

**PHILIPS**

Data handbook



Electronic  
components  
and materials

# Electron tubes

Part 1 January 1972

Transmitting tetrodes and pentodes

for communication

Amplifier circuit assemblies



# ELECTRON TUBES

Part 1

January 1972

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General section

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Transmitting tubes for communication

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TETRODES AND PENTODES

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Amplifier circuit assemblies

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**Associated accessories**  
**see Handbook Electron Tubes Part 9**

## DATA HANDBOOK SYSTEM

To provide you with a comprehensive source of information on electronic components, subassemblies and materials, our Data Handbook System is made up of three series of handbooks, each comprising several parts.

The three series, identified by the colours noted, are:

<b>ELECTRON TUBES</b> (9 parts)	BLUE
<b>SEMICONDUCTORS AND INTEGRATED CIRCUITS</b> (5 parts)	RED
<b>COMPONENTS AND MATERIALS</b> (7 parts)	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued annually; the contents of each series are summarized on the following pages.

We have made every effort to ensure that each series is as accurate, comprehensive and up-to-date as possible, and we hope you will find it to be a valuable source of reference. Where ratings or specifications quoted differ from those published in the preceding edition they will be pointed out by arrows. You will understand that we can not guarantee that all products listed in any one edition of the handbook will remain available, or that their specifications will not be changed, before the next edition is published. If you need confirmation that the published data about any of our products are the latest available, may we ask that you contact our representative. He is at your service and will be glad to answer your inquiries.

## ELECTRON TUBES (BLUE SERIES)

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

<b>Part 1</b> Transmitting tubes (Tetrodes, Pentodes)	<b>January 1972</b> Amplifier circuit assemblies
<b>Part 2</b> Tubes for microwave equipment	<b>March 1971</b>
<b>Part 3</b> Special Quality tubes	<b>March 1970</b> Miscellaneous devices
<b>Part 4</b> Receiving tubes	<b>April 1971</b>
<b>Part 5</b> Cathode-ray tubes Photo tubes Camera tubes	<b>May 1971</b> Associated accessories
<b>Part 6</b> Photomultipliers tubes Channel electron multipliers Scintillators Photoscintillators	<b>June 1971</b> Radiation counter tubes Semiconductor radiation detectors Neutron generator tubes Photo diodes Associated accessories
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<b>Part 9</b> Transmitting tubes (Triodes) Tubes for R. F. heating (Triodes)	<b>December 1971</b> Associated accessories

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# SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

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

## **Part 1      Diodes and Thyristors      September 1971**

General	Thyristors, diacs, triacs
Signal diodes	Rectifier stacks
Variable capacitance diodes	Accessories
Voltage regulator diodes	Heatsinks
Rectifier diodes	

## **Part 2      Low frequency; Deflection      October 1971**

General	Deflection transistors
Low frequency transistors (low power)	Accessories
Low frequency power transistors	

## **Part 3      High frequency; Switching      November 1971**

General	Switching transistors
High frequency transistors	Accessories

## **Part 4      Special types      December 1971**

General	Photoconductive devices
Transmitting transistors	Photodiodes
Microwave devices	Phototransistors
Field effect transistors	Light emitting diodes
Dual transistors	Infra-red sensitive devices
Microminiature devices for thick- and thin-film circuits	Accessories

## **Part 5      Integrated Circuits      March 1971**

General	Linear integrated circuits
Digital integrated circuits	
DTL (FC family)	
TTL (FJ family)	
MOS (FD family)	

# COMPONENTS AND MATERIALS (GREEN SERIES)

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

## **Part 1 Circuit Blocks, Input/Output Devices, October 1971 Electro-mechanical Components \*), Peripheral Devices**

Circuit blocks 40-Series	Input/output devices
Counter modules 50-Series	Electro-mechanical components *)
Norbis 60-Series, 61-Series	Peripheral devices
Circuit blocks 90-Series	

## **Part 2 Resistors, Capacitors December 1971**

Fixed resistors	Paper capacitors and film capacitors
Variable resistors	Electrolytic capacitors
Non-linear resistors	Variable capacitors
Ceramic capacitors	

## **Part 3 Radio, Audio, Television February 1971**

FM tuners	Audio and mains transformers
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## **Part 4 Magnetic Materials, Piezoelectric Ceramics April 1971**

Ferrites for radio, audio and television	Ferroxcube potcores and square cores
Small coils, assemblies and assembling parts	Ferroxcube transformer cores
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## **Part 5 Memory Products, Magnetic Heads, Quartz Crystals, June 1971 Microwave Devices, Variable Transformers**

Ferrite memory cores	Quartz crystal units, crystal filters
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## **Part 6 Electric Motors and Accessories, August 1971 Timing and Control Devices**

Stepper motors	Small d. c. motors
Small synchronous motors	Tachogenerators and servomotors
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## **Part 7 Circuit Blocks September 1971**

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

\*) From October 1971 published in Part 1 instead of Part 5.

\* \*) Also included (under "Small coils, etc.") in Part 4.

December 1971

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## **General section**

**List of symbols**

**General operational recommendations**

**Bases**



# 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 star point of three star connected filaments	f <sub>c</sub>
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<sub>1</sub>, g<sub>2</sub>, g<sub>3</sub>.
- 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 the case of d.c. fed, directly heated tubes with respect to the negative side of the filament, and in the 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 values of the concerning voltages, unless otherwise stated.

Anode voltage	V <sub>a</sub>
Anode a.c. voltage	V <sub>a~</sub>
Anode voltage in cut-off or cold condition	V <sub>a0</sub>
Supply voltage of tube electrodes	V <sub>b</sub>

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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 heater and cathode	$V_{kf}$
Peak value of a voltage	$V_p$
RMS value of a voltage	$V_{RMS}$
Secondary transformer voltage	$V_{tr}$

3. Symbols denoting currents

Remarks

- The positive electrical current is directed opposite to the direction of the electron current.
- The symbols quoted below represent the average values of the concerning currents, 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	$I_{RMS}$
Saturation current	$I_{sat}$

4. Symbols denoting powers

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

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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)	$C_{g1g2}$
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	$d_{in}$
Frequency	$f$
Pulse repetition rate	$f_{imp}$
Height above sea level	$h$
Modulation factor	$m$
Pressure drop of cooling air or cooling water	$p_i$
Required flow of cooling air or cooling water	$q$
Thermal resistance	$R_{th}$
Mutual conductance	$S$
Temperature of anode or anode block	$t_a$
Ambient temperature	$t_{amb}$
Bulb temperature	$t_{bulb}$
Cathode heating time	$T_h$
Inlet temperature of cooling air or cooling water	$t_i$
Pulse duration	$T_{imp}$
Outlet temperature of cooling air or cooling water	$t_o$
Seal temperature	$t_s$
Waiting time (= time which has to pass between switching on of the filament or heater voltage and switching on of the other voltages)	$T_w$
Duty factor	$\delta$
Efficiency	$\eta$
Wavelength	$\lambda$
Amplification factor	$\mu$
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$

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



## 1. GENERAL

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

1.2 The tubes are classified into three groups

Preferred types - to be considered when designing new equipment

Maintenance types - still in production but to be avoided when designing new equipment.

Obsolescent types - will be supplied until present stocks are exhausted.

Full details are given of preferred types. Data on maintenance and obsolescent types is 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 values 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 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 permissible distortion, is reached

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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  $\pm 5\%$ , 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



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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 Anode return

If the filament is fed with d.c. the anode return lead should be connected to the negative end of the filament. If the filament is fed with a.c. the anode return lead should be connected to the transformer mid-tap or to a tapped resistor shunted across the filament.

#### 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 $\mu$ 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 <sub>a</sub>	I <sub>a</sub>	I <sub>g</sub>	W <sub>ia</sub>	W <sub>a</sub>	W <sub>g2</sub>
R. F. class C telegraphy		1	1	1	1	1	1
Anode mod.	Th	0.8	0.833	1	0.67	0.67	0.67
	Wo	0.8	0.5	1	0.4	0.4	0.4
R. F. class B	Th.	1	0.833	1	0.833 <sup>1)</sup>	1	0.67
	Wo	1	0.5	1	0.5	1	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 <sub>a</sub>	1	1
Self-rectifying oscillator	Th	1.13	0.53	0.53	0.665	1	
	Wo	1.13	0.32	0.32	0.4	1	
Two-phase half-wave without filter	Th	0.9	0.89	0.89	1	1	
	Wo	0.9	0.6	0.6	1	1	

<sup>1)</sup> or 1.5 W<sub>a</sub>.

### 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.

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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

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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.  $0.95 \times V_{gp} \times I_g$ ). 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  $W_{ia}$ . 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  $0.9 \times$  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

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greater than the cut-off voltage so that anode 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 should 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 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

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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  $W_0$  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  $W_0$ . 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.

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#### 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.



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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



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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

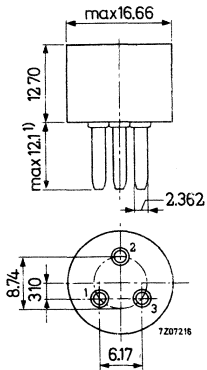
When a tube is used under pulsed operation the pulse duration must be so short that no part of the tube reaches an abnormally high temperature and flash-overs do not develop. In general the average load will be considerably less than the maximum limiting load value.

General information on this kind of information is not available but, if requested, information will be given on specific applications.



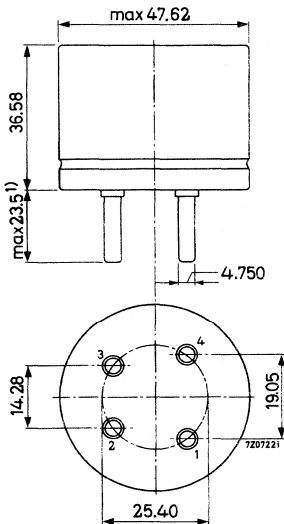


Pee Wee 3-pin base  
(IEC 67-I-19a)



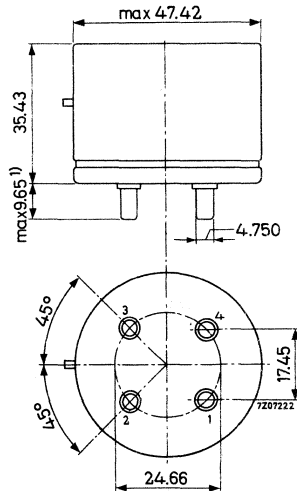
1) Including solder

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



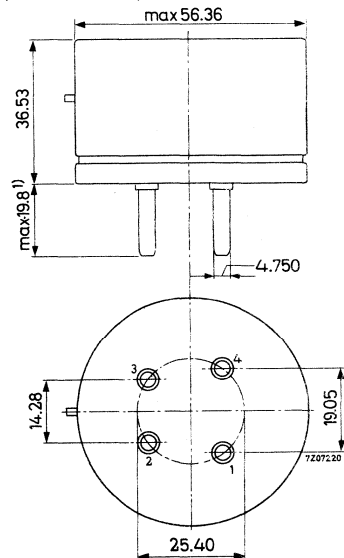
1) Including solder

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



1) Including solder

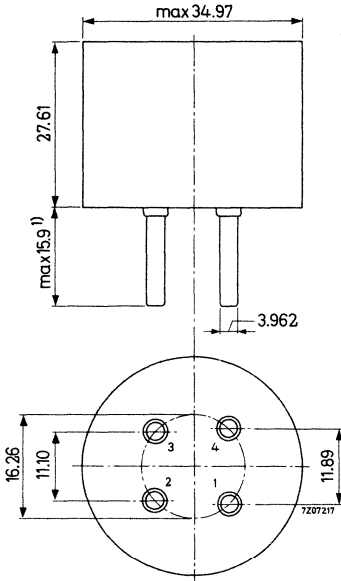
Super Jumbo 4-pin base with bayonet  
(IEC 67-I-24)



1) Including solder

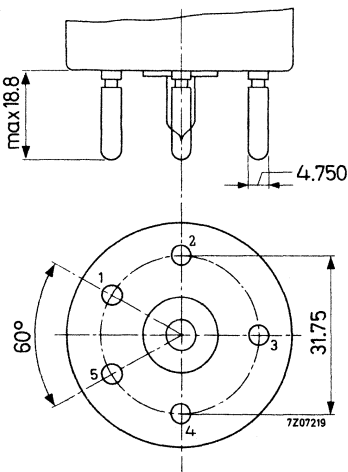
# BASES

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

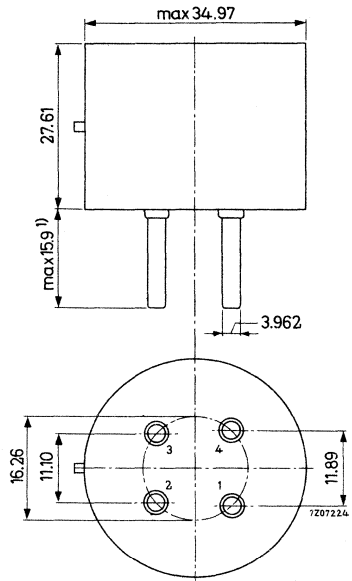


1) Including solder

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

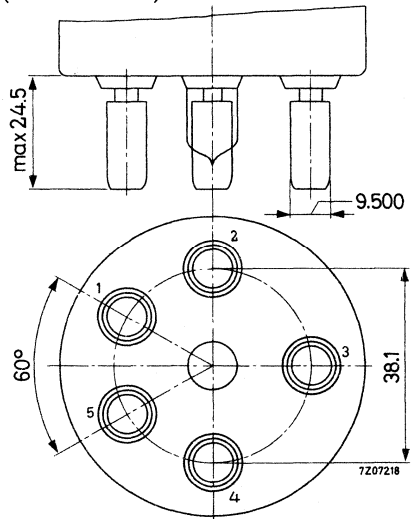


Medium 4-pin base with bayonet  
(IEC 67-I-3)

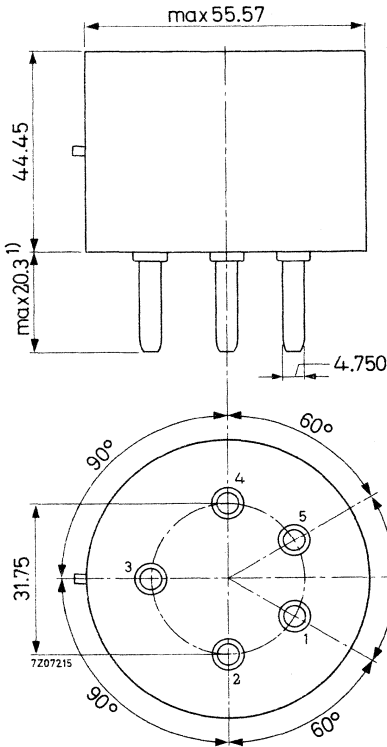


1) Including solder

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

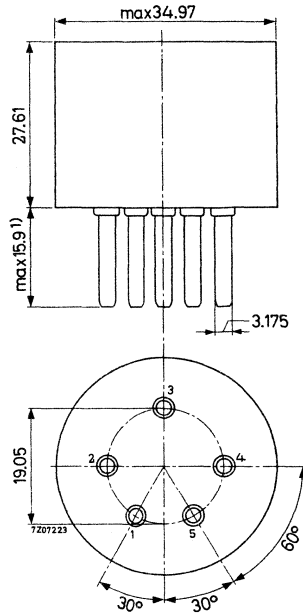


Medium shell Giant 5-pin base  
with bayonet  
(IEC 67-I-21a)



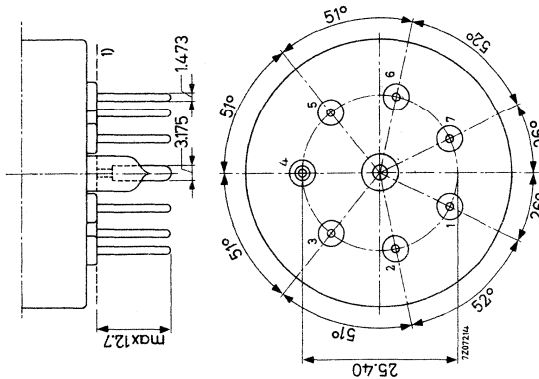
1) Including solder

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.



# TETRODES AND PENTODES







## R.F. POWER PENTODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegr.		B teleph.		$C_{ag2}$ mod.		$C_{g3}$ mod.	
	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)
< 10	2500	600			2000	325		
< 20	2000	550	2000	90	1800	290	2000	100
60 <sup>1)</sup>	1500	625	1500	100	1200	350	1500	90

HEATING : direct; filament thoriated tungsten

Filament voltage  $V_f = 12$  V  
 Filament current  $I_f = 7.3$  A

## CAPACITANCES

Anode to all except grid No. 1  $C_a = 20$  pF  
 Grid No. 1 to all except anode  $C_{g1} = 23$  pF  
 Anode to grid No. 1  $C_{ag1} = 0.2$  pF

## TYPICAL CHARACTERISTICS

Anode current  $I_a = 120$  mA  
 Amplification factor  $\mu_{g2g1} = 6.2$   
 Mutual conductance  $S = 6$  mA/V

<sup>1)</sup> Two tubes

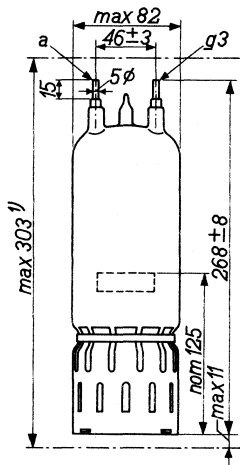
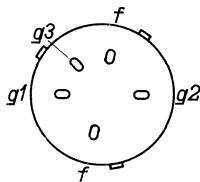
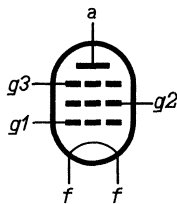
**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	2500 V
Anode dissipation	$W_a$	= max.	250 W
Grid No.3 circuit resistance	$R_{g_3}$	= max.	40 k $\Omega$
Grid No.2 voltage	$V_{g_2}$	= max.	500 V
Grid No.2 dissipation	$W_{g_2}$	= max.	60 W
Grid No.1 dissipation	$W_{g_1}$	= max.	20 W
Grid No.1 circuit resistance	$R_{g_1}$	= max.	40 k $\Omega$
Cathode current	$I_k$	= max.	600 mA
Peak cathode current	$I_{kp}$	= max.	2400 mA
Pin seal temperature		= max.	200 °C

**MECHANICAL DATA**

Net weight: 0.63 kg

Dimensions in mm



Mounting position: vertical with base up or down

When the tube is mounted with the base up it is recommended to support the tube

**ACCESSORIES**

Socket: 40200

Anode connectors: 40600

<sup>1)</sup> Required height in apparatus

## R.F. POWER PENTODE

## QUICK REFERENCE DATA

$\lambda$	Freq.	C telegr.		B teleph.		B mod. <sup>1)</sup>	
		$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)
> 30	< 10	3000	1200	3000	190	3000	1600
> 15	< 20	2500	950	2500	130		
5	60	1800	485	1800	68		
		C <sub>ag2</sub> mod.		C <sub>g3</sub> mod.			
> 30	< 10	2500	580	3000	200		
> 15	< 20	2000	425	2500	150		

**HEATING:** direct; filament thoriated tungsten

Filament voltage  $V_f = 12$  V

Filament current  $I_f = 8.5$  A

**CAPACITANCES**

Anode to all other elements except grid No.1  $C_a = 21$  pF

Grid No.1 to all other elements except anode  $C_{g1} = 29$  pF

Anode to grid No.1  $C_{ag1} = 0.05$  pF

**TYPICAL CHARACTERISTICS**

Amplification factor of grid No.2  
with respect to grid No.1  $\mu_{g2g1} = 3.5$

Mutual conductance  $S (I_a = 225 \text{ mA}) = 6.5 \text{ mA/V}$

<sup>1)</sup> Two tubes

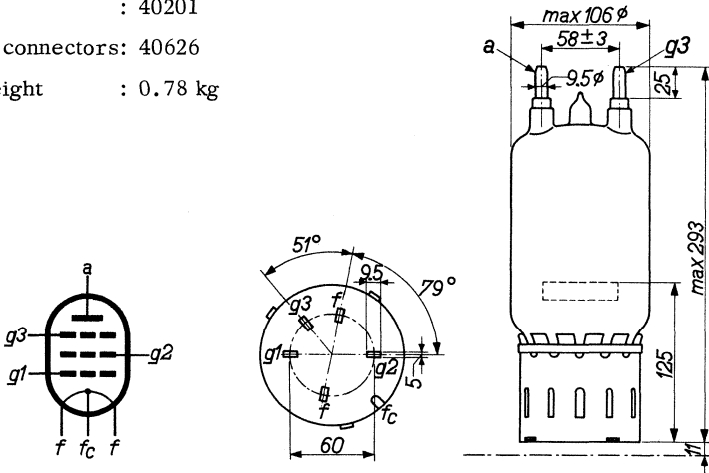
**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	3000 V
Anode dissipation	$W_a$	= max.	450 W
Grid No.2 voltage	$V_{g2}$	= max.	600 V
Grid No.2 voltage for class B modulation	$V_{g2}$ (B mod.)	= max.	750 V
Grid No.2 dissipation	$W_{g2}$	= max.	100 W
Grid No.3 resistor	$R_{g3}$	= max.	30 k $\Omega$
Grid No.1 dissipation	$W_{g1}$	= max.	20 W
Grid No.1 resistor	$R_{g1}$	= max.	30 k $\Omega$
Cathode current	$I_k$	= max.	700 mA
Peak cathode current	$I_{kp}$	= max.	4500 mA
Temperature of pin seals a and $g_3$		= max.	200 °C

To ensure safe seal temperatures a low velocity air flow is required above 60 MHz

**MECHANICAL DATA** (Dimensions in mm)

Socket : 40201  
 Anode connectors: 40626  
 Net weight : 0.78 kg



Mounting position: vertical with base up <sup>1)</sup> or down  
<sup>1)</sup> In that case it is recommended to support the tube

## R.F. POWER PENTODE

QUICK REFERENCE DATA									
$\lambda$ (m)	Freq. (MHz)	C telegr.		B teleph.		C <sub>ag2</sub> mod.		B mod <sup>1)</sup>	
		V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
> 3	< 100	500	33	500	6	400	20	500	49
		400	28	400	5.4	300	16	400	49
		300	24					300	40
$\lambda$ (m)	Freq. (MHz)	C fr. mult.							
		V <sub>a</sub> (V)	W <sub>o</sub> (W)						
5.4/1.8	55/165	400	9						

**HEATING:** indirect; cathode oxide-coated

Heater voltage  $V_f = 12.6$  V

Heater current  $I_f = 0.7$  A

**CAPACITANCES**

Anode to all other elements except grid No.1  $C_a = 7.8$  pF

Grid No.1 to all other elements except anode  $C_{g1} = 14.5$  pF

Anode to grid No.1  $C_{ag1} = 0.15$  pF

**TYPICAL CHARACTERISTICS**

Amplification factor of grid No.2  
with respect to grid No.1  $\mu_{g2g1} = 7.6$

Mutual conductance  $S (I_a = 30 \text{ mA}) = 3.3$  mA/V

<sup>1)</sup> Two tubes

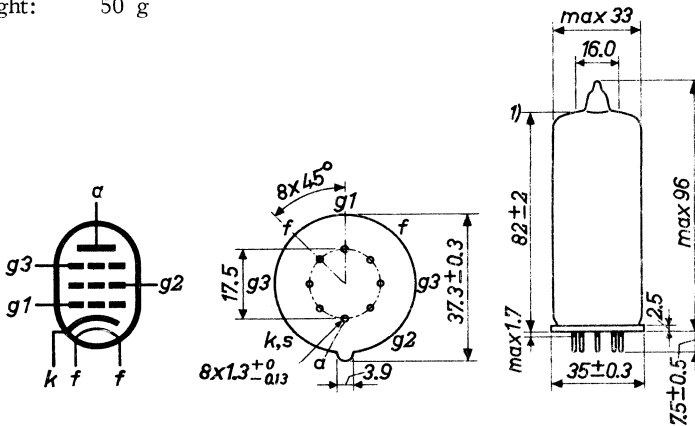
**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a = \text{max. } 500 \text{ V}$
Anode dissipation	$W_a = \text{max. } 12 \text{ W}$
Grid No.2 voltage	$V_{g2} = \text{max. } 300 \text{ V}$
Grid No.2 dissipation	$W_{g2} = \text{max. } 5 \text{ W}$
Grid No.1 dissipation	$W_{g1} = \text{max. } 0.5 \text{ W}$
Grid No.1 resistor with fixed bias	$R_{g1} = \text{max. } 50 \text{ k}\Omega$
Grid No.1 resistor with automatic bias	$R_{g1} = \text{max. } 100 \text{ k}\Omega$
Cathode current	$I_k = \text{max. } 130 \text{ mA}$
Peak cathode current	$I_{kp} = \text{max. } 800 \text{ mA}$
Heater to cathode voltage	$V_{kf} = \text{max. } 75 \text{ V}$
Tube base temperature	$= \text{max. } 180 \text{ }^\circ\text{C}$

**MECHANICAL DATA**

Socket : 40210/02  
 Net weight: 50 g

Dimensions in mm



Mounting position: arbitrary

1) Reference line

**R.F. POWER PENTODE**

QUICK REFERENCE DATA							
$\lambda$	Freq.	C telegr.		B teleph.		$C_{ag2}$ mod.	
m	MHz	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)
> 15	< 20	600	45	600	11	500	40
5	60	600	36	600	6.5	500	20

$\lambda$	Freq.	C fr. mult.	
m	MHz	$V_a$ (V)	$W_o$ (W)
150/75	2/4	600	27

B mod. <sup>1)</sup>	
$V_a$ (V)	$W_o$ (W)
600	100

**HEATING** : indirect; cathode oxide-coated

<b>PE06/40 P</b>	{ Heater voltage	$V_f$	=	6.3 V
<b>PE06/40 N</b>		{ Heater current	$I_f$	=
<b>PE06/40 E</b>	{ Heater voltage	$V_f$	=	12.6 V
		{ Heater current	$I_f$	=

**CAPACITANCES**

Anode to all other elements except grid No.1	$C_a$	=	8.7 pF
Grid No.1 to all other elements except anode	$C_{g1}$	=	15 pF
Anode to grid No.1	$C_{ag1}$	=	0.1 pF

**TYPICAL CHARACTERISTICS**

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$	=	5.5
Mutual conductance	$S (I_a = 40 \text{ mA})$	=	4 mA/V

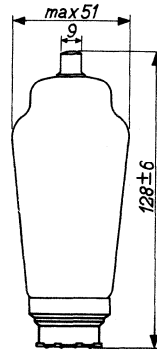
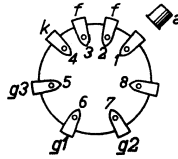
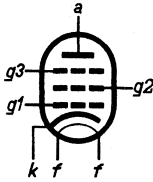
1) Two tubes

**MECHANICAL DATA**

Dimensions in mm

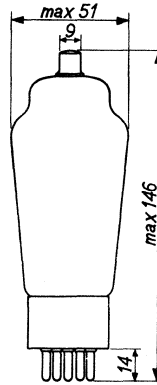
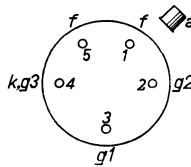
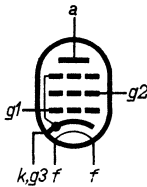
**PE06/40 P**

Base P  
 Socket 2422 514 00001  
 Cap 28 906 022  
 Net weight 65 g



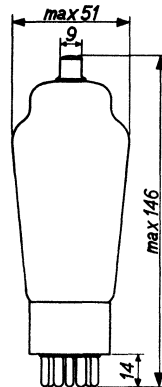
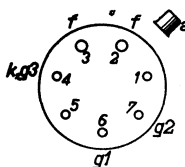
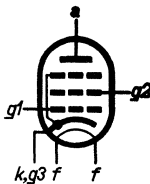
**PE06/40 N**

Base N  
 Socket 2422 512 03001  
 Cap 28 906 022  
 Net weight 65 g



**PE06/40 E**

Base E  
 Cap 28 906 022  
 Net weight 65 g



Mounting position: arbitrary



**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	600	V
Anode dissipation	$W_a$	= max.	25	W
Grid No.2 voltage	$V_{g_2}$	= max.	300	V
Grid No.2 dissipation	$W_{g_2}$	= max.	5	W
Grid No.1 dissipation	$W_{g_1}$	= max.	1	W
Grid No.1 resistance	$R_{g_1}$	= max.	100	$k\Omega$ <sup>1)</sup>
Grid No.1 resistance	$R_{g_1}$	= max.	200	$k\Omega$ <sup>2)</sup>
Cathode current	$I_k$	= max.	130	mA
Peak cathode current	$I_{k_p}$	= max.	520	mA
Cathode to heater voltage	$V_{kf}$	= max.	75	V

**OPERATING CONDITIONS; R.F. CLASS C TELEGRAPHY**

Wave length	$\lambda$	=	>15	>15	53)	m
Anode voltage	$V_a$	=	600	600	600	V
Grid No.1 voltage	$V_{g_1}$	=	-75	-40	-75	V
Grid No.2 voltage	$V_{g_2}$	=	300	300	300	V
Grid No.3 voltage	$V_{g_3}$	=	0	0	0	V
Anode current	$I_a$	=	109	109	195	mA
Grid No.1 current	$I_{g_1}$	=	2	0	0	mA
Grid No.2 current	$I_{g_2}$	=	11.5	11	20	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	90	40	75	V
Grid No.1 input power	$W_{ig_1}$	=	0.2	0	0	W
Grid No.2 dissipation	$W_{g_2}$	=	3.5	3.3	6	W
Anode input power	$W_{ia}$	=	65	65	117	W
Anode dissipation	$W_a$	=	20	25	45	W
Output power	$W_o$	=	45	40	72	W
Efficiency	$\eta$	=	69	62	62	%

1) With fixed grid bias

2) With automatic grid bias

3) Two tubes.

OPERATING CONDITIONS R.F. CLASS C ANODE AND SCREEN GRID

MODULATION

Wavelength	$\lambda$	=	>15	5 <sup>1)</sup> m
Anode voltage	$V_a$	=	500	500 V
Grid No.1 voltage	$V_{g1}$	=	-75	-55 V
Grid No.2 voltage	$V_{g2}$	=	300 <sup>2)</sup>	160 <sup>3)</sup> V
Grid No.3 voltage	$V_{g3}$	=	0	0 V
Anode current	$I_a$	=	114	146 mA
Grid No.1 current	$I_{g1}$	=	1.4	2 mA
Grid No.2 current	$I_{g2}$	=	10	10 mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	90	75 V
Grid No.1 input power	$W_{ig1}$	=	0.1	0.15 W
Grid No.2 dissipation	$W_{g2}$	=	3	1.6 W
Anode input power	$W_{ia}$	=	57	73 W
Anode dissipation	$W_a$	=	17	33 W
Output power	$W_o$	=	40	40 W
Efficiency	$\eta$	=	70	55 %
-----				
Modulation factor	$m$	=	100	100 %
Peak grid No.2 A.C. voltage	$V_{g2p}$	=	300	160 V
Modulation power	$W_{mod}$	=	30	40 W

1) Two tubes

2)  $R_{g2} = 20 \text{ k}\Omega$

3)  $R_{g2} = 34 \text{ k}\Omega$

## R.F. POWER PENTODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr.		B teleph.		B mod. <sup>1)</sup>	
(m)	(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
>5	<60	1000	132	1000	23	1000	194
		800	107	800	23	800	110
		600	78	600	23	600	82
λ	Freq.	C <sub>ag2</sub> mod.		C <sub>g3</sub> mod.			
(m)	(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)		
>5	<60	800	75	1000	27		
		600	51	800	26		
				600	22		

**HEATING :** indirect; oxide-coated cathode

Heater voltage                    V<sub>f</sub> = 12.6 V

Heater current                    I<sub>f</sub> = 1.3 A

### CAPACITANCES

Anode to all other elements except grid No.1                    C<sub>a</sub> = 12 pF

Grid No.1 to all other elements except anode                    C<sub>g1</sub> = 20.5 pF

Anode to grid No.1                    C<sub>ag1</sub> = 0.1 pF

### TYPICAL CHARACTERISTICS

Anode voltage                    V<sub>a</sub> = 1000 V

Grid No.2 voltage                    V<sub>g2</sub> = 250 V

Amplification factor of grid No.2  
with respect to grid No.1                    μ<sub>g2g1</sub> = 6.7

Mutual conductance                    S (I<sub>a</sub> = 40 mA) = 6 mA/V

<sup>1)</sup> Two tubes

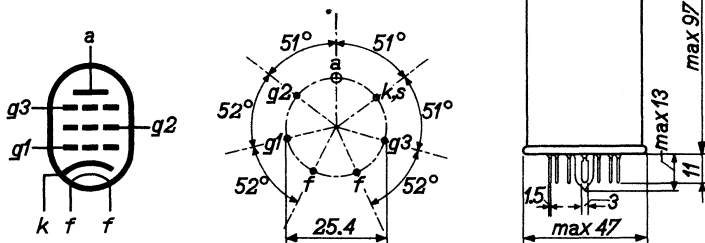
**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	1000	V
Anode dissipation	$W_a$	= max.	45	W
Grid No.2 voltage	$V_{g_2}$	= max.	300	V
Grid No.2 dissipation	$W_{g_2}$	= max.	7	W
Grid No. 1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 dissipation	$W_{g_1}$	= max.	0.5	W
Grid No.3 resistance	$R_{g_3}$	= max.	50	$k\Omega$
Grid No.1 resistance with fixed bias	$R_{g_1}$	= max.	25	$k\Omega$
Grid No.1 resistance with automatic bias	$R_{g_1}$	= max.	50	$k\Omega$
Cathode current	$I_k$	= max.	240	mA
Peak cathode current	$I_{kp}$	= max.	1.5	A
Cathode to heater voltage	$V_{kf}$	= max.	100	V

**MECHANICAL DATA**

Base : Septar  
 Socket : 2422 513 00001  
 Net weight: 80 g

Dimensions in mm



Mounting position: arbitrary

## OPERATING CONDITIONS R.F. class C telegraphy

Wavelength	$\lambda$	>5	>5	>5 m
Anode voltage	$V_a$	= 1000	800	600 V
Grid No.1 voltage	$V_{g1}$	= -120	-110	-100 V
Grid No.2 voltage	$V_{g2}$	= 250	250	250 V
Grid No.3 voltage	$V_{g3}$	= 0	0	0 V
Anode current	$I_a$	= 177	190	205 mA
Grid No.1 current	$I_{g1}$	= 5	6	7.5 mA
Grid No.2 current	$I_{g2}$	= 28	28	28 mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	= 144	134	124 V
Grid No.1 input power	$W_{ig1}$	= 0.65	0.73	0.84 W
Grid No.2 dissipation	$W_{g2}$	= 7	7	7 W
Anode input power	$W_{ia}$	= 177	152	123 W
Anode dissipation	$W_a$	= 45	45	45 W
Output power	$W_o$	= 132	107	78 W
Efficiency	$\eta$	= 74.5	70.5	63.5 %

## OPERATING CONDITIONS R.F. class B telephony

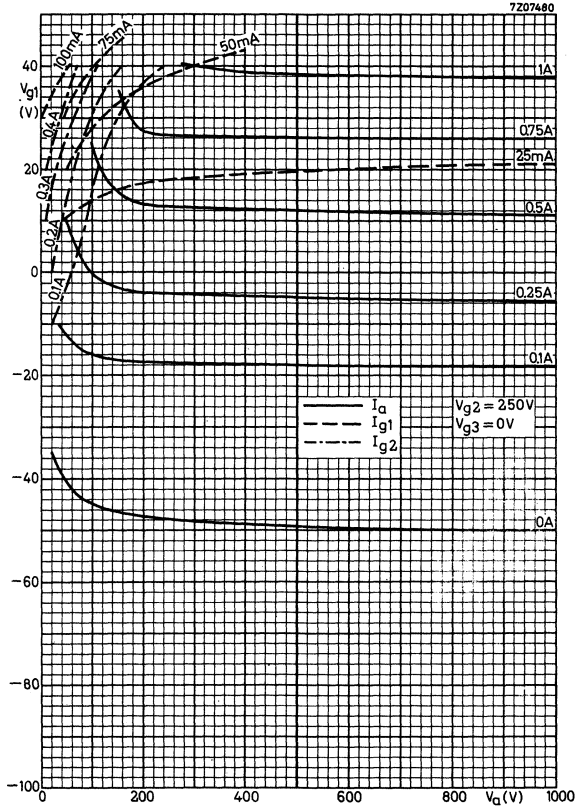
Wavelength	$\lambda$	>5	>5	>5 m
Anode voltage	$V_a$	= 1000	800	600 V
Grid No.1 voltage	$V_{g1}$	= -34	-33	-30.5 V
Grid No.2 voltage	$V_{g2}$	= 250	250	250 V
Grid No.3 voltage	$V_{g3}$	= 0	0	0 V
Anode current	$I_a$	= 68	85	114 mA
Grid No.2 current	$I_{g2}$	= 4.5	6	7.5 mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	= 20.5	22.5	26.5 V
Grid No.2 dissipation	$W_{g2}$	= 1.15	1.5	1.9 W
Anode input power	$W_{ia}$	= 68	68	68.4 W
Anode dissipation	$W_a$	= 45	45	45 W
Output power	$W_o$	= 23	23	23.4 W
Efficiency	$\eta$	= 34	34	34 %
Modulation factor	$m$	= 100	100	100 %
Grid No.1 current	$I_{g1}$	= 2	4	8 mA
Grid No.1 input power	$W_{ig1}$	= 0.08	0.17	0.38 W

OPERATING CONDITIONS R.F. class C

		anode and screen grid modulation		suppressor grid modulation
Wavelength	$\lambda$	>5	>5	>5 m
Anode voltage	$V_a$	= 800	600	1000 V
Grid No.1 voltage	$V_{g1}$	= -120	-120	-100 V
Grid No.2 voltage	$V_{g2}$	= 250	250	150 V
Grid No.3 voltage	$V_{g3}$	= 0	0	-100 V
Anode current	$I_a$	= 120	120	72 mA
Grid No.1 current	$I_{g1}$	= 6.5	6.5	10 mA
Grid No.2 current	$I_{g2}$	= 23	23	24 mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	= 150	150	140 V
Grid No.1 input power	$W_{ig1}$	= 0.9	0.9	1.3 W
Grid No.2 dissipation	$W_{g2}$	= 5.8	5.8	3.6 W
Anode input power	$W_{ia}$	= 96	72	72 W
Anode dissipation	$W_a$	= 21	21	45 W
Output power	$W_o$	= 75	51	27 W
Efficiency	$\eta$	= 78	71	37.5 %
-----				
Modulation factor	$m$	= 100	100	100 %
Peak grid No.2 A.C. voltage	$V_{g2p}$	= 250	250	- V
Peak grid No.3 A.C. voltage	$V_{g3p}$	= -	-	100 V
Modulation power	$W_{mod}$	= 48	36	0 W

**OPERATING CONDITIONS** as A.F. class B amplifier and modulator, two tubes;  
(Grid No.3 connected to cathode)

Anode voltage	$V_a$	=	1000	800	V
Grid No.1 voltage	$V_{g1}$	=	-34	-33.5	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Load resistance	$R_{aa\sim}$	=	8800	7560	$\Omega$
Peak grid to grid voltage	$V_{g1g1p}$	=	0 84	0 68	V
Anode current	$I_a$	=	2x26 2x134	2x28 2x108	mA
Grid No.1 current	$I_{g1}$	=	0 2x0.5	0 0	mA
Grid No.2 current	$I_{g2}$	=	2x5 2x28	2x8 2x27	mA
Grid No.1 input power	$W_{ig1}$	=	0 2x0.03	0 0	W
Grid No.2 dissipation	$W_{g2}$	=	2x1.3 2x7	2x2 2x6.8	W
Anode input power	$W_{ia}$	=	2x26 2x134	2x22.4 2x86.4	W
Anode dissipation	$W_a$	=	2x26 2x37	2x22.4 2x31.4	W
Output power	$W_o$	=	0 194	0 110	W
Total harmonic distortion	$d_{tot}$	=	- 5	- 4.5	%
Efficiency	$\eta$	=	- 72	- 63.5	%
Anode voltage	$V_a$	=	600		V
Grid No.1 voltage	$V_{g1}$	=	-33		V
Grid No.2 voltage	$V_{g2}$	=	250		V
Load resistance	$R_{aa\sim}$	=	6320		$\Omega$
Peak grid to grid voltage	$V_{g1g1p}$	=	0	66	V
Anode current	$I_a$	=	2x28	2x102	mA
Grid No.1 current	$I_{g1}$	=	0	0	mA
Grid No.2 current	$I_{g2}$	=	2x11	2x28	mA
Grid No.1 input power	$W_{ig1}$	=	0	0	W
Grid No.2 dissipation	$W_{g2}$	=	2x2.8	2x7	W
Anode input power	$W_{ia}$	=	2x16.8	2x61.2	W
Anode dissipation	$W_a$	=	2x16.8	2x20.2	W
Output power	$W_o$	=	0	82	W
Total harmonic distortion	$d_{tot}$	=	-	3.3	%
Efficiency	$\eta$	=	-	67	%





## R.F. BEAM POWER TETRODE

Beam power tetrode for use as A.F. or R.F. amplifier or oscillator

QUICK REFERENCE DATA.																						
$\lambda$ (m)	Freq. (MHz)	C telegr.			B teleph.			$C_{ag2}$ mod.														
		$V_a$ (V)	$W_o$ (W)		$V_a$ (V)	$W_o$ (W)		$V_a$ (V)	$W_o$ (W)													
			CCS	ICAS		CCS	ICAS		CCS	ICAS												
10	30	2000	275		2000	50		1600	180													
		1500	210								1500	50		1250	140							
		1250	170														2250		70	2000		300
		2250		375																		
$\lambda$ (m)	Freq. (MHz)	$C_{g1}$ mod.			AB mod. <sup>1)</sup>																	
		$V_a$ (V)	$W_o$ (W)		$V_a$ (V)	$W_o$ (W)																
			CCS	ICAS		CCS	ICAS															
10	30	2000	50		2250	380																
		1500	40		2000	335																
		2250		75	1500	260																
					2500		490															

**HEATING:** direct; filament thoriated tungsten

Filament voltage  $V_f = 10$  V

Filament current  $I_f = 5$  A

### CAPACITANCES

Grid No.1 to all other elements except anode  $C_{g1} = 16.3$  pF

Anode to all other elements except grid No.1  $C_a = 14.0$  pF

Anode to grid No.1  $C_{ag1} < 0.25$  pF

### TYPICAL CHARACTERISTICS

Amplification factor of grid No.2  
with respect to grid No.1

$\mu_{g2g1} = 8.5$

Mutual conductance

$S (I_a = 50 \text{ mA}) = 3.75 \text{ mA/V}$

<sup>1)</sup> Without grid current; two tubes

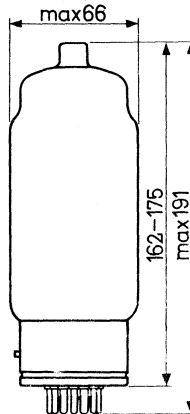
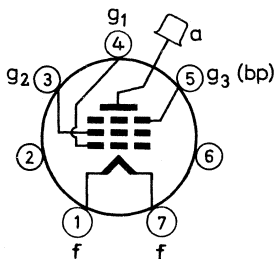
**MECHANICAL DATA**

Dimensions in mm

Anode connector: 40619

Base : Giant 7-pin

Net weight : 230 g



Mounting position: Vertical with base up or down,  
or horizontal with pins 2 and 6 in a vertical plane

Pages 5, 6

2) Obtained preferably from a separate source modulated with the plate supply  
or from the modulated plate supply through a series resistor of

27 kΩ at  $V_a = 1250$  V

43 kΩ at  $V_a = 1600$  V

41 kΩ at  $V_a = 2000$  V

## R.F. CLASS C TELEGRAPHY

## C. C. S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	2000	1500	1000	V
Anode input power	$W_{ia}$	= max.	360	270	180	W
Anode dissipation	$W_a$	=		max. 100		W
Anode current	$I_a$	=		max. 180		mA
Grid No.2 voltage	$V_{g2}$	=		max. 400		V
Grid No.2 dissipation	$W_{g2}$	=		max. 22		W
Negative grid No.1 voltage	$-V_{g1}$	=		max. 300		V
Grid No.1 current	$I_{g1}$	=		max. 25		mA
Grid No.1 circuit resistance	$R_{g1}$	=		max. 30		k $\Omega$

## C. C. S. OPERATING CONDITIONS, continuous service

Frequency	f	=	30	60	60	MHz
Anode voltage	$V_a$	=	2000	1500	1250	V
Grid No.1 voltage	$V_{g1}$	=	-120	-90	-75	V <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	400	300	300	V
Grid No.3 voltage	$V_{g3}$	=	0	0	0	V
Anode current	$I_a$	=	180	180	180	mA
Grid No.1 current	$I_{g1}$	=	10	12	12	mA
Grid No.2 current	$I_{g2}$	=	45	30	35	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	205	175	160	V
Grid No.1 input power	$W_{ig1}$	=	1.9	1.9	1.7	W
Grid No.2 dissipation	$W_{g2}$	=	18	9.0	10.5	W
Anode input power	$W_{ia}$	=	360	270	225	W
Anode dissipation	$W_a$	=	85	60	55	W
Output power	$W_o$	=	275	210	170	W
Efficiency	$\eta$	=	76.5	78	75.5	%

<sup>1)</sup> For A.C. filament supply

**R.F. CLASS C TELEGRAPHY**

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	2250	1700	1125	V
Anode input power	$W_{ia}$	= max.	500	375	250	W
Anode dissipation	$W_a$	=		max. 125		W
Anode current	$I_a$	=		max. 225		mA
Grid No.2 voltage	$V_{g2}$	=		max. 400		V
Grid No.2 dissipation	$W_{g2}$	=		max. 22		W
Negative grid No.1 voltage	$-V_{g1}$	=		max. 300		V
Grid No.1 current	$I_{g1}$	=		max. 30		mA
Grid No.1 circuit resistance	$R_{g1}$	=		max. 30		k $\Omega$

**I. C. A. S. OPERATING CONDITIONS**, intermittent service

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	2250	V
Grid No.1 voltage	$V_{g1}$	=	-155	V <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	400	V
Grid No.3 voltage	$V_{g3}$	=	0	V
Anode current	$I_a$	=	220	mA
Grid No.1 current	$I_{g1}$	=	15	mA
Grid No.2 current	$I_{g2}$	=	40	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	275	V
Grid No.1 input power	$W_{ig1}$	=	4	W
Grid No.2 dissipation	$W_{g2}$	=	16	W
Anode input power	$W_{ia}$	=	495	W
Anode dissipation	$W_a$	=	120	W
Output power	$W_o$	=	375	W
Efficiency	$\eta$	=	76	%

<sup>1)</sup> For A.C. filament supply

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	1600	1200	800	V
Anode input power	$W_{ia}$	= max.	240	180	120	W
Anode dissipation	$W_a$	=		max. 67		W
Anode current	$I_a$	=		max. 150		mA
Grid No.2 voltage	$V_{g2}$	=		max. 400		V
Grid No.2 dissipation	$W_{g2}$	=		max. 15		W
Negative grid No.1 voltage	$-V_{g1}$	=		max. 300		V
Grid No.1 current	$I_{g1}$	=		max. 25		mA
Grid No.1 circuit resistance	$R_{g1}$	=		max. 30		k $\Omega$

**C.C.S. OPERATING CONDITIONS**, continuous service

Frequency	f	=	30	60	MHz
Anode voltage	$V_a$	=	1600	1250	V
Grid No.1 voltage	$V_{g1}$	=	-160	-160	V <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	300	300	V <sup>2)</sup>
Grid No.3 voltage	$V_{g3}$	=	0	0	V
Anode current	$I_a$	=	150	150	mA
Grid No.1 current	$I_{g1}$	=	12	13	mA
Grid No.2 current	$I_{g2}$	=	30	35	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	250	250	V
Grid No.1 input power	$W_{ig1}$	=	2.7	2.9	W
Grid No.2 dissipation	$W_{g2}$	=	9	10.5	W
Anode input power	$W_{ia}$	=	240	187.5	W
Anode dissipation	$W_a$	=	60	47.5	W
Output power	$W_o$	=	180	140	W
Efficiency	$\eta$	=	75	74.5	%
Modulation factor	m	=	100	100	%
Modulation power	$W_{mod}$	=	120	94	W

<sup>1)</sup> For A.C. filament supply

<sup>2)</sup> See page 2

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	2000	1500	1000	V
Anode input power	$W_{ia}$	= max.	400	300	200	W
Anode dissipation	$W_a$	=		max. 100		W
Anode current	$I_a$	=		max. 200		mA
Grid No.2 voltage	$V_{g2}$	=		max. 400		V
Grid No.2 dissipation	$W_{g2}$	=		max. 20		W
Negative grid No.1 voltage	$-V_{g1}$	=		max. 300		V
Grid No.1 current	$I_{g1}$	=		max. 30		mA
Grid No.1 circuit resistance	$R_{g1}$	=		max. 30		k $\Omega$

**I. C. A. S. OPERATING CONDITIONS**, intermittent service

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	2000	V
Grid No.1 voltage	$V_{g1}$	=	-175	V <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	350	V <sup>2)</sup>
Grid No.3 voltage	$V_{g3}$	=	0	V
Anode current	$I_a$	=	200	mA
Grid No.1 current	$I_{g1}$	=	16	mA
Grid No.2 current	$I_{g2}$	=	40	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	300	V
Grid No.1 input power	$W_{ig1}$	=	4.5	W
Grid No.2 dissipation	$W_{g2}$	=	14	W
Anode input power	$W_{ia}$	=	400	W
Anode dissipation	$W_a$	=	100	W
Output power	$W_o$	=	300	W
Efficiency	$\eta$	=	75	%
Modulation factor	m	=	100	%
Modulation power	$W_{mod}$	=	200	W

<sup>1)</sup> For A.C. filament supply

<sup>2)</sup> See page 2

**R.F. CLASS C GRID MODULATION**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	2000	1760	1520	V
Anode input power	$W_{ia}$	= max.	150	132	114	W
Anode dissipation	$W_a$	=	max. 100			W
Anode current	$I_a$	=	max. 100			mA
Grid No.2 voltage	$V_{g2}$	=	max. 400			V
Grid No.2 dissipation	$W_{g2}$	=	max. 15			W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 200			V
Grid No.1 circuit resistance	$R_{g1}$	=	max. 30			k $\Omega$

**C.C.S. OPERATING CONDITIONS**, continuous service

Frequency	f	=	30	up to	120	MHz
Anode voltage	$V_a$	=	2000		1500	V
Grid No.1 voltage	$V_{g1}$	=	-120		-140	V 1)
Grid No.2 voltage	$V_{g2}$	=	400		400	V
Grid No.3 voltage	$V_{g3}$	=	0		0	V
Anode current	$I_a$	=	75		70	mA
Grid No.1 current	$I_{g1}$	=				2)
Grid No.2 current	$I_{g2}$	=	3		3	mA
Peak A.C. input voltage, R.F.	$V_{g1p}$	=	120		145	V
Peak A.C. input voltage, A.F.	$V_{g1p}$	=	60		60	V
Grid No.1 input power	$W_{ig1}$	=				3)
Grid No.2 dissipation	$W_{g2}$	=	1.2		1.2	W
Anode input power	$W_{ia}$	=	150		105	W
Anode dissipation	$W_a$	=	100		65	W
Output power	$W_o$	=	50		40	W
Efficiency	$\eta$	=	33		38	%

1) Fixed supply or cathode resistor bias, unbypassed for A.F., is recommended

2) Usually negligible

3) R.F. driving power is never more than 2 W

A.F. driving power is usually not more than 1 W

**R.F. CLASS C GRID MODULATION**

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	2250	1980	1710	V
Anode input power	$W_{ia}$	= max.	200	176	152	W
Anode dissipation	$W_a$	=	max. 125			W
Anode current	$I_a$	=	max. 125			mA
Grid No.2 voltage	$V_{g2}$	=	max. 400			V
Grid No.2 dissipation	$W_{g2}$	=	max. 20			W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 200			V
Grid No.1 circuit resistance	$R_{g1}$	=	max. 30			k $\Omega$

**I. C. A. S. OPERATING CONDITIONS**, intermittent service

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	2250	V
Grid No.1 voltage	$V_{g1}$	=	-110	V <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	400	V
Grid No.3 voltage	$V_{g3}$	=	0	V
Anode current	$I_a$	=	85	mA
Grid No.1 current	$I_{g1}$	=		2)
Grid No.2 current	$I_{g2}$	=	2.5	mA
Peak A.C. input voltage, R.F.	$V_{g1p}$	=	135	V
Peak A.C. input voltage, A.F.	$V_{g1p}$	=	55	V
Grid No.1 input power	$W_{ig1}$	=		3)
Grid No.2 dissipation	$W_{g2}$	=	1.0	W
Anode input power	$W_{ia}$	=	191	W
Anode dissipation	$W_a$	=	116	W
Output power	$W_o$	=	75	W
Efficiency	$\eta$	=	39	%

1) Fixed supply or cathode resistor bias, unbypassed for A.F., is recommended

2) Usually negligible

3) R.F. driving power is never more than 2 W

A.F. driving power is usually not more than 1 W



**R.F. CLASS B TELEPHONY**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	2000	1760	1520	V
Anode input power	$W_{ia}$	= max.	150	132	114	W
Anode dissipation	$W_a$	=	max. 100			W
Anode current	$I_a$	=	max. 100			mA
Grid No.2 voltage	$V_{g2}$	=	max. 400			V
Grid No.2 dissipation	$W_{g2}$	=	max. 15			W

**C.C.S. OPERATING CONDITIONS**, continuous service

Frequency	f	=	30 up to	120	MHz
Anode voltage	$V_a$	=	2000	1500	V
Grid No.1 voltage	$V_{g1}$	=	-75	-60	V <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	400	400	V
Grid No.3 voltage	$V_{g3}$	=	0	0	V
Anode current	$I_a$	=	75	100	mA
Grid No.2 current	$I_{g2}$	=	3	4	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	80	70	V
Grid No.2 dissipation	$W_{g2}$	=	1.2	1.6	W
Anode input power	$W_{ia}$	=	150	150	W
Anode dissipation	$W_a$	=	100	100	W
Output power	$W_o$	=	50	50	W
Efficiency	$\eta$	=	33	33	%
Modulation factor	m	=	100	100	%
Grid No.1 input power	$W_{ig1}$		$\leq 2$	$\leq 2$	W

<sup>1)</sup> For A.C. filament supply

**R.F. CLASS B TELEPHONY**

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	30	60	120	MHz
Anode voltage	$V_a$	= max.	2250	1980	1710	V
Anode input power	$W_{ia}$	= max.	200	176	152	W
Anode dissipation	$W_a$	=	max. 125			W
Anode current	$I_a$	=	max. 125			mA
Grid No.2 voltage	$V_{g2}$	=	max. 400			V
Grid No.2 dissipation	$W_{g2}$	=	max. 20			W

**I. C. A. S. OPERATING CONDITIONS**, intermittent service

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	2250	V
Grid No.1 voltage	$V_{g1}$	=	-60	V <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	400	V
Grid No.3 voltage	$V_{g3}$	=	0	V
Anode current	$I_a$	=	85	mA
Grid No.2 current	$I_{g2}$	=	3	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	70	V
Grid No.2 dissipation	$W_{g2}$	=	1.2	W
Anode input power	$W_{ia}$	=	191	W
Anode dissipation	$W_a$	=	121	W
Output power	$W_o$	=	70	W
Efficiency	$\eta$	=	36.5	%
Modulation factor	m	=	100	%
Grid No.1 input power	$W_{ig1}$	$\leq$	2	W

<sup>1)</sup> For A.C. filament supply

**A.F. CLASS AB AMPLIFIER AND MODULATOR**

**C. C. S. LIMITING VALUES** (Absolute limits), continuous service

Anode voltage	$V_a$	= max.	2250	V
Anode current	$I_a$	= max.	180	mA
Anode input power	$W_{ia}$	= max.	360	W
Anode dissipation	$W_a$	= max.	100	W
Grid No.2 voltage	$V_{g2}$	= max.	1100	V
Grid No.2 dissipation	$W_{g2}$	= max.	22	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	$k\Omega$ 1)

**C. C. S. OPERATING CONDITIONS**, continuous service; two tubes

$V_a$	=	2250		2000		1500		V
$V_{g1}$	=	-95		-90		-85		V 2)
$V_{g2}$	=	750		750		750		V
$V_{g3}$	=	0		0		0		V
$R_{aa\sim}$	=	20		16		9.3		$k\Omega$
$V_{g1g1p}$	=	0	170	0	160	0	160	V
$I_a$	=	2x25	2x127.5	2x25	2x132.5	2x25	2x152.5	mA
$I_{g2}$	=	2x1.0	2x26.5	2x1.0	2x21.5	2x1.0	2x22.5	mA
$W_{ig1}$	=	0	0	0	0	0	0	W
$W_{g2}$	=	2x0.75	2x19.9	2x0.75	2x16.1	2x0.75	2x16.9	W
$W_{ia}$	=	2x56	2x287	2x50	2x265	2x37.5	2x229	W
$W_a$	=	2x56	2x97	2x50	2x97.5	2x37.5	2x99	W
$W_o$	=	0	380	0	335	0	260	W
$\eta$	=	-	66	-	63	-	57	%

1) With fixed grid bias. Cathode bias is not recommended

2) For A.C. filament supply

**A.F. CLASS AB AMPLIFIER AND MODULATOR**

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Anode voltage	$V_a$	=	max.	2500	V
Anode current	$I_a$	=	max.	225	mA
Anode input power	$W_{ia}$	=	max.	450	W
Anode dissipation	$W_a$	=	max.	125	W
Grid No.2 voltage	$V_{g2}$	=	max.	1100	V
Grid No.2 dissipation	$W_{g2}$	=	max.	22	W
Grid No.1 circuit resistance	$R_{g1}$	=	max.	30	$k\Omega$ <sup>1)</sup>

**I. C. A. S. OPERATING CONDITIONS**, intermittent service; two tubes

Anode voltage	$V_a$	=	2500	V	
Grid No.1 voltage	$V_{g1}$	=	-95	V <sup>2)</sup>	
Grid No.2 voltage	$V_{g2}$	=	750	V	
Grid No.3 voltage	$V_{g3}$	=	0	V	
Load resistance	$R_{aa\sim}$	=	19	$k\Omega$	
Input A.C. voltage, peak to peak	$V_{g1g1p}$	=	0	180	V
Anode current	$I_a$	=	2x25	2x145	mA
Grid No.2 current	$I_{g2}$	=	2x1.0	2x27	mA
Grid No.1 input power	$W_{ig1}$	=	0	0	W
Grid No.2 dissipation	$W_{g2}$	=	2x0.75	2x20.3	W
Anode input power	$W_{ia}$	=	2x62.5	2x362.5	W
Anode dissipation	$W_a$	=	2x62.5	2x117.5	W
Output power	$W_o$	=	0	490	W
Efficiency	$\eta$	=	-	67.5	%

1) With fixed grid bias. Cathode bias is not recommended

2) For A.C. filament supply

## R.F. POWER TETRODE

QUICK REFERENCE DATA						
Freq.	C teleg.		C <sub>ag2</sub> mod.		S.S.B.	
(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>l</sub> (W)
50	3000	280	2500	230		
50	1500	165	1500	140		
50	600	45	600	45		
220	1500	110	1500	75		
30					2500	87
30					2000	77
30					1500	58

B mod. 1)			
I <sub>g1</sub> = 0		I <sub>g1</sub> > 0	
V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
1750	175	1800	270
1500	145	1500	250
1000	80	1000	170
		600	90

**HEATING:** direct; filament thoriated tungsten

Filament voltage  $V_f = 6 \text{ V}$   
 Filament current  $I_f = 3.5 \text{ A}$

**COOLING:** radiation/low-velocity air flow

**CAPACITANCES**

Anode to all other elements except grid No.1  $C_a = 2.1 \text{ pF}$   
 Grid No.1 to all other elements except anode  $C_{g1} = 8 \text{ pF}$   
Anode to grid No.1  $C_{ag1} = 0.08 \text{ pF}$

<sup>1)</sup> Two tubes

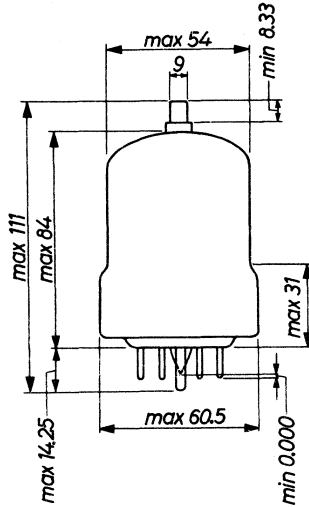
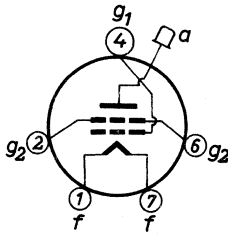
**TYPICAL CHARACTERISTICS**

Anode voltage	$V_a$	=	500 V
Grid No. 2 voltage	$V_{g2}$	=	250 V
Anode current	$I_a$	=	125 mA
Mutual conductance	$S$	=	4 mA/V
Amplification factor of grid No. 2 with respect to grid No. 1	$\mu_{g2g1}$	=	5

**MECHANICAL DATA**

Dimensions in mm

- Base : Septar
- Socket : 2422 513 00001
- Anode connector: 40624
- Net weight : 85 g



Mounting position: vertical with base up or down

**TEMPERATURE LIMITS (Absolute limits)**

Temperature of bulb and pin seals = max. 225 °C

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to 250	up to 150	MHz
Anode voltage	$V_a$	= max. 1500	max. 3000	V
Anode current	$I_a$	= max. 150		mA
Anode input power	$W_{ia}$	= max. 450		W
Anode dissipation	$W_a$	= max. 65		W
Grid No. 2 voltage	$V_{g2}$	= max. 400		V
Grid No. 2 dissipation	$W_{g2}$	= max. 10		W
Negative grid No. 1 voltage	$-V_{g1}$	= max. 500		V
Grid No. 1 current	$I_{g1}$	= max. 30		mA
Grid No. 1 dissipation	$W_{g1}$	= max. 5		W

OPERATING CONDITIONS

Frequency	f	= 50	50	50	220	MHz
Anode voltage	$V_a$	= 3000	1500	600	1500	V
Grid No. 2 voltage	$V_{g2}$	= 250	250	250	250	V
Grid No. 1 voltage	$V_{g1}$	= -100	-85	-75	-85	V
Anode current	$I_a$	= 115	150	150	117	mA
Grid No. 2 current	$I_{g2}$	= 8	24	40	24	mA
Grid No. 1 current	$I_{g1}$	= 5	12	15	12	mA
Peak grid No. 1 A.C. voltage	$V_{g1p}$	= 180	185	170	190	V
Grid No. 1 input power	$W_{ig1}$	= 0.8	2.0	2.3	8	W
Grid No. 2 dissipation	$W_{g2}$	= 2.0	6	10	6	W
Anode input power	$W_{ia}$	= 345	225	90	175	W
Anode dissipation	$W_a$	= 65	60	45	65	W
Output power	$W_o$	= 280	165	45	110	W
Efficiency	$\eta$	= 81	73	50	63	%

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES (Absolute limits)**

Frequency	f	up to 250	up to 150	MHz
Anode voltage	$V_a$	= max. 1500	max. 2500	V
Anode current	$I_a$	=	max. 120	mA
Anode input power	$W_{ia}$	=	max. 300	W
Anode dissipation	$W_a$	=	max. 45	W
Grid No.2 voltage	$V_{g2}$	=	max. 400	V
Grid No.2 dissipation	$W_{g2}$	=	max. 10	W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 500	V
Grid No.1 current	$I_{g1}$	=	max. 25	mA

**OPERATING CONDITIONS**

Frequency	f	=	50	50	50	220	MHz
Anode voltage	$V_a$	=	2500	1500	600	1500	V
Grid No.2 voltage	$V_{g2}$	=	250	250	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-135	-125	-120	-85	V
Anode current	$I_a$	=	110	120	120	80	mA
Grid No.2 current	$I_{g2}$	=	10	15	30	27	mA
Grid No.1 current	$I_{g1}$	=	6	8	12	12	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	215	220	215	185	V
Grid No.1 input power	$W_{ig1}$	=	1.2	1.6	2.3	8	W
Grid No.2 dissipation	$W_{g2}$	=	2.5	3.8	7.5	6.25	W
Anode input power	$W_{ia}$	=	275	180	72	120	W
Anode dissipation	$W_a$	=	45	40	27	45	W
Output power	$W_o$	=	230	140	45	75	W
Efficiency	$\eta$	=	84	78	62	63	%
Modulation factor	m	=	100	100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g2p}$	=	250	250	250	250	V
Modulation power	$W_{mod}$	=	137	90	36	60	W



R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Anode voltage	$V_a$	= max.	3000	V
Anode current	$I_a$	= max.	150	mA
Anode input power	$W_{ia}$	= max.	450	W
Anode dissipation	$W_a$	= max.	65	W
Grid No.2 voltage	$V_{g2}$	= max.	600	V
Grid No.2 dissipation	$W_{g2}$	= max.	10	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	250	k $\Omega$

OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Anode voltage	$V_a$	=	2500	2000	1500	V
Grid No.2 voltage	$V_{g2}$	=	405	450	480	V
Grid No.1 voltage <sup>1)</sup>	$V_{g1}$	=	-88	-100	-86	V
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0 165	0 190	0 150	V
Anode current	$I_a$	=	7 70	22 80	30 90	mA
Grid No.2 current	$I_{g2}$	=	- 2	- 2	- 3	mA
Grid No.1 current	$I_{g1}$	=	- 8	- 20	- 15	mA
Grid No.2 dissipation	$W_{g2}$	=	- 22.5	- 26	- 13.5	W
Grid No.1 input power	$W_{ig1}$	=	- 1.3	- 3.8	- 2.3	W
Anode input power	$W_{ia}$	=	42.5 175	44 160	45 135	W
Anode dissipation	$W_a$	=	42.5 60	44 60	45 60	W
Output power <sup>2)</sup>	$W_p$	=	0 87	0 77	0 58	W

<sup>1)</sup> To be adjusted for the stated zero signal anode current

<sup>2)</sup> Useful power in the load measured in a circuit having an efficiency of about 75 %.

**A.F. CLASS B AMPLIFIER AND MODULATOR**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	3000	V
Anode current	$I_a$	= max.	150	mA
Anode dissipation	$W_a$	= max.	65	W
Grid No.2 voltage	$V_{g2}$	= max.	600	V
Grid No.2 dissipation	$W_{g2}$	= max.	20	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V
Grid No.1 current	$I_{g1}$	= max.	20	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	250	k $\Omega$

**OPERATING CONDITIONS**, two tubes.  $I_{g1} = 0$

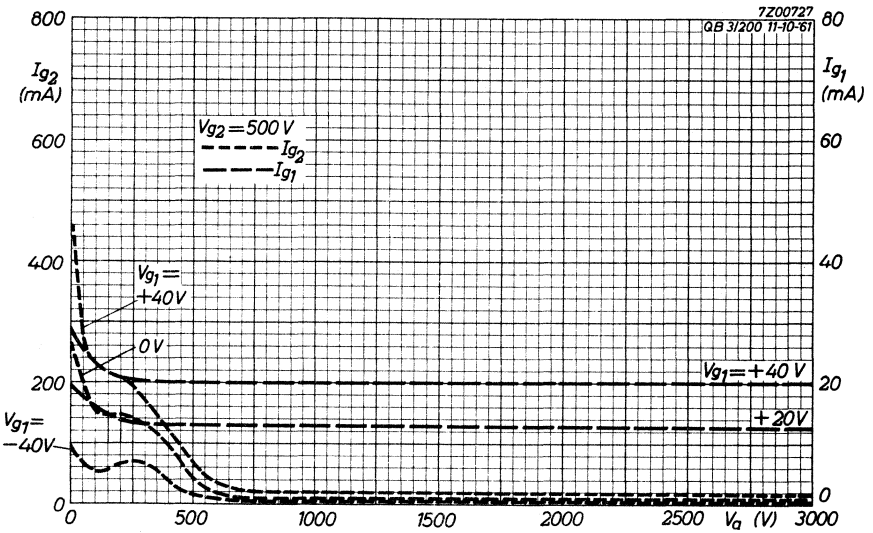
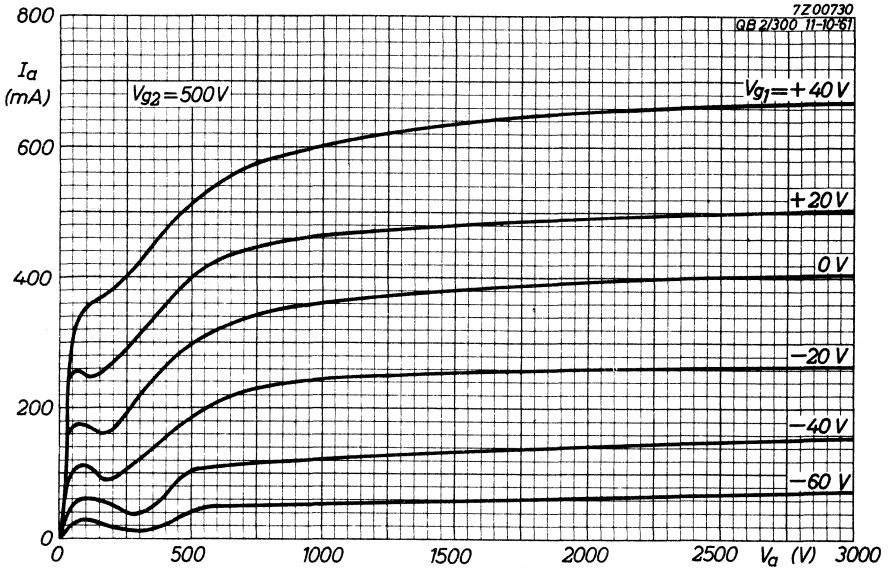
$V_a$	=	1750	1500	1000	V
$V_{g2}$	=	500	500	500	V
$V_{g1}$	=	-115	-110	-100	V
$R_{aa\sim}$	=	20	15	9	k $\Omega$
$V_{g1g1p}$	=	0    180	0    170	0    170	V
$I_a$	=	2x20    2x85	2x30    2x90	2x30    2x85	mA
$I_{g2}$	=	-    2x11.5	-    2x10	-    2x15	mA
$W_{g2}$	=	-    2x6	-    2x5	-    2x7.5	W
$W_{ia}$	=	2x35    2x150	2x45    2x135	2x30    2x85	W
$W_a$	=	2x35    2x62.5	2x45    2x62.5	2x30    2x45	W
$W_o$	=	0    175	0    145	0    80	W
$\eta$	=	-    59	-    54	-    47	%
$d_{tot}$	=	-    4.5	-    3	-    3	%

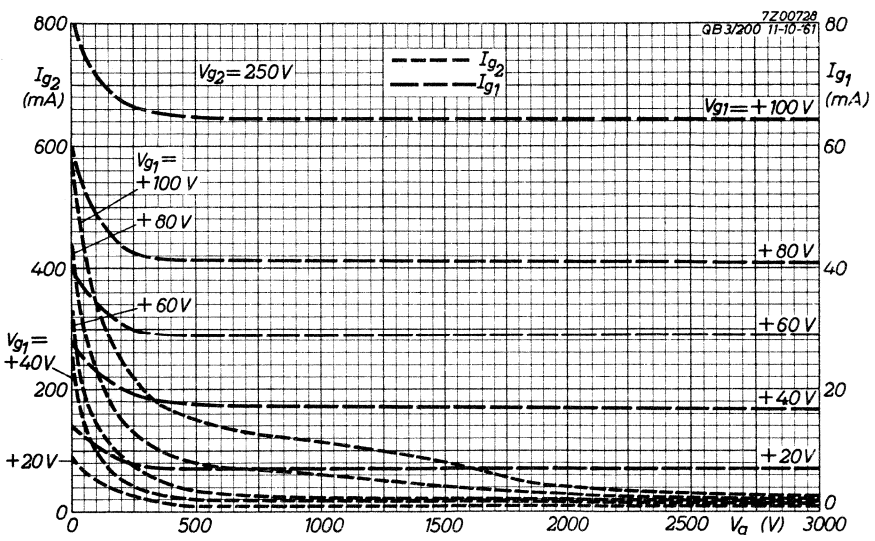
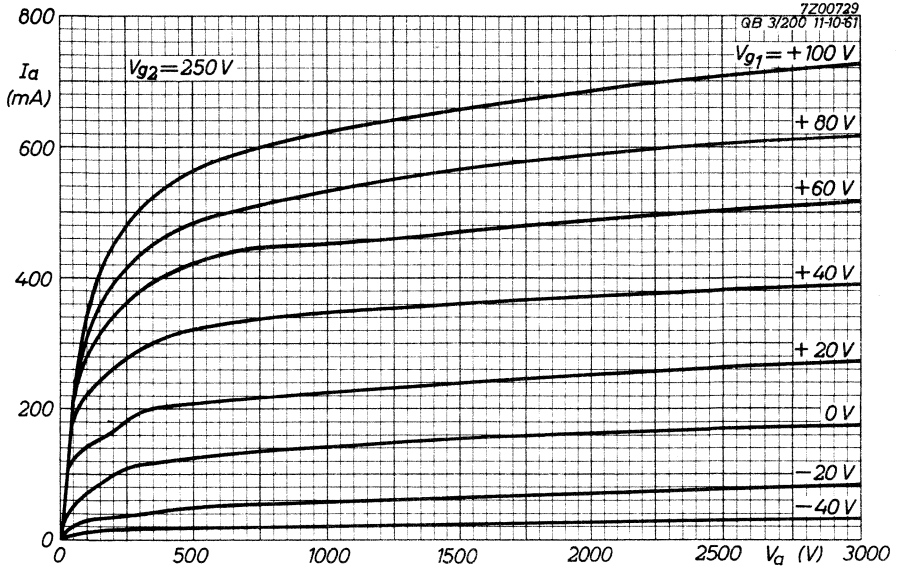
A.F. CLASS B AMPLIFIER AND MODULATOR (continued)

OPERATING CONDITIONS, two tubes.  $I_{g1} > 0$

Anode voltage	$V_a$	=	1800	1500	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-50	-45	V
Load resistance	$R_{aa\sim}$	=	20	14	k $\Omega$
Peak grid to grid voltage	$V_{g1g1p}$	=	0 180	0 200	V
Anode current	$I_a$	=	2x25 2x110	2x30 2x125	mA
Grid No.2 current	$I_{g2}$	=	- 2x15	- 2x20	mA
Grid No.1 current	$I_{g1}$	=	0 2x9	0 2x10	mA
Grid No.2 dissipation	$W_{g2}$	=	- 2x4	- 2x5	W
Grid No.1 input power	$W_{ig1}$	=	0 2x0.8	0 2x0.9	W
Anode input power	$W_{ia}$	=	2x45 2x198	2x45 2x188	W
Anode dissipation	$W_a$	=	2x45 2x63	2x45 2x63	W
Output power	$W_o$	=	0 270	0 250	W
Efficiency	$\eta$	=	- 68	- 67	%
Total harmonic distortion	$d_{tot}$	=	- 5	- 6	%

Anode voltage	$V_a$	=	1000	600	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-40	-40	V
Load resistance	$R_{aa\sim}$	=	6.8	3.6	k $\Omega$
Peak grid to grid voltage	$V_{g1g1p}$	=	0 210	0 240	V
Anode current	$I_a$	=	2x30 2x150	2x30 2x150	mA
Grid No.2 current	$I_{g2}$	=	- 2x30	- 2x40	mA
Grid No.1 current	$I_{g1}$	=	0 2x14	0 2x15	mA
Grid No.2 dissipation	$W_{g2}$	=	- 2x7.5	- 2x10	W
Grid No.1 input power	$W_{ig1}$	=	0 2x1.3	0 2x1.6	W
Anode input power	$W_{ia}$	=	2x30 2x150	2x18 2x90	W
Anode dissipation	$W_a$	=	2x30 2x65	2x18 2x45	W
Output power	$W_o$	=	0 170	0 90	W
Efficiency	$\eta$	=	- 57	- 50	%
Total harmonic distortion	$d_{tot}$	=	- 6	- 10	%







## R.F. POWER TETRODE

QUICK REFERENCE DATA									
$\lambda$	Freq.	C telegr.		B teleph.		C <sub>ag2</sub> mod.		B mod. <sup>1)</sup>	
(m)	(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
2.5	120	3000	375	3000	58	2500	300	2500	550
2.5	120	2500	375	2500	55	2000	225	2000	550
2.5	120	2000	275	2000	54	1500	157	1500	455
2.5	120	1500	110						
2	150	2500	360						
1.5	200	2000	225						

**HEATING** : direct; filament thoriated tungsten

Filament voltage  $V_f = 5 \text{ V}$

Filament current  $I_f = 6.5 \text{ A}$

**COOLING**: Radiation/low-velocity air flow

### CAPACITANCES

Anode to all other elements except grid No.1  $C_a = 3.5 \text{ pF}$

Grid No.1 to all other elements except anode  $C_{g1} = 10.8 \text{ pF}$

Anode to grid No.1  $C_{ag1} = 0.05 \text{ pF}$

### TYPICAL CHARACTERISTICS

Amplification factor of grid No.2  
with respect to grid No.1

$\mu_{g2g1} = 6.2$

Mutual conductance

$S(I_a = 40 \text{ mA}) = 2.2 \text{ mA/V}$

<sup>1)</sup> Two tubes;  $I_{g1} > 0$

**TEMPERATURE LIMITS** (Absolute limits)

Temperature of anode seal	= max.	220 °C
Temperature of pin seals	= max.	180 °C
Bulb temperature	= max.	350 °C

**COOLING**

In general cooling of the tube is not necessary at normal ambient temperature at frequencies below 50 MHz.

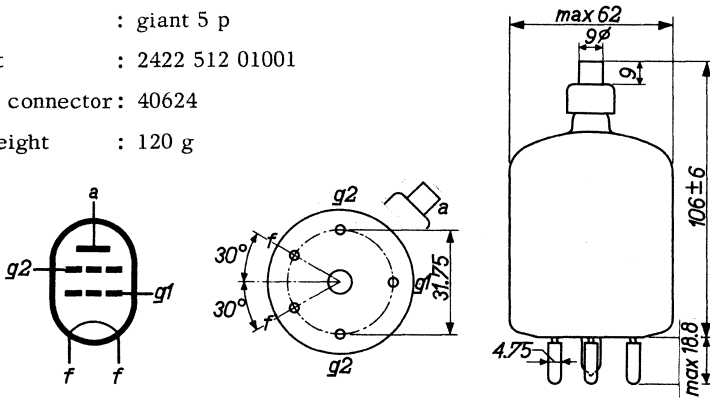
When the tube is used at or near maximum values at frequencies above 50 MHz , it will be necessary to direct a low-velocity air flow on the anode seal and the bottom of the envelope.

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

**MECHANICAL DATA**

- Base : giant 5 p
- Socket : 2422 512 01001
- Anode connector : 40624
- Net weight : 120 g

Dimensions in mm



Mounting position: vertical with base up or down



**R.F. CLASS C TELEGRAPHY**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 120	up to 170	up to 200	MHz
Anode voltage	$V_a$	= max. 3000	max. 2500	max. 2200	V
Anode input power	$W_{ia}$	= max. 625	max. 560	max. 435	W
Anode current	$I_a$	=	max. 225		mA
Anode dissipation	$W_a$	=	max. 125 <sup>1)</sup>		W
Grid No.2 voltage	$V_{g2}$	=	max. 400		V
Grid No.2 dissipation	$W_{g2}$	=	max. 20		W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 500		V
Grid No.1 current	$I_{g1}$	=	max. 15		mA

**OPERATING CONDITIONS**

Frequency	f	<120	<120	<120	<120	MHz
Anode voltage	$V_a$	= 3000	2500	2000	1500	V
Grid No.2 voltage	$V_{g2}$	= 350	350	350	350	V
Grid No.1 voltage	$V_{g1}$	= -150	-150	-100	-150	V
Anode current	$I_a$	= 167	200	200	110	mA
Grid No.2 current	$I_{g2}$	= 30	40	50	56	mA
Grid No.1 current	$I_{g1}$	= 6.5	9	9	8	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	= 300	330	260	225	V
Grid No.1 input power	$W_{ig1}$	= 2	3	2.4	1.7	W
Grid No.2 dissipation	$W_{g2}$	= 10.5	14	17.5	19.6	W
Anode input power	$W_{ia}$	= 500	500	400	165	W
Anode dissipation	$W_a$	= 125	125	125	55	W
Output power	$W_o$	= 375	375	275	110	W
Efficiency	$\eta$	= 75	75	69	67	%

<sup>1)</sup> Anode red hot, temperature = 850 °C

**R.F. CLASS B TELEPHONY**
**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 120	up to 170	up to 200	MHz
Anode voltage	$V_a$	= max. 3000	max. 2500	max. 2200	V
Anode input power	$W_{ia}$	= max. 200	max. 190	max. 150	W
Anode current	$I_a$	=	max. 135		mA
Anode dissipation	$W_a$	=	max. 125 <sup>1)</sup>		W
Grid No.2 voltage	$V_{g2}$	=	max. 400		V
Grid No.2 dissipation	$W_{g2}$	=	max. 14		W

**OPERATING CONDITIONS**

Frequency	f	<120	<120	<120	MHz
Anode voltage	$V_a$	= 3000	2500	2000	V
Grid No.2 voltage	$V_{g2}$	= 350	350	350	V
Grid No.1 voltage	$V_{g1}$	= -50	-50	-50	V
Anode current	$I_a$	= 60	70	83	mA
Grid No.2 current	$I_{g2}$	= 1	1	1.5	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	= 50	55	65	V
Grid No.2 dissipation	$W_{g2}$	= 0.35	0.35	0.52	W
Anode input power	$W_{ia}$	= 180	175	166	W
Anode dissipation	$W_a$	= 122	120	112	W
Output power	$W_o$	= 58	55	54	W
Efficiency	$\eta$	= 32	31.5	32.5	%
-----					
Modulation factor	m	= 100	100	100	%
Grid No.1 current	$I_{g1}$	= 4.5	4	4	mA
Grid No.1 input power	$W_{ig1}$	= 0.45	0.44	0.52	W

<sup>1)</sup> Anode red hot, temperature = 850 °C

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 120	up to 170	up to 200	MHz
Anode voltage	$V_a$	= max. 2500	max. 2100	max. 1800	V
Anode input power	$W_{ia}$	= max. 415	max. 375	max. 290	W
Anode current	$I_a$	=	max. 200		mA
Anode dissipation	$W_a$	=	max. 83		W
Grid No.2 voltage	$V_{g2}$	=	max. 400		V
Grid No.2 dissipation	$W_{g2}$	=	max. 20		W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 500		V
Grid No.1 current	$I_{g1}$	=	max. 15		mA

**OPERATING CONDITIONS**

Frequency	f	<120	<120	<120	MHz
Anode voltage	$V_a$	= 2500	2000	1500	V
Grid No.2 voltage	$V_{g2}$	= 350	350	300	V
Grid No.1 voltage	$V_{g1}$	= -210	-220	-150	V
Anode current	$I_a$	= 152	150	160	mA
Grid No.2 current	$I_{g2}$	= 30	33	33	mA
Grid No.1 current	$I_{g1}$	= 4.5	5	10	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	= 380	390	250	V
Grid No.1 input power	$W_{ig1}$	= 1.7	2	2.5	W
Grid No.2 dissipation	$W_{g2}$	= 10.5	11.5	10	W
Anode input power	$W_{ia}$	= 380	300	240	W
Anode dissipation	$W_a$	= 80	75	83	W
Output power	$W_o$	= 300	225	157	W
Efficiency	$\eta$	= 79	75	65	%
Modulation factor	m	= 100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g2p}$	= 300	300	255	V
Modulation power	$W_{mod}$	= 190	150	120	W

**A.F. CLASS B AMPLIFIER AND MODULATOR.  $I_{g1} = 0$**

**LIMITING VALUES (Absolute limits)**

Anode voltage	$V_a$	= max.	3000	V
Anode current	$I_a$	= max.	225	mA
Anode dissipation	$W_a$	= max.	125	W <sup>1)</sup>
Grid No. 2 voltage	$V_{g2}$	= max.	600	V
Grid No. 2 dissipation	$W_{g2}$	= max.	20	W
Negative grid No. 1 voltage	$-V_{g1}$	= max.	500	V
Grid No. 1 circuit resistance	$R_{g1}$	= max.	150	k $\Omega$

**OPERATING CONDITIONS , two tubes**

$V_a$	=	2500	2000	1500	V			
$V_{g1}$	=	-97	-95.5	-94	V			
$V_{g2}$	=	600	600	600	V			
$R_{aa\sim}$	=	25	17.6	12	k $\Omega$			
$V_{g1g1p}$	=	0	190	0	185	V		
$I_a$	=	2x30	2x108	2x30	2x111	2x30	2x109	mA
$I_{g2}$	=	2x0.1	2x13	2x0.1	2x12	2x0.15	2x13.5	mA
$W_{g2}$	=	2x0.1	2x7.8	2x0.1	2x7.2	2x0.1	2x8.1	W
$W_{ia}$	=	2x75	2x270	2x60	2x222	2x45	2x163	W
$W_a$	=	2x75	2x97.5	2x60	2x92	2x45	2x78	W
$W_o$	=	0	345	0	260	0	170	W
$\eta$	=	-	64	-	58.5	-	52	%
$d_{tot}$	=	-	4.0	-	3.6	-	3.5	%

<sup>1)</sup> Anode red hot, temperature = 850 °C

**A.F. CLASS B AMPLIFIER AND MODULATOR.  $I_{g1} > 0$**

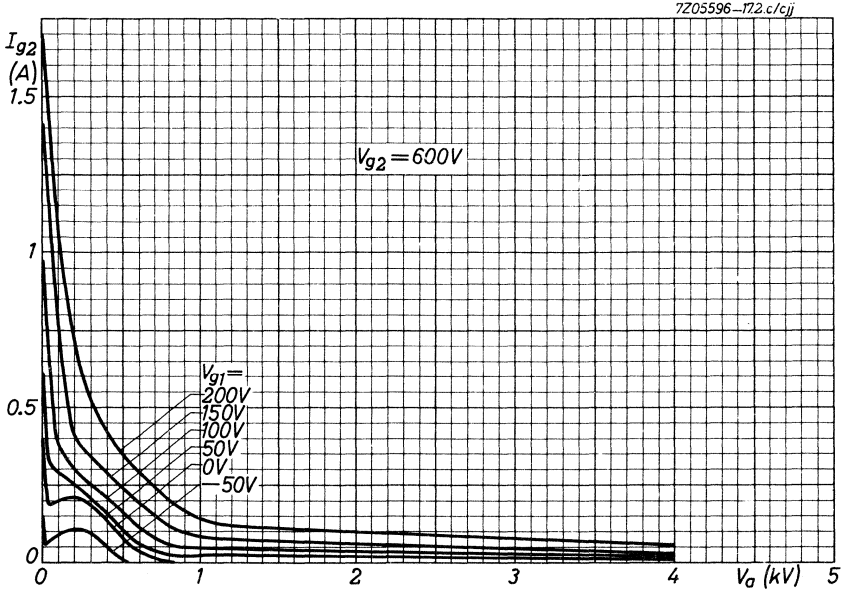
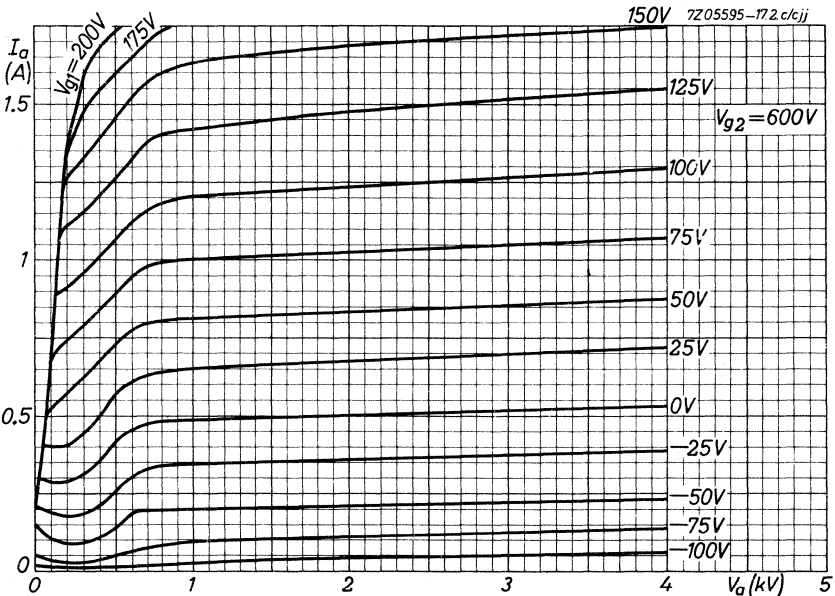
**LIMITING VALUES (Absolute limits)**

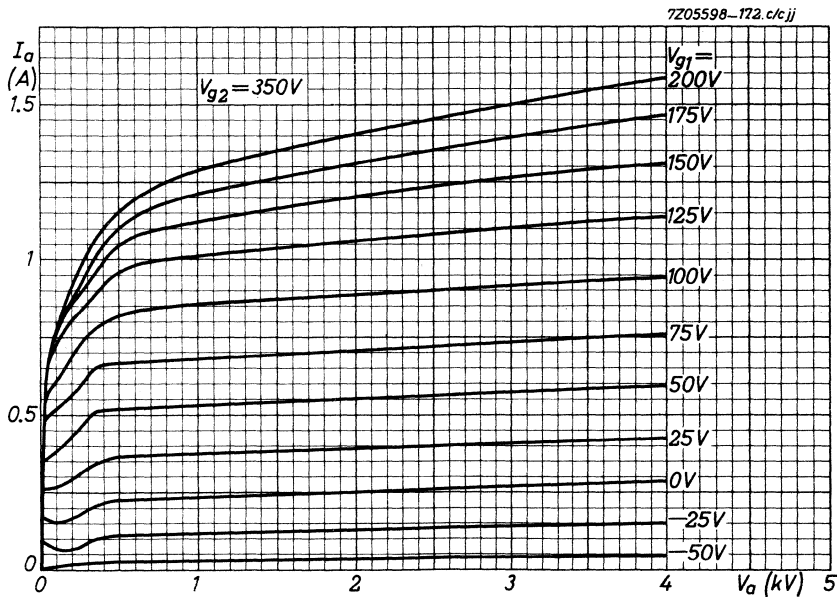
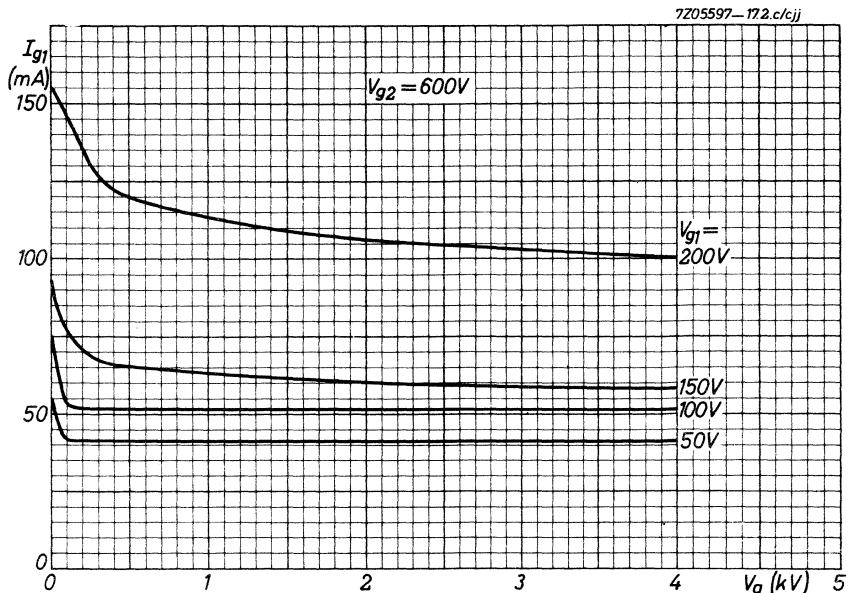
Anode voltage	$V_a$	= max.	3000	V
Anode current	$I_a$	= max.	225	mA
Anode dissipation	$W_a$	= max.	125	W <sup>1)</sup>
Grid No. 2 voltage	$V_{g2}$	= max.	400	V
Grid No. 2 dissipation	$W_{g2}$	= max.	20	W
Negative grid No. 1 voltage	$-V_{g1}$	= max.	500	V

**OPERATING CONDITIONS , two tubes**

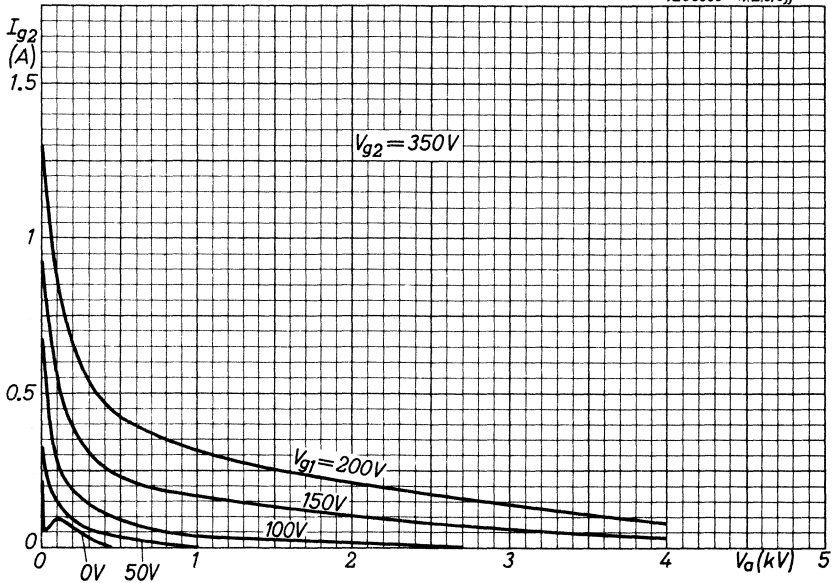
$V_a$	=	2500	2000	1500	V
$V_{g1}$	=	-51	-50	-48	V
$V_{g2}$	=	350	350	350	V
$R_{aa\sim}$	=	20	12	7.2	k $\Omega$
$V_{g1g1p}$	=	0    240	0    296	0    330	V
$I_a$	=	2x30    2x151	2x30    2x197.5	2x30    2x227.5	mA
$I_{g1}$	=	0    2x8.5	0    2x12	0    2x16	mA
$I_{g2}$	=	2x0.1    2x18	2x0.15    2x32	2x0.25    2x42	mA
$W_{ig1}$	=	0    2x0.9	0    2x1.6	0    2x2.4	W
$W_{g2}$	=	0    2x6.3	2x0.1    2x11.2	2x0.1    2x15	W
$W_{ia}$	=	2x75    2x377.5	2x60    2x395	2x45    2x341.5	W
$W_a$	=	2x75    2x102.5	2x60    2x120	2x45    2x114	W
$W_o$	=	0    550	0    550	0    455	W
$\eta$	=	-    72.5	-    69.5	-    66.5	%
$d_{tot}$	=	-    5	-    5	-    5	%

<sup>1)</sup> Anode red hot, temperature = 850 °C

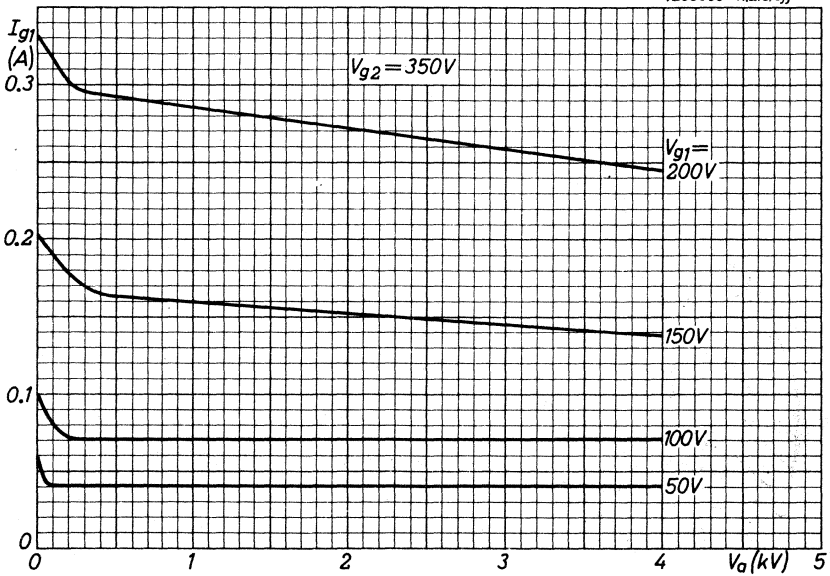




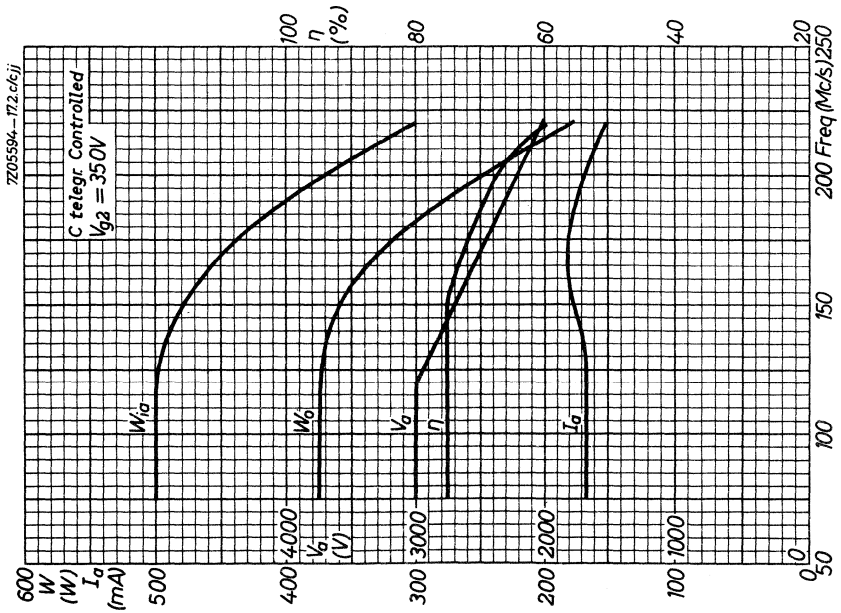
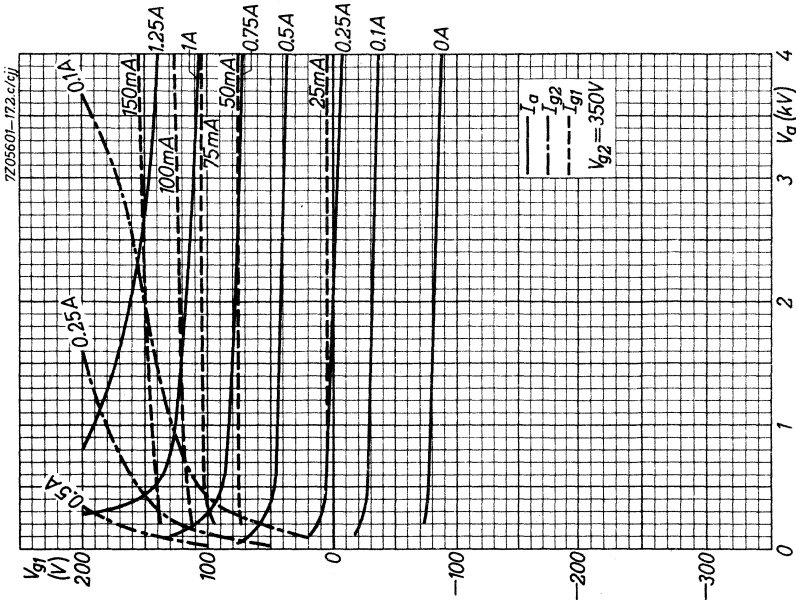
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7205600-172.c/cjj







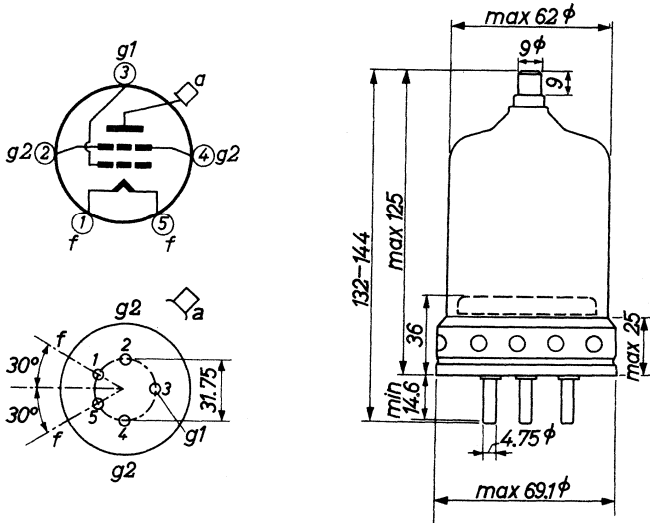
### R.F. POWER TETRODE

#### MECHANICAL DATA

Base : Metal-shell Giant 5p

Dimensions in mm

Socket: 2422 512 01001



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For further data and curves of this type  
please refer to type QB3/300  
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## R.F. POWER TETRODE

QUICK REFERENCE DATA									
$\lambda$	Freq.	C telegr.		B teleph.		C <sub>ag2</sub> mod.		B mod. <sup>1)</sup>	
(m)	(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
> 4	< 75	4000	1000	4000	126	3000	510	3000	1240
		3000	800	3000	125	2500	375	2500	1140
		2500	575	2500	125			2000	974
2.5	120	2500	500					1500	660

**HEATING:** direct; filament thoriated tungsten

Filament voltage  $V_f = 5$  V

Filament current  $I_f = 14.1$  A

**COOLING:** radiation/low-velocity air flow

### CAPACITANCES

Anode to all other elements except grid No.1  $C_a = 4.5$  pF

Grid No.1 to all other elements except anode  $C_{g1} = 12.7$  pF

Anode to grid No.1  $C_{ag1} = 0.12$  pF

### TYPICAL CHARACTERISTICS

Amplification factor of grid No.2  
with respect to grid No.1

$\mu_{g2g1} = 5.1$

Mutual conductance

$S (I_a = 100 \text{ mA}) = 4 \text{ mA/V}$

<sup>1)</sup> Two tubes

**TEMPERATURE LIMITS** (Absolute limits)

Temperature of anode seal	= max. 220 °C
Temperature of pin seals	= max. 180 °C
Bulb temperature	= max. 350 °C

**COOLING**

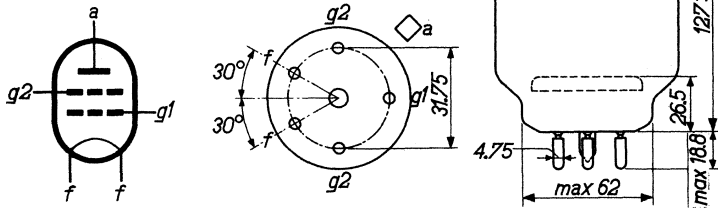
In order to keep the temperatures below the maximum permitted values a low-velocity air flow has to be directed to the anode seal and the bottom of the envelope

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

**MECHANICAL DATA**

Dimensions in mm

- Base : Giant 5p
- Socket : 2422 512 01001
- Anode connector : 40624
- Net weight : 185 g



Mounting position: vertical with base up or down

**R.F. CLASS C TELEGRAPHY**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 75	up to 100	up to 120	MHz
Anode voltage	$V_a$	= max. 4000	max. 3300	max. 2500	V
Anode input power	$W_{ia}$	= max. 1250	max. 1000	max. 750	W
Anode dissipation	$W_a$	=	max. 250		W
Anode current	$I_a$	=	max. 350		mA
Grid No. 2 voltage	$V_{g2}$	=	max. 600		V
Grid No. 2 dissipation	$W_{g2}$	=	max. 35		W
Negative grid No. 1 voltage	$-V_{g1}$	=	max. 500		V
Grid No. 1 current	$I_{g1}$	=	max. 20		mA

**OPERATING CONDITIONS**

Frequency	f	=	75	75	75	MHz
Anode voltage	$V_a$	=	4000	3000	2500	V
Grid No. 2 voltage	$V_{g2}$	=	500	500	500	V
Grid No. 1 voltage	$V_{g1}$	=	-225	-180	-150	V
Anode current	$I_a$	=	312	345	300	mA
Grid No. 2 current	$I_{g2}$	=	45	60	60	mA
Grid No. 1 current	$I_{g1}$	=	9	10	9	mA
Peak grid No. 1 A.C. voltage	$V_{g1p}$	=	303	265	220	V
Grid No. 1 input power	$W_{ig1}$	=	2.5	2.4	1.8	W
Grid No. 2 dissipation	$W_{g2}$	=	22.5	30	30	W
Anode input power	$W_{ia}$	=	1248	1035	750	W
Anode dissipation	$W_a$	=	248	235	175	W
Output power	$W_o$	=	1000	800	575	W
Efficiency	$\eta$	=	80	77	77	%

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**R.F. CLASS B TELEPHONY**

**LIMITING VALUES (Absolute limits)**

Frequency	f	up to 75	up to 100	up to 120	MHz
Anode voltage	$V_a$	= max. 4000	max. 3300	max. 2500	V
Anode input power	$W_{ia}$	= max. 400	max. 320	max. 240	W
Anode dissipation	$W_a$	=	max. 250		W
Anode current	$I_a$	=	max. 250		mA
Grid No.2 voltage	$V_{g2}$	=	max. 600		V
Grid No.2 dissipation	$W_{g2}$	=	max. 23		W

**OPERATING CONDITIONS**

Frequency	f	=	75	75	75	MHz
Anode voltage	$V_a$	=	4000	3000	2500	V
Grid No.2 voltage	$V_{g2}$	=	500	500	500	V
Grid No.1 voltage	$V_{g1}$	=	-100	-90	-84	V
Anode current	$I_a$	=	94	125	150	mA
Grid No.2 current	$I_{g2}$	=	0	0	0	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	55.5	61	66	V
Anode input power	$W_{ia}$	=	376	375	375	W
Anode dissipation	$W_a$	=	250	250	250	W
Output power	$W_o$	=	126	125	125	W
Efficiency	$\eta$	=	33.5	33	33	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	$I_{g1}$	=	0.5	2	5.5	mA
Grid No.1 input power	$W_{ig1}$	=	0.06	0.25	0.75	W
Grid No.2 dissipation	$W_{g2}$	=	4	3.8	6	W

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 75	up to 100	up to 120	MHz
Anode voltage	$V_a$	= max. 3200	max. 2600	max. 2000	V
Anode input power	$W_{ia}$	= max. 825	max. 660	max. 500	W
Anode dissipation	$W_a$	=	max. 165		W
Anode current	$I_a$	=	max. 275		mA
Grid No.2 voltage	$V_{g2}$	=	max. 600		V
Grid No.2 dissipation	$W_{g2}$	=	max. 35		W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 500		V
Grid No.1 current	$I_{g1}$	=	max. 20		mA

**OPERATING CONDITIONS**

Frequency	f	=	75	75	MHz
Anode voltage	$V_a$	=	3000	2500	V
Grid No.2 voltage	$V_{g2}$	=	400	400	V
Grid No.1 voltage	$V_{g1}$	=	-310	-200	V
Anode current	$I_a$	=	225	200	mA
Grid No.2 current	$I_{g2}$	=	30	30	mA
Grid No.1 current	$I_{g1}$	=	9	9	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	400	280	V
Grid No.1 input power	$W_{ig1}$	=	3.3	2.3	W
Grid No.2 dissipation	$W_{g2}$	=	12	12	W
Anode input power	$W_{ia}$	=	675	500	W
Anode dissipation	$W_a$	=	165	125	W
Output power	$W_o$	=	510	375	W
Efficiency	$\eta$	=	75.5	75	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g2p}$	=	350	350	V
Modulation power	$W_{mod}$	=	344	256	W

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**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES (Absolute limits)**

Frequency	f	up to	30	MHz
Anode voltage	$V_a$	= max.	4	kV
Anode current	$I_a$	= max.	350	mA
Anode input power	$W_{ia}$	= max.	1250	W
Peak anode dissipation	$W_{ap}$	= max.	275	W <sup>1)</sup>
Anode dissipation (Averaging time)	$W_a$ $T_{av}$	= max.	250	W 5 sec)
Grid No.2 voltage	$V_{g2}$	= max.	600	V
Grid No.2 dissipation	$W_{g2}$	= max.	35	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	250	k $\Omega$

**OPERATING CONDITIONS**

f	=	30	30	30	30	30	30	MHz
$V_a$	=	4	3.5	4	3.5	3	2.5	kV
$V_{g1}$	=	-105	-110	-105	-98	-94	-91	V
$V_{g2}$	=	550	600	500	500	500	500	V
$V_{g1p}$	=	0 105	0 110	0 105	0 98	0 94	0 91	V
$I_a$	=	50 182	50 207	50 164	50 164	50 164	50 164	mA
$I_{g1}$	=	0 0	0 0	0 0	0 0	0 0	0 0	mA
$I_{g2}$	=	0 9	0 12	0 8	0 9	0 10	0 10.5	mA
$W_{ig1}$	=	0 0	0 0	0 0	0 0	0 0	0 0	W
$W_{g2}$	=	0 5	0 7.2	0 4	0 4.5	0 5	0 5.3	W
$W_{ia}$	=	200 730	175 725	200 660	175 575	150 490	125 410	W
$W_a$	=	200 220	175 235	200 200	175 175	150 157	125 140	W
$W_o$	=	- 510	- 490	- 460	- 400	- 333	- 270	W
$\eta$	=	- 69	- 67	- 70	- 69	- 68	- 66	%

<sup>1)</sup> Max. value during a modulation cycle.



**A.F. CLASS B AMPLIFIER OR MODULATOR**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	4	kV
Anode dissipation	$W_a$	= max.	250	W
Anode current	$I_a$	= max.	350	mA
Grid No.2 voltage	$V_{g_2}$	= max.	600 <sup>1)</sup>	V
Grid No.2 dissipation	$W_{g_2}$	= max.	35	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	500	V
Grid No.1 current	$I_{g_1}$	= max.	30	mA
Grid No.1 circuit resistance	$R_{g_1}$	= max.	250	k $\Omega$

**OPERATING CONDITIONS**, two tubes.  $I_{g_1} > 0$

$V_a$	=	3000	2500	2000	1500	V
$V_{g_2}$	=	300	300	300	300	V
$V_{g_1}$	=	-55	-51	-49	-45	V
$R_{aa_{\omega}}$	=	14	9.2	6.6	4.55	k $\Omega$
$V_{g_1 g_1 p}$	=	0 280	0 306	0 328	0 323	V
$I_a$	=	2x50 2x275	2x50 2x312	2x50 2x347	2x50 2x347	mA
$I_{g_2}$	=	0 2x34.5	0 2x44	0 2x55	0 2x58	mA
$I_{g_1}$	=	0 2x15	0 2x21	0 2x27	0 2x28	mA
$W_{ig_1}$	=	0 2x1.9	0 2x2.9	0 2x4	0 2x4	W
$W_{g_2}$	=	0 2x10.5	0 2x13	0 2x16.5	0 2x17.5	W
$W_{ia}$	=	2x150 2x825	2x125 2x780	2x100 2x694	2x75 2x520	W
$W_a$	=	2x150 2x205	2x125 2x210	2x100 2x207	2x75 2x190	W
$W_o$	=	0 1240	0 1140	0 974	0 660	W
$d_{tot}$	=	- 5	- 5	- 5	- 5	%
$\eta$	=	- 75	- 73	- 70	- 63.5	%

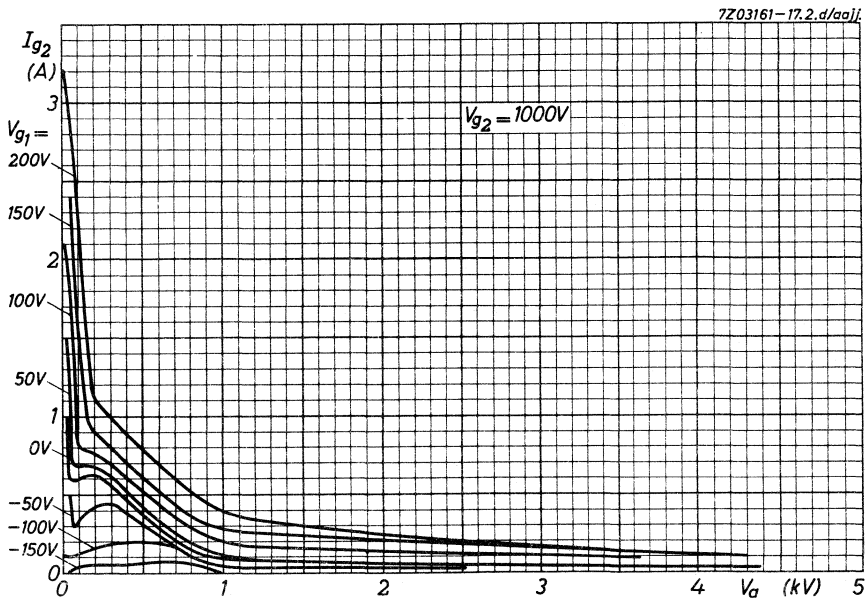
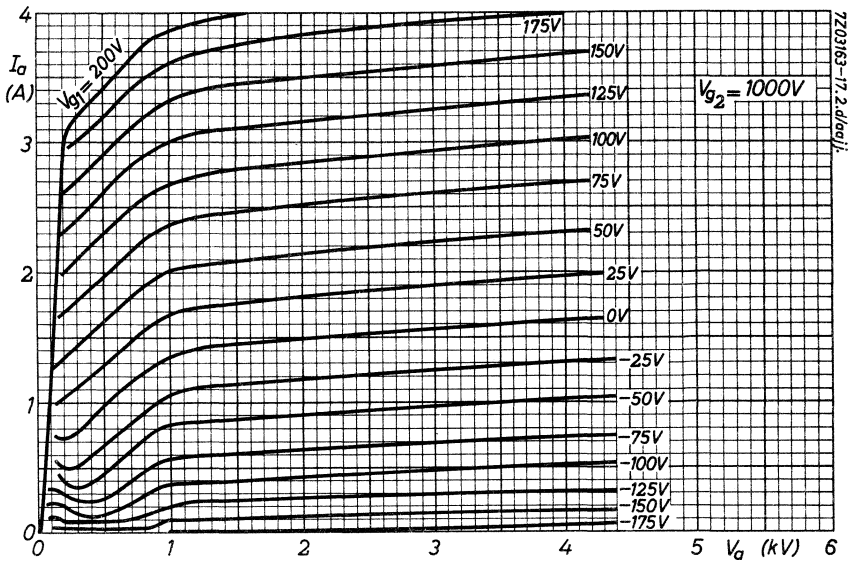
<sup>1)</sup>  $V_{g_2}$  = max. 1000 V, when the temperature of the pin seals is max. 120 °C  
7Z2 2785

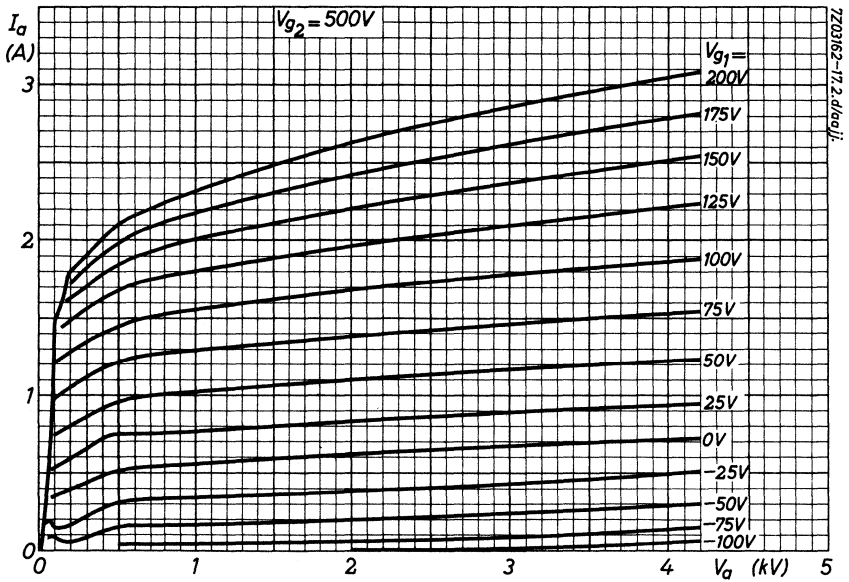
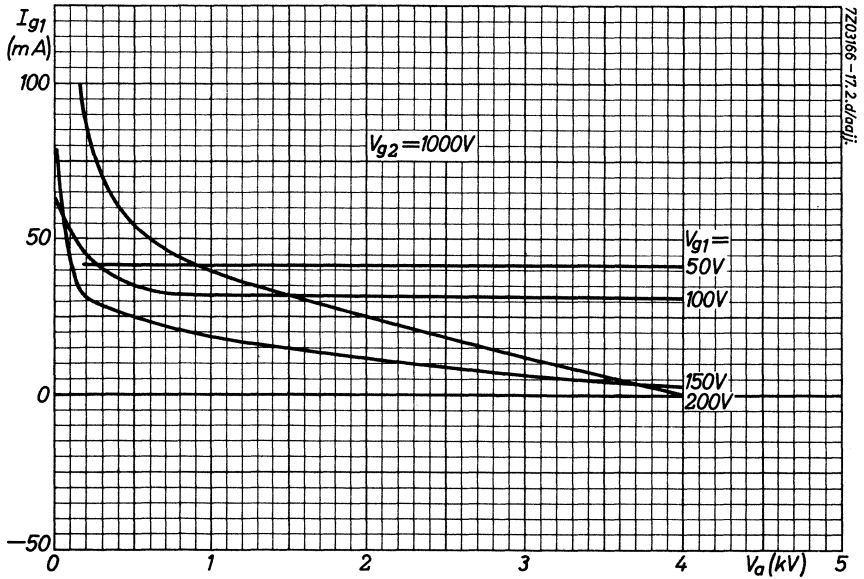
**A.F. CLASS B AMPLIFIER OR MODULATOR**

**LIMITING VALUES.** See page 7.

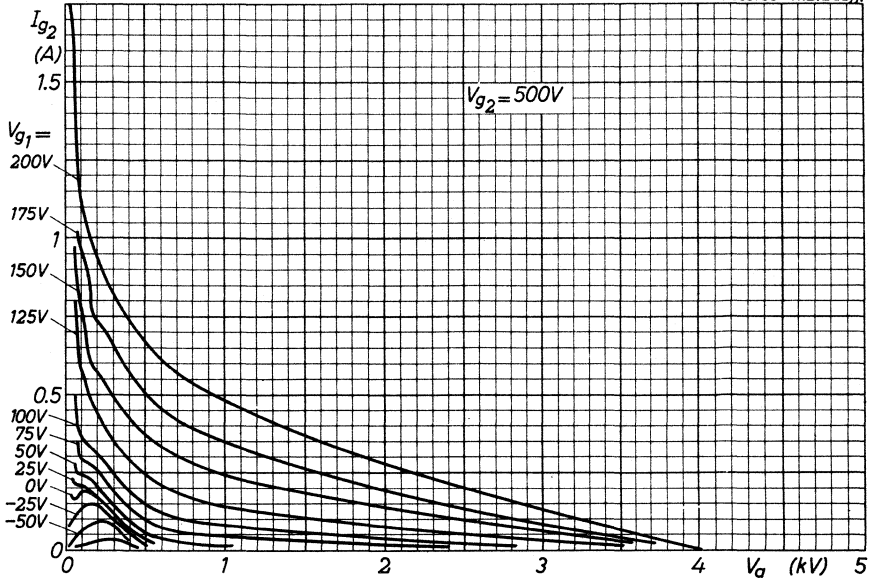
**OPERATING CONDITIONS,** two tubes.  $I_{g_1} = 0$

$V_a$	=	3000	2500	2000	1500	V
$V_{g_2}$	=	500	500	500	500	V
$V_{g_1}$	=	-94	-91	-88	-85	V
$R_{aa\sim}$	=	22	18	14.5	10	k $\Omega$
$V_{g_1g_1p}$	=	0 184	0 178	0 173	0 167	V
$I_a$	=	2x50 2x155	2x50 2x155	2x50 2x150	2x50 2x150	mA
$I_{g_2}$	=	0 2x10	0 2x10.5	0 2x14.5	0 2x15.5	mA
$W_{g_2}$	=	0 2x5	0 2x5.3	0 2x7.3	0 2x7.8	W
$W_{ia}$	=	2x150 2x465	2x125 2x387	2x100 2x300	2x75 2x225	W
$W_a$	=	2x150 2x147	2x125 2x132	2x100 2x105	2x75 2x91	W
$W_o$	=	0 635	0 510	0 390	0 268	W
$d_{tot}$	=	- 2.8	- 2.6	- 3.2	- 3	%
$\eta$	=	- 68	- 66	- 65	- 60	%

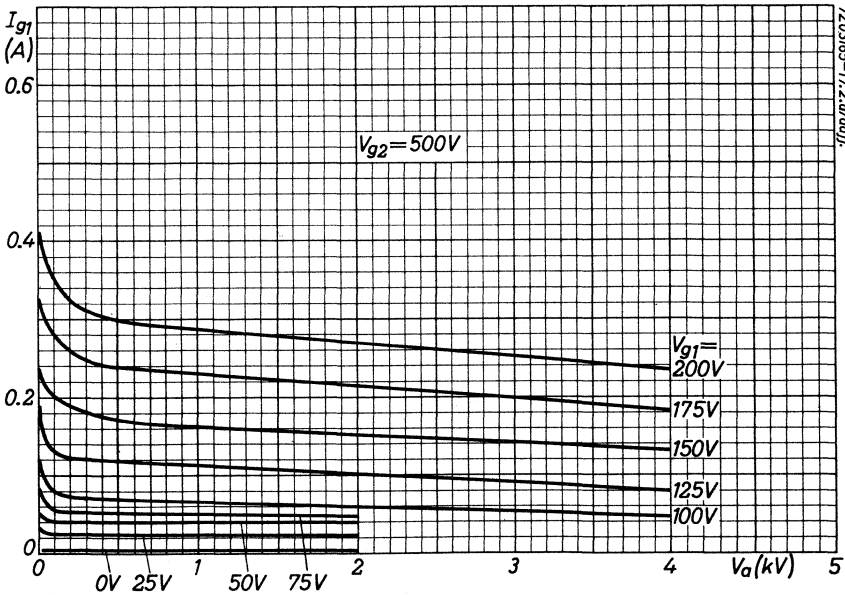




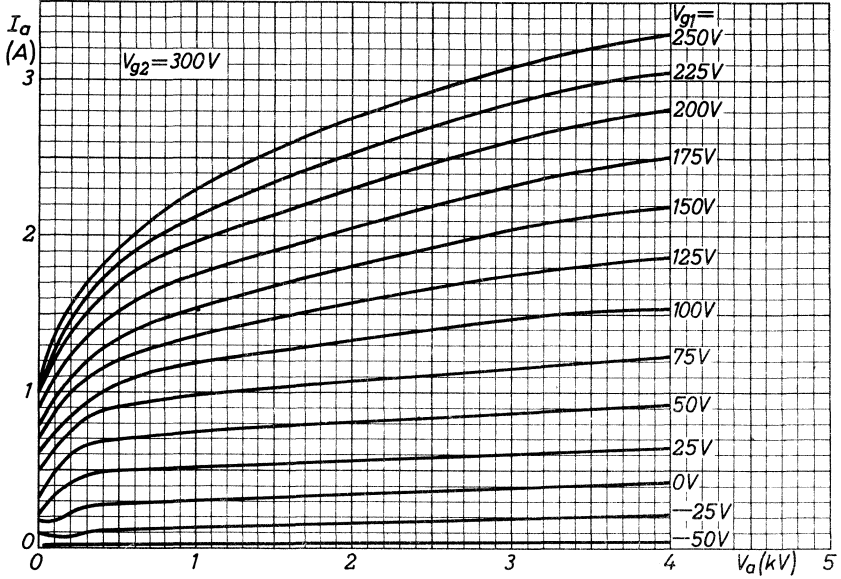
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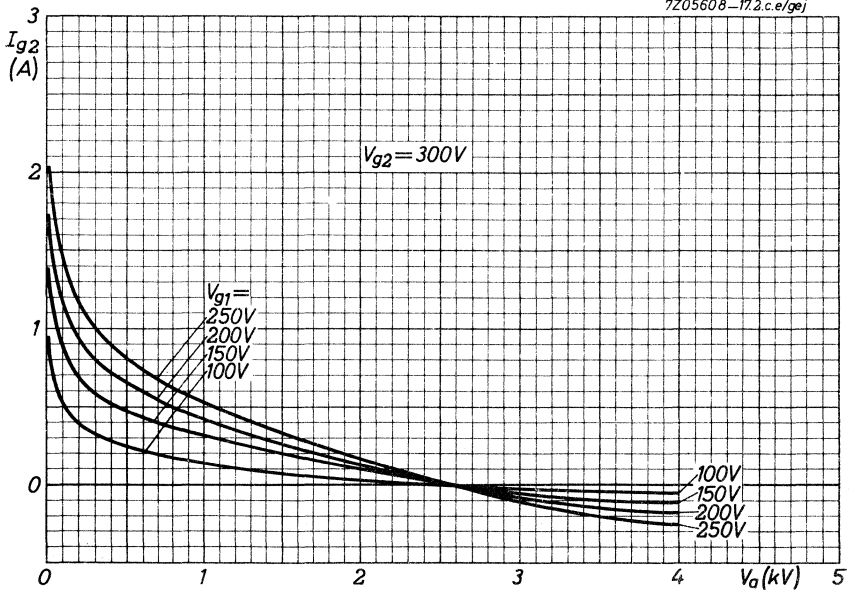
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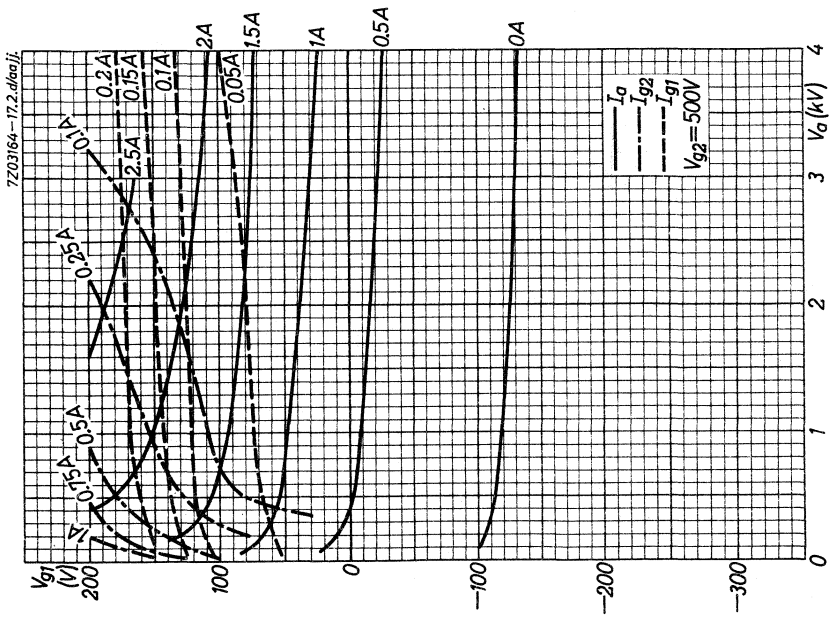
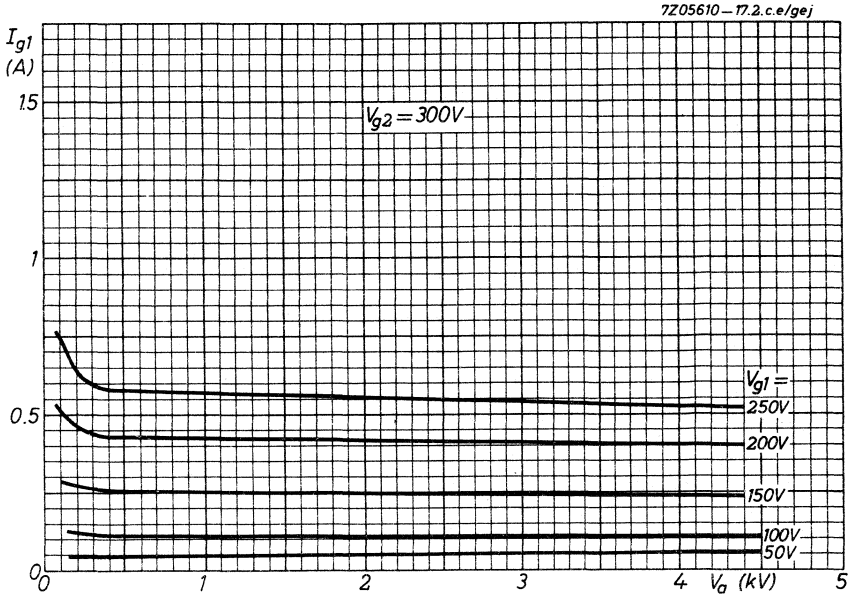


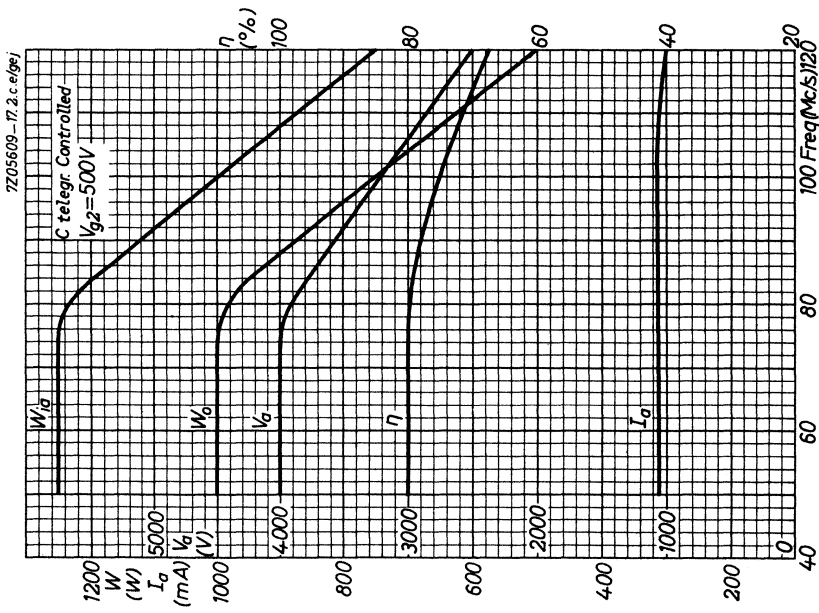
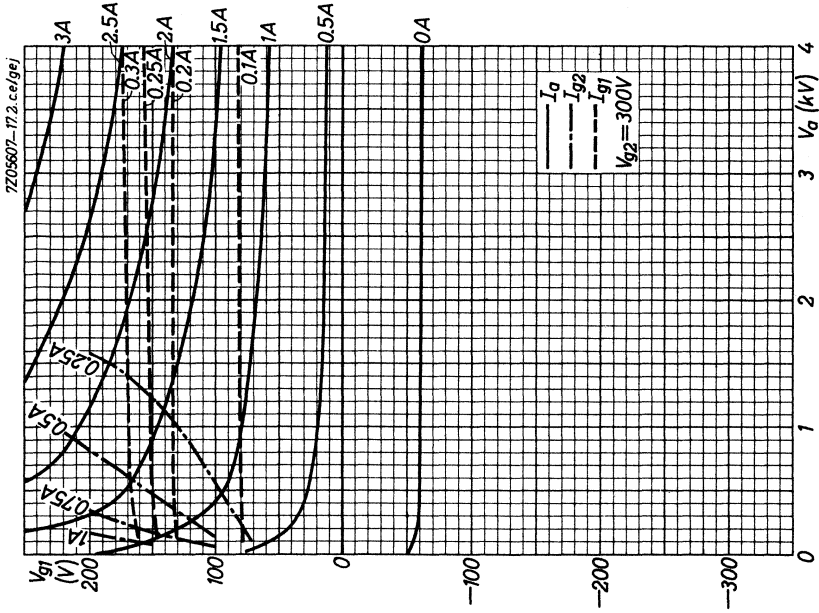
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7Z05608-17.2.c.e/gej









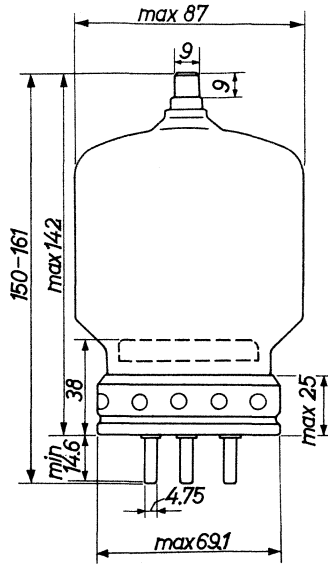
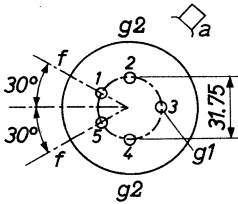
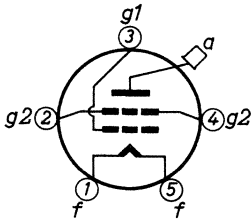
## R.F. POWER TETRODE

### MECHANICAL DATA

Dimensions in mm

Base : Metal-shell Giant 5p

Socket: 2422 512 01001



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 For further data and curves of this type  
 please refer to type QB3.5/750  
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## R.F. POWER TETRODE

QUICK REFERENCE DATA									
Freq. (MHz)	C teleg. .		C <sub>ag2</sub> mod.		B S.S.B.		B A.F.		
	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W) <sup>2)</sup>	
								I <sub>g1</sub> > 0	I <sub>g1</sub> = 0
30			3650	765 <sup>1)</sup>					
75	4000	1100	3000	630			4000	1750	1540
	3000	800	2500	510			3500	1650	1330
	2500	640	2000	380			3000	1375	1110
100	4000	800					2500	1110	850
	3500	650							
110					4000	650			
					3500	600			
					3000	500			

**HEATING:** direct; thoriated tungsten filament

Filament voltage

V<sub>f</sub> = 5 V

Filament current

I<sub>f</sub> = 14.1 A

### CAPACITANCES

Grid No.1 to all other elements except anode

C<sub>g1</sub> = 12.7 pF

Anode to all other elements except grid No.1

C<sub>a</sub> = 4.9 pF

Anode to grid No.1

C<sub>ag1</sub> = 0.12 pF

### TYPICAL CHARACTERISTICS

Anode voltage

V<sub>a</sub> = 2500 V

Grid No.2 voltage

V<sub>g2</sub> = 500 V

Anode current

I<sub>a</sub> = 100 mA

Mutual conductance

S = 4.0 mA/V

Amplification factor of grid No.2  
with respect to grid No.1

μ<sub>g2g1</sub> = 5.1

1) Intermittent service, ICAS

2) Two tubes

**COOLING:** radiation and forced air

At anode dissipations up to 250 W a low velocity air flow directed on the anode seal and the base generally will provide sufficient cooling. At higher dissipations the glass chimney should be used for circulating forced air along the bulb. At 400 W anode dissipation at least 0.4 m<sup>3</sup>/min air should be passed through the chimney. For this purpose the static pressure below the chassis should be min. 5 mm water pressure if cooling is arranged in the recommended way (see figure below).

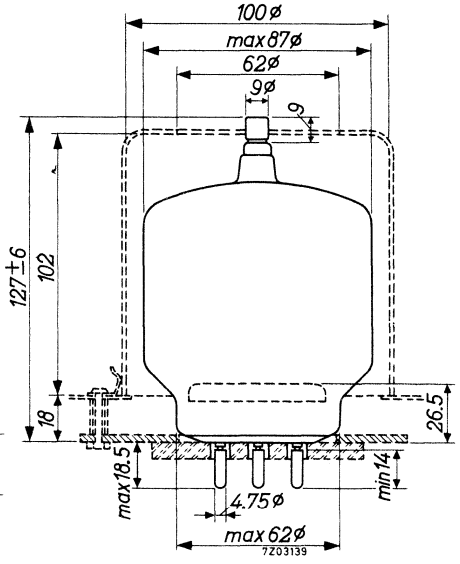
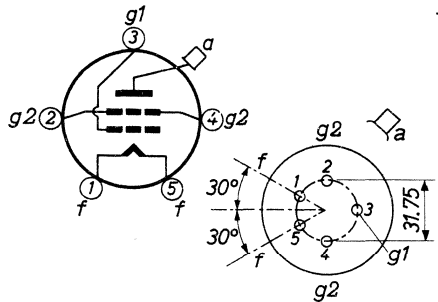
**TEMPERATURE LIMITS** (Absolute limits)

Bulb temperature	= max. 350 °C
Temperature of anode seal	= max. 220 °C
Temperature of pin seals	= max. 180 °C

**MECHANICAL DATA**

- Base : Giant 5p.
- Socket : 2422 512 01001
- Anode connector: 40624
- Chimney : 40666
- Net weight : 190 g

Dimensions in mm



Mounting position: vertical with base up or down

**R.F. CLASS C TELEGRAPHY**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	110	MHz
Anode voltage	$V_a$	= max.	4000	V
Anode input power	$W_{ia}$	= max.	1400	W
Anode dissipation	$W_a$	= max.	400	W
Anode current	$I_a$	= max.	350	mA
Grid No.2 voltage	$V_{g2}$	= max.	600	V
Grid No.2 dissipation	$W_{g2}$	= max.	35	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V
Grid No.1 current	$I_{g1}$	= max.	25	mA

**OPERATING CONDITIONS**

Frequency	f	=	75	75	75	100	100	MHz
Anode voltage	$V_a$	=	4000	3000	2500	4000	3500	V
Grid No.2 voltage	$V_{g2}$	=	500	500	500	500	500	V
Grid No.1 voltage	$V_{g1}$	=	-220	-220	-200	-170	-170	V
Anode current	$I_a$	=	350	350	350	270	250	mA
Grid No.2 current	$I_{g2}$	=	25	30	35	16	17	mA
Grid No.1 current	$I_{g1}$	=	6	6	6.5	9.5	9	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	305	305	290	240	235	V
Grid No.1 input power	$W_{ig1}$	=	1.8	1.8	1.8	2	1.8	W
Grid No.2 dissipation	$W_{g2}$	=	12.5	15	17.5	8	8.5	W
Anode input power	$W_{ia}$	=	1400	1050	875	1080	875	W
Anode dissipation	$W_a$	=	300	250	235	280	225	W
Output power	$W_o$	=	1100	800	640	800	650	W
Efficiency	$\eta$	=	78.5	76	73	74	74	%



**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

CCS = continuous service

ICAS = intermittent service

**LIMITING VALUES** (Absolute limits; carrier conditions with m = max. 100 %)

Frequency	f	CCS		ICAS	MHz
		up to	75	30	
Anode voltage	$V_a$	= max.	3200	4000	V
Anode input power	$W_{ia}$	= max.	880	1100	W
Anode dissipation	$W_a$	= max.	270	270	W
Anode current	$I_a$	= max.	275	275	mA
Grid No.2 voltage	$V_{g2}$	= max.	600	600	V
Grid No.2 dissipation	$W_{g2}$	= max.	35	35	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	500	V
Grid No.1 current	$I_{g1}$	= max.	25	25	mA

**OPERATING CONDITIONS** Grid No.2 modulated with transformer

Frequency	f	CCS			ICAS	MHz
		75	75	75	30	
Anode voltage	$V_a$	= 3000	2500	2000	3650	V
Grid No.2 voltage	$V_{g2}$	= 500	500	500	500	V
Grid No.1 voltage	$V_{g1}$	= -220	-220	-220	-225	V
Anode current	$I_a$	= 275	275	275	275	mA
Grid No.2 current	$I_{g2}$	= 36	38	40	30	mA
Grid No.1 current	$I_{g1}$	= 6	6	6	6	mA
Peak grid No.1						
A.C. voltage	$V_{g1p}$	= 305	308	305	308	V
Grid No.1 input power	$W_{ig1}$	= 1.6	1.7	1.6	1.7	W
Grid No.2 dissipation	$W_{g2}$	= 18	19	20	15	W
Anode input power	$W_{ia}$	= 825	688	550	1000	W
Anode dissipation	$W_a$	= 195	178	170	235	W
Output power	$W_o$	= 630	510	380	765	W
Efficiency	$\eta$	= 76	74	69	76.5	%
Modulation depth	m	= 100	100	100	100	%
Peak grid No.2						
A.C. voltage	$V_{g2p}$	= 400	400	400	400	V
Modulation power	$W_{mod}$	= 413	344	275	500	W

**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	110	MHz
Anode voltage	$V_a$	= max.	4000	V
Anode input power	$W_{ia}$	= max.	1400	W
Anode dissipation	$W_a$	= max.	400	W
Anode current	$I_a$	= max.	350	mA
Grid No.2 voltage	$V_{g2}$	= max.	850	V
Grid No.2 dissipation	$W_{g2}$	= max.	35	W

**OPERATING CONDITIONS**

Frequency	f	=	60	MHz						
Anode voltage	$V_a$	=	4000	V						
Grid No.1 voltage	$V_{g1}$	=	-130	V						
Grid No.2 voltage	$V_{g2}$	=	705	V						
			<table border="1"> <thead> <tr> <th>zero signal</th> <th>single tone signal</th> <th>double tone signal</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>130</td> <td>-</td> </tr> </tbody> </table>	zero signal	single tone signal	double tone signal	0	130	-	
zero signal	single tone signal	double tone signal								
0	130	-								
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0	130	-	V				
Anode current	$I_a$	=	65	250	175	mA				
Grid No.2 current	$I_{g2}$	=	-	10	7	mA				
Grid No.1 current	$I_{g1}$	=	0	0	0	mA				
Grid No.2 dissipation	$W_{g2}$	=	-	7.05	4.95	W				
Anode input power	$W_{ia}$	=	260	1000	700	W				
Anode dissipation	$W_a$	=	260	350	375	W				
Output power	$W_o$	=	0	650	325	W				
Efficiency	$\eta$	=	-	65	46.5	%				

**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

**OPERATING CONDITIONS (continued)**

f	=	60			60		MHz
V <sub>a</sub>	=	3500			3000		V
V <sub>g1</sub>	=	-135			-140		V
V <sub>g2</sub>	=	750			810		V
		zero signal	single tone signal	double tone signal	zero signal	single tone signal	double tone signal
V <sub>g1p</sub>	=	0	135	-	0	140	- V
I <sub>a</sub>	=	75	280	200	90	300	215 mA
I <sub>g2</sub>	=	-	12	8.4	-	15	10.5 mA
I <sub>g1</sub>	=	0	0	0	0	0	0 mA
W <sub>g2</sub>	=	-	9	6.3	-	12.2	8.5 W
W <sub>ia</sub>	=	263	980	700	270	900	645 W
W <sub>a</sub>	=	263	380	400	270	400	395 W
W <sub>o</sub>	=	0	600	300	0	500	250 W
η	=	-	61.2	43	-	55.5	38.8 %

**A.F. CLASS B AMPLIFIER**

**LIMITING VALUES (Absolute limits)**

Anode voltage	V <sub>a</sub>	= max.	4000	V
Anode dissipation	W <sub>a</sub>	= max.	400	W
Anode current	I <sub>a</sub>	= max.	350	mA
Grid No.2 voltage	V <sub>g2</sub>	= max.	800	V <sup>1)</sup>
Grid No.2 dissipation	W <sub>g2</sub>	= max.	35	W
Grid No.1 current	I <sub>g1</sub>	= max.	25	mA

For Operating conditions please refer to pages 7 and 8

1) V<sub>g2</sub> = max. 1000 V if the pin seal temperature is kept below 120 °C



A.F. CLASS B AMPLIFIER (continued)

OPERATING CONDITIONS with grid current (two tubes)

Anode voltage	$V_a = 4000$	3500	3000	2500	V
Grid No.2 voltage	$V_{g2} = 500$	500	500	500	V
Grid No.1 voltage	$V_{g1} = -90$	-85	-80	-75	V
Load resistance	$R_{aa} \sim 15000$	11300	10000	8000	$\Omega$
Peak grid to grid A.C. voltage	$V_{g1g1p} = 0$	0	0	0	290 V
Anode current	$I_a = 2x80$	2x319	2x90	2x95	2x350 mA
Grid No.2 current	$I_{g2} = -$	2x20	-	-	2x30 mA
Grid No.1 current	$I_{g1} = 0$	2x6	0	0	2x7 mA
Grid No.2 dissipation	$W_{g2} = -$	2x10	-	-	2x15 W
Grid No.1 input power	$W_{ig1} = 0$	2x0.8	0	0	2x0.91 W
Anode input power	$W_{ia} = 2x320$	2x1275	2x270	2x238	2x875 W
Anode dissipation	$W_a = 2x320$	2x400	2x270	2x238	2x320 W
Output power	$W_o = 0$	1750	0	0	1110 W
Efficiency	$\eta = -$	68.5	-	-	63.5 %

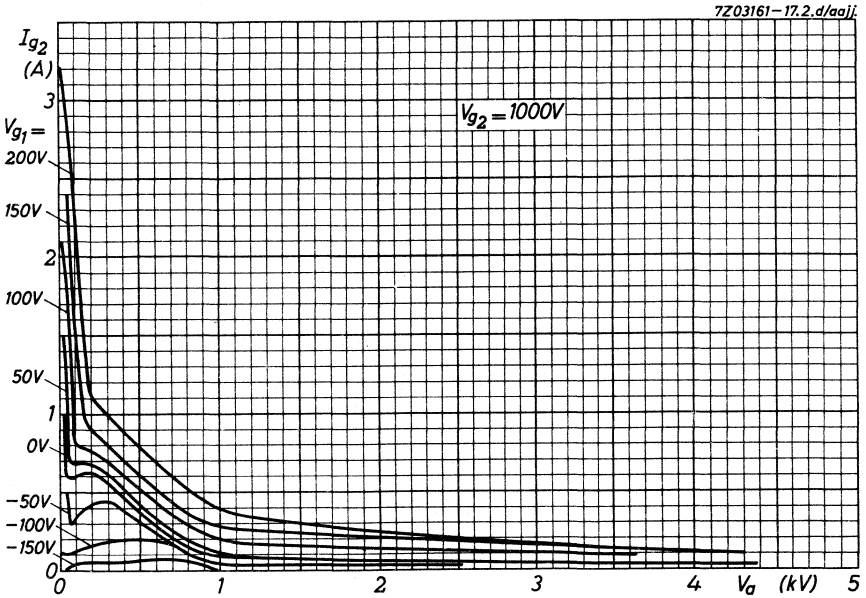
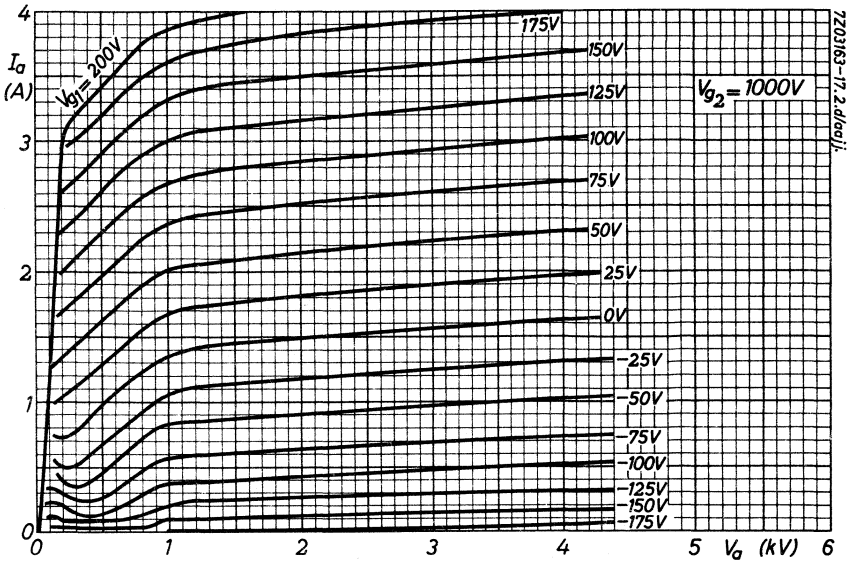


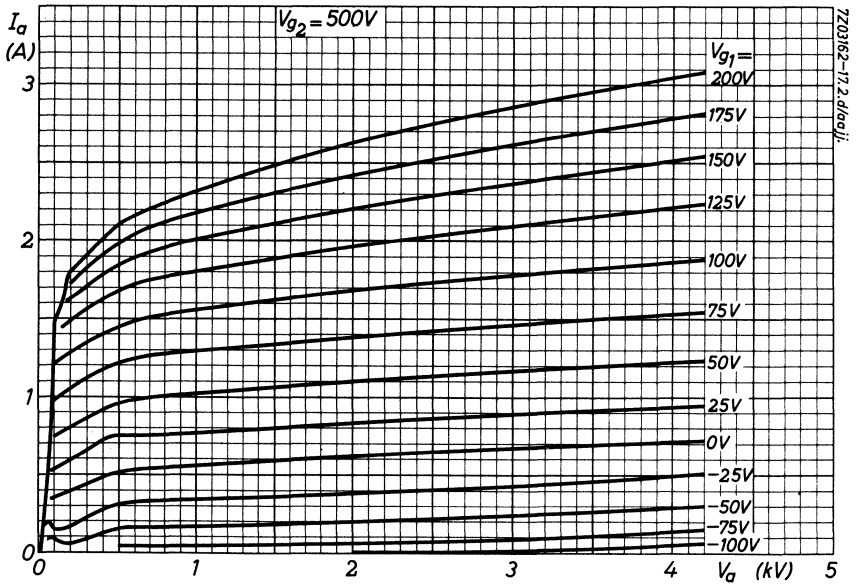
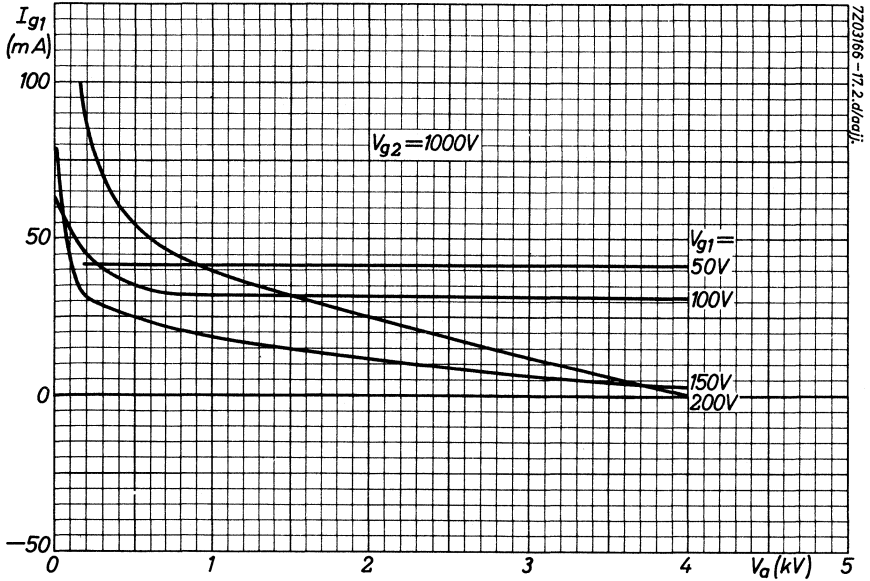


A.F. CLASS B AMPLIFIER (continued)

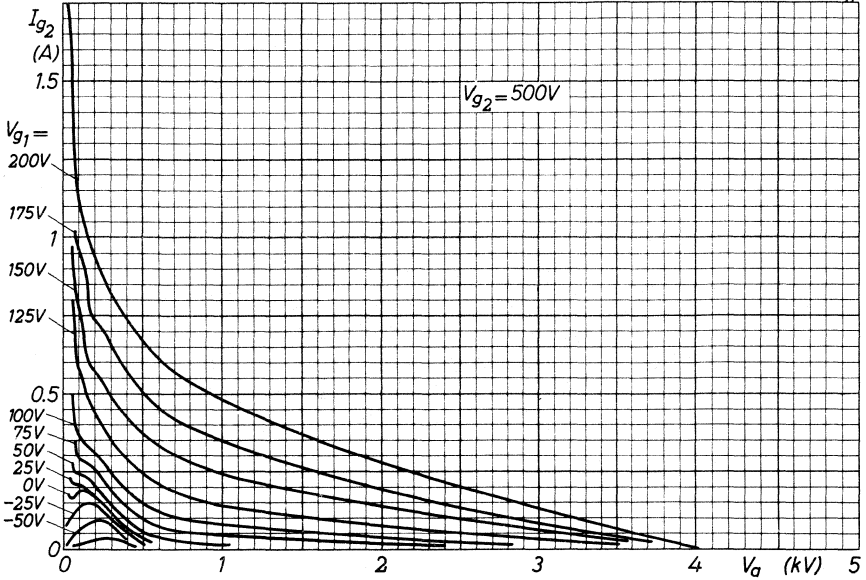
OPERATING CONDITIONS without grid current (two tubes)

Anode voltage	$V_a =$	4000	3500	3000	2500	V
Grid No.2 voltage	$V_{g2} =$	750	750	750	750	V
Grid No.1 voltage	$V_{g1} =$	-150	-145	-137	-130	V
Load resistance	$R_{aa} \sim$	14500	11500	8900	6800	$\Omega$
Peak grid to grid						
A.C. voltage	$V_{g1g1p} =$	0	0	0	0	V
Anode current	$I_a =$	2x60	2x70	2x80	2x95	2x318 mA
Grid No.2 current	$I_{g2} =$	-	2x13.5	-	2x11	2x11.6 mA
Grid No.2 dissipation	$W_{g2} =$	-	2x10.4	-	2x10.3	2x8.7 W
Anode input power	$W_{ia} =$	2x240	2x1170	2x240	2x955	2x795 W
Anode dissipation	$W_a =$	2x240	2x245	2x240	2x238	2x370 W
Output power	$W_o =$	0	0	0	0	850 W
Efficiency	$\eta =$	-	66	-	58	53.5 %

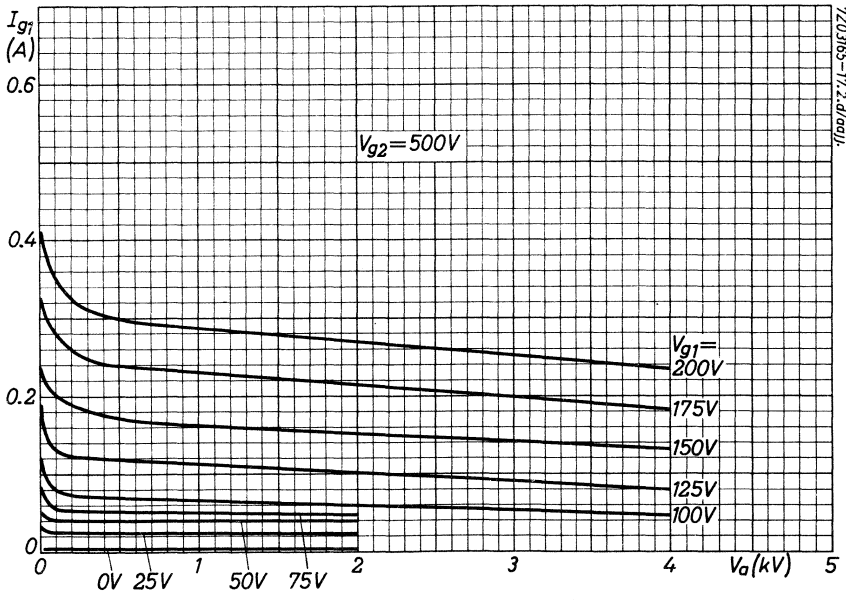


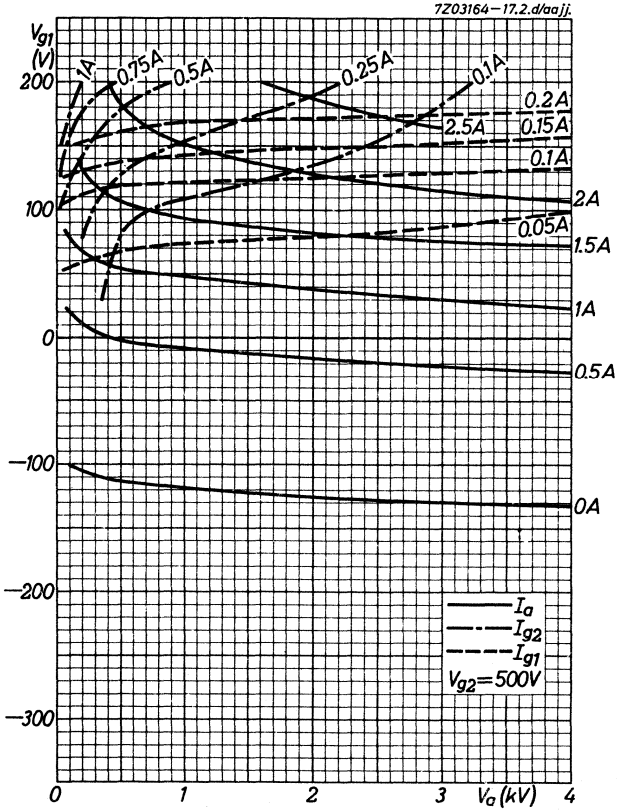


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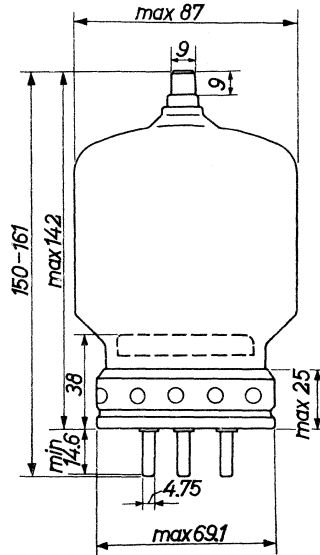
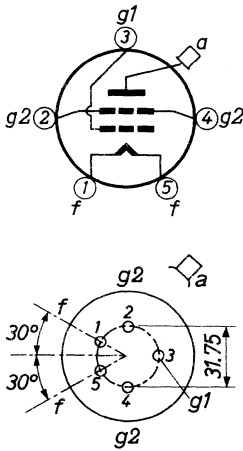
## R.F. POWER TETRODE

### MECHANICAL DATA

Dimensions in mm

Base : Metal-shell Giant 5p

Socket: 2422 512 01001



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For further data and curves of this type  
please refer to type QB4/1100  
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## R.F. POWER TETRODE

QUICK REFERENCE DATA							
For communication							
$\lambda$	Freq.	C telegr.		$C_{ag2}$ mod		$C_{g1}$ mod	
(m)	(MHz)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)
5	60	5000 4000	1760 1410	4000	1200	4500 4000	400 330
$\lambda$	Freq.	B single side band			$B_{mod}$ <sup>1)</sup>		
(m)	(MHz)	$V_a$ (V)	$W_o$ (W)			$V_a$ (V)	$W_o$ (W)
10	30	5000	900			5000 4000	2220 2250
For industrial application R.F. class C							
$\lambda$	Freq.	$\Delta \nabla$ <sup>2)</sup>		$\Delta \Delta$ <sup>3)</sup>			
(m)	(MHz)	$V_{tr}$ ( $V_{RMS}$ )	$W_o$ (W)	$V_{tr}$ ( $V_{RMS}$ ) <sup>4)</sup>		$W_o$ (W)	
5	60	4800	750	4250		1110	

**HEATING** direct; thoriated tungsten filament

Filament voltage	$V_f = 10 \text{ V}$
Filament current	$I_f = 9.9 \text{ A}$

**TYPICAL CHARACTERISTICS** at  $I_a = 120 \text{ mA}$

Amplification factor of grid No.2  
with respect to grid No.1

$\mu_{g2g1} = 9.5$

Mutual conductance

$S = 7 \text{ mA/V}$

1) Two tubes

2)  $\Delta \nabla$  = selfrectification

3)  $\Delta \Delta$  = two phase half wave rectification without filter

4) Each phase

**CAPACITANCES**

Grid No.1 to all other elements except anode	$C_{g1}$	=	24	pF
Anode to all other elements except grid No.1	$C_a$	=	8.3	pF
Anode to grid No.1	$C_{ag1}$	=	0.25	pF

**COOLING:** radiation/low-velocity air flow

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

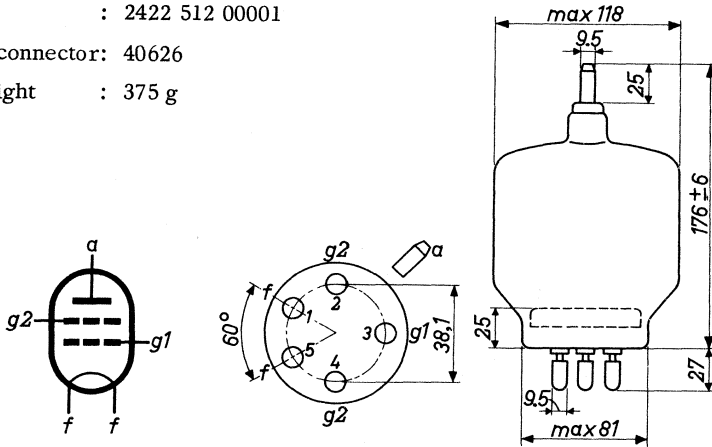
**TEMPERATURE LIMITS** (Absolute limits)

Bulb temperature	=	max.	250	°C
Temperature of anode seal	=	max.	220	°C
Temperature of pin seals	=	max.	180	°C

**MECHANICAL DATA**

- Base : Super giant
- Socket : 2422 512 00001
- Anode connector: 40626
- Net weight : 375 g

Dimensions in mm



Mounting position: vertical with base up or down

7Z2 8793

**R.F. CLASS C TELEGRAPHY**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	75	up to	110 <sup>1)</sup>	MHz
Anode voltage	$V_a$	=	max. 5	max.	4.5	kV
Anode input power	$W_{ia}$	=	max. 2250	max.	1800	W
Anode dissipation	$W_a$	=	max. 500			W
Anode current	$I_a$	=	max. 450			mA
Grid No.2 voltage	$V_{g2}$	=	max. 700			V
Grid No.2 dissipation	$W_{g2}$	=	max. 65			W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 500			V
Grid No.1 dissipation	$W_{g1}$	=	max. 25			W



**OPERATING CONDITIONS**

Frequency	f	$\leq$	60	60	60	60	MHz
Anode voltage	$V_a$	=	5	5	4	4	kV
Grid No.2 voltage	$V_{g2}$	=	600	700	600	700	V
Grid No.1 voltage	$V_{g1}$	=	-200	-200	-200	-200	V
Anode current	$I_a$	=	440	440	450	450	mA
Grid No.2 current	$I_{g2}$	=	80	75	90	85	mA
Grid No.1 current	$I_{g1}$	=	35	25	39	27	mA
Peak grid No.1 voltage	$V_{g1p}$	=	350	340	350	340	V
Anode input power	$W_{ia}$	=	2200	2200	1800	1800	W
Grid No.1 input power	$W_{ig1}$	=	12	8	14	8.5	W
Grid No.2 dissipation	$W_{g2}$	=	48	52.5	54	59.5	W
Anode dissipation	$W_a$	=	440	440	390	390	W
Output power	$W_o$	=	1760	1760	1410	1410	W
Efficiency	$\eta$	=	80	80	78	78	%

1) See page F

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

Screen grid modulated via a choke of 2 H

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	$V_a$	= max.	4	kV
Anode input power	$W_{ia}$	= max.	1600	W
Anode dissipation	$W_a$	= max.	330	W
Anode current	$I_a$	= max.	400	mA
Grid No.2 voltage	$V_{g2}$	= max.	700	V
Grid No.2 dissipation	$W_{g2}$	= max.	50	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V
Grid No.1 dissipation	$W_{g1}$	= max.	25	W

**OPERATING CONDITIONS**

Frequency	f	≤	60	MHz
Anode voltage	$V_a$	=	4	kV
Grid No.2 voltage	$V_{g2}$	=	600	V
Grid No.1 voltage	$V_{g1}$	=	-240	V
Peak grid No.2 voltage	$V_{g2P}$	=	340	V
Peak grid No.1 voltage	$V_{g1P}$	=	415	V
Anode current	$I_a$	=	380	mA
Grid No.2 current	$I_{g2}$	=	80	mA
Grid No.1 current	$I_{g1}$	=	20	mA
Anode input power	$W_{ia}$	=	1520	W
Grid No.1 input power	$W_{ig1}$	=	7.5	W
Grid No.2 dissipation	$W_{g2}$	=	48	W
Anode dissipation	$W_a$	=	320	W
Output power	$W_o$	=	1200	W
Efficiency	$\eta$	=	79	%
Modulation factor	m	=	100	%
Modulation power	$W_{mod}$	=	760	W

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## R.F. CLASS C CONTROL GRID MODULATION

## LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	$V_a$	= max.	5000	V
Anode input power	$W_{ia}$	= max.	1000	W
Anode dissipation	$W_a$	= max.	500	W
Anode current	$I_a$	= max.	225	mA
Grid No.2 voltage	$V_{g2}$	= max.	700	V
Grid No.2 dissipation	$W_{g2}$	= max.	50	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V

## OPERATING CONDITIONS

Frequency	f	≤	60	60	MHz
Anode voltage	$V_a$	=	4500	4000	V
Grid No.2 voltage	$V_{g2}$	=	600	600	V
Grid No.1 voltage <sup>1)</sup>	$V_{g1}$	=	-180	-180	V
Grid No.1 circuit resistance	$R_{g1}$	=	1400	1400	Ω
Peak grid No.1 voltage	$V_{g1P}$	=	220	210	V
Anode current	$I_a$	=	200	200	mA
Grid No.2 current	$I_{g2}$	=	5	5	mA
Grid No.1 current	$I_{g1}$	=	6.5	6.5	mA
Grid No.1 input power	$W_{ig1}$	=	1.3	1.2	W
Anode input power	$W_{ia}$	=	900	800	W
Anode dissipation	$W_a$	=	500	470	W
Grid No.2 dissipation	$W_{g2}$	=	3	3	W
Output power	$W_o$	=	400	330	W
Efficiency	$\eta$	=	44.5	41	%
Modulation factor	m	=	100	100	%
Peak grid No.1 modulation voltage	$V_{g1 modp}$	=	100	100	V
Grid No.1 current <sup>2)</sup>	$I_{g1}$	=	26	27	mA
Grid No.1 input power <sup>2)</sup>	$W_{ig1}$	=	5	5	W

<sup>1)</sup> With -170 V from fixed bias supply included

<sup>2)</sup> At crest of modulation

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**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	$V_a$	=	max.	5000 V
Anode input power	$W_{ia}$	=	max.	2250 W
Anode dissipation	$W_a$	=	max.	500 W
Anode current	$I_a$	=	max.	450 mA
Grid No.2 voltage	$V_{g2}$	=	max.	700 V
Grid No.2 dissipation	$W_{g2}$	=	max.	65 W
Grid No.1 circuit resistance	$R_{g1}$	=	max.	50 k $\Omega$

**OPERATING CONDITIONS**

Frequency	f	$\leq$	30	MHz
Anode voltage	$V_a$	=	5000	V
Grid No.2 voltage	$V_{g2}$	=	700	V
Grid No.1 voltage	$V_{g1}$	=	-90	V
			zero signal	single tone signal
Peak grid No.1 voltage	$V_{g1p}$	=	0	130 V
Anode current	$I_a$	=	56	280 mA
Grid No.2 current	$I_{g2}$	=	0	25 mA
Grid No.1 current	$I_{g1}$	=	0	1 mA
Grid No.1 input power	$W_{ig1}$	=	0	1 W
Anode input power	$W_{ia}$	=	280	1400 W
Anode dissipation	$W_a$	=	280	500 W
Grid No.2 dissipation	$W_{g2}$	=	0	18 W
Output power	$W_o$	=	0	900 W
Efficiency	$\eta$	=	-	64.5 %

R.F. CLASS C AMPLIFIER FOR INDUSTRIAL USE with self rectification

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	75	MHz
Anode transformer voltage <sup>1)</sup>	$V_{tr a}$	= max.	5600	V(RMS)
Anode input power	$W_{ia}$	= max.	1460	W
Anode dissipation	$W_a$	= max.	500	W
Anode current	$I_a$	= max.	240	mA
Grid No.2 transformer voltage <sup>1)</sup>	$V_{tr g_2}$	= max.	780	V(RMS)
Grid No.2 dissipation	$W_{g_2}$	= max.	65	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	500	V
Grid No.1 current	$I_{g_1}$	= max.	25	mA
Grid No.1 circuit resistance	$R_{g_1}$	= max.	50	kΩ

**OPERATING CONDITIONS** <sup>2)</sup>

Frequency	f	≤	60	MHz
Anode transformer voltage <sup>1)</sup>	$V_{tr a}$	=	4800	V(RMS)
Grid No.2 transformer voltage <sup>1)</sup>	$V_{tr g_2}$	=	670	V(RMS)
Grid No.1 resistor	$R_{g_1}$	=	16	kΩ
Peak grid No.1 voltage	$V_{g_1 P}$	=	350	V
Anode current	$I_a$	=	200	mA
Grid No.2 current	$I_{g_2}$	=	32	mA
Grid No.1 current	$I_{g_1}$	=	11	mA
Grid No.1 input power	$W_{ig_1}$	=	3.5	W
Anode input power	$W_{ia}$	=	1060	W
Anode dissipation	$W_a$	=	310	W
Grid No.2 dissipation	$W_{g_2}$	=	24	W
Output power	$W_o$	=	750	W
Efficiency	$\eta$	=	71	%

1)  $V_{tr a}$  and  $V_{tr g_2}$  are the anode transformer secondary voltage per phase and the screen grid transformer secondary voltage per phase respectively.

2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.

**R.F. CLASS C AMPLIFIER FOR INDUSTRIAL USE**

with anode voltage from two-phase half-wave rectifier without filter

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	75	MHz
Anode transformer voltage <sup>1)</sup>	$V_{tr a}$	=	max. 5000	V(RMS)
Anode input power	$W_{ia}$	=	max. 2250	W
Anode dissipation	$W_a$	=	max. 500	W
Anode current	$I_a$	=	max. 400	mA
Grid No.2 transformer voltage <sup>1)</sup>	$V_{tr g_2}$	=	max. 700	V(RMS)
Grid No.2 dissipation	$W_{g_2}$	=	max. 65	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 500	V
Grid No.1 dissipation	$W_{g_1}$	=	max. 25	W
Grid No.1 current	$I_{g_1}$	=	max. 45	mA
Grid No.1 circuit resistance	$R_{g_1}$	=	max. 50	kΩ

**OPERATING CONDITIONS<sup>2)</sup>**

Frequency	f	≤	60	MHz
Anode transformer voltage <sup>1)</sup>	$V_{tr a}$	=	4250	V(RMS)
Anode voltage D.C. value	$V_a$	=	3825	V
Grid No.2 transformer voltage <sup>1)</sup>	$V_{tr g_2}$	=	600	V(RMS)
Grid No.2 voltage D.C. value	$V_{g_2}$	=	540	V
Grid No.1 resistor	$R_{g_1}$	=	14	kΩ
Peak grid No.1 voltage	$V_{g_1 p}$	=	300	V
Anode current	$I_a$	=	325	mA
Grid No.2 current	$I_{g_2}$	=	20	mA
Grid No.1 current	$I_{g_1}$	=	15	mA
Grid No.1 input power	$W_{ig_1}$	=	4	W
Anode input power	$W_{ia}$	=	1535	W
Anode dissipation	$W_a$	=	425	W
Grid No.2 dissipation	$W_{g_2}$	=	13.3	W
Output power	$W_o$	=	1110	W
Efficiency	$\eta$	=	72	%

1)  $V_{tr a}$  and  $V_{tr g_2}$  are the anode transformer secondary voltage per phase and the screen grid transformer secondary voltage per phase respectively.

2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.



**A.F. CLASS B AMPLIFIER AND MODULATOR**

**LIMITING VALUES** (Absolute limits)

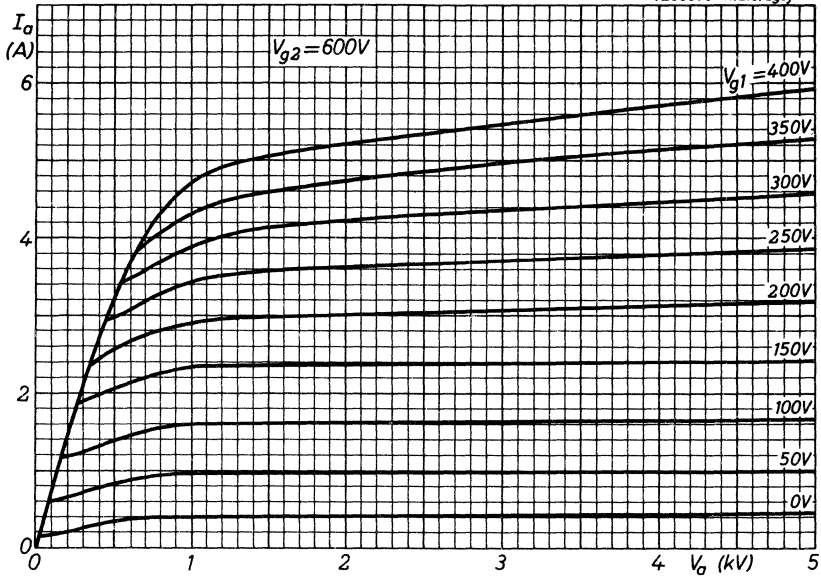
Anode voltage	$V_a$	=	max.	5000	V
Anode input power	$W_{ia}$	=	max.	2250	W
Anode dissipation	$W_a$	=	max.	500	W
Anode current	$I_a$	=	max.	450	mA
Grid No.2 voltage	$V_{g2}$	=	max.	700	V
Grid No.2 dissipation	$W_{g2}$	=	max.	65	W
Negative grid No.1 voltage	$-V_{g1}$	=	max.	500	V
Grid No.1 current	$I_{g1}$	=	max.	45	mA
Grid No.1 circuit resistance	$R_{g1}$	=	max.	50	k $\Omega$

**OPERATING CONDITIONS**, two tubes

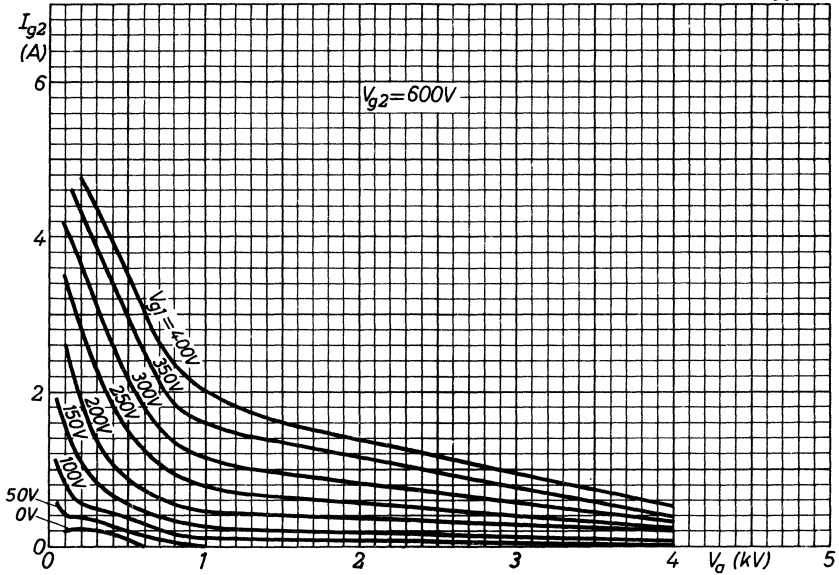
$V_a$	=	5000	4000	4000	V
$V_{g2}$	=	600	600	600	V
$V_{g1}$	=	-62.5	-62.5	-60	V
$R_{aa}$	=	26	20	16	k $\Omega$
$V_{g1g1p}$	=	0      260	0      254	0      305	V
$I_a$	=	2x50    2x290	2x45    2x285	2x55    2x366	mA
$I_{g2}$	=	0      2x43	0      2x40	0      2x60	mA
$I_{g1}$	=	0      2x13	0    2x13.5	0      2x18	mA
$W_{ig1}$	=	0      2x1.5	0      2x1.5	0      2x2.5	W
$W_{ia}$	=	2x250    2x1450	2x180    2x1140	2x220    2x1465	W
$W_a$	=	2x250    2x340	2x180    2x300	2x220    2x340	W
$W_{g2}$	=	0      2x26	0      2x24	0      2x36	W
$W_o$	=	0      2220	0      1680	0      2250	W
$d_{tot}$	=	-      5	-      4.7	-      5	%
$\eta$	=	-      76.5	-      74	-      76.5	%

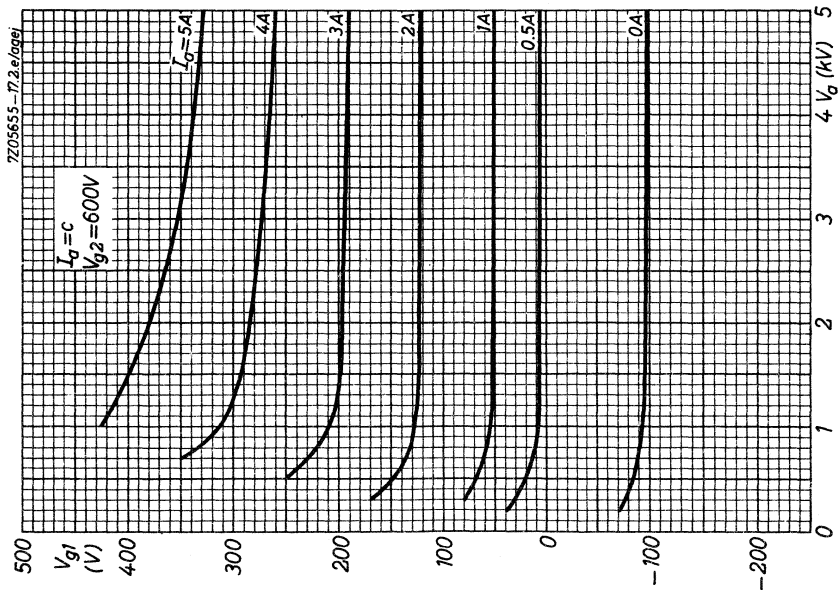
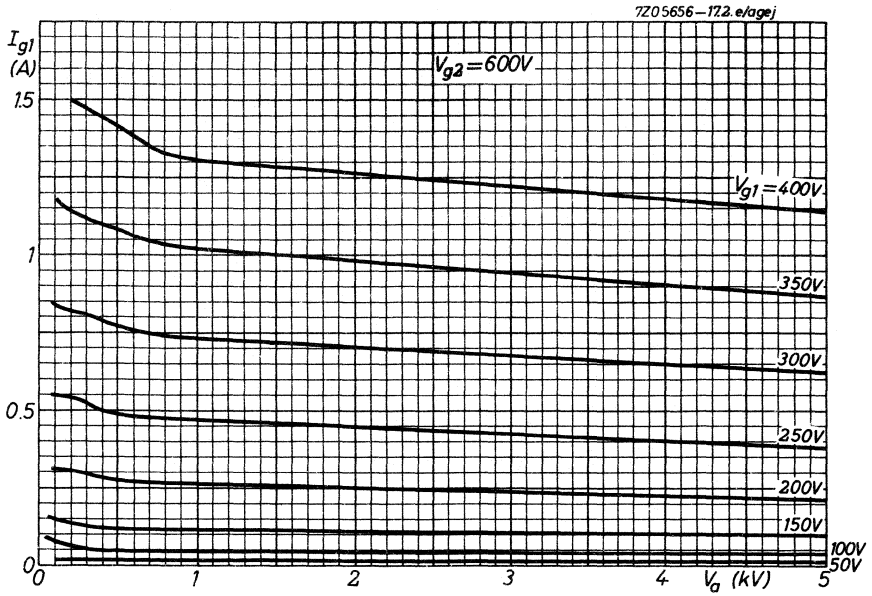
7Z2 2845

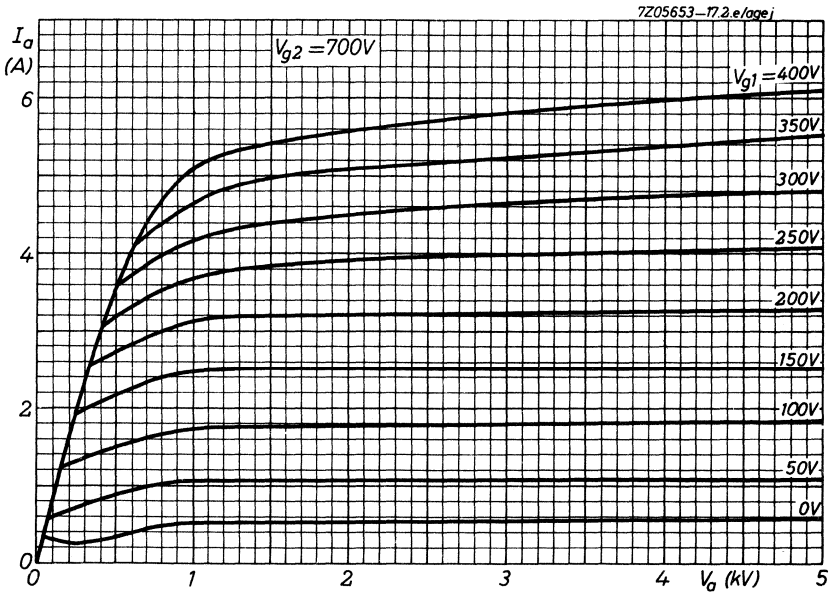
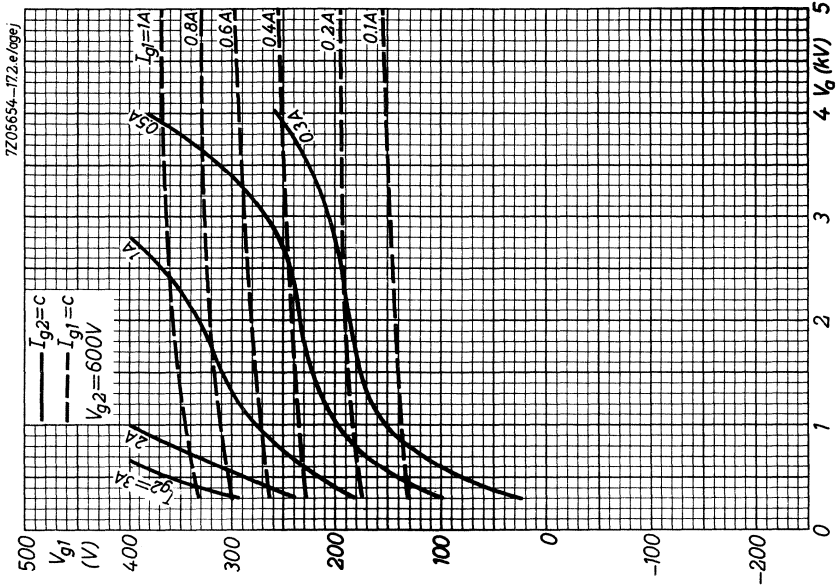
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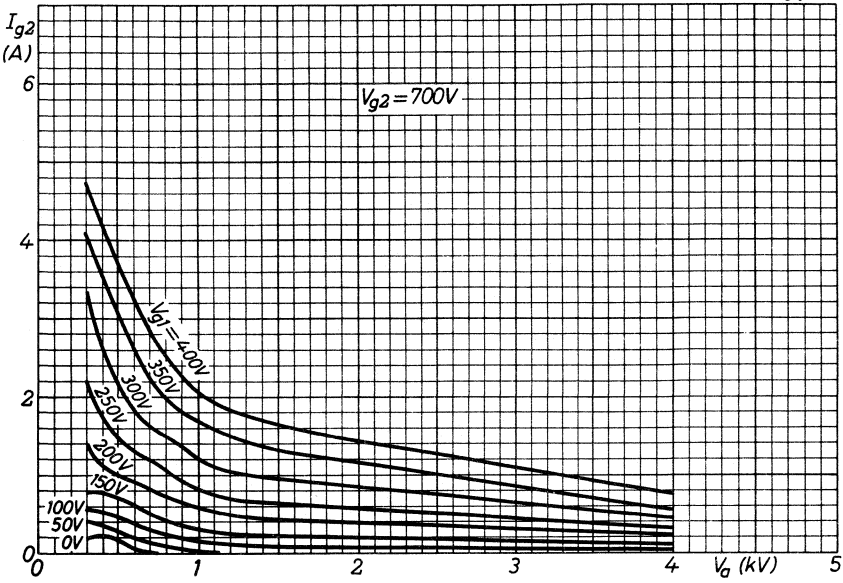
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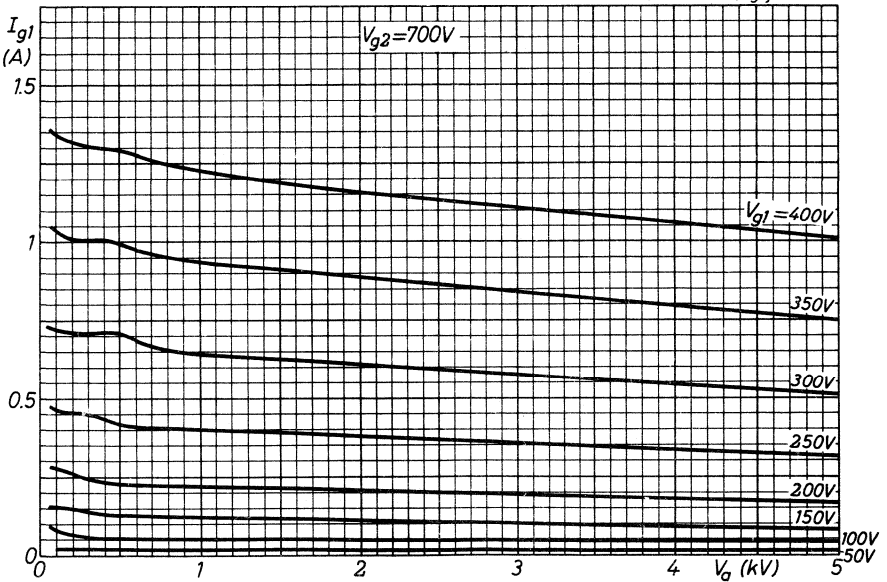


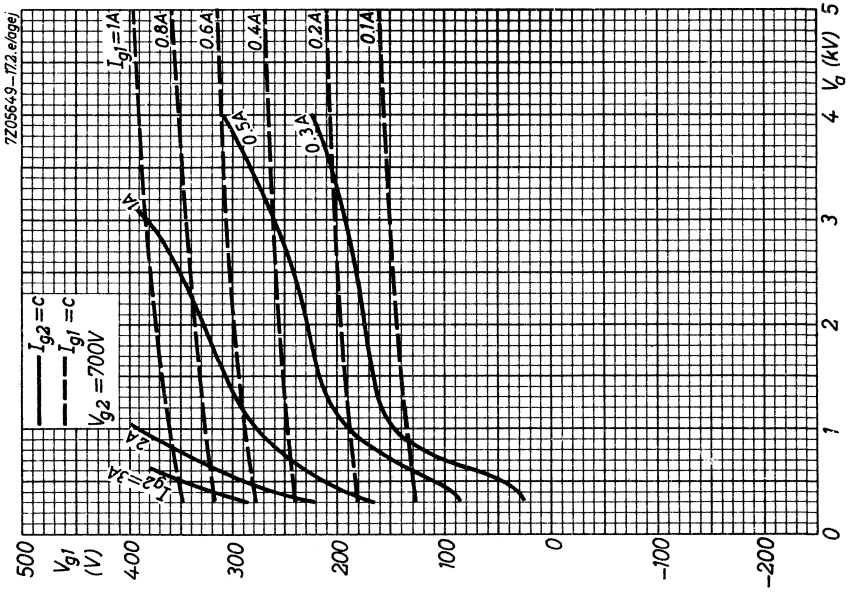
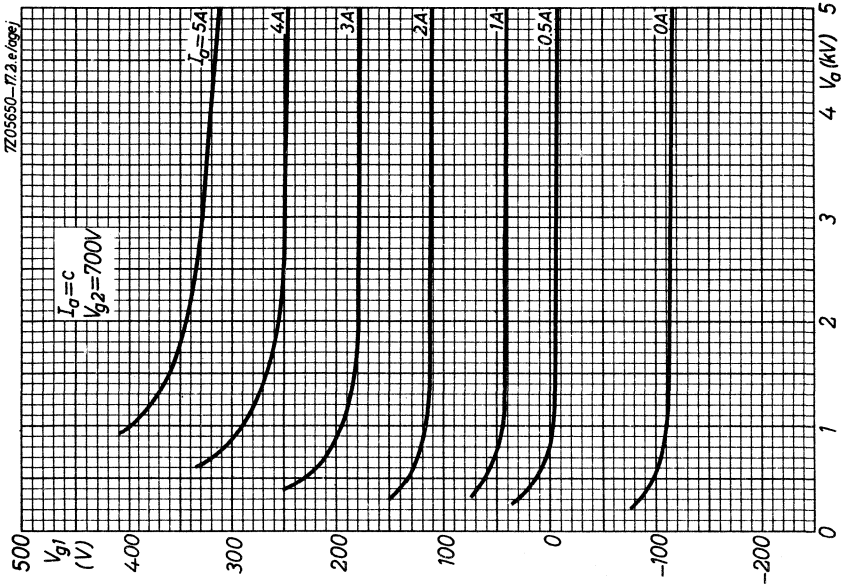


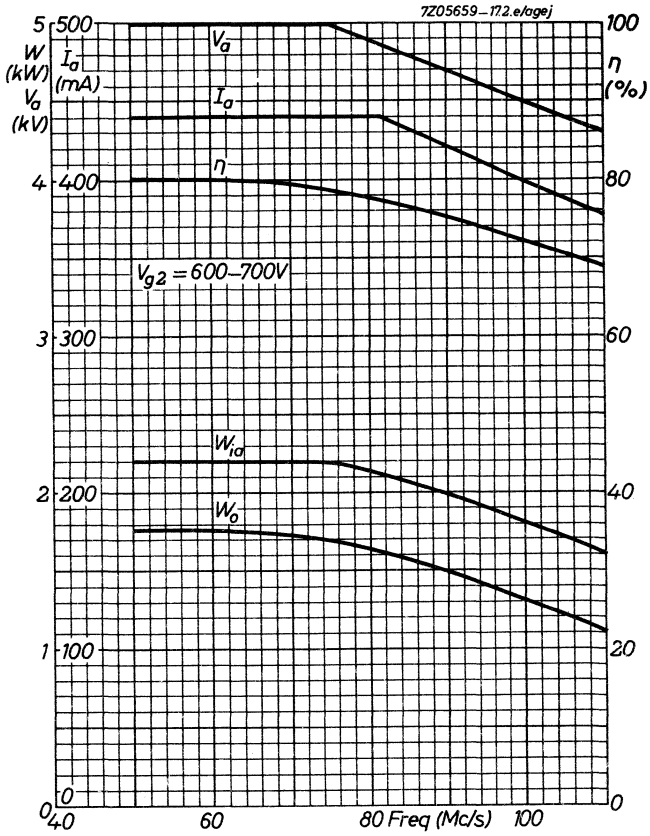
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## R.F. POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	C telegr.		B S.S.B.	
	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (PEP) (W)
30	5000	2400	4000	1300

**HEATING:** direct; thoriated tungsten filament

Filament voltage  $V_f = 7.5 \text{ V}$

Filament current  $I_f = 22.6 \text{ A}$

The filament current must never exceed a peak value of 45 A instantaneously at any time during the energizing schedule

### CAPACITANCES

Grid No.1 to all other elements except anode  $C_{g1} = 47.6 \text{ pF}$

Anode to all other elements except grid No.1  $C_a = 9.5 \text{ pF}$

Anode to grid No.1  $C_{ag1} = 0.1 \text{ pF}$

### TYPICAL CHARACTERISTICS

Anode voltage  $V_a = 4000 \text{ V}$

Grid No.2 voltage  $V_{g2} = 600 \text{ V}$

Anode current  $I_a = 200 \text{ mA}$

Mutual conductance  $S = 10 \text{ mA/V}$

Amplification factor of grid No.2  
with respect to grid No.1  $\mu_{g2g1} = 5.1$

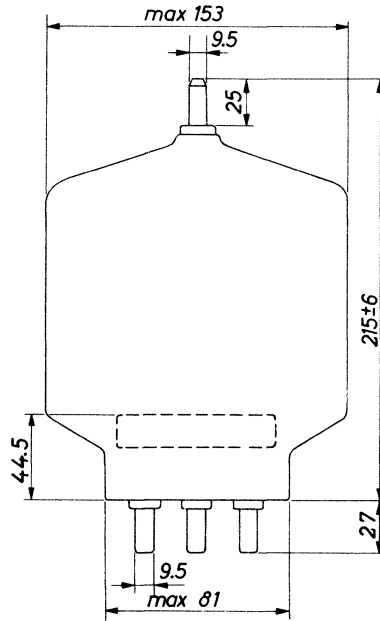
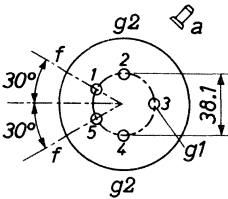
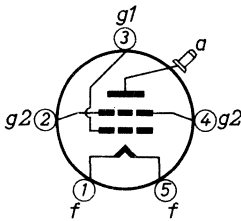
**COOLING:** radiation and convection; low velocity air flow

**TEMPERATURE LIMITS** (Absolute limits)

Bulb temperature = max. 350 °C  
 Temperature of anode seal = max. 220 °C  
 Temperature of pin seals = max. 180 °C

**MECHANICAL DATA**

Dimensions in mm



Base : Super giant 5p  
 Socket : 2422 512 00001  
 Anode connector : 40665  
 Net weight : 620 g  
 Mounting position: vertical

**R.F. CLASS C AMPLIFIER**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	$V_a$	= max.	5.5	kV
Anode dissipation	$W_a$	= max.	800	W
Anode input power	$W_{ia}$	= max.	3.5	kW
Anode current	$I_a$	= max.	700	mA
Grid No.2 voltage	$V_{g2}$	= max.	800	V
Grid No.2 dissipation	$W_{g2}$	= max.	120	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V
Grid No.1 current	$I_{g1}$	= max.	35	mA

**OPERATING CONDITIONS**

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	5	kV
Grid No.2 voltage	$V_{g2}$	=	600	V
Grid No.1 voltage	$V_{g1}$	=	-240	V
Anode current	$I_a$	=	600	mA
Grid No.2 current	$I_{g2}$	=	185	mA
Grid No.1 current	$I_{g1}$	=	20	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	300	V
Driving power	$W_{dr}$	=	10	W
Anode input power	$W_{ia}$	=	3000	W
Grid No.2 dissipation	$W_{g2}$	=	110	W
Anode dissipation	$W_a$	=	600	W
Output power	$W_o$	=	2400	W
Efficiency	$\eta$	=	80	%

Page 4

1) To be adjusted so that  $I_a = 150$  mA at  $V_{g1p} = 0$  V

2) Distortion levels with referencē to either of the tones in a double tone test signal. The quoted figures are the maximum encountered values at any driving level up to 100 %.

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**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

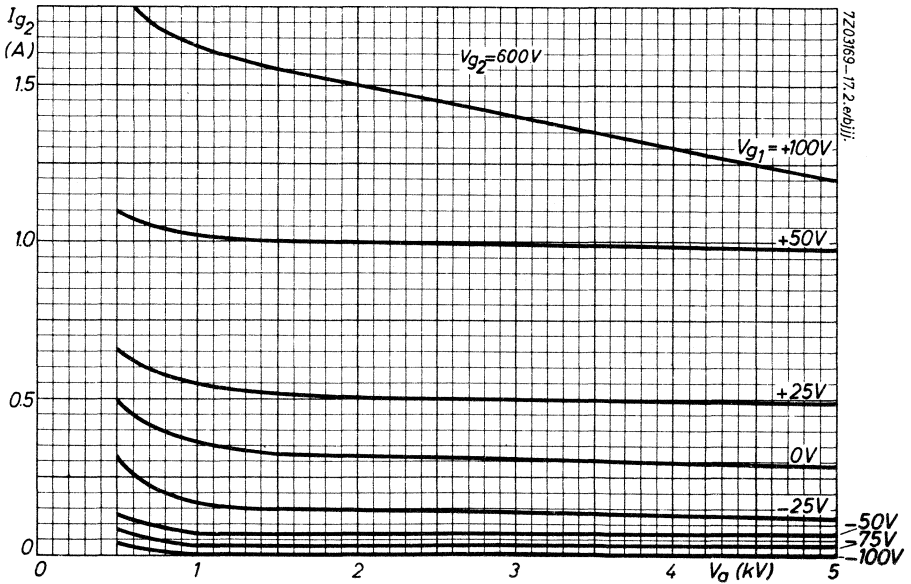
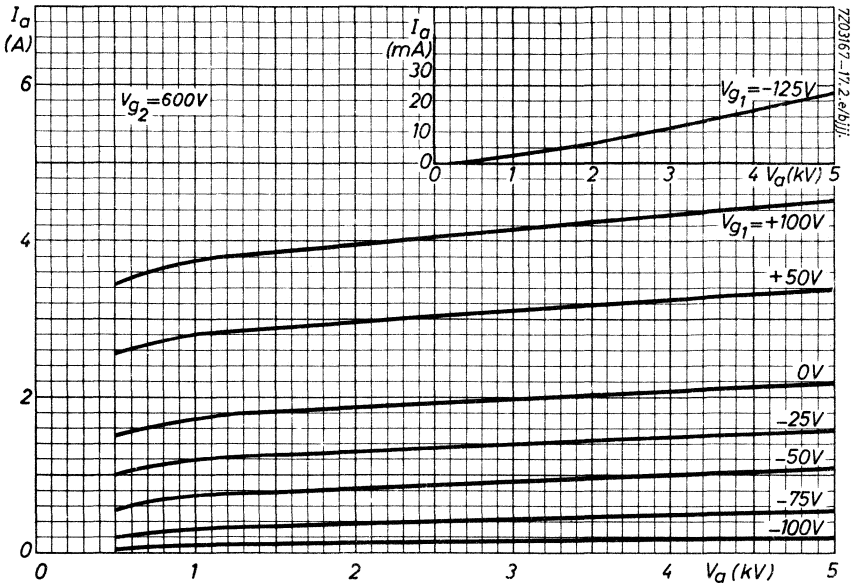
**LIMITING VALUES** (Absolute limits)

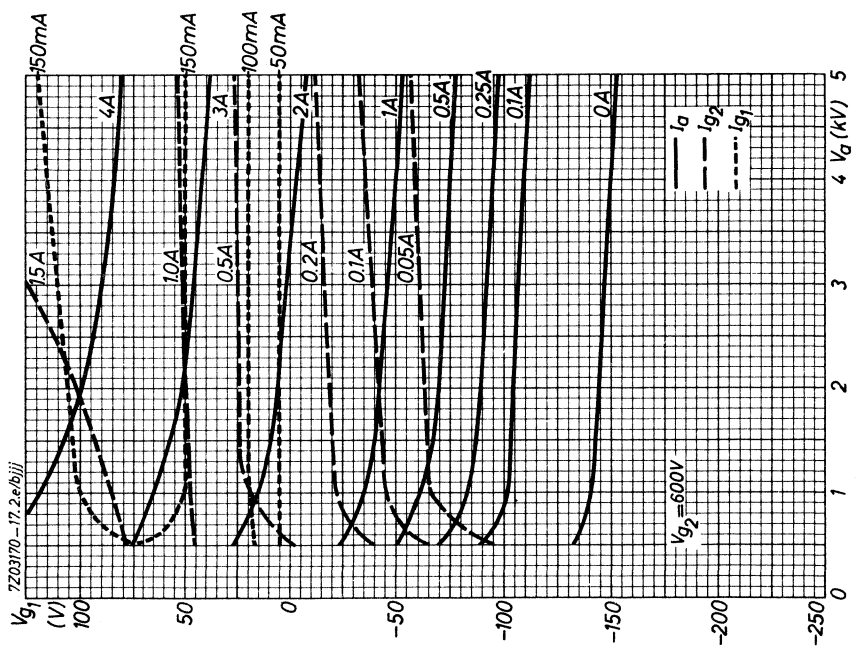
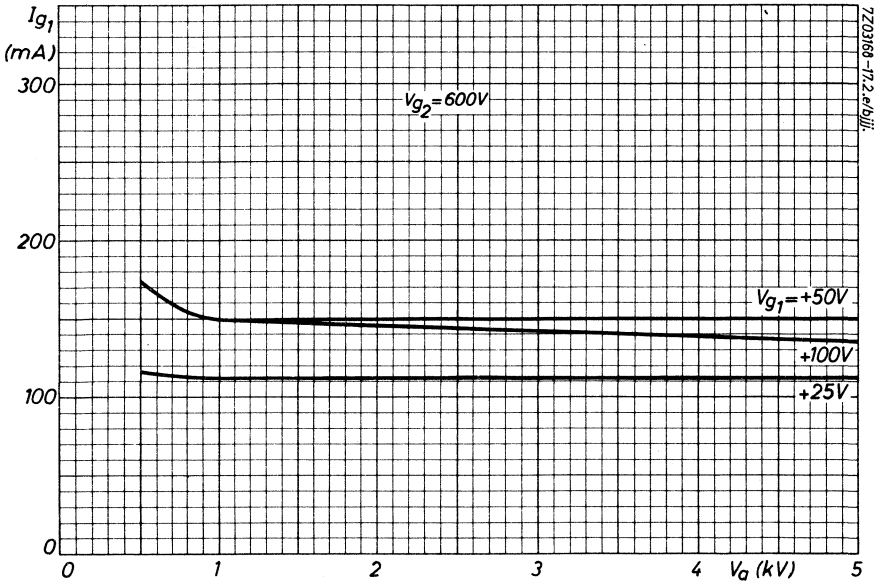
Frequency	f	up to	30	MHz
Anode voltage	$V_a$	= max.	5.5	kV
Anode dissipation	$W_a$	= max.	800	W
Anode input power	$W_{ia}$	= max.	2.5	kW
Anode current	$I_a$	= max.	600	mA
Grid No.2 voltage	$V_{g2}$	= max.	800	V
Grid No.2 dissipation	$W_{g2}$	= max.	120	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V
Grid No.1 circuit resistance	$R_{g1}$	= max.	20	k $\Omega$

**OPERATING CONDITIONS**

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	4	kV
Grid No.2 voltage	$V_{g2}$	=	600	V
Grid No.1 voltage	$V_{g1}$	=	-105	V <sup>1)</sup>
			zero	single
			signal	tone
				double
				tone
				signal
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0	100
Anode current	$I_a$	=	150	465
Grid No.2 current	$I_{g2}$	=	8	85
Grid No.1 current	$I_{g1}$	=	0	0
Anode input power	$W_{ia}$	=	600	1860
Grid No.2 dissipation	$W_{g2}$	=	4.8	51
Anode dissipation	$W_a$	=	600	560
Output power	$W_o$	=	0	1300
Driving power	$W_{dr}$	=	0	0
Efficiency	$\eta$	=	-	69
Peak envelope power	$W_o(PEP)$	=		1300
Third harmonic distortion	$d_3$	=		<-35
Fifth harmonic distortion	$d_5$	=		<-40

1)2) See page 3





## COAXIAL U.H.F. POWER TETRODE

Ceramic, coaxial, forced air cooled power tetrode with integral radiator for use as U.H.F. amplifier or oscillator at frequencies up to 1000 Mc/s. The coaxial arrangement of the terminals enables the tube to be used as plug-in tube in coaxial circuits.

QUICK REFERENCE DATA				
Freq. (MHz)	C telegraphy		A linear amplifier	
	$V_{a-g_1}$ (kV)	$W_o$ (W) <sup>1)</sup>	$V_{a-g_1}$ (kV)	$W_o$ (W) <sup>1)</sup>
790			2.5	210
800	4.31	2100		
Television service				
Freq. (MHz)	Neg. mod.		Pos. synchr.	
	$V_{a-g_1}$ (kV)	$W_o$ sync <sup>1)</sup> (W)	$W_o$ black <sup>1)</sup> (W)	
800	4.32	2200	1300	

**HEATING:** direct; filament thoriated tungsten

Filament voltage	$V_f$	=	3.6 V
Filament current	$I_f$	=	58 A
Filament surge current	$I_{f \text{ surge}}$	= max.	150 A

After the circuit has been adjusted for proper tube operation, the filament voltage should be reduced to a value slightly above that at which performance is affected. R.F. voltages on the filament should be avoided.

<sup>1)</sup> Useful power in the load

**TYPICAL CHARACTERISTICS**

Anode voltage	$V_a$	=	3000	V
Grid No.2 voltage	$V_{g_2}$	=	500	V
Anode current	$I_a$	=	0.48	A
Mutual conductance	$S$	=	20	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	9	

**CAPACITANCES**

Grounded cathode

Grid No.1 to all other elements except anode	$C_{g_1}$	=	46	pF
Anode to all other elements except grid No.1	$C_a$	=	6.0	pF
Anode to grid No.1	$C_{ag_1}$	=	0.15	pF

Grounded grids No.1 and 2

Anode to grid No.2	$C_{ag_2}$	=	7	pF
Grid No.1 to filament	$C_{g_1f}$	=	20	pF
Anode to filament	$C_{af}$	=	0.02	pF

**TEMPERATURE LIMITS (Absolute limits)**

Temperature of all seals	= max.	200	°C
Anode temperature	= max.	180	°C

For the measurement of the anode temperature see note 4) page 4.

**COOLING**

Cooling data for the anode radiator

For recommended cooling arrangement see page 5.

Anode dissipation $W_a$ (W)	Height $h$ (m)	Max. air inlet temp. $t_i$ (°C)	Min. air flow $q$ (m <sup>3</sup> /min.)	Pressure $P_i$ (mm H <sub>2</sub> O)
1500	0	45	3.2	75

7Z2 2903



**COOLING** (continued)

Remarks

Forced air cooling for the radiator and for the ceramic to metal seals will be required before and during the application of any voltage. After switching off voltages the cooling must be maintained for at least two minutes. The distribution of the cooling air will vary with the cavity configuration around the tube.

The screen grid and anode connections should be preferably made of contact finger stock. The fingers shall make good contact with the cylindrical planes of the electrode connections. Slots of sufficient width should be provided between the finger contacts to allow for passing of the cooling air.

The control grid and filament connections shall provide for good electrical contacts and sufficient heat conduction.

The amount and temperature of the cooling air shall be watched during operation. If the amount of cooling air decreases below the specified value all voltages shall be switched of automatically.

The cooling air shall be filtered to prevent the radiator from being choked.



Page 8

- 1) The cathode voltage should be adjusted for a zero signal anode current  
 $I_a = 580 \text{ mA}.$
- 2) Peak envelope power. The driving signal consists of three independent H.F. signal voltages, i.e.
 

picture carrier	-8 dB	}	with respect to the sum signal amplitude of the composite signal
sideband signal	-17 dB		
sound carrier	-7 dB		

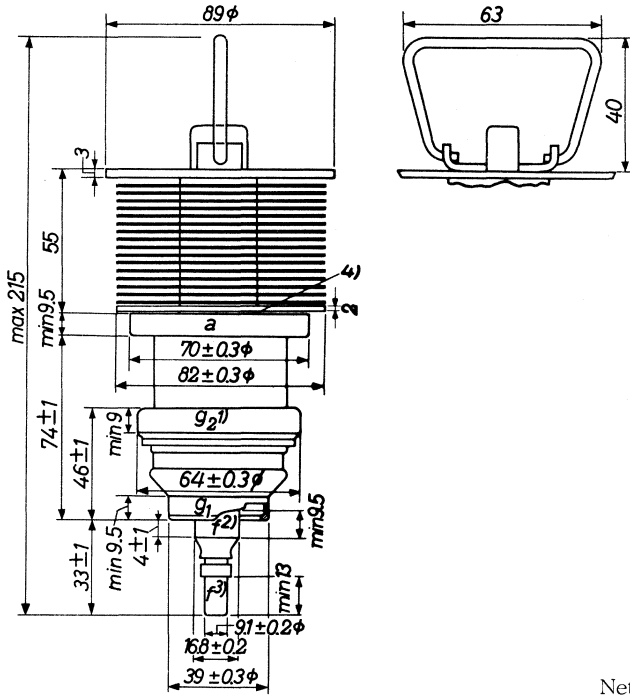
The frequency bandwidth of the driving signal is more than 6 MHz at -1 dB.

- 3) Peak envelope power. Typical value, measured in a circuit having an efficiency of about 85%.
- 4) The intermodulation product in the passband of the output signal is measured with reference to 0 dB.

7Z2 2904

MECHANICAL DATA

Dimensions in mm



Net weight 1900 g

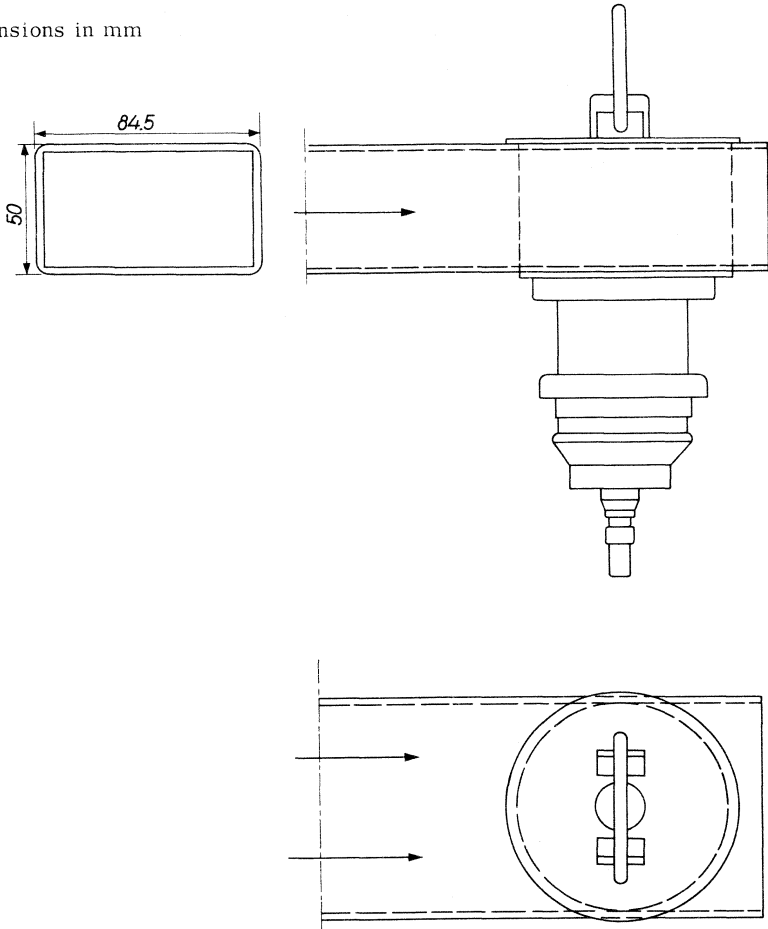
Mounting position: vertical with anode up or down

- 1) Eccentricity with respect to the axis through the anode and grid No.1  
max. 0.3 mm
- 2) Cathode return terminal. Eccentricity with respect to the axis through anode and grid No.1 max. 0.4 mm
- 3) Eccentricity with respect to the axis through anode and grid No.1  
max. 0.8 mm
- 4) Point for anode temperature measurement

7Z2 2905

Recommended anode cooling arrangement

Dimensions in mm



**U.H.F. POWER AMPLIFIER , CLASS C TELEGRAPHY ; cathode driven**

A tunable coaxial circuit is built between grids No.1 and 2 which introduces a variable capacitive reactance between these grids. The results of this arrangement are better efficiency and negligible regeneration from anode to cathode.

The reference point for the electrode voltages is the terminal of grid No.1

**LIMITING VALUES (Absolute limits)**

Frequency	f	up to 1000	MHz
Anode voltage	$V_{a-g_1}$	= max.	4500 V
Anode dissipation	$W_a$	= max.	1500 W
Anode input power	$W_{ia}$	= max.	3800 W
Anode current	$I_a$	= max.	0.9 A
Grid No.2 voltage	$V_{g_2-g_1}$	= max.	700 V
Grid No.2 dissipation	$W_{g_2}$	= max.	50 W
Grid No.2 current	$I_{g_2}$	= max.	75 mA
Grid No.1 current	$I_{g_1}$	= max.	100 mA
Cathode voltage	$V_{k-g_1}$	= max.	300 V

**OPERATING CONDITIONS**

Frequency	f	=	800	MHz
Anode voltage	$V_{a-g_1}$	=	4310	V
Grid No.2 voltage	$V_{g_2-g_1}$	=	600	V
Cathode voltage	$V_{k-g_1}$	=	110	V
Anode current	$I_a$	=	0.85	A
Grid No.2 current	$I_{g_2}$	=	28	mA
Grid No.1 current	$I_{g_1}$	=	50	mA
Driver output power	$W_{dr}$	=	180	W
Useful power in the load	$W_{\ell}$	=	2100	W <sup>1)</sup>
Power gain	$W_{\ell} / W_{dr}$	=	12	

<sup>1)</sup> Typical value, measured in a circuit having an efficiency of approx. 85%.

**U.H.F. CLASS C AMPLIFIER FOR TELEVISION SERVICE**, grid modulated, cathode driven; negative modulation, positive synchronisation

A tunable coaxial circuit is built between grids No.1 and 2 which introduces a variable capacitive reactance between these grids. The results of this arrangement are better efficiency and negligible regeneration from anode to cathode.

The reference point for the electrode voltages is the terminal of grid No.1

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 1000	MHz
Anode voltage	$V_{a-g_1}$	= max.	4500 V
Anode dissipation	$W_a$	= max.	1500 W
Anode input power	$W_{ia}$	= max.	4000 W
Anode current	$I_a$ sync	= max.	0.95 A
Grid No.2 voltage	$V_{g_2-g_1}$ sync	= max.	700 V
Grid No.2 dissipation	$W_{g_2}$	= max.	50 W
Grid No.2 current	$I_{g_2}$ sync	= max.	75 mA
Grid No.1 current	$I_{g_1}$ sync	= max.	100 mA
Cathode voltage	$V_{k-g_1}$	= max.	500 V

**OPERATING CONDITIONS**

Frequency	f	=	800	MHz
Bandwidth at -3 dB	B (-3 dB)	=	6	MHz
Anode voltage	$V_{a-g_1}$	=	4320	V
Grid No.2 voltage	$V_{g_2-g_1}$	=	600	V
Cathode voltage	sync	$V_{k-g_1}$ sync	=	120 V
	black	$V_{k-g_1}$ black	=	175 V
	white	$V_{k-g_1}$ white	=	345 V
Anode current	sync	$I_a$ sync	=	0.9 A
	black	$I_a$ black	=	0.68 A
Grid No.2 current	sync	$I_{g_2}$ sync	=	15 mA
	black	$I_{g_2}$ black	=	5 mA
Grid No.1 current	sync	$I_{g_1}$ sync	=	50 mA
	black	$I_{g_1}$ black	=	35 mA
Driver output power	$W_{dr}$ sync	=	220	W
Useful power in the load	sync	$W_l$ sync	=	2200 W
	black	$W_l$ black	=	1300 W
Power gain	$W_l / W_{dr}$	=	10	

7Z2 2908

**U.H.F. CLASS A LINEAR AMPLIFIER FOR TELEVISION SERVICE** , sound and vision, cathode driven

A tunable coaxial circuit is built between grids No.1 and 2 which introduces a variable capacitive reactance between these grids. The results of this arrangement are better efficiency and negligible regeneration from anode to cathode.

The reference point for the electrode voltages is the terminal of grid No.1

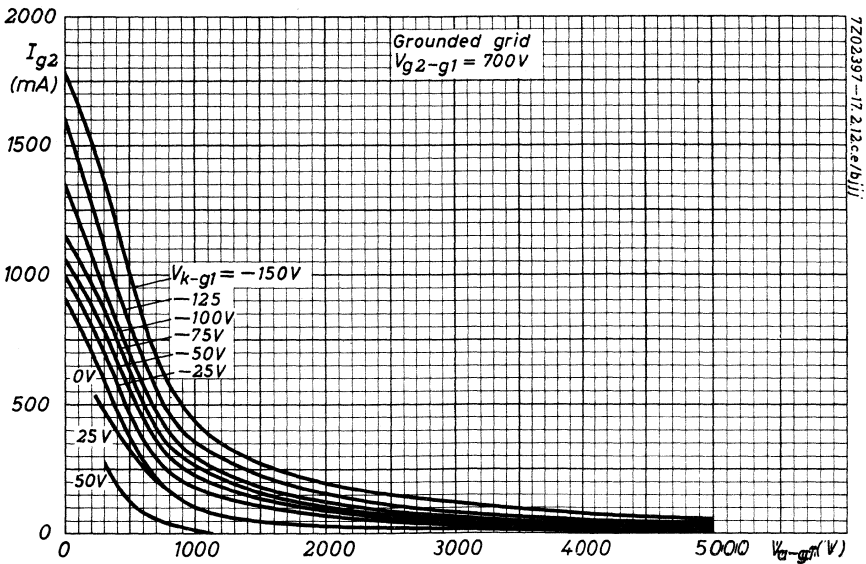
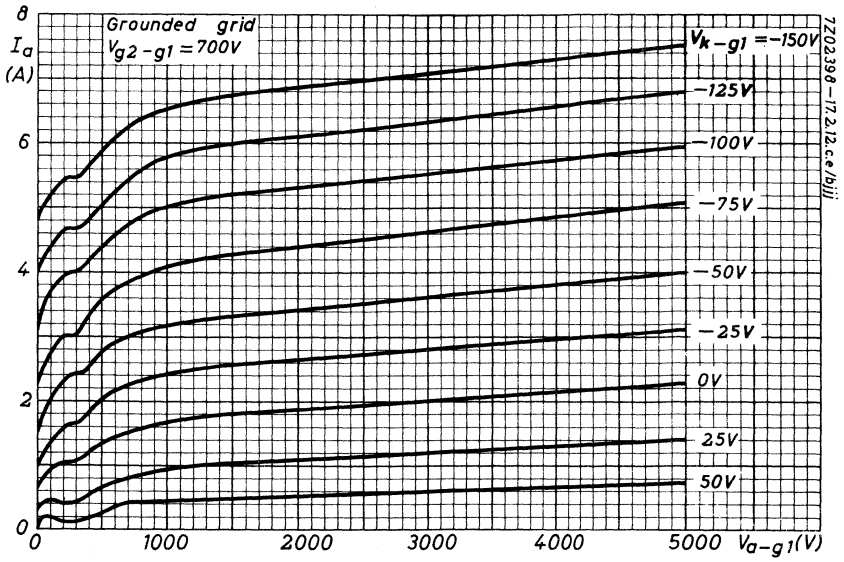
**LIMITING VALUES** (Absolute limits)

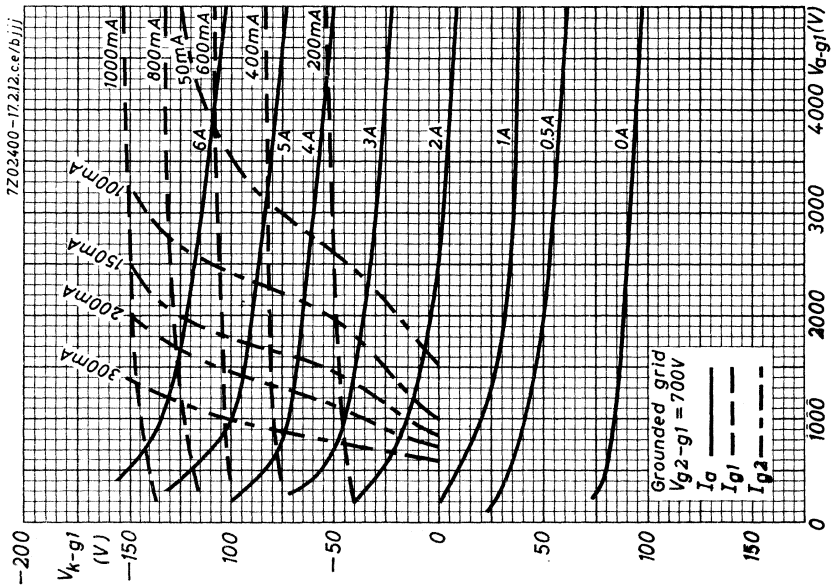
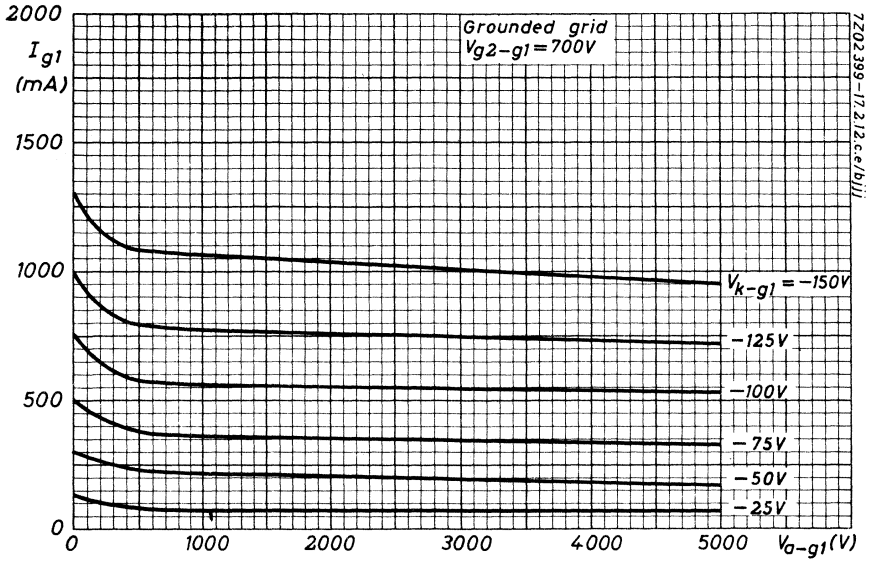
Frequency	f	up to 1000	MHz
Anode voltage	$V_{a-g_1}$	= max.	3000 V
Anode dissipation	$W_a$	= max.	1500 W
Anode input power	$W_{ia}$	= max.	1800 W
Anode current	$I_a$	= max.	800 mA
Grid No.2 voltage	$V_{g_2-g_1}$	= max.	700 V
Grid No.2 dissipation	$W_{g_2}$	= max.	50 W
Grid No.2 current	$I_{g_2}$	= max.	75 mA
Grid No.1 current	$I_{g_1}$	= max.	100 mA
Cathode voltage	$V_{k-g_1}$	= max.	300 V

**OPERATING CONDITIONS**

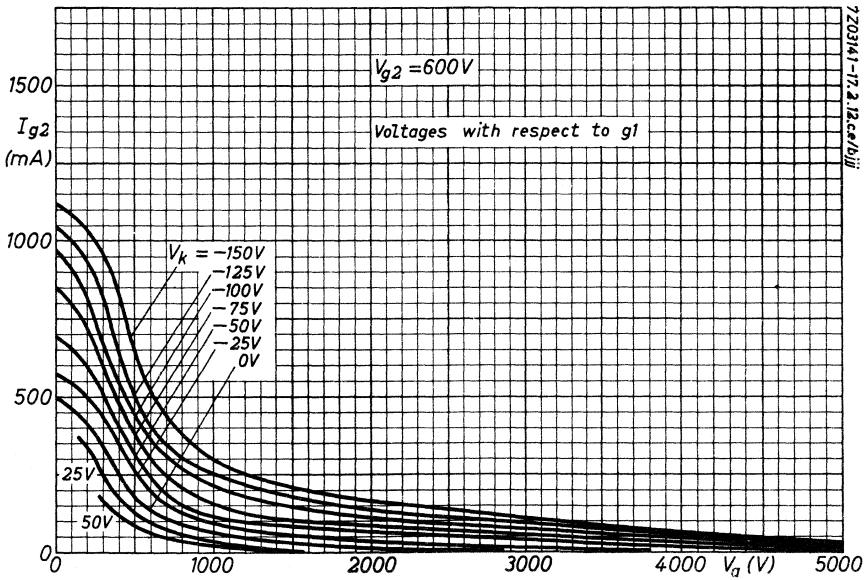
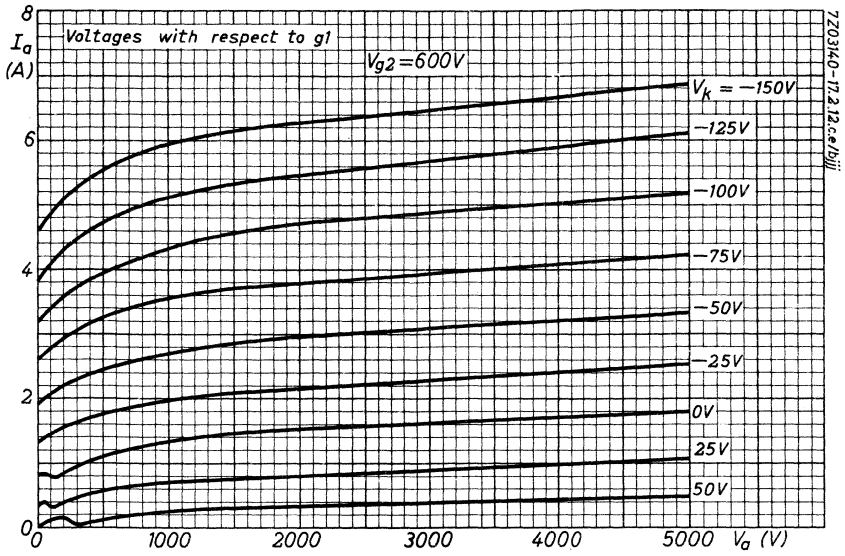
Frequency	f	=	790	MHz
Bandwidth at -1 dB	B	=	6	MHz
Anode voltage	$V_{a-g_1}$	=	2500	V
Grid No.2 voltage	$V_{g_2-g_1}$	=	500	V
Cathode voltage	$V_{k-g_1}$	=	28	V <sup>1)</sup>
Anode current	$I_a$	=	580	mA
Grid No.2 current	$I_{g_2}$	=	5	mA
Grid No.1 current	$I_{g_1}$	=	0	mA
Driver output power	$W_{dr}(PEP)$	=	16	W <sup>2)</sup>
Output power in load	$W_l (PEP)$	=	210	W <sup>3)</sup>
Intermodulation products	d	=	-52	dB <sup>4)</sup>
Power gain	$W_l / W_{dr}$	=	13	

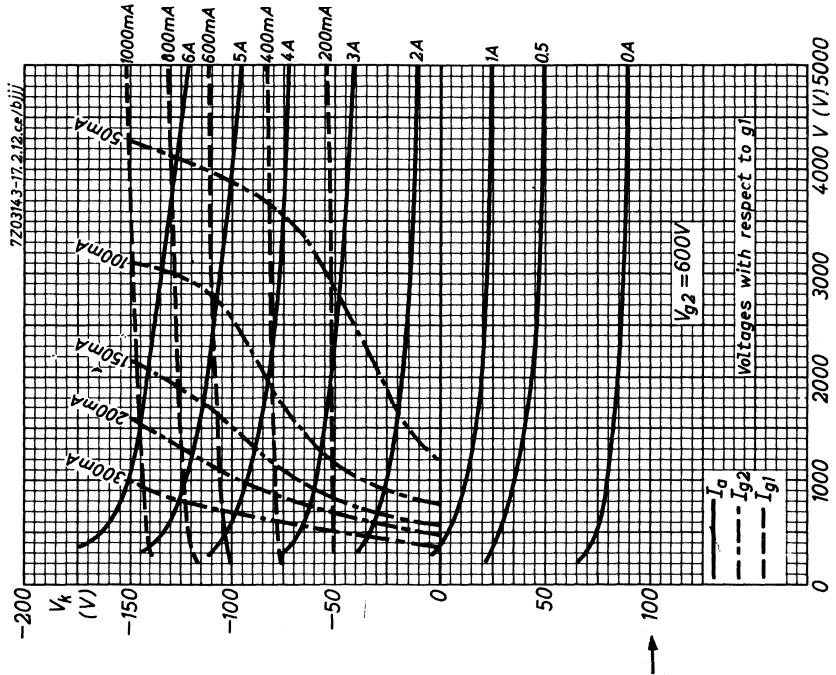
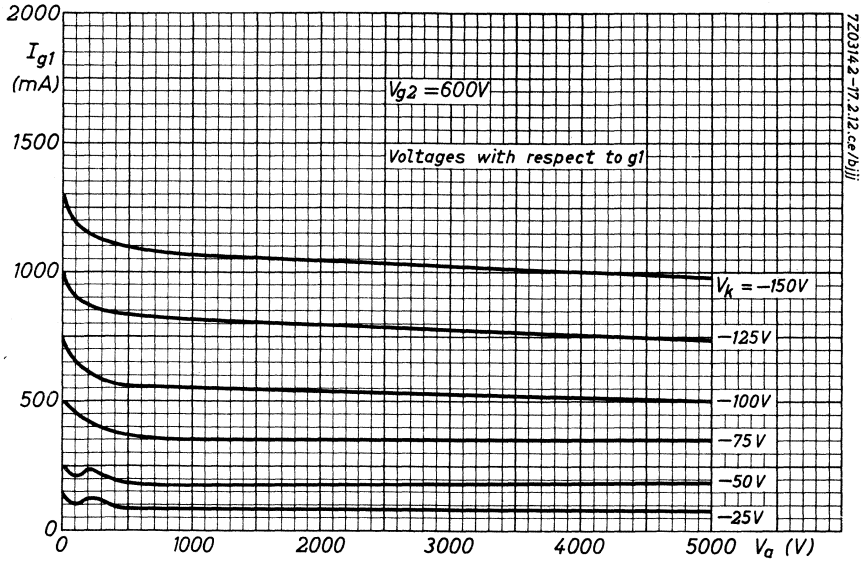
1)2)3)4) See page 3











## R.F. POWER TETRODE

QUICK REFERENCE DATA						
H.F. class C telegraphy			Television service Neg. mod.; pos. sync.			
Freq. (MHz)	$V_a$ (V)	$W_o$ (W)	Freq. (MHz)	$V_a$ (V)	$W_o$ (W)	
					sync.	black
110	4000	930	220	2400	600	340
	3000	670		1850	300	170
	2500	530				

**HEATING:** direct, filament thoriated tungsten

Filament voltage  $V_f = 5$  V

Filament current  $I_f = 13.5$  A

### CAPACITANCES

Anode to all other elements except grid No.1  $C_a = 5.6$  pF

Grid No.1 to all other elements except anode  $C_{g1} = 12.8$  pF

Anode to grid No.1  $C_{ag1} = 0.05$  pF

### TYPICAL CHARACTERISTICS

Amplification factor of grid No.2  
with respect to grid No.1

$\mu_{g2g1} = 6.2$

Mutual conductance

$S(I_a = 200 \text{ mA}) = 5.2 \text{ mA/V}$

### TEMPERATURE LIMITS (Absolute limits)

Temperature of seals = max. 150 °C

Anode temperature = max. 150 °C

In order to keep the temperatures of the seals below the maximum permissible value it is necessary to direct an air flow to the seals. Cooling air must be applied to the seals and the anode cooler prior to the application of filament power and the cooling must be continued for three minutes after the power has been removed from the filament.

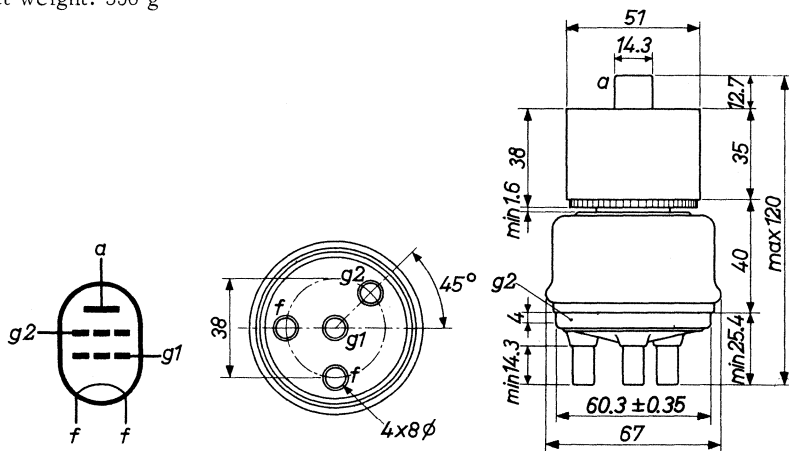
## COOLING CHARACTERISTICS

$W_a$ (W)	$h$ (m)	$t_{i,max.}$ (°C)	$q_{min.}$ (m <sup>3</sup> /min.)	$P_i$ (mm H <sub>2</sub> O)
300	0	35	0.50	9.8
	0	45	0.59	12.9
	1500	35	0.60	12.0
	3000	25	0.63	11.5
400	0	35	0.77	17.5
	0	45	0.90	23.0
	1500	35	0.93	21.3
	3000	25	0.97	20.5
500	0	35	1.13	35.5
	0	45	1.32	46.9
	1500	35	1.36	43.3
	3000	25	1.42	41.5

## MECHANICAL DATA

Net weight: 530 g

Dimensions in mm



Mounting position: vertical with anode up or down

**R.F. CLASS C TELEGRAPHY**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	120	MHz
Anode voltage	$V_a$	= max.	4000	V
Anode input power	$W_{ia}$	= max.	1400	W
Anode dissipation	$W_a$	= max.	500	W
Anode current	$I_a$	= max.	350	mA
Grid No.2 voltage	$V_{g2}$	= max.	500	V
Grid No.2 dissipation	$W_{g2}$	= max.	30	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V
Grid No.1 current	$I_{g1}$	= max.	30	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	k $\Omega$

**OPERATING CONDITIONS**

Frequency	f	=	110	110	110	MHz
Anode voltage	$V_a$	=	4000	3000	2500	V
Grid No.2 voltage	$V_{g2}$	=	500	500	500	V
Grid No.1 voltage	$V_{g1}$	=	-150	-150	-150	V
Anode current	$I_a$	=	315	310	310	mA
Grid No.2 current	$I_{g2}$	=	22	24	26	mA
Grid No.1 current	$I_{g1}$	=	16	16	15	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	230	230	230	V
Grid No.1 input power	$W_{ig1}$	=	5	5	5	W
Grid No.2 dissipation	$W_{g2}$	=	11	12	13	W
Anode input power	$W_{ia}$	=	1260	930	775	W
Anode dissipation	$W_a$	=	330	260	245	W
Output power	$W_o$	=	930	670	530	W
Efficiency	$\eta$	=	73.5	72	68.5	%
Useful power in the load	$W_l$	=	835	600	475	W

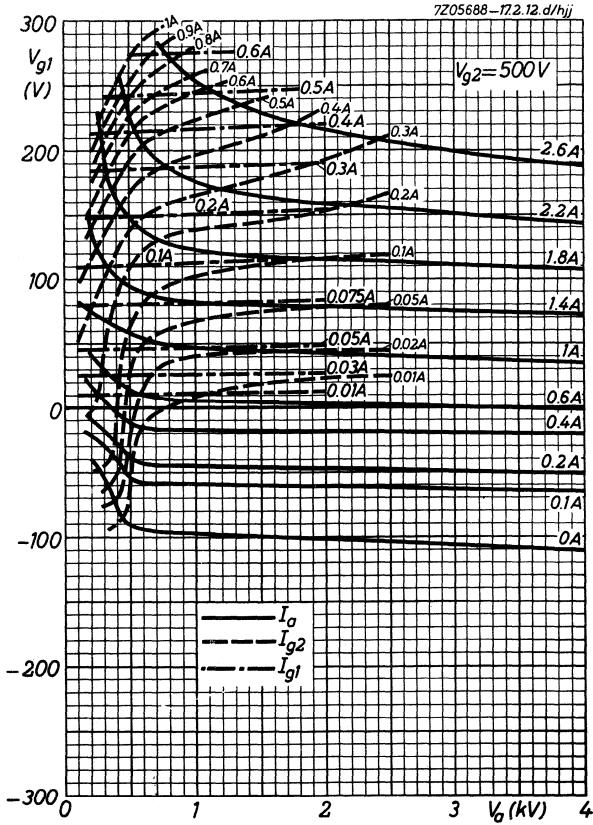
**R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE;** negative modulation, positive synchronisation.

**LIMITING VALUES** (black level; absolute limits)

Frequency	f	up to	220	MHz
Anode voltage	$V_a$	= max.	3000	V
Grid No.2 voltage	$V_{g2}$	= max.	500	V
Anode current	$I_a$	= max.	350	mA
Anode input power	$W_{ia}$	= max.	1050	W
Anode dissipation	$W_a$	= max.	500	W
Grid No.2 dissipation	$W_{g2}$	= max.	30	W
Grid No.1 current	$I_{g1}$	= max.	30	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	k $\Omega$

**OPERATING CONDITIONS** , one tube

Frequency	f	=	220	220	MHz
Bandwidth	B	=	6	6	MHz
Anode voltage	$V_a$	=	2400	1850	V
Grid No.2 voltage	$V_{g2}$	=	500	500	V
Grid No.1 voltage	$V_{g1}$	=	-100	-100	V
Peak grid No.1 A.C. voltage	$V_{g1p}$	sync	= 185	140	V
Anode current	$I_a$	sync	= 400	285	mA
		black	= 300	215	mA
Grid No.2 current	$I_{g2}$	sync	= 35	20	mA
		black	= 3	2	mA
Grid No.1 current	$I_{g1}$	sync	= 15	10	mA
		black	= 5	2	mA
Grid No.1 input power	$W_{ig1}$	sync	= 25	15	W
Anode input power	$W_{ia}$	sync	= 960	525	W
		black	= 720	400	W
Output power	$W_o$	sync	= 600	300	W
		black	= 340	170	W







## AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA						
General purposes						
$\lambda$ (m)	Freq. (MHz)	C teleg. .		$C_{ag2}$ mod.		
		$V_a$ (kV)	$W_o$ (kW)	$V_a$ (kV)	$W_o$ (kW)	
4	75	5	4.1			
		4	3.15			
2.7	110	5	3.9	4	2.7	
1.36	220	4	2.9			
Television service						
	Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
		$V_a$ (kV)	$W_o$ (kW)		$V_a$ (kV)	$W_o$ (kW) white
			sync	black		
Narrow-band	170-220	4	5.9	3.3	4	4.0
Broad-band	54-88	5	8.0	4.5		
	170-220	4	5.0	2.8	4	2.8



**HEATING:** direct; filament thoriated tungsten

Filament voltage  $V_f = 6.3$  V

Filament current  $I_f = 32.5$  A

### CAPACITANCES

Anode to all other elements except grid No.1  $C_a = 8.4$  pF

Grid No.1 to all other elements except anode  $C_{g1} = 23.5$  pF

Anode to grid No.1  $C_{ag1} < 0.35$  pF

### TYPICAL CHARACTERISTICS

Amplification factor of grid No.2  
with respect to grid No.1

$\mu_{g2g1} = 8.5$

Mutual conductance

$S (I_a = 2 \text{ A}) = 19$  mA/V

## TEMPERATURE LIMITS (Absolute limits)

Temperature of the seals = max. 180 °C

Bulb temperature = max. 250 °C

## 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 characteristics (see also cooling curves page 4 )

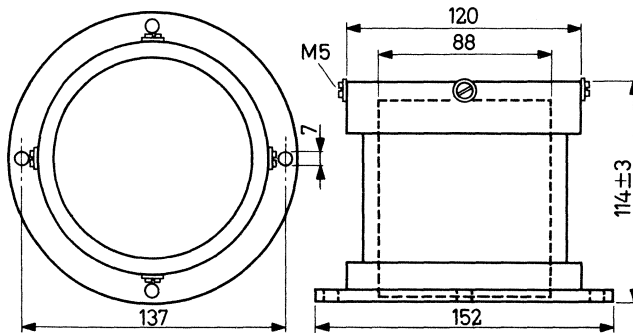
$W_a$ (kW)	h (m)	$t_i$ (°C)	$q$ (m <sup>3</sup> /min)	$P_i$ (mmH <sub>2</sub> O)
1	0	35	1.8	10
	0	45	2.2	15
	1500	35	2.2	13
	3000	25	2.3	13
2.5	0	35	4.5	60
	0	45	5.4	85
	1500	35	5.4	73
	3000	25	5.8	75
3	0	35	5.7	95

## MECHANICAL DATA

Dimensions in mm

Insulating pedestal : 40635

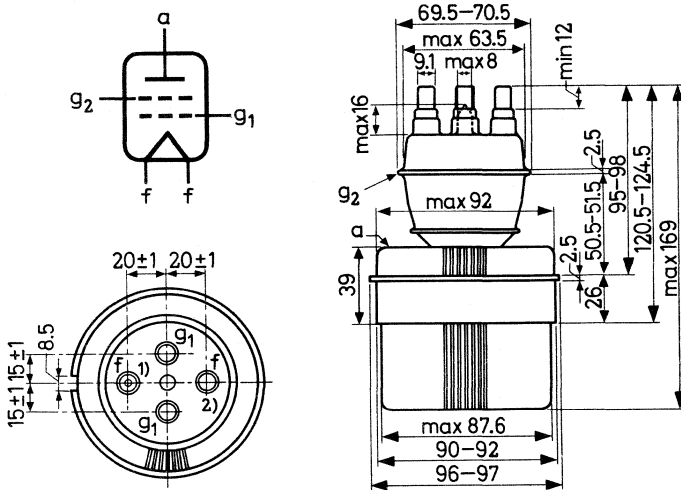
Net weight : 1.6 kg



**MECHANICAL DATA** (continued)

Dimensions in mm

Net weight of the tube : 2.25 kg  
 Filament and control grid connector : 40634  
 Screen grid connector : 40622



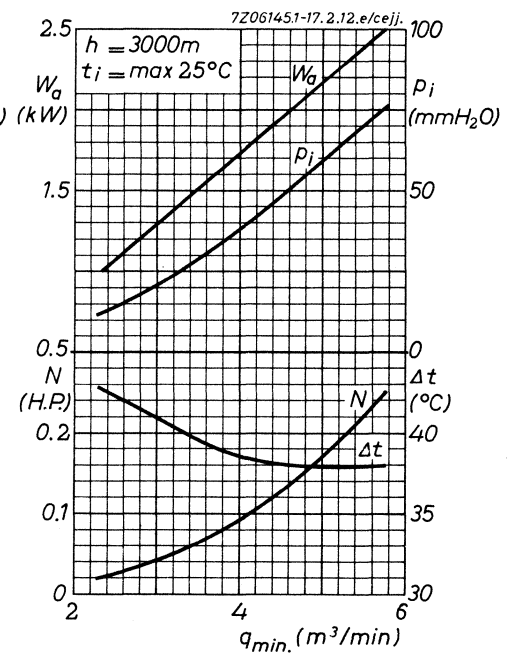
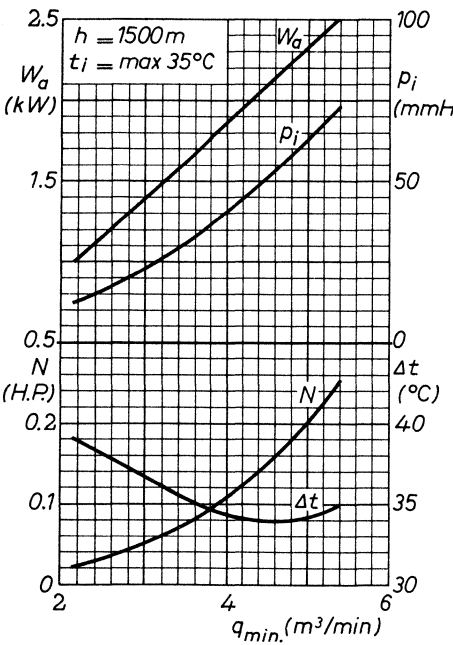
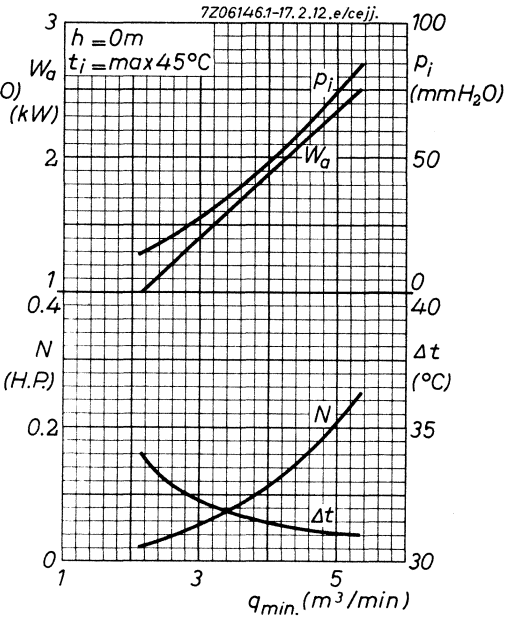
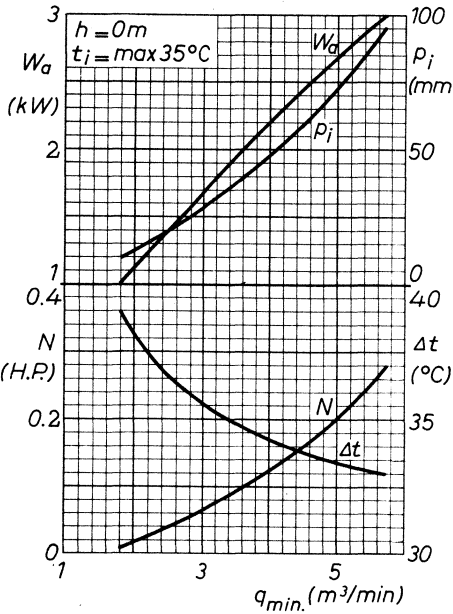
Mounting position: vertical with anode down

At frequencies above 30 MHz both connecting pins must be used when connecting the control grid

-----  
 For further data and curves (except cooling curves)  
 of this type please refer to type QBW5/3500  
 -----

1) This pin is marked "O"

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



## WATER COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA						
General purposes						
$\lambda$ (m)	Freq. (MHz)	C telegr.		$C_{ag2}$ mod.		
		$V_a$ (kV)	$W_o$ (kW)	$V_a$ (kV)	$W_o$ (kW)	
4	75	5	4.1			
2.7	110	4	3.15	4	2.7	
1.36	220	5	3.9			
		4	2.9			
Television service						
	Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
		$V_a$ (kV)	$W_o$ (kW)		$V_a$ (kV)	$W_o$ (kW) white
			sync	black		
Narrow-band	170-220	4	5.9	3.3	4	4.0
Broad-band	54-88	5 $\frac{1}{2}$	8.0	4.5		
	170-220	4	5.0	2.8	4	2.8

**HEATING:** direct; filament thoriated tungsten

Filament voltage  $V_f = 6.3$  V

Filament current  $I_f = 32.5$  A

### CAPACITANCES

Anode to all other elements except grid No.1  $C_a = 8.4$  pF

Grid No.1 to all other elements except anode  $C_{g1} = 23.5$  pF

Anode to grid No.1  $C_{ag1} < 0.35$  pF

**TYPICAL CHARACTERISTICS**

Amplification factor of grid No.2  
with respect to grid No.1

$$\mu_{g_2g_1} = 8.5$$

Mutual conductance

$$S (I_a = 2 \text{ A}) = 19 \text{ mA/V}$$

**TEMPERATURE LIMITS (Absolute limits)**

Temperature of seals = max. 180 °C

Bulb temperature = max. 250 °C

**COOLING**

In order to keep the temperature of the seals below 180 °C, it may be necessary to direct an air flow of sufficient velocity to the seals. At frequencies below 75 MHz this air cooling will in general not be necessary at  $V_a < 4 \text{ kV}$  ( $V_a < 3.2 \text{ kV}$  in the case of class C anode and screen grid modulation). At  $V_a < 5 \text{ kV}$  ( $V_a < 4 \text{ kV}$  in the case of class C anode and screen grid modulation) air cooling will generally be necessary at each frequency.

**COOLING CHARACTERISTICS** . See also cooling curves on page E

$W_a$ (kW)	$t_i$ (°C)	$q$ (l/min)	$P_i$ (atm)
1	20	2.5	0.073
	50	3.0	0.1
2	20	2.5	0.073
	50	4.8	0.25
3	20	3.0	0.105
	50	6.9	0.55

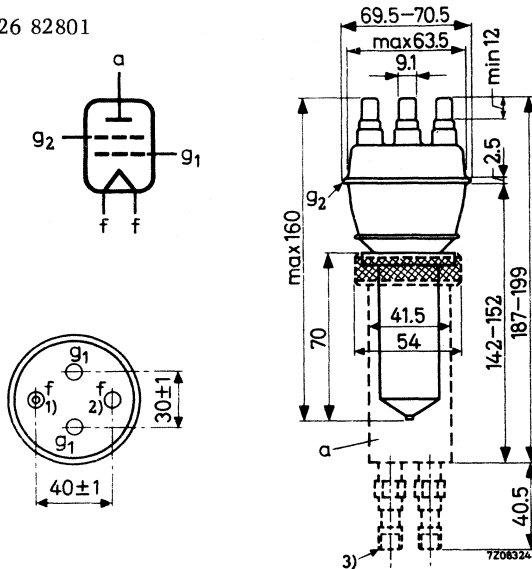
$$t_i = \text{max. } 50 \text{ } ^\circ\text{C}$$

**MECHANICAL DATA**

Dimensions in mm

Tube mounted in water jacket type K 713

O-ring 3322 026 82801



Mounting position: vertical with anode down

Filament and control grid connectors 40634

Screen grid connector 40622

At frequencies above 30 MHz both connecting pins must be used when connecting the control grid

Tube: Net weight 0.35 kg

K 713: Net weight 0.52 kg

1) This pin is marked "O"

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

3) 1/8" pipe thread

## R.F. CLASS C TELEGRAPHY

### LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	110	220	MHz
Anode voltage	$V_a$	= max.	5.5	5	4	kV
Anode input power	$W_{ia}$	= max.		5.5		kW
Anode dissipation	$W_a$	= max.		3		kW
Anode current	$I_a$	= max.		1.1		A
Grid No.2 voltage	$V_{g2}$	= max.		800		V
Grid No.2 dissipation	$W_{g2}$	= max.		100		W
Negative grid No.1 voltage	$-V_{g1}$	= max.		500		V
Grid No.1 dissipation	$W_{g1}$	= max.		30		W

### OPERATING CONDITIONS

Frequency	f	=	75	110	75	220	MHz
Anode voltage	$V_a$	=	5	5	4	4	kV
Grid No.2 voltage	$V_{g2}$	=	800	800	800	800	V
Grid No.1 voltage	$V_{g1}$	=	-250	-250	-250	-250	V
Anode current	$I_a$	=	1.1	1.1	1.1	1.1	A
Grid No.2 current	$I_{g2}$	=	100	100	120	120	mA
Grid No.1 current	$I_{g1}$	=	70	70	80	80	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	480	480	500	500	V
Grid No.1 input power	$W_{ig1}$	=	30	30	36	36	W
Grid No.2 dissipation	$W_{g2}$	=	80	80	96	96	W
Anode input power	$W_{ia}$	=	5.5	5.5	4.4	4.4	kW
Anode dissipation	$W_a$	=	1.4	1.6	1.25	1.5	kW
Output power	$W_o$	=	4.1	3.9	3.15	2.9	kW
Efficiency	$\eta$	=	74.5	71	72	66	%



**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

Screen grid modulated via a choke of 60 H

**LIMITING VALUES (Absolute limits)**

Frequency	f	up to	30	110	220	MHz
Anode voltage	$V_a$	= max.	4.5	4	3.2	kV
Anode input power	$W_{ia}$	= max.	3.6			kW
Anode dissipation	$W_a$	= max.	2			kW
Anode current	$I_a$	= max.	0.9			A
Grid No.2 voltage	$V_{g2}$	= max.	800			V
Grid No.2 dissipation	$W_{g2}$	= max.	100			W 1)
Negative grid No.1 voltage	$-V_{g1}$	= max.	500			V
Grid No.1 dissipation	$W_{g1}$	= max.	30			W

**OPERATING CONDITIONS**

Frequency	f	=	110	MHz
Anode voltage	$V_a$	=	4	kV
Grid No.2 voltage	$V_{g2}$	=	800	V
Grid No.1 voltage	$V_{g1}$	=	-375	V
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	625	V
Anode current	$I_a$	=	0.9	A
Grid No.2 current	$I_{g2}$	=	120	mA
Grid No.1 current	$I_{g1}$	=	85	mA
Anode input power	$W_{ia}$	=	3.6	kW
Anode dissipation	$W_a$	=	0.9	kW
Output power	$W_o$	=	2.7	kW
Grid No.2 dissipation	$W_{g2}$	=	96	W
Grid No.1 input power	$W_{ig1}$	=	48	W
Efficiency	$\eta$	=	75	%
Modulation factor	m	=	100	%
Modulation power	$W_{mod}$	=	1.8	kW

1) For all other modulation methods  $W_{g2} = \text{max. } 65 \text{ W}$

**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	$V_a$	= max.	5	kV
Anode current	$I_a$	= max.	1.3	A
Anode input power	$W_{ia}$	= max.	6.5	kW
Anode dissipation	$W_a$	= max.	3	kW
Grid No.2 voltage	$V_{g2}$	= max.	800	V
Grid No.2 dissipation	$W_{g2}$	= max.	100	W
Grid No.1 current	$I_{g1}$	= max.	80	mA

**OPERATING CONDITIONS**

Frequency	f	=	30	30	30	MHz
Anode voltage	$V_a$	=	5	4.5	4	kV
Grid No.2 voltage	$V_{g2}$	=	800	800	800	V
Grid No.1 voltage	$V_{g1}$	=	-107	-105	-104	V
			zero signal	single tone signal	zero signal	single tone signal
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0 277	0 275	0 274	V
Anode current	$I_a$	=	0.08 1.3	0.08 1.29	0.07 1.28	A
Grid No.2 current	$I_{g2}$	=	0 75	0 75	0 78	mA
Grid No.1 current	$I_{g1}$	=	0 55	0 55	0 54	mA
Grid No.1 input power	$W_{ig1}$	=	0 15	0 15	0 15	W
Grid No.2 dissipation	$W_{g2}$	=	0 60	0 60	0 62.5	W
Anode input power	$W_{ia}$	=	0.40 6.5	0.36 5.8	0.28 5.1	kW
Anode dissipation	$W_a$	=	0.40 2.1	0.36 1.95	0.28 1.8	kW
Output power	$W_o$	=	- 4.4	- 3.85	- 3.3	kW
Efficiency	$\eta$	=	- 68	- 66.5	- 65	%

**A.F. CLASS B AMPLIFIER AND MODULATOR**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	=	max.	5	kV
Anode input power	$W_{ia}$	=	max.	5.5	kW
Anode dissipation	$W_a$	=	max.	3	kW
Anode current	$I_a$	=	max.	1.1	A <sup>1)</sup>
Grid No.2 voltage	$V_{g2}$	=	max.	800	V
Grid No.2 dissipation	$W_{g2}$	=	max.	100	W
Negative grid No.1 voltage	$-V_{g1}$	=	max.	500	V
Grid No.1 dissipation	$W_{g1}$	=	max.	30	W

**OPERATING CONDITIONS**, two tubes

$V_a$	=	5	5	5	4	kV				
$V_{g2}$	=	800	800	800	800	V				
$V_{g1}$	=	-107	-107	-107	-103	V				
$R_{aa\sim}$	=	3700	5000	17600	7000	$\Omega$				
$V_{g1g1p}$	=	0	714	0	594	0	214	0	366	V
$I_a$	=	2x0.1	2x1.46	2x0.1	2x1.1	2x0.1	2x0.32	2x0.1	2x0.6	A
$I_{g2}$	=	0	2x120	0	2x50	0	2x10	0	2x60	mA
$I_{g1}$	=	0	2x150	0	2x40	0	0	0	2x11	mA
$I_{g1p}$	=	0	2x750	0	2x460	0	0	0	2x70	mA
$W_{ig1}$	=	0	2x50	0	2x11	0	0	0	2x2	W
$W_{g2}$	=	0	2x96	0	2x40	0	2x8	0	2x48	W
$W_{ia}$	=	2x0.5	2x7.3	2x0.5	2x5.5	2x0.5	2x1.6	2x0.4	2x2.4	kW
$W_a$	=	2x0.5	2x2.55	2x0.5	2x1.9	2x0.5	2x0.55	2x0.4	2x0.9	kW
$W_o$	=	0	9.5	0	7.2	0	2.1	0	3.0	kW
$\eta$	=	-	65	-	65	-	65	-	62	%

<sup>1)</sup> At 100 % modulation with single tone sine wave  $I_a = \text{max. } 1.5 \text{ A}$

**GRID MODULATED R.F. CLASS C AMPLIFIER FOR TELEVISION SERVICE ,**  
negative modulation, positive synchronisation

**LIMITING VALUES (Absolute limits)**

Frequency	f	up to 110	up to 220	MHz
Anode voltage	$V_a$	= max. 5	max. 4	kV
Anode input power	$W_{ia}$ sync	= max. 7	max. 6	kW
Anode current	$I_a$ sync	= max. 1.5		A
Anode dissipation	$W_a$ sync	= max. 3		kW
Grid No.2 voltage	$V_{g2}$	= max. 800		V
Grid No.2 dissipation	$W_{g2}$ sync	= max. 100		W
Negative grid No.1 voltage	$-V_{g1}$	= max. 500		V
Grid No.1 current	$I_{g1}$ sync	= max. 80		mA

**OPERATING CONDITIONS , two tubes in push-pull**

Frequency	f	= 54-88 <sup>1)</sup>	170-220 <sup>1)</sup>	170-220	MHz
Bandwidth	B (-1.5 dB)	= 6.5	6.5	-	MHz <sup>2)</sup>
Bandwidth	B (-3 dB)	= 12	12	7.5	MHz <sup>2)</sup>
Anode voltage	$V_a$	= 5	4	4	kV
Grid No.2 voltage	$V_{g2}$	= 800	800	800	V
Grid No.1 voltage	$V_{g1}$	sync =	-175	-150	-150 V
		black =	-260	-230	-260 V
		white =	-450	-450	-450 V
Input A.C. voltage, peak to peak	$V_{g1g1p}$	= 900	850	850	V <sup>3)</sup>
Anode current	$I_a$	sync =	2.7	2.75	2.75 A
		black =	1.75	2.1	1.5
Grid No.2 current	$I_{g2}$	sync =	145	110	250 mA
		black =	40	50	65
Grid No.1 current	$I_{g1}$	sync =	82	100	80 mA
		black =	35	50	20
Grid No.1 input power	$W_{ig1}$ sync	= 200-300	300-400	200-300	W <sup>4)</sup>
Output power	$W_o$	sync =	8.0	5.0	5.9 kW
		black =	4.5	2.8	3.3

<sup>1) 2) 3) 4)</sup> See page 13

**R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE**, negative modulation, positive synchronisation

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 110	up to 220	MHz
Anode voltage	$V_a$	= max. 5	max. 4	kV
Anode input power	$W_{ia}$ sync	= max. 7	max. 6	kW
Grid No.2 voltage	$V_{g2}$	= max. 800		V
Anode current	$I_a$ sync	= max. 1.5		A
Anode dissipation	$W_a$ sync	= max. 3		kW
Grid No.2 dissipation	$W_{g2}$ sync	= max. 100		W
Grid No.1 current	$I_{g1}$ sync	= max. 80		mA

**OPERATING CONDITIONS**, two tubes in push-pull

Frequency	f	=	54-88	170-220	MHz <sup>1)</sup>
Bandwidth	B (-1.5 dB)	=	6.5	6.5	MHz <sup>2)</sup>
Bandwidth	B (-3 dB)	=	12	12	MHz <sup>2)</sup>
Anode voltage	$V_a$	=	5	4	kV
Grid No.2 voltage	$V_{g2}$	=	800	800	V
Grid No.1 voltage	$V_{g1}$	=	-175	-150	V
Input A.C. voltage, peak to peak	$V_{g1g1p}$ sync	=	900	850	V <sup>3)</sup>
	$V_{g1g1p}$ black	=	730	700	V <sup>3)</sup>
Anode current	$I_a$ sync	=	2.7	2.75	A
	$I_a$ black	=	1.75	2.1	A
Grid No.2 current	$I_{g2}$ sync	=	145	110	mA
	$I_{g2}$ black	=	40	50	mA
Grid No.1 current	$I_{g1}$ sync	=	82	100	mA
	$I_{g1}$ black	=	35	50	mA
Grid No.1 input power	$W_{ig1}$ sync	=	200-300	300-400	W <sup>4)</sup>
Output power	$W_o$ sync	=	8.0	5.0	kW
	$W_o$ black	=	4.5	2.8	kW

<sup>1)2)3)4)</sup> See page 13

## GRID MODULATED R.F. CLASS C AMPLIFIER FOR TELEVISION SERVICE , positive modulation, negative synchronisation

### LIMITING VALUES (Absolute limits)

Frequency	f	up to 110	up to 220	MHz
Anode voltage	$V_a$	= max. 5	max. 4	kV
Anode input power	$W_{ia}$ white	= max. 5.5	max. 4.4	kW
Grid No.2 voltage	$V_{g2}$	=	max. 800	V
Negative grid No.1 voltage	$-V_{g1}$	=	max. 500	V
Anode current	$I_a$ white	=	max. 1.1	A
Anode dissipation	$W_a$ white	=	max. 3	kW
Grid No.2 dissipation	$W_{g2}$ white	=	max. 100	W
Grid No.1 current	$I_{g1}$ white	=	max. 80	mA

### OPERATING CONDITIONS, two tubes in push-pull

Frequency	f	=	170-220 <sup>1)</sup>	170-220	MHz
Bandwidth	B (-1.5 dB)	=	6.5	-	MHz <sup>2)</sup>
Bandwidth	B (-3 dB)	=	12	7.5	MHz <sup>2)</sup>
Anode voltage	$V_a$	=	4	4	kV
Grid No.2 voltage	$V_{g2}$	=	800	800	V
Grid No.1 voltage	$V_{g1}$ white	=	-230	-230	V
	$V_{g1}$ black	=	-380	-380	V
Input A.C. voltage, peak to peak	$V_{g1g1p}$	=	850	850	V <sup>3)</sup>
Anode current	$I_a$ white	=	2.1	1.7	A
	$I_a$ black	=	0.6	0.5	A
Grid No.2 current	$I_{g2}$ white	=	50	80	mA
	$I_{g2}$ black	=	10	10	mA
Grid No.1 current	$I_{g1}$ white	=	50	25	mA
	$I_{g1}$ black	=	0	0	mA
Grid No.1 input power	$W_{ig1}$	=	300-400	200-300	W <sup>4)</sup>
Output power	$W_o$ white	=	2.8 <sup>5)</sup>	4.0	kW
	$W_o$ black	=	0.25	0.36	kW

<sup>1)2)3)4)5)</sup> See page 13.

**R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE**, positive modulation, negative synchronisation

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 110	up to 220	MHz
Anode voltage	$V_a$	= max. 5	max. 4	kV
Anode input power	$W_{ia}$ white	= max. 5.5	max. 4.4	kW
Grid No.2 voltage	$V_{g2}$	=	max. 800	V
Anode current	$I_a$ white	=	max. 1.1	A
Anode dissipation	$W_a$ white	=	max. 3	kW
Grid No.2 dissipation	$W_{g2}$ white	=	max. 100	W
Grid No.1 current	$I_{g1}$ white	=	max. 80	mA



**OPERATING CONDITIONS**, two tubes in push-pull

Frequency	f	=	170-220	MHz <sup>1)</sup>
Bandwidth	B (-1.5 dB)	=	6.5	MHz <sup>2)</sup>
Bandwidth	B (-3 dB)	=	12	MHz <sup>2)</sup>
Anode voltage	$V_a$	=	4	kV
Grid No.2 voltage	$V_{g2}$	=	800	V
Grid No.1 voltage	$V_{g1}$	=	-150	V
Input A.C. voltage, peak to peak	$V_{g1g1p}$ white	=	700	V <sup>3)</sup>
	black	=	350	V <sup>3)</sup>
Anode current	$I_a$ white	=	2.1	A
	black	=	0.6	A
Grid No.2 current	$I_{g2}$ white	=	50	mA
	black	=	10	mA
Grid No.1 current	$I_{g1}$ white	=	50	mA
	black	=	0	mA
Grid No.1 input power	$W_{ig1}$ white	=	200-300	W <sup>4)</sup>
Output power	$W_o$ white	=	2.8	kW <sup>5)</sup>
	black	=	0.25	kW

<sup>1)2)3)4)5)</sup> See page 13.

**GRID MODULATED R.F. CLASS C AMPLIFIER FOR COLOUR TELEVISION SERVICE**, negative modulation, positive synchronisation

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 110	up to 220	MHz
Anode voltage	$V_a$	= max. 5	max. 4	kV
Anode input power	$W_{ia}$ sync	= max. 7	max. 6	kW
Anode current	$I_a$ sync	= max. 1.5		A
Anode dissipation	$W_a$ sync	= max. 3		kW
Grid No.2 voltage	$V_{g2}$	= max. 800		V
Grid No.2 dissipation	$W_{g2}$ sync	= max. 100		W
Negative grid No.1 voltage	$-V_{g1}$	= max. 500		V
Grid No.1 current	$I_{g1}$ sync	= max. 80		mA

**OPERATING CONDITIONS**, two tubes in push-pull

Frequency	f	= 170-220	MHz <sup>1)</sup>
Bandwidth	B (-1.5 dB)	= 4	MHz <sup>2)</sup>
Bandwidth	B (-3 dB)	= 8.5	MHz <sup>2)</sup>
Anode voltage	$V_a$	= 3.5	kV
Grid No.2 voltage	$V_{g2}$	= 700	V
Grid No.1 voltage	$V_{g1}$	sync =	-120 V
		black =	-170 V
		white =	-320 V
Input A.C. voltage, peak to peak	$V_{g1g1p}$	= 640	V <sup>3)</sup>
Anode current	$I_a$	sync =	2 A
		black =	1.5 A
Grid No.2 current	$I_{g2}$	sync =	82 mA
		black =	38 mA
Grid No.1 current	$I_{g1}$	sync =	100 mA
		black =	50 mA
Grid No.1 input power	$W_{ig1}$ sync	= 100-200	W <sup>4)</sup>
Output power	$W_o$	sync =	3 kW
		black =	1.7 kW

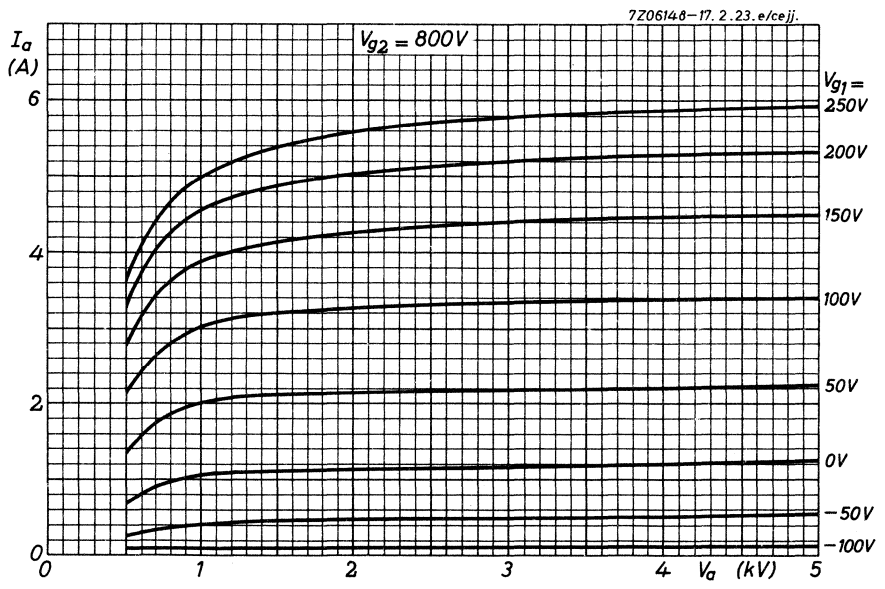
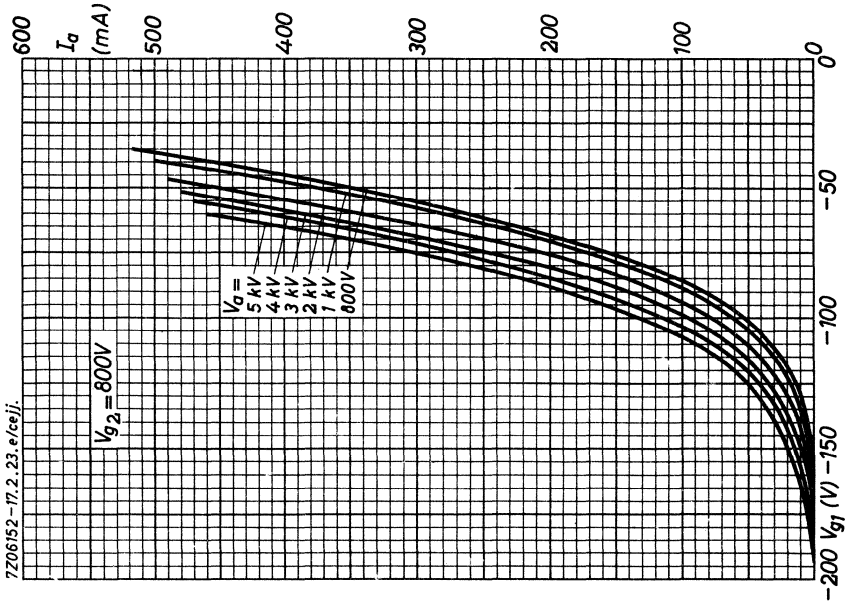
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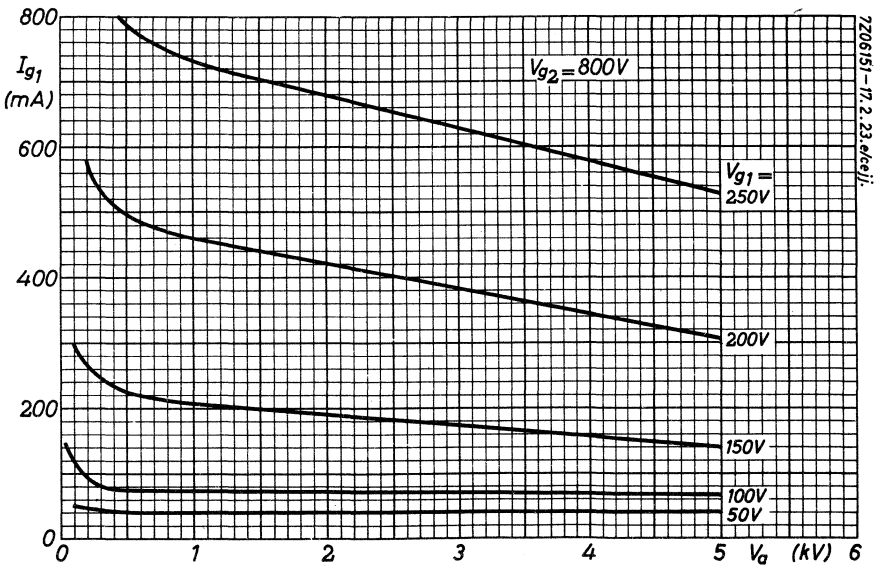
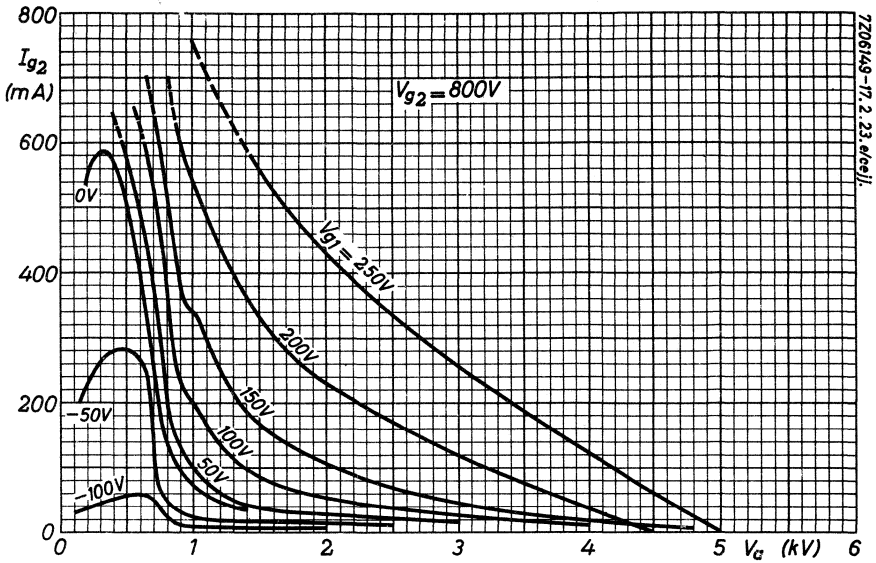


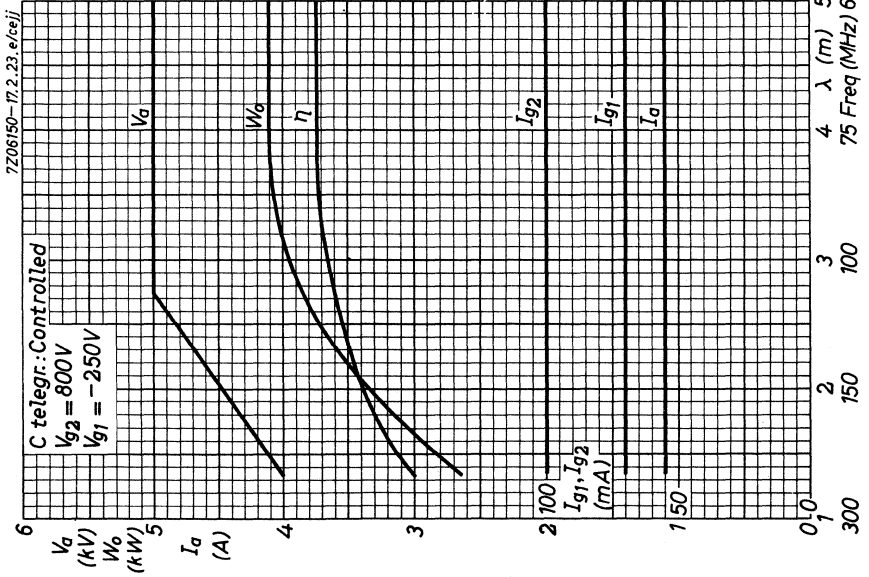
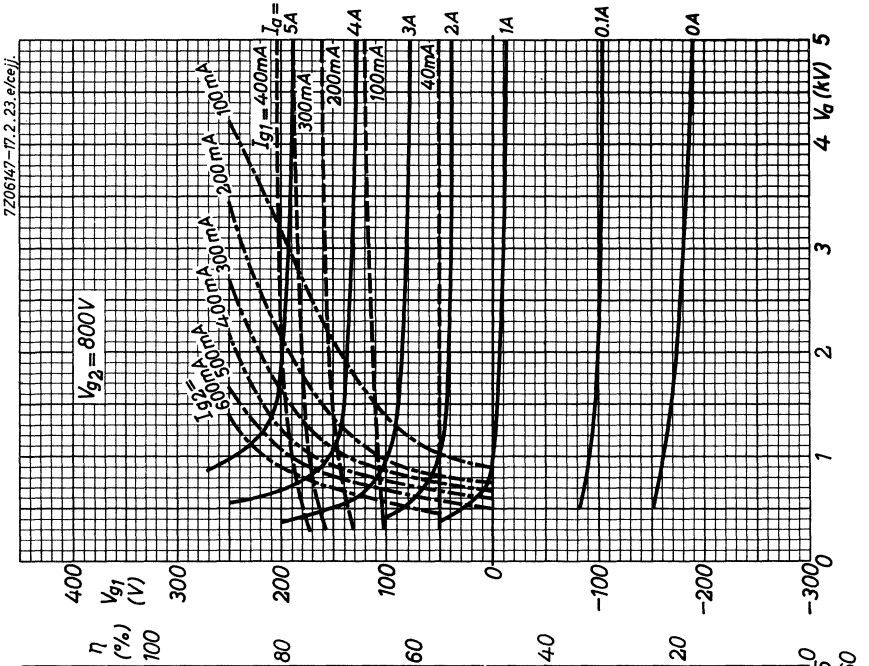


- 1) The operating conditions are given at a frequency slightly below the peak of the resonance curve.
- 2) This value of bandwidth is based on measurements on a circuit with a single L.C. section.
- 3) Measured by the slide back method.
- 4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.
- 5) In the peak of the resonance curve  $W_0$  (white) = 3.3 kW

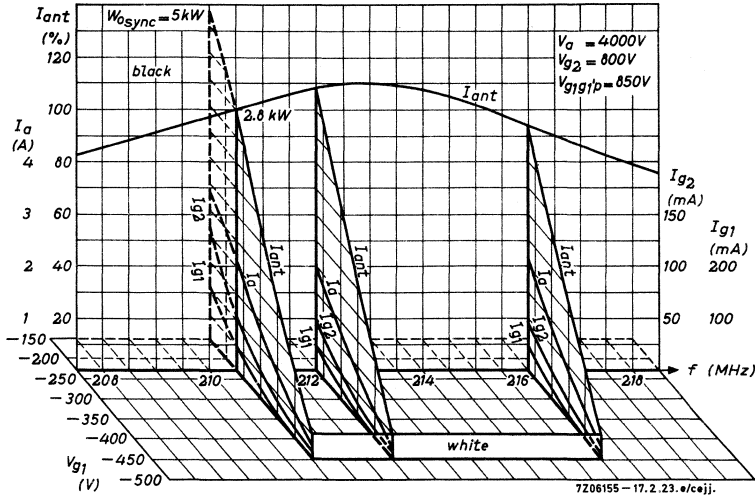
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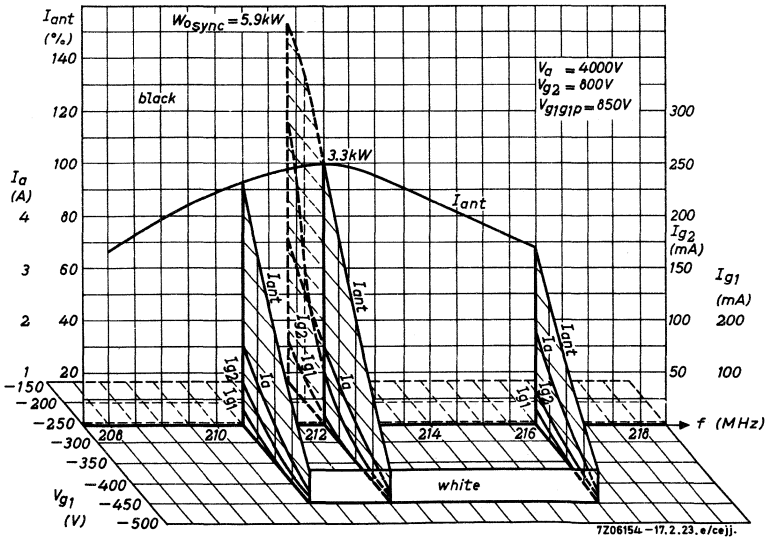




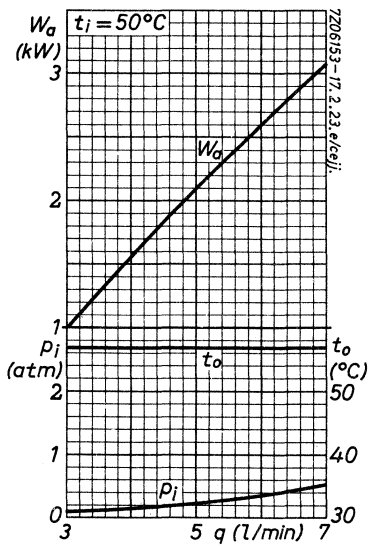
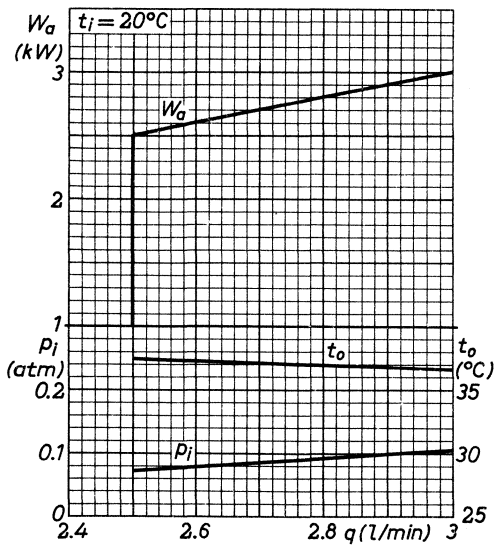
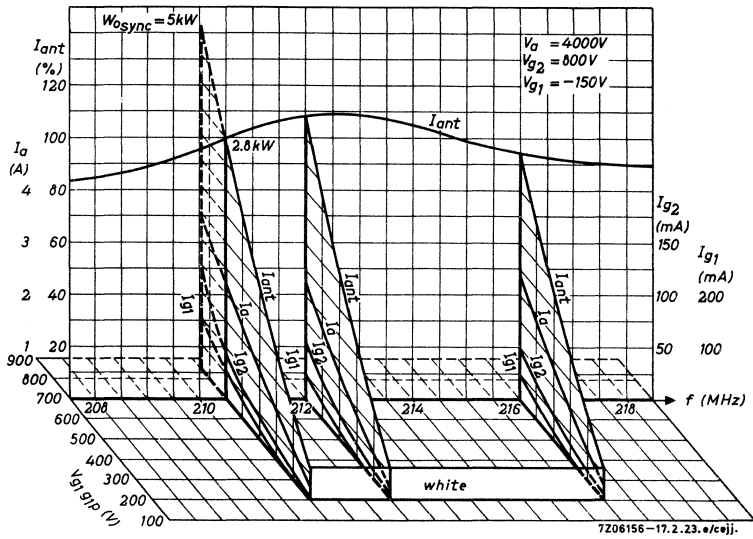
Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)



Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)



Grid-modulated R.F. class B amplifier for television service (2 tubes in push-pull)



## R.F. BEAM POWER TETRODE FOR MOBILE EQUIPMENT

QUICK REFERENCE DATA				
Freq. (MHz)	C telegr. FM teleph.		C <sub>ag2</sub> mod.	
	V <sub>a</sub> (V)	W <sub>o</sub> (W) IMS 1)	V <sub>a</sub> (V)	W <sub>o</sub> (W) IMS 1)
60	600	65	475 400	34 32
175	400	35		

**HEATING** : direct; filament oxide-coated

$$\text{Filament voltage} \quad V_f = 1.6 \text{ V} \pm 15\%$$

$$\text{Filament current} \quad I_f = 3.2 \text{ A}$$

The cathode heating time for  $W_o > 70\%$  of  $W_o \text{ max.} = 0.4 \text{ sec.}$

### CAPACITANCES

$$\text{Anode to all other elements except grid No.1} \quad C_a = 8.5 \text{ pF}$$

$$\text{Grid No.1 to all other elements except anode} \quad C_{g1} = 13.5 \text{ pF}$$

$$\text{Anode to grid No.1} \quad C_{ag1} < 0.24 \text{ pF}$$

### TYPICAL CHARACTERISTICS

$$\text{Anode voltage} \quad V_a = 200 \text{ V}$$

$$\text{Grid No.2 voltage} \quad V_{g2} = 200 \text{ V}$$

$$\text{Anode current} \quad I_a = 100 \text{ mA}$$

$$\text{Mutual conductance} \quad S = 7 \text{ mA/V}$$

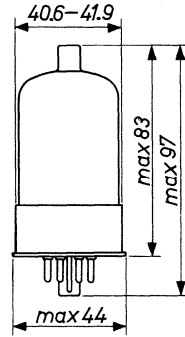
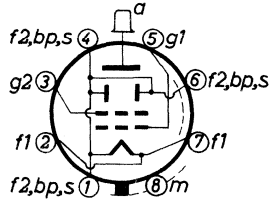
$$\text{Amplification factor of grid No.2} \\ \text{with respect to grid No.1} \quad \mu_{g2g1} = 4.5$$

1) Intermittent mobile service

**MECHANICAL DATA**

Base : Octal 8p  
 Socket : 2422 501 03001 1)  
 Anode connector: 28 906 022  
 Net weight : 57 g

Dimensions in mm



Mounting position: When the tube is mounted with its main axis deviating from the vertical it is recommended that the pins 3 and 7 be placed in a vertical plane.

**TEMPERATURE LIMITS** (Absolute limits)

Bulb temperature max. 220 °C

DERATING TABLE of the limiting values of  $V_a$  and  $W_{ia}$  as a function of the operating frequency

Freq. (MHz)	$V_a$ (%)	$W_{ia}$ (%)
60	100	100
80	84	92
125	65	78
150	58	72
160	56	70
175	53	67

<sup>1)</sup> Filament connections (tags 1-4-6 and 2-7) should be connected in parallel on the socket.



**R.F.CLASS C TELEGRAPHY AND F.M. TELEPHONY** , intermittent mobile service

**LIMITING VALUES** (Absolute limits)

See also page 2 for derating table

Frequency	f	up to	60	MHz
Anode voltage	$V_a$	= max.	650	V
Anode input power	$W_{ia}$	= max.	90	W
Anode dissipation	$W_a$	= max.	25	W
Anode current	$I_a$	= max.	160	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 current	$I_{g1}$	= max.	5	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	$k\Omega$ <sup>1)</sup>

**OPERATING CHARACTERISTICS**

Frequency	f	=	60	175	MHz
Anode voltage	$V_a$	=	600	400	V
Grid No.2 voltage	$V_{g2}$	=	180	190	V <sup>2)</sup>
Grid No.1 voltage	$V_{g1}$	=	-71	-54	V <sup>3)</sup>
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	91	68	V
Anode current	$I_a$	=	150	150	mA
Grid No.2 current	$I_{g2}$	=	15	15	mA
Grid No.1 current	$I_{g1}$	=	2.8	2.2	mA
Grid No.1 input power	$W_{ig1}$	=	0.3	3	W
Anode input power	$W_{ia}$	=	90	60	W
Anode dissipation	$W_a$	=	25	25	W
Output power	$W_o$	=	65	35	W
Efficiency	$\eta$	=	73.5	58	%

1) For operation at maximum ratings

2) Obtained preferably from the anode supply through a series resistor

3)  $V_{g1}$  may be obtained by means of a grid resistor or from a combination of grid resistor and fixed supply.

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION,** intermittent mobile service

**LIMITING VALUES** (Absolute limits) See also page 2 for derating table

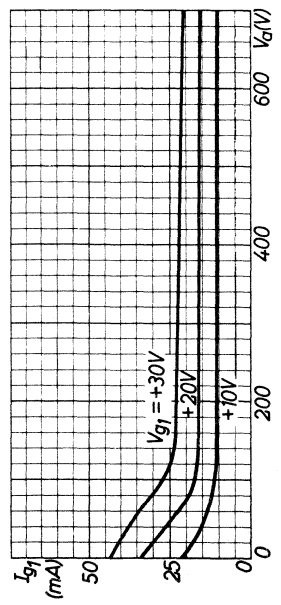
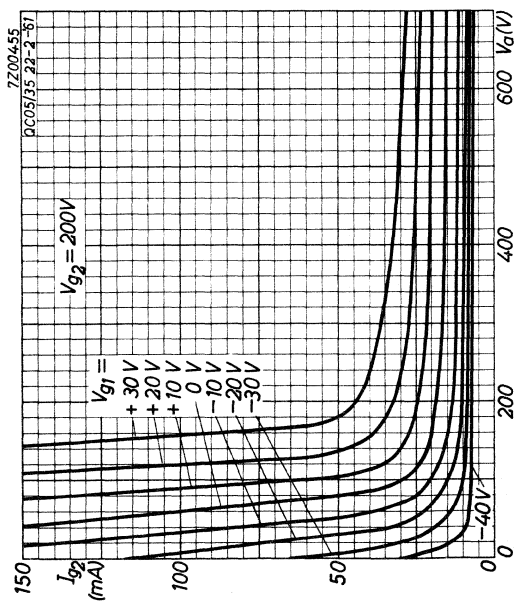
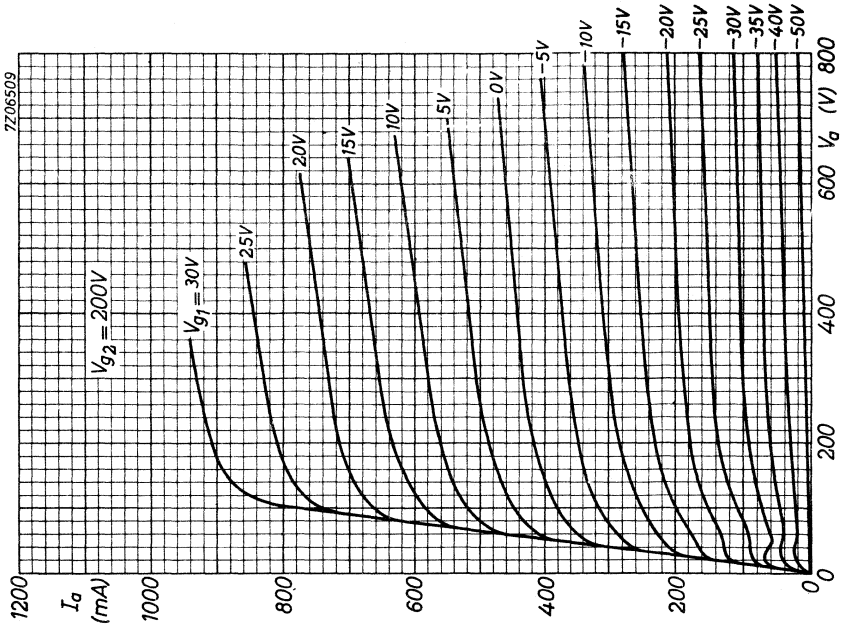
Frequency	f	up to	60 MHz
Anode voltage	$V_a$	= max.	480 V
Anode input power	$W_{ia}$	= max.	45 W
Anode dissipation	$W_a$	= max.	14 W
Anode current	$I_a$	= max.	120 mA
Grid No.2 voltage	$V_{g2}$	= max.	250 V
Grid No.2 dissipation	$W_{g2}$	= max.	2 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150 V
Grid No.1 current	$I_{g1}$	= max.	3.5 mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	30 $k\Omega$ <sup>1)</sup>

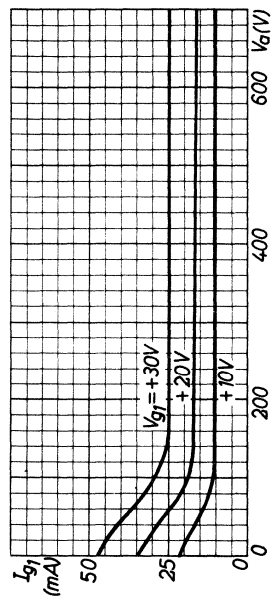
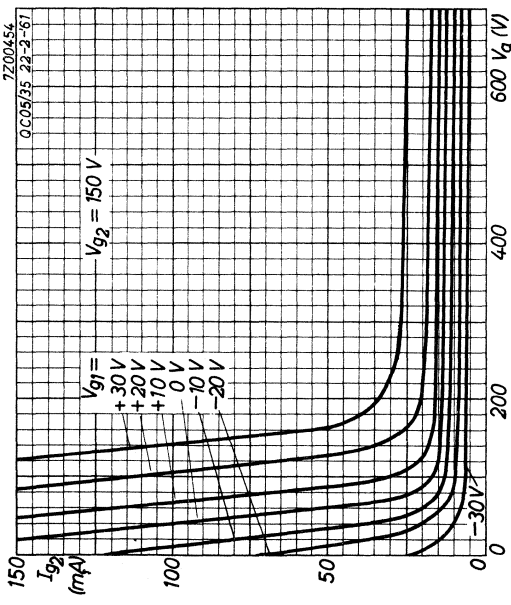
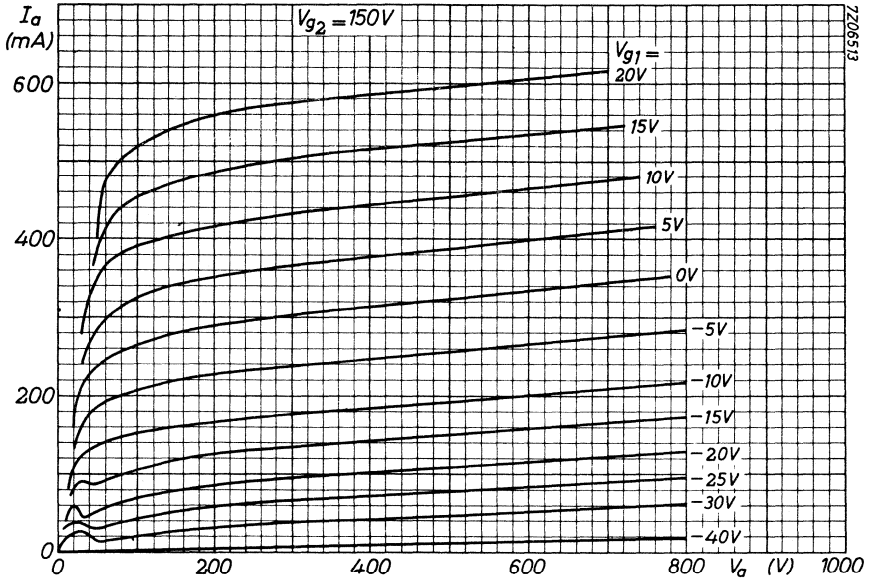
**OPERATING CHARACTERISTICS**

Frequency	f	=	60	60 MHz
Anode voltage	$V_a$	=	475	400 V
Grid No.2 voltage	$V_{g2}$	=	135	150 V <sup>4)</sup>
Grid No.1 voltage	$V_{g1}$	=	-77	-87 V <sup>3)</sup>
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	95	107 V
Anode current	$I_a$	=	94	112 mA
Grid No.2 current	$I_{g2}$	=	9	12 mA
Grid No.1 current	$I_{g1}$	=	2.8	3.4 mA
Grid No.1 input power	$W_{ig1}$	=	0.3	0.4 W
Anode input power	$W_{ia}$	=	45	45 W
Anode dissipation	$W_a$	=	11	13 W
Output power	$W_o$	=	34	32 W
Efficiency	$\eta$	=	75	71 %
Modulation factor	m	=	100	100 %
Modulation power	$W_{mod}$	=	23	23 W

1)3) See page 3

4) Obtained preferably from a separate source modulated by the anode supply or from the modulated anode supply through a series resistor.







R.F. TETRODE

QUICK REFERENCE DATA

C teleg. .				C fr. mult. .			
$\lambda$	Freq.	$V_a$ (V)	$W_o$ (W)	$\lambda$	Freq.	$V_a$ (V)	$W_o$ (W)
m	MHz			m	MHz		
>5	<60	300	8	8/4	37.5/75	300	5.6
3	100	300	7.4	6/3	50/100	300	4.4
2	150	300	6.3	4/2	75/150	250	2.3
1.7	175	280	5.4	12/4	25/75	300	3.2
		C <sub>ag2</sub> mod.		9/3	33.3/100	275	2.8
>5	<60	250	5.8	6/2	50/150	225	1.5

HEATING : indirect; cathode oxide-coated

Heater voltage  $V_f = 6.3$  V  
 Heater current  $I_f = 0.6$  A  
 Cathode heating time  $T_{hk} = 22$  sec

CAPACITANCES

Anode to all other elements except grid No.1  $C_a = 5.4$  pF  
 Grid No.1 to all other elements except anode  $C_{g1} = 8$  pF  
 Anode to grid No.1  $C_{ag1} < 0.1$  pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2  
 with respect to grid No.1  $\mu_{g2g1} = 5.6$   
 Mutual conductance ( $I_a = 25$  mA)  $S = 1.9$  mA/V  
 Internal resistance  $R_i = 67$  k $\Omega$

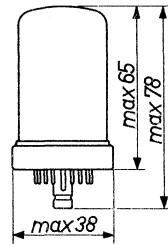
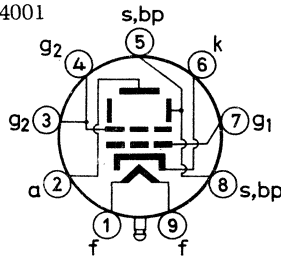
**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	400	V
Anode dissipation	$W_a$	= max.	7.5	W
Grid No.2 voltage	$V_{g_2}$	= max.	250	V
Grid No.2 dissipation	$W_{g_2}$	= max.	2	W
Grid No.1 dissipation	$W_{g_1}$	= max.	0.25	W
Grid No.1 circuit resistance	$R_{g_1}$	= max.	0.1	MΩ
Grid No.1 current	$I_{g_1}$	= max.	6	mA
Cathode current	$I_k$	= max.	50	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**MECHANICAL DATA**

Base : B9G  
 Socket : 2422 502 04001  
 Net weight: 40 g

Dimensions in mm



Mounting position: arbitrary

## OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

$\lambda$	=	>5	>5	3	2	2	1.7 <sup>1)</sup> m
$V_a$	=	300	300	300	300	300	280 V
$V_{g1}$	=	-60	-35	-60	-50	-30	-50 V
$V_{g2}$	=	250	150	250	250	150	250 V
$I_a$	=	43	40	44.5	46	44	2x46 mA
$I_{g1}$	=	0.5	2.8	0.4	0.4	1.5	2x0.3 mA
$I_{g2}$	=	6.7	7.2	5.3	4	4.5	2x3.5 mA
$V_{g1p}$	=	68	58	68	57	52	55 V
$W_{ig1}$	=	31	150	25	21	70	2x15 mW
$W_{g2}$	=	1.7	1.1	1.4	1	0.7	2x0.9 W
$W_{ia}$	=	12.9	12	13.4	13.8	13.2	2x12.9 W
$W_a$	=	4.9	4.9	6	7.5	6.9	2x7.5 W
$W_o$	=	8	7.1	7.4	6.3	6.3	10.8 W
$\eta$	=	62	59	55	46	48	42 %

## OPERATING CONDITIONS CLASS C ANODE AND SCREEN GRID MODULATION

Wavelength	$\lambda$	>	5 m
Anode voltage	$V_a$	=	250 V
Grid No.1 voltage	$V_{g1}$	=	-50 V
Grid No.2 voltage	$V_{g2}$	=	200 V
Anode current	$I_a$	=	38.5 mA
Grid No.1 current	$I_{g1}$	=	1.5 mA
Grid No.2 current	$I_{g2}$	=	10 mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	72 V
Grid No.1 input power	$W_{ig1}$	=	0.1 W
Grid No.2 dissipation	$W_{g2}$	=	2 W
Anode input power	$W_{ia}$	=	9.6 W
Anode dissipation	$W_a$	=	3.8 W
Output power	$W_o$	=	5.8 W
Efficiency	$\eta$	=	60 %
Modulation factor	m	=	100 %
Peak grid No.2 A.C. voltage	$V_{g2p}$	=	176 V
Modulation power	$W_{mod}$	=	5 W

<sup>1)</sup> Two tubes in push-pull

**OPERATING CONDITIONS AS CLASS C FREQUENCY DOUBLER**

Wavelength	$\lambda$	=	8/4	6/3	4/2	m
Anode voltage	$V_a$	=	300	300	250	V
Grid No.1 voltage	$V_{g1}$	=	-120	-120	-120	V
Grid No.2 voltage	$V_{g2}$	=	250	200	200	V
Anode current	$I_a$	=	43.3	38.4	36.8	mA
Grid No.1 current	$I_{g1}$	=	1.2	1.5	1.1	mA
Grid No.2 current	$I_{g2}$	=	5.5	2.6	2.1	mA
Peak grid No.1 A.C. voltage	$V_{g1P}$	=	124	120	144	V
Grid No.1 input power	$W_{ig1}$	=	134	162	143	mW
Grid No.2 dissipation	$W_{g2}$	=	1.4	0.52	0.42	W
Anode input power	$W_{ia}$	=	13	11.5	9.2	W
Anode dissipation	$W_a$	=	7.4	7.1	6.9	W
Output power	$W_o$	=	5.6	4.4	2.3	W
Efficiency	$\eta$	=	43	38	25	%

**OPERATING CONDITIONS AS CLASS C FREQUENCY TRIPLER**

Wavelength	$\lambda$	=	12/4	9/3	6/2 <sup>1)</sup>	m
Anode voltage	$V_a$	=	300	275	225	V
Grid No.1 voltage	$V_{g1}$	=	-140	-140	-140	V
Grid No.2 voltage	$V_{g2}$	=	250	200	200	V
Anode current	$I_a$	=	34.3	36	2x36	mA
Grid No.1 current	$I_{g1}$	=	0	1.5	2x1.3	mA
Grid No.2 current	$I_{g2}$	=	2.8	2.5	2x2.5	mA
Peak grid No.1 A.C. voltage	$V_{g1P}$	=	130	142	152	V
Grid No.1 input power	$W_{ig1}$	=	0	192	2x180	mW
Grid No.2 dissipation	$W_{g2}$	=	0.7	0.5	2x0.5	W
Anode input power	$W_{ia}$	=	10.3	9.9	2x8.1	W
Anode dissipation	$W_a$	=	7.1	7.1	2x6.6	W
Output power	$W_o$	=	3.2	2.8	3	W
Efficiency	$\eta$	=	31	28.5	18.5	%

1) Two tubes in push-pull



## R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA								
$\lambda$ (m)	Freq. (MHz)	C telegr.			$C_{ag2}$ mod.			
		$V_a$ (V)	$W_o$ (W)		$V_a$ (V)	$W_o$ (W)		
			CCS	ICAS		CCS	ICAS	
5	60	750		70	600		52	
		600	52	66	475	34		
		500	48		400	32		
1.7	175	400		35				
		320	25					
AB mod. 1)2)			AB mod. 1)3)			AB mod. 1)4)		
$V_a$ (V)	$W_o$ (W)		$V_a$ (V)	$W_o$ (W)		$V_a$ (V)	$W_o$ (W)	
	CCS	ICAS		CCS	ICAS		CCS	ICAS
750		120	750		131	400	22	22
600	82	95	600	90	113	250	10	
500	70		500	83				
400	55		400	62				

**HEATING:** indirect; cathode oxide-coated

Heater voltage

$V_f = 6.3$  V

Heater current

$I_f = 1.25$  A

### CAPACITANCES

Grid No.1 to all other elements except anode

$C_{g1} = 13.5$  pF

Anode to all other elements except grid No.1

$C_a = 8.5$  pF

Anode to grid No.1

$C_{ag1} < 0.24$  pF

1) Two tubes

2) Without grid current

3) With grid current

4) In triode connection

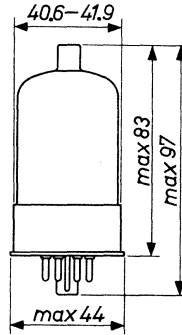
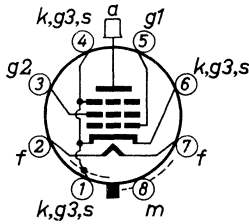
**TYPICAL CHARACTERISTICS**

Anode voltage	$V_a$	=	200 V
Grid No.2 voltage	$V_{g_2}$	=	200 V
Anode current	$I_a$	=	100 mA
Mutual conductance	$S$	=	7 mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	4.5

**MECHANICAL DATA**

Dimensions in mm

- Base : Octal 8p
- Socket : 2422 501 03001
- Anode connector: 28 906 022
- Net weight : 57 g



Mounting position: arbitrary

**TEMPERATURE LIMIT (Absolute limits)**

Bulb temperature = max. 220 °C

## R.F. CLASS C TELEGRAPHY AND R.F. CLASS C ANODE AND SCREEN GRID MODULATION

Derating table of the limiting values of  $V_a$  and  $W_{ia}$  (in %) as a function of the operating frequency

Freq. (MHz)	$V_a$ (%)	$W_{ia}$ (%)
60	100	100
80	84	92
125	65	78
150	58	72
160	56	70
175	53	67

Pages 4 and 5

- 1) For operation at maximum values
- 2)  $V_{g1}$  may be obtained from a separate supply, or from  $R_{g1}$  or  $R_k$ , or by combination methods
- 3) Obtained preferably from a separate source, or from the anode supply with a voltage divider or through a series resistor  
When the tube is keyed, a series screen resistor should not be used.  $V_{g2}$  must not exceed 400 V under key-up conditions
- 4)  $V_{g1}$  may be obtained by means of a grid resistor or from a combination of grid resistor with either fixed supply or cathode resistor
- 5) Obtained preferably from a separate source modulated with the anode supply or from the modulated anode supply through a series resistor

**R.F. CLASS C TELEGRAPHY**

See also page 3 for derating table

**LIMITING VALUES** (Absolute limits)

	f	Continuous C.C.S.		Intermittent I.C.A.S.		MHz
		up to	60	up to	60	
Anode voltage	$V_a$	= max.	600	max.	750	V
Anode input power	$W_{ia}$	= max.	67.5	max.	90	W
Anode dissipation	$W_a$	= max.	20	max.	25	W
Anode current	$I_a$	= max.	140	max.	150	mA
Grid No.2 voltage	$V_{g2}$	= max.	250	max.	250	V
Grid No.2 dissipation	$W_{g2}$	= max.	3	max.	3	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	max.	150	V
Grid No.1 current	$I_{g1}$	= max.	3.5	max.	4	mA
Peak heater to cathode voltage	$V_{kfp}$	= max.	135	max.	135	V
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	max.	30	$k\Omega^1)$

**OPERATING CONDITIONS**

	f	Continuous service C.C.S.			Intermittent service I.C.A.S.			MHz	
		=							
Frequency	f	=	60	60	175	60	60	175	MHz
Anode voltage	$V_a$	=	600	500	320	750	600	400	V
Grid No.1 voltage	$V_{g1}$	=	-58	-66	-51	-62	-71	-54	V <sup>2)</sup>
Grid No.2 voltage	$V_{g2}$	=	150	170	180	160	180	190	V <sup>3)</sup>
Anode current	$I_a$	=	112	135	140	120	150	150	mA
Grid No.1 current	$I_{g1}$	=	2.8	2.5	2.0	3.1	2.8	2.2	mA
Grid No.2 current	$I_{g2}$	=	9	9	10	11	10	10.4	mA
Peak grid No.1 voltage	$V_{g1p}$	=	73	84	64	79	91	68	V
Grid No.1 input power	$W_{ig1}$	=	0.2	0.2	3	0.2	0.3	3	W
Grid No.2 dissipation	$W_{g2}$	=	1.4	1.6	1.8	1.8	1.8	2.0	W
Anode input power	$W_{ia}$	=	67.5	67.5	45	90	90	60	W
Anode dissipation	$W_a$	=	15.5	19.5	20	20	24	25	W
Output power	$W_o$	=	52	48	25	70	66	35	W
Efficiency	$\eta$	=	77	71	55.5	78	73.5	58	%

<sup>1)2)3)</sup> See page 3

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

See also page 3 for derating table

		Continuous		Intermittent	
		C.C.S.		I.C.A.S.	
Frequency	f	up to	60	up to	60
Anode voltage	$V_a$	= max.	480	max.	600 V
Anode input power	$W_{ia}$	= max.	45	max.	67.5 W
Anode dissipation	$W_a$	= max.	13.3	max.	16.7 W
Anode current	$I_a$	= max.	117	max.	125 mA
Grid No.2 voltage	$V_{g2}$	= max.	250	max.	250 V
Grid No.2 dissipation	$W_{g2}$	= max.	2	max.	2 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	max.	150 V
Grid No.1 current	$I_{g1}$	= max.	3.5	max.	4 mA
Peak heater to cathode voltage	$V_{kf_p}$	= max.	135	max.	135 V
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	max.	30 $k\Omega^1)$

OPERATING CONDITIONS

		Continuous		Intermittent	
		service		service	
		C.C.S.		I.C.A.S.	
Frequency	f	=	60	60	MHz
Anode voltage	$V_a$	=	475	400	600 V
Grid No.1 voltage	$V_{g1}$	=	-77	-87	-87 V <sup>4)</sup>
Grid No.2 voltage	$V_{g2}$	=	135	150	150 V <sup>5)</sup>
Anode current	$I_a$	=	94	112	112 mA
Grid No.1 current	$I_{g1}$	=	2.8	3.4	3.4 mA
Grid No.2 current	$I_{g2}$	=	6.4	7.8	7.8 mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	95	107	107 V
Grid No.1 input power	$W_{ig1}$	=	0.3	0.4	0.4 W
Grid No.2 dissipation	$W_{g2}$	=	1.0	1.2	1.2 W
Anode input power	$W_{ia}$	=	45	45	67.5 W
Anode dissipation	$W_a$	=	11	13	15.5 W
Output power	$W_o$	=	34	32	52 W
Efficiency	$\eta$	=	75.5	71	77 %
Modulation factor	m	=	100	100	100 %
Modulation power	$W_{mod}$	=	23	23	34 W

<sup>1)4)5)</sup> See page 3

**A.F. CLASS AB AMPLIFIER AND MODULATOR** without grid current

**C. C. S. LIMITING VALUES** (Absolute limits), continuous service

Anode voltage	$V_a = \text{max.}$	600	V
Anode input power	$W_{ia} = \text{max.}$	60	W
Anode dissipation	$W_a = \text{max.}$	20	W
Anode current	$I_a = \text{max.}$	125	mA
Grid No.2 voltage	$V_{g_2} = \text{max.}$	250	V
Grid No.2 dissipation	$W_{g_2} = \text{max.}$	3	W
Peak heater to cathode voltage	$V_{kf_p} = \text{max.}$	135	V
Grid No.1 circuit resistance	$R_{g_1} = \text{max.}$	100	k $\Omega$

**C. C. S. OPERATING CONDITIONS**, continuous service; two tubes

$V_a$	=	600	500	400	V
$V_{g_2}$	=	180	185	190	V <sup>1)</sup>
$V_{g_1}$	=	-45	-40	-40	V <sup>2)</sup>
$R_{aa\sim}$	=	7000	5500	4000	$\Omega$
$V_{g_1g_{1p}}$	=	0 90	0 80	0 80	V
$I_a$	=	2x13 2x100	2x29 2x108	2x32 2x114	mA
$I_{g_2}$	=	2x0.5 2x12	2x1 2x13	2x1.3 2x13	mA
$W_{ig_1}$	=	0 0	0 0	0 0	W
$W_{g_2}$	=	2x0.1 2x2	2x0.2 2x2.4	2x0.25 2x2.5	W
$W_{ia}$	=	2x7.8 2x60	2x14.5 2x54	2x12.8 2x45.5	W
$W_a$	=	2x7.8 2x19	2x14.5 2x19	2x12.8 2x18	W
$W_o$	=	0 82	0 70	0 55	W
$\eta$	=	- 68	- 65	- 60	%

1) Obtained preferably from a separate source or from the anode supply using a voltage divider

2) Under these conditions only fixed bias is recommended

**A.F. CLASS AB AMPLIFIER AND MODULATOR** without grid current (continued)

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Anode voltage	$V_a$	=	max.	750	V
Anode input power	$W_{ia}$	=	max.	85	W
Anode dissipation	$W_a$	=	max.	25	W
Anode current	$I_a$	=	max.	135	mA
Grid No.2 voltage	$V_{g2}$	=	max.	250	V
Grid No.2 dissipation	$W_{g2}$	=	max.	3	W
Peak heater to cathode voltage	$V_{kfp}$	=	max.	135	V
Grid No.1 circuit resistance	$R_{g1}$	=	max.	100	k $\Omega$ <sup>1)</sup>



**I. C. A. S. OPERATING CONDITIONS**, intermittent service; two tubes

Anode voltage	$V_a$	=	750	600	V		
Grid No.2 voltage	$V_{g2}$	=	195	200	V 2)		
Grid No.1 voltage	$V_{g1}$	=	-50	-50	V 1)		
Load resistance	$R_{aa\sim}$	=	8000	6000	$\Omega$		
Input A.C. voltage peak to peak	$V_{g1g1p}$	=	0	100	0	100	V
Anode current	$I_a$	=	2x12	2x110	2x14	2x115	mA
Grid No.2 current	$I_{g2}$	=	2x0.5	2x13	2x0.5	2x13.5	mA
Grid No.1 input power	$W_{ig1}$	=	0	0	0	0	W
Grid No.2 dissipation	$W_{g2}$	=	2x0.1	2x2.5	2x0.1	2x2.7	W
Anode input power	$W_{ia}$	=	2x8.7	2x82.5	2x8.4	2x69	W
Anode dissipation	$W_a$	=	2x8.7	2x22.5	2x8.4	2x21.5	W
Output power	$W_o$	=	0	120	0	95	W
Efficiency	$\eta$	=	-	72.5	-	69	%

<sup>1)</sup> Under these conditions only fixed bias is recommended

2) Obtained preferably from a separate source or from the anode supply using a voltage divider

**A.F. CLASSAB AMPLIFIER AND MODULATOR with grid current**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Anode voltage	$V_a$	= max.	600	V
Anode input power	$W_{ia}$	= max.	62.5	W
Anode dissipation	$W_a$	= max.	20	W
Anode current	$I_a$	= max.	125	mA
Grid No.2 voltage	$V_{g2}$	= max.	250	V
Grid No.2 dissipation	$W_{g2}$	= max.	3	W
Peak heater to cathode voltage	$V_{kf_p}$	= max.	135	V
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	k $\Omega$ <sup>1)</sup>

**C.C.S. OPERATING CONDITIONS** , continuous service; two tubes ( $I_{g1} > 0$ )

$V_a$	=	600	500	400	V
$V_{g2}$	=	165	175	175	V <sup>2)</sup>
$V_{g1}$	=	-44	-44	-41	V <sup>1)</sup>
$R_{aa\sim}$	=	6800	4600	3700	$\Omega$
$V_{g1g1\sim}$	=	0 97	0 102	0 95	V
$I_a$	=	2x11 2x103	2x13 2x121	2x16 2x116	mA
$I_{g2}$	=	2x0.3 2x8.5	2x0.3 2x9	2x0.5 2x9	mA
$I_{g1}$	=	0 2x0.5	0 2x1.0	0 2x0.8	mA
$W_{ig1}$	=	0 2x0.1	0 2x0.15	0 2x0.1	W
$W_{g2}$	=	2x0.05 2x1.4	2x0.06 2x1.6	2x0.1 2x1.6	W
$W_{ia}$	=	2x6.6 2x62	2x6.5 2x60.5	2x6.4 2x46.5	W
$W_a$	=	2x6.6 2x17	2x6.5 2x19	2x6.4 2x15.5	W
$W_o$	=	0 90	0 83	0 62	W
$\eta$	=	- 72.5	- 68.5	- 66.5	%

<sup>1)</sup> Under these conditions only fixed bias is recommended

<sup>2)</sup> Obtained preferably from a separate source or from the anode supply using a voltage divider



**A.F. CLASS AB AMPLIFIER AND MODULATOR with grid current (continued)**

**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

Anode voltage	$V_a$	=	max.	750	V
Anode input power	$W_{ia}$	=	max.	90	W
Anode dissipation	$W_a$	=	max.	25	W
Anode current	$I_a$	=	max.	135	mA
Grid No.2 voltage	$V_{g_2}$	=	max.	250	V
Grid No.2 dissipation	$W_{g_2}$	=	max.	3	W
Peak heater to cathode voltage	$V_{kfp}$	=	max.	135	V
Grid No.1 circuit resistance	$R_{g_1}$	=	max.	30	$k\Omega$ <sup>1)</sup>

**I.C.A.S. OPERATING CONDITIONS**, intermittent service; two tubes ( $I_{g_1} > 0$ )

Anode voltage	$V_a$	=	750	600	V		
Grid No.2 voltage	$V_{g_2}$	=	165	190	V <sup>2)</sup>		
Grid No.1 voltage	$V_{g_1}$	=	-46	-48	V <sup>1)</sup>		
Load resistance	$R_{aa\sim}$	=	7400	5000	$\Omega$		
Input A.C. voltage peak to peak	$V_{g_1g_1p}$	=	0	108	0	109	V
Anode current	$I_a$	=	2x11	2x120	2x14	2x135	mA
Grid No.2 current	$I_{g_2}$	=	2x0.15	2x10	2x0.6	2x10	mA
Grid No.1 current	$I_{g_1}$	=	0	2x1.3	0	2x1.0	mA
Grid No.1 input power	$W_{ig_1}$	=	0	2x0.2	0	2x0.15	W
Grid No.2 dissipation	$W_{g_2}$	=	2x0.03	2x1.7	2x0.1	2x1.9	W
Anode input power	$W_{ia}$	=	2x8.3	2x90	2x8.4	2x81	W
Anode dissipation	$W_a$	=	2x8.3	2x24.5	2x8.4	2x24.5	W
Output power	$W_o$	=	0	131	0	113	W
Efficiency	$\eta$	=	-	73	-	70	%

<sup>1)</sup> Under these conditions only fixed bias is recommended

<sup>2)</sup> Obtained preferably from a separate source or from the anode supply using a voltage divider

**A.F. CLASS AB AMPLIFIER AND MODULATOR IN TRIODE CONNECTION** without grid current (screen grid connected to anode)

<b>LIMITING VALUES</b> (Absolute limits)		C. C. S.	I. C. A. S.
Anode voltage	$V_a$	= max. 400	max. 400 V
Anode current	$I_a$	= max. 90	max. 90 mA
Anode input power	$W_{ia}$	= max. 35	max. 35 W
Anode dissipation	$W_a$	= max. 20	max. 25 W
Peak heater to cathode voltage	$V_{kfp}$	= max. 135	max. 135 V
Grid No.1 circuit resistance	$R_{g1}$	= max. 100	max. 100 $k\Omega^1$ )
Grid No.1 circuit resistance	$R_{g1}$	= max. 500	max. 500 $k\Omega^1$ )

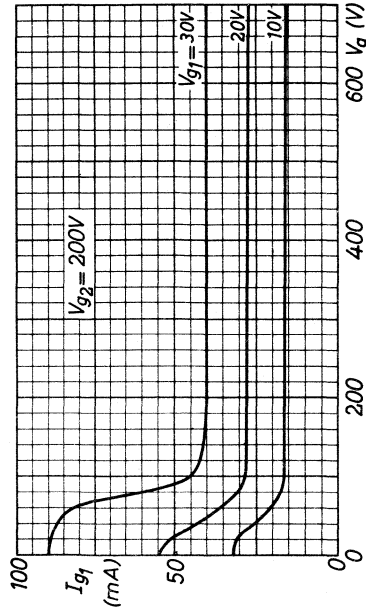
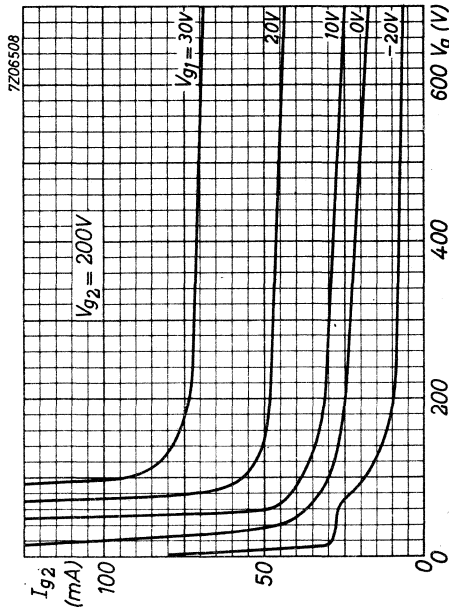
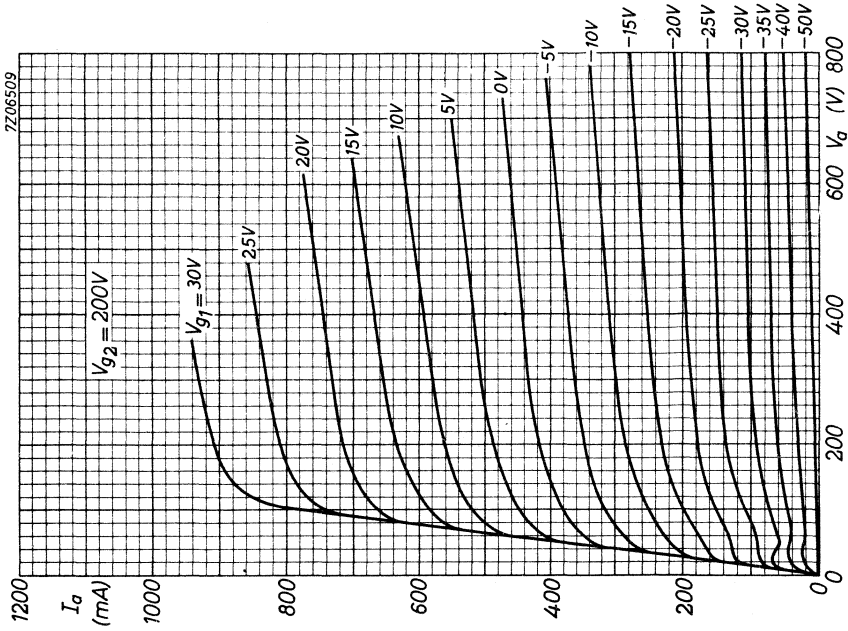
**C. C. S. OPERATING CONDITIONS**, continuous service; two tubes ( $I_{g1} = 0$ )

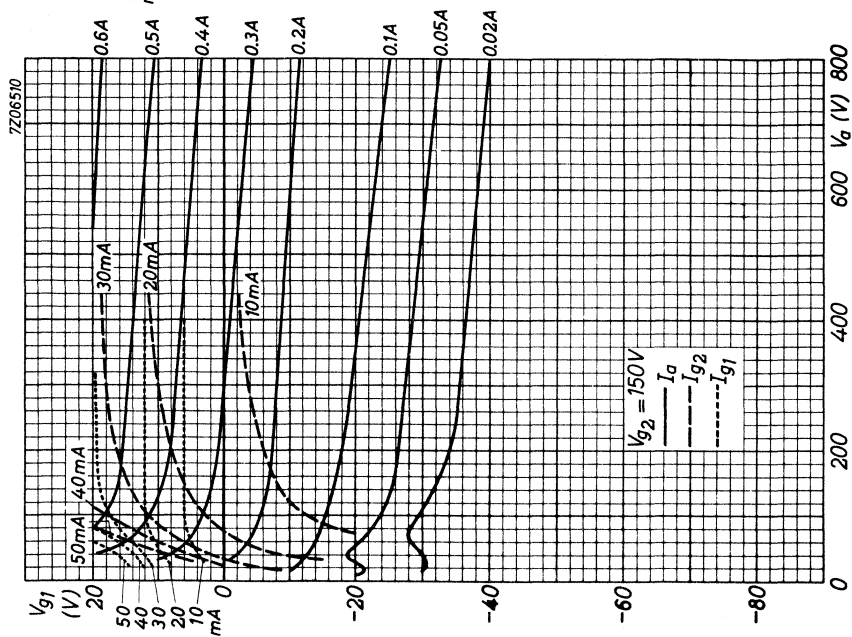
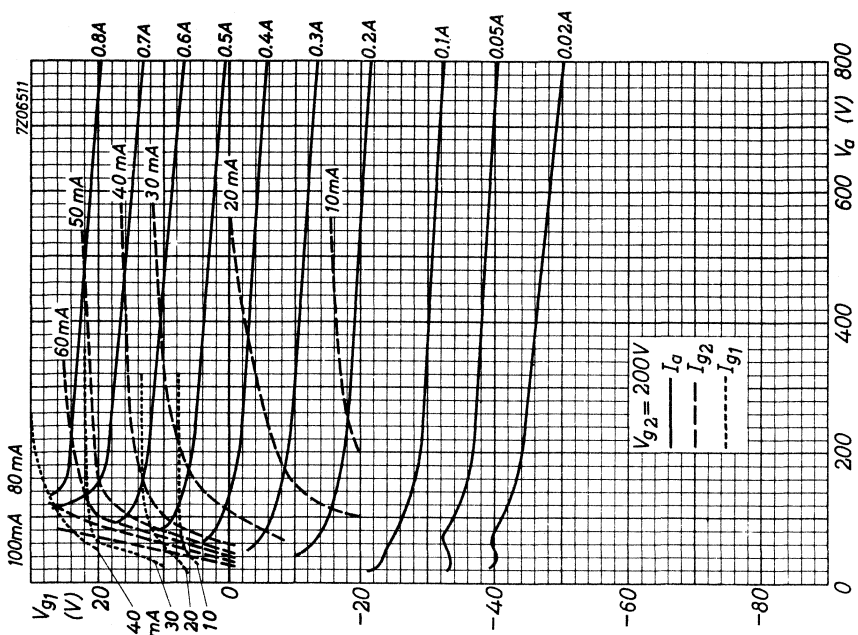
Anode voltage	$V_a$	=	400	250	V
Grid No.1 voltage	$V_{g1}$	=	-100	-50	V
Load resistance	$R_{aa\sim}$	=	<u>8000</u>	<u>5000</u>	$\Omega$
Peak grid to grid voltage	$V_{ggp}$	=	0 200	0 100	V
Anode current	$I_a$	=	2x20 2x50	2x60 2x62	mA
Anode input power	$W_{ia}$	=	2x8 2x20	2x15 2x15.5	W
Anode dissipation	$W_a$	=	2x8 2x9	2x15 2x10.5	W
Output power	$W_o$	=	0 22	0 10	W
Efficiency	$\eta$	=	- 55	- 32	%

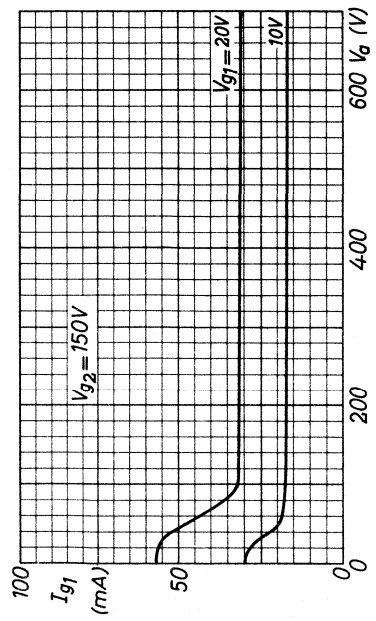
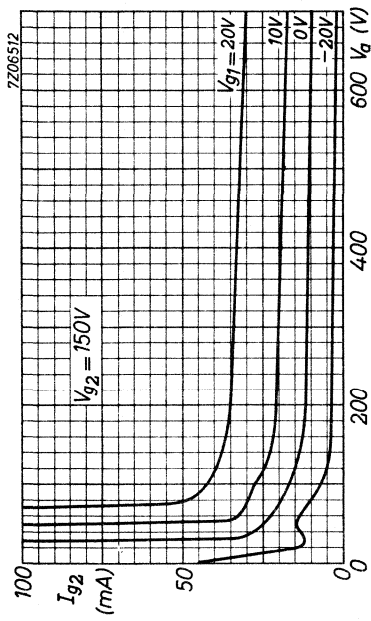
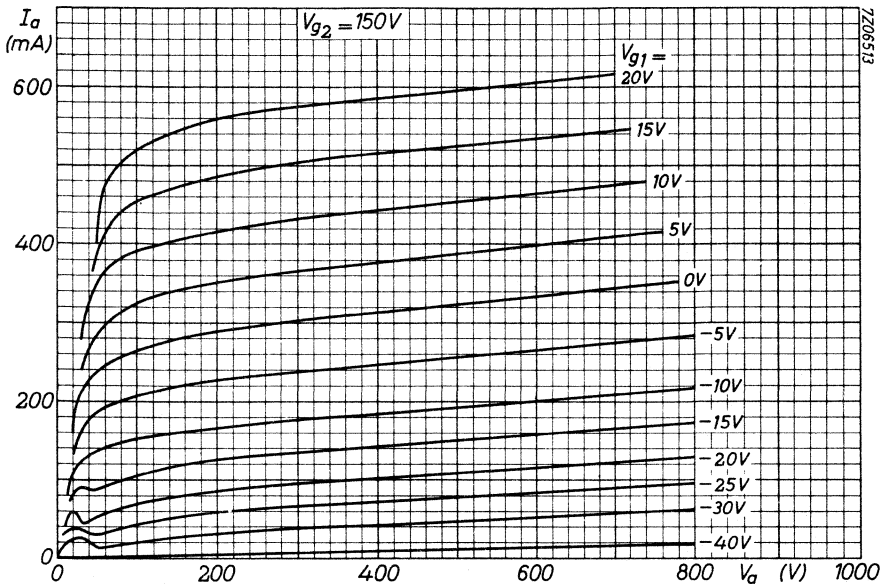
**I. C. A. S. OPERATING CONDITIONS**, intermittent service; two tubes

Anode voltage	$V_a$	=	400	V
Grid No.1 voltage	$V_{g1}$	=	-100	V
Load resistance	$R_{aa\sim}$	=	<u>8000</u>	$\Omega$
Peak grid to grid voltage	$V_{ggp}$	=	0 200	V
Anode current	$I_a$	=	2x20 2x50	mA
Anode input power	$W_{ia}$	=	2x8 2x20	W
Anode dissipation	$W_a$	=	2x8 2x9	W
Output power	$W_o$	=	0 22	W
Efficiency	$\eta$	=	- 55	%

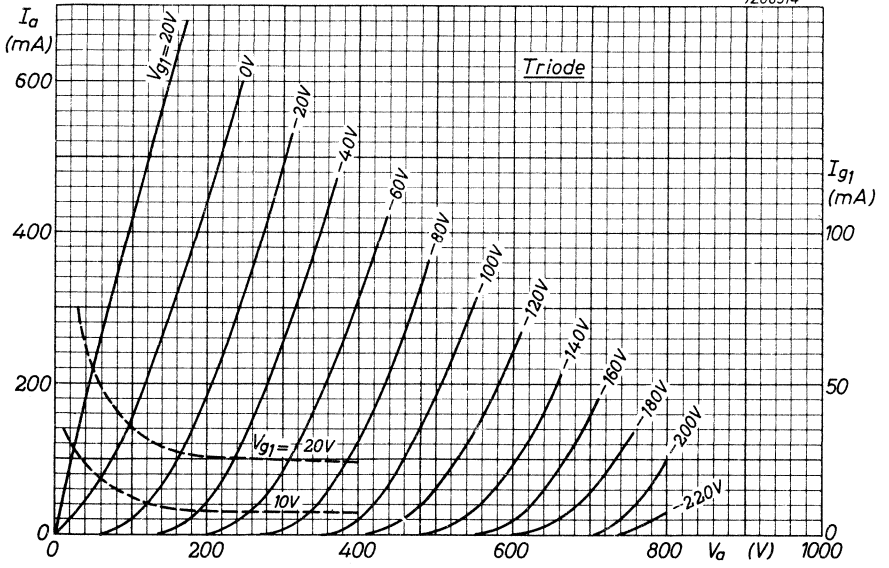
<sup>1</sup>) For values of  $R_{g1}$  exceeding 100  $k\Omega$ , cathode bias is required

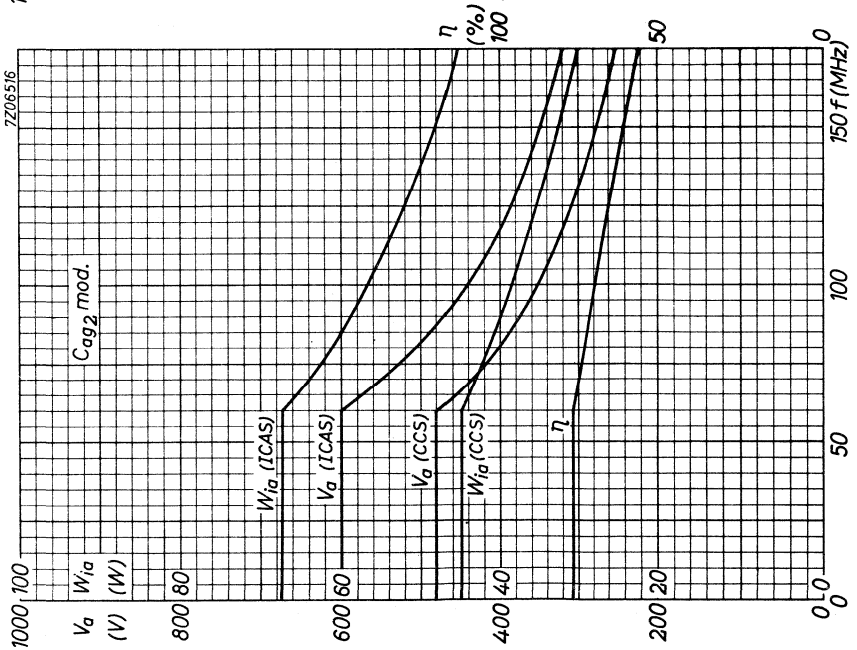
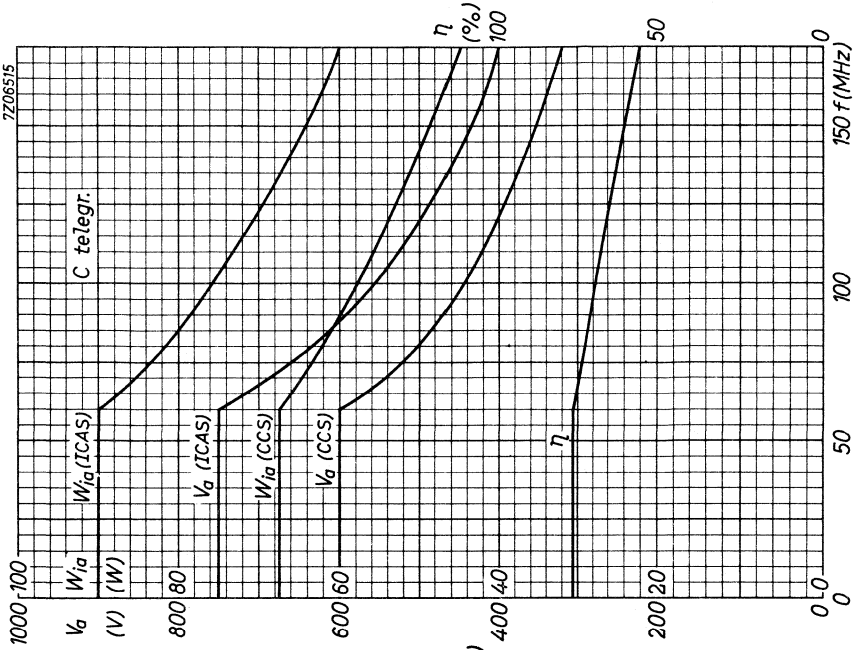






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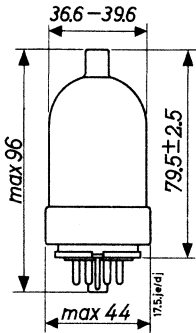


**QE05 / 40 F**

Heater voltage  $V_f = 12.6 \text{ V}$   
Heater current  $I_f = 0.625 \text{ A}$

**MECHANICAL DATA**

Base: Octal 8 p.

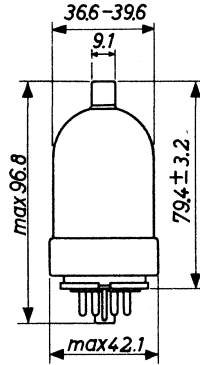


**QE05 / 40 K**

Heater voltage  $V_f = 13.5 \text{ V}$   
Heater current  $I_f = 0.585 \text{ A}$

Dimensions in mm

Base: Octal 8 p.



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For further data and curves of these types  
please refer to type QE05/40  
-----

**QE05 / 40 H**

Heater voltage  $V_f = 26.5 \text{ V}$   
Heater current  $I_f = 0.3 \text{ A}$

-----  
For further data and curves of this type  
please refer to type QE05/40  
-----



## R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA								
Freq.	C teleg.		C <sub>ag2</sub> mod.		B	S.S.B.	B mod. <sup>2)</sup>	
(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
30	750	200	600	130	750	220	750 600	300 200

**HEATING** : indirect; cathode oxide-coated

Heater voltage	V <sub>f</sub>	=	6.3	V
Heater current	I <sub>f</sub>	=	3.9	A

**COOLING** : radiation and convection

### CAPACITANCES

Anode to all other elements except grid No.1	C <sub>a</sub>	=	12.7	pF
Grid No.1 to all other elements except anode	C <sub>g1</sub>	=	30	pF
Anode to grid No.1	C <sub>ag1</sub>	<	0.9	pF

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	=	750	V
Grid No.2 voltage	V <sub>g2</sub>	=	250	V
Anode current	I <sub>a</sub>	=	100	mA
Mutual conductance	S	=	9	mA/V
Amplification factor of grid No.2 with respect to grid No.1	μ <sub>g2g1</sub>	=	5.7	

<sup>1)</sup> Peak envelope power with double tone signal

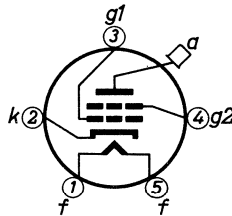
<sup>2)</sup> Two tubes

**TEMPERATURE LIMITS** (Absolute limits)

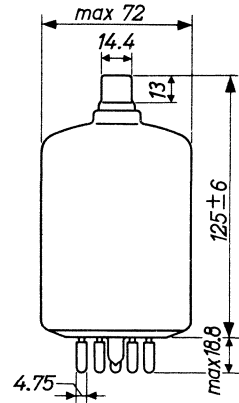
Anode seal temperature	= max. 220 °C
Pin temperature	= max. 180 °C
Bulb temperature	= max. 300 °C

**MECHANICAL DATA**

- Base : giant 5p
- Socket : 2422 512 01001
- Top cap : IEC 67-III-1b, type 3
- Anode connector : 40680
- Net weight: 220 g



Dimensions in mm



Mounting position: vertical, or horizontal with plane of anodes vertical.

**R.F. CLASS C TELEGRAPHY****LIMITING VALUES** (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	$V_a$	= max.	1100	V
Anode input power	$W_{i_a}$	= max.	400	W
Anode dissipation	$W_a$	= max.	100	W
Anode current	$I_a$	= max.	400	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.	150	V
Grid No. 1 current	$I_{g_1}$	= max.	30	mA
Grid No. 1 circuit resistance	$R_{g_1}$	= max.	25	k $\Omega$
Heater to cathode voltage	$V_{kf}$	= max.	125	V

**OPERATING CONDITIONS**

Frequency	f	=	30	30	MHz
Anode voltage	$V_a$	=	750	1000	V
Grid No. 2 voltage	$V_{g_2}$	=	250	250	V
Grid No. 1 voltage	$V_{g_1}$	=	-90	-90	V
Anode current	$I_a$	=	385	385	mA
Grid No. 2 current	$I_{g_2}$	=	20	20	mA
Grid No. 1 current	$I_{g_1}$	=	7	6	mA
Peak grid No. 1 A.C. voltage	$V_{g_1p}$	=	120	120	V
Anode input power	$W_{i_a}$	=	285	385	W
Grid No. 1 input power	$W_{i_{g_1}}$	=	1.0	1.0	W
Grid No. 2 dissipation	$W_{g_2}$	=	5	5	W
Anode dissipation	$W_a$	=	85	95	W
Output power	$W_o$	=	200	290	W
Efficiency	$\eta$	=	70	75	%

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	$V_a$	= max.	650	V
Anode input power	$W_{ia}$	= max.	200	W
Anode dissipation	$W_a$	= max.	67	W
Anode current	$I_a$	= max.	350	mA
Grid No.2 voltage	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	10	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 current	$I_{g1}$	= max.	30	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	k $\Omega$
Heater to cathode voltage	$V_{kf}$	= max.	125	V

**OPERATING CONDITIONS**

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	600	V
Grid No.2 voltage	$V_{g2}$	=	250	V
Grid No.1 voltage	$V_{g1}$	=	-100	V
Anode current	$I_a$	=	300	mA
Grid No.2 current	$I_{g2}$	=	20	mA
Grid No.1 current	$I_{g1}$	=	4	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	110	V
Anode input power	$W_{ia}$	=	180	W
Grid No.1 input power	$W_{ig1}$	=	0.4	W
Grid No.2 dissipation	$W_{g2}$	=	5	W
Anode dissipation	$W_a$	=	50	W
Output power	$W_o$	=	130	W
Efficiency	$\eta$	=	72	%
Modulation factor	m	=	100	%
Peak grid No.2 A.C. voltage	$V_{g2p}$	=	220	V <sup>1)</sup>
Modulation power	$W_{mod}$	=	90	W

<sup>1)</sup> Obtained from a separate winding on the modulation transformer

**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	$V_a$	= max.	825	V
Anode input power	$W_{ia}$	= max.	250	W
Anode dissipation	$W_a$	= max.	100	W
Anode current	$I_a$	= max.	400	mA
Grid No.2 voltage	$V_{g2}$	= max.	350	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	k $\Omega$
Heater to cathode voltage	$V_{kf}$	= max.	125	V

**OPERATING CONDITIONS**, with double tone modulation

The R.F. voltage is modulated with two sinusoidal A.F. signals of equal strength but different frequency.

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	750	V
Grid No.2 voltage	$V_{g2}$	=	310	V
Grid No.1 voltage	$V_{g1}$	=	-45	V <sup>1)</sup>
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0	45 <sup>2)</sup> V
Anode current	$I_a$	=	130	270 mA
Grid No.2 current	$I_{g2}$	=	<5	26 mA
Grid No.1 current	$I_{g1}$	=	0	0 mA
Anode input power	$W_{ia}$	=	98	200 W
Grid No.1 dissipation	$W_{g1}$	=	0	0 W
Grid No.2 dissipation	$W_{g2}$	=	1.5	8 W
Anode dissipation	$W_a$	=	98	90 W
Output power	$W_o$	=	0	220 W <sup>3)</sup>
Efficiency	$\eta$	=	-	55 %

1) To be adjusted so that  $I_a = 130$  mA at  $V_{g1p} = 0$

2) To be adjusted so that  $I_{g1} = 0$

3) Peak envelope power

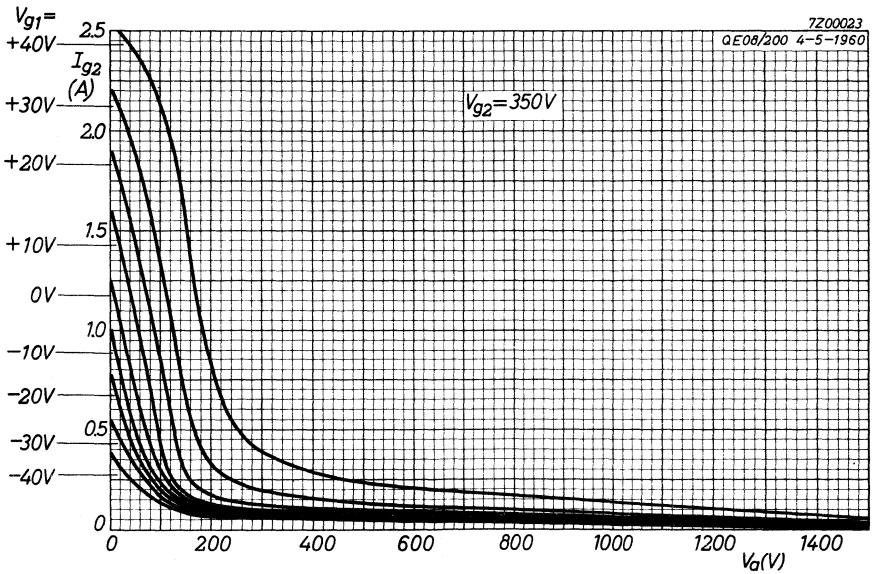
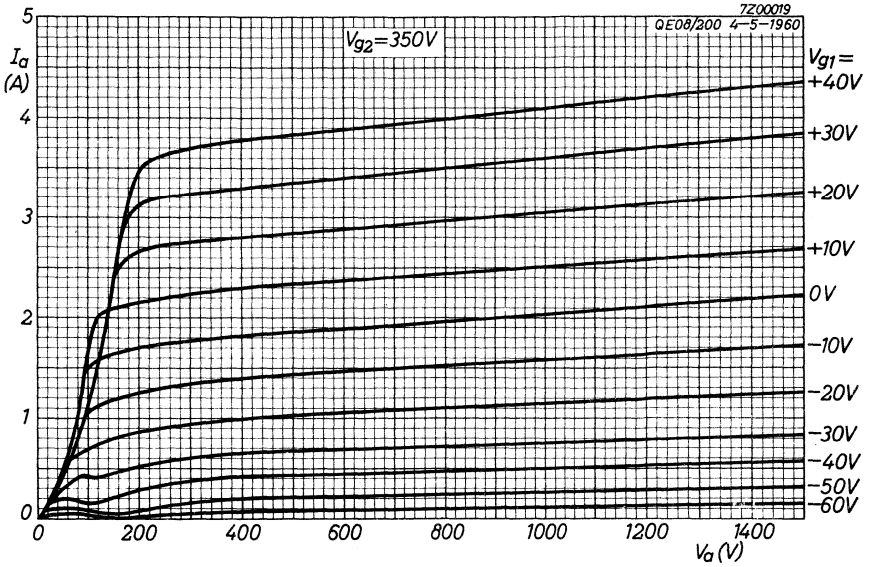
**A.F. CLASS B AMPLIFIER**

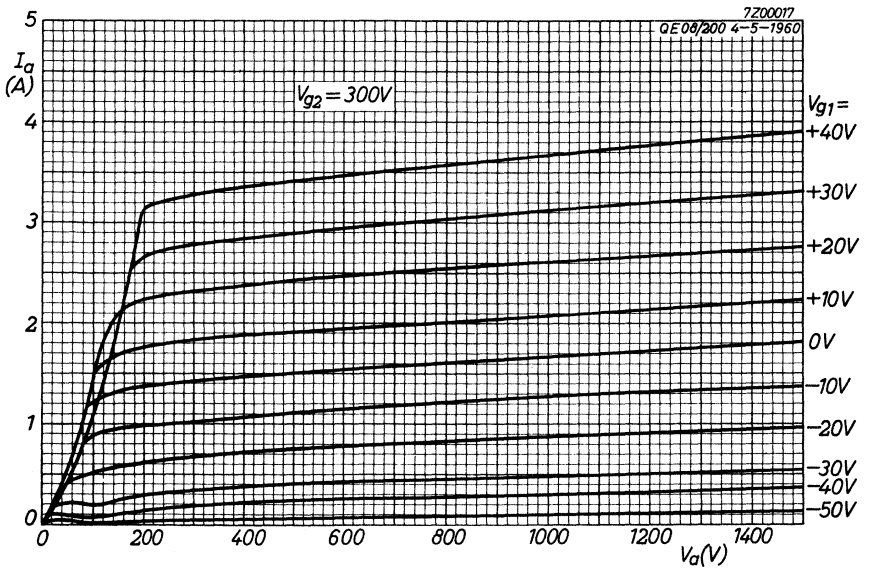
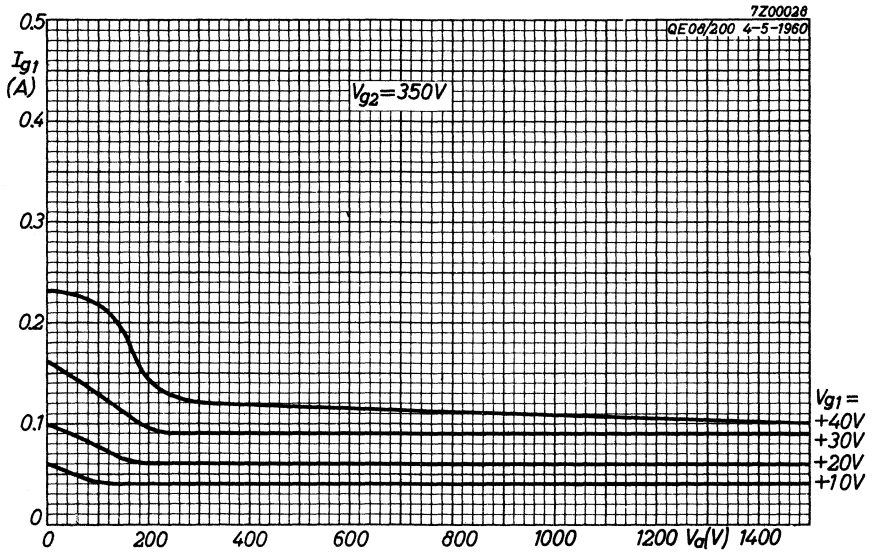
**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	825	V
Anode dissipation	$W_a$	= max.	100	W
Anode current	$I_a$	= max.	400	mA
Grid No.2 voltage	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 current	$I_{g1}$	= max.	30	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	15	k $\Omega$
Heater to cathode voltage	$V_{kf}$	= max.	125	V

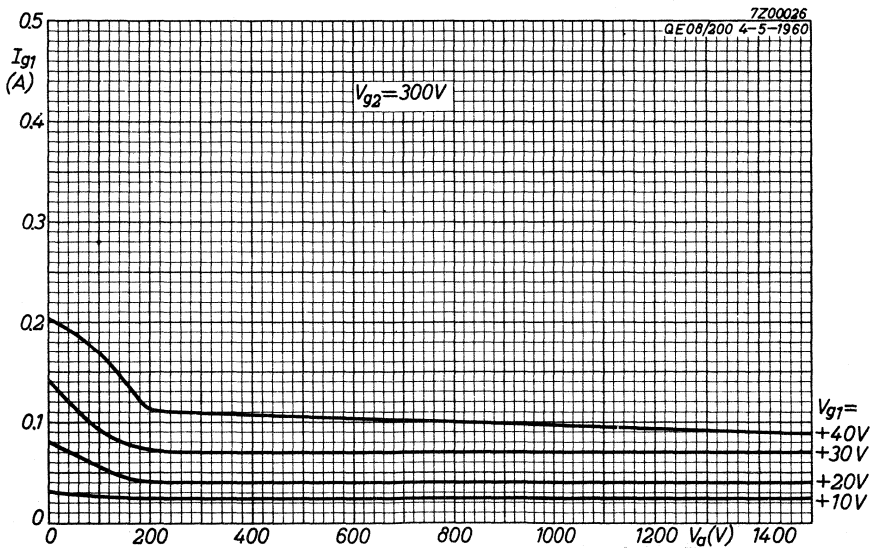
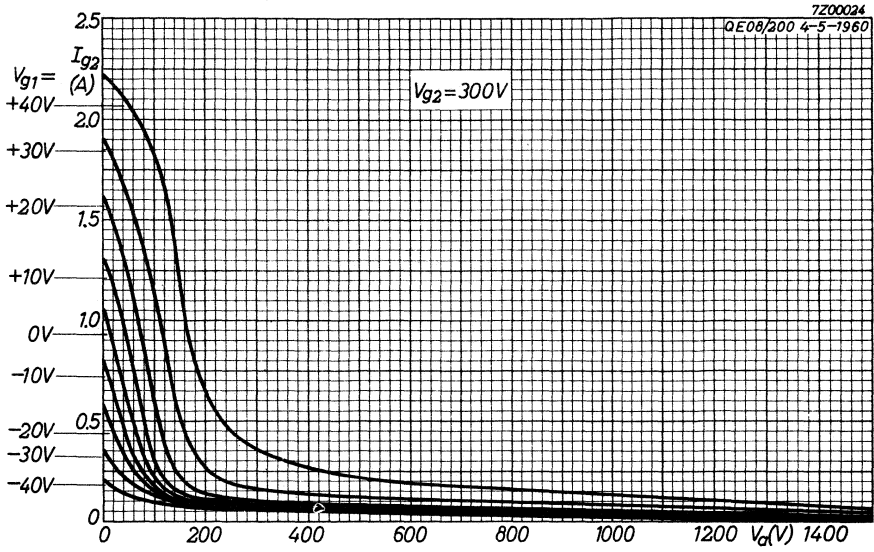
**OPERATING CONDITIONS**, two tubes

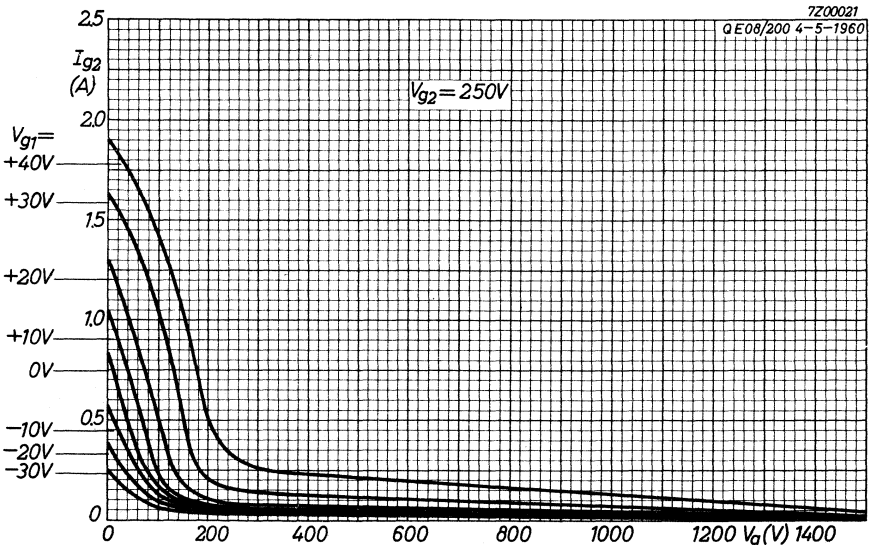
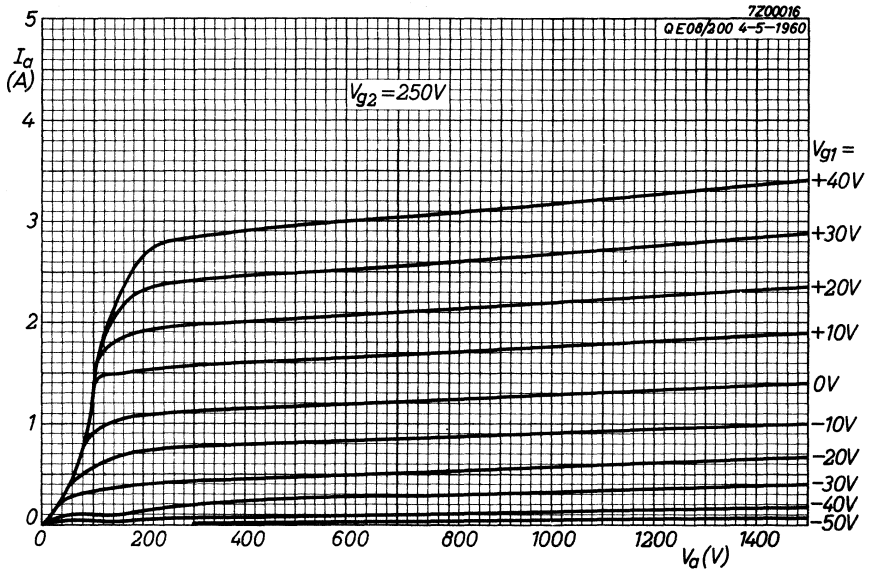
Anode voltage	$V_a$	=	750	600	V		
Grid No.2 voltage	$V_{g2}$	=	250	250	V		
Grid No.1 voltage	$V_{g1}$	=	-45	-45	V		
Load resistance	$R_{aa} \sim$	=	3600	3500	$\Omega$		
Peak grid to grid voltage	$V_{g1g1p}$	=	0	110	0	105	V
Anode current	$I_a$	=	2x45	2x280	2x25	2x235	mA
Grid No.2 current	$I_{g2}$	=	0	2x40	2x0.5	2x24	mA
Grid No.1 current	$I_{g1}$	=	0	2x1	0	2x0.5	mA
Anode input power	$W_{ia}$	=	2x34	2x210	2x15	2x140	W
Grid No.2 dissipation	$W_{g2}$	=	0	2x10	0	2x6	W
Anode dissipation	$W_a$	=	2x34	2x60	2x15	2x40	W
Output power	$W_o$	=	0	300	0	200	W
Total harmonic distortion	$d_{tot}$	=	-	6.5	-	5	%
Efficiency	$\eta$	=	-	71.5	-	71.5	%

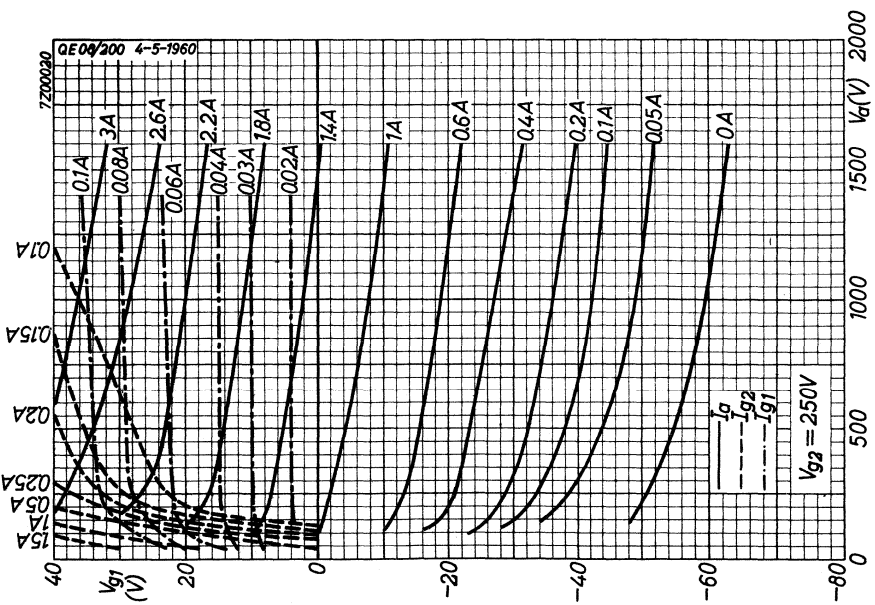
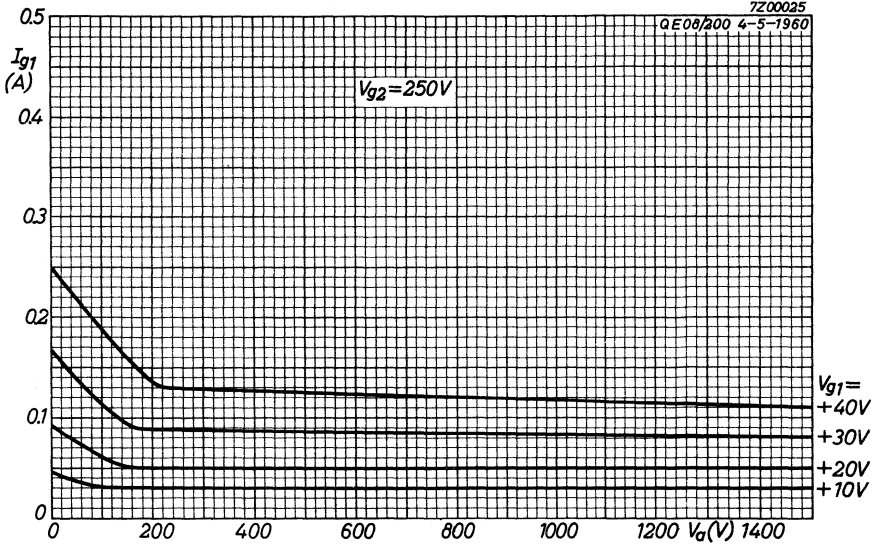


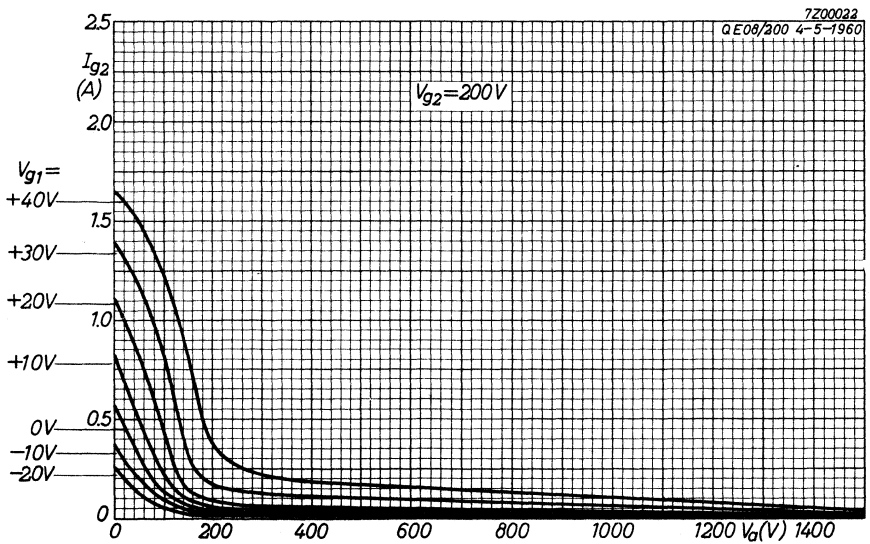
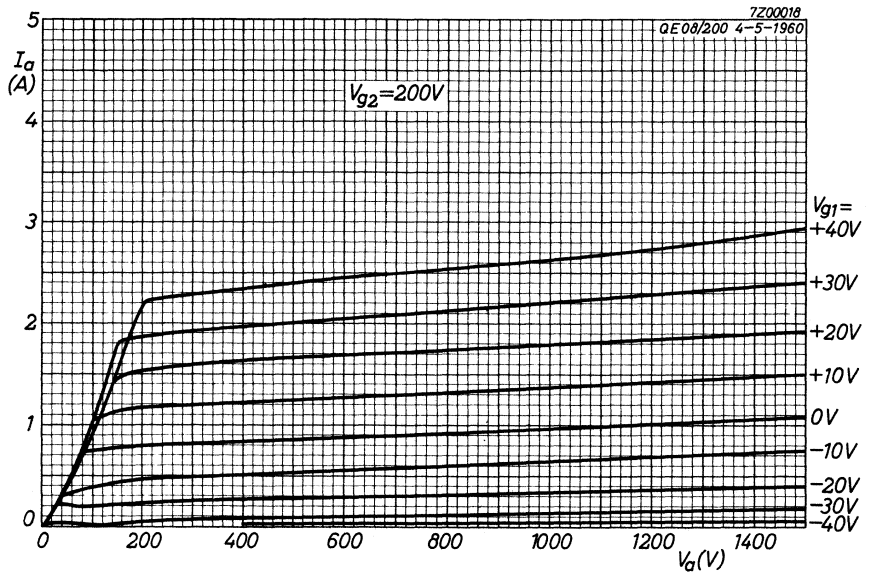


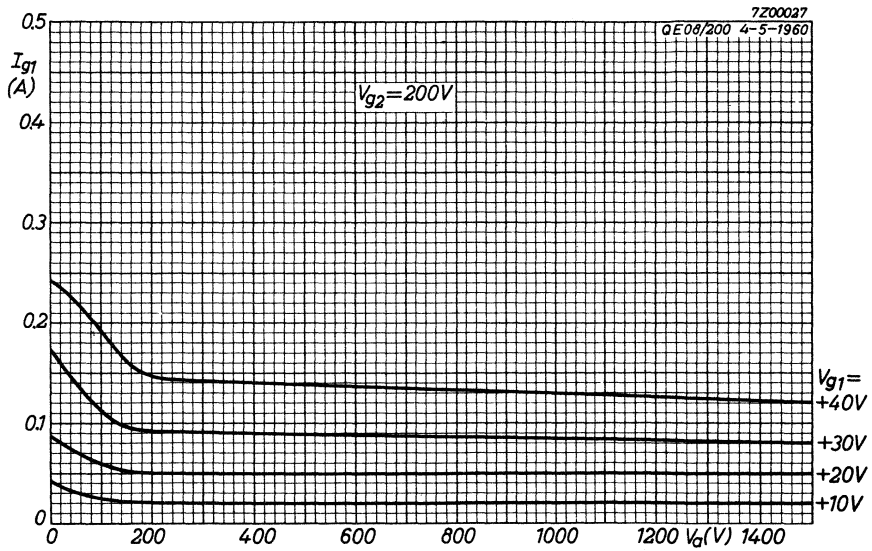












**R.F. BEAM POWER TETRODE**

HEATING: indirect

Heater voltage

 $V_f = 26.5 \text{ V}$ 

Heater current

 $I_f = 0.85 \text{ A}$ 

-----  
For further data and curves of this type  
please refer to type QE08/200  
-----

## FORCED AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA							
Freq. (MHz)	C teleg.		C <sub>ag2</sub> mod.		AB mod.		
	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> <sup>1)</sup> (W)	W <sub>o</sub> <sup>2)</sup> (W)
< 150	2000	370	1600	230	2000	580	630
	1500	260	1200	160			
165	1250	195	1000	140	1500	400	440
	1000	150	800	100			
	750	110	600	80			
	600	85	400	55			
500	1250	170			1000	230	270
	1000	120					
	800	95					
	600	50					

Freq. (MHz)	B SSB	
	V <sub>a</sub> (V)	W <sub>o</sub> (PEP) (W)
175	2000	300
	1500	220
	1000	130

Freq. (MHz)	B television	
	V <sub>a</sub> (V)	W <sub>o</sub> (sync) (W)
216	1250	250
	1000	200
	750	135

**HEATING** : indirect by A.C. or D.C.; cathode oxide-coated

Heater voltage	V <sub>f</sub> =	6.0 V
Heater current	I <sub>f</sub> =	2.6 A
Waiting time	T <sub>w</sub> = min.	30 sec

When the tube is driven to max. input as a straight through class C amplifier the heater voltage should be reduced according to the following table

f	≦ 300 MHz	300-400 MHz	400-500 MHz
V <sub>f</sub>	6.0 V	5.75 V	5.5 V

<sup>1)</sup> Without grid current, two tubes

<sup>2)</sup> With grid current, two tubes

**CAPACITANCES**

Anode to all other elements except grid No.1	$C_a$	=	4.4 pF
Grid No.1 to all other elements except anode	$C_{g1}$	=	16 pF
Anode to grid No.1	$C_{ag1}$	=	0.03 pF

**TYPICAL CHARACTERISTICS**

Anode voltage	$V_a$	=	500 V
Grid No.2 voltage	$V_{g2}$	=	250 V
Anode current	$I_a$	=	200 mA
Mutual conductance	$S$	=	12 mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$	=	5

**COOLING**

The use of the air-system socket with chimney is recommended, since a standard loctal socket does not ensure an adequate cooling of the base

With the air-system socket air is directed over the base seals, past grid No.2 seal, glass envelope and anode seal and through the radiator to provide effective cooling with minimum air flow. All four cathode connections should be used

The figures in the table below apply to the simultaneous cooling of the radiator and the base, making use of the socket 2422 513 01001 with air chimney 4322 026 11701

$W_a$	$h$	$t_i$	$g_{min}$	$p_i$ <sup>1)</sup>
250 W	0 m	20 °C	0.16 m <sup>3</sup> /min	12 mm H <sub>2</sub> O

**TEMPERATURE LIMITS** (Absolute limits)

Anode temperature	max. 250 °C <sup>2)</sup>
Anode seal temperature	max. 200 °C
Base seals and grid No.2 seal temperature	max. 175 °C

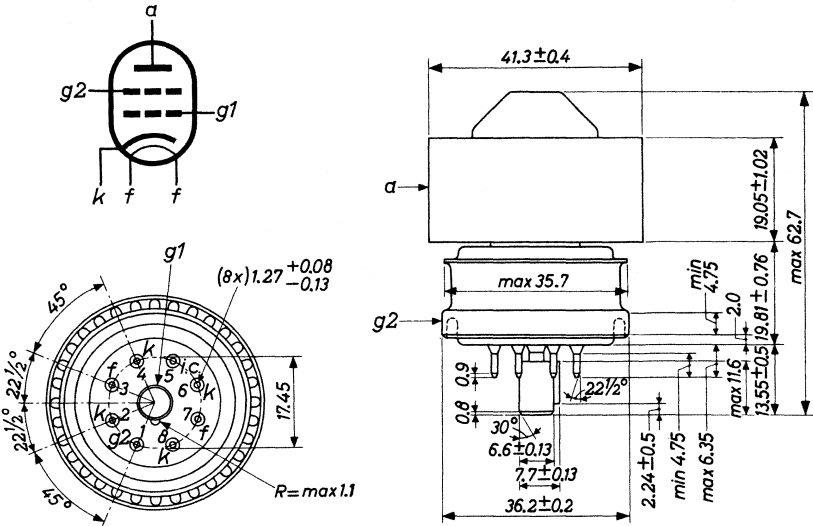
<sup>1)</sup> Pressure drop in cavities etc. excluded

<sup>2)</sup> Measured on base end of anode surface at the junction with the radiator fins



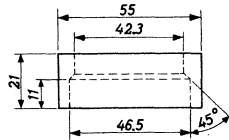
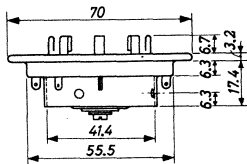
**MECHANICAL DATA** (Dimensions in mm)

Net weight: 130 g

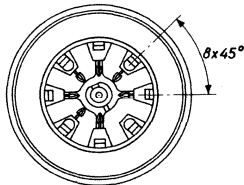


Mounting position: arbitrary

At higher frequencies the ring-surface terminal should be used for connecting the screen grid



Chimney 4322 026 11701



Socket 2422 513 01001

The socket 2422 513 01001 is intended for circuits where the cathode is at chassis potential

The type number 2422 513 01001 includes the chimney 4322 026 11701

**R.F. AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY OR F.M. TELEPHONY**

**LIMITING VALUES (Absolute limits)**

Frequency	f	up to	150	500	MHz
Anode voltage	$V_a$	= max.	2000	1250	V
Anode current	$I_a$	= max.	250	250	mA
Anode input power	$W_{ia}$	= max.	500	320	W
Anode dissipation	$W_a$	= max.	250	250	W
Grid No.2 voltage	$V_{g2}$	= max.	300	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	12	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	250	V
Grid No.1 dissipation	$W_{g1}$	= max.	2	2	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	25	k $\Omega$
Peak heater to cathode voltage	$V_{kfP}$	= max.	150	150	V

**OPERATING CONDITIONS**

Frequency	f	<	150	150	MHz
Anode voltage	$V_a$	=	2000	1500	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-88	-88	V
Peak grid No.1 A.C. voltage	$V_{g1P}$	=	110	110	V
Anode current	$I_a$	=	250	250	mA
Grid No.2 current	$I_{g2}$	=	24	24	mA
Grid No.1 current	$I_{g1}$	=	8	8	mA
Grid No.1 input power	$W_{ig1}$	=	2.5	1.5	W
Anode input power	$W_{ia}$	=	500	375	W
Anode dissipation	$W_a$	=	130	115	W
Output power	$W_o$	=	370	260	W

**R.F. AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY OR F.M. TELEPHONY**  
(continued)

**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
Peak grid No.1 A.C. 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
Grid No.1 input power	$W_{ig_1}$	=	1.2	1.0	1.0	1.0	W
Anode input power	$W_{ia}$	=	250	200	150	120	W
Anode dissipation	$W_a$	=	55	50	40	35	W
Output power	$W_o$	=	195	150	110	85	W

		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	$V_{g_1}$	=	-90	-110	-110	-110	V
Anode current	$I_a$	=	250	200	200	170	mA
Grid No.2 current	$I_{g_2}$	=	6	7	7	6	mA
Grid No.1 current	$I_{g_1}$	=	12	10	10	6	mA
Driver output power	$W_{dr}$	=	30	25	20	15	W
Anode input power	$W_{ia}$	=	312	200	160	102	W
Anode dissipation	$W_a$	=	142	80	65	52	W
Output power	$W_o$	=	170	120	95	50	W

**R.F. AMPLIFIER CLASS C TELEPHONY ,  
ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	150	500	MHz
Anode voltage	$V_a$	= max.	1600	1000	V
Anode current	$I_a$	= max.	200	200	mA
Anode input power	$W_{ia}$	= max.	480	300	W
Anode dissipation	$W_a$	= max.	165	165	W
Grid No.2 voltage	$V_{g2}$	= max.	300	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	10	10	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	250	V
Grid No.1 dissipation	$W_{g1}$	= max.	2	2	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	25	k $\Omega$
Peak heater to.cathode voltage	$V_{kf_p}$	= max.	150	150	V

**OPERATING CONDITIONS**

Frequency	f		<150	<150	MHz
Anode voltage	$V_a$	=	1600	1200	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-118	-118	V <sup>1)</sup>
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	136	136	V
Anode current	$I_a$	=	200	200	mA
Grid No.2 current	$I_{g2}$	=	23	23	mA
Grid No.1 current	$I_{g1}$	=	5	5	mA
Grid No.1 input power	$W_{ig1}$	=	3	2	W
Anode input power	$W_{ia}$	=	320	240	W
Anode dissipation	$W_a$	=	90	80	W
Output power	$W_o$	=	230	160	W
Modulation depth	m	=	100	100	%
Peak grid No.2 modulation voltage	$V_{g2p}$	=	200	180	V
Modulation power	$W_{mod}$	=	115	80	W

1) Obtained from grid No.1 resistor or from a combination of grid No.1 resistor with either fixed supply or cathode resistor

**R.F. AMPLIFIER CLASS C TELEPHONY,  
ANODE AND SCREEN GRID MODULATION (continued)**

**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 <sup>1)</sup>
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	125	120	120	110	V
Anode current	$I_a$	=	200	200	200	200	mA
Grid No.2 current	$I_{g_2}$	=	20	25	30	35	mA
Grid No.1 current	$I_{g_1}$	=	15	10	8	7	mA
Grid No.1 input power	$W_{ig_1}$	=	2	1.5	1.0	1.0	W
Anode input power	$W_{ia}$	=	200	160	120	80	W
Anode dissipation	$W_a$	=	60	60	40	25	W
Output power	$W_o$	=	140	100	80	55	W
Modulation depth	$m$	=	100	100	100	100	%
Peak grid No.2 modulation voltage	$V_{g_{2p}}$	=	170	160	150	140	V
Modulation power	$W_{mod}$	=	70	50	40	27.5	W

<sup>1)</sup> Obtained from grid No. 1 resistor or from a combination of grid No.1 resistor with either fixed supply or cathode resistor

**R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	175	500	MHz
Anode voltage	$V_a$	= max.	2000	1250	V
Anode current	$I_a$	= max.	250	250	mA
Anode input power	$W_{ia}$	= max.	500	315	W
Anode dissipation	$W_a$	= max.	250	250	W
Grid No.2 voltage	$V_{g2}$	= max.	400	400	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	12	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	250	V
Grid No.1 circuit resistance (with fixed bias)	$R_{g1}$	= max.	25	25	k $\Omega$
Peak heater to cathode voltage	$V_{kf_p}$	= max.	150	150	V

**OPERATING CONDITIONS** Operation with cathode bias is not recommended

Frequency	f	=	175		MHz
Anode voltage	$V_a$	=	2000		V
Grid No.2 voltage	$V_{g2}$	=	300		V
Grid No.1 voltage	$V_{g1}$	=	-47		V
Load resistance	$R_{a\sim}$	=	4200		$\Omega$
			zero signal	single tone signal	double tone signal
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0	47	47 V
Anode current	$I_a$	=	75	250	160 mA
Grid No.2 current	$I_{g2}$	=	-1	-7	-5 mA
Grid No.1 current	$I_{g1}$	=	0	0	0 mA
Grid No.1 input power	$W_{ig1}$	=	0	0	0 W
Anode input power	$W_{ia}$	=	150	500	320 W
Anode dissipation	$W_a$	=	150	200	170 W
Output power	$W_o$	=	0	300	150 W
Peak envelope power	$W_o(PEP)$	=	-	-	300 W
Third order intermodulation distortion	$d_3$	=	-	-	-32 dB

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER (continued)

OPERATING CONDITIONS (continued)

Operation with cathode bias is not recommended

	f	=	175	MHz	
				175	1000
Frequency		=	175	175	
Anode voltage	$V_a$	=	1500	1000	V
Grid No.2 voltage	$V_{g2}$	=	300	315	V
Grid No.1 voltage	$V_{g1}$	=	-45	-44.5	V
Load resistance	$R_{a\sim}$	=	2900	1850	$\Omega$
				zero signal	single tone signal
				double tone signal	double tone signal
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0	45	45
Anode current	$I_a$	=	75	250	165
Grid No.2 current	$I_{g2}$	=	-2	-4	-5
Grid No.1 current	$I_{g1}$	=	0	0	0
Grid No.1 input power	$W_{ig1}$	=	0	0	0
Anode input power	$W_{ia}$	=	115	375	250
Anode dissipation	$W_a$	=	115	155	140
Output power	$W_o$	=	0	220	110
Peak envelope power	$W_o(PEP)$	=	-	-	220
Third order intermodulation distortion	$d_3$	=	-	-	-31
				zero signal	single tone signal
				double tone signal	double tone signal
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	0	44.5	44.5
Anode current	$I_a$	=	100	250	180
Grid No.2 current	$I_{g2}$	=	-4	20	0
Grid No.1 current	$I_{g1}$	=	0	0	0
Grid No.1 input power	$W_{ig1}$	=	0	0	0
Anode input power	$W_{ia}$	=	100	250	180
Anode dissipation	$W_a$	=	100	120	115
Output power	$W_o$	=	0	130	65
Peak envelope power	$W_o(PEP)$	=	-	-	130
Third order intermodulation distortion	$d_3$	=	-	-	-30



**A.F. POWER AMPLIFIER AND MODULATOR ,  
CLASS AB WITHOUT GRID CURRENT**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	2000	V
Anode current	$I_a$	= max.	250	mA
Anode dissipation	$W_a$	= max.	250	W
Anode input power	$W_{ia}$	= max.	500	W
Grid No.2 voltage	$V_{g_2}$	= max.	400	V
Grid No.2 dissipation	$W_{g_2}$	= max.	12	W
Grid No.1 circuit resistance (each tube)	$R_{g_1}$	= max.	100	k $\Omega$
Peak cathode to heater voltage	$V_{kf_p}$	= max.	150	V

**OPERATING CONDITIONS** (Two tubes)

Anode voltage	$V_a$	=	2000	V	
Grid No.2 voltage	$V_{g_2}$	=	300	V	
Grid No.1 voltage	$V_{g_1}$	=	-50	V	
Load resistance	$R_{aa\sim}$	=	8760	$\Omega$	
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	100	V
Anode current	$I_a$	=	2x50	2x235	mA
Grid No.2 current	$I_{g_2}$	=	-	2x18	mA
Grid No.2 dissipation	$W_{g_2}$	=	-	2x5.4	W
Anode input power	$W_{ia}$	=	2x100	2x470	W
Anode dissipation	$W_a$	=	2x100	2x180	W
Output power	$W_o$	=	0	580	W



A.F. POWER AMPLIFIER AND MODULATOR ,  
 CLASS AB WITHOUT GRID CURRENT (continued)

OPERATING CONDITIONS (two tubes; continued)

Anode voltage	$V_a$	=	1500	V
Grid No.2 voltage	$V_{g_2}$	=	300	V
Grid No.1 voltage	$V_{g_1}$	=	-50	V
Load resistance	$R_{aa\sim}$	=	6570	$\Omega$
Peak grid to grid A.C. voltage	$V_{g_1g_1p}$	=	0	100 V
Anode current	$I_a$	=	2x50	2x228 mA
Grid No.2 current	$I_{g_2}$	=	-	2x21 mA
Grid No.2 dissipation	$W_{g_2}$	=	-	2x6.3 W
Anode input power	$W_{ia}$	=	2x75	2x340 W
Anode dissipation	$W_a$	=	2x75	2x140 W
Output power	$W_o$	=	0	400 W

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	$\Omega$	
Peak grid to grid A.C. voltage	$V_{g_1g_1p}$	=	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.2 dissipation	$W_{g_2}$	=	-	2x7.8	-	2x11.4 W
Anode input power	$W_{ia}$	=	2x82.5	2x225	2x84	2x174 W
Anode dissipation	$W_a$	=	2x82.5	2x110	2x84	2x89 W
Output power	$W_o$	=	0	230	0	170 W

**A.F. POWER AMPLIFIER AND MODULATOR,**

**CLASS AB WITH GRID CURRENT**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	2000	V
Anode current	$I_a$	= max.	250	mA
Anode dissipation	$W_a$	= max.	250	W
Anode input power	$W_{ia}$	= max.	500	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 (each tube)	$R_{g_1}$	= max.	100	k $\Omega$
Peak cathode to heater voltage	$V_{kf_p}$	= max.	150	V

**OPERATING CONDITIONS** (two tubes)

Anode voltage	$V_a$	=	2000	V
Grid No.2 voltage	$V_{g_2}$	=	300	V
Grid No.1 voltage	$V_{g_1}$	=	-50	V
Load resistance	$R_{aa\sim}$	=	8100	$\Omega$
Peak grid to grid A.C. voltage	$V_{g_1g_1p}$	=	0	106 V
Driving power	$W_{dr}$	=	0	0.2 W
Anode current	$I_a$	=	2x50	2x250 mA
Grid No.2 current	$I_{g_2}$	=	-	2x18 mA
Grid No.2 dissipation	$W_{g_2}$	=	-	2x5.4 W
Anode input power	$W_{ia}$	=	2x100	2x500 W
Anode dissipation	$W_a$	=	2x100	2x185 W
Output power	$W_o$	=	-	630 W

**A.F. POWER AMPLIFIER AND MODULATOR, CLASS AB WITH GRID CURRENT**  
(continued)

**OPERATING CONDITIONS** (two tubes; continued)

Anode voltage	$V_a$	=	1500	V
Grid No.2 voltage	$V_{g_2}$	=	300	V
Grid No.1 voltage	$V_{g_1}$	=	-50	V
Load resistance	$R_{aa\sim}$	=	5970	$\Omega$
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	106 V
Driving power	$W_{dr}$	=	0	0.2 W
Anode current	$I_a$	=	2x50	2x250 mA
Grid No.2 current	$I_{g_2}$	=	-	2x18 mA
Grid No.2 dissipation	$W_{g_2}$	=	-	2x5.4 W
Anode input power	$W_{ia}$	=	2x75	2x375 W
Anode dissipation	$W_a$	=	2x75	2x155 W
Output power	$W_o$	=	0	440 W

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	$\Omega$	
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	98	0	90 V
Driving power	$W_{dr}$	=	0	0.15	0	0.15 W
Anode current	$I_a$	=	2x83	2x247	2x105	2x250 mA
Grid No.2 current	$I_{g_2}$	=	-	2x29	-	2x40 mA
Grid No.2 dissipation	$W_{g_2}$	=	-	2x8.7	-	2x12 W
Anode input power	$W_{ia}$	=	2x83	2x247	2x84	2x200 W
Anode dissipation	$W_a$	=	2x83	2x112	2x84	2x93 W
Output power	$W_o$	=	0	270	0	215 W

**R.F. AMPLIFIER, CLASS B TELEVISION SERVICE**

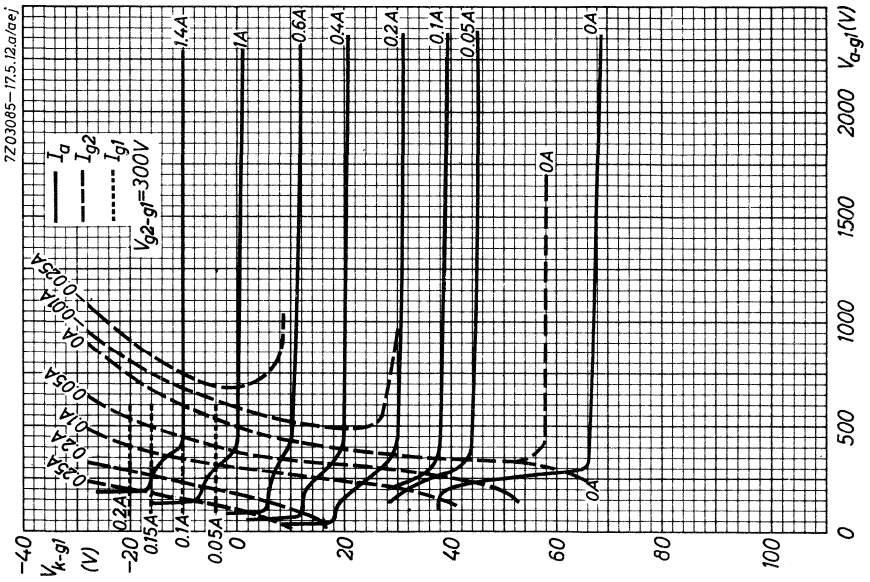
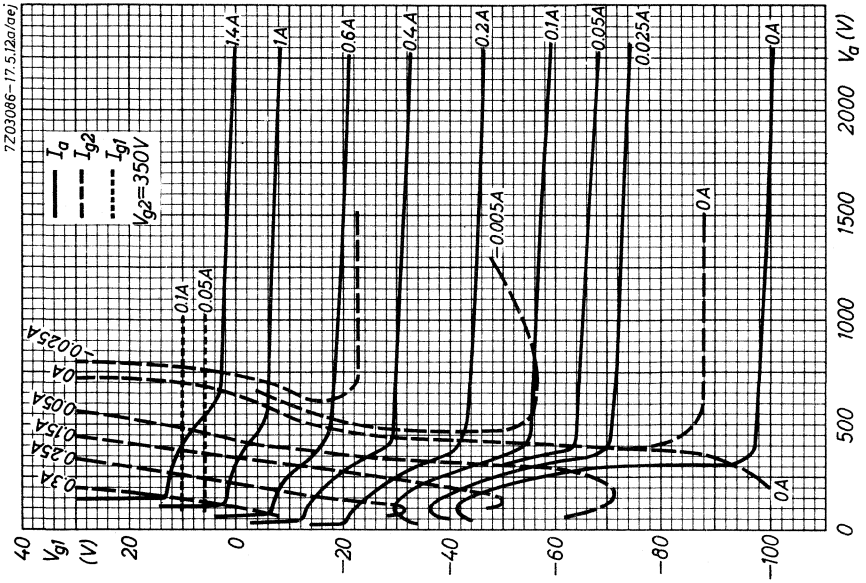
Negative modulation, positive synchronisation

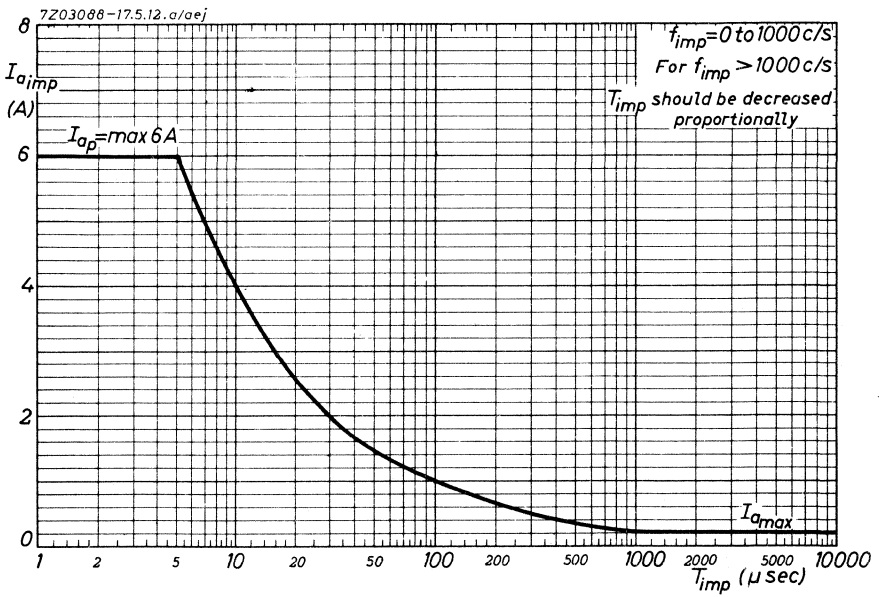
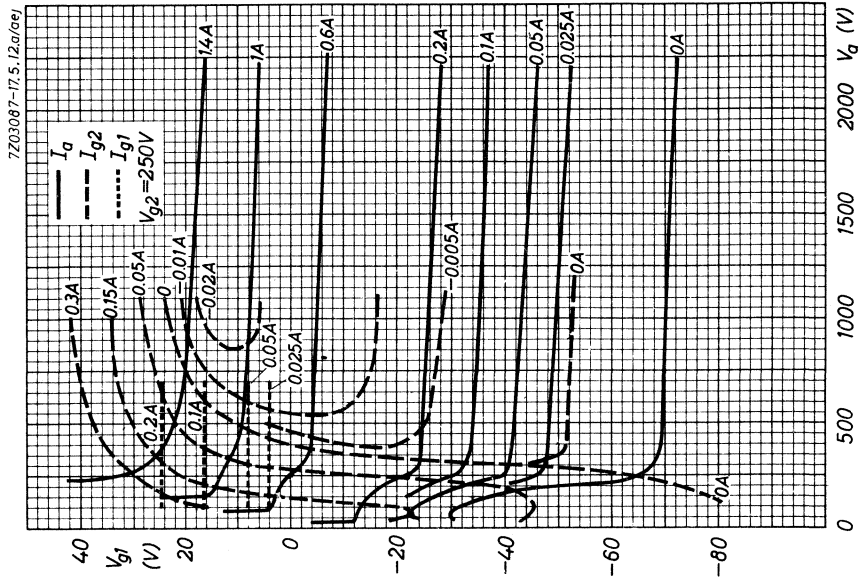
**LIMITING VALUES** (Absolute limits)

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
Anode input power	$W_{ia}$	= max.	500 W
Grid No.2 voltage	$V_{g2}$	= max.	400 V
Grid No.2 dissipation	$W_{g2}$	= max.	12 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250 V
Grid No.1 dissipation	$W_{g1}$	= max.	2 W
Grid No.1 circuit resistance	$R_{g1}$	= max.	50 k $\Omega$
Peak cathode to heater voltage	$V_{kfp}$	= max.	150 V

**OPERATING CONDITIONS** at centre frequency of resonance curve

Frequency	f	= 216	216	216	MHz
Bandwidth at -1.5 dB	B	= 5	5	5	MHz
Anode voltage	$V_a$	= 1250	1000	750	V
Grid No.2 voltage	$V_{g2}$	= 300	300	300	V
Grid No.1 voltage	$V_{g1}$	= -70	-65	-60	V
Peak grid No.1 A.C. voltage	$V_{g1p}$ 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	$I_{g2}$ sync	= 45	45	50	mA
	black	= 10	15	20	mA
Grid No.1 current	$I_{g1}$ sync	= 25	20	15	mA
	black	= 4	4	4	mA
Grid No.1 input power	$W_{ig1}$ sync	= 9	8	7	W
	black	= 5.5	4.7	4.25	W
Output power	$W_o$ sync	= 250	200	135	W
	black	= 140	110	75	W





## **FORCED AIR COOLED R.F. POWER TETRODE**

**HEATING:** indirect by AC or DC; cathode oxide coated

Heater voltage  $V_f = 26.5 \text{ V}$

Heater current  $I_f = 0.58 \text{ A}$



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For further data and curves of this type  
please refer to type QEL 1/150  
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## V.H.F./U.H.F. TRANSMITTING TETRODE

Forced air cooled beam power tetrode with ceramic to metal seals for use as linear R.F. power amplifier for frequencies up to 500 MHz and designed for S.S.B. transmitters

QUICK REFERENCE DATA				
Freq. (MHz)	S.S.B		A.M. teleph.	
	$V_a$ (V)	$W_l$ (W) PEP	$V_a$ (V)	$W_o$ (W)
30	2000	400	2000	105
500			2000	106

**HEATING:** indirect by A.C. or D.C.; cathode oxide-coated

Heater voltage  $V_f = 6.0 \text{ V} \pm 10 \%$

Heater current at  $V_f = 6 \text{ V}$   $I_f = 2.6 \text{ A}$

Cathode heating time  $T_w = \text{min. } 30 \text{ s}$

The heater voltage should be reduced according to the following table:

Frequency	$V_f$
300 MHz or lower	6.0 V
300 to 400 MHz	5.75 V
400 to 500 MHz	5.5 V

### TYPICAL CHARACTERISTICS

Anode voltage	$V_a = 500 \text{ V}$	-
Grid No.2 voltage	$V_{g2} = 250 \text{ V}$	300 V
Anode current	$I_a = 200 \text{ mA}$	-
Grid No.2 current	$I_{g2} = -$	50 mA
Mutual conductance	$S = 12 \text{ mA/V}$	-
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1} = -$	4

**CAPACITANCES**

Anode to all other elements except grid No.1	$C_a$	=	4.5	pF
Grid No.1 to all other elements except anode	$C_{g1}$	=	17	pF
Anode to grid No.1	$C_{ag1}$	=	0.065	pF

**TEMPERATURE LIMITS** (Absolute limits)

Temperature of anode core and all seals	max.	250	°C
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**COOLING**

Accessories

Air system socket	2422 513 01001 (air system chimney included)
Air system chimney	4322 026 11701

By means of the air system socket forced air is directed to the base seals, past the screen grid seal, the ceramic envelope and the anode seal and through the radiator

The use of the air system socket is recommended since a standard lock-in socket does not ensure adequate cooling of the base. All four cathode connections should be used

Required air flow with air system socket

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	0 m	20 °C	0.11 m <sup>3</sup> /min	8 mm H <sub>2</sub> O

At higher altitudes and/or temperatures the air flow must be increased to maintain the anode and seal temperatures within the limits

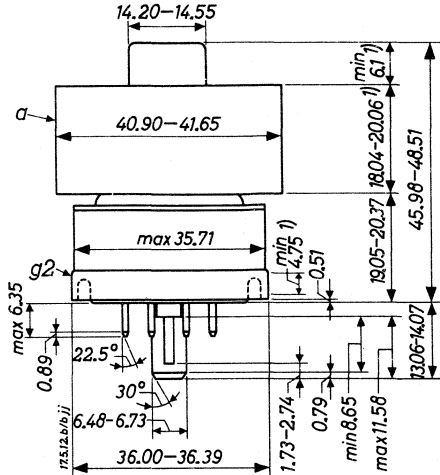
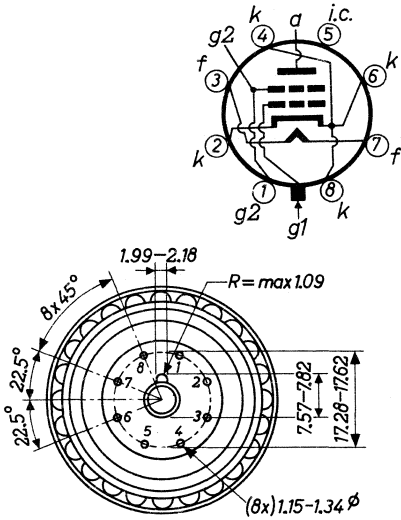
- 1) (Page 4) The limiting value for a signal having a minimum peak to average power ratio less than 2, such as is obtained in single tone operation, is 250 mA. During short periods of circuit adjustment under single tone conditions, the average anode current may be as high as 350 mA
- 2) (Page 4) Automatic bias is not recommended
- 3) (Page 4) Driver output power measured at grid No.1 circuit of the QEL2/200
- 4) (Pages 4 and 5) Average output power measured in the load of an output circuit having an efficiency of 95%
- 5) (Page 5) Average output power measured in the load of an output circuit having an efficiency of 85%
- 6) (Page 4) To be adjusted for zero signal anode current

7Z2 7984

**MECHANICAL DATA**

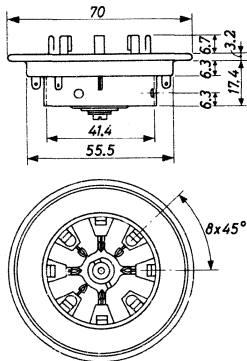
Dimensions in mm

Net weight 120 g

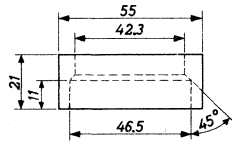


Mounting position: arbitrary

At higher frequencies the outer cylindrical surface of the ring terminal should be used for connecting the screen grid.



Socket 2422 513 01001



Chimney 4322 026 11701

1) Contact surface  
7Z2 7996

**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.	350	mA <sup>1)</sup>
Anode dissipation	$W_a$	max.	250	W
Grid No.2 voltage	$V_{g2}$	max.	500	V
Grid No.2 dissipation	$W_{g2}$	max.	12	W
Negative grid No.1 voltage	$-V_{g1}$	max.	250	V
Grid No.1 circuit resistance with fixed bias	$R_{g1}$	max.	25	k $\Omega$ <sup>2)</sup>
Peak heater to cathode voltage	$V_{kf_p}$	max.	150	V

**OPERATING CONDITIONS**

Frequency	f	30	MHz
Anode voltage	$V_a$	2000	V
Grid No.2 voltage	$V_{g2}$	400	V
Grid No.1 voltage	$V_{g1}$	-77	V <sup>6)</sup>
Load resistance	$R_{a\sim}$	3050	$\Omega$

		zero signal	single tone	double tone	
Anode current	$I_a$	70	350	225	mA
Grid No.2 current	$I_{g2}$	-	35	16	mA
Grid No.1 current	$I_{g1}$	-	-	0.05	mA
Driving power (PEP)	$W_{dr}$	-	1	1	W <sup>3)</sup>
Grid No.2 dissipation	$W_{g2}$	-	-	6.4	W
Anode dissipation	$W_a$	140	280	240	W
Output power in load	$W_{\ell}(PEP)$	0	400	400	W <sup>4)</sup>
Third order intermodulation distortion	$d_3$	-	-	-21	dB
Fifth order intermodulation distortion	$d_5$	-	-	-29	dB

<sup>1)2)3)4)6)</sup> See page 2.

**LINEAR R.F. POWER AMPLIFIER - A.M. TELEPHONY**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	500	MHz
Anode voltage	$V_a$	= max.	2000	V
Anode current	$I_a$	= max.	180	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
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 dissipation	$W_{g_1}$	= max.	2	W
Grid No.1 circuit resistance with fixed bias	$R_{g_1}$	= max.	25	$k\Omega^1)$
Peak heater to cathode voltage	$V_{kf_p}$	= max.	150	V

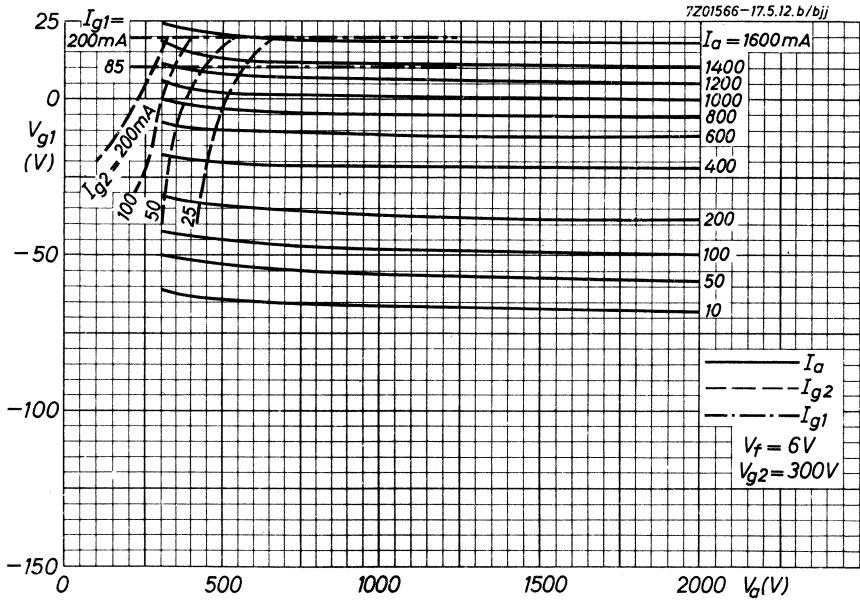
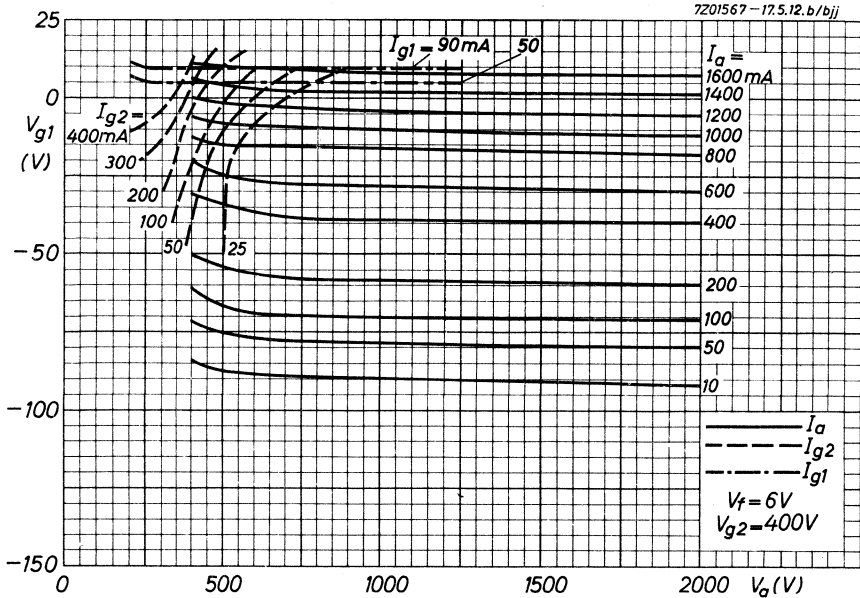
**OPERATING CONDITIONS**

Frequency	f	=	30	500	MHz
Anode voltage	$V_a$	=	2000	2000	V
Grid No.2 voltage	$V_{g_2}$	=	400	400	V
Grid No.1 voltage	$V_{g_1}$	=	-77	-77	V
Anode current	$I_a$	=	175	175	mA
Grid No.2 current	$I_{g_2}$	=	6	4	mA
Load resistance	$R_{a\sim}$	=	3050	3050	$\Omega$
Driver output power	$W_{dr}$	=	0.25	3	W <sup>2)</sup>
Anode input power	$W_{ia}$	=	350	350	W
Anode dissipation	$W_a$	=	245	244	W
Tube output power	$W_o$	=	105	106	W
Output power in the load	$W_{load}$	=	$100^4)$	$90^5)$	W

1) Automatic bias is not recommended

2) The driver output power represents the circuit losses and is the actual power measured at the input to the grid No.1 circuit of the tube. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts

4)5) See page 2



## V.H.F./U.H.F. TRANSMITTING TETRODE

Forced air cooled tetrode with ceramic to metal seals and coaxial arrangement of the terminals for R.F. amplifier, oscillator and frequency multiplier service and for single side band operation

QUICK REFERENCE DATA								
Freq. (MHz)	C teleg. .		C <sub>ag2</sub> mod.		AB SSB		AB mod <sup>1)</sup>	
	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
175	2000	390			2000	300	2000	600
	1500	280	1500	235	1500	215	1500	430
	1000	190	1000	145	1000	120	1000	240
	500	70	500	60				
500	2000	250						
Freq. (MHz)	B television Neg.mod. Pos.synchr.							
	V <sub>a</sub> (V)	W <sub>o</sub> sync (W)						
216	2000	440						
	1500	300						
	1000	160						

**HEATING:** indirect by A.C. or D.C.; cathode oxide-coated

Heater voltage	V <sub>f</sub> =	6.0 V ±10 %
Heater current at V <sub>f</sub> = 6 V	I <sub>f</sub> =	2.6 A
Cathode heating time	T <sub>w</sub> = min.	30 sec

The heater voltage should be reduced according to the following table:

Frequency	V <sub>f</sub>
300 MHz or lower	6.0 V
300 to 400 MHz	5.75 V
400 to 500 MHz	5.5 V

<sup>1)</sup> Two tubes

**CAPACITANCES**

		Control grid screen grid grounded	Cathode grounded
Anode to all other elements except grid No.1	$C_a$	= 4.5 pF	4.5 pF
Grid No.1 to all other elements except anode	$C_{g1}$	= 13.0 pF	15.7 pF
Anode to grid No.1	$C_{ag1}$	= 0.01 pF	<0.06 pF

**TYPICAL CHARACTERISTICS**

Anode voltage	$V_a$	= 500 V	-
Grid No.2 voltage	$V_{g2}$	= 250 V	300 V
Anode current	$I_a$	= 200 mA	-
Grid No.2 current	$I_{g2}$	= -	50 mA
Mutual conductance	$S$	= 12 mA/V	-
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$	= -	5.2

**TEMPERATURE LIMITS (Absolute limits)**

Temperature of anode core and all seals	max.	250 °C
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**COOLING**

Accessories

Air system socket	2422 513 01001 (air system chimney included)
Air system chimney	4322 026 11701

By means of the air system socket forced air is directed to the base seals, past the screen grid seal, the ceramic envelope and the anode seal and through the radiator

The use of the air system socket is recommended since a standard lock-in socket does not ensure adequate cooling of the base. All four cathode connections should be used



COOLING (continued)

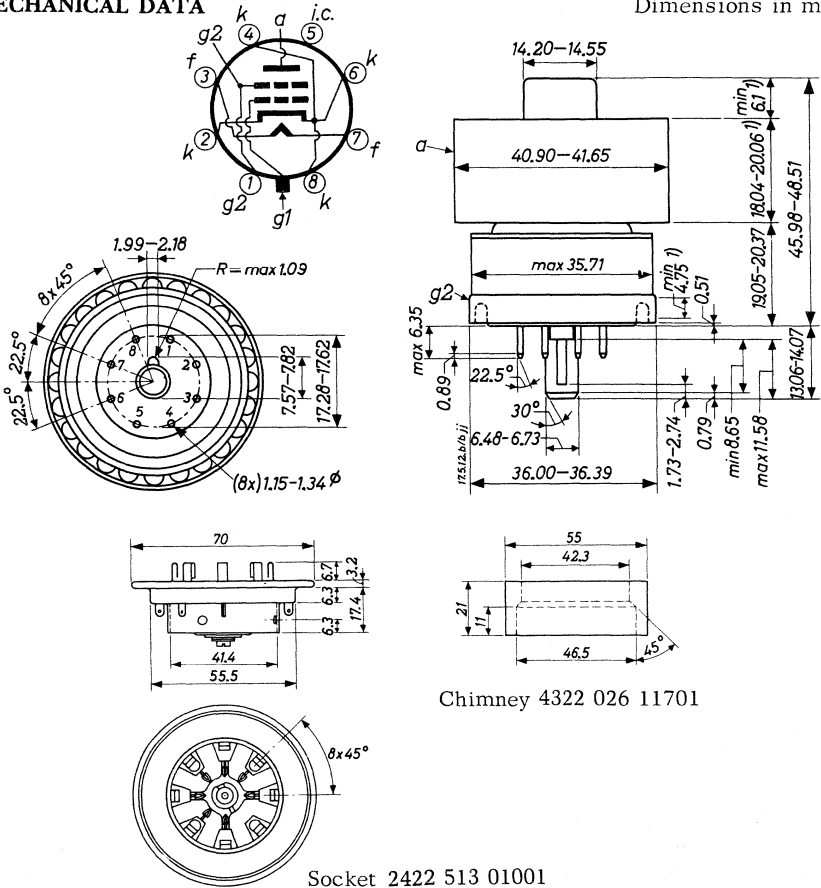
Required air flow with air system socket

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	0 m	20 °C	0.11 m <sup>3</sup> /min	8 mm H <sub>2</sub> O

At higher altitudes and/or temperatures the air flow must be increased to maintain the anode and seal temperature within the limits

MECHANICAL DATA

Dimensions in mm



**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 current	$I_a$	= max.	250	mA
Anode dissipation	$W_a$	= max.	250	W
Grid No.2 voltage	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	V
Grid No.1 dissipation	$W_{g1}$	= max.	2	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	k $\Omega$
Peak heater to cathode voltage	$V_{kf_p}$	= max.	150	V

**OPERATING CONDITIONS**

Frequency	f	=	175	175	175	175	500 <sup>1)</sup>	MHz
Anode voltage	$V_a$	=	2000	1500	1000	500	2000	V
Grid No.2 voltage	$V_{g2}$	=	250	250	250	250	300	V
Grid No.1 voltage	$V_{g1}$	=	-90	-90	-90	-90	-90	V
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	112	112	114	114	-	V
Anode current	$I_a$	=	250	250	250	250	250	mA
Grid No.2 current	$I_{g2}$	=	19	21	38	45	10	mA
Grid No.1 current	$I_{g1}$	=	26	28	31	35	25	mA
Driver output power	$W_{dr}$	=	2.9	3.2	3.5	4	18 <sup>2)</sup>	W
Grid No.2 dissipation	$W_{g2}$	=	7.5	9	11	12	-	W
Anode input power	$W_{ia}$	=	500	375	250	125	-	W
Anode dissipation	$W_a$	=	110	95	60	55	-	W
Output power	$W_o$	=	390	280	190	70	250	W
Efficiency	$\eta$	=	80	75	76	56	-	%

1) With coaxial cavity

2) The driver stage is required to supply tube losses and R.F. circuit losses. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in characteristics during life.

**R.F. CLASS C AMPLIFIER, ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to	500	MHz
Anode voltage	$V_a$	= max.	1500	V
Anode current	$I_a$	= max.	200	mA
Anode dissipation	$W_a$	= max.	165	W
Grid No.2 voltage	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	V
Grid No.1 dissipation	$W_{g1}$	= max.	2	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	k $\Omega$
Peak heater to cathode voltage	$V_{kf}$	= max.	150	V



**OPERATING CONDITIONS**

Frequency	f	=	175	175	175	MHz
Anode voltage	$V_a$	=	1500	1000	500	V
Grid No.2 voltage	$V_{g2}$	=	250	250	250	V <sup>1)</sup>
Grid No.1 voltage	$V_{g1}$	=	-100	-100	-100	V <sup>3)</sup>
Anode current	$I_a$	=	200	200	200	mA
Grid No.2 current	$I_{g2}$	=	20	22	31	mA
Grid No.1 current	$I_{g1}$	=	14	14	15	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	117	177	118	V
Driver output power	$W_{dr}$	=	1.7	1.7	1.8	W <sup>2)</sup>
Anode input power	$W_{ia}$	=	300	200	100	W
Anode dissipation	$W_a$	=	65	55	40	W
Output power	$W_o$	=	235	145	60	W
Efficiency	$\eta$	=	78	-	60	%

1) The D.C. grid No.2 voltage must be modulated approximately 55% in phase with the anode modulation in order to obtain 100% modulation.

2) See page 4.

3) Obtained from grid No.1 resistor or from a combination of grid No.1 resistor with either fixed supply or cathode resistor.

**R.F. CLASS AB SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES** (Absolute limits)

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	$V_{g2}$	= max.	400	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	$k\Omega$
Heater to cathode voltage	$V_{kf}$	= max.	150	V

**OPERATING CONDITIONS** (single tone signal)

Frequency	f	=	175	175	175	MHz
Anode voltage	$V_a$	=	1000	1500	2000	V
Grid No.2 voltage	$V_{g2}$	=	350	350	350	V
Grid No.1 voltage	$V_{g1}$	=	-55	-55	-55	V
Peak grid No.1 voltage	$V_{g1p}$	=	0 50	0 50	0 50	V
Anode current	$I_a$	=	100 250	100 250	100 250	mA
Grid No.2 current	$I_{g2}$	=	0 10	0 8	0 5	mA
Grid No.1 current	$I_{g1}$	=	0 0	0 0	0 0	mA
Anode input power	$W_{ia}$	=	100 250	150 375	200 500	W
Grid No.2 input power	$W_{ig2}$	=	0 1.75	0 1.4	0 1.4	W
Anode dissipation	$W_a$	=	100 130	150 160	200 200	W
Output power	$W_o$	=	0 120	0 215	0 300	W
Anode current	$I_a$	=	- 190	- 190	- 190	mA <sup>1)</sup>
Grid No.2 current	$I_{g2}$	=	- 2	- -1	- -2	mA <sup>1)</sup>

<sup>1)</sup> Double tone signal

**R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE**

Negative modulation, positive synchronisation

**LIMITING VALUES** (Absolute limits)

Frequency	f	54 to 216 MHz		
Anode voltage	$V_a$	= max.	2000	V
Anode current	$I_a$	= max.	250	mA <sup>1)</sup>
Anode dissipation	$W_a$	= max.	250	W
Grid No.2 voltage	$V_{g2}$	= max.	400	V
Grid No.2 dissipation	$W_{g2}$	= max.	12	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	V
Grid No.1 dissipation	$W_{g1}$	= max.	2	W
Peak heater to cathode voltage	$V_{kf_p}$	= max.	150	V

**OPERATING CONDITIONS**

Frequency	f	=	216	216	216	MHz	
Bandwidth	B	=	5	5	5	MHz	
Anode voltage	$V_a$	=	1000	1500	2000	V	
Grid No.2 voltage	$V_{g2}$	=	350	350	350	V	
Grid No.1 voltage	$V_{g1}$	=	-60	-65	-70	V	
Peak grid No.1 A.C. voltage	$V_{g1p}$	sync	=	65	71	76	V
		black	=	52	57	62	V
Anode current	$I_a$	sync	=	355	360	360	mA
		black	=	250	250	250	mA
Grid No.2 current	$I_{g2}$	sync	=	27	29	29	mA
		black	=	4	0	0	mA
Grid No.1 current	$I_{g1}$	sync	=	2	5	5	mA
		black	=	0	0	0	mA
Grid No.1 input power	$W_{ig1}$	sync	=	0.4	1.2	1.2	W <sup>2)</sup>
		black	=	0	0	0	W
Output power	$W_o$	sync	=	160	300	440	W
		black	=	90	170	250	W

<sup>1)</sup> Averaged over any frame

<sup>2)</sup> See page 4

**A.F. POWER AMPLIFIER AND MODULATOR CLASS AB**

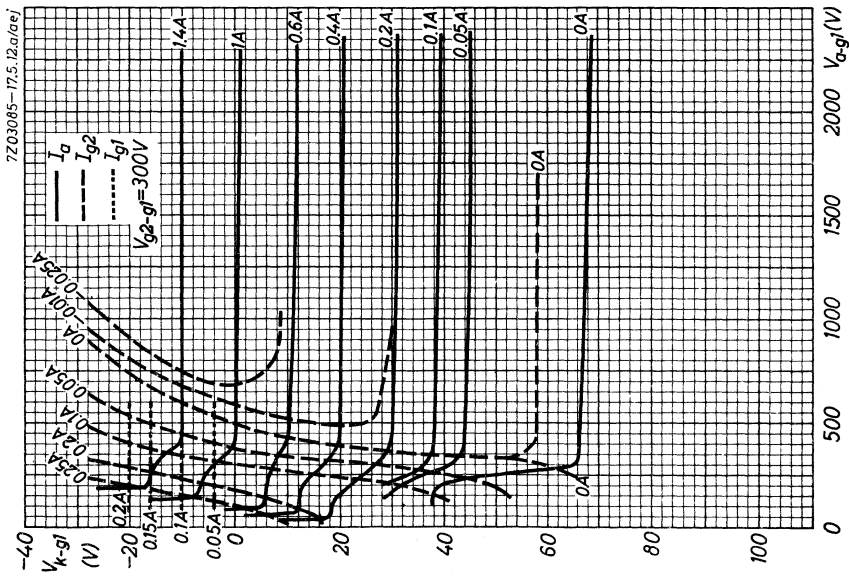
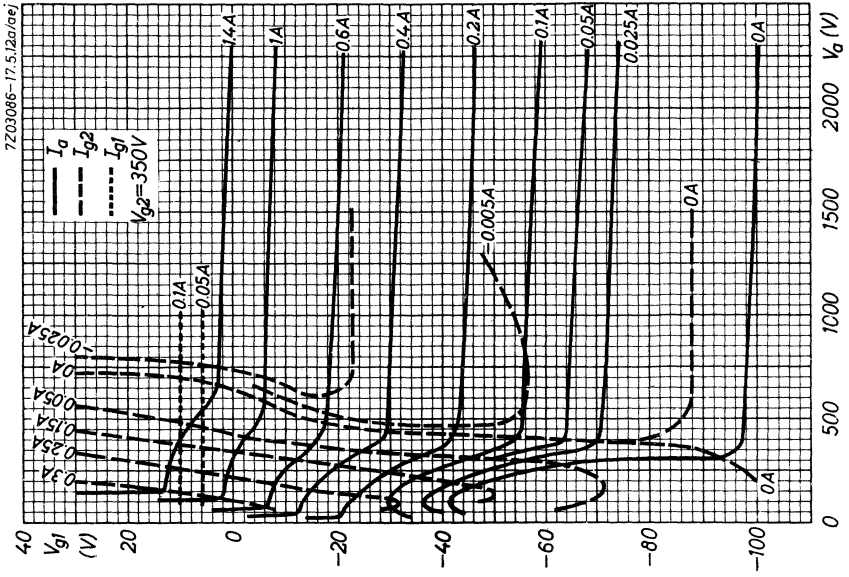
**LIMITING VALUES** (Absolute limits)

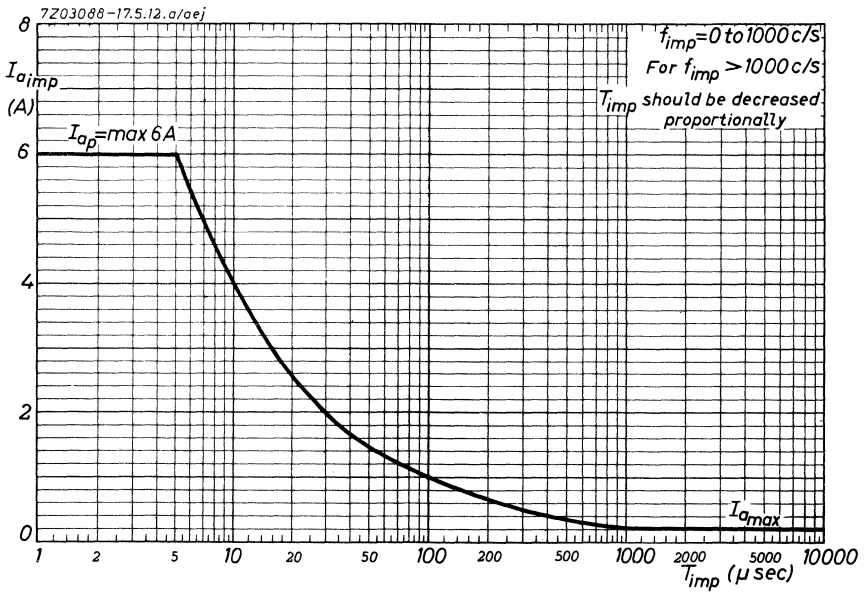
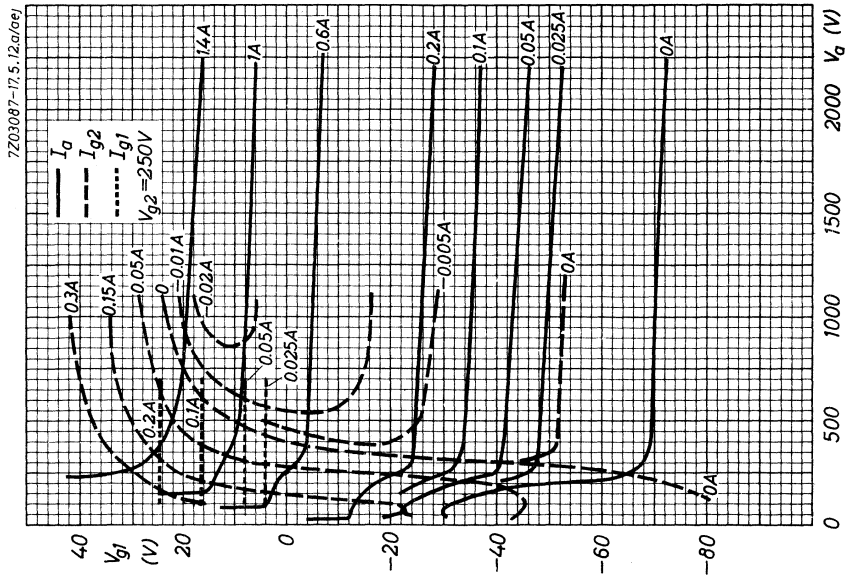
Anode voltage	$V_a$	= max.	2000	V
Anode current	$I_a$	= max.	250	mA <sup>1)</sup>
Anode input power	$W_{ia}$	= max.	250	W <sup>1)</sup>
Grid No.2 voltage	$V_{g_2}$	= max.	400	V
Grid No.2 dissipation	$W_{g_2}$	= max.	12	W <sup>1)</sup>
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 circuit resistance	$R_{g_1}$	= max.	100	k $\Omega$
Peak heater to cathode voltage	$V_{kf_p}$	= max.	150	V

**OPERATING CONDITIONS**(values for two tubes)

$V_a$	=	1000	1500	2000	V
$V_{g_2}$	=	350	350	350	V
$V_{g_1}$	=	-55	-55	-55	V
$R_{aa\sim}$	=	3500	6200	9500	$\Omega$
$V_{g_1g_{1p}}$	=	0    100	0    100	0    100	V
$I_{g_1}$	=	0    0	0    0	0    0	mA
$I_a$	=	2x100    2x250	2x100    2x250	2x100    2x250	mA
$I_{g_2}$	=	0    2x10	0    2x8	0    2x5	mA
$W_{ia}$	=	2x100    2x250	2x150    2x375	2x200    2x500	W
$W_a$	=	2x100    2x130	2x150    2x160	2x200    2x200	W
$W_o$	=	0    240	0    430	0    600	W

<sup>1)</sup> Averaged over any low-frequency cycle of sine wave form.







## COAXIAL R.F. POWER TETRODE

Heater voltage

$$V_f = 26.5 \text{ V} \pm 10\%$$

Heater current

$$I_f = 0.58 \text{ A}$$



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For further data and curves of this type  
please refer to type QEL2/275  
-----



## R.F. QUICK HEATING DOUBLE TETRODE FOR MOBILE EQUIPMENT

### QUICK REFERENCE DATA, intermittent service

Freq. (MHz)	C telegr. 1) F.M. teleph. 1)		Tripler - doubler	
	V <sub>a</sub> (V)	W <sub>l</sub> (W) 2)	V <sub>a</sub> (V)	W <sub>l</sub> (W) 3)
200	250	11		
	200	9.5		
27.5/165			250	1.25
			200	1.0

**HEATING:** direct; parallel supply; filament oxide-coated

Filament voltage  $V_f = 3.15 \text{ V} \pm 10 \%$

Filament current  $I_f = 1.65 \text{ A}$

It is recommended that the filament be fed from a D.C.-A.C. converter

Cathode heating time for obtaining an output power of more than 70% of the ultimate power  $T_h = \text{max. } 1 \text{ sec.}$

The filament voltage should be switched on during the whole conversation period. Interruption of the filament voltage during this period is not recommended.

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	=	200 V
Grid No.2 voltage	V <sub>g2</sub>	=	200 V
Anode current	I <sub>a</sub>	=	30 mA
Mutual conductance	S	=	3.2 mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$	=	7.5

1) Two systems in push-pull

2) Output power in the load according to circuit diagram on page 3

3) Output power in the load according to circuit diagram on page 4

**CAPACITANCES** (without external shield)

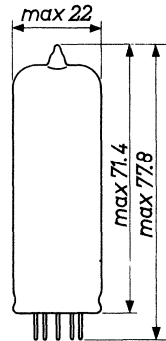
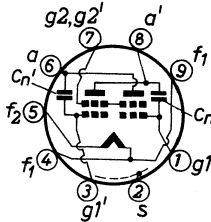
Anode to all other elements except grid No.1	$C_a$	=	$C_{a'}$	=	3.2	pF
Grid No.1 to all other elements except anode	$C_{g_1}$	=	$C_{g_1'}$	=	6.8	pF
Anode to grid No.1	$C_{ag_1}$	=	$C_{a'g_1'}$	<	0.1	pF
Anode of one system to grid No.1 of the other system	$C_{ag_1'}$	=	$C_{a'g_1}$	<	0.13	pF
Between the grids No.1	$C_{g_1g_1'}$	=		=	1.9	pF
Between the anodes	$C_{aa'}$	=		=	0.09	pF

The tube has been internally neutralized up to 200 Mc/s

**MECHANICAL DATA**

Dimensions in mm

- Base : Noval
- Socket : 2422 502 01003
- Tube retainer: 40647
- Net weight : 16 g



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

**COOLING:** radiation and convection  
The use of a closed tube shield is not allowed

**TEMPERATURE LIMITS** (Absolute limits)

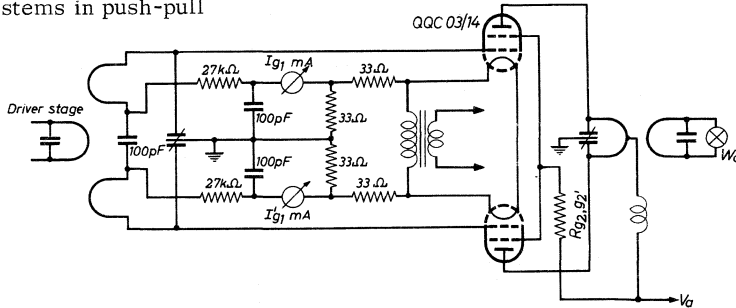
Bulb temperature	=	max. 225	°C
Pin temperature	=	max. 120	°C

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

**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	200	MHz
Anode voltage	$V_a = V_{a'}$	= max.	300	V
Anode dissipation	$W_a = W_{a'}$	= max.	7	W
Anode current	$I_a = I_{a'}$	= max.	55	mA
Grids No.2 voltage	$V_{g_2, g_2'}$	= max.	200	V
Grids No.2 dissipation	$W_{g_2+g_2'}$	= max.	2x1	W
Negative grid No.1 voltage	$-V_{g_1} = -V_{g_1'}$	= max.	150	V
Grid No.1 dissipation	$W_{g_1} = W_{g_1'}$	= max.	0.2	W
Grid No.1 current	$I_{g_1} = I_{g_1'}$	= max.	4	mA
Grid No.1 circuit resistance	$R_{g_1} = R_{g_1'}$	= max.	100	k $\Omega$
Cathode current	$I_k$	= max.	2x65	mA
Peak cathode current	$I_{kp}$	= max.	2x300	mA

**I.C.A.S. OPERATING CONDITIONS**, intermittent service;  
two systems in push-pull



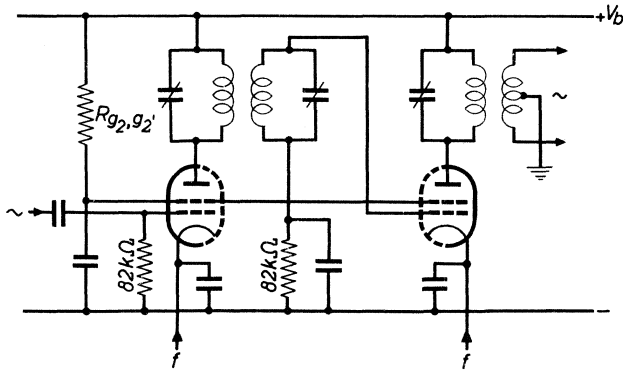
Frequency	f	=	200	200	MHz
Anode voltage	$V_a = V_{a'}$	=	250	200	V
Grids No.2 supply voltage	$V_{bg_2, g_2'}$	=	250	200	V
Grids No.2 resistor	$R_{g_2, g_2'}$	=	22	6.8	k $\Omega$
Anode current	$I_a = I_{a'}$	=	45	45	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	4.2	5.1	mA
Grid No.1 current	$I_{g_1} = I_{g_1'}$	=	1.5	1.5	mA
Anode input power	$W_{ia} = W_{ia'}$	=	11.2	9.0	W
Anode dissipation	$W_a = W_{a'}$	=	4.5	3.5	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	0.65	0.85	W
Output power in load	$W_l$	=	11	9.5	W

**R.F. CLASS C FREQUENCY TRIPLER AND DOUBLER**

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	200 MHz
Anode voltage	$V_a = V_{a'}$	= max.	300 V
Anode dissipation	$W_a = W_{a'}$	= max.	7 W
Anode current	$I_a = I_{a'}$	= max.	45 mA
Grids No.2 voltage	$V_{g_2, g_2'}$	= max.	200 V
Grids No.2 dissipation	$W_{g_2+g_2'}$	= max.	2x1 W
Grid No.1 current	$I_{g_1} = I_{g_1'}$	= max.	3 mA
Grid No.1 circuit resistance	$R_{g_1} = R_{g_1'}$	= max.	100 kΩ
Cathode current	$I_k$	= max.	2x50 mA
Peak cathode current	$I_{kp}$	= max.	2x300 mA

**I. C. A. S. OPERATING CONDITIONS**, intermittent service;  
one system as a tripler and one system as a doubler



For data see page 5.

I.C.A.S. OPERATING CONDITIONS, intermittent service;  
 one system as a tripler and one system as a doubler (continued)

		Tripler	Doubler	
Frequency	$f$	= 27.5/82.5	82.5/165	MHz
Anode voltage	$V_a = V_{a'}$	= 250	250	V
Grids No.2 supply voltage	$V_{bg_2, g_2'}$	=	250	V
Grids No.2 resistor	$R_{g_2, g_2'}$	=	39	k $\Omega$
Anode current	$I_a = I_{a'}$	= 20	20	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	4.0	mA
Grid No.1 current	$I_{g_1} = I_{g_1'}$	= 0.75	1.25	mA
Anode input power	$W_{ia} = W_{ia'}$	= 5.0	5.0	W
Anode dissipation	$W_a = W_{a'}$	= 3.5	3.0	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	0.38	W
Output power	$W_o$	= 1.5	2.0	W
Efficiency	$\eta$	= 30	40	%
Output power in load	$W_l$	= 1.25	1.25	W

		Tripler	Doubler	
Frequency	$f$	= 27.5/82.5	82.5/165	MHz
Anode voltage	$V_a = V_{a'}$	= 200	200	V
Grids No.2 supply voltage	$V_{bg_2, g_2'}$	=	200	V
Grids No.2 resistor	$R_{g_2, g_2'}$	=	22	k $\Omega$
Anode current	$I_a = I_{a'}$	= 20	20	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	4.0	mA
Grid No.1 current	$I_{g_1} = I_{g_1'}$	= 0.75	1.25	mA
Anode input power	$W_{ia} = W_{ia'}$	= 4.0	4.0	W
Anode dissipation	$W_a = W_{a'}$	= 2.8	2.4	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	0.45	W
Output power	$W_o$	= 1.2	1.6	W
Efficiency	$\eta$	= 30	40	%
Output power in load	$W_l$	= 1.0	1.0	W





## R.F. DOUBLE TETRODE FOR MOBILE EQUIPMENT

### QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		C <sub>ag2</sub> mod.			B mod. <sup>1)</sup>	
	V <sub>a</sub> (V)	W <sub>o</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>o</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	
60	600	CCS	450 250	CCS	17.5	C. C. S.	
		ICAS		ICAS		450	18
186	600	26.6	250	6.0	7.8	I. C. A. S.	
		33.6		600		28.2	

**HEATING** : direct; filament oxide-coated

Filament voltage	V <sub>f</sub>	3-3.15	6-6.3	V
Filament current	I <sub>f</sub>	1.36	0.68	A
Pins		3-(1+5)	1-5	

### TYPICAL CHARACTERISTICS

Amplification factor of grid No. 2  
with respect to grid No. 1

$\mu_{g2g1}$  7.5

Mutual conductance <sup>2)</sup>

S (I<sub>a</sub> = 20 mA) 2 mA/V

<sup>1)</sup> C. C. S. = continuous service  
I. C. A. S. = intermittent service  
<sup>2)</sup> One system

**CAPACITANCES**

Anode to all other elements except grid No. 1  
 Grid No. 1 to all other elements except anode  
 Anode to grid No. 1

per system

$C_a$	3.3	pF
$C_{g_1}$	8.5	pF
$C_{ag_1}$	0.05	pF

in push-pull

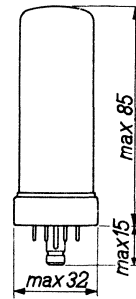
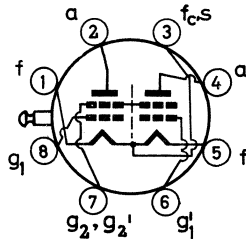
Output capacitance  
 Input capacitance

$C_o$	1.7	pF
$C_i$	5.7	pF

**MECHANICAL DATA**

Dimensions in mm

Base : loctal  
 Socket : 40213  
 Net weight: 40 g



Mounting position: Vertical with base up or down  
 Horizontal with pins 1 and 5 in a horizontal plane

**TEMPERATURE LIMITS (Absolute limits)**

Pin temperature	max.	100	°C
Bulb temperature	max.	200	°C

**R.F. CLASS C TELEGRAPHY**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to	186	MHz
Anode voltage	$V_a$	max.	600	V
Anode input power	$W_{ia}$	max.	2x18	W
Anode dissipation	$W_a$	max.	2x6	W
Anode current	$I_a$	max.	2x30	mA
Grid No. 2 voltage	$V_{g2}$	max.	250	V
Grid No. 2 dissipation	$W_{g2}$	max.	7	W
Negative grid No. 1 voltage	$-V_{g1}$	max.	200	V
Grid No. 1 current	$I_{g1}$	max.	2x5	mA

**C.C.S. OPERATING CONDITIONS**, continuous service

two system in push-pull

Frequency	f	60	186	MHz
Anode voltage	$V_a$	600	600	V
Grid No. 2 voltage	$V_{g2}$	200	200	V
Grid No. 1 voltage	$V_{g1}$	-80	-80	V
Anode current	$I_a$	2x30	2x30	mA
Grid No. 2 current	$I_{g2}$	6	3	mA
Grid No. 1 current	$I_{g1}$	2x1.0	2x1.0	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	210	210	V
Grid No. 1 input power	$W_{ig1}$	2x0.1	2x0.1	W
Grid No. 2 dissipation	$W_{g2}$	1.2	0.6	W
Anode input power	$W_{ia}$	2x18	2x18	W
Anode dissipation	$W_a$	2x4.7	2x5.2	W
Output power	$W_o$	26.6	25.6	W
Efficiency	$\eta$	74	71 <sup>1)</sup>	%

<sup>1)</sup> In order to prevent overheating a low-velocity air flow should be directed on the bulb and the base

**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	186	MHz
Anode voltage	$V_a$	max.	600	V
Anode input power	$W_{ia}$	max.	2x24	W
Anode dissipation	$W_a$	max.	2x8	W
Anode current	$I_a$	max.	2x40	mA
Grid No. 2 voltage	$V_{g2}$	max.	250	V
Grid No. 2 dissipation	$W_{g2}$	max.	7	W
Negative grid No. 1 voltage	$-V_{g1}$	max.	200	V
Grid No. 1 current	$I_{g1}$	max.	2x5	mA

**R.F. CLASS C TELEGRAPHY**

**I.C.A.S. OPERATING CONDITIONS**, intermittent service

two systems in push-pull

Frequency	f	60	186	MHz
Anode voltage	$V_a$	600	600	V
Grid No. 2 voltage	$V_{g2}$	200	200	V
Grid No. 1 voltage	$V_{g1}$	-80	-80	V
Anode current	$I_a$	2x40	2x40	mA
Grid No. 2 current	$I_{g2}$	5.5	4.5	mA
Grid No. 1 current	$I_{g1}$	2x1.2	2x1.3	mA
Input A. C. voltage, peak to peak	$V_{g1g1'p}$	220	220	V
Grid No. 1 input power	$W_{ig1}$	2x0.12	2x0.13	W
Grid No. 2 dissipation	$W_{g2}$	1.1	0.9	W
Anode input power	$W_{ia}$	2x24	2x24	W
Anode dissipation	$W_a$	2x6.5	2x7.2	W
Output power	$W_o$	35	33.6	W
Efficiency	$\eta$	73	70 1)	%

1) In order to prevent overheating a low-velocity air flow should be directed on the bulb and the base.

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to	186	MHz
Anode voltage	$V_a$	max.	480	V
Anode input power	$W_{ia}$	max.	2x11.5	W
Anode dissipation	$W_a$	max.	2x4	W
Anode current	$I_a$	max.	2x25	mA
Grid No. 2 voltage	$V_{g2}$	max.	250	V
Grid No. 2 dissipation	$W_{g2}$	max.	4.5	W
Negative grid No. 1 voltage	$-V_{g1}$	max.	200	V
Grid No. 1 current	$I_{g1}$	max.	2x5	mA

**C.C.S. OPERATING CONDITIONS**, continuous service

two system in push-pull

Frequency	f	60	186	MHz
Anode voltage	$V_a$	450	250	V
Grid No. 2 resistor	$R_{g2}$	18	10	k $\Omega$
Grid No. 1 voltage	$V_{g1}$	-80	-70	V
Anode current	$I_a$	2x25	2x19.5	mA
Grid No. 2 current	$I_{g2}$	14	11	mA
Grid No. 1 current	$I_{g1}$	2x1.0	2x1.5	mA
Peak grid No. 1 voltage	$V_{g1p}$	83	110	V
Grid No. 1 input power	$W_{ig1}$	2x0.08	2x0.15	W
Grid No. 2 dissipation	$W_{g2}$	2.8	1.6	W
Anode input power	$W_{ia}$	2x11.25	2x4.9	W
Anode dissipation	$W_a$	2x2.5	2x1.9	W
Output power	$W_o$	17.5	6.0	W
Efficiency	$\eta$	77.5	61	%
Modulation factor	m	100	100	%
Modulation power	$W_{mod}$	11.5	5	W

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION** (continued)

**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to	186	MHz
Anode voltage	$V_a$	max.	480	V
Anode input power	$W_{ia}$	max.	2x15.5	W
Anode dissipation	$W_a$	max.	2x5	W
Anode current	$I_a$	max.	2x32	mA
Grid No. 2 voltage	$V_{g2}$	max.	250	V
Grid No. 2 dissipation	$W_{g2}$	max.	4.5	W
Negative grid No. 1 voltage	$-V_{g1}$	max.	200	V
Grid No. 1 current	$I_{g1}$	max.	2x5	mA

**I.C.A.S. OPERATING CONDITIONS**, intermittent service e

two systems in push-pull

Frequency	f	60	186	MHz
Anode voltage	$V_a$	250	250	V
Grid No. 2 resistor	$R_{g2}$	10	10	k $\Omega$
Grid No. 1 voltage	$V_{g1}$	-70	-70	V
Anode current	$I_a$	2x26.5	2x26.5	mA
Grid No. 2 current	$I_{g2}$	9	9	mA
Grid No. 1 current	$I_{g1}$	2x1.8	2x1.5	mA
Peak grid No. 1 A.C. voltage	$V_{g1p}$	110	110	V
Grid No. 1 input power	$W_{ig1}$	2x0.18	2x0.15	W
Grid No. 2 dissipation	$W_{g2}$	1.5	1.5	W
Anode input power	$W_{ia}$	2x6.6	2x6.6	W
Anode dissipation	$W_a$	2x2.5	2x2.7	W
Output power	$W_o$	8.2	7.8	W
Efficiency	$\eta$	62	59	%
Modulation factor	m	100	100	%
Modulation power	$W_{mod}$	7	7	W

**A.F. CLASS B AMPLIFIER AND MODULATOR 'OR**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Anode voltage	$V_a$	max.	600	V
Anode input power	$W_{ia}$	max.	2x18	W
Anode dissipation	$W_a$	max.	2x6	W
Anode current	$I_a$	max.	2x30	mA
Grid No. 2 voltage	$V_{g2}$	max.	250	V
Grid No. 2 dissipation	$W_{g2}$	max.	7	W
Negative grid No. 1 voltage	$-V_{g1}$	max.	200	V

**C.C.S. OPERATING CONDITIONS** continuous service

two systems in push-pull

Heater voltage	$V_f$	6.3 <sup>1)</sup>		V
Anode voltage	$V_a$	450		V
Grid No. 2 voltage	$V_{g2}$	200		V
Grid No. 1 voltage	$V_{g1}$	-24		V
Load resistance	$R_{aa'}$	20		k $\Omega$
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	0	94	V
Anode current	$I_a$	2x2.8	2x32.5	mA
Grid No. 2 current	$I_{g2}$	2x0.16	2x5	mA
Grid No. 1 current	$I_{g1}$	0	2x1.1	mA
Anode input power	$W_{ia}$	2x1.3	2x14.6	W
Anode dissipation	$W_a$	2x1.3	2x5.6	W
Output power	$W_o$	0	18	W
Total distortion	$d_{tot}$	-	5	%
Efficiency	$\eta$	-	61.5	%

<sup>1)</sup> D.C. voltage

**A.F. CLASS B AMPLIFIER AND MODULATOR** (continued)

**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

Anode voltage	$V_a$	max.	600	V
Anode input power	$W_{ia}$	max.	2x24	W
Anode dissipation	$W_a$	max.	2x8	W
Anode current	$I_a$	max.	2x40	mA
Grid No. 2 voltage	$V_{g2}$	max.	250	V
Grid No. 2 dissipation	$W_{g2}$	max.	7	W
Negative grid No. 1 voltage	$-V_{g1}$	max.	200	V

**I.C.A.S. OPERATING CONDITIONS** intermittent service

two system in push-pull

Heater voltage	$V_f$	6.3 <sup>1)</sup>	V	
Anode voltage	$V_a$	600	V	
Grid No. 2 voltage	$V_{g2}$	200	V	
Grid No. 1 voltage	$V_{g1}$	-24	V	
Load resistance	$R_{aa'}$	25	k $\Omega$	
Input A. C. voltage, peak to peak	$V_{g1g1'p}$	0	85	V
Anode current	$I_a$	2x3.0	2x33.5	mA
Grid No. 2 current	$I_{g2}$	2x0.18	2x4.5	mA
Grid No. 1 current	$I_{g1}$	0	2x1.2	mA
Anode input power	$W_{ia}$	2x1.8	2x20.1	W
Anode dissipation	$W_a$	2x1.8	2x6	W
Output power	$W_o$	0	28.2	W
Total harmonic distortion	$d_{tot}$	-	5	%
Efficiency	$\eta$	-	70	%

<sup>1)</sup> D. C. voltage



## R.F. DOUBLE TETRODE

QUICK REFERENCE DATA							
$\lambda$	Freq.	C telegr.			C <sub>ag2</sub> mod.		
(m)	(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W) <sup>1)</sup>		V <sub>a</sub> (V)	W <sub>o</sub> (W) <sup>1)</sup>	
			CCS	ICAS		CCS	ICAS
0.6	500	180 200	5.8	7.2	180	4.2	5.8
$\lambda$	Freq.	C fr. mult.					
(m)	(MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W) <sup>1)</sup>				
			CCS	ICAS			
1.8/0.6	167/500	180 200	2.35	2.95			

**HEATING:** indirect; cathode oxide-coated

Heater voltage	V <sub>f</sub>	=	6.3	12.6	V <sup>2)</sup>
Heater current	I <sub>f</sub>	=	0.6	0.3	A
	Pins	=	9-(4+5)	4-5	

**TYPICAL CHARACTERISTICS** per system

Anode voltage	V <sub>a</sub>	=	150	V
Grid No.2 voltage	V <sub>g2</sub>	=	150	V
Anode current	I <sub>a</sub>	=	25	mA
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$	=	31	
Mutual conductance	S	=	10.5	mA/V

<sup>1)</sup> Two systems

<sup>2)</sup> A temporary deviation of 10% of V<sub>f</sub> is permissible; e.g. when the tube is fed from an accumulator, the actual V<sub>f</sub> should not exceed 7 V or 14 V and the accumulator may be used until its voltage has decreased to such an extent that V<sub>f</sub> is 5.7 V or 11.4 V

**CAPACITANCES**

Anode to all other elements except grid No.1  
 Grid No.1 to all other elements except anode  
 Anode to grid No.1

per system  
 $C_a = 1.6 \text{ pF}$   
 $C_{g_1} = 6.4 \text{ pF}$   
 $C_{ag_1} = 0.16 \text{ pF}$

Output  
 Input

in push-pull  
 $C_o = 0.95 \text{ pF}$   
 $C_i = 3.8 \text{ pF}$

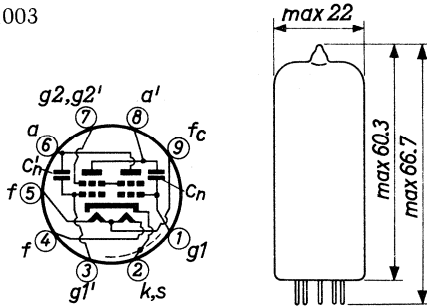
The tube is internally neutralized

**MECHANICAL DATA**

Dimensions in mm

Base : Noval

Socket: 2422 502 01003



Mounting position: arbitrary

Low loss socket without collar is recommended. At high frequencies use of a metal retaining device is not recommended due to loss of output power.

**COOLING**

Radiation and convection. The use of a closed can is not allowed.

**TEMPERATURE LIMITS (Absolute limits)**

Bulb temperature (at hottest point) max. 225 °C  
 Pin seal temperature max. 120 °C

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

**LIMITING VALUES** (Absolute limits)

Frequency	f	C.C.S.		I.C.A.S.	
		up to	500	up to	500 MHz
Anode voltage	$V_a$	= max.	250	max.	250 V
Anode input power	$W_{ia}$	= max.	2x6	max.	2x7 W
Anode dissipation	$W_a$	= max.	2x3	max.	2x3.75 W
Anode current	$I_a$	= max.	2x45	max.	2x50 mA
Grid No.2 voltage	$V_{g2}$	= max.	200	max.	200 V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1.5	max.	2x1.75 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	max.	100 V
Grid No.1 current	$I_{g1}$	= max.	2x3	max.	2x4 mA
Heater to cathode voltage	$V_{kf}$	= max.	100	max.	100 V

**OPERATING CONDITIONS**

Frequency	f	C.C.S.		I.C.A.S.	
		=	500	=	500 MHz
Anode voltage	$V_a$	=	180	=	200 V
Grid No.2 voltage	$V_{g2}$	=	180	=	200 V
Grid No.1 voltage	$V_{g1}$	=	-20	=	-20 V
Grid No.1 resistors	$R_{g1}$	=	27	=	27 $k\Omega$ <sup>1)</sup>
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	50	=	50 V
Anode current	$I_a$	=	2x27.5	=	2x31 mA
Grid No.2 current	$I_{g2}$	=	12.5	=	14 mA
Grid No.1 current	$I_{g1}$	=	2x0.75	=	2x0.75 mA
Anode input power	$W_{ia}$	=	2x5	=	2x6.2 W
Anode dissipation	$W_a$	=	2x2.1	=	2x2.6 W
Grid No.2 dissipation	$W_{g2}$	=	2.25	=	2.8 W
Driver output power	$W_{dr}$	=	1.2	=	1.2 W
Output power	$W_o$	=	5.8	=	7.2 W
Efficiency	$\eta$	=	58	=	58 %
Output power in load	$W_l$	=	5	=	6 W

1) Each system

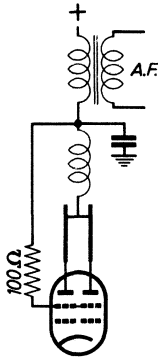
**R.F. CLASS C ANODE AND SCREEN GRID MODULATION; two systems in push-pull**

**LIMITING VALUES (Absolute limits)**

Frequency	f	C. C. S.		I. C. A. S.	
		up to	500	up to	500 MHz
Anode voltage	$V_a = \text{max.}$	200		max.	200 V
Anode input power	$W_{ia} = \text{max.}$	2x4		max.	2x5 W
Anode dissipation	$W_a = \text{max.}$	2x2		max.	2x2.5 W
Anode current	$I_a = \text{max.}$	2x32		max.	2x40 mA
Grid No.2 voltage	$V_{g2} = \text{max.}$	200		max.	200 V
Grid No.2 dissipation	$W_{g2} = \text{max.}$	2x1.0		max.	2x1.15 W
Negative grid No.1 voltage	$-V_{g1} = \text{max.}$	100		max.	100 V
Grid No.1 current	$I_{g1} = \text{max.}$	2x3		max.	2x4 mA
Heater to cathode voltage	$V_{kf} = \text{max.}$	100		max.	100 V

**OPERATING CONDITIONS**

		C. C. S.	I. C. A. S.
f	=	500	500 MHz
$V_a$	=	180	180 V
$V_{g2}$	=	see circuit diagram	
$V_{g1}$	=	-20	-20 V
$R_{g1}$	=	68	27 k $\Omega$ 1)
$V_{g1g1'p}$	=	45	50 V
$I_a$	=	2x20	2x27.5 mA
$I_{g2}$	=	9.5	12.5 mA
$I_{g1}$	=	2x0.3	2x0.75 mA
$W_{ia}$	=	2x3.6	2x5.0 W
$W_a$	=	2x1.5	2x2.1 W
$W_{g2}$	=	1.7	2.25 W
$W_{dr}$	=	1.0	1.2 W
$W_o$	=	4.2	5.8 W
$\eta$	=	58	58 %
$W_d$	=	3.5	5.0 W
m	=	100	100 %
$W_{mod}$	=	4.5	6.1 W



1) Each system

**R.F. CLASS C FREQUENCY TRIPLER**, two systems in push-pull

**LIMITING VALUES** (Absolute limits)

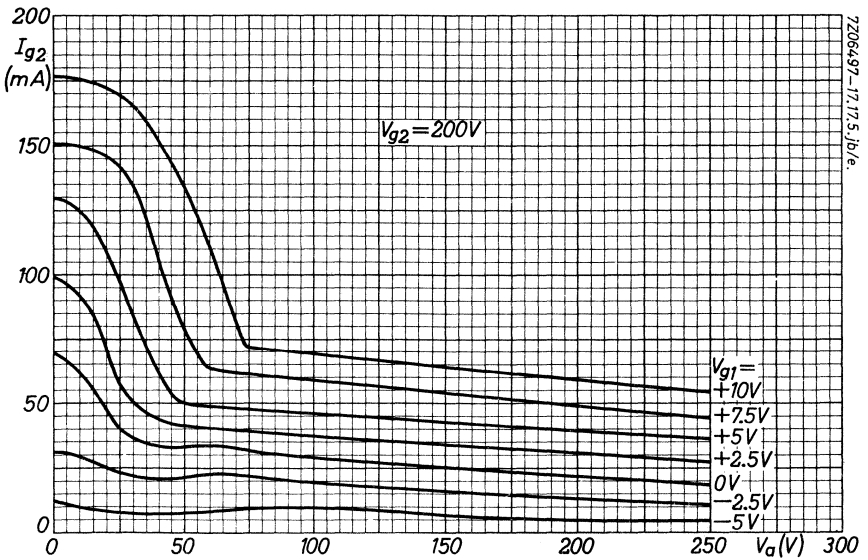
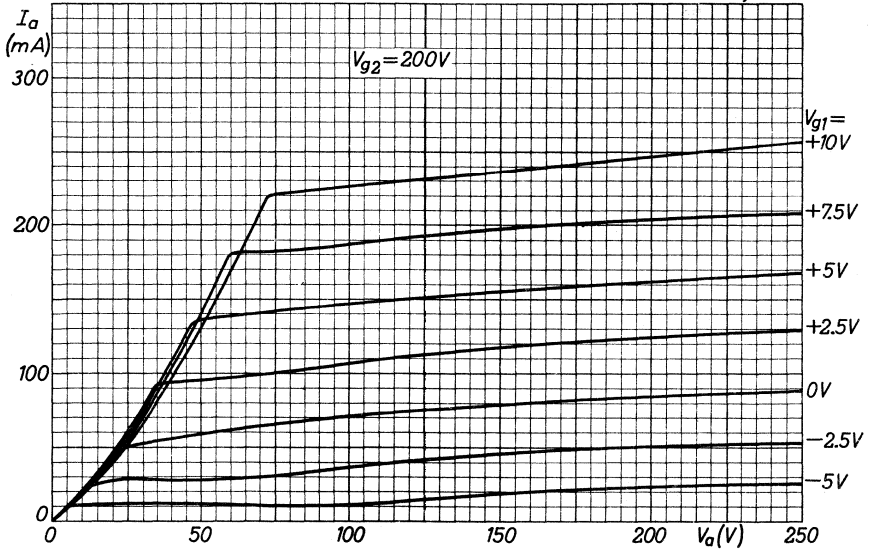
Frequency	f	C.C.S.		I.C.A.S.		MHz
		up to	500	up to	500	
Anode voltage	$V_a$	= max.	250	max.	250	V
Anode input power	$W_{ia}$	= max.	2x4	max.	2x5	W
Anode dissipation	$W_a$	= max.	2x3	max.	2x3.75	W
Anode current	$I_a$	= max.	2x30	max.	2x40	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1.5	max.	2x1.75	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	max.	100	V
Grid No.1 current	$I_{g1}$	= max.	2x3	max.	2x4	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	max.	100	V

**OPERATING CONDITIONS**

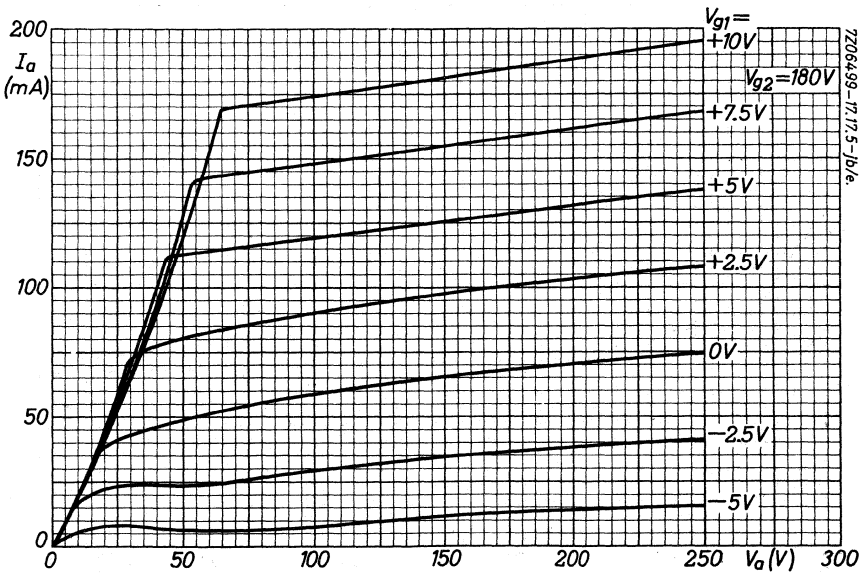
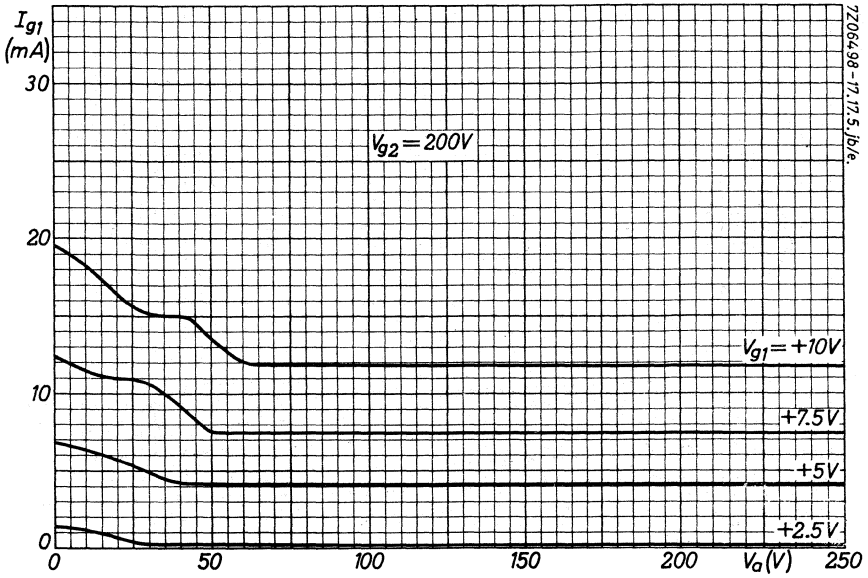
Frequency	f	C.C.S.		I.C.A.S.		MHz
Anode voltage	$V_a$	=	180		200	V
Grid No.2 supply voltage	$V_{bg2}$	=	180		200	V
Grid No.2 resistor	$R_{g2}$	=	1200		1200	$\Omega$
Grid No.1 resistors	$R_{g1}$	=	82		82	$k\Omega$ <sup>1)</sup>
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	165		165	V
Anode current	$I_a$	=	2x20		2x22.5	mA
Grid No.2 current	$I_{g2}$	=	9.7		11.0	mA
Grid No.1 current	$I_{g1}$	=	2x0.9		2x0.9	mA
Anode input power	$W_{ia}$	=	2x3.6		2x4.5	W
Anode dissipation	$W_a$	=	2x2.45		2x3.05	W
Grid No.2 dissipation	$W_{g2}$	=	1.65		2.05	W
Driver output power	$W_{dr}$	=	1.1		1.1	W
Output power	$W_o$	=	2.35		2.95	W
Efficiency	$\eta$	=	33		33	%
Output power in load	$W_l$	=	1.8		2.2	W

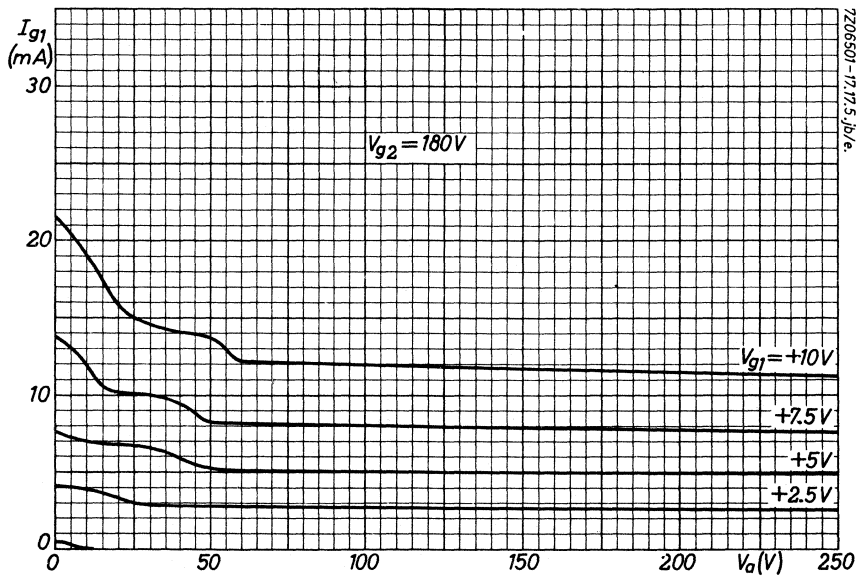
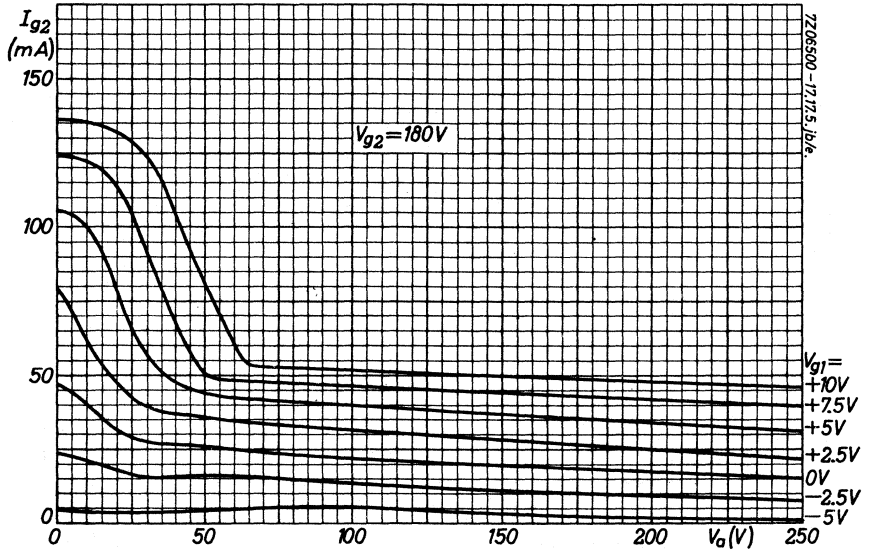
<sup>1)</sup> Each system. Fixed bias or a combination of fixed bias and grid current biasing is not recommended.

7206496-17.17.5, jb/e.



7206497-17.17.5, jb/e.







## R.F. DOUBLE TETRODE

QUICK REFERENCE DATA							
$\lambda$ (m)	Freq. (MHz)	C telegr.			$C_{ag2}$ mod.		
		$V_a$ (V)	$W_o$ (W) <sup>1)</sup>		$V_a$ (V)	$W_o$ (W) <sup>1)</sup>	
			CCS	ICAS		CCS	ICAS
1.5	200	300	12	16	200	7.1	8.8
		250	9.0	11.2			
		200	7.4	9.0			
$\lambda$ (m)	Freq. (MHz)	C fr. mult.			B mod.		
		$V_a$ (V)	$W_o$ (W) <sup>1)</sup>		$V_a$ (V)	$W_o$ <sup>1)</sup> (W)	
			CCS	ICAS			
4.5/1.5	67/200	300	3.5	4.8	300	17.5	
		250	3.0	4.2	250	14	
		200	2.8	3.5	200	8.7	

**HEATING** : indirect; cathode oxide-coated

Heater voltage	$V_f$	=	6.3	12.6	V <sup>2)</sup>
Heater current	$I_f$	=	0.82	0.41	A
	Pins	=	9-(4+5)	4-5	

### TYPICAL CHARACTERISTICS per system

Amplification factor of grid No.2  
with respect to grid No.1

$$\mu_{g2g1} = 7.5$$

Mutual conductance

$$S \quad (I_a = 30 \text{ mA}) = 3.3 \text{ mA/V}$$

1) Two systems in push-pull; useful power output in load

2) Occasional operation at 5.3 V or 7.8 V (resp. 10.6 V or 15.6 V) is acceptable. The tube may be used with only half the heater energized during the stand-by period of a transmitter in order to reduce heater current consumption during this time.

**CAPACITANCES**

Anode to all other elements except grid No.1  
 Grid No.1 to all other elements except anode  
 Anode to grid No.1

per system  
 $C_a = 2.6 \text{ pF}$   
 $C_{g1} = 6.2 \text{ pF}$   
 $C_{ag1} < 0.1 \text{ pF}$

Output capacitance  
 Input capacitance

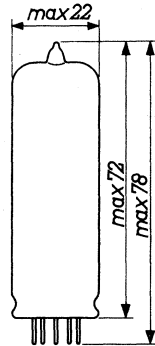
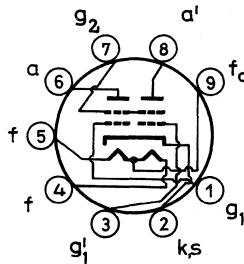
in push-pull  
 $C_o = 1.4 \text{ pF}$   
 $C_i = 5.1 \text{ pF}$

The tube is internally neutralized

**MECHANICAL DATA**

Base : Noval  
 Socket : 2422 502 01003  
 Tube retainer: 40647  
 Net weight : 17 g

Dimensions in mm



Mounting position: arbitrary; if the tube is mounted horizontally, it is recommended that pins 2 and 7 are placed in a vertical plane.

**COOLING**

Cooling: radiation and convection. The use of a closed can is not allowed

**TEMPERATURE LIMITS (Absolute limits)**

Bulb temperature max. 225 °C  
 Temperature of pin seals max. 120 °C

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

**C.C.S. LIMITING VALUES (Absolute limits) continuous service**

Frequency	f	up to	200	MHz
Anode voltage	$V_a$	= max.	300	V
Anode dissipation	$W_a$	= max.	2x5	W
Anode input power	$W_{ia}$	= max.	2x11.25	W
Anode current	$I_a$	= max.	2x45	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No.1 current	$I_{g1}$	= max.	2x3	mA
Cathode current	$I_k$	= max.	2x50	mA
Peak cathode current	$I_{kp}$	= max.	225	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**C.C.S. OPERATING CONDITIONS, continuous service**

Frequency	f	=	200	200	200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	$V_{g2}$	=	175	-	-	V
Grid No.2 resistor	$R_{g2}$	=	-	47	22	k $\Omega$
Grid No.1 voltage	$V_{g1}$	=	-40	-	-	V
Grid No.1 resistor	$R_{g1}$ <sup>1)</sup>	=	-	18	15	k $\Omega$
Input A.C. voltage, peak to peak	$V_{ig1'p}$	=	110	110	115	V
Anode current	$I_a$	=	2x37.5	2x33.5	2x35	mA
Grid No.2 current	$I_{g2}$	=	2.3	1.8	2.2	mA
Grid No.1 current	$I_{g1}$	=	2x0.9	2.2	2.7	mA
Anode input power	$W_{ia}$	=	2x11.25	2x8.4	2x7	W
Anode dissipation	$W_a$	=	2x4	2x2.9	2x2.8	W
Grid No.2 dissipation	$W_{g2}$	=	0.4	0.3	0.33	W
Grid No.1 input power	$W_{ig1}$	=	2x0.05	0.12	0.14	W
Output power	$W_o$	=	14.5	11	8.4	W
Efficiency	$\eta$	=	65	65	60	%
Output power	$W_o$ <sup>2)</sup>	=	12	9	7.4	W

1) Common resistor for both systems

2) Useful power output in load

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

I.C.A.S. LIMITING VALUES (Absolute limits) intermittent service

Frequency	f	up to	200	MHz
Anode voltage	$V_a$	= max.	300	V
Anode dissipation	$W_a$	= max.	2x7	W
Anode input power	$W_{ia}$	= max.	2x15	W
Anode current	$I_a$	= max.	2x55	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No.1 current	$I_{g1}$	= max.	2x4	mA
Cathode current	$I_k$	= max.	2x65	mA
Peak cathode current	$I_{kp}$	= max.	2x300	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

I.C.A.S. OPERATING CONDITIONS, intermittent service

Frequency	f	=	200	200	200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	$V_{g2}$	=	200	-	-	V
Grid No.2 resistor	$R_{g2}$	=	-	27	8.2	k $\Omega$
Grid No.1 voltage	$V_{g1}$	=	-45			V
Grid No.1 resistor	$R_{g1}$ 1)	=	-	18	15	k $\Omega$
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	130	120	130	V
Anode current	$I_a$	=	2x50	2x40	2x42	mA
Grid No.2 current	$I_{g2}$	=	3.0	2.4	3.1	mA
Grid No.1 current	$I_{g1}$	=	2x1.5	2.5	3.0	mA
Anode input power	$W_{ia}$	=	2x15	2x10	2x8.4	W
Anode dissipation	$W_a$	=	2x6	2x3.5	2x3.4	W
Grid No.2 dissipation	$W_{g2}$	=	0.6	0.45	0.55	W
Grid No.1 input power	$W_{ig1}$	=	2x0.1	0.15	0.18	W
Output power	$W_o$	=	18.5	13	10	W
Efficiency	$\eta$	=	62	65	60	%
Output power	$W_o$ 2)	=	16	11.2	9	W

1) Common resistor for both systems

2) Useful power output in load

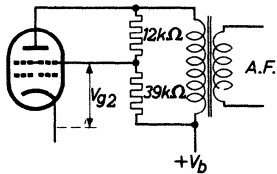
**R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull**

**C. C. S. LIMITING VALUES (Absolute limits) continuous service**

Frequency	f	up to	200	MHz
Anode voltage	$V_a$	= max.	240	V
Anode dissipation	$W_a$	= max.	2x3.3	W
Anode input power	$W_{ia}$	= max.	2x7.5	W
Anode current	$I_a$	= max.	2x37.5	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	1.3	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No.1 current	$I_{g1}$	= max.	2x3	mA
Cathode current	$I_k$	= max.	2x40	mA
Peak cathode current	$I_{kp}$	= max.	2x180	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**C. C. S. OPERATING CONDITIONS, continuous service**

f	=	200	MHz
$V_a = V_b$	=	200	V
$V_{g2}^{1)}$	=		
$R_{g1}^{2)}$	=	33	k $\Omega$
$V_{g1g1'p}$	=	130	V
$I_a$	=	2x33.5	mA
$I_{g2}$	=	2.6	mA
$I_{g1}$	=	1.5	mA
$W_{ia}$	=	2x6.7	W
$W_a$	=	2x2.65	W
$W_{g2}$	=	0.46	W
$W_{ig1}$	=	0.1	W
$W_o$	=	8.1	W
$\eta$	=	60	%
$W_o^{3)}$	=	7.1	W
m	=	100	%
$W_{mod}$	=	6.7	W



1) See diagram

2) Common resistor for both systems

3) Useful power output in load

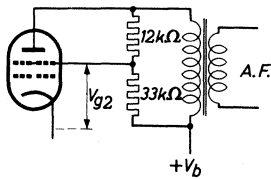
**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**, two systems in push-pull; continued

**I.C.A.S. LIMITING VALUES** (Absolute limits) intermittent service

Frequency	f	up to	200	MHz
Anode voltage	$V_a$	= max.	240	V
Anode dissipation	$W_a$	= max.	2x4.6	W
Anode input power	$W_{ia}$	= max.	2x10	W
Anode current	$I_a$	= max.	2x46	mA
Grid No. 2 voltage	$V_{g2}$	= max.	200	V
Grid No. 2 dissipation	$W_{g2}$	= max.	1.3	W
Negative grid No. 1 voltage	$-V_{g1}$	= max.	150	V
Grid No. 1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No. 1 current	$I_{g1}$	= max.	2x4	mA
Cathode current	$I_k$	= max.	2x52	mA
Peak cathode current	$I_{kp}$	= max.	2x240	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**I.C.A.S. OPERATING CONDITIONS**, intermittent service

f	=	200	MHz
$V_a = V_b$	=	200	V
$V_{g2}$ 1)	=		
$R_{g1}$ 2)	=	15	k $\Omega$
$V_{g1g1'p}$	=	130	V
$I_a$	=	2x43	mA
$I_{g2}$	=	3.1	mA
$I_{g1}$	=	3.3	mA
$W_{ia}$	=	2x8.6	W
$W_a$	=	2x3.7	W
$W_{g2}$	=	0.54	W
$W_{ig1}$	=	0.2	W
$W_o$	=	9.8	W
$\eta$	=	57	%
$W_Q$ 3)	=	8.8	W
m	=	100	%
$W_{mod}$	=	8.6	W



- 1) See diagram
- 2) Common resistor for both systems
- 3) Useful power output in load

**R.F. CLASS C FREQUENCY TRIPLER**, two systems in push-pull

**C.C.S. LIMITING VALUES** (Absolute limits) continuous service

Frequency	f	up to	200	MHz
Anode voltage	$V_a$	= max.	300	V
Anode dissipation	$W_a$	= max.	2x5	W
Anode input power	$W_{ia}$	= max.	2x7.5	W
Anode current	$I_a$	= max.	2x30	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	2	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No.1 current	$I_{g1}$	= max.	2x2	mA
Cathode current	$I_k$	= max.	2x35	mA
Peak cathode current	$I_{kp}$	= max.	2x225	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**C.C.S. OPERATING CONDITIONS**, continuous service

Frequency	f	= 67/200	67/200	67/200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200 V
Grid No.2 voltage	$V_{g2}$	=	150	161	155 V
Grid No.2 resistor	$R_{g2}$	=	-	47	15 k $\Omega$
Grid No.1 voltage	$V_{g1}$	=	-100	-	- V
Grid No.1 resistor	$R_{g1}$ <sup>1)</sup>	=	-	47	33 k $\Omega$
Input A.C. voltage, peak to peak	$V_{ig1'p}$	=	230	230	230 V
Anode current	$I_a$	=	2x24	2x25	2x28.5 mA
Grid No.2 current	$I_{g2}$	=	2.0	1.9	3.0 mA
Grid No.1 current	$I_{g1}$	=	2x1.0	2x1.0	2x1.6 mA
Anode input power	$W_{ia}$	=	2x7.2	2x6.25	2x5.7 W
Anode dissipation	$W_a$	=	2x4.0	2x3.75	2x3.8 W
Grid No.2 dissipation	$W_{g2}$	=	0.30	0.31	0.46 W
Grid No.1 input power	$W_{ig1}$	=	0.23	0.23	0.35 W
Output power	$W_o$	=	6.5	5.0	3.8 W
Efficiency	$\eta$	=	45	40	33.5 %
Output power	$W_o$ <sup>2)</sup>	=	3.5	3.0	2.8 W

<sup>1)</sup> Common resistor for both systems

<sup>2)</sup> Useful power output in load

**R.F. CLASS C FREQUENCY TRIPLER**, two systems in push-pull; continued

**I.C.A.S. LIMITING VALUES** (Absolute limits) intermittent service

Frequency	f	up to	200	MHz
Anode voltage	$V_a$	= max.	300	V
Anode dissipation	$W_a$	= max.	2x7	W
Anode input power	$W_{ia}$	= max.	2x10	W
Anode current	$I_a$	= max.	2x42	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	2	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No.1 current	$I_{g1}$	= max.	2x3	mA
Cathode current	$I_k$	= max.	2x45	mA
Peak cathode current	$I_{kp}$	= max.	2x300	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**I.C.A.S. OPERATING CONDITIONS**, intermittent service

f	=	67/200	67/200	67/200	67/200	MHz
$V_a = V_b$	=	300	300	250	200	V
$V_{g2}$	=	150	175	176	175	V
$R_{g2}$	=	-	-	18	4.7	kΩ
$V_{g1}$	=	-100	-100	-	-	V
$R_{g1}$ 1)	=	-	-	27	22	kΩ
$V_{g1g1'p}$	=	240	230	230	230	V
$I_a$	=	2x32.5	2x32.5	2x36	2x39	mA
$I_{g2}$	=	3.5	2.7	4.1	5.2	mA
$I_{g1}$	=	2x1.9	2x1.2	2x1.9	2x2.3	mA
$W_{ia}$	=	2x9.7	2x9.7	2x9	2x7.8	W
$W_a$	=	2x5.8	2x6.1	2x5.9	2x5.55	W
$W_{g2}$	=	0.53	0.47	0.72	0.91	W
$W_{ig1}$	=	0.45	0.28	0.43	0.52	W
$W_o$	=	7.8	7.2	6.2	4.5	W
$\eta$	=	40	37	34.5	29	%
$W_o$ 2)	=	4.8	4.2	4.2	3.5	W

1) Common resistor for both systems

2) Useful power output in load



**A.F. CLASS AB AMPLIFIER AND MODULATOR WITHOUT GRID CURRENT**

**LIMITING VALUES** (Absolute limits) only for speech and music

Anode voltage	$V_a$	= max.	300	V
Anode dissipation	$W_a$	= max.	2x7	W
Anode input power	$W_{ia}$	= max.	2x15	W
Anode current	$I_a$	= max.	2x50	mA
Grid No.2 voltage	$V_{g2}$	= max.	200	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1	W
Peak grid No.2 dissipation	$W_{g2p}$	= max.	2x2	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No.1 current	$I_{g1}$	= max.	2x4	mA
Cathode current	$I_k$	= max.	2x60	mA
Peak cathode current	$I_{kp}$	= max.	2x300	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**OPERATING CONDITIONS**

$V_a$	=	300	250	200	V			
$V_{g2}$	=	200	200	200	V			
$V_{g1}^1)$	=	-21.5	-21.5	-21.5	V			
$R_{aa'c}$	=	10	8	6.5	k $\Omega$			
$V_{g1g1'p}$	=	0	43.5	0	44.5	0	43.5	V
$I_a$	=	2x15	2x36	2x15	2x34.5	2x15	2x33	mA
$I_{g2}$	=	1.2	12.6	1.4	12.4	2.4	14	mA
$W_{g2}$	=	0.24	2.5	0.28	2.5	0.48	2.8	W
$W_{ia}$	=	2x4.5	2x10.8	2x3.75	2x8.65	2x3.0	2x6.6	W
$W_a$	=	2x4.5	2x4.8	2x3.75	2x4.0	2x3.0	2x3.1	W
$W_o$	=	0	12	0	9.3	0	7.0	W
$\eta$	=	-	56	-	54	-	53	%
$d_{tot}$	=	-	2.5	-	2.7	-	3.2	%

1) Individual adjustment of the grid bias of each system is recommended

**A.F. CLASS AB AMPLIFIER AND MODULATOR WITH GRID CURRENT**

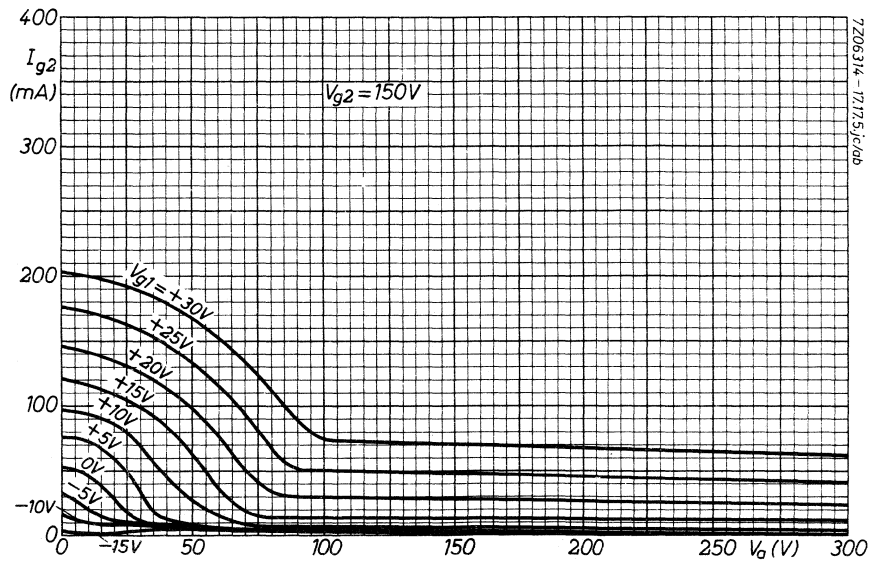
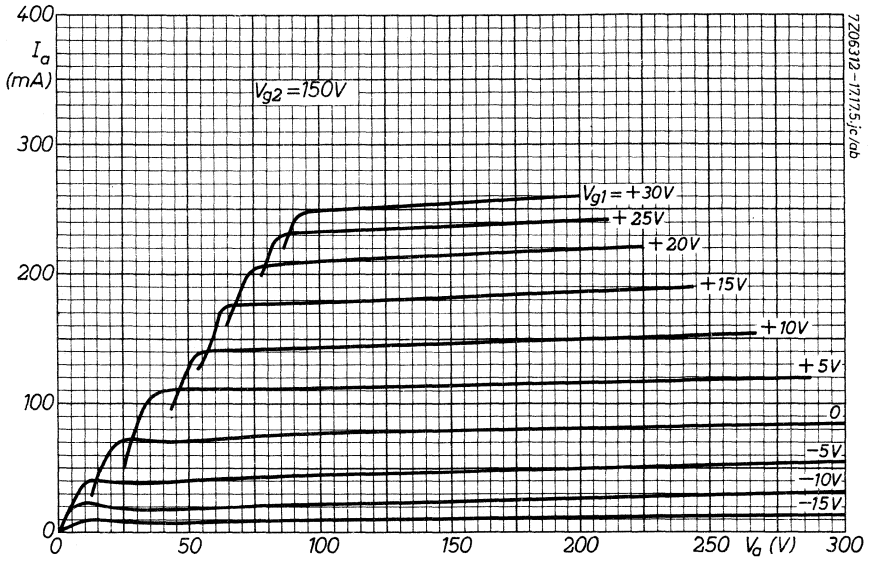
**LIMITING VALUES** (Absolute limits) only for speech and music

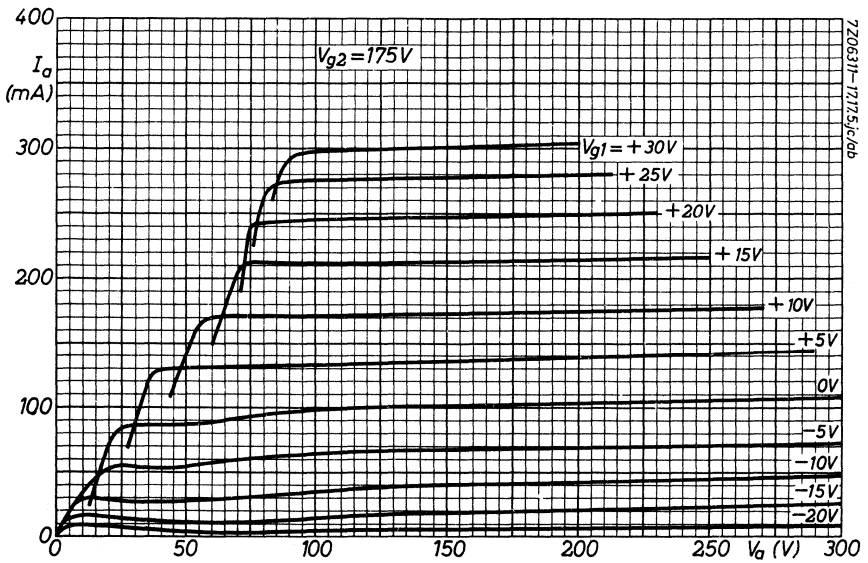
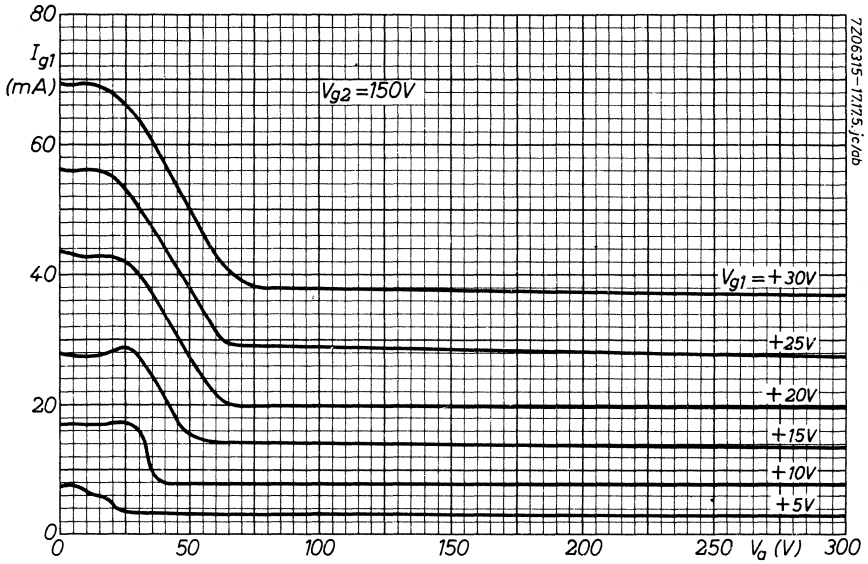
Anode voltage	$V_a$	= max.	300	V
Anode dissipation	$W_a$	= max.	2x7	W
Anode input power	$W_{ia}$	= max.	2x15	W
Anode current	$I_a$	= max.	2x50	mA
Grid No. 2 voltage	$V_{g2}$	= max.	200	V
Grid No. 2 dissipation	$W_{g2}$	= max.	2x1	W
Peak grid No. 2 dissipation	$W_{g2p}$	= max.	2x2	W
Negative grid No. 1 voltage	$-V_{g1}$	= max.	150	V
Grid No. 1 dissipation	$W_{g1}$	= max.	2x0.2	W
Grid No. 1 current	$I_{g1}$	= max.	2x4	mA
Cathode current	$I_k$	= max.	2x60	mA
Peak cathode current	$I_{kp}$	= max.	2x300	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

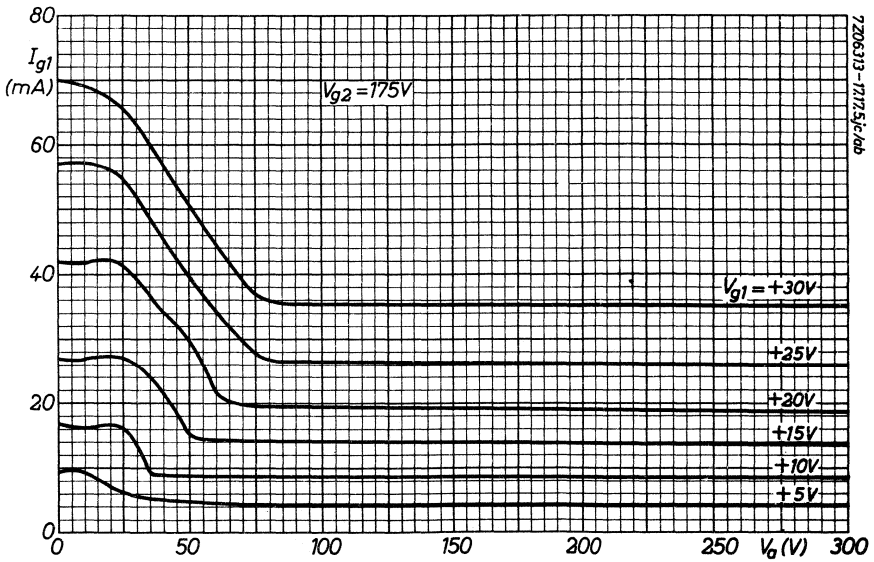
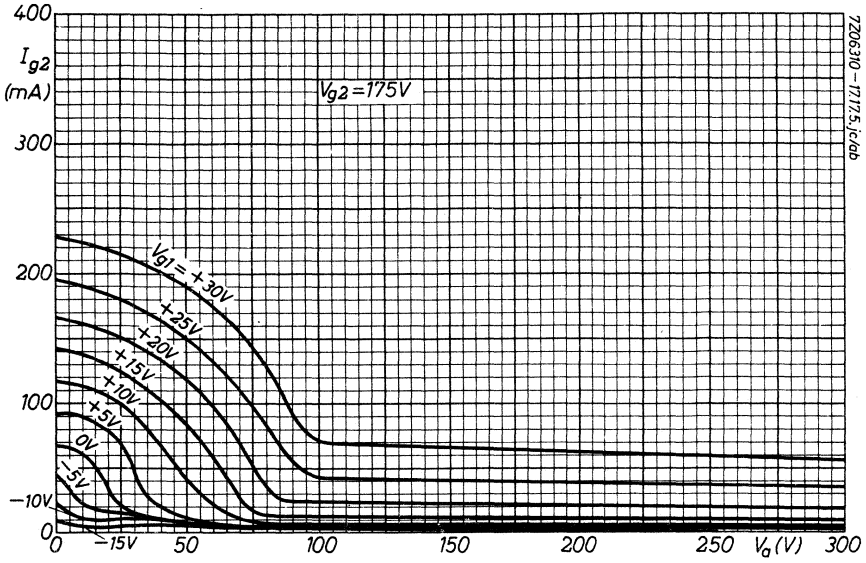
**OPERATING CONDITIONS**

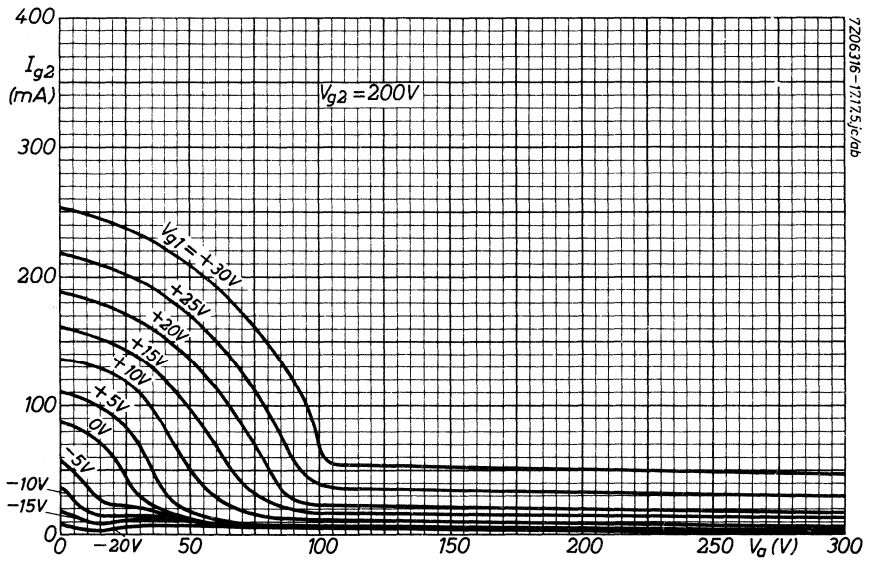
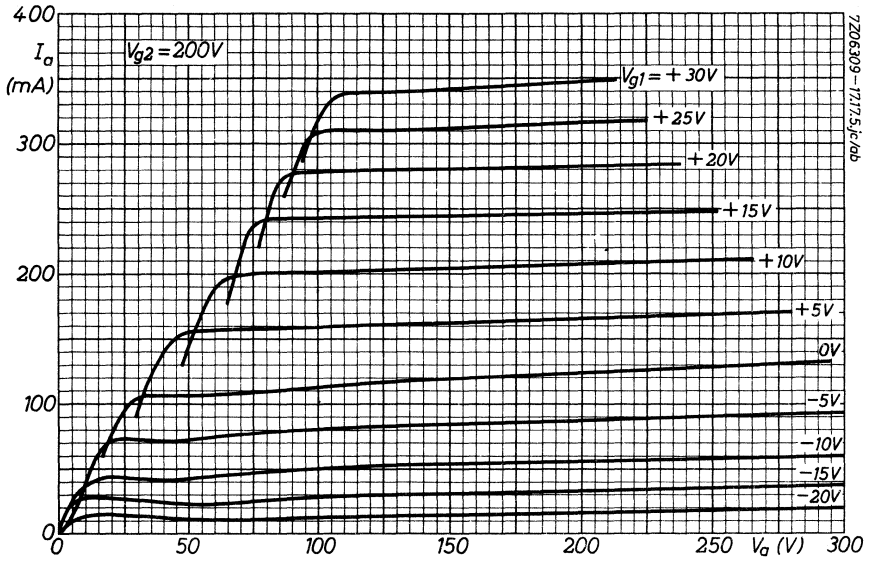
$V_a$	=	300	250	200	V
$V_{g2}$	=	200	200	200	V
$V_{g1}^{1)}$	=	-21.5	-21.5	-21.5	V
$R_{aa'r}$	=	6.5	5.0	5.0	k $\Omega$
$V_{g1g1'p}$	=	0      64	0      67	0      54	V
$I_a$	=	2x15    2x50	2x15    2x50	2x15    2x41.1	mA
$I_{g2}$	=	1.2    11.4	1.4    13	2.4    19	mA
$I_{g1}$	=	0    2x0.56	0    2x0.62	0    2x0.22	mA
$W_{g2}$	=	0.24    2.3	0.28    2.6	0.48    3.8	W
$W_{ig1}$	=	0    2x0.02	0    2x0.02	0    2x0.01	W
$W_{ia}$	=	2x4.5    2x15	2x3.75    2x12.5	2x3.0    2x8.22	W
$W_a$	=	2x4.5    2x6.25	2x3.75    2x5.5	2x3.0    2x3.87	W
$W_o$	=	0    17.5	0    14	0    8.7	W
$\eta$	=	-    58	-    56	-    53	%
$d_{tot}$	=	-    5.0	-    5.5	-    6.0	%

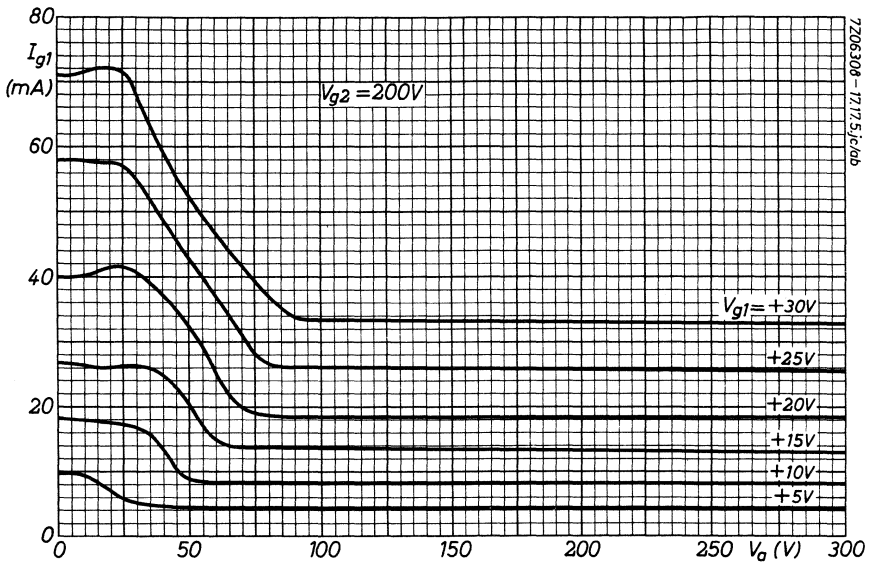
<sup>1)</sup> Individual adjustment of the grid bias of each system is recommended















## R.F. DOUBLE TETRODE

QUICK REFERENCE DATA (two systems)									
$\lambda$ (m)	Freq. (MHz)	C teleg.		$C_{ag2}$ mod.		$\lambda$ (m)	Freq. (MHz)	C fr. mult.	
		$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)			$V_a$ (V)	$W_o$ (W)
1.5	200	600	48	500	31	4.5/1.5	67/200	300	10
		400	30	300	17				
		300	21			B mod.			
		200	13			$V_a$ (V)	$W_o$ (W)		
0.75	400	400	24	300	13				
		300	17						
		200	11			500	23.5		
0.5	600	400	20			400	13.2		

**HEATING:** indirect, series or parallel supply; cathode oxide-coated

Heater voltage	$V_f$	=	6.3	12.6	V
Heater current	$I_f$	=	1.3	0.65	A
Pins			5-(1+7)	1-7	

## CAPACITANCES

per system

Anode to all other elements except grid No.1	$C_a$	=	2.6	pF
Grid No.1 to all other elements except anode	$C_{g1}$	=	7.0	pF
Anode to grid No.1	$C_{ag1}$	<	0.08	pF
	$C_{ag1} - C_n$	<	0.035	pF

See electrode arrangement (page 2) for internal neutralisation by  $C_n$  and  $C_n'$

in push-pull

Output capacitance	$C_o$	=	1.6	pF
Input capacitance	$C_i$	=	4.4	pF

**TYPICAL CHARACTERISTICS**

Amplification factor of grid No.2  
with respect to grid No.1

$$\mu_{g_2g_1} (I_a = 20 \text{ mA}) = 9$$

Mutual conductance

$$S (I_a = 20 \text{ mA}) = 2.5 \text{ mA/V}$$

**MECHANICAL DATA**

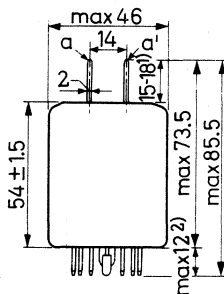
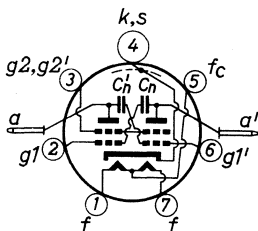
Dimensions in mm

Base : Septar

Socket : 2422 513 00001

Anode connector: 40623

Net weight : 55 g



Mounting position: arbitrary

**TEMPERATURE LIMITS** (Absolute limits)

Temperature of anode seals and bulb

max. 220 °C

Temperature of bottom seals

max. 180 °C

**COOLING**

Generally natural cooling is sufficient with:

$V_a = 600 \text{ V}$  up to 150 MHz

$V_a = 500 \text{ V}$  up to 200 MHz

$V_a = 300 \text{ V}$  up to 430 MHz

Above these limits or with high ambient temperatures it may be necessary to direct an air flow of about 15 l/min. on top of the bulb to keep the seal temperatures within the stated limits

1) Max. 3 mm glass included

2) Max. 2.5 mm glass included

**R.F. CLASS C TELEGRAPHY**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	600	V
Anode dissipation	$W_a$	= max.	$2 \times 10$	W
Grid No.2 voltage	$V_{g_2}$	= max.	250	V
Grid No.2 dissipation	$W_{g_2}$	= max.	$2 \times 1.5$	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	75	V
Grid No.1 circuit resistance with fixed bias	$R_{g_1}$	= max.	50	$k\Omega$
Grid No.1 circuit resistance with automatic bias	$R_{g_1}$	= max.	100	$k\Omega$
Grid No.1 current	$I_{g_1}$	= max.	$2 \times 2.5$	mA
Cathode current	$I_k$	= max.	$2 \times 55$	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**OPERATING CONDITIONS.** two systems in push-pull

Wavelength	$\lambda$	=	1.5	1.5	1.5	1.5	m
Frequency	f	=	200	200	200	200	MHz
Anode voltage	$V_a$	=	600	400	300	200	V
Grid No.2 voltage	$V_{g_2}$	=	250	250	250	200	V
Grid No.1 voltage	$V_{g_1}$	=	-60	-50	-40	-30	V
Anode current	$I_a$	=	$2 \times 50$	$2 \times 50$	$2 \times 50$	$2 \times 50$	mA
Grid No.2 current	$I_{g_2}$	=	$2 \times 4$	$2 \times 4$	$2 \times 4.5$	$2 \times 4$	mA
Grid No.1 current	$I_{g_1}$	=	$2 \times 0.7$	$2 \times 0.7$	$2 \times 0.7$	$2 \times 1$	mA
Anode input power	$W_{ia}$	=	$2 \times 30$	$2 \times 20$	$2 \times 15$	$2 \times 10$	W
Anode dissipation	$W_a$	=	$2 \times 6$	$2 \times 5$	$2 \times 4.5$	$2 \times 3.5$	W
Grid No.2 dissipation	$W_{g_2}$	=	$2 \times 1.0$	$2 \times 1.0$	$2 \times 1.1$	$2 \times 0.8$	W
Grid No.1 input power	$W_{ig_1}$	=	1.5	1	< 1	< 1	W
Output power	$W_o$	=	48	30	21	13	W
Efficiency	$\eta$	=	80	75	70	65	%

R.F. CLASS C TELEGRAPHY (continued)

OPERATING CONDITIONS, two systems in push-pull

Wavelength	$\lambda$	=	0.75	0.75	0.75	0.5	m
Frequency	$f$	=	400	400	400	600	MHz
Anode voltage	$V_a$	=	400	300	200	400	V
Grid No.2 voltage	$V_{g_2}$	=	250	250	200	250	V
Grid No.1 voltage	$V_{g_1}$	=	-50	-40	-30	-50	V
Anode current	$I_a$	=	2x50	2x50	2x50	2x50	mA
Grid No.2 current	$I_{g_2}$	=	2x2.5	2x2.5	2x3.0	2x2.5	mA
Grid No.1 current	$I_{g_1}$	=	2x0.7	2x0.6	2x0.5	2x0.7	mA
Anode input power	$W_{ia}$	=	2x20	2x15	2x10	2x20	W
Anode dissipation	$W_a$	=	2x8	2x6.5	2x4.5	2x10	W
Grid No.2 dissipation	$W_{g_2}$	=	2x0.6	2x0.6	2x0.6	2x0.63	W
Grid No.1 input power	$W_{ig_1}$	=	2	1.5	1		W
Output power	$W_o$	=	24	17	11	20	W
Efficiency	$\eta$	=	60	57	55	50	%

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	500	V
Anode dissipation	$W_a$	= max.	2x10	W
Grid No.2 voltage	$V_{g2}$	= max.	250	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	V
Grid No.1 current	$I_{g1}$	= max.	2x2.5	mA
Cathode current	$I_k$	= max.	2x50	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**OPERATING CONDITIONS**, two systems in push-pull

Wavelength	$\lambda$	=	1.5	1.5	0.75	m
Frequency	f	=	200	200	400	MHz
Anode voltage	$V_a$	=	500	300	300	V
Grid No.2 voltage	$V_{g2}$	=	250	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-80	-50	-50	V
Anode current	$I_a$	=	2x40	2x40	2x40	mA
Grid No.2 current	$I_{g2}$	=	2x4	2x4	2x3	mA
Grid No.1 current	$I_{g1}$	=	2x1.0	2x1.0	2x1.0	mA
Anode input power	$W_{ia}$	=	2x20	2x12	2x12	W
Anode dissipation	$W_a$	=	2x4.5	2x3.5	2x5.5	W
Grid No.2 dissipation	$W_{g2}$	=	2x1	2x1	2x0.75	W
Grid No.1 input power	$W_{ig1}$	=	2x5	2x2.5		W
Output power	$W_o$	=	31	17	13	W
Efficiency	$\eta$	=	77.5	71	54	%
Modulation factor	m	=	100	100	100	%
Modulation power	$W_{mod}$	=	20	12	12	W

**R.F. CLASS C FREQUENCY TRIPLER**

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	600	V
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 circuit resistance with fixed bias	$R_{g_1}$	= max.	50	k $\Omega$
Grid No.1 circuit resistance with automatic bias	$R_{g_1}$	= max.	100	k $\Omega$
Grid No.1 current	$I_{g_1}$	= max.	2x2.5	mA
Cathode current	$I_k$	= max.	2x50	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**OPERATING CONDITIONS**, two systems in push-pull

Wavelength	$\lambda$	=	4.5/1.5	2.25/0.75	m
Frequency	$f$	=	66.7/200	133/400	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
Anode current	$I_a$	=	2x45	2x45	mA
Grid No.2 current	$I_{g_2}$	=	2x3.0	2x2.8	mA
Grid No.1 current	$I_{g_1}$	=	2x1.5	2x1.2	mA
Anode input power	$W_{ia}$	=	2x13.5	2x13.5	W
Anode dissipation	$W_a$	=	2x8.5	2x9.5	W
Grid No.2 dissipation	$W_{g_2}$	=	2x0.75	2x0.7	W
Grid No.1 input power	$W_{ig_1}$	=	2x1	2x2	W
Output power	$W_o$	=	10	8.0	W
Efficiency	$\eta$	=	37	29.5	%

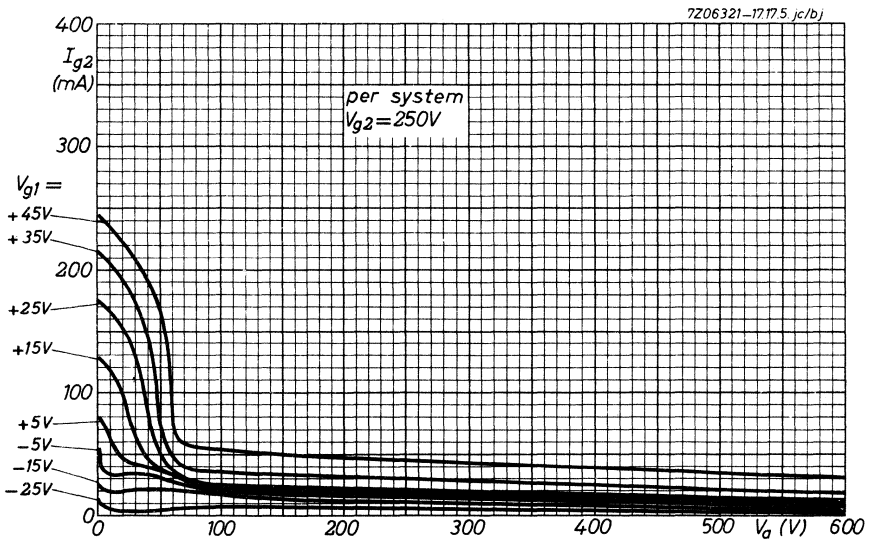
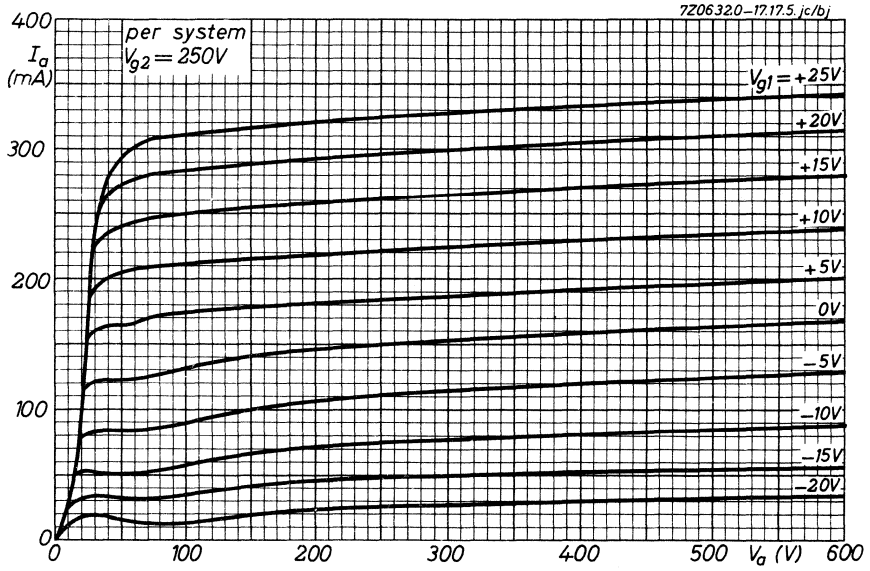
**A.F. CLASS B AMPLIFIER AND MODULATOR**

**LIMITING VALUES** (Absolute limits)

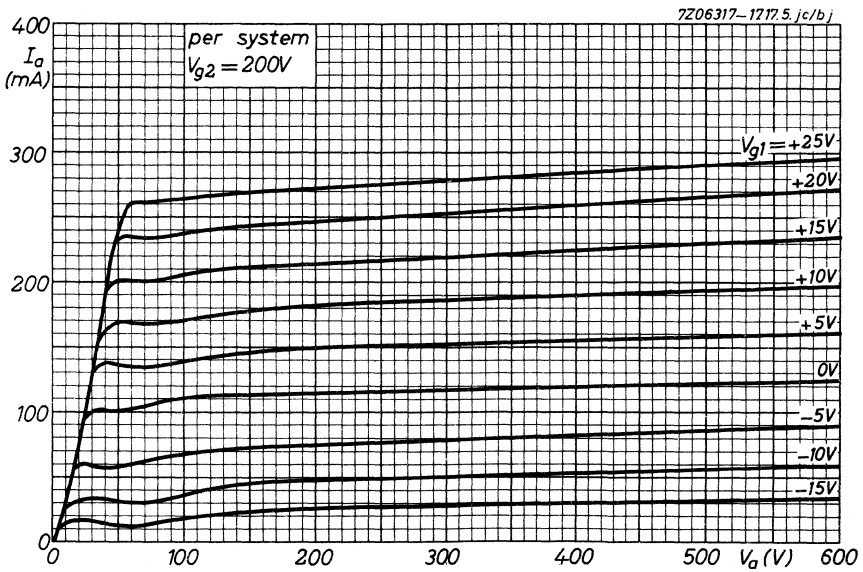
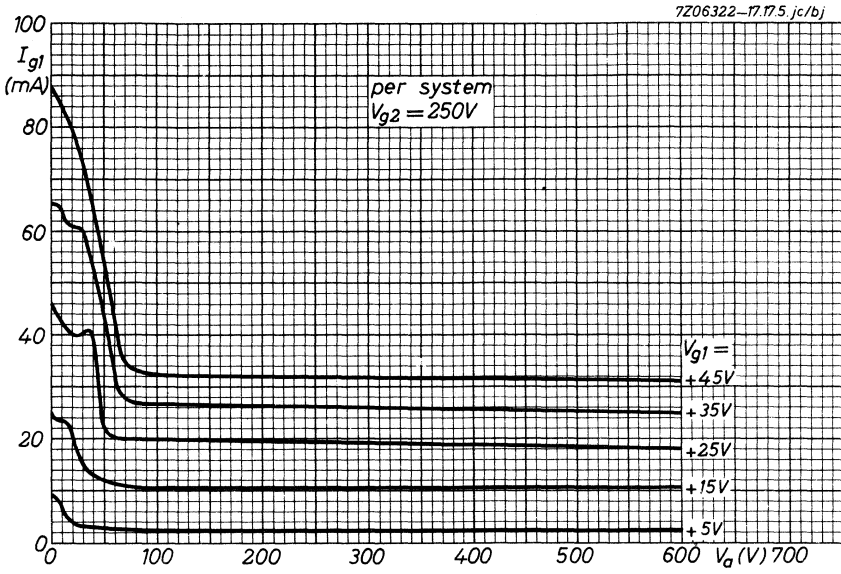
Anode voltage	$V_a$	= max.	600	V
Anode dissipation	$W_a$	= max.	2x10	W
Grid No.2 voltage	$V_{g_2}$	= max.	250	V
Grid No.2 dissipation	$W_{g_2}$	= max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	75	V
Grid No.1 circuit resistance with fixed bias	$R_{g_1}$	= max.	50	k $\Omega$
Grid No.1 circuit resistance with automatic bias	$R_{g_1}$	= max.	100	k $\Omega$
Cathode current	$I_k$	= max.	2x55	mA
Heater to cathode voltage	$V_{kf}$	= max.	100	V

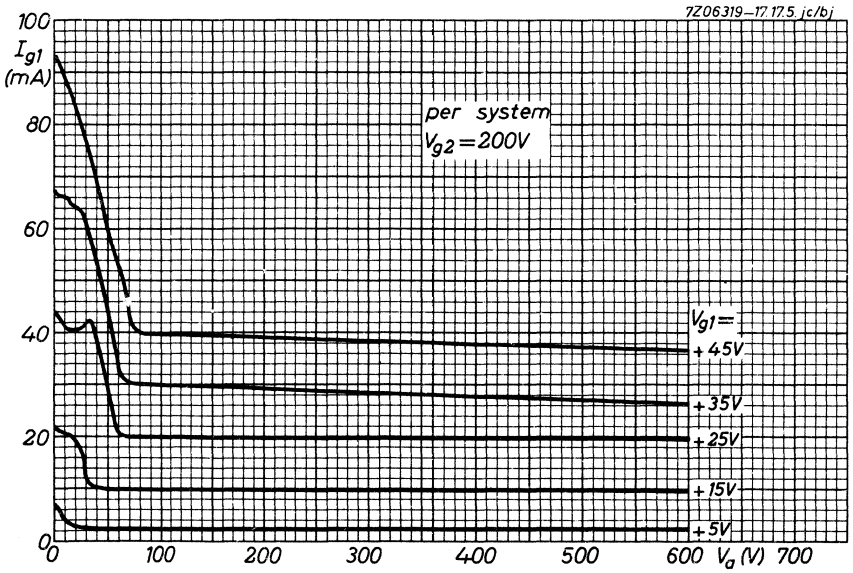
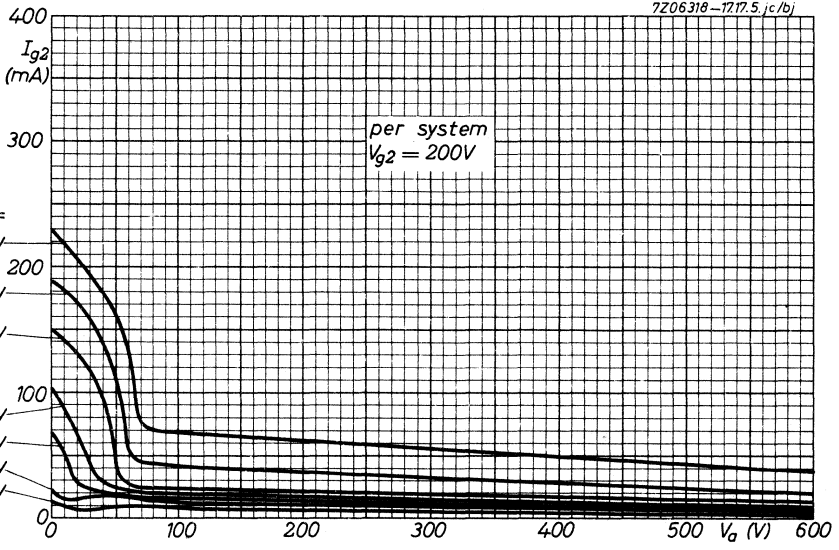
**OPERATING CONDITIONS**, two systems in push-pull

Anode voltage	$V_a$	=	500	300	V
Grid No.2 voltage	$V_{g_2}$	=	250	250	V
Grid No.1 voltage	$V_{g_1}$	=	-26	-25	V
Load resistance	$R_{aa'}$	=	20	11	k $\Omega$
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	0      52	0      50	V
Anode current	$I_a$	=	2x12.5    2x36.5	2x12.5    2x35	mA
Grid No.2 current	$I_{g_2}$	=	2x0.35    2x8.1	2x0.6    2x9.5	mA
Grid No.2 dissipation	$W_{g_2}$	=	0.18      4.05	0.3      4.75	W
Anode input power	$W_{ia}$	=	2x6.25    2x18.25	2x3.75    2x10.5	W
Anode dissipation	$W_a$	=	2x6.25    2x6.5	2x3.75    2x3.9	W
Output power	$W_o$	=	0      23.5	0      13.2	W
Total distortion	$d_{tot}$	=	-      3.5	-      3.5	%
Efficiency	$\eta$	=	-      63.5	-      63	%









## R.F. DOUBLE TETRODE

Double tetrode for use as class C amplifier at frequencies up to 600 MHz in continuous tunable transmitters for a large frequency range.

### CAPACITANCES

Anode to all other elements except grid No.1	$C_a$	=	2.6 pF
Grid No.1 to all other elements except anode	$C_{g1}$	=	6.2 pF
Anode to grid No.1	$C_{ag1}$	=	0.04 to 0.07 pF
Neutralizing capacitances	$C_n = C_n'$	=	0.015 to 0.04 pF



-----  
 For further data and curves of this type  
 please refer to type QQE03/20  
 -----



## R.F. DOUBLE TETRODE

QUICK REFERENCE DATA								
Freq. (MHz)	C teleg. .				C freq. tripler			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)
960 320/960	250	7	250	8	250	2.75	250	3

**HEATING** : indirect; cathode oxide-coated

Heater voltage	$V_f$	=	6.3	12.6	V $\pm$ 10 %
Heater current	$I_f$	=	0.6	0.3	A
Pins			7-(1+8)	1-8	

**CAPACITANCES** (each system)

Anode to all other elements except grid No.1	$C_a$	=	1.35	pF
Grid No.1 to all other elements except anode	$C_{g1}$	=	4.5	pF
Anode to grid No.1	$C_{ag1}$	=	0.145	pF

**TYPICAL CHARACTERISTICS**

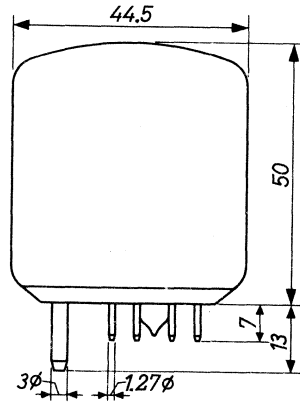
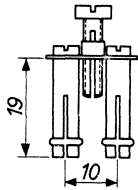
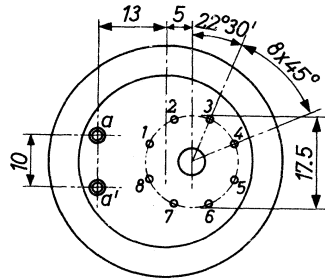
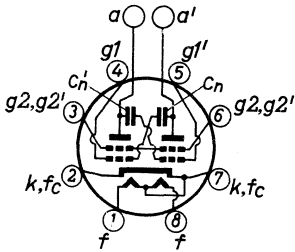
Anode voltage	$V_a$	=	350	V
Grid No.2 voltage	$V_{g2}$	=	200	V
Anode current	$I_a$	=	25	mA
Mutual conductance	$S$	=	10.5	mA/v
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$	=	26	

**TEMPERATURE LIMIT** (Absolute limit)

Temperature of pin seals	max.	220	°C
Bulb temperature	max.	220	°C

MECHANICAL DATA

Dimensions in mm



Example of anode-tank circuit connector at 960 MHz

Socket assembly : B8 700 71

Net weight : 35 g

Mounting position: arbitrary

**R.F. CLASS C TELEGRAPHY**

<b>LIMITING VALUES</b> (Absolute limits)		C.C.S.	I.C.A.S.
Frequency	f	up to 960	up to 960 MHz
Anode voltage	$V_a$	= max. 400	max. 400 V
Anode input power	$W_{ia}$	= max. 2x10	max. 2x12 W
Anode dissipation	$W_a$	= max. 2x8	max. 2x10 W
Anode current	$I_a$	= max. 2x45	max. 2x50 mA
Grid No.2 voltage	$V_{g2}$	= max. 225	max. 225 V
Grid No.2 dissipation	$W_{g2}$	= max. 2x1.5	max. 2x1.75 W
Negative grid No.1 voltage	$-V_{g1}$	= max. 100	max. 100 V
Grid No.1 current	$I_{g1}$	= max. 2x4	max. 2x5 mA

**OPERATING CONDITIONS**, two systems in push-pull

		C.C.S.	I.C.A.S.
Frequency	f	= 960	960 MHz
Anode voltage	$V_a$	= 250	250 V
Grid No.2 voltage	$V_{g2}$	= 160 <sup>1)</sup>	170 <sup>2)</sup> V
Grid No.1 voltage	$V_{g1}$	= -15	-15 V
Grid No.1 resistor	$R_{g1}$	= 20	20 k $\Omega$
Anode current	$I_a$	= 2x35	2x40 mA
Grid No.2 current	$I_{g2}$	= 15	15 mA
Grid No.1 current	$I_{g1}$	= 2x0.75	2x0.75 mA
Anode input power	$W_{ia}$	= 2x8.8	2x10 W
Anode dissipation	$W_a$	= 2x5.4	2x5.4 W
Grid No.2 dissipation	$W_{g2}$	= 2.5	2.9 W
Driver output power	$W_{dr}$	= 1.4	1.4 W
Output power	$W_o$	= 7	8 W
Output power in the load	$W_l$	= 4	5 W
Efficiency	$\eta$	= 40	40 %

1) Adjust  $V_{g2}$  until  $I_a = 2x35$  mA at  $W_o$  max.

2) Adjust  $V_{g2}$  until  $I_a = 2x40$  mA at  $W_o$  max.

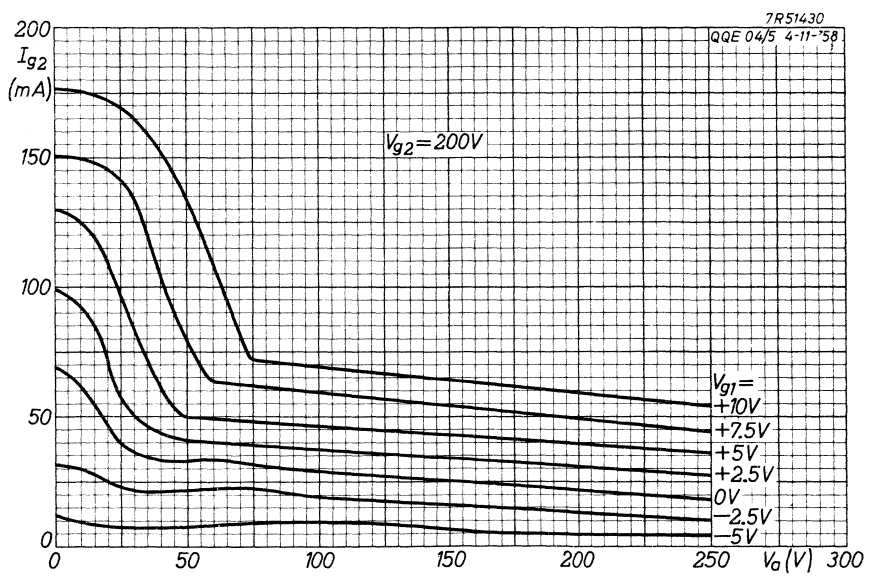
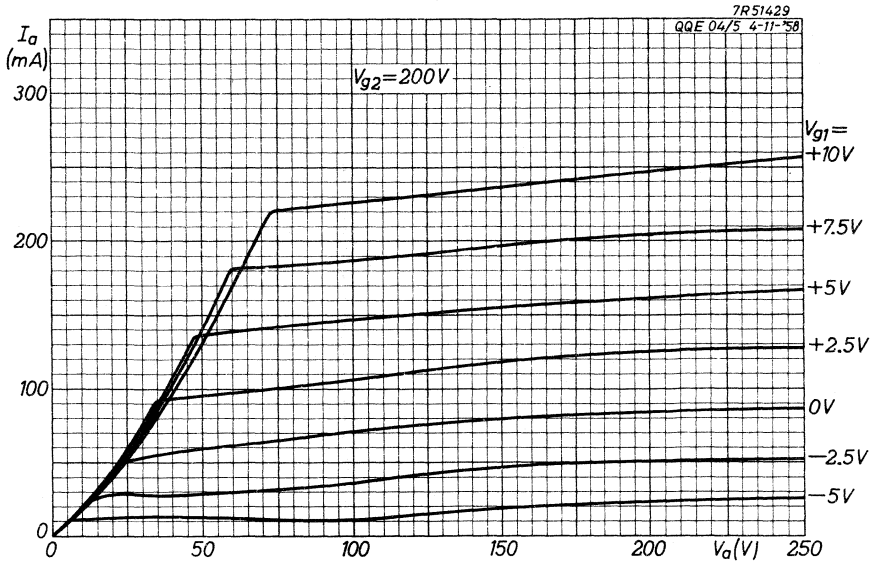
**R.F. CLASS C FREQUENCY TRIPLER**

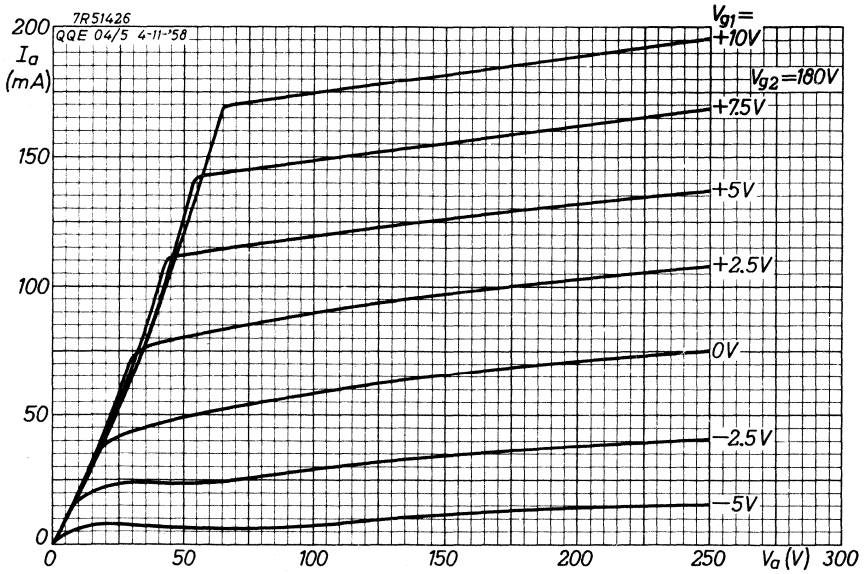
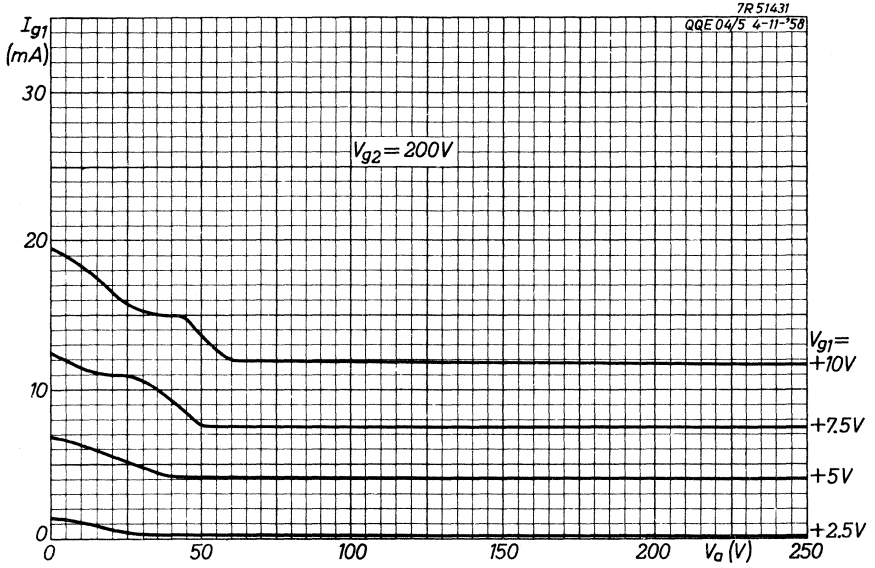
<b>LIMITING VALUES</b> (Absolute limits)		<b>C. C. S.</b>		<b>I. C. A. S.</b>	
Frequency	f	up to	960	up to	960 MHz
Anode voltage	$V_a$	= max.	400	max.	400 V
Anode input power	$W_{ia}$	= max.	2x10	max.	2x12 W
Anode dissipation	$W_a$	= max.	2x8	max.	2x10 W
Anode current	$I_a$	= max.	2x40	max.	2x40 mA
Grid No.2 voltage	$V_{g2}$	= max.	225	max.	250 V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1.5	max.	2x1.75 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	max.	100 V
Grid No.1 current	$I_{g1}$	= max.	2x4	max.	2x5 mA

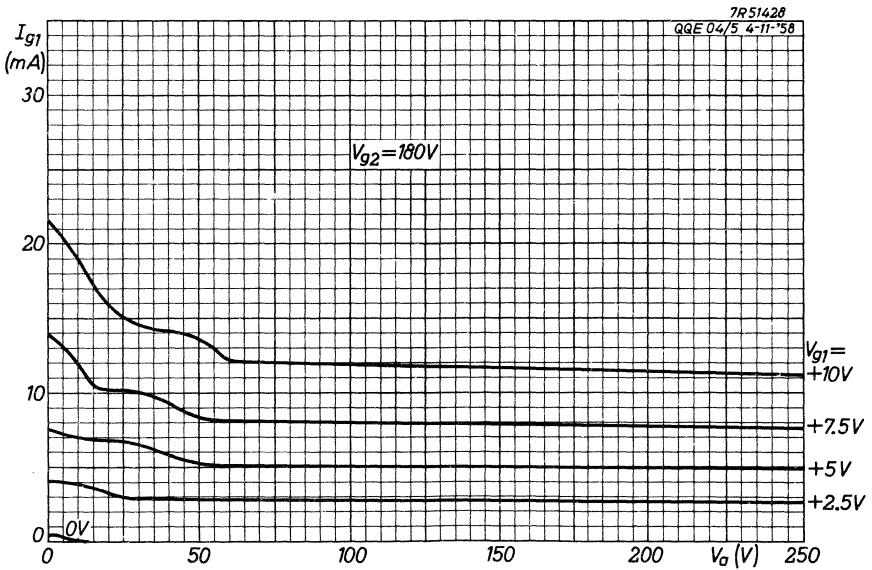
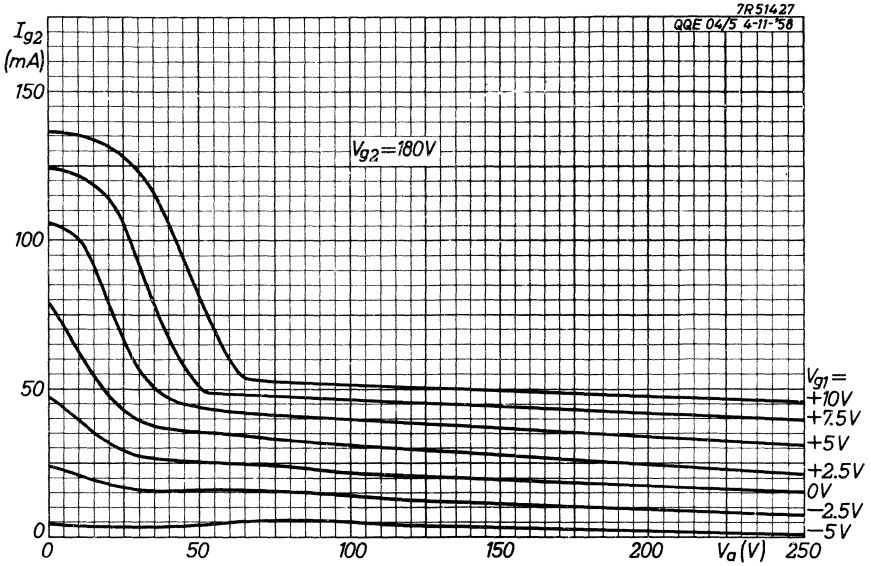
**OPERATING CONDITIONS** , two systems in push-pull

		<b>C. C. S.</b>		<b>I. C. A. S.</b>	
Frequency	f	=	320/960	320/960	MHz
Anode voltage	$V_a$	=	250	250	V
Grid No.2 voltage	$V_{g2}$	=	150	170	V
Grid No.1 resistor	$R_{g1}$	=	20	20	k $\Omega$
Anode current	$I_a$	=	2x37.5	2x40	mA
Grid No.2 current	$I_{g2}$	=	15	16	mA
Grid No.1 current	$I_{g1}$	=	2x2.25	2x2.25	mA
Anode input power	$W_{ia}$	=	2x9.5	2x10	W
Anode dissipation	$W_a$	=	2x8	2x8.5	W
Grid No.2 dissipation	$W_{g2}$	=	2.25	2.8	W
Driver output power	$W_{dr}$	=	3	3	W
Output power	$W_o$	=	2.75	3	W
Output power in the load	$W_l$	=	1.5	1.8	W
Efficiency	$\eta$	=	14.7	15	%











## R.F. DOUBLE POWER TETRODE

QUICK REFERENCE DATA							
$\lambda$	Freq.	C telegr. <sup>1)</sup>			$C_{ag2}$ mod. <sup>1)</sup>		
(m)	(MHz)	$V_a$ (V)	$W_o$ (W)		$V_a$ (V)	$W_o$ (W)	
			CCS	ICAS		CCS	ICAS
1.5	200	750	26	35	600	17	26
		500	26		425	16	
1.2	250	500	23				

**HEATING** : indirect; cathode oxide-coated

Heater voltage	$V_f$	=	6.3	12.6	V
Heater current	$I_f$	=	1.6	0.8	A
	Pins		5-(1+7)	1-7	

**CAPACITANCES** per system

Anode to all other elements except grid No.1	$C_a$	=	3.8	pF
Grid No.1 to all other elements except anode	$C_{g1}$	=	8	pF
Anode to grid No.1	$C_{ag1}$	<	0.07	pF
Cathode to grid No.2	$C_{kg2}$	=	65	pF <sup>2)</sup>

**TYPICAL CHARACTERISTICS**

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1}$	=	6.5
Mutual conductance	$S (I_a = 30 \text{ mA})$	=	3 mA/V <sup>3)</sup>

<sup>1)</sup> Two systems in push-pull

<sup>2)</sup> Including internal capacitor between grid No.2 and cathode

<sup>3)</sup> Per system

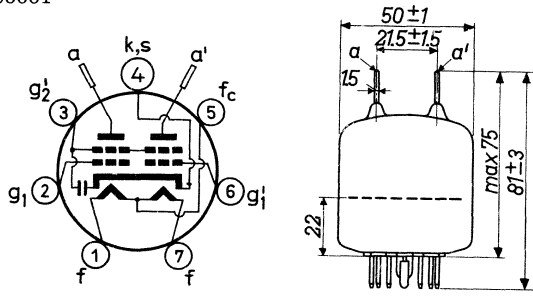
**TEMPERATURE LIMITS** (Absolute limits)

Temperature of anode and pin seals	max. 180 °C
Bulb temperature	max. 220 °C

**MECHANICAL DATA**

Dimensions in mm

Base	: Septar
Socket	: 2422 513 00001
Anode connector	: 40615
Net weight	: 60 g



Mounting position: arbitrary

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

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to 200	up to 250	MHz
Anode voltage	$V_a$	= max. 750	max. 670	V
Anode input power	$W_{ia}$	= max. 2x18	max. 2x16	W
Anode dissipation	$W_a$	=	max. 2x7.5	W
Anode current	$I_a$	=	max. 2x45	mA
Grid No.2 voltage	$V_{g2}$	=	max. 250	V
Grid No.2 dissipation	$W_{g2}$	=	max. 5	W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 175	V
Grid No.1 current	$I_{g1}$	=	max. 2x5	mA
Grid No.1 circuit resistance	$R_{g1}$	=	max. 50	k $\Omega$ 1)
Grid No.1 circuit resistance	$R_{g1}$	=	max. 25	k $\Omega$ 2)
Heater to cathode voltage	$V_{kf}$	=	max. 100	V

**C.C.S. OPERATING CONDITIONS** , continuous service

f	=	200	200	200	250	250	MHz
$V_a$	=	750	500	400	500	400	V
$V_{g2}$	=	200	200	200	200	200	V
$V_{g1}$	=	-65	-65	-65	-65	-65	V
$I_a$	=	2x24	2x36	2x45	2x32	2x40	mA
$I_{g2}$	=	15	14	14	12	14	mA
$I_{g1}$	=	2x1.4	2x1.3	2x1.4	2x0.9	2x1.0	mA
$V_{g1g1'p}$	=	150	150	150	140	140	V
$W_{ig1}$	=	2x0.10	2x0.09	2x0.10	2x0.06	2x0.07	W
$W_{g2}$	=	3.0	2.8	2.8	2.4	2.8	W
$W_{ia}$	=	2x18	2x18	2x18	2x16	2x16	W
$W_a$	=	2x5	2x5	2x5.25	2x7.0	2x7.5	W
$W_o$	=	26	26	25.5	18	17	W
$\eta$	=	72	72	71	56	53	%

1) Per system

2) per tube

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

**I.C.A.S. . LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to 200	up to 250	MHz
Anode voltage	$V_a$	= max. 750	max. 670	V
Anode input power	$W_{ia}$	= max. 2x25	max. 2x22	W
Anode dissipation	$W_a$	= max.	2x10	W
Anode current	$I_a$	= max.	2x57.5	mA
Grid No.2 voltage	$V_{g2}$	= max.	250	V
Grid No.2 dissipation	$W_{g2}$	= max.	5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	175	V
Grid No.1 current	$I_{g1}$	= max.	2x5	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	50	$k\Omega$ 1)
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	$k\Omega$ 2)
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**I.C.A.S. . OPERATING CONDITIONS** , intermittent service

Frequency	f	=	200	MHz
Anode voltage	$V_a$	=	750	V
Grid No.2 voltage	$V_{g2}$	=	200	V
Grid No.1 voltage	$V_{g1}$	=	-50	V
Anode current	$I_a$	=	2x32.5	mA
Grid No.2 current	$I_{g2}$	=	22	mA
Grid No.1 current	$I_{g1}$	=	2x2.0	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	130	V
Grid No.1 input power	$W_{ig1}$	=	2x0.12	W
Grid No.2 dissipation	$W_{g2}$	=	4.4	W
Anode input power	$W_{ia}$	=	2x24.4	W
Anode dissipation	$W_a$	=	2x6.9	W
Output power	$W_o$	=	35	W
Efficiency	$\eta$	=	72	%

1) Per system

2) Per tube



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

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to 200	up to 250	MHz
Anode voltage	$V_a$	= max. 600	max. 530	V
Anode input power	$W_{ia}$	= max. 2x11	max. 2x10	W
Anode dissipation	$W_a$	= max. 2x5		W
Anode current	$I_a$	= max. 2x37.5		mA
Grid No.2 voltage	$V_{g2}$	= max. 250		V
Grid No.2 dissipation	$W_{g2}$	= max. 3.4		W
Negative grid No.1 voltage	$-V_{g1}$	= max. 175		V
Grid No.1 current	$I_{g1}$	= max. 2x5		mA
Grid No.1 circuit resistance	$R_{g1}$	= max. 50		$k\Omega$ <sup>1)</sup>
Grid No.1 circuit resistance	$R_{g1}$	= max. 25		$k\Omega$ <sup>2)</sup>
Heater to cathode voltage	$V_{kf}$	= max. 100		V

**C.C.S. OPERATING CONDITIONS**, continuous service

Frequency	f	= 200	200	MHz
Anode voltage	$V_a$	= 600	425	V
Grid No.2 voltage	$V_{g2}$	= 200	200	V
Grid No.1 voltage	$V_{g1}$	= -65	-60	V
Anode current	$I_a$	= 2x18	2x26	mA
Grid No.2 current	$I_{g2}$	= 16	16	mA
Grid No.1 current	$I_{g1}$	= 2x1.3	2x1.2	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	= 150	140	V
Grid No.1 input power	$W_{ig1}$	= 2x0.09	2x0.075	W
Grid No.2 dissipation	$W_{g2}$	= 3.2	3.2	W
Anode input power	$W_{ia}$	= 2x10.8	2x11	W
Anode dissipation	$W_a$	= 2x2.3	2x3	W
Output power	$W_o$	= 17	16	W
Efficiency	$\eta$	= 79	72	%
Modulation factor	m	= 100	100	%
Modulation power	$W_{mod}$	= 13.5	13.5	W

1) Per system

2) Per tube

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

**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

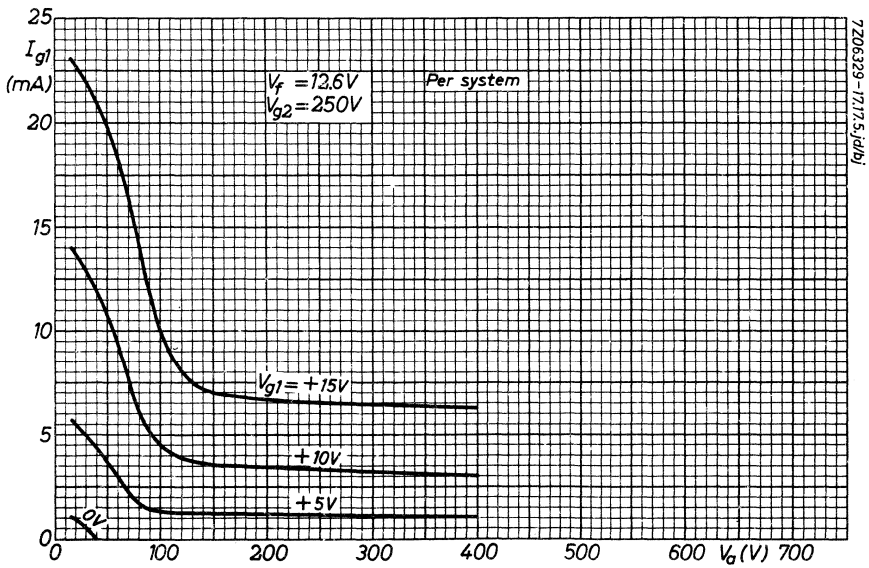
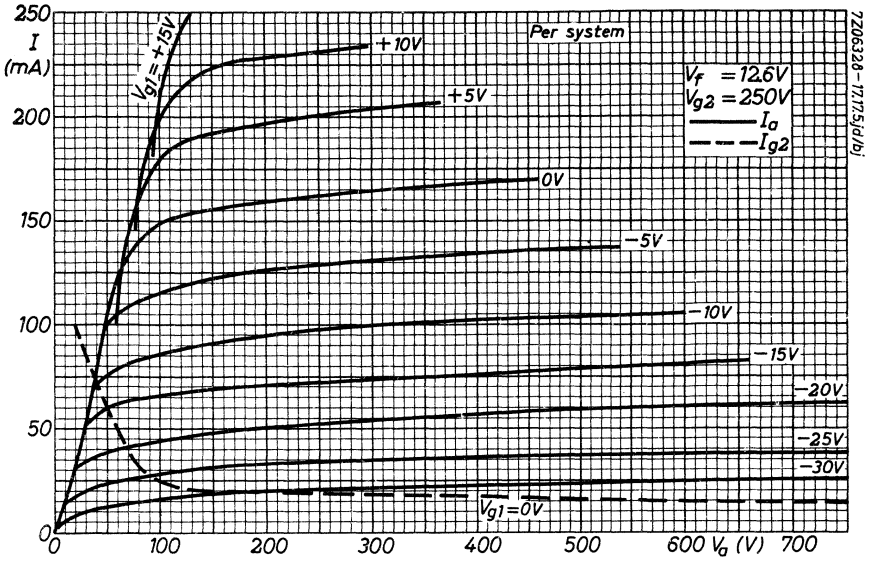
Frequency	f	up to	200	MHz
Anode voltage	$V_a$	= max.	600	V
Anode input power	$W_{ia}$	= max.	2x18	W
Anode dissipation	$W_a$	= max.	2x7.5	W
Anode current	$I_a$	= max.	2x47.5	mA
Grid No.2 voltage	$V_{g2}$	= max.	250	V
Grid No.2 dissipation	$W_{g2}$	= max.	5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	175	V
Grid No.1 current	$I_{g1}$	= max.	2x5	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	50	$k\Omega$ <sup>1)</sup>
Grid No.1 circuit resistance	$R_{g1}$	= max.	25	$k\Omega$ <sup>2)</sup>
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**I.C.A.S. OPERATING CONDITIONS**, intermittent service

Frequency	f	=	200	MHz
Anode voltage	$V_a$	=	600	V
Grid No.2 voltage	$V_{g2}$	=	200	V
Grid No.1 voltage	$V_{g1}$	=	-70	V
Anode current	$I_a$	=	2x30	mA
Grid No.2 current	$I_{g2}$	=	20	mA
Grid No.1 current	$I_{g1}$	=	2x1.5	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	160	V
Grid No.1 input power	$W_{ig1}$	=	2x0.105	W
Grid No.2 dissipation	$W_{g2}$	=	4.0	W
Anode input power	$W_{ia}$	=	2x18	W
Anode dissipation	$W_a$	=	2x5	W
Output power	$W_o$	=	26	W
Efficiency	$\eta$	=	72	%
Modulation factor	m	=	100	%
Modulation power	$W_{mod}$	=	20	W

1) Per system

2) Per tube





## R.F. DOUBLE POWER TETRODE

QUICK REFERENCE DATA									
$\lambda$ (m)	Freq. (MHz)	C telegr.				$C_{ag2}$ mod.			
		C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
		$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)	$V_a$ (V)	$W_o$ (W)
5	60					600	71	600	79
1.5	200	600	90						
1.2	250	750	85	750	96	600	64	600	71
0.7	430	520	66						
0.6	500	500	60						

$\lambda$ (m)	Freq. (MHz)	C fr. mult.	
		$V_a$ (V)	$W_o$ (W)
6/2	50/150	500	20
		400	18
4/1.3	75/225	400	12

B mod.	
$V_a$ (V)	$W_o$ (W)
600	86
450	60
300	37

**HEATING:** indirect; cathode oxide-coated

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

### TYPICAL CHARACTERISTICS

Amplification factor of grid No.2  
with respect to grid No.1

$$\mu_{g2g1} = 8.2$$

Mutual conductance (per system)

$$S (I_a = 30 \text{ mA}) = 4.5 \text{ mA/V}$$

**COOLING:** radiation

When the tube is used at frequencies above 150 Mc/s, it may be necessary to direct a low-velocity air flow on the bulb and on the anode seals

**CAPACITANCES**

			per system
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
	$C_{ag_1} - C_n$	<	0.035 pF

See electrode arrangement for internal neutralisation by  $C_n$  and  $C_{n'}$

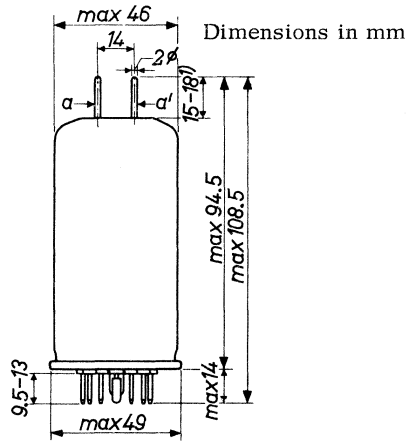
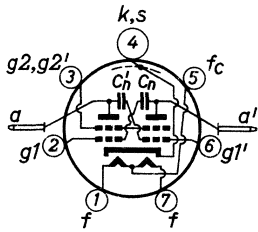
			in push-pull
Output capacitance	$C_o$	=	2.1 pF
Input capacitance	$C_i$	=	6.7 pF

**TEMPERATURE LIMITS** (Absolute limits)

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

**MECHANICAL DATA**

- Base : Septar
- Socket : 2422 513 00001
- Anode connector: 40623
- Net weight : 60 g



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

1) Max. 3 mm glass included

**R.F. CLASS C TELEGRAPHY**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to 250	up to 500	MHz
Anode voltage	$V_a =$	max. 750	max. 600	V
Anode input power	$W_{ia} =$	max. 2x60      max. 2x50		W
Anode dissipation	$W_a =$	max. 2x20		W
Anode current	$I_a =$	max. 2x110		mA
Grid No.2 voltage	$V_{g2} =$	max. 300		V
Grid No.2 dissipation	$W_{g2} =$	max. 2x3.5		W
Negative grid No.1 voltage	$-V_{g1} =$	max. 175		V
Grid No.1 current	$I_{g1} =$	max. 2x5		mA
Grid No.1 circuit resistance	$R_{g1} =$	max. 50		k $\Omega$
Heater to cathode voltage	$V_{kf} =$	max. 100		V

**C.C.S. OPERATING CONDITIONS**, continuous service  
two systems in push-pull

Frequency	f	=	200	250	430	500	MHz
Anode voltage	$V_a$	=	600	750	520	500	V
Grid No.1 voltage	$V_{g1}$	=	-80	-80	-80	-	V
Grid No.1 resistor	$R_{g1}$	=	-	-	-	20	k $\Omega$
Grid No.2 voltage	$V_{g2}$	=	250	250	250	250	V
Anode current	$I_a$	=	2x100	2x80	2x100	2x100	mA
Grid No.1 current	$I_{g1}$	=	2x2.5	2x1.5	2x2.8	2x3	mA
Grid No.2 current	$I_{g2}$	=	16	17	18	20	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	200	250	-	-	V
Grid No.2 dissipation	$W_{g2}$	=	4	4.25	4.5	5	W
Anode input power	$W_{ia}$	=	2x60	2x60	2x52	2x50	W
Anode dissipation	$W_a$	=	2x15	2x17.5	2x19	2x20	W
Output power	$W_o$	=	90	85	66	60	W
Efficiency	$\eta$	=	75	71	64	60	%

**R.F. CLASS C TELEGRAPHY** (continued)

**I. C. A. S. LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f	up to 250	up to 500	MHz
Anode voltage	$V_a$	= max. 750	max. 600	V
Anode input power	$W_{ia}$	= max. 2x75	max. 2x60	W
Anode dissipation	$W_a$	= max. 2x22.5		W
Anode current	$I_a$	= max. 2x120		mA
Grid No.2 voltage	$V_{g2}$	= max. 300		V
Grid No.2 dissipation	$W_{g2}$	= max. 2x4		W
Negative grid No.1 voltage	$-V_{g1}$	= max. 175		V
Grid No.1 current	$I_{g1}$	= max. 2x5		mA
Grid No.1 circuit resistance	$R_{g1}$	= max. 50		k $\Omega$
Heater to cathode voltage	$V_{kf}$	= max. 100		V

**I. C. A. S. OPERATING CONDITIONS**, intermittent service

two systems in push-pull

Frequency	f	=	250	MHz
Anode voltage	$V_a$	=	750	V
Grid No.1 voltage	$V_{g1}$	=	-80	V
Grid No.2 voltage	$V_{g2}$	=	250	V
Anode current	$I_a$	=	2x90	mA
Grid No.1 current	$I_{g1}$	=	2x1.7	mA
Grid No.2 current	$I_{g2}$	=	14	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	260	V
Grid No.2 dissipation	$W_{g2}$	=	3.5	W
Anode input power	$W_{ia}$	=	2x67.5	W
Anode dissipation	$W_a$	=	2x19.5	W
Output power	$W_o$	=	96	W
Efficiency	$\eta$	=	71	%



**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to	250	up to	500	MHz
Anode voltage	$V_a$	= max.	600	max.	480	V
Anode input power	$W_{ia}$	= max.	2x45	max.	2x33.5	W
Anode dissipation	$W_a$	= max.	2x14	max.	2x14	W
Anode current	$I_a$	= max.	2x92	max.	2x92	mA
Grid No.2 voltage	$V_{g2}$	= max.	300	max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x3.5	max.	2x3.5	W <sup>1)</sup>
Negative grid No.1 voltage	$-V_{g1}$	= max.	175	max.	175	V
Grid No.1 current	$I_{g1}$	= max.	2x5	max.	2x5	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	50	max.	50	k $\Omega$ <sup>2)</sup>
Heater to cathode voltage	$V_{kf}$	= max.	100	max.	100	V

**C.C.S. OPERATING CONDITIONS**, continuous service  
two systems in push-pull

Frequency	f	=	60	250	MHz
Anode voltage	$V_a$	=	600	600	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-80	-80	V
Anode current	$I_a$	=	2x75	2x75	mA
Grid No.2 current	$I_{g2}$	=	20	18	mA
Grid No.1 current	$I_{g1}$	=	2x3.8	2x1.6	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	105	130	V
Grid No.2 dissipation	$W_{g2}$	=	5	4.5	W
Anode input power	$W_{ia}$	=	2x45	2x45	W
Anode dissipation	$W_a$	=	2x9.5	2x13	W
Output power	$W_o$	=	71	64	W
Efficiency	$\eta$	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g2p}$	=	90	90	V
Modulation power	$W_{mod}$	=	45	45	W

1) Screen grid modulated via a choke. For all other modulation methods

$$W_{g2} = \text{max. } 2 \times 2.3 \text{ W}$$

2) Per system. When a common grid resistor is used  $R_{g1} = \text{max. } 25 \text{ k}\Omega$

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION (continued)**

**I. C. A. S. LIMITING VALUES (Absolute limits), intermittent service**

Frequency	f	up to 250	up to 500	MHz
Anode voltage	$V_a$	= max. 600	max. 480	V
Anode input power	$W_{ia}$	= max. 2x50	max. 2x40	W
Anode dissipation	$W_a$	= max. 2x15	max. 2x15	W
Anode current	$I_a$	= max. 2x100	max. 2x100	mA
Grid No.2 voltage	$V_{g2}$	= max. 300	max. 300	V
Grid No.2 dissipation	$W_{g2}$	= max. 2x4	max. 2x4	W <sup>1)</sup>
Negative grid No.1 voltage	$-V_{g1}$	= max. 175	max. 175	V
Grid No.1 current	$I_{g1}$	= max. 2x5	max. 2x5	mA
Grid No.1 circuit resistance	$R_{g1}$	= max. 50	max. 50	$k\Omega$ <sup>2)</sup>
Heater to cathode voltage	$V_{kf}$	= max. 100	max. 100	V

**I. C. A. S. OPERATING CONDITIONS, intermittent service; two systems in push-pull**

Frequency	f	=	60	250	MHz
Anode voltage	$V_a$	=	600	600	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-80	-80	V
Anode current	$I_a$	=	2x83	2x83	mA
Grid No.2 current	$I_{g2}$	=	16	16	mA
Grid No.1 current	$I_{g1}$	=	2x4	2x1.7	mA
Peak grid No.1 A.C. voltage	$V_{g1p}$	=	105	130	V
Grid No.2 dissipation	$W_{g2}$	=	4	4	W
Anode input power	$W_{ia}$	=	2x50	2x50	W
Anode dissipation	$W_a$	=	2x10.5	2x14.5	W
Output power	$W_o$	=	79	71	W
Efficiency	$\eta$	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g2p}$	=	90	90	V
Modulation power	$W_{mod}$	=	50	50	W

1) Screen grid modulated via a choke. For all other modulation methods

$$W_{g2} = \text{max. } 2x2.6 \text{ W}$$

2) Per system. When a common grid resistor is used  $R_{g1} = \text{max. } 25 \text{ k}\Omega$

**R.F. CLASS C FREQUENCY TRIPLER**

**LIMITING VALUES** (Absolute limits)

Frequency	f	up to 250	up to 500	MHz
Anode voltage	$V_a$	= max. 750	max. 600	V
Anode input power	$W_{ia}$	= max. 2x60	max. 2x50	W
Anode dissipation	$W_a$	=	max. 2x20	W
Anode current	$I_a$	=	max. 2x110	mA
Grid No.2 voltage	$V_{g2}$	=	max. 300	V
Grid No.2 dissipation	$W_{g2}$	=	max. 2x3.5	W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 175	V
Grid No.1 current	$I_{g1}$	=	max. 2x5	mA
Grid No.1 circuit resistance	$R_{g1}$	=	max. 50	k $\Omega$
Heater to cathode voltage	$V_{kf}$	=	max. 100	V

**OPERATING CONDITIONS** two systems in push-pull

Wavelength	$\lambda$	=	6/2	6/2	4/1.3	m
Anode voltage	$V_a$	=	500	400	400	V
Grid No.2 voltage	$V_{g2}$	=	250	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-150	-150	-150	V
Anode current	$I_a$	=	2x60	2x73	2x65	mA
Grid No.2 current	$I_{g2}$	=	10	16	20	mA
Grid No.1 current	$I_{g1}$	=	2x3	2x2.5	2x1.5	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	360	360	360	V
Grid No.1 input power	$W_{ig1}$	=	2x0.6	2x0.5	2x0.3	W
Grid No.2 dissipation	$W_{g2}$	=	2.5	4	5	W
Anode input power	$W_{ia}$	=	2x30	2x29	2x26	W
Anode dissipation	$W_a$	=	2x20	2x20	2x20	W
Output power	$W_o$	=	20	18	12	W
Efficiency	$\eta$	=	33	31	23	%

**A.F. CLASS B AMPLIFIER AND MODULATOR** without grid current

**LIMITING VALUES** (Absolute limits)

Anode voltage	$V_a$	= max.	600	V
Anode input power	$W_{ia}$	= max.	2x60	W
Anode dissipation	$W_a$	= max.	2x20	W
Anode current	$I_a$	= max.	2x110	mA
Grid No.2 voltage	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x3.5	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	50	k $\Omega$
Heater to cathode voltage	$V_{kf}$	= max.	100	V

**OPERATING CONDITIONS;** two systems in push-pull

$V_a$	=	600	450	300	V
$V_{g1}^{1)}$	=	-27.5	-27.5	-26	V
$V_{g2}$	=	250	250	250	V
$R_{aa\sim}$	=	12.5	10	6.5	k $\Omega$
$V_{g1g1'p}$	=	0 55	0 55	0 52	V
$I_a$	=	2x20 2x62	2x20 2x58	2x20 2x56	mA
$I_{g2}$	=	0.9 23	1.4 27	2.2 28	mA
$W_{g2}$	=	0.2 5.8	0.4 6.7	0.6 7.0	W
$W_{ia}$	=	2x12 2x37	2x9.0 2x26	2x6.0 2x16.8	W
$W_a$	=	2x12 2x12	2x9.0 2x8.5	2x6.0 2x5.6	W
$W_o$	=	0 50	0 35	0 22.5	W
$d_{tot}$	=	- 2.4	- 3.1	- 2.9	%
$\eta$	=	- 67.5	- 67.5	- 67	%

1) Individual adjustment of the grid bias of each system is recommended

**A.F. CLASS B AMPLIFIER AND MODULATOR** with grid current

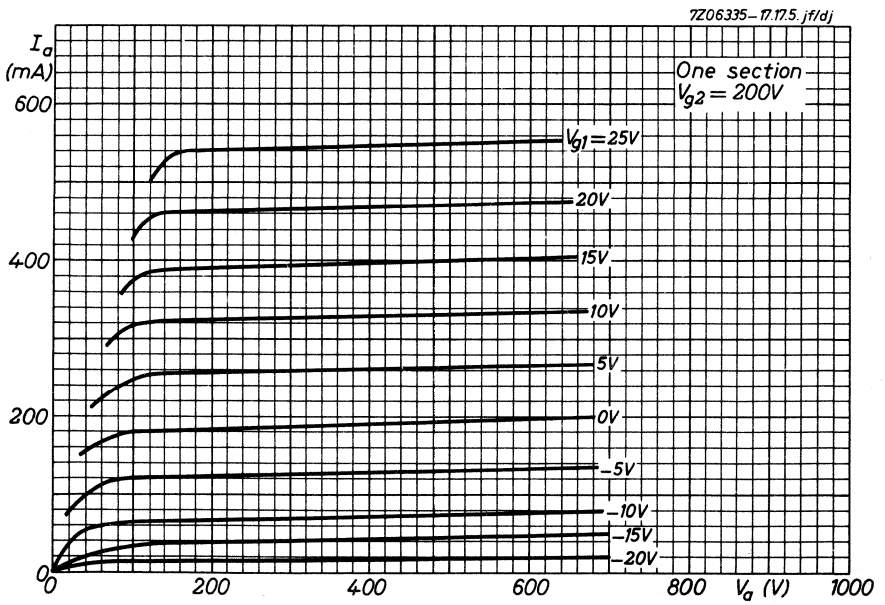
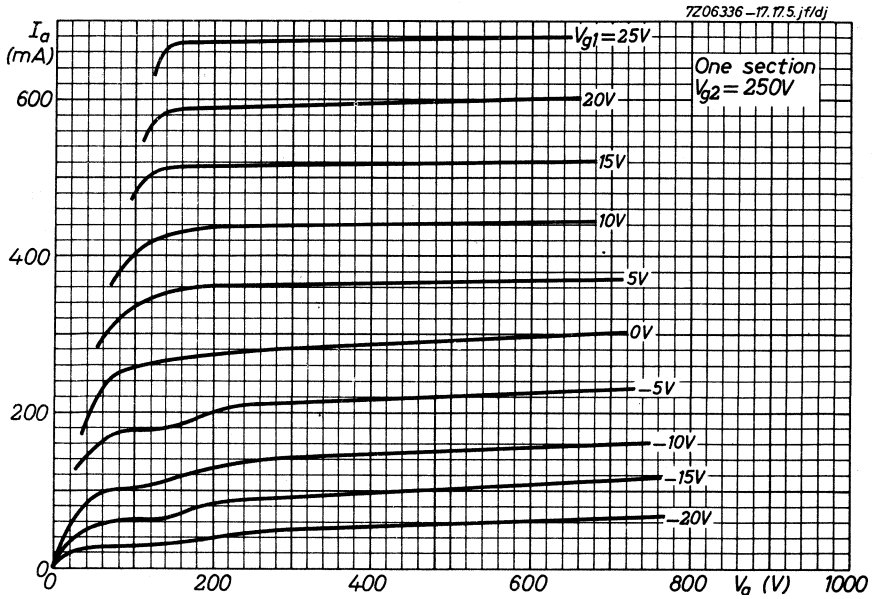
**LIMITING VALUES** (Absolute limits)

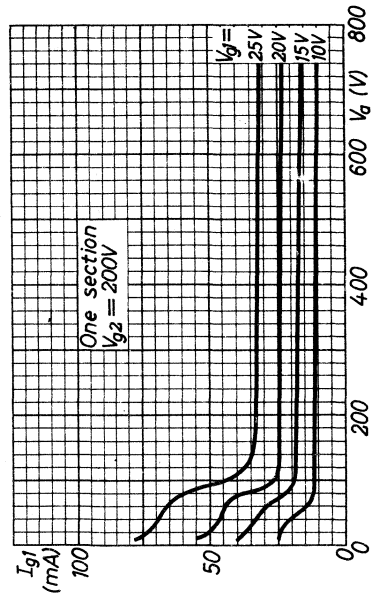
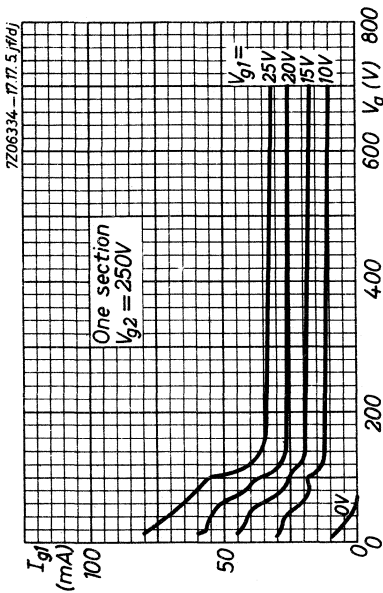
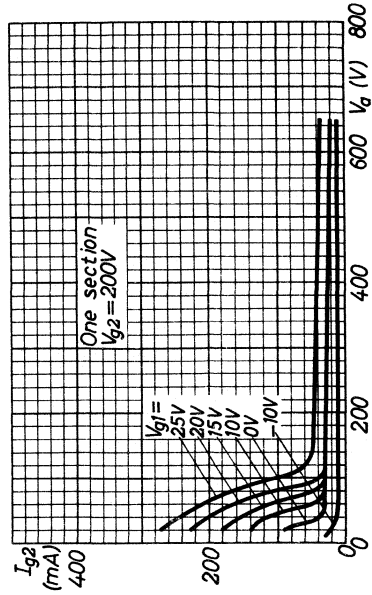
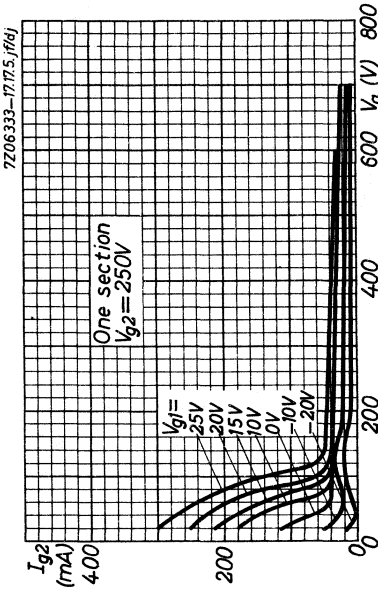
Anode voltage	$V_a$	=	max.	600	V
Anode input power	$W_{ia}$	=	max.	2x60	W
Anode dissipation	$W_a$	=	max.	2x20	W
Anode current	$I_a$	=	max.	2x110	mA
Grid No.2 voltage	$V_{g2}$	=	max.	300	V
Grid No.2 dissipation	$W_{g2}$	=	max.	2x3.5	W
Grid No.1 current	$I_{g1}$	=	max.	2x5	mA
Grid No.1 circuit resistance	$R_{g1}$	=	max.	50	k $\Omega$
Heater to cathode voltage	$V_{kf}$	=	max.	100	V

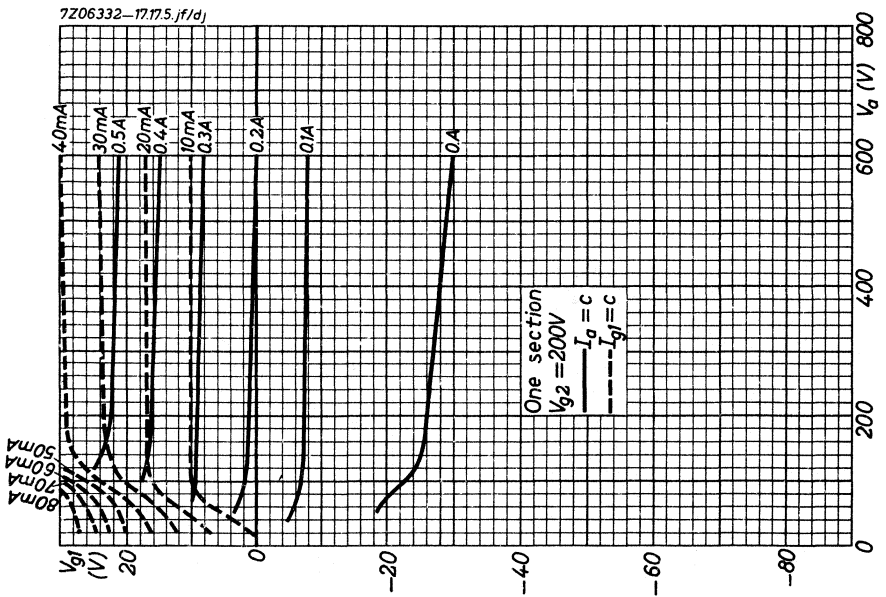
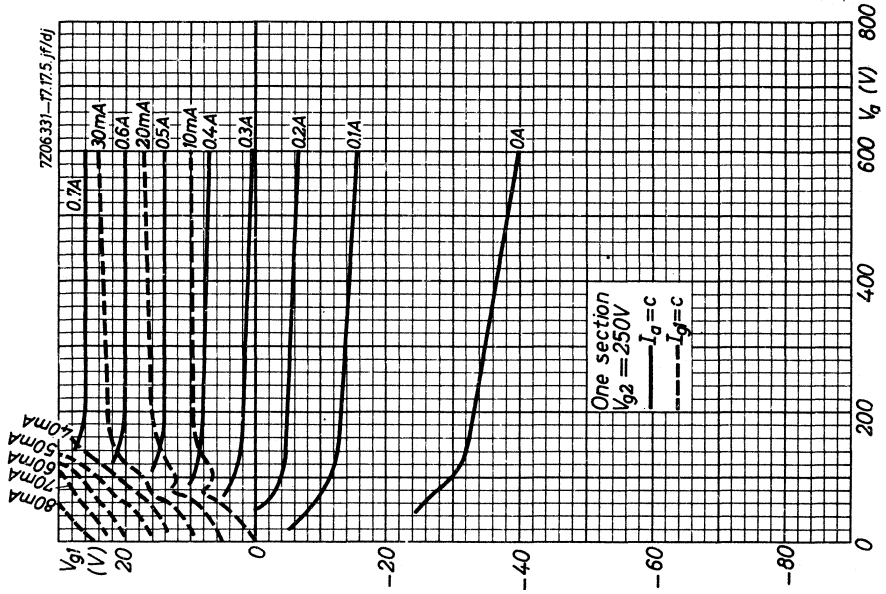
**OPERATING CONDITIONS**, two systems in push-pull

$V_a$	=	600	450	300	V
$V_{g1}^{1)}$	=	-25	-25	-25	V
$V_{g2}$	=	250	250	250	V
$R_{aa}$	=	8.0	6.0	4.0	k $\Omega$
$V_{g1g1'p}$	=	0 78	0 76	0 75	V
$I_a$	=	2x25 2x100	2x25 2x97	2x25 2x94	mA
$I_{g1}$	=	0 2x2.6	0 2x2.6	0 2x2.6	mA
$I_{g2}$	=	1.2 26	1.9 28	2.8 28	mA
$W_{ig1}$	=	0 2x0.1	0 2x0.1	0 2x0.1	W
$W_{g2}$	=	0.3 6.5	0.5 7.0	0.7 7.0	W
$W_{ia}$	=	2x15 2x60	2x11.2 2x43.5	2x7.5 2x28.2	W
$W_a$	=	2x15 2x17	2x11.2 2x13.5	2x7.5 2x9.7	W
$W_o$	=	0 86	0 60	0 37	W
$d_{tot}$	=	- 5	- 5	- 5	%
$\eta$	=	- 71.5	- 69	- 65.5	%

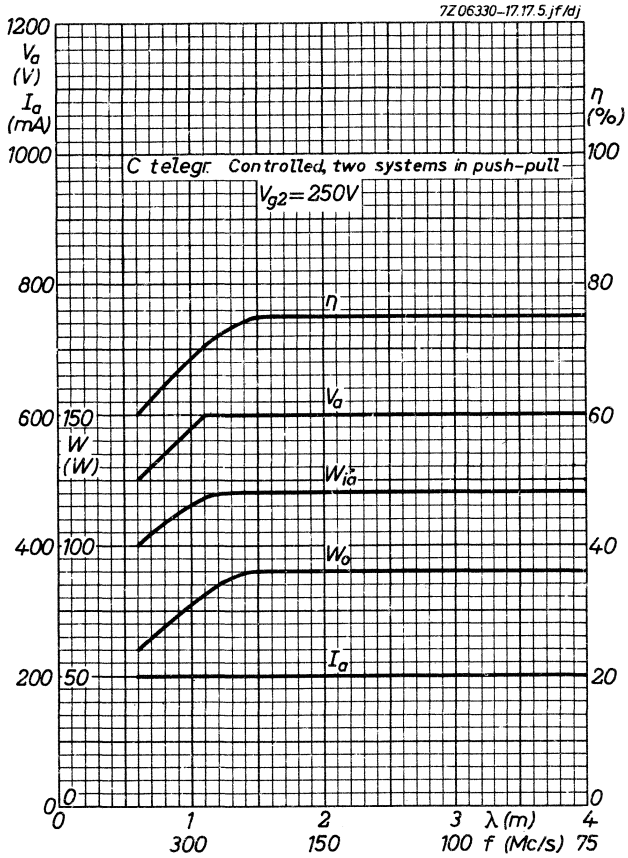
<sup>1)</sup> Individual adjustment of the grid bias of each system is recommended













## 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  $\pm$  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)

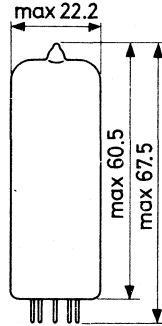
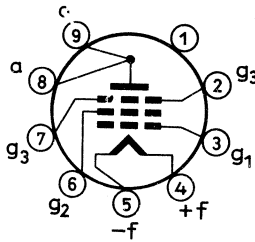
Bulb temperature	max. 200 °C
Pin seal temperature	max. 120 °C

## 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

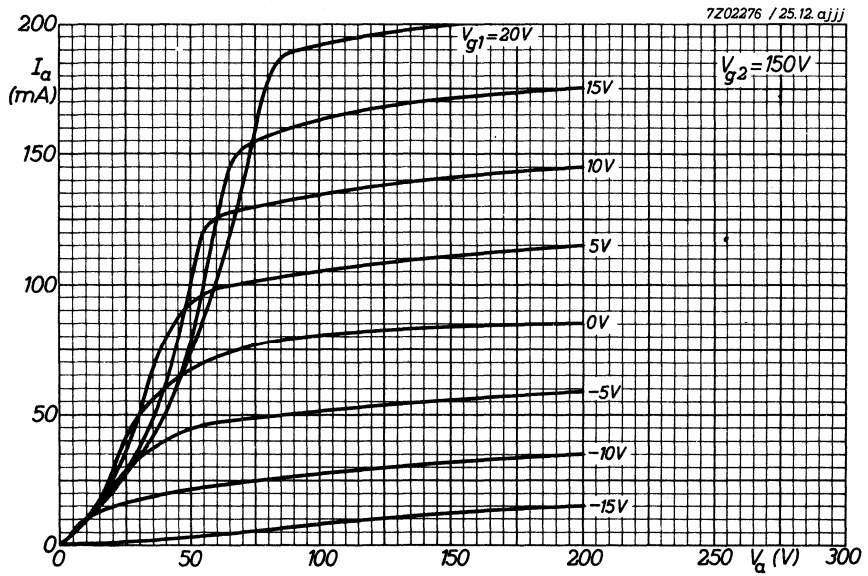
LIMITING VALUES (Absolute limits)

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



## 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 <sub>ag2</sub> mod.	
	V <sub>a</sub> (kV)	W <sub>o</sub> (kW) PEP	V <sub>a</sub> (kV)	W <sub>l</sub> (kW)	V <sub>a</sub> (kV)	W <sub>o</sub> (kW)
30	8	30			10	55
220	10	33	5.5	25		

**HEATING:** Direct; filament thoriated tungsten

Filament voltage	V <sub>f</sub>	10 V
Filament current	I <sub>f</sub>	200 A

### CAPACITANCES

Anode to all except grid No.1	C <sub>a</sub> (g <sub>1</sub> )	42 pF
Grid No.1 to all except anode	C <sub>g1(a)</sub>	260 pF
Anode to grid No.1	C <sub>ag1</sub>	1.5 pF

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	3 kV
Grid No.2 voltage	V <sub>g2</sub>	1.2 kV
Anode current	I <sub>a</sub>	2.5 A
Transconductance	S	65 mA/V
Amplification factor	μ <sub>g2g1</sub>	6.6 -

## TEMPERATURE LIMITS AND COOLING

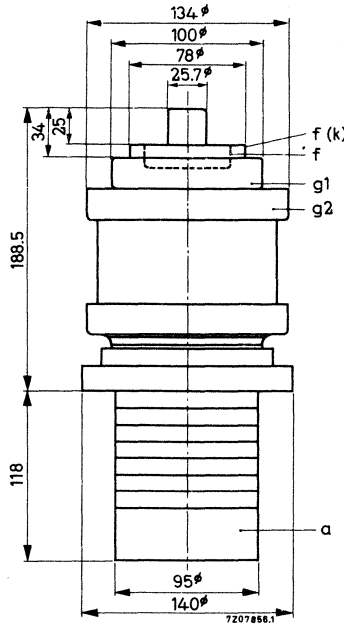
Absolute max. envelope and seal temperature  $t_{env.}$  max. 220 °C  
Absolute max. water inlet temperature  $t_i$  max. 50 °C  
Required quantity of water see cooling curves  
For temperatures  $t_i$  between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

## 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 <sup>1)</sup>		
		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	$\eta$	-	63.5	49	%
Intermodulation distortion					
3 <sup>d</sup> order	$d_3$	-	-	41	dB <sup>2)</sup>
5 <sup>th</sup> order	$d_5$	-	-	54	dB <sup>2)</sup>

1) 2) See page 4

**OPERATING CONDITIONS** (continued)

Frequency	f	30			MHz
Anode voltage	V <sub>a</sub>	10			kV
Grid No.2 voltage	V <sub>g2</sub>	1.2			kV
Grid No.1 voltage	V <sub>g1</sub>	-185			V <sup>1)</sup>
			zero signal	single tone	double tone
Grid No.1 driving voltage	V <sub>g1p</sub>	0	185	185	V
Anode current	I <sub>a</sub>	2	5.2	3.3	A
Grid No.2 current	I <sub>g2</sub>	0	250	80	mA
Grid No.1 current	I <sub>g1</sub>	0	0	0	mA
Anode input power	W <sub>i_a</sub>	20	52	33	kW
Anode dissipation	W <sub>a</sub>	20	19	16.5	kW
Grid No.2 dissipation	W <sub>g2</sub>	0	300	96	W
Output power (P.E.P.)	W <sub>o</sub>	0	33	33	kW
Efficiency	η	-	63	50	%
Intermodulation distortion					
3 <sup>d</sup> order	d <sub>3</sub>	-	-	-41	dB <sup>2)</sup>
5 <sup>th</sup> order	d <sub>5</sub>	-	-	-54	dB <sup>2)</sup>

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	$V_{g2}$	max. 1 kV
Grid No.1 voltage	$-V_{g1}$	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	$W_{g2}$	max. 300 W
Grid No.1 dissipation	$W_{g1}$	max. 200 W

## OPERATING CONDITIONS

Frequency	f	220 MHz
Anode voltage	$V_a$	5.5 kV
Grid No.2 voltage	$V_{g2}$	800 V
Grid No.1 voltage	$V_{g1}$	-200 V
Anode current	$I_a$	7 A
Grid No.2 current	$I_{g2}$	250 mA
Grid No.1 current	$I_{g1}$	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	$W_f$	25 kW <sup>1)</sup>
Efficiency	$\eta$	77 %

<sup>1)</sup> Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

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

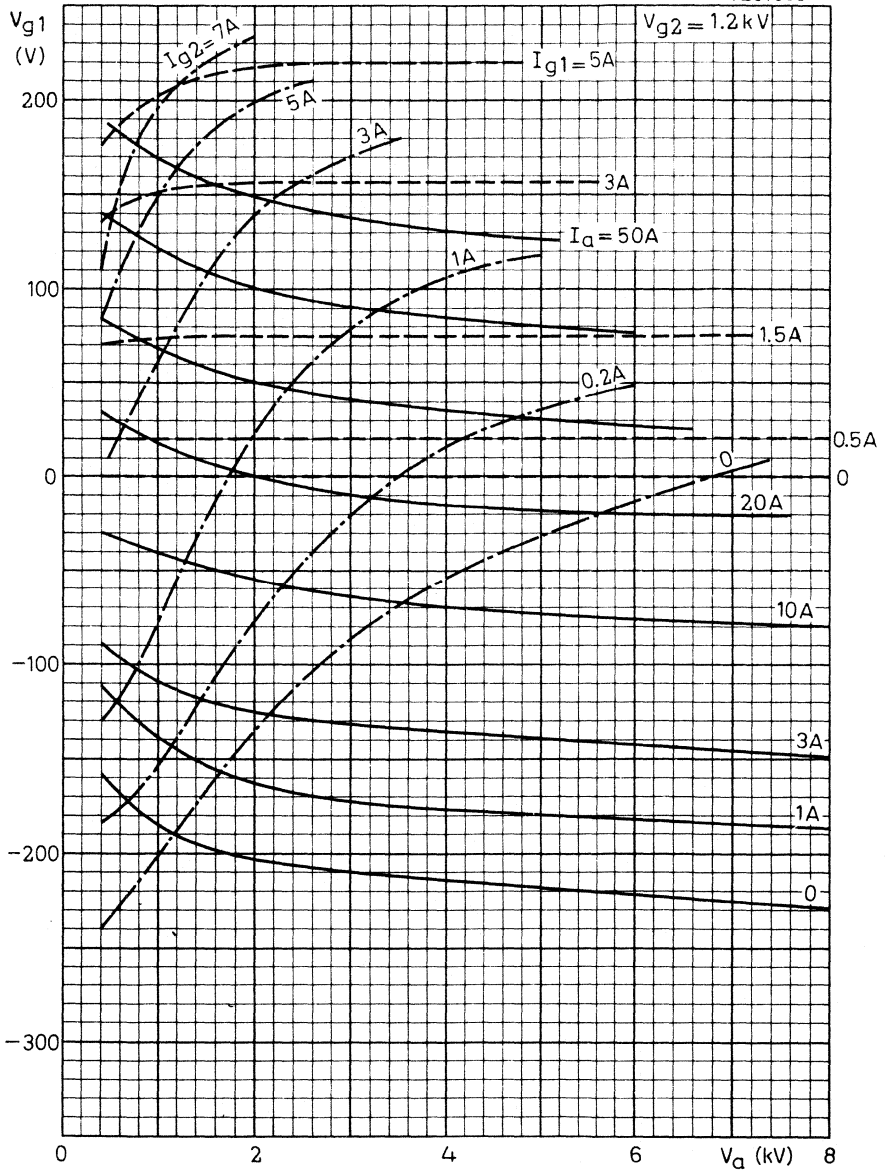
**LIMITING VALUES** (Absolute max. rating system)

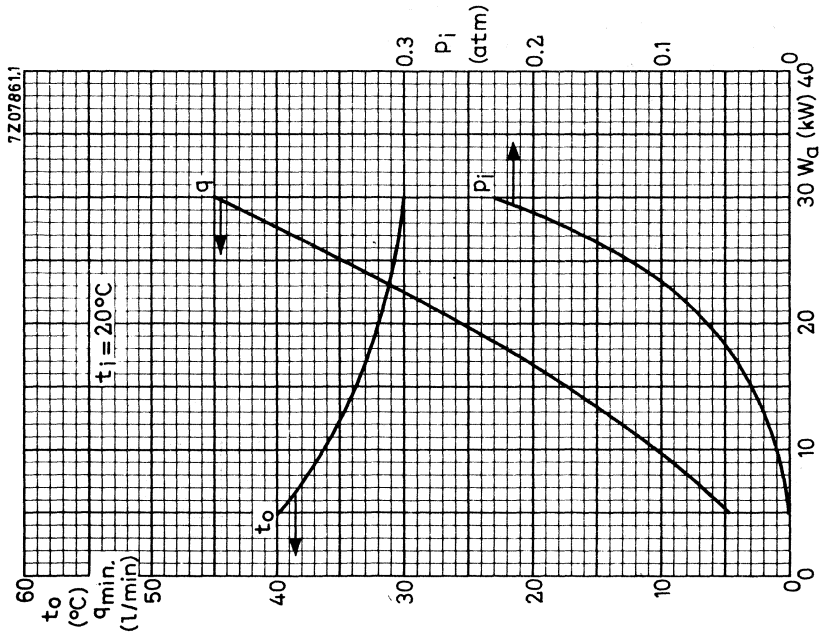
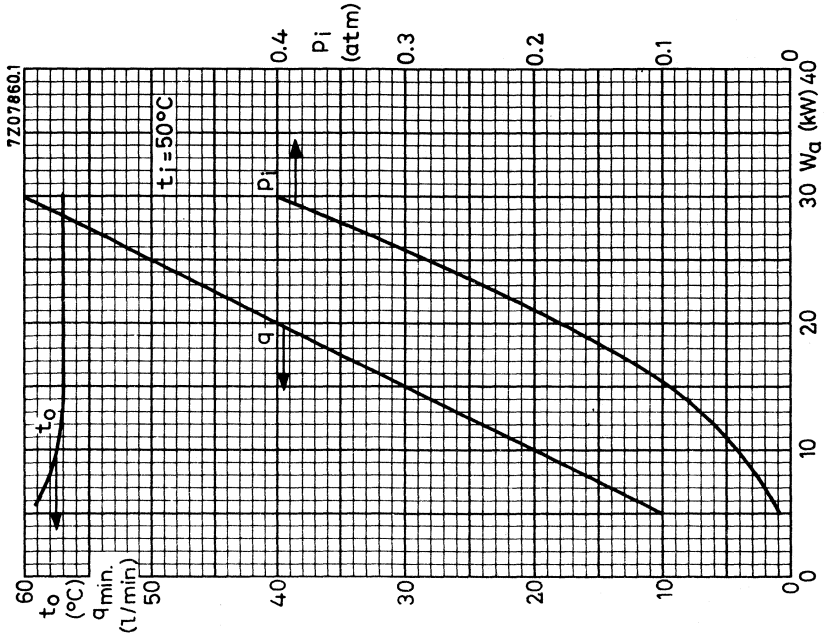
Frequency	f	up to	30 MHz
Anode voltage	$V_a$	max.	10 kV
Anode input power	$W_{i_a}$	max.	74 kW
Anode dissipation	$W_a$	max.	20 kW
Anode current	$I_a$	max.	8.5 A
Grid No. 2 voltage	$V_{g2}$	max.	900 V
Grid No. 2 dissipation	$W_{g2}$	max.	600 W
Grid No. 1 voltage	$-V_{g1}$	max.	350 V
Grid No. 1 dissipation	$W_{g1}$	max.	300 W

**OPERATING CONDITIONS**

Frequency	f	30 MHz
Anode voltage	$V_a$	10 kV
Grid No. 2 voltage	$V_{g2}$	800 V
Grid No. 1 voltage	$V_{g1}$	-150 V
Grid No. 1 resistor	$R_{g1}$	500 $\Omega$
Anode current	$I_a$	7.4 A
Grid No. 2 current	$I_{g2}$	340 mA
Grid No. 1 current	$I_{g1}$	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	$\eta$	74.4 %
Modulation depth	m	100 %
Modulation power	$W_{mod}$	37 kW
Grid No. 2 voltage, peak	$V_{g2p}$	700 V

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## 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)	$W_f$ (kW)
30	8	30		
	10	33		
220			5.5	25

**HEATING:** Direct; filament thoriated tungsten

Filament voltage	$V_f$	10 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

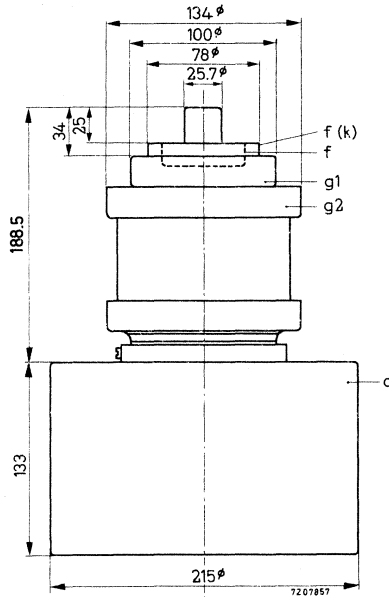
$t_{env.}$  max. 220 °C

## MECHANICAL DATA

Dimensions in mm

Net weight: approx. 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	$V_{g2}$	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 <sup>1)</sup>		
		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	$\eta$	-	63.5	49	%
Intermodulation distortion					
3 <sup>d</sup> order	$d_3$	-	-	41	dB <sup>2)</sup>
5 <sup>th</sup> order	$d_5$	-	-	54	dB <sup>2)</sup>

1) 2) See page 4

**OPERATING CONDITIONS(continued)**

Frequency	f	30		MHz
Anode voltage	V <sub>a</sub>	10		kV
Grid No.2 voltage	V <sub>g2</sub>	1.2		kV
Grid No.1 voltage	V <sub>g1</sub>	-185		V <sup>1)</sup>
		zero signal	single tone	double tone
Grid No.1 driving voltage	V <sub>g1p</sub>	0	185	185 V
Anode current	I <sub>a</sub>	2	5.2	3.3 A
Grid No.2 current	I <sub>g2</sub>	0	250	80 mA
Grid No.1 current	I <sub>g1</sub>	0	0	0 mA
Anode input power	W <sub>i<sub>a</sub></sub>	20	52	33 kW
Anode dissipation	W <sub>a</sub>	20	19	16.5 kW
Grid No.2 dissipation	W <sub>g2</sub>	0	300	96 W
Output power (P.E.P.)	W <sub>o</sub>	0	33	33 kW
Efficiency	η	-	63	50 %
Intermodulation distortion				
3 <sup>d</sup> order	d <sub>3</sub>	-	-	-41 dB <sup>2)</sup>
5 <sup>th</sup> order	d <sub>5</sub>	-	-	-54 dB <sup>2)</sup>

<sup>1)</sup> Adjust to give the zero signal anode current.

<sup>2)</sup> 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)

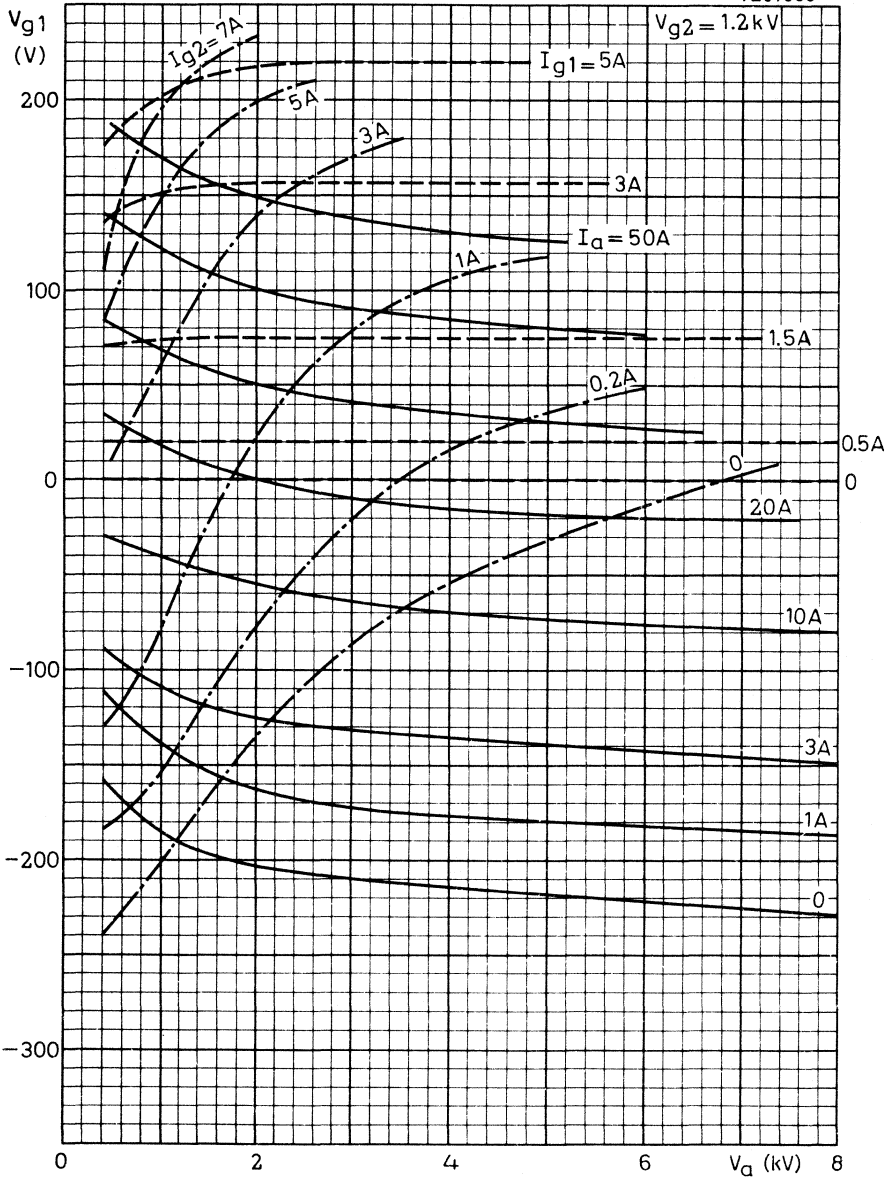
Frequency	f	up to 220 MHz
Anode voltage	$V_a$	max. 5.6 kV
Grid No.2 voltage	$V_{g2}$	max. 1 kV
Grid No.1 voltage	$-V_{g1}$	max. 250 V
Anode current	$I_a$	max. 10 A
Anode input power	$W_{i_a}$	max. 72 kW
Anode dissipation	$W_a$	max. 30 kW
Grid No.2 dissipation	$W_{g2}$	max. 300 W
Grid No.1 dissipation	$W_{g1}$	max. 200 W

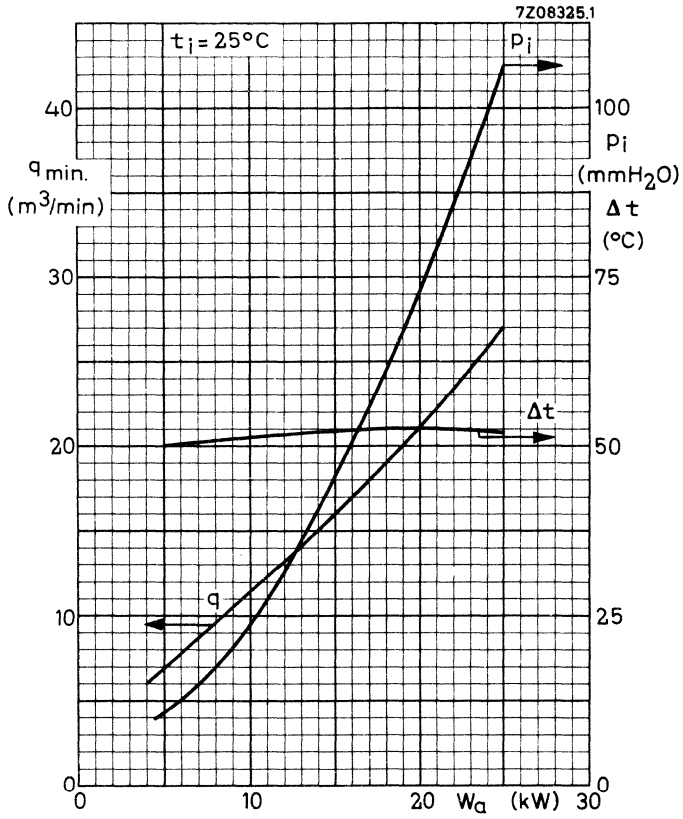
## OPERATING CONDITIONS

Frequency	f	220 MHz
Anode voltage	$V_a$	5.5 kV
Grid No.2 voltage	$V_{g2}$	800 V
Grid No.1 voltage	$V_{g1}$	-200 V
Anode current	$I_a$	7 A
Grid No.2 current	$I_{g2}$	250 mA
Grid No.1 current	$I_{g1}$	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 <sup>1)</sup>
Efficiency	$\eta$	77 %

<sup>1)</sup> Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

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## 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.		$C_{ag2}$ mod.	
	$V_a$ (kV)	$W_o$ (kW) PEP	$V_a$ (kV)	$W_f$ (kW)	$V_a$ (kV)	$W_o$ (kW)
30	8	30			10	55
220	10	33	5.5	25		

**HEATING:** Direct; filament thoriated tungsten

Filament voltage	$V_f$	10 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	$C_{g1}(a)$	260 pF
Anode to grid No.1	$C_{ag1}$	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	$\mu_{g2g1}$	6.6 -

## TEMPERATURE LIMITS AND COOLING

Absolute max. envelope and seal temperature

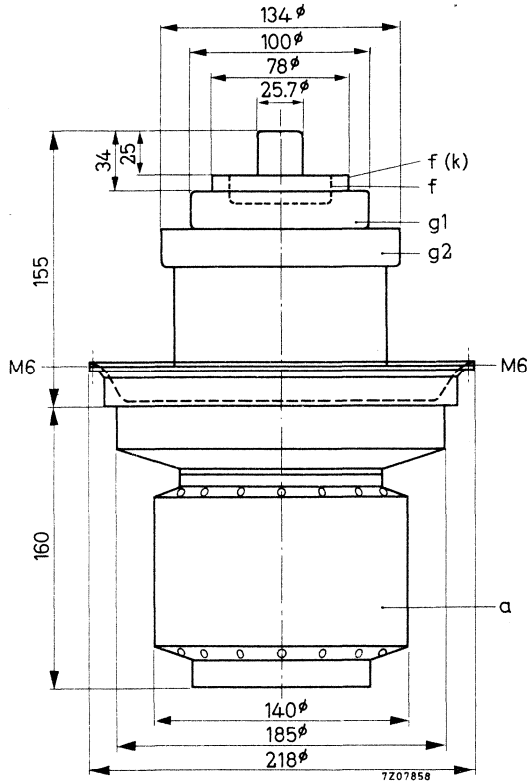
$t_{env.}$  max. 220 °C

## 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	$\eta$	-	63.5	49	%
Intermodulation distortion					
3 <sup>d</sup> order	$d_3$	-	-	41	dB 2)
5 <sup>th</sup> 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 <sup>1)</sup>	
		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	$\eta$	-	63	50 %
Intermodulation distortion				
3 <sup>d</sup> order	$d_3$	-	-	-41 dB <sup>2)</sup>
5 <sup>th</sup> order	$d_5$	-	-	-54 dB <sup>2)</sup>

<sup>1)</sup> Adjust to give the zero signal anode current.

<sup>2)</sup> 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	$V_{g2}$	max.	1	kV
Grid No.1 voltage	$-V_{g1}$	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	$W_{g2}$	max.	300	W
Grid No.1 dissipation	$W_{g1}$	max.	200	W

## OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	$V_a$	5.5	kV
Grid No.2 voltage	$V_{g2}$	800	V
Grid No.1 voltage	$V_{g1}$	-200	V
Anode current	$I_a$	7	A
Grid No.2 current	$I_{g2}$	250	mA
Grid No.1 current	$I_{g1}$	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	$W_\ell$	25	kW <sup>1)</sup>
Efficiency	$\eta$	77	%

<sup>1)</sup> Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

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

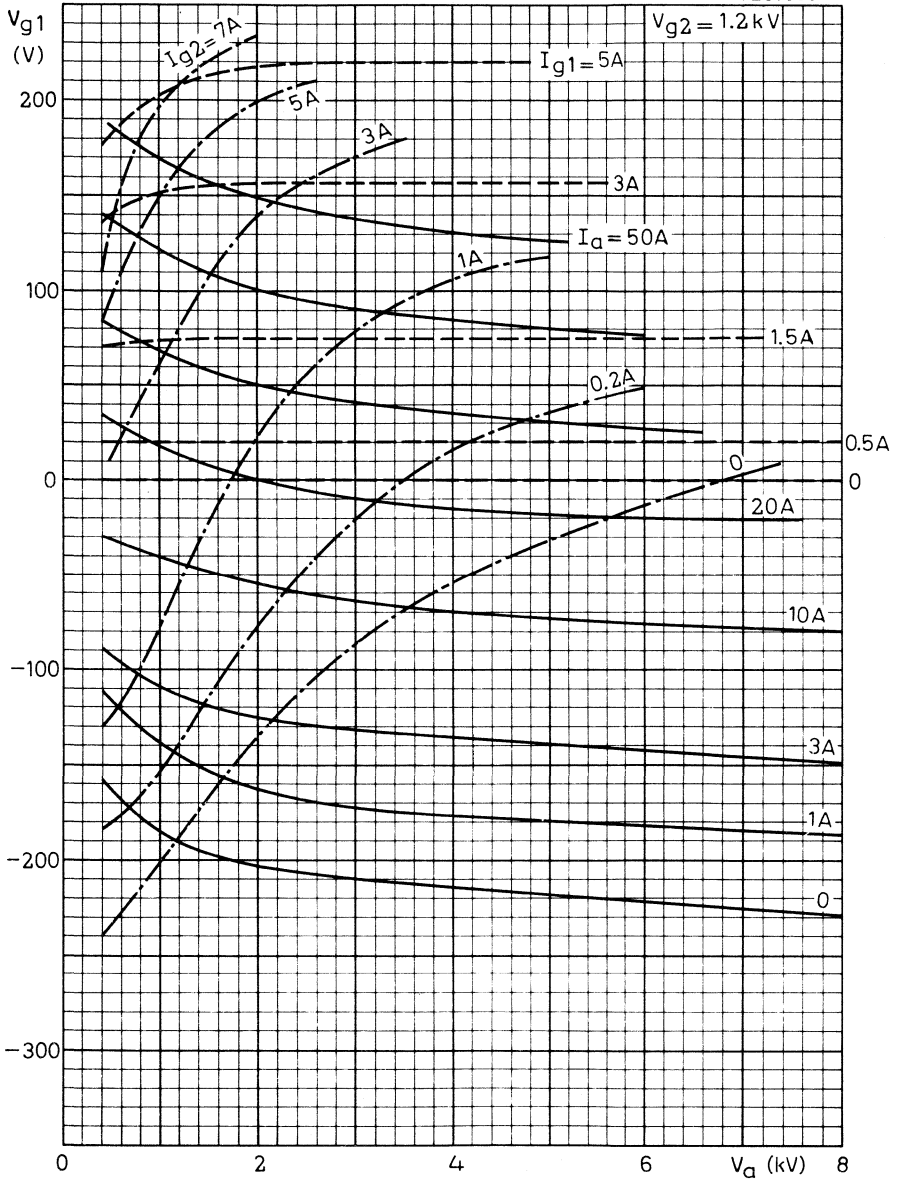
**LIMITING VALUES (Absolute max. rating system)**

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 $\Omega$
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	$\eta$	74.4 %
Modulation depth	m	100 %
Modulation power	$W_{mod}$	37 kW
Grid No.2 voltage, peak	$V_{g_2p}$	700 V

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## 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 <sub>a-g<sub>2</sub></sub> mod.		C freq. tripler	
	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)
200	300	16	300	13		
	400	22				
	600	35				
460	400	17				
66.7/200 153/460					300	7
					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

<sup>1)</sup> 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	$V_{g2}$	=	250	V
Anode current	$I_a$	=	40	mA
Mutual conductance	$S$	=	4.0	mA/V
Amplification factor	$\mu_{g2g1}$	=	9	

## TEMPERATURE LIMITS (Absolute limits)

Bulb and anode seal temperature	= max.	250	°C
Base seal temperature	= max.	180	°C

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

## MECHANICAL DATA

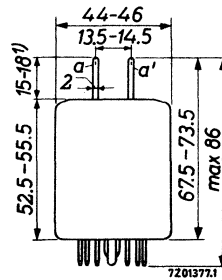
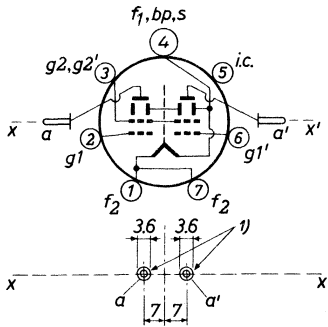
Dimensions in mm

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	$V_a = \text{max.}$	600	max. 450	V
Anode input power	$W_{ia} = \text{max.}$	70	max. 50	W
Anode dissipation	$W_a = \text{max.}$	2x10	max. 2x10	W
Grid No.2 voltage	$V_{g2} = \text{max.}$	300	max. 300	V
Grid No.2 dissipation	$W_{g2} = \text{max.}$	2x1.5	max. 2x1.5	W
Negative grid No.1 voltage	$-V_{g1} = \text{max.}$	75	max. 75	V
Grid No.1 current	$I_{g1} = \text{max.}$	2x2.5	max. 2x2.5	mA
Grid No.1 dissipation	$W_{g1} = \text{max.}$	2x0.5	max. 2x0.5	W
Cathode current	$I_k = \text{max.}$	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	$V_{g2} =$	250	250	250	250	V
Grid No.1 voltage	$V_{g1} =$	-40	-50	-60	-50	V
Driving voltage	$V_{g1g1'p} =$	106	136	156	-	V
Anode current	$I_a =$	2x50	2x50	2x50	2x50	mA
Grid No.2 current	$I_{g2} =$	2x4	2x3.5	2x3.0	2x3.0	mA
Grid No.1 current	$I_{g1} =$	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	$\eta =$	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	$V_{g2}$	= max.	300	max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1.2	max.	2x1.2	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	max.	100	V
Grid No.1 current	$I_{g1}$	= max.	2x2.5	max.	2x2.5	mA
Grid No.1 dissipation	$W_{g1}$	= 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	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-50	-80	V
Driving voltage	$V_{g1g1'p}$	=	166	220	V
Anode current	$I_a$	=	2x40	2x40	mA
Grid No.2 current	$I_{g2}$	=	2x3.5	2x4.0	mA
Grid No.1 current	$I_{g1}$	=	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	$\eta$	=	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.

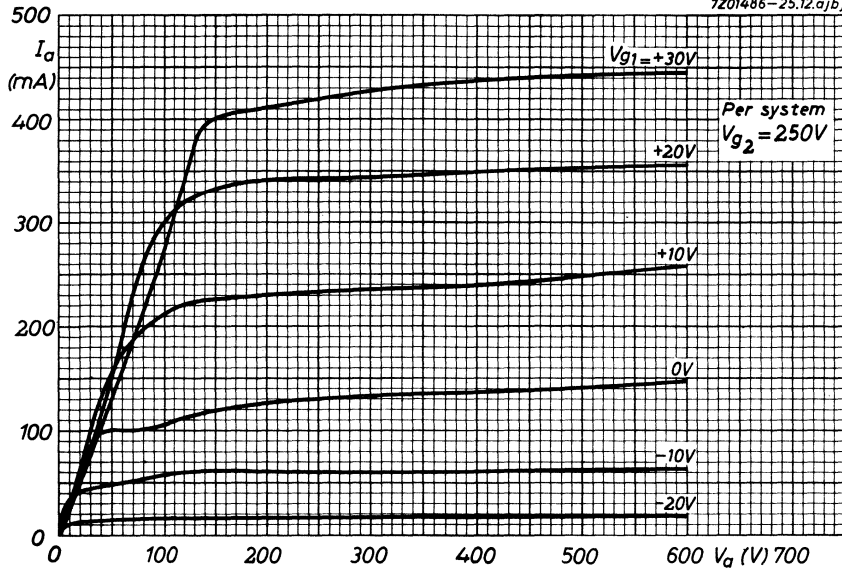
**LIMITING VALUES** (Absolute limits)

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	$V_{g2}$	= max.	250	V
Grid No.2 dissipation	$W_{g2}$	= max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	200	V
Grid No.1 current	$I_{g1}$	= max.	2x4.5	mA
Grid No.1 dissipation	$W_{g1}$	= max.	2x0.5	W
Cathode current	$I_k$	= max.	2x55	mA

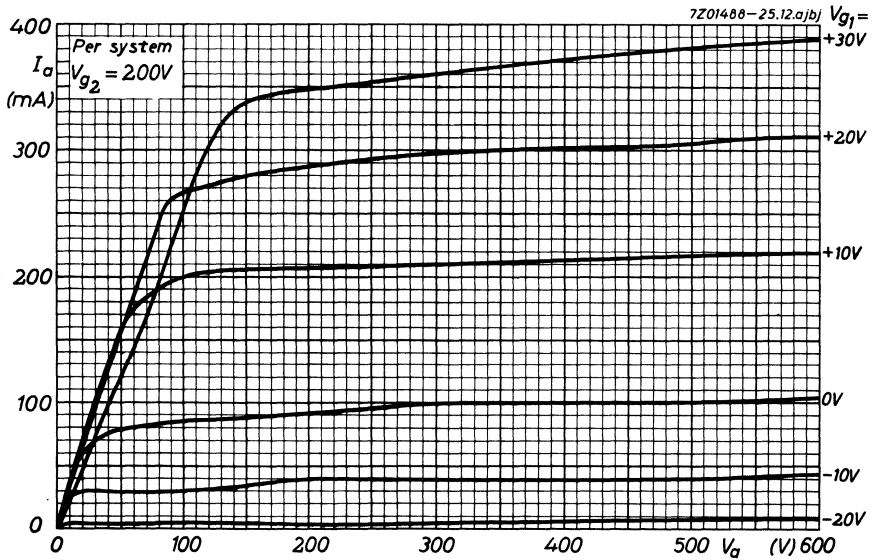
**OPERATING CHARACTERISTICS**

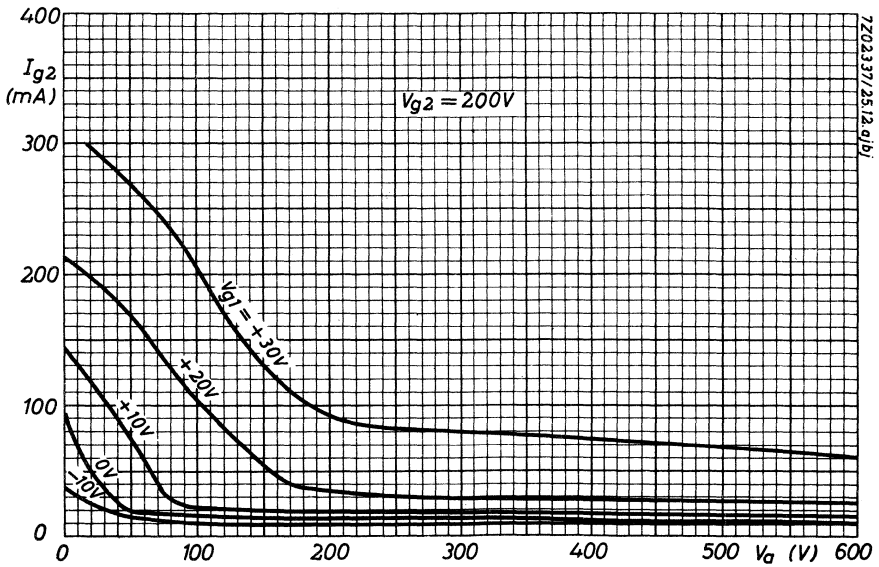
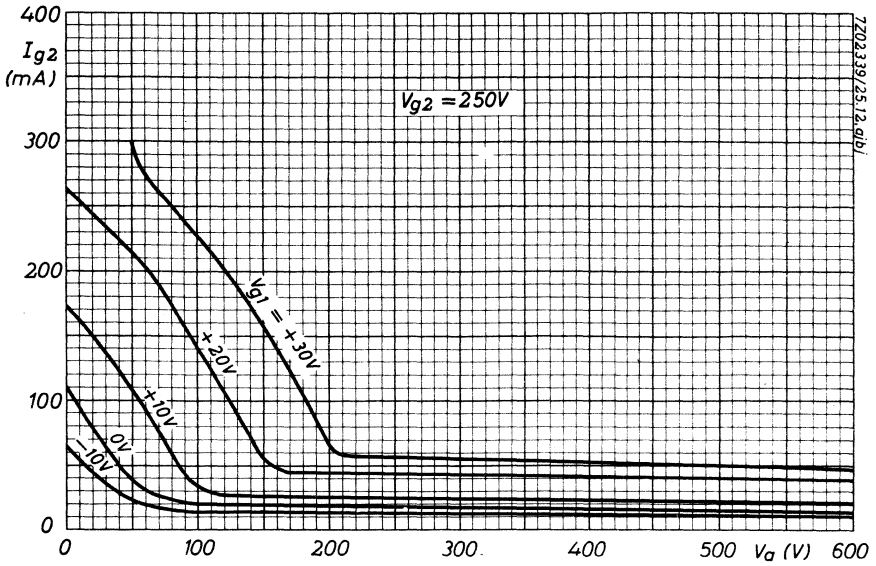
Frequency	f	=	66.7/200	153/460	MHz
Anode voltage	$V_a$	=	300	300	V
Grid No.2 voltage	$V_{g2}$	=	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-175	-175	V
Driving voltage	$V_{g1g1'p}$	=	410	410	V
Anode current	$I_a$	=	2x45	2x45	mA
Grid No.2 current	$I_{g2}$	=	2x4.0	2x3.5	mA
Grid No.1 current	$I_{g1}$	=	2x3.0	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	$\eta$	=	33	26	%
Output power in load	$W_l$	=	7	5.5	W

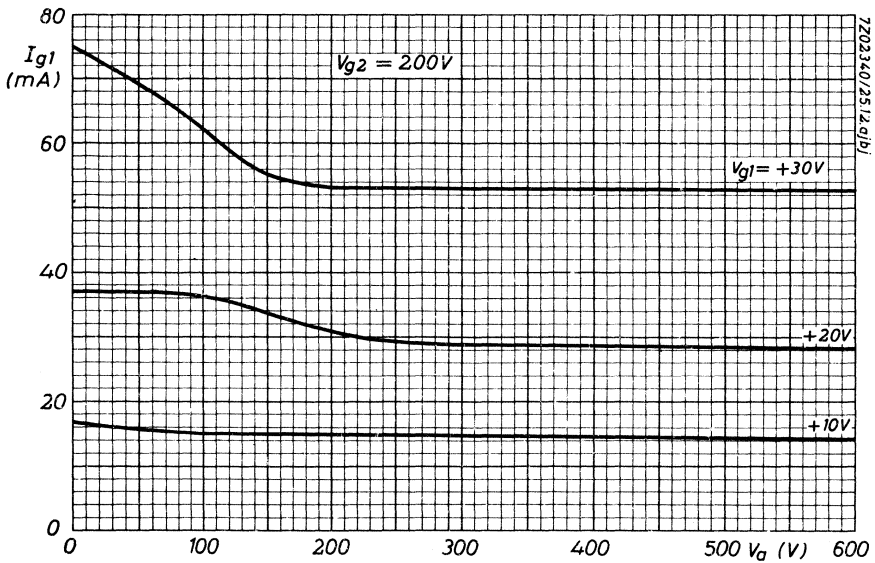
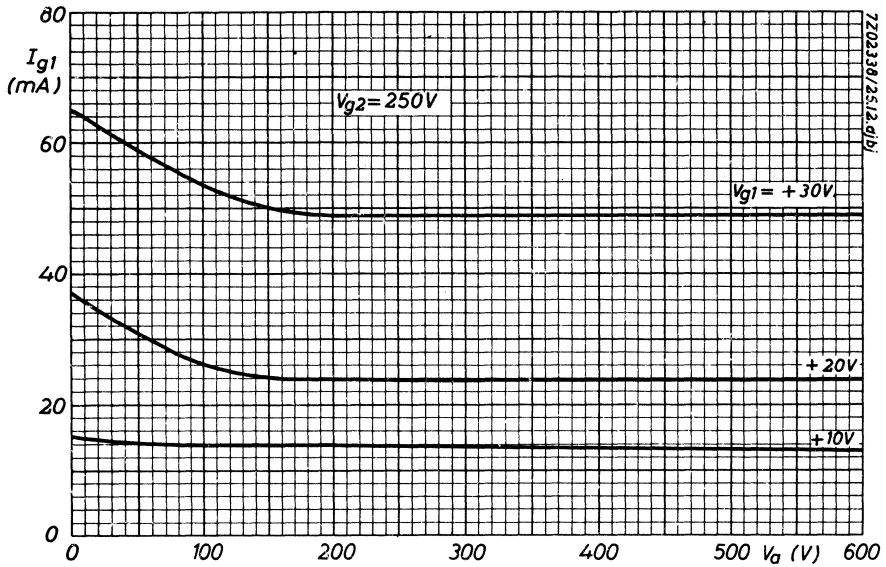
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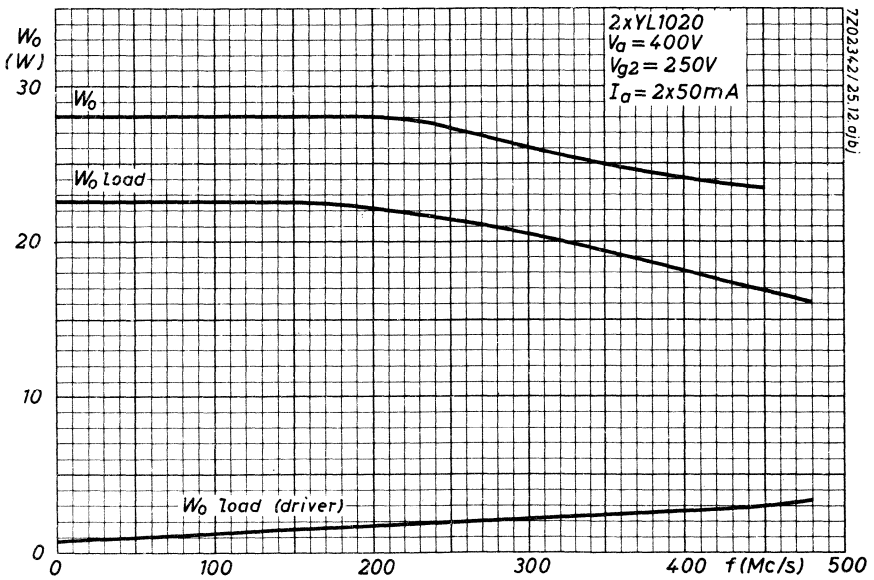
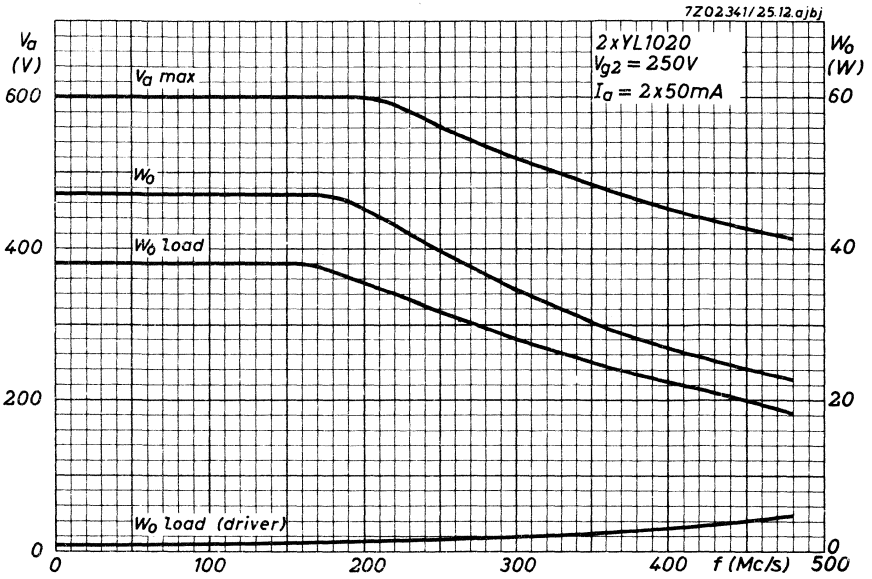


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## QUICK HEATING R.F. DOUBLE TETRODE

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 <sub>2</sub> mod.		Frequency multiplier	
	C.C.S. W <sub>ℓ</sub> (W) <sup>1</sup>	I.C.A.S. W <sub>ℓ</sub> (W) <sup>1</sup>	C.C.S. W <sub>ℓ</sub> (W) <sup>1</sup>	I.C.A.S. W <sub>ℓ</sub> (W) <sup>1</sup>	C.C.S. W <sub>ℓ</sub> (W) <sup>1</sup>	I.C.A.S. W <sub>ℓ</sub> (W) <sup>1</sup>
180	45	75	32	53	16	
50/150						
157/470						12

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

Filament voltage  $V_f = 2.1 \text{ V}$

Filament current  $I_f = 4.5 \text{ A}$

Heating time for  $W_o = 70\%$  of  $W_o \text{ max.}$   $T_h < 0.5 \text{ sec}$

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

with sinusoidal supply voltages  $\text{max. } 200 \text{ Hz}$

with square-wave supply voltages  $\text{any}$

The filament has been designed to accept temporary fluctuations of supply voltage of  $\pm 15\%$ .

**CAPACITANCES;** two sections in push-pull connection

Input capacitance  $C_i = 6.0 \text{ pF}$

Output capacitance  $C_o = 2.0 \text{ pF}$

**TYPICAL CHARACTERISTICS;** each section

Anode voltage  $V_a = 600 \text{ V}$

Grid No.2 voltage  $V_{g_2} = 250 \text{ V}$

Anode current  $I_a = 40 \text{ mA}$

Mutual conductance  $S = 4.5 \text{ mA/V}$

Amplification factor  $\mu_{g_2g_1} = 8$

<sup>1</sup>) 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

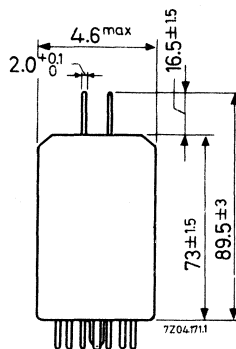
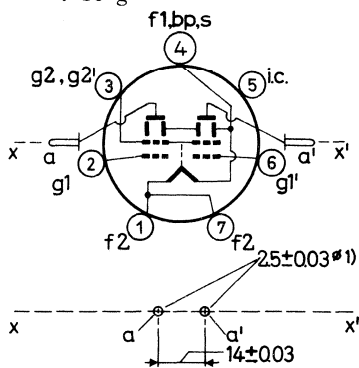
Radiation and convection

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.

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	$V_{g2}$	= max.	300	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	3.5	3.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	100	V
Grid No.1 current	$I_{g1}$	= max.	5.0	5.0	mA
Grid No.1 dissipation	$W_{g1}$	= max.	1.0	1.0	W
Grid No.1 circuit resistance					
with fixed bias	$R_{g1}$	= max.	50	50	k $\Omega$
with automatic bias	$R_{g1}$	= max.	100	100	k $\Omega$
Cathode current	$I_k$	= max.	120	120	mA

**OPERATING CONDITIONS;** two systems in push-pull

Frequency	f	CCS		ICAS	MHz
		180	475		
Anode voltage	$V_a$	= 400	350	600	V
Grid No.2 voltage	$V_{g2}$	= 250	250	250	V
Grid No.1 voltage	$V_{g1}$	= -60	-45	-80	V
Anode current	$I_a$	= 2x100	2x100	2x100	mA
Grid No.2 current	$I_{g2}$	= 2x8	2x4.5	2x9	mA
Grid No.1 current	$I_{g1}$	= 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	$\eta$	= 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 k $\Omega$
with automatic bias	$R_{g_1}$	= max. 100	100 k $\Omega$
Cathode current	$I_k$	= max. 120	120 mA

**OPERATING CONDITIONS;** two systems in push-pull

		<b>CCS</b>	<b>ICAS</b>
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	$\eta$	= 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

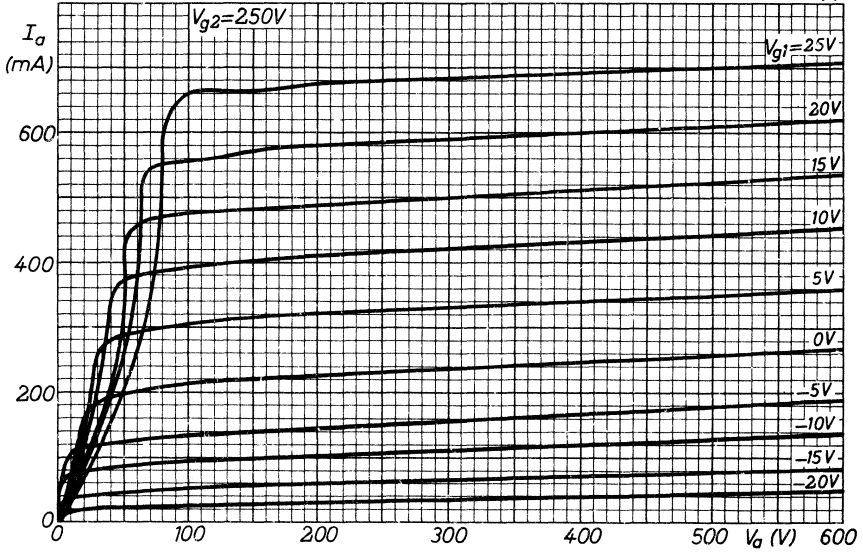
## LIMITING VALUES (Each system; absolute limits)

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	$V_{g2}$	=	max. 300	V
Grid No.2 dissipation	$W_{g2}$	=	max. 3.5	W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 175	V
Grid No.1 dissipation	$W_{g1}$	=	max. 1.0	W
Grid No.1 circuit resistance				
with fixed bias	$R_{g1}$	=	max. 50	k $\Omega$
with automatic bias	$R_{g1}$	=	max. 100	k $\Omega$
Cathode current	$I_k$	=	max. 100	mA

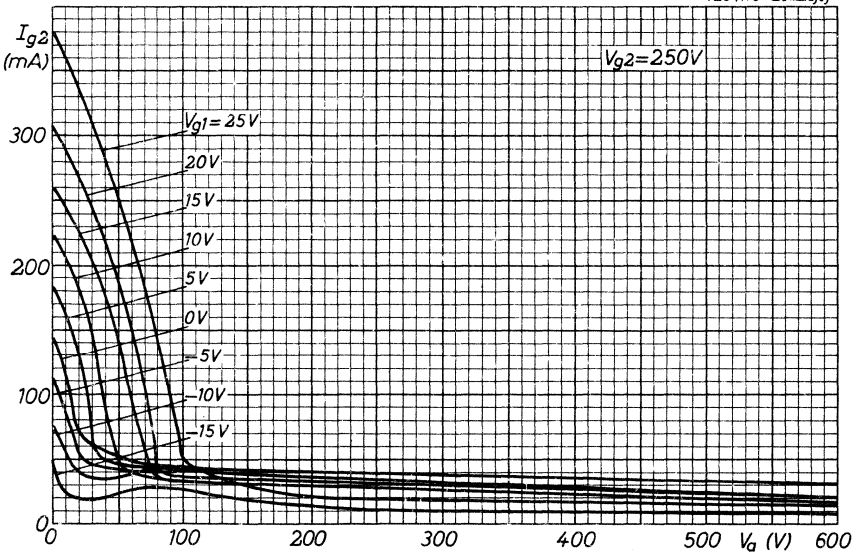
## OPERATING CONDITIONS; two systems in push-pull

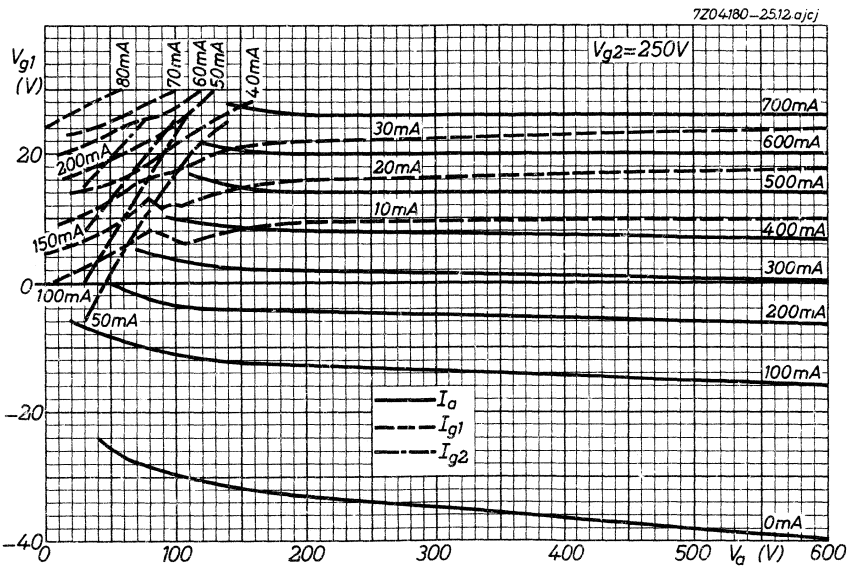
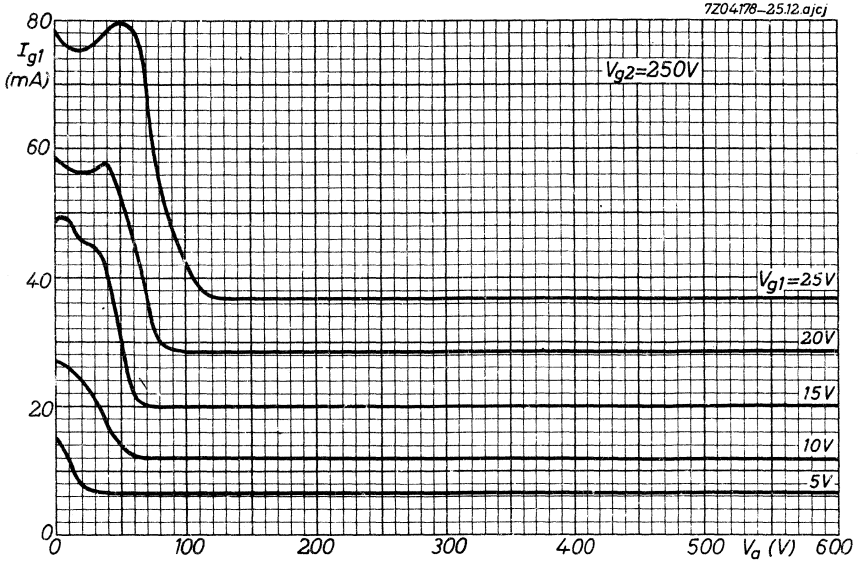
Frequency	$f$	=	CCS		157/470	MHz
			50/150	50/150		
Anode voltage	$V_a$	=	400	500	400	V
Grid No.2 voltage	$V_{g2}$	=	250	250	250	V
Grid No.1 voltage	$V_{g1}$	=	-150	-150	-175	V
Peak grid No.1 driving voltage	$V_{g1p}$	=	360	360	360	V
Anode current	$I_a$	=	2x72	2x60	2x65	mA
Grid No.2 current	$I_{g2}$	=	2x8	2x5	2x6	mA
Grid No.1 current	$I_{g1}$	=	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	$\eta$	=	31	33	31	%
Output power in the load	$W_l$	=	14.5	16	12	W

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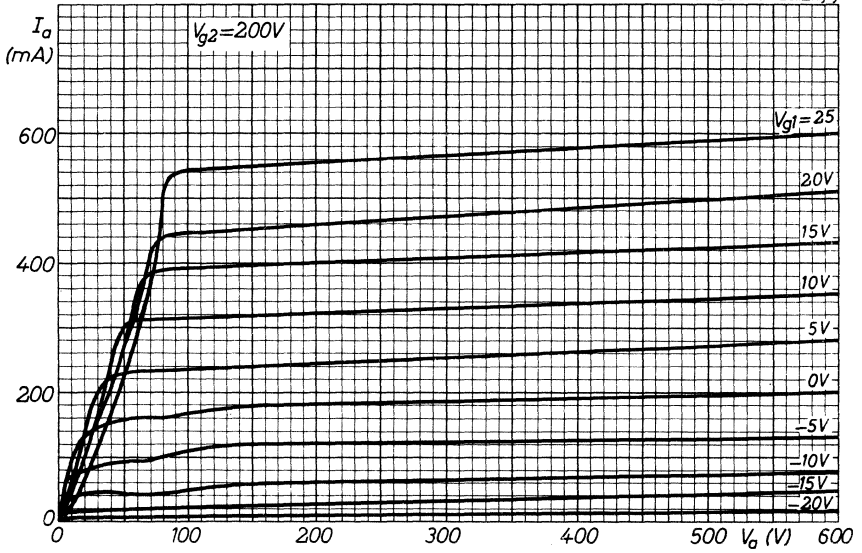


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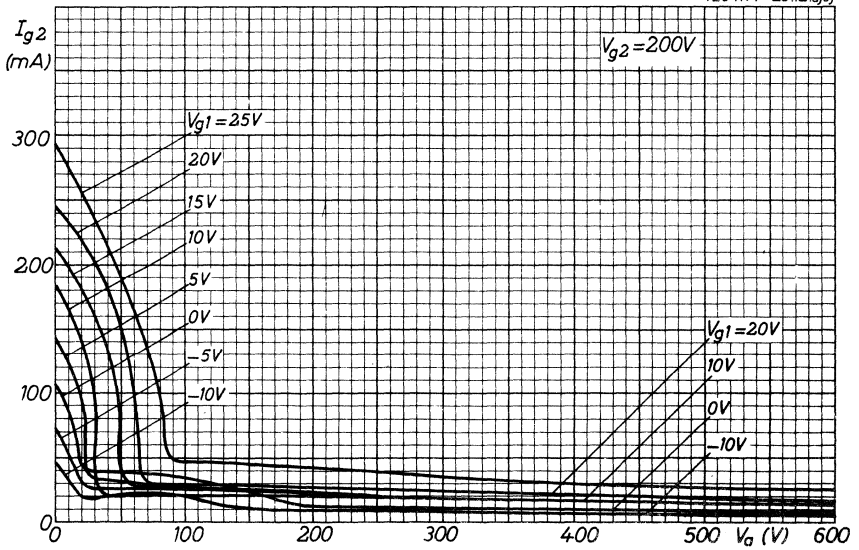




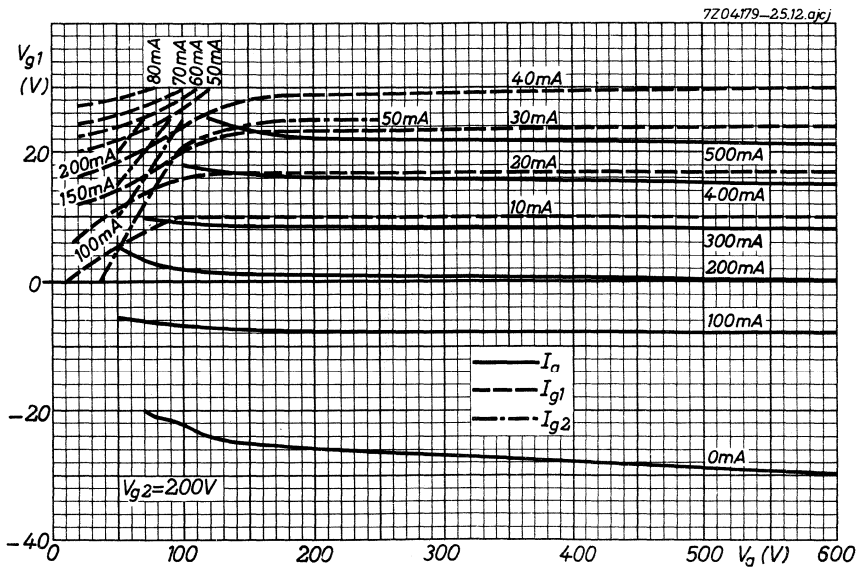
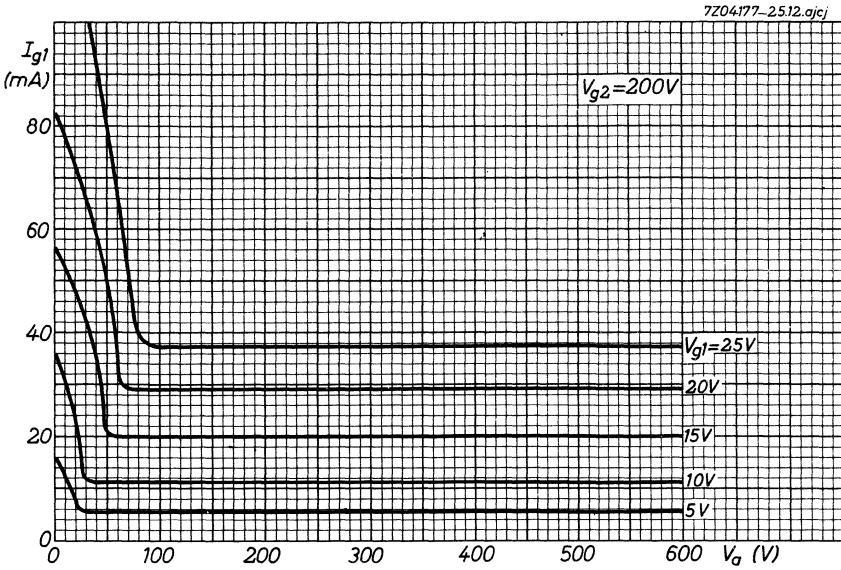
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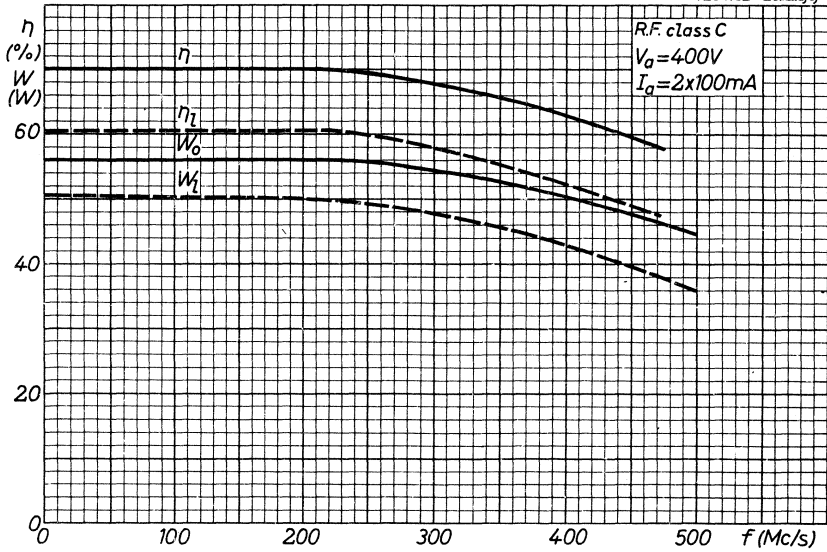
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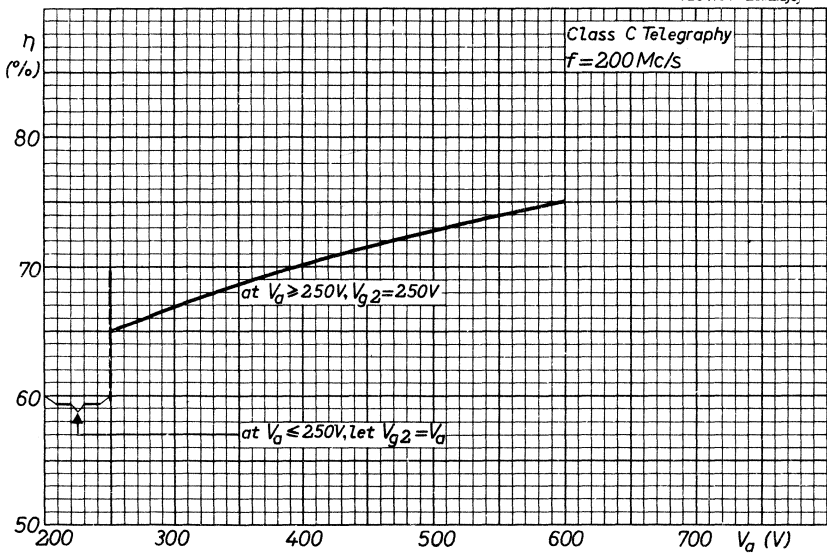


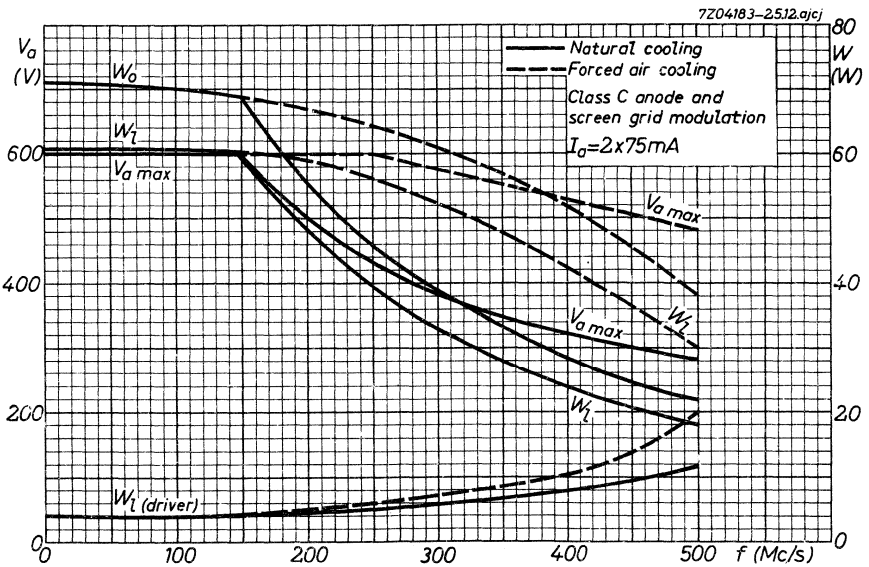
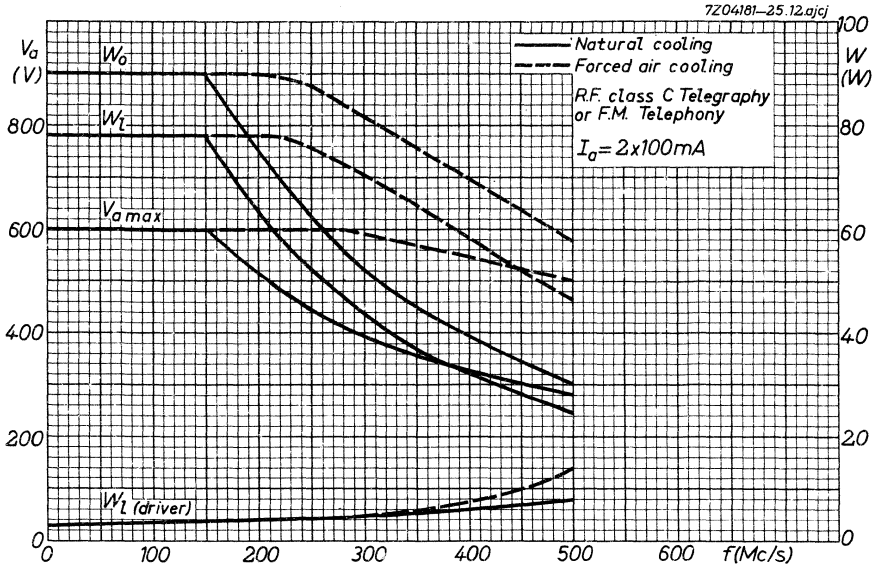


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## R.F. DOUBLE TETRODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.				C <sub>ag2</sub> mod.			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)
175	900	132	1000	163	750	85	800	107

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

Heater voltage	V <sub>f</sub>	=	6.3 V		12.6 V
Heater current	I <sub>f</sub>	=	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 <sub>a</sub>	=	3.2 pF
Grid No.1 to all other elements except anode	C <sub>g1</sub>	=	10.5 pF
Anode to grid No.1	C <sub>ag1</sub>	<	0.09 pF

For internal neutralization (C<sub>n</sub>, C<sub>n</sub>') please refer to the electrode connections

**TYPICAL CHARACTERISTICS** (each system)

Anode current	I <sub>a</sub>	=	30 mA
Mutual conductance	S	=	4.5 mA/V
Amplification factor	μ <sub>g2g1</sub>	=	8.2

<sup>1)</sup> 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<sup>3</sup>/min. will be sufficient.

**TEMPERATURE LIMITS** (Absolute limits)

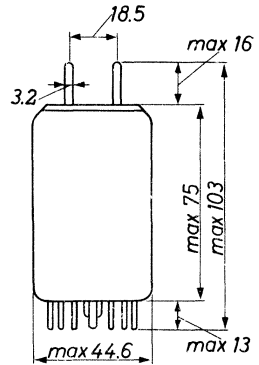
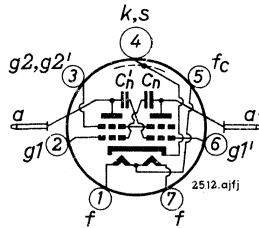
Temperature of bulb and anode seals = max. 250 °C

Temperature of base pin seals = max. 180 °C

**MECHANICAL DATA**

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

Dimensions in mm



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	$k\Omega$ <sup>1)</sup>
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	$k\Omega$
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	$\eta$	=	73	75	%
Useful power in the load	$W_p$	=	125	132	W

<sup>1)</sup> 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	$k\Omega$ <sup>1)</sup>
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	$k\Omega$
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	$\eta$	=	75	77	%
Useful power in the load	$W_{\phi}$	=	163	147	W

1) Each section



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

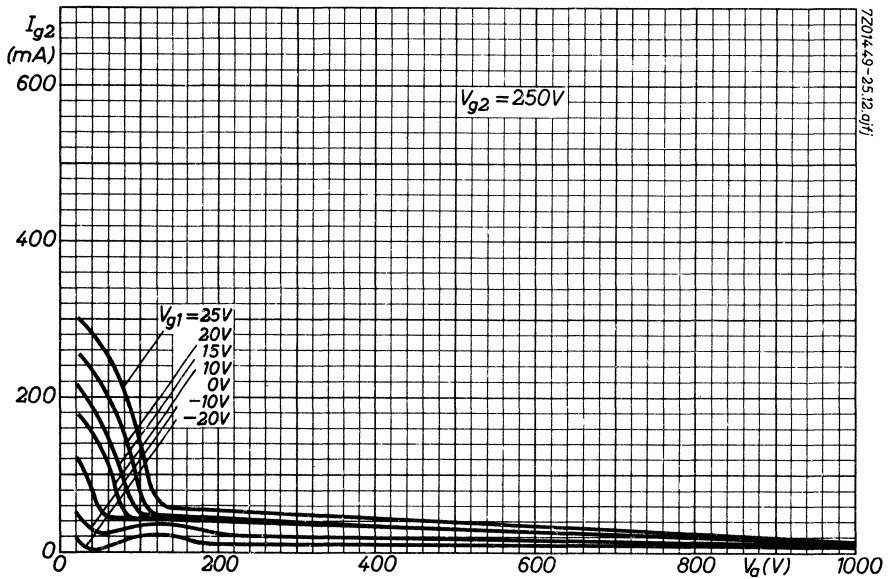
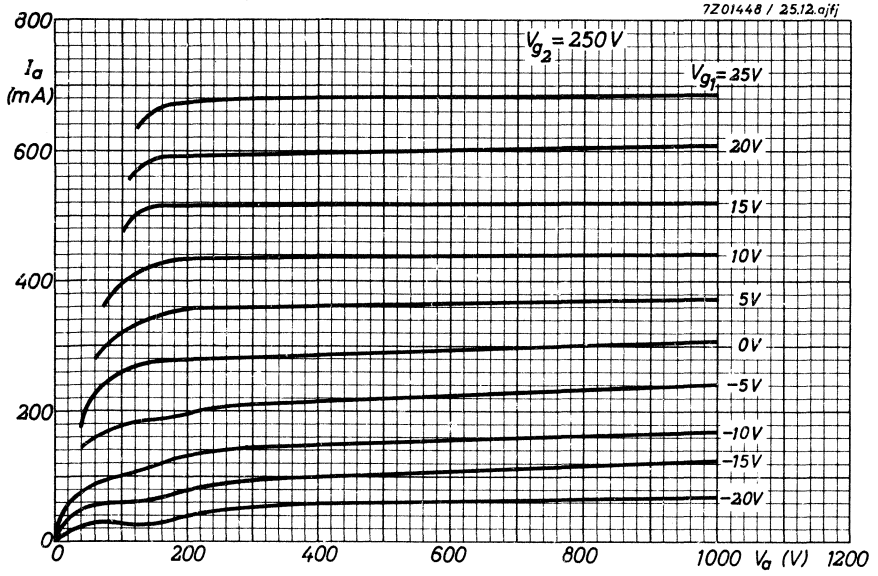
**LIMITING VALUES** (Absolute limits)

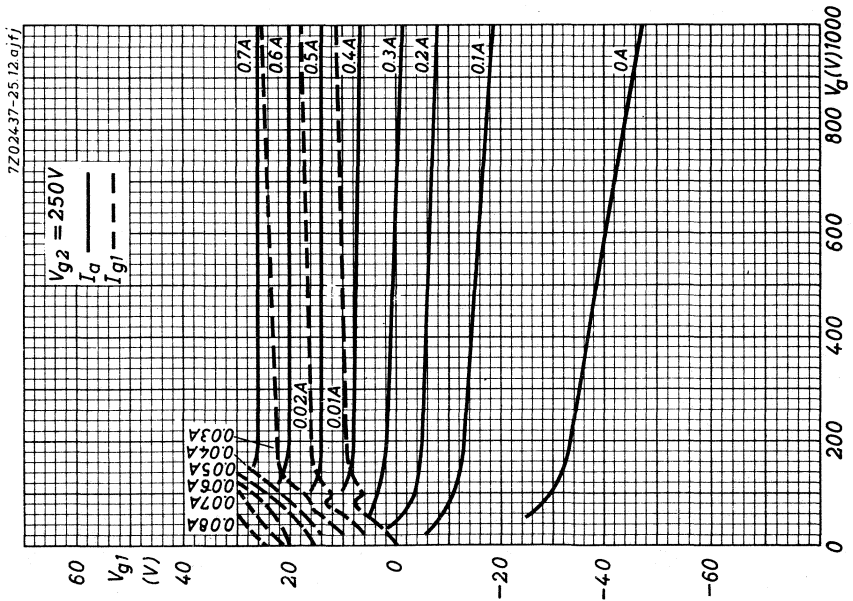
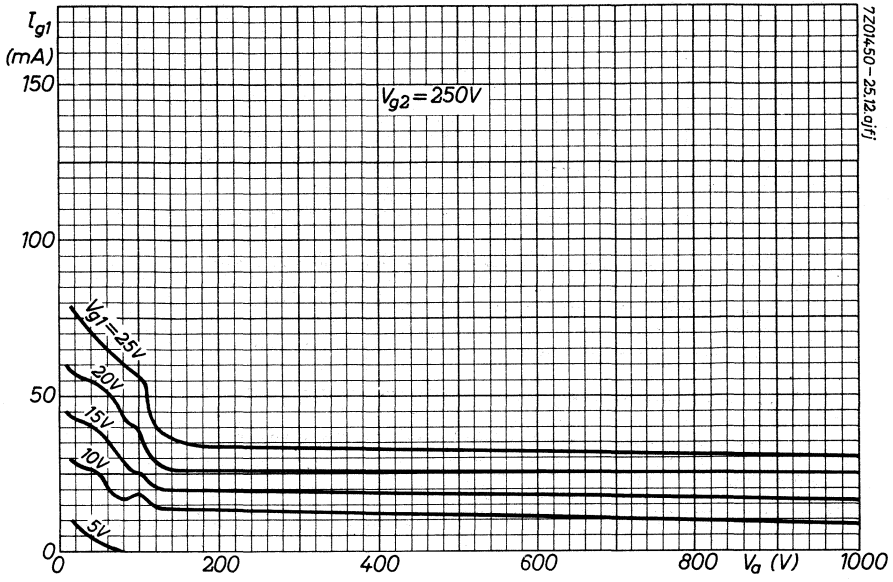
		C. C. S.	I. C. A. S.	
Frequency	f	up to 175	up to 175	MHz
Anode voltage	$V_a$	= max. 800	max. 800	V
Anode current	$I_a$	= max. 2x90	max. 2x100	mA
Anode dissipation	$W_a$	= max. 2x21	max. 2x23.5	W
Anode input power	$W_{ia}$	= max. 140	max. 160	W
Grids No.2 voltage	$V_{g_2, g_2'}$	= max. 250	max. 250	V
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	$k\Omega$ <sup>1)</sup>
Heater to cathode voltage	$V_{kf}$	= max. 100	max. 100	V

**OPERATING CONDITIONS**

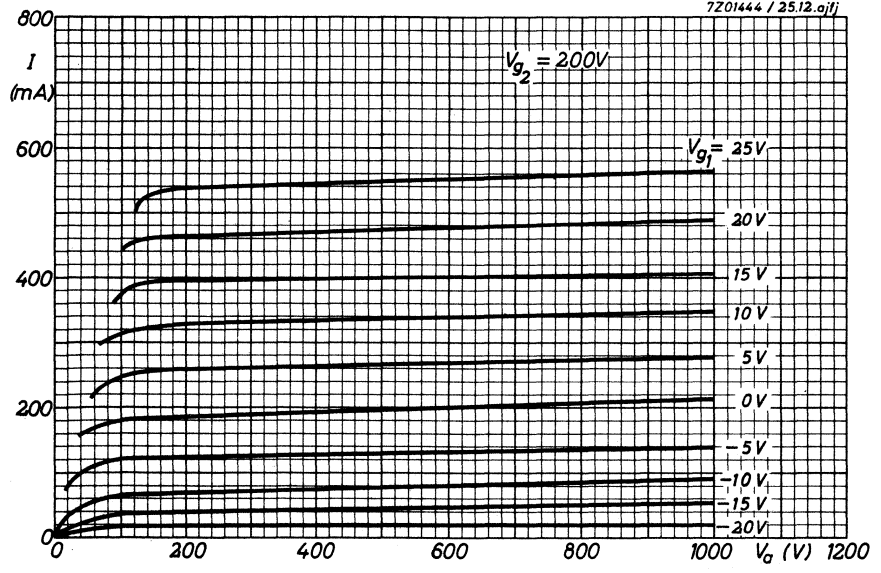
		C. C. S.	I. C. A. S.	
Frequency	f	= 175	175	MHz
Anode voltage	$V_a$	= 750	800	V
Grids No.2 voltage	$V_{g_2, g_2'}$	= 250	225	V
Grid No.1 voltage	$V_{g_1}$	= -66	-75	V
Common grids No.1 resistor	$R_{g_1, g_1'}$	= 15	15	$k\Omega$
Anode current	$I_a$	= 2x90	2x100	mA
Grids No.2 current	$I_{g_2+g_2'}$	= 10.2	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	$\eta$	= 72	74	%
Useful power in the load	$W_{\ell}$	= 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

<sup>1)</sup> Each section

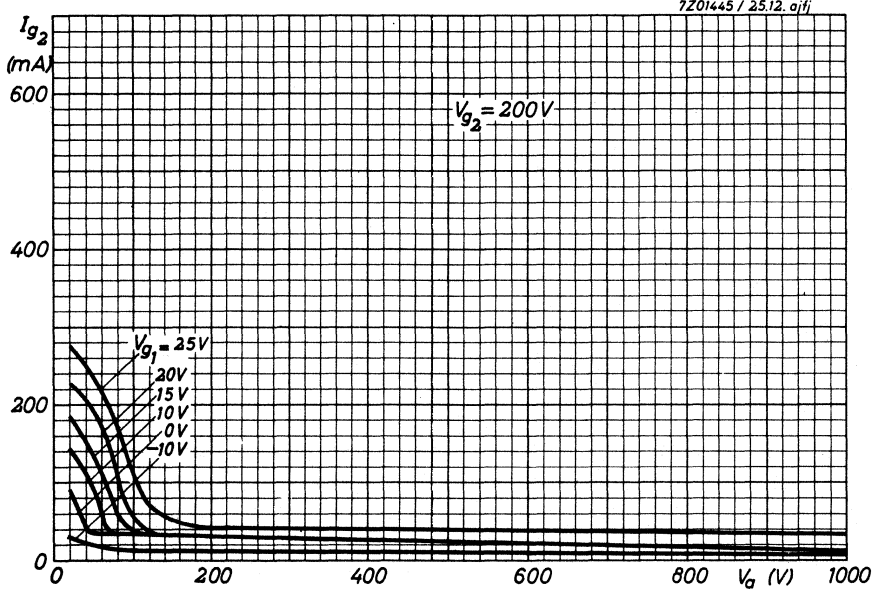


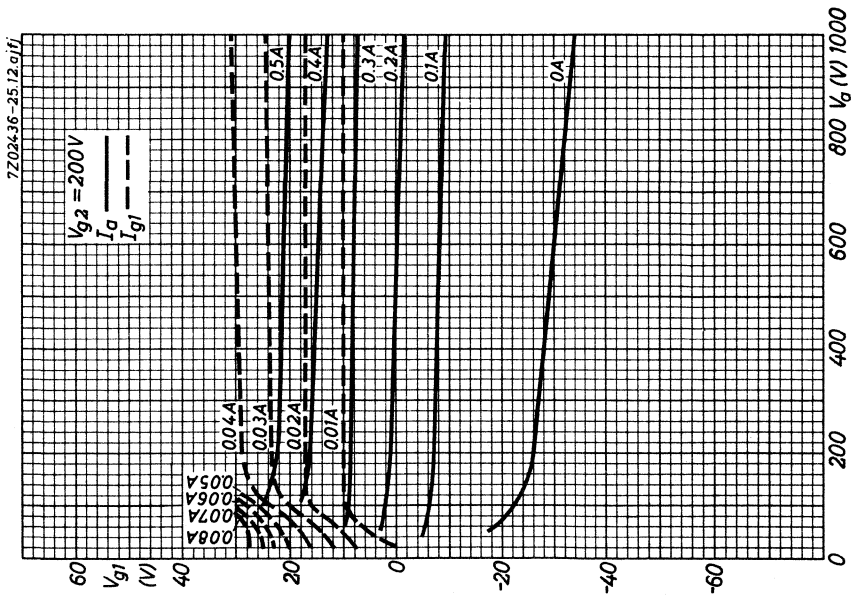
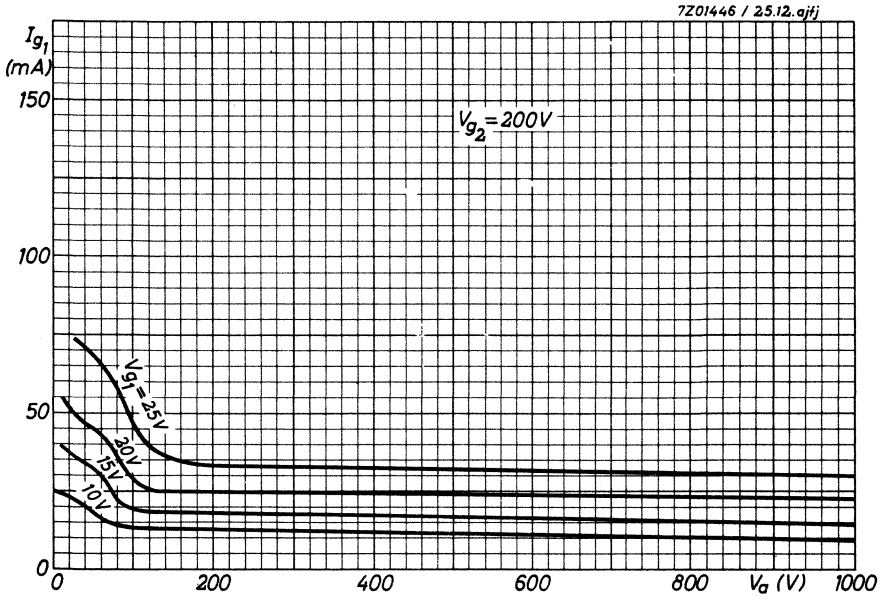


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## DOUBLE TETRODES

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				
ABI 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	$C_{g1} = 10.6$ pF
Anode to grid No.1	$C_{ag1} < 0.09$ pF

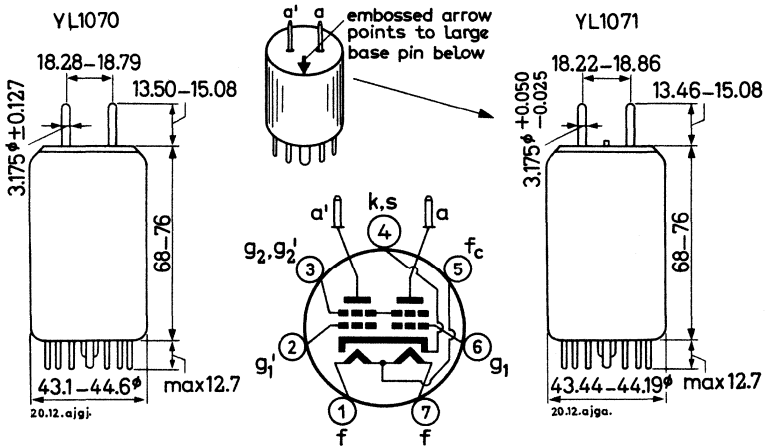
# YL 1070 YL 1071

## 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.  $0.6 \text{ m}^3/\text{min}$  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	W
Anode dissipation	$W_a$	= max. 30	max. 30	W
Anode current	$I_a$	= max. 110	max. 110	mA
Grid No.2 voltage	$V_{g2}$	= max. 300	max. 300	V
Grid No.2 dissipation	$W_{g2}$	= max. 7	max. 7	W
Negative grid No.1 voltage	$-V_{g1}$	= max. 175	max. 175	V
Grid No.1 current	$I_{g1}$	= 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	$V_{g2}$	= max. 360	max. 360	V
Grid No.2 dissipation	$W_{g2}$	= max. 3.5	max. 4	W
Negative grid No.1 voltage	$-V_{g1}$	= max. 175	max. 175	V
Grid No.1 current	$I_{g1}$	= 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.			
			zero signal	single tone	two tone
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 <sup>1)</sup>
Load resistance	$R_{a\sim}$	=	3100		$\Omega$
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 <sup>2)</sup> W
Intermodulation distortion					
of the third order	$d_{i_3}$	=	-	-	< -30 dB <sup>3)</sup>
of the fifth order	$d_{i_5}$	=	-	-	< -45 dB <sup>3)</sup>

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.

**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 <sup>1)</sup>
Load resistance	$R_a$	=	2300	$\Omega$
			<div style="border-top: 1px solid black; width: 100%; margin: 0 auto;"></div> zero      single      two signal    tone      tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	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	$W_{i_{a+a'}}$	=	40	158 104 W
Anode dissipation	$W_{a+a'}$	=	40	46 43 W
Output power	$W_o$	=	-	112 112 <sup>2)</sup> W
Intermodulation distortion				
of the third order	$d_{i_3}$	=	-	- < -30 dB <sup>3)</sup>
of the fifth order	$d_{i_5}$	=	-	- < -45 dB <sup>3)</sup>

<sup>1)</sup> Adjust to obtain the stated zero signal anode current.

<sup>2)</sup> Peak envelope power value

<sup>3)</sup> 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.

**OPERATING CONDITIONS** (two sections in parallel) (continued)

<u>Table C</u>		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 <sup>1)</sup>
Load resistance	$R_a$	=	1410 $\Omega$	
			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 <sup>2)</sup> W
Intermodulation distortion				
of the third order	$d_{i_3}$	=	-	- < -30 dB <sup>3)</sup>
of the fifth order	$d_{i_5}$	=	-	- < -45 dB <sup>3)</sup>

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.

OPERATING CONDITIONS (two sections in parallel) (continued)

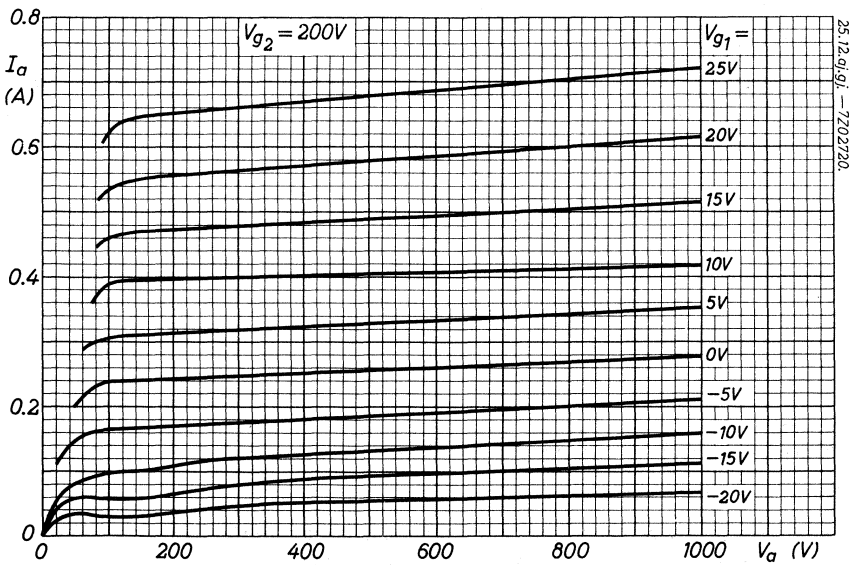
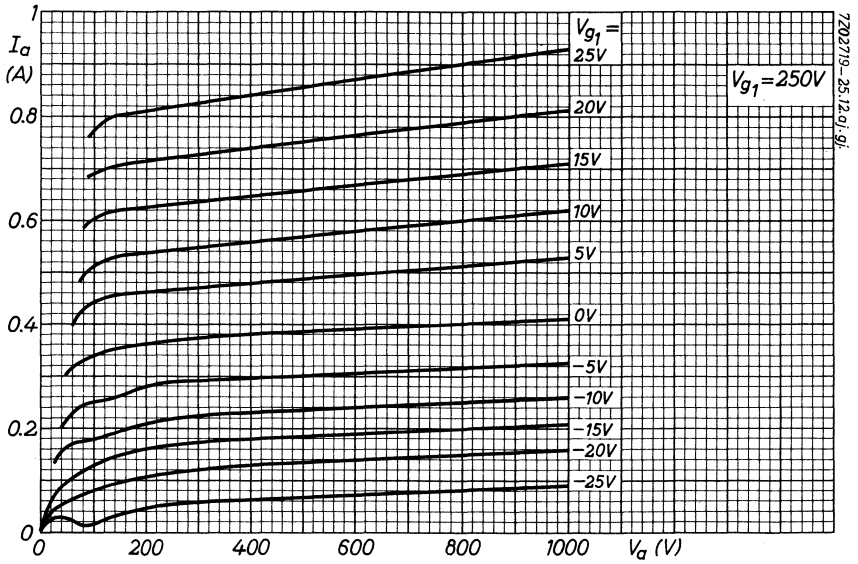
Table D		I. C. A. S.		
Frequency	$f$	=	7	MHz
Anode voltage	$V_a$	=	1000	V
Grid No. 2 voltage	$V_{g_2}$	=	250	V
Grid No. 1 voltage	$V_{g_1}$	=	-36	V <sup>1)</sup>
Load resistance	$R_a$	=	3000	$\Omega$
			<div style="border-top: 1px solid black; width: 100%; margin: 0 auto;"></div> zero      single      two signal    tone      tone	
Peak grid No. 1 driving voltage	$V_{g_{1\sim p}}$	=	0	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	$W_{i_{a+a'}}$	=	55	216 144 W
Anode dissipation	$W_{a+a'}$	=	55	58 65 W
Output power	$W_o$	=	-	158 158 <sup>2)</sup> W
Intermodulation distortion				
of the third order	$d_{i_3}$	=	-	-
of the fifth order	$d_{i_5}$	=	-	-
				< -30 dB <sup>3)</sup>
				< -45 dB <sup>3)</sup>

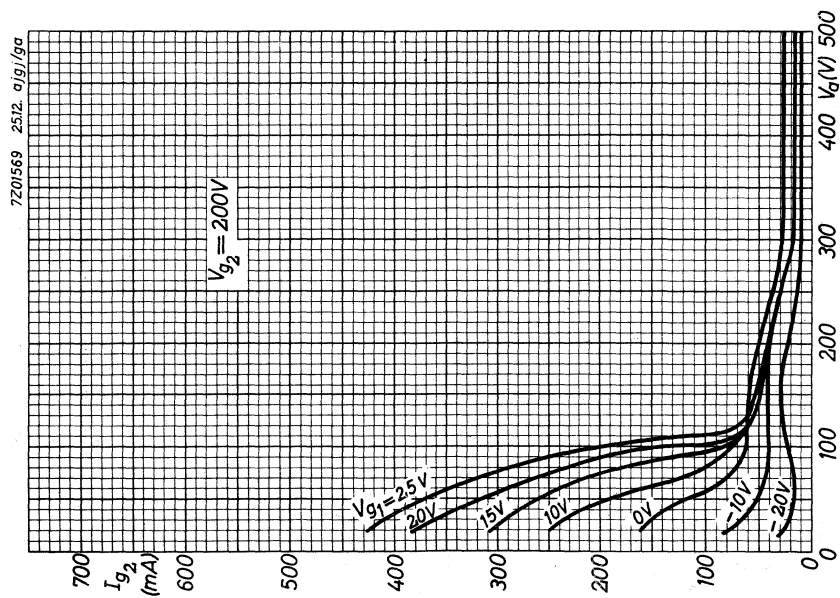
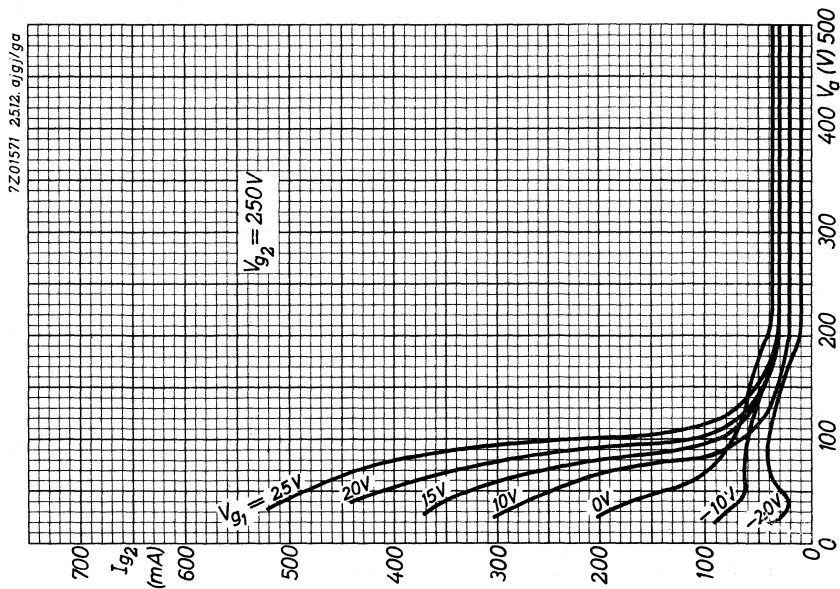
<sup>1)</sup> Adjust to obtain the stated zero signal anode current.

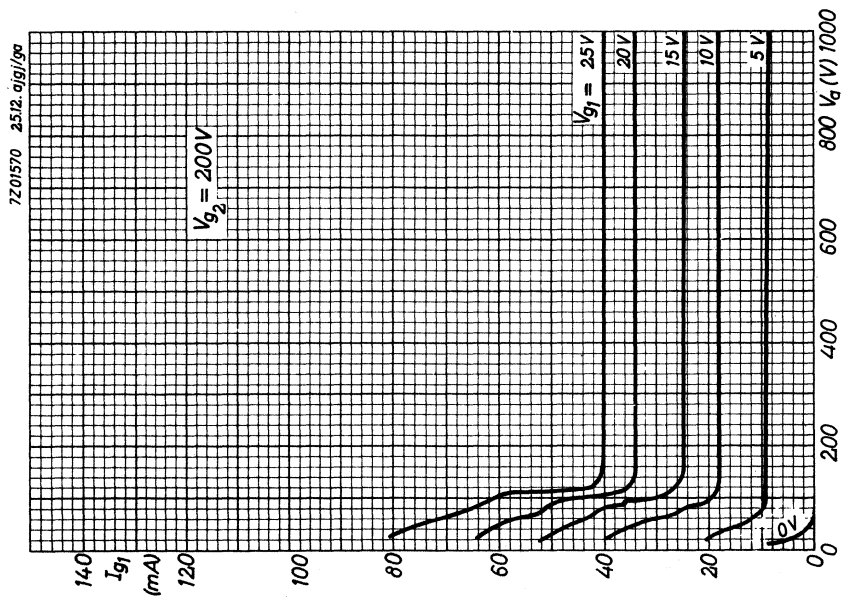
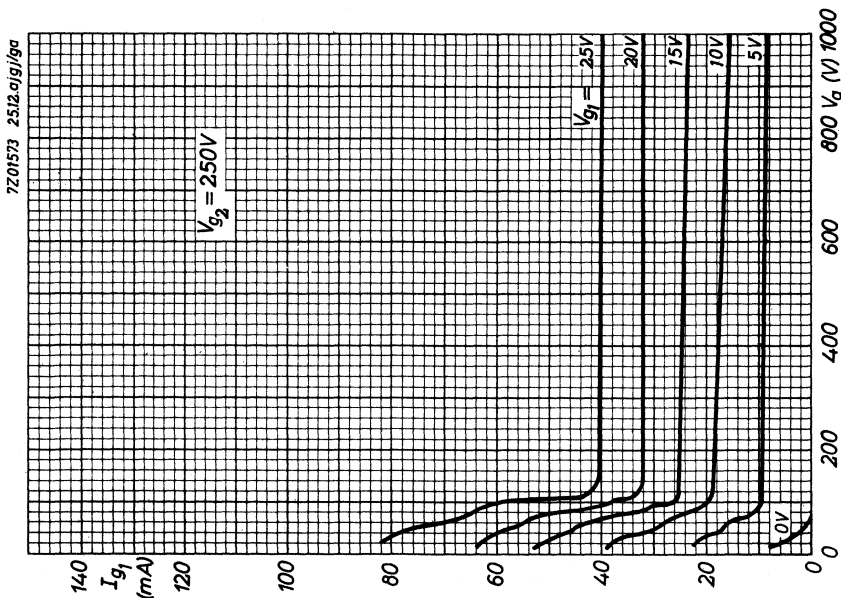
<sup>2)</sup> Peak envelope power value.

<sup>3)</sup> 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.

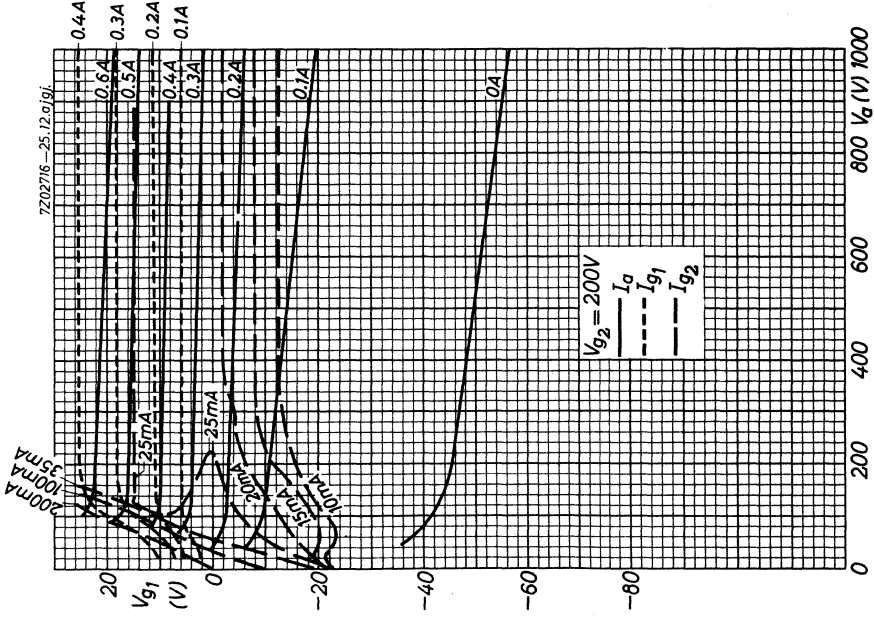
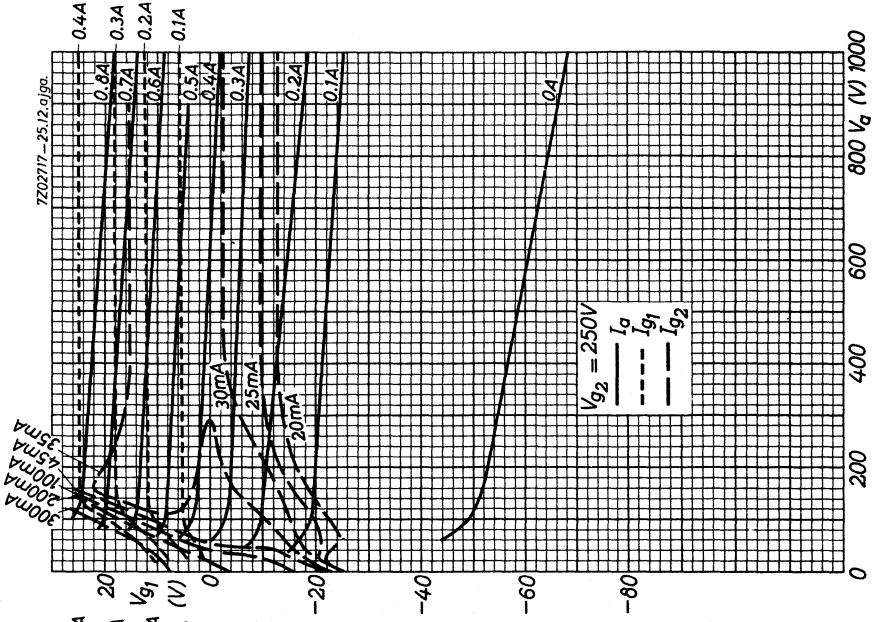
YL 1070  
YL 1071



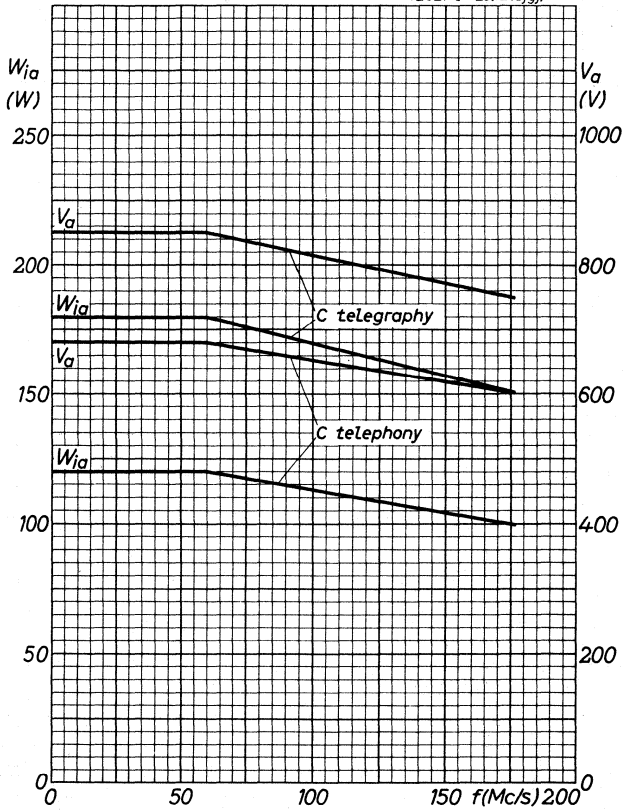








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## QUICK HEATING R.F. DOUBLE TETRODE

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 <sub>2</sub> modulator			R.F. class C freq. multiplier		
	V <sub>a</sub> (V)	W <sub>dr</sub> <sup>1)</sup> (W)	W <sub>l</sub> <sup>2)</sup> (W)	V <sub>a</sub> (V)	W <sub>dr</sub> <sup>1)</sup> (W)	W <sub>l</sub> <sup>2)</sup> (W)	V <sub>a</sub> (V)	W <sub>dr</sub> <sup>1)</sup> (W)	W <sub>l</sub> <sup>2)</sup> (W)
200	300	1.0	12	200	1.0	7.0			
67/200							300	1.0	3.5

**HEATING:** direct by A.C. or D.C.; parallel or series supply  
Filament oxide coated, 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  $V_f = 1.6 \text{ V} \pm 15\%$ <sup>3)</sup>

Filament current  $I_f = 2.5 \text{ A}$

Heating time for  $W_o = 70\%$  of full output power  $T_h < 0.5 \text{ sec}$

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

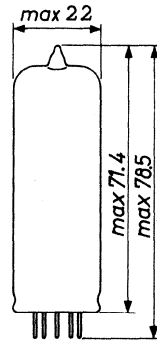
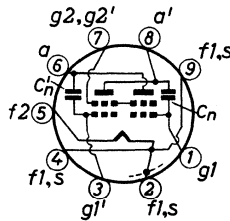
The tube is internally neutralised up to 200 MHz

## TYPICAL CHARACTERISTICS

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

## 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	k $\Omega$
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	k $\Omega$
Grid No. 1 voltage	$V_{g_1}$	=	-40	-	-	V
Common grid No. 1 resistor	$R_{g_1}$	=	-	18	15	k $\Omega$
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	$\eta$	=	65	65	60	%
Output power in the load	$W_l$	=	12	9.0	7.4	W

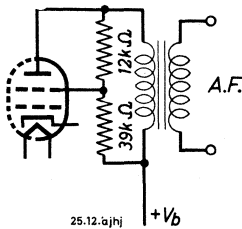
**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**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	$V_{g_1g_1'p}$	=	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	$W_{i_a}$	=	2 x 6.7 W
Anode dissipation	$W_a$	=	2 x 2.65 W
Tube efficiency	$\eta$	=	60 %
Useful power in the load	$W_\ell$	=	7.0 W
Modulation depth	m	=	100 %
Modulation power	$W_{mod}$	=	6.7 W

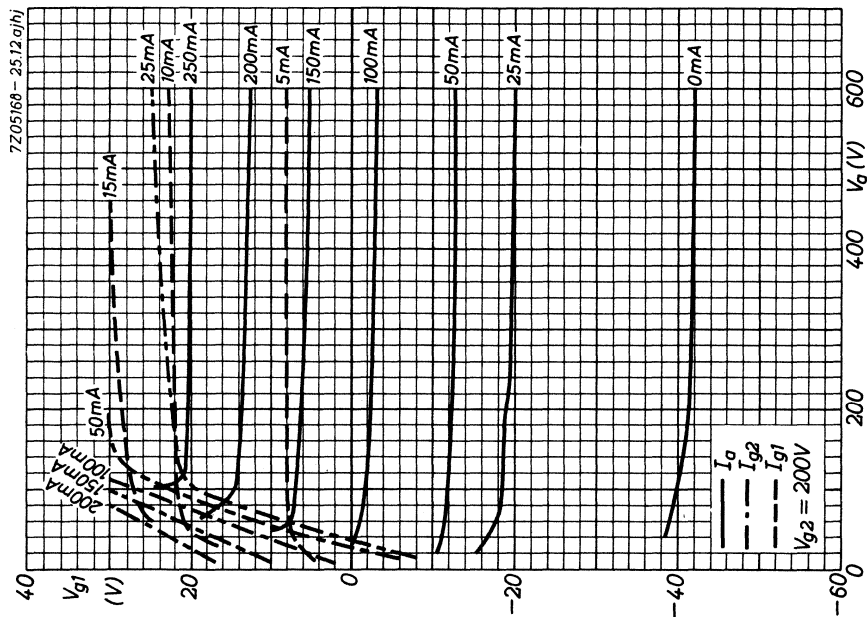
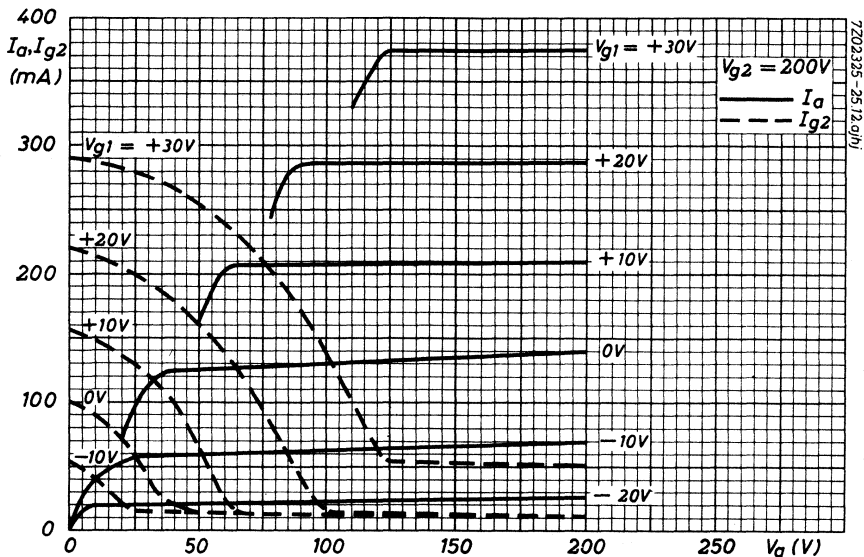


**R.F. CLASS C FREQUENCY TRIPLER****LIMITING VALUES** (each system; absolute limits)

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	k $\Omega$
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	k $\Omega$
Grid No. 1 voltage	$V_{g_1}$	=	-100	-	-	V
Common grid No. 1 resistor	$R_{g_1}$	=	-	47	33	k $\Omega$
Peak grid-to-grid A. C. voltage	$V_{g_1 g_1'}$	=	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	$\eta$	=	45	40	33.5	%
Output power in the load	$W_l$	=	3.5	3.0	2.8	W





## WATER COOLED R.F. POWER TETRODE

Water 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 <sub>a-g<sub>2</sub></sub> mod.		Class B mod.	
	V <sub>a</sub> (kV)	W <sub>o</sub> (kW) P. E. P.	V <sub>a</sub> (kV)	W <sub>o</sub> (kW)	V <sub>a</sub> (kV)	W <sub>o</sub> (kW)
30	9	120	11	220	11	320

**HEATING :** Direct, filament thoriated tungsten

Filament voltage	V <sub>f</sub>	21 V
Filament current	I <sub>f</sub>	350 A

### CAPACITANCES

Anode to all except grid No.1	C <sub>a(g<sub>1</sub>)</sub>	120 pF
Grid No.1 to all except anode	C <sub>g<sub>1</sub>(a)</sub>	600 pF
Anode to grid No.1	C <sub>ag<sub>1</sub></sub>	8.5 pF <sup>1)</sup>

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	3 kV
Grid No.2 voltage	V <sub>g<sub>2</sub></sub>	1 kV
Anode current	I <sub>a</sub>	10 A
Transconductance	S	130 mA/V
Amplification factor	μ <sub>g<sub>2</sub>g<sub>1</sub></sub>	4 -

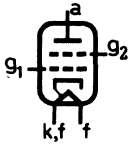
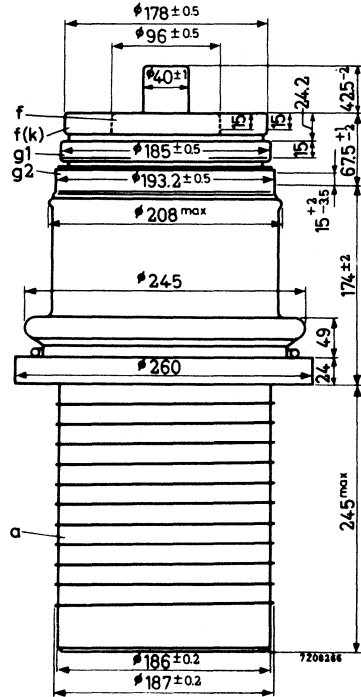
<sup>1)</sup> Measured with a flat shield of 500 mm diameter in the plane of grid No.2

## MECHANICAL DATA

Dimensions in mm

Net weight: approx. 33 kg

Mounting position: vertical with anode down



## ACCESSORIES

- |  |            |
|--|------------|
| Water jacket                                     | type K734  |
| 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	$V_{g2}$	max.	1.6	kV
Grid No.1 voltage	$-V_{g1}$	max.	800	V
Anode current	$I_a$	max.	40	A
Grid No.1 current	$I_{g1}$	max.	3	A
Anode input power	$W_{i_a}$	max.	360	kW
Anode dissipation	$W_a$	max.	120	kW
Grid No.2 dissipation	$W_{g2}$	max.	2.7	kW
Grid No.1 dissipation	$W_{g1}$	max.	1.2	kW

**OPERATING CONDITIONS**

Frequency	f	30	MHz	
Anode voltage	$V_a$	9	kV	
Grid No.2 voltage	$V_{g2}$	1.5	kV	
Grid No.1 voltage	$V_{g1}$	-450	V <sup>1)</sup>	
		zero signal	single tone	double tone
Grid No.1 driving voltage	$V_{g1p}$	0	450	450 V
Anode current	$I_a$	5	21	13.2 A
Grid No.2 current	$I_{g2}$	0	0.8	0.5 A
Anode input power	$W_{i_a}$	45	189	118.8 kW
Anode dissipation	$W_a$	45	69	58.8 kW
Grid No.2 dissipation	$W_{g2}$	0	1.2	0.75 kW
Output power (P.E.P.)	$W_o$	-	120	120 kW

<sup>1)</sup> 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	$V_{g2}$	max.	1 kV
Grid No.1 voltage	$-V_{g1}$	max.	800 V
Anode current	$I_a$	max.	32 A
Grid No.1 current	$I_{g1}$	max.	3 A
Anode input power	$W_{i_a}$	max.	300 kW
Anode dissipation	$W_a$	max.	80 kW
Grid No.2 dissipation	$W_{g2}$	max.	2.7 kW
Grid No.1 dissipation	$W_{g1}$	max.	1.2 kW

**OPERATING CONDITIONS**

Frequency	f	30 MHz
Anode voltage	$V_a$	11 kV
Grid No.2 voltage	$V_{g2}$	800 V
Grid No.1 voltage	$V_{g1}$	-590 V
Grid No.1 resistor	$R_{g1}$	60 $\Omega$
Grid No.1 driving voltage	$V_{g1p}$	960 V
Anode current	$I_a$	25 A
Grid No.2 current	$I_{g2}$	3 A
Grid No.1 current	$I_{g1}$	1.6 A
Driving power	$W_{dr}$	1.4 kW
Grid No.2 dissipation	$W_{g2}$	2.4 kW
Anode input power	$W_{i_a}$	275 kW
Output power	$W_o$	220 kW
Anode dissipation	$W_a$	55 kW
Efficiency	$\eta$	80 %
-----		
Modulation depth	m	100 %
Modulation power	$W_{mod}$	140 kW
Grid No.2 voltage, peak	$V_{g2p}$	700 V

**A.F. CLASS B AMPLIFIER AND MODULATOR**

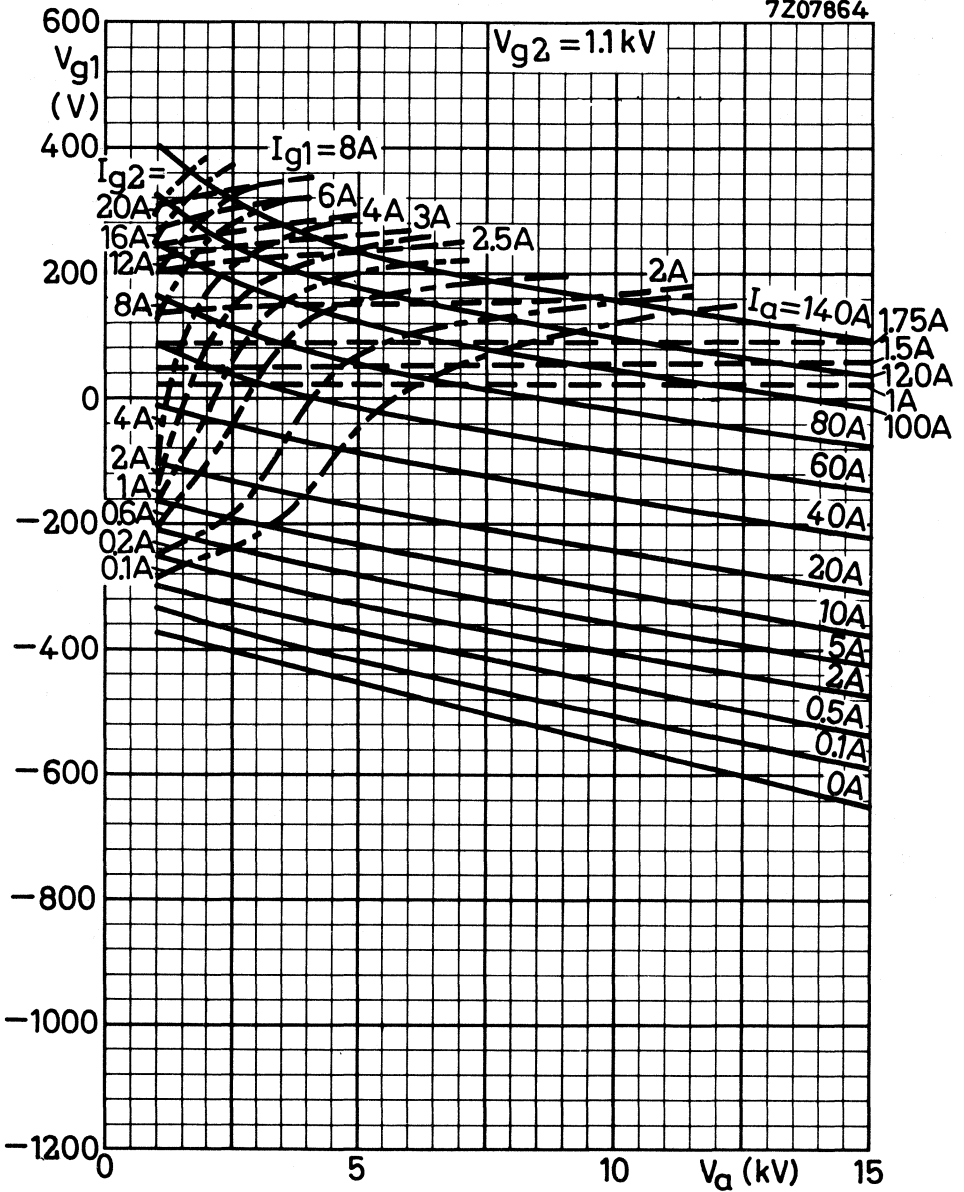
**LIMITING VALUES** (Absolute max. rating system)

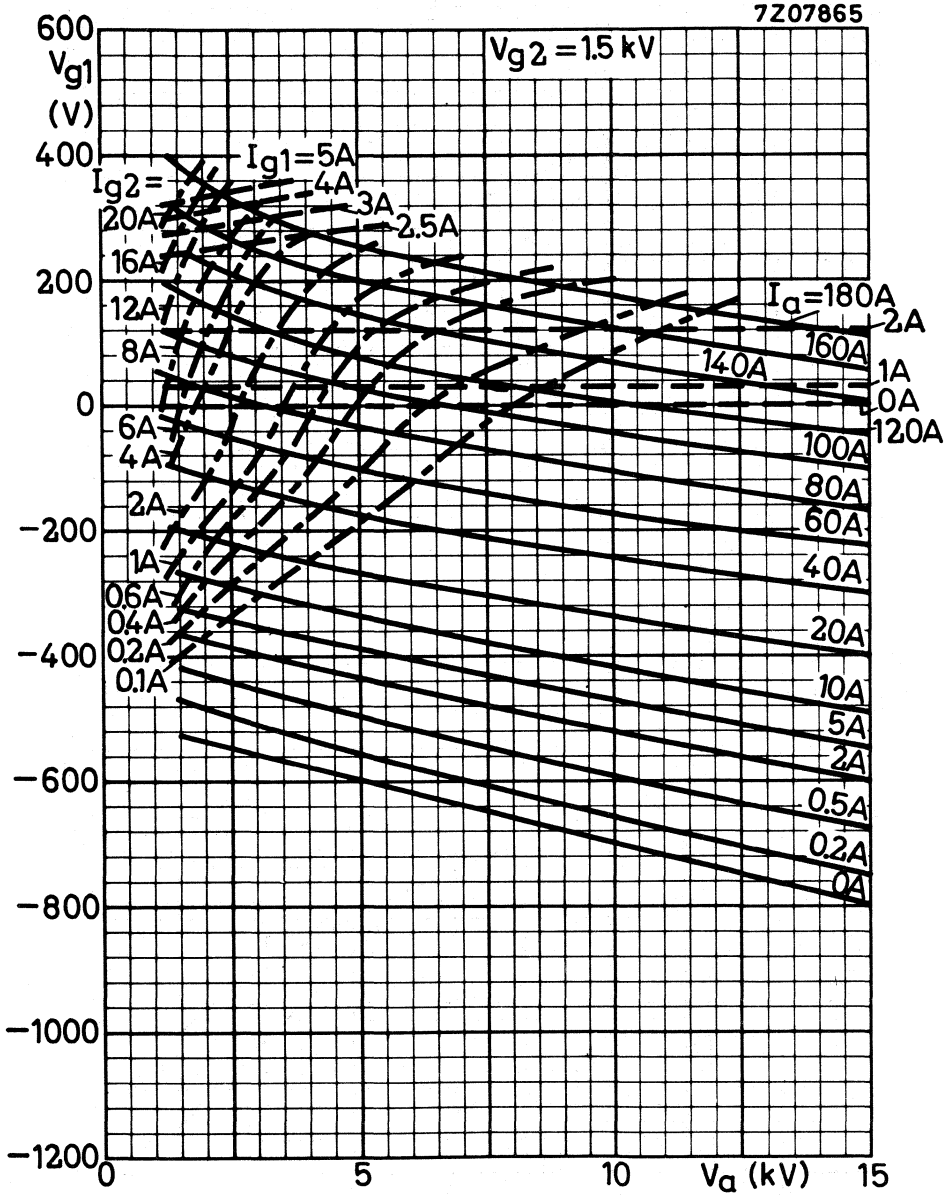
Anode voltage	$V_a$	max.	12	kV
Anode input power	$W_{ia}$	max.	300	kW
Anode dissipation	$W_a$	max.	120	kW
Cathode current	$I_k$	max.	50	A
Cathode current (peak)	$I_{kp}$	max.	280	A
Grid No. 2 voltage	$V_{g2}$	max.	1.7	kV
Grid No. 2 dissipation	$W_{g2}$	max.	2.7	kW
Grid No. 1 resistance	$R_{g1}$	max.	1	k $\Omega$
Grid No. 1 dissipation	$W_{g1}$	max.	1.2	kW

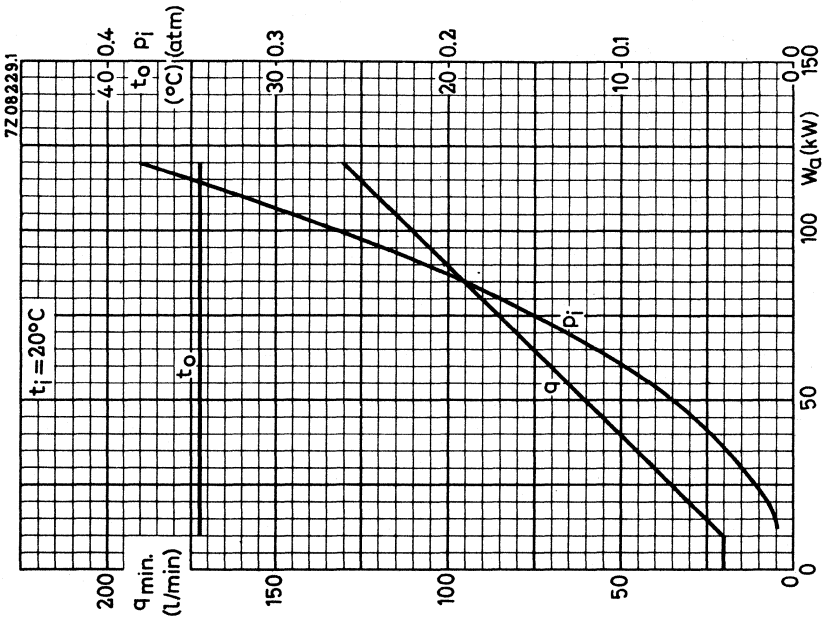
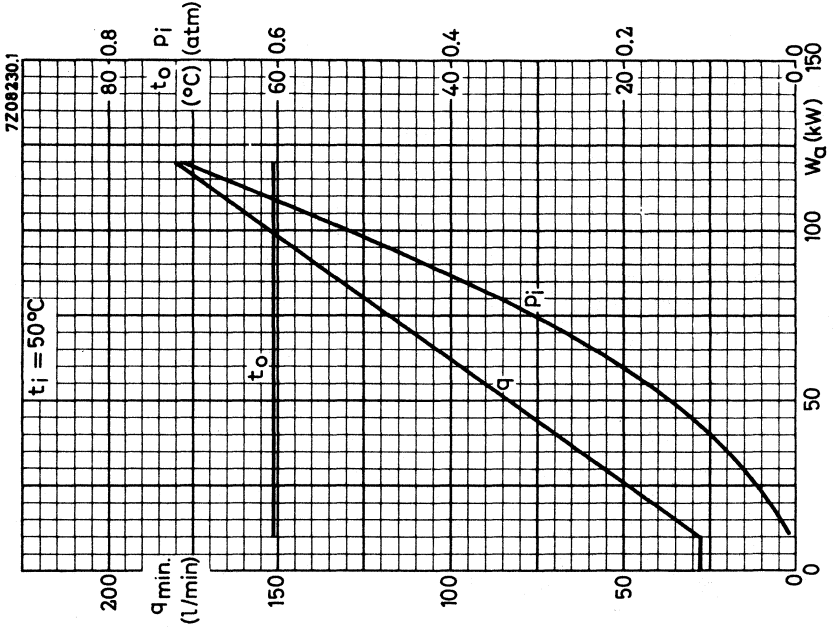
**OPERATING CONDITIONS** two tubes in push-pull

Anode voltage	$V_a$	11	11	kV		
Grid No. 2 voltage	$V_{g2}$	1.5	1.5	kV		
Grid No. 1 voltage	$V_{g1}$	-520	-520	V		
Load resistance	$R_{aa\sim}$	500	670	$\Omega$		
Peak driving voltage	$V_{g1g1p}$	0	1100	0	950	V
Anode current	$I_a$	2x3	2x22	2x3	2x16.5	A
Grid No. 2 current	$I_{g2}$	0	2x0.45	0	2x0.35	A
Grid No. 1 current	$I_{g1}$	0	2x0.04	0	0	A
Grid No. 2 dissipation	$W_{g2}$	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	$\eta$		66		66	%

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## 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 <sub>a-g<sub>2</sub></sub> mod.		Class B mod.	
	V <sub>a</sub> (kV)	W <sub>o</sub> (kW) P. E. P.	V <sub>a</sub> (kV)	W <sub>o</sub> (kW)	V <sub>a</sub> (kV)	W <sub>o</sub> (kW)
30	9	120	11	220	11	320

**HEATING:** Direct, filament thoriated tungsten

Filament voltage	V <sub>f</sub>	21 V
Filament current	I <sub>f</sub>	350 A

### CAPACITANCES

Anode to all except grid No.1	C <sub>a(g<sub>1</sub>)</sub>	120 pF
Grid No.1 to all except anode	C <sub>g<sub>1</sub>(a)</sub>	600 pF
Anode to grid No.1	C <sub>ag<sub>1</sub></sub>	8.5 pF <sup>1)</sup>

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	3 kV
Grid No.2 voltage	V <sub>g<sub>2</sub></sub>	1 kV
Anode current	I <sub>a</sub>	10 A
Transconductance	S	130 mA/V
Amplification factor	μ <sub>g<sub>2</sub>g<sub>1</sub></sub>	4 -

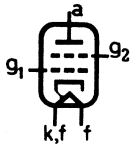
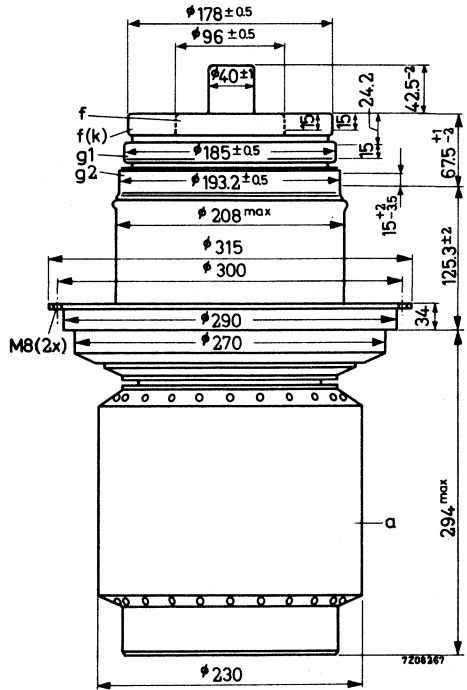
<sup>1)</sup> Measured with a flat shield of 500 mm diameter in the plane of grid No.2

**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	$V_{g2}$	max.	1.6	kV
Grid No.1 voltage	$-V_{g1}$	max.	800	V
Anode current	$I_a$	max.	40	A
Grid No.1 current	$I_{g1}$	max.	3	A
Anode input power	$W_{i_a}$	max.	360	kW
Anode dissipation	$W_a$	max.	150	kW
Grid No.2 dissipation	$W_{g2}$	max.	2.7	kW
Grid No.1 dissipation	$W_{g1}$	max.	1.2	kW

**OPERATING CONDITIONS**

Frequency	f	30	MHz	
Anode voltage	$V_a$	9	kV	
Grid No.2 voltage	$V_{g2}$	1.5	kV	
Grid No.1 voltage	$V_{g1}$	-450	V <sup>1)</sup>	
		zero signal	single tone	double tone
Grid No.1 driving voltage	$V_{g1p}$	0	450	450 V
Anode current	$I_a$	5	21	13.2 A
Grid No.2 current	$I_{g2}$	0	0.8	0.5 A
Anode input power	$W_{i_a}$	45	189	118.8 kW
Anode dissipation	$W_a$	45	69	58.8 kW
Grid No.2 dissipation	$W_{g2}$	0	1.2	0.75 kW
Output power (P.E.P.)	$W_o$	-	120	120 kW

<sup>1)</sup> 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	$V_{g2}$	max.	1	kV
Grid No.1 voltage	$-V_{g1}$	max.	800	V
Anode current	$I_a$	max.	32	A
Grid No.1 current	$I_{g1}$	max.	3	A
Anode input power	$W_{i_a}$	max.	300	kW
Anode dissipation	$W_a$	max.	100	kW
Grid No.2 dissipation	$W_{g2}$	max.	2.7	kW
Grid No.1 dissipation	$W_{g1}$	max.	1.2	kW

**OPERATING CONDITIONS**

Frequency	f	30	MHz
Anode voltage	$V_a$	11	kV
Grid No.2 voltage	$V_{g2}$	800	V
Grid No.1 voltage	$V_{g1}$	-590	V
Grid No.1 resistor	$R_{g1}$	60	$\Omega$
Grid No.1 driving voltage	$V_{g1p}$	960	V
Anode current	$I_a$	25	A
Grid No.2 current	$I_{g2}$	3	A
Grid No.1 current	$I_{g1}$	1.6	A
Driving power	$W_{dr}$	1.4	kW
Grid No.2 dissipation	$W_{g2}$	2.4	kW
Anode input power	$W_{i_a}$	275	kW
Output power	$W_o$	220	kW
Anode dissipation	$W_a$	55	kW
Efficiency	$\eta$	80	%
<hr style="border-top: 1px dashed black;"/>			
Modulation depth	m	100	%
Modulation power	$W_{mod}$	140	kW
Grid No.2 voltage, peak	$V_{g2p}$	700	V

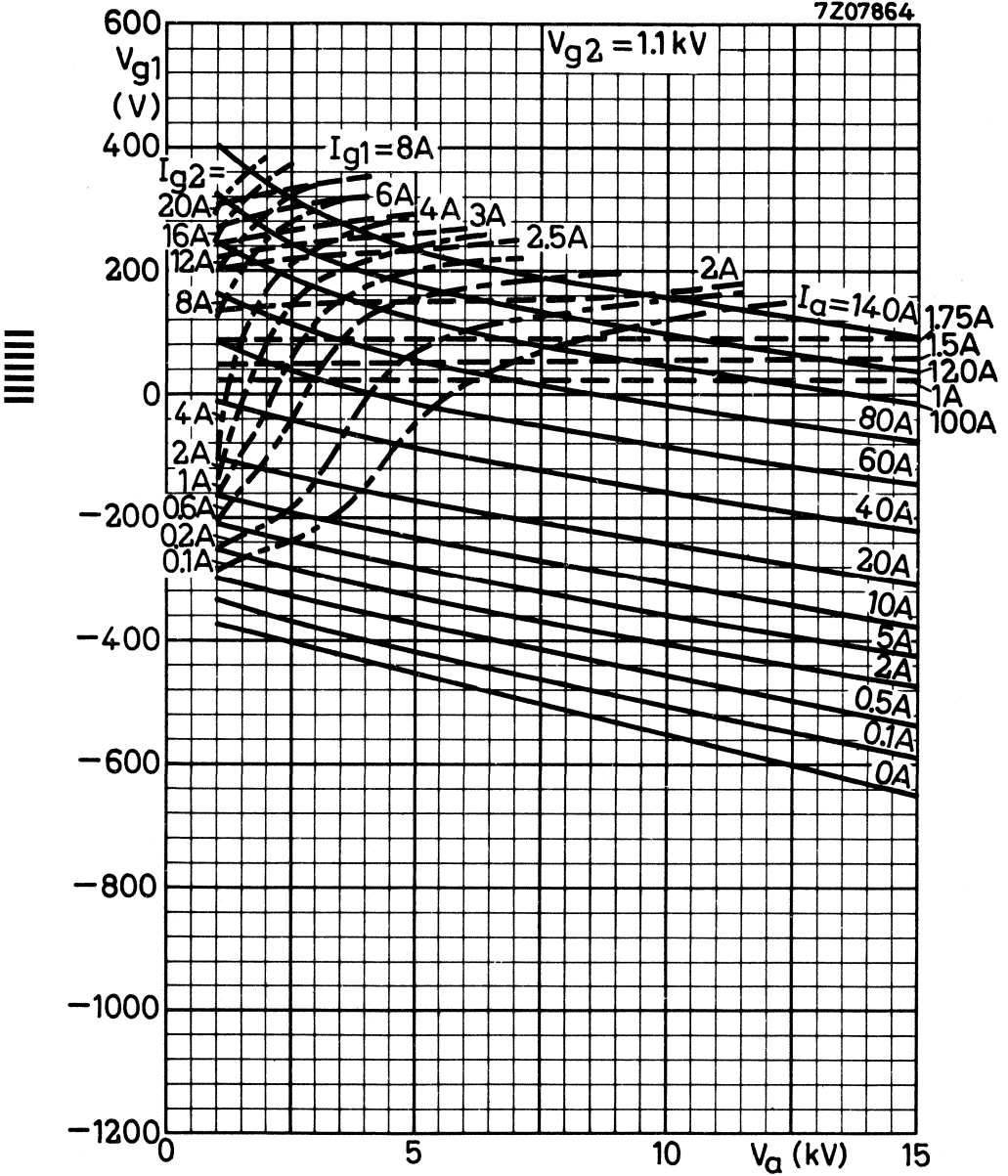
## A.F. CLASS B AMPLIFIER AND MODULATOR

## LIMITING VALUES (Absolute max. rating system)

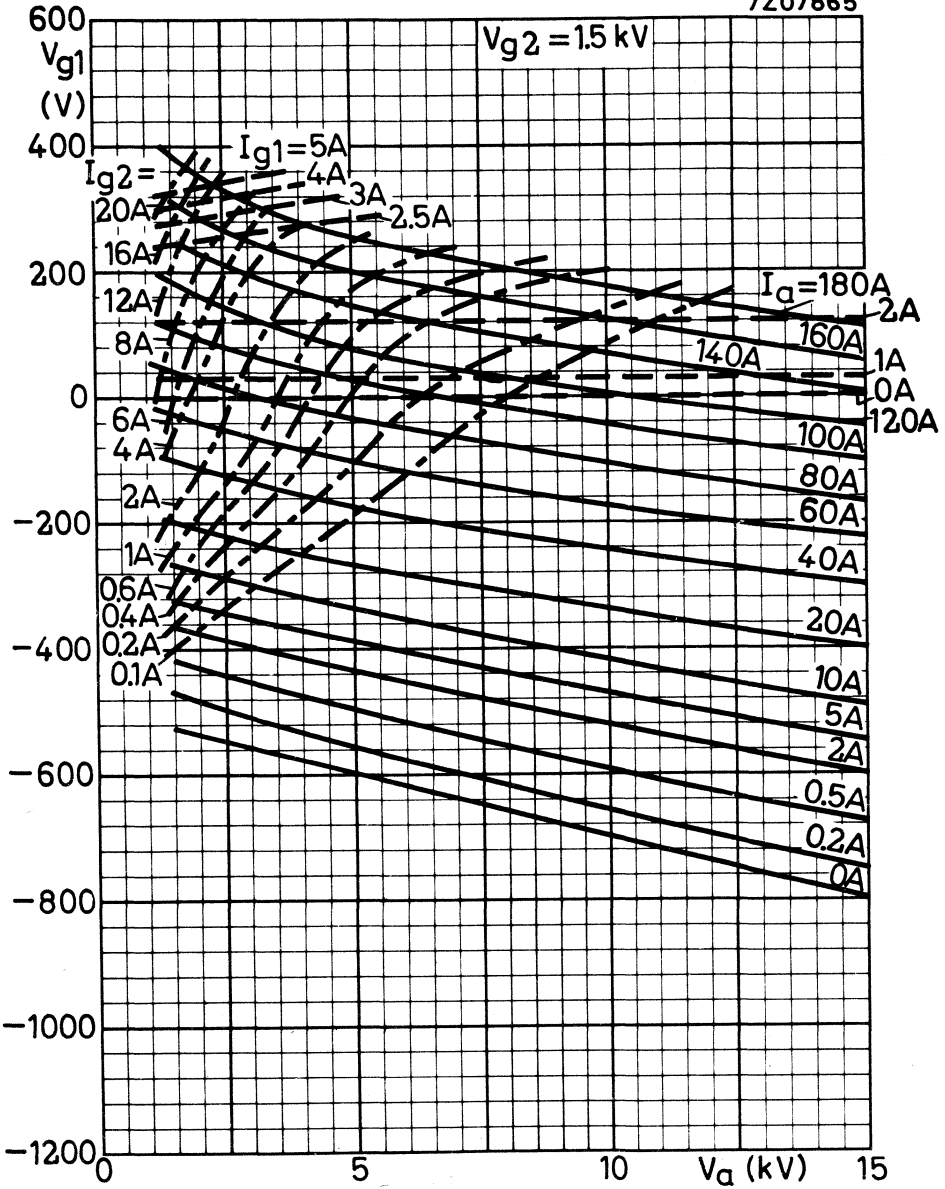
Anode voltage	$V_a$	max.	12	kV
Anode input power	$W_{ia}$	max.	300	kW
Anode dissipation	$W_a$	max.	150	kW
Cathode current	$I_k$	max.	50	A
Cathode current (peak)	$I_{kp}$	max.	280	A
Grid No.2 voltage	$V_{g2}$	max.	1.7	kV
Grid No.2 dissipation	$W_{g2}$	max.	2.7	kW
Grid No.1 resistance	$R_{g1}$	max.	1	k $\Omega$
Grid No.1 dissipation	$W_{g1}$	max.	1.2	kW

## OPERATING CONDITIONS: two tubes in push-pull

Anode voltage	$V_a$	11	11	kV		
Grid No.2 voltage	$V_{g2}$	1.5	1.5	kV		
Grid No.1 voltage	$V_{g1}$	-520	-520	V		
Load resistance	$R_{aa}$	500	670	$\Omega$		
Peak driving voltage	$V_{g1g1p}$	0	1100	0	950	V
Anode current	$I_a$	2x3	2x22	2x3	2x16.5	A
Grid No.2 current	$I_{g2}$	0	2x0.45	0	2x0.35	A
Grid No.1 current	$I_{g1}$	0	2x0.04	0	0	A
Grid No.2 dissipation	$W_{g2}$	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	$\eta$		66		66	%



7Z07865







## 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 RF power amplifier, oscillator and frequency multiplier and as AF amplifier and modulator in AM, FM and SSB transmitters for frequencies up to 2000 MHz.

QUICK REFERENCE DATA						
Frequency (MHz)	C telegr.		C <sub>ag2</sub> mod.		SSB	
	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W) <sup>1)</sup>
1200	900	40				
400	900	80	700	45		
60					850	40

### COOLING

YL1100 and YL1101: forced air cooling of radiator and seals

YL1102 and YL1103: heatsink cooling

**HEATING:** indirect by A.C. or D.C.; cathode oxide coated

YL1100 and YL1102

Heater voltage	V <sub>f</sub> = 26.5 V
Heater current	I <sub>f</sub> = 0.52 A
Heating time	T <sub>h</sub> = min. 60 sec

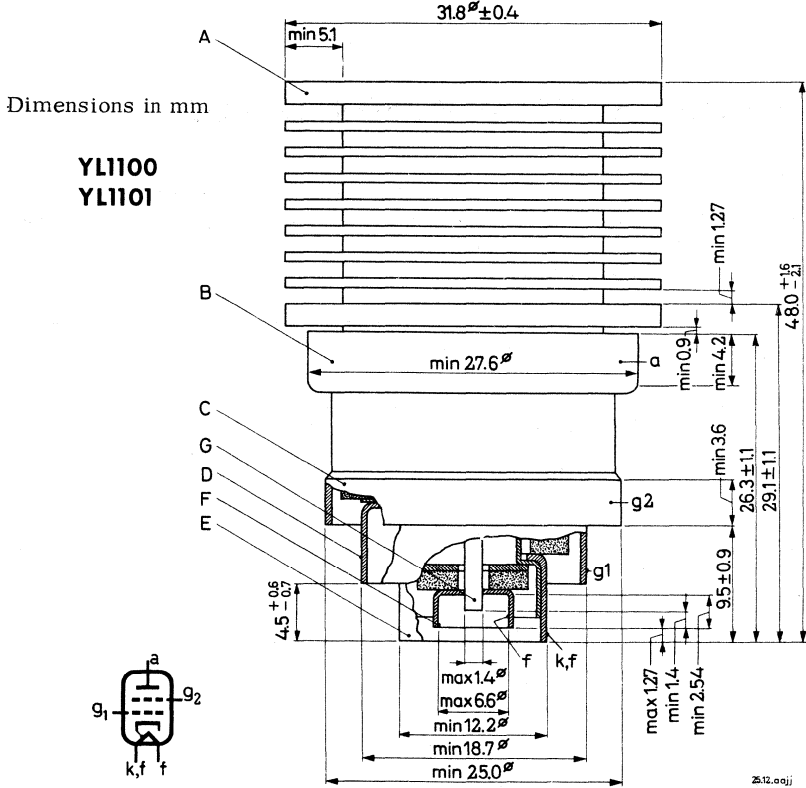
YL1101 and YL1103

Heater voltage	V <sub>f</sub> = 6.3 V
Heater current	I <sub>f</sub> = 2.1 A
Heating time	T <sub>h</sub> = min. 60 sec

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

<sup>1)</sup> Single tone operation

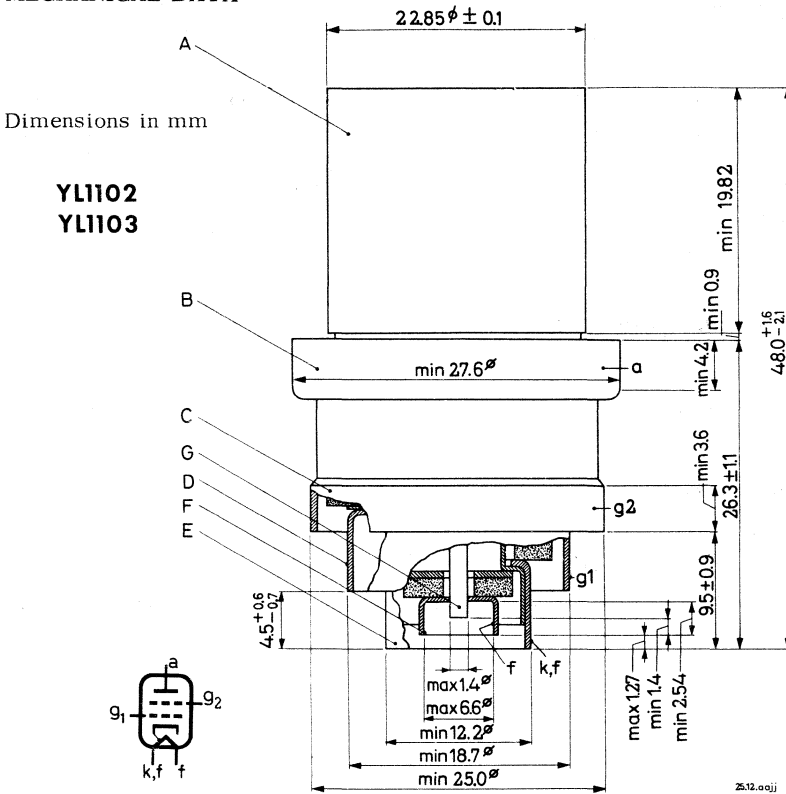
MECHANICAL DATA



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

Radiator	:	A	inside	33.40 mm diameter
Anode terminal	:	B	inside	28.40 mm diameter
g <sub>2</sub> terminal	:	C	inside	25.86 mm diameter
g <sub>1</sub> 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
Mounting position	:		any	
Net weight	:			60 g

MECHANICAL DATA



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

Cooling cylinder	:	A	inside	24.15 mm diameter
Anode terminal	:	B	inside	28.40 mm diameter
g <sub>2</sub> terminal	:	C	inside	25.86 mm diameter
g <sub>1</sub> 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

Mounting position : any

Net weight : 60 g

**CAPACITANCES**

Anode to grid No.1	$C_{ag1}$	<	0.065	pF
Grid No.1 to cathode and heater	$C_{g1-(k+f)}$	=	14	pF
Anode to cathode and heater	$C_{a-(k+f)}$	<	0.015	pF
Grid No.2 to grid No.1	$C_{g2g1}$	=	19	pF
Anode to grid No.2	$C_{ag2}$	=	4.4	pF
Grid No.2 to cathode and heater	$C_{g2-(k+f)}$	<	0.4	pF

**TYPICAL CHARACTERISTICS**

Anode voltage	$V_a$	=	1000	V
Grid No.2 voltage	$V_{g2}$	=	250	V
Anode current	$I_a$	=	100	mA
Amplification factor	$\mu_{g2g1}$	=	18	

**TEMPERATURE LIMITS (Absolute limits)**

Anode seal temperature	t	=	max. 250	°C
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**R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY**

**LIMITING VALUES (Absolute limits)**

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
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	V
Grid No.1 current	$I_{g1}$	= max.	30	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	k $\Omega$

**OPERATING CONDITIONS (grid drive)**

Frequency	f	=	400	1200	MHz
Anode voltage	$V_a$	=	900	900	V
Grid No.2 voltage	$V_{g2}$	=	300	300	V <sup>1)</sup>
Grid No.1 voltage	$V_{g1}$	=	-30	-22	V
Anode current	$I_a$	=	170	170	mA
Grid No.2 current	$I_{g2}$	=	1	1	mA
Grid No.1 current	$I_{g1}$	=	10	4	mA
Driving power	$W_{dr}$	=	3	5	W
Output power in load	$W_{load}$	=	80	40	W

**OPERATING CONDITIONS (cathode drive)**

Frequency	f	=	1200	MHz
Anode voltage	$V_a$	=	900	V
Grid No.2 voltage	$V_{g2}$	=	300	V
Grid No.1 voltage	$V_{g1}$	=	-31	V
Anode current	$I_a$	=	170	mA
Grid No.2 current	$I_{g2}$	=	3.2	mA
Grid No.1 current	$I_{g1}$	=	3.4	mA
Driving power	$W_{dr}$	=	8	W
Output power in load	$W_{load}$	=	40	W <sup>2)</sup>

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 ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES** (Absolute limits)

(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	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	3	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	V
Grid No.1 current	$I_{g1}$	= max.	30	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	k $\Omega$

**OPERATING CONDITIONS**

Frequency	f	=	400	MHz
Anode voltage	$V_a$	=	700	V
Grid No.2 voltage	$V_{g2}$	=	250	V
Grid No.1 voltage	$V_{g1}$	=	-50	V
Anode current	$I_a$	=	130	mA
Grid No.2 current	$I_{g2}$	=	10	mA
Grid No.1 current	$I_{g1}$	=	10	mA
Driving power	$W_{dr}$	=	3	W
Output power in load	$W_{load}$	=	45	W

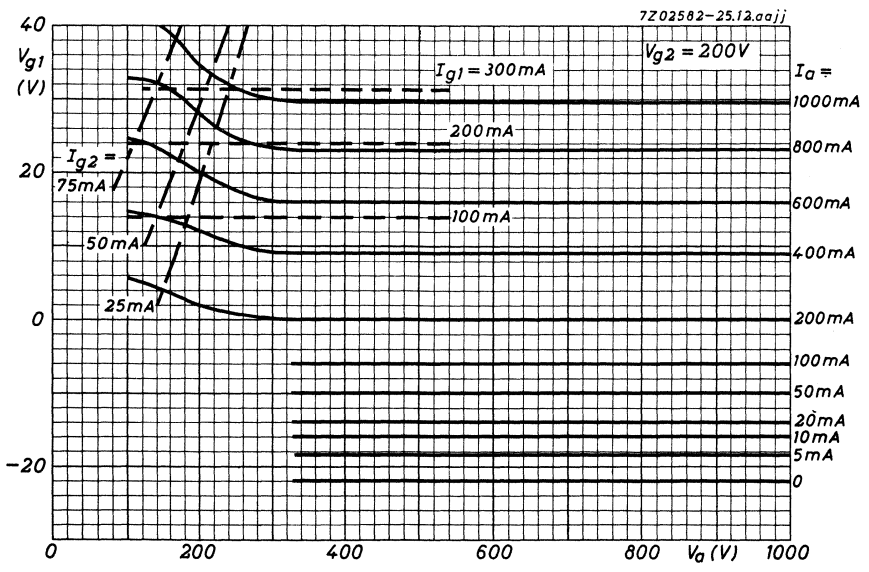
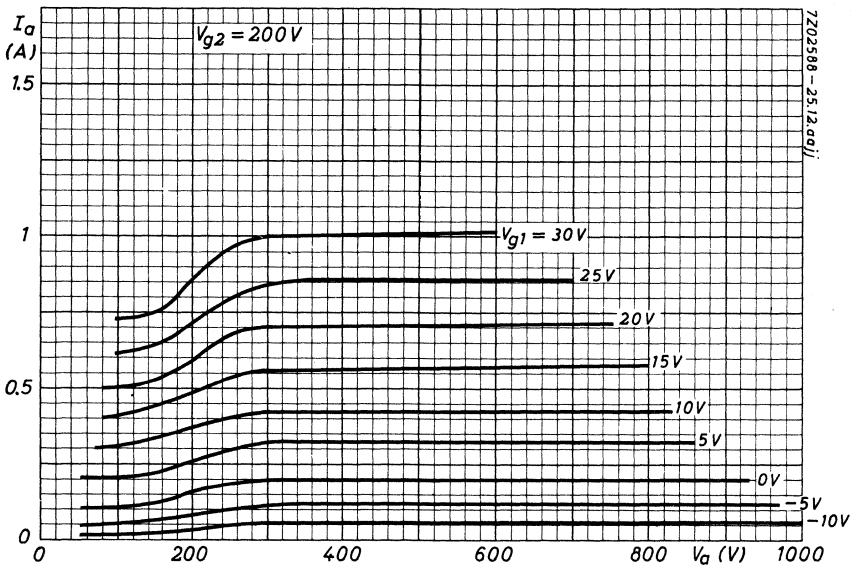
**R. F. CLASS AB1 SINGLE SIDE BAND AMPLIFIER**

**LIMITING VALUES (Absolute limits)**

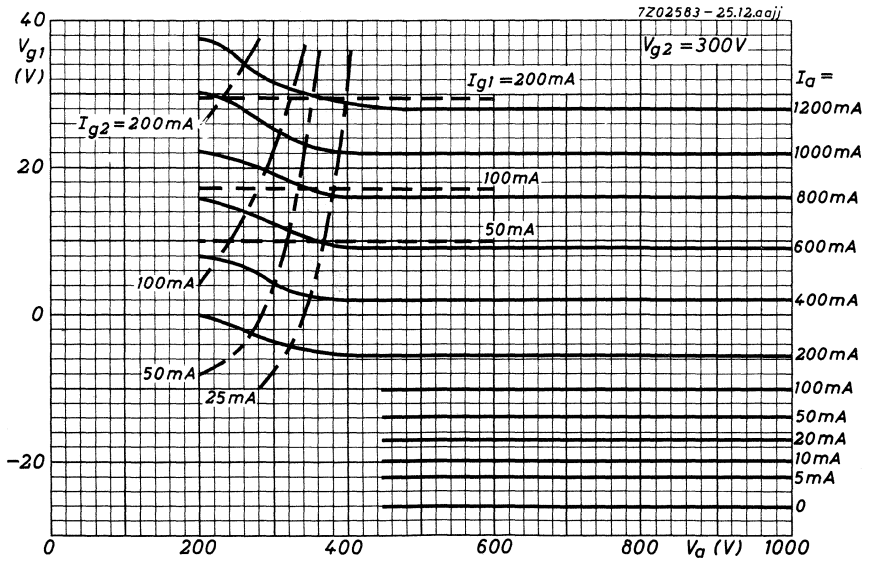
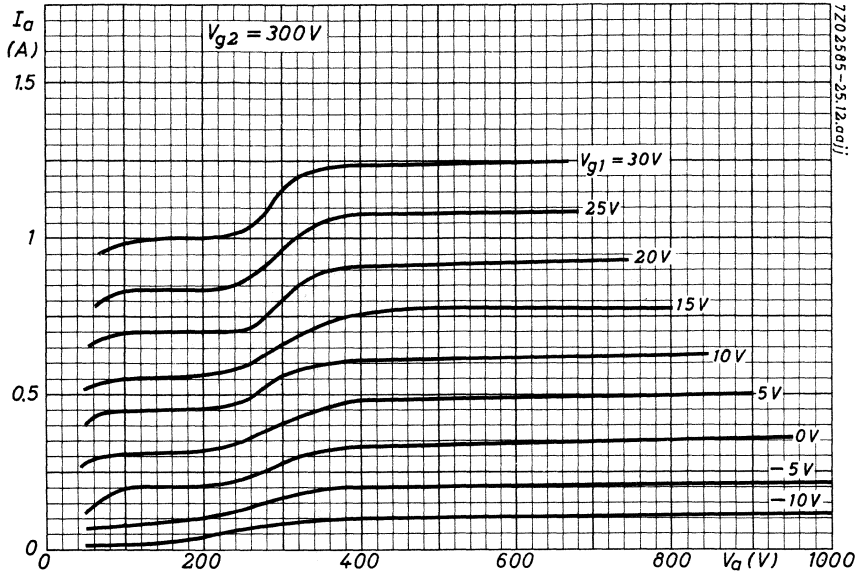
Frequency	f	up to	1200	MHz
Anode voltage	$V_a$	= max.	1000	V
Anode input power	$W_{ia}$	= max.	180	W
Anode dissipation	$W_a$	= max.	115	W
Anode current	$I_a$	= max.	180	mA
Grid No.2 voltage	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	4.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	V
Grid No.1 circuit resistance	$R_{g1}$	= max.	30	k $\Omega$

**OPERATING CONDITIONS**

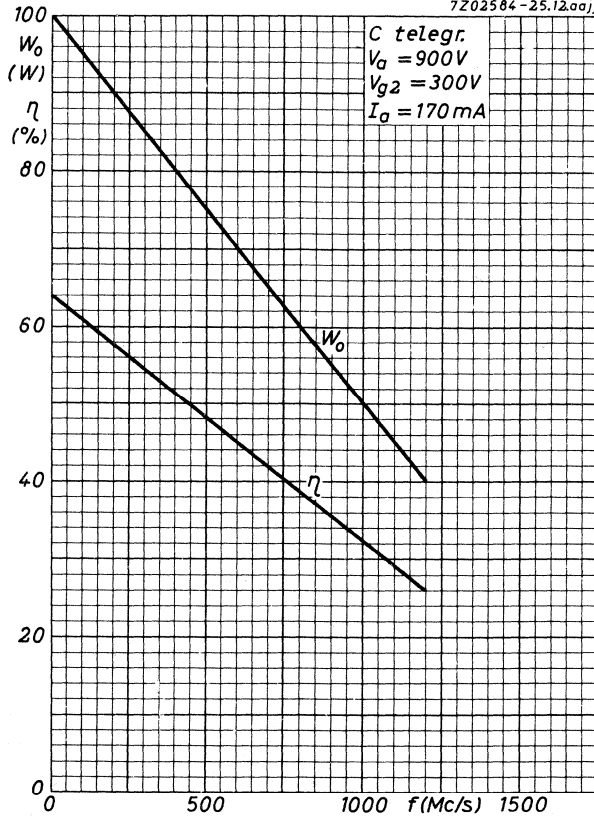
Frequency	f	=	60	60	MHz
Anode voltage	$V_a$	=	650	850	V
Grid No.2 voltage	$V_{g2}$	=	300	300	V
Grid No.1 voltage	$V_{g1}$	=	-15	-15	V
			zero signal	double tone	
Peak driving voltage	$V_{g1p}$	=	0	15	0 15 V
Anode current	$I_a$	=	40	100	40 100 mA
Grid No.2 current	$I_{g2}$	=	0	10	0 10 mA
Grid No.1 current	$I_{g1}$	=	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

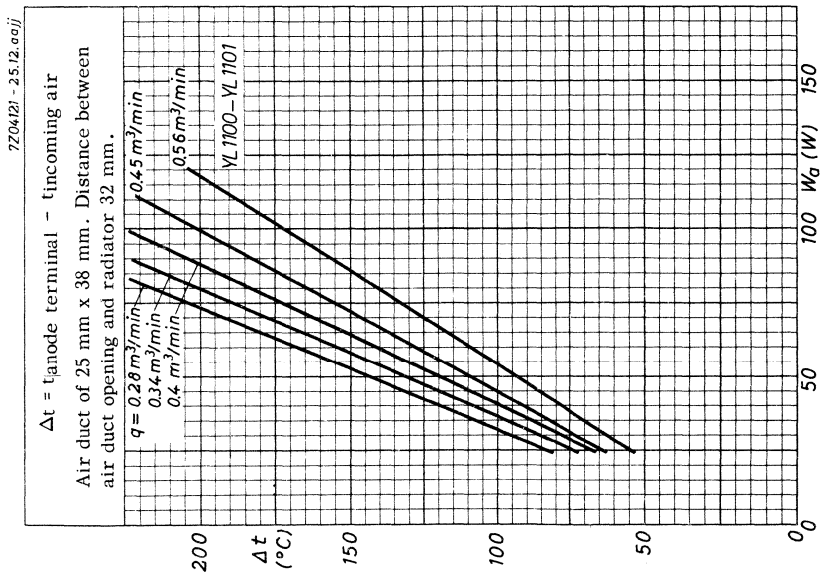
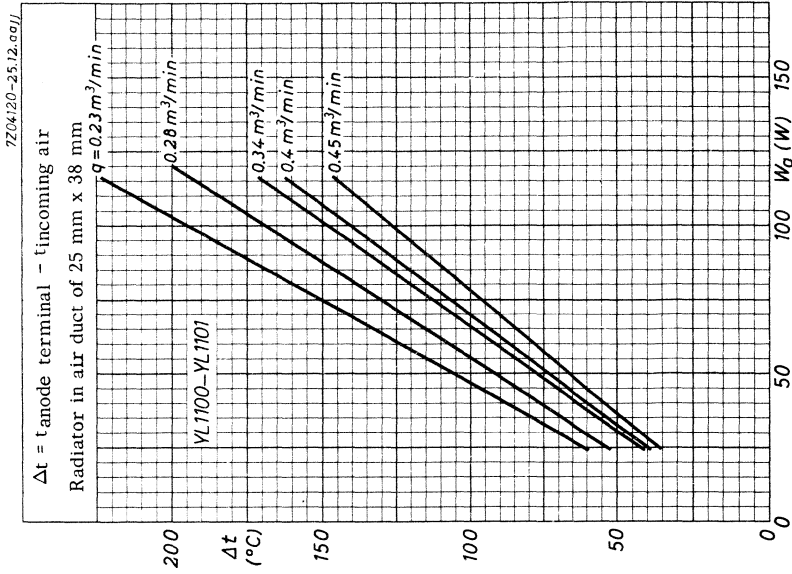






7Z02584-25.12.00jj







## 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 <sub>2</sub> mod.
	V <sub>a</sub> (V)	W <sub>load</sub> (W)	W <sub>load</sub> (W)	W <sub>o</sub> PEP (W)	W <sub>load</sub> (W)
790	2500 1400	590	55		
470 400 30	2500 2000 2500	730		680	600

**HEATING:** indirect by A.C. or D.C.; cathode oxide coated, matrix type

Heater voltage V<sub>f</sub> = 6.3 V ±10%

Heater current I<sub>f</sub> = 7.85 A

Heating time T<sub>h</sub> = min. 120 sec

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

### CAPACITANCES

Anode to grid No.1 C<sub>ag1</sub> < 0.11 pF

Grid No.1 to cathode and heater C<sub>g1/kf</sub> = 29 pF

Anode to cathode and heater C<sub>a/kf</sub> < 0.011 pF

Grid No.1 to grid No.2 C<sub>g1g2</sub> = 37 pF

Grid No.2 to cathode and heater C<sub>g2/kf</sub> < 1.1 pF

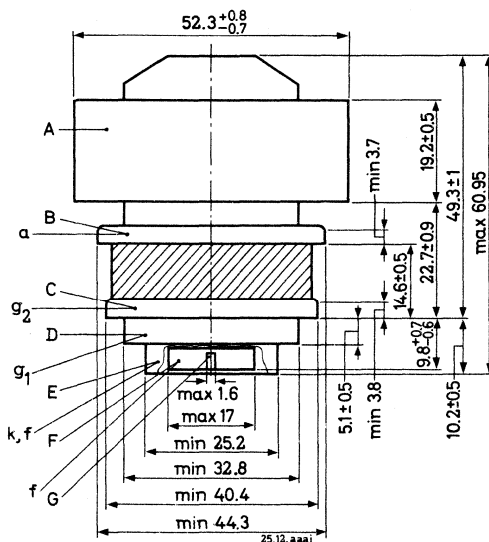
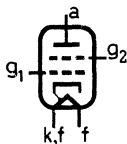
## TYPICAL CHARACTERISTICS

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	$\mu_{g_2g_1}$	=	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 WMin. required air flow  $q_{min}$  = 0.06 0.12 0.32 0.46 m<sup>3</sup>/minPressure loss  $p_i$  = 2 4 17 25 mm H<sub>2</sub>O

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	$V_{g2}$	= max.	1200 V
Grid No.2 dissipation	$W_{g2}$	= max.	25 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250 V
Grid No.1 current	$I_{g1}$	= max.	100 mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	15 k $\Omega$

**OPERATING CONDITIONS**

Frequency	f	=	790 MHz
Bandwidth	B	>	6.5 MHz
Anode voltage	$V_a$	=	1400 V
Grid No.2 voltage	$V_{g2}$	=	400 V
Grid No.1 voltage	$V_{g1}$	=	-30 V
Anode current	$I_a$	=	400 mA
Grid No.2 current	$I_{g2}$	=	-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	$V_{g2}$	= max.	1200	V
Grid No.2 dissipation	$W_{g2}$	= max.	25	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	V
Grid No.1 current	$I_{g1}$	= max.	100	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	15	k $\Omega$

**OPERATING CONDITIONS**

Frequency	f	=	30	MHz
Anode voltage	$V_a$	=	2500	V
Grid No.2 voltage	$V_{g2}$	=	450	V
Grid No.1 voltage	$V_{g1}$	=	-37	V
			zero	double tone
			signal	signal
Anode current	$I_a$	=	160	350 mA
Grid No.2 current	$I_{g2}$	=	0	2.5 mA
Grid No.1 current	$I_{g1}$	=	0	0 mA
Driving power	$W_{dr}$	=	0	1 W
Peak envelope power output	$W_{oPEP}$	=	-	680 W
Intermodulation distortion:				
of the third order	$d_{i3}$	=	-	-31 dB
of the fifth order	$d_{i5}$	=	-	-36 dB

**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**

**LIMITING VALUES (Absolute limits)**

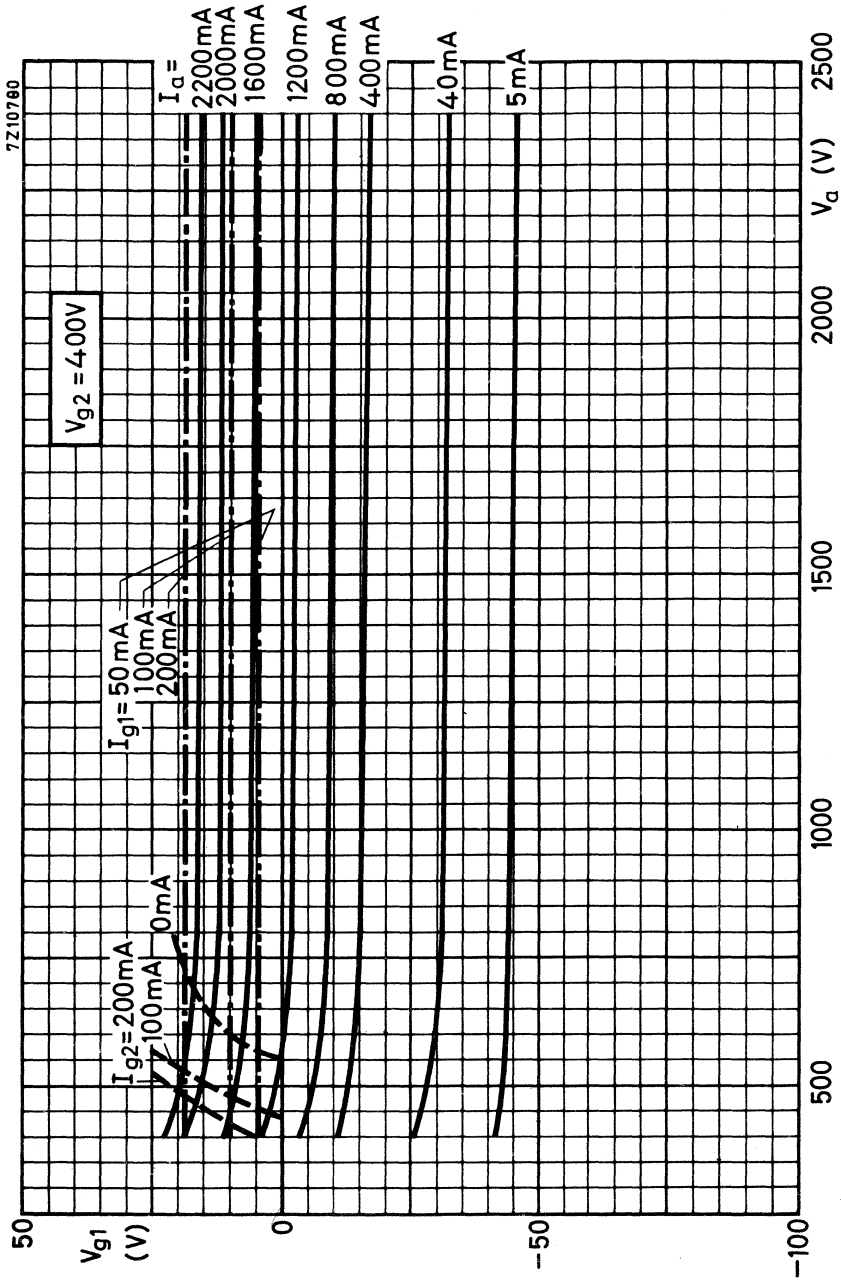
Frequency	f	up to	1215	MHz
Anode voltage	$V_a$	= max.	2000	V
Anode input power	$W_{ia}$	= max.	1000	W
Anode dissipation	$W_a$	= max.	400	W
Anode current	$I_a$	= max.	500	mA
Grid No.2 voltage	$V_{g2}$	= max.	1200	V
Grid No.2 dissipation	$W_{g2}$	= max.	17	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	250	V
Grid No.1 current	$I_{g1}$	= max.	100	mA
Grid No.1 circuit resistance	$R_{g1}$	= max.	15	k $\Omega$

**OPERATING CONDITIONS (cathode drive)**

Frequency	f	=	400	MHz
Anode voltage	$V_a$	=	2000	V
Grid No.2 voltage	$V_{g2}$	=	400	V <sup>1)</sup>
Grid No.1 voltage	$V_{g1}$	=	-35	V <sup>2)</sup>
Anode current	$I_a$	=	500	mA
Grid No.2 current	$I_{g2}$	=	8	mA
Grid No.1 current	$I_{g1}$	=	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.





## AIR COOLED COAXIAL R.F. POWER TETRODE

QUICK REFERENCE DATA		
Freq. (MHz)	Class AB1 linear SSB amplifier	
	$V_a$ (V)	$W_p$ <sup>1)</sup> (kW, PEP)
13	5000	5.1
28	5000	5.1

**HEATING:** indirect. Cathode oxide-coated

Heater voltage	$V_f = 12.6 \text{ V} \pm 10 \%$
Heater current	$I_f = 14.5 \text{ A}$
Heating time	$T_w = \text{min. } 10 \text{ min.}$

### CAPACITANCES

Grid No.1 to all other elements except anode	$C_{g1} = 115 \text{ pF}$
Anode to all other elements except grid No.1	$C_a = 41 \text{ pF}$
Anode to grid No.1	$C_{ag1} = 0.2 \text{ pF}$

### TYPICAL CHARACTERISTICS

Anode voltage	$V_a = 5 \text{ kV}$
Grid No.2 voltage	$V_{g2} = 700 \text{ V}$
Anode current	$I_a = 0.7 \text{ A}$
Amplification factor	$\mu_{g2g1} = 3.5$
Mutual conductance	$S = 45 \text{ mA/V}$

<sup>1)</sup> Useful power in the load

**TEMPERATURE LIMITS** (Absolute limits)

Envelope temperature = max. 200 °C  
 Air inlet temperature = max. 45 °C

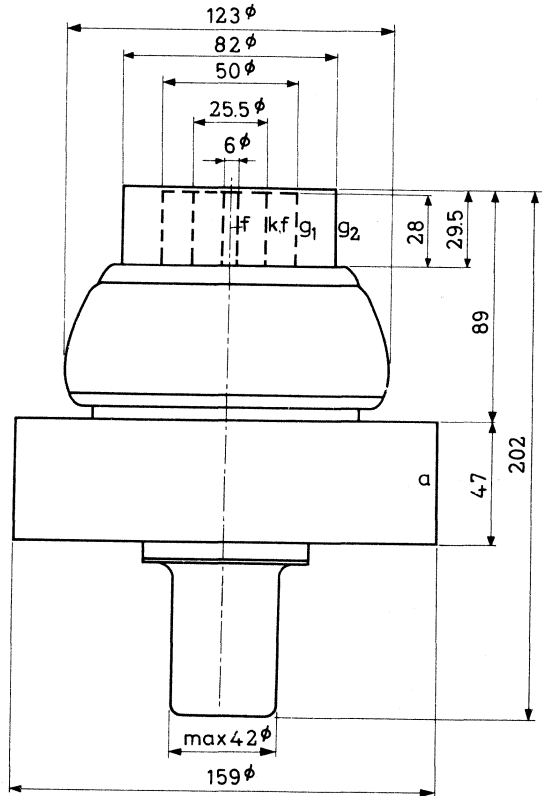
**AIR COOLING CHARACTERISTICS**

	W <sub>a</sub> (kW)	q <sub>min</sub> (m <sup>3</sup> /min)	P <sub>i</sub> (mm H <sub>2</sub> O)
Anode radiator	4	6	20
Socket		0.5	20

**MECHANICAL DATA**

Socket 40682  
 Air duct 40683  
 or  
 Insulating pedestal 40654  
 Net weight of tube 4.5 kg

Dimensions in mm



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)			
			<table border="0" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">zero signal</td> <td style="text-align: center;">single tone signal</td> <td style="text-align: center;">double tone signal</td> </tr> </table>	zero signal	single tone signal	double tone signal	
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)	$W_p$	=	-	5.1	5.1	kW	
Total efficiency	$\eta$	=	-	57	45	%	
3 <sup>rd</sup> order intermodulation distortion	$d_3$	=	-	-	<-35	dB 2)	
5 <sup>th</sup> 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)

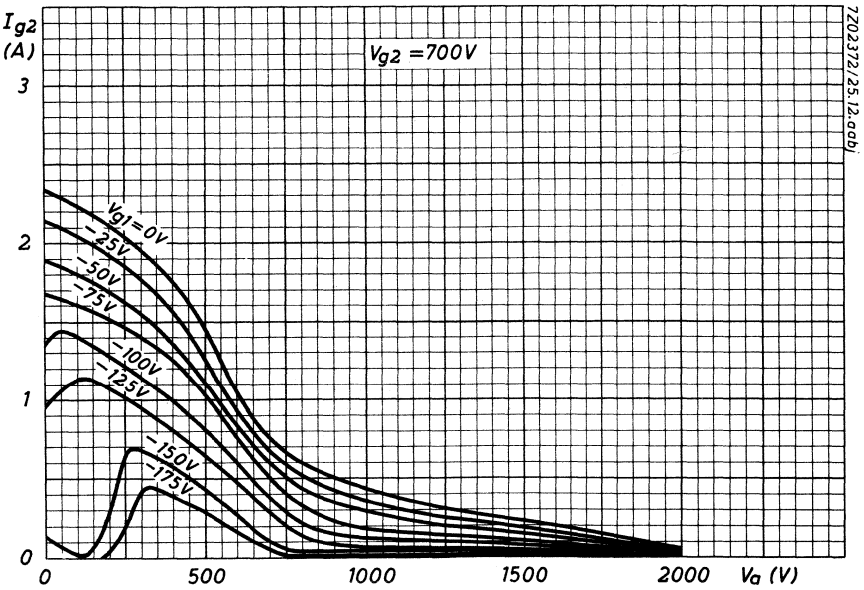
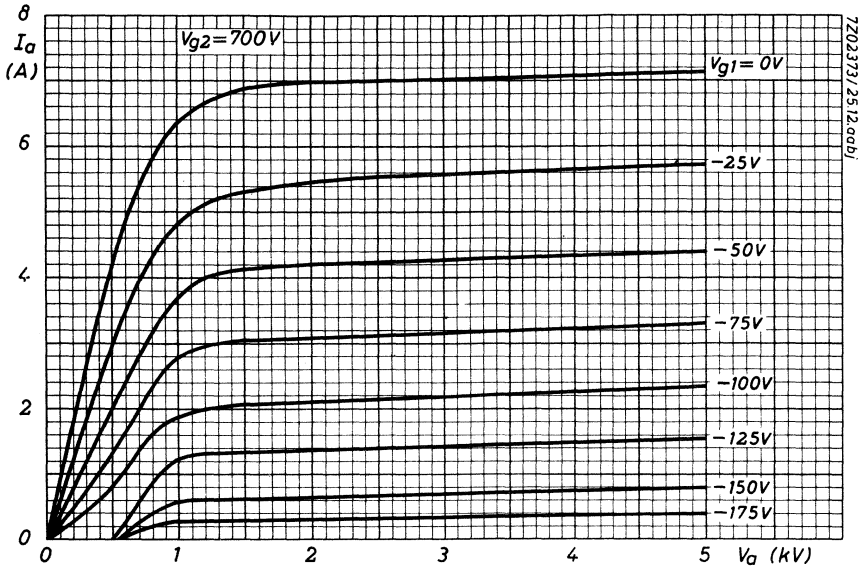
Frequency	$f$	=	28	MHz		
Anode voltage	$V_a$	=	5	kV		
Grid No.2 voltage	$V_{g2}$	=	700	V		
Grid No.1 voltage	$V_{g1}$	=	-150	V <sup>1)</sup>		
			<div style="display: flex; justify-content: space-around; border-top: 1px solid black; border-bottom: 1px solid black;"> <span>zero signal</span> <span>single tone signal</span> <span>double tone signal</span> </div>			
Peak driving voltage	$V_{g1p}$	=	0	150	150	V
Anode current	$I_a$	=	0.7	1.8	1.26	A
Grid No.2 current	$I_{g2}$	=	-10 to +10	120	40	mA
Grid No.1 current	$I_{g1}$	=	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)	$W_p$	=	-	5.1	5.1	kW
Total efficiency	$\eta$	=	-	57	45	%
3 <sup>rd</sup> order intermodulation distortion	$d_3$	=	-	-	<-35	dB <sup>2)</sup>
5 <sup>th</sup> order intermodulation distortion	$d_5$	=	-	-	<-40	dB <sup>2)</sup>

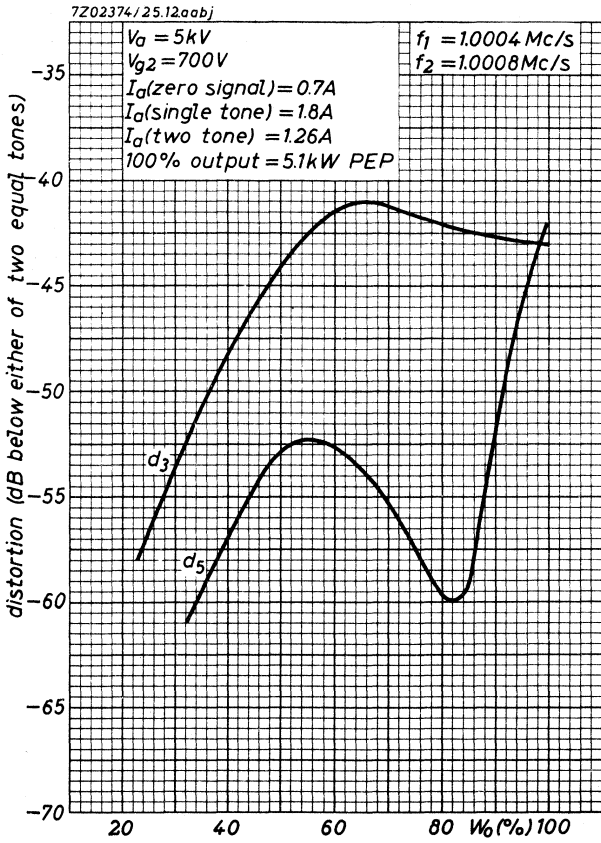
<sup>1)</sup> To be adjusted for zero signal anode current.

<sup>2)</sup> 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.







## 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)	$W_{oPEP}$ (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	$C_{g1}$	=	156	pF
Anode to grid No.1	$C_{ag1}$	=	0.16	pF

### TYPICAL CHARACTERISTICS

Anode voltage	$V_a$	=	1	5	kV
Grid No.2 voltage	$V_{g2}$	=	650	650	V
Anode current	$I_a$	=	6	0.7	A
Amplification factor	$\mu_{g2g1}$	=		3	
Mutual conductance	$S$	=	45		mA/V

### TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	$t$	=	max. 200	$^{\circ}\text{C}$
Air inlet temperature	$t_i$	=	max. 45	$^{\circ}\text{C}$

COOLING DATA

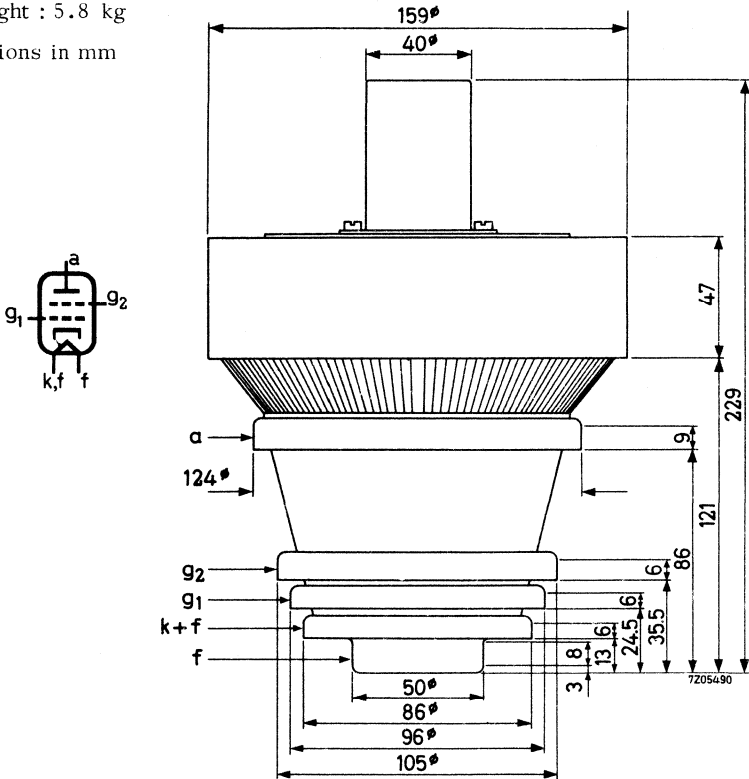
$W_a$ (kW)	$h$ (m)	$t_i$ (°C)	$q_{min}$ (m <sup>3</sup> /min)	$P_i$ (mm H <sub>2</sub> O)
4.0	0	45	5	23

Required air flow on socket  $q = \text{min. } 0.55 \text{ m}^3/\text{min}$   
 at a pressure loss  $p_i = 16 \text{ mm H}_2\text{O}$

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	$V_{g2}$	= max. 1 kV
Grid No.2 dissipation	$W_{g2}$	= max. 140 W
Negative grid No.1 voltage	$-V_{g1}$	= max. 250 V
Grid No.1 circuit resistance	$R_{g1}$	= max. 10 k $\Omega$

OPERATING CONDITIONS

Frequency	f	=	1	MHz								
Anode voltage	$V_a$	=	5.0	kV								
Grid No.2 voltage	$V_{g2}$	=	650	V								
Grid No.1 voltage	$V_{g1}$	=	-185	V <sup>1)</sup>								
			<table border="0" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">zero</td> <td style="text-align: center;">single tone</td> <td style="text-align: center;">double tone</td> <td></td> </tr> <tr> <td style="text-align: center;">signal</td> <td style="text-align: center;">signal</td> <td style="text-align: center;">signal</td> <td></td> </tr> </table>	zero	single tone	double tone		signal	signal	signal		
zero	single tone	double tone										
signal	signal	signal										
Grid No.1 driving voltage	$V_{g1p}$	=	0	160 <sup>2)</sup>	160 <sup>2)</sup>	V						
Anode current	$I_a$	=	0.7	1.85	1.30	A						
Grid No.2 current	$I_{g2}$	=	-10 to +10	140	40	mA						
Grid No.1 current	$I_{g1}$	=	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	$W_\ell$	=	0	5.7	-	kW <sup>3)</sup>						
PEP output power in load	$W_\ell$	=	0	-	5.7	kW <sup>3)</sup>						
Total efficiency	$\eta$	=	-	61.5	43.5	%						
Intermodulation distortion												
of the 3rd order	$d_3$	=	-	-	-40	dB <sup>4)</sup>						
of the 5th order	$d_5$	=	-	-	-40	dB <sup>4)</sup>						

<sup>1)2)3)4)</sup> 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	$V_{g2}$	=	650		V
Grid No.1 voltage	$V_{g1}$	=	-185		V <sup>1)</sup>
			<div style="display: flex; justify-content: space-around; border-top: 1px solid black; border-bottom: 1px solid black;"> <span>zero signal</span> <span>single tone signal</span> <span>double tone signal</span> </div>		
Grid No.1 driving voltage	$V_{g1p}$	=	0	160 <sup>2)</sup>	160 <sup>2)</sup> V
Anode current	$I_a$	=	0.7	1.85	1.30 A
Grid No.2 current	$I_{g2}$	=	-10 to +10	140	40 mA
Grid No.1 current	$I_{g1}$	=	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	$W_\ell$	=	0	5.0	- kW <sup>5)</sup>
PEP output power in load	$W_\ell$	=	0	-	5.0 kW <sup>5)</sup>
Total efficiency	$\eta$	=	-	54	38 %
Intermodulation distortion					
of the 3rd order	$d_3$	=	-	-	-38 dB <sup>4)</sup>
of the 5th order	$d_5$	=	-	-	-40 dB <sup>4)</sup>

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 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.

5) Measured in a circuit having an efficiency of 85%.

## R.F. CLASS B ANODE MODULATION

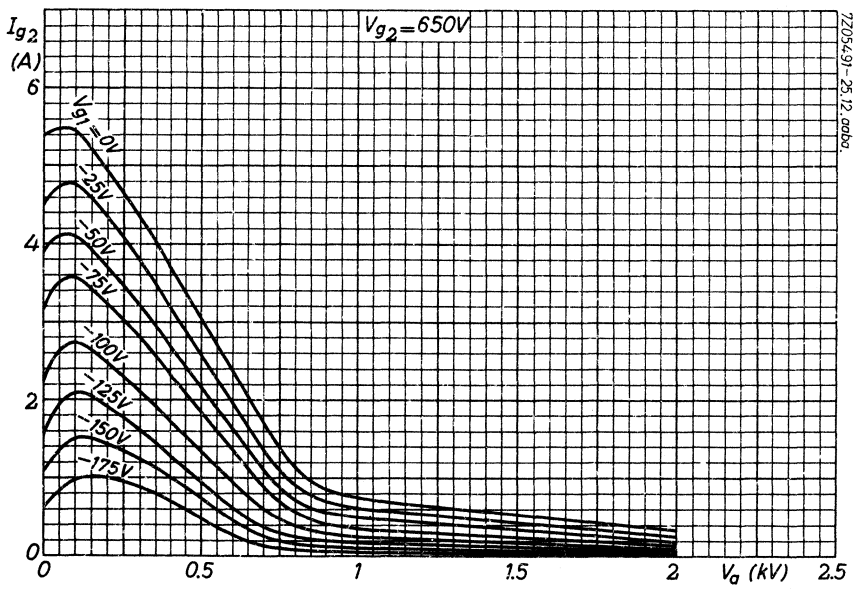
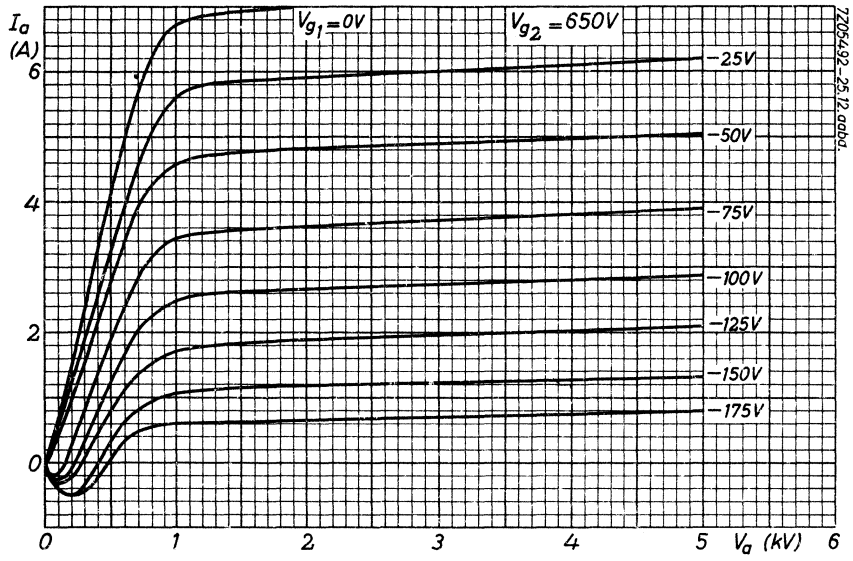
## LIMITING VALUES (Absolute limits)

Frequency	f	=	up to 60 MHz
Anode voltage	$V_a$	=	max. 5.5 kV
Anode input power	$W_{i_a}$	=	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	$W_{g_2}$	=	max. 140 W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250 V
Grid No.1 circuit resistance	$R_{g_1}$	=	max. 10 k $\Omega$

## OPERATING CONDITIONS

Frequency	f	=	1 MHz
Anode voltage	$V_a$	=	5.0 kV
Grid No.2 voltage	$V_{g_2}$	=	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	$I_{g_2}$	=	100 mA
Grid No.1 current	$I_{g_1}$	=	0 mA
Grid No.2 dissipation	$W_{g_2}$	=	60 W
Driving power	$W_{dr}$	=	0 W
Anode input power	$W_{i_a}$	=	7.3 kW
Anode dissipation	$W_a$	=	2.2 kW
Output power in the load	$W_{\ell}$	=	4.6 kW <sup>1)</sup>
Tube efficiency	$\eta$	=	70 %
Modulation depth	m	=	100 %
Modulation power	$W_{mod}$	=	3.65 kW

1) Measured in a circuit having an efficiency of 90 %.





## 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)	$W_{\ell}^{2)}$ (W)	$V_a$ (V)	$W_{dr}^{1)}$ (W)	$W_{\ell}^{2)}$ (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  $V_f = 1.1 V \pm 15\%$

Filament current  $I_f = 2.9 A$

Heating time for  $W_o = 70\%$  of full output power  $T_h < 0.5 \text{ sec}$

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  $C_i = 4.1 \text{ pF}$

Output capacitance  $C_o = 1.2 \text{ pF}$

The tube is internally neutralised for frequencies up to 500 MHz

<sup>1)</sup> Driver output power

<sup>2)</sup> 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)

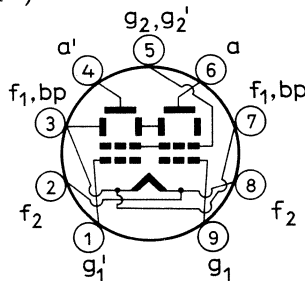
Bulb temperature = max. 230 °C

## MECHANICAL DATA

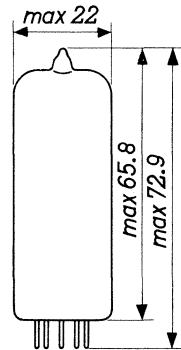
Base : Noval

Socket : 2422 502 01004 <sup>1)</sup>

Net weight: 16 g



Dimensions in mm



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.

<sup>1)</sup> 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	k $\Omega$

**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	k $\Omega$
Grid No.1 voltage	$V_{g_1}$	=	-20	-22	V
Grid No.1 resistor	$R_{g_1}$	=	3.9 <sup>1)</sup>	9.4 <sup>2)</sup>	k $\Omega$
Driving voltage	$V_{g_1 g_1' p}$	=	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	$\eta$	=	68	57	%
Output power in the load	$W_l$	=	13	6.5	W <sup>3)</sup>

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)

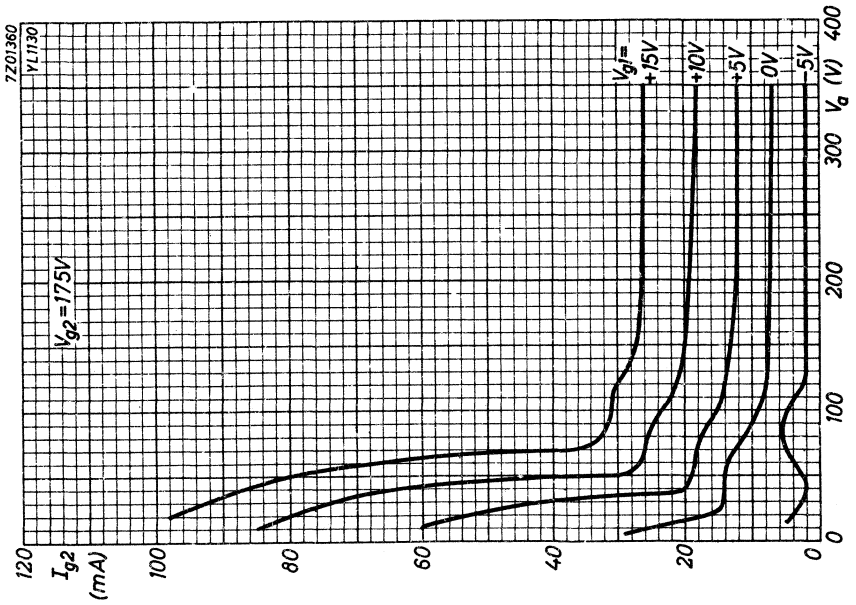
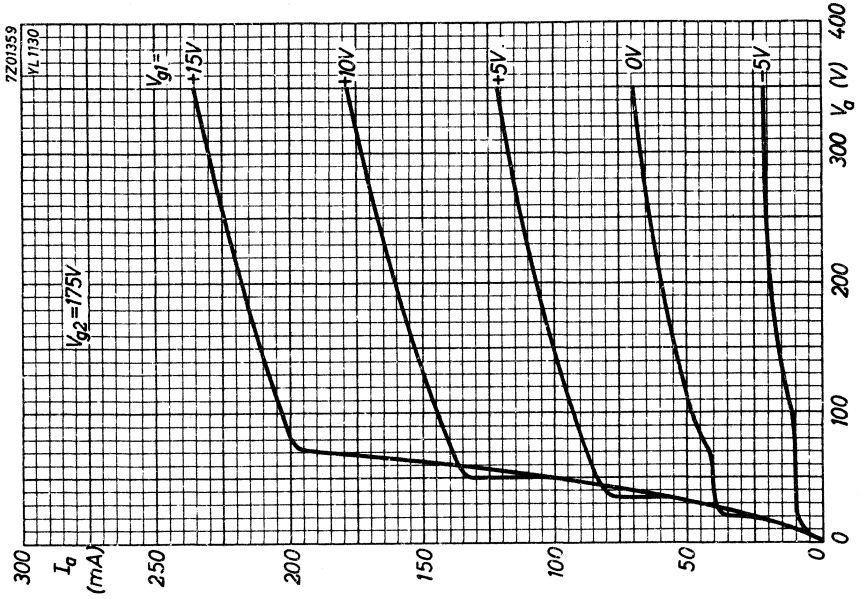
Frequency	f	up to	500	MHz
Anode voltage	$V_a$	= max.	200	V
Anode current	$I_a$	= max.	2x35	mA
Anode input power	$W_{i_a}$	= max.	12	W
Anode dissipation	$W_a$	= max.	2x4	W
Grid No.2 voltage	$V_{g_2}$	= max.	200	V
Grid No.2 dissipation	$W_{g_2}$	= max.	2.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	$I_{g_1}$	= max.	2x3	mA
Grid No.1 circuit resistance	$R_{g_1}$	= max.	100	kΩ

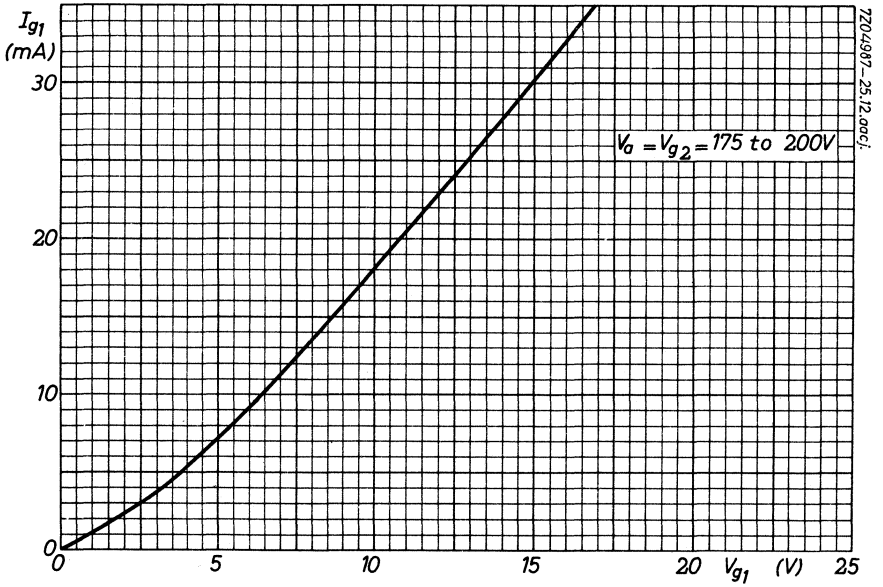
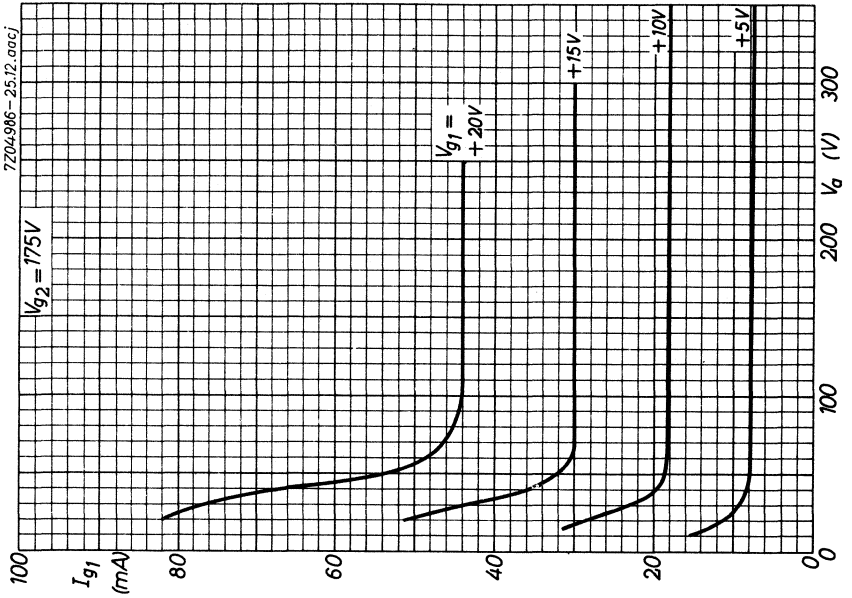
**OPERATING CONDITIONS**

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 <sup>1)</sup>
Driving voltage	$V_{g_1 g_1' p}$	=	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	$\eta$	=	33	%
Output power in the load	$W_\ell$	=	2	W <sup>2)</sup>

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.





## R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	Class AB Single sideband		Class AB mod. Two tubes	
	V <sub>a</sub> (V)	W <sub>ℓ</sub> <sup>1)</sup> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)
30	600	110	600	200
60	600	100		

**HEATING:** Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V <sub>f</sub> =	6.3 V	12.6 V
Heater current	I <sub>f</sub> =	1.90 A	0.95 A
Pins		(5+6)-2	5-6
Heating time	T <sub>h</sub> =	min. 30	sec

### CAPACITANCES

Anode to all other elements except grid No.1	C <sub>a</sub>	=	10.7 pF
Grid No.1 to all other elements except anode	C <sub>g1</sub>	=	24.5 pF
Anode to grid No.1	C <sub>ag1</sub>	=	0.23 pF

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	=	600 V
Grid No.2 voltage	V <sub>g2</sub>	=	250 V
Anode current	I <sub>a</sub>	=	100 mA
Amplification factor	μ <sub>g2g1</sub>	=	4.0
Mutual conductance	S	=	10 mA/V

<sup>1)</sup> 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

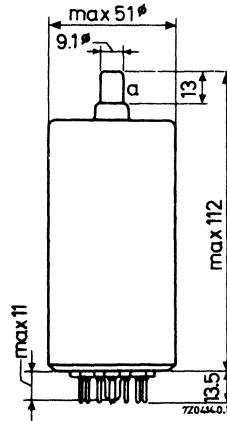
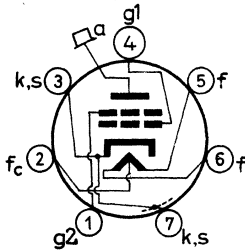
**COOLING**

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	$V_{g2}$	= max.	300	V
Grid No.2 dissipation	$W_{g2}$	= max.	7.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	V
Grid No.1 dissipation	$W_{g1}$	= max.	0.5	W
Grid No.1 circuit resistance	$R_{g1}$	= max.	10	k $\Omega$

**OPERATING CONDITIONS**

Frequency	f	=	30	MHz										
Anode voltage	$V_a$	=	600	V										
Grid No.2 voltage	$V_{g2}$	=	250	V										
Grid No.1 voltage	$V_{g1}$	=	-50	V 1)										
			<table border="0" style="margin-left: 40px;"> <tr> <td></td> <td>zero</td> <td>single tone</td> <td>double tone</td> <td></td> </tr> <tr> <td></td> <td>signal</td> <td>signal</td> <td>signal</td> <td></td> </tr> </table>		zero	single tone	double tone			signal	signal	signal		
	zero	single tone	double tone											
	signal	signal	signal											
Peak driving voltage	$V_{g1p}$	=	0	50	50	V								
Anode current	$I_a$	=	100	325	220	mA								
Grid No.2 current	$I_{g2}$	=	3	22	12	mA								
Grid No.1 current	$I_{g1}$	=	0	0	0	mA 2)								
Grid No.2 dissipation	$W_{g2}$	=	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	$W_{\ell}$	=	-	110	110 3)	W								
Efficiency	$\eta$	=	-	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 <sub>a</sub>	=	600	V		
Grid No.2 voltage	V <sub>g2</sub>	=	250	V		
Grid No.1 voltage	V <sub>g1</sub>	=	-50	V <sup>1)</sup>		
			<div style="display: flex; justify-content: space-around; border-top: 1px solid black; border-bottom: 1px solid black;"> <span>zero signal</span> <span>single tone signal</span> <span>double tone signal</span> </div>			
Peak driving voltage	V <sub>g1p</sub>	=	0	50	50	V
Anode current	I <sub>a</sub>	=	100	325	220	mA
Grid No.2 current	I <sub>g2</sub>	=	3	22	12	mA
Grid No.1 current	I <sub>g1</sub>	=	0	0	0	mA <sup>2)</sup>
Grid No.2 dissipation	W <sub>g2</sub>	=	0.75	7	3.5	W
Driving power	W <sub>dr</sub>	=	-	2	2	W
Anode input power	W <sub>i<sub>a</sub></sub>	=	60	195	132	W
Anode dissipation	W <sub>a</sub>	=	60	75	72	W
Output power in the load	W <sub>l</sub>	=	-	100	100 <sup>3)</sup>	W
Efficiency	η	=	-	51	38	%
Intermodulation products						
third order	d <sub>3</sub>	=	-	-	< 30	dB <sup>4)</sup>
fifth order	d <sub>5</sub>	=	-	-	< 40	dB <sup>4)</sup>

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

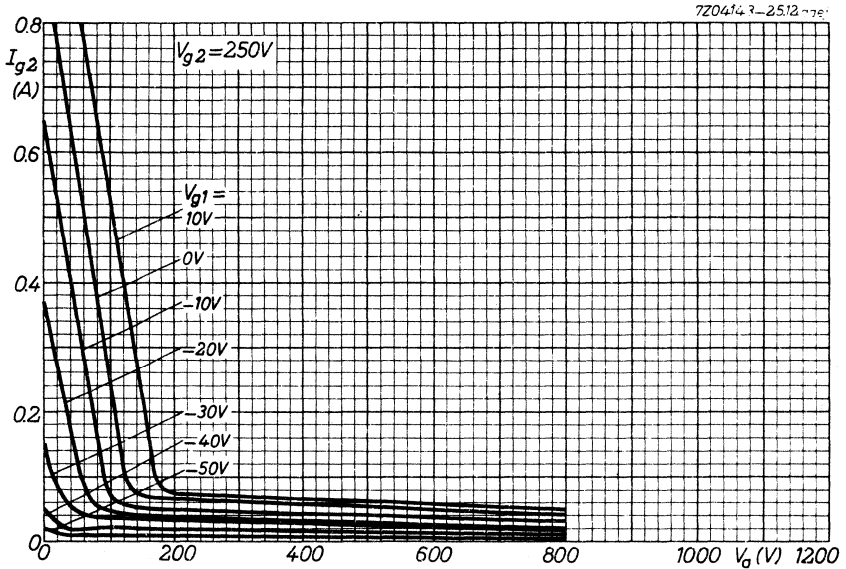
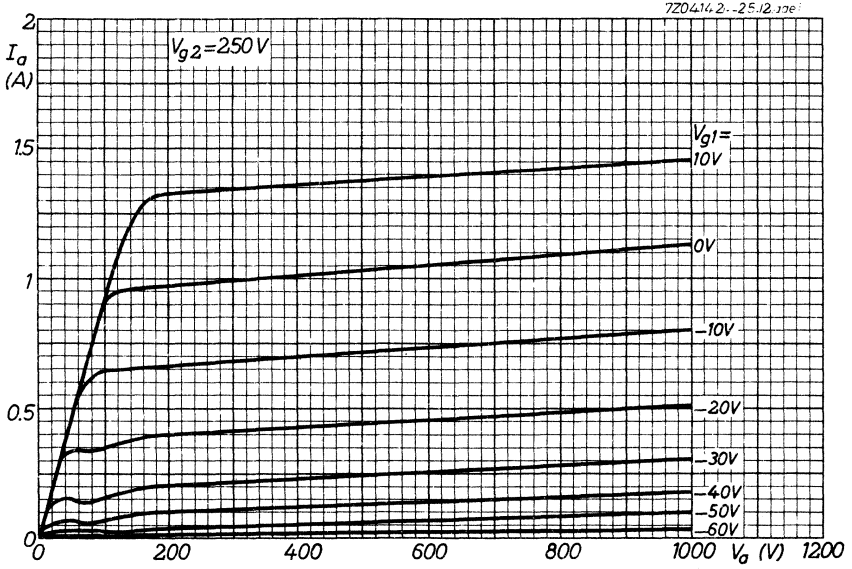
## LIMITING VALUES (Absolute limits)

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	$V_{g2}$	=	max.	300	V
Grid No.2 dissipation	$W_{g2}$	=	max.	7.5	W
Negative grid No.1 voltage	$-V_{g1}$	=	max.	100	V
Grid No.1 current	$I_{g1}$	=	max.	10	mA
Grid No.1 circuit resistance	$R_{g1}$	=	max.	10	k $\Omega$

## OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	$V_a$	=	600	V	
Grid No.2 voltage	$V_{g2}$	=	250	V	
Grid No.1 voltage	$V_{g1}$	=	-50	V <sup>1)</sup>	
Load resistance	$R_{aa\sim}$	=	2.8	k $\Omega$	
Peak driving voltage	$V_{g1g1p}$	=	0	100	V
Anode current	$I_a$	=	2x100	2x260	mA
Grid No.2 current	$I_{g2}$	=	2x3	2x24	mA
Grid No.1 current	$I_{g1}$	=	0	0	mA
Grid No.2 dissipation	$W_{g2}$	=	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	$\eta$	=	-	64	%
Total harmonic distortion	$dt_{tot}$	=	-	< 2	%

1) To be adjusted for the stated value of the zero-signal anode current



## R.F. POWER TETRODE

Forced-air cooled beam power tetrode with ceramic to metal seals intended for use as linear R.F. power amplifier for frequencies up to 500 MHz and for use in S.S.B. transmitters. The YL1170 is shock and vibration resistant.

### SHOCK AND VIBRATION RESISTANCE

Samples of production are periodically selected at random and tested under the following conditions:

Shock With maximum rated anode and grid No.2 voltages and the grid No.1 voltage at  $V_{g1} = -200$  V:

- a. The tubes are subjected to 6 shocks of a minimum of 90 g approximate half sine wave motion.
- b. The duration of the shocks is  $11 \pm 2$  ms in each of the three major axes.

Vibration With maximum rated anode and grid No.2 voltages applied and the grid No.1 voltage adjusted to maintain an anode current of 100 mA through an anode resistor  $R_a = 4.9$  k $\Omega$ :

- a. The tubes are subjected to vibration in 3 major axes through the range of 10 to 1000 to 10 Hz in a period of min. 6 min. per axis.
- b. The vibration level is maintained at 10 g from 28 Hz to 1000 Hz and at 6.3 mm double amplitude from 10 to 28 Hz.
- c. During this test a noise voltage of max. 30  $V_{RMS}$  may develop across the anode resistor.

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For further data please refer to  
data of type QEL2/200  
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## 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 <sub>a</sub> (kV)	W <sub>f</sub> (kW)	V <sub>a</sub> (kV)	W <sub>f</sub> sync (kW)
30	4.5	3		
230			4	5.5

**HEATING:** Direct; filament thoriated tungsten

Filament voltage	V <sub>f</sub>	5 V
Filament current	I <sub>f</sub>	64 A

### CAPACITANCES

Anode to all except grid No. 1	C <sub>a(g1)</sub>	14 pF
Grid No. 1 to all except anode	C <sub>g1(a)</sub>	78 pF
Anode to grid No. 1	C <sub>ag1</sub>	0.23 pF

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	3 kV
Grid No. 2 voltage	V <sub>g2</sub>	600 V
Anode current	I <sub>a</sub>	1 A
Transconductance	S	22 mA/V
Amplification factor	μ <sub>g2g1</sub>	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 <sup>3</sup> /min.)	$P_i$ mm H <sub>2</sub> O
2.5	0	25	2.7	50
4	0	25	4.3	130

See also cooling curve.

A low velocity air flow ( $> 0.5 \text{ m}^3/\text{min}$ ) should be directed to the filament and grid seals.

## MECHANICAL DATA

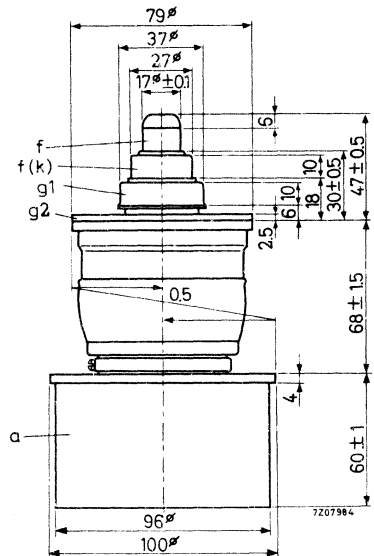
Dimensions in mm

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	$V_{g2}$	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. 4	kW
Grid No.2 dissipation	$W_{g2}$	max. 120	W
Grid No.1 dissipation	$W_{g1}$	max. 40	W

**OPERATING CONDITIONS**

Frequency	f	30	MHz	
Anode voltage	$V_a$	4.5	kV	
Grid No.2 voltage	$V_{g2}$	800	V	
Grid No.1 voltage	$V_{g1}$	-140	V <sup>1)</sup>	
		zero signal	single tone	double tone
Grid No.1 driving voltage	$V_{g1p}$	0	140	140 V
Anode current	$I_a$	0.5	1.33	0.93 A
Grid No.2 current	$I_{g2}$	0	30	8 mA
Grid No.1 current	$I_{g1}$	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	$W_{g2}$	0	24	6.4 W
Driver output power	$W_{dr}$	0	30	30 W <sup>3)</sup>
Output power in load (P.E.P.)	$W_{\ell}$		3	3 kW <sup>2)</sup>

<sup>1)</sup> Adjust to give the zero signal anode current.

<sup>2)</sup> Measured in a circuit having an efficiency of 95%.

<sup>3)</sup> 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)

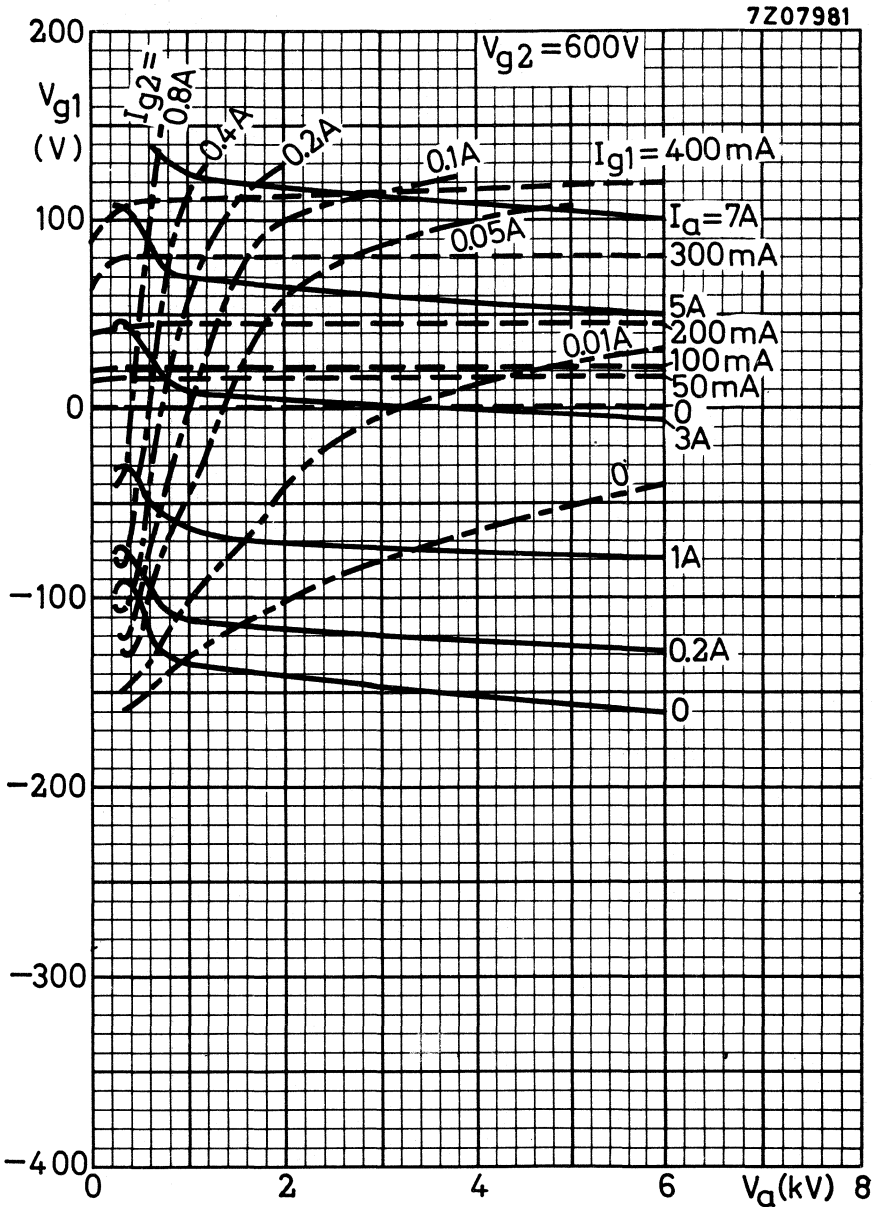
Frequency	f	max. 230 MHz
Anode voltage	$V_a$	max. 4.2 kV
Grid No.2 voltage	$V_{g2}$	max. 800 V
Grid No.1 voltage	$-V_{g1}$	max. 400 V
Anode current	$I_a$	max. 2.5 A
Grid No.1 current	$I_{g1}$	max. 200 mA
Anode input power	$W_{i_a}$	max. 8 kW
Anode dissipation	$W_a$	max. 4 kW
Grid No.2 dissipation	$W_{g2}$	max. 100 W
Grid No.1 dissipation	$W_{g1}$	max. 30 W

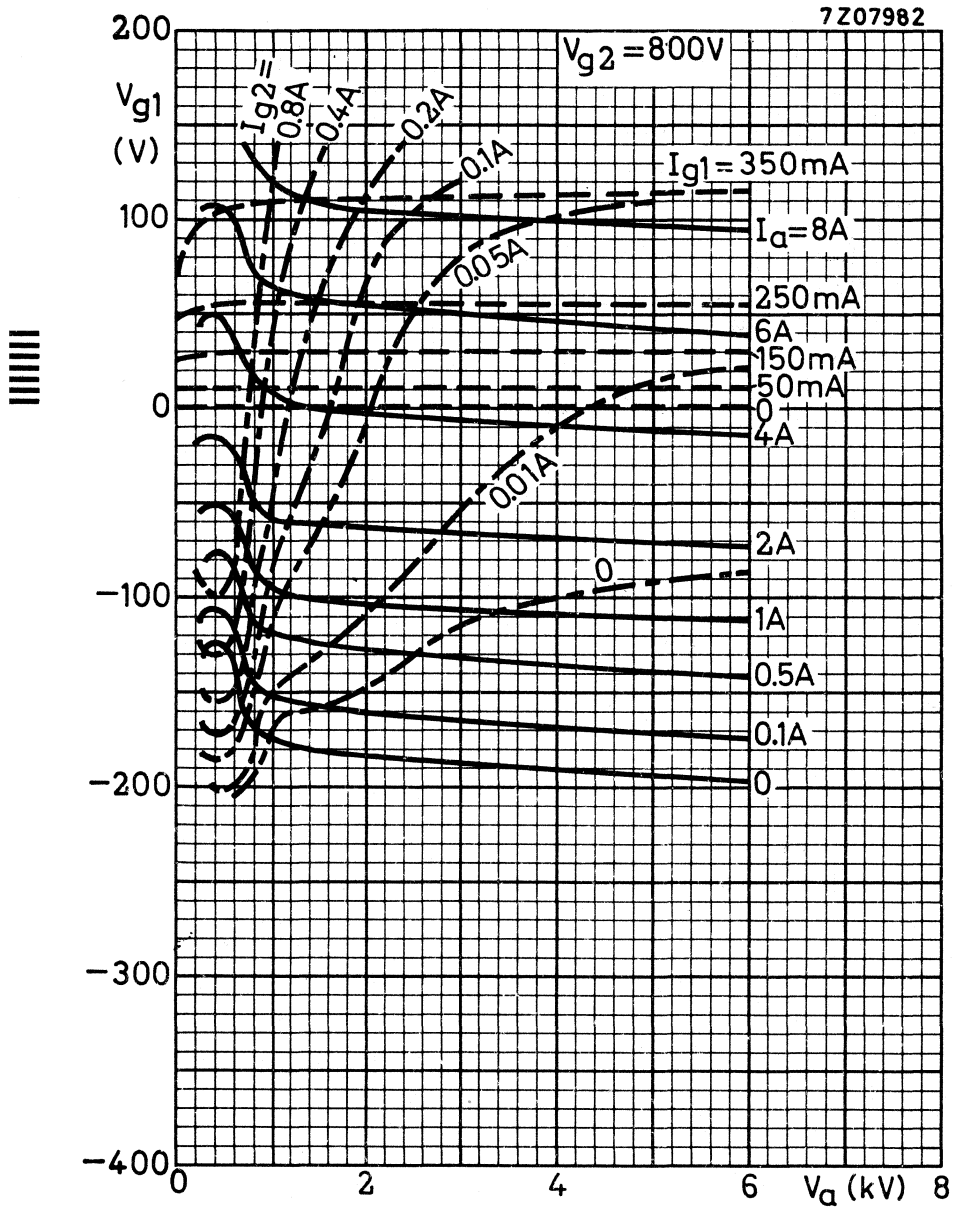
**OPERATING CONDITIONS**

Frequency	f	230 MHz
Bandwidth (-3 dB)	B (-3 dB)	10 MHz <sup>1)</sup>
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 black	5.5 kW <sup>2)</sup> 3 kW <sup>2)</sup>
Anode dissipation	$W_a$ black	3 kW

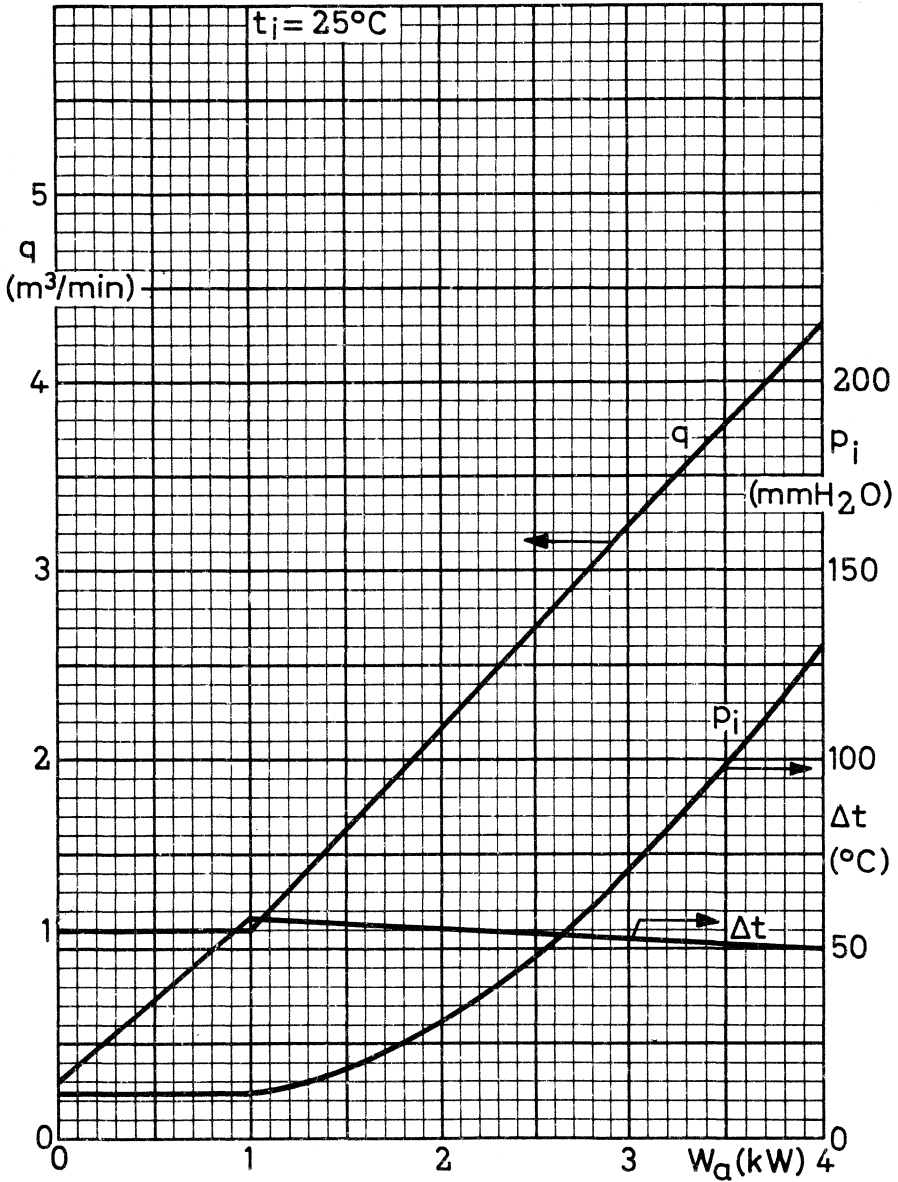
<sup>1)</sup> Bandwidth obtained with secondary circuit.

<sup>2)</sup>  $W_l$  represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%.





7Z07983





## 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 ( $> 0.5 \text{ m}^3/\text{min}$ ) should be directed to the filament and grid seals.

**MECHANICAL DATA**

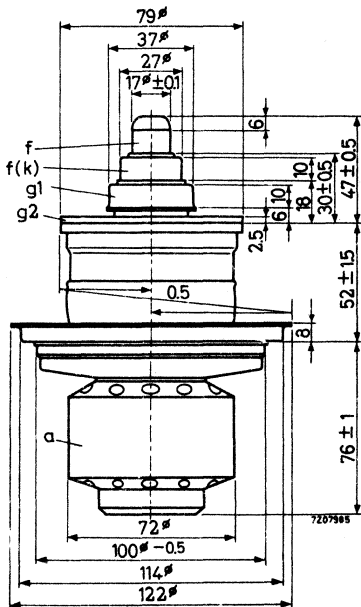
Dimensions in mm

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	$V_{g2}$	max.	800	V
Grid No.1 voltage	$-V_{g1}$	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	$W_{g2}$	max.	120	W
Grid No.1 dissipation	$W_{g1}$	max.	40	W

**OPERATING CONDITIONS**

Frequency	f	30	MHz	
Anode voltage	$V_a$	4.5	kV	
Grid No.2 voltage	$V_{g2}$	800	V	
Grid No.1 voltage	$V_{g1}$	-140	V <sup>1)</sup>	
		zero signal	single tone	double tone
Grid No.1 driving voltage	$V_{g1p}$	0	140	140 V
Anode current	$I_a$	0.5	1.33	0.93 A
Grid No.2 current	$I_{g2}$	0	30	8 mA
Grid No.1 current	$I_{g1}$	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	$W_{g2}$	0	24	6.4 W
Driver output power	$W_{dr}$	0	30	30 W <sup>3)</sup>
Output power in load (P.E.P.)	$W_l$	-	3	3 kW <sup>2)</sup>

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

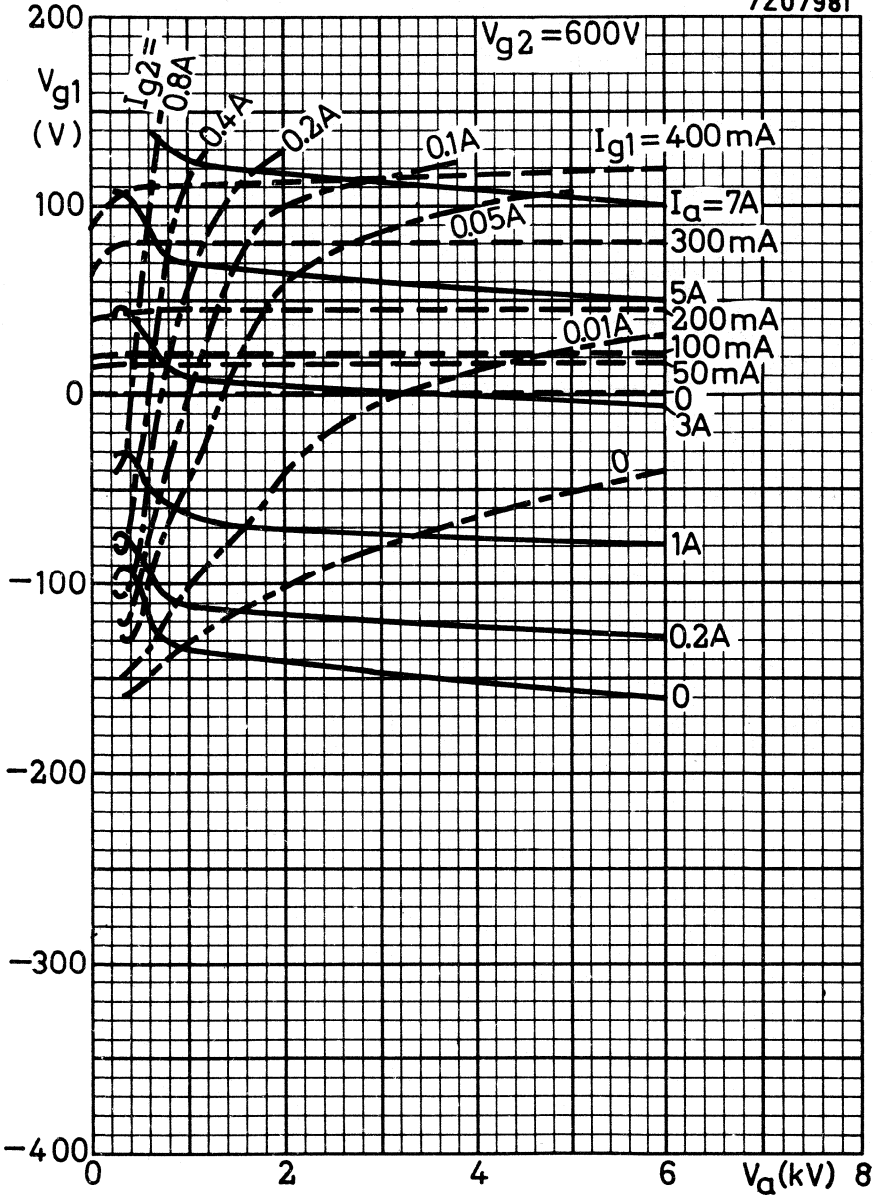
**OPERATING CONDITIONS**

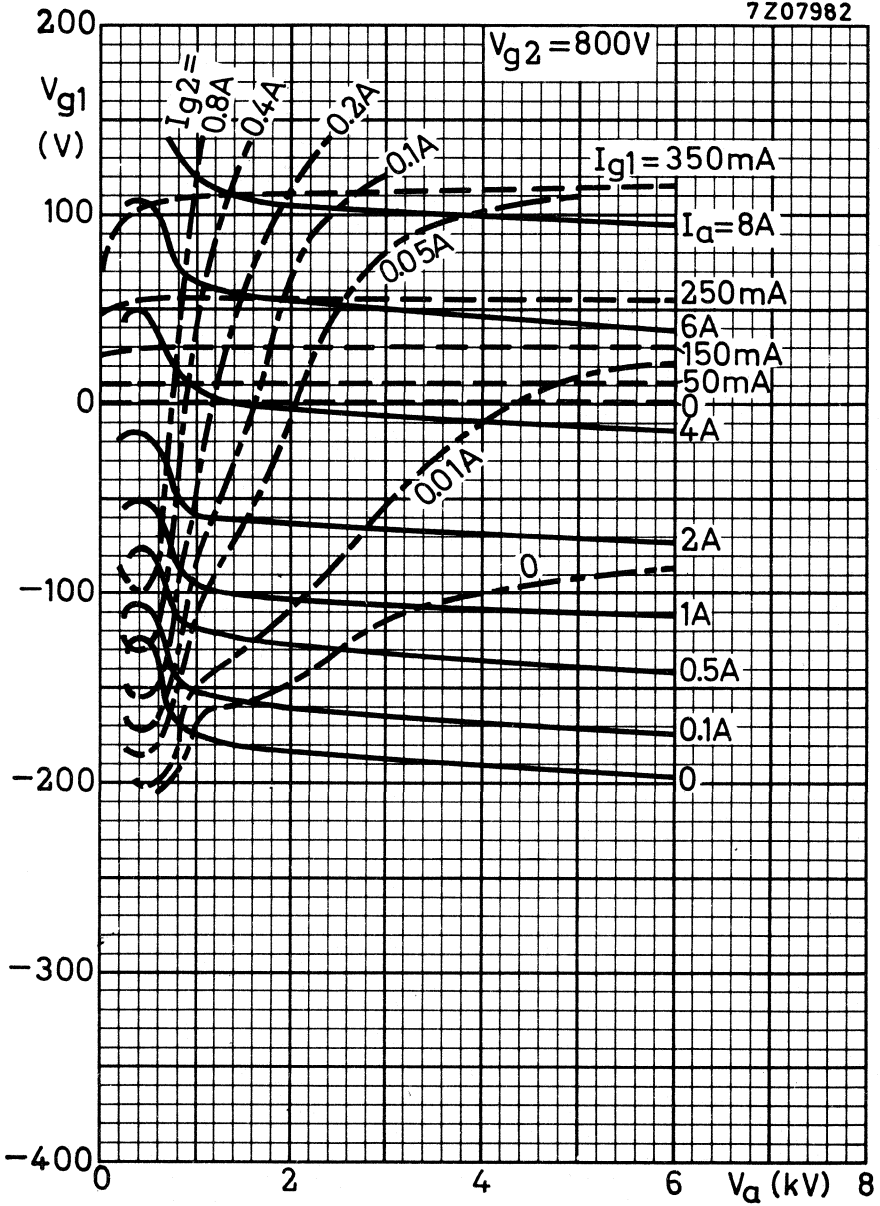
Frequency	$f$	230 MHz
Bandwidth (-3 dB)	$B$ (-3 dB)	10 MHz <sup>1)</sup>
Anode voltage	$V_a$	4 kV
Grid No. 2 voltage	$V_{g2}$	600 V
Grid No. 1 voltage	$V_{g1}$	-115 V
Input A.C. voltage, peak	$V_{g1p}$ sync	280 V
Anode current	$I_a$ black	1.5 A
Grid No. 2 current	$I_{g2}$ black	40 mA
Grid No. 1 current	$I_{g1}$ black	60 mA
Driver output power	$W_{dr}$ sync	550 W
Output power in load	$W_l$ sync	5.5 kW <sup>2)</sup>
	$W_l$ black	3 kW <sup>2)</sup>
Anode dissipation	$W_a$ black	3 kW

<sup>1)</sup> Bandwidth obtained with secondary circuit.

<sup>2)</sup>  $W_l$  represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%.

7Z07981





## 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 <sub>a</sub>	350	V
	W <sub>dr</sub>	1.0	W	W <sub>ℓ</sub>	26	W
RF class C telegraphy	f	500	MHz	V <sub>a</sub>	250	V
	W <sub>dr</sub>	2.5	W	W <sub>ℓ</sub>	14.5	W
RF class C frequency multiplier	f	167/500	MHz	V <sub>a</sub>	250	V
	W <sub>dr</sub>	2.2	W	W <sub>ℓ</sub>	2.5	W
RF class C a/g <sub>2</sub> mod.	f	175	MHz	V <sub>a</sub>	280	V
	W <sub>dr</sub>	1.5	W	W <sub>ℓ</sub>	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  $\pm 15\%$

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

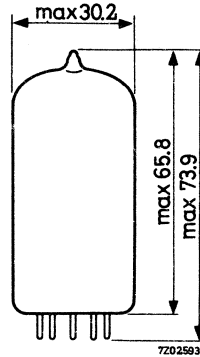
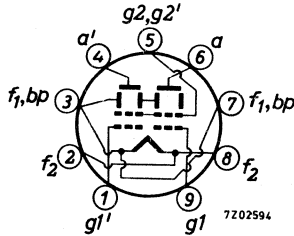
Input  $C_i$  4.7 pF

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

$\mu_{g2g1} \quad 20$

Transconductance

at  $V_a = 150$  V,  $V_{g2} = 150$  V,  $I_a = 45$  mA

S  $9.5 \text{ mA/V}$

## 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 typesuitable for the high filament current.

Filament connections (tags 3-7 and 2-8) should be connected in parallel on the socket.

## WEIGHT

Net weight  $27 \text{ g}$

## TEMPERATURE LIMITS AND COOLING

Radiation and convection cooling. The use of a closed tube shield is not recommended.

Absolute maximum bulb temperature

$t_{bulb} \quad \text{max. } 230 \text{ } ^\circ\text{C}$

**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	$V_{g2}$	max.	200	200	V
Grid No.1 voltage	$-V_{g1}$	max.	150	100	V
Anode current	$I_a$	max.	2x75	2x75	mA
Grid No.1 current	$I_{g1}$	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	$W_{g2}$	max.	3.5	3.5	W
Grid No.1 circuit resistance	$R_{g1}$	max.	100	100	k $\Omega$

**OPERATING CONDITIONS** Intermittent service, **ICAS**

Frequency	f	200	200	500	MHz
Anode voltage	$V_a$	350	350	260	V
Grid No.2 supply voltage	$V_{bg2}$	350	350	260	V
Grid No.2 series resistor	$R_{g2}$	9	9	4.3	k $\Omega$
Grid No.1 voltage	$V_{g1}$	-26	-13	-22.5	V
Grid No.1 circuit resistance	$R_{g1}$	4.7 <sup>1)</sup>	2 <sup>1)</sup>	6.9 <sup>2)</sup>	k $\Omega$
Driving voltage	$V_{g1g1'p}$	85	85	65	V
Anode current	$I_a$	2x70	2x70	2x70	mA
Grid No.2 current	$I_{g2}$	20	23.5	20	mA
Grid No.1 current	$I_{g1}$	2x6.5	2x6.5	2x3.25	mA
Anode input power	$W_{ia}$	49	49	36.5	W
Anode dissipation	$W_a$	2x8	2x8	2x8	W
Grid No.2 dissipation	$W_{g2}$	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	$\eta$	67	67	52	%
Output power in load	$W_\ell$	26	26	14	W <sup>3)</sup>

<sup>1)</sup> Common for both units.

<sup>2)</sup> It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

<sup>3)</sup> For optimal conditions  $R_{g1}$  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	$V_{g2}$	max.	200 V
Grid No.1 voltage	$-V_{g1}$	max.	150 V
Anode current	$I_a$	max.	2x50 mA
Grid No.1 current	$I_{g1}$	max.	2x3 mA
Anode input power	$W_{ia}$	max.	27 W
Anode dissipation	$W_a$	max.	2x8 W
Grid No.2 dissipation	$W_{g2}$	max.	3.5 W
Grid No.1 circuit resistance	$R_{g1}$	max.	100 k $\Omega$

**OPERATING CONDITIONS** Intermittent service. **ICAS**

Frequency	f	167/500 MHz
Anode voltage	$V_a$	250 V
Grid No.2 supply voltage	$V_{bg2}$	250 V
Grid No.2 series resistor	$R_{g2}$	5.6 k $\Omega$
Grid No.1 circuit resistance-each unit	$R_{g1}$	27 k $\Omega$ 1)
Driving voltage	$V_{g1g1'p}$	170 V
Anode current	$I_a$	2x45 mA
Grid No.2 current	$I_{g2}$	14 mA
Grid No.1 current	$I_{g1}$	2x2.5 mA
Anode input power	$W_{ia}$	22.5 W
Anode dissipation	$W_a$	2x8 W
Grid No.2 dissipation	$W_{g2}$	2.4 W
Driver output power	$W_{dr}$	2.2 W
Output power	$W_o$	6.5 W
Efficiency	$\eta$	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  $R_{g1}$  should be adjusted to obtain the desired anode current.

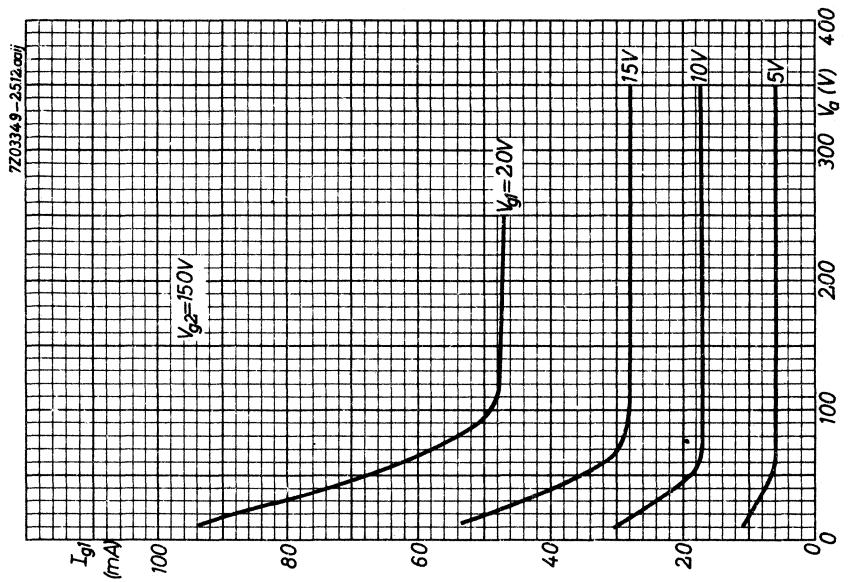
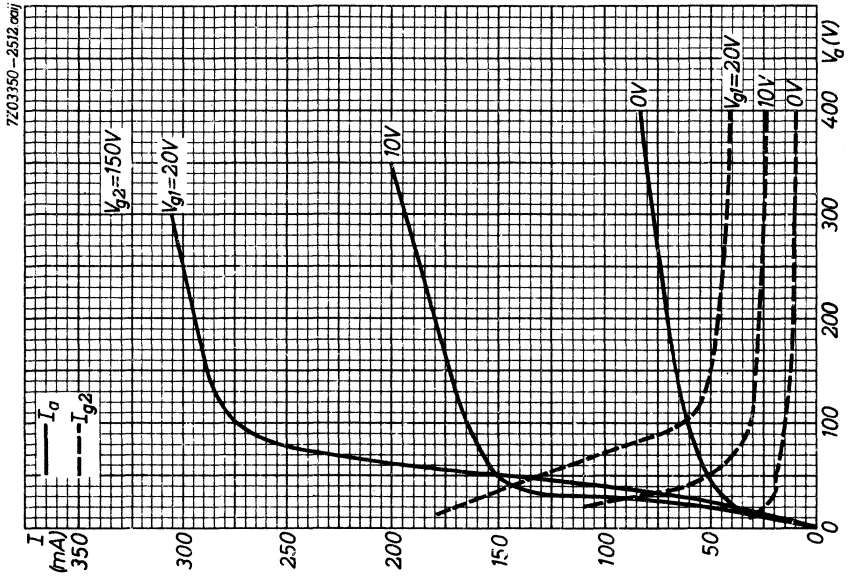


**R.F. CLASS C ANODE AND SCREEN GRID MODULATION**, two units in push-pull**LIMITING VALUES** (Absolute limits). Intermittent service, **ICAS**

Frequency	$f$	max.	200	500	MHz
Anode voltage	$V_a$	max.	330	260	V
Grid No. 2 voltage	$V_{g2}$	max.	200	200	V
Grid No. 1 voltage	$-V_{g1}$	max.	150	150	V
Anode current	$I_a$	max.	2x56	2x56	mA
Grid No. 1 current	$I_{g1}$	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	$W_{g2}$	max.	2x1.5	2x1.5	W
Grid No. 1 circuit resistance	$R_{g1}$	max.	100	100	k $\Omega$

**OPERATING CONDITIONS** ; intermittent service, **ICAS**

Frequency	$f$		175	500	MHz
Anode voltage	$V_a$		280	225	V
Grid No. 2 voltage	$V_{g2}$		150	150	V
Grid No. 1 voltage	$-V_{g1}$		35	25	V
Anode current	$I_a$		2x50	2x50	mA
Grid No. 2 current	$I_{g2}$		19	17	mA
Grid No. 1 current	$I_{g1}$		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	$\eta$		68	58	%
Output power in load	$W_l$		15	10	W
Depth of modulation	$m$		100	100	%
Modulator output power	$W_o \text{ mod}$		16	12.5	W
Grid No. 2 peak modulator voltage	$V_{g2p \text{ mod}}$		120	120	V



## 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

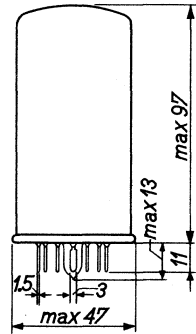
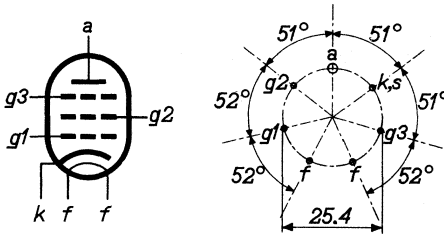
## COOLING

Radiation and convection

## MECHANICAL DATA

Base : Septar  
 Socket : 2422 513 00001  
 Net weight : 80 g

Dimensions in mm



Mounting position: any

## LIMITING VALUES (Absolute limits)

Anode voltage without cathode current	$V_{a_0}$	= 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 k $\Omega$
Grid No.2 voltage without cathode current	$V_{g_{20}}$	= 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 k $\Omega$
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

<u>Heater current</u>		I	II	III
Heater voltage	$V_f$	= 12.6		V
Heater current	$I_f$	= 1.3	1.1-1.5	1.1-1.5 A
<u>Characteristics</u>				
Heater voltage	$V_f$	= 12.6		V
Anode voltage	$V_a$	= 100		V
Grid No.3 voltage	$V_{g3}$	= 0		V
Grid No.2 voltage	$V_{g2}$	= 250		V
Anode current	$I_a$	= 100		mA
Grid No.1 voltage	$-V_{g1}$	= 18	14 - 20	12 - 22 V
Grid No.2 current	$I_{g2}$	=	12 - 25	8 - 30 mA
Grid No.1 current	$-I_{g1}$	=		20 $\mu$ A
<u>Cut-off voltage</u>				
Heater voltage	$V_f$	= 12.6		V
Anode voltage	$V_a$	= 100		V
Grid No.3 voltage	$V_{g3}$	= 0		V
Grid No.2 voltage	$V_{g2}$	= 250		V
Anode current	$I_a$	= 0.2		mA
Cut-off voltage	$-V_{g1}$	=	<60	65 V
<u>Capacitances</u>				
Anode to all other elements except grid No.1	$C_{a(g1)}$	= 12	11 - 13	pF
Grid No.1 to all other elements except anode	$C_{g1(a)}$	= 20.5	19 - 22	pF
Anode to grid No.1	$C_{ag1}$	=	<0.22	pF

**CHARACTERISTICS AND RANGE VALUES (continued)**

Insulation between the electrodes

A leakage current of 10  $\mu$ A is not exceeded when the following voltages, with polarity as indicated are applied to the indicated electrodes via a series resistor of 10 M $\Omega$

		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	$V_{ap}$	= 515 V

**STAND-BY PERFORMANCE** <sup>1)</sup>

After 200 hours of operation with  $V_f = 14$  V only, the tubes are criticised for Cathode interface resistance  $>10 \Omega$  (continuous wave method IEC Publ. 151-9, two frequency method)

**LIFE PERFORMANCE** <sup>1)</sup>

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	$V_{g3}$	=	0	V
Grid No.2 voltage	$V_{g2}$	=	250	V
Grid No.1 voltage	$V_{g1}$	=	-20	V
Grid No.1 pulse voltage (pulse substantially square)	$V_{g1p}$	=	40	V
Pulse repetition frequency	$f_{imp}$	=	80	Hz
Pulse duration	$T_{imp}$	=	8	ms

the tubes are criticised for

Inoperatives

Control grid voltage for cut-off

Control grid current

Leakage current

} See section  
"Characteristics and range values".

<sup>1)</sup> This test is performed on a sample taken from each production run.

**VIBRATIONAL NOISE OUTPUT** <sup>1)2)</sup>

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
Frequency	f	=	25	Hz <span style="float: right;">X<sub>1</sub>, X<sub>2</sub> and Y</span>
Anode load resistance	$R_a$	=	2	k $\Omega$

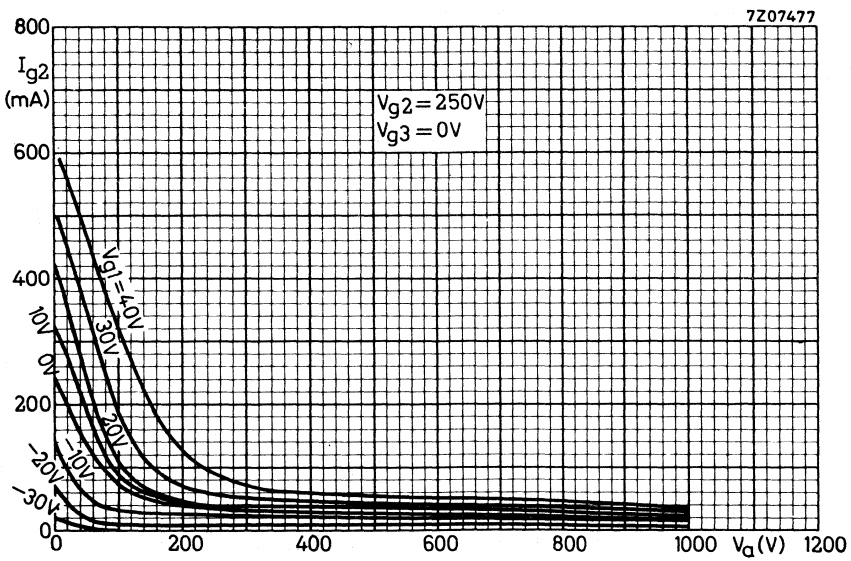
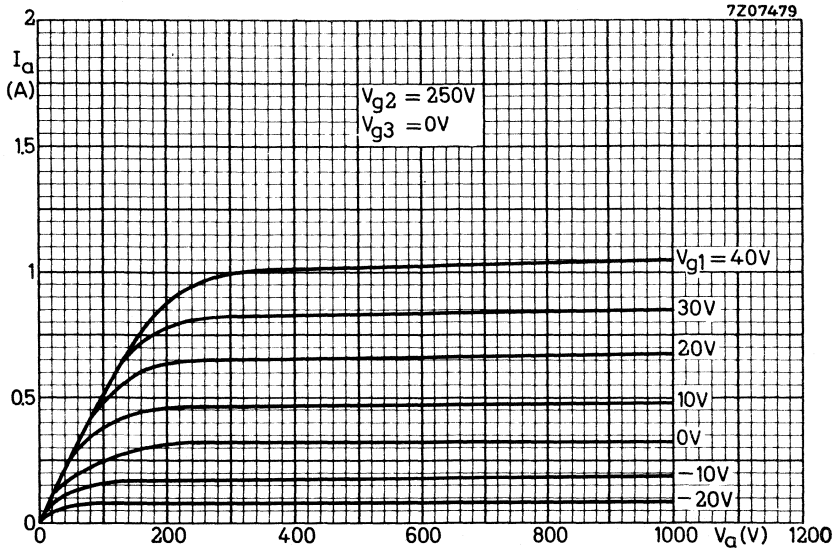
Limit of the vibrational noise output  $V_{noise} = \max. 750$  mV(RMS)**FATIGUE**: 2.5 g <sup>1)2)</sup>Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of the three directions X<sub>1</sub>, X<sub>2</sub> and Y**VIBRATION**: 5 g <sup>1)2)</sup>Vibrational forces for a period of 2 hours at a frequency of 25 Hz in each of the three directions X<sub>1</sub>, X<sub>2</sub> and Y

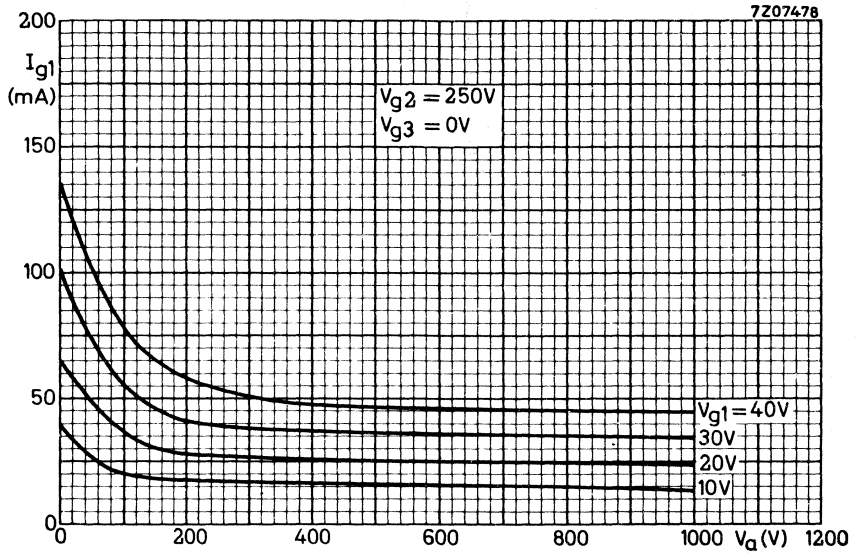
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<sup>1)</sup> This test is performed on a sample taken from each production run.

<sup>2)</sup> 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.







**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)	B amplifier		Class AB SSB	
	$V_a$ (V)	$W_{load}$ (W)	$V_a$ (V)	$W_o$ PEP (W)
220	3000	1000	3000	> 1050
30				

**HEATING:** indirect by A.C. or D.C.; cathode oxide-coated, matrix type

Heater voltage	$V_f$	5.0 V $\pm$ 3%
Heater current	$I_f$	18 A (< 20 A)
Waiting time	$T_w$	min. 5 min.

### CAPACITANCES

Anode to cathode and heater	$C_{a-k, f}$	< 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	$C_{g1-k, f}$	33 to 42 pF
Grid No.1 to grid No.2	$C_{g1-g2}$	48 to 64 pF
Grid No.2 to cathode and heater	$C_{g2-k, f}$	< 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
Mutual conductance	S	20 mA/V
Amplification factor	$\mu_{g2g1}$	7.5 -

## TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals (see also outline drawing)	$t_s$	max. 200 °C
Air inlet temperature	$t_i$	max. 45 °C

## COOLING

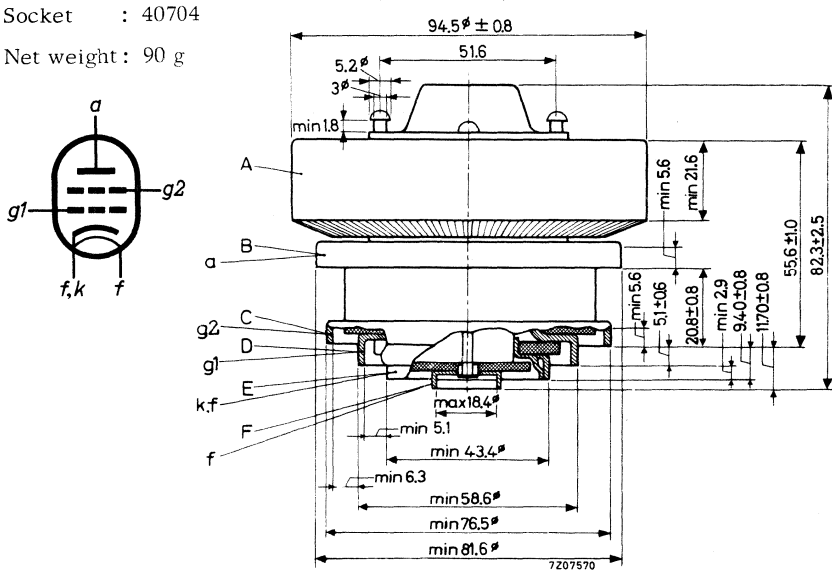
Forced air cooling for the anode. For cooling characteristics see page 5. Low velocity air flow for the ceramic to metal seals. Cooling will also be necessary when only the heater voltage is applied to the tube.

## MECHANICAL DATA

Dimensions in mm

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	k $\Omega$

**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	$W_{\ell}$	0	1.0 kW

1) For AM.

2) Page 4.

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 A.B. LINEAR AMPLIFIER SINGLE SIDE BAND suppressed carrier

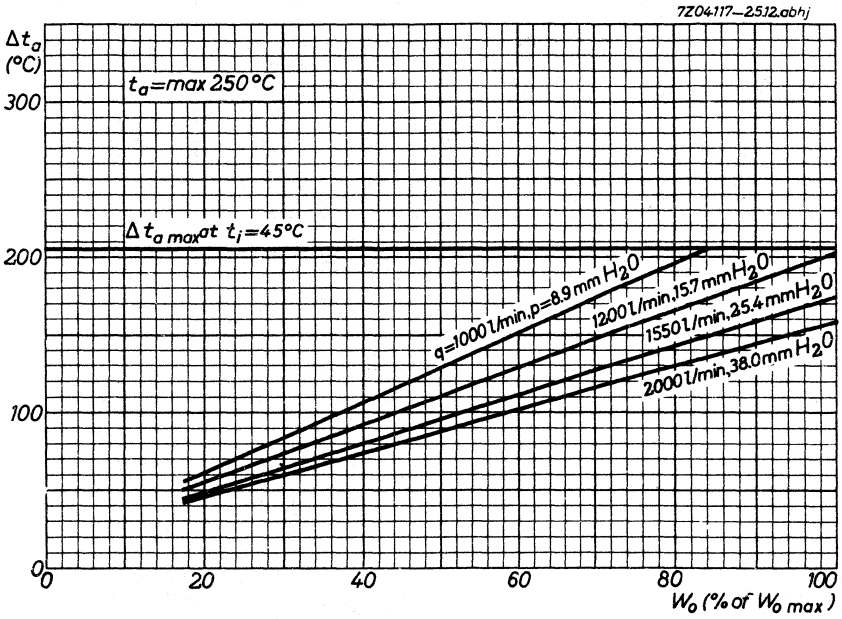
### LIMITING VALUES (Absolute limits)

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	$W_{i_{g_2}}$	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.	0 mA
Grid No.1 circuit resistance	$R_{g_1}$	max.	5 k $\Omega$

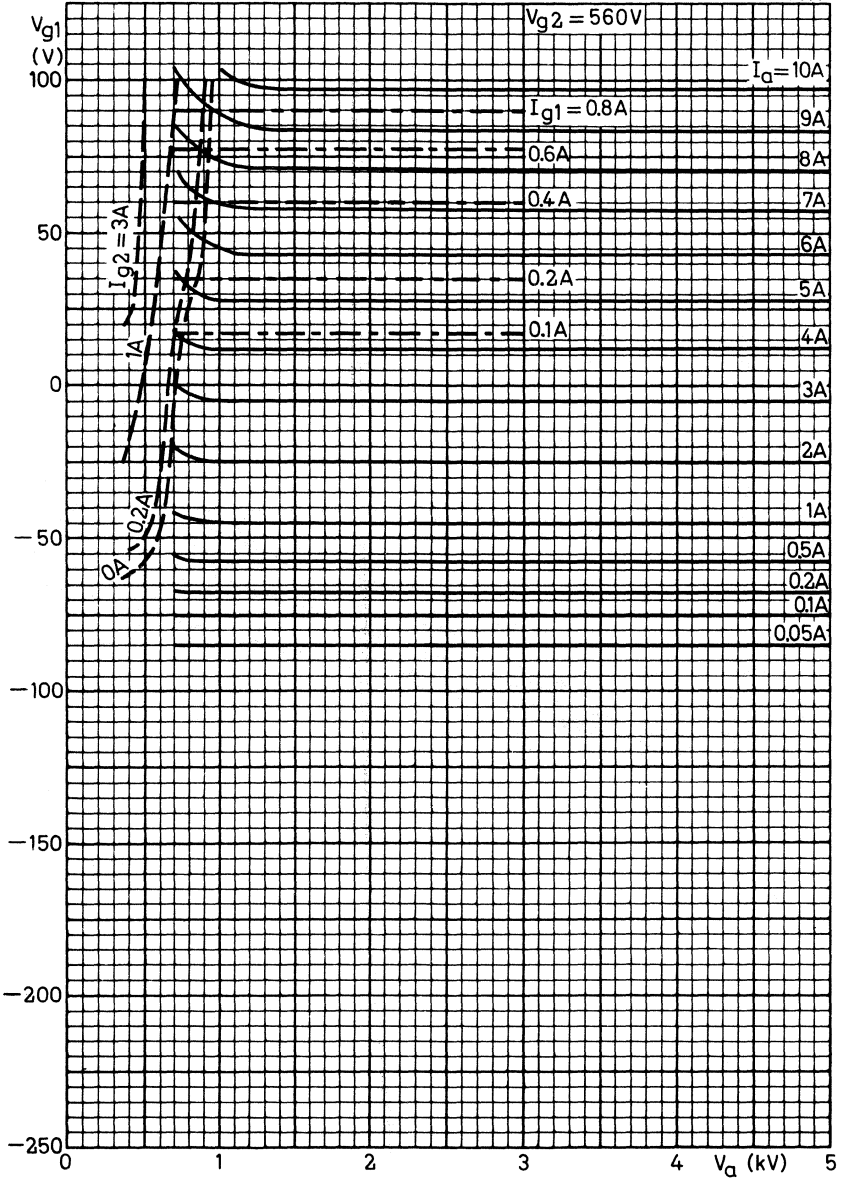
### OPERATING CONDITIONS

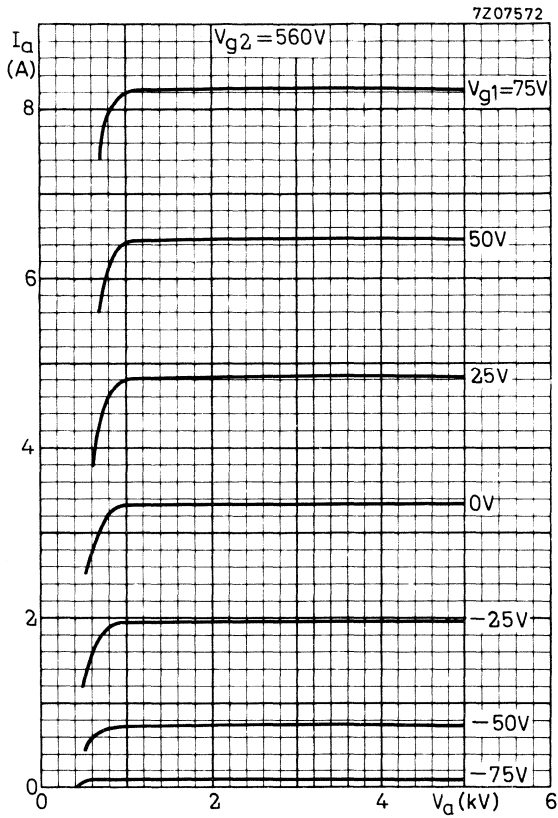
Frequency	f	1 to 30	MHz
Anode voltage	$V_a$	3.0	kV
Grid No.2 voltage	$V_{g_2}$	560	V
Grid No.1 voltage	$V_{g_1}$	-55	V
		zero signal	single tone signal
Peak driving voltage	$V_{g_{1p}}$	0	48 (<53)
Anode current	$I_a$	380	750
Grid No.2 current	$I_{g_2}$	-5	-20
Grid No.1 current	$I_{g_1}$	0	0
Grid No.1 resistor	$R_{g_1}$	2	2
Driver output power	$W_{dr}$	0	< 5
Anode input power	$W_{i_a}$	1140	2250
Anode dissipation	$W_a$	1140	1080
Output power in load	$W_l$	0	1050
PEP output power in load	$W_l$	0	-
Intermodulation distortion			double tone signal
1 MHz. of the 3rd order	$d_3$	-	< -38 dB 2)
of the 5th order	$d_5$	-	< -38 dB 2)
30 MHz. of the 3rd order	$d_3$	-	< -36 dB 2)
of the 5th order	$d_5$	-	< -36 dB 2)

2) See page 3.



7Z07571







## 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-g2 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 $V_a = \text{max.}$	450 V	360 V	450 V
Anode dissipation $W_a = \text{max.}$	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 $W_f =$	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	$C_{ag1} <$	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

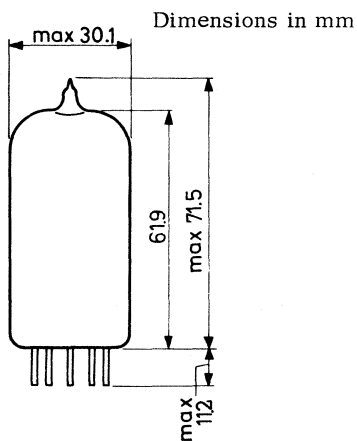
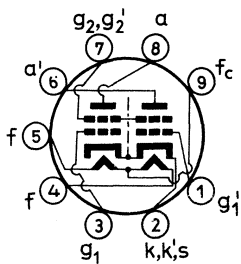
**COOLING:** radiation and convection

The use of a closed tube shield is not recommended

## MECHANICAL DATA

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)

Frequency	f	CCS		ICAS	
		up to 200	up to 200	up to 200	MHz
Anode voltage	$V_a$	= max. 400	max. 400	max. 450	V
Anode current	$I_a$	= max. 45	max. 45	max. 55	mA
Anode input power	$W_{ia}$	= max. 18	max. 18	max. 25	W
Anode dissipation	$W_a$	= max. 7.5	max. 7.5	max. 10	W
Grid No.2 voltage	$V_{g2}$	= max. 200	max. 200	max. 200	V
Grid No.2 dissipation	$W_{g2}$	= max. 1	max. 1	max. 1	W
Negative grid No.1 voltage	$-V_{g1}$	= max. 150	max. 150	max. 150	V
Grid No.1 current	$I_{g1}$	= max. 3	max. 3	max. 4	mA
Grid No.1 dissipation	$W_{g1}$	= max. 0.2	max. 0.2	max. 0.2	W
Heater to cathode voltage	$V_{kf}$	= max. 100	max. 100	max. 100	V

OPERATING CONDITIONS; two systems in push-pull

Frequency	f	CCS		ICAS	
		175	175	175	MHz
Anode voltage	$V_a$	= 400	400	450	V
Grid No.2 voltage	$V_{g2}$	= 180	190	190	V
Grid No.1 voltage	$V_{g1}$	= -50	-50	-50	V
Grid No.1 resistor	$R_{g1}$	= 31	28	26	k $\Omega$
Anode current	$I_a$	= 2x45	2x55	2x55	mA
Grid No.2 current	$I_{g2+g2'}$	= 3.8	5.0	4.5	mA
Grid No.1 current	$I_{g1}$	= 2x0.8	2x0.9	2x0.95	mA
Grid No.2 dissipation	$W_{g2+g2'}$	= 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	$\eta$	= 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)

Frequency	f	CCS		ICAS	
		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

Frequency	f	CCS		ICAS	
		=	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	$\eta$	=	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%.

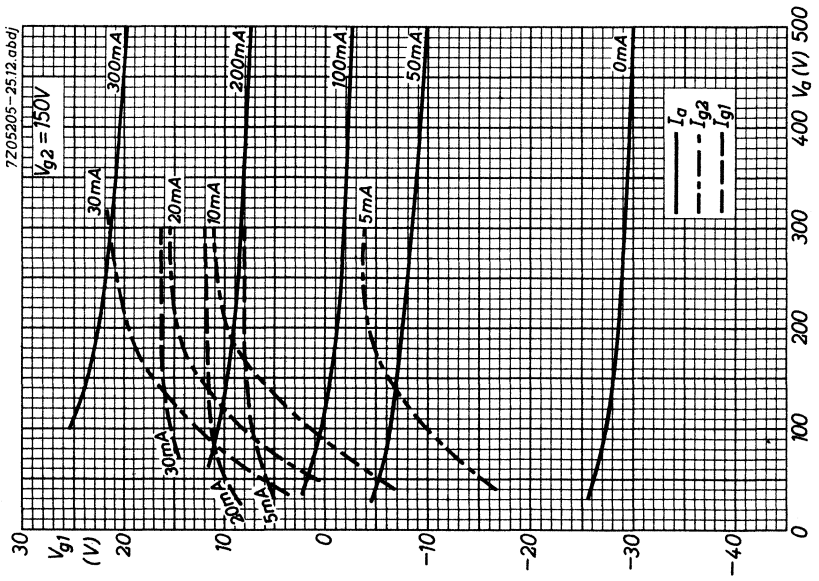
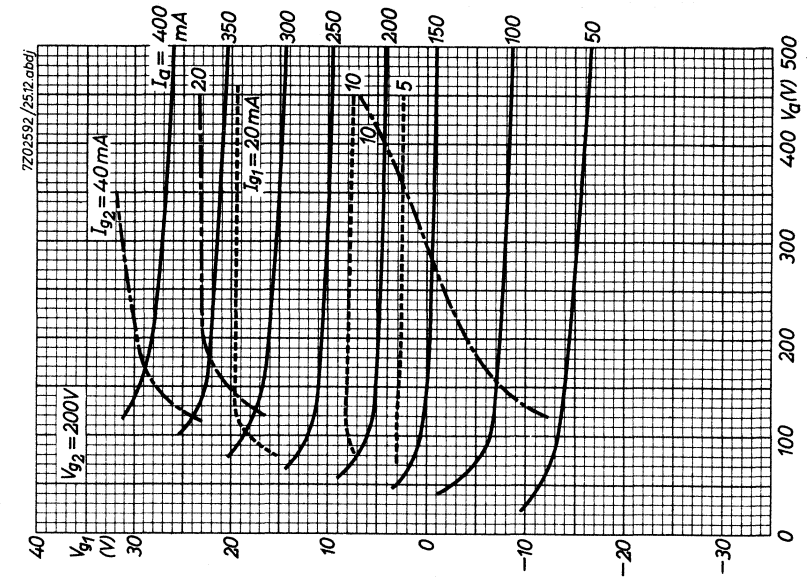
**R.F. CLASS C FREQUENCY TRIPLER**

**LIMITING VALUES** (Each system; absolute limits)

		<b>CCS</b>	<b>ICAS</b>
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	$V_{g2}$	= max. 200	max. 200 V
Grid No.2 dissipation	$W_{g2}$	= max. 1	max. 1 W
Negative grid No.1 voltage	$-V_{g1}$	= max. 150	max. 150 V
Grid No.1 current	$I_{g1}$	= max. 2	max. 3 mA
Heater to cathode voltage	$V_{kf}$	= max. 100	max. 100 V

**OPERATING CONDITIONS** ; two systems in push-pull

		<b>ICAS</b>
Frequency	f	= 58/174 MHz
Anode voltage	$V_a$	= 350 V
Grid No.2 voltage	$V_{g2}$	= 165 V
Grid No.1 voltage	$V_{g1}$	= -150 V
Grid No.1 resistor	$R_{g1}$	= 34 k $\Omega$
Anode current	$I_a$	= 2x43 mA
Grid No.2 current	$I_{g2+g2'}$	= 5.0 mA
Grid No.1 current	$I_{g1}$	= 2x2.2 mA
Driving power	$W_{dr}$	= 2.0 W
Output power in the load	$W_l$	= 10 W
Overall efficiency	$\eta$	= 33 %



## 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	58.5
	600		
175	400	38	46
	450	38	
	500		
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	$\mu_{g2g1}$	=	8
Mutual conductance	$S$	=	7 mA/V

## TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 250 °C

Seal temperature = max. 230 °C

## MECHANICAL DATA

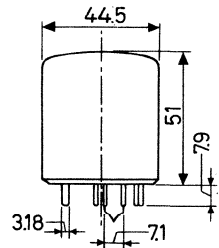
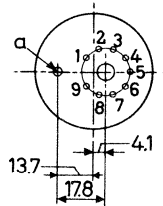
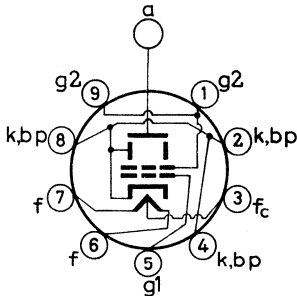
Dimensions in mm

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	$V_{g2}$	= max. 300	max. 300	V
Grid No.2 input power	$W_{ig2}$	= max. 4	max. 4	W
Negative grid No.1 voltage	$-V_{g1}$	= max. 200	max. 200	V
Grid No.1 circuit resistance				
with fixed bias	$R_{g1}$	= max. 50	max. 50	k $\Omega$
with automatic bias	$R_{g1}$	= max. 100	max. 100	k $\Omega$
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	$V_{g2}$	= 235	250	230	V
Grid No.1 voltage	$V_{g1}$	= -50	-55	-51	V
Grid No.1 resistor	$R_{g1}$	= 10	21	11	k $\Omega$
Anode current	$I_a$	= 136	134	150	mA
Grid No.2 current	$I_{g2}$	= 11	11	10	mA
Grid No.1 current	$I_{g1}$	= 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	$\eta$	= 69	63.5	63.5	%

**R.F. AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY**

**ICAS** Intermittent service

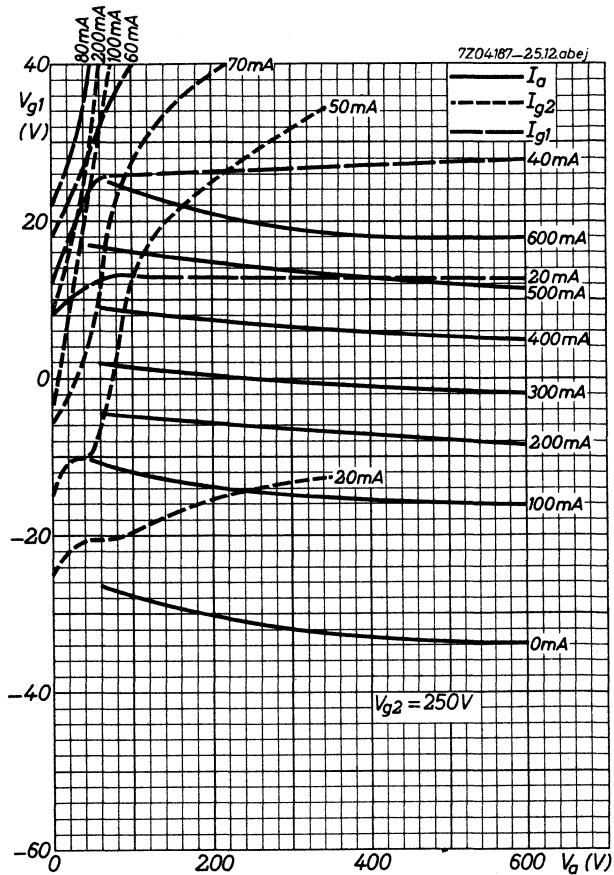
**LIMITING VALUES** (Absolute limits)

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	$V_{g2}$	= max.	300	300	300	V
Grid No.2 input power	$W_{ig2}$	= max.	4	4	4	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	200	200	200	V
Grid No.1 circuit resistance						
with fixed bias	$R_{g1}$	= max.	50	50	50	k $\Omega$
with automatic bias	$R_{g1}$	= max.	100	100	100	k $\Omega$
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	$V_{g2}$	=	255	225	235	V
Grid No.1 voltage	$V_{g1}$	=	-50	-55	-54	V
Grid No.1 resistor	$R_{g1}$	=	10	11	11	k $\Omega$
Anode current	$I_a$	=	150	150	150	mA
Grid No.2 current	$I_{g2}$	=	10	10	4	mA
Grid No.1 current	$I_{g1}$	=	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	$\eta$	=	65	61.5	53.5	%







**R.F. BEAM POWER TETRODE****HEATING:** indirect; cathode oxide coated

Heater voltage

 $V_f = 19 \text{ V}$ 

Heater current

 $I_f = 2.3 \text{ A}$ 

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For further data and curves of this type  
please refer to type QE08/200  
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## HEATSINK COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA		
Frequency (MHz)	Class C telegraphy	
	V <sub>a</sub> (V)	W <sub>o</sub> (W)
175	2000	270
470	800	100

**HEATING:** indirect by AC or DC; cathode oxide coated

Heater voltage	V <sub>f</sub>	=	6.0 V
Heater current	I <sub>f</sub>	=	2.6 A
Waiting time	T <sub>w</sub>	= 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 <sub>a</sub>	=	4.5 pF
Grid No.1 to all except anode	C <sub>g1</sub>	=	15.7 pF
Anode to grid No.1	C <sub>ag1</sub>	=	0.03 pF

### TYPICAL CHARACTERISTICS

Anode and grid No.2 voltage (interconnected)	V <sub>a</sub> = V <sub>g2</sub>	=	300 V
Cathode current	I <sub>k</sub>	=	50 mA
Amplification factor	μ <sub>g2g1</sub>	=	5.2

### TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	t <sub>s</sub>	= max.	250 °C
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### COOLING DATA

Thermal contact area		=	3.2 cm <sup>2</sup>
Thermal resistance from seal to thermal contact area	R <sub>th</sub>	=	0.03 °C/W

See also operating notes

# YL1320

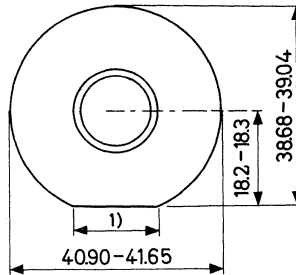
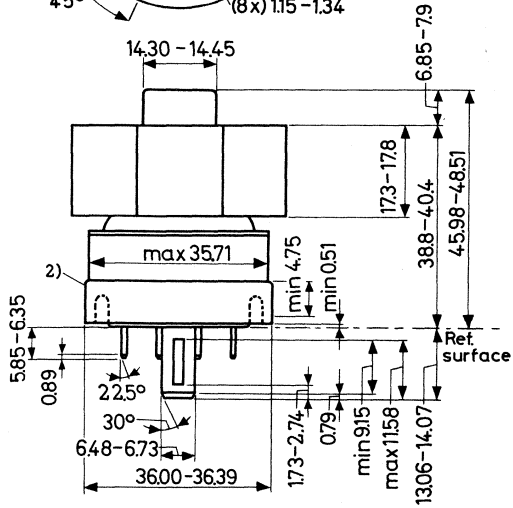
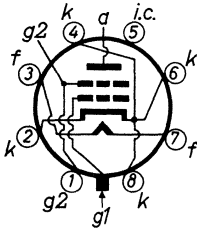
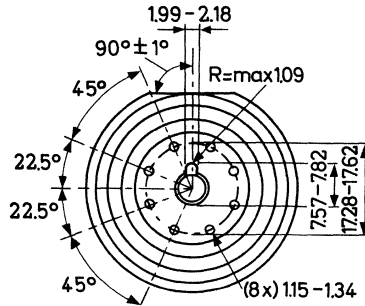
## MECHANICAL DATA

Net weight: 230 g

### Accessories

Socket 40739

Dimensions in mm



Mounting position: any

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 <sup>1)</sup>	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	$\eta$	=	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:

$$R_{th \max} = \frac{t_s \max - t_{amb}}{W_d} \quad (1)$$

where  $t_s \max$  = max. seal temperature (°C)

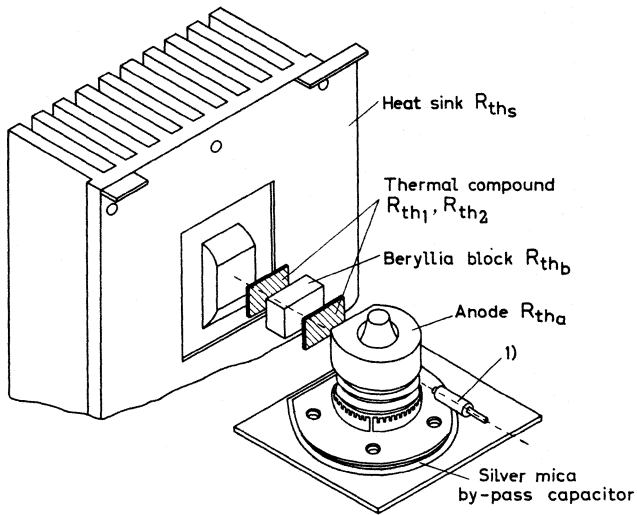
$t_{amb}$  = ambient temperature (°C)

$W_d$  = power to be dissipated (W)

The graphs on page A illustrate a plot of this equation assuming the maximum seal temperature to be 250 °C. 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 °C and a maximum allowable seal temperature of 250 °C. Through the use of either equation (1) or the curves of page A we see that the maximum allowable thermal resistance is 2.0 °C/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:

$$R_{th_a} + R_{th_1} + R_{th_b} + R_{th_2} + R_{th_s} \leq R_{th_{max}} \quad (2)$$

<sup>1)</sup> 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

$$R_{th_x} = \frac{\text{thickness}}{\text{standard thickness}} \times \frac{\text{standard area}}{\text{area}} \times R_{th} \quad (3)$$

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<sup>2</sup>. 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<sup>2</sup> x 4.45 cm is found in this way:

$$R_{th_b} = \frac{4.45}{1} \times \frac{1}{3.2} \times 0.635 = 0.88 \text{ } ^\circ\text{C/W.}$$

The value of  $R_{th_a}$  is given in the data sheets as 0.03 °C/W.

Assuming a value of 0.2 °C/W for the sum of  $R_{th_1}$  and  $R_{th_2}$  and the previous found value of 2.0 °C/W for  $R_{th_{max}}$ , equation (2) yields:

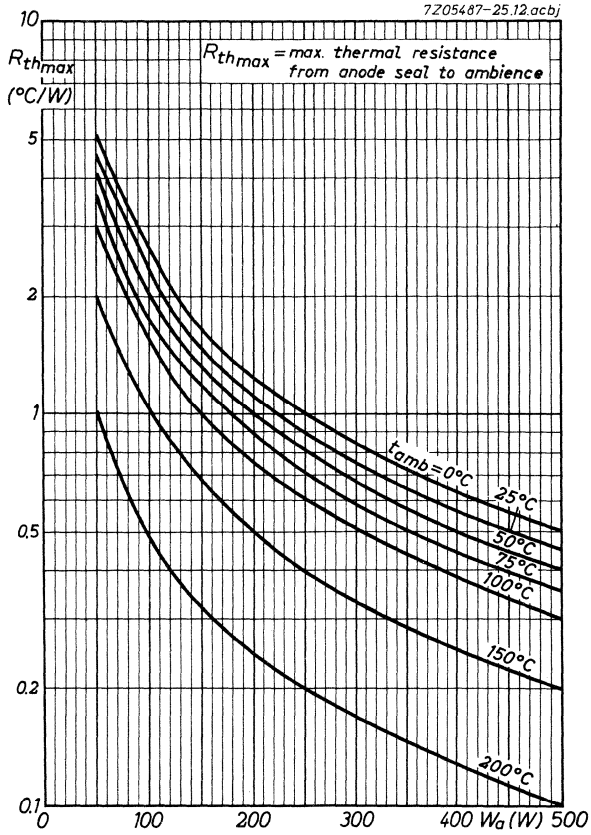
$$0.03 + 0.2 + 0.88 + R_{th_s} \leq 2.0$$

thus leaving for  $R_{th_s}$  a value of max. 0.89 °C/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 <sup>2</sup>		Cubes 1 cm x 1 cm <sup>2</sup>	
Item	°C/W	Item	°C/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





## FORCED AIR COOLED R.F. POWER TETRODE

Forced air cooled R.F. power tetrode in coaxial construction mainly intended for use as linear amplifier for S.S.B. suppressed carrier service and F.M. amplifier up to 225 MHz.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		C telegraphy FM telephony	
	$V_a$ (kV)	$W_L$ (kW)PEP	$V_a$ (kV)	$W_L$ (kW)
10	6	10.8	7	15
220				

**HEATING** : Direct; filament thoriated tungsten, mesh type

Filament voltage	$V_f$	7	$V \pm 5\%$
Filament current	$I_f$	127	A
Filament surge current	$I_{fp}$	max. 500	A
Cold filament resistance	$R_{fo}$	0.006	$\Omega$

### CAPACITANCES

	(grounded cathode)	(grounded grid)
Input	$C_{g1(a)}$ 170 pF	$C_{f(a)}$ 80 pF
Output	$C_{a(g1)}$ 34 pF	$C_{a(f)}$ 34.9 pF
Anode to grid No.1	$C_{ag1}$ 1 pF	
Anode to filament		$C_{af}$ 0.12 pF

### TYPICAL CHARACTERISTICS

Anode voltage	$V_a$	6	kV
Grid No.2 voltage	$V_{g2}$	1.35	kV
Anode current	$I_a$	1.3	A
Transconductance	S	27	mA/V
Amplification factor	$\mu_{g2g1}$	5.5	

### TEMPERATURE LIMITS

Absolute max. envelope temperature	$t_{env}$ max.	240	$^{\circ}C$
Recommended envelope temperature	$t_{env} \leq$	200	$^{\circ}C$
Absolute max. anode core temperature (measured in the reference plane for temperature measurement. See outline drawing)	$t_a$ max.	240	$^{\circ}C$



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

**LIMITING VALUES** (Absolute max. rating system)

Frequency	f	up to	225	MHz
Anode voltage	$V_{a/g_1}$	max.	8.6	kV
Grid No.2 voltage	$V_{g_2/g_1}$	max.	1300	V
Cathode voltage	$V_{k/g_1}$	max.	400	V
Anode current	$I_a$	max.	4	A
Anode input power	$W_{i_a}$	max.	30	kW
Anode dissipation	$W_a$	max.	10	kW
Grid No.2 dissipation	$W_{g_2}$	max.	400	W
Grid No.1 dissipation	$W_{g_1}$	max.	100	W

**OPERATING CONDITIONS**

Frequency	f	220	MHz
Anode voltage	$V_{a/g_1}$	7	kV
Grid No.2 voltage	$V_{g_2/g_1}$	1260	V
Cathode voltage	$V_{k/g_1}$	200	V
Anode current	$I_a$	3.8	A
Grid No.2 current	$I_{g_2}$	150	mA
Grid No.1 current	$I_{g_1}$	27	mA
Driving power	$W_{dr}$	700	W
Anode input power	$W_{i_a}$	26.6	kW
Anode dissipation	$W_a$	9	kW
Output power	$W_o$	17,6	kW
Output power in load	$W_l$	15	kW <sup>1)</sup>
Efficiency, total	$\eta$	56	%

<sup>1)</sup> Measured in a circuit having an efficiency of approx. 85%.

**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.	7.2 kV
Grid No.2 voltage	$V_{g2}$	max.	1.5 kV
Grid No.1 voltage	$-V_{g1}$	max.	250 V
Anode current	$I_a$	max.	4 A
Anode input power	$W_{i_a}$	max.	28.8 kW
Anode dissipation	$W_a$	max.	10 kW
Grid No.2 dissipation	$W_{g2}$	max.	400 W

**OPERATING CONDITIONS**

Frequency	f	10	MHz	
Anode voltage	$V_a$	6	kV	
Grid No.2 voltage	$V_{g2}$	1350	V	
Grid No.1 voltage	$V_{g1}$	-202	V 1)	
Grid No.1 resistor	$R_{g1}$	3	k $\Omega$	
		zero signal	single tone	double tone
Grid No.1 driving voltage	$V_{g1p}$	0	185	185 V
Anode current	$I_a$	1.3	3.5	2.4 A
Grid No.2 current	$I_{g2}$	0	250	91 mA
Grid No.1 current	$I_{g1}$	0	0	0 mA
Anode input power	$W_{i_a}$	7.8	21	14 kW
Anode dissipation	$W_a$	7.8	9	8 kW
Grid No.2 dissipation	$W_{g2}$	-	340	120 W
Output power in load (P.E.P.)	$W_l$	-	10.8	10.8 kW 2)
Efficiency, total	$\eta$	-	51.5	38.5 %
Intermodulation distortion				
3 <sup>d</sup> order	$d_3$	-	-	-38 dB 3)
5 <sup>th</sup> order	$d_5$	-	-	-45 dB 3)

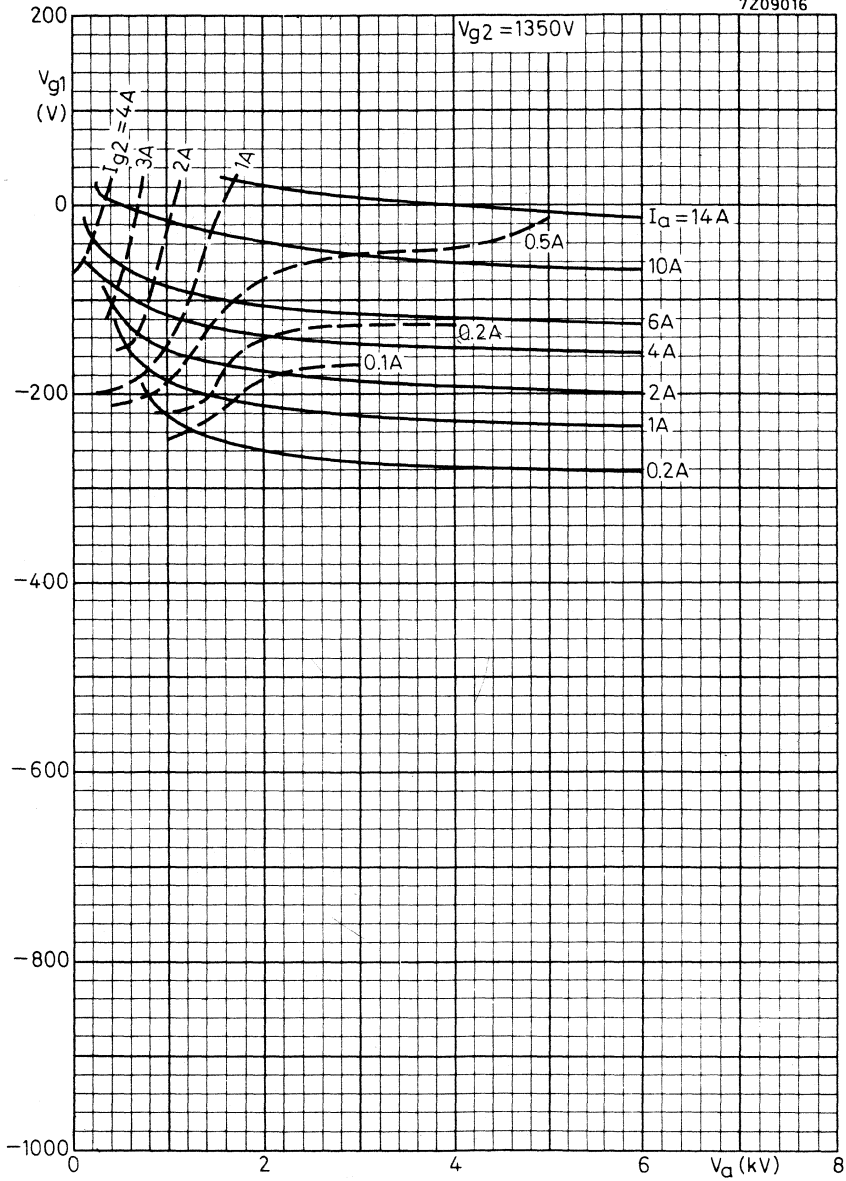
1) To be adjusted for  $I_a$  zero signal.

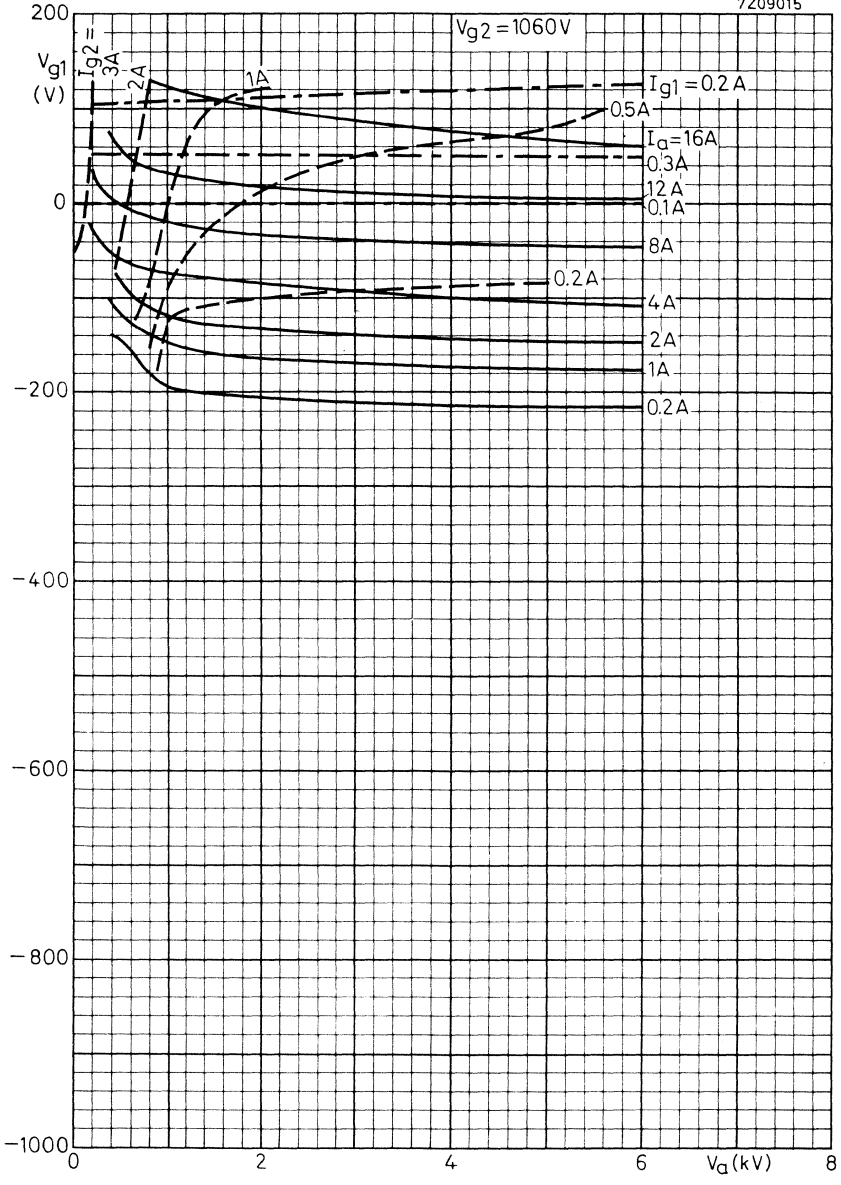
2) Measured in a circuit having an efficiency of approx. 90%.

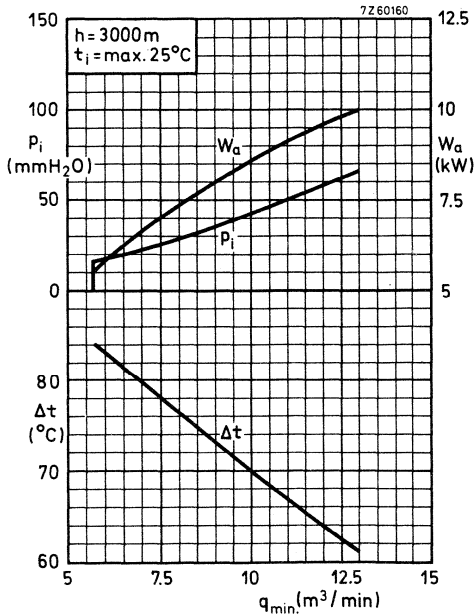
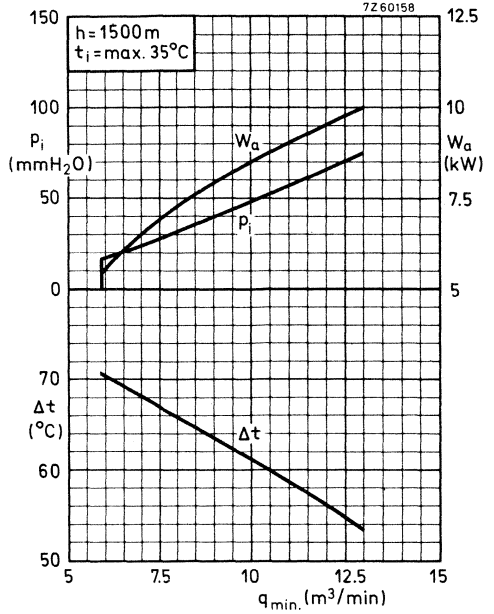
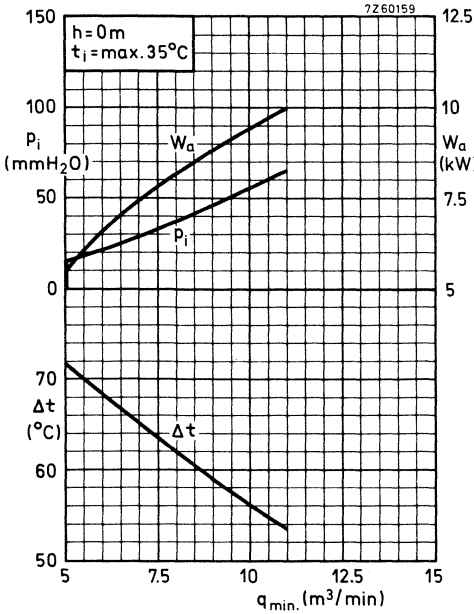
3) Maximum encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two tones at that level.



7209016









## 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) <sup>1)</sup>
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	$\mu_{g_2g_1}$	13	

### TEMPERATURE LIMITS (Absolute max. rating system)

Temperature of all seals	$t_s$ max.	250	°C
Temperature of anode core	$t_a$ max.	250	°C

<sup>1)</sup> 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 <sup>3</sup> /min.)	$P_i$ (mm H <sub>2</sub> O)
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 2422 513 01001 (air system chimney included)

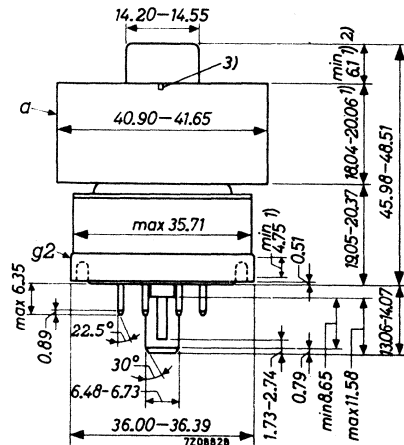
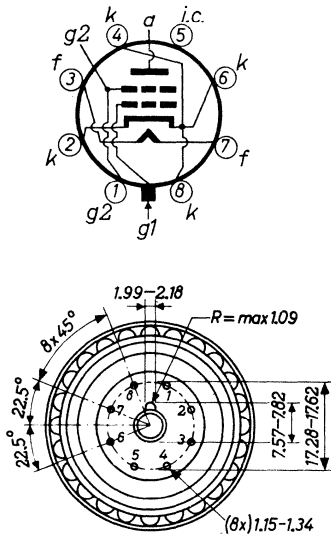
Air system chimney 4322 026 11701

## 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	$V_{g2}$	max.	400	V
Grid No.2 dissipation	$W_{g2}$	max.	8	W
Grid No.1 voltage	$-V_{g1}$	max.	250	V
Grid No.1 current	$I_{g1}$	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	$V_{g2}$	400	400	400	V			
Grid No.1 voltage	$V_{g1}$	-27	-27	-27	V <sup>1)</sup>			
Load resistance	$R_{aa}$	2600	5000	7800	$\Omega$			
Driving voltage, peak	$V_{g1p}$	0 21		0 50		V		
Anode current	$I_a$	2x100	2x260	2x100	2x265	2x100	2x290	mA
Grid No.2 current	$I_{g2}$	-	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

<sup>1)</sup> 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	$V_{g2}$	max.	400	V
Grid No.2 dissipation	$W_{g2}$	max.	8	W
Grid No.1 voltage	$-V_{g1}$	max.	250	V
Grid No.1 current	$I_{g1}$	max.	2	mA
Cathode to heater voltage, peak	$V_{kfp}$	max.	150	V

**OPERATING CONDITIONS**

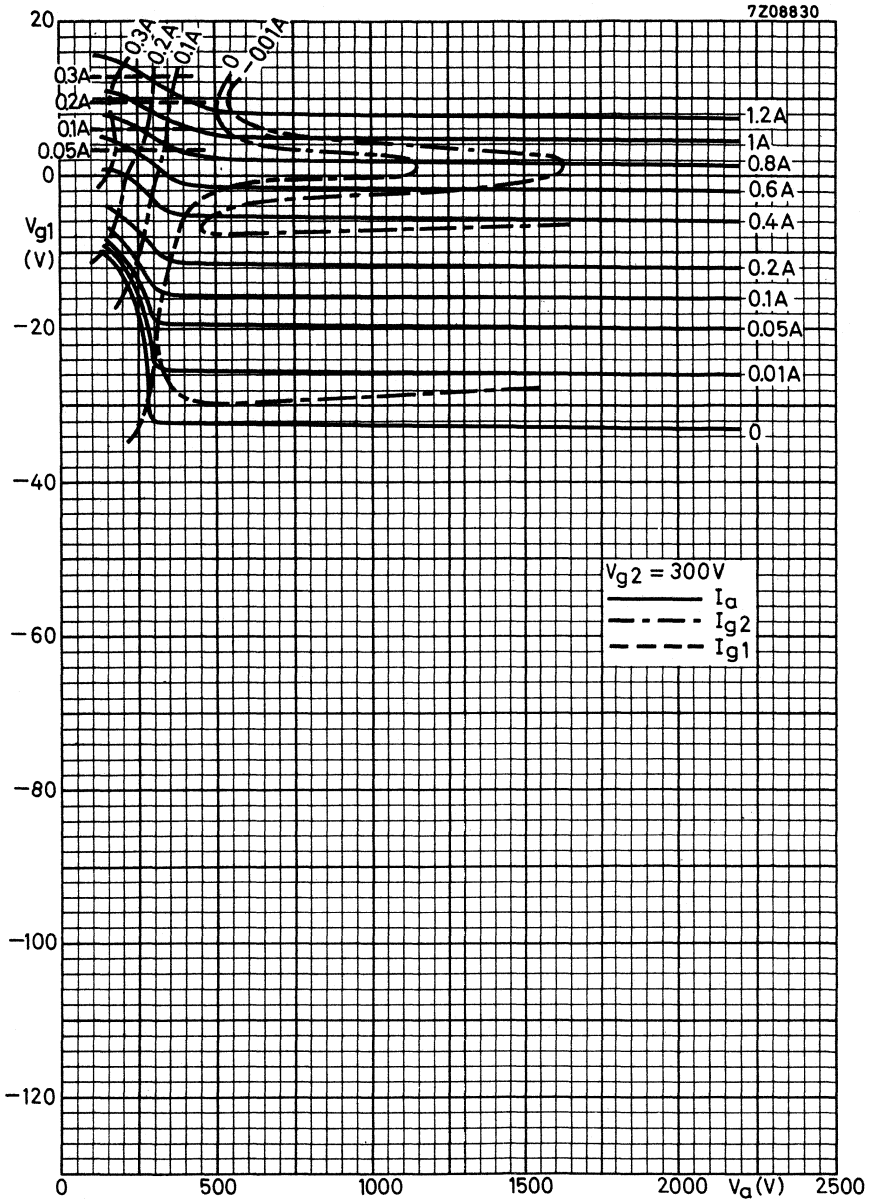
Frequency	f	30	MHz		
Anode voltage	$V_a$	2200	V		
Grid No.2 voltage	$V_{g2}$	300	V		
Grid No.1 voltage	$V_{g1}$	-20	V 1)		
Load resistance	$R_{a\sim}$	6000	$\Omega$		
		zero signal	single tone	double tone	
Driving voltage, peak	$V_{g1p}$	0	18	18	V
Anode current	$I_a$	100	215	167	mA
Grid No.2 current	$I_{g2}$	-	-2.5	-6	mA
Grid No.1 current	$I_{g1}$	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 3 <sup>d</sup> order	$d_3$			29	dB 3)
of the 5 <sup>th</sup> order	$d_5$			30	dB 3)

1) To be adjusted for zero signal anode current.

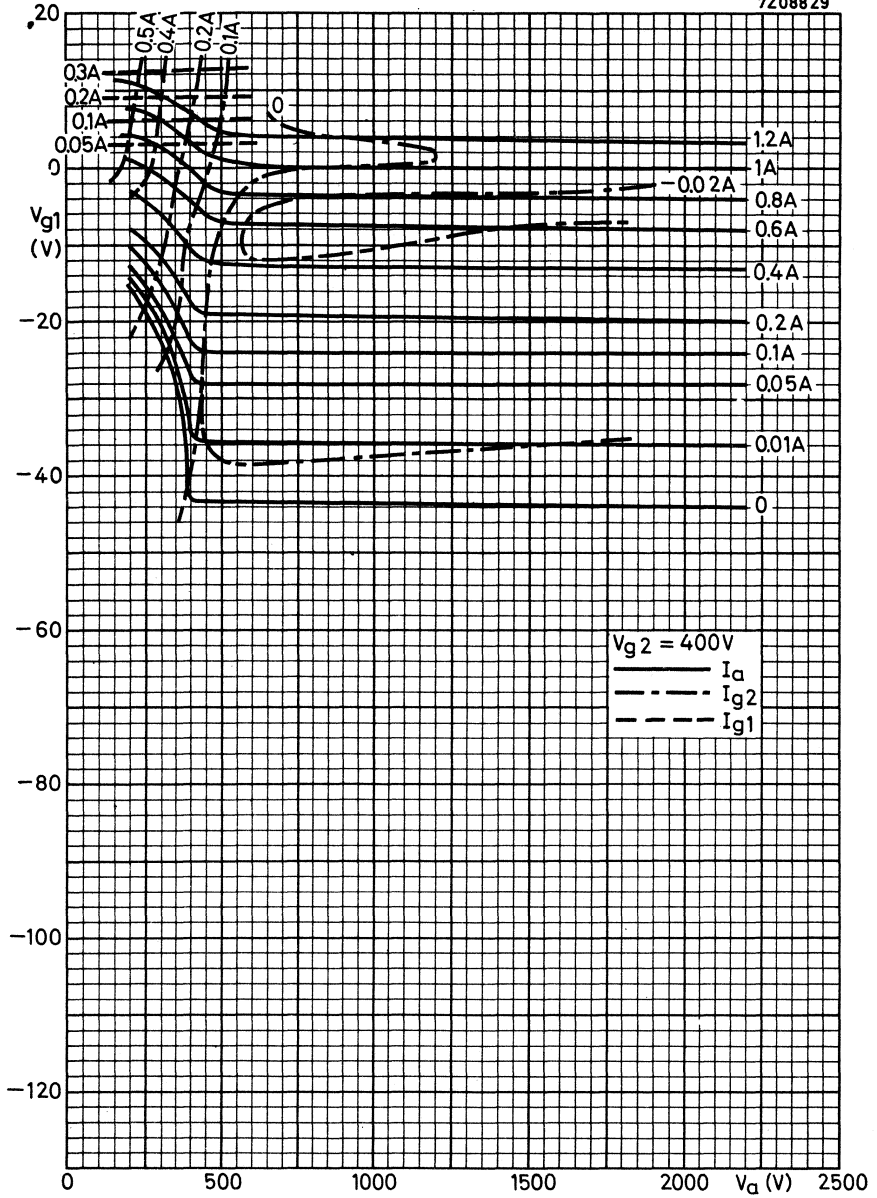
2) Measured in a typical circuit having an efficiency of 85%.

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.





7Z08829



## 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

 $V_f = 13.5 \text{ V}$ 

Heater current

 $I_f = 280 \text{ mA}$ 

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 <sub>ag2</sub> mod.			Class AB SSB				
Freq. (MHz)	V <sub>a</sub> (V)	W <sub>o</sub> (W)		V <sub>a</sub> (V)	W <sub>o</sub> (W)		Freq. (MHz)	V <sub>a</sub> (V)	W <sub>o</sub> PEP (W)		
		CCS	ICAS		CCS	ICAS			CCS	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 <sub>a</sub> (V)	W <sub>o</sub> (W)		V <sub>a</sub> (V)	W <sub>o</sub> (W)						
		CCS	ICAS		CCS	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 <sub>f</sub>	6.3 V
Heater current at V <sub>f</sub> = 6.3 V	I <sub>f</sub>	1.125 A
Cathode heating time	T <sub>h</sub>	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	$\mu_{g2g1}$	4.5 -

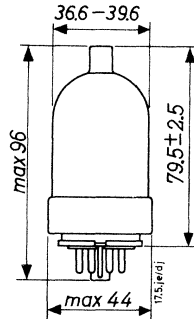
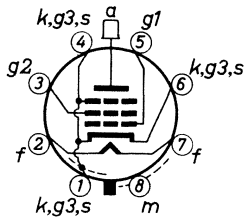
## MECHANICAL DATA

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).

	f	C.C.S.	I.C.A.S.	MHz
		up to 60		
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	$k\Omega$ <sup>1)</sup>

**OPERATING CONDITIONS**

	f	up to 60		MHz
Anode voltage	$V_a$	600	750	V
Grid No.2 voltage	$V_{g2}$	200	200	V <sup>2)</sup>
Grid No.1 voltage	$V_{g1}$	-70	-77	V <sup>3)</sup>
Grid No.1 resistor	$R_{g1}$	24	28	$k\Omega$
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	$\eta$	70	71	%

Notes see page 11

## R.F. CLASS C TELEGRAPHY AND FM TELEPHONY

## OPERATING CONDITIONS(continued)

Frequency	f	up to	175	MHz
Anode voltage	$V_a$	320	400	V
Grid No.2 voltage	$V_{g2}$	210	220	V <sup>2)</sup>
Grid No.1 voltage	$V_{g1}$	-52	-55	V <sup>3)</sup>
Grid No.1 resistor	$R_{g1}$	26	30	k $\Omega$
Grid No.1 current	$I_{g1}$	2	1.9	mA
Grid No.1 driving voltage	$V_{g1p}$	65	67	V
Driving power	$W_{dr}$	2	2	W
Anode current	$I_a$	170	180	mA
Grid No.2 current	$I_{g2}$	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	$\eta$	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	$k\Omega^1$ )

**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 <sup>4)</sup>
Grid No.1 voltage	$V_{g_1}$	-86	-92	V <sup>3)</sup>
Grid No.1 resistor	$R_{g_1}$	26	27	$k\Omega$
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	$\eta$	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	$V_{k_f p}$	max. 135	max. 135	V
Grid No.1 circuit resistance (fixed bias)	$R_{g_1}$	max. 30	max. 30	k $\Omega$

### OPERATING CONDITIONS

		C.C.S.		
Frequency	f	30		MHz
Anode voltage	$V_a$	600		V
Grid No.2 voltage	$V_{g_2}$	200		V <sup>5)</sup>
Grid No.1 voltage	$V_{g_1}$	-47		V <sup>5)</sup>
		zero signal	single tone signal	double tone signal
Grid No.1 driving voltage	$V_{g_1 p}$	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	$\eta$	-	65.5	47.5 %
Intermodulation distortion of the 3rd order	d3			24.5 dB <sup>6)</sup>
of the 5th order	d5			30 dB <sup>6)</sup>

Notes see page 11

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

OPERATING CONDITIONS (continued)

I.C.A.S.

		I.C.A.S.		
		zero signal	single tone signal	double tone signal
Frequency	f		30	MHz
Anode voltage	$V_a$		750	V
Grid No.2 voltage	$V_{g2}$		200	V <sup>5)</sup>
Grid No.1 voltage	$V_{g1}$		-48	V <sup>5)</sup>
Grid No.1 driving voltage	$V_{g1p}$	0	48	48 V
Anode current	$I_a$	25	125	86 mA
Grid No.2 current	$I_{g2}$		6.3	3.9 mA
Grid No.1 current	$I_{g1}$	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	$\eta$	-	65	47 %
Intermodulation distortion				
of the 3rd order	$d_3$			26 dB <sup>6)</sup>
of the 5th order	$d_5$			31 dB <sup>6)</sup>



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	$V_{g2}$	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. 0	max. 0 mA
Grid No.1 circuit resistance	$R_{g1}$	max. 100	max. 100 k $\Omega$
Cathode to heater voltage, peak	$V_{kfp}$	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	$V_{g2}$	200		200	V <sup>7)</sup>
Grid No.1 voltage	$V_{g1}$	-47		-48	V
Load resistance	$R_{aa} \sim$	5600		7200	$\Omega$
Grid to grid voltage, peak	$V_{g1g1p}$	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	$I_{g2}$	-	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	$\eta$	-	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	$V_{g2}$	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
Grid No.1 circuit resistance	$R_{g1}$	max. 30	max. 30 $k\Omega^1$ )
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	$V_{g2}$	200	200	V 7)	
Grid No.1 voltage	$V_{g1}$	-46	-48	V	
Load resistance	$R_{aa\sim}$	3620	5200	$\Omega$	
Grid to grid voltage, peak	$V_{g1g1p}$	0	108	0	106 V
Anode current	$I_a$	2x25	2x154	2x20	2x135 mA
Grid No.2 current	$I_{g2}$	-	2x13	-	2x13.5 mA
Grid No.1 current	$I_{g1}$	0	2x1.35	0	2x0.65 mA
Driving power	$W_{dr}$	0	0.2	0	0.7 W
Anode input power	$W_{i_a}$	2x12.5	2x77	2x12	2x81 W
Anode dissipation	$W_a$	2x12.5	2x27	2x12	2x26 W
Output power	$W_o$	0	100	0	110 W
Efficiency	$\eta$	-	65	-	68 %

Notes see page 11

OPERATING CONDITIONS(continued)

I.C.A.S.

Anode voltage	$V_a$	600	750	V		
Grid No.2 voltage	$V_{g2}$	200	150	V		
Grid No.1 voltage	$V_{g1}$	-47	-39	V		
Load resistance	$R_{aa\sim}$	4160	6050	$\Omega$		
Grid to grid voltage, peak	$V_{g1g1p}$	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	$I_{g2}$	-	2 x 13	-	2 x 14	mA
Grid No.1 current	$I_{g1}$	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	$\eta$	-	66	-	68	%



Notes pages 3 through 9

1. For operation at maximum ratings.  
For operation at less than maximum ratings:  
 $R_{g_1} = \text{max. } 100 \text{ k}\Omega$ .
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 <sup>1)</sup>
Heater current at $V_f = 6.3$ V	$I_f$	1050	-	1200	mA
Grid No.2 current	$I_{g2}$	-	-	15	mA <sup>2)</sup>
Output power in load	$W_\ell$	59	-	-	W <sup>2)</sup>

### Mobile equipment operation

	min.	design range	max.		
Heater voltage	$V_f$	-	6.0 to 7.5	-	V <sup>3)</sup>
Heater current at $V_f = 6.75$ V	$I_f$	1100	-	1230	mA
Grid No.2 current	$I_{g2}$	-	-	15	mA <sup>2)</sup>
Output power in load	$W_\ell$	59	-	-	W <sup>2)</sup>
Decrease output power in load	$\Delta W_\ell$	-	-	10	% <sup>4)</sup>

### 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	$k\Omega \pm 10\%$
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  $\Delta W_\ell = \text{max. } 10\%$ .

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;  $V_{kf} = \pm 100$  V

$I_{kf}$  max. 100  $\mu$ A

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  $M\Omega$

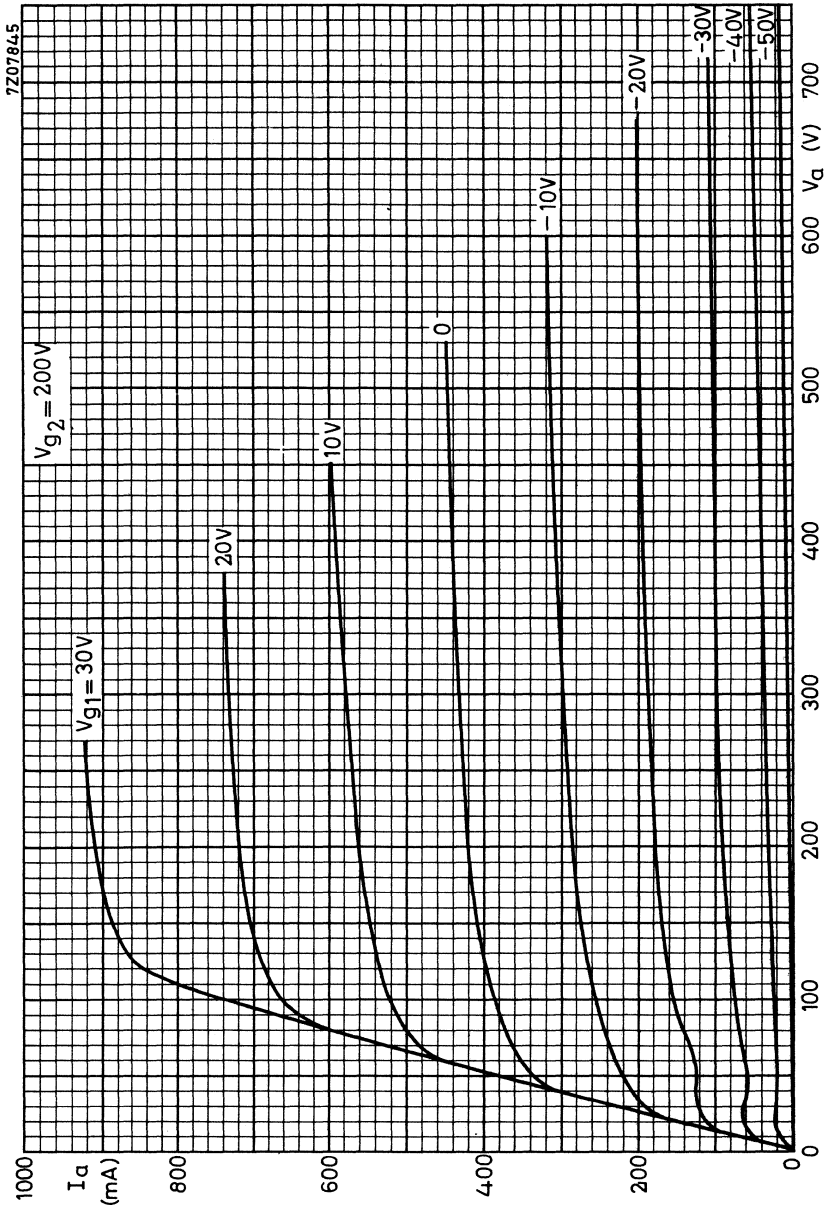
Leakage resistance anode

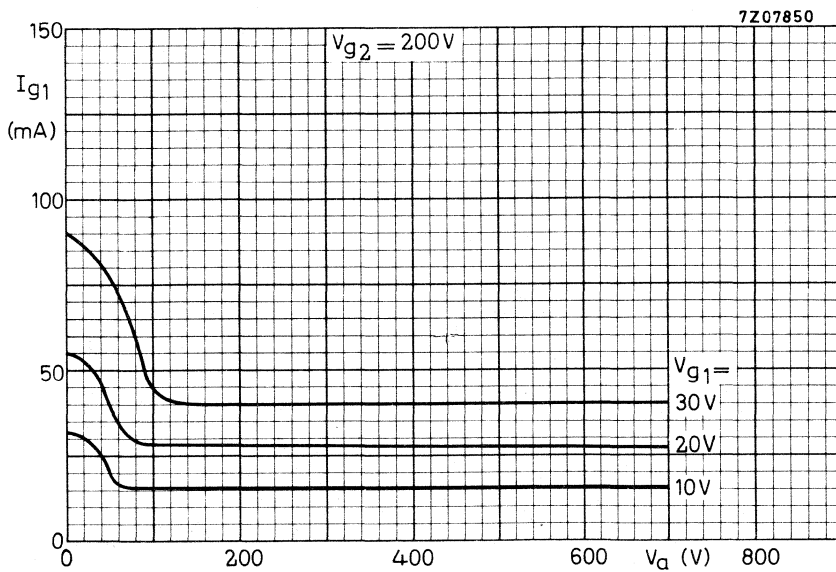
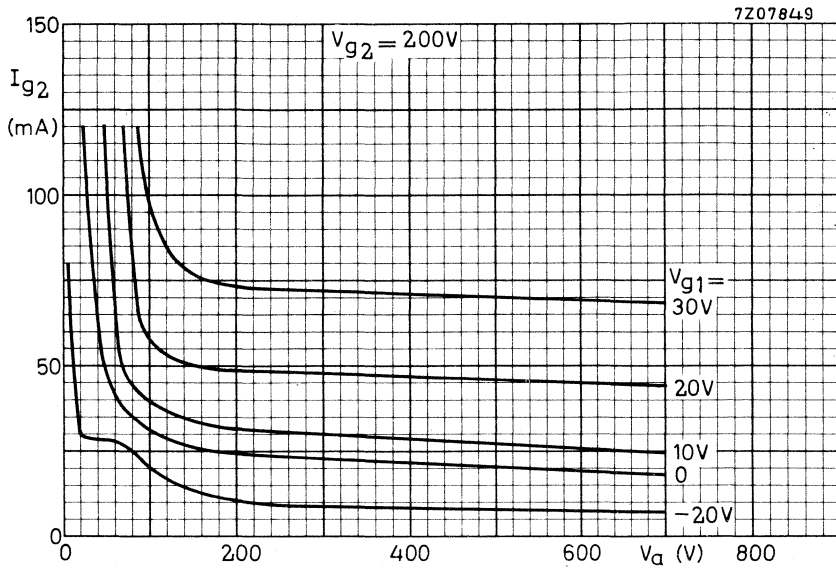
at  $V_f = 6.75$  V;  $V_a = -200$  V

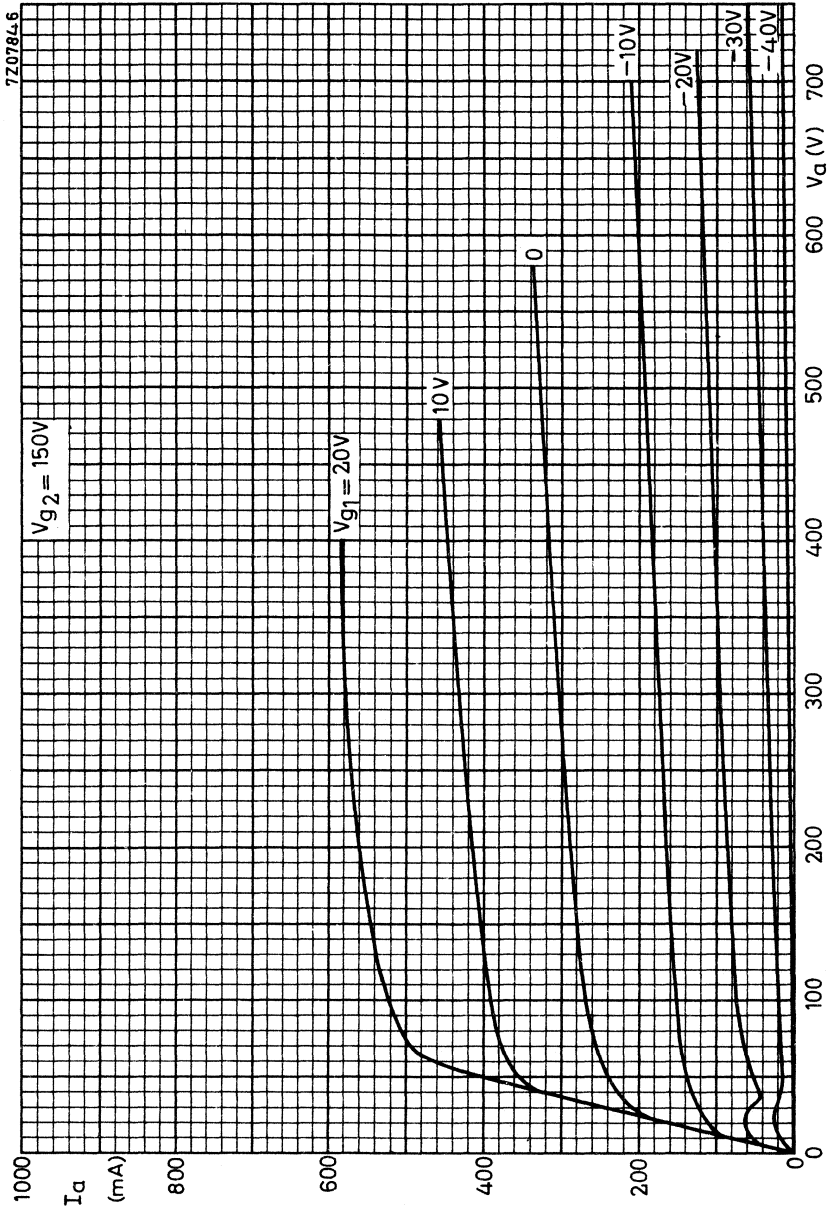
$V_{g2}, V_{g1}, V_k = 0$  V

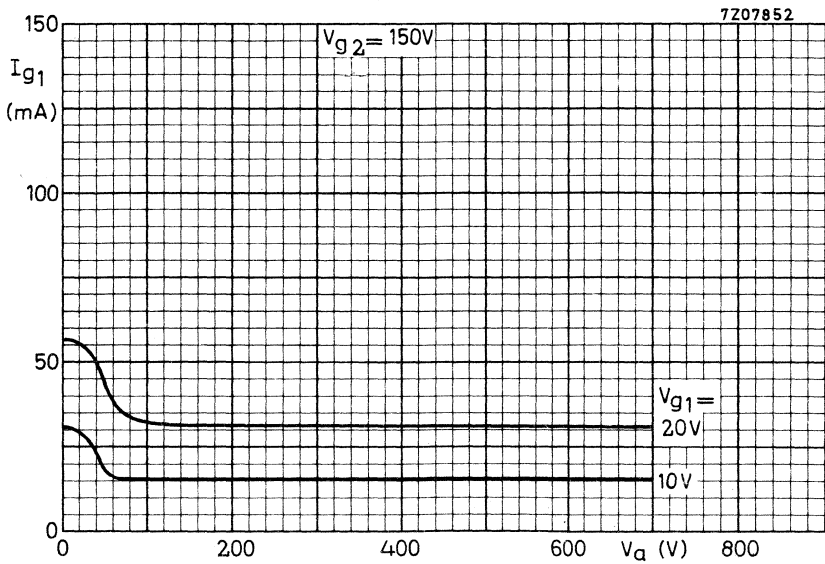
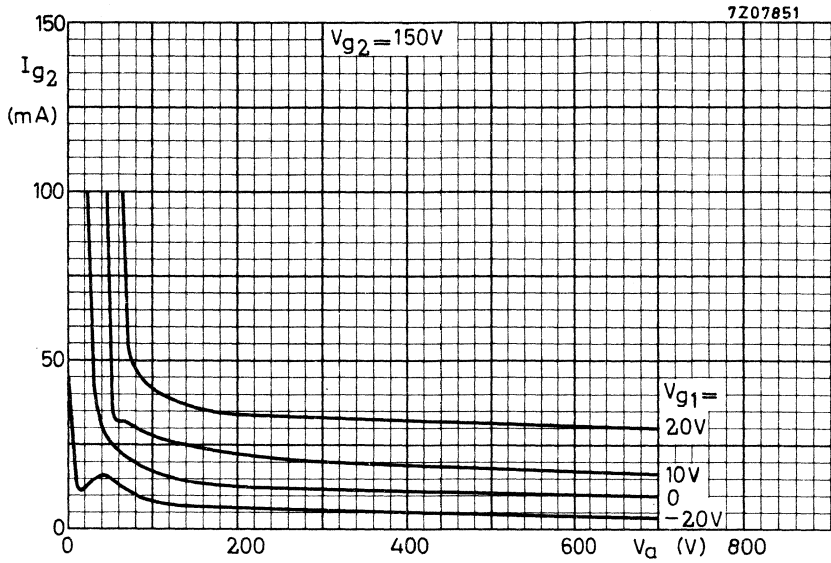
$r_{ins}$  min. 10  $M\Omega$

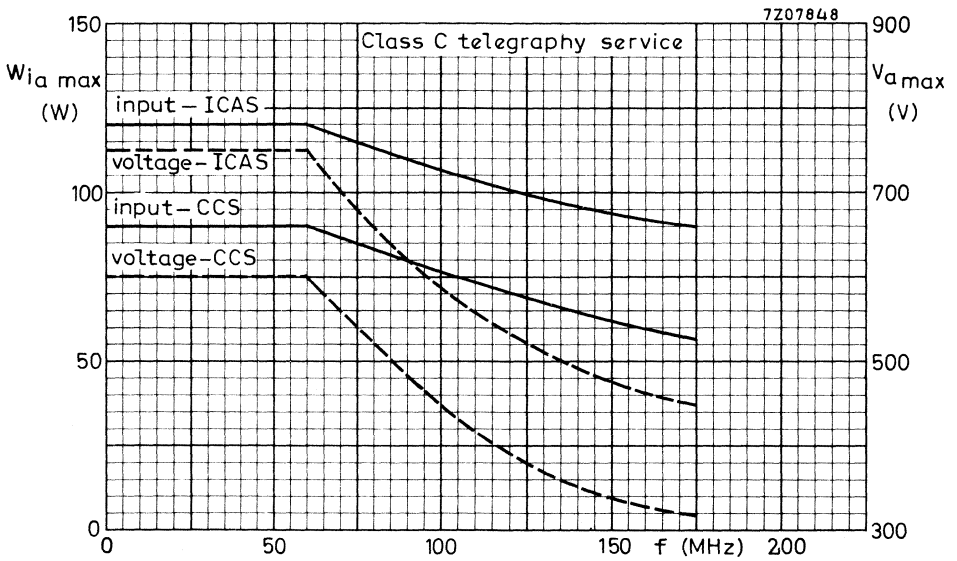
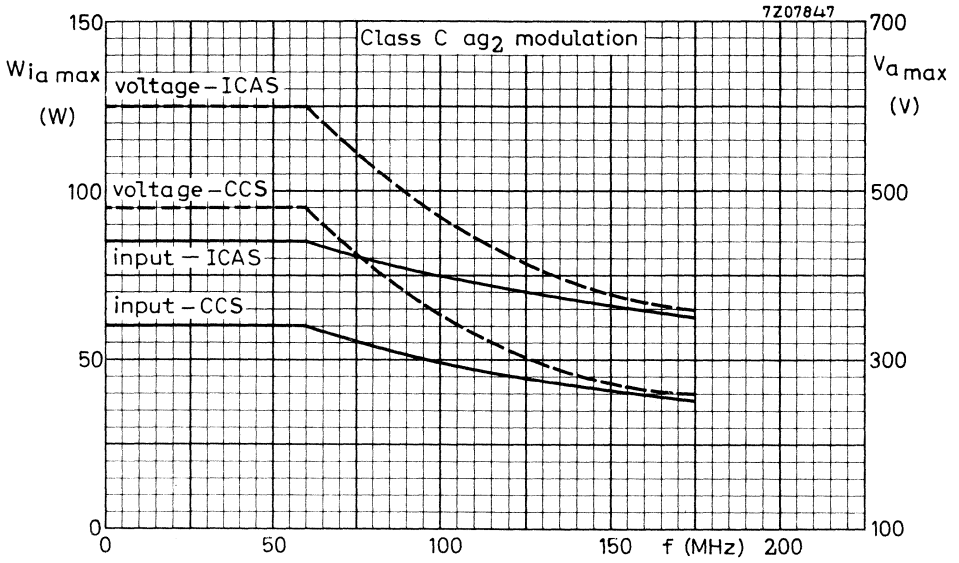














## R.F. BEAM POWER TETRODE

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	$C_{g1(a)}$	13.0 pF
Anode to all except grid No.1	$C_a(g1)$	8.5 pF
Anode to grid No.1	$C_{ag1}$	max. 0.24 pF

### SPECIAL PERFORMANCE DATA

#### Stationary equipment operation

	Min.	Nom.	Max.	
Heater voltage	$V_f$	-	12.6	- V <sup>1)</sup>
Heater current at $V_f = 12.6$ V	$I_f$	525	-	600 mA
Output power in load	$W_\ell$	59	-	- W <sup>2)</sup>

#### Mobile equipment operation

	Min.	Design range	Max.	
Heater voltage	$V_f$	-	12 to 15	- V <sup>3)</sup>
Heater current at $V_f = 13.5$ V	$I_f$	550	-	620 mA
Output power in load	$W_\ell$	59	-	- W <sup>2)</sup>
Decrease output power in load	$\Delta W_\ell$	-	-	10 % <sup>4)</sup>

<sup>1)</sup> <sup>2)</sup> <sup>3)</sup> <sup>4)</sup> 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	$V_{g2}$	200 V
Grid No.1 resistor	$R_{g1}$	24 $k\Omega \pm 10\%$
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 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  $\Delta W_\ell = \text{max. } 10\%$ .

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 $V_f = 13.5 \text{ V}; V_{kf} = \pm 100 \text{ V}$	$I_{kf}$	max. 100 $\mu\text{A}$
Leakage resistance grid No.1 at $V_f = 13.5 \text{ V}; V_{g1} = -200 \text{ V}$ $V_a = V_{g2} = V_k = 0 \text{ V}$	$r_{ins}$	min. 10 $M\Omega$
Leakage resistance anode at $V_f = 13.5 \text{ V}; V_a = -200 \text{ V}$ $V_{g2} = V_{g1} = V_k = 0 \text{ V}$	$r_{ins}$	min. 10 $M\Omega$

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 For further data and curves please refer to type YL1370  
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## 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

#### Stationary equipment operation

	Min.	Nom.	Max.		
Heater voltage	$V_f$	-	26.5	-	V 1)
Heater current at $V_f = 26.5$ V	$I_f$	280	-	320	mA
Output power in load	$W_\ell$	59	-	-	W 2)

#### Mobile equipment operation

	Min.	Design range	Max.		
Heater voltage	$V_f$	-	24 to 29	-	V 3)
Heater current at $V_f = 26.5$ V	$I_f$	280	-	320	mA
Output power in load	$W_\ell$	59	-	-	2)
Decrease output power in load	$\Delta W_\ell$	-	-	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	$V_{g2}$	200	V
Grid No.1 resistor	$R_{g1}$	24	$k\Omega \pm 10\%$
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 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  $\Delta W_l = \text{max. } 10\%$ .

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 $V_f = 26.5 \text{ V}$ ; $V_{kf} = \pm 100 \text{ V}$	$I_{kf}$	max. 150 $\mu\text{A}$
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Leakage resistance grid No.1 at $V_f = 26.5 \text{ V}$ ; $V_{g1} = -200 \text{ V}$ $V_a = V_{g2} = V_k = 0 \text{ V}$	$r_{ins}$	min. 10 $M\Omega$
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Leakage resistance anode at $V_f = 26.5 \text{ V}$ ; $V_a = -200 \text{ V}$ $V_{g2} = V_{g1} = V_k = 0 \text{ V}$	$r_{ins}$	min. 10 $M\Omega$
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For further data and curves please refer to type YL1370  
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## 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.

QUICK REFERENCE DATA						
Freq. (MHz)	Class AB linear amplifier (vision)			Class B service (260 MHz)		
	V <sub>a</sub> (kV)	W <sub>l</sub> sync (kW)	Power gain	V <sub>a</sub> (kV)	W <sub>l</sub> (kW)	Power gain
175.25	5	8.6	24	5.5	6.3	33.1
175.25	4	6.25	24			
83.25	4	6.25	18.5			
55.25	4	6.25	16			

**HEATING:** direct; filament thoriated tungsten, mesh type

Filament voltage	V <sub>f</sub>	6.3	V ± 5%
Filament current	I <sub>f</sub>	120	A
Filament peak starting current	I <sub>fp</sub>	max. 750	A
Cold filament resistance	R <sub>fo</sub>	6	mΩ
Waiting time	T <sub>w</sub>	min. 1	s

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	5	kV
Grid No. 2 voltage	V <sub>g2</sub>	600	V
Anode current	I <sub>a</sub>	1.45	A
Transconductance	S	30	mA/V
Amplification factor	μg <sub>2g1</sub>	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	°C
Recommended max. seal temperature	$t$	max.	200	°C

**COOLING**

See curves  
 Direction of air flow: see drawing.

**ACCESSORIES**

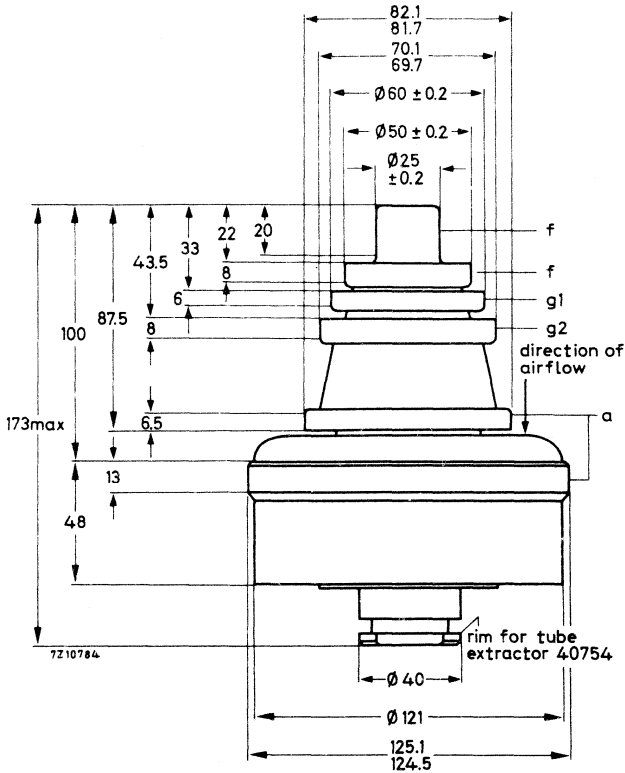
Band I amplifier circuit assembly (vision)	type 40757
Band I amplifier circuit assembly (sound)	type 40758
Band III amplifier circuit assembly (vision)	type 40745
Band III amplifier circuit assembly (sound)	type 40746

**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. 6.5 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. 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
Grid No.1 circuit resistance	$R_{g1}$	max. 10 k $\Omega$

### OPERATING CONDITIONS, grounded grid.

→ Frequency	f	up to 260 MHz
Anode voltage	$V_a$	5.5 kV
Grid No.2 voltage	$V_{g2}$	600 V
Grid No.1 voltage	$V_{g1}$	-115 V <sup>1)</sup>
Anode current, no signal condition	$I_a$	0.1 A
Anode current	$I_a$	1.7 A
Grid No.2 current	$I_{g2}$	70 mA
Grid No.1 current	$I_{g1}$	25 mA
Anode input power	$W_{ia}$	9.35 kW
Anode dissipation	$W_a$	2.7 kW
Output power in load	$W_{\ell}$	6.3 kW
Efficiency, total	$\eta$	67.3 %
Driving power	$W_{dr}$	190 W
Power gain	$\frac{W_{\ell}}{W_{dr}}$	33.1
Notes see page 7.		

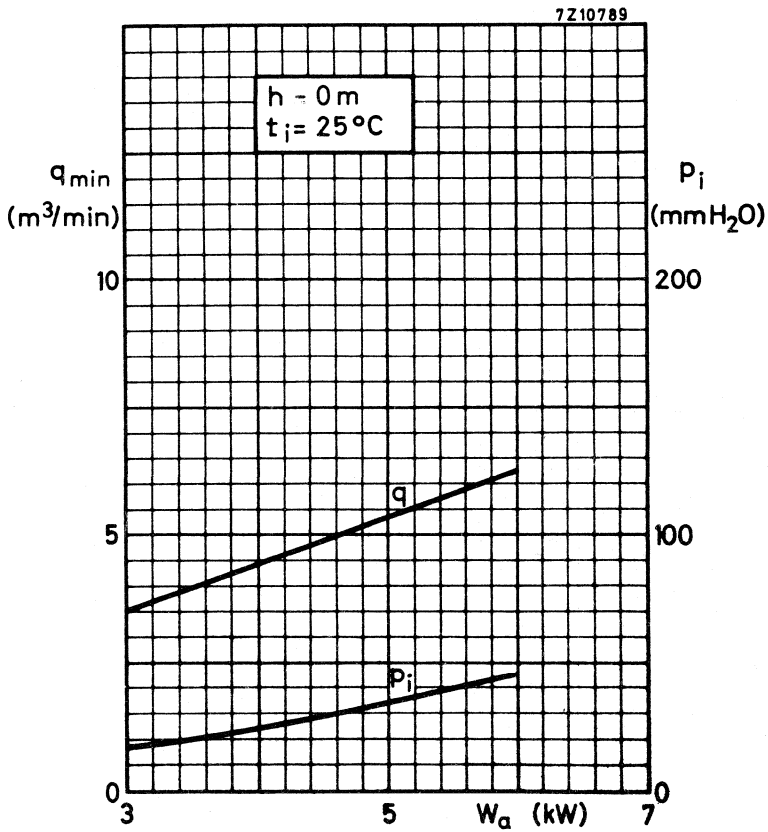


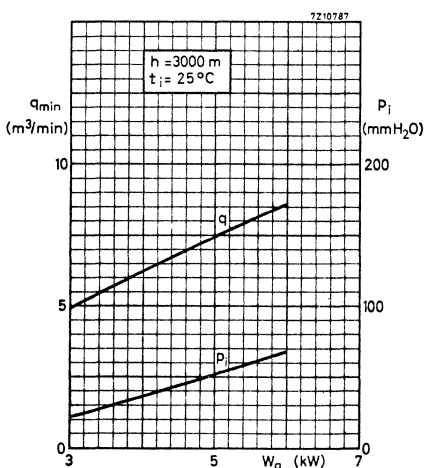
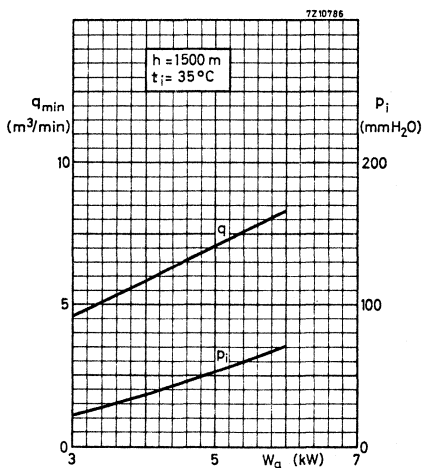
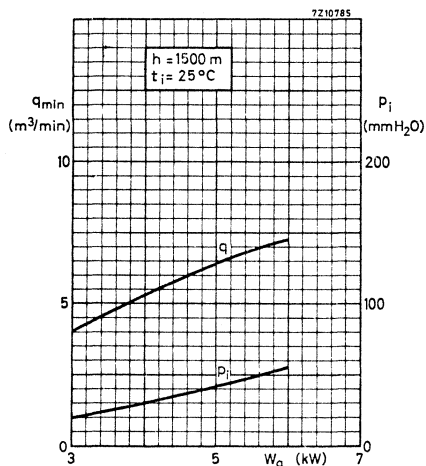
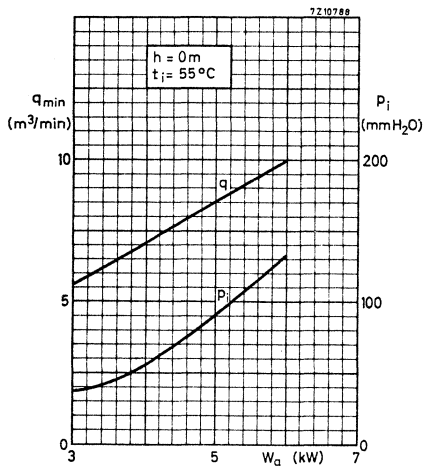


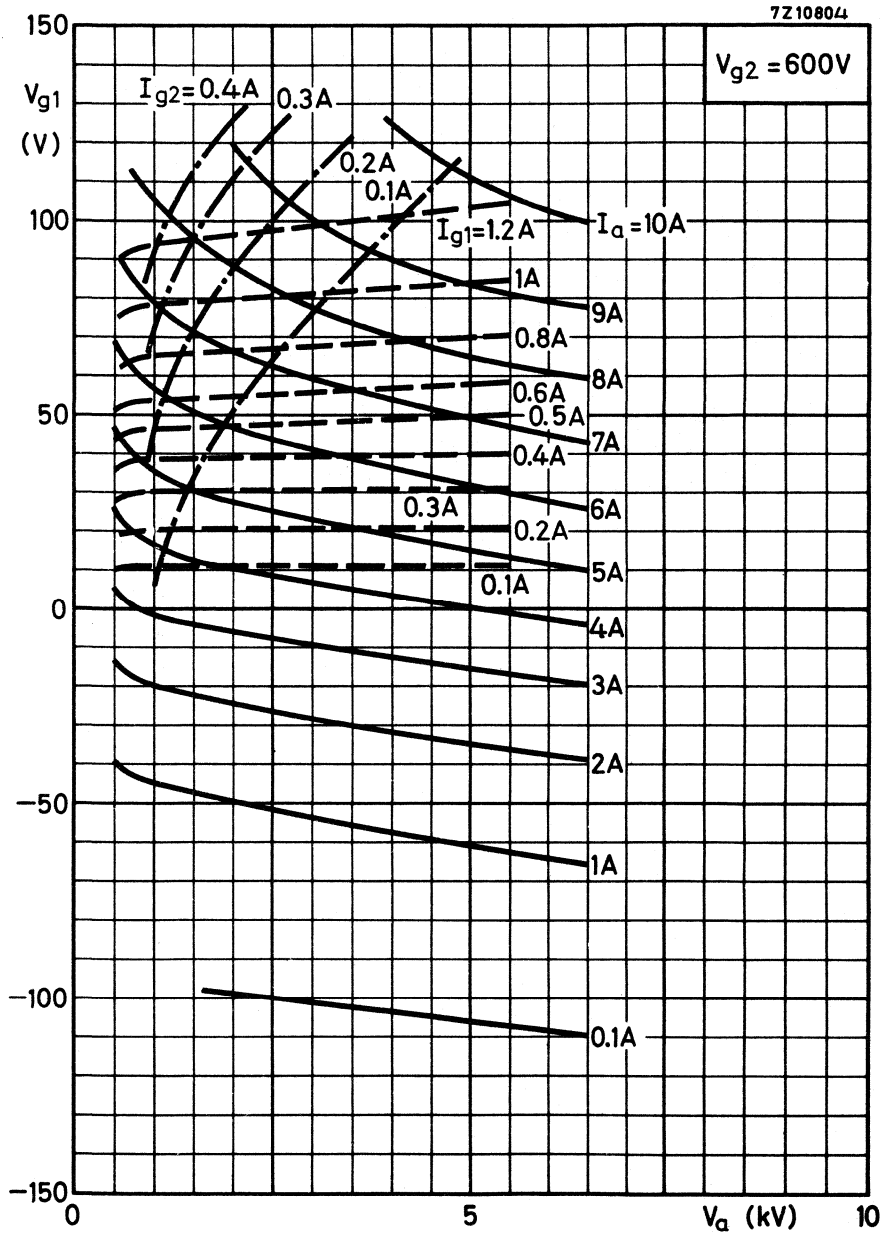


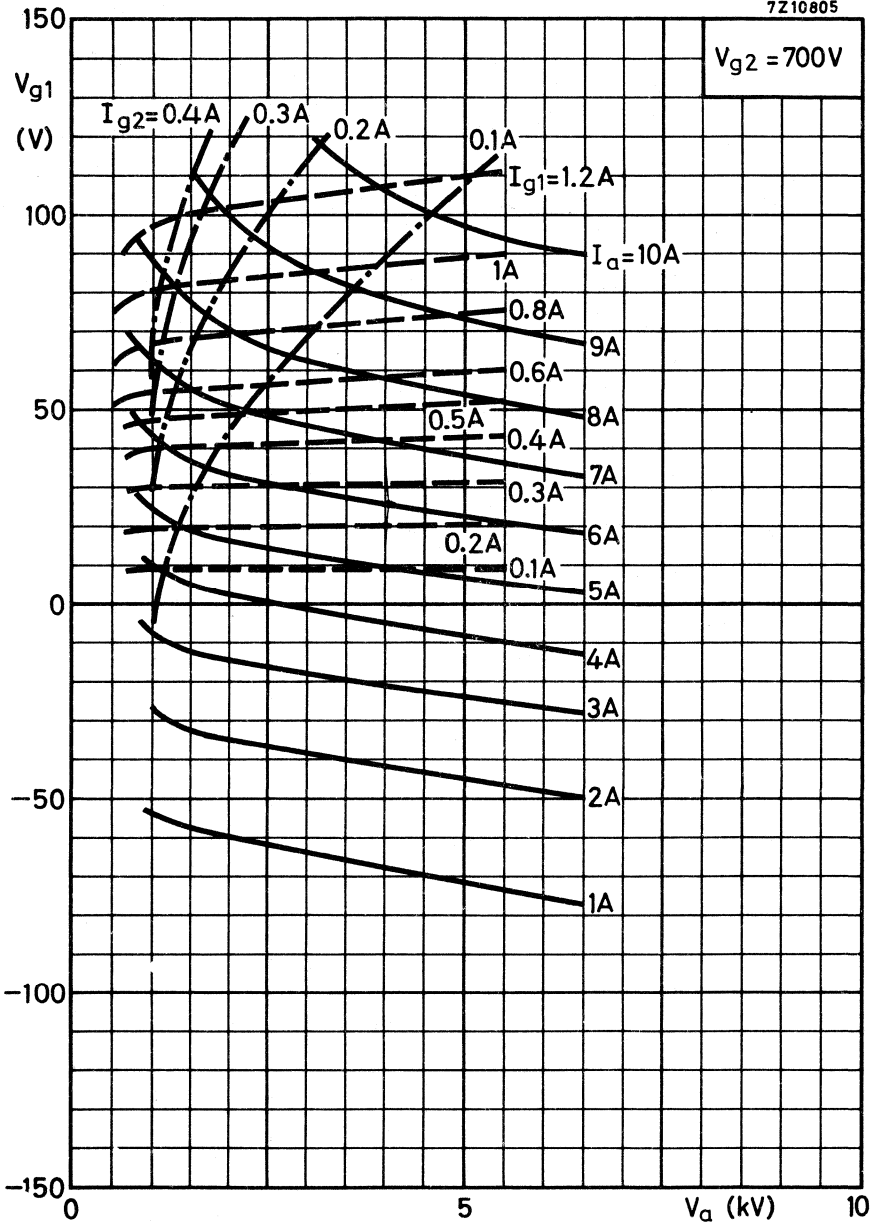
NOTES

- 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.



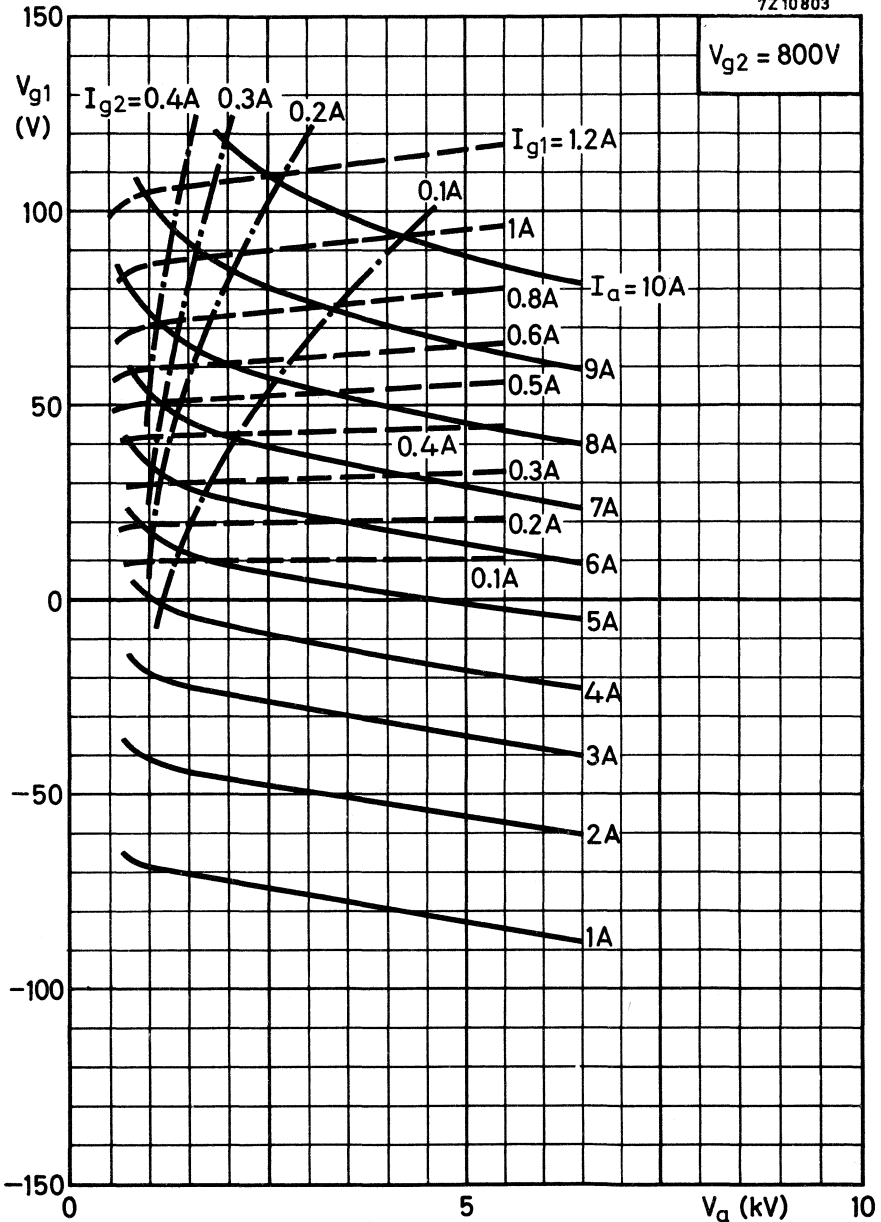






7Z10803

$V_{g2} = 800V$







## 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.

QUICK REFERENCE DATA						
Freq. (MHz)	Class AB linear amplifier (vision)			Class B service		
	V <sub>a</sub> (kV)	W <sub>ℓ</sub> sync (kW)	Power gain	V <sub>a</sub> (kV)	W <sub>ℓ</sub> (kW)	Power gain
175.25	7	18.4	25	7.5	13	32.5
	6	12.5	30			
83.25	5.5	13.2	20			
55.25	5.5	13.2	18			
	4	6.4	18			

**HEATING** : direct; filament thoriated tungsten, mesh type.

Filament voltage	V <sub>f</sub>	8.0	V ± 5%
Filament current	I <sub>f</sub>	120	A
Filament peak starting current	I <sub>f<sub>p</sub></sub>	max. 750	A
Cold filament starting current	R <sub>f<sub>o</sub></sub>	7.5	mΩ
Waiting time	T <sub>w</sub>	min. 1	s

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	6	kV
Grid No. 2 voltage	V <sub>g2</sub>	650	V
Anode current	I <sub>a</sub>	2.4	A
Transconductance	S	45	mA/V
Amplification factor	μ <sub>g2g1</sub>	8.5	

**CAPACITANCES**

	grounded cathode		grounded grid	
Input	$C_{g1(a)}$	110	$C_{f(a)}$	55 pF
Output	$C_{a(g_1)}$	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 °C
Recommended max. seal temperature	$t$	max.	200 °C

**COOLING**

See curves.

Direction of air flow: see drawing.

**ACCESSORIES**

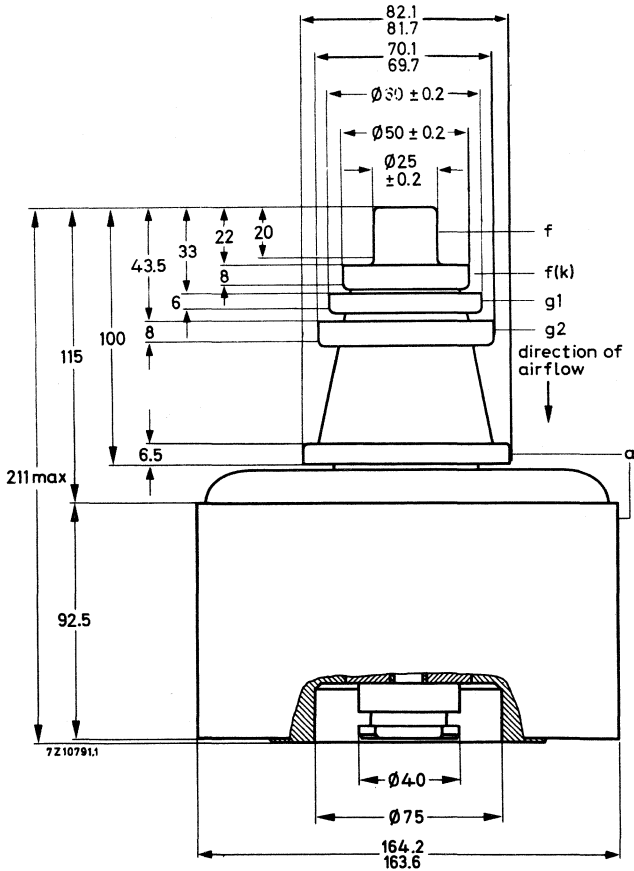
Band I amplifier circuit assembly (vision)	type 40759
Band I amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40747
Band III amplifier circuit assembly (sound)	type 40748

Dimensions in mm

→ MECHANICAL DATA

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
Grid No.1 circuit resistance	$R_{g1}$	max.	10	kΩ

**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 <sup>1)</sup>
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	$\eta$		69.3	%
Driving power	$W_{dr}$		400	W
Power gain	$\frac{W_l}{W_{dr}}$		32.5	

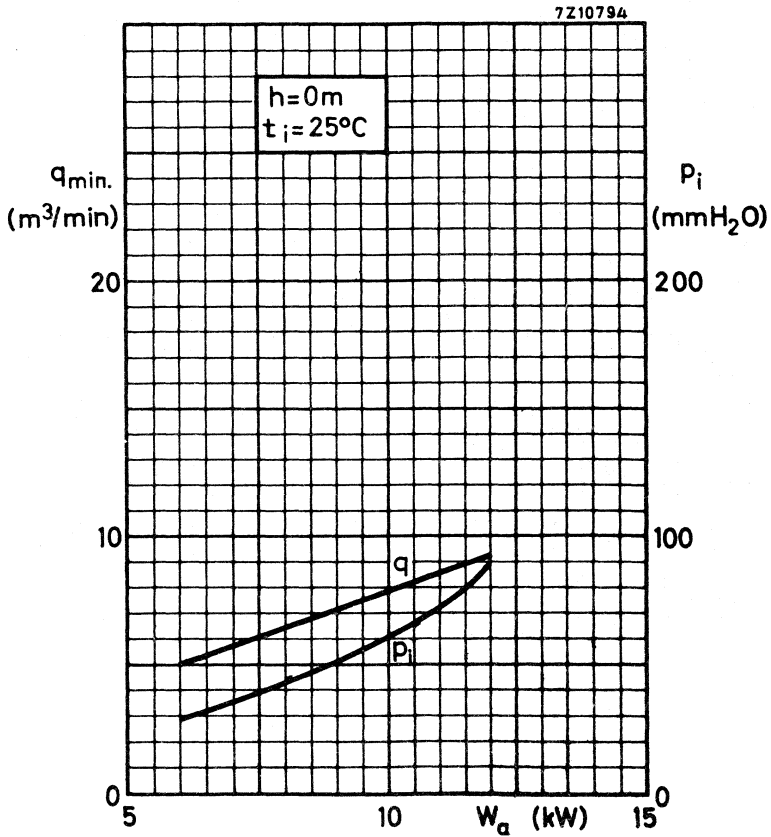
Note see page 7.

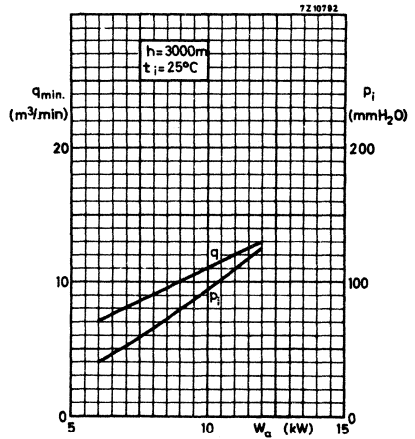
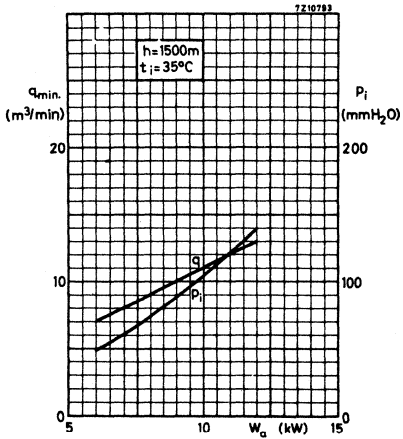
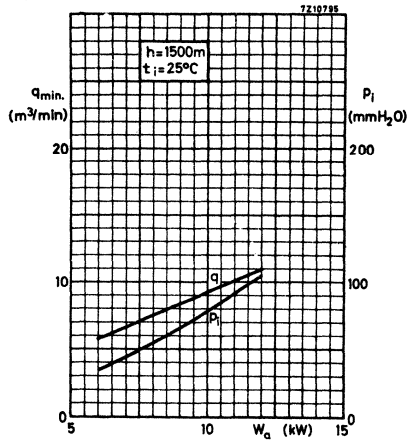
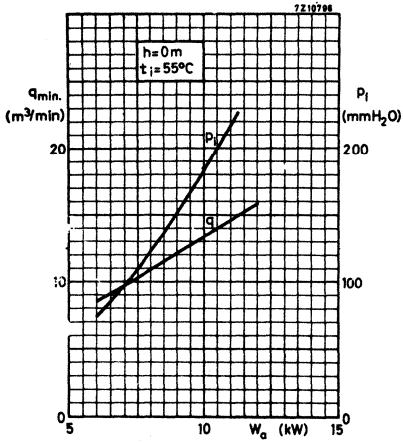




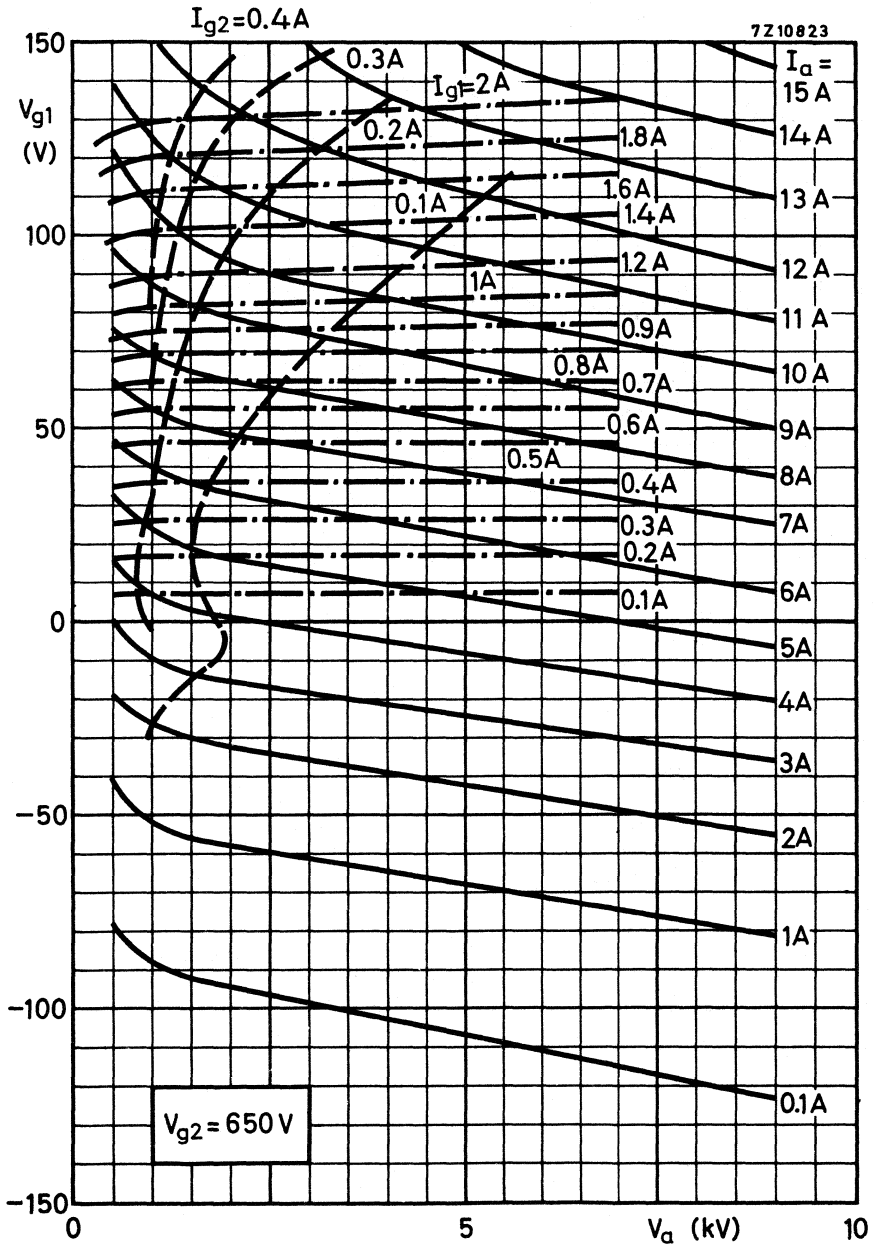
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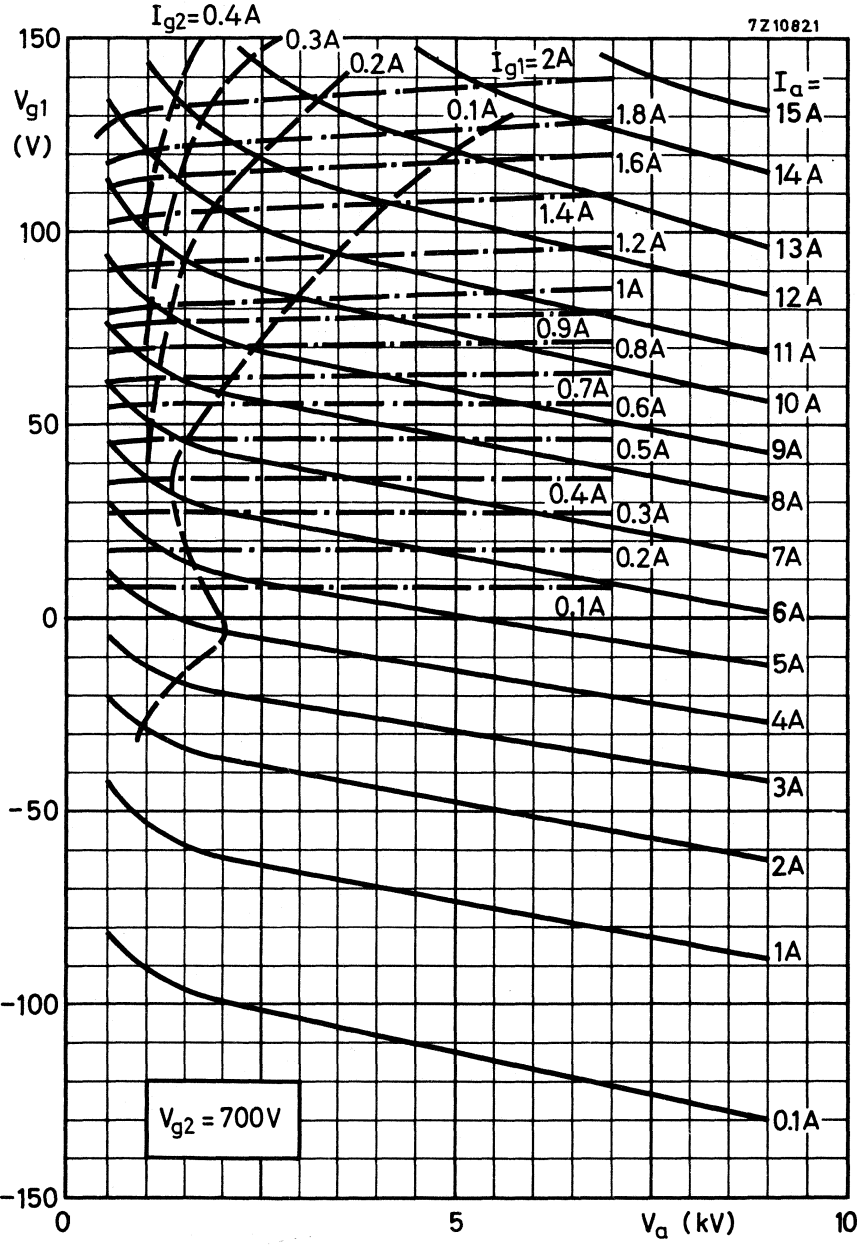
- 1) To be adjusted for the stated no signal anode current.
- 2) With double tuned circuit.
- 3) Black signal including line sync pulses.
- 4) A picture/sync ratio of 72/25 for the outgoing signal requires a ratio of max. 70/30 ← for the incoming signal in which case the sync compression sync in/out = 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.

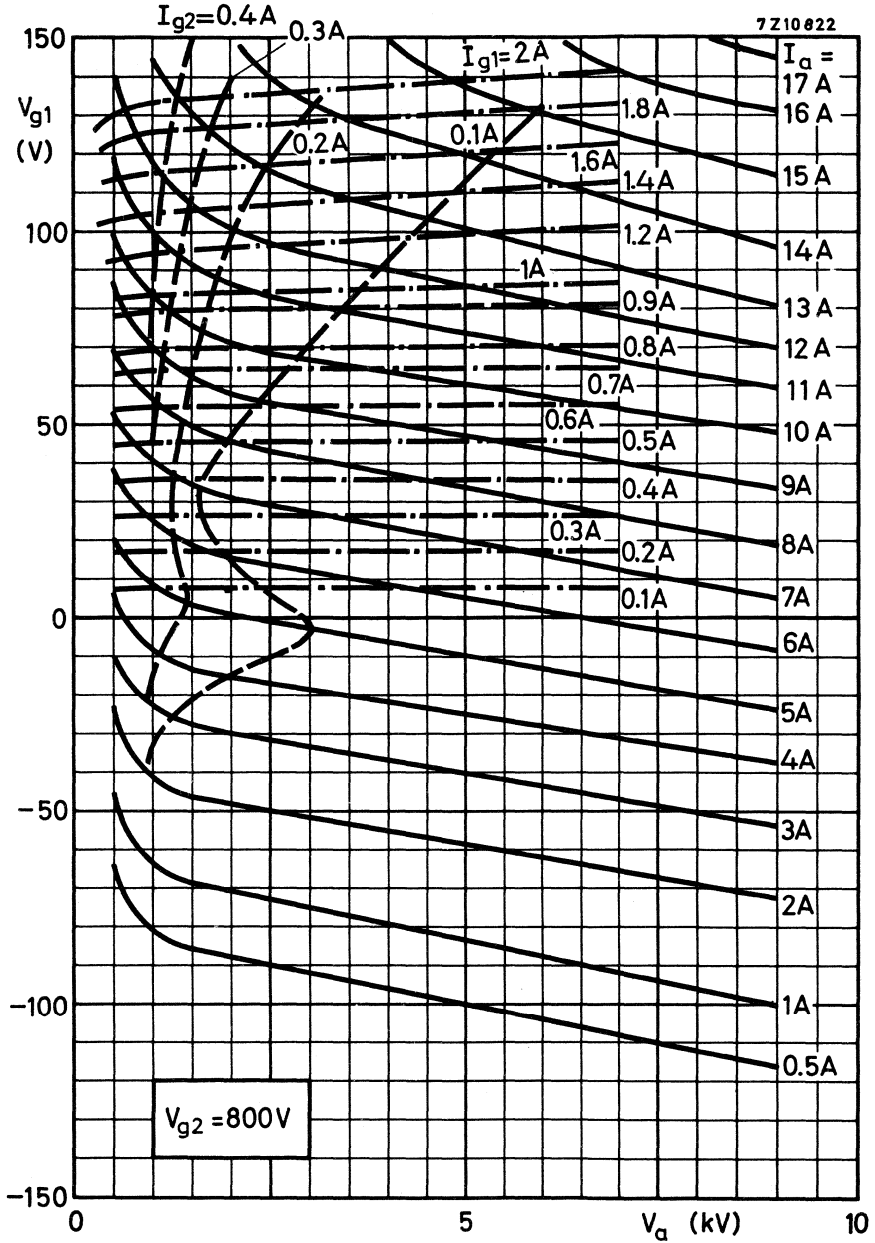














## AIR COOLED V.H.F. POWER TETRODE

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.

QUICK REFERENCE DATA						
Freq. (MHz)	Class AB linear amplifier (vision)			Class B service (260 MHz)		
	V <sub>a</sub> (kV)	W <sub>l sync</sub> (kW)	Power gain	V <sub>a</sub> (kV)	W <sub>l</sub> (kW)	Power gain
175.25	3	1.55	26	3.5	2.2	29.3
	2.5	0.7	23			
83.25	2.5	1.5	16			
	2	0.67	17			
55.25	2.5	1.17	14			
	2.5	1.5	16			
	2	0.67	16			

**HEATING:** direct; filament thoriated tungsten, mesh type.

Filament voltage	V <sub>f</sub>	4.2	V ± 5%
Filament current	I <sub>f</sub>	53	A
Filament peak starting current	I <sub>f p</sub>	max. 300	A
Cold filament resistance	R <sub>f 0</sub>	8.5	mΩ
Waiting time	T <sub>w</sub>	min. 1	s

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	4	kV
Grid No. 2 voltage	V <sub>g2</sub>	500	V
Anode current	I <sub>a</sub>	0.4	A
Transconductance	S	25	mA/V
Amplification factor	μ <sub>g2g1</sub>	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	°C
Recommended max. seal temperature	$t$	max.	200	°C

**COOLING**

See curves

Direction of air flow: see drawing.

**ACCESSORIES**

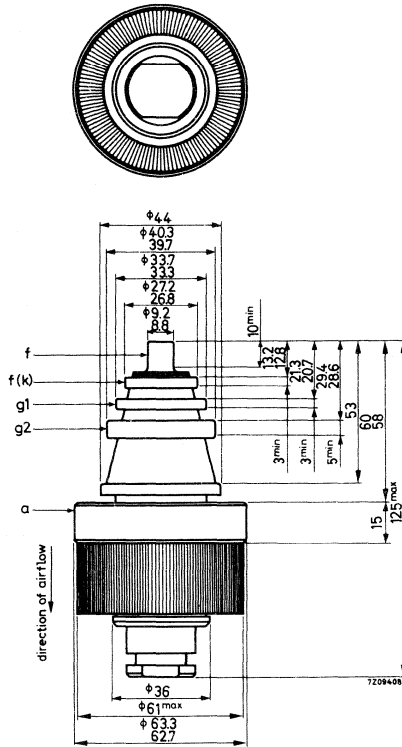
Band I amplifier circuit assembly (vision)	type 40755
Band I amplifier circuit assembly (sound)	type 40756
Band III amplifier circuit assembly (vision)	type 40743
Band III amplifier circuit assembly (sound)	type 40744

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 0.55 kg

Mounting position: Vertical with anode up or down.



**R.F. CLASS B SERVICE**

Unless otherwise specified the voltages are given with respect to the cathode.

→ **LIMITING VALUES** (Absolute max. rating system)

Frequency	f	up to 260 MHz
Anode voltage	$V_a$	max. 4.0 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	$W_{i_a}$	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 k $\Omega$

→ **OPERATING CONDITIONS** grounded grid

Frequency	f	up to 260 MHz
Anode voltage	$V_a$	3.5 kV
Grid No.2 voltage	$V_{g2}$	500 V
Grid No.1 voltage	$V_{g1}$	-32 V <sup>2)</sup>
Anode current, no signal condition	$I_a$	100 mA
Anode current	$I_a$	900 mA
Grid No.2 current	$I_{g2}$	70 mA
Grid No.1 current	$I_{g1}$	120 mA
Anode input power	$W_{i_a}$	3.15 kW
Anode dissipation	$W_a$	0.84 kW
Output power in load	$W_l$	2.2 kW
Efficiency, total	$\eta$	70 %
Driving power	$W_{dr}$	75 W
Power gain	$\frac{W_l}{W_{dr}}$	29.3

<sup>2)</sup> See page 5

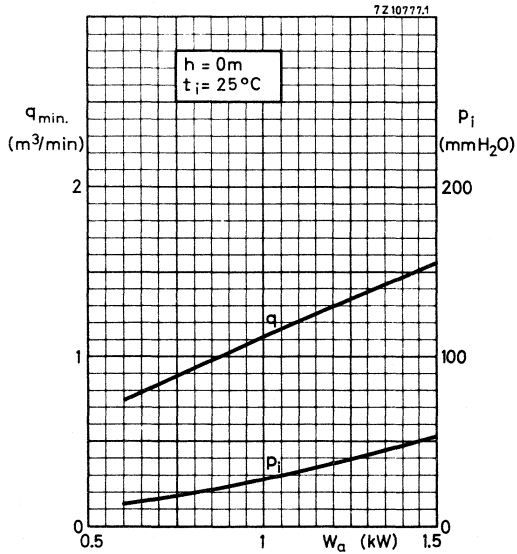


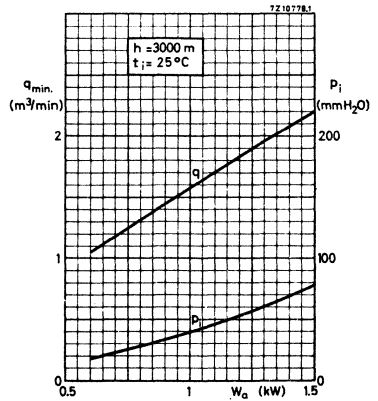
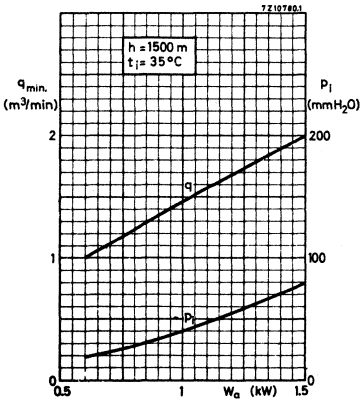
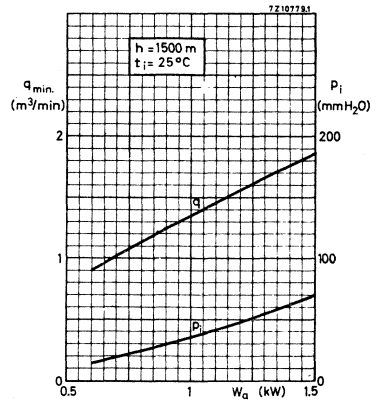
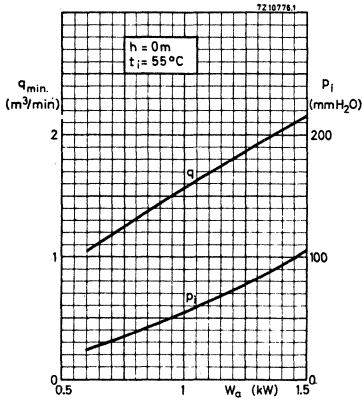


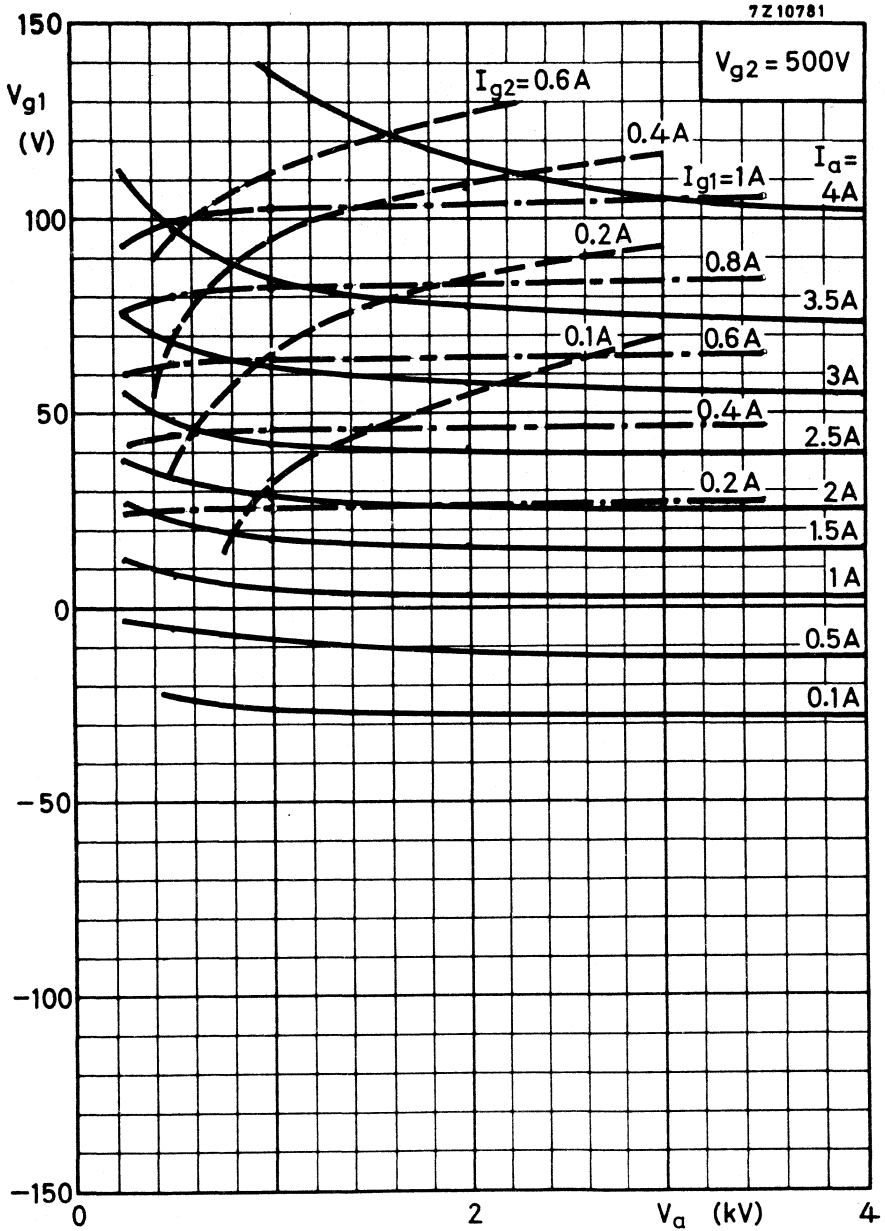


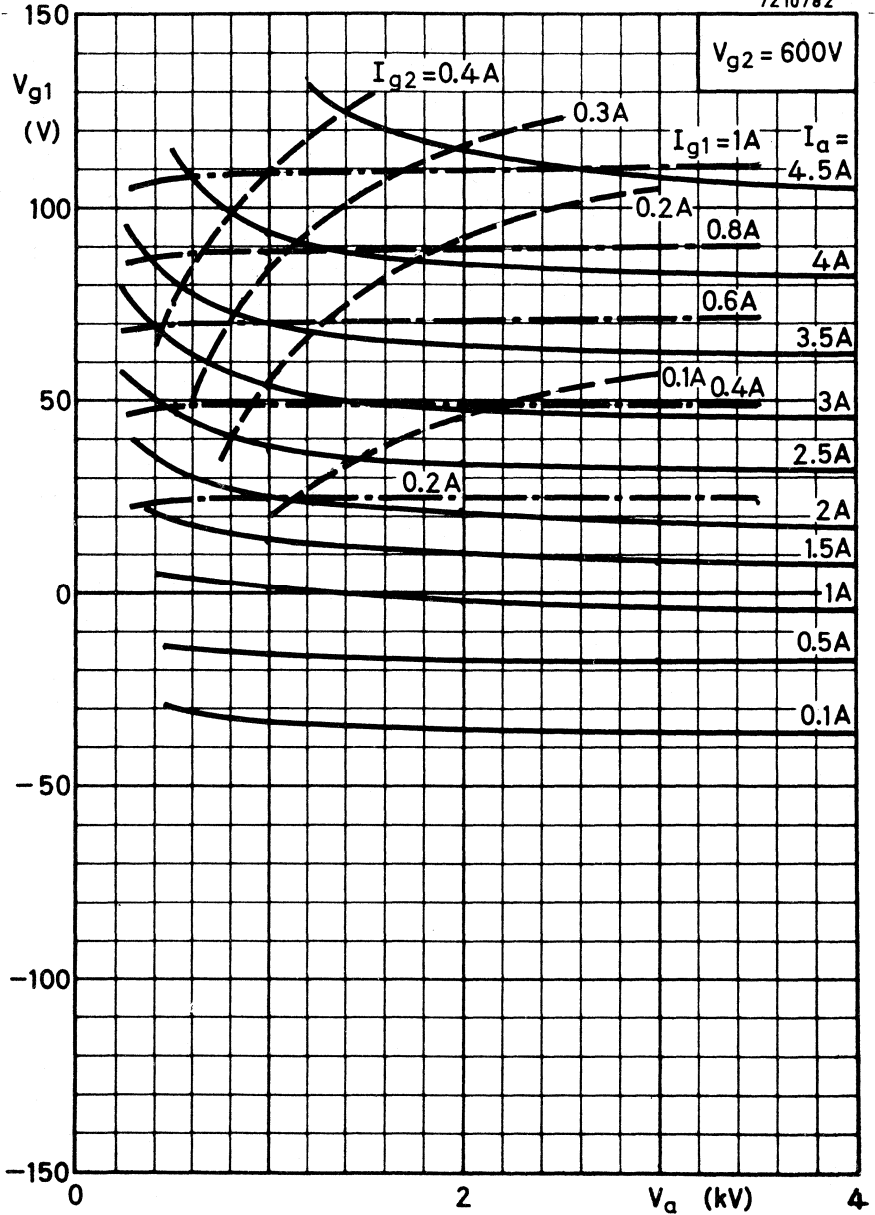
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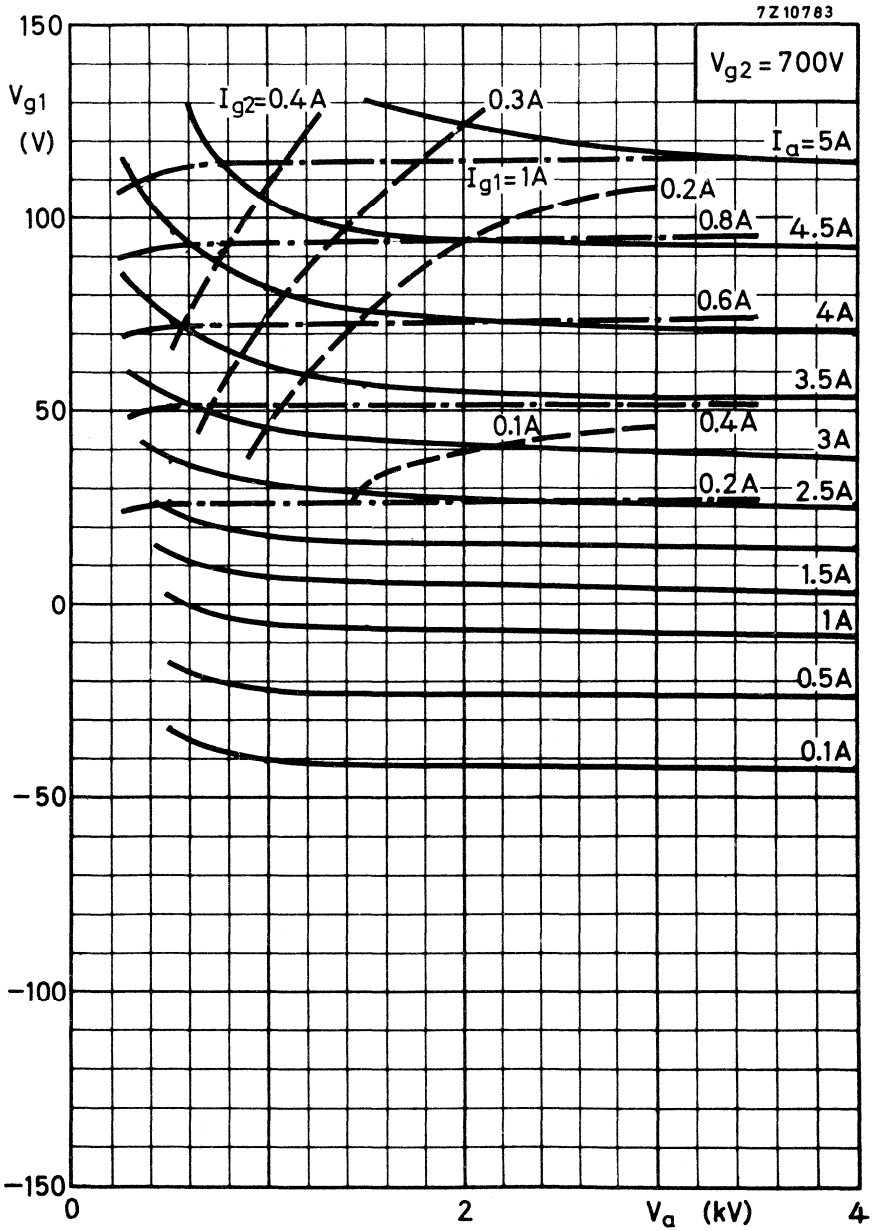
- 1) With double tuned circuit.
- 2) To be adjusted for the stated no signal anode current.
- 3) Black signal including line sync pulses.
- 4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 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.















**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.



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For data and curves of this type please refer to type QB4/1100.

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**YL1461**

## **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.



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For data and curves of this type please refer to type QB4/1100GA.

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## 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 <sub>a</sub> (kV)	W <sub>l</sub> (kW)	Power gain
110	6.0	6.6	300
	7.0	10.5	210

**HEATING :** Direct; filament thoriated tungsten, mesh type.

Filament voltage	V <sub>f</sub>	6.8	V ± 5%
Filament current	I <sub>f</sub>	120	A
Filament peak starting current	I <sub>f</sub> <sub>p</sub>	max. 750	A
Cold filament resistance	R <sub>f0</sub>	6	mΩ
Waiting time	T <sub>w</sub>	min. 1	s

### CAPACITANCES

Input	C <sub>g1(a)</sub>	87	pF
Output	C <sub>a(g1)</sub>	16.6	pF
Anode to grid No. 1	C <sub>ag1</sub>	0.5	pF

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	5	kV
Grid No. 2 voltage	V <sub>g2</sub>	600	V
Anode current	I <sub>a</sub>	1.2	A
Transconductance	S	30	mA/V
Amplification factor	μ <sub>g2g1</sub>	7.2	-

### TEMPERATURE LIMITS

Absolute max. envelope temperature	t <sub>env</sub>	max. 240	°C
Recommended max. seal temperature	t	max. 200	°C

## COOLING

In order to keep the temperature of the seals below the maximum permissible value, it may be necessary to direct an air flow to the seals.

Anode cooling: see cooling curves.

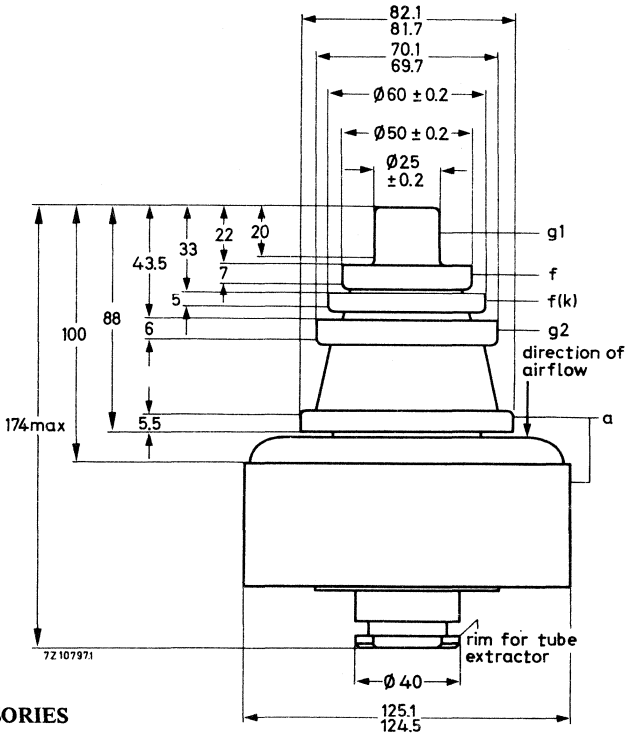
Direction of air flow: see outline drawing.

## MECHANICAL DATA

Dimensions in mm

Net weight: approx. 3.1 kg

Mounting position: vertical with anode up or down.



## ACCESSORIES

Filament connector	type 40693
Filament/cathode connector	type 40740
Grid No. 1 connector	type 40692
Grid No. 2 connector	type 40741
Complete socket including grid No. 1, grid No. 2 cathode and filament connections	type 40742
Insulating pedestal	type 40630
Tube extractor	type 40754

**R.F. CLASS B AMPLIFIER**

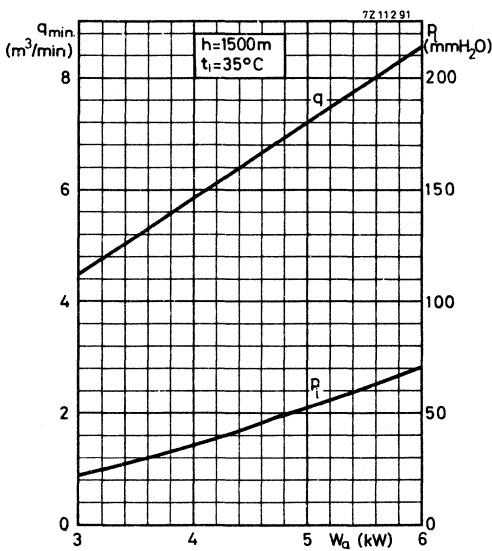
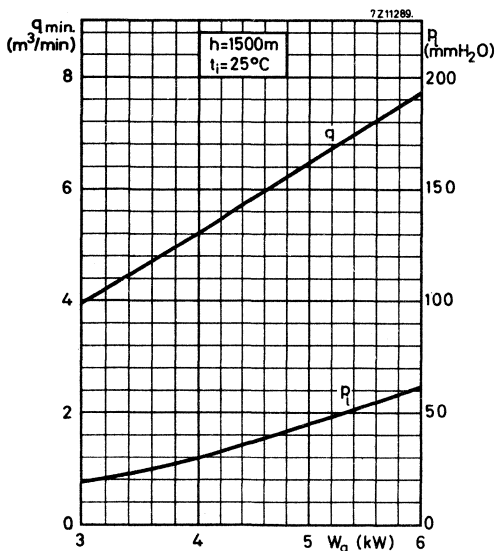
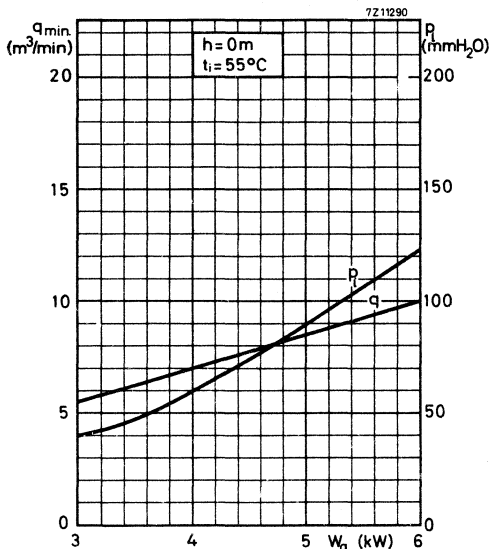
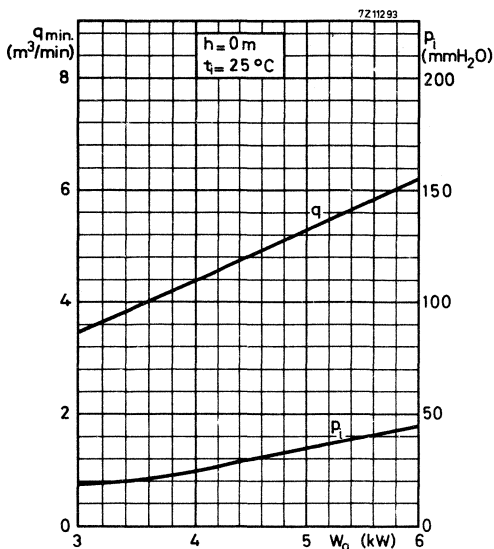
**LIMITING VALUES** (absolute max. rating system)

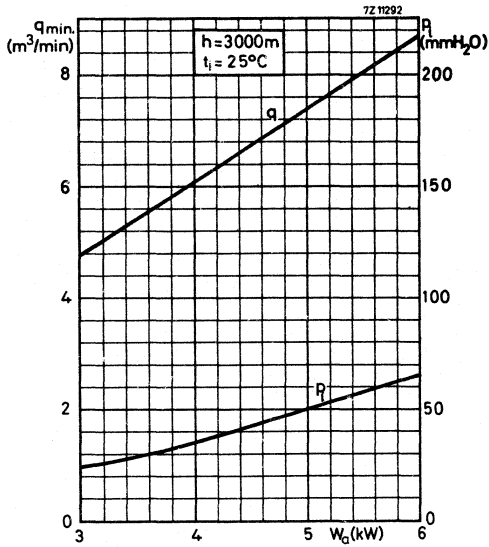
Frequency	f	up to	110	MHz
Anode voltage	$V_a$	max.	8.4	kV
Grid No. 2 voltage	$V_{g2}$	max.	1	kV
Grid No. 1 voltage	$-V_{g1}$	max.	500	V
Anode current	$I_a$	max.	4	A
Anode input power	$W_{ia}$	max.	18.5	kW
Anode dissipation	$W_a$	max.	6	kW
Grid No. 2 dissipation	$W_{g2}$	max.	80	W
Grid No. 1 dissipation	$W_{g1}$	max.	40	W
Cathode current	$I_k$	max.	4.5	A
Grid No. 1 circuit resistance	$R_{g1}$	max.	10	k $\Omega$

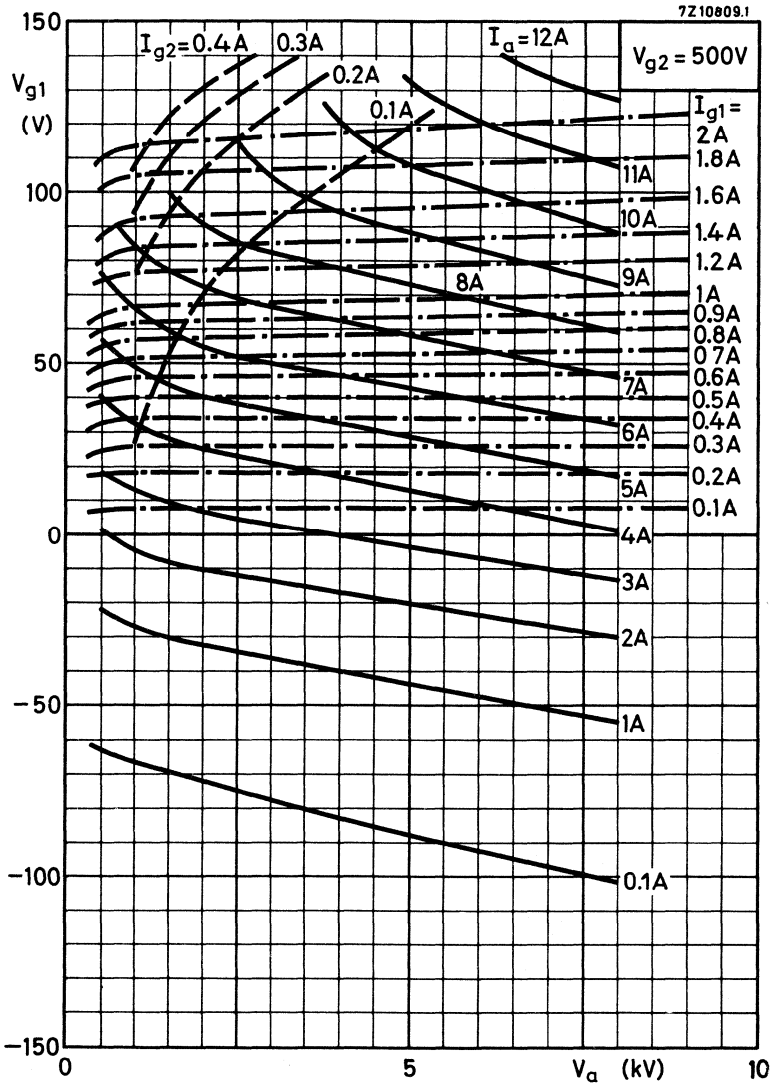
**OPERATING CONDITIONS** grounded cathode

Frequency	f	110	110	MHz
Anode voltage	$V_a$	7.0	6.0	kV
Grid No. 2 voltage	$V_{g2}$	550	500	V
Grid No. 1 voltage	$V_{g1}$	-100	-90	V <sup>1)</sup>
Anode current, no signal condition	$I_a$	175	200	mA
Grid No. 1 driving voltage, peak	$V_{g1p}$	170	150	V
Anode current	$I_a$	2.2	1.5	A
Grid No. 2 current	$I_{g2}$	80	85	mA
Grid No. 1 current	$I_{g1}$	170	90	mA
Anode input power	$W_{ia}$	15.4	9	kW
Anode dissipation	$W_a$	4.3	2.1	kW
Output power in load	$W_l$	10.5	6.6	kW
Efficiency, total	$\eta$	68	73	%
Driving power	$W_{dr}$	50	22	W
Power gain	$\frac{W_l}{W_{dr}}$	210	300	

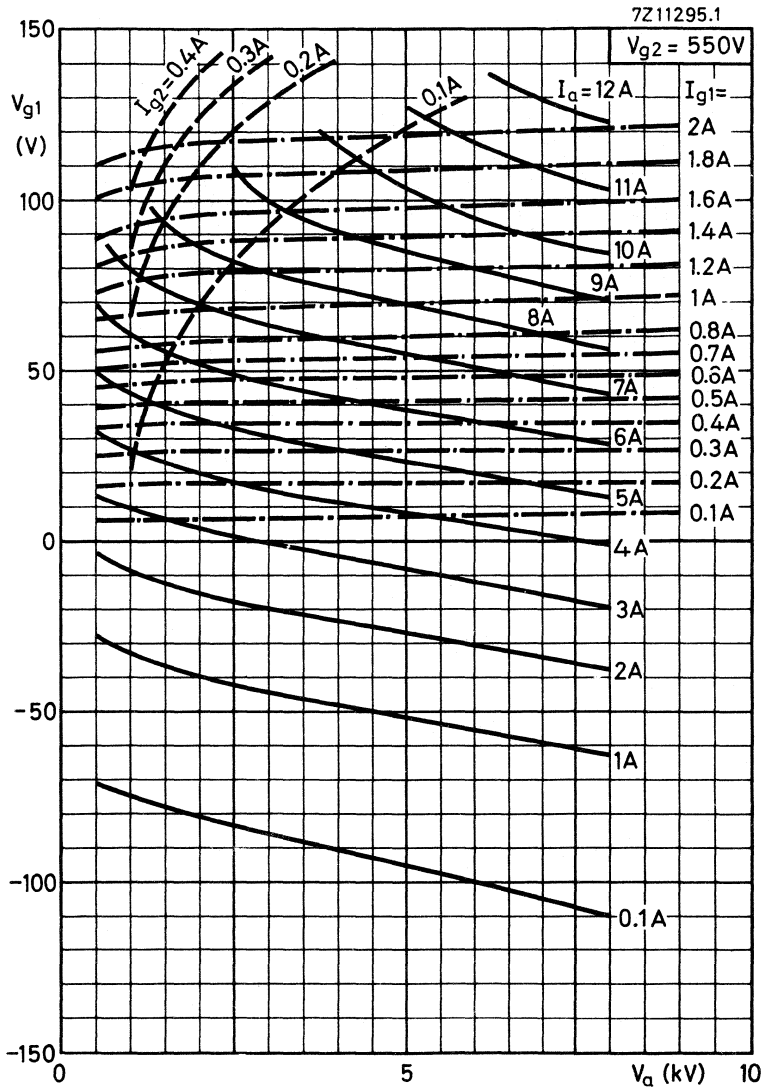
1) To be adjusted for the stated no signal anode current.

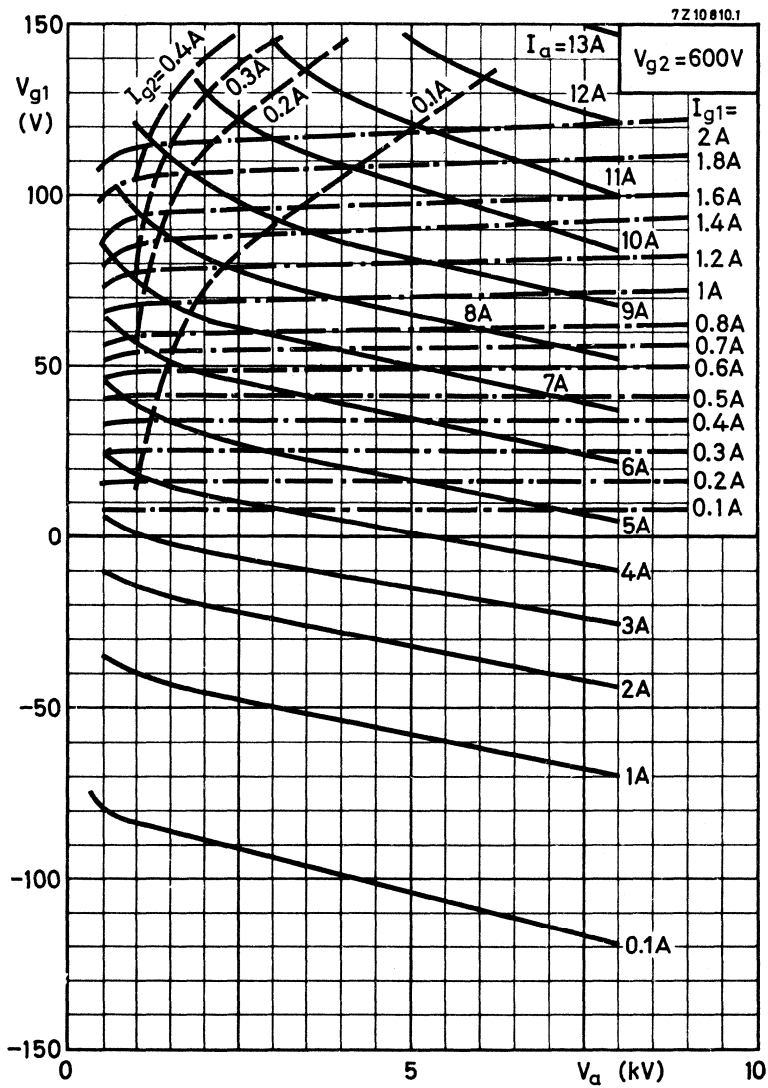


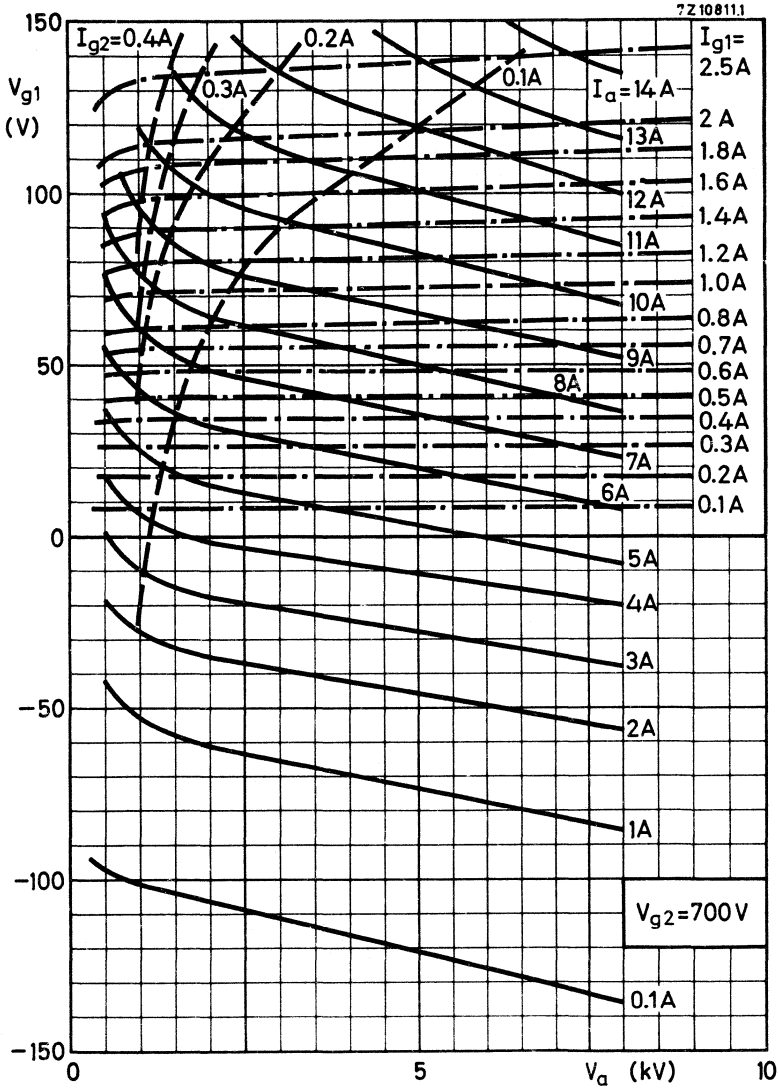














## AIR COOLED V.H.F. POWER TETRODE

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.

QUICK REFERENCE DATA			
Frequency (MHz)	Class AB linear amplifier (vision)		
	$V_a$ (kV)	$W_{l \text{ sync}}$ (kW)	Gain
175.25	8	27.5	27.5
83.25	6.5	20	24
55.25	6.5	20	22

**HEATING** : direct; filament thoriated tungsten, mesh type.

Filament voltage	$V_f$	11.5	V $\pm$ 5%
Filament current	$I_f$	120	A
Filament peak starting current	$I_{fp}$	max. 750	A
Cold filament resistance	$R_{f0}$	10.5	$m\Omega$
Waiting time	$T_w$	min. 1	s

### TYPICAL CHARACTERISTICS

Anode voltage	$V_a$	8	kV
Grid No. 2 voltage	$V_{g2}$	700	V
Anode current	$I_a$	2.4	A
Transconductance	$S$	60	mA/V
Amplification factor	$\mu_{g2g1}$	8.5	

Data based on pre-production tubes.

## CAPACITANCES

	grounded cathode		grounded grid	
Input	$C_{g1(a)}$	135	$C_{f(a)}$	69 pF
Output	$C_{a(g1)}$	23	$C_{a(f)}$	23 pF
Anode to grid No. 1	$C_{ag1}$	0.85		pF
Anode to filament			$C_{af}$	0.25 pF

## TEMPERATURE LIMITS

Absolute max. envelope temperature	$t_{env}$ max.	240 °C
Recommended max. seal temperature	$t$ max.	200 °C

## COOLING

$W_a$ (kW)	$h$ (m)	$t_i$ (°C)	$q$ (m <sup>3</sup> /min)	$P_i$ (mm H <sub>2</sub> O)
16	0	35	12	145

Direction of airflow: see 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 <sup>1)</sup>
Band III amplifier circuit assembly (sound)	type 40769 <sup>1)</sup>
Complete socket including grid No. 1, grid No. 2 cathode and filament connections	type 40742

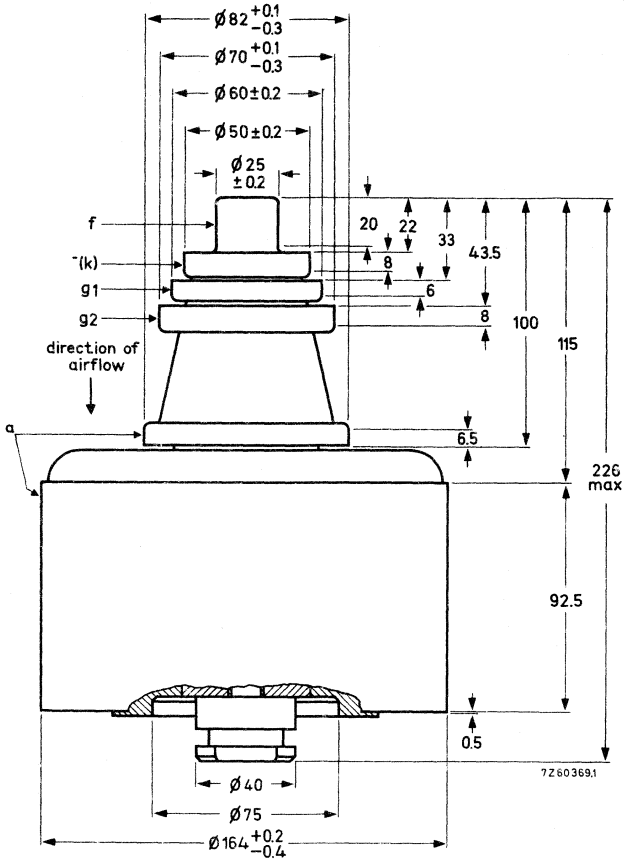
<sup>1)</sup> Including tube extractor

**MECHANICAL DATA**

Dimensions in mm

Net weight: approx. 11 kg

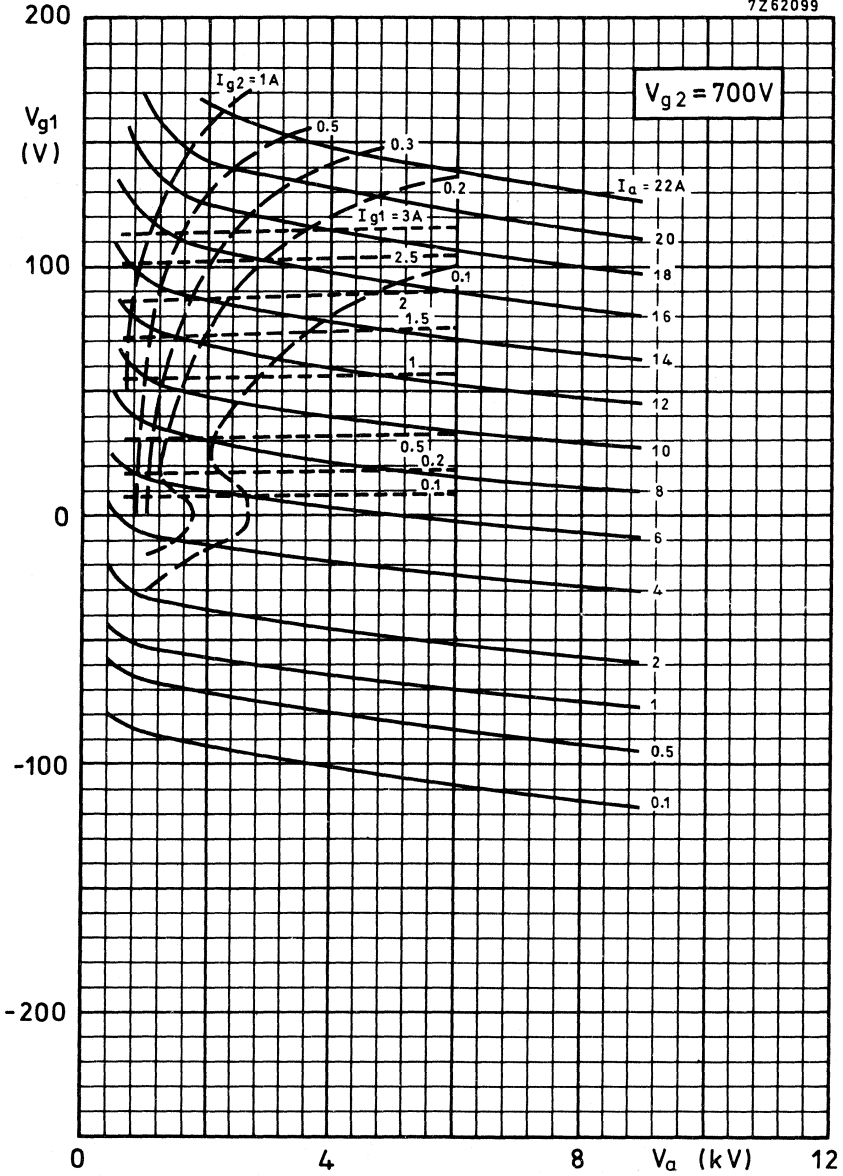
Mounting position: Vertical with anode up or down











## BEAM POWER TETRODE

Beam power amplifier tube intended for use as a pulse modulator tube in both fixed and mobile equipment.

### QUICK REFERENCE DATA

Rectangular pulse modulator			
Anode supply voltage	$V_{ba}$	3000	V
Grid No. 1 voltage, positive peak	$V_{g1p}$	65	V
Load resistance	$R_l$	1500	$\Omega$
Anode current, peak	$I_{ap}$	1.5	A

**HEATING:** Indirect by A. C. or D. C.; parallel supply.

Heater voltage	$V_f$	6.3	V $\pm$ 10%
Heater current	$I_f$	1.25	A

### 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	$C_{ag1}$	max. 0.24	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	$\mu_{g2g1}$	4.5	-

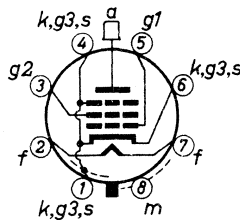
### MECHANICAL DATA

Base: Octal 8 pin, IEC 67-I-5a

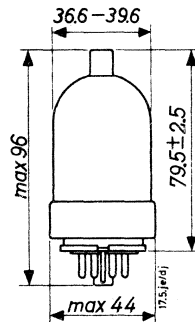
Cap: JEDEC C1-1, IEC 67-III-1b

Net weight: approx. 65 g

Mounting position: any



Dimensions in mm





**CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN**

		min.	max.
Heater current at $V_f = 6.3 \text{ V}$	$I_f$	1.175	1.325 A
Capacitances			
Grid No. 1 to all except anode	$C_{g1(a)}$	12.0	15.0 pF
Anode to all except grid No. 1	$C_{a(g1)}$	7.3	9.5 pF
Anode to grid No. 1	$C_{ag1}$		0.24 pF
Anode current <sup>4)</sup>	$I_a$	46	94 mA
, peak <sup>5)</sup>	$I_{ap}$	2.4	A
Grid No. 2 current <sup>4)</sup>	$I_{g2}$	0	5.5 mA

1) Duty factor for the 6293 is defined as the "on" time in  $\mu\text{s}$  divided by 10 000  $\mu\text{s}$ . "On" time is defined as the sum of the durations of all the individual pulses which occur during any 10 000  $\mu\text{s}$  interval.

"Pulse duration" is defined as the time interval between the two points of the pulse at which the instantaneous value is 70% of the peak value. The peak value is defined as the maximum value attained by a smooth curve representing the average fluctuation over the top portion of the pulse.

2) For tube protection it is essential that sufficient resistance be used in the anode supply circuit, the grid No. 2 supply circuit, and the grid No. 1 supply circuit so that the short-circuit current is limited to 0.5 A in each circuit.

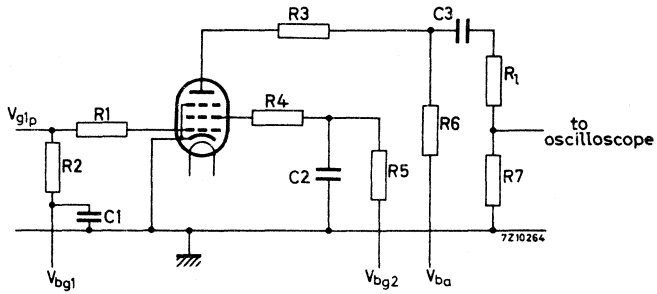
3) Averaged over any interval not exceeding 10 000  $\mu\text{s}$ . Care should be used in determining the anode dissipation. A calculated value based on rectangular pulses can be considerably in error when the actual pulses have a finite rise and fall time. Anode dissipation should preferably be determined by measuring the bulb temperature under actual operating conditions; then, with the tube in the same socket and under the same ambient-temperature conditions, apply to the tube sufficient d.c. input to obtain the same bulb temperature. This value of d.c. input is a measure of the anode dissipation.

4)  $V_f = 6.3 \text{ V}$ ,  $V_a = V_{g2} = 300 \text{ V}$ ,  $V_{g1} = -33 \text{ V}$

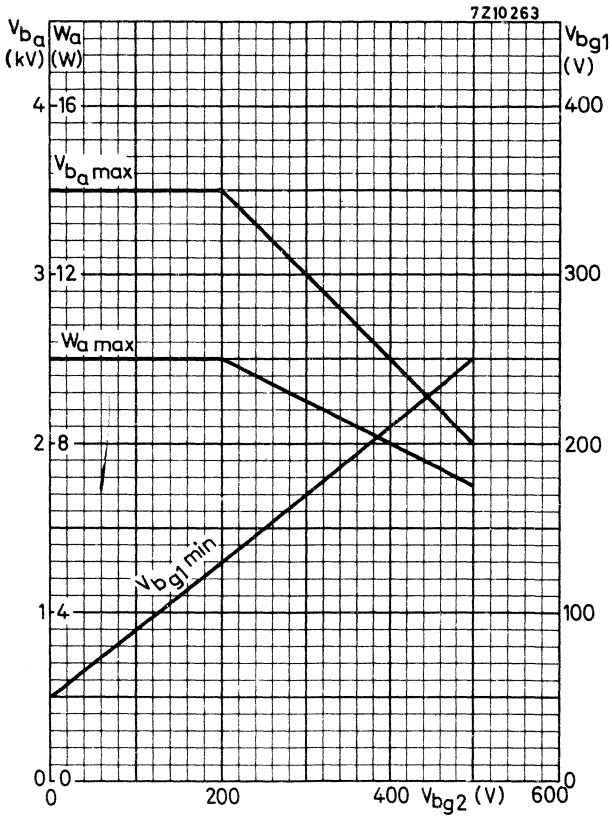
5) With the tube in the test circuit on page 4, and under the following conditions:

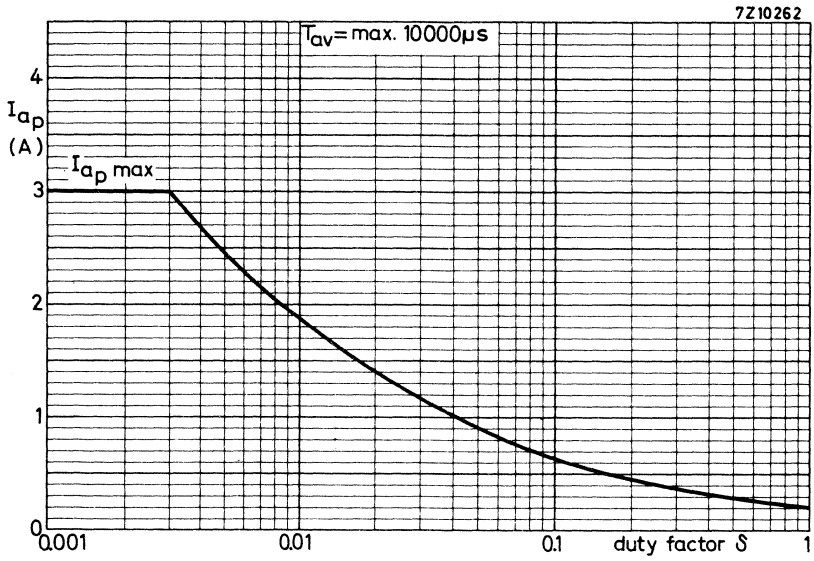
Rectangular-wave modulation applied to grid No. 1

pulse duration approx.	$T_{imp}$	1 $\mu\text{s}$
pulse repetition frequency approx.	$f_{imp}$	3000 p.p.s
Anode supply voltage	$V_{ba}$	2000 V
Grid No. 2 supply voltage	$V_{bg2}$	500 V
Grid No. 1 supply voltage	$V_{bg1}$	-300 V
Grid No. 1 swing, peak positive	$V_{g1p}$	100 V
Load resistance, 50 W	$R_l$	375 $\Omega$
Heater voltage	$V_f$	6.3 V

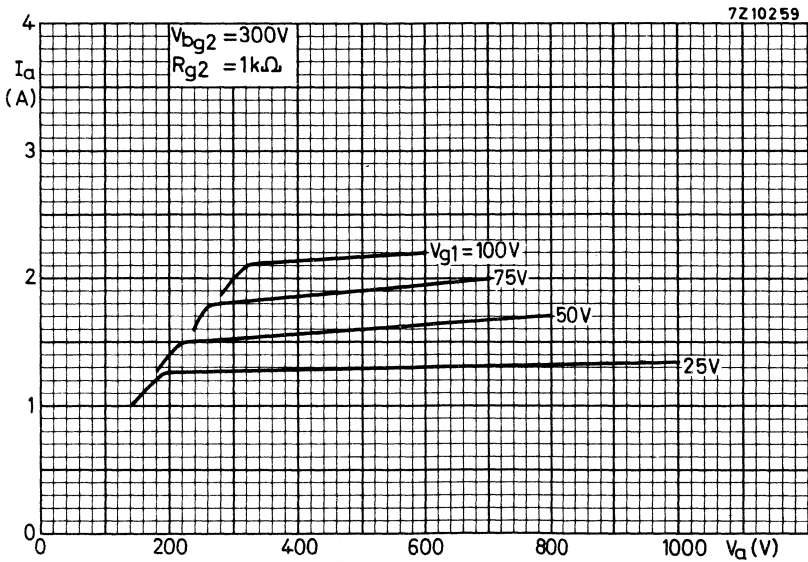
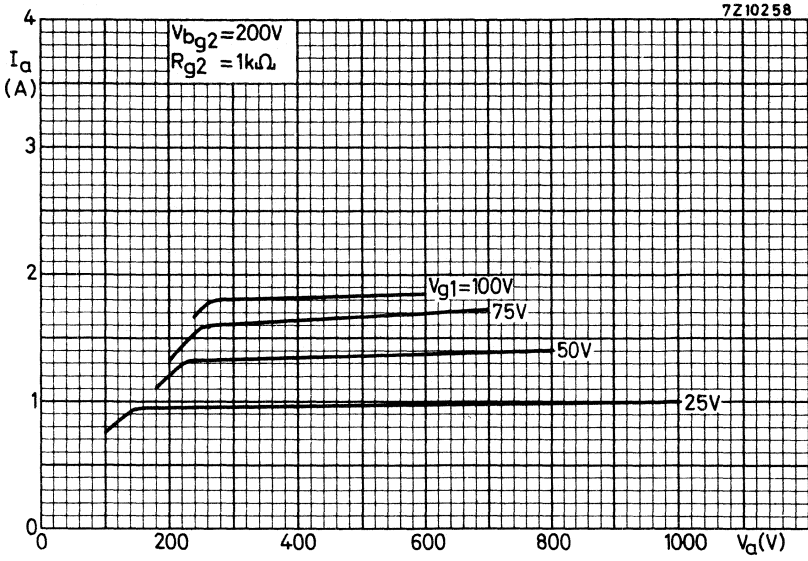


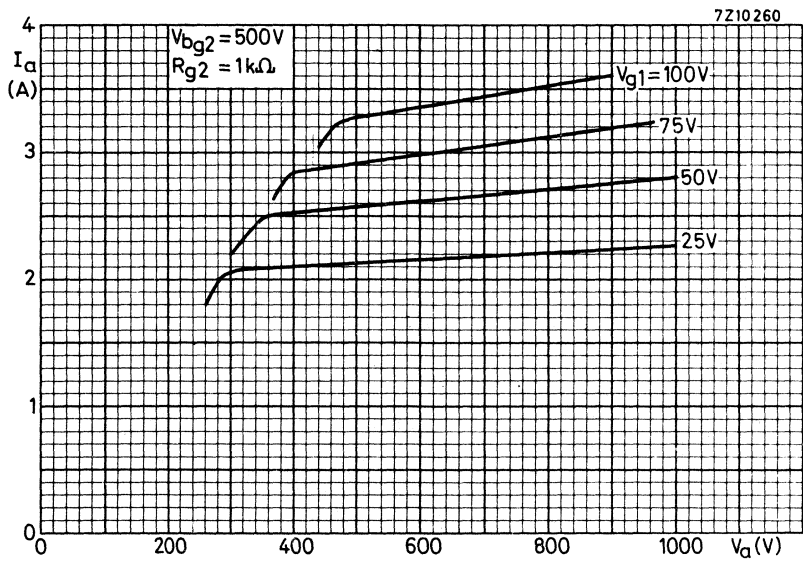
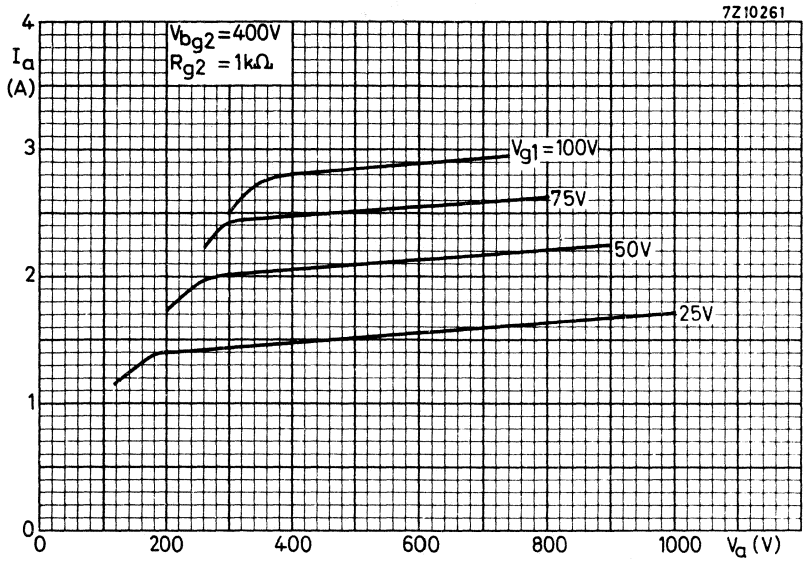
C1	0.1 $\mu$ F, 600 V <sub>d.c.</sub>	R4	25 $\Omega$ , 1 W
C2	2 $\mu$ F, 600 V <sub>d.c.</sub>	R5	1000 $\Omega$ , 1 W
C3	0.25 $\mu$ F, 5000 V <sub>d.c.</sub>	R6	10 000 $\Omega$ , 1 W
R1	20 $\Omega$ , 1 W	R7	30 $\Omega$ , $\pm 1\%$
R2	3000 $\Omega$ , 1 W	R $\ell$	see page 3, note 5
R3	10 $\Omega$ , 5 W		











## 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 <sub>2</sub> mod.		AB mod.		
	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W)	V <sub>a</sub> (V)	W <sub>o</sub> (W) <sup>1</sup>	W <sub>o</sub> (W) <sup>2</sup>
< 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			
500	600	85	400	55	Freq. (MHz)	B television	
	1250	140				V <sub>a</sub> (V)	W <sub>o</sub> sync (W)
	1000	120			216	1250	250
	800	95				1000	200
	600	50				750	135

**HEATING:** Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V <sub>f</sub>	26.5 V
Heater current	I <sub>f</sub>	570 mA
Waiting time	T <sub>w</sub>	min. 30 s

### CAPACITANCES

Grid No. 1 to all except anode	C <sub>g1(a)</sub>	15.5 pF
Anode to all except grid No. 1	C <sub>a(g1)</sub>	4.0 pF
Anode to grid No. 1	C <sub>ag1</sub>	0.03 pF

<sup>1</sup>) Without grid current, two tubes.

<sup>2</sup>) 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 °C
Anode seal temperature	$t_s$	max. 200 °C
Base seals and grid No.2 seal temperature	$t_g$	max. 175 °C

**COOLING** air inlet temperature  $t_i = 20$  °C, altitude  $h = 0$  m <sup>1)</sup>

With an air system socket

Air flow	q	0.16 m <sup>3</sup> /min
Pressure drop	$p_i$	7 mm H <sub>2</sub> O

Without an air system socket

Air flow	q	0.15 m <sup>3</sup> /min
Pressure drop	$p_i$	7 mm H <sub>2</sub> O

<sup>1)</sup> 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	2422 513 01001
Chimney	4322 026 11701

**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

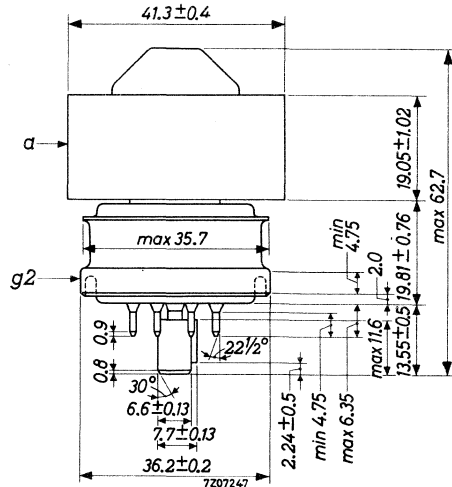
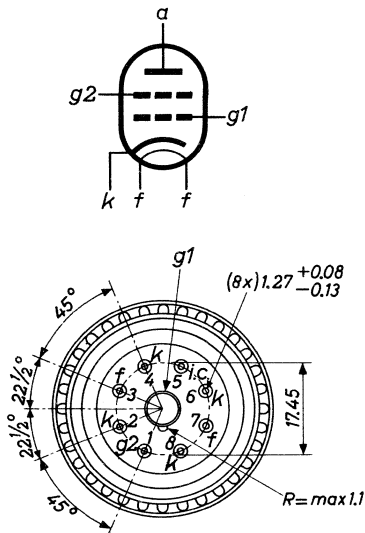
The tube is subjected to vibration frequencies from 25 Hz to 2000 Hz with an acceleration of 10 g.

**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	$V_{g2}$	max. 300	300	V
Grid No. 2 dissipation	$W_{g2}$	max. 12	12	W
Grid No. 1 voltage, negative	$-V_{g1}$	max. 250	250	V
Grid No. 1 dissipation	$W_{g1}$	max. 2	2	W
Grid No. 1 circuit resistance	$R_{g1}$	max. 25	25	k $\Omega$
Cathode to heater voltage, peak	$V_{kfp}$	max. 150	150	V

**OPERATING CONDITIONS**

Frequency	f	up to 150	150	MHz
Anode voltage	$V_a$	2000	1500	V
Grid No. 2 voltage	$V_{g2}$	250	250	V
Grid No. 1 voltage	$V_{g1}$	-88	-88	V
Grid No. 1 driving voltage	$V_{g1p}$	110	110	V
Anode current	$I_a$	250	250	mA
Grid No. 2 current	$I_{g2}$	24	24	mA
Grid No. 1 current	$I_{g1}$	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	$V_{g2}$	max. 300	300	V
Grid No. 2 dissipation	$W_{g2}$	max. 10	10	W
Grid No. 1 voltage, negative	$-V_{g1}$	max. 250	250	V
Grid No. 1 dissipation	$W_{g1}$	max. 2	2	W
Grid No. 1 circuit resistance	$R_{g1}$	max. 25	25	k $\Omega$
Cathode to heater voltage, peak	$V_{kfp}$	max. 150	150	V

**OPERATING CONDITIONS**

Frequency	f	up to 150	150	MHz
Anode voltage	$V_a$	1600	1200	V
Grid No. 2 voltage	$V_{g2}$	250	250	V
Grid No. 1 voltage	$V_{g1}$	-118	-118	V <sup>1)</sup>
Anode current	$I_a$	200	200	mA
Grid No. 2 current	$I_{g2}$	23	23	mA
Grid No. 1 current	$I_{g1}$	5	5	mA
Driving power	$W_{dr}$	3	2	W
Anode input power	$W_{ia}$	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	$V_{g2p\ mod}$	200	180	V

<sup>1)</sup> 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	$W_{i_a}$	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	$k\Omega$
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	$\Omega$
Driving voltage	$V_{ggp}$	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	$\Omega$
Driving voltage	$V_{ggp}$	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	$V_{g2}$	300	300	V
Grid No.1 voltage	$V_{g1}$	-45	-40	V
Load resistance	$R_{aa\sim}$	3950	3140	$\Omega$
Driving voltage	$V_{ggp}$	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	$I_{g2}$	- 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	$V_{g2}$	300	300	V
Grid No.1 voltage	$V_{g1}$	-50	-50	V
Load resistance	$R_{aa\sim}$	8100	5970	$\Omega$
Driving voltage	$V_{ggp}$	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	$I_{g2}$	- 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)

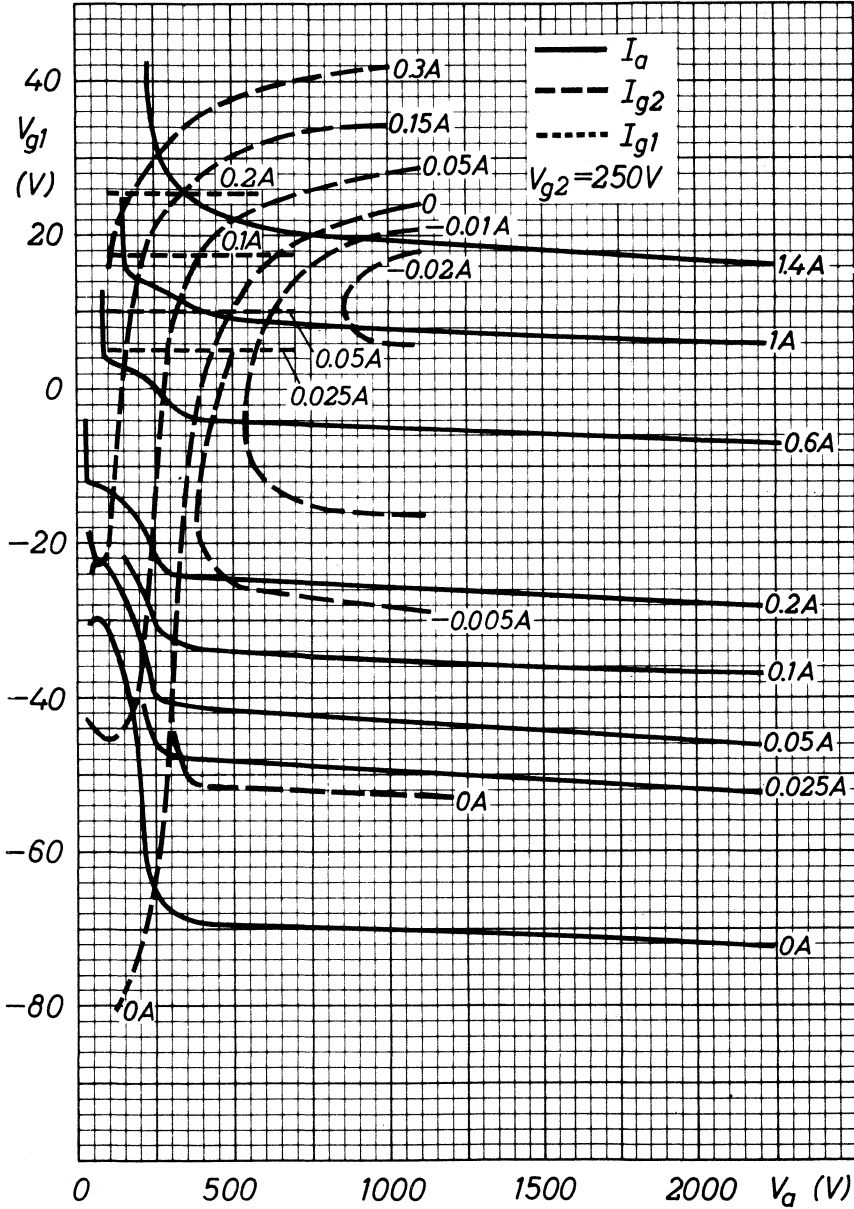
Frequency	f	54 to 216	MHz
Anode voltage	$V_a$	max. 1250	V
Anode current	$I_a$	max. 250	mA
Anode dissipation	$W_a$	max. 250	W
Grid No.2 voltage	$V_{g2}$	max. 250	V
Grid No.2 dissipation	$W_{g2}$	max. 12	W
Grid No.1 voltage, negative	$-V_{g1}$	max. 400	V
Grid No.1 dissipation	$W_{g1}$	max. 2	W
Grid No.1 circuit resistance	$R_{g1}$	max. 25	$k\Omega$ <sup>1)</sup>
Cathode to heater voltage, peak	$V_{kf_p}$	max. 150	V

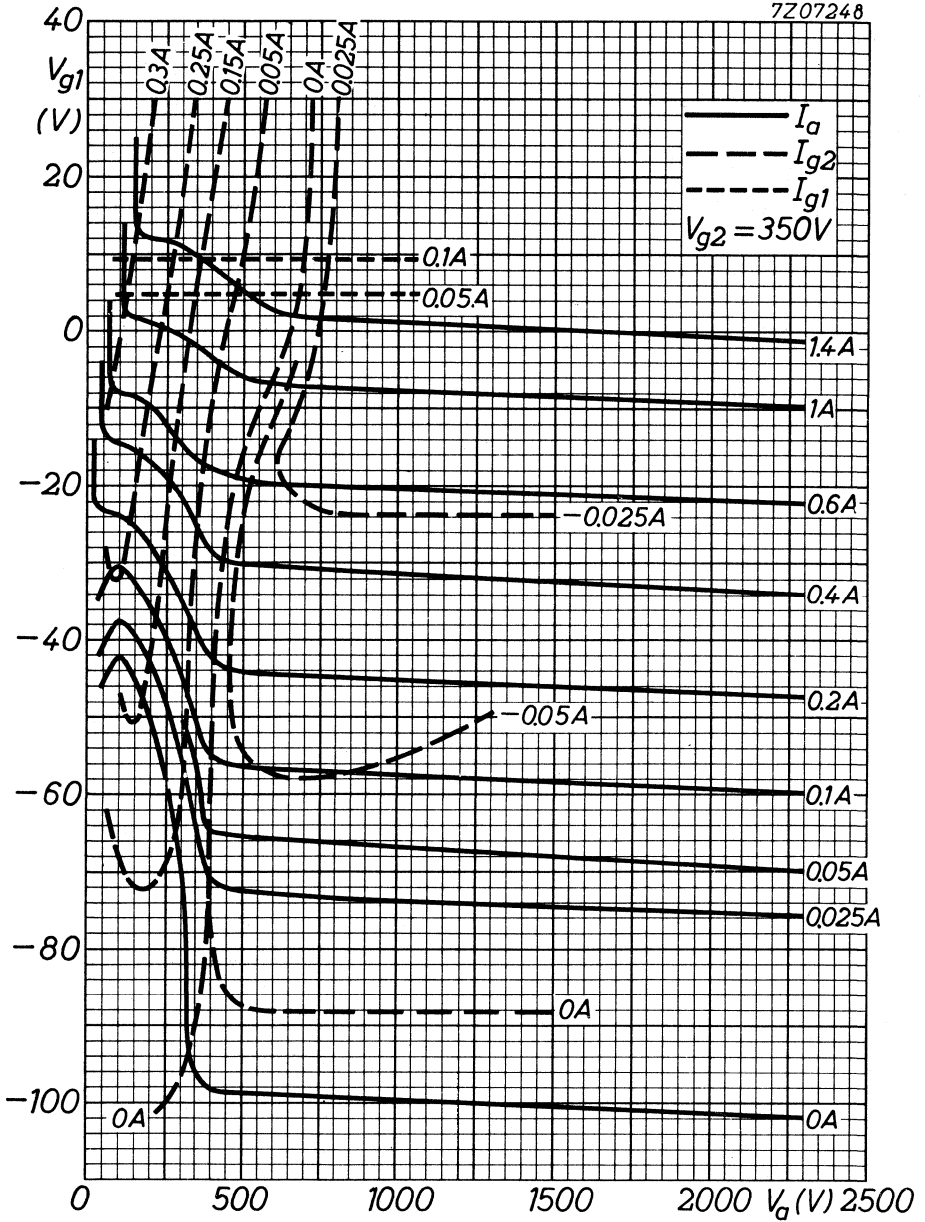
**OPERATING CONDITIONS**

Bandwidth	B (-1.5 dB)	5	5	5	MHz
Anode voltage	$V_a$	1250	1000	750	V
Grid No.2 voltage	$V_{g2}$	300	300	300	V
Grid No.1 voltage	$V_{g1}$	-70	-65	-60	V
Driving voltage, peak to peak	sync	100	95	85	V
	$V_{g1pp}$ black	75	70	65	V
Anode current	sync	305	330	335	mA
	black	230	240	245	mA
Grid No.2 current	sync	45	45	50	mA
	black	10	15	20	mA
Grid No.1 current	sync	25	20	15	mA
	black	4	4	4	mA
Driving power	sync	9	8	7	W
	black	5.5	4.7	4.25	W
Output power in load	sync	250	200	135	W
	black	140	110	75	W

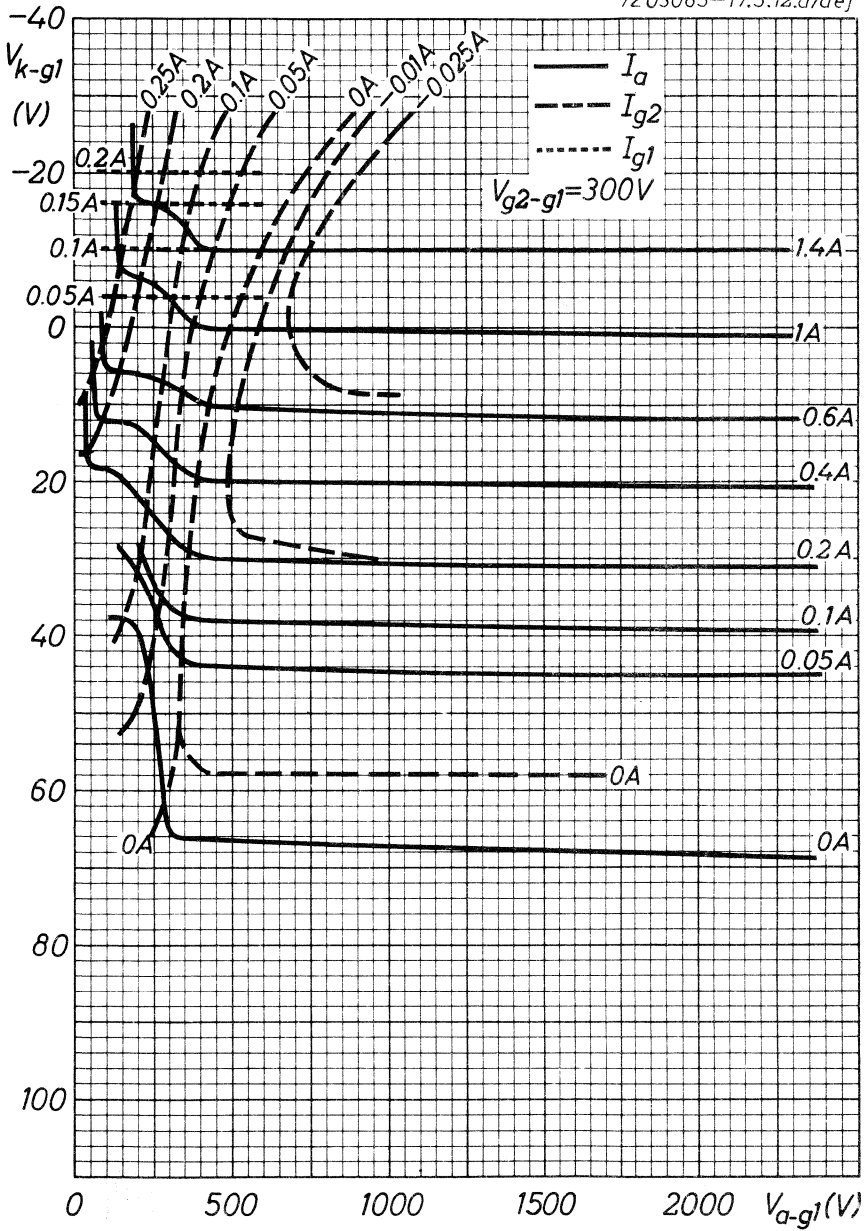
<sup>1)</sup> Cathode bias is not recommended.

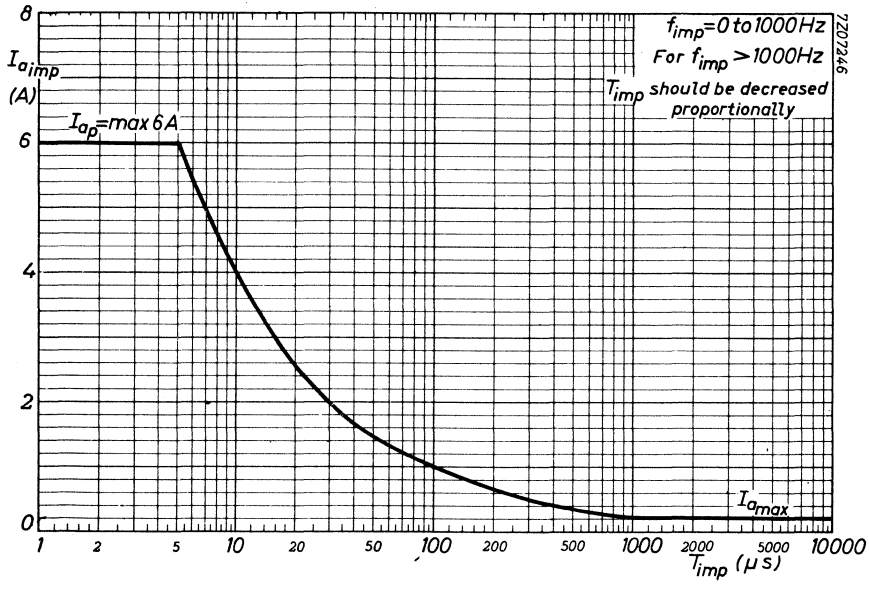
7Z07255





7Z03085-17.5.12.a/aej







## R.F. POWER PENTODE

Radiation and convection cooled beam pentode intended for use as R. F. power amplifier in mobile equipment.

QUICK REFERENCE DATA					
R. F. Class C telegraphy or F. M. telephony					
		CCS	ICAS	IMS	
Frequency	f	175	175	175	MHz
Anode voltage	$V_a$	315	375	450	V
Output power	$W_o$	26.5	32	46	W

**HEATING:** Indirect by A. C. or D. C.; cathode: oxide coated

Heater voltage	$V_f$	13.5	$V \pm 1.5V$
Heater current	$I_f$	580	mA

### CAPACITANCES

Grid No. 1 to all except anode	$C_{g_1(a)}$	16	pF
Anode to all except grid No. 1	$C_a(g_1)$	6.0	pF
Anode to grid No. 1	$C_{ag_1}$	0.16	pF

### TYPICAL CHARACTERISTICS

Anode voltage	$V_a$	200	V
Grid No. 2 voltage	$V_{g_2}$	125	V
Anode current	$I_a$	125	mA
Transconductance	S	13.5	mA/V
Amplification factor	$\mu_{g_2g_1}$	6	

**TEMPERATURE LIMITS** (Absolute max. rating system)

Envelope temperature	$t_{env}$	max.	220	$^{\circ}C$
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**COOLING** Radiation and convection

**MECHANICAL DATA**

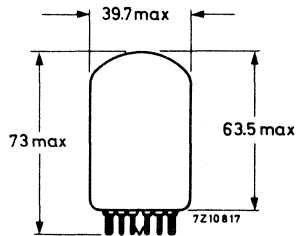
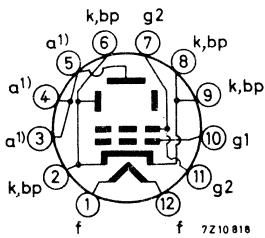
Dimensions in mm

Base: E12-74; IEC 67-I-35a

Outline: T12; IEC 67-II-14a, type 5

Net weight: approx. 45 g

Mounting position: any



<sup>1)</sup> Pins 3, 4 and 5 should be interconnected on the socket.

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

## LIMITING VALUES (Absolute max. rating system)

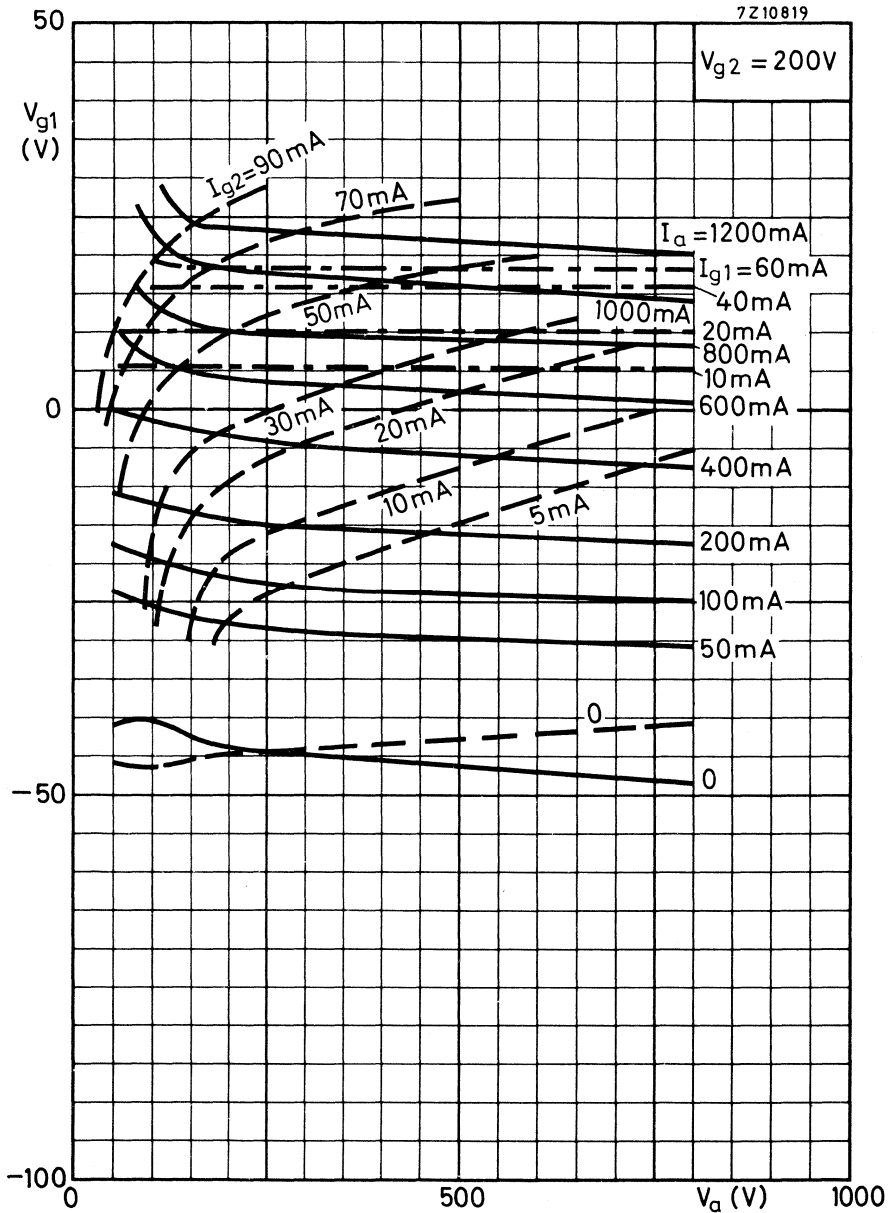
		CCS	ICAS	IMS <sup>1)</sup>	
Frequency	$f$	up to 175	175	175	MHz
Anode voltage	$V_a$	max. 600	750	750	V
Grid No. 2 voltage	$V_{g2}$	max. 250	250	250	V
Grid No. 1 voltage	$-V_{g1}$	max. 100	100	100	V
Anode current	$I_a$	max. 150	150	180	mA
Anode input power	$W_{ia}$	max. 47	56	81	W
Anode dissipation	$W_a$	max. 20	25	35	W
Grid No. 2 dissipation	$W_{g2}$	max. 3.0	3.0	3.0	W
Grid No. 1 current	$I_{g1}$	max. 6.0	6.0	6.0	mA
Grid No. 1 dissipation	$W_{g1}$	max. 2.0	2.0	2.0	W
Cathode current	$I_k$	max. 165	165	195	mA
Grid No. 1 circuit resistance	$R_{g1}$	max. 30	30	30	k $\Omega$

## OPERATING CONDITIONS

Frequency	$f$	175	175	175	MHz
Anode voltage	$V_a$	315	375	450	V
Grid No. 2 voltage	$V_{g2}$	165	160	200	V
Grid No. 1 voltage	$V_{g1}$	-74	-80	-60	V
Anode current	$I_a$	150	150	180	mA
Grid No. 2 current	$I_{g2}$	8.5	8.5	12	mA
Grid No. 1 current	$I_{g1}$	3.7	4	4	mA
Grid No. 1 circuit resistance	$R_{g1}$	20	20	15	k $\Omega$
Anode input power	$W_{ia}$	47	56	81	W
Anode dissipation	$W_a$	20.5	24	35	W
Anode output power	$W_o$	26.5	32	46	W
Driving power	$W_{dr}$	2	2	2	W
Efficiency	$\eta$	56	57	57	%

<sup>1)</sup> Intermittent Mobile Service: Maximum "on" period 15 s followed by an "off" period of at least 60 s.

During equipment tests maximum "on" periods of 5 min followed by "off" periods of at least 5 min are permissible provided the total "on" time of such periods does not exceed 10 h during the life of any tube.



## R.F. POWER TETRODE

Forced-air cooled tetrode in ceramic-metal construction intended for use in S.S.B. transmitters.

Freq. (MHz)	QUICK REFERENCE DATA		
	S.S.B.		
	$V_a$ (V)	$W_{\ell}$ (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 $\pm$ 5% <sup>1)</sup>
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

<sup>1)</sup> Short term variations of  $\pm 10\%$  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	0 m	50 °C	0.15 m <sup>3</sup> /min	15 mm H <sub>2</sub> O
250 W	3000 m	50 °C	0.19 m <sup>3</sup> /min	22 mm H <sub>2</sub> O

**ACCESSORIES**

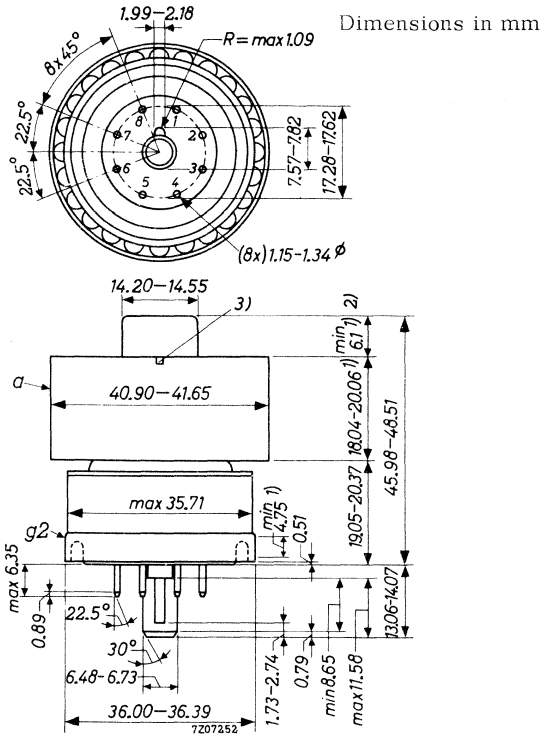
Socket 2422 513 01001

Chimney type 4322 026 11701

**MECHANICAL DATA**

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	$V_{g2}$	max.	400	V
Grid No.2 dissipation	$W_{g2}$	max.	12	W
Grid No.1 voltage, negative	$-V_{g1}$	max.	150	V
Cathode to heater voltage, peak	$V_{kf_p}$	max.	150	V

**OPERATING CONDITIONS**

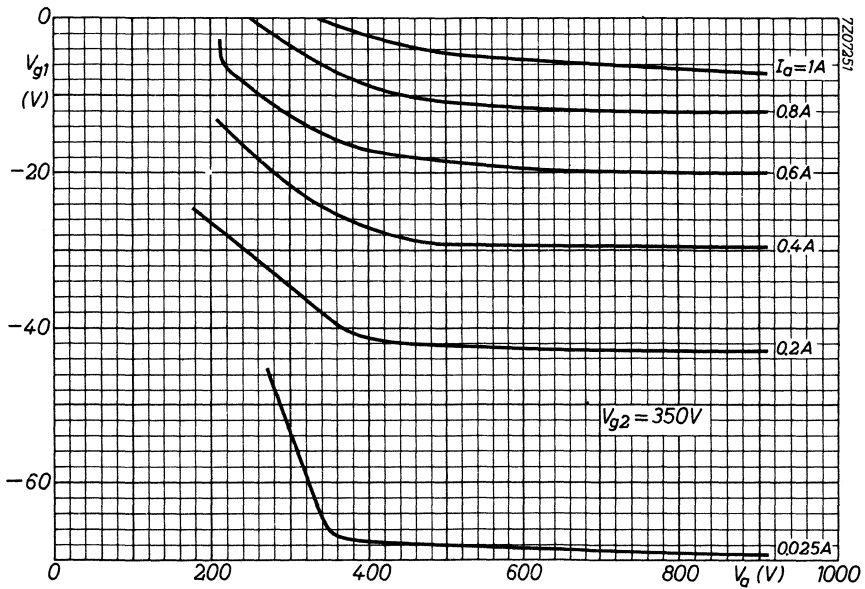
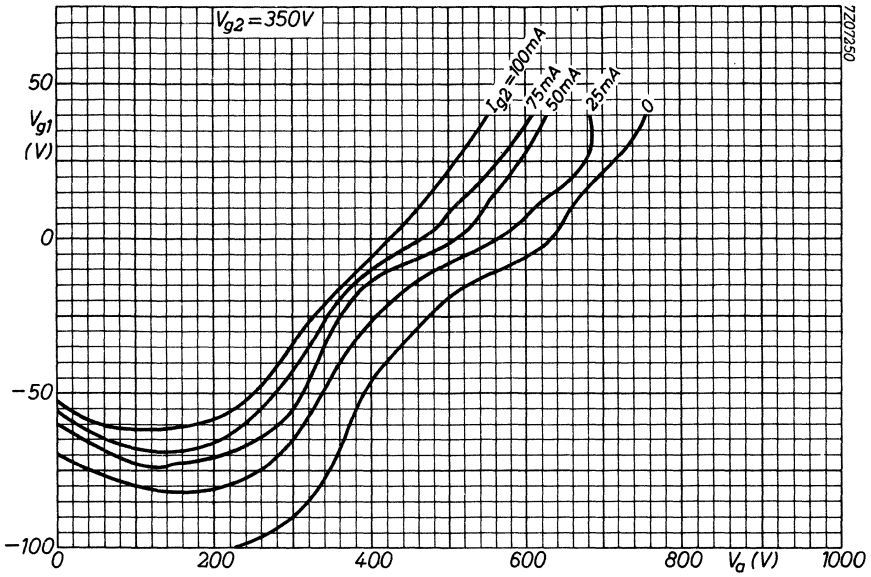
Frequency	f	7	MHz	
Anode voltage	$V_a$	2000	V	
Grid No.2 voltage	$V_{g2}$	350	V	
Grid No.1 voltage	$V_{g1}$	-57.5	V	
Load resistance	$R_{a\sim}$	4000	$\Omega$	
		zero signal	single tone	double tone
Driving voltage, peak	$V_{g1p}$	0	45.3	45.3 V
Anode current	$I_a$	100	250	174 mA
Grid No.2 current	$I_{g2}$	-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)

		zero signal	single tone <sup>1)</sup>	double tone	
Frequency	f		7		MHz
Anode voltage	V <sub>a</sub>		2000		V
Grid No.2 voltage	V <sub>g2</sub>		350		V
Grid No.1 voltage	V <sub>g1</sub>		-72		V
Load resistance	R <sub>a ~</sub>		3570		Ω
Driving voltage, peak	V <sub>g1p</sub>	0	62	62	V
Anode current	I <sub>a</sub>	75	310	204	mA
Grid No.2 current	I <sub>g2</sub>	-0.85	14	2.4	mA
Anode input power	W <sub>i<sub>a</sub></sub>	150	620	407	W
Output power in the load	W <sub>ℓ (PEP)</sub>	-	436	436	W
Third order intermodulation distortion	d <sub>3</sub>	-	-	-23	dB
Fifth order intermodulation distortion	d <sub>5</sub>	-	-	-37	dB

<sup>1)</sup> 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.







## Amplifier circuit assemblies

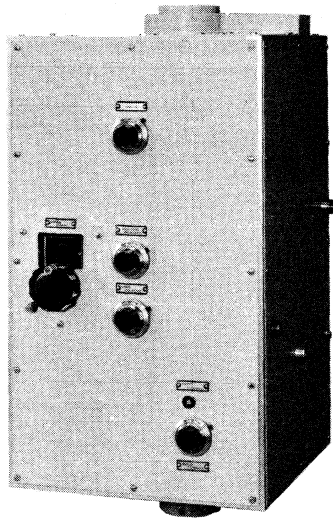




## BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 VISION

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.

RZ 29115-1



### QUICK REFERENCE DATA

Frequency (MHz)	Class AB linear amplifier (vision)		
	$V_a$ (kV)	$W_l$ sync (kW) (CCIR system)	Power gain
170 to 260	3	1.55	26
	2.5	0.7	23

### FREQUENCY RANGE

170 to 220 MHz continuously tunable. Up to 260 MHz with minor, channel dependent, modifications.

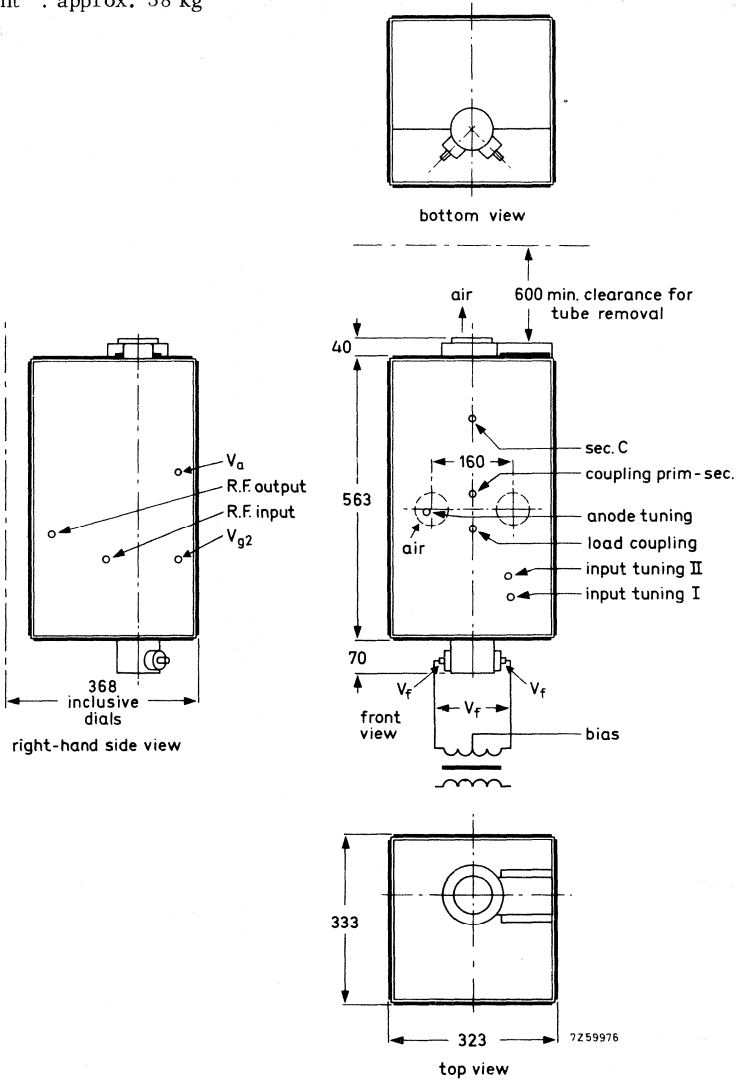
### OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

**MECHANICAL DATA**

Dimensions : approx. 673 x 333 x 323 mm<sup>3</sup>

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  $\Omega$  (coaxial female connector type N)

Output : 50  $\Omega$  (coaxial female connector type HN)

**ENVIRONMENTAL DATA**

Ambient temperature : 0  $^{\circ}\text{C}$  to +55  $^{\circ}\text{C}$

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

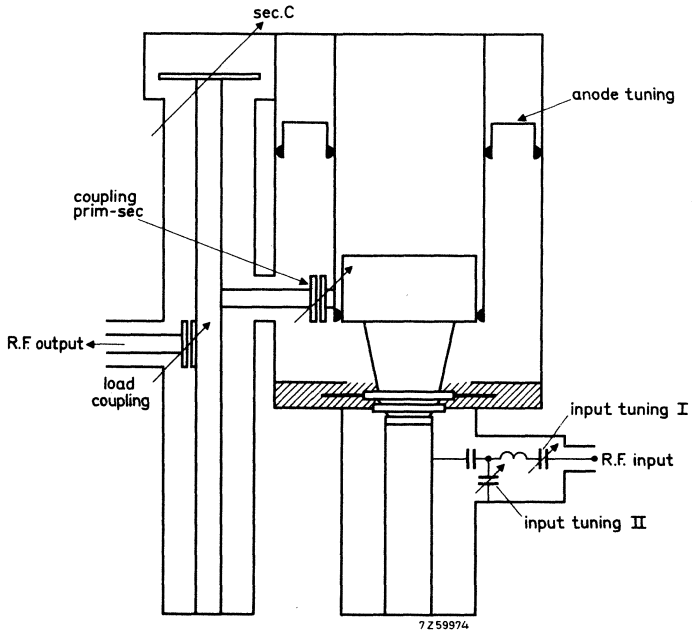
**ADDITIONAL COMPONENTS**a) Delivered with the assembly

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

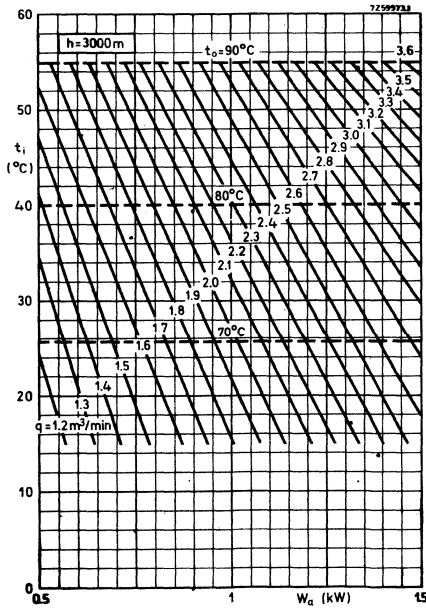
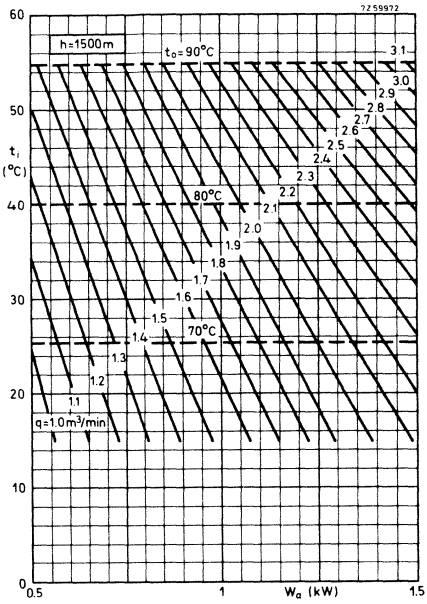
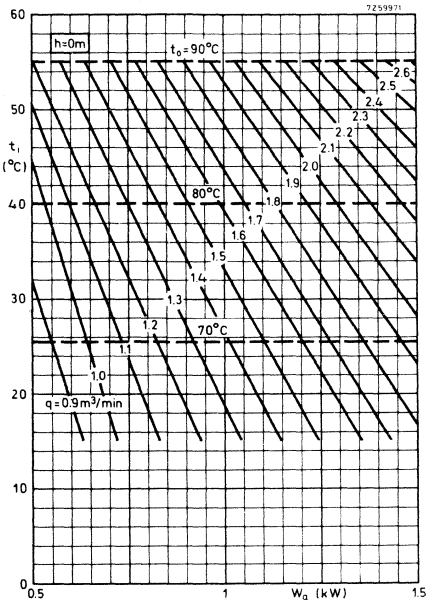
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 1201 (200 to 230 MHz) is recommended.

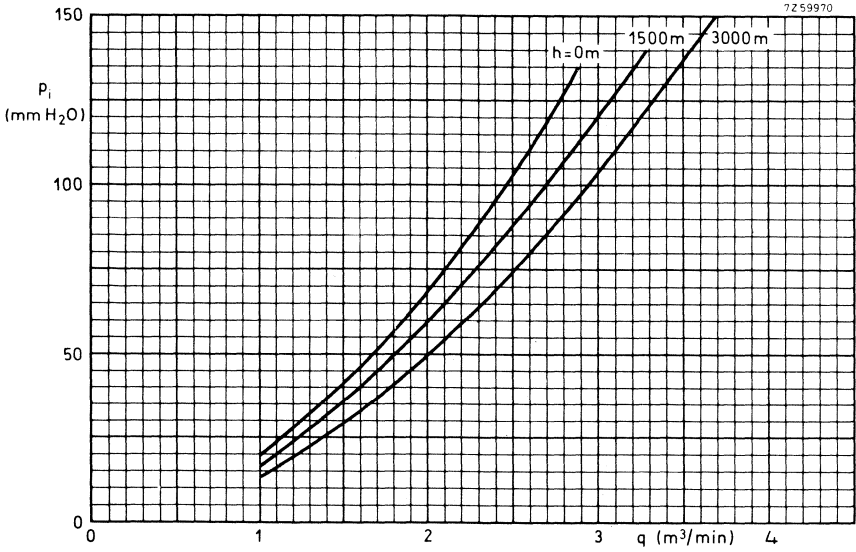
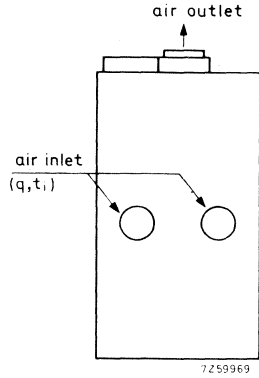
CIRCUIT DIAGRAM





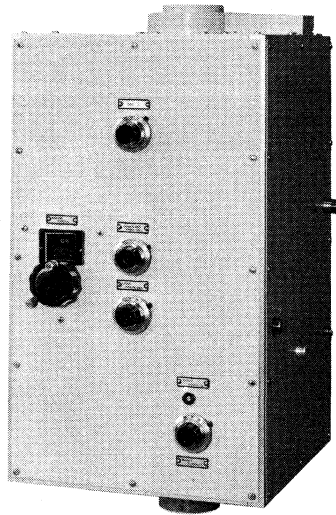
Cooling curves





## 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.



RZ 29115-8



QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	$V_a$ (kV)	$W_l$ (kW) CCIR system	Power gain
170 to 260	4	2.4	33

### 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.

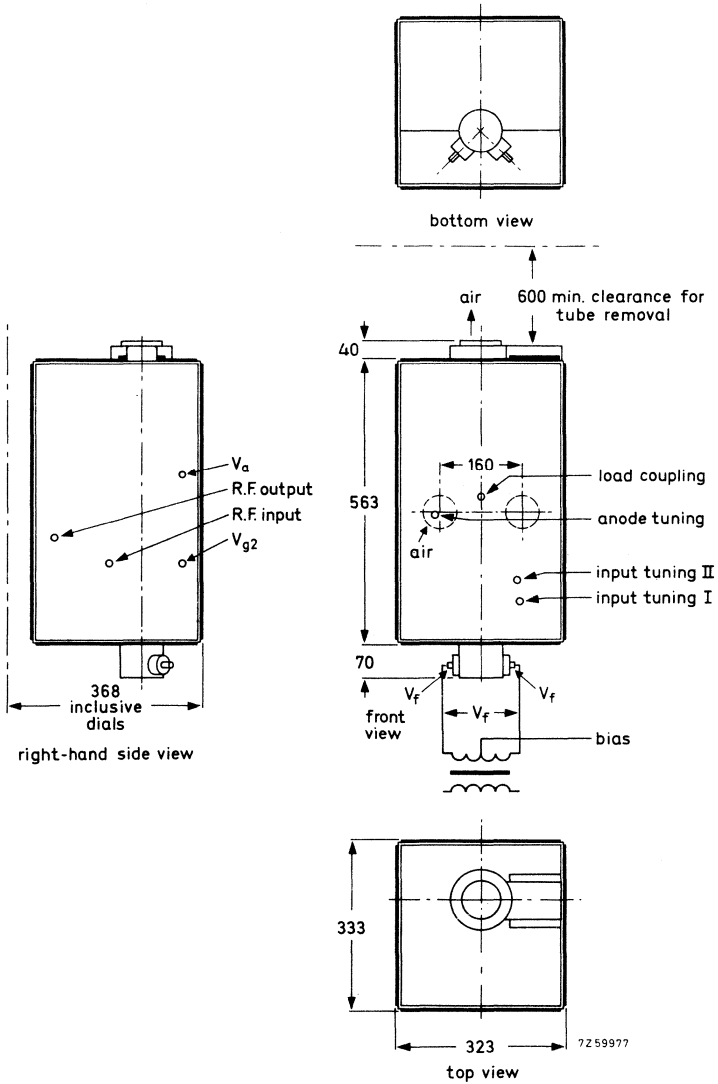
40744

MECHANICAL DATA

Dimensions in mm

Dimensions : approx. 673 x 333 x 323 mm<sup>3</sup>

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  $\Omega$  (coaxial female connector type N)

Output : 50  $\Omega$  (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

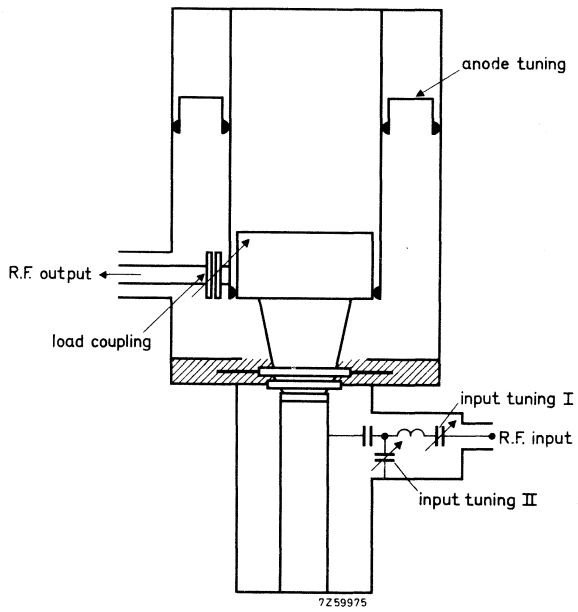
**ADDITIONAL COMPONENTS**a) Delivered with the assembly

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

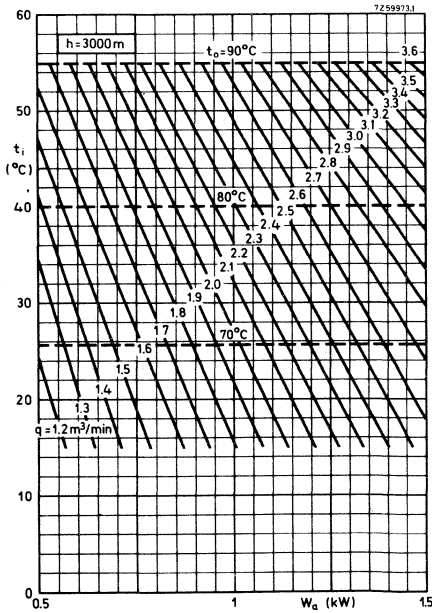
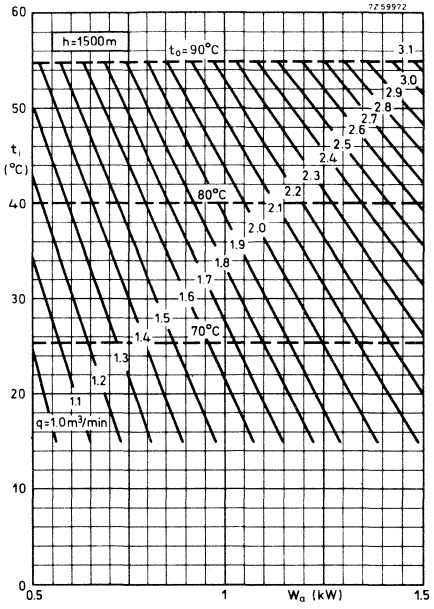
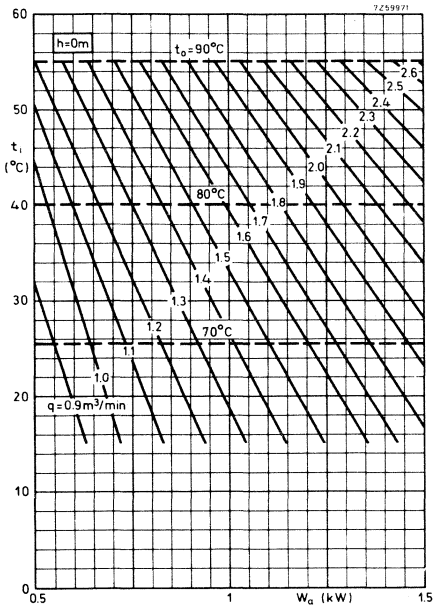
b) Recommended

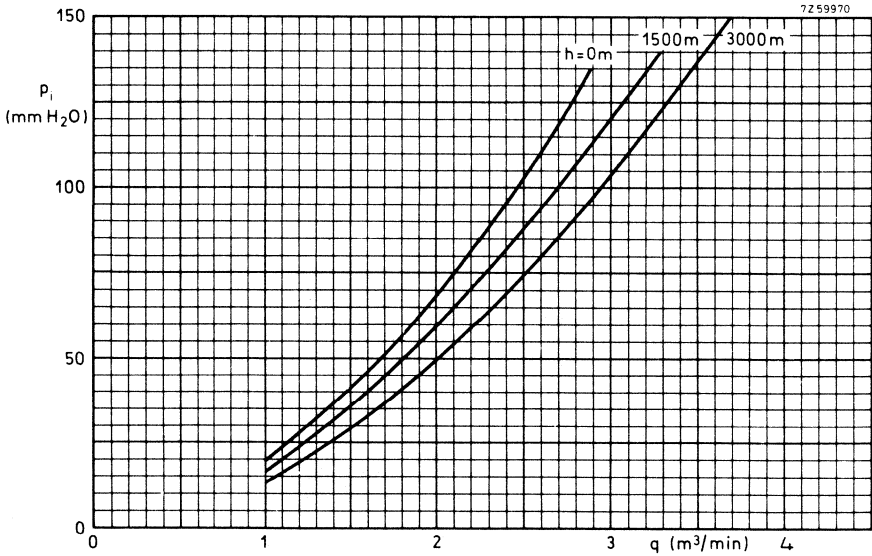
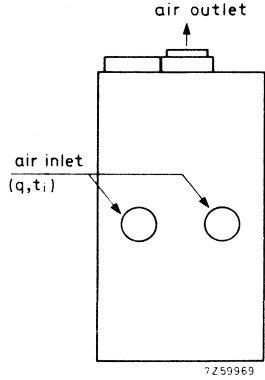
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

CIRCUIT DIAGRAM



Cooling curves



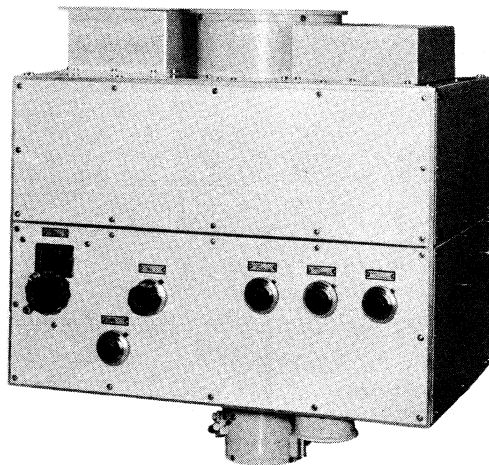




## BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420 VISION

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.



RZ29115-2

### QUICK REFERENCE DATA

Frequency (MHz)	Class AB linear amplifier (vision)		
	$V_a$ (kV)	$Wl_{sync}$ (kW) (CCIR system)	Power gain
170 to 230	4	6.25	24
	5	8.6	24

### FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

### OPERATING CONDITIONS (For YL1420)

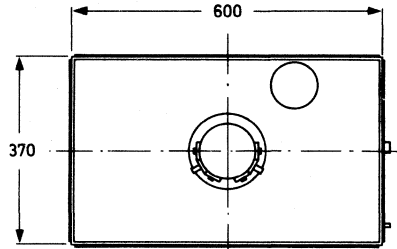
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

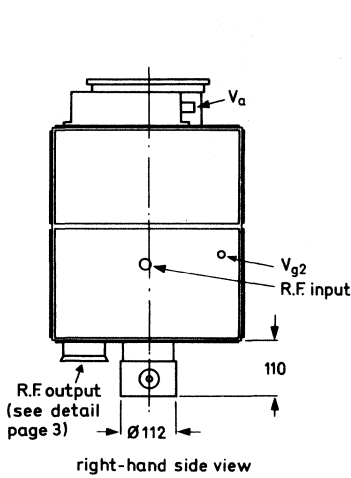
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm<sup>3</sup>

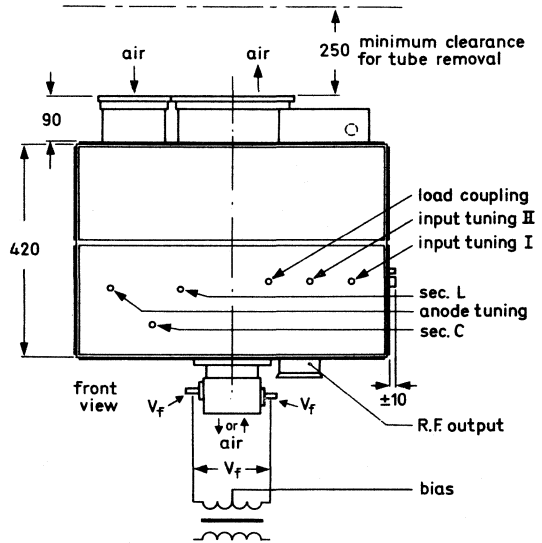
Net weight : approx. 67 kg



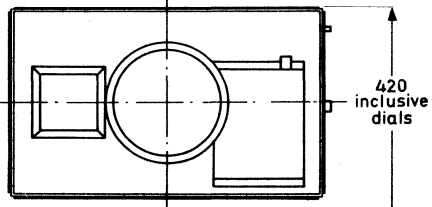
bottom view



right-hand side view



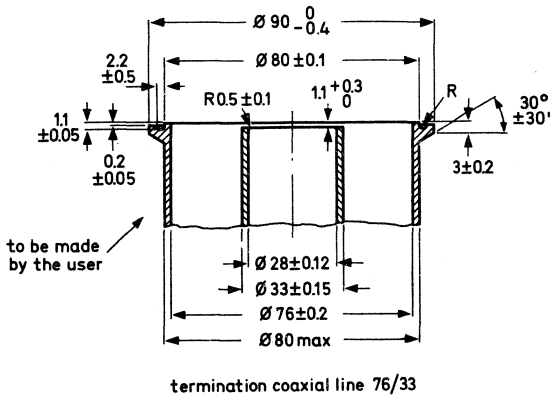
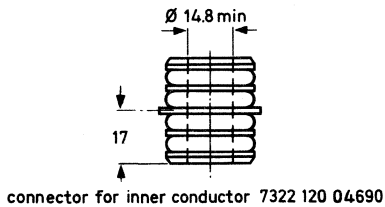
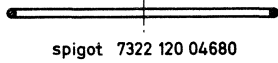
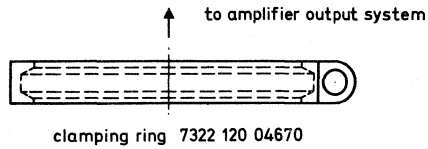
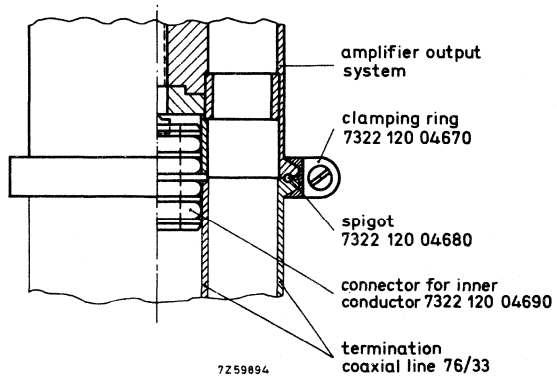
front view



top view

7259585

R. F. output connector



**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  $\Omega$  (coaxial female connector, type N)

Output : 50  $\Omega$  (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

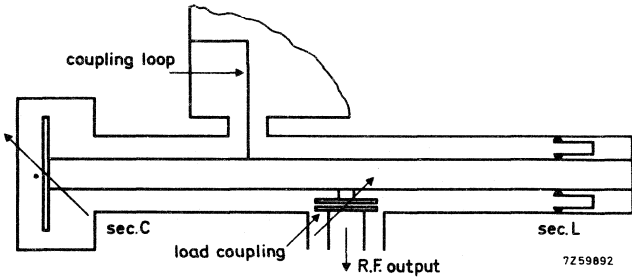
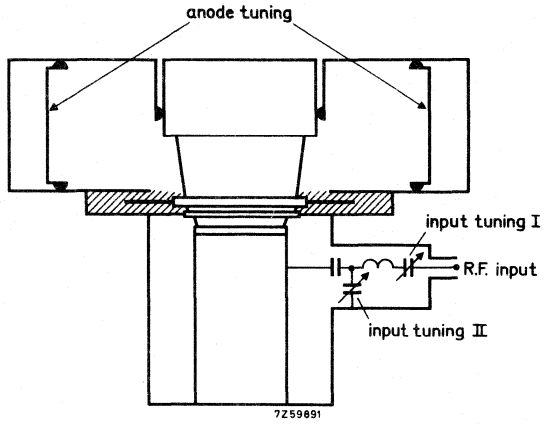
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175.25 MHz	7322 120 04730
Coupling loop for remaining frequencies except 223.25 MHz <sup>1)</sup>	7322 120 04760
Insulating protection cap	7322 120 04750
Spanner for fitting	

b) Recommended

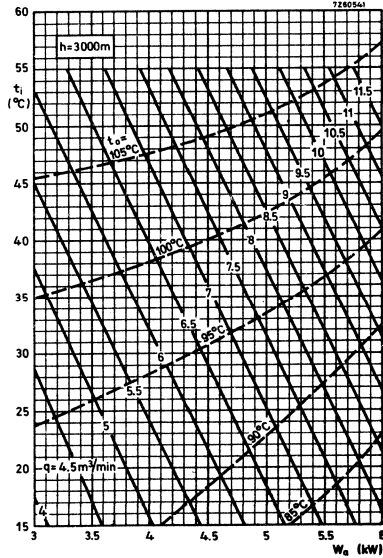
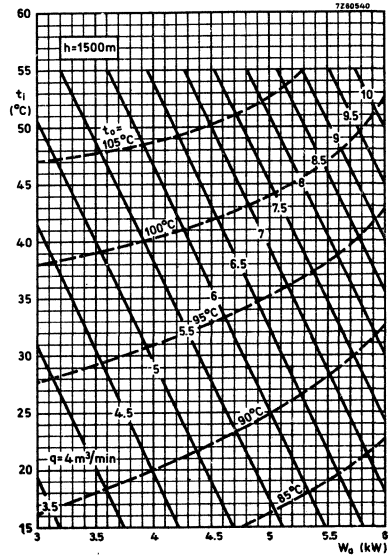
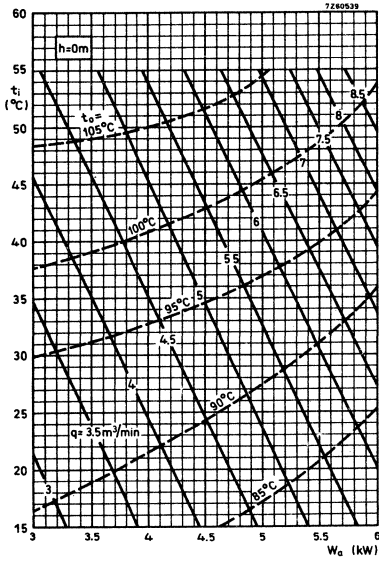
The use of circulator 2722 162 01191 (170 to 200 MHz) or  
2722 162 01201 (200 to 230 MHz) is recommended.

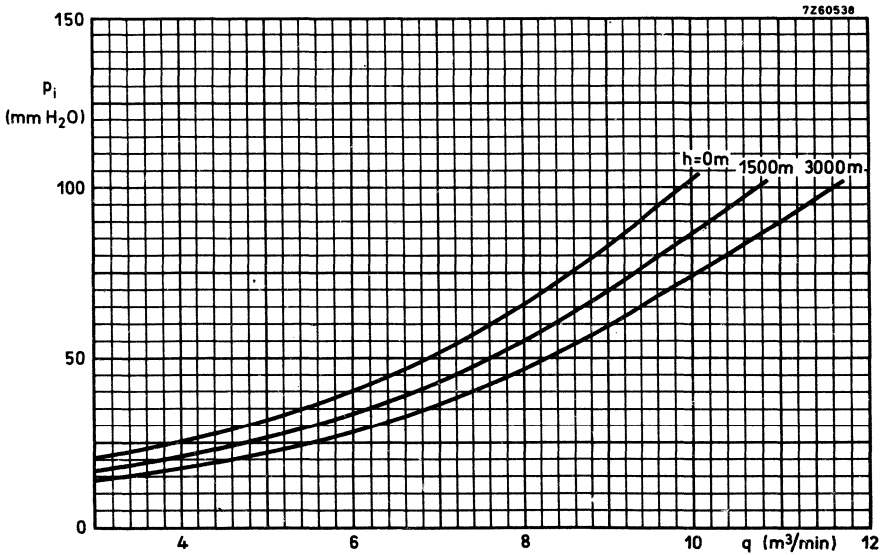
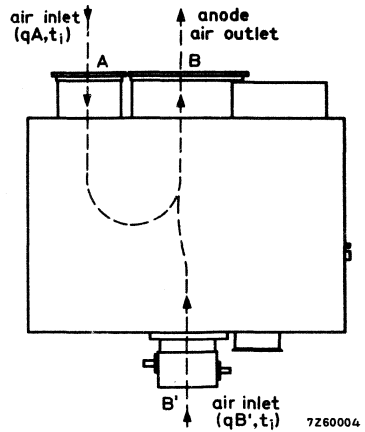
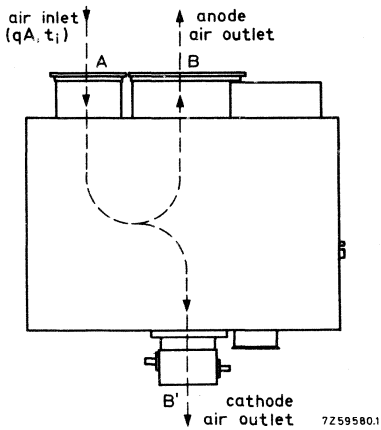
1) For 223.25 MHz a different coupling loop is needed, which can be delivered on request.

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  $q = q_A$

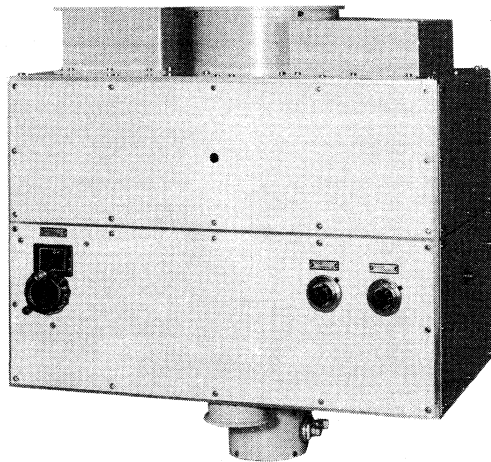
For sucking  $q = q_A + q_{B'}$





## 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 signals in Band III.



RZ29115-9

### QUICK REFERENCE DATA

Frequency (MHz)	Class B amplifier (sound)		
	$V_a$ (kV)	$W_l$ (kW) CCIR system	Power gain
170 to 230	5.5	6.3	33

### FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

### OPERATING CONDITIONS (For YL1420)

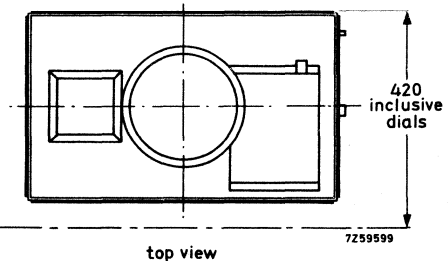
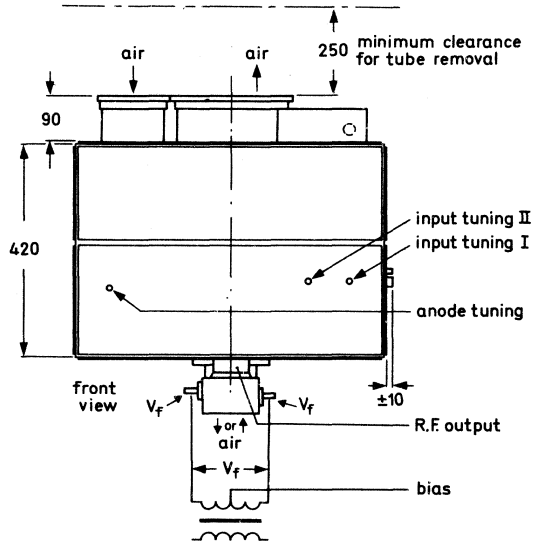
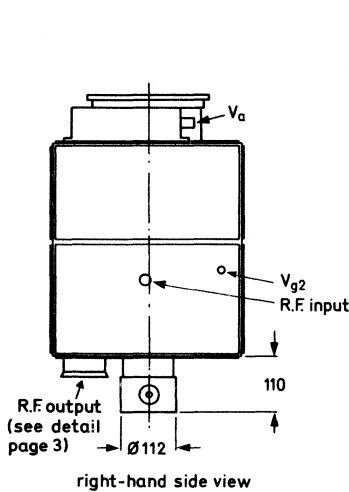
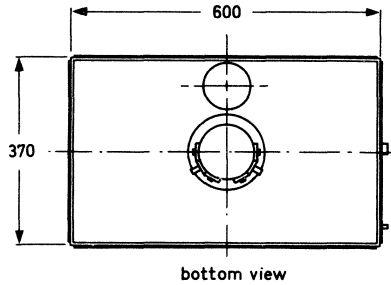
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

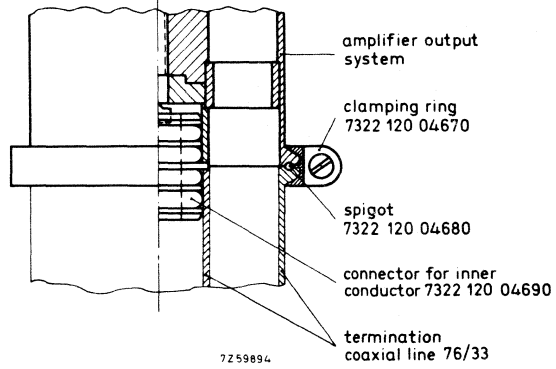
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm<sup>3</sup>

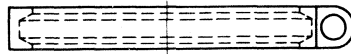
Net weight : approx. 54 kg



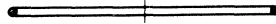
R.F. output connector



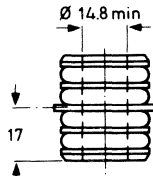
to amplifier output system



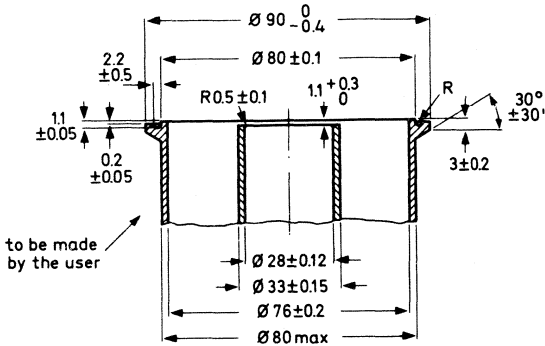
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



to be made  
by the user

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  $\Omega$  (coaxial female connector, type N)

Output : 50  $\Omega$  (coaxial connector: see drawing page 3)

**ENVIRONMENTAL DATA**

Ambient temperature : 0  $^{\circ}\text{C}$  to +55  $^{\circ}\text{C}$

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

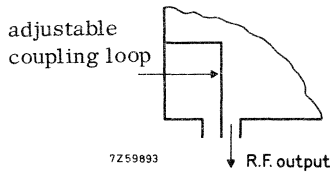
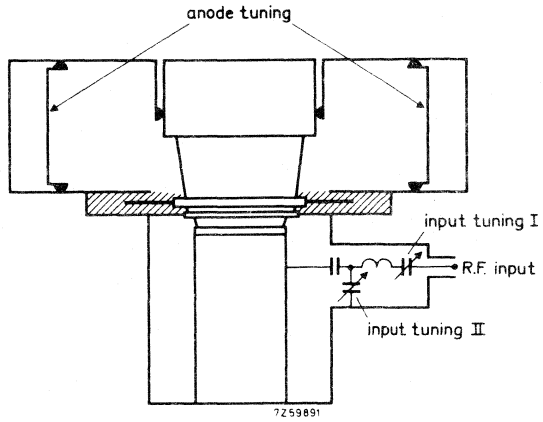
**ADDITIONAL COMPONENTS**a) Delivered with the assembly

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

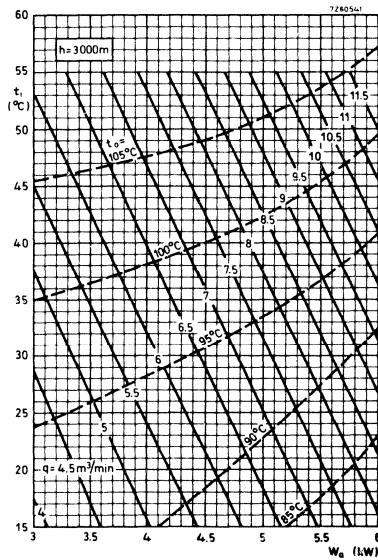
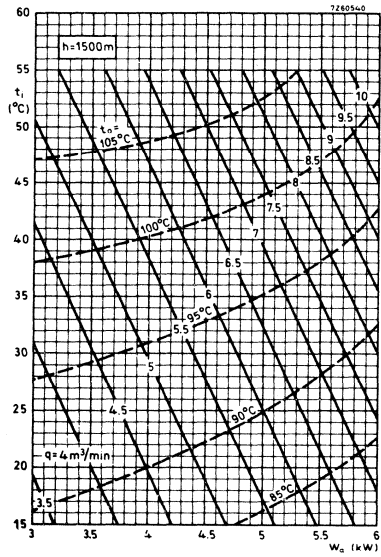
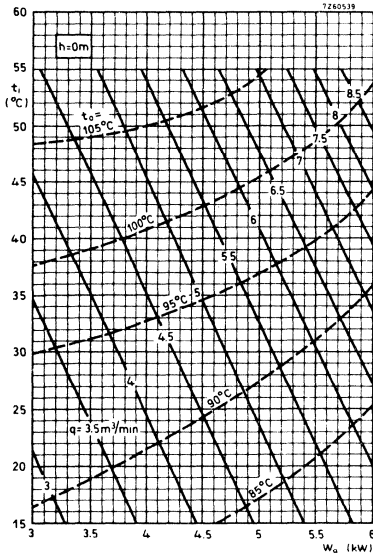
Recommended

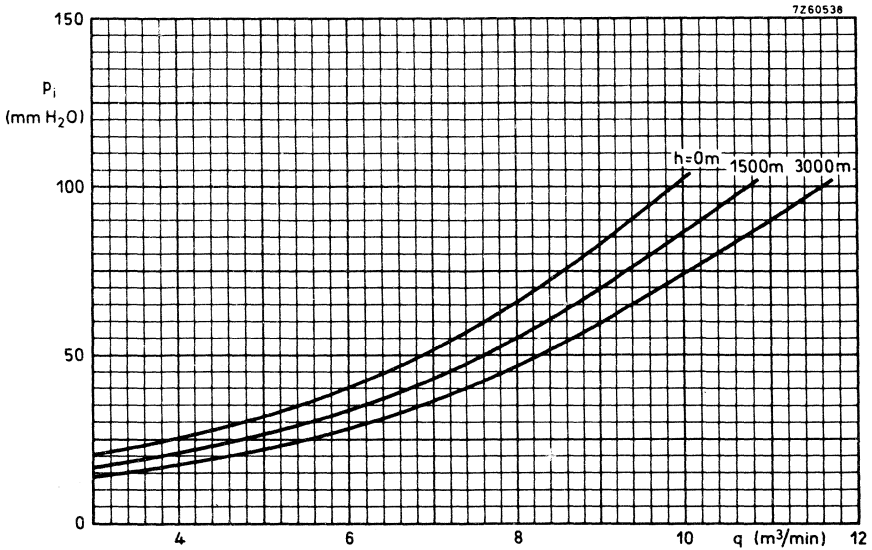
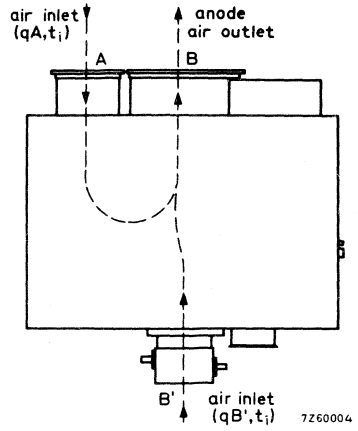
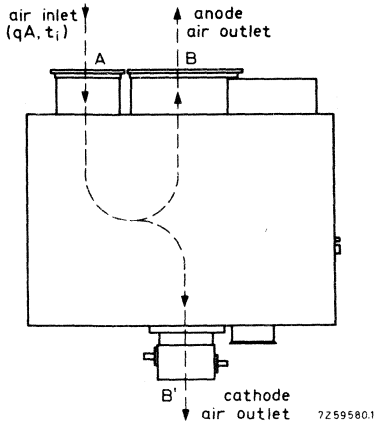
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

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  $q = q_A + q_{B'}$

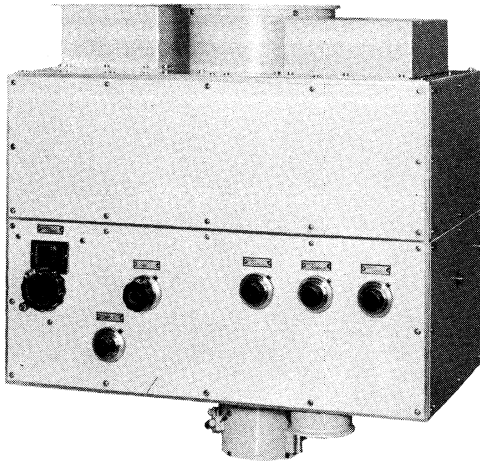




## BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 VISION

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.

RZ 29115-2



QUICK REFERENCE DATA			
Frequency (MHz)	Class AB linear amplifier (vision)		
	$V_a$ (kV)	$Wl_{sync}$ (kW) (CCIR system)	Power gain
170 to 230	6	12.5	30
	7	18.4	25

### FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

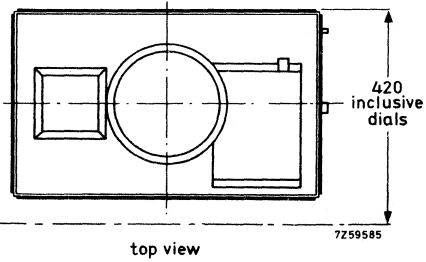
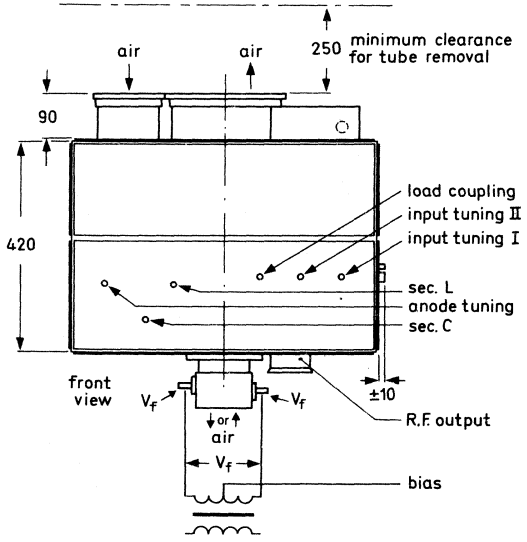
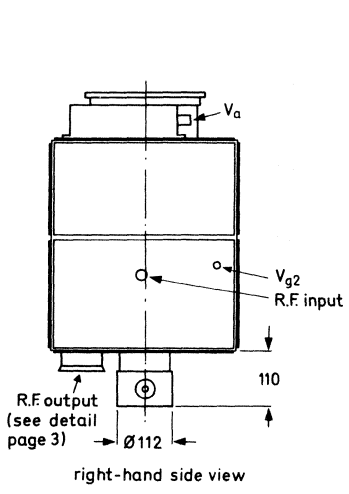
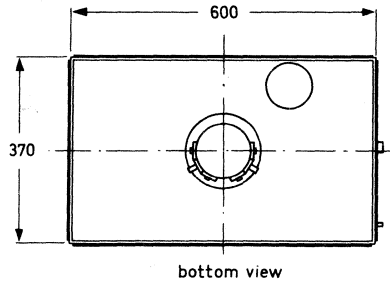
### OPERATING CONDITIONS (For YL1430)

For detailed operating conditions reference is made to the data sheets for tube type YL1430.

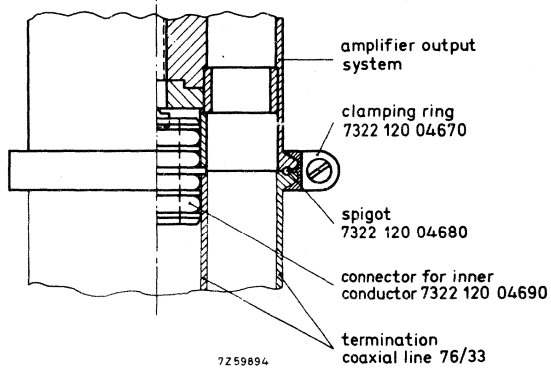
MECHANICAL DATA

Dimensions in mm

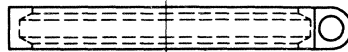
Dimensions : approx. 600 x 620 x 370 mm<sup>3</sup>  
 Net weight : approx. 67 kg



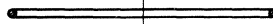
Output connector



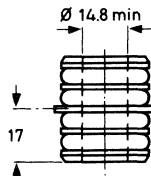
to amplifier output system



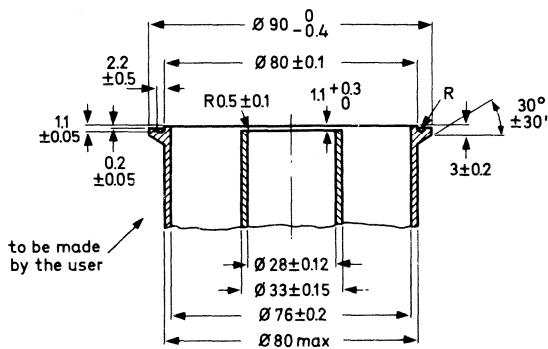
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

**COOLING**

See cooling curves.

Direction of airflow: see drawing page 7.

Either sucking and blowing is possible via connections on the top panel.

**IMPEDANCES**

Input : 50  $\Omega$  (coaxial female connector, type N)

Output : 50  $\Omega$  (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

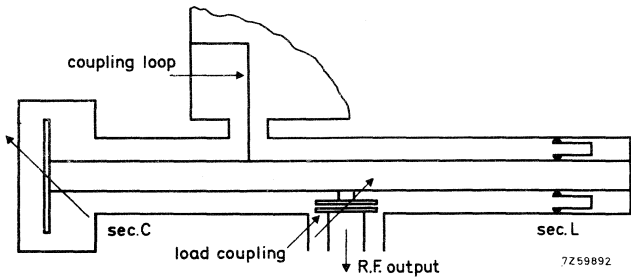
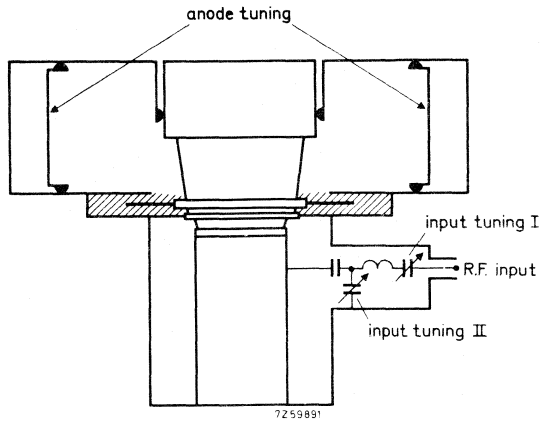
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for 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

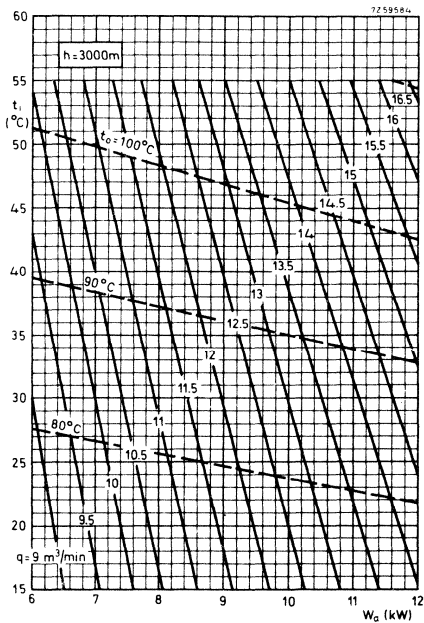
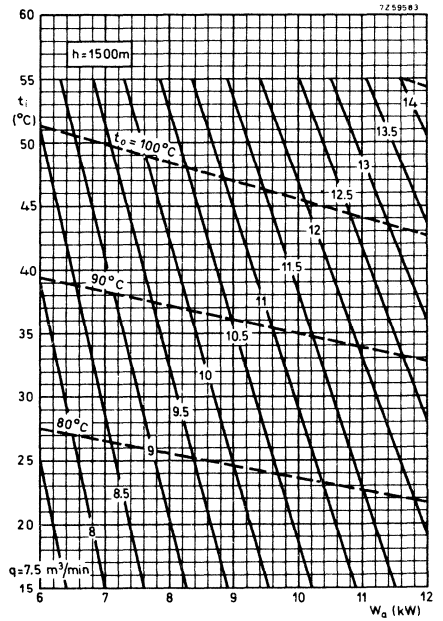
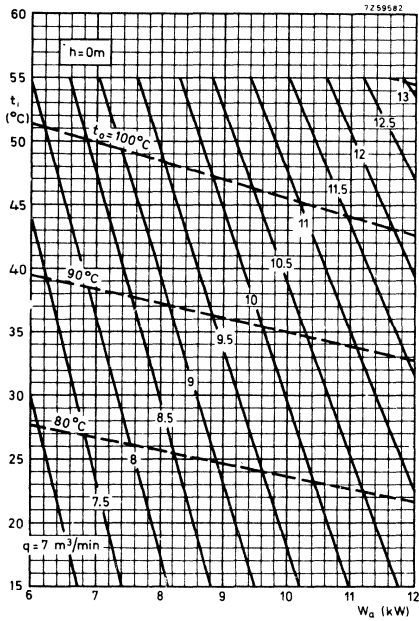
The use of circulator 2722 162 01191 (170 to 200 MHz) or  
2722 162 01201 (200 to 230 MHz) is recommended.

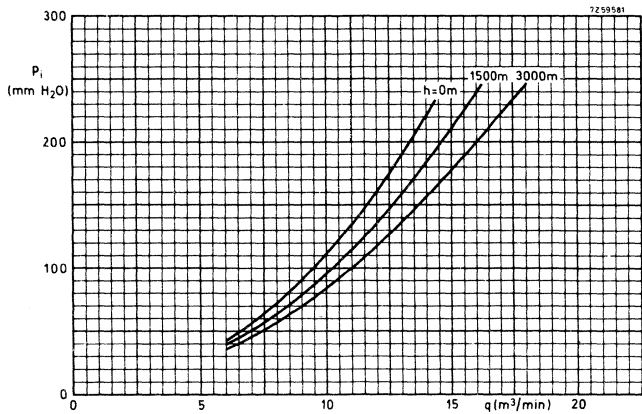
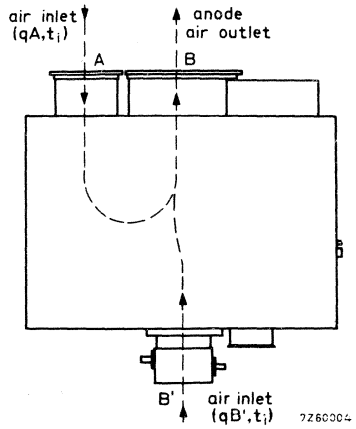
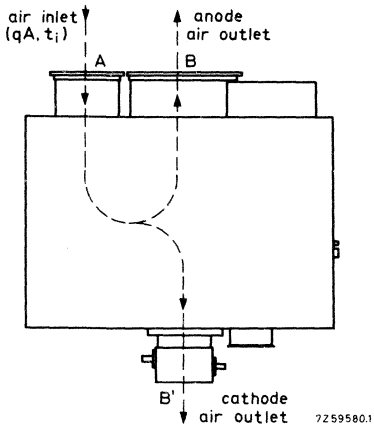
→ 1) For 224.25 MHz a different coupling loop is needed, which can be delivered on request.

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  $q = q_A + q_{B'}$

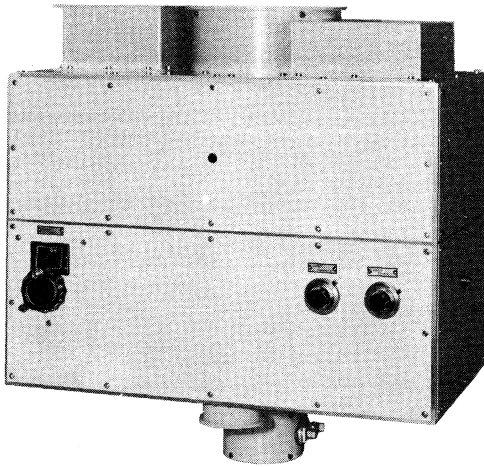




## BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 SOUND

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)

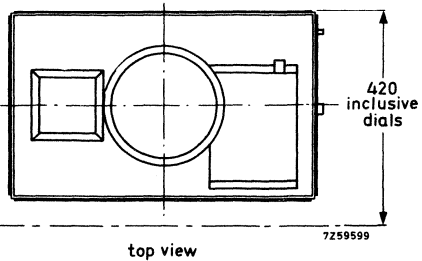
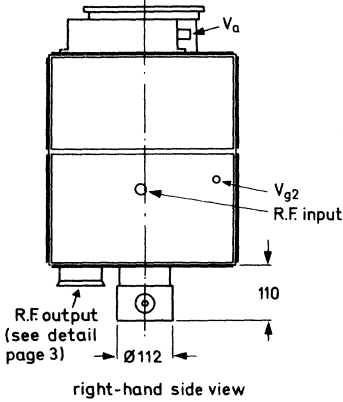
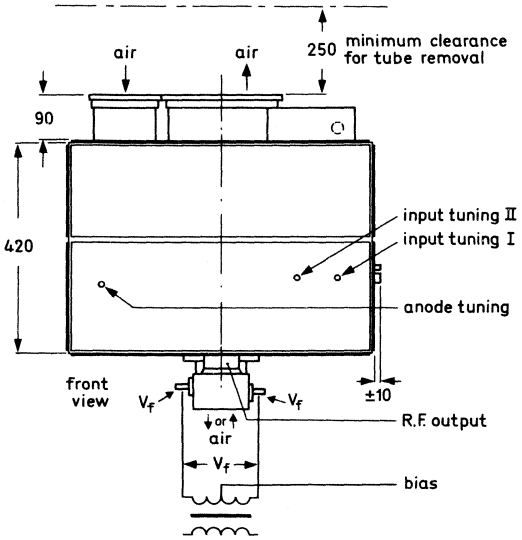
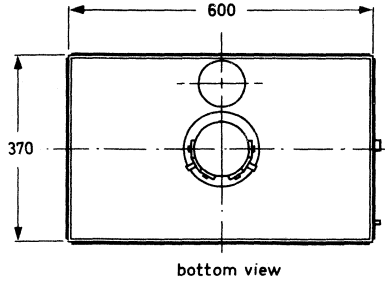
For detailed operating conditions reference is made to the data sheets for tube type YL1430.

MECHANICAL DATA

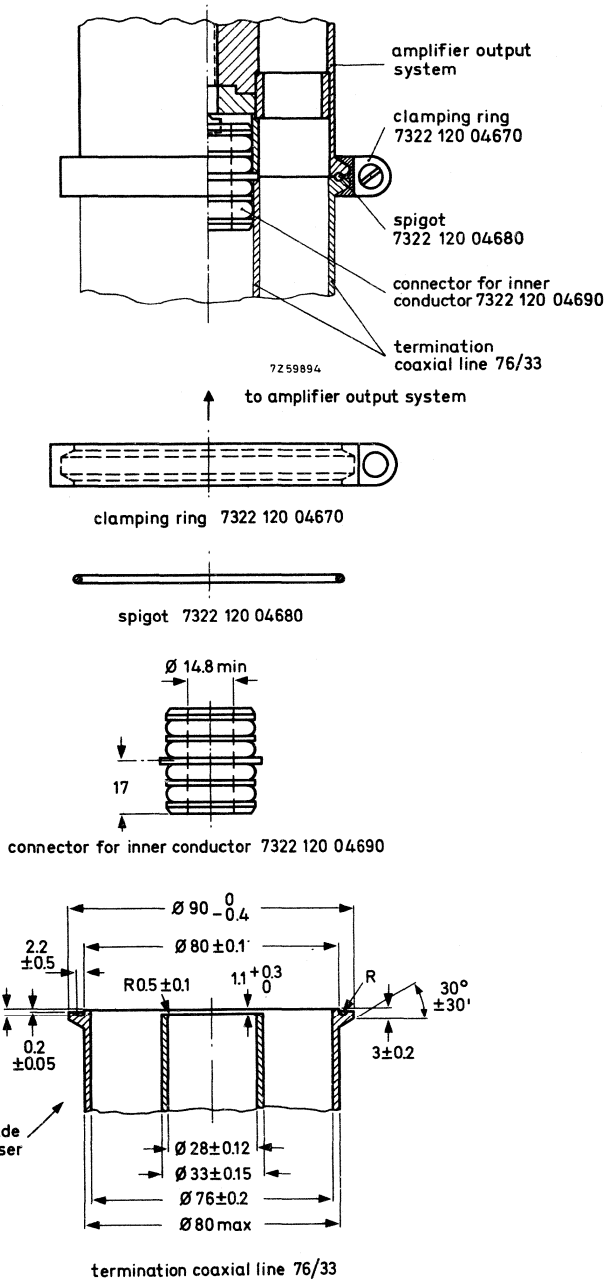
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm<sup>3</sup>

Net weight : approx. 54 kg



R. F. output connector



**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  $\Omega$  (coaxial female connector, type N)

Output : 50  $\Omega$  (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

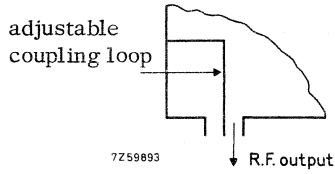
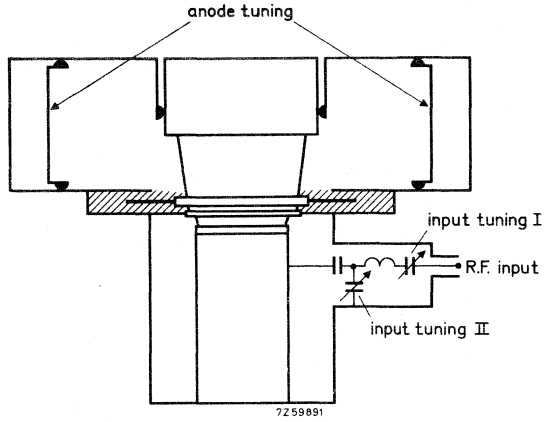
**ADDITIONAL COMPONENTS**a) Delivered with the assembly

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

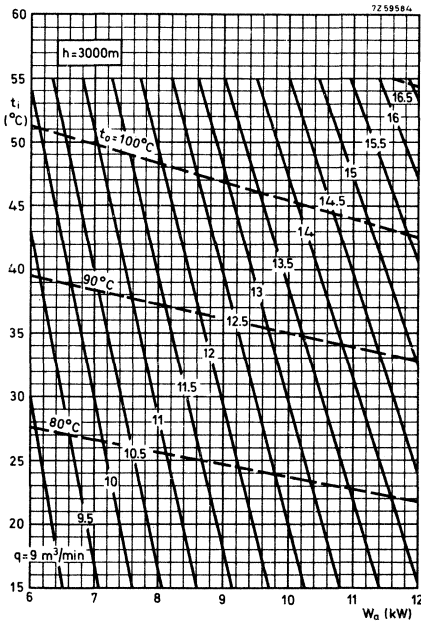
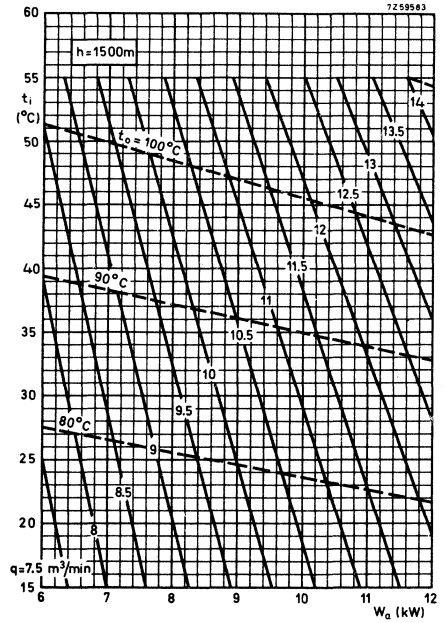
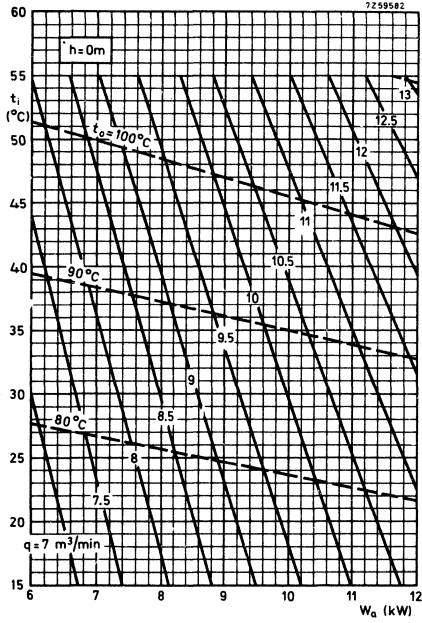
b) Recommended

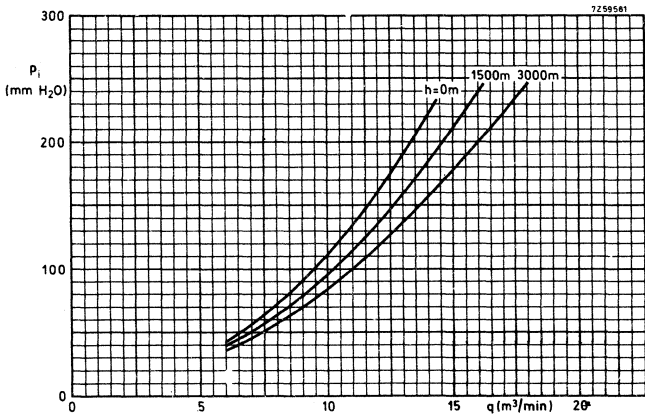
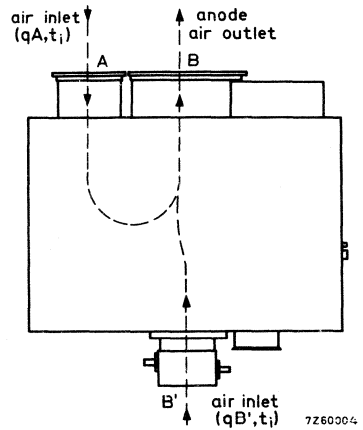
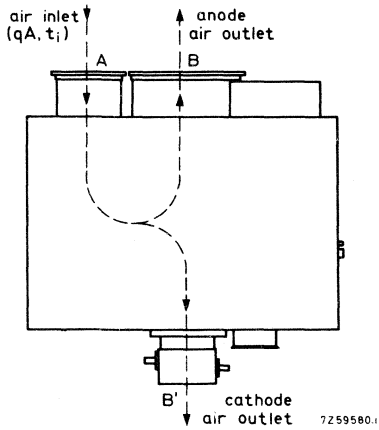
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

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  $q = q_A + q_{B'}$

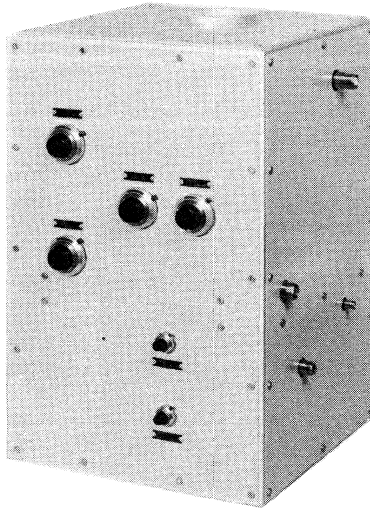




## BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 VISION

Channel tuned amplifier 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.

RZ 28938-2



QUICK REFERENCE DATA			
Frequency (MHz)	Class AB linear amplifier (vision)		
	$V_a$ (kV)	$W_{l\text{ sync}}$ (kW) (CCIR system)	Power gain
	48 to 83	2.5	1.2

### FREQUENCY RANGE

48.25 to 69.25 MHz and } channel tuned  
77.25 to 83.25 MHz }

### OPERATING CONDITIONS (For YL1440)

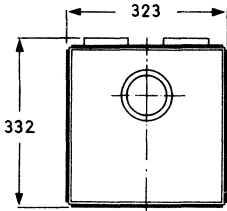
For detailed operating conditions reference is made to the data sheets for tube type YL1440.

MECHANICAL DATA

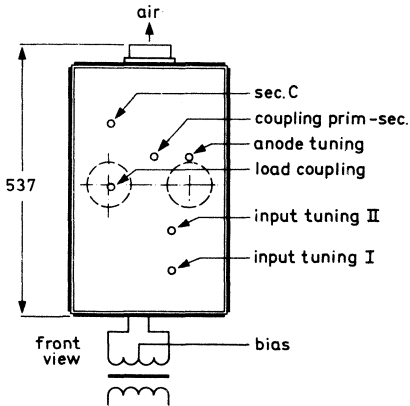
Dimensions in mm

Dimensions: approx. 516 x 323 x 323 mm<sup>3</sup>

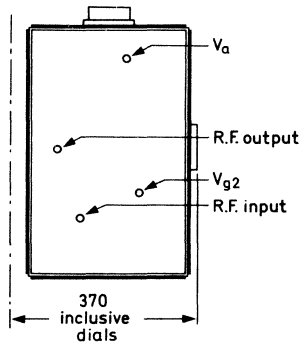
Net weight : approx. 23 kg



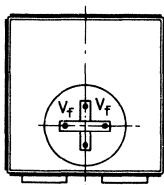
top view



front view



right hand side view



bottom view

7260316

**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  $\Omega$  (coaxial female connector type N)

Output : 50  $\Omega$  (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

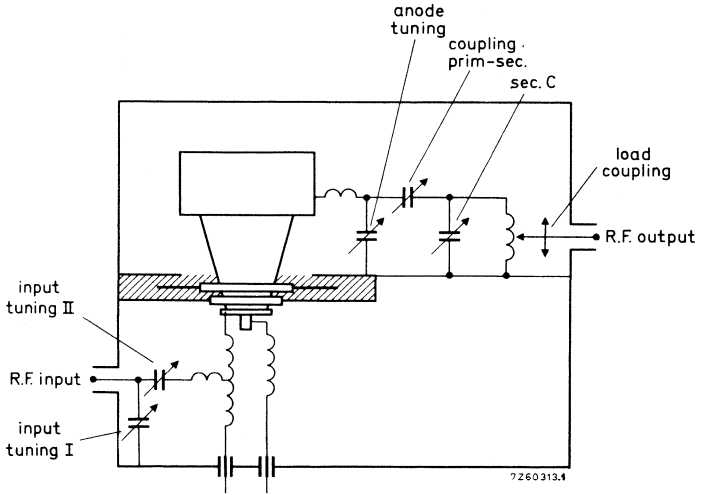
Output : max. permissible 1.3 for acceptable performance

**ADDITIONAL COMPONENTS**Delivered with the assembly

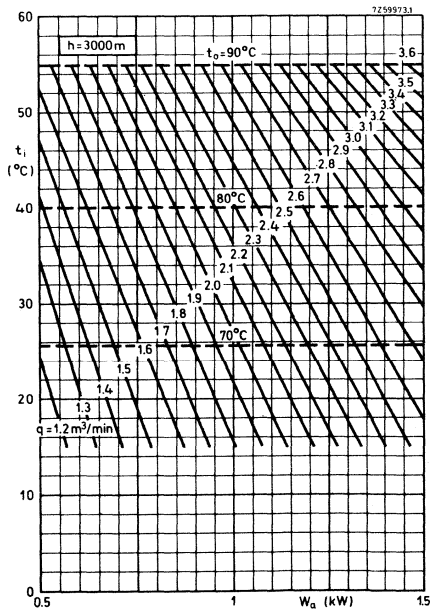
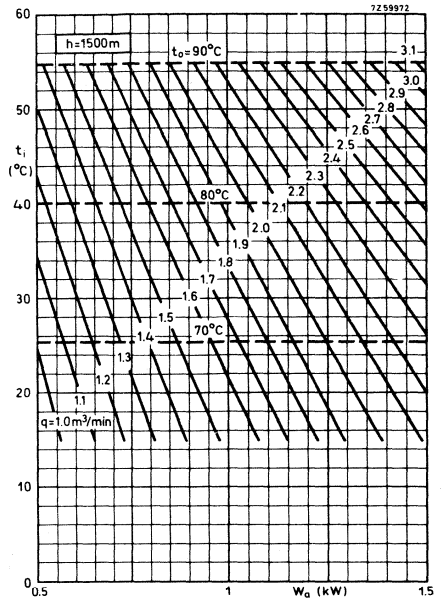
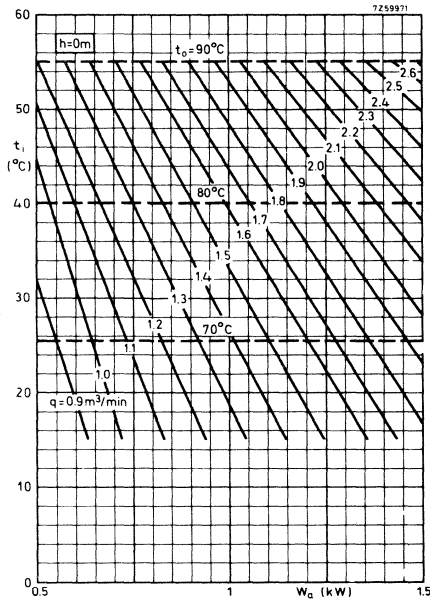
Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for vision carries	
5 coils for vision carrier frequencies	
55.25; 61.25 to 62.25; 67.25;	
77.25; 83.25 MHz	1)
Spanner for fitting the coils	

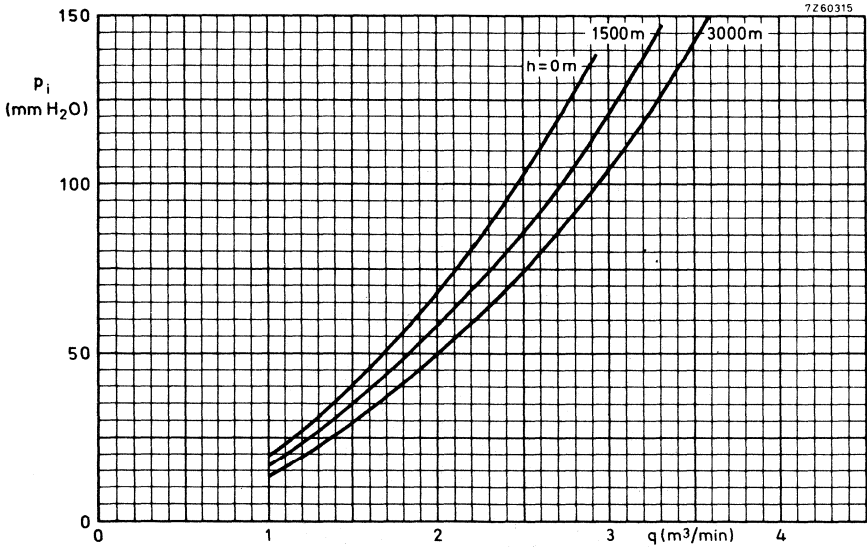
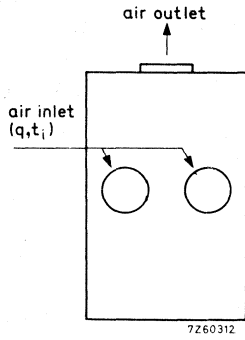
1) Coils covering vision carrier frequencies other than specified can be delivered on request.

→ CIRCUIT DIAGRAM



Cooling curves

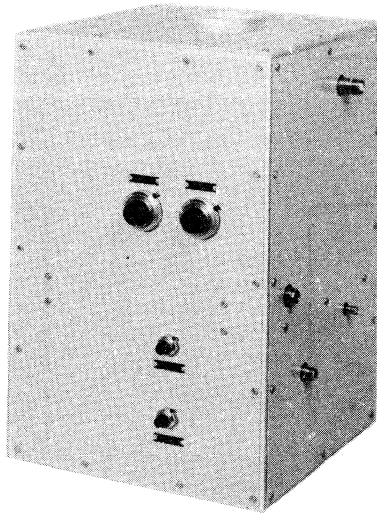




## BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 SOUND

Channel tuned amplifier circuit assembly to be used with YL1440 to form a grounded-grid amplifier of frequency modulated signals in band I.

RZ 28938-1



QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	$V_a$ (kV)	$W_l$ (kW) CCIR system	Power gain
up to 88	4	2.4	33

### FREQUENCY RANGE

53 to 70 MHz and  
82 to 88 MHz } channel tuned

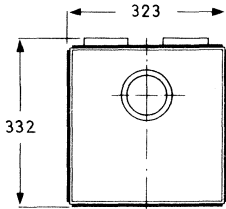
### OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

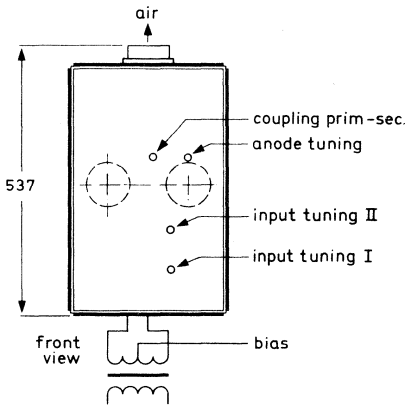
→ MECHANICAL DATA

Dimensions in mm

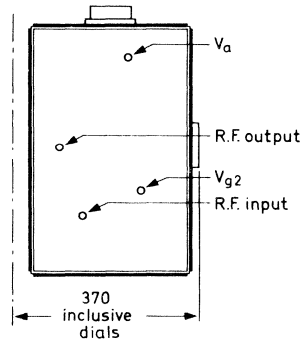
Dimensions: approx. 516 x 323 x 323 mm<sup>3</sup>  
 Net weight : approx. 22.5 kg



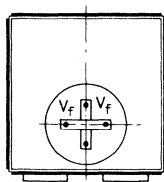
top view



front view



right hand side view



bottom view

7260317



**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  $\Omega$  (coaxial female connector type N)

Output : 50  $\Omega$  (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

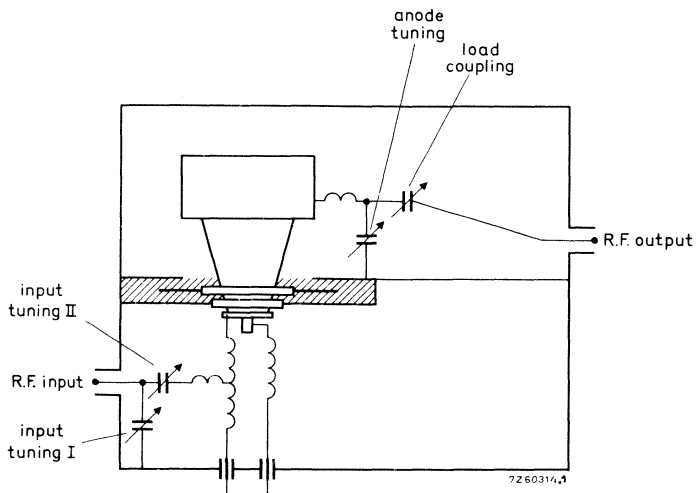
Output : max. permissible 1.3 for acceptable performance

**ADDITIONAL COMPONENTS**Delivered with the assembly

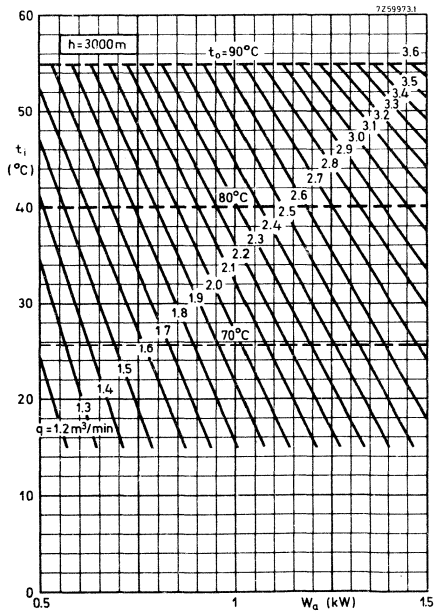
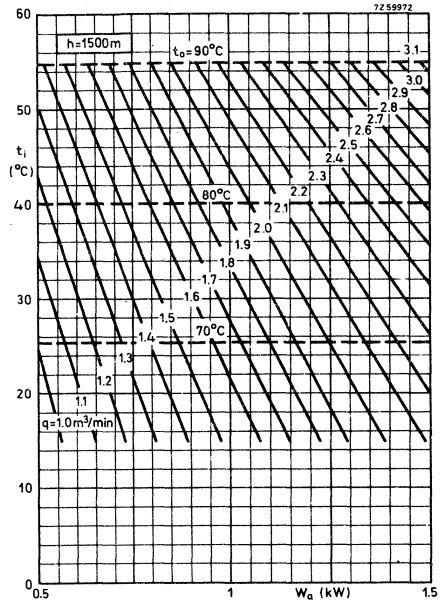
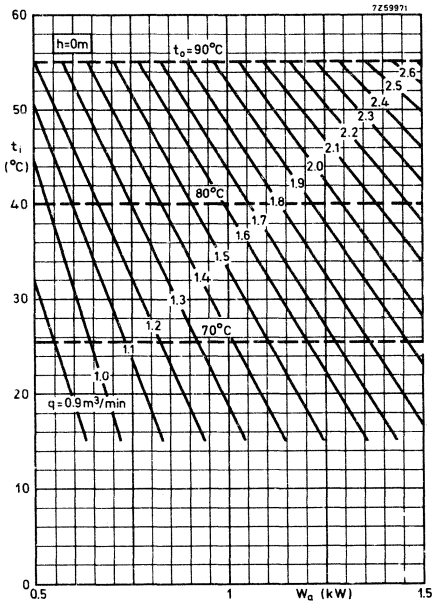
Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for sound carrier frequencies 59.75 to 60.75; 65.75 to 67.75; 71.75 81.75; 87.75 MHz	1)
Spanner for fitting the coils	

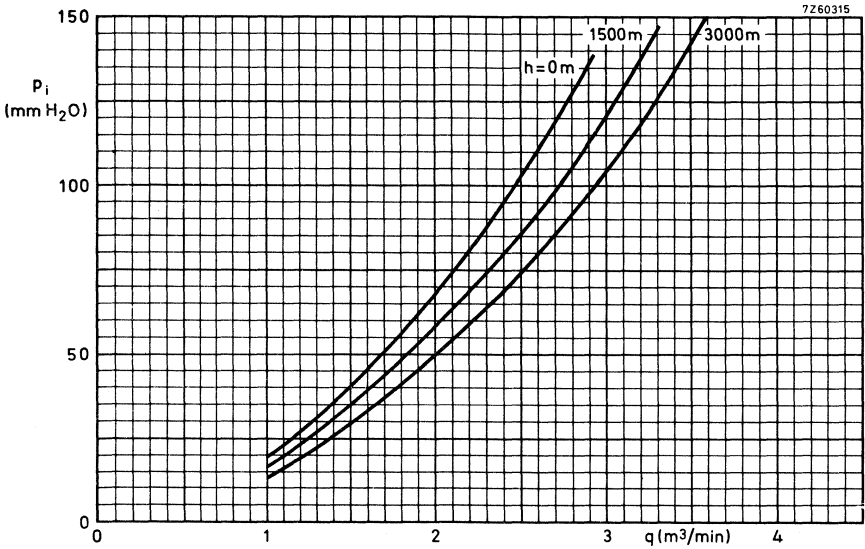
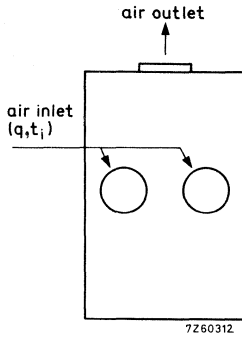
1) Coils covering sound carrier frequencies other than specified can be delivered on request.

→ CIRCUIT DIAGRAM



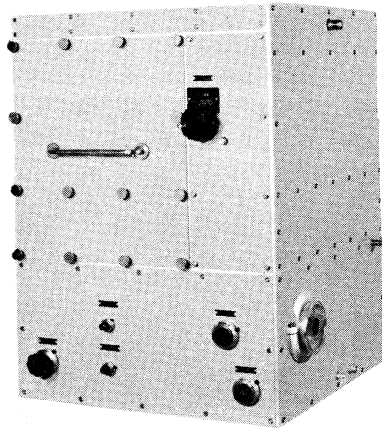
Cooling curves





**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.



RZ 29794-2

**QUICK REFERENCE DATA**

Frequency (MHz)	Class AB linear amplifier (vision)		
	$V_a$ (kV)	$W_{l\text{sync}}$ (kW)(CCIR system)	Power gain
83.25	4	6.25	18.5
55.25	4	6.25	16

**FREQUENCY RANGE**

55.25 to 67.25 MHz and  
77.25 to 83.25 MHz } channel tuned

**OPERATING CONDITIONS** (For YL1420)

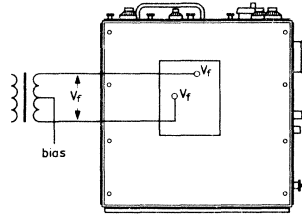
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

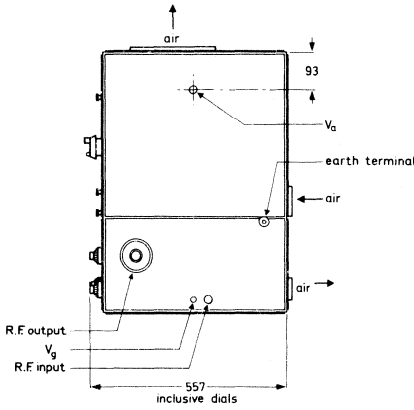
Dimensions in mm

Dimensions: approx. 700 x 500 x 500 mm<sup>3</sup>

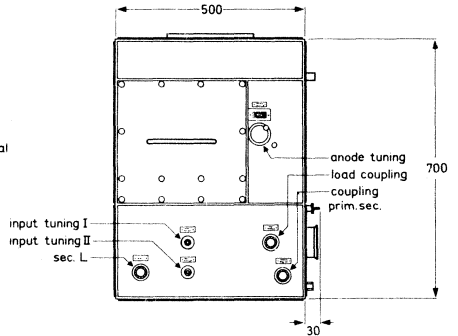
Net weight: approx. 70 kg



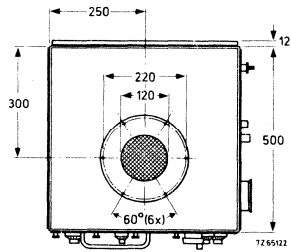
bottom view



right hand side view

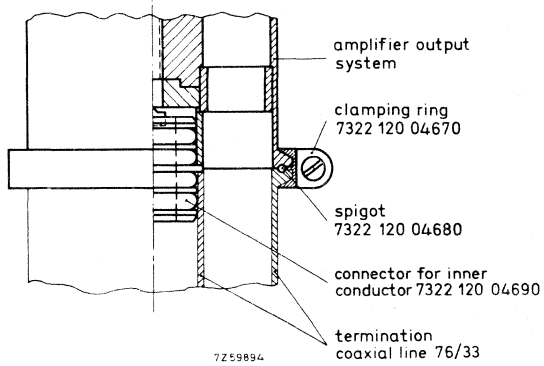


front view

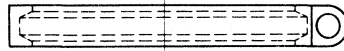


top view

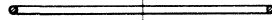
Output connector



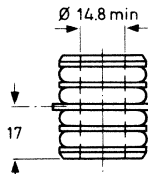
↑ to amplifier output system



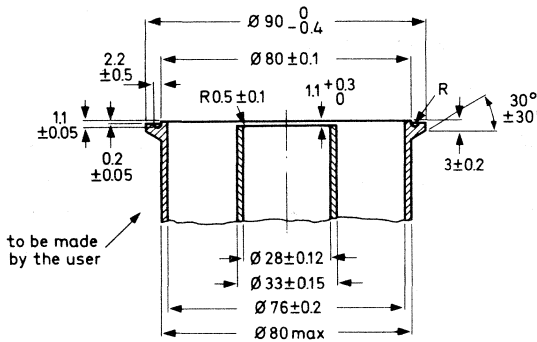
clamping ring 7322 120 04670



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  $\Omega$  (coaxial femal connector, type N)

Output: 50  $\Omega$  (coaxial female connector, see drawing page 3)

**ENVIRONMENTAL DATA**

Ambient temperature : 0  $^{\circ}\text{C}$  to +55  $^{\circ}\text{C}$

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	-----	

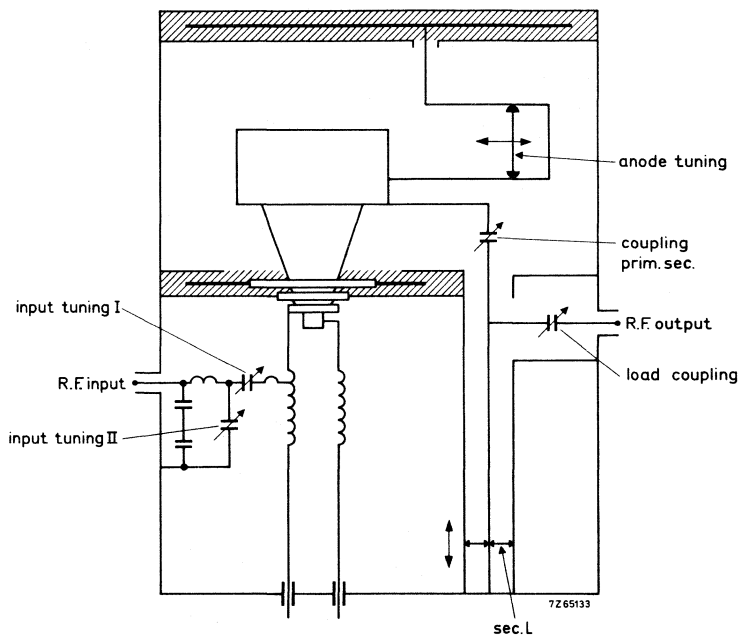
b) Not delivered with assembly

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	

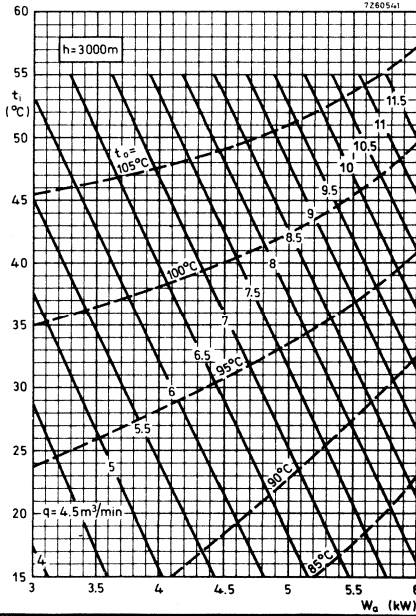
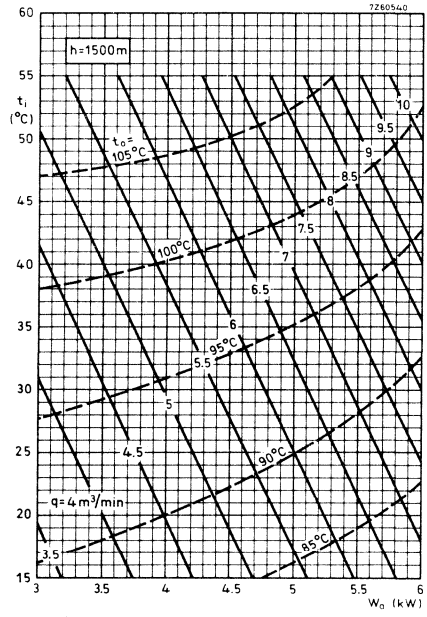
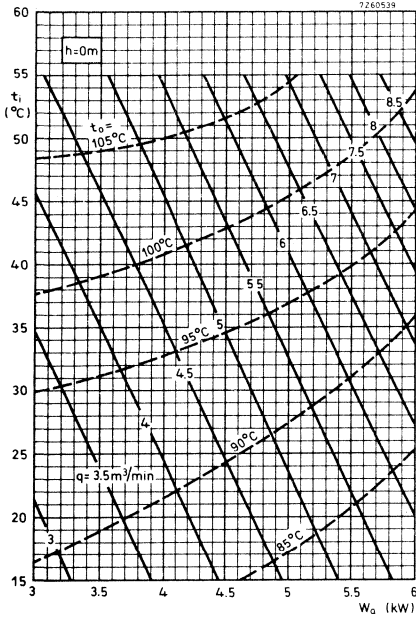
1) For use on carrier frequencies other than specified please contact the manufacturer.

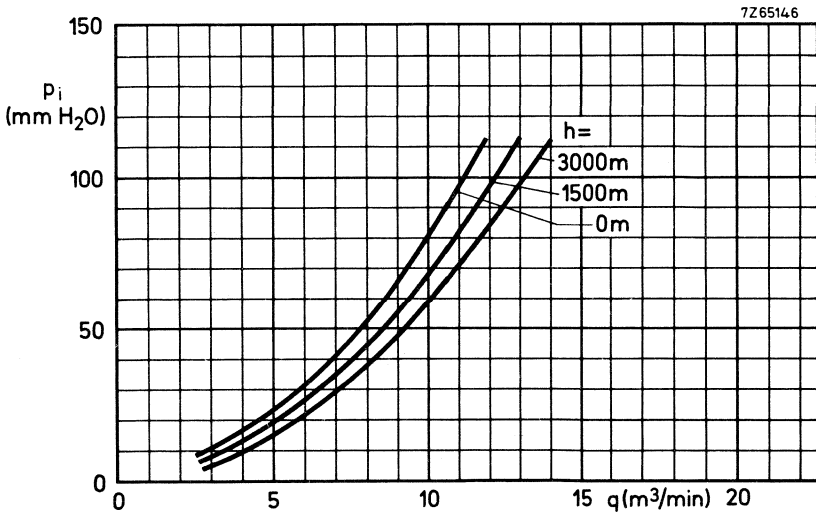
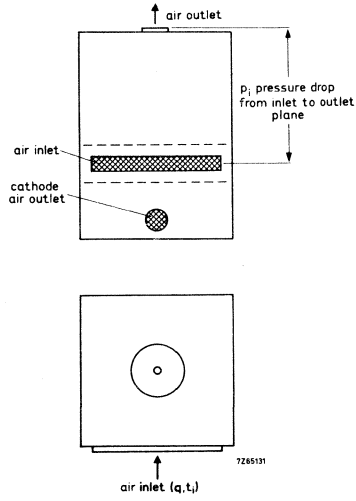


CIRCUIT DIAGRAM



Cooling curves





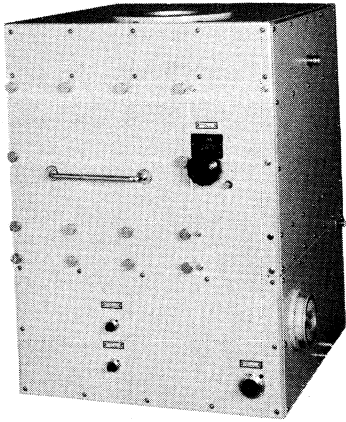


# BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420

## SOUND

Amplifier circuit assembly to be used with YL1420 to form a grounded-grid amplifier of frequency modulated signals in Band I.

RZ 30263-3



### QUICK REFERENCE DATA

Frequency (MHz)	Class B service (sound)		
	$V_a$ (kV)	$W_l$ (kW)	Power gain
up to 88	5.5	6.3	33

### FREQUENCY RANGE

53 to 72 MHz and  
82 to 88 MHz } channel tuned

### OPERATING CONDITIONS (For YL1420)

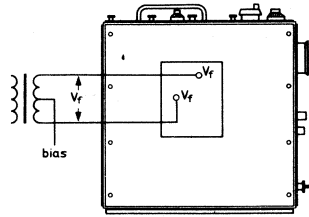
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

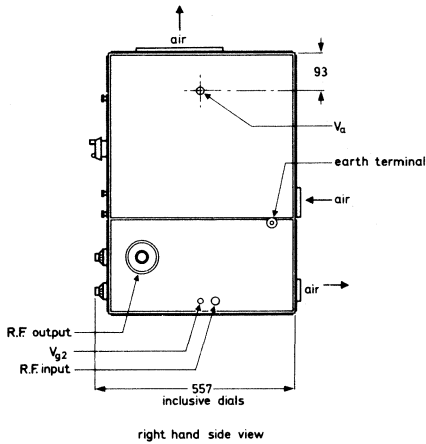
Dimensions in mm

Dimensions : approx. 700 x 500 x 500 mm<sup>3</sup>

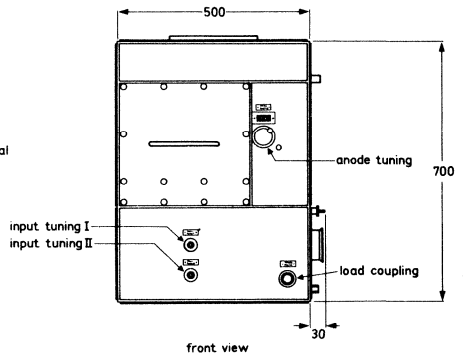
Net weight : approx. 58 kg



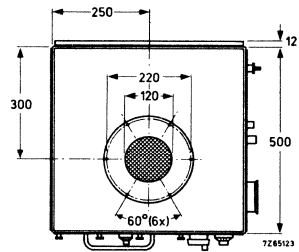
bottom view



right hand side view

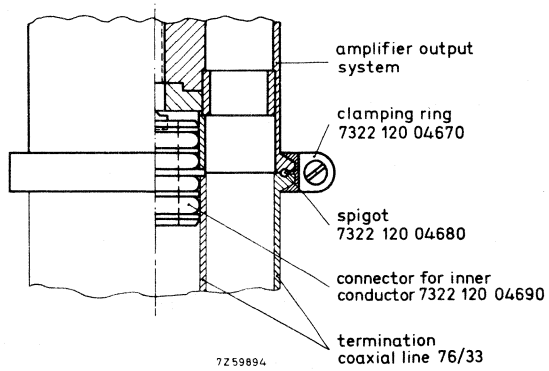


front view

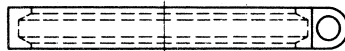


top view

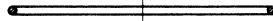
Output connector



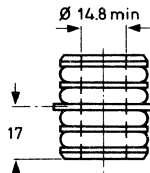
↑ to amplifier output system



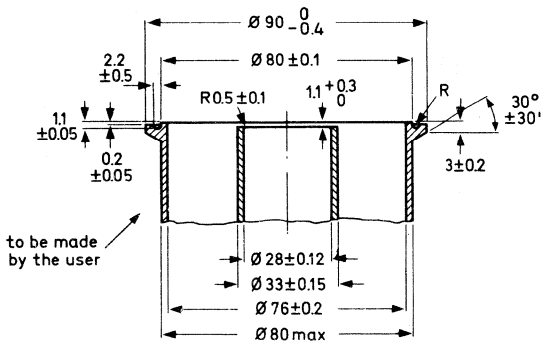
clamping ring 7322 120 04670



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  $\Omega$  (coaxial female connector, type N)

Output : 50  $\Omega$  (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

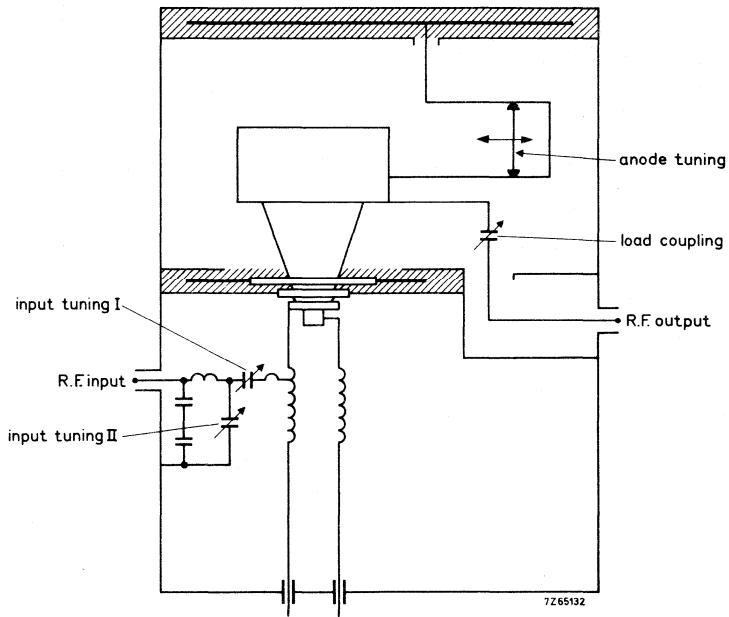
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Anode coil covering frequency range	
53 to 72 MHz	----

b) Not delivered with assembly

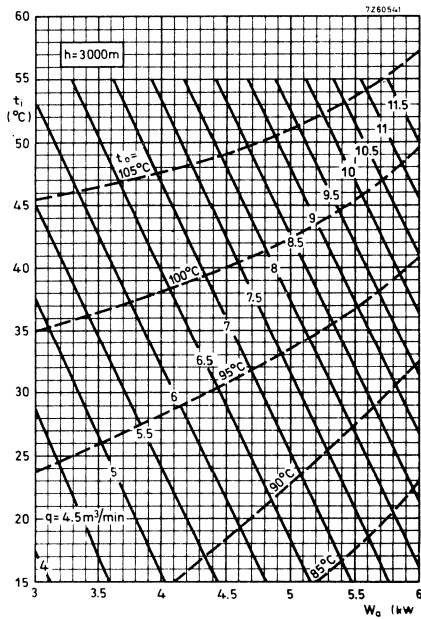
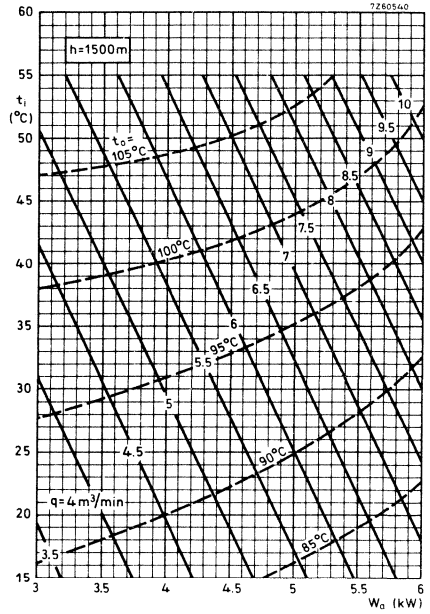
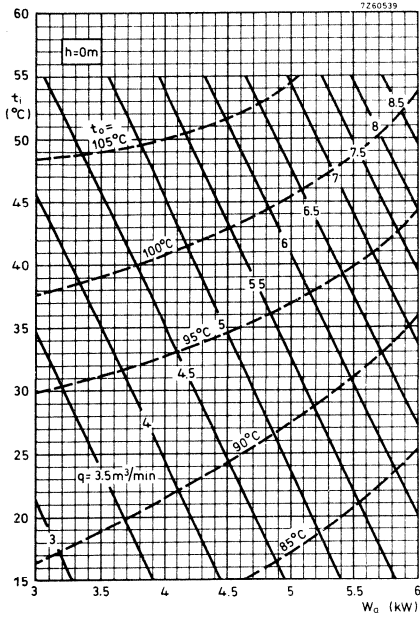
Anode coil covering frequency range	
82 to 88 MHz	8222 032 11860

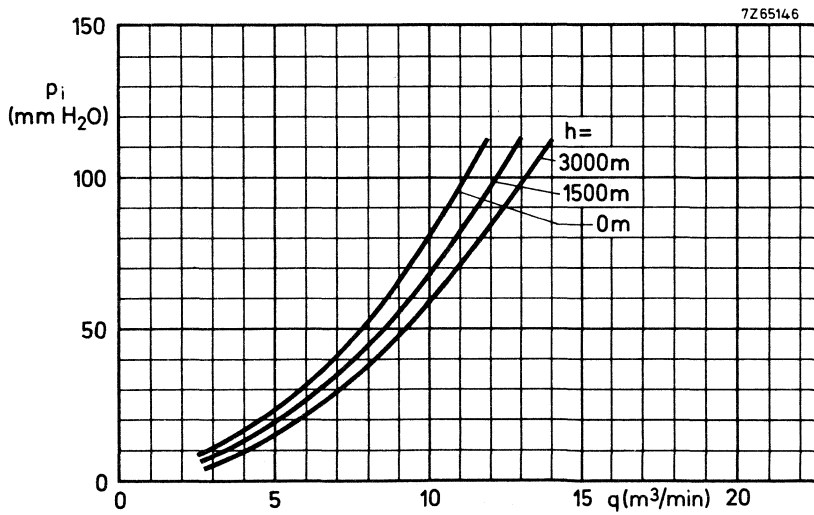
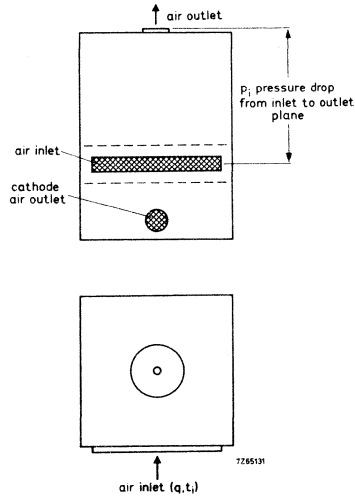


CIRCUIT DIAGRAM



Cooling curves



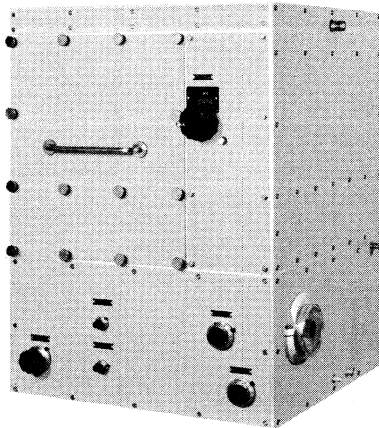




# BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 OR YL1520

## 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)	$W_{\ell}$ sync (kW)(CCIR) system	Power gain
83.25	YL1430	5.5	13.2	20
55.25		5.5	13.2	18
55.25		4.0	6.4	18
83.25	YL1520	6.5	20	24
55.25			20	22

### FREQUENCY RANGE

55.25 to 69.25 MHz and } channel tuned  
77.25 to 83.25 MHz

### OPERATING CONDITIONS (For YL1430 or YL1520)

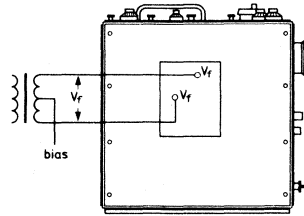
For detailed operating conditions reference is made to the data sheets for tube type YL1430 or YL1520.

MECHANICAL DATA

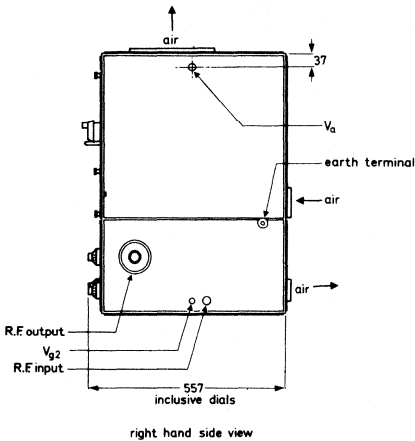
Dimensions in mm

Dimensions: approx. 700 x 500 x 500 mm<sup>3</sup>

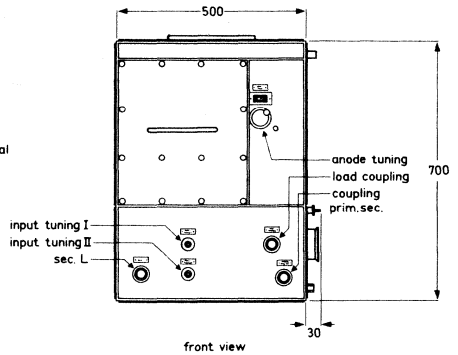
Net weight : approx. 70 kg



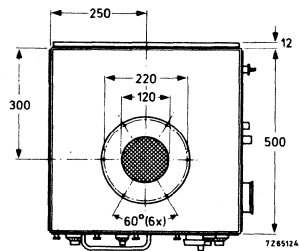
bottom view



right hand side view

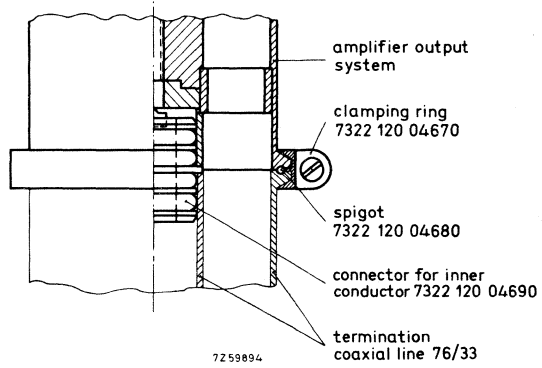


front view

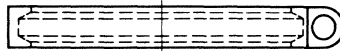


top view

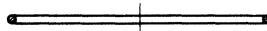
Output connector



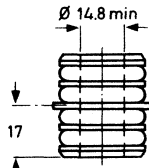
to amplifier output system



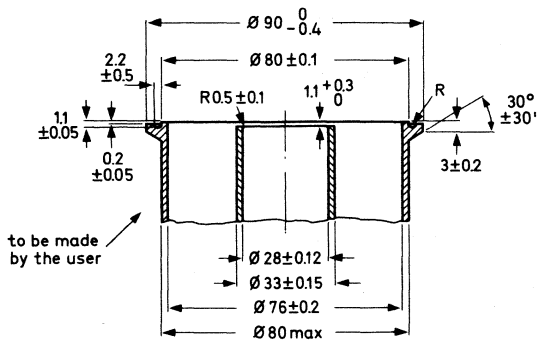
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

**COOLING**

See cooling curve.

Direction of air flow: see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

**IMPEDANCES**

Input : 50  $\Omega$  (coaxial female connector, type N)

Output : 50  $\Omega$  (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	----	1)
55.25 to 61.25 MHz for YL1520		
Elbow for secondary circuit covering		
frequency range 55.25 to 67.25 MHz	----	
for both types		

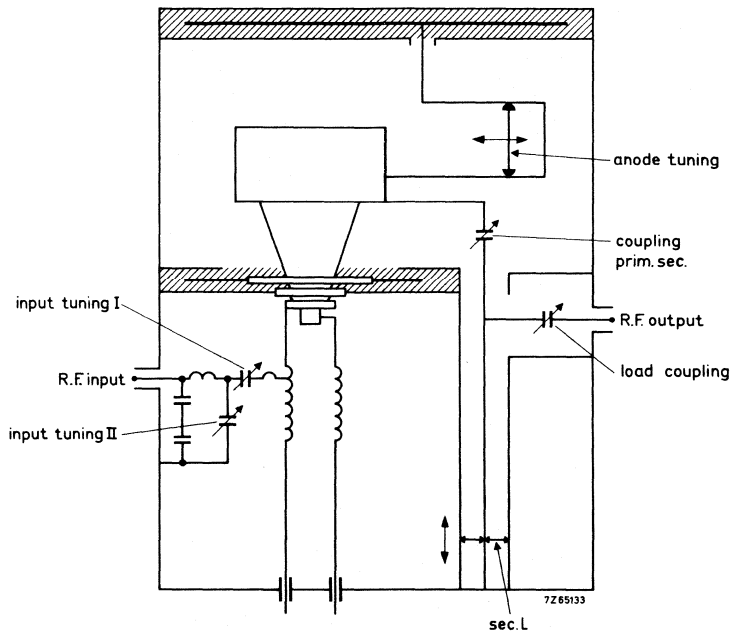
b) Not delivered with assembly

Anode coil covering frequency range		
77.25 to 83.25 MHz for YL1430 and	8222 032 11860	1)
67.25 to 83.25 MHz for YL1520		
Elbow for secondary circuit covering		
frequency range 77.25 to 83.25 MHz	8222 032 11790	
for both types		

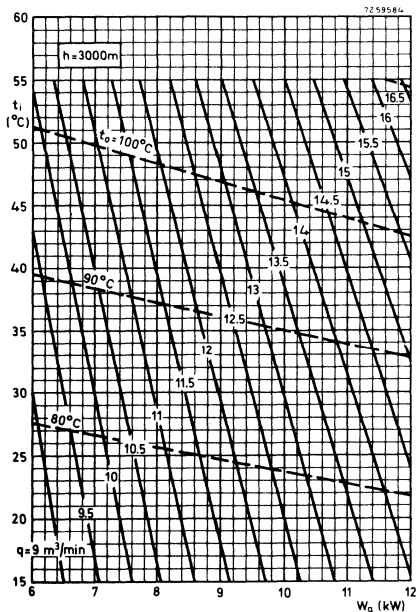
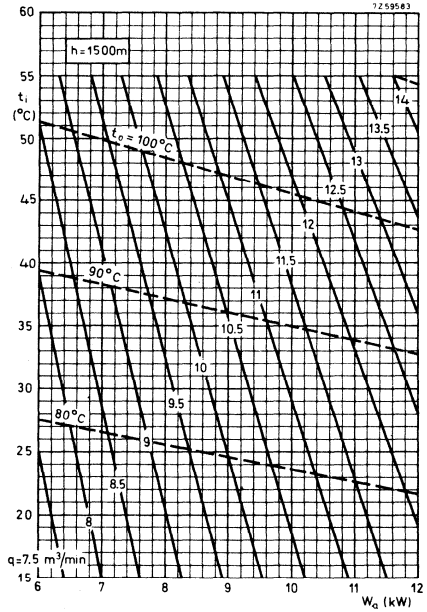
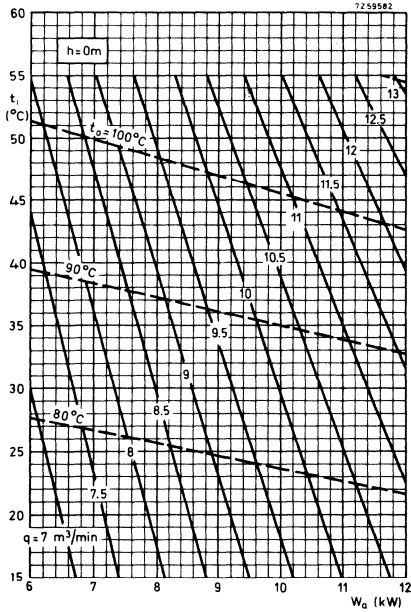
1) For use on carrier frequencies other than specified please contact the manufacturer.

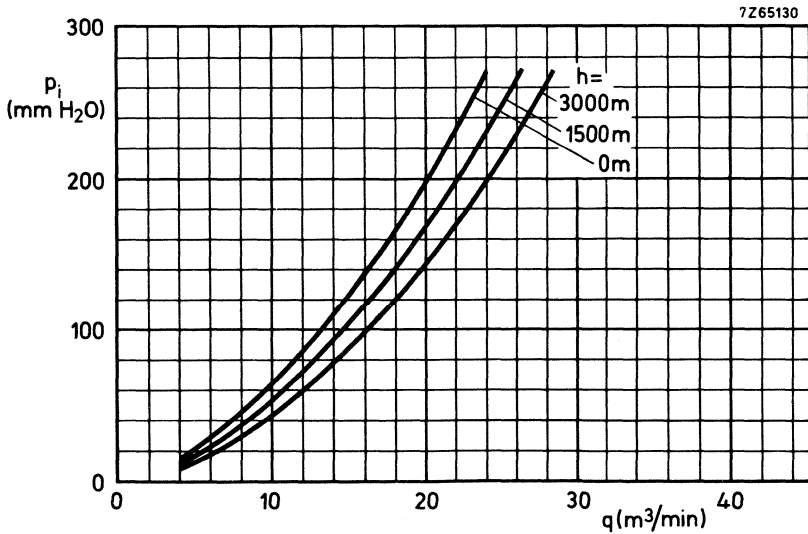
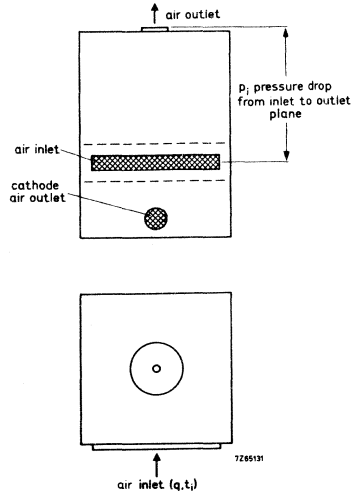


CIRCUIT DIAGRAM



Cooling curves

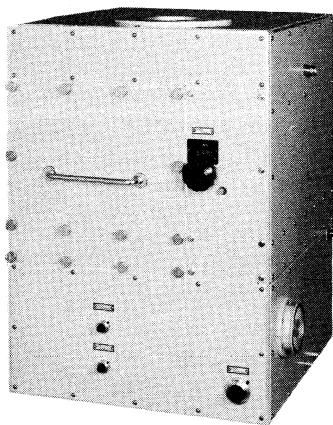






## BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 OR YL1520 SOUND

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

QUICK REFERENCE DATA				
Frequency (MHz)	Class AB linear amplifier (sound)			
	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 } channel tuned  
82 to 88 MHz

#### OPERATING CONDITIONS (For YL1430 and YL1520)

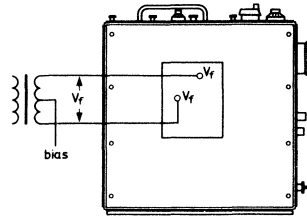
For detailed operating conditions reference is made to the data sheets for tube type YL1430 and YL1520.

MECHANICAL DATA

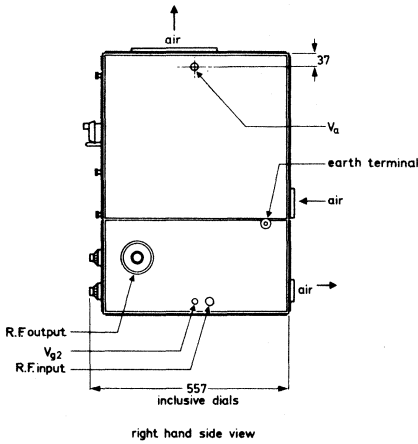
Dimensions in mm

Dimensions in : approx. 700 x 500 x 500 mm<sup>3</sup>

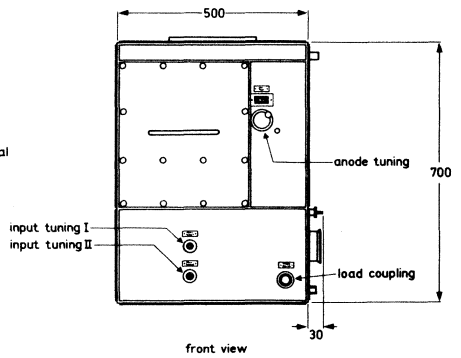
Net weight : approx. 58 kg



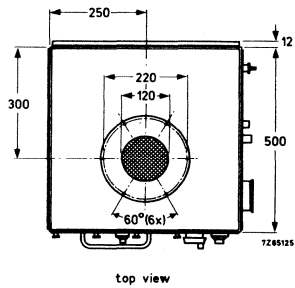
bottom view



right hand side view

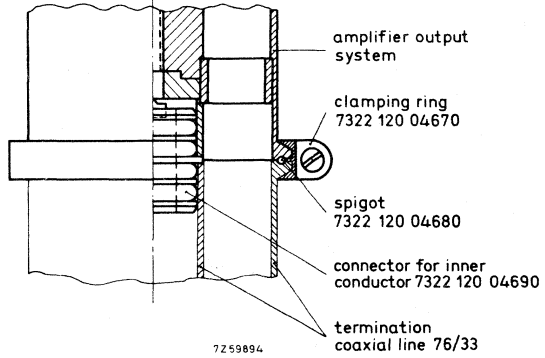


front view

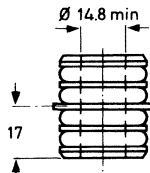
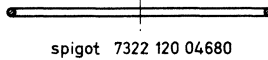
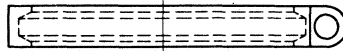


top view

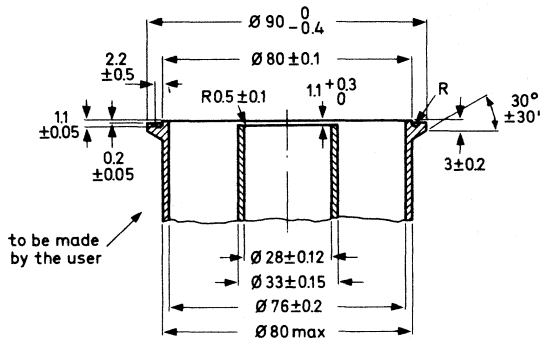
Output connector



↑ to amplifier output system



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  $\Omega$  (coaxial female connector, type N)

Output : 50  $\Omega$  (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

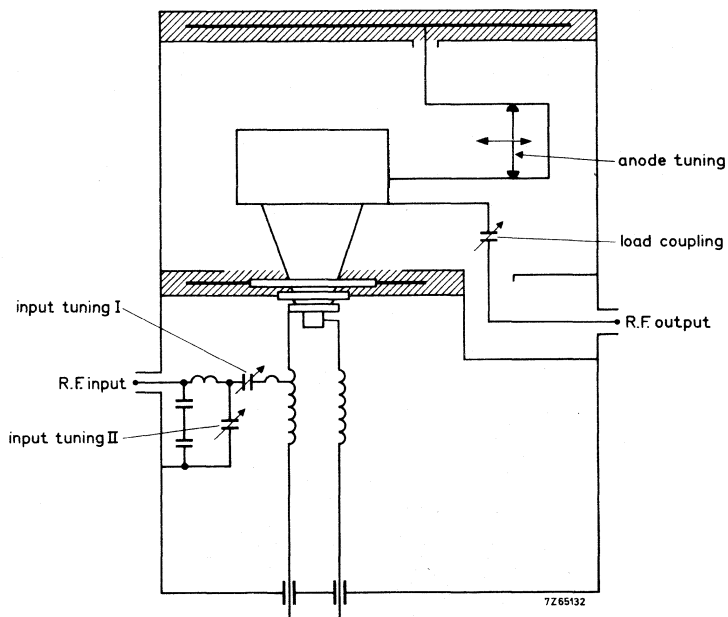
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for 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

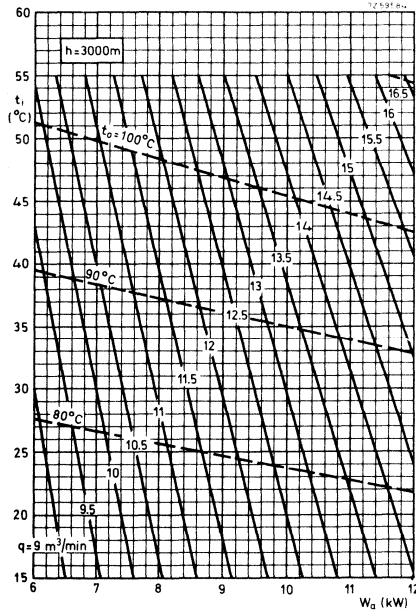
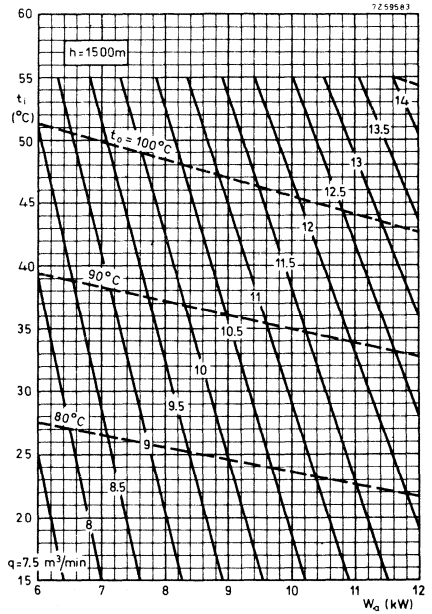
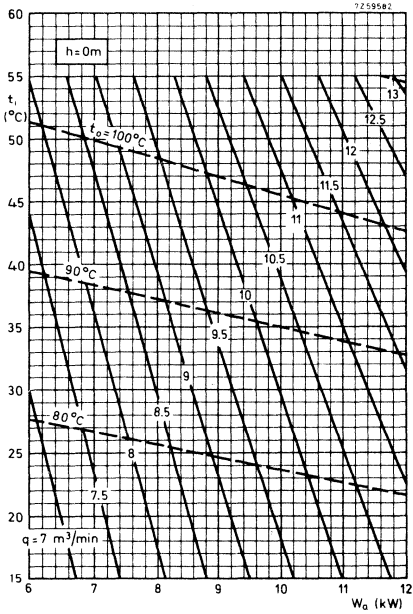
Anode coil covering frequency range	
82 to 88 MHz for YL1430 and	8222 032 11860
70 to 88 MHz for YL1520	
Shorting bar to use in addition with coils, for highest channel for YL1520	8222 032 57110

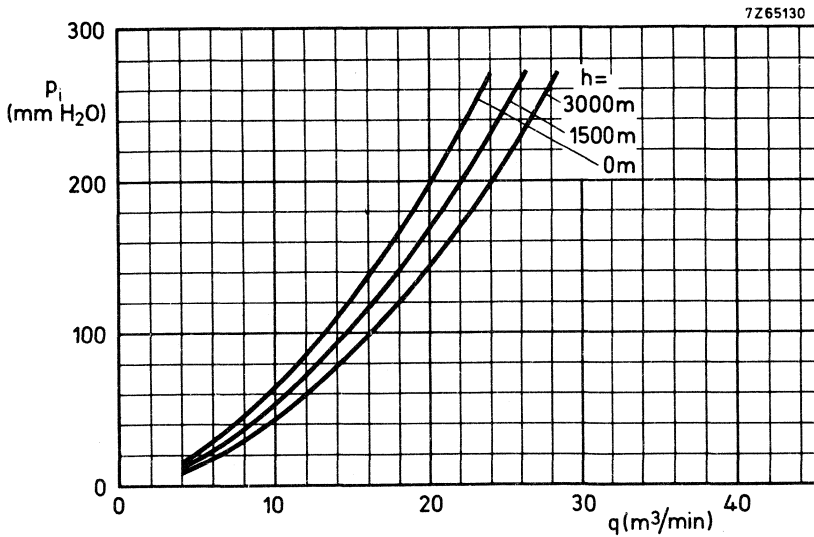
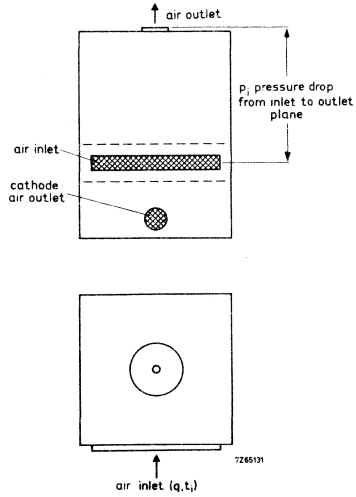


CIRCUIT DIAGRAM



Cooling curves







## INDEX OF TYPE NUMBERS

Type No.	Section	Type No.	Section
PB2/500	Tr. P.	QEL2/275	Tr. P.
PB3/800	Tr. P.	QEL2/275H	Tr. P.
PE05/25	Tr. P.	QQC03/14	Tr. P.
PE06/40	Tr. P.	QQC04/15	Tr. P.
PE1/100	Tr. P.	QQE02/5	Tr. P.
QB2/250	Tr. P.	QQE03/12	Tr. P.
QB3/200	Tr. P.	QQE03/20	Tr. P.
QB3/300	Tr. P.	QQE03/32	Tr. P.
QB3/300GA	Tr. P.	QQE04/5	Tr. P.
QB3.5/750	Tr. P.	QQE04/20	Tr. P.
QB3.5/750GA	Tr. P.	QQE06/40	Tr. P.
QB4/1100	Tr. P.	YL1000	Tr. P.
QB4/1100GA	Tr. P.	YL1010	Tr. P.
QB5/1750	Tr. P.	YL1011	Tr. P.
QB5/2000	Tr. P.	YL1012	Tr. P.
QBL3.5/2000	Tr. P.	YL1020	Tr. P.
QBL4/800	Tr. P.	YL1030	Tr. P.
QBL5/3500	Tr. P.	YL1060	Tr. P.
QBW5/3500	Tr. P.	YL1070	Tr. P.
QC05/35	Tr. P.	YL1071	Tr. P.
QE04/10	Tr. P.	YL1080	Tr. P.
QE05/40	Tr. P.	YL1090	Tr. P.
QE05/40F	Tr. P.	YL1091	Tr. P.
QE05/40H	Tr. P.	YL1100	Tr. P.
QE05/40K	Tr. P.	YL1101	Tr. P.
QE08/200	Tr. P.	YL1102	Tr. P.
QE08/200H	Tr. P.	YL1103	Tr. P.
QEL1/150	Tr. P.	YL1110	Tr. P.
QEL1/150H	Tr. P.	YL1120	Tr. P.
QEL2/200	Tr. P.	YL1121	Tr. P.

For associated accessories see Handbook Electron tubes, Part 9

Tr. P. = Transmitting tubes, Tetrodes, Pentodes

# INDEX

Type No.	Section
YL1130	Tr. P.
YL1150	Tr. P.
YL1170	Tr. P.
YL1181	Tr. P.
YL1182	Tr. P.
YL1190	Tr. P.
YL1200	Tr. P.
YL1210	Tr. P.
YL1220	Tr. P.
YL1230	Tr. P.
YL1240	Tr. P.
YL1250	Tr. P.
YL1290	Tr. P.
YL1320	Tr. P.
YL1330	Tr. P.
YL1340	Tr. P.
YL1341	Tr. P.
YL1360	Tr. P.
YL1370	Tr. P.
YL1371	Tr. P.
YL1372	Tr. P.
YL1420	Tr. P.
YL1430	Tr. P.
YL1440	Tr. P.
YL1460	Tr. P.
YL1461	Tr. P.
YL1470	Tr. P.
YL1520	Tr. P.
4-65A	See QB3/200
4-125A	See QB3/300GA
4-250A	See QB3.5/750GA
4-400A	See QB4/11000GA
4CX250B	See QEL2/275
4CX250F	See QEL2/275H
4CX250R	See YL1170
4X150A	See QEL1/150
4X150D	See QEL1/150H

Type No.	Section
4X500A	See QBL4/800
813	See QB2/250
832A	See QQE04/20
5894	See QQE06/40
5895	See QC04/15
6075	See QBW5/3500
6076	See QBL5/3500
6079	See QB5/1750
6083	See PE1/100
6146	See QE05/40
6146A	See QE05/40
6146B	See YL1370
6155	See QB3/300
6156	See QB3.5/750
6159	See QE05/40H
6159A	See QE05/40H
6159B	See YL1372
6252	See QQE03/20
6293	Tr. P.
6360	See QQE03/12
6816	See YL1101
6883	See QE05/40F
6883A	See QE05/40F
6883B	See YL1371
6884	See YL1100
6939	See QQE02/5
7034	See QEL1/150
7035	See QEL1/150H
7203	See QEL2/275
7204	See QEL2/275H
7377	See QQE04/5
7378	See QE08/200
7527	See QB4/1100
7580	See QEL2/200
7580W	See YL1170

For associated accessories see Handbook Electron tubes, Part 9

Tr. P. Transmitting tubes, Tetrodes, Pentodes

Type No.	Section
7609	Tr. P.
7650	See YL1110
7836	See QE08/200H
7843	See YL1102
7844	See YL1103
7854	See YL1060
7983	See QQC03/14
7984	Tr. P.
8032	See QE05/40K
8032A	See YL1371
8042	See QE05/35
8116	See YL1071
8117	See YL1070
8118	See YL1020
8165	See QB3/200
8177	See QBL3. 5/2000
8179	See QB5/2000
8298A	See YL1370
8321	See YL1340
8322	See YL1341
8348	See YL1080
8408	See YL1130
8429	See YL1120
8438	See QB4/1100GA
8457	See YL1210
8458	See YL1240
8463	See YL1000
8505	See YL1250
8552	See YL1371
8560	See YL1320
8577	See YL1220
8579	See YL1150
8580	See YL1190
8603	See YL1310
8621	Tr. P.

Type No.	Section
8654	See YL1230
8683	See YL1360
8744	See YL1330
40743	Ampl.
40744	Ampl.
40745	Ampl.
40746	Ampl.
40747	Ampl.
40748	Ampl.
40755	Ampl.
40756	Ampl.
40757	Ampl.
40758	Ampl.
40759	Ampl.
40760	Ampl.

For associated accessories see Handbook Electron tubes, Part 9

Ampl. = Amplifier circuit assemblies

Tr. P. = Transmitting tubes, Tetrodes, Pentodes









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General section

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Transmitting tubes for communication

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TETRODES AND PENTODES

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Amplifier circuit assemblies

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