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**

General section

Transmitting tubes for communication

TETRODES AND PENTODES

Amplifier circuit assemblies

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:

ELECTRON TUBES (9 parts)	BLUE
SEMICONDUCTORS AND INTEGRATED CIRCUITS (5 parts)	RED
COMPONENTS AND MATERIALS (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 pusblished 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.

May 1971

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

Part 1 **January 1972**

Transmitting tubes (Tetrodes, Pentodes)
Amplifier circuit assemblies

Part 2 **March 1971**

Tubes for microwave equipment

Part 3 **March 1970**

Special Quality tubes
Miscellaneous devices

Part 4 **April 1971**

Receiving tubes

Part 5 **May 1971**

Cathode-ray tubes
Photo tubes
Camera tubes
Associated accessories

Part 6 **June 1971**

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Associated accessories

Part 7 **July 1971**

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

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T.V. Picture tubes

Part 9 **December 1971**

Transmitting tubes (Triodes)
Tubes for R.F. heating (Triodes)
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
Signal diodes
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Voltage regulator diodes
Rectifier diodes
Thyristors, diacs, triacs
Rectifier stacks
Accessories
Heatsinks

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

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

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

General
High frequency transistors
Switching transistors
Accessories

Part 4 Special types **December 1971**

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

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

COMPONENTS AND MATERIALS (GREEN SERIES)

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

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

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

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

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

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

FM tuners
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Loudspeakers
Audio and mains transformers
Television tuners
Components for black and white television
Components for colour television
Deflection assemblies for camera tubes

Part 4 Magnetic Materials, Piezoelectric Ceramics — **April 1971**

Ferrites for radio, audio and television
Small coils, assemblies and assembling parts
Ferroxcube potcores and square cores
Ferroxcube transformer cores
Piezoxide
Permanent magnet materials

Part 5 Memory Products, Magnetic Heads, Quartz Crystals, Microwave Devices, Variable Transformers — **June 1971**

Ferrite memory cores
Matrix planes, matrix stacks
Complete memories
Magnetic heads
Quartz crystal units, crystal filters
Isolators, circulators
Variable mains transformers

Part 6 Electric Motors and Accessories, Timing and Control Devices — **August 1971**

Stepper motors
Small synchronous motors
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Indicators for built-in test equipment

Part 7 Circuit Blocks — **September 1971**

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

*) From October 1971 published in Part 1 instead of Part 5.
**) Also included (under "Small coils, etc.") in Part 4.

December 1971

Argentina
FAPESA I.y.C.
Melincué 2594
Tel. 50-9941/8155
BUENOS AIRES

Australia
Philips Industries Ltd.
Elcoma Division
95-99 York Street
Tel. 20223
SYDNEY, N.S.W. 2000

Austria
WIVEG
Zieglergasse 6
Tel. 93 26 22
A1072 VIENNA

Belgium
M.B.L.E.
80, rue des Deux Gares
Tel. 23 00 00
1070 BRUSSELS

Brazil
IBRAPE S.A.
Av. Paulista 2073-S/Loja
Tel. 278-1111
SAO PAULO, SP

Canada
Philips Electron Devices
116, Vanderhoof Ave.
Tel. 425-5161
TORONTO 17, Ontario

Chile
Philips Chilena S.A.
Av. Santa Maria 0760
Tel. 39-40 01
SANTIAGO

Colombia
SADAPE S.A.
Calle 19, No. 5-51
Tel. 422-175
BOGOTA D.E. 1

Denmark
Miniwatt A/S
Emdrupvej 115A
Tel. (01) 69 16 22
DK-2400 KØBENHAVN NV

Finland
Oy Philips A.B.
Elcoma Division
Kaivokatu 8
Tel. 10 915
HELSINKI 10

France
R.T.C.
La Radiotechnique-Compelec
Avenue Ledru Rollin 130
Tel. 357-69-30
PARIS 11

Germany
Valvo G.m.b.H.
Valvo Haus
Burchardstrasse 19,
Tel. (0411) 3296-1
2 HAMBURG 1

Greece
Philips S.A. Hellénique
Elcoma Division
52, Av. Syngrou
Tel. 915 311
ATHENS

Hong Kong
Philips Hong Kong Ltd.
Components Dept.
St. George's Building, 21st Fl.
Tel. K-42 82 05
HONG KONG

India
IMBELEC Div. of
Philips India Ltd.
Band Box House
254-D, Dr. Annie Besant Road
Tel. 475 311 to 15
Worli, BOMBAY 18 (WB)

Indonesia
P.T. Philips-Ralin Electronics
Elcoma Division
Djalan Gadjah Mada 18
Tel. 44 163
DJAKARTA

Ireland
Philips Electrical (Ireland) Ltd.
Newstead, Clonskeagh
Tel. 69 33 55
DUBLIN 14

Italy
Philips S.p.A.
Sezione Elcoma
Piazza IV Novembre 3
Tel. 69 94
MILANO

Japan
NIHON PHILIPS
32nd Fl. World Trade Center Bldg.
5, 3-chome, Shiba Hamamatsu-cho
Minato-ku
Tel. (435) 5204-5
TOKYO

Mexico
Electrónica S.A. de C.V.
Varsovia No.36
Tel. 5-33-11-80
MEXICO 6, D.F.

Netherlands
Philips Nederland N.V.
Afd. Elonco
Boschdijk,VB
Tel. (040) 43 33 33
EINDHOVEN

New Zealand
EDAC Ltd.
70-72 Kingsford Smith Street
Tel. 873 159
WELLINGTON

Norway
Electronica A/S
Middelthunsgate 27
Tel. 46 39 70
OSLO 3

Peru
CADESA
Jr. Ilo, No. 216
Appartado 10132
Tel. 27 7317
LIMA

Portugal
Philips Portuguesa S.A.R.L.
Rua Joaquim Antonio de Aguiar 66
Tel. 68 31 21/9
LISBOA

South Africa
EDAC (Pty.) Ltd.
South Park Lane
New Doornfontein
Tel. 24/6701-2
JOHANNESBURG

Spain
COPRESA S.A.
Balmes 22
Tel. 232 66 80
BARCELONA 7

Sweden
ELCOMA A.B.
Lidingövägen 50
Tel. 08/67 97 80
10250 STOCKHOLM 27

Switzerland
Philips A.G.
Edenstrasse 20
Tel. 051/44 22 11
CH-8027 ZUERICH

Taiwan
Philips Taiwan Ltd.
San Min Building, 3rd Fl.
57-1, Chung Shan N. Road
Section 2
Tel. 553101-5
TAIPEI

Turkey
Turk Philips Ticaret A.S.
EMET Department
Gümüssuyu Cad. 78-80
Tel. 45.32.50
Beyoglü, ISTANBUL

United Kingdom
Mullard Ltd.
Mullard House
Torrington Place
Tel. 01-580 6633
LONDON WC1E 7HD

United States
Amperex Electronic Corp.
Electron Tube Division
Tel. 516 WE 1-6200
HICKSVILLE N.Y. 11802

Sem. and Microcircuits Div.
Tel. 401-762-9000
SLATERSVILLE R.I. 02876

Electro-Optical Devices Div.
Tel. 401-762-3800
SLATERSVILLE R.I. 02876

Component & Entertainment Tube Div.
Tel.516-234-7000
HAUPPAUGE N.Y. 11787

Ferroxcube Corp.
(Memory Products)
P.O. Box 359
Tel. (914) 246-2811
SAUGERTIES, N.Y. 12477

Uruguay
Luzilectron S.A.
Rondeau 1567, piso 5
Tel. 9 43 21
MONTEVIDEO

Venezuela
C.A. Philips Venezolana
Elcoma Department
Colinas de Bello Monte
Tel. 72.01.51
CARACAS

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_c
Grid	g
Tube pin which must not be connected externally	i.c.
Cathode	k
External conductive coating	m
Internal shield	s

Remarks

a. Similar electrodes of the same electrode system are distinguished by means of an additional numeral; the electrode nearest to the cathode has the smallest number. Example: with pentodes g_1, g_2, g_3.

b. Equivalent electrodes of a multi-unit tube are distinguished by means of an apostrophe; e.g. the anodes of a double tetrode are indicated by a and a'.

2. Symbols denoting voltages

Remarks

a. In the case of indirectly heated tubes the voltages on the various electrodes are with respect to the cathode, in 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_a
Anode a.c. voltage	$V_{a\sim}$
Anode voltage in cut-off or cold condition	V_{a_o}
Supply voltage of tube electrodes	V_b

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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

a. The positive electrical current is directed opposite to the direction of the electron current.

b. 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)	$C_{g_1g_2}$
Capacitance between grid and cathode (all other elements not connected to the cathode being earthed)	C_{gk}
Input capacitance of a push-pull circuit	C_i
Capacitance between cathode and all other elements	C_k
Output capacitance of a push-pull circuit	C_o

6. Symbols denoting resistances

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

7. Symbols denoting various quantities

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

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7. Symbols denoting various quantities (continued)

Intermodulation distortion	d_i
n-th order intermodulation distortion	d_{i_n}
Frequency	f
Pulse repetition rate	f_{imp}
Height above sea level	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	δ
Efficiency	η
Wavelength	λ
Amplification factor	μ
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$

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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

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

2.2.2 Thoriated tungsten cathodes (filaments)

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

2.2.3 Quick heating cathodes (filaments)

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

2.2.4 Indirectly heated oxide coated cathodes

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

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

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

2.2.5 Switching on the filament voltage

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

2.2.6 By-passing the filament

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

2.3 Switching on of the electrode voltages

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

2.4 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 μ and transconductance S

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

2.7 Saturation current I_{sat}

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

2.8 Accessories

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

3. LIMITING VALUES

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

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

3.3 Derating the limiting values

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

Wo = tungsten filament Th = thoriated tungsten filament

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

[1]) or 1.5 W_a.

3.4 Rating system

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

3.5 Absolute maximum rating system

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.
The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment components variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

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

3.7 Electrode voltages

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

3.8 Anode dissipation

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

3.9 Anode input power

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

account.

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

3.11 Control-grid dissipation

The control-grid dissipation W_g or W_{g_1} can be approximated, by taking the power supplied to the grid bias source ($-V_g \times I_g$) from the grid driving power (approx. $0.95 \times V_{g_p} \times I_g$). When an a.c., or unsmoothed d.c., voltage supply is used the form factor should be taken into account.

3.12 Grid resistance

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

4. OPERATING CONDITIONS

4.1 General

In the published data, operating conditions for various applications have been given, stating the maximum frequency at which the conditions apply. If it is required to operate a tube at higher frequencies the manufacturer should be consulted. The published values of operating conditions are average values derived from measurements made on nominal tubes working under optimum conditions. Thus, small deviations from the published value can occur if measurements are made on a particular tube. However some of the measured values of voltage or current must be adjusted to give the published figure. As an example, the published value of output power is an average value which can be reached in practice by adjusting e.g. the r.f. or a.f. input voltage V_{g_p}, when the published value of output power is not obtained at the nominal value of V_{g_p}. When designing a multi-stage transmitter it is good practice to leave a margin in the output power and input voltage to allow for adjustments similar to that just described.
The published output power W_o of transmitting tubes is the tube output, which means the anode dissipation W_a taken from the anode input W_{i_a}. When a tube is used in a common grid circuit (grounded grid circuit), the published value of the output power includes the power transferred from the input.
Unless otherwise stated losses in the anode circuit and coupling losses are not taken into account.
The quoted grid input power is assumed to be 0.9 x the product of the average grid current I_g and the peak value of the grid voltage V_{g_p}. Losses in the grid circuit and the bleeder are sometimes accounted for by stating the required driver output power.
At high frequencies where reduced ratings have to be applied, the required driving power will often be considerably higher than the grid input power, and in some cases, may be determined almost exclusively by circuit losses.

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

A class C amplifier or oscillator is one in which the grid bias is appreciably greater than the cut-off voltage so that 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

anode dissipation to be exceeded by 10%.
To suppress even harmonics, separate controllable grid bias for each tube, or a balancing circuit, should be incorporated. This data is purely arbitrary, i.e. the same output can be obtained with less modulation of the anode current (with smaller load resistance and lower peak grid current) although the efficiency would be lower. The requirements of the complete a.f. amplifier determines which kind of operation is preferred.

4.7 Industrial operating conditions

Section 5.4 gives some general information on the application of power tubes in industrial apparatus. With a single phase mains connection a hum filter will sometimes be omitted as is normal in three phase mains connection. Operating conditions and derating factors are given for this kind of operation (section 3.3). It must be ensured that no limiting values are exceeded because of fluctuations in the mains supply or by tolerances in other components. The published value of W_o is the actual tube output power. The output power of a self-oscillating circuit W_{osc} is obtained by deducting the grid dissipation W_g and the losses in the grid resistor W_{Rg} from the output power W_o, The power in the load W_l is obtained by deducting the losses in the output circuit from W_{osc}. A favourable load output characteristic may be obtained by automatically controlling the grid voltage and current, depending on the matching. A non-linear device e.g. a tungsten lamp or an P.T.C. resistor may perform this function adequately and help to prevent overloading the grid.
With self oscillating circuits the frequency must be held within the available frequency band. This may be done by having large circuit capacitance, small stable self inductance, undercritical inductive coupling with the output circuit, electrostatic screening between oscillator and output circuit etc.
If the frequency of an industrial oscillator has to be limited to a narrow frequency band, crystal controlled driving stages may be used, then however, it is rather difficult to obtain matching between the tube input and output. A greater safety margin in the tube will be necessary with the output still depending on the load, or special measures, such as automatic tuning and/or matching control, will have to be taken.
For smaller tubes in industrial applications operating conditions have been given for when power is supplied from a single phase full-wave rectifier, a three phase half-wave rectifier (which is nearly equivalent to d.c.) and with raw a.c. In the latter case the output is about 0.6 times that obtained with d.c. and the peak inverse voltage is equal to the full anode voltage (this is of special importance as the grid voltage is in anti-phase to the anode voltage). With a single-phase, half-wave rectified anode voltage the useful output is nearly equal to that with a d.c. supply. To obtain the most favourable mains loading when using a self rectifying oscillator, a quasi push-pull circuit can be used, in which two tubes function alternately on each half wave. The best mains loading for three-phase, self rectification is obtained by using 6 tubes in a triple push-pull circuit.

4.8 Intermittent service

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

5. APPLICATION OF THE OPERATING CONDITIONS

5.1 General

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

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

5.2 Fixed transmitters

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

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

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

5.3 Mobile transmitters

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

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

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

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

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

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

5.4.1 Multiple tube operation

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

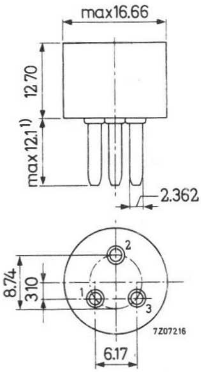
5.5 Amateur transmitters and special adjustments

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

5.6 Pulsed operation

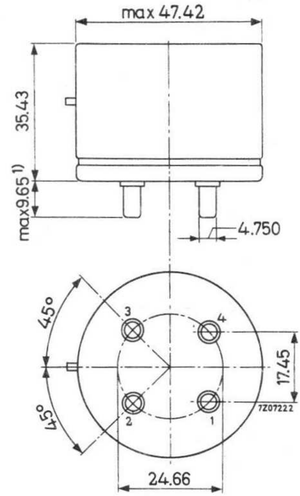
When a tube is used under pulsed operation the pulse duration must be so short that no part of the tube reaches an abnormally high temperature and flash-overs do not develop. In general the average load will be considerably less than the maximum limiting load value.
General information on this kind of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

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



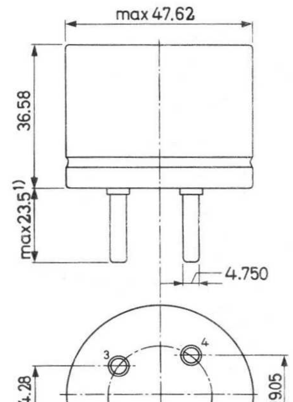
1) Including solder

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



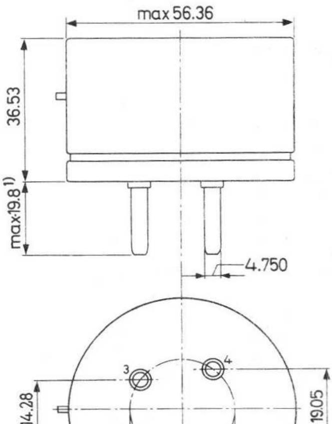
1) Including solder

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



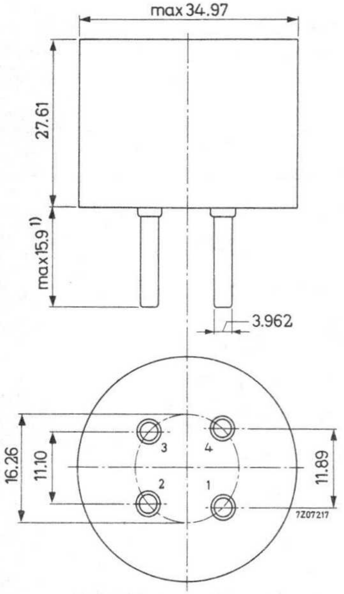
1) Including solder

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



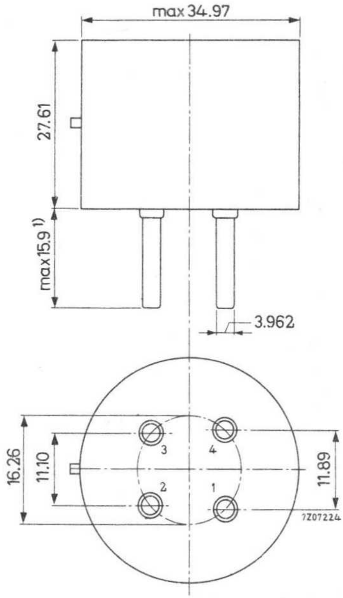
1) Including solder

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



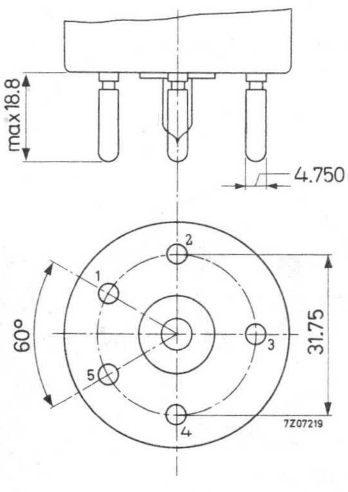
1) Including solder

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

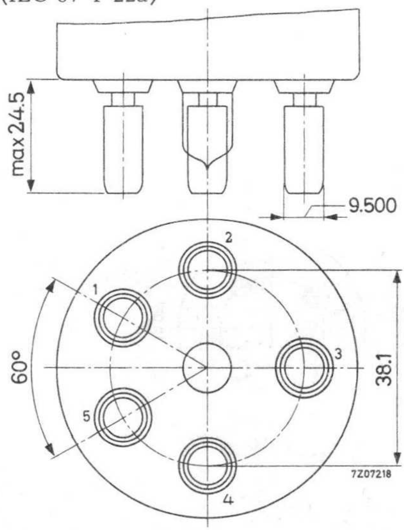


1) Including solder

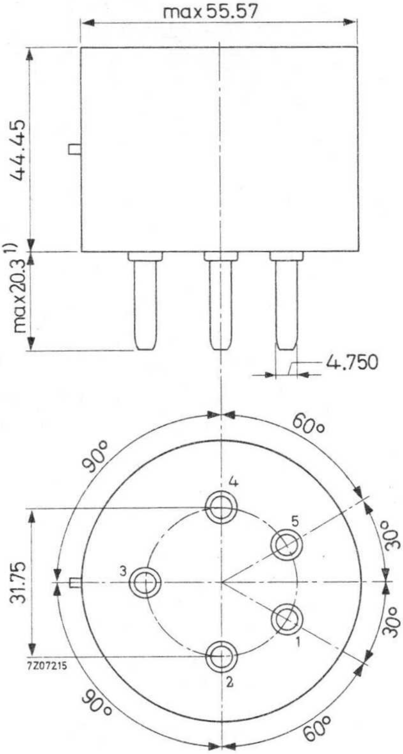
Giant 5-pin base
(IEC 67-I-21c)



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

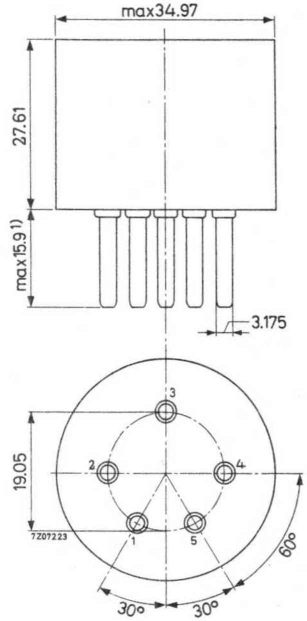


Medium shell Giant 5-pin base
with bayonet
(IEC 67-I-21a)



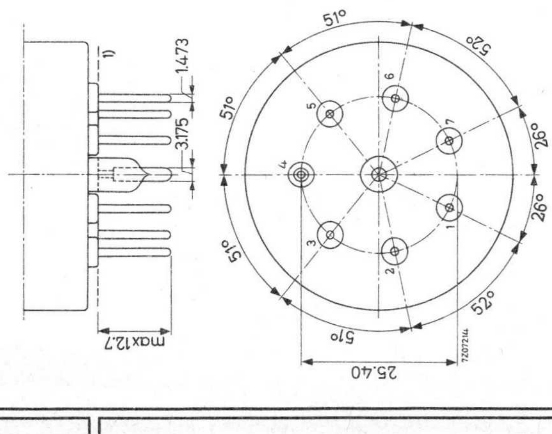
1) Including solder

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



1) Including solder

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



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

TETRODES AND PENTODES

R.F. POWER PENTODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegr.		B teleph.		C_{ag_2} mod.		C_{g_3} 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 [1])	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_{g_1}	=	23 pF
Anode to grid No. 1	C_{ag_1}	=	0.2 pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	120 mA
Amplification factor	$\mu_{g_2g_1}$	=	6.2
Mutual conductance	S	=	6 mA/V

[1]) Two tubes

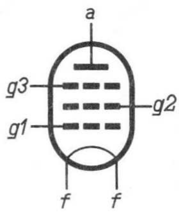
LIMITING VALUES (Absolute limits)

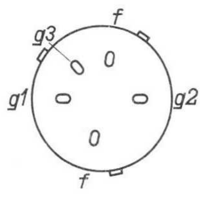
Anode voltage	V_a	= max.	2500	V
Anode dissipation	W_a	= max.	250	W
Grid No.3 circuit resistance	R_{g_3}	= max.	40	kΩ
Grid No.2 voltage	V_{g_2}	= max.	500	V
Grid No.2 dissipation	W_{g_2}	= max.	60	W
Grid No.1 dissipation	W_{g_1}	= max.	20	W
Grid No.1 circuit resistance	R_{g_1}	= max.	40	kΩ
Cathode current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

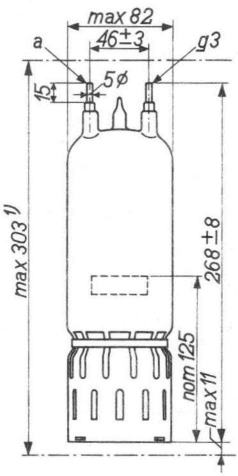
MECHANICAL DATA

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

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1) Required height in apparatus

R.F. POWER PENTODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr.		B teleph.		B mod. [1]	
(m)	(MHz)	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_{ag_2} mod.		C_{g_3} 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_{g_1}	=	29 pF
Anode to grid No.1	C_{ag_1}	=	0.05 pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	μ_{g2g1}	=	3.5
Mutual conductance	S (I_a = 225 mA)	=	6.5 mA/V

[1]) 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_{g_2}	= max.	600	V
Grid No.2 voltage for class B modulation	V_{g_2} (B mod.)	= max.	750	V
Grid No.2 dissipation	W_{g_2}	= max.	100	W
Grid No.3 resistor	R_{g_3}	= max.	30	kΩ
Grid No.1 dissipation	W_{g_1}	= max.	20	W
Grid No.1 resistor	R_{g_1}	= max.	30	kΩ
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

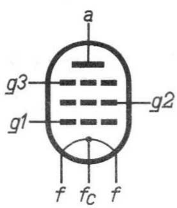
To ensure safe seal temperatures a low velocity air flow is required above 60 MHz

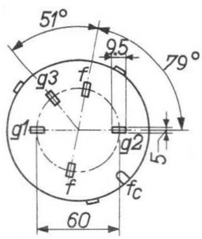
MECHANICAL DATA (Dimensions in mm)

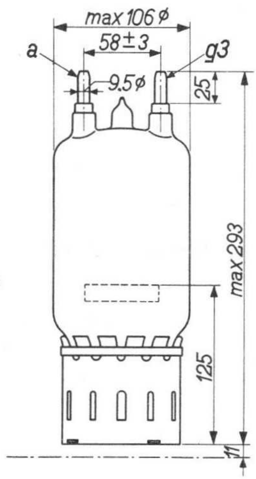
Socket : 40201

Anode connectors: 40626

Net weight : 0.78 kg







Mounting position: vertical with base up [1]) or down

[1]) In that case it is recommended to support the tube

R.F. POWER PENTODE

QUICK REFERENCE DATA									
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_{ag_2} mod.		B mod [1]	
		V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
> 3	< 100	500 400 300	33 28 24	500 400	6 5.4	400 300	20 16	500 400 300	49 49 40

λ (m)	Freq. (MHz)	C fr. mult.	
		V_a (V)	W_o (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_{g_1}	=	14.5	pF
Anode to grid No.1	C_{ag_1}	=	0.15	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	7.6	
Mutual conductance	S (I_a = 30 mA)	=	3.3	mA/V

[1]) Two tubes

LIMITING VALUES (Absolute limits)

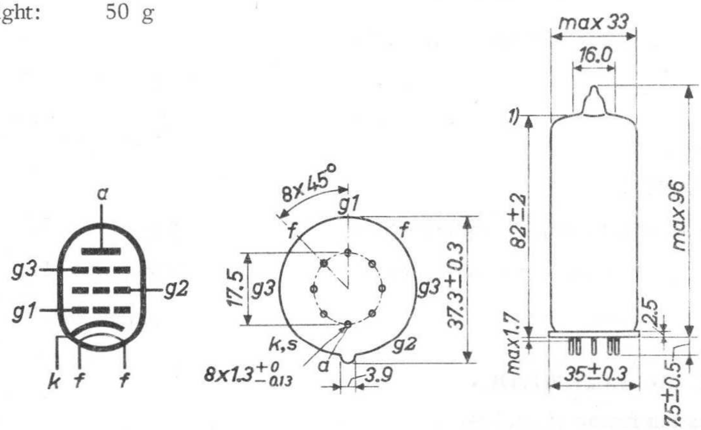
Anode voltage	V_a	=	max.	500	V
Anode dissipation	W_a	=	max.	12	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	5	W
Grid No.1 dissipation	W_{g_1}	=	max.	0.5	W
Grid No.1 resistor with fixed bias	R_{g_1}	=	max.	50	kΩ
Grid No.1 resistor with automatic bias	R_{g_1}	=	max.	100	kΩ
Cathode current	I_k	=	max.	130	mA
Peak cathode current	I_{k_p}	=	max.	800	mA
Heater to cathode voltage	V_{kf}	=	max.	75	V
Tube base temperature		=	max.	180	°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							
λ	Freq.	C telegr.		B teleph.		C_{ag_2} 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

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

B mod.[1])	
V_a (V)	W_o (W)
600	100

HEATING : indirect; cathode oxide-coated

PE06/40 P **PE06/40 N**	Heater voltage	V_f	=	6.3	V
	Heater current	I_f	=	1.3	A
PE06/40 E	Heater voltage	V_f	=	12.6	V
	Heater current	I_f	=	0.65	A

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_{g_1}	=	15	pF
Anode to grid No.1	C_{ag_1}	=	0.1	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.5	
Mutual conductance	S (I_a = 40 mA)	=	4	mA/V

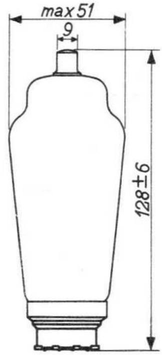
1) Two tubes

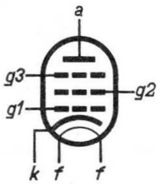
MECHANICAL DATA

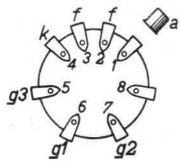
Dimensions in mm

PE06/40 P

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

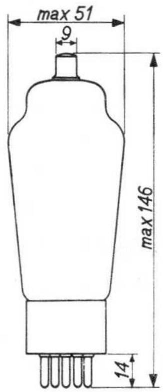


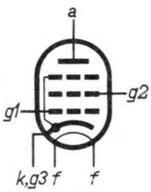


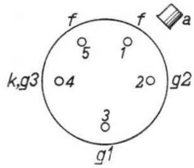


PE06/40 N

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

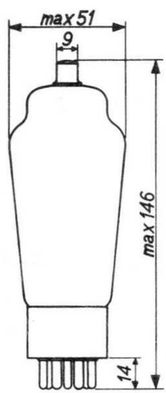


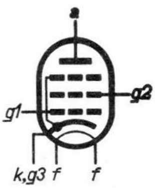


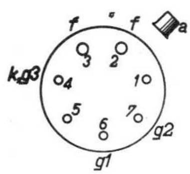


PE06/40 E

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	kΩ [1])
Grid No.1 resistance	R_{g_1}	= max.	200	kΩ [2])
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	λ	= >15	>15	5[3])	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	η	= 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	λ	=	>15	5 [1]	m
Anode voltage	V_a	=	500	500	V
Grid No.1 voltage	V_{g_1}	=	−75	−55	V
Grid No.2 voltage	V_{g_2}	=	300 [2]	160 [3]	V
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	114	146	mA
Grid No.1 current	I_{g_1}	=	1.4	2	mA
Grid No.2 current	I_{g2}	=	10	10	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	90	75	V
Grid No.1 input power	W_{ig_1}	=	0.1	0.15	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	70	55	%

Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	300	160	V
Modulation power	W_{mod}	=	30	40	W

[1]) Two tubes

[2]) $R_{g_2} = 20\ k\Omega$

[3]) $R_{g_2} = 34\ k\Omega$

R.F. POWER PENTODE

QUICK REFERENCE DATA

λ	Freq.	C telegr.		B teleph.		B mod.[1]	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
>5	<60	1000	132	1000	23	1000	194
		800	107	800	23	800	110
		600	78	600	23	600	82

λ	Freq.	C_{ag_2} mod.		C_{g_3} mod.	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
>5	<60	800	75	1000	27
		600	51	800	26
				600	22

HEATING: indirect; oxide-coated cathode

Heater voltage	V_f	=	12.6 V
Heater current	I_f	=	1.3 A

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	12 pF
Grid No.1 to all other elements except anode	C_{g_1}	=	20.5 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_{g2}	=	250 V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	6.7
Mutual conductance	S (I_a = 40 mA)	=	6 mA/V

[1]) 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	kΩ
Grid No.1 resistance with fixed bias	R_{g_1}	=	max.	25	kΩ
Grid No.1 resistance with automatic bias	R_{g_1}	=	max.	50	kΩ
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

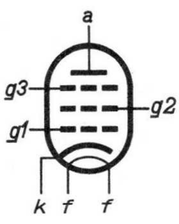
MECHANICAL DATA

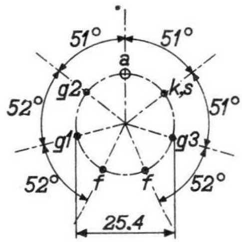
Dimensions in mm

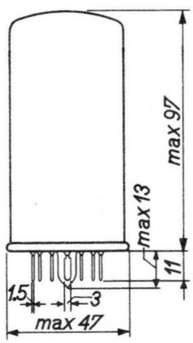
Base : Septar

Socket : 2422 513 00001

Net weight: 80 g







Mounting position: arbitrary

OPERATING CONDITIONS R.F. class C telegraphy

Wavelength	λ		>5	>5	>5	m
Anode voltage	V_a	=	1000	800	600	V
Grid No.1 voltage	V_{g_1}	=	-120	-110	-100	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	177	190	205	mA
Grid No.1 current	I_{g_1}	=	5	6	7.5	mA
Grid No.2 current	I_{g_2}	=	28	28	28	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	144	134	124	V
Grid No.1 input power	W_{ig_1}	=	0.65	0.73	0.84	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	74.5	70.5	63.5	%

OPERATING CONDITIONS R.F. class B telephony

Wavelength	λ		>5	>5	>5	m
Anode voltage	V_a	=	1000	800	600	V
Grid No.1 voltage	V_{g_1}	=	-34	-33	-30.5	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	68	85	114	mA
Grid No.2 current	I_{g_2}	=	4.5	6	7.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	20.5	22.5	26.5	V
Grid No.2 dissipation	W_{g_2}	=	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	η	=	34	34	34	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	I_{g_1}	=	2	4	8	mA
Grid No.1 input power	W_{ig_1}	=	0.08	0.17	0.38	W

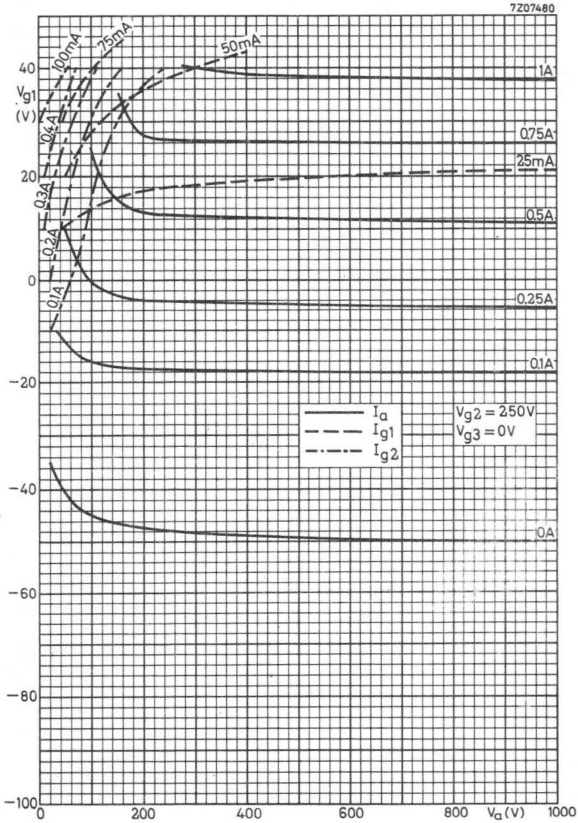
OPERATING CONDITIONS R.F. class C

			anode and screen grid modulation		suppressor grid modulation	
Wavelength	λ		>5	>5	>5	m
Anode voltage	V_a	=	800	600	1000	V
Grid No.1 voltage	V_{g_1}	=	−120	−120	−100	V
Grid No.2 voltage	V_{g_2}	=	250	250	150	V
Grid No.3 voltage	V_{g_3}	=	0	0	−100	V
Anode current	I_a	=	120	120	72	mA
Grid No.1 current	I_{g_1}	=	6.5	6.5	10	mA
Grid No.2 current	I_{g_2}	=	23	23	24	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	150	150	140	V
Grid No.1 input power	W_{ig_1}	=	0.9	0.9	1.3	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	78	71	37.5	%
Modulation factor	m	=	100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	250	250	-	V
Peak grid No.3 A.C. voltage	$V_{g_{3p}}$	=	-	-	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_{g_1}	=	-34		-33.5		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Load resistance	$R_{aa\sim}$	=	8800		7560		Ω
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	84	0	68	V
Anode current	I_a	=	2x26	2x134	2x28	2x108	mA
Grid No.1 current	I_{g_1}	=	0	2x0.8	0	0	mA
Grid No.2 current	I_{g_2}	=	2x5	2x28	2x8	2x27	mA
Grid No.1 input power	W_{ig_1}	=	0	2x0.03	0	0	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	-	72	-	63.5	%

Anode voltage	V_a	=	600		V
Grid No.1 voltage	V_{g_1}	=	-33		V
Grid No.2 voltage	V_{g_2}	=	250		V
Load resistance	$R_{aa\sim}$	=	6320		Ω
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	66	V
Anode current	I_a	=	2x28	2x102	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Grid No.2 current	I_{g_2}	=	2x11	2x28	mA
Grid No.1 input power	W_{ig_1}	=	0	0	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	-	67	%



7Z07480
V_{g1} (V)
V_a (V)
100mA
75mA
50mA
25mA
1A
0.75A
0.5A
0.25A
0.1A
0A
0.4A
0.3A
0.2A
0.1A
I_a
I_{g1}
I_{g2}
$V_{g2} = 250V$
$V_{g3} = 0V$
40
20
0
−20
−40
−60
−80
−100
0
200
400
600
800
1000

R.F. BEAM POWER TETRODE

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

QUICK REFERENCE DATA.

λ (m)	Freq. (MHz)	C telegr.			B teleph.			C_{ag_2} mod.		
		V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
10	30	2000	275		2000	50		1600	180	
		1500	210		1500	50		1250	140	
		1250	170							
		2250		375	2250		70	2000		300

λ (m)	Freq. (MHz)	C_{g_1} mod.			AB mod. [1]		
		V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) 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_{g_1}	=	16.3	pF
Anode to all other elements except grid No.1	C_a	=	14.0	pF
Anode to grid No.1	C_{ag_1}	<	0.25	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 = 50 mA)	=	3.75	mA/V

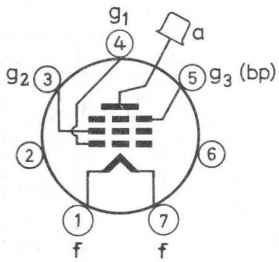
[1]) Without grid current; two tubes

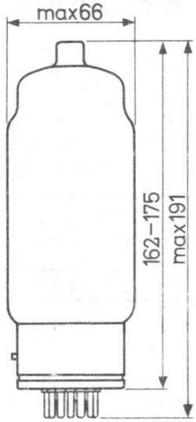
MECHANICAL DATA — Dimensions in mm

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

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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_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 22		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 300		V
Grid No.1 current	I_{g_1}	=		max. 25		mA
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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_{g_1}	=	-120	-90	-75	V [1])
Grid No.2 voltage	V_{g_2}	=	400	300	300	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	180	180	180	mA
Grid No.1 current	I_{g_1}	=	10	12	12	mA
Grid No.2 current	I_{g_2}	=	45	30	35	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	205	175	160	V
Grid No.1 input power	W_{ig_1}	=	1.9	1.9	1.7	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	76.5	78	75.5	%

[1]) 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_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 22		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 300		V
Grid No.1 current	I_{g_1}	=		max. 30		mA
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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

Frequency	f	=	30	MHz
Anode voltage	V_a	=	2250	V
Grid No.1 voltage	V_{g_1}	=	-155	V [1]
Grid No.2 voltage	V_{g_2}	=	400	V
Grid No.3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	220	mA
Grid No.1 current	I_{g_1}	=	15	mA
Grid No.2 current	I_{g_2}	=	40	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	275	V
Grid No.1 input power	W_{ig_1}	=	4	W
Grid No.2 dissipation	W_{g_2}	=	16	W
Anode input power	W_{ia}	=	495	W
Anode dissipation	W_a	=	120	W
Output power	W_o	=	375	W
Efficiency	η	=	76	%

[1]) 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_{g_2}	=			max. 400		V
Grid No.2 dissipation	W_{g_2}	=			max. 15		W
Negative grid No.1 voltage	$-V_{g_1}$	=			max. 300		V
Grid No.1 current	I_{g_1}	=			max. 25		mA
Grid No.1 circuit resistance	R_{g_1}	=			max. 30		kΩ

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

Frequency	f	=	30	60	MHz	
Anode voltage	V_a	=	1600	1250	V	
Grid No.1 voltage	V_{g_1}	=	−160	−160	V	1)
Grid No.2 voltage	V_{g_2}	=	300	300	V	2)
Grid No.3 voltage	V_{g_3}	=	0	0	V	
Anode current	I_a	=	150	150	mA	
Grid No.1 current	I_{g_1}	=	12	13	mA	
Grid No.2 current	I_{g_2}	=	30	35	mA	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	250	250	V	
Grid No.1 input power	W_{ig_1}	=	2.7	2.9	W	
Grid No.2 dissipation	W_{g_2}	=	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	η	=	75	74.5	%	
Modulation factor	m	=	100	100	%	
Modulation power	W_{mod}	=	120	94	W	

1) For A.C. filament supply

2) 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_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 20		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 300		V
Grid No.1 current	I_{g_1}	=		max. 30		mA
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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

Frequency	f	=	30	MHz
Anode voltage	V_a	=	2000	V
Grid No.1 voltage	V_{g_1}	=	-175	V [1])
Grid No.2 voltage	V_{g_2}	=	350	V [2])
Grid No.3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	200	mA
Grid No.1 current	I_{g_1}	=	16	mA
Grid No.2 current	I_{g_2}	=	40	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	300	V
Grid No.1 input power	W_{ig_1}	=	4.3	W
Grid No.2 dissipation	W_{g_2}	=	14	W
Anode input power	W_{ia}	=	400	W
Anode dissipation	W_a	=	100	W
Output power	W_o	=	300	W
Efficiency	η	=	75	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	200	W

[1]) For A.C. filament supply

[2]) 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_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 15		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 200		V
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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_{g_1}	=	-120		-140	V [1]
Grid No.2 voltage	V_{g_2}	=	400		400	V
Grid No.3 voltage	V_{g_3}	=	0		0	V
Anode current	I_a	=	75		70	mA
Grid No.1 current	I_{g_1}	=				[2]
Grid No.2 current	I_{g_2}	=	3		3	mA
Peak A.C. input voltage, R.F.	$V_{g_{1p}}$	=	120		145	V
Peak A.C. input voltage, A.F.	$V_{g_{1p}}$	=	60		60	V
Grid No.1 input power	W_{ig_1}	=				[3]
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 20		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 200		V
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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

Frequency	f	=	30	MHz	
Anode voltage	V_a	=	2250	V	
Grid No.1 voltage	V_{g_1}	=	-110	V	1)
Grid No.2 voltage	V_{g_2}	=	400	V	
Grid No.3 voltage	V_{g_3}	=	0	V	
Anode current	I_a	=	85	mA	
Grid No.1 current	I_{g_1}	=			2)
Grid No.2 current	I_{g_2}	=	2.5	mA	
Peak A.C. input voltage, R.F.	$V_{g_{1p}}$	=	135	V	
Peak A.C. input voltage, A.F.	$V_{g_{1p}}$	=	55	V	
Grid No.1 input power	W_{ig_1}	=			3)
Grid No.2 dissipation	W_{g_2}	=	1.0	W	
Anode input power	W_{ia}	=	191	W	
Anode dissipation	W_a	=	116	W	
Output power	W_o	=	75	W	
Efficiency	η	=	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_{g_2}	=			max. 400		V
Grid No.2 dissipation	W_{g_2}	=			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_{g_1}	=	−75	−60	V [1]
Grid No.2 voltage	V_{g_2}	=	400	400	V
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	75	100	mA
Grid No.2 current	I_{g_2}	=	3	4	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	80	70	V
Grid No.2 dissipation	W_{g_2}	=	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	η	=	33	33	%
Modulation factor	m	=	100	100	%
Grid No.1 input power	W_{ig_1}		$\leqq 2$	$\leqq 2$	W

[1]) 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_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		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_{g_1}	=	-60	V [1]
Grid No.2 voltage	V_{g_2}	=	400	V
Grid No.3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	85	mA
Grid No.2 current	I_{g_2}	=	3	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	70	V
Grid No.2 dissipation	W_{g_2}	=	1.2	W
Anode input power	W_{ia}	=	191	W
Anode dissipation	W_a	=	121	W
Output power	W_o	=	70	W
Efficiency	η	=	36.5	%
Modulation factor	m	=	100	%
Grid No.1 input power	W_{ig_1}	$\leqq$	2	W

[1]) 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_{g_2}	=	max.	1100	V
Grid No.2 dissipation	W_{g_2}	=	max.	22	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1]

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

V_a	=	2250		2000		1500		V
V_{g_1}	=	-95		-90		-85		V [2]
V_{g_2}	=	750		750		750		V
V_{g_3}	=	0		0		0		V
$R_{aa\sim}$	=	20		16		9.3		kΩ
$V_{g_1g_{1p}}$	=	0	170	0	160	0	160	V
I_a	=	2x25	2x127.5	2x25	2x132.5	2x25	2x152.5	mA
I_{g_2}	=	2x1.0	2x26.5	2x1.0	2x21.5	2x1.0	2x22.5	mA
W_{ig_1}	=	0	0	0	0	0	0	W
W_{g_2}	=	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
η	=	–	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_{g_2}	= max.	1100	V	
Grid No.2 dissipation	W_{g_2}	= max.	22	W	
Grid No.1 circuit resistance	R_{g_1}	= max.	30	kΩ	[1]

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

Anode voltage	V_a	=	2500		V	
Grid No.1 voltage	V_{g_1}	=	-95		V	[2]
Grid No.2 voltage	V_{g_2}	=	750		V	
Grid No.3 voltage	V_{g_3}	=	0		V	
Load resistance	$R_{aa\sim}$	=	19		kΩ	
Input A.C. voltage, peak to peak	$V_{g_1g_{1p}}$	=	0	180	V	
Anode current	I_a	=	2x25	2x145	mA	
Grid No.2 current	I_{g_2}	=	2x1.0	2x27	mA	
Grid No.1 input power	W_{ig_1}	=	0	0	W	
Grid No.2 dissipation	W_{g_2}	=	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	η	=	–	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 telegr.		C_{ag_2} mod.		S.S.B.	
(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_ℓ (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]			
$I_{g_1} = 0$		$I_{g_1} > 0$	
V_a (V)	W_o (W)	V_a (V)	W_o (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	V
Filament current	I_f	=	3.5	A

COOLING: radiation/low-velocity air flow

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	2.1	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	8	pF
Anode to grid No.1	C_{ag_1}	=	0.08	pF

[1]) 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	μ_{g2g1}	=	5	

MECHANICAL DATA

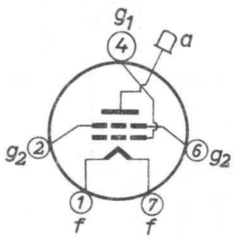
Dimensions in mm

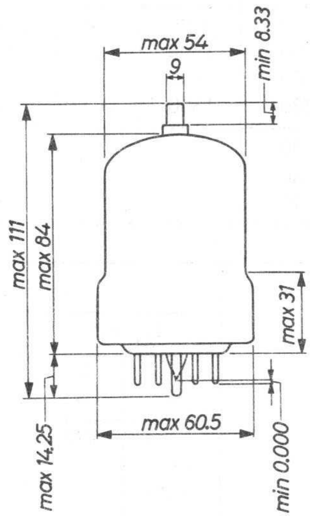
Base : Septar

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 ^{o}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_{g_2}	=	max. 400		V
Grid No.2 dissipation	W_{g_2}	=	max. 10		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 dissipation	W_{g_1}	=	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_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-100	-85	-75	-85	V
Anode current	I_a	=	115	150	150	117	mA
Grid No.2 current	I_{g_2}	=	8	24	40	24	mA
Grid No.1 current	I_{g_1}	=	5	12	15	12	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	180	185	170	190	V
Grid No.1 input power	W_{ig_1}	=	0.8	2.0	2.3	8	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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_{g_2}	=	max. 400		V
Grid No.2 dissipation	W_{g_2}	=	max. 10		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 500		V
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-135	-125	-120	-85	V
Anode current	I_a	=	110	120	120	80	mA
Grid No.2 current	I_{g_2}	=	10	15	30	27	mA
Grid No.1 current	I_{g_1}	=	6	8	12	12	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	215	220	215	185	V
Grid No.1 input power	W_{ig_1}	=	1.2	1.6	2.3	8	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	84	78	62	63	%
Modulation factor	m	=	100	100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	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_{g_2}	= max.	10	W
Grid No.1 circuit resistance	R_{g_1}	= max.	250	kΩ

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 [1]	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_{g_2}	=	–	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 [2]	W_ℓ	=	0	87	0	77	0	58	W

[1]) To be adjusted for the stated zero signal anode current

[2]) 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	kΩ

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

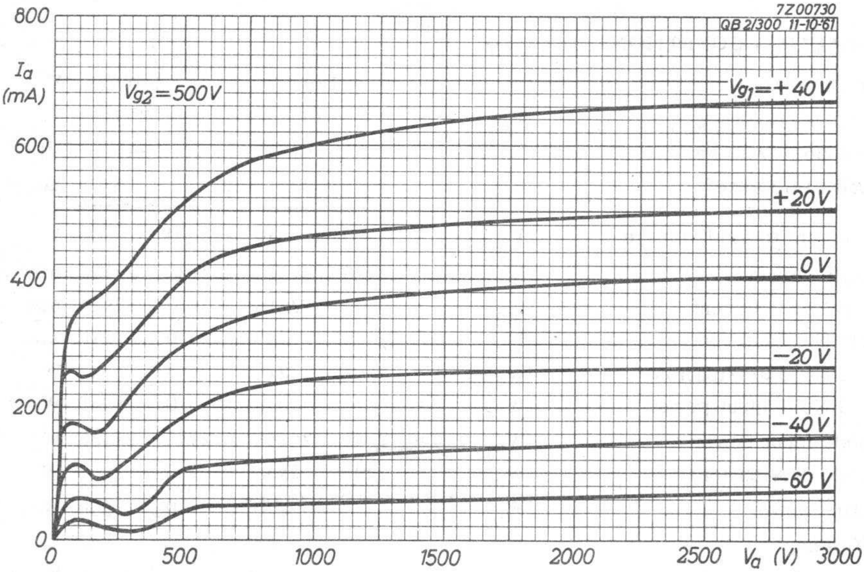
V_a	=	1750		1500		1000		V
V_{g2}	=	500		500		500		V
V_{g1}	=	−115		−110		−100		V
$R_{aa\sim}$	=	20		15		9		kΩ
V_{g1g1p}	=	0	180	0	170	0	170	V
I_a	=	2x20	2x85	2x30	2x90	2x30	2x85	mA
I_{g2}	=	–	2x11.5	–	2x10	–	2x15	mA
W_{g2}	=	–	2x6	–	2x5	–	2x7.5	W
W_{ia}	=	2x35	2x150	2x45	2x135	2x30	2x85	W
W_a	=	2x35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

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

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

Anode voltage	V_a	=	1800		1500		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-50		-45		V
Load resistance	$R_{aa\sim}$	=	20		14		kΩ
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	180	0	200	V
Anode current	I_a	=	2x25	2x110	2x30	2x125	mA
Grid No.2 current	I_{g_2}	=	–	2x15	–	2x20	mA
Grid No.1 current	I_{g_1}	=	0	2x9	0	2x10	mA
Grid No.2 dissipation	W_{g_2}	=	–	2x4	–	2x5	W
Grid No.1 input power	W_{ig_1}	=	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	η	=	–	68	–	67	%
Total harmonic distortion	d_{tot}	=	–	5	–	6	%

Anode voltage	V_a	=	1000		600		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-40		-40		V
Load resistance	$R_{aa\sim}$	=	6.8		3.6		kΩ
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	210	0	240	V
Anode current	I_a	=	2x30	2x150	2x30	2x150	mA
Grid No.2 current	I_{g_2}	=	–	2x30	–	2x40	mA
Grid No.1 current	I_{g_1}	=	0	2x14	0	2x15	mA
Grid No.2 dissipation	W_{g_2}	=	–	2x7.5	–	2x10	W
Grid No.1 input power	W_{ig_1}	=	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	η	=	–	57	–	50	%
Total harmonic distortion	d_{tot}	=	–	6	–	10	%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400
200
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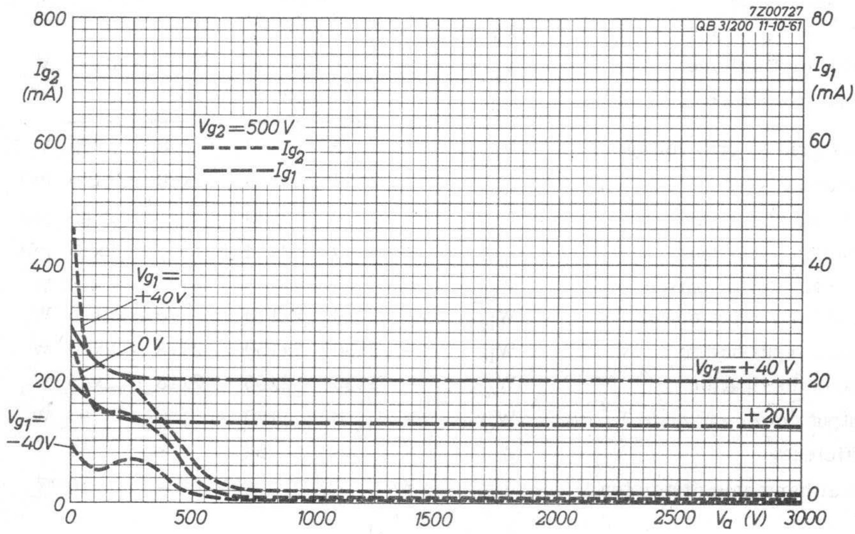
V_{g1}=+40 V
+20 V
0 V
−20 V
−40 V
−60 V
0
500
1000
1500
2000
2500
V_a (V)
3000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80
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40
20
0
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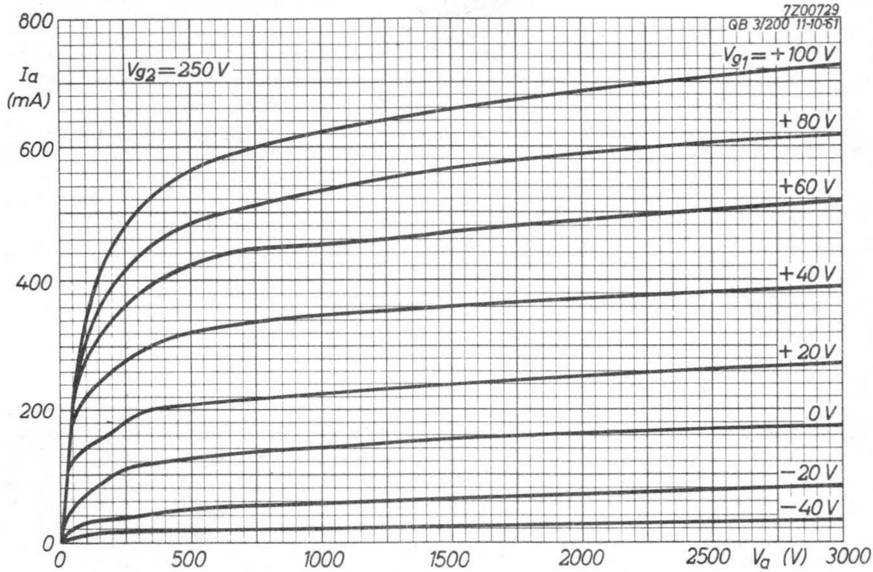
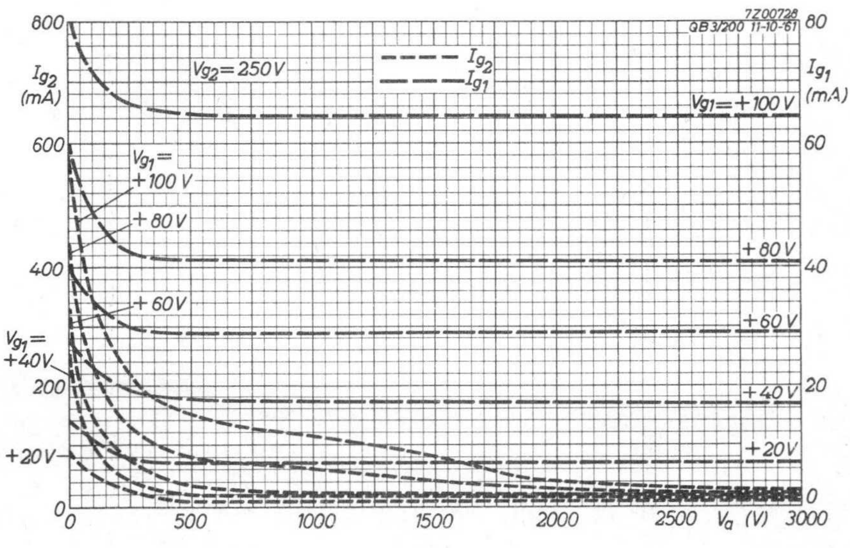
I_{g1} (mA)
V_{g2}=500 V
I_{g2}
I_{g1}
V_{g1}= +40 V
0 V
V_{g1}= −40V
V_{g1}=+40 V
+20V
0
500
1000
1500
2000
2500
V_a (V)
3000


7Z00729
QB 3/200 11-10-61
Ia (mA)
800
600
400
200
0
V_{g2} = 250 V
V_{g1} = +100 V
+80 V
+60 V
+40 V
+20 V
0 V
−20 V
−40 V
0
500
1000
1500
2000
2500
V_a (V)
3000


7Z00728
QB3/200 11-10-61
I_{g2} (mA)
800
600
400
200
0
I_{g1} (mA)
80
60
40
20
0
V_{g2} = 250 V
I_{g2}
I_{g1}
V_{g1} = +100 V
V_{g1} =
+100 V
+80 V
+60 V
V_{g1} =
+40 V
+20 V
+80 V
+60 V
+40 V
+20 V
0
500
1000
1500
2000
2500
V_a (V)
3000

R.F. POWER TETRODE

QUICK REFERENCE DATA										
λ	Freq.	C telegr.		B teleph.		C_{ag_2} mod.			B mod.[1]	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)		V_a (V)	W_o (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	V
Filament current	I_f	=	6.5	A

COOLING: Radiation/low-velocity air flow

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	3.5	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	10.8	pF
Anode to grid No.1	C_{ag_1}	=	0.05	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	6.2	
Mutual conductance	$S(I_a = 40\,mA)$	=	2.2	mA/V

[1]) Two tubes; $I_{g_1} > 0$

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode seal	= max. 220	^{o}C
Temperature of pin seals	= max. 180	^{o}C
Bulb temperature	= max. 350	^{o}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.

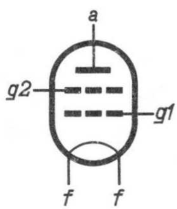
MECHANICAL DATA Dimensions in mm

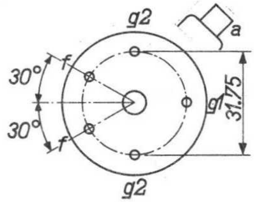
Base : giant 5 p

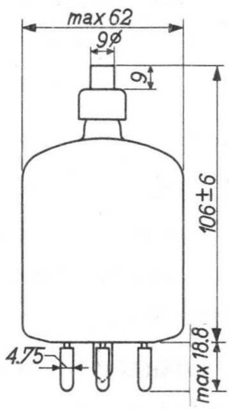
Socket : 2422 512 01001

Anode connector : 40624

Net weight : 120 g







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 [1]		W
Grid No.2 voltage	V_{g2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 20		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 500		V
Grid No.1 current	I_{g_1}	=		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_{g_2}	=	350	350	350	350	V
Grid No.1 voltage	V_{g_1}	=	-150	-150	-100	-150	V
Anode current	I_a	=	167	200	200	110	mA
Grid No.2 current	I_{g_2}	=	30	40	50	56	mA
Grid No.1 current	I_{g_1}	=	6.5	9	9	8	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	300	330	260	225	V
Grid No.1 input power	W_{ig_1}	=	2	3	2.4	1.7	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	75	75	69	67	%

[1]) 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 [1]		W
Grid No.2 voltage	V_{g_2} =		max. 400		V
Grid No.2 dissipation	W_{g_2} =		max. 14		W

OPERATING CONDITIONS

Frequency	f		<120	<120	<120	MHz
Anode voltage	V_a	=	3000	2500	2000	V
Grid No.2 voltage	V_{g_2}	=	350	350	350	V
Grid No.1 voltage	V_{g_1}	=	-50	-50	-50	V
Anode current	I_a	=	60	70	83	mA
Grid No.2 current	I_{g_2}	=	1	1	1.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	50	55	65	V
Grid No.2 dissipation	W_{g_2}	=	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	η	=	32	31.5	32.5	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	I_{g_1}	=	4.5	4	4	mA
Grid No.1 input power	W_{ig_1}	=	0.45	0.44	0.52	W

[1]) 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_{g_2}	=		max. 400		V
Grid No. 2 dissipation	W_{g_2}	=		max. 20		W
Negative grid No. 1 voltage	$-V_{g_1}$	=		max. 500		V
Grid No. 1 current	I_{g_1}	=		max. 15		mA

OPERATING CONDITIONS

Frequency	f		<120	<120	<120	MHz
Anode voltage	V_a	=	2500	2000	1500	V
Grid No. 2 voltage	V_{g_2}	=	350	350	300	V
Grid No. 1 voltage	V_{g_1}	=	−210	−220	−150	V
Anode current	I_a	=	152	150	160	mA
Grid No. 2 current	I_{g_2}	=	30	33	33	mA
Grid No. 1 current	I_{g_1}	=	4.5	5	10	mA
Peak grid No. 1 A.C. voltage	$V_{g_{1p}}$	=	380	390	250	V
Grid No. 1 input power	W_{ig_1}	=	1.7	2	2.5	W
Grid No. 2 dissipation	W_{g_2}	=	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	η	=	79	75	65	%
Modulation factor	m	=	100	100	100	%
Peak grid No. 2 A.C. voltage	$V_{g_{2p}}$	=	300	300	255	V
Modulation power	W_{mod}	=	190	150	120	W

A.F. CLASS B AMPLIFIER AND MODULATOR. $I_{g_1} = 0$

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[1]
Grid No.2 voltage	V_{g_2}	=	max.	600	V
Grid No.2 dissipation	W_{g_2}	=	max.	20	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	150	kΩ

OPERATING CONDITIONS , two tubes

V_a	=	2500		2000		1500		V
V_{g_1}	=	-97		-95.5		-94		V
V_{g_2}	=	600		600		600		V
$R_{aa\sim}$	=	25		17.6		12		kΩ
$V_{g_1g_{1p}}$	=	0	190	0	186	0	185	V
I_a	=	2x30	2x108	2x30	2x111	2x30	2x109	mA
I_{g_2}	=	2x0.1	2x13	2x0.1	2x12	2x0.15	2x13.5	mA
W_{g_2}	=	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
η	=	-	64	-	58.5	-	52	%
d_{tot}	=	-	4.0	-	3.6	-	3.5	%

[1]) Anode red hot, temperature ≐ 850 °C

A.F. CLASS B AMPLIFIER AND MODULATOR. $I_{g_1} > 0$

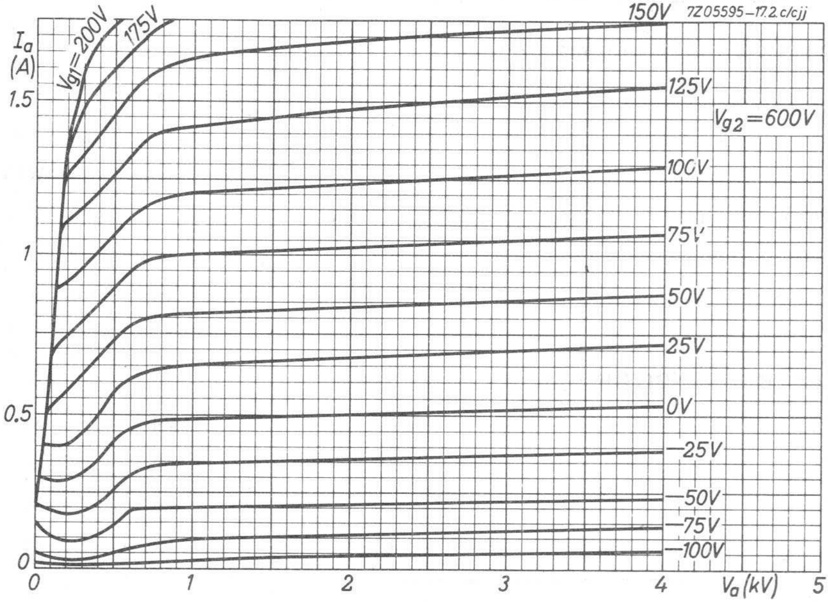
LIMITING VALUES (Absolute limits)

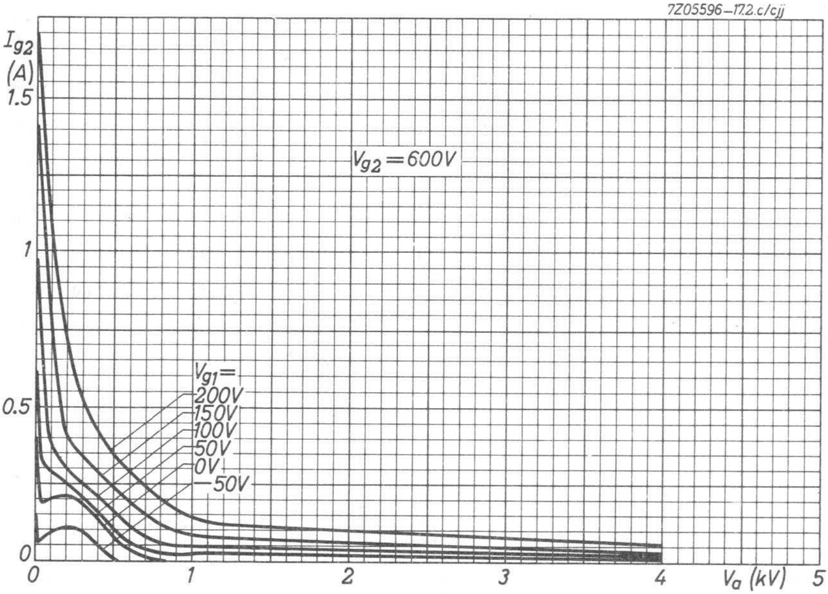
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	225	mA
Anode dissipation	W_a	=	max.	125	W[1]
Grid No.2 voltage	V_{g_2}	=	max.	400	V
Grid No.2 dissipation	W_{g_2}	=	max.	20	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V

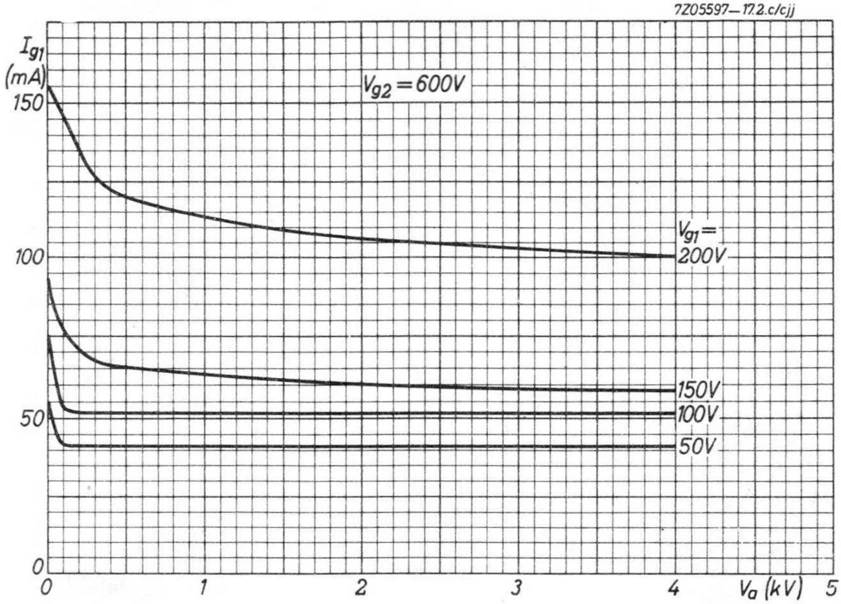
OPERATING CONDITIONS , two tubes

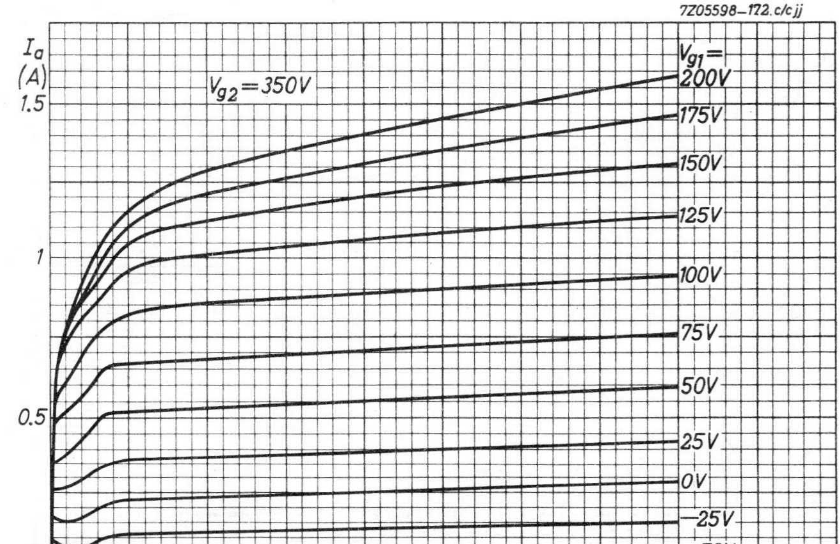
V_a	=	2500		2000		1500		V
V_{g_1}	=	-51		-50		-48		V
V_{g_2}	=	350		350		350		V
$R_{aa\sim}$	=	20		12		7.2		kΩ
$V_{g_1g_{1p}}$	=	0	240	0	296	0	330	V
I_a	=	2x30	2x151	2x30	2x197.5	2x30	2x227.5	mA
I_{g_1}	=	0	2x8.5	0	2x12	0	2x16	mA
I_{g_2}	=	2x0.1	2x18	2x0.15	2x32	2x0.25	2x42	mA
W_{ig_1}	=	0	2x0.9	0	2x1.6	0	2x2.4	W
W_{g_2}	=	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
η	=	–	72.5	–	69.5	–	66.5	%
d_{tot}	=	–	5	–	5	–	5	%

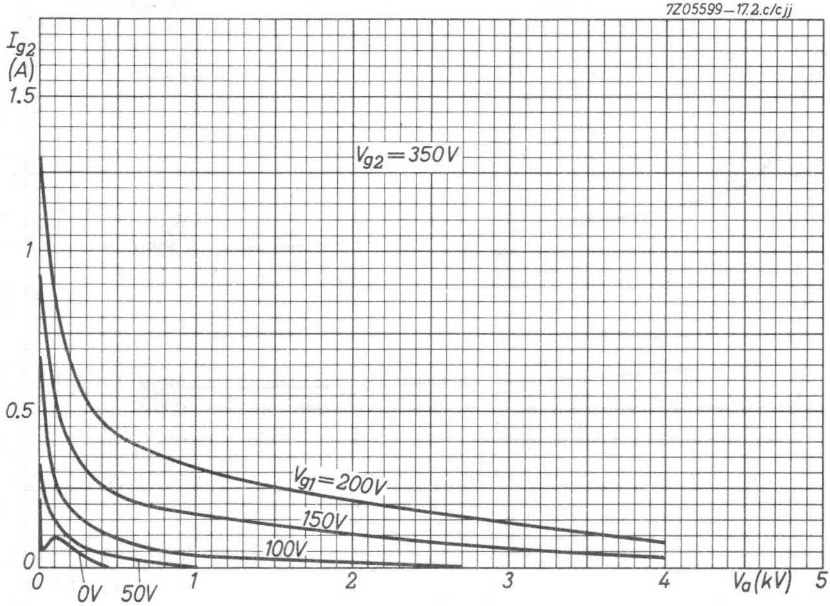
[1]) Anode red hot, temperature = 850 °C

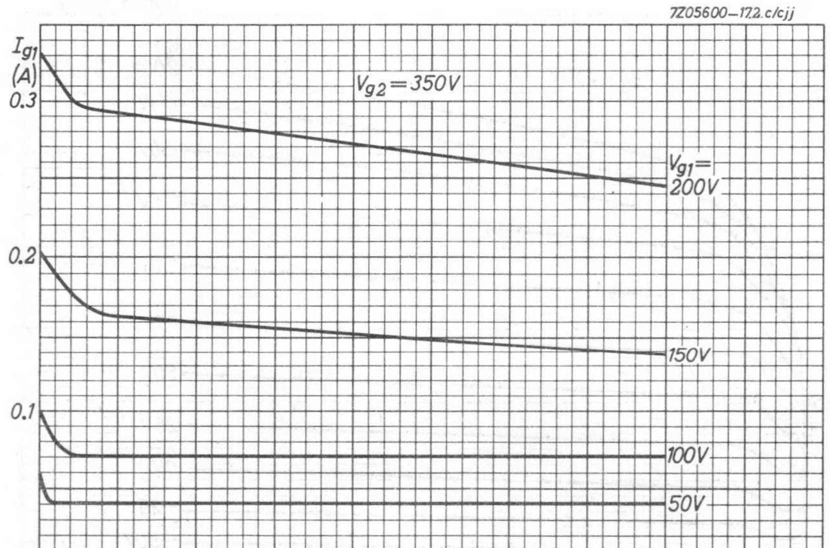

7Z05595—17.2.c/cjj
I_a (A)
1.5
1
0.5
0
V_{g1}=200V
175V
150V
125V
100V
75V
50V
25V
0V
—25V
—50V
—75V
—100V
V_{g2}=600V
0
1
2
3
4
V_a (kV)
5

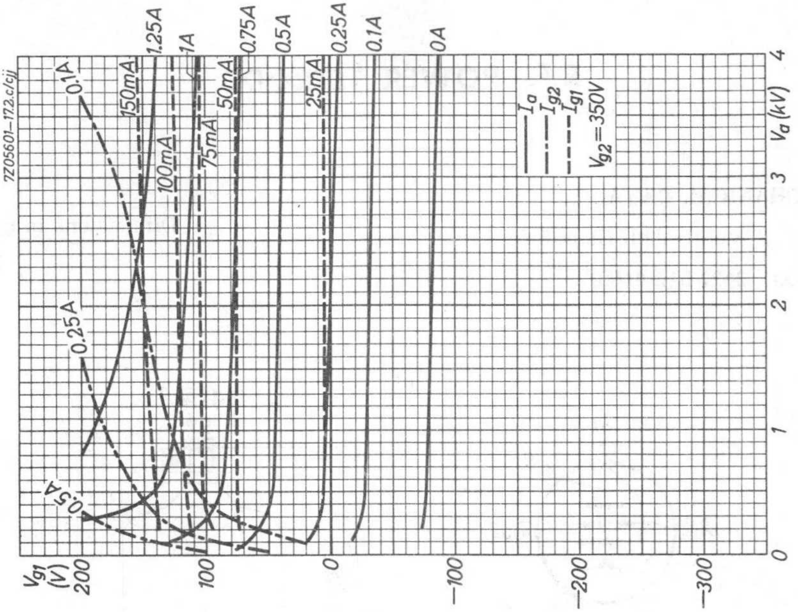

7Z05596—17.2.c/cjj
I_{g2} (A)
1.5
1
0.5
0
V_{g2}=600V
V_{g1}=
200V
150V
100V
50V
0V
—50V
0
1
2
3
4
V_a (kV)
5

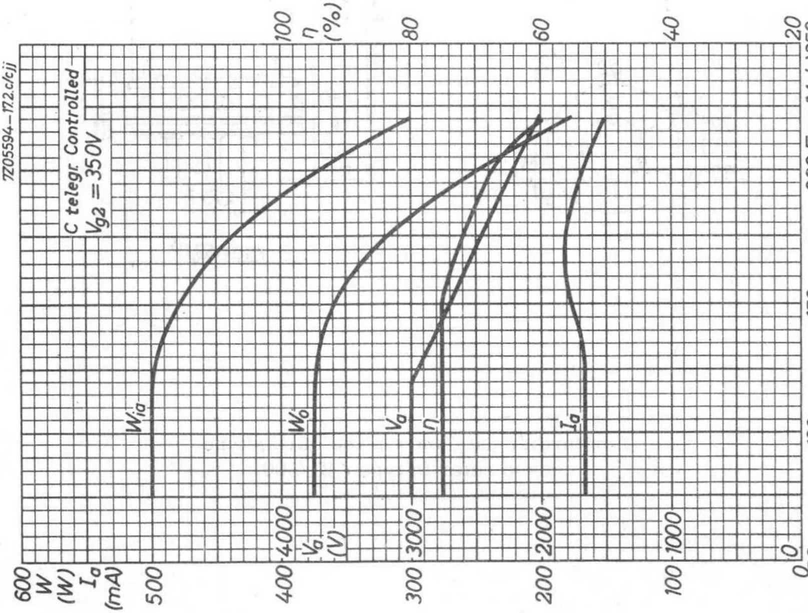

7Z05597–17.2.c/cjj
I_{g1} (mA)
150
100
50
0
$V_{g2} = 600V$
$V_{g1} =$ 200V
150V
100V
50V
0
1
2
3
4
V_a (kV)
5


7Z05598–17.2.c/cjj
I_a (A)
1.5
1
0.5
0
$V_{g2} = 350V$
$V_{g1} =$ 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
0
1
2
3
4
V_a (kV)
5


7Z05599—17.2.c/cjj
I_{g2} (A)
1.5
1
0.5
0
V_{g2} = 350 V
V_{g1} = 200 V
150 V
100 V
0 V
50 V
0
1
2
3
4
V_a (kV)
5


7Z05600—17.2.c/cjj
I_{g1} (A)
0.3
0.2
0.1
0
V_{g2} = 350 V
V_{g1} = 200 V
150 V
100 V
50 V
0
1
2
3
4
V_a (kV)
5


7Z05601-17.2.c/cjj
0.1A
150mA
1.25A
100mA
1A
75mA
50mA
0.75A
0.5A
25mA
0.25A
0.1A
0A
0.25A
0.5A
I_a
I_{g2}
I_{g1}
V_{g2}=350V
V_a (kV)
V_{g1} (V)


7Z05594-17.2.c/cjj
C telegr. Controlled
V_{g2} = 350V
W_{ia}
W_o
V_a
η
I_a
W (W)
I_a (mA)
V_a (V)
η (%)
Freq (Mc/s)

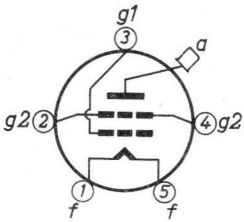
R.F. POWER TETRODE

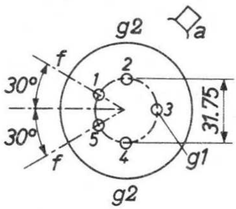
MECHANICAL DATA

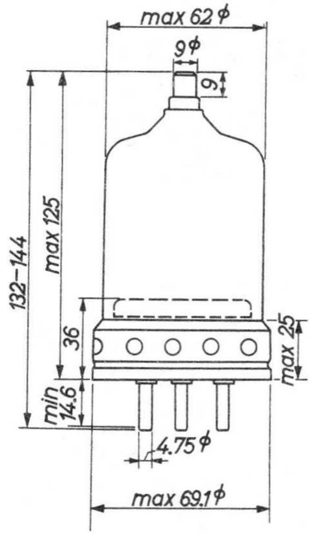
Dimensions in mm

Base : Metal-shell Giant 5p

Socket: 2422 512 01001







For further data and curves of this type
please refer to type QB3/300

R.F. POWER TETRODE

QUICK REFERENCE DATA										
λ	Freq.	C telegr.		B teleph.		C_{ag_2} mod.		B mod. [1]	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (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_{g_1}	=	12.7	pF
Anode to grid No.1	C_{ag_1}	=	0.12	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.1	
Mutual conductance	$S\,(I_a = 100\,\text{mA})$	=	4	mA/V

[1]) 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

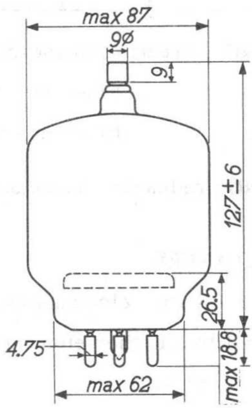
In order to keep the temperatures below the maximum permitted values a low-velocity air flow has to be directed to the anode seal and the bottom of the envelope

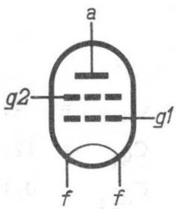
In order to prevent overheating of the screen-grid pins by high-frequency current it is recommended to include both screen-grid socket connections in the circuit

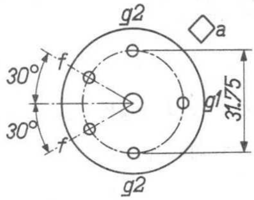
MECHANICAL DATA

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

7Z2 8788

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_{g_2}	=		max. 600		V
Grid No.2 dissipation	W_{g2}	=		max. 35		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 500		V
Grid No.1 current	I_{g_1}	=		max. 20		mA

OPERATING CONDITIONS

Frequency	f	=	75	75	75	MHz
Anode voltage	V_a	=	4000	3000	2500	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	−225	−180	−150	V
Anode current	I_a	=	312	345	300	mA
Grid No.2 current	I_{g_2}	=	45	60	60	mA
Grid No.1 current	I_{g_1}	=	9	10	9	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	303	265	220	V
Grid No.1 input power	W_{ig_1}	=	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	η	=	80	77	77	%

7Z2 2781

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_{g_2}	=		max. 600		V
Grid No.2 dissipation	W_{g_2}	=		max. 23		W

OPERATING CONDITIONS

Frequency	f	=	75	75	75	MHz
Anode voltage	V_a	=	4000	3000	2500	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	-100	-90	-84	V
Anode current	I_a	=	94	125	150	mA
Grid No.2 current	I_{g_2}	=	0	0	0	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	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	η	=	33.5	33	33	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	I_{g_1}	=	0.5	2	5.5	mA
Grid No.1 input power	W_{ig_1}	=	0.06	0.25	0.75	W
Grid No.2 dissipation	W_{g_2}	=	4	3.8	6	W

7Z2 2782

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_{g_2}	=		max. 600		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. 20		mA

OPERATING CONDITIONS

Frequency	f	=	75	75	MHz
Anode voltage	V_a	=	3000	2500	V
Grid No.2 voltage	V_{g_2}	=	400	400	V
Grid No.1 voltage	V_{g_1}	=	−310	−200	V
Anode current	I_a	=	225	200	mA
Grid No.2 current	I_{g_2}	=	30	30	mA
Grid No.1 current	I_{g_1}	=	9	9	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	400	280	V
Grid No.1 input power	W_{ig_1}	=	3.3	2.3	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	75.5	75	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	350	350	V
Modulation power	W_{mod}	=	344	256	W

7Z2 2783

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_{a_p}	= max.	275	W [1]
Anode dissipation	W_a	= max.	250	W
(Averaging time	T_{av}	= max.	5	sec)
Grid No.2 voltage	V_{g_2}	= max.	600	V
Grid No.2 dissipation	W_{g_2}	= max.	35	W
Grid No.1 circuit resistance	R_{g_1}	= max.	250	kΩ

OPERATING CONDITIONS

f	=	30		30		30		30		30		30	MHz
V_a	=	4		3.5		4		3.5		3		2.5	kV
V_{g_1}	=	-105		-110		-105		-98		-94		-91	V
V_{g_2}	=	550		600		500		500		500		500	V
$V_{g_{1p}}$	=	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_{g_1}	=	0	0	0	0	0	0	0	0	0	0	0	0 mA
I_{g_2}	=	0	9	0	12	0	8	0	9	0	10	0	10.5 mA
W_{ig_1}	=	0	0	0	0	0	0	0	0	0	0	0	0 W
W_{g_2}	=	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
η	=	–	69	–	67	–	70	–	69	–	68	–	66 %

[1]) Max. value during a modulation cycle.

7Z2 2784

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[1]	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	kΩ

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
$R_{aa\sim}$	=	14		9.2		6.6		4.55		kΩ
$V_{g_1g_{1p}}$	=	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	%
η	=	–	75	–	73	–	70	–	63.5	%

[1]) V_{g_2} = max. 1000 V, when the temperature of the pin seals is max. 120 °C

7Z2 2785

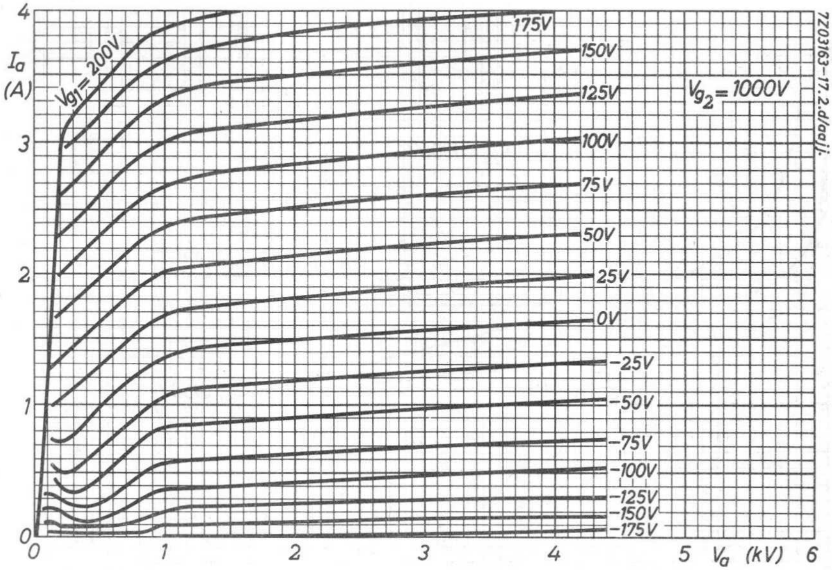
A.F. CLASS B AMPLIFIER OR MODULATOR

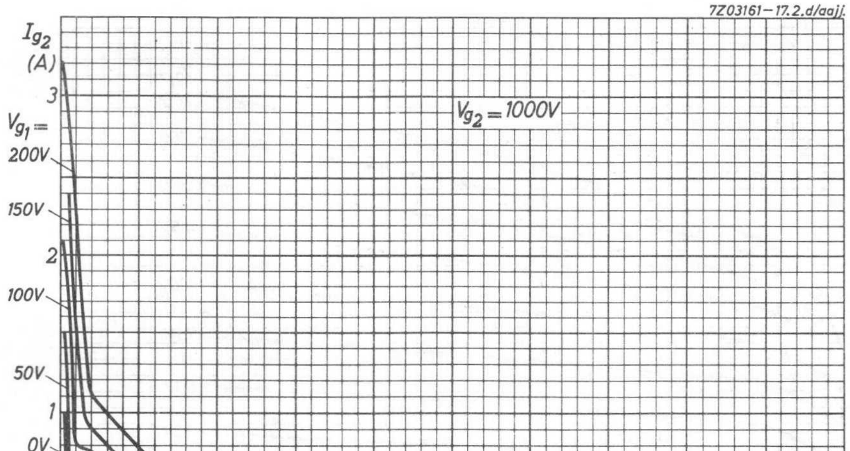
LIMITING VALUES. See page 7.

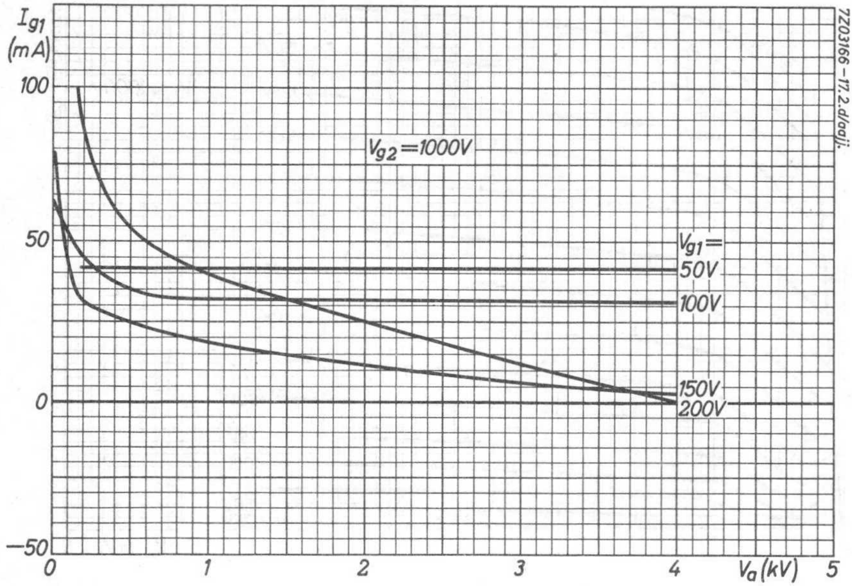
OPERATING CONDITIONS, two tubes. $I_{g_1} = 0$

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		kΩ
$V_{g_1g_1p}$	=	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	%
η	=	–	68	–	66	–	65	–	60	%

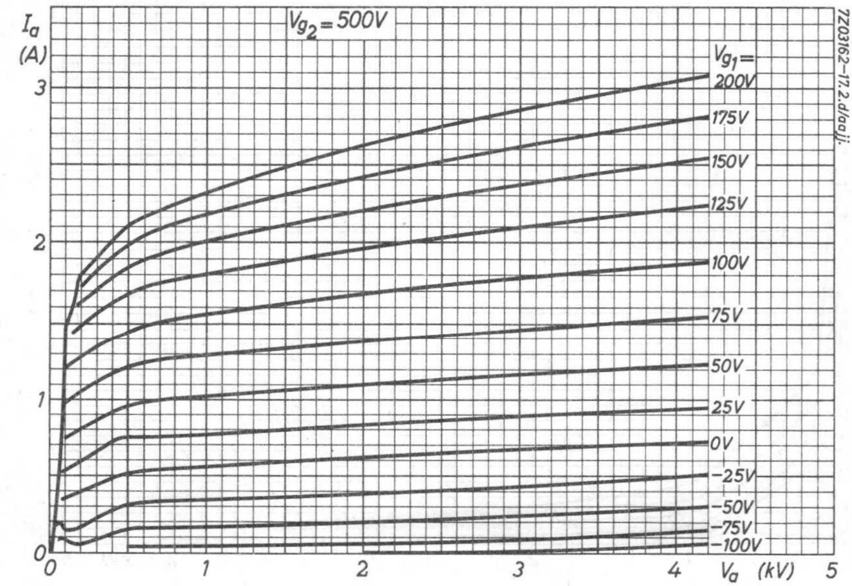
7Z2 2786


7Z03163-17.2.d/aaj.
I_a (A)
V_{g_1} = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
V_{g_2} = 1000V
V_a (kV)
0
1
2
3
4
5
6

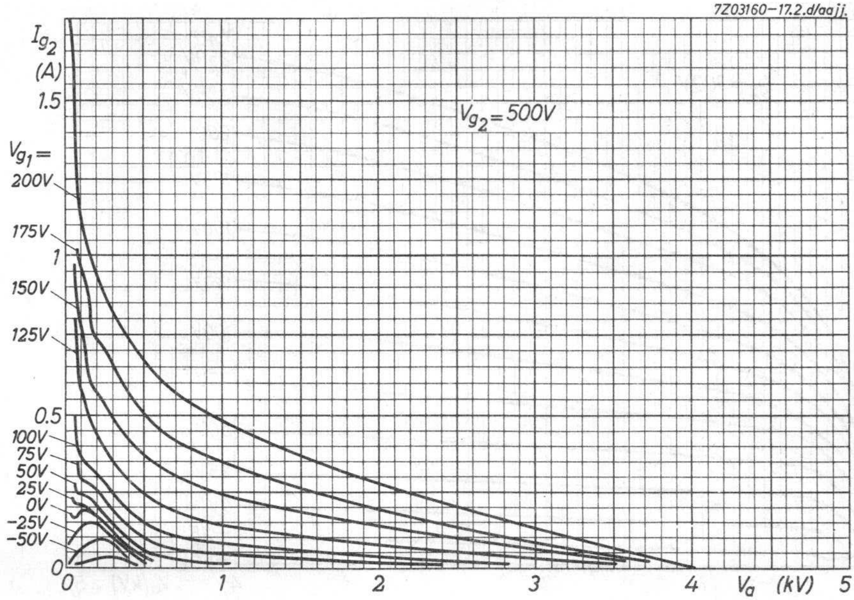

7Z03161-17.2.d/aaj.
I_{g_2} (A)
V_{g_2} = 1000V
V_{g_1} =
200V
150V
100V
50V
0V
−50V
−100V
−150V
V_a (kV)
0
1
2
3
4
5

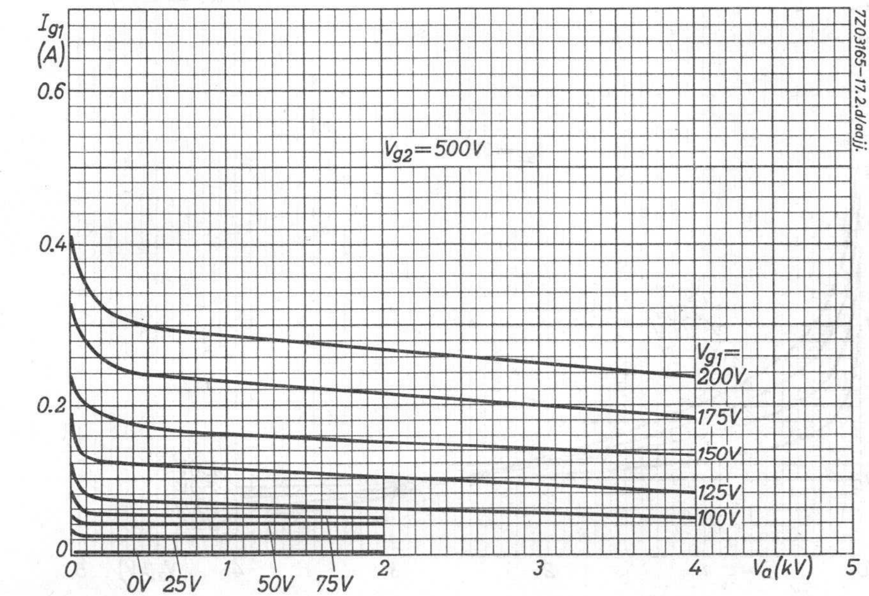


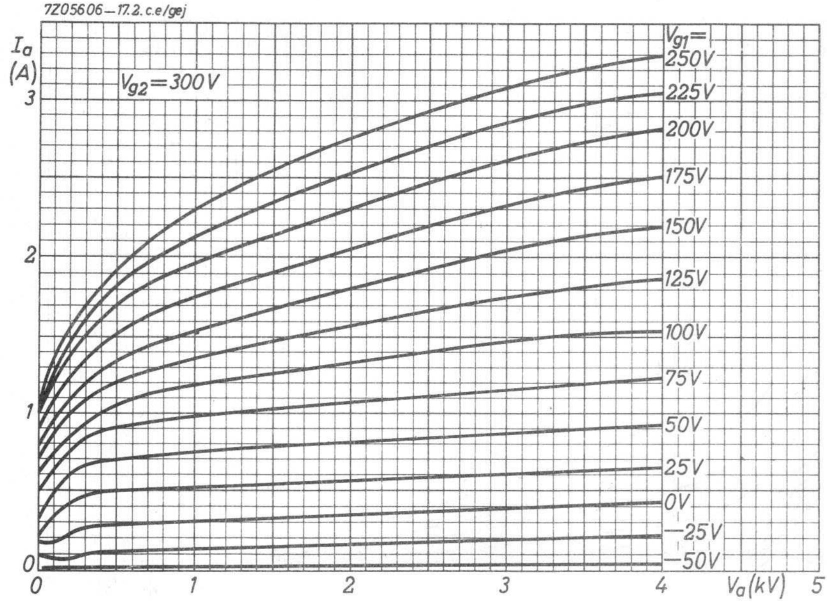
I_{g1}
(mA)
100
50
0
−50
V_{g2}=1000V
V_{g1}=
50V
100V
150V
200V
0
1
2
3
4
V_a (kV)
5
7Z03166−17.2.d/aaj.

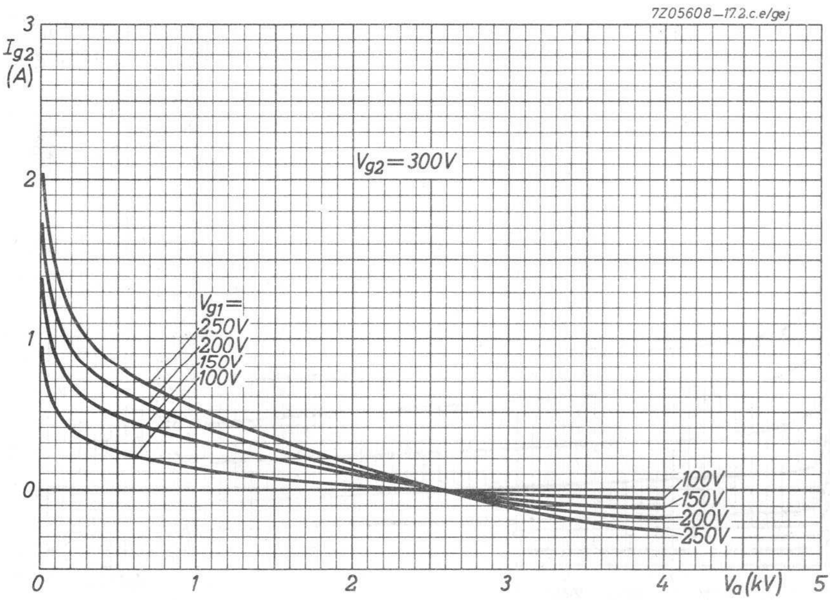


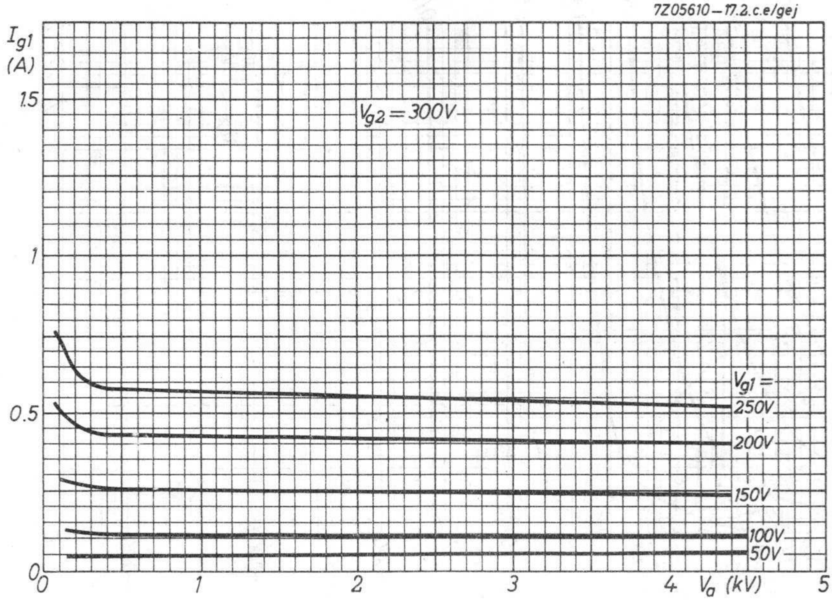
I_a
(A)
3
2
1
0
V_{g2}=500V
V_{g1}=
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
0
1
2
3
4
V_a (kV)
5
7Z03162−17.2.d/aaj.

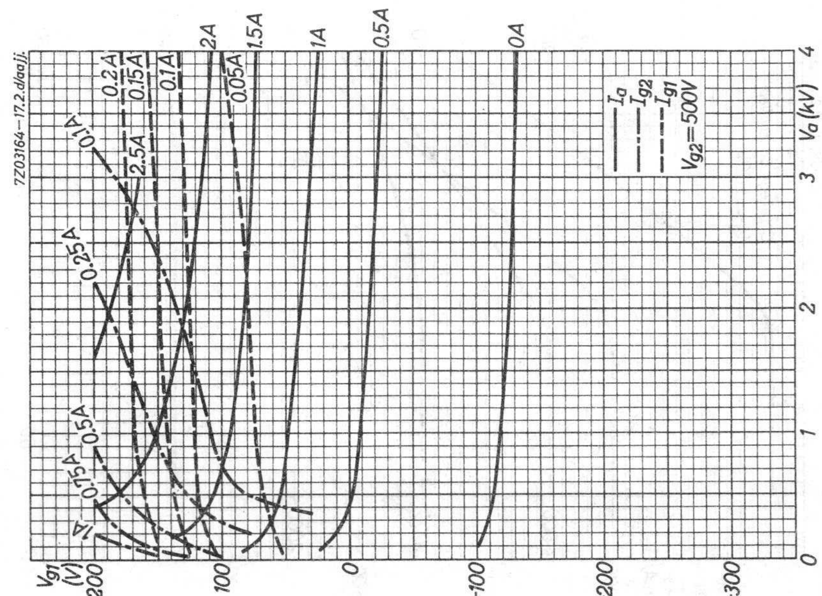

7Z03160-17.2.d/aajj.
I_{g_2} (A)
1.5
1
0.5
0
V_{g_2}=500V
V_{g_1}=
200V
175V
150V
125V
100V
75V
50V
25V
0V
-25V
-50V
0
1
2
3
4
5
V_a (kV)

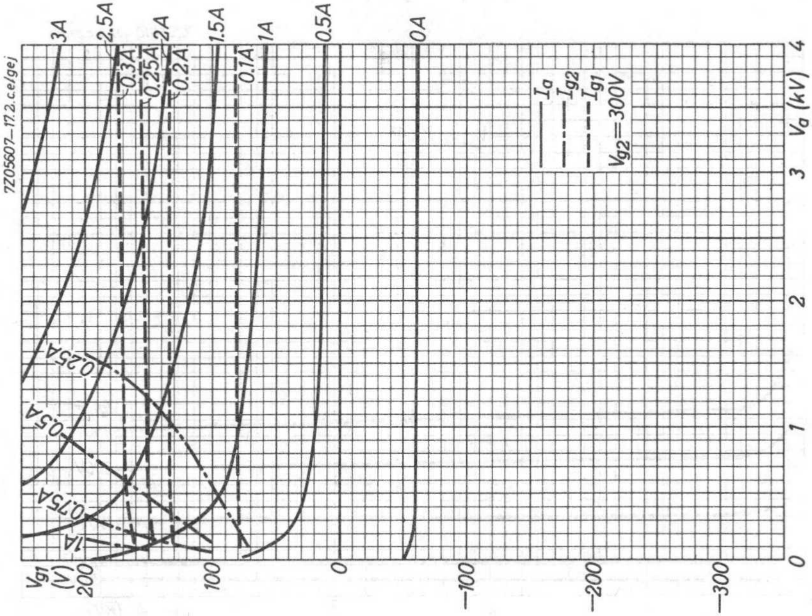

7Z03165-17.2.d/aajj.
I_{g_1} (A)
0.6
0.4
0.2
0
V_{g_2}=500V
V_{g_1}=
200V
175V
150V
125V
100V
0V
25V
50V
75V
0
1
2
3
4
5
V_a(kV)

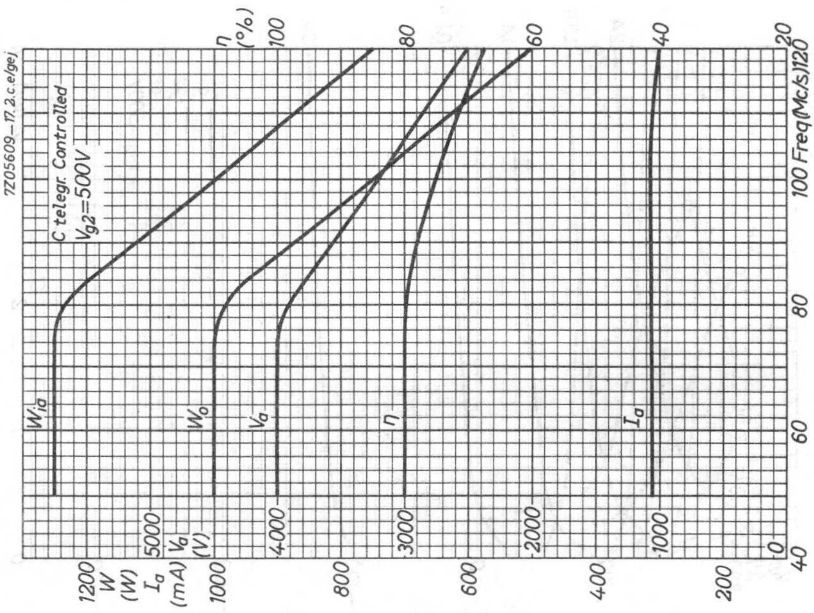

7Z05606—17.2.c.e/gej
I_a
(A)
V_{g2}=300V
V_{g1}=
250V
225V
200V
175V
150V
125V
100V
75V
50V
25V
0V
—25V
—50V
0
1
2
3
4
V_a(kV)
5


7Z05608—17.2.c.e/gej
I_{g2}
(A)
V_{g2}=300V
V_{g1}=
250V
200V
150V
100V
100V
150V
200V
250V
0
1
2
3
4
V_a(kV)
5


7Z05610-17.2.c.e/gej
I_{g1} (A)
1.5
1
0.5
0
V_{g2} = 300V
V_{g1} =
250V
200V
150V
100V
50V
0
1
2
3
4
5
V_a (kV)


7Z03164-17.2.d/aajj.
I_a
I_{g2}
I_{g1}
V_{g2}=500V
V_a (kV)
V_{g1} (V)
200
100
0
−100
−200
−300
0A
0.5A
1A
1.5A
2A
2.5A
0.05A
0.1A
0.15A
0.2A
0.25A
0.5A
0.75A
1A


7Z05607–17.2.c.e/gej
Vg1 (V)
200
100
0
−100
−200
−300
0
1
2
3
4
Va (kV)
3A
2.5A
2A
1.5A
1A
0.5A
0A
0.3A
0.25A
0.2A
0.1A
0.25A
0.5A
0.75A
1A
Ia
Ig2
Ig1
Vg2=300V


7Z05609–17.2.c.e/gej
C telegr. Controlled
Vg2=500V
Wia
Wo
Va
η
Ia
1200 W (W) Ia (mA)
1000
800
600
400
200
5000 Va (V)
4000
3000
2000
1000
0
η (%)
100
80
60
40
20
40
60
80
100
120
Freq (Mc/s)

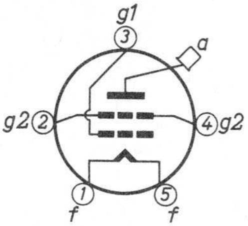
R.F. POWER TETRODE

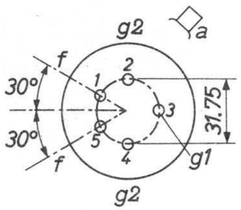
MECHANICAL DATA

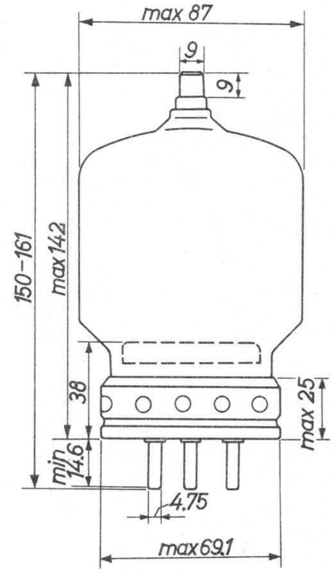
Dimensions in mm

Base : Metal-shell Giant 5p

Socket: 2422 512 01001







For further data and curves of this type
please refer to type QB3.5/750

R.F. POWER TETRODE

QUICK REFERENCE DATA

Freq. (MHz)	C telegr. V_a (V)	C telegr. W_o (W)	C_{ag_2} mod. V_a (V)	C_{ag_2} mod. W_o (W)	B S.S.B. V_a (V)	B S.S.B. W_o (W)
30			3650	765[1]		
75	4000	1100	3000	630		
	3000	800	2500	510		
	2500	640	2000	380		
100	4000	800				
	3500	650				
110					4000	650
					3500	600
					3000	500

B A.F. V_a (V)	W_o(W) [2] $I_{g_1} > 0$	W_o(W) [2] $I_{g_1} = 0$
4000	1750	1540
3500	1650	1330
3000	1375	1110
2500	1110	850

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f	= 5 V
Filament current	I_f	= 14.1 A

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	= 12.7 pF
Anode to all other elements except grid No.1	C_a	= 4.9 pF
Anode to grid No.1	C_{ag_1}	= 0.12 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	= 2500 V
Grid No.2 voltage	V_{g_2}	= 500 V
Anode current	I_a	= 100 mA
Mutual conductance	S	= 4.0 mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	= 5.1

1) Intermittent service, ICAS

2) Two tubes

COOLING: radiation and forced air

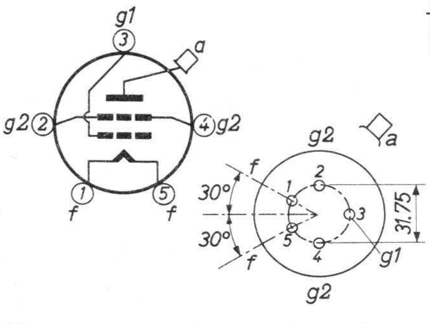
At anode dissipations up to 250 W a low velocity air flow directed on the anode seal and the base generally will provide sufficient cooling. At higher dissipations the glass chimney should be used for circulating forced air along the bulb. At 400 W anode dissipation at least 0.4 m^3/min air should be 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).

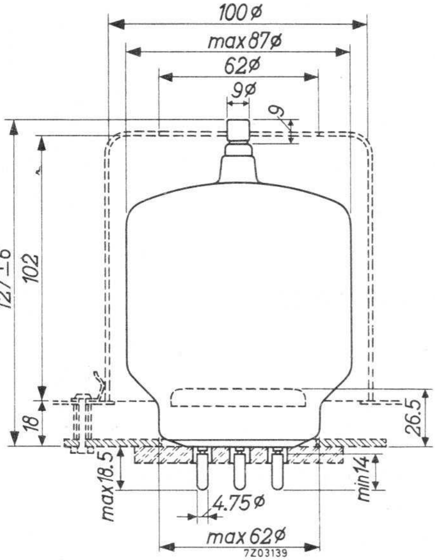
TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	= max.	350	^oC
Temperature of anode seal	= max.	220	^oC
Temperature of pin seals	= max.	180	^oC

MECHANICAL DATA Dimensions in mm

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





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_{g_2}	= max.	600	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.	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_{g_2}	=	500	500	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	−220	−220	−200	−170	−170	V
Anode current	I_a	=	350	350	350	270	250	mA
Grid No.2 current	I_{g_2}	=	25	30	35	16	17	mA
Grid No.1 current	I_{g_1}	=	6	6	6.5	9.5	9	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	305	305	290	240	235	V
Grid No.1 input power	W_{ig_1}	=	1.8	1.8	1.8	2	1.8	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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 %)

				CCS	ICAS	
Frequency	f		up to	75	30	MHz
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_{g_2}	=	max.	600	600	V
Grid No.2 dissipation	W_{g_2}	=	max.	35	35	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	500	V
Grid No.1 current	I_{g_1}	=	max.	25	25	mA

OPERATING CONDITIONS Grid No.2 modulated with transformer

			CCS			ICAS	
Frequency	f	=	75	75	75	30	MHz
Anode voltage	V_a	=	3000	2500	2000	3650	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	-220	-220	-220	-225	V
Anode current	I_a	=	275	275	275	275	mA
Grid No.2 current	I_{g_2}	=	36	38	40	30	mA
Grid No.1 current	I_{g_1}	=	6	6	6	6	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	305	308	305	308	V
Grid No.1 input power	W_{ig_1}	=	1.6	1.7	1.6	1.7	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	76	74	69	76.5	%
Modulation depth	m	=	100	100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	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_{g_2}	= max.	850	V
Grid No.2 dissipation	W_{g_2}	= max.	35	W

OPERATING CONDITIONS

			zero signal	single tone signal	double tone signal	
Frequency	f	=		60		MHz
Anode voltage	V_a	=		4000		V
Grid No.1 voltage	V_{g_1}	=		-130		V
Grid No.2 voltage	V_{g_2}	=		705		V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	130	-	V
Anode current	I_a	=	65	250	175	mA
Grid No.2 current	I_{g_2}	=	-	10	7	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Grid No.2 dissipation	W_{g_2}	=	-	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	η	=	-	65	46.5	%

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

OPERATING CONDITIONS (continued)

f	=		60			60		MHz
V_a	=		3500			3000		V
V_{g_1}	=		-135			-140		V
V_{g_2}	=		750			810		V
		zero signal	single tone signal	double tone signal	zero signal	single tone signal	double tone signal	
$V_{g_{1p}}$	=	0	135	-	0	140	-	V
I_a	=	75	280	200	90	300	215	mA
I_{g_2}	=	-	12	8.4	-	15	10.5	mA
I_{g_1}	=	0	0	0	0	0	0	mA
W_{g_2}	=	-	9	6.3	-	12.2	8.5	W
W_{ia}	=	263	980	700	270	900	645	W
W_a	=	263	380	400	270	400	395	W
W_o	=	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_a	= max.	4000	V
Anode dissipation	W_a	= max.	400	W
Anode current	I_a	= max.	350	mA
Grid No.2 voltage	V_{g_2}	= max.	800	V [1])
Grid No.2 dissipation	W_{g_2}	= max.	35	W
Grid No.1 current	I_{g_1}	= max.	25	mA

For Operating conditions please refer to pages 7 and 8

[1]) V_{g_2} = max. 1000 V if the pin seal temperature is kept below 120 °C

A.F. CLASS B AMPLIFIER (continued)

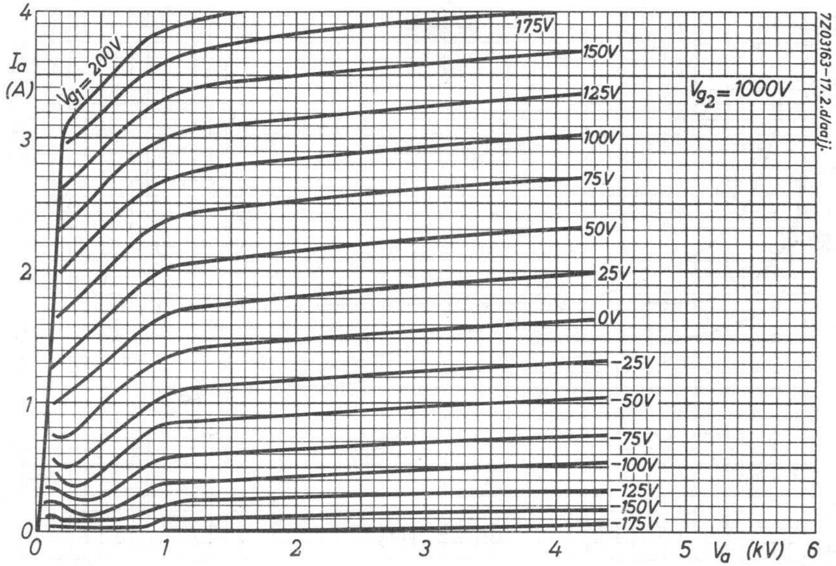
OPERATING CONDITIONS with grid current (two tubes)

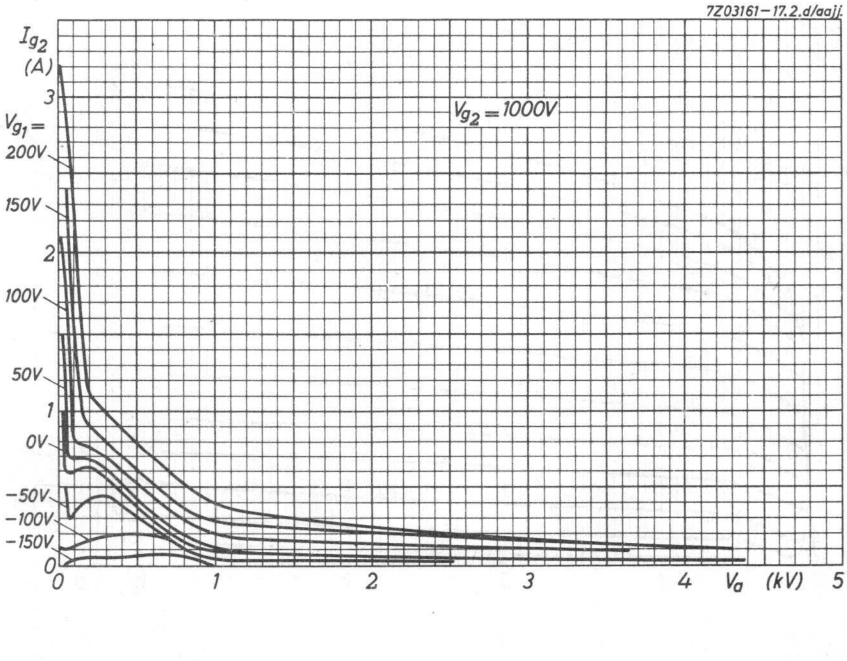
Anode voltage	V_a	=	4000		3500		3000		2500		V
Grid No.2 voltage	V_{g_2}	=	500		500		500		500		V
Grid No.1 voltage	V_{g_1}	=	-90		-85		-80		-75		V
Load resistance	$R_{aa\sim}$	=	15000		11300		10000		8000		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	290	0	305	0	292	0	290	V
Anode current	I_a	=	2x80	2x319	2x80	2x350	2x90	2x350	2x95	2x350	mA
Grid No.2 current	I_{g_2}	=	-	2x20	-	2x20	-	2x20	-	2x30	mA
Grid No.1 current	I_{g_1}	=	0	2x6	0	2x6.5	0	2x6.5	0	2x7	mA
Grid No.2 dissipation	W_{g_2}	=	-	2x10	-	2x10	-	2x10	-	2x15	W
Grid No.1 input power	W_{ig_1}	=	0	2x0.8	0	2x0.9	0	2x0.85	0	2x0.91	W
Anode input power	W_{ia}	=	2x320	2x1275	2x280	2x1225	2x270	2x1050	2x238	2x875	W
Anode dissipation	W_a	=	2x320	2x400	2x280	2x400	2x270	2x362	2x238	2x320	W
Output power	W_o	=	0	1750	0	1650	0	1375	0	1110	W
Efficiency	η	=	-	68.5	-	67.5	-	65.5	-	63.5	%

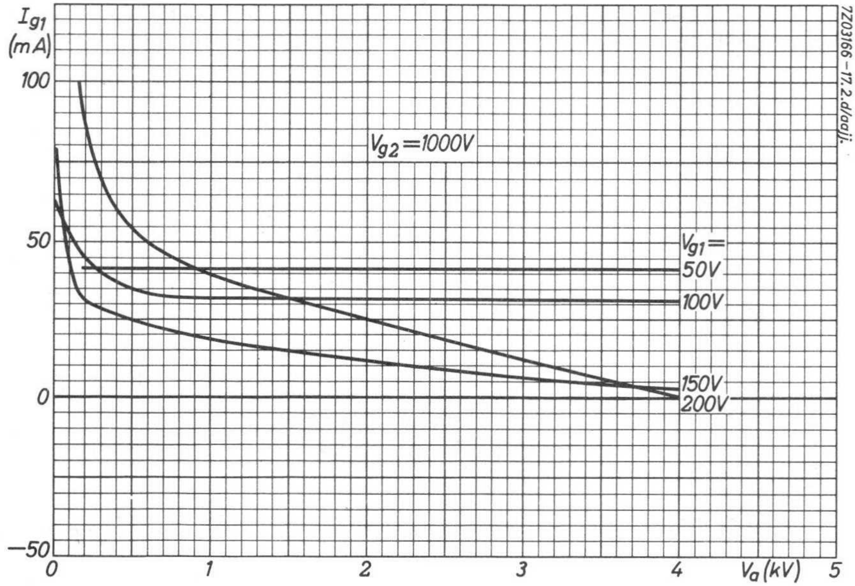
A.F. CLASS B AMPLIFIER (continued)

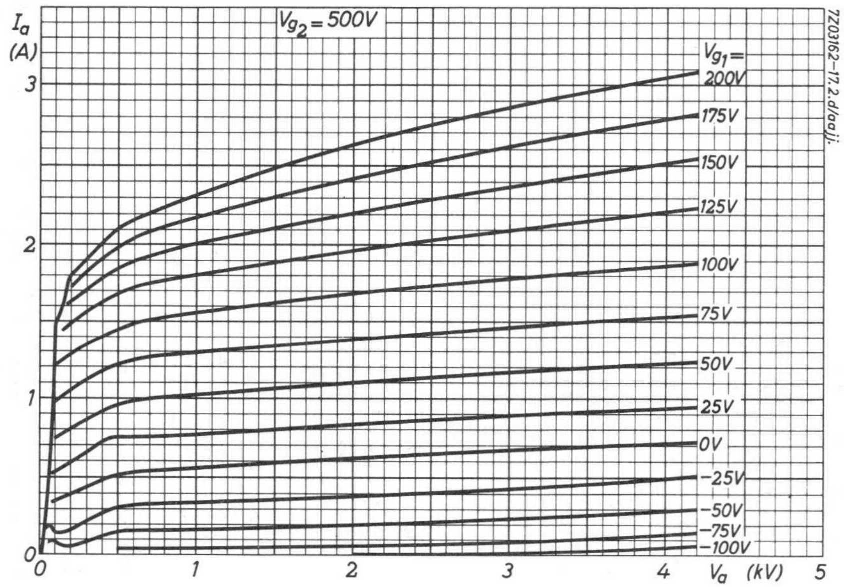
OPERATING CONDITIONS without grid current (two tubes)

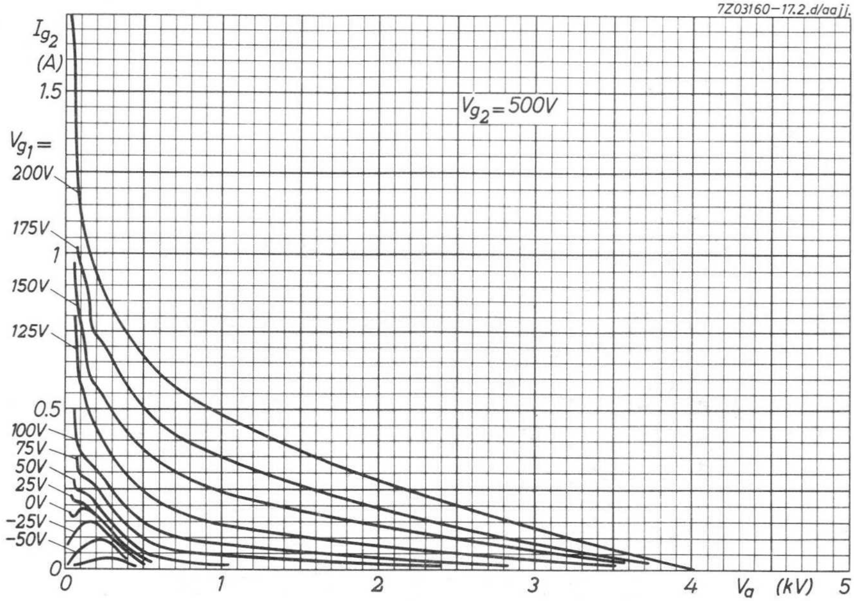
Anode voltage	V_a	=	4000		3500		3000		2500		V
Grid No.2 voltage	V_{g_2}	=	750		750		750		750		V
Grid No.1 voltage	V_{g_1}	=	-150		-145		-137		-130		V
Load resistance	$R_{aa\sim}$	=	14500		11500		8900		6800		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	300	0	290	0	274	0	260	V
Anode current	I_a	=	2x60	2x293	2x70	2x305	2x80	2x318	2x95	2x318	mA
Grid No.2 current	I_{g_2}	=	-	2x15	-	2x13.5	-	2x11	-	2x11.6	mA
Grid No.2 dissipation	W_{g_2}	=	-	2x11.2	-	2x10.4	-	2x10.3	-	2x8.7	W
Anode input power	W_{ia}	=	2x240	2x1170	2x245	2x1065	2x240	2x955	2x238	2x795	W
Anode dissipation	W_a	=	2x240	2x400	2x245	2x400	2x240	2x400	2x238	2x370	W
Output power	W_o	=	0	1540	0	1330	0	1110	0	850	W
Efficiency	η	=	-	66	-	62.5	-	58	-	53.5	%

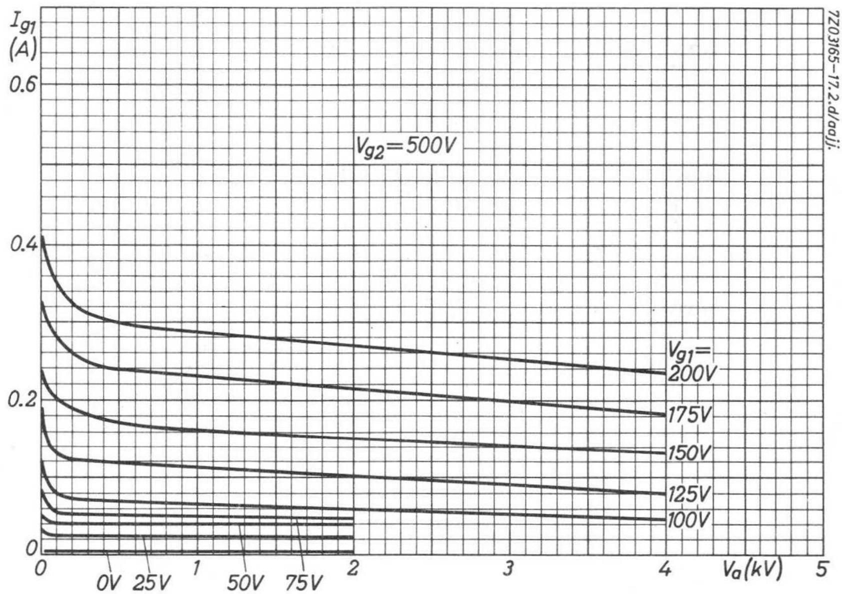

4
I_a
(A)
3
2
1
0
V_{g_1} = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
V_{g_2} = 1000V
7Z03163−17.2.d/aajj.
0
1
2
3
4
5
V_a (kV)
6

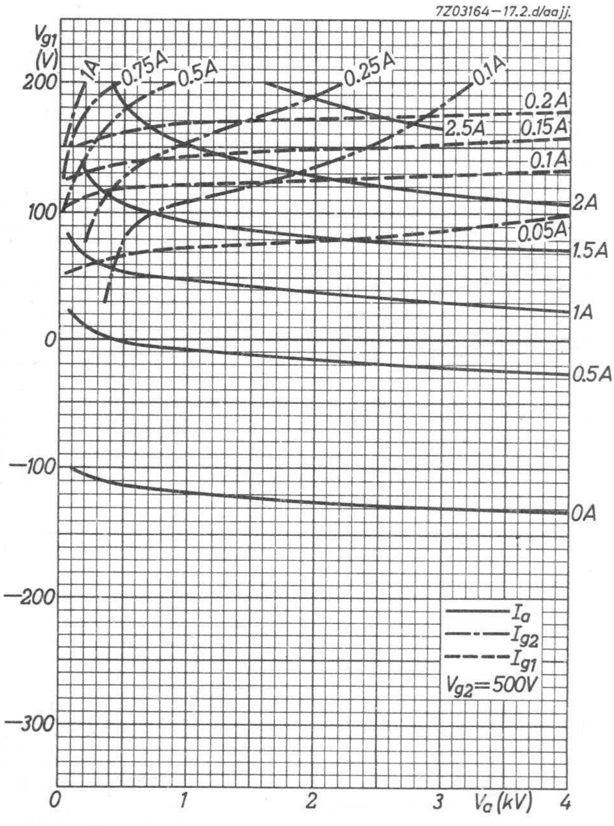

7Z03161−17.2.d/aajj.
I_{g_2}
(A)
3
2
1
0
V_{g_1} =
200V
150V
100V
50V
0V
−50V
−100V
−150V
V_{g_2} = 1000V
0
1
2
3
4
V_a (kV)
5


I_{g1} (mA)
100
50
0
−50
V_{g2}=1000V
V_{g1}=
50V
100V
150V
200V
0
1
2
3
4
V_a (kV)
5
7Z03166-17.2.d/aaJj.


I_a (A)
3
2
1
0
V_{g2}=500V
V_{g1}=
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
0
1
2
3
4
V_a (kV)
5
7Z03162-17.2.d/aaJj.


7Z03160–17.2.d/aajj.
I_{g_2} (A)
1.5
1
0.5
0
V_{g_2}=500V
V_{g_1}=
200V
175V
150V
125V
100V
75V
50V
25V
0V
–25V
–50V
0
1
2
3
4
V_a (kV)
5


7Z03165–17.2.d/aajj.
I_{g_1} (A)
0.6
0.4
0.2
0
V_{g_2}=500V
V_{g_1}=
200V
175V
150V
125V
100V
0V
25V
50V
75V
0
1
2
3
4
V_a(kV)
5


7Z03164-17.2.d/aajj.
V_{g1} (V)
200
100
0
-100
-200
-300
0
1
2
3
V_a (kV)
4
1A
0.75A
0.5A
0.25A
0.1A
0.2A
2.5A
0.15A
0.1A
2A
0.05A
1.5A
1A
0.5A
0A
I_a
I_{g2}
I_{g1}
V_{g2}=500V

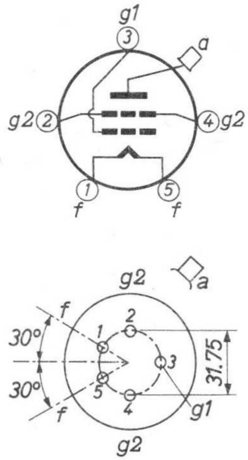
R.F. POWER TETRODE

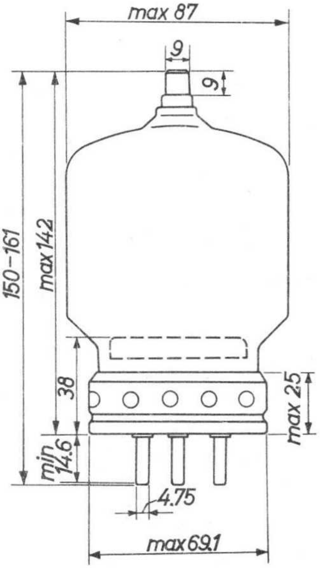
MECHANICAL DATA

Base : Metal-shell Giant 5p

Socket: 2422 512 01001

Dimensions in mm





For further data and curves of this type
please refer to type QB4/1100

R.F. POWER TETRODE

QUICK REFERENCE DATA

For communication

λ	Freq.	C telegr.		C_{ag_2} mod		C_{g_1} 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

λ	Freq.	B single side band		B_{mod} 1)	
(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

λ	Freq.	2)		3)	
(m)	(MHz)	V_{tr} (V_{RMS})	W_o (W)	V_{tr} (V_{RMS}) 4)	W_o (W)
5	60	4800	750	4250	1110

HEATING direct; thoriated tungsten filament

Filament voltage	V_f	=	10	V
Filament current	I_f	=	9.9	A

TYPICAL CHARACTERISTICS at I_a = 120 mA

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	9.5	
Mutual conductance	S	=	7	mA/V

1) Two tubes
2) = selfrectification
3) = two phase half wave rectification without filter
4) Each phase

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	24	pF
Anode to all other elements except grid No.1	C_a	=	8.3	pF
Anode to grid No.1	C_{ag_1}	=	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

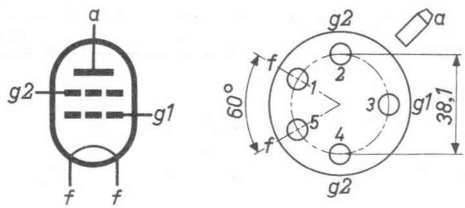
TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max.	250	$^{\circ}C$
Temperature of anode seal	=	max.	220	$^{\circ}C$
Temperature of pin seals	=	max.	180	$^{\circ}C$

MECHANICAL DATA

Dimensions in mm

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



Mounting position: vertical with base up or down

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R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 110[1])	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_{g_2}	=	max. 700		V
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

OPERATING CONDITIONS

Frequency	f	$\leqq$	60	60	60	60	MHz
Anode voltage	V_a	=	5	5	4	4	kV
Grid No.2 voltage	V_{g_2}	=	600	700	600	700	V
Grid No.1 voltage	V_{g_1}	=	−200	−200	−200	−200	V
Anode current	I_a	=	440	440	450	450	mA
Grid No.2 current	I_{g_2}	=	80	75	90	85	mA
Grid No.1 current	I_{g_1}	=	35	25	39	27	mA
Peak grid No.1 voltage	V_{g_1p}	=	350	340	350	340	V
Anode input power	W_{ia}	=	2200	2200	1800	1800	W
Grid No.1 input power	W_{ig_1}	=	12	8	14	8.5	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	80	80	78	78	%

[1]) See page F

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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_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	50	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 dissipation	W_{g_1}	=	max.	25	W

OPERATING CONDITIONS

Frequency	f	$\leqq$	60	MHz
Anode voltage	V_a	=	4	kV
Grid No.2 voltage	V_{g_2}	=	600	V
Grid No.1 voltage	V_{g_1}	=	-240	V
Peak grid No.2 voltage	$V_{g_2 p}$	=	340	V
Peak grid No.1 voltage	$V_{g_1 p}$	=	415	V
Anode current	I_a	=	380	mA
Grid No.2 current	I_{g_2}	=	80	mA
Grid No.1 current	I_{g_1}	=	20	mA
Anode input power	W_{ia}	=	1520	W
Grid No.1 input power	W_{ig_1}	=	7.5	W
Grid No.2 dissipation	W_{g_2}	=	48	W
Anode dissipation	W_a	=	320	W
Output power	W_o	=	1200	W
Efficiency	η	=	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_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	50	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V

OPERATING CONDITIONS

Frequency	f	$\leqq$	60	60	MHz
Anode voltage	V_a	=	4500	4000	V
Grid No.2 voltage	V_{g_2}	=	600	600	V
Grid No.1 voltage [1]	V_{g_1}	=	−180	−180	V
Grid No.1 circuit resistance	R_{g_1}	=	1400	1400	Ω
Peak grid No.1 voltage	$V_{g_1 p}$	=	220	210	V
Anode current	I_a	=	200	200	mA
Grid No.2 current	I_{g_2}	=	5	5	mA
Grid No.1 current	I_{g_1}	=	6.5	6.5	mA
Grid No.1 input power	W_{ig_1}	=	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_{g_2}	=	3	3	W
Output power	W_o	=	400	330	W
Efficiency	η	=	44.5	41	%
Modulation factor	m	=	100	100	%
Peak grid No.1 modulation voltage	$V_{g_1 \, mod_p}$	=	100	100	V
Grid No.1 current [2]	I_{g_1}	=	26	27	mA
Grid No.1 input power [2]	W_{ig_1}	=	5	5	W

1) With −170 V from fixed bias supply included
2) 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_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	65	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ

OPERATING CONDITIONS

Frequency	f	$\leq$	30		MHz
Anode voltage	V_a	=	5000		V
Grid No.2 voltage	V_{g_2}	=	700		V
Grid No.1 voltage	V_{g_1}	=	−90		V
			zero signal	single tone signal	
Peak grid No.1 voltage	$V_{g_1 p}$	=	0	130	V
Anode current	I_a	=	56	280	mA
Grid No.2 current	I_{g_2}	=	0	25	mA
Grid No.1 current	I_{g_1}	=	0	1	mA
Grid No.1 input power	W_{ig_1}	=	0	1	W
Anode input power	W_{ia}	=	280	1400	W
Anode dissipation	W_a	=	280	500	W
Grid No.2 dissipation	W_{g_2}	=	0	18	W
Output power	W_o	=	0	900	W
Efficiency	η	=	–	64.5	%

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode transformer voltage [1]	$V_{tr\,a}$	=	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 [1]	$V_{tr\,g_2}$	=	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 [2]

Frequency	f	$\leq$	60	MHz
Anode transformer voltage [1]	$V_{tr\,a}$	=	4800	V(RMS)
Grid No.2 transformer voltage [1]	$V_{tr\,g_2}$	=	670	V(RMS)
Grid No.1 resistor	R_{g_1}	=	16	kΩ
Peak grid No.1 voltage	V_{g_1p}	=	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	η	=	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.

7Z2 8798

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 [1]	$V_{tr\,a}$	=	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 [1]	$V_{tr\,g_2}$	=	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 [2]

Frequency	f	≤	60	MHz
Anode transformer voltage [1]	$V_{tr\,a}$	=	4250	V(RMS)
Anode voltage D.C. value	V_a	=	3825	V
Grid No.2 transformer voltage [1]	$V_{tr\,g_2}$	=	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	η	=	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.

7Z2 8799

A.F. CLASS B AMPLIFIER AND MODULATOR

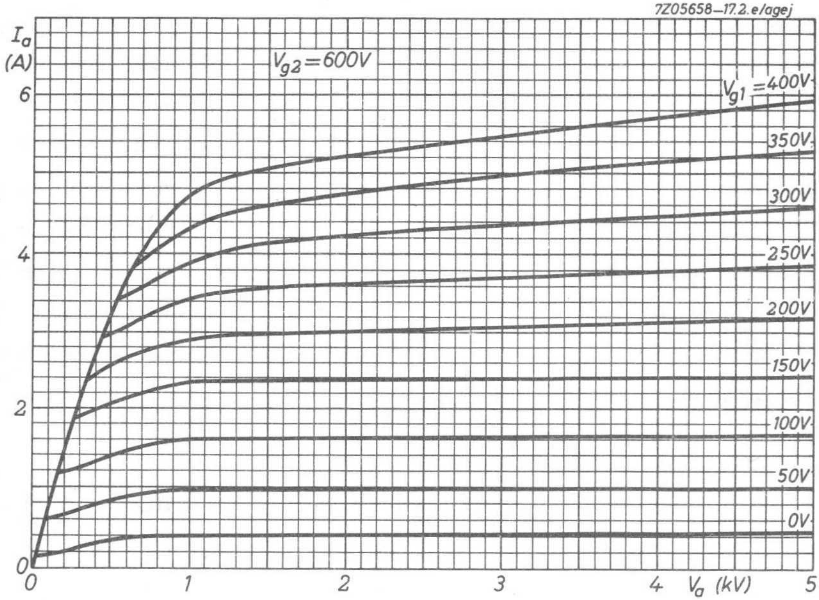
LIMITING VALUES (Absolute limits)

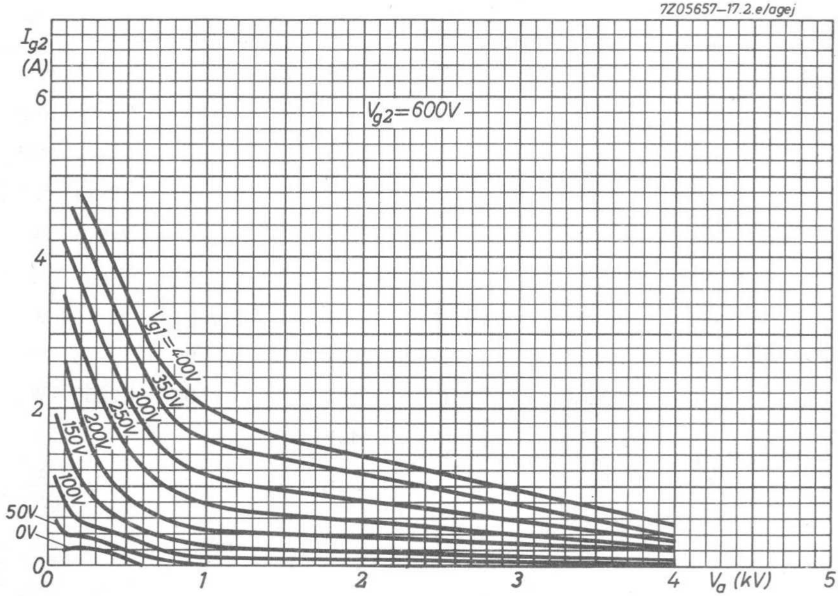
Anode voltage	V_a	=	max.	5000	V
Anode input power	W_{ia}	=	max.	2250	W
Anode dissipation	W_a	=	max.	500	W
Anode current	I_a	=	max.	450	mA
Grid No.2 voltage	V_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	65	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 current	I_{g_1}	=	max.	45	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ

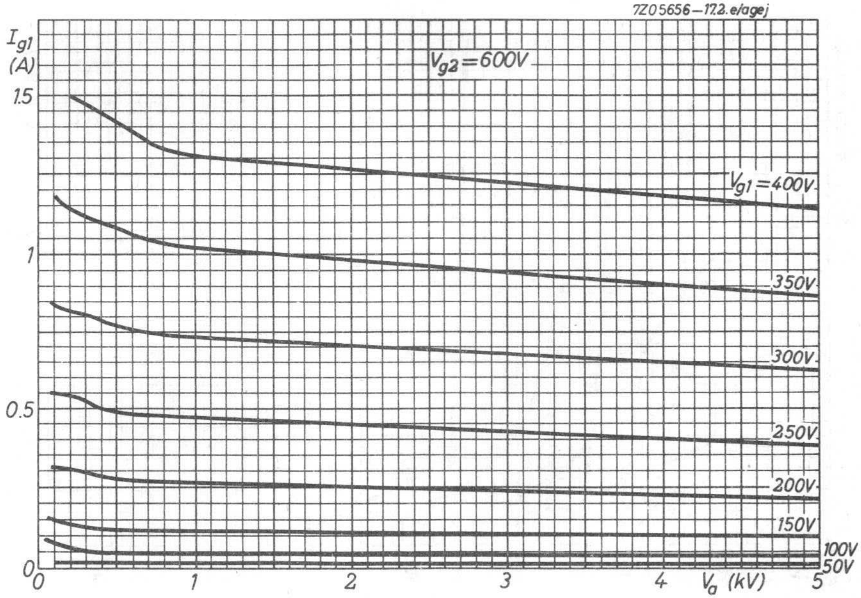
OPERATING CONDITIONS, two tubes

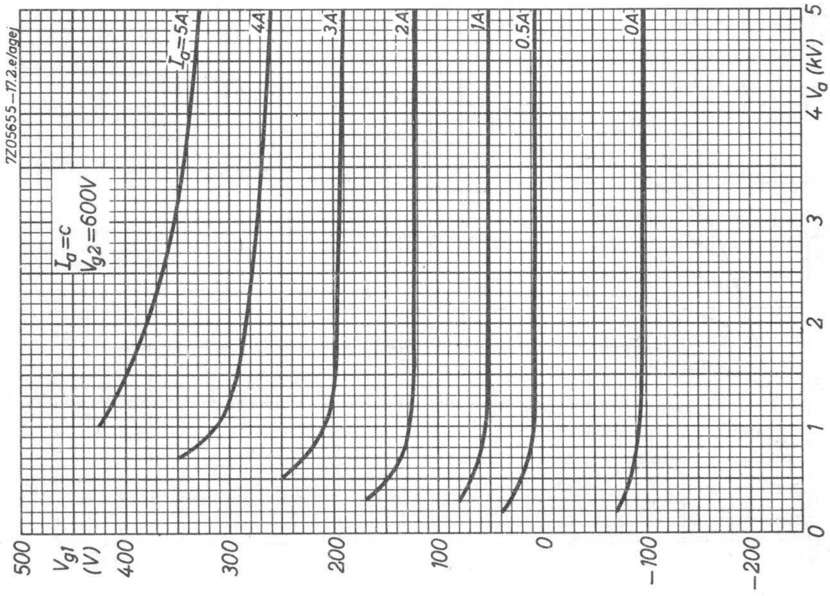
V_a	=	5000		4000		4000		V
V_{g_2}	=	600		600		600		V
V_{g_1}	=	-62.5		-62.5		-60		V
$R_{aa\sim}$	=	26		20		16		kΩ
$V_{g_1g_1p}$	=	0	260	0	254	0	305	V
I_a	=	2x50	2x290	2x45	2x285	2x55	2x366	mA
I_{g_2}	=	0	2x43	0	2x40	0	2x60	mA
I_{g_1}	=	0	2x13	0	2x13.5	0	2x18	mA
W_{ig_1}	=	0	2x1.5	0	2x1.5	0	2x2.5	W
W_{ia}	=	2x250	2x1450	2x180	2x1140	2x220	2x1465	W
W_a	=	2x250	2x340	2x180	2x300	2x220	2x340	W
W_{g_2}	=	0	2x26	0	2x24	0	2x36	W
W_o	=	0	2220	0	1680	0	2250	W
d_{tot}	=	-	5	-	4.7	-	5	%
η	=	-	76.5	-	74	-	76.5	%

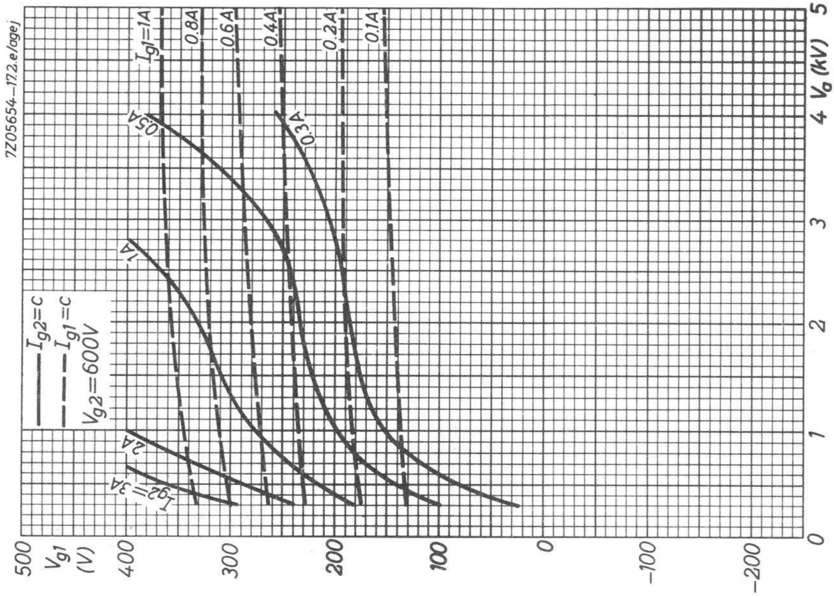
7Z2 2845

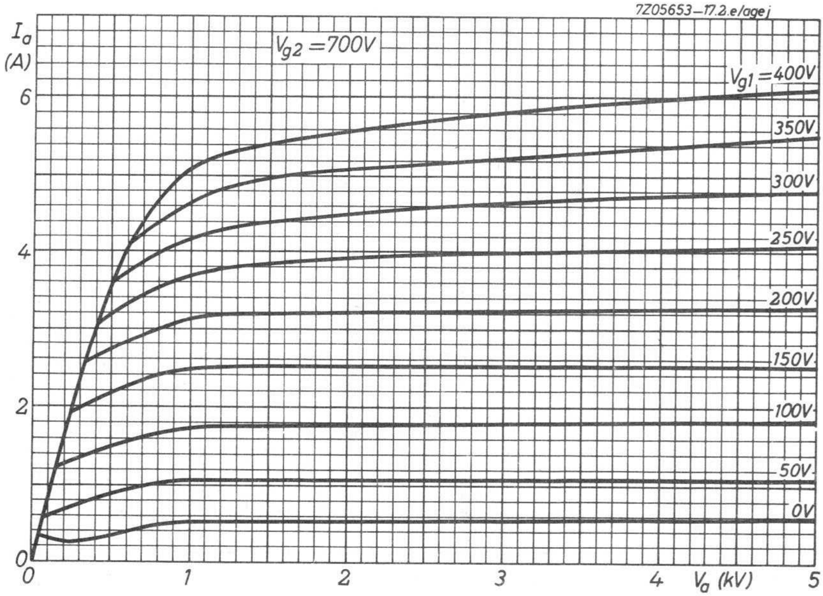

7Z05658—17.2.e/agej
I_a (A)
$V_{g2}=600V$
$V_{g1}=400V$
350V
300V
250V
200V
150V
100V
50V
0V
V_a (kV)
0
1
2
3
4
5
6

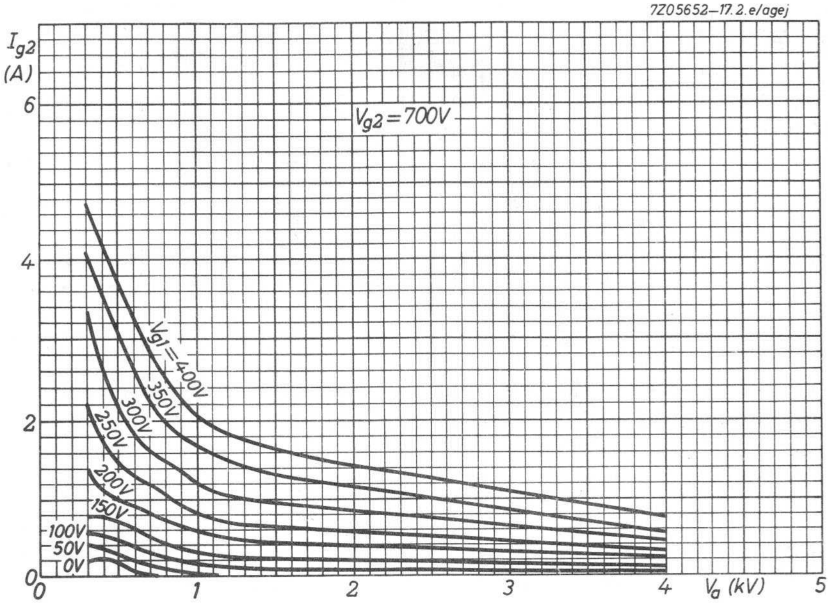

7Z05657—17.2.e/agej
I_{g2} (A)
$V_{g2}=600V$
$V_{g1}=400V$
350V
300V
250V
200V
150V
100V
50V
0V
V_a (kV)
0
1
2
3
4
5
6

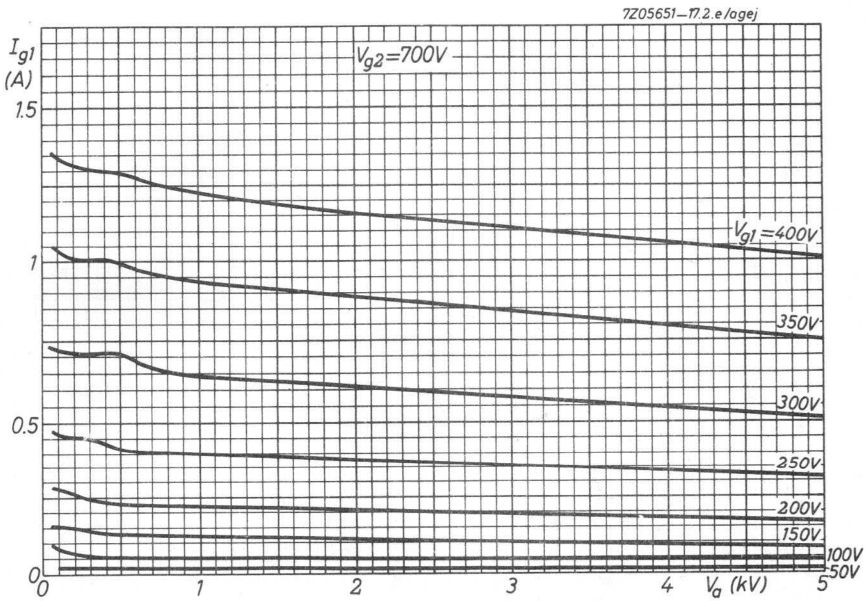

7Z05656-17.2.e/agej
I_{g1}
(A)
1.5
1
0.5
0
$V_{g2}=600V$
$V_{g1}=400V$
350V
300V
250V
200V
150V
100V
50V
0
1
2
3
4
5
V_a (kV)

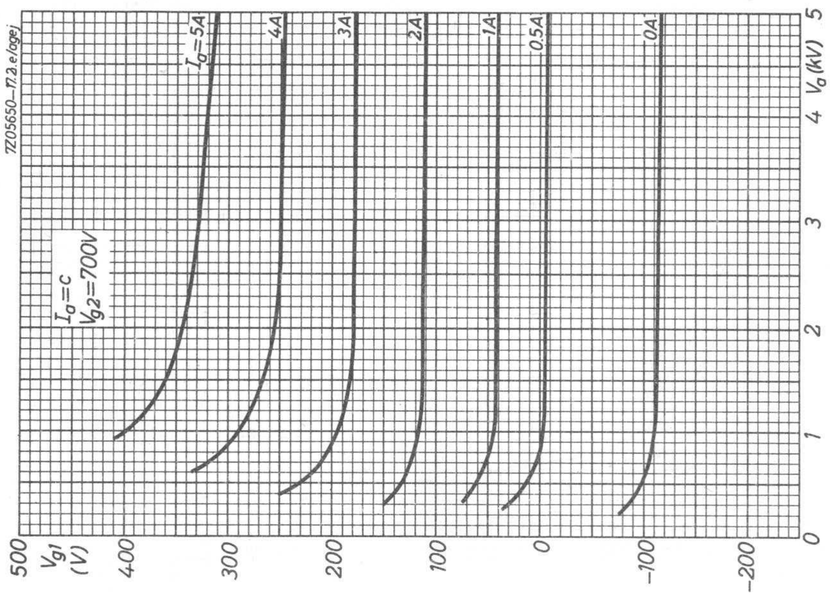

7Z05655-17.2.e/agej
$I_a=5A$
4A
3A
2A
1A
0.5A
0A
$I_a=c$
$V_{g2}=600V$
500
V_{g1}
(V)
400
300
200
100
0
−100
−200
0
1
2
3
4 V_a (kV)
5

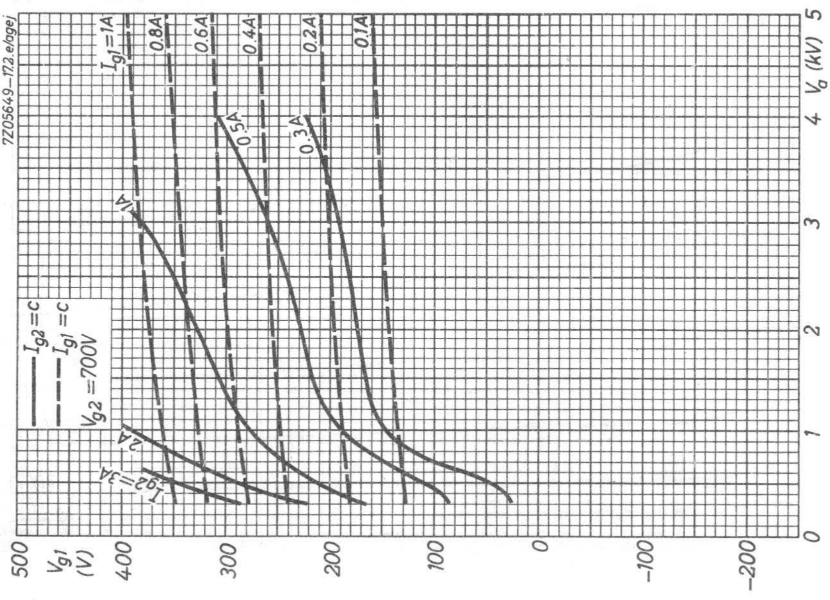

7Z05654–17.2.e/agej
I_{g1}=1A
0.8A
0.6A
0.4A
0.2A
0.1A
0.5A
0.3A
1A
2A
I_{g2}=3A
I_{g2}=c
I_{g1}=c
V_{g2}=600V
V_{g1} (V)
500
400
300
200
100
0
−100
−200
V_a (kV)
0
1
2
3
4
5

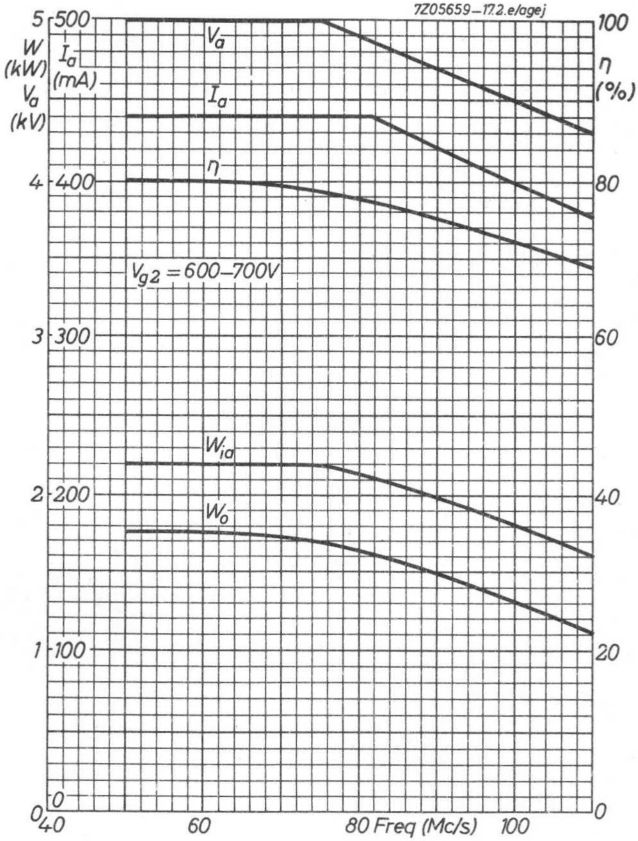

7Z05653–17.2.e/agej
I_a (A)
V_{g2} =700V
V_{g1}=400V
350V
300V
250V
200V
150V
100V
50V
0V
0
2
4
6
0
1
2
3
4
V_a (kV)
5


7Z05652–17.2.e/agej
I_{g2} (A)
6
4
2
0
$V_{g2}=700V$
$V_{g1}=400V$
350V
300V
250V
200V
150V
100V
50V
0V
0
1
2
3
4
V_a (kV)
5


7Z05651–17.2.e/agej
I_{g1} (A)
1.5
1
0.5
0
$V_{g2}=700V$
$V_{g1}=400V$
350V
300V
250V
200V
150V
100V
50V
0
1
2
3
4
V_a (kV)
5


7Z05650—17.2.e/agej
I_a=c
V_{g2}=700V
I_a=5A
4A
3A
2A
1A
0.5A
0A
V_{g1} (V)
V_a (kV)
500
400
300
200
100
0
−100
−200
0
1
2
3
4
5


7Z05649—17.2.e/agej
I_{g2}=c
I_{g1}=c
V_{g2}=700V
I_{g1}=1A
0.8A
0.6A
0.4A
0.2A
0.1A
1A
0.5A
0.3A
2A
I_{g2}=3A
V_{g1} (V)
V_a (kV)
500
400
300
200
100
0
−100
−200
0
1
2
3
4
5


7Z05659—17.2.e/agej
W
(kW)
Va
(kV)
Ia
(mA)
η
(%)
Va
Ia
η
Vg2 = 600–700V
Wia
Wo
5
4
3
2
1
0
500
400
300
200
100
0
100
80
60
40
20
0
40
60
80 Freq (Mc/s)
100

R.F. POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	C telegr.		B S.S.B.	
	V_a (V)	W_o (W)	V_a (V)	W_o (PEP) (W)
30	5000	2400	4000	1300

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f	=	7.5	V
Filament current	I_f	=	22.6	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_{g_1}	=	47.6	pF
Anode to all other elements except grid No.1	C_a	=	9.5	pF
Anode to grid No.1	C_{ag_1}	=	0.1	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4000	V
Grid No.2 voltage	V_{g_2}	=	600	V
Anode current	I_a	=	200	mA
Mutual conductance	S	=	10	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.1	

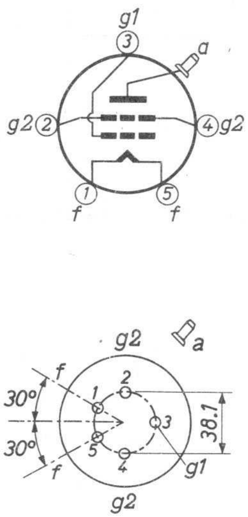
COOLING: radiation and convection; low velocity air flow

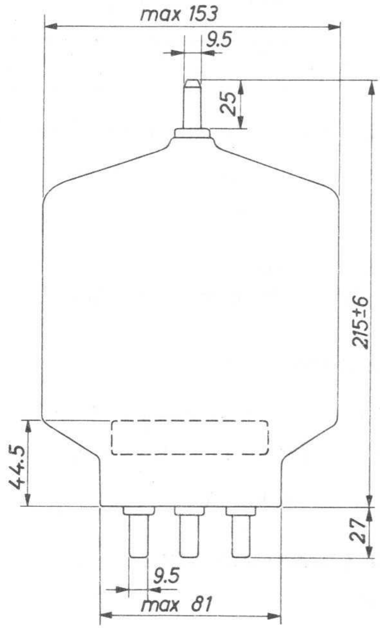
TEMPERATURE LIMITS (Absolute limits)

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	η	=	80	%

Page 4

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

2) Distortion levels with reference 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 %.

7Z2 2900

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

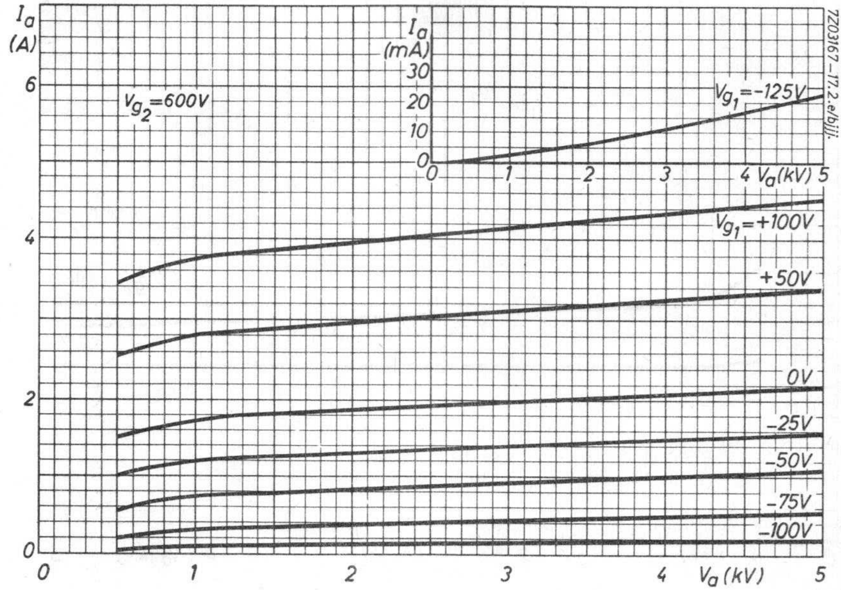
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	5.5	kV
Anode dissipation	W_a	=	max.	800	W
Anode input power	W_{ia}	=	max.	2.5	kW
Anode current	I_a	=	max.	600	mA
Grid No.2 voltage	V_{g_2}	=	max.	800	V
Grid No.2 dissipation	W_{g_2}	=	max.	120	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	20	kΩ

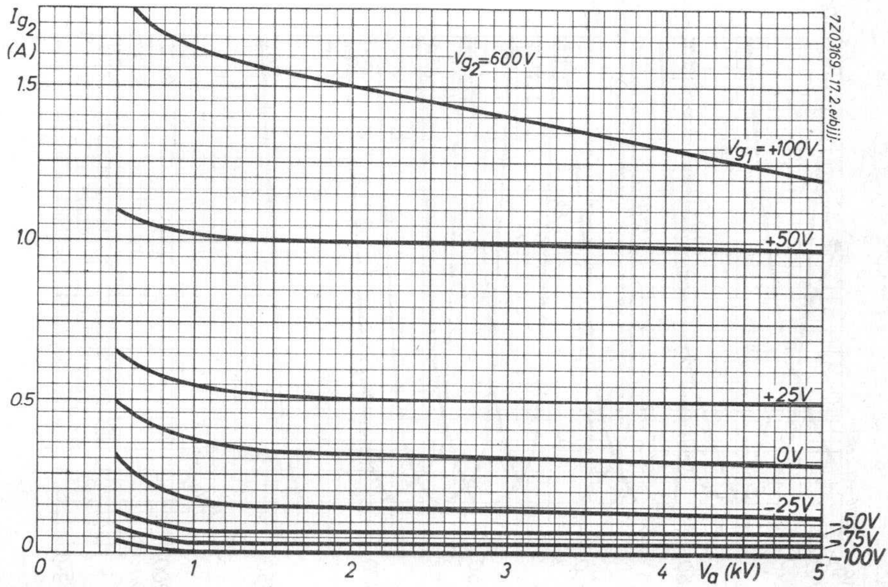
OPERATING CONDITIONS

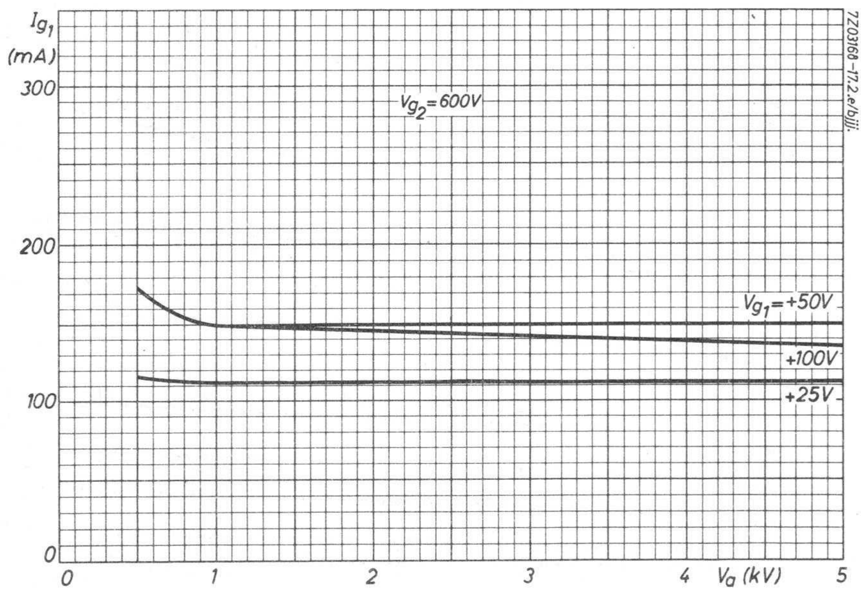
Frequency	f	=		30		MHz
Anode voltage	V_a	=		4		kV
Grid No.2 voltage	V_{g_2}	=		600		V
Grid No .1 voltage	V_{g_1}	=		-105		V 1)
			zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	V_{g1p}	=	0	100	100	V
Anode current	I_a	=	150	465	330	mA
Grid No.2 current	I_{g_2}	=	8	85	40	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Anode input power	W_{ia}	=	600	1860	1320	W
Grid No.2 dissipation	W_{g_2}	=	4.8	51	24	W
Anode dissipation	W_a	=	600	560	670	W
Output power	W_o	=	0	1300	650	W
Driving power	W_{dr}	=	0	0	0	W
Efficiency	η	=	–	69	49	%
Peak envelope power	$W_{o\,(PEP)}$	=			1300	W
Third harmonic distortion	d_3	=			<-35	dB 2)
Fifth harmonic distortion	d_5	=			<-40	dB 2)

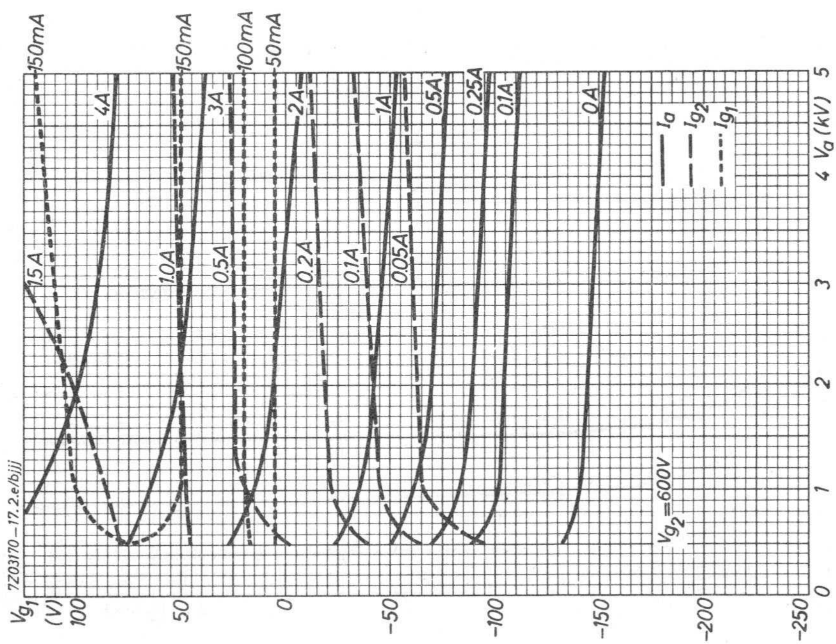
1)2) See page 3

7Z2 2901


Ia
(A)
6
4
2
0
V_{g_2}=600V
Ia
(mA)
30
20
10
0
V_{g_1}=-125V
0 1 2 3 4 Va(kV) 5
V_{g_1}=+100V
+50V
0V
-25V
-50V
-75V
-100V
0 1 2 3 4 Va (kV) 5
7Z03167-17.2.e/b/j.


Ig2
(A)
1.5
1.0
0.5
0
V_{g_2}=600V
V_{g_1}=+100V
+50V
+25V
0V
-25V
-50V
-75V
-100V
0 1 2 3 4 Va (kV) 5
7Z03169-17.2.e/b/j.


7Z03168-17.2.e/bijj.
I_{g_1} (mA)
300
200
100
0
V_{g_2}=600V
V_{g_1}=+50V
+100V
+25V
0
1
2
3
4
5
V_a (kV)


7Z03170-17.2.e/bijj
V_{g_2}=600V
I_a
I_{g_2}
I_{g_1}
V_a (kV)
V_{g_1} (V)
150mA
4A
1.5A
150mA
3A
1.0A
0.5A
100mA
50mA
2A
0.2A
0.2A
0.1A
1A
0.05A
0.5A
0.25A
0.1A
0A

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) [1]	V_{a-g_1} (kV)	W_o (W) [1]
790			2.5	210
800	4.31	2100		

Television service			
Freq. (MHz)	Neg. mod.	Pos. synchr.	
	V_{a-g_1} (kV)	W_o sync [1] (W)	W_o black [1] (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	$I_{f\,surge}$	=	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.

[1]) 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^3/min.)	Pressure p_i (mm H_2O)
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 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.

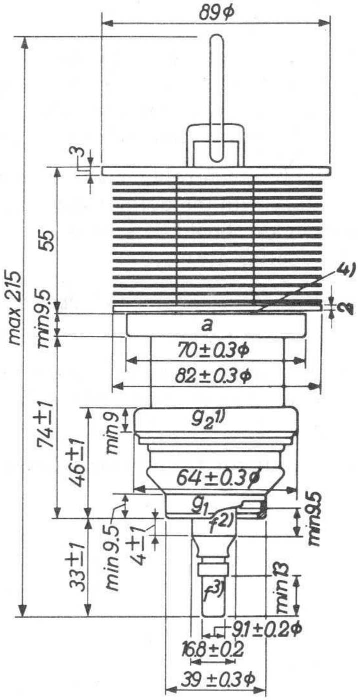
3) Peak envelope power. Typical value, measured in a circuit having an efficiency of about 85%.

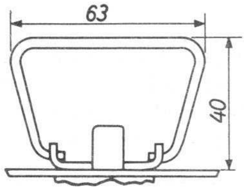
4) The intermodulation product in the passband of the output signal is measured with reference to 0 dB.

7Z2 2904

MECHANICAL DATA

Dimensions in mm





Net weight 1900 g

Mounting position: vertical with anode up or down

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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

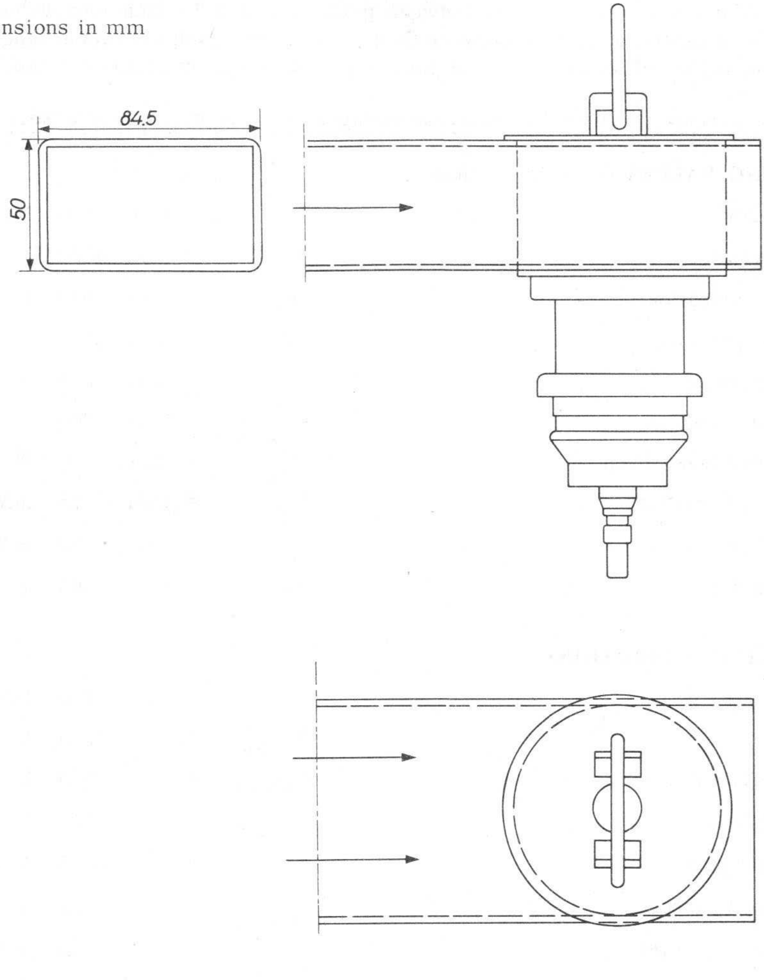
3) Eccentricity with respect to the axis through anode and grid No.1 max. 0.8 mm

4) Point for anode temperature measurement

7Z2 2905

Recommended anode cooling arrangement

Dimensions in mm



7Z2 2906

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_ℓ	=	2100	W [1]
Power gain	W_ℓ / W_{dr}	=	12	

[1] Typical value, measured in a circuit having an efficiency of approx. 85%.

7Z2 2907

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)

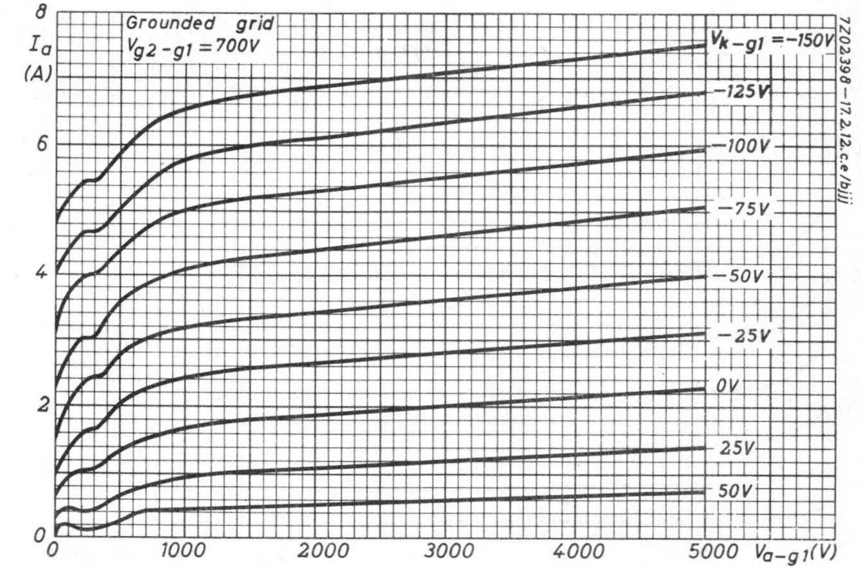
Frequency	f	up to	1000	MHz
Anode voltage	V_{a-g_1}	= max.	3000	V
Anode dissipation	W_a	= max.	1500	W
Anode input power	W_{ia}	= max.	1800	W
Anode current	I_a	= max.	800	mA
Grid No.2 voltage	$V_{g_2-g_1}$	= max.	700	V
Grid No.2 dissipation	W_{g_2}	= max.	50	W
Grid No.2 current	I_{g_2}	= max.	75	mA
Grid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

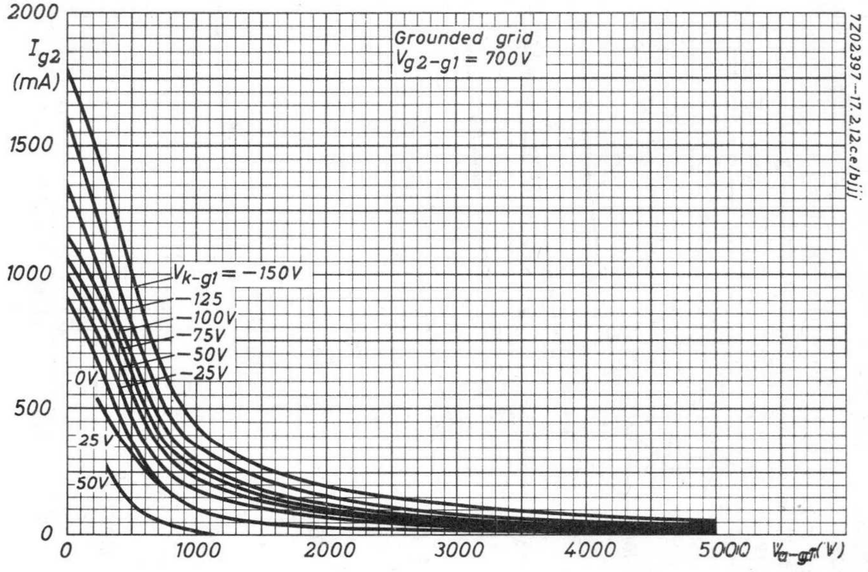
OPERATING CONDITIONS

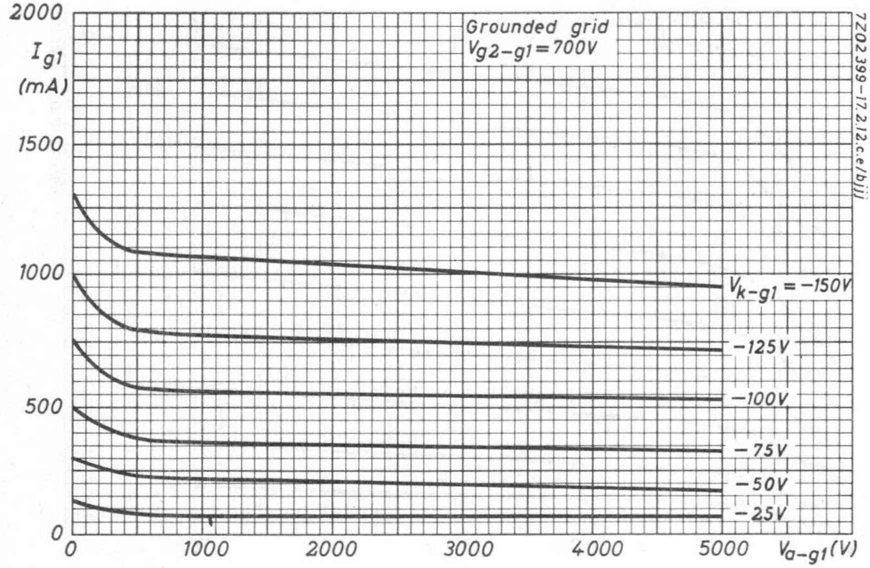
Frequency	f	=	790	MHz
Bandwidth at -1 dB	B	=	6	MHz
Anode voltage	V_{a-g_1}	=	2500	V
Grid No.2 voltage	$V_{g_2-g_1}$	=	500	V
Cathode voltage	V_{k-g_1}	=	28	V [1])
Anode current	I_a	=	580	mA
Grid No.2 current	I_{g_2}	=	5	mA
Grid No.1 current	I_{g_1}	=	0	mA
Driver output power	W_{dr}(PEP)	=	16	W [2])
Output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

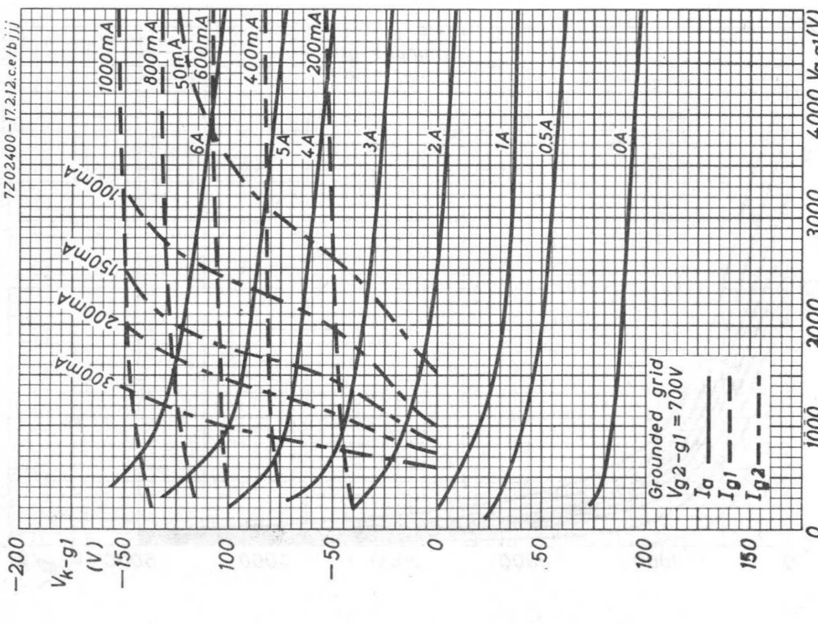
1)2)3)4) See page 3

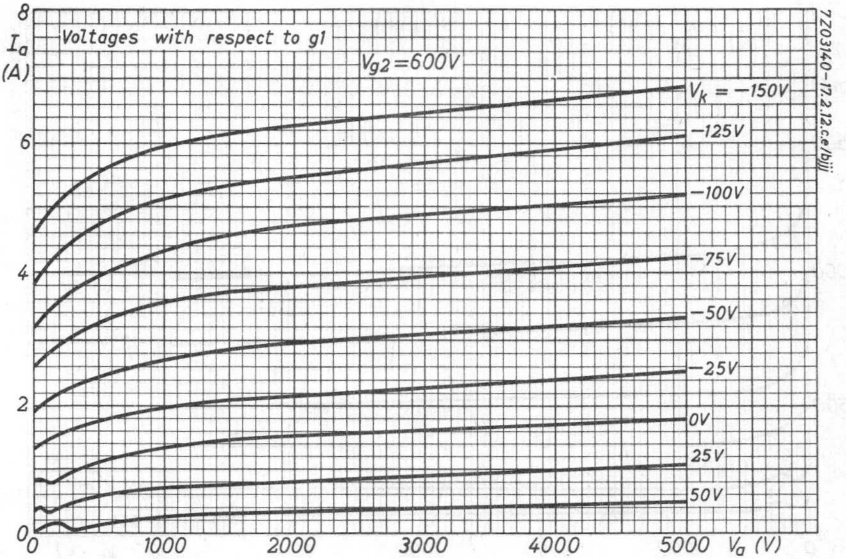
7Z2 2909

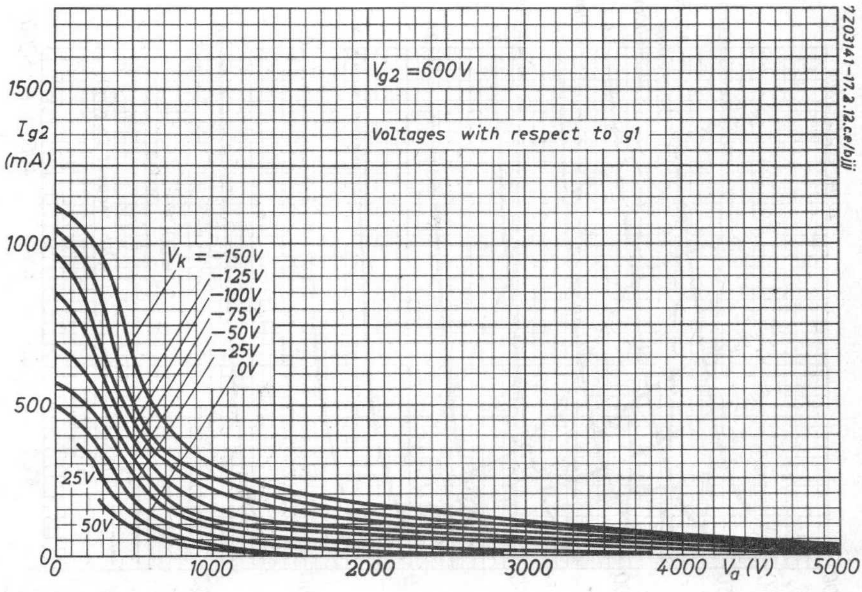

Grounded grid
$V_{g2-g1} = 700V$
I_a (A)
$V_{k-g1} = -150V$
−125V
−100V
−75V
−50V
−25V
0V
25V
50V
V_{a-g1} (V)
7Z02398−17.2.12.c.e/bjj

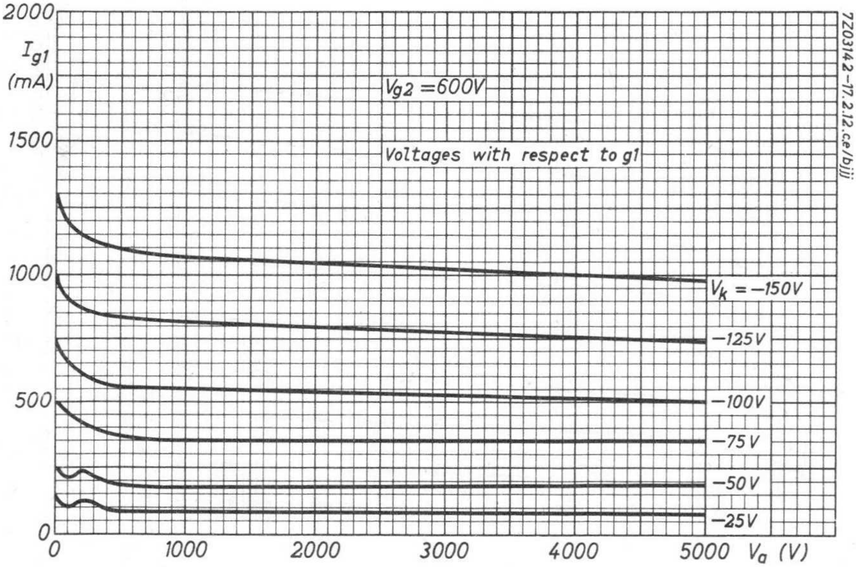

Grounded grid
$V_{g2-g1} = 700V$
I_{g2} (mA)
$V_{k-g1} = -150V$
−125
−100V
−75V
−50V
−25V
0V
25V
50V
7Z02397−17.2.12.c.e/bjj

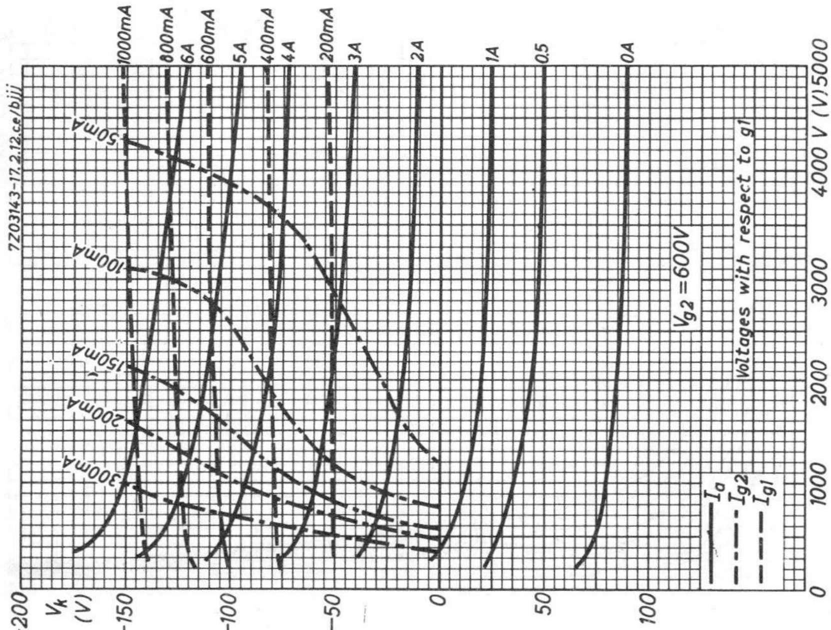

Grounded grid
$V_{g2-g1} = 700V$
7Z02399-17.2.12.c.e/bjjj
2000
1500
1000
500
0
I_{g1} (mA)
0
1000
2000
3000
4000
5000
V_{a-g1}(V)
$V_{k-g1} = -150V$
−125V
−100V
−75V
−50V
−25V


7Z02400-17.2.12.c.e/bjjj
Grounded grid
$V_{g2-g1} = 700V$
I_a
I_{g1}
I_{g2}
V_{k-g1} (V)
V_{a-g1}(V)
1000mA
800mA
50mA
600mA
400mA
200mA
100mA
150mA
200mA
300mA
6A
5A
4A
3A
2A
1A
0.5A
0A


7Z03140-17.2.12.ce/bjj
Voltages with respect to g1
V_{g2} =600V
I_a
(A)
V_k = −150V
−125V
−100V
−75V
−50V
−25V
0V
25V
50V
0
2
4
6
8
0
1000
2000
3000
4000
5000
V_a (V)


7Z03141-17.2.12.ce/bjj
V_{g2} =600V
Voltages with respect to g1
I_{g2}
(mA)
V_k = −150V
−125V
−100V
−75V
−50V
−25V
0V
25V
50V
0
500
1000
1500
0
1000
2000
3000
4000
5000
V_a (V)


7Z03142-17.2.12.ce/bjjj
2000
I_{g1}
(mA)
1500
1000
500
0
V_{g2} = 600V
Voltages with respect to g1
V_k = −150V
−125V
−100V
−75V
−50V
−25V
0
1000
2000
3000
4000
5000
V_a (V)


7Z03143-17.2.12.ce/bjjj
1000mA
800mA
6A
600mA
5A
400mA
4A
200mA
3A
2A
1A
0.5
0A
50mA
100mA
150mA
200mA
300mA
V_{g2} = 600V
Voltages with respect to g1
I_a
I_{g2}
I_{g1}
−200
V_k (V)
−150
−100
−50
0
50
100
0
1000
2000
3000
4000
5000
V (V)

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_{g_1}	=	12.8	pF
Anode to grid No.1	C_{ag_1}	=	0.05	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	6.2	
Mutual conductance	$S (I_a = 200\ \text{mA})$	=	5.2	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals	= max.	150	^{o}C
Anode temperature	= max.	150	^{o}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.

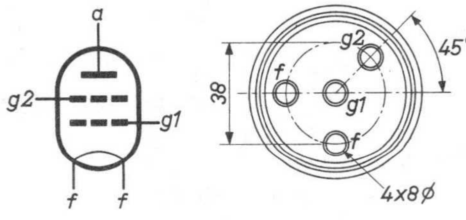
COOLING CHARACTERISTICS

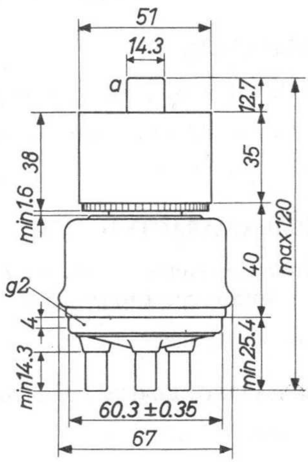
W_a (W)	h (m)	$t_{i\,max.}$ (^oC)	$q_{min.}$ ($m^3/min.$)	p_i (mm H_2O)
300	0	35	0.50	9.8
	0	45	0.59	12.9
	1500	35	0.60	12.0
	3000	25	0.63	11.5
400	0	35	0.77	17.5
	0	45	0.90	23.0
	1500	35	0.93	21.3
	3000	25	0.97	20.5
500	0	35	1.13	35.5
	0	45	1.32	46.9
	1500	35	1.36	43.3
	3000	25	1.42	41.5

MECHANICAL DATA

Dimensions in mm

Net weight: 530 g





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_{g_2}	=	max.	500	V
Grid No.2 dissipation	W_{g_2}	=	max.	30	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.	30	kΩ

OPERATING CONDITIONS

Frequency	f	=	110	110	110	MHz
Anode voltage	V_a	=	4000	3000	2500	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	-150	-150	-150	V
Anode current	I_a	=	315	310	310	mA
Grid No.2 current	I_{g_2}	=	22	24	26	mA
Grid No.1 current	I_{g_1}	=	16	16	15	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	230	230	230	V
Grid No.1 input power	W_{ig_1}	=	5	5	5	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	73.5	72	68 5	%
Useful power in the load	W_ℓ	=	835	600	475	W

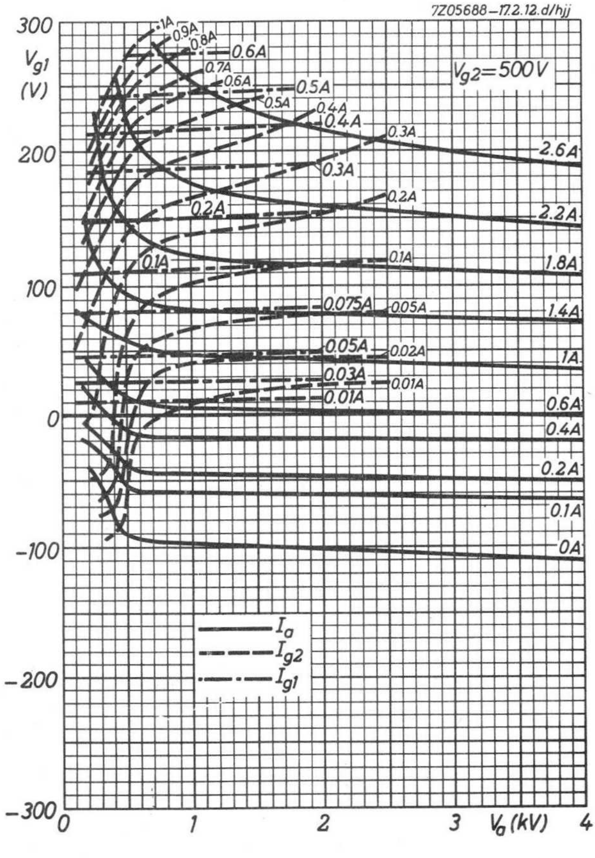
R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE; negative modulation, positive synchronisation.

LIMITING VALUES (black level; absolute limits)

Frequency	f		up to	220	MHz
Anode voltage	V_a	=	max.	3000	V
Grid No.2 voltage	V_{g_2}	=	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_{g_2}	=	max.	30	W
Grid No.1 current	I_{g_1}	=	max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

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_{g_2}		=	500	500	V
Grid No.1 voltage	V_{g_1}		=	-100	-100	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	sync	=	185	140	V
Anode current	I_a	sync	=	400	285	mA
		black	=	300	215	mA
Grid No.2 current	I_{g_2}	sync	=	35	20	mA
		black	=	3	2	mA
Grid No.1 current	I_{g_1}	sync	=	15	10	mA
		black	=	5	2	mA
Grid No.1 input power	W_{ig_1}	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


7Z05688-17.2.12.d/hjj
300
V_{g1}
(V)
200
100
0
-100
-200
-300
0
1
2
3
V_a (kV)
4
V_{g2}=500V
1A
0.9A
0.8A
0.6A
0.7A
0.6A
0.5A
0.5A
0.4A
0.4A
0.3A
0.3A
0.2A
0.2A
0.1A
0.1A
0.075A
0.05A
0.05A
0.02A
0.03A
0.01A
0.01A
2.6A
2.2A
1.8A
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0A
I_a
I_{g2}
I_{g1}

AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA					
General purposes					
λ (m)	Freq. (MHz)	C telegr.		C_{ag_2} 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) sync	W_o (kW) black	V_a (kV)	W_o (kW) white
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_{g_1}	=	23.5	pF
Anode to grid No.1	C_{ag_1}	<	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 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

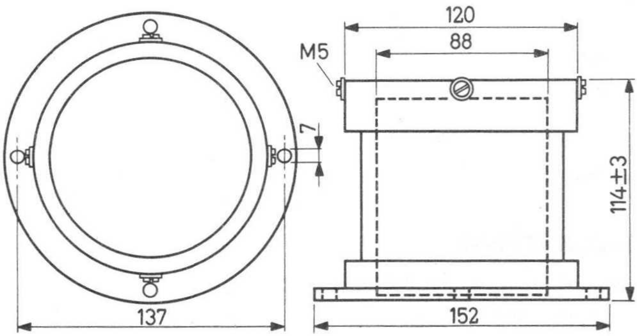
Anode cooling characteristics (see also cooling curves page 4)

W_a (kW)	h (m)	t_i (°C)	q (m^3/min)	p_i (mmH_2O)
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

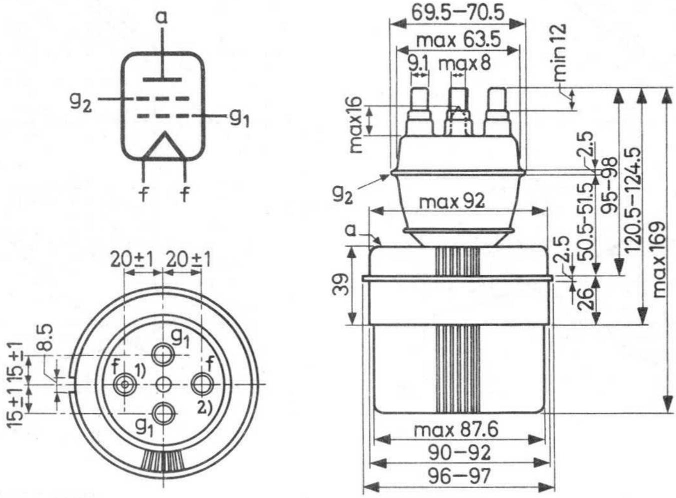


MECHANICAL DATA (continued) Dimensions in mm

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

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

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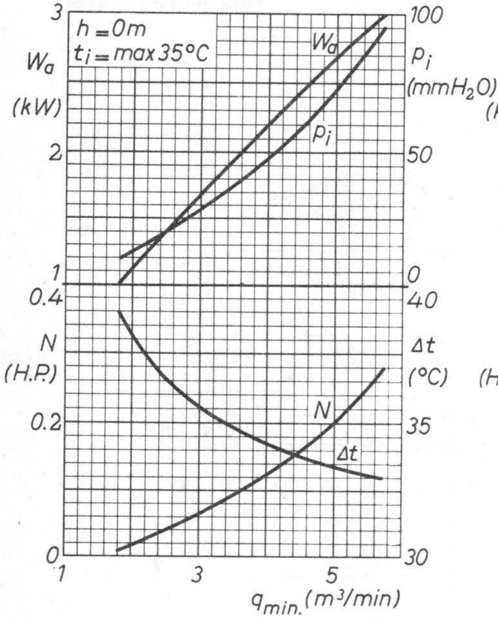
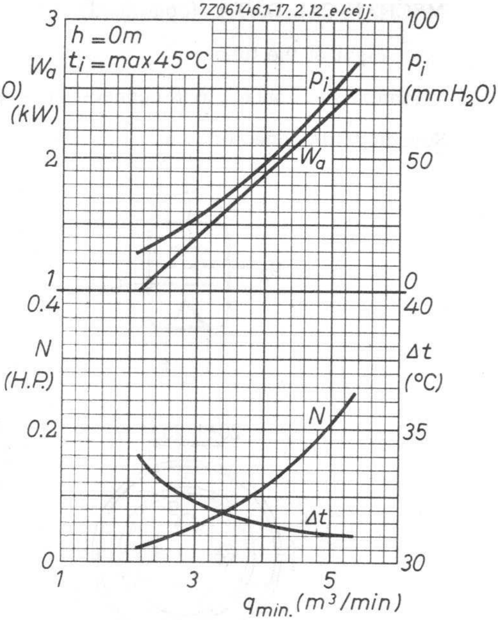
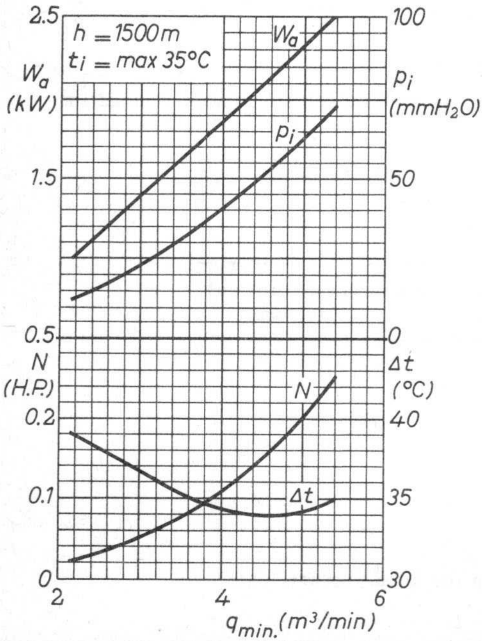
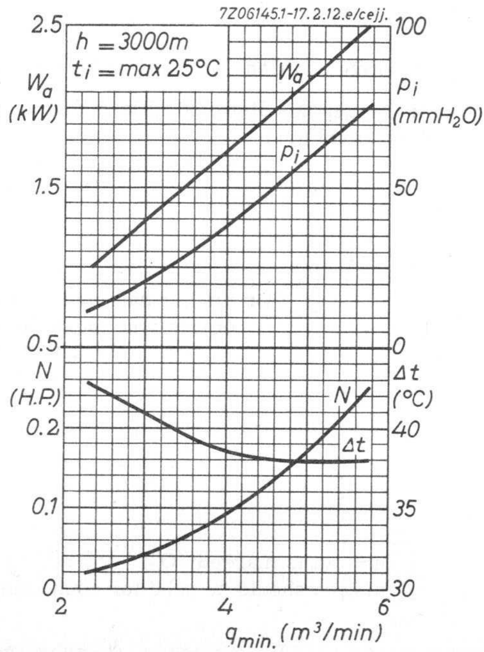
1) This pin is marked "O"

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


h = 0m
t_i = max 35°C
W_a (kW)
p_i (mmH₂O)
N (H.P.)
Δt (°C)
$q_{min.}$ (m³/min)


7Z06146.1-17.2.12.e/cejj.
h = 0m
t_i = max 45°C
W_a (kW)
p_i (mmH₂O)
N (H.P.)
Δt (°C)
$q_{min.}$ (m³/min)


h = 1500m
t_i = max 35°C
W_a (kW)
p_i (mmH₂O)
N (H.P.)
Δt (°C)
$q_{min.}$ (m³/min)


7Z06145.1-17.2.12.e/cejj.
h = 3000m
t_i = max 25°C
W_a (kW)
p_i (mmH₂O)
N (H.P.)
Δt (°C)
$q_{min.}$ (m³/min)

WATER COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA					
General purposes					
λ (m)	Freq. (MHz)	C telegr.		C_{ag_2} 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)
			sync	black		white
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_{g_1}	=	23.5	pF
Anode to grid No.1	C_{ag_1}	<	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 A)	=	19	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 $V_a < 4$ kV ($V_a < 3.2$ kV in the case of class C anode and screen grid modulation). At $V_a < 5$ kV ($V_a < 4$ 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 = max. 50 °C

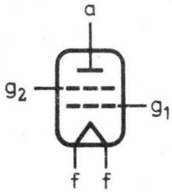
7Z2 8804

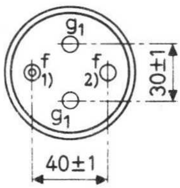
MECHANICAL DATA

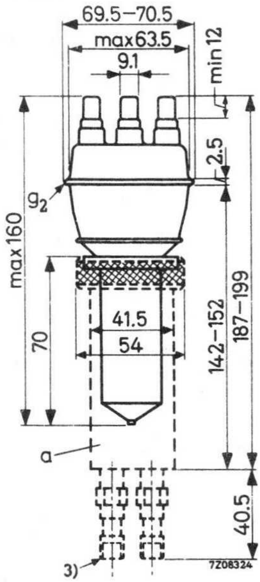
Dimensions in mm

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_{g_2}	=	max.	800		V
Grid No.2 dissipation	W_{g_2}	=	max.	100		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500		V
Grid No.1 dissipation	W_{g_1}	=	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_{g_2}	=	800	800	800	800	V
Grid No.1 voltage	V_{g_1}	=	−250	−250	−250	−250	V
Anode current	I_a	=	1.1	1.1	1.1	1.1	A
Grid No.2 current	I_{g_2}	=	100	100	120	120	mA
Grid No.1 current	I_{g_1}	=	70	70	80	80	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	480	480	500	500	V
Grid No.1 input power	W_{ig_1}	=	30	30	36	36	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	74.5	71	72	66	%

7Z2 8806

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_{g_2}	=	max.		800		V
Grid No.2 dissipation	W_{g_2}	=	max.		100		W 1)
Negative grid No.1 voltage	$-V_{g_1}$	=	max.		500		V
Grid No.1 dissipation	W_{g_1}	=	max.		30		W

OPERATING CONDITIONS

Frequency	f	=	110	MHz
Anode voltage	V_a	=	4	kV
Grid No.2 voltage	V_{g_2}	=	800	V
Grid No.1 voltage	V_{g_1}	=	-375	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	625	V
Anode current	I_a	=	0.9	A
Grid No.2 current	I_{g_2}	=	120	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	96	W
Grid No.1 input power	W_{ig_1}	=	48	W
Efficiency	η	=	75	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	1.8	kW

1) For all other modulation methods W_{g_2} = max. 65 W

7Z2 8807

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_{g_2}	=	max.	800	V
Grid No.2 dissipation	W_{g_2}	=	max.	100	W
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	800		800		800		V
Grid No.1 voltage	V_{g_1}	=	-107		-105		-104		V
			zero signal	single tone signal	zero signal	single tone signal	zero signal	single tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	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_{g_2}	=	0	75	0	75	0	78	mA
Grid No.1 current	I_{g_1}	=	0	55	0	55	0	54	mA
Grid No.1 input power	W_{ig_1}	=	0	15	0	15	0	15	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	-	68	-	66.5	-	65	%

7Z2 8808

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 [1]
Grid No.2 voltage	V_{g_2}	=	max.	800	V
Grid No.2 dissipation	W_{g_2}	=	max.	100	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 dissipation	W_{g_1}	=	max.	30	W

OPERATING CONDITIONS, two tubes

V_a	=	5		5		5		4	kV
V_{g_2}	=	800		800		800		800	V
V_{g_1}	=	-107		-107		-107		-103	V
$R_{aa\sim}$	=	3700		5000		17600		7000	Ω
$V_{g_1g_{1p}}$	= 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_{g_2}	= 0	2x120	0	2x50	0	2x10	0	2x60	mA
I_{g_1}	= 0	2x150	0	2x40	0	0	0	2x11	mA
$I_{g_{1p}}$	= 0	2x750	0	2x460	0	0	0	2x70	mA
W_{ig_1}	= 0	2x50	0	2x11	0	0	0	2x2	W
W_{g_2}	= 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
η	= –	65	–	65	–	65	–	62	%

[1]) At 100 % modulation with single tone sine wave I_a = max. 1.5 A

7Z2 2856

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_{g_2}	=	max. 800		V
Grid No.2 dissipation	W_{g_2} sync	=	max. 100		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 500		V
Grid No.1 current	I_{g_1} sync	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	54-88 1)	170-220 1)	170-220	MHz
Bandwidth	B (−1.5 dB)		=	6.5	6.5	–	MHz 2)
Bandwidth	B (−3 dB)		=	12	12	7.5	MHz 2)
Anode voltage	V_a		=	5	4	4	kV
Grid No.2 voltage	V_{g_2}		=	800	800	800	V
Grid No.1 voltage	V_{g_1}	sync	=	−175	−150	−150	V
		black	=	−260	−230	−260	V
		white	=	−450	−450	−450	V
Input A.C. voltage, peak to peak	$V_{g_1g_1p}$		=	900	850	850	V 3)
Anode current	I_a	sync	=	2.7	2.75	2.75	A
		black	=	1.75	2.1	1.5	A
Grid No.2 current	I_{g_2}	sync	=	145	110	250	mA
		black	=	40	50	65	mA
Grid No.1 current	I_{g_1}	sync	=	82	100	80	mA
		black	=	35	50	20	mA
Grid No.1 input power	W_{ig_1}	sync	=	200-300	300-400	200-300	W 4)
Output power	W_o	sync	=	8.0	5.0	5.9	kW
		black	=	4.5	2.8	3.3	kW

1) 2) 3) 4) See page 13

7Z2 8809

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_{g_2}		=	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_{g_2}	sync	=	max. 100		W
Grid No.1 current	I_{g_1}	sync	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	54-88	170-220	MHz [1]
Bandwidth	B (−1.5 dB)		=	6.5	6.5	MHz [2]
Bandwidth	B (−3 dB)		=	12	12	MHz [2]
Anode voltage	V_a		=	5	4	kV
Grid No.2 voltage	V_{g_2}		=	800	800	V
Grid No.1 voltage	V_{g_1}		=	−175	−150	V
Input A.C. voltage, peak to peak	$V_{g_1g_{1p}}$	sync	=	900	850	V [3]
		black	=	730	700	V [3]
Anode current	I_a	sync	=	2.7	2.75	A
		black	=	1.75	2.1	A
Grid No.2 current	I_{g_2}	sync	=	145	110	mA
		black	=	40	50	mA
Grid No.1 current	I_{g_1}	sync	=	82	100	mA
		black	=	35	50	mA
Grid No.1 input power	W_{ig_1}	sync	=	200-300	300-400	W [4]
Output power	W_o	sync	=	8.0	5.0	kW
		black	=	4.5	2.8	kW

[1][2][3][4] See page 13

7Z2 8810

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_{g_2}	=	max. 800		V
Negative grid No.1 voltage	$-V_{g_1}$	=	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_{g_2}	white =	max. 100		W
Grid No.1 current	I_{g_1}	white =	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f	=	170-220 1)	170-220	MHz
Bandwidth	B (−1.5 dB)	=	6.5	–	MHz 2)
Bandwidth	B (−3 dB)	=	12	7.5	MHz 2)
Anode voltage	V_a	=	4	4	kV
Grid No.2 voltage	V_{g_2}	=	800	800	V
Grid No.1 voltage	V_{g_1}	white =	−230	−230	V
		black =	−380	−380	V
Input A.C. voltage, peak to peak	$V_{g_1 g_1 p}$	=	850	850	V 3)
Anode current	I_a	white =	2.1	1.7	A
		black =	0.6	0.5	A
Grid No.2 current	I_{g_2}	white =	50	80	mA
		black =	10	10	mA
Grid No.1 current	I_{g_1}	white =	50	25	mA
		black =	0	0	mA
Grid No.1 input power	W_{ig_1}	=	300-400	200-300	W 4)
Output power	W_o	white =	2.8 5)	4.0	kW
		black =	0.25	0.36	kW

1)2)3)4)5) See page 13.

7Z2 8811

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_{g_2}	=	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_{g_2} white	=	max. 100		W
Grid No.1 current	I_{g_1} white	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	170-220	MHz [1]
Bandwidth	B (−1.5 dB)		=	6.5	MHz [2]
Bandwidth	B (−3 dB)		=	12	MHz [2]
Anode voltage	V_a		=	4	kV
Grid No.2 voltage	V_{g_2}		=	800	V
Grid No.1 voltage	V_{g_1}		=	-150	V
Input A.C. voltage, peak to peak	$V_{g_1g_1p}$	white	=	700	V [3]
		black	=	350	V [3]
Anode current	I_a	white	=	2.1	A
		black	=	0.6	A
Grid No.2 current	I_{g_2}	white	=	50	mA
		black	=	10	mA
Grid No.1 current	I_{g_1}	white	=	50	mA
		black	=	0	mA
Grid No.1 input power	W_{ig_1}	white	=	200-300	W [4]
Output power	W_o	white	=	2.8	kW [5]
		black	=	0.25	kW

[1][2][3][4][5] See page 13.

7Z2 8812

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_{g_2}		=	max. 800		V
Grid No.2 dissipation	W_{g_2}	sync	=	max. 100		W
Negative grid No.1 voltage	$-V_{g_1}$		=	max. 500		V
Grid No.1 current	I_{g_1}	sync	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	170-220	MHz 1)
Bandwidth	B (−1.5 dB)		=	4	MHz 2)
Bandwidth	B (−3 dB)		=	8.5	MHz 2)
Anode voltage	V_a		=	3.5	kV
Grid No.2 voltage	V_{g2}		=	700	V
Grid No.1 voltage	V_{g_1}	sync	=	−120	V
		black	=	−170	V
		white	=	−320	V
Input A.C. voltage, peak to peak	$V_{g_1g_{1p}}$		=	640	V 3)
Anode current	I_a	sync	=	2	A
		black	=	1.5	A
Grid No.2 current	I_{g_2}	sync	=	82	mA
		black	=	38	mA
Grid No.1 current	I_{g_1}	sync	=	100	mA
		black	=	50	mA
Grid No.1 input power	W_{ig_1}	sync	=	100-200	W 4)
Output power	W_o	sync	=	3	kW
		black	=	1.7	kW

1)2)3)4) See page 13.

7Z2 8813

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1) The operating conditions are given at a frequency slightly below the peak of the resonance curve.

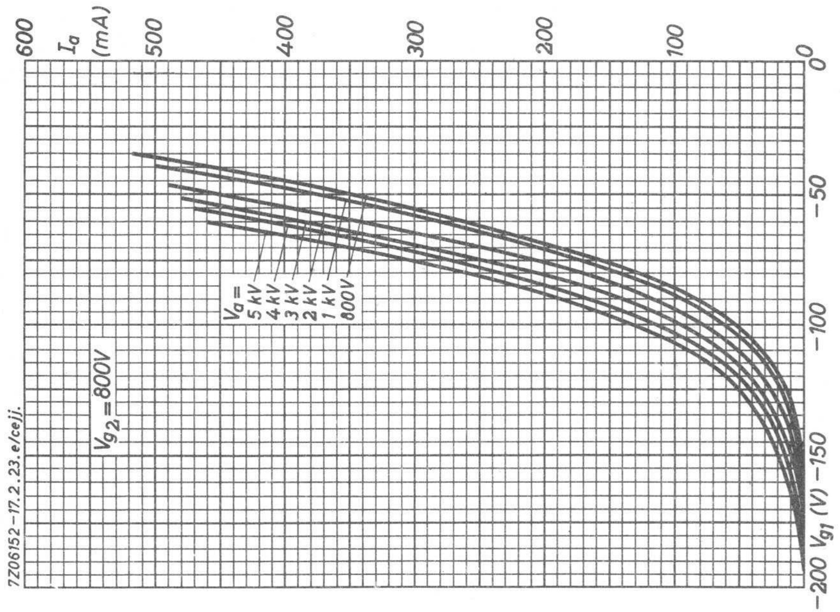
2) This value of bandwidth is based on measurements on a circuit with a single L.C. section.

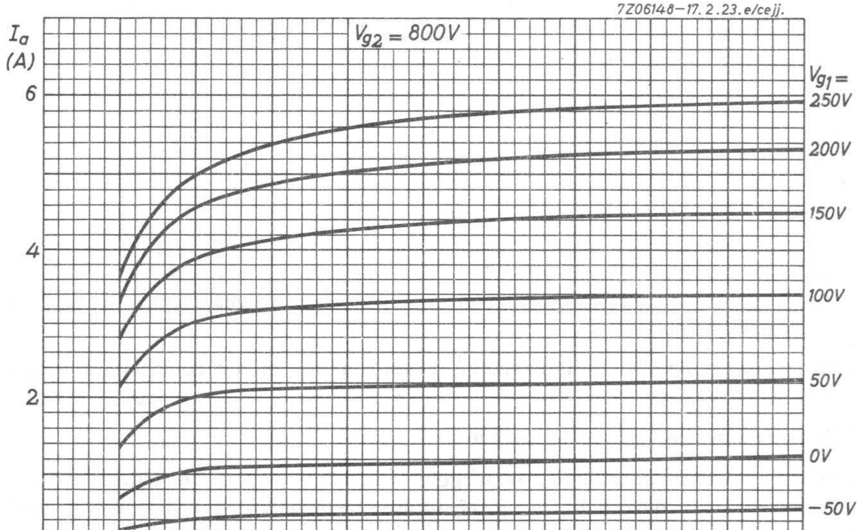
3) Measured by the slide back method.

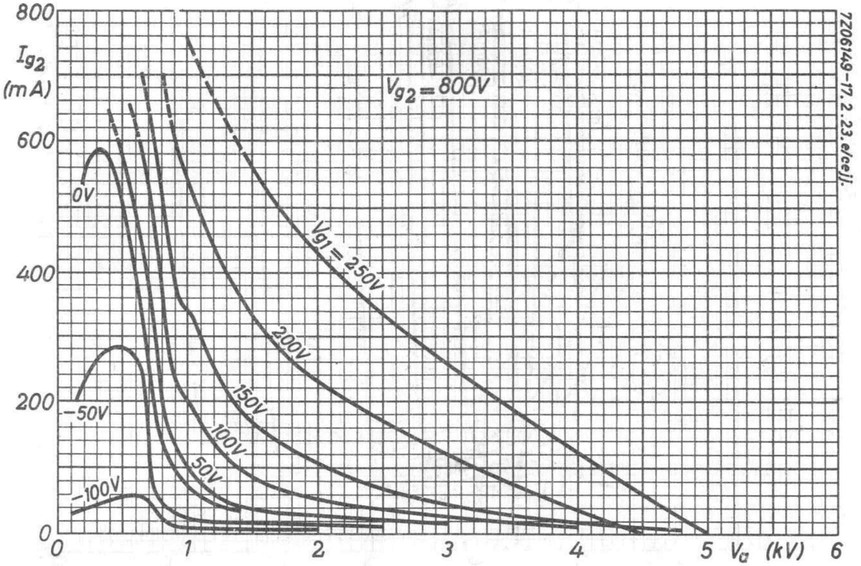
4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

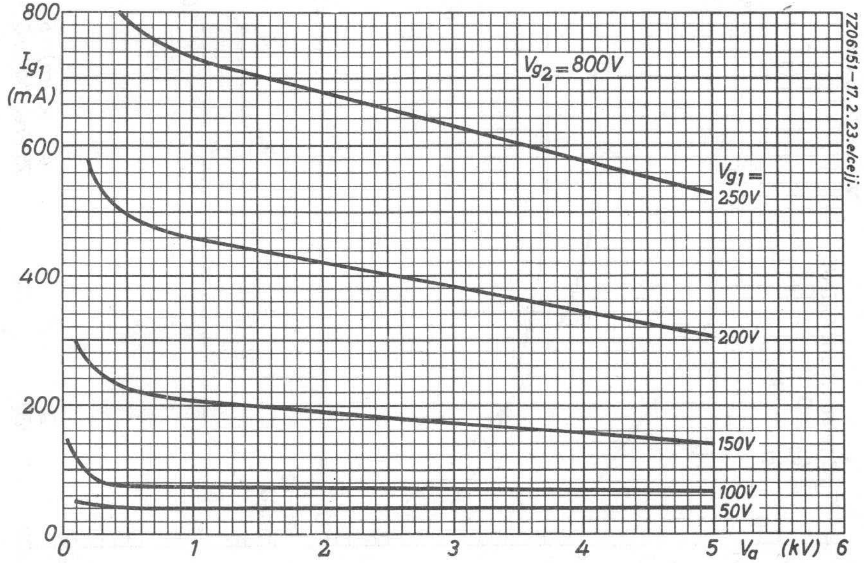
5) In the peak of the resonance curve W_o (white) = 3.3 kW

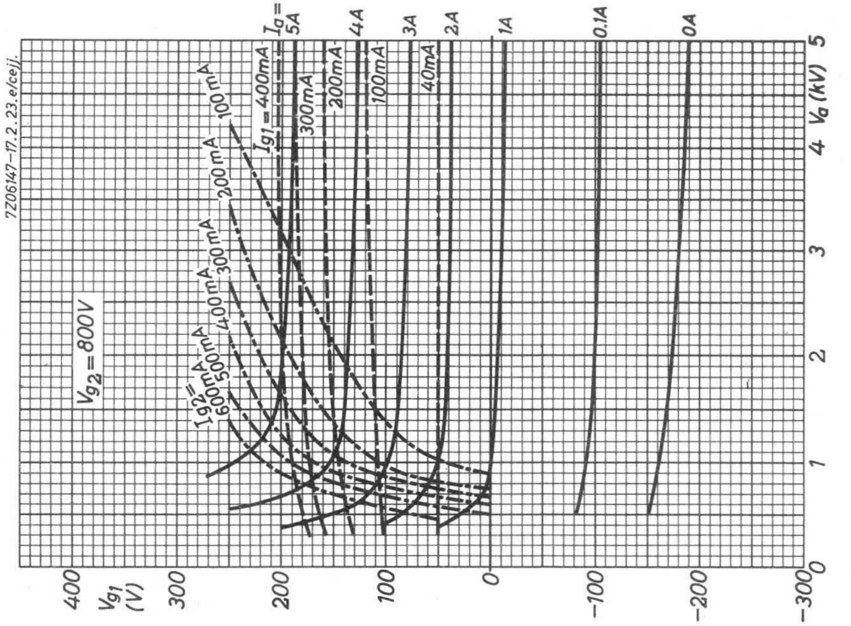
7Z2 2862

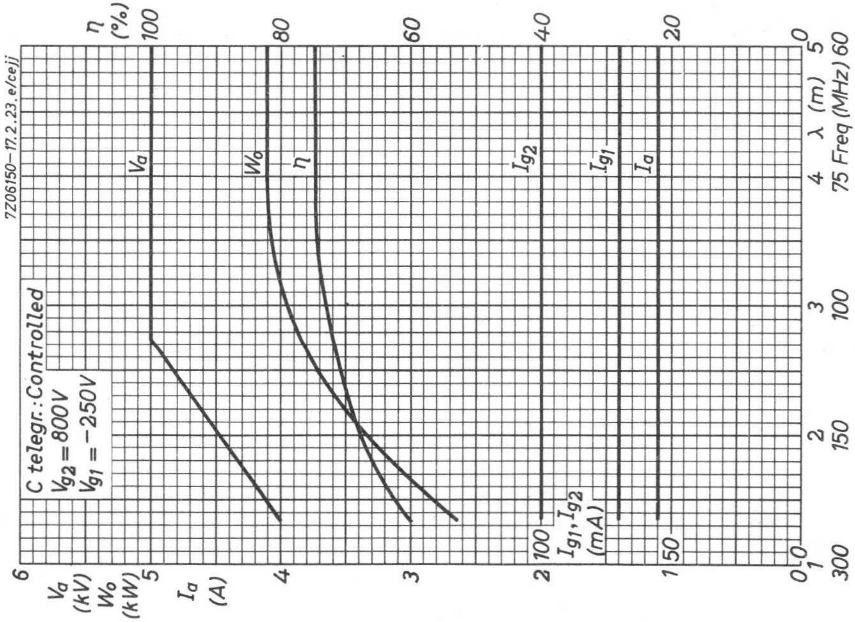

600
I_a (mA)
500
400
300
200
100
0
0
−50
−100
−150
−200 V_{g1} (V)
V_a =
5 kV
4 kV
3 kV
2 kV
1 kV
800V
V_{g2} = 800V
7Z06152−17.2.23.e/cejj.


7Z06148−17.2.23.e/cejj.
V_{g2} = 800V
I_a (A)
6
4
2
0
0
1
2
3
4
V_a (kV)
5
V_{g1} =
250V
200V
150V
100V
50V
0V
−50V
−100V

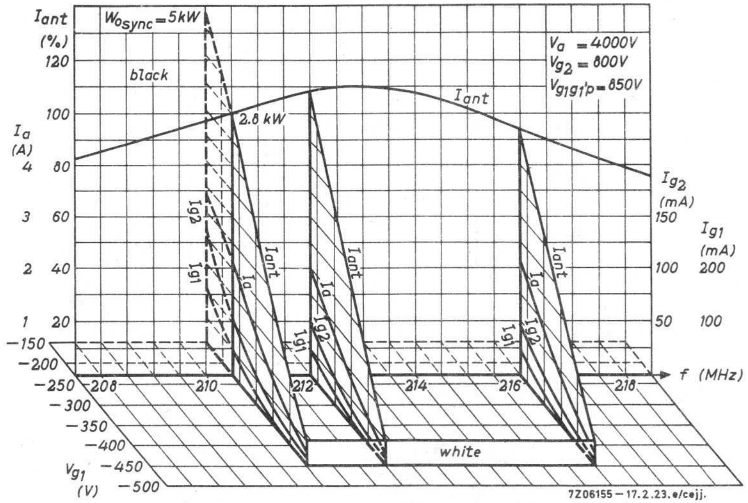

800
600
400
200
0
I_{g2} (mA)
$V_{g2} = 800V$
$V_{g1} = 250V$
200V
150V
100V
50V
0V
−50V
−100V
0
1
2
3
4
5
6
V_a (kV)
7Z06149-17.2.23.e/ce/j.


800
600
400
200
0
I_{g1} (mA)
$V_{g2} = 800V$
$V_{g1} =$ 250V
200V
150V
100V
50V
0
1
2
3
4
5
6
V_a (kV)
7Z06151-17.2.23.e/ce/j.

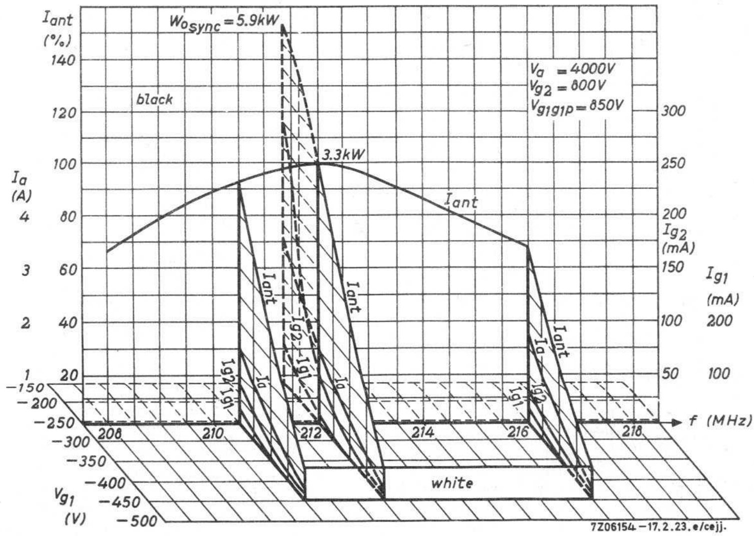

7Z06147-17.2.23.e/cej.
V_{g2}=800V
I_a=5A
4A
3A
2A
1A
0.1A
0A
I_{g1}=400mA
300mA
200mA
100mA
40mA
I_{g2}=600mA
500mA
400mA
300mA
200mA
100mA
V_{g1} (V)
400
300
200
100
0
-100
-200
-300
0
1
2
3
4
5 V_a (kV)


7Z06150-17.2.23.e/cej
C telegr.: Controlled
V_{g2}=800V
V_{g1}=-250V
V_a
W_o
η
I_{g2}
I_{g1}
I_a
V_a (kV)
W_o (kW)
I_a (A)
η (%)
I_{g1}, I_{g2} (mA)
λ (m)
Freq (MHz)
6
5
4
3
2
1
0
100
80
60
40
20
0
100
50
0
1
2
3
4
5
300
150
100
75
60

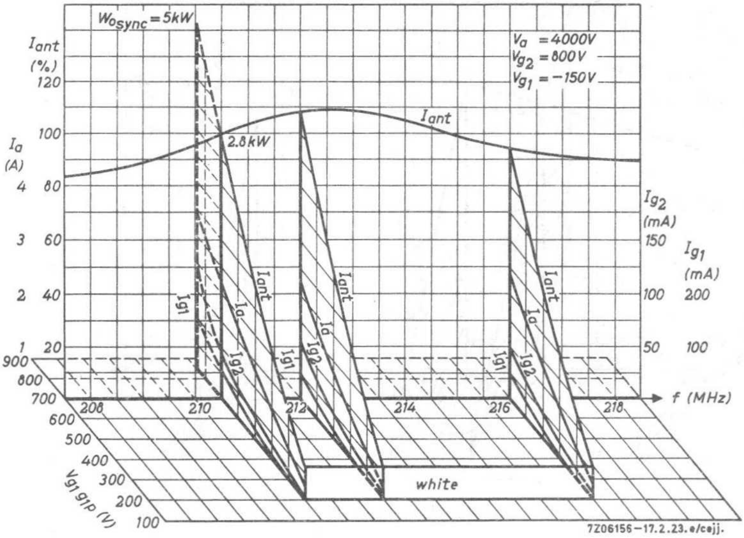
Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)

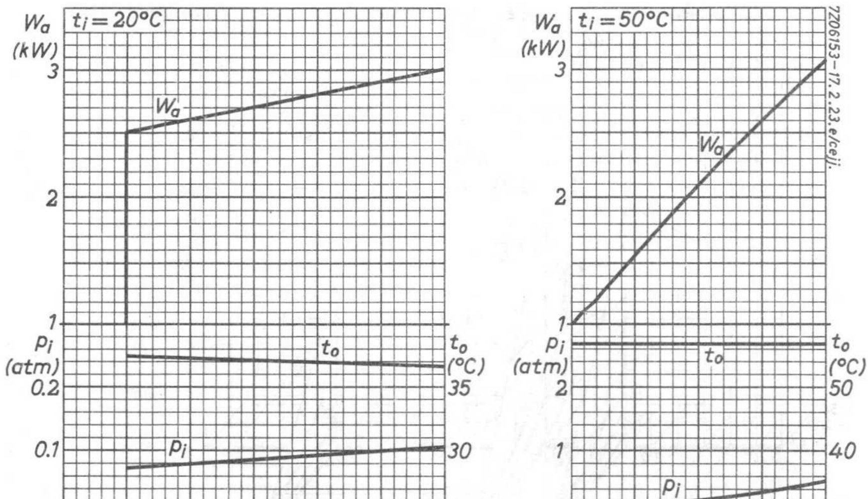


Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)



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_{ag_2} mod.	
	V_a (V)	W_o (W) IMS [1])	V_a (V)	W_o (W) IMS [1])
60	600	65	475 400	34 32
175	400	35		

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=	1.6	V $\pm$15%
Filament current	I_f	=	3.2	A

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

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	8.5	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	13.5	pF
Anode to grid No.1	C_{ag_1}	<	0.24	pF

TYPICAL CHARACTERISTICS

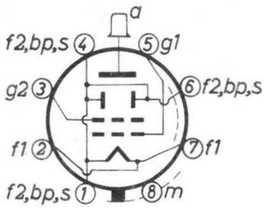
Anode voltage	V_a	=	200	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	100	mA
Mutual conductance	S	=	7	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	4.5	

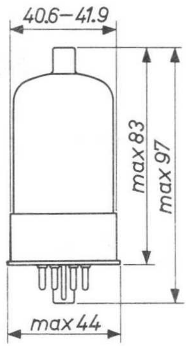
1) Intermittent mobile service

MECHANICAL DATA

Dimensions in mm

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





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

[1]) 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_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	5	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	30	kΩ [1]

OPERATING CHARACTERISTICS

Frequency	f	=	60	175	MHz
Anode voltage	V_a	=	600	400	V
Grid No.2 voltage	V_{g_2}	=	180	190	V [2]
Grid No.1 voltage	V_{g_1}	=	-71	-54	V [3]
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	91	68	V
Anode current	I_a	=	150	150	mA
Grid No.2 current	I_{g_2}	=	15	15	mA
Grid No.1 current	I_{g_1}	=	2.8	2.2	mA
Grid No.1 input power	W_{ig_1}	=	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	η	=	73.5	58	%

[1]) For operation at maximum ratings

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

[3]) V_{g_1} 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

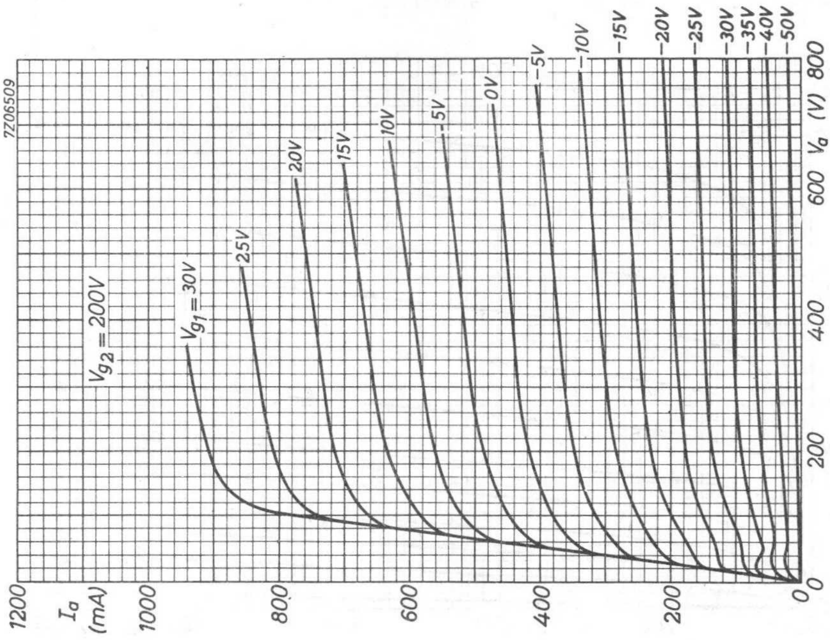
Frequency	f		up to	60	MHz
Anode voltage	V_a	=	max.	480	V
Anode input power	W_{ia}	=	max.	45	W
Anode dissipation	W_a	=	max.	14	W
Anode current	I_a	=	max.	120	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 current	I_{g_1}	=	max.	3.5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1]

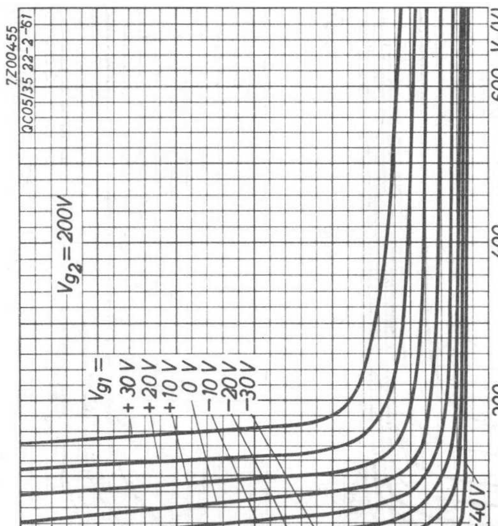
OPERATING CHARACTERISTICS

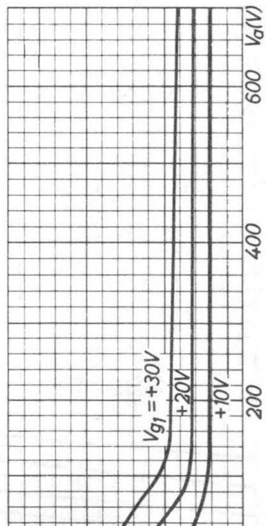
Frequency	f	=	60	60	MHz
Anode voltage	V_a	=	475	400	V
Grid No.2 voltage	V_{g_2}	=	135	150	V [4]
Grid No.1 voltage	V_{g_1}	=	−77	−87	V [3]
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	95	107	V
Anode current	I_a	=	94	112	mA
Grid No.2 current	I_{g_2}	=	9	12	mA
Grid No.1 current	I_{g_1}	=	2.8	3.4	mA
Grid No.1 input power	W_{ig_1}	=	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	η	=	75	71	%
Modulation factor	m	=	100	100	%
Modulation power	W_{mod}	=	23	23	W

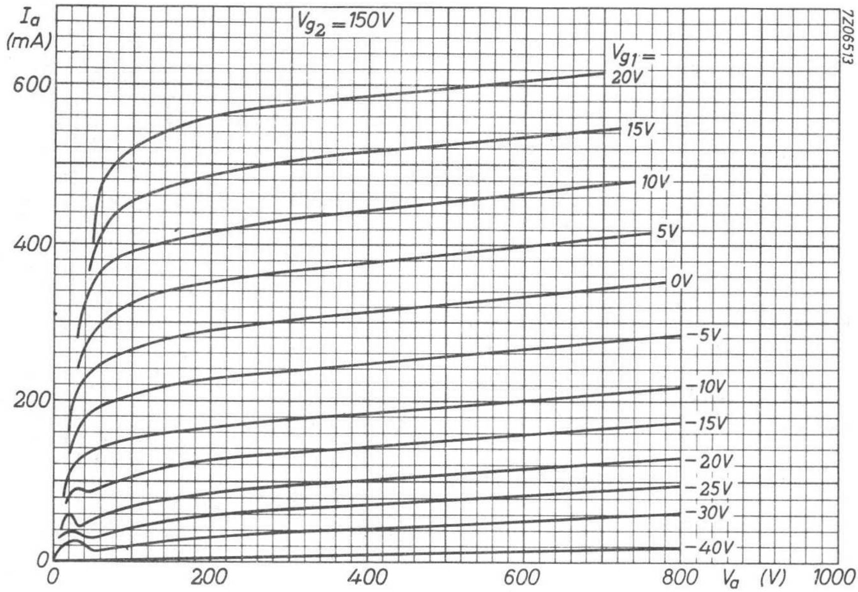
1)3) See page 3

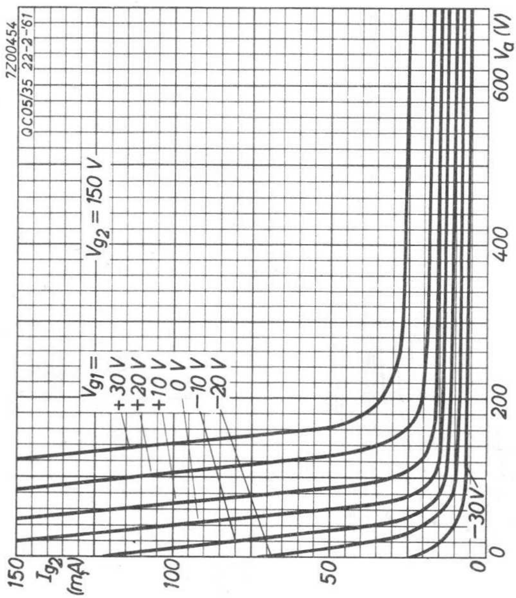
4) Obtained preferably from a separate source modulated by the anode supply or from the modulated anode supply through a series resistor.

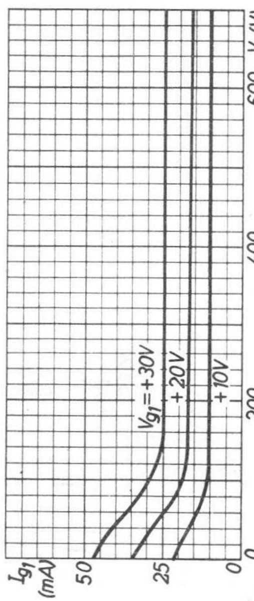

7Z06509
$V_{g2} = 200V$
$V_{g1} = 30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−50V
I_a (mA)
V_a (V)


7Z00455
QC05/35 22-2-'61
$V_{g2} = 200V$
$V_{g1} =$
+ 30 V
+ 20 V
+ 10 V
0 V
−10 V
−20 V
−30 V
−40V
I_{g2} (mA)
V_a(V)


$V_{g1} = +30V$
+20V
+10V
I_{g1} (mA)
V_a(V)


I_a (mA)
V_{g2} = 150V
7Z06513
V_{g1} = 20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−40V
0
200
400
600
800
1000
V_a (V)


7Z00454
QC05/35 22-2-'61
V_{g2} = 150 V
V_{g1} = +30 V
+20 V
+10 V
0 V
−10 V
−20 V
−30V
I_{g2} (mA)
150
100
50
0
200
400
600
V_a (V)


V_{g1} = +30V
+20V
+10V
I_{g1} (mA)
50
25
0
200
400
600
V_a(V)

R.F. TETRODE

QUICK REFERENCE DATA			
λ	Freq.	C telegr.	
m	MHz	V_a (V)	W_o (W)
>5	<60	300	8
3	100	300	7.4
2	150	300	6.3
1.7	175	280	5.4
		C_{ag_2} mod.	
>5	<60	250	5.8

λ	Freq.	C fr.mult.	
m	MHz	V_a (V)	W_o (W)
8/4	37.5/75	300	5.6
6/3	50/100	300	4.4
4/2	75/150	250	2.3
12/4	25/75	300	3.2
9/3	33.3/100	275	2.8
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_{g_1}	=	8	pF
Anode to grid No.1	C_{ag_1}	<	0.1	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.6	
Mutual conductance (I_a = 25 mA)	S	=	1.9	mA/V
Internal resistance	R_i	=	67	kΩ

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

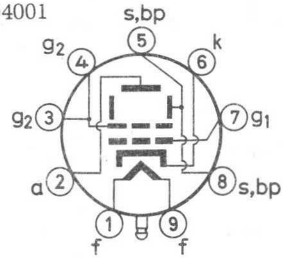
MECHANICAL DATA

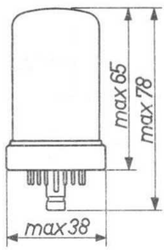
Dimensions in mm

Base : B9G

Socket : 2422 502 04001

Net weight: 40 g





Mounting position: arbitrary

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

λ	=	>5	>5	3	2	2	1.7[1])	m
V_a	=	300	300	300	300	300	280	V
V_{g_1}	=	-60	-35	-60	-50	-30	-50	V
V_{g_2}	=	250	150	250	250	150	250	V
I_a	=	43	40	44.5	46	44	2x46	mA
I_{g_1}	=	0.5	2.8	0.4	0.4	1.5	2x0.3	mA
I_{g_2}	=	6.7	7.2	5.3	4	4.5	2x3.5	mA
$V_{g_{1p}}$	=	68	58	68	57	52	55	V
W_{ig_1}	=	31	150	25	21	70	2x15	mW
W_{g_2}	=	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
η	=	62	59	55	46	48	42	%

OPERATING CONDITIONS CLASS C ANODE AND SCREEN GRID MODULATION

Wavelength	λ	>	5	m
Anode voltage	V_a	=	250	V
Grid No.1 voltage	V_{g_1}	=	-50	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	38.5	mA
Grid No.1 current	I_{g_1}	=	1.5	mA
Grid No.2 current	I_{g_2}	=	10	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	72	V
Grid No.1 input power	W_{ig_1}	=	0.1	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	60	%
Modulation factor	m	=	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	176	V
Modulation power	W_{mod}	=	5	W

---

[1]) Two tubes in push-pull

OPERATING CONDITIONS AS CLASS C FREQUENCY DOUBLER

Wavelength	λ	=	8/4	6/3	4/2	m
Anode voltage	V_a	=	300	300	250	V
Grid No.1 voltage	V_{g_1}	=	−120	−120	−120	V
Grid No.2 voltage	V_{g_2}	=	250	200	200	V
Anode current	I_a	=	43.3	38.4	36.8	mA
Grid No.1 current	I_{g_1}	=	1.2	1.5	1.1	mA
Grid No.2 current	I_{g_2}	=	5.5	2.6	2.1	mA
Peak grid No.1 A.C. voltage	V_{g_1p}	=	124	120	144	V
Grid No.1 input power	W_{ig_1}	=	134	162	143	mW
Grid No.2 dissipation	W_{g_2}	=	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	η	=	43	38	25	%

OPERATING CONDITIONS AS CLASS C FREQUENCY TRIPLER

Wavelength	λ	=	12/4	9/3	6/2[1])	m
Anode voltage	V_a	=	300	275	225	V
Grid No.1 voltage	V_{g_1}	=	−140	−140	−140	V
Grid No.2 voltage	V_{g_2}	=	250	200	200	V
Anode current	I_a	=	34.3	36	2x36	mA
Grid No.1 current	I_{g_1}	=	0	1.5	2x1.3	mA
Grid No.2 current	I_{g_2}	=	2.8	2.5	2x2.5	mA
Peak grid No.1 A.C. voltage	V_{g_1p}	=	130	142	152	V
Grid No.1 input power	W_{ig_1}	=	0	192	2x180	mW
Grid No.2 dissipation	W_{g_2}	=	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	η	=	31	28.5	18.5	%

[1]) Two tubes in push-pull

R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA

λ (m)	Freq. (MHz)	C telegr. V_a (V)	C telegr. W_o (W) CCS	C telegr. W_o (W) ICAS	C_{ag_2} mod. V_a (V)	C_{ag_2} mod. W_o (W) CCS	C_{ag_2} mod. W_o (W) 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) V_a (V)	AB mod. 1)2) W_o (W) CCS	AB mod. 1)2) W_o (W) ICAS	AB mod. 1)3) V_a (V)	AB mod. 1)3) W_o (W) CCS	AB mod. 1)3) W_o (W) ICAS	AB mod. 1)4) V_a (V)	AB mod. 1)4) W_o (W) CCS	AB mod. 1)4) W_o (W) 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_{g_1}	=	13.5	pF
Anode to all other elements except grid No.1	C_a	=	8.5	pF
Anode to grid No.1	C_{ag_1}	<	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

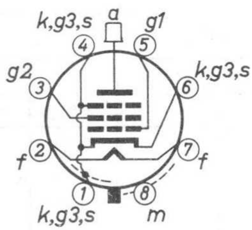
Dimensions in mm

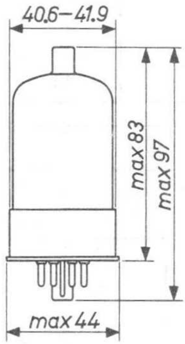
Base : Octal 8p

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_{g_1} may be obtained from a separate supply, or from R_{g_1} 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_{g_2} must not exceed 400 V under key-up conditions

[4]) V_{g_1} 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)

		Continuous C.C.S.	Intermittent I.C.A.S.	
Frequency	f	up to 60	up to 60	MHz
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_{g_2}	= max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	= max. 3	max. 3	W
Negative 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
Peak heater to cathode voltage	V_{kf_p}	= max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	= max. 30	max. 30	kΩ[1])

OPERATING CONDITIONS

			Continuous service C.C.S.			Intermittent service I.C.A.S.			
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_{g_1}	=	−58	−66	−51	−62	−71	−54	V [2])
Grid No.2 voltage	V_{g_2}	=	150	170	180	160	180	190	V [3])
Anode current	I_a	=	112	135	140	120	150	150	mA
Grid No.1 current	I_{g_1}	=	2.8	2.5	2.0	3.1	2.8	2.2	mA
Grid No.2 current	I_{g_2}	=	9	9	10	11	10	10.4	mA
Peak grid No.1 voltage	$V_{g_{1p}}$	=	73	84	64	79	91	68	V
Grid No.1 input power	W_{ig_1}	=	0.2	0.2	3	0.2	0.3	3	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	77	71	55.5	78	73.5	58	%

[1])[2])[3]) See page 3

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

See also page 3 for derating table

			Continuous C.C.S.		Intermittent I.C.A.S.		
Frequency	f		up to	60	up to	60	MHz
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_{g_2}	=	max.	250	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2	max.	2	W
Negative 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
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	max.	30	kΩ[1])

OPERATING CONDITIONS

			Continuous service C.C.S.		Intermittent service I.C.A.S.	
Frequency	f	=	60	60	60	MHz
Anode voltage	V_a	=	475	400	600	V
Grid No.1 voltage	V_{g_1}	=	−77	−87	−87	V [4])
Grid No.2 voltage	V_{g_2}	=	135	150	150	V [5])
Anode current	I_a	=	94	112	112	mA
Grid No.1 current	I_{g_1}	=	2.8	3.4	3.4	mA
Grid No.2 current	I_{g_2}	=	6.4	7.8	7.8	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	95	107	107	V
Grid No.1 input power	W_{ig_1}	=	0.3	0.4	0.4	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	75.5	71	77	%
Modulation factor	m	=	100	100	100	%
Modulation power	W_{mod}	=	23	23	34	W

[1])[4])[5]) 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	= max.	600	V
Anode input power	W_{ia}	= max.	60	W
Anode dissipation	W_a	= max.	20	W
Anode current	I_a	= max.	125	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_{kf_p}	= max.	135	V
Grid No.1 circuit resistance	R_{g_1}	= max.	100	kΩ

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

V_a	=	600		500		400		V
V_{g_2}	=	180		185		190		V 1)
V_{g_1}	=	−45		−40		−40		V 2)
$R_{aa\sim}$	=	7000		5500		4000		Ω
$V_{g_1g_{1p}}$	=	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
η	=	–	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_{g_2}	=	max.	3	W
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	kΩ[1]

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

Anode voltage	V_a	=	750		600		V
Grid No.2 voltage	V_{g_2}	=	195		200		V [2]
Grid No.1 voltage	V_{g_1}	=	-50		-50		V [1]
Load resistance	$R_{aa\sim}$	=	8000		6000		Ω
Input A.C. voltage peak to peak	$V_{g_1g_{1p}}$	=	0	100	0	100	V
Anode current	I_a	=	2x12	2x110	2x14	2x115	mA
Grid No.2 current	I_{g_2}	=	2x0.5	2x13	2x0.5	2x13.5	mA
Grid No.1 input power	W_{ig_1}	=	0	0	0	0	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	-	72.5	-	69	%

[1]) 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. CLASS AB 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_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	W
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ[1]

C.C.S. OPERATING CONDITIONS, continuous service; two tubes ($I_{g_1} > 0$)

V_a	=	600		500		400		V
V_{g_2}	=	165		175		175		V[2]
V_{g_1}	=	-44		-44		-41		V[1]
$R_{aa\sim}$	=	6800		4600		3700		Ω
$V_{g_1g_{1p}}$	=	0	97	0	102	0	95	V
I_a	=	2x11	2x103	2x13	2x121	2x16	2x116	mA
I_{g_2}	=	2x0.3	2x8.5	2x0.3	2x9	2x0.5	2x9	mA
I_{g_1}	=	0	2x0.5	0	2x1.0	0	2x0.8	mA
W_{ig_1}	=	0	2x0.1	0	2x0.15	0	2x0.1	W
W_{g_2}	=	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
η	=	-	72.5	-	68.5	-	66.5	%

[1]) 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. 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_{kf_p}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1]

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 [2]
Grid No.1 voltage	V_{g_1}	=	-46		-48		V [1]
Load resistance	$R_{aa\sim}$	=	7400		5000		Ω
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	η	=	–	73	–	70	%

[1]) 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. CLASS AB AMPLIFIER AND MODULATOR IN TRIODE CONNECTION without grid current (screen grid connected to anode)

LIMITING VALUES (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_{kf_p}	=	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 100	max. 100	kΩ[1])
Grid No.1 circuit resistance	R_{g_1}	=	max. 500	max. 500	kΩ[1])

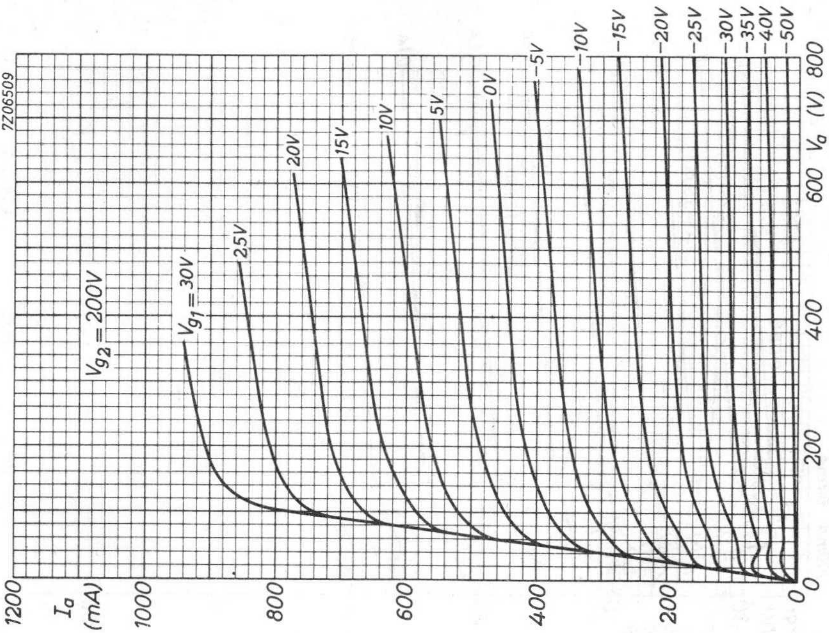
C.C.S. **OPERATING CONDITIONS**, continuous service; two tubes (I_{g_1} = 0)

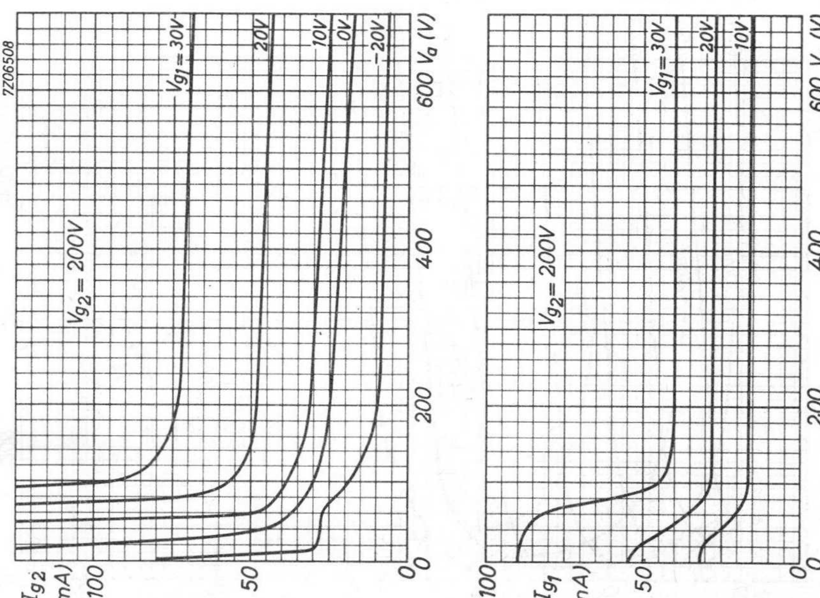
Anode voltage	V_a	=	400		250		V
Grid No.1 voltage	V_{g_1}	=	-100		-50		V
Load resistance	$R_{aa\sim}$	=	8000		5000		Ω
Peak grid to grid voltage	V_{gg_p}	=	0	200	0	100	V
Anode current	I_a	=	2x20	2x50	2x60	2x62	mA
Anode input power	W_{ia}	=	2x8	2x20	2x15	2x15.5	W
Anode dissipation	W_a	=	2x8	2x9	2x15	2x10.5	W
Output power	W_o	=	0	22	0	10	W
Efficiency	η	=	-	55	-	32	%

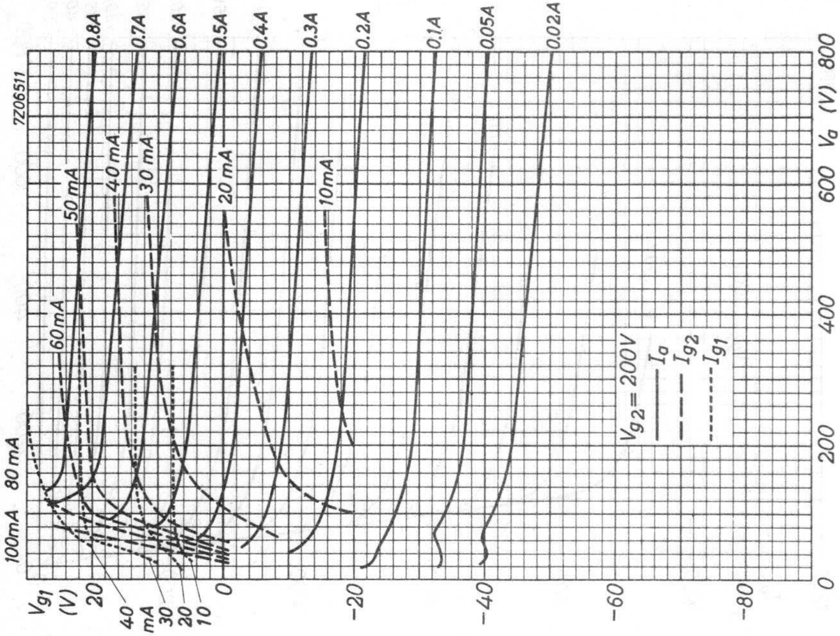
I.C.A.S. **OPERATING CONDITIONS**, intermittent service; two tubes

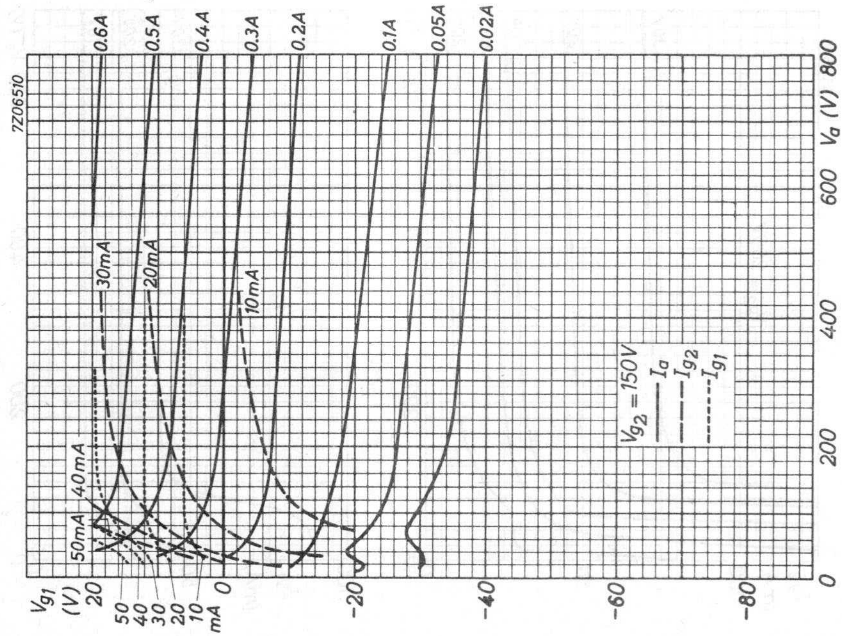
Anode voltage	V_a	=	400		V
Grid No.1 voltage	V_{g_1}	=	-100		V
Load resistance	$R_{aa\sim}$	=	8000		Ω
Peak grid to grid voltage	V_{gg_p}	=	0	200	V
Anode current	I_a	=	2x20	2x50	mA
Anode input power	W_{ia}	=	2x8	2x20	W
Anode dissipation	W_a	=	2x8	2x9	W
Output power	W_o	=	0	22	W
Efficiency	η	=	-	55	%

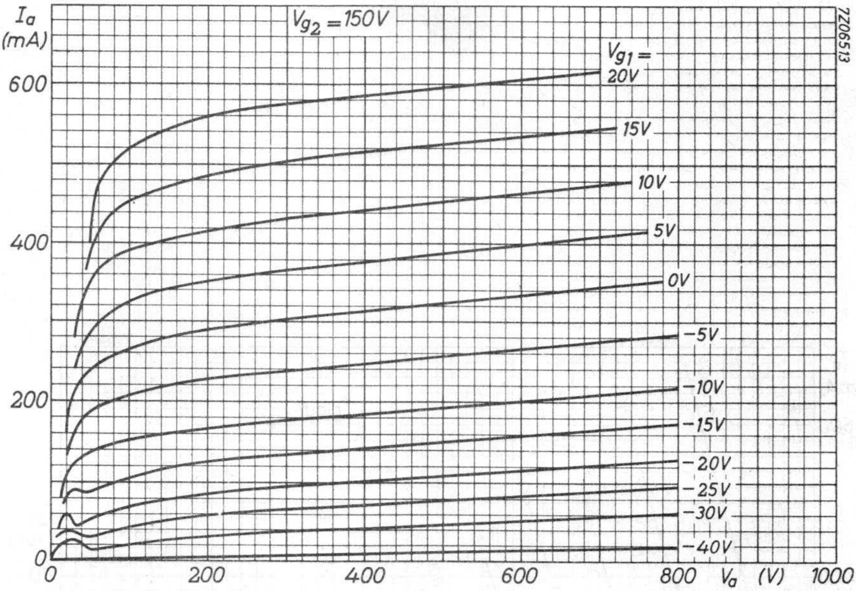
[1]) For values of R_{g_1} exceeding 100 kΩ, cathode bias is required


7Z06509
$V_{g2} = 200V$
$V_{g1} = 30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−50V
I_a (mA)
1200
1000
800
600
400
200
0
0
200
400
600
800
V_a (V)

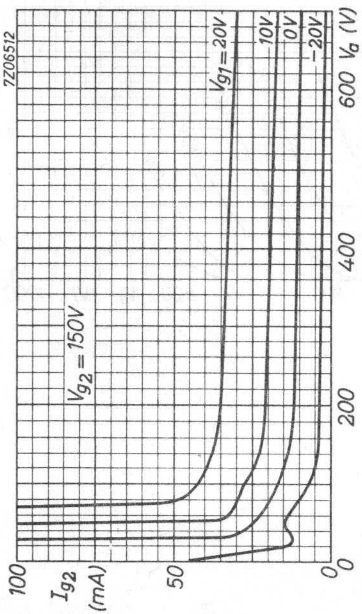

7Z06508
$V_{g2} = 200V$
$V_{g1} = 30V$
20V
10V
0V
−20V
I_{g2} (mA)
100
50
0
0
200
400
600
V_a (V)
$V_{g2} = 200V$
$V_{g1} = 30V$
20V
10V
I_{g1} (mA)
100
50
0
0
200
400
600
V_a (V)


7Z06511
Vg1 (V)
Va (V)
Vg2 = 200V
Ia
Ig2
Ig1
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
0.02A
100mA
80 mA
60mA
50 mA
40 mA
30 mA
20 mA
10mA

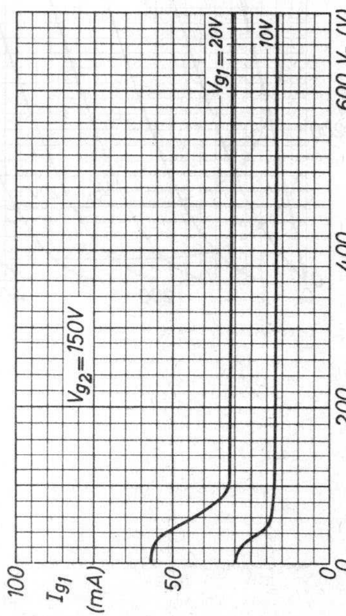

7Z06510
Vg1 (V)
Va (V)
Vg2 = 150V
Ia
Ig2
Ig1
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
0.02A
50mA
40mA
30mA
20mA
10mA



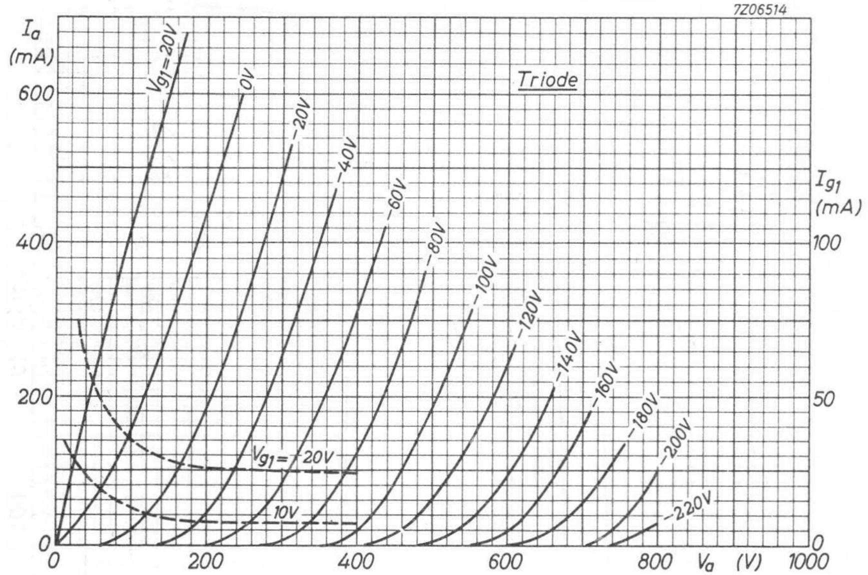
I_a (mA)
600
400
200
0
V_{g2} = 150V
7Z06513
V_{g1} =
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−40V
0
200
400
600
800
V_a (V)
1000

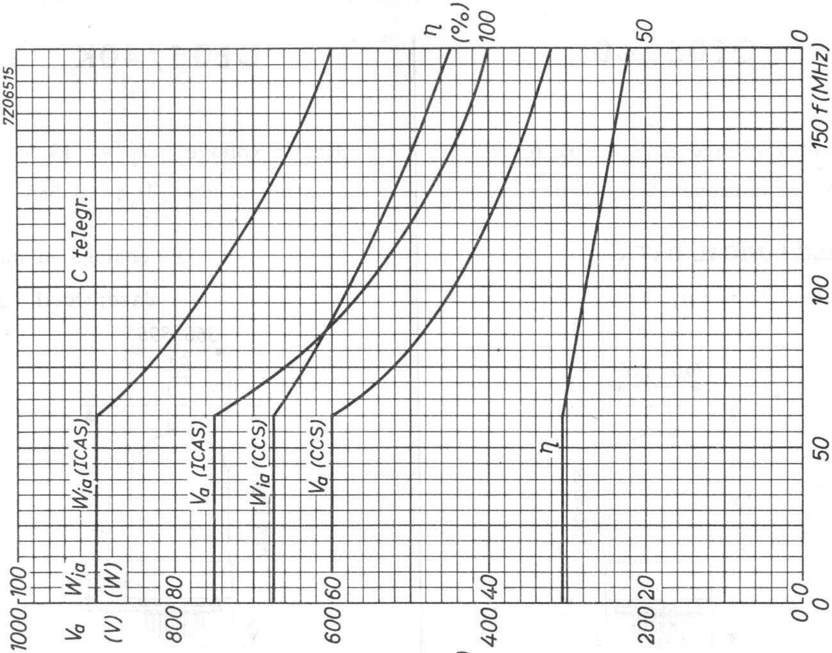


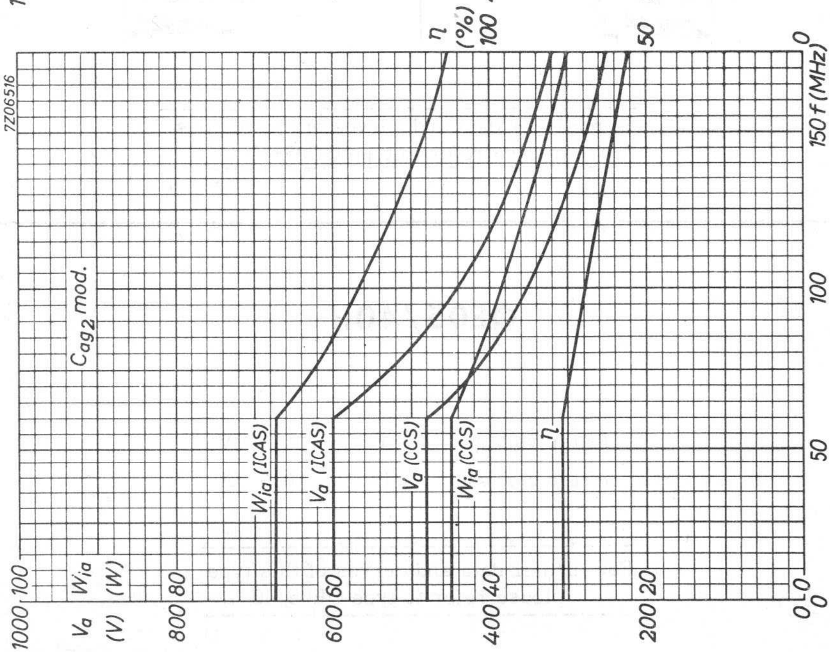
7Z06512
V_{g1} = 20V
10V
0V
−20V
V_a (V)
600
400
200
0
V_{g2} = 150V
100
I_{g2} (mA)
50
0



V_{g1} = 20V
10V
V_a (V)
600
400
200
0
V_{g2} = 150V
100
I_{g1} (mA)
50
0


7Z06514
Triode
I_a (mA)
600
400
200
0
V_{g1}=20V
0V
-20V
-40V
-60V
-80V
-100V
-120V
-140V
-160V
-180V
-200V
-220V
V_{g1}=+20V
10V
I_{g1} (mA)
100
50
0
0
200
400
600
800
V_a (V)
1000


7Z06515
C telegr.
V_a (V)
W_{ia} (W)
1000 100
800 80
600 60
400 40
200 20
0 0
η (%)
100
50
0
150 f (MHz)
100
50
0
W_{ia} (ICAS)
V_a (ICAS)
W_{ia} (CCS)
V_a (CCS)
η


7Z06516
C_{ag_2} mod.
V_a (V)
W_{ia} (W)
1000 100
800 80
600 60
400 40
200 20
0 0
η (%)
100
50
0
150 f (MHz)
100
50
0
W_{ia} (ICAS)
V_a (ICAS)
V_a (CCS)
W_{ia} (CCS)
η

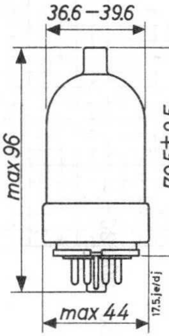
QE05/40F

Heater voltage V_f = 12.6 V

Heater current I_f = 0.625 A

MECHANICAL DATA

Base: Octal 8 p.



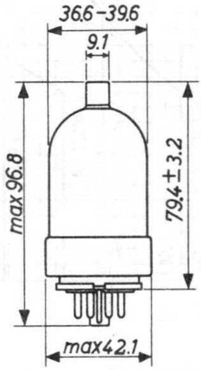
QE05/40K

Heater voltage V_f = 13.5 V

Heater current I_f = 0.585 A

Dimensions in mm

Base: Octal 8 p.



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

QE05/40H

Heater voltage V_f = 26.5 V

Heater current I_f = 0.3 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 telegr.		C_{ag_2} mod.		B S.S.B.		B mod. 2)	
(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o 1) (W)	V_a (V)	W_o (W)
30	750	200	600	130	750	220	750 600	300 200

HEATING : indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	V
Heater current	I_f	=	3.9	A

COOLING : radiation and convection

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	12.7	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	30	pF
Anode to grid No.1	C_{ag_1}	<	0.9	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	750	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	100	mA
Mutual conductance	S	=	9	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.7	

1) Peak envelope power with double tone signal

2) Two tubes

TEMPERATURE LIMITS (Absolute limits)

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

MECHANICAL DATA

Dimensions in mm

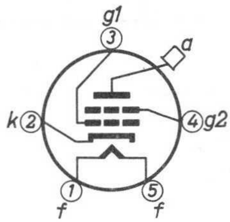
Base : giant 5p

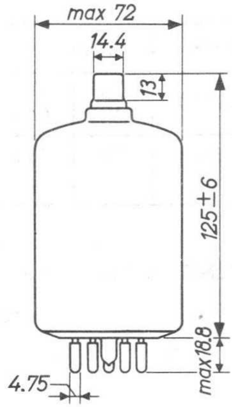
Socket : 2422 512 01001

Top cap : IEC 67-III-1b, type 3

Anode connector : 40680

Net weight: 220 g





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_{ia}	= 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	kΩ
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_{ia}	= 285	385	W
Grid No.1 input power	W_{ig_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	η	= 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_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	10	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	kΩ
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_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-100	V
Anode current	I_a	=	300	mA
Grid No.2 current	I_{g_2}	=	20	mA
Grid No.1 current	I_{g_1}	=	4	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	110	V
Anode input power	W_{ia}	=	180	W
Grid No.1 input power	W_{ig_1}	=	0.4	W
Grid No.2 dissipation	W_{g_2}	=	5	W
Anode dissipation	W_a	=	50	W
Output power	W_o	=	130	W
Efficiency	η	=	72	%
Modulation factor	m	=	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	220	V [1])
Modulation power	W_{mod}	=	90	W

[1]) 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_{g_2}	= max.	350	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
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_{g_2}	=	310		V
Grid No.1 voltage	V_{g_1}	=	-45		V 1)
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	45 2)	V
Anode current	I_a	=	130	270	mA
Grid No.2 current	I_{g_2}	=	<5	26	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Anode input power	W_{ia}	=	98	200	W
Grid No.1 dissipation	W_{g_1}	=	0	0	W
Grid No.2 dissipation	W_{g_2}	=	1.5	8	W
Anode dissipation	W_a	=	98	90	W
Output power	W_o	=	0	220	W 3)
Efficiency	η	=	-	55	%

1) To be adjusted so that I_a = 130 mA at $V_{g_{1p}} = 0$
2) To be adjusted so that $I_{g_1} = 0$
3) Peak envelope power

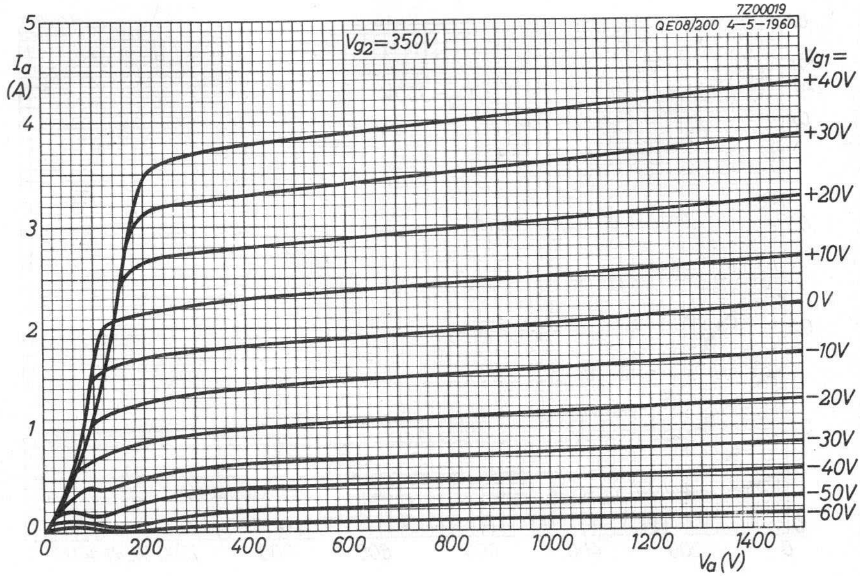
A.F. CLASS B AMPLIFIER

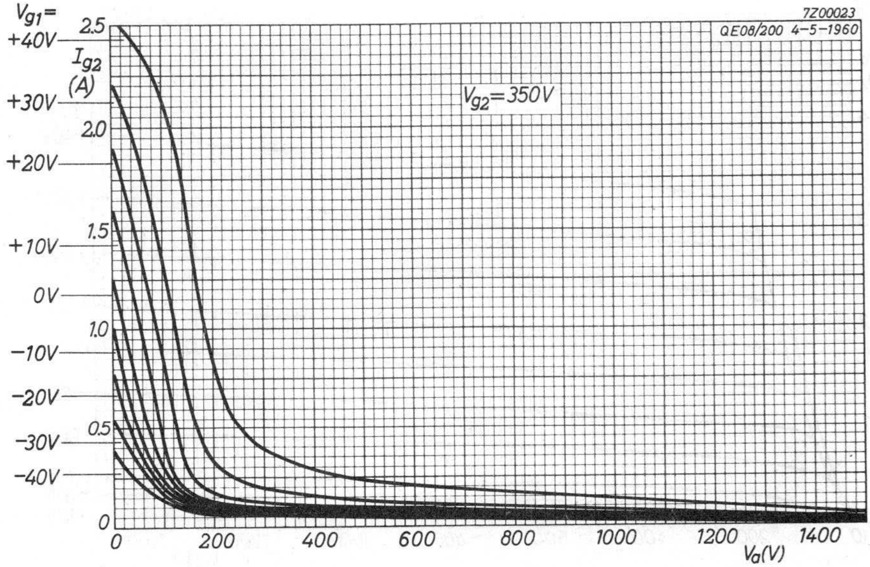
LIMITING VALUES (Absolute limits)

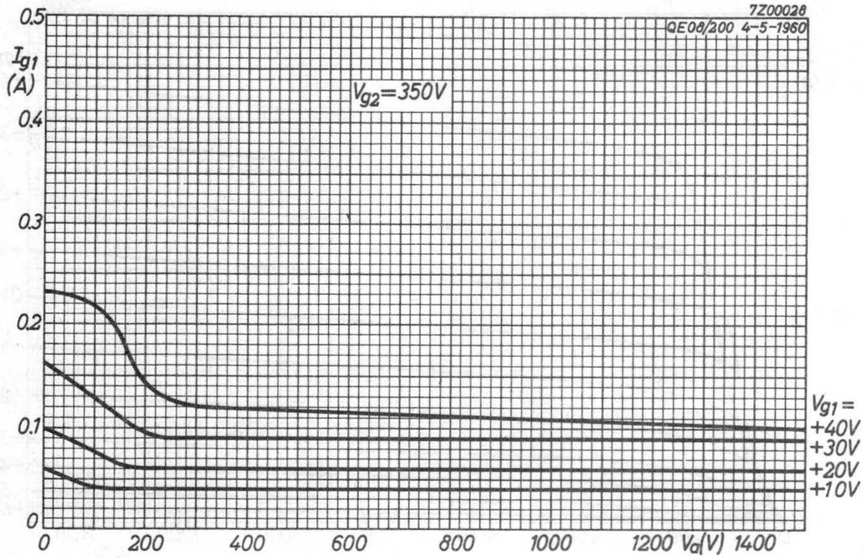
Anode voltage	V_a	= max. 825	V
Anode dissipation	W_a	= max. 100	W
Anode current	I_a	= max. 400	mA
Grid No.2 voltage	V_{g_2}	= max. 300	V
Grid No.2 dissipation	W_{g_2}	= max. 12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max. 150	V
Grid No.1 current	I_{g_1}	= max. 30	mA
Grid No.1 circuit resistance	R_{g_1}	= max. 15	kΩ
Heater to cathode voltage	V_{kf}	= max. 125	V

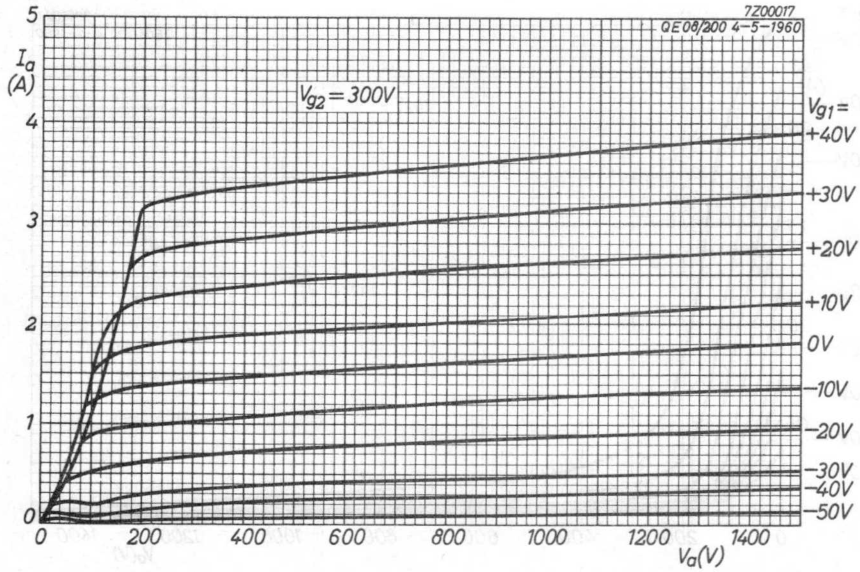
OPERATING CONDITIONS, two tubes

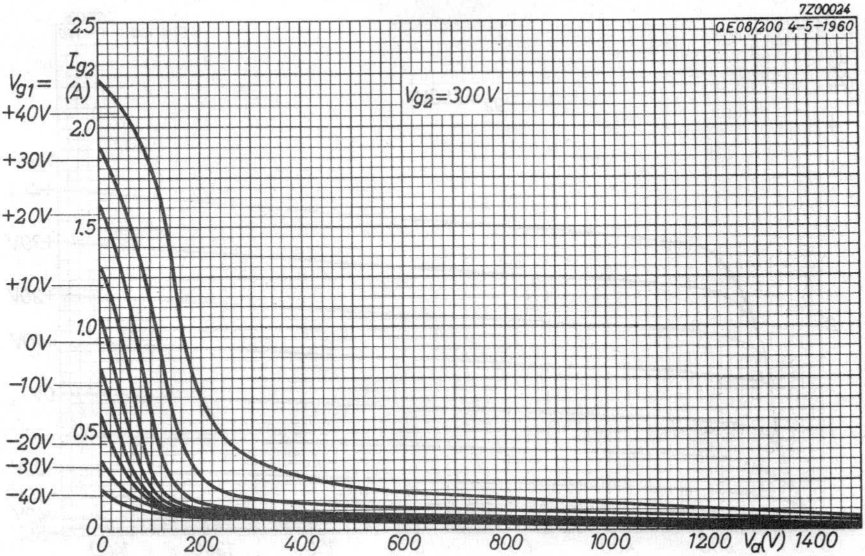
Anode voltage	V_a	=	750		600		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-45		-45		V
Load resistance	$R_{aa\sim}$	=	3600		3500		Ω
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	110	0	105	V
Anode current	I_a	=	2x45	2x280	2x25	2x235	mA
Grid No.2 current	I_{g_2}	=	0	2x40	2x0.5	2x24	mA
Grid No.1 current	I_{g_1}	=	0	2x1	0	2x0.5	mA
Anode input power	W_{ia}	=	2x34	2x210	2x15	2x140	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	–	71.5	–	71.5	%

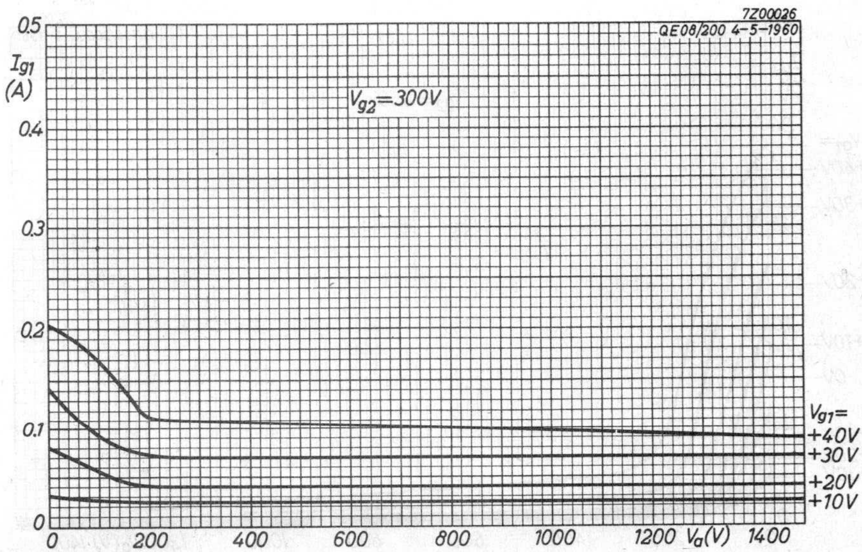

7Z00019
QE08/200 4-5-1960
V_{g2}=350V
I_a (A)
5
4
3
2
1
0
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
−50V
−60V
0
200
400
600
800
1000
1200
1400
V_a (V)

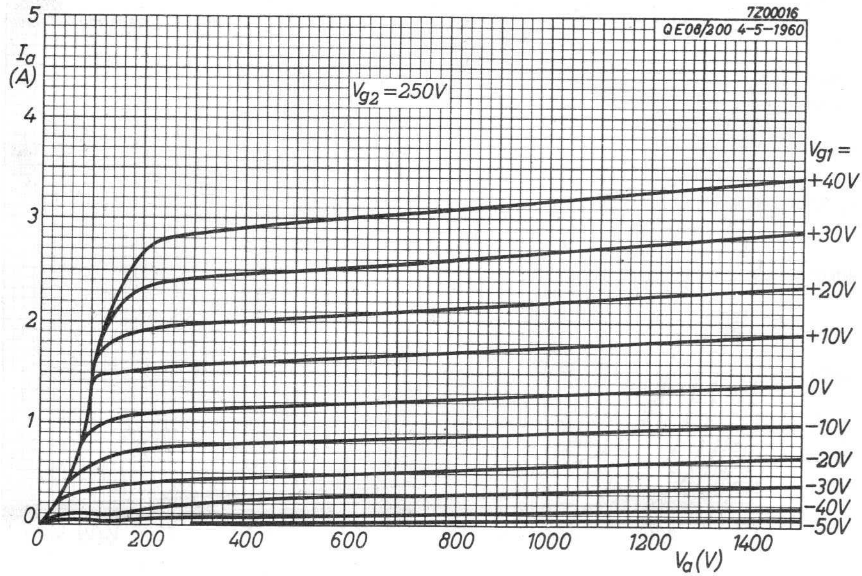

7Z00023
QE08/200 4-5-1960
V_{g2}=350V
I_{g2} (A)
2.5
2.0
1.5
1.0
0.5
0
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
0
200
400
600
800
1000
1200
1400
V_a(V)

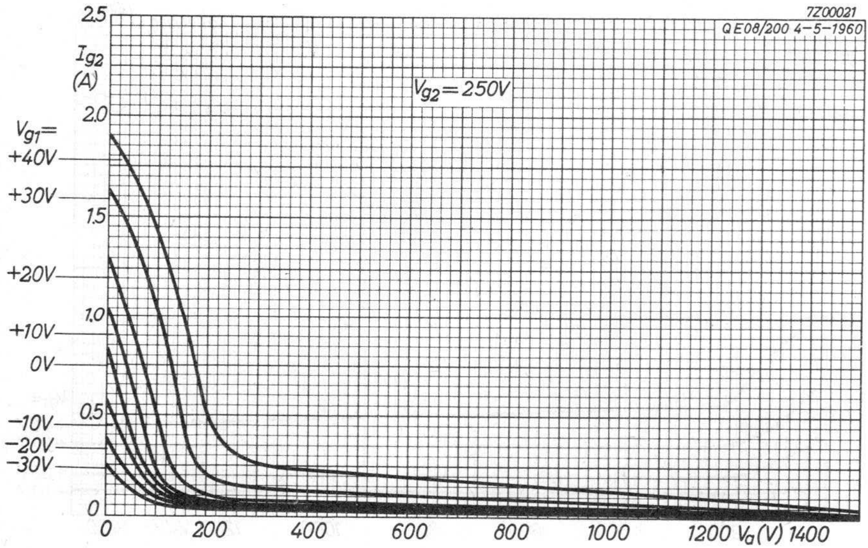

7Z00028
QE08/200 4-5-1960
I_{g1} (A)
0.5
0.4
0.3
0.2
0.1
0
V_{g2}=350V
V_{g1}=
+40V
+30V
+20V
+10V
0
200
400
600
800
1000
1200
V_a(V)
1400

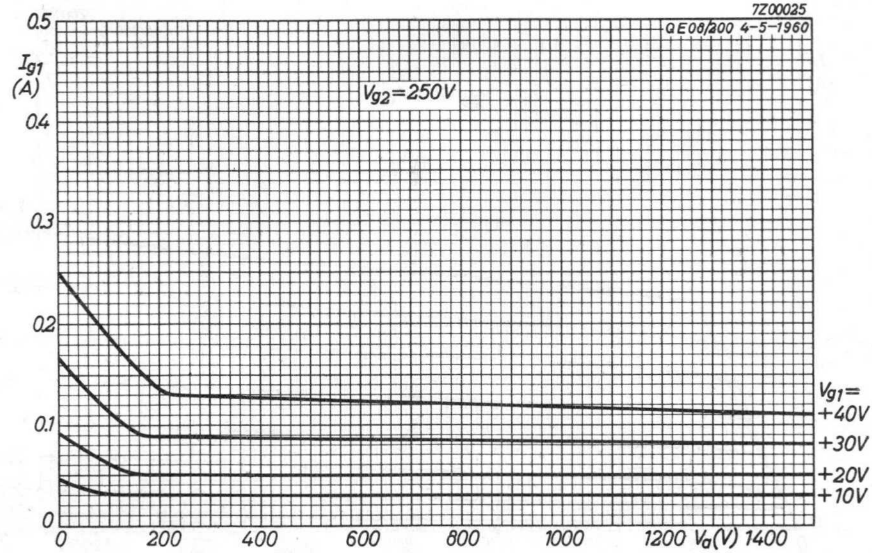

7Z00017
QE08/200 4-5-1960
I_a (A)
5
4
3
2
1
0
V_{g2}=300V
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
−50V
0
200
400
600
800
1000
1200
1400
V_a(V)

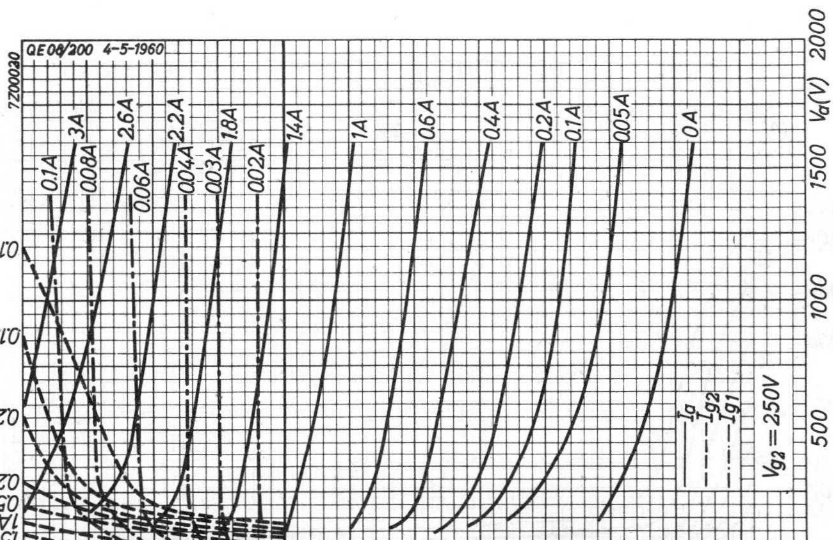

7Z00024
QE08/200 4-5-1960
I_{g2} (A)
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
V_{g2}=300V
2.5
2.0
1.5
1.0
0.5
0
0
200
400
600
800
1000
1200
V_a(V)
1400

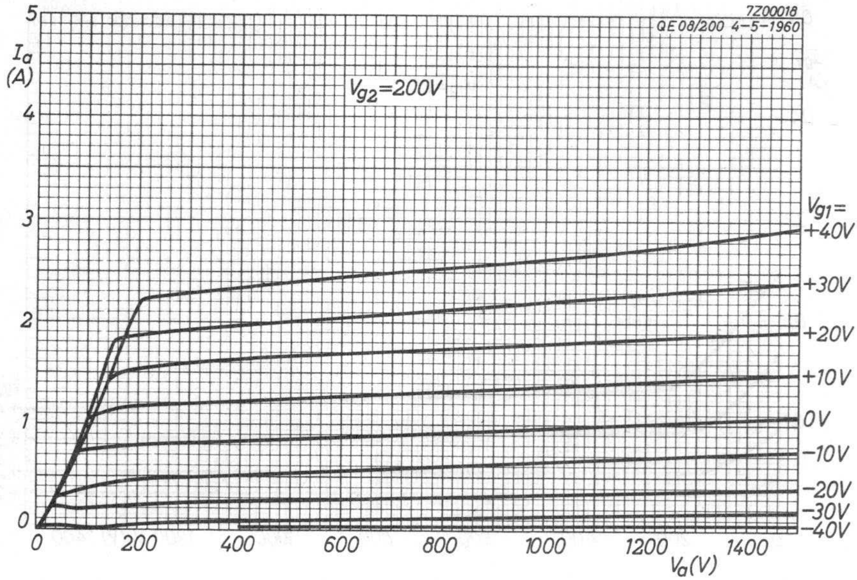

7Z00026
QE08/200 4-5-1960
I_{g1} (A)
V_{g2}=300V
V_{g1}=
+40V
+30V
+20V
+10V
0.5
0.4
0.3
0.2
0.1
0
0
200
400
600
800
1000
1200
V_a(V)
1400

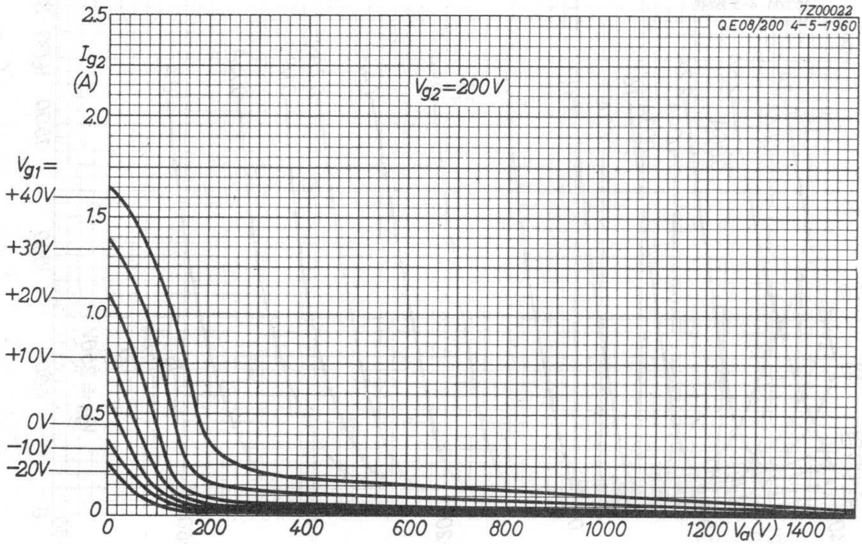

7Z00016
QE08/200 4-5-1960
I_a (A)
V_{g2} = 250V
V_{g1} =
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
−50V
0
1
2
3
4
5
0
200
400
600
800
1000
1200
1400
V_a (V)

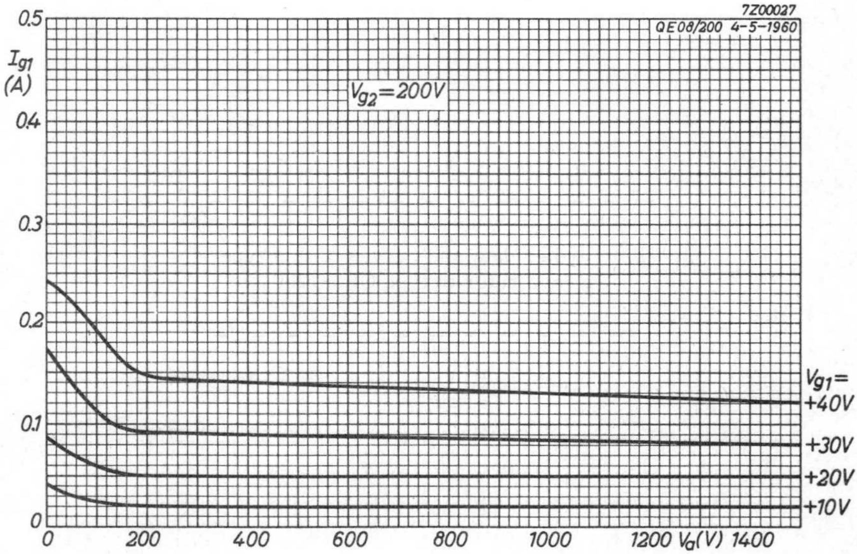

7Z00021
QE08/200 4-5-1960
I_{g2} (A)
V_{g2} = 250V
V_{g1} =
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
0
0.5
1.0
1.5
2.0
2.5
0
200
400
600
800
1000
1200
V_a (V)
1400


7Z00025
QE08/200 4-5-1960
V_{g2}=250V
I_{g1} (A)
V_{g1}=
+40V
+30V
+20V
+10V
1200 V_a(V) 1400


QE08/200 4-5-1960
7Z00030
V_{g2}=250V
V_a(V)
V_{g1} (V)
I_a
I_{g2}
I_{g1}


7Z00018
QE08/200 4-5-1960
I_a (A)
V_{g2}=200V
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
V_a(V)


7Z00022
QE08/200 4-5-1960
I_{g2} (A)
V_{g2}=200V
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
V_a(V)


7Z00027
QE08/200 4-5-1960
I_{g1} (A)
0.5
0.4
0.3
0.2
0.1
0
V_{g2}=200V
V_{g1}=
+40V
+30V
+20V
+10V
0
200
400
600
800
1000
1200
V_a(V)
1400

R.F. BEAM POWER TETRODE

HEATING: indirect

Heater voltage	V_f	=	26.5	V
Heater current	I_f	=	0.85	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 telegr. V_a (V)	C telegr. W_o (W)	C_{ag_2} mod. V_a (V)	C_{ag_2} mod. W_o (W)	AB mod. V_a (V)	AB mod. W_o 1) (W)	AB mod. W_o 2) (W)
< 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			
	750	110	600	80	800	170	215
	600	85	400	55			
500	1250	170					
	1000	120					
	800	95					
	600	50					

Freq. (MHz)	B SSB V_a (V)	B SSB W_o (PEP) (W)
175	2000	300
	1500	220
	1000	130

Freq. (MHz)	B television V_a (V)	B television W_o (sync) (W)
216	1250	250
	1000	200
	750	135

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

Heater voltage	V_f	=	6.0 V
Heater current	I_f	=	2.6 A
Waiting time	T_w	=	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_f	6.0 V	5.75 V	5.5 V

1) Without grid current, two tubes

2) 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_{g_1}	=	16	pF
Anode to grid No.1	C_{ag_1}	=	0.03	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	500	V
Grid No.2 voltage	V_{g_2}	=	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	$\mu_{g_2g_1}$	=	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	q_{min}	p_i 1)
250 W	0 m	20 °C	0.16 m^3/min	12 mm H_2O

TEMPERATURE LIMITS (Absolute limits)

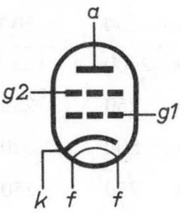
Anode temperature	max.	250	°C 2)
Anode seal temperature	max.	200	°C
Base seals and grid No.2 seal temperature	max.	175	°C

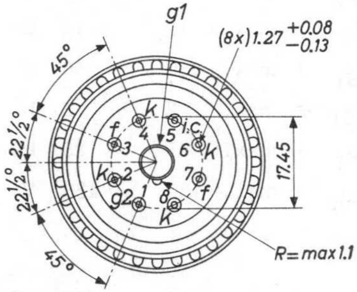
1) Pressure drop in caveties etc. excluded

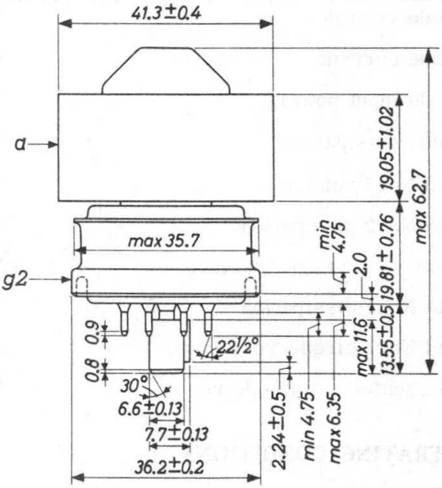
2) Measured on base end of anode surface at the junction with the radiator fins

MECHANICAL DATA (Dimensions in mm)

Net weight : 130 g

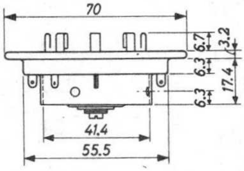


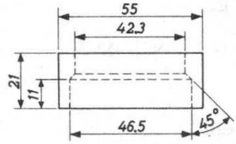




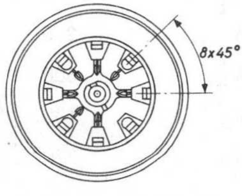
Mounting position: arbitrary

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_{g_2}	= max.	300	300	V
Grid No.2 dissipation	W_{g_2}	= max.	12	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	250	V
Grid No.1 dissipation	W_{g_1}	= max.	2	2	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	= max.	150	150	V

OPERATING CONDITIONS

Frequency	f	<	150	150	MHz
Anode voltage	V_a	=	2000	1500	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-88	-88	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	110	110	V
Anode current	I_a	=	250	250	mA
Grid No.2 current	I_{g_2}	=	24	24	mA
Grid No.1 current	I_{g_1}	=	8	8	mA
Grid No.1 input power	W_{ig_1}	=	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_{g2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g1}	=	-90	-80	-80	-75	V
Peak grid No.1 A.C. voltage	V_{g1p}	=	106	95	96	91	V
Anode current	I_a	=	200	200	200	200	mA
Grid No.2 current	I_{g2}	=	20	31	37	37	mA
Grid No.1 current	I_{g1}	=	11	10	11	11	mA
Grid No.1 input power	W_{ig1}	=	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_{g2}	=	280	250	250	250	V
Grid No.1 voltage	V_{g1}	=	-90	-110	-110	-110	V
Anode current	I_a	=	250	200	200	170	mA
Grid No.2 current	I_{g2}	=	6	7	7	6	mA
Grid No.1 current	I_{g1}	=	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_{g_2}	=	max.	300	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	10	10	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	250	V
Grid No.1 dissipation	W_{g_1}	=	max.	2	2	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	25	kΩ
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_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−118	−118	V 1)
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	136	136	V
Anode current	I_a	=	200	200	mA
Grid No.2 current	I_{g_2}	=	23	23	mA
Grid No.1 current	I_{g_1}	=	5	5	mA
Grid No.1 input power	W_{ig_1}	=	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	$V_{g_{2p}}$	=	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 [1]
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

[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. 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_{g_2}	= max.	400	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	250	V
Grid No.1 circuit resistance (with fixed bias)	R_{g_1}	= max.	25	25	kΩ
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_{g_2}	=		300		V
Grid No.1 voltage	V_{g_1}	=		-47		V
Load resistance	$R_{a\sim}$	=		4200		Ω
			zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	47	47	V
Anode current	I_a	=	75	250	160	mA
Grid No.2 current	I_{g_2}	=	-1	-7	-5	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Grid No.1 input power	W_{ig_1}	=	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

Frequency	f	=		175			175		MHz
Anode voltage	V_a	=		1500			1000		V
Grid No.2 voltage	V_{g_2}	=		300			315		V
Grid No.1 voltage	V_{g_1}	=		−45			−44.5		V
Load resistance	$R_{a\sim}$	=		2900			1850		Ω
			zero signal	single tone signal	double tone signal	zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	45	45	0	44.5	44.5	V
Anode current	I_a	=	75	250	165	100	250	180	mA
Grid No.2 current	I_{g_2}	=	−2	−4	−5	−4	20	0	mA
Grid No.1 current	I_{g_1}	=	0	0	0	0	0	0	mA
Grid No.1 input power	W_{ig_1}	=	0	0	0	0	0	0	W
Anode input power	W_{ia}	=	115	375	250	100	250	180	W
Anode dissipation	W_a	=	115	155	140	100	120	115	W
Output power	W_o	=	0	220	110	0	130	65	W
Peak envelope power	W_o(PEP)	=	–	–	220	–	–	130	W
Third order intermodulation distortion	d_3	=	–	–	−31	–	–	−30	dB

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	kΩ
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		Ω
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		Ω
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		Ω
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	kΩ
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		Ω
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		Ω
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		Ω
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

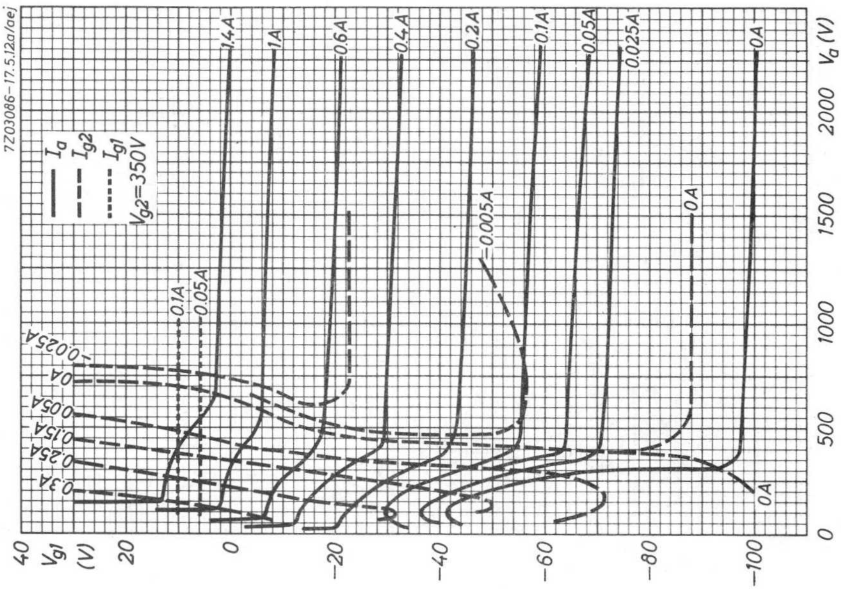
Negative modulation, positive synchronisation

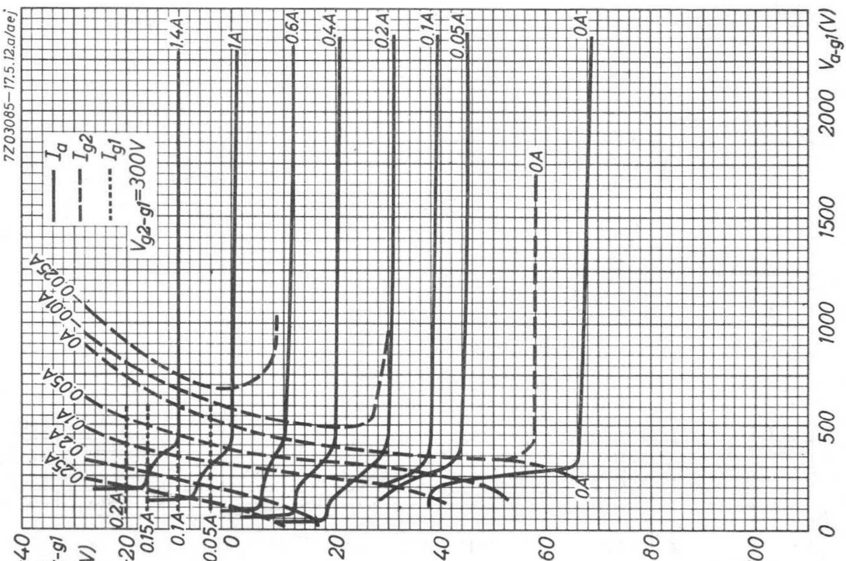
LIMITING VALUES (Absolute limits)

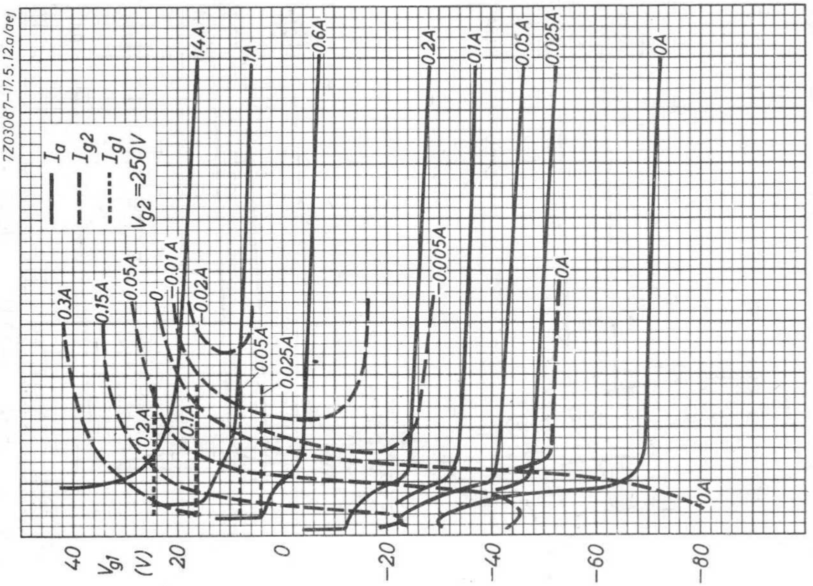
Frequency	f	= 54 to 216	MHz
Anode voltage	V_a	= max. 1250	V
Anode current	I_a	= max. 250	mA
Anode dissipation	W_a	= max. 250	W
Anode input power	W_{ia}	= max. 500	W
Grid No.2 voltage	V_{g_2}	= max. 400	V
Grid No.2 dissipation	W_{g_2}	= max. 12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max. 250	V
Grid No.1 dissipation	W_{g_1}	= max. 2	W
Grid No.1 circuit resistance	R_{g_1}	= max. 50	kΩ
Peak cathode to heater voltage	V_{kf_p}	= max. 150	V

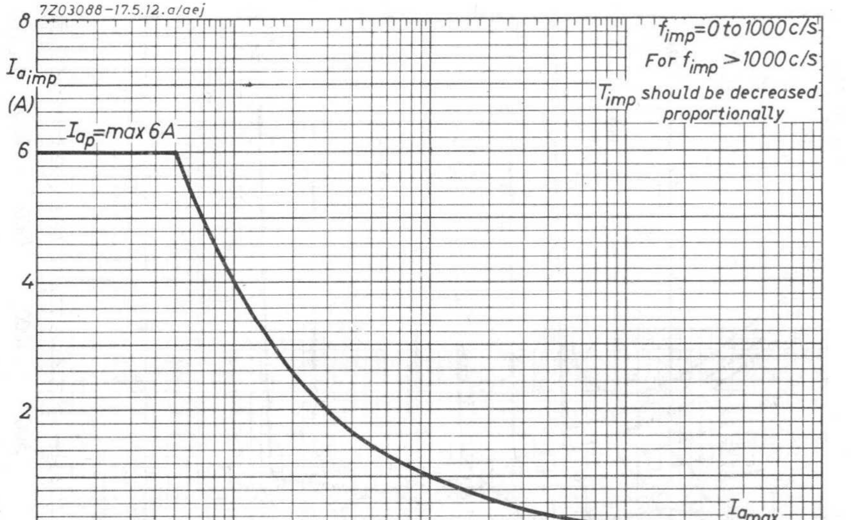
OPERATING CONDITIONS at centre frequency of resonance curve

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_{g_2}		=	300	300	300	V
Grid No.1 voltage	V_{g_1}		=	−70	−65	−60	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	sync	=	100	95	85	V
		black	=	75	70	65	V
Anode current	I_a	sync	=	305	330	335	mA
		black	=	230	240	245	mA
Grid No.2 current	I_{g_2}	sync	=	45	45	50	mA
		black	=	10	15	20	mA
Grid No.1 current	I_{g_1}	sync	=	25	20	15	mA
		black	=	4	4	4	mA
Grid No.1 input power	W_{ig_1}	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


7Z03086-17.5.12a/aej
I_a
I_{g2}
I_{g1}
V_{g2}=350V
V_{g1} (V)
V_a (V)


7Z03085-17.5.12.a/aej
I_a
I_{g2}
I_{g1}
V_{g2-g1}=300V
V_{k-g1} (V)
V_{a-g1}(V)


7Z03087-17.5.12.a/aej
I_a
I_{g2}
I_{g1}
V_{g2}=250V
1.4A
1A
0.6A
0.2A
0.1A
0.05A
0.025A
0A
0.3A
0.15A
0.05A
0
0.01A
0.02A
0.2A
0.1A
0.05A
0.025A
0.005A
0A
0A
V_a (V)
V_{g1} (V)
0
500
1000
1500
2000
40
20
0
−20
−40
−60
−80


7Z03088-17.5.12.a/aej
$I_{a_{imp}}$ (A)
I_{a_p}=max 6A
f_{imp}=0 to 1000 c/s
For f_{imp} > 1000 c/s
T_{imp} should be decreased proportionally
$I_{a_{max}}$
T_{imp} (μ sec)
0
2
4
6
8
1
2
5
10
20
50
100
200
500
1000
2000
5000
10000

FORCED AIR COOLED R.F. POWER TETRODE

HEATING: indirect by AC or DC; cathode oxide coated

Heater voltage	V_f	=	26.5	V
Heater current	I_f	=	0.58	A

For further data and curves of this type
please refer to type QEL 1/150

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	V ±10 %
Heater current at V_f = 6 V	I_f	=	2.6	A
Cathode heating time	T_w	=	min. 30	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	V	-	
Grid No.2 voltage	V_{g_2}	=	250	V	300	V
Anode current	I_a	=	200	mA	-	
Grid No.2 current	I_{g_2}	=	-		50	mA
Mutual conductance	S	=	12	mA/V	-	
Amplification factor of grid No.2 with respect to grid No.1	μ_{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_{ag_1}	=	0.065	pF

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode core and all seals max. 250 ^{o}C

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 ^{o}C	0.11 m^3/min	8 mm H_2O

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%

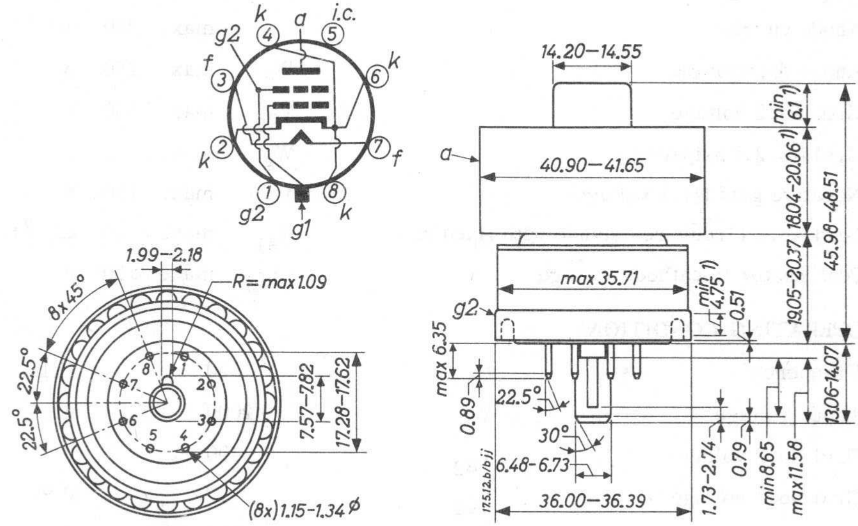
6) (Page 4) To be adjusted for zero signal anode current

7Z2 7984

MECHANICAL DATA

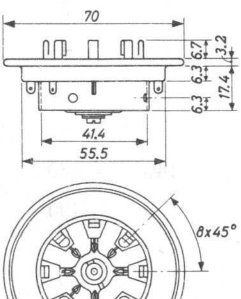
Dimensions in mm

Net weight 120 g

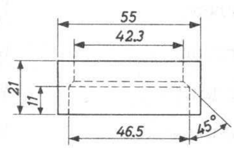


Mounting position: arbitrary

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 [1])
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	500	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 circuit resistance with fixed bias	R_{g_1}	max.	25	kΩ [2])
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_{g_2}		400		V
Grid No.1 voltage	V_{g_1}		-77		V [6])
Load resistance	$R_{a\sim}$		3050		Ω
		zero signal	single tone	double tone	
Anode current	I_a	70	350	225	mA
Grid No.2 current	I_{g_2}	-	35	16	mA
Grid No.1 current	I_{g_1}	-	-	0.05	mA
Driving power (PEP)	W_{dr}	-	1	1	W [3])
Grid No.2 dissipation	W_{g_2}	-	-	6.4	W
Anode dissipation	W_a	140	280	240	W
Output power in load	W_ℓ(PEP)	0	400	400	W [4])
Third order intermodulation distortion	d_3	-	-	-21	dB
Fifth order intermodulation distortion	d_5	-	-	-29	dB

[1])[2])[3])[4])[6]) See page 2.

7Z2 7985

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	kΩ[1])
Peak heater to cathode voltage	V_{kf_p}	= max.	150	V

OPERATING CONDITIONS

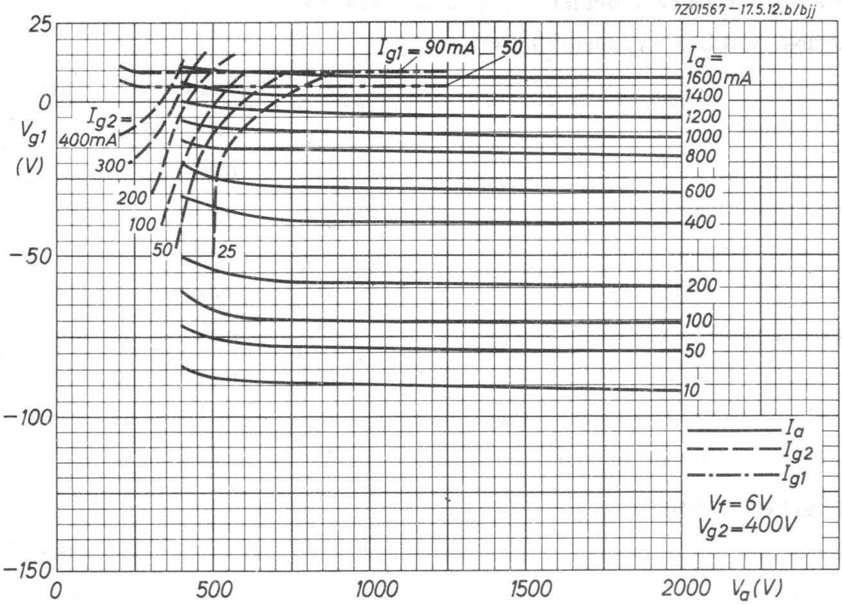
Frequency	f	= 30	500	MHz
Anode voltage	V_a	= 2000	2000	V
Grid No.2 voltage	V_{g_2}	= 400	400	V
Grid No.1 voltage	V_{g_1}	= −77	−77	V
Anode current	I_a	= 175	175	mA
Grid No.2 current	I_{g_2}	= 6	4	mA
Load resistance	$R_{a\sim}$	= 3050	3050	Ω
Driver output power	W_{dr}	= 0.25	3	W [2])
Anode input power	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

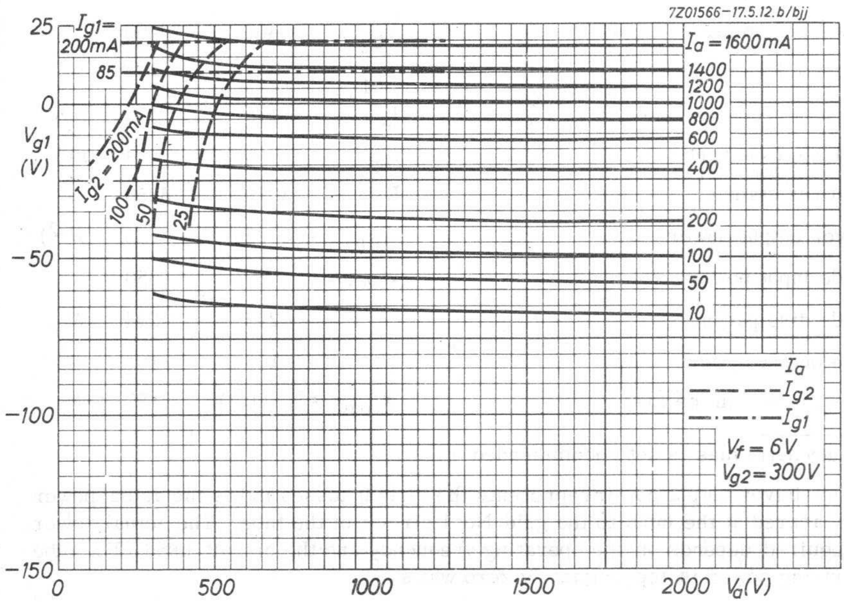
[1]) Automatic bias is not recommended

[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

7Z2 7986


7Z01567 – 17.5.12.b/bjj
I_{g1} = 90 mA
50
I_a = 1600 mA
1400
1200
1000
800
600
400
200
100
50
10
I_{g2} = 400mA
300
200
100
50
25
V_{g1} (V)
V_a (V)
I_a
I_{g2}
I_{g1}
V_f = 6V
V_{g2} = 400V


7Z01566 – 17.5.12.b/bjj
I_{g1} = 200mA
85
I_a = 1600 mA
1400
1200
1000
800
600
400
200
100
50
10
I_{g2} = 200mA
100
50
25
V_{g1} (V)
V_a (V)
I_a
I_{g2}
I_{g1}
V_f = 6V
V_{g2} = 300V

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 telegr.		C_{ag_2} mod.		AB SSB		AB mod [1]	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (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_a (V)	W_o sync (W)
216	2000	440
	1500	300
	1000	160

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

Heater voltage	V_f	=	6.0 V ±10 %
Heater current at V_f = 6 V	I_f	=	2.6 A
Cathode heating time	T_w	= min.	30 sec

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

[1]) 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_{g_1}	=	13.0	pF	15.7	pF
Anode to grid No.1	C_{ag_1}	=	0.01	pF	<0.06	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	500	V	-	
Grid No.2 voltage	V_{g_2}	=	250	V	300	V
Anode current	I_a	=	200	mA	-	
Grid No.2 current	I_{g_2}	=	-		50	mA
Mutual conductance	S	=	12	mA/V	-	
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	-		5.2	

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode core and all seals max. 250 ^{o}C

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)

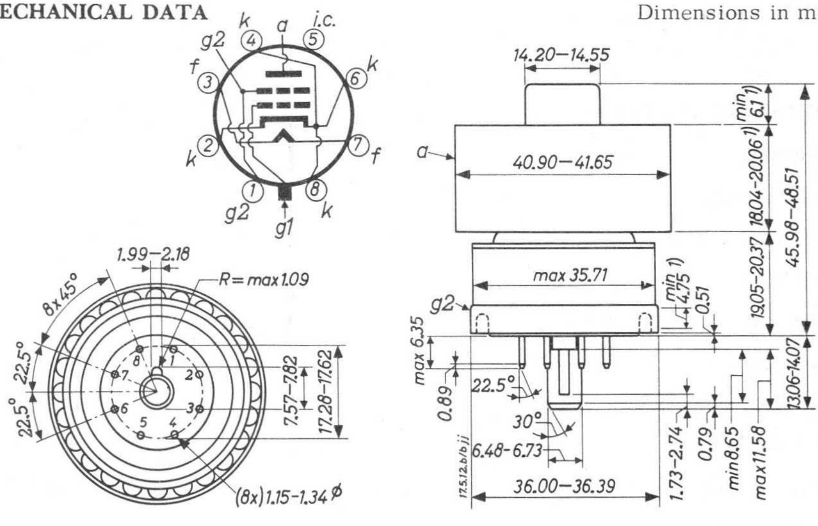
Required air flow with air system socket

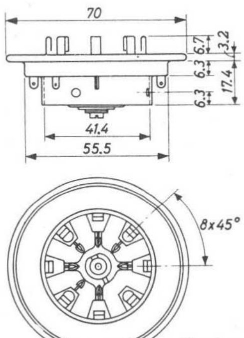
Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a	h	t_i	q_{min}	p_i
250 W	0 m	20 °C	0.11 m^3/min	8 mm H_2O

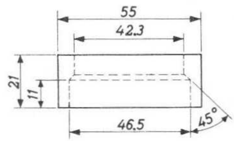
At higher altitudes and/or temperatures the air flow must be increased to maintain the anode and seal temperature within the limits

MECHANICAL DATA

Dimensions in mm







Chimney 4322 026 11701

Socket 2422 513 01001

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_{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
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	=	max.	150	V

OPERATING CONDITIONS

Frequency	f =	175	175	175	175	500[1])	MHz
Anode voltage	V_a =	2000	1500	1000	500	2000	V
Grid No.2 voltage	V_{g_2} =	250	250	250	250	300	V
Grid No.1 voltage	V_{g_1} =	-90	-90	-90	-90	-90	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$ =	112	112	114	114	-	V
Anode current	I_a =	250	250	250	250	250	mA
Grid No.2 current	I_{g_2} =	19	21	38	45	10	mA
Grid No.1 current	I_{g_1} =	26	28	31	35	25	mA
Driver output power	W_{dr} =	2.9	3.2	3.5	4	18[2])	W
Grid No.2 dissipation	W_{g_2} =	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	η =	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_{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
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	= max.	150	V

OPERATING CONDITIONS

Frequency	f	=	175	175	175	MHz
Anode voltage	V_a	=	1500	1000	500	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V [1])
Grid No.1 voltage	V_{g_1}	=	-100	-100	-100	V [3])
Anode current	I_a	=	200	200	200	mA
Grid No.2 current	I_{g_2}	=	20	22	31	mA
Grid No.1 current	I_{g_1}	=	14	14	15	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	117	177	118	V
Driver output power	W_{dr}	=	1.7	1.7	1.8	W [2])
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	η	=	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_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
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_{g_2}	=	350		350		350		V
Grid No.1 voltage	V_{g_1}	=	−55		−55		−55		V
Peak grid No.1 voltage	$V_{g_{1p}}$	=	0	50	0	50	0	50	V
Anode current	I_a	=	100	250	100	250	100	250	mA
Grid No.2 current	I_{g_2}	=	0	10	0	8	0	5	mA
Grid No.1 current	I_{g_1}	=	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_{ig_2}	=	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[1])
Grid No.2 current	I_{g_2}	=	−	2	−	−1	−	−2	mA[1])

[1]) 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[1]
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
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_{g_2}		=	350	350	350	V
Grid No.1 voltage	V_{g_1}		=	-60	-65	-70	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	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_{g_2}	sync	=	27	29	29	mA
		black	=	4	0	0	mA
Grid No.1 current	I_{g_1}	sync	=	2	5	5	mA
		black	=	0	0	0	mA
Grid No.1 input power	W_{ig_1}	sync	=	0.4	1.2	1.2	W [2]
		black	=	0	0	0	W
Output power	W_o	sync	=	160	300	440	W
		black	=	90	170	250	W

[1]) Averaged over any frame

[2]) See page 4

A.F. POWER AMPLIFIER AND MODULATOR CLASS AB

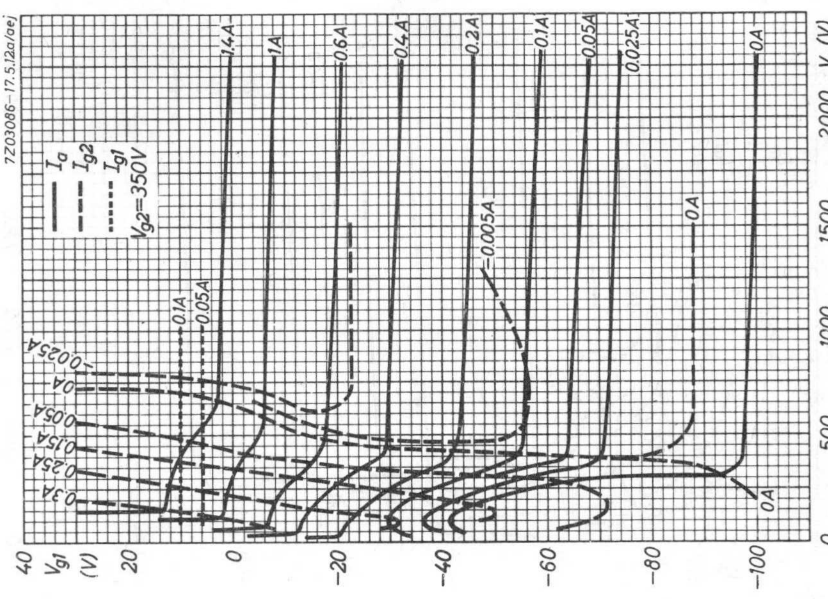
LIMITING VALUES (Absolute limits)

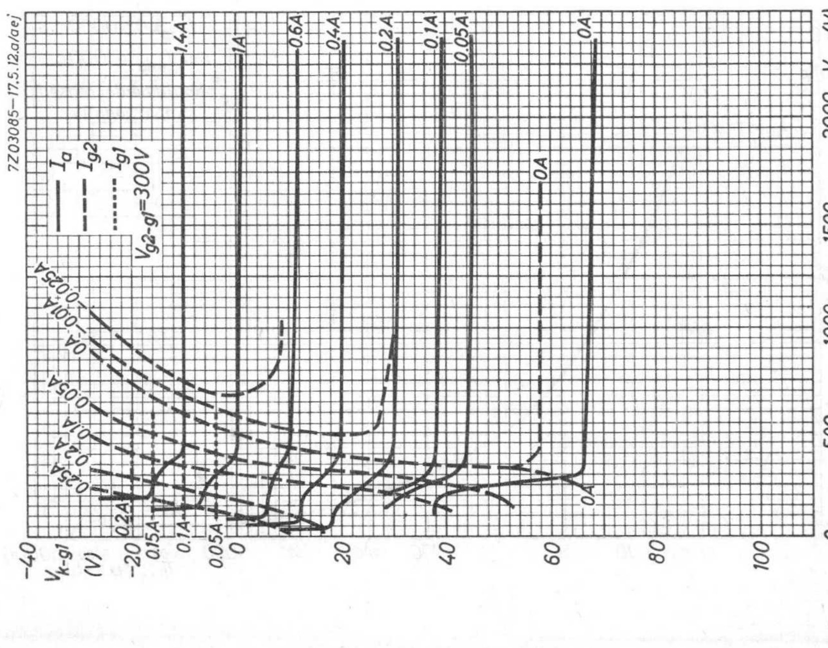
Anode voltage	V_a	= max.	2000	V
Anode current	I_a	= max.	250	mA [1])
Anode input power	W_{ia}	= max.	250	W [1])
Grid No.2 voltage	V_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W [1])
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 circuit resistance	R_{g_1}	= max.	100	kΩ
Peak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

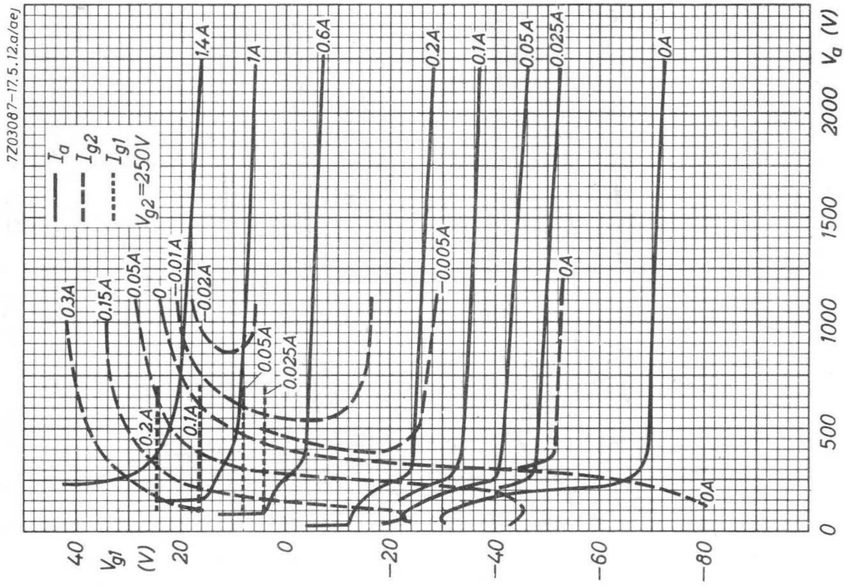
OPERATING CONDITIONS (values for two tubes)

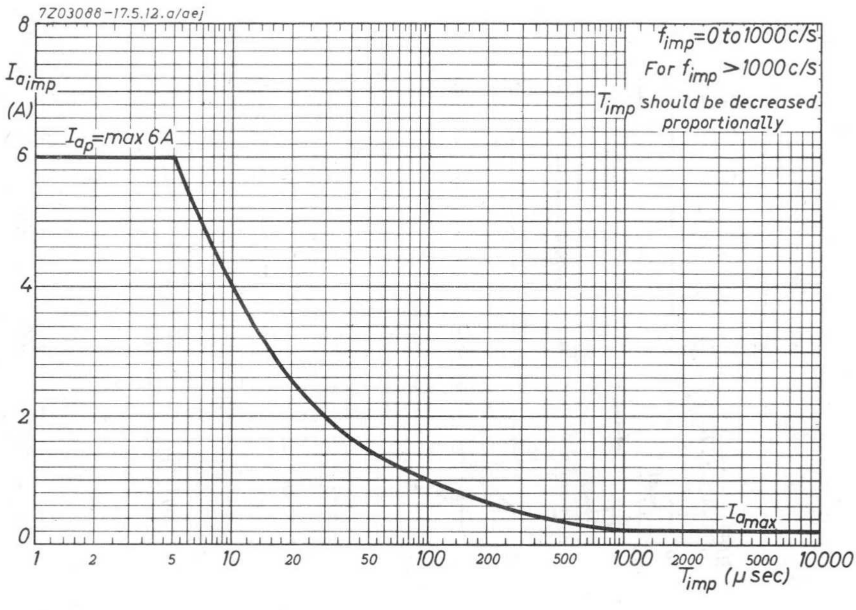
V_a	=	1000		1500		2000		V
V_{g_2}	=	350		350		350		V
V_{g_1}	=	-55		-55		-55		V
$R_{aa\sim}$	=	3500		6200		9500		Ω
$V_{g_1g_{1p}}$	=	0	100	0	100	0	100	V
I_{g_1}	=	0	0	0	0	0	0	mA
I_a	=	2x100	2x250	2x100	2x250	2x100	2x250	mA
I_{g_2}	=	0	2x10	0	2x8	0	2x5	mA
W_{ia}	=	2x100	2x250	2x150	2x375	2x200	2x500	W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

[1]) Averaged over any low-frequency cycle of sine wave form.


7Z03086-17.5.12a/aej
I_a
I_{g2}
I_{g1}
V_{g2}=350V
V_{g1} (V)
V_a (V)


7Z03085-17.5.12a/aej
I_a
I_{g2}
I_{g1}
V_{g2-g1}=300V
V_{k-g1} (V)
V_{a-g1}(V)


7Z03087–17.5.12.a/aej
I_a
I_{g2}
I_{g1}
V_{g2}=250V
V_a (V)
V_{g1} (V)
1.4A
1A
0.6A
0.2A
0.1A
0.05A
0.025A
0A
0.3A
0.15A
0.05A
0
0.01A
0.02A
0.005A
0.05A
0.025A
0.2A
0.1A
0A
0A
0
500
1000
1500
2000
40
20
0
−20
−40
−60
−80


7Z03088–17.5.12.a/aej
$I_{a_{imp}}$ (A)
I_{ap}=max 6A
f_{imp}=0 to 1000 c/s
For f_{imp} > 1000 c/s
T_{imp} should be decreased proportionally
$I_{a_{max}}$
T_{imp} (μ sec)
0
2
4
6
8
1
2
5
10
20
50
100
200
500
1000
2000
5000
10000

COAXIAL R.F. POWER TETRODE

Heater voltage	V_f	=	26.5 V ± 10%
Heater current	I_f	=	0.58 A

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. F.M. teleph. [1]		Tripler - doubler	
	V_a (V)	W_ℓ (W) [2]	V_a (V)	W_ℓ (W) [3]
200	250 200	11 9.5		
27.5/165			250 200	1.25 1.0

HEATING: direct; parallel supply; filament oxide-coated

Filament voltage	V_f	=	3.15 V ±10 %
Filament current	I_f	=	1.65 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 = max. 1 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_a	=	200 V
Grid No.2 voltage	V_{g_2}	=	200 V
Anode current	I_a	=	30 mA
Mutual conductance	S	=	3.2 mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	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

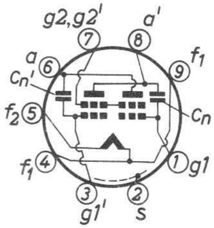
Dimensions in mm

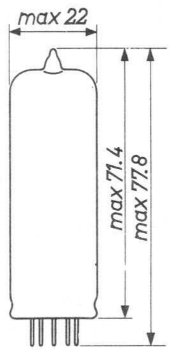
Base : Noval

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)

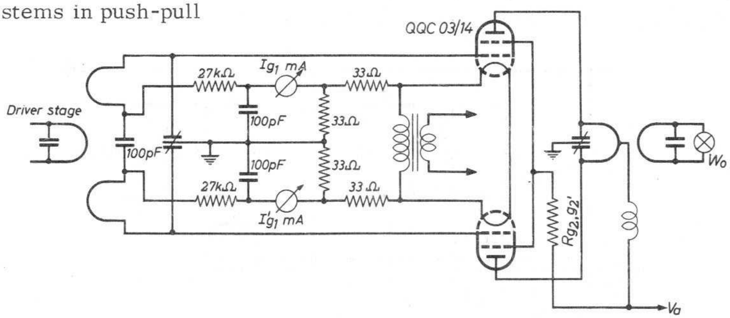
Bulb temperature	=	max. 225 °C
Pin temperature	=	max. 120 °C

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	kΩ
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



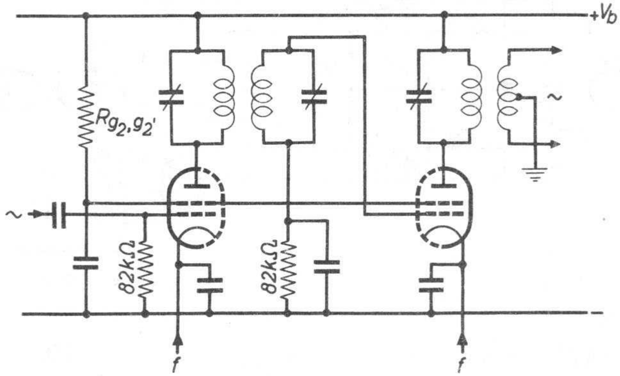
Frequency	f			=	200	200	MHz
Anode voltage	V_a	=	$V_{a'}$	=	250	200	V
Grids No.2 supply voltage	$V_{bg_2,g_{2'}}$			=	250	200	V
Grids No.2 resistor	$R_{g_2,g_{2'}}$			=	22	6.8	kΩ
Anode current	I_a	=	$I_{a'}$	=	45	45	mA
Grids No.2 current	$I_{g_2+g_{2'}}$			=	4.2	5.1	mA
Grid No.1 current	I_{g_1}	=	$I_{g_{1'}}$	=	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_{k_p}	=	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		kΩ
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	η	=	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		kΩ
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	η	=	30		40	%
Output power in load	W_ℓ	=	1.0		1.0	W

R.F. DOUBLE TETRODE FOR MOBILE EQUIPMENT

QUICK REFERENCE DATA								
Freq.	C telegr.			C_{ag2} mod.			B mod. 1)	
(MHz)	V_a (V)	W_o 1) (W)		V_a (V)	W_o 1) (W)		V_a (V)	W_o (W)
		CCS	ICAS		CCS	ICAS	C.C.S.	
60	600	26.6	35	450	17.5		450	18
				250		8.2		
186	600	25.6	33.6	250	6.0	7.8	I.C.A.S.	
							600	28.2

HEATING : direct; filament oxide-coated

Filament voltage	V_f	3 - 3.15	6 - 6.3	V
Filament current	I_f	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	$\mu_{g_2g_1}$	7.5	
Mutual conductance 2)	S (I_a = 20 mA)	2	mA/V

1) C.C.S. = continuous service
I.C.A.S. = intermittent service
2) One system

CAPACITANCES

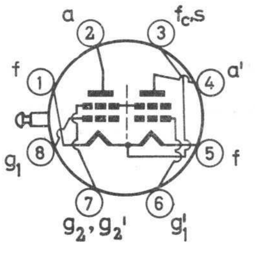
		per system	
Anode to all other elements except grid No. 1	C_a	3.3	pF
Grid No. 1 to all other elements except anode	C_{g_1}	8.5	pF
Anode to grid No. 1	C_{ag_1}	0.05	pF
		in push-pull	
Output capacitance	C_o	1.7	pF
Input capacitance	C_i	5.7	pF

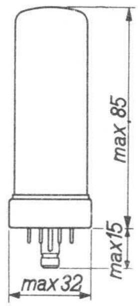
MECHANICAL DATA Dimensions in mm

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_{g_2}	max.	250	V
Grid No. 2 dissipation	W_{g_2}	max.	7	W
Negative grid No. 1 voltage	$-V_{g_1}$	max.	200	V
Grid No. 1 current	I_{g_1}	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_{g_2}	200	200	V
Grid No. 1 voltage	V_{g_1}	-80	-80	V
Anode current	I_a	2x30	2x30	mA
Grid No. 2 current	I_{g_2}	6	3	mA
Grid No. 1 current	I_{g_1}	2x1.0	2x1.0	mA
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	210	210	V
Grid No. 1 input power	W_{ig_1}	2x0.1	2x0.1	W
Grid No. 2 dissipation	W_{g_2}	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	η	74	71 [1]	%

[1]) 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_{g_2}	max.	250	V
Grid No. 2 dissipation	W_{g_2}	max.	7	W
Negative grid No. 1 voltage	$-V_{g_1}$	max.	200	V
Grid No. 1 current	I_{g_1}	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_{g_2}	200	200	V
Grid No. 1 voltage	V_{g_1}	-80	-80	V
Anode current	I_a	2x40	2x40	mA
Grid No. 2 current	I_{g_2}	5.5	4.5	mA
Grid No. 1 current	I_{g_1}	2x1.2	2x1.3	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	220	220	V
Grid No. 1 input power	W_{ig_1}	2x0.12	2x0.13	W
Grid No. 2 dissipation	W_{g_2}	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	η	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_{g_2}	max.	250	V
Grid No. 2 dissipation	W_{g_2}	max.	4.5	W
Negative grid No. 1 voltage	$-V_{g_1}$	max.	200	V
Grid No. 1 current	I_{g_1}	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_{g_2}	18	10	kΩ
Grid No. 1 voltage	V_{g_1}	−80	−70	V
Anode current	I_a	2x25	2x19.5	mA
Grid No. 2 current	I_{g_2}	14	11	mA
Grid No. 1 current	I_{g_1}	2x1.0	2x1.5	mA
Peak grid No. 1 voltage	$V_{g_{1p}}$	83	110	V
Grid No. 1 input power	W_{ig_1}	2x0.08	2x0.15	W
Grid No. 2 dissipation	W_{g_2}	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	η	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_{g_2}	max.	250	V
Grid No. 2 dissipation	W_{g_2}	max.	4.5	W
Negative grid No. 1 voltage	$-V_{g_1}$	max.	200	V
Grid No. 1 current	I_{g_1}	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_{g_2}	10	10	kΩ
Grid No. 1 voltage	V_{g_1}	−70	−70	V
Anode current	I_a	2x26.5	2x26.5	mA
Grid No. 2 current	I_{g_2}	9	9	mA
Grid No. 1 current	I_{g_1}	2x1.8	2x1.5	mA
Peak grid No. 1 A.C. voltage	$V_{g_{1p}}$	110	110	V
Grid No. 1 input power	W_{ig_1}	2x0.18	2x0.15	W
Grid No. 2 dissipation	W_{g_2}	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	η	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_{g_2}	max.	250	V
Grid No. 2 dissipation	W_{g_2}	max.	7	W
Negative grid No. 1 voltage	$-V_{g_1}$	max.	200	V

C.C.S. OPERATING CONDITIONS continuous service

two systems in push-pull

Heater voltage	V_f	6.3 [1]		V
Anode voltage	V_a	450		V
Grid No. 2 voltage	V_{g_2}	200		V
Grid No. 1 voltage	V_{g_1}	-24		V
Load resistance	$R_{aa'\sim}$	20		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	0	94	V
Anode current	I_a	2x2.8	2x32.5	mA
Grid No. 2 current	I_{g_2}	2x0.16	2x5	mA
Grid No. 1 current	I_{g_1}	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	η	-	61.5	%

[1] 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_{g_2}	max.	250	V
Grid No. 2 dissipation	W_{g_2}	max.	7	W
Negative grid No. 1 voltage	$-V_{g_1}$	max.	200	V

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

two system in push-pull

Heater voltage	V_f	6.3 [1]		V
Anode voltage	V_a	600		V
Grid No. 2 voltage	V_{g_2}	200		V
Grid No. 1 voltage	V_{g_1}	-24		V
Load resistance	$R_{aa'\sim}$	25		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	0	85	V
Anode current	I_a	2x3.0	2x33.5	mA
Grid No. 2 current	I_{g_2}	2x0.18	2x4.5	mA
Grid No. 1 current	I_{g_1}	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	η	-	70	%

[1] D.C. voltage

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA

λ	Freq.	C telegr.			Cag₂ mod.		
(m)	(MHz)	V_a (V)	W_o (W) [1] CCS	W_o (W) [1] ICAS	V_a (V)	W_o (W) [1] CCS	W_o (W) [1] ICAS
0.6	500	180	5.8		180	4.2	5.8
		200		7.2			

λ	Freq.	C fr.mult.		
(m)	(MHz)	V_a (V)	W_o (W) [1] CCS	W_o (W) [1] ICAS
1.8/0.6	167/500	180	2.35	
		200		2.95

HEATING: indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6	V [2]
Heater current	I_f	=	0.6	0.3	A
	Pins	=	9-(4+5)	4-5	

TYPICAL CHARACTERISTICS per system

Anode voltage	V_a	=	150	V
Grid No.2 voltage	V_{g_2}	=	150	V
Anode current	I_a	=	25	mA
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	31	
Mutual conductance	S	=	10.5	mA/V

[1]) Two systems

[2]) A temporary deviation of 10% of V_f is permissible; e.g. when the tube is fed from an accumulator, the actual V_f 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_f is 5.7 V or 11.4 V

CAPACITANCES

	per system
Anode to all other elements except grid No.1	C_a = 1.6 pF
Grid No.1 to all other elements except anode	C_{g_1} = 6.4 pF
Anode to grid No.1	C_{ag_1} = 0.16 pF
	in push-pull
Output	C_o = 0.95 pF
Input	C_i = 3.8 pF

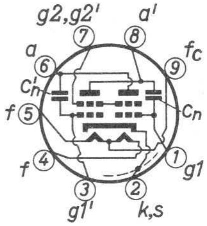
The tube is internally neutralized

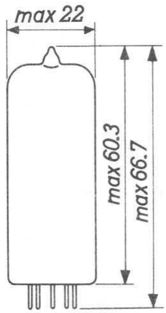
MECHANICAL DATA

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)

			C.C.S.	I.C.A.S.	
Frequency	f		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

			C.C.S.	I.C.A.S.	
Frequency	f	=	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	kΩ [1])
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	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	η	=	58	58	%
Output power in load	W_ℓ	=	5	6	W

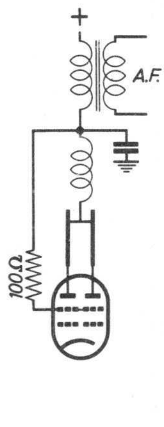
[1]) Each system

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

LIMITING VALUES (Absolute limits)

			C.C.S.		I.C.A.S.	
Frequency	f		up to	500	up to 500	MHz
Anode voltage	V_a	=	max.	200	max. 200	V
Anode input power	W_{ia}	=	max.	2x4	max. 2x5	W
Anode dissipation	W_a	=	max.	2x2	max. 2x2.5	W
Anode current	I_a	=	max.	2x32	max. 2x40	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.0	max. 2x1.15	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max. 100	V
Grid No.1 current	I_{g_1}	=	max.	2x3	max. 2x4	mA
Heater to cathode voltage	V_{kf}	=	max.	100	max. 100	V

OPERATING CONDITIONS



		C.C.S.	I.C.A.S.	
f	=	500	500	MHz
V_a	=	180	180	V
V_{g_2}	=	see circuit diagram		
V_{g_1}	=	-20	-20	V
R_{g_1}	=	68	27	kΩ 1)
$V_{g_1 g_1'p}$	=	45	50	V
I_a	=	2x20	2x27.5	mA
I_{g_2}	=	9.5	12.5	mA
I_{g_1}	=	2x0.3	2x0.75	mA
W_{ia}	=	2x3.6	2x5.0	W
W_a	=	2xi.5	2x2.1	W
W_{g_2}	=	1.7	2.25	W
W_{dr}	=	1.0	1.2	W
W_o	=	4.2	5.8	W
η	=	58	58	%
W_ℓ	=	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)

			C.C.S.		I.C.A.S.		
Frequency	f		up to	500	up to	500	MHz
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_{g_2}	=	max.	200	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	max.	2x1.75	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x3	max.	2x4	mA
Heater to cathode voltage	V_{kf}	=	max.	100	max.	100	V

OPERATING CONDITIONS

			C.C.S.	I.C.A.S.	
Frequency	f	=	167/500	167/500	MHz
Anode voltage	V_a	=	180	200	V
Grid No.2 supply voltage	V_{bg_2}	=	180	200	V
Grid No.2 resistor	R_{g_2}	=	1200	1200	Ω
Grid No.1 resistors	R_{g_1}	=	82	82	kΩ [1])
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	165	165	V
Anode current	I_a	=	2x20	2x22.5	mA
Grid No.2 current	I_{g_2}	=	9.7	11.0	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	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	η	=	33	33	%
Output power in load	W_ℓ	=	1.8	2.2	W

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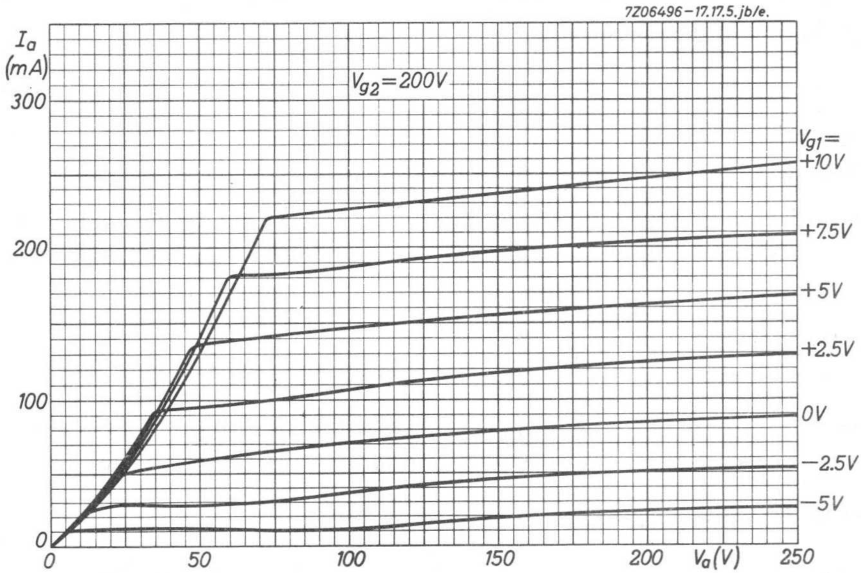
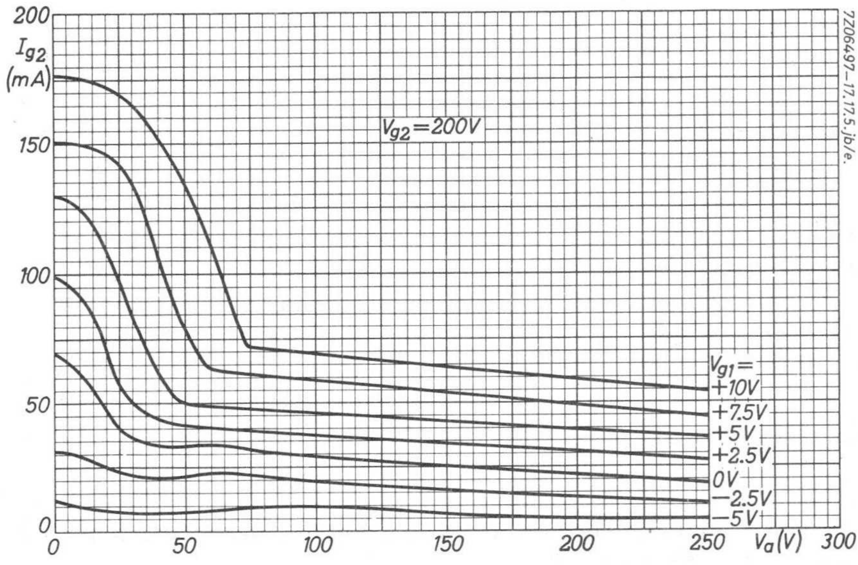
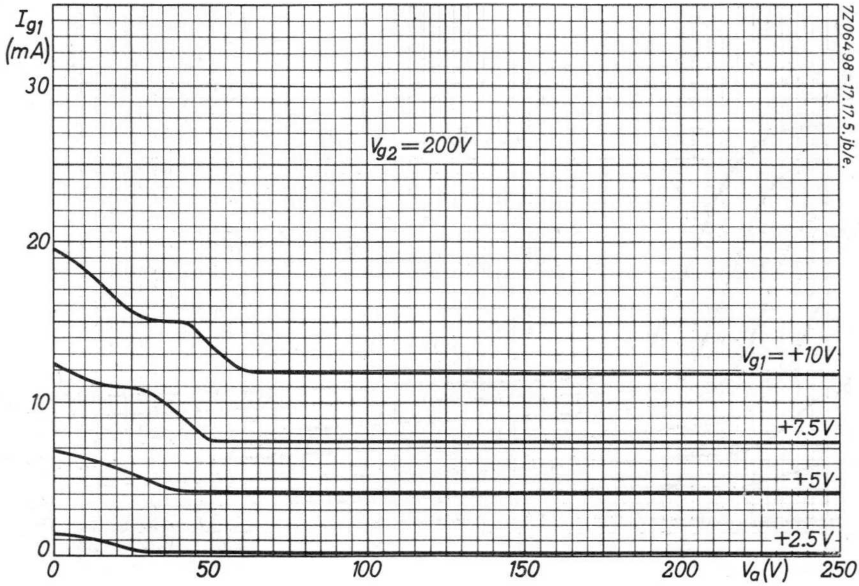
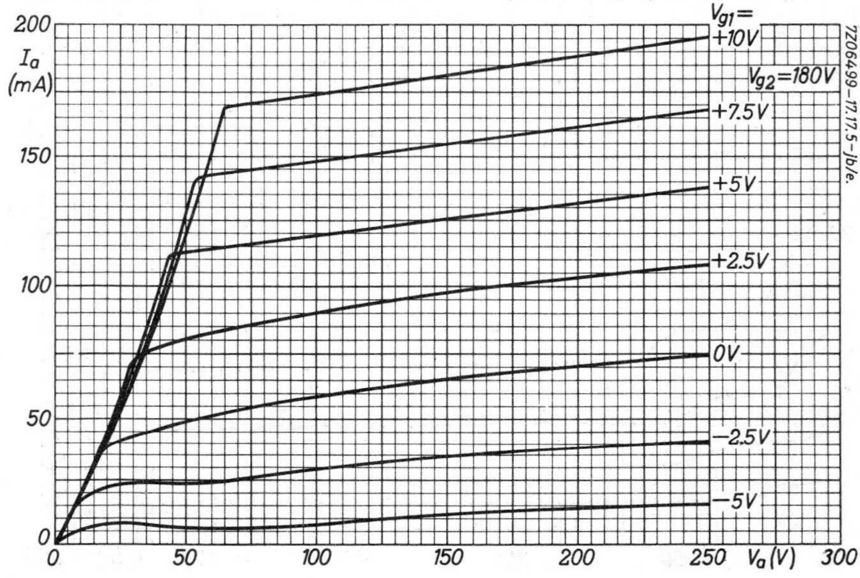
[1]) Each system. Fixed bias or a combination of fixed bias and grid current biasing is not recommended.


7Z06496-17.17.5.jb/e.
I_a (mA)
300
200
100
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
V_a(V)
250

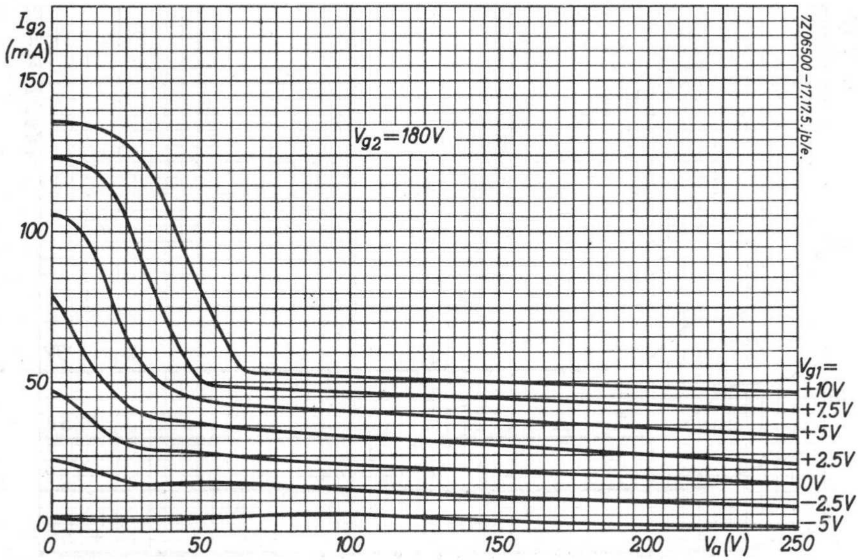

7Z06497-17.17.5.jb/e.
200
I_{g2} (mA)
150
100
50
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
V_a(V)
300

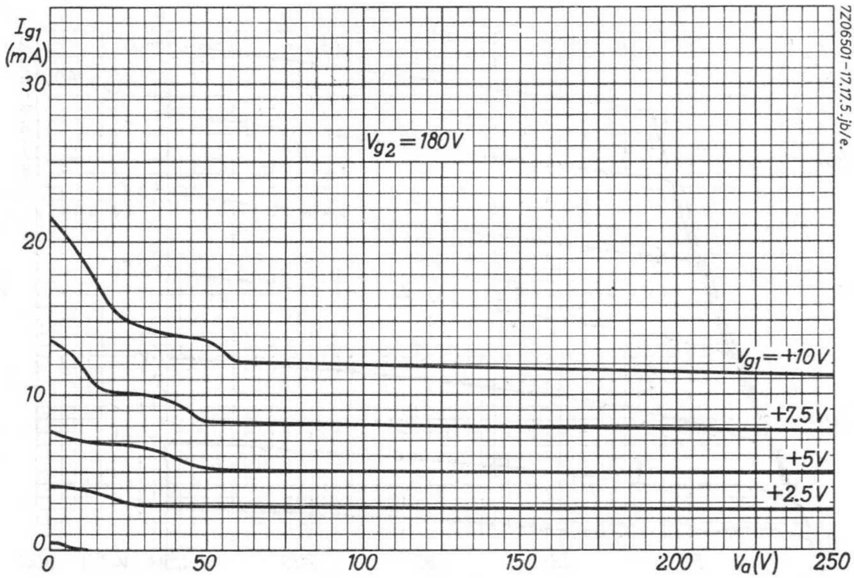


Ig1 (mA)
30
20
10
0
Vg2 = 200V
Vg1 = +10V
+7.5V
+5V
+2.5V
0
50
100
150
200
Va (V)
250
7Z06498-17.17.5.jb/e.



200
Ia (mA)
150
100
50
0
Vg1 =
+10V
Vg2 = 180V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
Va (V)
300
7Z06499-17.17.5-jb/e.


I_{g2} (mA)
150
100
50
0
$V_{g2}=180V$
7Z06500-17.17.5.jb/e.
$V_{g1}=$
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
$V_a(V)$
250


I_{g1} (mA)
30
20
10
0
$V_{g2}=180V$
7Z06501-17.17.5.jb/e.
$V_{g1}=+10V$
+7.5V
+5V
+2.5V
0
50
100
150
200
$V_a(V)$
250

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA								
λ (m)	Freq. (MHz)	C telegr.			C_{ag_2} mod.			
		V_a (V)	W_o (W) 1) CCS	W_o (W) 1) ICAS	V_a (V)	W_o (W) 1) CCS	W_o (W) 1) ICAS	
1.5	200	300	12	16	200	7.1	8.8	
		250	9.0	11.2				
		200	7.4	9.0				

λ (m)	Freq. (MHz)	C fr. mult.			B mod.	
		V_a (V)	W_o (W) 1) CCS	W_o (W) 1) ICAS	V_a (V)	W_o 1) (W)
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 2)
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 μ_{g2g1} = 7.5

Mutual conductance S (I_a = 30 mA) = 3.3 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

	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_{g_1} = 6.2 pF
Anode to grid No.1	C_{ag_1} < 0.1 pF
	in push-pull
Output capacitance	C_o = 1.4 pF
Input capacitance	C_i = 5.1 pF

The tube is internally neutralized

MECHANICAL DATA

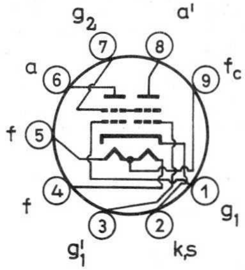
Dimensions in mm

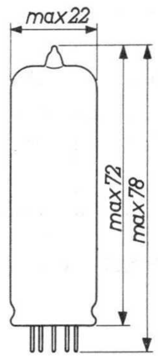
Base : Noval

Socket : 2422 502 01003

Tube retainer: 40647

Net weight : 17 g





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_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.2	W
Grid No.1 current	I_{g_1}	=	max.	2x3	mA
Cathode current	I_k	=	max.	2x50	mA
Peak cathode current	I_{k_p}	=	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_{g_2}	=	175	–	–	V
Grid No.2 resistor	R_{g_2}	=	–	47	22	kΩ
Grid No.1 voltage	V_{g_1}	=	−40	–	–	V
Grid No.1 resistor	R_{g_1} 1)	=	–	18	15	kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	110	110	115	V
Anode current	I_a	=	2x37.5	2x33.5	2x35	mA
Grid No.2 current	I_{g_2}	=	2.3	1.8	2.2	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	0.4	0.3	0.33	W
Grid No.1 input power	W_{ig_1}	=	2x0.05	0.12	0.14	W
Output power	W_o	=	14.5	11	8.4	W
Efficiency	η	=	65	65	60	%
Output power	W_o 2)	=	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_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.2	W
Grid No.1 current	I_{g_1}	=	max.	2x4	mA
Cathode current	I_k	=	max.	2x65	mA
Peak cathode current	I_{k_p}	=	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_{g_2}	=	200	–	–	V
Grid No.2 resistor	R_{g_2}	=	–	27	8.2	kΩ
Grid No.1 voltage	V_{g_1}	=	–45			V
Grid No.1 resistor	R_{g_1} 1)	=	–	18	15	kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	130	120	130	V
Anode current	I_a	=	2x50	2x40	2x42	mA
Grid No.2 current	I_{g_2}	=	3.0	2.4	3.1	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	0.6	0.45	0.55	W
Grid No.1 input power	W_{ig_1}	=	2x0.1	0.15	0.18	W
Output power	W_o	=	18.5	13	10	W
Efficiency	η	=	62	65	60	%
Output power	W_o 2)	=	16	11.2	9	W

1) Common resistor for both systems

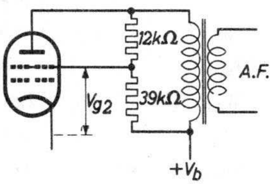
2) Useful power output in load

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	kΩ
$V_{g1g1'p}$	=	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
η	=	60	%
W_ℓ 3)	=	7.1	W
m	=	100	%
W_{mod}	=	6.7	W

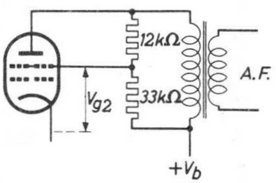
1) See diagram
2) Common resistor for both systems
3) Useful power output in load

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_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	1.3	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x52	mA
Peak cathode current	I_{k_p}	= 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_{g_2} 1)	=		
R_{g_1} 2)	=	15	kΩ
$V_{g_1g_1'p}$	=	130	V
I_a	=	2x43	mA
I_{g_2}	=	3.1	mA
I_{g_1}	=	3.3	mA
W_{ia}	=	2x8.6	W
W_a	=	2x3.7	W
W_{g_2}	=	0.54	W
W_{ig_1}	=	0.2	W
W_o	=	9.8	W
η	=	57	%
W_o 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	kΩ
Grid No.1 voltage	V_{g1}	=	-100	–	–	V
Grid No.1 resistor	R_{g1} 1)	=	–	47	33	kΩ
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	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	η	=	45	40	33.5	%
Output power	W_o 2)	=	3.5	3.0	2.8	W

1) Common resistor for both systems

2) 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_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= 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_{g_2}	=	150	175	176	175	V
R_{g_2}	=	–	–	18	4.7	kΩ
V_{g_1}	=	−100	−100	–	–	V
R_{g_1} 1)	=	–	–	27	22	kΩ
$V_{g_1g_1'p}$	=	240	230	230	230	V
I_a	=	2x32.5	2x32.5	2x36	2x39	mA
I_{g_2}	=	3.5	2.7	4.1	5.2	mA
I_{g_1}	=	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_{g_2}	=	0.53	0.47	0.72	0.91	W
W_{ig_1}	=	0.45	0.28	0.43	0.52	W
W_o	=	7.8	7.2	6.2	4.5	W
η	=	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_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	2x1	W
Peak grid No.2 dissipation	$W_{g_{2p}}$	= max.	2x2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x60	mA
Peak cathode current	I_{k_p}	= max.	2x300	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

OPERATING CONDITIONS

V_a	=	300		250		200		V
V_{g_2}	=	200		200		200		V
V_{g_1} 1)	=	-21.5		-21.5		-21.5		V
$R_{aa'\sim}$	=	10		8		6.5		kΩ
$V_{g_1g_1'p}$	=	0	43.5	0	44.5	0	43.5	V
I_a	=	2x15	2x36	2x15	2x34.5	2x15	2x33	mA
I_{g_2}	=	1.2	12.6	1.4	12.4	2.4	14	mA
W_{g_2}	=	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
η	=	–	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

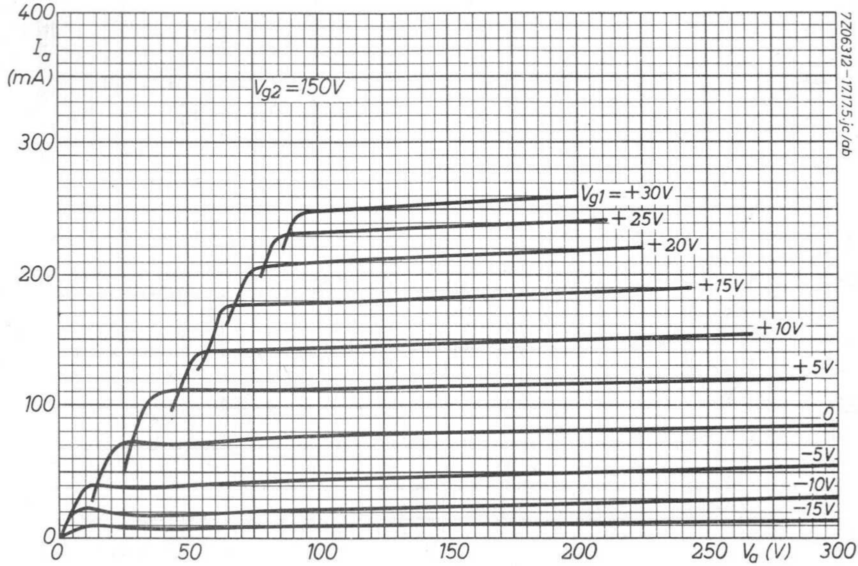
LIMITING VALUES (Absolute limits) only for speech and music

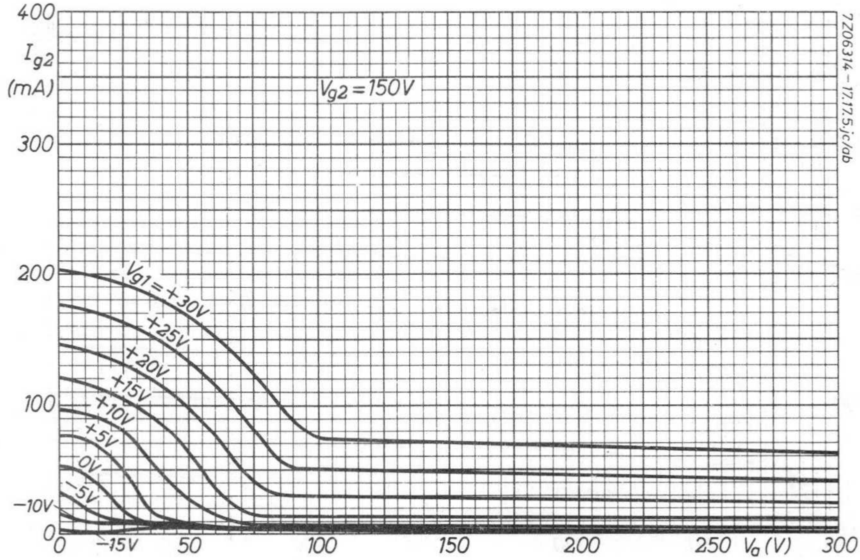
Anode voltage	V_a	= max.	300	V
Anode dissipation	W_a	= max.	2x7	W
Anode input power	W_{ia}	= max.	2x15	W
Anode current	I_a	= max.	2x50	mA
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	2x1	W
Peak grid No.2 dissipation	$W_{g_{2p}}$	= max.	2x2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x60	mA
Peak cathode current	I_{k_p}	= max.	2x300	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

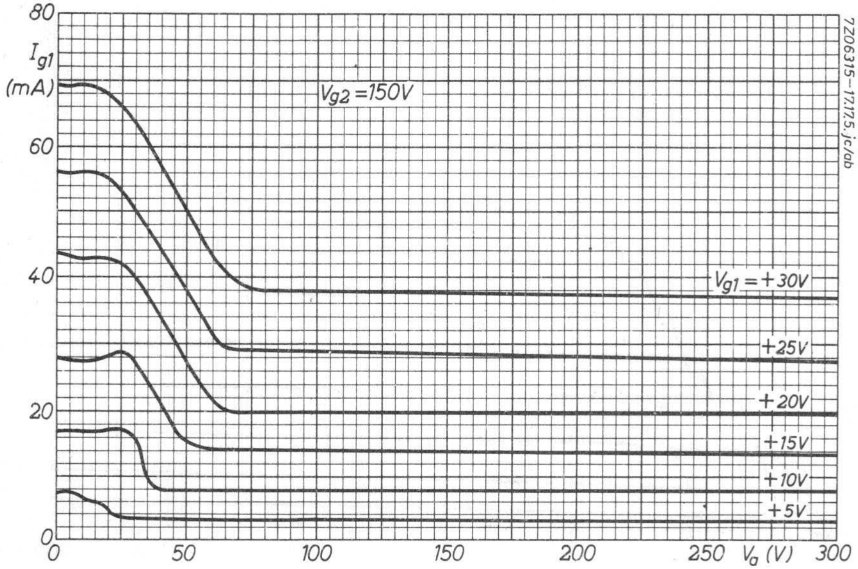
OPERATING CONDITIONS

V_a	=	300		250		200		V
V_{g_2}	=	200		200		200		V
V_{g_1} 1)	=	-21.5		-21.5		-21.5		V
$R_{aa'\sim}$	=	6.5		5.0		5.0		kΩ
$V_{g_1g_1'p}$	=	0	64	0	67	0	54	V
I_a	=	2x15	2x50	2x15	2x50	2x15	2x41.1	mA
I_{g_2}	=	1.2	11.4	1.4	13	2.4	19	mA
I_{g_1}	=	0	2x0.56	0	2x0.62	0	2x0.22	mA
W_{g_2}	=	0.24	2.3	0.28	2.6	0.48	3.8	W
W_{ig_1}	=	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
η	=	-	58	-	56	-	53	%
d_{tot}	=	-	5.0	-	5.5	-	6.0	%

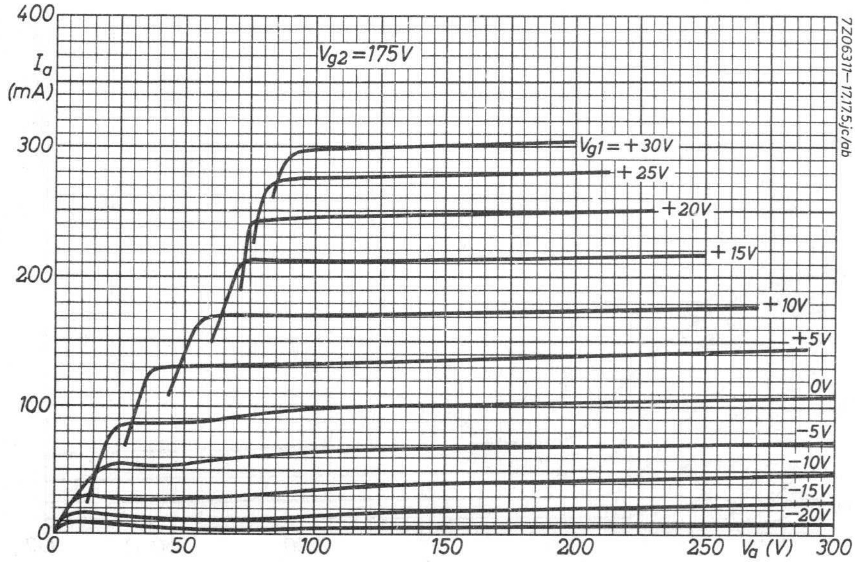
1) Individual adjustment of the grid bias of each system is recommended


400
I_a
(mA)
V_{g2} = 150V
300
200
100
0
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
0
50
100
150
200
250 V_a (V)
300
7Z06312 - 17.17.5.jc/ab

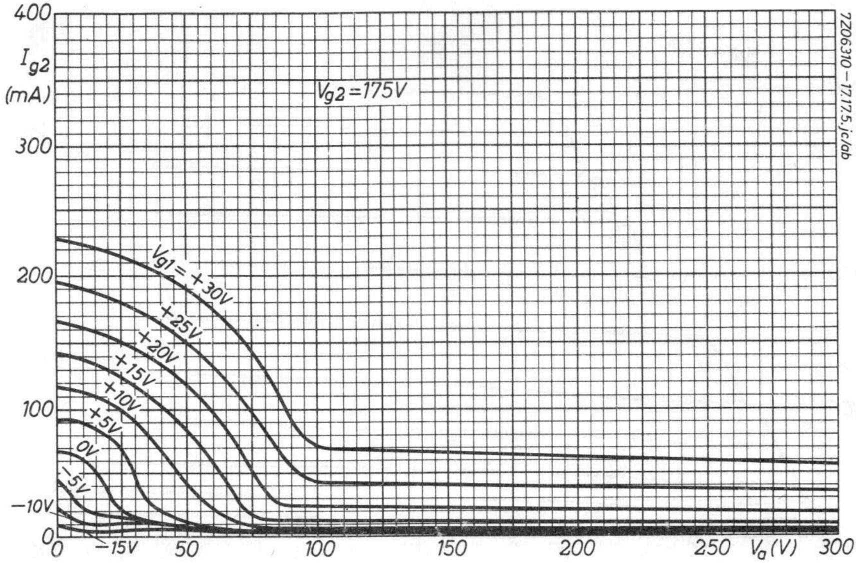

400
I_{g2}
(mA)
V_{g2} = 150V
300
200
100
0
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
0
50
100
150
200
250 V_a (V)
300
7Z06314 - 17.17.5.jc/ab



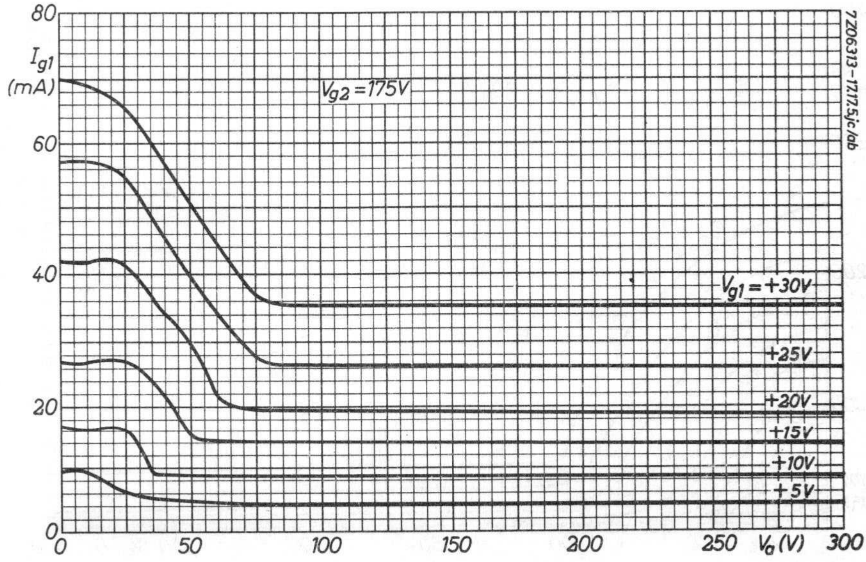
7Z06315-17.17.5.jc/ab
I_{g1} (mA)
V_{g2} = 150V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0
20
40
60
80
50
100
150
200
250
300
V_a (V)



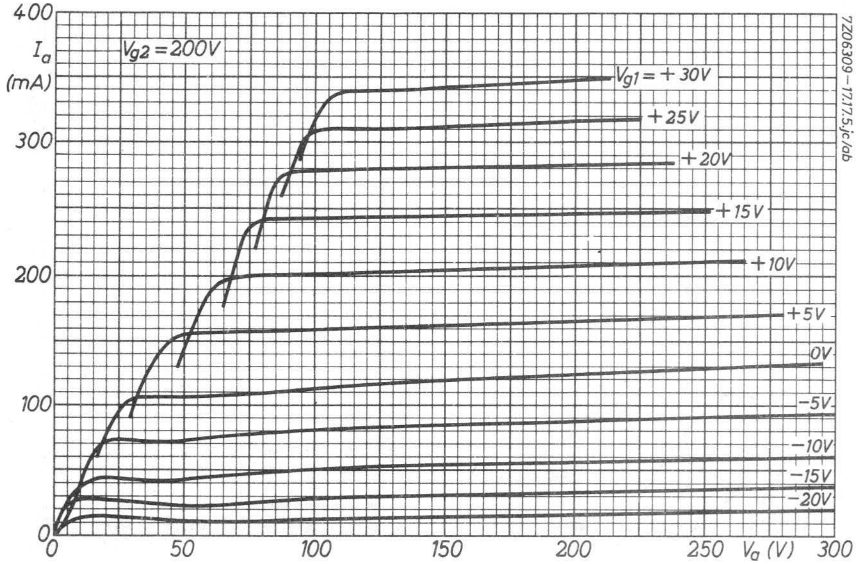
7Z06311-17.17.5.jc/ab
I_a (mA)
V_{g2} = 175V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
0
100
200
300
400
50
100
150
200
250
300
V_a (V)

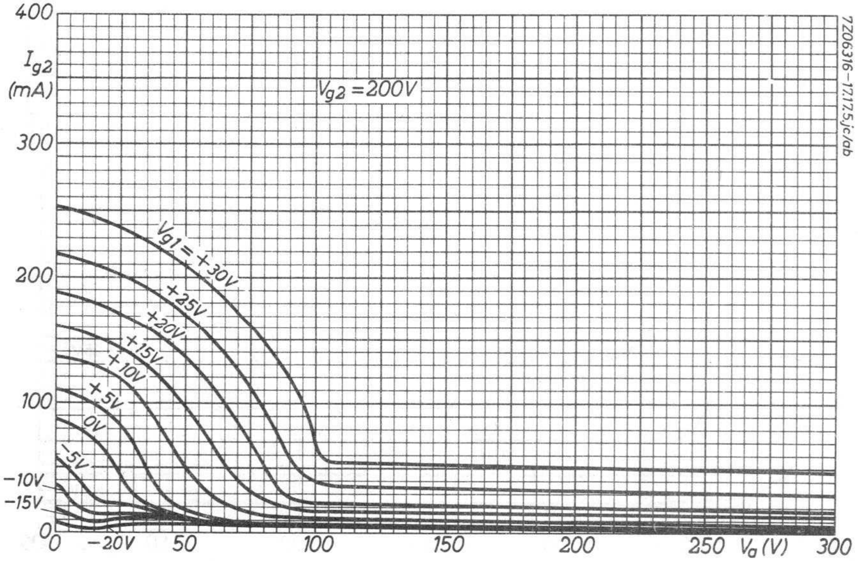


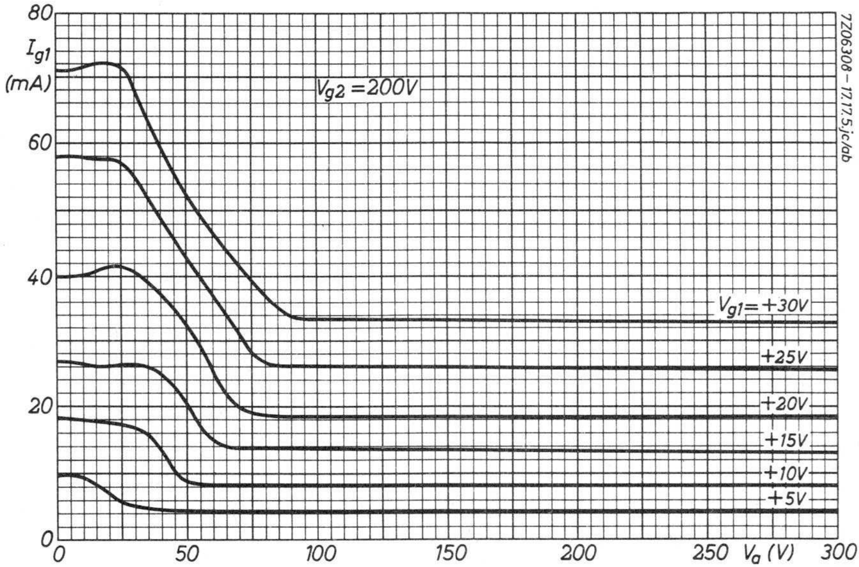
400
I_{g2}
(mA)
300
200
100
0
V_{g2}=175V
V_{g1}=+30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
0
50
100
150
200
250
V_a(V)
300
7Z06310−12.17.5.jc/ab



80
I_{g1}
(mA)
60
40
20
0
V_{g2}=175V
V_{g1}=+30V
+25V
+20V
+15V
+10V
+5V
0
50
100
150
200
250
V_a(V)
300
7Z06313−12.17.5.jc/ab


400
I_a
(mA)
300
200
100
0
$V_{g2} = 200V$
$V_{g1} = +30V$
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
0
50
100
150
200
250
V_a (V)
300
7Z06309−17.17.5.jc/ab


400
I_{g2}
(mA)
300
200
100
0
$V_{g2} = 200V$
$V_{g1} = +30V$
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
0
50
100
150
200
250
V_a (V)
300
7Z06316−17.17.5.jc/ab



80
I_{g1}
(mA)
60
40
20
0
0
50
100
150
200
250
V_a (V)
300
V_{g2} = 200V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
7Z06308 - 17.17.5.jc/ab

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA (two systems)						
		C telegr.		C_{ag_2} mod.		
λ (m)	Freq. (MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	
1.5	200	600	48	500	31	
		400	30	300	17	
		300	21			
		200	13			
0.75	400	400	24	300	13	
		300	17			
		200	11			
0.5	600	400	20			

		C fr.mult.	
λ (m)	Freq. (MHz)	V_a (V)	W_o (W)
4.5/1.5	67/200	300	10
2.25/0.75	133/400	300	8

B mod.	
V_a (V)	W_o (W)
500	23.5
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_{g_1}	=	7.0	pF
Anode to grid No.1	C_{ag_1}	<	0.08	pF
	$C_{ag_1}-C_n$	<	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 mA)	=	9	
Mutual conductance	S (I_a = 20 mA)	=	2.5	mA/V

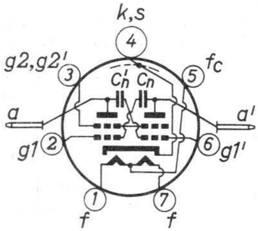
MECHANICAL DATA Dimensions in mm

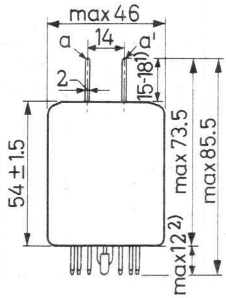
Base : Septar

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 V up to 150	MHz
	V_a	=	500 V up to 200	MHz
	V_a	=	300 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.	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	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g_1}	= max.	100	kΩ
Grid No.1 current	I_{g_1}	= max.	2x2.5	mA
Cathode current	I_k	= max.	2x55	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

OPERATING CONDITIONS, two systems in push-pull

Wavelength	λ	=	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	=	2x50	2x50	2x50	2x50	mA
Grid No.2 current	I_{g_2}	=	2x4	2x4	2x4.5	2x4	mA
Grid No.1 current	I_{g_1}	=	2x0.7	2x0.7	2x0.7	2x1	mA
Anode input power	W_{ia}	=	2x30	2x20	2x15	2x10	W
Anode dissipation	W_a	=	2x6	2x5	2x4.5	2x3.5	W
Grid No.2 dissipation	W_{g_2}	=	2x1.0	2x1.0	2x1.1	2x0.8	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	η	=	80	75	70	65	%

R.F. CLASS C TELEGRAPHY (continued)

OPERATING CONDITIONS, two systems in push-pull

Wavelength	λ	=	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	η	=	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_{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.	100	V
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	λ	=	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_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-80	-50	-50	V
Anode current	I_a	=	2x40	2x40	2x40	mA
Grid No.2 current	I_{g_2}	=	2x4	2x4	2x3	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	2x1	2x1	2x0.75	W
Grid No.1 input power	W_{ig_1}	=	2x5	2x2.5		W
Output power	W_o	=	31	17	13	W
Efficiency	η	=	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	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g_1}	= max. 100	kΩ
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	λ	=	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	η	=	37	29.5	%

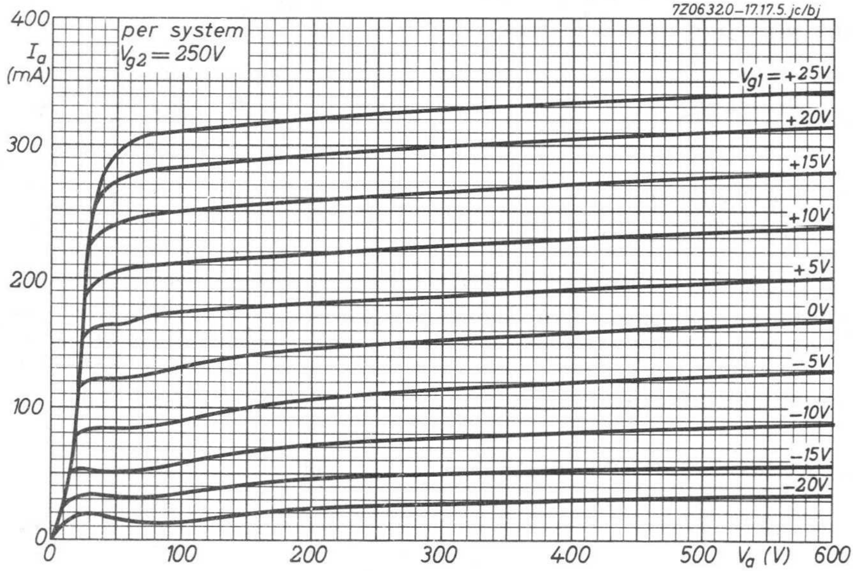
A.F. CLASS B AMPLIFIER AND MODULATOR

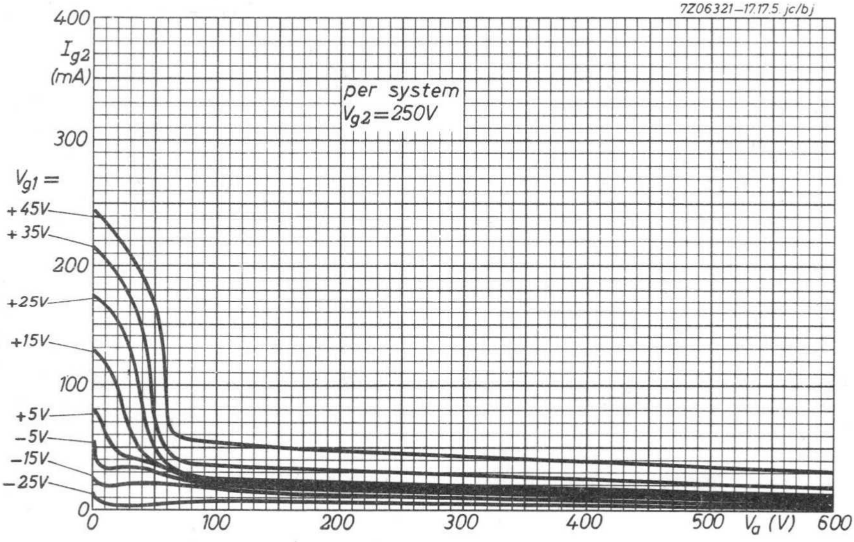
LIMITING VALUES (Absolute limits)

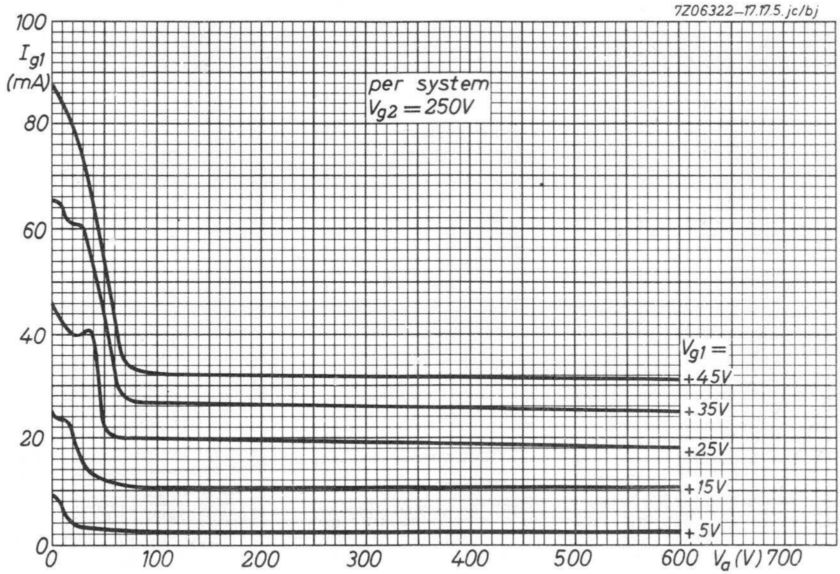
Anode voltage	V_a	=	max.	600	V
Anode dissipation	W_a	=	max.	2x10	W
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	75	V
Grid No.1 circuit resistance with fixed bias	R_{g_1}	=	max.	50	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g_1}	=	max.	100	kΩ
Cathode current	I_k	=	max.	2x55	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

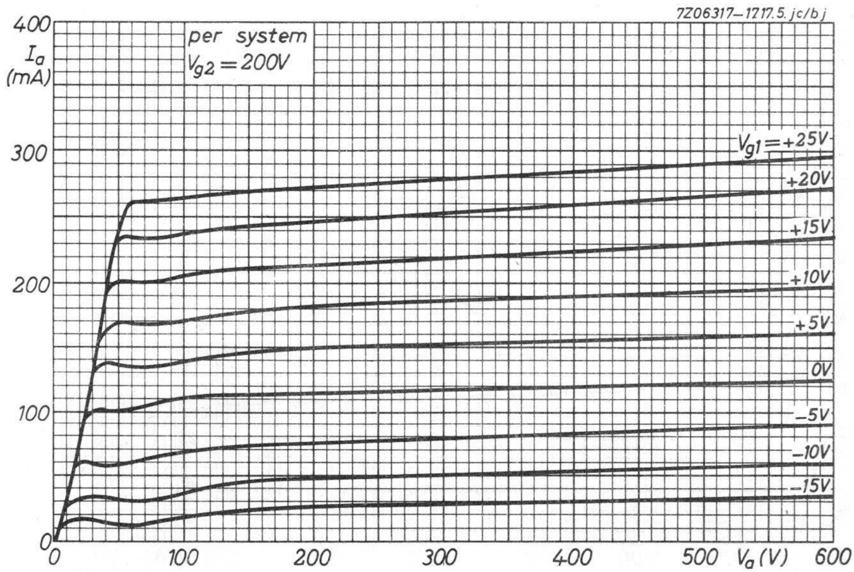
OPERATING CONDITIONS, two systems in push-pull

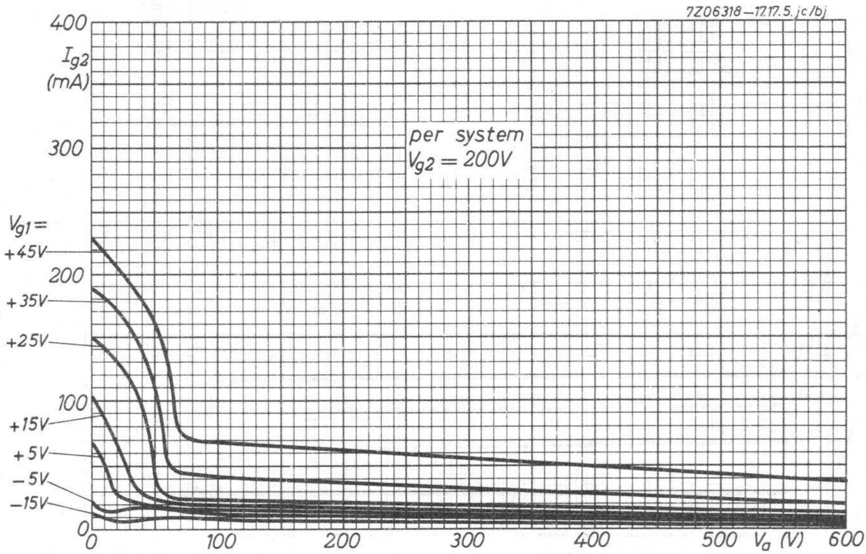
Anode voltage	V_a	=	500		300		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-26		-25		V
Load resistance	$R_{aa'\sim}$	=	20		11		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	0	52	0	50	V
Anode current	I_a	=	2x12.5	2x36.5	2x12.5	2x35	mA
Grid No.2 current	I_{g_2}	=	2x0.35	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	η	=	–	63.5	–	63	%

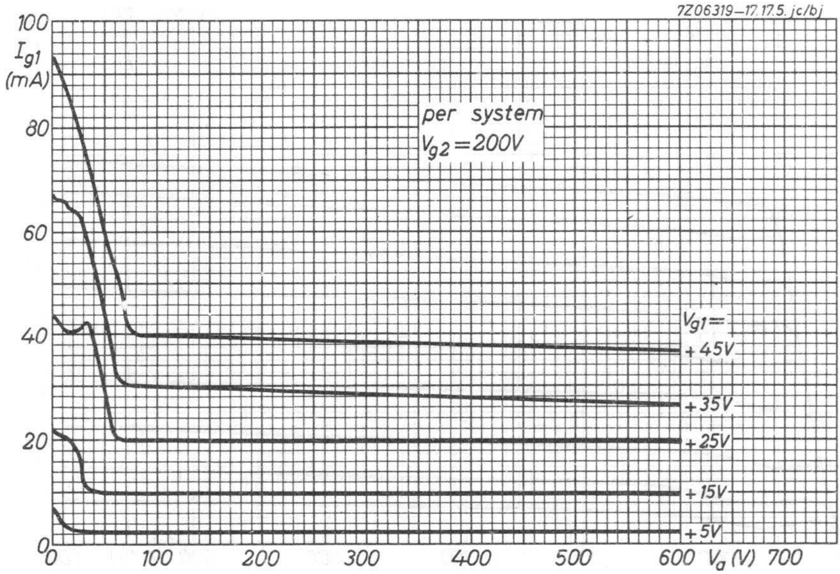

7Z06320–17.17.5. jc/bj
per system
V_{g2} = 250V
400
I_a
(mA)
300
200
100
0
V_{g1} = +25V
+20V
+15V
+10V
+5V
0V
–5V
–10V
–15V
–20V
0
100
200
300
400
500
V_a (V)
600


7Z06321–17.17.5. jc/bj
400
I_{g2}
(mA)
per system
V_{g2} = 250V
300
V_{g1} =
+45V
+35V
200
+25V
+15V
100
+5V
–5V
–15V
–25V
0
0
100
200
300
400
500
V_a (V)
600


7Z06322–17.17.5.jc/bj
100
I_{g1}
(mA)
80
60
40
20
0
per system
V_{g2} = 250V
V_{g1} =
+45V
+35V
+25V
+15V
+5V
0
100
200
300
400
500
600
V_a (V)
700


7Z06317–17.17.5.jc/bj
400
I_a
(mA)
300
200
100
0
per system
V_{g2} = 200V
V_{g1} = +25V
+20V
+15V
+10V
+5V
0V
–5V
–10V
–15V
0
100
200
300
400
500
V_a (V)
600


7Z06318—17.17.5. jc/bj
400
I_{g2}
(mA)
300
per system
$V_{g2} = 200V$
$V_{g1} =$
+45V
200
+35V
+25V
100
+15V
+5V
−5V
−15V
0
0
100
200
300
400
500
V_a (V)
600


7Z06319—17.17.5. jc/bj
100
I_{g1}
(mA)
80
per system
$V_{g2} = 200V$
60
$V_{g1} =$
40
+45V
+35V
20
+25V
+15V
+5V
0
0
100
200
300
400
500
600
V_a (V)
700

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_{g_1}	=	6.2	pF
Anode to grid No. 1	C_{ag_1}	=	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								
	C telegr.				C freq. tripler			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
Freq. (MHz)	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	250	7	250	8				
320/960					250	2.75	250	3

HEATING : indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6	V ± 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_{g_1}	=	4.5	pF
Anode to grid No.1	C_{ag_1}	=	0.145	pF

TYPICAL CHARACTERISTICS

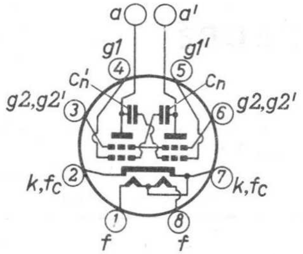
Anode voltage	V_a	=	350	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	25	mA
Mutual conductance	S	=	10.5	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	26	

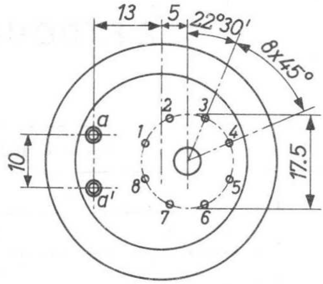
TEMPERATURE LIMIT (Absolute limit)

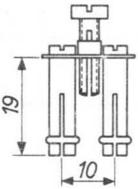
Temperature of pin seals	max.	220	$^{\circ}$C
Bulb temperature	max.	220	$^{\circ}$C

MECHANICAL DATA

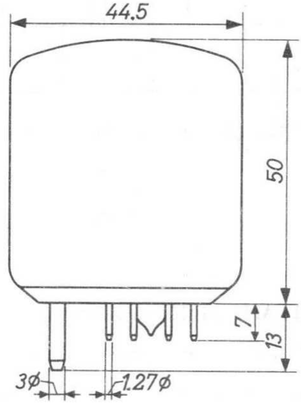
Dimensions in mm







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

LIMITING VALUES (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_{g_2}	=	max. 225	max. 225	V
Grid No.2 dissipation	W_{g_2}	=	max. 2x1.5	max. 2x1.75	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 100	max. 100	V
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	160 [1]	170 [2]	V
Grid No.1 voltage	V_{g_1}	=	-15	-15	V
Grid No.1 resistor	R_{g_1}	=	20	20	kΩ
Anode current	I_a	=	2x35	2x40	mA
Grid No.2 current	I_{g_2}	=	15	15	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	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	η	=	40	40	%

[1] Adjust V_{g_2} until I_a = 2x35 mA at W_o max.

[2] Adjust V_{g_2} until I_a = 2x40 mA at W_o max.

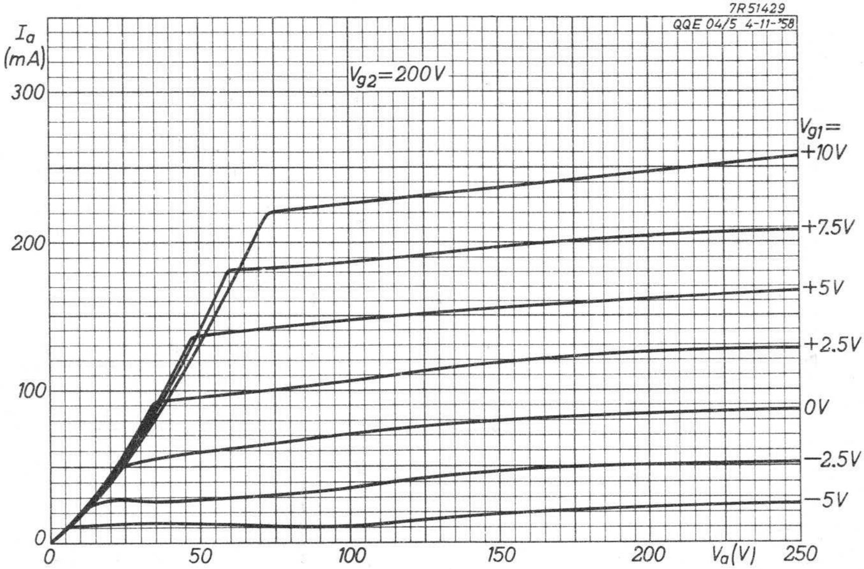
R.F. CLASS C FREQUENCY TRIPLER

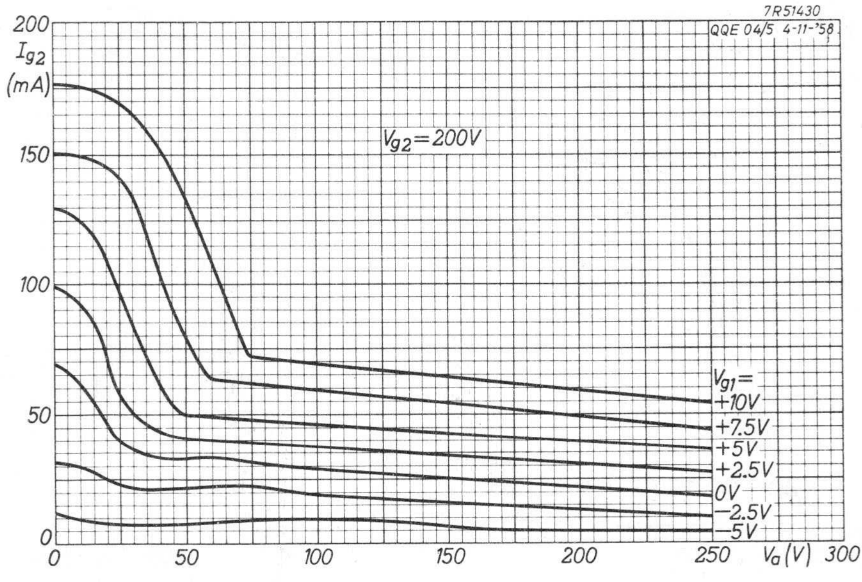
LIMITING VALUES (Absolute limits)

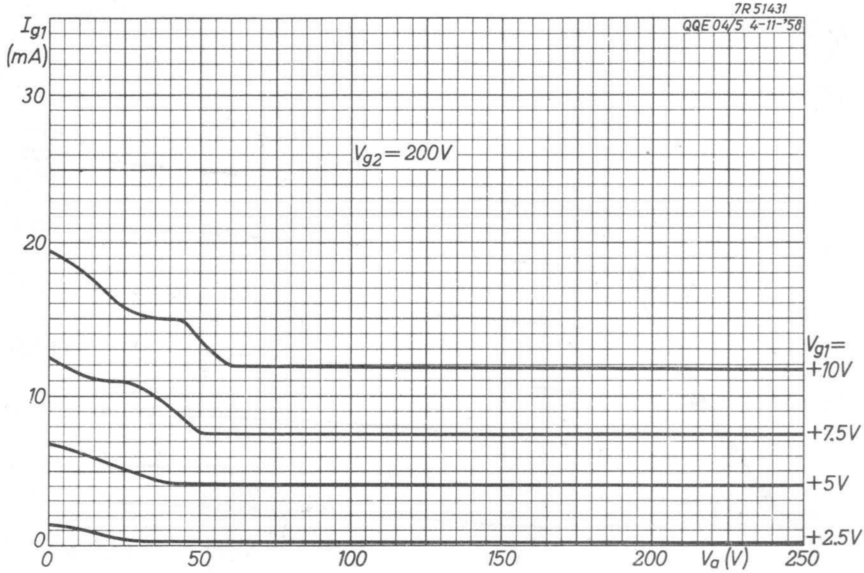
				C.C.S.		I.C.A.S.	
Frequency	f		up to	960	up to	960	MHz
Anode voltage	V_a	=	max.	400	max.	400	V
Anode input power	W_{ia}	=	max.	2x10	max.	2x12	W
Anode dissipation	W_a	=	max.	2x8	max.	2x10	W
Anode current	I_a	=	max.	2x40	max.	2x40	mA
Grid No.2 voltage	V_{g_2}	=	max.	225	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	max.	2x1.75	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x4	max.	2x5	mA

OPERATING CONDITIONS , two systems in push-pull

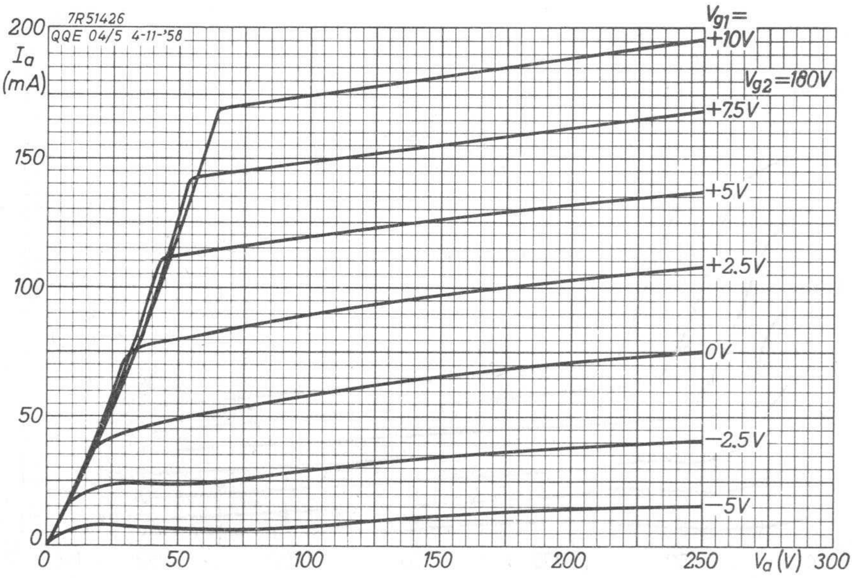
			C.C.S.	I.C.A.S.	
Frequency	f	=	320/960	320/960	MHz
Anode voltage	V_a	=	250	250	V
Grid No.2 voltage	V_{g_2}	=	150	170	V
Grid No.1 resistor	R_{g_1}	=	20	20	kΩ
Anode current	I_a	=	2x37.5	2x40	mA
Grid No.2 current	I_{g_2}	=	15	16	mA
Grid No.1 current	I_{g_1}	=	2x2.25	2x2.25	mA
Anode input power	W_{ia}	=	2x9.5	2x10	W
Anode dissipation	W_a	=	2x8	2x8.5	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	14.7	15	%


7R51429
QQE 04/5 4-11-'58
I_a (mA)
300
200
100
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
V_a(V)
250

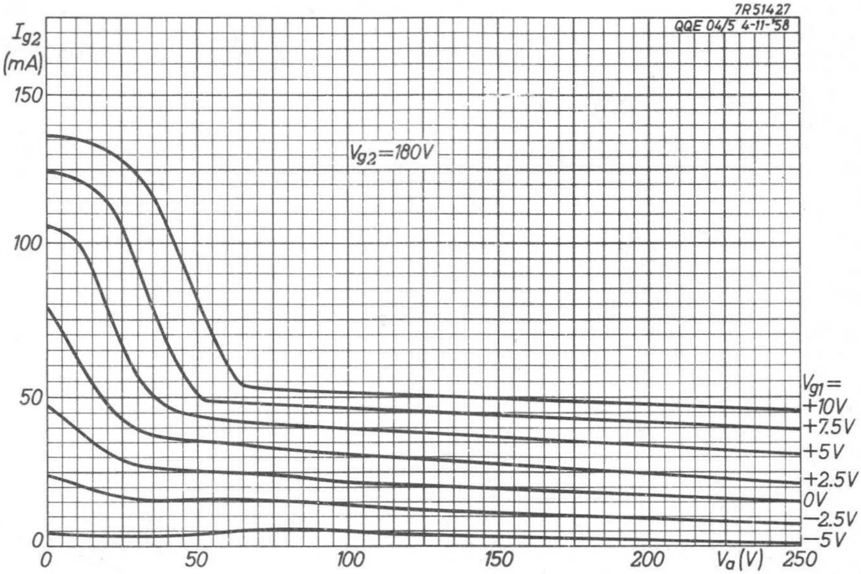

7R51430
QQE 04/5 4-11-'58
200
I_{g2} (mA)
150
100
50
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
V_a(V)
300

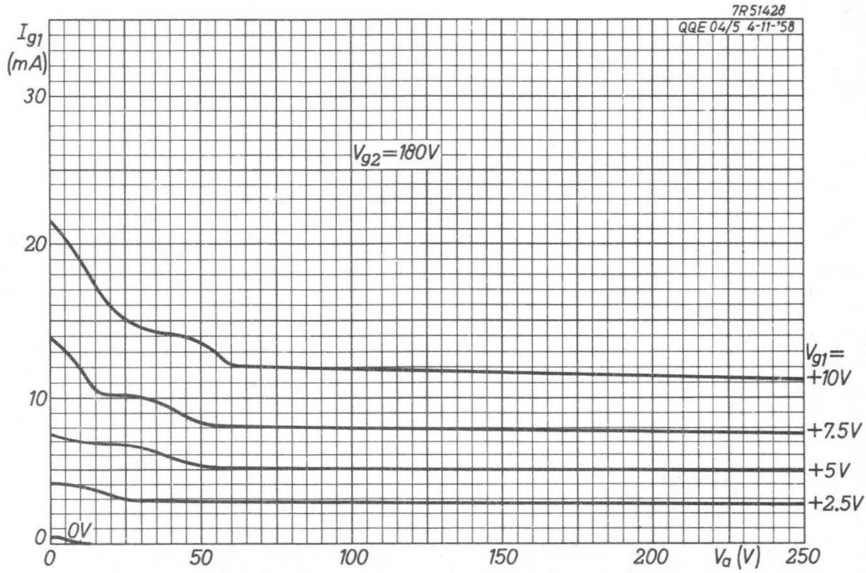


7R 51431
QQE 04/5 4-11-'58
I_{g1} (mA)
30
20
10
0
V_{g2} = 200V
V_{g1} =
+10V
+7.5V
+5V
+2.5V
0
50
100
150
200
V_a (V)
250



7R 51426
QQE 04/5 4-11-'58
200
I_a (mA)
150
100
50
0
V_{g1} =
+10V
V_{g2} = 180V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
V_a (V)
300


7R51427
QQE 04/5 4-11-'58
I_{g2} (mA)
150
100
50
0
V_{g2}=180V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
V_a (V)
250


7R51428
QQE 04/5 4-11-'58
I_{g1} (mA)
30
20
10
0
V_{g2}=180V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
0
50
100
150
200
V_a (V)
250

R.F. DOUBLE POWER TETRODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr. 1)			C_{ag_2} mod. 1)		
(m)	(MHz)	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) 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_{ag_1}	<	0.07	pF
Cathode to grid No.2	C_{kg_2}	=	65	pF 2)

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	6.5	
Mutual conductance	S (I_a = 30 mA)	=	3	mA/V 3)

1) Two systems in push-pull

2) Including internal capacitor between grid No.2 and cathode

3) Per system

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and pin seals	max. 180 ^{o}C
Bulb temperature	max. 220 ^{o}C

MECHANICAL DATA

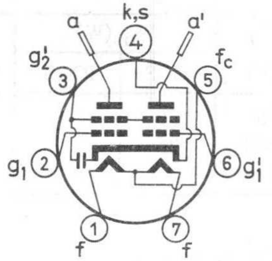
Dimensions in mm

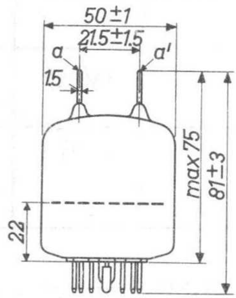
Base : Septar

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_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ 1)
Grid No.1 circuit resistance	R_{g_1}	=	max. 25		kΩ 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_{g_2}	=	200	200	200	200	200	V
V_{g_1}	=	-65	-65	-65	-65	-65	V
I_a	=	2x24	2x36	2x45	2x32	2x40	mA
I_{g_2}	=	15	14	14	12	14	mA
I_{g_1}	=	2x1.4	2x1.3	2x1.4	2x0.9	2x1.0	mA
$V_{g_1g_1'p}$	=	150	150	150	140	140	V
W_{ig_1}	=	2x0.10	2x0.09	2x0.10	2x0.06	2x0.07	W
W_{g_2}	=	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
η	=	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_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ [1]
Grid No.1 circuit resistance	R_{g_1}	=	max. 25		kΩ [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_{g_2}	=	200	V
Grid No.1 voltage	V_{g_1}	=	-50	V
Anode current	I_a	=	2x32.5	mA
Grid No.2 current	I_{g_2}	=	22	mA
Grid No.1 current	I_{g_1}	=	2x2.0	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	130	V
Grid No.1 input power	W_{ig_1}	=	2x0.12	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 3.4		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ 1)
Grid No.1 circuit resistance	R_{g_1}	=	max. 25		kΩ 2)
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_{g_2}	=	200	200	V
Grid No.1 voltage	V_{g_1}	=	−65	−60	V
Anode current	I_a	=	2x18	2x26	mA
Grid No.2 current	I_{g_2}	=	16	16	mA
Grid No.1 current	I_{g_1}	=	2x1.3	2x1.2	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	150	140	V
Grid No.1 input power	W_{ig_1}	=	2x0.09	2x0.075	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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

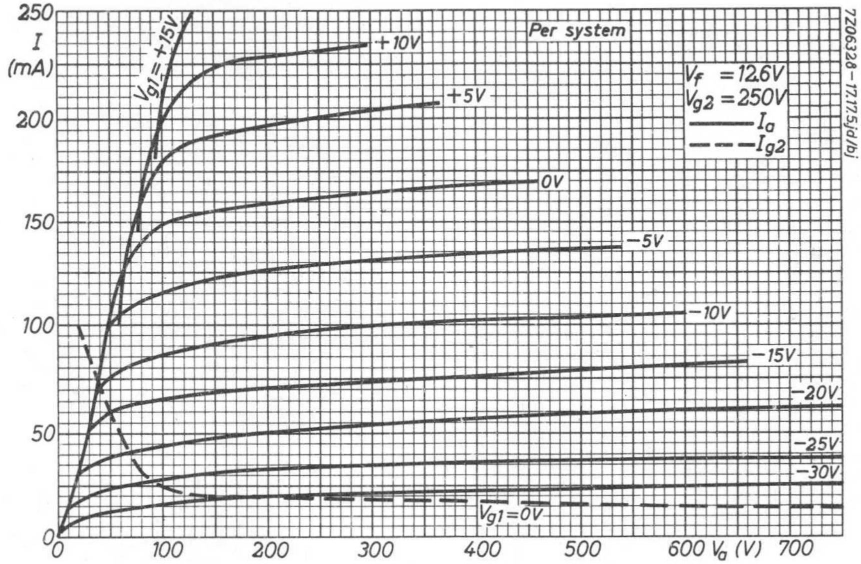
I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

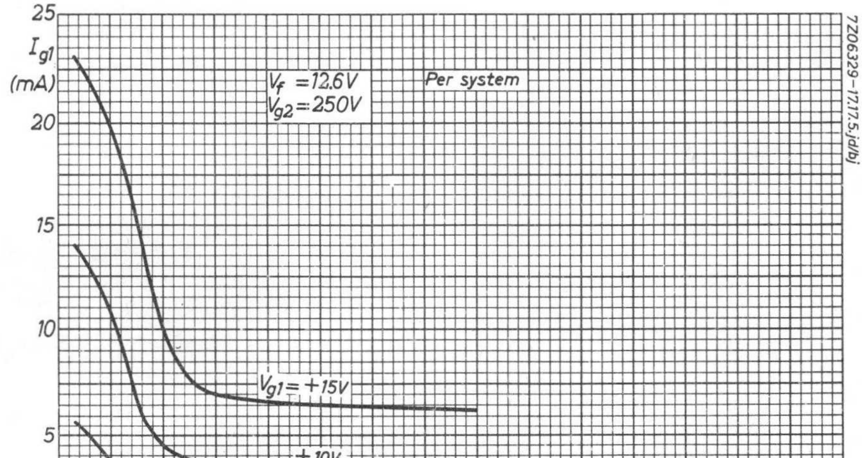
Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x18	W
Anode dissipation	W_a	=	max.	2x7.5	W
Anode current	I_a	=	max.	2x47.5	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ [1]
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	kΩ [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	=	600	V
Grid No.2 voltage	V_{g_2}	=	200	V
Grid No.1 voltage	V_{g_1}	=	-70	V
Anode current	I_a	=	2x30	mA
Grid No.2 current	I_{g_2}	=	20	mA
Grid No.1 current	I_{g_1}	=	2x1.5	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	160	V
Grid No.1 input power	W_{ig_1}	=	2x0.105	W
Grid No.2 dissipation	W_{g_2}	=	4.0	W
Anode input power	W_{ia}	=	2x18	W
Anode dissipation	W_a	=	2x5	W
Output power	W_o	=	26	W
Efficiency	η	=	72	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	20	W

[1]) Per system [2]) Per tube


Per system
V_f = 12.6V
V_{g2} = 250V
I_a
I_{g2}
V_{g1} = +15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
V_{g1} = 0V
I (mA)
V_a (V)
7Z06328 - 17.17.5.jd/bj


V_f = 12.6V
V_{g2} = 250V
Per system
V_{g1} = +15V
+10V
+5V
0V
I_{g1} (mA)
V_a (V)
7Z06329 - 17.17.5.jd/bj

R.F. DOUBLE POWER TETRODE

QUICK REFERENCE DATA

		C telegr.				C_{ag_2} mod.			
		C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
λ (m)	Freq. (MHz)	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						

		C fr.mult.		B mod.	
λ (m)	Freq. (MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
6/2	50/150	500	20	600	86
		400	18	450	60
4/1.3	75/225	400	12	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	$\mu_{g_2g_1}$	=	8.2	
Mutual conductance (per system)	S (I_a = 30 mA)	=	4.5	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

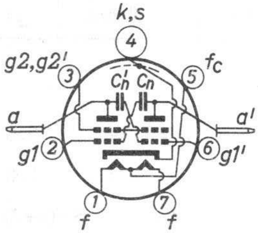
Dimensions in mm

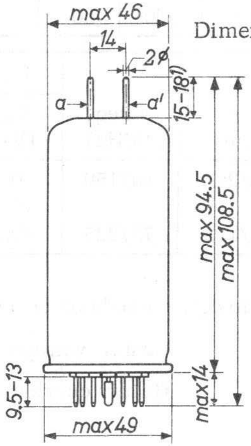
Base : Septar

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_{g_2}	=	max. 300		V
Grid No.2 dissipation	W_{g_2}	=	max. 2x3.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ
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_{g_1}	=	-80	-80	-80	-	V
Grid No.1 resistor	R_{g_1}	=	-	-	-	20	kΩ
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	V
Anode current	I_a	=	2x100	2x80	2x100	2x100	mA
Grid No.1 current	I_{g_1}	=	2x2.5	2x1.5	2x2.8	2x3	mA
Grid No.2 current	I_{g_2}	=	16	17	18	20	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	200	250	-	-	V
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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_{g_2}	=	max. 300		V
Grid No.2 dissipation	W_{g_2}	=	max. 2x4		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ
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_{g_1}	=	-80	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	2x90	mA
Grid No.1 current	I_{g_1}	=	2x1.7	mA
Grid No.2 current	I_{g_2}	=	14	mA
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	=	260	V
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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_{g_2}	=	max.	300	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x3.5	max.	2x3.5	W [1]
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	max.	50	kΩ [2]
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_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-80	-80	V
Anode current	I_a	=	2x75	2x75	mA
Grid No.2 current	I_{g_2}	=	20	18	mA
Grid No.1 current	I_{g_1}	=	2x3.8	2x1.6	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	105	130	V
Grid No.2 dissipation	W_{g_2}	=	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	η	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	90	90	V
Modulation power	W_{mod}	=	45	45	W

---

[1]) Screen grid modulated via a choke. For all other modulation methods W_{g_2} = max. 2x2.3 W

[2]) Per system. When a common grid resistor is used R_{g_1} = max. 25 kΩ

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_{g_2}	=	max.	300	max.	300	V	
Grid No.2 dissipation	W_{g_2}	=	max.	2x4	max.	2x4	W	1)
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	max.	175	V	
Grid No.1 current	I_{g_1}	=	max.	2x5	max.	2x5	mA	
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	max.	50	kΩ	2)
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_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	V
Anode current	I_a	=	2x83	2x83	mA
Grid No.2 current	I_{g_2}	=	16	16	mA
Grid No.1 current	I_{g_1}	=	2x4	2x1.7	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	105	130	V
Grid No.2 dissipation	W_{g_2}	=	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	η	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	90	90	V
Modulation power	W_{mod}	=	50	50	W

1) Screen grid modulated via a choke. For all other modulation methods W_{g_2} = max. 2x2.6 W

2) Per system. When a common grid resistor is used R_{g_1} = max. 25 kΩ

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_{g_2}	=	max. 300		V
Grid No.2 dissipation	W_{g_2}	=	max. 2x3.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ
Heater to cathode voltage	V_{kf}	=	max. 100		V

OPERATING CONDITIONS two systems in push-pull

Wavelength	λ	=	6/2	6/2	4/1.3	m
Anode voltage	V_a	=	500	400	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-150	-150	-150	V
Anode current	I_a	=	2x60	2x73	2x65	mA
Grid No.2 current	I_{g_2}	=	10	16	20	mA
Grid No.1 current	I_{g_1}	=	2x3	2x2.5	2x1.5	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	360	360	360	V
Grid No.1 input power	W_{ig_1}	=	2x0.6	2x0.5	2x0.3	W
Grid No.2 dissipation	W_{g_2}	=	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	η	=	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_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x3.5	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS; two systems in push-pull

V_a	=	600		450		300		V
V_{g_1} 1)	=	-27.5		-27.5		-26		V
V_{g_2}	=	250		250		250		V
$R_{aa'\sim}$	=	12.5		10		6.5		kΩ
$V_{g_1g_1'p}$	=	0	55	0	55	0	52	V
I_a	=	2x20	2x62	2x20	2x58	2x20	2x56	mA
I_{g_2}	=	0.9	23	1.4	27	2.2	28	mA
W_{g_2}	=	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	%
η	=	-	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

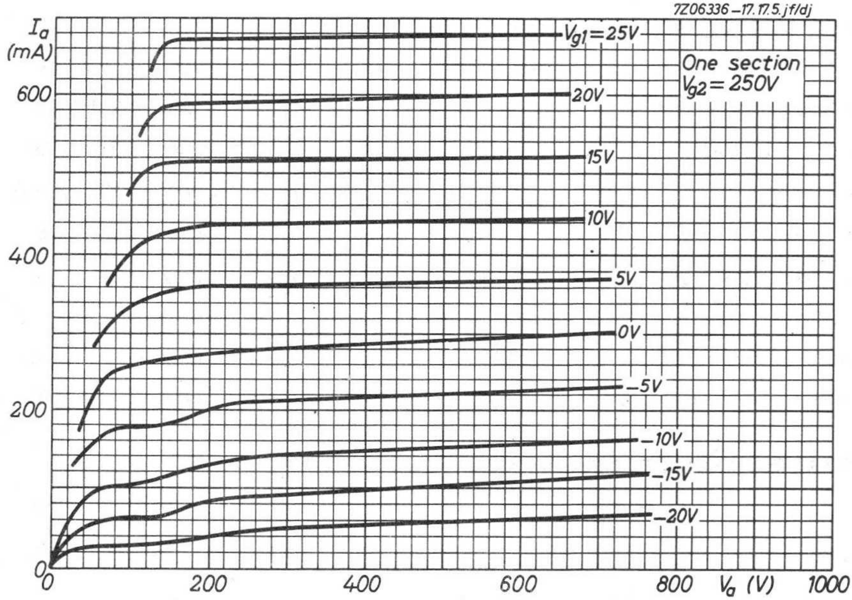
LIMITING VALUES (Absolute limits)

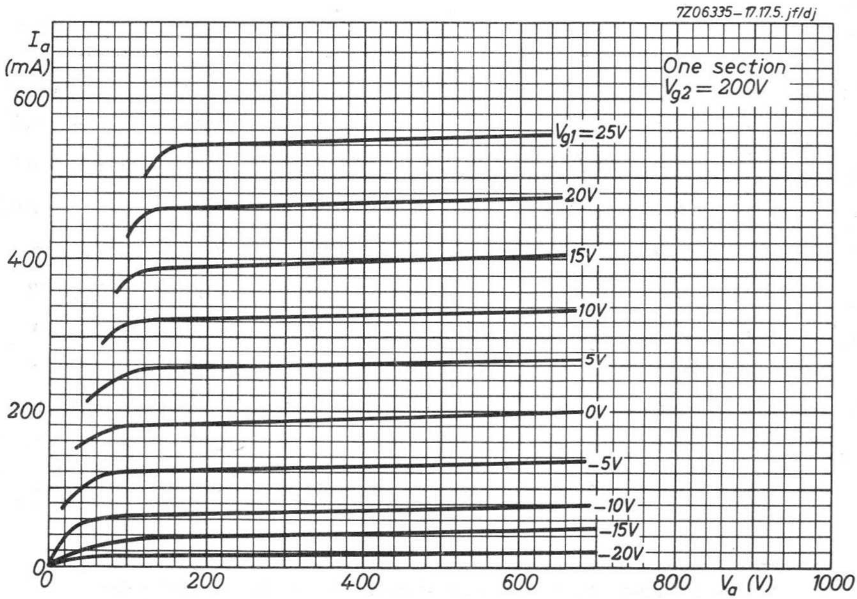
Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x60	W
Anode dissipation	W_a	=	max.	2x20	W
Anode current	I_a	=	max.	2x110	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x3.5	W
Grid No.1 current	I_{g_1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ
Heater to cathode voltage	V_{kf}	=	max.	100	V

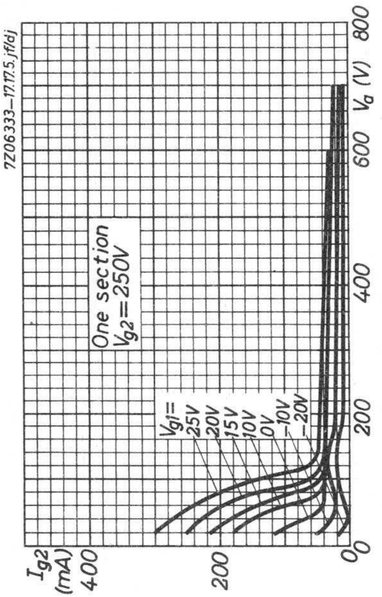
OPERATING CONDITIONS, two systems in push-pull

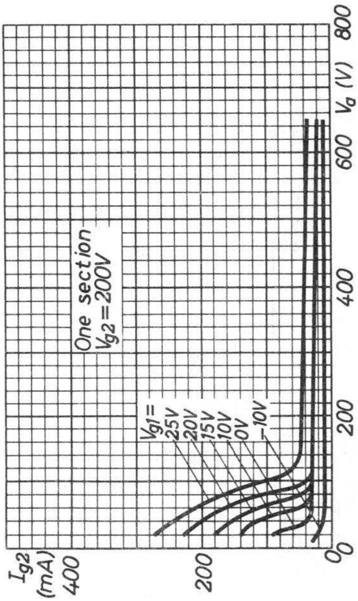
V_a	=	600		450		300		V
V_{g_1} 1)	=	−25		−25		−25		V
V_{g_2}	=	250		250		250		V
$R_{aa'\sim}$	=	8.0		6.0		4.0		kΩ
$V_{g_1g_1'p}$	=	0	78	0	76	0	75	V
I_a	=	2x25	2x100	2x25	2x97	2x25	2x94	mA
I_{g_1}	=	0	2x2.6	0	2x2.6	0	2x2.6	mA
I_{g_2}	=	1.2	26	1.9	28	2.8	28	mA
W_{ig_1}	=	0	2x0.1	0	2x0.1	0	2x0.1	W
W_{g_2}	=	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	%
η	=	–	71.5	–	69	–	65.5	%

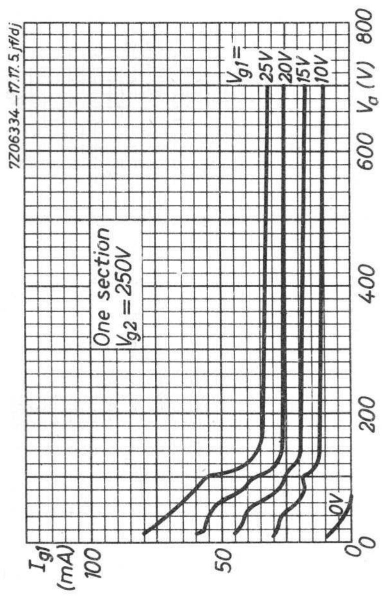
1) Individual adjustment of the grid bias of each system is recommended

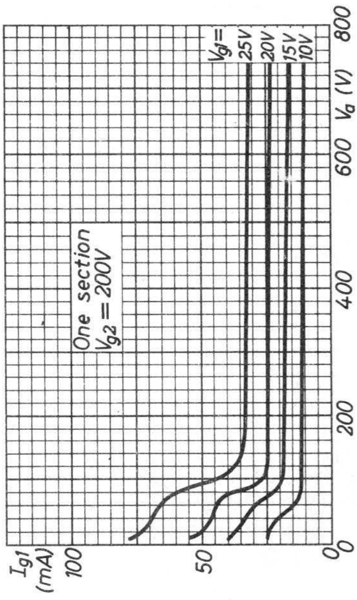

7Z06336-17.17.5.jf/dj
I_a (mA)
600
400
200
0
V_{g1} = 25V
20V
15V
10V
5V
0V
-5V
-10V
-15V
-20V
One section
V_{g2} = 250V
0
200
400
600
800
V_a (V)
1000

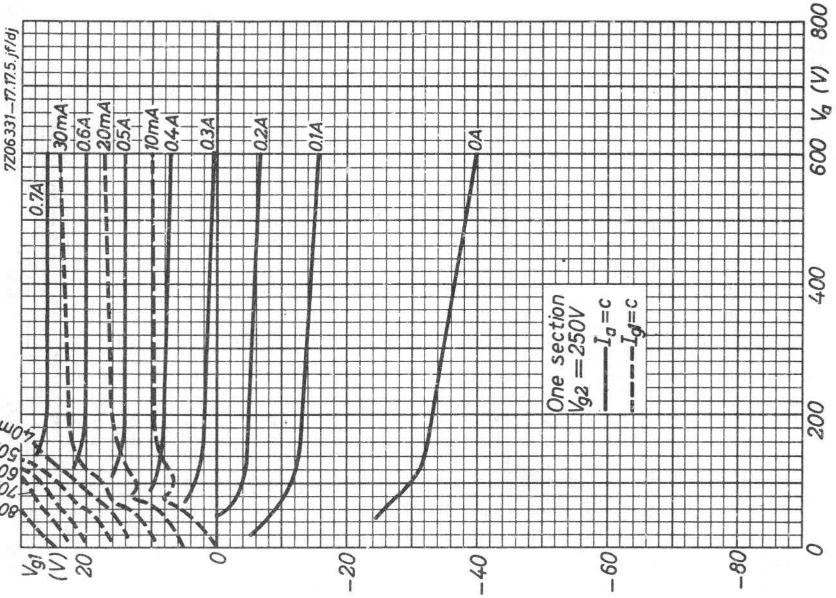

7Z06335-17.17.5.jf/dj
I_a (mA)
600
400
200
0
One section
V_{g2} = 200V
V_{g1} = 25V
20V
15V
10V
5V
0V
-5V
-10V
-15V
-20V
0
200
400
600
800
V_a (V)
1000

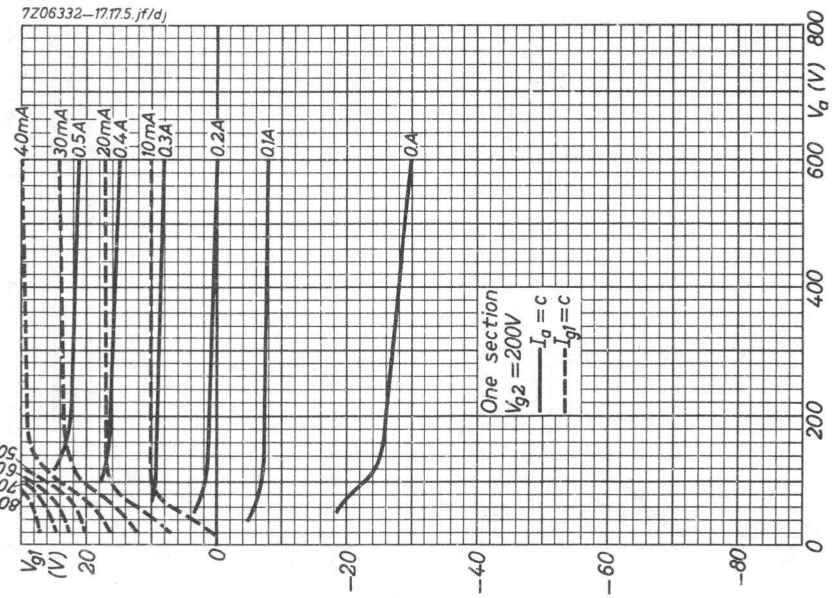

7Z06333—17.17.5.jf/dj
One section
V_{g2}=250V
V_{g1}=
25V
20V
15V
10V
0V
−10V
−20V
I_{g2} (mA)
400
200
0
0
200
400
600
V_a (V)
800

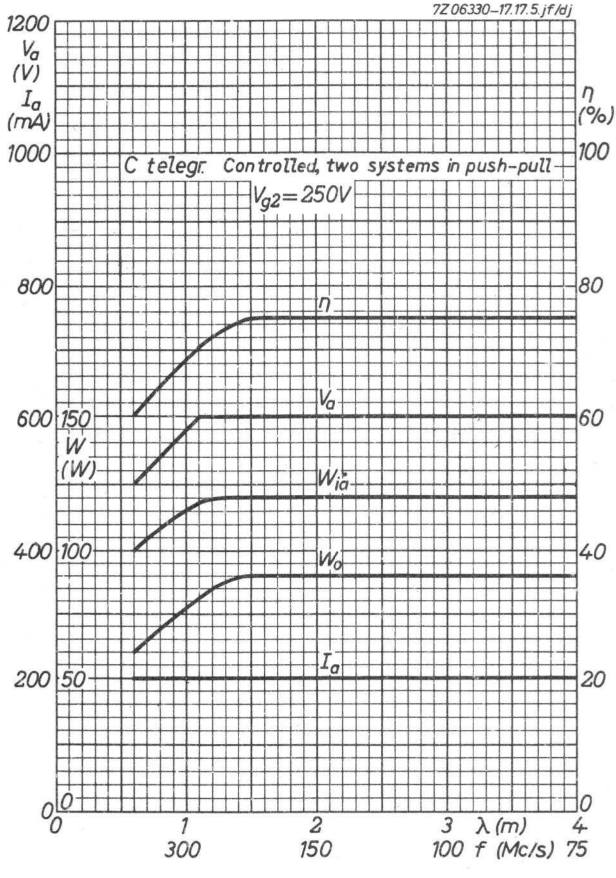

One section
V_{g2}=200V
V_{g1}=
25V
20V
15V
10V
0V
−10V
I_{g2} (mA)
400
200
0
0
200
400
600
V_a (V)
800


7Z06334—17.17.5.jf/dj
One section
V_{g2}=250V
V_{g1}=
25V
20V
15V
10V
0V
I_{g1} (mA)
100
50
0
0
200
400
600
V_a (V)
800


One section
V_{g2}=200V
V_{g1}=
25V
20V
15V
10V
I_{g1} (mA)
100
50
0
0
200
400
600
V_a (V)
800


7Z06331—17.17.5.jf/dj
One section
V_{g2} = 250V
I_a = c
I_{g1} = c
V_{g1} (V)
V_a (V)
0.7A
30mA
0.6A
20mA
0.5A
10mA
0.4A
0.3A
0.2A
0.1A
0A
40mA
50mA
60mA
70mA
80mA
20
0
−20
−40
−60
−80
0
200
400
600
800


7Z06332—17.17.5.jf/dj
One section
V_{g2} = 200V
I_a = c
I_{g1} = c
V_{g1} (V)
V_a (V)
40mA
30mA
0.5A
20mA
0.4A
10mA
0.3A
0.2A
0.1A
0A
50mA
60mA
70mA
80mA
20
0
−20
−40
−60
−80
0
200
400
600
800


7Z06330-17.17.5.jf/dj
1200
V_a
(V)
I_a
(mA)
1000
800
600
400
200
0
150
W
(W)
100
50
0
η
(%)
100
80
60
40
20
0
C telegr. Controlled, two systems in push-pull
V_{g2}=250V
η
V_a
W_{ia}
W_o
I_a
0
1
2
3
λ (m)
4
300
150
100
f (Mc/s)
75

QUICK HEATING R.F. PENTODE

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

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

HEATING: direct by AC or DC; parallel supply

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

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

CAPACITANCES

Anode to all except grid No.1	C_a	3.8	pF
Grid No.1 to all except anode	C_{g_1}	6.5	pF
Anode to grid No.1	C_{ag_1}	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	$\mu_{g_2 g_1}$	8
Mutual conductance	S	4.5 mA/V
Modulation hum		-60 dB relative to carrier (with centre tapped filament supply on a single stage

TEMPERATURE LIMITS (Absolute limits)

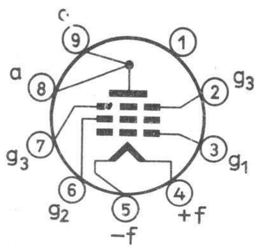
Bulb temperature	max.	200 °C
Pin seal temperature	max.	120 °C

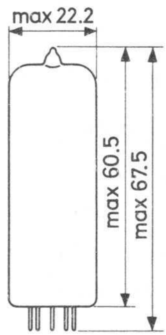
MECHANICAL DATA

Dimensions in mm

Base : Noval

Net weight: 15 g





Mounting position: any

ACCESSORIES

Socket: 2422·502 01003

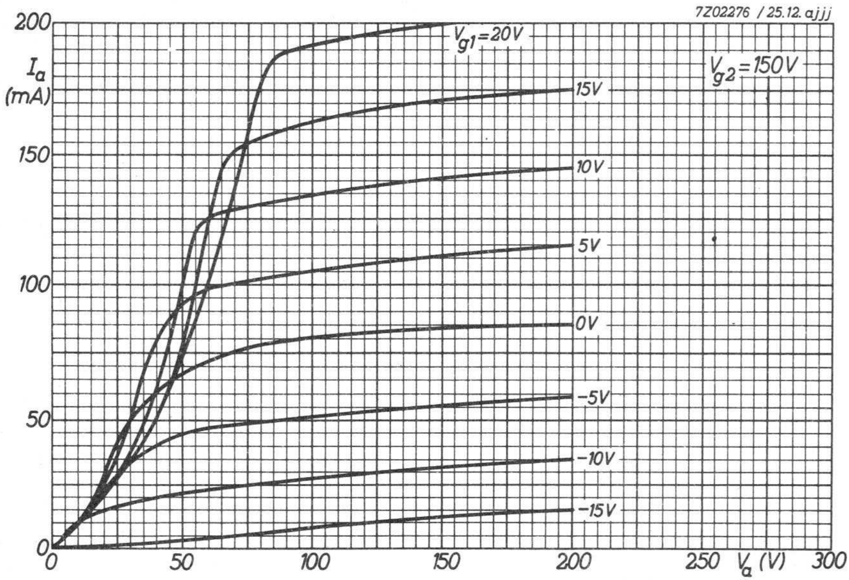
R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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



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

WATER COOLED R.F. POWER TETRODE

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

QUICK REFERENCE DATA						
Frequency (MHz)	S.S.B.		C telegr. FM teleph.		C_{ag_2} mod.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_o (kW)
30	8	30				
	10	33			10	55
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_{g2}	1.2	kV
Anode current	I_a	2.5	A
Transconductance	S	65	mA/V
Amplification factor	μ_{g2g1}	6.6	-

TEMPERATURE LIMITS AND COOLING

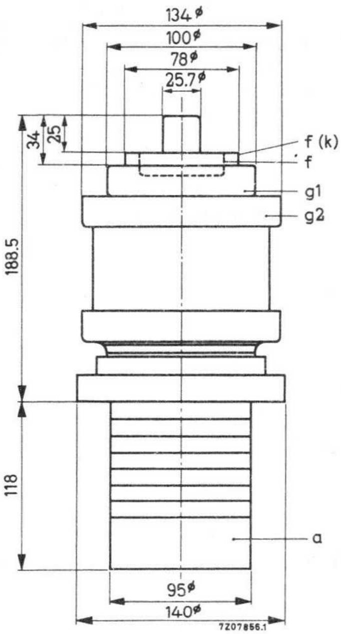
Absolute max. envelope and seal temperature	$t_{env.}$	max. 220 °C
Absolute max. water inlet temperature	t_i	max. 50 °C
Required quantity of water		see cooling curves

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

MECHANICAL DATA Dimensions in mm

Net weight: approx. 7 kg

Mounting position: Vertical with anode down



ACCESSORIES

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

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

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

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

1) 2) See page 4

OPERATING CONDITIONS (continued)

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

1) Adjust to give the zero signal anode current.

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

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

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

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

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

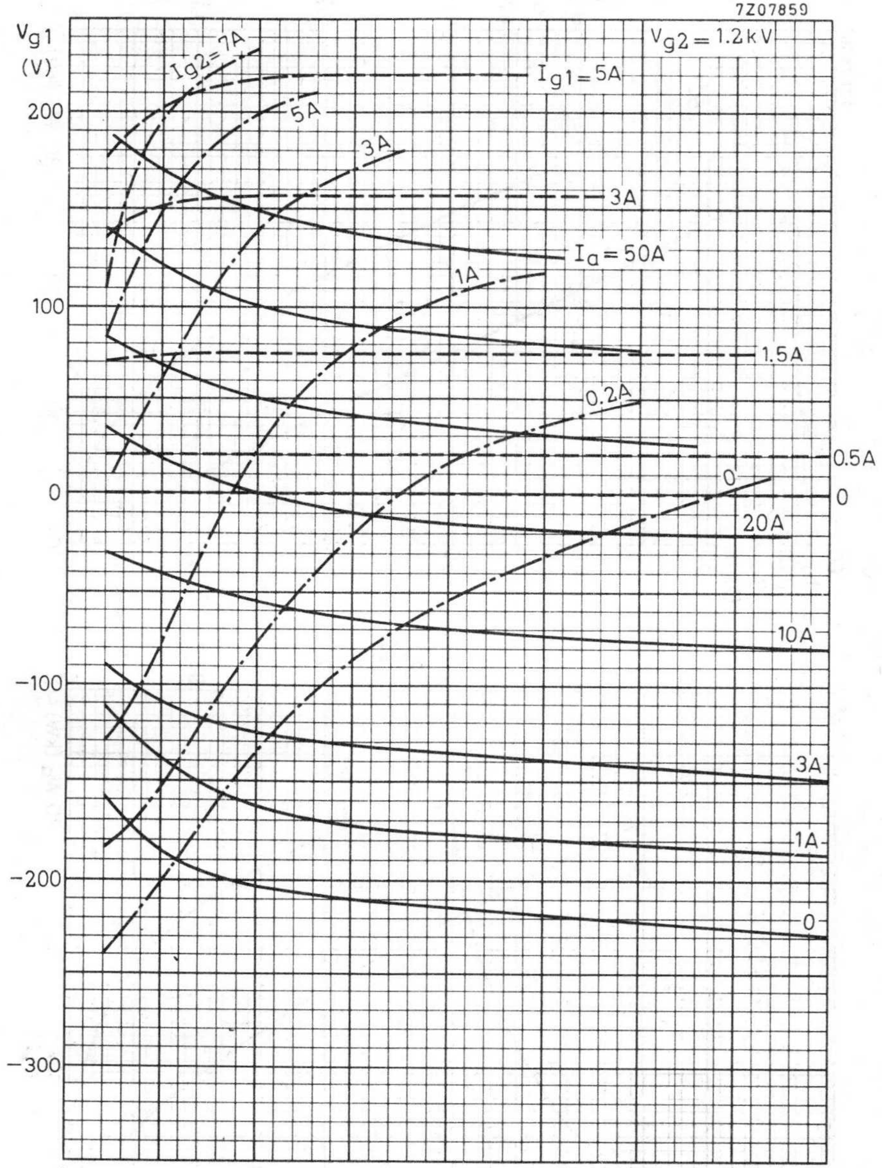
R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

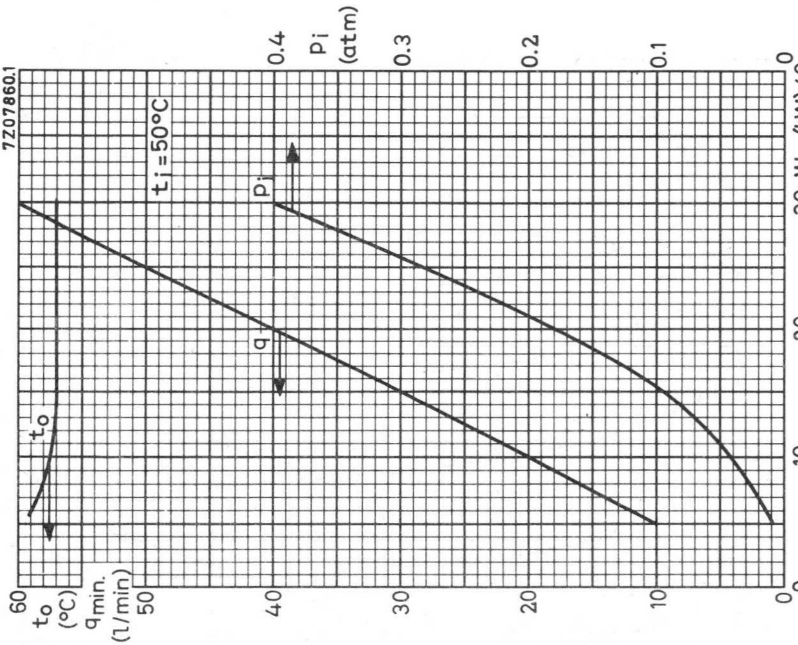
LIMITING VALUES (Absolute max. rating system)

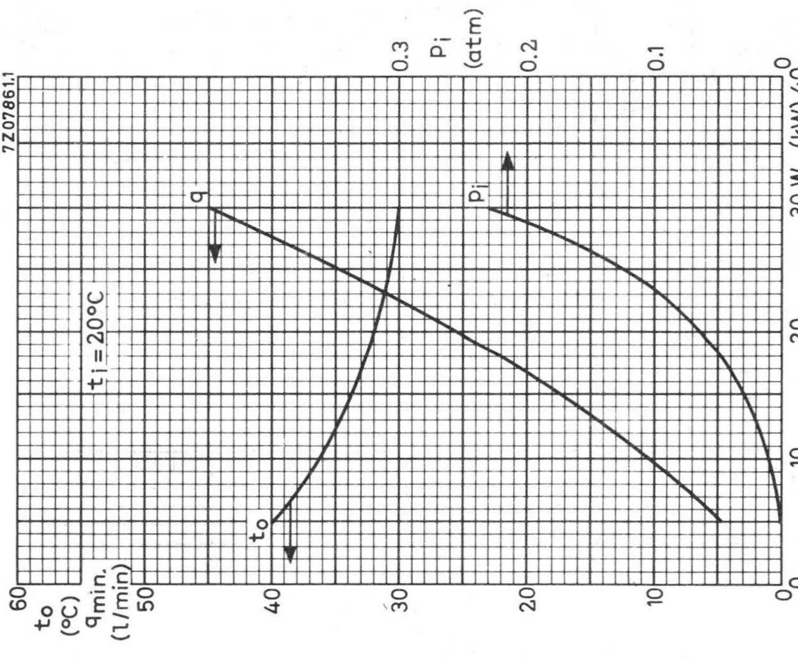
Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	10	kV
Anode input power	W_{i_a}	max.	74	kW
Anode dissipation	W_a	max.	20	kW
Anode current	I_a	max.	8.5	A
Grid No.2 voltage	V_{g_2}	max.	900	V
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Grid No.1 dissipation	W_{g_1}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

OPERATING CONDITIONS

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


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


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


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

AIR COOLED R.F. POWER TETRODE

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

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		C telegr. FM teleph.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)
30	8	30		
	10	33		
220			5.5	25

HEATING: Direct; 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_{g2}	1.2	kV
Anode current	I_a	2.5	A
Transconductance	S	65	mA/V
Amplification factor	$\mu_{g_2g_1}$	6.6	-

TEMPERATURE LIMITS AND COOLING

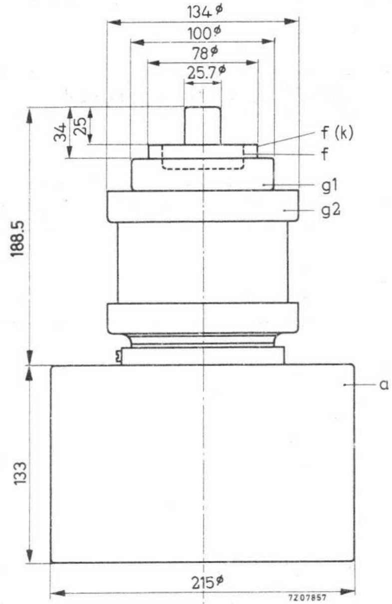
Absolute max. envelope and seal temperature $t_{env.}$ max. 220 ^{o}C

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 13.5 kg

Mounting position: Vertical with anode down



ACCESSORIES

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

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

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

		zero signal	single tone	double tone	
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)
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_{g_2}	0	250	100	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	16	47.2	30.4	kW
Anode dissipation	W_a	16	17.2	15.4	kW
Grid No.2 dissipation	W_{g_2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η	-	63.5	49	%
Intermodulation distortion					
3d order	d_3	-	-	41	dB 2)
5th order	d_5	-	-	54	dB 2)

1) 2) See page 4

OPERATING CONDITIONS(continued)

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

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

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

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

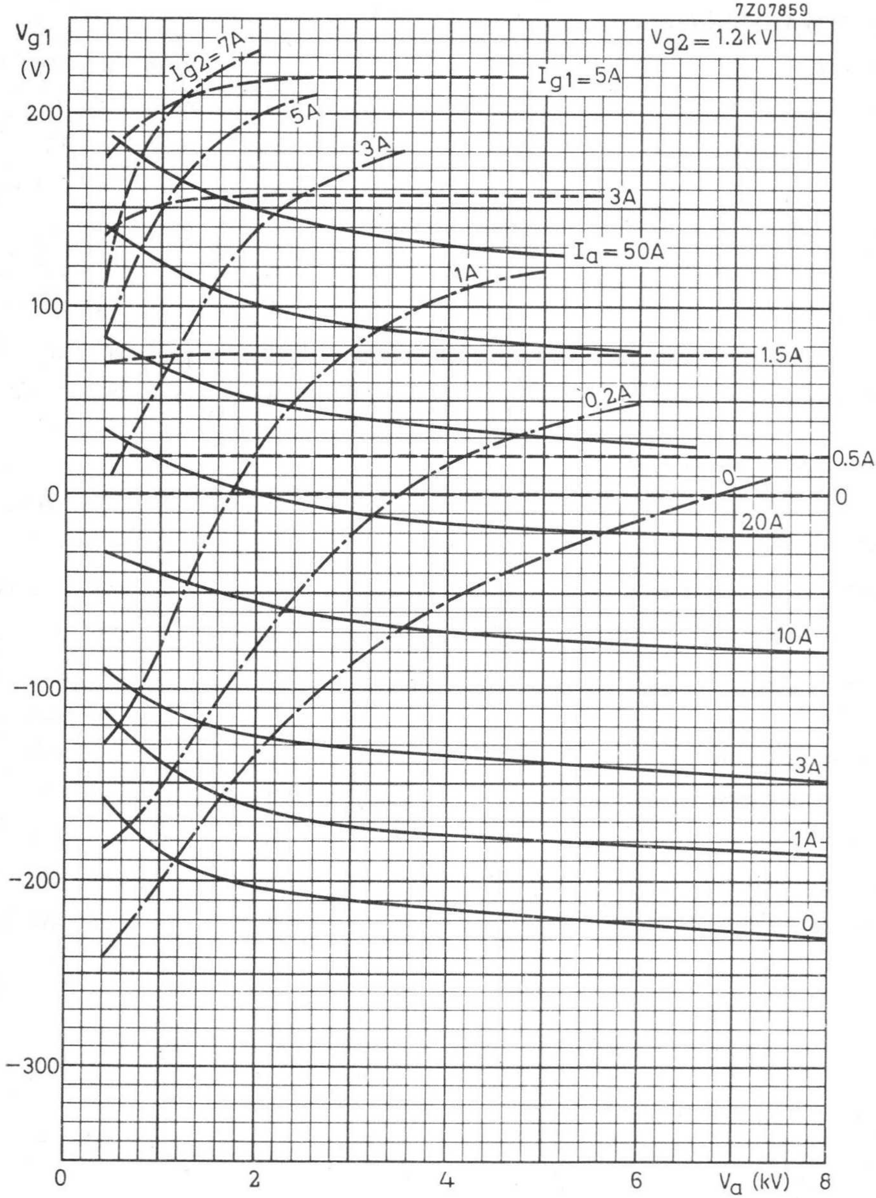
LIMITING VALUES (Absolute max. rating system)

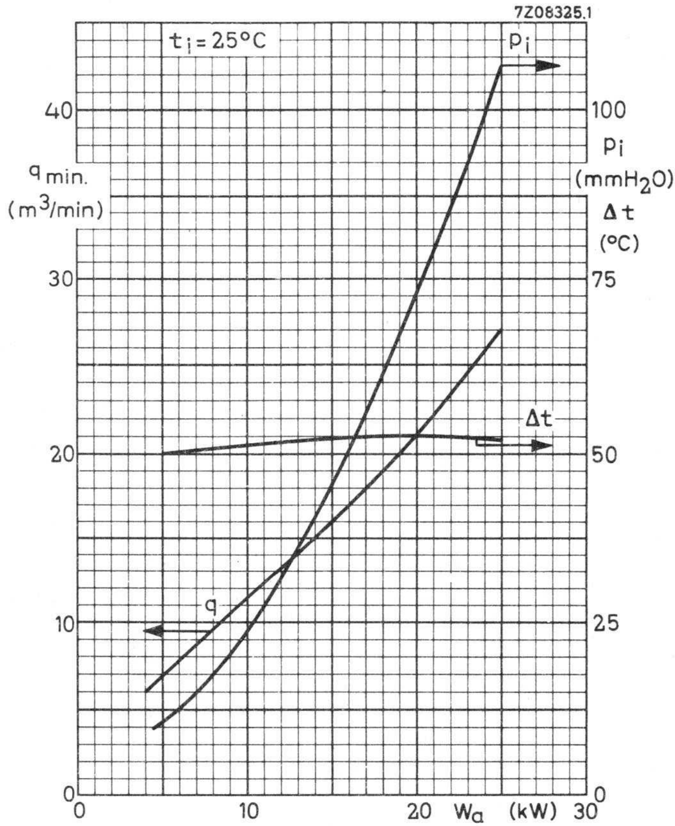
Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	5.6	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW
Grid No.2 dissipation	W_{g_2}	max.	300	W
Grid No.1 dissipation	W_{g_1}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

OPERATING CONDITIONS

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

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


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



7Z08325.1
t_i = 25°C
p_i
q min.
(m³/min)
p_i
(mmH₂O)
Δt
(°C)
Δt
q
40
30
20
10
0
100
75
50
25
0
0
10
20
W_a (kW)
30

VAPOUR COOLED R.F. POWER TETRODE

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

QUICK REFERENCE DATA						
Frequency (MHz)	S.S.B.		C telegr. FM teleph.		C_{ag_2} mod.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_o (kW)
30	8	30				
	10	33			10	55
220			5.5	25		

HEATING: Direct; 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

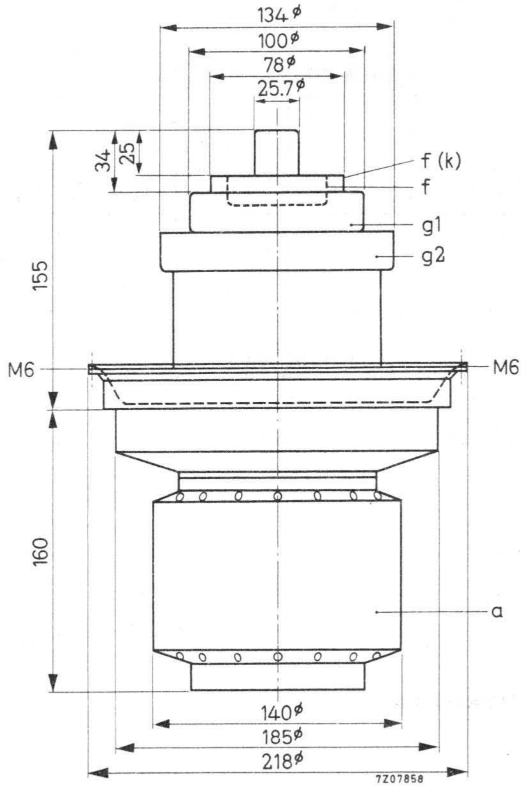
Absolute max. envelope and seal temperature	$t_{env.}$	max. 220 °C

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 14.7 kg

Mounting position: Vertical with anode down



ACCESSORIES

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

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

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

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

1) 2) See page 4

OPERATING CONDITIONS (continued)

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

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

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

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

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

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

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

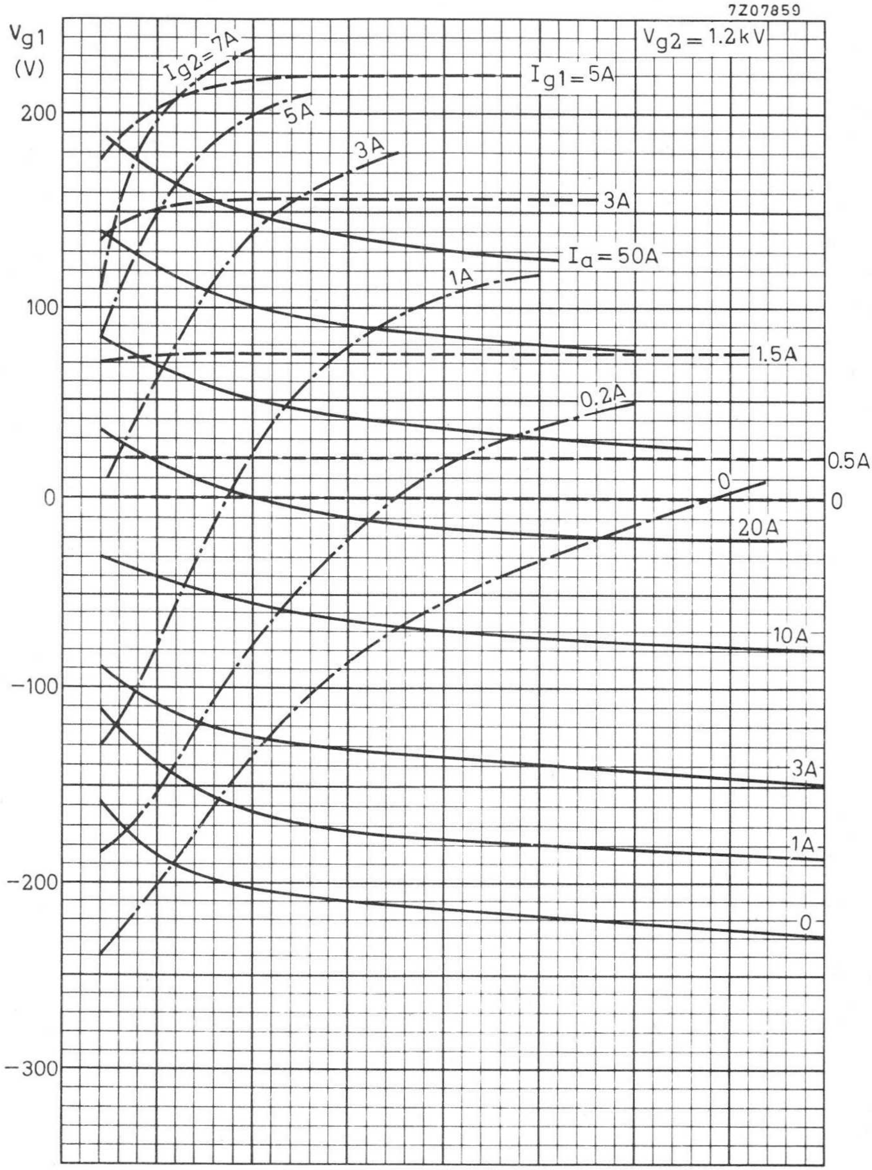
R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

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



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

QUICK HEATING R.F. DOUBLE TETRODE

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

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		C_{a-g_2} mod.		C freq. tripler	
	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)
200	300	16	300	13		
	400	22	500	22		
	600	35				
460	400	17				
66.7/200					300	7
153/460					300	5.5

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

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

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

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

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

CAPACITANCES in push-pull connection

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

The tube is internally neutralised

1) Useful power in the load

TYPICAL CHARACTERISTICS (each system)

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

TEMPERATURE LIMITS (Absolute limits)

Bulb and anode seal temperature	=	max.	250	^{o}C
Base seal temperature	=	max.	180	^{o}C

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

MECHANICAL DATA

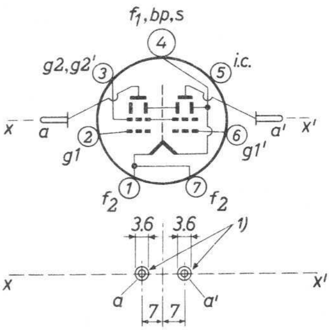
Dimensions in mm

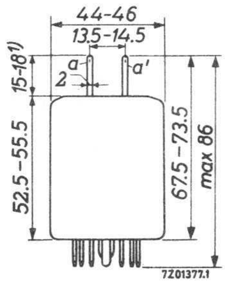
Net weight 50 g

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

OPERATING CHARACTERISTICS

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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CHARACTERISTICS

Frequency	f	=	200	200	MHz
Anode voltage	V_a	=	300	500	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-50	-80	V
Driving voltage	$V_{g_1g_1'p}$	=	166	220	V
Anode current	I_a	=	2x40	2x40	mA
Grid No.2 current	I_{g_2}	=	2x3.5	2x4.0	mA
Grid No.1 current	I_{g_1}	=	2x1.5	2x1.5	mA
Anode input power	W_{ia}	=	24	40	W
Anode dissipation	W_a	=	2x4	2x5.5	W
Output power	W_o	=	16	29	W
Efficiency	η	=	67	73	%
Output power in load	W_ℓ	=	13	22	W

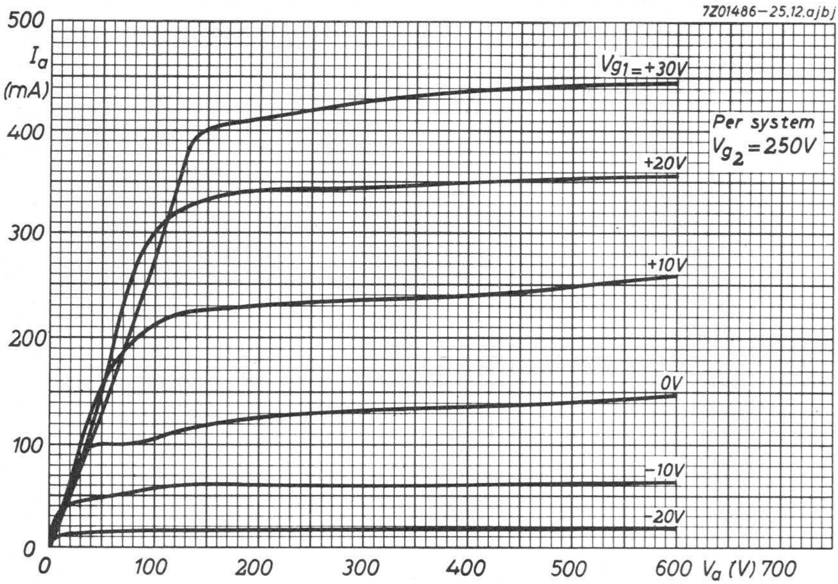
R.F. CLASS C FREQUENCY TRIPLER. Two systems in push-pull, intermittent mobile service.

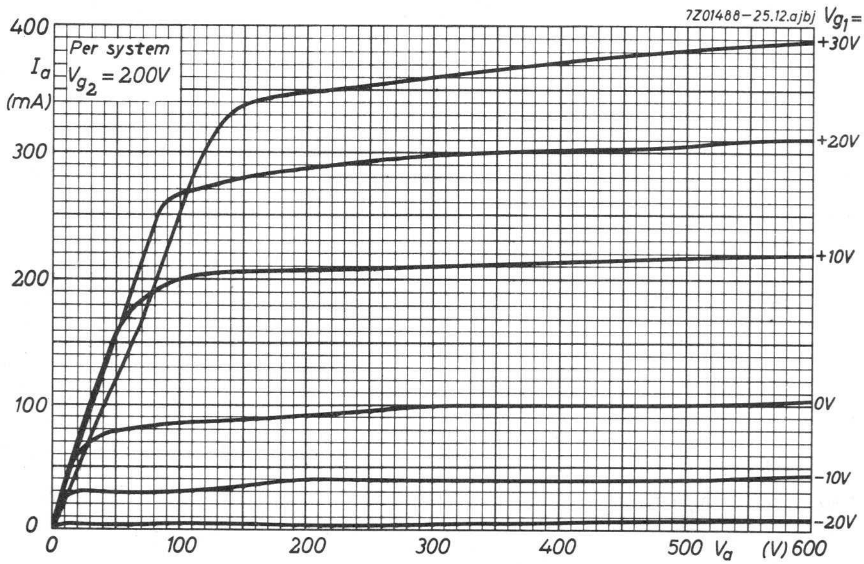
LIMITING VALUES (Absolute limits)

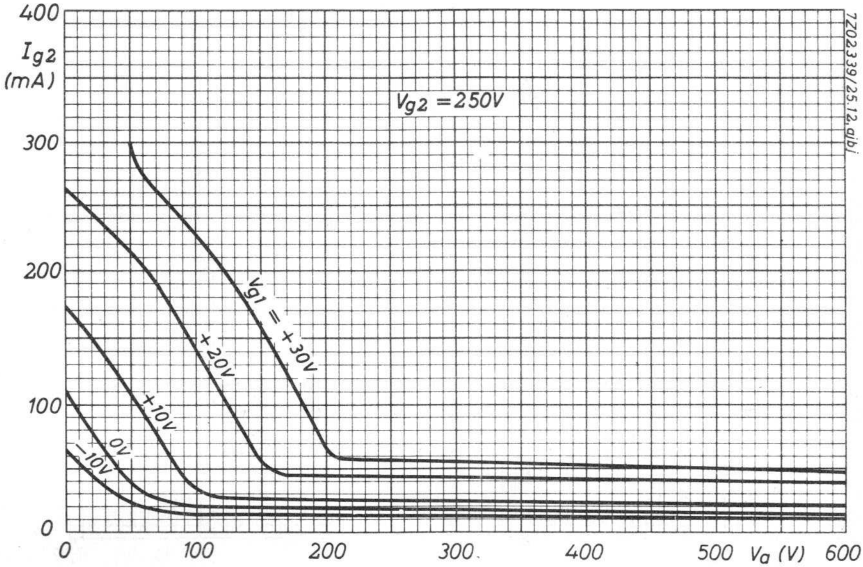
Frequency	f		up to	500	MHz
Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	54	W
Anode dissipation	W_a	=	max.	2x10	W
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	200	V
Grid No.1 current	I_{g_1}	=	max.	2x4.5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

OPERATING CHARACTERISTICS

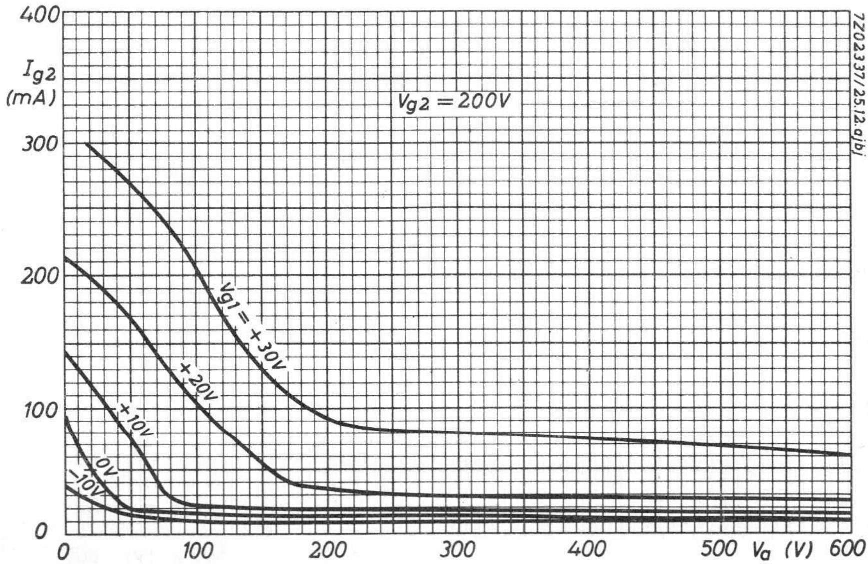
Frequency	f	=	66.7/200	153/460	MHz
Anode voltage	V_a	=	300	300	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-175	-175	V
Driving voltage	$V_{g_1g_1'p}$	=	410	410	V
Anode current	I_a	=	2x45	2x45	mA
Grid No.2 current	I_{g_2}	=	2x4.0	2x3.5	mA
Grid No.1 current	I_{g_1}	=	2x3.0	2x2.5	mA
Driver output power	W_{dr}	=	3	5	W
Anode input power	W_{ia}	=	27	27	W
Anode dissipation	W_a	=	2x9	2x10	W
Output power	W_o	=	9	7	W
Efficiency	η	=	33	26	%
Output power in load	W_ℓ	=	7	5.5	W


7Z01486–25.12.ajbj
500
I_a
(mA)
400
300
200
100
0
0
100
200
300
400
500
600 V_a (V) 700
V_{g1} = +30V
+20V
+10V
0V
−10V
−20V
Per system
V_{g2} = 250V

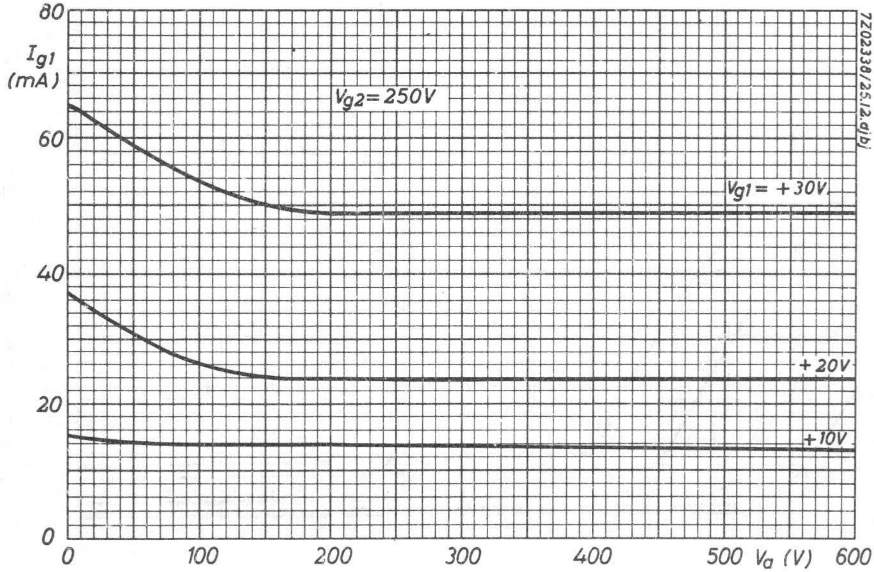

7Z01488–25.12.ajbj
V_{g1} =
400
I_a
(mA)
300
200
100
0
0
100
200
300
400
500 V_a (V) 600
Per system
V_{g2} = 200V
+30V
+20V
+10V
0V
−10V
−20V

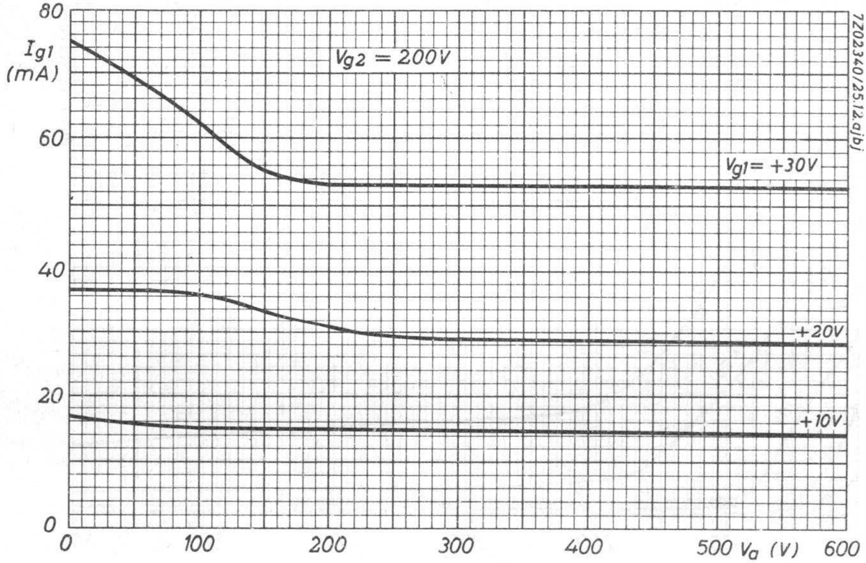


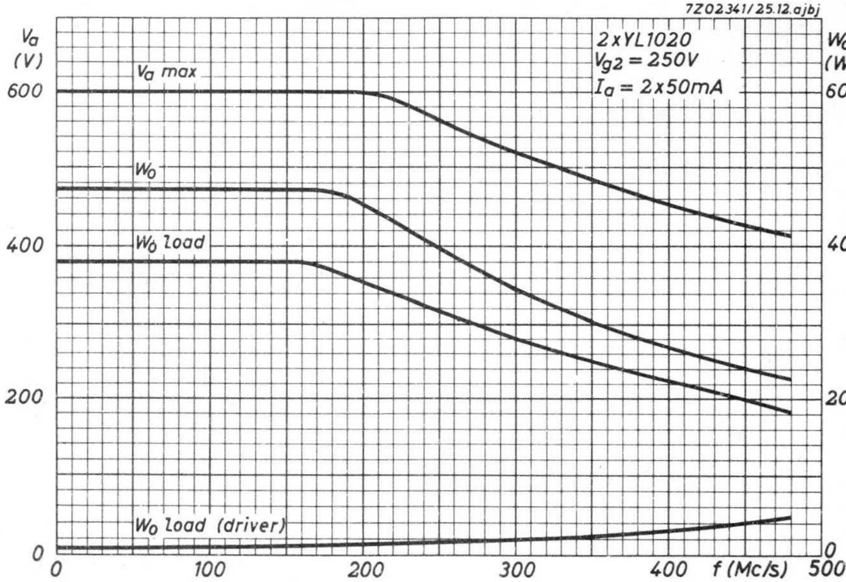
400
I_{g2} (mA)
300
200
100
0
$V_{g2} = 250V$
$V_{g1} = +30V$
+20V
+10V
0V
−10V
0
100
200
300
400
500
V_a (V)
600
7Z02339/25.12.a(b)

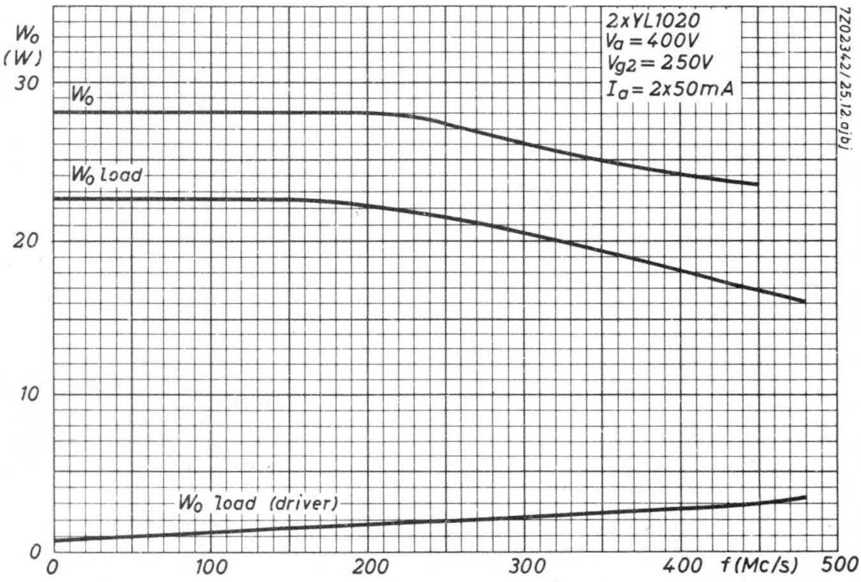


400
I_{g2} (mA)
300
200
100
0
$V_{g2} = 200V$
$V_{g1} = +30V$
+20V
+10V
0V
−10V
0
100
200
300
400
500
V_a (V)
600
7Z02337/25.12.a(b)


80
I_{g1}
(mA)
60
40
20
0
V_{g2}= 250V
V_{g1}= +30V
+20V
+10V
0
100
200
300
400
500 V_a (V)
600
7Z02338/25.12.ajbj


80
I_{g1}
(mA)
60
40
20
0
V_{g2} = 200V
V_{g1}= +30V
+20V
+10V
0
100
200
300
400
500 V_a (V)
600
7Z02340/25.12.ajbj


7Z02341/25.12.ajbj
V_a (V)
2xYL1020
V_{g2} = 250V
I_a = 2x50mA
W_o (W)
V_a max
W_o
W_o load
W_o load (driver)
600
400
200
0
60
40
20
0
100
200
300
400
f (Mc/s)
500


W_o (W)
2xYL1020
V_a = 400V
V_{g2} = 250V
I_a = 2x50mA
7Z02342/25.12.ajbj
W_o
W_o load
W_o load (driver)
30
20
10
0
100
200
300
400
f (Mc/s)
500

QUICK HEATING R.F. DOUBLE TETRODE

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

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

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

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

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

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

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

CAPACITANCES; two sections in push-pull connection

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

TYPICAL CHARACTERISTICS; each section

Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g2}	=	250	V
Anode current	I_a	=	40	mA
Mutual conductance	S	=	4.5	mA/V
Amplification factor	$\mu_{g_2g_1}$	=	8	

[1]) Output power in the load

TEMPERATURE LIMITS (Absolute limits)

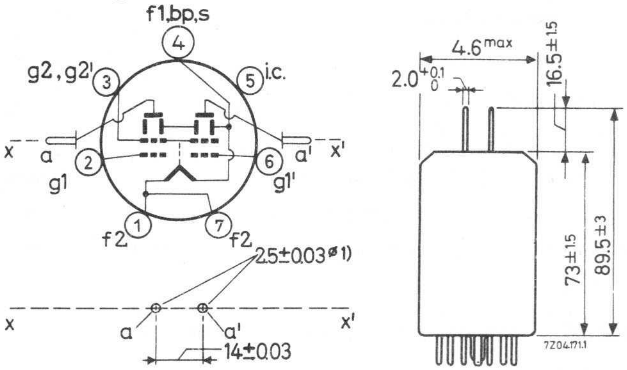
Bulb temperature	=	max. 250 °C
Temperature of all seals	=	max. 250 °C
Pin temperature	=	max. 180 °C

COOLING

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

MECHANICAL DATA Dimensions in mm

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



Mounting position: any

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

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1) Location of anode pins within these circles.

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

LIMITING VALUES (Each system; absolute limits)

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

OPERATING CONDITIONS; two systems in push-pull

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

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Each system; absolute limits)

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

OPERATING CONDITIONS; two systems in push-pull

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

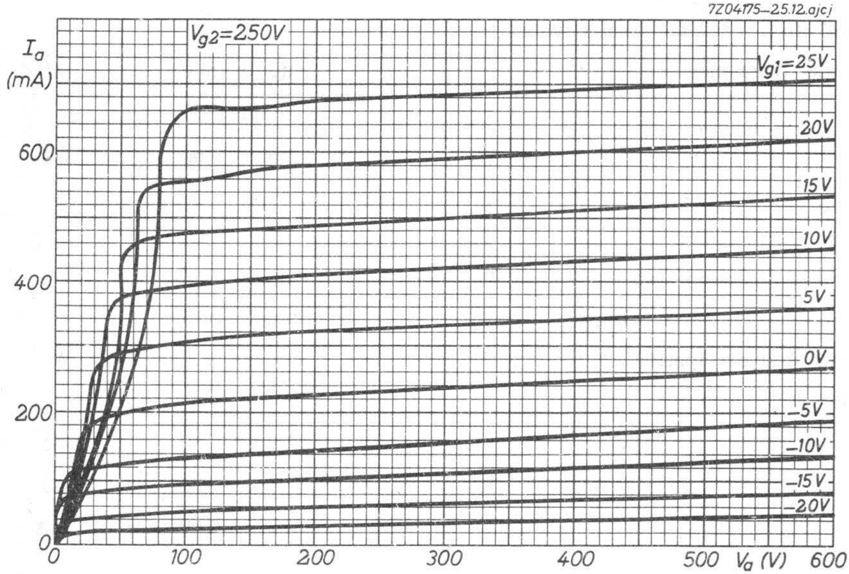
R.F. CLASS C FREQUENCY MULTIPLIER

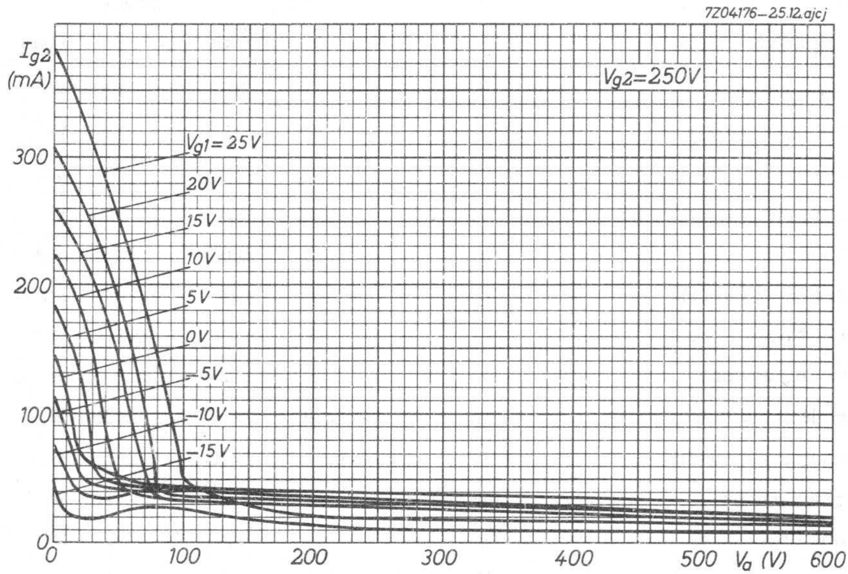
LIMITING VALUES (Each system; absolute limits)

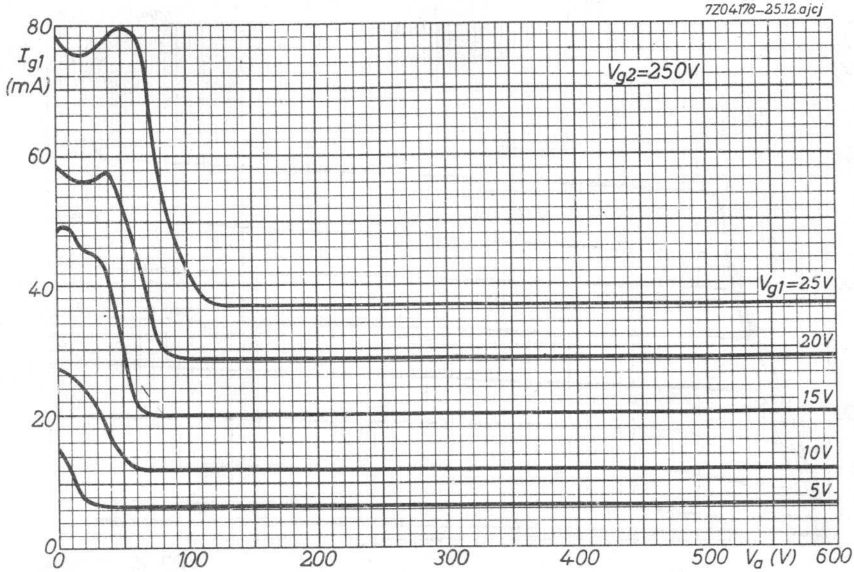
Output frequency	f_{out}		up to	500	MHz
Anode voltage	V_a	=	max.	750	V
Anode input power	W_{ia}	=	max.	60	W
Anode dissipation	W_a	=	max.	20	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	V
Grid No.1 dissipation	W_{g_1}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

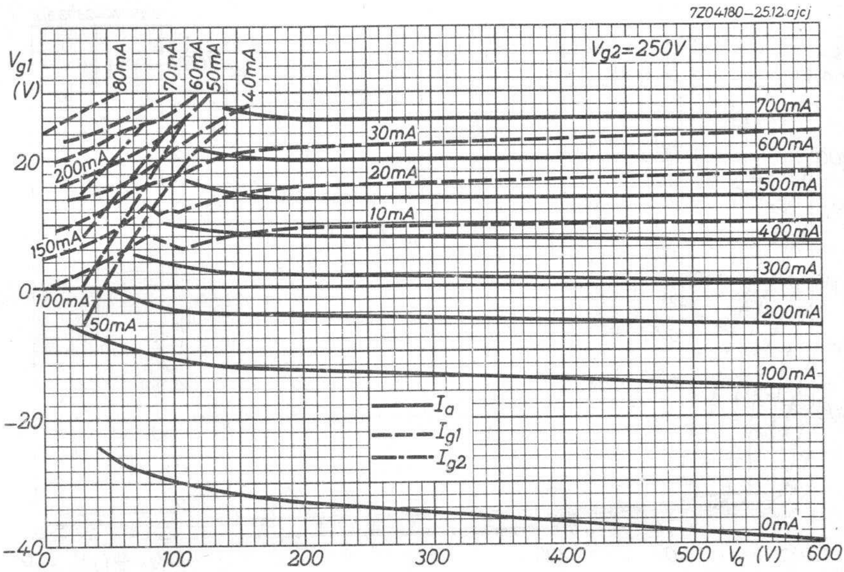
OPERATING CONDITIONS; two systems in push-pull

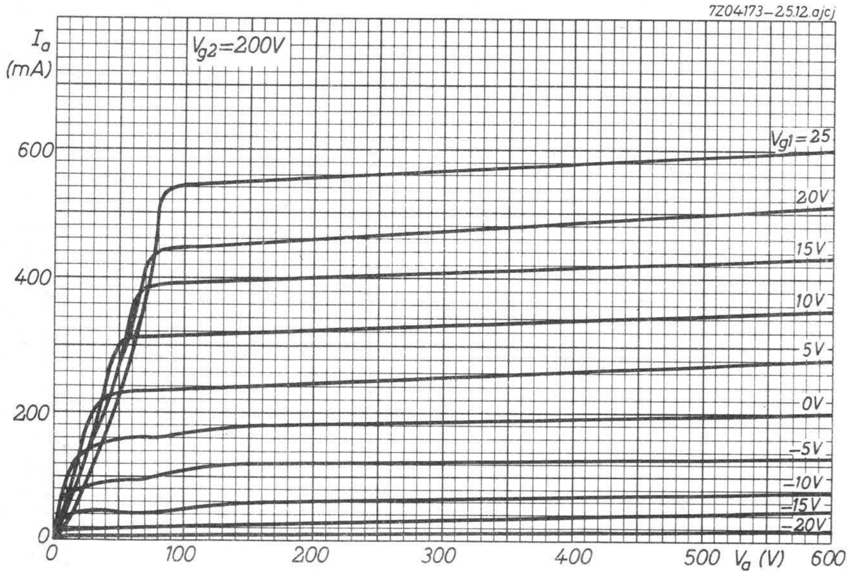
			CCS		ICAS	
Frequency	f	=	50/150	50/150	157/470	MHz
Anode voltage	V_a	=	400	500	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-150	-150	-175	V
Peak grid No.1 driving voltage	$V_{g_{1p}}$	=	360	360	360	V
Anode current	I_a	=	2x72	2x60	2x65	mA
Grid No.2 current	I_{g_2}	=	2x8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

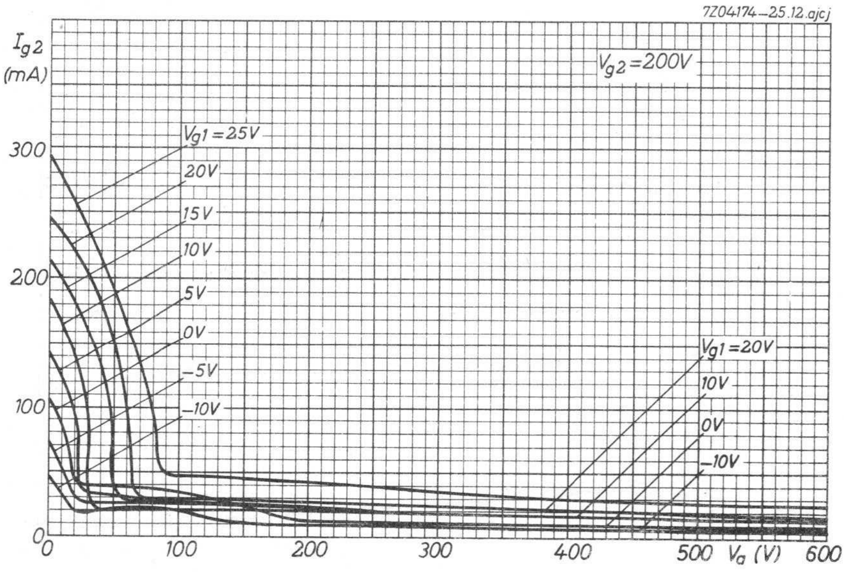

7Z04175–25.12.ajcj
I_a (mA)
V_{g2}=250V
V_{g1}=25V
20V
15V
10V
5V
0V
–5V
–10V
–15V
–20V
600
400
200
0
0
100
200
300
400
500
V_a (V)
600

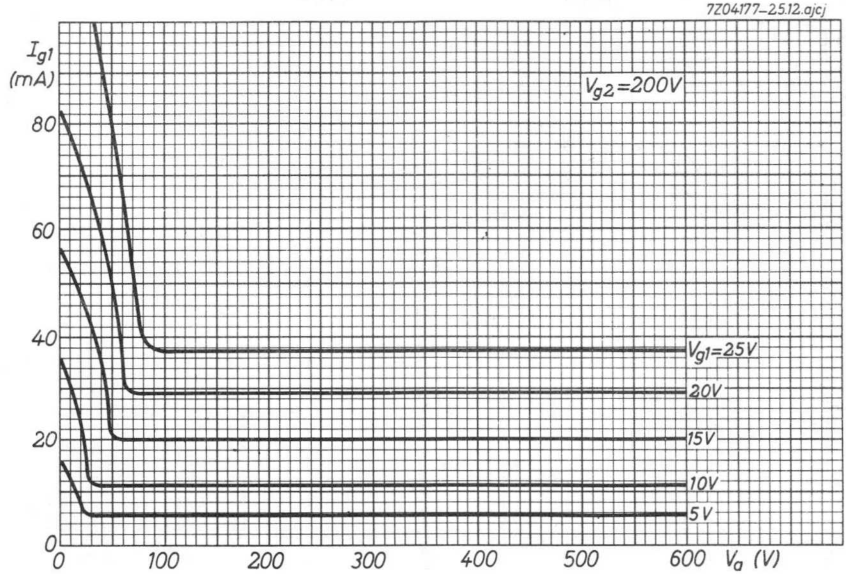

7Z04176–25.12.ajcj
I_{g2} (mA)
V_{g2}=250V
V_{g1}= 25V
20V
15V
10V
5V
0V
–5V
–10V
–15V
300
200
100
0
0
100
200
300
400
500
V_a (V)
600

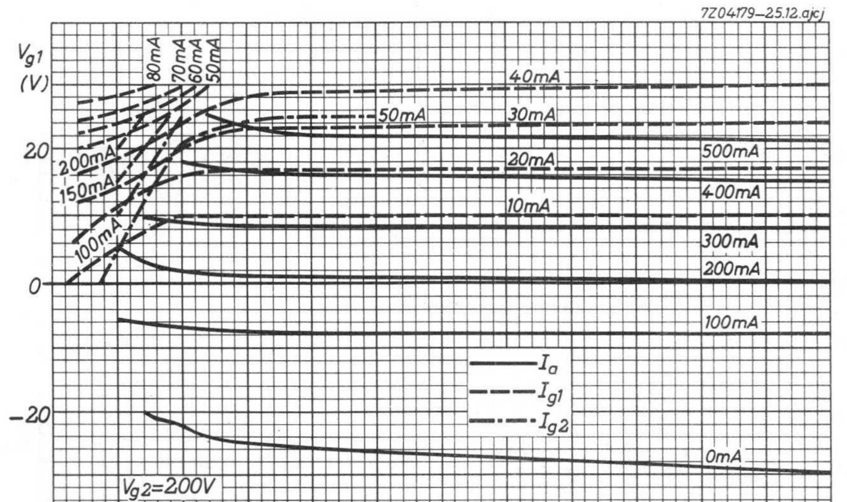

7Z04178–25.12.ajcj
I_{g1} (mA)
V_{g2}=250V
V_{g1}=25V
20V
15V
10V
5V
0
20
40
60
80
0
100
200
300
400
500
V_a (V)
600

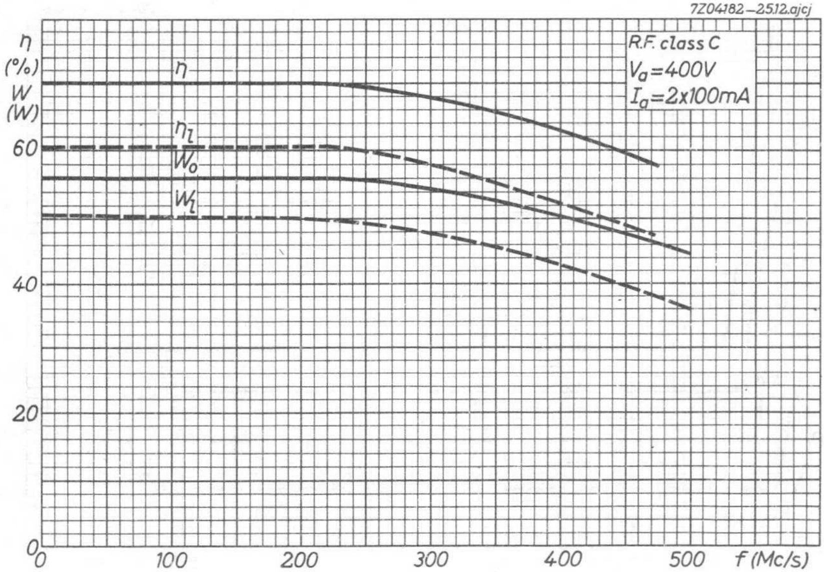

7Z04180–25.12.ajcj
V_{g1} (V)
V_{g2}=250V
80mA
70mA
60mA
50mA
40mA
700mA
30mA
600mA
200mA
20mA
500mA
10mA
150mA
400mA
300mA
100mA
50mA
200mA
100mA
0mA
I_a
I_{g1}
I_{g2}
−40
−20
0
20
0
100
200
300
400
500
V_a (V)
600

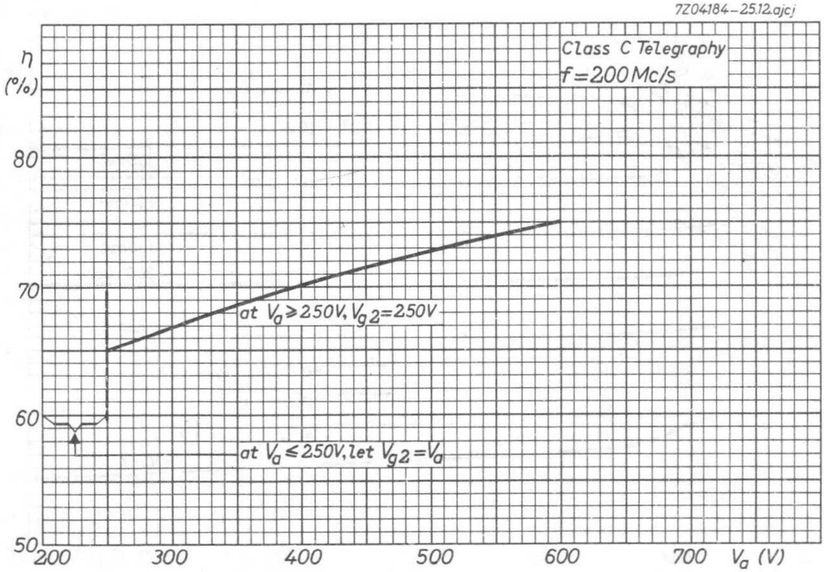

7Z04173–2.5.12.ajcj
I_a (mA)
V_{g2}=200V
V_{g1}=25
20V
15V
10V
5V
0V
–5V
–10V
–15V
–20V
0
200
400
600
100
300
500
V_a (V)

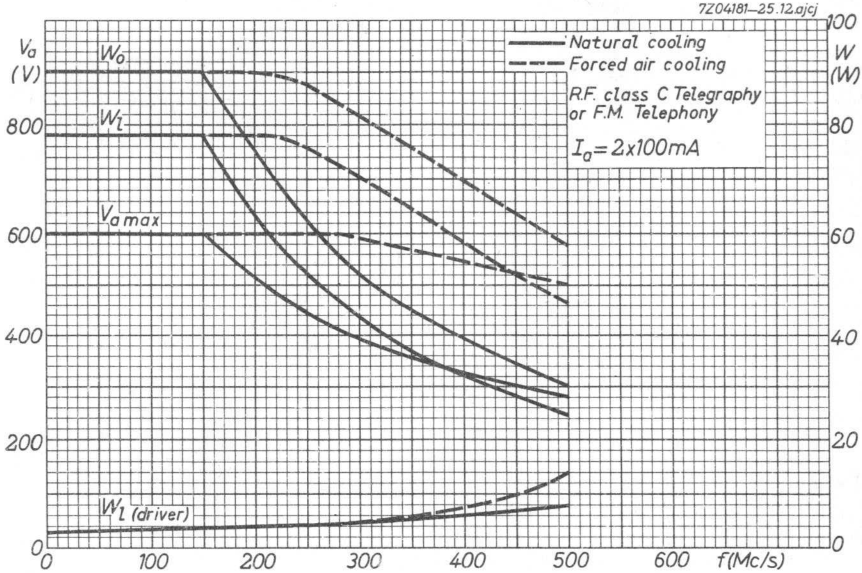

7Z04174–2.5.12.ajcj
I_{g2} (mA)
V_{g2}=200V
V_{g1}=25V
20V
15V
10V
5V
0V
–5V
–10V
V_{g1}=20V
10V
0V
–10V
0
100
200
300
400
500
V_a (V)
600

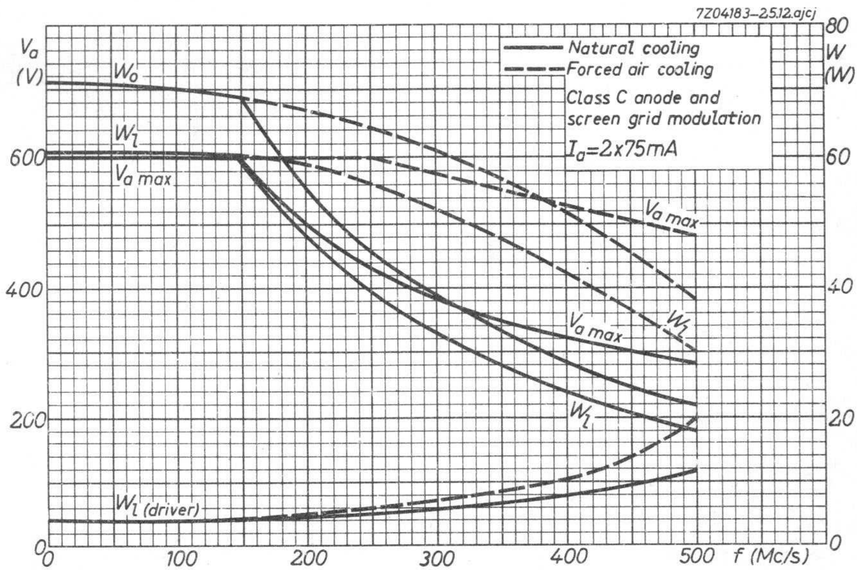

7Z04177-25.12.ajcj
I_{g1} (mA)
80
60
40
20
0
0
100
200
300
400
500
600
V_a (V)
V_{g2}=200V
V_{g1}=25V
20V
15V
10V
5V


7Z04179-25.12.ajcj
V_{g1} (V)
20
0
-20
-40
0
100
200
300
400
500
V_a (V)
600
80mA
70mA
60mA
50mA
40mA
50mA
30mA
200mA
150mA
100mA
20mA
10mA
500mA
400mA
300mA
200mA
100mA
0mA
I_a
I_{g1}
I_{g2}
V_{g2}=200V


7Z04182-25.12.ajcj
R.F. class C
V_a=400V
I_a=2x100mA
η
$η_l$
W_o
W_l
η (%)
W (W)
60
40
20
0
0
100
200
300
400
500
f (Mc/s)


7Z04184-25.12.ajcj
Class C Telegraphy
f=200 Mc/s
η (%)
80
70
60
50
at V_a≥250V, V_{g2}=250V
at V_a≤250V, let V_{g2}=V_a
200
300
400
500
600
700
V_a (V)


7Z04181–25.12.ajcj
Natural cooling
Forced air cooling
R.F. class C Telegraphy or F.M. Telephony
$I_a = 2x100mA$
V_a (V)
W (W)
W_o
W_l
$V_{a\,max}$
W_l (driver)
f(Mc/s)
0
100
200
300
400
500
600
800
20
40
60
80
100


7Z04183–25.12.ajcj
Natural cooling
Forced air cooling
Class C anode and screen grid modulation
$I_a = 2x75mA$
V_a (V)
W (W)
W_o
W_l
$V_{a\,max}$
W_l (driver)
f (Mc/s)
0
100
200
300
400
500
600
20
40
60
80

R.F. DOUBLE TETRODE

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

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

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

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

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

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

TYPICAL CHARACTERISTICS (each system)

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

1) Useful power in the load

COOLING: radiation

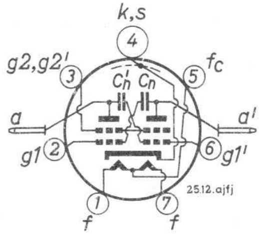
When the tube is used near its limiting values it may be necessary to direct an air flow on the bulb and the anode seals. In general an air flow of approximately 0.56 m^3/min. will be sufficient.

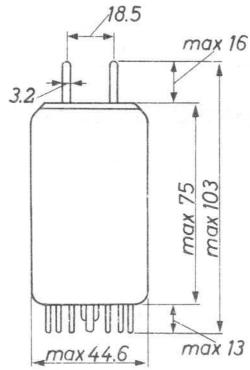
TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and anode seals	= max.	250	^{o}C
Temperature of base pin seals	= max.	180	^{o}C

MECHANICAL DATA Dimensions in mm

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





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

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

LIMITING VALUES (continuous service; absolute limits)

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

OPERATING CONDITIONS (continuous service)

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

[1]) Each section

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

LIMITING VALUES (Intermittent service; absolute limits)

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

OPERATING CONDITIONS (Intermittent service)

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

1) Each section

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

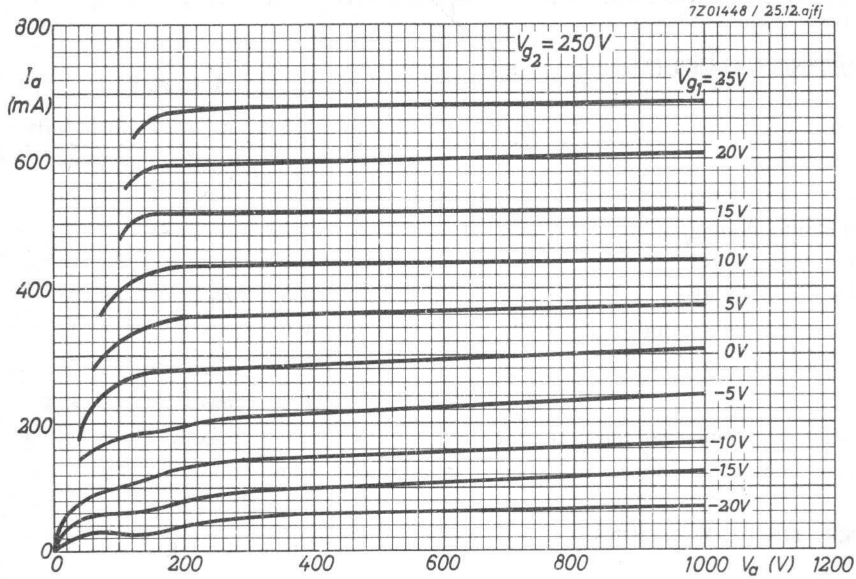
LIMITING VALUES (Absolute limits)

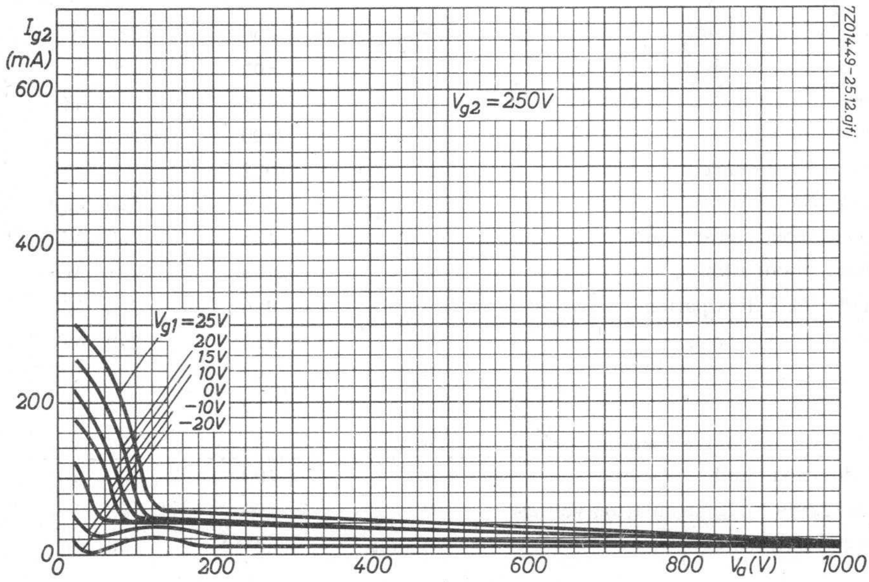
			C. C. S.		I. C. A. S.		
Frequency	f		up to	175	up to	175	MHz
Anode voltage	V_a	=	max.	800	max.	800	V
Anode current	I_a	=	max.	2x90	max.	2x100	mA
Anode dissipation	W_a	=	max.	2x21	max.	2x23.5	W
Anode input power	W_{ia}	=	max.	140	max.	160	W
Grids No.2 voltage	$V_{g_2,g_2'}$	=	max.	250	max.	250	V
Grids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

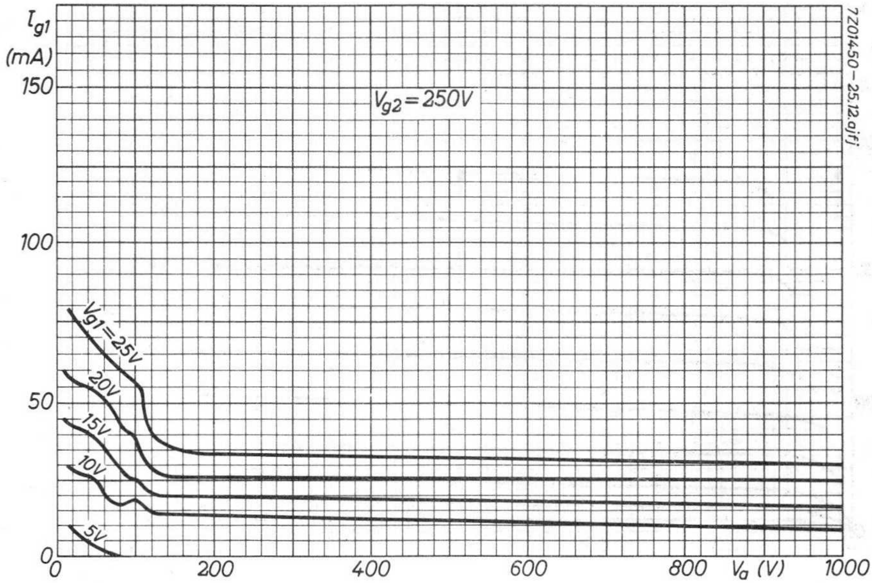
OPERATING CONDITIONS

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

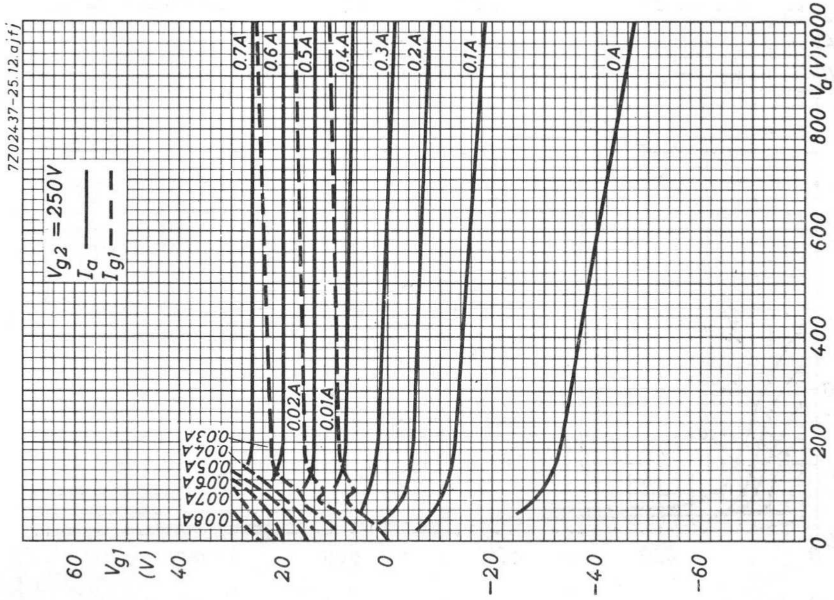
[1]) Each section


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

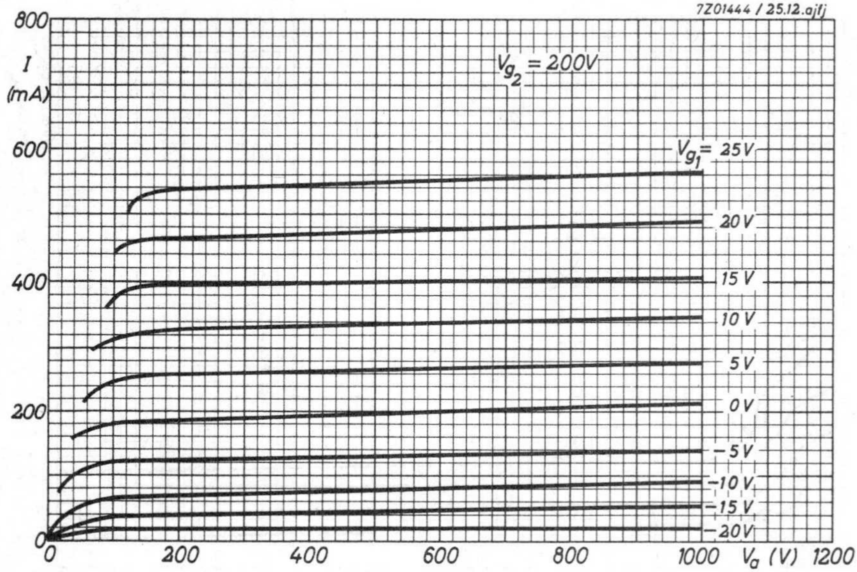

I_{g2} (mA)
600
400
200
0
$V_{g2} = 250V$
7Z01449−25.12.ajfj
$V_{g1} = 25V$
20V
15V
10V
0V
−10V
−20V
0
200
400
600
800
V_a(V)
1000

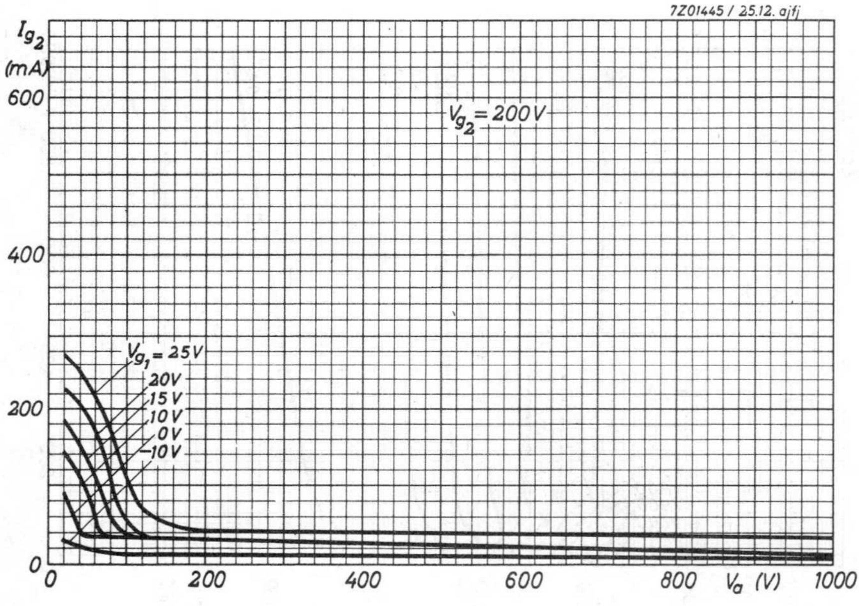


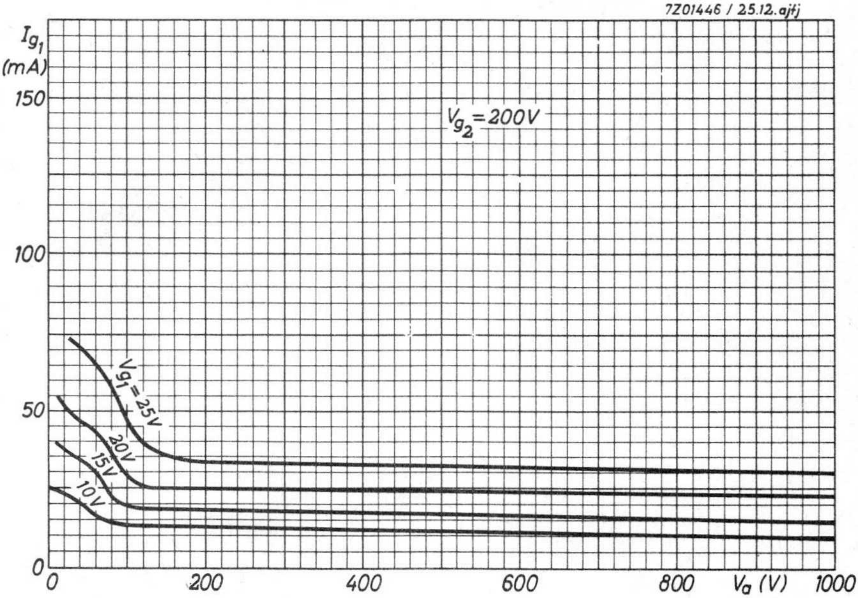
I_g1 (mA)
150
100
50
0
V_g2 = 250V
V_g1 = 25V
20V
15V
10V
5V
0
200
400
600
800
V_a (V)
1000
7Z01450-25.12.ajfj

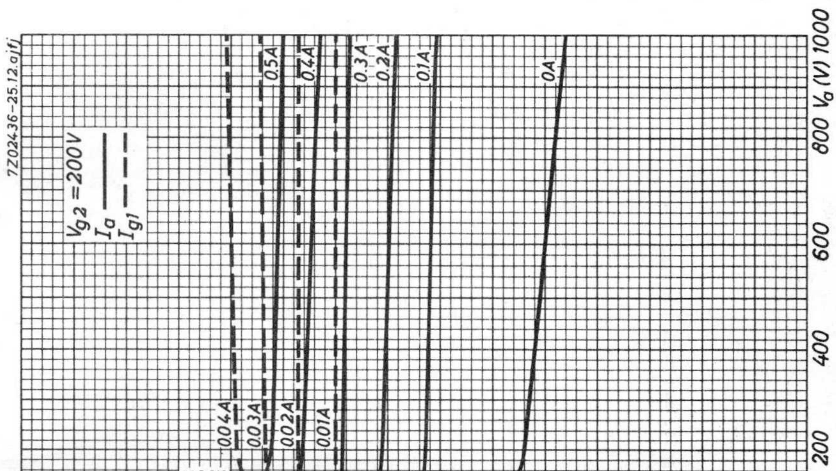


7Z02437-25.12.ajfj
V_g2 = 250 V
I_a
I_g1
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0A
0.02A
0.01A
0.03A
0.04A
0.05A
0.06A
0.07A
0.08A
60
V_g1 (V)
40
20
0
−20
−40
−60
V_a (V) 1000
800
600
400
200
0


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


7Z01445 / 25.12. ajfj
I_{g_2}
(mA)
600
400
200
0
$V_{g_2} = 200V$
$V_{g_1} = 25V$
20V
15 V
10 V
0 V
−10 V
0
200
400
600
800
V_a (V)
1000


7Z01446 / 25.12.ajfj
I_{g_1} (mA)
150
100
50
0
V_{g_2} = 200 V
V_{g_1} = 25 V
20 V
15 V
10 V
0
200
400
600
800
V_a (V)
1000


7Z02436-25.12.ajfj
V_{g2} = 200 V
I_a
I_{g1}
0.5A
0.4A
0.3A
0.2A
0.1A
0A
0.04A
0.03A
0.02A
0.01A
0.05A
0.06A
0.07A
0.08A
60
V_{g1} (V)
40
20
0
-20
-40
-60
V_a (V) 1000
800
600
400
200
0

DOUBLE TETRODES

Double tetrodes for use as linear single side band amplifier.

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

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

HEATING:

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

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

CAPACITANCES (each section)

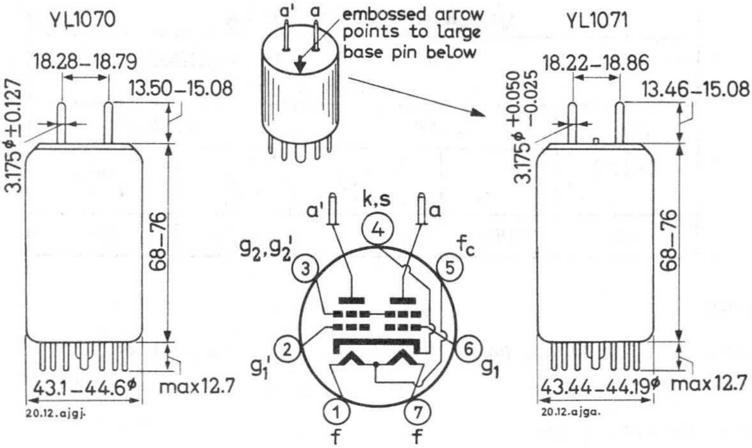
Anode to all other elements except grid No.1	C_a	=	3.15	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	10.6	pF
Anode to grid No.1	C_{ag_1}	<	0.09	pF

TYPICAL CHARACTERISTICS (each section)

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

MECHANICAL DATA

Dimensions in mm



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

COOLING: Radiation and convection

When the tube is used at maximum permissible values it may be necessary to direct an air flow of approx. 0.6 m^3/min to the bulb and to the anode seals. The YL1071 has a calibrated bulb held to close tolerances. This permits an accurate fit into heatsink cooling equipment. 7Z2 8844

TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and all seals max. 250 °C

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

LIMITING VALUES (Absolute limits) (each section)

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

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

LIMITING VALUES (Absolute limits) (each section)

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

7Z2 2885

OPERATING CONDITIONS (two sections in parallel)

Table A

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

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

[2] Peak envelope power value.

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

7Z2 2886

OPERATING CONDITIONS (two sections in parallel) (continued)

Table B

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

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

[2]) Peak envelope power value

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

7Z2 2887

OPERATING CONDITIONS (two sections in parallel) (continued)

Table C

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

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

[2]) Peak envelope power value.

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

7Z2 2888

OPERATING CONDITIONS (two sections in parallel) (continued)

Table D

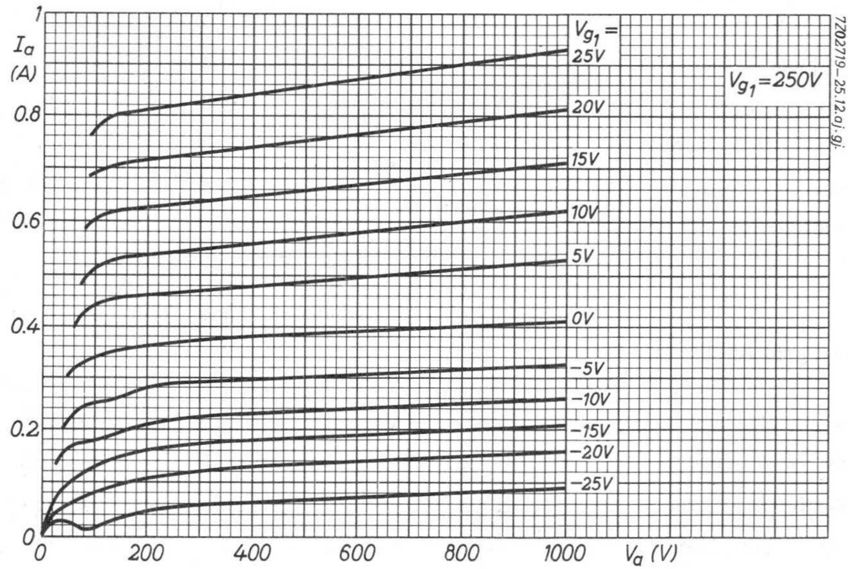
				I.C.A.S.		
Frequency	f	=		7		MHz
Anode voltage	V_a	=		1000		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-36		V [1]
Load resistance	R_a	=		3000		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	36	36	V
Anode current	$I_{a+a'}$	=	55	216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

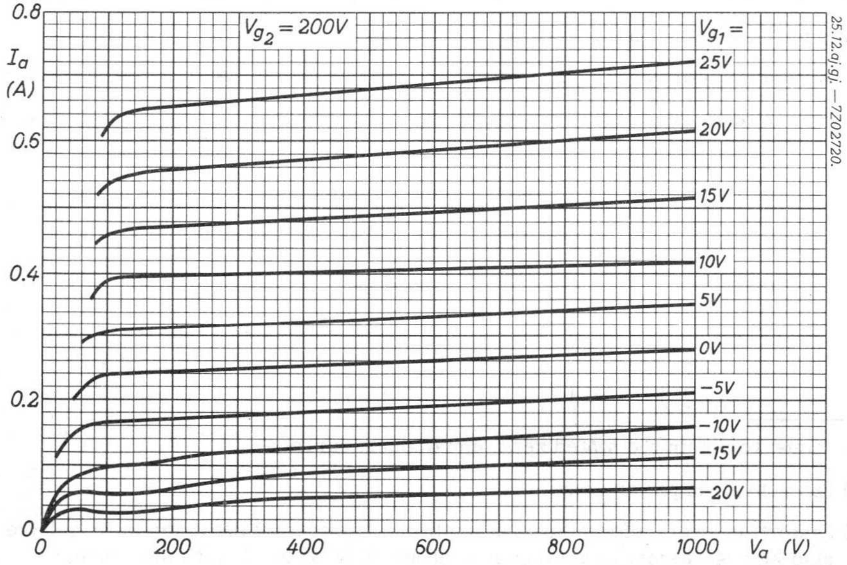
[1]) Adjust to obtain the stated zero signal anode current.

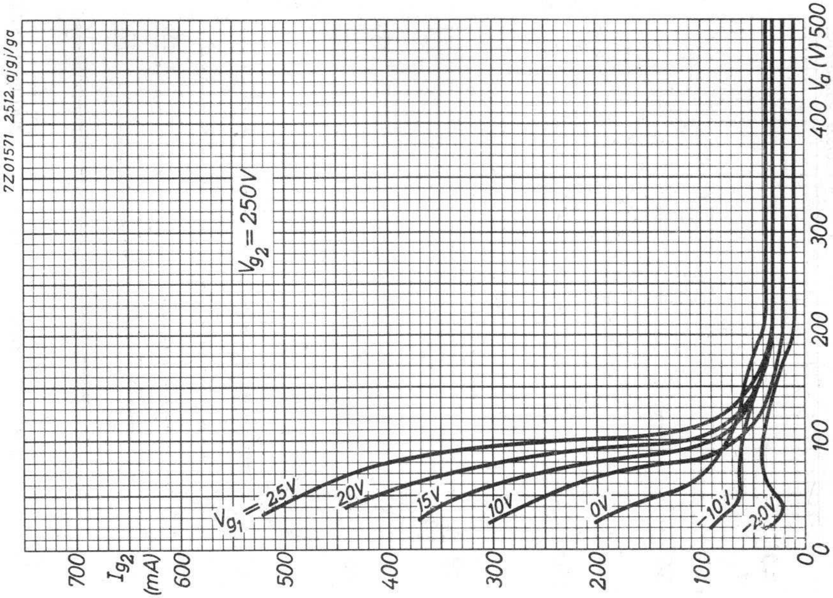
[2]) Peak envelope power value.

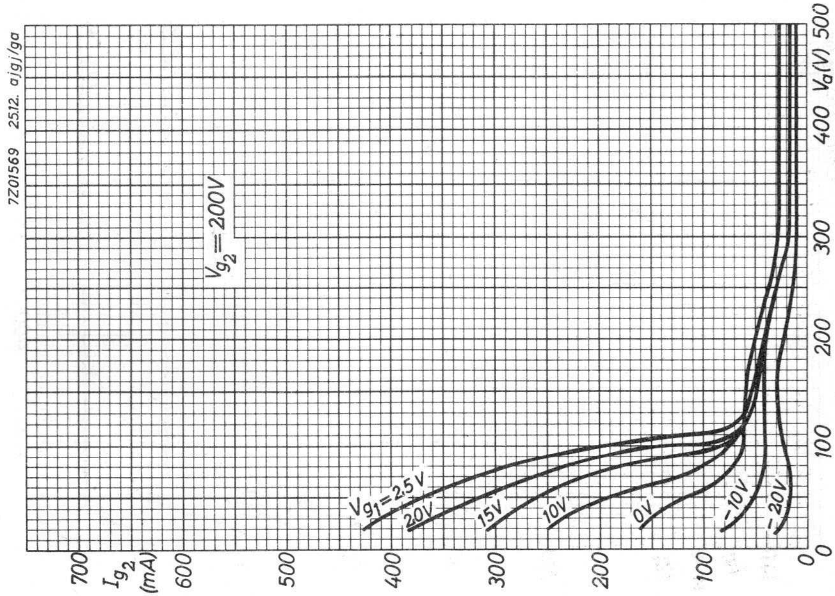
[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

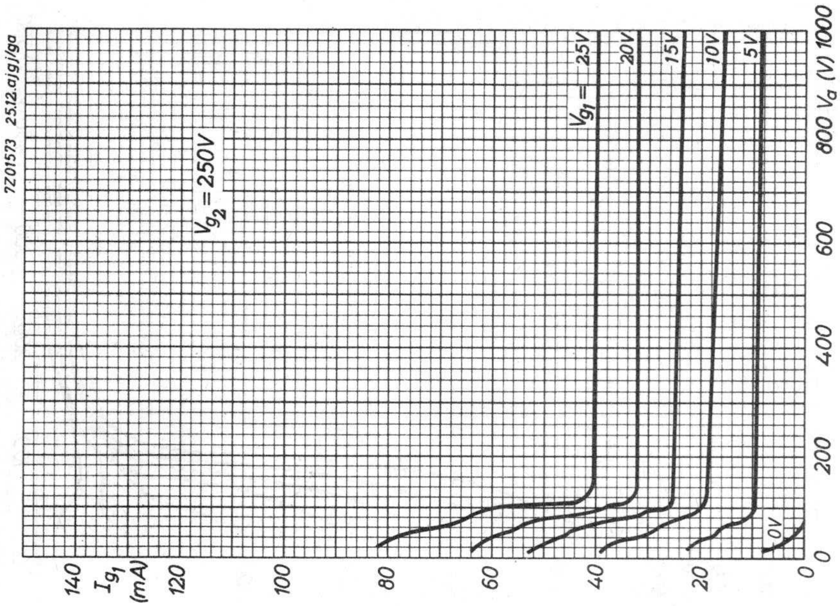
7Z2 2889

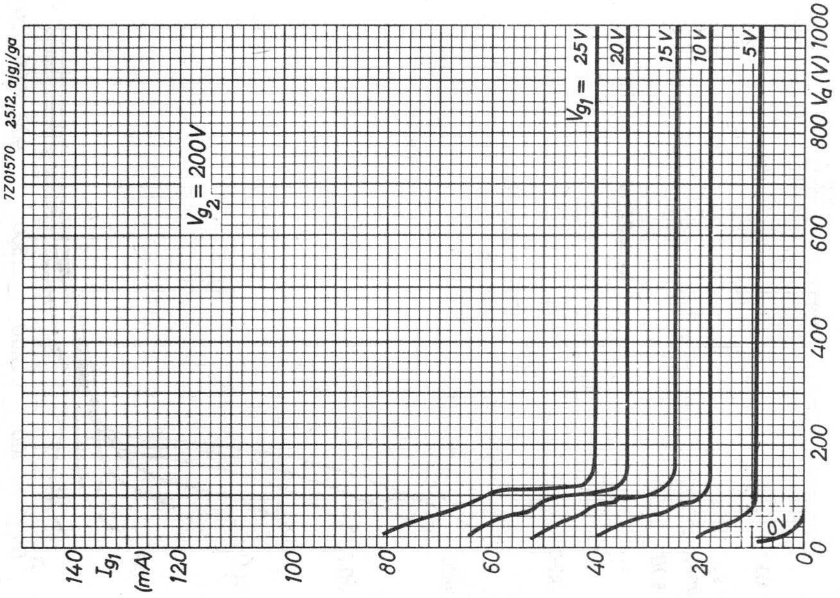

7202719 – 25.12.aj.gj.
I_a (A)
V_{g_2}=250V
V_{g_1} =
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
V_a (V)
0
0.2
0.4
0.6
0.8
1
200
400
600
800
1000

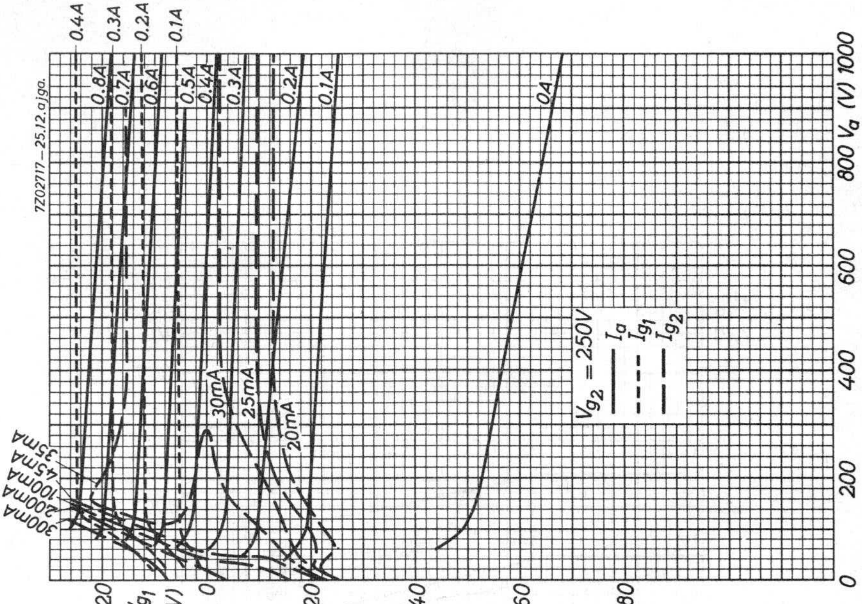

25.12.aj.gj. – 7202720.
I_a (A)
V_{g_2} = 200V
V_{g_1} =
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
V_a (V)
0
0.2
0.4
0.6
0.8
200
400
600
800
1000

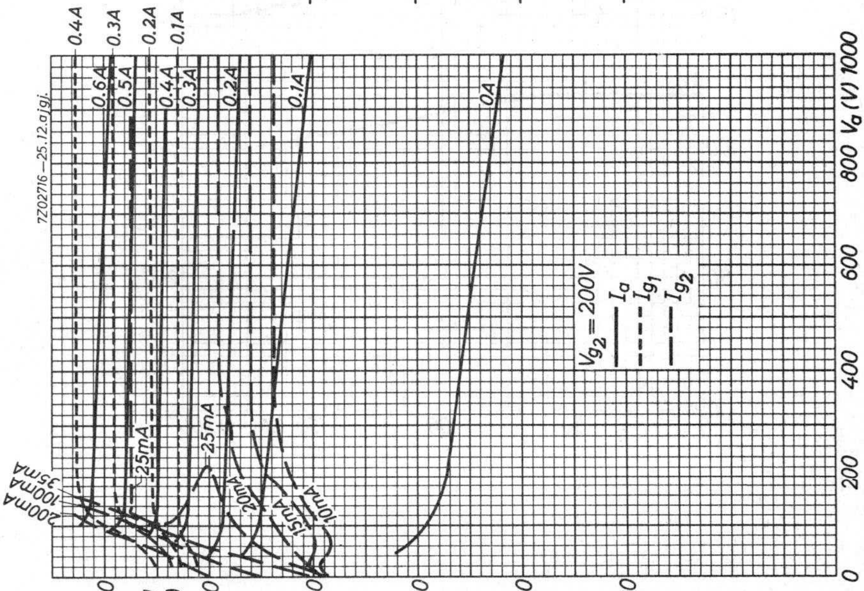

7Z01571 25.12. ajgj/ga
$V_{g_2} = 250V$
$V_{g_1} = 25V$
20V
15V
10V
0V
−10V
−20V
I_{g_2} (mA)
V_a (V)

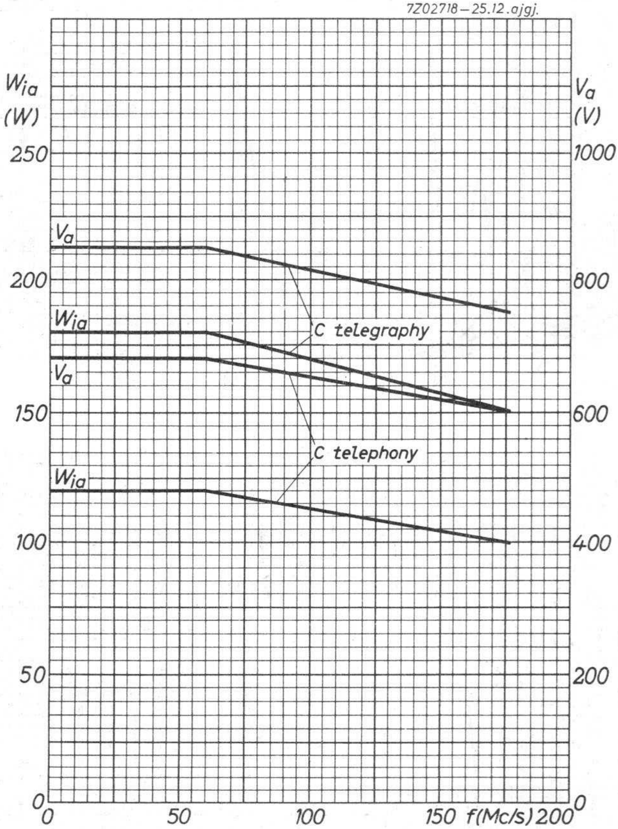

7Z01569 25.12. ajgj/ga
$V_{g_2} = 200V$
$V_{g_1} = 25V$
20V
15V
10V
0V
−10V
−20V
I_{g_2} (mA)
V_a (V)


7Z01573 25.12.ajgj/ga
V_{g_2} = 250V
V_{g_1} = 25V
20V
15V
10V
5V
0V
I_{g_1} (mA)
140
120
100
80
60
40
20
0
0
200
400
600
800 V_a (V) 1000


7Z01570 25.12. ajgj/ga
V_{g_2} = 200V
V_{g_1} = 25V
20V
15 V
10 V
5 V
0V
I_{g_1} (mA)
140
120
100
80
60
40
20
0
0
200
400
600
800 V_a (V) 1000


7Z02717 – 25.12.ajga.
$V_{g2} = 250V$
I_a
I_{g1}
I_{g2}
V_{g1} (V)
V_a (V)
0.4A
0.3A
0.2A
0.1A
0.8A
0.7A
0.6A
0.5A
0A
300mA
200mA
100mA
45mA
35mA
30mA
25mA
20mA
20
0
-20
-40
-60
-80
0
200
400
600
800
1000


7Z02716 – 25.12.ajgj.
$V_{g2} = 200V$
I_a
I_{g1}
I_{g2}
V_{g1} (V)
V_a (V)
0.4A
0.3A
0.2A
0.1A
0.6A
0.5A
0A
200mA
100mA
35mA
25mA
20mA
15mA
10mA
20
0
-20
-40
-60
-80
0
200
400
600
800
1000


7Z02718–25.12.ajgj.
W_{ia}
(W)
V_a
(V)
250
200
150
100
50
0
1000
800
600
400
200
0
V_a
W_{ia}
V_a
W_{ia}
C telegraphy
C telephony
0
50
100
150
f(Mc/s)
200

QUICK HEATING R.F. DOUBLE TETRODE

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

QUICK REFERENCE DATA									
Freq. (MHz)	R.F. class C telegraphy			R.F. class C a-g_2 modulator			R.F. class C freq. multiplier		
	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (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	V ± 15% 3)
Filament current	I_f	=	2.5	A
Heating time for W_o = 70% of full output power	T_h	<	0.5	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	pF
Grid No.1 to all other elements except anode	C_{g_1}	= $C_{g_1'}$	=	7.5	pF
Anode to grid No.1	C_{ag_1}	= $C_{a'g'_1}$	<	0.1	pF
Anode of one system to grid No.1 of the other system	$C_{ag_1'}$	= $C_{a'g_1}$	<	0.1	pF
Between the grids No.1	$C_{g_1g_1'}$		=	2	pF
Between the anodes	$C_{aa'}$		=	0.06	pF

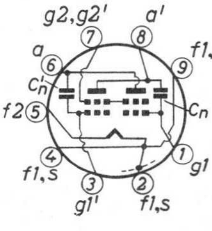
The tube is internally neutralised up to 200 MHz

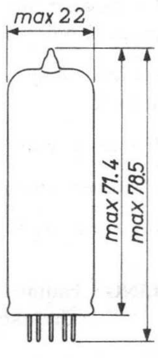
TYPICAL CHARACTERISTICS

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

MECHANICAL DATA (Dimensions in mm)

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





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

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max.	250	°C
Pin temperature	=	max.	120	°C

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

LIMITING VALUES (each system; absolute limits)

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

OPERATING CONDITIONS, two systems in push-pull

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

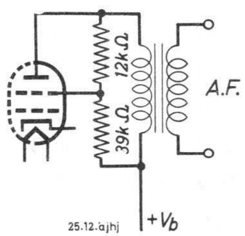
R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (each system; absolute limits)

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

OPERATING CONDITIONS, two systems in push-pull

Frequency	f	=	200	MHz
Anode voltage	V_a	=	200	V
Grid No.2 supply voltage (see fig. below)	V_{bg_2}	=	200	V
Common grid No.1 resistor	R_{g_1}	=	33	kΩ
Peak grid-to-grid A.C. voltage	$V_{g_1g_1'p}$	=	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_{ia}	=	2 x 6.7	W
Anode dissipation	W_a	=	2 x 2.65	W
Tube efficiency	η	=	60	%
Useful power in the load	W_ℓ	=	7.0	W
Modulation depth	m	=	100	%
Modulation power	W_{mod}	=	6.7	W



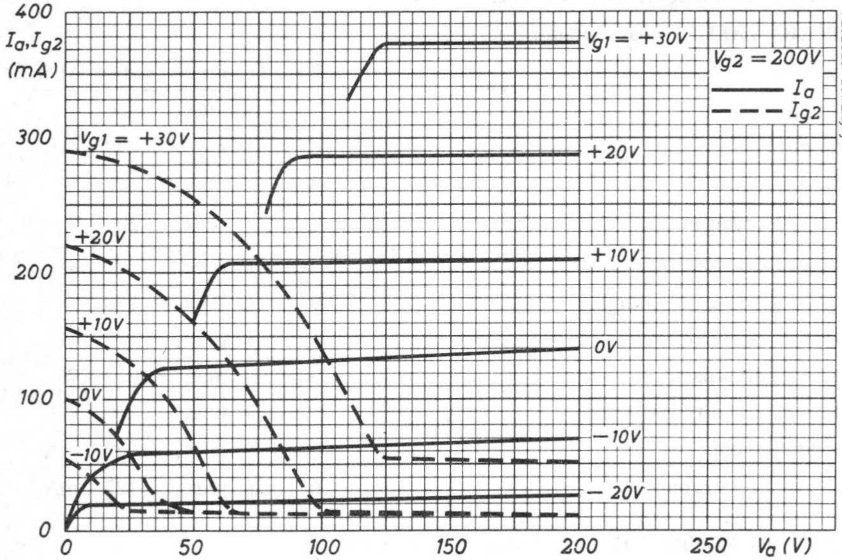
R.F. CLASS C FREQUENCY TRIPLER

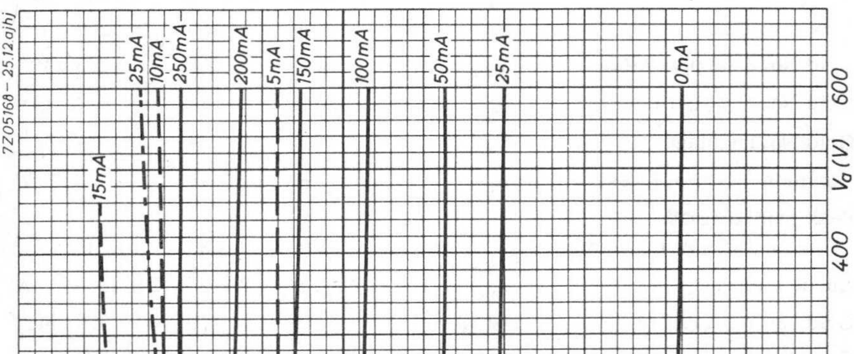
LIMITING VALUES (each system; absolute limits)

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

OPERATING CONDITIONS, two systems in push-pull

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


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


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

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_{a-g_2} mod.		Class B mod.	
	V_a(kV)	W_o(kW) P.E.P.	V_a(kV)	W_o(kW)	V_a(kV)	W_o(kW)
30	9	120	11	220	11	320

HEATING : Direct, filament thoriated tungsten

Filament voltage	V_f	21	V
Filament current	I_f	350	A

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

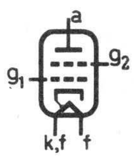
[1]) Measured with a flat shield of 500 mm diameter in the plane of grid No.2

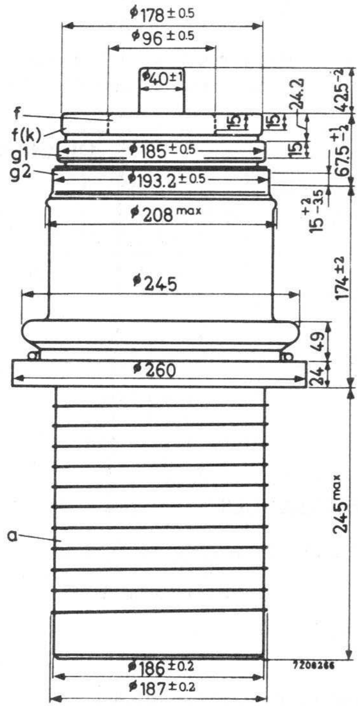
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 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_{g_2}	max.	1.6	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	40	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	360	kW
Anode dissipation	W_a	max.	120	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS

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

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

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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	11.5	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	32	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	300	kW
Anode dissipation	W_a	max.	80	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS

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

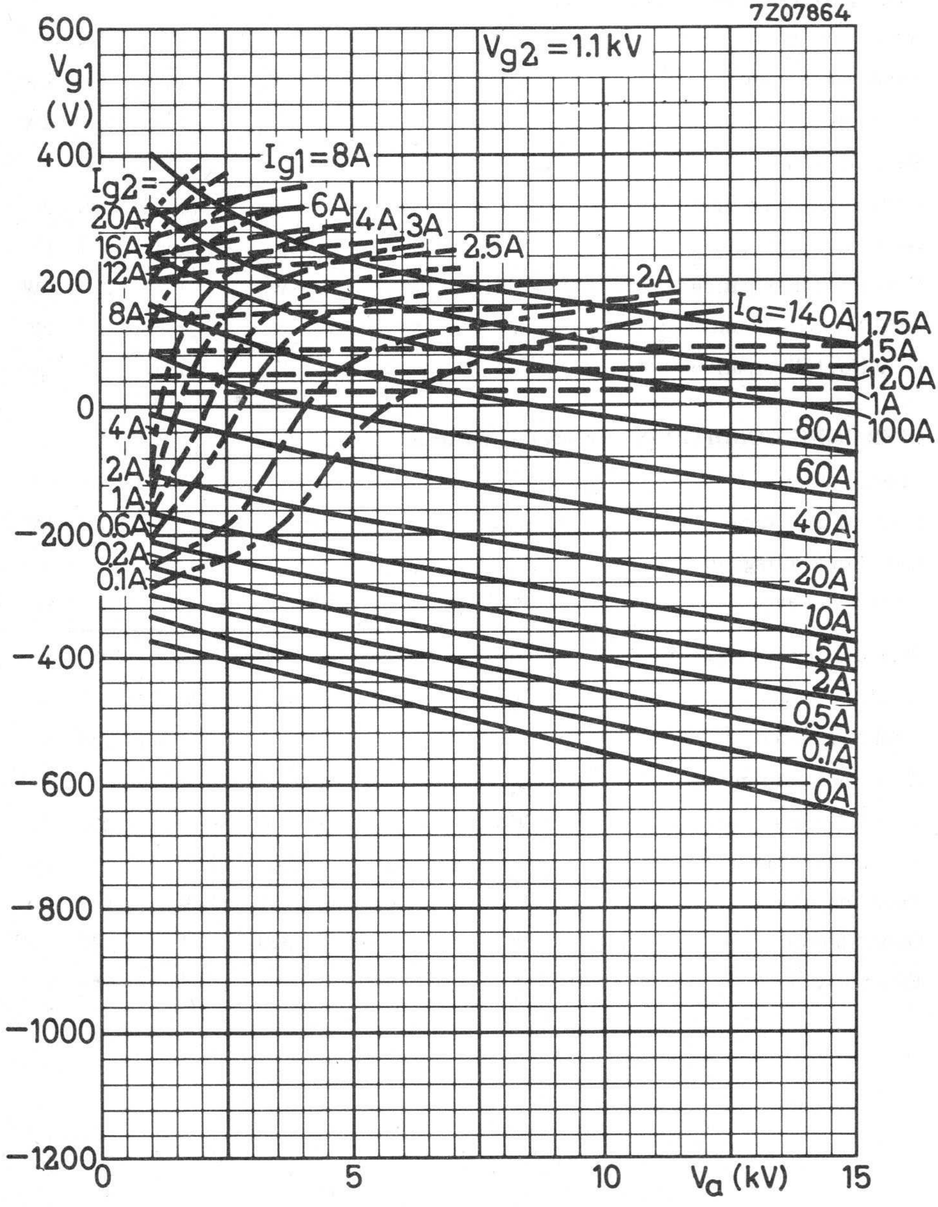
A.F. CLASS B AMPLIFIER AND MODULATOR

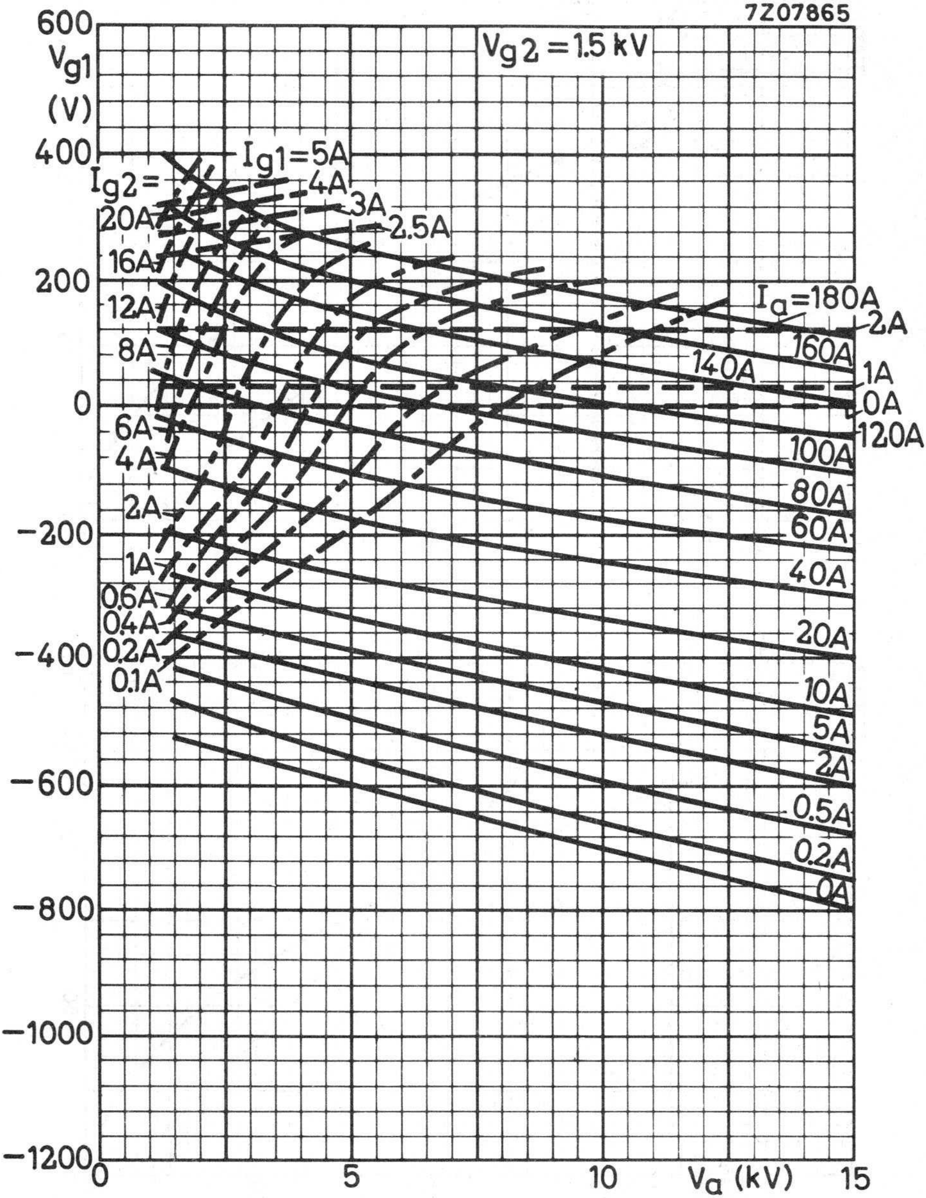
LIMITING VALUES (Absolute max. rating system)

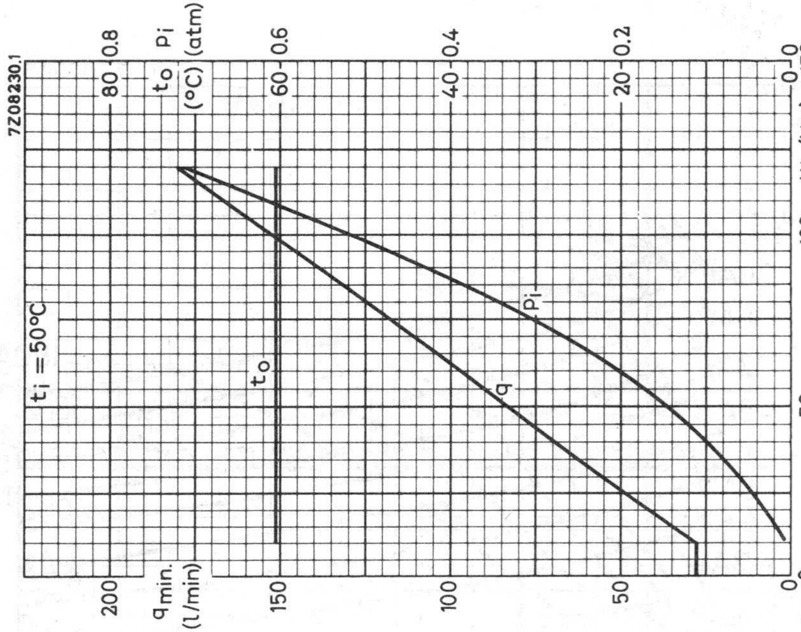
Anode voltage	V_a	max.	12	kV
Anode input power	W_{ia}	max.	300	kW
Anode dissipation	W_a	max.	120	kW
Cathode current	I_k	max.	50	A
Cathode current (peak)	I_{kp}	max.	280	A
Grid No. 2 voltage	V_{g2}	max.	1.7	kV
Grid No. 2 dissipation	W_{g2}	max.	2.7	kW
Grid No. 1 resistance	R_{g1}	max.	1	kΩ
Grid No. 1 dissipation	W_{g1}	max.	1.2	kW

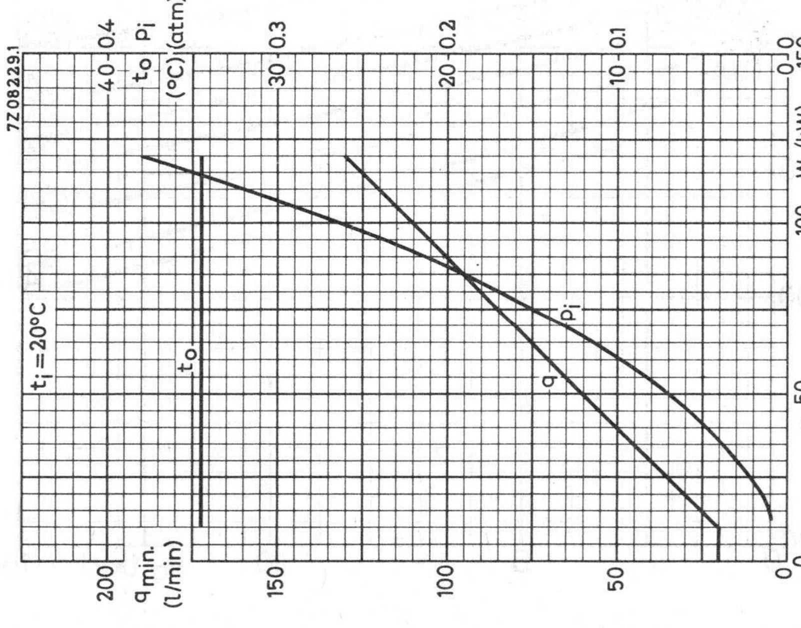
OPERATING CONDITIONS two tubes in push-pull

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		Ω
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	η		66		66	%


7Z07864
V_{g2} = 1.1 kV
600
V_{g1}
(V)
400
200
0
−200
−400
−600
−800
−1000
−1200
0
5
10
V_a (kV)
15
I_{g1}=8A
6A
4A
3A
2.5A
2A
I_{g2}=
20A
16A
12A
8A
4A
2A
1A
0.6A
0.2A
0.1A
I_a=140A
175A
1.5A
120A
1A
100A
80A
60A
40A
20A
10A
5A
2A
0.5A
0.1A
0A


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


7Z08230.1
$t_i = 50°C$
t_o
p_i
q
t_o (°C)
p_i (atm)
q min. (l/min)
W_a (kW)
0
50
100
150
200
0.2
0.4
0.6
0.8
20
40
60
80


7Z08229.1
$t_i = 20°C$
t_o
p_i
q
t_o (°C)
p_i (atm)
q min. (l/min)
W_a (kW)
0
50
100
150
200
0.1
0.2
0.3
0.4
10
20
30
40

VAPOUR COOLED R.F. POWER TETRODE

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

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

HEATING: Direct, filament thoriated tungsten

Filament voltage	V_f	21	V
Filament current	I_f	350	A

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

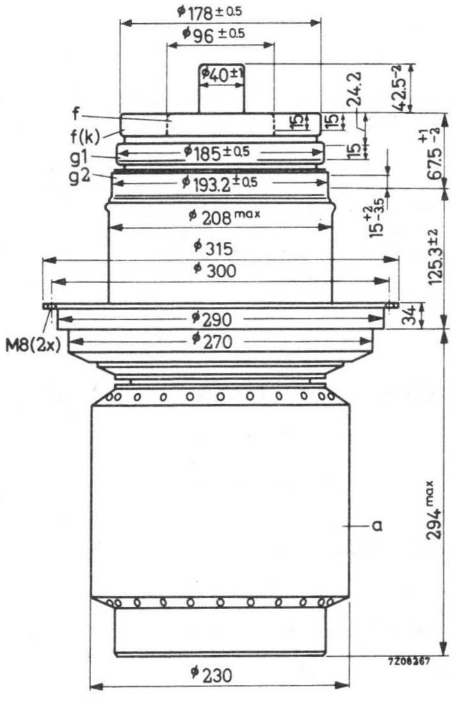
[1]) Measured with a flat shield of 500 mm diameter in the plane of grid No.2

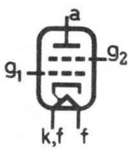
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 51 kg

Mounting position: vertical with anode down





ACCESSORIES

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

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

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

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

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

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

LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS

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

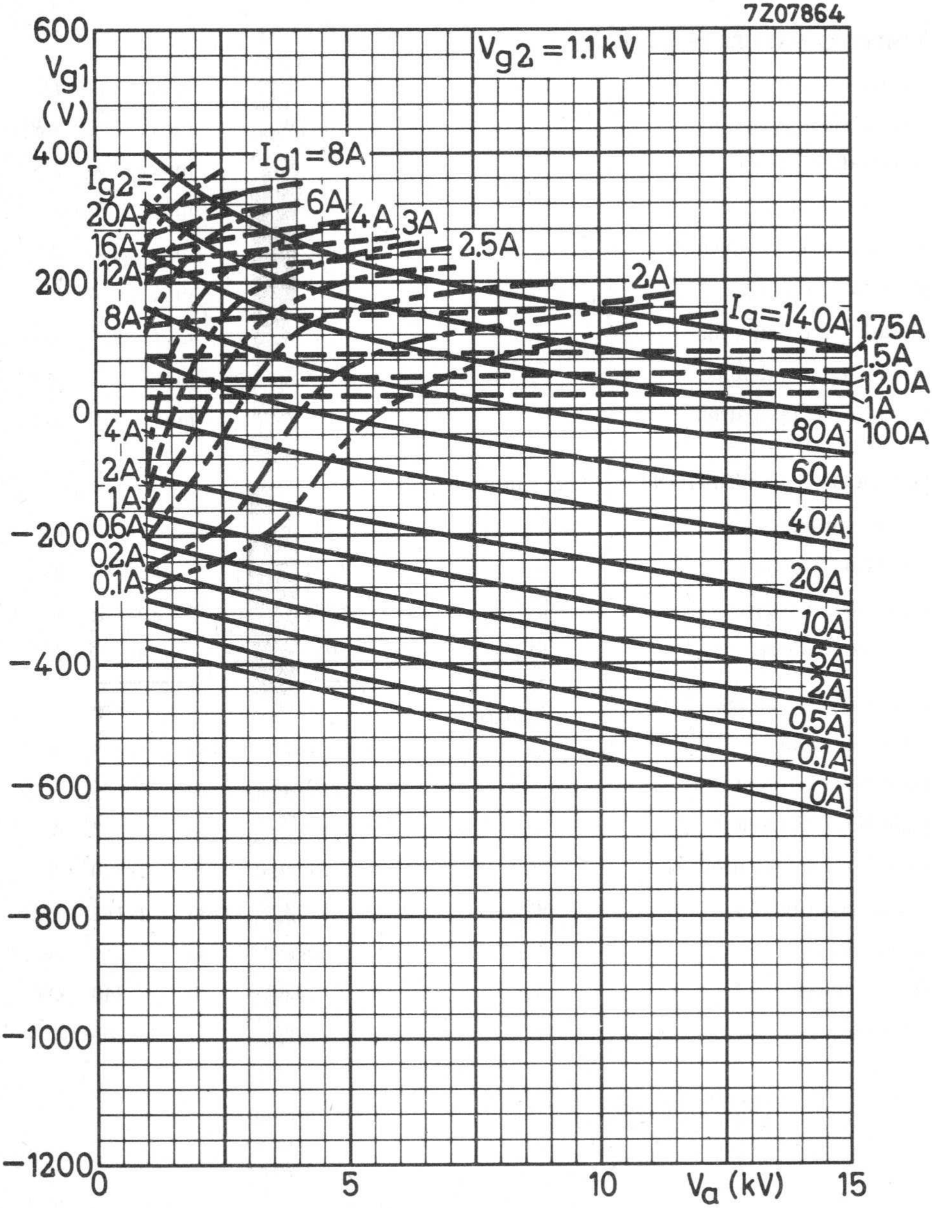
A.F. CLASS B AMPLIFIER AND MODULATOR

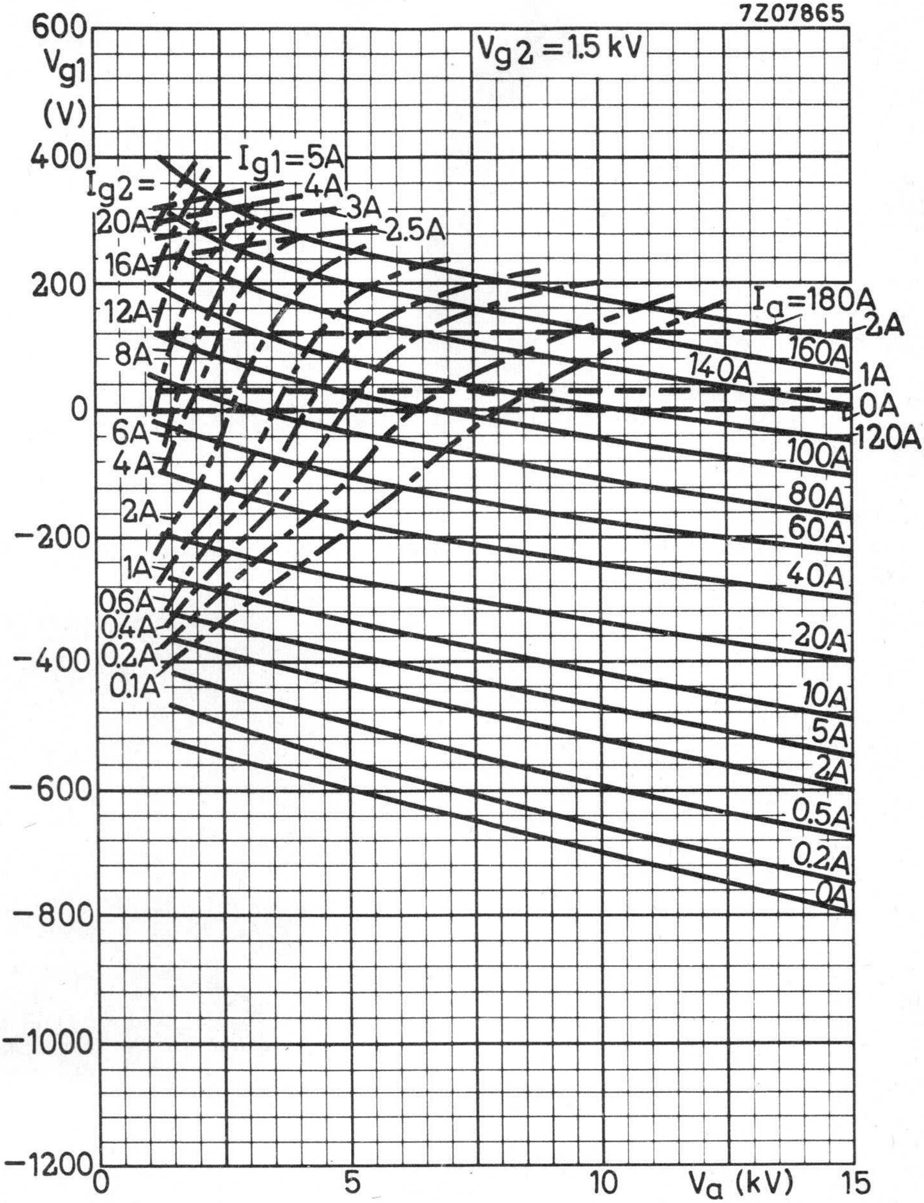
LIMITING VALUES (Absolute max. rating system)

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

OPERATING CONDITIONS; two tubes in push-pull

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


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


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

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_{ag_2} mod.		SSB	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)[1]
1200	900	40				
400	900	80	700	45		
60					850	40

COOLING

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_f	= 26.5	V
	Heater current	I_f	= 0.52	A
	Heating time	T_h	= min. 60	sec
YL1101 and YL1103	Heater voltage	V_f	= 6.3	V
	Heater current	I_f	= 2.1	A
	Heating time	T_h	= min. 60	sec

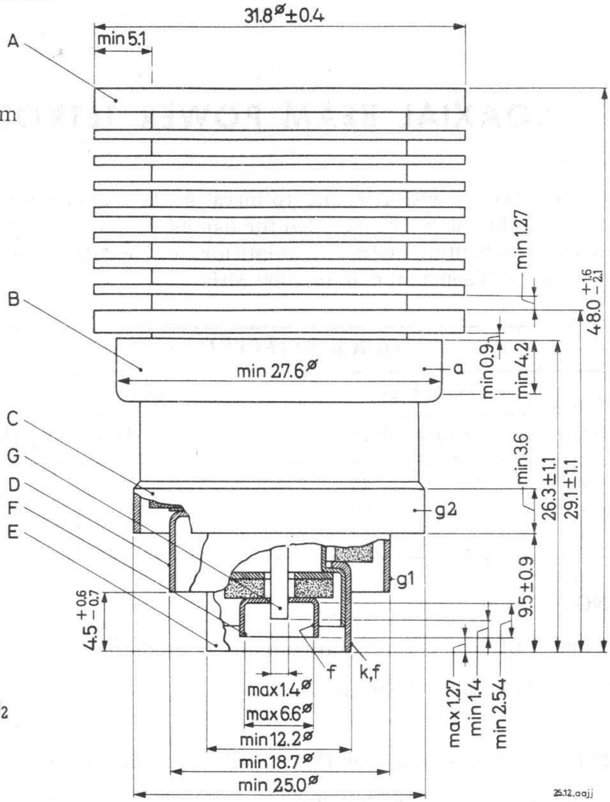
The heater voltage must be reduced dependent on the operating conditions and the frequency.

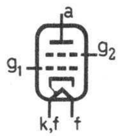
[1]) Single tone operation

MECHANICAL DATA

Dimensions in mm

YL1100
YL1101





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_2 terminal	:	C	inside	25.86 mm diameter
g_1 terminal	:	D	inside	19.38 mm diameter
Cathode terminal	:	E	inside	13.16 mm diameter
Heater terminal	:	F	outside	6.07 mm diameter
		G	inside	1.78 mm diameter

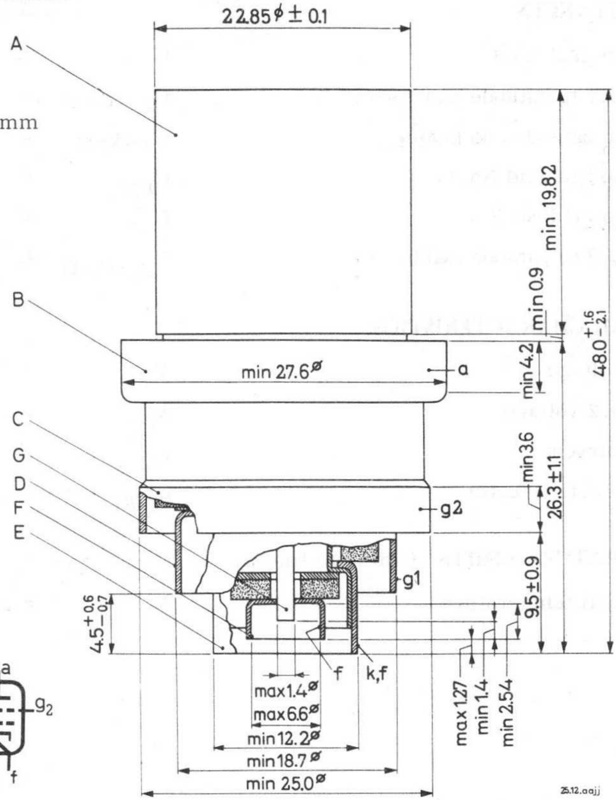
Mounting position : any

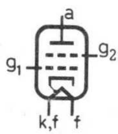
Net weight : 60 g

MECHANICAL DATA

Dimensions in mm

YL1102
YL1103





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_2 terminal	:	C	inside	25.86 mm diameter
g_1 terminal	:	D	inside	19.38 mm diameter
Cathode terminal	:	E	inside	13.16 mm diameter
Heater terminal	:	F	outside	6.07 mm diameter
	:	G	inside	1.78 mm diameter

Mounting position : any

Net weight : 60 g

CAPACITANCES

Anode to grid No.1	C_{ag_1}	<	0.065	pF
Grid No.1 to cathode and heater	$C_{g_1-(k+f)}$	=	14	pF
Anode to cathode and heater	$C_{a-(k+f)}$	<	0.015	pF
Grid No.2 to grid No.1	$C_{g_2g_1}$	=	19	pF
Anode to grid No.2	C_{ag_2}	=	4.4	pF
Grid No.2 to cathode and heater	$C_{g_2-(k+f)}$	<	0.4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1000	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	100	mA
Amplification factor	μ_{g2g1}	=	18	

TEMPERATURE LIMITS (Absolute limits)

Anode seal temperature	t	=	max. 250	^{o}C

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_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	4.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

OPERATING CONDITIONS (grid drive)

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

OPERATING CONDITIONS (cathode drive)

Frequency	f	=	1200	MHz
Anode voltage	V_a	=	900	V
Grid No.2 voltage	V_{g_2}	=	300	V
Grid No.1 voltage	V_{g_1}	=	−31	V
Anode current	I_a	=	170	mA
Grid No.2 current	I_{g_2}	=	3.2	mA
Grid No.1 current	I_{g_1}	=	3.4	mA
Driving power	W_{dr}	=	8	W
Output power in load	W_{load}	=	40	W [2])

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_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

OPERATING CONDITIONS

Frequency	f	=	400	MHz
Anode voltage	V_a	=	700	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-50	V
Anode current	I_a	=	130	mA
Grid No.2 current	I_{g_2}	=	10	mA
Grid No.1 current	I_{g_1}	=	10	mA
Driving power	W_{dr}	=	3	W
Output power in load	W_{load}	=	45	W

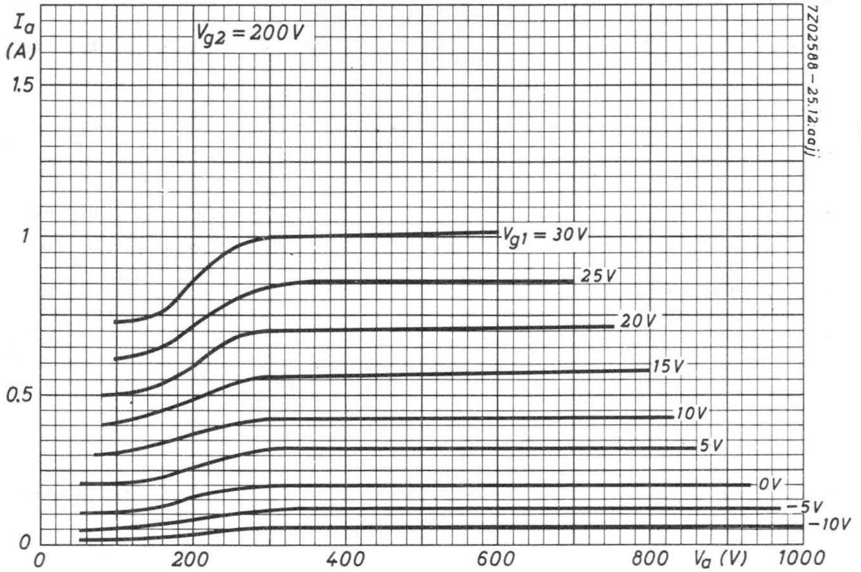
R. F. CLASS AB1 SINGLE SIDE BAND AMPLIFIER

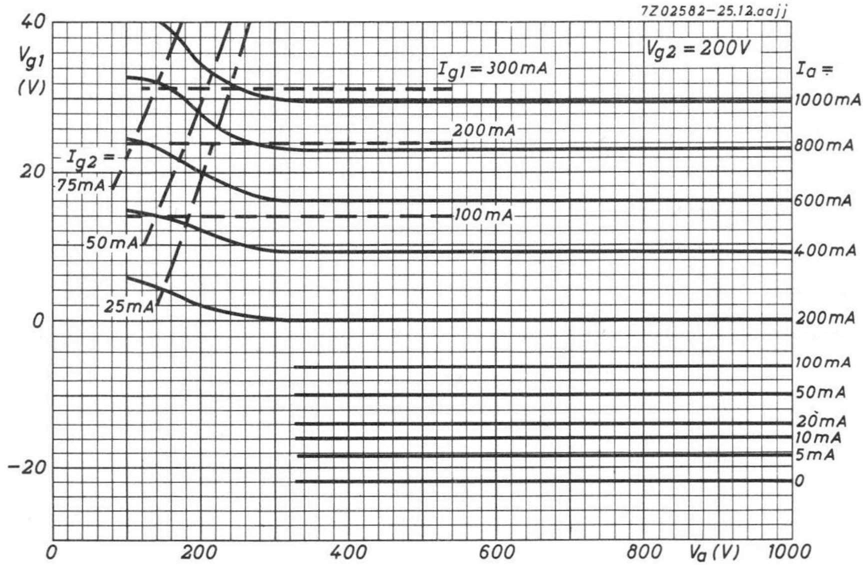
LIMITING VALUES (Absolute limits)

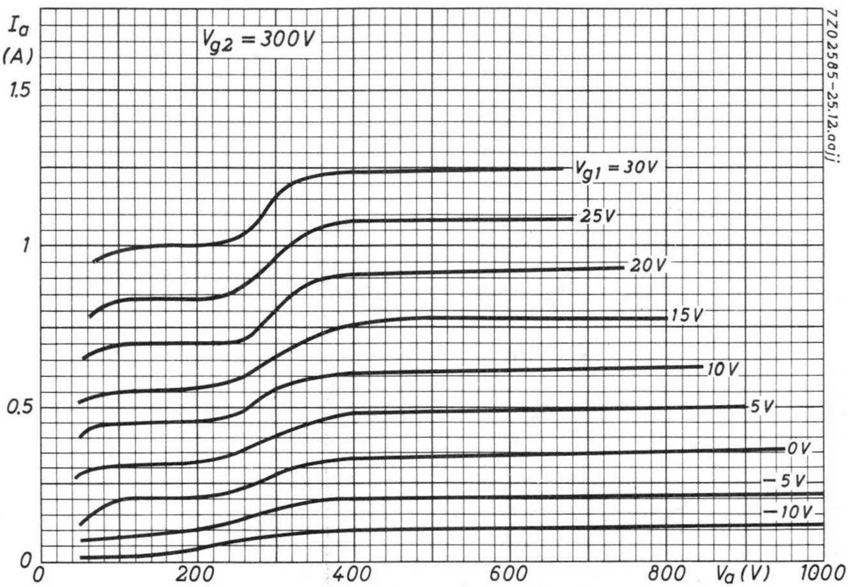
Frequency	f		up to	1200	MHz
Anode voltage	V_a	=	max.	1000	V
Anode input power	W_{ia}	=	max.	180	W
Anode dissipation	W_a	=	max.	115	W
Anode current	I_a	=	max.	180	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	4.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

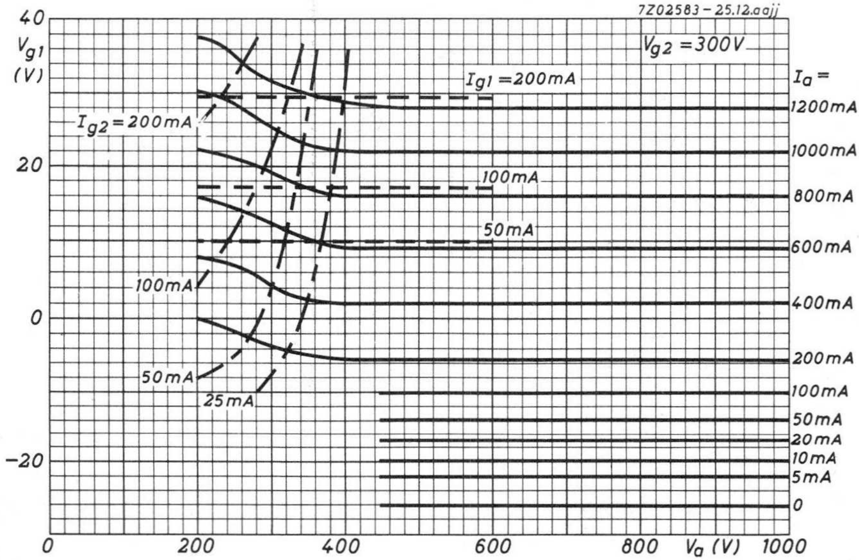
OPERATING CONDITIONS

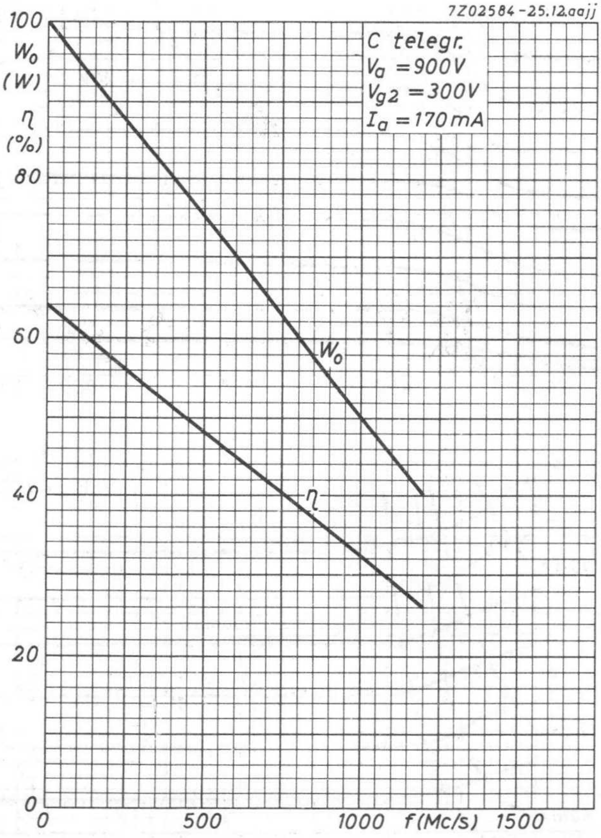
Frequency	f	=	60		60		MHz
Anode voltage	V_a	=	650		850		V
Grid No.2 voltage	V_{g_2}	=	300		300		V
Grid No.1 voltage	V_{g_1}	=	-15		-15		V
			zero signal	double tone	zero signal	double tone	
Peak driving voltage	$V_{g_{1p}}$	=	0	15	0	15	V
Anode current	I_a	=	40	100	40	100	mA
Grid No.2 current	I_{g_2}	=	0	10	0	10	mA
Grid No.1 current	I_{g_1}	=	0	0	0	0	mA
Driving power	W_{dr}	=	0	0	0	0	W
Peak envelope output power	$W_{o_{PEP}}$	=	0	25	0	40	W

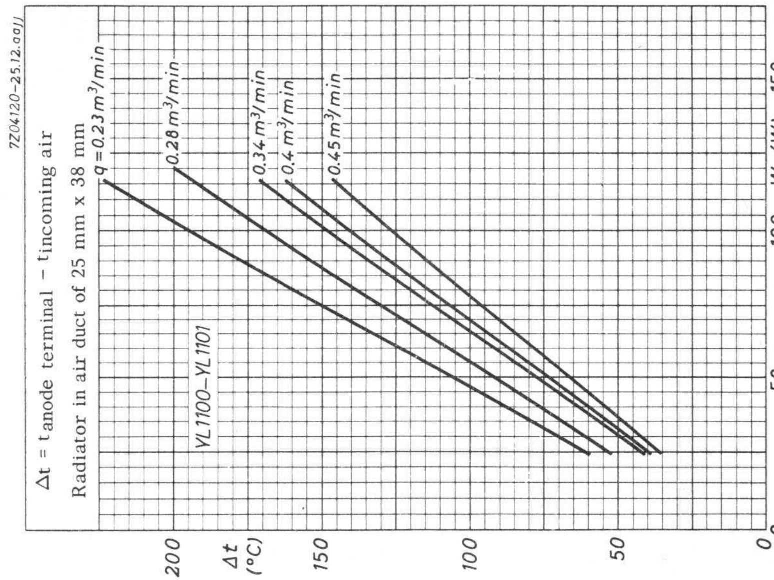

7Z02588 – 25.12.aajj
I_a (A)
$V_{g2} = 200\,V$
$V_{g1} = 30\,V$
25 V
20 V
15 V
10 V
5 V
0 V
−5 V
−10 V
0
0.5
1
1.5
0
200
400
600
800
V_a (V)
1000

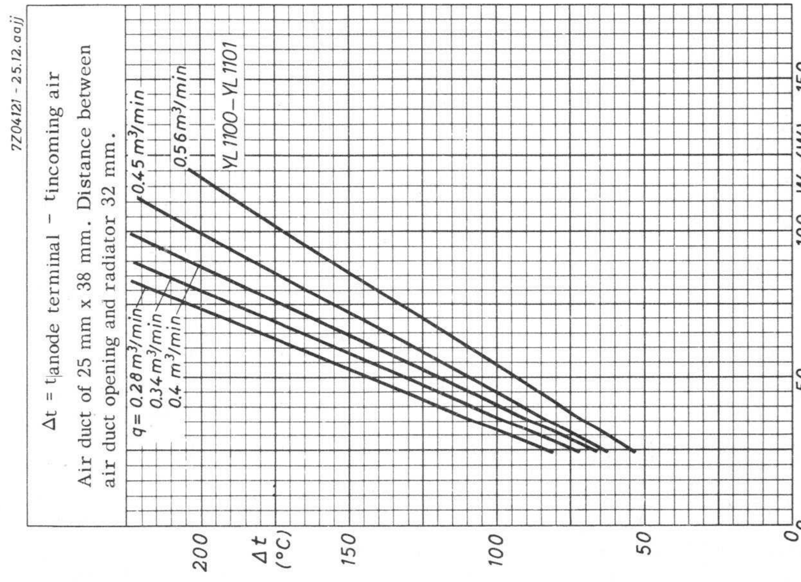

7Z02582–25.12.aajj
V_{g1} (V)
$V_{g2} = 200\,V$
$I_{g1} = 300\,mA$
200 mA
100 mA
$I_{g2} =$
75 mA
50 mA
25 mA
$I_a =$
1000 mA
800 mA
600 mA
400 mA
200 mA
100 mA
50 mA
20 mA
10 mA
5 mA
0
40
20
0
−20
0
200
400
600
800
V_a (V)
1000


7Z02585-25.12.aajj
I_a (A)
$V_{g2}=300V$
$V_{g1}=30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
1.5
1
0.5
0
0
200
400
600
800
V_a (V)
1000


7Z02583-25.12.aajj
V_{g1} (V)
$V_{g2}=300V$
$I_{g1}=200mA$
$I_{g2}=200mA$
100mA
50mA
100mA
50mA
25mA
$I_a=$
1200mA
1000mA
800mA
600mA
400mA
200mA
100mA
50mA
20mA
10mA
5mA
0
40
20
0
−20
0
200
400
600
800
V_a (V)
1000


7Z02584-25.12.aajj
100
W_o
(W)
η
(%)
80
60
40
20
0
0
500
1000
f(Mc/s)
1500
C telegr.
V_a = 900V
V_{g2} = 300V
I_a = 170 mA
W_o
η


7Z04120-25.12.aajj
Δt = t anode terminal − t incoming air
Radiator in air duct of 25 mm x 38 mm
q = 0.23 m³/min
0.28 m³/min
0.34 m³/min
0.4 m³/min
0.45 m³/min
YL1100–YL1101
Δt (°C)
200
150
100
50
0
0
50
100
150
Wa (W)


7Z04121 - 25.12.aajj
Δt = t anode terminal − t incoming air
Air duct of 25 mm x 38 mm. Distance between air duct opening and radiator 32 mm.
q = 0.28 m³/min
0.34 m³/min
0.4 m³/min
0.45 m³/min
0.56 m³/min
YL1100–YL1101
Δt (°C)
200
150
100
50
0
0
50
100
150
Wa (W)

AIR COOLED
COAXIAL BEAM POWER TETRODE

Forced air cooled beam power tetrode with integral radiator and coaxial, ceramic insulated terminals. Intended for use as UHF amplifier or oscillator at frequencies up to 1215 MHz.

QUICK REFERENCE DATA

Frequency (MHz)	Anode voltage V_a (V)	RF class C telegraphy W_{load} (W)	RF class A linear ampl. W_{load} (W)	RF class B SSB $W_{o\ PEP}$ (W)	RF class C ag_2 mod. W_{load} (W)
790	2500	590			
	1400		55		
470	2500	730			
400	2000				600
30	2500			680	

HEATING: indirect by A.C. or D.C.; cathode oxide coated, matrix type

Heater voltage	V_f	=	6.3	V ±10%
Heater current	I_f	=	7.85	A
Heating time	T_h	= min.	120	sec

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

CAPACITANCES

Anode to grid No.1	C_{ag_1}	<	0.11	pF
Grid No.1 to cathode and heater	$C_{g_1/kf}$	=	29	pF
Anode to cathode and heater	$C_{a/kf}$	<	0.011	pF
Grid No.1 to grid No.2	$C_{g_1g_2}$	=	37	pF
Grid No.2 to cathode and heater	$C_{g_2/kf}$	<	1.1	pF

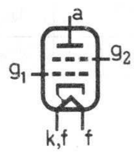
TYPICAL CHARACTERISTICS

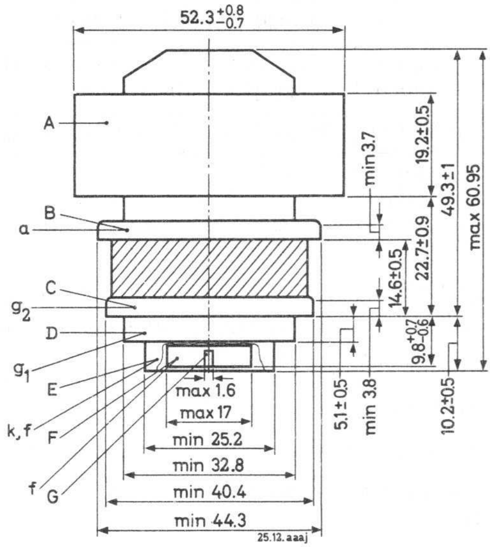
Anode voltage	V_a	=	225	2500	V
Grid No.2 voltage	V_{g_2}	=	225	400	V
Anode current	I_a	=	100	240	mA
Amplification factor	$\mu_{g_2g_1}$	=	13	-	
Mutual conductance	S	=	-	22	mA/V

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	W
Min. required air flow	q_{min}	=	0.06	0.12	0.32	0.46	m^3/min
Pressure loss	p_i	=	2	4	17	25	mm H_2O

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

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2500	V
Anode input power	W_{i_a}	=	max.	1250	W
Anode dissipation	W_a	=	max.	700	W
Anode current	I_a	=	max.	500	mA
Grid No.2 voltage	V_{g_2}	=	max.	1200	V
Grid No.2 dissipation	W_{g_2}	=	max.	25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	15	kΩ

OPERATING CONDITIONS in grounded grid circuit

Frequency	f	=	790	470	MHz
Anode voltage	V_a	=	2500	2500	V
Grid No.2 voltage	V_{g_2}	=	400	400	V
Grid No.1 voltage	V_{g_1}	=	-45	-35	V
Anode current	I_a	=	500	500	mA
Grid No.2 current	I_{g_2}	=	7	8	mA
Grid No.1 current	I_{g_1}	=	10	12	mA
Driving power	W_{dr}	=	60	35	W
Output power in load	W_{load}	=	590	730	W

R.F. CLASS A LINEAR AMPLIFIER, T.V. TRANSLATOR SERVICE, SOUND AND VISION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 1215	MHz
Anode voltage	V_a	=	max. 2500	V
Anode input power	W_{ia}	=	max. 1250	W
Anode dissipation	W_a	=	max. 600	W
Anode current	I_a	=	max. 500	mA
Grid No.2 voltage	V_{g_2}	=	max. 1200	V
Grid No.2 dissipation	W_{g_2}	=	max. 25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 current	I_{g_1}	=	max. 100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 15	kΩ

OPERATING CONDITIONS

Frequency	f	=	790	MHz
Bandwidth	B	>	6.5	MHz
Anode voltage	V_a	=	1400	V
Grid No.2 voltage	V_{g_2}	=	400	V
Grid No.1 voltage	V_{g_1}	=	-30	V
Anode current	I_a	=	400	mA
Grid No.2 current	I_{g_2}	=	-10	mA
Driving power	W_{dr}	=	5	W
Output power in load	W_{load}	=	55	W

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2500	V
Anode input power	W_{ia}	=	max.	1250	W
Anode dissipation	W_a	=	max.	600	W
Anode current	I_a	=	max.	500	mA
Grid No.2 voltage	V_{g_2}	=	max.	1200	V
Grid No.2 dissipation	W_{g_2}	=	max.	25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	15	kΩ

OPERATING CONDITIONS

Frequency	f	=	30		MHz
Anode voltage	V_a	=	2500		V
Grid No.2 voltage	V_{g_2}	=	450		V
Grid No.1 voltage	V_{g_1}	=	-37		V
			zero signal	double tone signal	
Anode current	I_a	=	160	350	mA
Grid No.2 current	I_{g_2}	=	0	2.5	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Driving power	W_{dr}	=	0	1	W
Peak envelope power output	W_{oPEP}	=	–	680	W
Intermodulation distortion:					
of the third order	d_{i_3}	=	–	-31	dB
of the fifth order	d_{i_5}	=	–	-36	dB

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

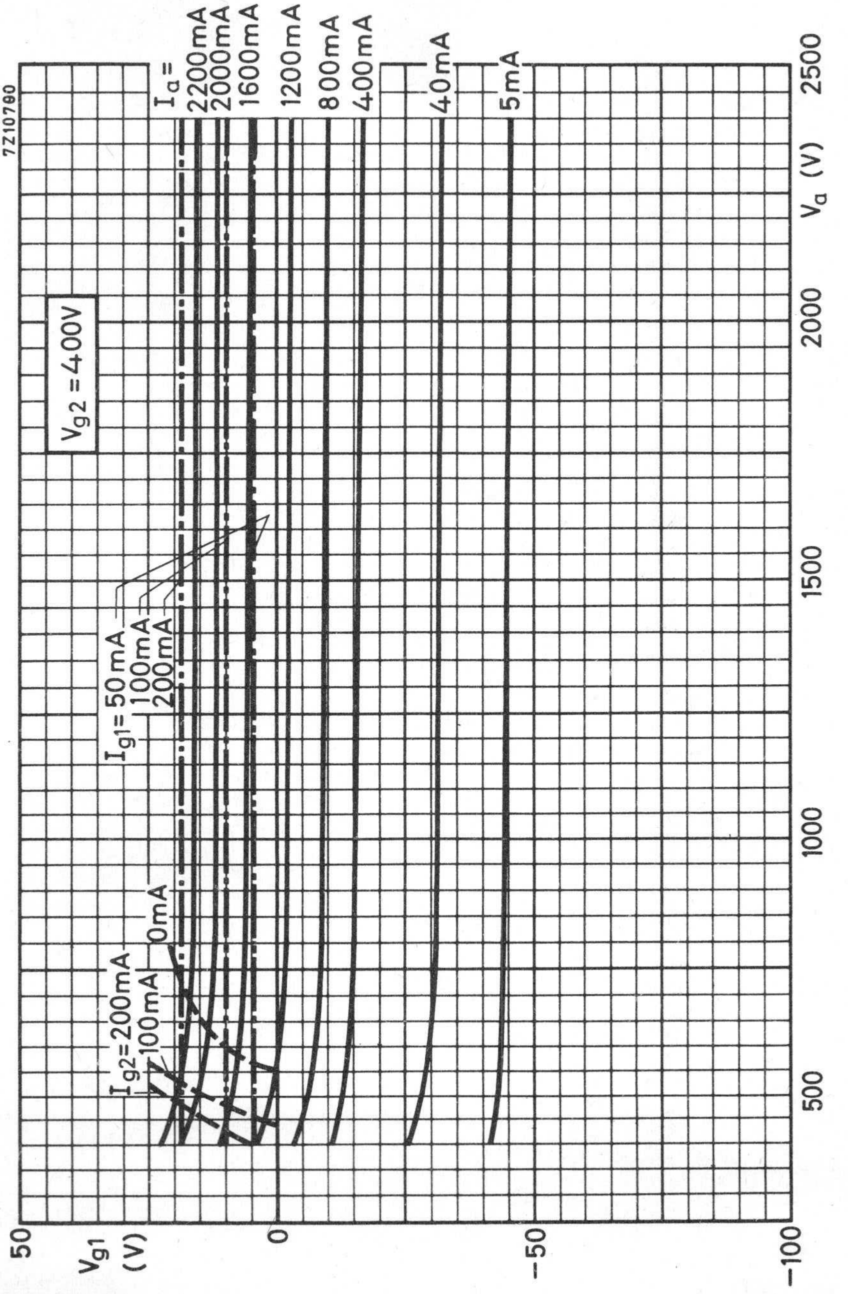
Frequency	f		up to 1215	MHz
Anode voltage	V_a	=	max. 2000	V
Anode input power	W_{ia}	=	max. 1000	W
Anode dissipation	W_a	=	max. 400	W
Anode current	I_a	=	max. 500	mA
Grid No.2 voltage	V_{g_2}	=	max. 1200	V
Grid No.2 dissipation	W_{g_2}	=	max. 17	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 current	I_{g_1}	=	max. 100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 15	kΩ

OPERATING CONDITIONS (cathode drive)

Frequency	f	=	400	MHz
Anode voltage	V_a	=	2000	V
Grid No.2 voltage	V_{g_2}	=	400	V [1]
Grid No.1 voltage	V_{g_1}	=	-35	V [2]
Anode current	I_a	=	500	mA
Grid No.2 current	I_{g_2}	=	8	mA
Grid No.1 current	I_{g_1}	=	12	mA
Driving power	W_{dr}	=	35	W
Output power in load	W_{load}	=	600	W

[1]) Obtained preferably from a separate source, modulated along with the anode supply.

[2]) Obtained from the grid resistor or from a combination of the grid resistor and either a fixed supply or a cathode resistor.


7Z10780
Vg2 = 400V
Ia =
2200mA
2000mA
1600mA
1200mA
800mA
400mA
40mA
5mA
Ig1 = 50mA
100mA
200mA
Ig2 = 200mA
100mA
0mA
Vg1 (V)
50
0
−50
−100
Va (V)
500
1000
1500
2000
2500

AIR COOLED
COAXIAL R.F. POWER TETRODE

QUICK REFERENCE DATA		
Freq. (MHz)	Class AB1 linear SSB amplifier	
	V_a (V)	W_ℓ [1] (kW, PEP)
13	5000	5.1
28	5000	5.1

HEATING: indirect. Cathode oxide-coated

Heater voltage	V_f	=	12.6	V ±10 %
Heater current	I_f	=	14.5	A
Heating time	T_w	= min.	10	min.

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	115	pF
Anode to all other elements except grid No.1	C_a	=	41	pF
Anode to grid No.1	C_{ag_1}	=	0.2	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	5	1	kV
Grid No.2 voltage	V_{g_2}	=	700	700	V
Anode current	I_a	=	0.7	6	A
Amplification factor	$\mu_{g_2g_1}$	=	3.5	–	
Mutual conductance	S	=	–	45	mA/V

[1]) Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	= max. 200 ^{o}C
Air inlet temperature	= max. 45 ^{o}C

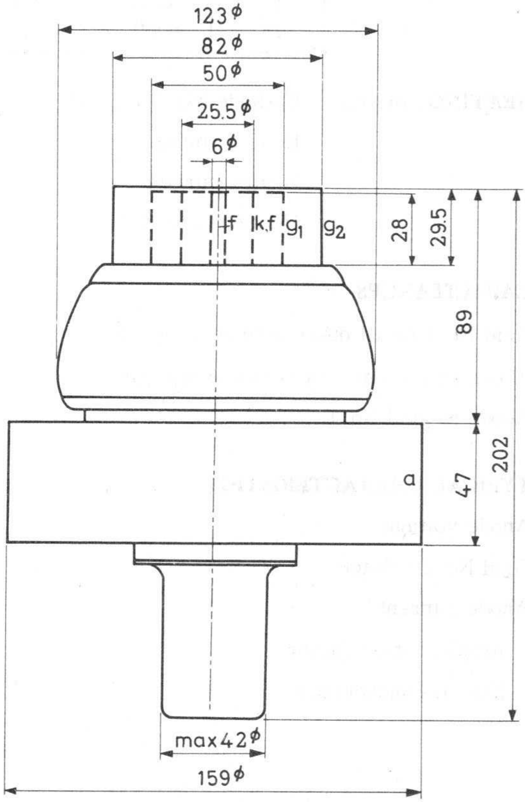
AIR COOLING CHARACTERISTICS

	W_a (kW)	q_{min} (m^3/min)	p_i (mm H_2O)
Anode radiator	4	6	20
Socket		0.5	20

MECHANICAL DATA

Dimensions in mm

Socket	40682
Air duct	40683
or	
Insulating pedestal	40654
Net weight of tube	4.5 kg



Mounting position: vertical with anode up or down

CLASS AB LINEAR S. S. B. AMPLIFIER, suppressed carrier service

LIMITING VALUES (Absolute limits)

Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	5.5	kV
Anode current	I_a	= max.	2	A
Anode input power	W_{i_a}	= max.	10	kW
Anode dissipation	W_a	= max.	4	kW
Grid No.2 voltage	V_{g_2}	= max.	1	kV
Grid No.2 dissipation	W_{g_2}	= max.	150	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 current	I_{g_1}	= max.	25	mA

OPERATING CHARACTERISTICS

Frequency	f	=		13		MHz
Anode voltage	V_a	=		5		kV
Grid No.2 voltage	V_{g_2}	=		700		V
Grid No.1 voltage	V_{g_1}	=		-150		V [1]
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	150	150	V
Anode current	I_a	=	0.7	1.8	1.26	A
Grid No.2 current	I_{g_2}	=	-10 to +10	120	40	mA
Grid No.1 current	I_{g_1}	=	0	-1	-0.3	mA
Anode input power	W_{i_a}	=	3.5	9	6.3	kW
Anode dissipation	W_a	=	3.5	2.85	3.2	kW
Output power in the load (PEP)	W_ℓ	=	-	5.1	5.1	kW
Total efficiency	η	=	-	57	45	%
3rd order intermodulation distortion	d_3	=	-	-	<-35	dB [2]
5th order intermodulation distortion	d_5	=	-	-	<-40	dB [2]

[1][2] See page 4

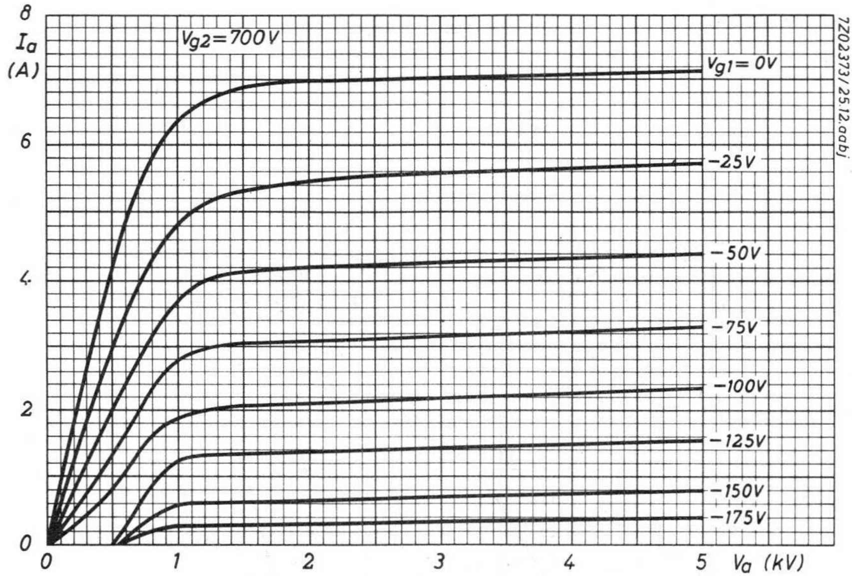
CLASS AB LINEAR S. S. B. AMPLIFIER, suppressed carrier service

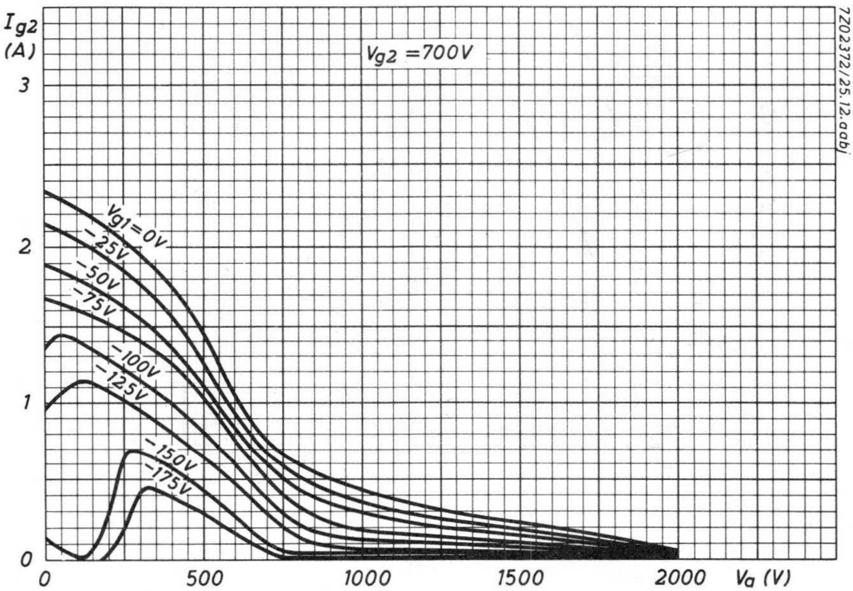
OPERATING CHARACTERISTICS (continued)

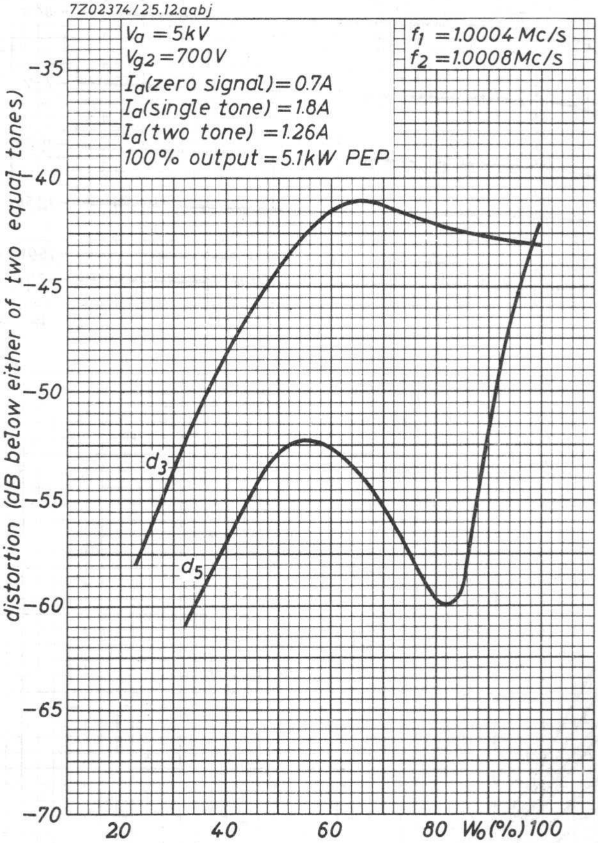
Frequency	f	=		28		MHz
Anode voltage	V_a	=		5		kV
Grid No.2 voltage	V_{g_2}	=		700		V
Grid No.1 voltage	V_{g_1}	=		-150		V [1]
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	150	150	V
Anode current	I_a	=	0.7	1.8	1.26	A
Grid No.2 current	I_{g_2}	=	-10 to +10	120	40	mA
Grid No.1 current	I_{g_1}	=	0	-4	-1	mA
Anode input power	W_{i_a}	=	3.5	9	6.3	kW
Anode dissipation	W_a	=	3.5	2.85	3.2	kW
Output power in the load (PEP)	W_ℓ	=	-	5.1	5.1	kW
Total efficiency	η	=	-	57	45	%
3rd order intermodulation distortion	d_3	=	-	-	<-35	dB [2]
5th order intermodulation distortion	d_5	=	-	-	<-40	dB [2]

[1]) To be adjusted for zero signal anode current.

[2]) Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two equal tones at that level.
Relative to the peak envelope power these figures will be increased by 6 dB.
Considerably better distortion figures can be achieved with I_a at zero signal = 0.8 A at the cost of higher zero signal anode dissipation. Efficiency for full drive is hardly deteriorated by this higher value of zero signal anode current.


8
I_a
(A)
6
4
2
0
$V_{g2}=700V$
$V_{g1}=0V$
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
1
2
3
4
5
V_a (kV)
7Z02373/25.12.aab)


I_{g2}
(A)
3
2
1
0
$V_{g2}=700V$
$V_{g1}=0V$
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
500
1000
1500
2000
V_a (V)
7Z02372/25.12.aab)


7Z02374/25.12.aabj
$V_a = 5kV$
$V_{g2} = 700V$
I_a(zero signal) = 0.7A
I_a(single tone) = 1.8A
I_a(two tone) = 1.26A
100% output = 5.1kW PEP
f_1 = 1.0004 Mc/s
f_2 = 1.0008 Mc/s
distortion (dB below either of two equal tones)
-35
-40
-45
-50
-55
-60
-65
-70
d_3
d_5
20
40
60
80
W_o(%)
100

AIR COOLED R.F. POWER TETRODE

Forced air cooled coaxial tetrode intended for use as linear amplifier for single side band, suppressed carrier service.

QUICK REFERENCE DATA				
Frequency (MHz)	Class AB1 SSB		Class B anode mod.	
	V_a (kV)	W_o PEP (kW)	V_a (kV)	W_o (kW)
1	5.0	5.7	5.0	5.1
30	5.0	5.0		

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

Heater voltage	V_f	=		12.6	V
Heater current	I_f	=		14.5	A
Waiting time	T_w	=	min.	10	min.

CAPACITANCES

Anode to all except grid No.1	C_a	=	33	pF
Grid No.1 to all except anode	C_{g_1}	=	156	pF
Anode to grid No.1	C_{ag_1}	=	0.16	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1	5	kV
Grid No.2 voltage	V_{g_2}	=	650	650	V
Anode current	I_a	=	6	0.7	A
Amplification factor	$\mu_{g_2g_1}$	=		3	
Mutual conductance	S	=	45		mA/V

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t	=	max.	200	^oC
Air inlet temperature	t_i	=	max.	45	^oC

COOLING DATA

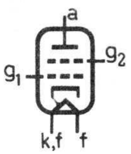
W_a (kW)	h (m)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)
4.0	0	45	5	23

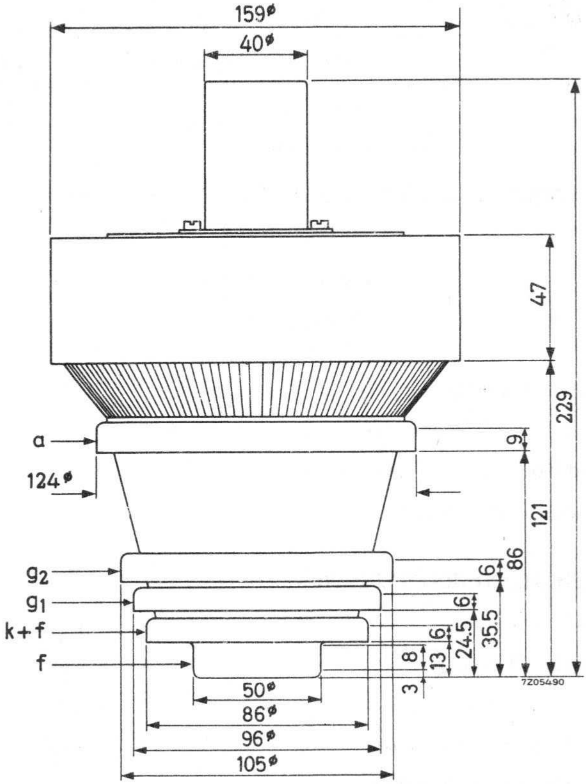
Required air flow on socket q = min. 0.55 m^3/min
at a pressure loss p_i = 16 mm H_2O

MECHANICAL DATA

Net weight : 5.8 kg

Dimensions in mm





ACCESSORIES

Socket	40699
Chimney	40683

Mounting position : vertical with anode up or down

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to 30	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{ia}	=	max. 9.5	kW
Anode dissipation	W_a	=	max. 4	kW
Anode current	I_a	=	max. 2	A
Grid No.2 voltage	V_{g_2}	=	max. 1	kV
Grid No.2 dissipation	W_{g_2}	=	max. 140	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

Frequency	f	=		1		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		−185		V [1]
			zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160 [2]	160 [2]	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	−10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Anode input power	W_{ia}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.25	3.5	kW
Output power in load	W_ℓ	=	0	5.7	–	kW [3]
PEP output power in load	W_ℓ	=	0	–	5.7	kW [3]
Total efficiency	η	=	–	61.5	43.5	%
Intermodulation distortion						
of the 3rd order	d_3	=	–	–	−40	dB [4]
of the 5th order	d_5	=	–	–	−40	dB [4]

[1][2][3][4] See page 4.

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

OPERATING CONDITIONS (continued)

Frequency	f	=		30		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		-185		V 1)
			zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160 2)	160 2)	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	-10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	< 5	< 5	mA
Anode input power	W_{i_a}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.35	3.55	kW
Output power in load	W_ℓ	=	0	5.0	-	kW 5)
PEP output power in load	W_ℓ	=	0	-	5.0	kW 5)
Total efficiency	η	=	-	54	38	%
Intermodulation distortion						
of the 3rd order	d_3	=	-	-	-38	dB 4)
of the 5th order	d_5	=	-	-	-40	dB 4)

1) To be adjusted for zero signal anode current of 0.7 A; characteristic range values 150 to 215 V.

2) Maximum 175 V.

3) Measured in a circuit having an efficiency of 95%.

4) Maximum values encountered at any level of drive voltage 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

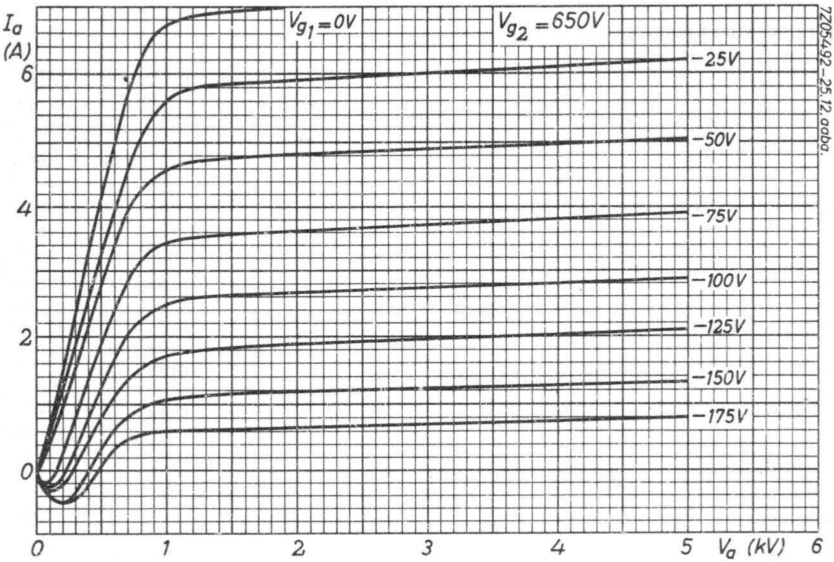
LIMITING VALUES (Absolute limits)

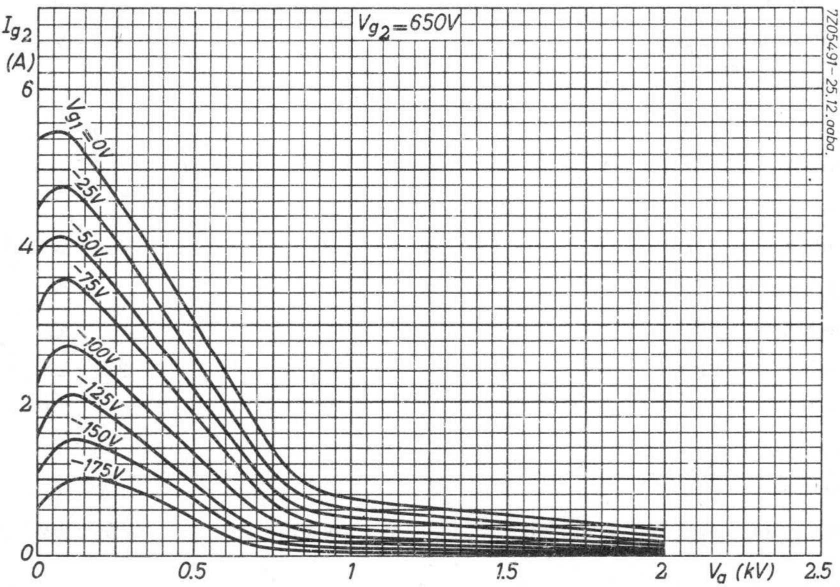
Frequency	f		up to 60	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{i_a}	=	max. 7.5	kW
Anode dissipation	W_a	=	max. 2.6	kW
Anode current	I_a	=	max. 1.6	A
Grid No.2 voltage	V_{g_2}	=	max. 800	V
Grid No.2 dissipation	W_{g2}	=	max. 140	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

Frequency	f	=	1	MHz
Anode voltage	V_a	=	5.0	kV
Grid No.2 voltage	V_{g2}	=	600	V
Grid No.1 voltage	V_{g_1}	=	-230	V
Peak grid No.1 driving voltage	$V_{g_{1p}}$	=	230	V
Anode current	I_a	=	1.46	A
Grid No.2 current	I_{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_ℓ	=	4.6	kW [1]
Tube efficiency	η	=	70	%
Modulation depth	m	=	100	%
Modulation power	W_{mod}	=	3.65	kW

[1]) Measured in a circuit having an efficiency of 90 %.


I_a
(A)
6
4
2
0
$V_{g_1}=0V$
$V_{g_2}=650V$
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
1
2
3
4
5
V_a (kV)
6
7Z05492-25.12.aaba.


I_{g2}
(A)
6
4
2
0
$V_{g_2}=650V$
$V_{g_1}=0V$
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
0.5
1
1.5
2
V_a (kV)
2.5
7Z05491-25.12.aaba.

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating radiation and convection cooled double tetrode for use as R.F. amplifier and frequency multiplier up to 500 MHz, designed for intermittent filament operation in transistorised mobile transmitters.

QUICK REFERENCE DATA						
Freq. (MHz)	Class C telegraphy			Class C frequency multiplier		
	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)
200	275	0.7	12.5			
500	175	1.5	6.0			
167/500				175	1.5	2.0

HEATING: direct by A.C. or D.C.; series or parallel supply
Filament oxide coated

Filament voltage	V_f	=	1.1	V ±15%
Filament current	I_f	=	2.9	A
Heating time for W_o = 70% of full output power	T_h	<	0.5	sec

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

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

CAPACITANCES, two systems in push-pull connection

Input capacitance	C_i	=	4.1	pF
Output capacitance	C_o	=	1.2	pF

The tube is internally neutralised for frequencies up to 500 MHz

1) Driver output power

2) Useful power in the load

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	175	V
Grid No.2 voltage	V_{g_2}	=	175	V
Anode current	I_a	=	40	mA
Amplification factor	$\mu_{g_2g_1}$	=	22	
Mutual conductance	S	=	7	mA/V

COOLING: Radiation and convection

The use of a closed tube shield is not recommended

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 230 °C

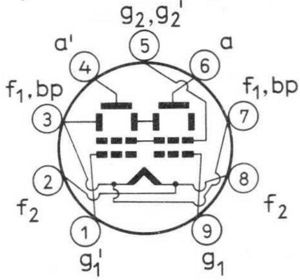
MECHANICAL DATA

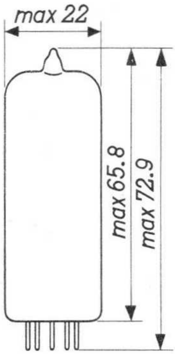
Dimensions in mm

Base : Noval

Socket : 2422 502 01004 [1])

Net weight: 16 g





Mounting position: any

If the tube is mounted with its main axis horizontally, it is recommended that the pins 3 and 7 be in a horizontal plane.

The filament connections (tags 3-7 and 2-8) should be connected in parallel on the socket.

[1]) Or equivalent type suitable for the high filament current

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY; two systems in push-pull

LIMITING VALUES (Absolute limits)

Frequency	f		up to	200	500	MHz
Anode voltage	V_a	=	max.	300	200	V
Anode current	I_a	=	max.	2x50	2x50	mA
Anode input power	W_{i_a}	=	max.	30	20	W
Anode dissipation	W_a	=	max.	2x4	2x4	W
Grid No.2 voltage	V_{g_2}	=	max.	200	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	3	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	150	V
Grid No.1 current	I_{g_1}	=	max.	2x5	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	100	kΩ

OPERATING CONDITIONS

Frequency	f	=	200	500	MHz
Anode voltage	V_a	=	275	175	V
Grid No.2 supply voltage	V_{bg_2}	=	275	175	V
Grid No.2 series resistor	R_{g_2}	=	6.8	0.1	kΩ
Grid No.1 voltage	V_{g_1}	=	-20	-22	V
Grid No.1 resistor	R_{g_1}	=	3.9 [1]	9.4 [2]	kΩ
Driving voltage	$V_{g_1g_1'p}$	=	65	65	V
Anode current	I_a	=	2x42.5	2x40	mA
Grid No.2 current	I_{g_2}	=	14	12	mA
Grid No.1 current	I_{g_1}	=	2x2.6	2x2.3	mA
Grid No.2 dissipation	W_{g_2}	=	2.5	2.1	W
Driver output power	W_{dr}	=	0.7	1.5	W
Anode input power	W_{i_a}	=	23.4	14	W
Anode dissipation	W_a	=	2x3.5	2x3	W
Output power	W_o	=	16	8	W
Efficiency	η	=	68	57	%
Output power in the load	W_ℓ	=	13	6.5	W [3]

[1] Common for both units.

[2] It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[3] For optimum conditions R_{g_1} should be adjusted to obtain the desired anode current.

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

LIMITING VALUES (Absolute limits)

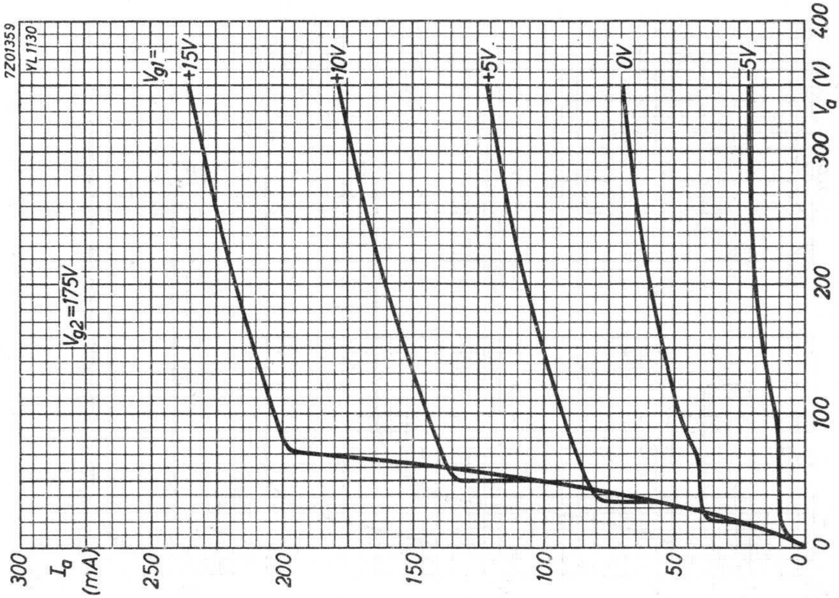
Frequency	f		up to	500	MHz
Anode voltage	V_a	=	max.	200	V
Anode current	I_a	=	max.	2x35	mA
Anode input power	W_{i_a}	=	max.	12	W
Anode dissipation	W_a	=	max.	2x4	W
Grid No.2 voltage	V_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 current	I_{g_1}	=	max.	2x3	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	kΩ

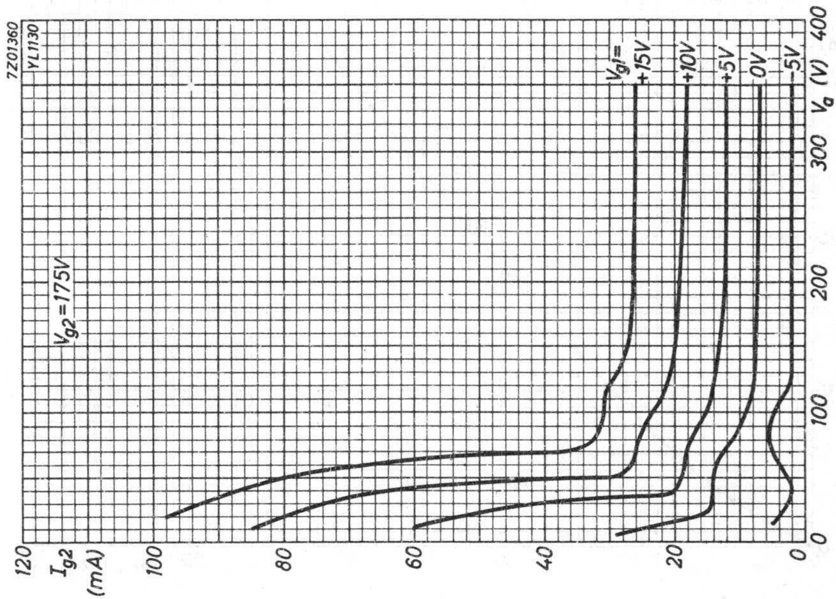
OPERATING CONDITIONS

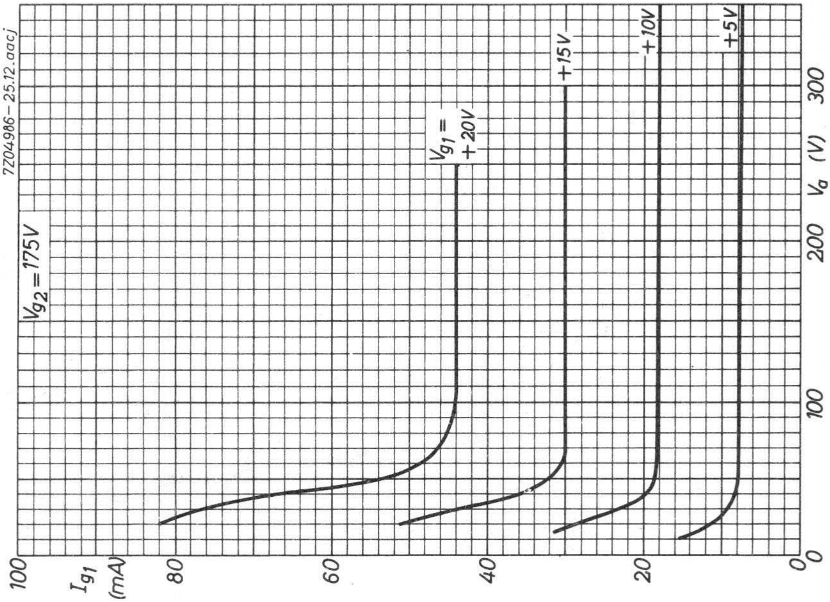
Frequency	f	=	167/500	MHz
Anode voltage	V_a	=	175	V
Grid No.2 supply voltage	V_{bg_2}	=	175	V
Grid No.2 series resistor	R_{g_2}	=	100	Ω
Grid No.1 resistor	R_{g_1}	=	56	kΩ[1])
Driving voltage	$V_{g_1g_1'p}$	=	175	V
Anode current	I_a	=	2x30	mA
Grid No.2 current	I_{g_2}	=	9	mA
Grid No.1 current	I_{g_1}	=	2x1.2	mA
Grid No.2 dissipation	W_{g_2}	=	1.6	W
Driver output power	W_{dr}	=	1.5	W
Anode input power	W_{i_a}	=	10.5	W
Anode dissipation	W_a	=	2x3.5	W
Output power	W_o	=	3.5	W
Efficiency	η	=	33	%
Output power in the load	W_ℓ	=	2	W [2])

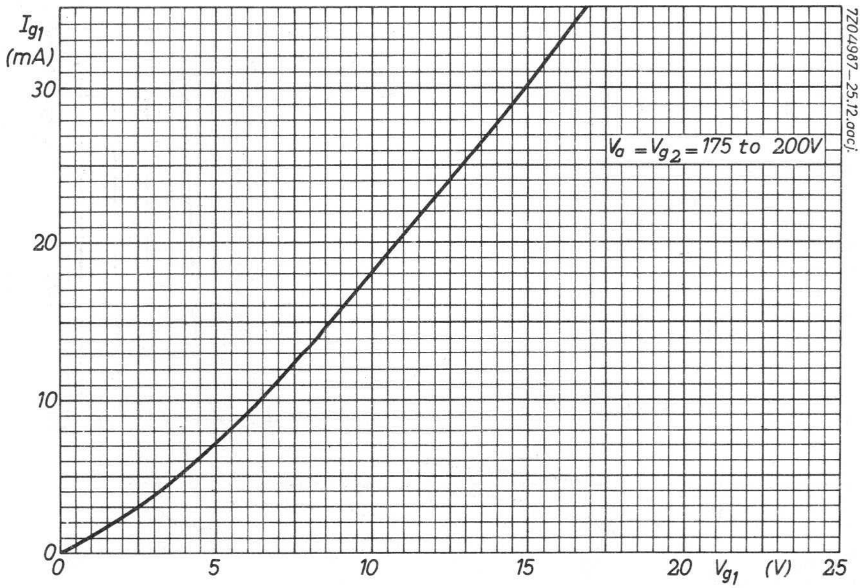
[1]) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[2]) For optimum conditions R_{g_1} should be adjusted to obtain the desired anode current.


7Z01359
YL1130
V_{g2}=175V
V_{g1}=
+15V
+10V
+5V
0V
-5V
I_a (mA)
300
250
200
150
100
50
0
100
200
300
400
V_a (V)


7Z01360
YL1130
V_{g2}=175V
V_{g1}=
+15V
+10V
+5V
0V
-5V
I_{g2} (mA)
120
100
80
60
40
20
0
100
200
300
400
V_a (V)


7Z04986-25.12.aacj
V_{g2}=175V
V_{g1} =
+20V
+15V
+10V
+5V
300
V_a (V)
200
100
0
100
I_{g1}
(mA)
80
60
40
20
0


I_{g1}
(mA)
30
20
10
0
0
5
10
15
20
V_{g1} (V)
25
V_a = V_{g2} = 175 to 200V
7Z04987-25.12.aacj.

R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	Class AB Single sideband		Class AB mod. Two tubes	
	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_o (W)
30 60	600 600	110 100	600	200

HEATING: Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=	6.3 V	12.6 V
Heater current	I_f	=	1.90 A	0.95 A
Pins			(5+6)-2	5-6
Heating time	T_h	=	min. 30	sec

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	10.7	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	24.5	pF
Anode to grid No.1	C_{ag_1}	=	0.23	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	100	mA
Amplification factor	$\mu_{g_2g_1}$	=	4.0	
Mutual conductance	S	=	10	mA/V

1) Peak envelope power. Useful power in the load.

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250 °C
Base pin seal temperature	=	max. 180 °C
Anode seal temperature	=	max. 220 °C

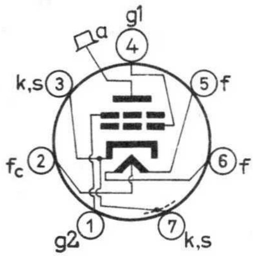
COOLING

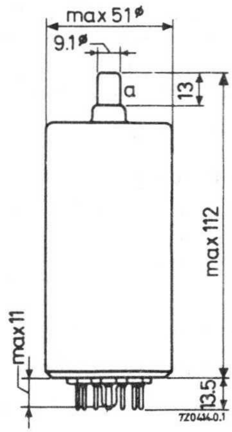
Radiation and convection. In order to keep the temperatures below the maximum permitted values it may be necessary to direct an air flow to the bulb or seals.

MECHANICAL DATA

Dimensions in mm

Base	:	Septar
Socket	:	2422 513 00001
Anode connector	:	40634
Net weight	:	110 g





Mounting position: any

R. F. CLASS AB LINEAR AMPLIFIER , single sideband, suppressed carrier

LIMITING VALUES (Absolute limits)

Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	750	V
Anode current	I_a	= max.	350	mA
Anode dissipation	W_a	= max.	75	W
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	7.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	100	V
Grid No.1 dissipation	W_{g_1}	= max.	0.5	W
Grid No.1 circuit resistance	R_{g_1}	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=		30		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-50		V 1)
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	50	50	V
Anode current	I_a	=	100	325	220	mA
Grid No.2 current	I_{g_2}	=	3	22	12	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA 2)
Grid No.2 dissipation	W_{g_2}	=	0.75	7	3.5	W
Driving power	W_{dr}	=	–	2	2	W
Anode input power	W_{i_a}	=	60	195	132	W
Anode dissipation	W_a	=	60	71	70	W
Output power in the load	W_ℓ	=	–	110	110 3)	W
Efficiency	η	=	–	57	42	%
Intermodulation products third order	d_3	=	–	–	< 30	dB 4)
fifth order	d_5	=	–	–	< 40	dB 4)

1)2)3)4) See page 4

R. F. CLASS AB LINEAR AMPLIFIER, single sideband, suppressed carrier (continued)

OPERATING CONDITIONS (continued)

Frequency	f	=		60		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-50		V 1)
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	50	50	V
Anode current	I_a	=	100	325	220	mA
Grid No.2 current	I_{g_2}	=	3	22	12	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA 2)
Grid No.2 dissipation	W_{g_2}	=	0.75	7	3.5	W
Driving power	W_{dr}	=	–	2	2	W
Anode input power	W_{i_a}	=	60	195	132	W
Anode dissipation	W_a	=	60	75	72	W
Output power in the load	W_ℓ	=	–	100	100 3)	W
Efficiency	η	=	–	51	38	%
Intermodulation products third order	d_3	=	–	–	< 30	dB 4)
fifth order	d_5	=	–	–	< 40	dB 4)

1) To be adjusted for the stated value of the zero-signal anode current.

2) Due to transit-time effects this value can differ from 0 mA and vary between +1 mA and −1 mA. This value will increase with increasing frequency.

3) Peak envelope power.

4) Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two equal tones at that level.
Relative to the peak envelope power these figures will be increased by 6 dB.

A.F. CLASS AB AMPLIFIER AND MODULATOR

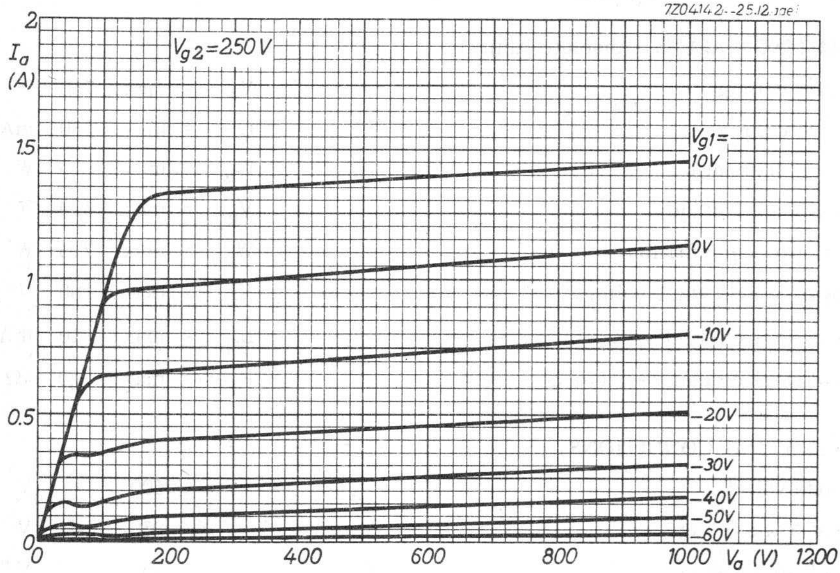
LIMITING VALUES (Absolute limits)

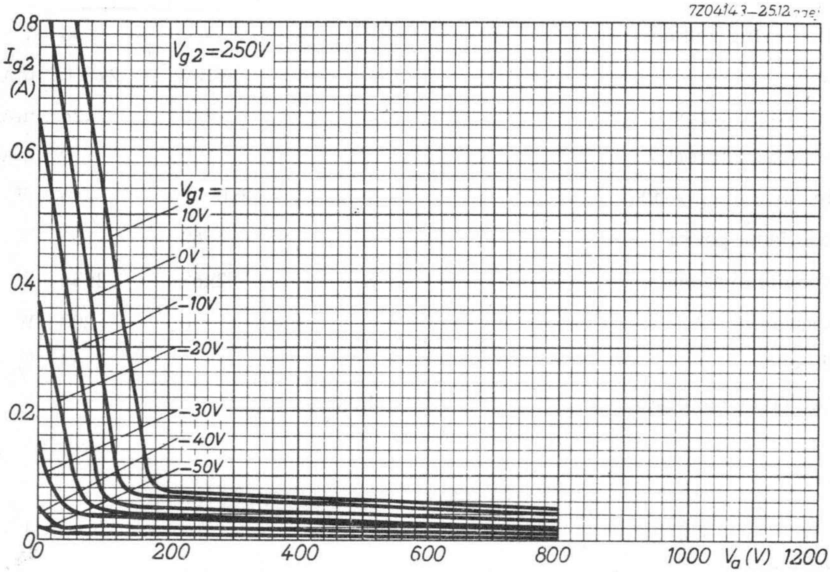
Anode voltage	V_a	=	max.	750	V
Anode current	I_a	=	max.	350	mA
Anode dissipation	W_a	=	max.	75	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	7.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	10	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	10	kΩ

OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a	=	600		V
Grid No.2 voltage	V_{g_2}	=	250		V
Grid No.1 voltage	V_{g_1}	=	-50		V [1])
Load resistance	$R_{aa\sim}$	=	2.8		kΩ
Peak driving voltage	$V_{g_1g_{1p}}$	=	0	100	V
Anode current	I_a	=	2x100	2x260	mA
Grid No.2 current	I_{g_2}	=	2x3	2x24	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Grid No.2 dissipation	W_{g_2}	=	2x0.75	2x6	W
Anode input power	W_{i_a}	=	2x60	2x156	W
Anode dissipation	W_a	=	2x60	2x56	W
Output power	W_o	=	0	200	W
Efficiency	η	=	-	64	%
Total harmonic distortion	d_{tot}	=	-	< 2	%

[1]) To be adjusted for the stated value of the zero-signal anode current


7Z04142--25.12.1967
2
I_a
(A)
V_{g2}=250V
1.5
1
0.5
0
V_{g1}=
10V
0V
−10V
−20V
−30V
−40V
−50V
−60V
0
200
400
600
800
1000
V_a (V)
1200


7Z04143–25.12.1967
0.8
I_{g2}
(A)
V_{g2}=250V
0.6
V_{g1} =
10V
0V
0.4
−10V
−20V
0.2
−30V
−40V
−50V
0
0
200
400
600
800
1000
V_a (V)
1200

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 ± 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 $R_a = 4.9$ kΩ:

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.

For further data please refer to data of type QEL2/200

AIR COOLED R.F. POWER TETRODE

Forced air cooled power tetrode in coaxial metal-glass construction intended for use as S.S.B. amplifier and amplifier in T.V. transmitters.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		Class B television service	
	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_ℓ sync (kW)
30	4.5	3		
230			4	5.5

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	5	V
Filament current	I_f	64	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	14	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	78	pF
Anode to grid No.1	C_{ag_1}	0.23	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	600	V
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	$\mu_{g_2g_1}$	5.2	

TEMPERATURE LIMITS AND COOLING

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

Cooling data

W_a (kW)	h (m)	t_i (°C)	q (m^3/min.)	p_i mm H_2O
2.5	0	25	2.7	50
4	0	25	4.3	130

See also cooling curve.

A low velocity air flow (> 0.5 m^3/min) should be directed to the filament and grid seals.

MECHANICAL DATA

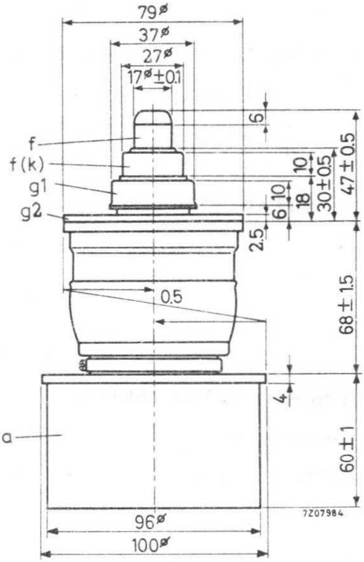
Dimensions in mm

Mounting position: vertical, anode up or down

Net weight: approx. 2.5 kg

Accessories:

Filament connector (one required)	type 40721
Grid No.1 connector	type 40722
Grid No.2 connector	type 40723
Insulating pedestal	type 40724



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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	max.	30	MHz
Anode voltage	V_a	max.	6	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g_1}	max.	0.2	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	4	kW
Grid No.2 dissipation	W_{g_2}	max.	120	W
Grid No.1 dissipation	W_{g_1}	max.	40	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		4.5		kV
Grid No.2 voltage	V_{g_2}		800		V
Grid No.1 voltage	V_{g_1}		-140		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	140	140	V
Anode current	I_a	0.5	1.33	0.93	A
Grid No.2 current	I_{g_2}	0	30	8	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	2.25	6	4.2	kW
Anode dissipation	W_a	2.25	2.8	2.6	kW
Grid No.2 dissipation	W_{g_2}	0	24	6.4	W
Driver output power	W_{dr}	0	30	30	W [3]
Output power in load (P.E.P.)	W_ℓ		3	3	kW [2]

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

[2]) Measured in a circuit having an efficiency of 95%.

[3]) The indicated driver output power is required to take care of losses in damping resistors and circuit losses.

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE; linear grounded-grid amplifier. Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute max. rating system)

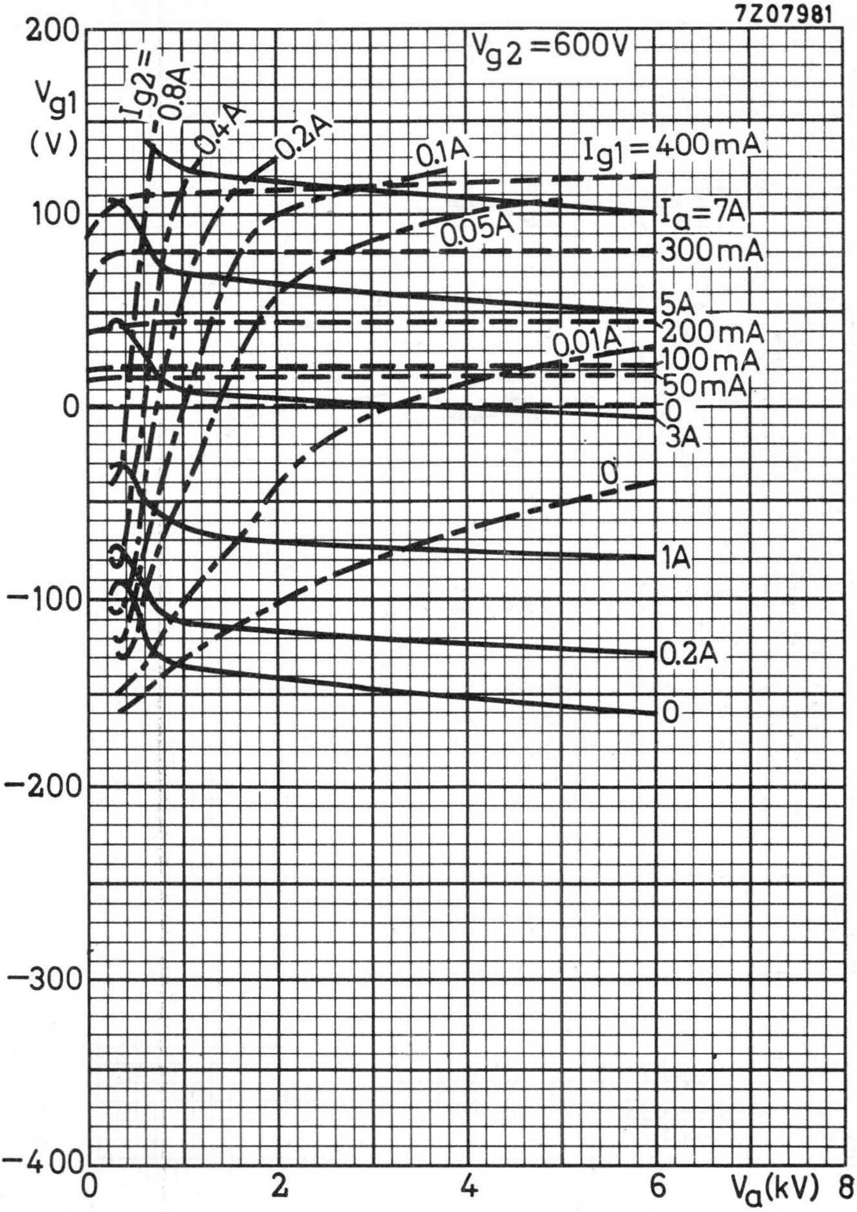
Frequency	f	max.	230	MHz
Anode voltage	V_a	max.	4.2	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g_1}	max.	200	mA
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	4	kW
Grid No.2 dissipation	W_{g_2}	max.	100	W
Grid No.1 dissipation	W_{g_1}	max.	30	W

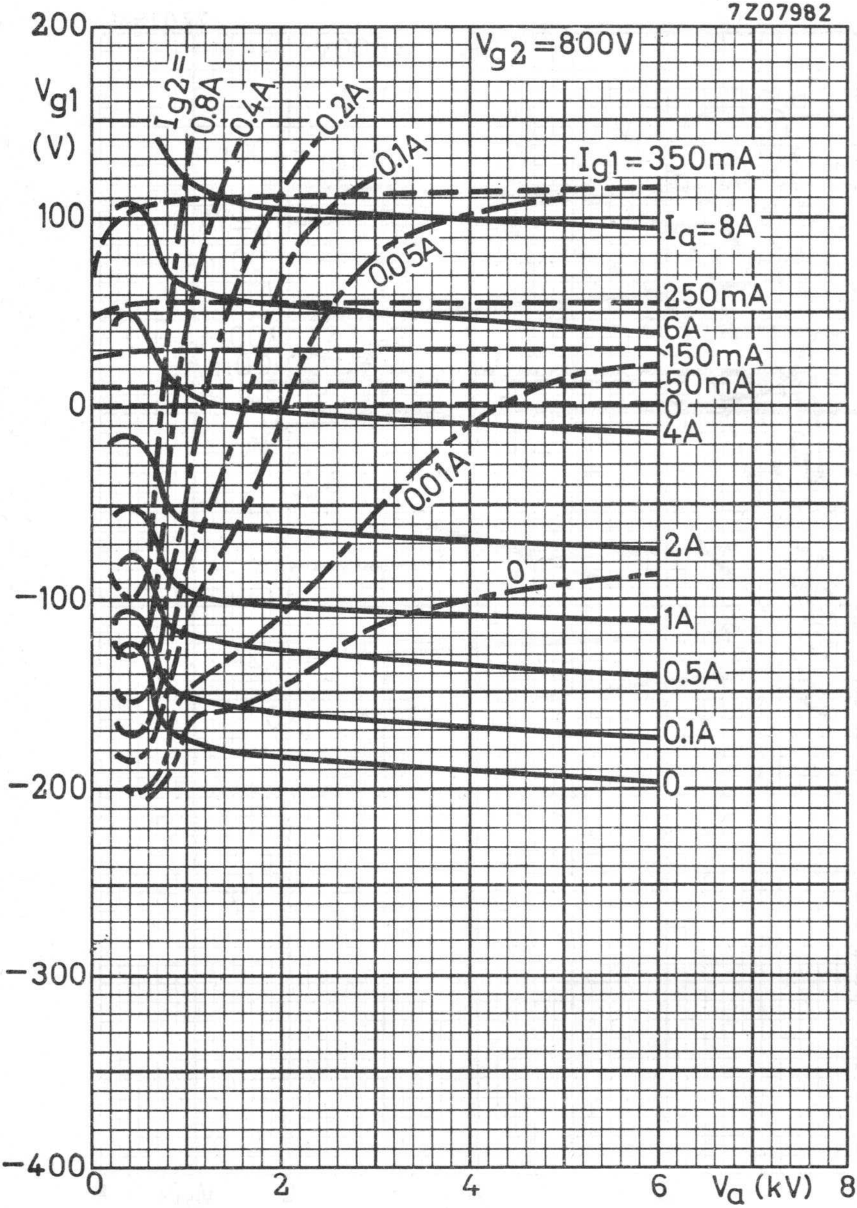
OPERATING CONDITIONS

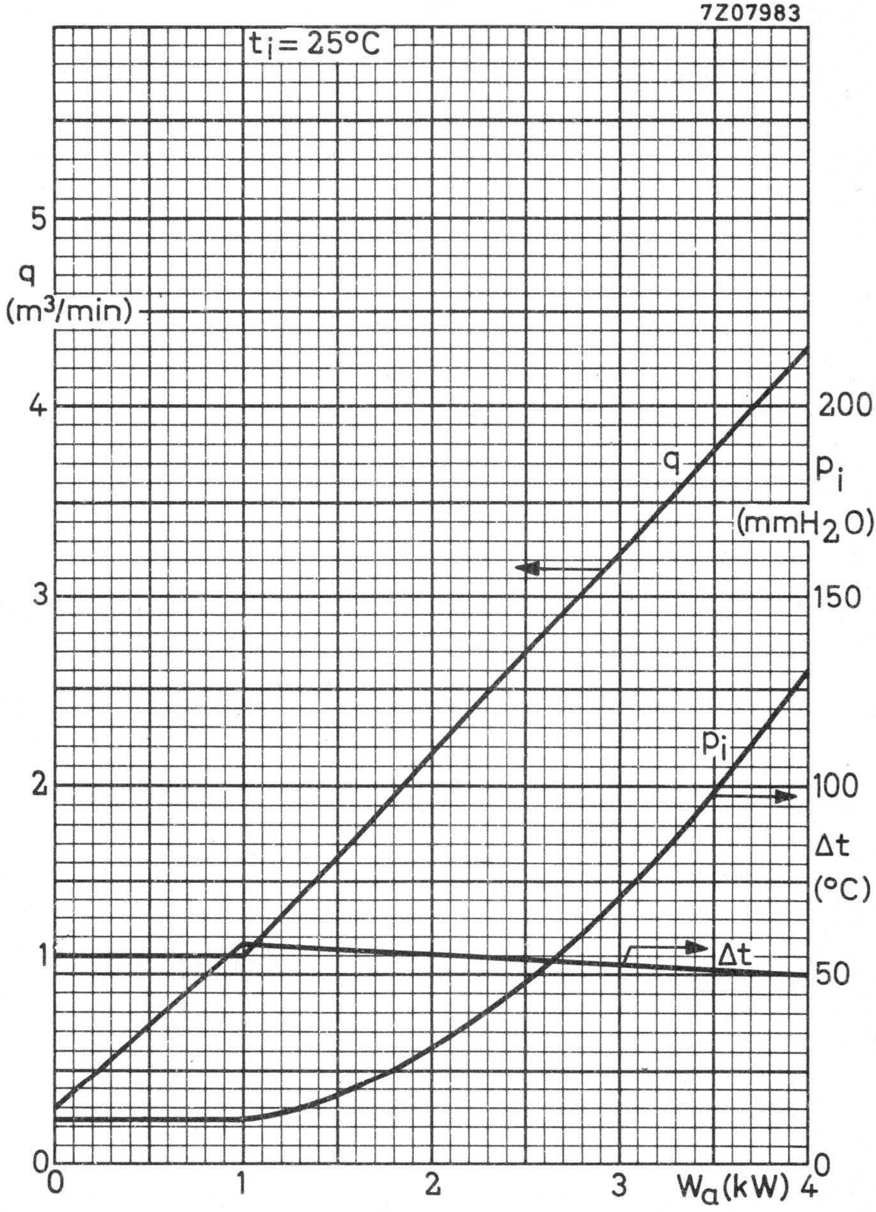
Frequency	f		230	MHz
Bandwidth (-3 dB)	B (-3 dB)		10	MHz [1]
Anode voltage	V_a		4	kV
Grid No.2 voltage	V_{g_2}		600	V
Grid No.1 voltage	V_{g_1}		-115	V
Input A.C. voltage, peak	V_{g1p}	sync	280	V
Anode current	I_a	black	1.5	A
Grid No.2 current	I_{g_2}	black	40	mA
Grid No.1 current	I_{g_1}	black	60	mA
Driver output power	W_{dr}	sync	550	W
Output power in load	W_ℓ	sync	5.5	kW [2]
		black	3	kW [2]
Anode dissipation	W_a	black	3	kW

[1]) Bandwidth obtained with secondary circuit.

[2]) W_ℓ represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%.


7Z07981
V_{g2} = 600V
V_{g1} (V)
200
100
0
−100
−200
−300
−400
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 400 mA
I_a = 7A
300 mA
5A
200 mA
100 mA
50 mA
0
3A
1A
0.2A
0
0
2
4
6
V_a (kV)
8


7Z07982
V_{g2} = 800V
200
100
0
−100
−200
−300
−400
V_{g1}
(V)
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 350mA
I_a = 8A
250mA
6A
150mA
50mA
0
4A
2A
1A
0.5A
0.1A
0
0
2
4
6
V_a (kV)
8


7Z07983
$t_i = 25°C$
q
(m³/min)
5
4
3
2
1
0
0
1
2
3
W_a(kW) 4
200
p_i
(mmH₂O)
150
100
Δt
(°C)
50
0
q
p_i
Δt

VAPOUR COOLED R.F. POWER TETRODE

Vapour cooled power tetrode in coaxial metal-glass construction intended for use as S.S.B. amplifier and amplifier in T.V. transmitters.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		Class B television service	
	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_ℓ sync (kW)
30	4.5	3		
230			4	5.5

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	5	V
Filament current	I_f	64	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	14	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	78	pF
Anode to grid No.1	C_{ag_1}	0.23	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	600	V
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	$\mu_{g_2g_1}$	5.2	

TEMPERATURE LIMITS AND COOLING

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

A low velocity air flow (> 0.5 m^3/min) should be directed to the filament and grid seals.

MECHANICAL DATA

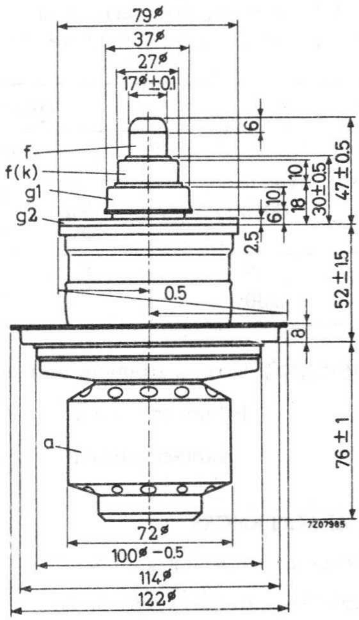
Dimensions in mm

Mounting position: vertical, anode down

Net weight: approx. 1.7 kg

Accessories

Filament connector (one required)	type 40721
Grid No.1 connector	type 40722
Grid No.2 connector	type 40723
Boiler	type K 731



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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	max.	30	MHz
Anode voltage	V_a	max.	6	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	6	kW
Grid No.2 dissipation	W_{g_2}	max.	120	W
Grid No.1 dissipation	W_{g_1}	max.	40	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		4.5		kV
Grid No.2 voltage	V_{g_2}		800		V
Grid No.1 voltage	V_{g_1}		-140		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	140	140	V
Anode current	I_a	0.5	1.33	0.93	A
Grid No.2 current	I_{g_2}	0	30	8	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	2.25	6	4.2	kW
Anode dissipation	W_a	2.25	2.8	2.6	kW
Grid No.2 dissipation	W_{g_2}	0	24	6.4	W
Driver output power	W_{dr}	0	30	30	W [3]
Output power in load (P.E.P.)	W_ℓ	-	3	3	kW [2]

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

[2]) Measured in a circuit having an efficiency of 95%.

[3]) The indicated driver output power is required to take care of losses in damping resistors and circuit losses.

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE ; linear grounded-grid amplifier.
Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute max. rating system)

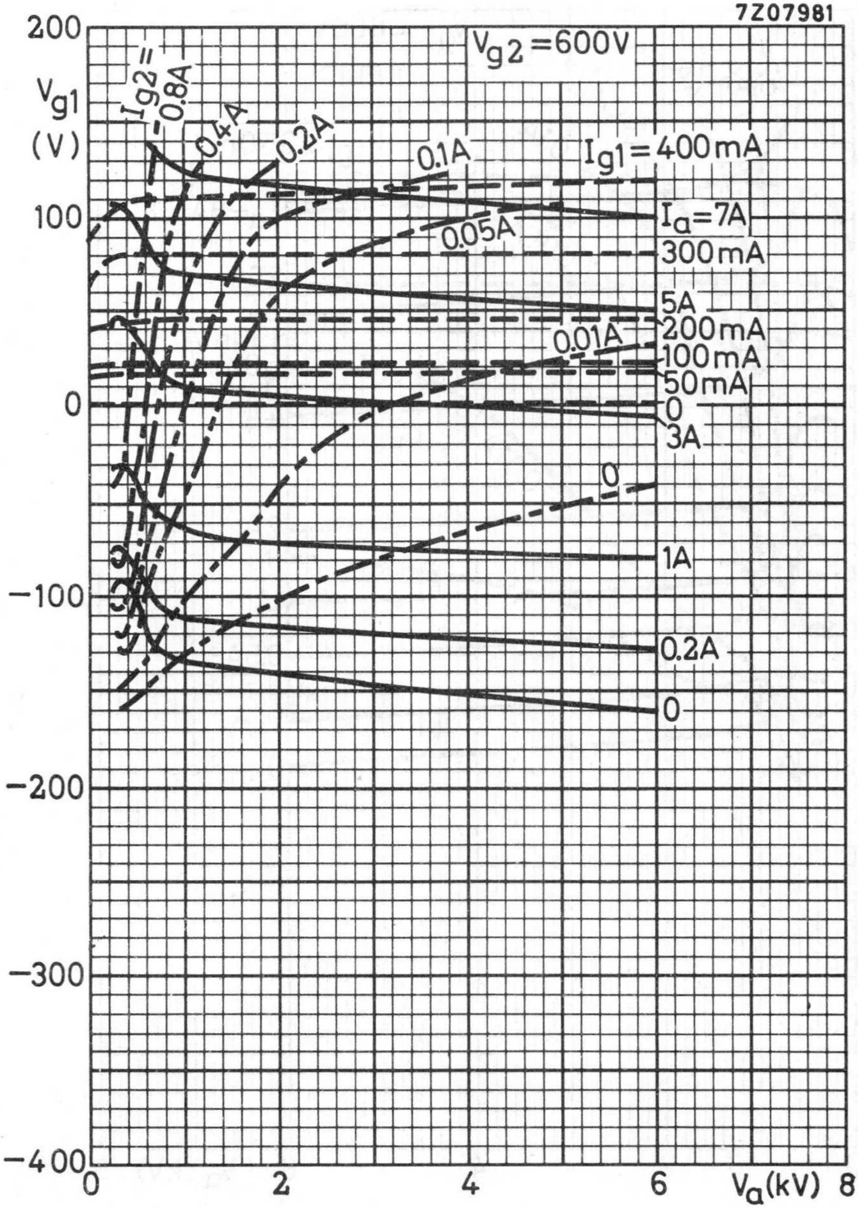
Frequency	f	max.	230	MHz
Anode voltage	V_a	max.	4.2	kV
Grid No.2 voltage	V_{g2}	max.	800	V
Grid No.1 voltage	$-V_{g1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g1}	max.	0.2	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	6	kW
Grid No.2 dissipation	W_{g2}	max.	100	W
Grid No.1 dissipation	W_{g1}	max.	30	W

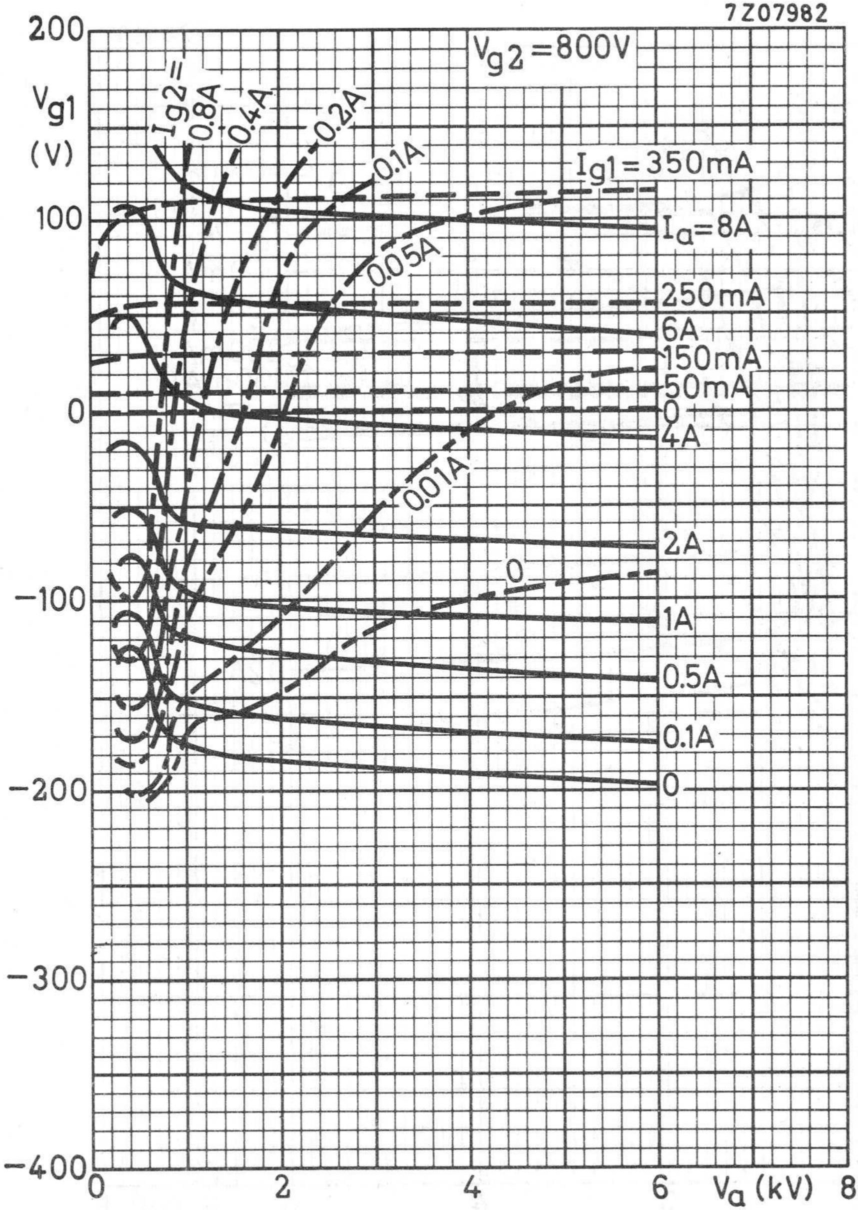
OPERATING CONDITIONS

Frequency	f		230	MHz
Bandwidth (−3 dB)	B (−3 dB)		10	MHz [1]
Anode voltage	V_a		4	kV
Grid No.2 voltage	V_{g2}		600	V
Grid No.1 voltage	V_{g1}		-115	V
Input A.C. voltage, peak	V_{g1p}	sync	280	V
Anode current	I_a	black	1.5	A
Grid No.2 current	I_{g2}	black	40	mA
Grid No.1 current	I_{g1}	black	60	mA
Driver output power	W_{dr}	sync	550	W
Output power in load	W_ℓ	sync	5.5	kW [2]
		black	3	kW [2]
Anode dissipation	W_a	black	3	kW

[1]) Bandwidth obtained with secondary circuit.

[2]) W_ℓ represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%.


7Z07981
V_{g2} = 600V
V_{g1} (V)
200
100
0
−100
−200
−300
−400
0
2
4
6
V_a(kV)
8
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 400mA
300mA
200mA
100mA
50mA
0
I_a = 7A
5A
3A
1A
0.2A
0


7Z07982
V_{g2} = 800V
V_{g1} (V)
200
100
0
−100
−200
−300
−400
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 350mA
250mA
150mA
50mA
0
I_a = 8A
6A
4A
2A
1A
0.5A
0.1A
0
0
2
4
6
8
V_a (kV)

QUICK HEATING R.F. DOUBLE TETRODE

Radiation and convection cooled double tetrode intended for use as RF amplifier and frequency multiplier up to 500 MHz, designed for intermittent filament operation in transistorized mobile transmitters.

QUICK REFERENCE DATA						
RF class C telegraphy	f	200	MHz	V_a	350	V
	W_{dr}	1.0	W	W_ℓ	26	W
RF class C telegraphy	f	500	MHz	V_a	250	V
	W_{dr}	2.5	W	W_ℓ	14.5	W
RF class C frequency multiplier	f	167/500	MHz	V_a	250	V
	W_{dr}	2.2	W	W_ℓ	2.5	W
RF class C a/g_2 mod.	f	175	MHz	V_a	280	V
	W_{dr}	1.5	W	W_ℓ	15	W

FILAMENT oxide coated

HEATING: Direct by A.C. or D.C.; series and parallel supply
The frequency of A.C. filament supply may be:
sinusoidal supply voltage max. 200 Hz
square wave supply voltage: any

Filament voltage	V_f		1.1	V ±15 %
Filament current	I_f		4.2	A
Heating time for W_o = 70 % of $W_{o\,max}$.		max.	0.5	s

CAPACITANCES

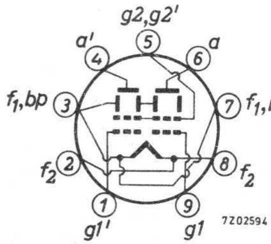
Units in push-pull

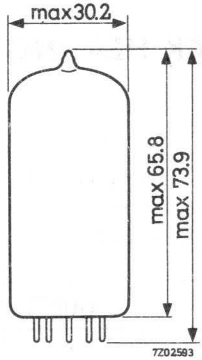
Input	C_i	4.7	pF
Output	C_o	1.2	pF

The tube is internally neutralized for frequencies up to 500 MHz

DIMENSIONS AND CONNECTIONS

Base: Magnoval





TYPICAL CHARACTERISTICS, each unit

Amplification factor			
at V_a = 150 V, V_{g2} = 150 V, I_a = 45 mA	$\mu_{g_2g_1}$	20	
Transconductance			
at V_a = 150 V, V_{g2} = 150 V, I_a = 45 mA	S	9.5	mA/V

MOUNTING POSITION any

If the tube is mounted with its main axis horizontally it is recommended that the pins 3 and 7 be in a horizontal plane.

ACCESSORIES

Socket: magnoval 2422 502 05001 or equivalent type suitable for the high filament current.
Filament connections (tags 3-7 and 2-8) should be connected in parallel on the socket.

WEIGHT

Net weight 27 g

TEMPERATURE LIMITS AND COOLING

Radiation and convection cooling. The use of a closed tube shield is not recommended.

Absolute maximum bulb temperature t_{bulb} max. 230 $^{\circ}C$

R.F. CLASS C TELEGRAPHY AND F.M. TELEPHONY, two units in push-pull

LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	200	500	MHz
Anode voltage	V_a	max.	400	300	V
Grid No.2 voltage	V_{g_2}	max.	200	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	100	V
Anode current	I_a	max.	2x75	2x75	mA
Grid No.1 current	I_{g_1}	max.	2x7	2x7	mA
Anode input power	W_{ia}	max.	56	42	W
Anode dissipation	W_a	max.	2x8	2x8	W
Grid No.2 dissipation	W_{g_2}	max.	3.5	3.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	100	kΩ

OPERATING CONDITIONS Intermittent service, **ICAS**

Frequency	f	200	200	500	MHz
Anode voltage	V_a	350	350	260	V
Grid No.2 supply voltage	$V_{b_{g_2}}$	350	350	260	V
Grid No.2 series resistor	R_{g_2}	9	9	4.3	kΩ
Grid No.1 voltage	V_{g_1}	-26	-13	-22.5	V
Grid No.1 circuit resistance	R_{g_1}	4.7 [1]	2 [1]	6.9 [2]	kΩ
Driving voltage	$V_{g_1 g_1' p}$	85	85	65	V
Anode current	I_a	2x70	2x70	2x70	mA
Grid No.2 current	I_{g_2}	20	23.5	20	mA
Grid No.1 current	I_{g_1}	2x6.5	2x6.5	2x3.25	mA
Anode input power	W_{i_a}	49	49	36.5	W
Anode dissipation	W_a	2x8	2x8	2x8	W
Grid No.2 dissipation	W_{g_2}	3.4	3.3	3.5	W
Driver output power	W_{dr}	1.0	1.0	2.5	W
Output power	W_o	33	33	19	W
Efficiency	η	67	67	52	%
Output power in load	W_ℓ	26	26	14	W [3]

[1]) Common for both units.

[2]) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[3]) For optimal conditions R_{g_1} should be adjusted to obtain the desired anode current.

R.F. CLASS C FREQUENCY TRIPLER, two units in push-pull

LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	500	MHz
Anode voltage	V_a	max.	300	V
Grid No.2 voltage	V_{g_2}	max.	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	V
Anode current	I_a	max.	2x50	mA
Grid No.1 current	I_{g_1}	max.	2x3	mA
Anode input power	W_{ia}	max.	27	W
Anode dissipation	W_a	max.	2x8	W
Grid No.2 dissipation	W_{g_2}	max.	3.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	kΩ

OPERATING CONDITIONS Intermittent service, **ICAS**

Frequency	f	167/500	MHz
Anode voltage	V_a	250	V
Grid No.2 supply voltage	V_{bg_2}	250	V
Grid No.2 series resistor	R_{g_2}	5.6	kΩ
Grid No.1 circuit resistance-each unit	R_{g_1}	27	kΩ 1)
Driving voltage	$V_{g_1g_1'p}$	170	V
Anode current	I_a	2x45	mA
Grid No.2 current	I_{g_2}	14	mA
Grid No.1 current	I_{g_1}	2x2.5	mA
Anode input power	W_{ia}	22.5	W
Anode dissipation	W_a	2x8	W
Grid No.2 dissipation	W_{g_2}	2.4	W
Driver output power	W_{dr}	2.2	W
Output power	W_o	6.5	W
Efficiency	η	29	%
Output power in load	W_ℓ	3	W 2)

1) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

2) For optimal conditions R_{g_1} should be adjusted to obtain the desired anode current.

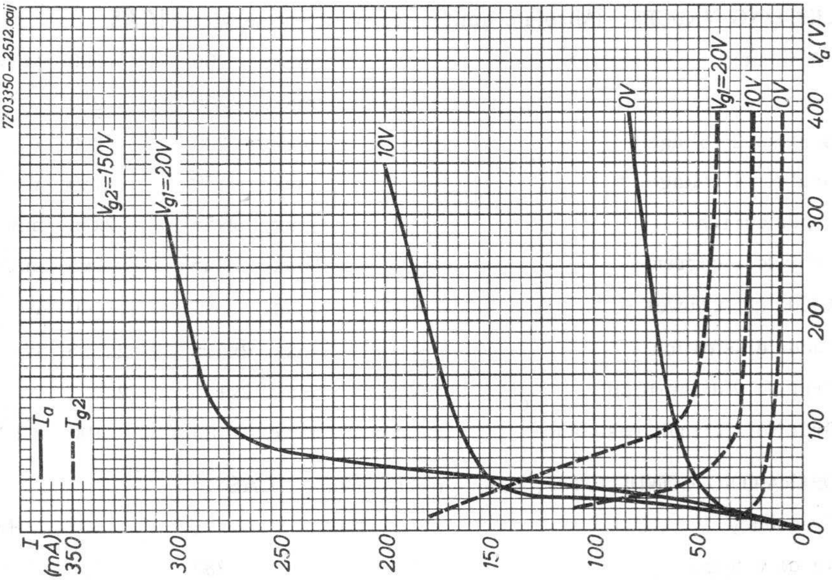
R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two units in push-pull

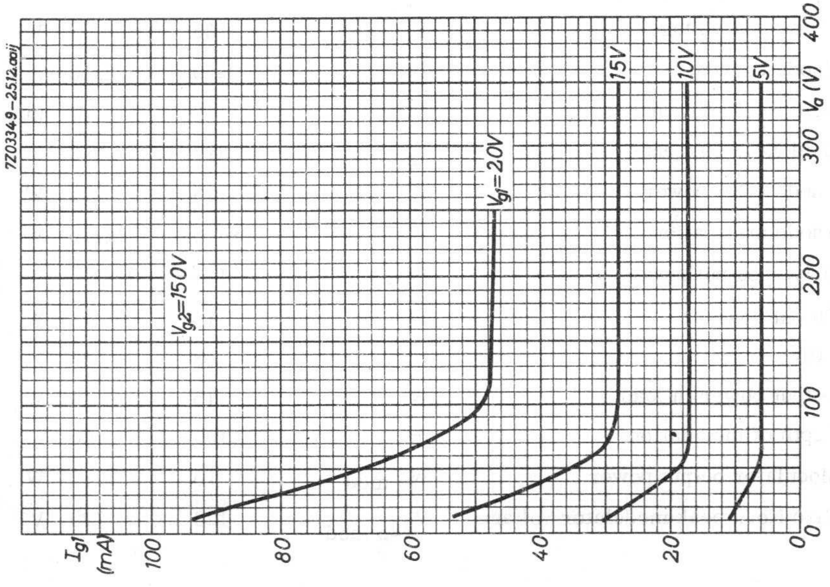
LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	200	500	MHz
Anode voltage	V_a	max.	330	260	V
Grid No. 2 voltage	V_{g_2}	max.	200	200	V
Grid No. 1 voltage	$-V_{g_1}$	max.	150	150	V
Anode current	I_a	max.	2x56	2x56	mA
Grid No. 1 current	I_{g_1}	max.	2x5	2x5	mA
Anode input power	W_{ia}	max.	40	40	W
Anode dissipation	W_a	max.	2x5.5	2x5.5	W
Grid No. 2 dissipation	W_{g_2}	max.	2x1.5	2x1.5	W
Grid No. 1 circuit resistance	R_{g_1}	max.	100	100	kΩ

OPERATING CONDITIONS ; intermittent service, **ICAS**

Frequency	f	175	500	MHz
Anode voltage	V_a	280	225	V
Grid No. 2 voltage	V_{g_2}	150	150	V
Grid No. 1 voltage	$-V_{g_1}$	35	25	V
Anode current	I_a	2x50	2x50	mA
Grid No. 2 current	I_{g_2}	19	17	mA
Grid No. 1 current	I_{g_1}	2x4	2x3	mA
Anode input power	W_{ia}	28	22.5	W
Anode dissipation	W_a	2x4.5	2x4.5	W
Driver output power	W_{dr}	1.5	3.0	W
Output power	W_o	19	13	W
Efficiency	η	68	58	%
Output power in load	W_ℓ	15	10	W
Depth of modulation	m	100	100	%
Modulator output power	$W_{o\ mod}$	16	12.5	W
Grid No. 2 peak modulator voltage	$V_{g_{2p}\ mod}$	120	120	V


7Z03350-2512.aaij
I
(mA)
350
300
250
200
150
100
50
0
0
100
200
300
400
V_a (V)
V_{g2}=150V
V_{g1}=20V
10V
0V
V_{g1}=20V
10V
0V
I_a
I_{g2}


7Z03349-2512.aaij
I_{g1}
(mA)
100
80
60
40
20
0
0
100
200
300
400
V_a (V)
V_{g2}=150V
V_{g1}=20V
15V
10V
5V

R.F. POWER PENTODE

QUICK REFERENCE DATA				
Heater voltage	V_f	=	12.6	V
Amplification factor	$\mu_{g_2g_1}$	=	6.7	
Mutual conductance	S	=	6	mA/V

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

Heater voltage	V_f	=	12.6	V
Heater current	I_f	=	1.3	A

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	20.5	pF
Anode to all other elements except grid No.1	C_a	=	12	pF
Anode to grid No.1	C_{ag_1}	=	0.1	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1000	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Amplification factor	$\mu_{g_2g_1}$	=	6.7	
Mutual conductance	S	=	6	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	= max.	300	^{o}C
Pin seal temperature	= max.	180	^{o}C

COOLING

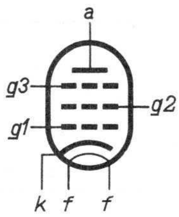
Radiation and convection

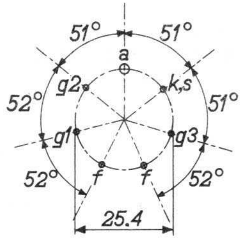
MECHANICAL DATA Dimensions in mm

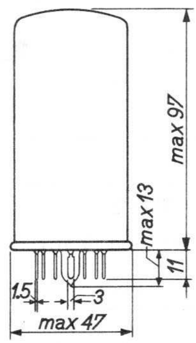
Base : Septar

Socket : 2422 513 00001

Net weight : 80 g







Mounting position: any

LIMITING VALUES (Absolute limits)

Anode voltage without cathode current	V_{a_o}	=	max.	3	kV
Anode voltage at W_a = 45 W	V_a	=	max.	1	kV
Anode dissipation	W_a	=	max.	45	W
Positive grid No.3 voltage	V_{g_3}	=	max.	200	V
Negative grid No.3 voltage	$-V_{g_3}$	=	max.	200	V
Grid No.3 dissipation	W_{g_3}	=	max.	1	W
Grid No.3 circuit resistance	R_{g_3}	=	max.	50	kΩ
Grid No.2 voltage without cathode current	$V_{g_{2o}}$	=	max.	1	kV
Grid No.2 voltage at W_{g_2} = 7 W	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	7	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	300	V
Grid No.1 dissipation	W_{g_1}	=	max.	0.5	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	kΩ
Average cathode current	I_k	=	max.	240	mA
Peak cathode current	I_{k_p}	=	max.	1.5	A
Cathode to heater voltage	V_{kf}	=	max.	100	V
Heater voltage	V_f	=	max.	13.9	V
		=	min.	11.3	V

CHARACTERISTICS AND RANGE VALUES

Column I : Setting of the tube and typical (average) measuring results of new tubes
II : Characteristic range values for equipment design
III : Data indicating the end point of life

			I	II	III	
Heater current						
Heater voltage	V_f	=	12.6			V
Heater current	I_f	=	1.3	1.1-1.5	1.1-1.5	A
Characteristics						
Heater voltage	V_f	=	12.6			V
Anode voltage	V_a	=	100			V
Grid No.3 voltage	V_{g_3}	=	0			V
Grid No.2 voltage	V_{g_2}	=	250			V
Anode current	I_a	=	100			mA
Grid No.1 voltage	$-V_{g_1}$	=	18	14 - 20	12 - 22	V
Grid No.2 current	I_{g_2}	=		12 - 25	8 - 30	mA
Grid No.1 current	$-I_{g_1}$	=			20	μA
Cut-off voltage						
Heater voltage	V_f	=	12.6			V
Anode voltage	V_a	=	100			V
Grid No.3 voltage	V_{g_3}	=	0			V
Grid No.2 voltage	V_{g_2}	=	250			V
Anode current	I_a	=	0.2			mA
Cut-off voltage	$-V_{g_1}$	=		<60	65	V
Capacitances						
Anode to all other elements except grid No.1	$C_{a(g_1)}$	=	12	11 - 13		pF
Grid No.1 to all other elements except anode	$C_{g_1(a)}$	=	20.5	19 - 22		pF
Anode to grid No.1	C_{ag_1}	=		<0.22		pF

CHARACTERISTICS AND RANGE VALUES (continued)

Insulation between the electrodes

A leakage current of 10 μA is not exceeded when the following voltages, with polarity as indicated are applied to the indicated electrodes via a series resistor of 10 MΩ

		I	II	III	
Grid No.1 (-) to grids No.2 and 3 and anode (+)	$V_{g_1}(-)/a, g_2, g_3(+)$	= 1000		550	V
Grid No.2 (+) to grid No.3 (-)	$V_{g_2}(+)/g_3(-)$	= 1000		550	V
Anode (+) to grid No.3 (-)	$V_a(+)/g_3(-)$	= 3000		1200	V
Cathode (+) to grid No.1 (-)	$V_k(+)/g_1(-)$	= 200		150	V

LIFE EXPECTANCY

3000 hours under the following conditions:

Heater voltage	V_f	=	12.6	V
Anode voltage	V_a	=	100	V
Grid No.3 voltage	V_{g_3}	=	0	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-20	V
Grid No.1 pulse voltage (pulse substantially square)	$V_{g_{1p}}$	=	40	V
Pulse repetition frequency	f_{imp}	=	80	Hz
Pulse duration	T_{imp}	=	8	ms

AGEING

In order to detect "early failures" and to ensure that the tubes are properly stabilised, all tubes are aged prior to testing during 200 hours under the following conditions:

Heater voltage	V_f	=	12.6	V
Anode current	I_a	=	70	mA
Anode dissipation	W_a	=	20	W
Peak anode voltage	V_{a_p}	=	515	V

STAND-BY PERFORMANCE [1]

After 200 hours of operation with V_f = 14 V only, the tubes are criticised for

Cathode interface resistance >10 Ω (continuous wave method IEC Publ. 151-9, two frequency method)

LIFE PERFORMANCE [1]

After 3000 hours of operation under the following conditions

Heater voltage	V_f	=	12.6	V
Anode voltage	V_a	=	100	V
Grid No.3 voltage	V_{g_3}	=	0	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-20	V
Grid No.1 pulse voltage (pulse substantially square)	$V_{g_{1p}}$	=	40	V
Pulse repetition frequency	f_{imp}	=	80	Hz
Pulse duration	T_{imp}	=	8	ms

the tubes are critised for

Inoperatives

$\left.\begin{array}{l}\text{Control grid voltage for cut-off}\\ \text{Control grid current}\\ \text{Leakage current}\end{array}\right\}$ See section "Characteristics and range values".

[1]) This test is performed on a sample taken from each production run.

VIBRATIONAL NOISE OUTPUT [1][2]

Conditions:

Anode voltage	V_a	=	100	V
Grid No.2 voltage	V_{g_2}	=	150	V
Grid No.3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	10	mA
Vibrational acceleration		=	10	g
Duration	T	=	60	sec in each of the three directions X_1, X_2 and Y
Frequency	f	=	25	Hz
Anode load resistance	R_a	=	2	kΩ

Limit of the vibrational noise output V_{noise} = max. 750 mV(RMS)

FATIGUE : 2.5 g [1][2]

Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of the three directions X_1, X_2 and Y

VIBRATION: 5 g [1][2]

Vibrational forces for a period of 2 hours at a frequency of 25 Hz in each of the three directions X_1, X_2 and Y

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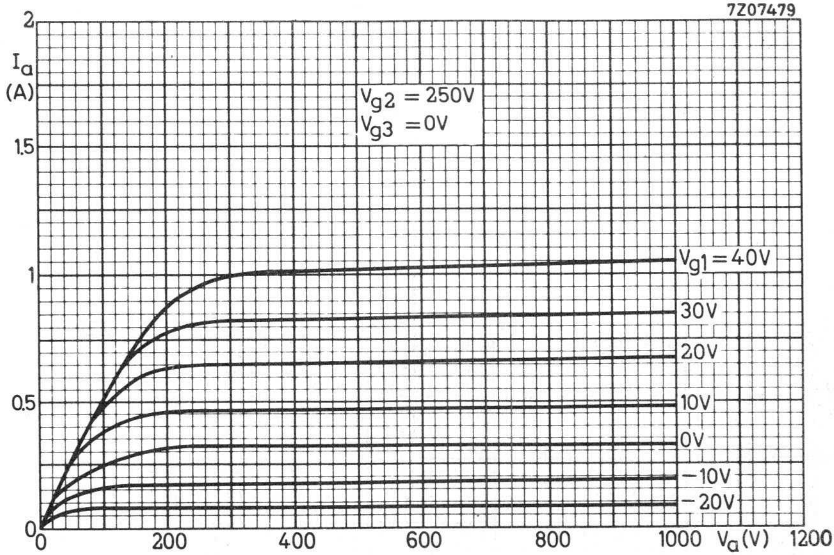
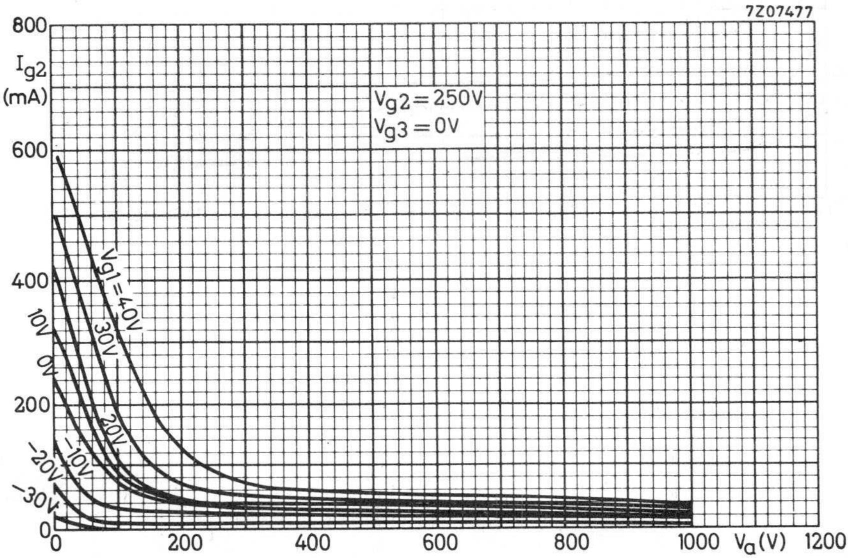
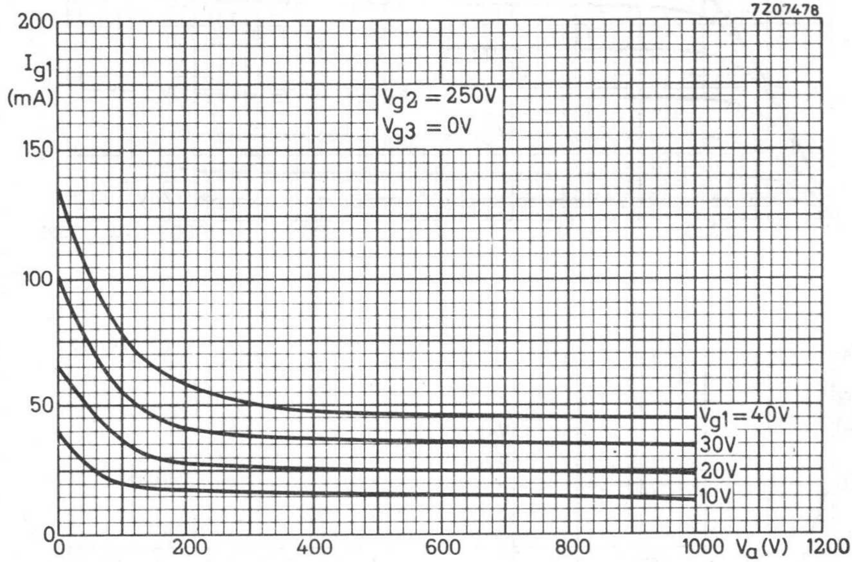
1) This test is performed on a sample taken from each production run.

2) These test conditions are only given for evaluation of the ruggedness of the tube and should by no means be interpreted as suitable operating conditions. Fatigue and vibration are destructive tests.


7Z07479
2
Ia
(A)
1.5
1
0.5
0
Vg2 = 250V
Vg3 = 0V
Vg1 = 40V
30V
20V
10V
0V
−10V
−20V
0
200
400
600
800
1000
Va (V)
1200


7Z07477
800
Ig2
(mA)
600
400
200
0
Vg2 = 250V
Vg3 = 0V
Vg1 = 40V
30V
20V
10V
0V
−10V
−20V
−30V
0
200
400
600
800
1000
Va (V)
1200


7Z07478
200
I_{g1}
(mA)
150
100
50
0
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0
200
400
600
800
1000
V_a (V)
1200

R.F. DOUBLE TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	6.75	V	13.5	V
Heater current	I_f	=	720	mA	360	mA
Pin connections			9-(4+5)		4-5	

For further data and curves of this type
please refer to type QQE03/12

R.F. DOUBLE TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	6.75	V	13.5	V
Heater current	I_f	=	560	mA	280	mA
Pin connections			9-(4+5)		4-5	

For further data and curves of this type
please refer to type QQE02/5

AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	B amplifier		Class AB SSB	
	V_a (V)	W_{load} (W)	V_a (V)	W_o PEP (W)
220	3000	1000		
30			3000	> 1050

HEATING: indirect by A.C. or D.C.; cathode oxide-coated, matrix type

Heater voltage	V_f	5.0	V ± 3%
Heater current	I_f	18	A (< 20 A)
Waiting time	T_w	min. 5	min.

CAPACITANCES

Anode to cathode and heater	$C_{a-k,f}$	< 0.08	pF
Anode to grid No.1	C_{ag_1}	< 0.1	pF
Anode to grid No.2	C_{ag_2}	13 to 17	pF
Grid No.1 to cathode and heater	$C_{g_1-k,f}$	33 to 42	pF
Grid No.1 to grid No.2	$C_{g_1-g_2}$	48 to 64	pF
Grid No.2 to cathode and heater	$C_{g_2-k,f}$	< 1.7	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	550	V
Anode current	I_a	500	mA
Mutual conductance	S	20	mA/V
Amplification factor	$\mu_{g_2g_1}$	7.5	–

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals (see also outline drawing)	t_s	max. 200	^oC
Air inlet temperature	t_i	max. 45	^oC

COOLING

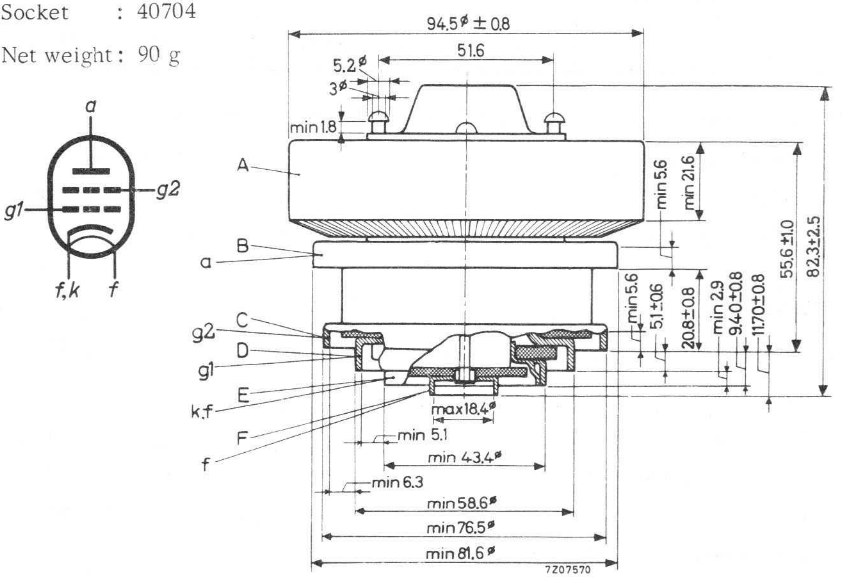
Forced air cooling for the anode. For cooling characteristics see page 5. Low velocity air flow for the ceramic to metal seals.
Cooling will also be necessary when only the heater voltage is applied to the tube.

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	kΩ

OPERATING CHARACTERISTICS

Frequency	f	220		MHz
Anode voltage	V_a	3000		V
Grid No.2 voltage	V_{g_2}	450		V
Grid No.1 voltage	V_{g_1}	-60		V
Anode current	I_a	150	830	mA
Grid No.2 current	I_{g_2}	-5	-20	mA
Grid No.1 current	I_{g_1}	-	5	mA
Driver output power	W_{dr}	-	40	W
Anode input power	W_{i_a}	0.45	2.49	kW
Anode dissipation	W_a	0.45	1.35	kW
Output power in the load	W_ℓ	0	1.0	kW

1) For AM.

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

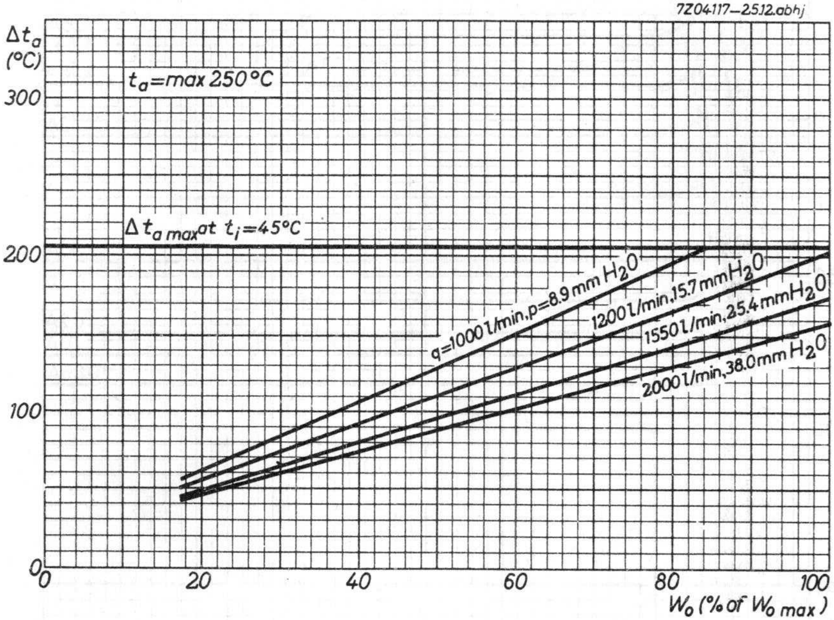
LIMITING VALUES (Absolute limits)

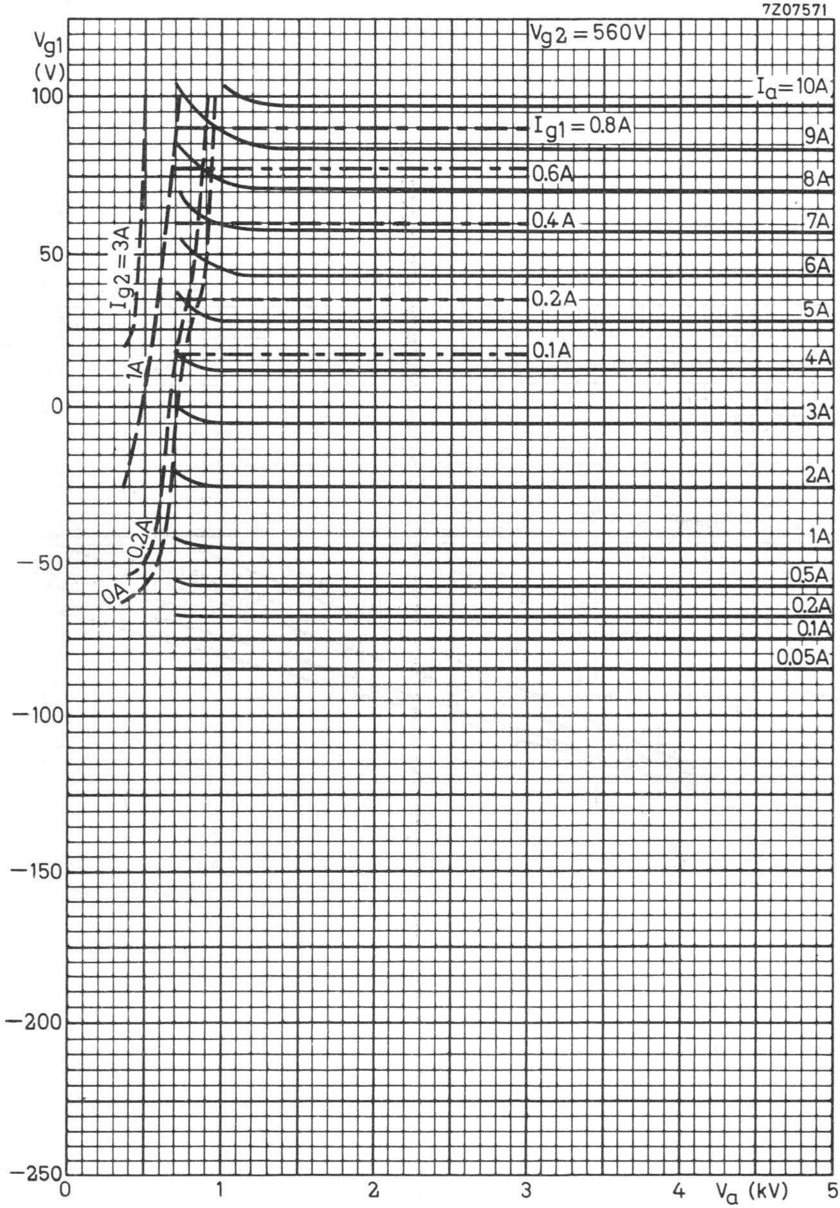
Frequency	f	up to	60	MHz
Anode voltage	V_a	max.	3.5	kV
Anode input power	W_{i_a}	max.	3.0	kW
Anode dissipation	W_a	max.	1.5	kW
Anode current	I_a	max.	1.0	A
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.2 dissipation	W_{ig_2}	max.	50	W
Grid No.2 current	I_{g_2}	max.	50	mA
	$-I_{g_2}$	max.	50	mA
Negative grid No.1 voltage	$-V_{g_1}$	max.	300	V
Grid No.1 current	I_{g_1}	max.	0	mA
Grid No.1 circuit resistance	R_{g_1}	max.	5	kΩ

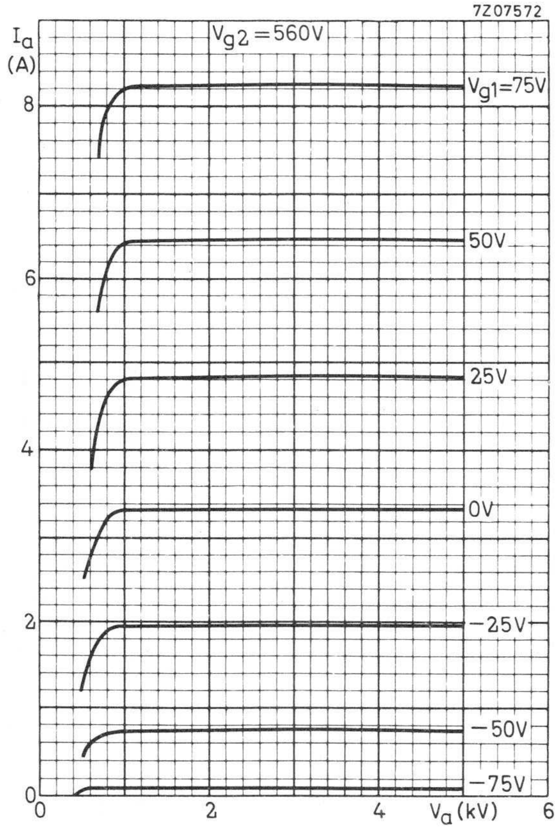
OPERATING CONDITIONS

Frequency	f		1 to 30		MHz
Anode voltage	V_a		3.0		kV
Grid No.2 voltage	V_{g_2}		560		V
Grid No.1 voltage	V_{g_1}		-55		V
		zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	0	48 (< 53)	46 (< 51)	V
Anode current	I_a	380	750	570	mA
Grid No.2 current	I_{g_2}	-5	-20	-15	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Grid No.1 resistor	R_{g_1}	2	2	2	kΩ
Driver output power	W_{dr}	0	< 5	< 5	W
Anode input power	W_{i_a}	1140	2250	1710	W
Anode dissipation	W_a	1140	1080	1100	W
Output power in load	W_ℓ	0	1050	–	W
PEP output power in load	W_ℓ	0	–	1050	W
Intermodulation distortion					
1 MHz. of the 3rd order	d_3	–	–	< -38	dB 2)
1 MHz. of the 5th order	d_5	–	–	< -38	dB 2)
30 MHz. of the 3rd order	d_3	–	–	< -36	dB 2)
30 MHz. of the 5th order	d_5			< -36	dB 2)

2) See page 3.


7Z04117–25.12.abhj
Δt_a
(°C)
300
200
100
0
t_a=max 250°C
Δt_a max at t_i=45°C
q=1000 l/min,p=8.9 mm H2O
1200 l/min,15.7 mmH2O
1550 l/min,25.4 mmH2O
2000 l/min,38.0 mm H2O
0
20
40
60
80
100
W_o (% of W_o max)


7Z07571
V_{g1} (V)
$V_{g2} = 560V$
$I_a = 10A$
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0.1A
0.05A
$I_{g1} = 0.8A$
0.6A
0.4 A
0.2A
0.1A
$I_{g2} = 3A$
1A
0.2A
0A
100
50
0
−50
−100
−150
−200
−250
0
1
2
3
4
5
V_a (kV)


7Z07572
I_a (A)
$V_{g2} = 560V$
$V_{g1}=75V$
50V
25V
0V
−25V
−50V
−75V
0
2
4
6
8
0
2
4
V_a (kV)
6

R.F. DOUBLE TETRODE

Single-ended double tetrode, indirectly heated, with novar base. Designed for mobile service as class C amplifier, oscillator or frequency multiplier up to 200 MHz. The tube is internally neutralised.

QUICK REFERENCE DATA			
	R.F. class C telegraphy or F.M. telephony	R.F. class C a-g_2 modulator	R.F. class C freq. tripler
	ICAS	ICAS	ICAS
Frequency f =	up to 200 MHz	up to 200 MHz	up to 200 MHz
Anode voltage V_a = max.	450 V	360 V	450 V
Anode dissipation W_a = max.	2 x 10 W	2 x 6.5 W	2 x 10 W
Frequency f =	175 MHz	175 MHz	58/174 MHz
Output power in load W_ℓ =	30 W	19 W	10 W

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

Heater voltage	V_f	=	6.75 V	13.5 V
Heater current	I_f	=	0.8 A	0.4 A
Pins			9-(4+5)	4-5

CAPACITANCES

Input capacitance, each system	C_i	=	6.2	pF
Output capacitance, each system	C_o	=	2.7	pF
Anode to grid No.1, each system	C_{ag_1}	<	0.1	pF
Input capacitance, push-pull connection	C_i	=	5.1	pF
Output capacitance, push-pull connection	C_o	=	1.5	pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	30	mA
Amplification factor	$\mu_{g_2 g_1}$	=	7.5	
Mutual conductance	S	=	3.3	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 225 °C

Pin seal temperature = max. 120 °C

COOLING: radiation and convection

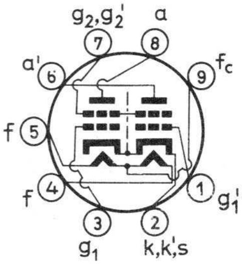
The use of a closed tube shield is not recommended

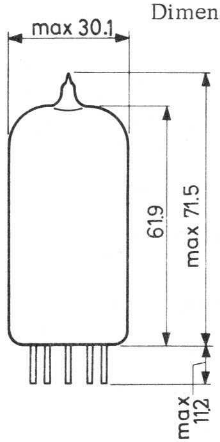
MECHANICAL DATA

Dimensions in mm

Base : Novar

Net weight: 28.5 g





Mounting position: any

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

LIMITING VALUES (Each system; absolute limits)

			CCS	ICAS	
Frequency	f		up to 200	up to 200	MHz
Anode voltage	V_a	=	max. 400	max. 450	V
Anode current	I_a	=	max. 45	max. 55	mA
Anode input power	W_{ia}	=	max. 18	max. 25	W
Anode dissipation	W_a	=	max. 7.5	max. 10	W
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 1	max. 1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	=	max. 3	max. 4	mA
Grid No.1 dissipation	W_{g_1}	=	max. 0.2	max. 0.2	W
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	ICAS	
Frequency	f	=	175	175	175	MHz
Anode voltage	V_a	=	400	400	450	V
Grid No.2 voltage	V_{g_2}	=	180	190	190	V
Grid No.1 voltage	V_{g_1}	=	-50	-50	-50	V
Grid No.1 resistor	R_{g_1}	=	31	28	26	kΩ
Anode current	I_a	=	2x45	2x55	2x55	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	3.8	5.0	4.5	mA
Grid No.1 current	I_{g_1}	=	2x0.8	2x0.9	2x0.95	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.68	0.95	0.85	W
Driving power	W_{dr}	=	1.0	1.1	1.2	W
Output power in the load	W_ℓ	=	21	26.5	30	W
Overall efficiency	η	=	58	60	61	%

R.F. CLASS C ANODE AND SCREEN GRID MODULATION. Grid No.3 modulated by a tertiary winding with a number of turns equal to 44% of that of the anode winding.

LIMITING VALUES (Each system; absolute limits)

			CCS		ICAS	
Frequency	f		up to 200		up to 200	MHz
Anode voltage	V_a	=	max. 320		max. 360	V
Anode current	I_a	=	max. 37.5		max. 46	mA
Anode input power	W_{ia}	=	max. 12		max. 16.5	W
Anode dissipation	W_a	=	max. 5.0		max. 6.5	W
Grid No.2 voltage	V_{g_2}	=	max. 200		max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 0.65		max. 0.65	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150		max. 150	V
Grid No.1 current	I_{g_1}	=	max. 3		max. 4	mA
Heater to cathode voltage	V_{kf}	=	max. 100		max. 100	V

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	320	360	V
Grid No.2 voltage	V_{g_2}	=	140	160	V
Grid No.1 voltage	V_{g_1}	=	−20	−25	V
Anode current	I_a	=	2x37.5	2x46	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	5.0	6.0	mA
Grid No.1 current	I_{g_1}	=	2x1.25	2x1.5	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.7	1.0	W
Driving power	W_{dr}	=	2.0	2.5	W
Output power in the load	W_ℓ	=	13.5	19	W [1]
Overall efficiency	η	=	56	57	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	12.5	17	W

[1] Measured in a circuit having an efficiency of 80%.

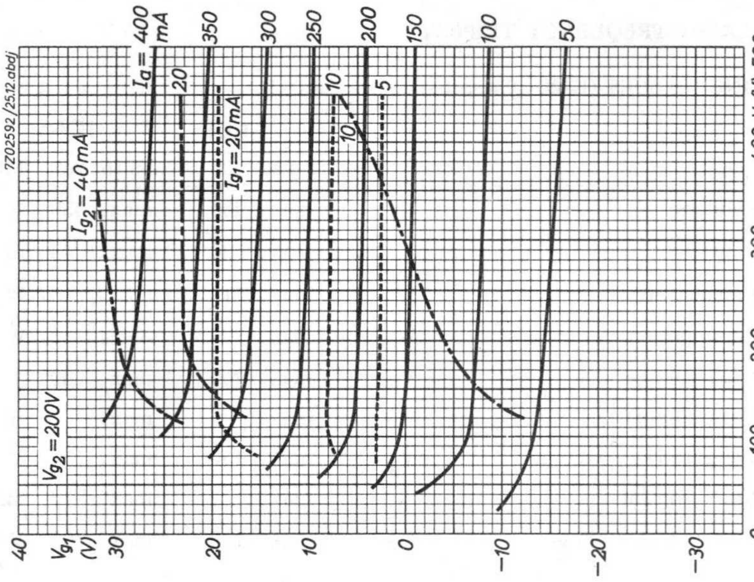
R.F. CLASS C FREQUENCY TRIPLER

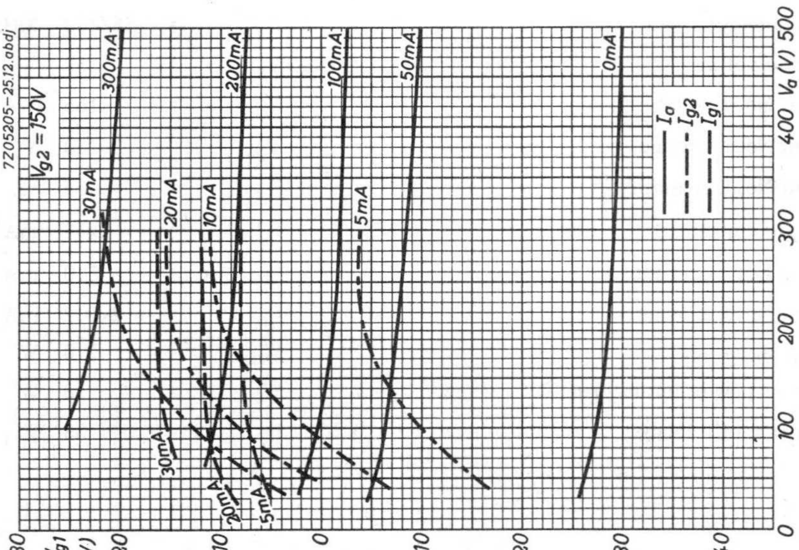
LIMITING VALUES (Each system; absolute limits)

			CCS	ICAS	
Frequency	f		up to 200	up to 200	MHz
Anode voltage	V_a	=	max. 400	max. 450	V
Anode current	I_a	=	max. 30	max. 44	mA
Anode input power	W_{ia}	=	max. 11	max. 15	W
Anode dissipation	W_a	=	max. 7.5	max. 10	W
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 1	max. 1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	=	max. 2	max. 3	mA
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS ; two systems in push-pull

			ICAS	
Frequency	f	=	58/174	MHz
Anode voltage	V_a	=	350	V
Grid No.2 voltage	V_{g_2}	=	165	V
Grid No.1 voltage	V_{g_1}	=	-150	V
Grid No.1 resistor	R_{g_1}	=	34	kΩ
Anode current	I_a	=	2x43	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	5.0	mA
Grid No.1 current	I_{g_1}	=	2x2.2	mA
Driving power	W_{dr}	=	2.0	W
Output power in the load	W_ℓ	=	10	W
Overall efficiency	η	=	33	%


7Z02592/25.12.abdj
V_{g2}=200V
I_a= 400 mA
350
300
250
200
150
100
50
I_{g2}=40mA
20
10
5
I_{g1}=20mA
10
V_{g1} (V)
V_a(V)


7Z05205-25.12.abdj
V_{g2}=150V
300mA
200mA
100mA
50mA
0mA
30mA
20mA
10mA
5mA
I_a
I_{g2}
I_{g1}
V_{g1} (V)
V_a (V)

R.F. BEAM POWER TETRODE

Indirectly heated beam power tetrode designed for use as R.F. power amplifier, oscillator, frequency multiplier and A.F. amplifier or modulator for fixed or mobile equipment.

QUICK REFERENCE DATA			
Freq. (MHz)	R.F. class C telegraphy		
	V_a (V)	W_o (W) CCS	W_o (W) ICAS
75	550	52	
	600		58.5
175	400	38	
	450	38	
	500		46
250	400		32

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

Heater voltage	V_f	=	6.75 V	13.5 V
Heater current	I_f	=	1.2 A	0.6 A
Pins			3–(6+7)	6-7

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g1}	=	11.5 pF
Anode to all other elements except grid No.1	C_a	=	5.0 pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	80 mA
Amplification factor	μ_{g2g1}	=	8
Mutual conductance	S	=	7 mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250 °C
Seal temperature	=	max. 230 °C

MECHANICAL DATA

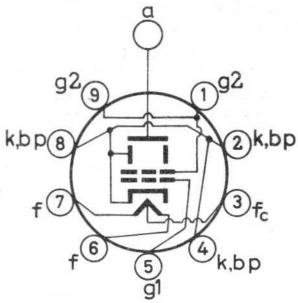
Dimensions in mm

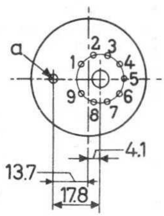
Base : Magnoval

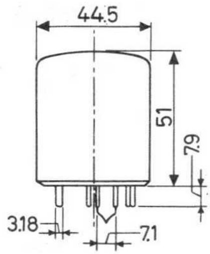
The anode pin is brought out through the base separated from the magnoval pin circle for convenient under-chassis circuitry.

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_{g_2}	=	max. 300	max. 300	V
Grid No.2 input power	W_{ig_2}	=	max. 4	max. 4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200	max. 200	V
Grid No.1 circuit resistance					
with fixed bias	R_{g_1}	=	max. 50	max. 50	kΩ
with automatic bias	R_{g_1}	=	max. 100	max. 100	kΩ
Cathode current	I_k	=	max. 165	max. 165	mA
Heater to cathode voltage (any polarity)	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS **CCS** Continuous service

Frequency	f	=	75	175	175	MHz
Anode voltage	V_a	=	550	450	400	V
Grid No.2 voltage	V_{g_2}	=	235	250	230	V
Grid No.1 voltage	V_{g_1}	=	-50	-55	-51	V
Grid No.1 resistor	R_{g_1}	=	10	21	11	kΩ
Anode current	I_a	=	136	134	150	mA
Grid No.2 current	I_{g_2}	=	11	11	10	mA
Grid No.1 current	I_{g_1}	=	5.0	2.6	4.6	mA
Driving power	W_{dr}	=	0.5	1.5	1.5	W
Anode input power	W_{ia}	=	75	60	60	W
Output power in the load	W_{ℓ}	=	52	38	38	W
Overall efficiency	η	=	69	63.5	63.5	%

R.F. AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY

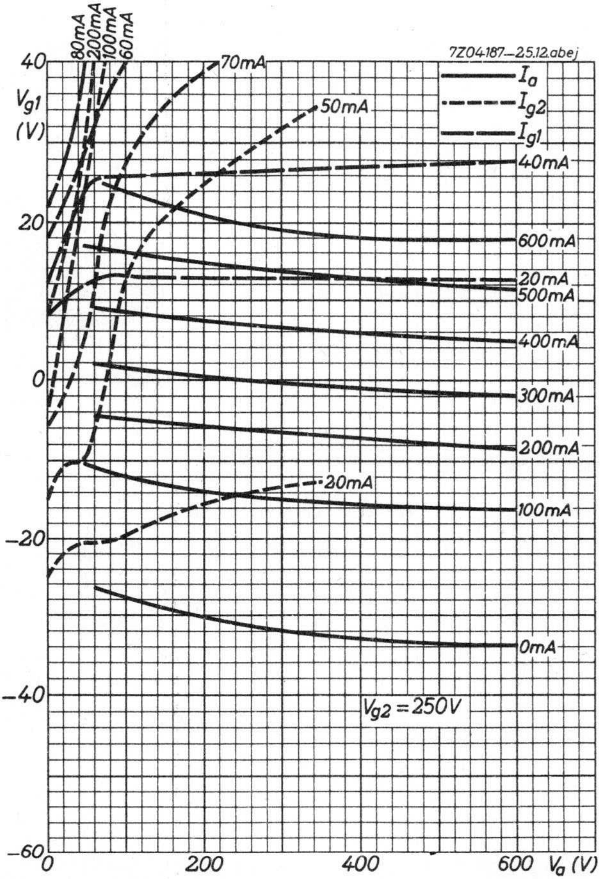
ICAS Intermittent service

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	175	250	MHz
Anode voltage	V_a	=	max. 600	500	400	V
Anode current	I_a	=	max. 150	150	150	mA
Anode input power	W_{ia}	=	max. 90	75	60	W
Anode dissipation	W_a	=	max. 30	30	30	W
Grid No.2 voltage	V_{g_2}	=	max. 300	300	300	V
Grid No.2 input power	W_{ig_2}	=	max. 4	4	4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200	200	200	V
Grid No.1 circuit resistance						
with fixed bias	R_{g_1}	=	max. 50	50	50	kΩ
with automatic bias	R_{g_1}	=	max. 100	100	100	kΩ
Cathode current	I_k	=	max. 165	165	165	mA
Heater to cathode voltage (any polarity)	V_{kf}	=	max. 100	100	100	V

OPERATING CONDITIONS **ICAS** Intermittent service

Frequency	f	=	75	175	250	MHz
Anode voltage	V_a	=	600	500	400	V
Grid No.2 voltage	V_{g_2}	=	255	225	235	V
Grid No.1 voltage	V_{g_1}	=	-50	-55	-54	V
Grid No.1 resistor	R_{g_1}	=	10	11	11	kΩ
Anode current	I_a	=	150	150	150	mA
Grid No.2 current	I_{g_2}	=	10	10	4	mA
Grid No.1 current	I_{g_1}	=	5.0	5.0	4.9	mA
Driving power	W_{dr}	=	0.7	1.5	2.0	W
Anode input power	W_{ia}	=	90	75	60	W
Output power in the load	W_ℓ	=	58.5	46	32	W
Overall efficiency	η	=	65	61.5	53.5	%


7Z04187–2.5.12.abej
V_{g1} (V)
40
20
0
−20
−40
−60
0
200
400
600
V_a (V)
I_a
I_{g2}
I_{g1}
80mA
200mA
100mA
60mA
70mA
50mA
40mA
600mA
20mA
500mA
400mA
300mA
200mA
20mA
100mA
0mA
V_{g2} = 250V

R.F. BEAM POWER TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	19	V
Heater current	I_f	=	2.3	A

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

HEATSINK COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA		
Frequency (MHz)	Class C telegraphy	
	V_a (V)	W_o (W)
175	2000	270
470	800	100

HEATING: indirect by AC or DC; cathode oxide coated

Heater voltage	V_f	=	6.0	V
Heater current	I_f	=	2.6	A
Waiting time	T_w	= min.	30	sec

At frequencies between 400 MHz and 500 MHz the heater voltage should be reduced to 5.0 V.

CAPACITANCES

Anode to all except grid No.1	C_a	=	4.5	pF
Grid No.1 to all except anode	C_{g_1}	=	15.7	pF
Anode to grid No.1	C_{ag_1}	=	0.03	pF

TYPICAL CHARACTERISTICS

Anode and grid No.2 voltage (interconnected)	$V_a = V_{g_2}$	=	300	V
Cathode current	I_k	=	50	mA
Amplification factor	$\mu_{g_2g_1}$	=	5.2	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	t_s	= max.	250	^{o}C

COOLING DATA

Thermal contact area		=	3.2	cm^2
Thermal resistance from seal to thermal contact area	R_{th}	=	0.03	^{o}C/W

See also operating notes

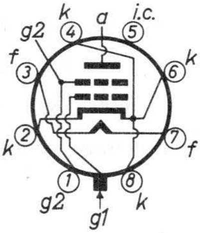
MECHANICAL DATA

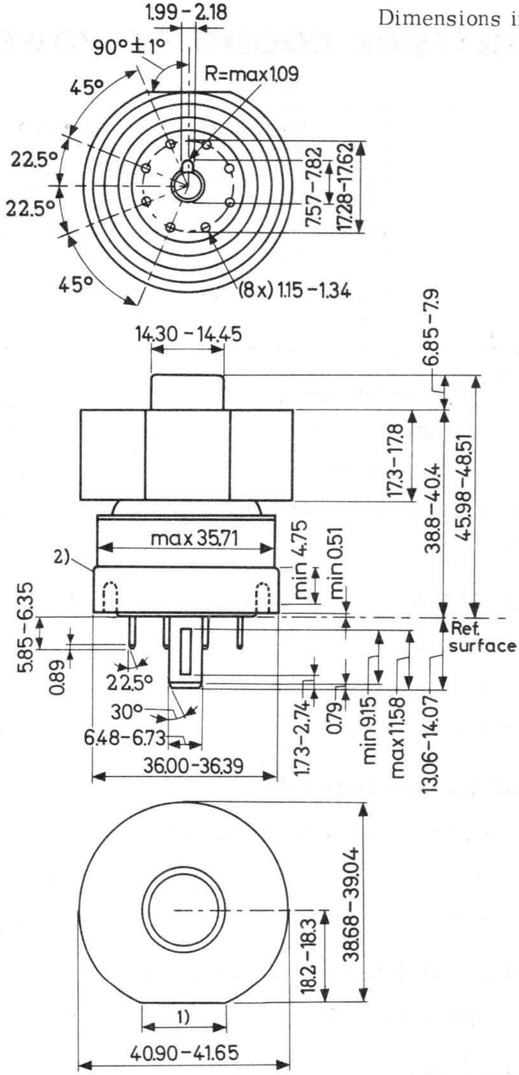
Dimensions in mm

Net weight: 230 g

Accessories

Socket 40739





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 1)	MHz
Anode voltage	V_a	=	2000	800	V
Grid No.2 voltage	V_{g_2}	=	200	2)	V
Grid No.1 voltage	V_{g_1}	=	-90	-60	V
Anode current	I_a	=	250	250	mA
Grid No.2 current	I_{g_2}	=	8	-4 to +10	mA
Grid No.1 current	I_{g_1}	=	16	3	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	=	112	2)	V
Driving power	W_{dr}	=	4	11	W
Anode input power	W_{i_a}	=	400	200	W
Output power	W_o	=	270	100	W
Efficiency	η	=	67.5	50	%

1) V_f should be reduced to 5.0 V at f = 470 MHz

2) To be adjusted for operating conditions

OPERATING NOTES

Heatsink or conduction cooling

Through the properties of beryllia (beryllium oxide), it is possible to remove heat directly from the anode of a tube to a safe point or "sink" while still maintaining the electrical insulation between the anode and the "sink", which is usually grounded. The path between the anode of the tube and the point of dissipation is known as a thermal system. This includes the anode of the tube, the beryllia insulating material, and the heatsink, plus all thermal compounds used to reduce the heat resistance between these parts. Consequently it is evident that a conduction cooled tube does not have an anode dissipation rating by itself. Only the entire thermal system has a dissipation rating. The purpose of this note is to assist in the understanding of the thermodynamics involved in a system of this type.

Thermal considerations

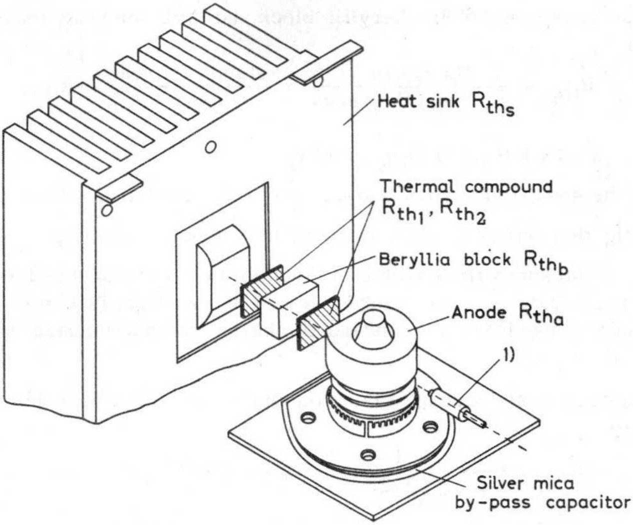
Page A shows a set of curves relating anode dissipation and ambient temperature to the maximum thermal resistance that will permit operation within the maximum allowable seal temperature. It is assumed that the equipment designer knows the anode power that must be dissipated (from circuit efficiencies) and the maximum ambient temperature in which his equipment must function. The problem is simply to devise a thermal circuit whose total thermal resistance is not more than that allowed. In order to determine the maximum thermal resistance of the system, the following equation may be used:

$$R_{th\ max} = \frac{t_{s\ max} - t_{amb}}{W_d} \qquad (1)$$

where $t_{s\ max}$ = max. seal temperature (^{o}C)
t_{amb} = ambient temperature (^{o}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 ^{o}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 ^{o}C and a maximum allowable seal temperature of 250 ^{o}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 $^{o}C/W$.



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:

$$R_{th_a} + R_{th_1} + R_{th_b} + R_{th_2} + R_{th_s} \leqq R_{th_{max}} \qquad (2)$$

1) In order to assure a good thermal connection to the heat sink, it is necessary to apply a force of approximately 11.5 kg to the side of the tube opposite the heat sink. The method shown uses a small ceramic cylinder to apply this pressure while maintaining the high voltage insulation necessary for proper operation.

The thermal resistance of the beryllia block and the compounds may be calculated from

$$R_{th_x} = \frac{\text{thickness}}{\text{standard thickness}} \times \frac{\text{standard area}}{\text{area}} \times R_{th} \qquad (3)$$

where R_{th_x} is either R_{th_b} or R_{th_1} or R_{th_2}

and R_{th} is the specific thermal resistance of the material involved.

The specific thermal resistance of a number of materials is given in table 1.

The standard thickness in this table is taken as 1 cm for cubes and as 0.001 cm for films; the standard area for cubes as well as for films is 1 cm^2. The same values should be used for the standard thickness and the standard area in formula (3).

For the thermal resistance of a beryllia block of 3.2 cm^2 x 4.45 cm is found in this way:

$$R_{th_b} = \frac{4.45}{1} \times \frac{1}{3.2} \times 0.635 = 0.88\ ^oC/W.$$

The value of R_{th_a} is given in the data sheets as 0.03 $^oC/W$.

Assuming a value of 0.2 $^oC/W$ for the sum of R_{th_1} and R_{th_2} and the previous found value of 2.0 $^oC/W$ for $R_{th_{max}}$, equation (2) yields:

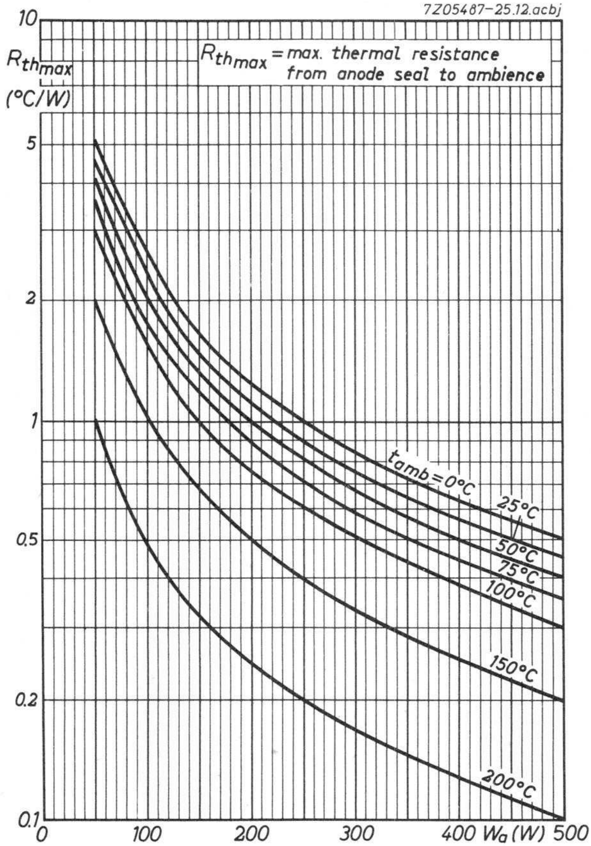
$$0.03 + 0.2 + 0.88 + R_{th_s} \leqq 2.0$$

thus leaving for R_{th_s} a value of max. 0.89 $^oC/W$.

With this figure a convenient heat sink can be selected from standard heat sink catalogues.

Table 1. Approximate thermal resistance R_{th} of typical materials

Films 0.001 cm x 1 cm^2		Cubes 1 cm x 1 cm^2	
Item	$^oC/W$	Item	$^oC/W$
Wakefield	0.127	Copper	0.28
Mica	0.254	Aluminium	0.51
Silicone	0.51	Beryllia	0.635
Mylar	0.61	Brass	0.89
Air (still)	3.1	Molybdenum	1.02
		Alumina	3.56


7Z05487-25.12.acbj
$R_{th_{max}}$ = max. thermal resistance from anode seal to ambience
$R_{th_{max}}$ (°C/W)
10
5
2
1
0.5
0.2
0.1
0
100
200
300
400
W_a (W)
500
t_{amb} = 0°C
25°C
50°C
75°C
100°C
150°C
200°C

FORCED AIR COOLED R.F. POWER TETRODE

Forced air cooled R.F. power tetrode in coaxial construction mainly intended for 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		
220			7	15

HEATING : Direct; filament thoriated tungsten, mesh type

Filament voltage	V_f	7	V ±5%
Filament current	I_f	127	A
Filament surge current	I_{f_p}	max. 500	A
Cold filament resistance	R_{f_o}	0.006	Ω

CAPACITANCES

	(grounded cathode)			(grounded grid)		
Input	$C_{g_1(a)}$	170	pF	$C_{f(a)}$	80	pF
Output	$C_{a(g_1)}$	34	pF	$C_{a(f)}$	34.9	pF
Anode to grid No.1	C_{ag_1}	1	pF			
Anode to filament				C_{af}	0.12	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6	kV
Grid No.2 voltage	V_{g_2}	1.35	kV
Anode current	I_a	1.3	A
Transconductance	S	27	mA/V
Amplification factor	$\mu_{g_2g_1}$	5.5	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max. 240	°C
Recommended envelope temperature	t_{env}	≤ 200	°C
Absolute max. anode core temperature (measured in the reference plane for temperature measurement. See outline drawing)	t_a	max. 240	°C

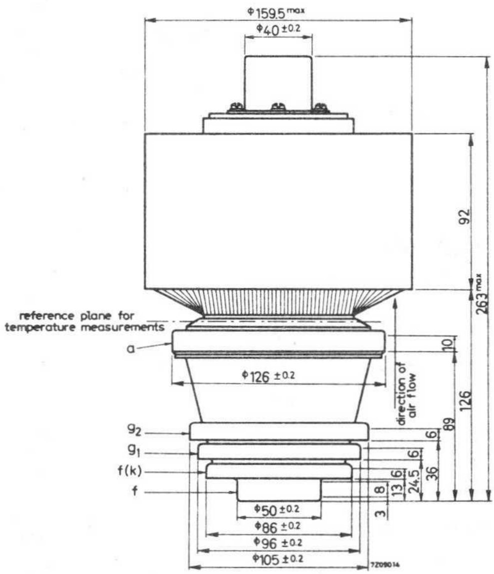
AIR COOLING CHARACTERISTICS See also the cooling curves on page 7

W_a (kW)	h (m)	t_i max. (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
5.5	0	35	5.0	16
	1500	35	5.9	16
	3000	25	5.7	16
8	0	35	7.7	35
	1500	35	9.0	40
	3000	25	9.0	36
10	0	35	11	65
	1500	35	13	75
	3000	25	13	66

MECHANICAL DATA Dimensions in mm

Net weight: approx. 7.5 kg

Mounting position: Vertical with anode up or down



ACCESSORIES

Socket	type 40699
Insulating pedestal	type 40654
Chimney	type 40683

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 [1]
Efficiency, total	η	56	%

[1] 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_{g_2}	max.	1.5	kV
Grid No.1 voltage	$-V_{g_1}$	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_{g_2}	max.	400	W

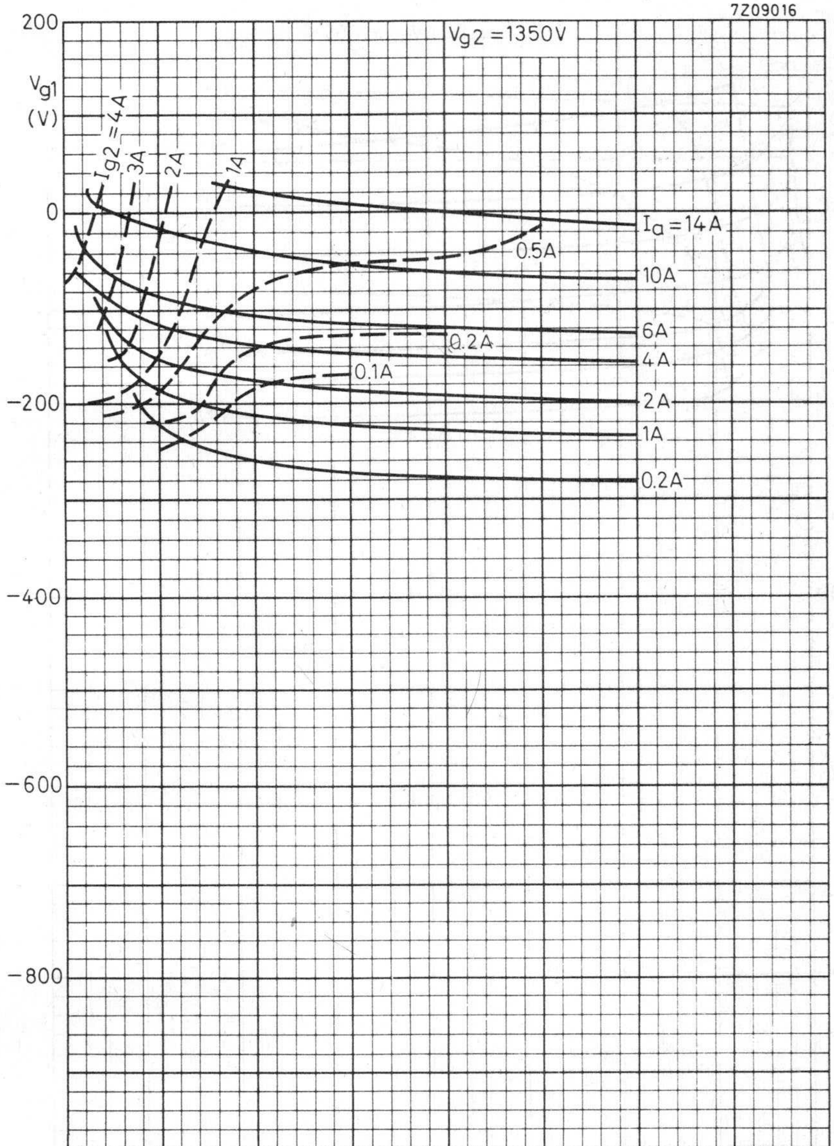
OPERATING CONDITIONS

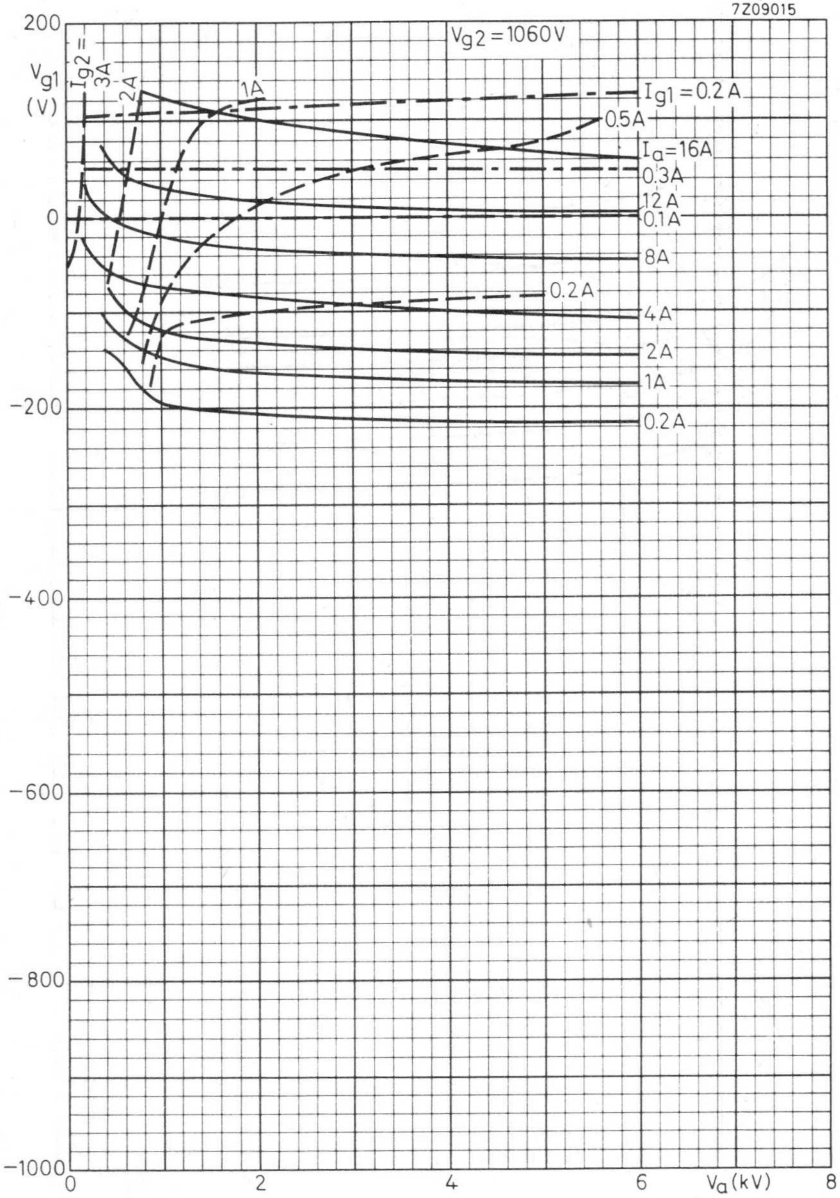
Frequency	f		10		MHz
Anode voltage	V_a		6		kV
Grid No.2 voltage	V_{g_2}		1350		V
Grid No.1 voltage	V_{g_1}		-202		V 1)
Grid No.1 resistor	R_{g_1}		3		kΩ
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	185	185	V
Anode current	I_a	1.3	3.5	2.4	A
Grid No.2 current	I_{g_2}	0	250	91	mA
Grid No.1 current	I_{g_1}	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_{g_2}	-	340	120	W
Output power in load (P.E.P.)	W_ℓ	-	10.8	10.8	kW 2)
Efficiency, total	η	-	51.5	38.5	%
Intermodulation distortion					
3d order	d_3	-	-	-38	dB 3)
5th order	d_5	-	-	-45	dB 3)

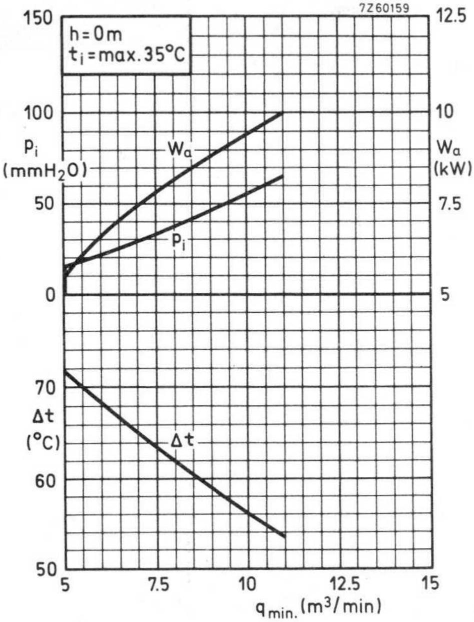
1) To be adjusted for I_a zero signal.

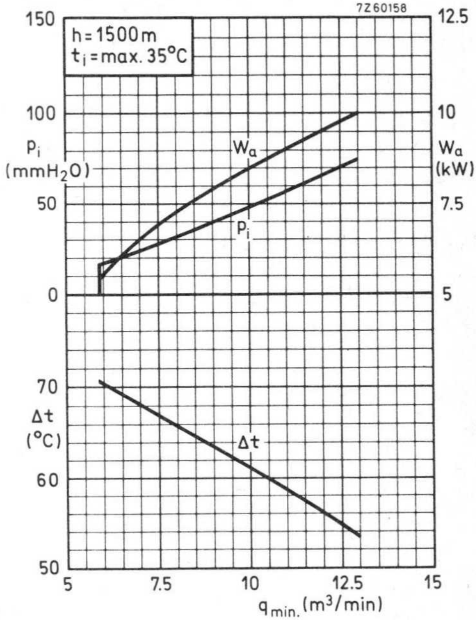
2) Measured in a circuit having an efficiency of approx. 90%.

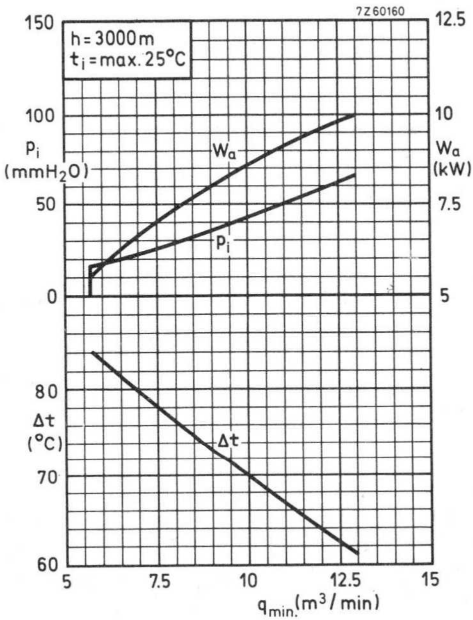
3) Maximum encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two tones at that level.


7Z09016
V_{g2} = 1350V
200
0
−200
−400
−600
−800
−1000
V_{g1}
(V)
I_{g2} = 4A
3A
2A
1A
I_a = 14A
10A
6A
4A
2A
1A
0.2A
0.5A
0.2A
0.1A
0
2
4
6
8
V_a (kV)


7Z09015
200
0
-200
-400
-600
-800
-1000
V_{g1} (V)
V_{g2} = 1060 V
I_{g2} = 3A
2A
1A
I_{g1} = 0.2 A
0.5A
I_a=16A
0.3A
12 A
0.1A
8A
0.2A
4A
2A
1A
0.2A
0
2
4
6
8
V_a (kV)


7Z60159
h = 0 m
t_i = max. 35°C
150
100
50
0
p_i
(mmH$_2$O)
12.5
10
7.5
5
W_a
(kW)
70
60
50
Δt
(°C)
5
7.5
10
12.5
15
$q_{min.}$ (m^3/min)


7Z60158
h = 1500 m
t_i = max. 35°C
150
100
50
0
p_i
(mmH$_2$O)
12.5
10
7.5
5
W_a
(kW)
70
60
50
Δt
(°C)
5
7.5
10
12.5
15
$q_{min.}$ (m^3/min)


7Z60160
h = 3000 m
t_i = max. 25°C
150
100
50
0
p_i
(mmH$_2$O)
12.5
10
7.5
5
W_a
(kW)
80
70
60
Δt
(°C)
5
7.5
10
12.5
15
$q_{min.}$ (m^3/min)

AIR COOLED R.F. POWER TETRODE

Forced air cooled beam power tetrode in ceramic-metal construction intended for use in Class AB audio or R.F. amplifier service.

QUICK REFERENCE DATA				
Freq. (MHz)	S.S.B.		AB Mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W) [1]
30	2200	318		
A.F.			2200	770
			1000	190

HEATING: indirect; oxide coated cathode

Heater voltage	V_f		6.0	V
Heater current	I_f		3.2	A
Waiting time	T_w	min.	30	s

CAPACITANCES

Grounded cathode

Grid No.1 to all except anode	$C_{g_1(a)}$	24.2	pF
Anode to all except grid No.1	$C_{a(g_1)}$	5.5	pF
Anode to grid No.1	C_{ag_1}	0.05	pF

Grounded grid

Input	$C_{kf/(a)}$	19.9	pF
Output	$C_{a(kf)}$	5.5	pF
Anode to cathode	$C_{a/kf}$	0.01	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2200	V
Grid No.2 voltage	V_{g_2}	400	V
Anode current	I_a	150	mA
Transconductance	S	22	mA/V
Amplification factor	μ_{g2g1}	13	

TEMPERATURE LIMITS (Absolute max. rating system)

Temperature of all seals	t_s	max.	250	°C
Temperature of anode core	t_a	max.	250	°C

[1]) Two tubes

COOLING: Forced air

Above dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a (W)	h (m)	t_i (°C)	q min. (m^3/min.)	P_i (mm H_2O)
250	0	50	0.15	15.5
300	0	50	0.19	23
350	0	50	0.22	31
250	3000	50	0.22	22
300	3000	50	0.27	32
350	3000	50	0.34	48

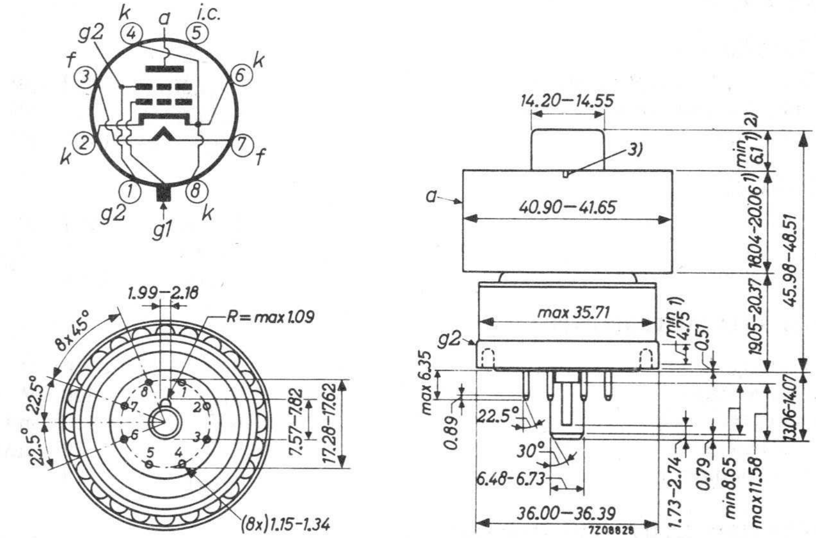
ACCESSORIES

Air system socket 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_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	8	W
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Grid No.1 current	I_{g_1}	max.	2	mA
Cathode to heater voltage, peak	V_{kfp}	max.	150	V

OPERATING CONDITIONS two tubes in push-pull

Anode voltage	V_a	1000		1500		2200		V
Grid No.2 voltage	V_{g_2}	400		400		400		V
Grid No.1 voltage	V_{g_1}	-27		-27		-27		V [1]
Load resistance	R_{aa}	2600		5000		7800		Ω
Driving voltage, peak	$V_{g_{1p}}$	0	21	0	21	0	50	V
Anode current	I_a	2x100	2x260	2x100	2x265	2x100	2x290	mA
Grid No.2 current	I_{g_2}	-	2x -4	-	2x -5	-	2x -3	mA
Driving power	W_{dr}	-	0	-	0	-	0	
Anode input power	W_{ia}	2x100	2x260	2x150	2x400	2x220	2x640	W
Output power	W_o	0	190	0	400	0	770	W

[1]) To be adjusted for zero signal anode current.

R.F. SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	175	MHz
Anode voltage	V_a	max.	2500	V
Anode current	I_a	max.	300	mA
Anode dissipation	W_a	max.	350	W
Grid No.2 voltage	V_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	8	W
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Grid No.1 current	I_{g_1}	max.	2	mA
Cathode to heater voltage, peak	V_{kfp}	max.	150	V

OPERATING CONDITIONS

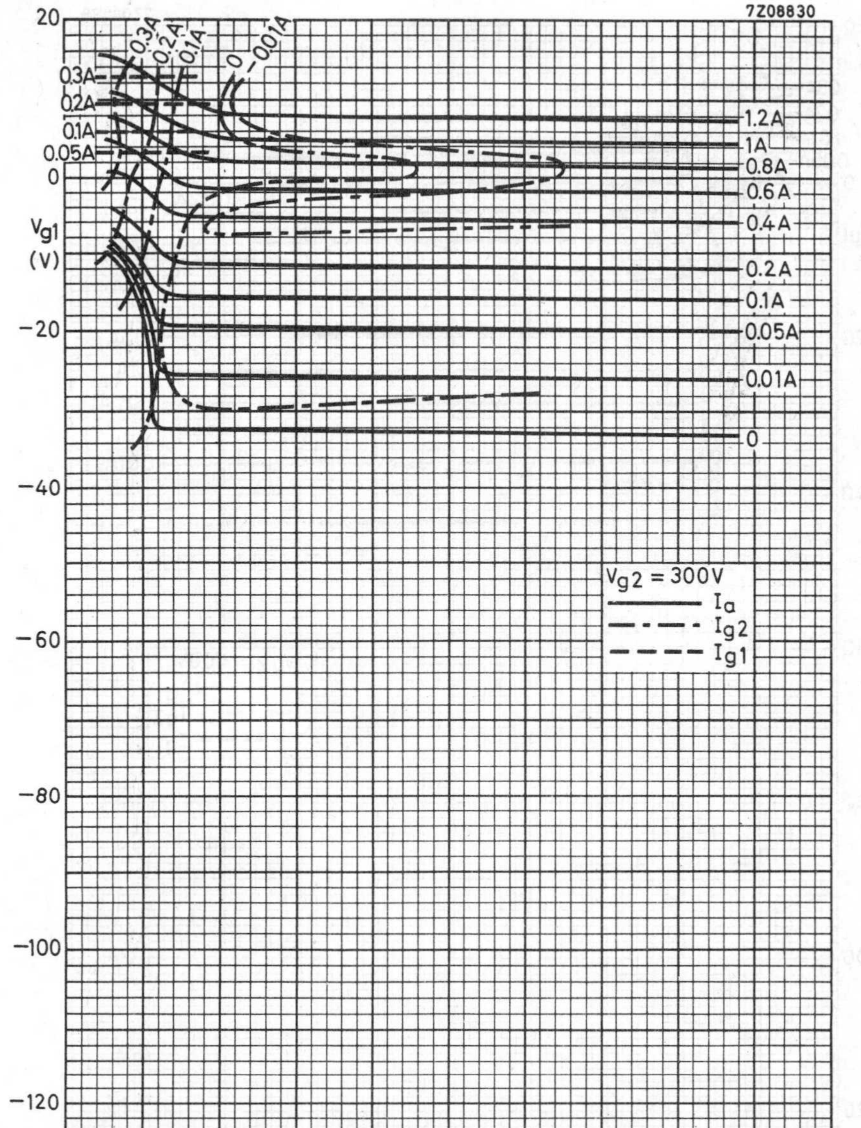
Frequency	f	30	MHz
Anode voltage	V_a	2200	V
Grid No.2 voltage	V_{g2}	300	V
Grid No.1 voltage	V_{g_1}	-20	V [1]
Load resistance	$R_{a\sim}$	6000	Ω

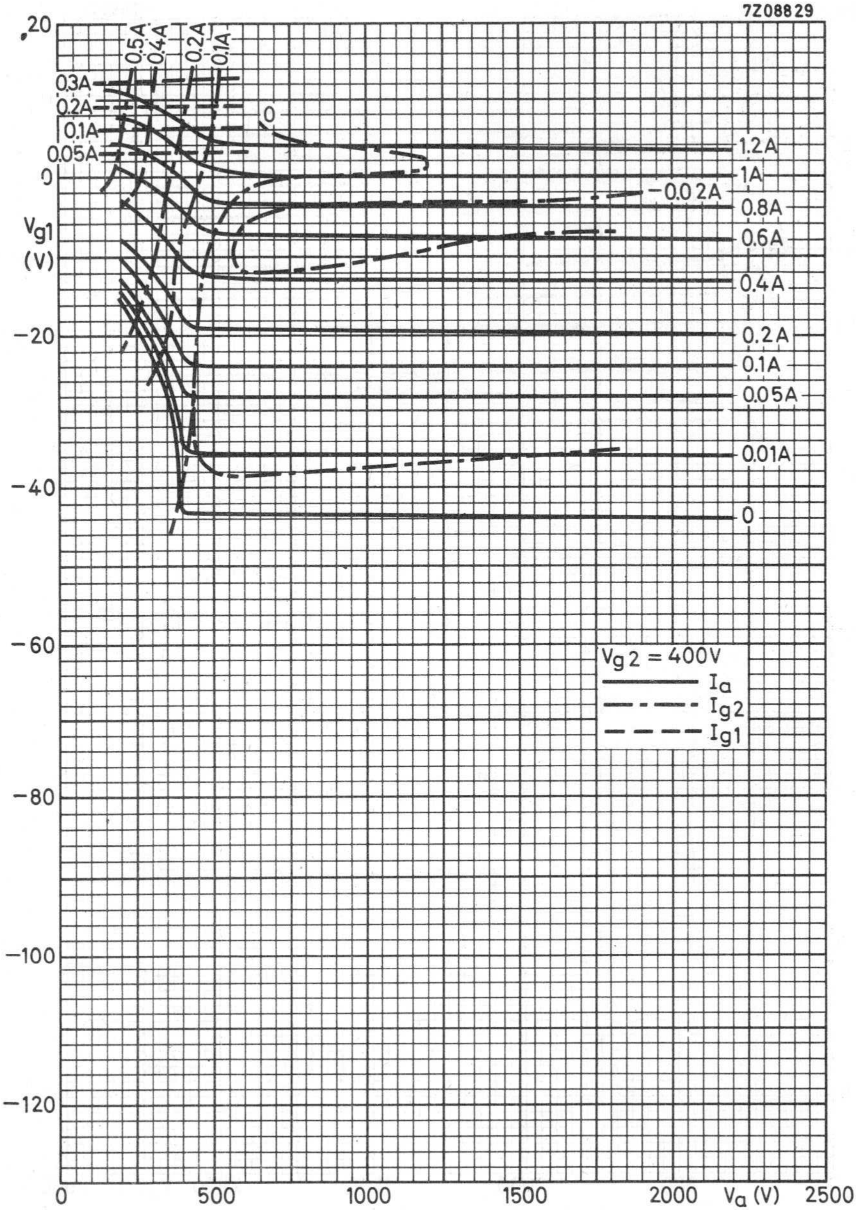
		zero signal	single tone	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	18	18	V
Anode current	I_a	100	215	167	mA
Grid No.2 current	I_{g_2}	-	-2.5	-6	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	220	473	430	W
Output power in the load	W_{ℓ}(PEP)	0	318	318	W [2]
Intermodulation distortion					
of the 3d order	d_3			29	dB [3]
of the 5th order	d_5			30	dB [3]

[1]) To be adjusted for zero signal anode current.

[2]) Measured in a typical circuit having an efficiency of 85%.

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


7Z08830
0.3A
0.2A
0.1A
0.01A
0
0.05A
1.2A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0.05A
0.01A
0
Vg1 (V)
20
0
−20
−40
−60
−80
−100
−120
0
500
1000
1500
2000
Va (V)
2500
Vg2 = 300V
Ia
Ig2
Ig1


7Z08829
20
0
-20
-40
-60
-80
-100
-120
V_{g1} (V)
0.5A
0.4A
0.2A
0.1A
0.3A
0.2A
0.1A
0.05A
0
1.2A
1A
0.02A
0.8A
0.6A
0.4A
0.2A
0.1A
0.05A
0.01A
0
V_{g2} = 400V
I_a
I_{g2}
I_{g1}
0
500
1000
1500
2000
V_a (V)
2500

AIR COOLED R.F. POWER TETRODE

Forced air cooled beam power tetrode in ceramic-metal construction intended for use in Class AB audio or R.F. amplifier service.

HEATING: Indirect; oxide coated cathode

Heater voltage	V_f		26.5	V
Heater current	I_f		730	mA
Waiting time	T_w	min.	30	s

For further data please refer to type YL1340

R.F. DOUBLE TETRODE

HEATING: Indirect; cathode oxide-coated

Heater voltage	V_f	=	13.5	V
Heater current	I_f	=	280	mA
Pin connections			1 - 8	

For further data and curves of this type
please refer to type QQE04/5

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. power amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

QUICK REFERENCE DATA

C telegr.				C_{ag_2} mod.			Class AB SSB			
Freq. (MHz)	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS	Freq. (MHz)	V_a (V)	W_o PEP (W) CCS	W_o PEP (W) ICAS
60	750		85	600		62	30	750		61
60	600	63		475	42		30	600	49	
175	400		40							
175	320	29								

A.F. class AB 1)2)			A.F. class AB 1)3)		
V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
750		124	750		150
600	96		600	110	130
			500	100	

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

Heater voltage	V_f		6.3	V
Heater current at V_f = 6.3 V	I_f		1.125	A
Cathode heating time	T_h	min.	60	s

See "Special performance data" for heater operation in stationary and mobile equipment.

1) Two tubes
2) Without grid current
3) With grid current

CAPACITANCES

Grid No.1 to all except anode	$C_{g1(a)}$	13.0	pF
Anode to all except grid No.1	$C_{a(g1)}$	8.5	pF
Anode to grid No.1	C_{ag1}	< 0.22	pF

TYPICAL CHARACTERISTICS

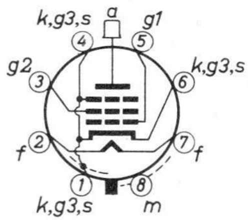
Anode voltage	V_a	200	V
Grid No.2 voltage	V_{g2}	200	V
Anode current	I_a	100	mA
Transconductance	S	7	mA/V
Amplification factor	μ_{g2g1}	4.5	-

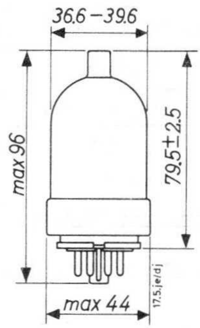
MECHANICAL DATA Dimensions in mm

Base: octal 8 pin

Socket: 2422 501 03001

Net weight: 65 g





Mounting position: any

TEMPERATURE LIMIT (Absolute limit)

Bulb temperature t_{bulb} max. 260 ^{o}C

R.F. CLASS C TELEGRAPHY AND FM TELEPHONY

LIMITING VALUES (Absolute max. rating system)
(For maximum anode voltage and maximum anode input power at f > 60 MHz see page 18).

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	max. 600	max. 750	V
Anode input power	W_{i_a}	max. 90	max. 120	W
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1]

OPERATING CONDITIONS

Frequency	f	up to 60		MHz
Anode voltage	V_a	600	750	V
Grid No.2 voltage	V_{g_2}	200	200	V [2]
Grid No.1 voltage	V_{g_1}	-70	-77	V [3]
Grid No.1 resistor	R_{g_1}	24	28	kΩ
Grid No.1 current	I_{g_1}	2.8	2.7	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	90	95	V
Driving power	W_{dr}	0.3	0.3	W
Anode current	I_a	150	160	mA
Grid No.2 current	I_{g_2}	10	10	mA
Anode input power	W_{i_a}	90	120	W
Anode dissipation	W_a	27	35	W
Output power	W_o	63	85	W
Efficiency	η	70	71	%

Notes see page 11

R.F. CLASS C TELEGRAPHY AND FM TELEPHONY

OPERATING CONDITIONS (continued)

Frequency	f	up to	175	MHz
Anode voltage	V_a	320	400	V
Grid No.2 voltage	V_{g2}	210	220	V 2)
Grid No.1 voltage	V_{g1}	-52	-55	V 3)
Grid No.1 resistor	R_{g1}	26	30	kΩ
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	η	53	56	%

Notes see page 11

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute max. rating system)
(For maximum anode voltage and maximum anode input power at f > 60 MHz see page 18)

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	max. 480	max. 600	V
Anode input power	W_{i_a}	max. 60	max. 85	W
Anode dissipation	W_a	max. 18	max. 23	W
Anode current	I_a	max. 145	max. 180	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 2	max. 2	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1]

OPERATING CONDITIONS

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	475	600	V
Grid No.2 voltage	V_{g_2}	165	175	V [4]
Grid No.1 voltage	V_{g_1}	-86	-92	V [3]
Grid No.1 resistor	R_{g_1}	26	27	kΩ
Grid No.1 current	I_{g_1}	3.3	3.4	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	106	114	V
Driving power	W_{dr}	0.4	0.5	W
Anode current	I_a	125	140	mA
Anode input power	W_{i_a}	60	84	W
Anode dissipation	W_a	18	22	W
Output power	W_o	42	62	W
Efficiency	η	70	74	%
Modulation factor	m	100	100	%
Modulation power	W_{mod}	25	37	W

Notes see page 11

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

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Frequency	f	up to 30		MHz
Anode voltage	V_a	max. 600	max. 750	V
Anode input power	W_{i_a}	max. 90	max. 126	W
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance (fixed bias)	R_{g_1}	max. 30	max.' 30	kΩ

OPERATING CONDITIONS

			C.C.S.		
Frequency	f		30		MHz
Anode voltage	V_a		600		V
Grid No.2 voltage	V_{g_2}		200		V 5)
Grid No.1 voltage	V_{g_1}		-47		V 5)
		zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	V_{g1_p}	0	47	47	V
Anode current	I_a	24	125	86	mA
Grid No.2 current	I_{g_2}		7.4	5	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	14.4	75	51.5	W
Anode dissipation	W_a	14.4	26	27	W
Output power (PEP)	W_o	-	49	49	W
Efficiency	η	-	65.5	47.5	%
Intermodulation distortion					
of the 3rd order	d_3			24.5	dB 6)
of the 5th order	d_5			30	dB 6)

Notes see page 11

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

OPERATING CONDITIONS (continued)

			I.C.A.S.		
Frequency	f		30		MHz
Anode voltage	V_a		750		V
Grid No.2 voltage	V_{g_2}		200		V [5]
Grid No.1 voltage	V_{g_1}		-48		V [5]
		zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	48	48	V
Anode current	I_a	25	125	86	mA
Grid No.2 current	I_{g_2}		6.3	3.9	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	18.8	94	64.5	W
Anode dissipation	W_a	18.8	33	34	W
Output power (PEP)	W_o	-	61	61	W
Efficiency	η	-	65	47	%
Intermodulation distortion					
of the 3rd order	d_3			26	dB [6]
of the 5th order	d_5			31	dB [6]

Notes see page 11

A.F. CLASS AB AMPLIFIER (without grid current)

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Anode voltage	V_a	max. 600	max. 750	V
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 0	max. 0	mA
Grid No.1 circuit resistance	R_{g_1}	max. 100	max. 100	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V

OPERATING CONDITIONS two tubes in push-pull

		C.C.S.		I.C.A.S.		
Anode voltage	V_a	600		750		V
Grid No.2 voltage	V_{g_2}	200		200		V[7])
Grid No.1 voltage	V_{g_1}	−47		−48		V
Load resistance	$R_{aa\sim}$	5600		7200		Ω
Grid to grid voltage, peak	$V_{g_1g_{1p}}$	0	94	0	96	V
Anode current	I_a	2 x 24	2 x 125	2 x 25	2 x 125	mA
Grid No.2 current	I_{g_2}	-	2 x 7.4	-	2 x 6.3	mA
Anode input power	W_{i_a}	2 x 14.4	2 x 75	2 x 19	2 x 94	W
Anode dissipation	W_a	2 x 14.4	2 x 27	2 x 19	2 x 32	W
Output power	W_o	0	96	0	124	
Efficiency	η	-	64	-	66	%

Notes see page 11

A.F. CLASS AB AMPLIFIER (with grid current)

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Anode voltage	V_a	max. 600	max. 750	V
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1]
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V

OPERATING CONDITIONS, two tubes in push-pull

		C.C.S.				
Anode voltage	V_a	500		600		V
Grid No.2 voltage	V_{g_2}	200		200		V [7]
Grid No.1 voltage	V_{g_1}	−46		−48		V
Load resistance	$R_{aa\sim}$	3620		5200		Ω
Grid to grid voltage, peak	$V_{g_1g_{1p}}$	0	108	0	106	V
Anode current	I_a	2 x 25	2 x 154	2 x 20	2 x 135	mA
Grid No.2 current	I_{g_2}	-	2 x 13	-	2 x 13.5	mA
Grid No.1 current	I_{g_1}	0	2x1.35	0	2 x 0.65	mA
Driving power	W_{dr}	0	0.2	0	0.7	W
Anode input power	W_{i_a}	2 x 12.5	2 x 77	2 x 12	2 x 81	W
Anode dissipation	W_a	2 x 12.5	2 x 27	2 x 12	2 x 26	W
Output power	W_o	0	100	0	110	W
Efficiency	η	-	65	-	68	%

Notes see page 11

OPERATING CONDITIONS(continued)

		I.C.A.S.				
Anode voltage	V_a	600		750		V
Grid No.2 voltage	V_{g_2}	200		150		V
Grid No.1 voltage	V_{g_1}	-47		-39		V
Load resistance	$R_{aa\sim}$	4160		6050		Ω
Grid to grid voltage, peak	$V_{g_1g_{1p}}$	0	114	0	110	V
Anode current	I_a	2 x 25	2 x 164	2 x 20	2 x 147	mA
Grid No.2 current	I_{g_2}	-	2 x 13	-	2 x 14	mA
Grid No.1 current	I_{g_1}	0	2 x 1.7	0	2 x 3.8	mA
Driving power	W_{dr}	0	0.2	0	0.5	W
Anode input power	W_{i_a}	2 x 12	2 x 98	2 x 15	2 x 110	W
Anode dissipation	W_a	2 x 12	2 x 33	2 x 15	2 x 35	W
Output power	W_o	0	130	0	150	W
Efficiency	η	-	66	-	68	%

Notes pages 3 through 9

1. For operation at maximum ratings.
   For operation at less than maximum ratings:
   R_{g_1} = max. 100 kΩ.
2. Obtained preferably from a separate source, or from the anode supply voltage with a voltage divider, or through a series resistor.
   A series resistor should be used only when the tube is used in a circuit which is not keyed. Grid No.2 voltage must not exceed 435 V under key-up conditions.
3. V_{g_1} may be obtained from a separate supply, or from R_{g_1} or R_k, or by combination methods.
4. Obtained preferably from a separate source modulated with the anode supply, or from the anode supply through a series resistor.
5. Obtained from a separate source.
6. Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.
7. Obtained preferably from a separate source or from the anode voltage supply with a voltage divider.

SPECIAL PERFORMANCE DATA

Stationary equipment operation

		min.	nom.	max.	
Heater voltage	V_f	-	6.3	-	V [1])
Heater current at V_f = 6.3 V	I_f	1050	-	1200	mA
Grid No.2 current	I_{g2}	-	-	15	mA [2])
Output power in load	W_ℓ	59	-	-	W [2])

Mobile equipment operation

		min.	design range	max.	
Heater voltage	V_f	-	6.0 to 7.5	-	V [3])
Heater current at V_f = 6.75 V	I_f	1100	-	1230	mA
Grid No.2 current	I_{g2}	-	-	15	mA [2])
Output power in load	W_ℓ	59			W [2])
Decrease output power in load	ΔW_ℓ			10	% [4])

Notes

1. Recommended design centre heater voltage 6.3 V. To ensure long life the heater voltage should not fluctuate more than 10%.

2. In a self-excited oscillator circuit and

Heater voltage	V_f	6.3	V
Anode voltage	V_a	600	V
Grid No.2 voltage	V_{g2}	200	V
Grid No.1 resistor	R_{g1}	24	kΩ $\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

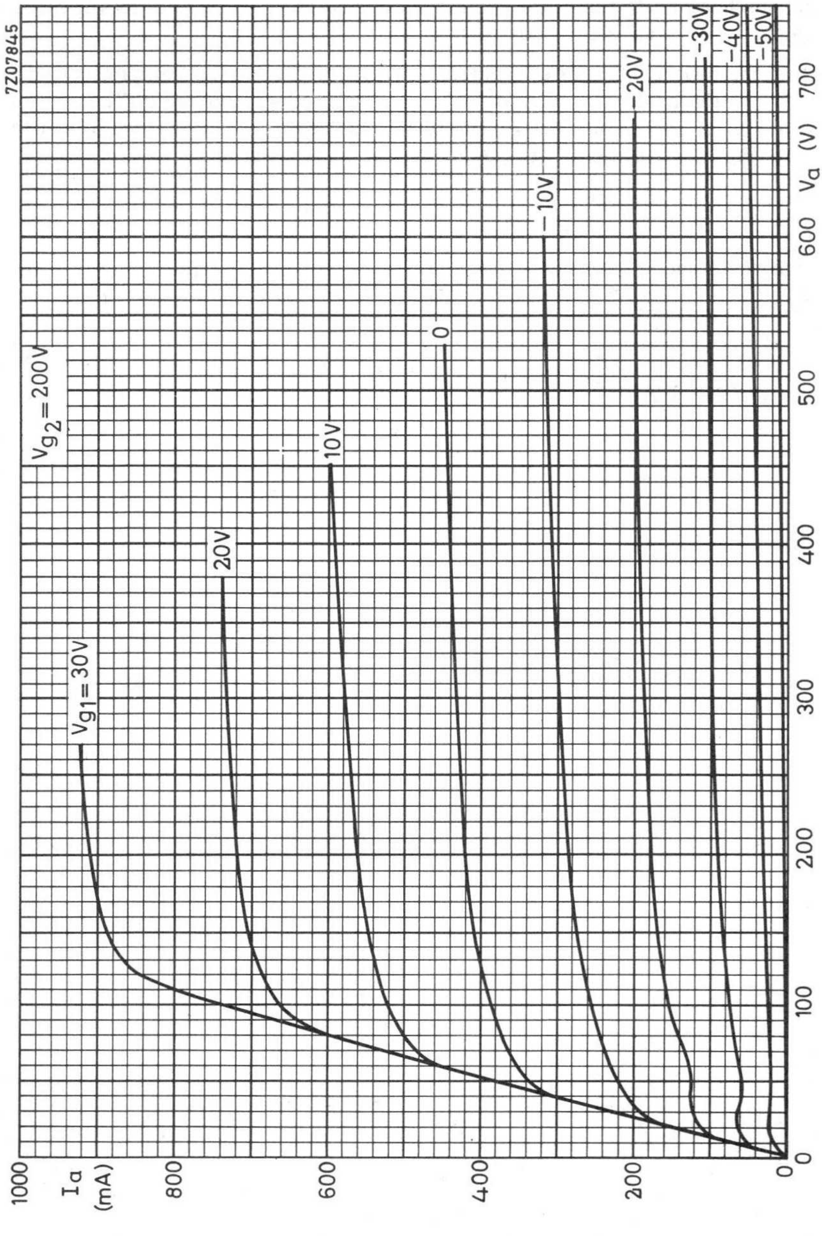
4. With the conditions of note 2, reduce the heater voltage to 5.0 V. The decrease in output power ΔW_ℓ = max. 10%.

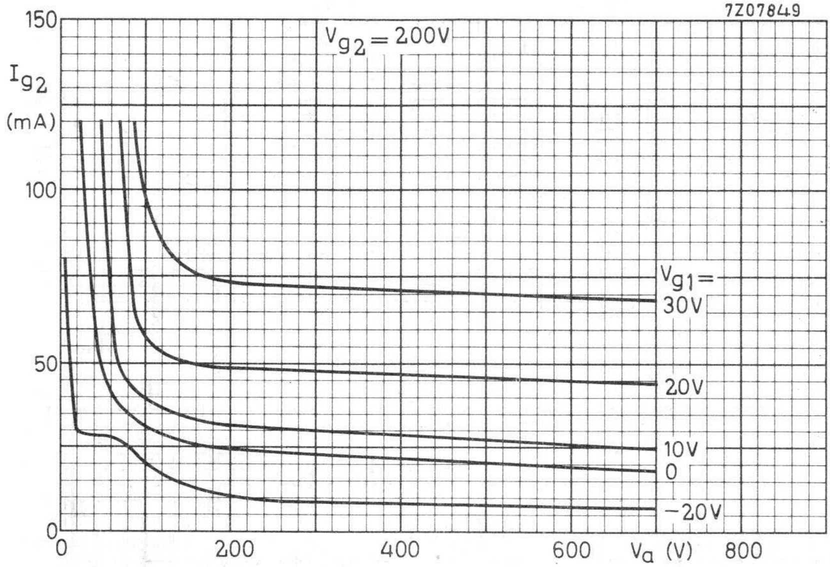
Over voltage heater life tests

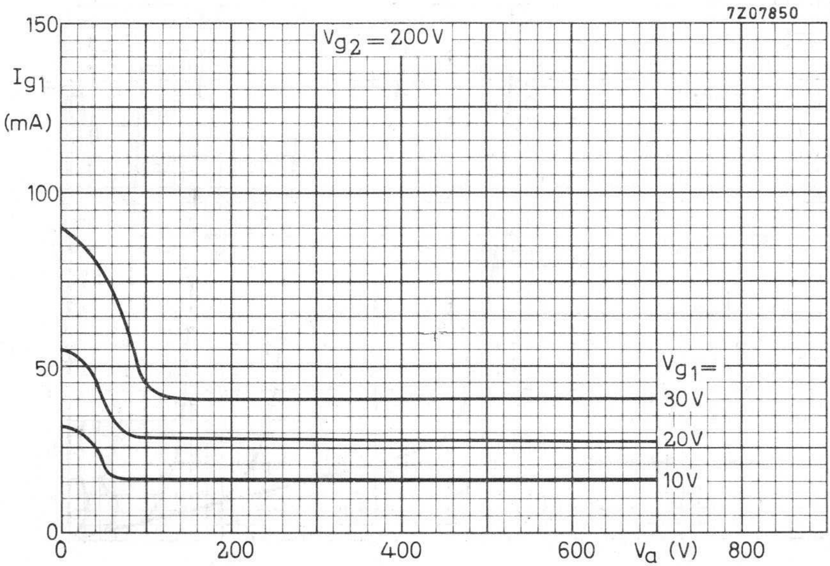
Continuous heater life tests are performed periodically on sample lots of tubes with 8 V on the heater, all electrodes floating.

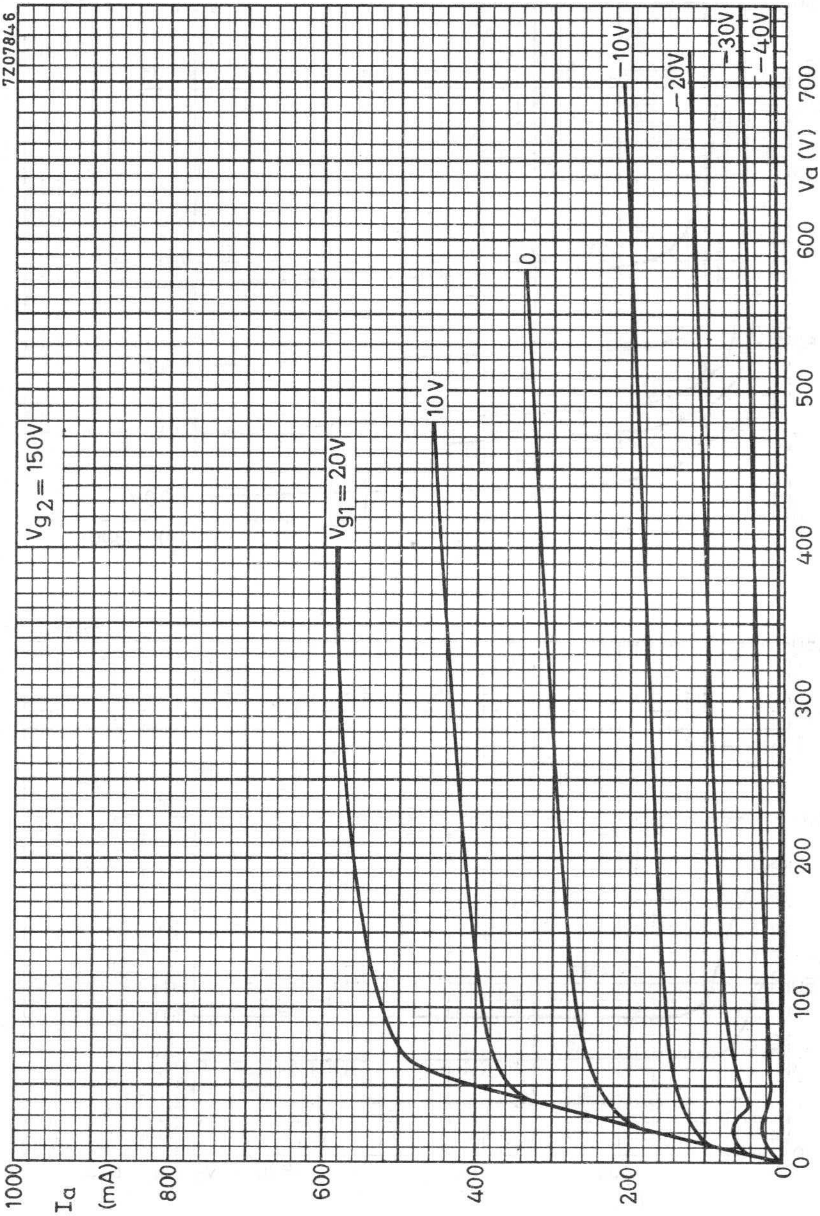
Intermittent heater life tests are performed periodically on sample lots of tubes with 11 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of entermittent life test the following measurements are performed:

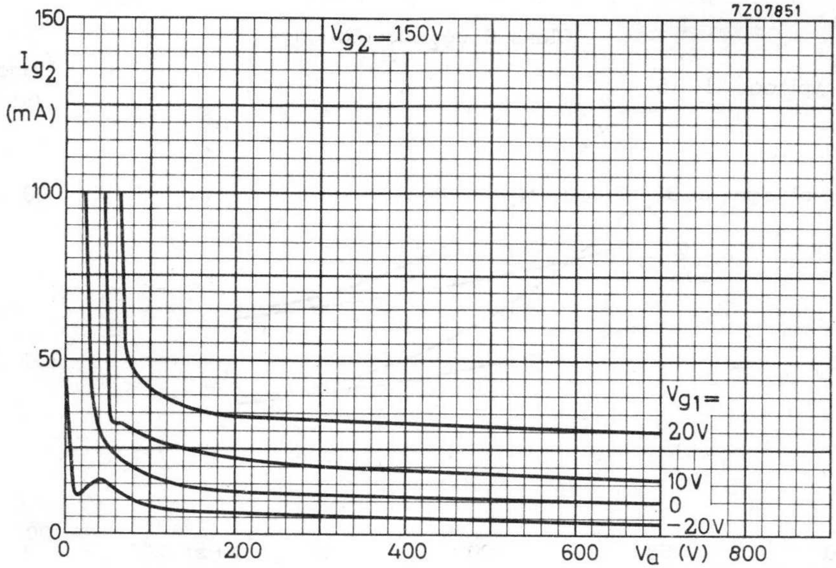
Cathode to heater leakage at V_f = 6.75 V; V_{kf} = $\pm$ 100 V	I_{kf}	max.	100	μA
Leakage resistance grid No.1 at V_f = 6.75 V; V_{g1} = −200 V; $V_a = V_{g2} = V_k$ = 0 V	r_{ins}	min.	10	MΩ
Leakage resistance anode at V_f = 6.75 V; V_a = −200 V V_{g2}, V_{g1}, V_k = 0 V	r_{ins}	min.	10	MΩ

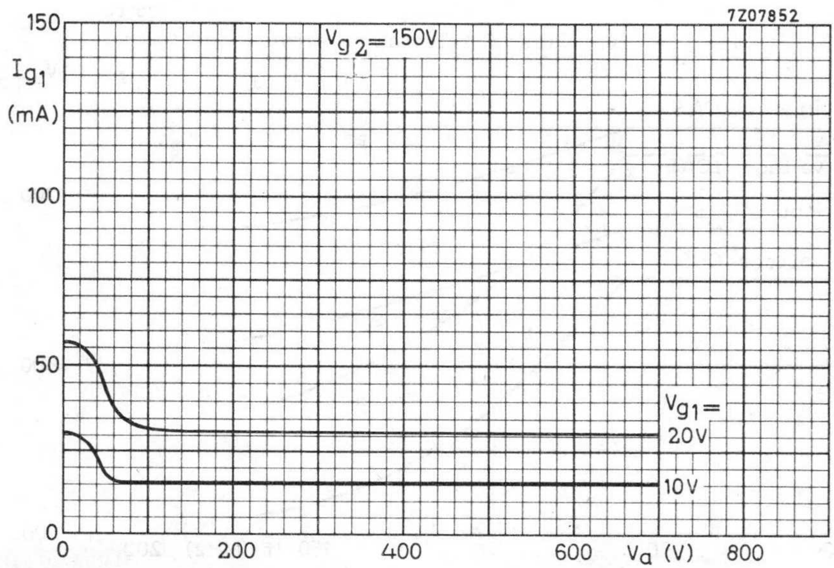

7Z07845
V_{g_2} = 200V
V_{g_1} = 30V
20V
10V
0
−10V
−20V
−30V
−40V
−50V
I_a (mA)
1000
800
600
400
200
0
0
100
200
300
400
500
600
700
V_a (V)

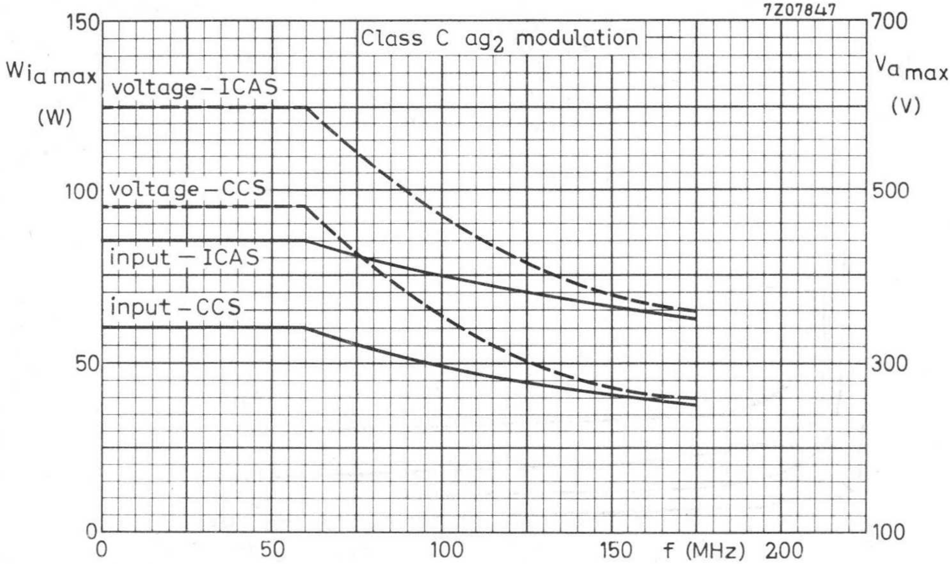

7Z07849
$V_{g2} = 200V$
I_{g2}
(mA)
150
100
50
0
0
200
400
600
800
V_a (V)
$V_{g1}=$
30V
20V
10V
0
−20V

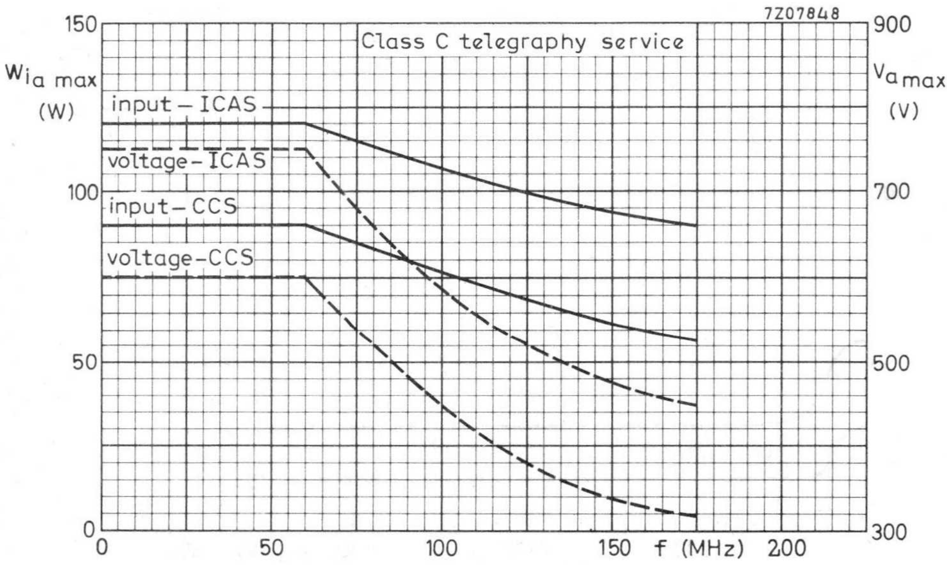

7Z07850
$V_{g2} = 200V$
I_{g1}
(mA)
150
100
50
0
0
200
400
600
800
V_a (V)
$V_{g1}=$
30V
20V
10V


7Z07846
$V_{g2} = 150V$
$V_{g1} = 20V$
10V
0
−10V
−20V
−30V
−40V
I_a (mA)
1000
800
600
400
200
0
V_a (V)
100
200
300
400
500
600
700


7Z07851
150
I_{g_2}
(mA)
100
50
0
$V_{g_2}=150V$
$V_{g_1}=$
20V
10V
0
−20V
0
200
400
600
V_a (V)
800


7Z07852
150
I_{g_1}
(mA)
100
50
0
$V_{g_2}=150V$
$V_{g_1}=$
20V
10V
0
200
400
600
V_a (V)
800


7Z07847
Class C ag_2 modulation
$W_{ia\,max}$ (W)
$V_{a\,max}$ (V)
voltage – ICAS
voltage – CCS
input – ICAS
input – CCS
150
100
50
0
700
500
300
100
0
50
100
150
f (MHz)
200


7Z07848
Class C telegraphy service
$W_{ia\,max}$ (W)
$V_{a\,max}$ (V)
input – ICAS
voltage – ICAS
input – CCS
voltage – CCS
150
100
50
0
900
700
500
300
0
50
100
150
f (MHz)
200

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. power amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

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

Heater voltage	V_f		12.6	V
Heater current at V_f = 12.6 V	I_f		562	mA
Cathode heating time	T_h	min.	60	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1(a)}$		13.0	pF
Anode to all except grid No.1	$C_{a(g_1)}$		8.5	pF
Anode to grid No.1	C_{ag1}	max.	0.24	pF

SPECIAL PERFORMANCE DATA

Stationary equipment operation		Min.	Nom.	Max.	
Heater voltage	V_f	-	12.6	-	V 1)
Heater current at V_f = 12.6 V	I_f	525	-	600	mA
Output power in load	W_ℓ	59	-	-	W 2)

Mobile equipment operation		Min.	Design range	Max.	
Heater voltage	V_f	-	12 to 15	-	V 3)
Heater current at V_f = 13.5 V	I_f	550	-	620	mA
Output power in load	W_ℓ	59	-	-	W 2)
Decrease output power in load	ΔW_ℓ	-	-	10	% 4)

1) 2) 3) 4) See page 2

NOTES

1. Recommended design centre heater voltage 12.6 V.
   To ensure long life the heater voltage should not fluctuate more than 10%.
2. In a self-excited oscillator circuit and

Heater voltage	V_f	12.6	V
Anode voltage	V_a	600	V
Grid No.2 voltage	V_{g_2}	200	V
Grid No.1 resistor	R_{g_1}	24	kΩ ± 10%
Anode current	I_a	max. 150	mA
Grid No.1 current	I_{g_1}	2.5 to 3	mA
Frequency	f	15	MHz

3. Recommended heater voltage within the range 12.0 to 15.0 V.
   In battery operation within the range 10 to 15 V.
4. With the conditions of note 2, reduce the heater voltage to 10 V. The decrease in output power ΔW_ℓ = max. 10%.

Overvoltage life tests

Continuous heater life tests are performed periodically on sample lots of tubes with 16 V on the heater, all electrodes floating.

Intermittent heater life tests are performed periodically on sample lots of tubes with 22 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of intermittent life test the following measurements are performed:

Cathode to heater leakage at V_f = 13.5 V; V_{kf} = ± 100 V	I_{kf}	max. 100	μA
Leakage resistance grid No.1 at V_f = 13.5 V; V_{g_1} = − 200 V $V_a = V_{g_2} = V_k$ = 0 V	r_{ins}	min. 10	MΩ
Leakage resistance anode at V_f = 13.5 V; V_a = −200 V $V_{g_2} = V_{g_1} = V_k$ = 0 V	r_{ins}	min. 10	MΩ

For further data and curves please refer to type YL1370

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

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

Heater voltage	V_f		26.5	V
Heater current at V_f = 26.5 V	I_f		300	mA
Cathode heating time	T_h	min.	60	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g1(a)}$		13.0	pF
Anode to all except grid No.1	$C_{a(g1)}$		8.5	pF
Anode to grid No.1	C_{ag1}	min.	0.24	pF

SPECIAL PERFORMANCE DATA

Stationary equipment operation		Min.	Nom.	Max.	
Heater voltage	Vf	-	26.5	-	V 1)
Heater current at V_f = 26.5 V	If	280	-	320	mA
Output power in load	W_ℓ	59	-	-	W 2)

Mobile equipment operation		Min.	Design range	Max.	
Heater voltage	Vf	-	24 to 29	-	V 3)
Heater current at V_f = 26.5 V	If	280	-	320	mA
Output power in load	W_ℓ	59	-	-	2)
Decrease output power in load	ΔW_ℓ	-	-	10	% 4)

1) 2) 3) 4) See page 2.

NOTES

1. Recommended design centre heater voltage 26.5 V.
   To ensure long life the heater voltage should not fluctuate more than 10%.

2. In a self excited oscillator circuit and

Heater voltage	V_f		26.5	V
Anode voltage	V_a		600	V
Grid No.2 voltage	V_{g_2}		200	V
Grid No.1 resistor	R_{g_1}		24	kΩ ± 10%
Anode current	I_a	max.	150	mA
Grid No.1 current	I_{g_1}		2.5 to 3	mA
Frequency	f		15	MHz

3. Recommended heater voltage within the range 24 to 29 V.
   In battery operation within the range 21 to 31 V.

4. With the conditions of note 2, reduce the heater voltage to 10 V. The decrease in output power ΔW_ℓ = max. 10%.

Overvoltage life tests

Continuous heater life tests are performed periodically on sample lots of tubes with 31 V on the heater, all electrodes floating.

Intermittent heater life tests are performed periodically on sample lots of tubes with 43 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of intermittent life test the following measurements are performed:

Cathode to heater leakage at V_f = 26.5 V; V_{kf} = ± 100 V	I_{kf}	max.	150	μA
Leakage resistance grid No.1 at V_f = 26.5 V; V_{g_1} = − 200 V $V_a = V_{g_2} = V_k$ = 0 V	r_{ins}	min.	10	MΩ
Leakage resistance anode at V_f = 26.5 V; V_a = −200 V $V_{g_2} = V_{g_1} = V_k$ = 0 V	r_{ins}	min.	10	MΩ

For further data and curves please refer to type YL1370

AIR COOLED V.H.F. POWER TETRODE

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

QUICK REFERENCE DATA

Freq. (MHz)	Class AB linear amplifier (vision)			Class B service (260 MHz)		
	V_a (kV)	W_ℓ sync (kW)	Power gain	V_a (kV)	W_ℓ (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_f		6.3	V ± 5%
Filament current	I_f		120	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{f_o}		6	mΩ
Waiting time	T_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid No. 2 voltage	V_{g2}	600	V
Anode current	I_a	1.45	A
Transconductance	S	30	mA/V
Amplification factor	μ_{g2g1}	7.5	

CAPACITANCES

	(grounded cathode)		(grounded grid)		
Input	$C_{g1(a)}$	90	$C_{f(a)}$	48	pF
Output	$C_{a(g1)}$	16	$C_{a(f)}$	16.4	pF
Anode to grid No. 1	C_{ag1}	0.55			pF
Anode to filament			C_{af}	0.15	pF

TEMPERATURE LIMITS

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

COOLING

See curves

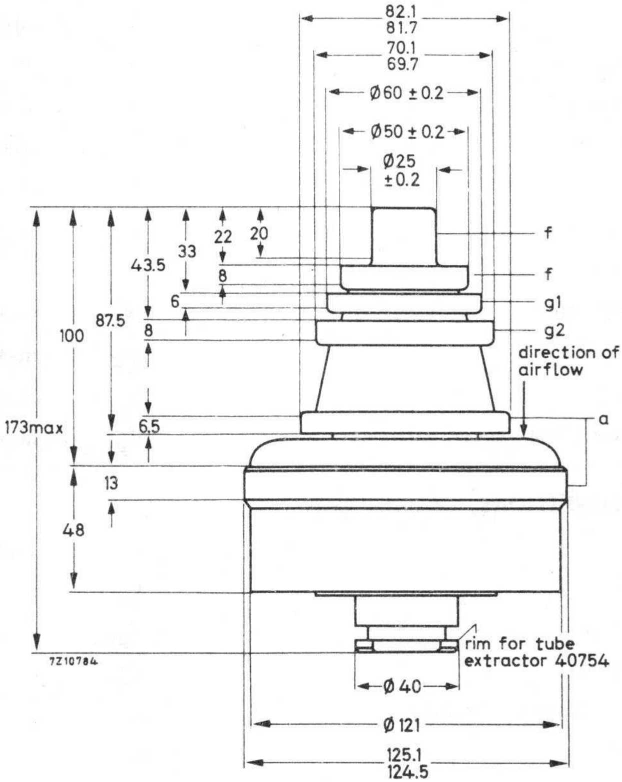
Direction of air flow: see drawing.

ACCESSORIES

Band I amplifier circuit assembly (vision)	type 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_{g_2}	max. 1	kV
Grid No.1 voltage	$-V_{g_1}$	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_{g_2}	max. 80	W
Grid No.1 dissipation	W_{g_1}	max. 40	W
Cathode current	I_k	max. 4.5	A
Grid No.1 circuit resistance	R_{g_1}	max. 10	kΩ

OPERATING CONDITIONS, grounded grid.

Frequency	f	up to 260	MHz
Anode voltage	V_a	5.5	kV
Grid No.2 voltage	V_{g_2}	600	V
Grid No.1 voltage	V_{g_1}	-115	V [1])
Anode current, no signal condition	I_a	0.1	A
Anode current	I_a	1.7	A
Grid No.2 current	I_{g_2}	70	mA
Grid No.1 current	I_{g_1}	25	mA
Anode input power	W_{i_a}	9.35	kW
Anode dissipation	W_a	2.7	kW
Output power in load	W_ℓ	6.3	kW
Efficiency, total	η	67.3	%
Driving power	W_{dr}	190	W
Power gain	$\frac{W_\ell}{W_{dr}}$	33.1	

Notes see page 7.

R.F. CLASS AB AMPLIFIER FOR TELEVISION SERVICE +

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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	6.5	kV
Grid No.2 voltage	V_{g2}	max.	1	kV
Anode current, black	$I_{a\ black}$	max.	2.25	A
Anode input power, black	$W_{ia\ black}$	max.	12	kW
Anode dissipation	W_a	max.	6	kW
Grid No.2 dissipation	W_{g2}	max.	80	W
Grid No.1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4.5	A
Grid No.1 circuit resistance	R_{g1}	max.	10	kΩ

OPERATING CONDITIONS, grounded grid

Frequency of vision carrier	f	175.25	175.25	MHz	
Bandwidth (-1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	5	4	kV	
Grid No.2 voltage	V_{g2}	600	600	V	
Grid No.1 voltage	V_{g1}	-75	-65	V	1)
Anode current, no signal condition	I_a	650	750	mA	
Anode current, black	I_{abl}	2.1	1.9	A	3)
Grid No.2 current, black	I_{g2bl}	20	30	mA	3)
Grid No.1 current, black	I_{g1bl}	75	55	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	8.6	6.25	kW	
black	$W_{\ell\ black}$	5.15	3.75	kW	
Driving power, sync	$W_{dr\ sync}$	350	260	W	
black	$W_{dr\ black}$	200	140	W	
Gain, sync	G_{sync}	24	24		2)
black	G_{black}	25.8	26.7		
Sync compression	sync in/out	27/25	29/25		4)
Differential phase		< 3	< 3	°	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	$R_{a\sim}$	1100	900	Ω	2)

Notes see **page** 7.

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

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f	83.25	55.25	MHz	
Bandwidth (-1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	4	4	kV	
Grid No. 2 voltage	V_{g2}	600	600	V	
Grid No. 1 voltage	V_{g1}	-65	-65	V	1)
Anode current, no signal condition	I_a	750	750	mA	
Anode current, black	I_{abl}	2.1	2.3	A	3)
Grid No. 2 current, black	I_{g2bl}	45	45	mA	3)
Grid No. 1 current, black	I_{g1bl}	75	85	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	6.25	6.25	kW	
black	$W_{\ell\ black}$	3.75	3.75	kW	
Driving power, sync	$W_{dr\ sync}$	340	385	W	
black	$W_{dr\ black}$	180	210	W	
Gain, sync	G_{sync}	18.5	16		2)
black	G_{black}	21.5	18		2)
Sync compression	sync in/out	30/25	29/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	$R_{a\sim}$	810	690	Ω	2)

Notes see page 7.

NOTES

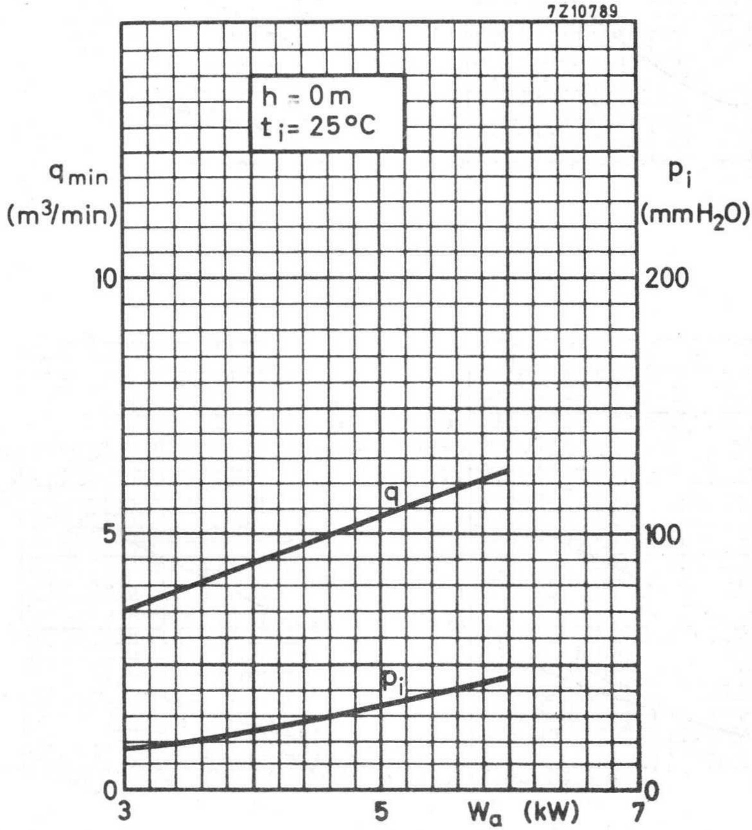
1) To be adjusted for the stated no signal anode current.

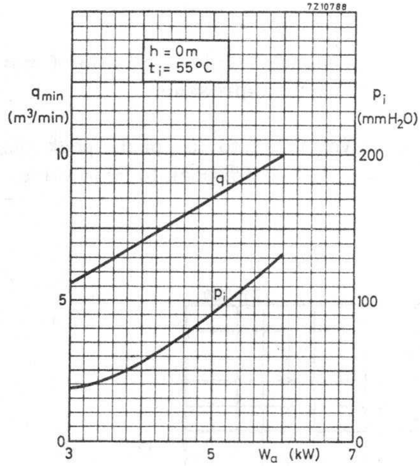
2) With double tuned circuit.

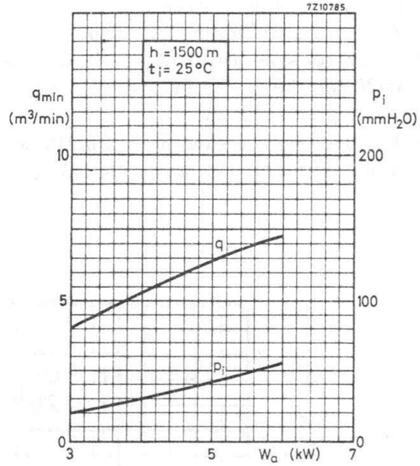
3) Black signal including line sync pulses

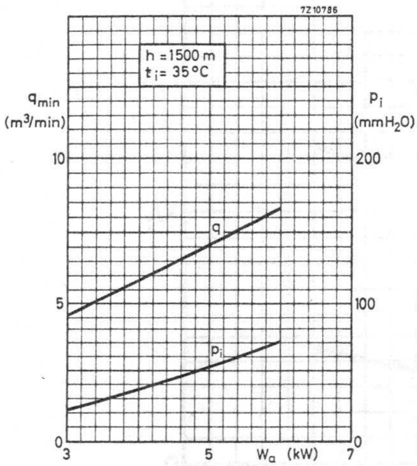
4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

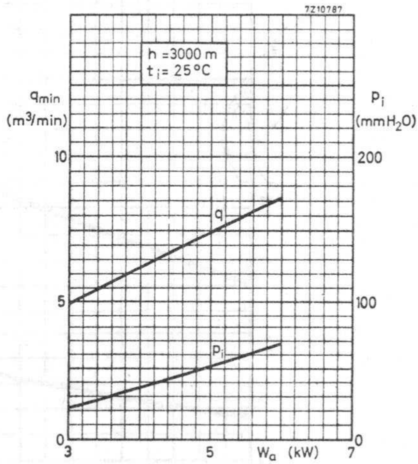
5) Measured with a saw tooth amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4.43 MHz sine wave with a 10% peak to peak value.

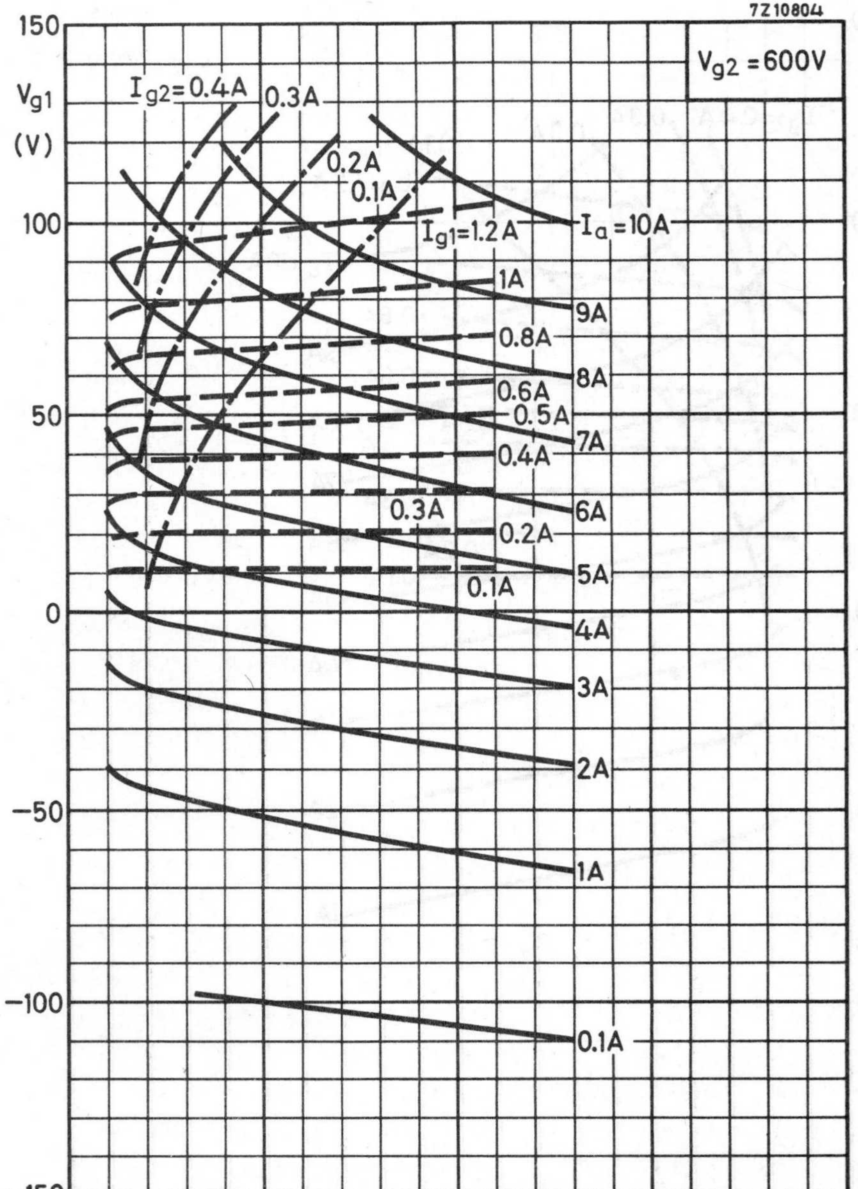


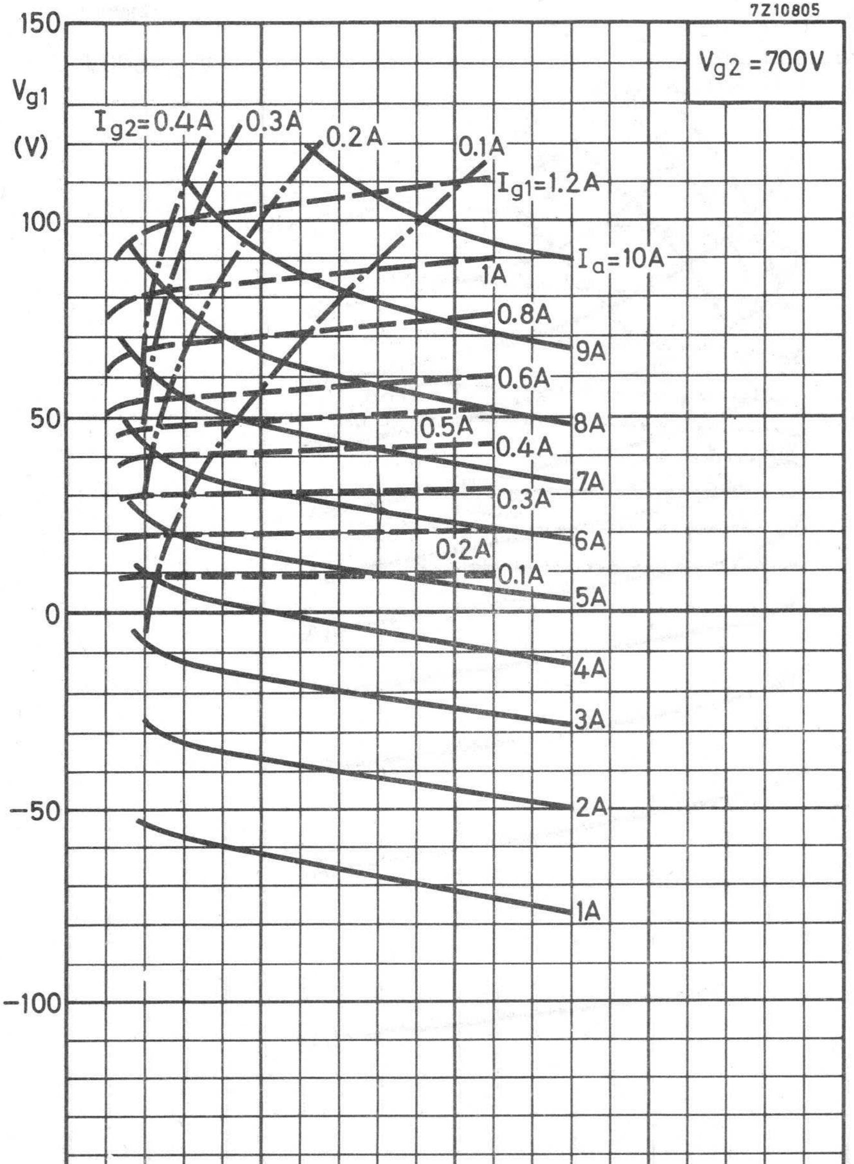

7Z10788
h = 0 m
t_i = 55 °C
q_{min} (m^3/min)
p_i (mmH_2O)
q
p_i
W_a (kW)

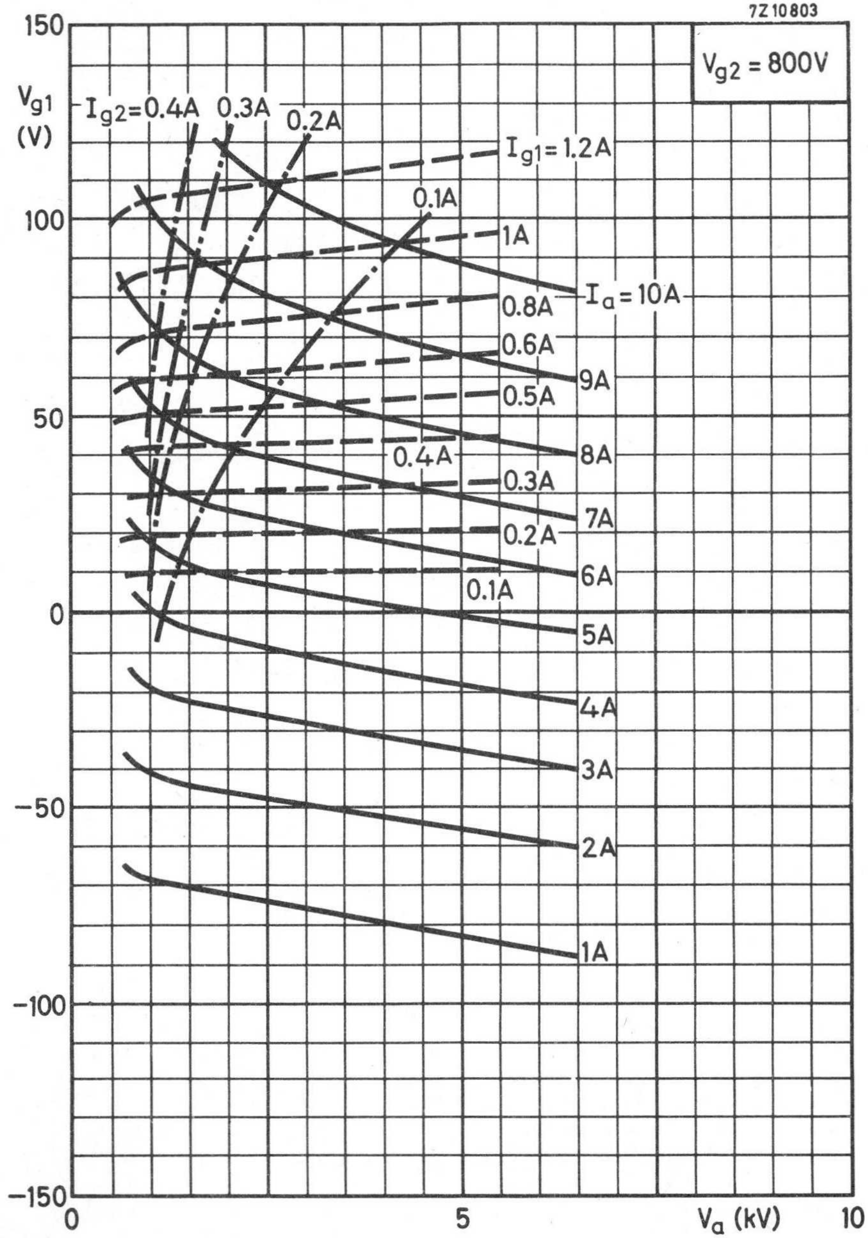

7Z10785
h = 1500 m
t_i = 25 °C
q_{min} (m^3/min)
p_i (mmH_2O)
q
p_i
W_a (kW)


7Z10786
h = 1500 m
t_i = 35 °C
q_{min} (m^3/min)
p_i (mmH_2O)
q
p_i
W_a (kW)


7Z10787
h = 3000 m
t_i = 25 °C
q_{min} (m^3/min)
p_i (mmH_2O)
q
p_i
W_a (kW)


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


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


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

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.	Class AB linear amplifier (vision)			Class B service		
(MHz)	V_a (kV)	W_ℓ sync (kW)	Power gain	V_a (kV)	W_ℓ (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_f		8.0	V ±5%
Filament current	I_f		120	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament starting current	R_{f_o}		7.5	mΩ
Waiting time	T_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6	kV
Grid No. 2 voltage	V_{g2}	650	V
Anode current	I_a	2.4	A
Transconductance	S	45	mA/V
Amplification factor	μ_{g2g1}	8.5	

CAPACITANCES

	grounded cathode		grounded grid		
Input	$C_{g1(a)}$	110	$C_{f(a)}$	55	pF
Output	$C_{a(g_1)}$	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	^{o}C
Recommended max. seal temperature	t	max.	200	^{o}C

COOLING

See curves.

Direction of air flow: see drawing.

ACCESSORIES

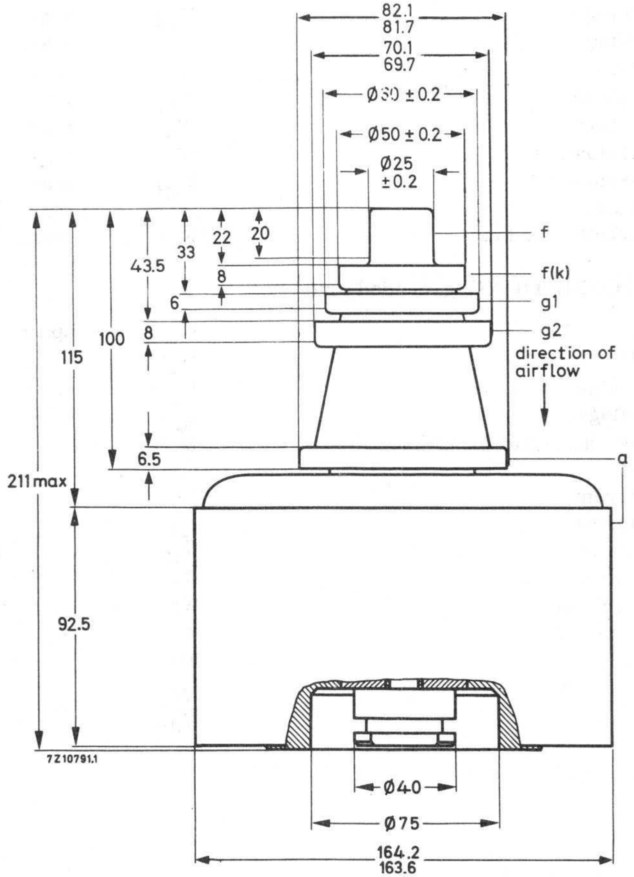
Band I amplifier circuit assembly (vision)	type 40759
Band I amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40747
Band III amplifier circuit assembly (sound)	type 40748

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 11 kg

Mounting position: Vertical with anode up or down.



R.F. CLASS B SERVICE

Unless otherwise stated the voltages are specified with respect to cathode

LIMITING VALUES (Absolute max. rating system)

→ Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9	kV
Grid No.2 voltage	V_{g2}	max.	1	kV
Grid No.1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	5	A
Anode input power	W_{ia}	max.	24	kW
Anode dissipation	W_a	max.	12	kW
Grid No.2 dissipation	W_{g2}	max.	100	W
Grid No.1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	6	A
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 [1])
Anode current, no signal condition	I_a		0.1	A
Anode current	I_a		2.5	A
Grid No.2 current	I_{g2}		80	mA
Grid No.1 current	I_{g1}		90	mA
Anode input power	W_{ia}		18.75	kW
Anode dissipation	W_a		5	kW
Output power in load	W_ℓ		13	kW
Efficiency, total	η		69.3	%
Driving power	W_{dr}		400	W
Power gain	$\frac{W_\ell}{W_{dr}}$		32.5	

Note see page 7.

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

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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9	kV
Grid No.2 voltage	V_{g2}	max.	1	kV
Grid No.1 voltage	$-V_{g1}$	max.	500	V
Anode current, black	I_{ablack}	max.	3.5	A
Anode input power, black	$W_{iablack}$	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 of vision carrier	f	175.25		MHz	
Bandwidth (-1dB)	B	7	7	MHz	2)
Anode voltage	V_a	7	6	kV	
Grid No.2 voltage	V_{g2}	700	650	V	
Grid No.1 voltage	V_{g1}	-85	-70	V	1)
Anode current, no signal condition	I_a	750	900	mA	
Anode current, black	$I_{a_{bl}}$	2.9	2.5	A	3)
Grid No.2 current, black	I_{g2bl}	45	25	mA	3)
Grid No.1 current, black	I_{g1bl}	170	90	mA	3)
Output power in load, sync	$W_{\ell\,sync}$	18.4	12.5	kW	
black	$W_{\ell\,black}$	11	7.5	kW	3)
Driving power, sync	W_{drsync}	720	415	W	
black	$W_{drblack}$	370	225	W	2)
Gain, sync	G_{sync}	25	30		
black	G_{black}	29.7	33		
Sync compression	sync in/out	30/25	28/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	$R_{a\sim}$	1050	1050	Ω	2)

Notes see page 7

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

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f	83.25	MHz
Bandwidth (−1 dB)	B	7	MHz [2]
Anode voltage	V_a	5.5	kV
Grid No. 2 voltage	V_{g2}	700	V
Grid No. 1 voltage	V_{g1}	−72	V [1]
Anode current, no signal condition	I_a	900	mA
Anode current, black	I_{abl}	3.2	A [3]
Grid No. 2 current, black	I_{g2bl}	55	mA [3]
Grid No. 1 current, black	I_{g1bl}	165	mA [3]
Output power in load, sync	$W_{\ell\, sync}$	13.2	kW
black	$W_{\ell\, black}$	7.9	kW [3]
Driving power, sync	$W_{dr\, sync}$	660	W
black	$W_{dr\, black}$	350	W [2]
Gain, sync	G_{sync}	20	
black	G_{black}	22	
Sync compression	sync in/out	30/25	[4]
Differential phase		< 3	o [5]
Differential gain		≥ 85	% [5]
Anode resistance	$R_{a\sim}$	740	Ω [2]

Frequency of visions carrier	f		55.25	MHz
Bandwidth (−1 dB)	B	7	7	MHz [2]
Anode voltage	V_a	4	5.5	kV
Grid No. 2 voltage	V_{g2}	700	700	V
Grid No. 1 voltage	V_{g1}	−70	−72	V [1]
Anode current, no signal condition	I_a	800	900	mA
Anode current, black	I_{abl}	2.4	3.4	A [3]
Grid No. 2 current, black	I_{g2bl}	55	45	mA [3]
Grid No. 1 current, black	I_{g1bl}	60	175	mA [3]
Output power in load, sync	$W_{\ell\, sync}$	6.4	13.2	kW
black	$W_{\ell\, black}$	3.8	7.9	kW [3]
Driving power, sync	$W_{dr\, sync}$	352	733	W
black	$W_{dr\, black}$	190	390	W [2]
Gain, sync	G_{sync}	18	18	
black	G_{black}	20	20	
Sync compression	sync in/out	28/25	30/25	[4]
Differential phase		< 3	< 3	o [5]
Differential gain		≥ 85	≥ 85	% [5]
Anode resistance	$R_{a\sim}$	650	670	Ω [2]

Notes see page 7.

NOTES

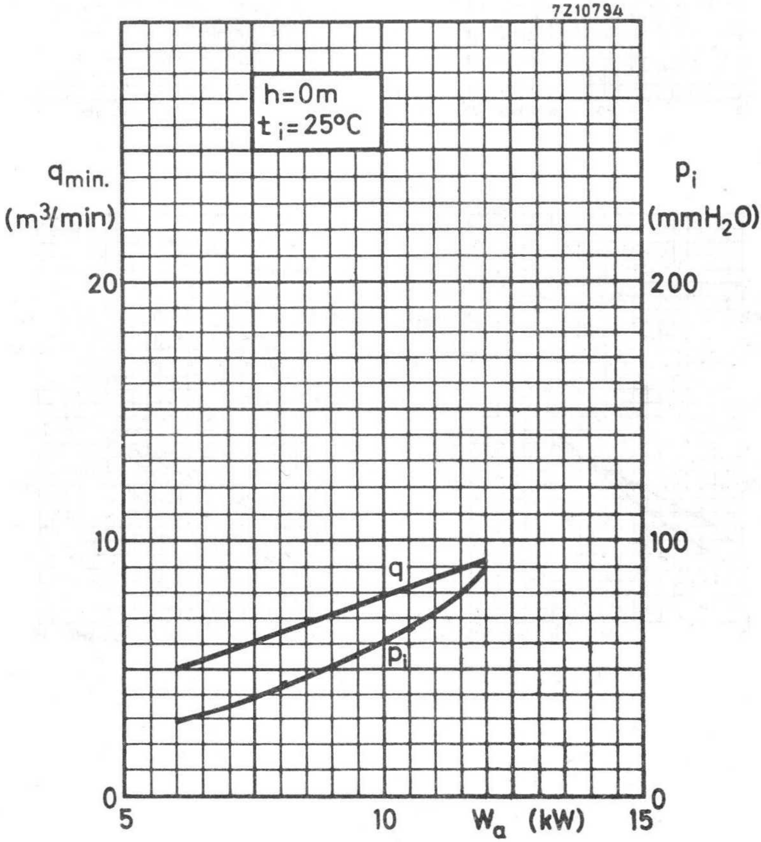
1) To be adjusted for the stated no signal anode current.

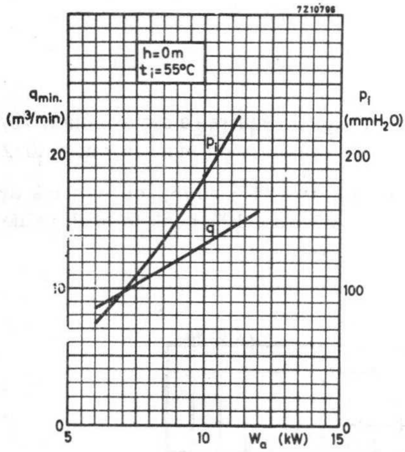
2) With double tuned circuit.

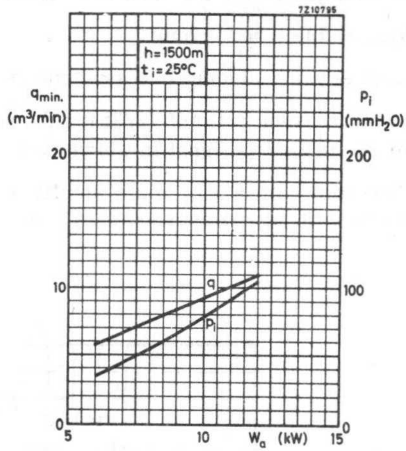
3) Black signal including line sync pulses.

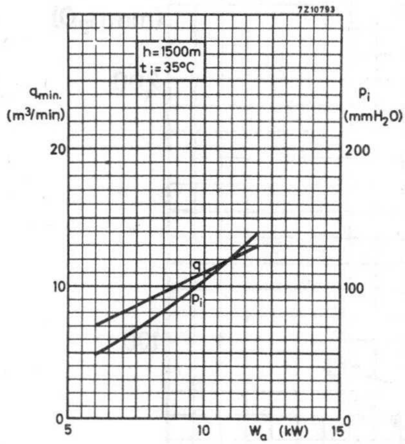
4) A picture/sync ratio of 72/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

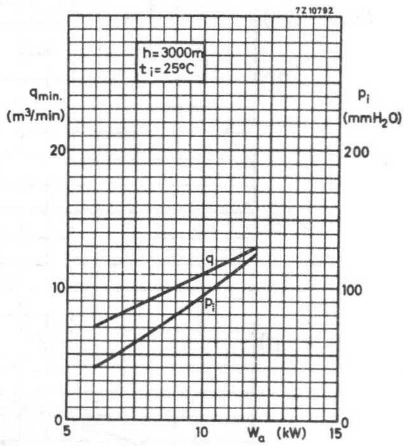
5) Measured with a saw tooth amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4.43 MHz sine wave with a 10% peak to peak value.

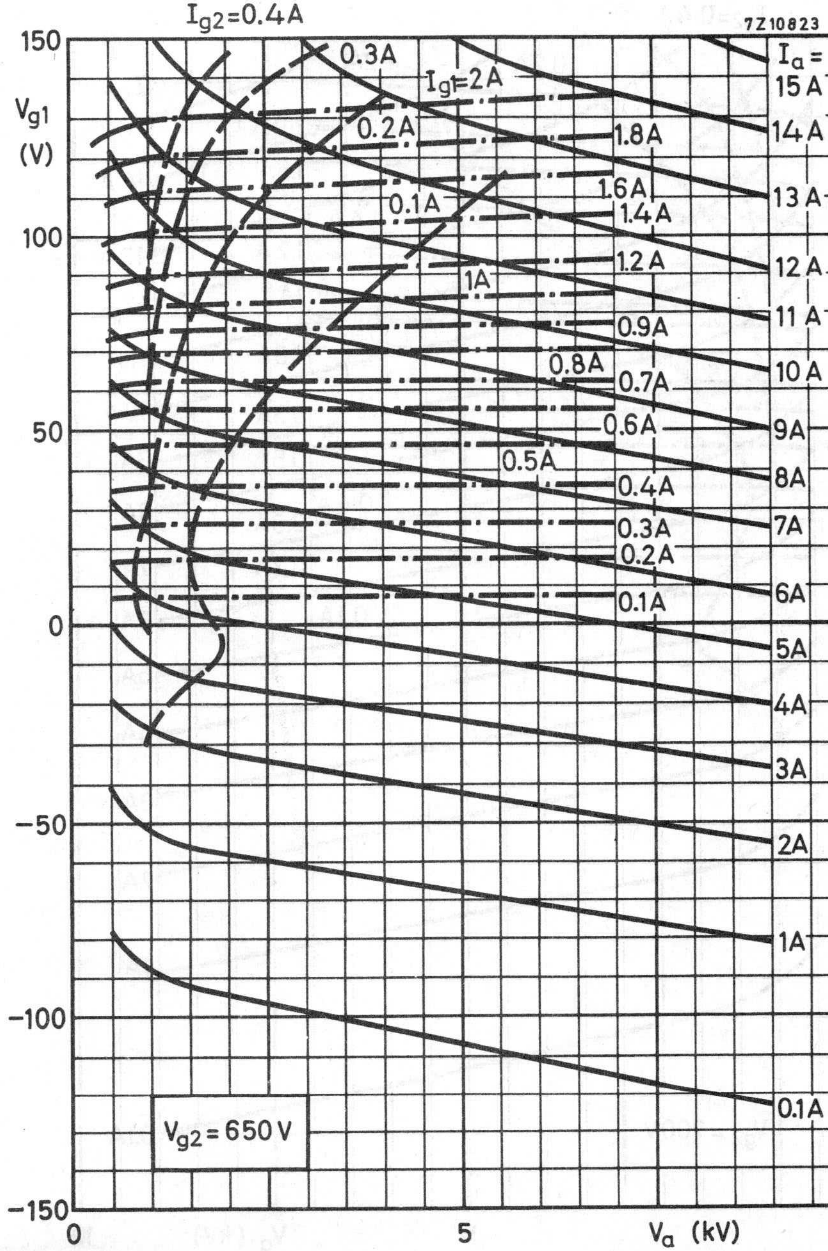


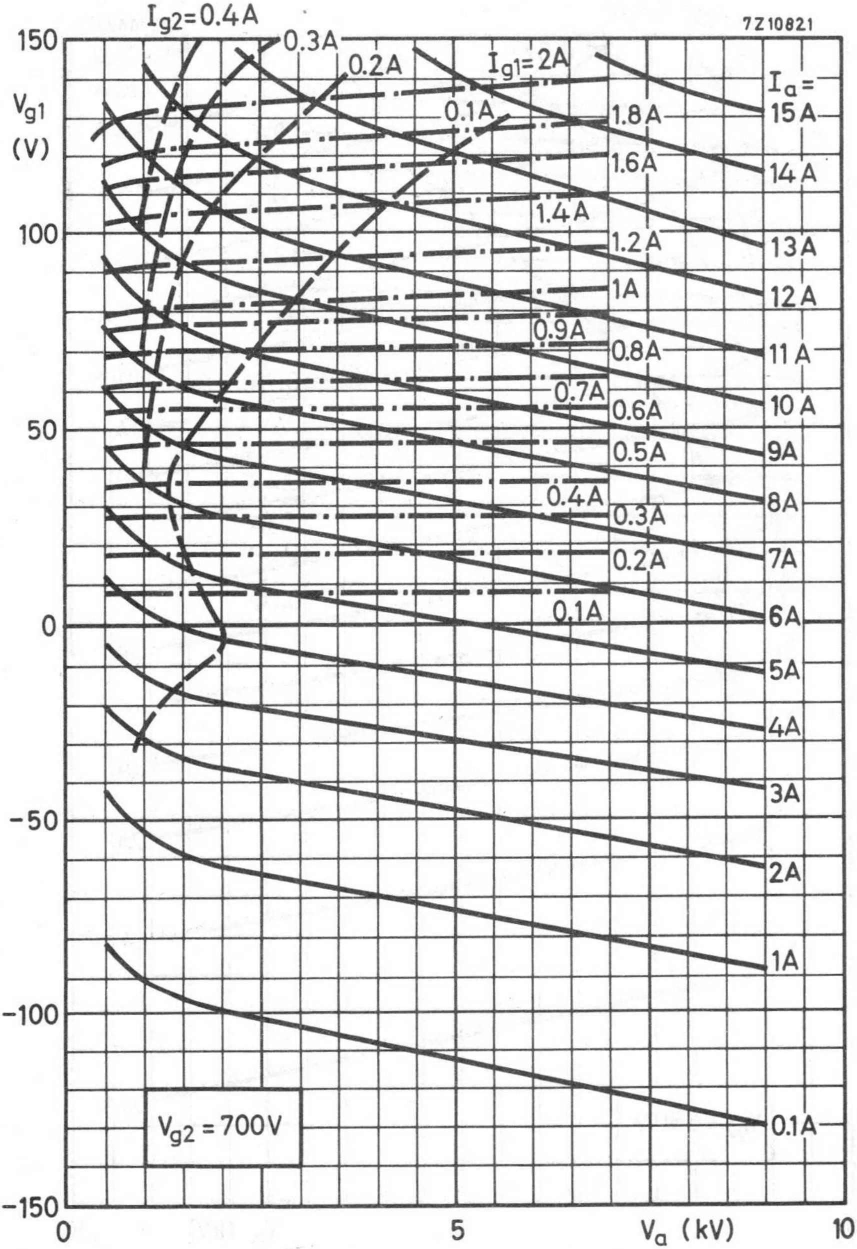

7Z10796
h=0m
t i=55°C
q min.
(m³/min)
p i
(mmH2O)
W a (kW)

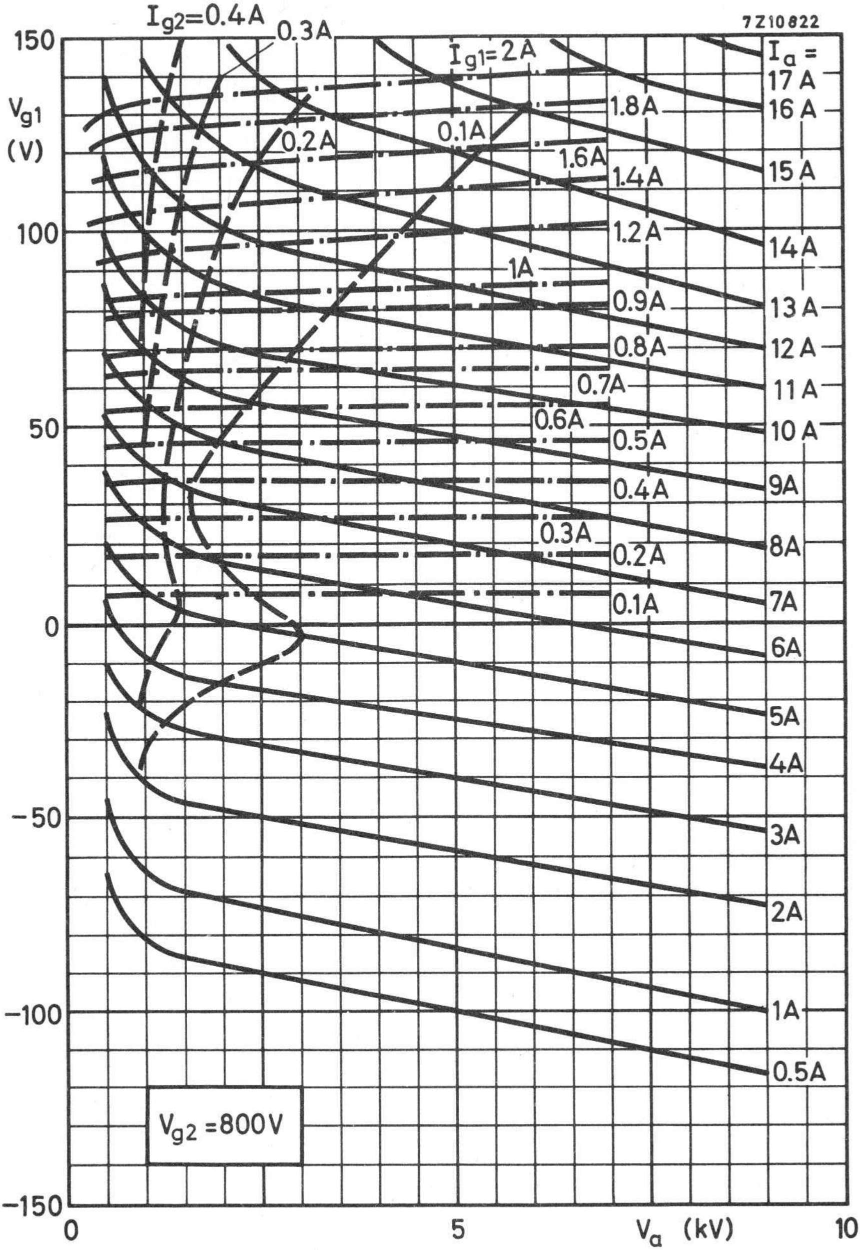

7Z10795
h=1500m
t i=25°C
q min.
(m³/min)
p i
(mmH2O)
W a (kW)


7Z10793
h=1500m
t i=35°C
q min.
(m³/min)
p i
(mmH2O)
W a (kW)


7Z10792
h=3000m
t i=25°C
q min.
(m³/min)
p i
(mmH2O)
W a (kW)


I_g2=0.4A
7Z10823
150
100
50
0
−50
−100
−150
V_g1
(V)
0.3A
0.2A
0.1A
I_g1=2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a =
15 A
14 A
13 A
12 A
11 A
10 A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
V_g2 = 650 V
0
5
10
V_a (kV)


7Z10821
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}= 2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a =
15A
14A
13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
150
100
50
0
-50
-100
-150
V_{g1} (V)
0
5
10
V_a (kV)
V_{g2} = 700V


7Z10822
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}= 2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a =
17 A
16 A
15 A
14 A
13 A
12 A
11 A
10 A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
V_{g1} (V)
150
100
50
0
-50
-100
-150
0
5
10
V_a (kV)
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 (260 MHz)		
	V_a (kV)	$W_{\ell\ sync}$ (kW)	Power gain	V_a (kV)	W_ℓ (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_f		4.2	V ± 5%
Filament current	I_f		53	A
Filament peak starting current	I_{fp}	max.	300	A
Cold filament resistance	R_{fo}		8.5	mΩ
Waiting time	T_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	4	kV
Grid No. 2 voltage	V_{g2}	500	V
Anode current	I_a	0.4	A
Transconductance	S	25	mA/V
Amplification factor	μ_{g2g1}	16	

CAPACITANCES

	grounded cathode		grounded grid		
Input	$C_{g1(a)}$	47			pF
			$C_{f(a)}$	24	pF
Output	$C_{a(g1)}$	9	$C_{a(f)}$	9	pF
Anode to grid No. 1	C_{ag1}	0.1			pF
Anode to filament			C_{af}	< 0.1	pF

TEMPERATURE LIMITS

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

COOLING

See curves
Direction of air flow: see drawing.

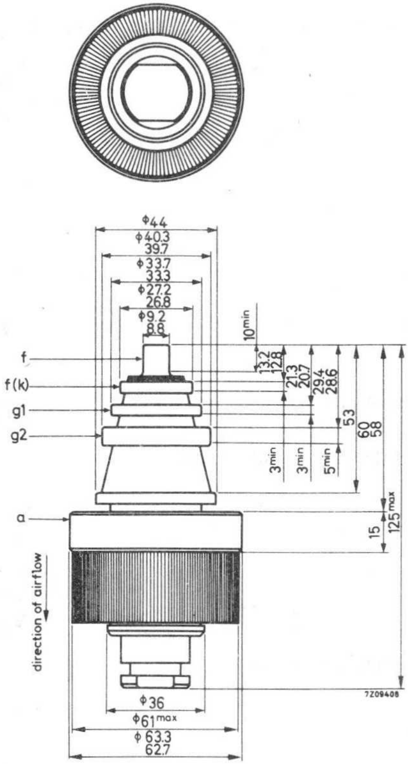
ACCESSORIES

Band I	amplifier circuit assembly (vision)	type 40755
Band I	amplifier circuit assembly (sound)	type 40756
Band III	amplifier circuit assembly (vision)	type 40743
Band III	amplifier circuit assembly (sound)	type 40744

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 0.55 kg
Mounting position: Vertical with anode up or down.



R.F. CLASS B SERVICE

Unless otherwise specified the voltages are given with respect to the cathode.

→ LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	4.0	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	kΩ

→ 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 [2]
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	η		70	%
Driving power	W_{dr}		75	W
Power gain	$\frac{W_\ell}{W_{dr}}$		29.3	

[2]) See page 5

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

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

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	4.0	kV
Grid No.2 voltage	V_{g2}	max.	700	V
Grid No.1 voltage	$-V_{g1}$	max.	100	V
Anode current, black	$I_{a\ black}$	max.	1	A
Anode input power, black	$W_{ia\ black}$	max.	4	kW
Anode dissipation	W_a	max.	1.5	kW
Grid No.2 dissipation	W_{g2}	max.	50	W
Grid No.1 dissipation	W_{g1}	max.	30	W
Cathode current	I_k	max.	1.5	A
Grid No.1 circuit resistance	R_{g1}	max.	10	kΩ

OPERATING CONDITIONS grounded grid.

Frequency of vision carrier	f		175.25	MHz	
Bandwidth (-1 dB)	B	7	8	MHz	1)
Anode voltage	V_a	3	2.5	kV	
Grid No.2 voltage	V_{g2}	500	500	V	
Grid No.1 voltage	V_{g1}	-23	-14	V	2)
Anode current, no signal condition	I_a	200	400	mA	
Anode current, black	$I_{a\ black}$	700	600	mA	3)
Grid No.2 current, black	$I_{g2\ black}$	50	40	mA	3)
Grid No.1 current, black	$I_{g1\ black}$	60	30	mA	3)
Output power in load, sync	$W_{\ell\ sync}$	1550	700	W	
black	$W_{\ell\ black}$	930	420	W	3)
Driving power, sync	$W_{dr\ sync}$	60	30	W	
black	$W_{dr\ black}$	32.5	17	W	
Gain, sync	G_{sync}	26	23		
black	G_{black}	28.6	24.7		
Sync compression	sync in/out	28/25	27/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	
Anode resistance	$R_{a\sim}$	1.8	1.6	kΩ	1)

Notes see page 7

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

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f		55.25		MHz	
Bandwidth (−1 dB)	B	7	7	6	MHz	1)
Anode voltage	V_a	2.5	2	2.5	kV	
Grid No. 2 voltage	V_{g2}	600	600	600	V	
Grid No. 1 voltage	V_{g1}	−21	−20	−21	V	2)
Anode current, no signal condition	I_a	200	200	200	mA	
Anode current, black	$I_{a\,black}$	820	650	900	mA	3)
Grid No. 2 current, black	$I_{g2\,black}$	45	40	50	mA	3)
Grid No. 1 current, black	$I_{g1\,black}$	80	50	90	mA	3)
Output power in load, sync	$W_{\ell\,sync}$	1170	670	1500	W	
black	$W_{\ell\,black}$	700	400	900	W	3)
Driving power, sync	$W_{dr\,sync}$	83	42	94	W	
black	$W_{dr\,black}$	46	24	50	W	
Gain, sync	G_{sync}	14	16	16		
black	G_{black}	15.2	16.6	18		
Sync compression	sync in/out	28/25	27/25	30/25		4)
Differential phase		< 3	< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	≥ 85	%	
Anode resistance	$R_{a\sim}$	0.9	0.9	1.05	kΩ	1)

Frequency of vision carrier	f	83.25		MHz	
Bandwidth (−1 dB)	B	7	7	MHz	1)
Anode voltage	V_a	2.5	2	kV	
Grid No. 2 voltage	V_{g2}	600	600	V	
Grid No. 1 voltage	V_{g1}	−21	−20	V	2)
Anode current, no signal condition	I_a	200	200	mA	
Anode current, black	$I_{a\,black}$	900	610	mA	3)
Grid No. 2 current, black	$I_{g2\,black}$	50	45	mA	3)
Grid No. 1 current, black	$I_{g1\,black}$	90	45	mA	3)
Output power in load, sync	$W_{\ell\,sync}$	1500	670	W	
black	$W_{\ell\,black}$	900	400	W	3)
Driving power, sync	$W_{dr\,sync}$	94	39	W	
black	$W_{dr\,black}$	50	22	W	
Gain, sync	G_{sync}	16	17		
black	G_{black}	18	18		
Sync compression	sync in/out	30/25	28/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	
Anode resistance	$R_{a\sim}$	1.05	1.05	kΩ	1)

NOTES

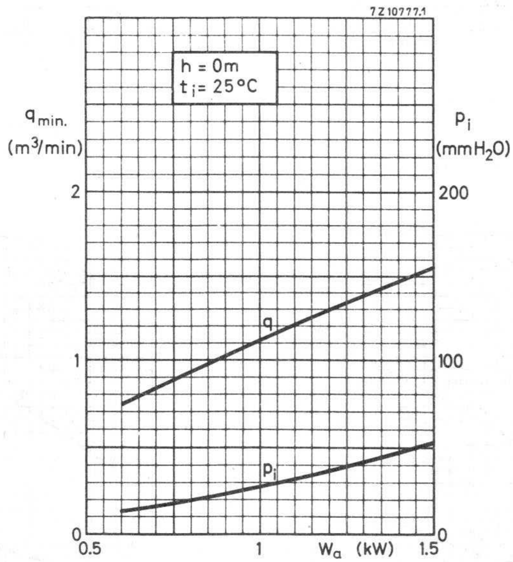
1) With double tuned circuit.

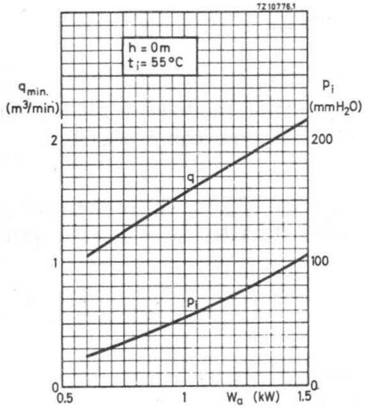
2) To be adjusted for the stated no signal anode current.

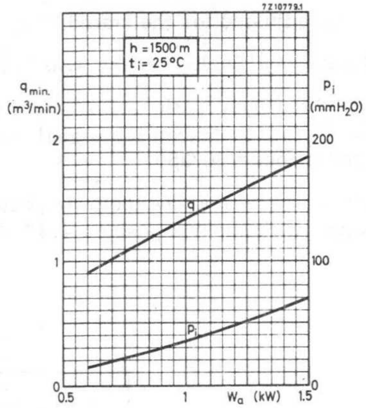
3) Black signal including line sync pulses.

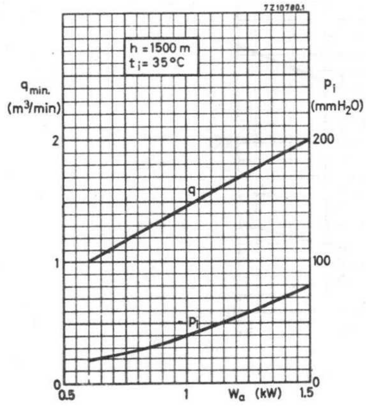
4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

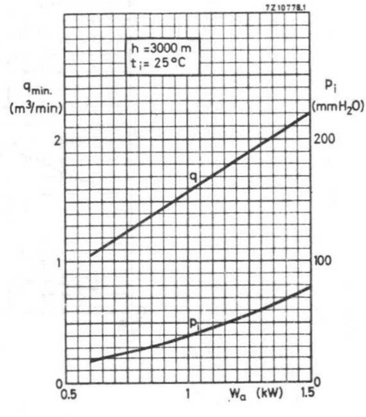
5) Measured with a saw tooth amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4.43 MHz sine wave with a 10% peak to peak value.

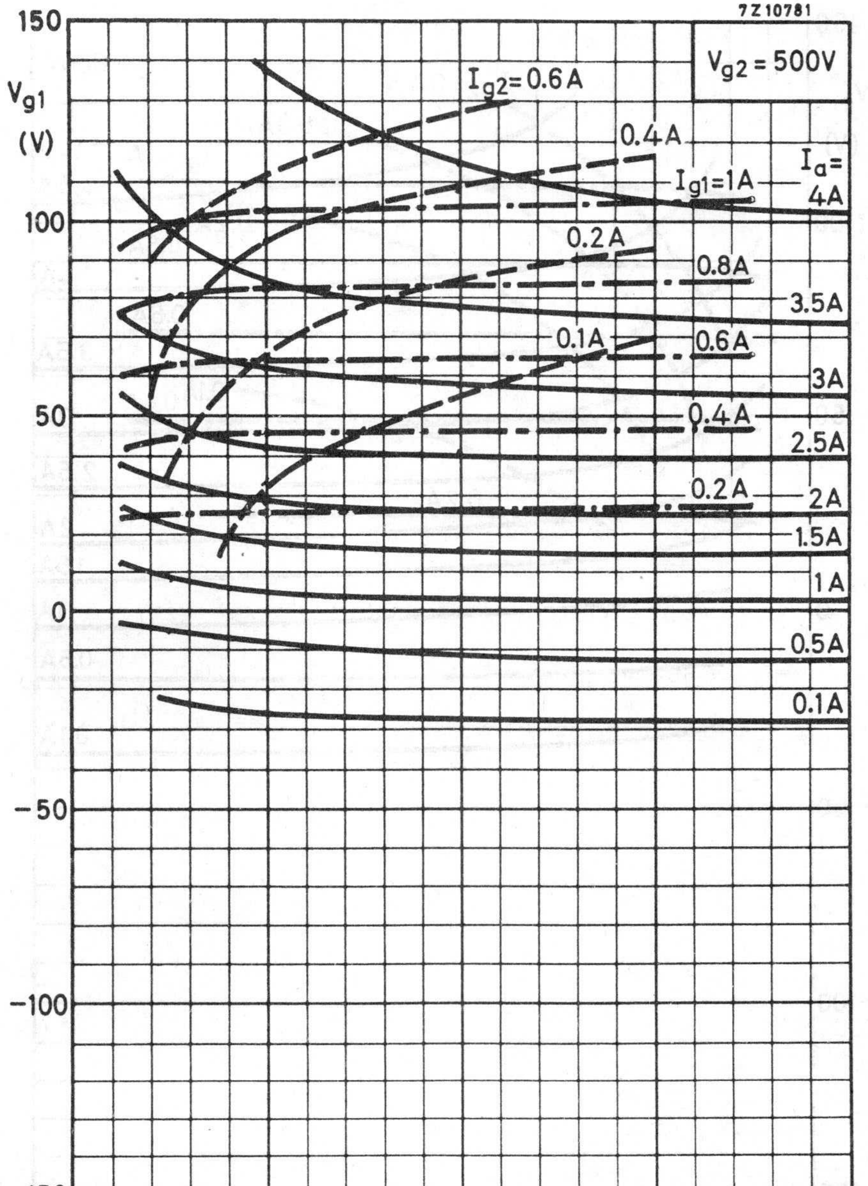


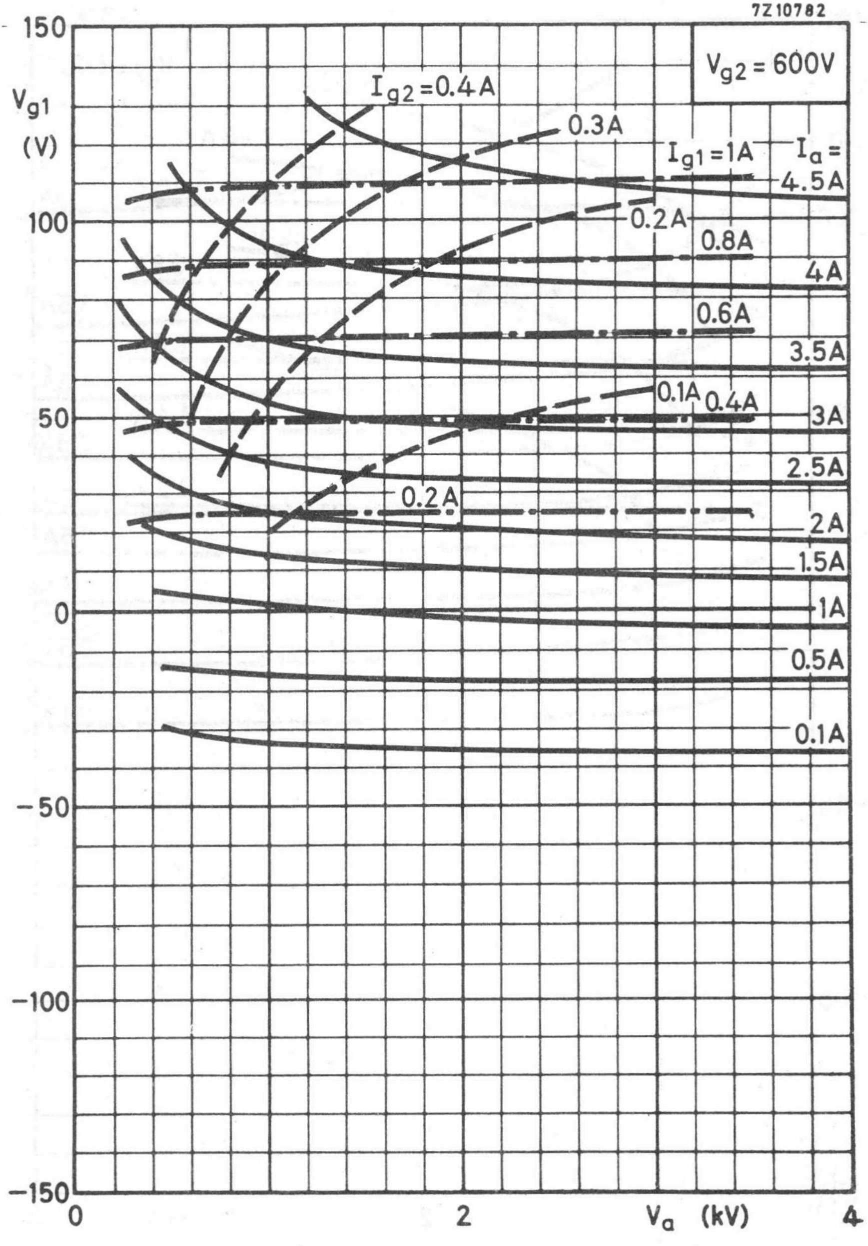

7Z10776.1
h = 0m
t_i = 55 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)
0.5
1
1.5
0
1
2
100
200

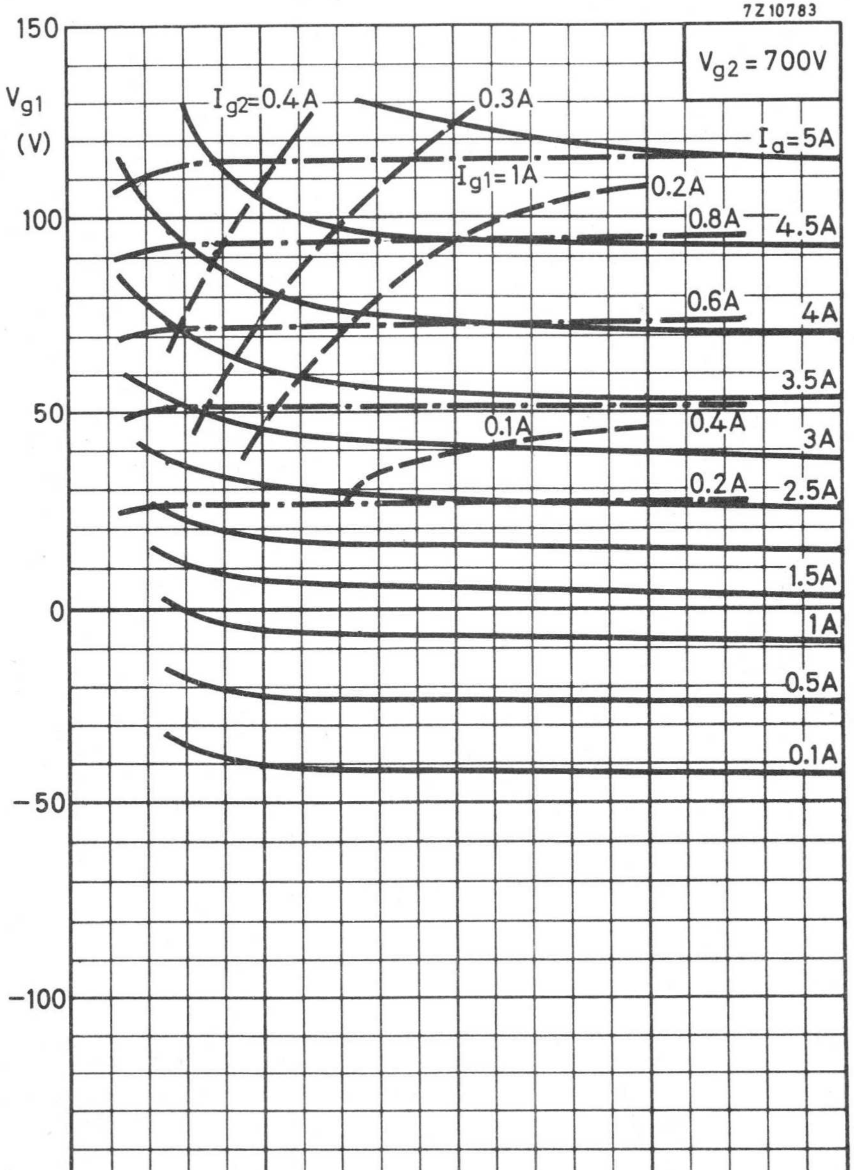

7Z10779.1
h = 1500 m
t_i = 25 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)
0.5
1
1.5
0
1
2
100
200


7Z10780.1
h = 1500 m
t_i = 35 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)
0.5
1
1.5
0
1
2
100
200


7Z10778.1
h = 3000 m
t_i = 25 °C
$q_{min.}$
(m^3/min)
p_i
(mmH_2O)
q
p_i
W_a (kW)
0.5
1
1.5
0
1
2
100
200


7Z10781
Vg2 = 500V
Vg1
(V)
150
100
50
0
-50
-100
-150
Ig2=0.6A
0.4A
0.2A
0.1A
Ig1=1A
0.8A
0.6A
0.4A
0.2A
Ia=
4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0.1A
0
2
Va (kV)
4


7Z10782
V_{g2} = 600V
V_{g1}
(V)
150
100
50
0
−50
−100
−150
0
2
4
V_a (kV)
I_{g2} = 0.4 A
0.3A
0.2A
0.1A
0.2A
I_{g1} = 1A
0.8A
0.6A
0.4A
I_a =
4.5A
4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0.1A


7Z10783
$V_{g2} = 700V$
V_{g1} (V)
150
100
50
0
−50
−100
−150
0
2
V_a (kV)
4
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}= 1A
0.8A
0.6A
0.4A
0.2A
I_a=5A
4.5A
4A
3.5A
3A
2.5A
1.5A
1A
0.5A
0.1A

R.F. POWER TETRODE

Mesh-type cathode version of QB4/1100.

With this tube in centre-tapped filament transformer arrangement the hum level is reduced to better than -60 dB.

For data and curves of this type please refer to type QB4/1100.

R.F. POWER TETRODE

Mesh-type cathode version of QB4/1100GA.

With this tube in centre-tapped filament transformer arrangement the hum level is reduced to better than -60 dB.

For data and curves of this type please refer to type QB4/1100GA.

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as final amplifier in F.M. transmitters in band II in grounded cathode circuits.

QUICK REFERENCE DATA			
Frequency (MHz)	H.F. Class B amplifier		
	V_a (kV)	W_ℓ (kW)	Power gain
110	6.0	6.6	300
	7.0	10.5	210

HEATING : Direct; filament thoriated tungsten, mesh type.

Filament voltage	V_f		6.8	V ±5%
Filament current	I_f		120	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{fo}		6	mΩ
Waiting time	T_w	min.	1	s

CAPACITANCES

Input	$C_{g1}(a)$	87	pF
Output	$C_a(g_1)$	16.6	pF
Anode to grid No. 1	C_{ag1}	0.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid No. 2 voltage	V_{g2}	600	V
Anode current	I_a	1.2	A
Transconductance	S	30	mA/V
Amplification factor	μ_{g2g1}	7.2	-

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. seal temperature	t	max.	200	°C

COOLING

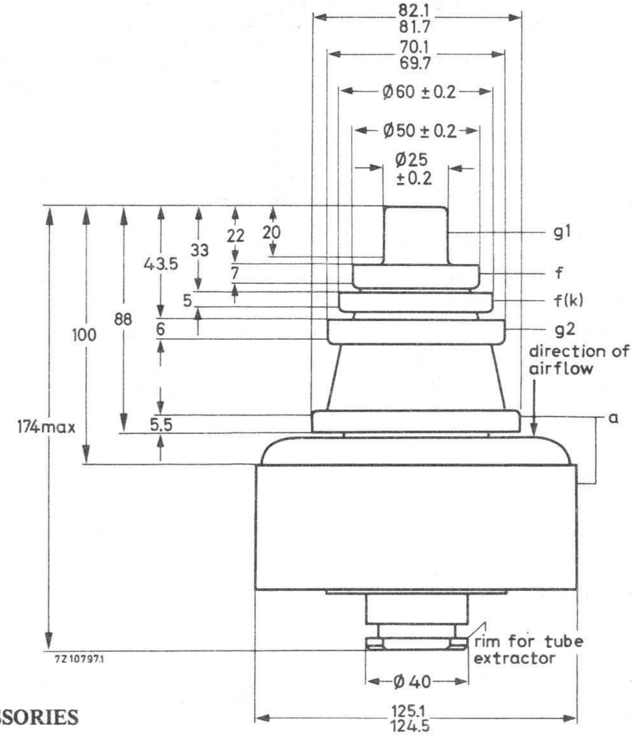
In order to keep the temperature of the seals below the maximum permissible value, it may be neccessary to direct an air flow to the seals.

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

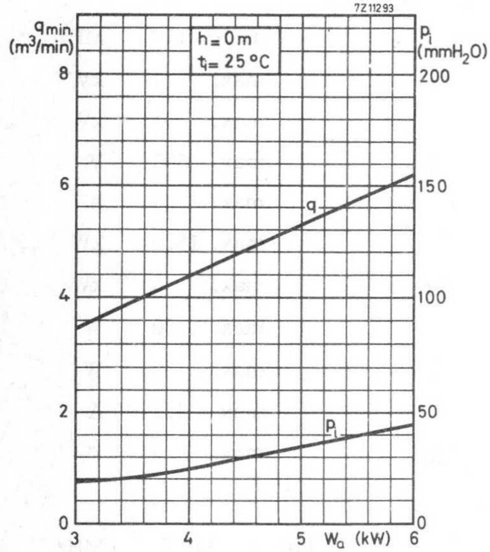
LIMITING VALUES (absolute max. rating system)

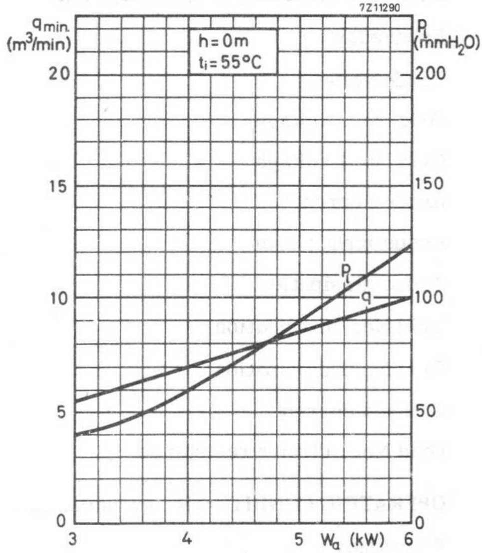
Frequency	f	up to 110	MHz
Anode voltage	V_a	max. 8.4	kV
Grid No. 2 voltage	V_{g2}	max. 1	kV
Grid No. 1 voltage	$-V_{g1}$	max. 500	V
Anode current	I_a	max. 4	A
Anode input power	W_{ia}	max. 18.5	kW
Anode dissipation	W_a	max. 6	kW
Grid No. 2 dissipation	W_{g2}	max. 80	W
Grid No. 1 dissipation	W_{g1}	max. 40	W
Cathode current	I_k	max. 4.5	A
Grid No. 1 circuit resistance	R_{g1}	max. 10	kΩ

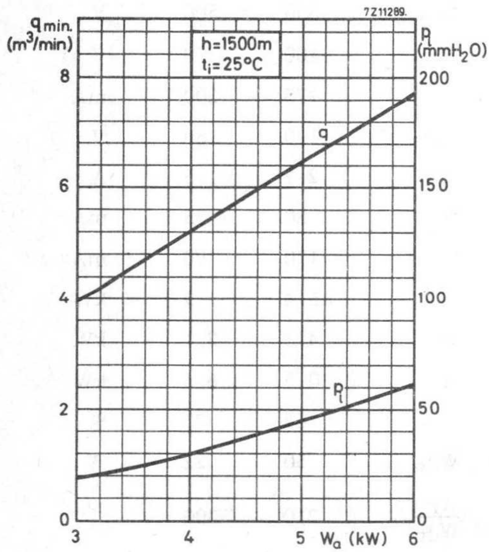
OPERATING CONDITIONS grounded cathode

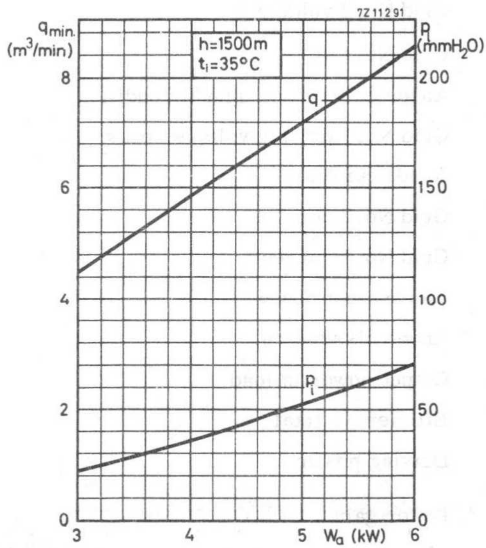
Frequency	f	110	110	MHz
Anode voltage	V_a	7.0	6.0	kV
Grid No. 2 voltage	V_{g2}	550	500	V
Grid No. 1 voltage	V_{g1}	-100	-90	V [1])
Anode current, no signal condition	I_a	175	200	mA
Grid No. 1 driving voltage, peak	V_{g1p}	170	150	V
Anode current	I_a	2.2	1.5	A
Grid No. 2 current	I_{g2}	80	85	mA
Grid No. 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	η	68	73	%
Driving power	W_{dr}	50	22	W
Power gain	$\frac{W_\ell}{W_{dr}}$	210	300	

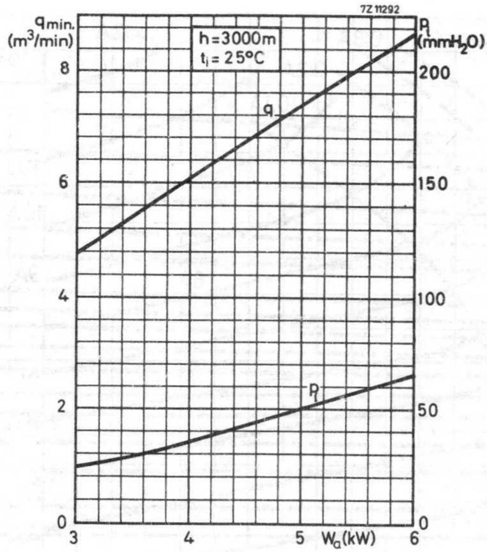
[1]) To be adjusted for the stated no signal anode current.

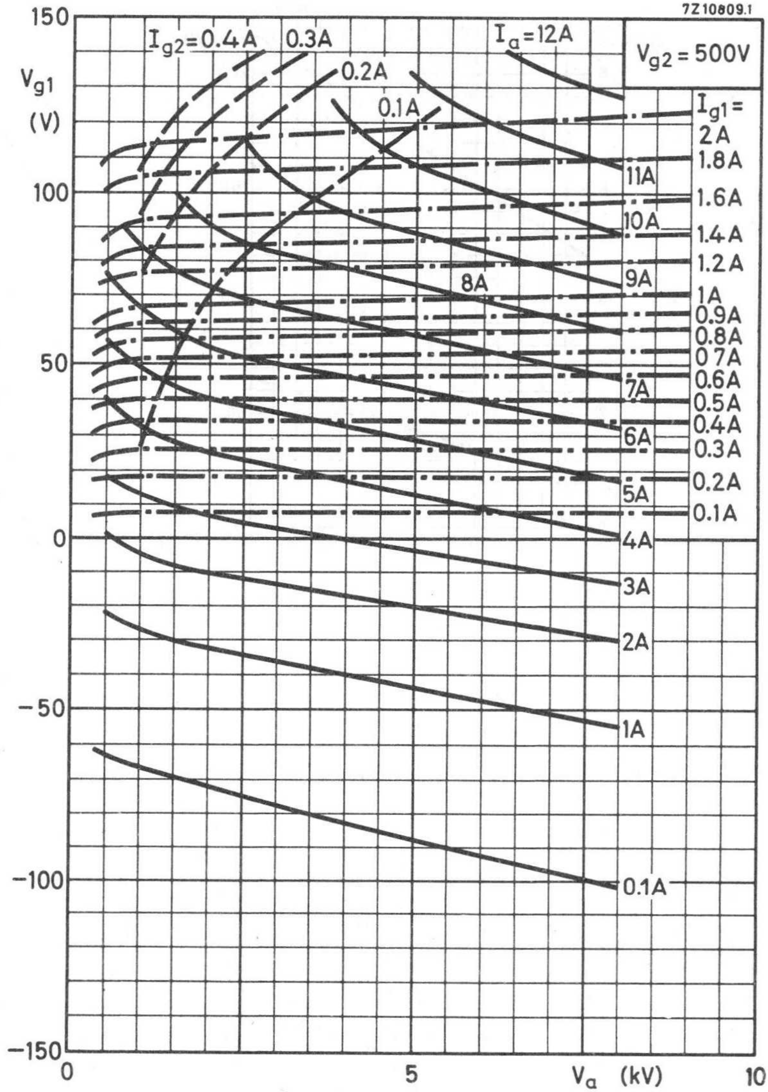

7Z11293
$q_{min.}$ (m³/min)
p_i (mmH₂O)
h = 0 m
t_i = 25 °C
q
p_i
W_a (kW)

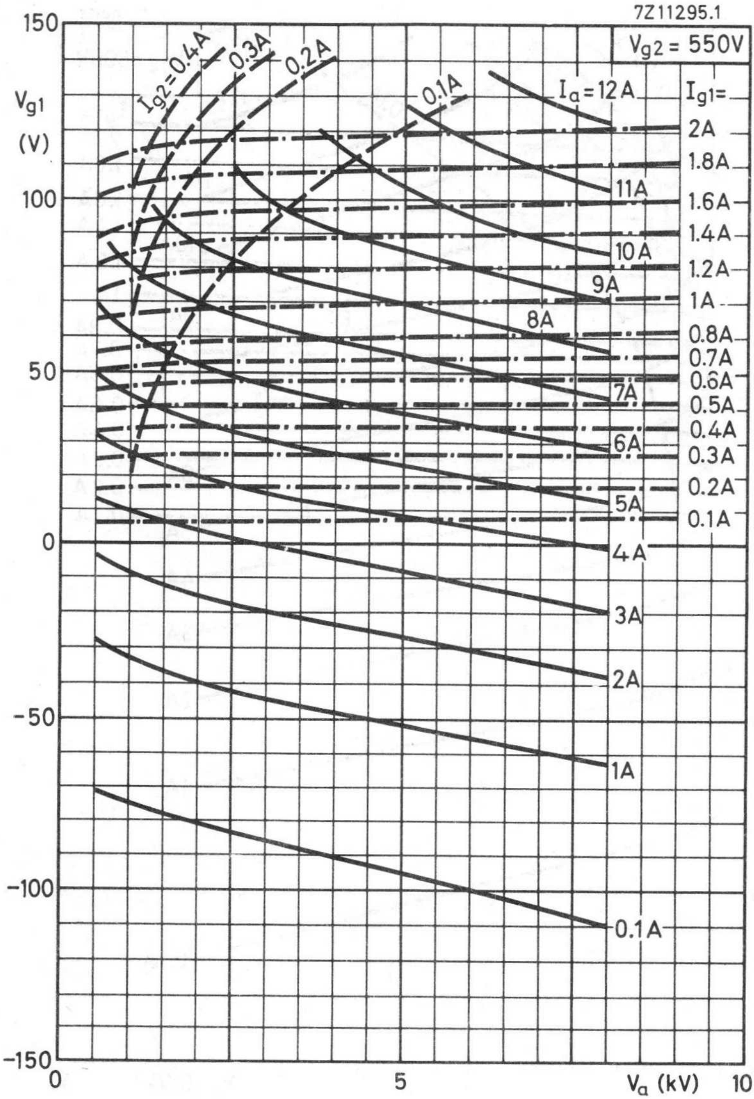

7Z11290
$q_{min.}$ (m³/min)
p_i (mmH₂O)
h = 0 m
t_i = 55 °C
p_i
q
W_a (kW)

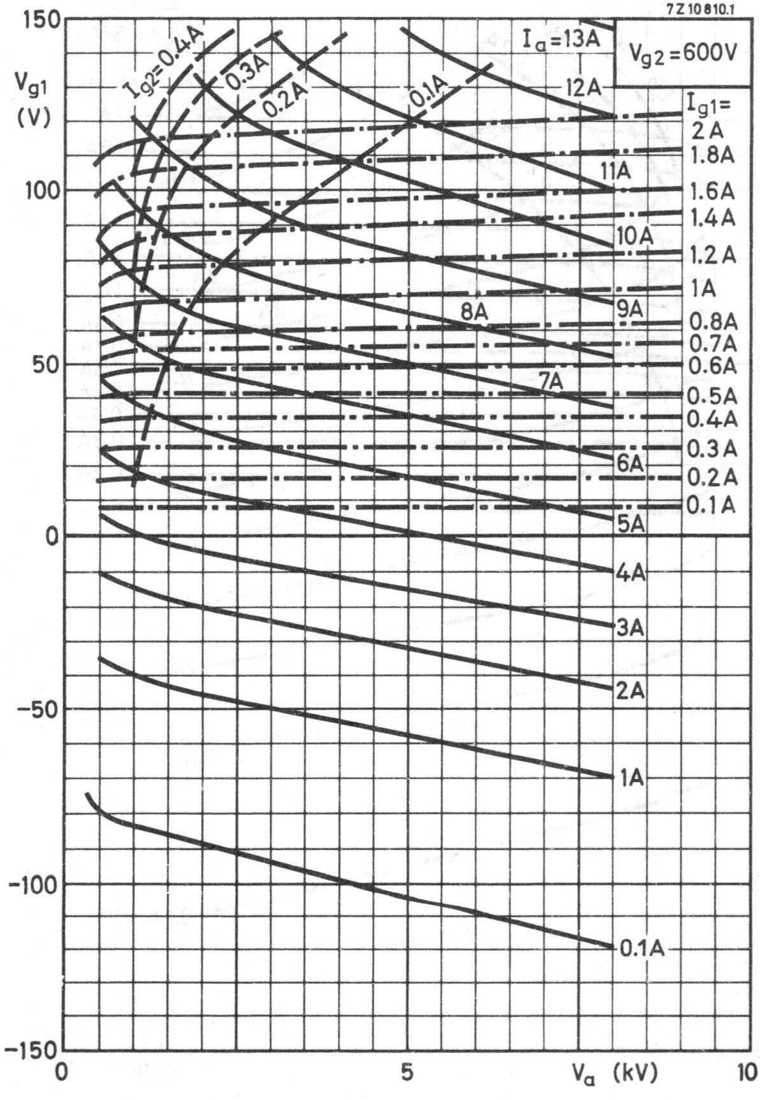

7Z11289
$q_{min.}$ (m³/min)
p_i (mmH₂O)
h=1500m
t_i=25°C
q
p_i
W_a (kW)

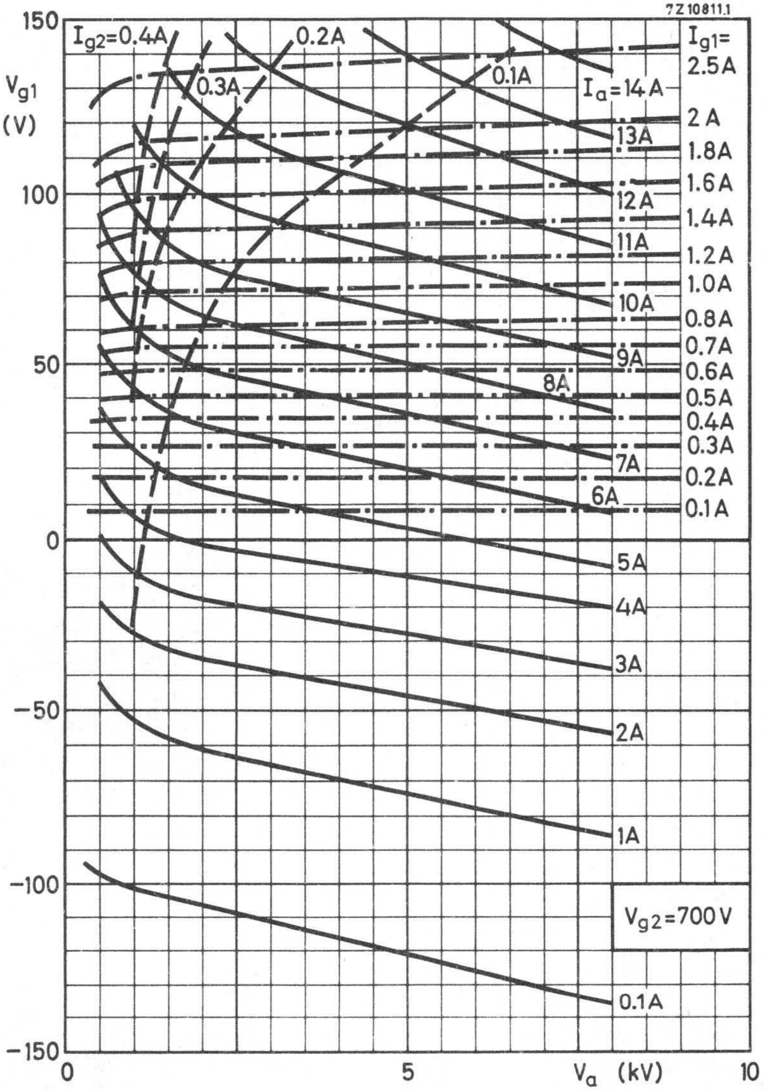

7Z11291
$q_{min.}$ (m³/min)
p_i (mmH₂O)
h=1500m
t_i=35°C
q
p_i
W_a (kW)


7Z 11292
$q_{min.}$
(m^3/min)
h = 3000m
t_i = 25°C
p_i
(mmH_2O)
q
p_i
0
2
4
6
8
0
50
100
150
200
3
4
5
6
W_a (kW)


7Z10809.1
150
100
50
0
-50
-100
-150
V_{g1} (V)
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_a=12A
V_{g2} = 500V
I_{g1} =
2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
0
5
10
V_a (kV)


7Z11295.1
V_{g2} = 550V
V_{g1} (V)
150
100
50
0
-50
-100
-150
0
5
10
V_a (kV)
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_a=12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
I_{g1}=
2A
1.8A
1.6A
1.4A
1.2A
1A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A


7Z10810.1
150
100
50
0
-50
-100
-150
V_{g1} (V)
0
5
10
V_a (kV)
V_{g2} = 600V
I_a=13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=
2 A
1.8A
1.6A
1.4A
1.2 A
1A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3 A
0.2 A
0.1 A


7Z10811.1
150
100
50
0
−50
−100
−150
V_{g1}
(V)
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=
2.5A
2 A
1.8A
1.6A
1.4A
1.2A
1.0A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a=14 A
13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
V_{g2}=700 V
0
5
10
V_a (kV)

AIR COOLED V.H.F. POWER TETRODE

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

	QUICK REFERENCE DATA		
	Class AB linear amplifier (vision)		
Frequency (MHz)	V_a (kV)	$W_{\ell\ sync}$ (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 ± 5%
Filament current	I_f		120	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{fo}		10.5	mΩ
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	μ_{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	^{o}C
Recommended max. seal temperature	t	max.	200	^{o}C

COOLING

W_a (kW)	h (m)	t_i (^{o}C)	q (m^3/min)	p_i (mm H_2O)
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 [1])
Band III amplifier circuit assembly (sound)	type 40769 [1])
Complete socket including grid No. 1, grid No. 2 cathode and filament connections	type 40742

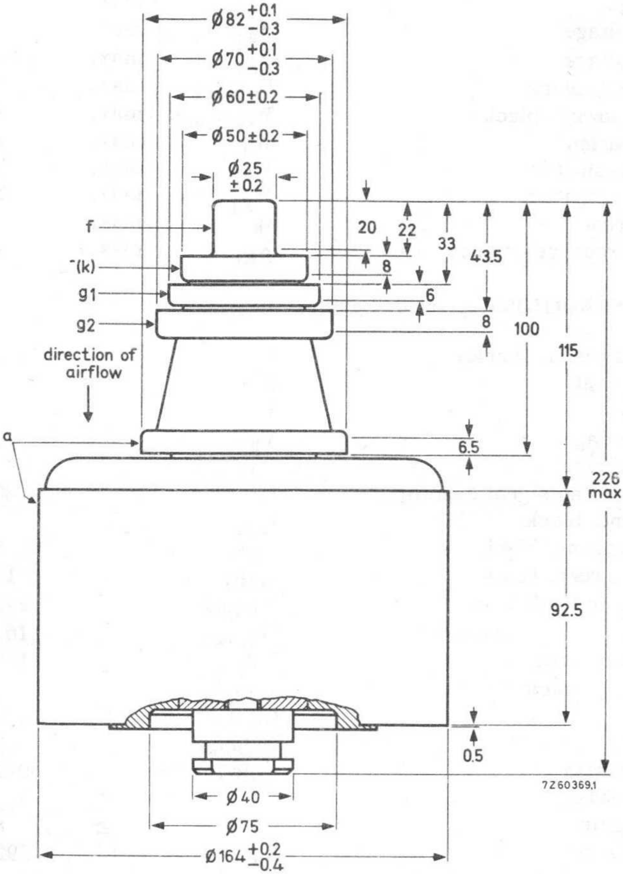
[1]) Including tube extractor type 40754

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 11 kg

Mounting position: Vertical with anode up or down



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

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

LIMITING VALUES (Absolute max. rating system)

→ Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	9	kV
Grid No. 2 voltage	V_{g2}	max.	1	kV
Grid No. 1 voltage	$-V_{g1}$	max.	500	V
Anode current, black	$I_{a\ black}$	max.	7	A
Anode input power, black	$W_{ia\ black}$	max.	40	kW
Anode dissipation	W_a	max.	18	kW
Grid No. 2 dissipation	W_{g2}	max.	100	W
Grid No. 1 dissipation	W_{g1}	max.	50	W
Cathode current	I_k	max.	9	A
Grid No. 1 circuit resistance	R_{g1}	max.	10	kΩ

OPERATING CONDITIONS, grounded grid

Frequency of vision carrier	f		175.25	MHz	
Bandwidth (-1 dB)	B		7	MHz	2)
Anode voltage	V_a		8	kV	
Grid No. 2 voltage	V_{g2}		700	V	
Grid No. 1 voltage	V_{g1}		-92	V	1)
Anode current, no signal condition	I_a		800	mA	
Anode current, black	I_{ab1}		4	A	3)
Grid No. 2 current, black	I_{g2b1}		55	mA	3)
Grid No. 1 current, black	I_{g1b1}		175	mA	3)
Output power in load, sync	$W_{\ell\ sync}$		27.5	kW	
black	$W_{\ell black}$		16.5	kW	3)
Driving power, sync	$W_{dr_{sync}}$		1000	W	
black	$W_{dr_{black}}$		530	W	2)
Gain, sync	G_{sync}		27.5		
black	G_{black}		31		
Sync compression	sync in/out		30/25		4)
Differential phase		<	3	o	5)
Differential gain		≥	85	%	5)
Anode resistance	$R_{a\sim}$		920	Ω	

Notes see page 5

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

OPERATING CONDITIONS (continued)

Frequency of vision carrier	f	83.25	55.25	MHz	
Bandwidth (-1 dB)	B	7	7	MHz	2)
Anode voltage	V_a	6.5	6.5	kV	
Grid No. 2 voltage	V_{g2}	700	700	V	
Grid No. 1 voltage	V_{g1}	-88	-88	V	1)
Anode curremt, no signal condition	I_a	900	900	mA	
Anode current, black	I_{abl}	4.1	4.5	A	3)
Grid No. 2 current, black	I_{g2bl}	55	45	mA	3)
Grid No. 1 current, black	I_{g1bl}	160	175	mA	3)
Output power in load, sync	$W_{\ell\,sync}$	20	20	kW	
black	$W_{\ell\,black}$	12	12	kW	3)
Driving power, sync	W_{drsync}	835	910	W	
black	$W_{drblack}$	444	520	W	2)
Gain, sync	G_{sync}	24	22		
black	G_{black}	27	23		
Sync compression	sync in/out	30/25	27/25		4)
Differential phase		< 3	< 3	o	5)
Differential gain		≥ 85	≥ 85	%	5)
Anode resistance	$R_{a\sim}$	720	580	Ω	

NOTES

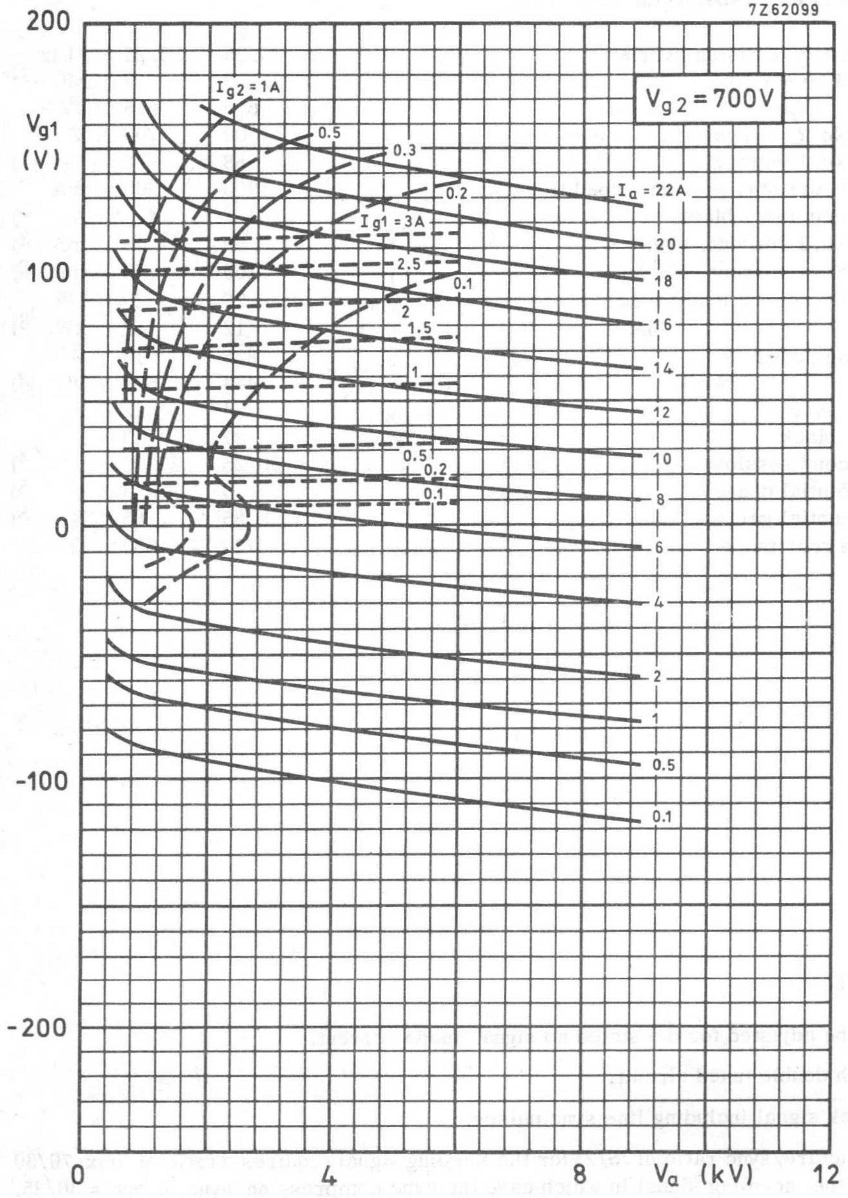
1) To be adjusted for the stated no signal anode current.

2) With double tuned circuit.

3) Black signal including line sync pulses.

4) A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.

5) Measured with a 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.


7Z62099
200
100
0
-100
-200
V_{g1} (V)
$V_{g2} = 700V$
$I_{g2} = 1A$
0.5
0.3
0.2
0.1
$I_{g1} = 3A$
2.5
2
1.5
1
0.5
0.2
0.1
$I_a = 22A$
20
18
16
14
12
10
8
6
4
2
1
0.5
0.1
0
4
8
12
V_a (kV)

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	Ω
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 ± 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	μ_{g2g1}	4.5	-

MECHANICAL DATA

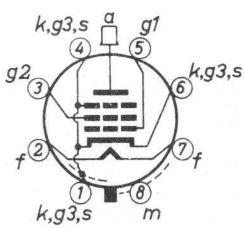
Dimensions in mm

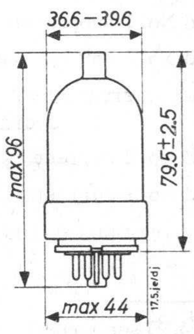
Base: Octal 8 pin, IEC 67-I-5a

Cap : JEDEC C1-1, IEC 67-III-1b

Net weight: approx. 65 g

Mounting position: any





TEMPERATURE LIMIT (Absolute limit)

Bulb temperature	t_{bulb}	max.	200	°C

RECTANGULAR PULSE MODULATOR

LIMITING VALUES (Absolute max. rating system) C.C.S.

Duty factor	δ		0.001 to 1	[1]
Averaging time	T_{av}	max.	10000	μs [1]
Anode supply voltage, d.c.	V_{b_a}		see page 5	[2]
Anode voltage, peak	V_{a_p}	max. 115% of d.c. anode supply voltage		
Grid No.2 supply voltage	$V_{b_{g2}}$	max.	500	V [2]
Grid No.1 supply voltage	$-V_{b_{g1}}$	max.	300	V [2]
	$-V_{b_{g1}}$	min.	see page 5	
Grid No.1 voltage, negative peak	$-V_{g1_p}$	max.	400	V
positive peak	V_{g1_p}	max.	100	V
Anode current, peak	I_{a_p}		see page 6	
Grid No.2 current, peak	I_{g2p}	max.	0.75	A
Grid No.1 current, peak	I_{g1_p}	max.	0.5	A
Anode input power	W_{ia}	max.	80	W
Anode dissipation	W_a		see page 5	[3]
Grid No.2 input power	$W_{i_{g2}}$	max.	1.75	W
Grid No.1 input power	$W_{i_{g1}}$	max.	0.5	W
Cathode-to-heater voltage, peak	V_{kf_p}	max.	135	V
Grid No.1 circuit resistance	R_{g1}	max.	30	kΩ

OPERATING CONDITIONS

Anode supply voltage, d.c.	V_{b_a}	3000	V
Grid No.2 supply voltage, d.c.	$V_{b_{g2}}$	300	V
Grid No.1 supply voltage, d.c.	$V_{b_{g1}}$	-175	V
Grid No.1 voltage, positive peak	V_{g1_p}	65	V
Anode current, peak	I_{a_p}	1.5	A
average	I_a	15	mA
Grid No.2 current	I_{g2}	4	mA
Grid No.1 current	I_{g1}	2.5	mA
Load resistance, 100 W	R_ℓ	1500	Ω ± 5%

[1], [2], [3] see page 3

CHARACTERISTIC RANGE VALUES FOR EQUIPMENT DESIGN

		min.	max.	
Heater current at V_f = 6.3 V	I_f	1.175	1.325	A
Capacitances				
Grid No. 1 to all except anode	$C_{g_1(a)}$	12.0	15.0	pF
Anode to all except grid No. 1	$C_{a(g_1)}$	7.3	9.5	pF
Anode to grid No. 1	C_{ag_1}		0.24	pF
Anode current 4)	I_a	46	94	mA
, peak 5)	I_{a_p}	2.4		A
Grid No. 2 current 4)	I_{g_2}	0	5.5	mA

1) Duty factor for the 6293 is defined as the "on" time in μs divided by 10 000 μs. "On" time is defined as the sum of the durations of all the individual pulses which occur during any 10 000 μs 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.

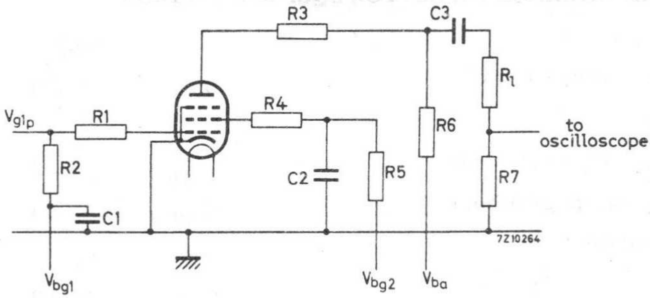
2) For tube protection it is essential that sufficient resistance be used in the anode supply circuit, the grid No. 2 supply circuit, and the grid No. 1 supply circuit so that the short-circuit current is limited to 0.5 A in each circuit.

3) Averaged over any interval not exceeding 10 000 μs. 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.

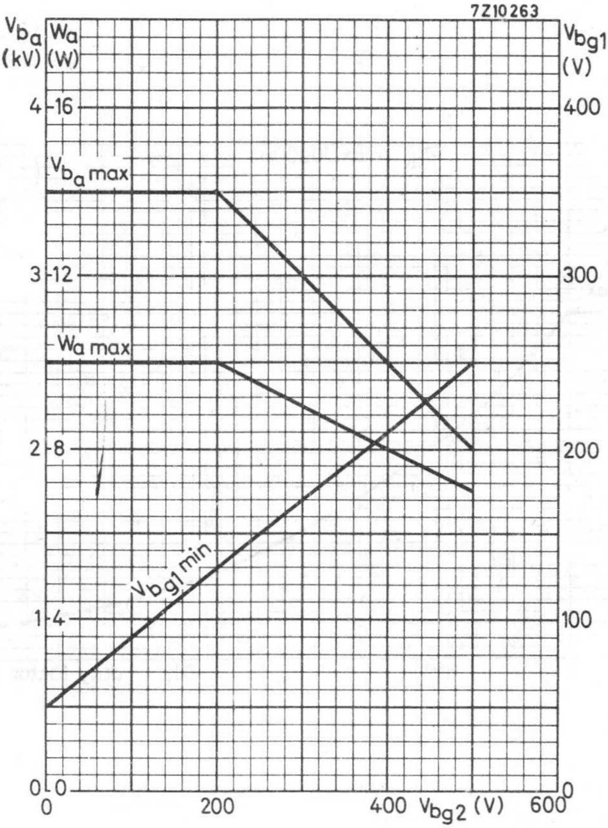
4) V_f = 6.3 V, $V_a = V_{g_2}$ = 300 V, V_{g_1} = -33 V

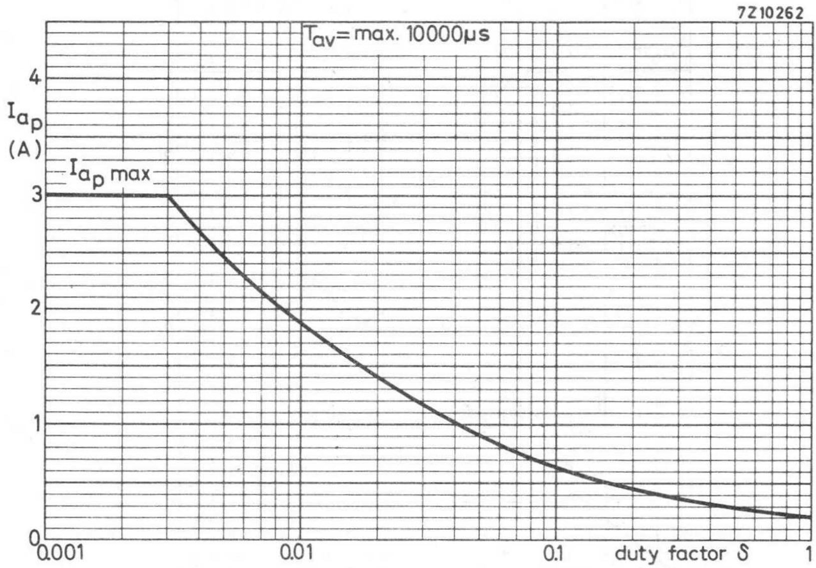
5) With the tube in the test circuit on page 4, and under the following conditions:

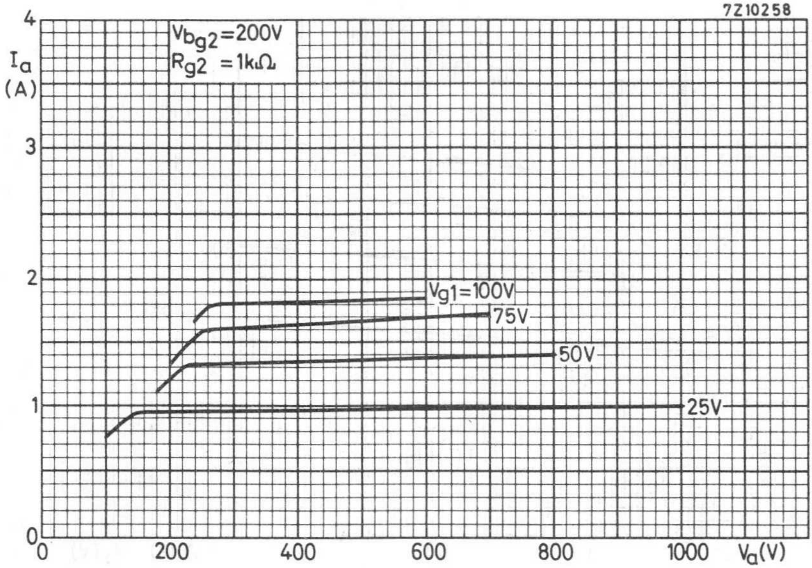
Rectangular-wave modulation applied to grid No. 1			
pulse duration approx.	T_{imp}	1	μs
pulse repetition frequency approx.	f_{imp}	3000	p.p.s
Anode supply voltage	V_{ba}	2000	V
Grid No. 2 supply voltage	V_{bg_2}	500	V
Grid No. 1 supply voltage	V_{bg_1}	-300	V
Grid No. 1 swing, peak positive	V_{g_1p}	100	V
Load resistance, 50 W	R_ℓ	375	Ω
Heater voltage	V_f	6.3	V

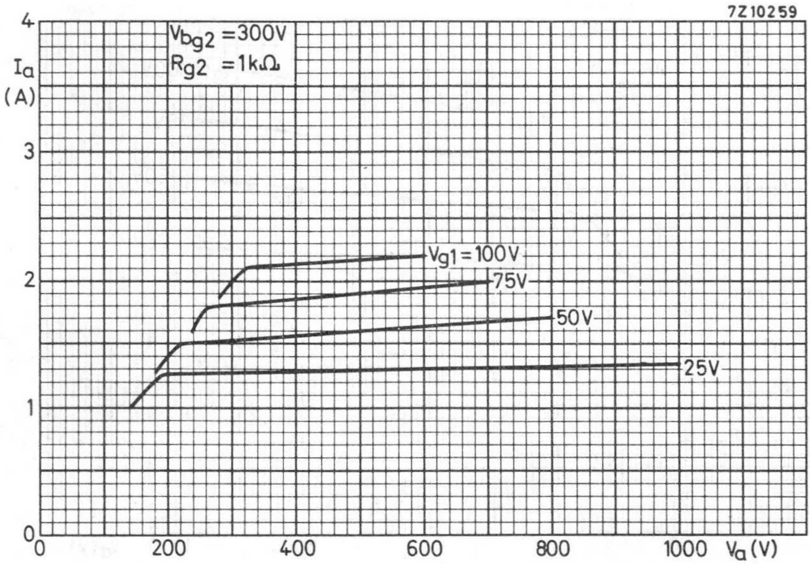


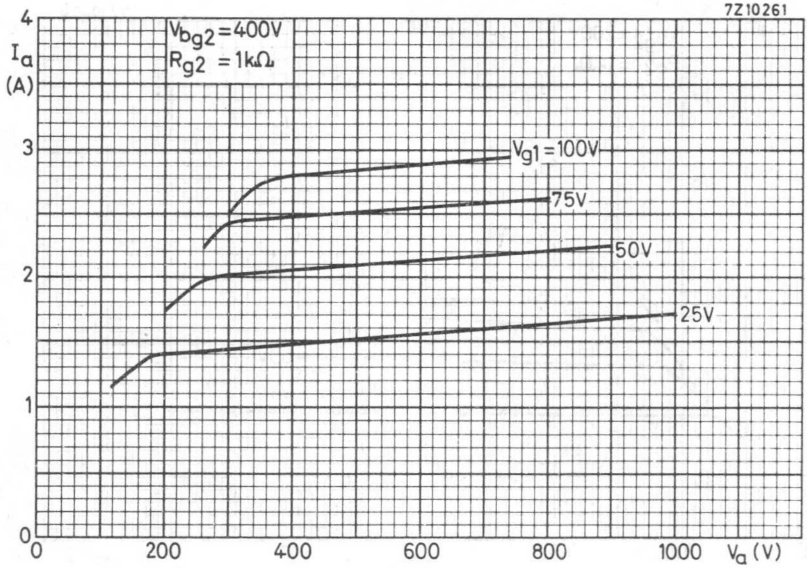
C1	0.1	μF, 600 $V_{d.c.}$
C2	2	μF, 600 $V_{d.c.}$
C3	0.25	μF, 5000 $V_{d.c.}$
R1	20	Ω, 1 W
R2	3000	Ω, 1 W
R3	10	Ω, 5 W
R4	25	Ω, 1 W
R5	1 000	Ω, 1 W
R6	10 000	Ω, 1 W
R7	30	Ω, $\pm$ 1%
$R\ell$	see page 3, note 5	

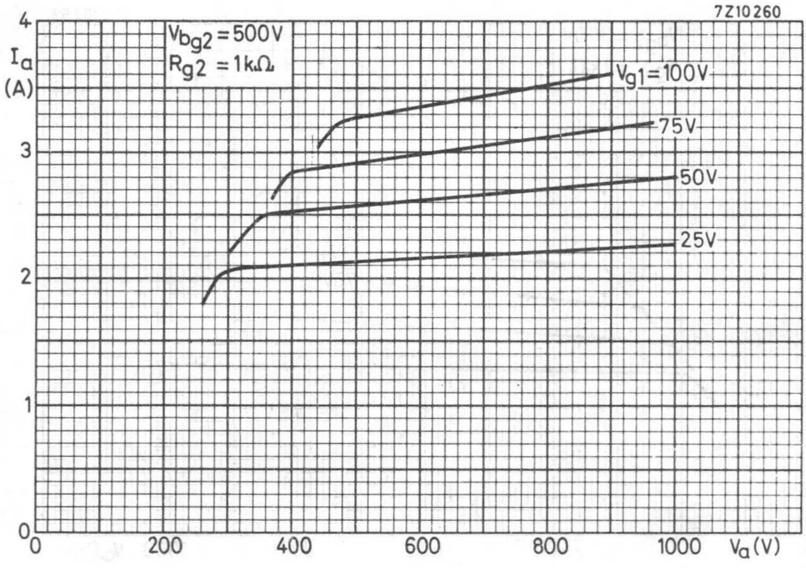

7Z10263
V_{b_a} (kV)
W_a (W)
V_{bg1} (V)
4
16
400
V_{b_a} max
3
12
300
W_a max
2
8
200
V_{bg1} min
1
4
100
0
0
0
0
200
400
V_{bg2} (V)
600


7Z10262
T_{av} = max. 10000μs
4
I_{a_p}
(A)
I_{a_p} max
3
2
1
0
0.001
0.01
0.1
duty factor δ
1


7Z10258
V_{bg2}=200V
R_{g2} =1kΩ
I_a (A)
4
3
2
1
0
0
200
400
600
800
1000
V_a(V)
V_{g1}=100V
75V
50V
25V


7Z10259
V_{bg2} =300V
R_{g2} =1kΩ
I_a (A)
4
3
2
1
0
0
200
400
600
800
1000
V_a (V)
V_{g1}=100V
75V
50V
25V


7Z10261
V_{bg2} = 400V
R_{g2} = 1kΩ
I_a (A)
4
3
2
1
0
0
200
400
600
800
1000
V_a (V)
V_{g1} = 100V
75V
50V
25V


7Z10260
V_{bg2} = 500V
R_{g2} = 1kΩ
I_a (A)
4
3
2
1
0
0
200
400
600
800
1000
V_a (V)
V_{g1} = 100V
75V
50V
25V

R.F. POWER TETRODE

Forced-air cooled tetrode intended for use as R.F. power amplifier and oscillator. The 7609 is shock and vibration resistant.

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		Cag_2 mod.		AB mod.		
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)[1]	W_o (W)[2]
< 150	2000	370	1600	230	2000	580	630
	1500	260	1200	160	1500	400	440
165	1250	195	1000	140	1000	230	270
	1000	150	800	100	800	170	215
	750	110	600	80			
	600	85	400	55			
500	1250	140					
	1000	120					
	800	95					
	600	50					

Freq. (MHz)	B television	
	V_a (V)	$W_o$sync (W)
216	1250	250
	1000	200
	750	135

HEATING: Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	26.5	V
Heater current	I_f	570	mA
Waiting time	T_w	min. 30	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1(a)}$	15.5	pF
Anode to all except grid No.1	$C_{a(g_1)}$	4.0	pF
Anode to grid No.1	C_{ag_1}	0.03	pF

1) Without grid current, two tubes.
2) With grid current, two tubes.

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500	V
Grid No. 2 voltage	V_{g_2}	250	V
Anode current	I_a	200	mA
Transconductance	S	12	mA/V
Amplification factor	$\mu_{g_2g_1}$	5	-

TEMPERATURE LIMITS (Absolute max. rating system)

Anode temperature measured on base end of anode surface at junction with fins	t_a	max. 250	°C
Anode seal temperature	t_s	max. 200	°C
Base seals and grid No. 2 seal temperature	t_s	max. 175	°C

COOLING air inlet temperature t_i = 20 °C, altitude h = 0 m [1])

With an air system socket			
Air flow	q	0.16	m^3/min
Pressure drop	p_i	7	mm H_2O
Without an air system socket			
Air flow	q	0.15	m^3/min
Pressure drop	p_i	7	mm H_2O

[1]) At higher altitudes and ambient temperatures, an increase in air flow is necessary to maintain the respective seal temperatures and the anode temperature within the maximum ratings.

With an air system socket

The air is directed over the base seals, past the grid No. 2 seal, glass envelope and anode seal, and through the radiator to provide effective cooling with minimum air flow.

Without air system socket

Adequate cooling air must be directed over the base seals, past the envelope, and through the radiator.

ACCESSORIES

Socket	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°.

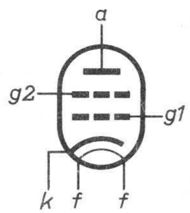
Vibration

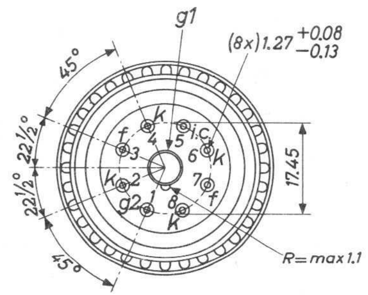
The tube is subjected to vibration frequencies from 25 Hz to 2000 Hz with an acceleration of 10 g.

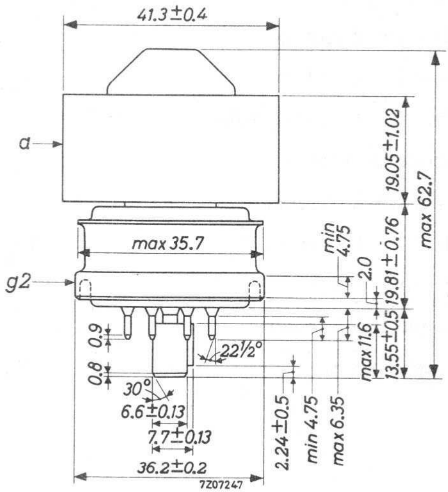
MECHANICAL DATA Dimensions in mm

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_{g_2}	max. 300	300	V
Grid No. 2 dissipation	W_{g_2}	max. 12	12	W
Grid No. 1 voltage, negative	$-V_{g_1}$	max. 250	250	V
Grid No. 1 dissipation	W_{g_1}	max. 2	2	W
Grid No. 1 circuit resistance	R_{g_1}	max. 25	25	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 150	150	V

OPERATING CONDITIONS

Frequency	f	up to 150	150	MHz
Anode voltage	V_a	2000	1500	V
Grid No. 2 voltage	V_{g_2}	250	250	V
Grid No. 1 voltage	V_{g_1}	-88	-88	V
Grid No. 1 driving voltage	$V_{g_{1p}}$	110	110	V
Anode current	I_a	250	250	mA
Grid No. 2 current	I_{g_2}	24	24	mA
Grid No. 1 current	I_{g_1}	8	8	mA
Driving power	W_{dr}	2.5	1.5	W
Anode input power	W_{i_a}	500	375	W
Output power	W_o	370	260	W

OPERATING CONDITIONS (continued)

Frequency	f	165	165	165	165	MHz
Anode voltage	V_a	1250	1000	750	600	V
Grid No. 2 voltage	V_{g_2}	250	250	250	250	V
Grid No. 1 voltage	V_{g_1}	-90	-80	-80	-75	V
Grid No. 1 driving voltage	$V_{g_{1p}}$	106	95	96	91	V
Anode current	I_a	200	200	200	200	mA
Grid No. 2 current	I_{g_2}	20	31	37	37	mA
Grid No. 1 current	I_{g_1}	11	10	11	11	mA
Driving power	W_{dr}	1.2	1	1	1	W
Anode input power	W_{i_a}	250	200	150	120	W
Output power	W_o	195	150	110	85	W

OPERATING CONDITIONS with coaxial cavity

Frequency	f	500	500	500	500	MHz
Anode voltage	V_a	1250	1000	800	600	V
Grid No. 2 voltage	V_{g_2}	280	250	250	250	V
Grid No. 1 voltage	V_{g_1}	-115	-110	-110	-110	V
Anode current	I_a	200	200	200	170	mA
Grid No. 2 current	I_{g_2}	5	7	7	6	mA
Grid No. 1 current	I_{g_1}	10	10	10	6	mA
Driving power	W_{dr}	30	25	20	15	W
Anode input power	W_{i_a}	250	200	160	100	W
Output power	W_o	140	120	95	50	W

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to 150	150 to 500	MHz
Anode voltage	V_a	max. 1600	1000	V
Anode current	I_a	max. 200	200	mA
Anode dissipation	W_a	max. 165	165	W
Grid No. 2 voltage	V_{g_2}	max. 300	300	V
Grid No. 2 dissipation	W_{g_2}	max. 10	10	W
Grid No. 1 voltage, negative	$-V_{g_1}$	max. 250	250	V
Grid No. 1 dissipation	W_{g_1}	max. 2	2	W
Grid No. 1 circuit resistance	R_{g_1}	max. 25	25	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 150	150	V

OPERATING CONDITIONS

Frequency	f	up to 150	150	MHz
Anode voltage	V_a	1600	1200	V
Grid No. 2 voltage	V_{g_2}	250	250	V
Grid No. 1 voltage	V_{g_1}	-118	-118	V [1])
Anode current	I_a	200	200	mA
Grid No. 2 current	I_{g_2}	23	23	mA
Grid No. 1 current	I_{g_1}	5	5	mA
Driving power	W_{dr}	3	2	W
Anode input power	W_{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	$V_{g2_p\,mod}$	200	180	V

[1]) Obtained from a grid resistor or from a combination of grid resistor with either fixed supply or cathode resistor.

OPERATING CONDITIONS (continued)

Frequency	f	165	165	165	165	MHz
Anode voltage	V_a	1000	800	600	400	V
Grid No.2 voltage	V_{g_2}	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	-105	-100	-95	-90	V
Anode current	I_a	200	200	200	200	mA
Grid No.2 current	I_{g_2}	20	25	35	40	mA
Grid No.1 current	I_{g_1}	15	10	8	7	mA
Driving power	W_{dr}	2	1.5	1	1	W
Anode input power	W_{ia}	200	160	120	80	W
Output power	W_o	140	100	80	55	W
Modulation depth	m	100	100	100	100	%
Modulator output power	$W_{o\,mod}$	70	50	40	27.5	W
Grid No.2 mod.voltage, peak	$V_{g_{2p}\,mod}$	170	160	150	140	V

A.F. CLASS AB AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	max.	2000	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Grid No.1 dissipation	W_{g_1}	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

OPERATING CONDITIONS two tubes in push-pull

Anode voltage	V_a	1000		800		V
Grid No. 2 voltage	V_{g_2}	300		300		V
Grid No. 1 voltage	V_{g_1}	-43		-40		V
Load resistance	$R_{aa\sim}$	4250		4400		Ω
Driving voltage	V_{gg_p}	0	86	0	80	V
Anode current	I_a	2x82.5	2x225	2x105	2x218	mA
Grid No. 2 current	I_{g_2}	–	2x26	–	2x38	mA
Grid No. 1 current	I_{g_1}	0	0	0	0	mA
Anode input power	W_{i_a}	2x82.5	2x225	2x84	2x175	W
Anode dissipation	W_a	2x82.5	2x110	2x84	2x90	W
Output power	W_o	0	230	0	170	W

Anode voltage	V_a	2000		1500		V
Grid No. 2 voltage	V_{g_2}	300		300		V
Grid No. 1 voltage	V_{g_1}	-50		-50		V
Load resistance	$R_{aa\sim}$	8760		6570		Ω
Driving voltage	V_{gg_p}	0	100	0	100	V
Anode current	I_a	2x50	2x235	2x50	2x228	mA
Grid No. 2 current	I_{g_2}	–	2x18	–	2x21	mA
Grid No. 1 current	I_{g_1}	0	0	0	0	mA
Anode input power	W_{i_a}	2x100	2x470	2x75	2x340	W
Anode dissipation	W_a	2x100	2x180	2x75	2x140	W
Output power	W_o	0	580	0	400	W

OPERATING CONDITIONS (continued)

Anode voltage	V_a	1000		800		V
Grid No. 2 voltage	V_{g_2}	300		300		V
Grid No. 1 voltage	V_{g_1}	-45		-40		V
Load resistance	$R_{aa\sim}$	3950		3140		Ω
Driving voltage	V_{gg_p}	0	98	0	90	V
Driving power	W_{dr}	-	0.15	-	0.15	W
Anode current	I_a	2x83	2x247	2x105	2x250	mA
Grid No. 2 current	I_{g_2}	-	2x29	-	2x40	mA
Anode input power	W_{i_a}	2x83	2x247	2x84	2x200	W
Anode dissipation	W_a	2x83	2x112	2x84	2x93	W
Output power	W_o	0	270	0	215	W

Anode voltage	V_a	2000		1500		V
Grid No. 2 voltage	V_{g_2}	300		300		V
Grid No. 1 voltage	V_{g_1}	-50		-50		V
Load resistance	$R_{aa\sim}$	8100		5970		Ω
Driving voltage	V_{gg_p}	0	106	0	106	V
Driving power	W_{dr}	-	0.2	-	0.2	W
Anode current	I_a	2x50	2x250	2x50	2x250	mA
Grid No. 2 current	I_{g_2}	-	2x18	-	2x18	mA
Anode input power	W_{i_a}	2x100	2x500	2x75	2x375	W
Anode dissipation	W_a	2x100	2x185	2x75	2x155	W
Output power	W_o	0	630	0	440	W

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

LIMITING VALUES (Absolute max. rating system)

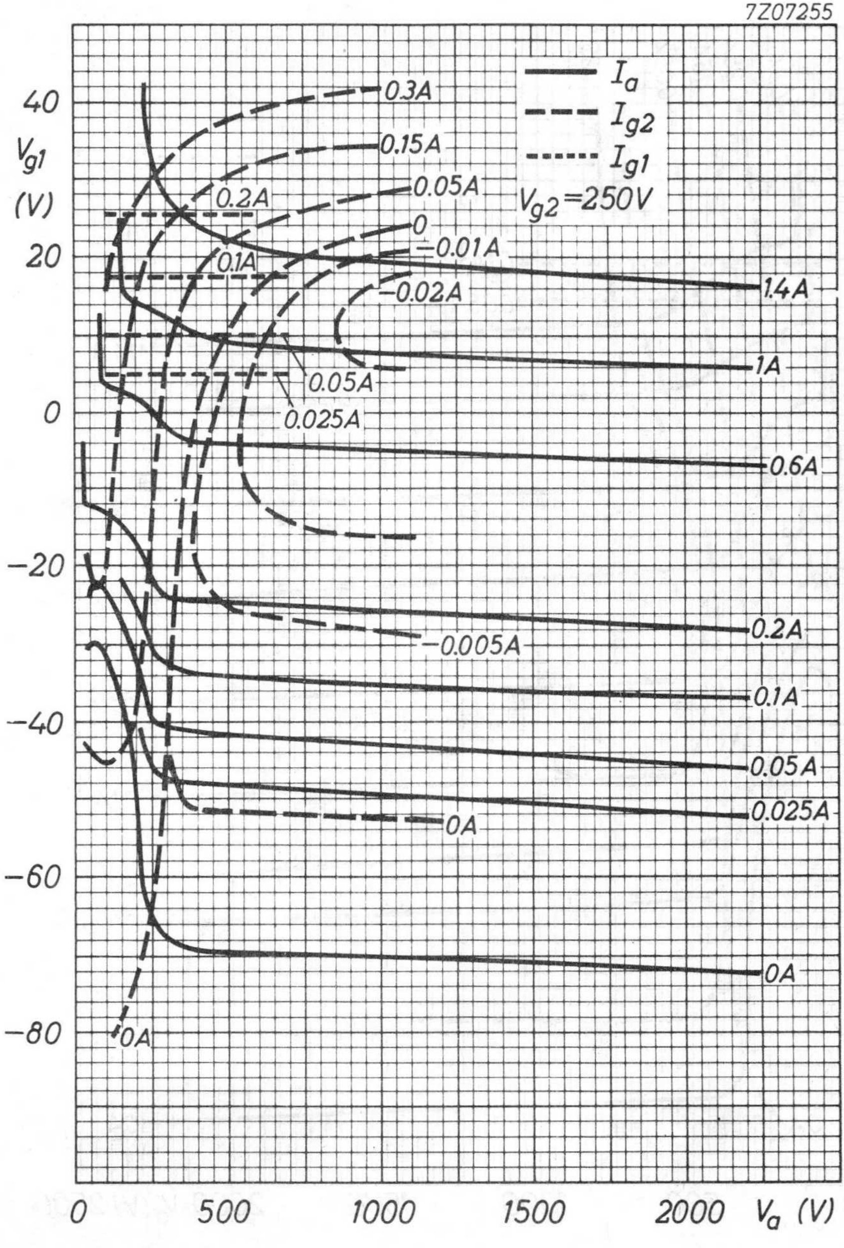
Frequency	f		54 to 216	MHz
Anode voltage	V_a	max.	1250	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	250	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Grid No.1 voltage, negative	$-V_{g_1}$	max.	400	V
Grid No.1 dissipation	W_{g_1}	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	max.	25	kΩ [1]
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

OPERATING CONDITIONS

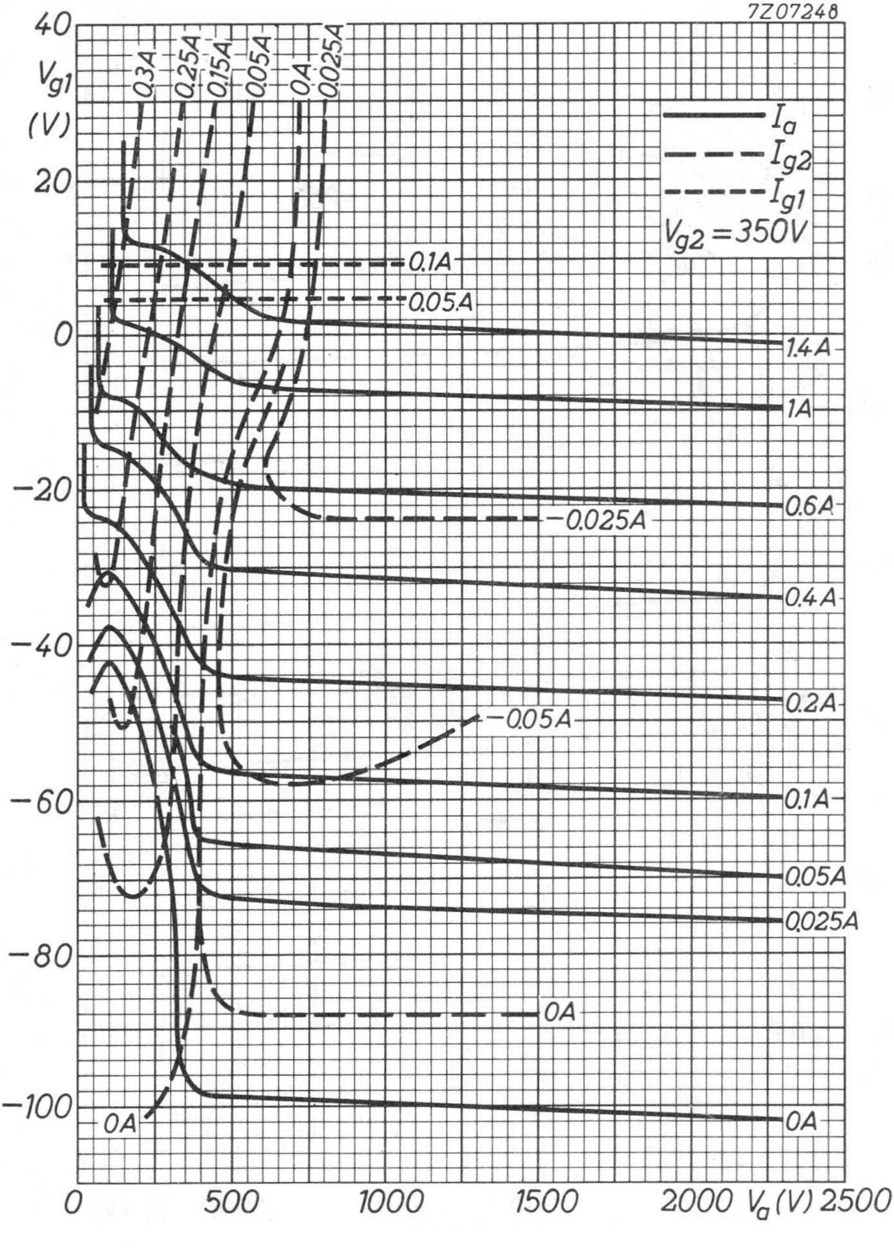
Bandwidth	B (-1.5 dB)		5	5	5	MHz
Anode voltage	V_a		1250	1000	750	V
Grid No.2 voltage	V_{g_2}		300	300	300	V
Grid No.1 voltage	V_{g_1}		-70	-65	-60	V
Driving voltage, peak to peak	$V_{g_{1pp}}$	sync	100	95	85	V
		black	75	70	65	V
Anode current	I_a	sync	305	330	335	mA
		black	230	240	245	mA
Grid No.2 current	I_{g_2}	sync	45	45	50	mA
		black	10	15	20	mA
Grid No.1 current	I_{g_1}	sync	25	20	15	mA
		black	4	4	4	mA
Driving power	W_{dr}	sync	9	8	7	W
		black	5.5	4.7	4.25	W
Output power in load	W_ℓ	sync	250	200	135	W
		black	140	110	75	W

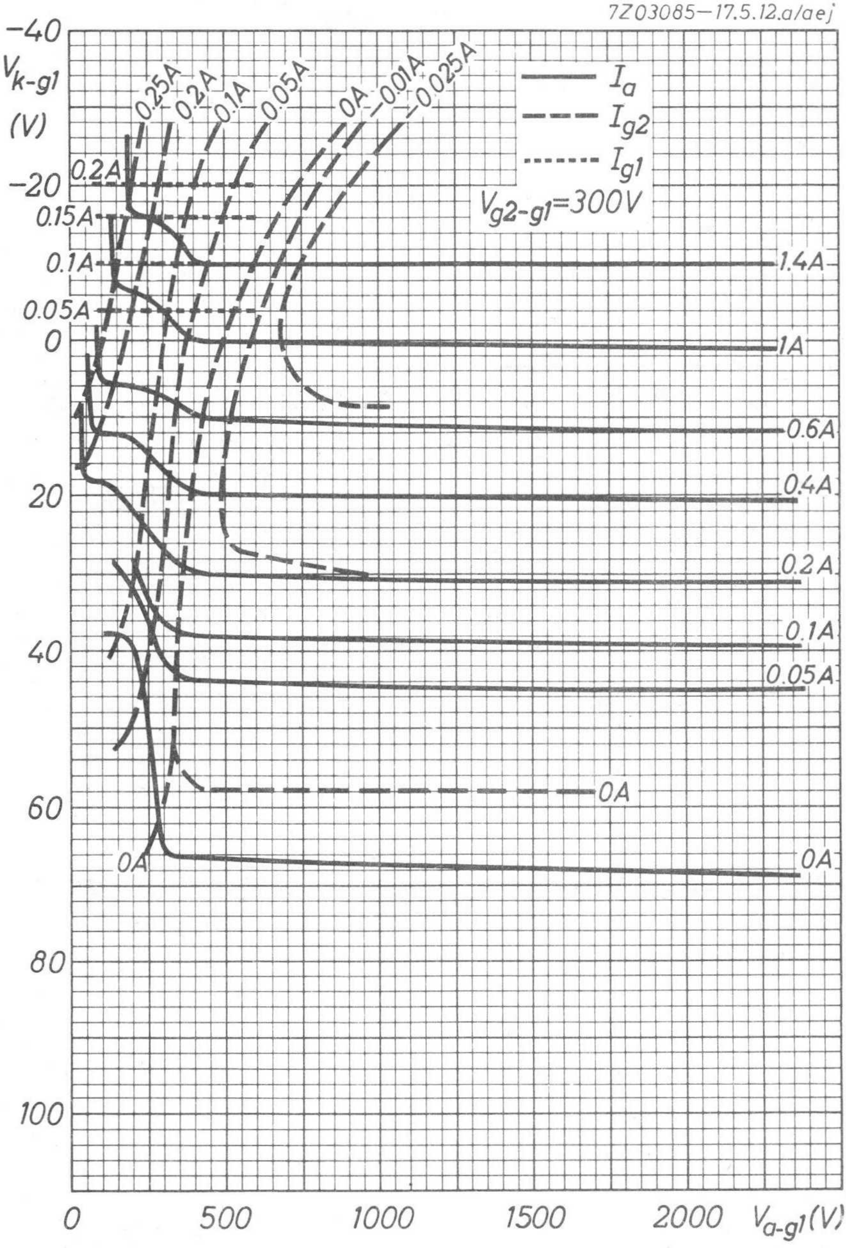
[1]) Cathode bias is not recommended.

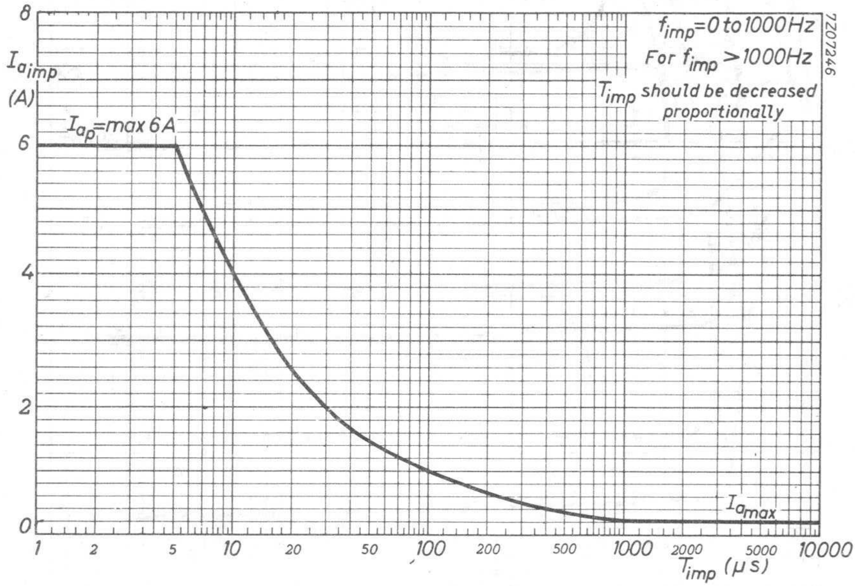
7Z07255



I_a
I_{g2}
I_{g1}
V_{g2}=250V
V_{g1} (V)
40
20
0
−20
−40
−60
−80
0
500
1000
1500
2000
V_a (V)
0.3A
0.15A
0.05A
0
−0.01A
−0.02A
0.2A
0.1A
0.05A
0.025A
1.4A
1A
0.6A
0.2A
0.1A
0.05A
0.025A
0A
−0.005A
0A
0A


7Z07248
40
V_{g1}
(V)
20
0
−20
−40
−60
−80
−100
0
500
1000
1500
2000
V_a (V)
2500
0.3A
0.25A
0.15A
0.05A
0A
0.025A
I_a
I_{g2}
I_{g1}
V_{g2} = 350V
0.1A
0.05A
1.4A
1A
0.6A
−0.025A
0.4A
0.2A
−0.05A
0.1A
0.05A
0.025A
0A
0A
0A


7Z03085—17.5.12.a/aej
−40
$V_{k\text{-}g1}$
(V)
−20
0
20
40
60
80
100
0
500
1000
1500
2000
$V_{a\text{-}g1}$(V)
I_a
I_{g2}
I_{g1}
$V_{g2\text{-}g1}$=300V
0.25A
0.2A
0.1A
0.05A
0A
0.01A
0.025A
0.2A
0.15A
0.1A
0.05A
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0A
0A
0A



7Z07246
$I_{a_{imp}}$ (A)
I_{ap}=max 6A
f_{imp}=0 to 1000Hz
For f_{imp} > 1000Hz
T_{imp} should be decreased proportionally
$I_{a_{max}}$
T_{imp} (μs)
0
2
4
6
8
1
2
5
10
20
50
100
200
500
1000
2000
5000
10000

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	^oC

COOLING Radiation and convection

MECHANICAL DATA

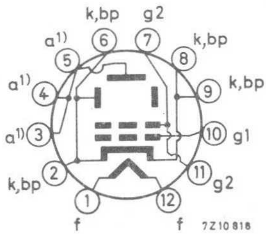
Dimensions in mm

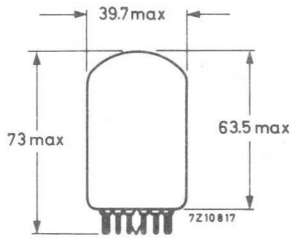
Base: E12-74; IEC 67-I-35a

Outline: T12; IEC 67-II-14a, type 5

Net weight: approx. 45 g

Mounting position: any





[1]) Pins 3, 4 and 5 should be interconnected on the socket.

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

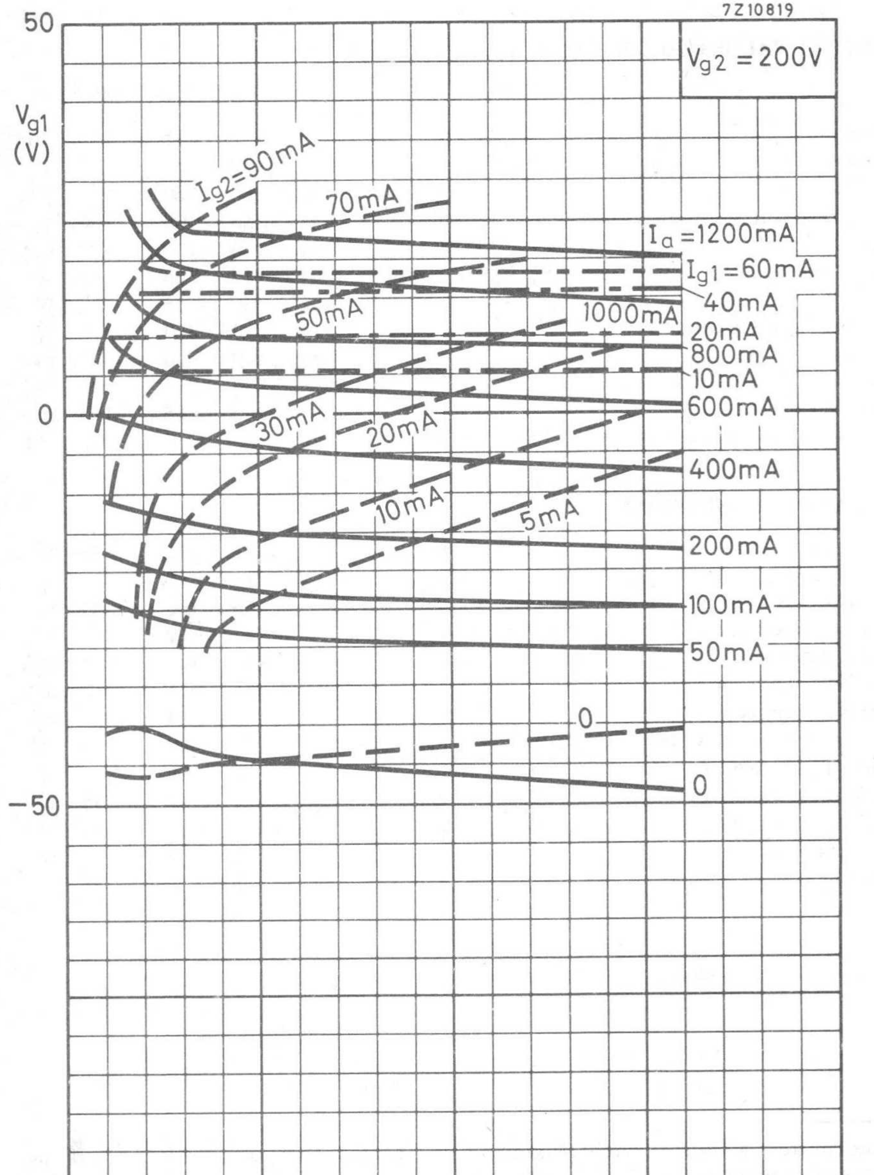
LIMITING VALUES (Absolute max. rating system)

			CCS	ICAS	IMS [1]	
Frequency	f	up to	175	175	175	MHz
Anode voltage	V_a	max.	600	750	750	V
Grid No.2 voltage	V_{g_2}	max.	250	250	250	V
Grid No.1 voltage	$-V_{g_1}$	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_{g_2}	max.	3.0	3.0	3.0	W
Grid No.1 current	I_{g_1}	max.	6.0	6.0	6.0	mA
Grid No.1 dissipation	W_{g_1}	max.	2.0	2.0	2.0	W
Cathode current	I_k	max.	165	165	195	mA
Grid No.1 circuit resistance	R_{g_1}	max.	30	30	30	kΩ

OPERATING CONDITIONS

Frequency	f	175	175	175	MHz
Anode voltage	V_a	315	375	450	V
Grid No.2 voltage	V_{g_2}	165	160	200	V
Grid No.1 voltage	V_{g_1}	-74	-80	-60	V
Anode current	I_a	150	150	180	mA
Grid No.2 current	I_{g_2}	8.5	8.5	12	mA
Grid No.1 current	I_{g_1}	3.7	4	4	mA
Grid No.1 circuit resistance	R_{g_1}	20	20	15	kΩ
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	η	56	57	57	%

[1]) 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.


7Z10819
V_{g2} = 200V
50
V_{g1}
(V)
0
−50
−100
0
500
1000
V_a (V)
I_{g2}=90mA
70mA
50mA
30mA
20mA
10mA
5mA
0
I_a =1200mA
I_{g1}=60mA
40mA
1000mA
20mA
800mA
10mA
600mA
400mA
200mA
100mA
50mA
0

R.F. POWER TETRODE

Forced-air cooled tetrode in ceramic-metal construction intended for use in S.S.B. transmitters.

	QUICK REFERENCE DATA		
Freq. (MHz)	S.S.B.		
	V_a (V)	W_ℓ (W)PEP	d_3 (dB)
7	2000	271	-26
7	2000	436	-23

HEATING: indirect; oxide coated cathode

Heater voltage	V_f	25.6	V ± 5% [1]
Heater current	I_f	560	mA
Waiting time	T_w	min. 30	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1}(a)$	17.0	pF
Anode to all except grid No.1	$C_{a(g_1)}$	4.7	pF
Anode to grid No.1	C_{ag_1}	0.06	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500		V
Grid No.2 voltage	V_{g_2}	250	300	V
Anode current	I_a	200		mA
Grid No.2 current	I_{g_2}	-	50	mA
Transconductance	S	12	-	mA/V
Amplification factor	$\mu_{g_2g_1}$		5.2	

TEMPERATURE LIMITS (Absolute max. rating system)

Temperature of all seals	t_s	max.	250	°C
Temperature of anode core	t_a	max.	250	°C

[1]) Short term variations of ± 10% will not damage the tube, but variations in performance must be expected.

COOLING: Forced air

Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a	h	t_i	q min	p_i
250 W 250 W	0 m 3000 m	50 °C 50 °C	0.15 m^3/min 0.19 m^3/min	15 mm H_2O 22 mm H_2O

ACCESSORIES

Socket 2422 513 01001

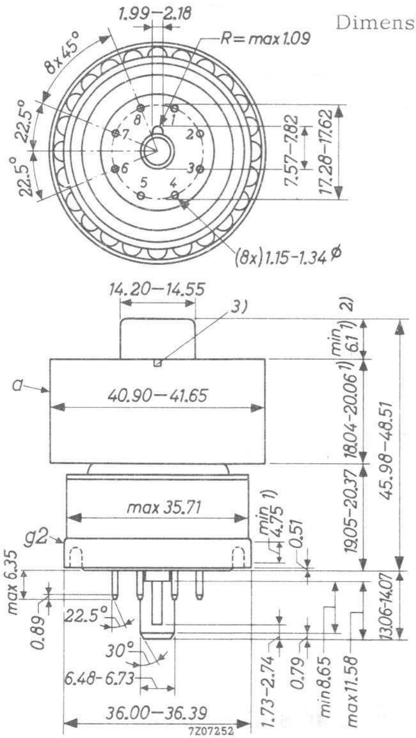
Chimney type 4322 026 11701

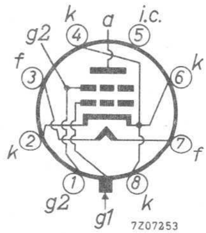
MECHANICAL DATA

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

R.F. SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	500	MHz
Anode voltage	V_a	max.	2000	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No. 2 voltage	V_{g_2}	max.	400	V
Grid No. 2 dissipation	W_{g_2}	max.	12	W
Grid No. 1 voltage, negative	$-V_{g_1}$	max.	150	V
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

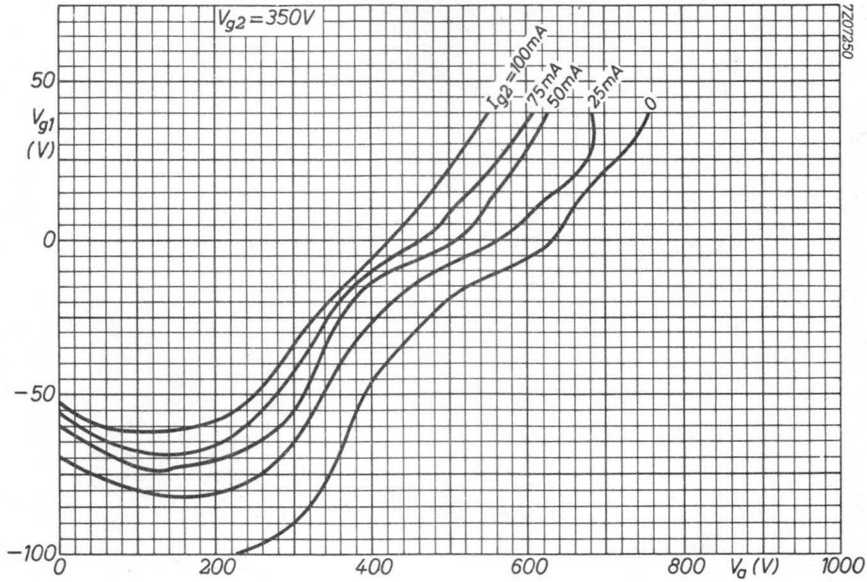
OPERATING CONDITIONS

Frequency	f		7		MHz
Anode voltage	V_a		2000		V
Grid No. 2 voltage	V_{g_2}		350		V
Grid No. 1 voltage	V_{g_1}		-57.5		V
Load resistance	$R_{a\sim}$		4000		Ω
		zero signal	single tone	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	45.3	45.3	V
Anode current	I_a	100	250	174	mA
Grid No. 2 current	I_{g_2}	-1.22	-4.1	-31.5	mA
Anode input power	W_{i_a}	200	500	348	W
Output power in the load	W_ℓ (PEP)	-	271	271	W
Third order intermodulation distortion	d_3	-	-	-26	dB
Fifth order intermodulation distortion	d_5	-	-	-54	dB

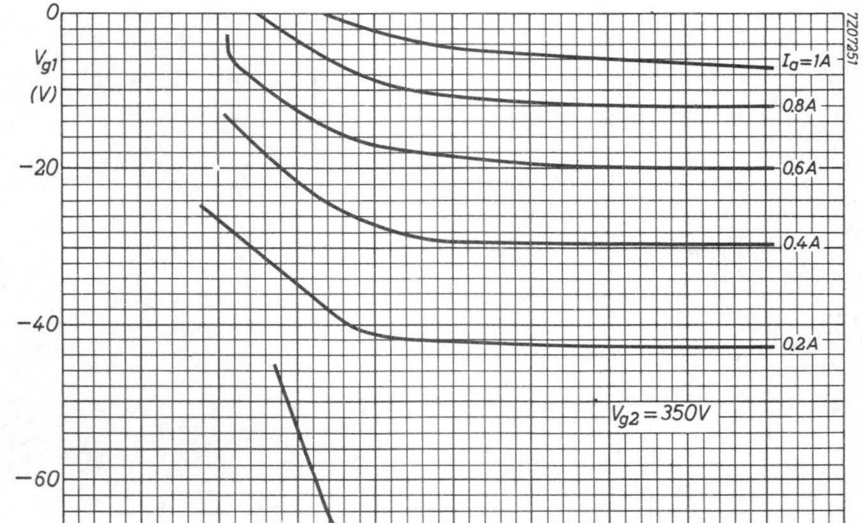
OPERATING CONDITIONS (continued)

Frequency	f		7		MHz
Anode voltage	V_a		2000		V
Grid No. 2 voltage	V_{g_2}		350		V
Grid No. 1 voltage	V_{g_1}		-72		V
Load resistance	$R_{a\sim}$		3570		Ω
		zero signal	single tone [1]	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	62	62	V
Anode current	I_a	75	310	204	mA
Grid No. 2 current	I_{g_2}	-0.85	14	2.4	mA
Anode input power	W_{i_a}	150	620	407	W
Output power in the load	W_ℓ (PEP)	-	436	436	W
Third order intermodulation distortion	d_3	-	-	-23	dB
Fifth order intermodulation distortion	d_5	-	-	-37	dB

[1]) Conditions in this column are permissible only for a signal having a peak to average power ratio which equals or exceeds 2 to 1 (e.g. two tone conditions) and for tune up during maximum 2 min.



$V_{g2}=350V$
7Z07250
$I_{g2}=100mA$
75mA
50mA
25mA
0
50
V_{g1}
(V)
0
−50
−100
0
200
400
600
800
V_a (V)
1000



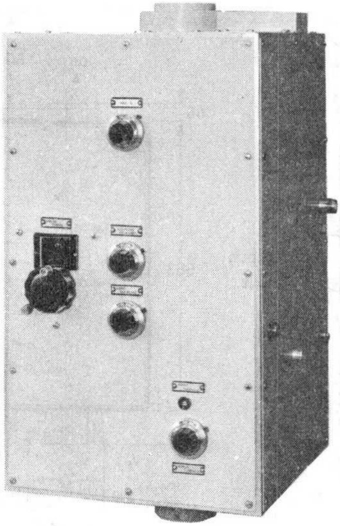
7Z07251
0
V_{g1}
(V)
−20
−40
−60
I_a=1A
0.8A
0.6A
0.4A
0.2A
0.025A
$V_{g2}=350V$
0
200
400
600
800
V_a (V)
1000

Amplifier circuit assemblies

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 VISION

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 2.5	1.55 0.7	26 23

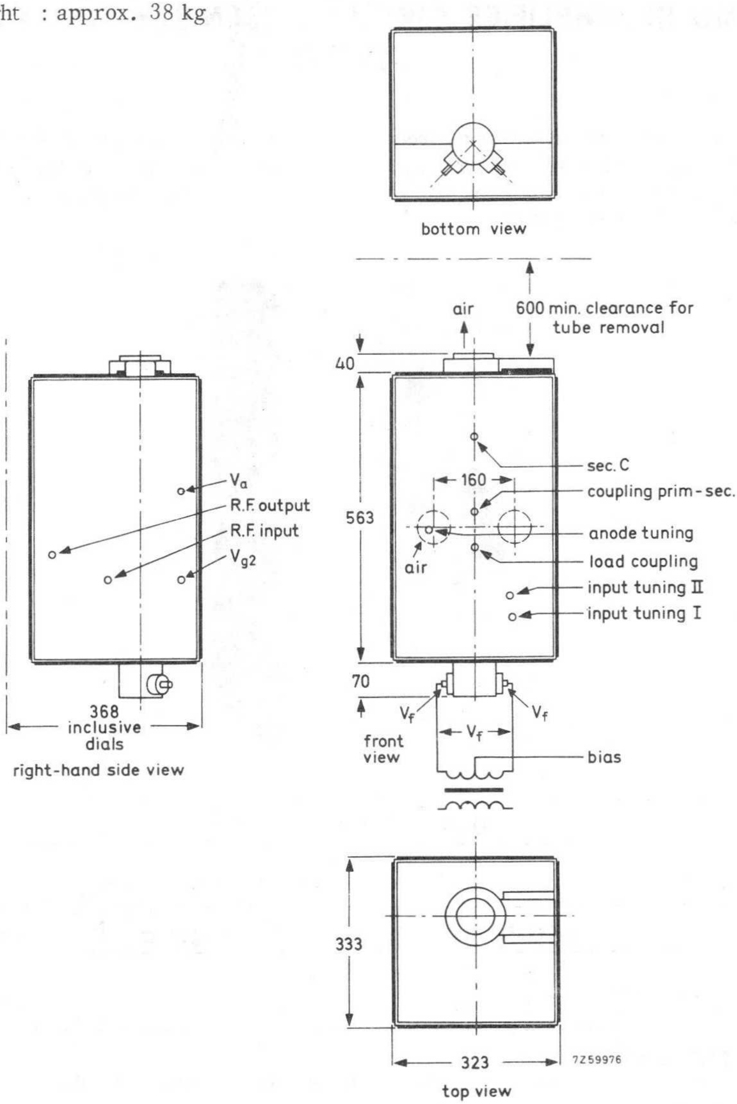
FREQUENCY RANGE
170 to 220 MHz continuously tunable. Up to 260 MHz with minor, channel dependent, modifications.

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^3
Net weight : approx. 38 kg



COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

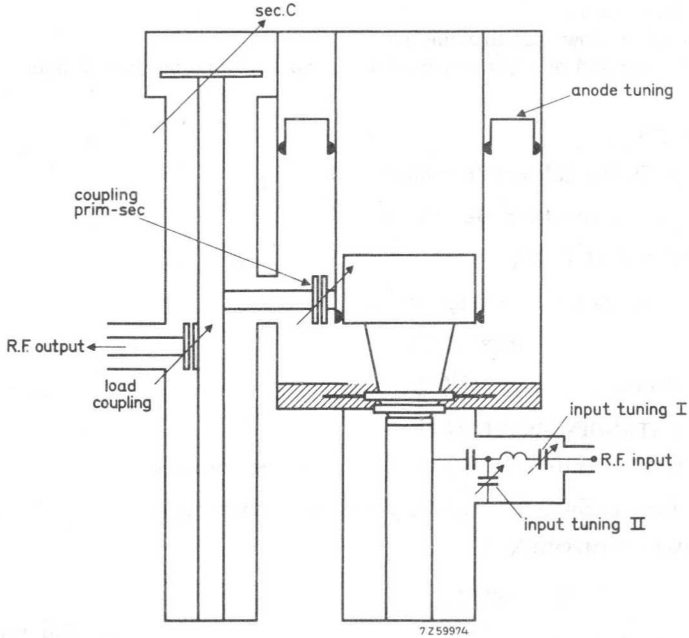
a) Delivered with the assembly

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

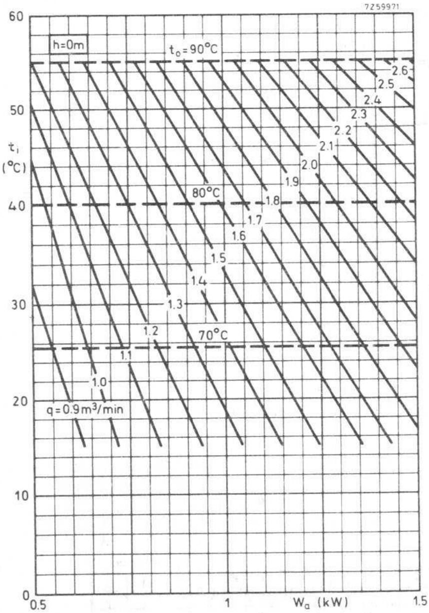
b) Recommended

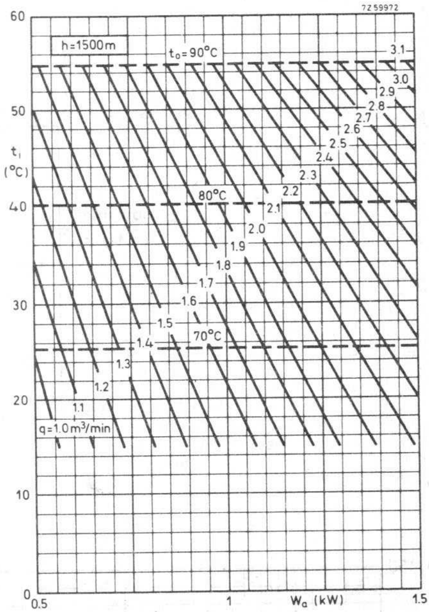
The use of circulator 2722 162 01191 (170 to 200 MHz) or
2722 162 1201 (200 to 230 MHz) is recommended.

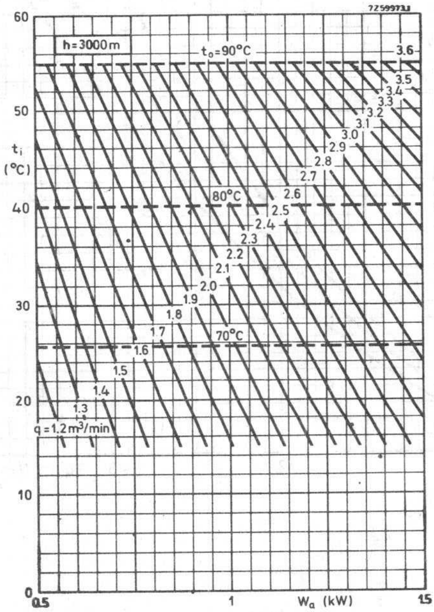
CIRCUIT DIAGRAM

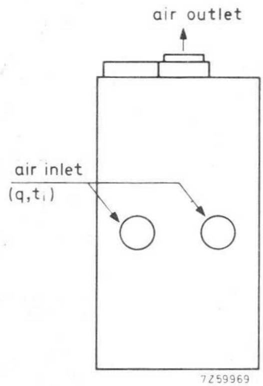


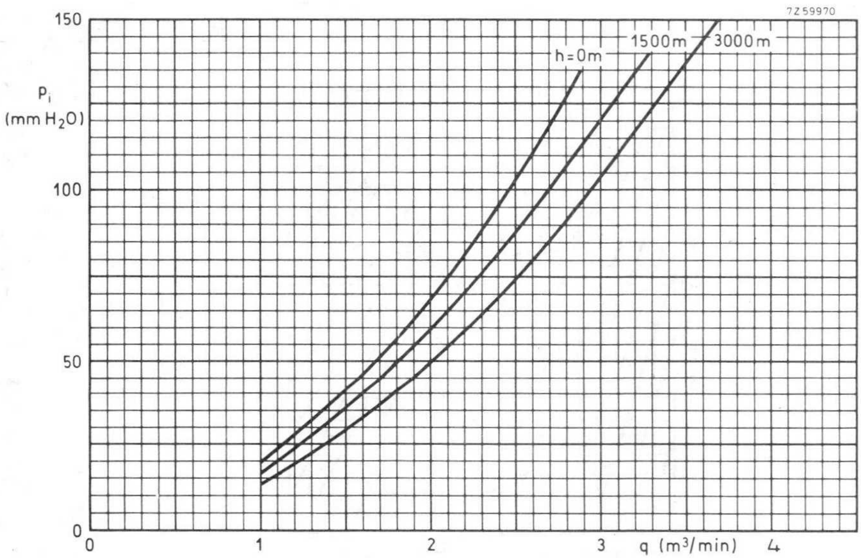
Cooling curves





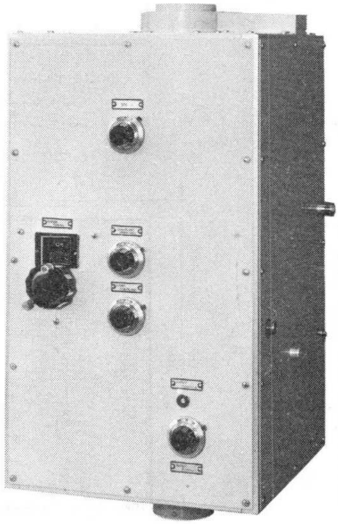



air outlet
air inlet
(q,t_i)
7Z59969


7Z59970
150
100
50
0
p_i
(mm H_2O)
h=0m
1500m
3000m
0
1
2
3
q (m^3/min)
4

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

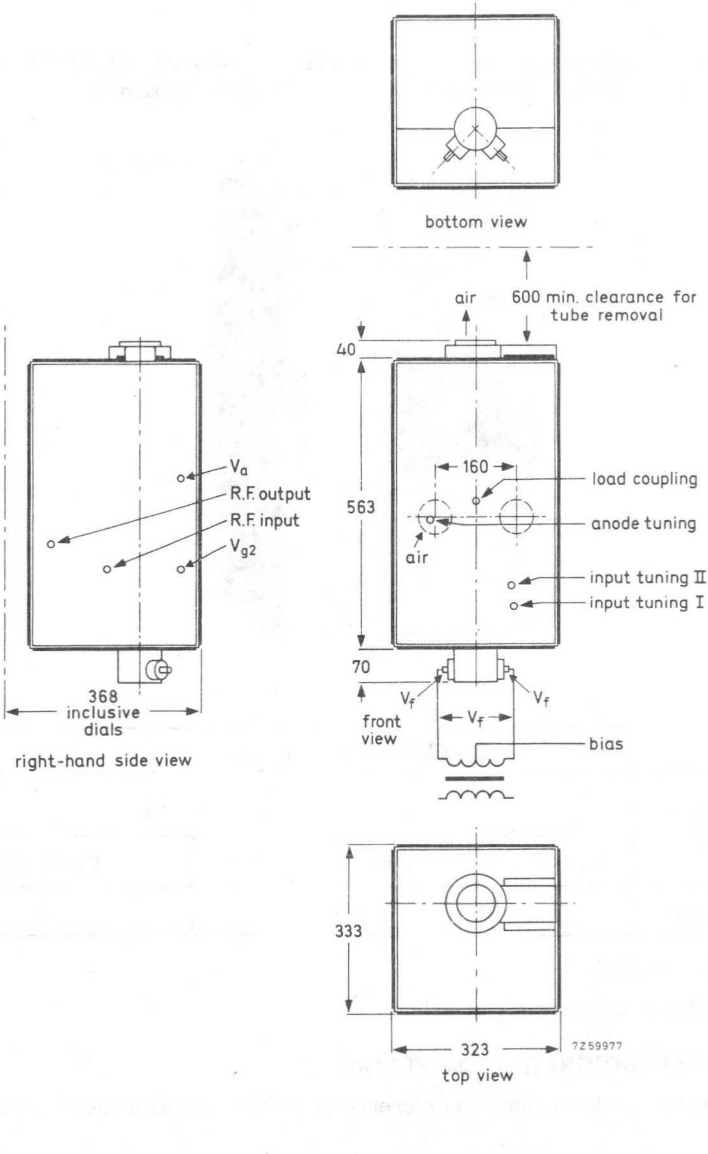
170 to 260 MHz, continuously tunable.

OPERATING CONDITIONS (For tube YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

MECHANICAL DATA Dimensions in mm

Dimensions : approx. 673 x 333 x 323 mm^3
Net weight : approx. 33 kg



COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature : 0 ^{o}C to +55 ^{o}C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

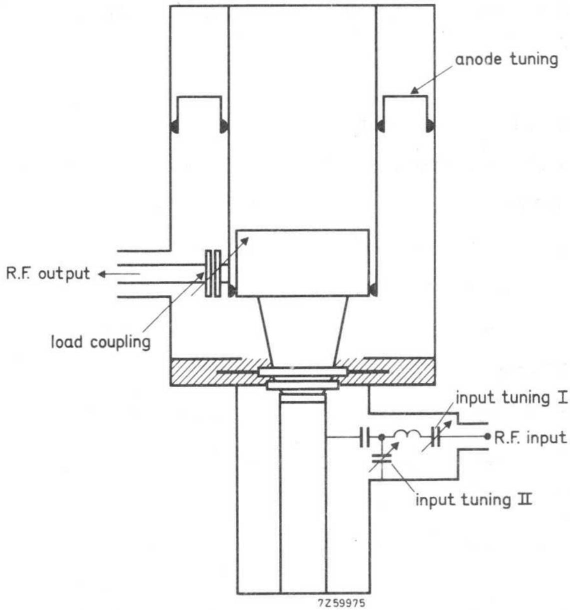
a) Delivered with the assembly

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

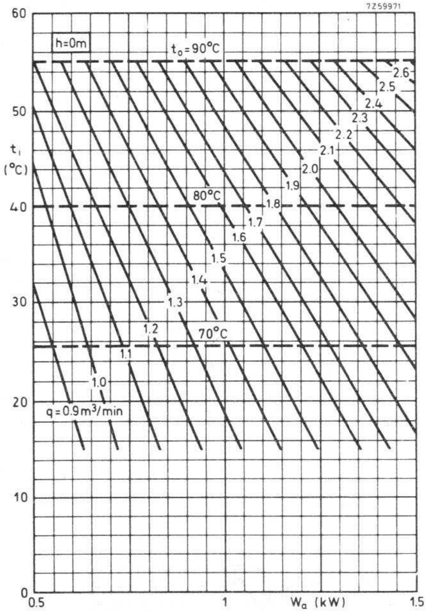
b) Recommended

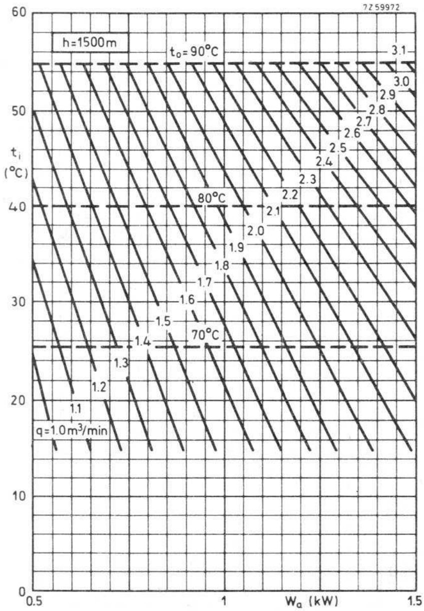
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

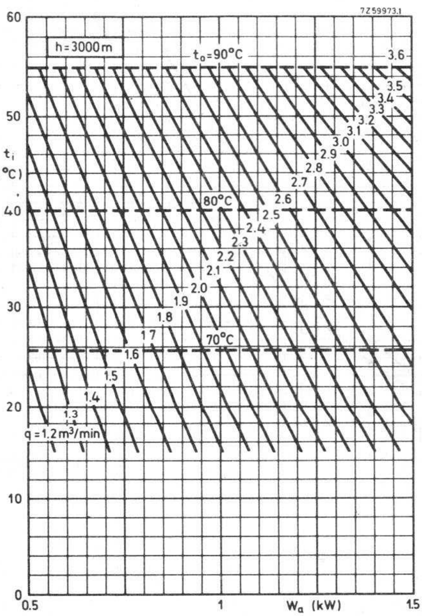
CIRCUIT DIAGRAM

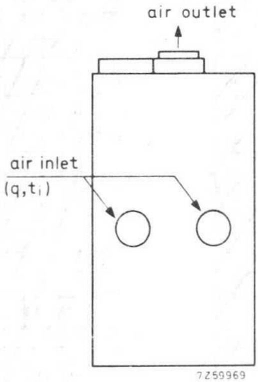


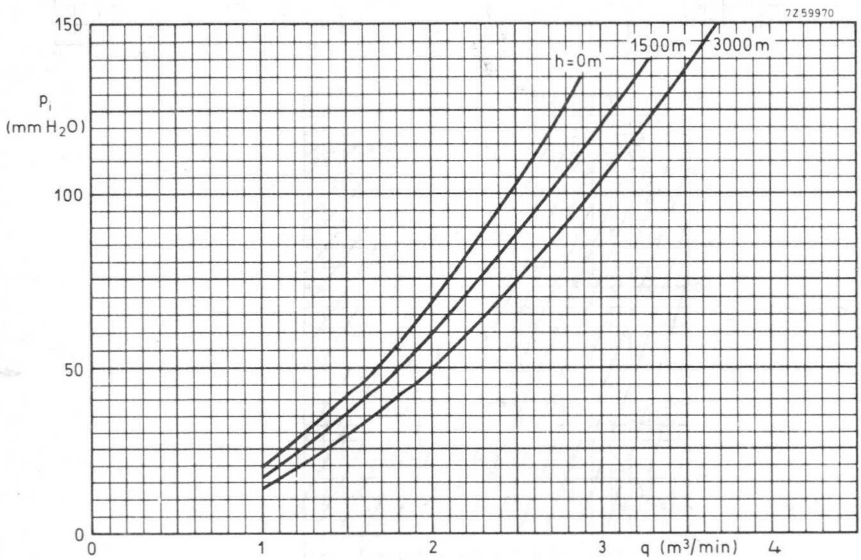
Cooling curves







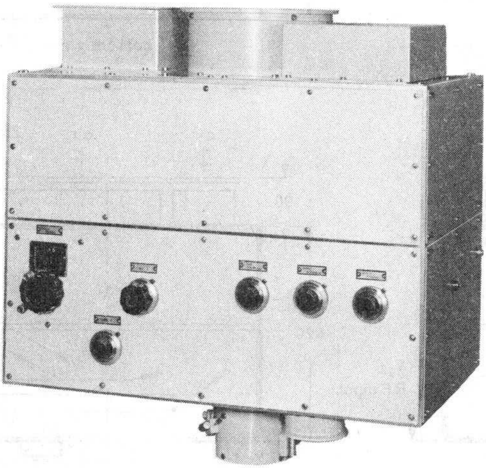

air outlet
air inlet
(q,t_i)
7Z59969


7Z59970
150
p_i
(mm H_2O)
100
50
0
0
1
2
3
q (m^3/min)
4
h=0m
1500m
3000m

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)	$W_{\ell\ sync}$ (kW) (CCIR system)	Power gain
170 to 230	4	6.25	24
	5	8.6	24

FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

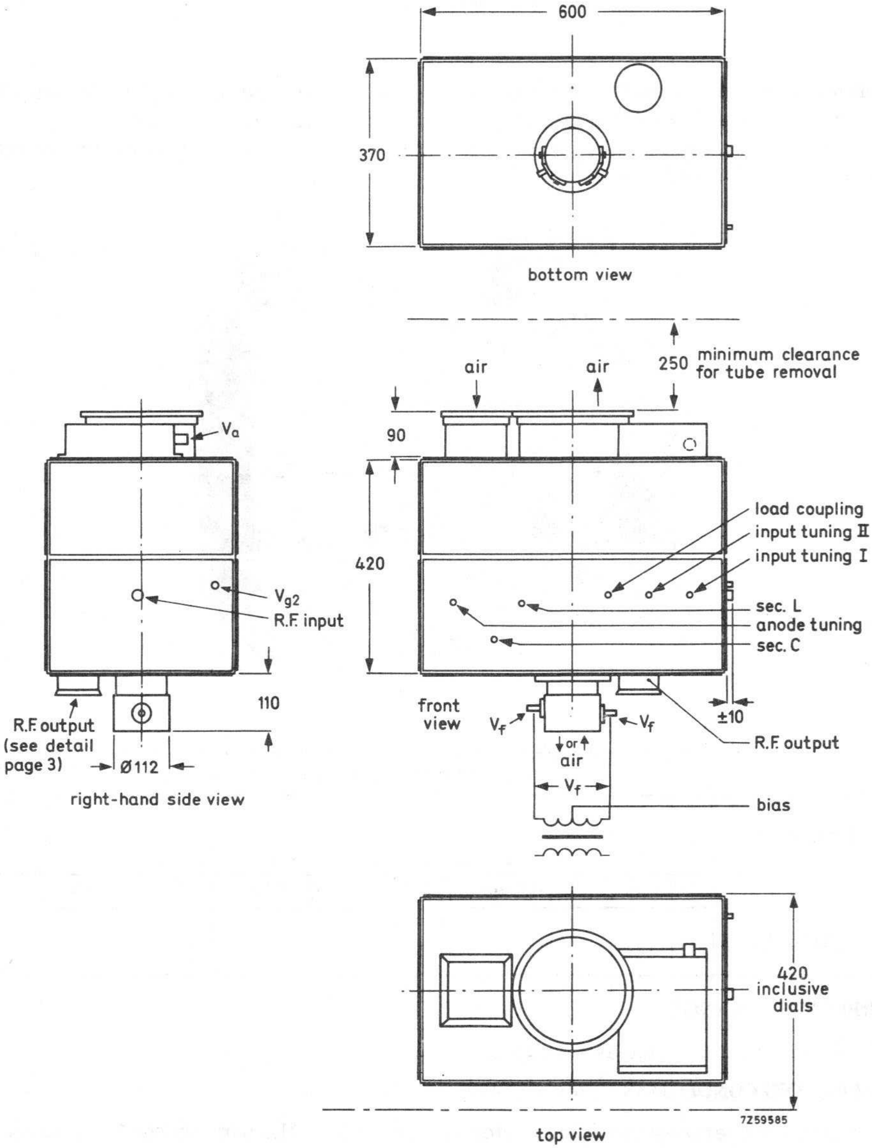
OPERATING CONDITIONS (For YL1420)

For detailed operating conditions reference is made to the data sheets for tube type YL1420.

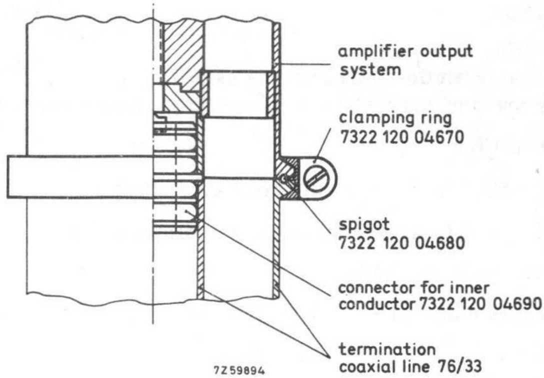
MECHANICAL DATA

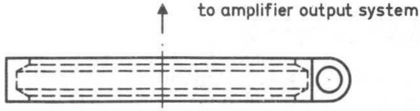
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 67 kg

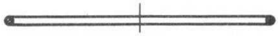


R. F. output connector

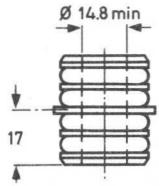




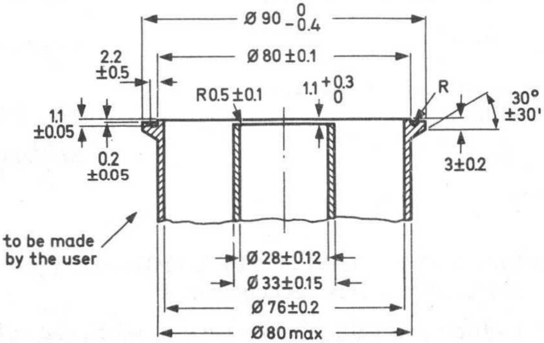
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Either sucking and blowing is possible via connections on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial connector: see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

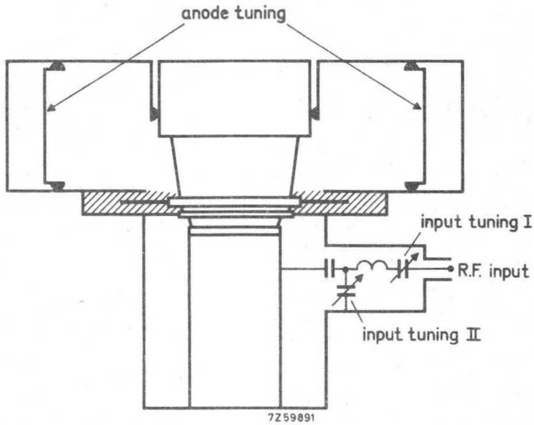
a) Delivered with the assembly

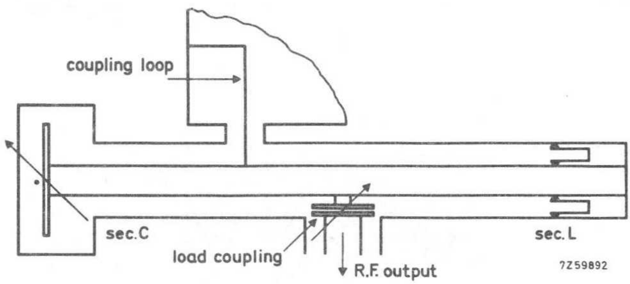
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175.25 MHz	7322 120 04730
Coupling loop for remaining frequencies except 223.25 MHz [1])	7322 120 04760
Insulating protection cap	7322 120 04750
Spanner for fitting	

b) Recommended
The use of circulator 2722 162 01191 (170 to 200 MHz) or
2722 162 01201 (200 to 230 MHz) is recommended.

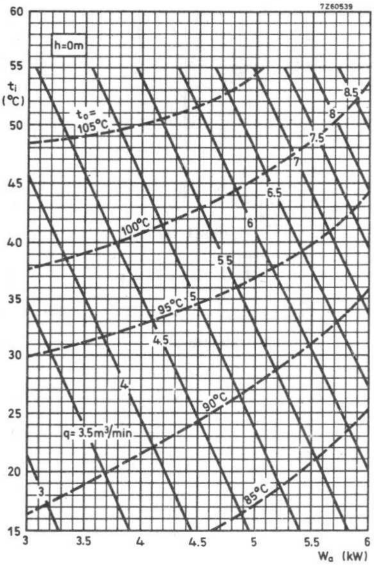
[1]) For 223.25 MHz a different coupling loop is needed, which can be delivered on request.

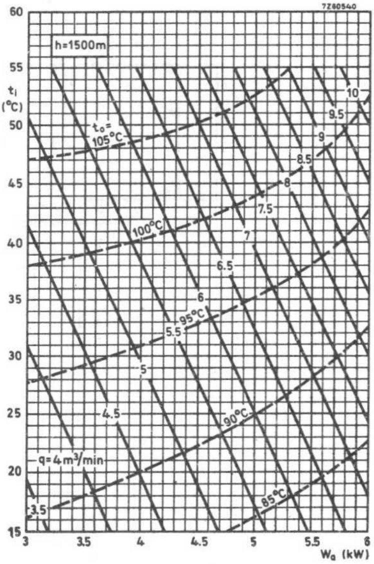
CIRCUIT DIAGRAM

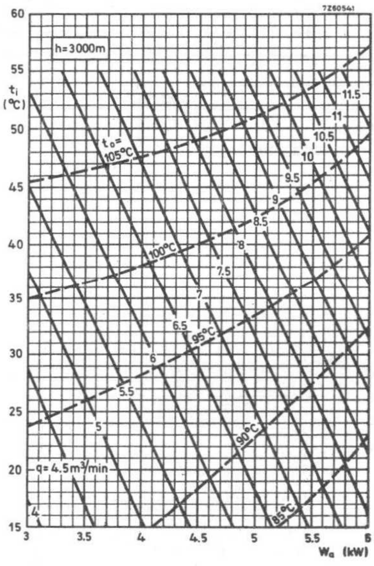


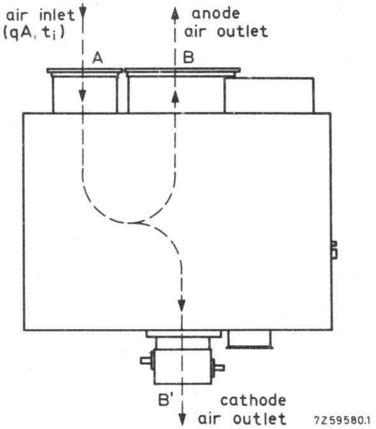


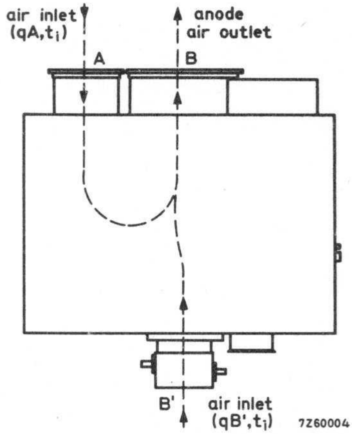
Cooling curves

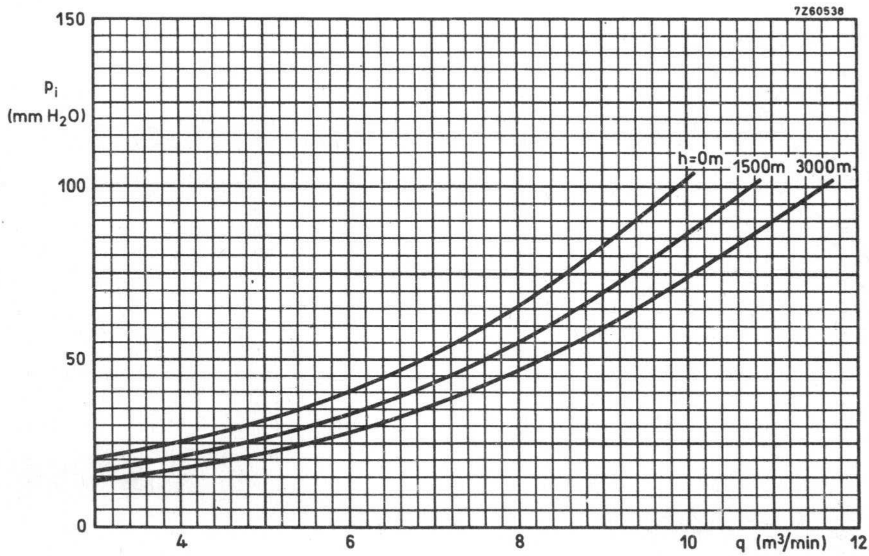












Pressure drop p_i across cavity with YL1420 as a function of airflow q.

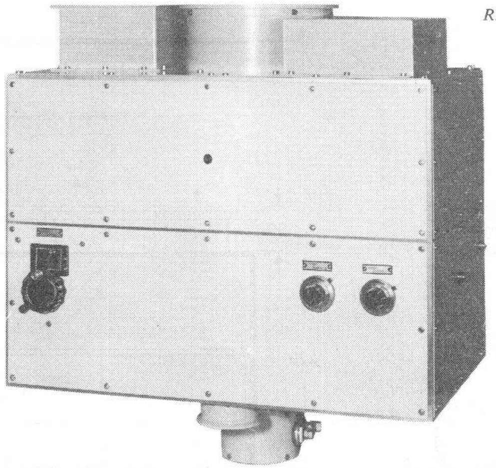
p_i = pressure drop from plane A to plane B or B'.

For blowing $q = q_A$

For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420 SOUND

Continuously tunable cavity-type circuit assembly to be used with YL1420 to form a grounded-grid amplifier of frequency-modulated 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.

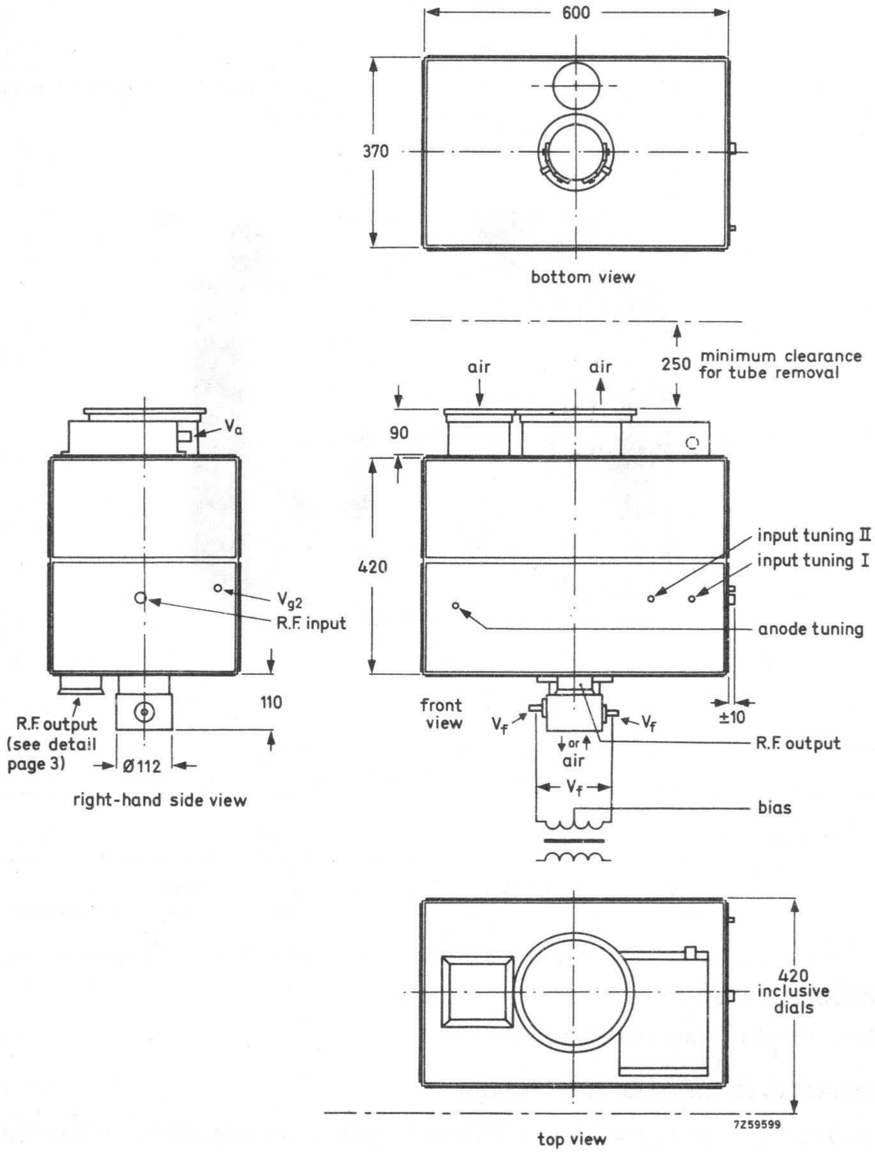
OPERATING CONDITIONS (For YL1420)

For detailed operating conditions reference is made to the data sheets for tube type YL1420.

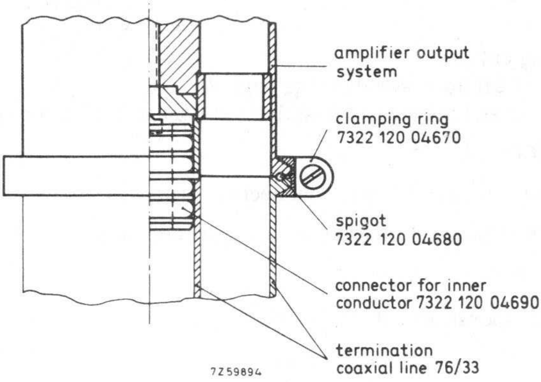
MECHANICAL DATA

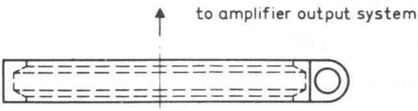
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 54 kg



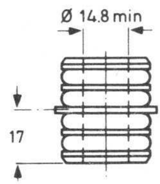
R.F. output connector



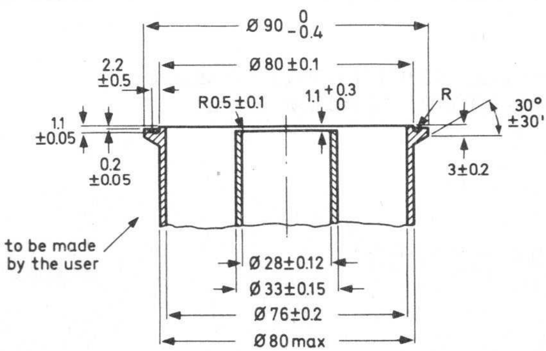


clamping ring 7322 120 04670

spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Both sucking and blowing is possible via connection on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial connector: see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature : 0 ^{o}C to +55 ^{o}C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

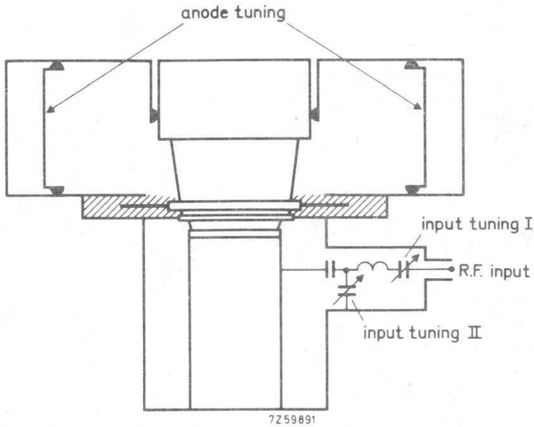
a) Delivered with the assembly

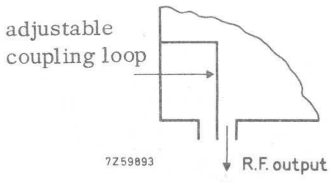
Tube extractor input connector	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

Recommended

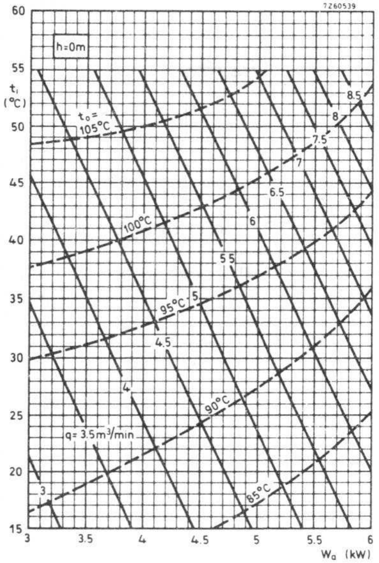
The use of circulator 2722 162 01191 (170 to 200 MHz) or
2722 162 01201 (200 to 230 MHz) is recommended.

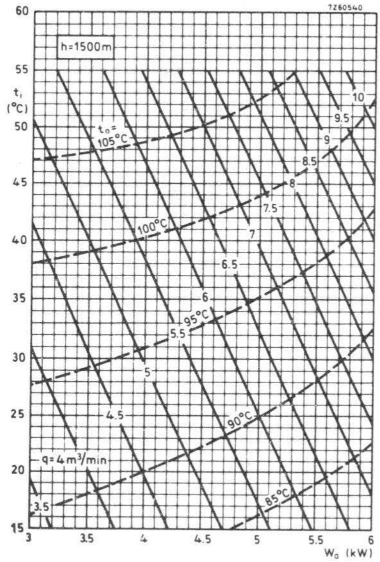
CIRCUIT DIAGRAM

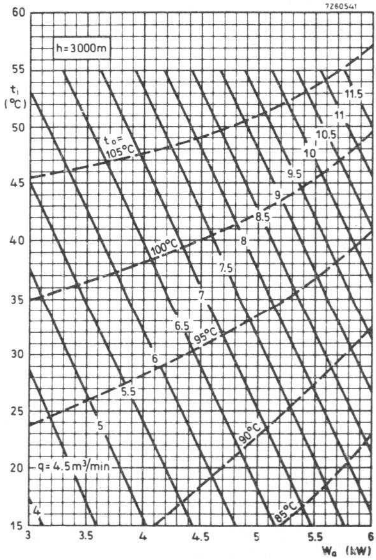


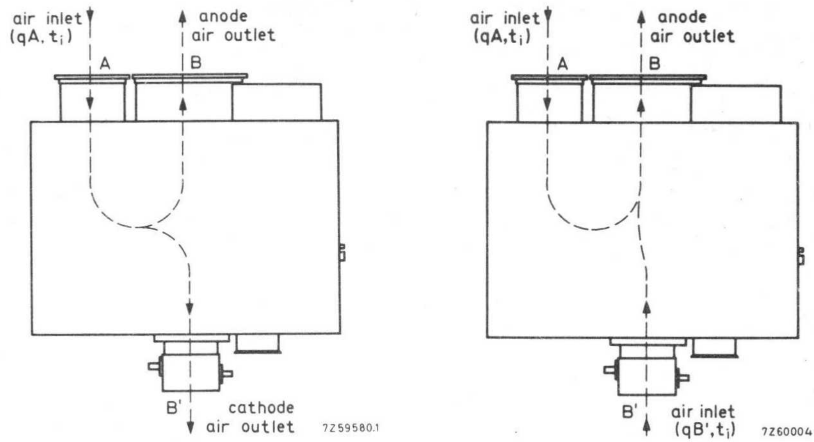


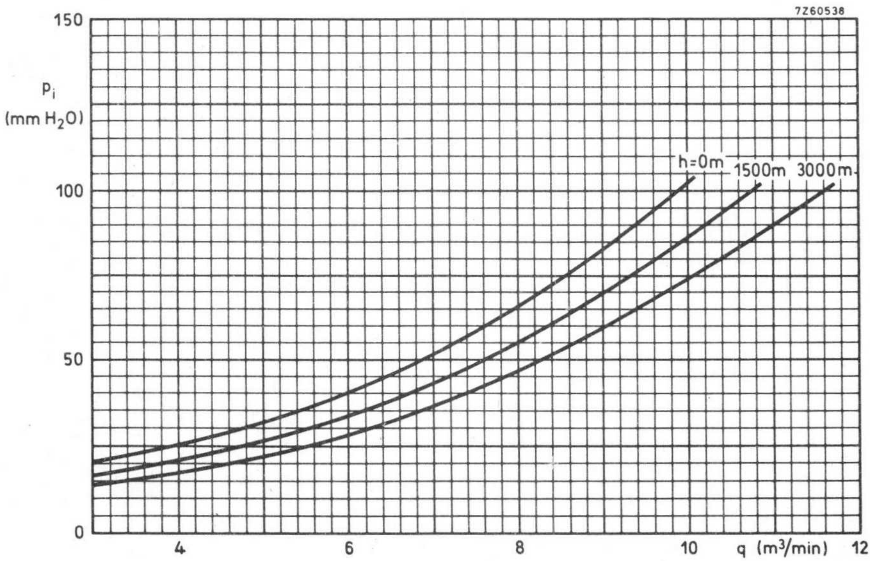
Cooling curves









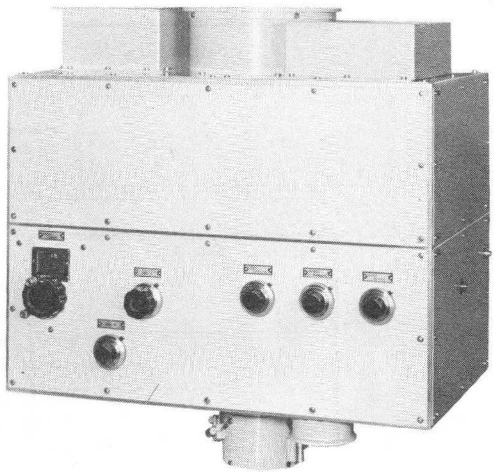


Pressure drop p_i across cavity with YL1420 as a function of airflow q.
p_i = pressure from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

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)	$W_{\ell\ sync}$ (kW) (CCIR system)	Power gain
170 to 230	6 7	12.5 18.4	30 25

FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

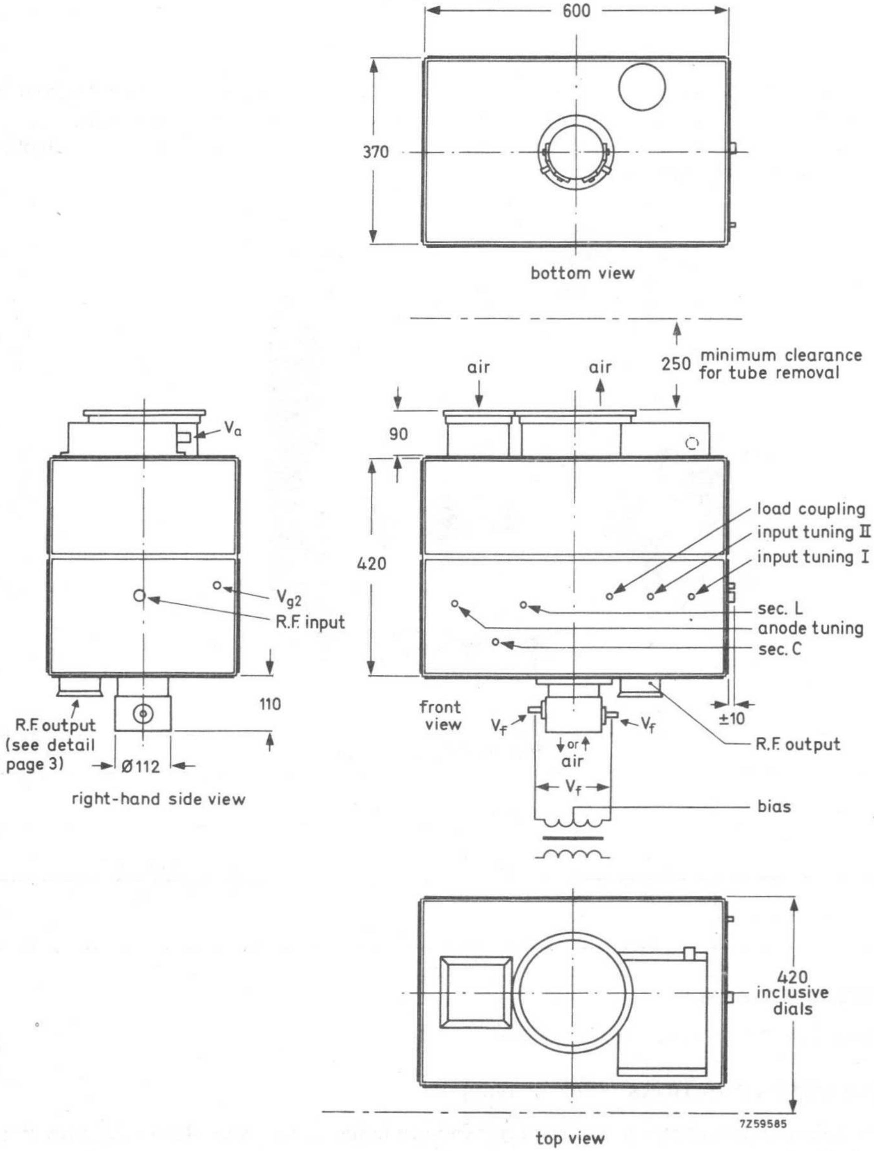
OPERATING CONDITIONS (For YL1430)

For detailed operating conditions reference is made to the data sheets for tube type YL1430.

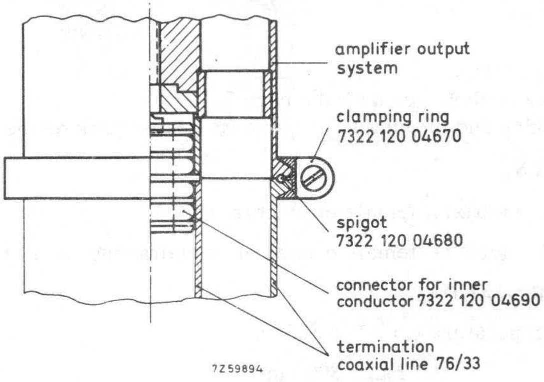
MECHANICAL DATA Dimensions in mm

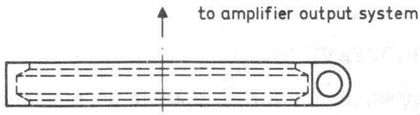
Dimensions : approx. 600 x 620 x 370 mm^3

Net weight : approx. 67 kg

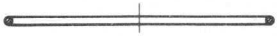


Output connector

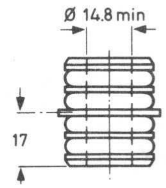




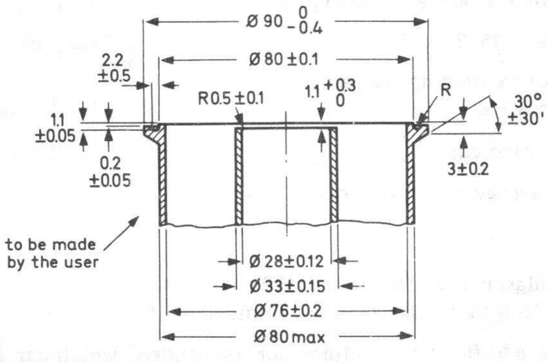
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Either sucking and blowing is possible via connections on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial female connector: see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with the assembly

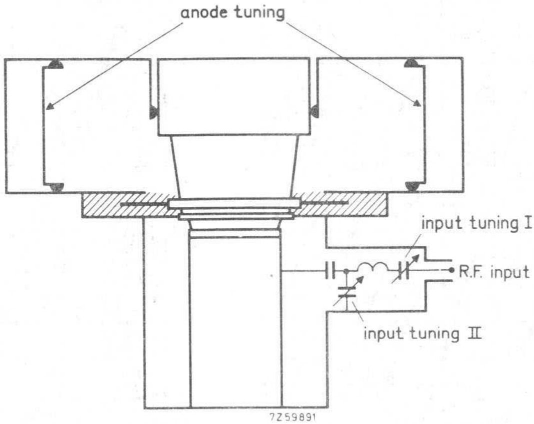
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175.25 MHz	7322 120 04730
Coupling loop for remaining frequencies except 224.25 MHz	7322 120 04769 [1]
Insulating protection cap	7322 120 04750
Spanner for fitting the coupling loops	

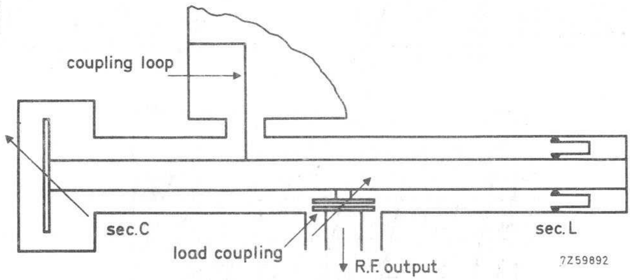
b) Recommended

The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

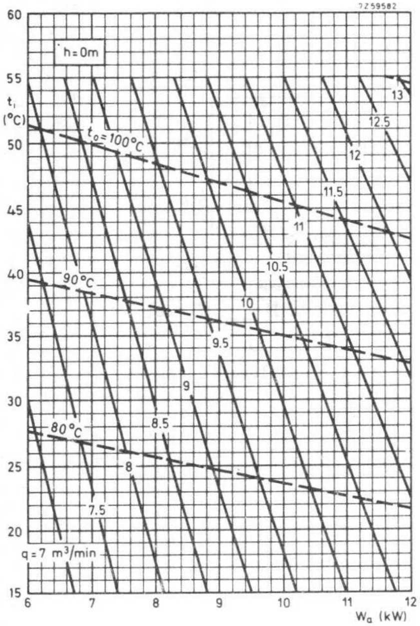
[1] For 224.25 MHz a different coupling loop is needed, which can be delivered on request.

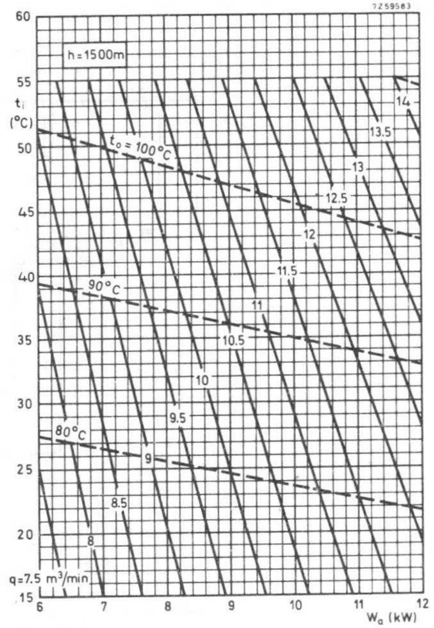
CIRCUIT DIAGRAM

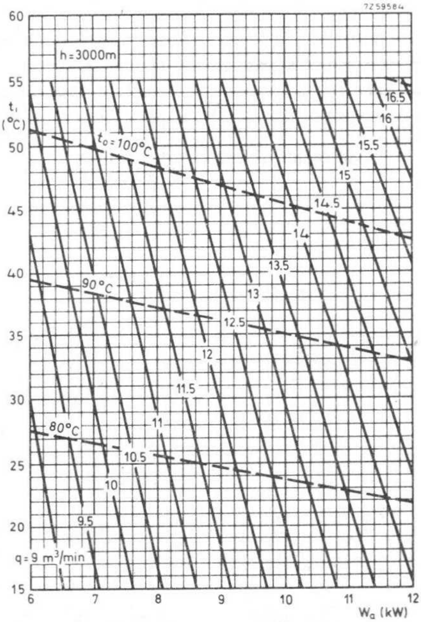


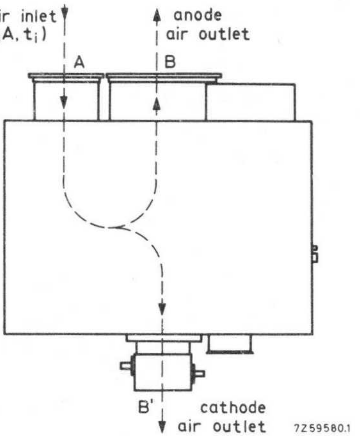


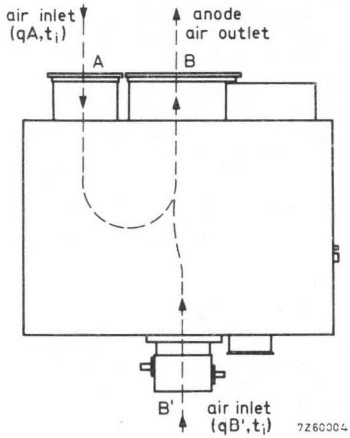
Cooling curves

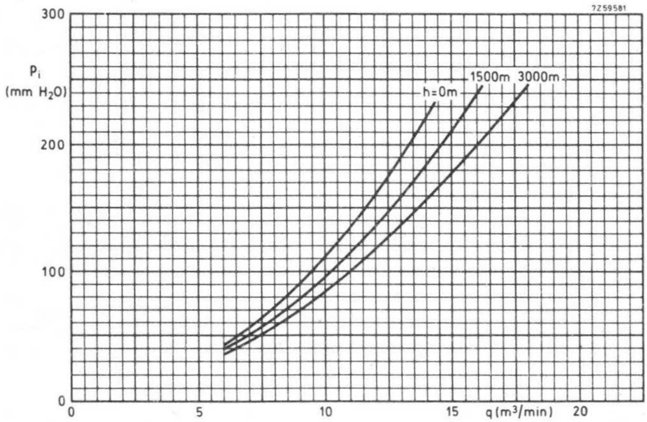












Pressure drop q_i across cavity with YL1430 as a function of airflow q.
p_i = pressure drop from plane A to plane B or B'
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 SOUND

Continuously tunable cavity-type circuit assembly to be used with YL1430 to form a grounded-grid amplifier of frequency modulated signals in band III.

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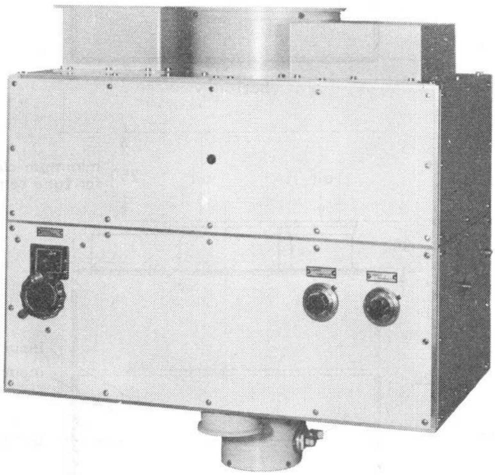


QUICK REFERENCE DATA			
Frequency (MHz)	Class B amplifier (sound)		
	V_a (kV)	W_ℓ (kW) CCIR system	Power gain
170 to 230	7.5	13	33

FREQUENCY RANGE

170 to 230 MHz, continuously tunable.

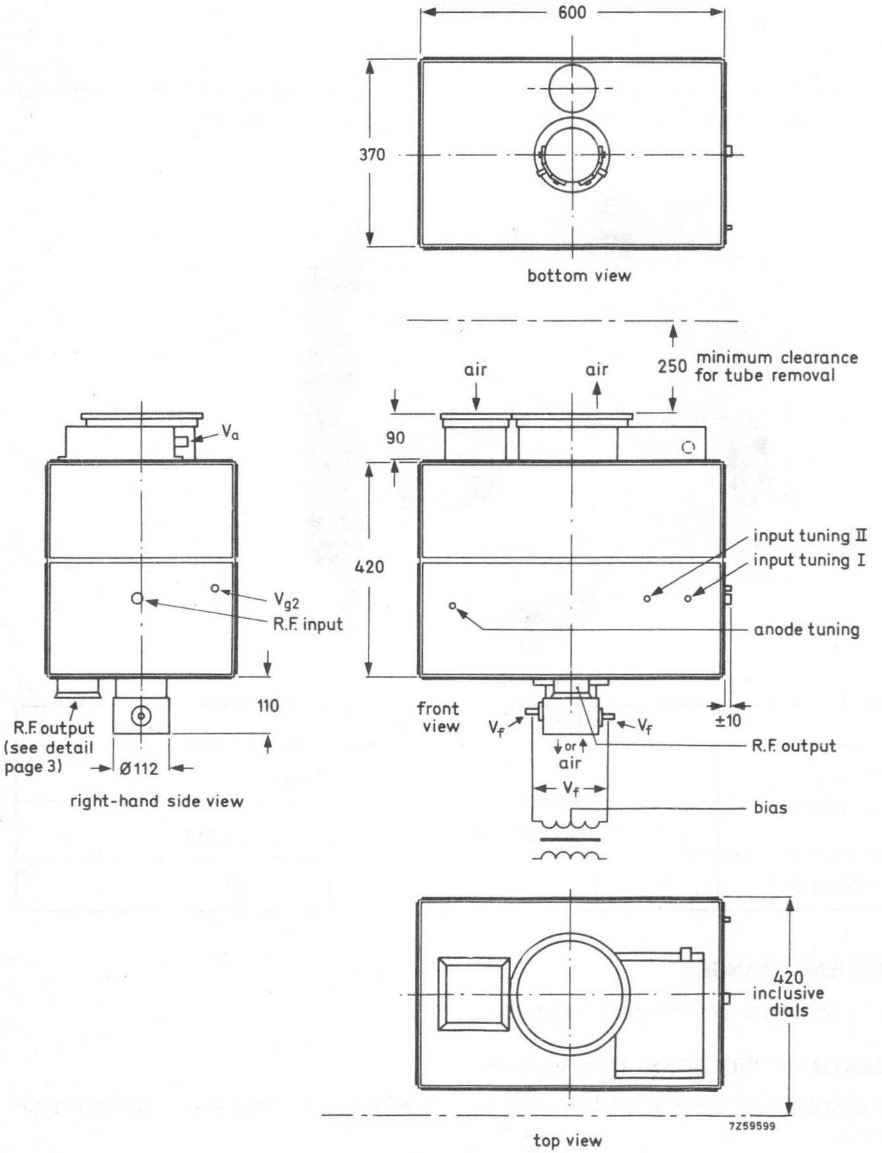
OPERATING CONDITIONS (For YL1430)

For detailed operating conditions reference is made to the data sheets for tube type YL1430.

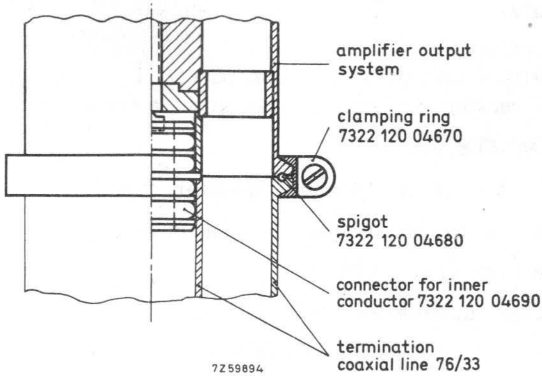
MECHANICAL DATA

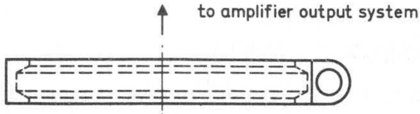
Dimensions in mm

Dimensions : approx. 600 x 620 x 370 mm^3
Net weight : approx. 54 kg

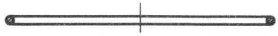


R.F. output connector

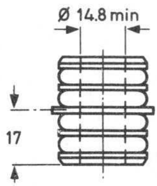




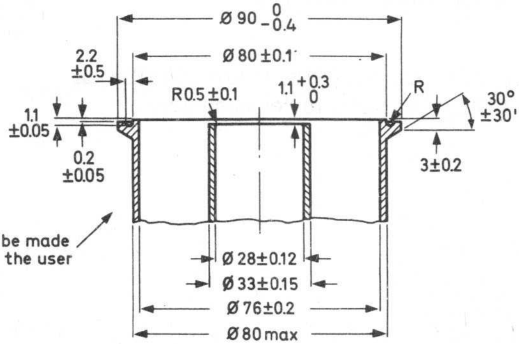
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of airflow: see drawing page 7.
Either sucking and blowing is possible via connections on the top panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial connector : see drawing page 3).

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

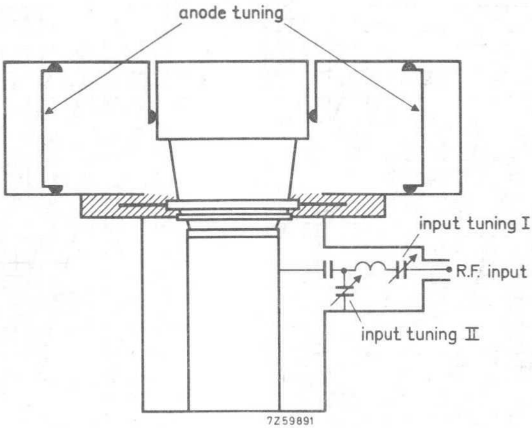
a) Delivered with the assembly

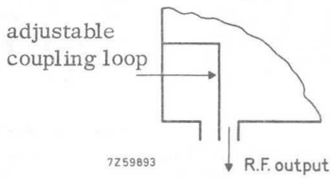
Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

b) Recommended

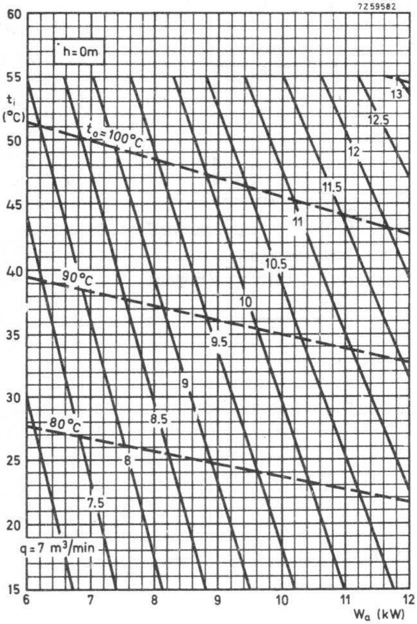
The use of circulator 2722 162 01191 (170 to 200 MHz) or 2722 162 01201 (200 to 230 MHz) is recommended.

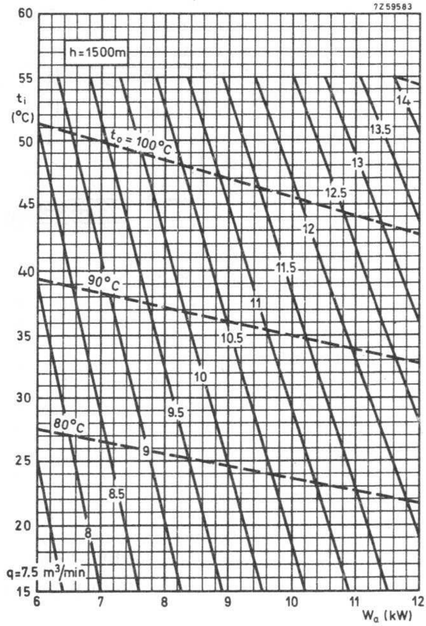
CIRCUIT DIAGRAM

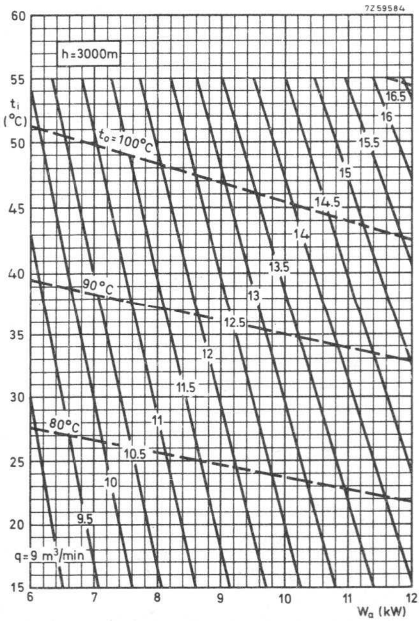


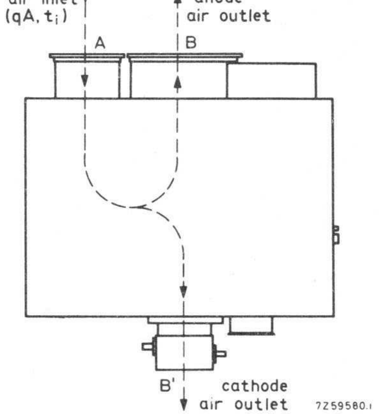


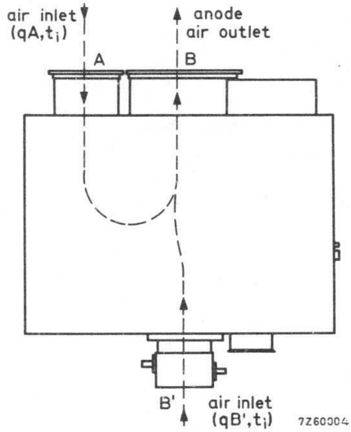
Cooling curves

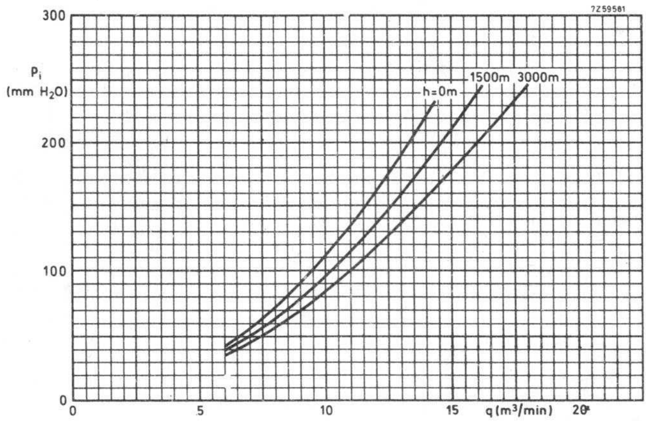










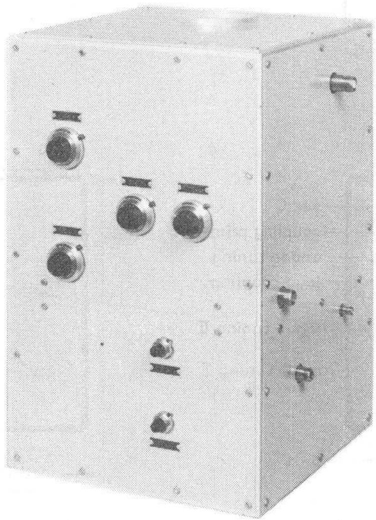


Pressure drop p_i across cavity with YL1430 as a function of air flow q.
p_i = pressure drop from plane A to plane B or B'.
For blowing $q = q_A$
For sucking $q = q_A + q_{B'}$

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440 VISION

Channel tuned 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 amplfier (vision)		
	V_a (kV)	$W_{\ell\, sync}$ (kW) (CCIR system)	Power gain
48 to 83	2.5	1.2	15

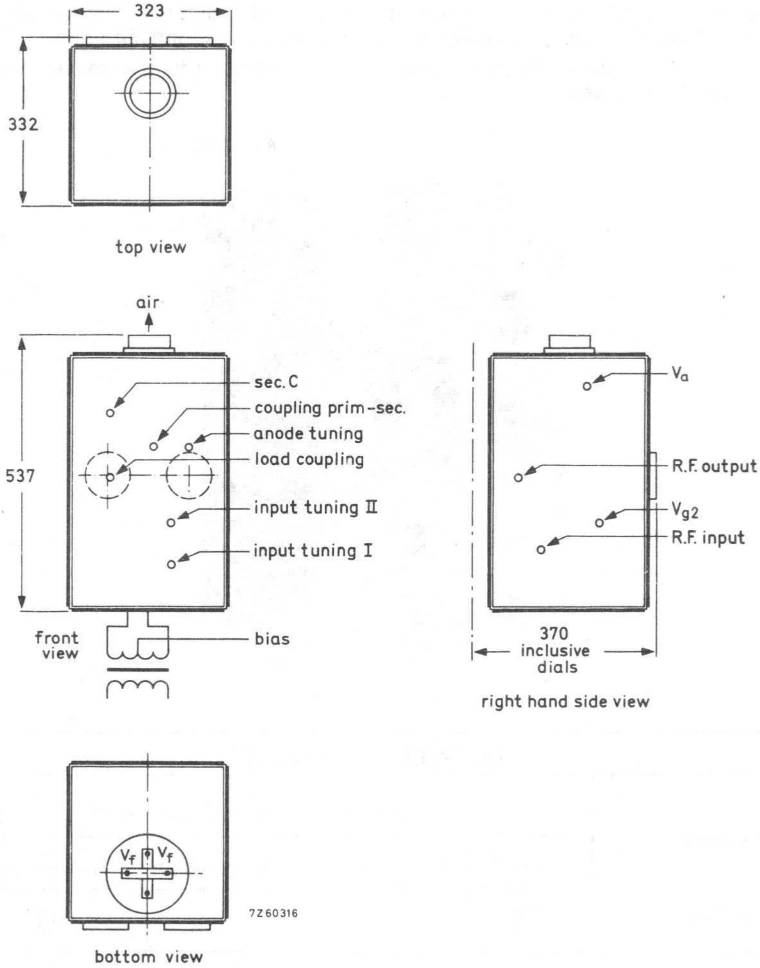
FREQUENCY RANGE
48.25 to 69.25 MHz and } channel tuned
77.25 to 83.25 MHz

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^3
Net weight : approx. 23 kg



COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

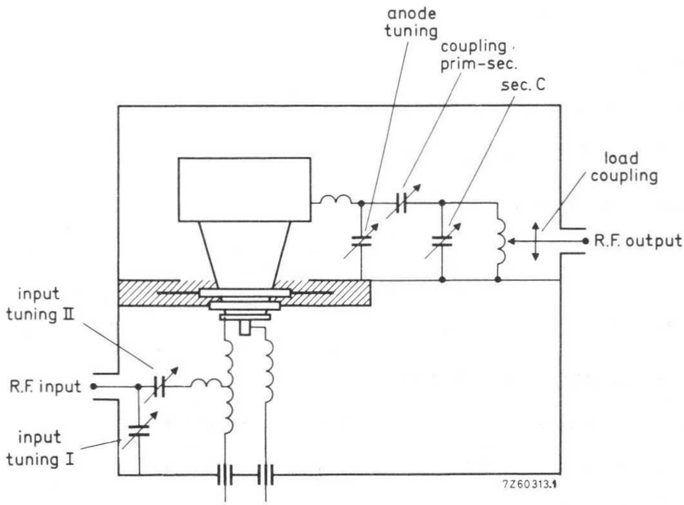
ADDITIONAL COMPONENTS

Delivered with the assembly

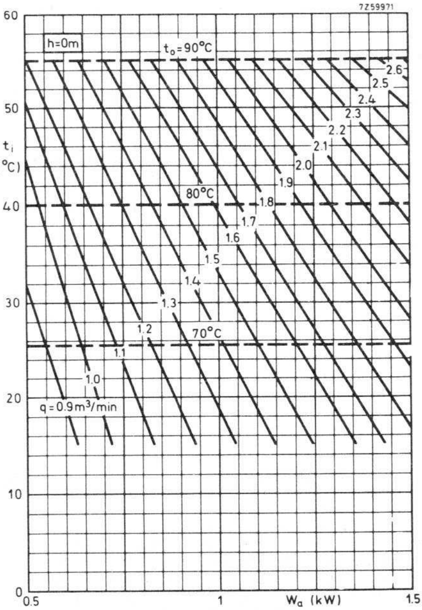
Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for vision carries	
5 coils for vision carrier frequencies 55.25; 61.25 to 62.25; 67.25; 77.25; 83.25 MHz	[1]
Spanner for fitting the coils	

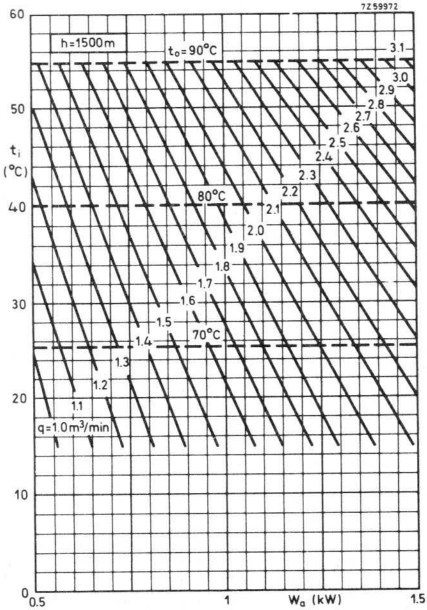
[1] Coils covering vision carrier frequencies other than specified can be delivered on request.

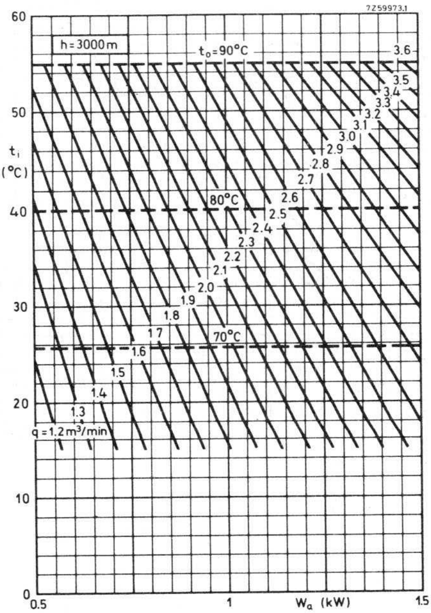
→ CIRCUIT DIAGRAM

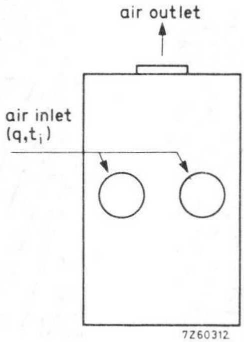


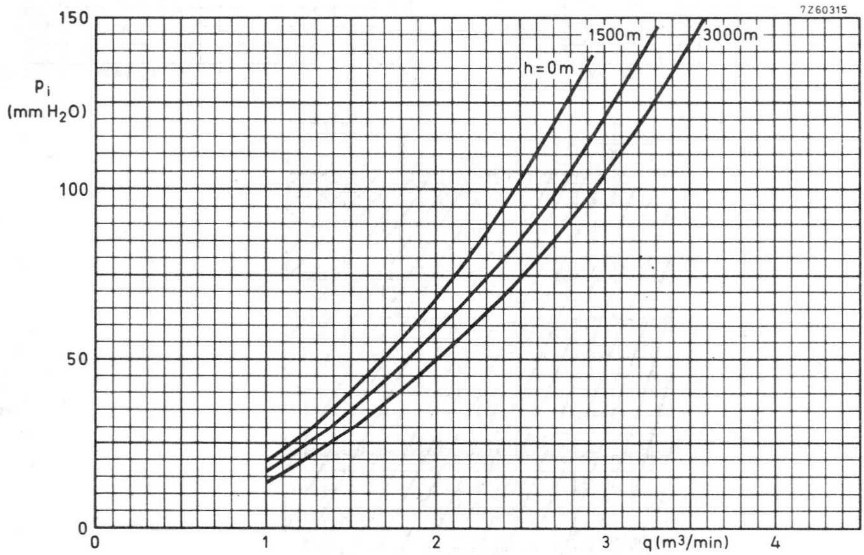
Cooling curves







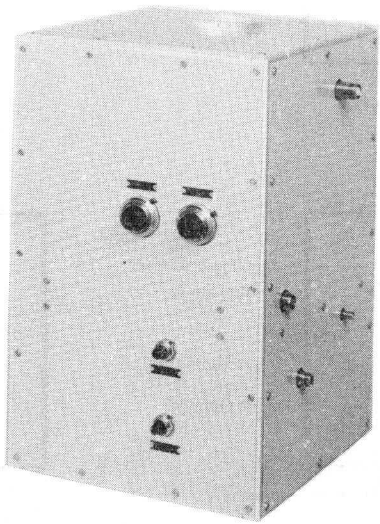

air outlet
air inlet
(q,t_i)
7Z60312


7Z60315
150
100
50
0
P_i
(mm H_2O)
1500m
3000m
h=0m
0
1
2
3
q(m^3/min)
4

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

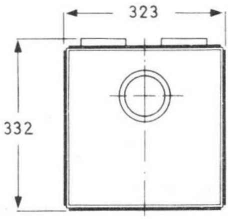
OPERATING CONDITIONS (For YL1440)

For detailed operating conditions reference is made to the data sheets for tube type YL1440.

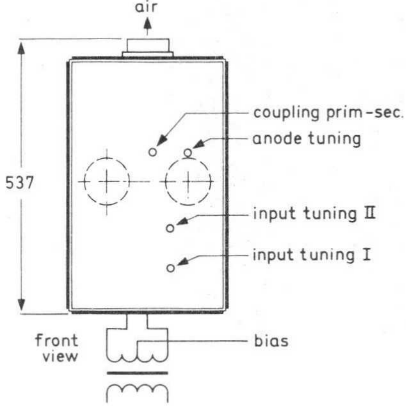
MECHANICAL DATA

Dimensions in mm

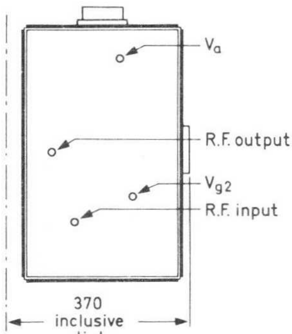
Dimensions: approx. 516 x 323 x 323 mm^3
Net weight : approx. 22.5 kg



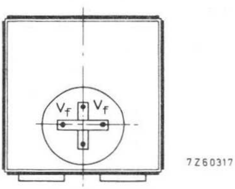
top view



front view



right hand side view



bottom view

COOLING

See cooling curves.
Direction of airflow: see drawing page 6.
Either sucking and blowing is possible via connections on the top panel and the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector type N)

Output : 50 Ω (coaxial female connector type HN)

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90 %

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

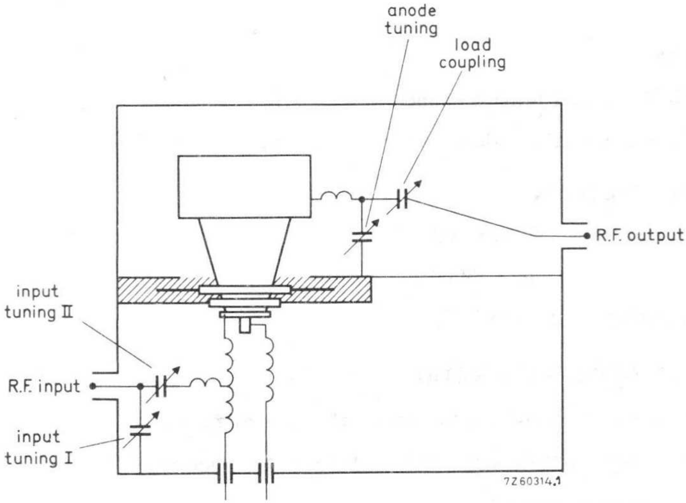
ADDITIONAL COMPONENTS

Delivered with the assembly

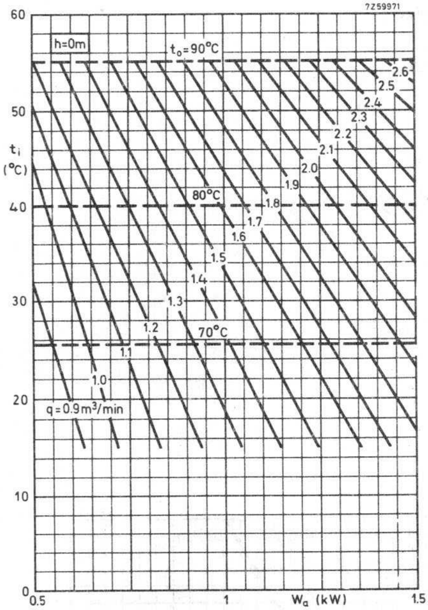
Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
5 coils for sound carrier frequencies 59.75 to 60.75; 65.75 to 67.75; 71.75 81.75; 87.75 MHz	[1]
Spanner for fitting the coils	

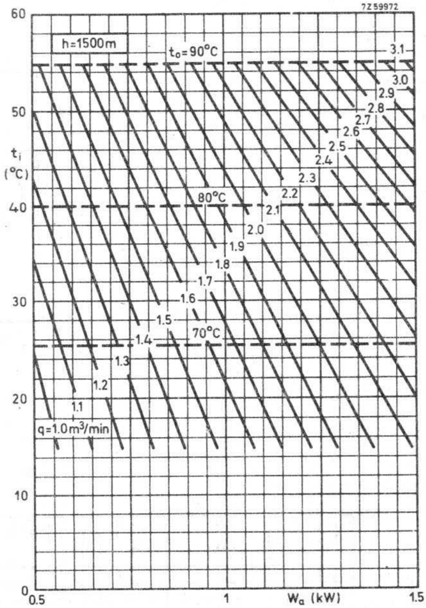
[1]) Coils covering sound carrier frequencies other than specified can be delivered on request.

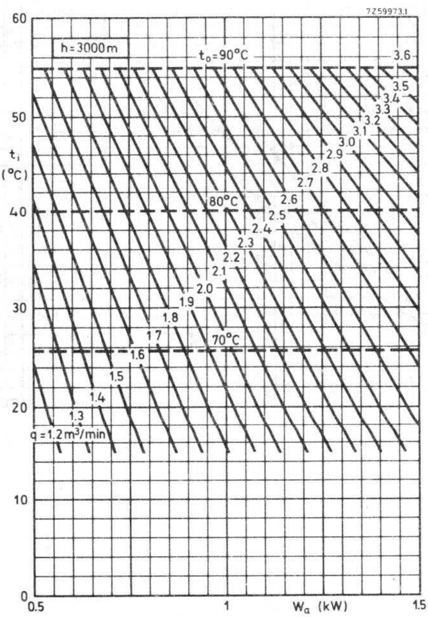
→ CIRCUIT DIAGRAM

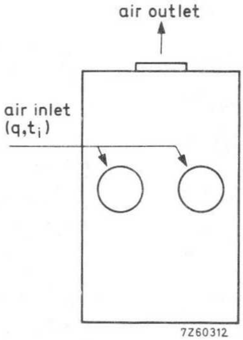


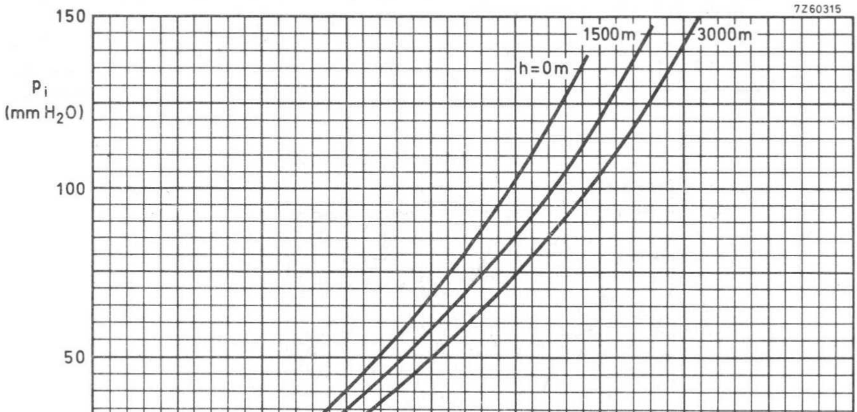
Cooling curves







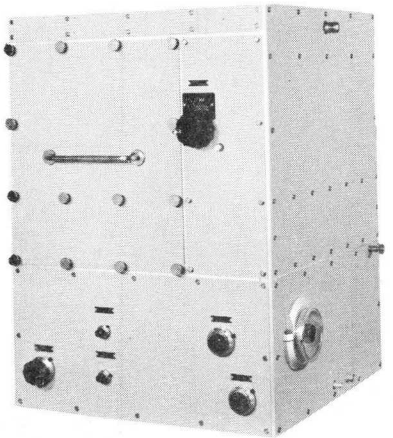

air outlet
air inlet
(q,t$_i$)
7Z60312


7Z60315
150
p$_i$
(mm H$_2$O)
100
50
0
1500m
3000m
h=0m
0
1
2
3
q(m^3/min)
4

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			
	Class AB linear amplifier (vision)		
Frequency (MHz)	V_a(kV)	$W_{\ell\,sync}$ (kW)(CCIR system)	Power gain
83.25	4	6.25	18.5
55.25	4	6.25	16

FREQUENCY RANGE

55.25 to 67.25 MHz and } channel tuned
77.25 to 83.25 MHz

OPERATING CONDITIONS (For YL1420)

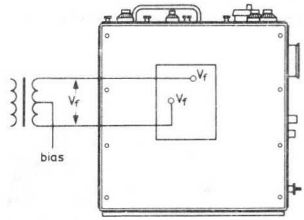
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

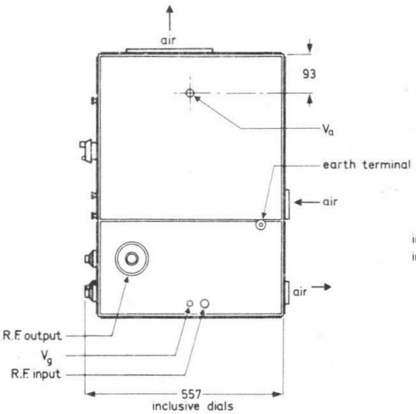
Dimensions in mm

Dimensions: approx. 700 x 500 x 500 mm^3

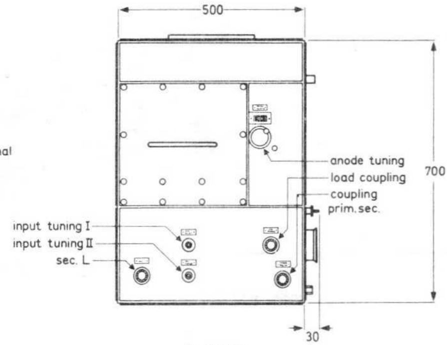
Net weight: approx. 70 kg



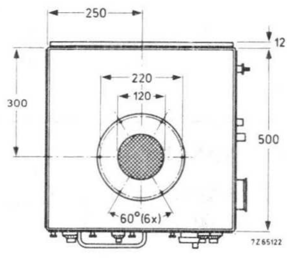
bottom view



right hand side view

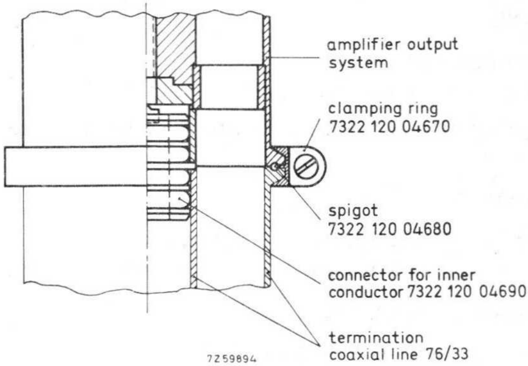


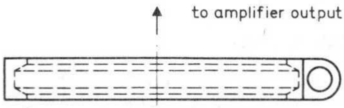
front view



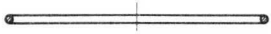
top view

Output connector

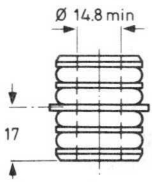




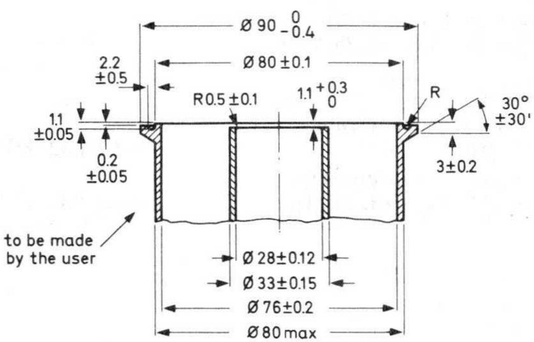
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of air flow: see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial femal connector, type N)
Output: 50 Ω (coaxial female connector, see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C
Altitude : max. 3000 m
Relative humidity : up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance
Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with assembly

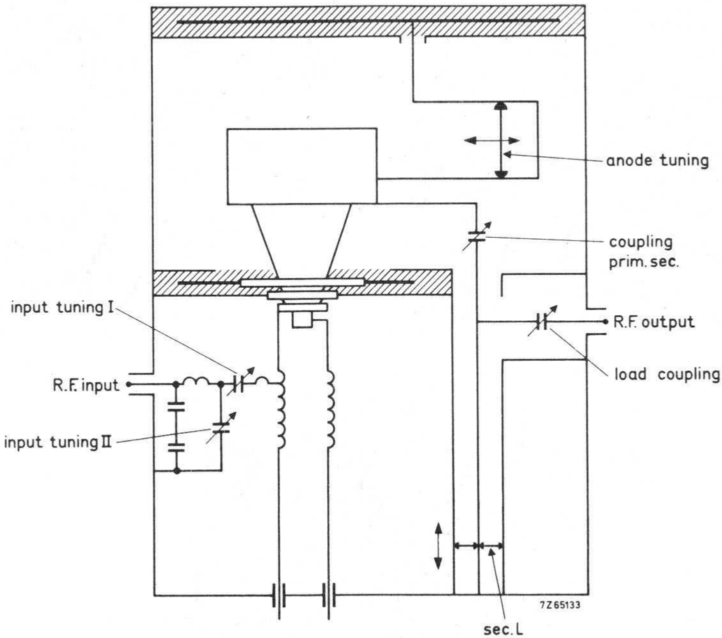
Tube extractor	7322 120 07850	
Mating male input connector	Radiall type N	
Output connector		
connector for inner conductor	7322 120 04690	
spigot for outer conductor	7322 120 04680	
clamping ring for outer conductor	7322 120 04670	
Mating connector for anode voltage	Radiall type R13060	
Mating connector for screen grid voltage	Radiall type R9510	
Anode coil covering frequency range 55.25 to 67.25 MHz	-----	1)
Elbow for secondary circuit covering frequency range 55.25 to 67.25 MHz	-----	

b) Not delivered with assembly

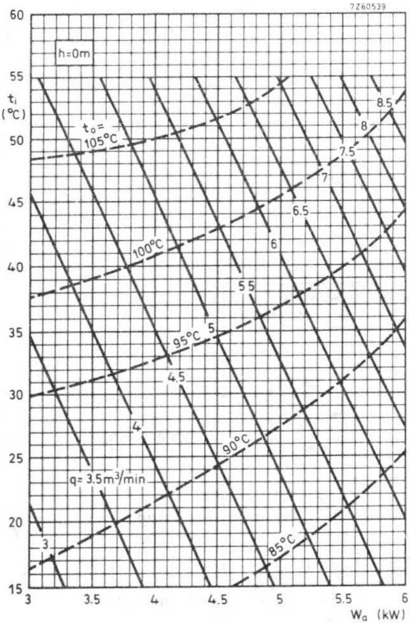
Anode coil covering frequency range 77.25 to 83.25 MHz	8222 032 11860	1)
Elbow for secondary circuit covering frequency range 77.25 to 83.25 MHz	8222 032 11790	

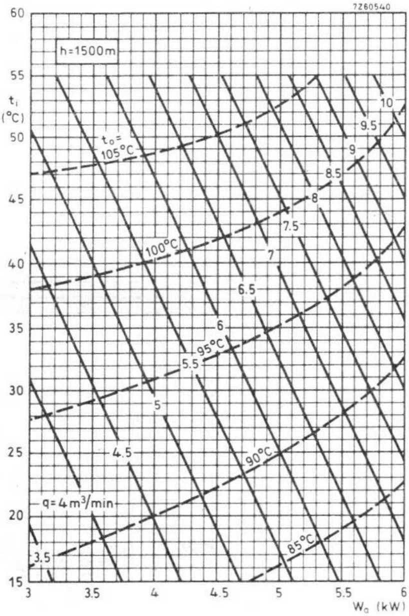
1) For use on carrier frequencies other than specified please contact the manufacturer.

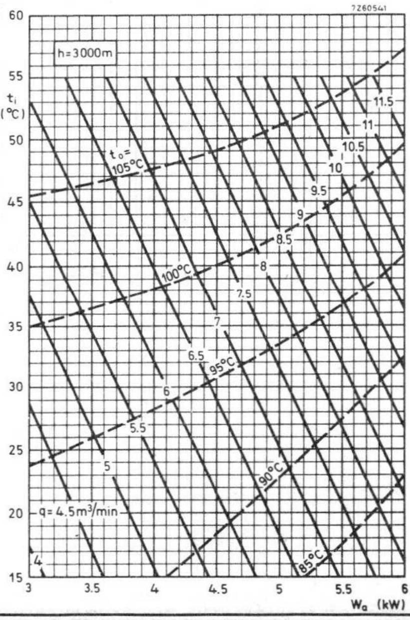
CIRCUIT DIAGRAM

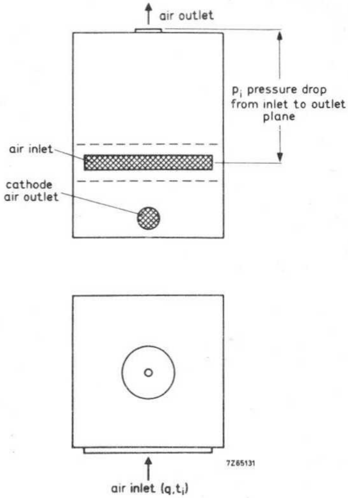


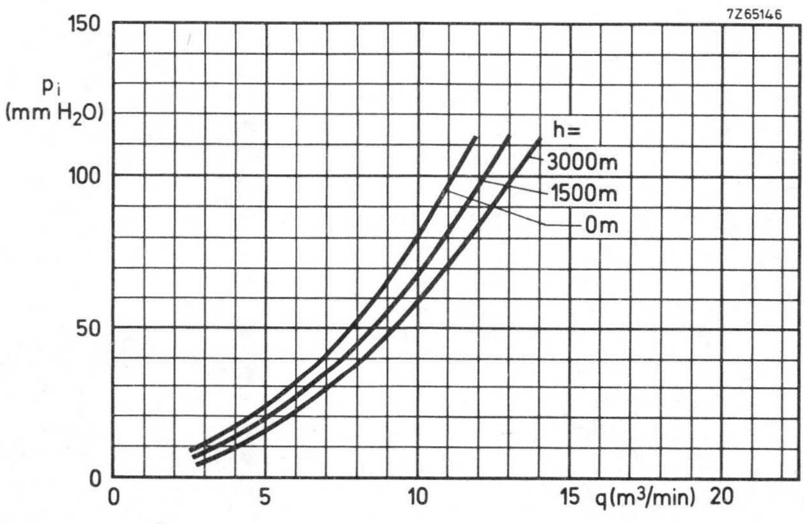
Cooling curves







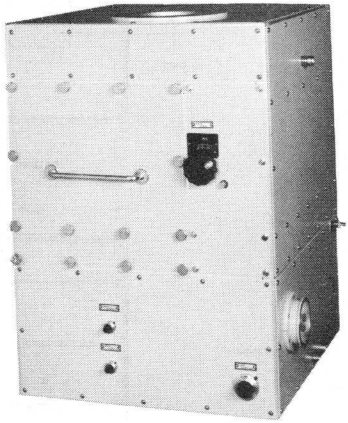

air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q, t_i)


7Z65146
p_i (mm H_2O)
150
100
50
0
h=
3000m
1500m
0m
0
5
10
15
q(m^3/min)
20

BAND I AMPLIFIER CIRCUIT 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)

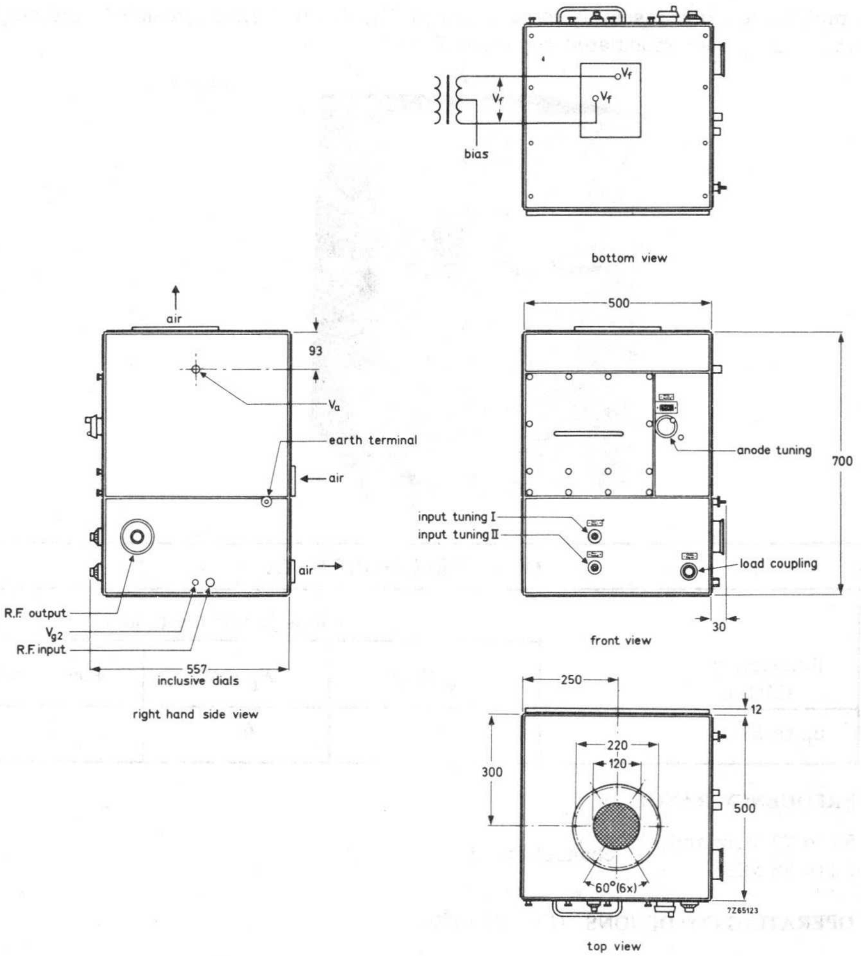
For detailed operating conditions reference is made to the data sheets for tube type YL1420.

MECHANICAL DATA

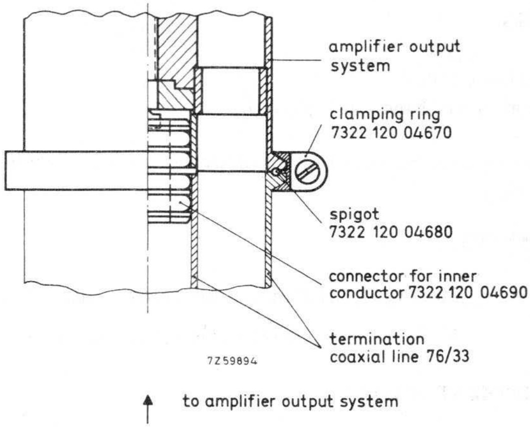
Dimensions in mm

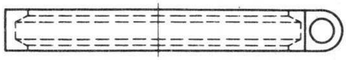
Dimensions : approx. 700 x 500 x 500 mm^3

Net weight : approx. 58 kg

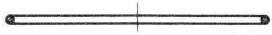


Output connector

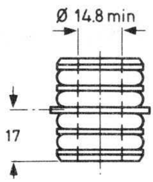




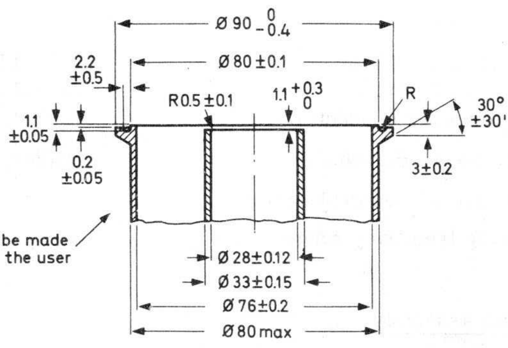
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of air flow : see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)

Output : 50 Ω (coaxial female connector, see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature : 0 °C to +55 °C

Altitude : max. 3000 m

Relative humidity : up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance

Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

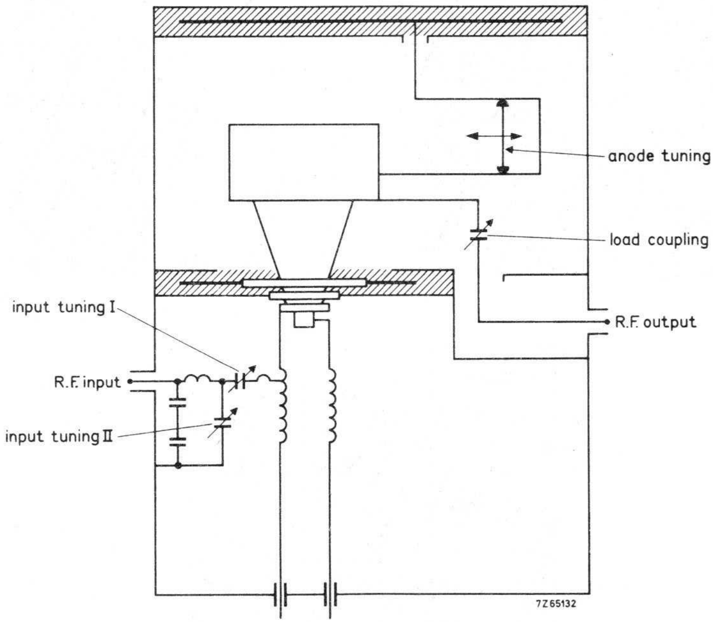
a) Delivered with assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Anode coil covering frequency range 53 to 72 MHz	----

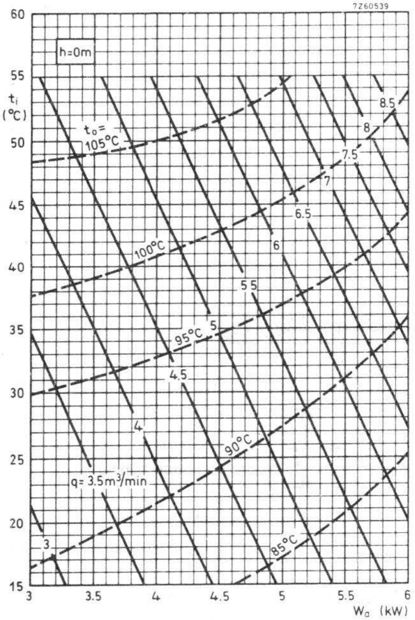
b) Not delivered with assembly

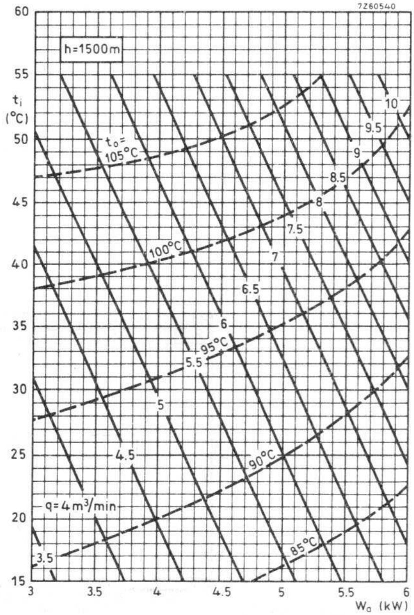
Anode coil covering frequency range 82 to 88 MHz	8222 032 11860

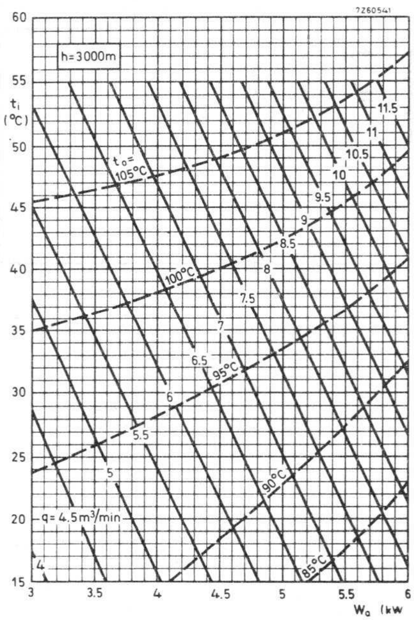
CIRCUIT DIAGRAM

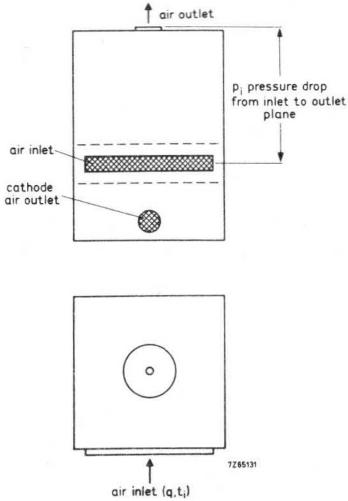


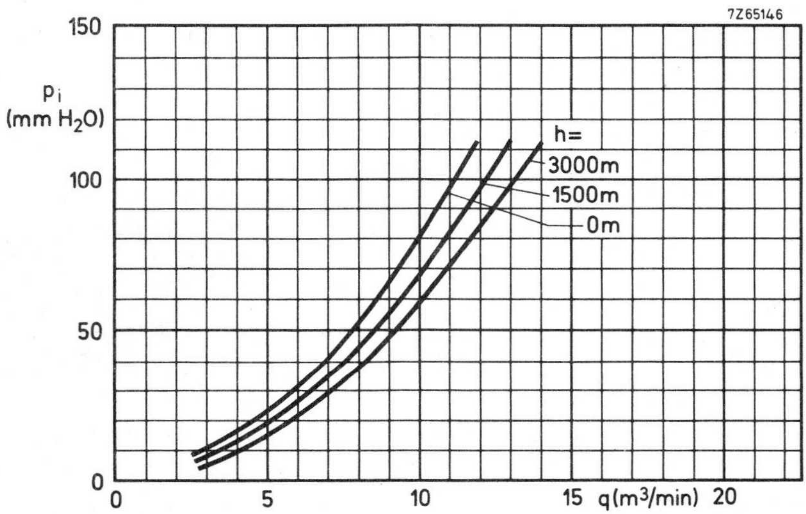
Cooling curves







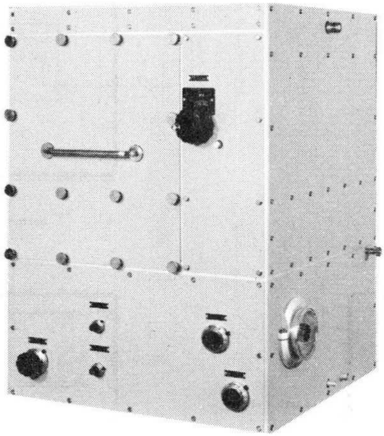

air outlet
p_i pressure drop
from inlet to outlet
plane
air inlet
cathode
air outlet
7Z65131
air inlet (q, t_i)


7Z65146
p_i
(mm H_2O)
150
100
50
0
h=
3000m
1500m
0m
0
5
10
15
$q(m^3/min)$
20

BAND I AMPLIFIER CIRCUIT 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.



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QUICK REFERENCE DATA				
Frequency (MHz)	Type	Class AB linear amplifier (vision)		
		V_a (kV)	W_ℓ sync (kW)(CCIR) system	Power gain
83.25 55.25 55.25	YL1430	5.5 5.5 4.0	13.2 13.2 6.4	20 18 18
83.25 55.25	YL1520	6.5	20 20	24 22

FREQUENCY RANGE

55.25 to 69.25 MHz and }
77.25 to 83.25 MHz } channel tuned

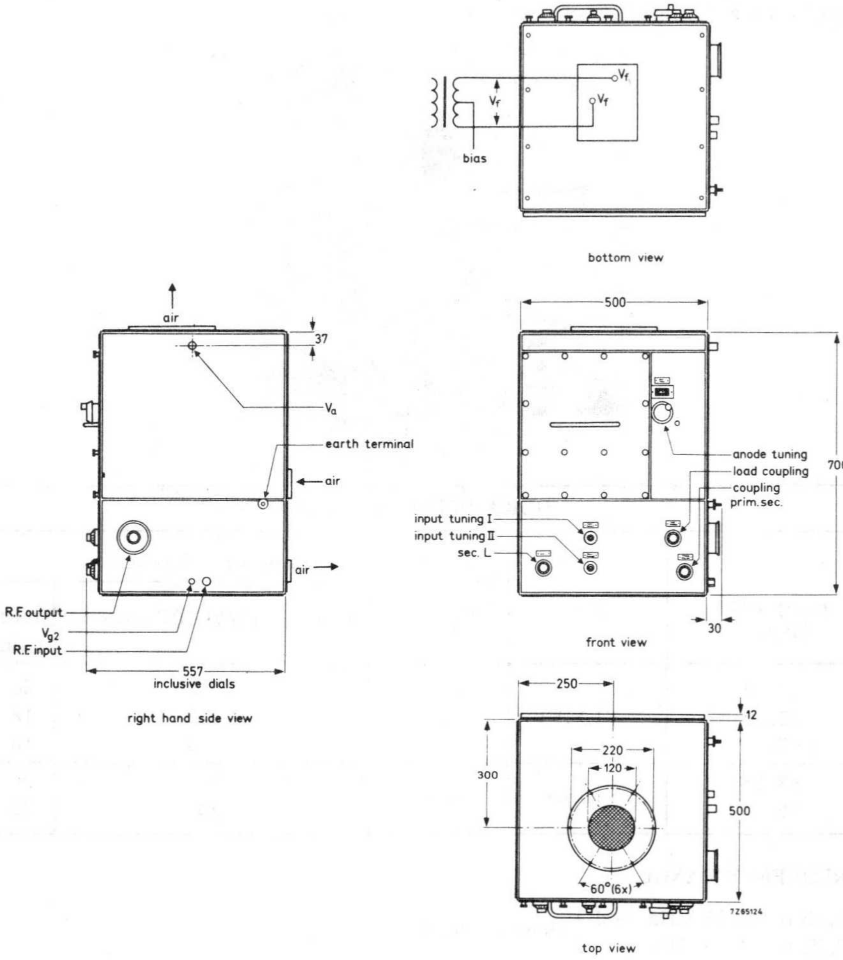
OPERATING CONDITIONS (For YL1430 or YL1520)

For detailed operating conditions reference is made to the data sheets for tube type YL1430 or YL1520.

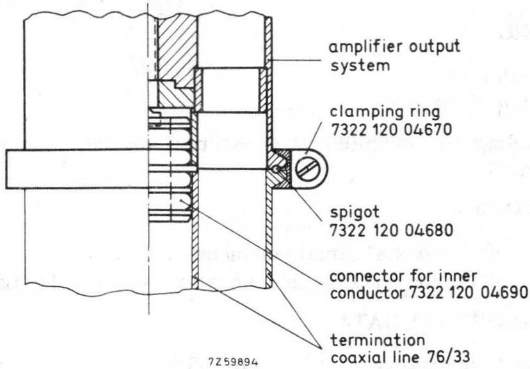
MECHANICAL DATA Dimensions in mm

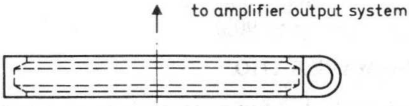
Dimensions: approx. 700 x 500 x 500 mm^3

Net weight : approx. 70 kg

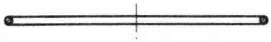


Output connector

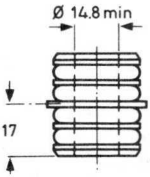




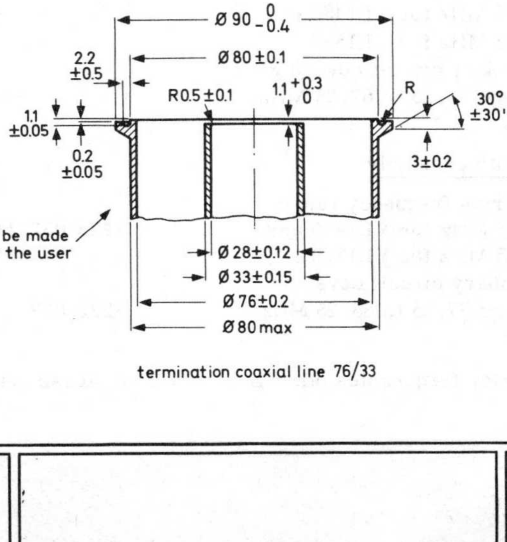
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curve.
Direction of air flow: see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)
Output : 50 Ω (coaxial female connector, see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature	: 0 °C to +55 °C
Altitude	: max. 3000 m
Relative humidity	: up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance
Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

a) Delivered with assembly

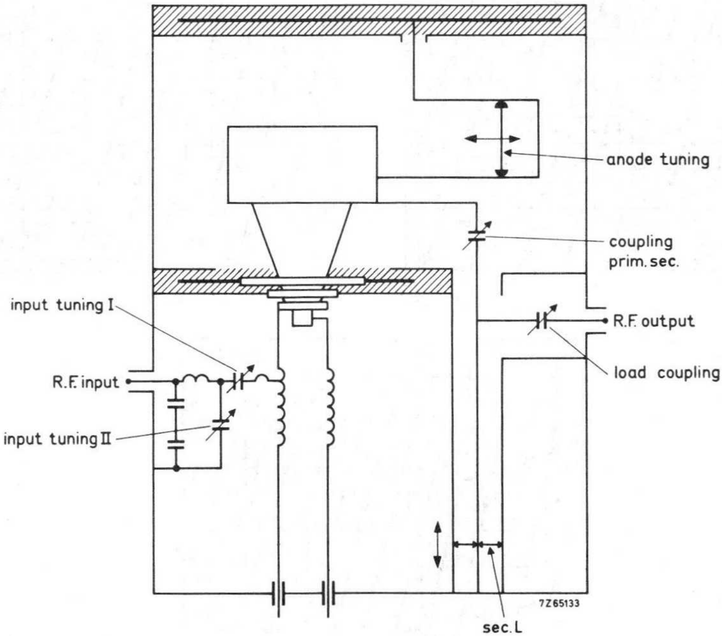
Tube extractor	7322 120 07850	
Mating male input connector	Radiall type N	
Output connector		
connector for inner conductor	7322 120 04690	
spigot for outer conductor	7322 120 04680	
clamping ring for outer conductor	7322 120 04670	
Mating connector for anode voltage	Radiall type R13060	
Mating connector for screen grid voltage	Radiall type R9510	
Anode coil covering frequency range 55.25 to 67.25 MHz for YL1430 and 55.25 to 61.25 MHz for YL1520	----	[1]
Elbow for secondary circuit covering frequency range 55.25 to 67.25 MHz for both types	----	

b) Not delivered with assembly

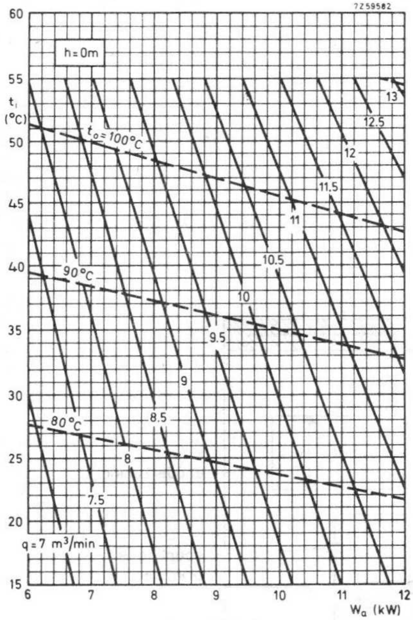
Anode coil covering frequency range 77.25 to 83.25 MHz for YL1430 and 67.25 to 83.25 MHz for YL1520	8222 032 11860	[1]
Elbow for secondary circuit covering frequency range 77.25 to 83.25 MHz for both types	8222 032 11790	

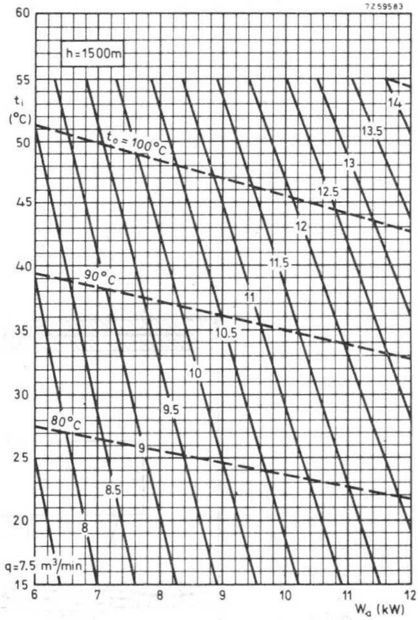
1) For use on carrier frequencies other than specified please contact the manufacturer.

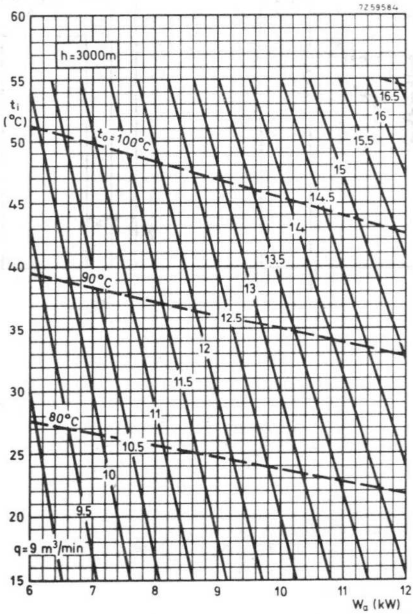
CIRCUIT DIAGRAM

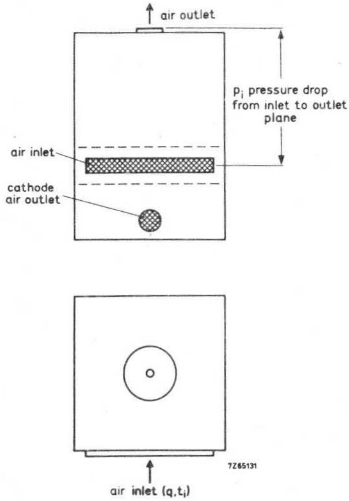


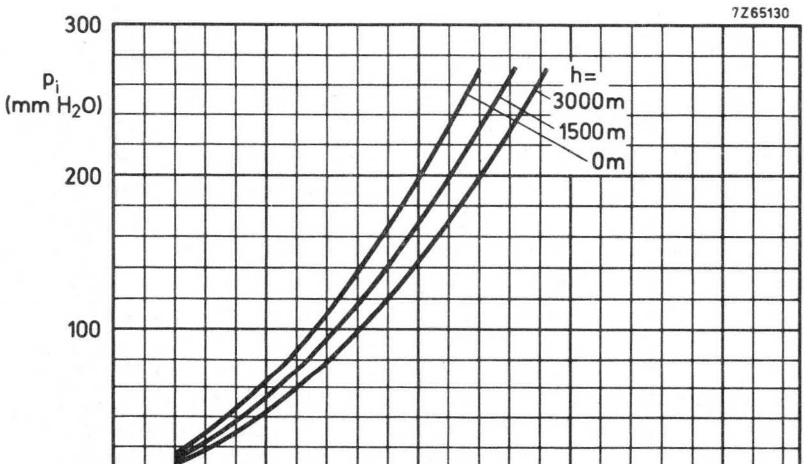
Cooling curves







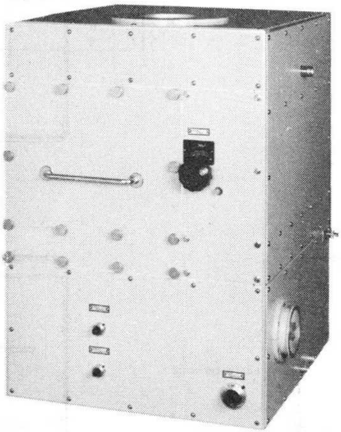

air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q, t_i)


7Z65130
p_i (mm H_2O)
300
200
100
0
10
20
30
40
q(m^3/min)
h=
3000m
1500m
0m

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 OR YL1520 SOUND

Amplifier circuit assembly to be used with YL1430 or YL1520 to form a grounded-grid amplifier of frequency modulated signals in Band I.

RZ 30263-3



QUICK REFERENCE DATA				
	Class AB linear amplifier (sound)			
Frequency (MHz)	Type	V_a (kV)	W_ℓ (kW)	Power gain
up to 88	YL1430	7.5	13	32.5

FREQUENCY RANGE

$\left.\begin{array}{l}\text{53 to 72 MHz and}\\ \text{82 to 88 MHz}\end{array}\right\}$ channel tuned

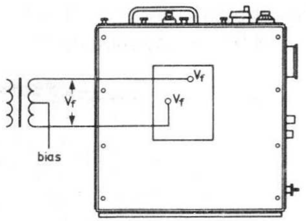
OPERATING CONDITIONS (For YL1430 and YL1520)

For detailed operating conditions reference is made to the data sheets for tube type YL1430 and YL1520.

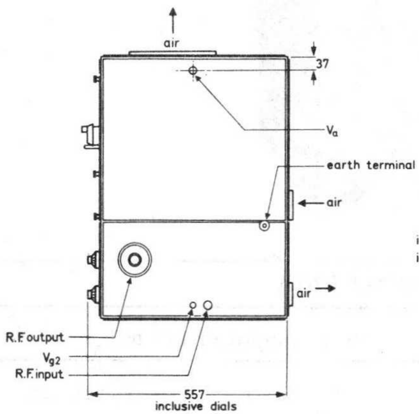
MECHANICAL DATA Dimensions in mm

Dimensions in : approx. 700 x 500 x 500 mm^3

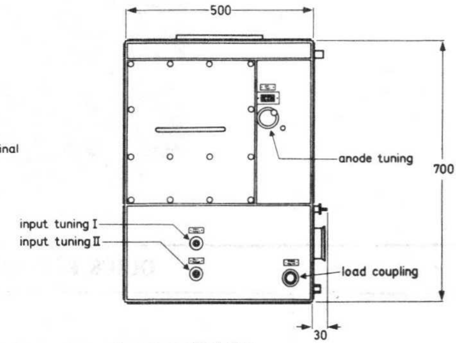
Net weight : approx. 58 kg



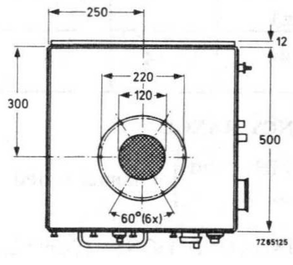
bottom view



right hand side view

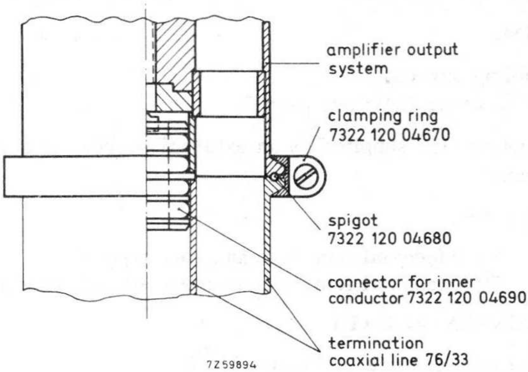


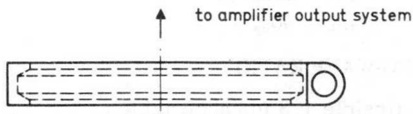
front view



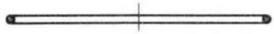
top view

Output connector

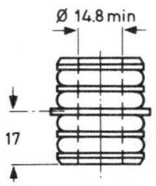




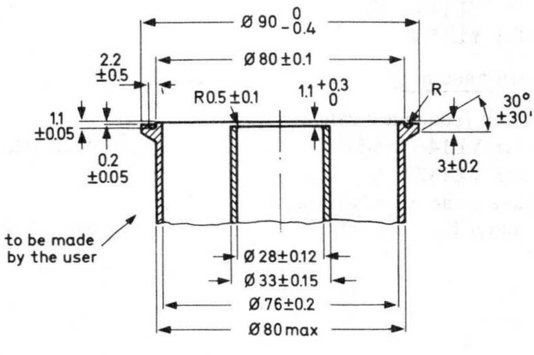
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

COOLING

See cooling curves.
Direction of air flow: see page 7.

The cooling air, supplied by an external source, is admitted through an inlet in the rear panel.

IMPEDANCES

Input : 50 Ω (coaxial female connector, type N)
Output : 50 Ω (coaxial female connector, see drawing page 3)

ENVIRONMENTAL DATA

Ambient temperature : 0 ^{o}C to +55 ^{o}C
Altitude : max. 3000 m
Relative humidity : up to 90%

VOLTAGE STANDING-WAVE RATIO

Input : max. permissible 1.3 for acceptable performance
Output : max. permissible 1.3 for acceptable performance

ADDITIONAL COMPONENTS

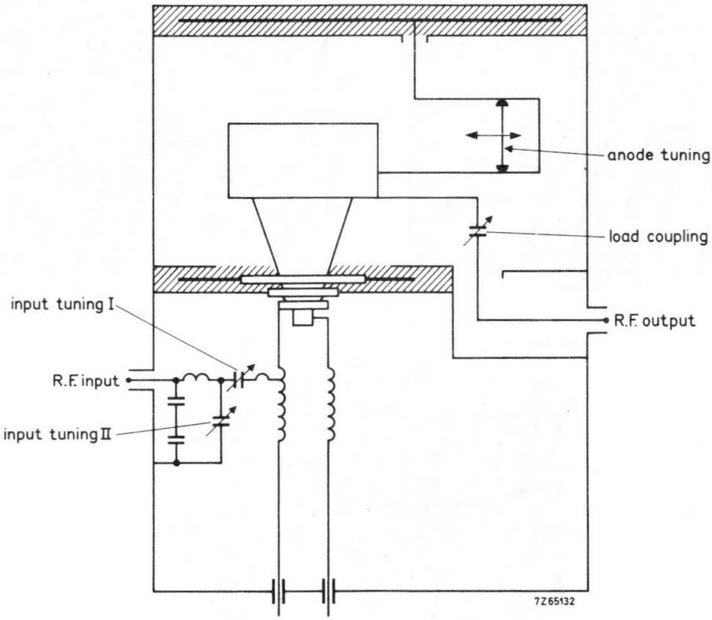
a) Delivered with assembly

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Output connector	
connector for inner conductor	7322 120 04690
spigot for outer conductor	7322 120 04680
clamping ring for outer conductor	7322 120 04670
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Anode coil covering frequency range 53 to 72 MHz for YL1430 and 53 to 66 MHz for YL1520	---

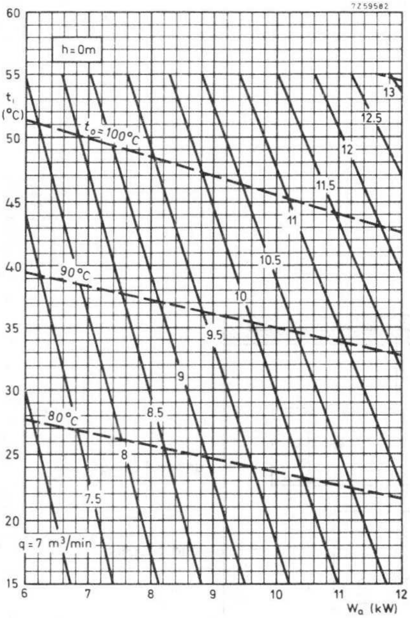
b) Not delivered with assembly

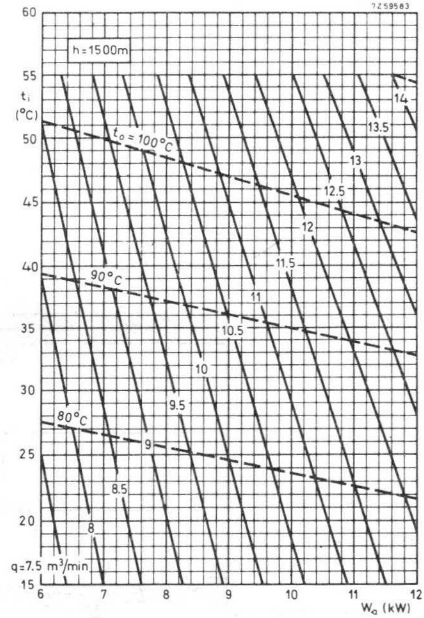
Anode coil covering frequency range 82 to 88 MHz for YL1430 and 70 to 88 MHz for YL1520	8222 032 11860
Shorting bar to use in addition with coils, for highest channel for YL1520	8222 032 57110

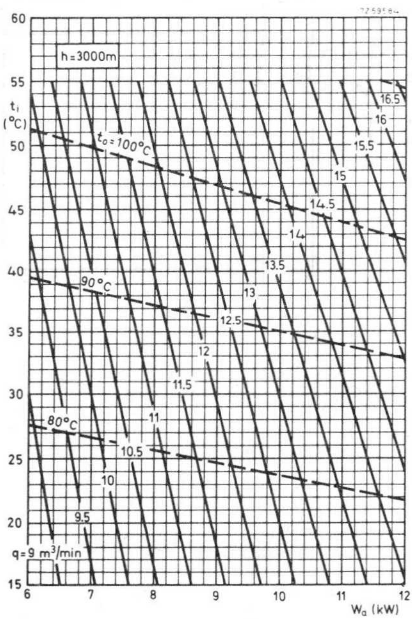
CIRCUIT DIAGRAM

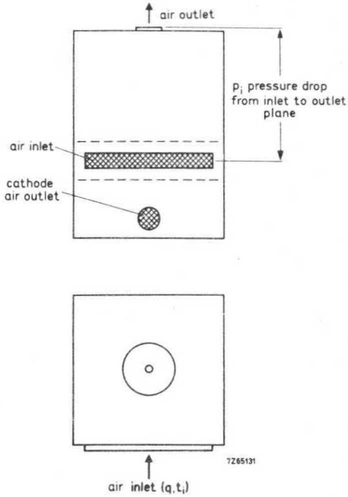


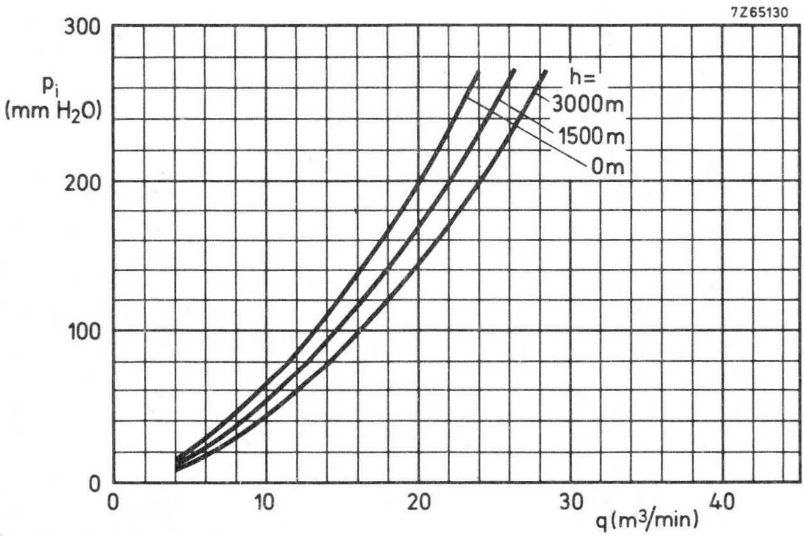
Cooling curves








air outlet
p_i pressure drop from inlet to outlet plane
air inlet
cathode air outlet
7Z65131
air inlet (q, t_i)


7Z65130
300
p_i (mm H2O)
200
100
0
0
10
20
30
40
q (m3/min)
h=
3000m
1500m
0m

INDEX OF TYPE NUMBERS

For associated accessories see Handbook Electron tubes, Part 9

Tr.P. = Transmitting tubes, Tetrodes, Pentodes

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 QB4/1100GA
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 QQC04/15
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

For associated accessories see Handbook Electron tubes, Part 9

Ampl. = Amplifier circuit assemblies

Tr.P. = Transmitting tubes, Tetrodes, Pentodes

General section

Transmitting tubes for communication

TETRODES AND PENTODES

Amplifier circuit assemblies

Printed in The Netherlands

9399 241 18501