PHILIPS

Data handbook

PHILIPS Electronic components and materials

Electron tubes

Part 1a December 1975

Transmitting tubes for communication

Tubes for r.f. heating

PE05/25 ÷ TBW15/125

ELECTRON TUBES

Part 1a **December 1975**

General section

Transmitting tubes for communication

Tubes for r.f. heating — Types PE05/25 ÷ TBW15/125

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DATA HANDBOOK SYSTEM

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

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

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

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

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

General section

TRANSMITTING TUBES FOR COMMUNICATION

TUBES FOR R.F. HEATING

LIST OF SYMBOLS

1. Symbols denoting electrodes and electrode connections

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

Remarks

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

2. Symbols denoting voltages

Remarks

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

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

2. Symbols denoting voltages (continued)

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

3. Symbols denoting currents

Remarks

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

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

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

4. Symbols denoting powers

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

5. Symbols denoting capacitances

In general the published capacitance values refer to the cold tube

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

6. Symbols denoting resistances

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

7. Symbols denoting various quantities

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

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7. Symbols denoting various quantities (continued)

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

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

1. GENERAL

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

1.2 The tubes are classified into groups:

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

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

2. CHARACTERISTIC DATA

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

2.2 Filament/heater supply.

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

2.2.1 Pure tungsten cathodes (filaments)

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

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

2.2.2 Thoriated tungsten cathodes (filaments)

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

2.2.3 Quick heating cathodes (filaments)

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

2.2.4 Indirectly heated oxide coated cathodes

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

- by-passing the heater to cathode insulation and decoupling the heater at v.h.f. and u.h.f.
- r.f. blocking with series chokes in heater supply leads and decoupling with capacitors.

2.2.5 Switching on the filament voltage

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

2.2.6 By-passing the filament

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

2.3 Switching on of the electrode voltages

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

2.4 Effective cathode

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

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

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

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

2.5 Inter-electrode capacitances

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

2.6 Amplification factor μ and transconductance S

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

2.7 Saturation current I_{sat}

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

2.8 Accessories

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

3. LIMITING VALUES

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

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

3.3 Derating the limiting values

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

Wo = tungsten filament Th = thoriated tungsten filament

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

[1]) or 1.5 W_a.

3.4 Rating system

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

3.5 Absolute maximum rating system

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

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

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

3.7 Electrode voltages

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

3.8 Anode dissipation

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

3.9 Anode input power

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

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

3.11 Control-grid dissipation

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

3.12 Grid resistance

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

4. OPERATING CONDITIONS

4.1 General

In the published data, operating conditions for various applications have been given, stating the maximum frequency at which the conditions apply. If it is required to operate a tube at higher frequencies the manufacturer should be consulted. The published values of operating conditions are average values derived from measurements made on nominal tubes working under optimum conditions. Thus, small deviations from the published value can occur if measurements are made on a particular tube. However some of the measured values of voltage or current must be adjusted to give the published figure. As an example, the published value of output power is an average value which can be reached in practice by adjusting e.g. the r.f. or a.f. input voltage V_{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 current flows for less than one half of each cycle of the alternating grid voltage. working to the values published in the data sheets will ensure good output power and efficiency.

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

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

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

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

4.4 R.F. class B telephony

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

4.5 R.F. class AB SSB amplifier

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

4.6 A.F. class B amplifier

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

4.7 Industrial operating conditions

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

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

4.8 Intermittent service

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

5. APPLICATION OF THE OPERATING CONDITIONS

5.1 General

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

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

5.2 Fixed transmitters

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

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

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

5.3 Mobile transmitters

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

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

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

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

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

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

5.4.1 Multiple tube operation

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

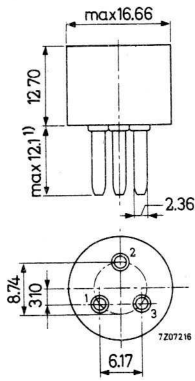
5.5 Amateur transmitters and special adjustments

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

5.6 Pulsed operation

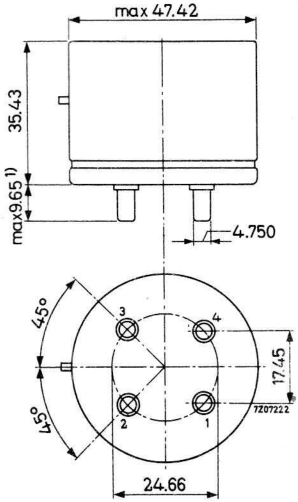
When a tube is used under pulsed operation the pulse duration must be so short that no part of the tube reaches an abnormally high temperature and flash-overs do not develop. In general the average load will be considerably less than the maximum limiting load value.
General information on this kind of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

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



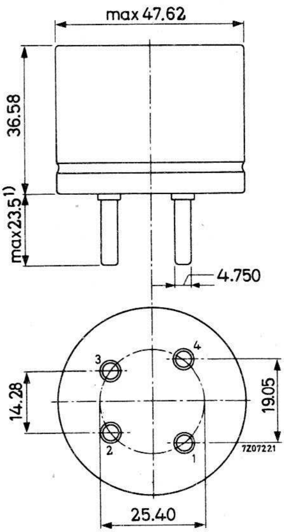
1) Including solder

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



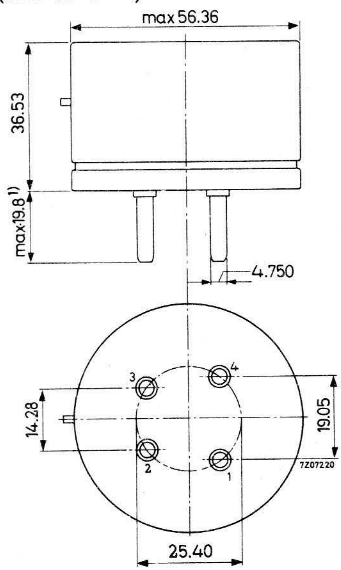
1) Including solder

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



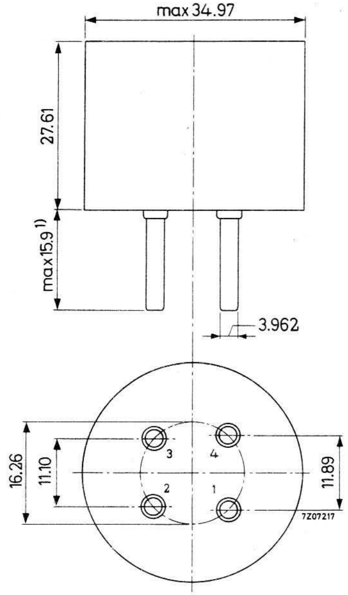
1) Including solder

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



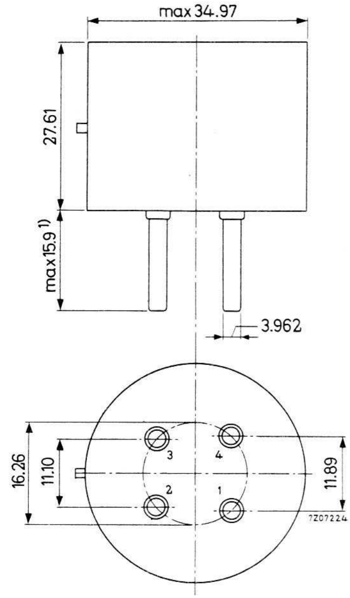
1) Including solder

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



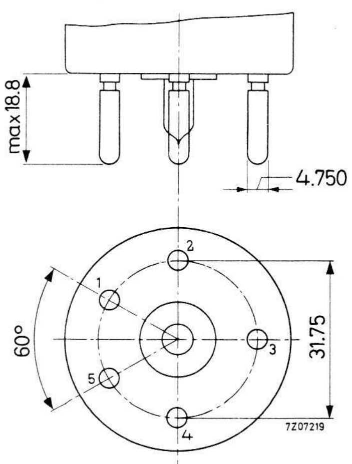
1) Including solder

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

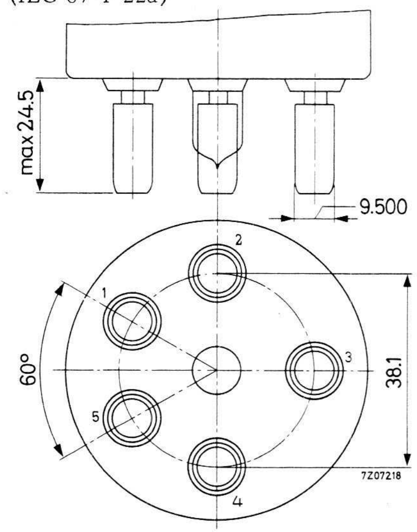


1) Including solder

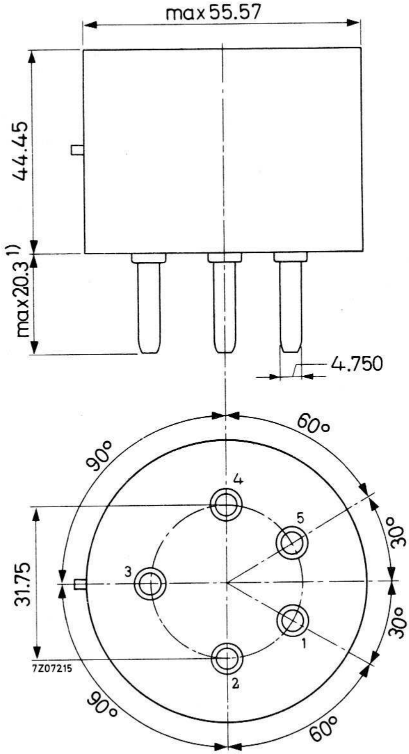
Giant 5-pin base
(IEC 67-I-21c)



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

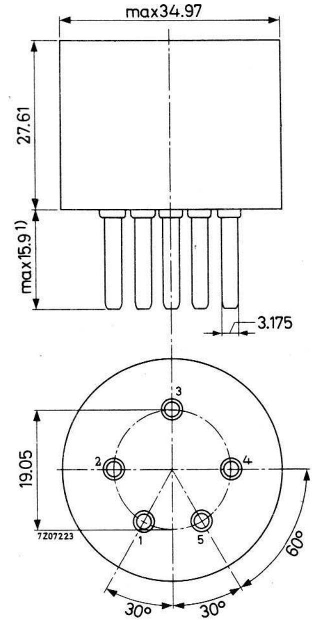


Medium shell Giant 5-pin base
with bayonet
(IEC 67-I-21a)



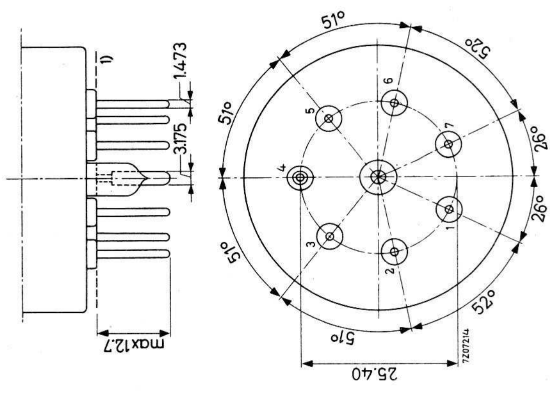
1) Including solder

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



1) Including solder

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



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

Transmitting tubes for communiction

Tubes for r.f. heating

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)

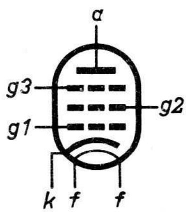
Anode voltage	V_a	=	max.	500	V
Anode dissipation	W_a	=	max.	12	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	5	W
Grid No.1 dissipation	W_{g_1}	=	max.	0.5	W
Grid No.1 resistor with fixed bias	R_{g_1}	=	max.	50	kΩ
Grid No.1 resistor with automatic bias	R_{g_1}	=	max.	100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

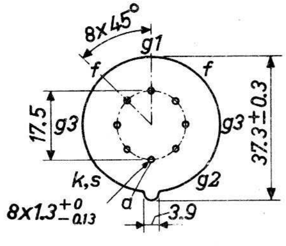
MECHANICAL DATA

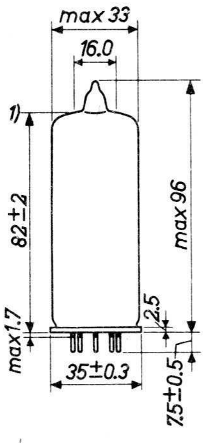
Socket : 40210/02

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

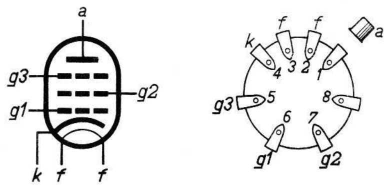
1) Two tubes

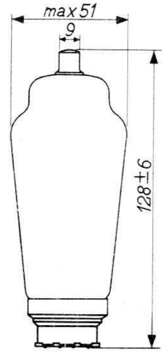
MECHANICAL DATA

Dimensions in mm

PE06/40 P

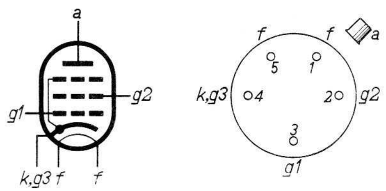
Base P
Socket 2422 514 00001
Cap 28 906 022
Net weight 65 g

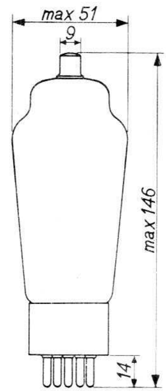




PE06/40 N

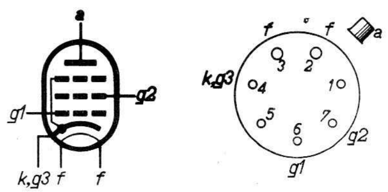
Base N
Socket 2422 512 03001
Cap 28 906 022
Net weight 65 g

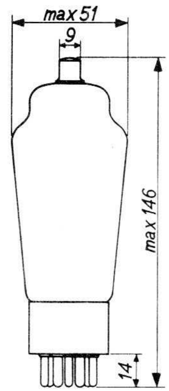




PE06/40 E

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_{g_2}	=	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 kΩ

[3] R_{g_2} = 34 kΩ

R.F. POWER PENTODE

QUICK REFERENCE DATA						
λ	Freq.	C telegr.		B teleph.		
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	
>5	<60	1000 800 600	132 107 78	1000 800 600	23 23 23	

B mod. [1]	
V_a (V)	W_o (W)
1000 800 600	194 110 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	800 600	75 51	1000 800 600	27 26 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	$-V_{g1}$	=	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

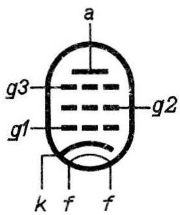
MECHANICAL DATA

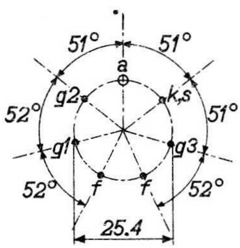
Base : Septar

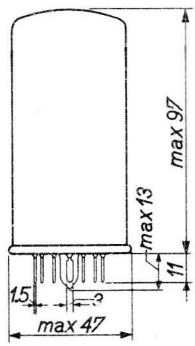
Socket : 2422 513 00001

Net weight: 80 g

Dimensions in mm





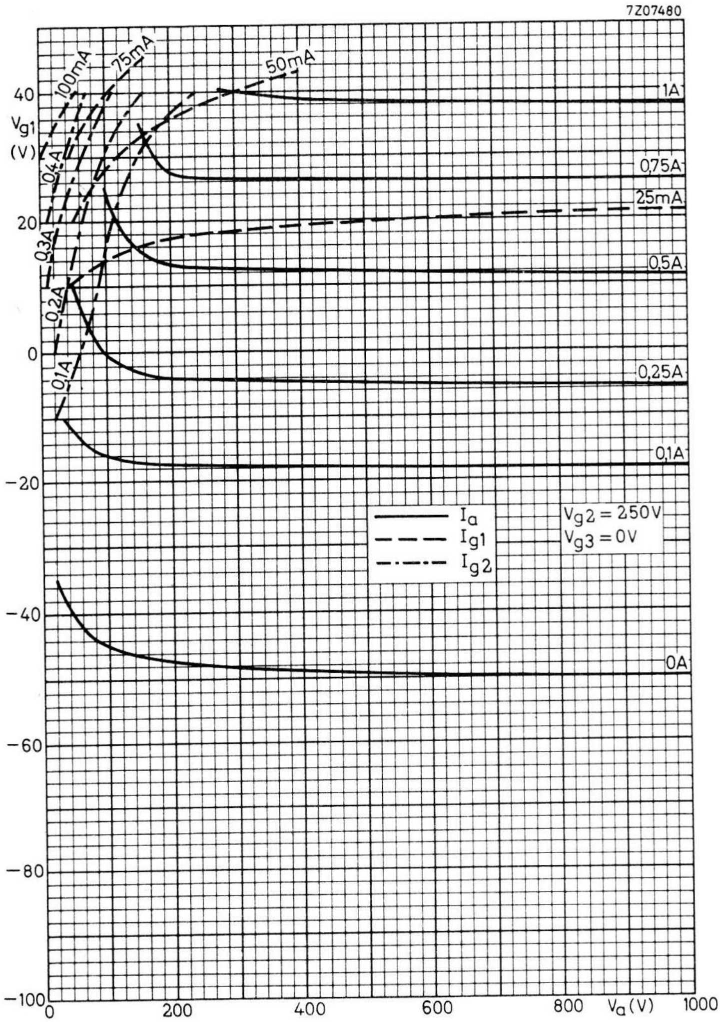


Mounting position: arbitrary

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_{g1}	−120	−110	−100	V
Grid no. 2 voltage	V_{g2}	250	250	250	V
Grid no. 3 voltage	V_{g3}	0	0	0	V
Anode current	I_a	177	190	205	mA
Grid no. 1 current	I_{g1}	5	6	7,5	mA
Grid no. 2 current	I_{g2}	28	28	28	mA
Peak grid no. 1 a.c. voltage	V_{g1_p}	144	134	124	V
Grid no. 1 input power	W_{ig1}	0,65	0,73	0,84	W
Grid no. 2 dissipation	W_{g2}	7	7	7	W
Anode dissipation	W_a	45	45	45	W
Output power	W_o	132	107	78	W
Efficiency	η	74,5	70,5	63,5	%


7Z07480
V_{g1} (V)
V_a (V)
40
20
0
−20
−40
−60
−80
−100
0
200
400
600
800
1000
1A
0,75A
0,5A
0,25A
0,1A
0A
25mA
50mA
75mA
100mA
0,4A
0,3A
0,2A
0,1A
I_a
I_{g1}
I_{g2}
$V_{g2} = 250V$
$V_{g3} = 0V$

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. V_a (V)	C telegr. W_o (W) CCS	C telegr. W_o (W) ICAS	B teleph. V_a (V)	B teleph. W_o (W) CCS	B teleph. 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
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. V_a (V)	C_{g_1} mod. W_o (W) CCS	C_{g_1} mod. W_o (W) ICAS	AB mod. [1] V_a (V)	AB mod. [1] W_o (W) CCS	AB mod. [1] 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

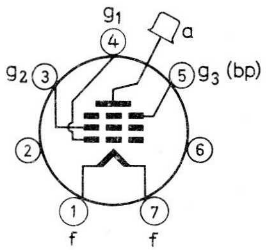
Dimensions in mm

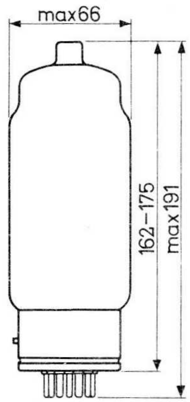
Mounting position : vertical with base up or down, or horizontal with pins 2 and 6 in a vertical plane.

Net mass : 430 g

Base : Giant 7-pin

Accessories : Anode connector type 40619





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 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. 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_{g_2}	=	250	V
Anode current	I_a	=	125	mA
Mutual conductance	S	=	4	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5	

MECHANICAL DATA

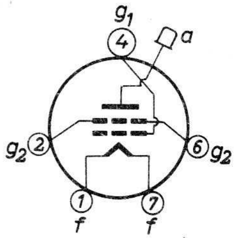
Dimensions in mm

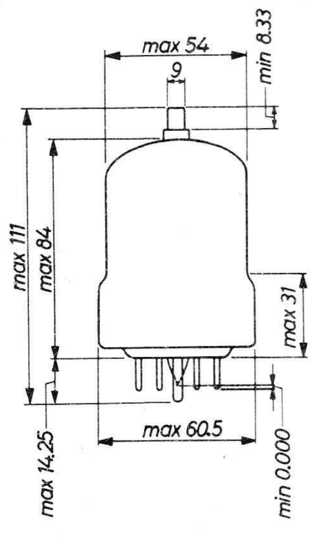
Base : Septar

Socket : 2422 513 00001

Anode connector: 40712

Net weight : 85 g





Mounting position: vertical with base up or down

TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and pin seals = max. 225 $^{\circ}C$

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

<table>
<tr><td>Frequency</td><td>f</td><td></td><td>up to 250</td><td>up to 150</td><td>MHz</td></tr>
<tr><td>Anode voltage</td><td>V_a</td><td>=</td><td>max. 1500</td><td>max. 3000</td><td>V</td></tr>
<tr><td>Anode current</td><td>I_a</td><td>=</td><td colspan="2">max. 150</td><td>mA</td></tr>
<tr><td>Anode input power</td><td>W_{ia}</td><td>=</td><td colspan="2">max. 450</td><td>W</td></tr>
<tr><td>Anode dissipation</td><td>W_a</td><td>=</td><td colspan="2">max. 65</td><td>W</td></tr>
<tr><td>Grid No.2 voltage</td><td>V_{g_2}</td><td>=</td><td colspan="2">max. 400</td><td>V</td></tr>
<tr><td>Grid No.2 dissipation</td><td>W_{g_2}</td><td>=</td><td colspan="2">max. 10</td><td>W</td></tr>
<tr><td>Negative grid No.1 voltage</td><td>$-V_{g_1}$</td><td>=</td><td colspan="2">max. 500</td><td>V</td></tr>
<tr><td>Grid No.1 current</td><td>I_{g_1}</td><td>=</td><td colspan="2">max. 30</td><td>mA</td></tr>
<tr><td>Grid No.1 dissipation</td><td>W_{g_1}</td><td>=</td><td colspan="2">max. 5</td><td>W</td></tr>
</table>

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_{g1p}	=	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_{g2}	= max.	10	W
Grid No.1 circuit resistance	R_{g1}	= 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_{g2}	=	-	22.5	-	26	-	13.5	W
Grid No.1 input power	W_{ig1}	=	-	1.3	-	3.8	-	2.3	W
Anode input power	W_{ia}	=	42.5	175	44	160	45	135	W
Anode dissipation	W_a	=	42.5	60	44	60	45	60	W
Output power 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_{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 current	I_{g_1}	=	max.	20	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	250	kΩ

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

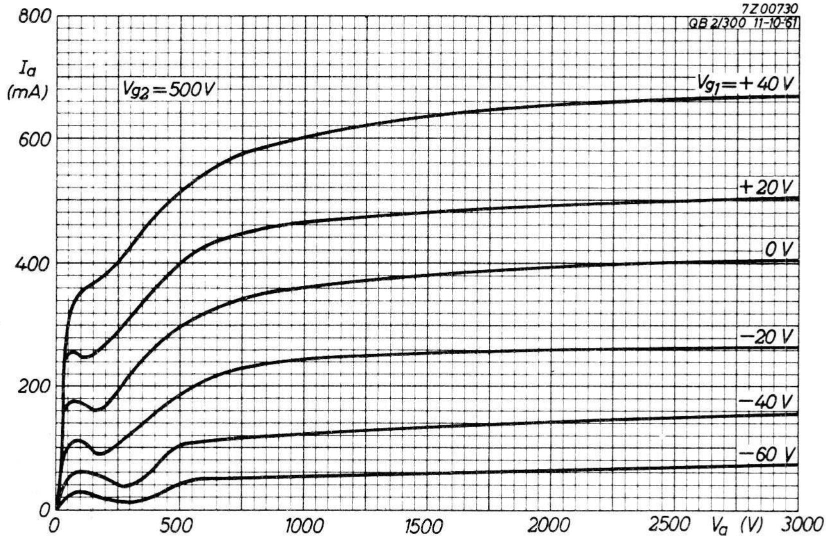
V_a	=	1750		1500		1000		V
V_{g_2}	=	500		500		500		V
V_{g_1}	=	-115		-110		-100		V
$R_{aa\sim}$	=	20		15		9		kΩ
$V_{g_1g_1p}$	=	0	180	0	170	0	170	V
I_a	=	2x20	2x85	2x30	2x90	2x30	2x85	mA
I_{g_2}	=	-	2x11.5	-	2x10	-	2x15	mA
W_{g_2}	=	-	2x6	-	2x5	-	2x7.5	W
W_{ia}	=	2x35	2x150	2x45	2x135	2x30	2x85	W
W_a	=	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	%

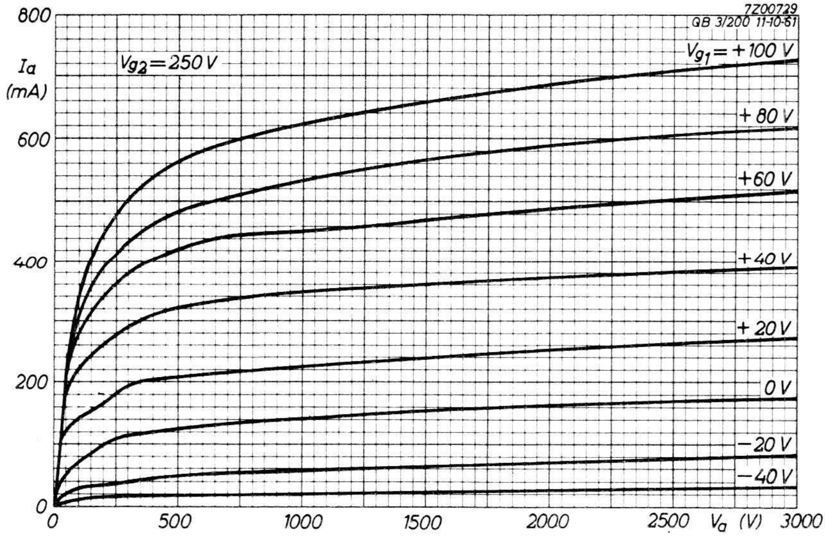
A.F. CLASS B AMPLIFIER AND MODULATOR (continued)

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	%


7Z00730
QB 2/300 11-10-61
800
600
400
200
0
Ia
(mA)
Vg2 = 500 V
Vg1 = +40 V
+20 V
0 V
−20 V
−40 V
−60 V
0
500
1000
1500
2000
2500
Va (V)
3000


7Z00729
QB 3/200 11-10-61
800
600
400
200
0
Ia
(mA)
Vg2 = 250 V
Vg1 = +100 V
+80 V
+60 V
+40 V
+20 V
0 V
−20 V
−40 V
0
500
1000
1500
2000
2500
Va (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 max. rating system)

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

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 its 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 that both screen-grid socket connections be included in the circuit.

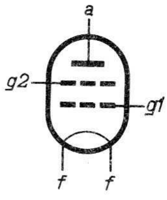
MECHANICAL DATA Dimensions in mm

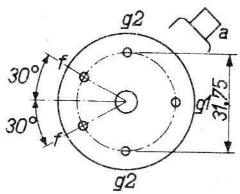
Mounting position : vertical with base up or down

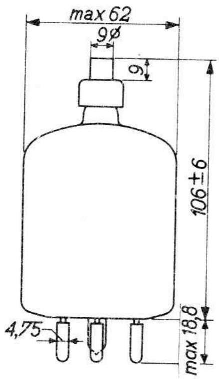
Net mass : 130 g

Base : Giant 5-pin

Accessories : Socket code 2422 512 01001 ; Anode connector type 40712







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_{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	<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. $I_{g_1} > 0$

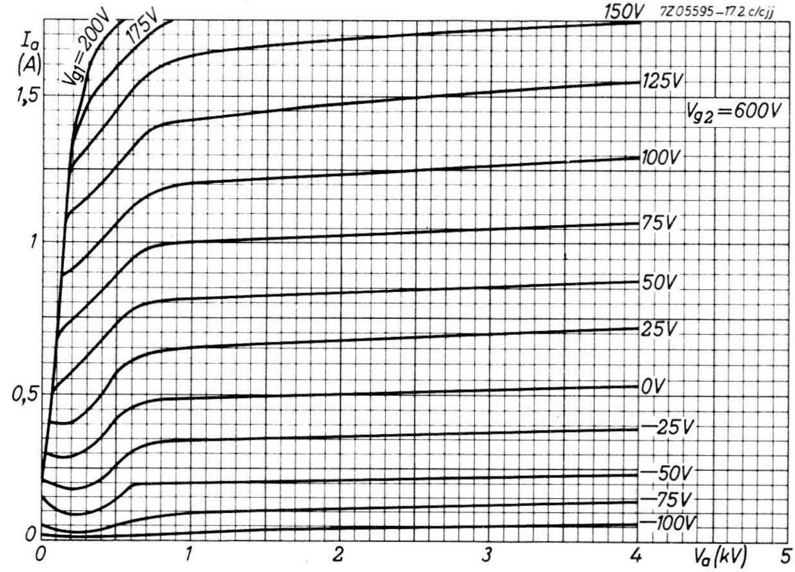
LIMITING VALUES (Absolute limits)

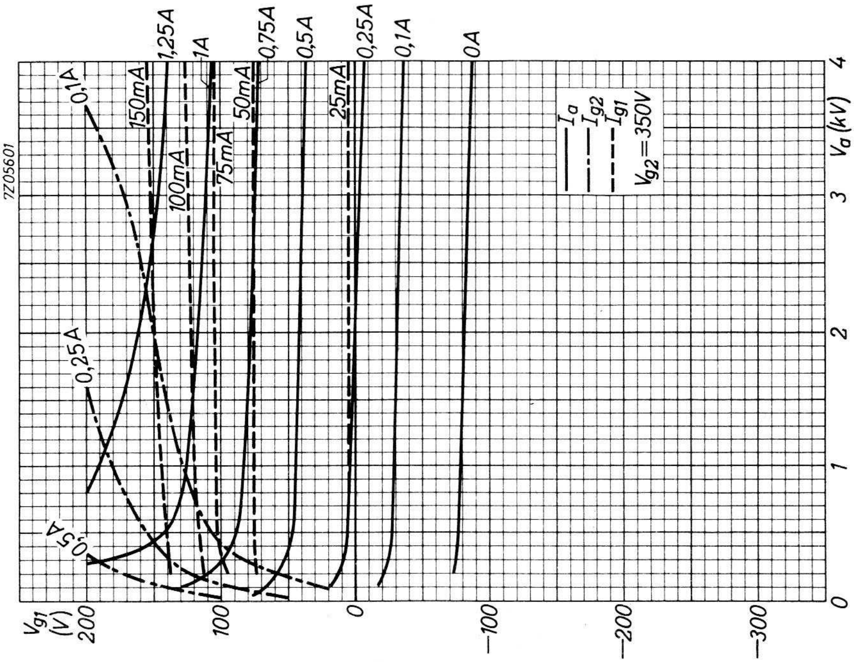
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	225	mA
Anode dissipation	W_a	=	max.	125	W[1])
Grid No.2 voltage	V_{g_2}	=	max.	400	V
Grid No.2 dissipation	W_{g_2}	=	max.	20	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V

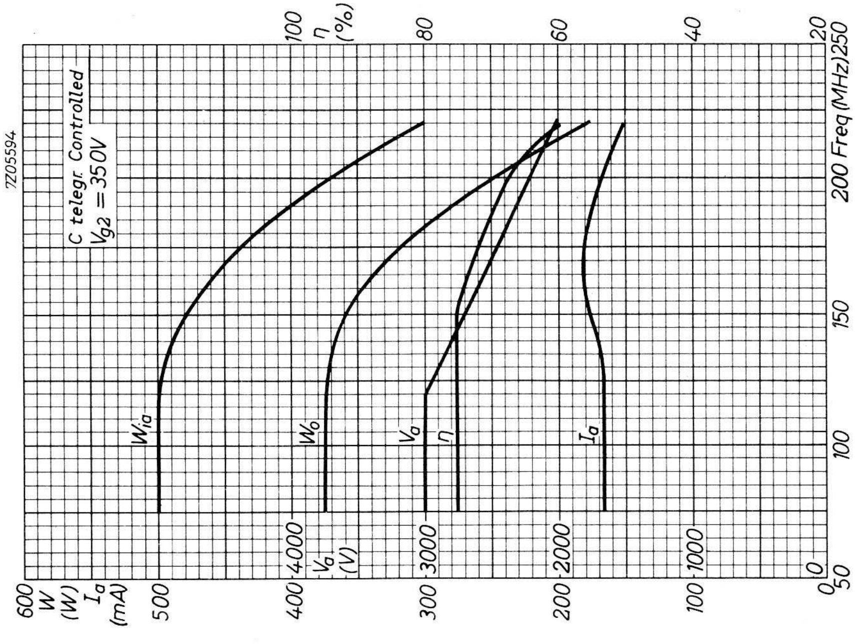
OPERATING CONDITIONS , two tubes

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
5
V_a(kV)


7Z05601
0,1A
150mA
1,25A
1A
75mA
50mA
0,75A
0,5A
25mA
0,25A
0,1A
0A
100mA
0,25A
0,5A
Ia
Ig2
Ig1
Vg2 = 350V
Va (kV)
Vg1 (V)


7Z05594
C telegr. Controlled
Vg2 = 350V
Wia
Wo
Va
η
Ia
η (%)
Va (V)
W (W)
Ia (mA)
Freq (MHz)

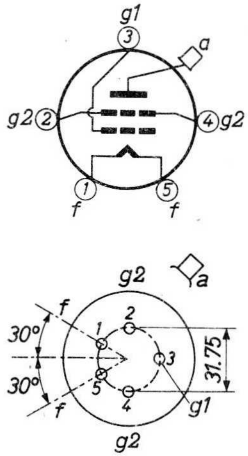
R.F. POWER TETRODE

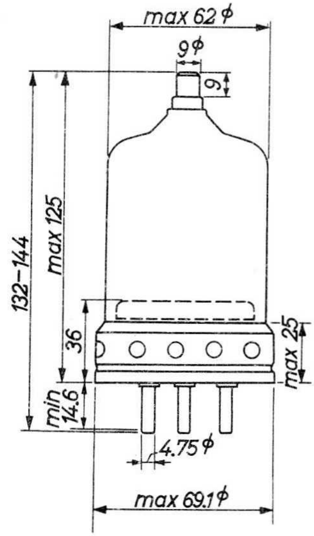
MECHANICAL DATA

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	$S (I_a = 100\ mA)$	=	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

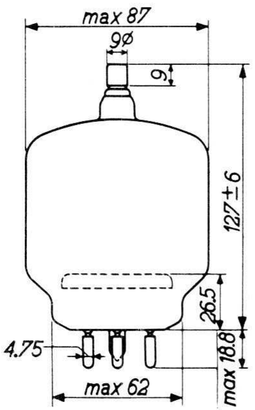
In order to keep the temperatures below the maximum permitted values a low-velocity air flow has to be directed to the anode seal and the bottom of the envelope

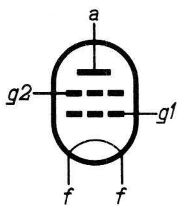
In order to prevent overheating of the screen-grid pins by high-frequency current it is recommended to include both screen-grid socket connections in the circuit

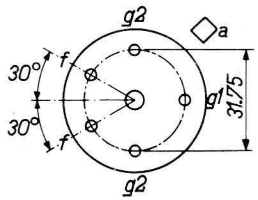
MECHANICAL DATA

Dimensions in mm

Base	:	Giant 5p
Socket	:	2422 512 01001
Anode connector	:	40712
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_{g2}	=		max. 600		V
Grid No.2 dissipation	W_{g2}	=		max. 35		W
Negative grid No.1 voltage	$-V_{g1}$	=		max. 500		V
Grid No.1 current	I_{g1}	=		max. 20		mA

OPERATING CONDITIONS

Frequency	f	=	75	75	75	MHz
Anode voltage	V_a	=	4000	3000	2500	V
Grid No.2 voltage	V_{g2}	=	500	500	500	V
Grid No.1 voltage	V_{g1}	=	−225	−180	−150	V
Anode current	I_a	=	312	345	300	mA
Grid No.2 current	I_{g2}	=	45	60	60	mA
Grid No.1 current	I_{g1}	=	9	10	9	mA
Peak grid No.1 A.C. voltage	V_{g1p}	=	303	265	220	V
Grid No.1 input power	W_{ig1}	=	2.5	2.4	1.8	W
Grid No.2 dissipation	W_{g2}	=	22.5	30	30	W
Anode input power	W_{ia}	=	1248	1035	750	W
Anode dissipation	W_a	=	248	235	175	W
Output power	W_o	=	1000	800	575	W
Efficiency	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_{g2}	=	max. 600		V
Grid No.2 dissipation	W_{g2}	=	max. 23		W

OPERATING CONDITIONS

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

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_{g2}	=	max.	600	V
Grid No.2 dissipation	W_{g2}	=	max.	35	W
Grid No.1 circuit resistance	R_{g1}	=	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_{g1} =	-105		-110		-105		-98		-94		-91		V
V_{g2} =	550		600		500		500		500		500		V
V_{g1p} =	0	105	0	110	0	105	0	98	0	94	0	91	V
I_a =	50	182	50	207	50	164	50	164	50	164	50	164	mA
I_{g1} =	0	0	0	0	0	0	0	0	0	0	0	0	mA
I_{g2} =	0	9	0	12	0	8	0	9	0	10	0	10.5	mA
W_{ig1} =	0	0	0	0	0	0	0	0	0	0	0	0	W
W_{g2} =	0	5	0	7.2	0	4	0	4.5	0	5	0	5.3	W
W_{ia} =	200	730	175	725	200	660	175	575	150	490	125	410	W
W_a =	200	220	175	235	200	200	175	175	150	157	125	140	W
W_o =	-	510	-	490	-	460	-	400	-	333	-	270	W
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

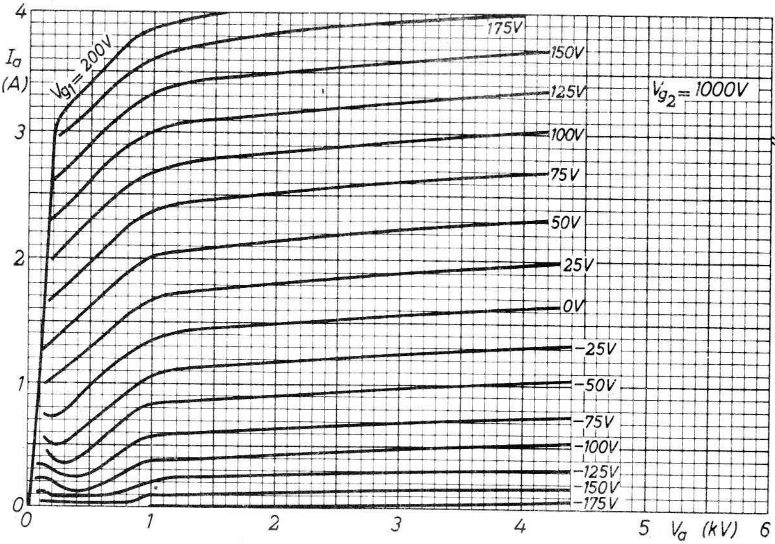
A.F. CLASS B AMPLIFIER OR MODULATOR

LIMITING VALUES. See page 7.

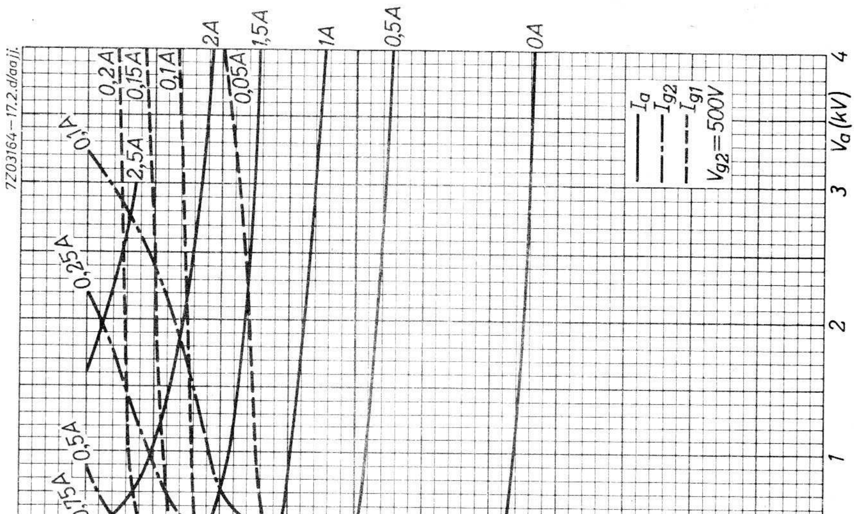
OPERATING CONDITIONS, two tubes. $I_{g_1} = 0$

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	%

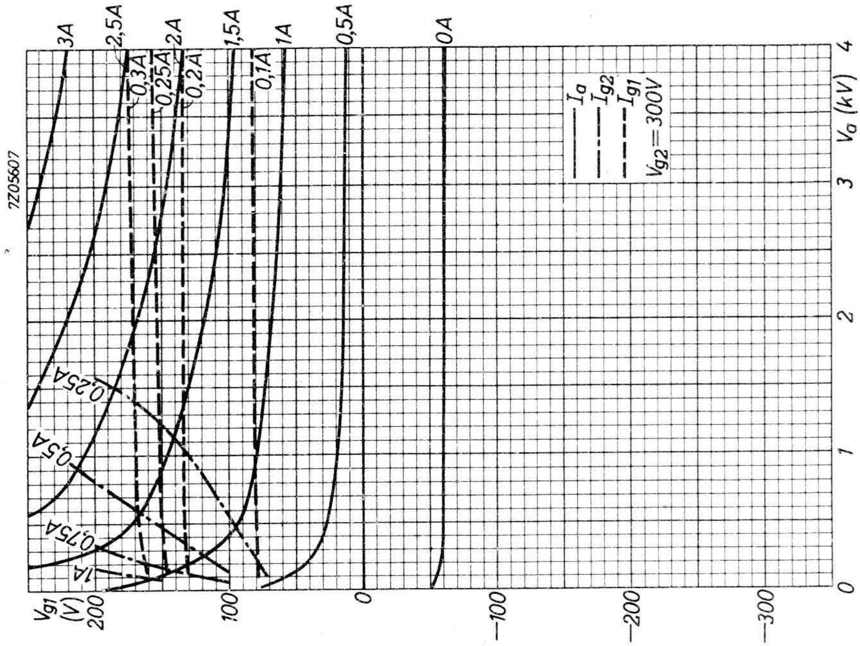
7Z2 2786

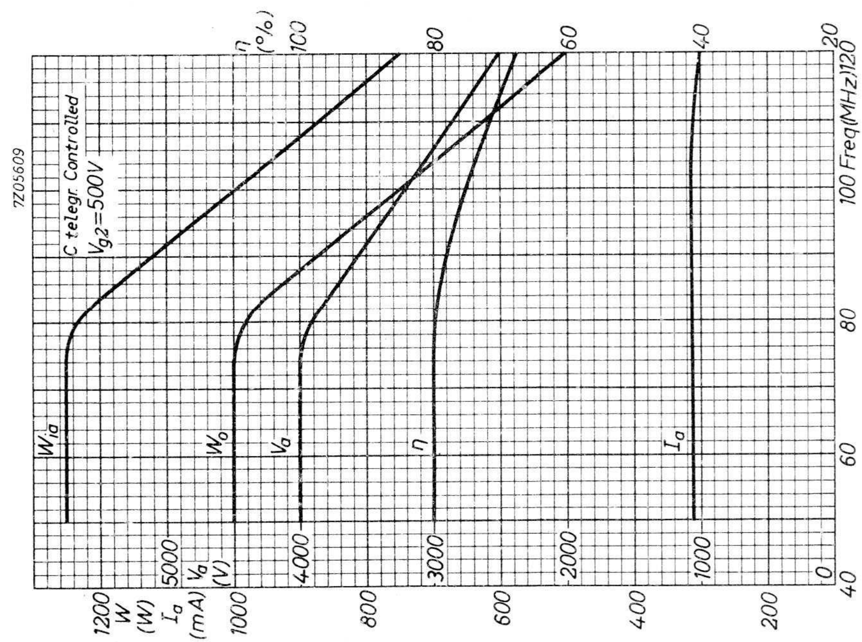


7Z03163-17.2.d/aa jj.
I_a (A)
V_{g_1} = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
V_{g_2} = 1000V
0 1 2 3 4 5 6
V_a (kV)



7Z03164-17.2.d/aa jj.
2A
1,5A
1A
0,5A
0A
0,2A
0,15A
0,1A
0,05A
0,1A
2,5A
0,25A
0,5A
0,75A
1A
I_a
I_{g2}
I_{g1}
V_{g2}=500V
V_a(kV)
V_{g1} (V)
200 100 0 −100 −200 −300


7Z05607
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
I_a
I_{g2}
I_{g1}
V_{g2}=300V
V_a (kV)
V_{g1} (V)

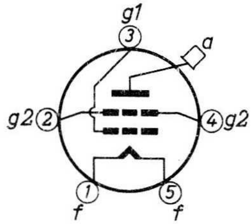

7Z05609
C telegr. Controlled
V_{g2}=500V
W_{ia}
W_o
V_a
η
I_a
η (%)
W (W)
I_a (mA)
V_a (V)
Freq(MHz)

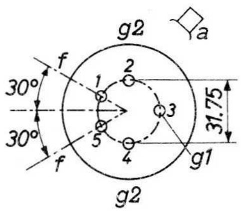
R.F. POWER TETRODE

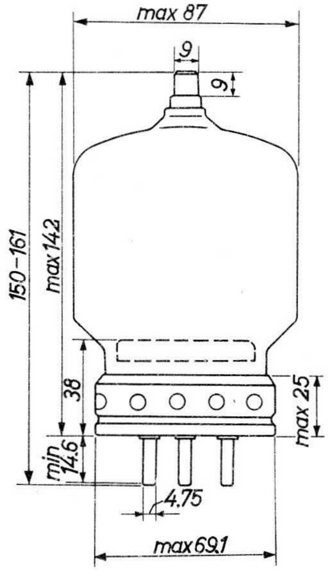
MECHANICAL DATA Dimensions in mm

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.		C_{ag_2} mod.		B S.S.B.		B A.F.		
	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] $I_{g_1} > 0$	W_o(W) [2] $I_{g_1} = 0$
30			3650	765 [1]			4000	1750	1540
75	4000	1100	3000	630			3500	1650	1330
	3000	800	2500	510			3000	1375	1110
	2500	640	2000	380			2500	1110	850
100	4000	800							
	3500	650							
110					4000	650			
					3500	600			
					3000	500			

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

MECHANICAL DATA Dimensions in mm

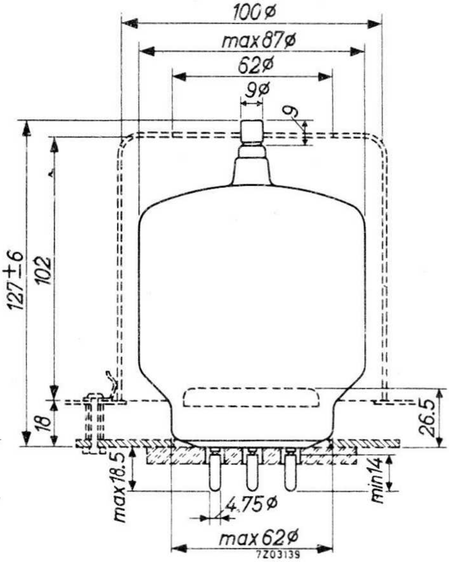
Base : Giant 5p.

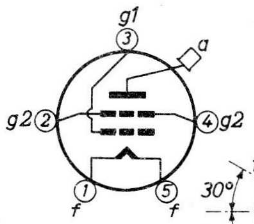
Socket : 2422 512 01001

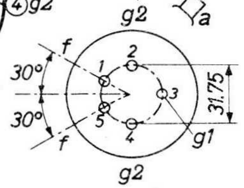
Anode connector: 40712

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

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
			zero signal	single tone signal	double tone signal	
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)

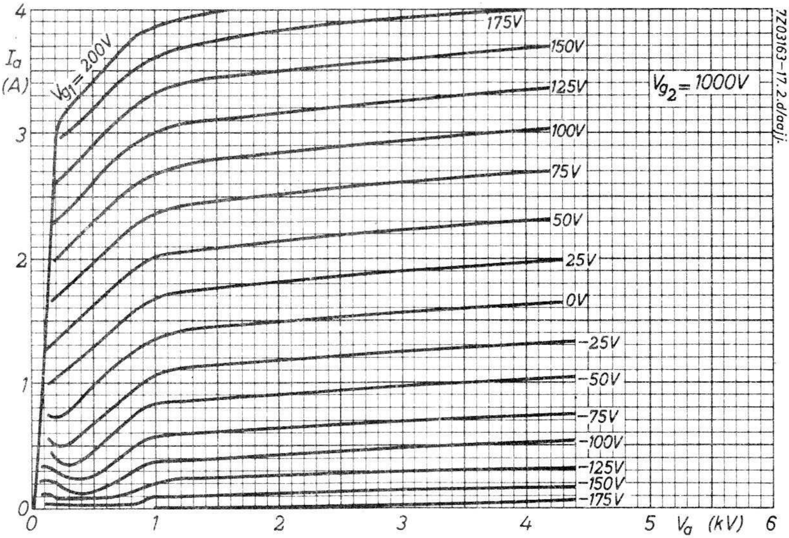
OPERATING CONDITIONS with grid current (two tubes)

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	%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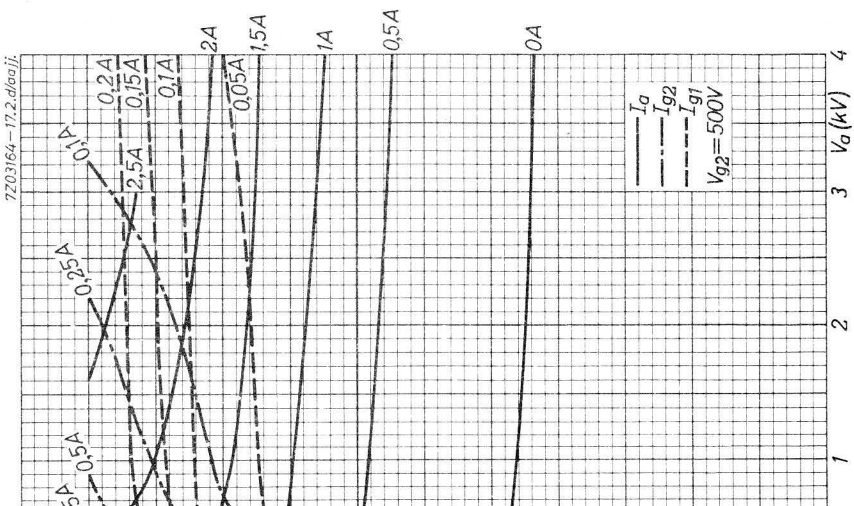
I_a (A)
V_{g1} = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
V_{g2} = 1000V
V_a (kV)


7Z03164-17.2.d/aajj.
I_a
I_{g2}
I_{g1}
V_{g2} = 500V
V_a (kV)
V_{g1} (V)
0A
0,5A
1A
1,5A
2A
2,5A
0,05A
0,1A
0,15A
0,2A
0,25A
0,5A
0,75A
1A

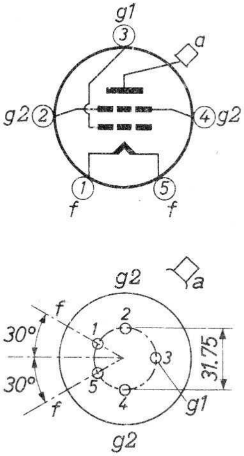
R.F. POWER TETRODE

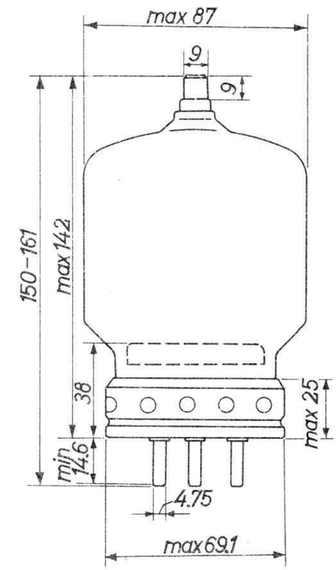
MECHANICAL DATA

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

MECHANICAL DATA

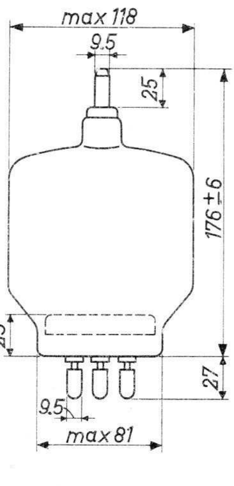
Base : Super giant

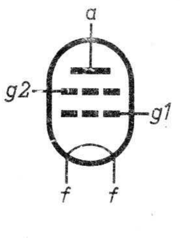
Socket : 2422 512 00001

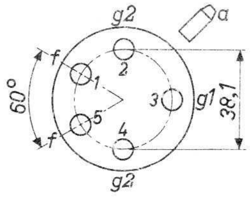
Anode connector: 40626

Net weight : 375 g

Dimensions in mm







Mounting position: vertical with base up or down

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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	$\leq$	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	$V_{g_1 p}$	=	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	$\leqq$	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	$V_{g_1 p}$	=	350	V
Anode current	I_a	=	200	mA
Grid No.2 current	I_{g_2}	=	32	mA
Grid No.1 current	I_{g_1}	=	11	mA
Grid No.1 input power	W_{ig_1}	=	3.5	W
Anode input power	W_{ia}	=	1060	W
Anode dissipation	W_a	=	310	W
Grid No.2 dissipation	W_{g_2}	=	24	W
Output power	W_o	=	750	W
Efficiency	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	$\leq$	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

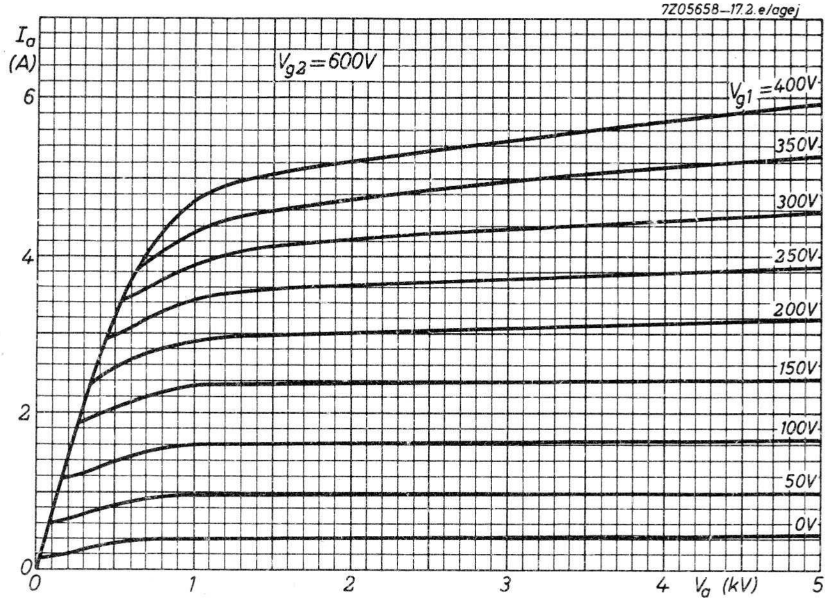
LIMITING VALUES (Absolute limits)

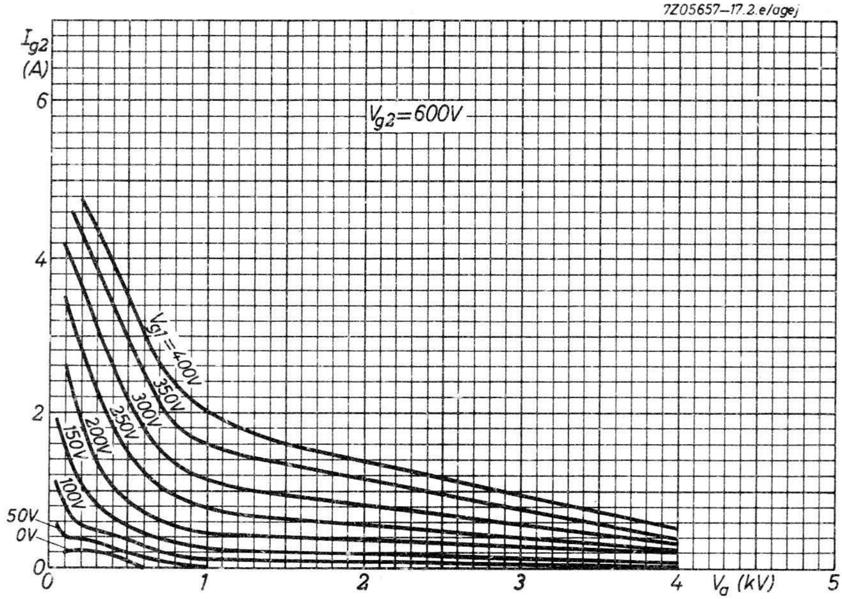
Anode voltage	V_a	=	max.	5000	V
Anode input power	W_{ia}	=	max.	2250	W
Anode dissipation	W_a	=	max.	500	W
Anode current	I_a	=	max.	450	mA
Grid No.2 voltage	V_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	65	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 current	I_{g_1}	=	max.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

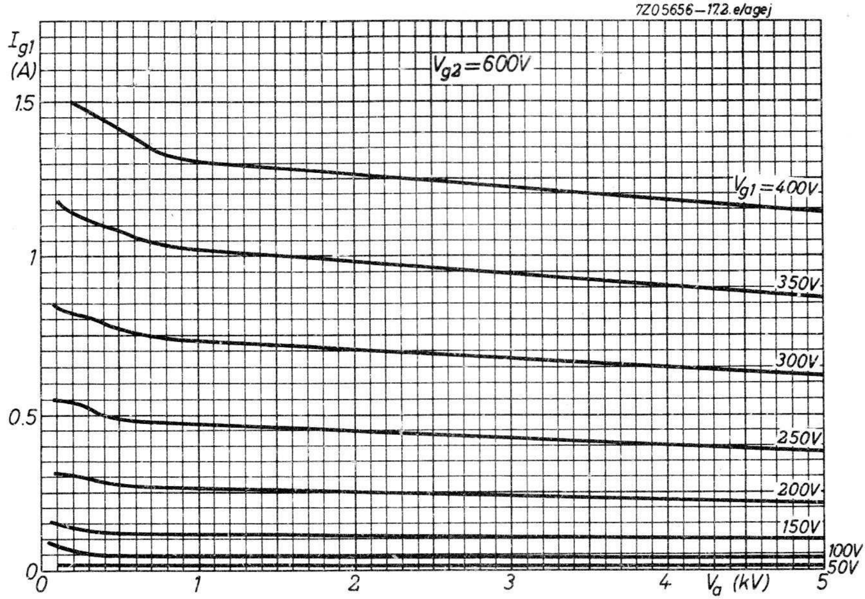
OPERATING CONDITIONS, two tubes

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	%

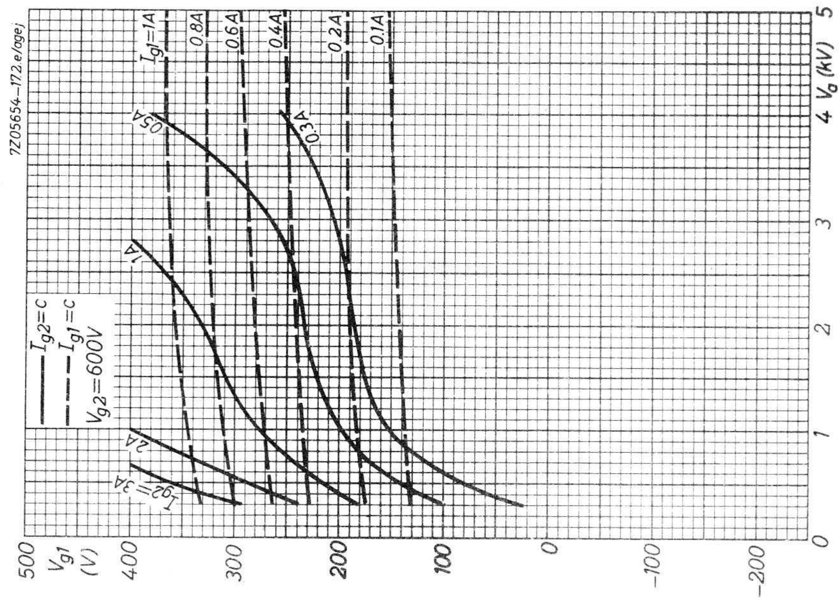
7Z2 2845

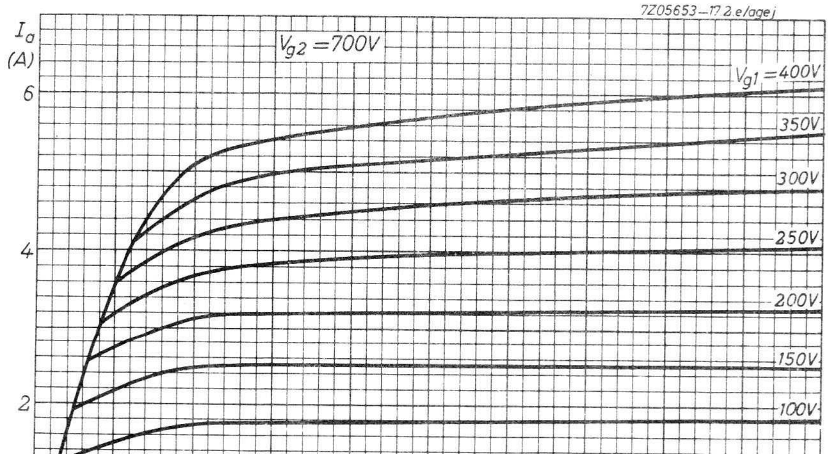

7Z05658–17.2.e/agej
I_a (A)
V_{g2}=600V
V_{g1}=400V
350V
300V
250V
200V
150V
100V
50V
0V
0
2
4
6
0
1
2
3
4
5
V_a (kV)

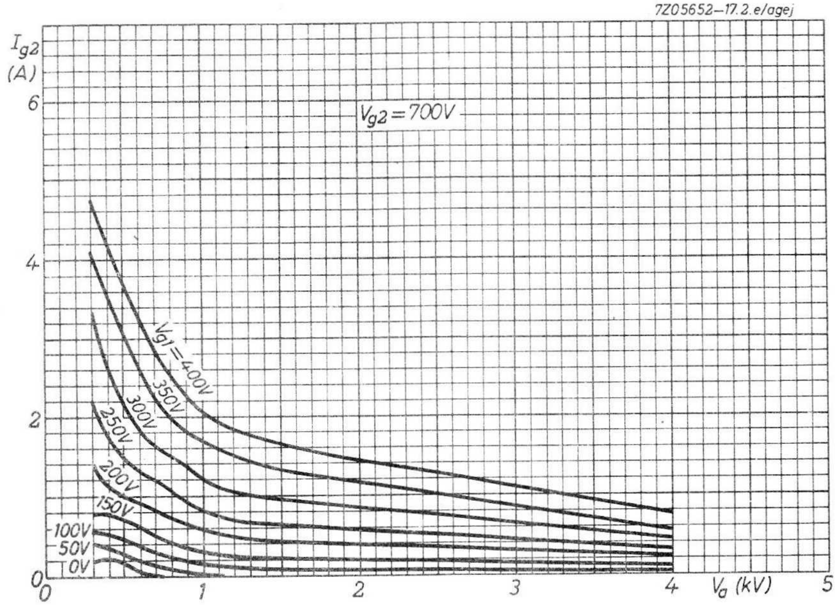

7Z05657–17.2.e/agej
I_{g2} (A)
V_{g2}=600V
V_{g1}=400V
350V
300V
250V
200V
150V
100V
50V
0V
0
2
4
6
0
1
2
3
4
5
V_a (kV)

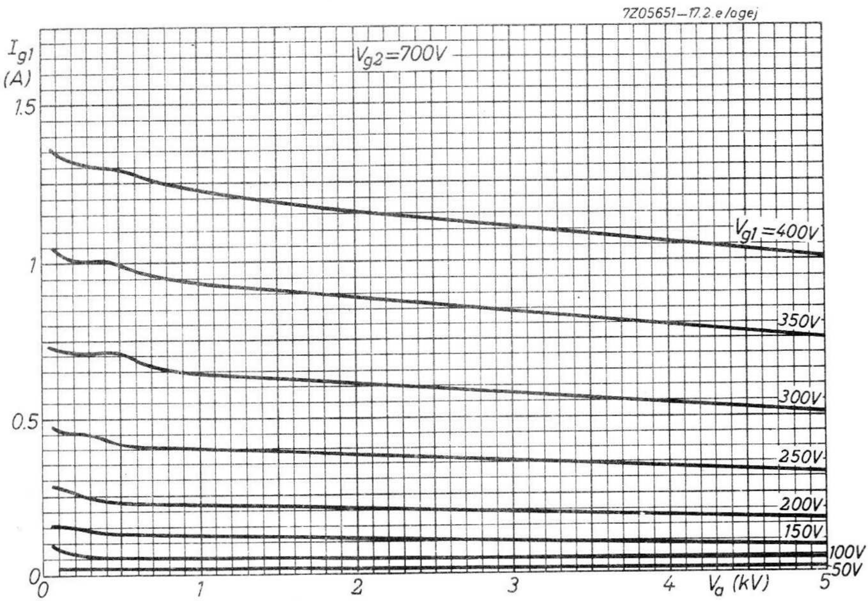

7Z05656-17.2.e/agej
I_{g1} (A)
V_{g2}=600V
1.5
1
0.5
0
V_{g1}=400V
350V
300V
250V
200V
150V
100V
50V
0
1
2
3
4
V_a (kV)
5

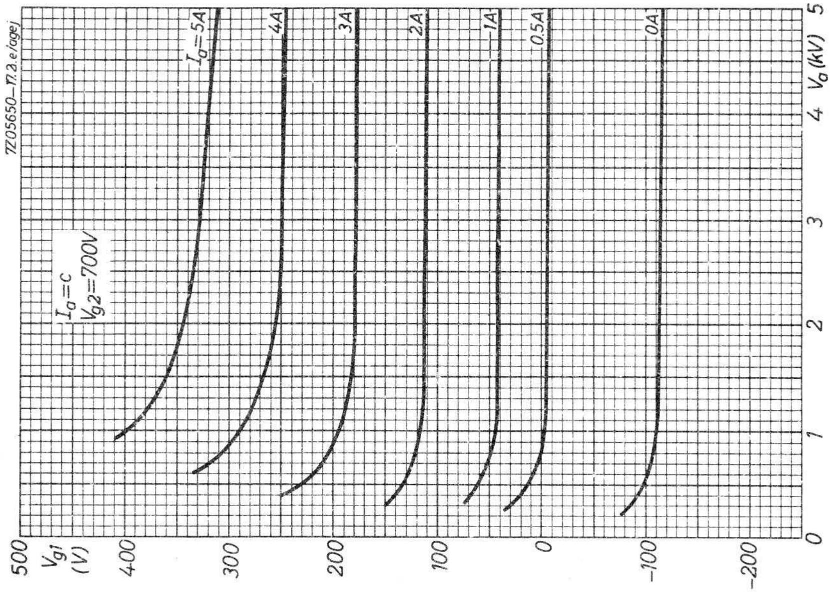

7Z05655-17.2.e/agej
I_a=5A
4A
3A
2A
1A
0.5A
0A
I_a=c
V_{g2}=600V
V_{g1} (V)
500
400
300
200
100
0
−100
−200
0
1
2
3
4 V_a (kV)
5

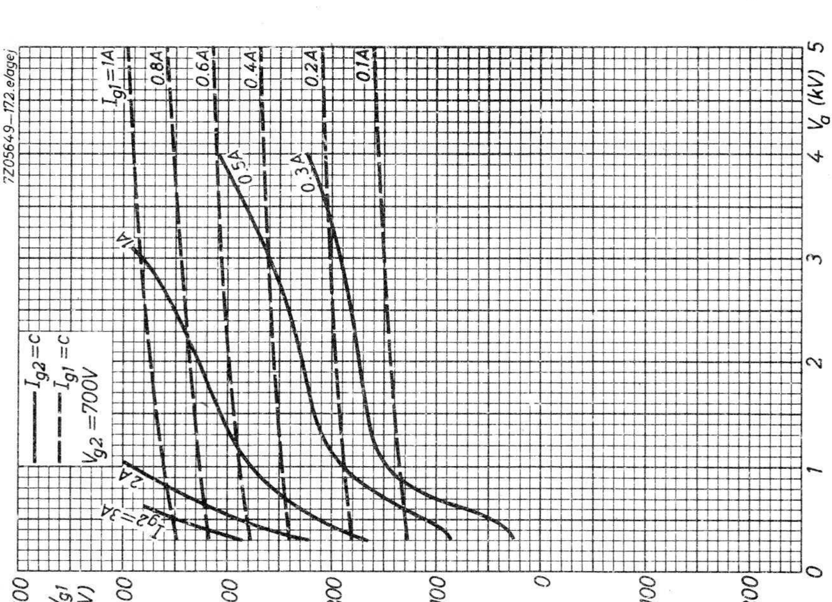

7Z05654-17.2.e/agej
I_{g1}=1A
0.8A
0.6A
0.4A
0.2A
0.1A
0.5A
0.3A
1A
2A
I_{g2}=3A
I_{g2}=c
I_{g1}=c
V_{g2}=600V
V_a (kV)
V_{g1} (V)

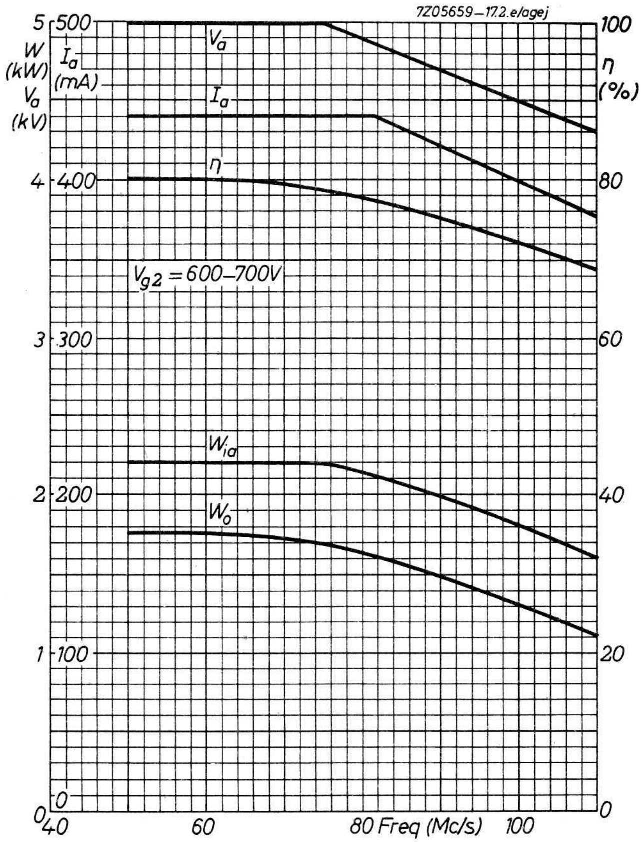

7Z05653-17.2.e/agej
I_a (A)
V_{g2} =700V
V_{g1}=400V
350V
300V
250V
200V
150V
100V
50V
0V
V_a (kV)


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)
500
400
300
200
100
0
-100
-200
0
1
2
3
4
5
V_a (kV)


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
0.5A
0.3A
1A
2A
I_{g2}=3A
V_{g1} (V)
500
400
300
200
100
0
-100
-200
0
1
2
3
4
5
V_a (kV)


7Z05659—17.2.e/agej
5
500
W
(kW)
V_a
(kV)
I_a
(mA)
4
400
3
300
2
200
1
100
0
0
40
60
80 Freq (Mc/s)
100
100
η
(%)
80
60
40
20
0
V_a
I_a
η
$V_{g2} = 600\text{–}700V$
W_{ia}
W_o

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

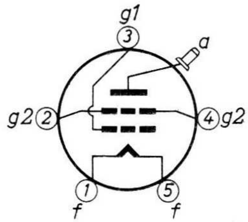
Anode voltage	V_a	=	4000	V
Grid No.2 voltage	V_{g_2}	=	600	V
Anode current	I_a	=	200	mA
Mutual conductance	S	=	10	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.1	

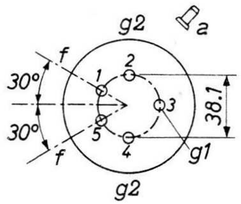
COOLING: radiation and convection; low velocity air flow

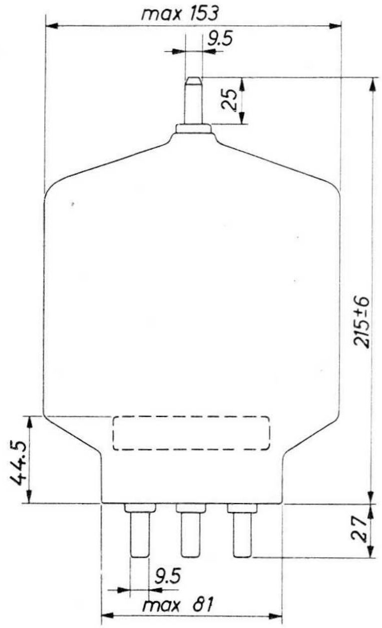
TEMPERATURE LIMITS (Absolute limits)

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_{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 current	I_{g_1}	=	max.	35	mA

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V_a	=	5	kV
Grid No.2 voltage	V_{g_2}	=	600	V
Grid No.1 voltage	V_{g_1}	=	-240	V
Anode current	I_a	=	600	mA
Grid No.2 current	I_{g_2}	=	185	mA
Grid No.1 current	I_{g_1}	=	20	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	300	V
Driving power	W_{dr}	=	10	W
Anode input power	W_{ia}	=	3000	W
Grid No.2 dissipation	W_{g_2}	=	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 $V_{g_{1p}}$ = 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)

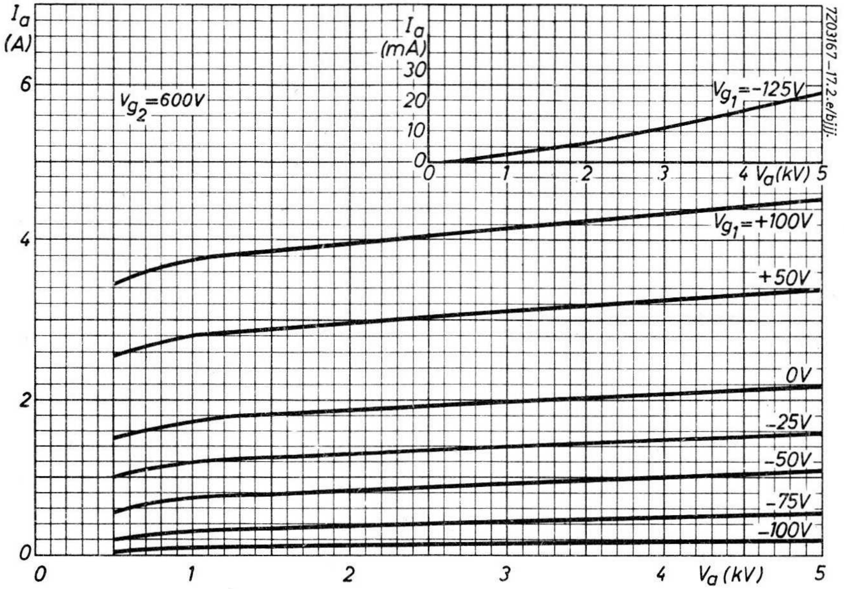
Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	5.5	kV
Anode dissipation	W_a	= max.	800	W
Anode input power	W_{ia}	= max.	2.5	kW
Anode current	I_a	= max.	600	mA
Grid No.2 voltage	V_{g_2}	= max.	800	V
Grid No.2 dissipation	W_{g_2}	= max.	120	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	500	V
Grid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

OPERATING CONDITIONS

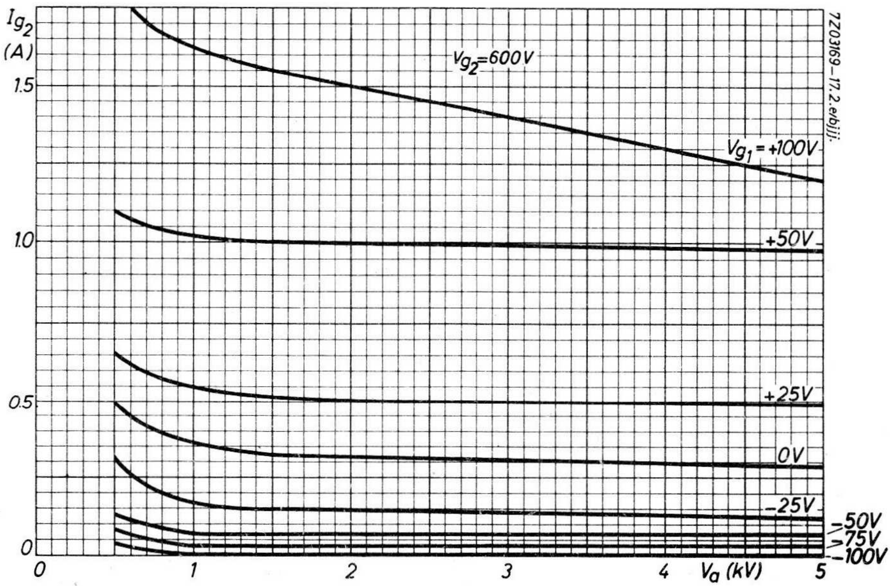
Frequency	f	=		30		MHz
Anode voltage	V_a	=		4		kV
Grid No.2 voltage	V_{g_2}	=		600		V
Grid No .1 voltage	V_{g_1}	=		−105		V 1)
			zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	V_{g1p}	=	0	100	100	V
Anode current	I_a	=	150	465	330	mA
Grid No.2 current	I_{g_2}	=	8	85	40	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

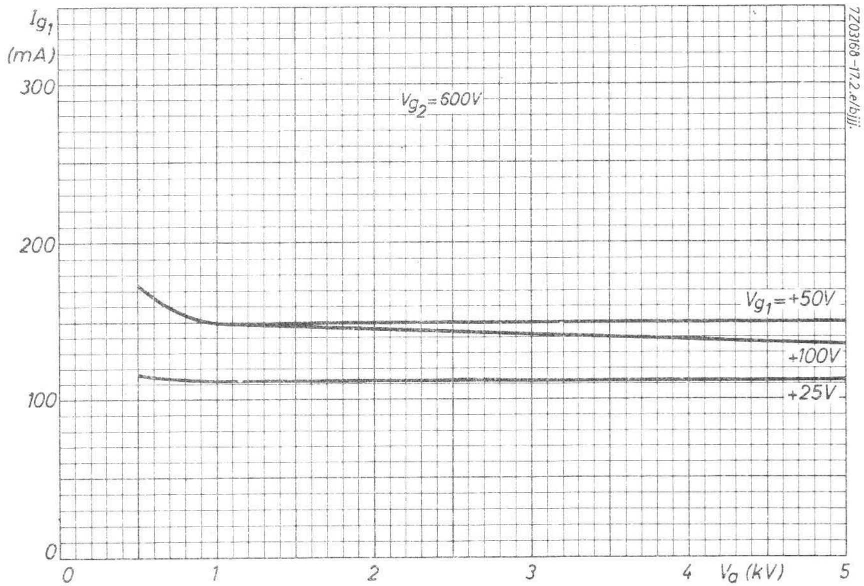
7Z2 2901

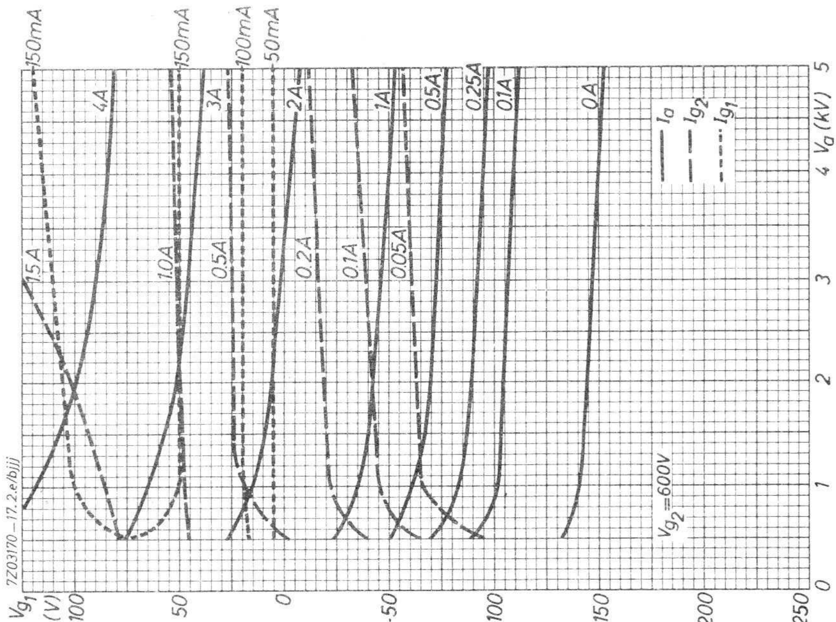


I_a (A)
6
4
2
0
V_{g_2}=600V
I_a (mA)
30
20
10
0
0 1 2 3 4 V_a(kV) 5
V_{g_1}=-125V
V_{g_1}=+100V
+50V
0V
-25V
-50V
-75V
-100V
0 1 2 3 4 V_a (kV) 5
7Z03167-17.2.e/b/jj.



I_{g_2} (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 V_a (kV) 5
7Z03169-17.2.e/b/jj.


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


150mA
4A
150mA
3A
100mA
50mA
2A
1A
0.5A
0.25A
0.1A
0A
I_a
I_{g_2}
I_{g_1}
1.5A
1.0A
0.5A
0.2A
0.1A
0.05A
V_{g_2}=600V
7Z03170-17.2.e/bjj
V_{g_1} (V)
100
50
0
-50
-100
-150
-200
-250
V_a (kV)
0
1
2
3
4
5

COAXIAL U.H.F. POWER TETRODE

Forced-air cooled coaxial power tetrode in metal-ceramic construction with integral radiator, intended for use as U.H.F. amplifier or oscillator at frequencies up to 1000 MHz. The coaxial arrangement of the terminals enables the tube to be used as plug-in tube in coaxial circuits.

QUICK REFERENCE DATA

Freq. (MHz)	Class C telegraphy		Class A linear amplifier	
	V_{a-g1} (kV)	W_ℓ (W)	V_{a-g1} (kV)	W_ℓ (W)
790			2,5	210
800	4,31	2100		

Television service

Freq. (MHz)	Neg. modulation, positive synchronization		
	V_{a-g1} (kV)	W_ℓ sync (W)	W_ℓ black (W)
800	4,32	2200	1300

HEATING : direct; thoriated tungsten filament

Filament voltage	V_f		3,6	V
Filament current	I_f		58	A
Filament starting current	I_f	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.

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	^oC
Anode temperature	= max.	180	^oC

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 (^oC)	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	

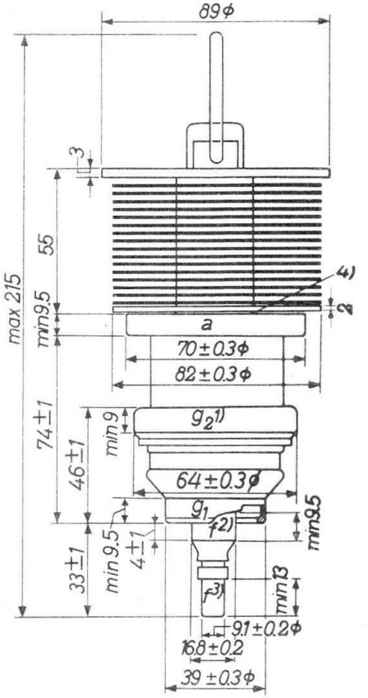
The frequency bandwidth of the driving signal is more than 6 MHz at −1 dB.

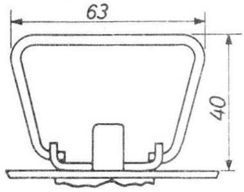
[3]) Peak envelope power. Typical value, measured in a circuit having an efficiency of about 85%.

[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

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

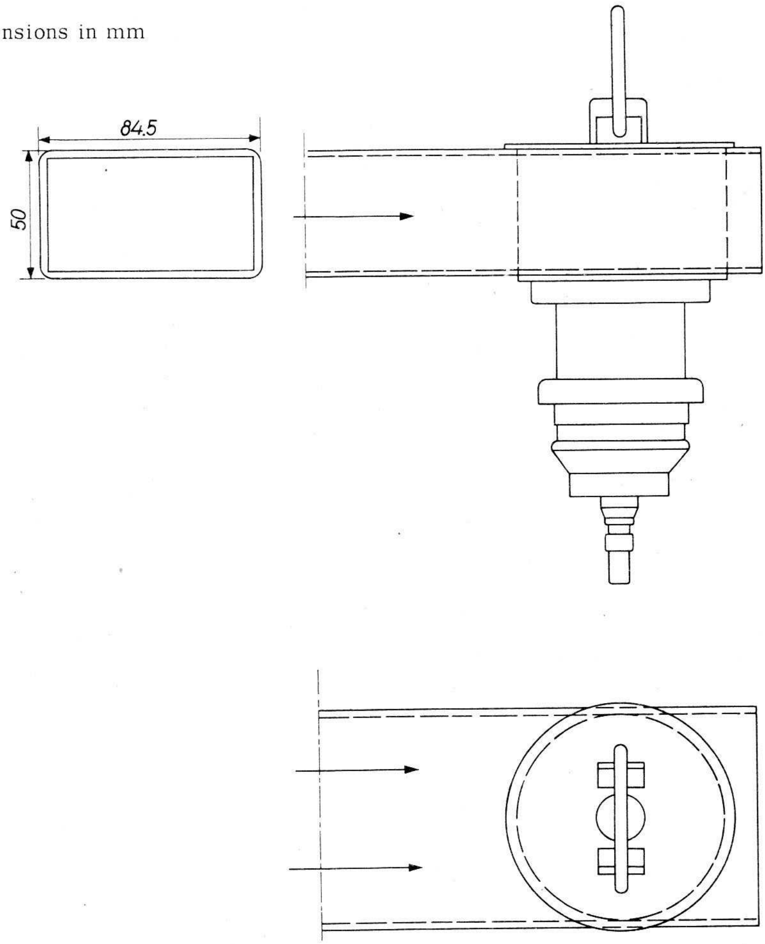
3) Eccentricity with respect to the axis through anode and grid No.1 max. 0.8 mm

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)

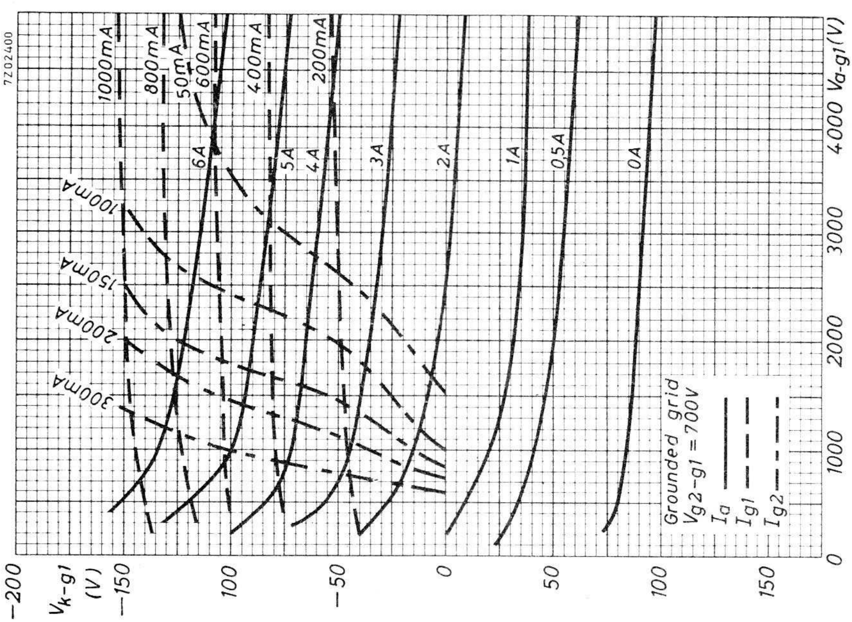
Frequency	f		up to 1000	MHz
Anode voltage	V_{a-g_1}	=	max. 3000	V
Anode dissipation	W_a	=	max. 1500	W
Anode input power	W_{ia}	=	max. 1800	W
Anode current	I_a	=	max. 800	mA
Grid No.2 voltage	$V_{g_2-g_1}$	=	max. 700	V
Grid No.2 dissipation	W_{g_2}	=	max. 50	W
Grid No.2 current	I_{g_2}	=	max. 75	mA
Grid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

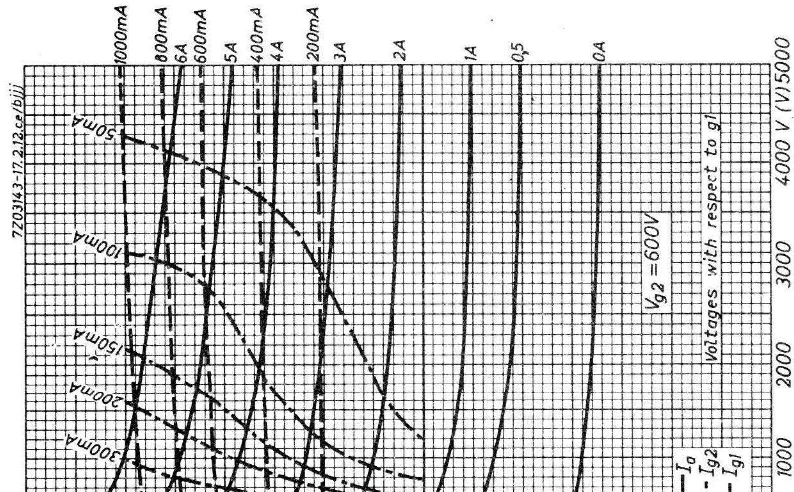
OPERATING CONDITIONS

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


7Z02400
Grounded grid
V_{g2-g1} = 700V
I_a
I_{g1}
I_{g2}
V_{k-g1} (V)
V_{a-g1} (V)
1000mA
800mA
600mA
400mA
200mA
50mA
100mA
150mA
200mA
300mA
6A
5A
4A
3A
2A
1A
0,5A
0A
-200
-150
100
-50
0
50
100
150
0
1000
2000
3000
4000


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

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.	W_o (W) 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	μ_{g2g1}	=	6.2	
Mutual conductance	S (I_a = 200 mA)	=	5.2	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals	= max.	150 °C
Anode temperature	= max.	150 °C

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

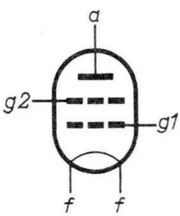
COOLING CHARACTERISTICS

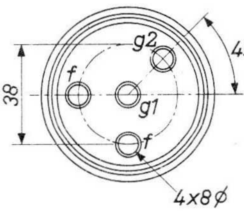
W_a (W)	h (m)	$t_{i\,max.}$ (^oC)	$q_{min.}$ (m^3/min.)	p_i (mm H_2O)
300	0	35	0.50	9.8
	0	45	0.59	12.9
	1500	35	0.60	12.0
	3000	25	0.63	11.5
400	0	35	0.77	17.5
	0	45	0.90	23.0
	1500	35	0.93	21.3
	3000	25	0.97	20.5
500	0	35	1.13	35.5
	0	45	1.32	46.9
	1500	35	1.36	43.3
	3000	25	1.42	41.5

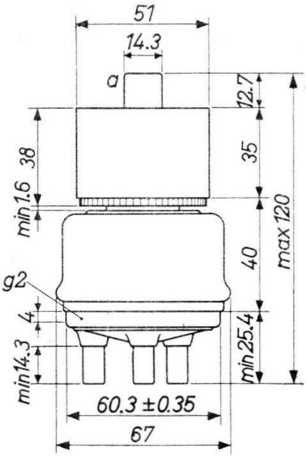
MECHANICAL DATA

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

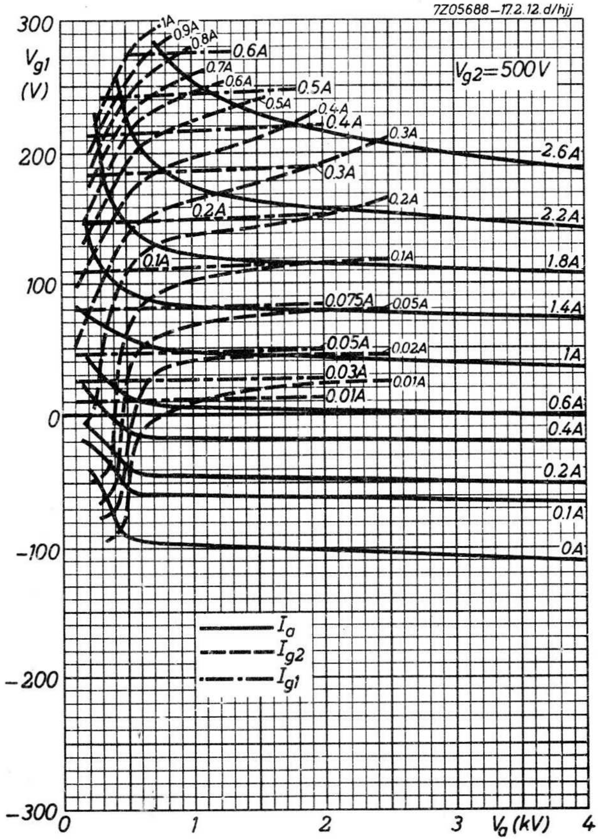
R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE; negative modulation, positive synchronisation.

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)

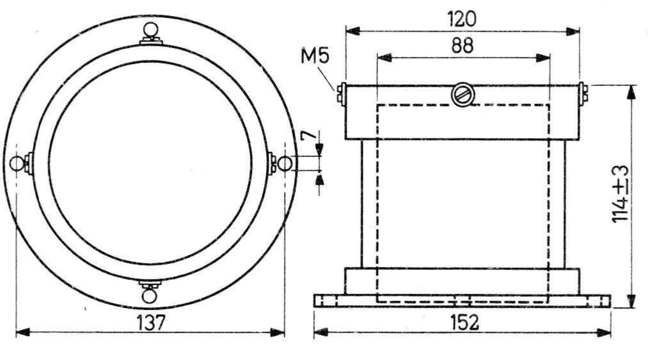
W_a (kW)	h (m)	t_i (°C)	q (m^3/min)	p_i (mmH_2O)
1	0	35	1.8	10
	0	45	2.2	15
	1500	35	2.2	13
	3000	25	2.3	13
2.5	0	35	4.5	60
	0	45	5.4	85
	1500	35	5.4	73
	3000	25	5.8	75
3	0	35	5.7	95

MECHANICAL DATA

Dimensions in mm

Insulating pedestal: 40635

Net weight : 1.6 kg

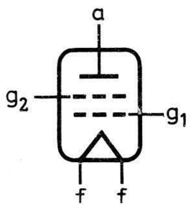


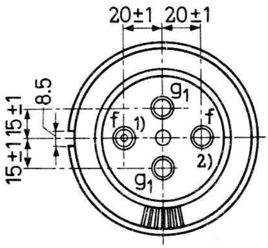
MECHANICAL DATA (continued) Dimensions in mm

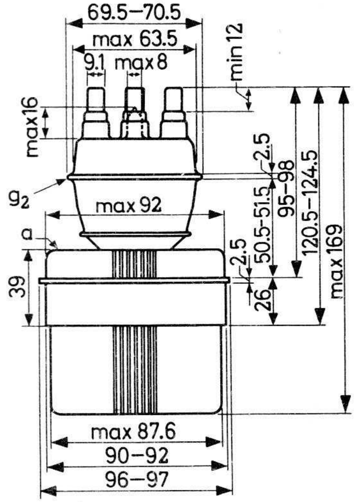
Net weight of the tube : 2.25 kg

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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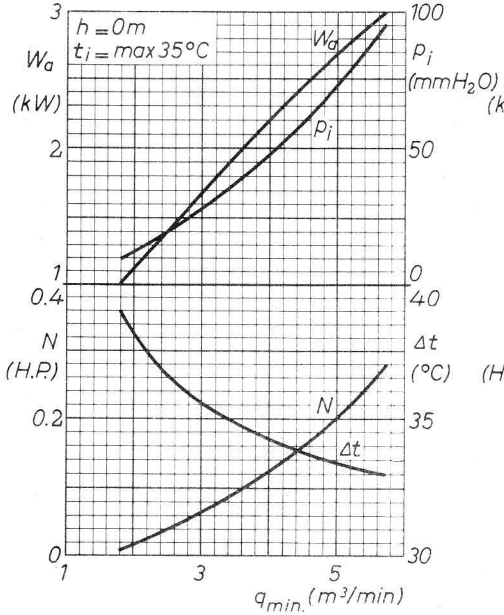
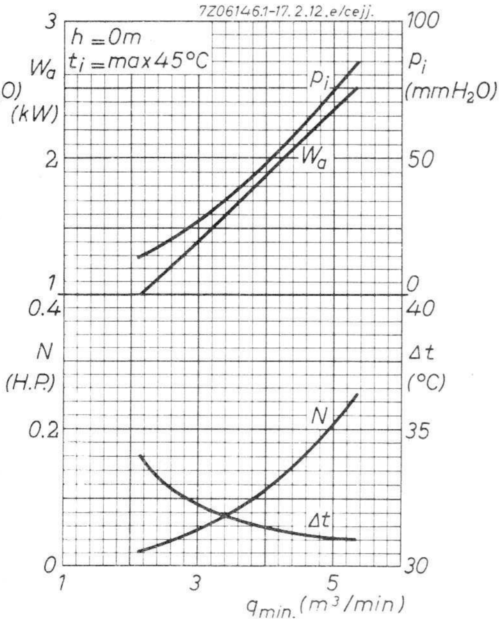
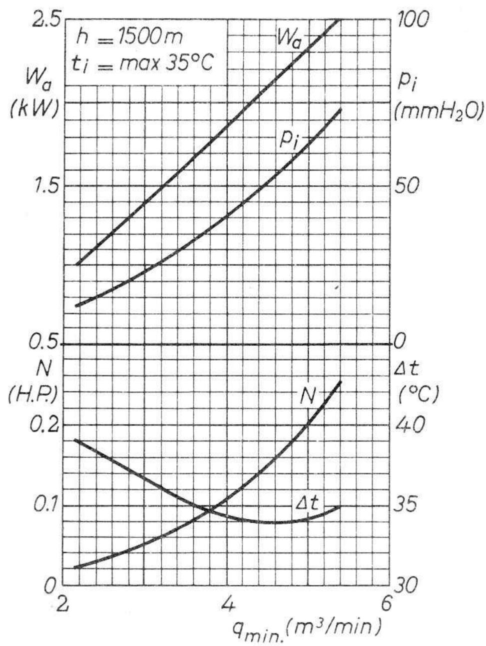
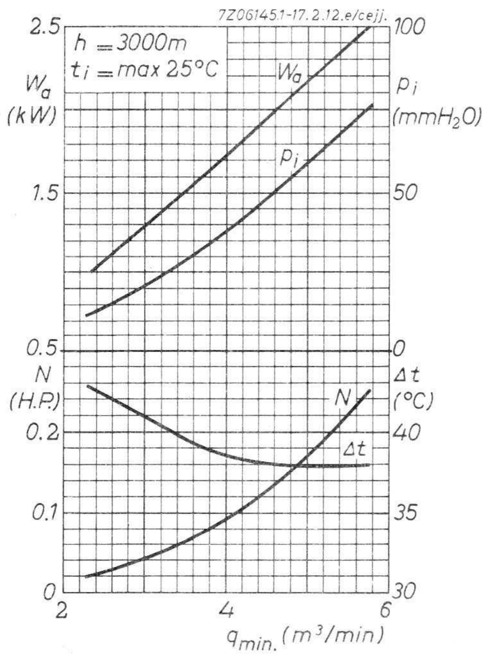
1) This pin is marked "O"

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)
W_a
p_i
N
Δt
$q_{min.}$ (m³/min)
3
2
1
0.4
0.2
0
100
50
0
40
35
30
1
3
5


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)
p_i
W_a
N
Δt
$q_{min.}$ (m³/min)
3
2
1
0.4
0.2
0
100
50
0
40
35
30
1
3
5


h = 1500m
t_i = max 35°C
W_a
(kW)
p_i
(mmH2O)
N
(H.P.)
Δt
(°C)
W_a
p_i
N
Δt
$q_{min.}$ (m³/min)
2.5
1.5
0.5
0.2
0.1
0
100
50
0
40
35
30
2
4
6


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)
W_a
p_i
N
Δt
$q_{min.}$ (m³/min)
2.5
1.5
0.5
0.2
0.1
0
100
50
0
40
35
30
2
4
6

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) 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 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 50	2.5 3.0	0.073 0.1
2	20 50	2.5 4.8	0.073 0.25
3	20 50	3.0 6.9	0.105 0.55

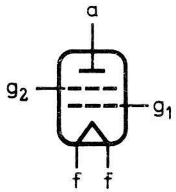
t_i = max. 50 °C

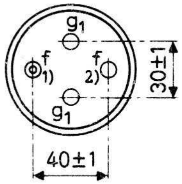
7Z2 8804

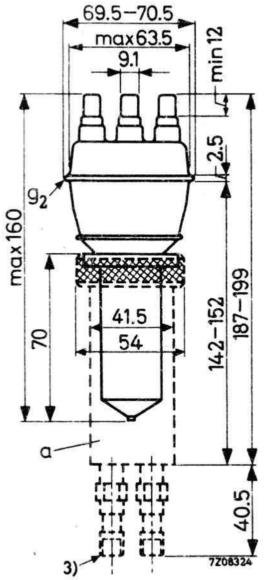
MECHANICAL DATA Dimensions in mm

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	$V_{g_1g_{1p}}$		=	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_{g_2}		=	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.

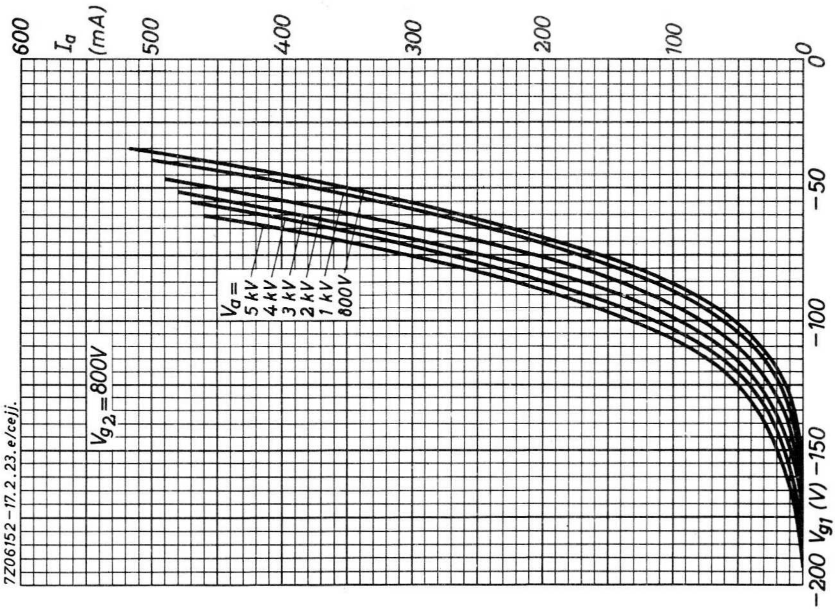
2) This value of bandwidth is based on measurements on a circuit with a single L.C. section.

3) Measured by the slide back method.

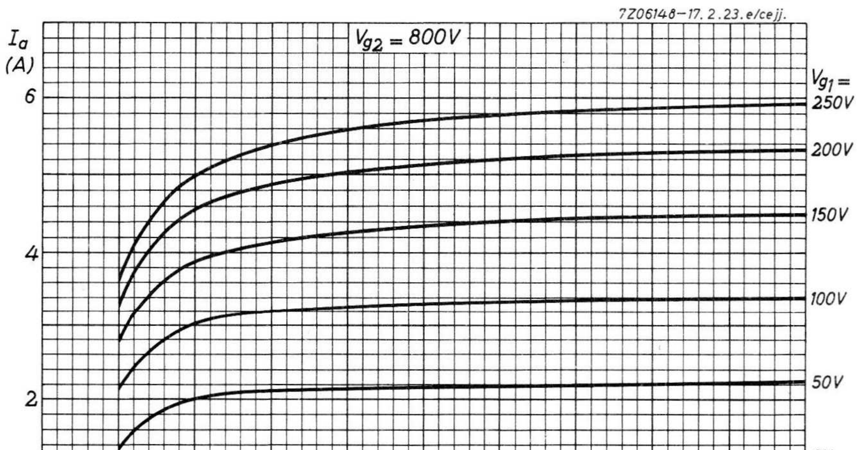
4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

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

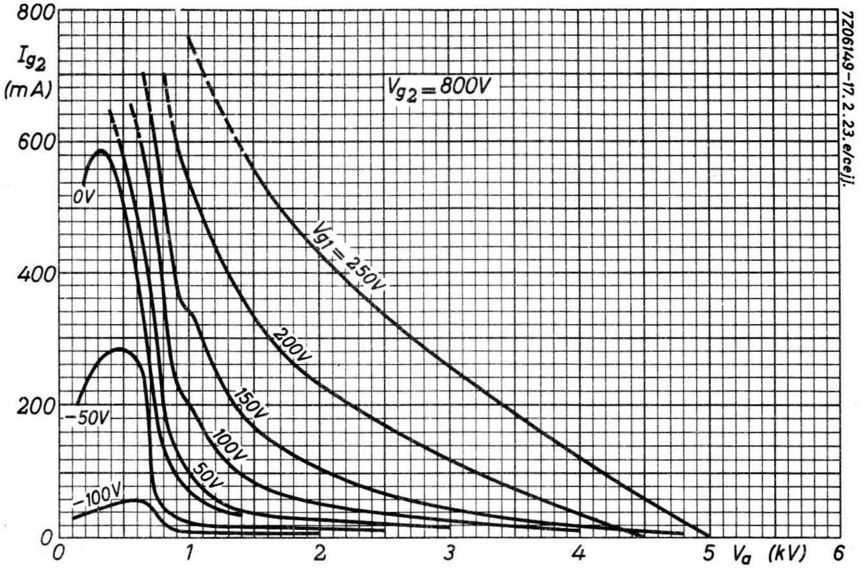
7Z2 2862



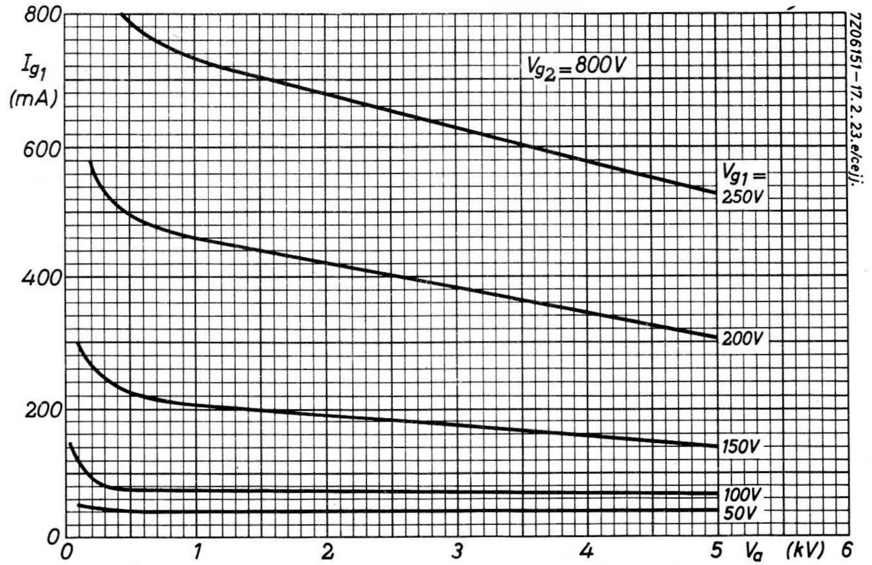
I_a (mA)
600
500
400
300
200
100
0
0
−50
−100
−150
−200 V_{g1} (V)
$V_a =$
5 kV
4 kV
3 kV
2 kV
1 kV
800V
$V_{g2} = 800V$
7Z06152−17.2.23.e/cejj.



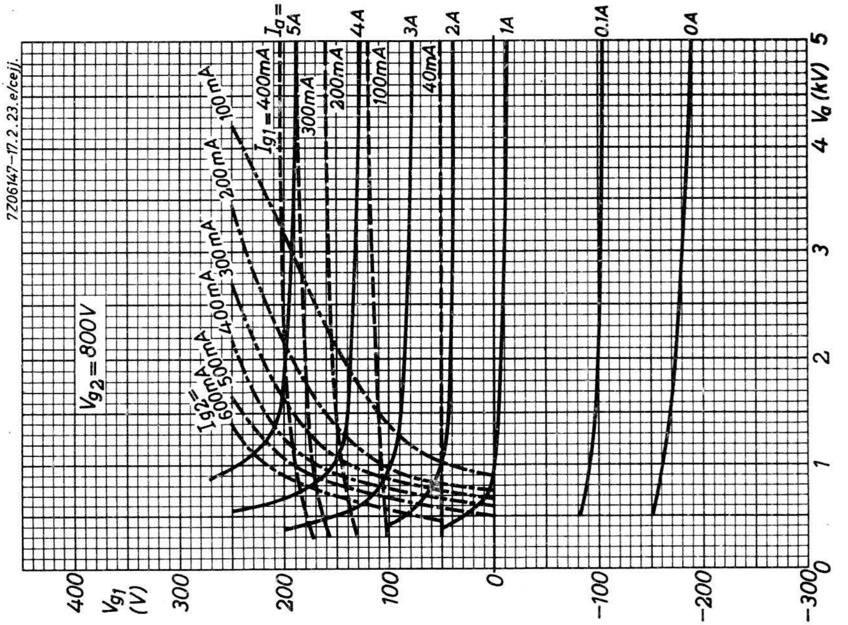
7Z06148−17.2.23.e/cejj.
$V_{g2} = 800V$
I_a (A)
6
4
2
0
$V_{g1} =$
250V
200V
150V
100V
50V
0V
−50V
−100V
0
1
2
3
4
V_a (kV)
5

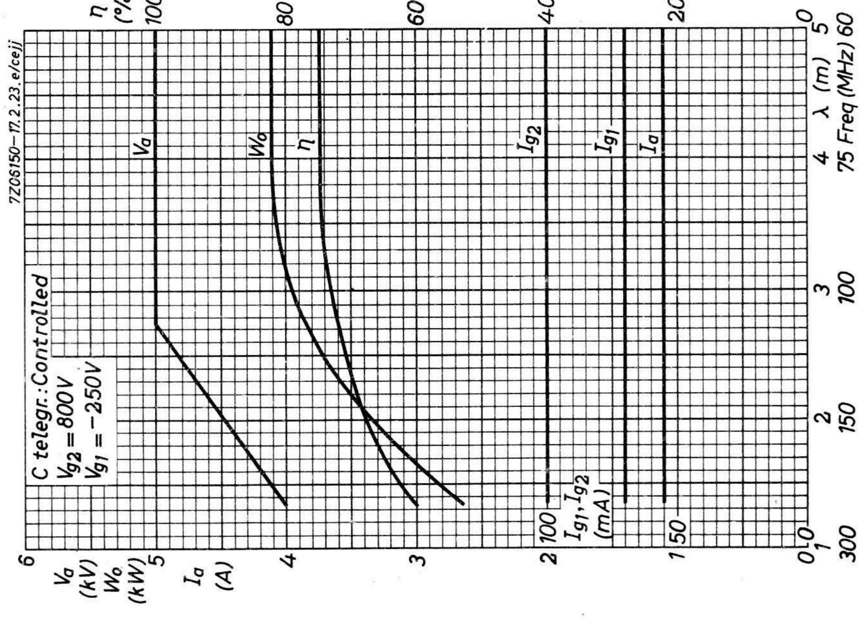


800
600
400
200
0
I_{g_2} (mA)
$V_{g_2}=800V$
$V_{g_1}=250V$
200V
150V
100V
50V
0V
−50V
−100V
0 1 2 3 4 5 V_a (kV) 6
7Z06149-17.2.23.e/cejj.

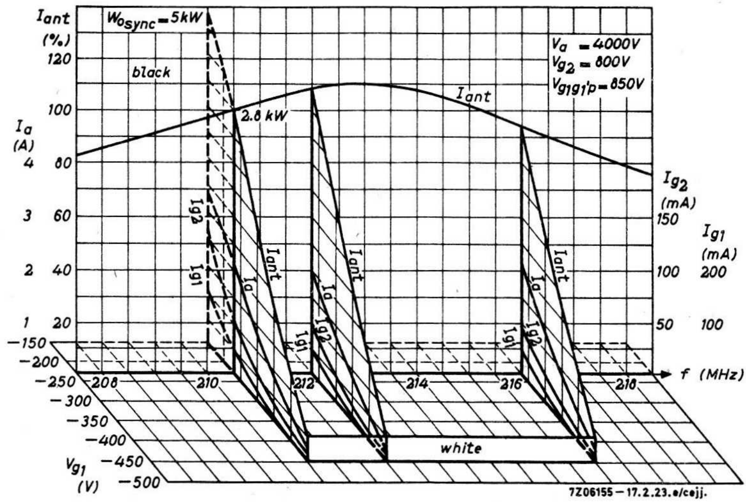


800
600
400
200
0
I_{g_1} (mA)
$V_{g_2}=800V$
$V_{g_1}=$ 250V
200V
150V
100V
50V
0 1 2 3 4 5 V_a (kV) 6
7Z06151-17.2.23.e/cejj.

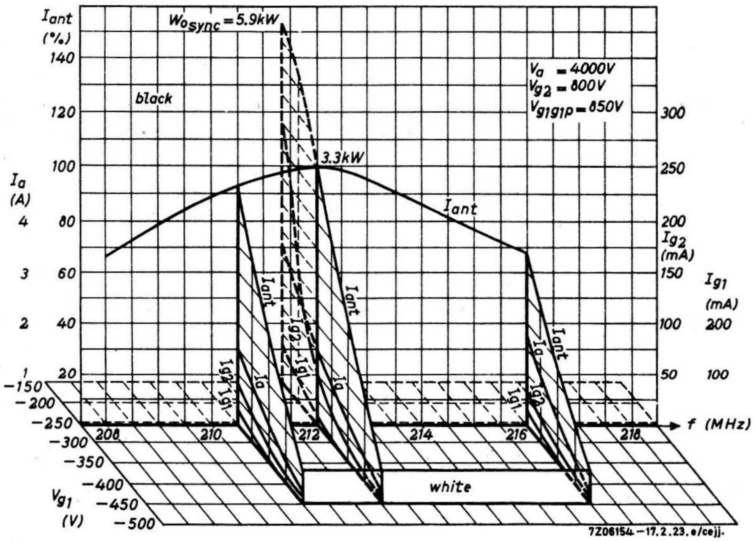

7Z06147-17.2.23.e/cejj.
Vg2 = 800V
Ia = 5A
4A
3A
2A
1A
0.1A
0A
Ig1 = 400mA
300mA
200mA
100mA
40mA
Ig2 = A
600mA
500mA
400mA
300mA
200mA
100mA
Vg1 (V)
Va (kV)


7Z06150-17.2.23.e/cejj
C telegr.: Controlled
Vg2 = 800V
Vg1 = −250V
Va
Wo
η
Ig2
Ig1
Ia
η (%)
Va (kV) Wo (kW)
Ia (A)
Ig1, Ig2 (mA)
λ (m)
Freq (MHz)

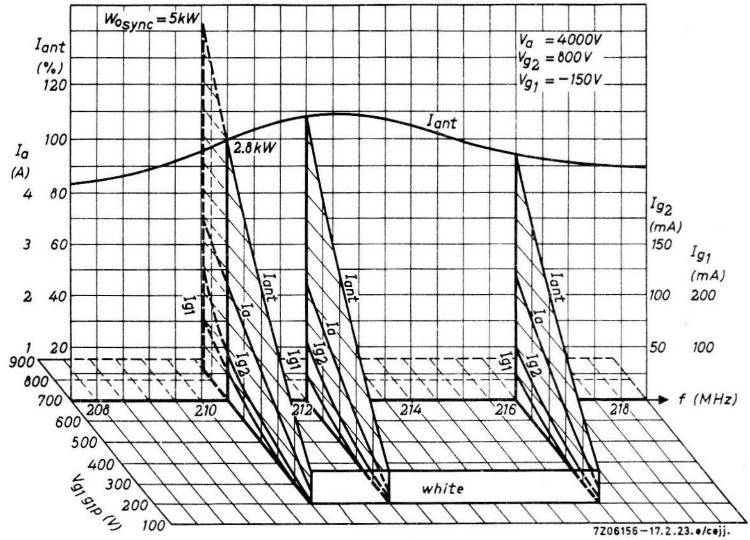
Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)

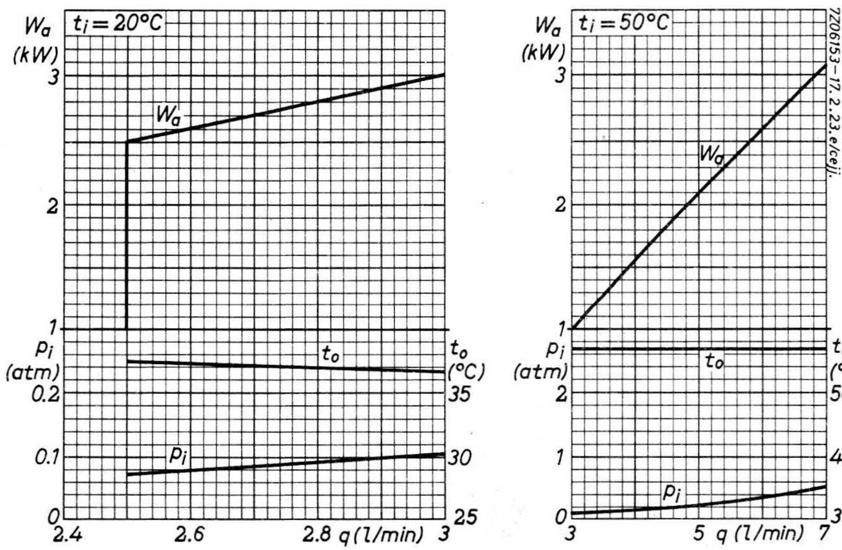


Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)



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 ±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

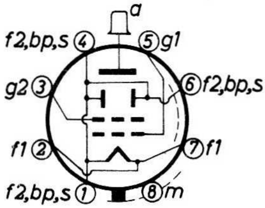
Dimensions in mm

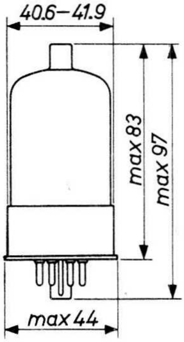
Base : Octal 8p

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

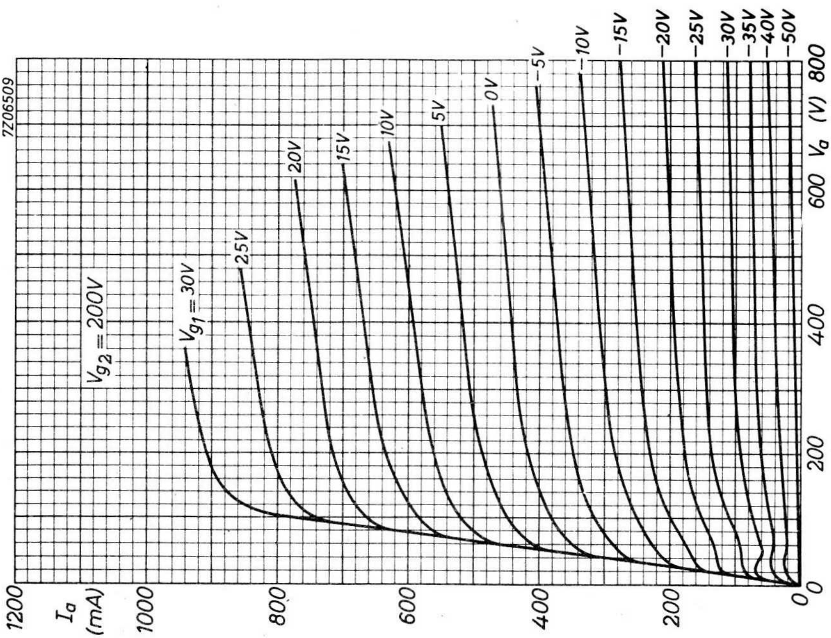
Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	480	V
Anode input power	W_{ia}	= max.	45	W
Anode dissipation	W_a	= max.	14	W
Anode current	I_a	= max.	120	mA
Grid No.2 voltage	V_{g_2}	= max.	250	V
Grid No.2 dissipation	W_{g_2}	= max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current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

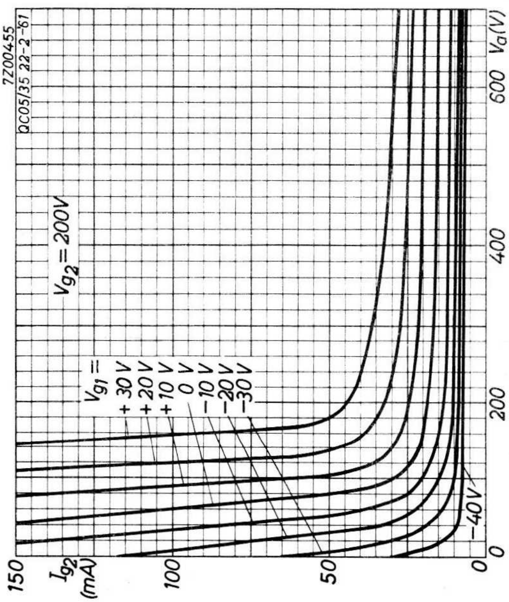
OPERATING CHARACTERISTICS

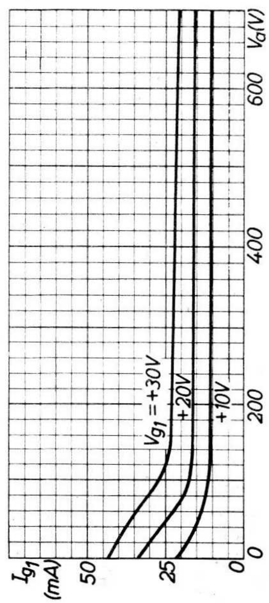
Frequency	f	=	60	60	MHz
Anode voltage	V_a	=	475	400	V
Grid No.2 voltage	V_{g_2}	=	135	150	V [4]
Grid No.1 voltage	V_{g_1}	=	-77	-87	V [3]
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	95	107	V
Anode current	I_a	=	94	112	mA
Grid No.2 current	I_{g_2}	=	9	12	mA
Grid No.1 current	I_{g_1}	=	2.8	3.4	mA
Grid No.1 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

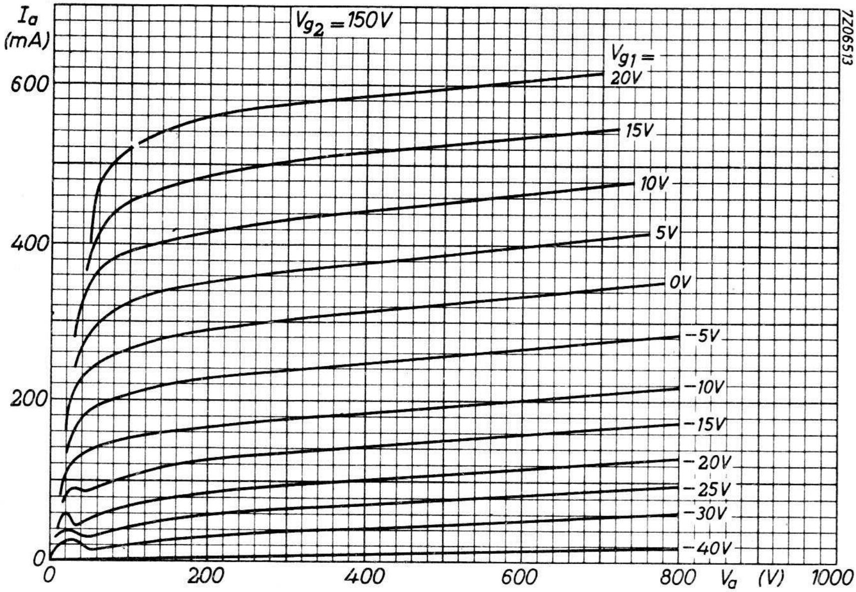
[1][3]) See page 3

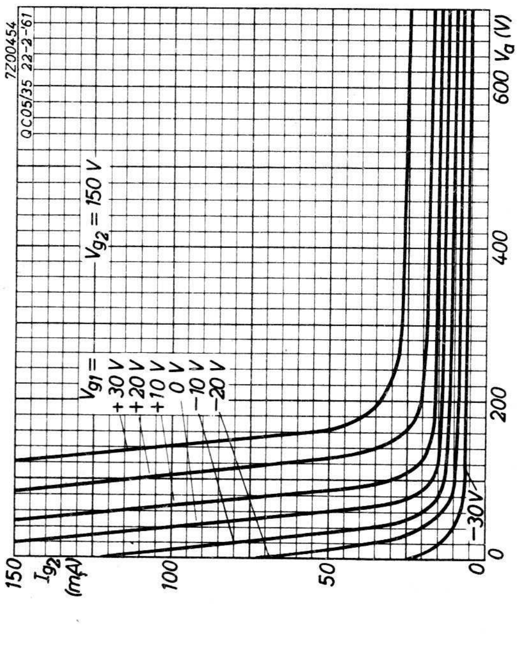
[4]) Obtained preferably from a separate source modulated by the anode supply or from the modulated anode supply through a series resistor.

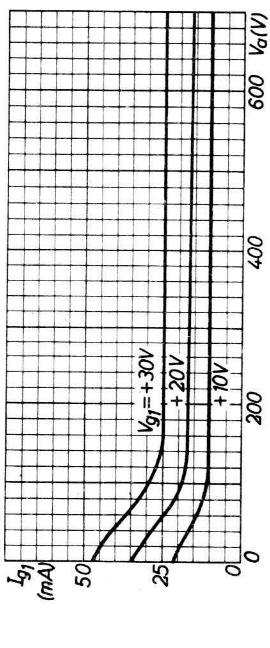

7Z06509
$V_{g_2} = 200V$
$V_{g_1} = 30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−50V
I_a (mA)
1200
1000
800
600
400
200
0
V_a (V)
200
400
600
800


7Z00455
QC05/35 22-2-'61
$V_{g_2} = 200V$
$V_{g_1} =$
+ 30 V
+ 20 V
+ 10 V
0 V
−10 V
−20 V
−30 V
−40V
I_{g_2} (mA)
150
100
50
0
V_a(V)
200
400
600


$V_{g_1} = +30V$
+20V
+10V
I_{g_1} (mA)
50
25
0
V_a(V)
200
400
600


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


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


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

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	

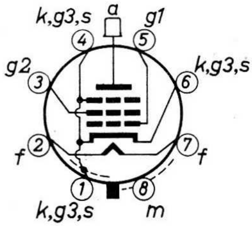
MECHANICAL DATA Dimensions in mm

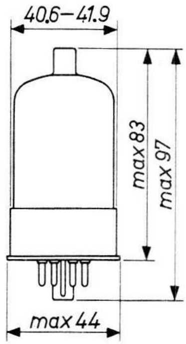
Base : Octal 8p

Socket : 2422 501 03001

Anode connector: 28 906 022

Net weight : 57 g





Mounting position: arbitrary

TEMPERATURE LIMIT (Absolute limits)

Bulb temperature = max. 220 ^{o}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])

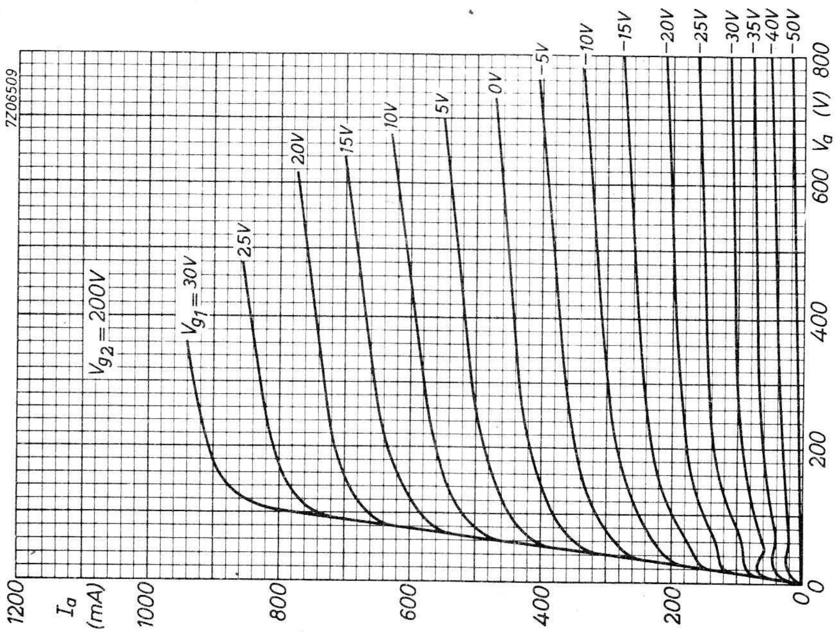
C.C.S. OPERATING CONDITIONS, continuous service; two tubes (I_{g_1} = 0)

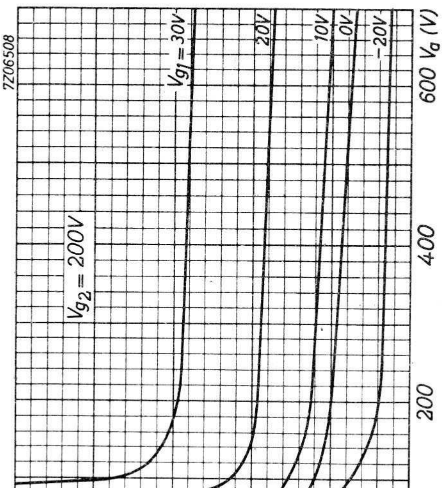
Anode voltage	V_a	=	400		250		V
Grid No.1 voltage	V_{g_1}	=	-100		-50		V
Load resistance	$R_{aa\sim}$	=	8000		5000		Ω
Peak grid to grid voltage	V_{gg_p}	=	0	200	0	100	V
Anode current	I_a	=	2x20	2x50	2x60	2x62	mA
Anode input power	W_{ia}	=	2x8	2x20	2x15	2x15.5	W
Anode dissipation	W_a	=	2x8	2x9	2x15	2x10.5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

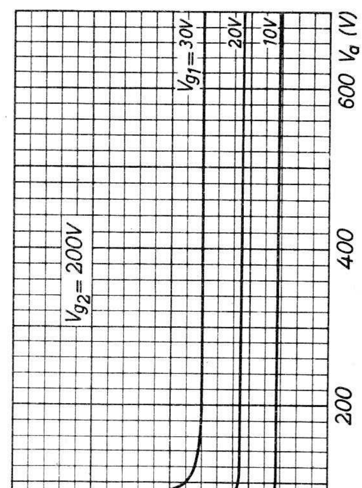
I.C.A.S. OPERATING CONDITIONS, intermittent service; two tubes

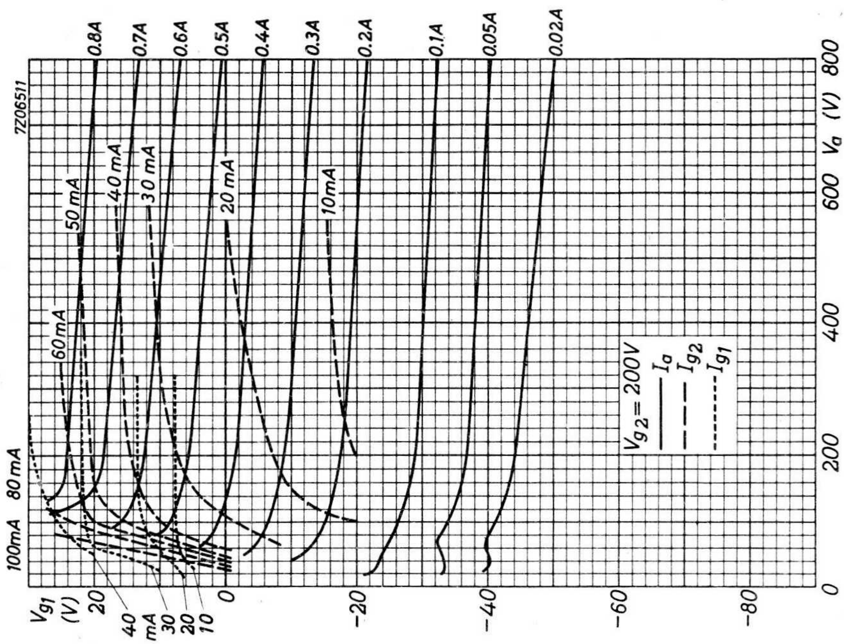
Anode voltage	V_a	=	400		V
Grid No.1 voltage	V_{g_1}	=	-100		V
Load resistance	$R_{aa\sim}$	=	8000		Ω
Peak grid to grid voltage	V_{gg_p}	=	0	200	V
Anode current	I_a	=	2x20	2x50	mA
Anode input power	W_{ia}	=	2x8	2x20	W
Anode dissipation	W_a	=	2x8	2x9	W
Output power	W_o	=	0	22	W
Efficiency	η	=	-	55	%

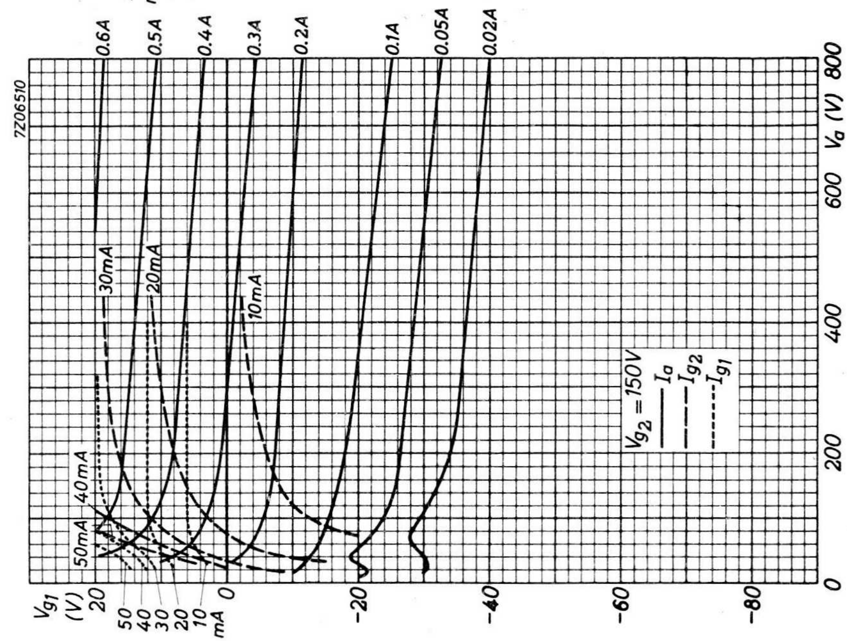
[1]) For values of R_{g_1} exceeding 100 kΩ, cathode bias is required

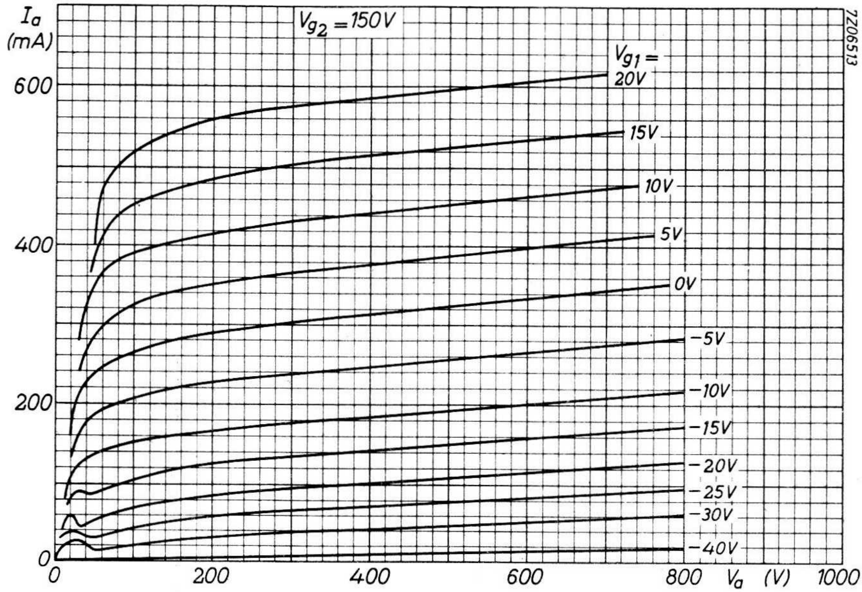

7Z06509
Ia (mA)
Va (V)
Vg2 = 200V
Vg1 = 30V
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−50V
1200
1000
800
600
400
200
0
0
200
400
600
800


7Z06508
Ig2 (mA)
Va (V)
Vg2 = 200V
Vg1 = 30V
20V
10V
0V
−20V
100
50
0
0
200
400
600

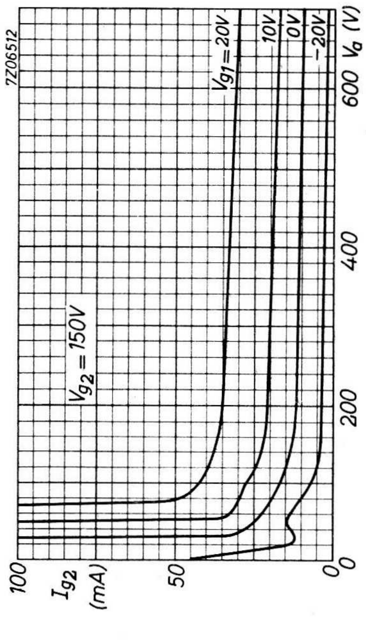

Ig1 (mA)
Va (V)
Vg2 = 200V
Vg1 = 30V
20V
10V
100
50
0
0
200
400
600


7Z06511
V_{g_2} = 200V
I_a
I_{g_2}
I_{g_1}
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
0.02A
50 mA
40 mA
30 mA
20 mA
10mA
60mA
80mA
100mA
V_a (V)
V_{g_1} (V)
mA

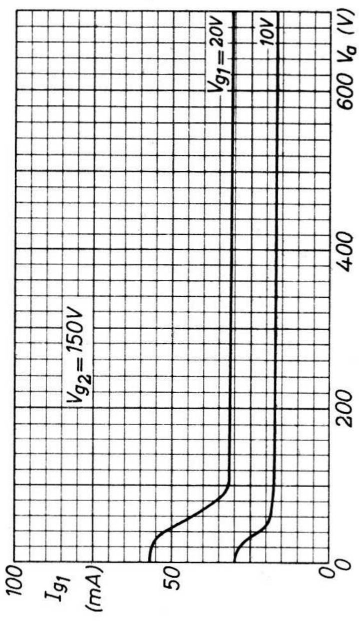

7Z06510
V_{g_2} = 150V
I_a
I_{g_2}
I_{g_1}
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
0.02A
30mA
20mA
10mA
40mA
50mA
V_a (V)
V_{g_1} (V)
mA



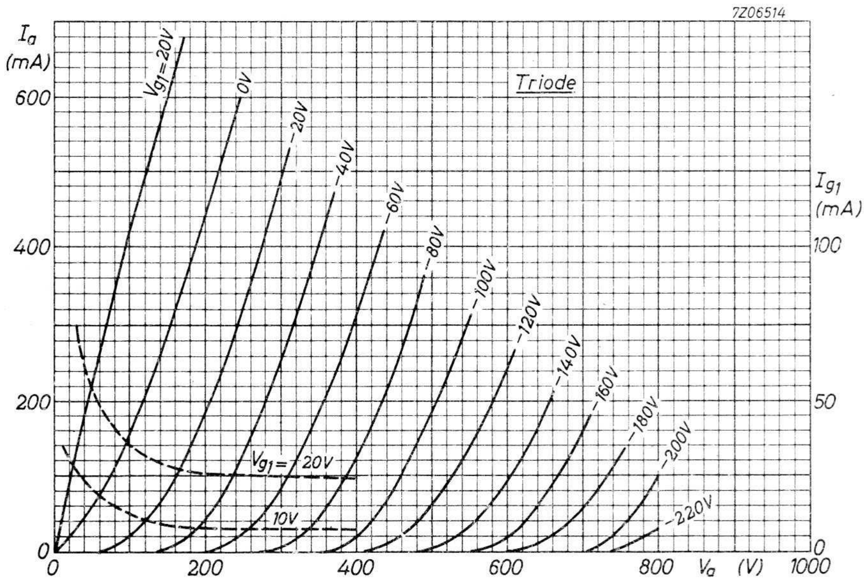
I_a (mA)
$V_{g_2} = 150V$
7Z06513
$V_{g_1} =$
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−40V
600
400
200
0
0
200
400
600
800
V_a (V)
1000

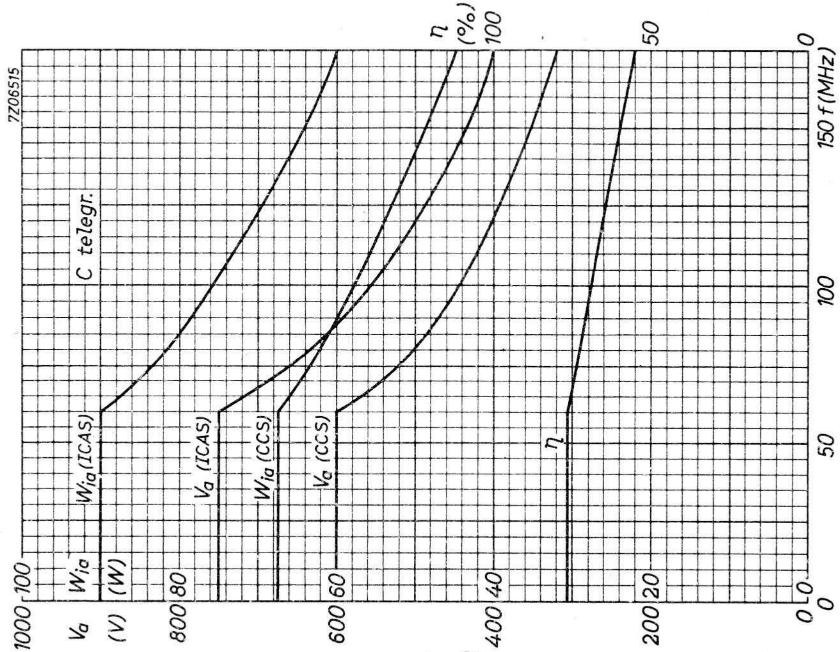


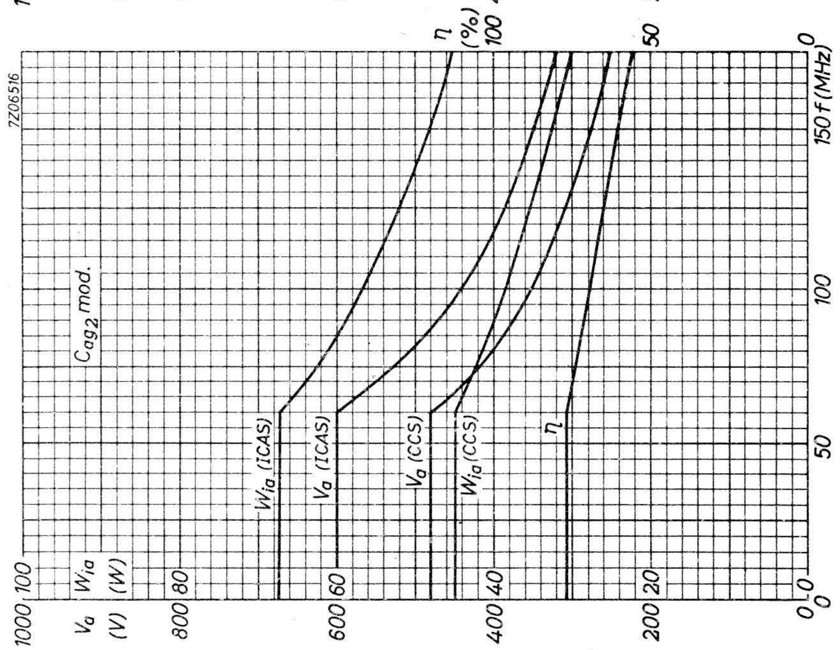
7Z06512
$V_{g_1} = 20V$
10V
0V
−20V
V_a (V)
600
400
200
0
$V_{g_2} = 150V$
100
I_{g_2} (mA)
50
0



$V_{g_1} = 20V$
10V
V_a (V)
600
400
200
0
$V_{g_2} = 150V$
100
I_{g_1} (mA)
50
0


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


7Z06515
C telegr.
Wia (ICAS)
Va (ICAS)
Wia (CCS)
Va (CCS)
η
η (%)
Va (V)
Wia (W)
f (MHz)


7Z06516
Cag2 mod.
Wia (ICAS)
Va (ICAS)
Va (CCS)
Wia (CCS)
η
η (%)
Va (V)
Wia (W)
f (MHz)

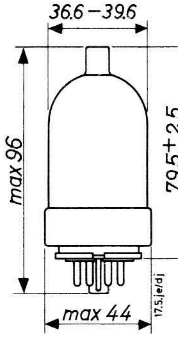
QE05/40F

Heater voltage V_f = 12.6 V

Heater current I_f = 0.625 A

MECHANICAL DATA

Base: Octal 8 p.



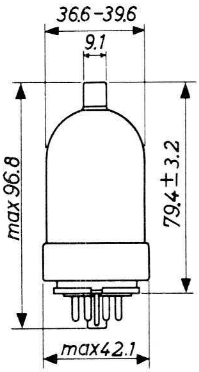
QE05/40K

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

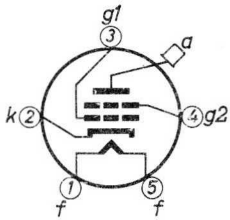
Base : giant 5p

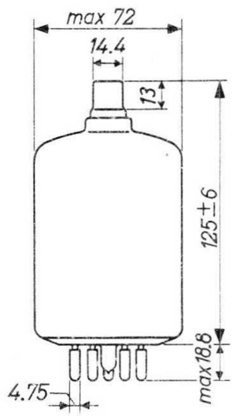
Socket : 2422 512 01001

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 fr^m 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

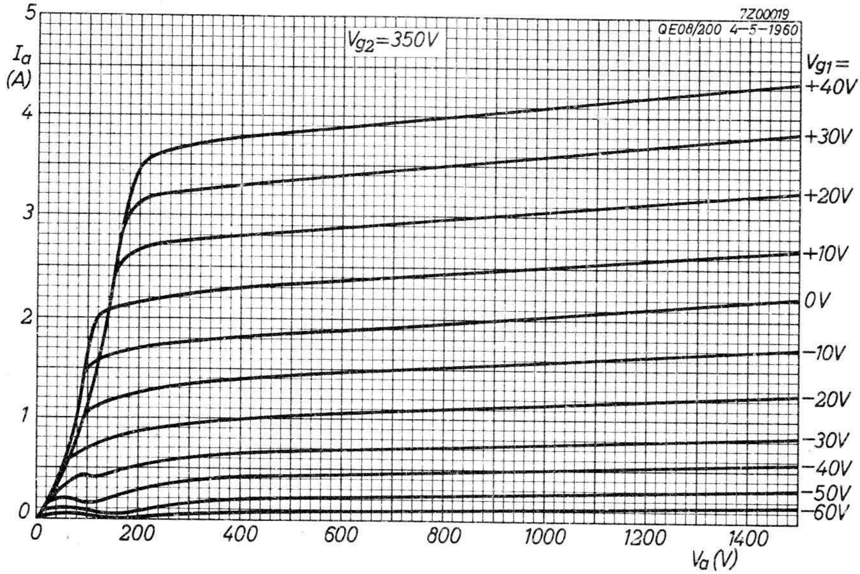
A.F. CLASS B AMPLIFIER

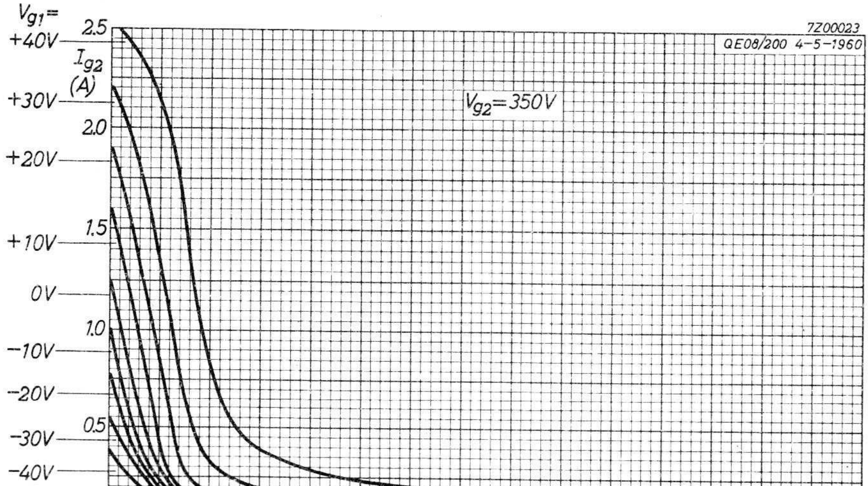
LIMITING VALUES (Absolute limits)

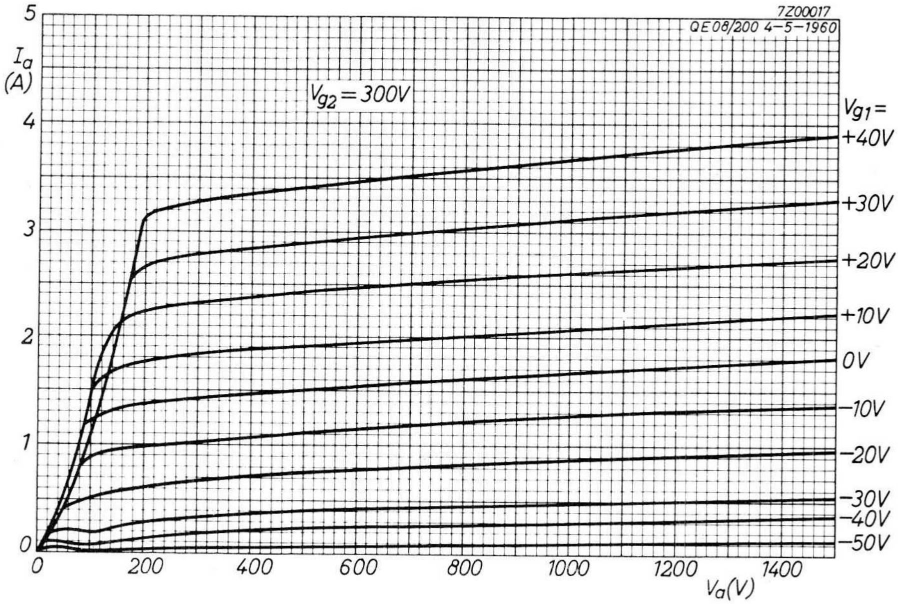
Anode voltage	V_a	= max.	825	V
Anode dissipation	W_a	= max.	100	W
Anode current	I_a	= max.	400	mA
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	30	mA
Grid No.1 circuit resistance	R_{g_1}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

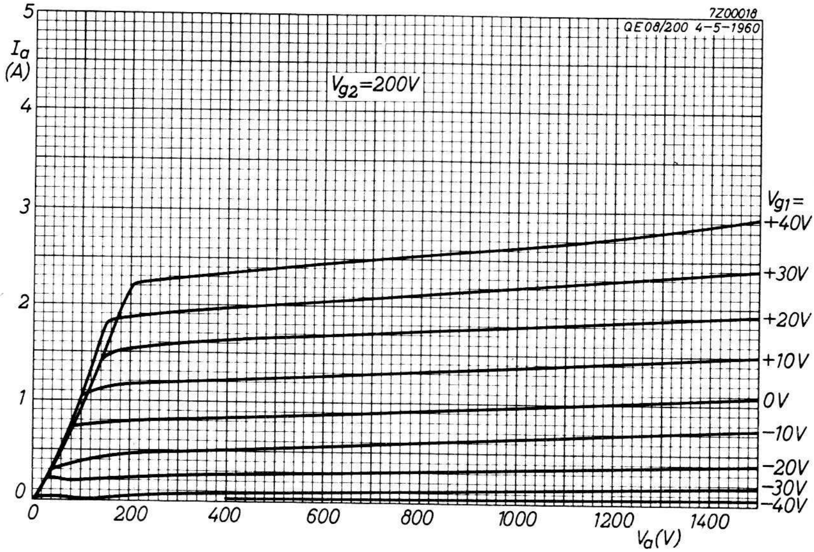
OPERATING CONDITIONS, two tubes

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
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
I_{g2} (A)
2.5
2.0
1.5
1.0
0.5
0
0
200
400
600
800
1000
1200
1400
V_a(V)


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


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)
0
200
400
600
800
1000
1200
1400
1
2
3
4
5

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	800	170	215
	750	110	600	80			
	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	$C_{a(g1)}$	4, 4	pF
Grid no. 1 to all other elements except anode	$C_{g1(a)}$	16	pF
Anode to grid no. 1	C_{ag1}	0, 03	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500	V
Grid no. 2 voltage	V_{g2}	250	V
Anode current	I_a	200	mA
Transconductance	S	12	mA/V
Amplification factor	μ_{g2g1}	5	

COOLING

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

With an air-system socket air is directed to the base seals, past grid no. 2 seals, 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 a socket with air chimney.

W_a	h	t_i	q_{min}	p_i [1]
250 W	0 m	20 °C	0, 16 m^3/min	12 Pa *)

TEMPERATURE LIMITS (Absolute max. rating system)

Anode temperature	max.	250	°C [2]
Anode seal temperature	max.	200	°C
Base and grid no. 2 seal temperature	max.	175	°C

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[1]) Pressure drop in cavities etc. excluded.

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

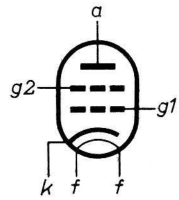
*)1 Pa ≈ 0, 1 mmH_2O.

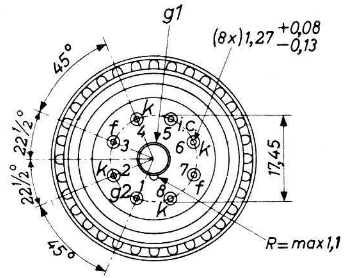
MECHANICAL DATA

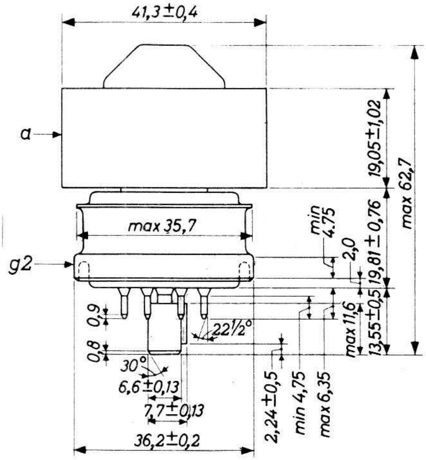
Dimensions in mm

Mounting position : any

Net mass : 130 g







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

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_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-90	-80	-80	-75	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	106	95	96	91	V
Anode current	I_a	=	200	200	200	200	mA
Grid No.2 current	I_{g_2}	=	20	31	37	37	mA
Grid No.1 current	I_{g_1}	=	11	10	11	11	mA
Grid No.1 input power	W_{ig_1}	=	1.2	1.0	1.0	1.0	W
Anode input power	W_{ia}	=	250	200	150	120	W
Anode dissipation	W_a	=	55	50	40	35	W
Output power	W_o	=	195	150	110	85	W

			With coaxial cavity				
Frequency	f	=	500	500	500	500	MHz
Anode voltage	V_a	=	1250	1000	800	600	V
Grid No.2 voltage	V_{g_2}	=	280	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-90	-110	-110	-110	V
Anode current	I_a	=	250	200	200	170	mA
Grid No.2 current	I_{g_2}	=	6	7	7	6	mA
Grid No.1 current	I_{g_1}	=	12	10	10	6	mA
Driver output power	W_{dr}	=	30	25	20	15	W
Anode input power	W_{ia}	=	312	200	160	102	W
Anode dissipation	W_a	=	142	80	65	52	W
Output power	W_o	=	170	120	95	50	W

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	500	MHz
Anode voltage	V_a	=	max.	1600	1000	V
Anode current	I_a	=	max.	200	200	mA
Anode input power	W_{ia}	=	max.	480	300	W
Anode dissipation	W_a	=	max.	165	165	W
Grid No.2 voltage	V_{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

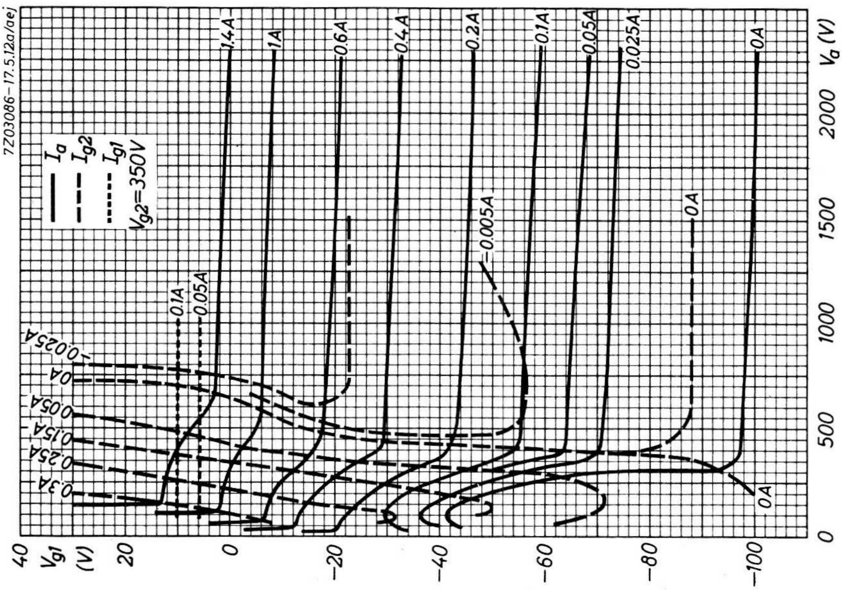
Negative modulation, positive synchronisation

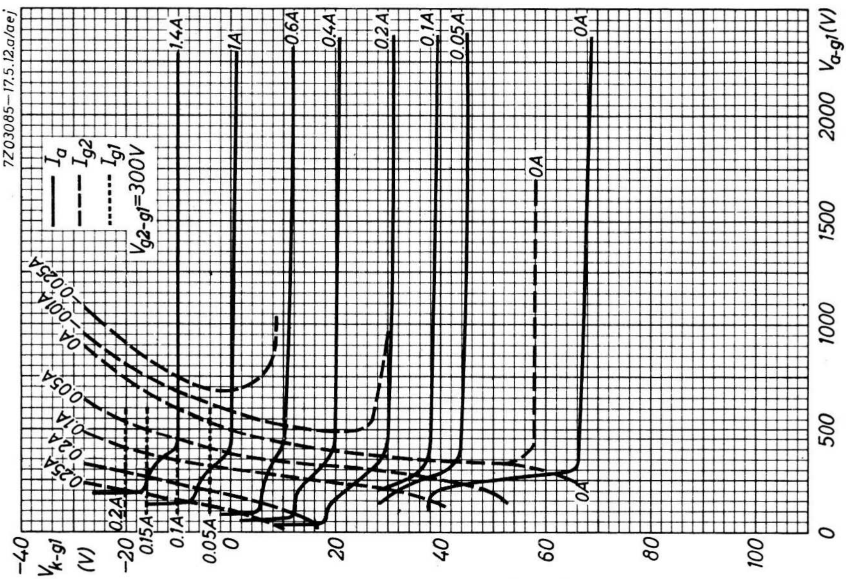
LIMITING VALUES (Absolute limits)

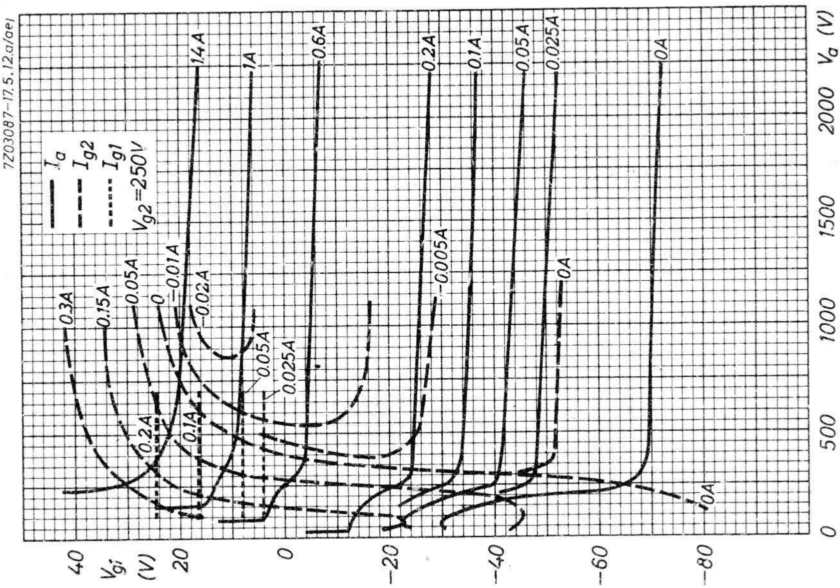
Frequency	f	=	54 to 216	MHz
Anode voltage	V_a	= max.	1250	V
Anode current	I_a	= max.	250	mA
Anode dissipation	W_a	= max.	250	W
Anode input power	W_{ia}	= max.	500	W
Grid No.2 voltage	V_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid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

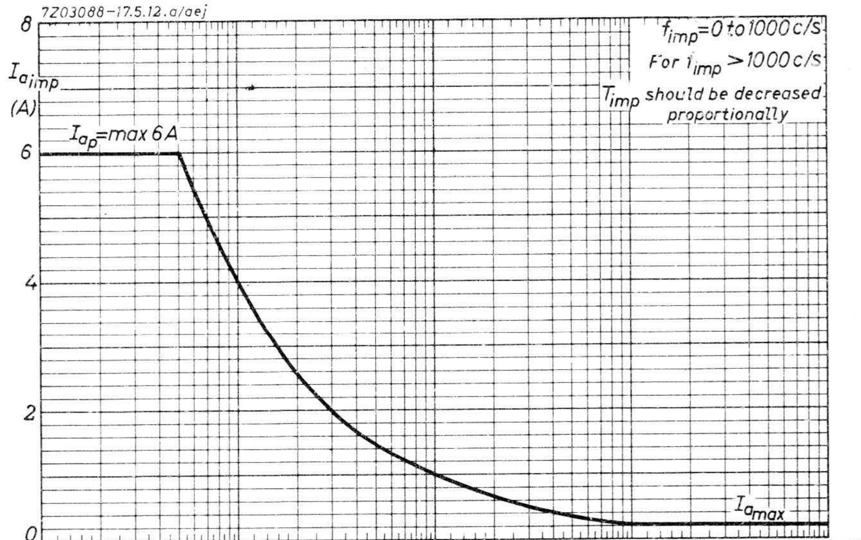
OPERATING CONDITIONS at centre frequency of resonance curve

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


7Z03086-17.5.12.a/aej
Ia
Ig2
Ig1
Vg2=350V
Vg1 (V)
Va (V)
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0.025A
0A
0.005A
0.1A
0.05A
0.025A
0A
0.05A
0.15A
0.25A
0.3A
40
20
0
-20
-40
-60
-80
-100
0
500
1000
1500
2000


7Z03085-17.5.12.a/aej
Ia
Ig2
Ig1
Vg2-g1=300V
Vk-g1 (V)
Va-g1(V)
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0A
0.025A
0.01A
0A
0.05A
0.1A
0.2A
0.25A
0.2A
0.15A
0.1A
0.05A
-40
-20
0
20
40
60
80
100
0
500
1000
1500
2000


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
0.05A
0.025A
-0.005A
0.2A
0.1A
V_a (V)
V_{g1} (V)


7Z03088-17.5.12.a/aej
$I_{a_{imp}}$ (A)
I_{a_p}=max 6 A
f_{imp}=0 to 1000 c/s
For f_{imp} > 1000 c/s
T_{imp} should be decreased proportionally
$I_{a_{max}}$
T_{imp} (μsec)

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)
30 500	2000	400	2000 2000	105 106

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	$\mu_{g_2g_1}$	=	-		4	

CAPACITANCES

Anode to all other elements except grid no. 1	$C_{a(g1)}$	4,5	pF
Grid no. 1 to all other elements except anode	$C_{g1(a)}$	17	pF
Anode to grid no. 1	C_{ag1}	0,065	pF

TEMPERATURE LIMITS (Absolute max. rating system)

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

COOLING

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

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

Required air flow with air-system socket

W_a	h	t_i	q_{min}	p_i
250 W	0 m	20 °C	0,11 m^3/min	80 Pa *)

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

---

*) 1 Pa ≈ 0,1 mm H_2O.

1) The limiting value for a signal having a minimum peak to average power ratio < 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 350 mA.

2) Automatic bias is not recommended.

3) Driver output power measured at the grid no. 1 circuit of the QEL2/200.

4) Average power measured in the load of an output circuit having an efficiency of 95%.

5) Average power measured in the load of an output circuit having an efficiency of 85%.

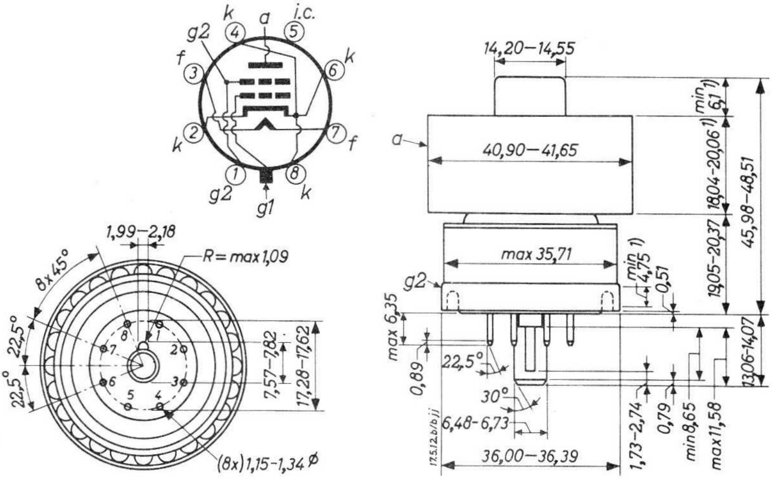
6) To be adjusted for zero signal anode current.

MECHANICAL DATA

Dimensions in mm

Mounting position : any

Net mass : 120 g



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

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1) Contact surface.

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.

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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

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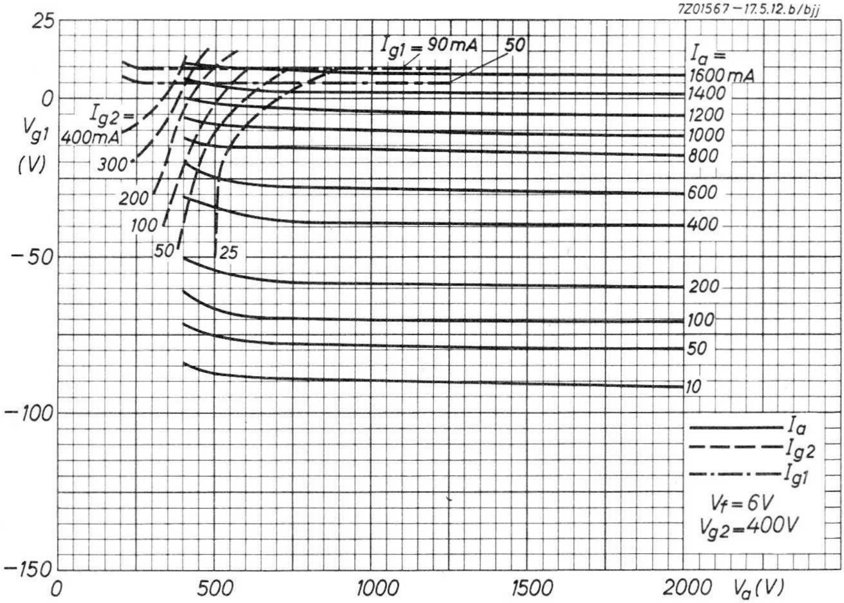
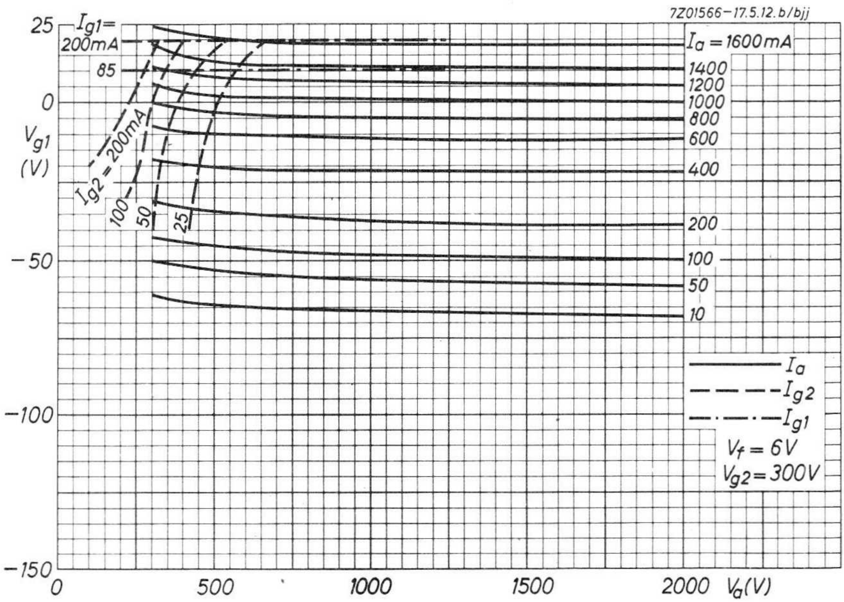

7Z01567 – 17.5.12.b/bjj
I_{g1} = 90 mA
50
I_a =
1600 mA
1400
1200
1000
800
600
400
200
100
50
10
I_{g2} =
400mA
300
200
100
50
25
V_{g1}
(V)
25
0
−50
−100
−150
0
500
1000
1500
2000
V_a(V)
I_a
I_{g2}
I_{g1}
V_f = 6V
V_{g2} = 400V


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)
25
0
−50
−100
−150
0
500
1000
1500
2000
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

Anode to all other elements except grid no. 1	$C_{a(g1)}$	4,5	pF
Grid no. 1 to all other elements except anode	$C_{g1(a)}$	15,7	pF
Anode to grid no. 1	C_{ag1}	<0,06	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500	V
Grid no. 2 voltage	V_{g2}	250	V
Anode current	I_a	200	mA
Transconductance	S	12	mA/V
Amplification factor	μ_{g2g1}	5,2	

TEMPERATURE LIMITS (Absolute max. rating system)

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

COOLING

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

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

Required air flow with air-system socket

W_a	h	t_i	q_{min}	p_i
250 W	0 m	20 ^{o}C	0,11 m^3/min	80 Pa *)

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

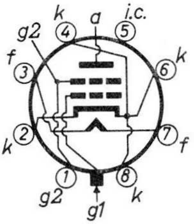
*) 1 Pa ≈ 0,1 mm H_2O.

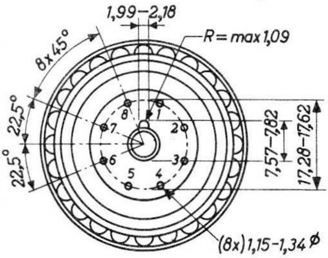
MECHANICAL DATA

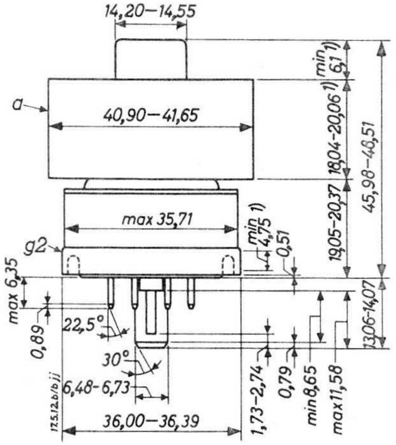
Dimensions in mm

Mounting position : any

Net mass : 120 g







1) Contact surface.

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

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[1]) Averaged over any frame

[2]) See page 4

A.F. POWER AMPLIFIER AND MODULATOR CLASS AB

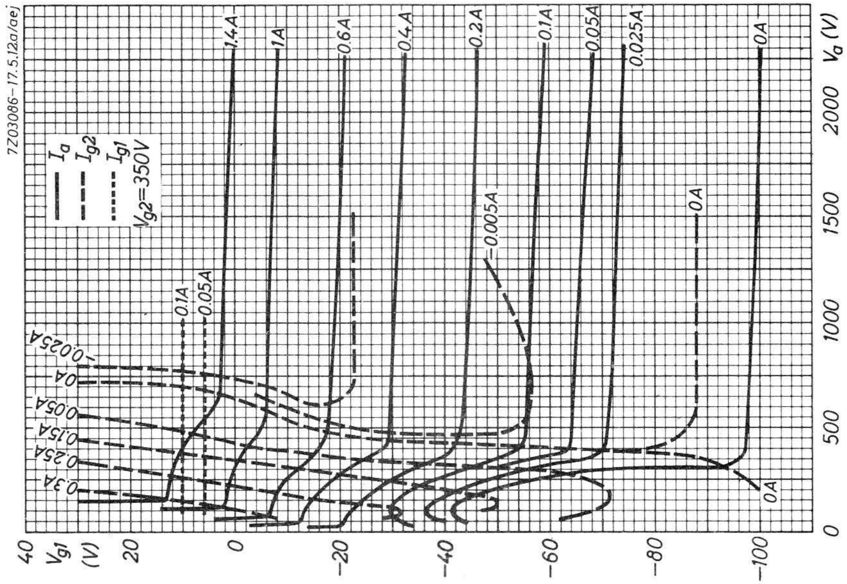
LIMITING VALUES (Absolute limits)

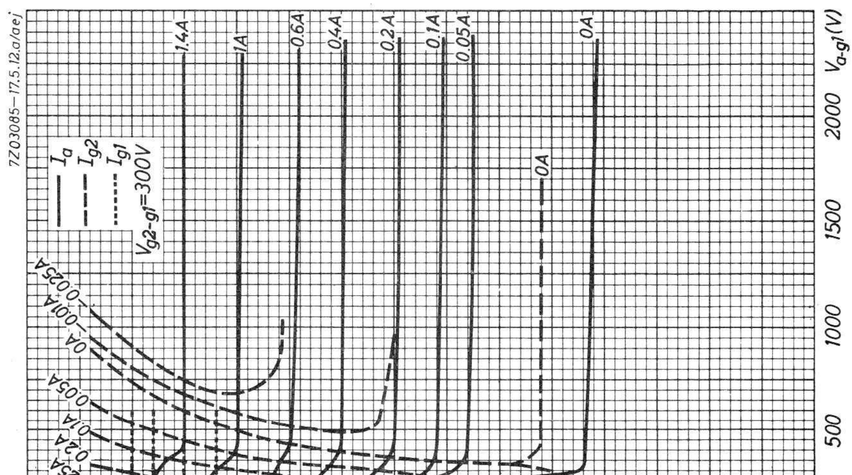
Anode voltage	V_a	= max.	2000	V
Anode current	I_a	= max.	250	mA [1]
Anode input power	W_{ia}	= max.	250	W [1]
Grid No.2 voltage	V_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W [1]
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 circuit resistance	R_{g_1}	= max.	100	kΩ
Peak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

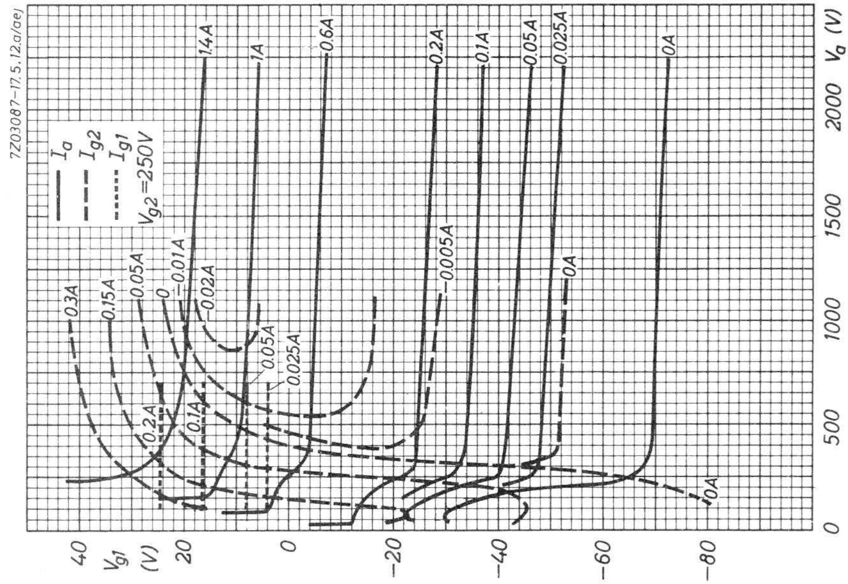
OPERATING CONDITIONS (values for two tubes)

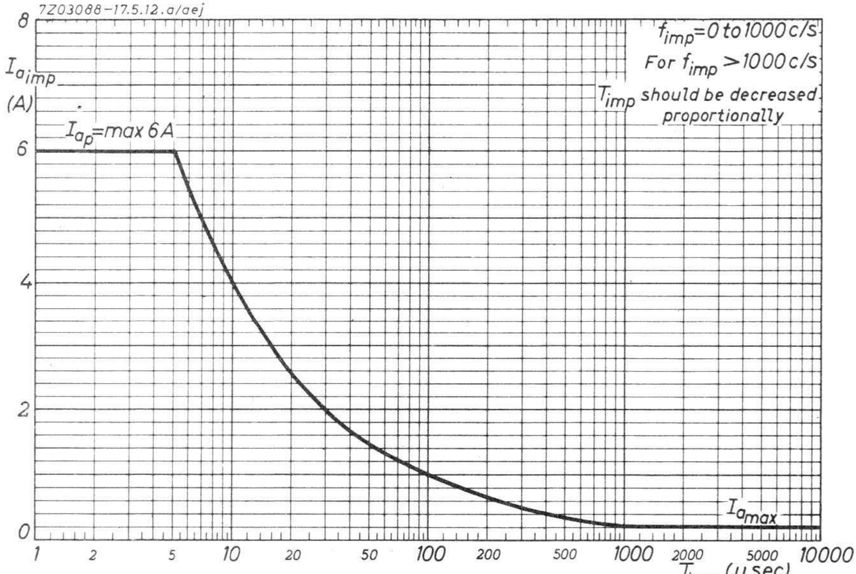
V_a	=	1000		1500		2000		V
V_{g_2}	=	350		350		350		V
V_{g_1}	=	-55		-55		-55		V
$R_{aa\sim}$	=	3500		6200		9500		Ω
$V_{g_1g_{1p}}$	=	0	100	0	100	0	100	V
I_{g_1}	=	0	0	0	0	0	0	mA
I_a	=	2x100	2x250	2x100	2x250	2x100	2x250	mA
I_{g_2}	=	0	2x10	0	2x8	0	2x5	mA
W_{ia}	=	2x100	2x250	2x150	2x375	2x200	2x500	W
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_a (V)
V_{g1} (V)
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0.025A
0A
0.005A
0.3A
0.25A
0.15A
0.05A
0.025A


7Z03085-17.5.12a/aej
I_a
I_{g2}
I_{g1}
V_{g2-g1}=300V
V_{a-g1}(V)
V_{k-g1} (V)
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0A
0.025A
0.01A
0.25A
0.2A
0.15A


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
0.05A
0.025A
0.2A
0.1A
-0.005A
0A
0A
V_a (V)
0
500
1000
1500
2000
V_{g1} (V)
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
$I_{a_{max}}$
0
2
4
6
8
1
2
5
10
20
50
100
200
500
1000
2000
5000
10000
T_{imp} (μ sec)

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

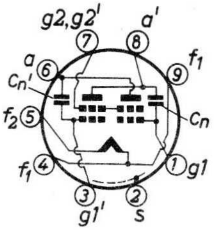
MECHANICAL DATA Dimensions in mm

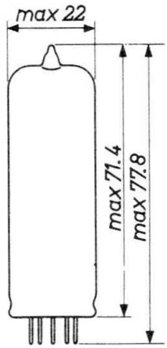
Base : Noval

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)

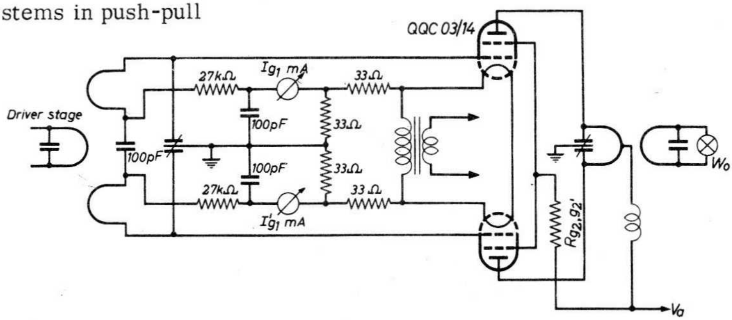
Bulb temperature	=	max.	225	$^{\circ}$C
Pin temperature	=	max.	120	$^{\circ}$C

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



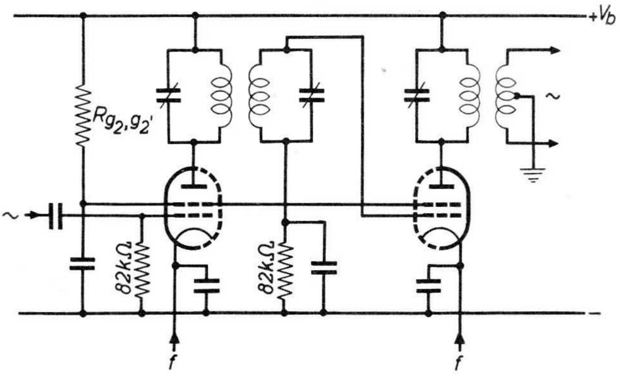
Frequency	f			=	200	200	MHz
Anode voltage	V_a	=	$V_{a'}$	=	250	200	V
Grids No.2 supply voltage	$V_{bg_2,g_2'}$			=	250	200	V
Grids No.2 resistor	$R_{g_2,g_2'}$			=	22	6.8	kΩ
Anode current	I_a	=	$I_{a'}$	=	45	45	mA
Grids No.2 current	$I_{g_2+g_2'}$			=	4.2	5.1	mA
Grid No.1 current	I_{g_1}	=	$I_{g_1'}$	=	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.		
(MHz)	V_a (V)	W_o [1] (W)		V_a (V)	W_o [1] (W)	
		CCS	ICAS		CCS	ICAS
60	600	26.6	35	450	17.5	
				250		8.2
186	600	25.6	33.6	250	6.0	7.8

B mod. [1]	
V_a (V)	W_o (W)
C.C.S.	
450	18
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

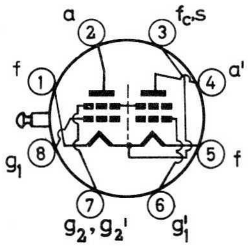
		per system	
Anode to all other elements except grid No. 1	C_a	3.3	pF
Grid No. 1 to all other elements except anode	C_{g_1}	8.5	pF
Anode to grid No. 1	C_{ag_1}	0.05	pF
		in push-pull	
Output capacitance	C_o	1.7	pF
Input capacitance	C_i	5.7	pF

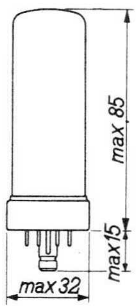
MECHANICAL DATA Dimensions in mm

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	^{o}C
Bulb temperature	max.	200	^{o}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	$V_{g_1g_1'p}$	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.			C_{ag_2} 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	180 200	5.8	 7.2	180	4.2	5.8	

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	180 200	2.35	 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

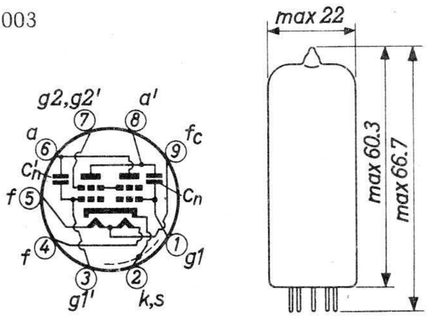
The tube is internally neutralized

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	^{o}C
Pin seal temperature	max. 120	^{o}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_{g_2}	=	max.	200	max. 200	V
Grid No.2 dissipation	W_{g2}	=	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	=	500	500	MHz
Anode voltage	V_a	=	180	200	V
Grid No.2 voltage	V_{g_2}	=	180	200	V
Grid No.1 voltage	V_{g_1}	=	-20	-20	V
Grid No.1 resistors	R_{g_1}	=	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_{g_2}	=	12.5	14	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	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

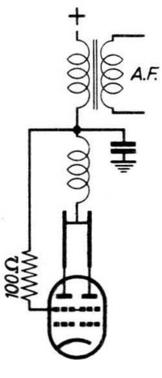
[1]) Each system

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]
$V_{g_1g_1'p}$	=	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	=	2x1.5	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

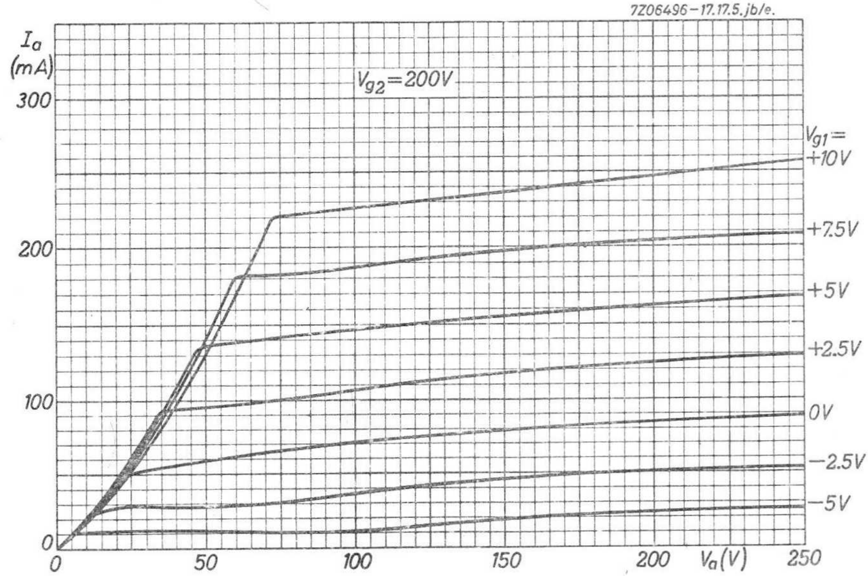
LIMITING VALUES (Absolute limits)

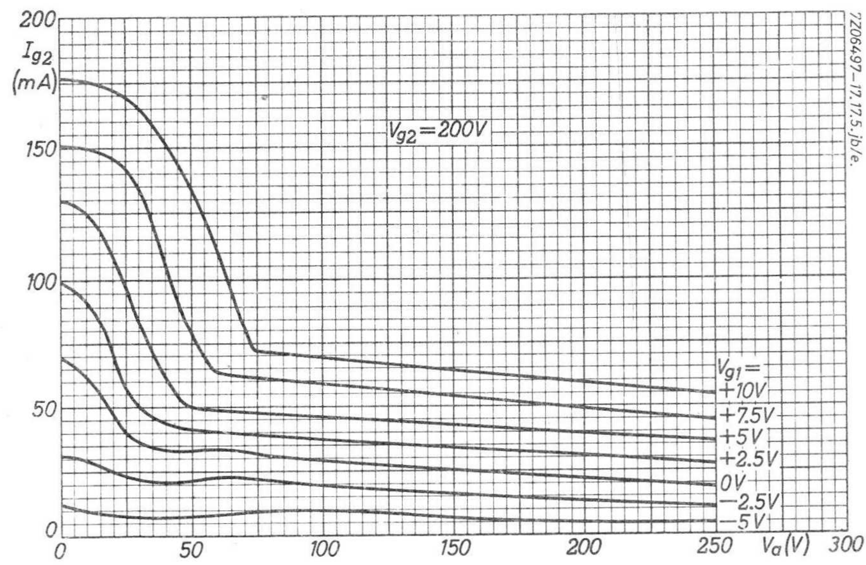
			C.C.S.		I.C.A.S.		
Frequency	f		up to	500	up to	500	MHz
Anode voltage	V_a	=	max.	250	max.	250	V
Anode input power	W_{ia}	=	max.	2x4	max.	2x5	W
Anode dissipation	W_a	=	max.	2x3	max.	2x3.75	W
Anode current	I_a	=	max.	2x30	max.	2x40	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	max.	200	V
Grid No.2 dissipation	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	$V_{g_1 g_1' p}$	=	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

[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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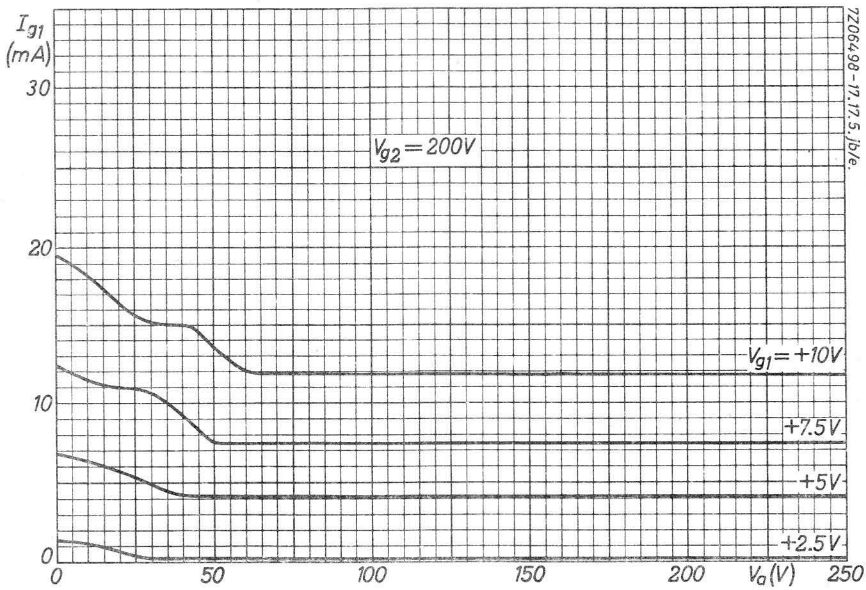
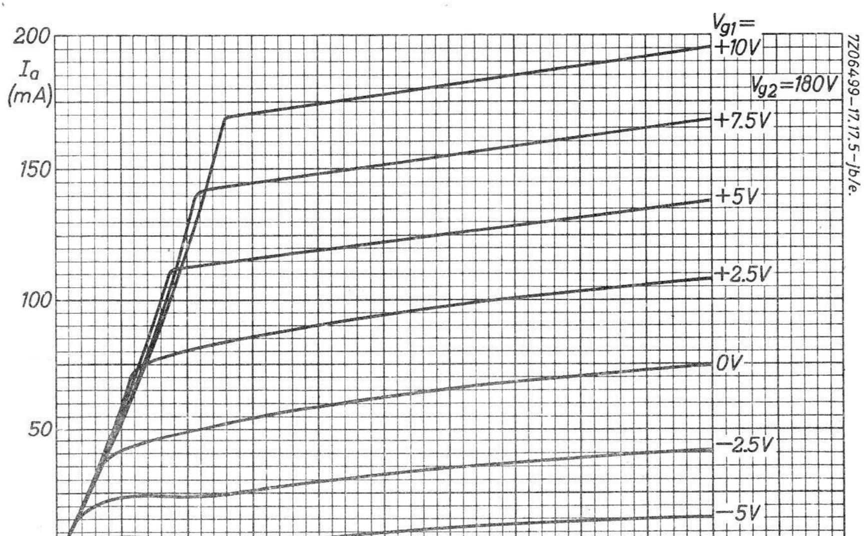
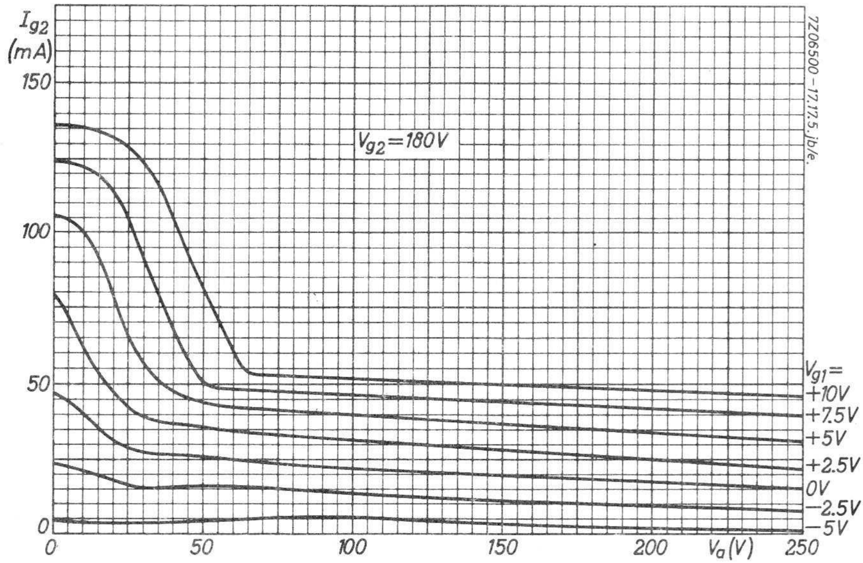
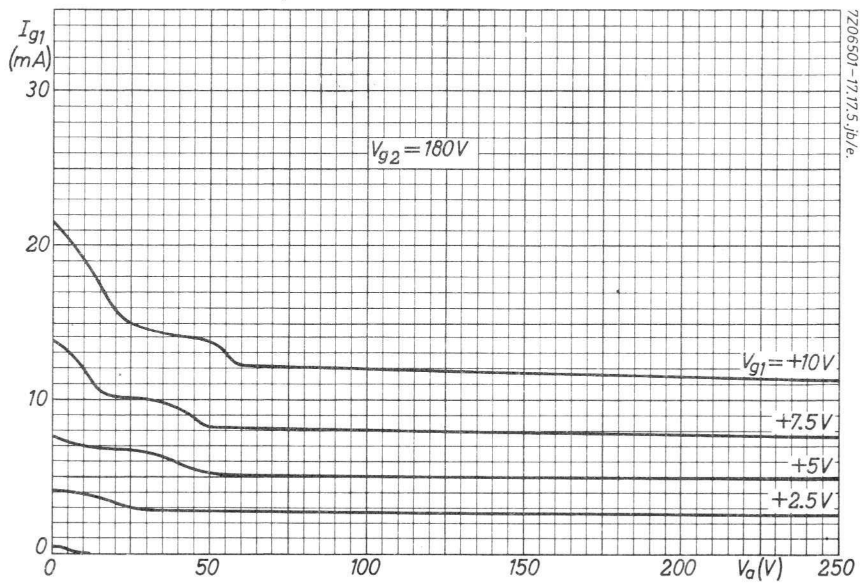
200
I_{g2} (mA)
150
100
50
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
V_a(V)
300


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
7Z06498-17.17.5.jb/e.


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
7Z06499-17.17.5-jb/e.


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
7Z06500−17.17.5.jb/e.


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

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

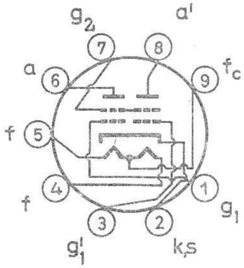
Dimensions in mm

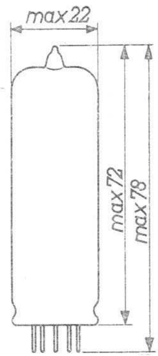
Base : Noval

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_{kp}	= max.	2x300	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

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

Frequency	f	=	200	200	200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	V_{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

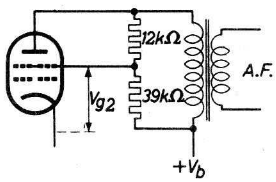
2) Useful power output in load

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

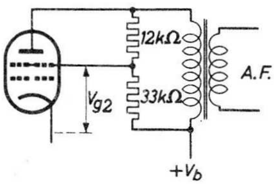
1) See diagram
2) Common resistor for both systems
3) Useful power output in load

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_ℓ [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_{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.	2x2	mA
Cathode current	I_k	= max.	2x35	mA
Peak cathode current	I_{k_p}	= 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_{g_2}	=	150	161	155	V
Grid No.2 resistor	R_{g_2}	=	–	47	15	kΩ
Grid No.1 voltage	V_{g_1}	=	-100	–	–	V
Grid No.1 resistor	R_{g_1} 1)	=	–	47	33	kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	230	230	230	V
Anode current	I_a	=	2x24	2x25	2x28.5	mA
Grid No.2 current	I_{g_2}	=	2.0	1.9	3.0	mA
Grid No.1 current	I_{g_1}	=	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_{g_2}	=	0.30	0.31	0.46	W
Grid No.1 input power	W_{ig_1}	=	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

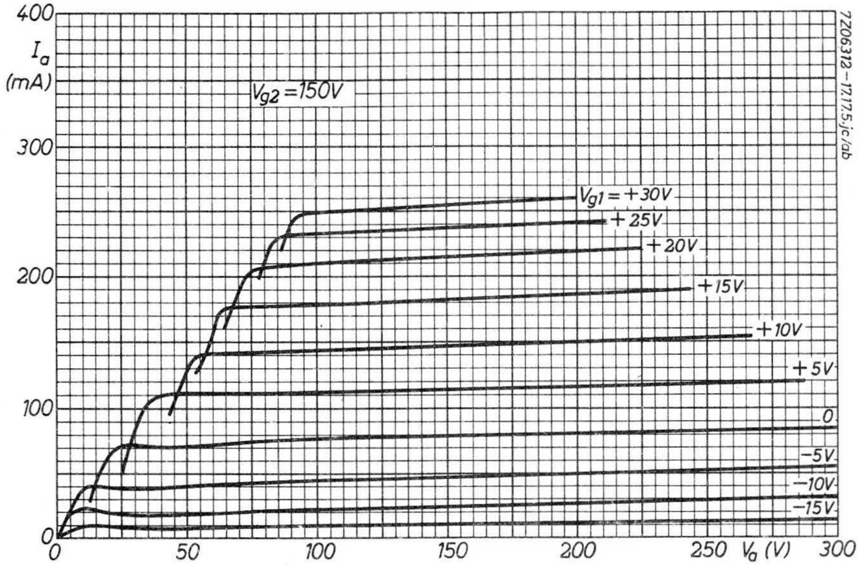
LIMITING VALUES (Absolute limits) only for speech and music

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_{g2}	= max.	200	V
Grid No.2 dissipation	W_{g2}	= max.	2x1	W
Peak grid No.2 dissipation	W_{g2p}	= max.	2x2	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	W_{g1}	= max.	2x0.2	W
Grid No.1 current	I_{g1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x60	mA
Peak cathode current	I_{kp}	= max.	2x300	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

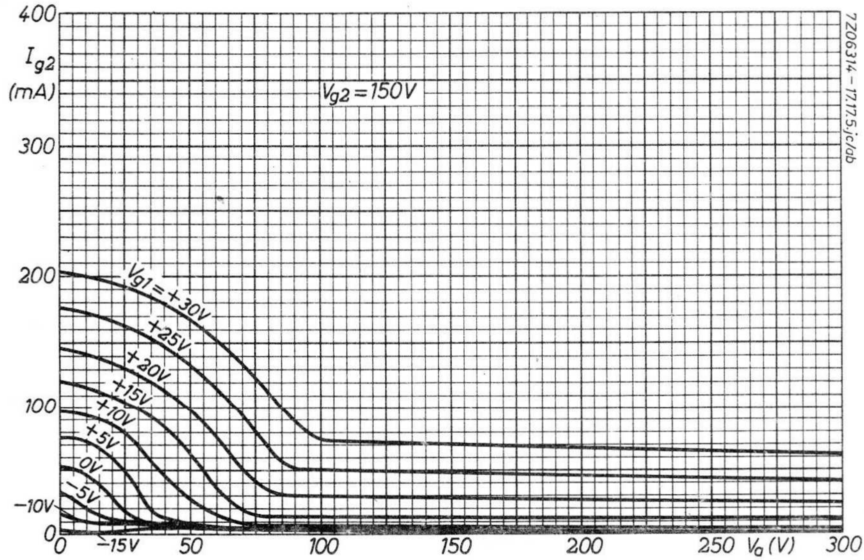
OPERATING CONDITIONS

V_a	=	300		250		200		V
V_{g2}	=	200		200		200		V
V_{g1} [1]	=	-21.5		-21.5		-21.5		V
$R_{aa'\sim}$	=	6.5		5.0		5.0		kΩ
$V_{g1g1'p}$	=	0	64	0	67	0	54	V
I_a	=	2x15	2x50	2x15	2x50	2x15	2x41.1	mA
I_{g2}	=	1.2	11.4	1.4	13	2.4	19	mA
I_{g1}	=	0	2x0.56	0	2x0.62	0	2x0.22	mA
W_{g2}	=	0.24	2.3	0.28	2.6	0.48	3.8	W
W_{ig1}	=	0	2x0.02	0	2x0.02	0	2x0.01	W
W_{ia}	=	2x4.5	2x15	2x3.75	2x12.5	2x3.0	2x8.22	W
W_a	=	2x4.5	2x6.25	2x3.75	2x5.5	2x3.0	2x3.87	W
W_o	=	0	17.5	0	14	0	8.7	W
η	=	–	58	–	56	–	53	%
d_{tot}	=	–	5.0	–	5.5	–	6.0	%

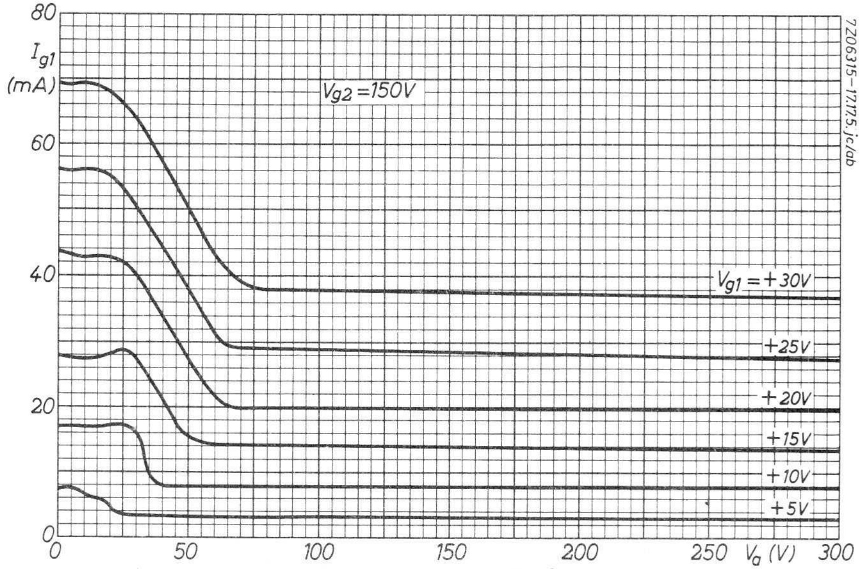
[1]) Individual adjustment of the grid bias of each system is recommended

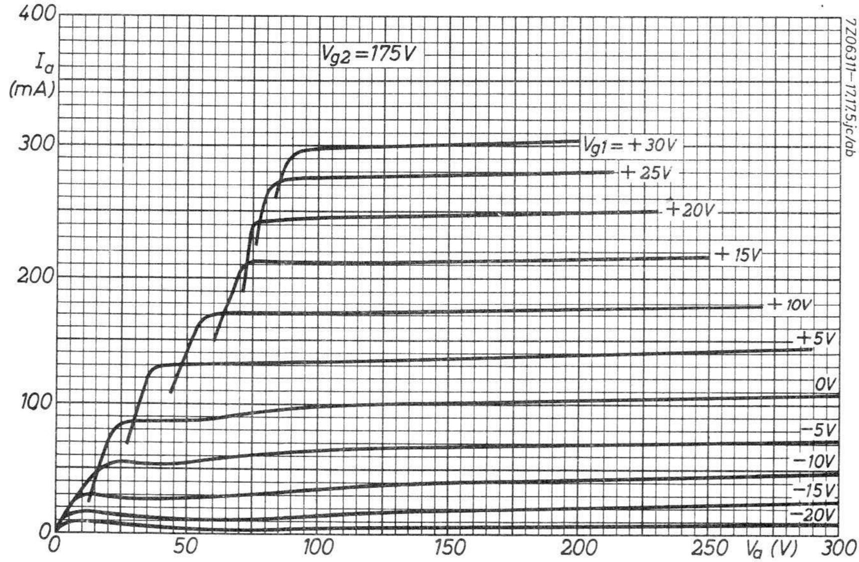


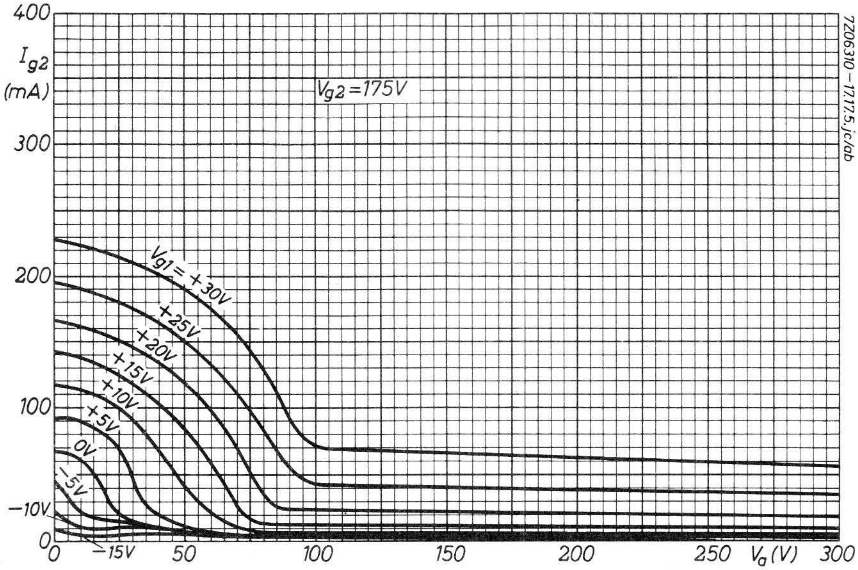
400
I_a
(mA)
300
200
100
0
V_{g2} = 150V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
0
50
100
150
200
250
V_a (V)
300
7Z06312 − 17.17.5.jc/ab

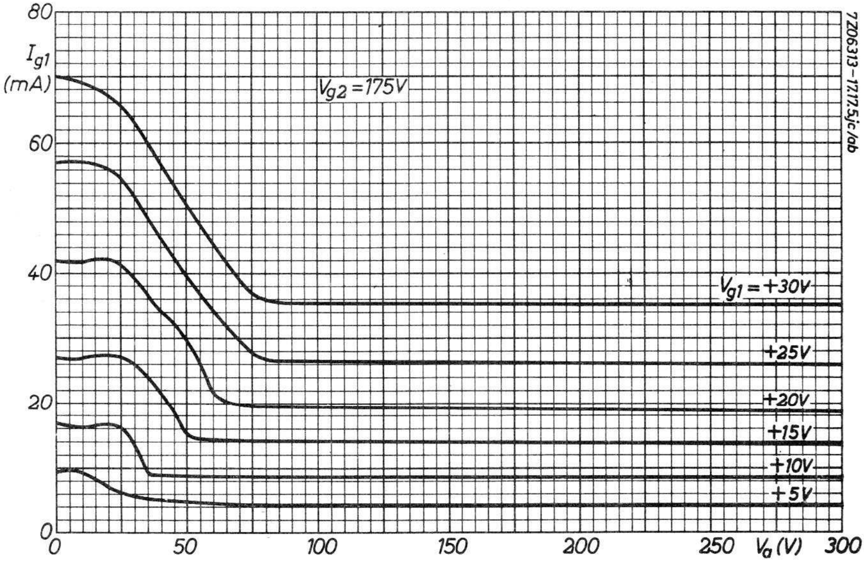


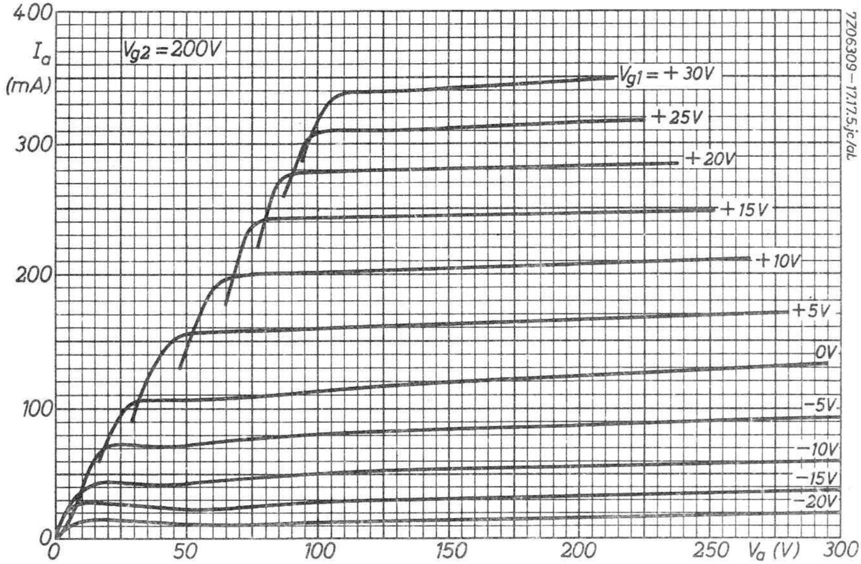
400
I_{g2}
(mA)
300
200
100
0
V_{g2} = 150V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
0
50
100
150
200
250
V_a (V)
300
7Z06314 − 17.17.5.jc/ab

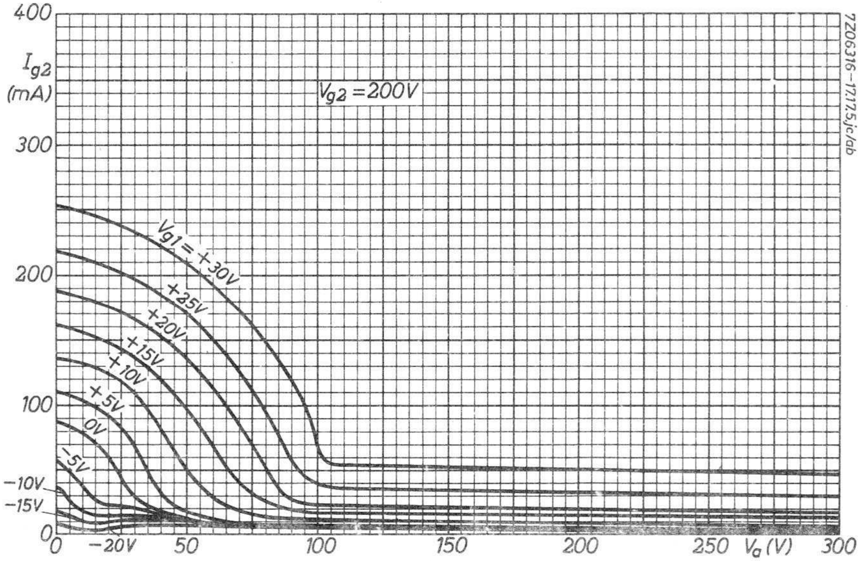

80
I_{g1}
(mA)
60
40
20
0
0
50
100
150
200
250
V_a (V)
300
V_{g2} =150V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
7Z06315-17.17.5.jc/ab

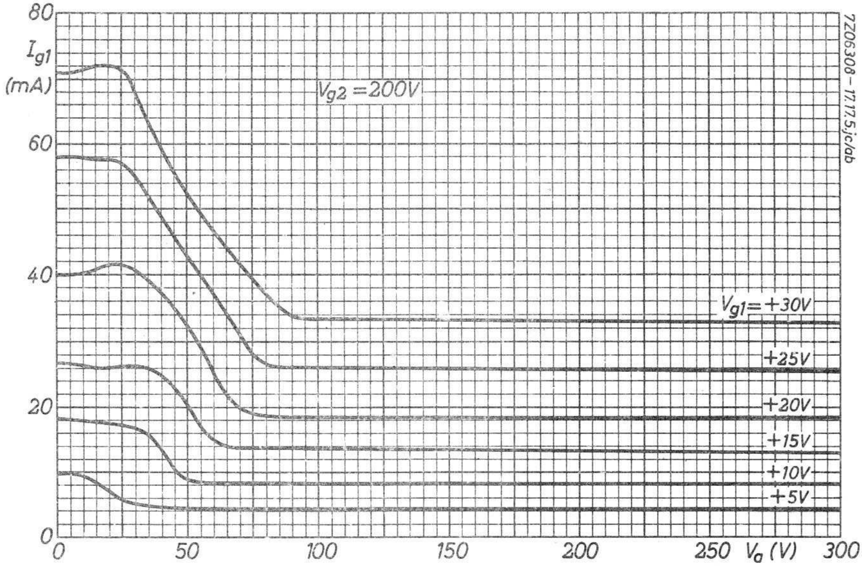

400
I_a
(mA)
300
200
100
0
0
50
100
150
200
250
V_a (V)
300
V_{g2} =175V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
7Z06311-17.17.5.jc/ab


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
7Z06310−1.7.17.5.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
7Z06313−17.17.5.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
7Z06309−1.17.17.5.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
7Z06316−1.17.17.5.jc/ab


80
I_{g1}
(mA)
60
40
20
0
$V_{g2} = 200V$
$V_{g1} = +30V$
+25V
+20V
+15V
+10V
+5V
0
50
100
150
200
250
V_a (V)
300
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

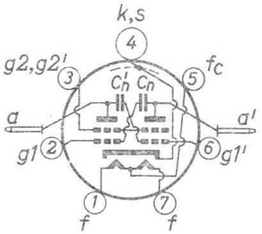
Dimensions in mm

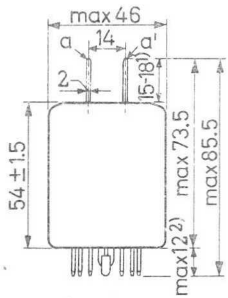
Base : Septar

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	%

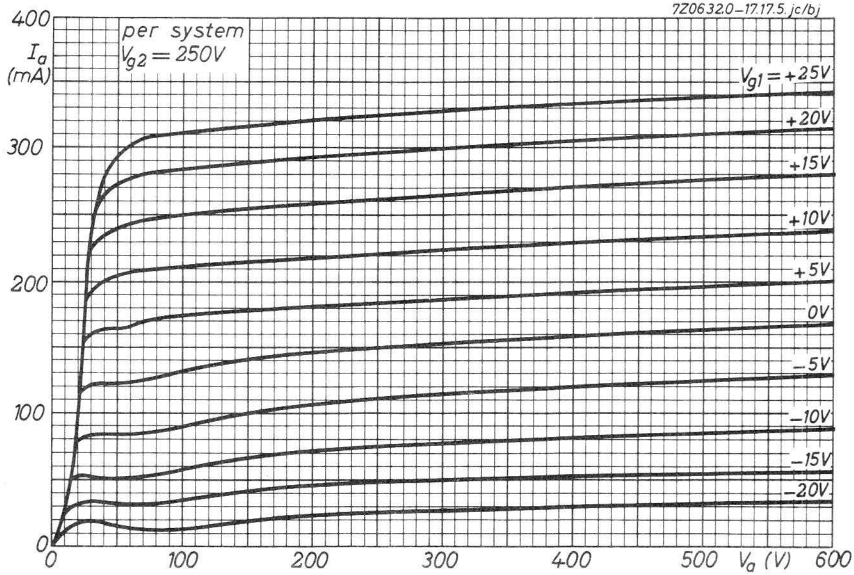
A.F. CLASS B AMPLIFIER AND MODULATOR

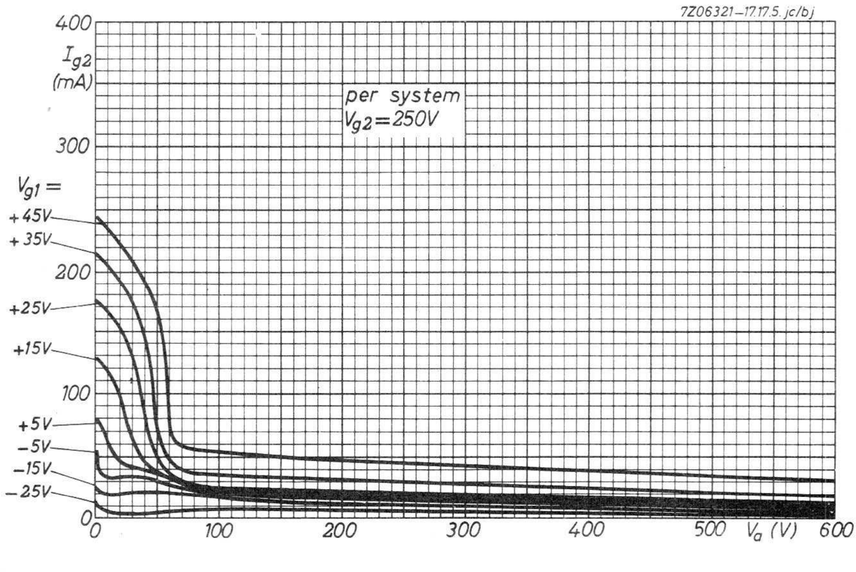
LIMITING VALUES (Absolute limits)

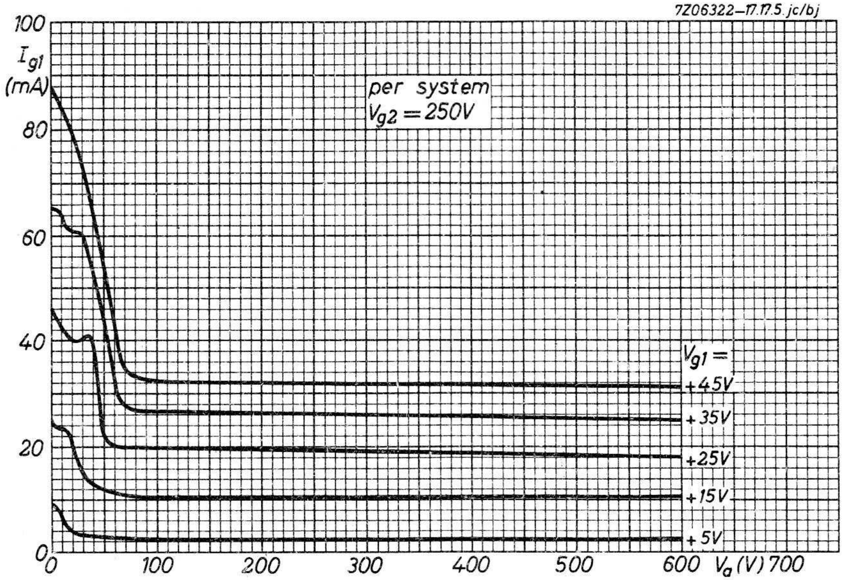
Anode voltage	V_a	= max.	600	V
Anode dissipation	W_a	= max.	2x10	W
Grid No.2 voltage	V_{g_2}	= max.	250	V
Grid No.2 dissipation	W_{g_2}	= max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	75	V
Grid No.1 circuit resistance with fixed bias	R_{g_1}	= max.	50	kΩ
Grid No.1 circuit resistance with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

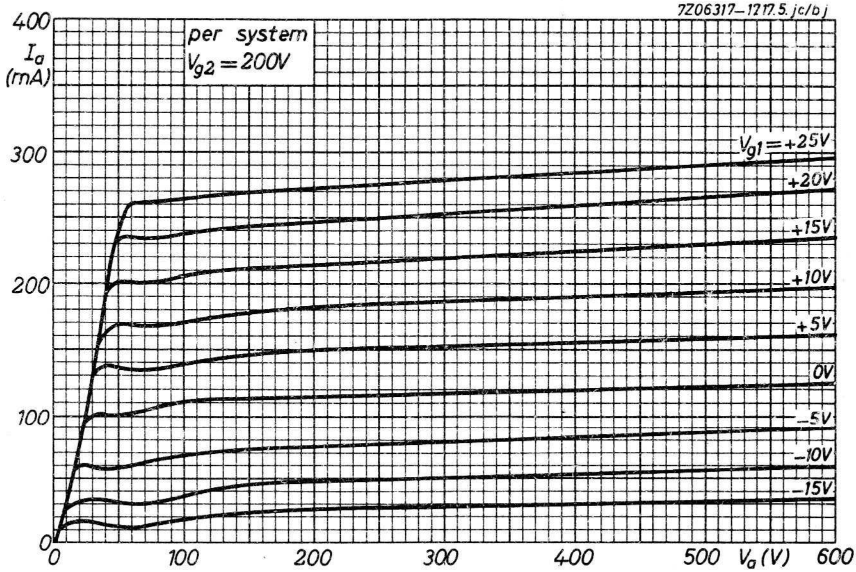
OPERATING CONDITIONS, two systems in push-pull

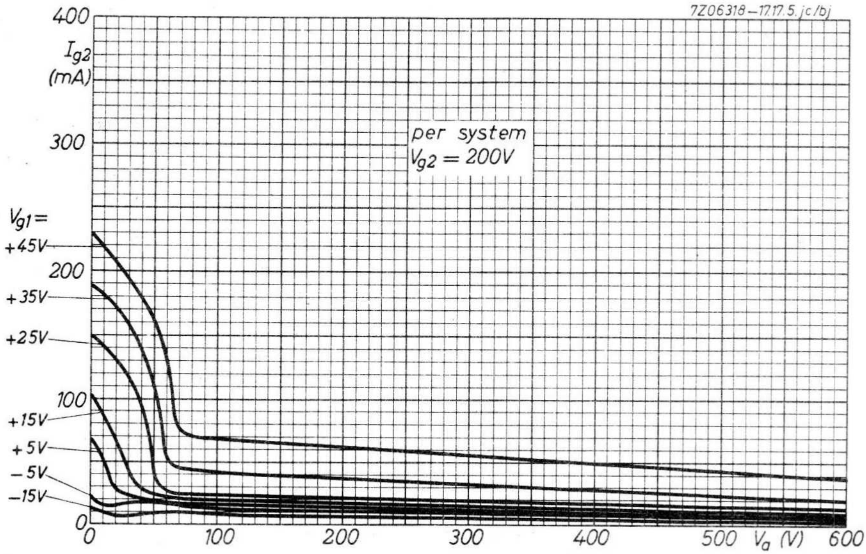
Anode voltage	V_a	=	500		300		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-26		-25		V
Load resistance	$R_{aa'\sim}$	=	20		11		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	0	52	0	50	V
Anode current	I_a	=	2x12.5	2x36.5	2x12.5	2x35	mA
Grid No.2 current	I_{g_2}	=	2x0.35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

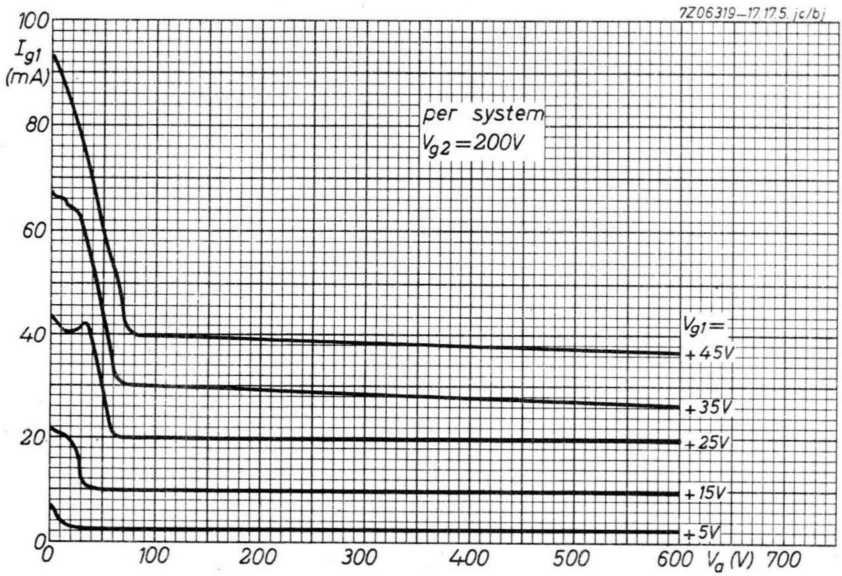

7Z06320-17.17.5.jc/bj
per system
$V_{g2} = 250V$
I_a (mA)
$V_{g1} = +25V$
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
V_a (V)
0
100
200
300
400
500
600


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


7Z06317–1217.5.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
40
$V_{g1} =$
+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

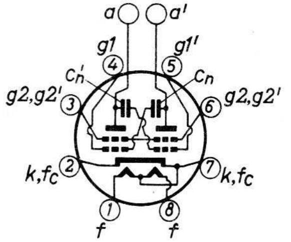
TYPICAL CHARACTERISTICS

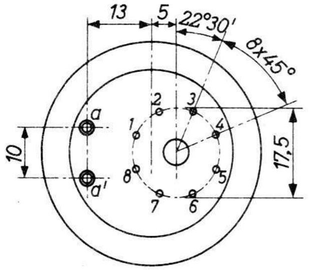
Anode voltage	V_a	=	350	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	25	mA
Mutual conductance	S	=	10.5	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	26	

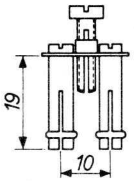
TEMPERATURE LIMIT (Absolute limit)

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

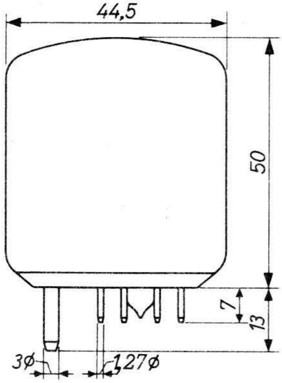
MECHANICAL DATA Dimensions in mm







Example of anode-tank circuit connector at 960 MHz



Socket assembly : 2422 501 90007

Net mass : 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.

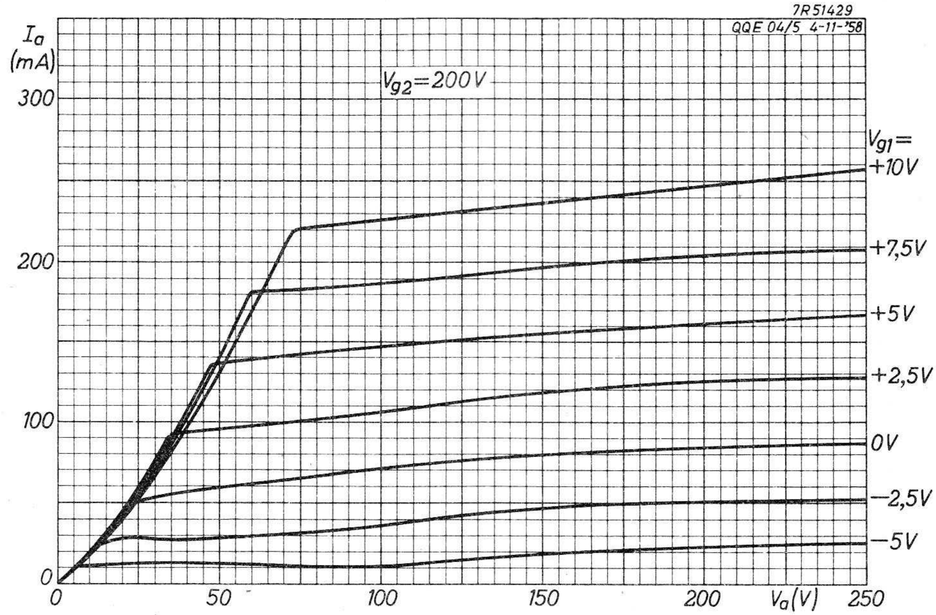
R.F. CLASS C FREQUENCY TRIPLER

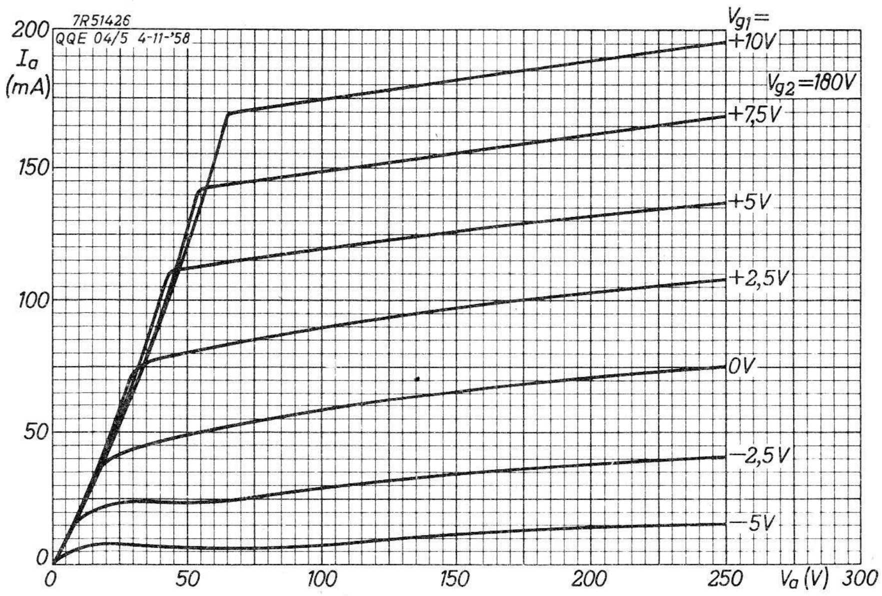
LIMITING VALUES (Absolute limits)

			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


7R51426
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

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_{ag1}	<	0.07	pF
Cathode to grid No.2	C_{kg2}	=	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 °C
Bulb temperature	max. 220 °C

MECHANICAL DATA

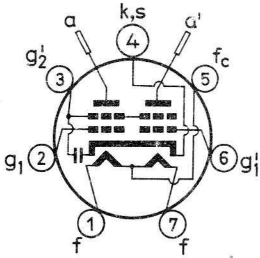
Dimensions in mm

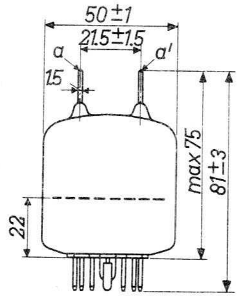
Base : Septar

Socket : 2422 513 00001

Anode connector : 40615

Net. weight : 60 g





Mounting position: arbitrary

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

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

Frequency	f		up to 200	up to 250	MHz
Anode voltage	V_a	=	max. 750	max. 670	V
Anode input power	W_{ia}	=	max. 2x18	max. 2x16	W
Anode dissipation	W_a	=	max. 2x7.5		W
Anode current	I_a	=	max. 2x45		mA
Grid No.2 voltage	V_{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

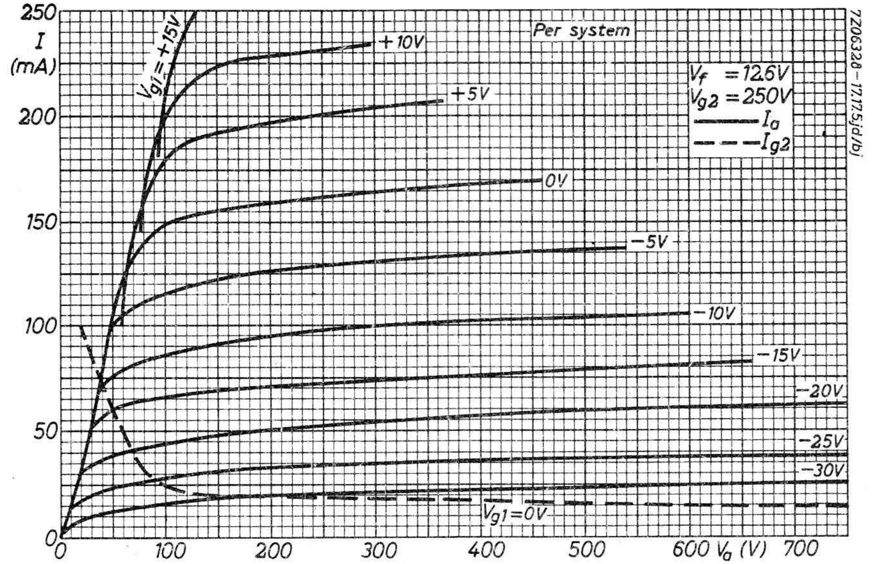
I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

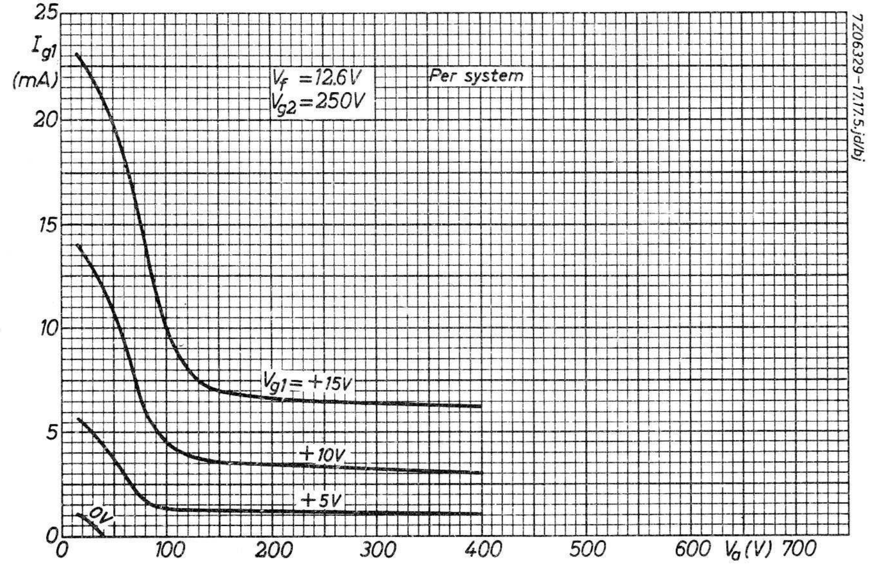
Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x18	W
Anode dissipation	W_a	=	max.	2x7.5	W
Anode current	I_a	=	max.	2x47.5	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	V
Grid 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


250
I
(mA)
200
150
100
50
0
0
100
200
300
400
500
600 V_a (V)
700
$V_{g1}=+15V$
+10V
+5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
$V_{g1}=0V$
Per system
V_f = 12.6V
V_{g2} = 250V
I_a
I_{g2}
7Z06328-17.17.5.jd/bj


25
I_{g1}
(mA)
20
15
10
5
0
0
100
200
300
400
500
600 V_a (V) 700
V_f = 12.6V
V_{g2} = 250V
Per system
$V_{g1}=+15V$
+10V
+5V
0V
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.	
λ (m)	Freq. (MHz)	V_a (V)	W_o (W)
6/2	50/150	500	20
		400	18
4/1.3	75/225	400	12

B mod.	
V_a (V)	W_o (W)
600	86
450	60
300	37

HEATING: indirect; cathode oxide-coated

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

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	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

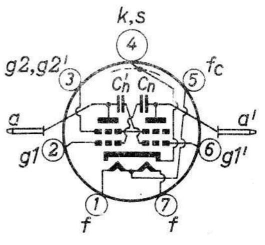
Dimensions in mm

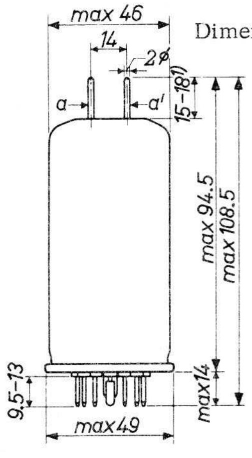
Base : Septar

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

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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	$V_{g_1g_1'p}$	=	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

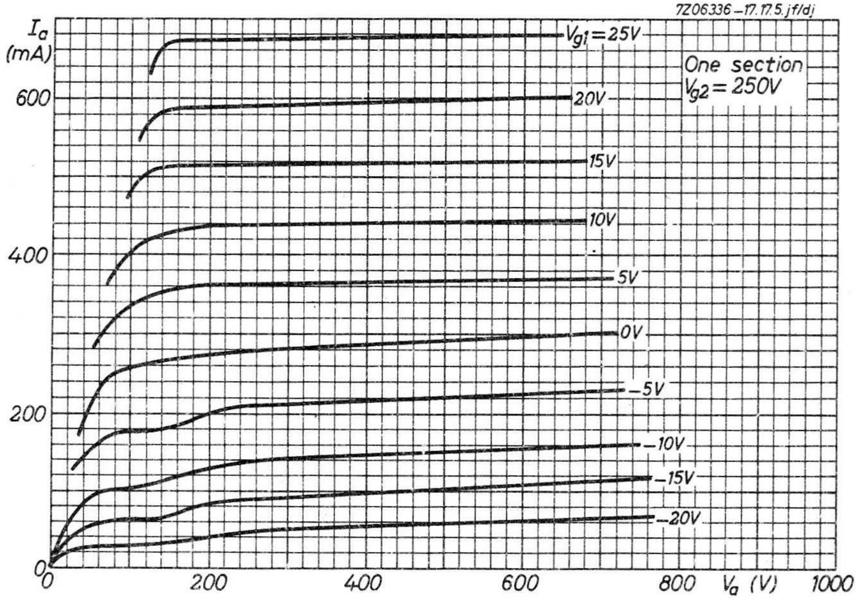
LIMITING VALUES (Absolute limits)

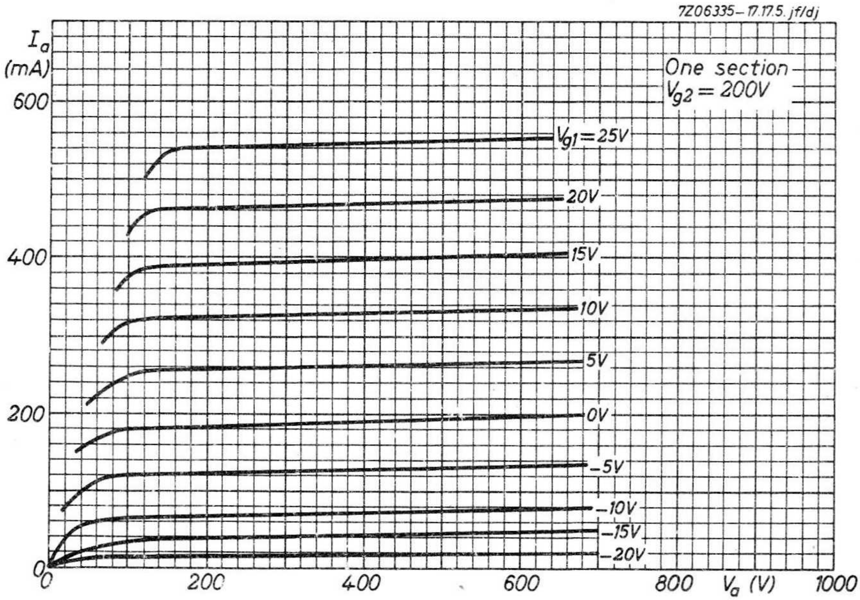
Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x60	W
Anode dissipation	W_a	=	max.	2x20	W
Anode current	I_a	=	max.	2x110	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x3.5	W
Grid No.1 current	I_{g_1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}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

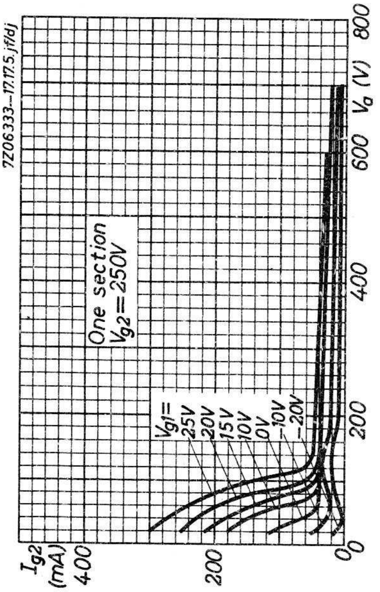
OPERATING CONDITIONS, two systems in push-pull

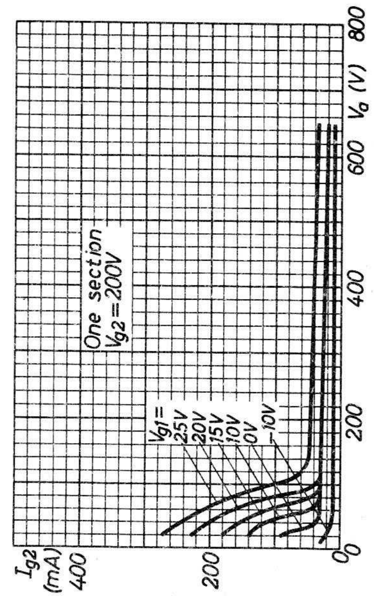
V_a	=	600		450		300		V
V_{g_1} 1)	=	−25		−25		−25		V
V_{g_2}	=	250		250		250		V
$R_{aa'\sim}$	=	8.0		6.0		4.0		kΩ
$V_{g_1g_1'p}$	=	0	78	0	76	0	75	V
I_a	=	2x25	2x100	2x25	2x97	2x25	2x94	mA
I_{g_1}	=	0	2x2.6	0	2x2.6	0	2x2.6	mA
I_{g_2}	=	1.2	26	1.9	28	2.8	28	mA
W_{ig_1}	=	0	2x0.1	0	2x0.1	0	2x0.1	W
W_{g_2}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

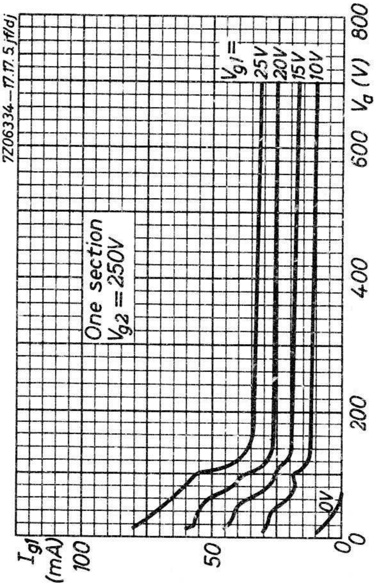
1) Individual adjustment of the grid bias of each system is recommended

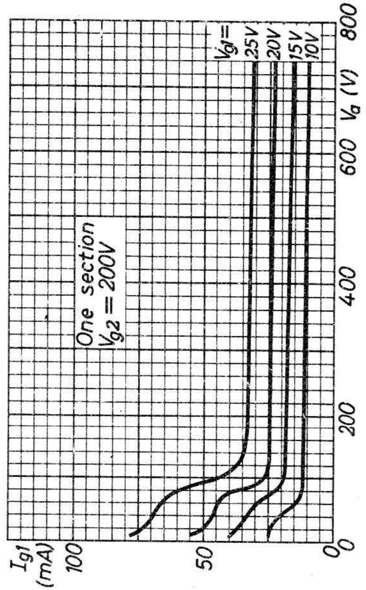

7Z06336-17.17.5.jf/dj
I_a (mA)
600
400
200
0
$V_{g1}=25V$
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
One section
$V_{g2}=250V$
0
200
400
600
800
V_a (V)
1000

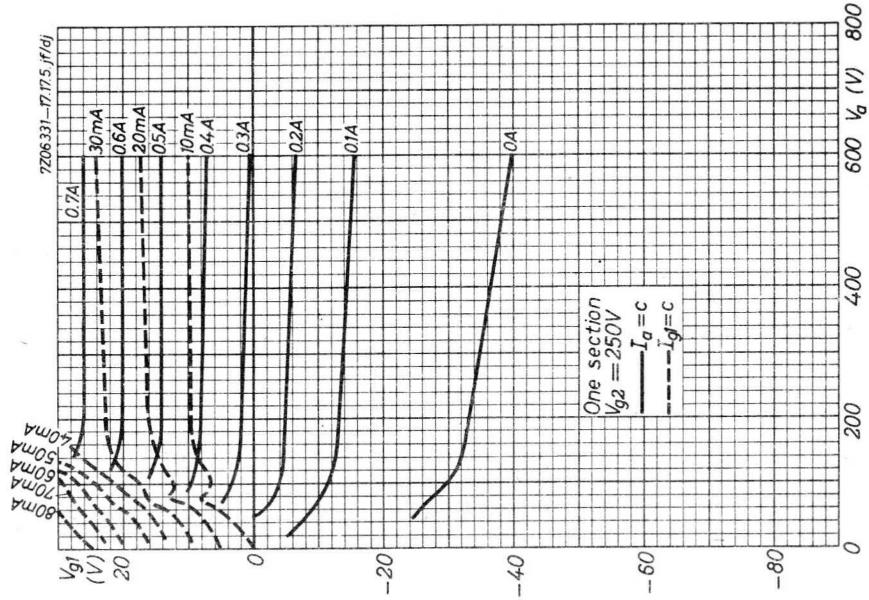

7Z06335-17.17.5.jf/dj
I_a (mA)
600
400
200
0
One section
$V_{g2}=200V$
$V_{g1}=25V$
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
0
200
400
600
800
V_a (V)
1000

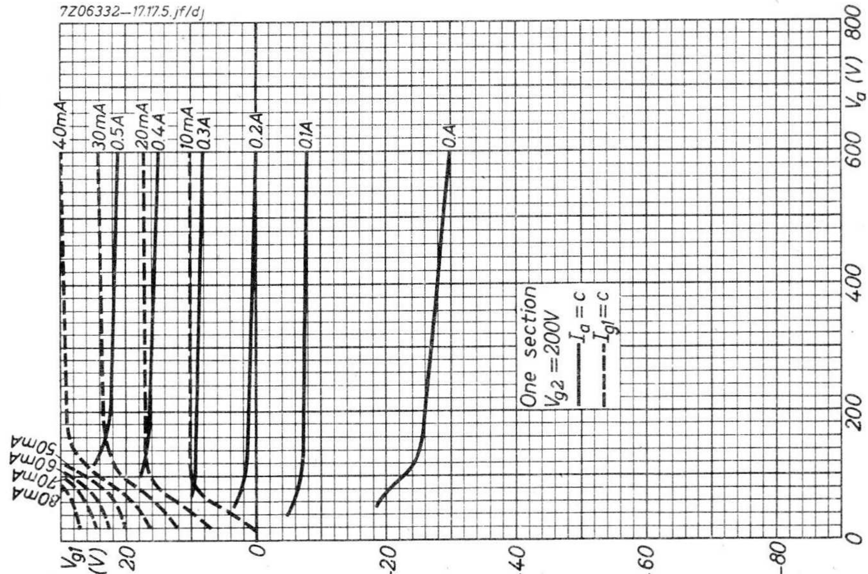

7Z06333–17.17.5.jf/dj
One section
Vg2 = 250V
Vg1 =
25V
20V
15V
10V
0V
−10V
−20V
Ig2 (mA)
400
200
0
0
200
400
600
800
Va (V)

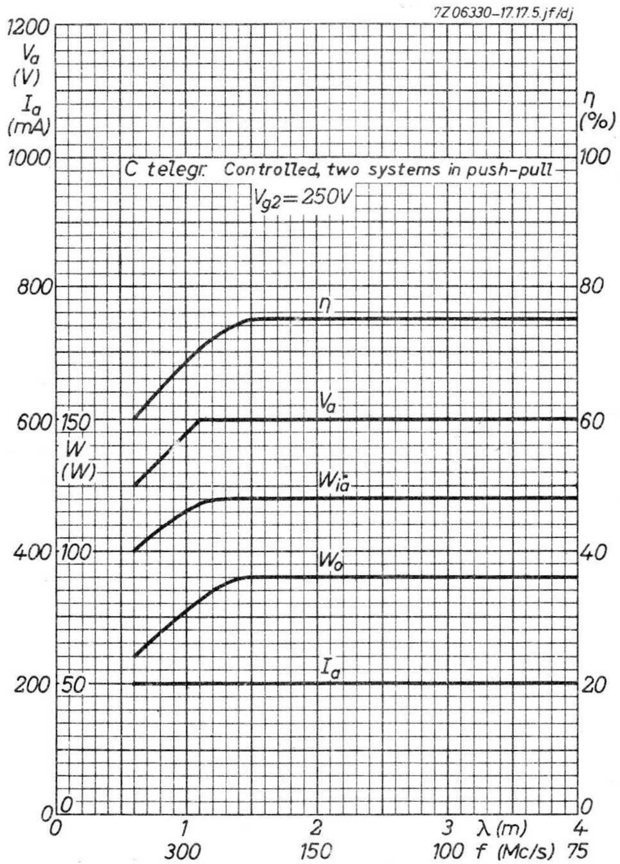

One section
Vg2 = 200V
Vg1 =
25V
20V
15V
10V
0V
−10V
Ig2 (mA)
400
200
0
0
200
400
600
800
Va (V)


7Z06334–17.17.5.jf/dj
One section
Vg2 = 250V
Vg1 =
25V
20V
15V
10V
0V
Ig1 (mA)
100
50
0
0
200
400
600
800
Va (V)


One section
Vg2 = 200V
Vg1 =
25V
20V
15V
10V
Ig1 (mA)
100
50
0
0
200
400
600
800
Va (V)


7Z06331—17.17.5.jf/dj
V_{g1} (V)
20
0
−20
−40
−60
−80
0
200
400
600
800
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
One section
V_{g2} = 250V
I_a = c
I_{g1} = c


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


7Z 06330-17.17.5.jf/dj
C telegr. Controlled, two systems in push-pull
$V_{g2} = 250V$
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
η
V_a
W_{ia}
W_o
I_a
0
1
2
3
4
λ (m)
300
150
100
75
f (Mc/s)

R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Frequ. (MHz)	C telegr.		B teleph.		C an. mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
>11	<28	12 10	22 18	12	5	10	9,5	12 10	42 16

HEATING : direct; tungsten filament

Filament voltage	V_f		21,5	V
Filament current	I_f		80	A
Filament starting current	I_f	max.	160	A
Cold filament resistance	R_{fo}		22,4	mΩ

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 11 A.

TYPICAL CHARACTERISTICS

Transconductance	S	10	mA/V
Amplification factor	μ	38	
Saturation current	I_{sat}	11	A

CAPACITANCES

Filament to anode	C_{fa}	1,4	pF
Grid to filament	C_{gf}	23,5	pF
Grid to anode	C_{ga}	25	pF

COOLING water

It is necessary to direct a low-velocity air flow to the grid seals at frequencies higher than 20 MHz.

[1]) Two tubes.

Rate of flow	q_{min}	20	l/min
Pressure drop	p_i	50	kPa *

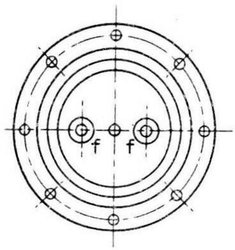
MECHANICAL DATA Dimensions in mm

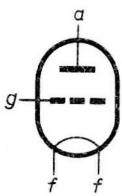
Accessories

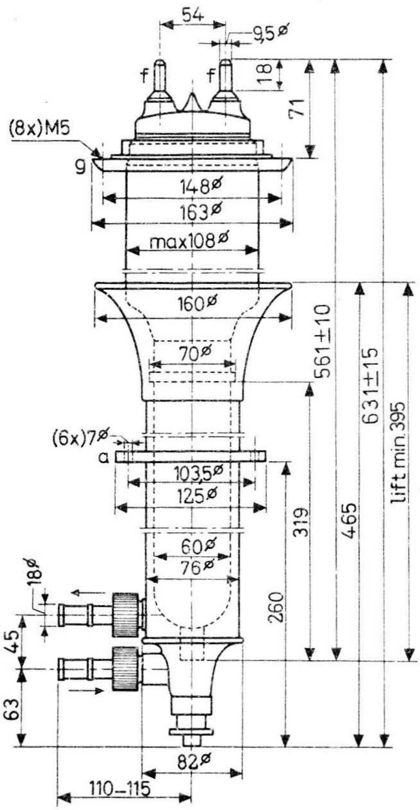
Grid connector	type	40664
Filament connector with cable (2 required)	type	40662
Water jacket (net mass 4,3 kg)	type	K707
O-ring	code	3322 026 83802

Mounting position : exactly vertical with anode down

Net mass : 3,6 kg







* 100 kPa ≈ 1 at.

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	max.	12	kV
Anode dissipation	W_a	max.	18	kW
Grid dissipation	W_g	max.	500	W
Grid circuit resistance	R_g	max.	20	kΩ
Rate of flow (W_a = 18 kW)	q	min.	20	l/min
Outlet temperature of cooling water	t_o	max.	60	°C
Temperature rise of cooling water	$t_o - t_i$	max.	14	°C
Temperature of bulb and seals	t	max.	150	°C

OPERATING CONDITIONS R.F. CLASS C

		Telegraphy		Anode modulation	
Wavelength	λ	>11	>11	<11	m
Anode voltage	V_a	12	10	10	kV
Grid voltage	V_g	-600	-500	-900	V
Anode current	I_a	2,7	2,7	1,4	A
Grid current	I_g	0,4	0,42	0,5	A
Peak grid a.c. voltage	V_{gp}	1800	1600	2100	V
Grid input power	W_{ig}	720	670	1050	W
Anode input power	W_{ia}	32,4	27	14	kW
Anode dissipation	W_a	10,4	9	4,5	kW
Output power	W_o	22	18	9,5	kW
Efficiency	ηa	68	67	68	%
Modulation depth	m			100	%
Modulation power	W_{mod}			7	kW

R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (Mc/s)	C telegr.		C osc.		B teleph.		C_a 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)
4	75	2500	390			2500	65	2000	204
		2000	295			2000	64	1500	153
		1500	210			1500	59	1000	95
		1000	126						
2	150			2500	376				
				2000	282				
1.5	200			2000	198				

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	= 6.3	V
Filament current	I_f	= 5.4	A

CAPACITANCES

Anode to all other elements except grid	C_a	= 0.1	pF
Grid to all other elements except anode	C_g	= 4.3	pF
Anode to grid	C_{ag}	= 5.2	pF

TYPICAL CHARACTERISTICS

Amplification factor	μ	= 25	
Mutual conductance	S (I_a = 44 mA)	= 2.8	mA/V

COOLING: radiation/low-velocity air flow

It is necessary to direct a low-velocity air flow to the bottom and the top seal if the tube is used at or near the limiting values at frequencies above 50 Mc/s.

7Z2 3779

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	2500	V
Anode dissipation	W_a	=	max.	135	W [1])
Grid dissipation	W_g	=	max.	16	W
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ
Cathode current	I_k	=	max.	250	mA
Peak cathode current	I_{kp}	=	max.	1.6	A
Temperature of anode seal		=	max.	220	°C
Bottom temperature		=	max.	180	°C

MECHANICAL DATA

Dimensions in mm

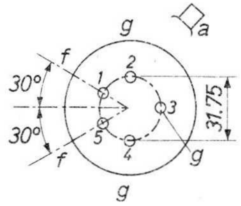
Base : giant 5p

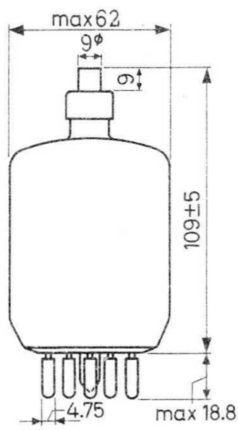
Anode connector : 40624

Socket : 2422 512 01001

Socket with grounded grid connections: 40215/01

Net weight : 110 g





Mounting position: vertical with base up or down

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

7Z2 8626

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

Wavelength	λ	=	4	4	4	4	m
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	−200	−150	−110	−80	V
Anode current	I_a	=	205	205	205	205	mA
Grid current	I_g	=	40	40	40	40	mA
Peak grid A.C. voltage	V_{g_p}	=	390	340	300	260	V
Grid input power	W_{ig}	=	14	13	11	10	W
Anode input power	W_{ia}	=	512	410	308	205	W
Anode dissipation	W_a	=	122	115	98	79	W
Output power	W_o	=	390	295	210	126	W
Efficiency	η	=	76	72	68	61.5	%

OPERATING CONDITIONS R.F. CLASS B TELEPHONY

Wavelength	λ	=	4	4	4	m
Anode voltage	V_a	=	2500	2000	1500	V
Grid voltage	V_g	=	−87	−67	−45	V
Anode current	I_a	=	77	97	120	mA
Peak grid A.C. voltage	V_{g_p}	=	100	100	100	V
Anode input power	W_{ia}	=	193	194	180	W
Anode dissipation	W_a	=	128	130	121	W
Output power	W_o	=	65	64	59	W
Efficiency	η	=	34	33	33	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	20	28	52	mA
Grid input power	W_{ig}	=	3.6	5.1	9.4	W

7Z2 3781

OPERATING CONDITIONS R.F. CLASS C ANODE MODULATION; two tubes

Wavelength	λ	=	4	4	4	m
Anode voltage	V_a	=	2000	1500	1000	V
Grid voltage	V_g	=	−225	−180	−130	V
Anode current	I_a	=	255	255	255	mA
Grid current	I_g	=	80	80	80	mA
Peak grid A.C. voltage	V_{gp}	=	415	370	320	V
Grid input power	W_{ig}	=	30	27	23	W
Anode input power	W_{ia}	=	510	382	255	W
Anode dissipation	W_a	=	102	76	65	W
Output power	$W_{o.}$	=	408	306	190	W
Efficiency	η	=	80	80	74.5	%
Modulation depth	m	=	100	100	100	%
Modulation power	W_{mod}	=	255	191	126	W

OPERATING CONDITIONS AS R.F. CLASS C OSCILLATOR; two tubes

Wavelength	λ	=	2	2	1.5	m
Anode voltage	V_a	=	2500	2000	2000	V
Anode current	I_a	=	410	410	346	mA
Grid current	I_g	=	80	80	80	mA
Grid resistor	R_g	=	2500	1875	1875	Ω
Anode input power	W_{ia}	=	1025	820	692	W
Anode dissipation	W_a	=	245	230	270	W
Grid input power	W_{ig}	=	28	26	26	W
Output power	W_o	=	752	564	396	W
Efficiency	η	=	73	69	57	%

7Z2 3782

OPERATING CONDITIONS AS R.F. CLASS C OSCILLATOR for high frequency heating and diathermy generators

A. With anode voltage from single-phase full-wave rectifier without filter

Wavelength	λ	=	7.3	m
Anode voltage	V_a	=	2000	V [1]
Anode current	I_a	=	170	mA
Grid current	I_g	=	34	mA
Grid resistor	R_g	=	3750	Ω
Anode input power	W_{ia}	=	420	W
Anode dissipation	W_a	=	120	W
Grid input power	W_{ig}	=	10	W
Output power	W_o	=	290	W
Efficiency	η	=	69	%

B. With anode and grid alternating voltage. Phase-shift of 180^o between V_a and V_g

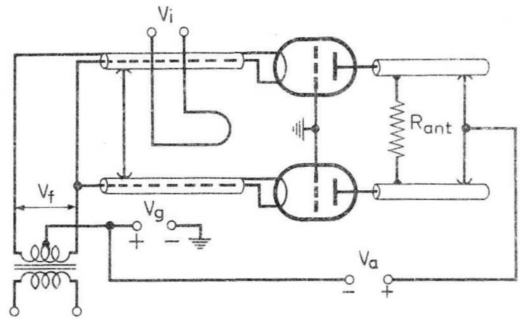
Wavelength	λ	=	7.3	m
Anode voltage	V_a	=	2500	V_{RMS}
Anode current	I_a	=	90	mA
Grid current	I_g	=	20	mA
Grid resistor	R_g	=	1700	Ω
Grid voltage	V_g	=	85	V_{RMS}
Anode input power	W_{ia}	=	255	W
Anode dissipation	W_a	=	85	W
Output power	W_o	=	170	W
Efficiency	η	=	67	%

[1]) Mean value

7Z2 3783

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

grounded grid, two tubes



Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	-200	-150	-110	-80	V
Anode current	I_a	=	410	410	410	410	mA
Grid current	I_g	=	80	80	80	80	mA
Peak grid A.C. voltage	V_{gp}	=	390	340	300	260	V
Grid input power	W_{ig}	=	158	136	118	100	W
Anode input power	W_{ia}	=	1025	820	615	410	W
Anode dissipation	W_a	=	245	230	195	158	W
Output power	W_o	=	780+130	590+110	420+96	252+80	W[1])
Efficiency	η	=	76	72	68	61.5	%[2])

1) Power transferred from driving stage included

2) Pure tube efficiency

7Z2 3784

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

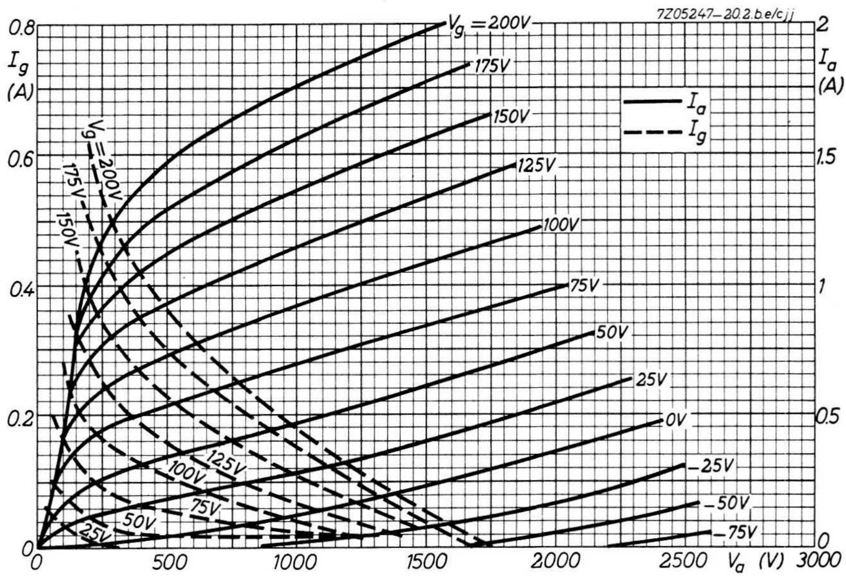
Anode voltage	V_a	=	max.	2500	V
Anode dissipation	W_a	=	max.	135	W
Grid dissipation	W_g	=	max.	16	W
Cathode current	I_k	=	max.	250	mA
Peak cathode current	I_{kp}	=	max.	1.6	A

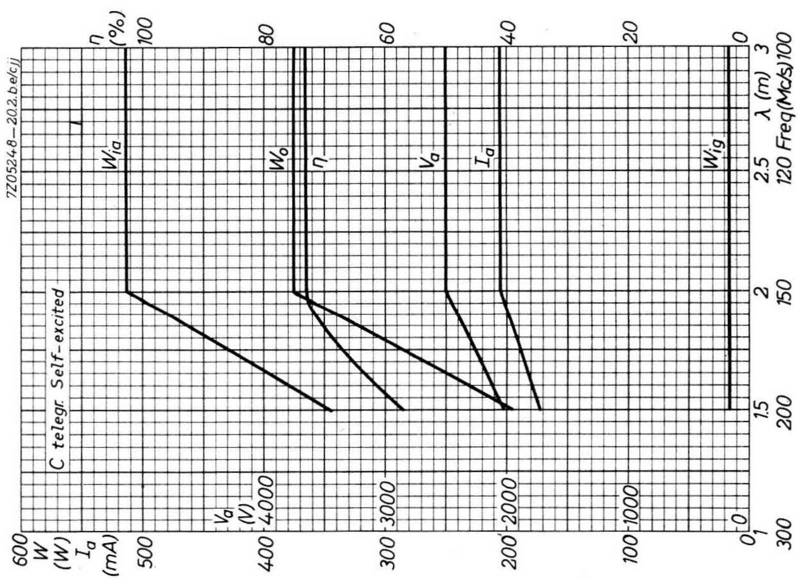
OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	2500		2000		V
Grid voltage	V_g	=	-86		-65		V
Load resistance	$R_{aa\sim}$	=	18.2		12.0		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	412	0	394	V
Anode current	I_a	=	2x30	2x178	2x30	2x208	mA
Grid current	I_g	=	0	2x42	0	2x42	mA
Grid input power	W_{ig}	=	0	2x7.8	0	2x7.3	W
Anode input power	W_{ia}	=	2x75	2x445	2x60	2x416	W
Anode dissipation	W_a	=	2x75	2x95	2x60	2x101	W
Output power	W_o	=	0	700	0	630	W
Total harmonic distortion	d_{tot}	=	–	5.0	–	3.7	%
Efficiency	η	=	–	78.5	–	76	%

Anode voltage	V_a	=	1500		1000		V
Grid voltage	V_g	=	-46		-23		V
Load resistance	$R_{aa\sim}$	=	8.5		5.0		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	340	0	295	V
Anode current	I_a	=	2x30	2x210	2x30	2x210	mA
Grid current	I_g	=	0	2x40	0	2x40	mA
Grid input power	W_{ig}	=	0	2x6.1	0	2x5.4	W
Anode input power	W_{ia}	=	2x45	2x315	2x30	2x210	W
Anode dissipation	W_a	=	2x45	2x90	2x30	2x73	W
Output power	W_o	=	0	450	0	274	W
Total harmonic distortion	d_{tot}	=	–	2.9	–	2.2	%
Efficiency	η	=	–	71.5	–	65	%

7Z2 3785


7Z05247-20.2.b.e/cjj
I_g (A)
I_a (A)
I_a
I_g
V_g = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
V_a (V)


7Z05248-20.2.b.e/cjj
C telegr. Self-excited
η (%)
W_{ia}
W_o
η
V_a
I_a
W_{ig}
λ (m)
Freq (Mc/s)
V_a (V)
W (W)
I_a (mA)

R.F. POWER TRIODE

QUICK REFERENCE DATA

λ (m)	Freq. (Mc/s)	C telegr.		C grounded grid		B teleph.		C_a 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)
2	150	2500	390			2500	65		
		2000	295			2000	64	2000	205
		1500	210			1500	59	1500	154
		1000	126					1000	96
3	100			2500	910				
				2000	700				
				1500	516				
				1000	332				

λ (m)	Freq. (Mc/s)	C osc. industrial				B mod. two tubes	
		V_a (V)	W_o (W)	$V_a \sim$ (V)	W_o (W)	V_a (V)	W_o (W)
6	50	2000	290	2500	170	2500	700
						1000	274

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3	V
Filament current	I_f	=	5.8	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.1	pF
Grid to all other elements except anode	C_g	=	4.9	pF
Anode to grid	C_{ag}	=	5.0	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	2500	V
Anode current	I_a	=	60	mA
Amplification factor	μ	=	25	
Mutual conductance	S	=	2.8	mA/V

7Z2 3440

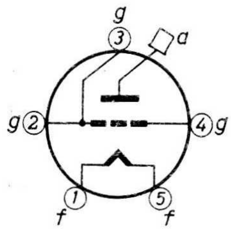
TEMPERATURE LIMITS (Absolute limits)

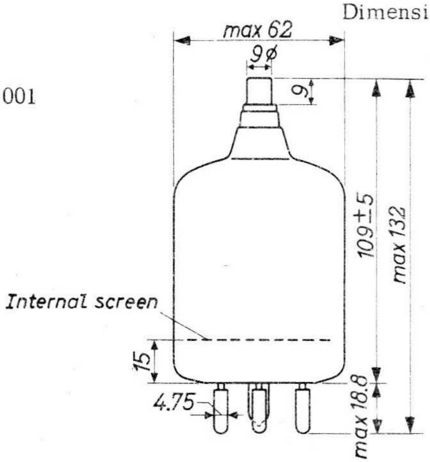
Temperature of anode seal	=	max. 220 °C
Bottom temperature	=	max. 180 °C

It is recommended to direct a low-velocity air flow on bottom and top seal if the tube is used at or near the limiting values at frequencies above 50 Mc/s

MECHANICAL DATA Dimensions in mm

Base	:	giant 5p
→ Socket	:	2422 512 01001
Anode connector	:	40624
Net weight	:	125 g





Mounting position: vertical with base up or down

COOLING: radiation/low-velocity air flow

7Z2 8627

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	255	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	45	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	150	150	150	150	Mc/s
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	-200	-150	-110	-80	V
Anode current	I_a	=	205	205	205	205	mA
Grid current	I_g	=	40	40	40	40	mA
Peak grid A.C. voltage	V_{g_p}	=	390	340	300	260	V
Grid input power	W_{ig}	=	14	13	11	10	W
Anode input power	W_{ia}	=	512	410	308	205	W
Anode dissipation	W_a	=	122	115	98	79	W
Output power	W_o	=	390	295	210	126	W
Efficiency	η	=	76	72	68	61.5	%

7Z2 3442

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	170	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	200	W
Grid current	I_g	=	max.	55	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	150	150	150	Mc/s
Anode voltage	V_a	=	2500	2000	1500	V
Grid voltage	V_g	=	-87	-67	-45	V
Anode current	I_a	=	77	97	120	mA
Peak grid A.C. voltage	V_{gp}	=	100	100	100	V
Anode input power	W_{ia}	=	193	194	180	W
Anode dissipation	W_a	=	128	130	121	W
Output power	W_o	=	65	64	59	W
Efficiency	η	=	34	33	33	%
Modulation factor	m	=	100	100	100	%
Grid current	I_g	=	20	28	52	mA
Grid input power	W_{ig}	=	3.6	5.1	9.4	W

7Z2 3443

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	2400	V
Anode current	I_a	=	max.	170	mA
Anode dissipation	W_a	=	max.	100	W
Anode input power	W_{ia}	=	max.	340	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	45	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	150	150	150	Mc/s
Anode voltage	V_a	=	2000	1500	1000	V
Grid voltage	V_g	=	-225	-180	-130	V
Anode current	I_a	=	128	128	128	mA
Grid current	I_g	=	40	40	40	mA
Peak grid A.C. voltage	V_{g_p}	=	415	370	320	V
Grid input power	W_{ig}	=	15	14	12	W
Anode input power	W_{ia}	=	256	192	128	W
Anode dissipation	W_a	=	51	38	32	W
Output power	W_o	=	205	154	96	W
Efficiency	η	=	80	80	75	%
Modulation factor	m	=	100	100	100	%
Modulation power	W_{mod}	=	128	96	64	W

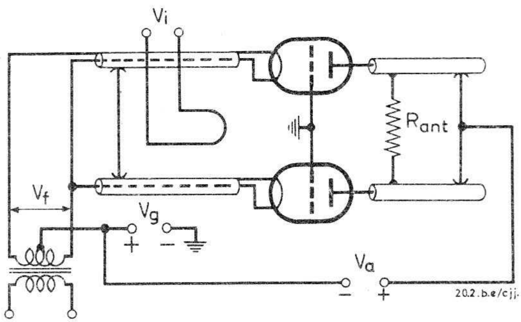
7Z2 3444

R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	205	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	45	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS, two tubes



Frequency	f	=	100	100	100	100	Mc/s
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	-200	-150	-110	-80	V
Anode current	I_a	=	410	410	410	410	mA
Grid current	I_g	=	80	80	80	80	mA
Peak grid A.C. voltage	V_{gp}	=	390	340	300	260	V
Grid input power	W_{ig}	=	158	136	118	100	W
Anode input power	W_{ia}	=	1025	820	615	410	W
Anode dissipation	W_a	=	245	230	195	158	W
Output power	W_o	=	780+130	590+110	420+96	252+80	W [1])
Efficiency	η	=	76	72	68	61.5	% [2])

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

7Z2 3445

R.F. CLASS C OSCILLATOR for high-frequency heating and diathermy generators, with anode voltage from single-phase full-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	2700	V [1]
Anode current	I_a	=	max.	180	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	40	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	50	Mc/s
Anode voltage	V_a	=	2000	V [1]
Anode current	I_a	=	170	mA
Grid current	I_g	=	34	mA
Grid resistor	R_g	=	3750	Ω
Anode input power	W_{ia}	=	420	W
Anode dissipation	W_a	=	120	W
Grid input power	W_{ig}	=	10	W
Output power	W_o	=	290	W
Efficiency	η	=	69	%

[1]) Mean value

7Z2 3446

R.F. CLASS C OSCILLATOR for industrial use with self-rectification. Phase shift of 180° between V_a and V_g

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	Mc/s
Anode voltage	V_a	=	max.	2825	V_{RMS}
Anode current	I_a	=	max.	110	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	340	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current	I_g	=	max.	35	mA
Grid circuit resistance with fixed grid bias	R_g	=	max.	0.1	MΩ
Grid circuit resistance with automatic grid bias	R_g	=	max.	0.2	MΩ

OPERATING CONDITIONS

Frequency	f	=	50	Mc/s
Anode voltage	V_a	=	2500	V_{RMS}
Anode current	I_a	=	90	mA
Grid current	I_g	=	20	mA
Grid resistor	R_g	=	1700	Ω
Grid voltage	V_g	=	85	V_{RMS}
Anode input power	W_{ia}	=	255	W
Anode dissipation	W_a	=	85	W
Output power	W_o	=	170	W
Efficiency	η	=	67	%

7Z2 3447

A.F. CLASS B AMPLIFIER AND MODULATOR

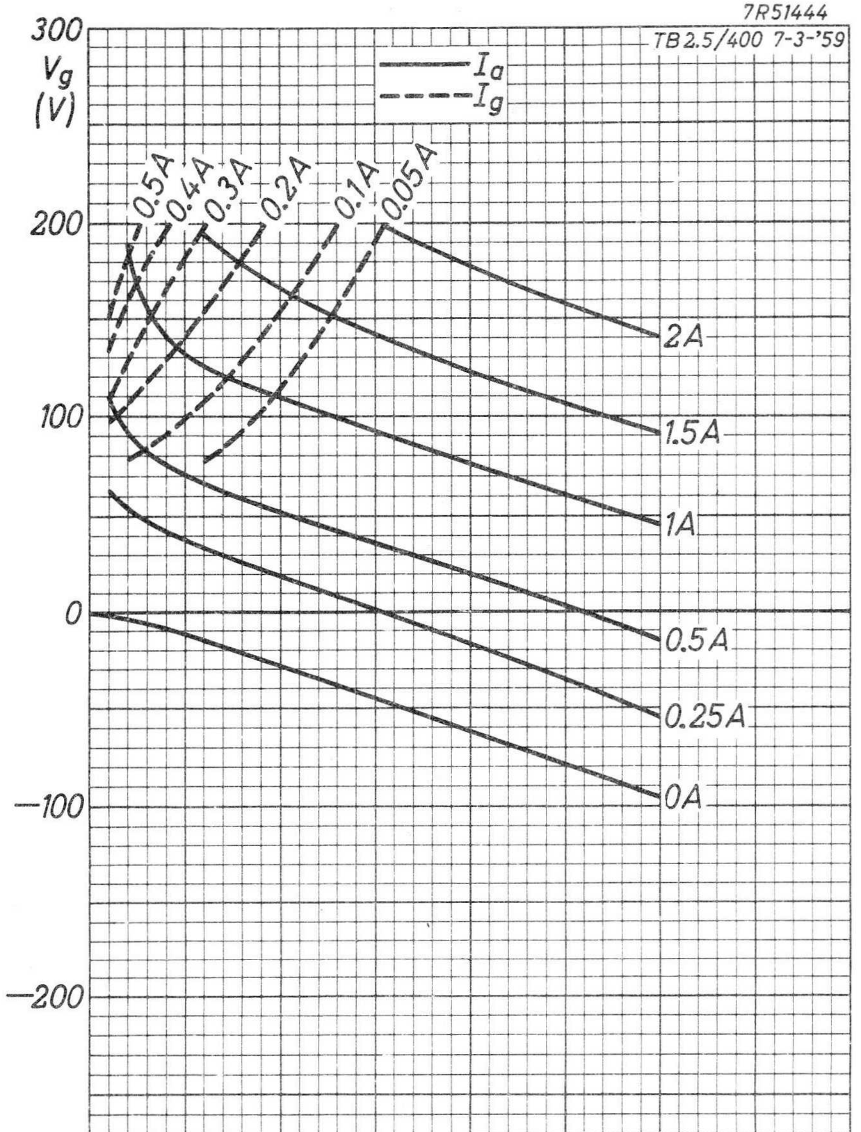
LIMITING VALUES (Absolute limits)

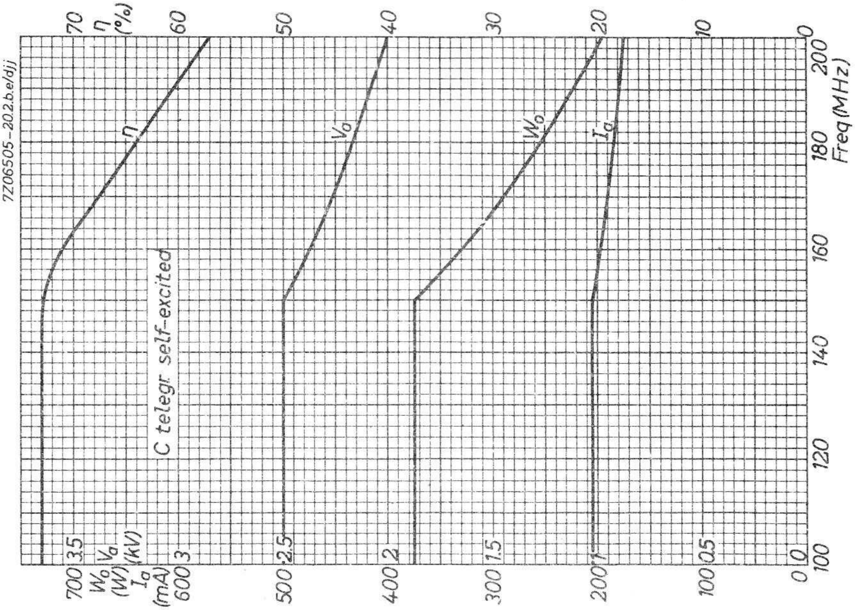
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	210	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Grid current	I_g	=	max.	45	mA

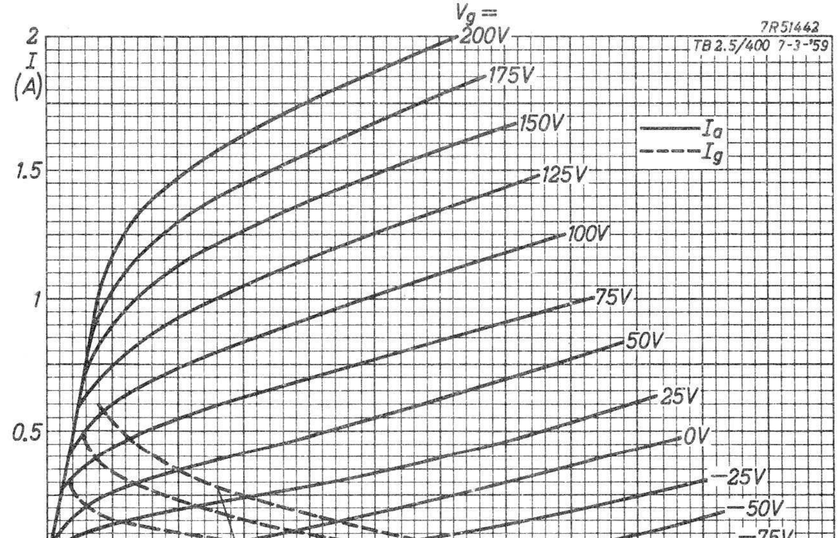
OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	2500		1000		V
Grid voltage	V_g	=	−86		−23		V
Load resistance	$R_{aa\sim}$	=	18.2		5.0		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	412	0	295	V
Anode current	I_a	=	2x30	2x178	2x30	2x210	mA
Grid current	I_g	=	0	2x42	0	2x40	mA
Grid input power	W_{ig}	=	0	2x7.8	0	2x5.4	W
Anode input power	W_{ia}	=	2x75	2x445	2x30	2x210	W
Anode dissipation	W_a	=	2x75	2x95	2x30	2x73	W
Output power	W_o	=	0	700	0	274	W
Total harmonic distortion	d_{tot}	=	–	5.0	–	2.2	%
Efficiency	η	=	–	78.5	–	65	%

7Z2 3448


7R51444
TB2.5/400 7-3-'59
300
200
100
0
—100
—200
—300
V_g (V)
I_a
I_g
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
2A
1.5A
1A
0.5A
0.25A
0A
0
1
2
3
4
V_a (kV)


7Z06505-20.2.b.e/djj
C telegr. self-excited
η (%)
V_a (kV)
W_o (W)
I_a (mA)
η
V_a
W_o
I_a
Freq (MHz)


7R51442
TB 2.5/400 7-3-'59
I (A)
V_g =
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
I_a
I_g
V_a (kV)
V_g=200V
150V
100V

R.F. POWER TRIODE

QUICK REFERENCE DATA								
Freq. (Mc/s)	C telegr.		C grounded grid		C osc.		B mod.	
	V_a (kV)	W_o (W)	V_a (kV)	W_o[1] (W)	V_a (kV)	W_o[1] (W)	V_a (kV)	W_o[1] (W)
100	4	1200			4	2320	4	1550
	3	840	3	1936	3	1626	3	1360
	2.5	750	2.5	1747			2.5	1140
	2	585	2	1374				
	1.5	425	1.5	1040				

Freq. (Mc/s)	C oscillator, industrial			
	V_a (kV)	W_o (W)	V_a (kV)	W_o (W)
50	3.5	1100	4	630
	2.25	685	3	415

HEATING: direct, parallel supply; filament thoriated tungsten

Filament voltage	V_f	=	$5\ \text{V}\ ^{+5\%}_{-10\%}$
Filament current	I_f	=	14.1 A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.16 pF
Grid to all other elements except anode	C_g	=	6.3 pF
Anode to grid	C_{ag}	=	5.0 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3 kV
Anode current	I_a	=	90 mA
Mutual conductance	S	=	5 mA/V
Amplification factor	μ	=	25

[1] Two tubes

TEMPERATURE LIMITS (Absolute limits)

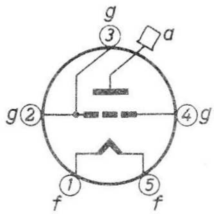
Bulb temperature	t_{bulb}	= max. 350	°C
Anode seal temperature	t_a	= max. 220	°C
Pin temperature	t_{pin}	= max. 180	°C

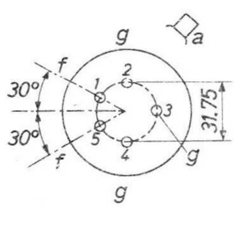
COOLING

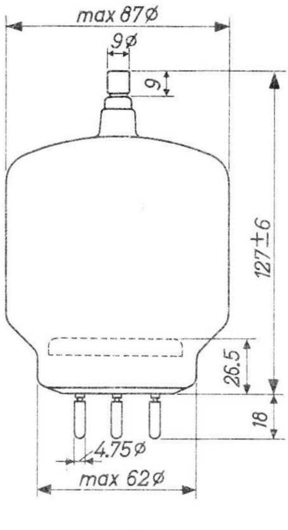
In cases where the maximum permissible temperatures are likely to be exceeded, as would normally be the case at frequencies above 30 Mc/s with full ratings, a low-velocity air flow has to be directed onto the anode seal and the bottom of the envelope. The cooling will be facilitated by the use of a blower and a glass chimney type 40666

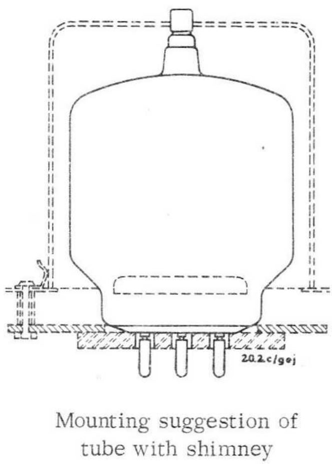
MECHANICAL DATA Dimensions in mm

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









Mounting suggestion of tube with shimney

Mounting position: vertical with base up or down

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

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

LIMITING VALUES (Absolute limits)

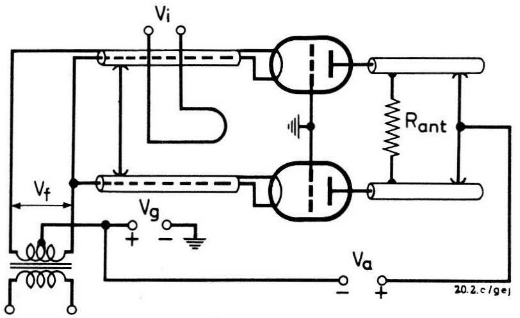
Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	4	kV
Anode input power	W_{ia}	=	max.	1550	W
Anode dissipation	W_a	=	max.	350	W
Negative grid voltage	$-V_g$	=	max.	500	V
Grid dissipation	W_g	=	max.	40	W
Grid circuit resistance	R_g	=	max.	100	kΩ
Cathode current	I_k	=	max.	500	mA

OPERATING CONDITIONS

Frequency	f	=	100	100	100	100	100	Mc/s
Anode voltage	V_a	=	4	3	2.5	2	1.5	kV
Grid voltage	V_g	=	-350	-250	-200	-150	-120	V
Peak grid A.C. voltage	V_{gp}	=	535	430	380	320	295	V
Anode current	I_a	=	380	363	400	400	400	mA
Grid current	I_g	=	80	69	69	80	80	mA
Driving power	W_{dr}	=	40	27	23.5	23	21.5	W
Anode input power	W_{ia}	=	1520	1090	1000	800	600	W
Anode dissipation	W_a	=	320	250	250	215	175	W
Output power	W_o	=	1200	840	750	585	425	W
Efficiency	η	=	79	77	75	73	71	%

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY (continued)

OPERATING CONDITIONS, grounded grid, two tubes



Frequency	f	=	100	100	100	100	Mc/s
Anode voltage	V_a	=	3	2.5	2	1.5	kV
Grid voltage	V_g	=	-250	-200	-150	-120	V
Peak grid A.C. voltage	V_{gp}	=	430	380	320	295	V
Anode current	I_a	=	726	800	800	800	mA
Grid current	I_g	=	138	138	160	160	mA
Driving power	W_{dr}	=	310	294	250	233	W
Anode input power	W_{ia}	=	2180	2000	1600	1200	W
Anode dissipation	W_a	=	500	500	430	350	W
Output power	W_o	=	1680+256	1500+247	1170+204	850+190	W [1])
Efficiency	η	=	77	75	73	71	%

[1]) Power transferred from driving stage included

R.F. CLASS C OSCILLATOR

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	4	kV
Anode input power	W_{ia}	=	max.	1550	W
Anode dissipation	W_a	=	max.	350	W
Negative grid voltage	$-V_g$	=	max.	500	V
Grid dissipation	W_g	=	max.	40	W
Grid circuit resistance	R_g	=	max.	100	kΩ
Cathode current	I_k	=	max.	500	mA

OPERATING CONDITIONS, two tubes

Frequency	f	=	100	100	Mc/s
Anode voltage	V_a	=	4	3	kV
Anode current	I_a	=	760	726	mA
Grid current	I_g	=	160	138	mA
Grid resistor	R_g	=	2200	1800	Ω
Driving power	W_{dr}	=	80	54	W
Anode input power	W_{ia}	=	3040	2180	W
Anode dissipation	W_a	=	640	500	W
Output power	W_o	=	2320	1626	W
Efficiency	η	=	77	75	%

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from single-phase full-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f		up to 50	up to 100	up to 150	Mc/s
Anode voltage	V_a	=	max. 3.8	max. 2.7	max. 1.8	kV
Anode input power	W_{ia}	=	max. 1500	max. 975	max. 650	W
Anode dissipation	W_a	=	max. 350	max. 350	max. 350	W
Negative grid voltage	$-V_g$	=	max. 500	max. 500	max. 500	V
Grid dissipation	W_g	=	max. 40	max. 40	max. 40	W
Grid circuit resistance	R_g	=	max. 100	max. 100	max. 100	kΩ
Cathode current	I_k	=	max. 450	max. 450	max. 450	mA

OPERATING CONDITIONS

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	3.5	2.25	kV
Anode current	I_a	=	325	340	mA
Grid current	I_g	=	65	60	mA
Grid resistor	R_g	=	4500	3330	Ω
Anode input power	W_{ia}	=	1400	935	W
Anode dissipation	W_a	=	300	250	W
Output power	W_o	=	1100	685	W
Efficiency	η	=	78	73	%
Output power in the load	W_ℓ	=	900	560	W

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self rectification, 180^{o} phase shift between V_a and V_g

LIMITING VALUES (Absolute limits)

Frequency	f		up to 50	up to 100	up to 150	Mc/s
Transformer voltage	V_{tr}	=	max. 4.5	max. 3.5	max. 2.25	kV_{RMS}
Anode input power	W_{ia}	=	max. 900	max. 730	max. 500	W
Anode dissipation	W_a	=	max. 350	max. 350	max. 350	W
Negative grid voltage	$-V_g$	=	max. 500	max. 500	max. 500	V
Grid dissipation	W_g	=	max. 40	max. 40	max. 40	W
Grid circuit resistance	R_g	=	max. 100	max. 100	max. 100	kΩ
Cathode current	I_k	=	max. 285	max. 285	max. 285	mA

OPERATING CONDITIONS

Frequency	f	=	50	50	Mc/s
Transformer voltage	V_{tr}	=	4	3	kV_{RMS}
Anode current	I_a	=	190	180	mA
Driving voltage	V_g	=	280	110	V_{RMS}
Grid current	I_g	=	35	32	mA
Grid resistor	R_g	=	5500	3000	Ω
Anode input power	W_{ia}	=	840	600	W
Anode dissipation	W_a	=	210	185	W
Output power	W_o	=	630	415	W
Efficiency	η	=	75	69	%
Output power in the load	W_ℓ	=	515	350	W

A.F. CLASS B AMPLIFIER AND MODULATOR two tubes in push-pull

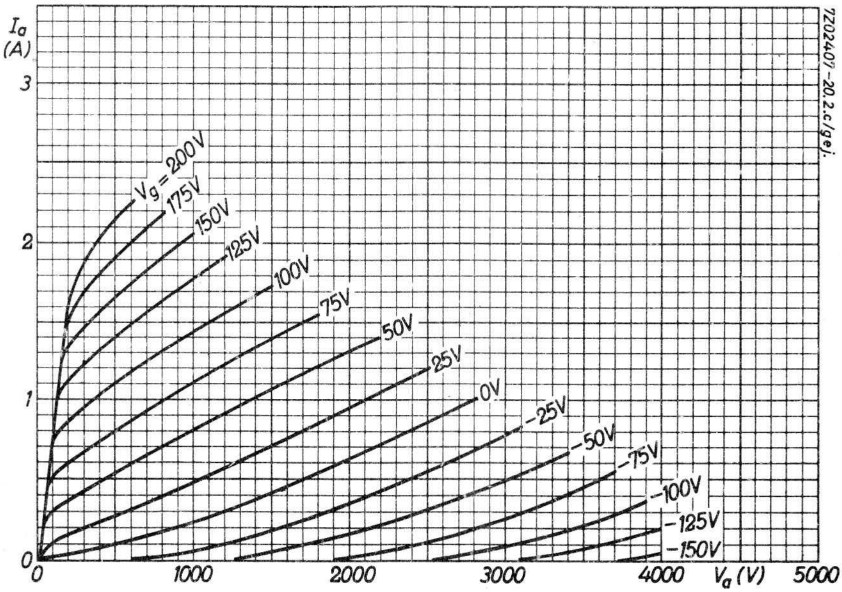
LIMITING VALUES (Absolute limits)

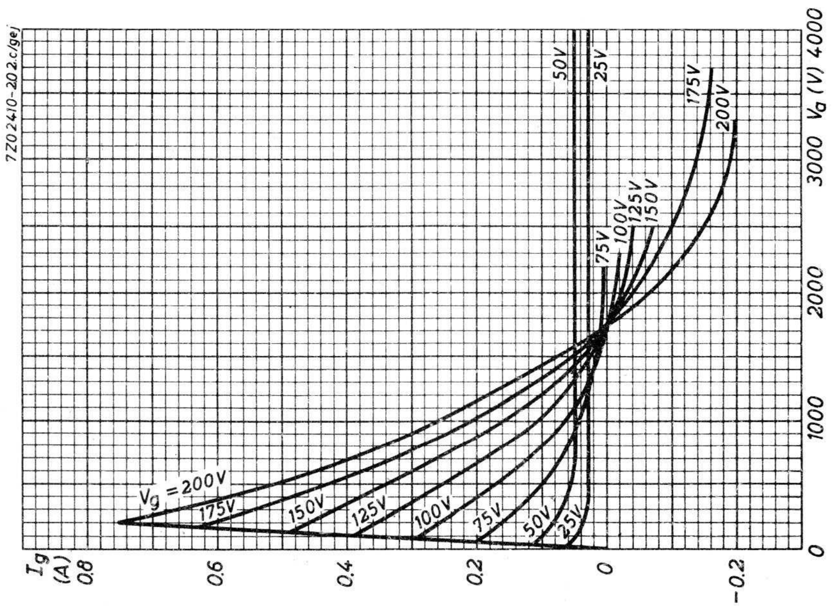
Anode voltage	V_a	=	max.	4	kV
Anode input power	W_{ia}	=	max.	1550	W
Anode dissipation	W_a	=	max.	350	W
Negative grid voltage	$-V_g$	=	max.	500	V
Grid dissipation	W_g	=	max.	40	W
Grid circuit resistance	R_g	=	max.	100	kΩ
Cathode current	I_k	=	max.	500	mA

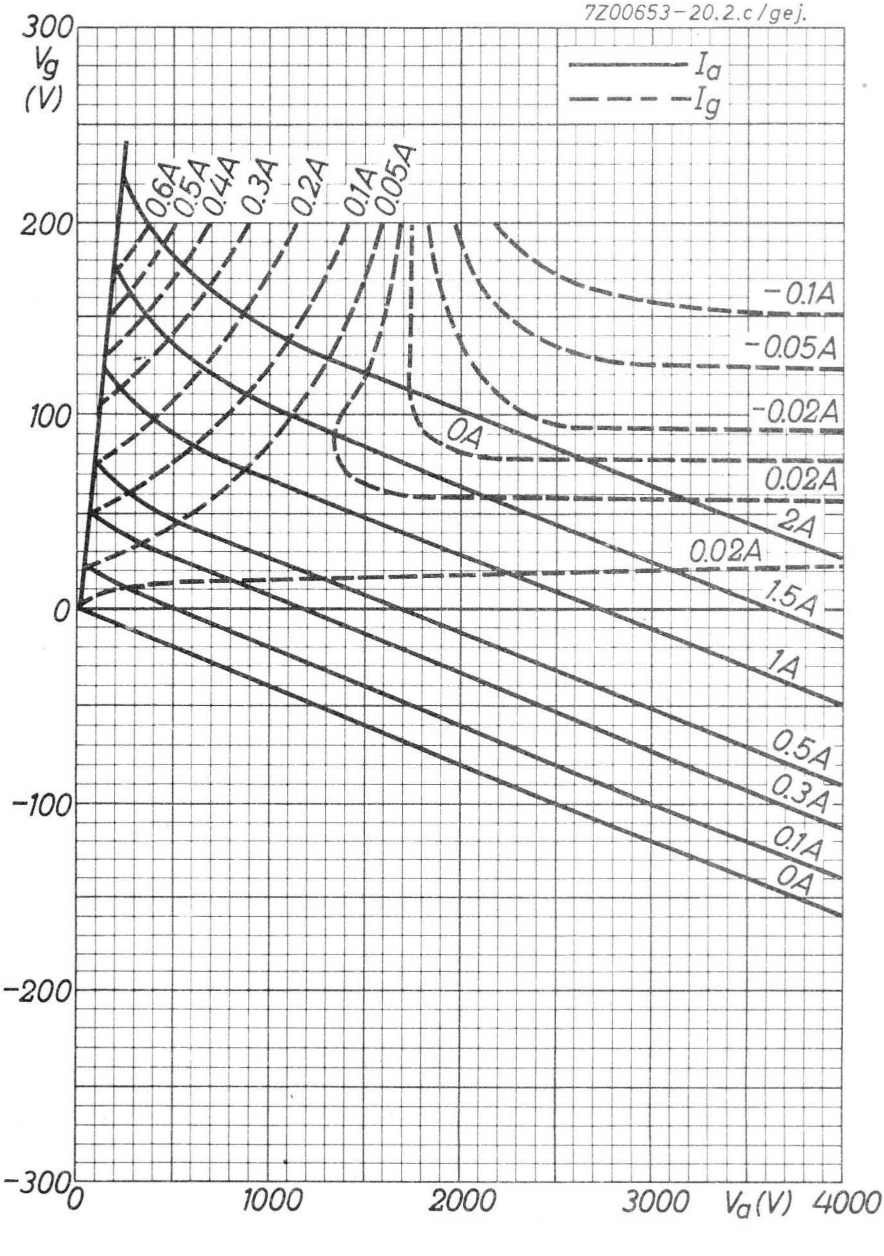
OPERATING CONDITIONS

V_a	=	4		3		2.5		kV
V_g	=	-135		-102		-77.5		V[1]
$R_{aa\sim}$	=	20		14.5		12		kΩ
V_{gg_p}	=	0	485	0	475	0	400	V
I_a	=	2x88	2x270	2x60	2x290	2x90	2x300	mA
I_g	=	0	2x30	0	2x60	0	2x55	mA
W_{dr}	=	0	2x7	0	2x13	0	2x10	W
W_{ia}	=	2x350	2x1080	2x180	2x870	2x225	2x750	W
W_a	=	2x350	2x305	2x180	2x190	2x225	2x180	W
W_o	=	0	1550	0	1360	0	1140	W
d_{tot}	=	-	< 2.5	-	< 2.5	-	< 2.5	%
η	=	-	71.7	-	78.1	-	76	%

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


I_a (A)
3
2
1
0
V_g = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
−125V
−150V
0
1000
2000
3000
4000
V_a (V)
5000
7Z02407-20.2.c/gej.


7Z02410-20.2.c/gej
50V
25V
175V
200V
75V
100V
125V
150V
V_g = 200V
175V
150V
125V
100V
75V
50V
25V
V_a (V)
4000
3000
2000
1000
0
I_g (A)
0.8
0.6
0.4
0.2
0
−0.2


7Z00653-20.2.c/gej.
300
V_g
(V)
200
100
0
-100
-200
-300
0
1000
2000
3000
V_a(V)
4000
I_a
I_g
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
-0.1A
-0.05A
-0.02A
0A
0.02A
2A
0.02A
1.5A
1A
0.5A
0.3A
0.1A
0A

R.F. POWER TRIODE

QUICK REFERENCE DATA										
λ (m)	Freq. (Mc/s)	C telegr.		C grounded grid		C_a mod.			B mod. 2)	
		V_a (V)	W_o (W)	V_a (V)	W_o 1) (W)	V_a (V)	W_o (W)		V_a (V)	W_o (W)
3	100	4000 3500 3000 2500	1690 1430 1175 950	4000 3500 3000 2500	1950 1650 1375 1120	3000	1050		4000 3500 3000 2500	2290 2440 2310 2000

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.17	pF
Grid to all other elements except anode	C_g	=	8.0	pF
Anode to grid	C_{ag}	=	7.0	pF

TYPICAL CHARACTERISTICS

Amplification factor	μ	=	28	
Mutual conductance	S (I_a = 125 mA)	=	4.5	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode seal	=	max.	220	^{o}C
Temperature of bottom pin seals	=	max.	180	^{o}C
Bulb temperature	=	max.	250	^{o}C

---

1) Power transferred from driving stage included
2) Two tubes

COOLING

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

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

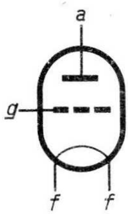
MECHANICAL DATA

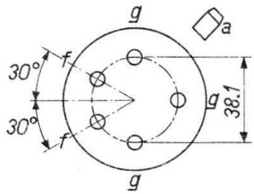
Dimensions in mm

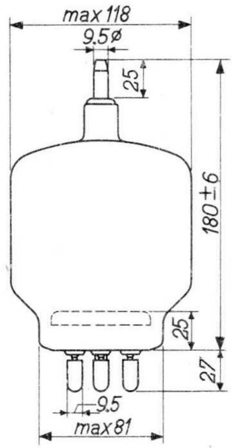
Socket : 2422 512 00001

Anode connector: 40626

Net weight : 420 g







Mounting position: vertical with base up or down

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	4000	V
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W
Grid current	I_g	=	max.	115	mA
Cathode current	I_k	=	max.	650	mA

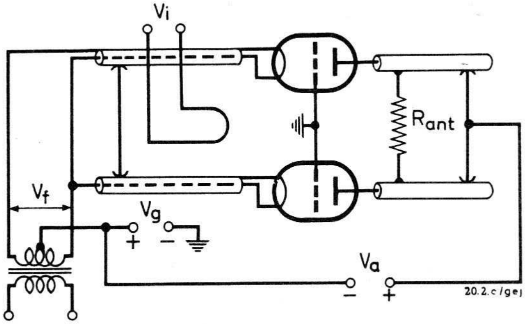
OPERATING CONDITIONS (controlled)

Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid voltage	V_g	=	-350	-300	-250	-200	V
Anode current	I_a	=	535	535	535	535	mA
Grid current	I_g	=	115	115	115	115	mA
Peak grid A.C. voltage	V_{gp}	=	580	520	460	405	V
Grid input power	W_{ig}	=	60	54	48	42	W
Anode input power	W_{ia}	=	2140	1880	1600	1340	W
Anode dissipation	W_a	=	450	450	425	390	W
Output power	W_o	=	1690	1430	1175	950	W
Efficiency	η	=	79	76	73.5	71	%

OPERATING CONDITIONS (self excited)

Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid resistor	R_g	=	3000	2600	2200	1800	Ω
Anode current	I_a	=	535	535	535	535	mA
Grid current	I_g	=	115	115	115	115	mA
Peak grid A.C. voltage	V_{gp}	=	580	520	460	405	V
Grid input power	W_{ig}	=	60	54	48	42	W
Anode input power	W_{ia}	=	2140	1880	1600	1340	W
Anode dissipation	W_a	=	450	450	425	390	W
Output power	W_o	=	1630	1376	1127	908	W
Efficiency	η	=	76.5	73	70.5	67.5	%

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY (continued)
Grounded grid circuit, two tubes



Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid voltage	V_g	=	−350	−300	−250	−200	V
Anode current	I_a	=	2x535	2x535	2x535	2x535	mA
Grid current	I_g	=	2x115	2x115	2x115	2x115	mA
Peak grid voltage	V_{gp}	=	580	520	460	405	V
Grid input power	W_{ig}	=	2x320	2x274	2x248	2x212	W
Anode input power	W_{ia}	=	2x2140	2x1880	2x1600	2x1340	W
Anode dissipation	W_a	=	2x450	2x450	2x425	2x390	W
Output power	W_o	=	3380+520	2860+440	2350+400	1900+340	W [1])
Efficiency	η	=	79	76	73.5	71	% [2])

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	100	Mc/s
Anode voltage	V_a	=	max.	3000	V
Anode dissipation	W_a	=	max.	300	W
Grid dissipation	W_g	=	max.	50	W
Grid current	I_g	=	max.	115	mA
Cathode current	I_k	=	max.	550	mA

OPERATING CONDITIONS

Wavelength	λ	=	3	m
Anode voltage	V_a	=	3000	V
Grid voltage	V_g	=	−375	V
Anode current	I_a	=	450	mA
Grid current	I_g	=	85	mA
Peak grid A.C. voltage	V_{g_p}	=	580	V
Grid input power	W_{ig}	=	42	W
Anode input power	W_{ia}	=	1350	W
Anode dissipation	W_a	=	300	W
Output power	W_o	=	1050	W
Efficiency	η	=	78	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	675	W

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	4000	V
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W
Cathode current	I_k	=	max.	700	mA
Peak cathode current	I_{kp}	=	max.	5	A
Grid current	I_g	=	max.	130	mA
Grid circuit resistance	R_g	=	max.	50	kΩ

OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	4000		3500		V
Grid voltage	V_g	=	-135		-114		V
Load resistance	$R_{aa\sim}$	=	14.5		10.2		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	566	0	563	V
Anode current	I_a	=	2x70	2x368	2x70	2x442	mA
Grid current	I_g	=	0	2x93	0	2x115	mA
Grid input power	W_{ig}	=	0	2x24	0	2x29	W
Anode input power	W_{ia}	=	2x280	2x1474	2x245	2x1550	W
Anode dissipation	W_a	=	2x280	2x329	2x245	2x330	W
Output power	W_o	=	0	2290	0	2440	W
Total distortion	d_{tot}	=	-	5	-	5	%
Efficiency	η	=	-	77.7	-	78.8	%

Anode voltage	V_a	=	3000		2500		V
Grid voltage	V_g	=	-94		-75		V
Load resistance	$R_{aa\sim}$	=	7.5		5.2		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	560	0	530	V
Anode current	I_a	=	2x70	2x500	2x70	2x555	mA
Grid current	I_g	=	0	2x130	0	2x126	mA
Grid input power	W_{ig}	=	0	2x33	0	2x30	W
Anode input power	W_{ia}	=	2x210	2x1500	2x175	2x1387	W
Anode dissipation	W_a	=	2x210	2x345	2x175	2x387	W
Output power	W_o	=	0	2310	0	2000	W
Total distortion	d_{tot}	=	-	5	-	3.5	%
Efficiency	η	=	-	77	-	72	%

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from two-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	100	Mc/s
Anode voltage	V_a	= max.	3600	V
Negative grid voltage	$-V_g$	= max.	320	V
Anode current	I_a	= max.	475	mA
Grid current	I_g	= max.	100	mA
Anode input power	W_{ia}	= max.	2200	W
Anode dissipation	W_a	= max.	450	W
Grid dissipation	W_g	= max.	50	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	= 4000[1]	3350[2]	V_{RMS}
Anode voltage	V_a	= 3600	3000	V [3]
Anode current	I_a	= 450	400	mA
Grid current	I_g	= 100	85	mA
Grid resistor	R_g	= 3.0	3.0	kΩ
Anode input power	W_{ia}	= 2000	1480	W
Anode dissipation	W_a	= 450	400	W
Output power	W_o	= 1500	1040	W
Efficiency	η	= 75	70	%

[1]) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

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

[3]) D.C. value

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	100	Mc/s
Anode voltage	V_a	= max.	4000	V
Negative grid voltage	$-V_g$	= max.	500	V
Anode current	I_a	= max.	535	mA
Grid current	I_g	= max.	115	mA
Anode input power	W_{ia}	= max.	2200	W
Anode dissipation	W_a	= max.	450	W
Grid dissipation	W_g	= max.	50	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	3400[1]	2900[2]	V_{RMS}
Anode voltage	V_a	=	4000	3400	V [3]
Anode current	I_a	=	535	450	mA
Grid current	I_g	=	115	100	mA
Grid resistor	R_g	=	3.0	3.0	kΩ
Anode input power	W_{ia}	=	2140	1530	W
Anode dissipation	W_a	=	450	390	W
Output power	W_o	=	1630	1090	W
Efficiency	η	=	76.5	71	%

[1] Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

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

[3] D.C. value.

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

LIMITING VALUES (Absolute limits)

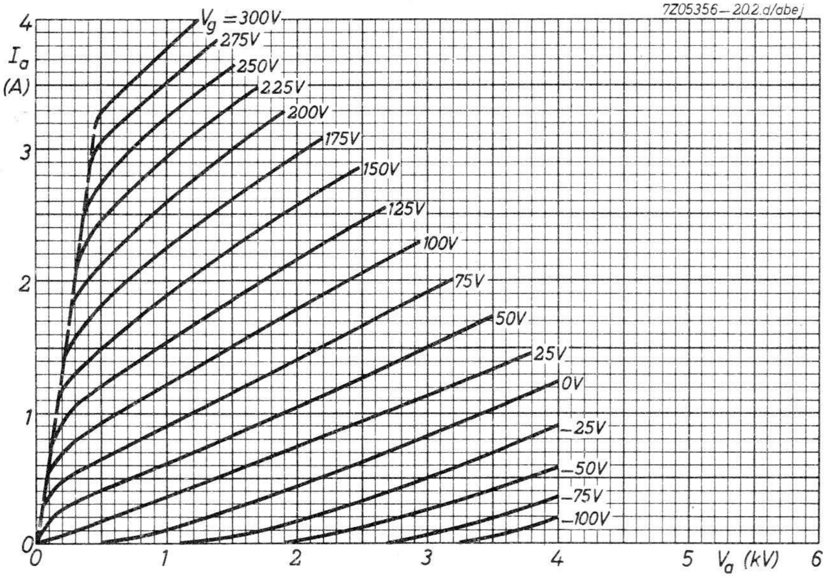
Frequency	f		up to	100	Mc/s
Transformer voltage	V_{tr}	=	max.	4500	V_{RMS}
Negative grid voltage	$-V_g$	=	max.	500	V
Anode current	I_a	=	max.	280	mA
Grid current	I_g	=	max.	55	mA
Anode input power	W_{ia}	=	max.	1450	W
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	4500[1]	3800[2]	V_{RMS}
Anode current	I_a	=	280	240	mA
Grid current	I_g	=	55	47	mA
Grid resistor	R_g	=	3.4	3.4	kΩ
Anode input power	W_{ia}	=	1400	1010	W
Anode dissipation	W_a	=	350	295	W
Output power	W_o	=	1000	670	W
Efficiency	η	=	71.5	66	%

[1]) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

[2]) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.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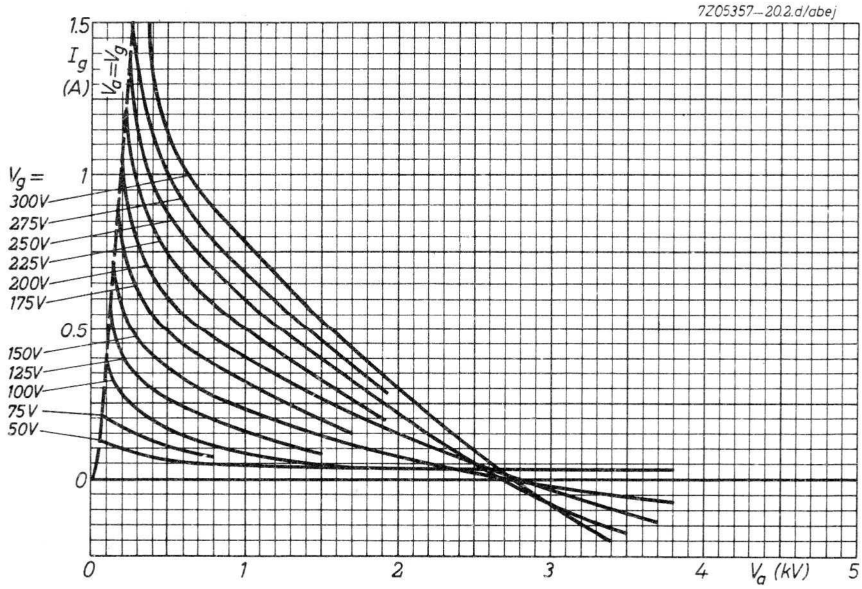
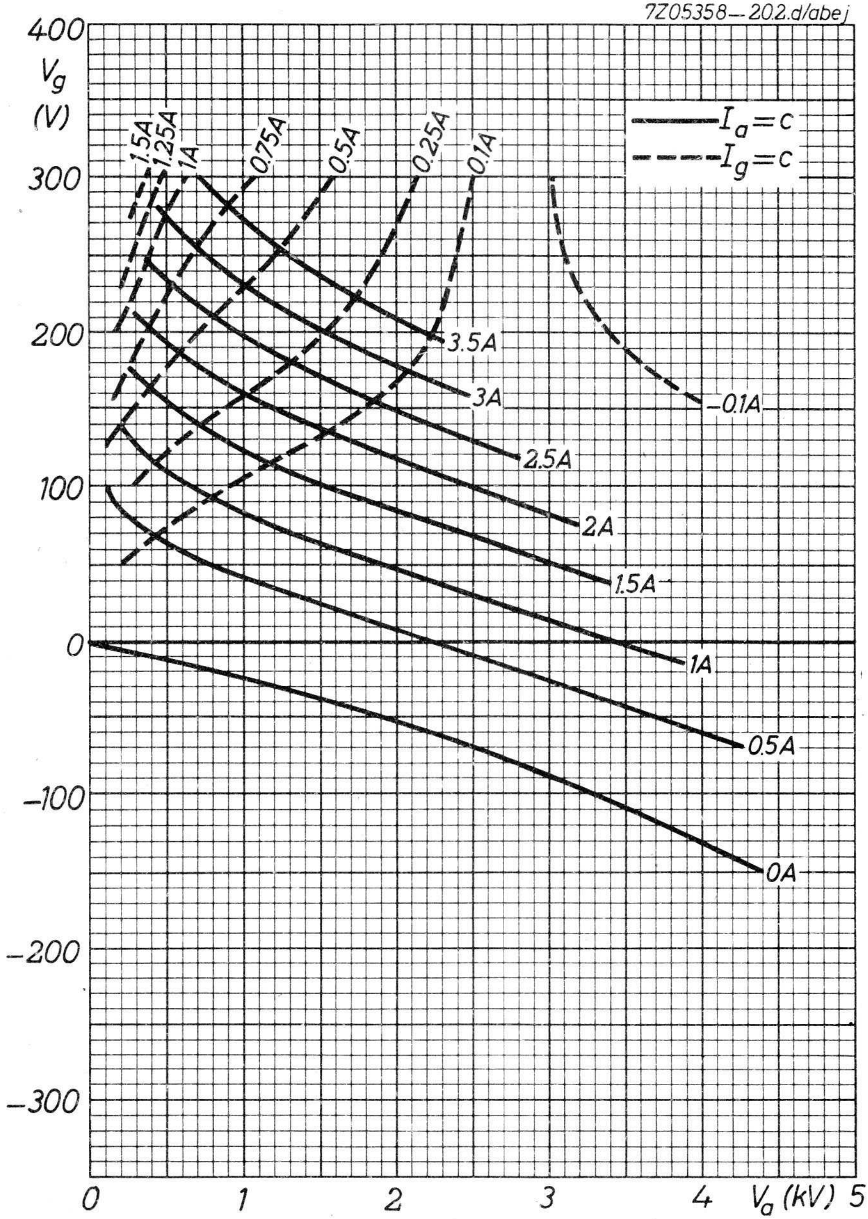
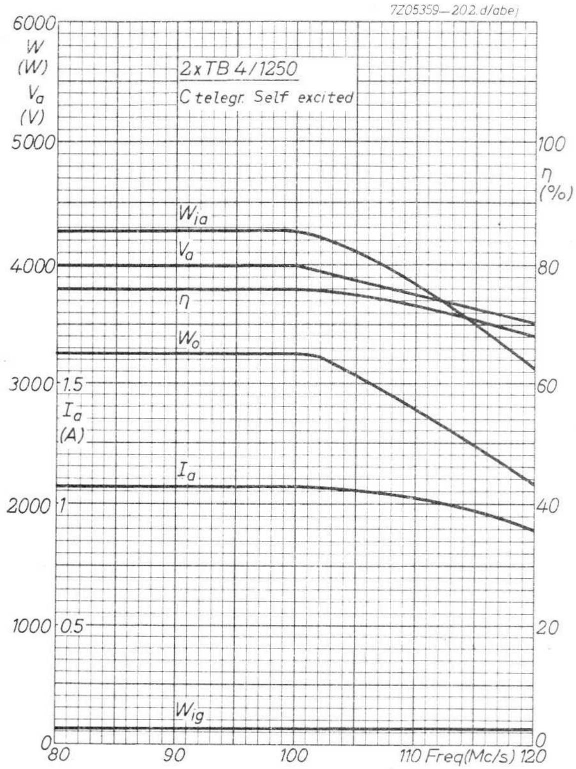
V_g = 300V
275V
250V
225V
200V
175V
150V
125V
100V
75V
50V
25V
0V
–25V
–50V
–75V
–100V
I_a
(A)
4
3
2
1
0
0
1
2
3
4
5
V_a (kV)
6


7Z05357–20.2.d/abej
I_g
(A)
1.5
1
0.5
0
$V_a = V_g$
V_g =
300V
275V
250V
225V
200V
175V
150V
125V
100V
75V
50V
0
1
2
3
4
V_a (kV)
5


7Z05358--20.2.d/abej
400
V_g
(V)
300
200
100
0
–100
–200
–300
0
1
2
3
4
V_a (kV)
5
$I_a = c$
$I_g = c$
1.5A
1.25A
1A
0.75A
0.5A
0.25A
0.1A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0A
–0.1A


7Z05359—20.2.d/abej
6000
W
(W)
V_a
(V)
5000
4000
3000
2000
1000
0
1.5
I_a
(A)
1
0.5
100
η
(%)
80
60
40
20
0
2 x TB 4/1250
C telegr. Self excited
W_{ia}
V_a
η
W_o
I_a
W_{ig}
80
90
100
110 Freq(Mc/s) 120

R.F INDUSTRIAL TRIODE

Radiation cooled triode of metal-glass construction intended for use as an industrial oscillator

QUICK REFERENCE DATA				
Oscillator output power (W_o-W_{feedb}), typical	W_{osc}		1.58	kW
Frequency for full ratings	f	max.	50	MHz

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

A. R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

with anode voltage from a three-phase rectifier

OPERATING CONDITIONS continuous service

Frequency	f	50	50	50	MHz
Oscillator output power (W_o-W_{feedb})	W_{osc}	1.55	1.58	1.55	kW
Anode vootage	V_a	6	5	4	kV
Anode current	I_a	350	430	535	mA
Anode input power	W_{ia}	2100	2150	2140	W
Anode dissipation	W_a	460	480	490	W
Anode output power	W_o	1640	1670	1650	W
Anode efficiency	η_a	78	78	77	%
Oscillator efficiency	η_{osc}	74	73.5	72.5	%
Feedback ratio	V_{gp}/V_{ap}	15	15.5	20	%
Grid resistor	R_g	4.2	3.5	2.7	kΩ
Grid current, on load	I_g	120	130	150	mA
Grid voltage, negative	$-V_g$	500	456	405	V
Grid dissipation	W_g	23	29	41	W
Grid resistor dissipation	W_{Rg}	60	59	61	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Anode voltage	V_a	max.	7	kV
Anode current	I_a	max.	560	mA
Anode input power	W_{ia}	max.	2.5	kW
Anode dissipation	W_a	max.	500	W
Grid voltage	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	210	mA
off load	I_g	max.	280	mA
Grid dissipation	W_g	max.	100	W
Grid circuit resistance	R_g	max.	15	kΩ
Cathode current, mean	I_k	max.	850	mA
Envelope temperature	t_{env}	max.	350	^oC
Seal temperature	t	max.	220	^oC

B. **R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE,**

with anode voltage from three-phase rectifier,

OPERATING CONDITIONS , intermittent service

Frequency	f	50	50	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	3.05	2.28	kW
Anode voltage	V_a	6	6	kV
Anode current	I_a	700	630	mA
Anode input power	W_{ia}	4200	3150	W
Anode dissipation	W_a	1000	750	W
Anode output power	W_o	3200	2400	W
Anode efficiency	η_a	76	76	%
Oscillator efficiency	η_{osc}	72.5	72.5	%
Feedback ratio	V_{gp}/V_{ap}	16	17	%
Grid resistor	R_g	3.3	2.7	kΩ
Grid current, on load	I_g	170	160	mA
Grid voltage, negative	$-V_g$	560	432	V
Grid dissipation	W_g	55	48	W
Grid resistor dissipation	W_{Rg}	95	69	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Anode voltage	V_a	max.	7	kV
Anode current	I_a	max.	750	mA
Anode input power	W_{ia}	max.	5	kW
Anode dissipation	W_a	max.	See page 7	
Grid voltage	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	185	mA
off load	I_g	max.	300	mA
Grid dissipation	W_g	max.	100	W
Grid circuit resistance	R_g	max.	15	kΩ
Cathode current, mean	I_k	max.	1.1	A
Envelope temperature	t_{env}	max.	330	°C
Seal temperature	t	max.	220	°C

C. R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE,

with anode voltage from single-phase rectifier without filter

OPERATING CONDITIONS, continuous service

Frequency	f	50	50	MHz
Oscillator output power (W_o-Wfeedb)	W_{osc}	1.565	1.525	kW
Anode voltage	V_a	5.4	4.5	kV
Anode current	I_a	320	380	mA
Anode input power	W_{ia}	2125	2100	W
Anode dissipation	W_a	490	500	W
Anode output power	W_o	1635	1600	W
Anode efficiency	η_a	77	76	%
Oscillator efficiency	η_{osc}	74	73	%
Feedback ratio	V_{gp}/V_{ap}	13	15.5	%
Grid resistor	R_g	4.2	3.5	kΩ
Grid current, on load	I_g	110	120	mA
Grid voltage, negative	$-V_g$	462	420	V
Grid dissipation	W_g	15	25	W
Grid resistor dissipation	W_{Rg}	50	50	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Anode voltage	V_a	max.	6.3	kV
Anode current	I_a	max.	500	mA
Anode input power	W_{ia}	max.	2.5	kW
Anode dissipation	W_a	max.	500	W
Grid voltage	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	185	mA
off load	I_g	max.	280	mA
Grid dissipation	W_g	max.	100	W
Grid circuit resistance	R_g	max.	15	kΩ
Cathode current, mean	I_k	max.	780	mA
Envelope temperature	t_{env}	max.	330	°C
Seal temperature	t	max.	220	°C

D. R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE,

with self rectification

OPERATING CONDITIONS, continuous service

Frequency	f	50	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	990	W
Transformer voltage, RMS	V_{tr}	4.5	kV
Anode current	I_a	280	mA [1]
Anode input power	W_{ia}	1400	W
Anode dissipation	W_a	380	W
Anode output power	W_o	1020	W
Anode efficiency	η_a	78	%
Oscillator efficiency	η_{osc}	71	%
Feedback ratio	V_{gp}/V_{ap}	18	%
Grid resistor	R_g	2.7	kΩ
Grid current, on load	I_g	80	mA [1]
Grid voltage, negative	$-V_g$	216	V
Grid dissipation	W_g	14	W
Grid resistor dissipation	W_{Rg}	17	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Transformer voltage, RMS	V_a	max.	5	kV
Anode current	I_a	max.	320	mA [1]
Anode input power	W_{ia}	max.	1600	W
Anode dissipation	W_a	max.	500	W
Grid voltage, at peak of mains frequency sine wave	$-V_g$	max.	1350	V
Grid current, on load	I_g	max.	110	mA [1]
off load	I_g	max.	150	mA [1]
Grid dissipation	W_g	max.	100	W
Grid circuit resistance	R_g	max.	15	kΩ
Cathode current, mean	I_k	max.	470	mA [1]
Envelope temperature	t_{env}	max.	330	°C
Seal temperature	t	max.	220	°C

1) Average over any mains frequency cycle.

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f	5	V
Filament current	I_f	32.5	A

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

CAPACITANCES

Anode to filament	C_{af}	0.2	pF
Grid to filament	C_{gf}	7.5	pF
Anode to grid	C_{ag}	5.1	pF

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

Transconductance	S	3.3	mA/V
Amplification factor	μ	21	

COOLING

In general cooling of the tube working at the published operating conditions with matched load is not necessary. When the tube is mounted in a small cabinet adequate ventilation must be provided.

At non-matched load, combined with the highest operating frequencies a low-velocity air flow on the tube is necessary. A small fan will suffice; it is recommended to mount the fan underneath the tube socket.

ACCESSORIES

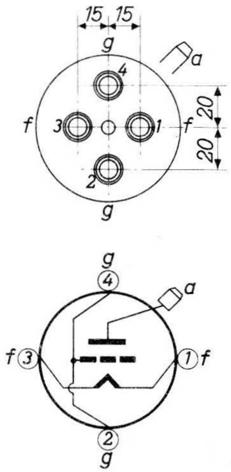
Socket	catalogue nr.	2422 511 05001
Anode connector	type	40665

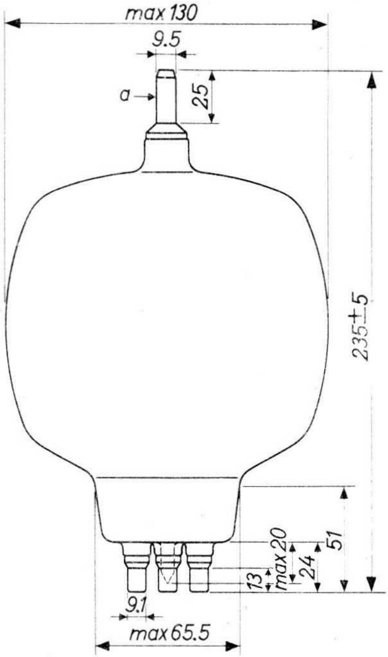
MECHANICAL DATA

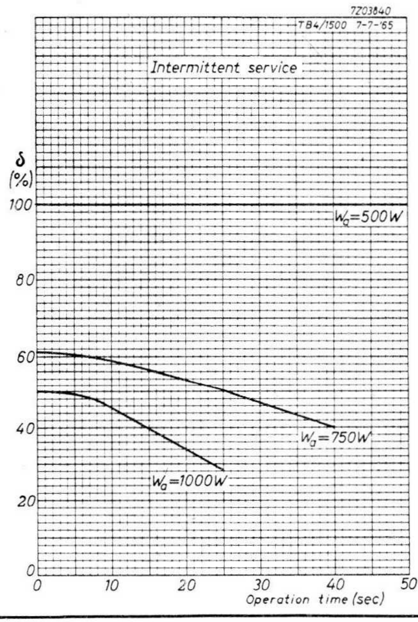
Dimensions in mm

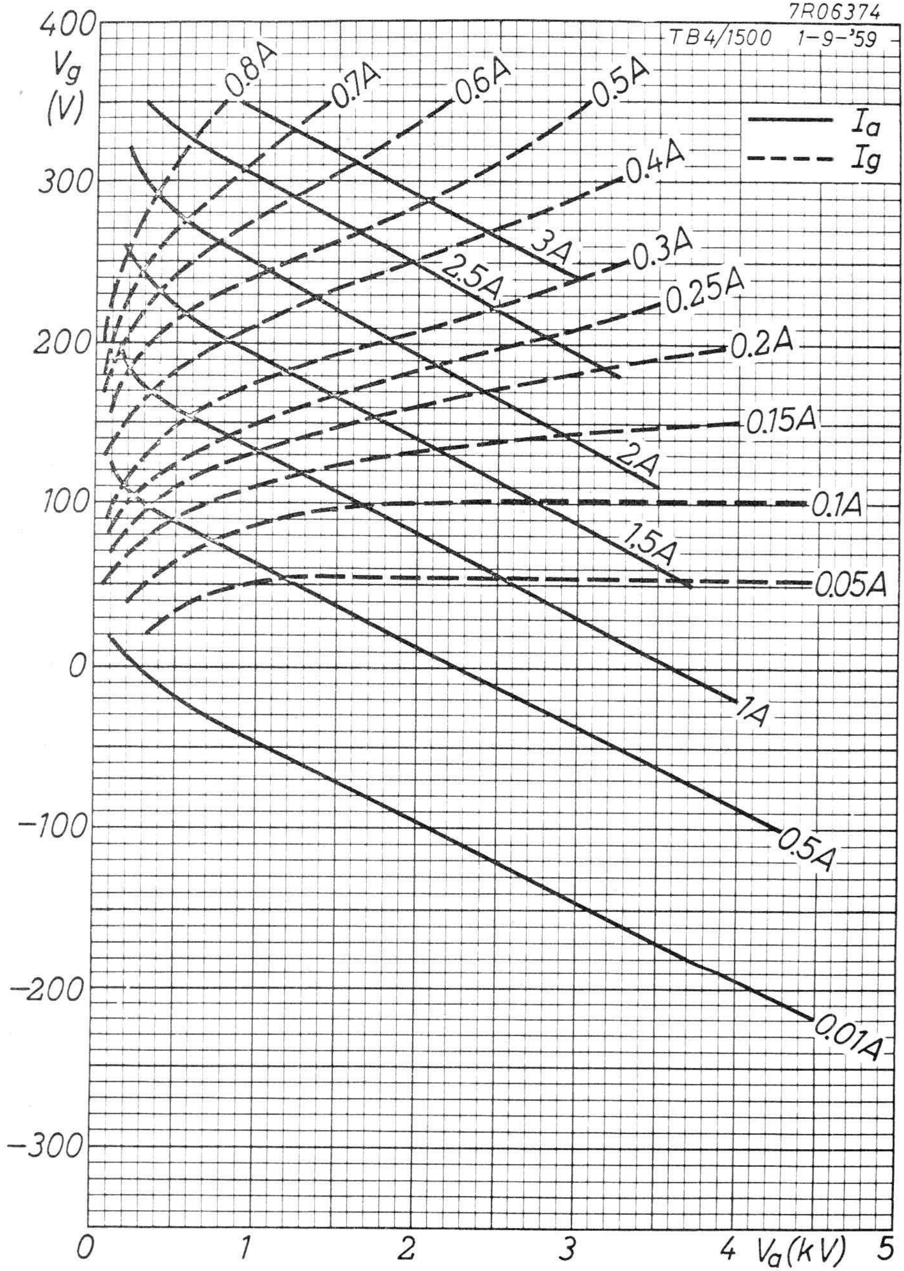
Mounting position: vertical

Net weight: approx. 450 g








7R06374
TB4/1500 1-9-'59
400
V_g
(V)
300
200
100
0
−100
−200
−300
0
1
2
3
4
V_a(kV)
5
I_a
I_g
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.25A
0.2A
0.15A
0.1A
0.05A
3A
2.5A
2A
1.5A
1A
0.5A
0.01A

R.F. INDUSTRIAL TRIODE

Radiation cooled triode of glass construction intended for use as an industrial oscillator

QUICK REFERENCE DATA				
Oscillator output power (W_o - W_{feedb}), typical	W_{osc}		2.73	kW
Frequency for full ratings	f	max.	50	MHz

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

A. R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

with anode voltage from a three-phase rectifier

OPERATING CONDITIONS, continuous service

Frequency	f	50	50	50	50	MHz
Oscillator output power (W_o-W_{feedb})	W_{osc}	2.73	2.61	2.04	1.44	kW
Anode voltage	V_a	6	5	4	3	kV
Anode current	I_a	600	700	700	700	mA
Anode input power	W_{ia}	3600	3500	2800	2100	W
Anode dissipation	W_a	760	780	640	540	W
Anode output power	W_o	2840	2720	2160	1560	W
Anode efficiency	η_a	79	78	77	74	%
Oscillator efficiency	η_{osc}	76	75	73	69	%
Feedback ratio	V_{gp}/V_{ap}	13	17	20	25	%
Grid resistor	R_g	3	2.5	2	1.5	kΩ
Grid current, on load	I_g	150	160	180	200	mA
Grid voltage, negative	$-V_g$	450	400	360	300	V
Grid dissipation	W_g	43	46	55	60	W
Grid resistor dissipation	W_{Rg}	67	64	65	60	W

Recommended grid blocking capacitor at high frequencies about 100 pF
at 1 MHz about 1000 pF

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Anode voltage	V_a	max.	7	kV
Anode current	I_a	max.	750	mA
Anode input power	W_{ia}	max.	4000	W
Anode dissipation	W_a	max.	800	W
Grid voltage	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	300	mA
off load	I_g	max.	400	mA
Grid dissipation	W_g	max.	150	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	1.2	A
peak	I_{kp}	max.	4.3	A
Envelope temperature	t_{env}	max.	350	^oC
Seal temperature	t	max.	220	^oC

B. R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

with anode voltage from a three-phase rectifier

OPERATING CONDITIONS , intermittent service

Frequency	f	50	50	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	4.25	3.24	kW
Anode voltage	V_a	6	5	kV
Anode current	I_a	950	900	mA
Anode input power	W_{ia}	5700	4500	W
Anode dissipation	W_a	1300	1125	W
Anode output power	W_o	4400	3375	W
Anode efficiency	η_a	77	75	%
Oscillator efficiency	η_{osc}	74	72	%
Feedback ratio	V_{gp}/V_{ap}	17	20	%
Grid resistor	R_g	2.5	2	kΩ
Grid current, on load	I_g	190	190	mA
Grid voltage, negative	$-V_g$	475	380	V
Grid dissipation	W_g	63	63	W
Grid resistor dissipation	W_{Rg}	90	72	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	max.	50	MHz
Anode voltage	V_a	max.	7	kV
Anode current	I_a	max.	1000	mA
Anode -input power	W_{ia}	max.	7000	W
Anode dissipation	W_a	max.	see page 7	
Grid voltage	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	300	mA
off load	I_g	max.	400	mA
Grid dissipation	W_g	max.	150	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	1.4	A
peak	I_{kp}	max.	4.3	A
Envelope temperature	t_{env}	max.	350	°C
Seal temperature	t	max.	220	°C

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

with anode voltage from single-phase rectifier without filter

OPERATING CONDITIONS, continuous service

Frequency	f	50	50	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	2655	2451	W
Anode voltage	V_a	5.4	4.5	kV
Anode current	I_a	530	600	mA
Anode input power	W_{ia}	3520	3320	W
Anode dissipation	W_a	770	770	W
Anode output power	W_o	2750	2550	W
Anode efficiency	η_a	78	77	%
Oscillator efficiency	η_{osc}	75	74	%
Feedback ratio	V_{gp}/V_{ap}	13	15.5	%
Grid resistor	R_g	3	2.5	kΩ
Grid current, on load	I_g	140	150	mA
Grid voltage, negative	$-V_g$	420	375	V
Grid dissipation	W_g	36	43	W
Grid resistor dissipation	W_{Rg}	59	56	W

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Anode voltage	V_a	max.	6.3	kV
Anode current	I_a	max.	670	mA
Anode input power	W_{ia}	max.	4000	W
Anode dissipation	W_a	max.	800	W
Grid voltage	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	270	mA
off load	I_g	max.	400	mA
Grid dissipation	W_g	max.	150	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	1.0	A
peak	I_{kp}	max.	3.3	A
Envelope temperature	t_{env}	max.	350	°C
Seal temperature	t	max.	220	°C

D. R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

with self rectification

OPERATING CONDITIONS

Frequency	f	50	MHz
Oscillator output power ($W_o - W_{feedb}$)	W_{osc}	1.49	kW
Transformer voltage, RMS	V_{tr}	5.2	kV
Anode current	I_a	360	mA 1)
Anode input power	W_{ia}	2080	W
Anode dissipation	W_a	520	W
Anode output power	W_o	1560	W
Anode efficiency	η_a	75	%
Oscillator efficiency	η_{osc}	72	%
Feedback ratio	V_{gp}/V_{ap}	17	%
Grid resistor	R_g	1.8	kΩ
Grid current, on load	I_g	100	mA 1)
Grid voltage, negative	$-V_g$	180	V
Grid dissipation	W_g	54	W
Grid resistor dissipation	W_{Rg}	18	W
Recommended grid blocking capacitor	at high frequencies about	100	pF
	at about 1 MHz about	1000	pF

LIMITING VALUES (Absolute max. rating system)

Frequency for full ratings	f	up to	50	MHz
Transformer voltage, RMS	V_{tr}	max.	5.6	kV
Anode current	I_a	max.	400	mA 1)
Anode input power	W_{ia}	max.	2250	W
Anode dissipation	W_a	max.	800	W
Grid voltage, at peak of mains frequency sine wave	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	160	mA 1)
off load	I_g	max.	210	mA 1)
Grid dissipation	W_g	max.	150	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current, mean	I_k	max.	610	mA 1)
peak	I_{kp}	max.	4.3	A
Envelope temperature	t_{env}	max.	350	°C
Seal temperature	t	max.	220	°C

1) Averaged over any mains frequency cycle

HEATING : direct; filament thoriated tungsten

Filament voltage	Vf	6.3	V
Filament current	If	32.5	A

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

CAPACITANCES

Anode to filament	Caf	0.25	pF
Grid to filament	Cgf	10.5	pF
Anode to grid	Cag	6.2	pF

CHARACTERISTICS measured at V_a = 4 kV, I_a = 190 mA

Transconductance	S	5.1	mA/V
Amplification factor	μ	22	

COOLING

In general cooling of the tube is not necessary at matched load. When the tube is mounted in a small cabinet adequate ventilation must be provided.

At non-matched load or at high anode voltages, combined with the highest operating frequencies a low-velocity air flow directed on the tube is necessary. A small fan will suffice; it is recommended to mount the fan underneath the tube socket.

ACCESSORIES

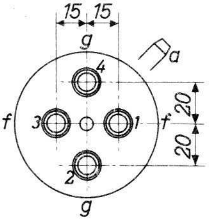
Socket	catalogue nr.	2422 511 05001
Anode connector	type	40665

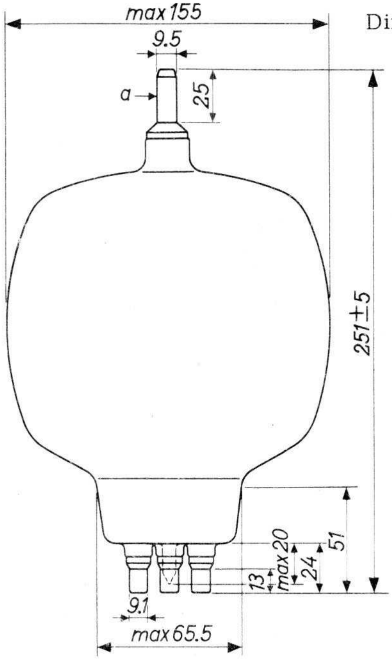
MECHANICAL DATA

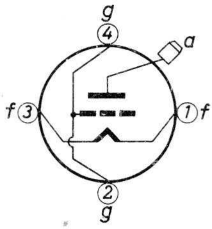
Mounting positions: vertical

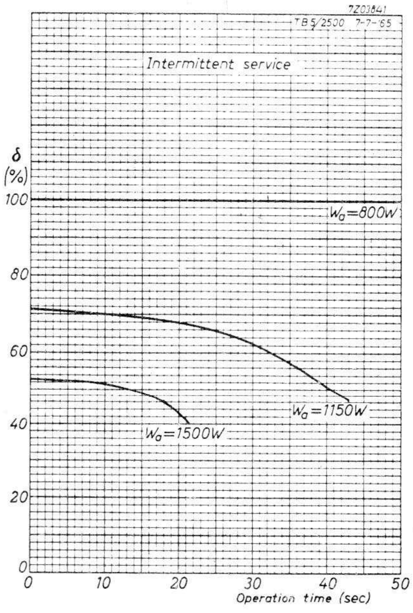
Net weight: approx. 600 g

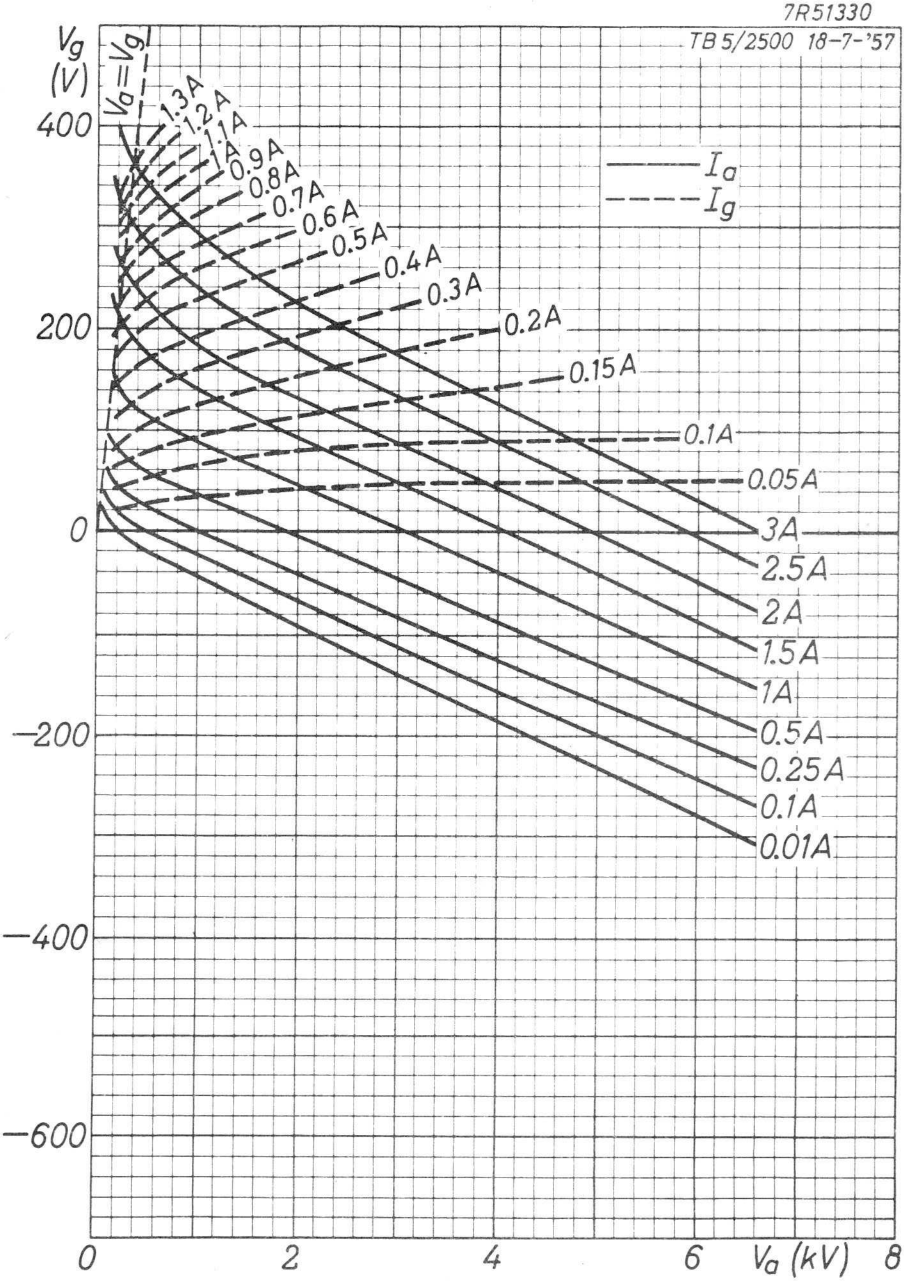
Dimensions in mm










7R51330
TB 5/2500 18-7-'57
V_g (V)
$V_a = V_g$
I_a
I_g
1.3A
1.2A
1.1A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.15A
0.1A
0.05A
3A
2.5A
2A
1.5A
1A
0.5A
0.25A
0.1A
0.01A
400
200
0
−200
−400
−600
0
2
4
6
8
V_a (kV)

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA			
	Industrial R.F. oscillator class C		
	Freq. (MHz)	three phase	
		V_a (kV)	W_o (kW)
	30	7 6	17.7 14.3

HEATING: direct ; filament thoriated tungsten

Filament voltage	V_f	6.3	V $^{+\ 5\%}_{-\ 10\%}$
Filament current	I_f	136	A
Cold filament resistance	R_{f_o}	5	mΩ
Peak filament starting current	I_{f_p}	max.280	A

CAPACITANCES

Anode to all other elements except grid	C_a	1.2	pF
Grid to all other elements except anode	C_g	44.5	pF
Anode to grid	C_{ag}	33.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6	kV
Anode current	I_a	2.5	A
Mutual conductance	S	23	mA/V
Amplification factor	μ	17.5	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	t	max. 220	^oC

WATER COOLING CHARACTERISTICS

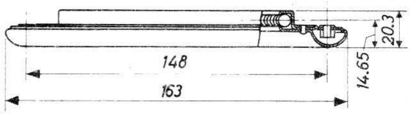
W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm)	t_o (^oC)
5	20	2.3	0.02	56
	50	4.6	0.07	68
10	20	4.5	0.06	55
	50	9.0	0.21	67
15	20	7.0	0.14	53
	50	14.0	0.45	66

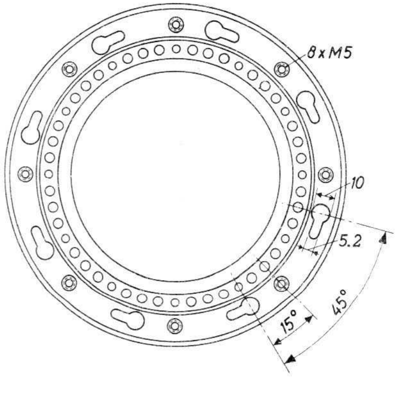
Water inlet temperature t_i = max. 50 ^oC

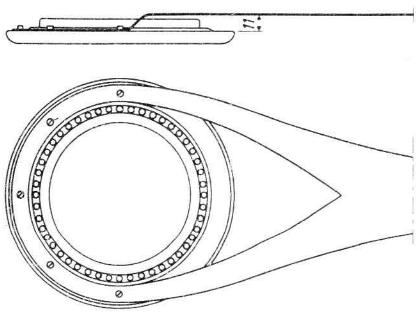
At water inlet temperatures between 20 ^oC and 50 ^oC the required quantity of water can be found by linear interpolation.

MECHANICAL DATA

Dimensions in mm







Grid connector 40664

Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right

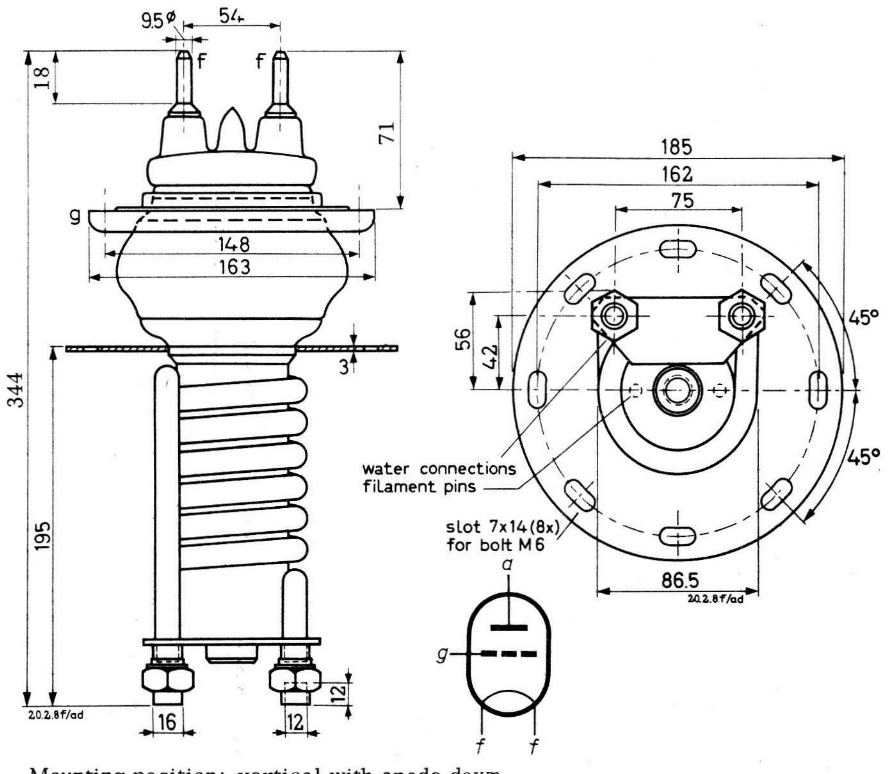
MECHANICAL DATA (continued)

Dimensions in mm

Filament connectors with cable 40662

Grid connector 40664

Net weight 3.8 kg



Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

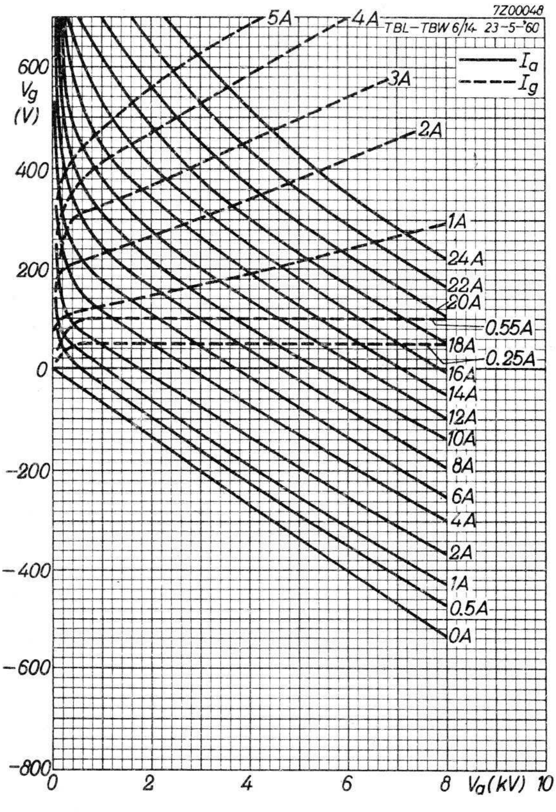
LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	8	kV
Anode input power	W_{ia}	max.	30	kW
Anode dissipation	W_a	max.	15	kW 2)
Anode current	I_a	max.	4.0	A
Negative grid voltage	$-V_g$	max.	1600	V
Grid current, loaded	I_g	max.	1.5	A
Grid current, unloaded	I_g	max.	2.0	A
Grid circuit resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	30	30	MHz
Anode voltage	V_a	7	6	kV
Anode current, loaded	I_a	3.5	3.3	A
Anode current, unloaded	I_a	0.7	0.51	A
Grid current, loaded	I_g	0.95	0.8	A
Grid current, unloaded	I_g	1.35	1.1	A
Grid resistor	R_g	950	1000	Ω
Load resistance	$R_{a\sim}$	1000	870	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	25	26	%
Anode input power	W_{ia}	24.5	19.8	kW
Anode dissipation	W_a	6.8	5.5	kW
Output power	W_o	17.7	14.3	kW
Efficiency	η	72	72	%
Output power in the load	W_ℓ	14	11	kW 1)

1) Useful power in the load, measured in a circuit having an efficiency of about 85%.
2) TBL6/14 Wa max. =10kW


7Z00048
TBL–TBW 6/14 23–5–'60
I_a
I_g
5A
4A
3A
2A
1A
0.55A
0.25A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.5A
0A
V_g (V)
600
400
200
0
–200
–400
–600
–800
0
2
4
6
8
V_a(kV)
10

WATER COOLED R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
4	75	6	6.9	6	1.9			6	13.3
		5	5.6	5	1.45	5	4.7	5	6.6
		4	4			4.5	4.1	4.5	6.0
						4	3.5	4	5.3
						3.5	3	3.5	4.6
						3	2.2	3	3.3

Television service

Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
	V_a (kV)	W_o sync (kW)	W_o black (kW)	V_a (kV)	W_o white (kW)
75	5	9	5.35	5	9

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	12.6	V
Filament current	I_f	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	0.3	pF
Grid to all other elements except anode	C_g	16	pF
Anode to grid	C_{ag}	11	pF

[1]) Two tubes

7Z2 8641

TYPICAL CHARACTERISTICS

Anode voltage	V_a	4	kV
Anode current	I_a	1	A
Amplification factor	μ	32	
Mutual conductance	S	17	mA/V

COOLING : Water and low velocity air flow

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	max.	50	°C
Temperature of filament seals		max.	210	°C
Temperature of anode and grid seals		max.	180	°C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
2	20	1.5	0.06	44
	50	3	0.22	62
4	20	3	0.22	42
	50	6	0.73	61
6	20	5	0.54	39
	50	10	1.8	59

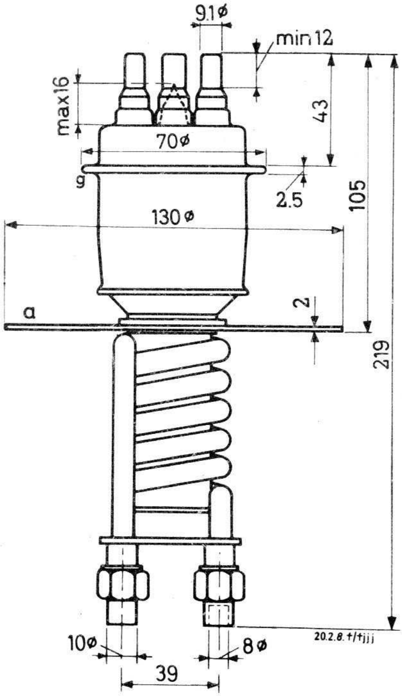
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

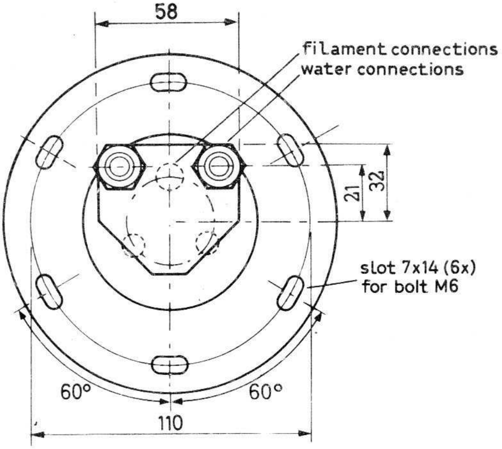
In general no air cooling will be required at ambient temperatures below 35 °C. At higher temperatures a low velocity air flow to the grid and filament seals will be necessary.

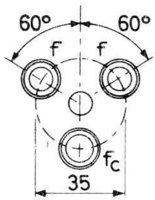
7Z2 8642

MECHANICAL DATA Dimensions in mm

Filament connectors	40634	
Grid connector	40622	
Net weight	0.8	kg







The use of wing nuts for connecting the water connections should be avoided

The centre tap f_c must not be used for filament current supply.
The connectors 40634, however, must be used for the cooling of all three filament pins, thus also of pin f_c.

Mounting position: vertical with anode down

For further data except cooling curves, please refer to type TBW6/6000

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

Water cooled triode with integral helical cooler intended for use as an industrial oscillator

QUICK REFERENCE DATA				
Oscillator output power (W_o - W_{feedb})	W_{osc}		6	kW
Frequency for full ratings	f	max.	55	MHz

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

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE *

OPERATING CONDITIONS

Frequency	f	50	MHz
Oscillator output power (W_o - W_{feedb})	W_{osc}	6	kW
Transformer voltage, RMS	V_{tr}	5,1	kV
Anode voltage	V_a	6	kV
Anode current	I_a	1,5	A
Anode input power	W_{ia}	9	kW
Anode dissipation	W_a	2,7	kW
Anode output power	W_o	6,3	kW
Anode efficiency	η_a	70	%
Oscillator efficiency	η_{osc}	67	%
Grid current, on load	I_g	0,4	A
Grid input power	W_{ig}	300	W

* With anode voltage from three-phase half-wave rectifier without filter.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	55	MHz
Anode voltage	V_a	max.	7	kV
Anode current	I_a	max.	1,8	A
Anode input power	W_{ia}	max.	11	kW
Anode dissipation	W_a	max.	6	kW
Grid voltage	$-V_g$	max.	1250	V
Grid current, on load	I_g	max.	0,5	A
off load	I_g	max.	0,7	A
Grid resistor	R_g	max.	10	kΩ
Temperature of filament seals	t	max.	210	°C
Temperature of anode and grid seals	t	max.	180	°C

HEATING: direct ; filament thoriated tungsten

Filament voltage	V_f	12,6	V
Filament current	I_f	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	0,3	pF
Grid to all other elements except anode	C_g	16	pF
Anode to grid	C_{ag}	11	pF

CHARACTERISTICS measured at V_a = 6 kV, I_a = 1 A

Transconductance	S	15	mA/V
Amplification factor	μ	32	

COOLING

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
2	20	1,5	0,06	44
	50	3	0,22	62
4	20	3	0,22	42
	50	6	0,73	61
6	20	5	0,54	39
	50	10	1,8	59

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

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

In general no air cooling will be required at frequencies up to 30 MHz and at ambient temperatures below 35 °C. At higher temperatures or at higher frequencies a low velocity air flow to the grid and filament seals will be necessary.

ACCESSORIES

Filament connectors	type	40643
Connector for centre pin of the filament		40649
Grid connector	40650 or	40622

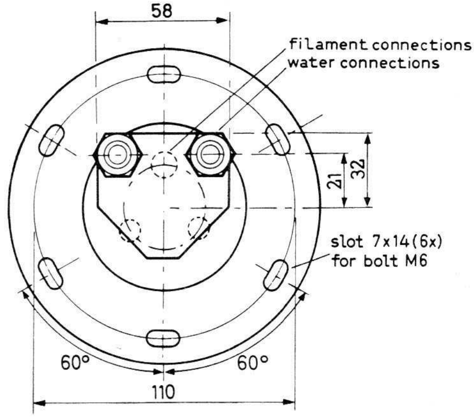
The centre filament pin f_c must not be used for filament current supply. The connector type 40649 should, however, be used for cooling of this pin.

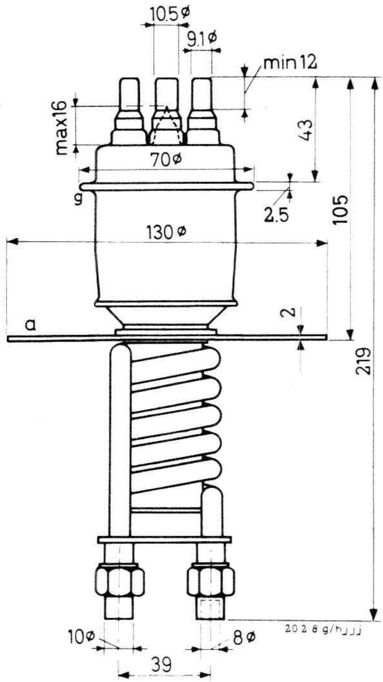
The grid connector type 40650 must not be used at frequencies higher than 30 MHz.

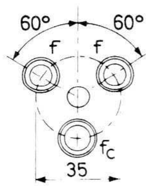
MECHANICAL DATA Dimensions in mm

Mounting position: vertical with anode down

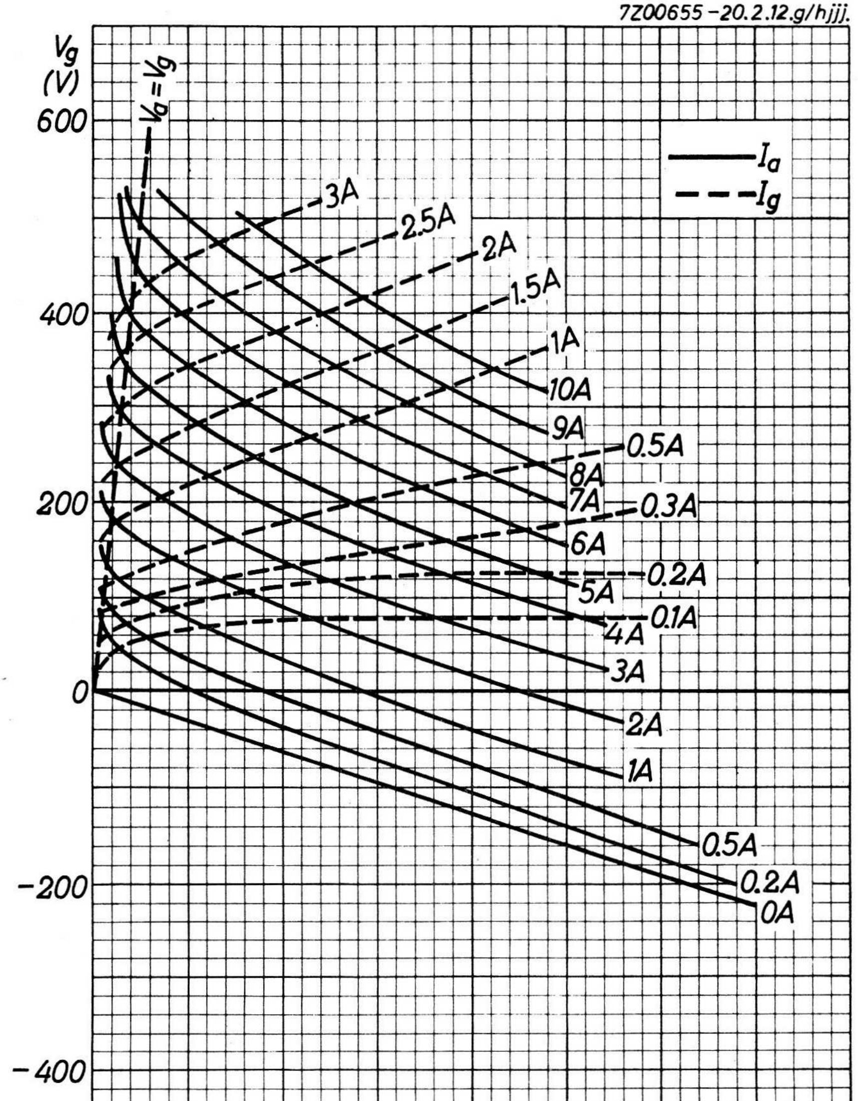
Net weight: approx. 0,8 kg







The use of wing nuts for the water connections should be avoided.


7Z00655-20.2.12.g/hjjj.
Vg
(V)
600
400
200
0
-200
-400
Va=Vg
Ia
Ig
3A
2.5A
2A
1.5A
1A
10A
9A
0.5A
8A
7A
0.3A
6A
0.2A
5A
0.1A
4A
3A
2A
1A
0.5A
0.2A
0A
0
2
4
6
Va(kV)
8

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq.	Three phase	
(MHz)	V_a (kV)	W_ℓ [1] (kW)
50	7.2 6.2	6.1 5.0

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	1.0	pF
Grid to all other elements except anode	C_g	=	14.2	pF
Anode to grid	C_{ag}	=	7.9	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	1	A
Mutual conductance	S	=	12	mA/V
Amplification factor	μ	=	24	

[1]) Useful power in the load

7Z2 8646

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of the seals = max. 220 °C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
2	20	1	0.032	56
	50	2	0.084	68
4	20	2.2	0.10	49
	50	4.4	0.49	65
6	20	4	0.41	43
	50	8	1.4	62

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

At frequencies above 4 MHz a low velocity air flow should be directed to the seals.

At frequencies above 4 MHz both grid terminals should be connected in parallel and care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive temperatures.

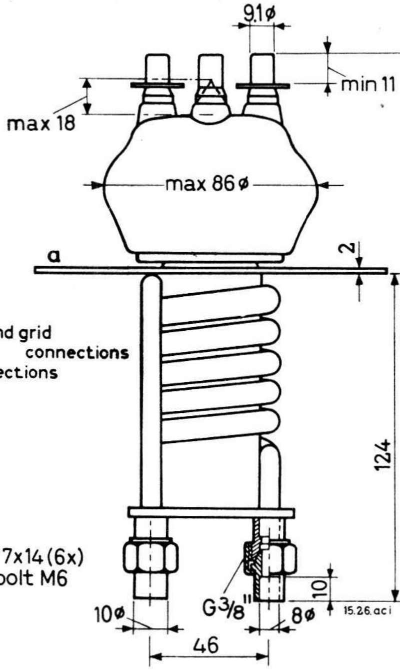
ACCESSORIES

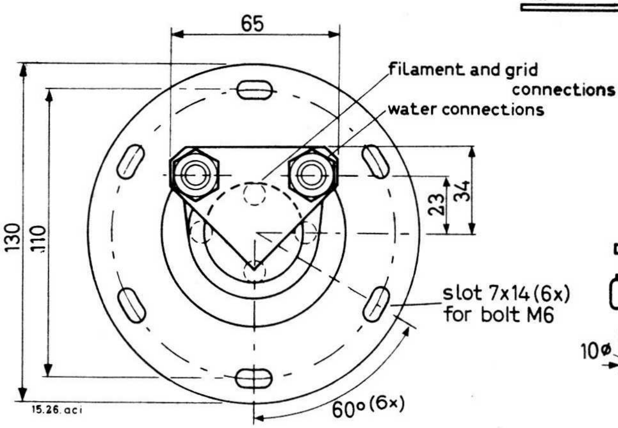
Filament and grid connectors (4 required) type 40634

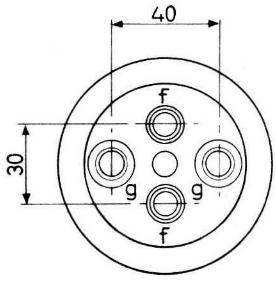
MECHANICAL DATA

Dimensions in mm

Net weight 1 kg







The use of wing nuts for connecting the water connections should be avoided

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits), continuous service

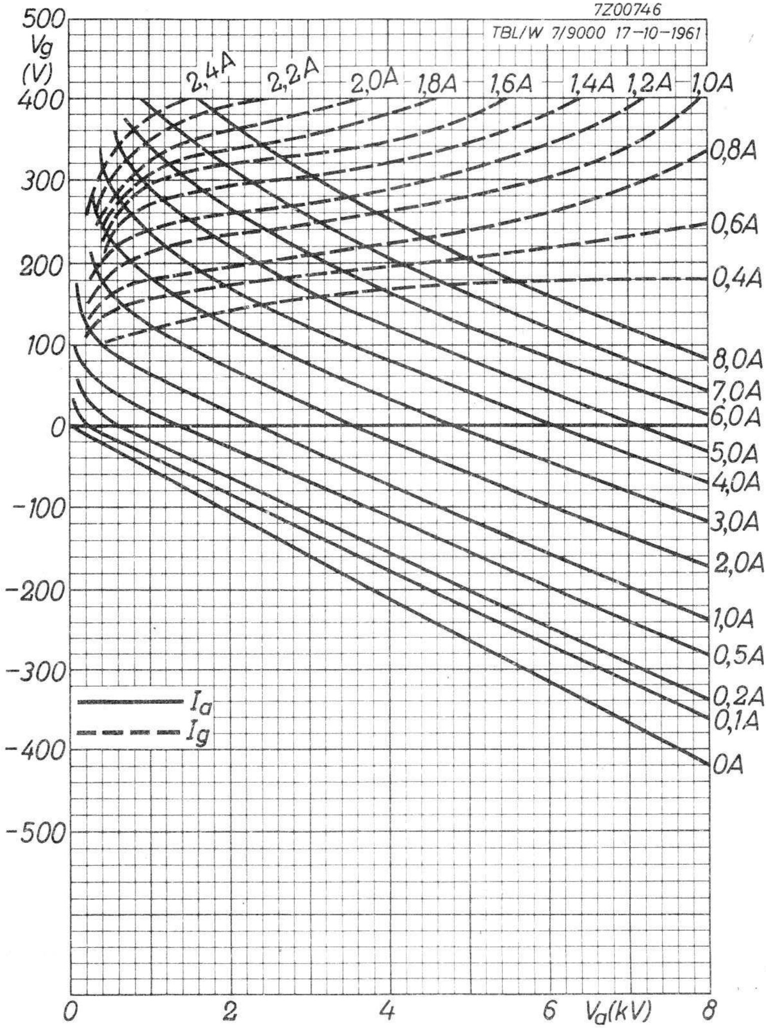
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CHARACTERISTICS, continuous service

Frequency	f	=	50	50	MHz
Anode voltage	V_a	=	7200	6200	V
Anode current, loaded	I_a	=	1.5	1.4	A
Anode current, unloaded	I_a	=	0.37	0.40	A
Grid current, loaded	I_g	=	0.36	0.37	A
Grid current, unloaded	I_g	=	0.47	0.47	A
Grid resistor	R_g	=	1850	1500	Ω
Load resistance	$R_{a\sim}$	=	2300	2100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	17	%
Anode input power	W_{ia}	=	10.8	8.68	kW
Anode dissipation	W_a	=	3.3	2.5	kW
Efficiency	η	=	70	71	%
Output power in the load	W_ℓ	=	6.1	5.0	kW [1])

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

7Z2 3540


7Z00746
TBL/W 7/9000 17-10-1961
500
Vg
(V)
400
300
200
100
0
-100
-200
-300
-400
-500
2,4A
2,2A
2,0A
1,8A
1,6A
1,4A
1,2A
1,0A
0,8A
0,6A
0,4A
8,0A
7,0A
6,0A
5,0A
4,0A
3,0A
2,0A
1,0A
0,5A
0,2A
0,1A
0A
Ia
Ig
0
2
4
6
Va(kV)
8

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	Three phase	
	V_a (kV)	W_o (kW)
30	12	29.0
	10	23.3
	8	17.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8.0	$V^{+5\%}_{-10\%}$
Filament current	I_f	=	98	A
Cold filament resistance	R_f	=	0.008	Ω

The filament current must never exceed a peak value of 210 A instantaneously at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	37	pF
Anode to grid	C_{ag}	=	30	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	34	
Mutual conductance	S	=	20	mA/V

7Z2 8647

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	= max.	50 °C
Temperature off all seals		= max.	220 °C

WATER COOLING CHARACTERISTICS

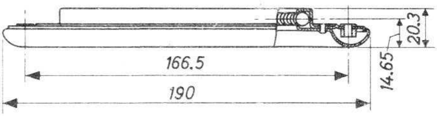
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.50
20	20	9.3	0.30
	50	18.6	1.0

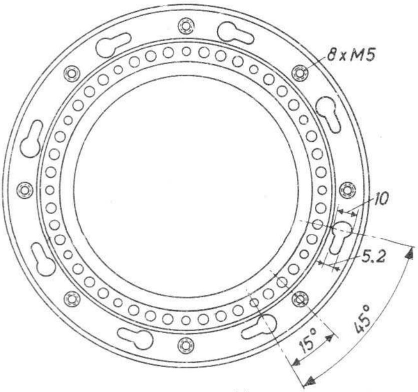
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation

Generally a low velocity air flow to the seals is required

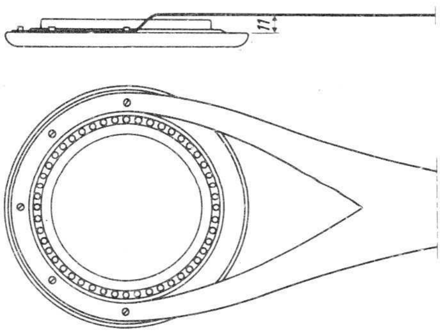
MECHANICAL DATA

Dimensions in mm





Grid connector 40663



Connection of the grid lead

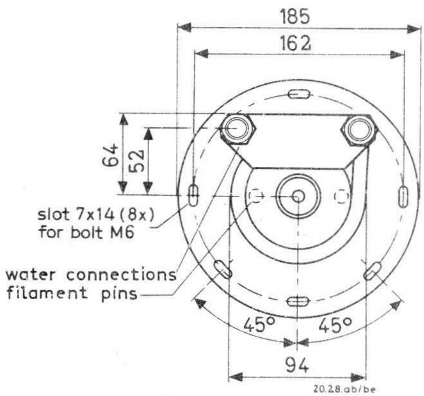
The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown at right.

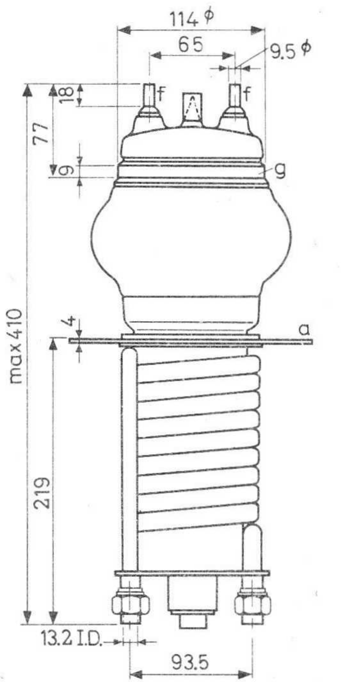
7Z2 3556

MECHANICAL DATA (continued)

Dimensions in mm

Filament connectors with cable	40662
Grid connector	40663
Net weight	5.2 kg





Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

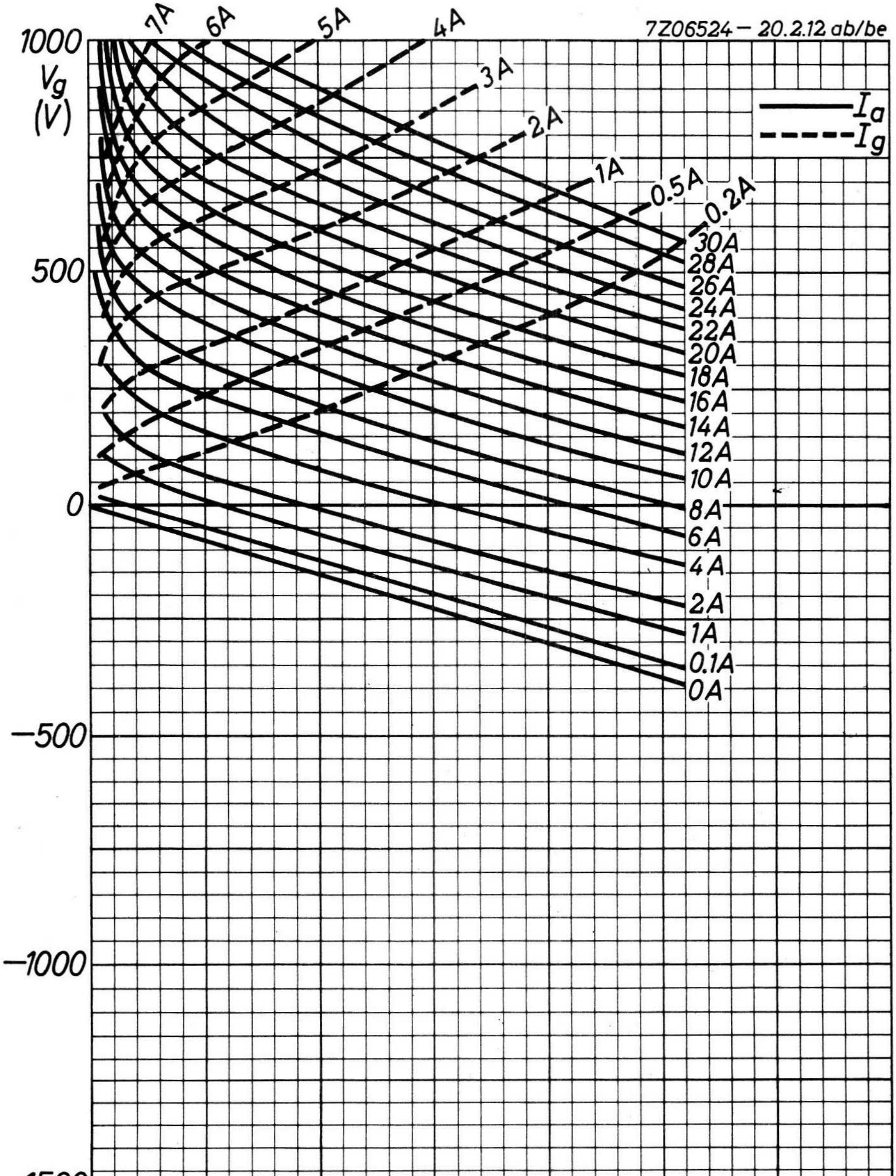
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	20	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

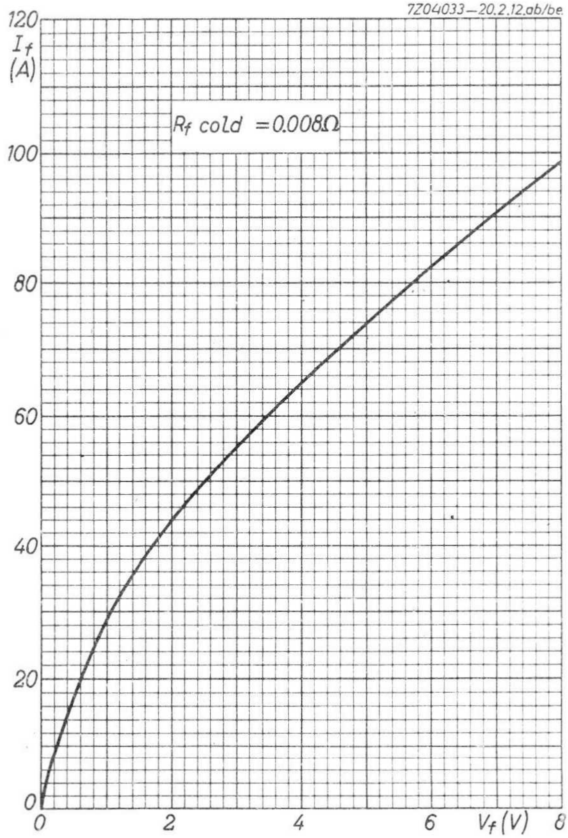
OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Transformer voltage	V_{tr}	=	8.9	7.4	6.0	kV
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	3.2	3.2	3.2	A
Anode current, unloaded	I_a	=	0.52	0.50	0.48	A
Grid current, loaded	I_g	=	0.50	0.50	0.50	A
Grid current, unloaded	I_g	=	0.74	0.77	0.80	A
Grid resistor	R_g	=	2.0	1.6	1.1	kΩ
Load resistance	$R_{a\sim}$	=	1800	1450	1100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	19	%
Anode input power	W_{ia}	=	38.4	32.0	25.6	kW
Anode dissipation	W_a	=	9.4	8.7	7.7	kW
Output power	W_o	=	29.0	23.3	17.9	kW
Efficiency	η	=	75.5	72.5	70	%
Output power in the load	W_ℓ	=	25	20	15.5	kW[1]

[1] Useful power in the load measured in a circuit having an efficiency of 90%

7Z2 3554


7Z06524 – 20.2.12 ab/be
1000
V_g (V)
500
0
–500
–1000
–1500
0
5
10
15 V_a (kV)
I_a
I_g
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
30A
28A
26A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.1A
0A


7Z04033—20.2.12.ab/be.
120
I_f
(A)
R_f cold = 0.008Ω
100
80
60
40
20
0
0
2
4
6
V_f (V)
8

WATER COOLED INDUSTRIAL R.F. POWER TRIODE WITH INTEGRAL HELICAL COOLER

QUICK REFERENCE DATA		
Freq. (MHz)	C osc. industrial	
	V_a (kV)	W_o (kW)
30	12	39
	10	31.3
	8	23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	8	V	+5 % / −10 %
Filament current	I_f	130	A	
Cold filament resistance	R_f	0.006	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	0.9	pF
Grid to all other elements except anode	C_g	45	pF
Anode to grid	C_{ag}	23.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	12	kV
Anode current	I_a	2	A
Amplification factor	μ	21	
Mutual conductance	S	25	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals		max.	220	°C
Water inlet temperature	t_i	max.	50	°C

COOLING: Generally a low velocity air flow to the seals is required

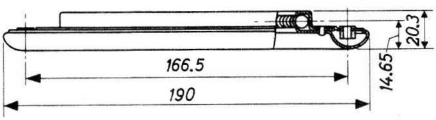
WATER COOLING CHARACTERISTICS

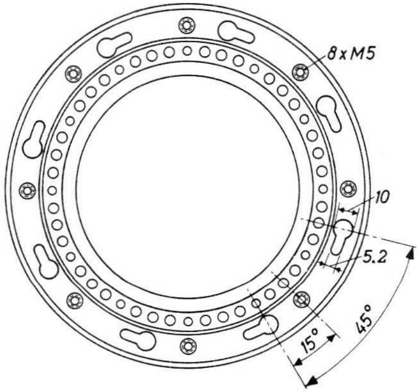
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.5
20	20	9.3	0.3
	50	18.6	1.0

At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation

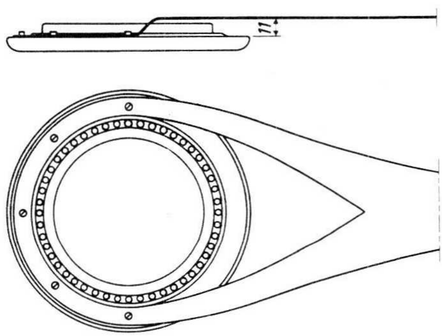
MECHANICAL DATA

Dimensions in mm





Grid connector 40663



Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right.

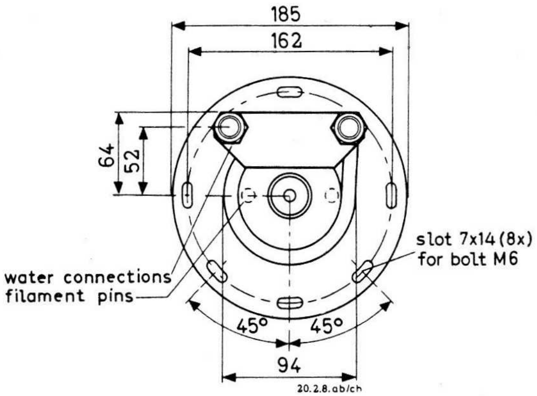
MECHANICAL DATA (continued)

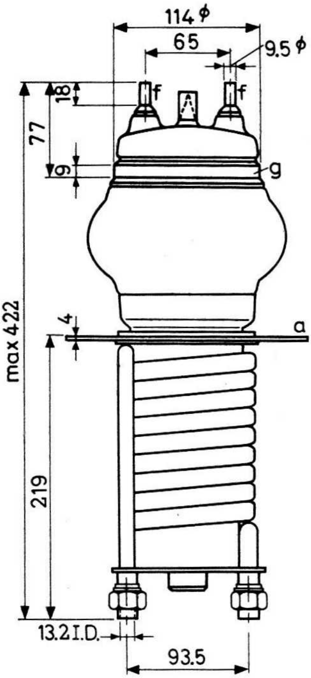
Dimensions in mm

Connectors with cable for filament : 40662

Grid connector 40663

Net weight : 5.4 kg





Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

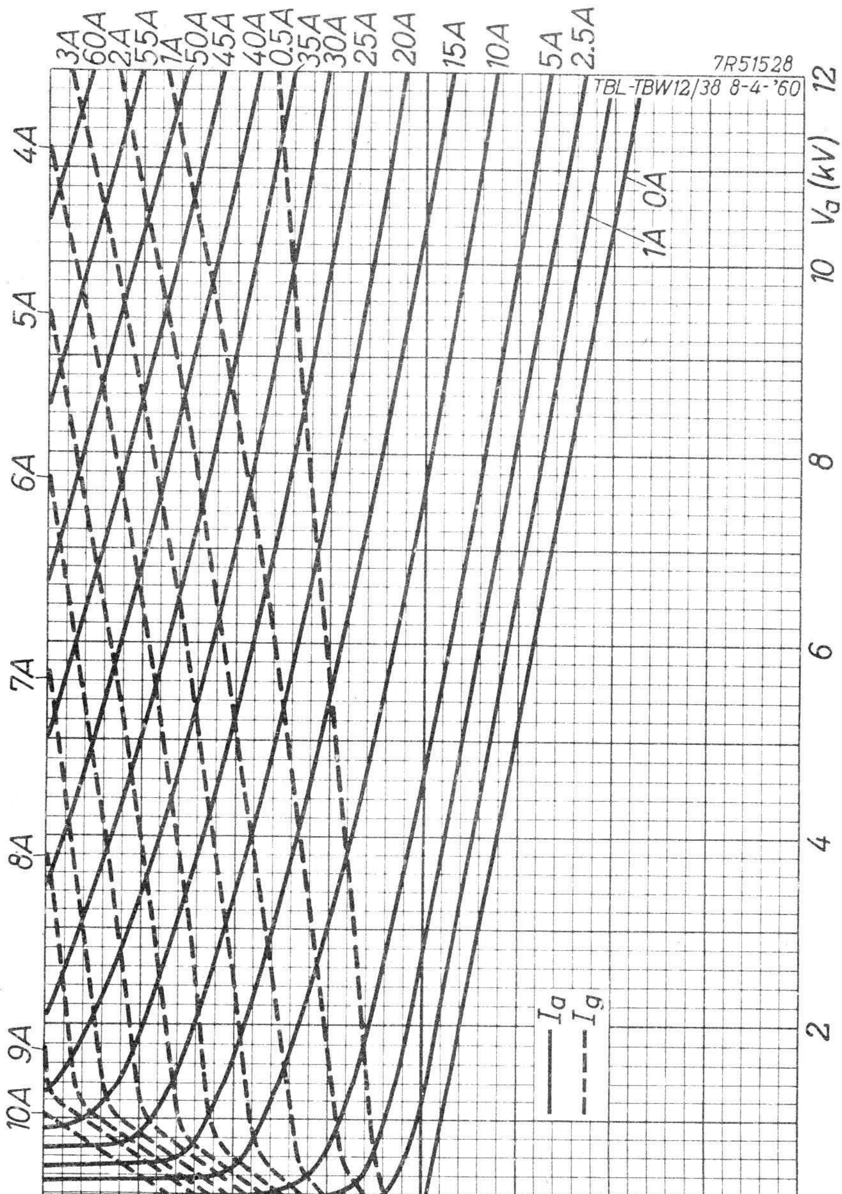
LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	13	kV
Anode current	I_a	max.	5	A
Anode dissipation	W_a	max.	20	kW
Anode input power	W_{ia}	max.	60	kW
Negative grid voltage	$-V_g$	max.	2	kV
Grid current, loaded	I_g	max.	1.5	A
Grid current, unloaded	I_g	max.	2.0	A
Grid circuit resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	30	30	30	MHz
Anode voltage	V_a	12	10	8	kV
Anode current, loaded	I_a	4.5	4.5	4.5	A
Anode current, unloaded	I_a	0.65	0.63	0.62	A
Grid current, loaded	I_g	0.9	0.9	0.9	A
Grid current, unloaded	I_g	1.22	1.3	1.35	A
Grid resistor	R_g	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	1450	1100	800	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	16	19	24	%
Anode input power	W_{ia}	54	45	36	kW
Anode dissipation	W_a	15	13.7	12.8	kW
Output power	W_o	39	31.3	23.2	kW
Efficiency	η	72.5	70	64.5	%
Output power in the load	W_ℓ	30	25	18	kW[1]

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


7R51528
TBL-TBW12/38 8-4-'60
Va (kV)
Vg (V)
Ia
Ig

AIR COOLED COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA				
Frequency (MHz)	C telegr.		C an.mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)
175	2500	475	2000	505
300	2000	460	1600	370
470	1750	405	1400	275
600	1600	350	1280	225
900	1300	155	1040	107

Industrial oscillator class C				
Frequency (MHz)	AC operation		Single-phase full-wave with filter	
	V_{tr} (V)	W_o (W)	V_a (V)	W_o (W)
470	1750	235	1750	385

HEATING: direct; filament thoriated tungsten

Frequency	f	< 600	600 to 750	750 to 900	MHz
Filament voltage	V_f	= 3.4	3.3	3.2	V
Filament current	I_f	= 19	–	–	A

CAPACITANCES

Anode to all except grid	C_a	< 0.12	pF
Grid to all except anode	C_g	= 9	pF
Anode to grid	C_{ag}	= 4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	= 2000	V
Anode current	I_a	= 150	mA
Amplification factor	μ	= 32	
Mutual conductance	S	= 10	mA/V

AIR COOLING CHARACTERISTICS

W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
< 300	0	45	0.45	24.0
	1500	35	0.46	22.5
	3000	25	0.49	21.5

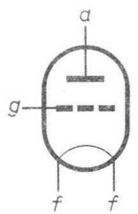
Temperature of envelope = max. 200 °C

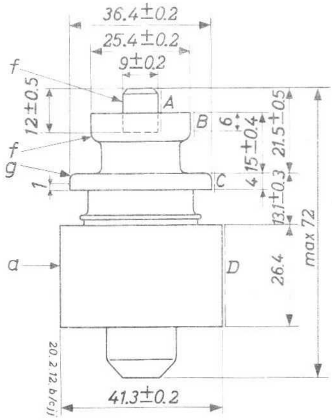
Generally it will be necessary to direct an air flow to the centre filament seal.

MECHANICAL DATA

Dimensions in mm

Net weight: 143 g





Eccentricity of the electrode connections: The electrode connections A, B and C are within cylindrical surfaces having a diameter of 9.5, 25.9 and 36.9mm respectively and being coaxial with the cylindrical surface D.

Mounting position: vertical with anode up or down

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 175	300	470	600	900	MHz
Anode voltage	V_a	=	max. 2500	2000	1750	1600	1300	V
Anode current	I_a	=	max. 400	400	400	400	400	mA
Anode input power	W_{i_a}	=	max. 1000	800	700	640	520	W
Anode dissipation	W_a	=	max. 300	300	300	300	300	W
Negative grid voltage	$-V_g$	=	max. 300	300	300	300	300	V
Grid current	I_g	=	max. 120	120	120	120	120	mA

OPERATING CONDITIONS

Data for grounded grid circuit except for the data at 175 MHz which refer to a grounded cathode circuit.

Frequency	f	=	175	300	470	600	900	MHz
Anode voltage	V_a	=	2500	2000	1750	1600	1300	V
Anode current	I_a	=	260	335	380	400	350	mA
Grid voltage	V_g	=	-200	-120	-105	-90	-60	V
Grid current	I_g	=	100	100	100	100	100	mA
Peak grid AC voltage	V_{g_p}	=	275	-	-	-	-	V
Grid input power	W_{i_g}	=	25	-	-	-	-	W
Anode input power	W_{i_a}	=	650	670	665	640	455	W
Anode dissipation	W_a	=	175	210	260	290	300	W
Output power	W_o	=	475	460	405	350	155	W
Efficiency	η	=	73	69	61	55	34	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 175	300	470	600	900	MHz
Anode voltage	V_a	=	max. 2000	1600	1400	1280	1040	V
Anode current	I_a	=	max. 335	335	335	335	335	mA
Anode input power	W_{i_a}	=	max. 670	536	465	429	348	W
Anode dissipation	W_a	=	max. 200	200	200	200	200	W
Negative grid voltage	$-V_g$	=	max. 300	300	300	300	300	V
Grid current	I_g	=	max. 120	120	120	120	120	mA

OPERATING CONDITIONS

Data for grounded grid circuit except for the data at 175 MHz which refer to a grounded cathode circuit

Frequency	f	=	175	300	470	600	900	MHz
Anode voltage	V_a	=	2000	1600	1400	1280	1040	V [1])
Anode current	I_a	=	335	335	332	332	290	mA
Grid voltage	V_g	=	-200 [2])	-140 [2])	-120	-100	-80	V
Grid current	I_g	=	120	120	110	100	80	mA
Peak grid AC voltage	V_{g_p}	=	275	-	-	-	-	V
Grid input power	W_{i_g}	=	30	-	-	-	-	W
Anode input power	W_{i_a}	=	670	536	465	425	302	W
Anode dissipation	W_a	=	165	166	190	200	200	W
Output power	W_o	=	505	370	275	225	102	W
Efficiency	η	=	75.5	69	59	53	34	%
Modulation depth	m	=	100	100	100	100	100	%
Modulation power	W_{mod}	=	335	268	233	213	151	W

[1]) With respect to cathode

[2]) Partially fixed bias

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with self-rectification

LIMITING VALUES (Absolute limits)

Frequency	f	up to	470	MHz
Transformer voltage	V_{tr}	= max.	1800	V(RMS)
Anode current	I_a	= max.	210	mA
Anode input power	W_{i_a}	= max.	400	W
Anode dissipation	W_a	= max.	170	W
Negative grid voltage	$-V_g$	= max.	500	V
Grid current, loaded	I_g	= max.	85	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance	R_g	= max.	5	kΩ

OPERATING CONDITIONS

Frequency	f	=	470	MHz
Transformer voltage	V_{tr}	=	1750	V(RMS)
Anode current, loaded	I_a	=	185	mA
Anode current, unloaded	I_a	=	105	mA
Grid current, loaded	I_g	=	75	mA
Grid current, unloaded [1]	I_g	=	80	mA
Grid circuit resistance under matched conditions	R_g	=	400	Ω
Anode input power	W_{i_a}	=	365	W
Anode dissipation	W_a	=	130	W
Tube output power	W_o	=	235	W
Tube efficiency	η	=	64	%
Output power in the load [2]	W_ℓ	=	165	W

[1] The grid resistance is obtained by a current stabilising device

[2] Measured by a calorimetric method

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from a single-phase full-wave rectifier with filter.

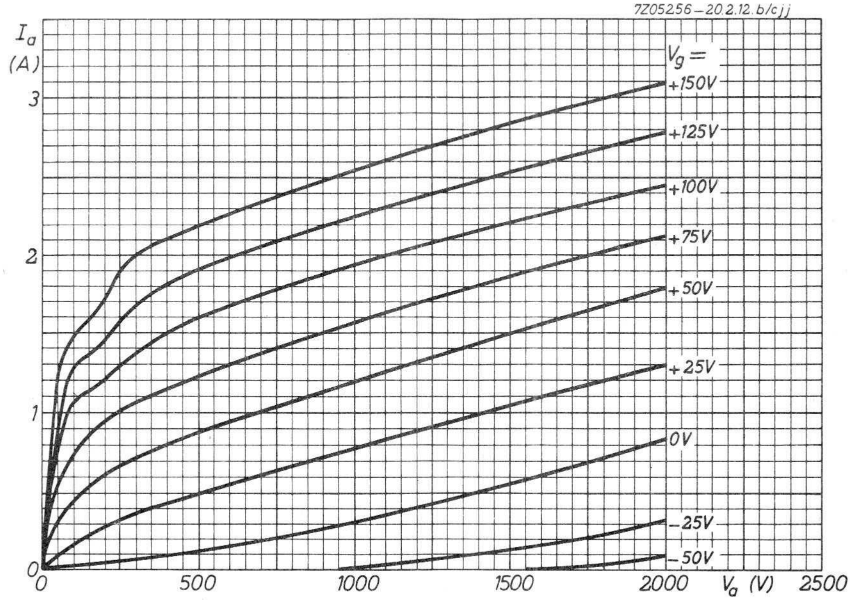
LIMITING VALUES (Absolute limits)

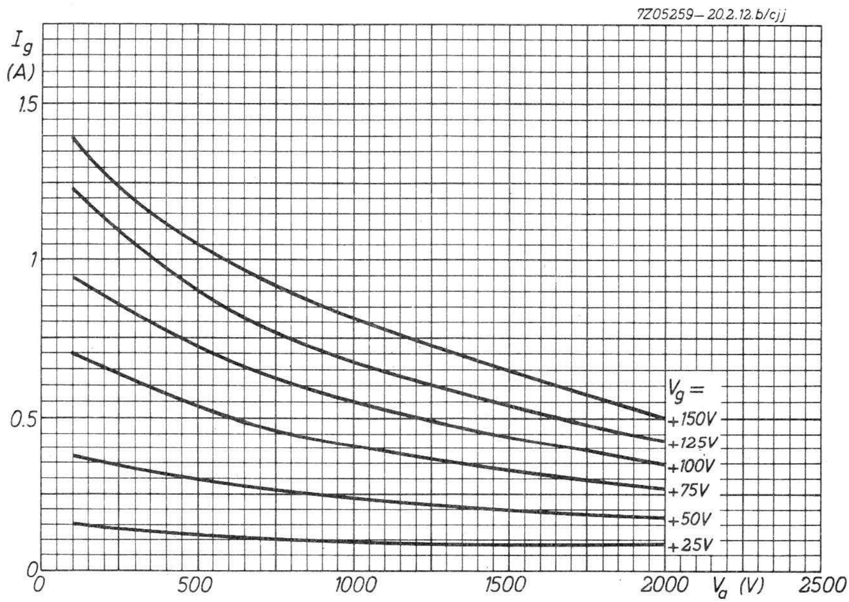
Frequency	f	up to	470	MHz
Anode voltage	V_a	= max.	1800	V
Anode current	I_a	= max.	400	mA
Anode input power	W_{i_a}	= max.	700	W
Anode dissipation	W_a	= max.	300	W
Negative grid voltage	$-V_g$	= max.	300	V
Grid current, loaded	I_g	= max.	110	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance	R_g	= max.	5	kΩ

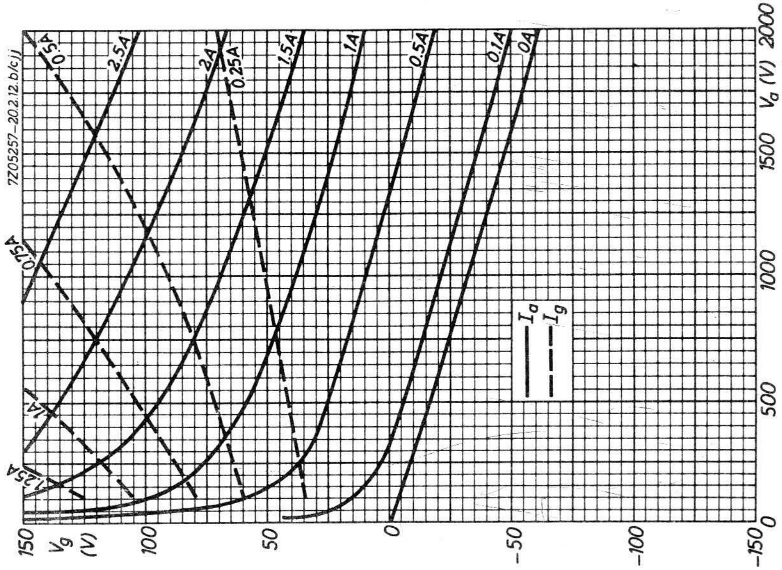
OPERATING CONDITIONS

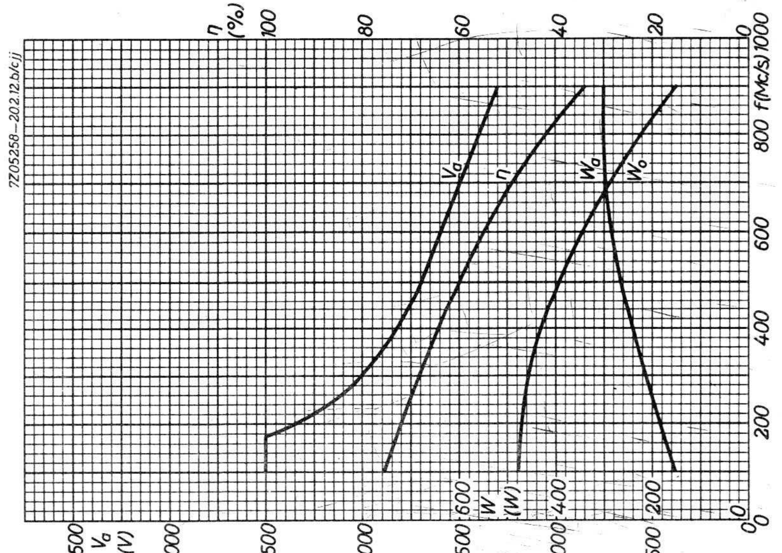
Frequency	f	=	470	MHz
Anode voltage	V_a	=	1750	V
Anode current, loaded	I_a	=	340	mA
Anode current, unloaded	I_a	=	170	mA
Grid current, loaded	I_g	=	95	mA
Grid current, unloaded [1]	I_g	=	100	mA
Grid circuit resistance under matched conditions	R_g	=	1000	Ω
Anode input power	W_{i_a}	=	595	W
Anode dissipation	W_a	=	210	W
Tube output power	W_o	=	385	W
Tube efficiency	η	=	65	%
Output power in the load	W_ℓ	=	270	W

[1]) The grid resistance is obtained by a current stabilising device.


7Z05256-20.2.12.b/cjj
I_a
(A)
3
2
1
0
$V_g =$
+150V
+125V
+100V
+75V
+50V
+25V
0V
-25V
-50V
0
500
1000
1500
2000
V_a (V)
2500


7Z05259-20.2.12.b/cjj
I_g
(A)
1.5
1
0.5
0
$V_g =$
+150V
+125V
+100V
+75V
+50V
+25V
0
500
1000
1500
2000
V_a (V)
2500


7Z05257-202.12.b/cij
V_a (V)
V_g (V)
I_a
I_g
2.5A
2A
1.5A
1A
0.5A
0.1A
0A
0.5A
0.25A
0.75A
1A
1.25A


7Z05258-202.12.b/cij
η (%)
f (Mc/s)
V_a (V)
W (W)
V_a
η
W_a
W_o

AIR COOLED COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA						
Frequency (MHz)	C telegr. grounded grid		Industrial oscillator class C			
			DC operation		AC operation	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_{tr} (V)	W_o (W)
470	2000	595	2000	480	1800	230
640	1800	490				
730	1800	460				
810	1800	408	1800	284		

HEATING: direct; filament thoriated tungsten

Frequency	f	<	600	600 to 750	750 to 900	MHz
Filament voltage	V_f	=	3.4	3.3	3.2	V
Filament current	I_f	=	19	–	–	A

CAPACITANCES

Anode to all except grid	C_a	<	0.12	pF
Grid to all except anode	C_g	=	11.5	pF
Anode to grid	C_{ag}	=	6.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	2000	V
Anode current	I_a	=	200	mA
Amplification factor	μ	=	33	
Mutual conductance	S	=	10	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seal between filament terminals = max. 200 °C

Temperature of other seals = max. 250 °C

COOLING CHARACTERISTICS

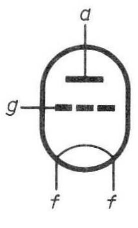
W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
400	0	45	0.65	12
	1500	35	0.65	12
	3000	25	0.65	12

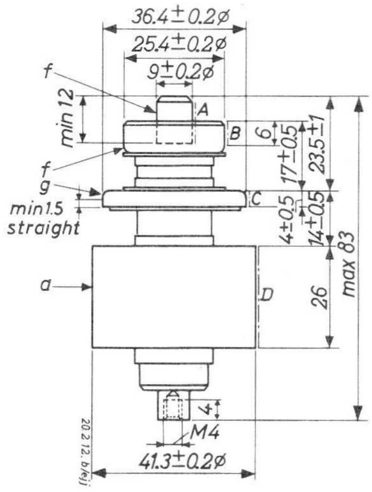
The required quantity of air is independent of the anode dissipation and the frequency.

MECHANICAL DATA

Dimensions in mm

Net weight: 157 g





Eccentricity of the electrode connections: The electrode connections A, B and C are within cylindrical surfaces having a diameter of 9.5, 25.9 and 36.9 mm respectively and being concentric with the cylindrical surface D.

Mounting position: vertical with the anode up or down.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	470	600	900	MHz
Anode voltage	V_a	=	max.	2200	2100	2000	V
Anode current	I_a	=	max.	400	400	400	mA
Anode input power	W_{i_a}	=	max.	880	840	800	W
Anode dissipation	W_a	=	max.	400	400	400	W
Negative grid voltage	$-V_g$	=	max.	300	300	300	V
Grid current	I_g	=	max.	120	120	120	mA

OPERATING CONDITIONS in grounded grid circuit

Frequency	f	=	470	640	730	810	MHz
Anode voltage	V_a	=	2000	1800	1800	1800	V [1]
Anode current	I_a	=	400	400	400	400	mA
Grid voltage	V_g	=	−140	−120	−120	−120	V
Grid current	I_g	=	120	100	100	100	mA
Grid input power	W_{i_g}	=	120	105	105	105	W
Anode input power	W_{i_a}	=	800	720	720	720	W
Anode dissipation	W_a	=	290	310	340	392	W
Output power	W_o	=	510+85	410+80	380+80	328+80	W [2]
Tube efficiency	η	=	63.5	57	53	45.5	%

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[1]) With respect to cathode

[2]) Power transferred from driving stage included

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute limits)

Frequency	f	up to	470	900	MHz
Anode voltage	V_a	= max.	2200	2000	V
Anode current	I_a	= max.	400	400	mA
Anode input power	W_{i_a}	= max.	880	800	W
Anode dissipation	W_a	= max.	400	400	W
Negative grid voltage	$-V_g$	= max.	300	300	V
Grid current, loaded	I_g	= max.	120	120	mA
Grid current, unloaded	I_g	= max.	130	130	mA
Grid circuit resistance	R_g	= max.	10	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	470	810	MHz
Anode voltage	V_a	=	2000	1800	V
Anode current, loaded	I_a	=	380	380	mA
Anode current, unloaded	I_a	=	170	-	mA
Grid circuit resistance	R_g	=	1000	1000	Ω [1]
Grid current, loaded	I_g	=	110	110	mA
Grid current, unloaded	I_g	=	120	120	mA
Anode input power	W_{i_a}	=	760	684	W
Anode dissipation	W_a	=	280	400	W
Tube output power	W_o	=	480	284	W
Tube efficiency	η	=	63	41	%
Output power in the load	W_ℓ	=	340	200	W

[1] The grid circuit resistance is obtained by a current stabilising device. The stated value applies to loaded conditions.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE in grounded grid circuit with self rectification

LIMITING VALUES (Absolute limits)

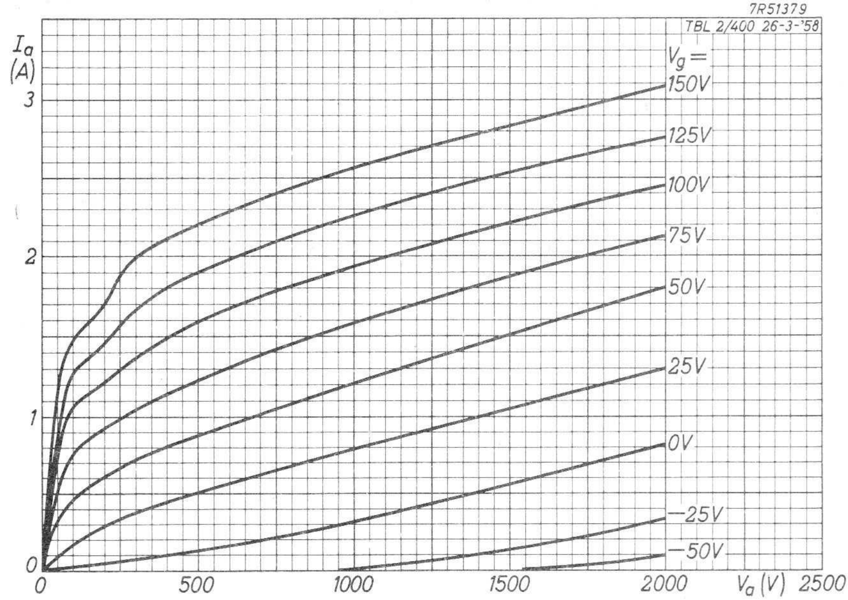
Voltages with respect to cathode

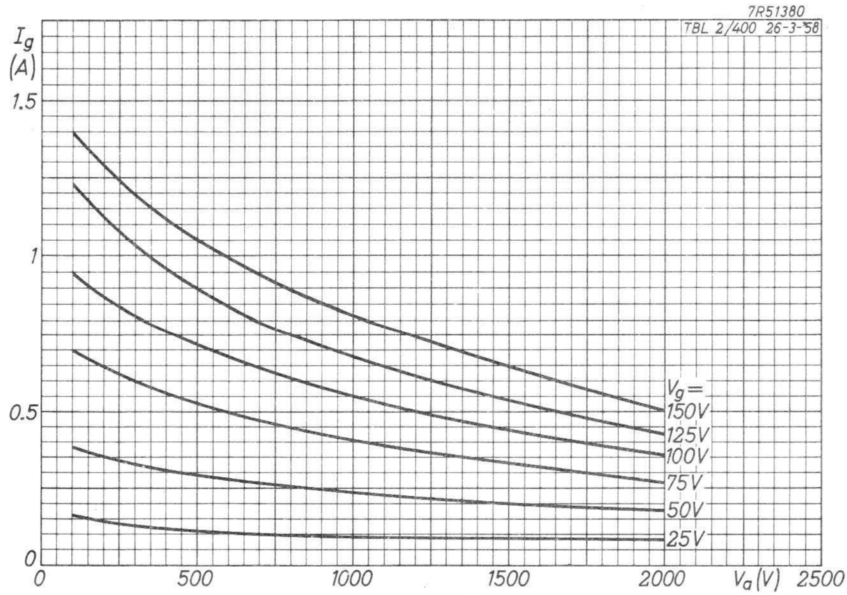
Frequency	f		up to	470	MHz
Transformer voltage	V_{tr}	=	max.	2000	V(RMS)
Anode current	I_a	=	max.	210	mA
Anode input power	W_{i_a}	=	max.	450	W
Anode dissipation	W_a	=	max.	170	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current, loaded	I_g	=	max.	85	mA
Grid current, unloaded	I_g	=	max.	120	mA
Grid circuit resistance	R_g	=	max.	5	kΩ

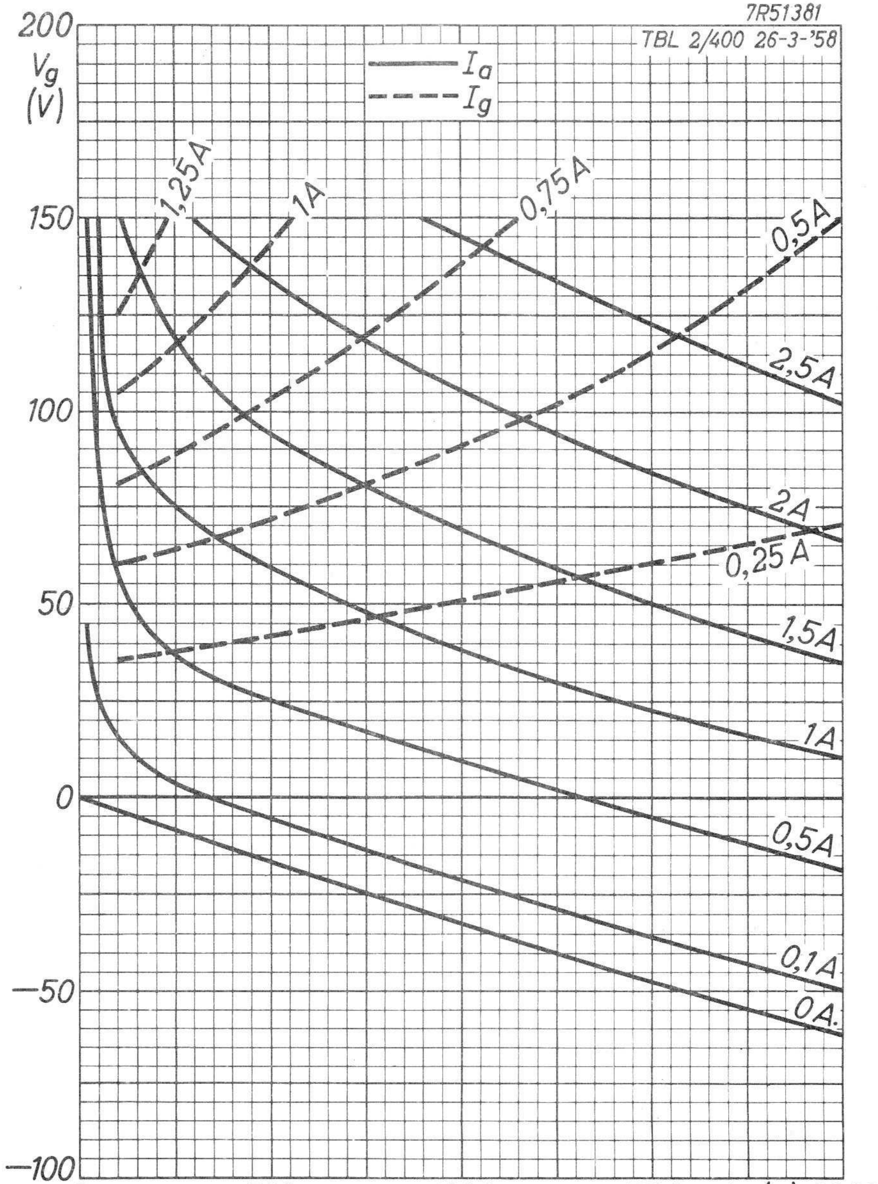
OPERATING CHARACTERISTICS

Voltages with respect to cathode

Frequency	f	=	470	MHz
Transformer voltage	V_{tr}	=	1800	V(RMS)
Anode current, loaded	I_a	=	190	mA
Anode current, unloaded	I_a	=	110	mA
Grid current, loaded	I_g	=	70	mA
Grid current, unloaded	I_g	=	100	mA
Grid circuit resistance	R_g	=	400	Ω
Anode input power	W_{i_a}	=	380	W
Anode dissipation	W_a	=	150	W
Tube output power	W_o	=	230	W
Tube efficiency	η	=	60	%
Output power in the load	W_ℓ	=	160	W


7R51379
TBL 2/400 26-3-'58
I_a (A)
3
2
1
0
V_g =
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
0
500
1000
1500
2000
V_a (V)
2500


7R51380
TBL 2/400 26-3-'58
I_g (A)
1.5
1
0.5
0
V_g =
150V
125V
100V
75V
50V
25V
0
500
1000
1500
2000
V_a (V)
2500


7R51381
TBL 2/400 26-3-'58
200
150
100
50
0
−50
−100
V_g (V)
I_a
I_g
1,25A
1A
0,75A
0,5A
2,5A
2A
0,25 A
1,5A
1A
0,5A
0,1A
0A
0
500
1000
1500
V_a (V) 2000

AIR COOLED COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Frequency (MHz)	C telegr. grounded grid	
	V_a (V)	W_o (W)
400	2500	670
625	2200	580

HEATING : direct; filament thoriated tungsten

Frequency	f	< 600	600 to 750	> 750	MHz
Filament voltage	V_f	= 3.4	3.3	3.2	V
Filament current	I_f	= 19	-	-	A

CAPACITANCES

Anode to all except grid	C_a	=	0.05	pF
Grid to all except anode	C_g	=	11	pF
Anode to grid	C_{ag}	=	3.8	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	2400	V
Anode current	I_a	=	240	mA
Amplification factor	μ	=	70	
Mutual conductance	S	=	14	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of envelope = max. 200 °C

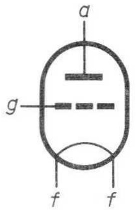
COOLING CHARACTERISTICS

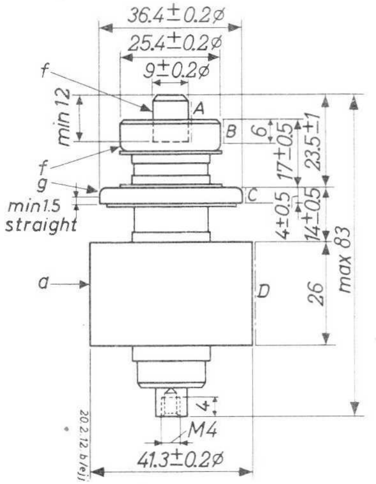
W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
500	0	45	0.9	24
	1500	35	0.9	20
	3000	25	1.0	21

MECHANICAL DATA

Dimensions in mm

Net weight: 157 g





Eccentricity of the electrode connections: The electrode connections A, B and C are within cylindrical surfaces having a diameter of 9.5, 25.9 and 36.9 mm respectively and being concentric with the cylindrical surface D.

Mounting position: vertical with the anode up or down

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

LIMITING VALUES (Absolute limits)

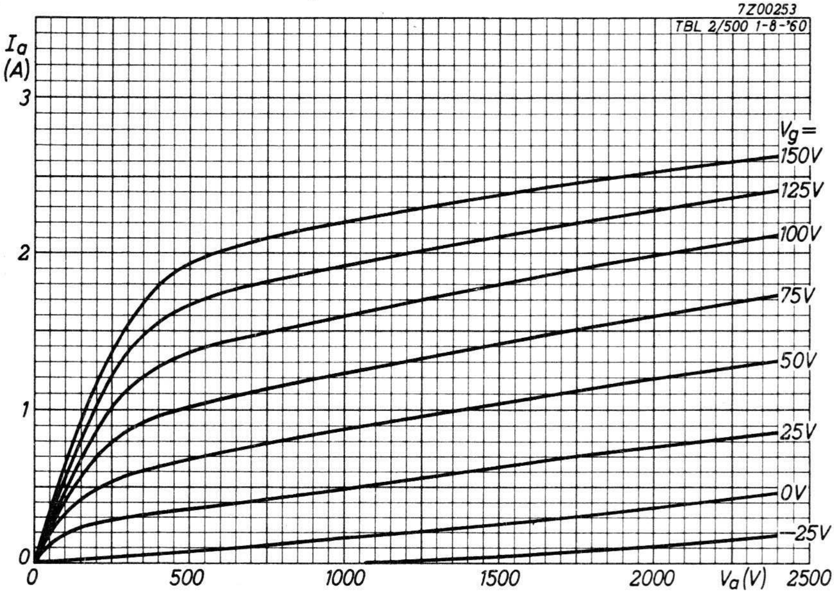
Frequency	f	up to	400	625	940	MHz
Anode voltage	V_a	= max.	2700	2500	2000	V
Anode current	I_a	= max.	400	400	400	mA
Anode input power	W_{i_a}	= max.	1000	880	800	W
Anode dissipation	W_a	= max.	500	500	500	W
Negative grid voltage	$-V_g$	= max.	300	300	300	V
Grid current	I_g	= max.	175	175	160	mA

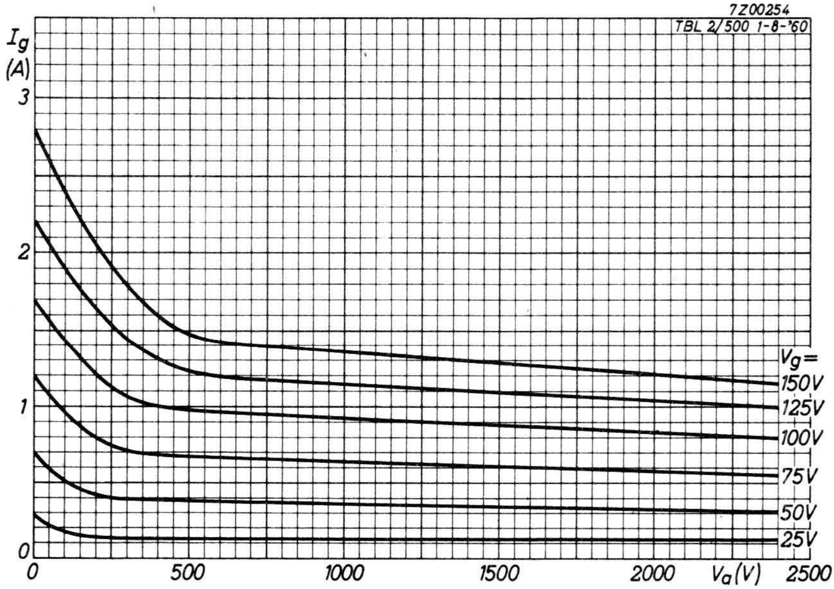
OPERATING CONDITIONS in grounded grid circuit

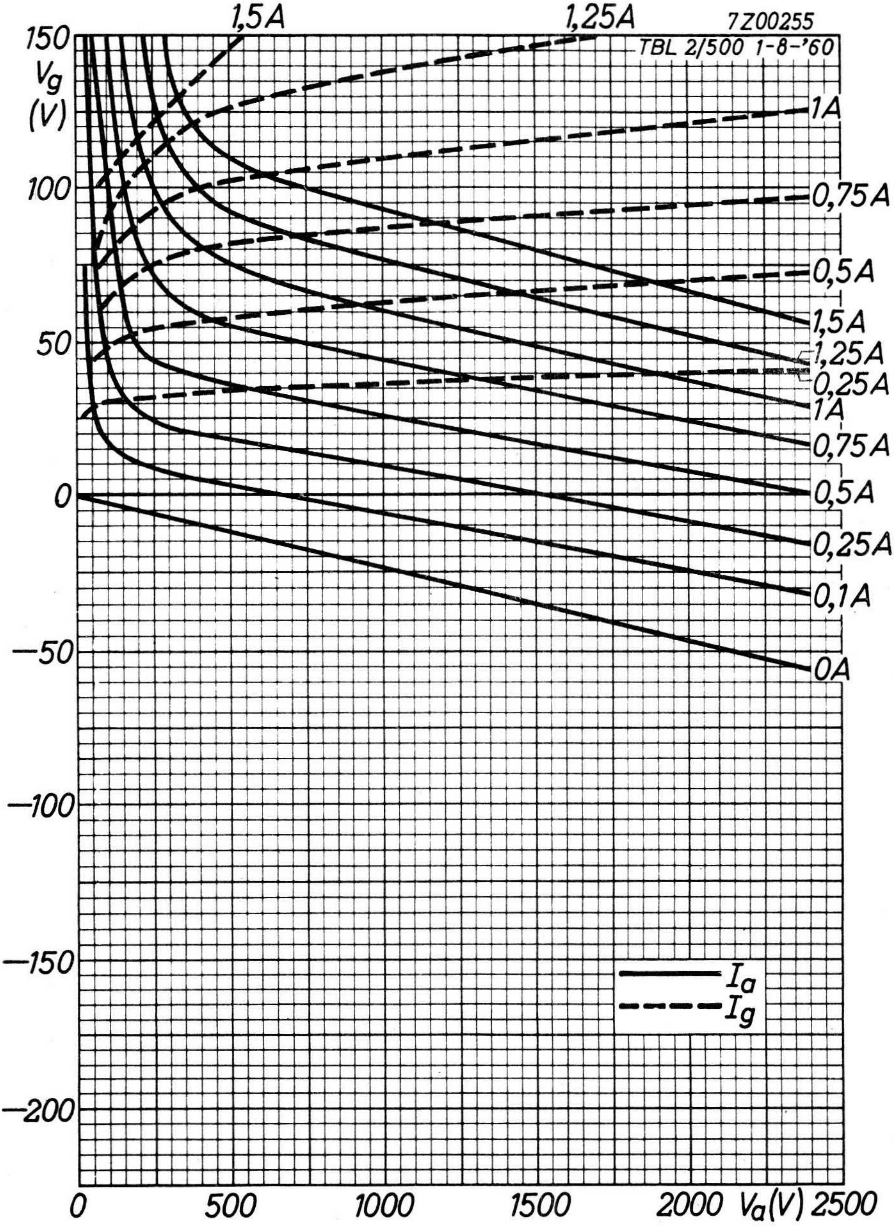
Frequency	f	=	400	625	MHz
Anode voltage	V_a	=	2500	2200	V
Negative grid voltage	$-V_g$	=	70	60	V
Anode current	I_a	=	380	380	mA
Grid current	I_g	=	160	170	mA
Grid input power	W_{i_g}	=	70	65	W
Anode input power	W_{i_a}	=	950	835	W
Anode dissipation	W_a	=	330	302	W
Tube output power	W_o	=	620+50	533+47	W [1])
Tube efficiency	η	=	65	64	%
Output power in the load	W_ℓ	=	470	405	W [2])
Power gain	W_o/W_i	=	9.6	8.9	

[1]) Power transferred from driving stage included

[2]) Measured in a circuit having an efficiency of 70%


7Z00253
TBL 2/500 1-8-'60
I_a (A)
3
2
1
0
V_g =
150V
125V
100V
75V
50V
25V
0V
−25V
0
500
1000
1500
2000
V_a (V)
2500


7Z00254
TBL 2/500 1-8-'60
I_g (A)
3
2
1
0
V_g =
150V
125V
100V
75V
50V
25V
0
500
1000
1500
2000
V_a (V)
2500


1,5A
1,25A
7Z00255
TBL 2/500 1-8-'60
150
V_g
(V)
100
50
0
−50
−100
−150
−200
1A
0,75A
0,5A
1,5A
1,25A
0,25A
1A
0,75A
0,5A
0,25A
0,1A
0A
I_a
I_g
0
500
1000
1500
2000
V_a(V)
2500

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	three phase	
	V_a (kV)	W_o (kW)
30	7 6	17.7 14.3

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	6.3	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	136	A
Cold filament resistance	R_{fo}	=	0.005	Ω

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	1.2	pF
Grid to all other elements except anode	C_g	=	44.5	pF
Anode to grid	C_{ag}	=	33.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	2.5	A
Mutual conductance	S	=	23	mA/V
Amplification factor	μ	=	17.5	

TEMPERATURE LIMITS (Absolute limits)

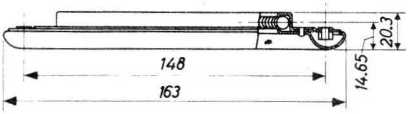
Temperature of all seals = max. 220 ^{o}C

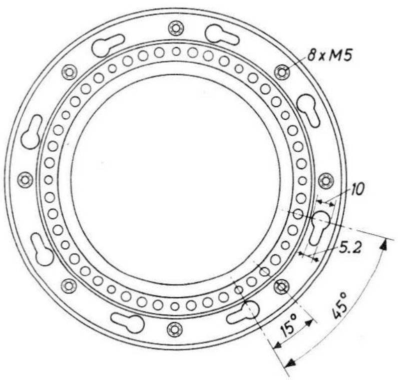
AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
5	0	45	5.9	15
	0	35	5.2	12
	1500	35	6.2	14
	3000	25	6.6	15
7.5	0	45	9.0	34
	0	35	8.0	27
	1500	35	9.5	32
	3000	25	10.2	34
10	0	45	12.3	63
	0	35	11	50
	1500	35	13	59
	3000	25	14	64

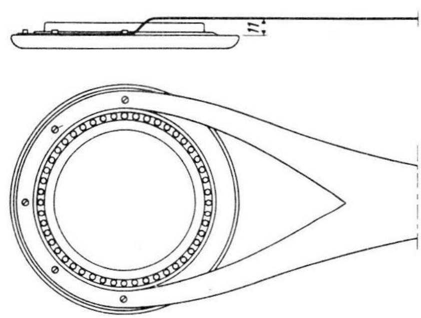
MECHANICAL DATA

Dimensions in mm





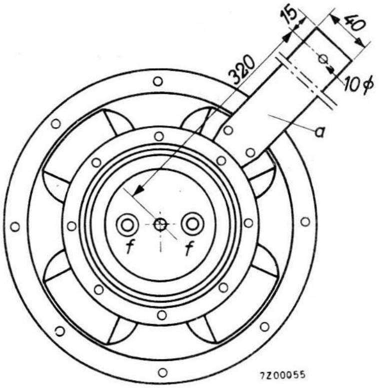
Grid connector 40664

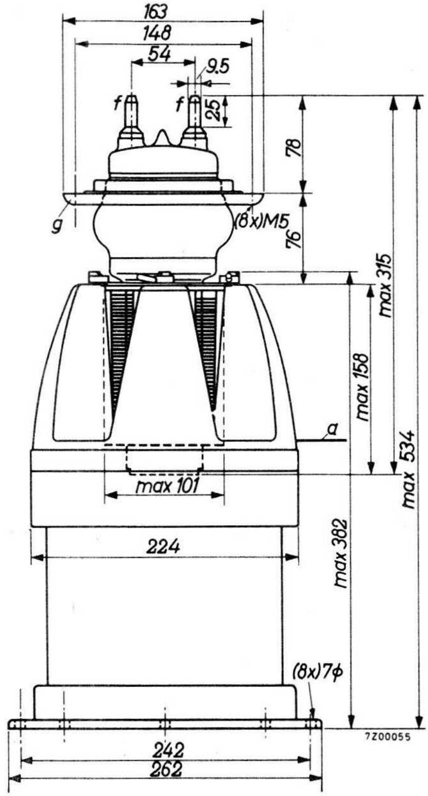


Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz , the grid lead should be connected as shown in the figure at right

MECHANICAL DATA (continued)





ACCESSORIES

Filament connectors with cable	: 40662
Frid connector	: 40664
Insulating pedestal	: K508
or air distributor	: K509
Net weight of tube	: 3.8 kg
Net weight of pedestal	: 7.4 kg

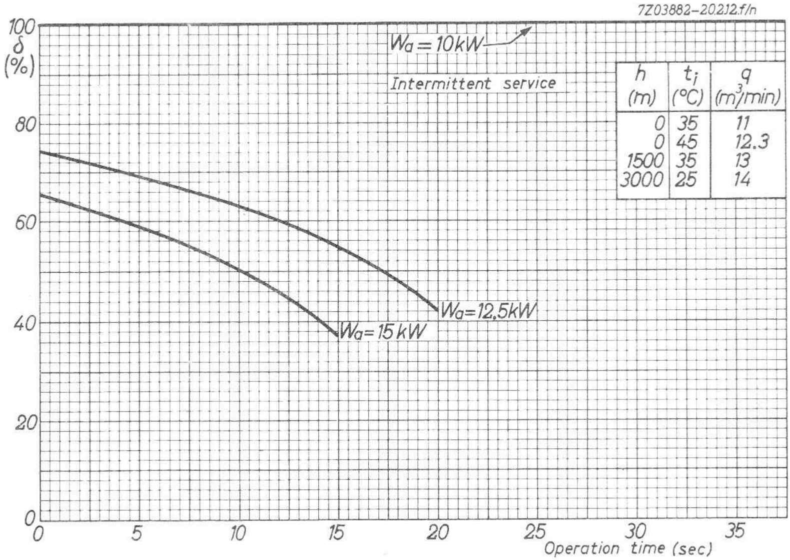
Dimensions in mm

Mounting position: vertical with anode down

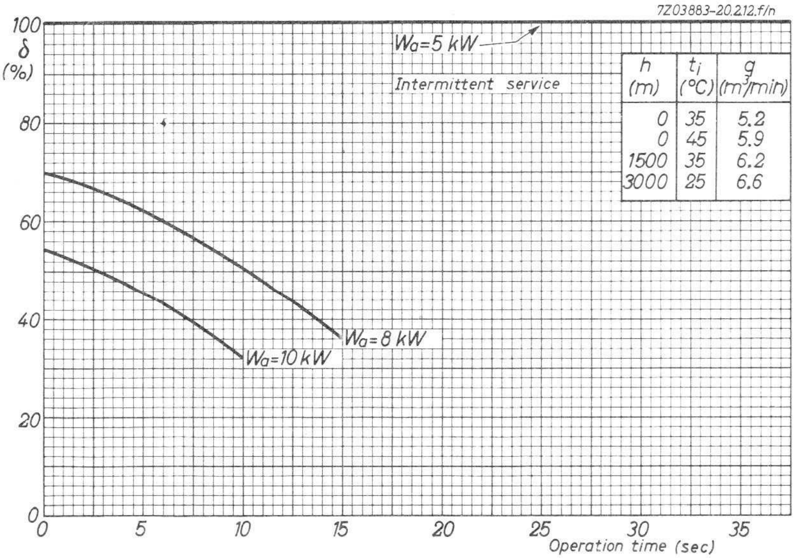
For intermittent service see curves page 4

For further data and curves (except cooling curves) please refer to type TBH6/14

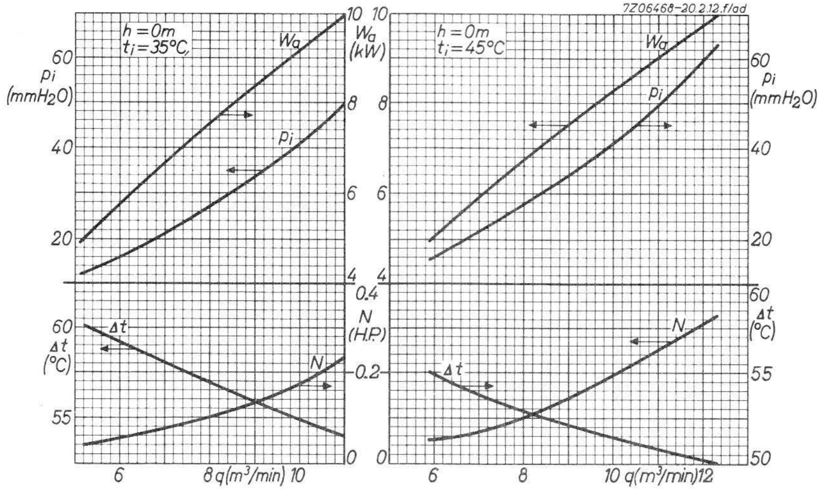
Limits of anode dissipation and cooling, intermittent service.

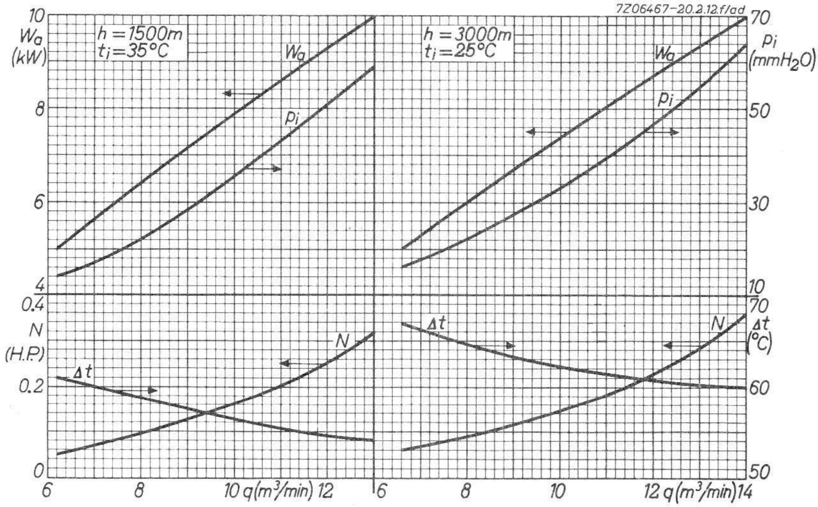


h (m)	t_i (°C)	q (m^3/min)
0	35	11
0	45	12.3
1500	35	13
3000	25	14



h (m)	t_i (°C)	q (m^3/min)
0	35	5.2
0	45	5.9
1500	35	6.2
3000	25	6.6


7Z06468-20.2.12.f/ad
h = 0m
t_i = 35°C,
h = 0m
t_i = 45°C
W_a
p_i
(mmH$_2$O)
W_a
(kW)
N
(H.P.)
Δt
(°C)
q(m³/min)


7Z06467-20.2.12.f/ad
h = 1500m
t_i = 35°C
h = 3000m
t_i = 25°C
W_a
(kW)
p_i
(mmH$_2$O)
N
(H.P.)
Δt
(°C)
q(m³/min)

AIR COOLED
COAXIAL R.F. POWER TRIODE

QUICK REFERENCE DATA						
Freq. (MHz)	C telegr. grounded grid		B television			
			Neg. mod. Pos. sync.		Pos. mod. Neg. sync.	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW) sync.	V_a (kV)	W_o (kW) white
110	5	17				
48 to 88			5	17	5	17
170 to 220			4	12	4	12

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3	V
Filament current	I_f	=	154	A
Cold filament resistance	R_{fo}	=	0.0054	Ω

The filament current must never exceed a peak value of 500 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.6	pF [1])
Grid to all other elements except anode	C_g	=	65	pF
Anode to grid	C_{ag}	=	29	pF

TYPICAL CHARACTERISTICS

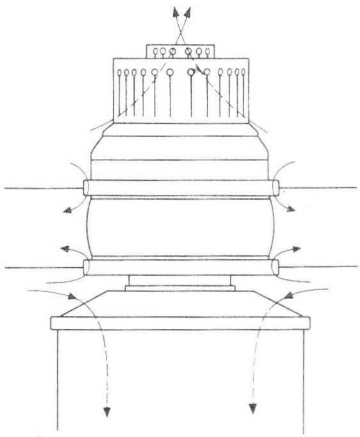
Anode current	I_a	=	1	A
Anode voltage	V_a	=	4	kV
Amplification factor	μ	=	60	
Mutual conductance	S	=	60	mA/V

[1]) Anode fully screened from filament terminals by a flat metal screen connected to the grid terminal

AIR COOLING CHARACTERISTICS. See also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
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	40
	3000	25	9	36
10	0	35	11	65
	1500	35	13	75
	3000	25	13	66

Recommended direction of air flow



Generally it is necessary to direct an air flow on the grid, anode and filament seals. E.g. at 220 MHz an air flow of 0.6 m^3/min on each of these seals is necessary.

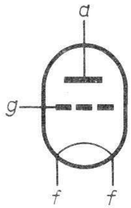
TEMPERATURE LIMITS (Absolute limits)

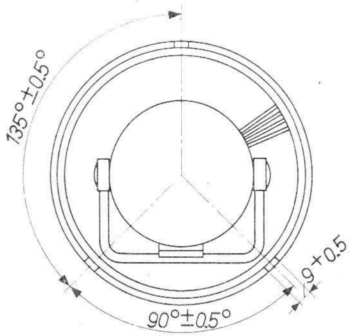
Temperature of seals = max. 180 °C

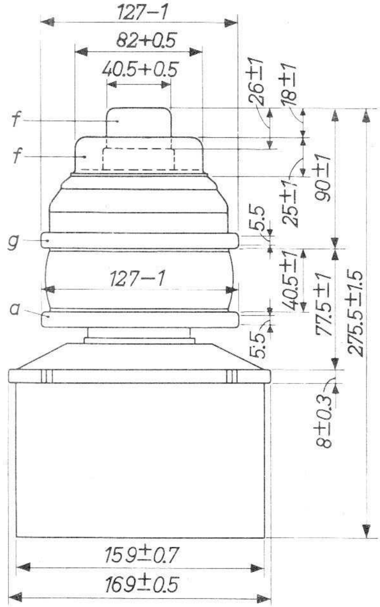
MECHANICAL DATA

Dimensions in mm

Net weight: 9.5 kg







Eccentricity of outer diameters of the electrode terminals and of the protruding edge of the radiator housing with respect to the radiator housing is max. 1 mm

Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal	40654
Grid and anode connector	40651
Inner filament connector	40652
Outer filament connector	40653

R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f		up to 110	MHz
Anode voltage	V_a	=	max. 5.5	kV
Negative grid voltage	$-V_g$	=	max. 500	V
Anode current	I_a	=	max. 6	A
Grid current	I_g	=	max. 1.5	A
Anode input power	W_{ia}	=	max. 30	kW
Anode dissipation	W_a	=	max. 10	kW

OPERATING CONDITIONS

Frequency	f	=	110	MHz
Anode voltage	V_a	=	5	kV
Grid voltage	V_g	=	-300	V
Anode current	I_a	=	4.8	A
Grid current	I_g	=	1.2	A
Peak grid A.C. voltage	V_{g_p}	=	520	V
Grid input power	W_{ig}	=	2560	W
Anode input power	W_{ia}	=	24	kW
Anode dissipation	W_a	=	9	kW
Output power	W_o	=	15 + 2	kW [1])
Efficiency	η	=	62.5	% [2])

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE; linear, grounded-grid amplifier
Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute limits)

Frequency	f		up to 88	up to 220	MHz
Anode voltage	V_a	=	max. 5.5	max. 4.5	kV
Anode input power	W_{ia} sync	=	max. 25	max. 22	kW
Anode dissipation	W_a sync	=	max. 10	max. 10	kW
Anode current	I_a sync	=	max. 6	max. 6	A
Grid current	I_g sync	=	max. 1.2	max. 1.2	A

OPERATING CONDITIONS (at centre frequency of the resonance curve)

Frequency	f		=	48 to 88	170 to 220	MHz
Bandwidth	B (−1.5 dB)		=	–	7	MHz
Bandwidth	B (−3 dB)		=	6	12	MHz
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g		=	−90	−75	V
Peak grid A.C. voltage	V_{g_p}	sync	=	270	255	V
		black	=	200	180	V
Anode current	I_a	sync	=	4.8	4.8	A
		black	=	3.6	3.6	A
Grid current	I_g	sync	=	1.0	1.0	A
		black	=	0.35	0.35	A
Grid input power	W_{ig}	sync	=	1.4	1.3	kW
Output power	W_o	sync	=	17	12	kW
		black	=	9.6	6.75	kW

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE ; linear, grounded-grid amplifier
Positive modulation, negative synchronisation (RTF and BBC system)

LIMITING VALUES (Absolute limits)

Frequency	f			up to 88	up to 220	MHz
Anode voltage	V_a		=	max. 5.5	max. 4.5	kV
Anode input power	W_{ia}	white	=	max. 25	max. 22	kW
Anode current	I_a	white	=	max. 6	max. 6	A
Grid current	I_g	white	=	max. 1.2	max. 1.2	A
Anode dissipation	W_a	white	=	max. 10	max. 10	kW

OPERATING CONDITIONS (at centre frequency of the resonance curve)

Frequency	f		=	48 to 88	170 to 220	MHz
Bandwidth	B (−3 dB)		=	6	12	MHz
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g		=	−90	−75	V
Peak grid A.C. voltage	V_{g_p}	white	=	270	255	V
		black	=	110	95	V
Anode current	I_a	white	=	4.8	4.8	A
		black	=	1.45	1.45	A
Grid current	I_g	white	=	1	1	A
		black	=	0.2	0.2	A
Grid input power	W_{ig}	white	=	1.4	1.3	kW
Output power	W_o	white	=	17	12	kW
		black	=	1.7	1.2	kW

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA				
Industrial R.F. oscillator class C				
Freq. (MHz)	Three phase rectifier			
	Continuous		Intermittent	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
50	7 6	4.85 4.1	 6	 5.9

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3	V $^{+\ 5\%}_{-10\%}$
Filament current	I_f	=	65	A

CAPACITANCES

Anode to all other elements except grid	C_a	<	0.5	pF
Grid to all other elements except anode	C_g	=	13	pF
Anode to grid	C_{ag}	=	7.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	0.24	A
Amplification factor	μ	=	23	
Mutual conductance	S	=	7	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	= max.	220 °C
Temperature of external parts of the anode	= max.	270 °C

7Z2 3531

COOLING

Continuous service

W_a (kW)	q_{min} (m^3/min)	p_i (mm H_2O)
1.3	1.6	16
1.7	2.1	25

For intermittent service see figure page A

At higher altitudes and/or temperatures a corresponding higher amount of air should be applied

RECOMMENDED COOLING DEVICE

(1) = metal housing (see page 3)

(2) = glass cylinder

(3) = socket 2422 511 05001

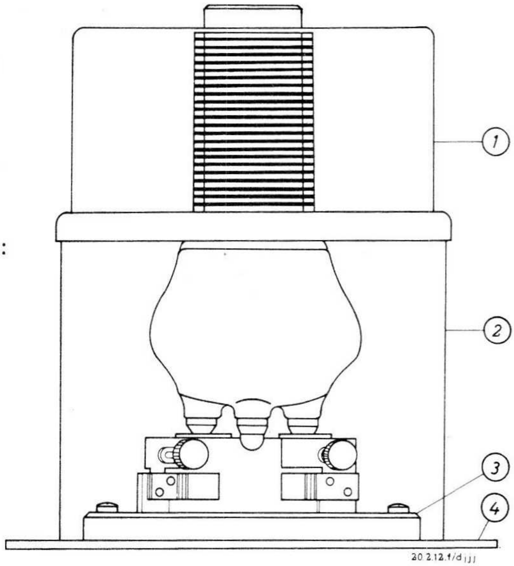
(4) = ground plate (see page 3)

Dimensions of the glass cylinder:

Height : 118 mm

Outside diameter : 150 mm

Inside diameter : 144 mm

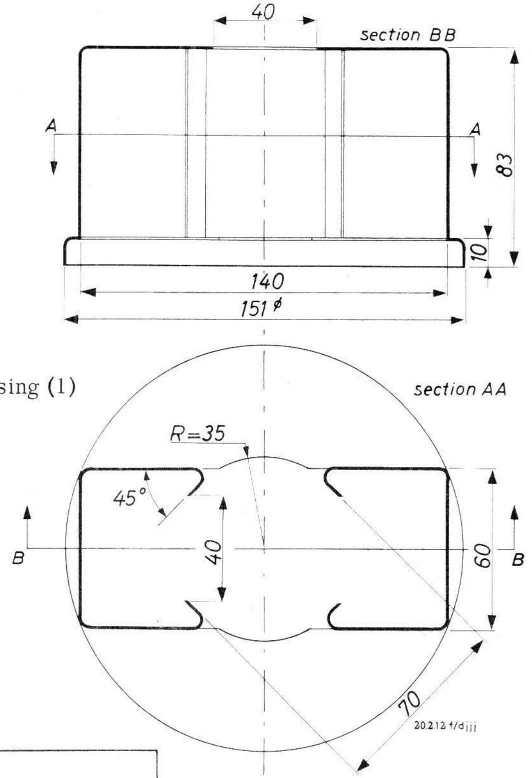


The cooling air should preferably be supplied through the space under the ground plate (4). This ground plate should have holes of sufficient cross section to pass the required air flow.

The housing (1) should be connected to the anode connector. At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally between both grid terminals to avoid excessive grid seal temperatures.

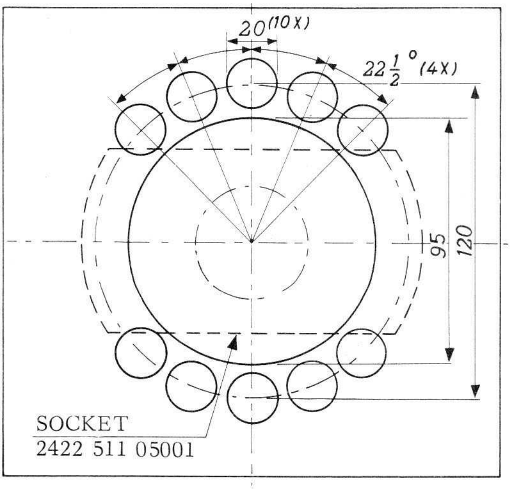
RECOMMENDED COOLING DEVICE (continued)

Dimensions in mm



Metal housing (1)

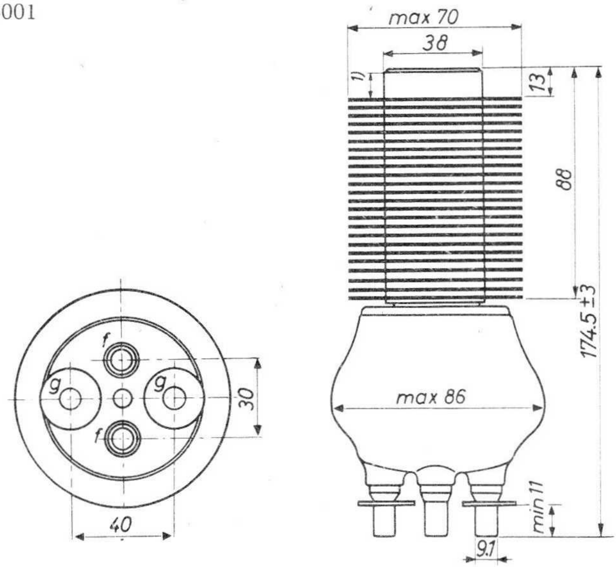
Ground plate (4)



7Z2 8656

MECHANICAL DATA (dimensions in mm)

Socket: 2422 511 05001



Mounting position: vertical with anode up or down

1) Area for anode connector

7Z2 8657

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits) continuous service

Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode current	I_a	= max.	1	A
Anode input power	W_{ia}	= max.	7	kW
Anode dissipation	W_a	= max.	1.7	kW
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid resistor	R_g	= max.	10	kΩ

OPERATING CONDITIONS, continuous service

Frequency	f	=	50	50	MHz
Transformer voltage	V_{tr}	=	6.0	5.1	kV_{RMS}
Anode voltage	V_a	=	7	6	kV
Anode current, loaded	I_a	=	0.9	0.9	A
Anode current, unloaded	I_a	=	0.2	0.2	A [1]
Grid current, loaded	I_g	=	0.25	0.28	A
Grid current, unloaded	I_g	=	0.30	0.35	A [1]
Grid resistor	R_g	=	2.5	2	kΩ
Load resistance	$R_{a\sim}$	=	3.85	3.3	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	15	16	%
Anode input power	W_{ia}	=	6.3	5.4	kW
Anode dissipation	W_a	=	1.45	1.3	kW
Output power	W_o	=	4.85	4.1	kW
Efficiency	η	=	77	76	%
Output power in the load	W_ℓ	=	4.0	3.3	kW [2]

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

7Z2 3535

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits) intermittent service

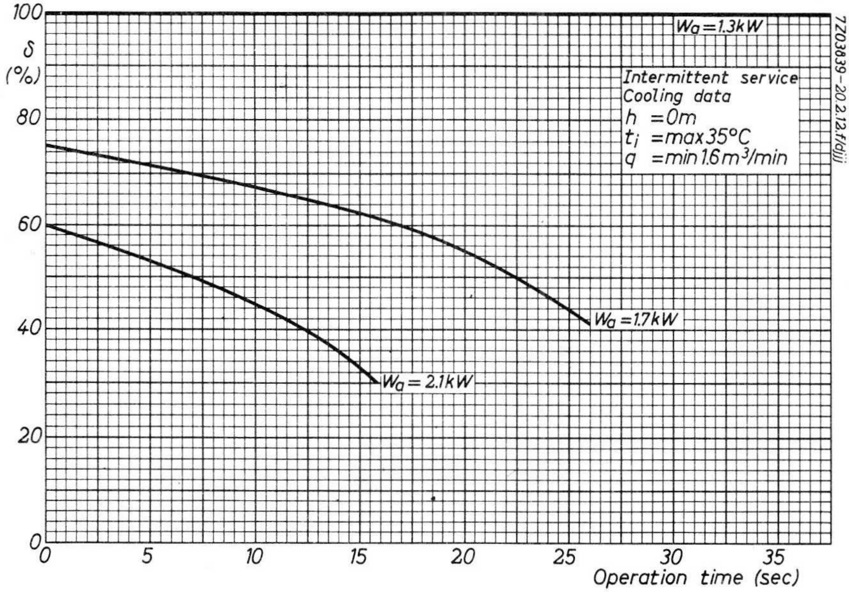
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode current	I_a	= max.	1.5	A
Anode input power	W_{ia}	= max.	9	kW
Anode dissipation	W_a	= max.	2.1	kW [1])
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid resistor	R_g	= max.	10	kΩ

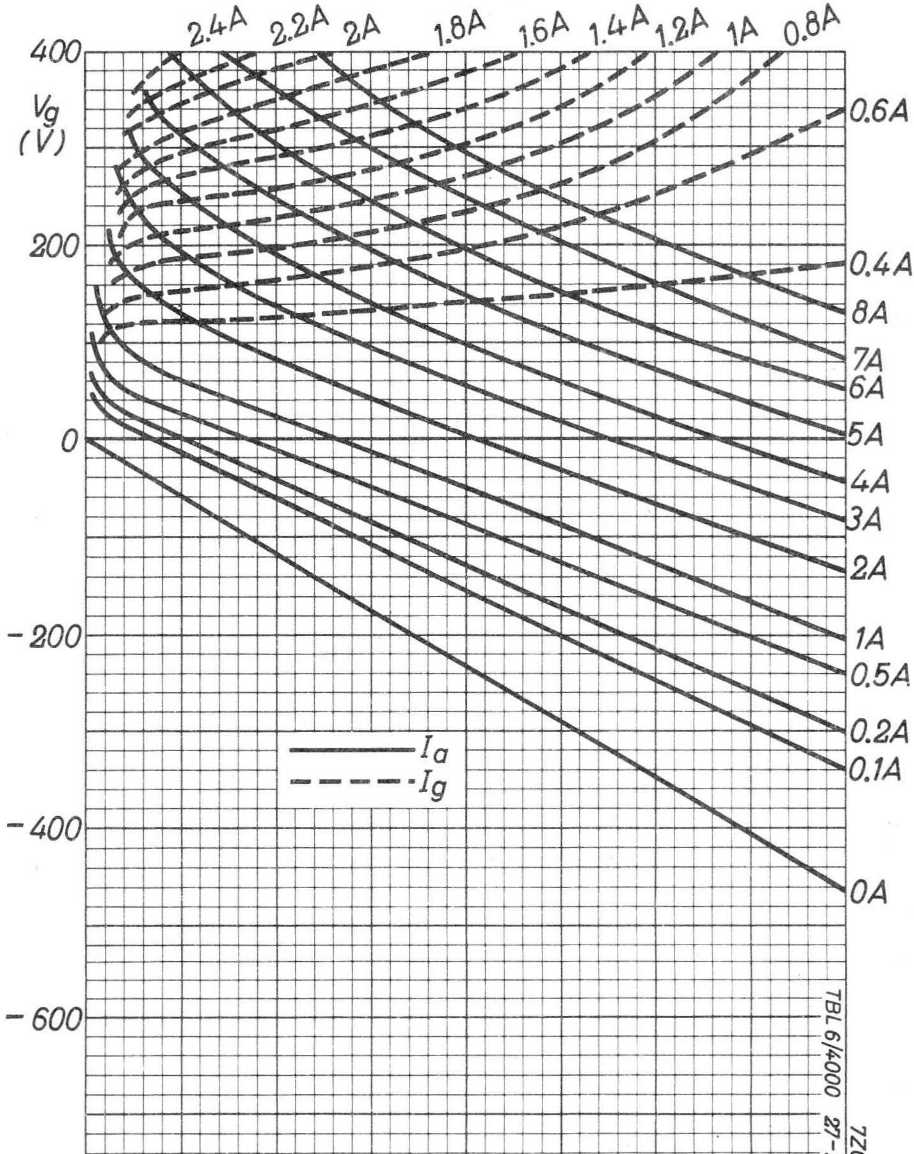
OPERATING CONDITIONS, intermittent service

Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5.1	kV_{RMS}
Anode voltage	V_a	=	6	kV
Anode current, loaded	I_a	=	1.33	A
Anode current, unloaded	I_a	=	0.33	A [2])
Grid current, loaded	I_g	=	0.38	A
Grid current, unloaded	I_g	=	0.48	A [2])
Grid resistor	R_g	=	1450	Ω
Load resistance	$R_{a\sim}$	=	2200	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	%
Anode input power	W_{ia}	=	8	kW
Anode dissipation	W_a	=	2.1	kW [1])
Output power	W_o	=	5.9	kW
Efficiency	η	=	74	%
Output power in the load	W_ℓ	=	4.75	kW [3])

[1]) See figure page A
[2]) In a typical circuit
[3]) Useful power in the load measured in a circuit having an efficiency of 85%.

7Z2 4051


100
δ
(%)
80
60
40
20
0
0
5
10
15
20
25
30
35
Operation time (sec)
Wa = 1.3kW
Intermittent service
Cooling data
h = 0m
ti = max 35°C
q = min 1.6 m³/min
Wa = 1.7kW
Wa = 2.1kW
7Z03639-20.2.12.f(dj)


2.4A
2.2A
2A
1.8A
1.6A
1.4A
1.2A
1A
0.8A
0.6A
0.4A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0.1A
0A
400
V_g (V)
200
0
-200
-400
-600
-800
0
2
4
6
8
V_a(kV)
I_a
I_g
TBL 6/4000 27-5-'60
7Z00061

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr. V_a (kV)	C telegr. W_o (kW)	B teleph. V_a (kV)	B teleph. W_o (kW)	C_a mod. V_a (kV)	C_a mod. W_o (kW)	B mod. [1] V_a (kV)	B mod. [1] W_o (kW)
4	75	6	6.9	6	1.9			6	13.3
		5	5.6	5	1.45	5	4.7	5	6.6
		4	4			4.5	4.1	4.5	6.0
						4	3.5	4	5.3
						3.5	3	3.5	4.6
						3	2.2	3	3.3

Television service

Freq. (MHz)	Neg. mod. Pos. sync. V_a (kV)	Neg. mod. Pos. sync. W_o sync (kW)	Neg. mod. Pos. sync. W_o black (kW)	Pos. mod. Neg. sync. V_a (kV)	Pos. mod. Neg. sync. W_o white (kW)
75	5	9	5.35	5	9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	12.6	V
Filament current	I_f	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	0.3	pF
Grid to all other elements except anode	C_g	16	pF
Anode to grid	C_{ag}	11	pF

COOLING: forced air

---

[1] Two tubes

TYPICAL CHARACTERISTICS

Anode voltage	V_a	4	kV
Anode current	I_a	1	A
Amplification factor	μ	32	
Mutual conductance	S	17	mA/V

AIR COOLING CHARACTERISTICS, see also the cooling curves

W_a (kW)	h (m)	t_i max. (°C)	$q_{min.}$ (m^3/min)	p_i (mm H_2O)
1	0	35	3	8
	0	45	3.1	8
	1500	35	3.7	9
	3000	25	4.1	10
3	0	35	5.2	23
	0	45	6.1	29
	1500	35	6.2	26
	3000	25	6.6	26
5	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.6	79

TEMPERATURE LIMITS (Absolute limits)

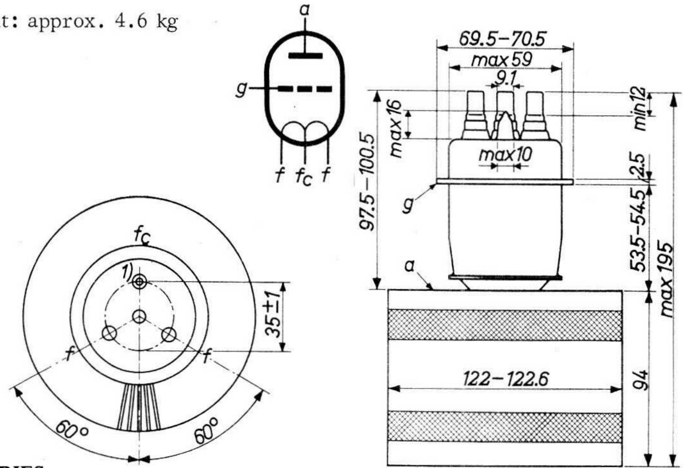
Temperature of seals = max. 180 °C

MECHANICAL DATA

Dimensions in mm

Mounting position: Vertical with anode up or down.
The centre tap f_c must not be used for filament current supply. The connectors type 40634, however, must be used for cooling of all three filament pins.

Net weight: approx. 4.6 kg



ACCESSORIES

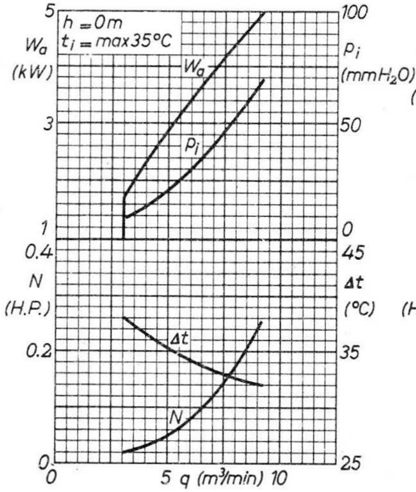
Grid connector		type 40650	2)
	or	40622	
Filament connectors		40634	
Insulating pedestal		40630	

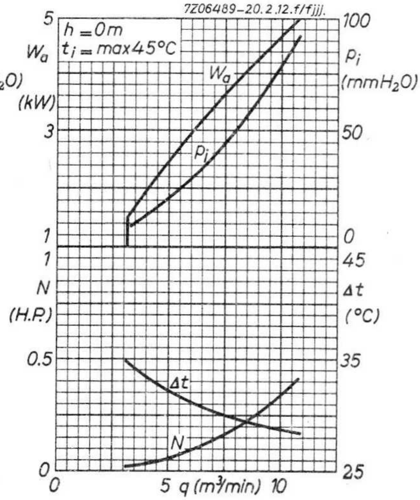
For further data and curves (except cooling curves) please refer to type TBW6/6000

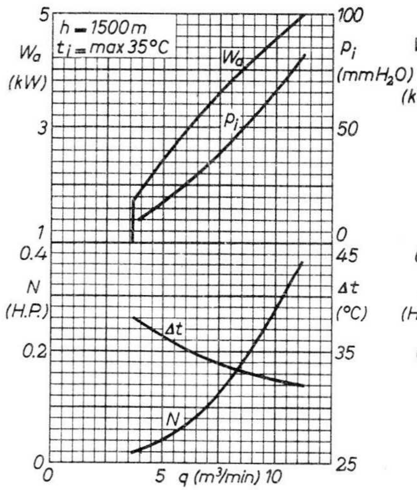
---

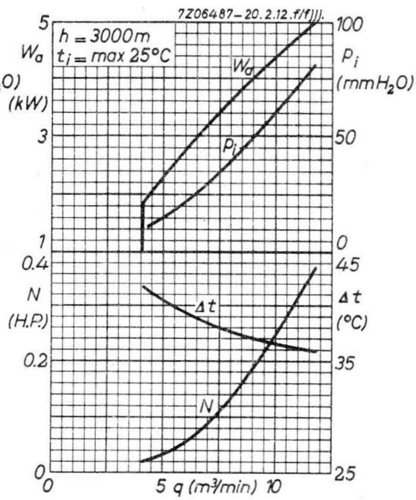
1) This pin is marked "O"

2) The connector 40650 should be used only below 30 MHz.


h = 0m
t_i = max35°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10


7Z06489–20.2.12.f/fjjj.
h = 0m
t_i = max45°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10


h = 1500m
t_i = max 35°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10


7Z06487–20.2.12.f/fjjj.
h = 3000m
t_i = max 25°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10

AIR COOLED R.F. POWER TRIODE

Triode for use in industrial R.F. generators and in telegraphy and telephony transmitters.

QUICK REFERENCE DATA

λ	Freq.	C telegr.		C osc.		B mod. [1]	
(m)	(MHz)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	30	6.5	9.5			7.0	20
		6.0	8.5			5.0	9.0
		5.0	7.1			4.0	7.1
6	50			6.0	6.0		

COOLING : forced air

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f	12.6	V
Filament current	I_f	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	0.3	pF
Grid to all other elements except anode	C_g	16	pF
Anode to grid	C_{ag}	11	pF

TYPICAL CHARACTERISTICS

Anode current	I_a	1	A
Anode voltage	V_a	6	kV
Amplification factor	μ	32	
Mutual conductance	S	15	mA/V

[1]) Two tubes

AIR COOLING CHARACTERISTICS

W_a	h	t_i max.	q min.	p_i
(kW)	(m)	(°C)	(m^3/min)	(mm H_2O)
2	0	35	4.8	20
	0	45	5.7	25
	1500	35	5.7	23
	3000	25	6.1	23
3.5	0	35	6.2	32
	0	45	7.3	42
	1500	35	7.3	36
	3000	25	7.8	36
6	0	35	9.2	68
	0	45	10.7	91
	1500	35	11.2	81
	3000	25	11.7	80

See cooling curves

Temperature of filament seals	max.	210 °C
Temperature of grid and anode seals	max.	180 °C
Filament connectors		40634
Connector for centre pin of filament		40649 [1])
Grid connector	40650 [2]) or	40622
Insulating pedestal (see page 4)		40630

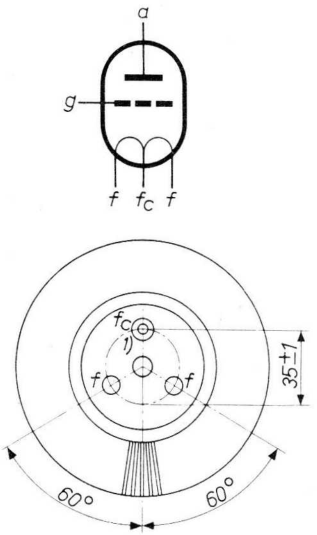
1) The centre tap f_c (diameter 10.5 mm; marked O) must not be used for filament current supply. The connector type 40649, however, must be used for the cooling of this pin.

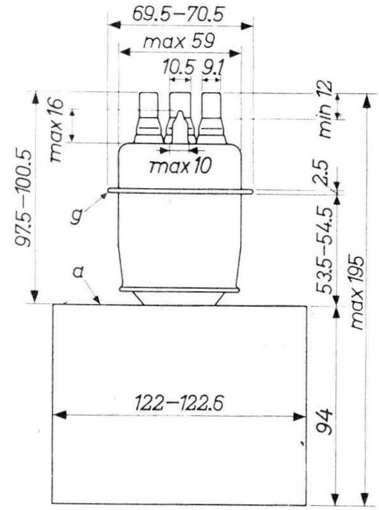
2) See page 4. The connector 40650 should only be used below 30 MHz .

MECHANICAL DATA

Dimensions in mm

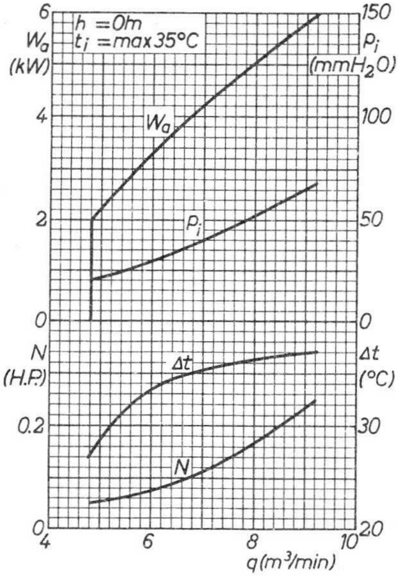
Mounting position: vertical with anode up or down

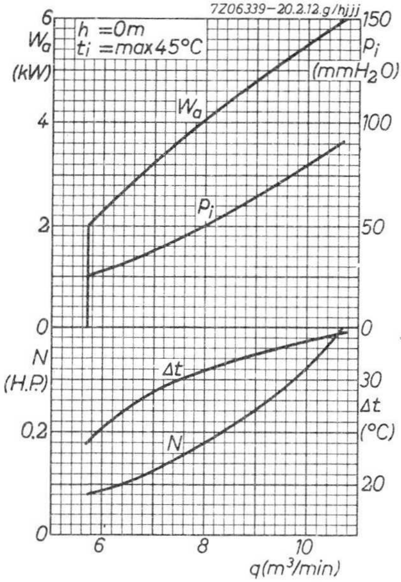


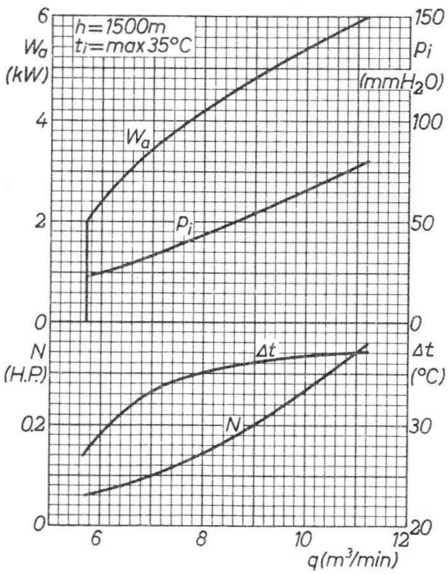


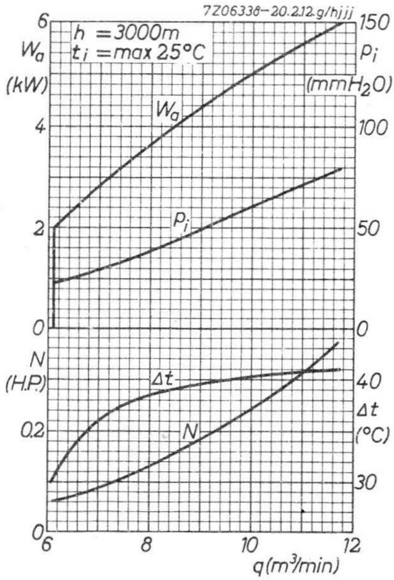
For further data and curves (except cooling curves) please refer to type TBW6/6000

1) See page 2


h = 0m
t_i = max 35°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q(m³/min)


7Z06339–20.2.12.g/hjjj
h = 0m
t_i = max 45°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q(m³/min)


h = 1500m
t_i = max 35°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q(m³/min)


7Z06338–20.2.12.g/hjjj
h = 3000m
t_i = max 25°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q(m³/min)

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq.	Three phase	
(MHz)	V_a (kV)	W_ℓ [1] (kW)
50	7.2 6.2	6.1 5.0

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	32	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	13.5	pF
Anode to grid	C_{ag}	=	7.4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	1	A
Mutual conductance	S	=	12	mA/V
Amplification factor	μ	=	24	

[1]) Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and seals = max. 220 °C

AIR COOLING CHARACTERISTICS for continuous service

For intermittent service see figure page A

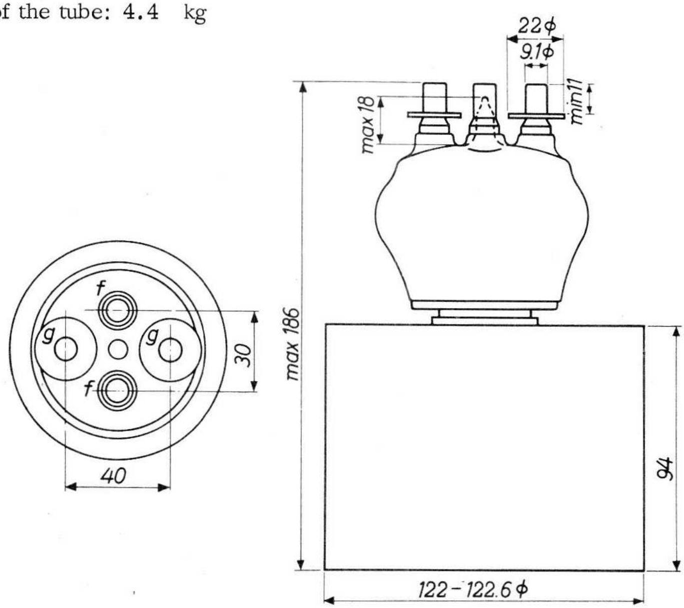
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
2	0	35	4.8	20
	0	45	5.7	25
	1500	35	5.7	23
	3000	25	6.1	23
4	0	35	6.8	38
	0	45	7.9	49
	1500	35	7.8	42
	3000	25	8.4	42
6	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.7	81

At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive grid seal temperatures.

MECHANICAL DATA

Dimensions in mm

Net weight of the tube: 4.4 kg



Connectors for grid and filament	40634
Insulating pedestal	40630

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

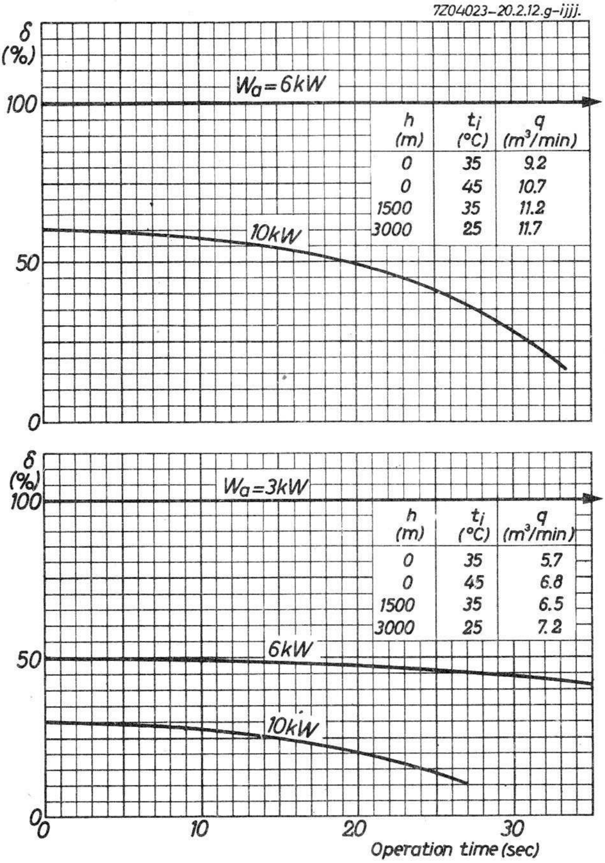
LIMITING VALUES (Absolute limits), continuous service

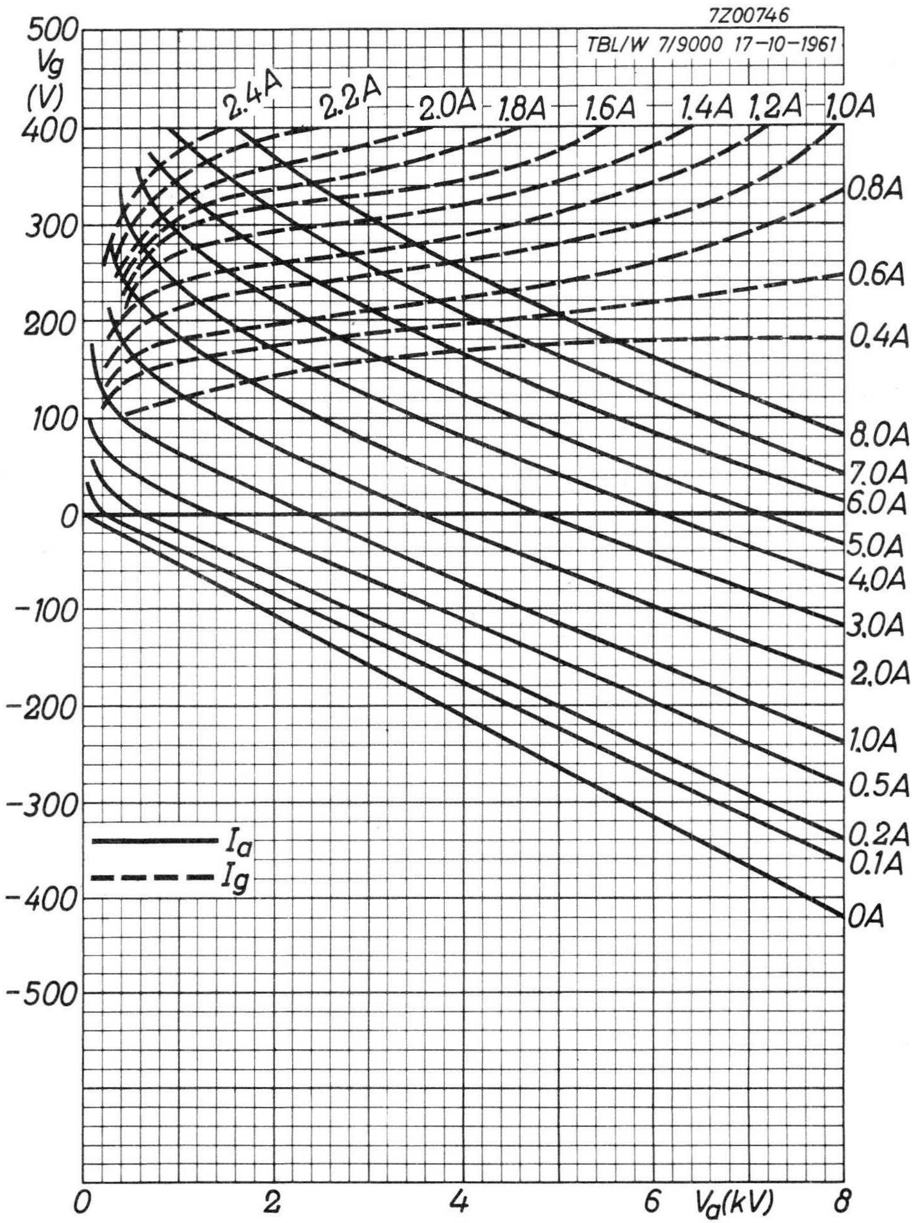
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CHARACTERISTICS , continuous service

Frequency	f	=	50	50	MHz
Anode voltage	V_a	=	7200	6200	V
Anode current, loaded	I_a	=	1.5	1.4	A
Anode current, unloaded	I_a	=	0.37	0.40	A
Grid current, loaded	I_g	=	0.36	0.37	A
Grid current, unloaded	I_g	=	0.47	0.47	A
Grid resistor	R_g	=	1850	1500	Ω
Load resistance	$R_{a\sim}$	=	2300	2100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	17	%
Anode input power	W_{ia}	=	10.8	8.68	kW
Anode dissipation	W_a	=	3.3	2.5	kW
Efficiency	η	=	70	71	%
Output power in the load	W_ℓ	=	6.1	5.0	kW [1]

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


7Z04023-20.2.12.g-ijjj.
δ
(%)
100
50
0
W_a=6kW
10kW
h (m)
t_i (°C)
q (m³/min)
0
35
9.2
0
45
10.7
1500
35
11.2
3000
25
11.7
δ
(%)
100
50
0
W_a=3kW
6kW
10kW
h (m)
t_i (°C)
q (m³/min)
0
35
5.7
0
45
6.8
1500
35
6.5
3000
25
7.2
0
10
20
30
Operation time (sec)


7Z00746
TBL/W 7/9000 17-10-1961
500
Vg
(V)
400
300
200
100
0
-100
-200
-300
-400
-500
2.4A
2.2A
2.0A
1.8A
1.6A
1.4A
1.2A
1.0A
0.8A
0.6A
0.4A
8.0A
7.0A
6.0A
5.0A
4.0A
3.0A
2.0A
1.0A
0.5A
0.2A
0.1A
0A
Ia
Ig
0
2
4
6
Va(kV)
8

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	three phase	
	V_a (kV)	W_o (kW)
30	12	29.0
	10	23.3
	8	17.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8.0 V	+ 5 % / -10 %
Filament current	I_f	=	98 A	
Cold filament resistance	R_{fo}	=	0.008 Ω	

The filament current must never exceed a peak value of 210 A instantaneously at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	37	pF
Anode to grid	C_{ag}	=	30	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	34	
Mutual conductance	S	=	20	mA/V

TEMPERATURE LIMIT (Absolute limit)

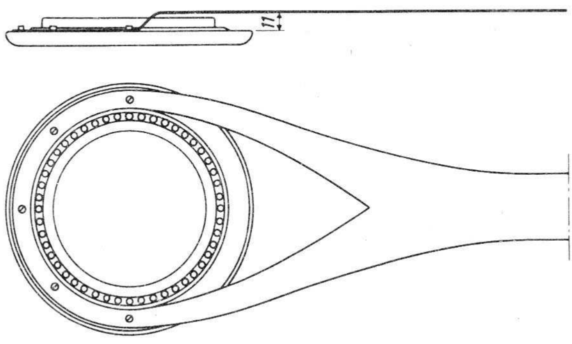
Seal temperature = max. 220 ^{o}C

7Z2 8674

AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

To ensure a uniform R.F. current distribution in the grid seal especially at frequencies higher than 4 MHz, the grid lead should be connected as shown below



7Z2 3548

MECHANICAL DATA

Dimensions in mm

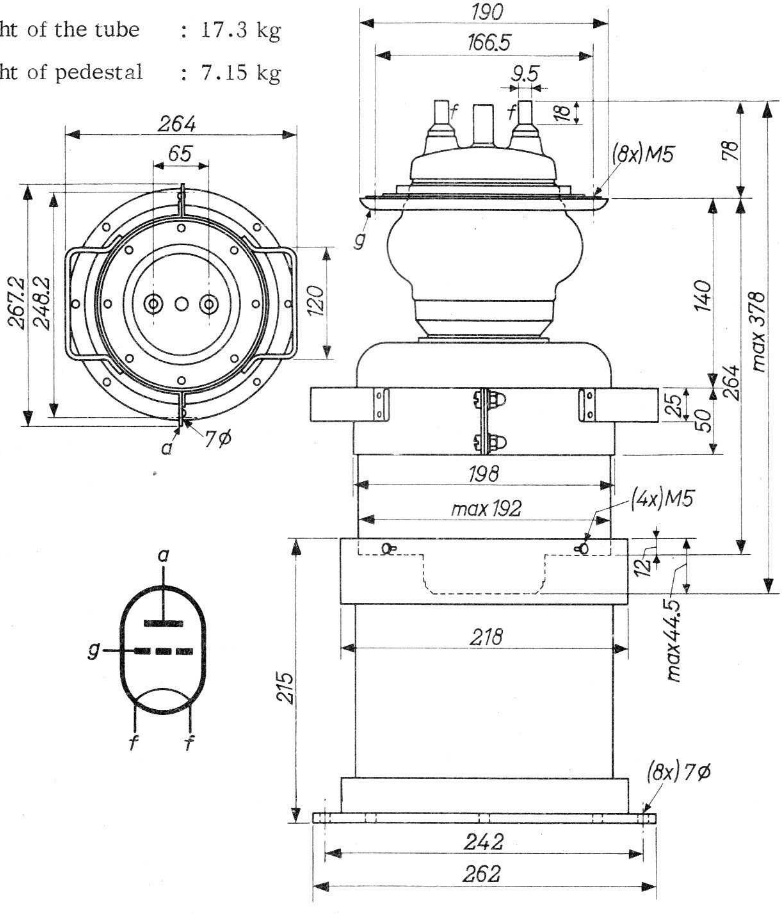
Filament connectors with cable : 40662

Grid connector : 40663

Insulating pedestal : 40648

Net weight of the tube : 17.3 kg

Net weight of pedestal : 7.15 kg



Mounting position: vertical with anode down

7Z2 8675

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

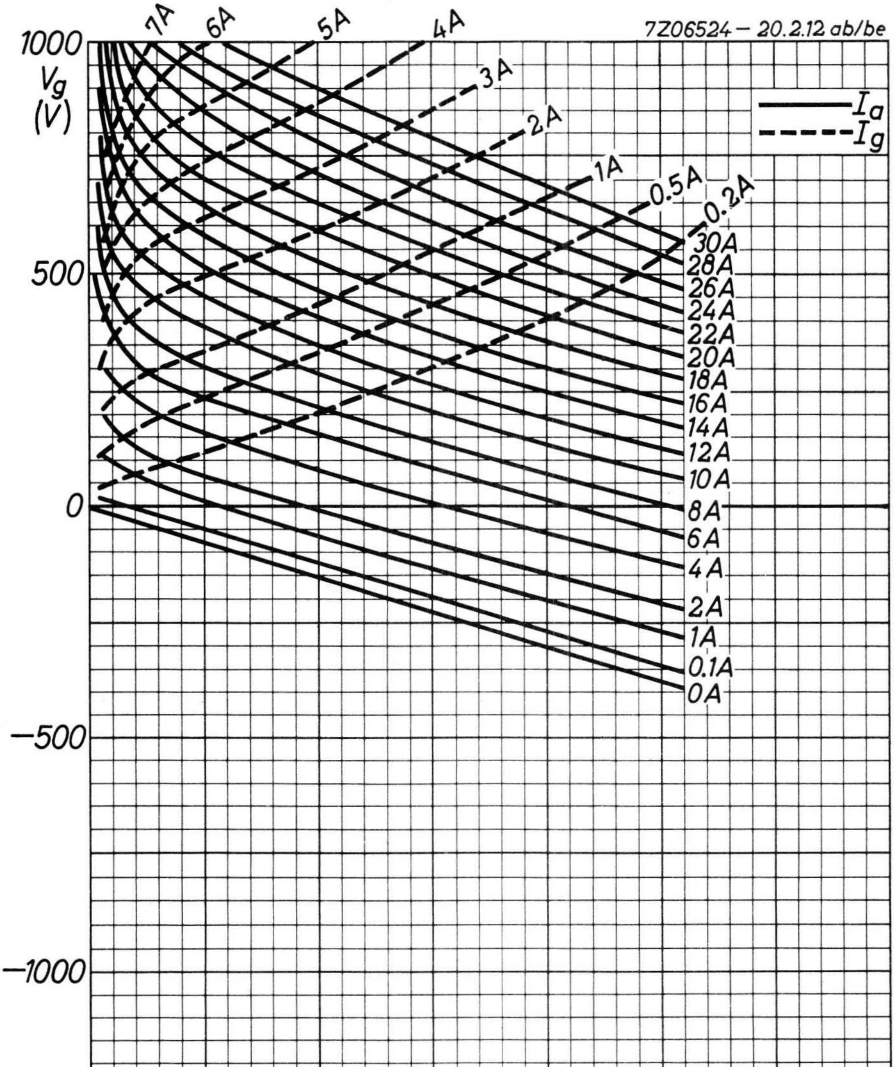
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	15	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

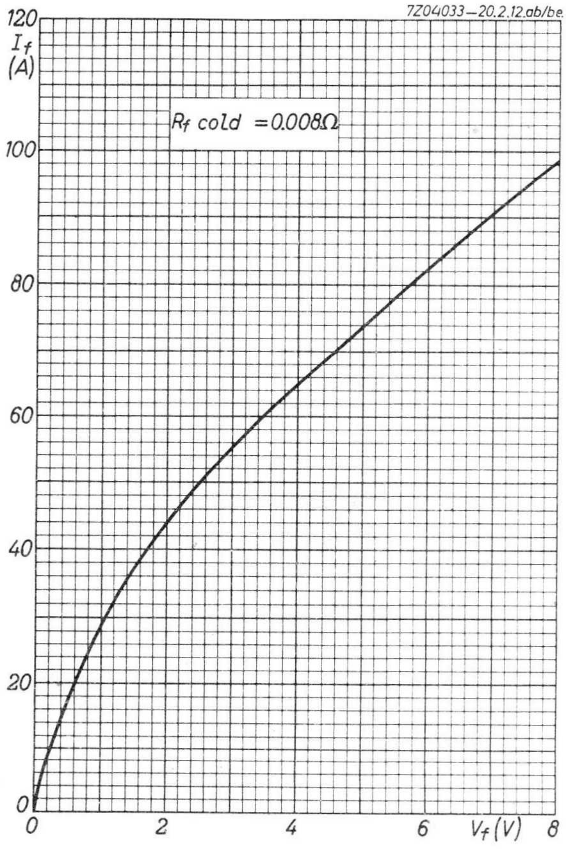
OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Transformer voltage	V_{tr}	=	8.9	7.4	6.0	kV
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	3.2	3.2	3.2	A
Anode current, unloaded	I_a	=	0.52	0.50	0.48	A
Grid current, loaded	I_g	=	0.50	0.50	0.50	A
Grid current, unloaded	I_g	=	0.74	0.77	0.80	A
Grid resistor	R_g	=	2.0	1.6	1.1	kΩ
Load resistance	$R_{a\sim}$	=	1800	1450	1100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	19	%
Anode input power	W_{ia}	=	38.4	32.0	25.6	kW
Anode dissipation	W_a	=	9.4	8.7	7.7	kW
Output power	W_o	=	29.0	23.3	17.9	kW
Efficiency	η	=	75.5	72.5	70	%
Output power in the load	W_ℓ	=	25	20	15.5	kW [1])

[1]) Useful power in the load measured in a circuit having an efficiency of about 90%

7Z2 3550


7Z06524 – 20.2.12 ab/be
1000
V_g
(V)
500
0
–500
–1000
–1500
0
5
10
15 V_a (kV)
I_a
I_g
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
30A
28A
26A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.1A
0A


7Z04033—20.2.12.ab/be.
120
I_f
(A)
100
80
60
40
20
0
R_f cold =0.008Ω
0
2
4
6
V_f (V)
8

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	three phase	
	V_a (kV)	W_o (kW)
30	12	39
	10	31.3
	8	23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	8	V	+5 % / -10 %
Filament current	I_f	130	A	
Cold filament resistance	R_{fo}	0.006	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	0.9	pF
Grid to all other elements except anode	C_g	45	pF
Anode to grid	C_{ag}	23.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	12	kV
Anode current	I_a	2	A
Mutual conductance	S	25	mA/V
Amplification factor	μ	21	

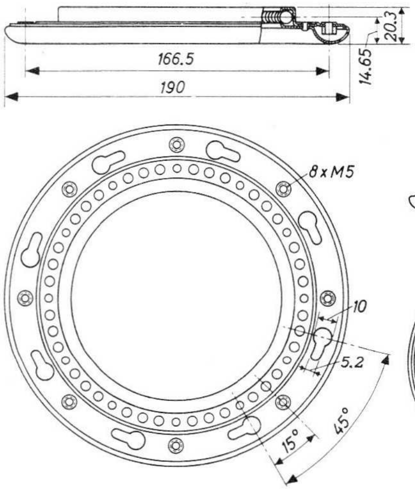
TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals max. 220 °C

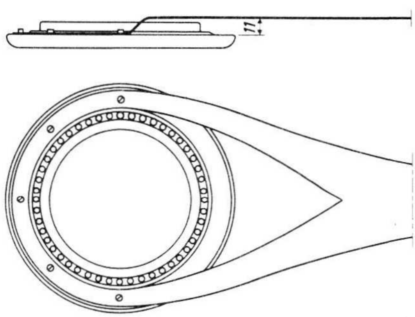
COOLING See also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

MECHANICAL DATA Dimensions in mm



Grid connector 40663



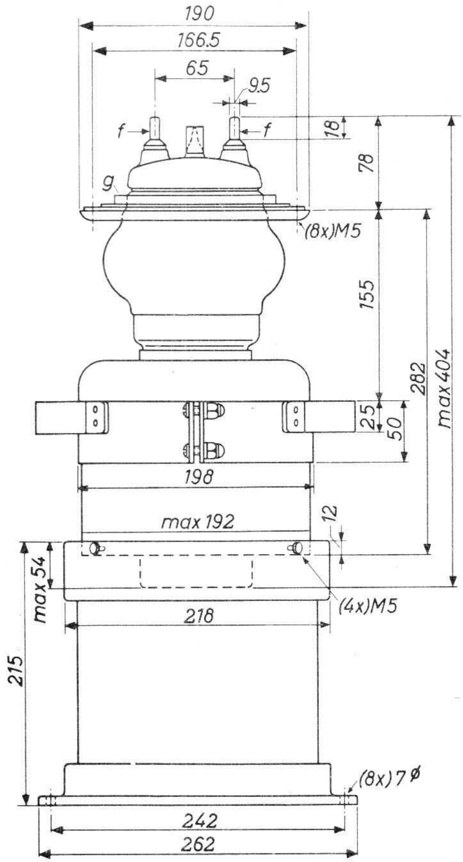
Connection of the grid lead

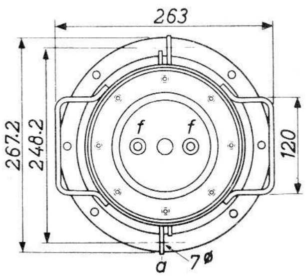
The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right.

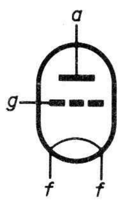
MECHANICAL DATA (continued) Dimensions in mm

Mounting position: vertical

Net weight: approx. 16.1 kg







ACCESSORIES

Filament connectors	type 40662		
Grid connector	40663		
Insulating pedestal	40648	net weight	7.15 kg

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

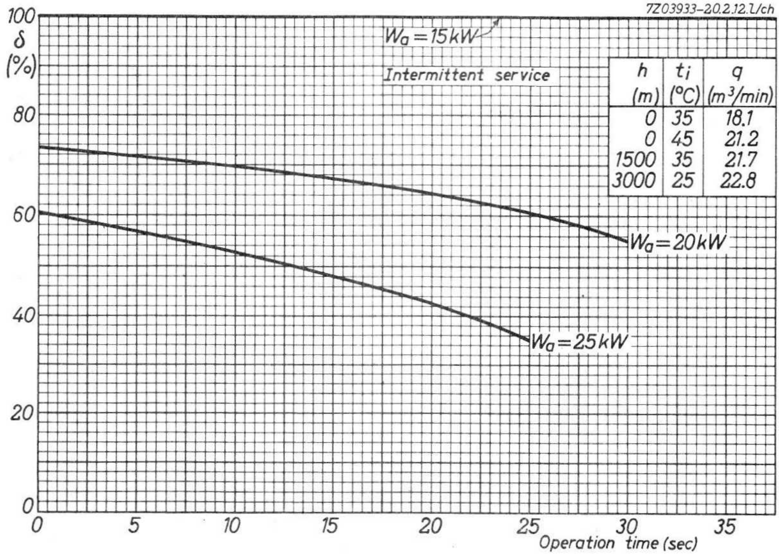
LIMITING VALUES (Absolute limits)

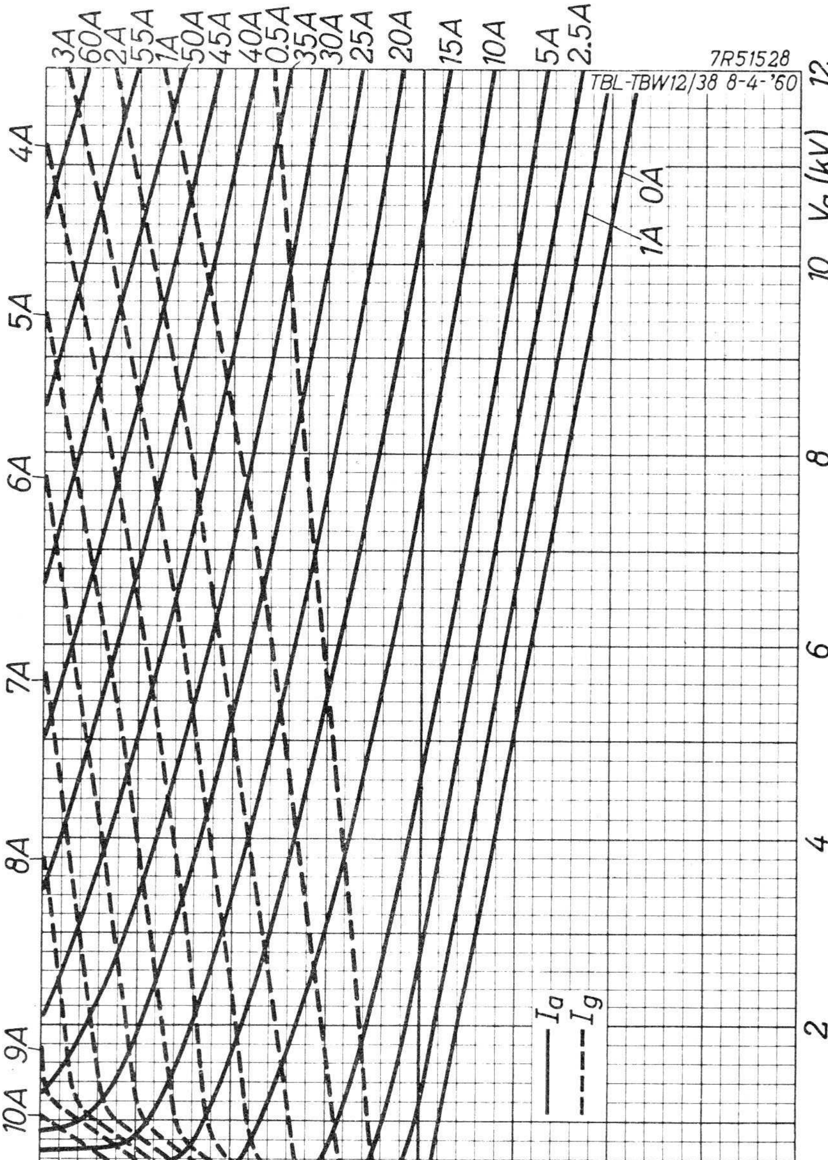
Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	13	kV
Anode current	I_a	max.	5	A
Anode dissipation	W_a	max.	15	kW
Anode input power	W_{ia}	max.	60	kW
Negative grid voltage	$-V_g$	max.	2	kV
Grid current, loaded	I_g	max.	1.5	A
Grid current, unloaded	I_g	max.	2.0	A
Grid circuit resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

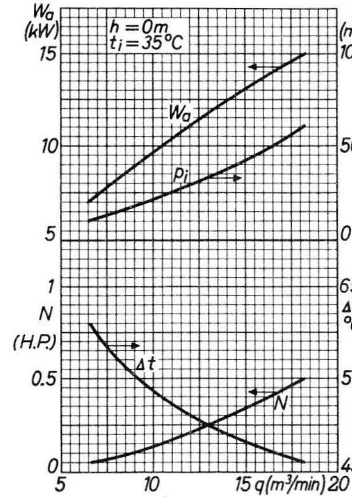
Frequency	f	30	30	30	MHz
Anode voltage	V_a	12	10	8	kV
Anode current, loaded	I_a	4.5	4.5	4.5	A
Anode current, unloaded	I_a	0.65	0.63	0.62	A
Grid current, loaded	I_g	0.9	0.9	0.9	A
Grid current, unloaded	I_g	1.22	1.3	1.35	A
Grid resistor	R_g	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	1450	1100	800	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	16	19	24	%
Anode input power	W_{ia}	54	45	36	kW
Anode dissipation	W_a	15	13.7	12.8	kW
Output power	W_o	39	31.3	23.2	kW
Efficiency	η	72.5	70	64.5	%
Output power in the load	W_ℓ	30	25	18	kW [1])

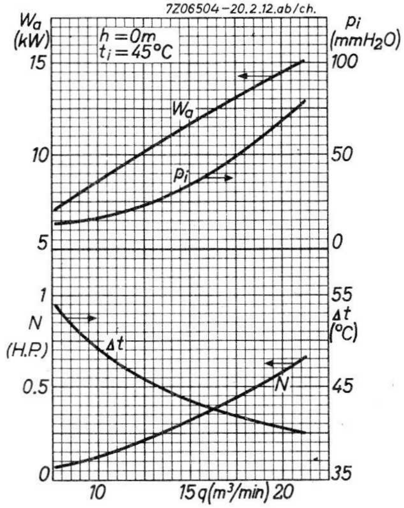
[1]) Useful power in the load, measured in a circuit having an efficiency of about 85%.


7Z03933-2.0.2.12.1/ch
100
δ
(%)
80
60
40
20
0
0
5
10
15
20
25
30
35
Operation time (sec)
$W_a = 15 kW$
Intermittent service
$W_a = 20 kW$
$W_a = 25 kW$
h (m) | t_i (°C) | q (m^3/min)
0 | 35 | 18.1
0 | 45 | 21.2
1500 | 35 | 21.7
3000 | 25 | 22.8

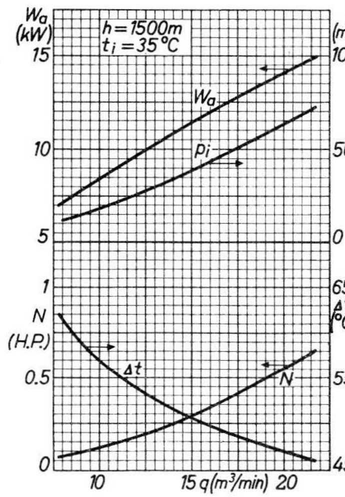

7R51528
TBL-TBW12/38 8-4-'60
3A 60A 2A 55A 1A 50A 45A 40A 0.5A 35A 30A 25A 20A 15A 10A 5A 2.5A
1A 0A
V_a (kV)
0 2 4 6 8 10 12
V_g (V)
1000 500 0 −500 −1000
4A 5A 6A 7A 8A 9A 10A
I_a
I_g

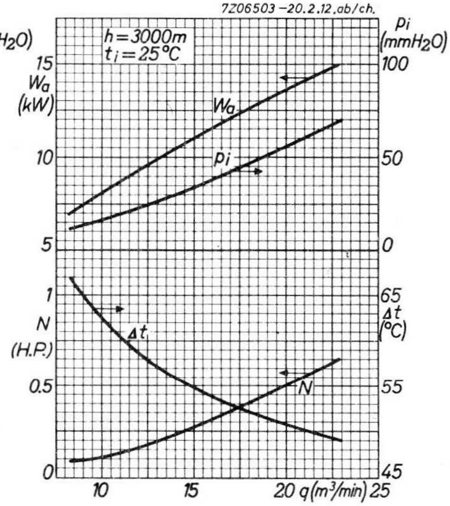
7Z06504-20.2.12.ab/ch.





7Z06503-20.2.12.ab/ch.





AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA						
Freq. (MHz)	C telegr.		C_a mod.		B mod. [1]	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	12	41	10	27.5	10	19.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8	V
Filament current	I_f	=	130	A

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.6	pF
Grid to all other elements except anode	C_g	=	45	pF
Anode to grid	C_{ag}	=	27	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Mutual conductance	S	=	25	mA/V
Amplification factor	μ		33	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

[1]) Two tubes

AIR COOLING CHARACTERISTICS

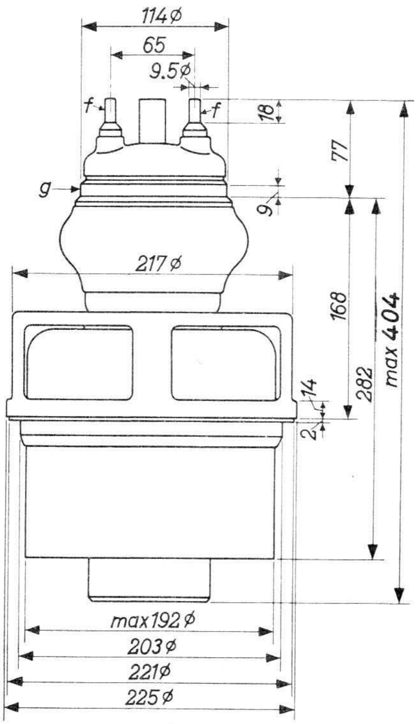
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

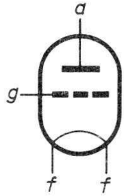
MECHANICAL DATA

Dimensions in mm

Net weight of tube : 19 kg

Net weight of pedestal: 7.15 kg





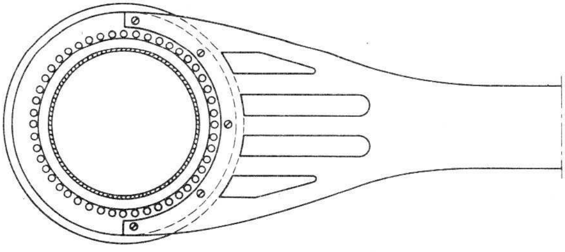
Mounting position: vertical

ACCESSORIES

Dimensions in mm

Connectors with cable for filament:	40662
Insulating pedestal	40648
Grid connector	40663

The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown below



R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode input power	W_{ia}	=	max.	60	kW
Anode dissipation	W_a	=	max.	15	kW
Anode current	I_a	=	max.	4.8	A
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	1.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V_a	=	12	kV
Grid voltage	V_g	=	-1000	V
Anode current	I_a	=	4.5	A
Grid current	I_g	=	0.8	A
Peak grid A.C. voltage	V_{gp}	=	1600	V
Grid input power	W_{ig}	=	1150	W
Anode input power	W_{ia}	=	54	kW
Anode dissipation	W_a	=	13	kW
Output power	W_o	=	41	kW
Efficiency	η	=	76	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	10	kV [1]
Anode input power	W_{ia}	=	max.	40	kW
Anode dissipation	W_a	=	max.	10	kW
Anode current	I_a	=	max.	3.8	A
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	1.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V_a	=	10	kV
Grid voltage	V_g	=	-1000	V [2]
Anode current	I_a	=	3.5	A
Grid current	I_g	=	0.8	A
Peak grid A.C. voltage	V_{gp}	=	1500	V
Grid input power	W_{ig}	=	1080	W
Anode input power	W_{ia}	=	35	kW
Anode dissipation	W_a	=	7.5	kW
Output power	W_o	=	27.5	kW
Efficiency	η	=	78.5	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	17.5	kW

[1]) With 120% modulation and 3000 m above sea level

[2]) Grid bias partially obtained by a grid resistor

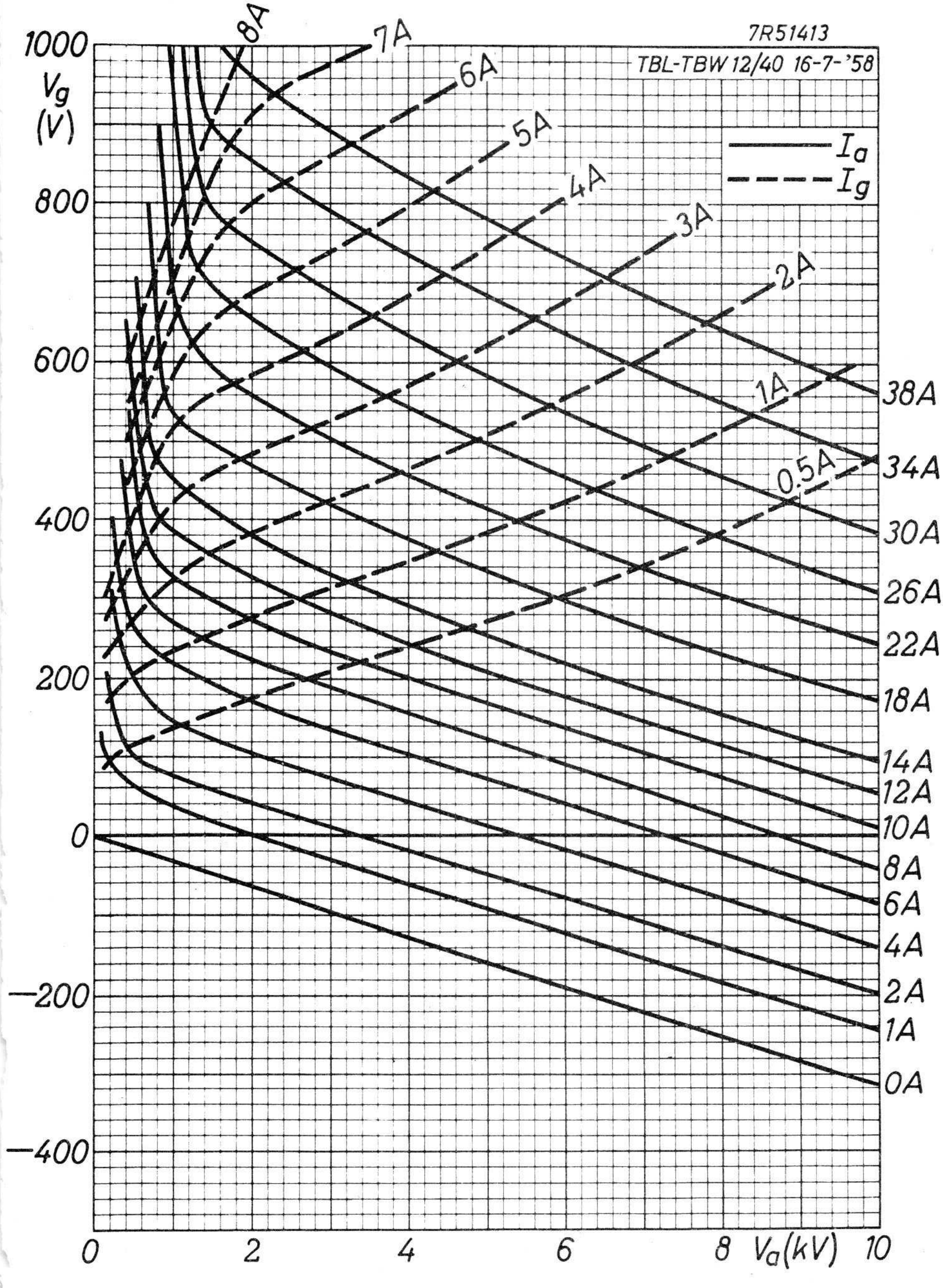
A.F. CLASS B AMPLIFIER AND MODULATOR (especially for use with a cathode-follower)

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	13	kV
Anode input power	W_{ia}	=	max.	60	kW
Anode dissipation	W_a	=	max.	15	kW
Anode current	I_a	=	max.	4.5	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	10		kV
Grid voltage	V_g	=	-290		V
Load resistance	$R_{aa\sim}$	=	6240		Ω
Peak grid to grid A.C. voltage	V_{ggp}	=	0	900	V
Anode current	I_a	=	2x0.1	2x1.6	A
Grid current	I_g	=	0	2x0.035	A
Peak grid current	I_{gp}	=	-	2x0.24	A
Grid input power	W_{ig}	=	0	2x14	W
Anode input power	W_{ia}	=	2x1.0	2x16	kW
Anode dissipation	W_a	=	2x1.0	2x6.4	kW
Output power	W_o	=	0	19.2	kW
Efficiency	η	=	-	60	%


7R51413
TBL-TBW 12/40 16-7-'58
1000
V_g
(V)
800
600
400
200
0
−200
−400
0
2
4
6
8
V_a(kV)
10
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
I_a
I_g
38A
34A
30A
26A
22A
18A
14A
12A
10A
8A
6A
4A
2A
1A
0A

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA							
General purposes							
		C telegr.		C an. mod.		B mod. 1)	
λ (m)	Freq. (MHz)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
20	15	12	108	10	80	12	202
15	20	12	94.5	10	54.5	10	116
12	25	11	70	9	42.5	10	77
11	27.5	10.5	59	8.5	36.5	9	62
10	30	10	50	8	31	8.5	54
						8	46.8

Television service		
	Neg. mod., pos. sync. 1)	
Freq. (MHz)	V_a (kV)	W_o sync (kW)
48 - 68	6.5	100 2)

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	17.5	V
Filament current	I_f	196	A
Cold filament resistance	R_{f_o}	12	mΩ
Filament peak starting current	I_{f_p} max.	420	A

CAPACITANCES

Anode to all other elements except grid	C_a	3.4	pF
Grid to all other elements except anode	C_g	116	pF
Anode to grid	C_{ag}	86	pF

1) Two tubes

2) Power transferred from driving stage included

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	10	kV
Anode current	I_a	50	5	A
Amplification factor	μ	-	27	
Mutual conductance	S	-	50	mA/V
Maximum mutual conductance	S_{max}	92	-	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals	t	max. 180	^{o}C

COOLING

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

When the tube is used at frequencies above 6 MHz , special attention must be paid to the anode and grid-seal temperatures.
Cooling of these seals is effected by air flowing through the slots provided at the top of the cooler housing. In certain cases, e.g. at low anode dissipation and with cooling by the minimum quantity of air (according to the cooling curves), the air flow to the seals will not be sufficient to maintain the seal temperatures below the maximum permissible value at frequencies above 6 MHz.
Consequently, in these cases, a larger quantity of air must be supplied.

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

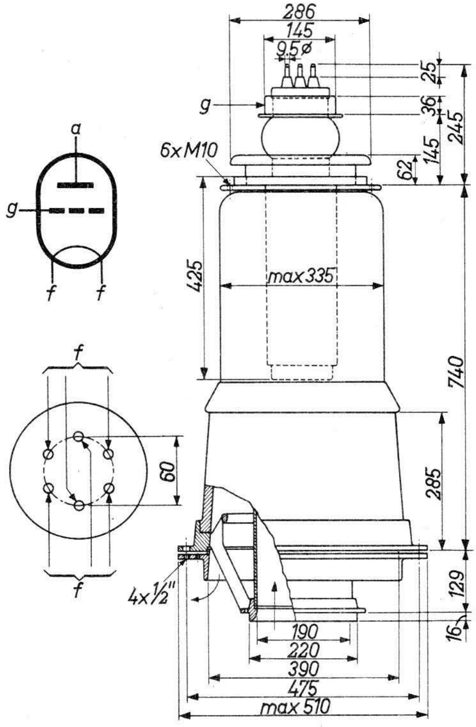
Care should be taken to ensure firm contact of the filament terminals in order to obtain equal distribution of current over these terminals.

MECHANICAL DATA Dimensions in mm

Mounting position: vertical with anode down

Net weight: 28.5 kg

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



Tube mounted in cooler housing type K506

ACCESSORIES

Filament connectors	type	40628	
Cooler housing		K506	
Net weight of K506		72	kg

For further data and curves please refer to type TBW12/100

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	three phase	
	V_a (kV)	W_o (kW)
30	7 6	17.7 14.3

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	6.3	V	+ 5 % -10 %
Filament current	I_f	=	136	A	
Cold filament resistance	R_{fo}	=	0.005	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	1.2	pF
Grid to all other elements except anode	C_g	=	44.5	pF
Anode to grid	C_{ag}	=	33.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	2.5	A
Mutual conductance	S	=	23	mA/V
Amplification factor	μ	=	17.5	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 ^{o}C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm.)
5	20	4.5	0.03
	50	12	0.2
10	20	9.5	0.15
	50	22	0.6
15	20	15	0.3
	50	34	1.4

MECHANICAL DATA

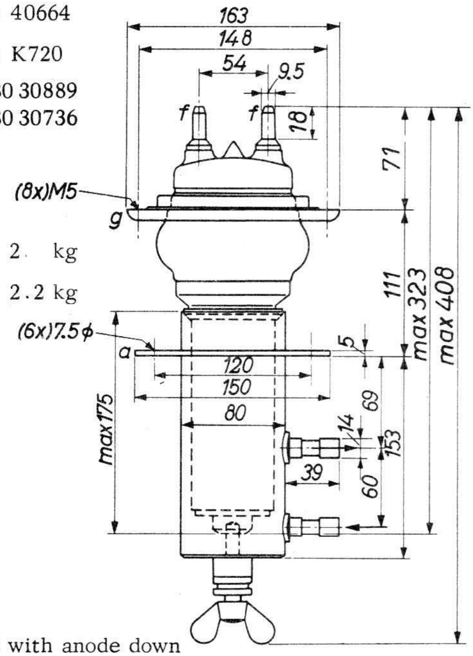
Dimensions in mm

Filament clips with cable : 40662

Grid connector : 40664

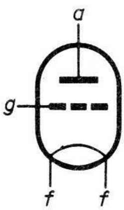
Water jacket : K720

O-ring large : 2622 080 30889
small : 2622 080 30736



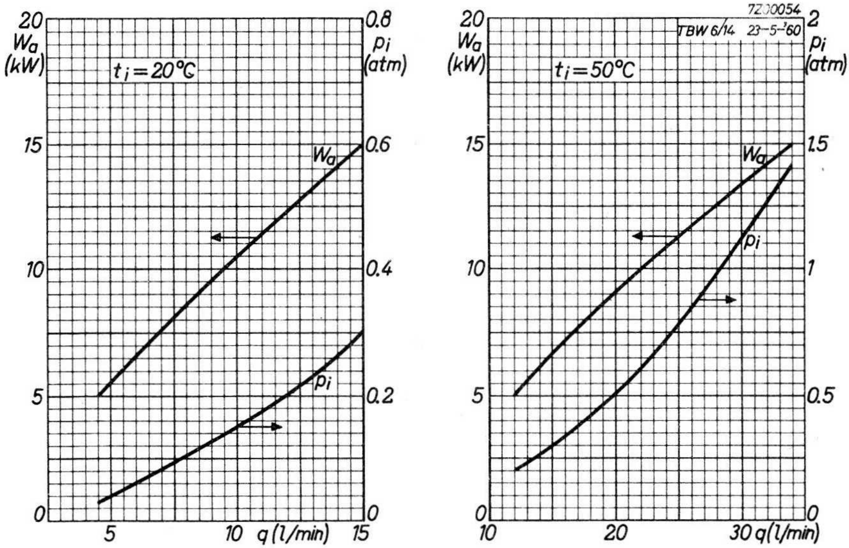
Net weight of tube : 2. kg

Net weight of water jacket: 2.2 kg



Mounting position: vertical with anode down

For further data and curves (except cooling curves) please refer to type TBH 6/14


20
W_a
(kW)
$t_i = 20°C$
0.8
p_i
(atm)
15
0.6
W_a
10
0.4
5
0.2
p_i
0
0
5
10
q (l/min)
15
7Z00054
TBW 6/14 23-5-'60
20
W_a
(kW)
$t_i = 50°C$
2
p_i
(atm)
15
1.5
W_a
10
1
p_i
5
0.5
0
0
10
20
30 q (l/min)

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA										
General purposes										
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
4	75	6	6.9	6	1.9			6	13.3
		5	5.6	5	1.45	5	4.7	5	6.6
		4	4			4.5	4.1	4.5	6.0
						4	3.5	4	5.3
						3.5	3	3.5	4.6
						3	2.2	3	3.3

Television service					
Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
	V_a (kV)	W_o sync (kW)	W_o black (kW)	V_a (kV)	W_o white (kW)
75	5	9	5.35	5	9

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	12.6	V
Filament current	I_f	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	0.3	pF
Grid to all other elements except anode	C_g	16	pF
Anode to grid	C_{ag}	11	pF

[1]) Two tubes

TYPICAL CHARACTERISTICS

Anode voltage	V_a	4	kV
Anode current	I_a	1	A
Mutual conductance	S	17	mA/V
Amplification factor	μ	32	

COOLING: water/low-velocity air flow

WATER COOLING CHARACTERISTICS See also the cooling curves

W_a (kW)	t_i (°C)	q_{min}[1] (l/min)	p_i (atm)
1	20	2.5	0.08
	50	3	0.1
2	20	2.5	0.08
	50	5	0.3
4	20	4	0.18
	50	9	0.9
6	20	6	0.4
	50	14	2.5

It is necessary to direct a low-velocity air flow to the anode and the grid seal at frequencies above 30 MHz
The air flow must be started upon or before application of the filament voltage

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	max.	50	°C
Temperature of seals	t	max.	180	°C

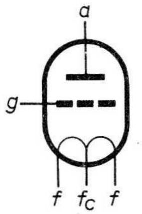
[1]) At inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

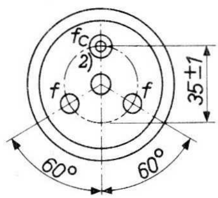
MECHANICAL DATA

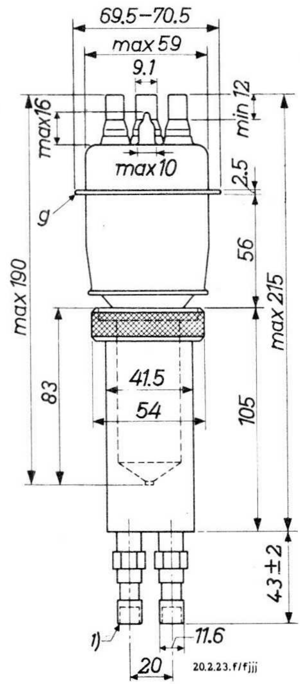
Dimensions in mm

Mounting position: vertical with anode down

Net weight: 0.45 kg







Tube mounted in water jacket K713

The centre tap f_c must not be used for filament current supply. The connectors type 40634, however, must be used for the cooling of all three filament pins, thus also of pin f_c

ACCESSORIES

Grid connector	type	40650 [3]	or 40622
Water jacket		K713	net weight 0.52 kg
Filament connector		40634	
"O" ring		3322 026 82801	

1) 1/8 in pipe thread

2) This pin is marked "O"

3) The connector 40650 should be used only below 30 MHz. When the tube is used with this connector at maximum ratings additional cooling of the grid seals will be required.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	max.	6	kV
Negative grid voltage	$-V_g$	max.	1000	V
Anode current	I_a	max.	1.5	A
Grid current	I_g	max.	0.35	A
Grid dissipation	W_g	max.	120	W
Anode input power	W_{ia}	max.	9	kW
Anode dissipation	W_a	max.	6	kW 1)

OPERATING CONDITIONS

Wavelength	λ	4	4	4	m
Frequency	f	75	75	75	MHz
Anode voltage	V_a	6	5	4	kV
Grid voltage	V_g	-400	-300	-200	V
Anode current	I_a	1.5	1.5	1.37	A
Grid current	I_g	0.31	0.33	0.35	A
Peak grid A.C. voltage	V_{g_p}	740	640	500	V
Grid input power	W_{ig}	210	190	160	W
Anode input power	W_{ia}	9	7.5	5.5	kW
Anode dissipation	W_a	2.1	1.9	1.5	kW
Output power	W_o	6.9	5.6	4	kW
Efficiency	η	76.5	75	73	%

1) TBL6/6000 W_a max. = 5 kW

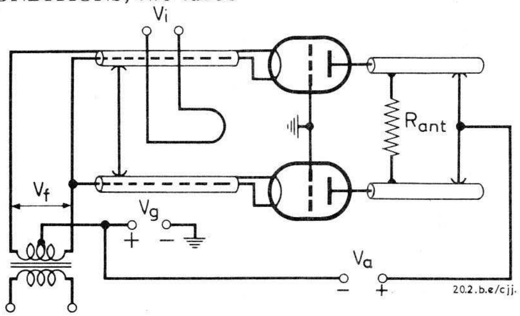
R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	max.	6	kV
Positive cathode to grid voltage	V_{kg}	max.	1000	V
Anode current	I_a	max.	1.5	A
Grid current	I_g	max.	0.35	A
Grid dissipation	W_g	max.	120	W
Anode input power	W_{ia}	max.	9	kW
Anode dissipation	W_a	max.	6	kW 1)

For frequencies from 75 MHz up to 220 MHz See page 17

OPERATING CONDITIONS, two tubes



For data please refer to page 6

1) TBL6/6000 W_a max. = 5 kW

R.F. CLASS C TELEGRAPHY, grounded grid (continued)

OPERATING CONDITIONS, two tubes (continued)

λ	4	2.7[1]	2.7[1]	1.36[1]	m
f	75	110	110	220	MHz
V_a	6	5	4	4	kV
V_g	-400	-300	-200	-200	V
I_a	2x1.5	2x1.5	2x1.37	2x1.25	A
I_g	2x0.31	2x0.33	2x0.35	2x0.2	A
V_{g_p}	740	640	500	450	V
W_{ig}	2x1120	2x920	2x675	2x380	W
W_{ia}	2x9	2x7.5	2x5.5	2x5	kW
W_a	2x2.1	2x2.2	2x1.7	2x2.5	kW
W_o	13.8+1.82	10.6+1.46	7.6+1.03	5+0.6	kW [2]
η	76.5	71	69	50	% [3]

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation.

[2]) Power transferred from driving stage included.

[3]) Pure tube efficiency.

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	max.	6	kV
Anode current	I_a	max.	1.1	A
Anode input power	W_{ia}	max.	6.6	kW
Anode dissipation	W_a	max.	6	kW 1)

OPERATING CONDITIONS

Wavelength	λ	4	4	m
Frequency	f	75	75	MHz
Anode voltage	V_a	6	5	kV
Grid voltage	V_g	-180	-145	V
Anode current	I_a	0.99	0.9	A
Peak grid A.C. voltage	V_{g_p}	250	225	V
Anode input power	W_{ia}	5.9	4.5	kW
Anode dissipation	W_a	4	3.05	kW
Output power	W_o	1.9	1.45	kW
Efficiency	η	32	32	%
Modulation factor	m	100	100	%
Grid current	I_g	0.3	0.32	A
Grid input power	W_{ig}	140	130	W

1) TBL6/6000 W_a max. = 5 kW

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz	
Anode voltage	V_a	max.	5	kV	
Negative grid voltage	$-V_g$	max.	1000	V	
Anode current	I_a	max.	1.3	A	
Grid current	I_g	max.	0.35	A	
Grid dissipation	W_g	max.	120	W	
Anode input power	W_{ia}	max.	6.5	kW	
Anode dissipation	W_a	max.	4	kW	2)

OPERATING CONDITIONS

Wavelength	λ	4	4	4	4	4	m
Frequency	f	75	75	75	75	75	MHz
Anode voltage	V_a	5	4.5	4	3.5	3	kV
Grid voltage	V_g	-400	-350	-300	-300	-250	V 1)
Anode current	I_a	1.2	1.2	1.2	1.2	1	A
Grid current	I_g	0.3	0.3	0.3	0.3	0.3	A
Peak grid A.C. voltage	V_{g_p}	690	650	600	600	510	V
Grid input power	W_{ig}	190	180	165	165	140	W
Anode input power	W_{ia}	6	5.4	4.8	4.2	3	kW
Anode dissipation	W_a	1.3	1.3	1.3	1.2	0.8	kW
Output power	W_o	4.7	4.1	3.5	3.0	2.2	kW
Efficiency	η	78	76	73	71.5	73	%
Modulation fator	m	100	100	100	100	100	%
Modulation power	W_{mod}	3.0	2.7	2.4	2.1	1.5	kW

1) Grid bias partially obtained by the grid resistor
2) TBL6/6000 W_a max. = 3.4 kW

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	max.	6	kV
Anode current	I_a	max.	1.5	A
Anode input power	W_{ia}	max.	9	kW
Anode dissipation	W_a	max.	6	kW1)
Grid circuit resistance	R_g	max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a	6		5		4.5		kV
V_g	-165		-138		-125		V
$R_{aa\sim}$	4900		6400		6100		Ω
V_{ggp}	0	910	0	661	0	655	V
I_a	2x0.125	2x1.5	2x0.11	2x0.91	2x0.1	2x0.92	A
I_g	0	2x0.28	0	2x0.14	0	2x0.09	A
W_{ig}	0	2x115	0	2x42	0	2x27	W
W_{ia}	2x0.75	2x9	2x0.55	2x4.55	2x0.45	2x4.15	kW
W_a	2x0.75	2x2.35	2x0.55	2x1.25	2x0.45	2x1.15	kW
W_o	0	13.3	0	6.6	0	6	kW
d_{tot}	-	4.3	-	3.3	-	3.7	%
η	-	74	-	73	-	72	%

V_a	4		3.5		3		kV
V_g	-112		-100		-90		V
$R_{aa\sim}$	4900		4200		4400		Ω
V_{ggp}	0	632	0	618	0	570	V
I_a	2x0.1	2x0.94	2x0.075	2x0.95	2x0.065	2x0.8	A
I_g	0	2x0.19	0	2x0.18	0	2x0.2	A
W_{ig}	0	2x54	0	2x50	0	2x52	W
W_{ia}	2x0.4	2x3.75	2x0.26	2x3.3	2x0.2	2x2.4	kW
W_a	2x0.4	2x1.1	2x0.26	2x1	2x0.2	2x0.75	kW
W_o	0	5.3	0	4.6	0	3.3	kW
d_{tot}	-	2.6	-	2.9	-	3.3	%
η	-	71	-	70	-	69	%

1) TBL6/6000 W_a max. = 5 kW

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; negative modulation, positive synchronisation (American and European system)

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	up to	220	MHz
Anode voltage	V_a		max.	5	max.	4	kV
Anode input power	W_{ia}	sync	max.	9.5	max.	6.5	kW
Anode dissipation	W_a	sync	max.	5	max.	4	kW
Anode current	I_a	sync	max.	1.9	max.	1.6	A
Grid dissipation	W_g	sync	max.	120	max.	120	W
Negative grid voltage	$-V_g$		max.	1000	max.	1000	V

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		48 to 75	170 to 220[1]	MHz
Bandwidth (-1.5 db)	B		5.25	6.5	MHz [2]
Bandwidth (-3 db)	B		8	10	MHz [2]
Anode voltage	V_a		5	4	kV
Grid voltage	V_g	sync	-200	-150	V
		black	-300	-225	V
		white	-550	-500	V
Peak grid to grid voltage	V_{ggp}	sync	1000	1000	V [3]
Anode current	I_a	sync	3.8	3.2	A
		black	2.8	2.6	A
Grid current	I_g	sync	0.5	0.4	A
		black	0.35	0.22	A
Grid input power	W_{ig}	sync	250	350 to 450	W [4]
Output power	W_o	sync	9	6	kW
		black	5.35	3.37	kW

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

[2]) These values are based on measurements on a circuit with a single LC 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

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; positive modulation, negative synchronisation (BBC system)

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a		max.	5	kV
Negative grid voltage	$-V_g$		max.	1000	V
Anode current	I_a	white	max.	1.9	A
Anode input power	W_{ia}	white	max.	9.5	kW
Anode dissipation	W_a	white	max.	6	kW 1)
Grid dissipation	W_g	white	max.	120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		48-75	MHz
Bandwidth (I_{ant} = 85 %)	B		5.25	MHz
Bandwidth (I_{ant} = 70 %)	B		8	MHz
Anode voltage	V_a		5	kV
Grid voltage	V_g	white	-200	V
		black	-460	V
		sync	-580	V
Peak grid to grid voltage	V_{ggp}	white	1000	V
Anode current	I_a	white	3.8	A
		black	0.8	A
Grid current	I_g	white	0.5	A
		black	0	A
Grid input power	W_{ig}	white	250	W
Output power	W_o	white	9	kW
		black	0.6	kW

1) TBL6/6000 W_a max. = 5 kW

R.F. CLASS B TELEPHONY for television service (American and European system

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 220	MHz
Anode voltage	V_a		max. 5	max. 4	kV
Anode input power	W_{ia}	sync	max. 9.5	max. 6.5	kW
Anode dissipation	W_a	sync	max. 5	max. 4	kW
Anode current	I_a	sync	max. 1.9	max. 1.6	A
Grid dissipation	W_g	sync	max. 120	max. 120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		48 to 75	170 to 220 [1])	MHz
Bandwidth (-1.5 db)	B		5.25	6.5	MHz [2])
Bandwidth (-3 db)	B		8	10	MHz [2])
Anode voltage	V_a		5	4	kV
Grid voltage	V_g		-200	-150	V
Peak grid to grid voltage	V_{gg_p}	sync	1000	1000	V [3])
		black	800	750	V [3])
		white	0	200	V [3])
Anode current	I_a	sync	3.8	3.2	A
		black	3	2.6	A
		white	0.2	-	A
Grid current	I_g	sync	0.5	0.4	A
		black	0.22	0.22	A
		white	0	-	A
Grid input power	W_{ig}	sync	250	350 to 450	W [4])
Output power	W_o	sync	9	6	kW
		black	5.35	3.37	kW

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

[2]) These values are based on measurements on a circuit with a single LC 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

R.F. CLASS C OSCILLATOR 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 voltage	V_a	max.	5400	V
Negative grid voltage	$-V_g$	max.	900	V
Anode current	I_a	max.	1.35	A
Grid current	I_g	max.	0.31	A
Anode input power	W_{ia}	max.	9	kW
Anode dissipation	W_a	max.	6	kW [4]
Grid dissipation	W_g	max.	120	W

OPERATING CONDITIONS

Transformer voltage, RMS	V_{tr}	6.0[1]	5.1[2]	kV
Anode voltage	V_a	5.4	4.6	kV[3]
Anode current	I_a	1.35	1.15	A
Grid current	I_g	0.31	0.27	A
Grid resistor	R_g	1300	1100	Ω
Grid input power	W_{ig}	210	160	W
Anode input power	W_{ia}	9	6.5	kW
Anode dissipation	W_a	2.3	1.84	kW
Output power	W_o	6.5	4.5	kW
Efficiency	η	72	70	%

---

1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

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

3) D.C. value

4) TBL6/6000 W_a max.= 5 kW

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Anode voltage	V_a	max.	6000	V
Negative grid voltage	$-V_g$	max.	1000	V
Anode current	I_a	max.	1.5	A
Grid current	I_g	max.	0.35	A
Anode input power	W_{ia}	max.	9	kW
Anode dissipation	W_a	max.	6	kW 4)
Grid dissipation	W_g	max.	120	W

OPERATING CONDITIONS

Frequency	f	75	75	MHz
Transformer voltage, RMS	V_{tr}	5.1 1)	4.4 2)	kV
Anode voltage	V_a	6.0	5.1	kV 3)
Anode current	I_a	1.5	1.25	A
Grid current	I_g	0.31	0.28	A
Grid resistor	R_g	1300	1100	Ω
Grid input power	W_{ig}	210	160	W
Anode input power	W_{ia}	9	6.4	kW
Anode dissipation	W_a	1.9	1.74	kW
Output power	W_o	6.9	4.5	kW
Efficiency	η	76.5	70	%

1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

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

3) D.C. value

4) TBL6/6000 W_a max. = 5 kW

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

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Transformer voltage, RMS	V_{tr}	max.	6800	V
Negative grid voltage	$-V_g$	max.	640	V
Anode current	I_a	max.	0.8	A
Grid current	I_g	max.	0.19	A
Anode input power	W_{ia}	max.	9	kW
Anode dissipation	W_a	max.	6	kW 3)
Grid dissipation	W_g	max.	120	W

OPERATING CONDITIONS

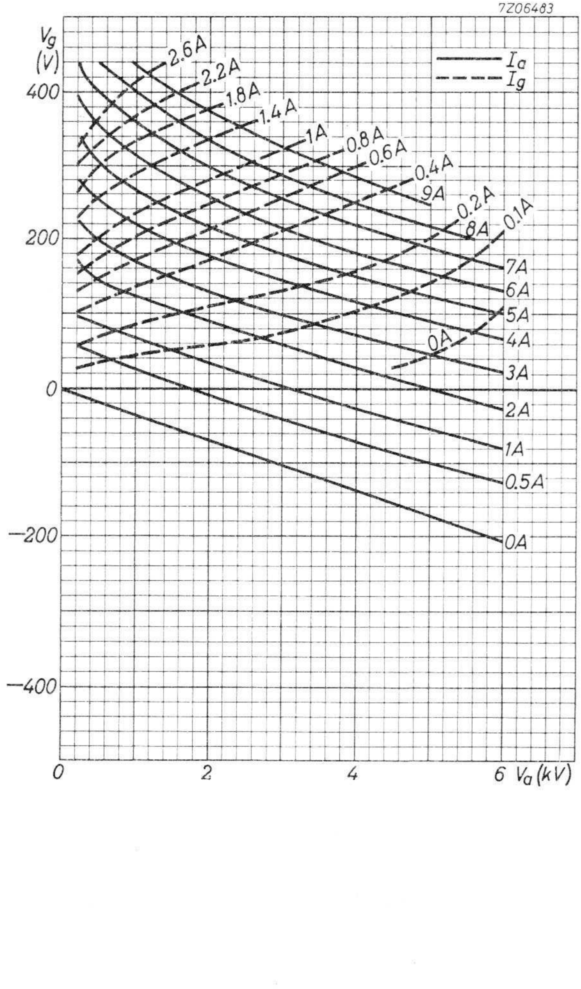
Frequency	f	75	75	MHz
Transformer voltage, RMS	V_{tr}	6.8[1])	5.9[2])	kV
Anode current	I_a	0.8	0.7	A
Grid current	I_g	0.19	0.165	A
Grid resistor	R_g	1050	1050	
Grid input power	W_{ig}			W
Anode input power	W_{ia}	6.05	4.6	kW
Anode dissipation	W_a	1.5	1.24	kW
Output power	W_o	4.55	3.36	kW
Efficiency	η	75	73	%

---

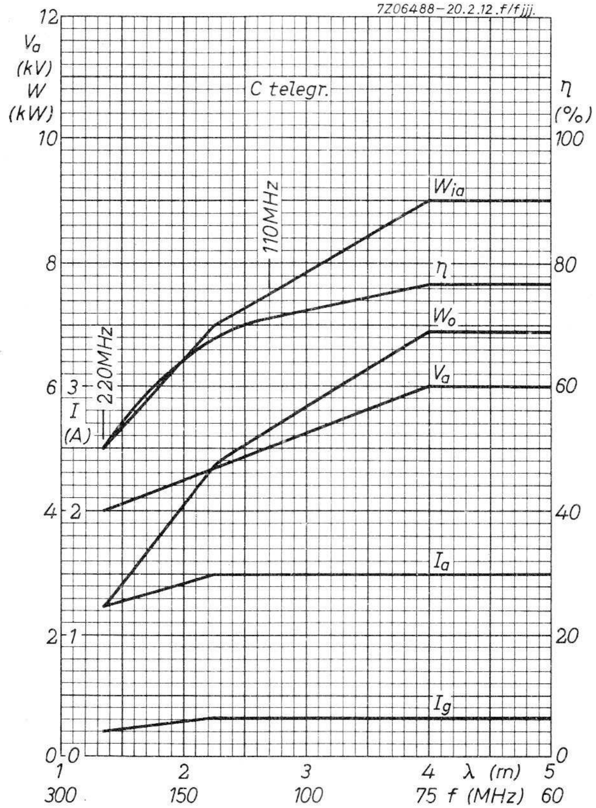
1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

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

3) TBL6/6000 W_a max. = 5 kW



7Z06483
V_g (V)
400
200
0
−200
−400
0
2
4
6 V_a (kV)
I_a
I_g
2.6A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
9A
0.2A
8A
0.1A
7A
6A
5A
4A
0A
3A
2A
1A
0.5A
0A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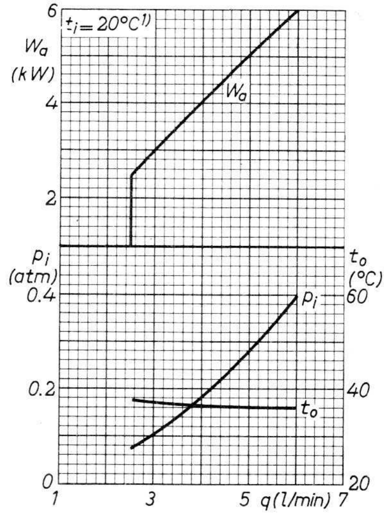
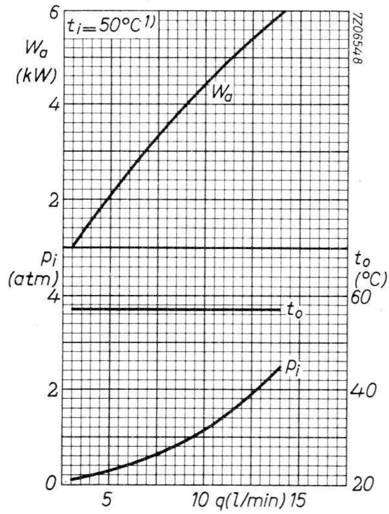
12
V_a
(kV)
W
(kW)
10
8
6
4
2
0
3
I
(A)
2
1
0
C telegr.
110MHz
220MHz
W_{ia}
η
W_o
V_a
I_a
I_g
η
(%)
100
80
60
40
20
0
1
2
3
4
λ (m)
5
300
150
100
75
f (MHz)
60



$t_i = 20°C$ 1)
W_a (kW)
W_a
p_i (atm)
t_o (°C)
p_i
t_o
q (l/min)



$t_i = 50°C$ 1)
W_a (kW)
W_a
p_i (atm)
t_o (°C)
t_o
p_i
q (l/min)
7Z06548

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA							
		C telegr.		C osc.		B mod. [1]	
λ (m)	Freq. (MHz)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	30	6.5	9.5			7.0	20
		6.0	8.5			5.0	9.0
		5.0	7.1			4.0	7.1
6	50			6.0	6.0		

COOLING: water/low velocity air flow

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	12.6	V
Filament current	I_f	33	A

CAPACITANCES

Anode to all other elements except grid	C_a	0.3	pF
Grid to all other elements except anode	C_g	16	pF
Anode to grid	C_{ag}	11	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6	kV
Anode current	I_a	1	A
Amplification factor	μ	32	
Mutual conductance	S	15	mA/V

[1]) Two tubes

WATER COOLING CHARACTERISTICS, see also the cooling curves

W_a (kW)	t_i (°C)	q_{min} [1] (l/min)	p_i (atm)
1	20	2.5	0.08
	50	3	0.1
2	20	2.5	0.08
	50	5	0.3
4	20	4	0.18
	50	9	0.9
6	20	6	0.4
	50	14	2.5

TEMPERATURE LIMITS (Absolute limits)

Inlet temperature	t_i	max.	50	°C
Temperature of filament seals		max.	210	°C
Temperature of grid and anode seals		max.	180	°C

ACCESSORIES

Filament connectors	40634
Connector centre pin of filament	40649 [2]
Grid connector	40650 [3] or 40622
Water jacket	K713

In general, no air cooling will be required at frequencies up to 30 MHz and at ambient temperatures below 35 °C.
At higher frequencies or at higher ambient temperatures a low-velocity air flow to the grid and filament seals will be necessary.

---

1) At water inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

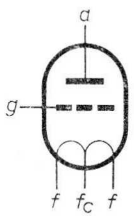
2) The centre tap f_c (diameter 10.5 mm; marked O) must not be used for filament current supply. The connector type 40649, however, must be used for the cooling of this pin

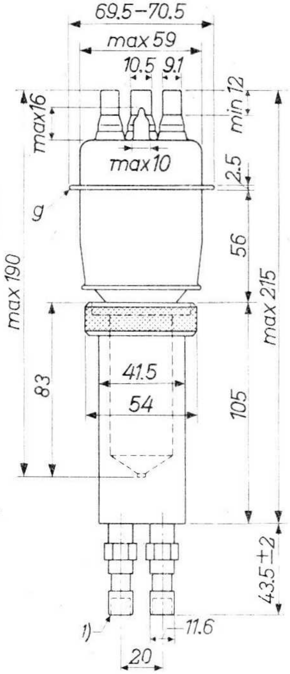
3) See page 3. The connector 40650 should only be used below 30 MHz

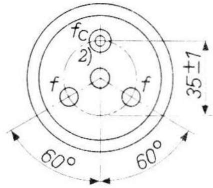
MECHANICAL DATA

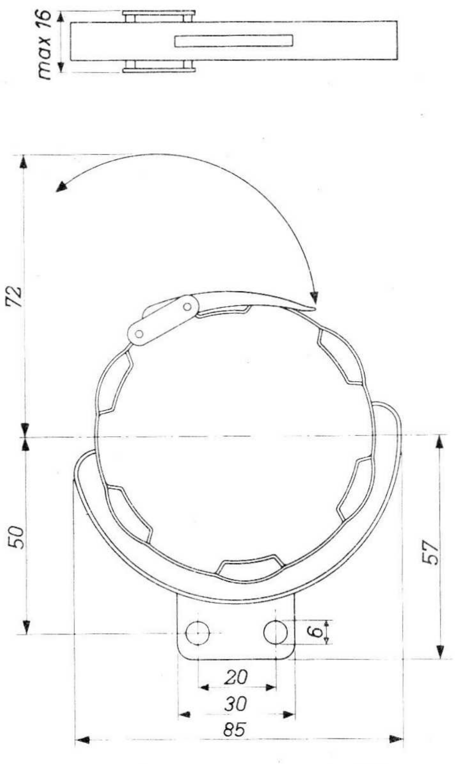
Dimensions in mm

Mounting position: vertical with anode down
Net weight: 0.45 kg
Net weight of water jacket: 0.52 kg
O-ring: 3322 026 82801









Grid connector type 40650

1) 1/8 in pipe thread

2) See page 2

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	7.2	kV
Negative grid voltage	$-V_g$	max.	1250	V
Anode current	I_a	max.	2.2	A
Grid current	I_g	max.	0.6	A
Anode input power	W_{ia}	max.	14	kW
Anode dissipation	W_a	max.	6	kW

OPERATING CONDITIONS

Wavelength	λ	10	10	10	m
Frequency	f	30	30	30	MHz
Anode voltage	V_a	6.5	6.0	5.0	kV
Grid voltage	V_g	-450	-400	-300	V
Anode current	I_a	2.0	2.0	2.0	A
Grid current	I_g	0.5	0.5	0.5	A
Peak grid A.C. voltage	V_{g_p}	820	780	660	V
Grid input power	W_{ig}	370	350	297	W
Anode input power	W_{ia}	13	12	10	kW
Anode dissipation	W_a	3.5	3.5	2.9	kW
Output power	W_o	9.5	8.5	7.1	kW
Efficiency	η	73	71	71	%

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	max.	7.2	kV
Anode current	I_a	max.	2.2	A
Anode input power	W_{ia}	max.	14	kW
Anode dissipation	W_a	max.	6	kW
Grid circuit resistance	R_g	max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a	7		5		5		4		kV
V_g	-250		-165		-165		-135		V
$R_{aa\sim}$	4150		4800		5500		3800		Ω
V_{gg_p}	0	1300	0	880	0	730	0	930	V
I_a	2x0.2	2x2.0	2x0.15	2x1.25	2x0.15	2x1.1	2x0.1	2x1.25	A
I_g	0	2x0.53	0	2x0.33	0	2x0.22	0	2x0.36	A
I_{g_p}	-	2x2.8	-	2x1.75	-	2x1.2	-	2x1.8	A
W_{ig}	0	2x310	0	2x130	0	2x70	0	2x135	W
W_{ia}	2x1.4	2x14	2x0.75	2x6.2	2x0.75	2x5.5	2x0.4	2x5.0	kW
W_a	2x1.4	2x4.0	2x0.75	2x1.7	2x0.75	2x1.5	2x0.4	2x1.45	kW
W_o	0	20	0	9	0	8.0	0	7.1	kW
η	-	71.5	-	72.5	-	72.5	-	71	%

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

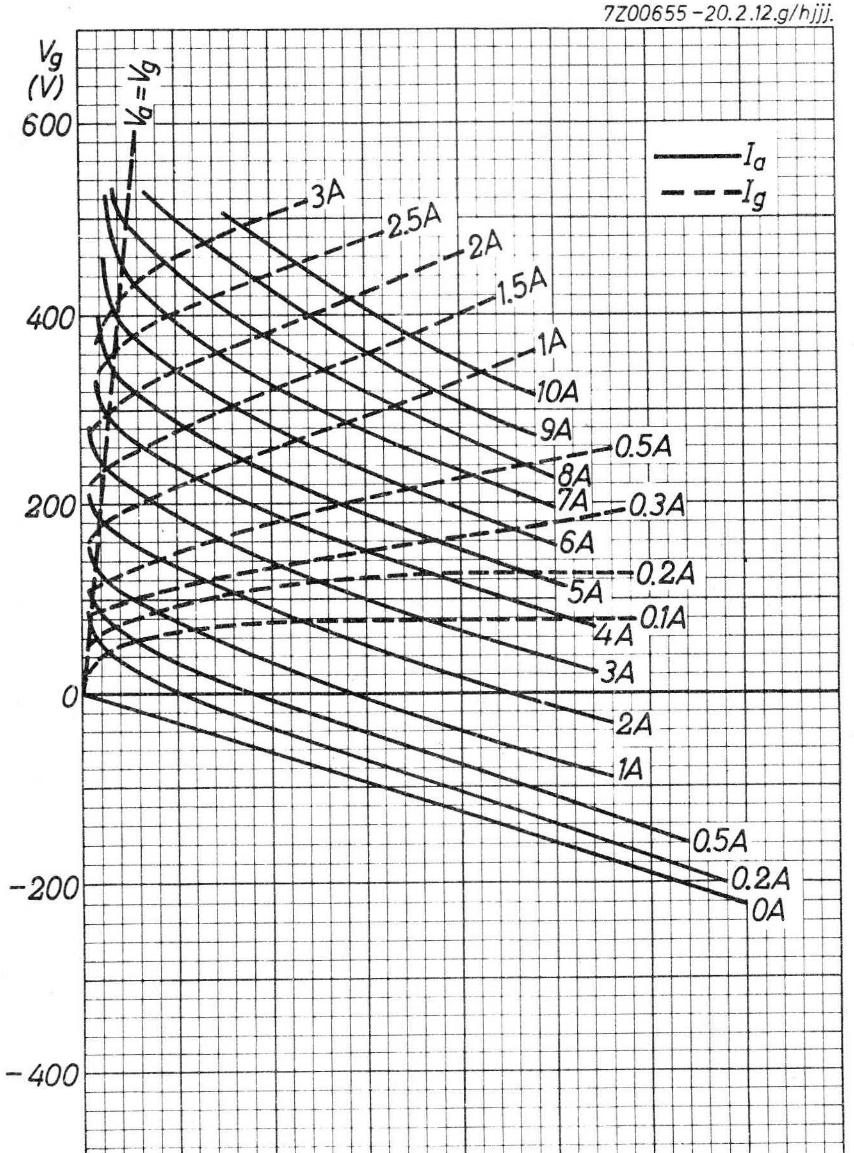
Frequency	f	up to	55	MHz
Anode voltage	V_a	max.	7	kV
Negative grid voltage	$-V_g$	max.	1250	V
Anode current	I_a	max.	1.8	A
Grid current , off load	I_g	max.	0.5	A [1]
Anode input power	W_{ia}	max.	11	kW
Anode dissipation	W_a	max.	6	kW
Grid circuit resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	50	MHz
Transformer voltage	V_{tr}	5100	V_{RMS}
Anode voltage	V_a	6.0	kV
Anode current	I_a	1.5	A
Grid current , on load	I_g	0.4	A
Grid resistor	R_g	1000	Ω
Grid input power	W_{ig}	300	W
Anode input power	W_{ia}	9	kW
Anode dissipation	W_a	2.7	kW
Output power	W_o	6	kW [2]
Efficiency	η	67	%

[1]) Off load max. 0.7 A

[2]) Available power (load + circuit losses)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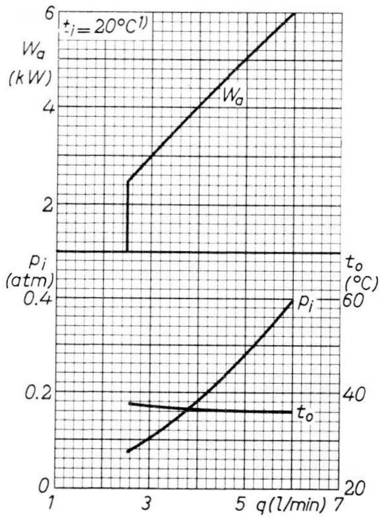
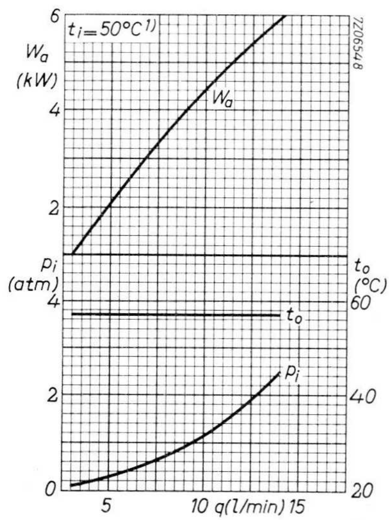
Vg (V)
600
400
200
0
-200
-400
Va=Vg
Ia
Ig
3A
2.5A
2A
1.5A
1A
10A
9A
0.5A
8A
7A
0.3A
6A
0.2A
5A
0.1A
4A
3A
2A
1A
0.5A
0.2A
0A
0
2
4
6
Va(kV)
8


$t_i = 20°C$ 1)
W_a
(kW)
W_a
p_i
(atm)
t_o
(°C)
p_i
t_o
q(l/min)
0
0.2
0.4
2
4
6
20
40
60
1
3
5
7


$t_i = 50°C$ 1)
7Z06548
W_a
(kW)
W_a
p_i
(atm)
t_o
(°C)
t_o
p_i
q(l/min)
0
2
4
6
20
40
60
5
10
15

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq.	Three phase	
(MHz)	V_a (kV)	W_ℓ [1] (kW)
50	7.2 6.2	6.1 5.0

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V $^{+5\,\%}_{-10\,\%}$
Filament current	I_f	=	32	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	13.5	pF
Anode to grid	C_{ag}	=	7.4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6	kV
Anode current	I_a	=	1	A
Mutual conductance	S	=	12	mA/V
Amplification factor	μ	=	24	

[1]) Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of the seals = max. 220 °C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
2	20	2.5	0.06
	50	5	0.2
4	20	4	0.14
	50	9	0.7
6	20	6	0.3
	50	14	1.9

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

At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive grid seal temperatures.

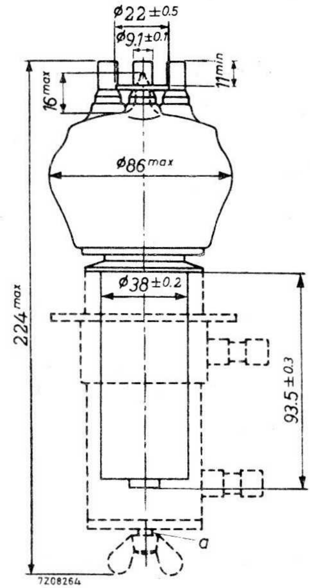
7Z2 3542

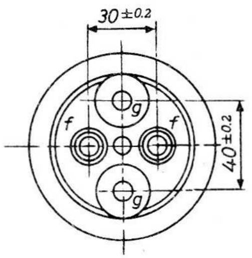
MECHANICAL DATA

Dimensions in mm

Net weight of the tube : 0.57 kg

Net weight of water-jacket : 0.76 kg





Grid and filament connectors 40634

Water jacket K721

→ O-ring large : 2622 080 30798
small : 2622 080 30733

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier without filter

LIMITING VALUES (Absolute limits), continuous service

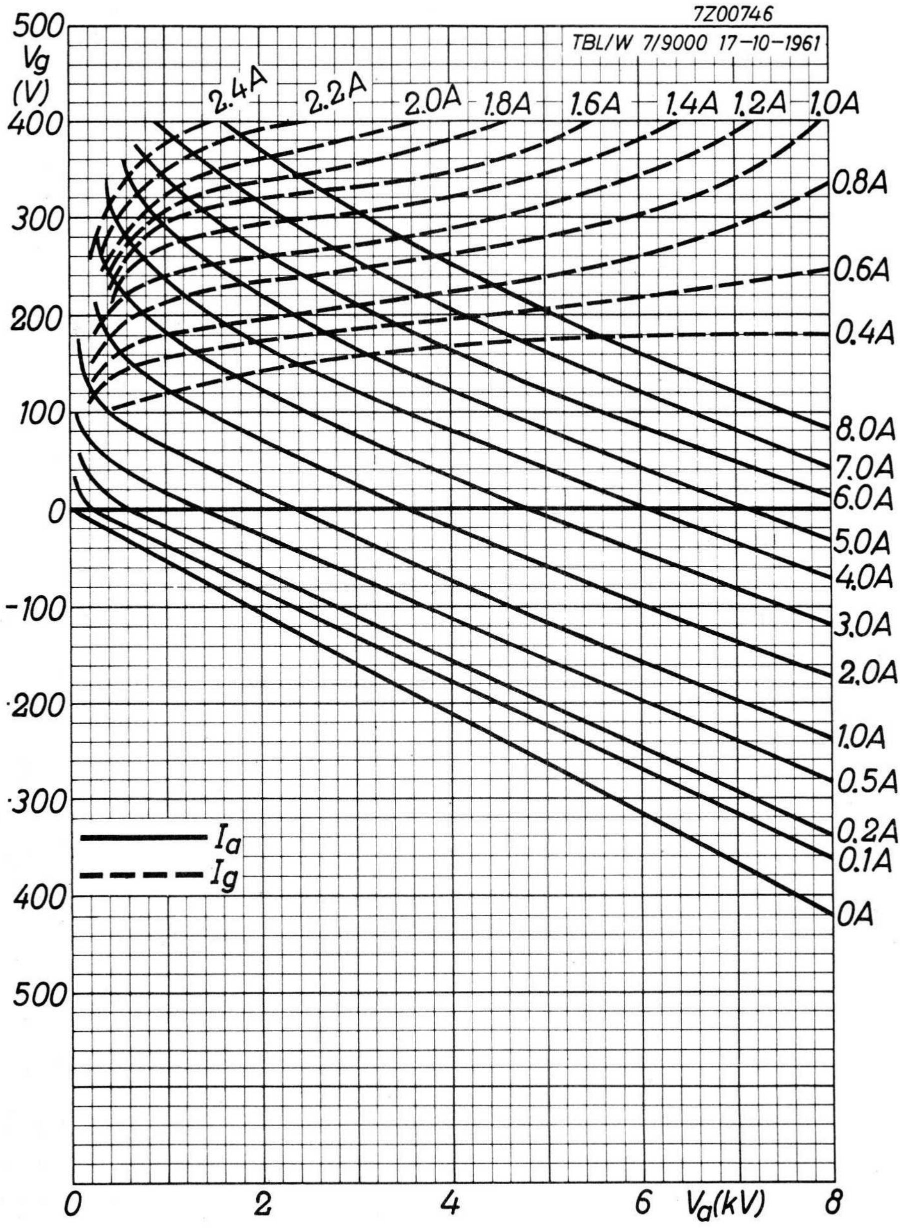
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance	R_g	= max.	10	kΩ

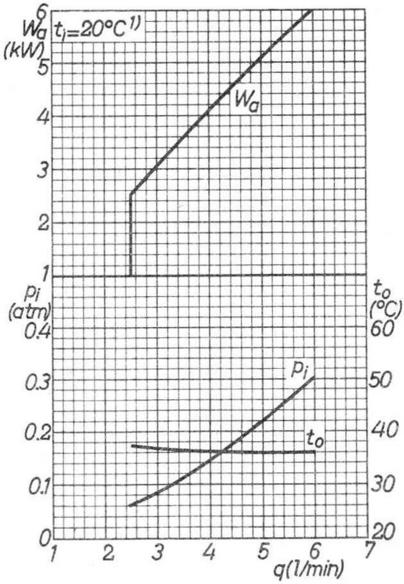
OPERATING CHARACTERISTICS, continuous service

Frequency	f	=	50	50	MHz
Anode voltage	V_a	=	7200	6200	V
Anode current, loaded	I_a	=	1.5	1.4	A
Anode current, unloaded	I_a	=	0.37	0.40	A
Grid current, loaded	I_g	=	0.36	0.37	A
Grid current, unloaded	I_g	=	0.47	0.47	A
Grid resistor	R_g	=	1850	1500	Ω
Load resistance	$R_{a\sim}$	=	2300	2100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	17	%
Anode input power	W_{ia}	=	10.8	8.68	kW
Anode dissipation	W_a	=	3.3	2.5	kW
Efficiency	η	=	70	71	%
Output power in the load	W_ℓ	=	6.1	5.0	kW [1]

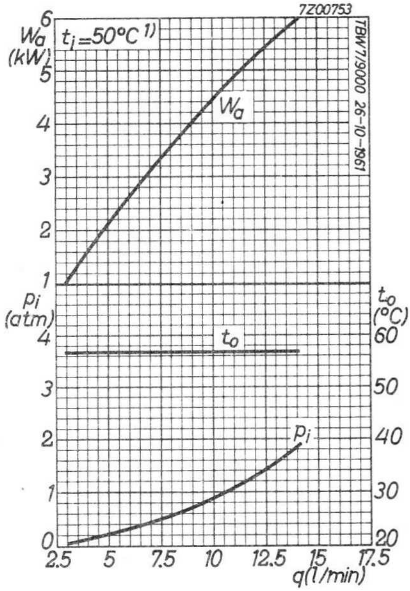
[1]) Useful power in the load, measured in a circuit having an efficiency of 85 %

7Z2 3540


7Z00746
TBL/W 7/9000 17-10-1961
500
Vg
(V)
400
300
200
100
0
-100
-200
-300
400
500
2.4A
2.2A
2.0A
1.8A
1.6A
1.4A
1.2A
1.0A
0.8A
0.6A
0.4A
8.0A
7.0A
6.0A
5.0A
4.0A
3.0A
2.0A
1.0A
0.5A
0.2A
0.1A
0A
Ia
Ig
0
2
4
6
Va(kV)
8



W_a (kW)
$t_i = 20°C$ 1)
W_a
p_i (atm)
t_o (°C)
p_i
t_o
q (l/min)



7Z00753
TBW7/9000 26-10-1961
W_a (kW)
$t_i = 50°C$ 1)
W_a
p_i (atm)
t_o (°C)
t_o
p_i
q (l/min)

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (MHz)	Three phase	
	V_a (kV)	W_o (kW)
30	12	29.0
	10	23.3
	8	17.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8.0	V	+5 % / −10 %
Filament current	I_f	=	98	A	
Cold filament resistance	R_{fo}	=	0.008	Ω	

The filament current must never exceed a peak value of 210 A instantaneously at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.4	pF
Grid to all other elements except anode	C_g	=	37	pF
Anode to grid	C_{ag}	=	30	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	34	
Mutual conductance	S	=	20	mA/V

TEMPERATURE LIMIT (Absolute limit)

Seal temperature = max. 220 °C

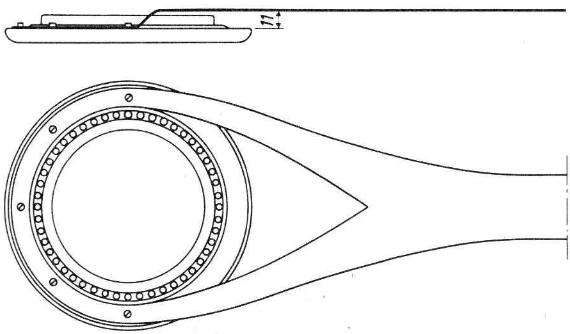
Generally a low velocity air flow to the seals is required

WATER COOLING CHARACTERISTICS

t_i = max. 50 °C

W_a (kW)	t_i (°C)	q_{min} [1] (l/min)	p_i (atm.)
5	20	6	0.02
	50	15	0.22
10	20	11	0.1
	50	25	0.7
15	20	16	0.25
	50	37	1.3
20	20	22	0.5
	50	49	2.3

To ensure a uniform R.F. current distribution in the grid seal especially at frequencies higher than 4 MHz, the grid lead should be connected as shown below.



[1]) At inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

7Z2 3552

MECHANICAL DATA

Dimensions in mm

Net weight of the tube : 2.8 kg

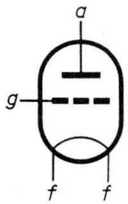
Net weight of water jacket: 2.1 kg

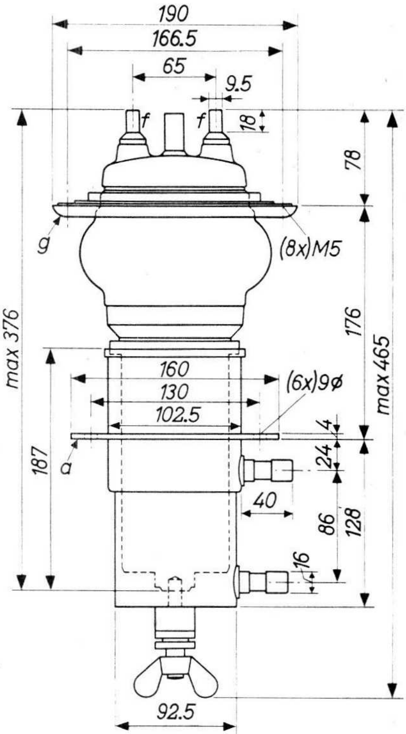
Filament connectors with cable : 40662

Grid connector : 40663

Water jacket : K717

→ O-ring large : 2622 080 30895
small : 2622 080 30736





Tube with grid connector and water jacket

Mounting position: vertical with anode down

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase half-wave rectifier without filter

LIMITING VALUES (Absolute limits)

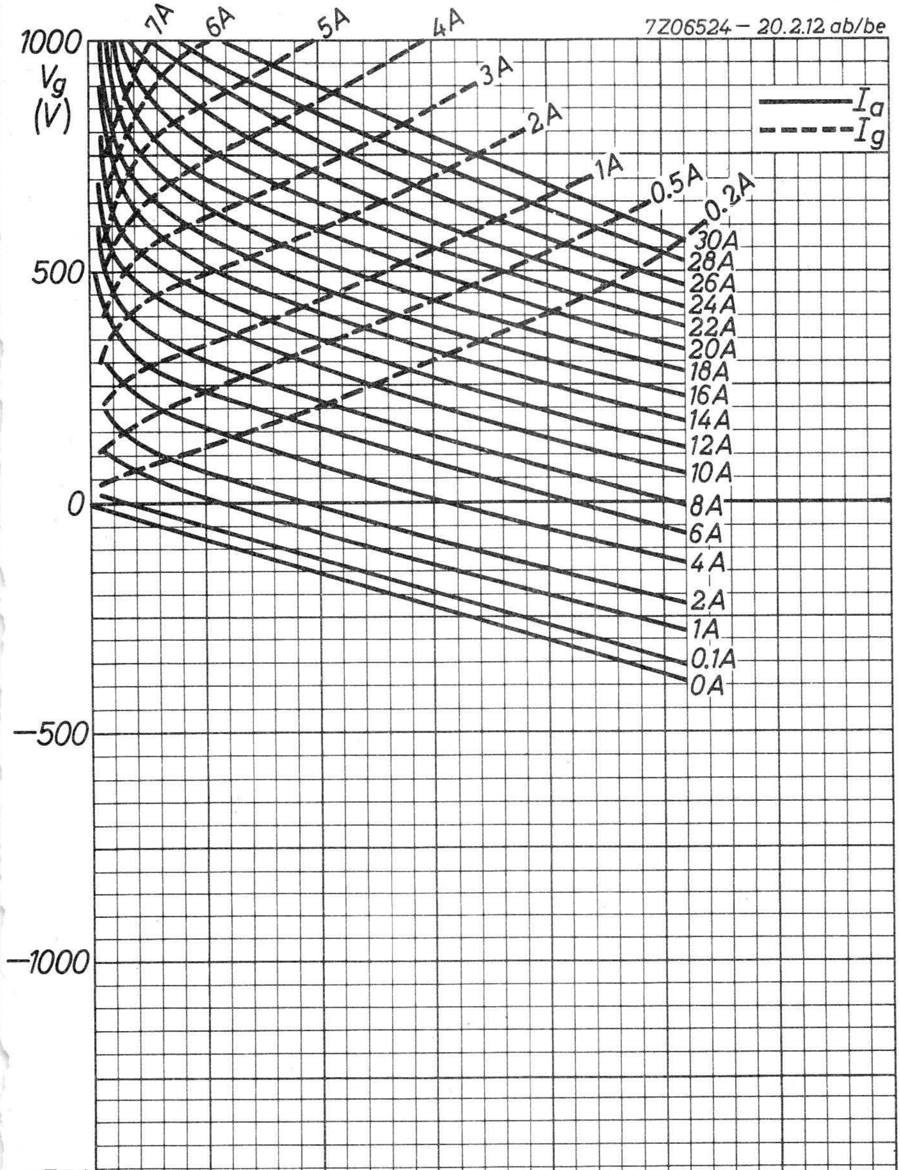
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	20	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

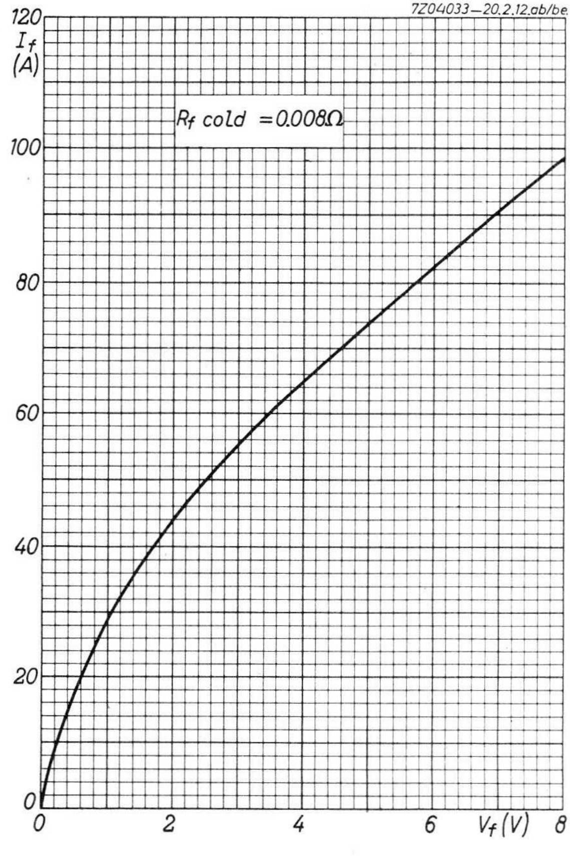
OPERATING CONDITIONS

Frequency	f	=	30	30	30	MHz
Transformer voltage	V_{tr}	=	8.9	7.4	6.0	kV
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	3.2	3.2	3.2	A
Anode current, unloaded	I_a	=	0.52	0.50	0.48	A
Grid current, loaded	I_g	=	0.50	0.50	0.50	A
Grid current, unloaded	I_g	=	0.74	0.77	0.80	A
Grid resistor	R_g	=	2.0	1.6	1.1	kΩ
Load resistance	$R_{a\sim}$	=	1800	1450	1100	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	19	%
Anode input power	W_{ia}	=	38.4	32.0	25.6	kW
Anode dissipation	W_a	=	9.4	8.7	7.7	kW
Output power	W_o	=	29.0	23.3	17.9	kW
Efficiency	η	=	75.5	72.5	70	%
Output power in the load	W_ℓ	=	25	20	15.5	kW[1])

[1]) Useful power in the load measured in a circuit having an efficiency of 90%

7Z2 3554


7Z06524 – 20.2.12 ab/be
1000
V_g
(V)
500
0
−500
−1000
−1500
0
5
10
15 V_a (kV)
I_a
I_g
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
30A
28A
26A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.1A
0A


7Z04033—20.2.12.ab/be.
120
I_f
(A)
R_f cold = 0.008Ω
100
80
60
40
20
0
0
2
4
6
V_f (V)
8

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Freq. (MHz)	C osc. industrial	
	V_a (kV)	W_o (kW)
30	12	39
	10	31.3
	8	23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	8	V	+5 % / −10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_{fo}	=	0.006	Ω	

The filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.9	pF
Grid to all other elements except anode	C_g	=	45	pF
Anode to grid	C_{ag}	=	23.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	2	A
Amplification factor	μ	=	21	
Mutual conductance	S	=	25	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals		=	max.	220	°C
Water inlet temperature	t_i	=	max.	50	°C

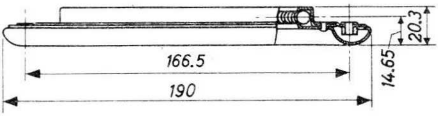
COOLING: Generally a low velocity air flow to the seals is required

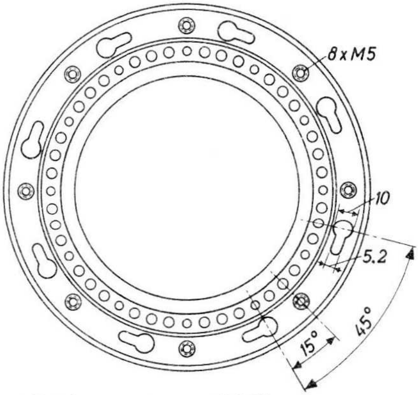
WATER COOLING CHARACTERISTICS. See also page A

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
5	20	6	0.02
	50	15	0.22
10	20	11	0.1
	50	25	0.7
15	20	16	0.25
	50	37	1.3
20	20	22	0.5
	50	49	2.3

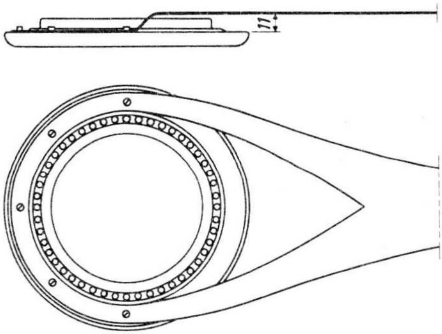
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation

MECHANICAL DATA Dimensions in mm





Grid connector 40663



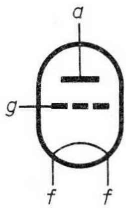
Connection of the grid lead

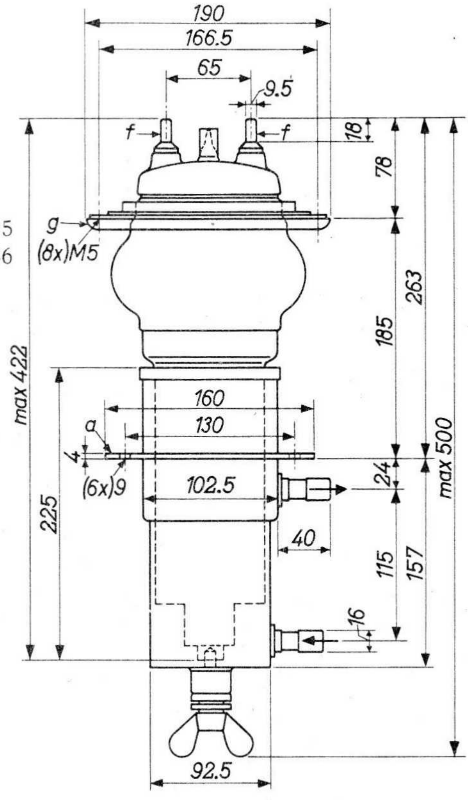
The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right. 7Z2 3563

MECHANICAL DATA (continued)

Dimensions in mm

Water jacket	: K722
Filament connectors	: 40662
Grid connector	: 40663
Net weight of the tube	: 3.0 kg
Net weight of water jacket	: 2.7 kg
O-ring large	: 2622 080 30895
O-ring small	: 2622 080 30736

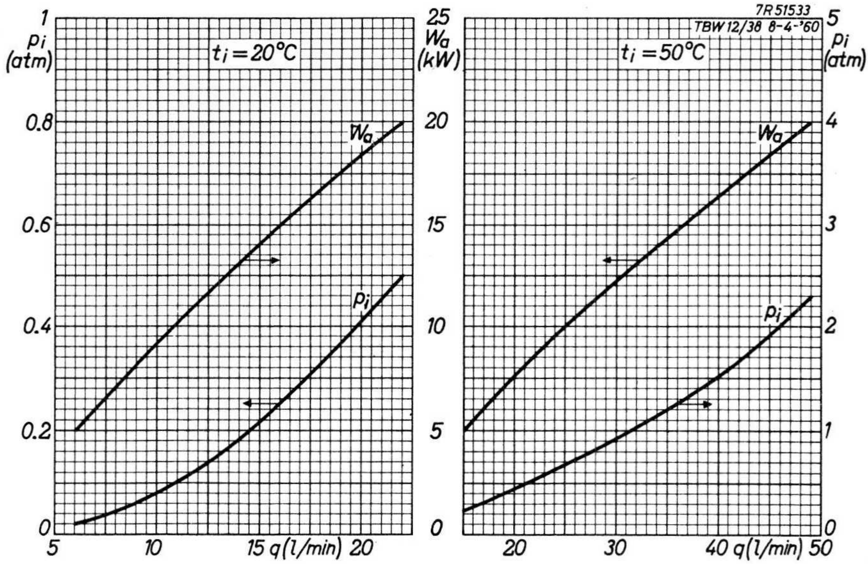




Tube mounted in water jacket

Mounting position: vertical with anode down

For further data and curves (except cooling curves) please refer to type TBH 12/38


7R 51533
TBW 12/38 8-4-'60
$t_i = 20°C$
$t_i = 50°C$
p_i (atm)
W_a (kW)
W_a
p_i
q (l/min)
1
0.8
0.6
0.4
0.2
0
25
20
15
10
5
0
5
4
3
2
1
0
5
10
15
20
20
30
40
50

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA							
General purposes							
λ (m)	Freq. (MHz)	C telegr.		C anode mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
20	15	12	108	10	80	12	202
15	20	12	94.5	10	54.5	10	116
12	25	11	70	9	42.5	10	77
11	27.5	10.5	59	8.5	36.5	9	62
10	30	10	50	8	31	8.5	54
						8	46.8

Television service		
Freq. (MHz)	Neg. mod., pos. sync. [1]	
	V_a (kV)	W_o sync (kW)
48 to 68	6.5	100 [2]

HEATING : direct ; filament thoriated tungsten

Filament voltage	V_f	17.5	V
Filament current	I_f	196	A
Cold filament resistance	R_{f_o}	12	mΩ

The filament current must never exceed a peak value of 420 A at any time during the initial energizing schedule.

CAPACITANCES

Anode to all other elements except grid	C_a	3.4	pF
Grid to all other elements except anode	C_g	116	pF
Anode to grid	C_{ag}	86	pF

[1]) Two tubes

[2]) Power transferred from driving stage included

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	10	kV
Anode current	I_a	50	5	A
Amplification factor	μ	–	27	
Mutual conductance	S	–	50	mA/V
Maximum mutual conductance	S_{max}	92	–	mA/V

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	max.	50	°C
Temperature of seals		max.	180	°C

WATER COOLING CHARACTERISTICS; see also cooling curves

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

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

To keep the seal temperatures below 180 °C it will often be necessary to direct an air flow of sufficient velocity to the seals. This air flow must be started upon or before the application of the filament voltage.
Anode and grid seals can be cooled by connecting a blower of suitable size to the air inlet of the anticorona ring, attached to the tube. At frequencies below 6 MHz air cooling will, as a rule, not be necessary. Above 6 MHz air cooling must be used in order to prevent overheating of anode and grid seals.
At maximum frequency (30 MHz) and at the published operating conditions at least 2.5 m^3 per minute is required with a pressure loss of about 500 mm water column.

MECHANICAL DATA

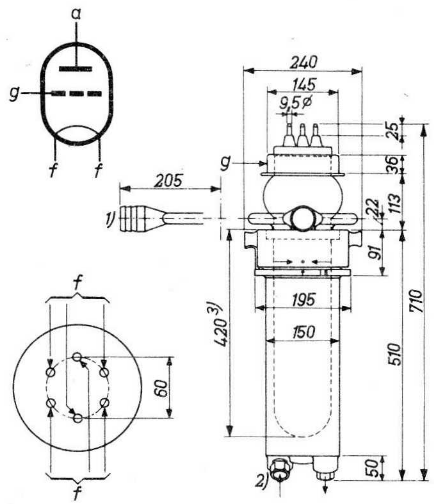
Dimensions in mm

Mounting position : vertical with anode down

Net mass : 14 kg

Accessories

Water jacket	type K714	net mass 20,5 kg
Filament connectors	type 40628	
O-ring	code 2622 080 31817	



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

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

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

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

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

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

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (absolute limits)

Frequency	f	up to	4	15	30	MHz
Anode voltage	V_a	max.	15	13.5	10	kV
Anode current	I_a	max.	12	12	10	A
Anode input power	W_{ia}	max.	162	162	80	kW
Anode dissipation	W_a		max.	50		kW 1)
Negative grid voltage	$-V_g$		max.	1200		V
Grid current	I_g		max.	3		A

OPERATING CONDITIONS

Wavelength	λ	20	15	12	11	10	m
Frequency	f	15	20	25	27.5	30	MHz
Anode voltage	V_a	12	12	11	10.5	10	kV
Grid voltage	V_g	-1000	-1000	-900	-850	-800	V
Anode current	I_a	12	10.5	8.5	7.5	6.7	A
Grid current	I_g	2.25	2	1.6	1.5	1.4	A
Peak grid A.C. voltage	V_{gp}	1700	1650	1450	1350	1300	V
Grid input power	W_{ig}	3.5	3	2.1	1.9	1.7	kW
Anode input power	W_{ia}	144	126	93.5	79	67	kW
Anode dissipation	W_a	36	31.5	23.5	20	17	kW
Output power	W_o	108	94.5	70	59	50	kW
Efficiency	η	75	75	75	75	75	%

1) TBL12/100 W_a max. 45 kW

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	15	20	30	MHz
Anode voltage	V_a	max.	10	10	8	kV
Anode input power	W_{ia}	max.	105	80	50	kW
Anode dissipation	W_a	max.		30		kW
Anode current	I_a	max.		10.5		A
Negative grid voltage	$-V_g$	max.		1200		V
Grid current	I_g	max.		3.5		A

OPERATING CONDITIONS

f	15	15	20	25	27.5	30	MHz
V_a	10	10	10	9	8.5	8	kV
V_g	-1050	-1050	-1050	-925	-900	-850	V [1])
I_a	10.5	8.5	7.0	6.2	5.7	5.25	A
I_g	3.5	2.6	2.0	2.0	1.9	1.8	A
V_{gp}	1960	1750	1650	1500	1450	1400	V
W_{ig}	6.2	4.1	3.0	2.7	2.5	2.3	kW
W_{ia}	105	85	70	56	48.5	42	kW
W_a	25	17	15.5	13.5	12	11	kW
W_o	80	68	54.5	42.5	36.5	31	kW
η	76	80	78	76	75	74	%
m	100	100	100	100	100	100	%
W_{mod}	52.5	42.5	35	28	24.5	21	kW

[1]) Grid bias partially obtained by the grid resistor

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	max.	15	kV
Anode current	I_a	max.	12	A
Anode input power	W_{ia}	max.	162	kW
Anode dissipation	W_a	max.	50	kW [1]
Grid circuit resistance	R_g	max.	20	kΩ

OPERATING CONDITIONS, two tubes

V_a	12		10		10		kV
V_g	-450		-375		-400		V
$R_{aa\sim}$	1200		1500		2060		Ω
V_{ggp}	0	2060	0	1680	0	1460	V
I_a	2 x 0.65	2 x 12	2 x 0.5	2 x 7.9	2 x 0.2	2 x 5.4	A
I_g	0	2 x 2.5	0	2 x 1.9	0	2 x 0.7	A
W_{ig}	0	2 x 2.4	0	2 x 1.44	0	2 x 0.5	kW
W_{ia}	2 x 7.8	2 x 144	2 x 5	2 x 79	2 x 2	2 x 54	kW
W_a	2 x 7.8	2 x 43	2 x 5	2 x 21	2 x 2	2 x 15.5	kW
W_o	0	202	0	116	0	77	kW
η		70	-	75	-	71	%

V_a	9		8.5		8		kV
V_g	-350		-325		-300		V
$R_{aa\sim}$	2080		2120		2210		Ω
V_{ggp}	0	1300	0	1200	0	1120	V
I_a	2 x 0.25	2 x 4.8	2 x 0.25	2 x 4.4	2 x 0.25	2 x 4.1	A
I_g	0	2 x 0.65	0	2 x 0.55	0	2 x 0.4	A
W_{ig}	0	2 x 0.4	0	2 x 0.3	0	2 x 0.25	kW
W_{ia}	2 x 2.25	2 x 43.2	2 x 2.1	2 x 37.4	2 x 2	2 x 32.8	kW
W_a	2 x 2.25	2 x 12.2	2 x 2.1	2 x 10.4	2 x 2	2 x 9.4	kW
W_o	0	62	0	54	0	46.8	kW
η	-	72	-	72	-	71	%

[1] TBL12/100 W_a max. 45 kW

R.F. CLASS B AMPLIFIER for television service, negative modulation, positive synchronisation

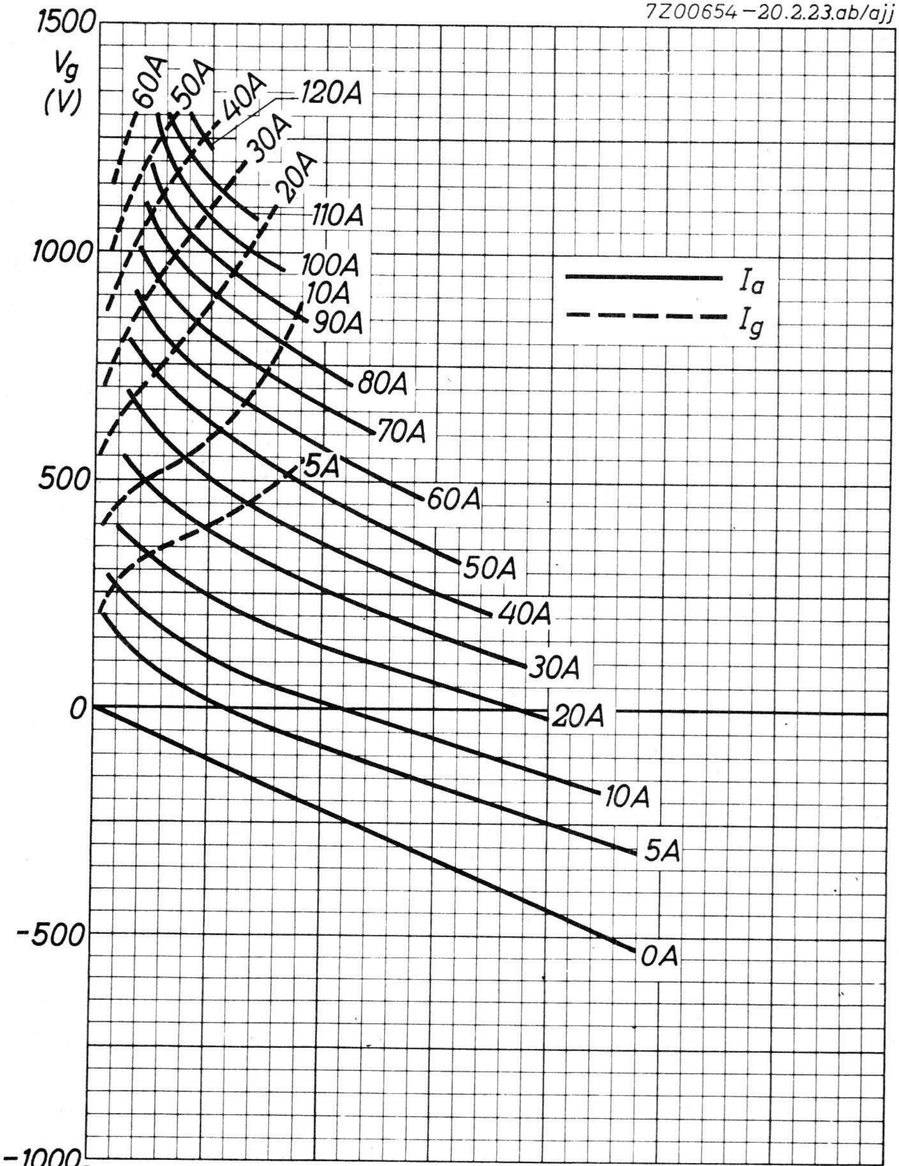
LIMITING VALUES (Absolute limits)

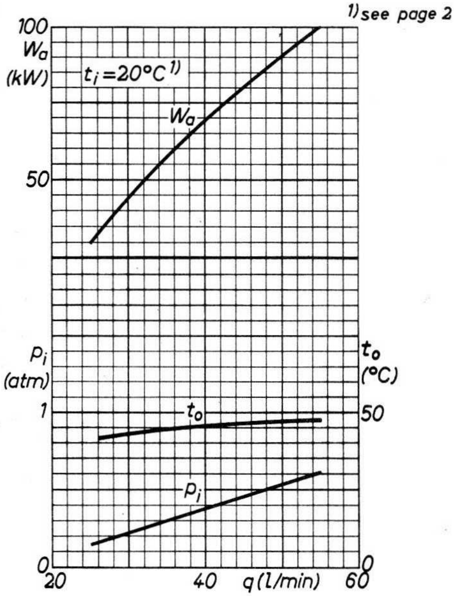
Frequency	f		up to	68	MHz
Anode voltage	V_a		max.	6.5	kV
Anode current	I_a	sync	max.	16	A
Anode input power	W_{ia}	sync	max.	100	kW
Anode dissipation	W_a	sync	max.	50	kW
Grid current	I_g	sync	max.	2	A

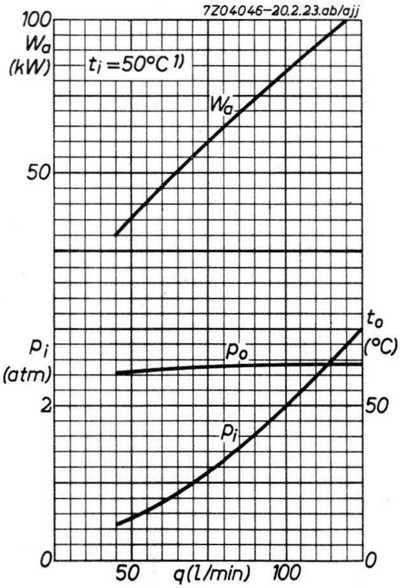
OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		48 to 68	MHz [1]
Bandwidth (-1.5 dB)	B		5.5	MHz [2]
Bandwidth (-3 dB)	B		7.5	MHz [2]
Anode voltage	V_a		6.5	kV
Grid voltage	V_g		-250	V
Peak grid to grid A.C. voltage	V_{ggp}	sync	1740	V [3]
		black	1300	V [3]
Anode current	I_a	sync	32	A
		black	24	A
Grid current	I_g	sync	3.4	A
		black	2.2	A
Grid input power	W_{ig}	sync	22.4	kW [4]
Output power	W_o	sync	80+20	kW [5]
		black	45+11	kW [5]

1) In the frequency range of 60 to 68 MHz a special version of the tube is necessary.
2) This value of bandwidth is based on measurements on a circuit with a single LC 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) Power transferred from driving stage included.

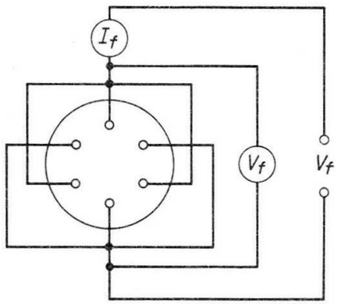

7Z00654−20.2.23.ab/ajj
1500
1000
500
0
-500
−1000
V_g (V)
0
5
10
15
V_a (kV)
60A
50A
40A
30A
20A
120A
110A
100A
10A
90A
80A
70A
5A
60A
50A
40A
30A
20A
10A
5A
0A
I_a
I_g


1) see page 2
100
W_a
(kW)
$t_i = 20°C$ 1)
W_a
50
p_i
(atm)
1
t_o
t_o
(°C)
50
p_i
0
0
20
40
q (l/min)
60


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

WATER COOLED R.F. POWER TRIODE

This type is equivalent to type TBW12/100 except for the filament data

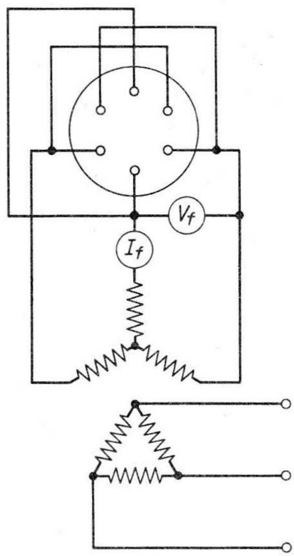


Single-phase filament energizing

V_f = 17.5 V

I_f = 196 A

Filament current must never exceed a peak value of 420 A at any time during the initial energizing schedule



Three-phase filament energizing

V_f = 15.5 V

I_f = 131 A

Filament current must never exceed a peak value of 280 A at any time during the initial energizing schedule

A safety device must be used to prevent filament energizing with one phase interrupted.

7Z2 3596

INDEX OF TYPE NUMBERS

General section

Transmitting tubes for communication

Tubes for r.f. heating

Types PE5/25 ÷ TBW15/125

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