

PHILIPS

Data handbook



Electronic
components
and materials

Electron tubes

Part 1a April 1973

Transmitting tubes for communication

Tubes for r.f. heating

PB2/500- $\frac{1}{2}$ -TBW15/125



ELECTRON TUBES

Part 1a

April 1973

General section

Transmitting tubes for communication

Tubes for r.f. heating

Types PB2/500 +
TBW15/125

Accessories see Part 1 b

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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

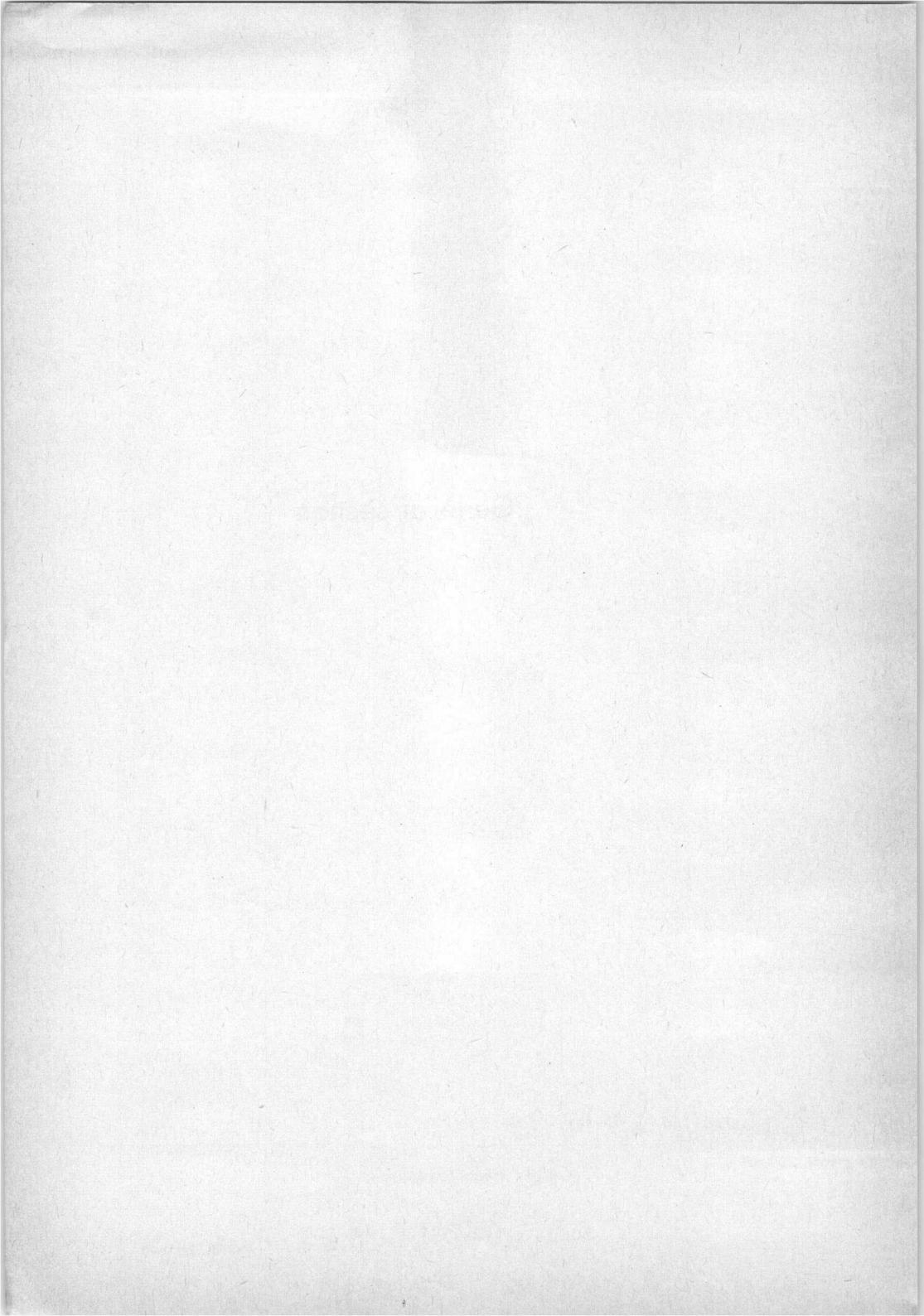
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General section



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

- 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 .
- 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

- 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.
- 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_0}
Supply voltage of tube electrodes	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 heater and cathode	V_{kf}
Peak value of a voltage	V_p
RMS value of a voltage	V_{RMS}
Secondary transformer voltage	V_{tr}

3. Symbols denoting currents

Remarks

- The positive electrical current is directed opposite to the direction of the electron current.
- The symbols quoted below represent the average values of the concerning currents, unless otherwise stated.

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

4. Symbols denoting powers

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

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5. Symbols denoting capacitances

In general the published capacitance values refer to the cold tube

Capacitance between the anode and all other elements

except the control grid

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_{σ}

Capacitance between two grids (all other elements being earthed) $C_{g_1 g_2}$

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

Matching resistance of a push-pull amplifier (anode to anode) R_{aa}

Filament or heater resistance R_f

Filament or heater resistance in cold condition R_f

External resistor in a grid lead R_g

External resistor in a cathode lead

7. Symbols denoting various quantities

Bandwidth B

Harmonic distortion factor d

n-th harmonic distortion

Total harmonic distortion d_{tot}

7. Symbols denoting various quantities (continued)

Intermodulation distortion	d_i
n-th order intermodulation distortion	d_{in}
Frequency	f
Pulse repetition rate	f_{imp}
Height above sea level	h
Modulation factor	m
Pressure drop of cooling air or cooling water	p_i
Required flow of cooling air or cooling water	q
Thermal resistance	R_{th}
Mutual conductance	S
Temperature of anode or anode block	t_a
Ambient temperature	t_{amb}
Bulb temperature	t_{bulb}
Cathode heating time	T_h
Inlet temperature of cooling air or cooling water	t_i
Pulse duration	T_{imp}
Outlet temperature of cooling air or cooling water	t_o
Seal temperature	t_s
Waiting time (= time which has to pass between switching on of the filament or heater voltage and switching on of the other voltages)	T_w
Duty factor	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 section data and curves are given for transmitting tubes and tubes for R.F. heating.

1.2 The tubes are classified into three groups

- | | |
|-------------------|---|
| Preferred types | - to be considered when designing new equipment |
| Maintenance types | - still in production but to be avoided when designing new equipment. |
| Obsolescent types | - will be supplied until present stocks are exhausted. |

Full details are given of preferred types. Data on maintenance and obsolescent types is given in condensed form.

2. CHARACTERISTIC DATA

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

2.2 Filament/heater supply

The published value of filament/heater voltage is generally that which should be present directly at the tube terminals. Filaments fed with direct current should have their supply polarity reversed at regular intervals (say monthly), to ensure uniform wear of the filament with consequent longer life.

Reduction of filament voltage is sometimes recommended to compensate e.g. the heating by back-bombardment at high frequencies; see the relevant data sheets.

Special precautions must be taken when operating the filaments/heaters of transmitting tubes in series and the manufacturer should be consulted before doing so.

2.2.1 Pure tungsten cathodes (filaments)

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

and, (to obtain peak output power) further adjusted after modulation is applied. Regular adjustment (say monthly) will be necessary to maintain the required conditions and, towards the end of tube life, the filament voltage may be raised above the nominal.

To compensate for mains supply fluctuations, automatic or manual control of the filament voltage should be exercised, especially when operating at nominal, or higher than nominal, filament voltage.

2.2.2 Thoriated tungsten cathodes (filaments)

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

2.2.3 Quick heating cathodes (filaments)

In general, tubes with quick heating cathodes should have their filaments in parallel only. When a sinusoidal voltage is used for heating the filament, the frequency must not be in the range 200 Hz to 5000 Hz.

When a non-sinusoidal voltage from a d.c.-a.c. converter is used the r.m.s. value should be adjusted to the published value of filament voltage.

If required the heating time can be further reduced by applying a higher value for a short time. The manufacturer should be consulted before doing so.

2.2.4 Indirectly heated oxide coated cathodes

For maximum life the heater voltage should be as near as possible to the nominal value and the maximum permissible deviation must not exceed 10%, unless otherwise specified.

R.F. voltages between heater and cathode may induce faulty r.f. insulation with resultant r.f. power losses. To overcome these losses an increase in the driving power would be required resulting in an increase of cathode temperature with a consequent reduction of tube life. Such r.f. voltages should therefore be avoided e.g. by using one of the following techniques:

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

2.2.5 Switching on the filament voltage

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

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 be 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_{ia} 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_{ia} 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. $0.95 \times V_{gp} \times I_g$). When an a.c., or unsmoothed d.c., voltage supply is used the form factor should be taken into account.

3.12 Grid resistance

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

4. OPERATING CONDITIONS

4.1 General

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

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

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

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

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

A class C amplifier or oscillator is one in which the grid bias is appreciably 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_1 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

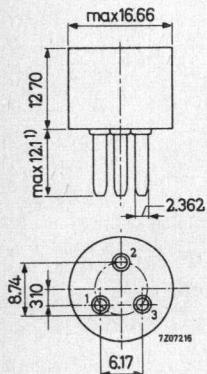
The maximum permissible load of a tube is determined by the physical maxima of the tube incorporated in the limiting values. No guaranteed tube life can be given if the limiting values are exceeded although this does not imply that exceeding the limits will always result in an immediate breakdown of 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.

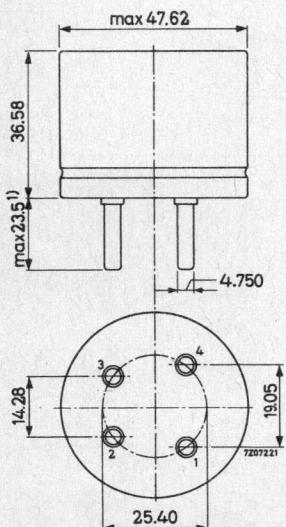
General information on this kind of information is not available but, if requested, information will be given on specific applications.

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



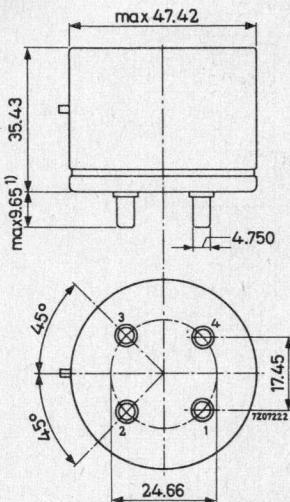
1) Including solder

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



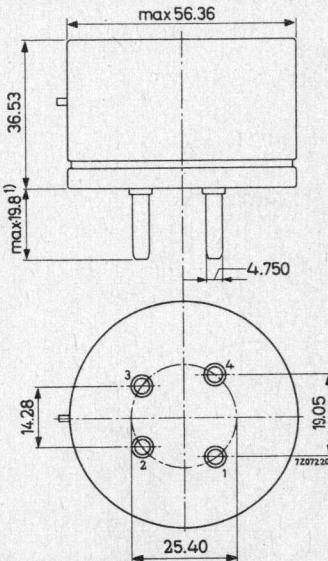
1) Including solder

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



1) Including solder

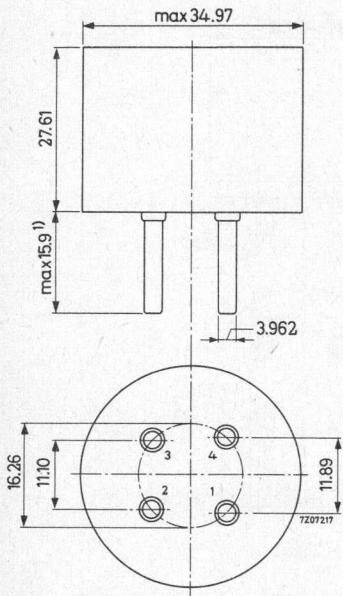
Super Jumbo 4-pin base with bayonet
(IEC 67-I-24)



1) Including solder

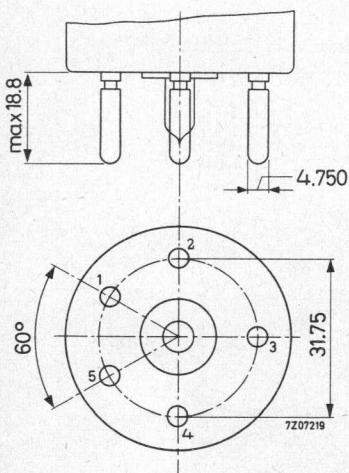
BASES

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

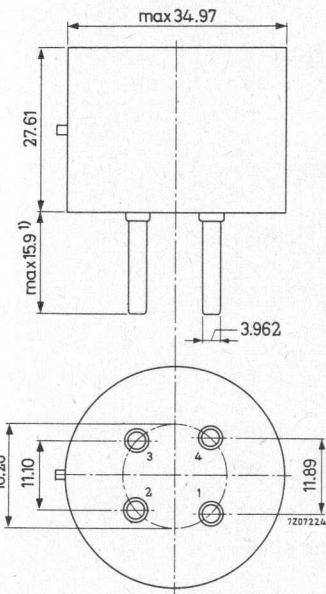


1) Including solder

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

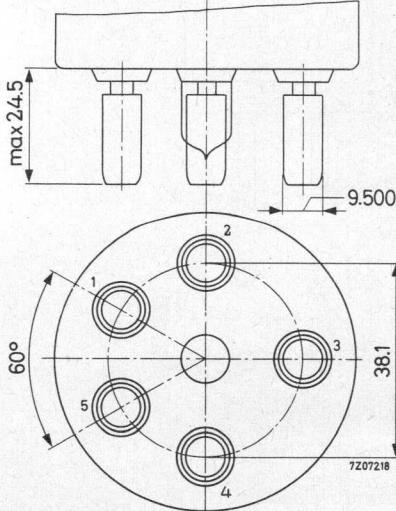


Medium 4-pin base with bayonet
(IEC 67-I-3)

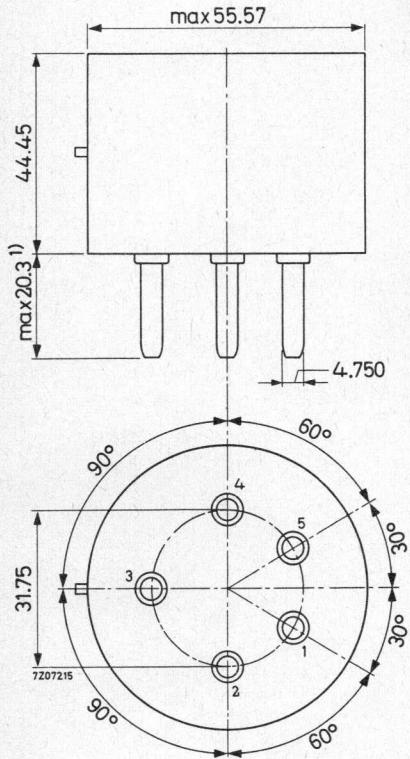


1) Including solder

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

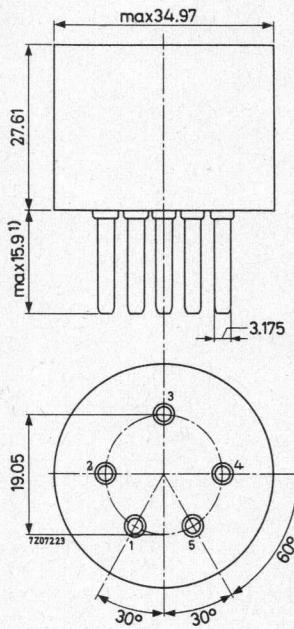


Medium shell Giant 5-pin base
with bayonet
(IEC 67-I-21a)



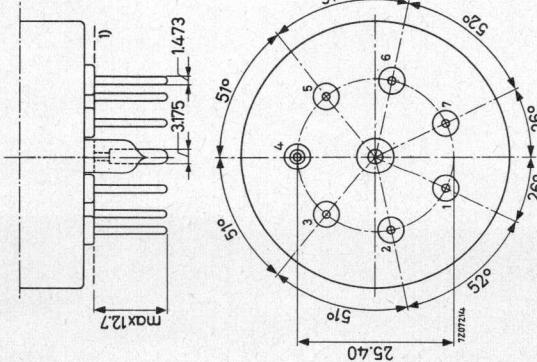
1) Including solder

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

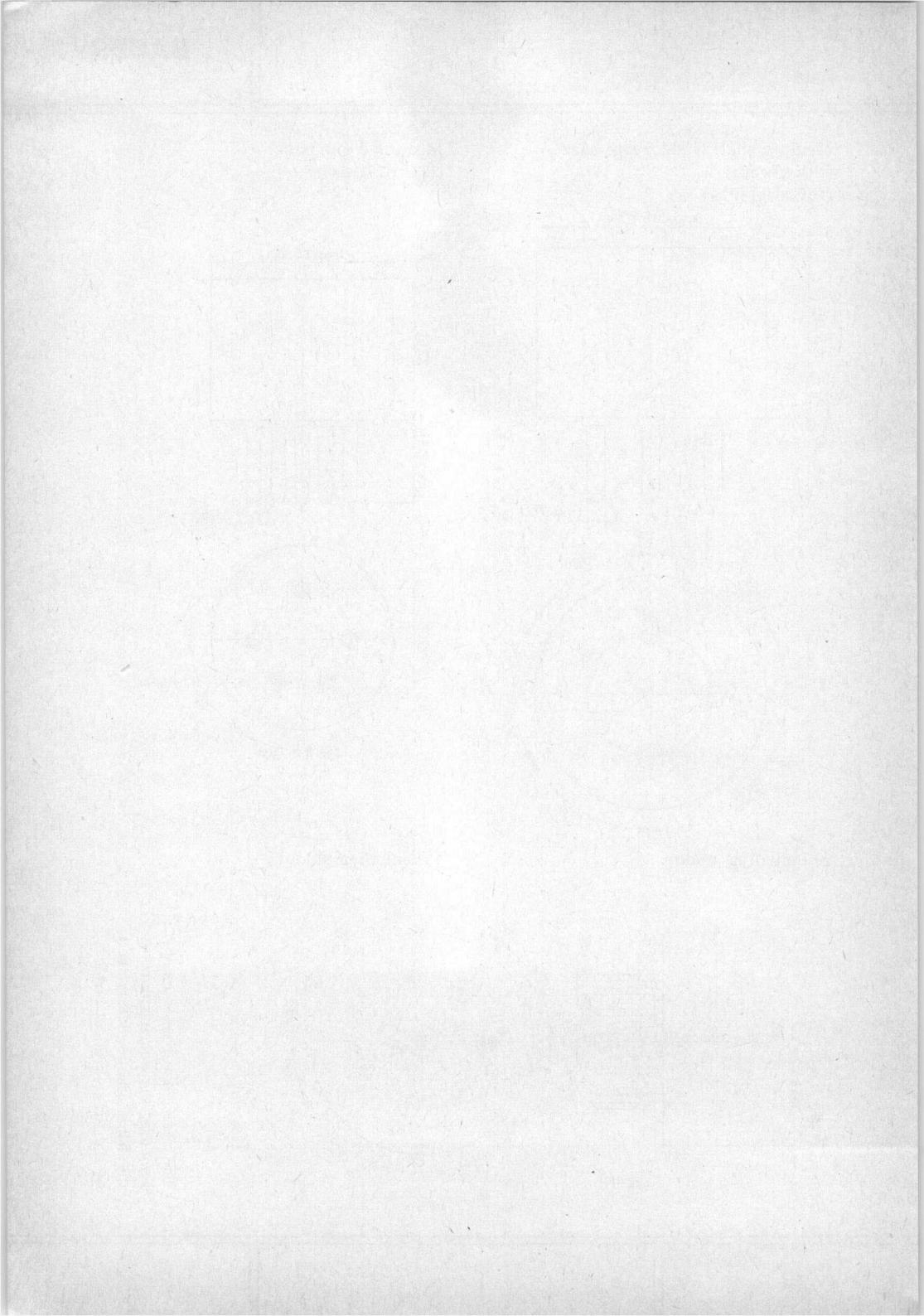


1) Including solder

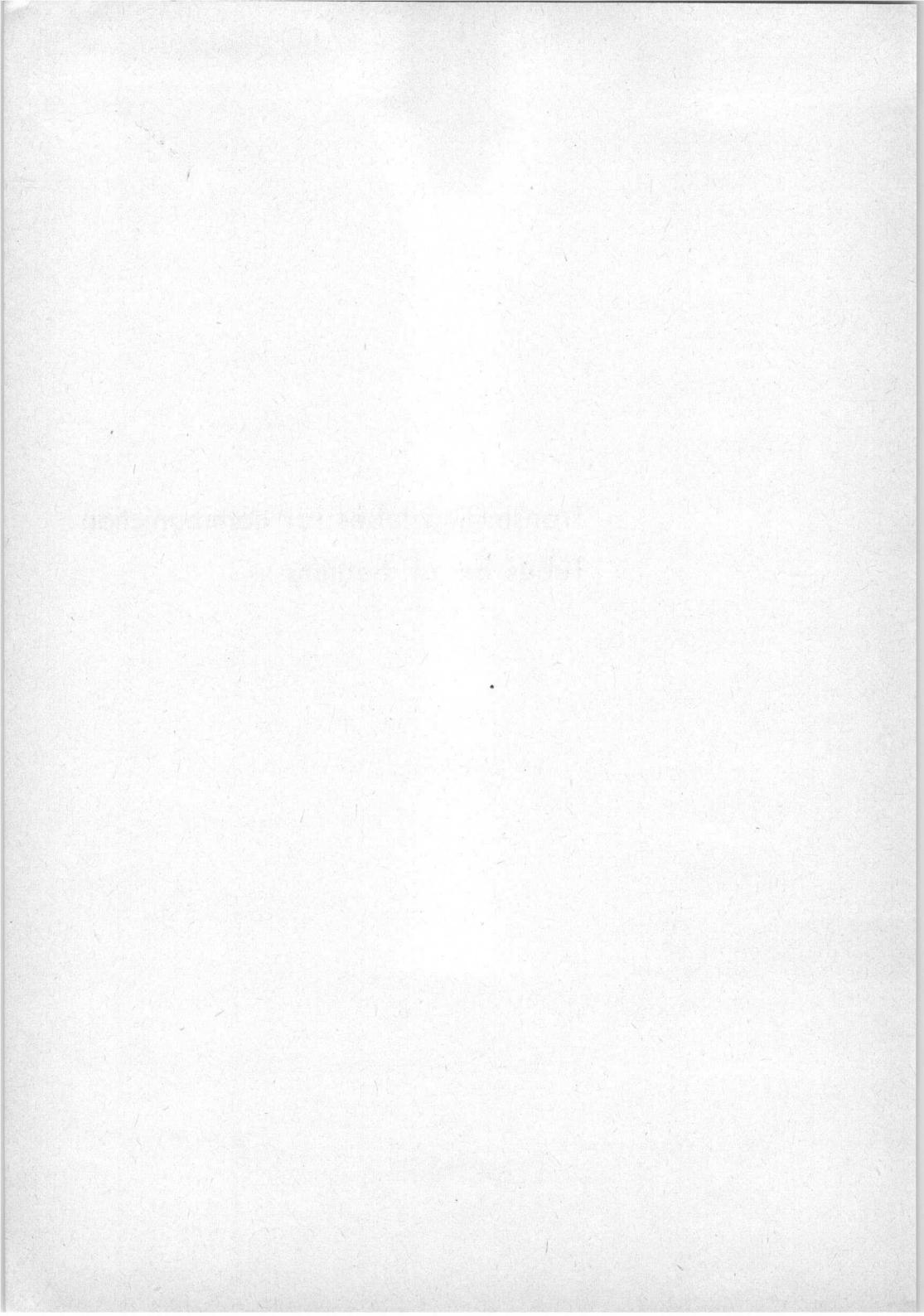
Septar 7-pin base
(IEC 67-I-20a)



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



**Transmitting tubes for communication
Tubes for r.f. heating**



R.F. POWER PENTODE

Frequency (MHz)	C telegr.		B teleph.		C _{ag2} mod.		C _{g3} mod.	
	V _a (V)	W _o (W)	V _a (V)	W _o (W)	V _a (V)	W _o (W)	V _a (V)	W _o (W)
	< 10	2500	600		2000	325		
< 20	2000	550	2000	90	1800	290	2000	100
60 ¹⁾	1500	625	1500	100	1200	350	1500	90

HEATING: direct; filament thoriated tungsten

Filament voltage	$V_f = 12 \text{ V}$
Filament current	$I_f = 7.3 \text{ A}$

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

¹⁾ Two tubes

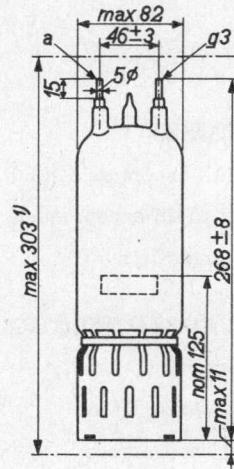
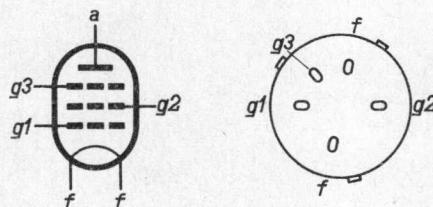
LIMITING VALUES (Absolute limits)

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

MECHANICAL DATA

Net weight: 0.63 kg

Dimensions in mm



Mounting position: vertical with base up or down

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

ACCESSORIES

Socket: 40200

Anode connectors: 40600

¹⁾ Required height in apparatus

R.F. POWER PENTODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr.		B teleph.		B mod. ¹⁾	
(m)	(MHz)	V _a (V)	W _o (W)	V _a (V)	W _o (W)	V _a (V)	W _o (W)
> 30 > 15 5	< 10 < 20 60	3000	1200	3000	190	3000	1600
		2500	950	2500	130		
		1800	485	1800	68		
	< 10 < 20	C _{ag2} mod.		C _{g3} mod.			
		2500	580	3000	200		
> 15		2000	425	2500	150		

HEATING: direct; filament thoriated tungsten

Filament voltage

V_f = 12 V

Filament current

I_f = 8.5 A

CAPACITANCES

Anode to all other elements except grid No. 1

C_a = 21 pF

Grid No. 1 to all other elements except anode

C_{g1} = 29 pF

Anode to grid No. 1

C_{ag1} = 0.05 pF

TYPICAL CHARACTERISTICS

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

μ_{g2g1} = 3.5

Mutual conductance

S (I_a = 225 mA) = 6.5 mA/V

¹⁾ Two tubes

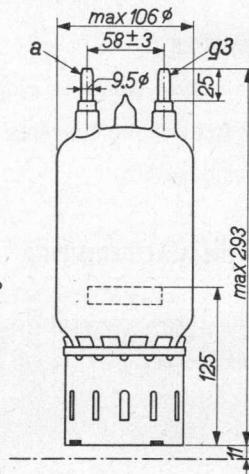
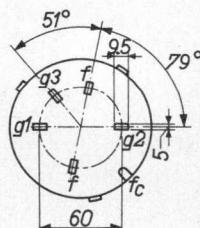
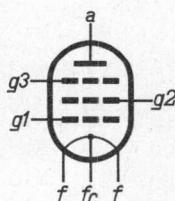
LIMITING VALUES (Absolute limits)

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

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

MECHANICAL DATA (Dimensions in mm)

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



Mounting position: vertical with base up ¹⁾ or down

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

R.F. POWER PENTODE

QUICK REFERENCE DATA										
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C _{ag2} mod.		B mod ¹⁾		
		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.								
5.4/1.8	55/165	400	9							

HEATING: indirect; cathode oxide-coated

$$\text{Heater voltage} \quad V_f = 12.6 \text{ V}$$

$$\text{Heater current} \quad I_f = 0.7 \text{ A}$$

CAPACITANCES

Anode to all other elements except grid No.1 $C_a = 7.8 \text{ pF}$

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

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

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1 $\mu_{g_2 g_1} = 7.6$

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

¹⁾ Two tubes

LIMITING VALUES (Absolute limits)

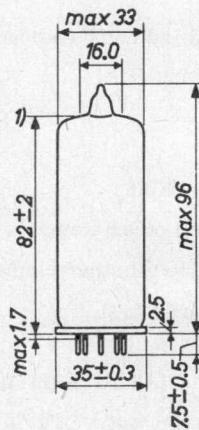
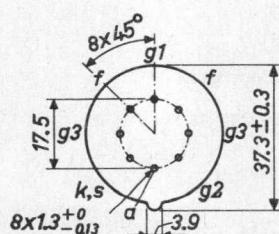
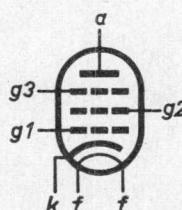
Anode voltage	V_a	= max. 500 V
Anode dissipation	W_a	= max. 12 W
Grid No.2 voltage	V_{g2}	= max. 300 V
Grid No.2 dissipation	W_{g2}	= max. 5 W
Grid No.1 dissipation	W_{g1}	= max. 0.5 W
Grid No.1 resistor with fixed bias	R_{g1}	= max. 50 kΩ
Grid No.1 resistor with automatic bias	R_{g1}	= max. 100 kΩ
Cathode 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

Dimensions in mm

Net weight: 50 g



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 { Heater voltage
PE06/40 N { Heater current

V_f = 6.3 V
 I_f = 1.3 A

PE06/40 E { Heater voltage
 Heater current

V_f = 12.6 V
 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_{g1} = 15 pF

Anode to grid No.1

C_{ag1} = 0.1 pF

TYPICAL CHARACTERISTICS

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

$\mu g_2 g_1$ = 5.5

Mutual conductance

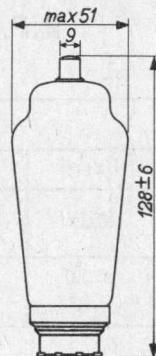
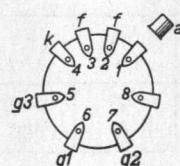
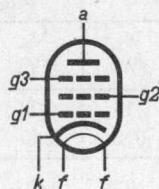
S (I_a = 40 mA) = 4 mA/V

1) Two tubes

MECHANICAL DATA

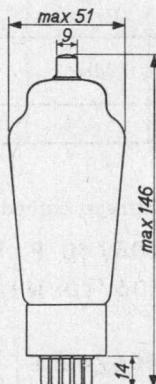
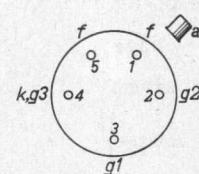
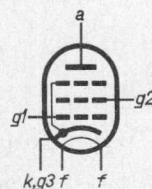
PE06/40 P

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



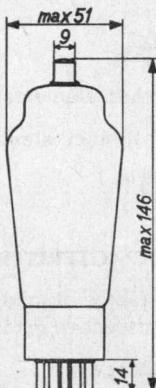
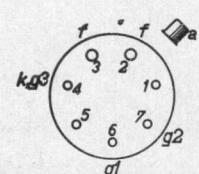
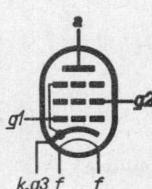
PE06/40 N

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



PE06/40 E

Base E
Cap 28 906 022
Net weight 65 g



Mounting position: arbitrary

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	= max.	600	V
Anode dissipation	W_a	= max.	25	W
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	5	W
Grid No.1 dissipation	W_{g_1}	= max.	1	W
Grid No.1 resistance	R_{g_1}	= max.	100	$k\Omega^1)$
Grid No.1 resistance	R_{g_1}	= max.	200	$k\Omega^2)$
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	53) m
Anode voltage	V_a	=	600	600	600 V
Grid No.1 voltage	V_{g_1}	=	-75	-40	-75 V
Grid No.2 voltage	V_{g_2}	=	300	300	300 V
Grid No.3 voltage	V_{g_3}	=	0	0	0 V
Anode current	I_a	=	109	109	195 mA
Grid No.1 current	I_{g_1}	=	2	0	0 mA
Grid No.2 current	I_{g_2}	=	11.5	11	20 mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	90	40	75 V
Grid No.1 input power	W_{ig_1}	=	0.2	0	0 W
Grid No.2 dissipation	W_{g_2}	=	3.5	3.3	6 W
Anode input power	W_{ia}	=	65	65	117 W
Anode dissipation	W_a	=	20	25	45 W
Output power	W_o	=	45	40	72 W
Efficiency	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_{g1}	=	-75	-55	V
Grid No.2 voltage	V_{g2}	=	300	2)	160 3) V
Grid No.3 voltage	V_{g3}	=	0	0	V
Anode current	I_a	=	114	146	mA
Grid No.1 current	I_{g1}	=	1.4	2	mA
Grid No.2 current	I_{g2}	=	10	10	mA
Peak grid No.1 A.C. voltage	V_{g1p}	=	90	75	V
Grid No.1 input power	W_{ig1}	=	0.1	0.15	W
Grid No.2 dissipation	W_{g2}	=	3	1.6	W
Anode input power	W_{ia}	=	57	73	W
Anode dissipation	W_a	=	17	33	W
Output power	W_o	=	40	40	W
Efficiency	η	=	70	55	%
<hr/>					
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	V_{g2p}	=	300	160	V
Modulation power	W_{mod}	=	30	40	W

1) Two tubes

2) $R_{g2} = 20 \text{ k}\Omega$ 3) $R_{g2} = 34 \text{ k}\Omega$

R.F. POWER PENTODE

QUICK REFERENCE DATA						
λ (m)	Freq. (MHz)	C telegr.		B teleph.		B mod. ¹⁾ V _a (V)
		V _a (V)	W _o (W)	V _a (V)	W _o (W)	
>5	<60	1000	132	1000	23	1000
		800	107	800	23	800
		600	78	600	23	600
λ (m)	Freq. (MHz)	C _{ag2} mod.		C _{g3} mod.		W _o (W)
		V _a (V)	W _o (W)	V _a (V)	W _o (W)	
>5	<60	800	75	1000	27	194
		600	51	800	26	110
				600	22	82

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_{g1} = 20.5 pF

Anode to grid No.1 C_{ag1} = 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 μ_{g2g1} = 6.7

Mutual conductance S (I_a = 40 mA) = 6 mA/V

¹⁾ Two tubes

LIMITING VALUES (Absolute limits)

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

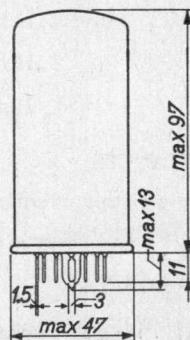
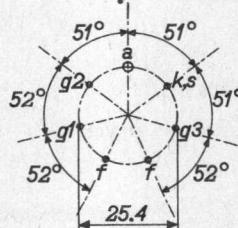
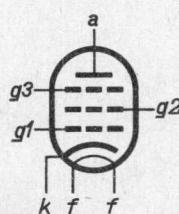
MECHANICAL DATA

Base : Septar

Dimensions in mm

Socket : 2422 513 00001

Net weight: 80 g



Mounting position: arbitrary

OPERATING CONDITIONS R.F. class C telegraphy

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

OPERATING CONDITIONS R.F. class B telephony

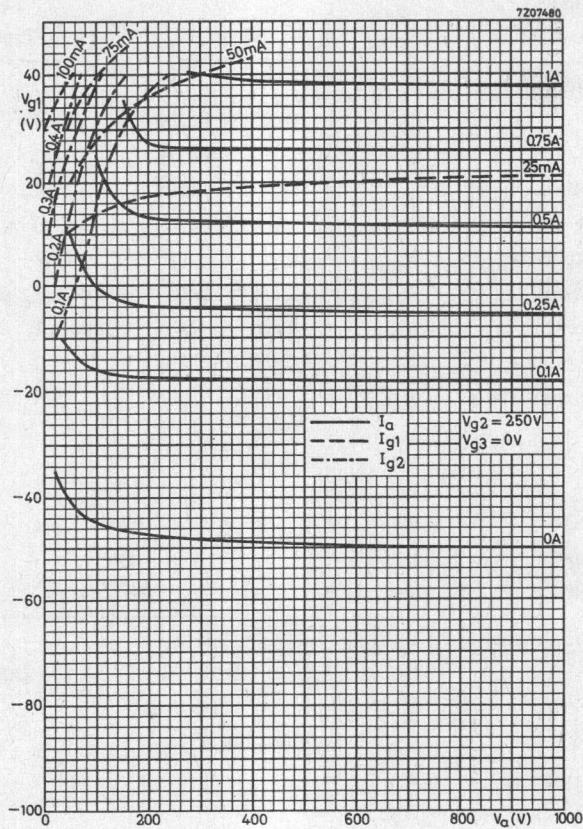
Wavelength	λ	>5	>5	>5	m
Anode voltage	V_a	= 1000	800	600	V
Grid No.1 voltage	V_{g1}	= -34	-33	-30.5	V
Grid No.2 voltage	V_{g2}	= 250	250	250	V
Grid No.3 voltage	V_{g3}	= 0	0	0	V
Anode current	I_a	= 68	85	114	mA
Grid No.2 current	I_{g2}	= 4.5	6	7.5	mA
Peak grid No.1 A.C. voltage	V_{g1p}	= 20.5	22.5	26.5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

OPERATING CONDITIONS R.F. class C

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

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

Anode voltage	V _a	=	1000	800	V
Grid No.1 voltage	V _{g₁}	=	-34	-33.5	V
Grid No.2 voltage	V _{g₂}	=	250	250	V
Load resistance	R _{aa~}	=	8800	7560	Ω
Peak grid to grid voltage	V _{g₁g_{1p}}	=	0 84	0 68	V
Anode current	I _a	=	2x26 2x134	2x28 2x108	mA
Grid No.1 current	I _{g₁}	=	0 2x0.8	0 0	mA
Grid No.2 current	I _{g₂}	=	2x5 2x28	2x8 2x27	mA
Grid No.1 input power	W _{ig₁}	=	0 2x0.03	0 0	W
Grid No.2 dissipation	W _{g₂}	=	2x1.3 2x7	2x2 2x6.8	W
Anode input power	W _{ia}	=	2x26 2x134	2x22.4 2x86.4	W
Anode dissipation	W _a	=	2x26 2x37	2x22.4 2x31.4	W
Output power	W _o	=	0 194	0 110	W
Total harmonic distortion	d _{tot}	=	- 5	- 4.5	%
Efficiency	η	=	- 72	- 63.5	%
Anode voltage	V _a	=	600	600	V
Grid No.1 voltage	V _{g₁}	=	-33	-33	V
Grid No.2 voltage	V _{g₂}	=	250	250	V
Load resistance	R _{aa~}	=	6320	6320	Ω
Peak grid to grid voltage	V _{g₁g_{1p}}	=	0 66	66	V
Anode current	I _a	=	2x28	2x102	mA
Grid No.1 current	I _{g₁}	=	0 0	0 0	mA
Grid No.2 current	I _{g₂}	=	2x11	2x28	mA
Grid No.1 input power	W _{ig₁}	=	0 0	0 0	W
Grid No.2 dissipation	W _{g₂}	=	2x2.8	2x7	W
Anode input power	W _{ia}	=	2x16.8	2x61.2	W
Anode dissipation	W _a	=	2x16.8	2x20.2	W
Output power	W _o	=	0 82	82	W
Total harmonic distortion	d _{tot}	=	- 3.3	3.3	%
Efficiency	η	=	- 67	67	%



R.F. BEAM POWER TETRODE

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

QUICK REFERENCE DATA.										
λ (m)	Freq. (MHz)	C telegr.			B teleph.			C _{ag2} mod.		
		V _a (V)	W _O (W)		V _a (V)	W _O (W)		V _a (V)	W _O (W)	
			CCS	ICAS		CCS	ICAS		CCS	ICAS
10	30	2000 1500 1250 2250	275 210 170 375		2000 1500 2250	50 50 70		1600 1250 2000	180 140 300	
λ (m)	Freq. (MHz)	C _{g1} mod.			AB mod. ¹⁾					
		V _a (V)	W _O (W)		V _a (V)	W _O (W)				
10	30	2000 1500 2250	50 40 75		2250 2000 1500 2500	380 335 260 490				

HEATING: direct; filament thoriated tungsten

Filament voltage $V_f = 10$ V

Filament current $I_f = 5$ A

CAPACITANCES

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

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

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

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2
with respect to grid No.1 $\mu_{g2g1} = 8.5$

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

1) Without grid current; two tubes

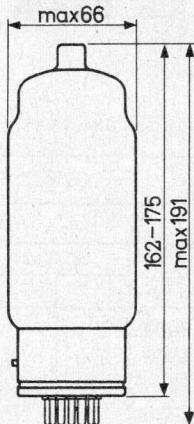
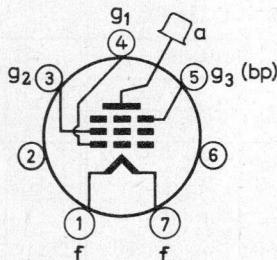
MECHANICAL DATA

Dimensions in mm

Anode connector: 40619

Base : Giant 7-pin

Net weight : 230 g



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

Pages 5, 6

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

$$27 \text{ k}\Omega \text{ at } V_a = 1250 \text{ V}$$

$$43 \text{ k}\Omega \text{ at } V_a = 1600 \text{ V}$$

$$41 \text{ k}\Omega \text{ at } V_a = 2000 \text{ V}$$

R.F. CLASS C TELEGRAPHY**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

Frequency	f	up to	30	60	120	MHz
Anode voltage	V_a	=	max. 2000	1500	1000	V
Anode input power	W_{ia}	=	max. 360	270	180	W
Anode dissipation	W_a	=		max. 100		W
Anode current	I_a	=		max. 180		mA
Grid No.2 voltage	V_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 22		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 300		V
Grid No.1 current	I_{g_1}	=		max. 25		mA
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	30	60	60	MHz
Anode voltage	V_a	=	2000	1500	1250	V
Grid No.1 voltage	V_{g_1}	=	-120	-90	-75	V ¹⁾
Grid No.2 voltage	V_{g_2}	=	400	300	300	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	180	180	180	mA
Grid No.1 current	I_{g_1}	=	10	12	12	mA
Grid No.2 current	I_{g_2}	=	45	30	35	mA
Peak grid No.1 A.C. voltage	$V_{g_{1P}}$	=	205	175	160	V
Grid No.1 input power	W_{ig_1}	=	1.9	1.9	1.7	W
Grid No.2 dissipation	W_{g_2}	=	<u>18</u>	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 supply²⁾ 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_o (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

$C_{g1} = 8$ pF

Anode to grid No.1

$C_{ag_1} = 0.08$ pF

¹⁾ Two tubes

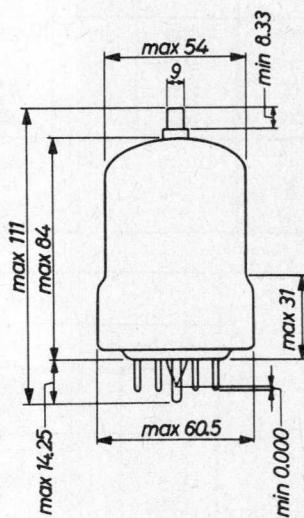
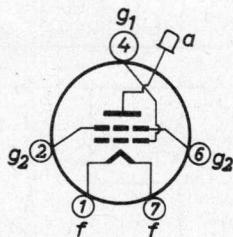
TYPICAL CHARACTERISTICS

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	$\mu_{g_2 g_1}$	=	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 °C

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

Frequency	f	=	50	50	50	220	MHz
Anode voltage	V_a	=	3000	1500	600	1500	V
Grid No.2 voltage	V_{g2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g1}	=	-100	-85	-75	-85	V
Anode current	I_a	=	115	150	150	117	mA
Grid No.2 current	I_{g2}	=	8	24	40	24	mA
Grid No.1 current	I_{g1}	=	5	12	15	12	mA
Peak grid No.1 A.C. voltage	V_{g1p}	=	180	185	170	190	V
Grid No.1 input power	W_{ig1}	=	0.8	2.0	2.3	8	W
Grid No.2 dissipation	W_{g2}	=	2.0	6	10	6	W
Anode input power	W_{ia}	=	345	225	90	175	W
Anode dissipation	W_a	=	65	60	45	65	W
Output power	W_o	=	280	165	45	110	W
Efficiency	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_{g2}	=		max.	400	V
Grid No. 2 dissipation	W_{g2}	=		max.	10	W
Negative grid No. 1 voltage	$-V_{g1}$	=		max.	500	V
Grid No. 1 current	I_{g1}	=		max.	25	mA

OPERATING CONDITIONS

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

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**LIMITING VALUES (Absolute limits)**

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

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_{g2}	= max.	600	V
Grid No. 2 dissipation	W_{g2}	= max.	20	W
Negative grid No. 1 voltage	$-V_{g1}$	= max.	500	V
Grid No. 1 current	I_{g1}	= max.	20	mA
Grid No. 1 circuit resistance	R_{g1}	= max.	250	k Ω

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

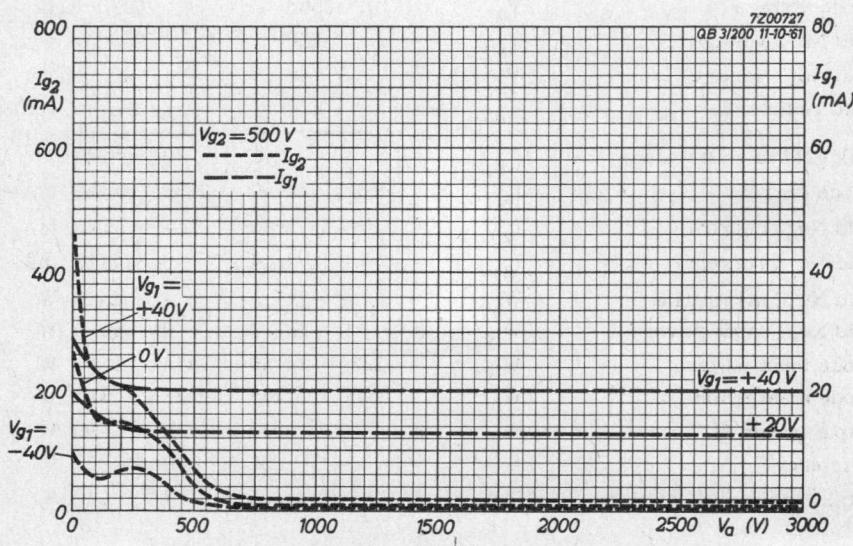
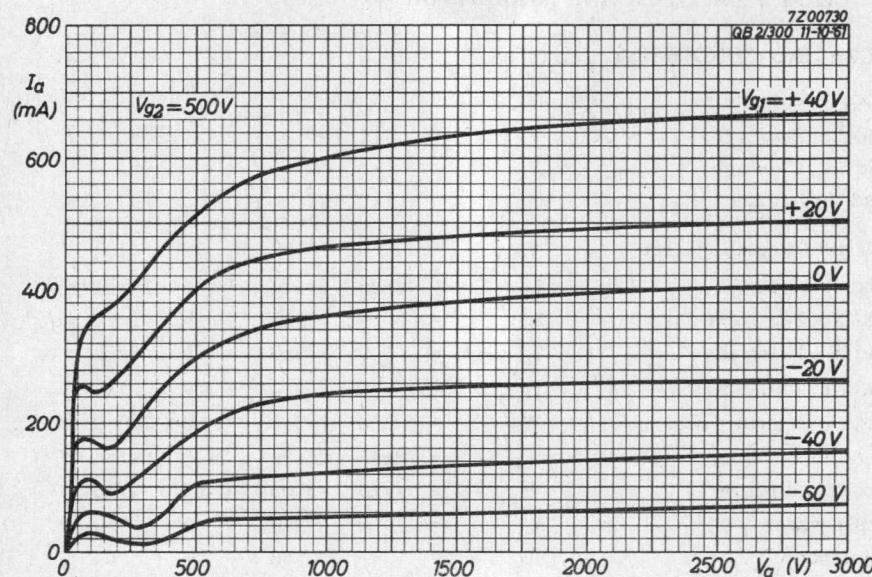
V_a	=	1750	1500	1000	V
V_{g2}	=	500	500	500	.V
V_{g1}	=	-115	-110	-100	V
$R_{aa\sim}$	=	20	15	9	k Ω
V_{g1g1p}	=	0 180	0 170	0 170	V
I_a	=	2x20 2x85	2x30 2x90	2x30 2x85	mA
I_{g2}	=	- 2x11.5	- 2x10	- 2x15	mA
W_{g2}	=	- 2x6	- 2x5	- 2x7.5	W
W_{ia}	=	2x35 2x150	2x45 2x135	2x30 2x85	W
W_a	=	2x35 2x62.5	2x45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

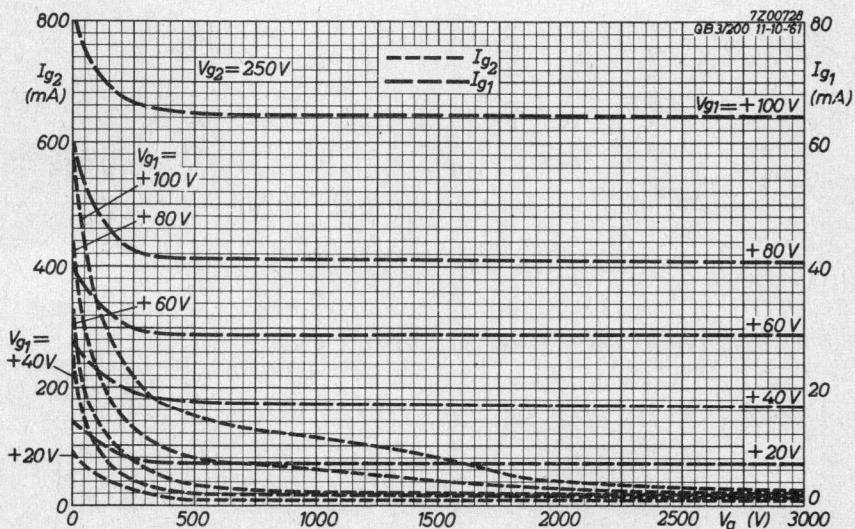
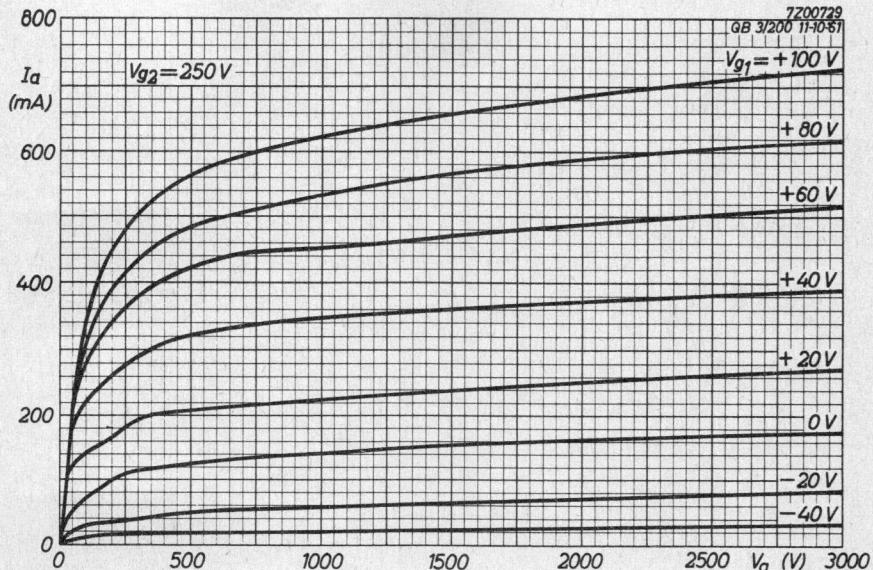
A.F. CLASS B AMPLIFIER AND MODULATOR (continued)

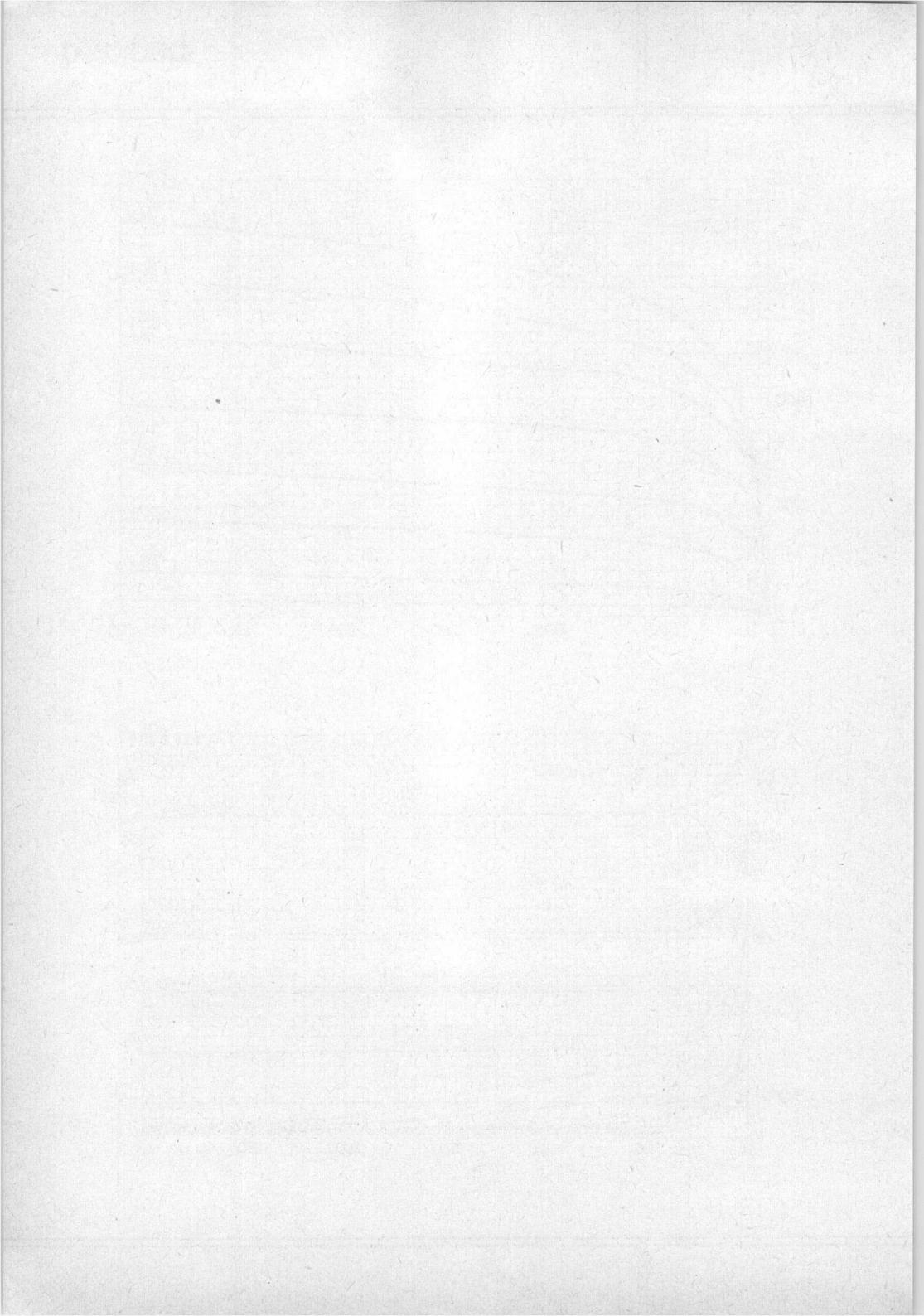
OPERATING CONDITIONS, two tubes. $I_{g1} > 0$

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

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







R.F. POWER TETRODE

QUICK REFERENCE DATA									
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C _{ag2} mod.		B mod. ¹⁾	
		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

$V_f = 5 \text{ V}$

Filament current

$I_f = 6.5 \text{ A}$

COOLING: Radiation/low-velocity air flow

CAPACITANCES

Anode to all other elements except grid No.1

$C_a = 3.5 \text{ pF}$

Grid No.1 to all other elements except anode

$C_{g1} = 10.8 \text{ pF}$

Anode to grid No.1

$C_{ag1} = 0.05 \text{ pF}$

TYPICAL CHARACTERISTICS

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

$\mu_{g2g1} = 6.2$

Mutual conductance

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

¹⁾ Two tubes; $I_{g1} > 0$

TEMPERATURE LIMITS (Absolute limits)

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

COOLING

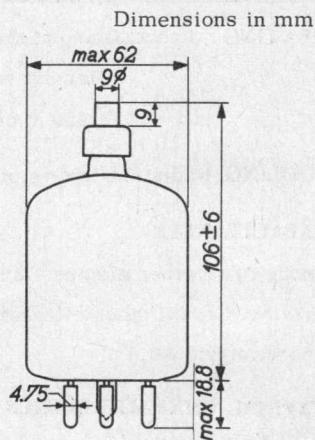
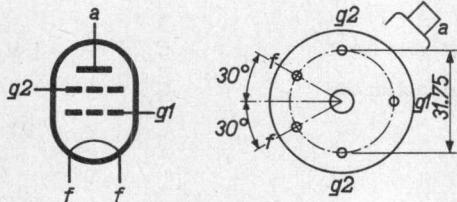
In general cooling of the tube is not necessary at normal ambient temperature at frequencies below 50 MHz.

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

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

MECHANICAL DATA

Base : giant 5 p
Socket : 2422 512 01001
→ Anode connector: 40712
Net weight : 120 g



Mounting position: vertical with base up or down

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

OPERATING CONDITIONS

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

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_{g1p}	= 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_{g2p}	= 300	300	255	V
Modulation power	W_{mod}	= 190	150	120	W

A.F. CLASS B AMPLIFIER AND MODULATOR. $I_{g1} = 0$ **LIMITING VALUES (Absolute limits)**

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

OPERATING CONDITIONS , two tubes

V_a	=	2500	2000		1500		V	
V_{g1}	=	-97	-95.5		-94		V	
V_{g2}	=	600	600		600		V	
$R_{aa\sim}$	=	25	17.6		12		kΩ	
V_{g1g1p}	=	0	190	0	186	0	185	V
I_a	=	2x30	2x108	2x30	2x111	2x30	2x109	mA
I_{g2}	=	2x0.1	2x13	2x0.1	2x12	2x0.15	2x13.5	mA
W_{g2}	=	2x0.1	2x7.8	2x0.1	2x7.2	2x0.1	2x8.1	W
W_{ia}	=	2x75	2x270	2x60	2x222	2x45	2x163	W
W_a	=	2x75	2x97.5	2x60	2x92	2x45	2x78	W
W_o	=	0	345	0	260	0	170	W
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. $I_{g1} > 0$

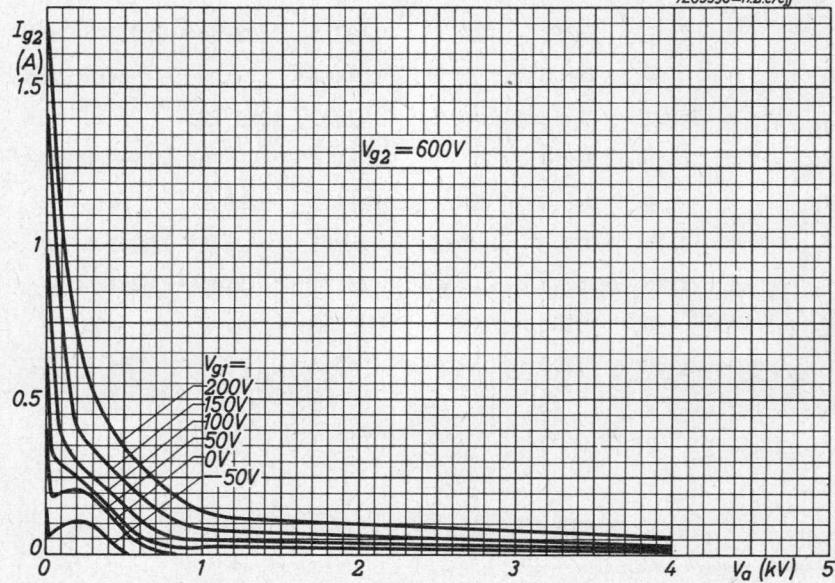
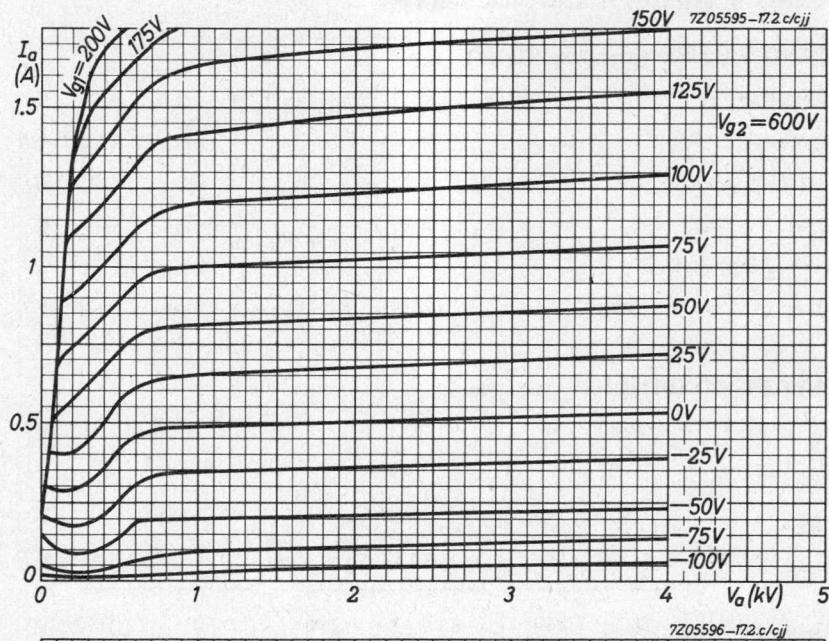
LIMITING VALUES (Absolute limits)

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

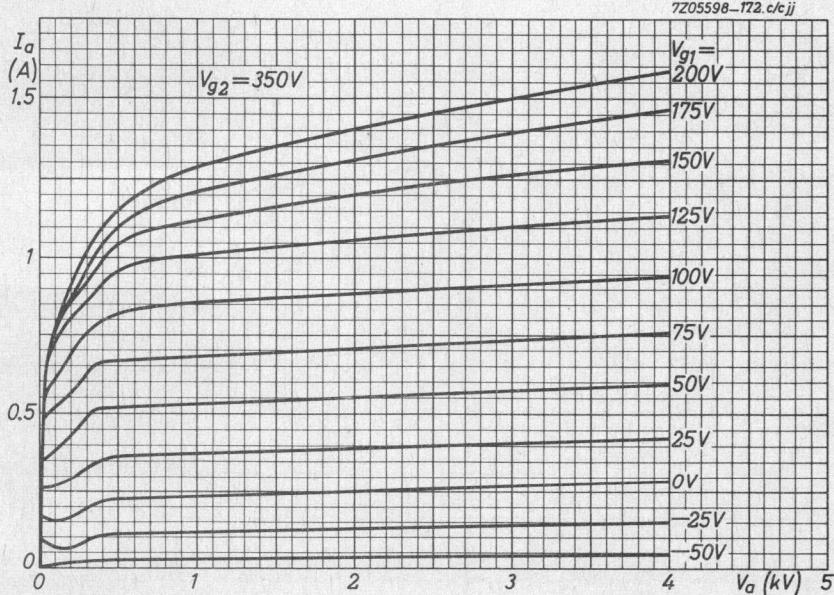
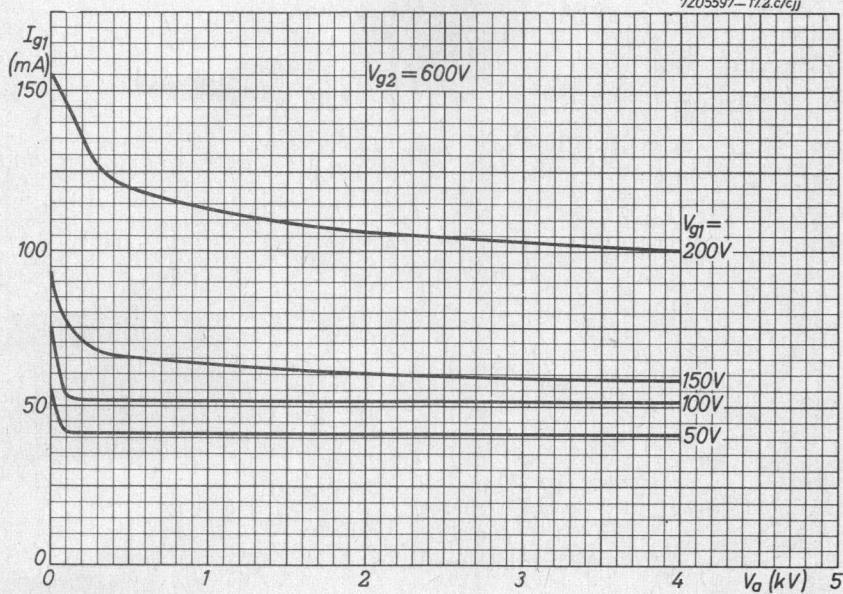
OPERATING CONDITIONS, two tubes

V_a	=	2500	2000	1500	V
V_{g1}	=	-51	-50	-48	V
V_{g2}	=	350	350	350	V
$R_{aa\sim}$	=	20	12	7.2	kΩ
V_{g1g1p}	=	0	240	0	V
I_a	=	2x30	2x151	2x30	mA
I_{g1}	=	0	2x8.5	0	mA
I_{g2}	=	2x0.1	2x18	2x0.15	mA
W_{ig1}	=	0	2x0.9	0	W
W_{g2}	=	0	2x6.3	2x0.1	W
W_{ia}	=	2x75	2x377.5	2x60	W
W_a	=	2x75	2x102.5	2x60	W
W_o	=	0	550	0	W
η	=	-	72.5	-	%
d_{tot}	=	-	5	-	%

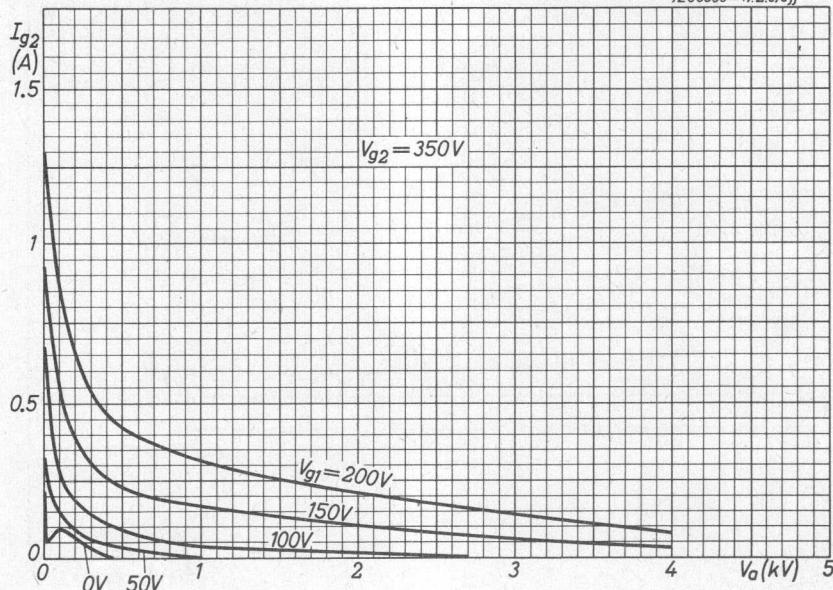
¹⁾ Anode red hot, temperature = 850 °C



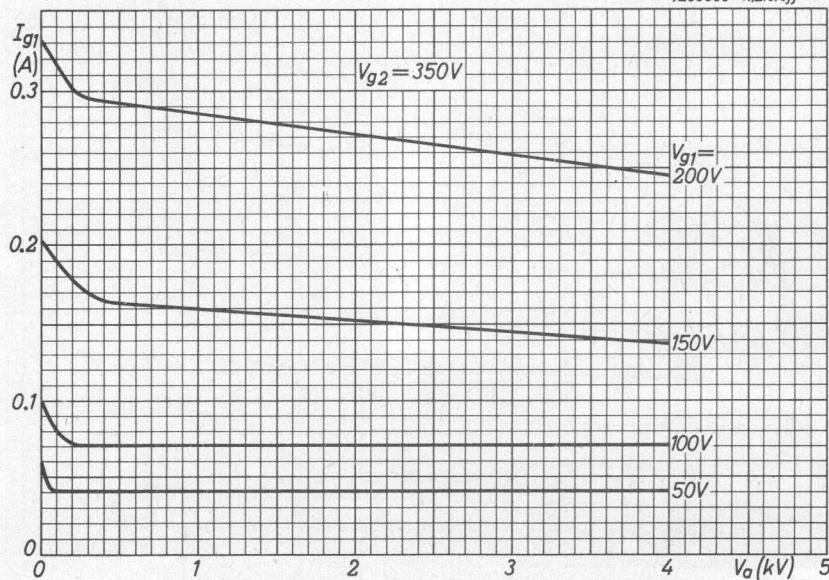
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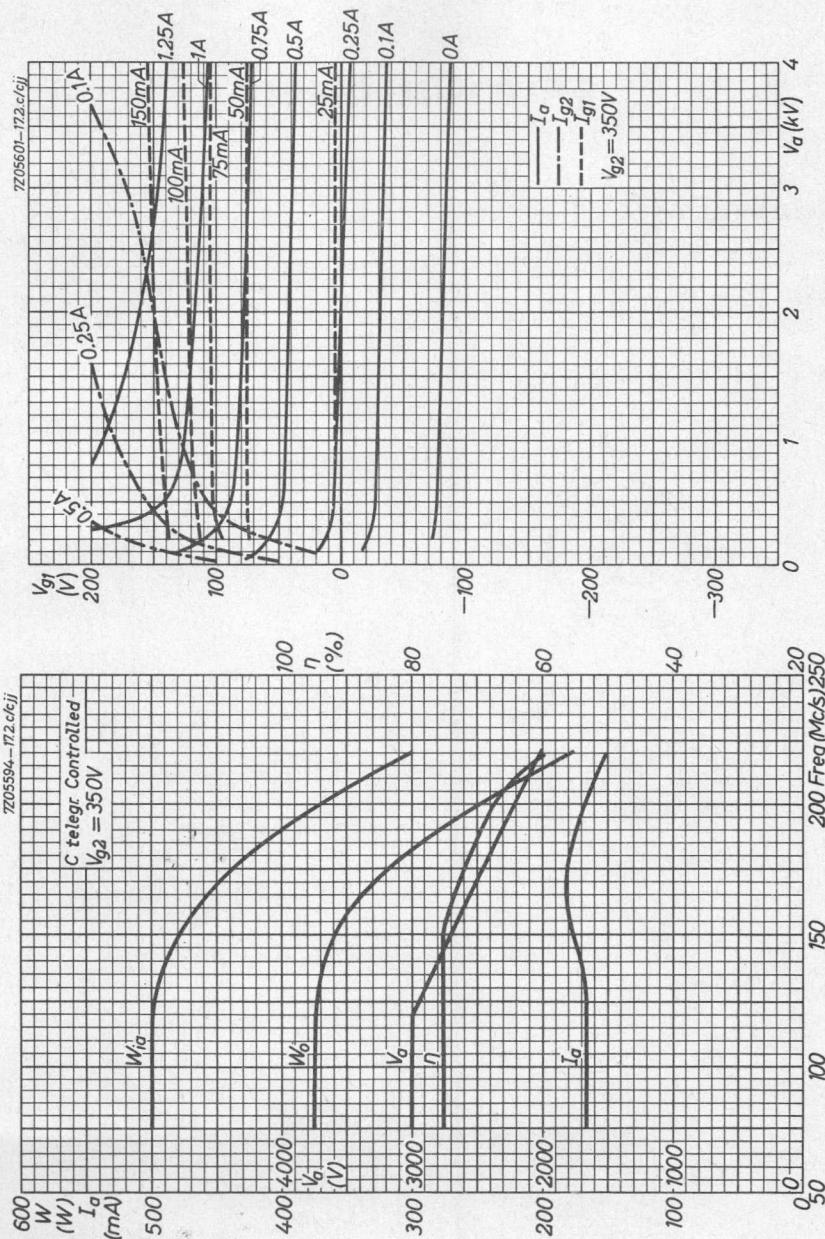


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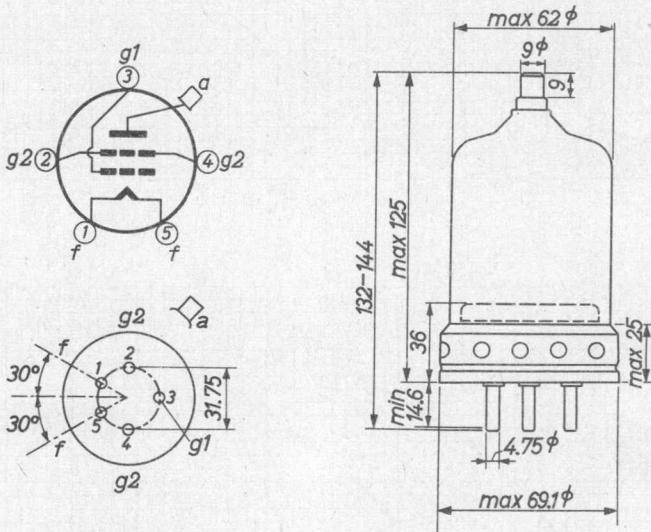
R.F. POWER TETRODE

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 QB3/300

R.F. POWER TETRODE

QUICK REFERENCE DATA

λ (m)	Freq. (MHz)	C telegr.		B teleph.		C _{ag2} mod.		B mod. 1) V _a (V)	
		V _a (V)	W _o (W)	V _a (V)	W _o (W)	V _a (V)	W _o (W)	3000	1240
> 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

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

$$\text{Filament current} \quad I_f = 14.1 \text{ A}$$

COOLING: radiation/low-velocity air flow

CAPACITANCES

Anode to all other elements except grid No.1	C _a = 4.5 pF
Grid No.1 to all other elements except anode	C _{g1} = 12.7 pF
Anode to grid No.1	C _{ag1} = 0.12 pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1} = 5.1$
Mutual conductance	S (I _a = 100 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

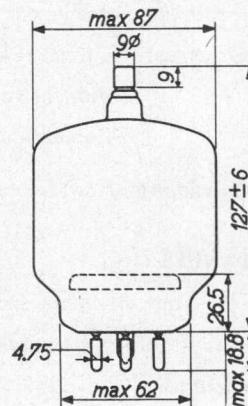
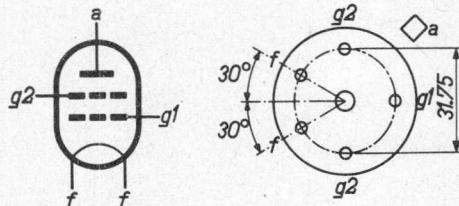
In order to keep the temperatures below the maximum permitted values a low-velocity air flow has to be directed to the anode seal and the bottom of the envelope

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

Base	: Giant 5p
Socket	: 2422 512 01001
→ Anode connector	: 40712
Net weight	: 185 g

Dimensions in mm



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_{glp}	=	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

R.F. CLASS C ANODE AND SCREEN GRID MODULATION**LIMITING VALUES (Absolute limits)**

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

OPERATING CONDITIONS

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

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_{ap}	= max.	275	W ¹⁾
Anode dissipation (Averaging time	W_a	= max.	250	W
	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	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.

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
$V_{g_1 g_1 p}$	=	0 280	0 306	0 328	0 323	V
I_a	=	2x50 2x275	2x50 2x312	2x50 2x347	2x50 2x347	mA
I_{g_2}	=	0 2x34.5	0 2x44	0 2x55	0 2x58	mA
I_{g_1}	=	0 2x15	0 2x21	0 2x27	0 2x28	mA
W_{ig_1}	=	0 2x1.9	0 2x2.9	0 2x4	0 2x4	W
W_{g_2}	=	0 2x10.5	0 2x13	0 2x16.5	0 2x17.5	W
W_{ia}	=	2x150 2x825	2x125 2x780	2x100 2x694	2x75 2x520	W
W_a	=	2x150 2x205	2x125 2x210	2x100 2x207	2x75 2x190	W
W_o	=	0 1240	0 1140	0 974	0 660	W
d_{tot}	=	- 5	- 5	- 5	- 5	%
η	=	- 75	- 73	- 70	- 63.5	%

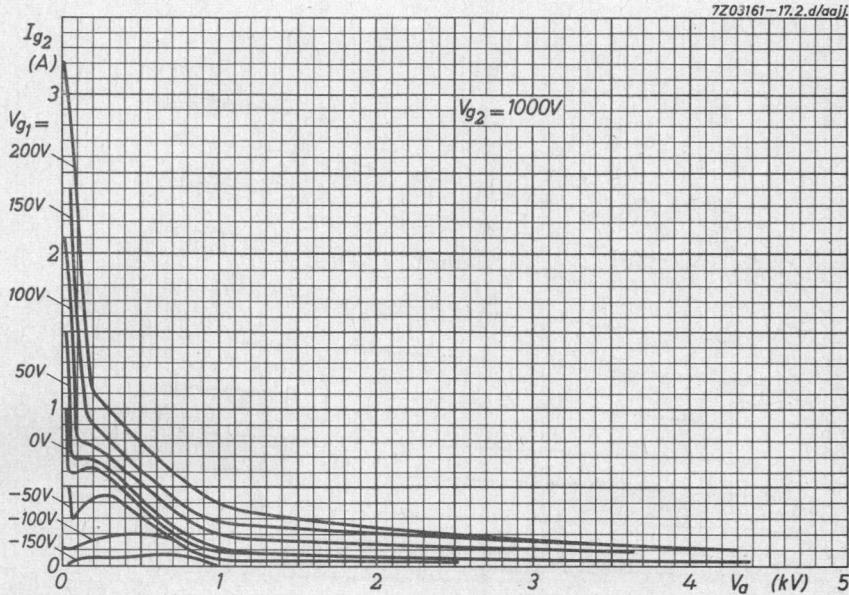
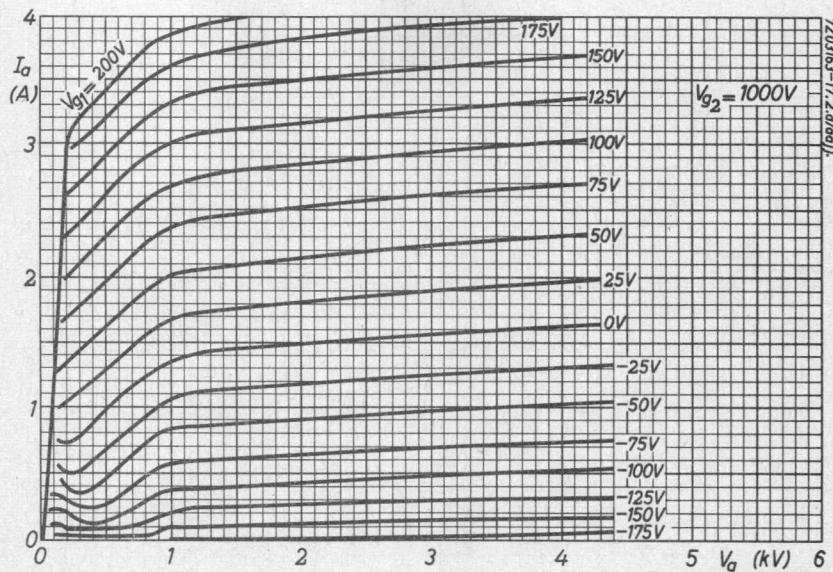
¹⁾ V_{g_2} = max. 1000 V, when the temperature of the pin seals is max. 120 °C
7Z2 2785

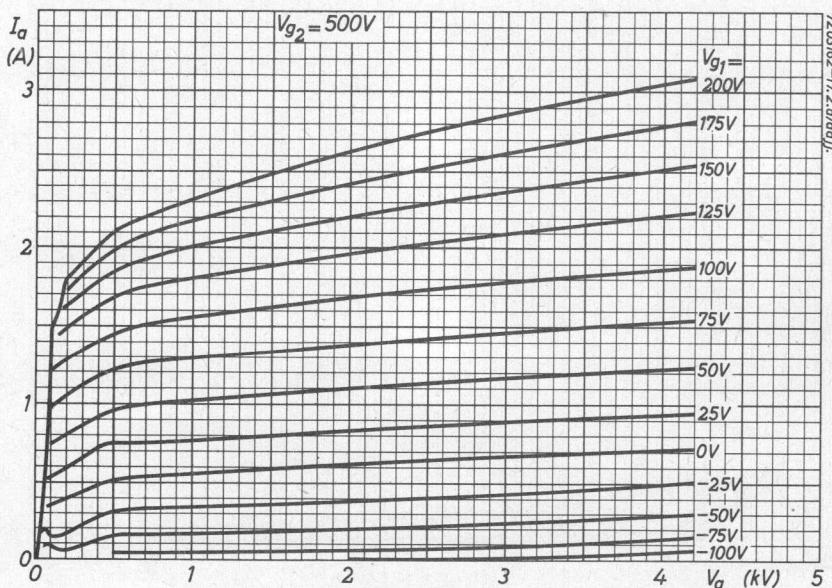
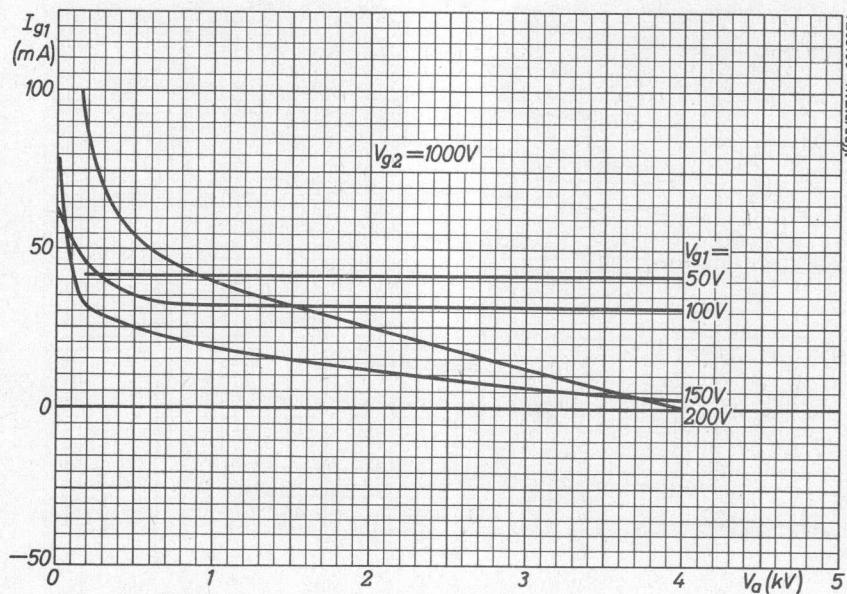
A.F. CLASS B AMPLIFIER OR MODULATOR

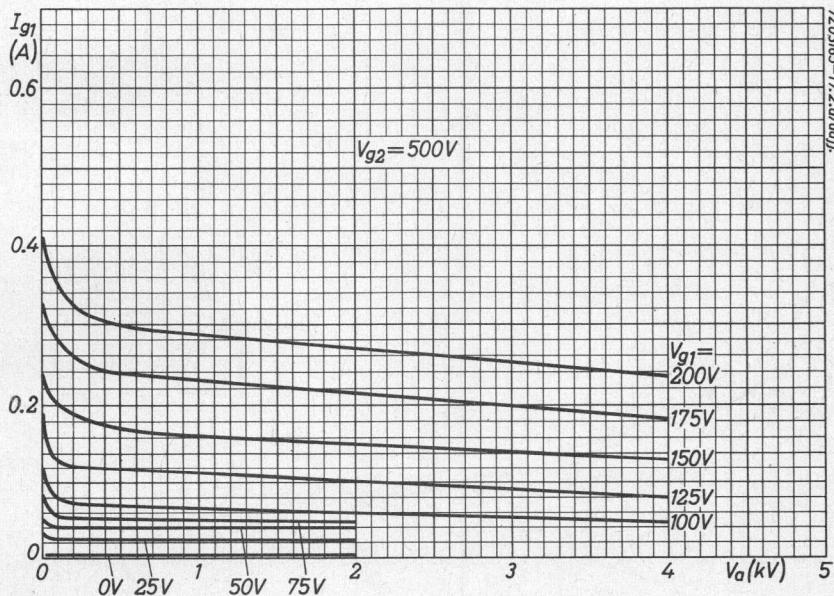
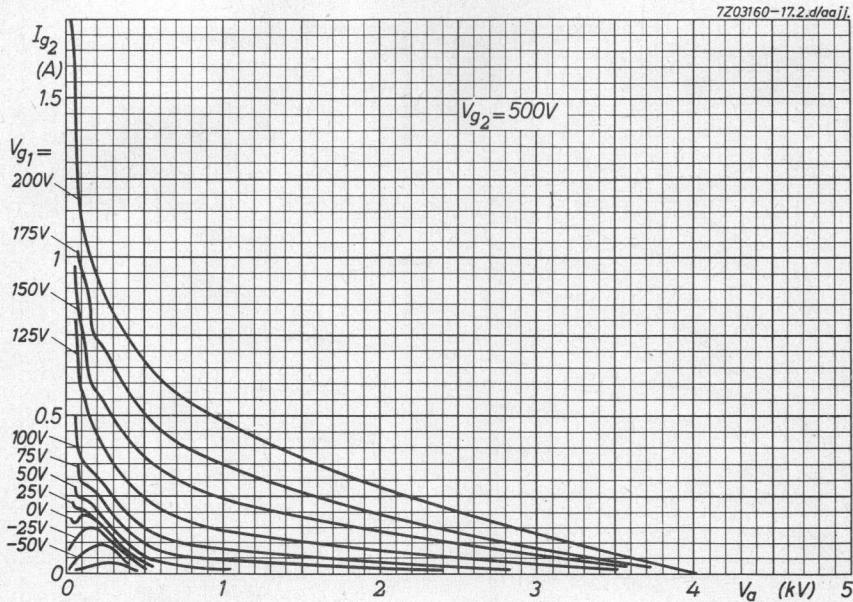
LIMITING VALUES. See page 7.

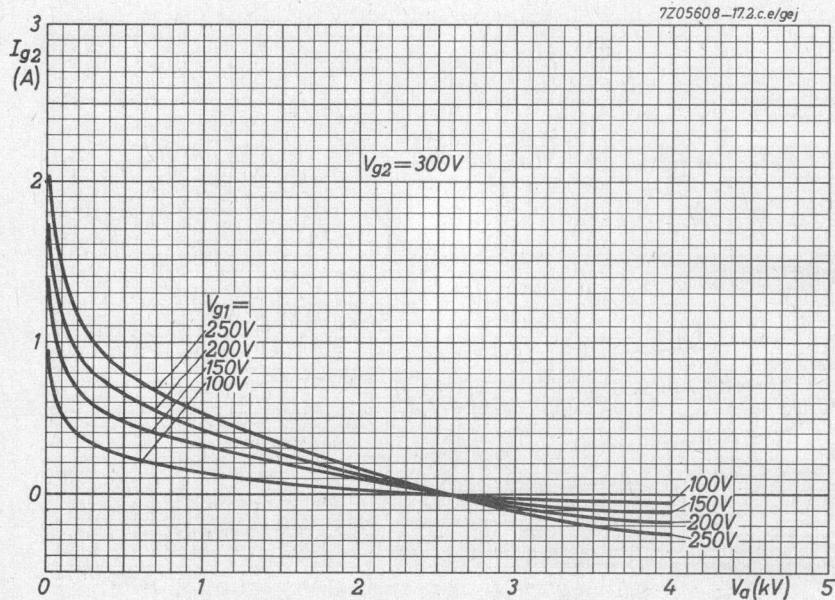
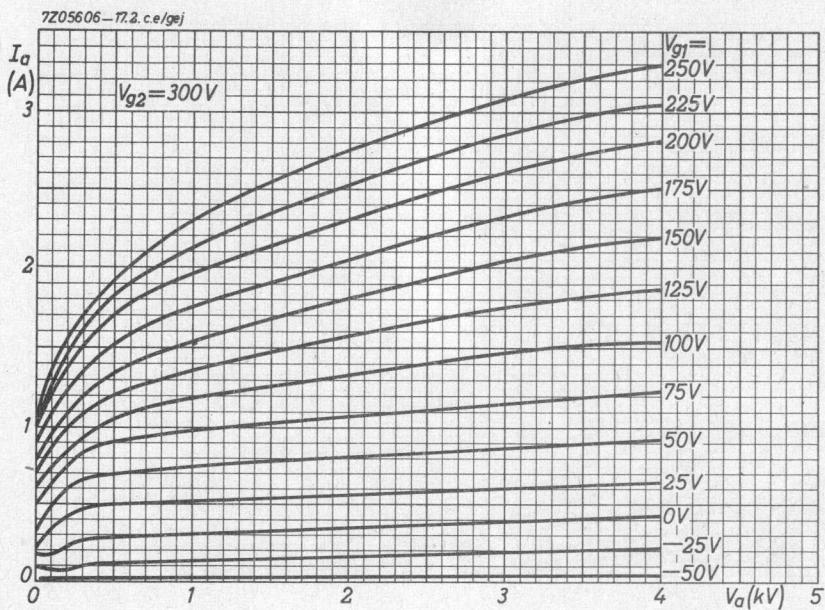
OPERATING CONDITIONS, two tubes. $I_{g1} = 0$

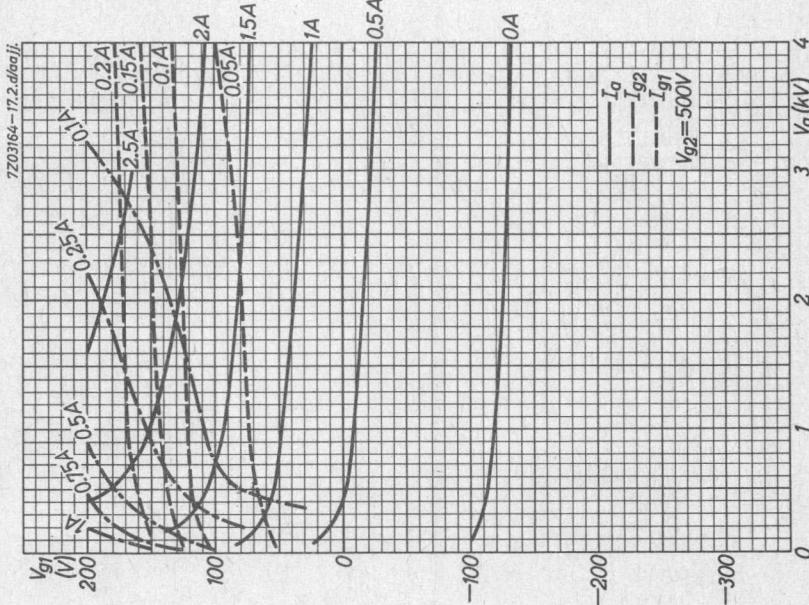
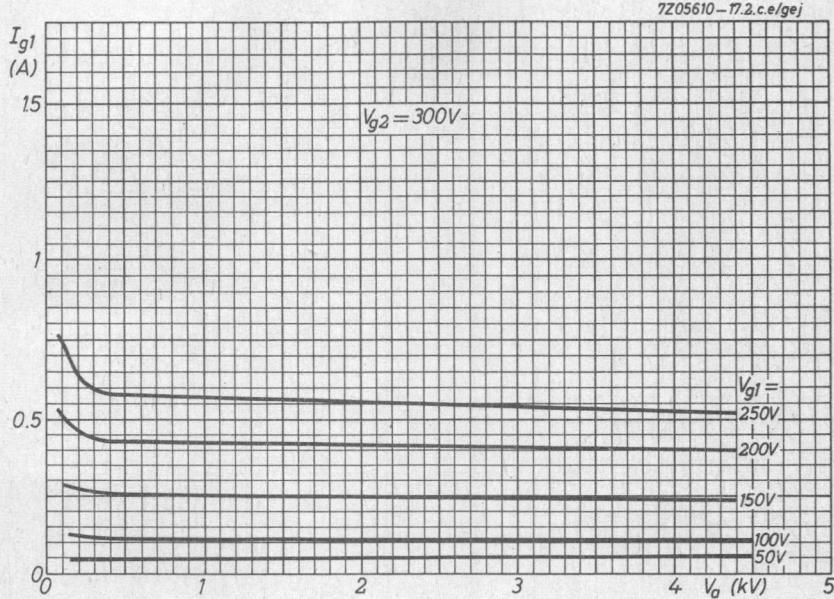
V_a	=	3000	2500	2000	1500	V
V_{g2}	=	500	500	500	500	V
V_{g1}	=	-94	-91	-88	-85	V
$R_{aa\sim}$	=	22	18	14.5	10	kΩ
V_{g1g1p}	=	0 184	0 178	0 173	0 167	V
I_a	=	2x50 2x155	2x50 2x155	2x50 2x150	2x50 2x150	mA
I_{g2}	=	0 2x10	0 2x10.5	0 2x14.5	0 2x15.5	mA
W_{g2}	=	0 2x5	0 2x5.3	0 2x7.3	0 2x7.8	W
W_{ia}	=	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	%

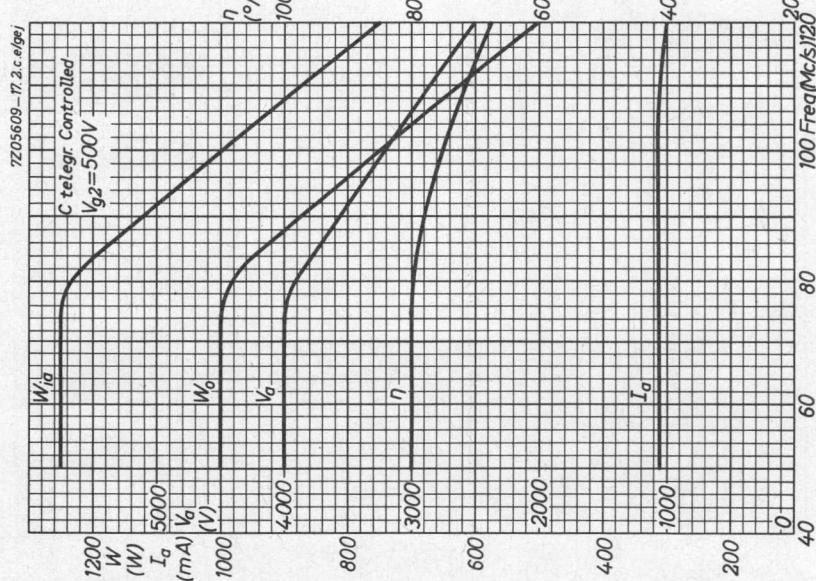
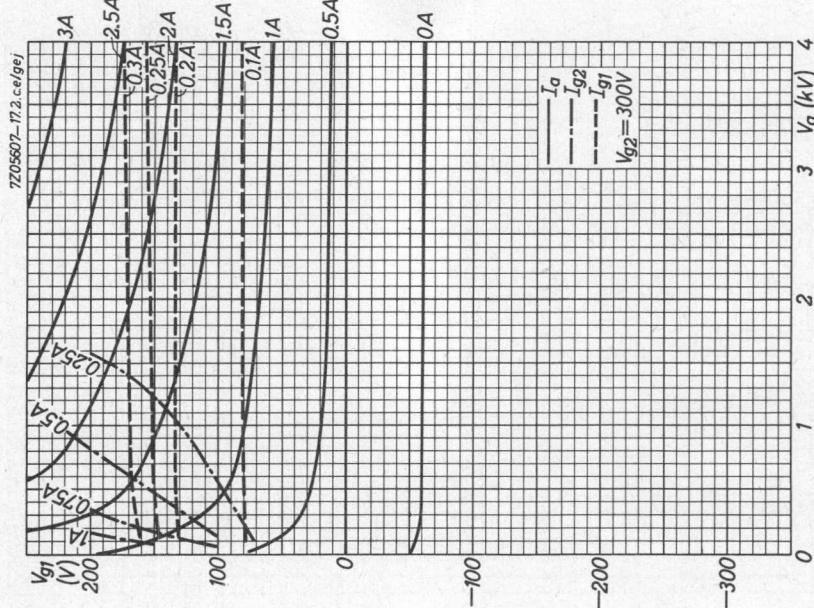










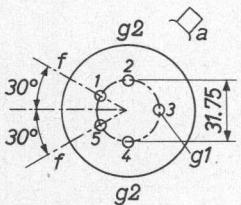
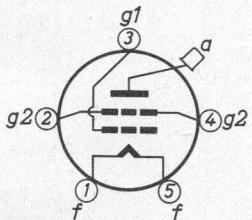


R.F. POWER TETRODE

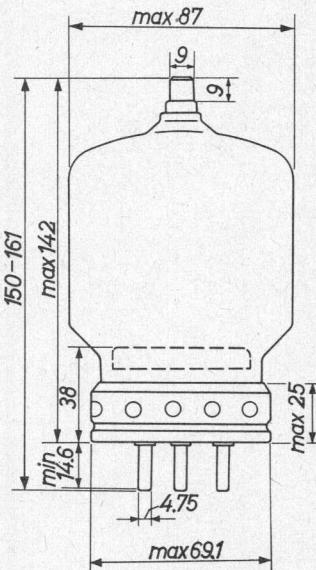
MECHANICAL DATA

Base : Metal-shell Giant 5p

Socket: 2422 512 01001



Dimensions in mm



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

R.F. POWER TETRODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.		C _{ag2} 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
30			3650	765 ¹⁾			4000	1750
75	4000	1100	3000	630			3500	1650
	3000	800	2500	510			3000	1375
	2500	640	2000	380			2500	1110
100	4000	800					4000	850
	3500	650					3500	
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_{g1} = 12.7 pF

Anode to all other elements except grid No.1

C_a = 4.9 pF

Anode to grid No.1

C_{ag1} = 0.12 pF

TYPICAL CHARACTERISTICS

Anode voltage

V_a = 2500 V

Grid No.2 voltage

V_{g2} = 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

$\mu_{g2g1} = 5.1$

1) Intermittent service, ICAS

2) Two tubes

COOLING: radiation and forced air

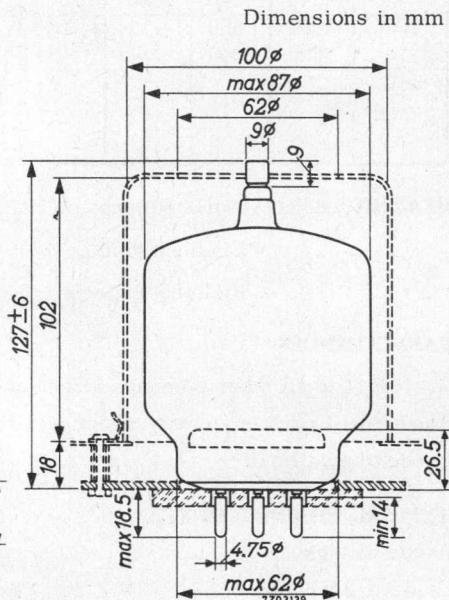
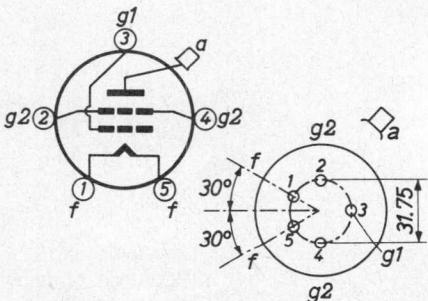
At anode dissipations up to 250 W a low velocity air flow directed on the anode seal and the base generally will provide sufficient cooling. At higher dissipations the glass chimney should be used for circulating forced air along the bulb. At 400 W anode dissipation at least 0.4 m³/min air should be passed through the chimney. For this purpose the static pressure below the chassis should be min. 5 mm water pressure if cooling is arranged in the recommended way (see figure below).

TEMPERATURE LIMITS (Absolute limits)

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

MECHANICAL DATA

Base	: Giant 5p.
Socket	: 2422 512 01001
→ Anode connector: 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_{g2}	= max.	600	V
Grid No.2 dissipation	W_{g2}	= max.	35	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	500	V
Grid No.1 current	I_{g1}	= max.	25	mA

OPERATING CONDITIONS

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

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 _{g2}	= max.	600	600	V
Grid No.2 dissipation	W _{g2}	= max.	35	35	W
Negative grid No.1 voltage	-V _{g1}	= max.	500	500	V
Grid No.1 current	I _{g1}	= max.	25	25	mA

OPERATING CONDITIONS Grid No.2 modulated with transformer

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

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**LIMITING VALUES** (Absolute limits)

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

OPERATING CONDITIONS

Frequency	f	=	60	MHz
Anode voltage	V_a	=	4000	V
Grid No.1 voltage	V_{g1}	=	-130	V
Grid No.2 voltage	V_{g2}	=	705	V
		zero signal	single tone signal	double tone signal
Peak grid No.1 A.C. voltage	V_{g1p}	= 0	130	- V
Anode current	I_a	= 65	250	175 mA
Grid No.2 current	I_{g2}	= -	10	7 mA
Grid No.1 current	I_{g1}	= 0	0	0 mA
Grid No.2 dissipation	W_{g2}	= -	7.05	4.95 W
Anode input power	W_{ia}	= 260	1000	700 W
Anode dissipation	W_a	= 260	350	375 W
Output power	W_o	= 0	650	325 W
Efficiency	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_{g1}	=	-135			-140			V
V_{g2}	=	750			810			V
		zero signal	single tone signal	double tone signal	zero signal	single tone signal	double tone signal	
V_{g1p}	=	0	135	-	0	140	-	V
I_a	=	75	280	200	90	300	215	mA
I_{g2}	=	-	12	8.4	-	15	10.5	mA
I_{g1}	=	0	0	0	0	0	0	mA
W_{g2}	=	-	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_{g2}	= max.	800	V^1)
Grid No.2 dissipation	W_{g2}	= max.	35	W
Grid No.1 current	I_{g1}	= max.	25	mA

For Operating conditions please refer to pages 7 and 8

1) V_{g2} = max. 1000 V if the pin seal temperature is kept below 120 °C

A.F. CLASS B AMPLIFIER (continued)

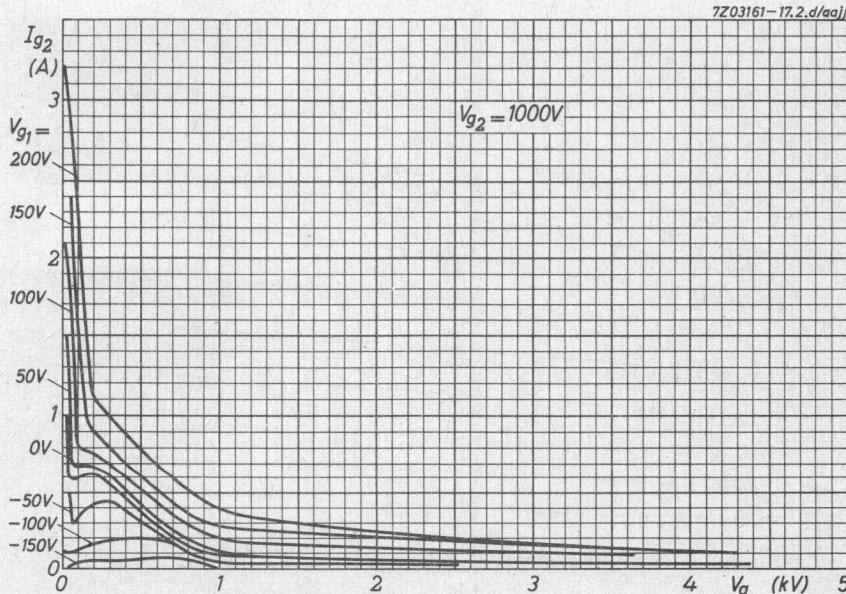
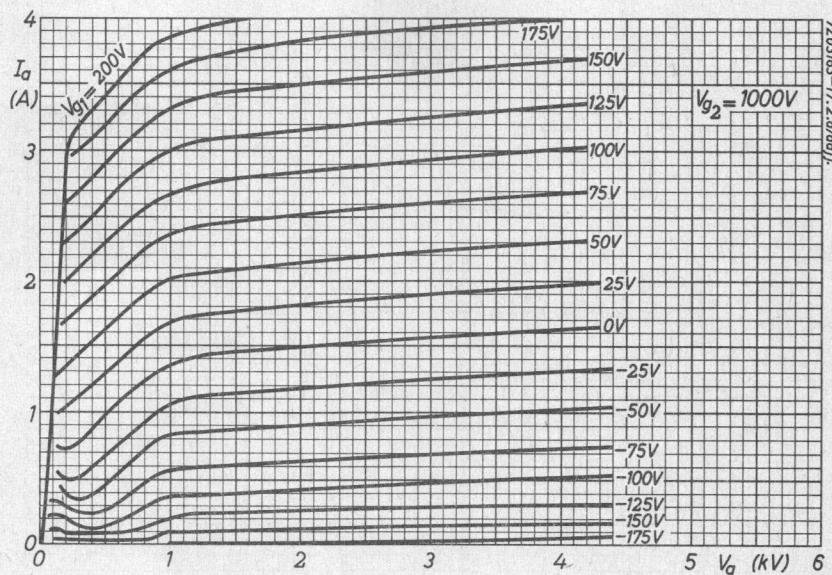
OPERATING CONDITIONS with grid current (two tubes)

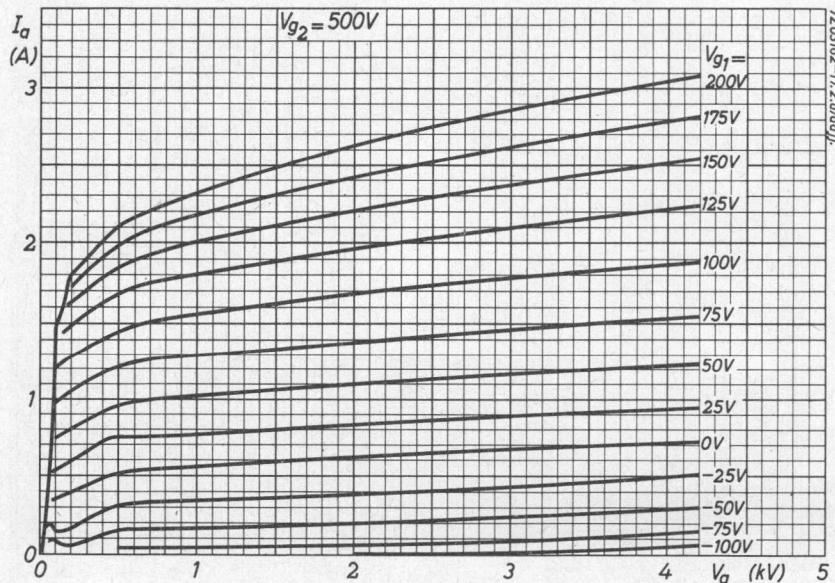
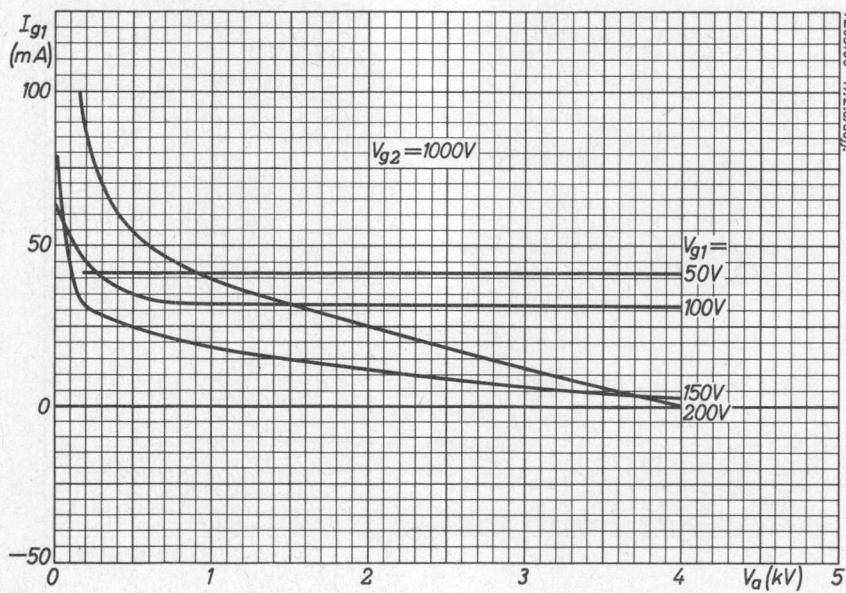
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid No.2 voltage	V_{g2}	=	500	500	500	500	V
Grid No.1 voltage	V_{g1}	=	-90	-85	-80	-75	V
Load resistance	$R_{aa\sim}$	=	15000	11300	10000	8000	Ω
<hr/>				<hr/>			
Peak grid to grid A.C. voltage	$V_{g1}V_{g2}I_p$	=	0	290	0	292	0
Anode current	I_a	=	2x80	2x319	2x80	2x350	2x90
Grid No.2 current	I_{g2}	=	-	2x20	-	2x20	-
Grid No.1 current	I_{g1}	=	0	2x6	0	2x6.5	0
Grid No.2 dissipation	W_{g2}	=	-	2x10	-	2x10	-
Grid No.1 input power	W_{ig1}	=	0	2x0.8	0	2x0.9	0
Anode input power	W_{ia}	=	2x320	2x1275	2x280	2x1225	2x270
Anode dissipation	W_a	=	2x320	2x400	2x280	2x400	2x270
Output power	W_o	=	0	1750	0	1650	0
Efficiency	η	=	68.5	-	67.5	-	65.5
							-
							63.5 %

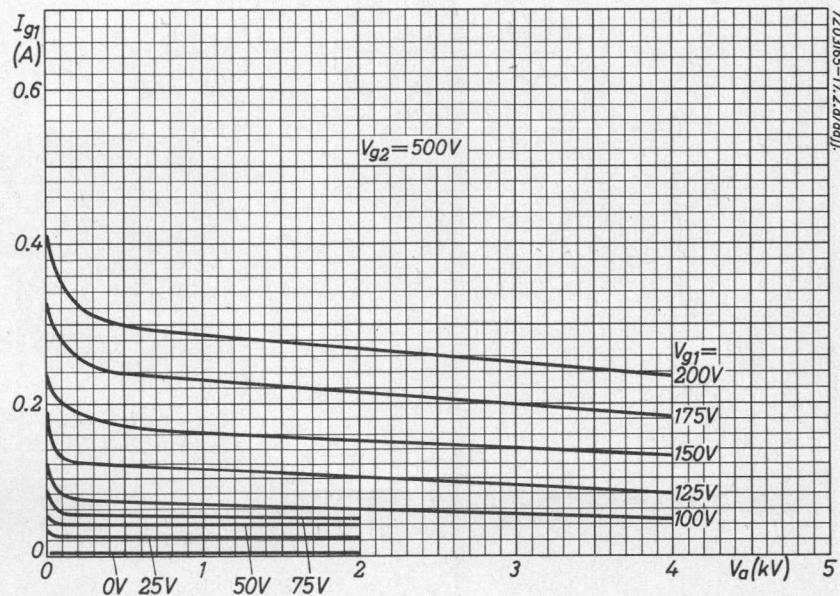
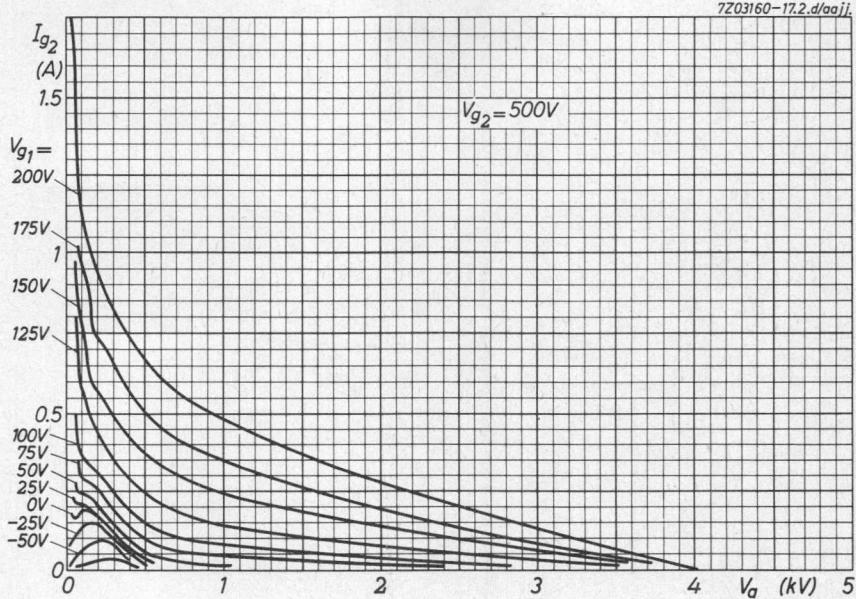
A.F. CLASS B AMPLIFIER (continued)

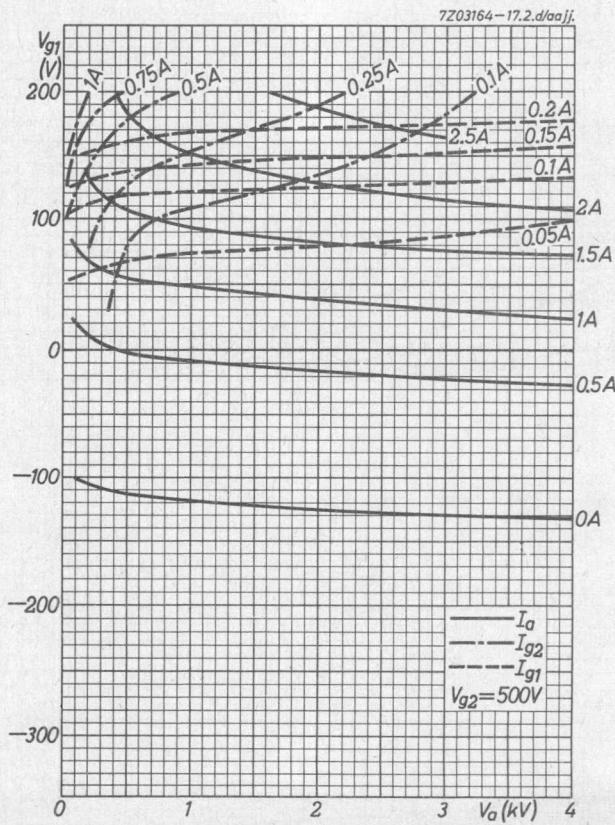
OPERATING CONDITIONS without grid current (two tubes)

Anode voltage	V_a	=	4000	3500	3000	2500	2500
Grid No.2 voltage	V_{g2}	=	-750	750	750	750	V
Grid No.1 voltage	V_{g1}	=	-150	-145	-137	-130	V
Load resistance	$R_{aa\sim}$	=	14500	11500	8900	6800	Ω
Peak grid to grid A.C. voltage				{ }			
Anode current	I_a	=	2x60	2x293	2x70	2x305	2x80
Grid No.2 current	I_{g2}	=	-	2x15	-	2x13.5	-
Grid No.2 dissipation	W_{g2}	=	-	2x11.2	-	2x10.4	-
Anode input power	W_{ia}	=	2x240	2x1170	2x245	2x1065	2x240
Anode dissipation	W_a	=	2x240	2x400	2x245	2x400	2x240
Output power	W_o	=	0	1540	0	1330	0
Efficiency	η	=	-	66	-	62.5	-
						1110	0
						58	-
						850	W
						53.5	%









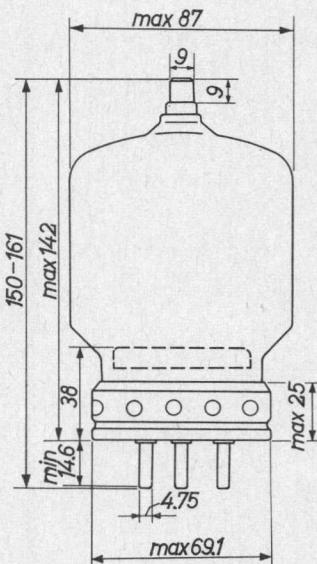
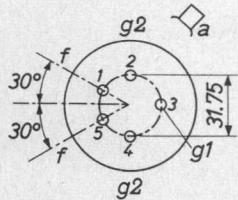
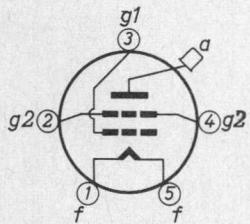
R.F. POWER TETRODE

MECHANICAL DATA

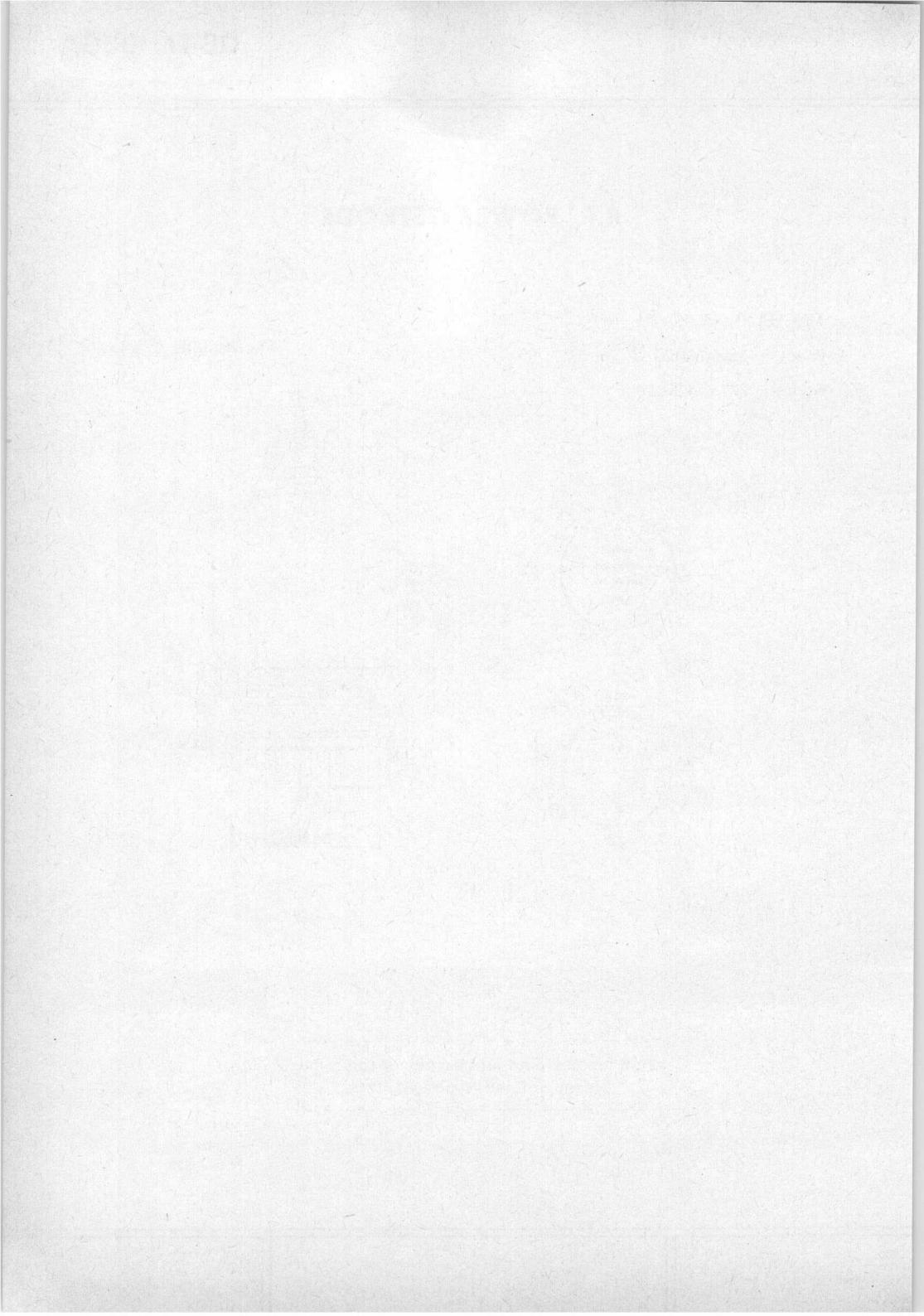
Base : Metal-shell Giant 5p

Dimensions in mm

Socket: 2422 512 01001



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⁾		V_a (V)	
(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.	Δ_U ²⁾		Δ ³⁾			
(m)	(MHz)	V_{tr} (VRMS)	W_o (W)	V_{tr} (VRMS) 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

$\mu_{g_2 g_1} = 9.5$

Mutual conductance

$S = 7$ mA/V

1) Two tubes

2) Δ_U = selfrectification

3) Δ = two phase half wave rectification without filter

4) Each phase

CAPACITANCES

Grid No.1 to all other elements except anode

$$C_{g1} = 24 \text{ pF}$$

Anode to all other elements except grid No.1

$$C_a = 8.3 \text{ pF}$$

Anode to grid No.1

$$C_{ag1} = 0.25 \text{ pF}$$

COOLING: radiation/low-velocity air flow

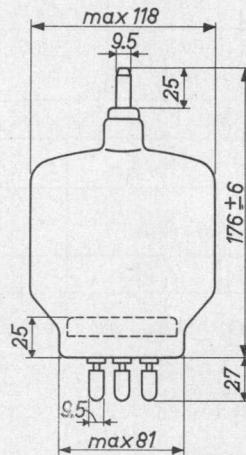
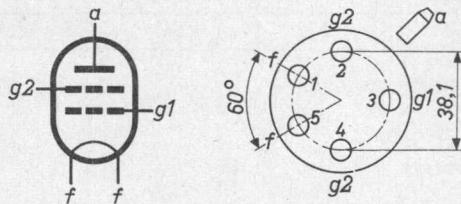
In order to keep the temperatures below the maximum permitted values it may be necessary to direct an air flow to the seals

TEMPERATURE LIMITS (Absolute limits)

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

MECHANICAL DATA

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



Mounting position: vertical with base up or down

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

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

OPERATING CONDITIONS

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

1) See page F

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

Screen grid modulated via a choke of 2 H

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

Frequency	f	\leq	60	MHz
Anode voltage	V_a	=	4	kV
Grid No.2 voltage	V_{g2}	=	600	V
Grid No.1 voltage	V_{g1}	=	-240	V
Peak grid No.2 voltage	V_{g2p}	=	340	V
Peak grid No.1 voltage	V_{g1p}	=	415	V
Anode current	I_a	=	380	mA
Grid No.2 current	I_{g2}	=	80	mA
Grid No.1 current	I_{g1}	=	20	mA
Anode input power	W_{ia}	=	1520	W
Grid No.1 input power	W_{ig1}	=	7.5	W
Grid No.2 dissipation	W_{g2}	=	48	W
Anode dissipation	W_a	=	320	W
Output power	W_o	=	1200	W
Efficiency	η	=	79	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	760	W

7Z2 8795

R.F. CLASS C CONTROL GRID MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

¹⁾ With -170 V from fixed bias supply included²⁾ At crest of modulation

7Z2 8796

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**LIMITING VALUES** (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 8797

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	≤	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.

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 _{tra}	=	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 _{trg2}	=	max.	700 V(RMS)
Grid No.2 dissipation	W _{g2}	=	max.	65 W
Negative grid No.1 voltage	-V _{g1}	=	max.	500 V
Grid No.1 dissipation	W _{g1}	=	max.	25 W
Grid No.1 current	I _{g1}	=	max.	45 mA
Grid No.1 circuit resistance	R _{g1}	=	max.	50 kΩ

OPERATING CONDITIONS²⁾

Frequency	f	≤	60	MHz
Anode transformer voltage ¹⁾	V _{tra}	=	4250	V(RMS)
Anode voltage D.C. value	V _a	=	3825	V
Grid No.2 transformer voltage ¹⁾	V _{trg2}	=	600	V(RMS)
Grid No.2 voltage D.C. value	V _{g2}	=	540	V
Grid No.1 resistor	R _{g1}	=	14	kΩ
Peak grid No.1 voltage	V _{g1p}	=	300	V
Anode current	I _a	=	325	mA
Grid No.2 current	I _{g2}	=	20	mA
Grid No.1 current	I _{g1}	=	15	mA
Grid No.1 input power	W _{ig1}	=	4	W
Anode input power	W _{ia}	=	1535	W
Anode dissipation	W _a	=	425	W
Grid No.2 dissipation	W _{g2}	=	13.3	W
Output power	W _o	=	1110	W
Efficiency	η	=	72	%

1) V_{tra} and V_{trg2} are the anode transformer secondary voltage per phase and the screen grid transformer secondary voltage per phase respectively.

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

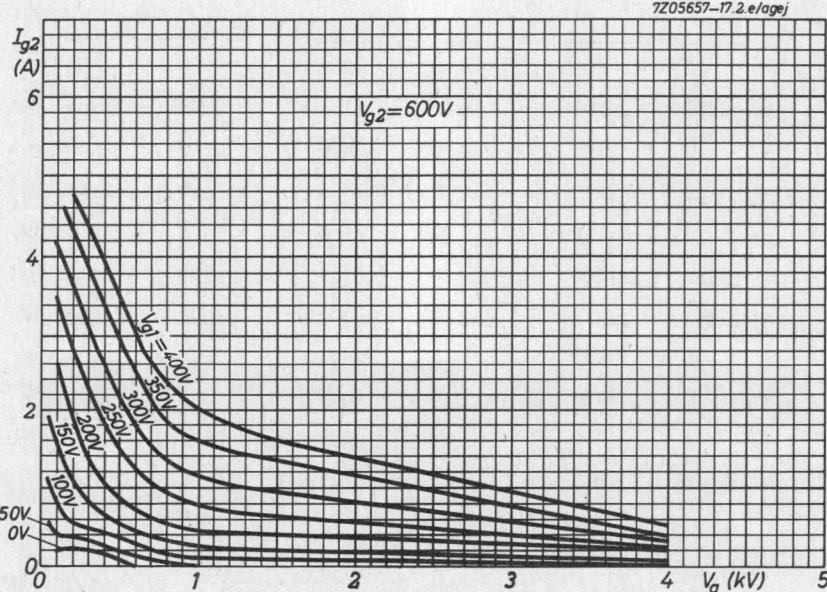
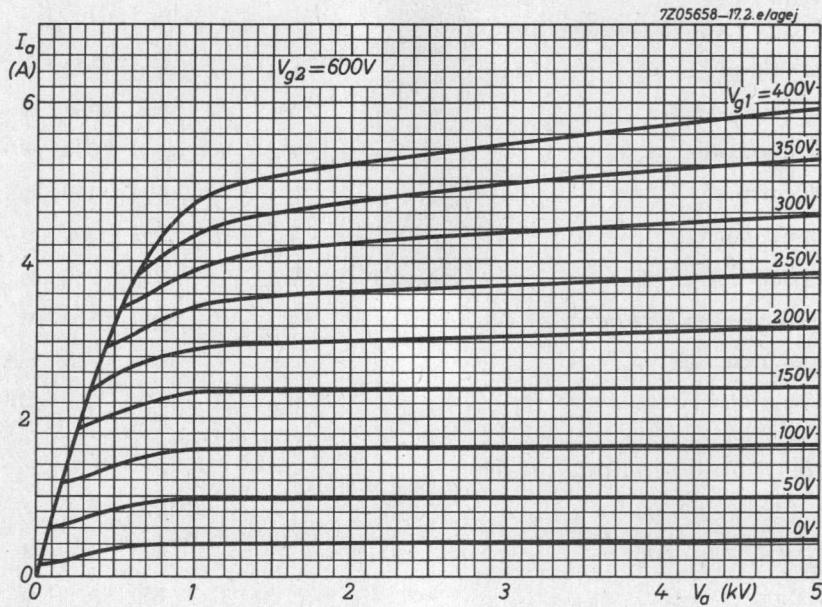
A.F. CLASS B AMPLIFIER AND MODULATOR**LIMITING VALUES** (Absolute limits)

Anode voltage	V_a	=	max.	5000	V
Anode input power	W_{ia}	=	max.	2250	W
Anode dissipation	W_a	=	max.	500	W
Anode current	I_a	=	max.	450	mA
Grid No.2 voltage	V_{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

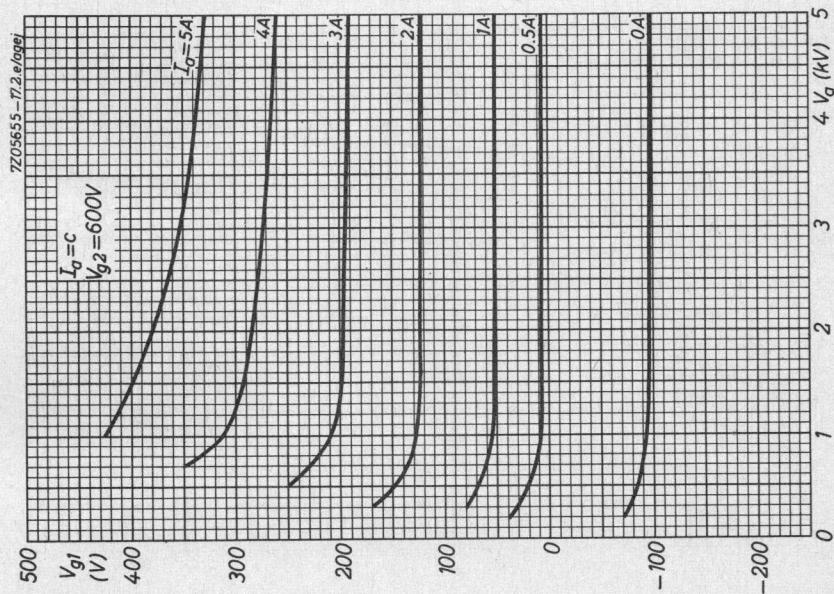
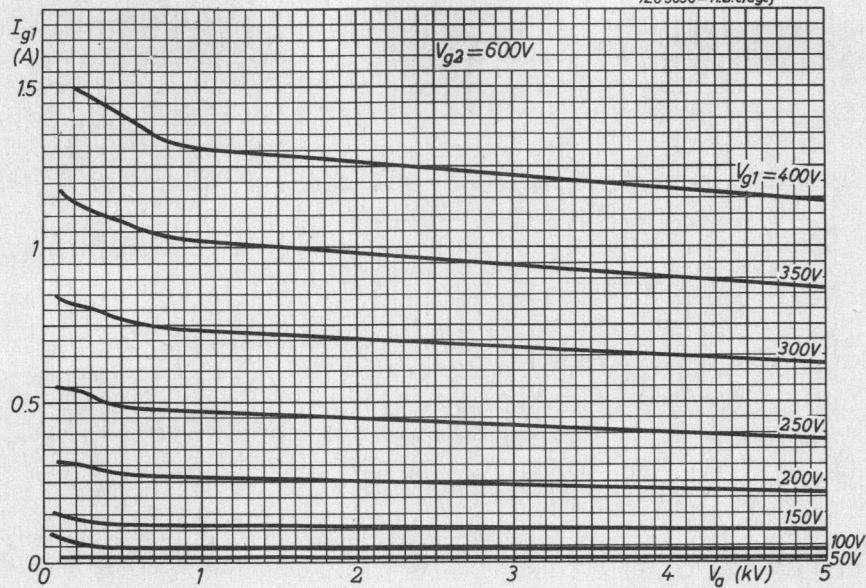
OPERATING CONDITIONS, two tubes

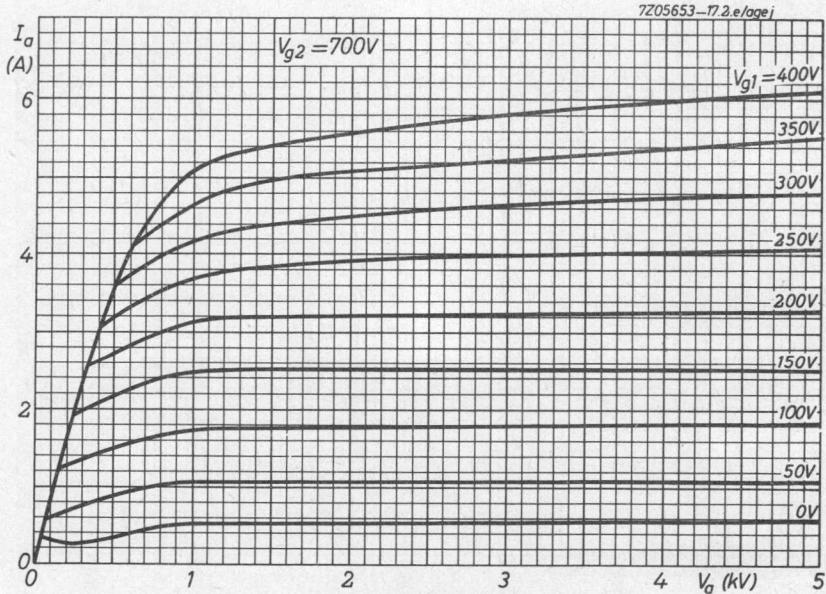
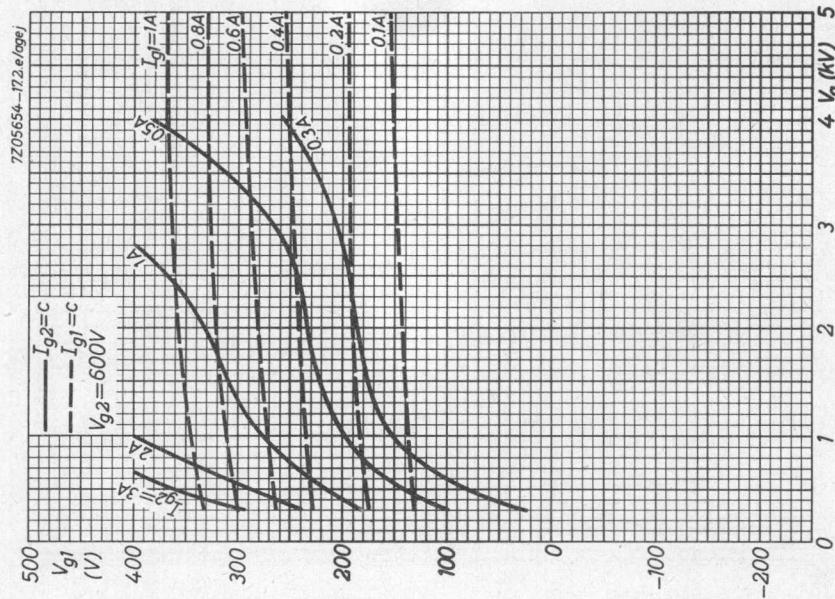
V_a	=	5000	4000	4000	V			
V_{g_2}	=	600	600	600	V			
V_{g_1}	=	-62.5	-62.5	-60	V			
$R_{aa,\sim}$	=	26	20	16	kΩ			
$V_{g_1g_1p}$	=	0	260	0	305	V		
I_a	=	2x50	2x290	2x45	2x285	2x55	2x366	mA
I_{g_2}	=	0	2x43	0	2x40	0	2x60	mA
I_{g_1}	=	0	2x13	0	2x13.5	0	2x18	mA
W_{ig_1}	=	0	2x1.5	0	2x1.5	0	2x2.5	W
W_{ia}	=	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	%

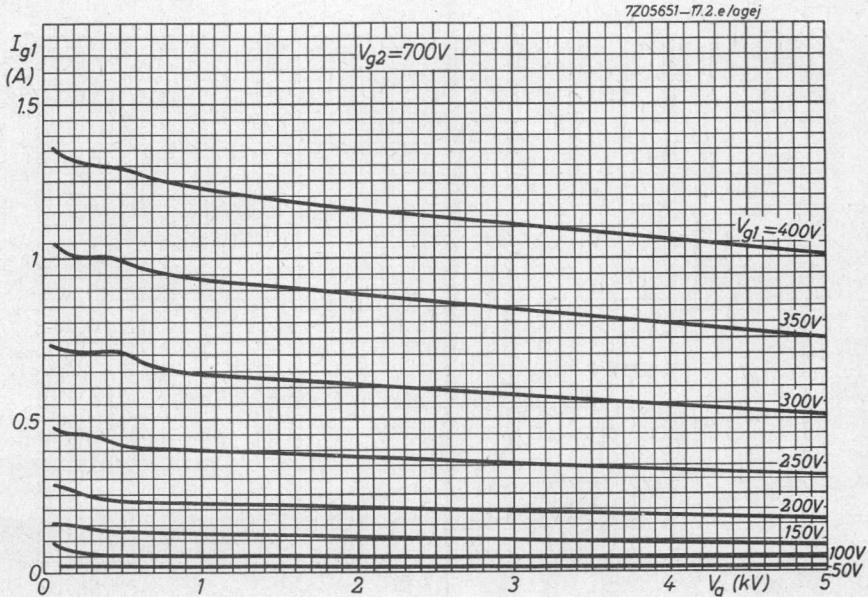
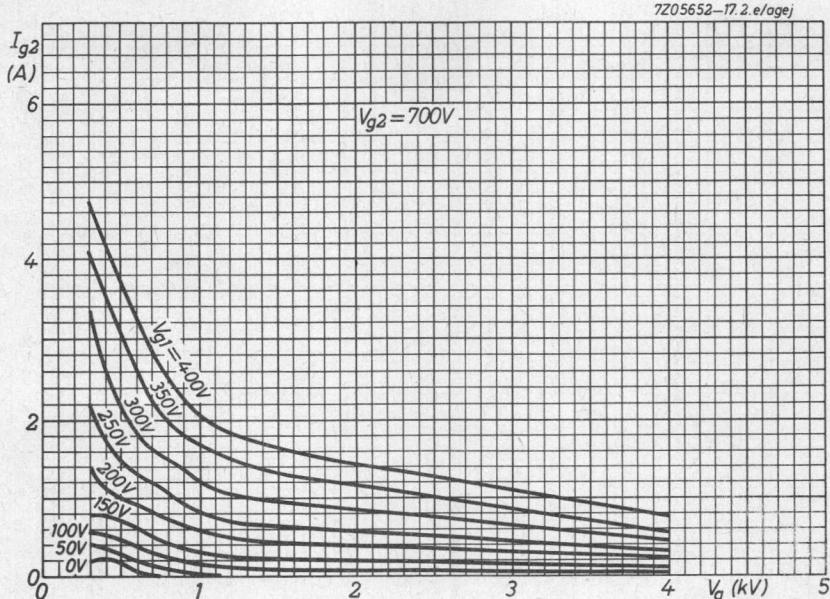
7Z2 2845

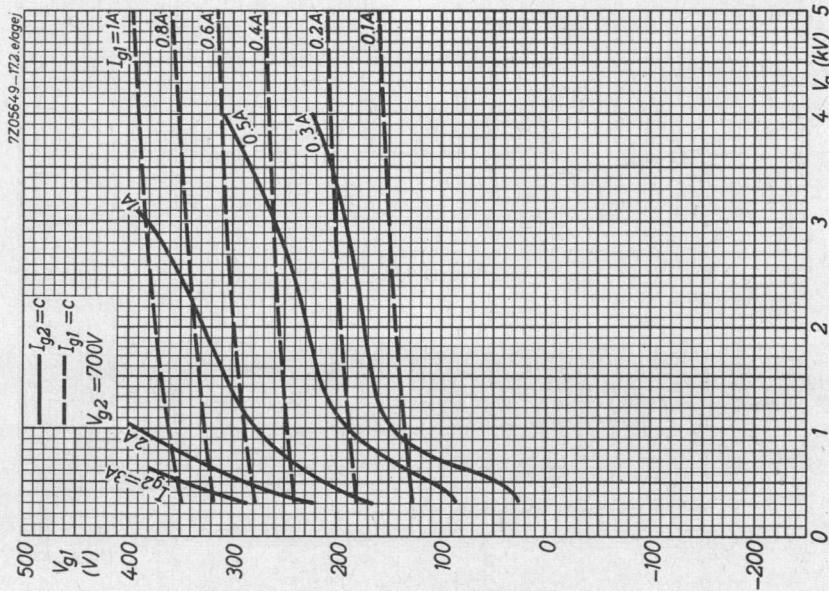
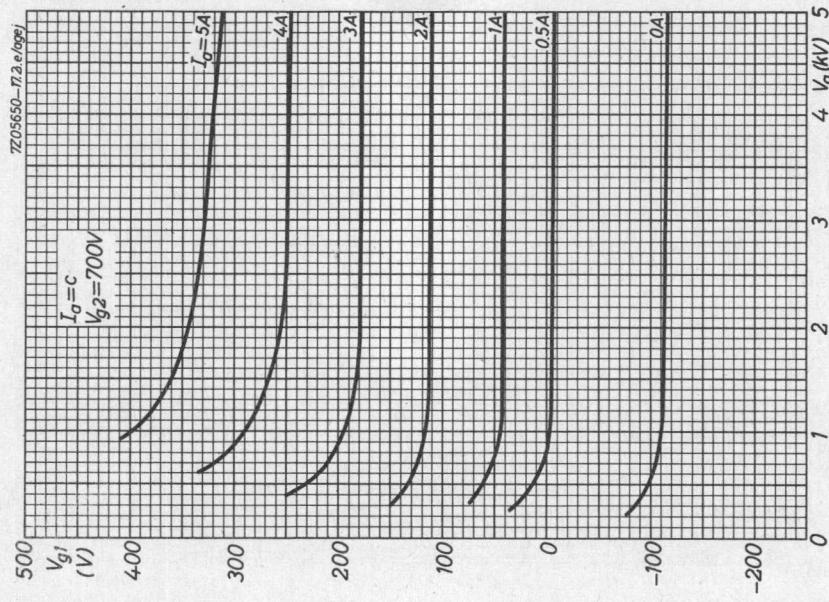


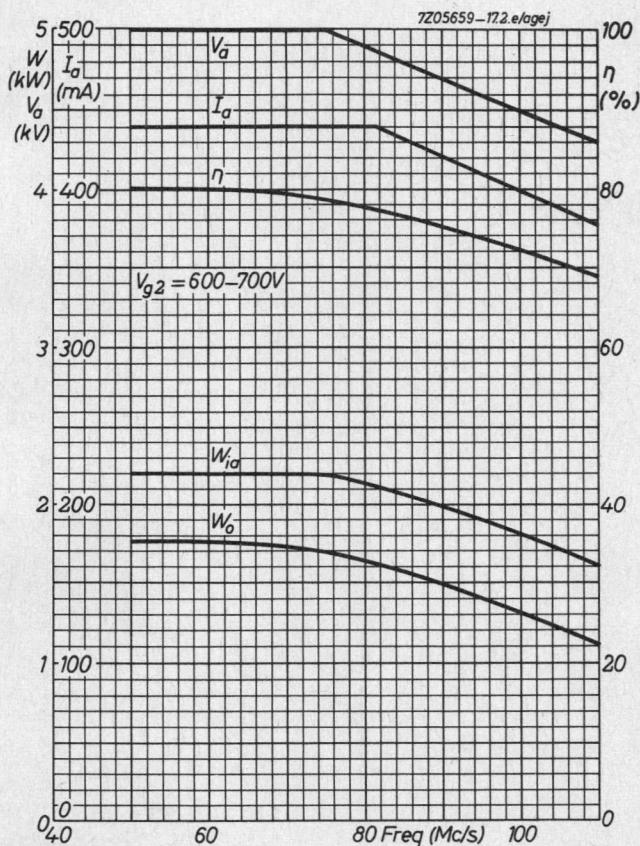
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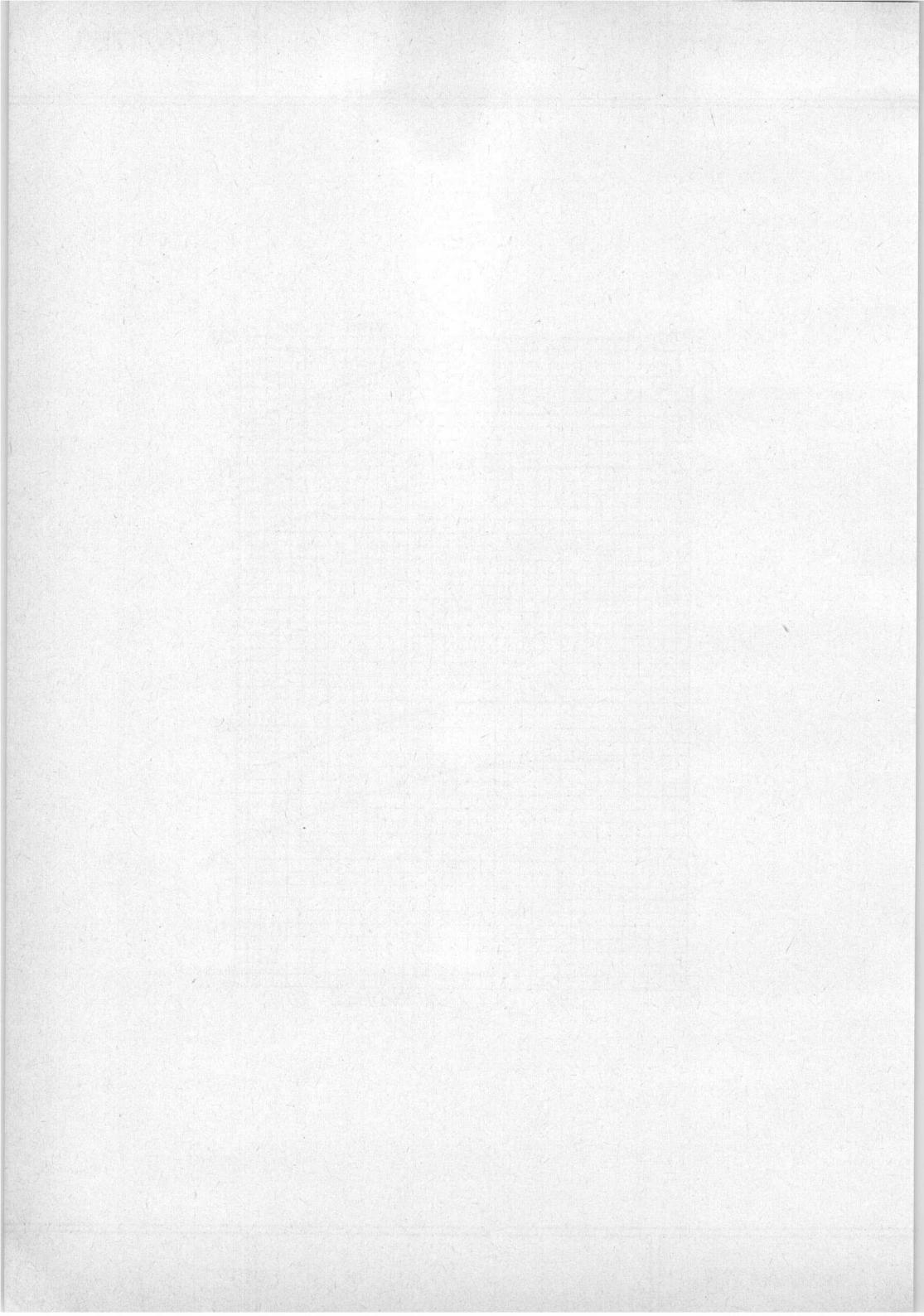












R.F. POWER TETRODE

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	$V_f = 7.5 \text{ V}$
Filament current	$I_f = 22.6 \text{ A}$

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

CAPACITANCES

Grid No.1 to all other elements except anode	$C_{g1} = 47.6 \text{ pF}$
Anode to all other elements except grid No.1	$C_a = 9.5 \text{ pF}$
Anode to grid No.1	$C_{ag1} = 0.1 \text{ pF}$

TYPICAL CHARACTERISTICS

Anode voltage	$V_a = 4000 \text{ V}$
Grid No.2 voltage	$V_{g2} = 600 \text{ V}$
Anode current	$I_a = 200 \text{ mA}$
Mutual conductance	$S = 10 \text{ mA/V}$
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g2g1} = 5.1$

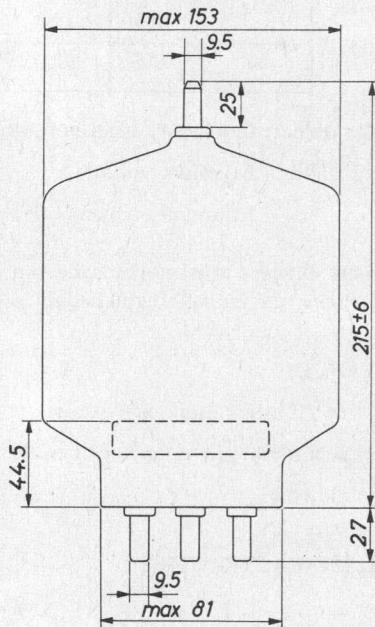
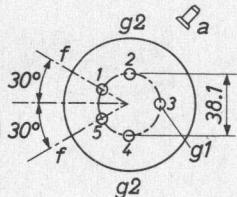
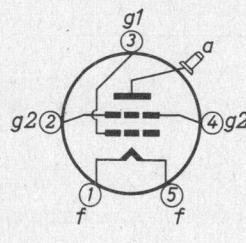
COOLING: radiation and convection; low velocity air flow

TEMPERATURE LIMITS (Absolute limits)

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

MECHANICAL DATA

Dimensions in mm



Base : Super giant 5p

Socket : 2422 512 00001

Anode connector : 40665

Net weight : 620 g

Mounting position: vertical

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

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

OPERATING CONDITIONS

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

Page 4

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

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

7Z2 2900

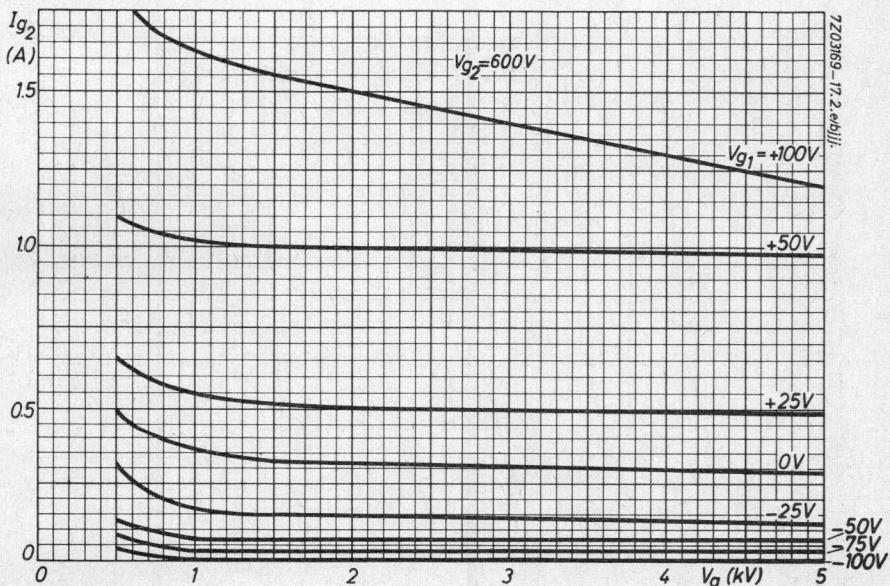
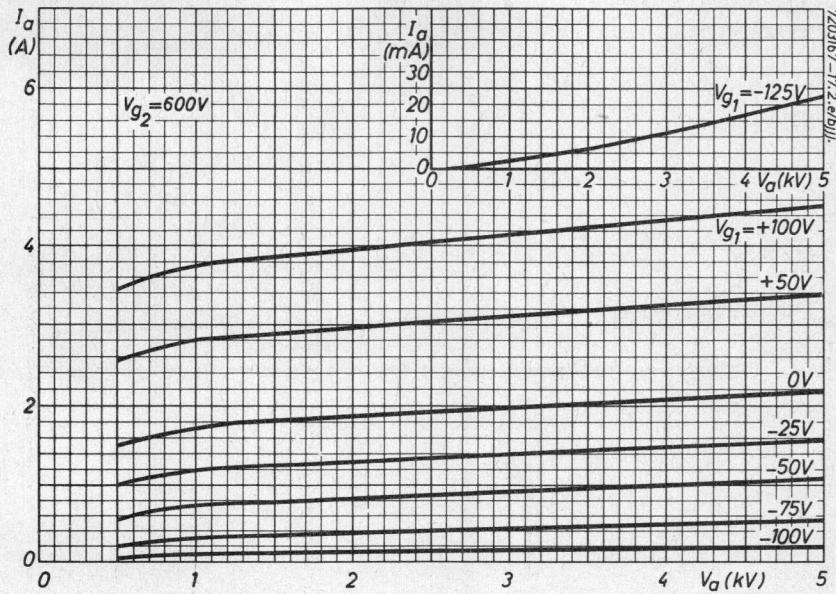
R.F. CLASS B SINGLE SIDE BAND AMPLIFIER**LIMITING VALUES (Absolute limits)**

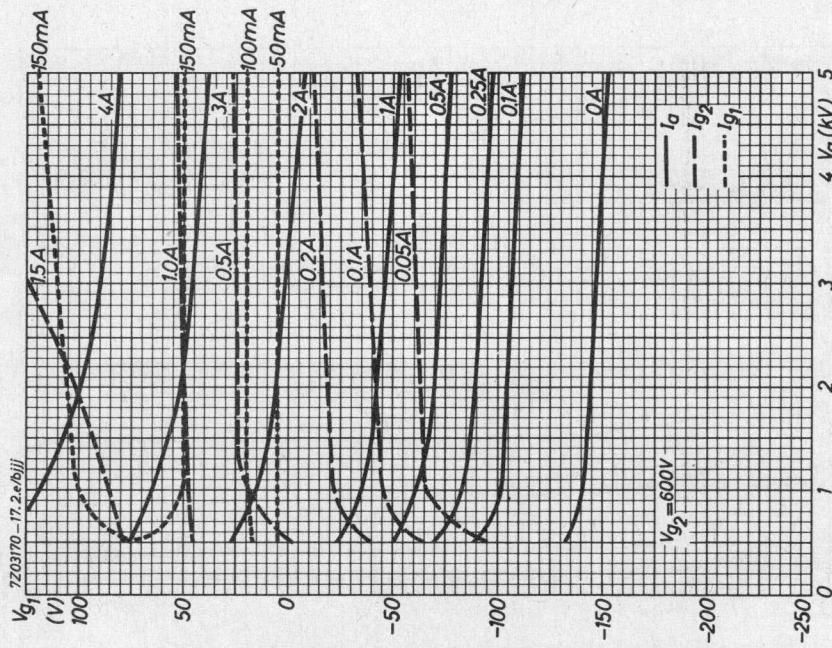
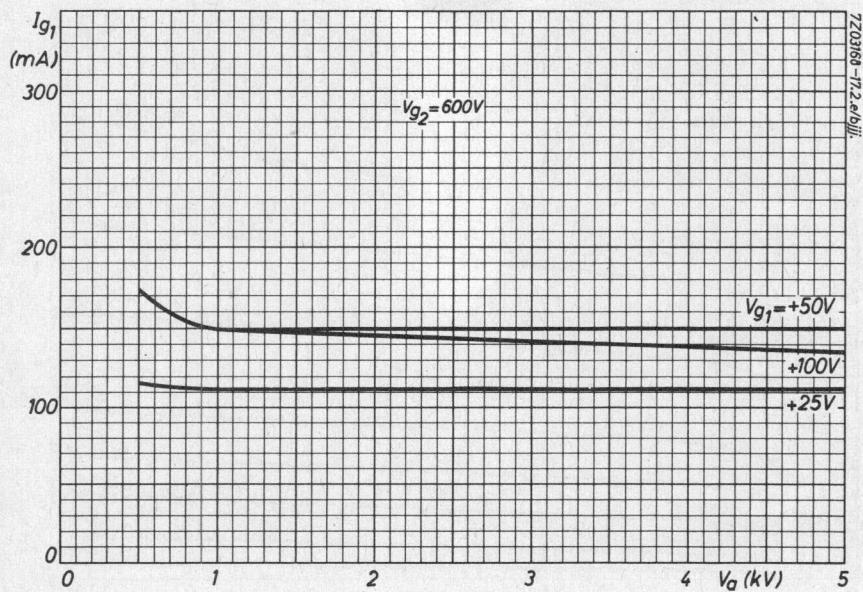
Frequency	f	up to	30	MHz
Anode voltage	V _a	= max.	5.5	kV
Anode dissipation	W _a	= max.	800	W
Anode input power	W _{ia}	= max.	2.5	kW
Anode current	I _a	= max.	600	mA
Grid No.2 voltage	V _{g2}	= max.	800	V
Grid No.2 dissipation	W _{g2}	= max.	120	W
Negative grid No.1 voltage	-V _{g1}	= max.	500	V
Grid No.1 circuit resistance	R _{g1}	= max.	20	kΩ

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V _a	=	4	kV
Grid No.2 voltage	V _{g2}	=	600	V
Grid No.1 voltage	V _{g1}	=	-105	V ¹⁾
			single zero signal	
			double tone signal	
Peak grid No.1 A.C. voltage	V _{g1p}	=	100	V
Anode current	I _a	=	150	mA
Grid No.2 current	I _{g2}	=	8	mA
Grid No.1 current	I _{g1}	=	0	mA
Anode input power	W _{ia}	=	600	W
Grid No.2 dissipation	W _{g2}	=	4.8	W
Anode dissipation	W _a	=	600	W
Output power	W _o	=	0	W
Driving power	W _{dr}	=	0	W
Efficiency	η	=	69	%
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





COAXIAL U.H.F. POWER TETRODE

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

QUICK REFERENCE DATA				
Freq. (MHz)	C telegraphy		A linear amplifier	
	V_{a-g_1} (kV)	W_o (W) ¹⁾	V_{a-g_1} (kV)	W_o (W) ¹⁾
790			2.5	210
800	4.31	2100		

Television service			
Freq. (MHz)	Neg. mod.	Pos. synchr.	
	V_{a-g_1} (kV)	W_o sync ¹⁾ (W)	W_o black ¹⁾ (W)
800	4.32	2200	1300

HEATING: direct; filament thoriated tungsten

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

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

¹⁾ Useful power in the load

TYPICAL CHARACTERISTICS

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

CAPACITANCESGrounded cathode

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

Grounded grids No.1 and 2

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

TEMPERATURE LIMITS (Absolute limits)

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

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

COOLINGCooling data for the anode radiator

For recommended cooling arrangement see page 5.

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

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 off 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	

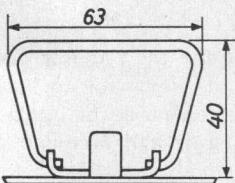
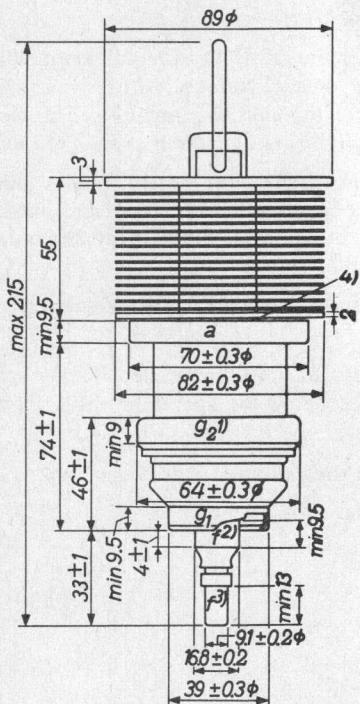
The frequency bandwidth of the driving signal is more than 6 MHz at -1 dB.

- 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



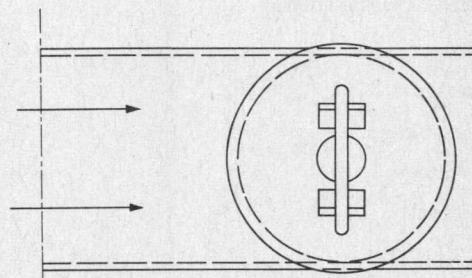
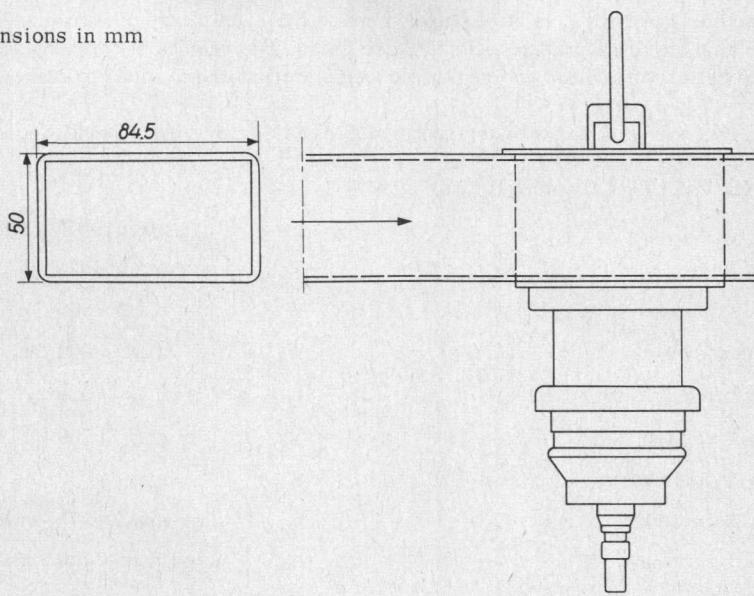
Net weight 1900 g

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%.

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 black white	V_{k-g_1} sync V_{k-g_1} black V_{k-g_1} white	= = =	120 V 175 V 345 V
Anode current	sync black	I_a sync I_a black	= =	0.9 A 0.68 A
Grid No.2 current	sync black	I_{g_2} sync I_{g_2} black	= =	1.5 mA 5 mA
Grid No.1 current	sync black	I_{g_1} sync I_{g_1} black	= =	50 mA 35 mA
Driver output power		W_{dr} sync	=	220 W
Useful power in the load	sync black	W_d sync W_d black	= =	2200 W 1300 W
Power gain		W_d / 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

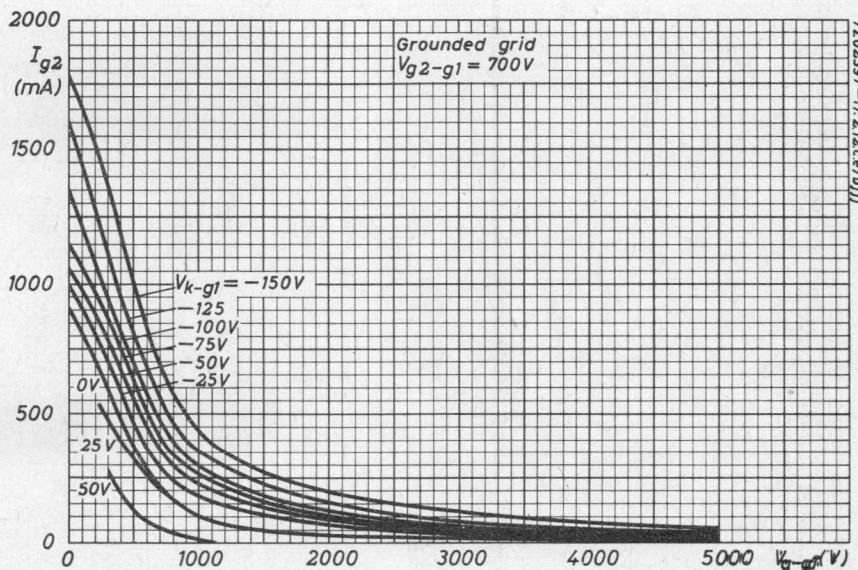
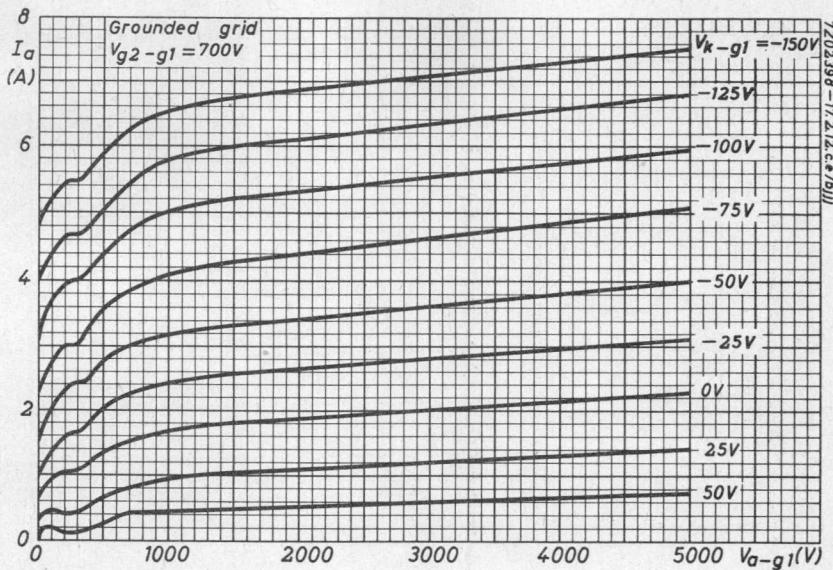
LIMITING VALUES (Absolute limits)

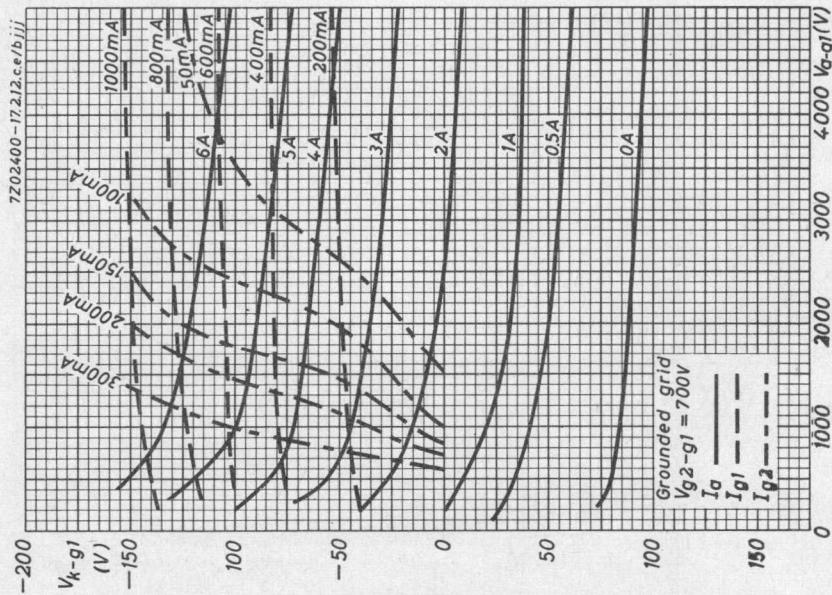
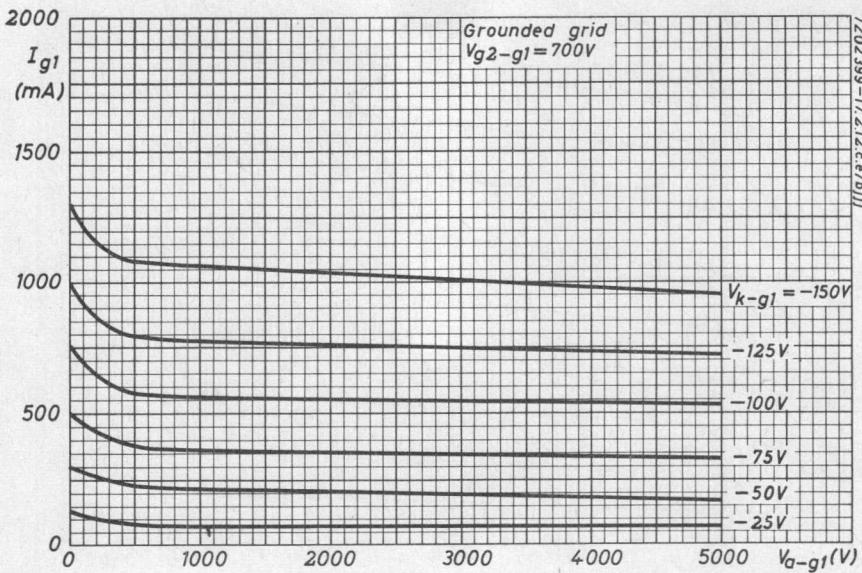
Frequency	f	up to 1000	MHz
Anode voltage	V_{a-g_1}	= max.	3000 V
Anode dissipation	W_a	= max.	1500 W
Anode input power	W_{ia}	= max.	1800 W
Anode current	I_a	= max.	800 mA
Grid No.2 voltage	$V_{g_2-g_1}$	= max.	700 V
Grid No.2 dissipation	W_{g_2}	= max.	50 W
Grid No.2 current	I_{g_2}	= max.	75 mA
Grid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

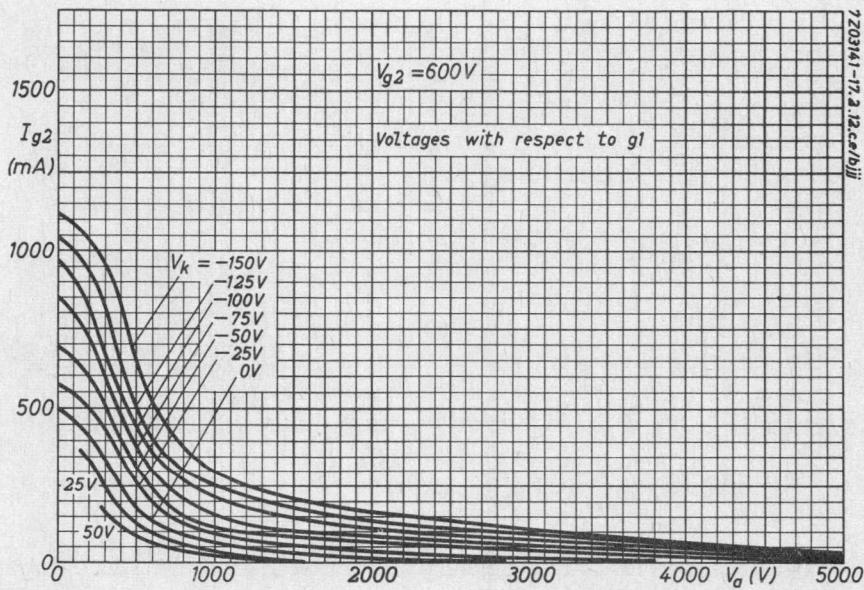
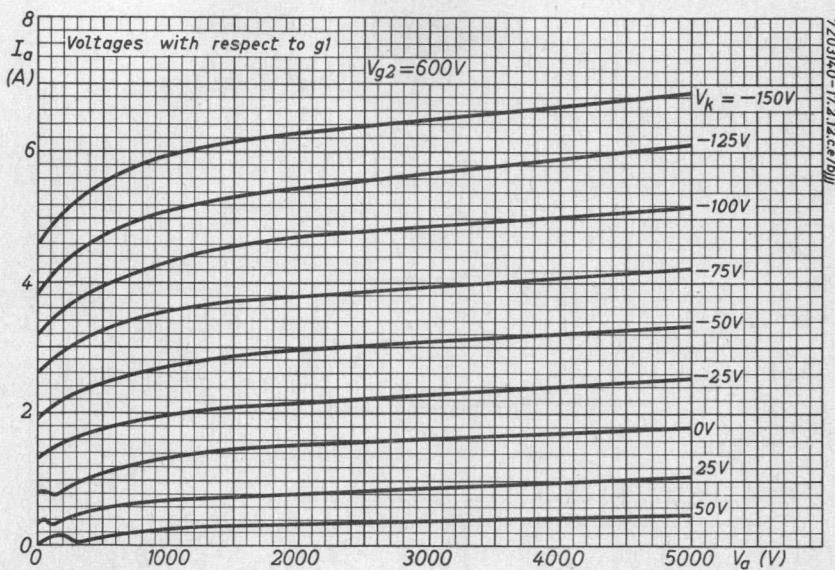
OPERATING CONDITIONS

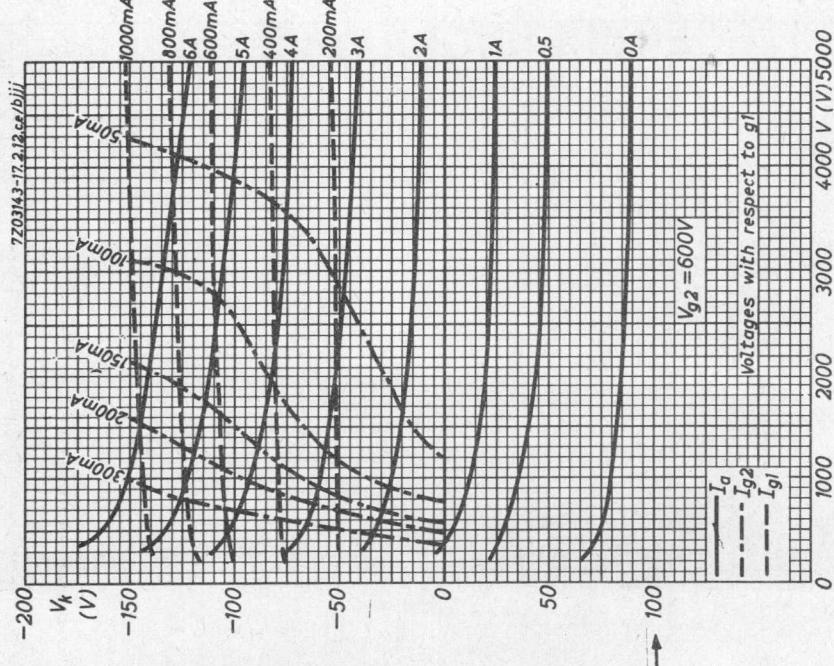
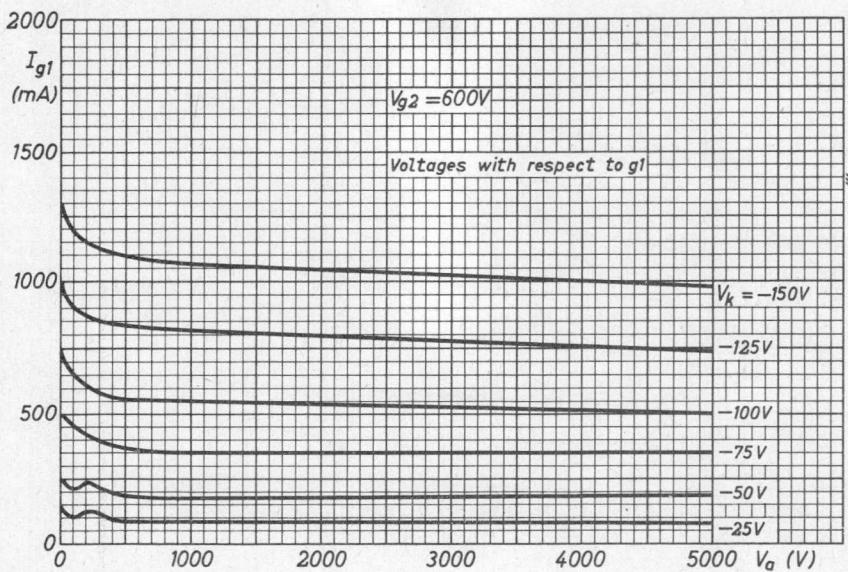
Frequency	f	=	790	MHz
Bandwidth at -1 dB	B	=	6	MHz
Anode voltage	V_{a-g_1}	=	2500	V
Grid No.2 voltage	$V_{g_2-g_1}$	=	500	V
Cathode voltage	V_{k-g_1}	=	28	$V^1)$
Anode current	I_a	=	580	mA
Grid No.2 current	I_{g_2}	=	5	mA
Grid No.1 current	I_{g_1}	=	0	mA
Driver output power	$W_{dr}(PEP)$	=	16	$w^2)$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

¹⁾²⁾³⁾⁴⁾ See page 3









R.F. POWER TETRODE

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

HEATING: direct, filament thoriated tungsten

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

Filament current $I_f = 13.5 \text{ A}$

CAPACITANCES

Anode to all other elements except grid No.1 $C_a = 5.6 \text{ pF}$

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

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

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2
with respect to grid No.1 $\mu_{g2g1} = 6.2$

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals $= \text{max. } 150 \text{ }^{\circ}\text{C}$

Anode temperature $= \text{max. } 150 \text{ }^{\circ}\text{C}$

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

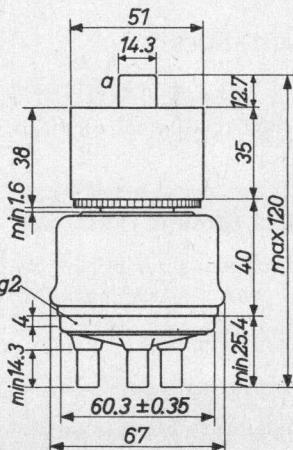
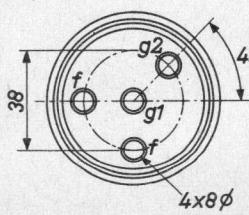
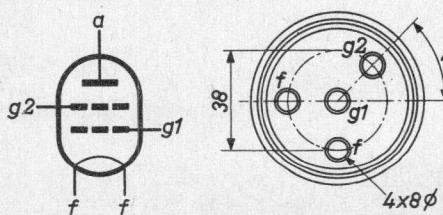
COOLING CHARACTERISTICS

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

MECHANICAL DATA

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_{g1p}	=	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

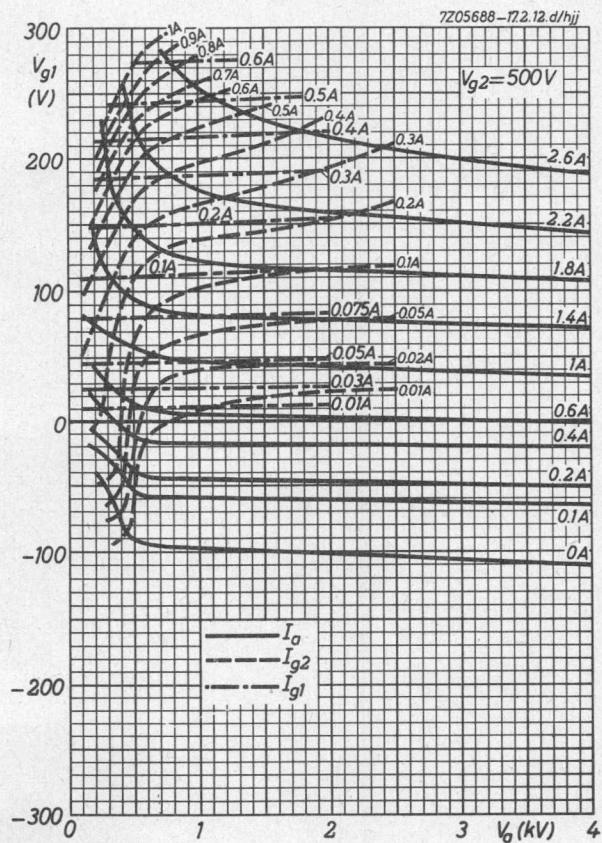
R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE; negative modulation,
positive synchronisation.

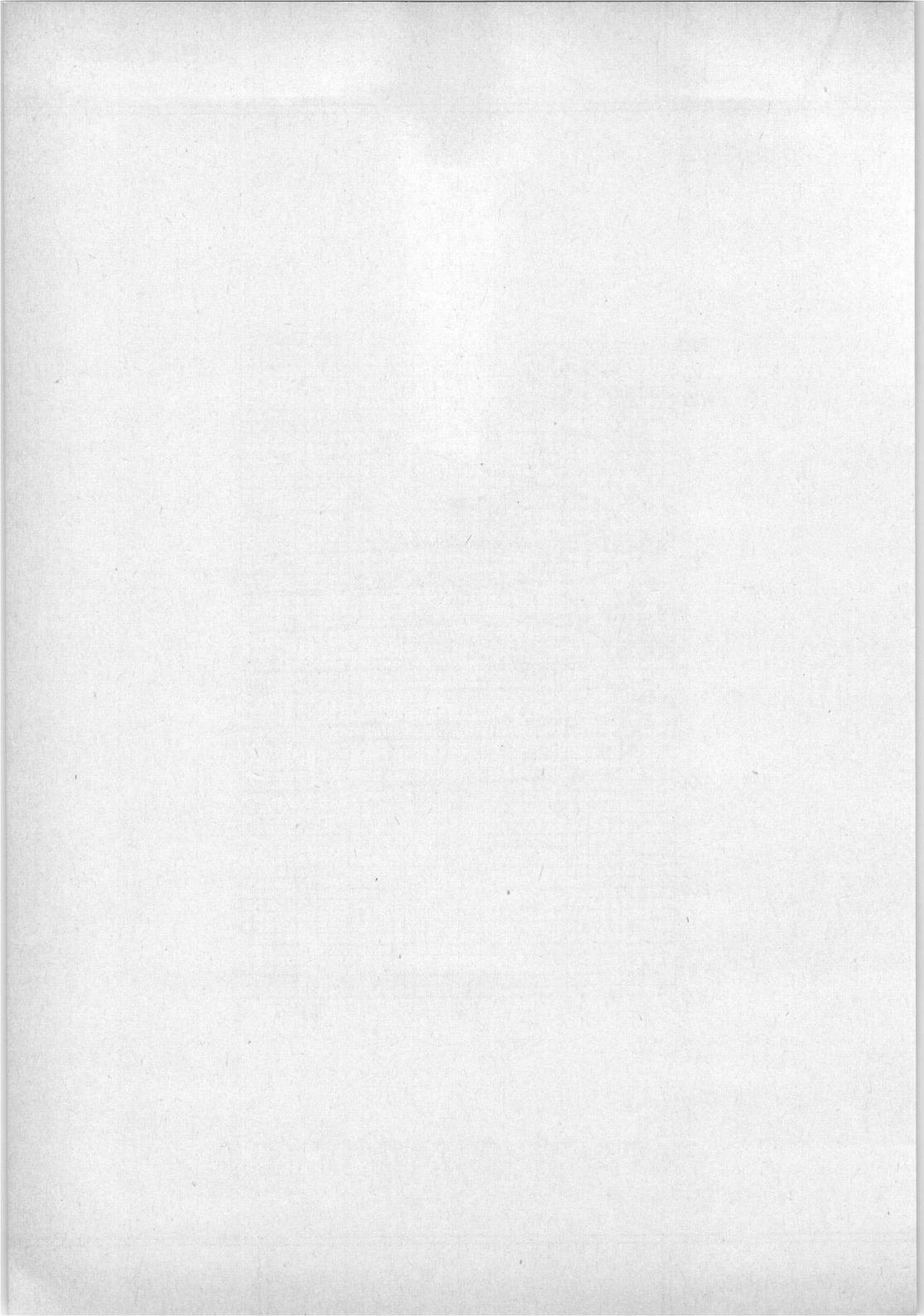
LIMITING VALUES (black level; absolute limits)

Frequency	f	up to	220	MHz
Anode voltage	V_a	= max.	3000	V
Grid No.2 voltage	V_{g2}	= max.	500	V
Anode current	I_a	= max.	350	mA
Anode input power	W_{ia}	= max.	1050	W
Anode dissipation	W_a	= max.	500	W
Grid No.2 dissipation	W_{g2}	= max.	30	W
Grid No.1 current	I_{g1}	= max.	30	mA
Grid No.1 circuit resistance	R_{g1}	= max.	30	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_{g2}	=	500	500	V
Grid No.1 voltage	V_{g1}	=	-100	-100	V
Peak grid No.1 A.C. voltage	V_{g1p}	sync	=	185	V
Anode current	I_a	sync	=	400	285 mA
		black	=	300	215 mA
Grid No.2 current	I_{g2}	sync	=	35	20 mA
		black	=	3	2 mA
Grid No.1 current	I_{g1}	sync	=	15	10 mA
		black	=	5	2 mA
Grid No.1 input power	W_{ig1}	sync	=	25	15 W
Anode input power	W_{ia}	sync	=	960	525 W
		black	=	720	400 W
Output power	W_o	sync	=	600	300 W
		black	=	340	170 W





AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA						
General purposes						
λ (m)	Freq. (MHz)	C telegr.		C _{ag2} mod.		
		V _a (kV)	W _o (kW)	V _a (kV)	W _o (kW)	
4	75	5 4	4.1 3.15			
2.7	110	5	3.9	4	2.7	
1.36	220	4	2.9			
Television service						
	Freq. (MHz)	Neg. mod. Pos. sync.			Pos. mod. Neg. sync.	
		V _a (kV)	W _o (kW)		V _a (kV)	W _o (kW) white
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

$$\text{Filament voltage} \quad V_f = 6.3 \text{ V}$$

$$\text{Filament current} \quad I_f = 32.5 \text{ A}$$

CAPACITANCES

Anode to all other elements except grid No.1	$C_a = 8.4 \text{ pF}$
Grid No.1 to all other elements except anode	$C_{g1} = 23.5 \text{ pF}$
Anode to grid No.1	$C_{ag1} < 0.35 \text{ pF}$

TYPICAL CHARACTERISTICS

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

$$\mu_{g2g1} = 8.5$$

Mutual conductance

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

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)

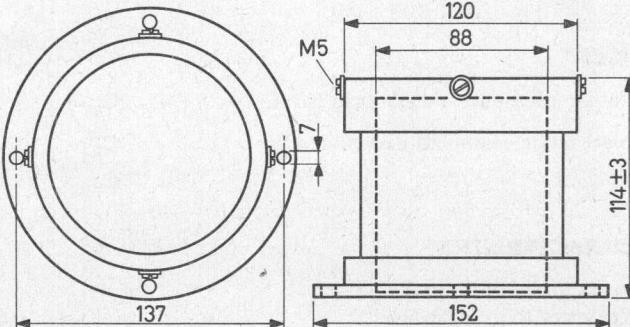
W_a (kW)	h (m)	t_i (°C)	q (m ³ /min)	p_i (mmH ₂ O)
1	0	35	1.8	10
	0	45	2.2	15
	1500	35	2.2	13
	3000	25	2.3	13
2.5	0	35	4.5	60
	0	45	5.4	85
	1500	35	5.4	73
	3000	25	5.8	75
3	0	35	5.7	95

MECHANICAL DATA

Dimensions in mm

Insulating pedestal: 40635

Net weight : 1.6 kg



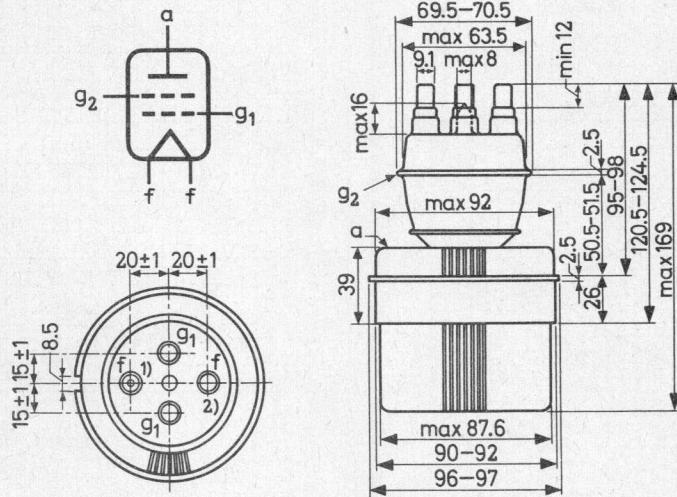
MECHANICAL DATA (continued)

Dimensions in mm

Net weight of the tube : 2.25 kg

Filament and control grid connector: 40634

Screen grid connector : 40622



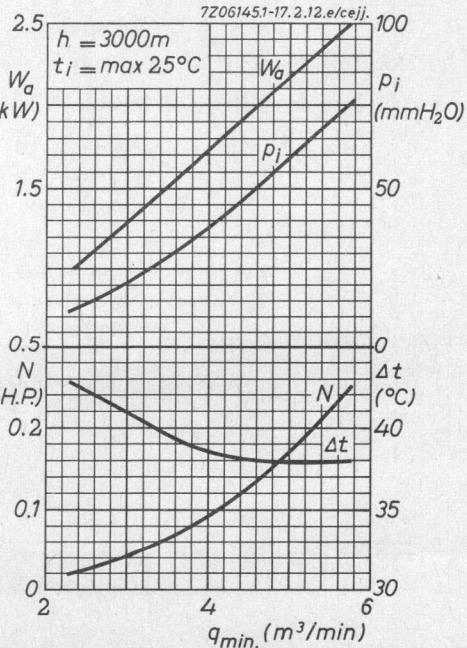
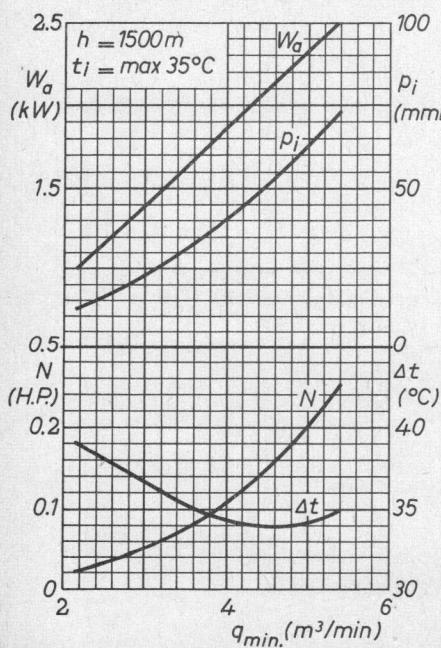
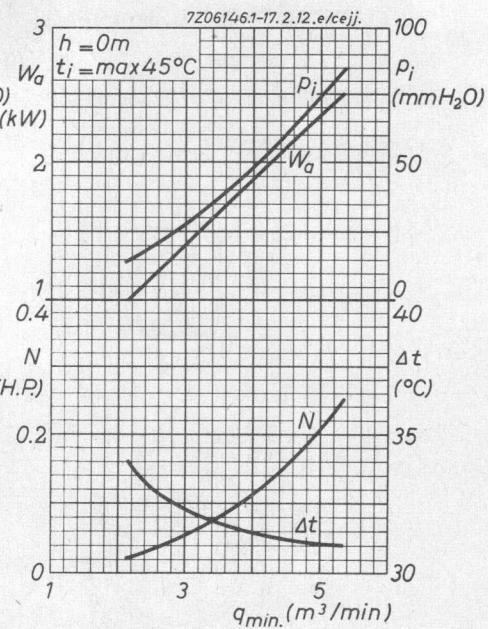
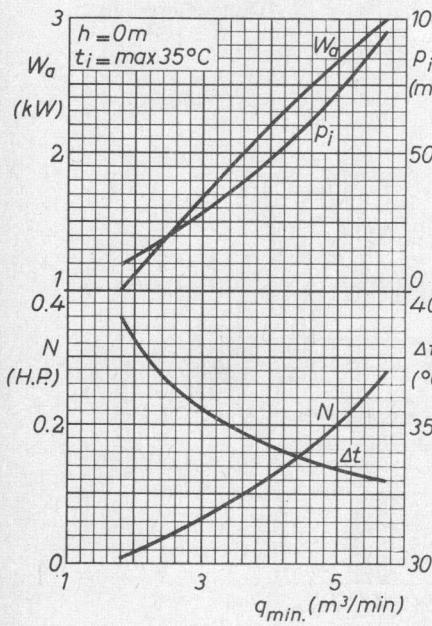
Mounting position: vertical with anode down

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

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

1) This pin is marked "O"

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



WATER COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA					
General purposes					
λ (m)	Freq. (MHz)	C telegr.		C _{ag2} mod.	
		V _a (kV)	W _o (kW)	V _a (kV)	W _o (kW)
4	75	5 4	4.1 3.15		
2.7	110	5	3.9	4	2.7
1.36	220	4	2.9		
Television service					
	Freq. (MHz)	Neg.mod.		Pos.mod.	Neg.sync.
		V _a (kV)	W _o (kW) sync	V _a (kV)	W _o (kW) white
Narrow-band	170-220	4	5.9	3.3	4.0
	54-88	5	8.0	4.5	
	170-220	4	5.0	2.8	2.8

HEATING: direct; filament thoriated tungsten

Filament voltage	$V_f = 6.3 \text{ V}$
Filament current	$I_f = 32.5 \text{ A}$

CAPACITANCES

Anode to all other elements except grid No.1	$C_a = 8.4 \text{ pF}$
Grid No.1 to all other elements except anode	$C_{g1} = 23.5 \text{ pF}$
Anode to grid No.1	$C_{ag1} < 0.35 \text{ pF}$

TYPICAL CHARACTERISTICS

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

$$\mu_{g2g1} = 8.5$$

Mutual conductance

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals

$$= \text{max. } 180 \text{ }^{\circ}\text{C}$$

Bulb temperature

$$= \text{max. } 250 \text{ }^{\circ}\text{C}$$

COOLING

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

COOLING CHARACTERISTICS . See also cooling curves on page E

W_a (kW)	t_i ($^{\circ}\text{C}$)	q (l/min)	p_i (atm)
1	20	2.5	0.073
	50	3.0	0.1
2	20	2.5	0.073
	50	4.8	0.25
3	20	3.0	0.105
	50	6.9	0.55

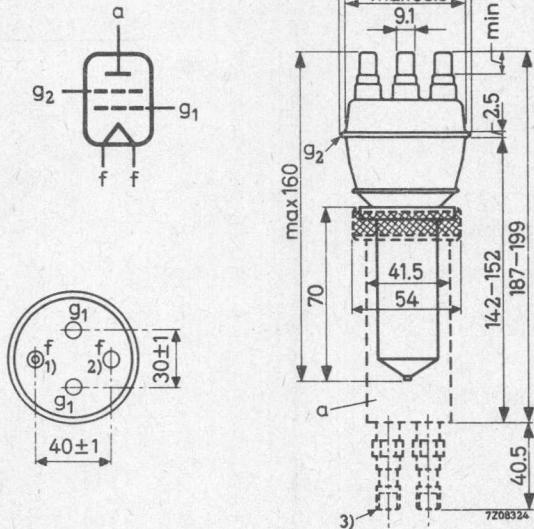
$$t_i = \text{max. } 50 \text{ }^{\circ}\text{C}$$

MECHANICAL DATA

Dimensions in mm

Tube mounted in water jacket type K 713

→ O-ring 3322 026 82801



Mounting position: vertical with anode down

Filament and control grid connectors 40634

Screen grid connector 40622

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

Tube : Net weight 0.35 kg

K 713: Net weight 0.52 kg

1) This pin is marked "O"

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

3) 1/8" pipe thread

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

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

OPERATING CONDITIONS

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

OPERATING CONDITIONS

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

A.F. CLASS B AMPLIFIER AND MODULATOR**LIMITING VALUES** (Absolute limits)

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

OPERATING CONDITIONS, two tubes

V_a	=	5	5	5	4	kV
V_{g2}	=	800	800	800	800	V
V_{g1}	=	-107	-107	-107	-103	V
$R_{aa\sim}$	=	3700	5000	17600	7000	Ω
V_{g1g1p}	=	0	714	0	594	0
					214	366
I_a	=	2x0.1	2x1.46	2x0.1	2x1.1	2x0.1
I_{g2}	=	0	2x120	0	2x50	0
I_{g1}	=	0	2x150	0	2x40	0
I_{g1p}	=	0	2x750	0	2x460	0
W_{ig1}	=	0	2x50	0	2x11	0
W_{g2}	=	0	2x96	0	2x40	0
W_{ia}	=	2x0.5	2x7.3	2x0.5	2x5.5	2x0.5
W_a	=	2x0.5	2x2.55	2x0.5	2x1.9	2x0.5
W_o	=	0	9.5	0	7.2	0
η	=	-	65	-	65	-
						62 %

¹⁾ At 100 % modulation with single tone sine wave $I_a = \text{max. } 1.5 \text{ A }$ 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_{g2}	=	max. 800		V
Grid No.2 dissipation	W_{g2} sync	=	max. 100		W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 500		V
Grid No.1 current	I_{g1} sync	=	max. 80		mA

OPERATING CONDITIONS , two tubes in push-pull

Frequency	f	=	54-88 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_{g2}	=	800	800	800	V
	sync	=	-175	-150	-150	V
Grid No.1 voltage	V_{g1}	black =	-260	-230	-260	V
		white =	-450	-450	-450	V
Input A.C. voltage, peak to peak	V_{g1g1p}	=	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_{g2}	sync =	145	110	250	mA
		black =	40	50	65	mA
Grid No.1 current	I_{g1}	sync =	82	100	80	mA
		black =	35	50	20	mA
Grid No.1 input power	W_{ig1}	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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f	=	54-88	170-220	MHz 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_{g2}	=	800	800	V
Grid No.1 voltage	V_{g1}	=	-175	-150	V
Input A.C. voltage, peak to peak	V_{g1g1p}	sync	= 900	850	V 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_{g2}	sync	= 145	110	mA
		black	= 40	50	mA
Grid No.1 current	I_{g1}	sync	= 82	100	mA
		black	= 35	50	mA
Grid No.1 input power	W_{ig1}	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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f	= 170-220 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_{g2}	= 800	800	V
Grid No.1 voltage	V_{g1} white black	= -230 = -380	-230 -380	V
Input A.C. voltage, peak to peak	V_{g1g1p}	= 850	850	V ³⁾
Anode current	I_a white black	= 2.1 = 0.6	1.7 0.5	A
Grid No.2 current	I_{g2} white black	= 50 = 10	80 10	mA
Grid No.1 current	I_{g1} white black	= 50 = 0	25 0	mA
Grid No.1 input power	W_{ig1}	= 300-400	200-300	W ⁴⁾
Output power	W_o white black	= 2.8 ⁵⁾ = 0.25	4.0 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_{g2}	=		max. 800	V
Anode current	I_a white	=		max. 1.1	A
Anode dissipation	W_a white	=		max. 3	kW
Grid No. 2 dissipation	W_{g2} white	=		max. 100	W
Grid No. 1 current	I_{g1} white	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f	=	170-220	MHz	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_{g2}	=	800	V	
Grid No. 1 voltage	V_{g1}	=	-150	V	
Input A.C. voltage, peak to peak	V_{g1g1p} white black	= =	700 350	V	³⁾
Anode current	I_a	white black	= =	2.1 0.6	A
Grid No. 2 current	I_{g2}	white black	= =	50 10	mA
Grid No. 1 current	I_{g1}	white black	= =	50 0	mA
Grid No. 1 input power	W_{ig1}	white	=	200-300	W
Output power	W_o	white black	= =	2.8 0.25	kW

¹⁾²⁾³⁾⁴⁾⁵⁾ See page 13.

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

LIMITING VALUES (Absolute limits)

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

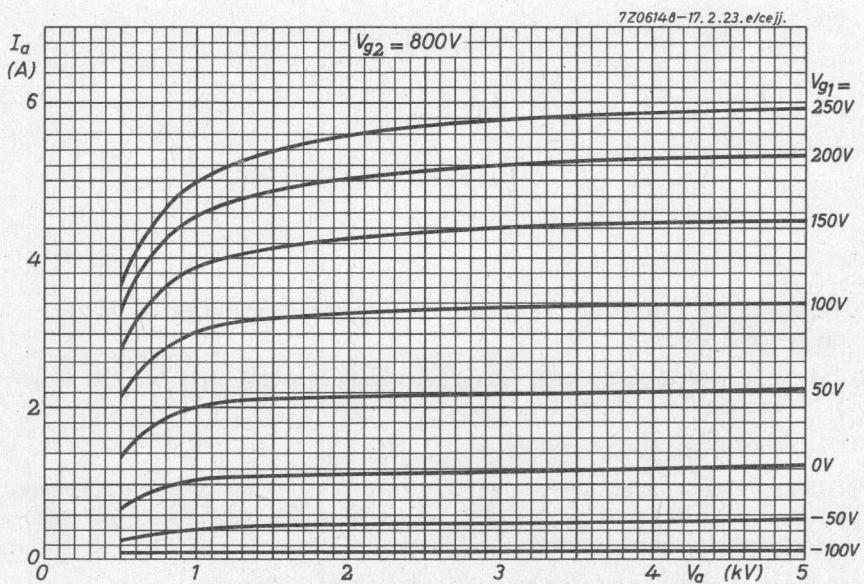
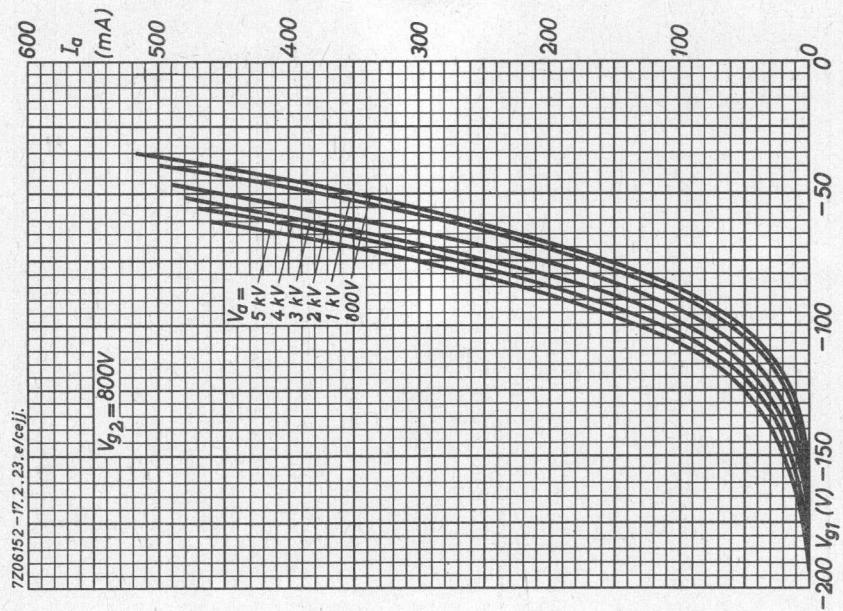
OPERATING CONDITIONS, two tubes in push-pull

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

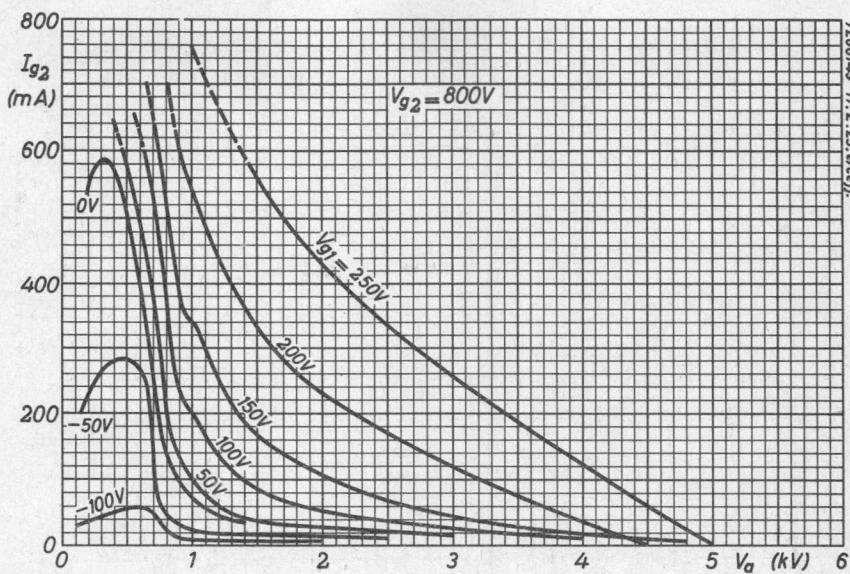
¹⁾²⁾³⁾⁴⁾ See page 13.

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

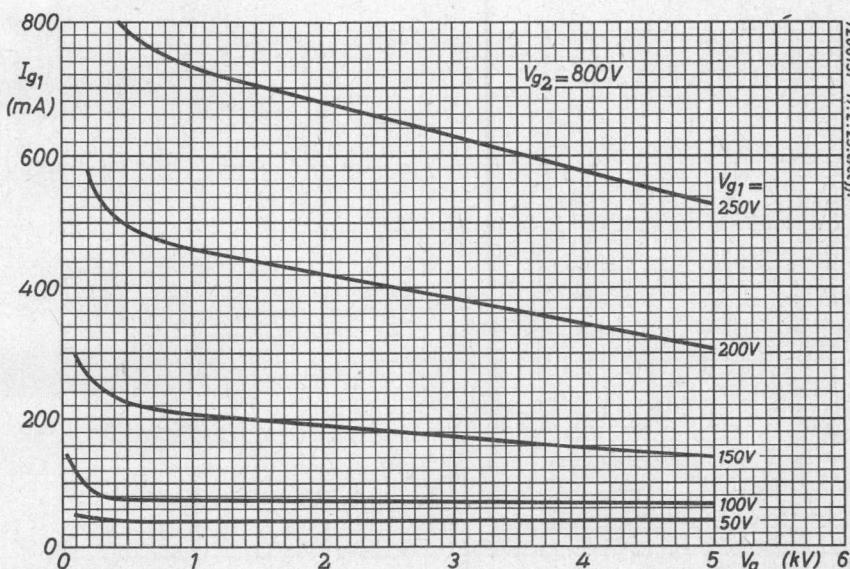
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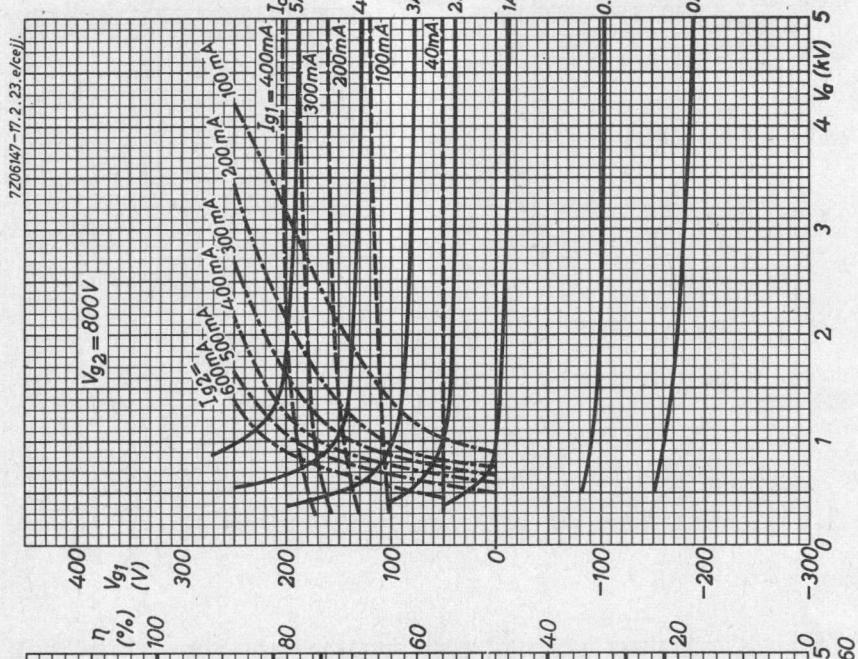
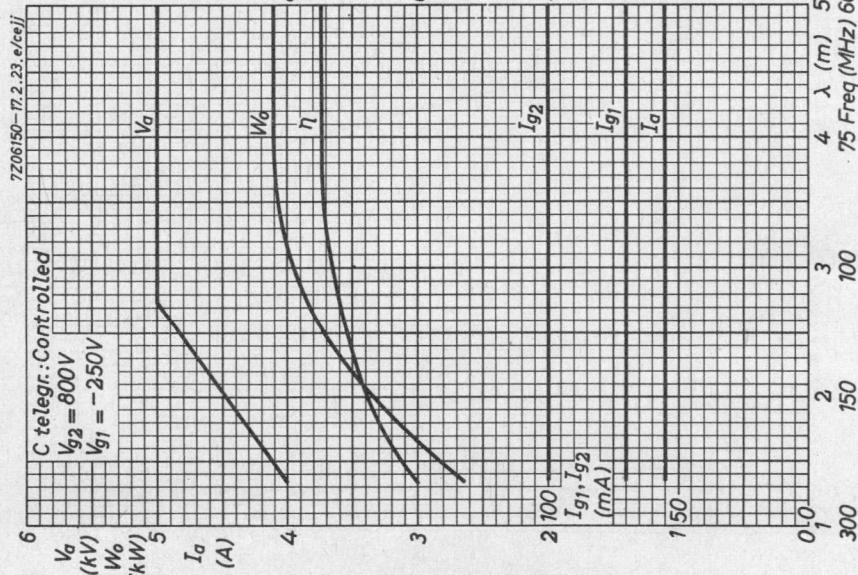


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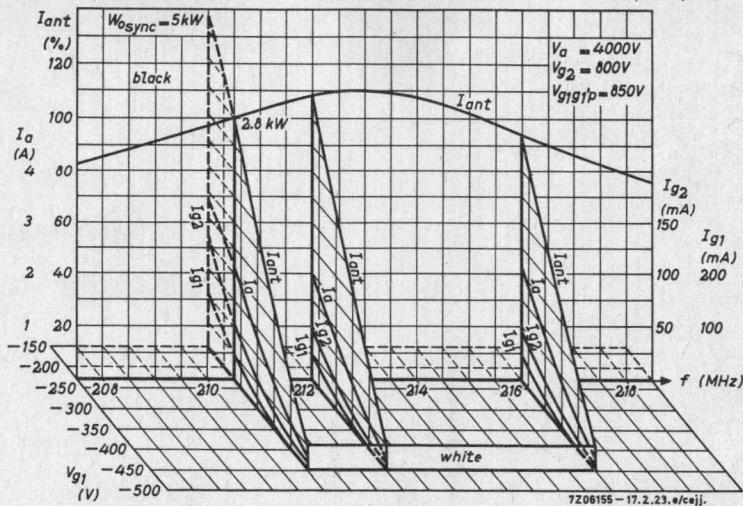


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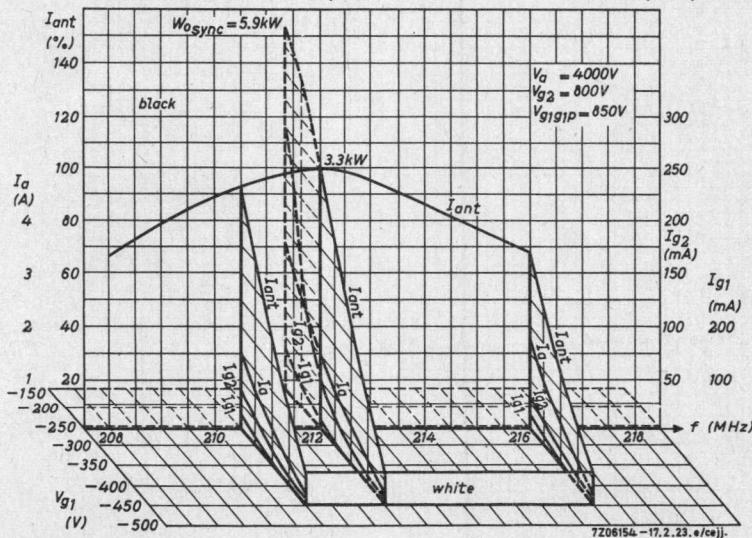


Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)



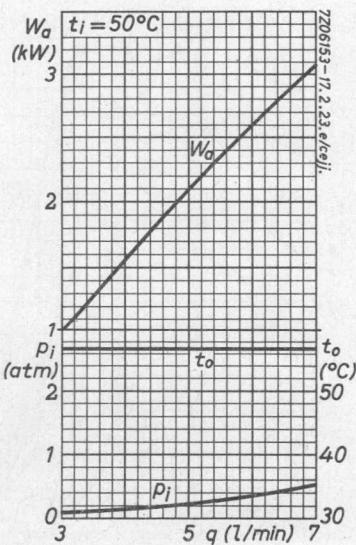
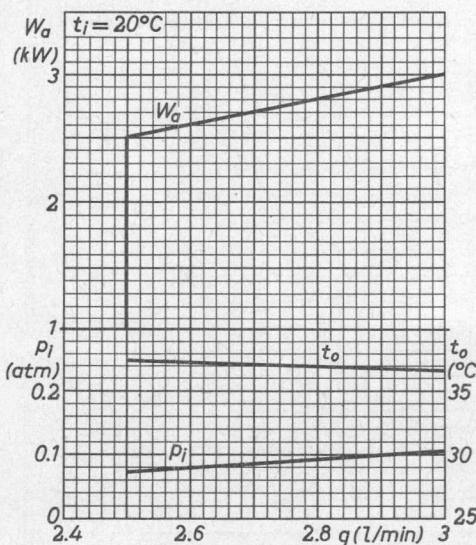
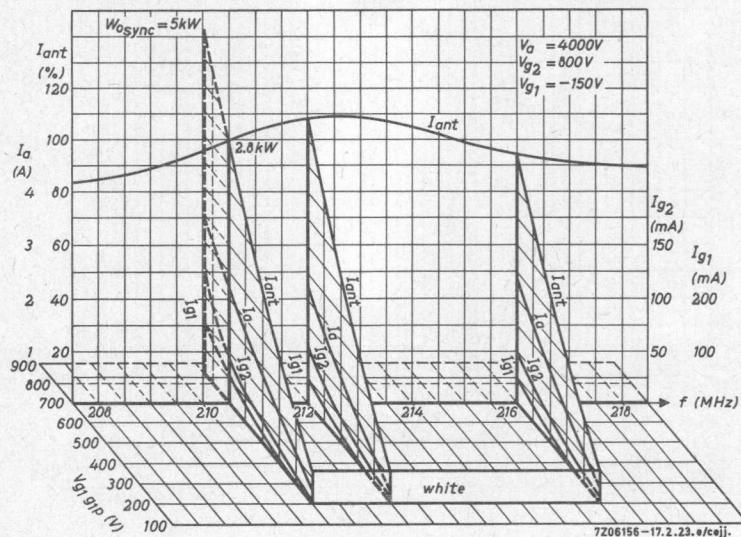
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Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)



7Z06154 - 17.2.23.e/cejj.

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

$$\begin{array}{lll} \text{Filament voltage} & V_f & = 1.6 \text{ V} \pm 15\% \\ \text{Filament current} & I_f & = 3.2 \text{ A} \end{array}$$

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

CAPACITANCES

$$\begin{array}{lll} \text{Anode to all other elements except grid No.1} & C_a & = 8.5 \text{ pF} \\ \text{Grid No.1 to all other elements except anode} & C_{g1} & = 13.5 \text{ pF} \\ \text{Anode to grid No.1} & C_{ag_1} & < 0.24 \text{ pF} \end{array}$$

TYPICAL CHARACTERISTICS

$$\begin{array}{lll} \text{Anode voltage} & V_a & = 200 \text{ V} \\ \text{Grid No.2 voltage} & V_{g2} & = 200 \text{ V} \\ \text{Anode current} & I_a & = 100 \text{ mA} \\ \text{Mutual conductance} & S & = 7 \text{ mA/V} \\ \text{Amplification factor of grid No.2} & & \\ \text{with respect to grid No.1} & \mu_{g_2 g_1} & = 4.5 \end{array}$$

1) Intermittent mobile service

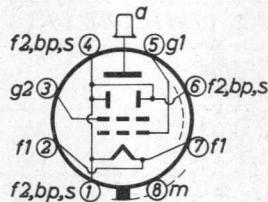
MECHANICAL DATA

Base : Octal 8p

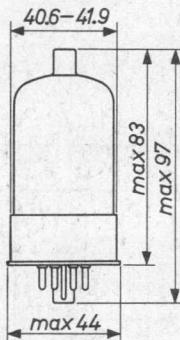
Socket : 2422 501 03001 1)

Anode connector: 28 906 022

Net weight : 57 g



Dimensions in mm



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

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature max. 220 °C

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

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

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	$k\Omega$ 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

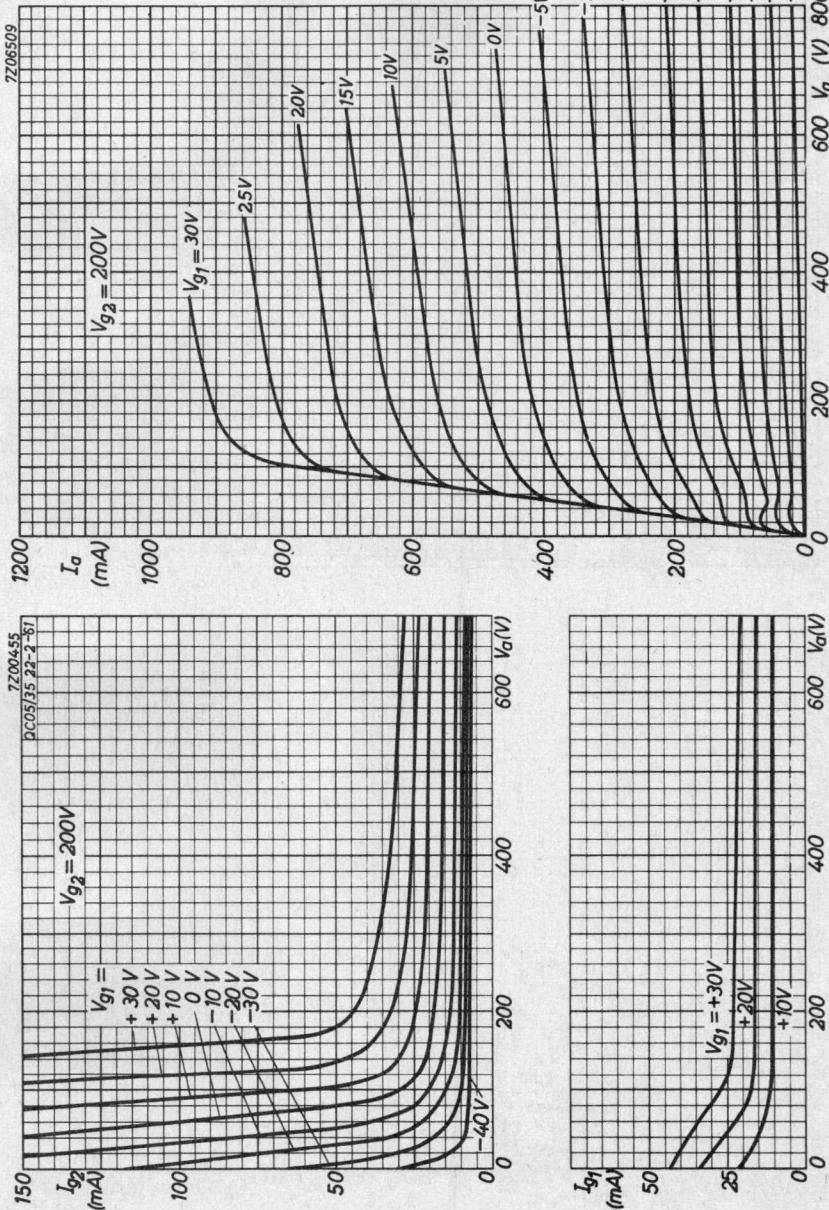
Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	480	V
Anode input power	W_{ia}	= max.	45	W
Anode dissipation	W_a	= max.	14	W
Anode current	I_a	= max.	120	mA
Grid No.2 voltage	V_{g_2}	= max.	250	V
Grid No.2 dissipation	W_{g_2}	= max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current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

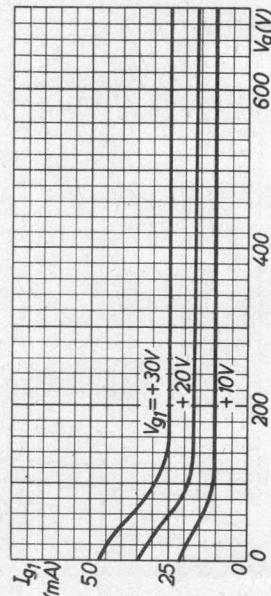
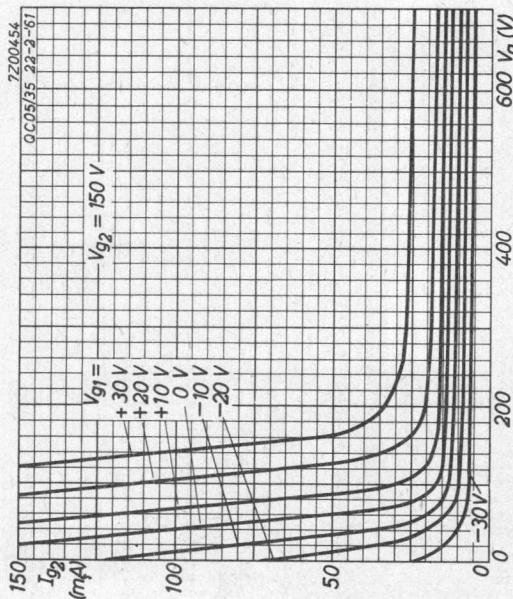
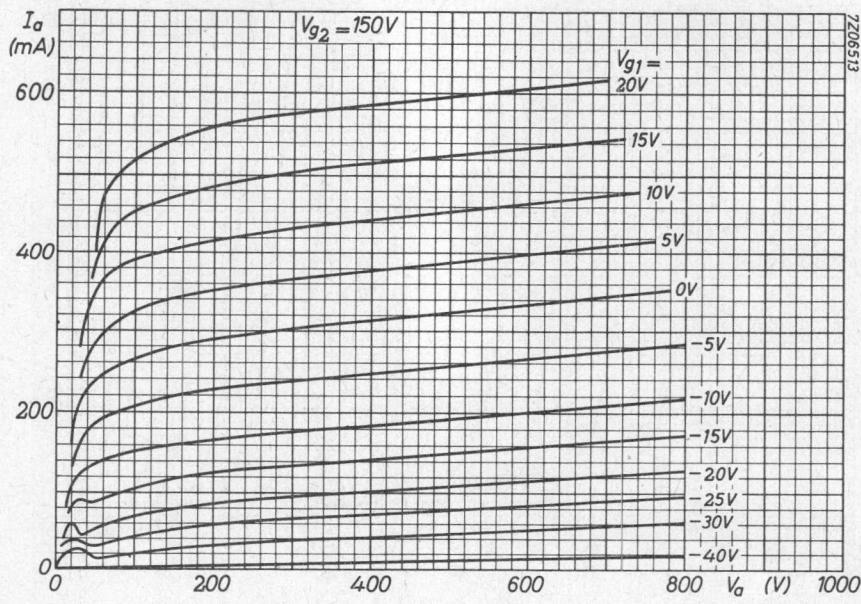
OPERATING CHARACTERISTICS

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_{g1p}	=	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.





R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA								
λ (m)	Freq. (MHz)	C telegr.			Cag ₂ mod.			
		V _a (V)	W _O (W)		V _a (V)	W _O (W)		
			CCS	ICAS		CCS	ICAS	
5	60	750		70	600		52	
		600	52	66	475	34		
		500	48		400	32		
	175	400		35				
		320	25					
AB mod. 1) ²⁾		AB mod. 1) ³⁾			AB mod. 1) ⁴⁾			
V _a (V)	W _O (W)		V _a (V)	W _O (W)		V _a (V)	W _O (W)	
	CCS	ICAS		CCS	ICAS		CCS	ICAS
750		120	750		131	400	22	22
600	82	95	600	90	113	250	10	
500	70		500	83				
400	55		400	62				

HEATING: indirect; cathode oxide-coated

Heater voltage	$V_f = 6.3 \text{ V}$
Heater current	$I_f = 1.25 \text{ A}$

CAPACITANCES

Grid No.1 to all other elements except anode

$$C_{g1} = 13.5 \text{ pF}$$

Anode to all other elements except grid No.1

$$C_a = 8.5 \text{ pF}$$

Anode to grid No.1

$$C_{ag1} < 0.24 \text{ pF}$$

¹⁾ Two tubes

²⁾ Without grid current

³⁾ With grid current

⁴⁾ In triode connection

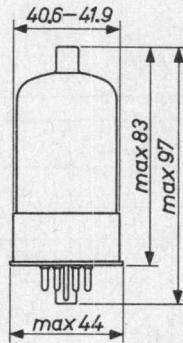
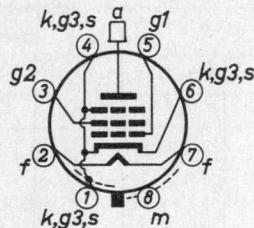
TYPICAL CHARACTERISTICS

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	$\mu_{g_2 g_1}$	=	4.5	

MECHANICAL DATA

Dimensions in mm

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



Mounting position: arbitrary

TEMPERATURE LIMIT (Absolute limits)

Bulb temperature = max. 220 °C

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

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

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

Pages 4 and 5

- 1) For operation at maximum values
- 2) V_{g_1} may be obtained from a separate supply, or from R_{g_1} or R_k , or by combination methods
- 3) Obtained preferably from a separate source, or from the anode supply with a voltage divider or through a series resistor
When the tube is keyed, a series screen resistor should not be used. V_{g_2} must not exceed 400 V under key-up conditions
- 4) V_{g_1} may be obtained by means of a grid resistor or from a combination of grid resistor with either fixed supply or cathode resistor
- 5) Obtained preferably from a separate source modulated with the anode supply or from the modulated anode supply through a series resistor

R.F. CLASS C TELEGRAPHY

See also page 3 for derating table

LIMITING VALUES (Absolute limits)

Frequency	f	Continuous			Intermittent		
		C.C.S.	up to 60	up to 60	I.C.A.S.		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_{g2}	=	max.	250	max.	250	V
Grid No. 2 dissipation	W_{g2}	=	max.	3	max.	3	W
Negative grid No. 1 voltage	$-V_{g1}$	=	max.	150	max.	150	V
Grid No. 1 current	I_{g1}	=	max.	3.5	max.	4	mA
Peak heater to cathode voltage	V_{kfp}	=	max.	135	max.	135	V
Grid No. 1 circuit resistance	R_{g1}	=	max.	30	max.	30	$k\Omega^1)$

OPERATING CONDITIONS

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

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

OPERATING CONDITIONS

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

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_{g2}	= max.	250	V
Grid No.2 dissipation	W_{g2}	= max.	3	W
Peak heater to cathode voltage	V_{kfp}	= max.	135	V
Grid No.1 circuit resistance	R_{g1}	= max.	100	k Ω

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

V_a	=	600	500	400	V
V_{g2}	=	180	185	190	V ¹⁾
V_{g1}	=	-45	-40	-40	V ²⁾
$R_{aa\sim}$	=	7000	5500	4000	Ω
V_{g1g1p}	=	0 90	0 80	0 80	V
I_a	=	2x13 2x100	2x29 2x108	2x32 2x114	mA
I_{g2}	=	2x0.5 2x12	2x1 2x13	2x1.3 2x13	mA
W_{ig1}	=	0 0	0 0	0 0	W
W_{g2}	=	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_{g2}	=	max.	3	W
Peak heater to cathode voltage	V_{kfp}	=	max.	135	V
Grid No.1 circuit resistance	R_{g1}	=	max.	100	$k\Omega^1)$

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

Anode voltage	V_a	=	750	600	V	
Grid No.2 voltage	V_{g2}	=	195	200	$V^2)$	
Grid No.1 voltage	V_{g1}	=	-50	-50	$V^1)$	
Load resistance	$R_{aa\sim}$	=	8000	6000	Ω	
Input A.C. voltage peak to peak	V_{g1g1p}	=	0	100	V	
Anode current	I_a	=	2x12	2x110	2x14	2x115 mA
Grid No.2 current	I_{g2}	=	2x0.5	2x13	2x0.5	2x13.5 mA
Grid No.1 input power	W_{ig1}	=	0	0	0	0 W
Grid No.2 dissipation	W_{g2}	=	2x0.1	2x2.5	2x0.1	2x2.7 W
Anode input power	W_{ia}	=	2x8.7	2x82.5	2x8.4	2x69 W
Anode dissipation	W_a	=	2x8.7	2x22.5	2x8.4	2x21.5 W
Output power	W_o	=	0	120	0	95 W
Efficiency	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_{g2}	= max.	250	V
Grid No.2 dissipation	W_{g2}	= max.	3	W
Peak heater to cathode voltage	V_{kfp}	= max.	135	V
Grid No.1 circuit resistance	R_{g1}	= max.	30	$k\Omega^1)$

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

V_a	=	600	500	400	V
V_{g2}	=	165	175	175	$V^2)$
V_{g1}	=	-44	-44	-41	$V^1)$
$R_{aa \sim}$	=	6800	4600	3700	Ω
V_{g1g1p}	=	0 97	0 102	0 95	V
I_a	=	2x11 2x103	2x13 2x121	2x16 2x116	mA
I_{g2}	=	2x0.3 2x8.5	2x0.3 2x9	2x0.5 2x9	mA
I_{g1}	=	0 2x0.5	0 2x1.0	0 2x0.8	mA
W_{ig1}	=	0 2x0.1	0 2x0.15	0 2x0.1	W
W_{g2}	=	2x0.05 2x1.4	2x0.06 2x1.6	2x0.1 2x1.6	W
W_{ia}	=	2x6.6 2x62	2x6.5 2x60.5	2x6.4 2x46.5	W
W_a	=	2x6.6 2x17	2x6.5 2x19	2x6.4 2x15.5	W
W_o	=	0 90	0 83	0 62	W
η	=	- 72.5	- 68.5	- 66.5	%

¹⁾ Under these conditions only fixed bias is recommended²⁾ Obtained preferably from a separate source or from the anode supply using a voltage divider

A.F. CLASS AB AMPLIFIER AND MODULATOR with grid current (continued)**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

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

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 recommended²⁾ 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_{kfp} = max. 135	max. 135 V
Grid No.1 circuit resistance	R_{g1} = max. 100	max. 100 $k\Omega^1)$
Grid No.1 circuit resistance	R_{g1} = max. 500	max. 500 $k\Omega^1)$

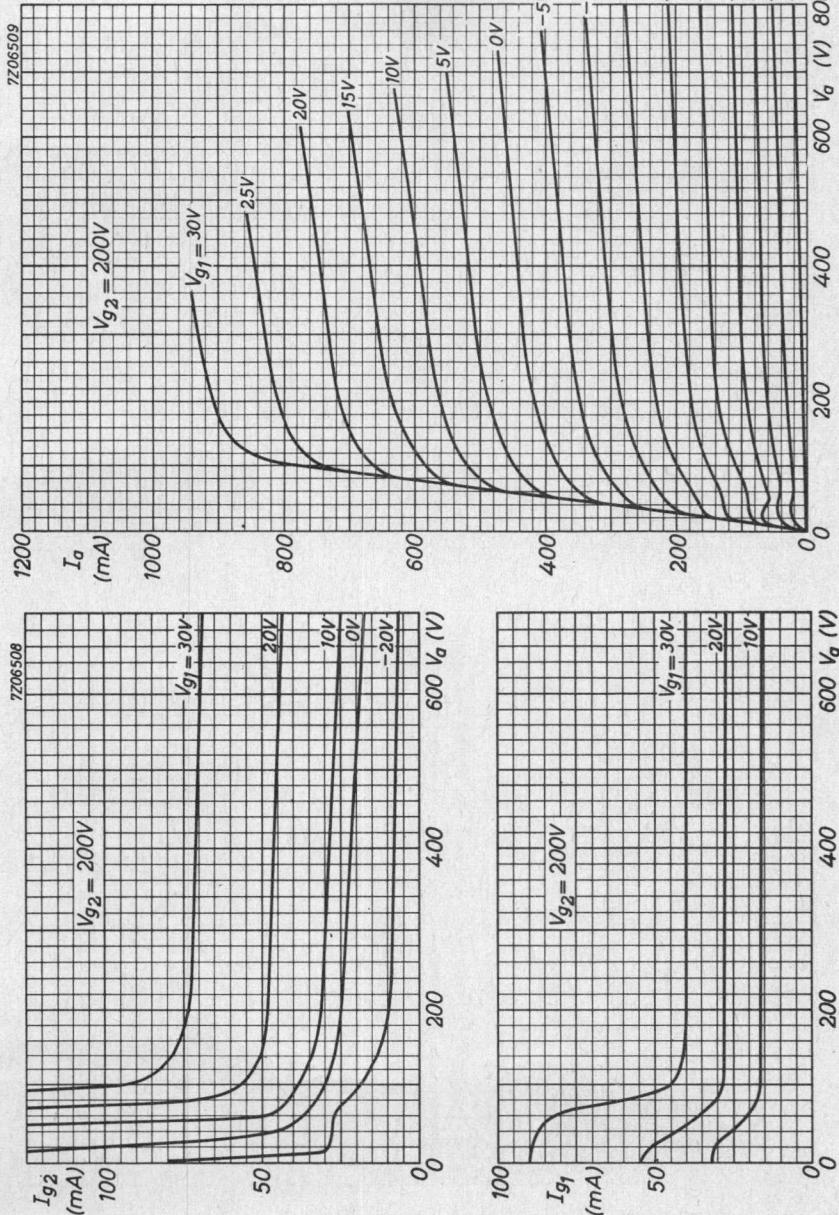
C.C.S. OPERATING CONDITIONS, continuous service; two tubes ($I_{g1} = 0$)

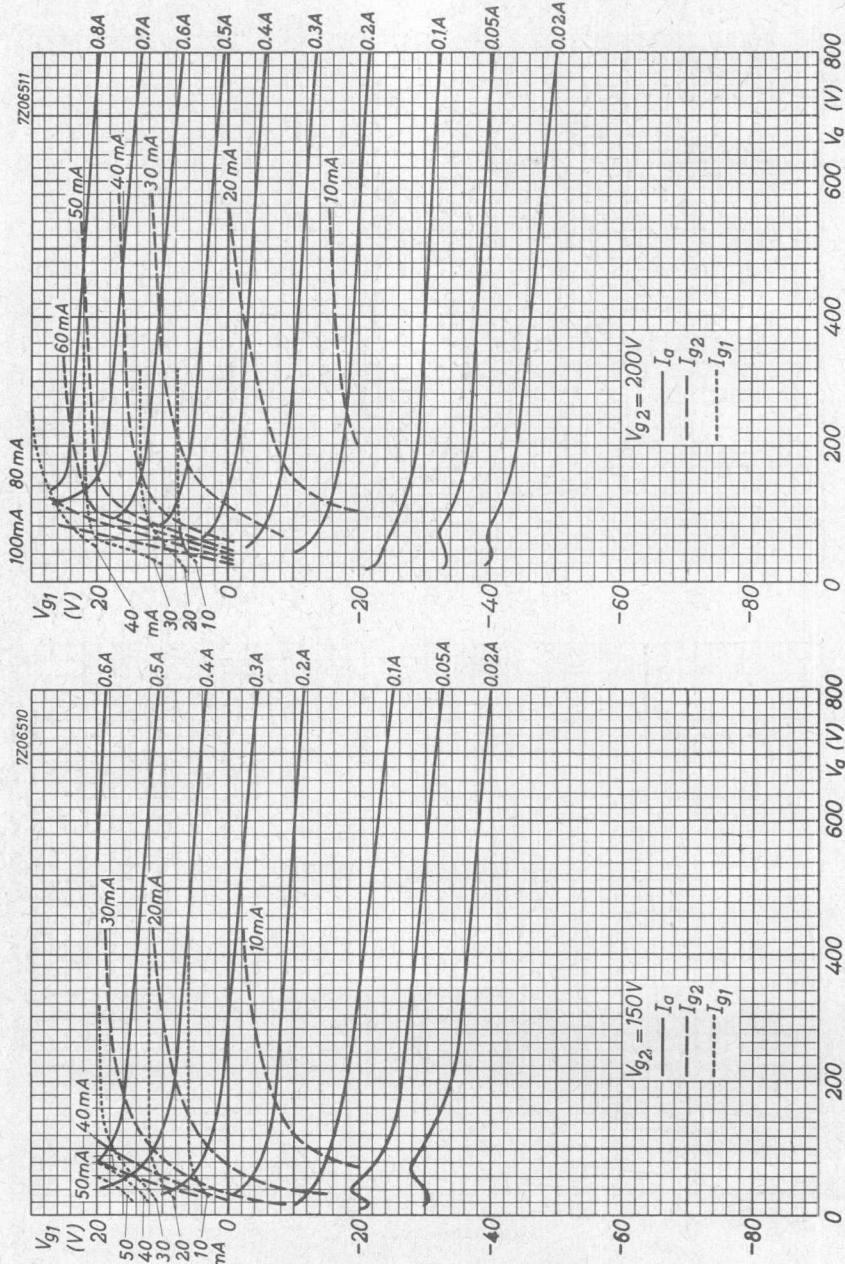
Anode voltage	V_a	=	400	250	V
Grid No.1 voltage	V_{g1}	=	-100	-50	V
Load resistance	$R_{aa\sim}$	=	8000	5000	Ω
Peak grid to grid voltage	V_{ggp}	=	0 200	0 100	V
Anode current	I_a	=	2x20 2x50	2x60 2x62	mA
Anode input power	W_{ia}	=	2x8 2x20	2x15 2x15.5	W
Anode dissipation	W_a	=	2x8 2x9	2x15 2x10.5	W
Output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

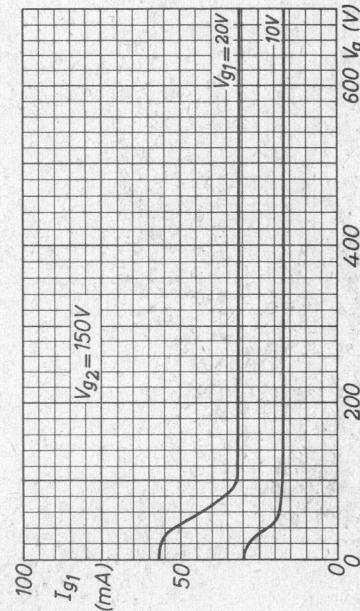
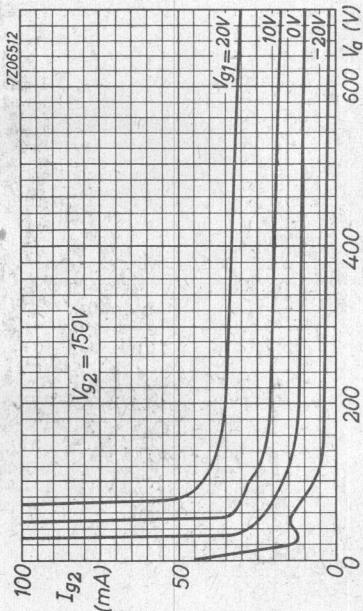
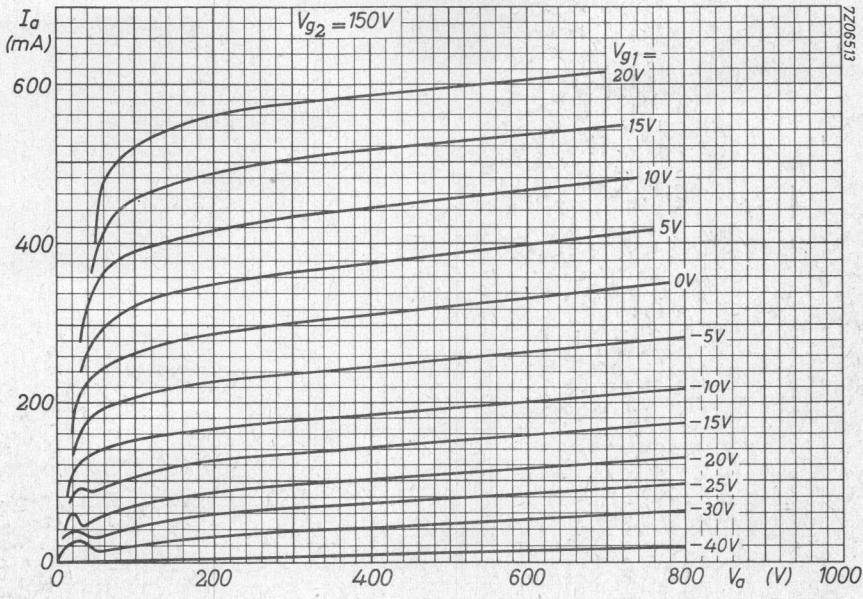
I.C.A.S. OPERATING CONDITIONS, intermittent service; two tubes

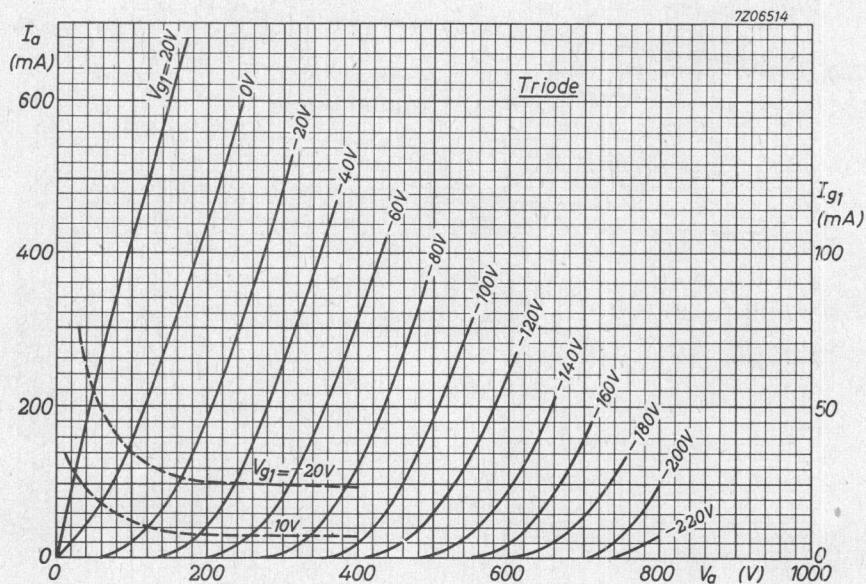
Anode voltage	V_a	=	400	V
Grid No.1 voltage	V_{g1}	=	-100	V
Load resistance	$R_{aa\sim}$	=	8000	Ω
Peak grid to grid voltage	V_{ggp}	=	0 200	V
Anode current	I_a	=	2x20 2x50	mA
Anode input power	W_{ia}	=	2x8 2x20	W
Anode dissipation	W_a	=	2x8 2x9	W
Output power	W_o	=	0 22	W
Efficiency	η	=	-	55 %

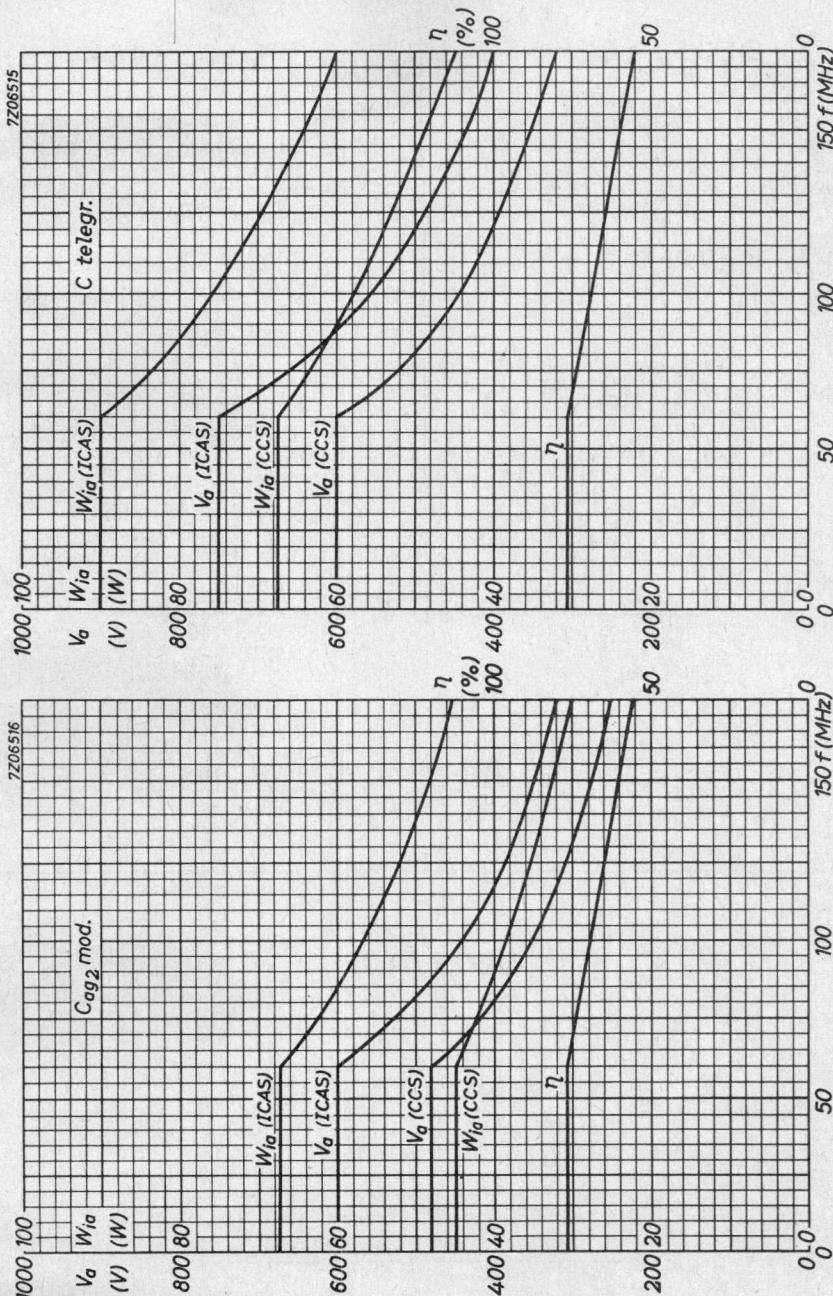
¹) For values of R_{g1} exceeding 100 $k\Omega$, cathode bias is required









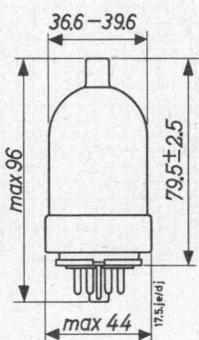


QE05/40F

Heater voltage $V_f = 12.6$ V
Heater current $I_f = 0.625$ A

MECHANICAL DATA

Base: Octal 8 p.

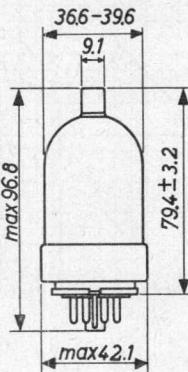


QE05/40K

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

$$\text{Heater voltage} \quad V_f = 6.3 \text{ V}$$

$$\text{Heater current} \quad I_f = 3.9 \text{ A}$$

COOLING: radiation and convection

CAPACITANCES

Anode to all other elements except grid No.1

$$C_a = 12.7 \text{ pF}$$

Grid No.1 to all other elements except anode

$$C_{g1} = 30 \text{ pF}$$

Anode to grid No.1

$$C_{ag1} < 0.9 \text{ pF}$$

TYPICAL CHARACTERISTICS

Anode voltage

$$V_a = 750 \text{ V}$$

Grid No.2 voltage

$$V_{g2} = 250 \text{ V}$$

Anode current

$$I_a = 100 \text{ mA}$$

Mutual conductance

$$S = 9 \text{ mA/V}$$

Amplification factor of grid No.2

with respect to grid No.1

$$\mu_{g2g1} = 5.7$$

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

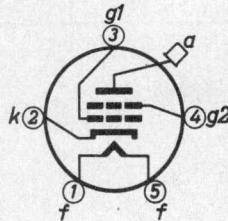
Base : giant 5p

Socket : 2422 512 01001

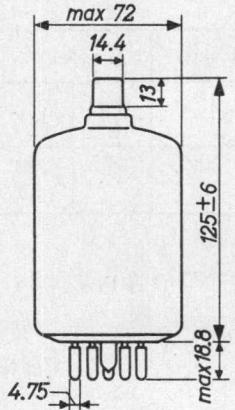
Top cap : IEC 67-III-1b, type 3

Anode connector : 40680

Net weight: 220 g



Dimensions in mm



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

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

Frequency	f	up to	30	MHz
Anode voltage	V _a	= max.	1100	V
Anode input power	W _{ia}	= max.	400	W
Anode dissipation	W _a	= max.	100	W
Anode current	I _a	= max.	400	mA
Grid No. 2 voltage	V _{g2}	= max.	300	V
Grid No. 2 dissipation	W _{g2}	= max.	12	W
Negative grid No. 1 voltage	-V _{g1}	= max.	150	V
Grid No. 1 current	I _{g1}	= max.	30	mA
Grid No. 1 circuit resistance	R _{g1}	= max.	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 _{g2}	=	250	250	V
Grid No. 1 voltage	V _{g1}	=	-90	-90	V
Anode current	I _a	=	385	385	mA
Grid No. 2 current	I _{g2}	=	20	20	mA
Grid No. 1 current	I _{g1}	=	7	6	mA
Peak grid No. 1 A.C. voltage	V _{g1p}	=	120	120	V
Anode input power	W _{ia}	=	285	385	W
Grid No. 1 input power	W _{ig1}	=	1.0	1.0	W
Grid No. 2 dissipation	W _{g2}	=	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_{g2}	= max.	300	V
Grid No.2 dissipation	W_{g2}	= max.	10	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 current	I_{g1}	= max.	30	mA
Grid No.1 circuit resistance	R_{g1}	= max.	25	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_{g2}	=	250	V
Grid No.1 voltage	V_{g1}	=	-100	V
Anode current	I_a	=	300	mA
Grid No.2 current	I_{g2}	=	20	mA
Grid No.1 current	I_{g1}	=	4	mA
Peak grid No.1 A.C. voltage	V_{g1p}	=	110	V
Anode input power	W_{ia}	=	180	W
Grid No.1 input power	W_{ig1}	=	0.4	W
Grid No.2 dissipation	W_{g2}	=	5	W
Anode dissipation	W_a	=	50	W
Output power	W_o	=	130	W
Efficiency	η	=	72	%
Modulation factor	m	=	100	%
Peak grid No.2 A.C. voltage	V_{g2p}	=	220	V ¹⁾
Modulation power	W_{mod}	=	90	W

1) Obtained from a separate winding on the modulation transformer

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V _a	= max.	825	V
Anode input power	W _{ia}	= max.	250	W
Anode dissipation	W _a	= max.	100	W
Anode current	I _a	= max.	400	mA
Grid No.2 voltage	V _{g2}	= max.	350	V
Grid No.2 dissipation	W _{g2}	= max.	12	W
Grid No.1 circuit resistance	R _{g1}	= 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 _{g2}	=	310	V
Grid No.1 voltage	V _{g1}	=	-45	V ¹⁾
Peak grid No.1 A.C. voltage	V _{g1p}	=	0	45 ²⁾ V
Anode current	I _a	=	130	270 mA
Grid No.2 current	I _{g2}	=	<5	26 mA
Grid No.1 current	I _{g1}	=	0	0 mA
Anode input power	W _{ia}	=	98	200 W
Grid No.1 dissipation	W _{g1}	=	0	0 W
Grid No.2 dissipation	W _{g2}	=	1.5	8 W
Anode dissipation	W _a	=	98	90 W
Output power	W _o	=	0	220 W ³⁾
Efficiency	η	=	-	55 %

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

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

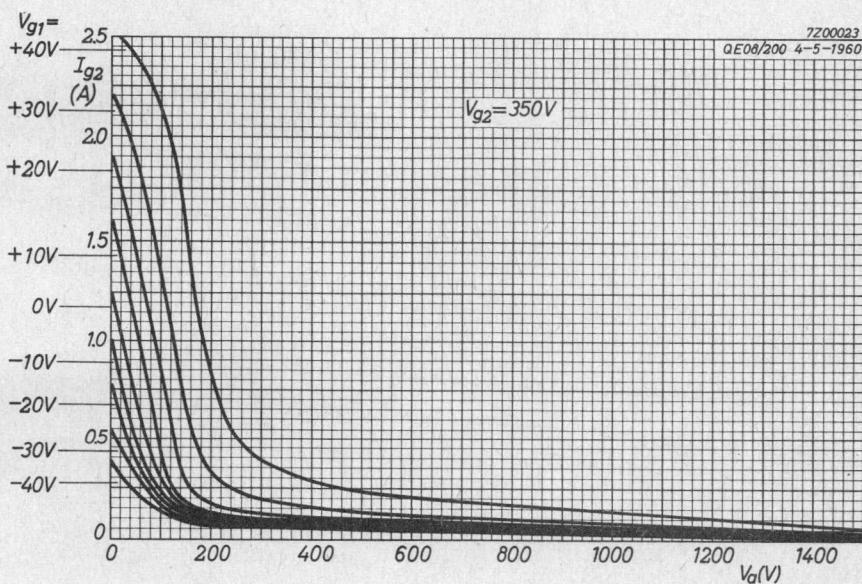
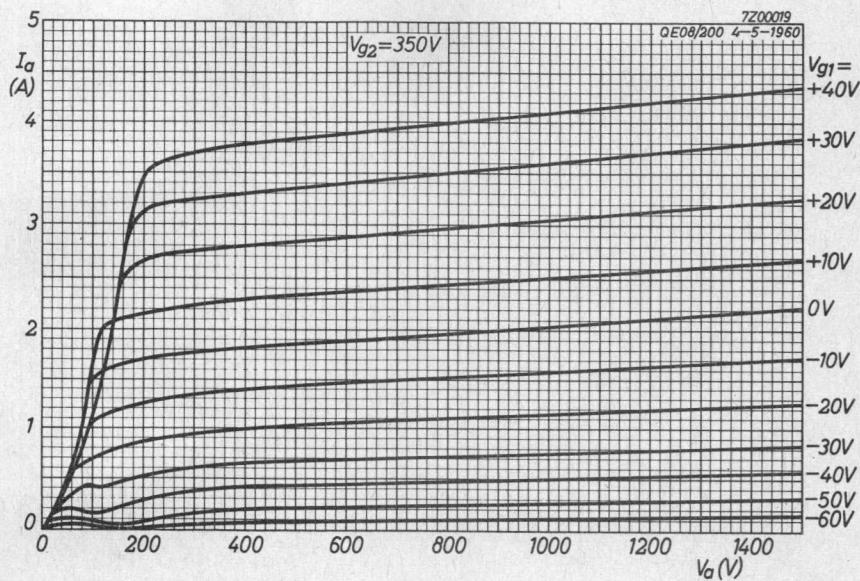
3) Peak envelope power

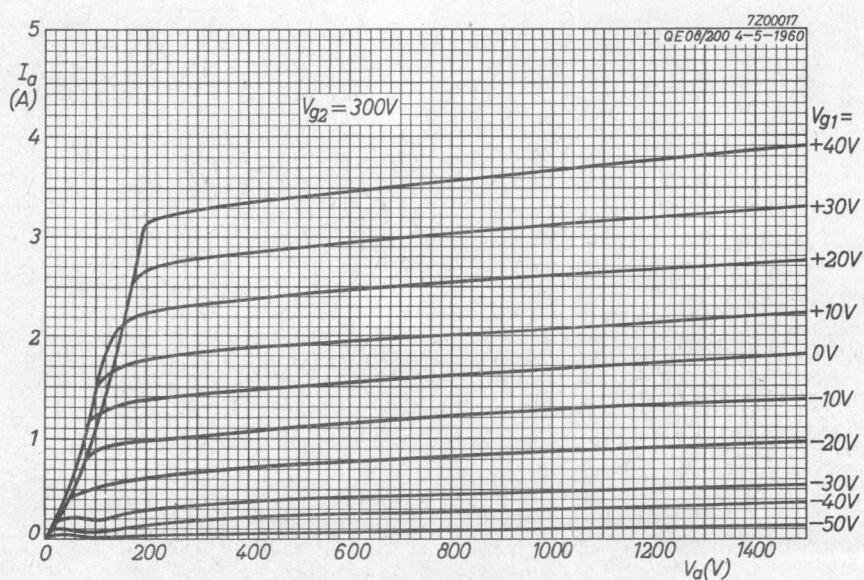
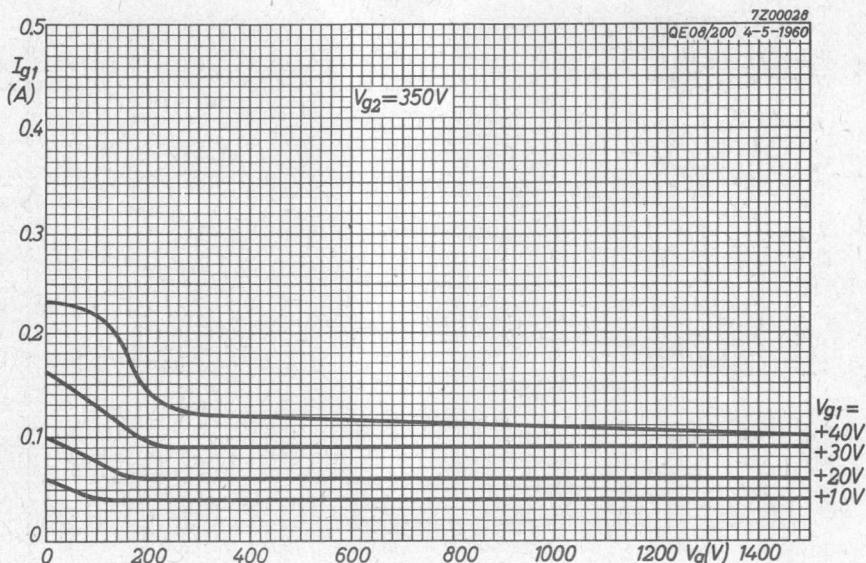
A.F. CLASS B AMPLIFIER**LIMITING VALUES (Absolute limits)**

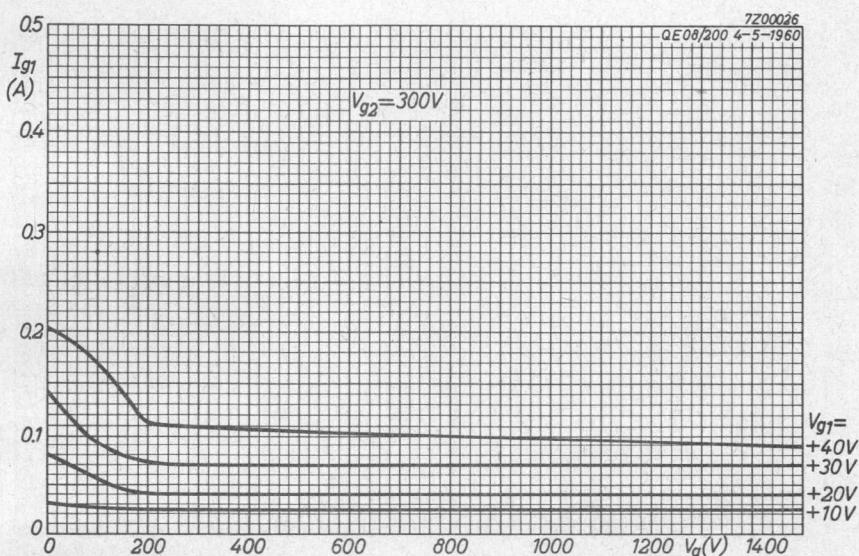
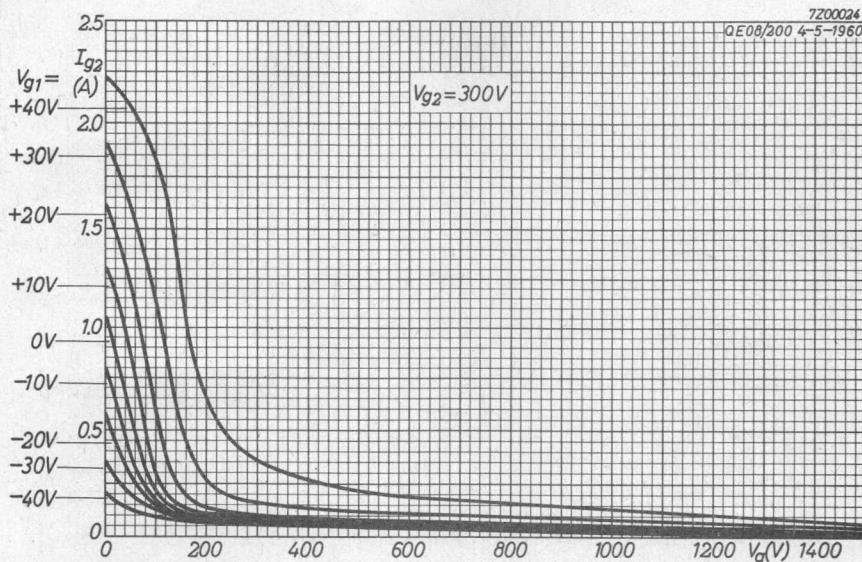
Anode voltage	V_a	= max.	825	V
Anode dissipation	W_a	= max.	100	W
Anode current	I_a	= max.	400	mA
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	30	mA
Grid No.1 circuit resistance	R_{g_1}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

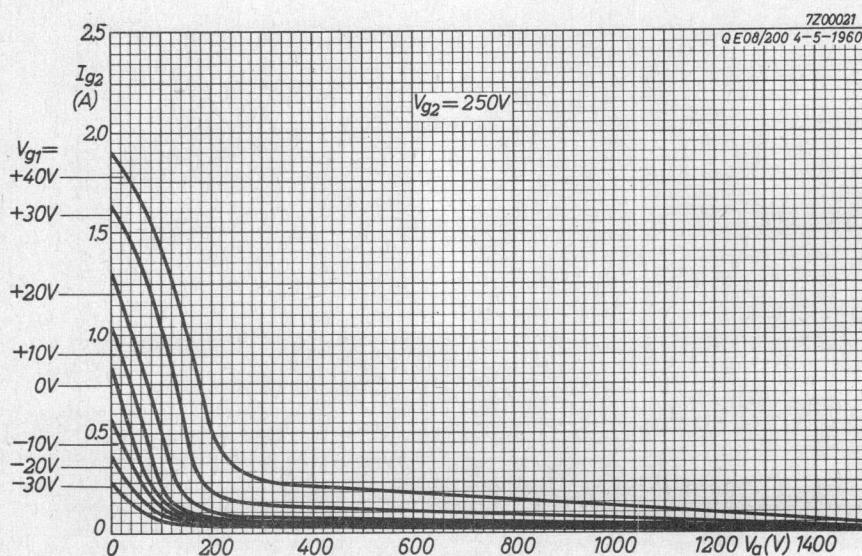
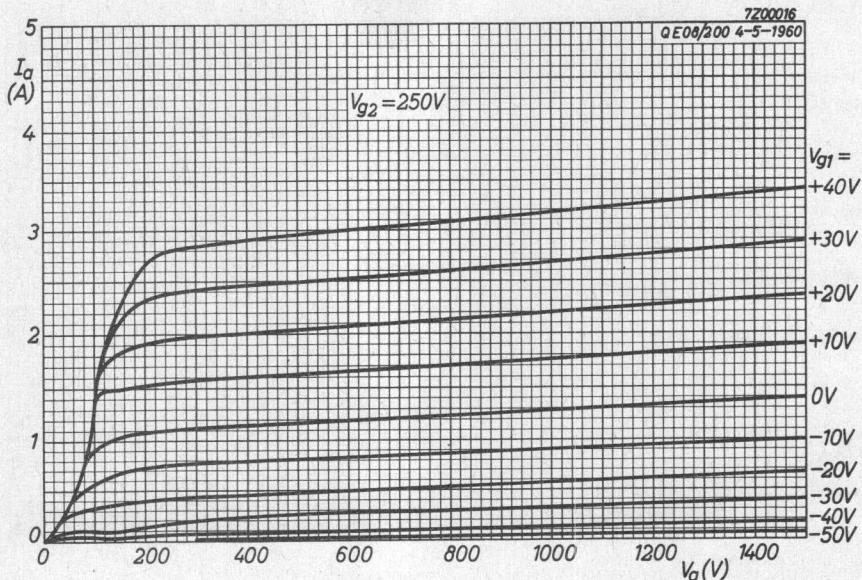
OPERATING CONDITIONS, two tubes

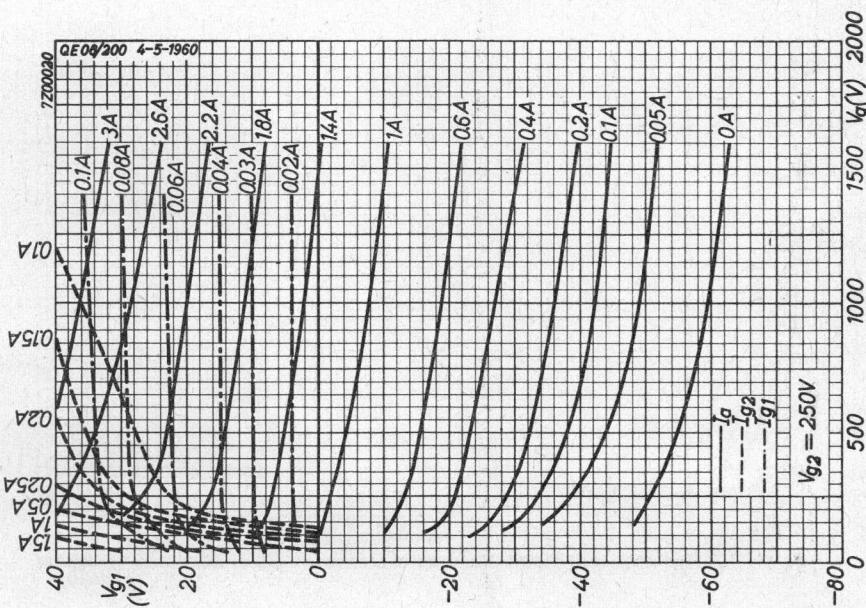
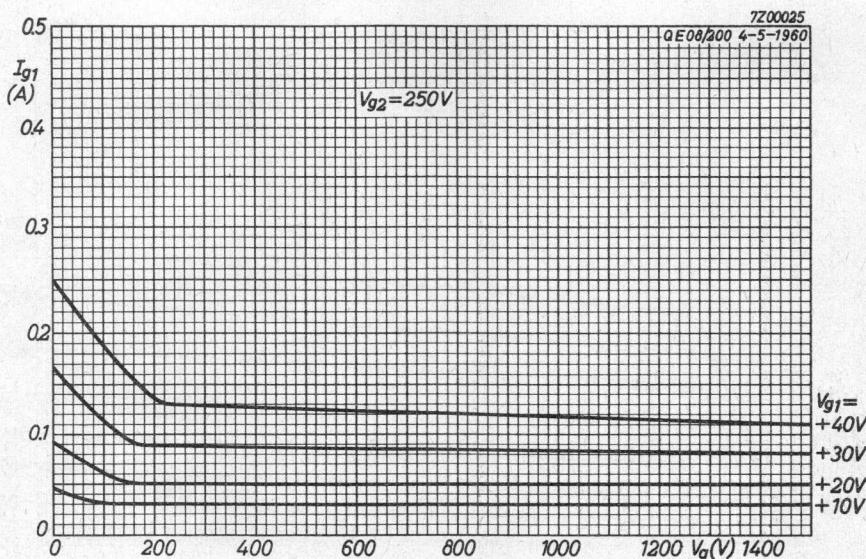
Anode voltage	V_a	=	750	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-45	-45	V
Load resistance	$R_{aa\sim}$	=	3600	3500	Ω
Peak grid to grid voltage	$V_{g_1g_1p}$	=	0 110	0 105	V
Anode current	I_a	=	2x45 2x280	2x25 2x235	mA
Grid No.2 current	I_{g_2}	=	0 2x40	2x0.5 2x24	mA
Grid 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	%

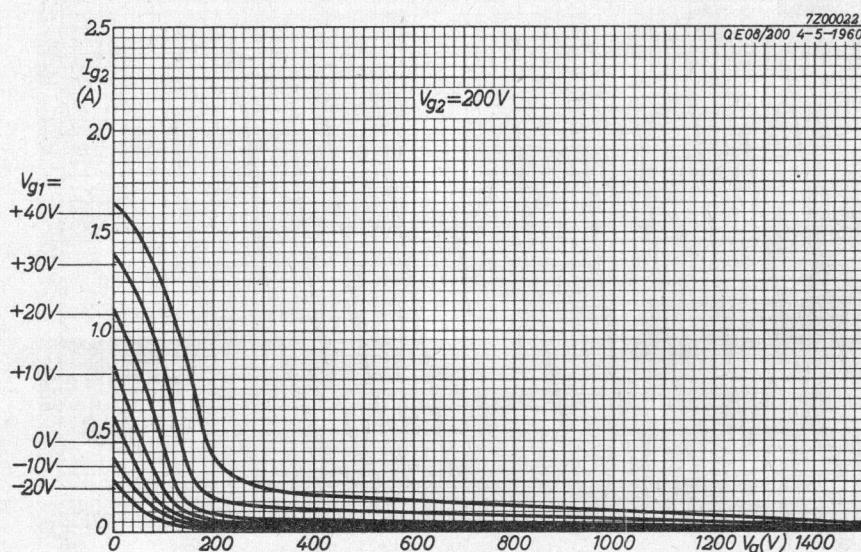
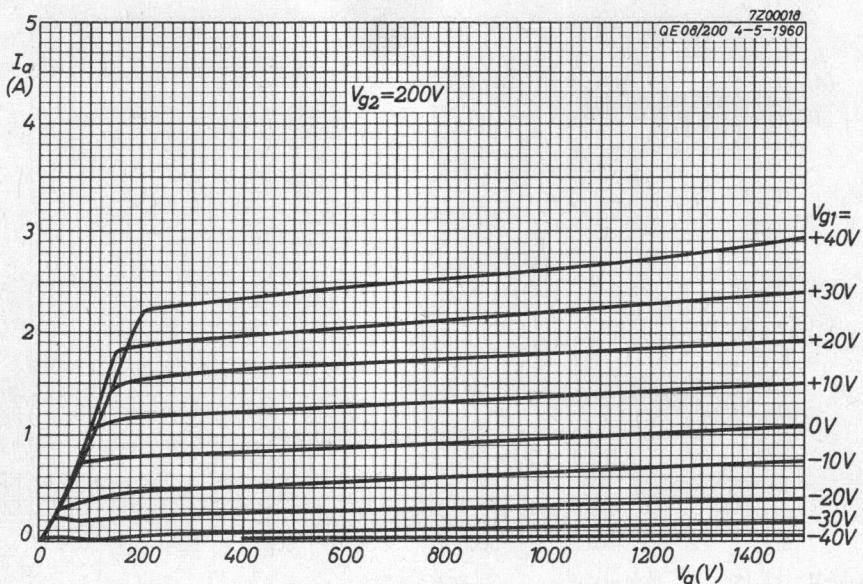


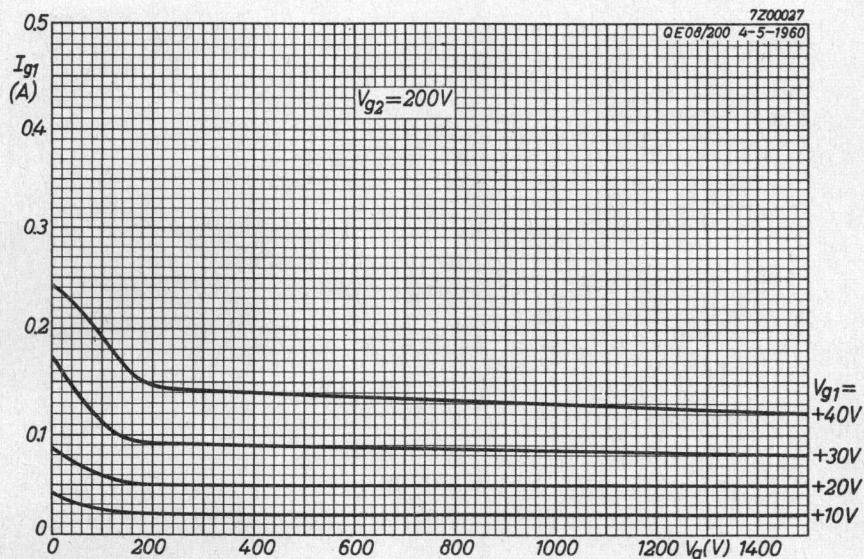












R.F. BEAM POWER TETRODE

HEATING: indirect

Heater voltage

 $V_f = 26.5 \text{ V}$

Heater current

 $I_f = 0.85 \text{ A}$

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

FORCED AIR COOLED R.F. POWER TETRODE**QUICK REFERENCE DATA**

Freq. (MHz)	C telegr.		C_{ag_2} mod.		AB mod.		
	V _a (V)	W _o (W)	V _a (V)	W _o (W)	V _a (V)	W _o ¹⁾ (W)	W _o ²⁾ (W)
< 150	2000	370	1600	230	2000	580	630
	1500	260	1200	160		1500	400
165	1250	195	1000	140	1000	230	270
	1000	150	800	100		800	170
500	750	110	600	80			
	600	85	400	55			
500	1250	170					
	1000	120					
	800	95					
	600	50					

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

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

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

Heater voltage	$V_f = 6.0 \text{ V}$
Heater current	$I_f = 2.6 \text{ A}$
Waiting time	$T_w = \text{min. } 30 \text{ sec}$

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	$\leq 300 \text{ MHz}$	300-400 MHz	400-500 MHz
V_f	6.0 V	5.75 V	5.5 V

1) Without grid current, two tubes

2) With grid current, two tubes

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

COOLING

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

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

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

W_a	h	t_i	q_{min}	p_i ¹⁾
250 W	0 m	20 °C	0.16 m ³ /min	12 mm H ₂ O

TEMPERATURE LIMITS (Absolute limits)

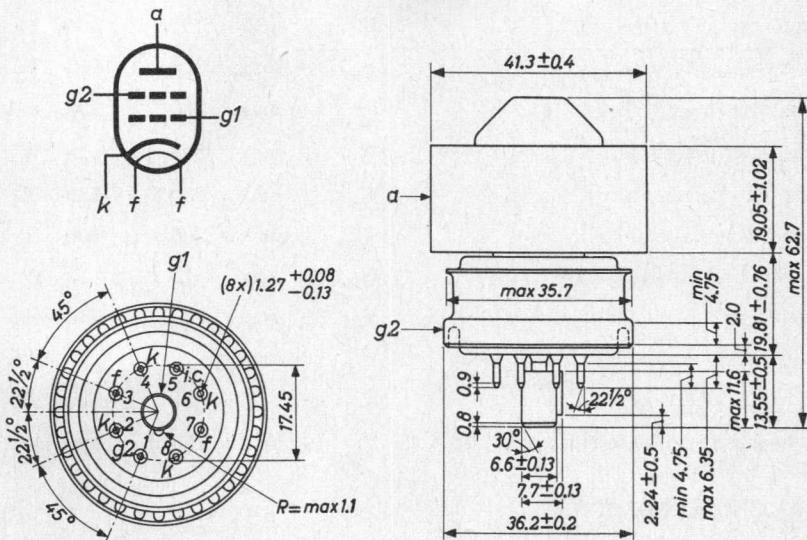
Anode temperature	max. 250 °C	²⁾
Anode seal temperature	max. 200 °C	
Base seals and grid No.2 seal temperature	max. 175 °C	

¹⁾ Pressure drop in cavities etc. excluded

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

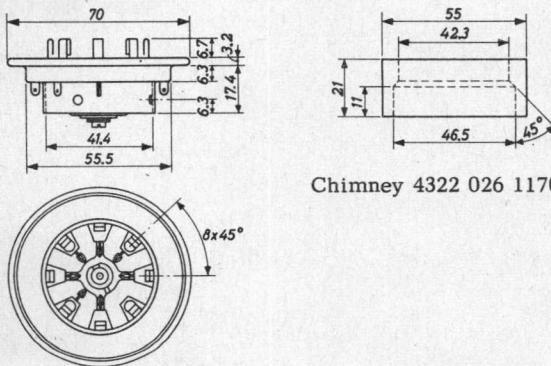
MECHANICAL DATA (Dimensions in mm)

Net weight: 130 g



Mounting position: arbitrary

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



Socket 2422 513 01001

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

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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

Frequency	f	<	150	150	MHz
Anode voltage	V_a	=	2000	1500	V
Grid No.2 voltage	V_{g2}	=	250	250	V
Grid No.1 voltage	V_{g1}	=	-88	-88	V
Peak grid No.1 A.C. voltage	V_{g1p}	=	110	110	V
Anode current	I_a	=	250	250	mA
Grid No.2 current	I_{g2}	=	24	24	mA
Grid No.1 current	I_{g1}	=	8	8	mA
Grid No.1 input power	W_{ig1}	=	2.5	1.5	W
Anode input power	W_{ia}	=	500	375	W
Anode dissipation	W_a	=	130	115	W
Output power	W_o	=	370	260	W

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

OPERATING CONDITIONS (continued)

Frequency	f	=	165	165	165	165	MHz
Anode voltage	V _a	=	1250	1000	750	600	V
Grid No.2 voltage	V _{g2}	=	250	250	250	250	V
Grid No.1 voltage	V _{g1}	=	-90	-80	-80	-75	V
Peak grid No.1 A.C. voltage	V _{g1p}	=	106	95	96	91	V
Anode current	I _a	=	200	200	200	200	mA
Grid No.2 current	I _{g2}	=	20	31	37	37	mA
Grid No.1 current	I _{g1}	=	11	10	11	11	mA
Grid No.1 input power	W _{ig1}	=	1.2	1.0	1.0	1.0	W
Anode input power	W _{ia}	=	250	200	150	120	W
Anode dissipation	W _a	=	55	50	40	35	W
Output power	W _o	=	195	150	110	85	W

	f	=	With coaxial cavity				MHz
			500	500	500	500	
Frequency	f	=	500	500	500	500	MHz
Anode voltage	V _a	=	1250	1000	800	600	V
Grid No.2 voltage	V _{g2}	=	280	250	250	250	V
Grid No.1 voltage	V _{g1}	=	-90	-110	-110	-110	V
Anode current	I _a	=	250	200	200	170	mA
Grid No.2 current	I _{g2}	=	6	7	7	6	mA
Grid No.1 current	I _{g1}	=	12	10	10	6	mA
Driver output power	W _{dr}	=	30	25	20	15	W
Anode input power	W _{ia}	=	312	200	160	102	W
Anode dissipation	W _a	=	142	80	65	52	W
Output power	W _o	=	170	120	95	50	W

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

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

OPERATING CONDITIONS (continued)

Frequency	f	=	165	165	165	165	MHz
Anode voltage	V _a	=	1000	800	600	400	V
Grid No. 2 voltage	V _{g2}	=	250	250	250	250	V
Grid No. 1 voltage	V _{g1}	=	-105	-100	-95	-90	V ¹⁾
Peak grid No. 1 A.C. voltage	V _{g1p}	=	125	120	120	110	V
Anode current	I _a	=	200	200	200	200	mA
Grid No. 2 current	I _{g2}	=	20	25	30	35	mA
Grid No. 1 current	I _{g1}	=	15	10	8	7	mA
Grid No. 1 input power	W _{ig1}	=	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 _{g2p}	=	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	500	MHz
Anode voltage	V_a	=	2000	2000	V
Grid No. 2 voltage	V_{g_2}	=	300	300	V
Grid No. 1 voltage	V_{g_1}	=	-47	-47	V
Load resistance	$R_{a\sim}$	=	4200	4200	Ω
		zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	V_{g1p}	=	0	47	47 V
Anode current	I_a	=	75	250	160 mA
Grid No. 2 current	I_{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	MHz
Anode voltage	V_a	=	1500	V
Grid No. 2 voltage	V_{g2}	=	300	V
Grid No. 1 voltage	V_{g1}	=	-45	V
Load resistance	$R_{a\sim}$	=	2900	Ω
				1850
				double tone signal
				single tone signal
				zero signal
Peak grid No. 1 A.C. voltage	V_{g1P}	=	0	45
Anode current	I_a	=	75	250
Grid No. 2 current	I_{g2}	=	-2	-4
Grid No. 1 current	I_{g1}	=	0	0
Grid No. 1 input power	W_{ig1}	=	0	0
Anode input power	W_{ia}	=	115	375
Anode dissipation	W_a	=	115	155
Output power	W_o	=	0	220
Peak envelope power	$W_o(PEP)$	=	-	220
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 _{g2}	=	300	V
Grid No. 1 voltage	V _{g1}	=	-50	V
Load resistance	R _{aa~}	=	6570	Ω
Peak grid to grid A.C. voltage	V _{g1g1p}	=	0 100	V
Anode current	I _a	=	2x50	2x228 mA
Grid No. 2 current	I _{g2}	=	-	2x21 mA
Grid No. 2 dissipation	W _{g2}	=	-	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	V
Grid No. 2 voltage	V _{g2}	=	300	V
Grid No. 1 voltage	V _{g1}	=	-43	V
Load resistance	R _{aa~}	=	4250	4400 Ω
Peak grid to grid A.C. voltage	V _{g1g1p}	=	0 86	0 80 V
Anode current	I _a	=	2x82.5	2x225 2x105 2x218 mA
Grid No. 2 current	I _{g2}	=	-	2x26 - 2x38 mA
Grid No. 2 dissipation	W _{g2}	=	-	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 _{g₂}	= max.	400	V
Grid No.2 dissipation	W _{g₂}	= max.	12	W
Grid No.1 dissipation	W _{g₁}	= max.	2	W
Grid No.1 circuit resistance (each tube)	R _{g₁}	= max.	100	kΩ
Peak cathode to heater voltage	V _{kfp}	= max.	150	V

OPERATING CONDITIONS (two tubes)

Anode voltage	V _a	=	2000	V
Grid No.2 voltage	V _{g₂}	=	300	V
Grid No.1 voltage	V _{g₁}	=	-50	V
Load resistance	R _{aa~}	=	8100	Ω
Peak grid to grid A.C. voltage	V _{g₁g_{1p}}	=	0 106	V
Driving power	W _{dr}	=	0 0,2	W
Anode current	I _a	=	2x50 2x250	mA
Grid No.2 current	I _{g₂}	=	- 2x18	mA
Grid No.2 dissipation	W _{g₂}	=	- 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 _{g₂}	=	300	V
Grid No.1 voltage	V _{g₁}	=	-50	V
Load resistance	R _{aa~}	=	5970	Ω
Peak grid to grid A.C. voltage	V _{g₁g_{1p}}	=	0 106	V
Driving power	W _{dr}	=	0 0.2	W
Anode current	I _a	=	2x50	2x250 mA
Grid No.2 current	I _{g₂}	=	-	2x18 mA
Grid No.2 dissipation	W _{g₂}	=	-	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 _{g₂}	=	300	300	V
Grid No.1 voltage	V _{g₁}	=	-45	-40	V
Load resistance	R _{aa~}	=	3950	3140	Ω
Peak grid to grid A.C. voltage	V _{g₁g_{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 _{g₂}	=	-	2x29	- 2x40 mA
Grid No.2 dissipation	W _{g₂}	=	-	2x8.7	- 2x12 W
Anode input power	W _{ia}	=	2x83	2x247	2x84 2x200 W
Anode dissipation	W _a	=	2x83	2x112	2x84 2x93 W
Output power	W _o	=	0 270	0 215	W

R.F. AMPLIFIER, CLASS B TELEVISION SERVICE

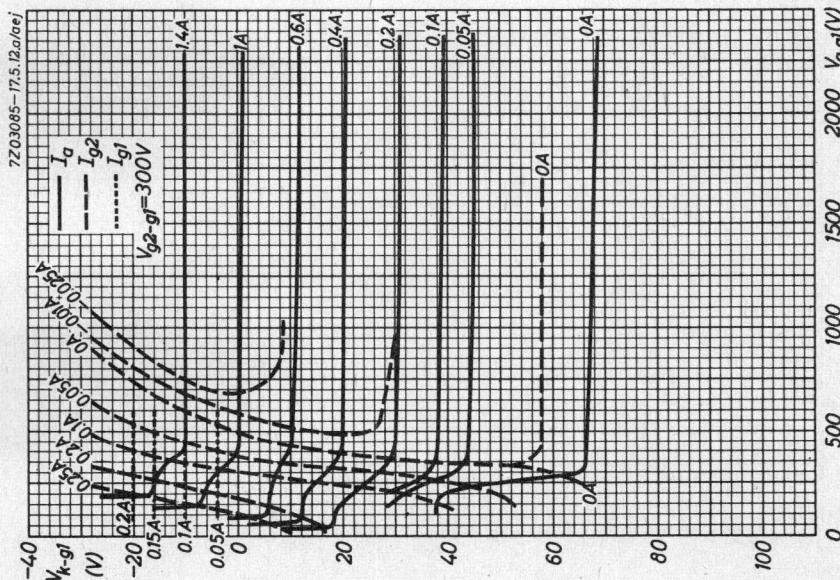
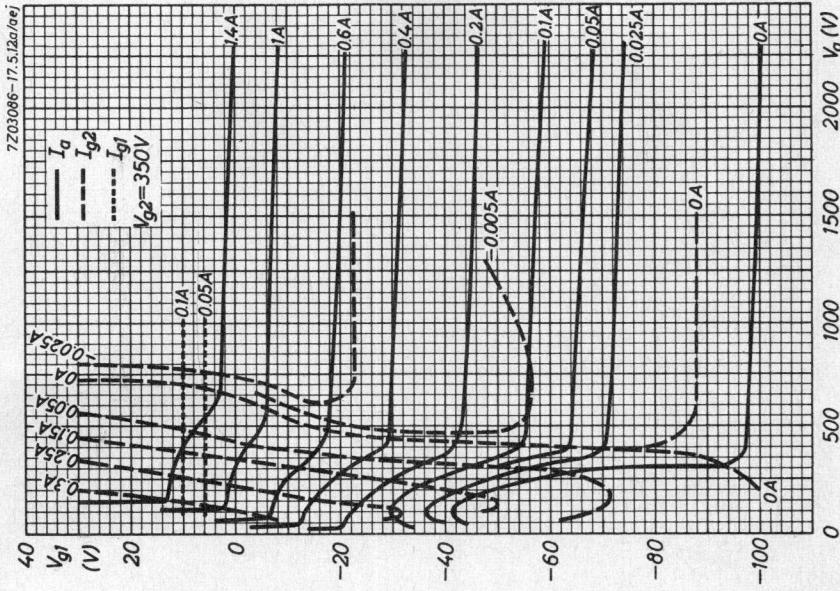
Negative modulation, positive synchronisation

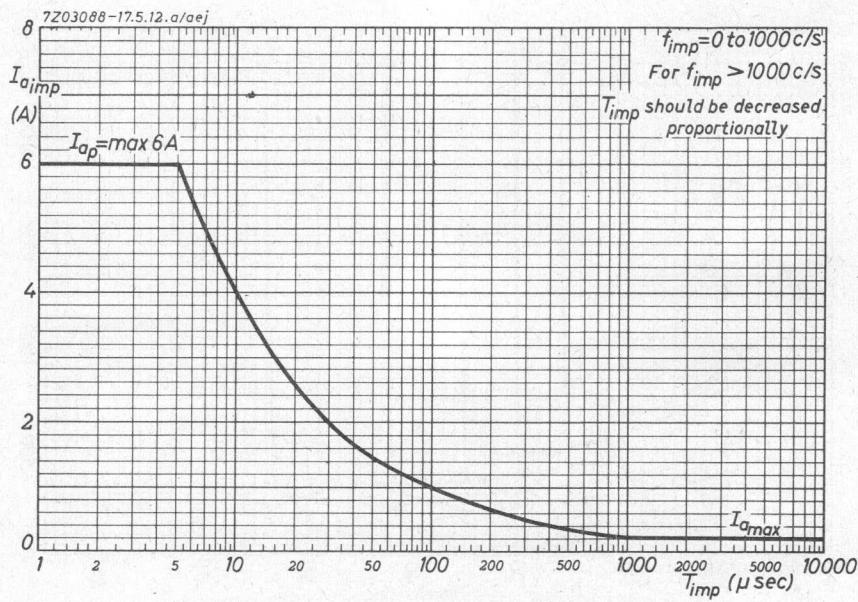
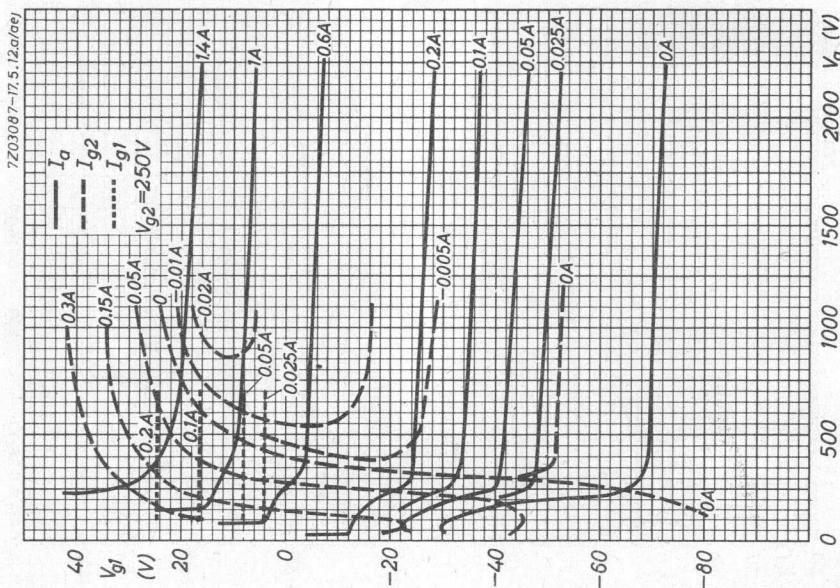
LIMITING VALUES (Absolute limits)

Frequency	f	=	54	to	216	MHz
Anode voltage	V _a	=	max.	1250	V	
Anode current	I _a	=	max.	250	mA	
Anode dissipation	W _a	=	max.	250	W	
Anode input power	W _{ia}	=	max.	500	W	
Grid No.2 voltage	V _{g2}	=	max.	400	V	
Grid No.2 dissipation	W _{g2}	=	max.	12	W	
Negative grid No.1 voltage	-V _{g1}	=	max.	250	V	
Grid No.1 dissipation	W _{g1}	=	max.	2	W	
Grid No.1 circuit resistance	R _{g1}	=	max.	50	kΩ	
Peak cathode to heater voltage	V _{kfp}	=	max.	150	V	

OPERATING CONDITIONS at centre frequency of resonance curve

Frequency	f	=	216	216	216	MHz	
Bandwidth at -1.5 dB	B	=	5	5	5	MHz	
Anode voltage	V _a	=	1250	1000	750	V	
Grid No.2 voltage	V _{g2}	=	300	300	300	V	
Grid No.1 voltage	V _{g1}	=	-70	-65	-60	V	
Peak grid No.1 A.C. voltage	V _{g1p}	sync	=	100	95	85	V
		black	=	75	70	65	V
Anode current	I _a	sync	=	305	330	335	mA
		black	=	230	240	245	mA
Grid No.2 current	I _{g2}	sync	=	45	45	50	mA
		black	=	10	15	20	mA
Grid No.1 current	I _{g1}	sync	=	25	20	15	mA
		black	=	4	4	4	mA
Grid No.1 input power	W _{ig1}	sync	=	9	8	7	W
		black	=	5.5	4.7	4.25	W
Output power	W _o	sync	=	250	200	135	W
		black	=	140	110	75	W





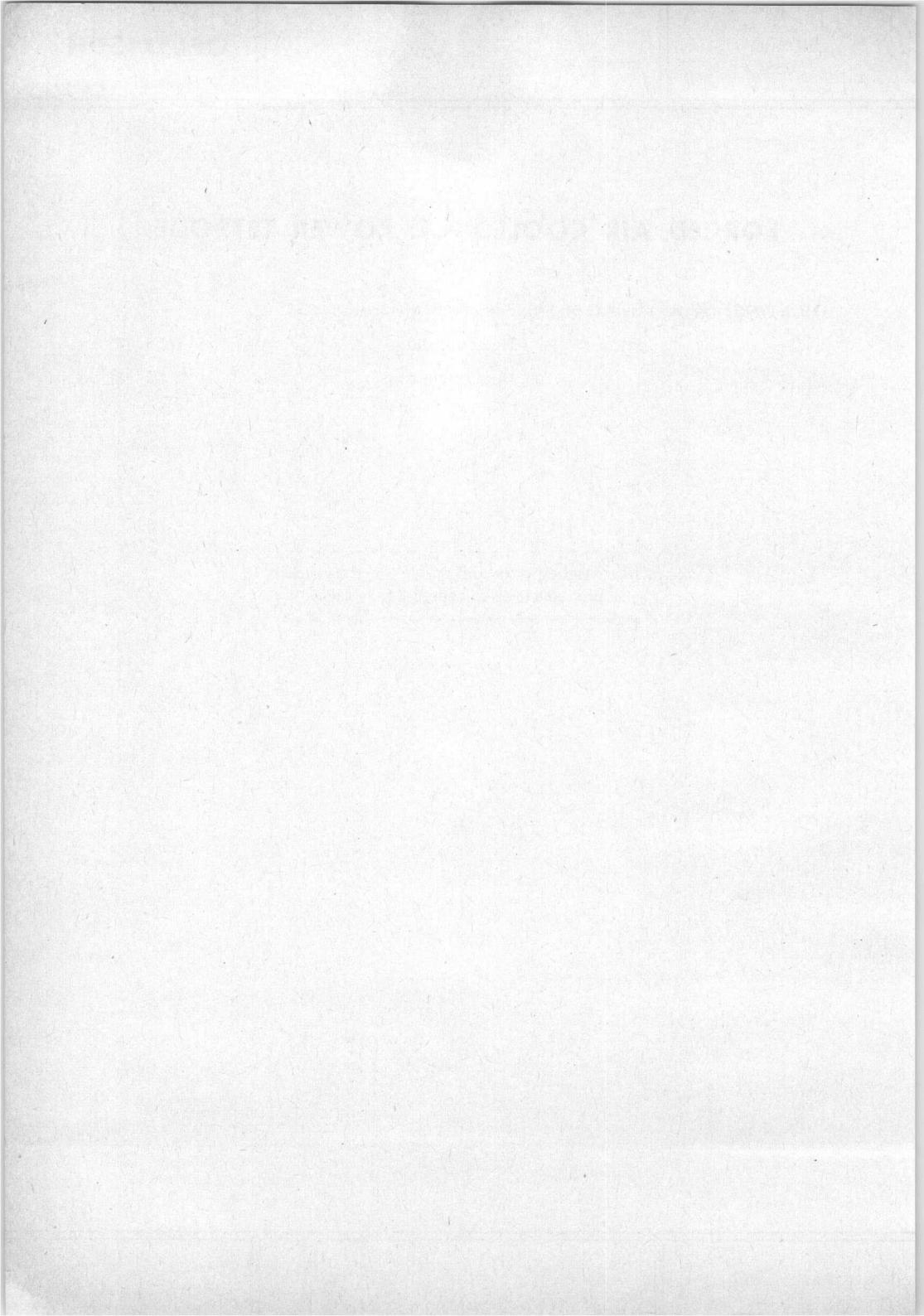
FORCED AIR COOLED R.F. POWER TETRODE

HEATING: indirect by AC or DC; cathode oxide coated

Heater voltage V_f = 26.5 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 _f (W) PEP	V _a (V)	W _o (W)
30	2000	400	2000	105
500			2000	106

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

Heater voltage	V _f	=	6.0 V	±10 %
Heater current at V _f = 6 V	I _f	=	2.6 A	
Cathode heating time	T _w	=	min. 30	s

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

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

TYPICAL CHARACTERISTICS

Anode voltage	V _a	=	500 V	-
Grid No.2 voltage	V _{g2}	=	250 V	300 V
Anode current	I _a	=	200 mA	-
Grid No.2 current	I _{g2}	=	-	50 mA
Mutual conductance	S	=	12 mA/V	-
Amplification factor of grid No.2 with respect to grid No.1	μ_{g2g1}	=	-	4

CAPACITANCES

Anode to all other elements except grid No.1

$$C_a = 4.5 \text{ pF}$$

Grid No.1 to all other elements except anode

$$C_{g1} = 17 \text{ pF}$$

Anode to grid No.1

$$C_{ag_1} = 0.065 \text{ pF}$$

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode core and all seals

max. 250 °C

COOLINGAccessories

Air system socket 2422 513 01001 (air system chimney included)

Air system chimney 4322 026 11701

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

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

Required air flow with air system socket

Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a	h	t_i	q_{min}	P_i
250 W	0 m	20 °C	0.11 m ³ /min	8 mm H ₂ O

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

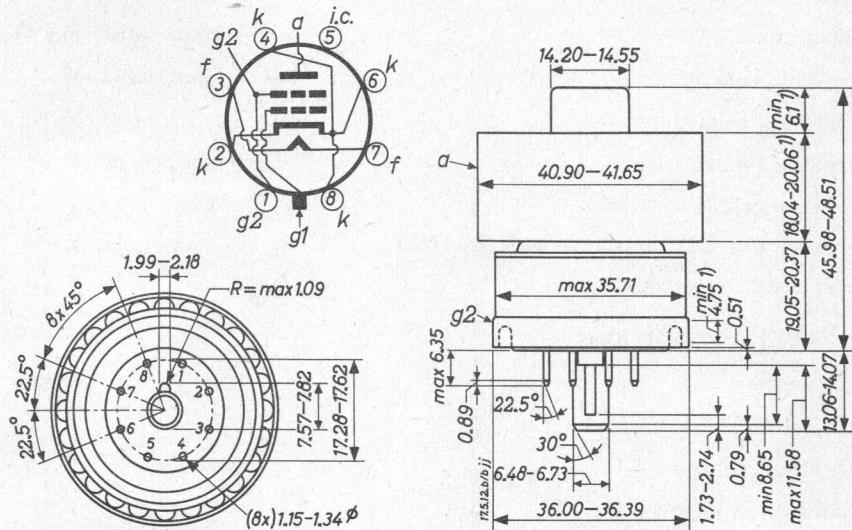
- 1) (Page 4) The limiting value for a signal having a minimum peak to average power ratio less than 2, such as is obtained in single tone operation, is 250 mA. During short periods of circuit adjustment under single tone conditions, the average anode current may be as high as 350 mA
- 2) (Page 4) Automatic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

7Z2 7984

MECHANICAL DATA

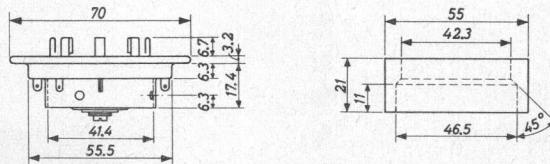
Dimensions in mm

Net weight 120 g

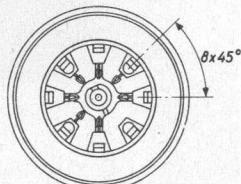


Mounting position: arbitrary

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



Chimney 4322 026 11701



Socket 2422 513 01001

1) Contact surface
7Z2 7996

R.F. SINGLE SIDE BAND AMPLIFIER**LIMITING VALUES** (Absolute max. rating system)

Frequency	f	up to	500	MHz
Anode voltage	V _a	max.	2000	V
Anode current	I _a	max.	350	mA ¹⁾
Anode dissipation	W _a	max.	250	W
Grid No.2 voltage	V _{g2}	max.	500	V
Grid No.2 dissipation	W _{g2}	max.	12	W
Negative grid No.1 voltage	-V _{g1}	max.	250	V
Grid No.1 circuit resistance with fixed bias	R _{g1}	max.	25	kΩ ²⁾
Peak heater to cathode voltage	V _{kfp}	max.	150	V

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V _a	2000	V
Grid No.2 voltage	V _{g2}	400	V
Grid No.1 voltage	V _{g1}	-77	V ⁶⁾
Load resistance	R _{a~}	3050	Ω

		zero signal	single tone	double tone	
Anode current	I _a	70	350	225	mA
Grid No.2 current	I _{g2}	-	35	16	mA
Grid No.1 current	I _{g1}	-	-	0.05	mA
Driving power (PEP)	W _{dr}	-	1	1	W ³⁾
Grid No.2 dissipation	W _{g2}	-	-	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	d ₃	-	-	-21	dB
distortion					
Fifth order intermodulation	d ₅	-	-	-29	dB
distortion					

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

LINEAR R.F. POWER AMPLIFIER - A.M. TELEPHONY**LIMITING VALUES (Absolute limits)**

Frequency	f	up to	500	MHz
Anode voltage	V_a	= max.	2000	V
Anode current	I_a	= max.	180	mA
Anode dissipation	W_a	= max.	250	W
Grid No.2 voltage	V_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 dissipation	W_{g_1}	= max.	2	W
Grid No.1 circuit resistance with fixed bias	R_{g_1}	= max.	25	$k\Omega^1)$
Peak heater to cathode voltage	V_{kf_p}	= max.	150	V

OPERATING CONDITIONS

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

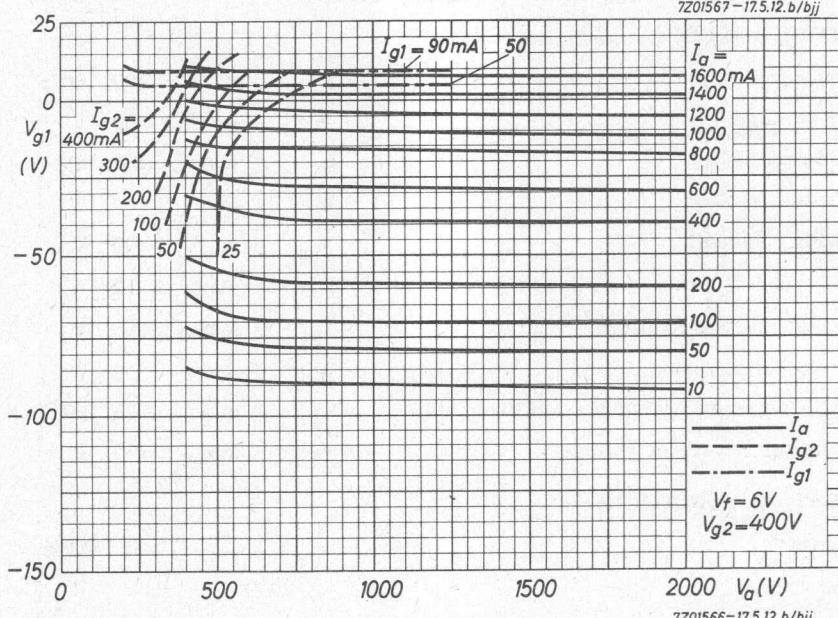
1) Automatic bias is not recommended

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

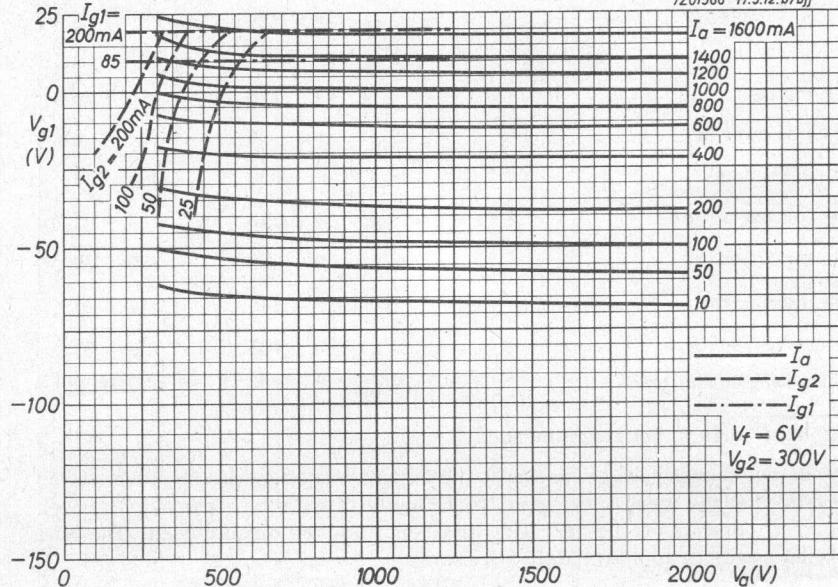
4)5) See page 2

7Z2 7986

7Z01567-17.5.12.b/bjj



7Z01566-17.5.12.b/bjj



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.		Cag 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)
175	2000	390	1500	235	2000	300	2000
	1500	280			1500	215	1500
	1000	190			1000	120	1000
	500	70					240
	500	2000	500	60			
500	2000	250					
216	B television Neg. mod. Pos. synchr.		V _a (V)	W _o sync (W)			
	V _a (V)	W _o sync (W)					
	2000	440					
	1500	300					
	1000	160					

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

Heater voltage V_f = 6.0 V $\pm 10\%$

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

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

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	500	V	-
Grid No.2 voltage	V_{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	$\mu_{g_2 g_1}$	=	-		5.2

TEMPERATURE LIMITS (Absolute limits)

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

COOLING

Accessories

Air system socket 2422 513 01001 (air system chimney included)

Air system chimney 4322 026 11701

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

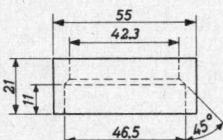
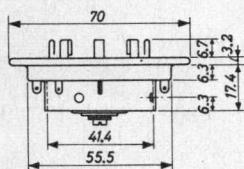
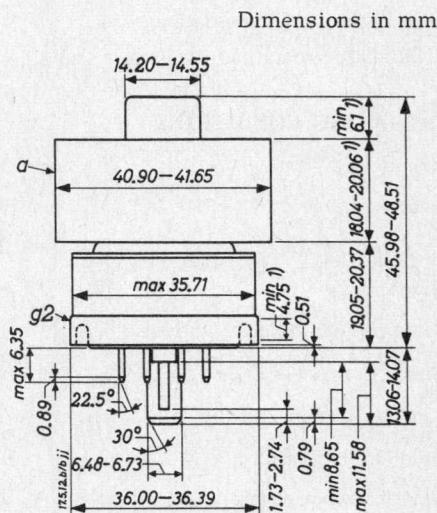
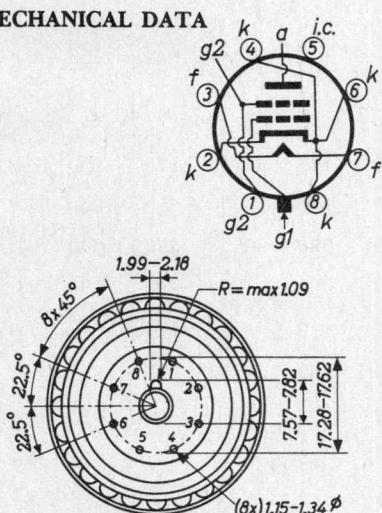
The use of the air system socket is recommended since a standard lock-in socket does not ensure adequate cooling of the base. All four cathode connections should be used.

COOLING (continued)

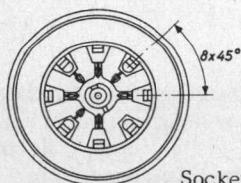
Required air flow with air system socket

Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a 250 W	h 0 m	t_i 20 °C	q_{min} 0.11 m ³ /min	p_i 8 mm H ₂ O

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

MECHANICAL DATA

Chimney 4322 026 11701



Socket 2422 513 01001

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

LIMITING VALUES (Absolute limits)

Frequency	f	up to	500	MHz
Anode voltage	V_a	= max.	2000	V
Anode current	I_a	= max.	250	mA
Anode dissipation	W_a	= max.	250	W
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 dissipation	W_{g_1}	= max.	2	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
Peak heater to cathode voltage	V_{kfp}	= 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_{g1p}	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_{g1p}	=	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_{g2}	= max.	400	V
Grid No.2 dissipation	W_{g2}	= max.	12	W
Grid No.1 circuit resistance	R_{g1}	= 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_{g2}	=	350	350	350	V
Grid No.1 voltage	V_{g1}	=	-55	-55	-55	V
Peak grid No.1 voltage	V_{g1p}	=	0 50	0 50	0 50	V
Anode current	I_a	=	100 250	100 250	100 250	mA
Grid No.2 current	I_{g2}	=	0 10	0 8	0 5	mA
Grid No.1 current	I_{g1}	=	0 0	0 0	0 0	mA
Anode input power	W_{ia}	=	100 250	150 375	200 500	W
Grid No.2 input power	W_{ig2}	=	0 1.75	0 1.4	0 1.4	W
Anode dissipation	W_a	=	100 130	150 160	200 200	W
Output power	W_o	=	0 120	0 215	0 300	W
Anode current	I_a	=	- 190	- 190	- 190	mA ¹⁾
Grid No.2 current	I_{g2}	=	- 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_{g2}	=	max.	400	V
Grid No.2 dissipation	W_{g2}	=	max.	12	W
Negative grid No.1 voltage	$-V_{g1}$	=	max.	250	V
Grid No.1 dissipation	W_{g1}	=	max.	2	W
Peak heater to cathode voltage	V_{kfp}	=	max.	150	V

OPERATING CONDITIONS

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

1) Averaged over any frame

2) See page 4

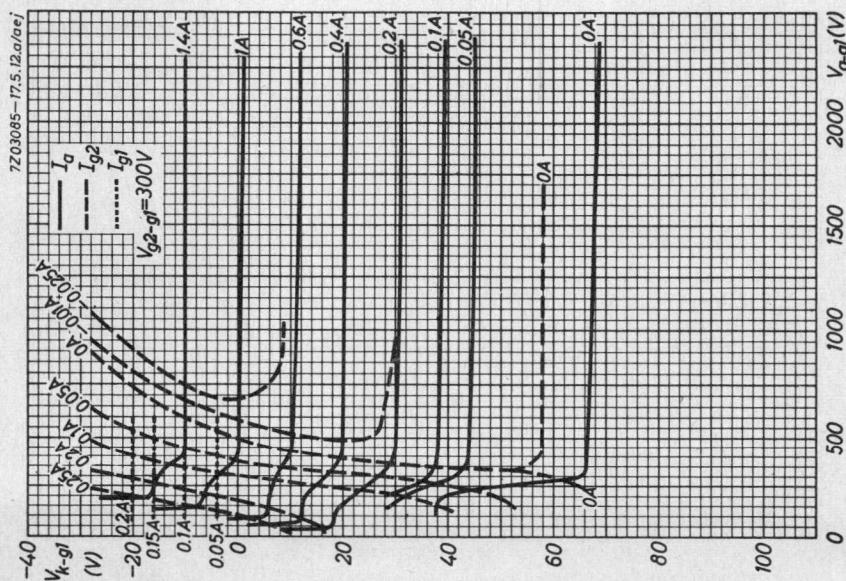
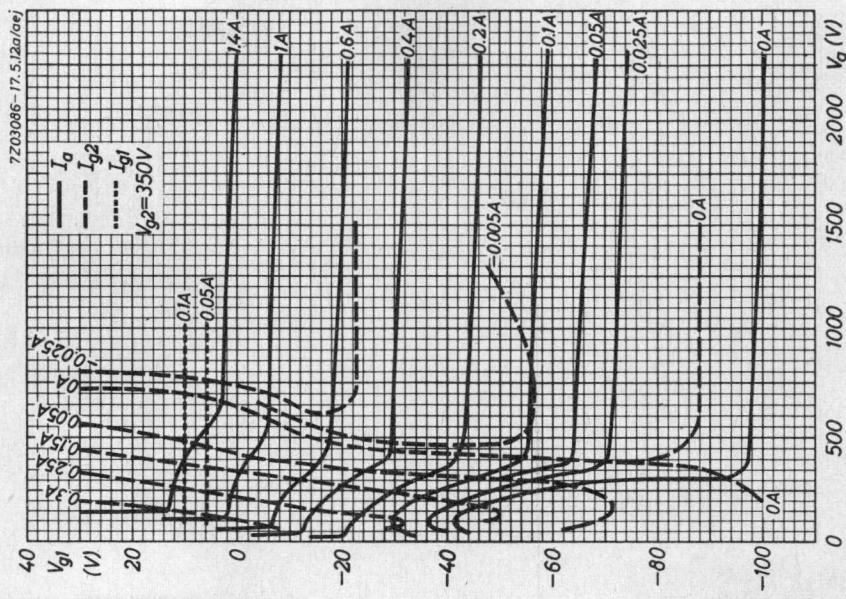
A.F. POWER AMPLIFIER AND MODULATOR CLASS AB**LIMITING VALUES (Absolute limits)**

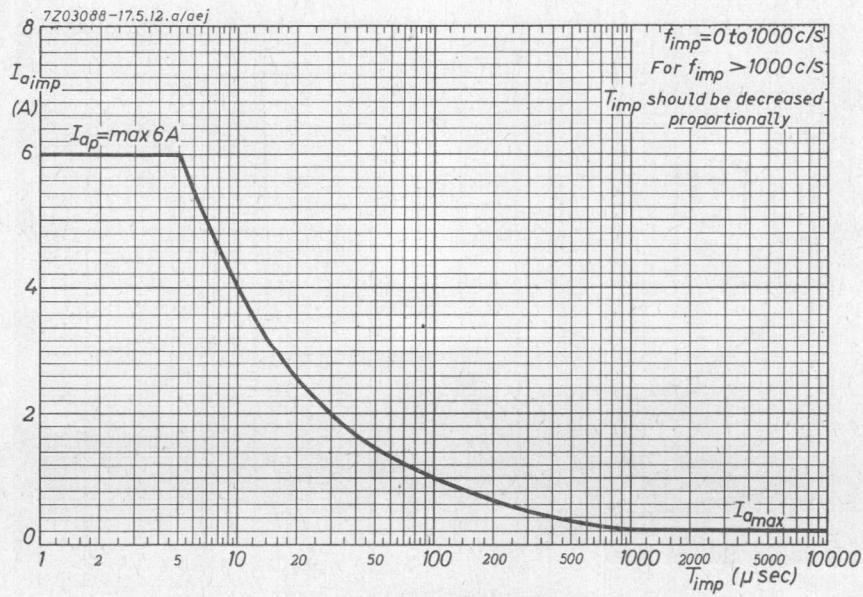
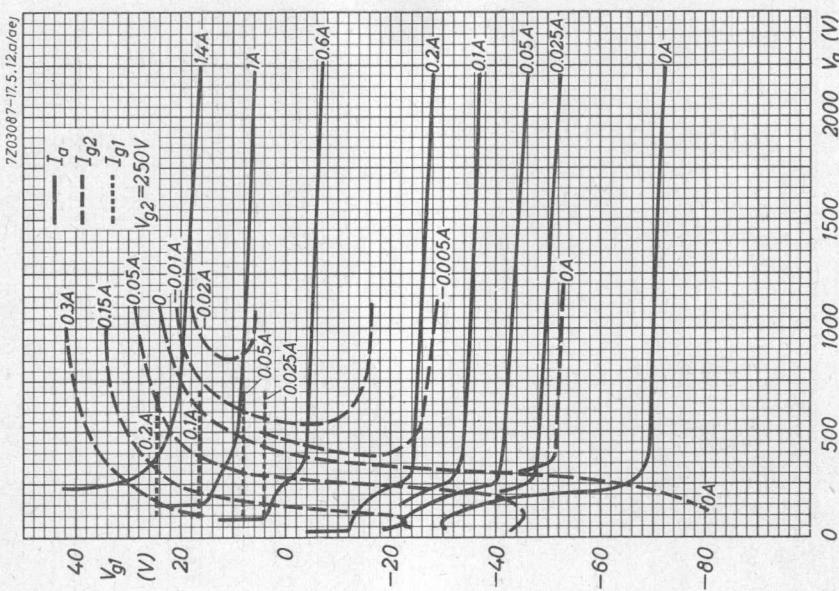
Anode voltage	V_a	= max.	2000	V
Anode current	I_a	= max.	250	mA ¹⁾
Anode input power	W_{ia}	= max.	250	W ¹⁾
Grid No. 2 voltage	V_{g_2}	= max.	400	V
Grid No. 2 dissipation	W_{g_2}	= max.	12	W ¹⁾
Negative grid No. 1 voltage	$-V_{g_1}$	= max.	250	V
Grid No. 1 circuit resistance	R_{g_1}	= max.	100	kΩ
Peak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





COAXIAL R.F. POWER TETRODE

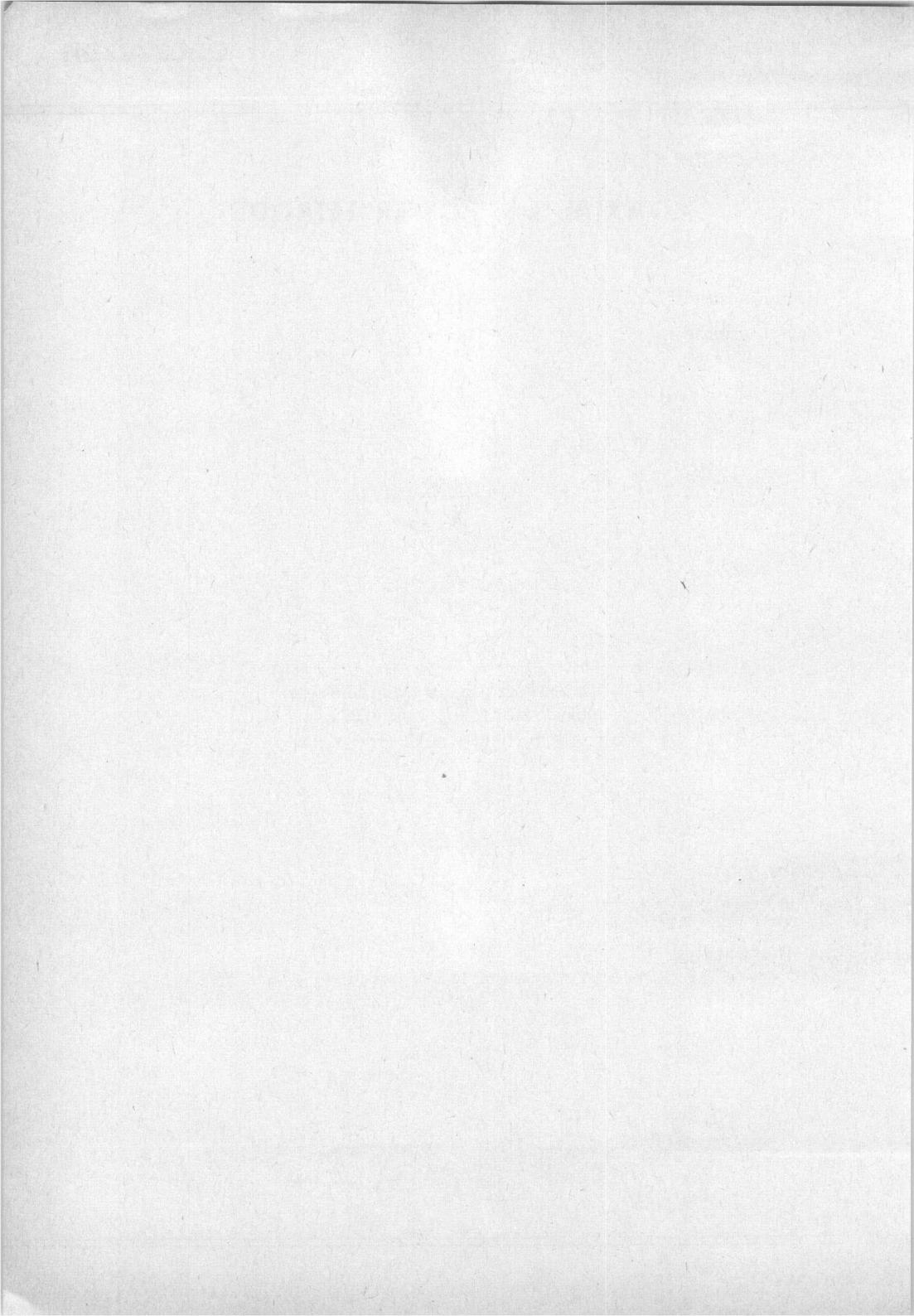
Heater voltage

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

Heater current

$I_f = 0.58 \text{ A}$

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

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

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

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

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

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

TYPICAL CHARACTERISTICS

Anode voltage	V _a	=	200	V
Grid No.2 voltage	V _{g2}	=	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	$\mu_{g_2 g_1}$	=	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	$C_a = C_{a'} = 3.2 \text{ pF}$
Grid No.1 to all other elements except anode	$C_{g1} = C_{g1'} = 6.8 \text{ pF}$
Anode to grid No.1	$C_{ag1} = C_{a'g1'} < 0.1 \text{ pF}$
Anode of one system to grid No.1 of the other system	$C_{ag1'} = C_{a'g1} < 0.13 \text{ pF}$
Between the grids No.1	$C_{g1g1'} = 1.9 \text{ pF}$
Between the anodes	$C_{aa'} = 0.09 \text{ pF}$

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

MECHANICAL DATA

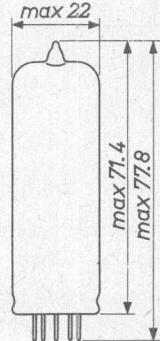
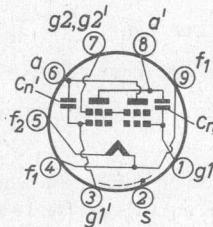
Dimensions in mm

Base : Noval

Socket : 2422 502 01003

Tube retainer: 40647

Net weight : 16 g



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

COOLING: radiation and convection

The use of a closed tube shield is not allowed

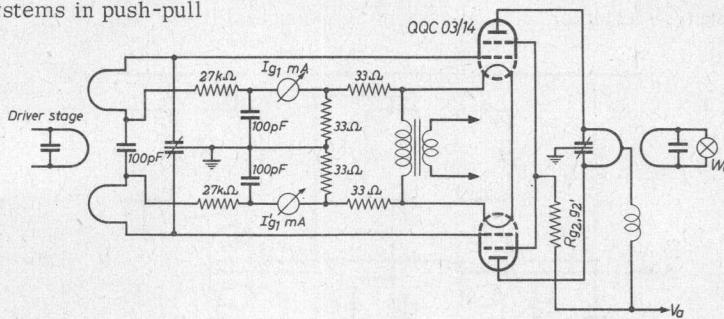
TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 225 °C

Pin temperature = max. 120 °C

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY**I.C.A.S. LIMITING VALUES** (Absolute limits), intermittent service

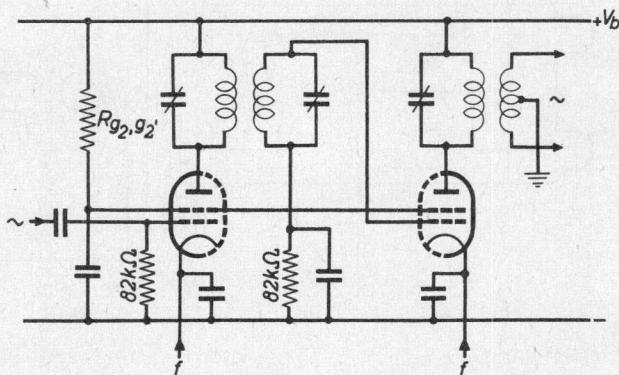
Frequency	f	up to	200	MHz
Anode voltage	$V_a = V_{a'}$	= max.	300	V
Anode dissipation	$W_a = W_{a'}$	= max.	7	W
Anode current	$I_a = I_{a'}$	= max.	55	mA
Grids No.2 voltage	$V_{g_2, g_2'} =$	= max.	200	V
Grids No.2 dissipation	$W_{g_2+g_2'} =$	= max.	2x1	W
Negative grid No.1 voltage	$-V_{g_1} = -V_{g_1'}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

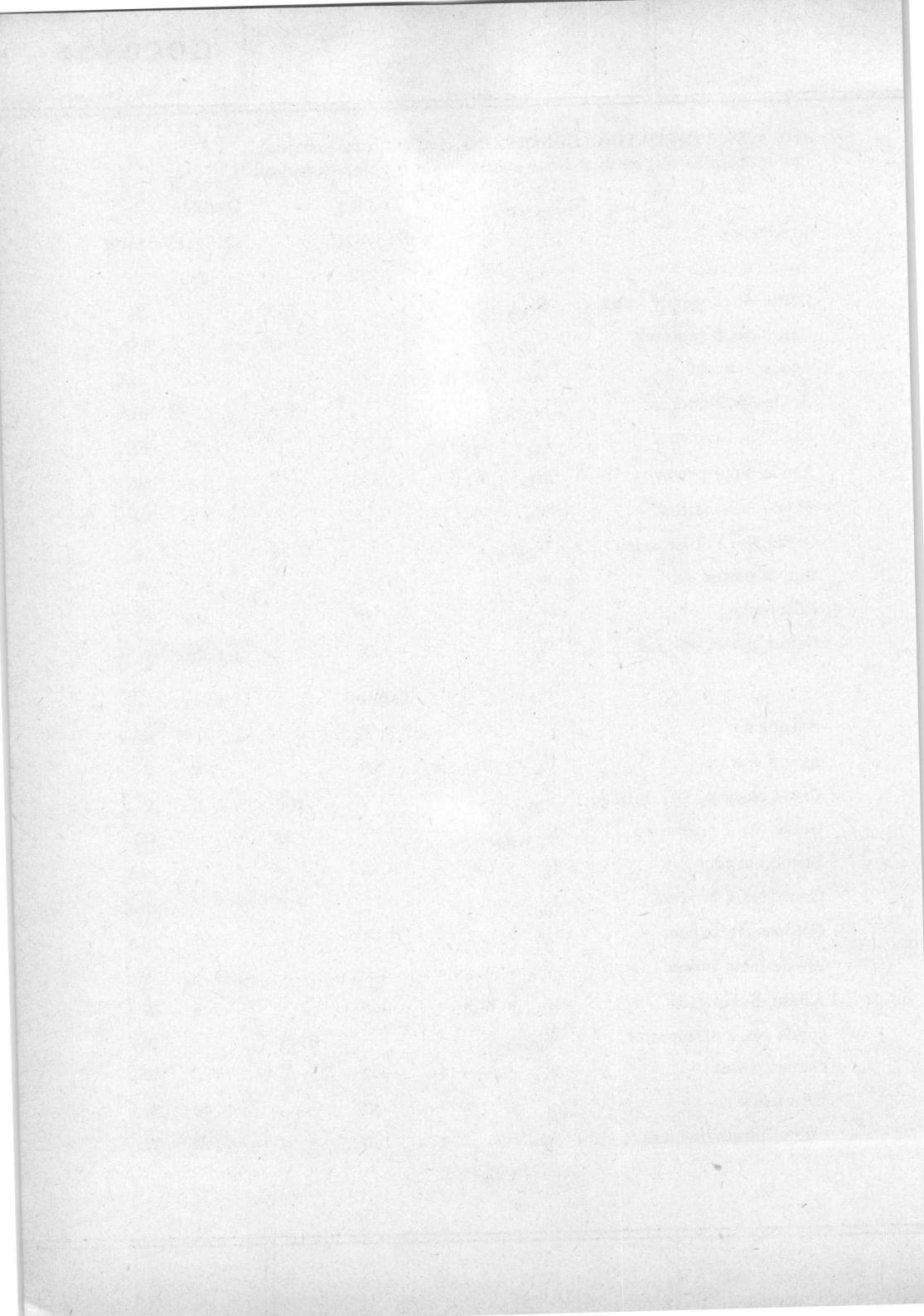
I.C.A.S. OPERATING CONDITIONS, intermittent service;
one system as a tripler and one system as a doubler

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. (MHz)	C telegr.			Cag ₂ mod.		B mod. ¹⁾ V _a (V)	
	V _a (V)	W _o ¹⁾ (W)		V _a (V)	W _o ¹⁾ (W)		
60	600	CCS	ICAS	450 250	CCS	ICAS	C. C. S.
		26.6	35		17.5	8.2	450 18
186	600	25.6	33.6	250	6.0	7.8	I. C. A. S.
							600 28.2

HEATING : direct; filament oxide-coated

Filament voltage	V _f	3 - 3.15	6 - 6.3	V
Filament current	I _f	1.36	0.68	A
Pins		3-(1+5)	1-5	

TYPICAL CHARACTERISTICS

Amplification factor of grid No. 2 with respect to grid No. 1	$\mu_{g_2 g_1}$	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

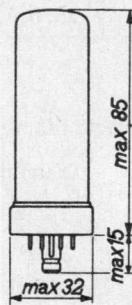
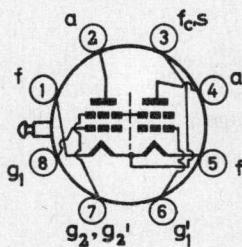
MECHANICAL DATA

Base : octal

Socket : 40213

Net weight: 40 g

Dimensions in mm



Mounting position: Vertical with base up or down

Horizontal with pins 1 and 5 in a horizontal plane

TEMPERATURE LIMITS (Absolute limits)

Pin temperature max. 100 °C

Bulb temperature max. 200 °C

R.F. CLASS C TELEGRAPHY**C.C.S. LIMITING VALUES** (Absolute limits), continuous service

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

C.C.S. OPERATING CONDITIONS, continuous service

two system in push-pull

Frequency	f	60	186	MHz
Anode voltage	V_a	600	600	V
Grid No. 2 voltage	V_{g2}	200	200	V
Grid No. 1 voltage	V_{g1}	-80	-80	V
Anode current	I_a	2x30	2x30	mA
Grid No. 2 current	I_{g2}	6	3	mA
Grid No. 1 current	I_{g1}	2x1.0	2x1.0	mA
Input A.C. voltage, peak to peak	$V_{g1}g_1'p$	210	210	V
Grid No. 1 input power	W_{ig1}	2x0.1	2x0.1	W
Grid No. 2 dissipation	W_{g2}	1.2	0.6	W
Anode input power	W_{ia}	2x18	2x18	W
Anode dissipation	W_a	2x4.7	2x5.2	W
Output power	W_o	26.6	25.6	W
Efficiency	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 _{g2}	max.	250	V
Grid No. 2 dissipation	W _{g2}	max.	7	W
Negative grid No. 1 voltage	-V _{g1}	max.	200	V
Grid No. 1 current	I _{g1}	max.	2x5	mA

R.F. CLASS C TELEGRAPHY**I.C.A.S. OPERATING CONDITIONS**, intermittent service

two systems in push-pull

Frequency	f	60	186	MHz
Anode voltage	V _a	600	600	V
Grid No. 2 voltage	V _{g2}	200	200	V
Grid No. 1 voltage	V _{g1}	-80	-80	V
Anode current	I _a	2x40	2x40	mA
Grid No. 2 current	I _{g2}	5.5	4.5	mA
Grid No. 1 current	I _{g1}	2x1.2	2x1.3	mA
Input A.C. voltage, peak to peak	V _{g1g1'p}	220	220	V
Grid No. 1 input power	W _{ig1}	2x0.12	2x0.13	W
Grid No. 2 dissipation	W _{g2}	1.1	0.9	W
Anode input power	W _{ia}	2x24	2x24	W
Anode dissipation	W _a	2x6.5	2x7.2	W
Output power	W _o	35	33.6	W
Efficiency	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 _{g2}	max.	250	V
Grid No. 2 dissipation	W _{g2}	max.	4.5	W
Negative grid No. 1 voltage	-V _{g1}	max.	200	V
Grid No. 1 current	I _{g1}	max.	2x5	mA

C.C.S. OPERATING CONDITIONS, continuous service

two system in push-pull

Frequency	f	60	186	MHz
Anode voltage	V _a	450	250	V
Grid No. 2 resistor	R _{g2}	18	10	kΩ
Grid No. 1 voltage	V _{g1}	-80	-70	V
Anode current	I _a	2x25	2x19.5	mA
Grid No. 2 current	I _{g2}	14	11	mA
Grid No. 1 current	I _{g1}	2x1.0	2x1.5	mA
Peak grid No. 1 voltage	V _{g1p}	83	110	V
Grid No. 1 input power	W _{ig1}	2x0.08	2x0.15	W
Grid No. 2 dissipation	W _{g2}	2.8	1.6	W
Anode input power	W _{ia}	2x11.25	2x4.9	W
Anode dissipation	W _a	2x2.5	2x1.9	W
Output power	W _o	17.5	6.0	W
Efficiency	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**

<u>Frequency</u>	<u>f</u>	<u>up to</u>	<u>186</u>	<u>MHz</u>
Anode voltage	V _a	max.	480	V
Anode input power	W _{ia}	max.	2x15.5	W
Anode dissipation	W _a	max.	2x5	W
Anode current	I _a	max.	2x32	mA
Grid No. 2 voltage	V _{g2}	max.	250	V
Grid No. 2 dissipation	W _{g2}	max.	4.5	W
Negative grid No. 1 voltage	-V _{g1}	max.	200	V
Grid No. 1 current	I _{g1}	max.	2x5	mA

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

two systems in push-pull

<u>Frequency</u>	<u>f</u>	<u>60</u>	<u>186</u>	<u>MHz</u>
Anode voltage	V _a	250	250	V
Grid No. 2 resistor	R _{g2}	10	10	kΩ
Grid No. 1 voltage	V _{g1}	-70	-70	V
Anode current	I _a	2x26.5	2x26.5	mA
Grid No. 2 current	I _{g2}	9	9	mA
Grid No. 1 current	I _{g1}	2x1.8	2x1.5	mA
Peak grid No. 1 A.C. voltage	V _{g1p}	110	110	V
Grid No. 1 input power	W _{ig1}	2x0.18	2x0.15	W
Grid No. 2 dissipation	W _{g2}	1.5	1.5	W
Anode input power	W _{ia}	2x6.6	2x6.6	W
Anode dissipation	W _a	2x2.5	2x2.7	W
Output power	W _o	8.2	7.8	W
<u>Efficiency</u>	<u>η</u>	<u>62</u>	<u>59</u>	<u>%</u>
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	$R_{aa'}$	20	kΩ	
Input A.C. voltage, peak to peak	$V_{g_1}g_1'p$	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 _{g2}	max.	250	V
Grid No. 2 dissipation	W _{g2}	max.	7	W
Negative grid No. 1 voltage	-V _{g1}	max.	200	V

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

two system in push-pull

Heater voltage	V _f	6.3 ¹⁾	V	
Anode voltage	V _a	600	V	
Grid No. 2 voltage	V _{g2}	200	V	
Grid No. 1 voltage	V _{g1}	-24	V	
Load resistance	R _{aa'}	25	kΩ	
Input A.C. voltage, peak to peak	V _{g1g1'p}	0 85	V	
Anode current	I _a	2x3.0	2x33.5	mA
Grid No. 2 current	I _{g2}	2x0.18	2x4.5	mA
Grid No. 1 current	I _{g1}	0	2x1.2	mA
Anode input power	W _{ia}	2x1.8	2x20.1	W
Anode dissipation	W _a	2x1.8	2x6	W
Output power	W _o	0	28.2	W
Total harmonic distortion	d _{tot}	-	5	%
Efficiency	η	-	70	%

1) D.C. voltage

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA							
λ (m)	Freq. (MHz)	C telegr.			Cag ₂ mod.		
		V _a (V)	W _O (W) ⁻¹		V _a (V)	W _O (W) ⁻¹	
			CCS	ICAS		CCS	ICAS
0.6	500	180 200	5.8	7.2	180	4.2	5.8

λ (m)	Freq. (MHz)	C fr. mult.		
		V _a (V)	W _O (W) ⁻¹	
			CCS	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_{g2}	=	150	V
Anode current	I_a	=	25	mA
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2 g_1}$	=	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

Anode to all other elements except grid No.1

per system

$$C_a = 1.6 \text{ pF}$$

Grid No.1 to all other elements except anode

$$C_{g1} = 6.4 \text{ pF}$$

Anode to grid No.1

$$C_{ag1} = 0.16 \text{ pF}$$

in push-pull

Output

$$C_o = 0.95 \text{ pF}$$

Input

$$C_i = 3.8 \text{ pF}$$

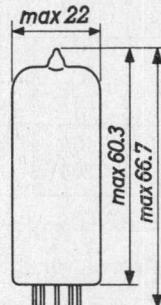
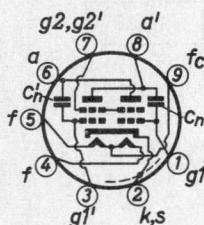
The tube is internally neutralized

MECHANICAL DATA

Dimensions in mm

Base : Naval

Socket: 2422 502 01003



Mounting position: arbitrary

Low loss socket without collar is recommended. At high frequencies use of a metal retaining device is not recommended due to loss of output power.

COOLING

Radiation and convection. The use of a closed can is not allowed.

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature (at hottest point) max. 225 °C

Pin seal temperature max. 120 °C

R.F. CLASS C TELEGRAPHY; two systems in push-pull**LIMITING VALUES** (Absolute limits)

Frequency	f	C.C.S.		I.C.A.S.		MHz
		up to	500	up to	500	
Anode voltage	V _a	= max.	250	max.	250	V
Anode input power	W _{ia}	= max.	2x6	max.	2x7	W
Anode dissipation	W _a	= max.	2x3	max.	2x3.75	W
Anode current	I _a	= max.	2x45	max.	2x50	mA
Grid No.2 voltage	V _{g2}	= max.	200	max.	200	V
Grid No.2 dissipation	W _{g2}	= max.	2x1.5	max.	2x1.75	W
Negative grid No.1 voltage	-V _{g1}	= max.	100	max.	100	V
Grid No.1 current	I _{g1}	= max.	2x3	max.	2x4	mA
Heater to cathode voltage	V _{kf}	= max.	100	max.	100	V

OPERATING CONDITIONS

		C.C.S.	I.C.A.S.	
Frequency	f	=	500	500 MHz
Anode voltage	V _a	=	180	200 V
Grid No.2 voltage	V _{g2}	=	180	200 V
Grid No.1 voltage	V _{g1}	=	-20	-20 V
Grid No.1 resistors	R _{g1}	=	27	27 kΩ ¹⁾
Input A.C. voltage, peak to peak	V _{g1g1'p}	=	50	50 V
Anode current	I _a	=	2x27.5	2x31 mA
Grid No.2 current	I _{g2}	=	12.5	14 mA
Grid No.1 current	I _{g1}	=	2x0.75	2x0.75 mA
Anode input power	W _{ia}	=	2x5	2x6.2 W
Anode dissipation	W _a	=	2x2.1	2x2.6 W
Grid No.2 dissipation	W _{g2}	=	2.25	2.8 W
Driver output power	W _{dr}	=	1.2	1.2 W
Output power	W _o	=	5.8	7.2 W
Efficiency	η	=	58	58 %
Output power in load	W _l	=	5	6 W

1) Each system

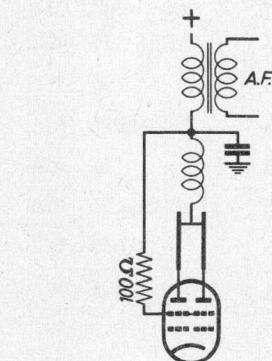
R.F. CLASS C ANODE AND SCREEN GRID MODULATION; two systems in push-pull

LIMITING VALUES (Absolute limits)

Frequency	f	C.C.S.	I.C.A.S.
Anode voltage	V_a = max.	500	up to 500 MHz
Anode input power	W_{ia} = max.	2×4	max. 2x5 W
Anode dissipation	W_a = max.	2×2	max. 2x2.5 W
Anode current	I_a = max.	2×32	max. 2x40 mA
Grid No.2 voltage	V_{g_2} = max.	200	max. 200 V
Grid No.2 dissipation	W_{g_2} = max.	2×1.0	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.	2×3	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 k Ω ¹⁾
$V_{g_1 g_1'p}$	= 45	50 V
I_a	= 2×20	2x27.5 mA
I_{g_2}	= 9.5	12.5 mA
I_{g_1}	= 2×0.3	2x0.75 mA
W_{ia}	= 2×3.6	2x5.0 W
W_a	= 2×1.5	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_m	= $3.5 \over 100$	$5.0 \over 100$ W %
W_{mod}	= 4.5	6.1 W



¹⁾ Each system

R.F. CLASS C FREQUENCY TRIPLER, two systems in push-pull**LIMITING VALUES (Absolute limits)**

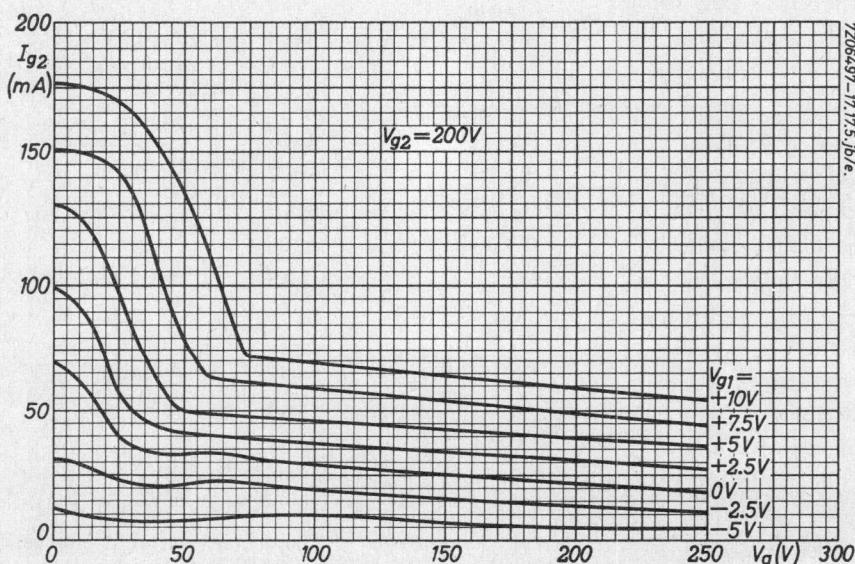
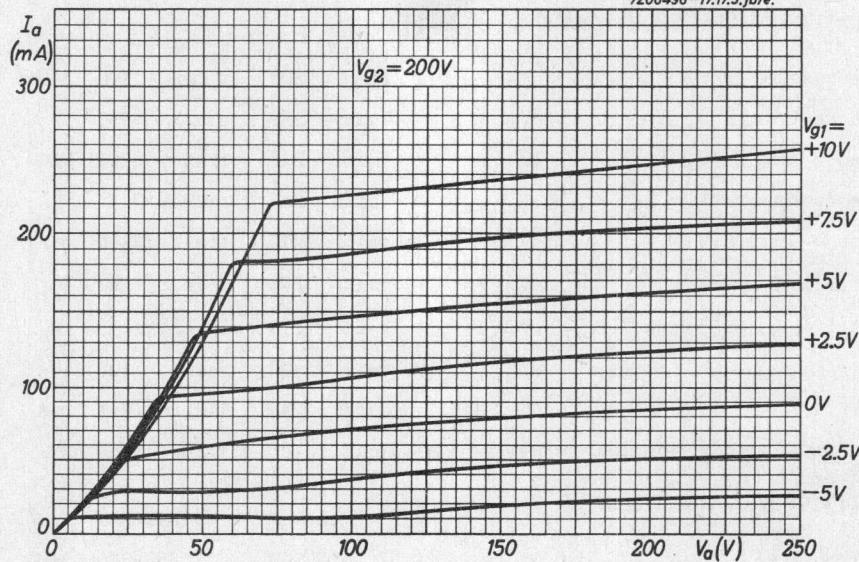
Frequency	f		C.C.S.	I.C.A.S.	
		=	up to 500	up to 500	MHz
Anode voltage	V_a	=	max. 250	max. 250	V
Anode input power	W_{ia}	=	max. 2x4	max. 2x5	W
Anode dissipation	W_a	=	max. 2x3	max. 2x3.75	W
Anode current	I_a	=	max. 2x30	max. 2x40	mA
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation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

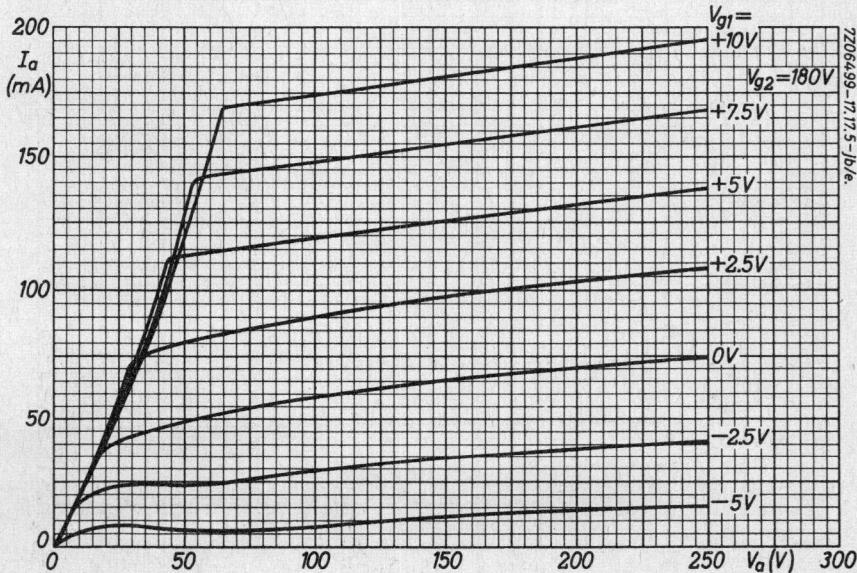
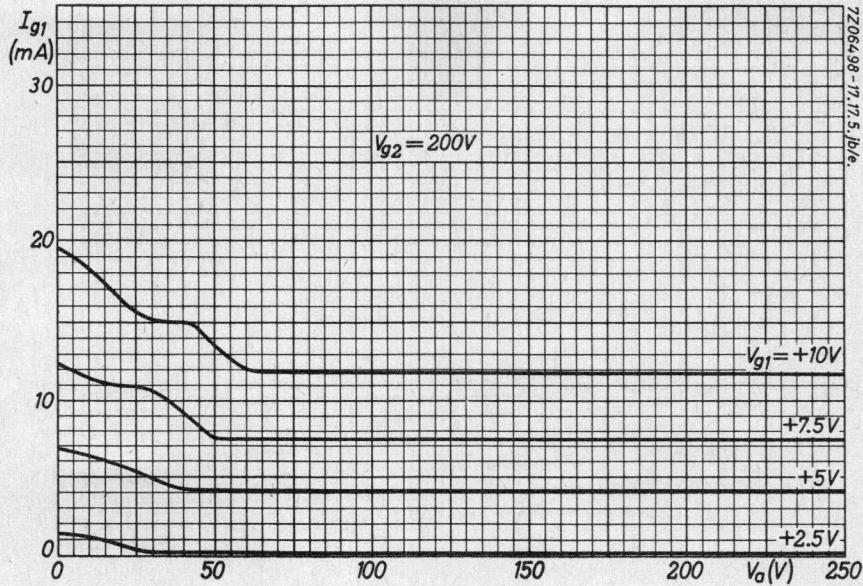
	C.C.S.	I.C.A.S.		
Frequency	f	=	167/500	167/500 MHz
Anode voltage	V_a	=	180	200 V
Grid No.2 supply voltage	V_{bg_2}	=	180	200 V
Grid No.2 resistor	R_{g_2}	=	1200	1200 Ω
Grid No.1 resistors	R_{g_1}	=	82	82 k Ω ¹⁾
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	=	165	165 V
Anode current	I_a	=	2x20	2x22.5 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

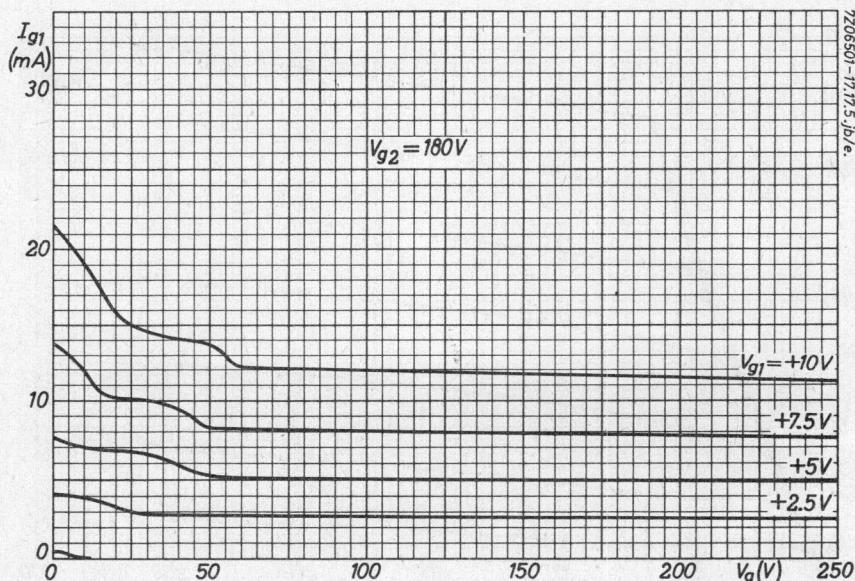
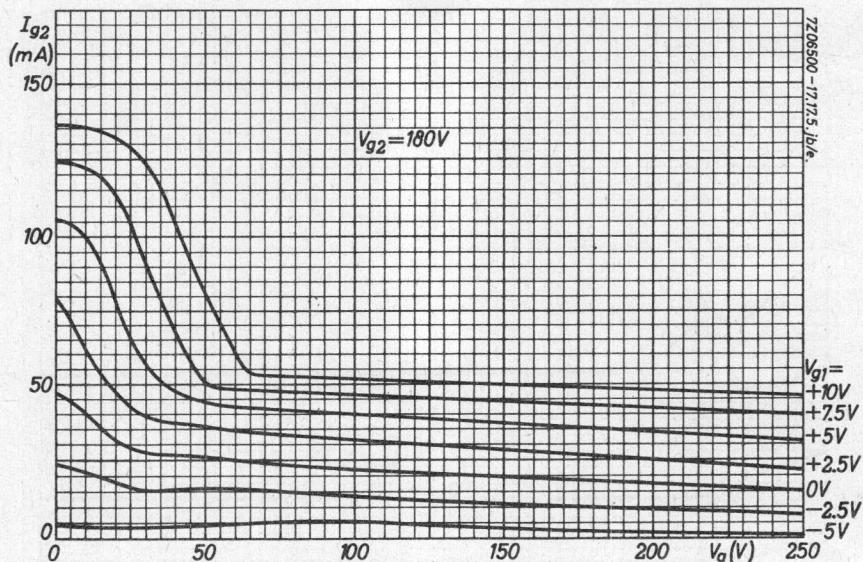
1) Each system. Fixed bias or a combination of fixed bias and grid current biasing is not recommended.

7Z06496-17.17.5,j/b/e.



7206499-17.17.5-jb/e.





R.F. DOUBLE TETRODE

QUICK REFERENCE DATA							
λ (m)	Freq. (MHz)	C telegr.			C _{ag2} mod.		
		V _a (V)	W _O (W) ¹⁾		V _a (V)	W _O (W) ¹⁾	
			CCS	ICAS		CCS	ICAS
1.5	200	300	12	16	200	7.1	8.8
		250	9.0	11.2			
		200	7.4	9.0			

λ (m)	Freq. (MHz)	C fr. mult.			B mod.	
		V _a (V)	W _O (W) ¹⁾			
			CCS	ICAS		
4.5/1.5	67/200	300	3.5	4.8	300	
		250	3.0	4.2	250	
		200	2.8	3.5	200	

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

$$\text{with respect to grid No.1} \quad \mu_{g2g1} = 7.5$$

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

¹⁾ Two systems in push-pull; useful power output in load

²⁾ Occasional operation at 5.3 V or 7.8 V (resp. 10.6 V or 15.6 V) is acceptable.

The tube may be used with only half the heater energized during the stand-by period of a transmitter in order to reduce heater current consumption during this time.

CAPACITANCES

Anode to all other elements except grid No.1

per system

$$C_a = 2.6 \text{ pF}$$

Grid No.1 to all other elements except anode

$$C_{g_1} = 6.2 \text{ pF}$$

Anode to grid No.1

$$C_{ag_1} < 0.1 \text{ pF}$$

in push-pull

Output capacitance

$$C_o = 1.4 \text{ pF}$$

Input capacitance

$$C_i = 5.1 \text{ pF}$$

The tube is internally neutralized

MECHANICAL DATA

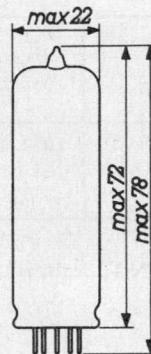
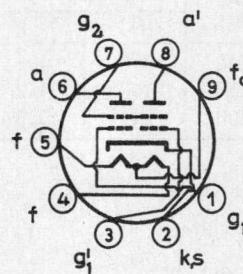
Dimensions in mm

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_{g2}	= max.	200	V	
Grid No.2 dissipation	W_{g2}	= max.	2x1	W	
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V	
Grid No.1 dissipation	W_{g1}	= max.	2x0.2	W	
Grid No.1 current	I_{g1}	= max.	2x3	mA	
Cathode current	I_k	= max.	2x50	mA	
Peak cathode current	I_{kp}	= max.	225	mA	
Heater to cathode voltage	V_{kf}	= max.	100	V	

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	200	200	200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	V_{g2}	=	175	-	-	V
Grid No.2 resistor	R_{g2}	=	-	47	22	kΩ
Grid No.1 voltage	V_{g1}	=	-40	-	-	V
Grid No.1 resistor	R_{g1} ¹⁾	=	-	18	15	kΩ
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	110	110	115	V
Anode current	I_a	=	2x37.5	2x33.5	2x35	mA
Grid No.2 current	I_{g2}	=	2.3	1.8	2.2	mA
Grid No.1 current	I_{g1}	=	2x0.9	2.2	2.7	mA
Anode input power	W_{ia}	=	2x11.25	2x8.4	2x7	W
Anode dissipation	W_a	=	2x4	2x2.9	2x2.8	W
Grid No.2 dissipation	W_{g2}	=	0.4	0.3	0.33	W
Grid No.1 input power	W_{ig1}	=	2x0.05	0.12	0.14	W
Output power	W_o	=	14.5	11	8.4	W
Efficiency	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_{g2}	= max.	200	V
Grid No.2 dissipation	W_{g2}	= max.	2x1	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	W_{g1}	= max.	2x0.2	W
Grid No.1 current	I_{g1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x65	mA
Peak cathode current	I_{kp}	= max.	2x300	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

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

Frequency	f	=	200	200	200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	V_{g2}	=	200	-	-	V
Grid No.2 resistor	R_{g2}	=	-	27	8.2	kΩ
Grid No.1 voltage	V_{g1}	=	-45			V
Grid No.1 resistor	R_{g1} ¹⁾	=	-	18	15	kΩ
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	130	120	130	V
Anode current	I_a	=	2x50	2x40	2x42	mA
Grid No.2 current	I_{g2}	=	3.0	2.4	3.1	mA
Grid No.1 current	I_{g1}	=	2x1.5	2.5	3.0	mA
Anode input power	W_{ia}	=	2x15	2x10	2x8.4	W
Anode dissipation	W_a	=	2x6	2x3.5	2x3.4	W
Grid No.2 dissipation	W_{g2}	=	0.6	0.45	0.55	W
Grid No.1 input power	W_{ig1}	=	2x0.1	0.15	0.18	W
Output power	W_o	=	18.5	13	10	W
Efficiency	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

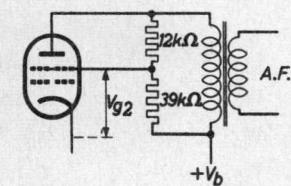
R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull

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_o ³⁾	=	7.1	W
m	=	100	%
W_{mod}	=	6.7	W



1) See diagram

2) Common resistor for both systems

3) Useful power output in load

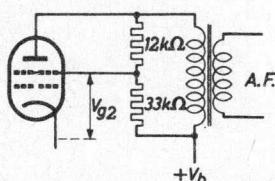
R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull; continued

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

Frequency	f	up to	200	MHz
Anode voltage	V_a	= max.	240	V
Anode dissipation	W_a	= max.	2x4.6	W
Anode input power	W_{ia}	= max.	2x10	W
Anode current	I_a	= max.	2x46	mA
Grid No.2 voltage	V_{g2}	= max.	200	V
Grid No.2 dissipation	W_{g2}	= max.	1.3	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	W_{g1}	= max.	2x0.2	W
Grid No.1 current	I_{g1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x52	mA
Peak cathode current	I_{kp}	= max.	2x240	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

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

f	=	200	MHz
$V_a = V_b$	=	200	V
V_{g2} ¹⁾	=		
R_{g1} ²⁾	=	15	kΩ
$V_{g1g1'p}$	=	130	V
I_a	=	2x43	mA
I_{g2}	=	3.1	mA
I_{g1}	=	3.3	mA
W_{ia}	=	2x8.6	W
W_a	=	2x3.7	W
W_{g2}	=	0.54	W
W_{ig1}	=	0.2	W
W_o	=	9.8	W
η	=	57	%
W_Q ³⁾	=	8.8	W
m	=	100	%
W_{mod}	=	8.6	W



1) See diagram

2) Common resistor for both systems

3) Useful power output in load

R.F. CLASS C FREQUENCY TRIPLER, two systems in push-pull**C.C.S. LIMITING VALUES (Absolute limits) continuous service**

Frequency	f	up to	200	MHz
Anode voltage	V_a	= max.	300	V
Anode dissipation	W_a	= max.	2x5	W
Anode input power	W_{ia}	= max.	2x7.5	W
Anode current	I_a	= max.	2x30	mA
Grid No. 2 voltage	V_{g2}	= max.	200	V
Grid No. 2 dissipation	W_{g2}	= max.	2	W
Negative grid No. 1 voltage	$-V_{g1}$	= max.	150	V
Grid No. 1 dissipation	W_{g1}	= max.	2x0.2	W
Grid No. 1 current	I_{g1}	= max.	2x2	mA
Cathode current	I_k	= max.	2x35	mA
Peak cathode current	I_{kp}	= max.	2x225	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	= 67/200	67/200	67/200	MHz
Anode supply voltage	$V_a = V_b$	= 300	250	200	V
Grid No. 2 voltage	V_{g2}	= 150	161	155	V
Grid No. 2 resistor	R_{g2}	= -	47	15	kΩ
Grid No. 1 voltage	V_{g1}	= -100	-	-	V
Grid No. 1 resistor	R_{g1}	¹⁾ = -	47	33	kΩ
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	= 230	230	230	V
Anode current	I_a	= 2x24	2x25	2x28.5	mA
Grid No. 2 current	I_{g2}	= 2.0	1.9	3.0	mA
Grid No. 1 current	I_{g1}	= 2x1.0	2x1.0	2x1.6	mA
Anode input power	W_{ia}	= 2x7.2	2x6.25	2x5.7	W
Anode dissipation	W_a	= 2x4.0	2x3.75	2x3.8	W
Grid No. 2 dissipation	W_{g2}	= 0.30	0.31	0.46	W
Grid No. 1 input power	W_{ig1}	= 0.23	0.23	0.35	W
Output power	W_o	= 6.5	5.0	3.8	W
Efficiency	η	= 45	40	33.5	%
Output power	W_o	²⁾ = 3.5	3.0	2.8	W

¹⁾ Common resistor for both systems²⁾ Useful power output in load

R.F. CLASS C FREQUENCY TRIPLEX, two systems in push-pull; continued**I.C.A.S. LIMITING VALUES** (Absolute limits) intermittent service

Frequency	f	up to	200	MHz
Anode voltage	V _a	= max.	300	V
Anode dissipation	W _a	= max.	2x7	W
Anode input power	W _{ia}	= max.	2x10	W
Anode current	I _a	= max.	2x42	mA
Grid No.2 voltage	V _{g2}	= max.	200	V
Grid No.2 dissipation	W _{g2}	= max.	2	W
Negative grid No.1 voltage	-V _{g1}	= max.	150	V
Grid No.1 dissipation	W _{g1}	= max.	2x0.2	W
Grid No.1 current	I _{g1}	= max.	2x3	mA
Cathode current	I _k	= max.	2x45	mA
Peak cathode current	I _{kP}	= max.	2x300	mA
Heater to cathode voltage	V _{kf}	= max.	100	V

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

f	=	67/200	67/200	67/200	67/200	MHz
V _a = V _b	=	300	300	250	200	V
V _{g2}	=	150	175	176	175	V
R _{g2}	=	-	-	18	4.7	kΩ
V _{g1}	=	-100	-100	-	-	V
R _{g1} ¹⁾	=	-	-	27	22	kΩ
V _{g1g1'p}	=	240	230	230	230	V
I _a	=	2x32.5	2x32.5	2x36	2x39	mA
I _{g2}	=	3.5	2.7	4.1	5.2	mA
I _{g1}	=	2x1.9	2x1.2	2x1.9	2x2.3	mA
W _{ia}	=	2x9.7	2x9.7	2x9	2x7.8	W
W _a	=	2x5.8	2x6.1	2x5.9	2x5.55	W
W _{g2}	=	0.53	0.47	0.72	0.91	W
W _{ig1}	=	0.45	0.28	0.43	0.52	W
W _o	=	7.8	7.2	6.2	4.5	W
η	=	40	37	34.5	29	%
W _o ²⁾	=	4.8	4.2	4.2	3.5	W

¹⁾ Common resistor for both systems²⁾ 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_{kp}	= 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
$R_{aa'}$	=	10	8	6.5	kΩ
$V_{g_1g_1'p}$	=	0	43.5	0	V
I_a	=	2x15	2x36	2x15	2x33 mA
I_{g_2}	=	1.2	12.6	1.4	14 mA
W_{g_2}	=	0.24	2.5	0.28	2.5 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

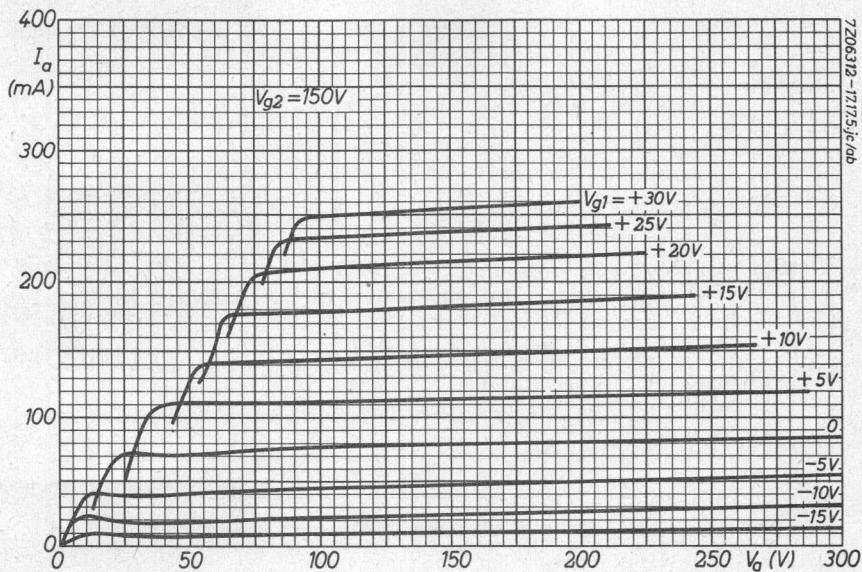
Anode voltage	V_a	= max.	300	V
Anode dissipation	W_a	= max.	2x7	W
Anode input power	W_{ia}	= max.	2x15	W
Anode current	I_a	= max.	2x50	mA
Grid No.2 voltage	V_{g2}	= max.	200	V
Grid No.2 dissipation	W_{g2}	= max.	2x1	W
Peak grid No.2 dissipation	W_{g2p}	= max.	2x2	W
Negative grid No.1 voltage	$-V_{g1}$	= 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

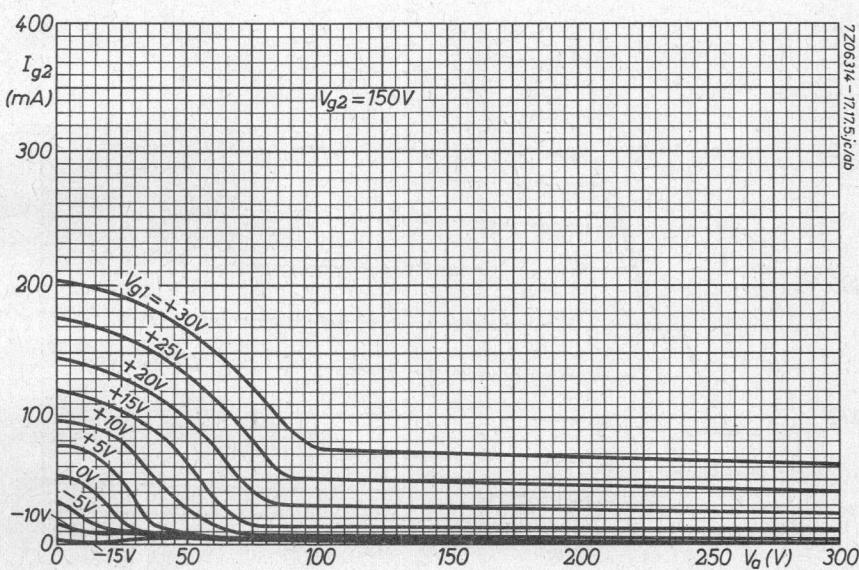
V_a	=	300	250	200	V
V_{g2}	=	200	200	200	V
V_{g1} ¹⁾	=	-21.5	-21.5	-21.5	V
R_{aa}	=	<u>6.5</u>	<u>5.0</u>	<u>5.0</u>	kΩ
$V_{g1g1'p}$	=	0	64	0	V
I_a	=	2x15	2x50	2x15	2x41.1 mA
I_{g2}	=	1.2	11.4	1.4	19 mA
I_{g1}	=	0	2x0.56	0	2x0.22 mA
W_{g2}	=	0.24	2.3	0.28	3.8 W
W_{ig1}	=	0	2x0.02	0	2x0.01 W
W_{ia}	=	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 %

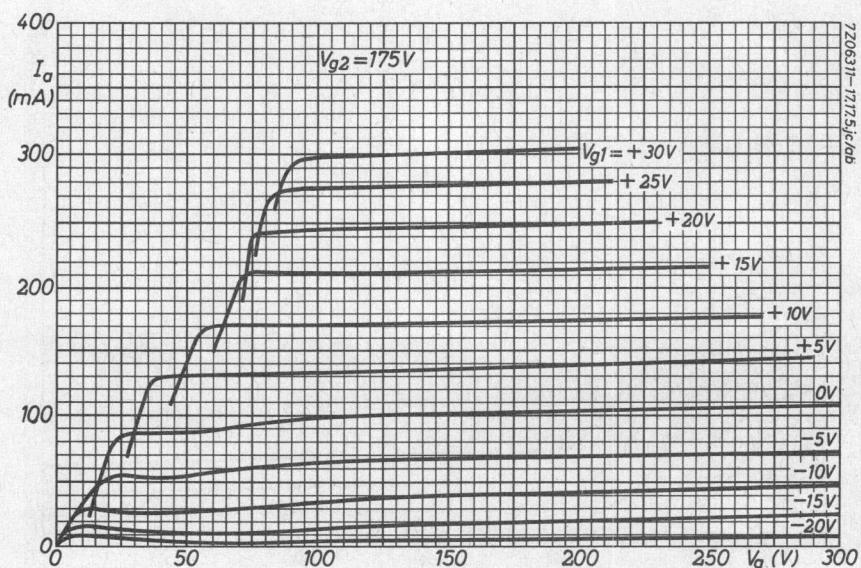
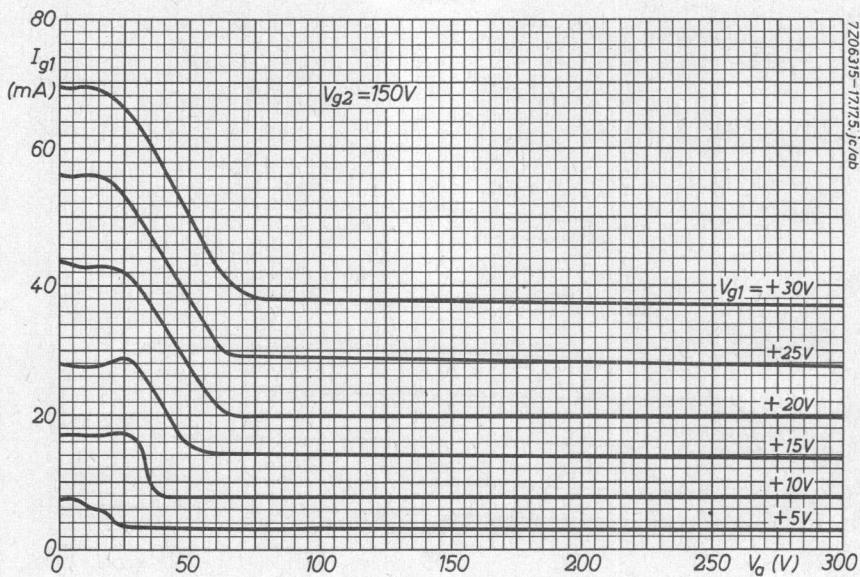
¹⁾ Individual adjustment of the grid bias of each system is recommended

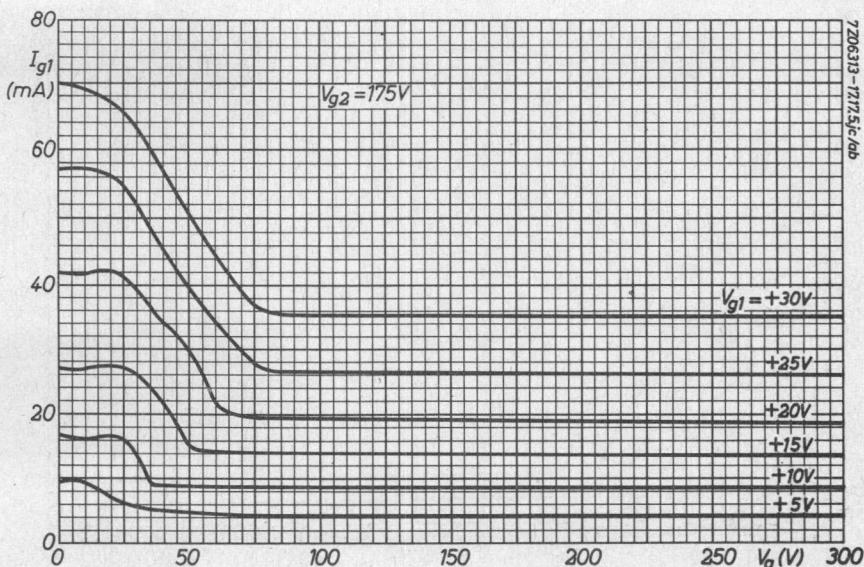
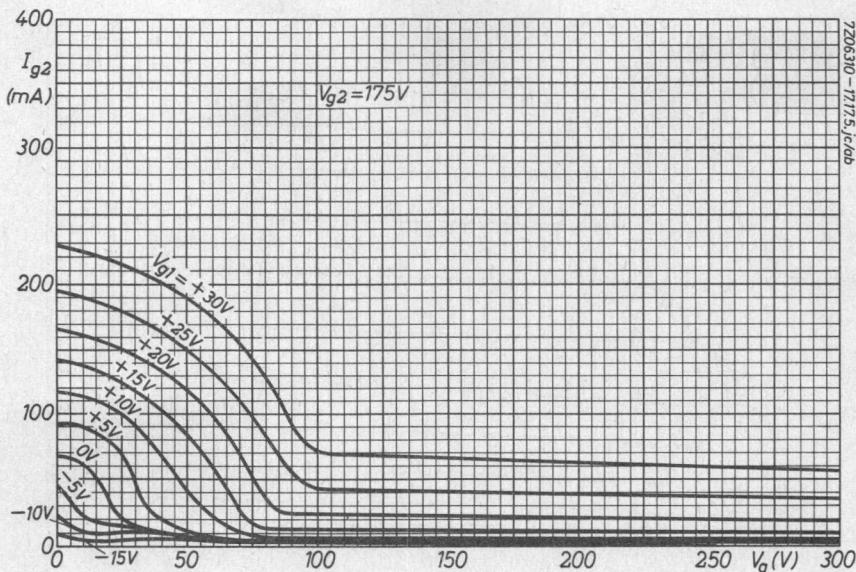
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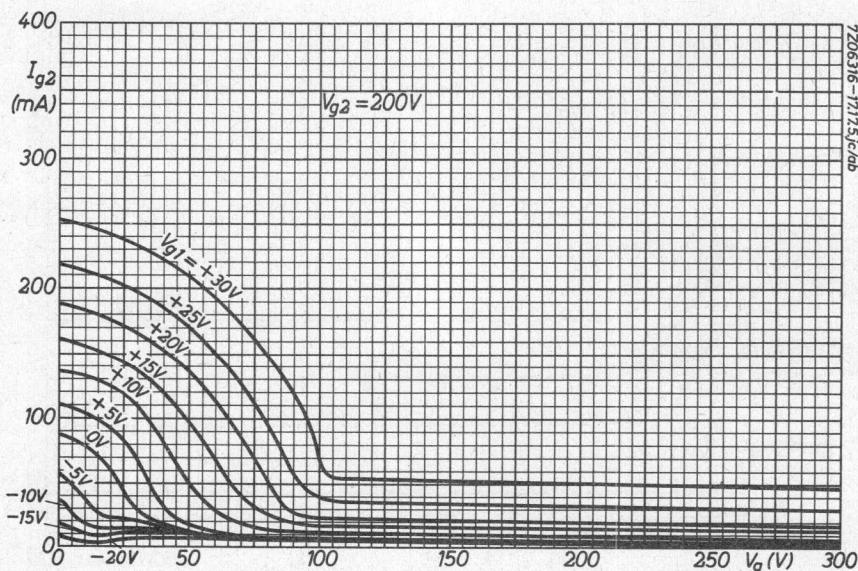
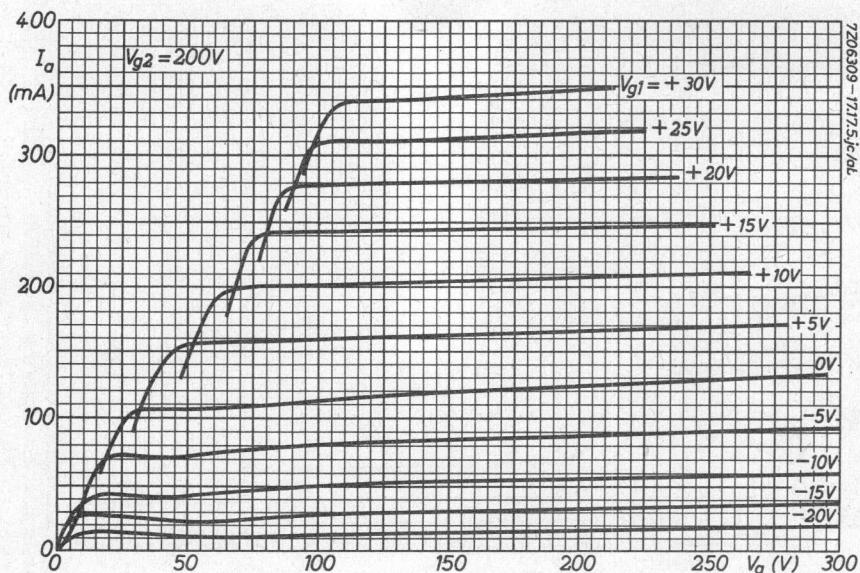


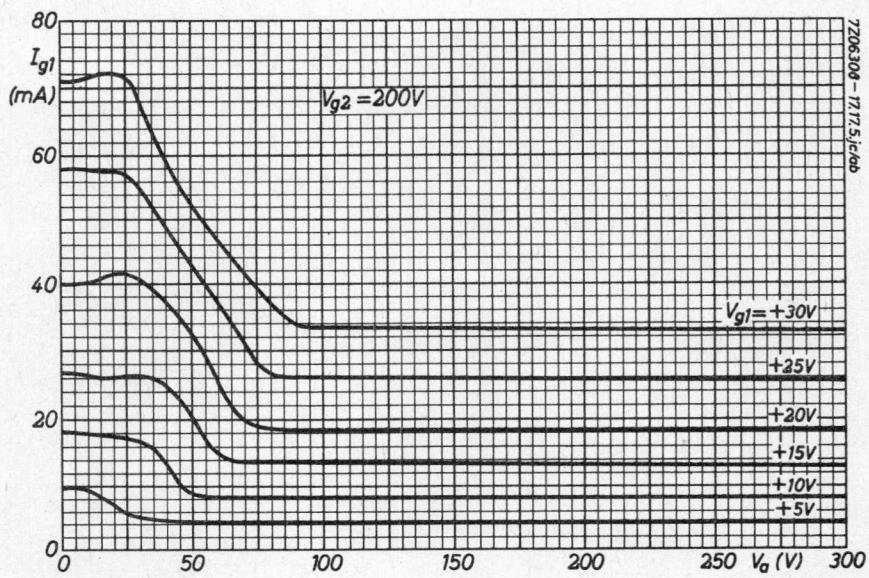
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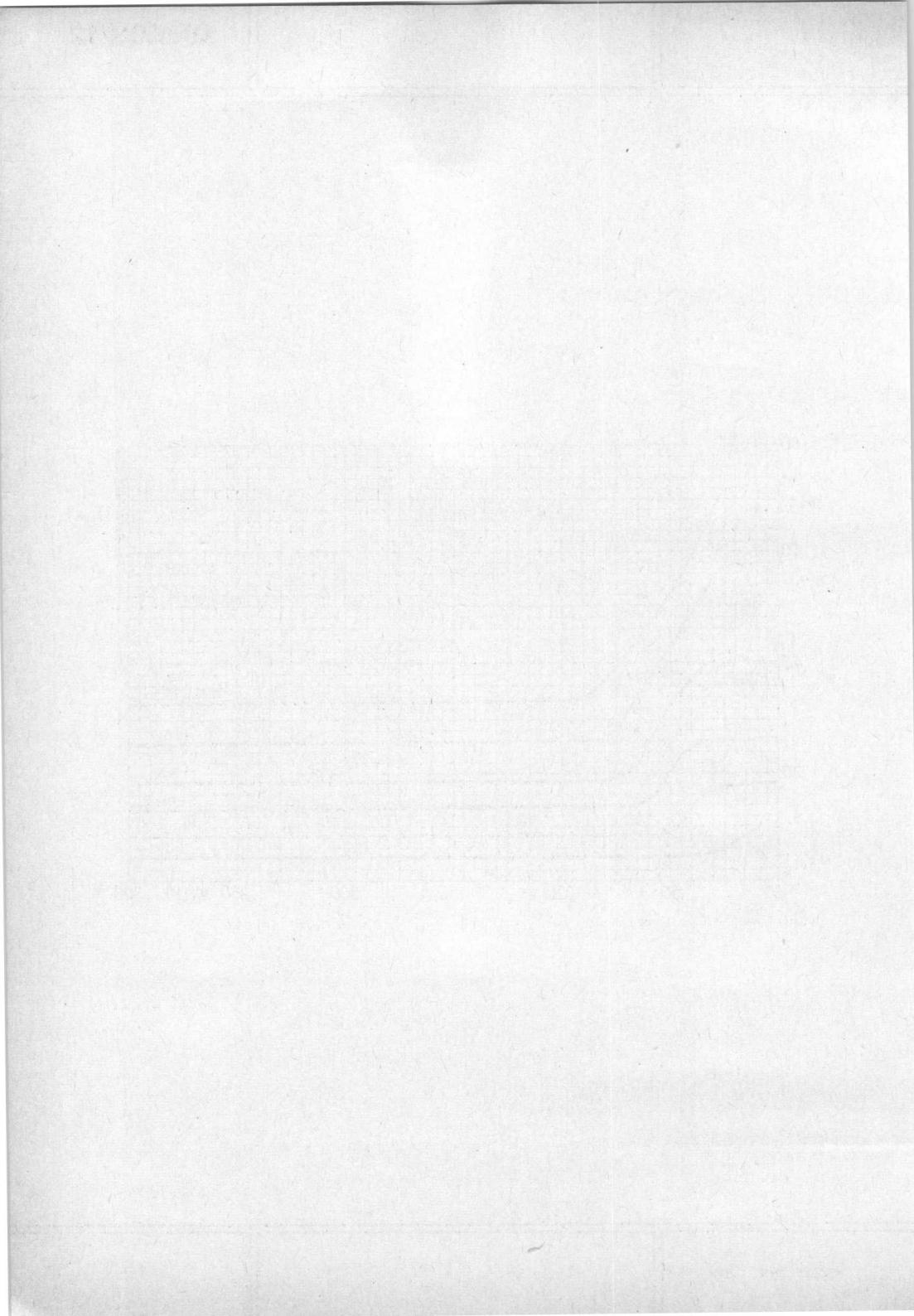












R.F. DOUBLE TETRODE

QUICK REFERENCE DATA (two systems)									
λ (m)	Freq. (MHz)	C telegr.		C _{ag2} mod.		λ (m)	Freq. (MHz)	Cfr. mult.	
		V _a (V)	W _o (W)	V _a (V)	W _o (W)			V _a (V)	
1.5	200	600	48	500	31	4.5/1.5 2.25/0.75	67/200 133/400	300	10
		400	30	300	17			300	8
		300	21						
	400	200	13						
		400	24	300	13				
		300	17						
0.5	600	200	11						
		400	20						

HEATING: indirect, series or parallel supply; cathode oxide-coated

Heater voltage	V _f	=	6.3	12.6	V
Heater current	I _f	=	1.3	0.65	A
Pins		5-(1+7)		1-7	

CAPACITANCES

per system

Anode to all other elements except grid No.1	C _a	=	2.6	pF
Grid No.1 to all other elements except anode	C _{g1}	=	7.0	pF
Anode to grid No.1	C _{ag1}	<	0.08	pF
	C _{ag1} -C _n	<	0.035	pF

See electrode arrangement (page 2) for internal neutralisation by C_n and C_{n'}

in push-pull

Output capacitance	C _o	=	1.6	pF
Input capacitance	C _i	=	4.4	pF

TYPICAL CHARACTERISTICS

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

$$\mu_{g_2 g_1} (I_a = 20 \text{ mA}) = 9$$

Mutual conductance

$$S (I_a = 20 \text{ mA}) = 2.5 \text{ mA/V}$$

MECHANICAL DATA

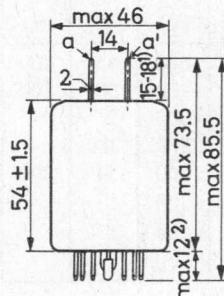
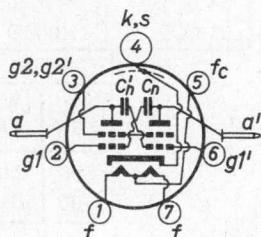
Base : Septar

Dimensions in mm

Socket : 2422 513 00001

Anode connector: 40623

Net weight : 55 g



Mounting position: arbitrary

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode seals and bulb max. 220 °C

Temperature of bottom seals max. 180 °C

COOLING

Generally natural cooling is sufficient with:

$V_a = 600 \text{ V up to } 150 \text{ MHz}$

$V_a = 500 \text{ V up to } 200 \text{ MHz}$

$V_a = 300 \text{ V up to } 430 \text{ MHz}$

Above these limits or with high ambient temperatures it may be necessary to direct an air flow of about 15 l/min. on top of the bulb to keep the seal temperatures within the stated limits

1) Max. 3 mm glass included

2) Max. 2.5 mm glass included

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

Anode voltage	V_a	= max.	600	V
Anode dissipation	W_a	= max.	2×10	W
Grid No.2 voltage	V_{g2}	= max.	250	V
Grid No.2 dissipation	W_{g2}	= max.	2×1.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	75	V
Grid No.1 circuit resistance with fixed bias	R_{g1}	= max.	50	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g1}	= max.	100	kΩ
Grid No.1 current	I_{g1}	= max.	2×2.5	mA
Cathode current	I_k	= max.	2×55	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_{g2}	=	250	250	250	200	V
Grid No.1 voltage	V_{g1}	=	-60	-50	-40	-30	V
Anode current	I_a	=	2×50	2×50	2×50	2×50	mA
Grid No.2 current	I_{g2}	=	2×4	2×4	2×4.5	2×4	mA
Grid No.1 current	I_{g1}	=	2×0.7	2×0.7	2×0.7	2×1	mA
Anode input power	W_{ia}	=	2×30	2×20	2×15	2×10	W
Anode dissipation	W_a	=	2×6	2×5	2×4.5	2×3.5	W
Grid No.2 dissipation	W_{g2}	=	2×1.0	2×1.0	2×1.1	2×0.8	W
Grid No.1 input power	W_{ig1}	=	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.	2×10	W
Grid No.2 voltage	V_{g2}	=	max.	250	V
Grid No.2 dissipation	W_{g2}	=	max.	2×1.5	W
Negative grid No.1 voltage	$-V_{g1}$	=	max.	100	V
Grid No.1 current	I_{g1}	=	max.	2×2.5	mA
Cathode current	I_k	=	max.	2×50	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_{g2}	=	250	250	250 V
Grid No.1 voltage	V_{g1}	=	-80	-50	-50 V
Anode current	I_a	=	2×40	2×40	2×40 mA
Grid No.2 current	I_{g2}	=	2×4	2×4	2×3 mA
Grid No.1 current	I_{g1}	=	2×1.0	2×1.0	2×1.0 mA
Anode input power	W_{ia}	=	2×20	2×12	2×12 W
Anode dissipation	W_a	=	2×4.5	2×3.5	2×5.5 W
Grid No.2 dissipation	W_{g2}	=	2×1	2×1	2×0.75 W
Grid No.1 input power	W_{ig1}	=	2×5	2×2.5	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 TRIPLEX**LIMITING VALUES (Absolute limits)**

Anode voltage	V_a	= max.	600	V
Anode dissipation	W_a	= max.	2×10	W
Grid No.2 voltage	V_{g2}	= max.	250	V
Grid No.2 dissipation	W_{g2}	= max.	2×1.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	200	V
Grid No.1 circuit resistance with fixed bias	R_{g1}	= max.	50	$k\Omega$
Grid No.1 circuit resistance with automatic bias	R_{g1}	= max.	100	$k\Omega$
Grid No.1 current	I_{g1}	= max.	2×2.5	mA
Cathode current	I_k	= max.	2×50	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_{g2}	=	250	250	V
Grid No.1 voltage	V_{g1}	=	-175	-175	V
Anode current	I_a	=	2x45	2x45	mA
Grid No.2 current	I_{g2}	=	2x3.0	2x2.8	mA
Grid No.1 current	I_{g1}	=	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_{g2}	=	2x0.75	2x0.7	W
Grid No.1 input power	W_{ig1}	=	2x1	2x2	W
Output power	W_o	=	10	8.0	W
Efficiency	η	=	37	29.5	%

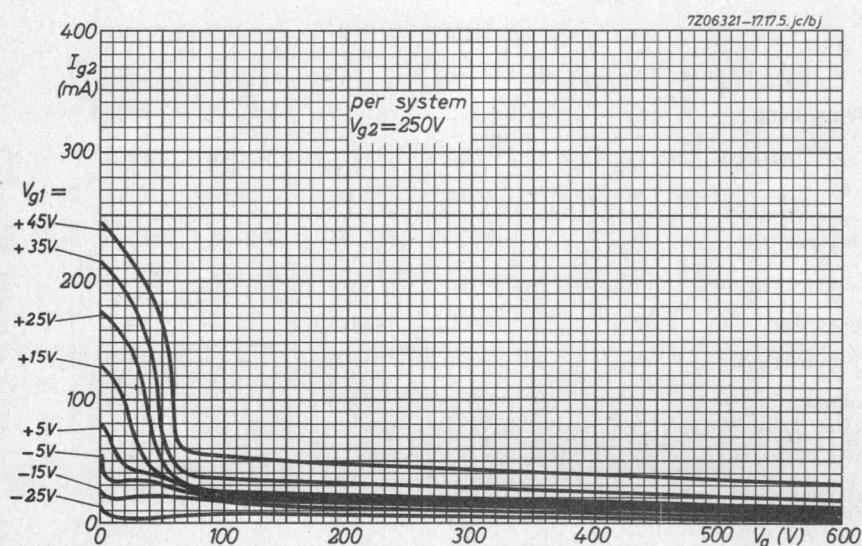
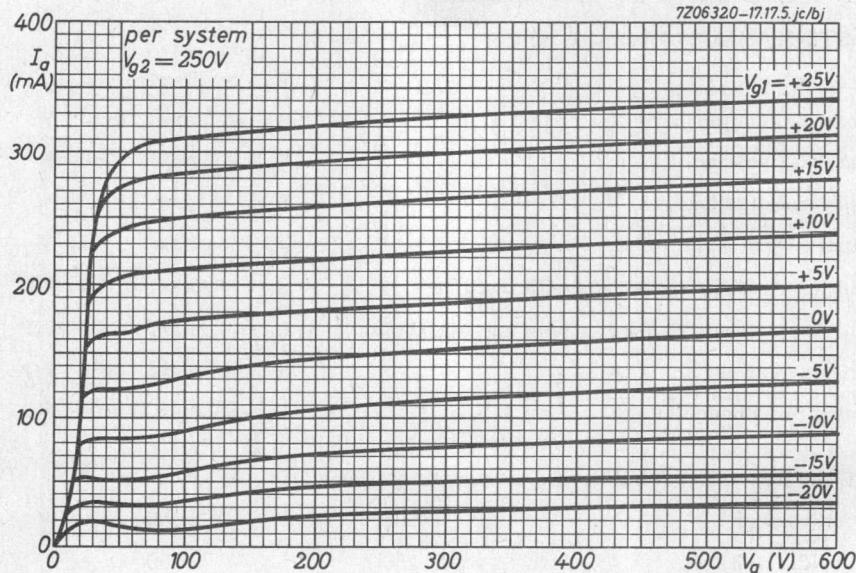
A.F. CLASS B AMPLIFIER AND MODULATOR**LIMITING VALUES (Absolute limits)**

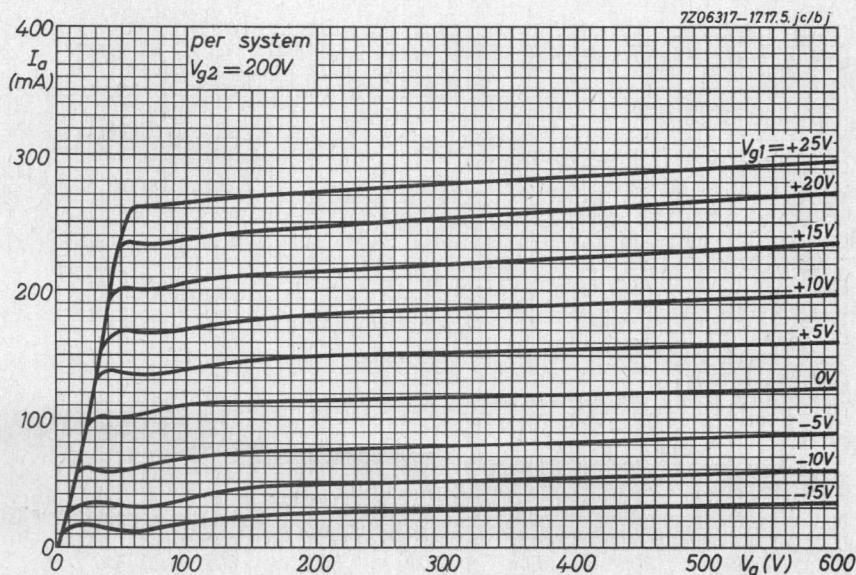
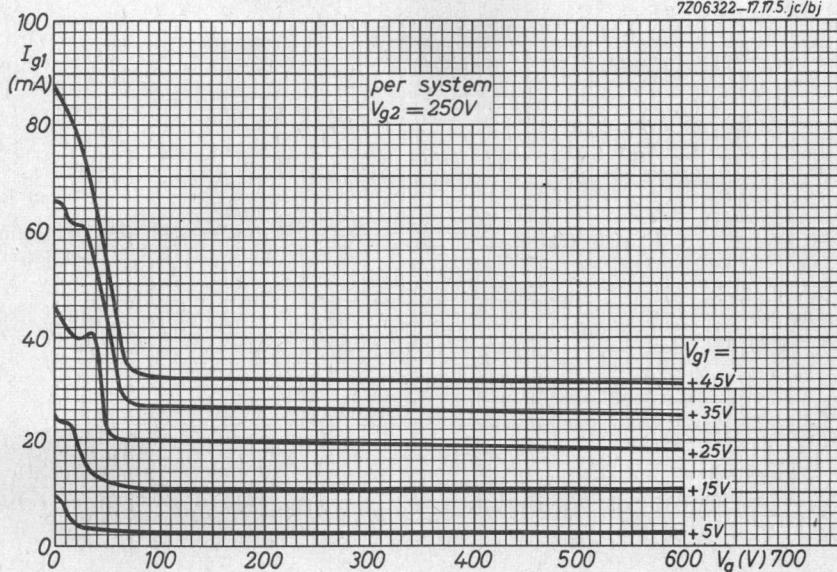
Anode voltage	V_a	= max.	600	V
Anode dissipation	W_a	= max.	2×10	W
Grid No.2 voltage	V_{g2}	= max.	250	V
Grid No.2 dissipation	W_{g2}	= max.	2×1.5	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	75	V
Grid No.1 circuit resistance with fixed bias	R_{g1}	= max.	50	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g1}	= max.	100	kΩ
Cathode current	I_k	= max.	2×55	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

OPERATING CONDITIONS, two systems in push-pull

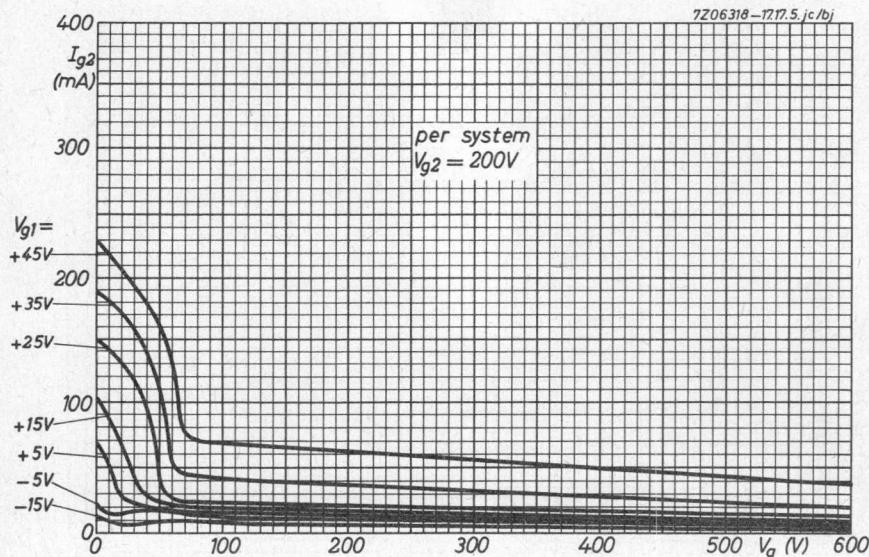
Anode voltage	V_a	=	500	300	V
Grid No.2 voltage	V_{g2}	=	250	250	V
Grid No.1 voltage	V_{g1}	=	-26	-25	V
Load resistance	$R_{aa'}$	=	20	11	kΩ

Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	0	52	0	50	V
Anode current	I_a	=	2×12.5	2×36.5	2×12.5	2×35	mA
Grid No.2 current	I_{g2}	=	2×0.35	2×8.1	2×0.6	2×9.5	mA
Grid No.2 dissipation	W_{g2}	=	0.18	4.05	0.3	4.75	W
Anode input power	W_{ia}	=	2×6.25	2×18.25	2×3.75	2×10.5	W
Anode dissipation	W_a	=	2×6.25	2×6.5	2×3.75	2×3.9	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	%

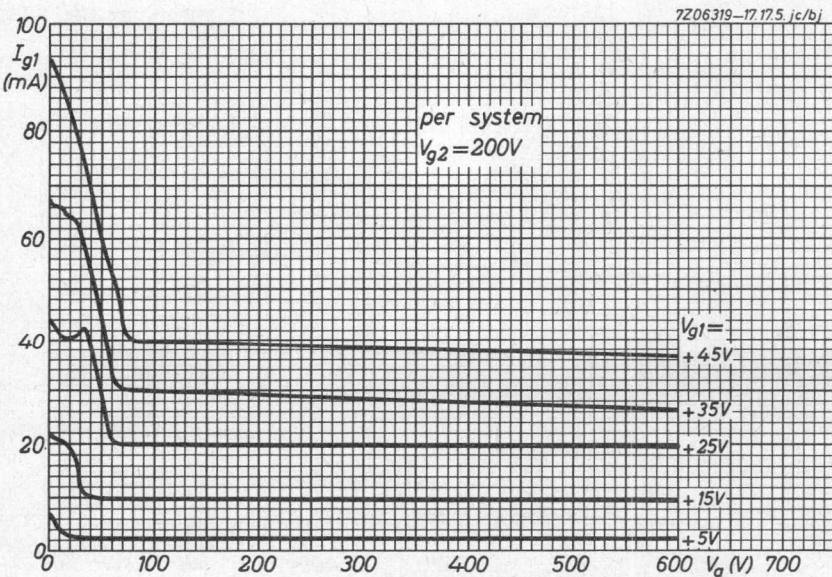




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7Z06319-17.17.5.jc/bj



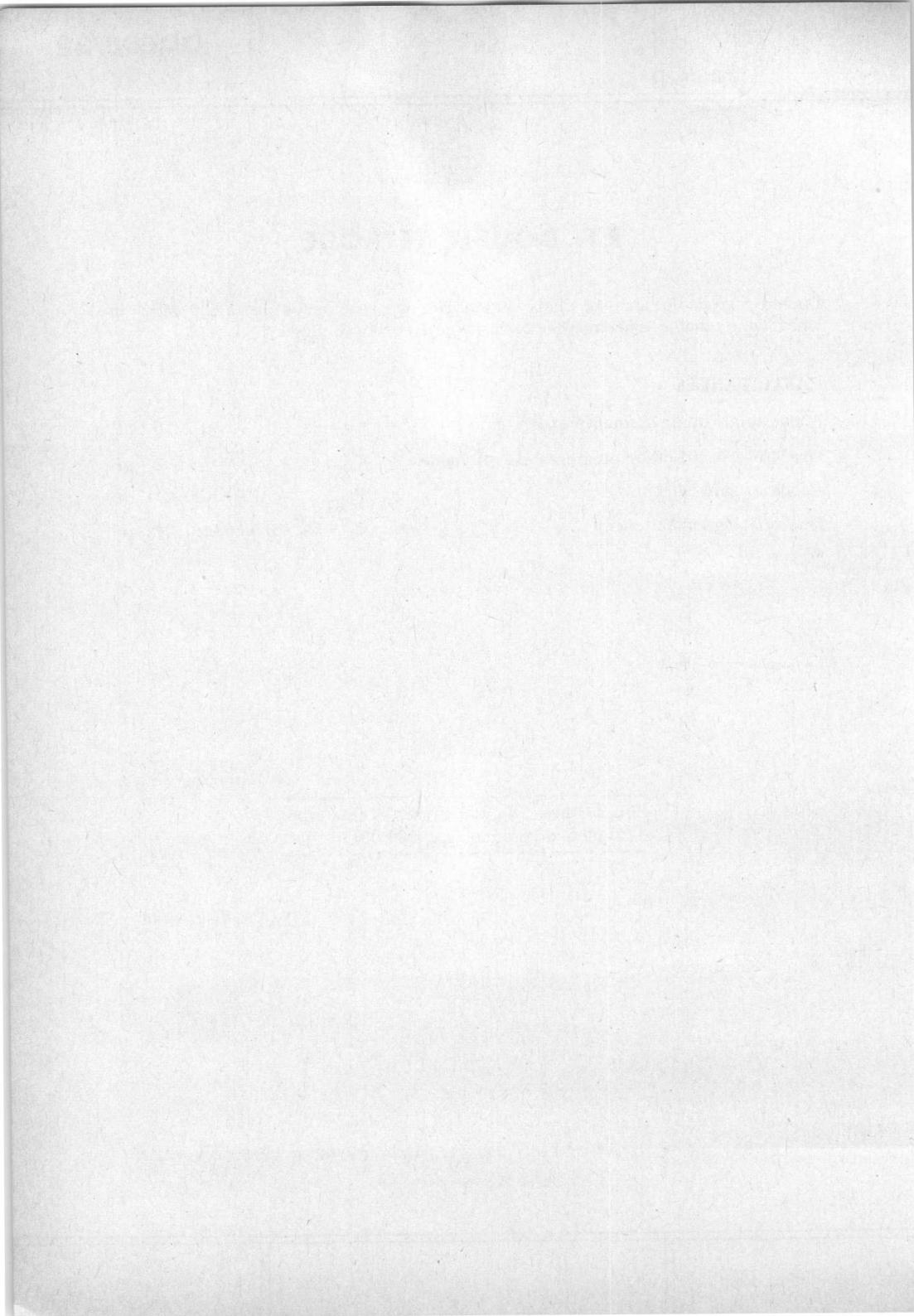
R.F. DOUBLE TETRODE

Double tetrode for use as class C amplifier at frequencies up to 600 MHz in continuous tunable transmitters for a large frequency range.

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	2.6 pF
Grid No.1 to all other elements except anode	C_{g1}	=	6.2 pF
Anode to grid No.1	C_{ag1}	=	0.04 to 0.07 pF
Neutralizing capacitances	$C_n = C_n'$	=	0.015 to 0.04 pF

For further data and curves of this type
please refer to type QQE03/20



R.F. DOUBLE TETRODE

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.				C freq. tripler			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
	V _a (V)	W _o (W)						
960	250	7	250	8	250	2.75	250	3
320/960								

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 _{g1}	=	4.5	pF
Anode to grid No.1	C _{ag1}	=	0.145	pF

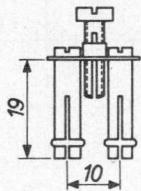
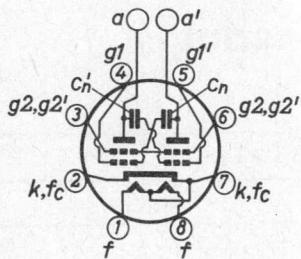
TYPICAL CHARACTERISTICS

Anode voltage	V _a	=	350	V
Grid No.2 voltage	V _{g2}	=	200	V
Anode current	I _a	=	25	mA
Mutual conductance	S	=	10.5	mA/V
Amplification factor of grid No.2 with respect to grid No.1	μ_{g2g1}	=	26	

TEMPERATURE LIMIT (Absolute limit)

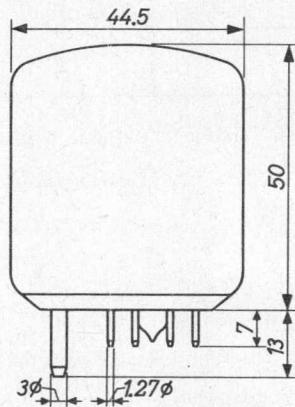
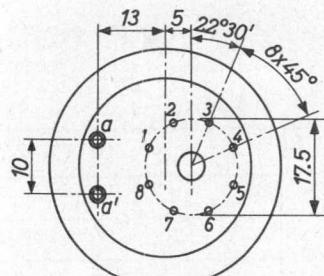
Temperature of pin seals	max.	220	°C
Bulb temperature	max.	220	°C

MECHANICAL DATA



Example of anode-tank
circuit connector at 960 MHz

Dimensions in mm



Socket assembly : B8 700 71

Net weight : 35 g

Mounting position: arbitrary

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)		C.C.S.	I.C.A.S.		
Frequency	f	up to	960	up to	960 MHz
Anode voltage	V_a	= max.	400	max.	400 V
Anode input power	W_{ia}	= max.	2x10	max.	2x12 W
Anode dissipation	W_a	= max.	2x8	max.	2x10 W
Anode current	I_a	= max.	2x45	max.	2x50 mA
Grid No.2 voltage	V_{g_2}	= max.	225	max.	225 V
Grid No.2 dissipation	W_{g_2}	= max.	2x1.5	max.	2x1.75 W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	100	max.	100 V
Grid No.1 current	I_{g_1}	= max.	2x4	max.	2x5 mA

OPERATING CONDITIONS, two systems in push-pull

		C.C.S.	I.C.A.S.	
Frequency	f	=	960	960 MHz
Anode voltage	V_a	=	250	250 V
Grid No.2 voltage	V_{g_2}	=	160 ¹⁾	170 ²⁾ V
Grid No.1 voltage	V_{g_1}	=	-15	-15 V
Grid No.1 resistor	R_{g_1}	=	20	20 kΩ
Anode current	I_a	=	2x35	2x40 mA
Grid No.2 current	I_{g_2}	=	15	15 mA
Grid No.1 current	I_{g_1}	=	2x0.75	2x0.75 mA
Anode input power	W_{ia}	=	2x8.8	2x10 W
Anode dissipation	W_a	=	2x5.4	2x5.4 W
Grid No.2 dissipation	W_{g_2}	=	2.5	2.9 W
Driver output power	W_{dr}	=	1.4	1.4 W
Output power	W_o	=	7	8 W
Output power in the load	W_l	=	4	5 W
Efficiency	η	=	40	40 %

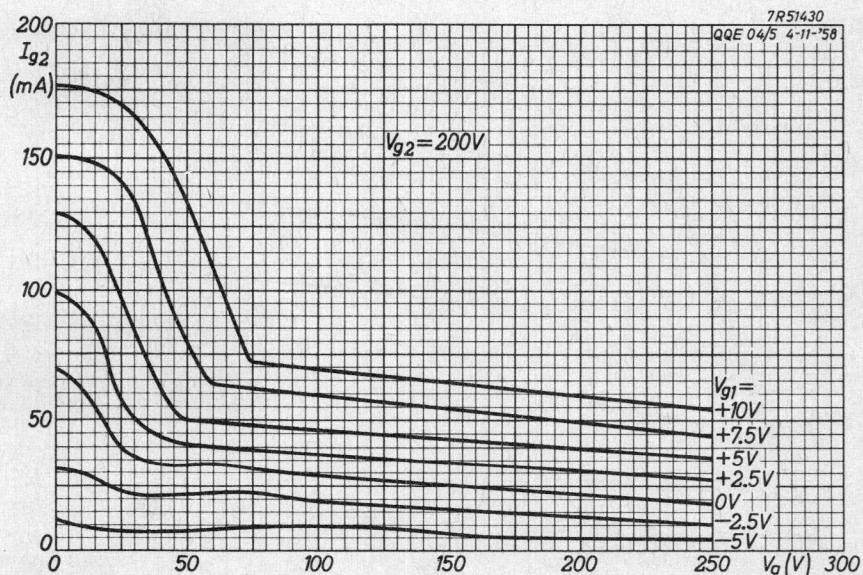
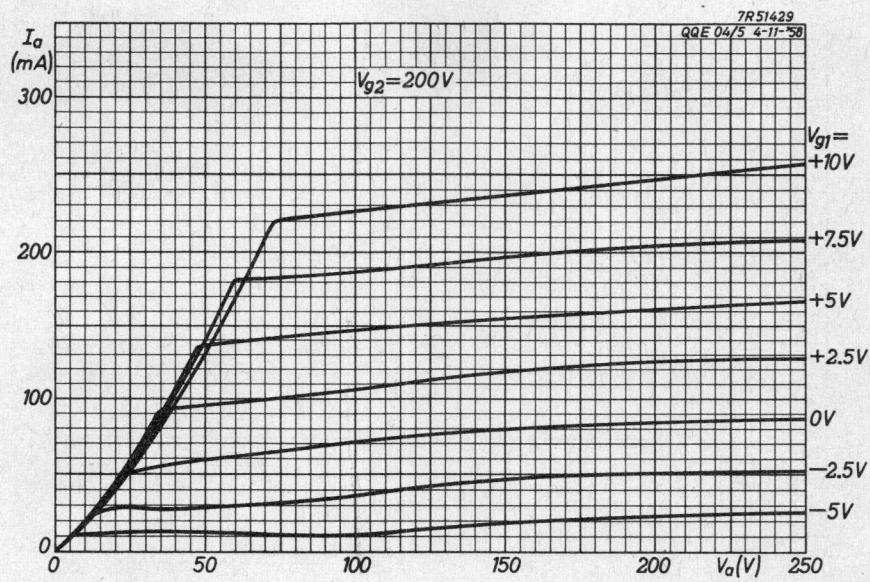
¹⁾ Adjust V_{g_2} until $I_a = 2x35$ mA at W_o max.²⁾ Adjust V_{g_2} until $I_a = 2x40$ mA at W_o max.

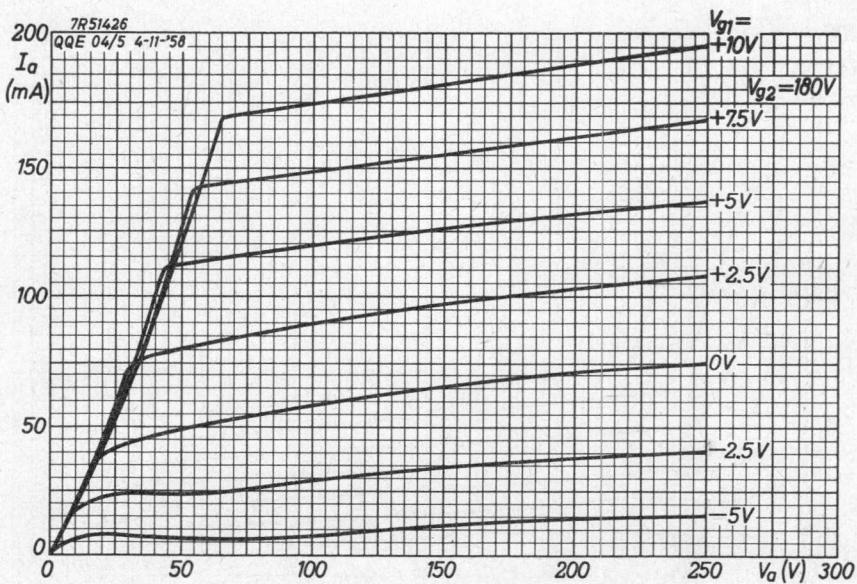
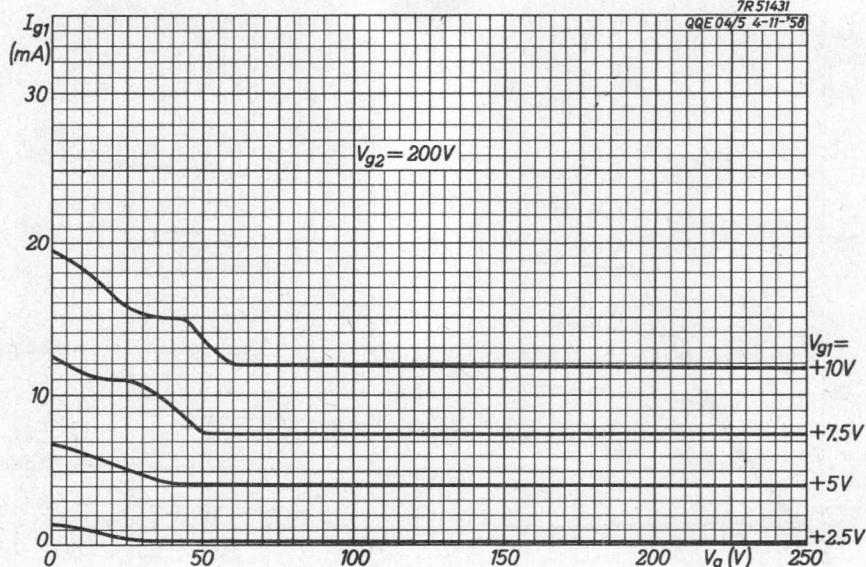
R.F. CLASS C FREQUENCY TRIPLER

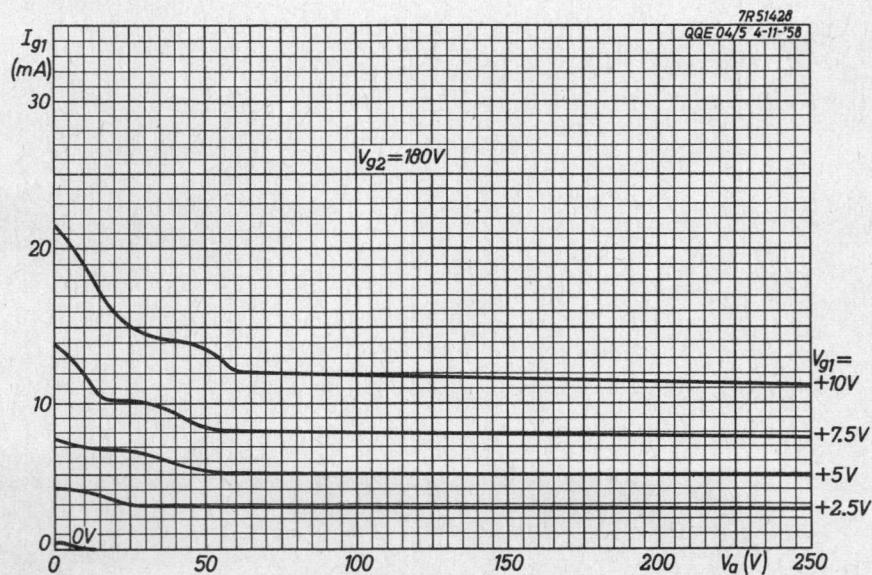
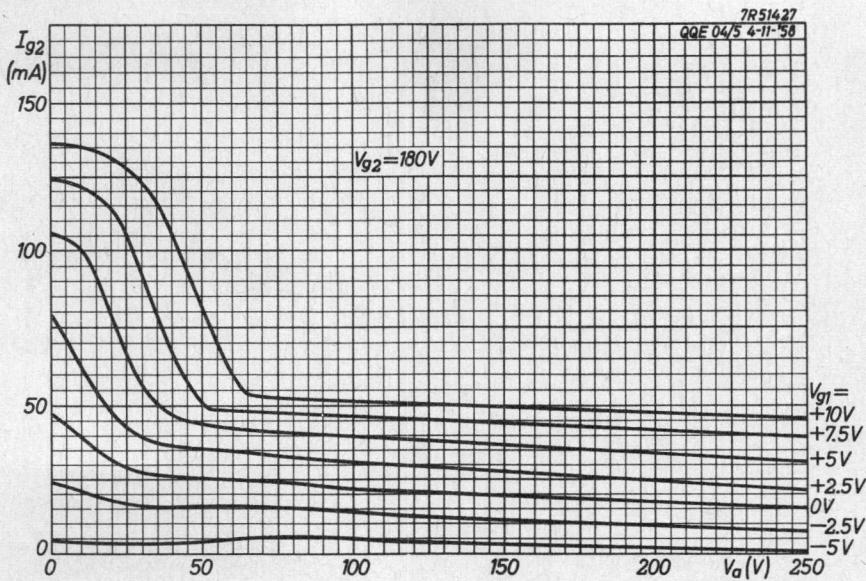
LIMITING VALUES (Absolute limits)		C.C.S.	I.C.A.S.	
Frequency	f	up to 960	up to 960	MHz
Anode voltage	V_a	= max.	400	max. 400 V
Anode input power	W_{ia}	= max.	2x10	max. 2x12 W
Anode dissipation	W_a	= max.	2x8	max. 2x10 W
Anode current	I_a	= max.	2x40	max. 2x40 mA
Grid No.2 voltage	V_{g2}	= max.	225	max. 250 V
Grid No.2 dissipation	W_{g2}	= max.	2x1.5	max. 2x1.75 W
Negative grid No.1 voltage	$-V_{g1}$	= max.	100	max. 100 V
Grid No.1 current	I_{g1}	= max.	2x4	max. 2x5 mA

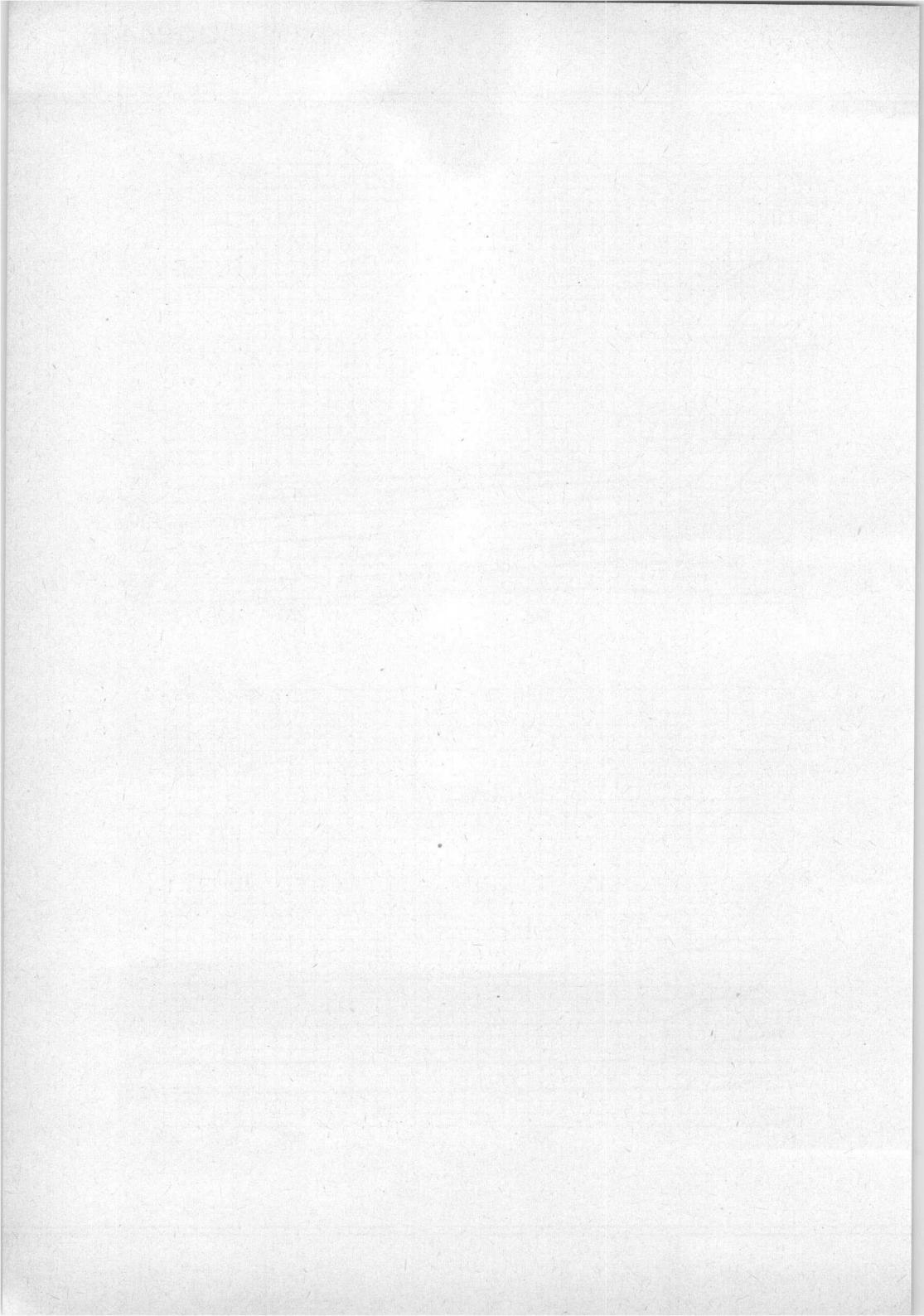
OPERATING CONDITIONS , two systems in push-pull

		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_{g2}	= 150	170	V
Grid No.1 resistor	R_{g1}	= 20	20	kΩ
Anode current	I_a	= 2x37.5	2x40	mA
Grid No.2 current	I_{g2}	= 15	16	mA
Grid No.1 current	I_{g1}	= 2x2.25	2x2.25	mA
Anode input power	W_{ia}	= 2x9.5	2x10	W
Anode dissipation	W_a	= 2x8	2x8.5	W
Grid No.2 dissipation	W_{g2}	= 2.25	2.8	W
Driver output power	W_{dr}	= 3	3	W
Output power	W_o	= 2.75	3	W
Output power in the load	W_l	= 1.5	1.8	W
Efficiency	η	= 14.7	15	%



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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)		V_a (V)	W_o (W)	
			CCS	ICAS		CCS	ICAS
1.5	200	750	26	35	600	17	26
		500	26		425	16	
1.2	250	500	23				

HEATING: indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6	V
Heater current	I_f	=	1.6	0.8	A
	Pins	5-(1+7)		1-7	

CAPACITANCES per system

Anode to all other elements except grid No.1	C_a	=	3.8	pF
Grid No.1 to all other elements except anode	C_{g1}	=	8	pF
Anode to grid No.1	C_{ag_1}	<	0.07	pF
Cathode to grid No.2	C_{kg_2}	=	65	pF ²⁾

TYPICAL CHARACTERISTICS

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

1) Two systems in push-pull

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

3) Per system

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and pin seals max. 180 °C

Bulb temperature max. 220 °C

MECHANICAL DATA

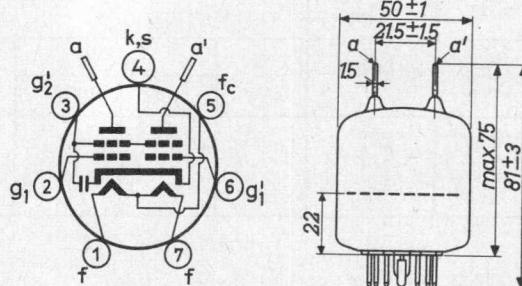
Base : Septar

Socket : 2422 513 00001

Anode connector: 40615

Net weight : 60 g

Dimensions in mm



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. 2×18	max. 2×16	W
Anode dissipation	W_a	= max. 2×7.5		W
Anode current	I_a	= max. 2×45		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. 2×5		mA
Grid No.1 circuit resistance	R_{g_1}	= max. 50		$k\Omega$ 1)
Grid No.1 circuit resistance	R_{g_1}	= max. 25		$k\Omega$ 2)
Heater to cathode voltage	V_{kf}	= max. 100		V

C.C.S. OPERATING CONDITIONS , continuous service

	f	200	200	200	250	250	MHz
	V_a	= 750	500	400	500	400	V
	V_{g_2}	= 200	200	200	200	200	V
	V_{g_1}	= -65	-65	-65	-65	-65	V
	I_a	= 2×24	2×36	2×45	2×32	2×40	mA
	I_{g_2}	= 15	14	14	12	14	mA
	I_{g_1}	= 2×1.4	2×1.3	2×1.4	2×0.9	2×1.0	mA
	$V_{g_1 g_1' p}$	= 150	150	150	140	140	V
	W_{ig_1}	= 2×0.10	2×0.09	2×0.10	2×0.06	2×0.07	W
	W_{g_2}	= 3.0	2.8	2.8	2.4	2.8	W
	W_{ia}	= 2×18	2×18	2×18	2×16	2×16	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_{g2}	=	max.	250		V
Grid No. 2 dissipation	W_{g2}	=	max.	5		W
Negative grid No. 1 voltage	$-V_{g1}$	=	max.	175		V
Grid No. 1 current	I_{g1}	=	max.	2x5		mA
Grid No. 1 circuit resistance	R_{g1}	=	max.	50		$k\Omega^1)$
Grid No. 1 circuit resistance	R_{g1}	=	max.	25		$k\Omega^2)$
Heater to cathode voltage	V_{kf}	=	max.	100		V

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

Frequency	f	=	200	MHz
Anode voltage	V_a	=	750	V
Grid No. 2 voltage	V_{g2}	=	200	V
Grid No. 1 voltage	V_{g1}	=	-50	V
Anode current	I_a	=	2x32.5	mA
Grid No. 2 current	I_{g2}	=	22	mA
Grid No. 1 current	I_{g1}	=	2x2.0	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	130	V
Grid No. 1 input power	W_{ig1}	=	2x0.12	W
Grid No. 2 dissipation	W_{g2}	=	4.4	W
Anode input power	W_{ia}	=	2x24.4	W
Anode dissipation	W_a	=	2x6.9	W
Output power	W_o	=	35	W
Efficiency	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. 2×11	max. 2×10	W
Anode dissipation	W_a	=	max.	2×5	W
Anode current	I_a	=	max. 2×37.5		mA
Grid No.2 voltage	V_{g2}	=	max. 250		V
Grid No.2 dissipation	W_{g2}	=	max. 3.4		W
Negative grid No.1 voltage	$-V_{g1}$	=	max. 175		V
Grid No.1 current	I_{g1}	=	max. 2×5		mA
Grid No.1 circuit resistance	R_{g1}	=	max. 50		$k\Omega^1)$
Grid No.1 circuit resistance	R_{g1}	=	max. 25		$k\Omega^2)$
Heater to cathode voltage	V_{kf}	=	max. 100		V

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	200	200	MHz
Anode voltage	V_a	=	600	425	V
Grid No.2 voltage	V_{g2}	=	200	200	V
Grid No.1 voltage	V_{g1}	=	-65	-60	V
Anode current	I_a	=	2×18	2×26	mA
Grid No.2 current	I_{g2}	=	16	16	mA
Grid No.1 current	I_{g1}	=	2×1.3	2×1.2	mA
Input A.C. voltage, peak to peak	$V_{g1g1'p}$	=	150	140	V
Grid No.1 input power	W_{ig1}	=	2×0.09	2×0.075	W
Grid No.2 dissipation	W_{g2}	=	3.2	3.2	W
Anode input power	W_{ia}	=	2×10.8	2×11	W
Anode dissipation	W_a	=	2×2.3	2×3	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

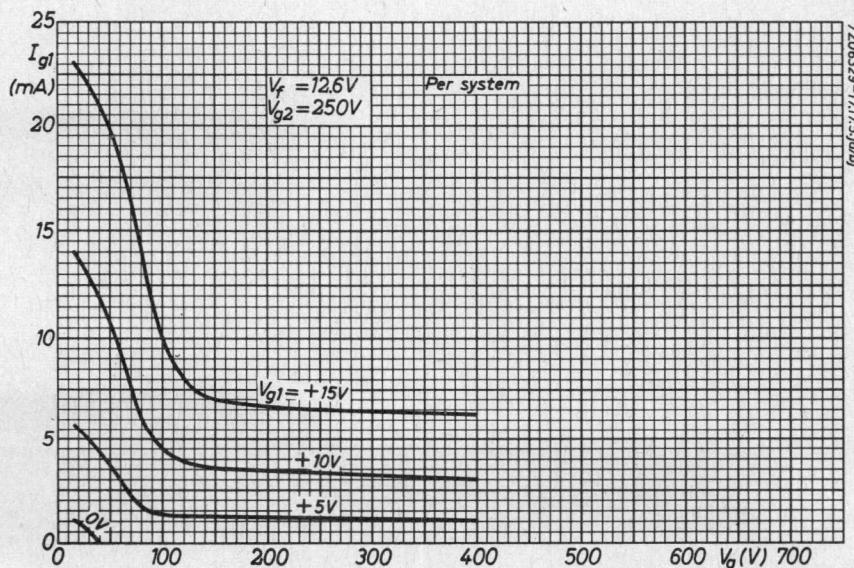
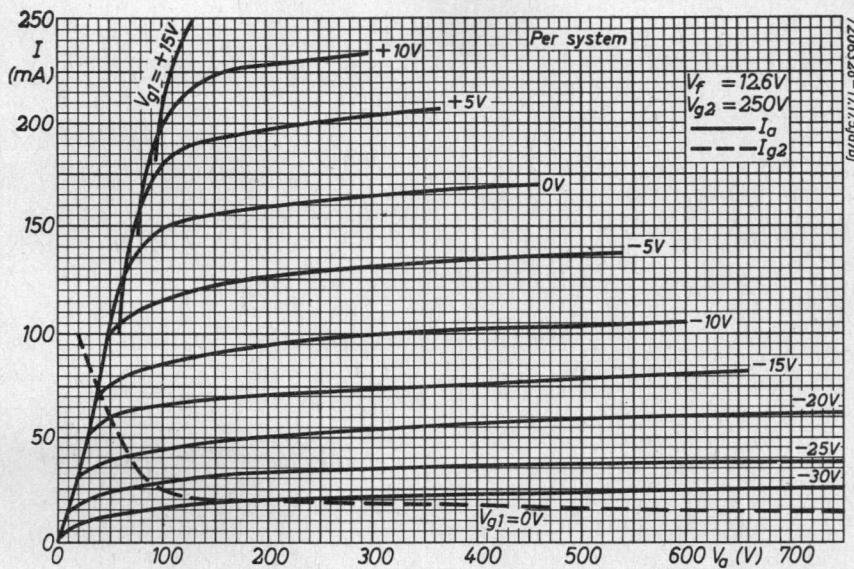
Frequency	f	=	up to	200	MHz
Anode voltage	V _a	=	max.	600	V
Anode input power	W _{ia}	=	max.	2x18	W
Anode dissipation	W _a	=	max.	2x7.5	W
Anode current	I _a	=	max.	2x47.5	mA
Grid No.2 voltage	V _{g2}	=	max.	250	V
Grid No.2 dissipation	W _{g2}	=	max.	5	W
Negative grid No.1 voltage	-V _{g1}	=	max.	175	V
Grid No.1 current	I _{g1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R _{g1}	=	max.	50	kΩ ¹⁾
Grid No.1 circuit resistance	R _{g1}	=	max.	25	kΩ ²⁾
Heater to cathode voltage	V _{kf}	=	max.	100	V

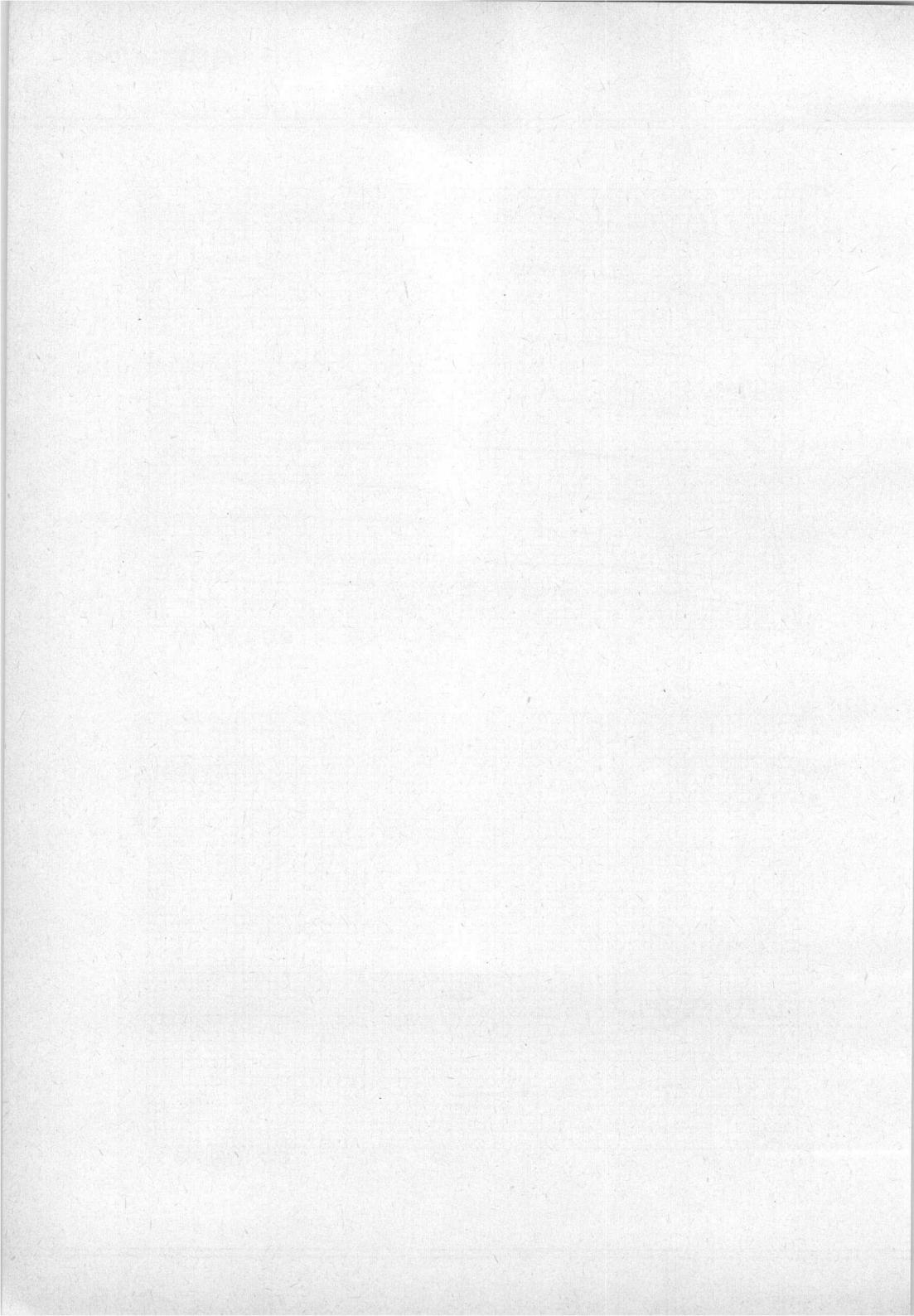
I.C.A.S. OPERATING CONDITIONS, intermittent service

Frequency	f	=	200	MHz
Anode voltage	V _a	=	600	V
Grid No.2 voltage	V _{g2}	=	200	V
Grid No.1 voltage	V _{g1}	=	-70	V
Anode current	I _a	=	2x30	mA
Grid No.2 current	I _{g2}	=	20	mA
Grid No.1 current	I _{g1}	=	2x1.5	mA
Input A.C. voltage, peak to peak	V _{g1g1'p}	=	160	V
Grid No.1 input power	W _{ig1}	=	2x0.105	W
Grid No.2 dissipation	W _{g2}	=	4.0	W
Anode input power	W _{ia}	=	2x18	W
Anode dissipation	W _a	=	2x5	W
Output power	W _o	=	26	W
Efficiency	η	=	72	%
Modulation factor	m	=	100	%
Modulation power	W _{mod}	=	20	W

1) Per system

2) Per tube





R.F. DOUBLE POWER TETRODE

QUICK REFERENCE DATA

λ (m)	Freq. (MHz)	C telegr.				C_{Ag_2} mod.			
		C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
		V_a (V)	W_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						

λ (m)	Freq. (MHz)	C fr. mult.		B mod.	
		V_a (V)	W_o (W)	V_a (V)	W_o (W)
6/2	50/150	500	20	600	86
		400	18	450	60
4/1.3	75/225	400	12	300	37

HEATING: indirect; cathode oxide-coated

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

TYPICAL CHARACTERISTICS

Amplification factor of grid No. 2 with respect to grid No. 1	$\mu g_2 g_1$	=	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	$C_a = 3.2 \text{ pF}$
Grid No.1 to all other elements except anode	$C_{g1} = 10.5 \text{ pF}$
Anode to grid No.1	$C_{ag_1} < 0.09 \text{ pF}$
	$C_{ag_1} - C_n < 0.035 \text{ pF}$

See electrode arrangement for internal neutralisation by C_n and C_n'

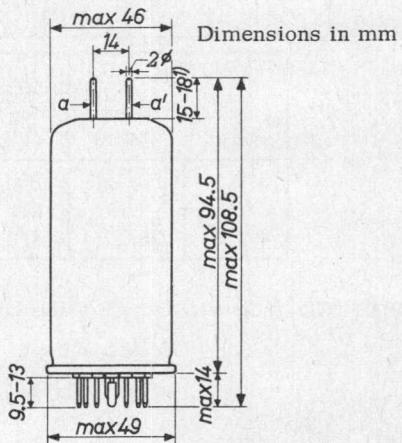
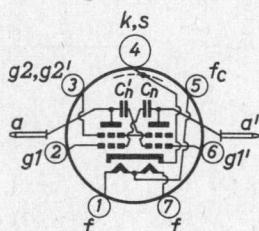
	in push-pull
Output capacitance	$C_o = 2.1 \text{ pF}$
Input capacitance	$C_i = 6.7 \text{ pF}$

TEMPERATURE LIMITS (Absolute limits)

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

MECHANICAL DATA

Base	: Septar
Socket	: 2422 513 00001
Anode connector:	40623
Net weight	: 60 g



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

¹⁾ Max. 3 mm glass included

R.F. CLASS C TELEGRAPHY

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

Frequency	f	up to	250	up to	500	MHz
Anode voltage	V_a	=	max.	750	max.	600 V
Anode input power	W_{ia}	=	max.	2×60	max.	2×50 W
Anode dissipation	W_a	=		max.	2×20	W
Anode current	I_a	=		max.	2×110	mA
Grid No.2 voltage	V_{g2}	=		max.	300	V
Grid No.2 dissipation	W_{g2}	=		max.	2×3.5	W
Negative grid No.1 voltage	$-V_{g1}$	=		max.	175	V
Grid No.1 current	I_{g1}	=		max.	2×5	mA
Grid No.1 circuit resistance	R_{g1}	=		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_{g1}	=	-80	-80	-80	-	V
Grid No.1 resistor	R_{g1}	=	-	-	-	20	kΩ
Grid No.2 voltage	V_{g2}	=	250	250	250	250	V
Anode current	I_a	=	2×100	2×80	2×100	2×100	mA
Grid No.1 current	I_{g1}	=	2×2.5	2×1.5	2×2.8	2×3	mA
Grid No.2 current	I_{g2}	=	16	17	18	20	mA
Input A.C. voltage, peak to peak	$V_{g1g1}'_p$	=	200	250	-	-	V
Grid No.2 dissipation	W_{g2}	=	4	4.25	4.5	5	W
Anode input power	W_{ia}	=	2×60	2×60	2×52	2×50	W
Anode dissipation	W_a	=	2×15	2×17.5	2×19	2×20	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. 2×75	max. 2×60	W
Anode dissipation	W_a	= max. 2×22.5		W
Anode current	I_a	= max. 2×120		mA
Grid No.2 voltage	V_{g_2}	= max. 300		V
Grid No.2 dissipation	W_{g_2}	= max. 2×4		W
Negative grid No.1 voltage	$-V_{g_1}$	= max. 175		V
Grid No.1 current	I_{g_1}	= max. 2×5		mA
Grid No.1 circuit resistance	R_{g_1}	= max. 50		$k\Omega$
Heater to cathode voltage	V_{kf}	= max. 100		V

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

two systems in push-pull

Frequency	f	=	250	MHz
Anode voltage	V_a	=	750	V
Grid No.1 voltage	V_{g_1}	=	-80	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	2×90	mA
Grid No.1 current	I_{g_1}	=	2×1.7	mA
Grid No.2 current	I_{g_2}	=	14	mA
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	=	260	V
Grid No.2 dissipation	W_{g_2}	=	3.5	W
Anode input power	W_{ia}	=	2×67.5	W
Anode dissipation	W_a	=	2×19.5	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_{g2}	= max.	300	max.	300	V
Grid No.2 dissipation	W_{g2}	= max.	2x3.5	max.	2x3.5	W ¹⁾
Negative grid No.1 voltage	$-V_{g1}$	= max.	175	max.	175	V
Grid No.1 current	I_{g1}	= max.	2x5	max.	2x5	mA
Grid No.1 circuit resistance	R_{g1}	= max.	50	max.	50	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_{g2}	=	250	250	V
Grid No.1 voltage	V_{g1}	=	-80	-80	V
Anode current	I_a	=	2x75	2x75	mA
Grid No.2 current	I_{g2}	=	20	18	mA
Grid No.1 current	I_{g1}	=	2x3.8	2x1.6	mA
Peak grid No.1 A.C. voltage	V_{g1p}	=	105	130	V
Grid No.2 dissipation	W_{g2}	=	5	4.5	W
Anode input power	W_{ia}	=	2x45	2x45	W
Anode dissipation	W_a	=	2x9.5	2x13	W
Output power	W_o	=	71	64	W
Efficiency	η	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	V_{g2p}	=	90	90	V
Modulation power	W_{mod}	=	45	45	W

1) Screen grid modulated via a choke. For all other modulation methods
 $W_{g2} = \text{max. } 2x2.3 \text{ W}$

2) Per system. When a common grid resistor is used $R_{g1} = \text{max. } 25 \text{ kΩ}$

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_{g2}	= max.	300	max.	300	V
Grid No.2 dissipation	W_{g2}	= max.	2x4	max.	2x4	W ¹⁾
Negative grid No.1 voltage	$-V_{g1}$	= max.	175	max.	175	V
Grid No.1 current	I_{g1}	= max.	2x5	max.	2x5	mA
Grid No.1 circuit resistance	R_{g1}	= max.	50	max.	50	k Ω 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_{g2}	=	250	250	V
Grid No.1 voltage	V_{g1}	=	-80	-80	V
Anode current	I_a	=	2x83	2x83	mA
Grid No.2 current	I_{g2}	=	16	16	mA
Grid No.1 current	I_{g1}	=	2x4	2x1.7	mA
Peak grid No.1 A.C. voltage	V_{g1p}	=	105	130	V
Grid No.2 dissipation	W_{g2}	=	4	4	W
Anode input power	W_{ia}	=	2x50	2x50	W
Anode dissipation	W_a	=	2x10.5	2x14.5	W
Output power	W_o	=	79	71	W
Efficiency	η	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	V_{g2p}	=	90	90	V
Modulation power	W_{mod}	=	50	50	W

1) Screen grid modulated via a choke. For all other modulation methods

$$W_{g2} = \text{max. } 2x2.6 \text{ W}$$

2) Per system. When a common grid resistor is used $R_{g1} = \text{max. } 25 \text{ k}\Omega$

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

Frequency	f	up to	250	up to	500	MHz
Anode voltage	V_a	=	max. 750	max.	600	V
Anode input power	W_{ia}	=	max. 2x60	max. 2x50	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	$V_{g_1 g_1' p}$	=	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_{g2}	= max.	300	V
Grid No.2 dissipation	W_{g2}	= max.	2x3.5	W
Grid No.1 circuit resistance	R_{g1}	= 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			
$V_{g1}^1)$	=	-27.5	-27.5	-26	V			
V_{g2}	=	250	250	250	V			
$R_{aa'}$	=	12.5	10	6.5	kΩ			
$V_{g1g1'p}$	=	0	55	0	V			
I_a	=	2x20	2x62	2x20	mA			
I_{g2}	=	0.9	23	1.4	27	2.2	28	mA
W_{g2}	=	0.2	5.8	0.4	6.7	0.6	7.0	W
W_{ia}	=	2x12	2x37	2x9.0	2x26	2x6.0	2x16.8	W
W_a	=	2x12	2x12	2x9.0	2x8.5	2x6.0	2x5.6	W
W_o	=	0	50	0	35	0	22.5	W
d_{tot}	=	-	2.4	-	3.1	-	2.9	%
η	=	-	67.5	-	67.5	-	67	%

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

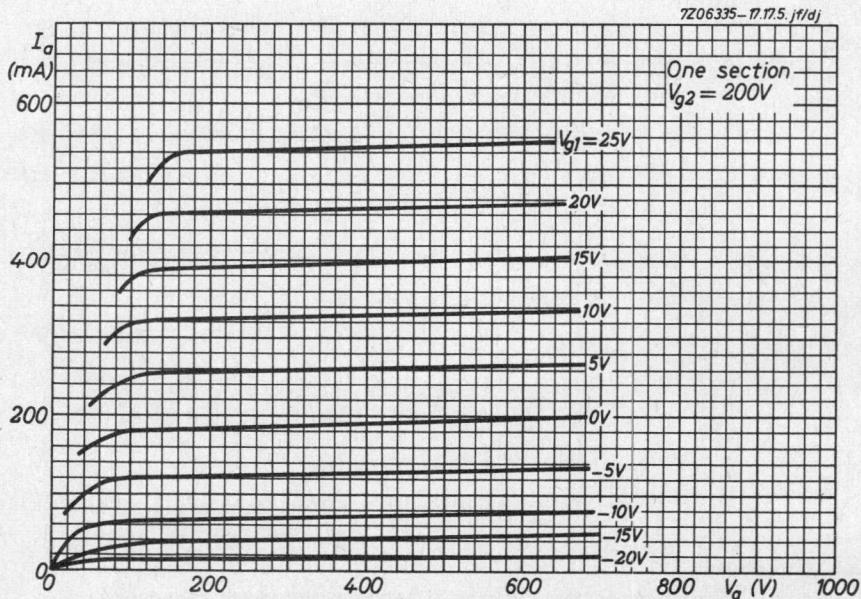
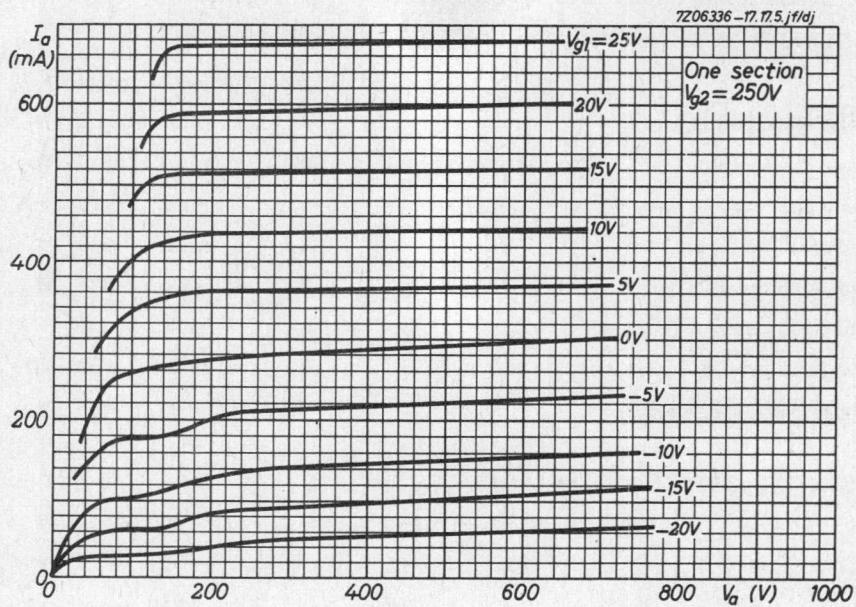
A.F. CLASS B AMPLIFIER AND MODULATOR with grid current**LIMITING VALUES** (Absolute limits)

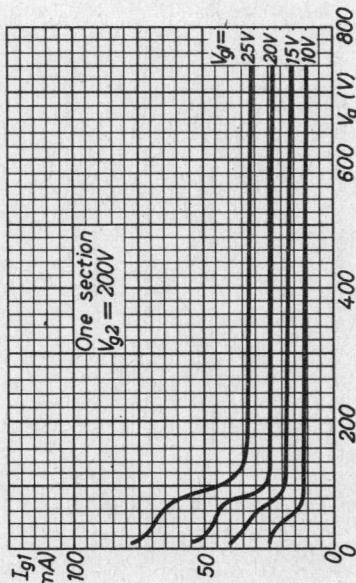
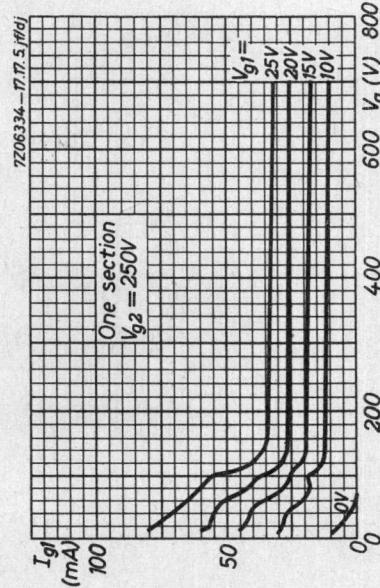
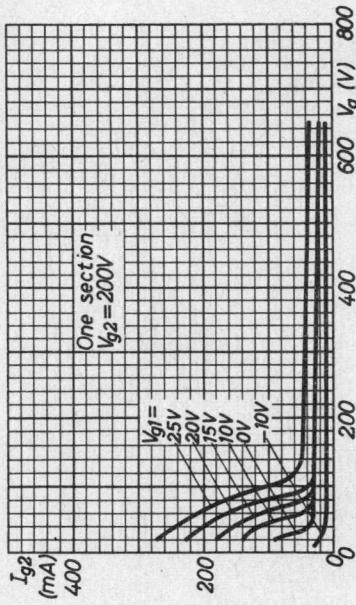
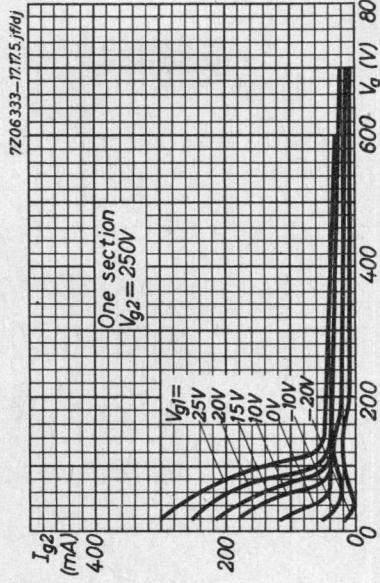
Anode voltage	V_a	= max.	600	V
Anode input power	W_{ia}	= max.	2x60	W
Anode dissipation	W_a	= max.	2x20	W
Anode current	I_a	= max.	2x110	mA
Grid No.2 voltage	V_{g2}	= max.	300	V
Grid No.2 dissipation	W_{g2}	= max.	2x3.5	W
Grid No.1 current	I_{g1}	= max.	2x5	mA
Grid No.1 circuit resistance	R_{g1}	= max.	50	kΩ
Heater to cathode voltage	V_{kf}	= max.	100	V

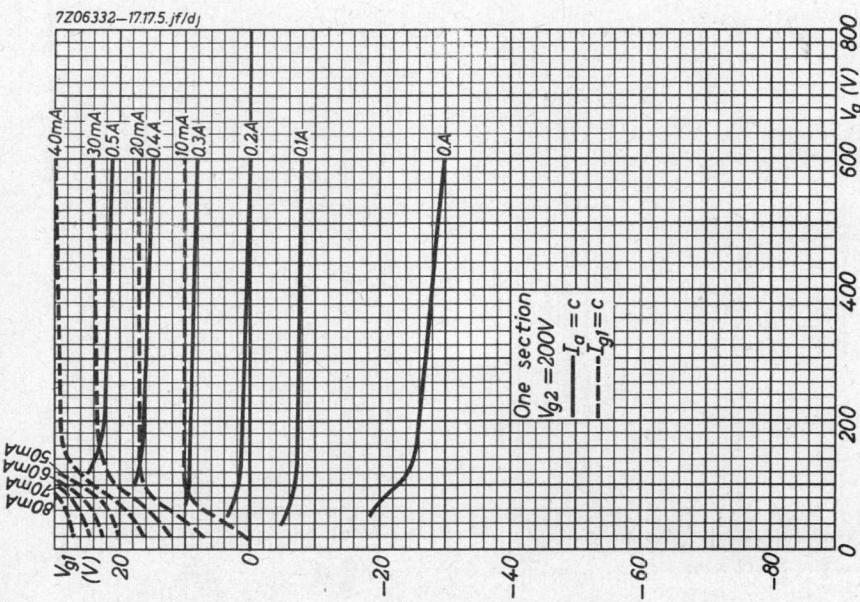
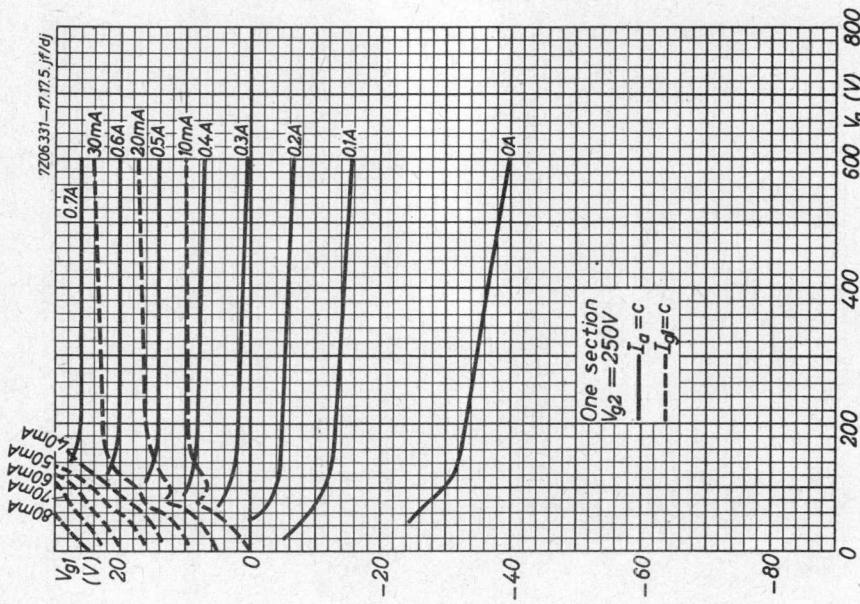
OPERATING CONDITIONS, two systems in push-pull

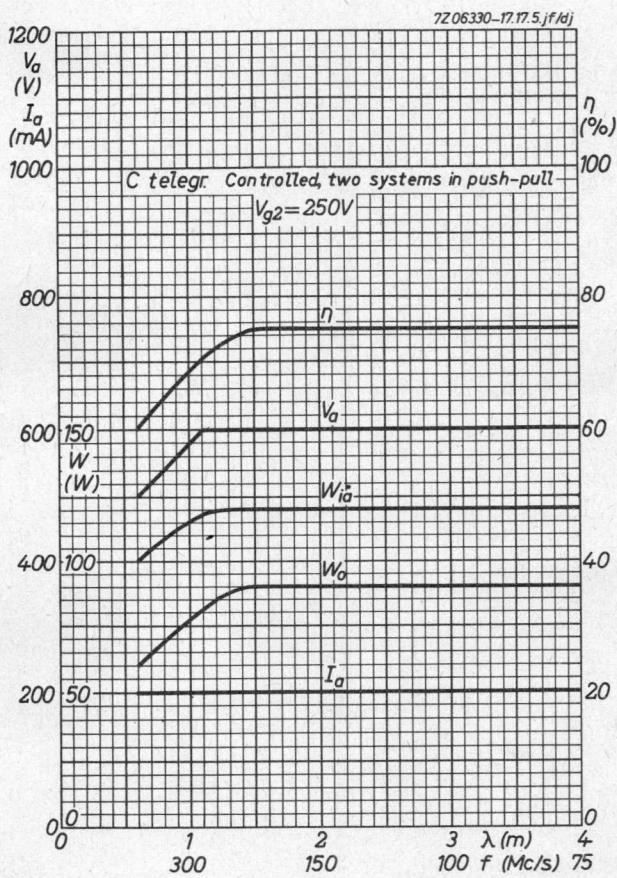
V_a	=	600	450	300	V
$V_{g1}^1)$	=	-25	-25	-25	V
V_{g2}	=	250	250	250	V
$R_{aa'}$	=	8.0	6.0	4.0	kΩ
$V_{g1g1'p}$	=	0 78	0 76	0 75	V
I_a	=	2x25 2x100	2x25 2x97	2x25 2x94	mA
I_{g1}	=	0 2x2.6	0 2x2.6	0 2x2.6	mA
I_{g2}	=	1.2 26	1.9 28	2.8 28	mA
W_{ig1}	=	0 2x0.1	0 2x0.1	0 2x0.1	W
W_{g2}	=	0.3 6.5	0.5 7.0	0.7 7.0	W
W_{ia}	=	2x15 2x60	2x11.2 2x43.5	2x7.5 2x28.2	W
W_a	=	2x15 2x17	2x11.2 2x13.5	2x7.5 2x9.7	W
W_o	=	0 86	0 60	0 37	W
d_{tot}	=	- 5	- 5	- 5	%
η	=	- 71.5	- 69	- 65.5	%

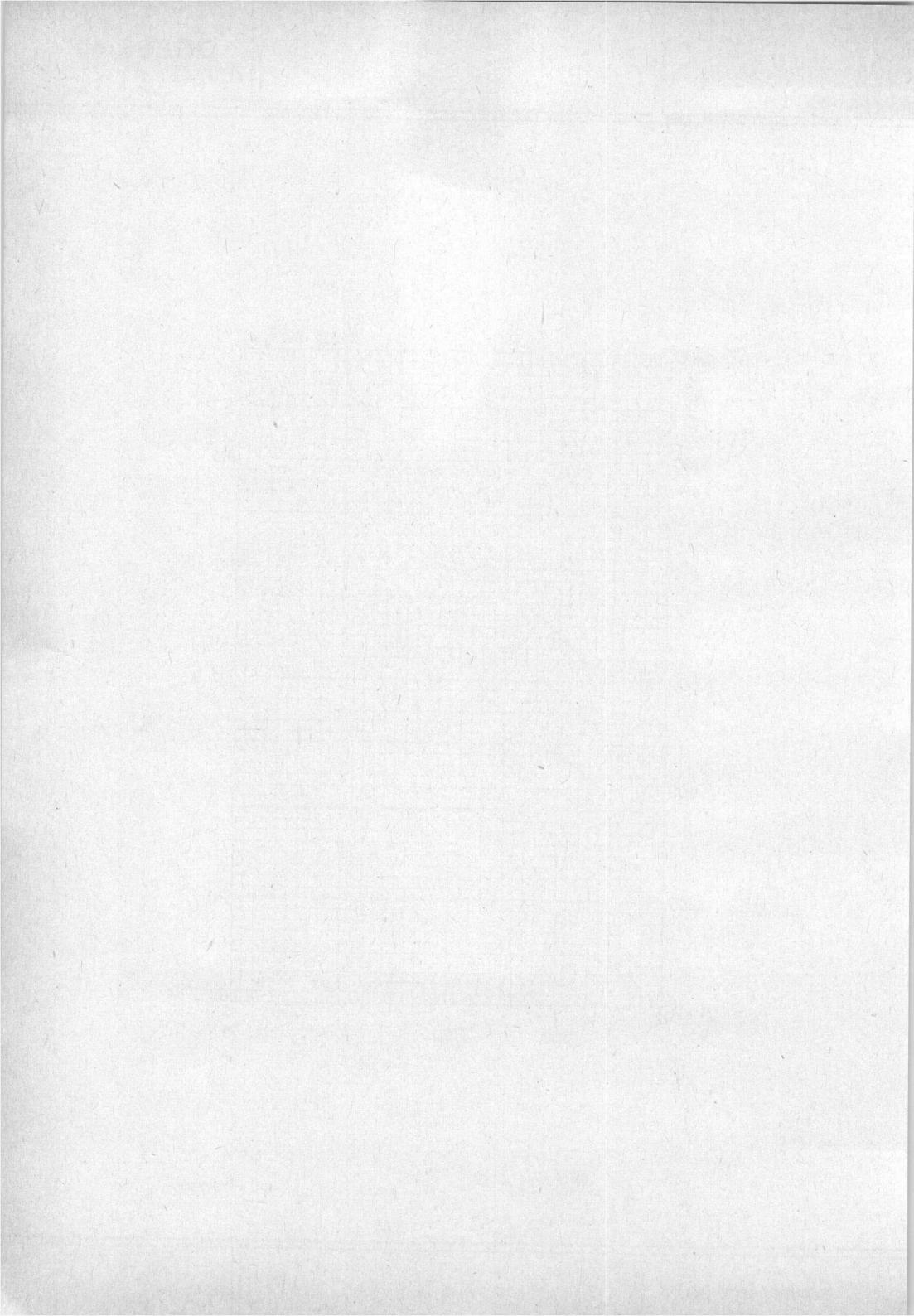
¹⁾ Individual adjustment of the grid bias of each system is recommended











R.F. POWER TRIODES

QUICK REFERENCE DATA

TAL12/10

λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C _a mod.		B mod. ¹⁾	
		V _a (kV)	W _o (kW)						
>60	< 5	12	10.5			10	7.7	12	17
>15	<20	10	10.5	8	2	8	6	10	16.6
				6	2			8	16.2

TAW12/10

λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C _a mod.		B mod. ¹⁾	
		V _a (kV)	W _o (kW)						
>60	< 5	12	15	12	3.7	10	7.7	12	30
>15	<20	10	12	10	3.3	8	6	10	25
6	50	6.5	6.5					8	19.5
4	75	4	3.5						

HEATING : direct; filament tungsten, two-phase

Filament voltage, per phase $V_f = 22$ VFilament current, per phase $I_f = 38$ A

The starting current must never exceed 78 A per phase

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 8 A

CAPACITANCES

Anode to all other elements except grid $C_a = 4$ pFGrid to all other elements except anode $C_g = 24.8$ pFAnode to grid $C_{ag} = 22$ pF

COOLING: TAL12/10 forced air cooled TAW12/10 water cooled

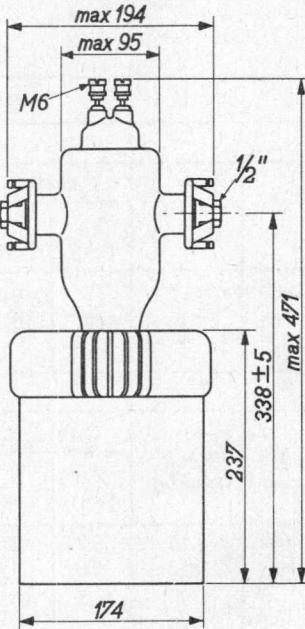
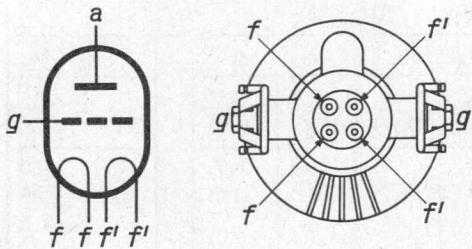
1) Two tubes 7Z2 3754

MECHANICAL DATA

Filament bracket : 40604
 Protective cap for grid seals: 40632
 Supporting ring : 40603
 Foot : K501
 Net weight : 13.5 kg

TAL12/10

Dimensions in mm



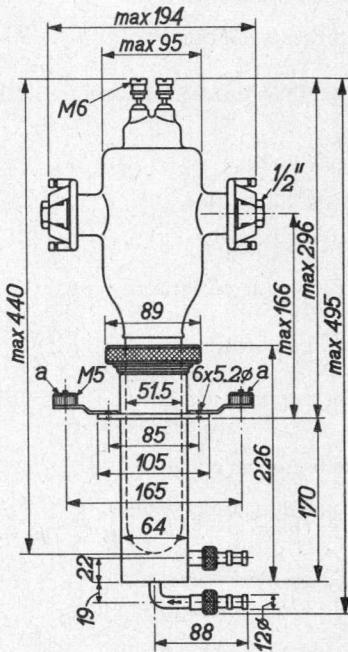
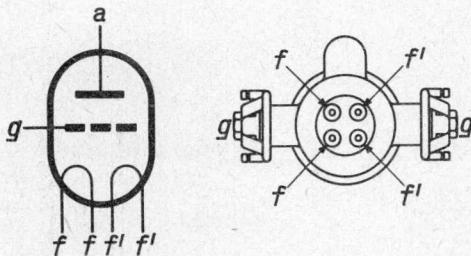
Mounting position: exactly vertical with anode down

Pressure loss	$p_i = 117 \text{ mm H}_2\text{O}$
at Inlet temperature	$t_i = 20^\circ\text{C}$
and Cooling air flow	$q = 5.4 \text{ m}^3/\text{min}$

MECHANICAL DATA**TAW12/10**

Dimensions in mm

Filament bracket	: 40604
Protective cap for grid seals	: 40632
Water-jacket	: K700
Net weight of the tube	: 2 kg
Net weight of the water-jacket:	2.1 kg
O-ring	: 3322 026 87801



Mounting position: exactly vertical with anode down

Pressure loss $p_i = 0.3 \text{ atm}$

with cooling water flow

 $q = 12 \text{ l/min}$

TYPICAL CHARACTERISTICS

Amplification factor	μ	= 22
Mutual conductance	$S (I_a = 0.5 \text{ A})$	= 7 mA/V
Saturation current	I_{sat}	= 8 A

LIMITING VALUES (Absolute limits)

		TAL12/10	TAW12/10
Anode voltage	V_a	= max. 12	max. 12 kV
Anode dissipation	W_a	= max. 4	max. 7.5 kW
Grid dissipation	W_g	= max. 300	max. 300 W
Grid circuit resistance	R_g	= max. 10	max. 10 kΩ
Required cooling air flow	$q \left\{ \begin{array}{l} t_i = 20^\circ\text{C} \\ W_a = 4 \text{ kW} \end{array} \right\}$	= min. 5.4	- m ³ /min
Inlet temperature of cooling air	t_i	= max. 45	- °C
Anode temperature	t_a	= max. 150	- °C
Required cooling water flow	$q (W_a = 7.5 \text{ kW})$	= -	min. 12 l/min
Outlet temperature of cooling water	t_o	= -	max. 50 °C
Temperature rise of cooling water	$t_o - t_i$	= -	max. 11 °C
Temperature of bulb and seals		= max. 150	max. 150 °C

R.F. POWER TRIODES

QUICK REFERENCE DATA								
λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C _a mod.		B mod. ¹⁾ V _a (kV)
		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; filament tungsten

Filament voltage

$$V_f = 21.5 \text{ V}$$

Filament current

$$I_f = 80 \text{ A}$$

Cold filament resistance

$$R_{fo} = 0.0224 \Omega$$

The starting current must never exceed 160 A

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

TYPICAL CHARACTERISTICSAmplification factor $\mu = 38$ Mutual conductance $S (I_a = 1 \text{ A}) = 10 \text{ mA/V}$ Saturation current $I_{sat} = 11 \text{ A}$ **CAPACITANCES** TAL12/20 TAW12/20Filament to anode $C_{af} = 1.9 \text{ pF}$ Grid to filament $C_{gf} = 23.5 \text{ pF}$ Grid to anode $C_{ag} = 25 \text{ pF}$ **COOLING:** TAL12/20 forced air cooled TAW12/20 water cooled

It is necessary to direct a low-velocity air flow to the grid seals at frequencies higher than 20 Mc/s

¹⁾ Two tubes

TAL12/20

Dimensions in mm

Grid connector

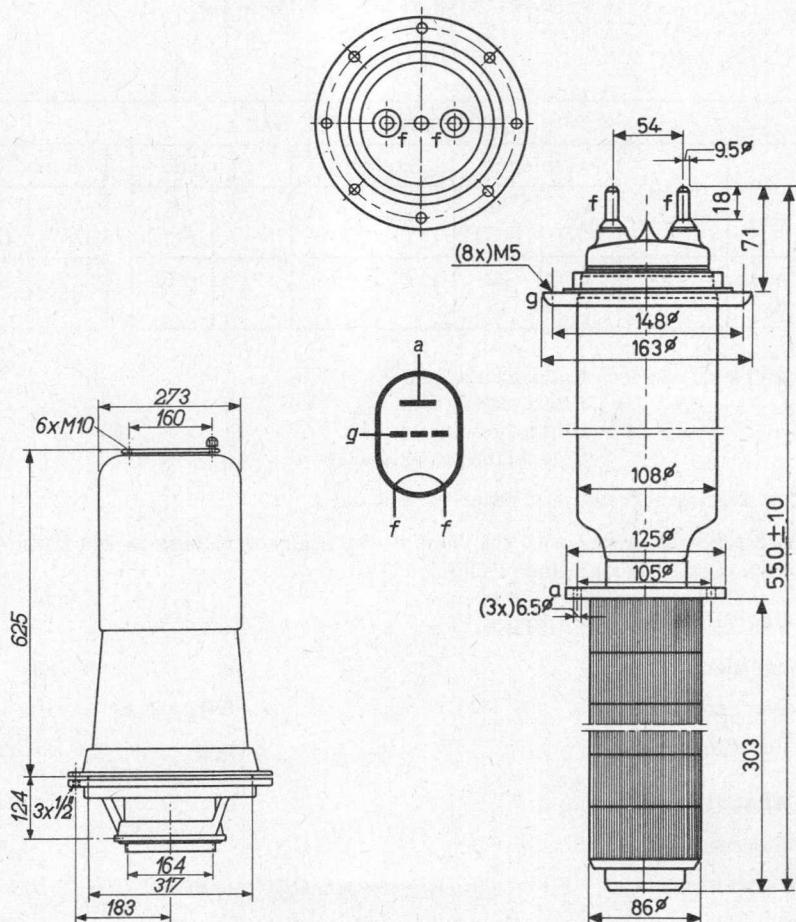
: 40664

Cooling house

: K503

Filament connector with cable : 40662

Net weight of the tube: 7.5 kg



K503/01

Housing with canalized outlet of the air

Mounting position:

exactly vertical with anode down

Pressure loss

$p_i = 130 \text{ mm H}_2\text{O}$

at Inlet temperature

$t_i = 20^\circ\text{C}$

and Cooling air flow

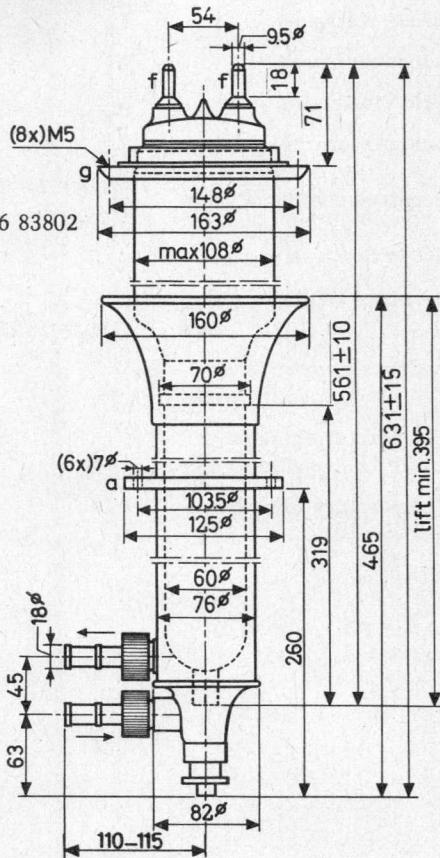
$q = 21.2 \text{ m}^3/\text{min}$

→ MECHANICAL DATA

Grid connector : 40664
 Filament connector with cable : 40662
 Water-jacket : K707
 Net weight of the tube : 3.6 kg (8x)M5
 Net weight of water-jacket : 4.3 kg
 O-ring : 3322 026 83802

TAW12/20

Dimensions in mm



Mounting position: exactly vertical with anode down

Pressure loss

with Cooling water flow

p_1 = 0.5 atm

q = 20 l/min

LIMITING VALUES (Absolute limits)**TAL12/20 TAW12/20**

Anode voltage	V _a	= max.	12	max.	12	kV
Anode dissipation	W _a	= max.	18	max.	18	kW
Grid dissipation	W _g	= max.	500	max.	500	W
Grid circuit resistance	R _g	= max.	10	max.	20	kΩ
Required cooling air flow	q $\left\{ \begin{array}{l} t_i = 20^\circ\text{C} \\ W_a = 18 \text{ kW} \end{array} \right\}$	= min.	21.2	-	-	m ³ /min
Anode temperature	t _a	= max.	180	-	-	°C
Required cooling water flow	q (W _a = 18 kW)	=	-	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		= max.	150	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	η	=	68	67	68 %
Modulation depth	m	=			100 %
Modulation power	W_{mod}	=			7 kW

OPERATING CONDITIONS R.F. CLASS B TELEPHONY

Wavelength	λ	>	11	m
Anode voltage	V_a	=	12	kV
Grid voltage	V_g	=	-200	V
Anode current	I_a	=	1.54	A
Peak grid A.C. voltage	V_{gp}	=	435	V
Anode input power	W_{ia}	=	18.5	kW
Anode dissipation	W_a	=	13.5	kW
Output power	W_o	=	5	kW
Efficiency	η	=	27	%
Modulation depth	m	=	100	%
Grid current	I_g	=	0.24	A
Grid input power	W_{ig}	=	210	W

OPERATING CONDITIONS AS A.F. CLASS B AMPLIFIER AND MODULATOR
two tubes

Anode voltage	V _a	=	12	10	kV
Grid voltage	V _g	=	-250	-200	V
Load resistance	R _{aa~}	=	5.6	10.5	kΩ
Peak grid to grid voltage	V _{ggp}	=	0 1900	0 1100	V
Anode current	I _a	=	2x0.32 2x2.45	2x0.25 2x1.1	A
Grid current	I _g	=	0 2x0.33	0 2x0.17	A
Grid input power	W _{ig}	=	0 2x280	0 2x85	W
Anode input power	W _{ia}	=	2x3.8 2x29	2x2.5 2x11	kW
Anode dissipation	W _a	=	2x3.8 2x8	2x2.5 2x3	kW
Output power	W _o	=	0 42	0 16	kW
Efficiency	η	=	- 72.5	- 73	%
Total harmonic distortion	d _{tot}	=	- 3.1	- 1.7	%

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C _a mod.		B mod. ¹⁾	
		V _a (kV)	W _o (kW)						
>15	<20	15	48.5	15	9	12	27	12	80
		12	38	12	8.5			12	38.5
		10	31	10	8	10	21.5	10	77
11	27	15	45			12	26	10	32
						10	20.5		
8	37.5	10	26						

HEATING: direct; filament tungsten, three-phase

Filament voltage, per phase V_f max. 28.3 V

Filament current, per phase I_f 48.5 A

Cold filament resistance, per phase R_{fo} 0.046 Ω

The filament current must never exceed a peak value of 100 A per phase at any time during the initial energizing schedule

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 23 A

CAPACITANCES

Anode to all other elements except grid C_a 2.6 pF

Grid to all other elements except anode C_g 72 pF

Anode to grid C_{ag} 31 pF

COOLING: forced air

¹⁾ Two tubes

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	12	kV
Anode current	I_a	=	1.25	A
Amplification factor	μ	=	25	
Mutual conductance	S	=	16.5	mA/V
Saturation current	I_{sat}	=	23	A

TEMPERATURE LIMIT (Absolute limit)

Temperature of seals max. 180 °C

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	max.	15	kV
Negative grid voltage	$-V_g$	max.	1000	V
Anode current	I_a	max.	5	A
Grid current	I_g	max.	0.6	A
Anode input power	W_{ia}	max.	75	kW
Anode dissipation	W_a	max.	18	kW

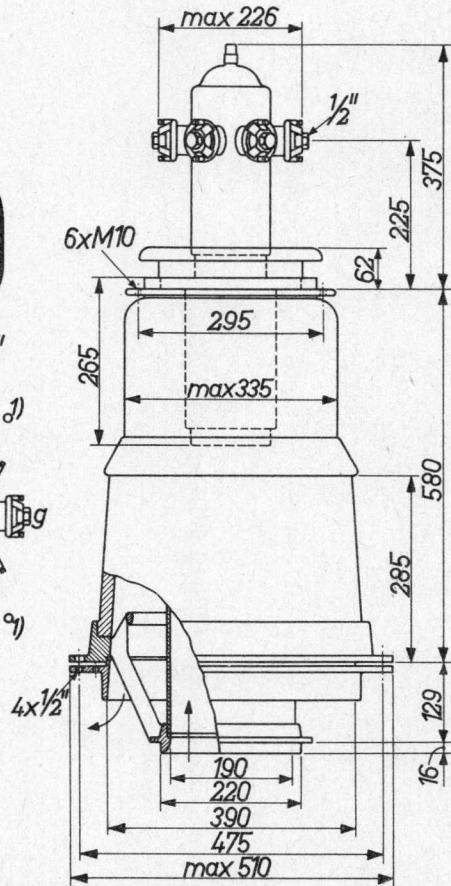
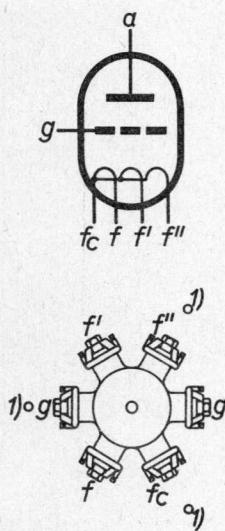
MECHANICAL DATA

Dimensions in mm

Protective caps for grid- and filament seals: 40632

Filament bracket (for D.C. supply) : 40606

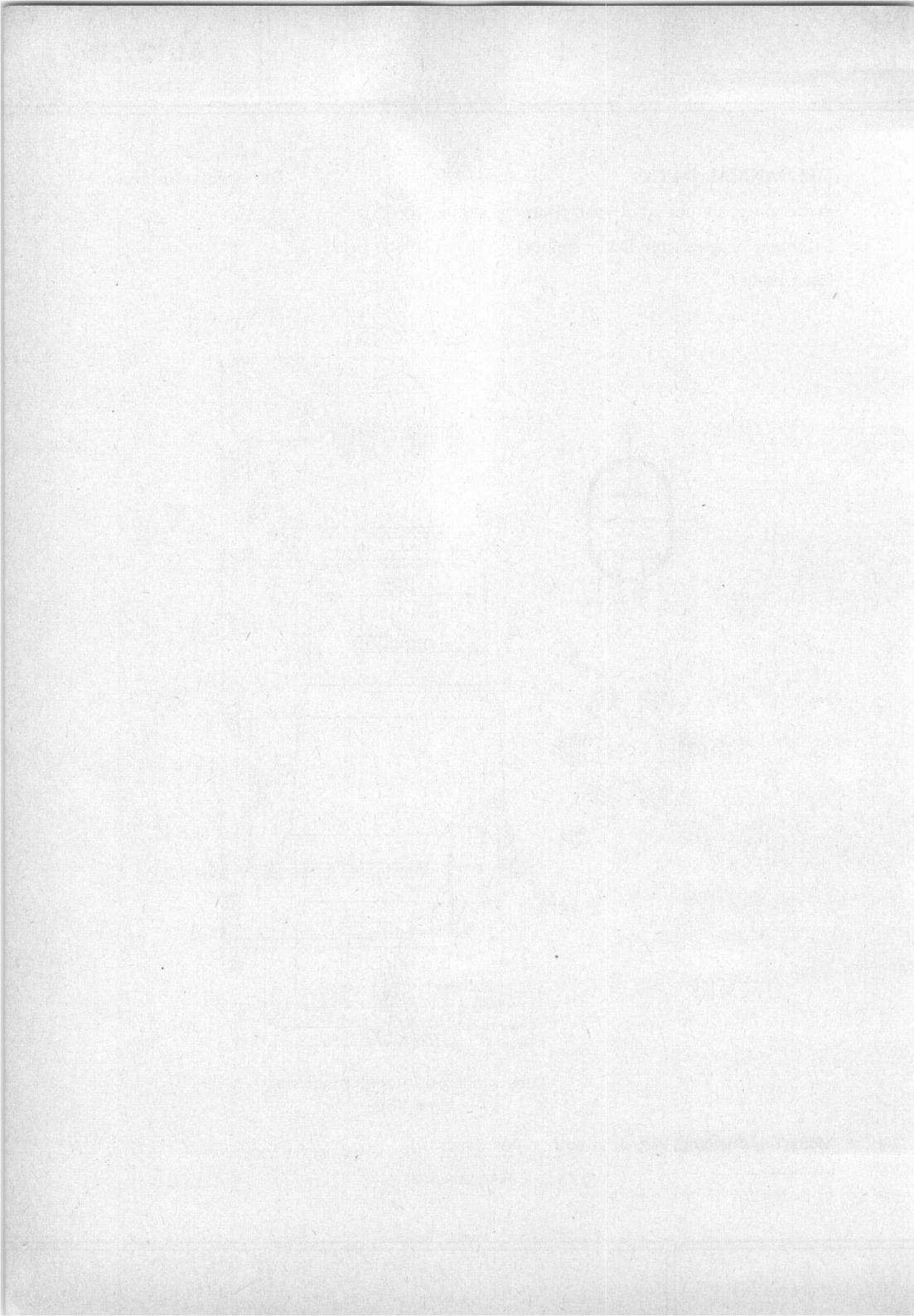
Net weight : 20 kg



Tube mounted in cooler housing
type K505

Mounting position: vertical with anode down

¹⁾ Holes for locating pins



WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C _a mod.		B mod. ¹⁾	
		V _a (kV)	W _o (kW)						
>15	<20	15	48.5	15	9	12	27	12	107
		12	38	12	8.5			12	38.5
		10	31	10	8	10	21.5	10	77
11	27	15	45			12	26	10	32
8	37.5	10	26			10	20.5		

HEATING: direct; filament tungsten, three-phase

Filament voltage, per phase V_f = max. 28.3 V

Filament current, per phase I_f = 48.5 A

Cold filament resistance, per phase R_{fo} = 0.046 Ω

The filament current must never exceed a peak value of 100 A per phase at any time during the initial energizing schedule

Each tube is marked with the value of the filament voltage at which the saturation current has a value of 23 A

CAPACITANCES

Anode to all other elements except grid C_a = 2.6 pF

Grid to all other elements except anode C_g = 72 pF

Anode to grid C_{ag} = 31 pF

COOLING: water/air flow to seals

1) Two tubes

7Z2 8624

TYPICAL CHARACTERISTICS

Anode voltage	V_a = 12 kV
Anode current	I_a = 1.25 A
Amplification factor	μ = 25
Mutual conductance	S = 16.5 mA/V
Saturation current	I_{sat} = 23 A

COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	$q_{min}^1)$ (l/min)	P_i (atm)
10	20	10	0.03
	50	22	0.15
20	20	18	0.09
	50	40	0.4
30	20	27	0.21
	50	59	1.0

See also the cooling curves

COOLING

It is necessary to direct a low-velocity air flow to the anode and grid seals at frequencies above 10 Mc/s. Cooling of the grid seals can be effected by means of the caps No.40632

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals = max. 180 °C

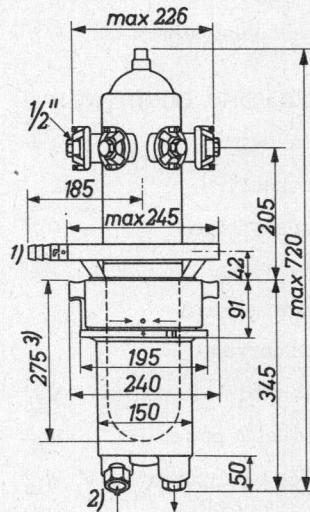
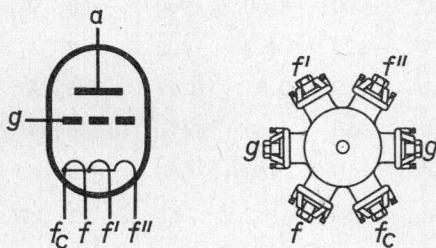
Inlet temperature of cooling water t_i = max. 50 °C

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

MECHANICAL DATA

Dimensions in mm

Water-jacket	: K715
Protective caps for grid and filament seals:	40632
Filament bracket (for D.C. supply)	: 40606
Net weight of the tube	: 6.8 kg
Net weight of the water-jacket	: 16.7 kg



Tube mounted in water-jacket
type K715

Mounting position: vertical with anode down

1) Use connecting hose with an inner diameter of 1"

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 275 mm

7Z2 3774

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

Anode voltage	V_a	=	max.	15	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	5	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	75	kW
Anode dissipation	W_a	=	max.	30	kW

OPERATING CONDITIONS

Wavelength	λ	=	>15	>15	>15	11	8	m
Frequency	f	=	<20	<20	<20	27	37.5	Mc/s
Anode voltage	V_a	=	15	12	10	15	10	kV
Grid voltage	V_g	=	-900	-700	-600	-900	-600	V
Anode current	I_a	=	4.2	4.2	4.2	4.2	4.2	A
Grid current	I_g	=	0.42	0.5	0.53	0.42	0.6	A
Peak grid A.C. voltage	V_{gp}	=	1470	1350	1160	1470	1200	V
Grid input power	W_{ig}	=	560	610	560	560	650	W
Anode input power	W_{ia}	=	63	50.4	42	63	42	kW
Anode dissipation	W_a	=	14.5	12.4	11	18	16	kW
Output power	W_o	=	48.5	38	31	45	26	kW
Efficiency	η	=	77	75.5	74	71.5	62	%

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)						
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 $\mu = 25$

Mutual conductance $S (I_a = 44 \text{ mA}) = 2.8 \text{ mA/V}$

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

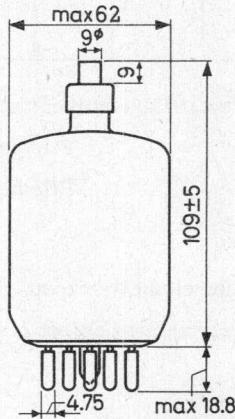
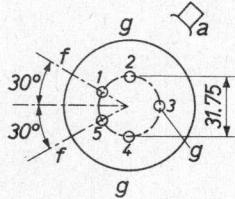
LIMITING VALUES (Absolute limits)

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

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_{gp}	=	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_{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 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	%

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	%

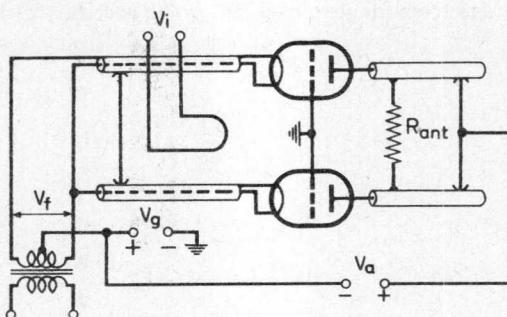
B. With anode and grid alternating voltage. Phase-shift of 180° between V_a and V_g

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

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

A.F. CLASS B AMPLIFIER AND MODULATOR**LIMITING VALUES (Absolute limits)**

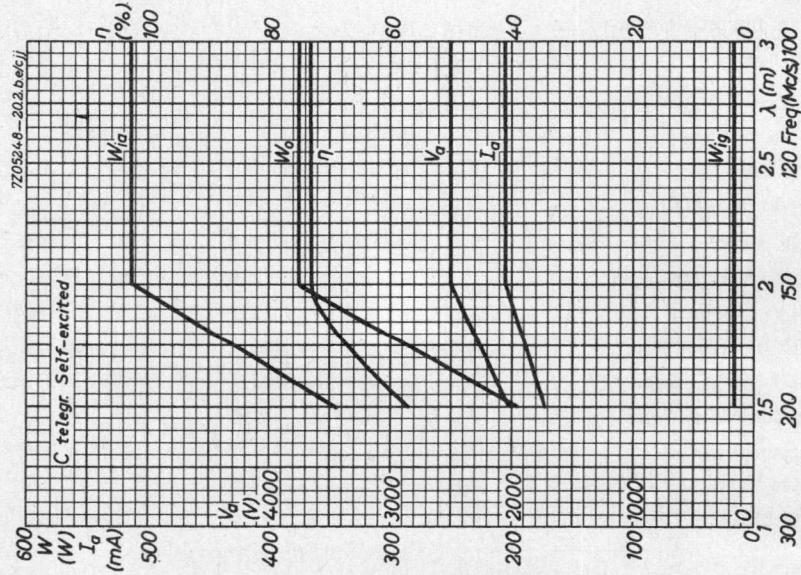
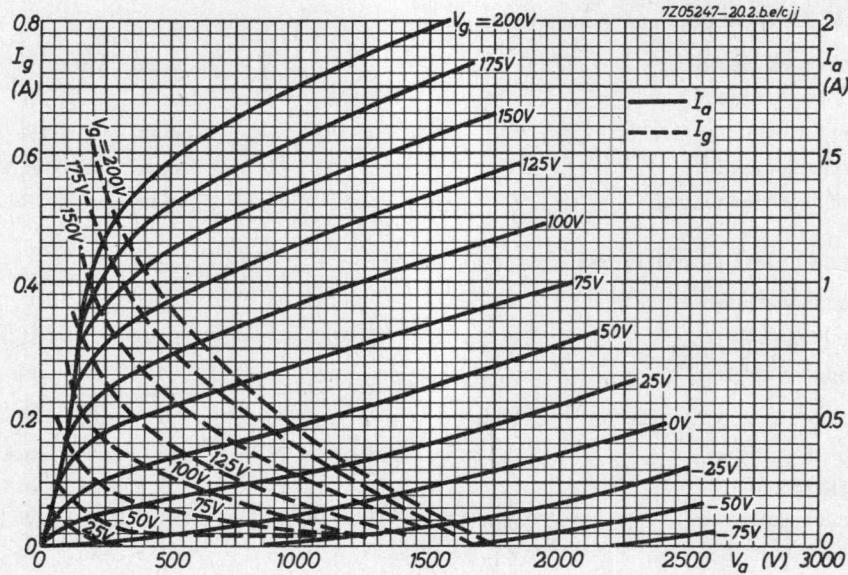
Anode voltage	V_a	=	max.	2500	V
Anode dissipation	W_a	=	max.	135	W
Grid dissipation	W_g	=	max.	16	W
Cathode current	I_k	=	max.	250	mA
Peak cathode current	I_{kp}	=	max.	1.6	A

OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	2500	2000	V
Grid voltage	V_g	=	-86	-65	V
Load resistance	$R_{aa\sim}$	=	<u>18.2</u>	<u>12.0</u>	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	$R_{aa\sim}$	=	<u>8.5</u>	<u>5.0</u>	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



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)
2	150	2500	390			2500	65	
		2000	295			2000	64	
		1500	210			1500	59	
		1000	126					
3	100			2500	910			
				2000	700			
				1500	516			
				1000	332			
C osc. industrial						B mod. two tubes		
6	50	V _a ∞ (V)	W _o (W)	V _a \sim (V)	W _o (W)		V _a (V)	W _o (W)
		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

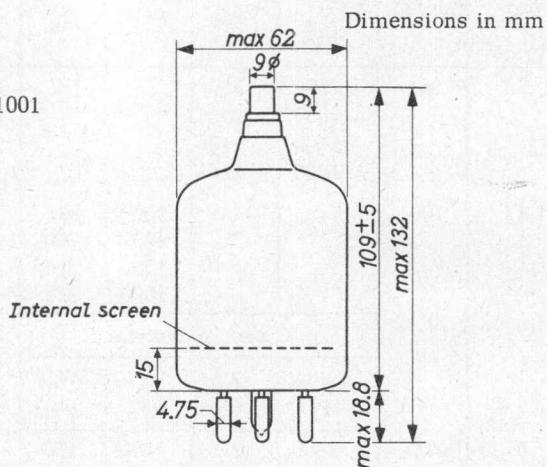
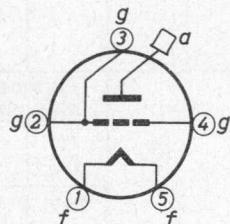
MECHANICAL DATA

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

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 _{gp}	=	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

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 _{gp}	=	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

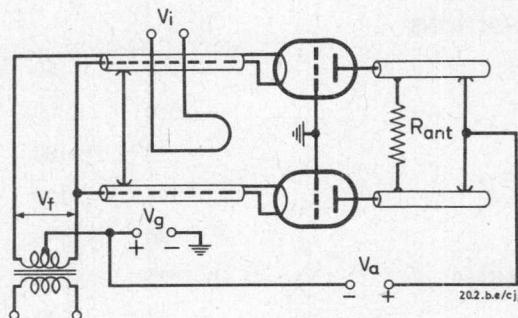
7Z2 3444

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

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 VRMS
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	VRMS
Anode current	I_a	=	90	mA
Grid current	I_g	=	20	mA
Grid resistor	R_g	=	1700	Ω
Grid voltage	V_g	=	85	VRMS
Anode input power	W_{ia}	=	255	W
Anode dissipation	W_a	=	85	W
Output power	W_o	=	170	W
Efficiency	η	=	67	%

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

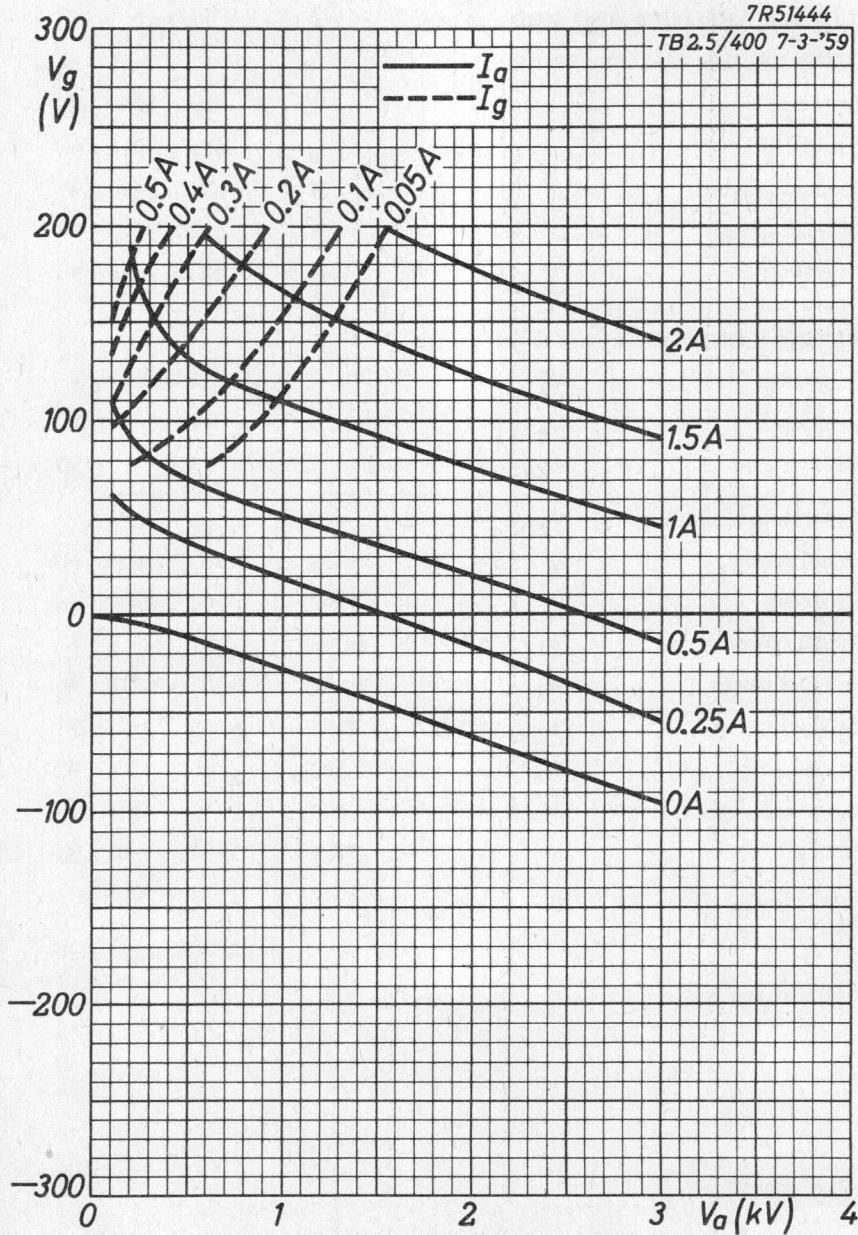
OPERATING CONDITIONS, two tubes

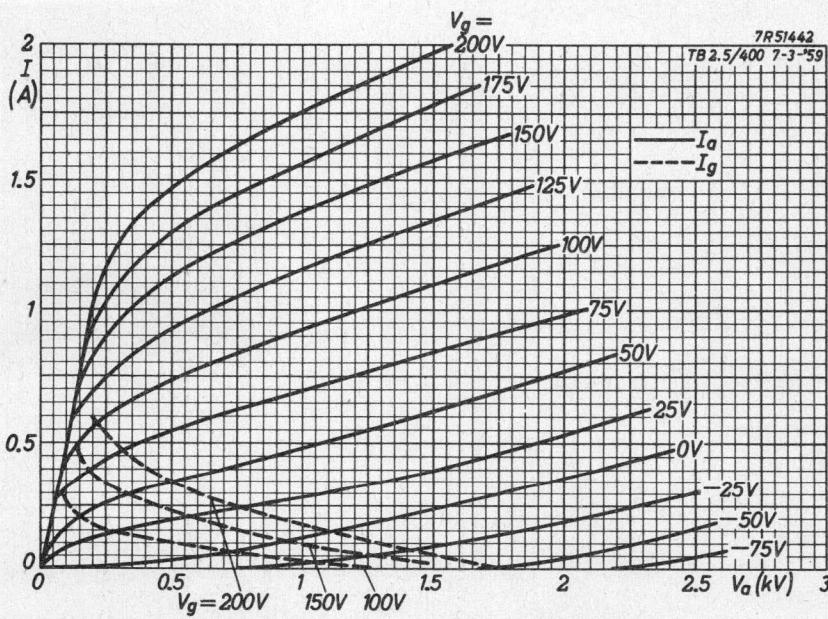
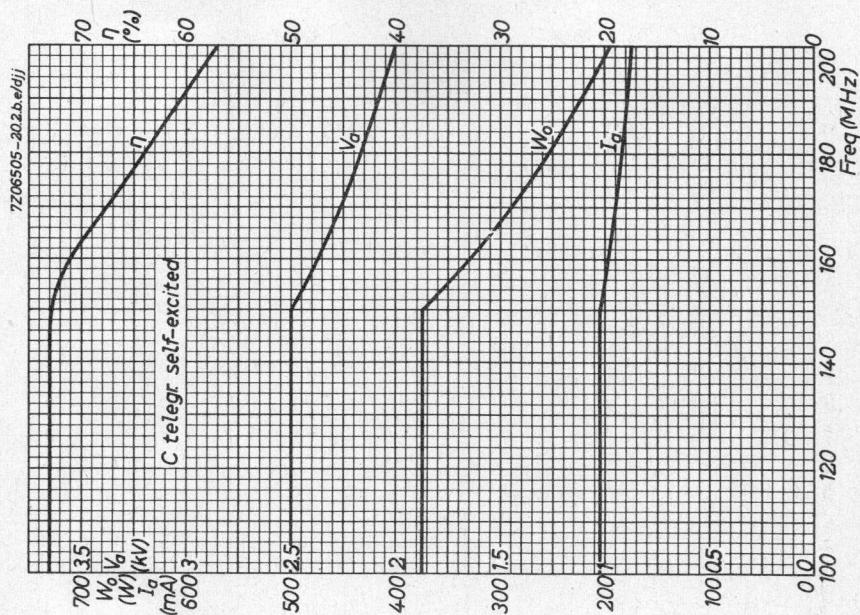
Anode voltage	V_a	=	2500	1000	V
Grid voltage	V_g	=	-86	-23	V
Load resistance	$R_{aa\sim}$	=	18.2	5.0	kΩ
Peak grid to grid voltage	V_{ggp}	=	0 412	0 295	V
Anode current'	I_a	=	2x30 2x178	2x30 2x210	mA
Grid current	I_g	=	0 2x42	0 2x40	mA
Grid input power	W_{ig}	=	0 2x7.8	0 2x5.4	W
Anode input power	W_{ia}	=	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	%

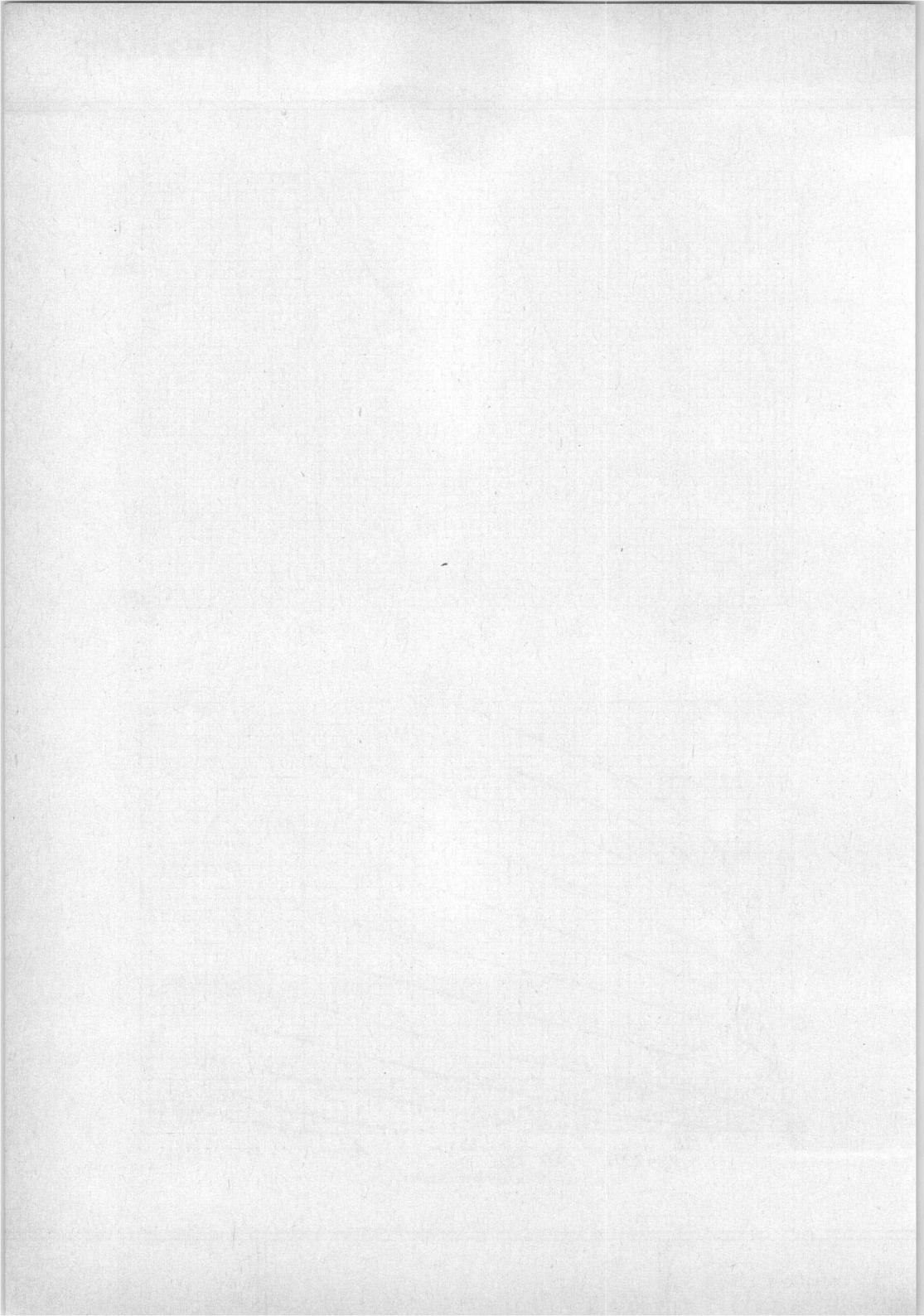
7Z2 3448

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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							
	∞		\sim					
50	V _a (kV)	W _o (W)	V _a (kV)	W _o (W)				
	3.5	1100	4	630				
	2.25	685	3	415				

HEATING: direct, parallel supply; filament thoriated tungsten

$$\text{Filament voltage} \quad V_f = 5 V + 5\% \\ -10\%$$

$$\text{Filament current} \quad I_f = 14.1 A$$

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)

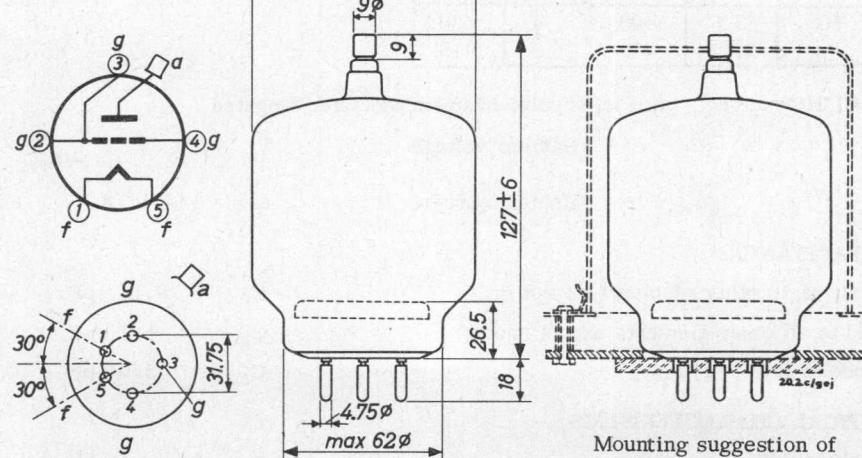
Bulb temperature	$t_{\text{bulb}} = \text{max. } 350^{\circ}\text{C}$
Anode seal temperature	$t_a = \text{max. } 220^{\circ}\text{C}$
Pin temperature	$t_{\text{pin}} = \text{max. } 180^{\circ}\text{C}$

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 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)**

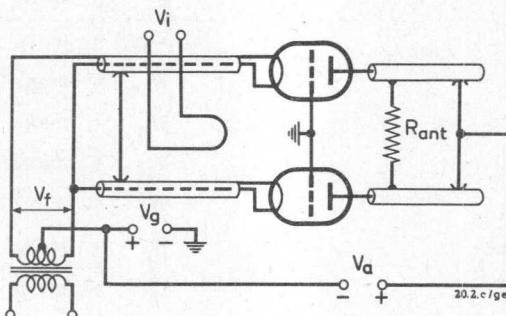
Frequency	f	up to	100	Mc/s
Anode voltage	V _a	= max.	4	kV
Anode input power	W _{ia}	= max.	1550	W
Anode dissipation	W _a	= max.	350	W
Negative grid voltage	-V _g	= max.	500	V
Grid dissipation	W _g	= max.	40	W
Grid circuit resistance	R _g	= max.	100	kΩ
Cathode current	I _k	= max.	500	mA

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 $k\Omega$
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° 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	kVRMS
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	k Ω
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	kVRMS
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

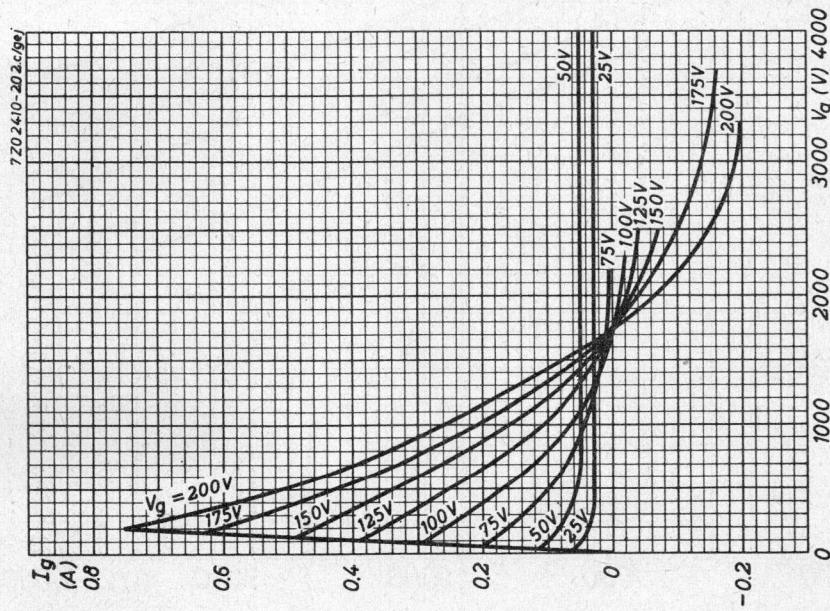
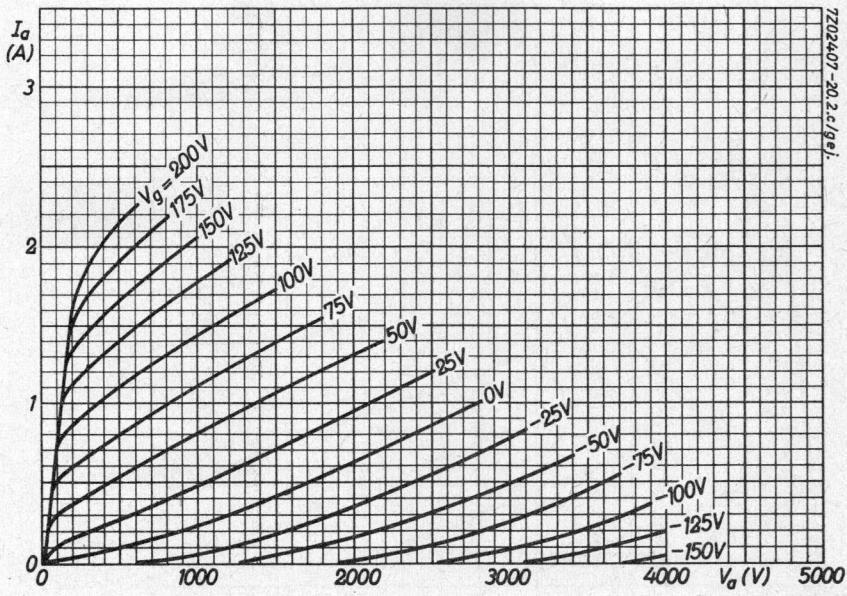
LIMITING VALUES (Absolute limits)

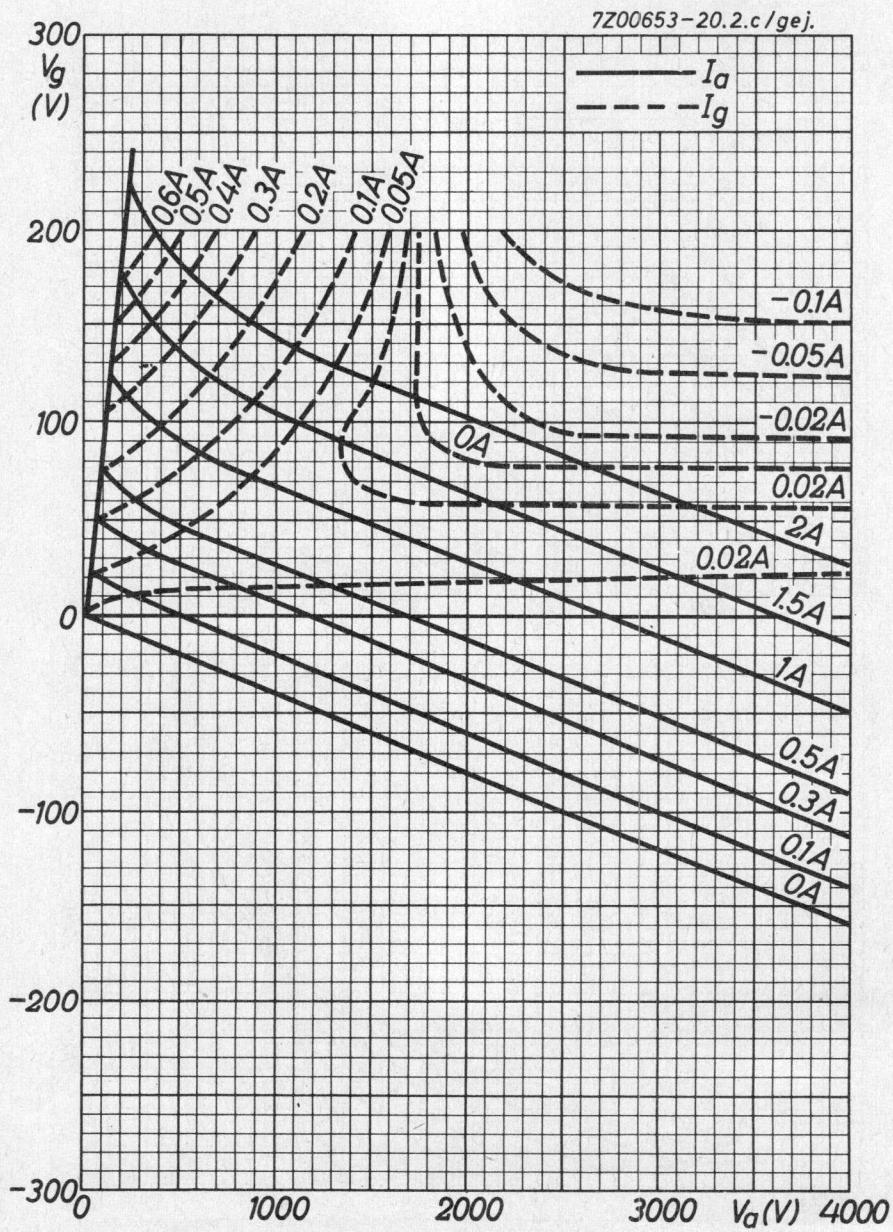
Anode voltage	V_a	= max.	4	kV
Anode input power	W_{ia}	= max.	1550	W
Anode dissipation	W_a	= max.	350	W
Negative grid voltage	$-V_g$	= max.	500	V
Grid dissipation	W_g	= max.	40	W
Grid circuit resistance	R_g	= max.	100	k Ω
Cathode current	I_k	= max.	500	mA

OPERATING CONDITIONS

V_a	=	4	3	2.5	kV
V_g	=	-135	-102	-77.5	V ¹⁾
$R_{aa\sim}$	=	20	14.5	12	k Ω
V_{ggp}	=	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





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)
3	100	4000	1690	4000	1950	3000	1050	4000
		3500	1430	3500	1650			3500
		3000	1175	3000	1375			3000
		2500	950	2500	1120			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	$\mu = 28$
Mutual conductance	$S (I_a = 125 \text{ mA}) = 4.5 \text{ mA/V}$

TEMPERATURE LIMITS (Absolute limits)

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

¹⁾ Power transferred from driving stage included

²⁾ Two tubes

COOLING

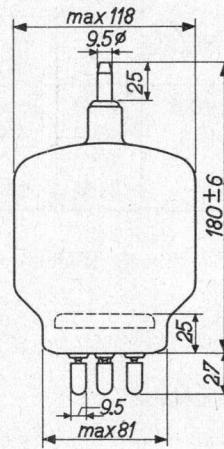
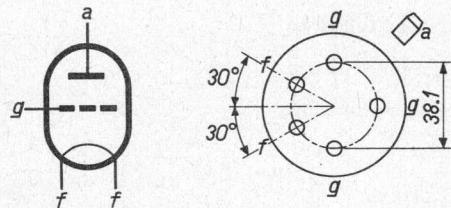
In general cooling of the tube is not necessary at normal ambient temperature at frequencies below 50 Mc/s.

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

Socket : 2422 512 00001
Anode connector: 40626
Net weight : 420 g

Dimensions in mm



Mounting position: vertical with base up or down

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

Frequency	f	up to	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

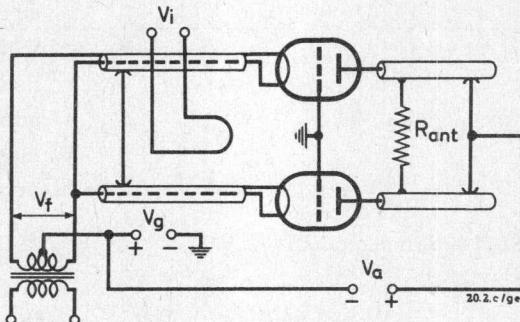
OPERATING CONDITIONS (controlled)

Wavelength	λ	=	3	3	3	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	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_{gp}	=	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	$R_{aa\sim}$	=	<u>14.5</u>	<u>10.2</u>	kΩ
Peak grid to grid voltage	V_{ggp}	=	0	566	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	$R_{aa\sim}$	=	<u>7.5</u>	<u>5.2</u>	kΩ
Peak grid to grid voltage	V_{ggp}	=	0	560	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	k Ω
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	k Ω
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 VRMS
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

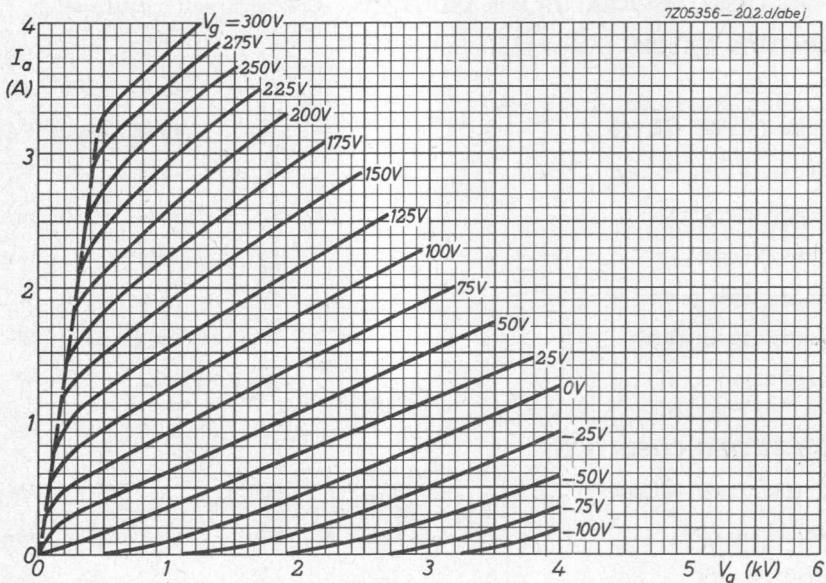
OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	4500 ¹⁾	3800 ²⁾	VRMS
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	%

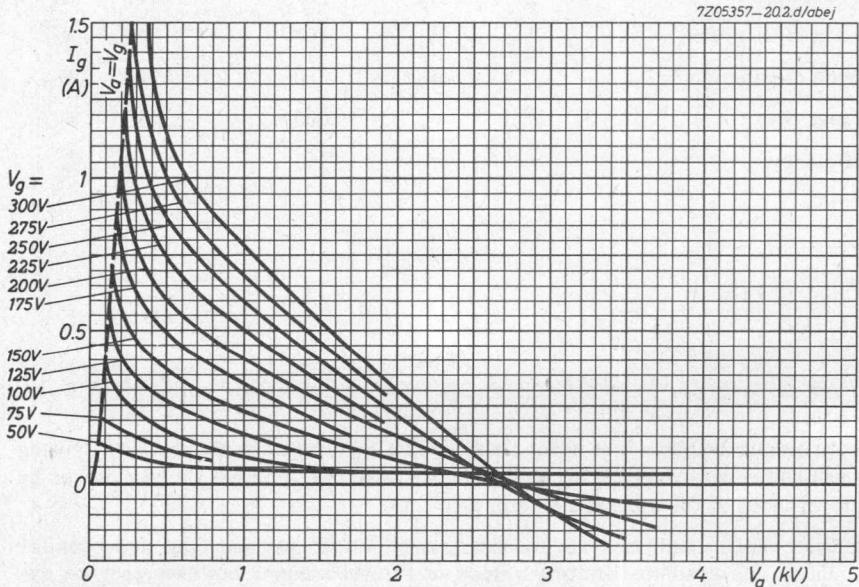
1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

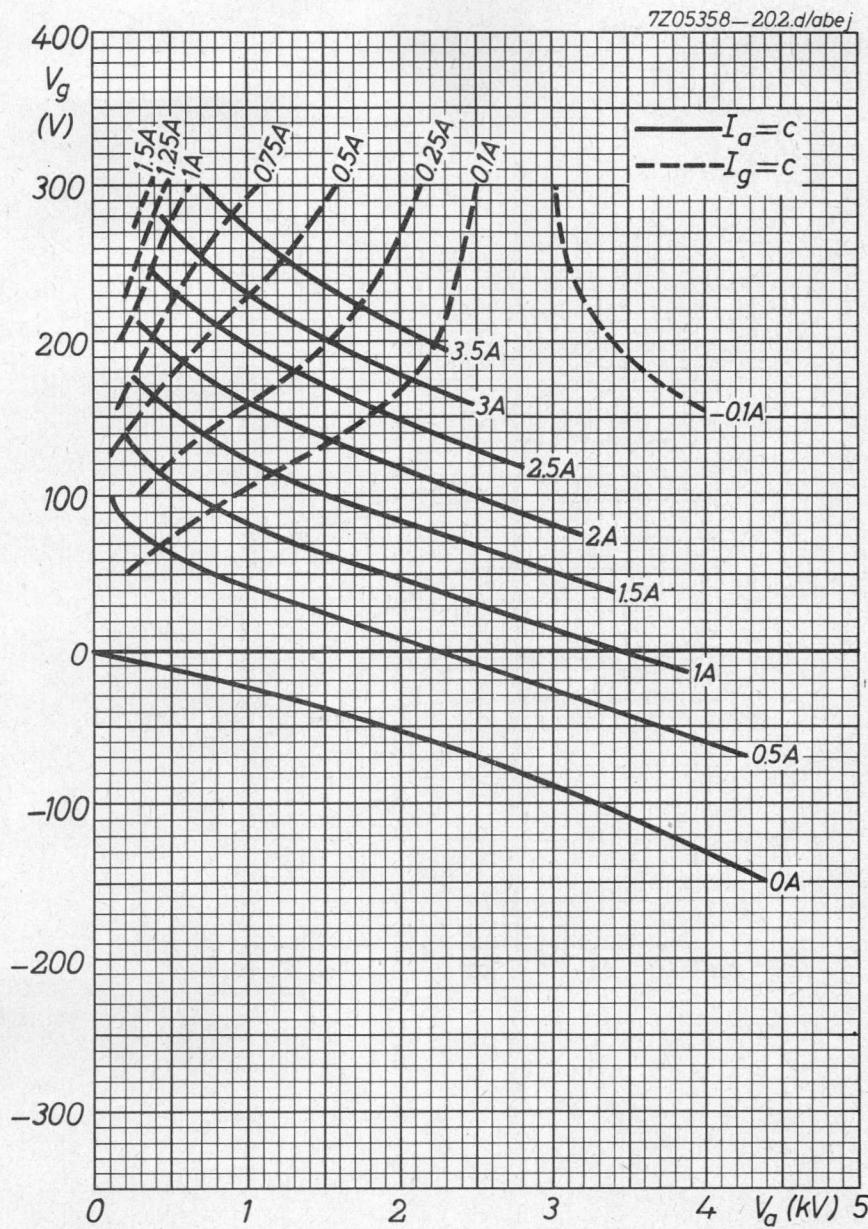
2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.

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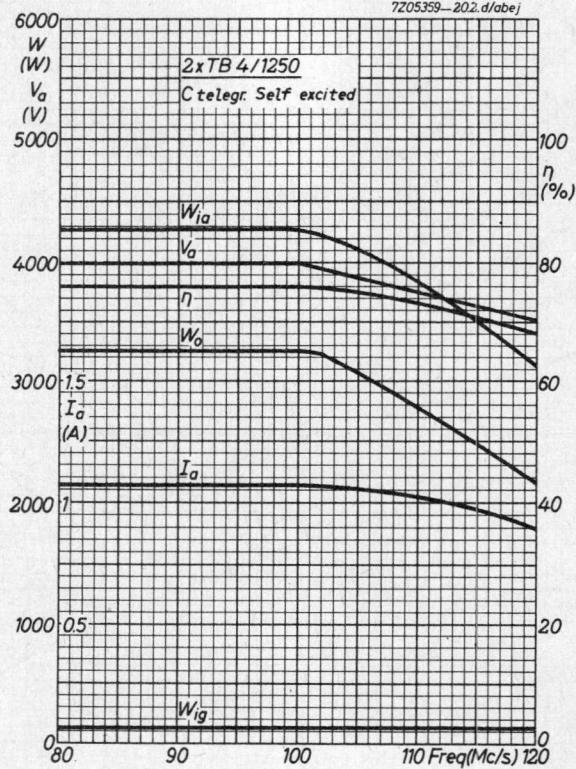


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7Z05359-202.d/abej



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	$k\Omega$
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	°C
Seal temperature	t	max.	220	°C

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 ($W_o - W_{\text{feedb}}$)	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 ($W_o - W_{feedb}$)	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 airflow on the tube is necessary. A small fan will suffice; it is recommended to mount the fan underneath the tube socket.

ACCESSORIES

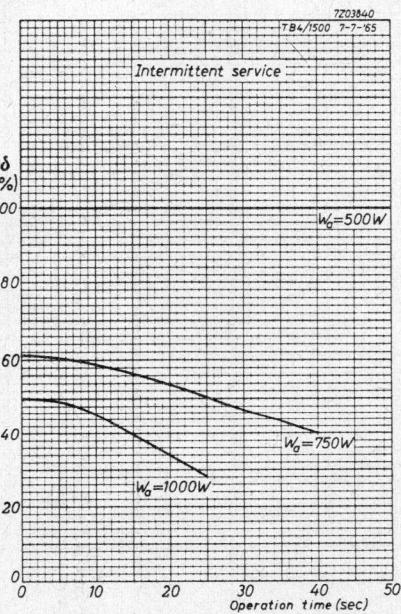
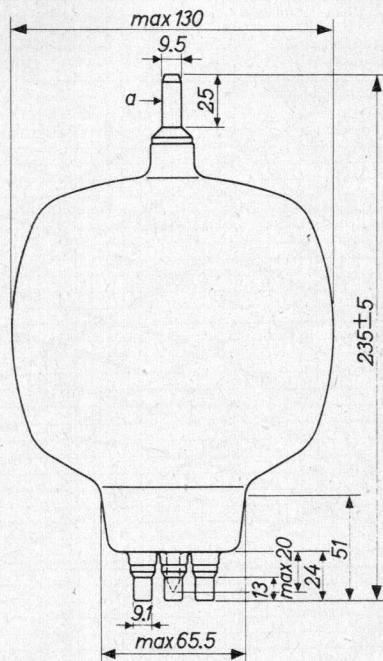
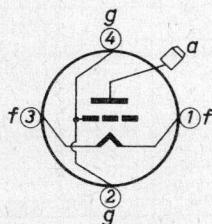
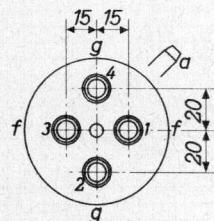
Socket	catalogue nr.	2422 511 05001
Anode connector	type	40665

MECHANICAL DATA

Mounting position: vertical

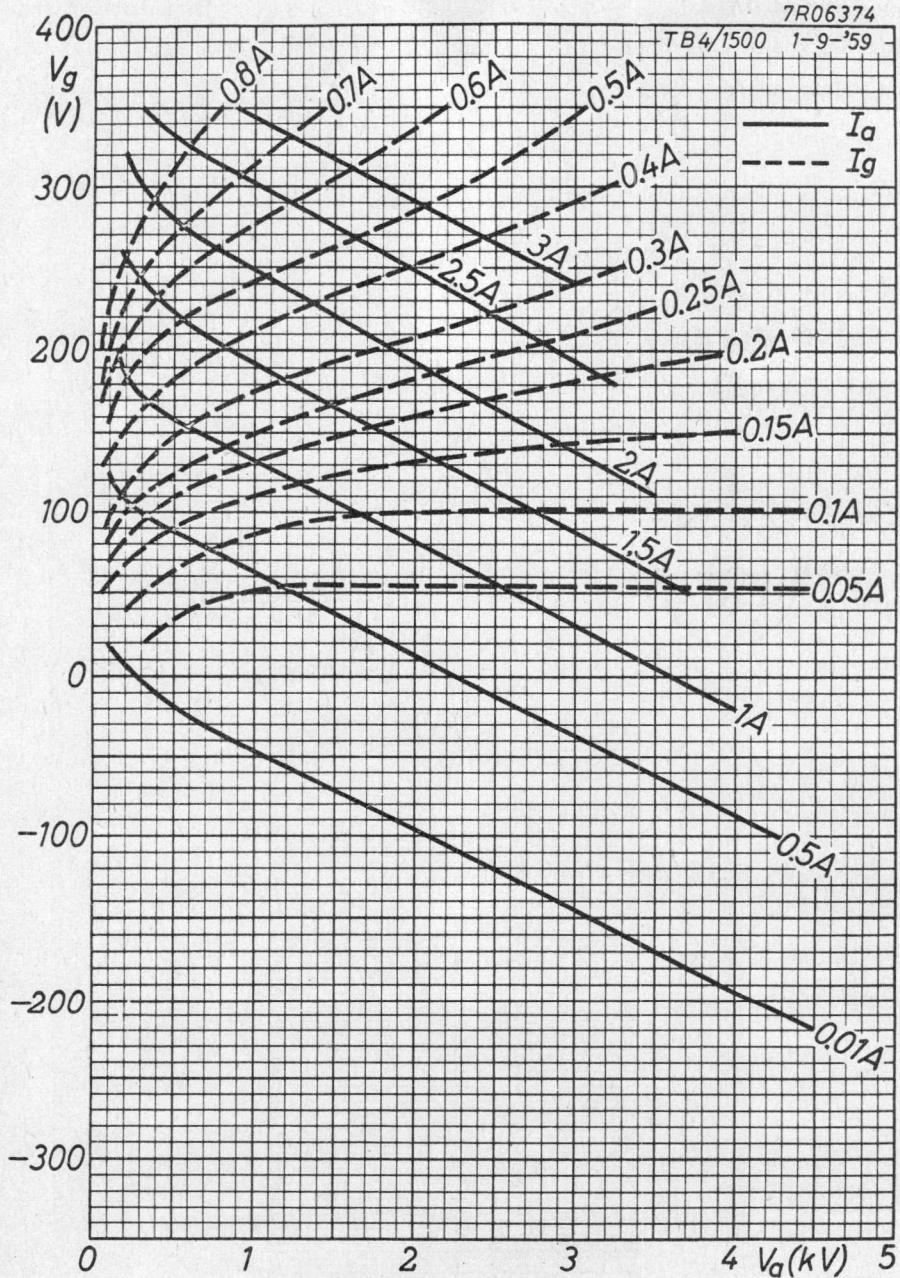
Net weight: approx. 450 g

Dimensions in mm



7R06374

TB4/1500 1-9-'59



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	$k\Omega$
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	°C
Seal temperature	t	max.	220	°C

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

with anode voltage from a three-phase rectifier

OPERATING CONDITIONS , intermittent service

	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)

	f	max.	50	MHz
Frequency for full ratings				
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

	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)

	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.

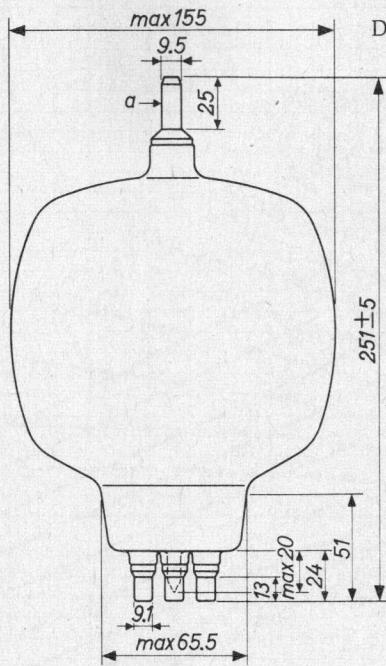
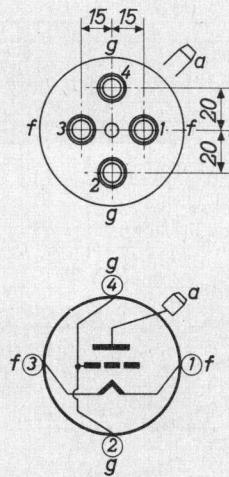
ACCESSORIES

Socket	catalogue nr.	2422 511 05001
Anode connector	type	40665

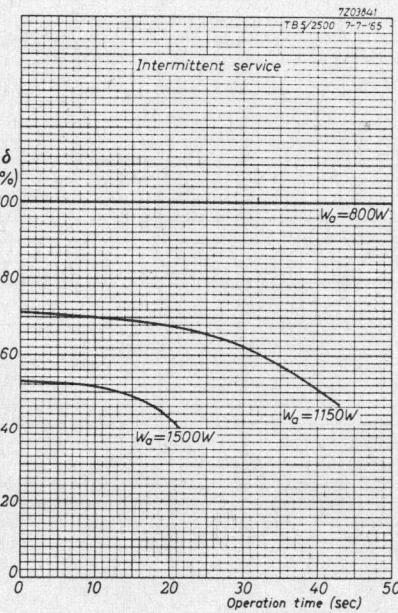
MECHANICAL DATA

Mounting positions: vertical

Net weight: approx. 600 g

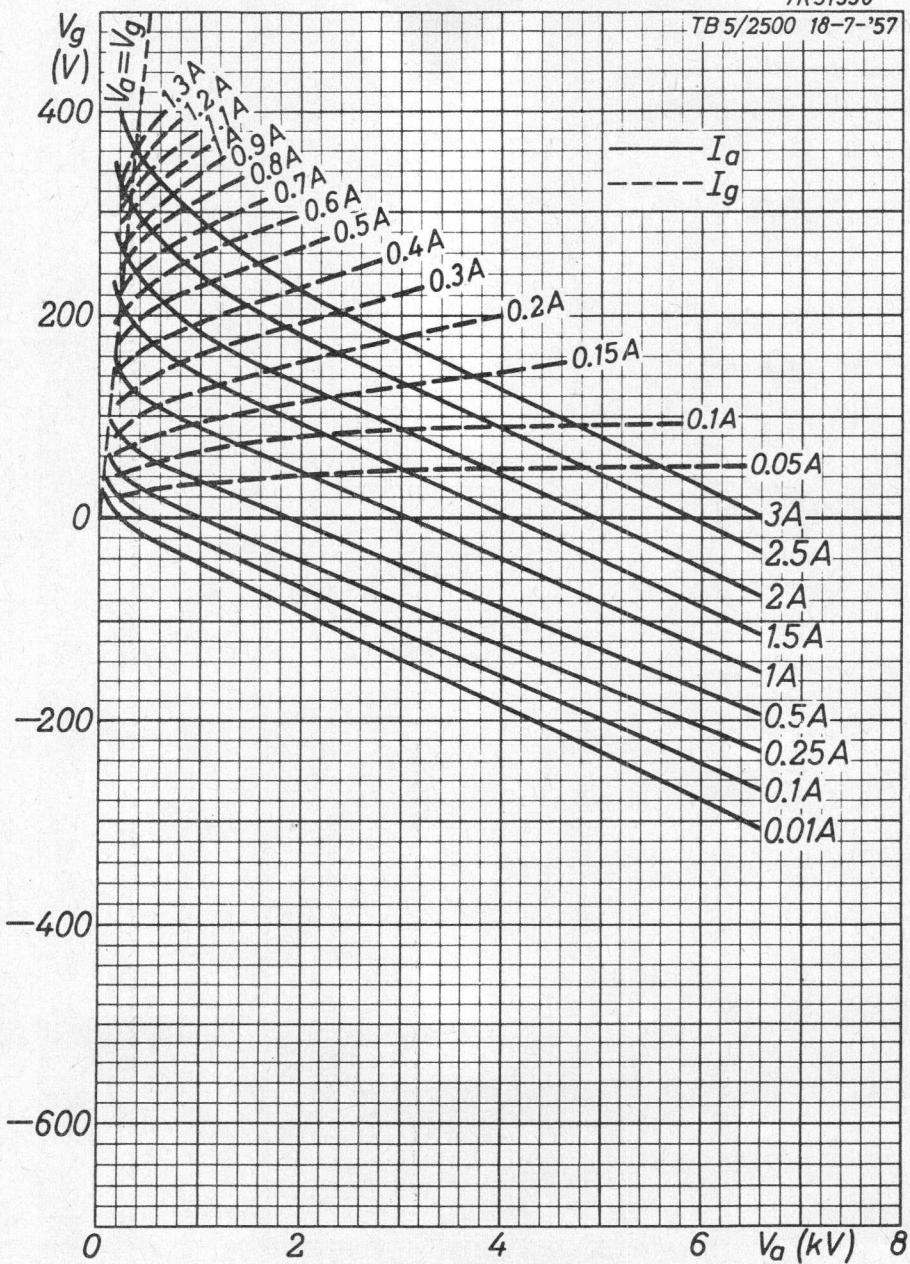


Dimensions in mm



7R51330

TB 5/2500 18-7-'57



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

QUICK REFERENCE DATA			
Freq. (MHz)	Industrial R.F. oscillator class C		
	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 _{f₀}	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	°C
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WATER COOLING CHARACTERISTICS

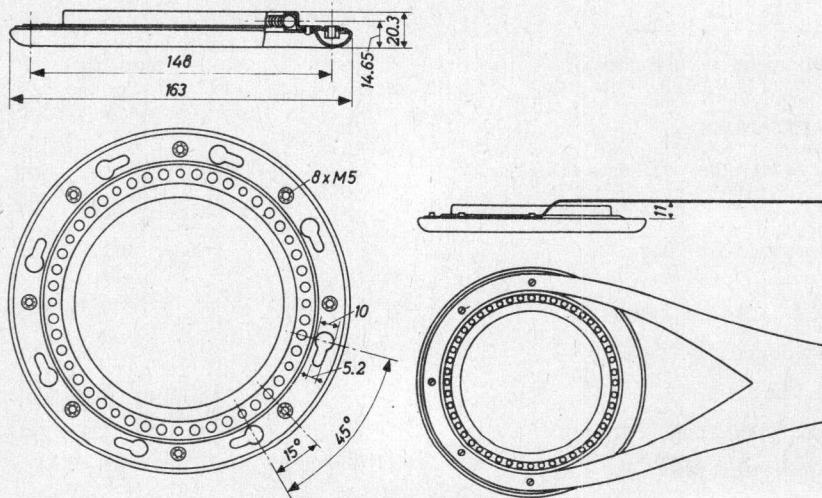
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
5	20	2.3	0.02	56
	50	4.6	0.07	68
10	20	4.5	0.06	55
	50	9.0	0.21	67
15	20	7.0	0.14	53
	50	14.0	0.45	66

Water inlet temperature t_i = max. 50 °C

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 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

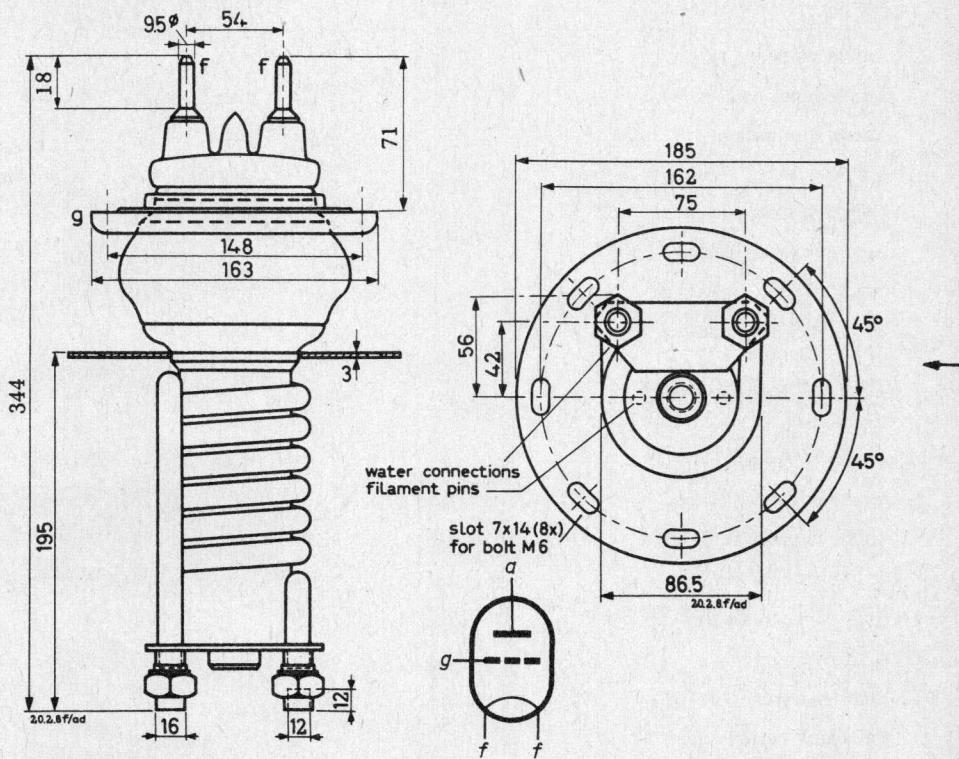
→ **MECHANICAL DATA** (continued)

Filament connectors with cable 40662

Dimensions in mm

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)

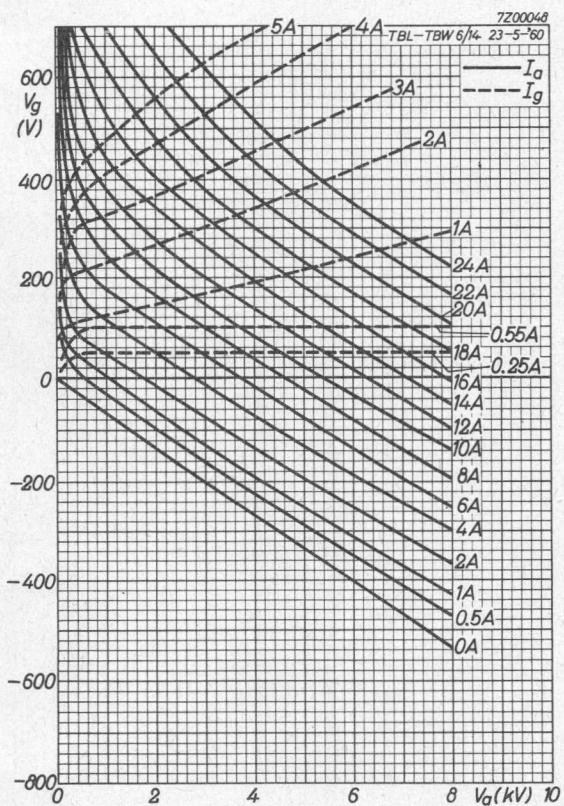
Frequency	f	up to	30	MHz
Anode voltage	V _a	max.	8	kV
Anode input power	W _{ia}	max.	30	kW
Anode dissipation	W _a	max.	15	kW ²⁾
Anode current	I _a	max.	4.0	A
Negative grid voltage	-V _g	max.	1600	V
Grid current, loaded	I _g	max.	1.5	A
Grid current, unloaded	I _g	max.	2.0	A
Grid circuit resistance	R _g	max.	10	kΩ

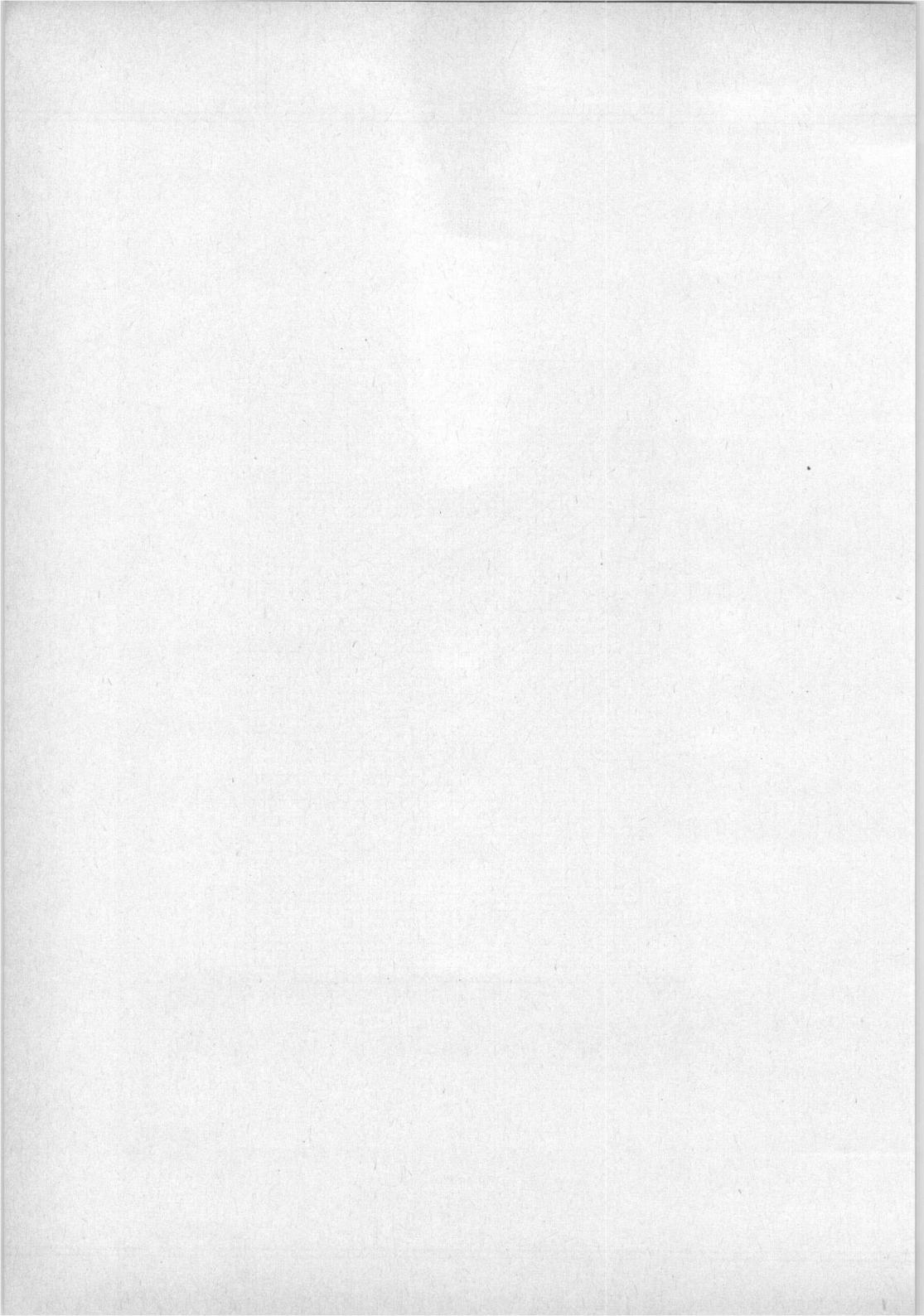
OPERATING CONDITIONS

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~}	1000	870	Ω
Feedback ratio under loaded conditions	V _{g~} /V _{a~}	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 W_a max.=10kW





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

QUICK REFERENCE DATA									
General purposes									
λ (m)	Freq. (MHz)	C telegr.		B teleph.		Ca 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	5	4.7	6	13.3
		5	5.6	5	1.45	4.5	4.1	5	6.6
		4	4			4	3.5	4.5	6.0
						3.5	3	4	5.3
						3	2.2	3.5	4.6
								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
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

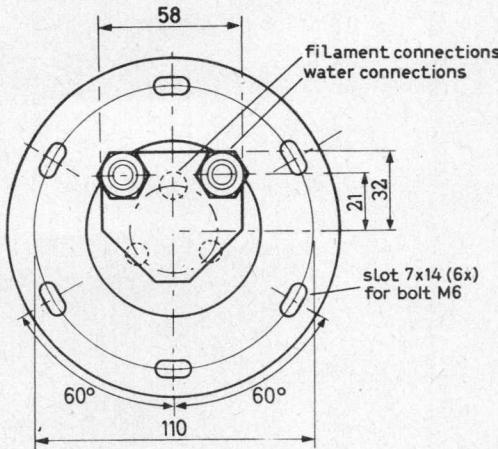
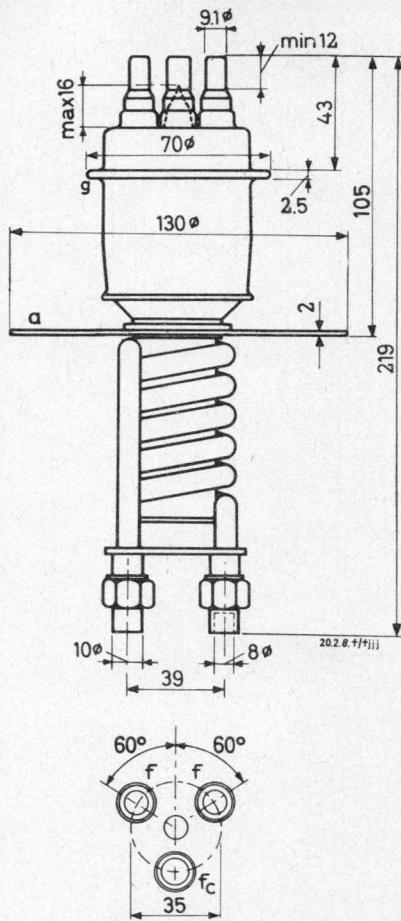
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

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.

MECHANICAL DATA

Filament connectors	40634
Grid connector	40622
Net weight	0.8 kg

Dimensions in mm

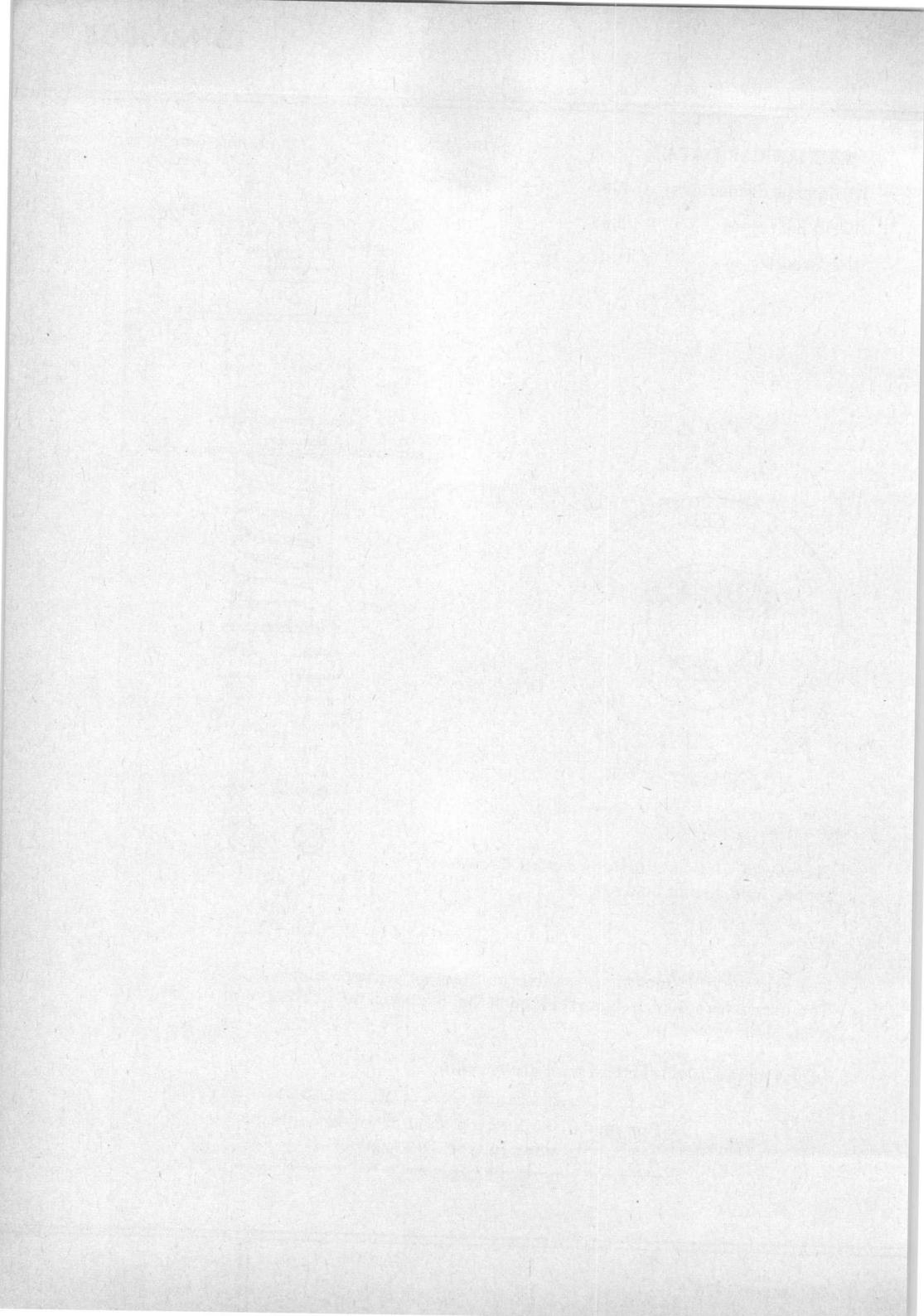


The use of wing nuts for connecting the water connections should be avoided

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

HEATING: direct ; filament thoriated tungsten

Filament voltage	<i>V_f</i>	12, 6	V
Filament current	<i>I_f</i>	33	A

CAPACITANCES

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

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

Transconductance	<i>S</i>	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 type 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.

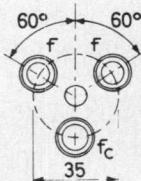
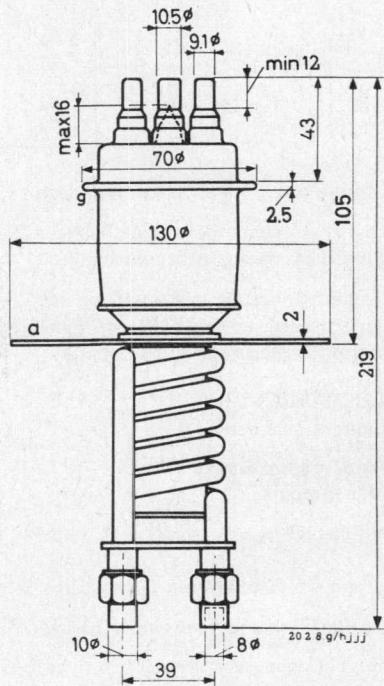
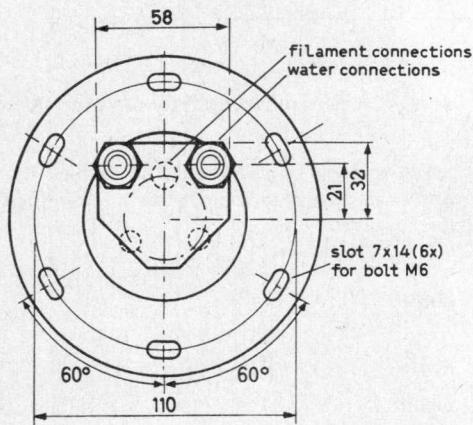
The grid connector type 40650 must not be used at frequencies higher than 30 MHz.

MECHANICAL DATA

Dimensions in mm

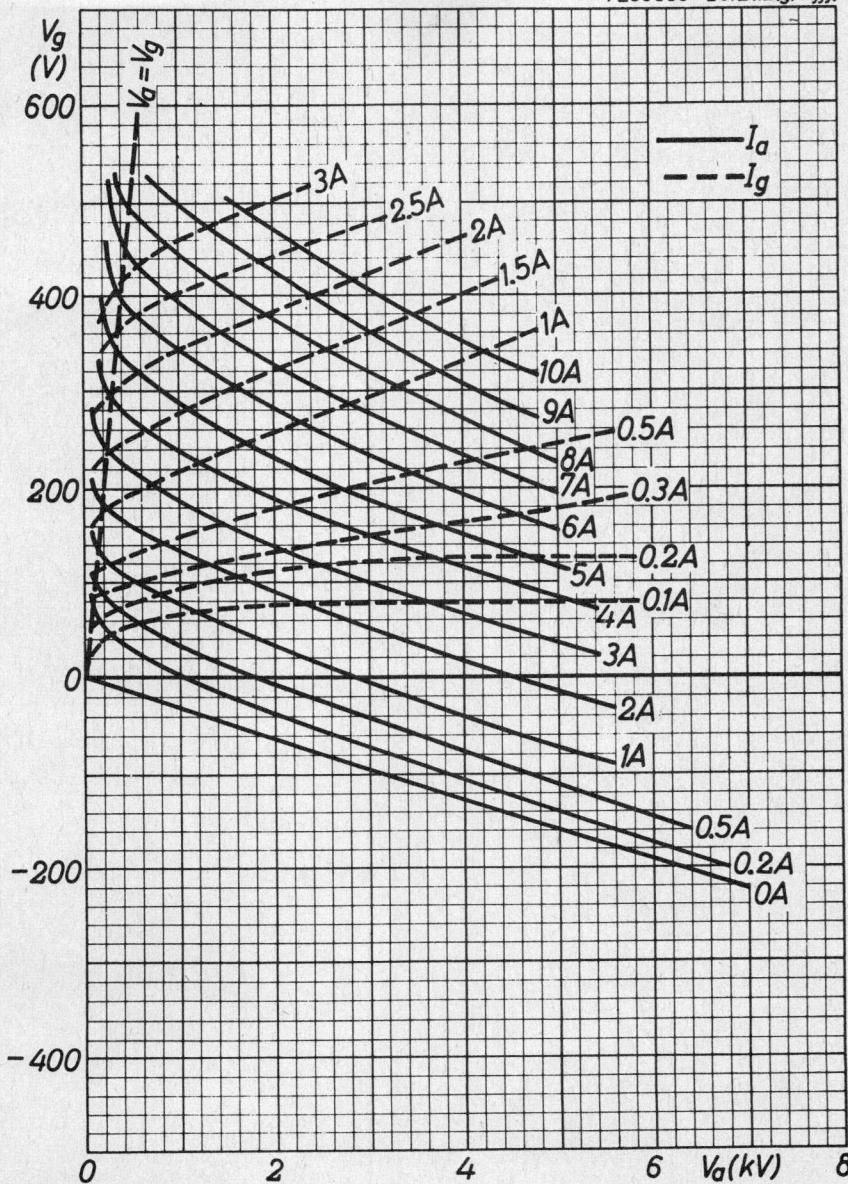
Mounting position: vertical with anode down

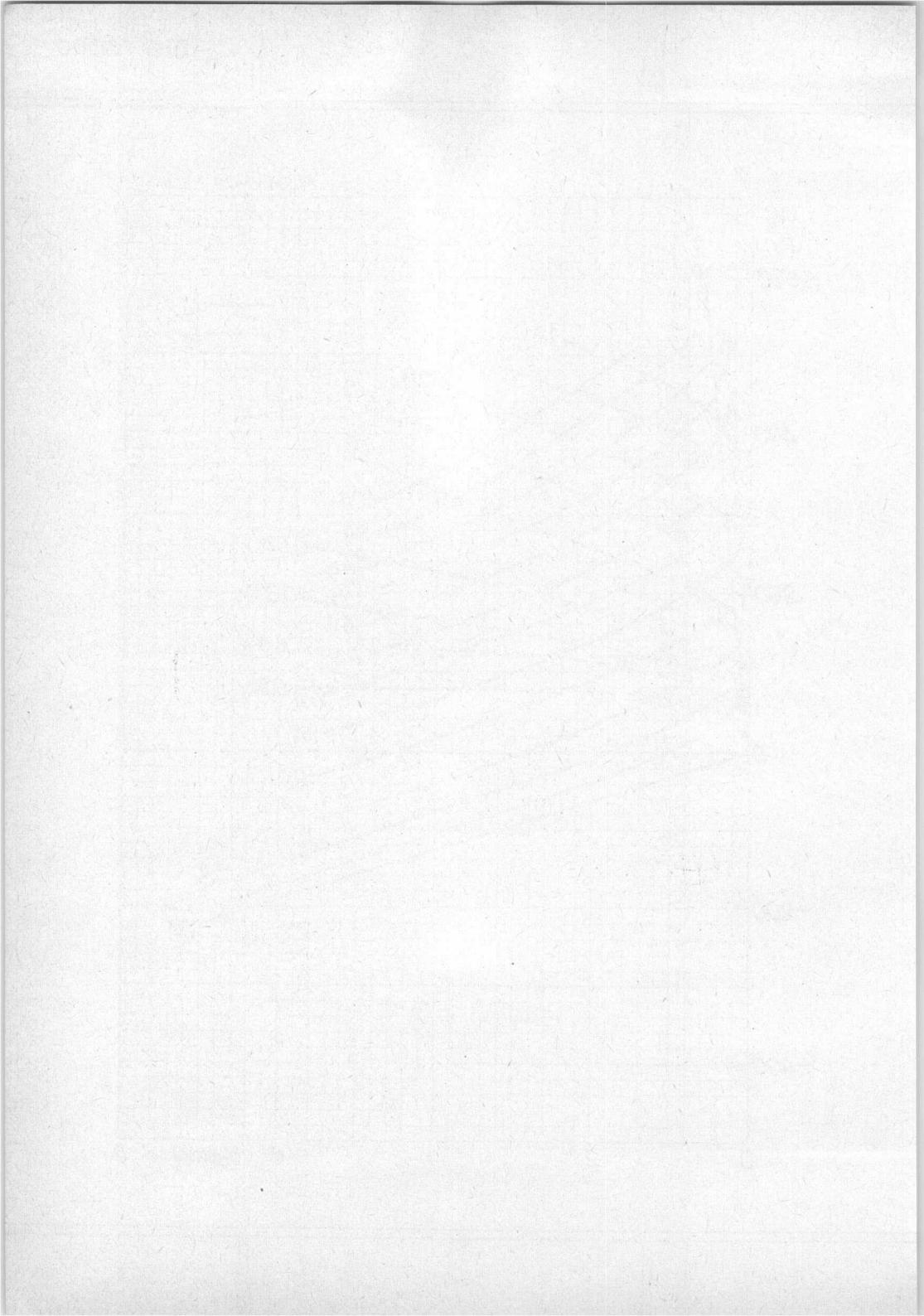
Net weight: approx. 0,8 kg



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

7Z00655 - 20.2.12.g/h/jjj.





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 _f 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

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.

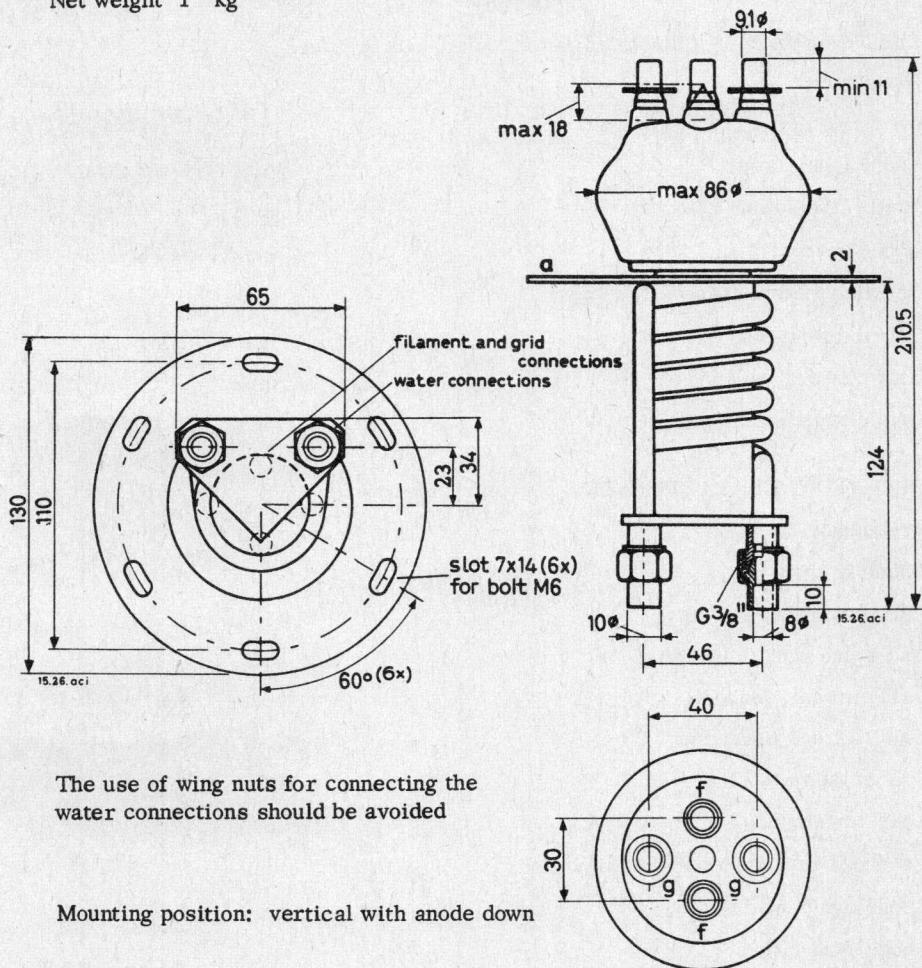
→ ACCESSORIES

Filament and grid connectors (4 required) type 40634

MECHANICAL DATA

Net weight 1 kg

Dimensions in mm



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

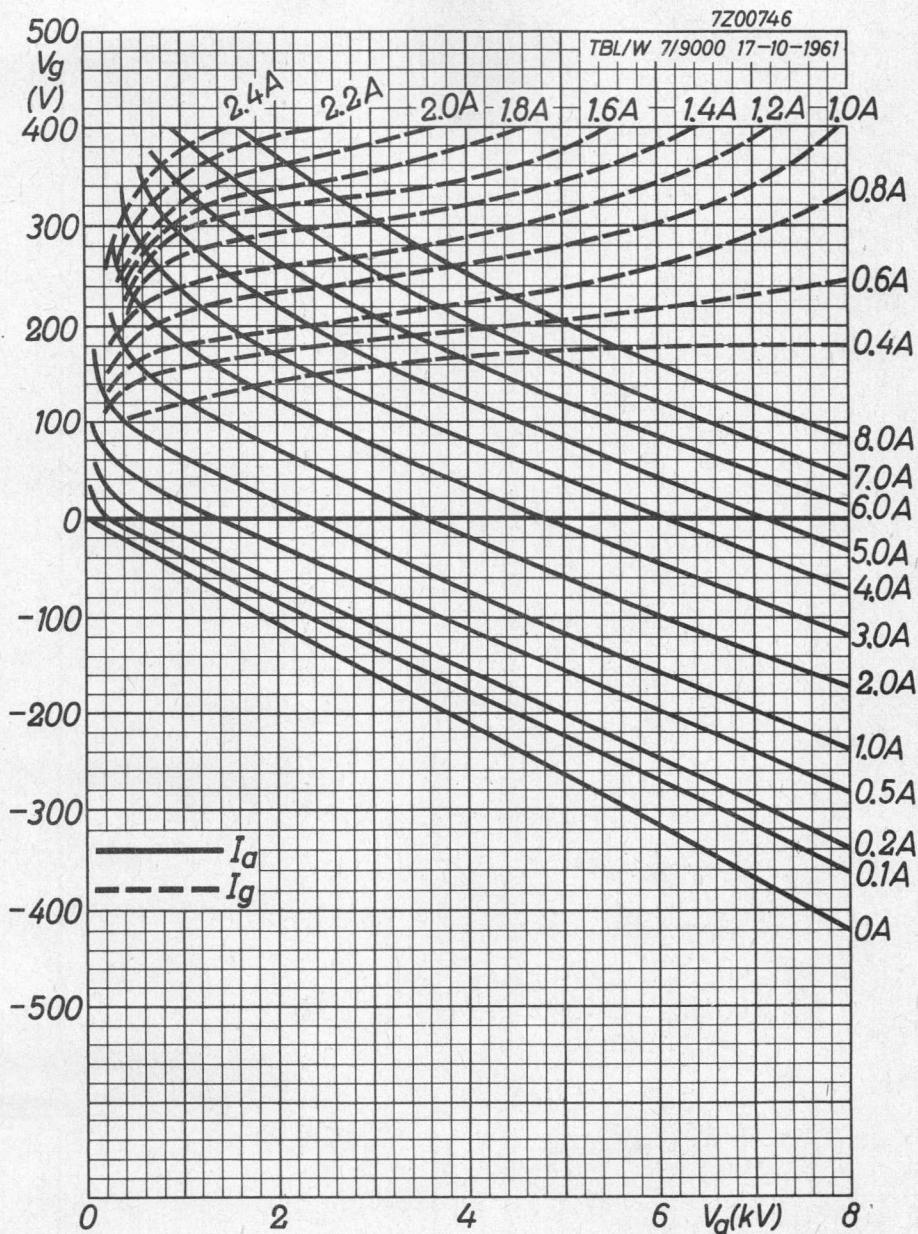
LIMITING VALUES (Absolute limits), continuous service

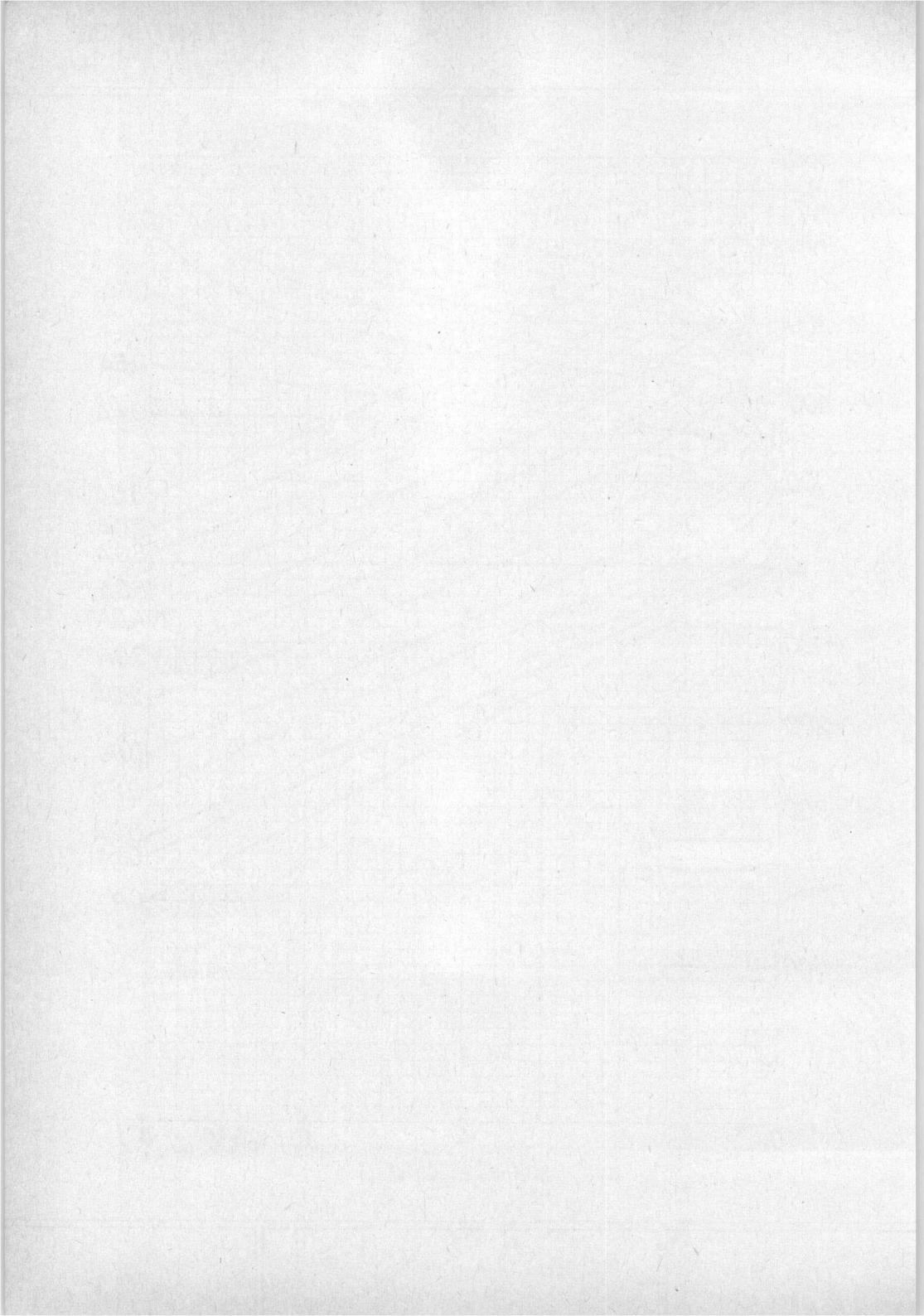
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance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

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 %





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 10 8	29.0 23.3 17.9

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	$=$	8.0	V	$+ 5\%$
Filament current	I_f	$=$	98	A	-10%
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

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TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature

 t_i = max. 50 °C

Temperature off all seals

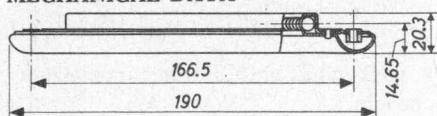
= max. 220 °C

WATER COOLING CHARACTERISTICS

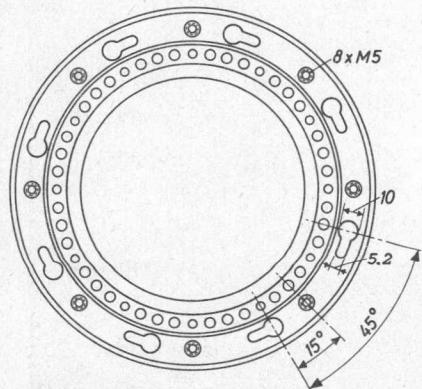
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.50
20	20	9.3	0.30
	50	18.6	1.0

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

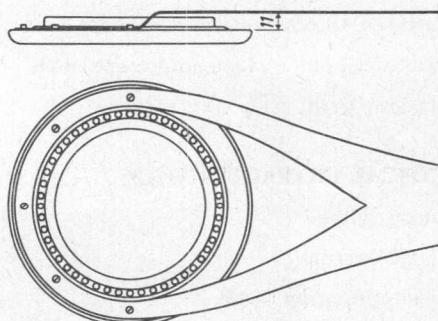
Generally a low velocity air flow to the seals is required

MECHANICAL DATA

Dimensions in mm



Grid connector 40663



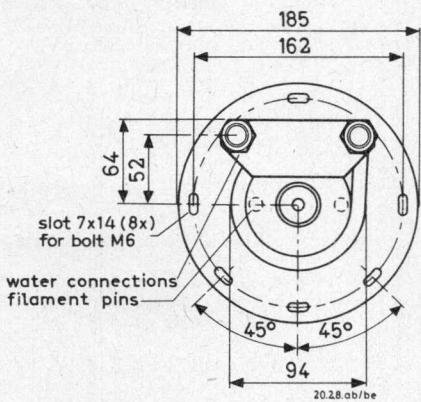
Connection of the grid lead

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.

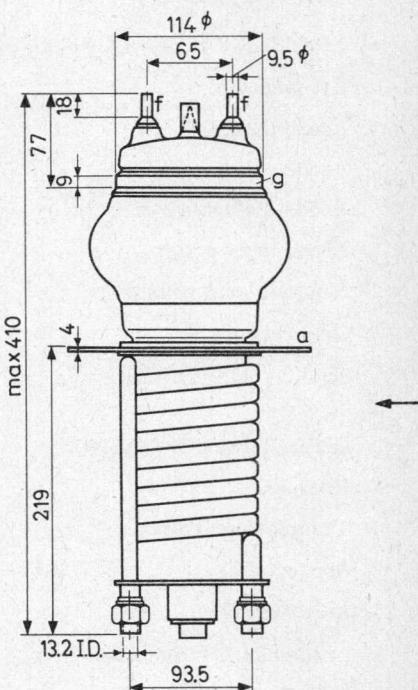
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MECHANICAL DATA (continued)

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



Dimensions in mm



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

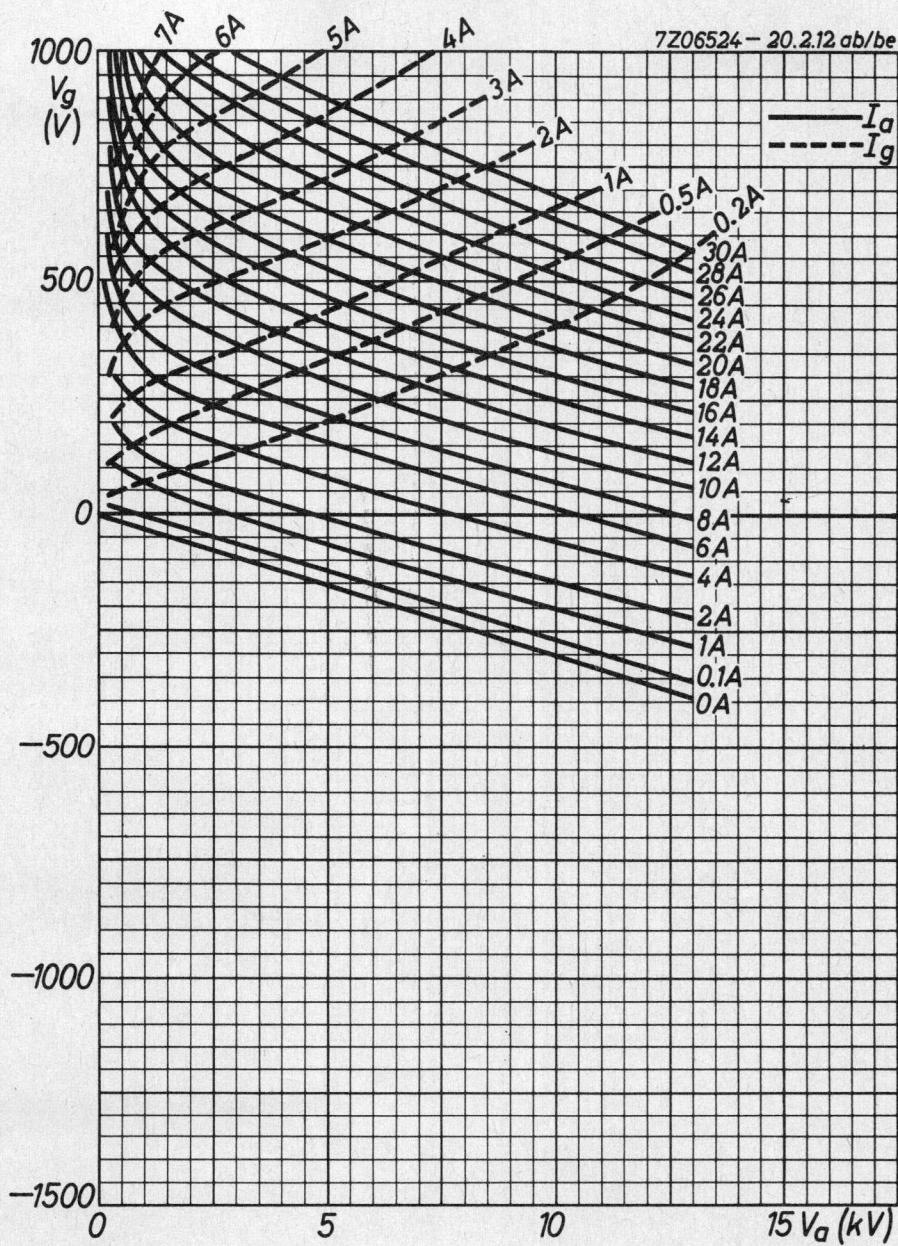
LIMITING VALUES (Absolute limits)

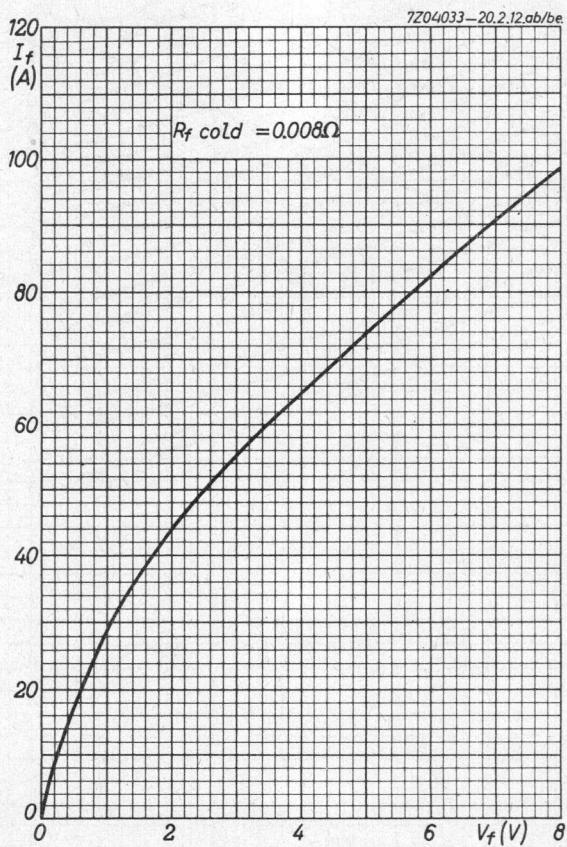
Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	4.8	A
Anode dissipation	W_a	= max.	20	kW
Anode input power	W_{ia}	= max.	60	kW
Negative grid voltage	$-V_g$	= max.	1500	V
Grid current	I_g	= max.	0.8	A
Grid circuit resistance	R_g	= max.	10	kΩ

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%





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 10 8	39 31.3 23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V _f	8	V	+ 5	%
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

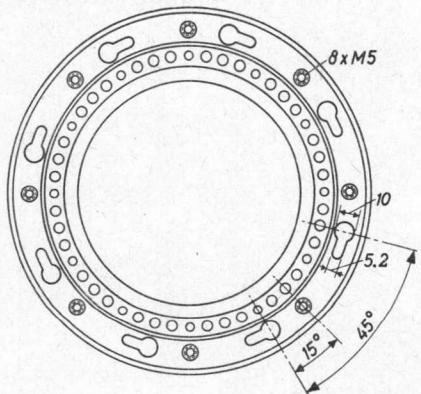
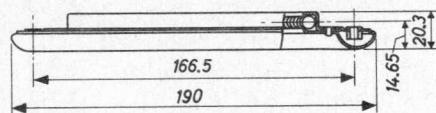
WATER COOLING CHARACTERISTICS

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

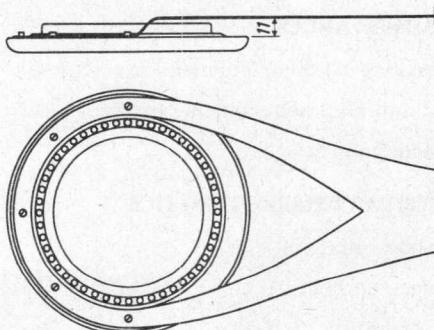
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation

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.

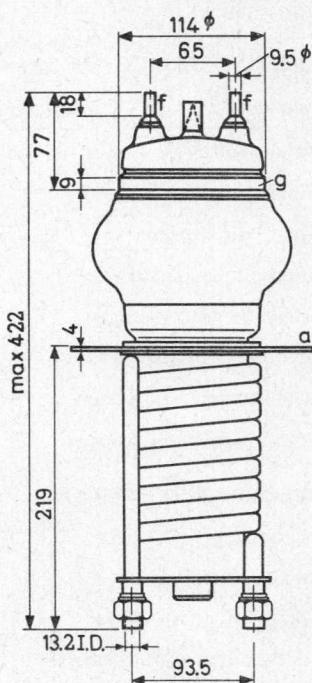
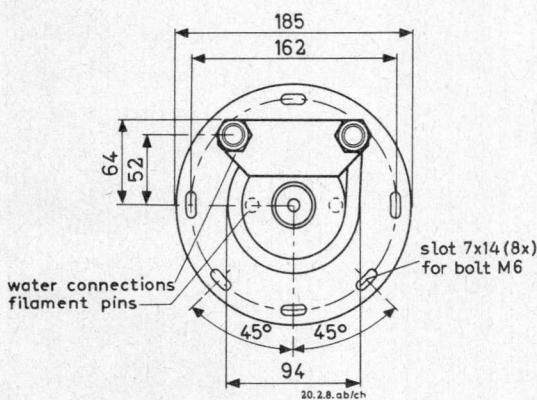
MECHANICAL DATA (continued)

Connectors with cable for filament : 40662

Grid connector 40663

Net weight : 5.4 kg

Dimensions in mm



Mounting position: vertical with anode down

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

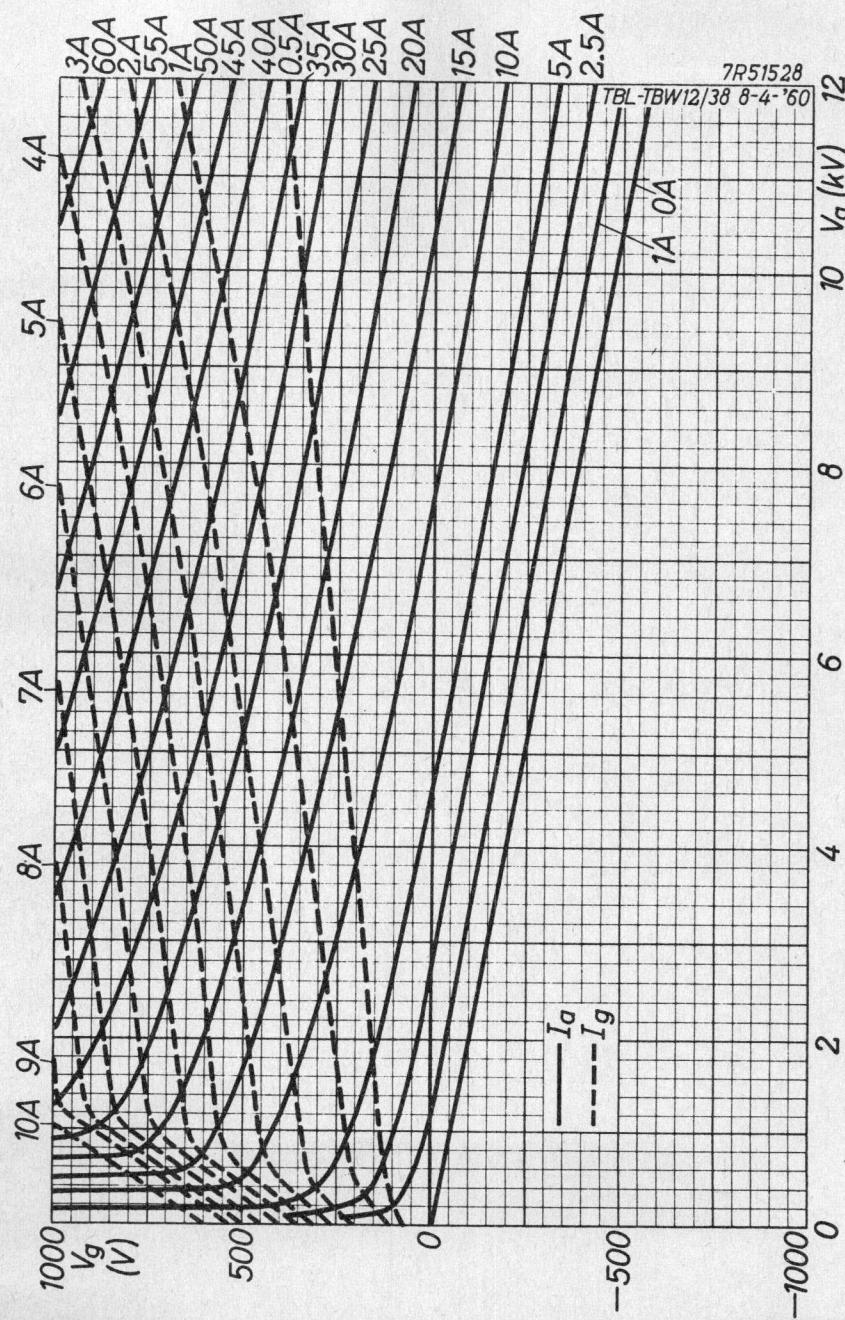
LIMITING VALUES (Absolute limits)

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~}	1450	1100	800	Ω
Feedback ratio under loaded conditions	V _{g~} /V _{a~}	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%.



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 ₂ O)
< 300	0	45	0.45	24.0
	1500	35	0.46	22.5
	3000	25	0.49	21.5

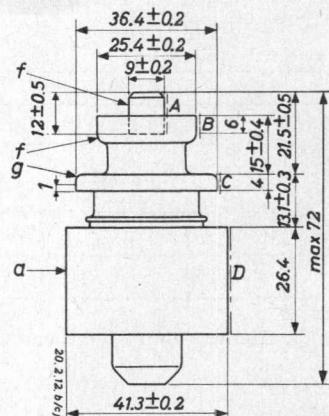
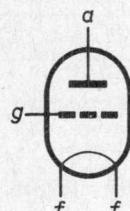
Temperature of envelope = max. 200 °C

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 36.9 mm 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_{ia}	=	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_{gp}	=	275	-	-	-	-	V
Grid input power	W_{ig}	=	25	-	-	-	-	W
Anode input power	W_{ia}	=	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_{ia}	=	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_{gp}	=	275	-	-	-	-	V
Grid input power	W_{ig}	=	30	-	-	-	-	W
Anode input power	W_{ia}	=	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 _{ia}	= 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 _{ia}	=	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.

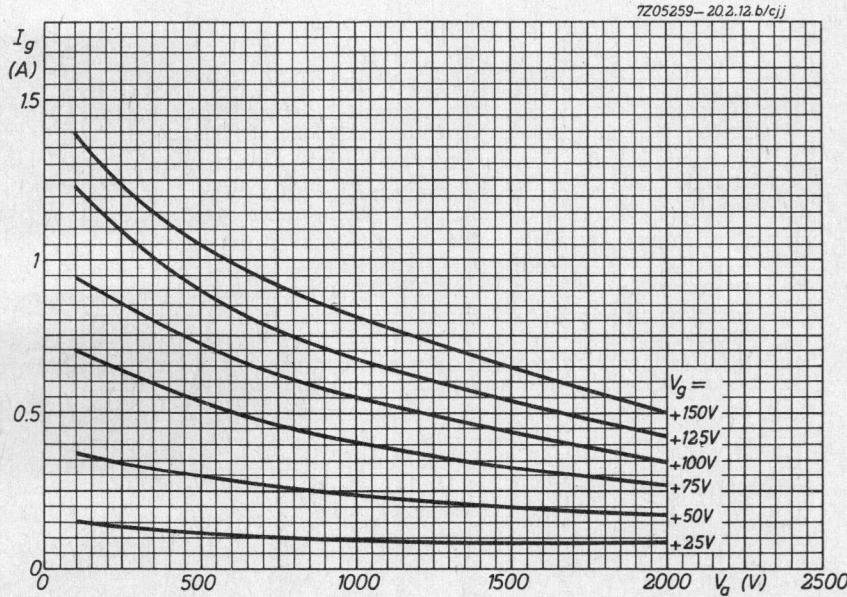
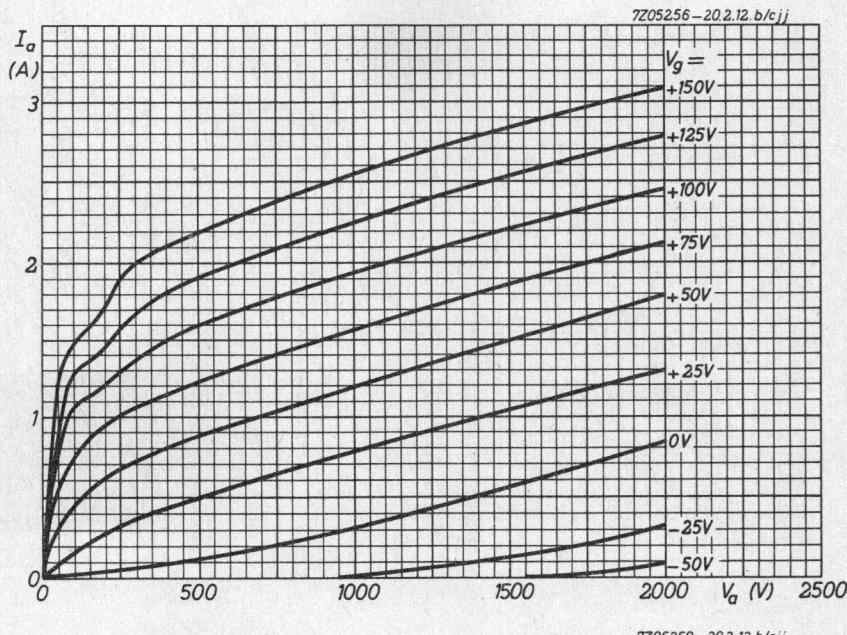
LIMITING VALUES (Absolute limits)

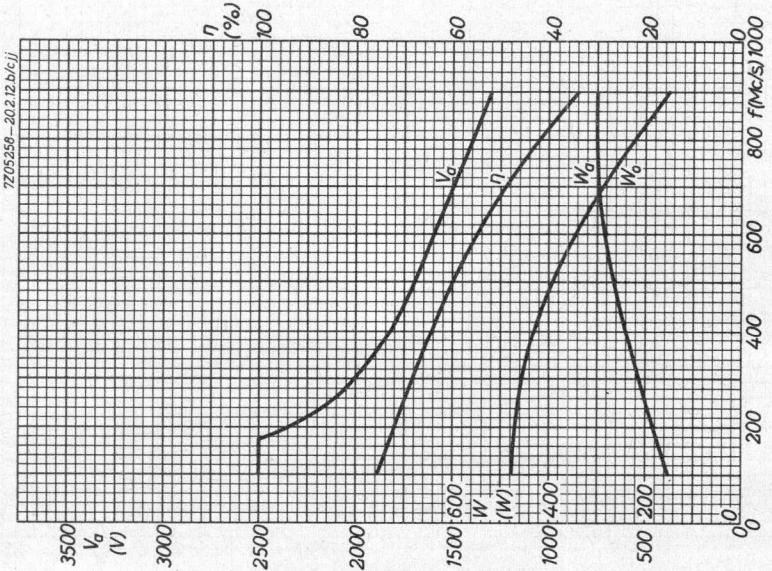
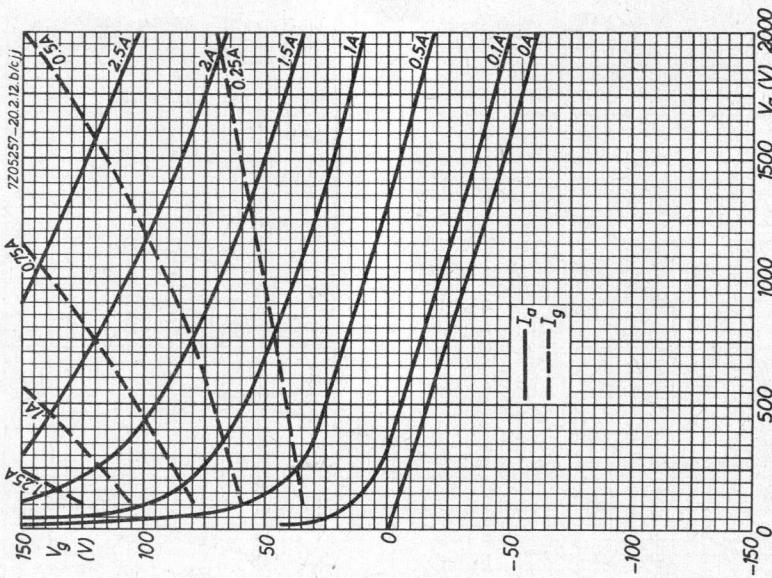
Frequency	f	up to	470	MHz
Anode voltage	V_a	= max.	1800	V
Anode current	I_a	= max.	400	mA
Anode input power	W_{i_a}	= max.	700	W
Anode dissipation	W_a	= max.	300	W
Negative grid voltage	$-V_g$	= max.	300	V
Grid current, loaded	I_g	= max.	110	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance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





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

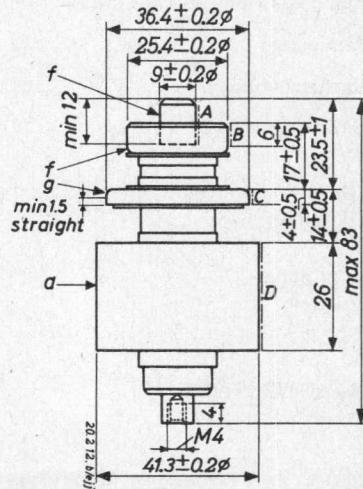
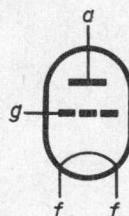
W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	P_i (mm H ₂ O)
400	0	45	0.65	12
	1500	35	0.65	12
	3000	25	0.65	12

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	%

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	$\text{k}\Omega$

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)

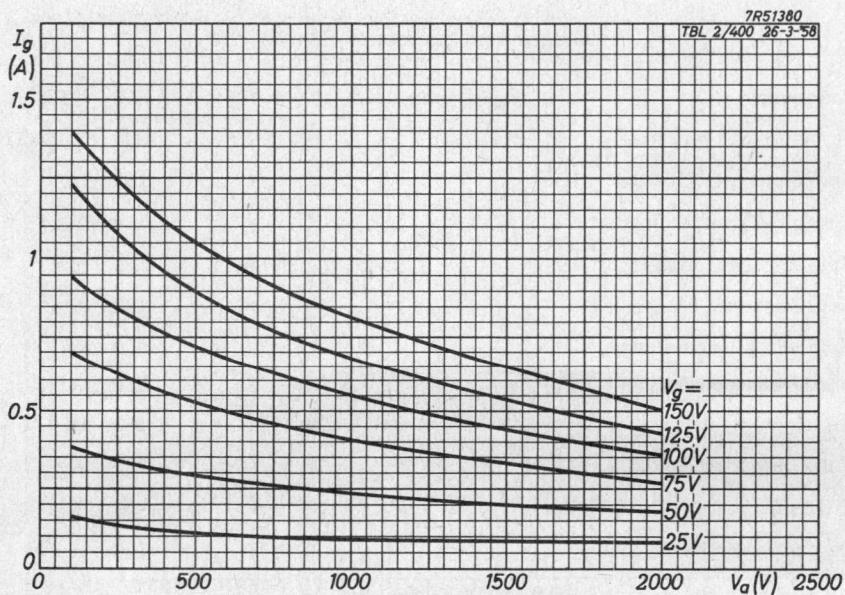
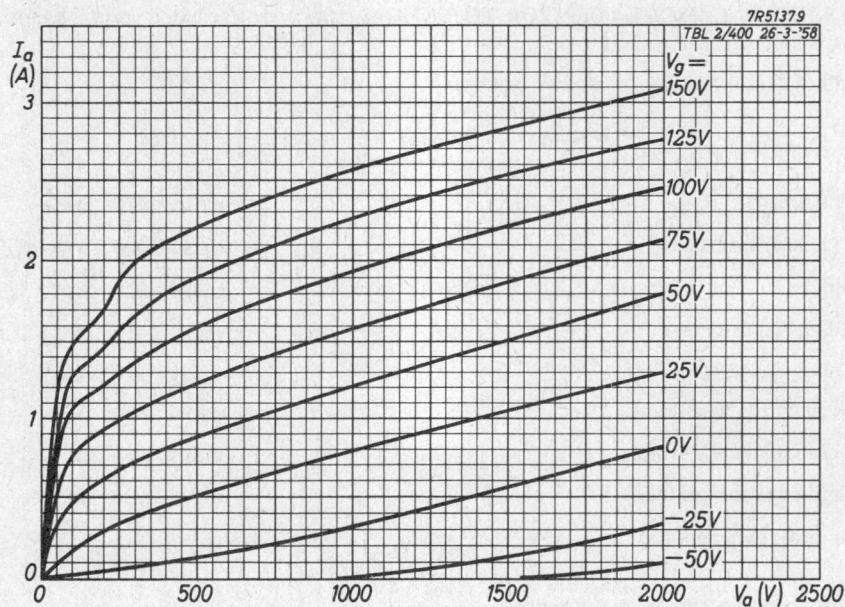
Voltages with respect to cathode

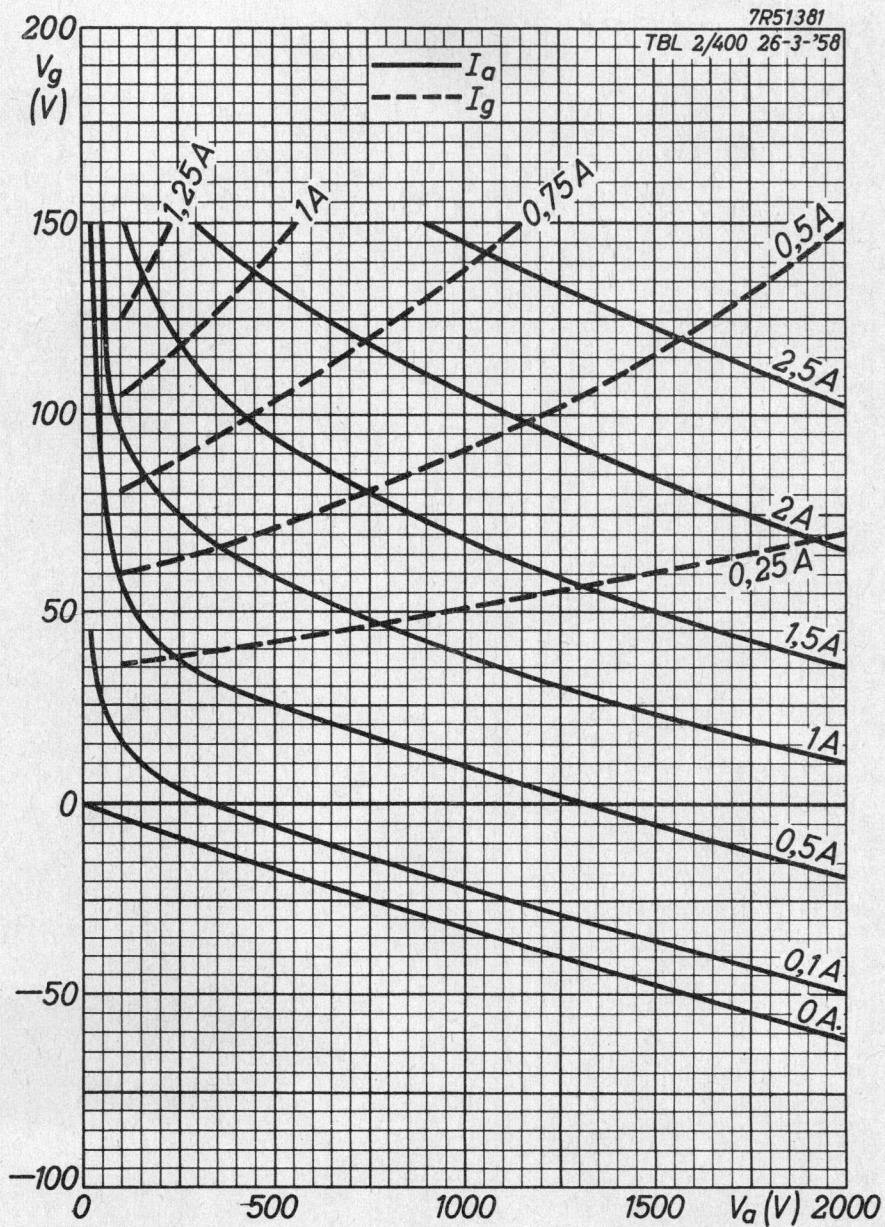
Frequency	f	=	up to	470	MHz
Transformer voltage	V_{tr}	=	max.	2000	V(RMS)
Anode current	I_a	=	max.	210	mA
Anode input power	W_{i_a}	=	max.	450	W
Anode dissipation	W_a	=	max.	170	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current, loaded	I_g	=	max.	85	mA
Grid current, unloaded	I_g	=	max.	120	mA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

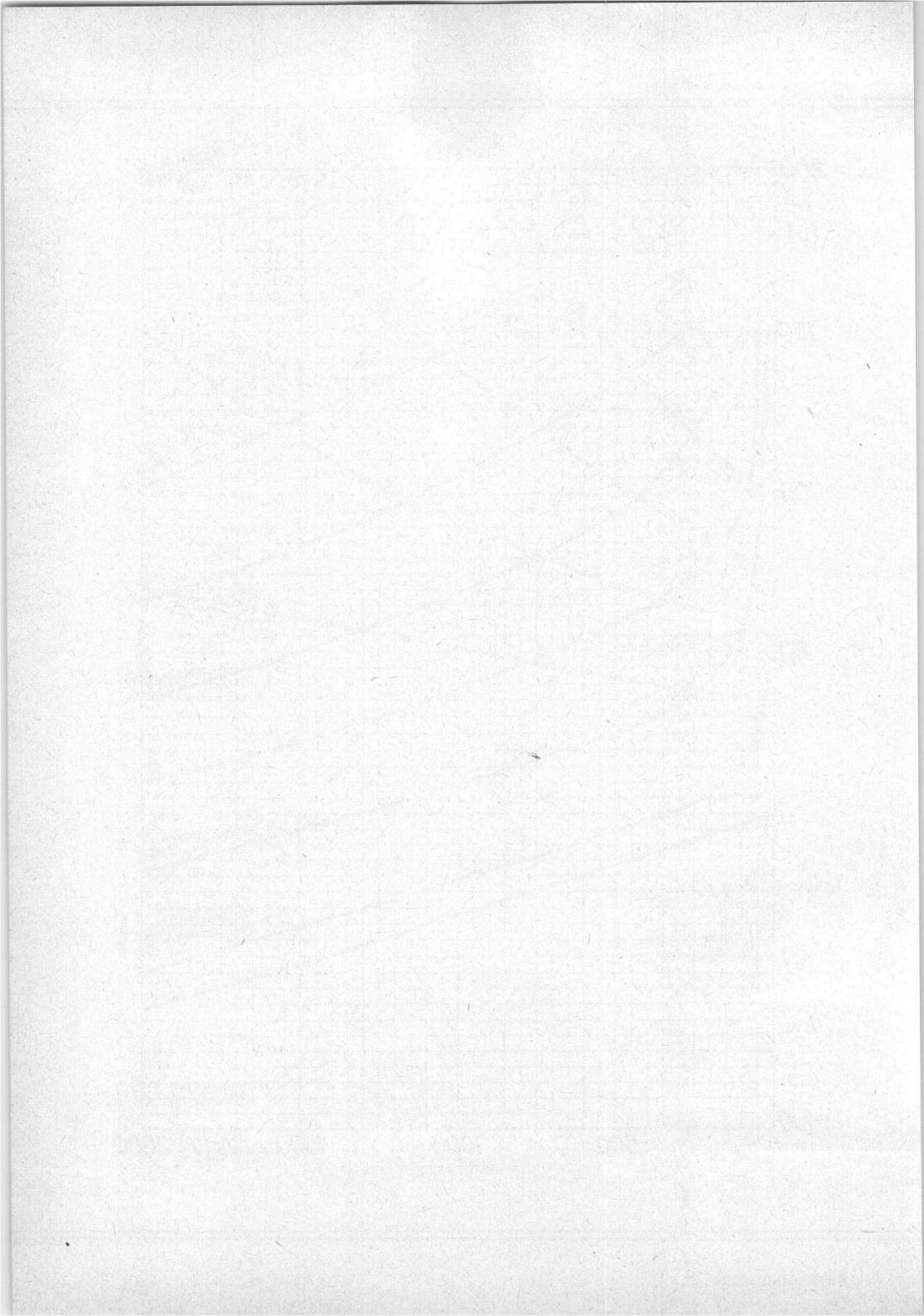
OPERATING CHARACTERISTICS

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







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

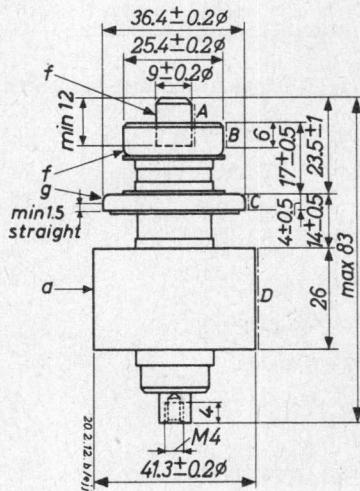
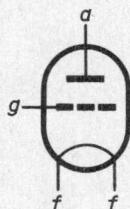
COOLING CHARACTERISTICS

W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H ₂ O)
500	0	45	0.9	24
	1500	35	0.9	20
	3000	25	1.0	21

MECHANICAL DATA

Net weight: 157 g

Dimensions in mm



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

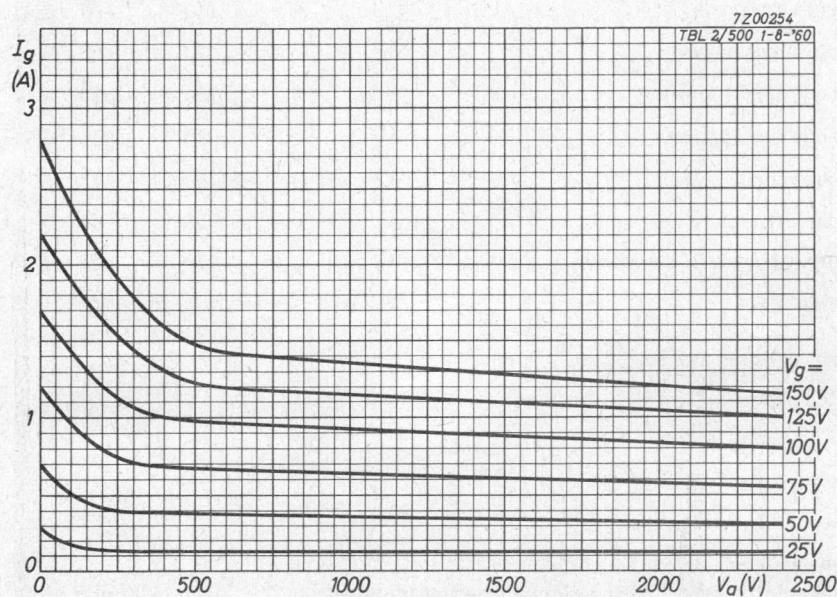
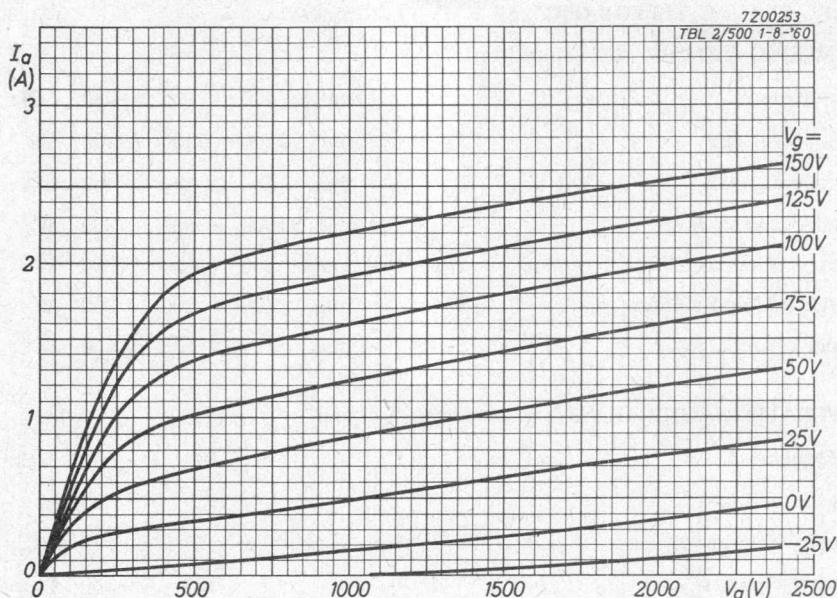
LIMITING VALUES (Absolute limits)

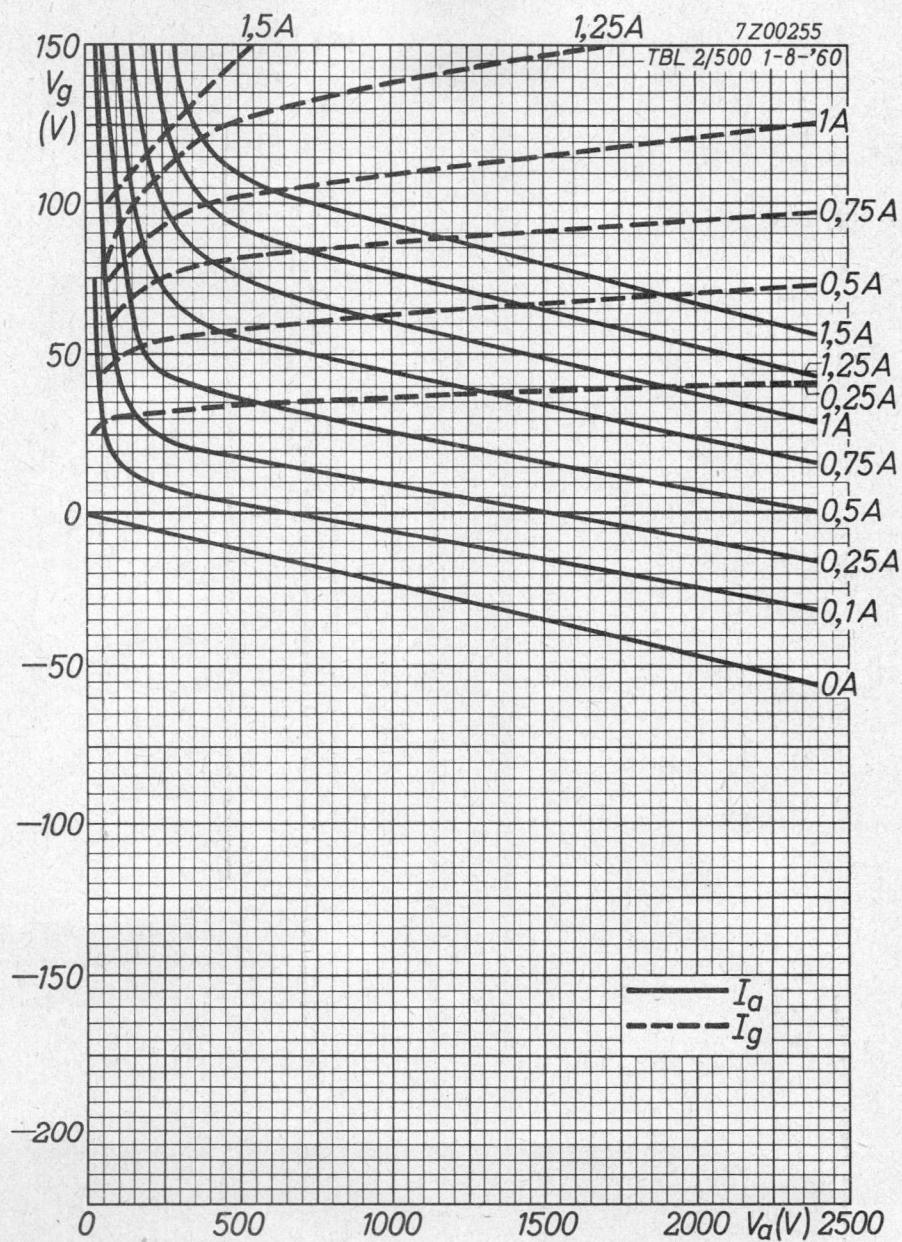
Frequency	f	= up to	400	625	940	MHz
Anode voltage	V_a	= max.	2700	2500	2000	V
Anode current	I_a	= max.	400	400	400	mA
Anode input power	W_{ia}	= max.	1000	880	800	W
Anode dissipation	W_a	= max.	500	500	500	W
Negative grid voltage	$-V_g$	= max.	300	300	300	V
Grid current	I_g	= max.	175	175	160	mA

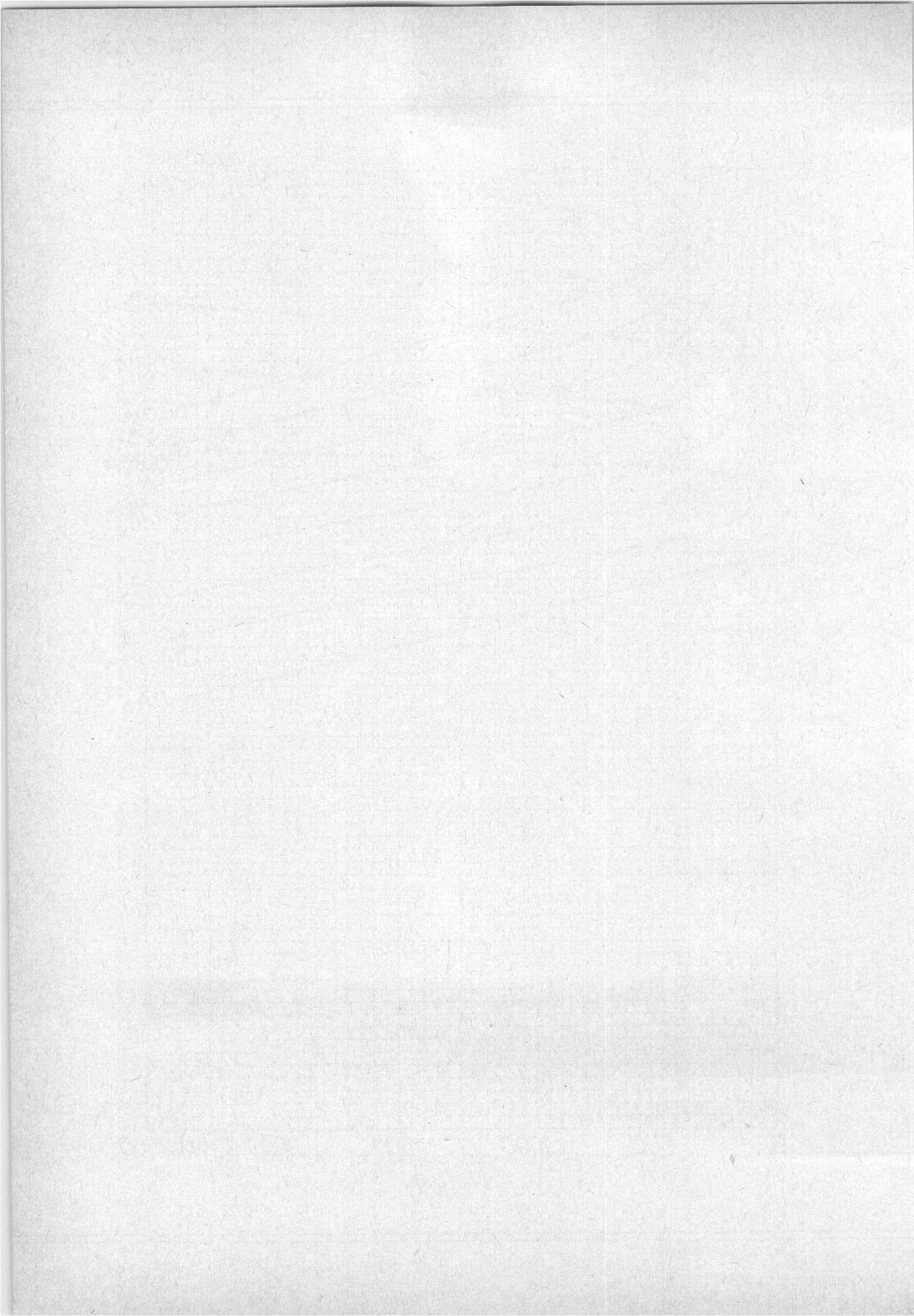
OPERATING CONDITIONS in grounded grid circuit

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_{ig}	=	70	65	W
Anode input power	W_{ia}	=	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 included²⁾ Measured in a circuit having an efficiency of 70%







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	$V_f = 6.3 \text{ V}$	$+ 5\% \quad -10\%$
Filament current	$I_f = 136 \text{ A}$	←
Cold filament resistance	$R_{fo} = 0.005 \Omega$	

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

TYPICAL CHARACTERISTICS

Anode voltage	$V_a = 6 \text{ kV}$
Anode current	$I_a = 2.5 \text{ A}$
Mutual conductance	$S = 23 \text{ mA/V}$
Amplification factor	$\mu = 17.5$

TEMPERATURE LIMITS (Absolute limits)

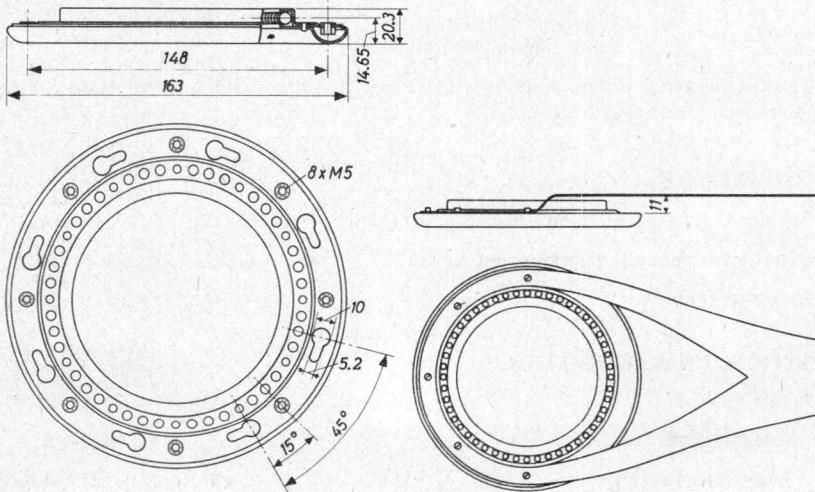
Temperature of all seals = max. 220 °C

AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (°C)	q_{min} (m³/min)	P_i (mm H₂O)
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

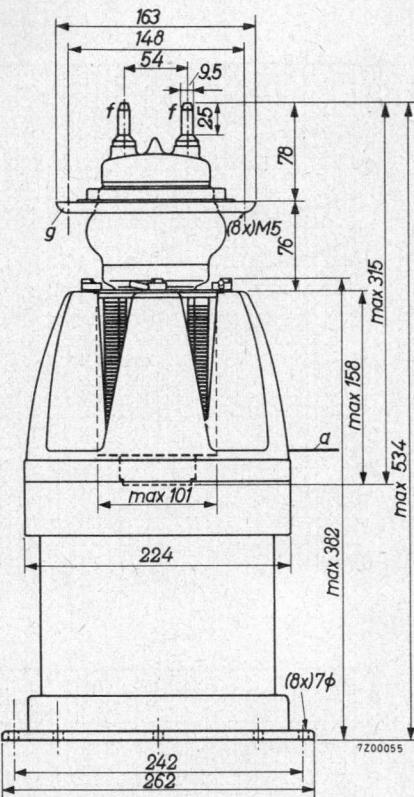
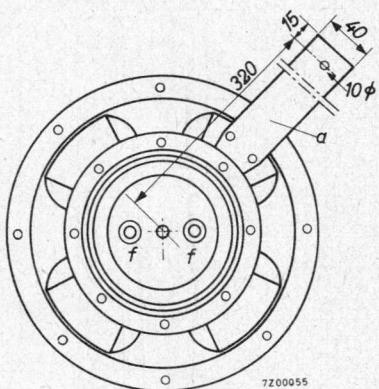


Grid connector 40664

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 or air distributor	: K508 : K509
Net weight of tube	: 3.8 kg
Net weight of pedestal	: 7.4 kg

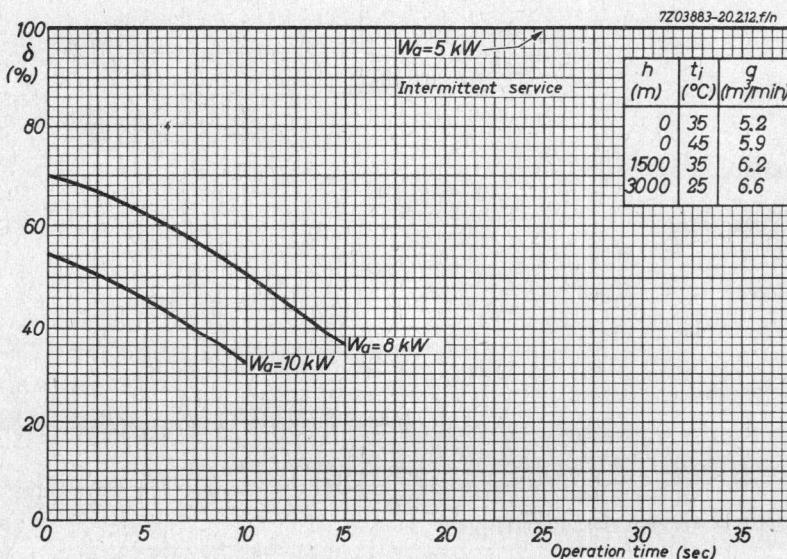
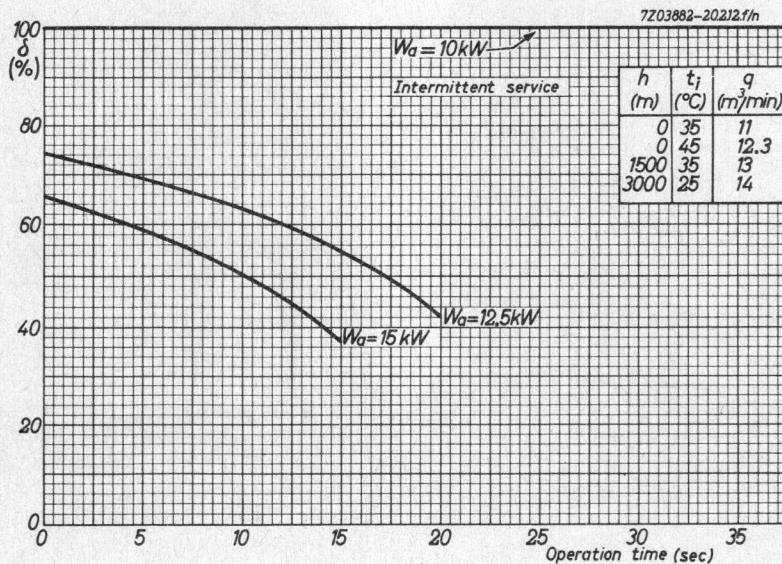
Dimensions in mm

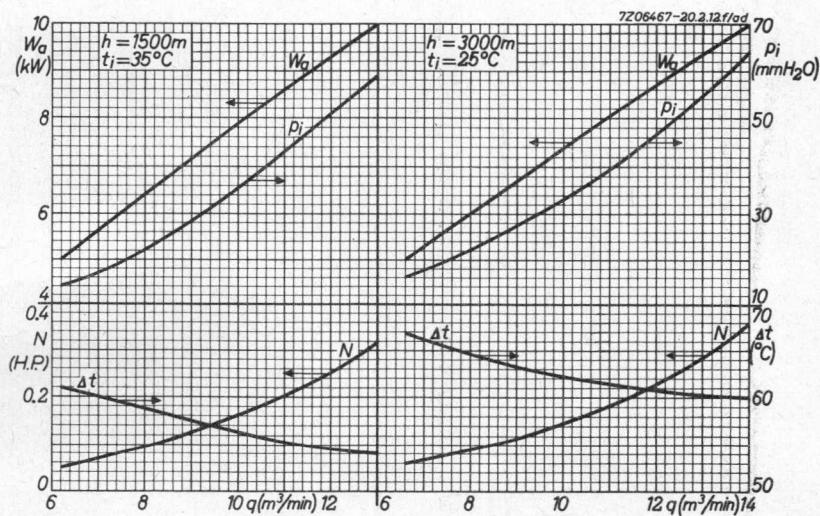
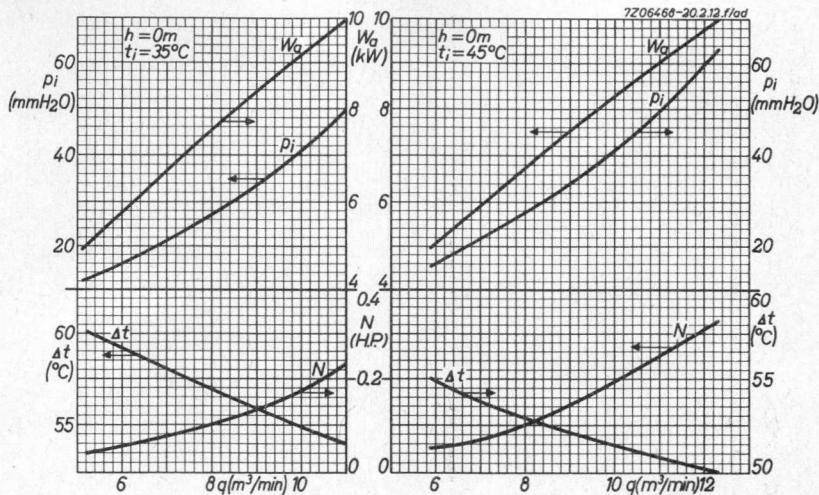
Mounting position: vertical with anode down

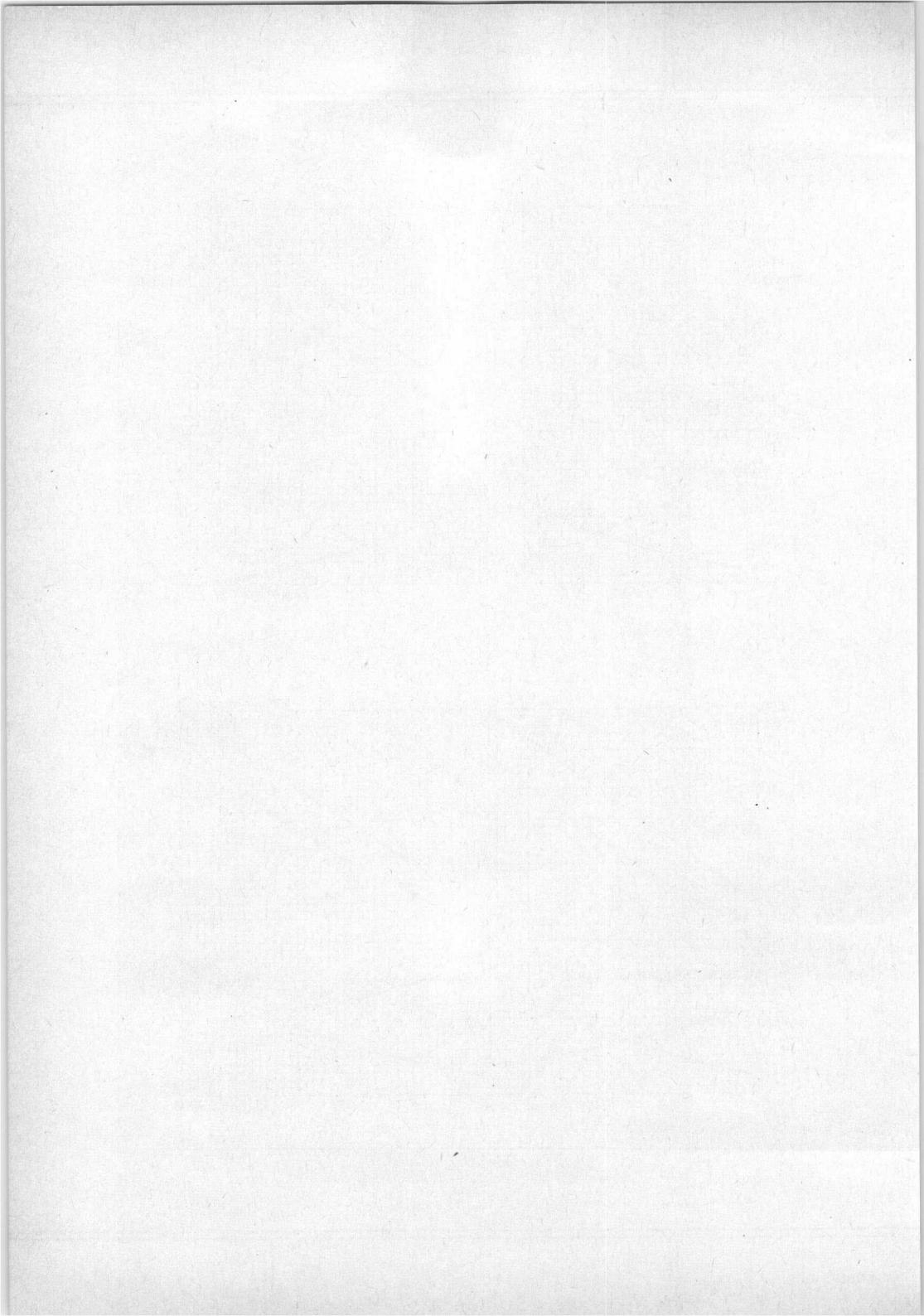
For intermittent service see curves page 4

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

Limits of anode dissipation and cooling, intermittent service.







**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	5	17	5	17
48 to 88			4	12	4	12
170 to 220						

HEATING: direct; filament thoriated tungsten

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

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	$C_a = 0.6 \text{ pF}^1)$
Grid to all other elements except anode	$C_g = 65 \text{ pF}$
Anode to grid	$C_{ag} = 29 \text{ pF}$

TYPICAL CHARACTERISTICS

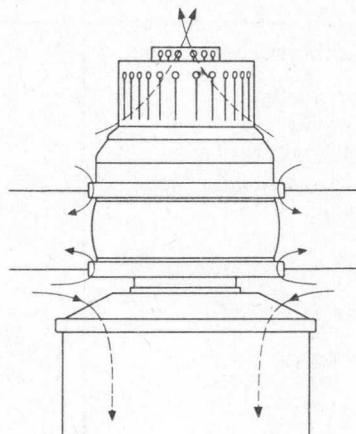
Anode current	$I_a = 1 \text{ A}$
Anode voltage	$V_a = 4 \text{ kV}$
Amplification factor	$\mu = 60$
Mutual conductance	$S = 60 \text{ mA/V}$

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 ₂ O)
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



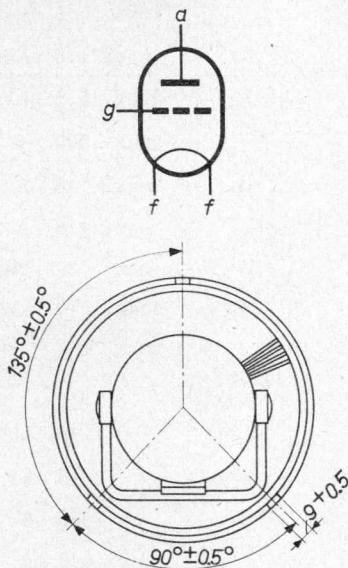
Generally it is necessary to direct an air flow on the grid, anode and filament seals. E.g. at 220 MHz an air flow of 0.6 m³/min on each of these seals is necessary.

TEMPERATURE LIMITS (Absolute limits)

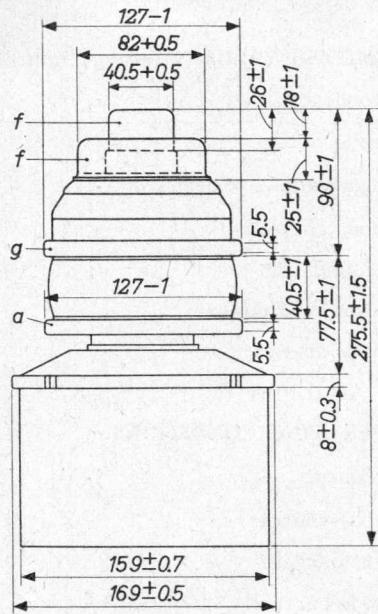
Temperature of seals = max. 180 °C

MECHANICAL DATA

Net weight: 9.5 kg



Dimensions in mm



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_{gp}	=	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 included²⁾ 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 _{gp}	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 _{gp} white black	= 270 = 110	255 95	V
Anode current	I _a white black	= 4.8 = 1.45	4.8 1.45	A
Grid current	I _g white black	= 1 = 0.2	1 0.2	A
Grid input power	W _{ig} white	= 1.4	1.3	kW
Output power	W _o white black	= 17 = 1.7	12 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

$$\begin{array}{ll} \text{Filament voltage} & V_f = 6.3 \text{ V} \begin{matrix} + 5\% \\ -10\% \end{matrix} \\ \text{Filament current} & I_f = 65 \text{ A} \end{array}$$

CAPACITANCES

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

TYPICAL CHARACTERISTICS

Anode voltage	$V_a = 6 \text{ kV}$
Anode current	$I_a = 0.24 \text{ A}$
Amplification factor	$\mu = 23$
Mutual conductance	$S = 7 \text{ mA/V}$

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	$= \text{max. } 220^\circ\text{C}$
Temperature of external parts of the anode	$= \text{max. } 270^\circ\text{C}$

7Z2 3531

COOLINGContinuous service

	W_a (kW)	q_{min} (m^3/min)	p_i (mm H ₂ O)
	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

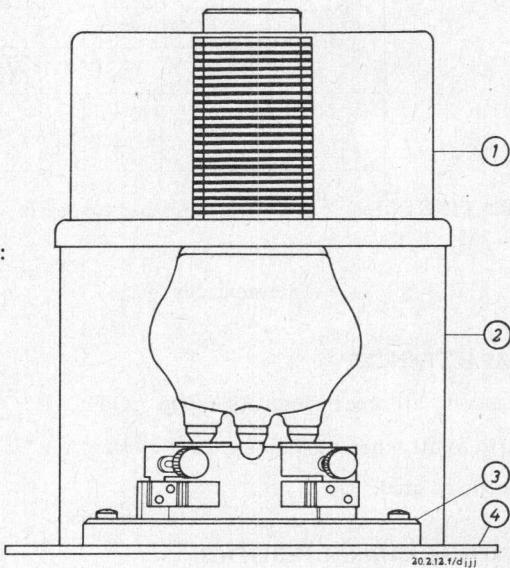
(4) = ground plate (see page 3)

Dimensions of the glass cylinder:

Height : 118 mm

Outside diameter : 150 mm

Inside diameter : 144 mm

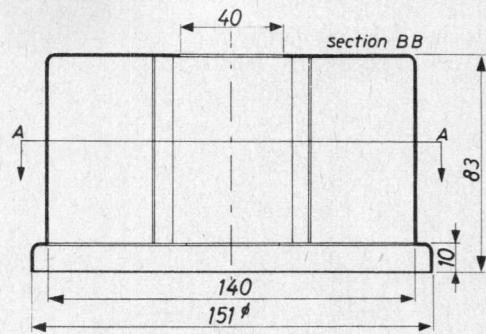


The cooling air should preferably be supplied through the space under the ground plate (4). This ground plate should have holes of sufficient cross section to pass the required air flow.

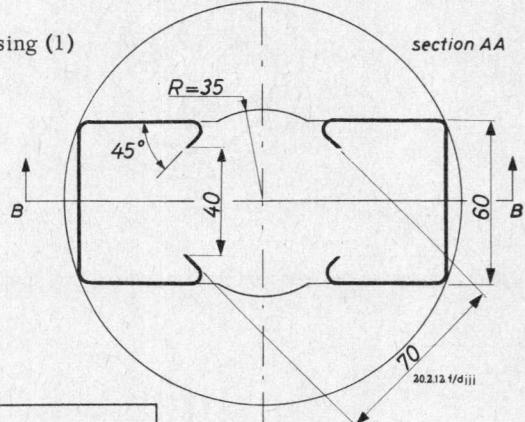
The housing (1) should be connected to the anode connector. At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally between both grid terminals to avoid excessive grid seal temperatures.

RECOMMENDED COOLING DEVICE (continued)

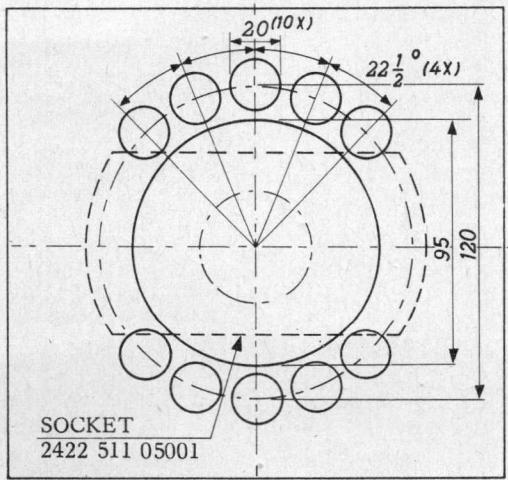
Dimensions in mm



Metal housing (1)



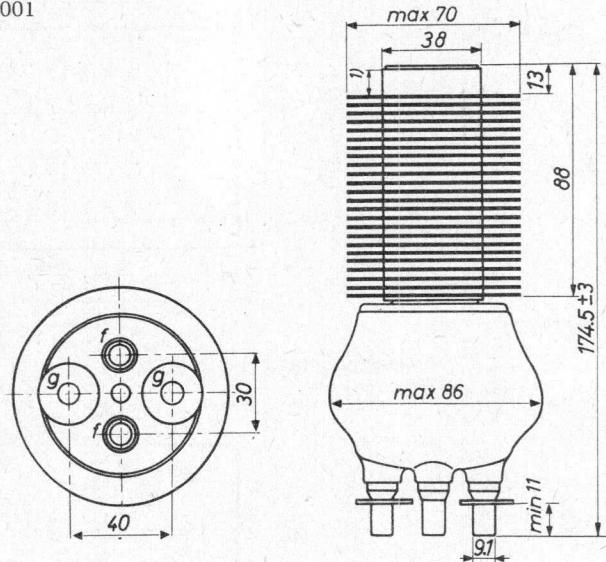
Ground plate (4)



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	MHz
Transformer voltage	V_{tr}	=	6.0	5.1 kVRMS
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%.

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

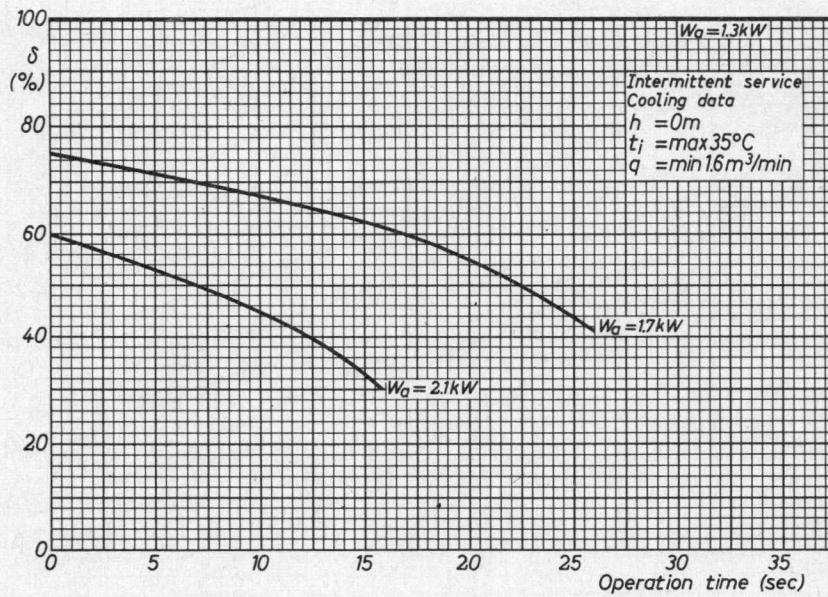
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5.1	kV _{RMS}
Anode voltage	V_a	=	6	kV
Anode current, loaded	I_a	=	1.33	A
Anode current, unloaded	I_a	=	0.33	A ²⁾
Grid current, loaded	I_g	=	0.38	A
Grid current, unloaded	I_g	=	0.48	A ²⁾
Grid resistor	R_g	=	1450	Ω
Load resistance	$R_{a~}$	=	2200	Ω
Feedback ratio under loaded conditions	$V_{g~}/V_{a~}$	=	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⁾

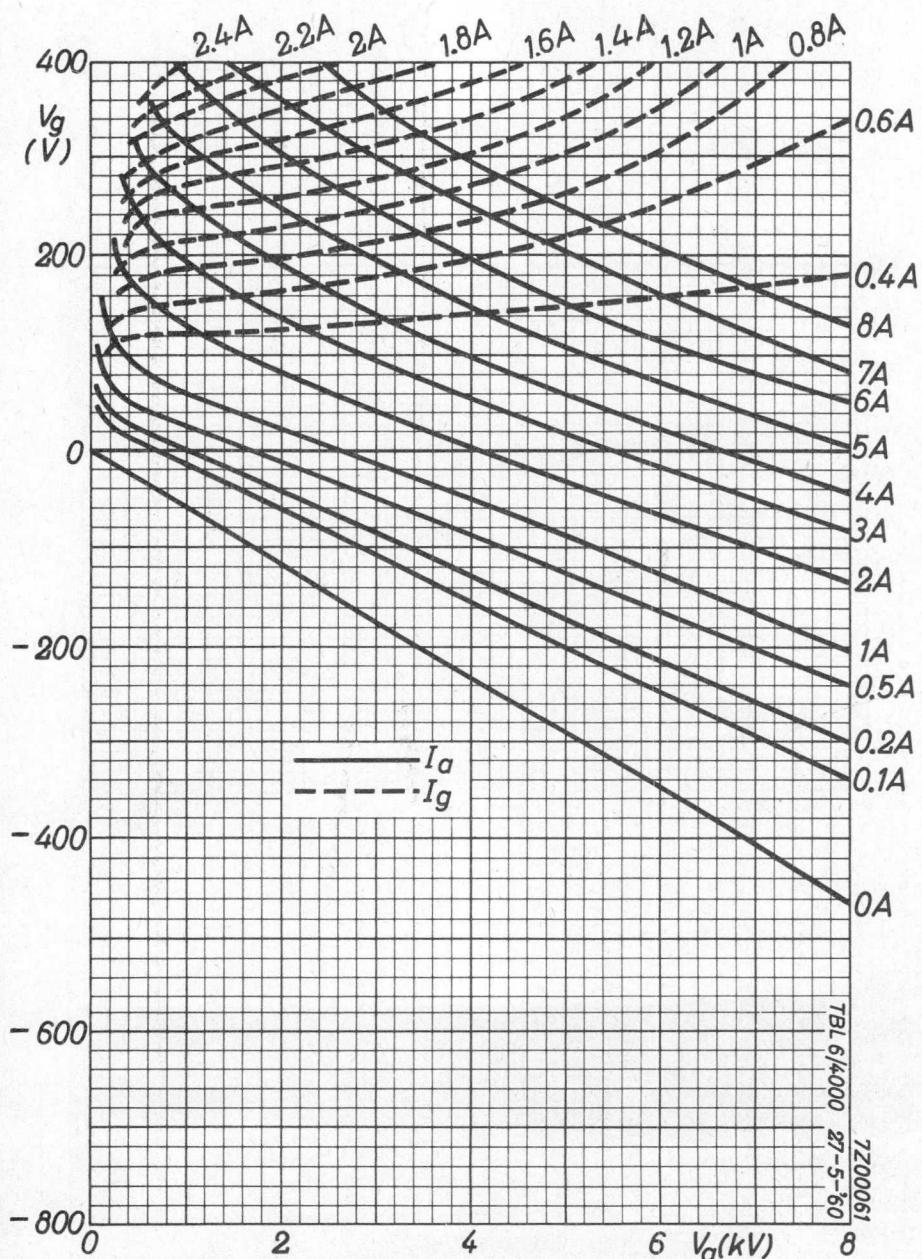
1) See figure page A

2) In a typical circuit

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

7Z030339-20.2.12.tdjj





AIR 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	5	4.7	6	13.3
		5	5.6	5	1.45	4.5	4.1	5	6.6
		4	4			4	3.5	4.5	6.0
						3.5	3	4	5.3
						3	2.2	3.5	4.6
								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

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 ₂ O)
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

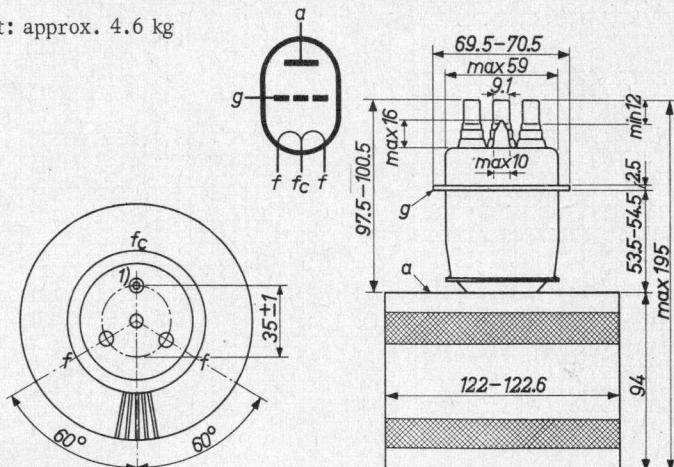
MECHANICAL DATA

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

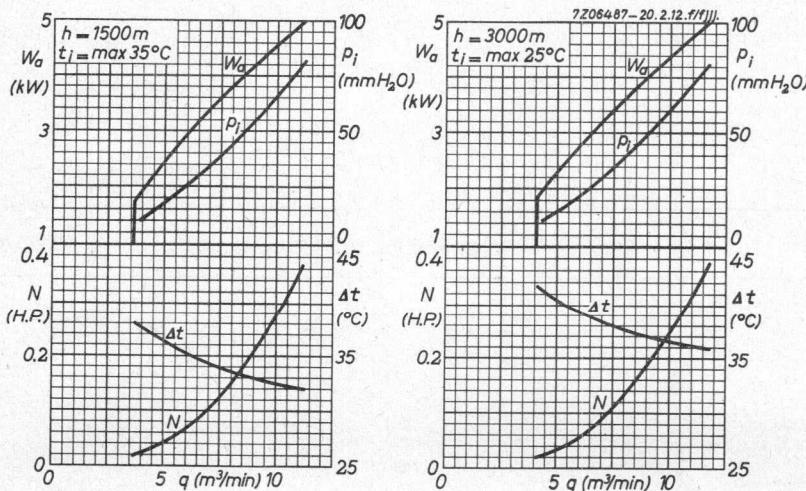
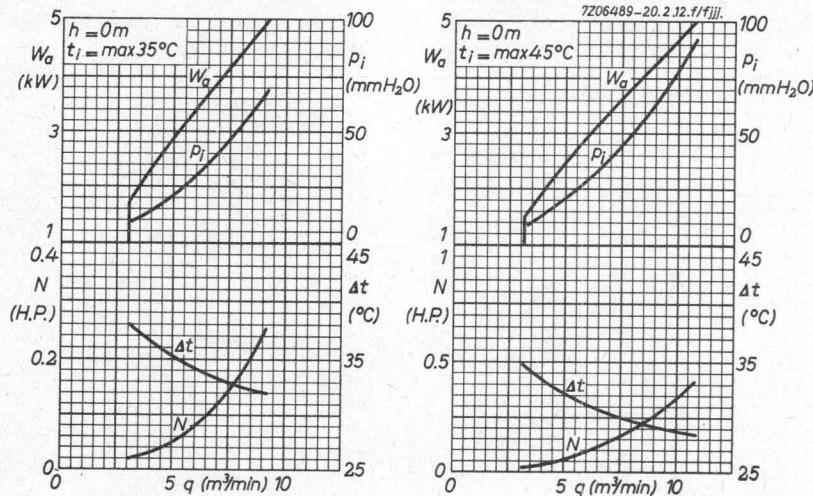
**ACCESSORIES**

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.



AIR COOLED R.F. POWER TRIODE

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

QUICK REFERENCE DATA							
λ (m)	Freq. (MHz)	C telegr.		C osc.		B mod. ¹⁾	
		V _a (kV)	W _o (kW)	V _a (kV)	W _o (kW)	V _a (kV)	W _o (kW)
10	30	6.5 6.0 5.0	9.5 8.5 7.1			7.0 5.0 4.0	20 9.0 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 ₂ O)
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

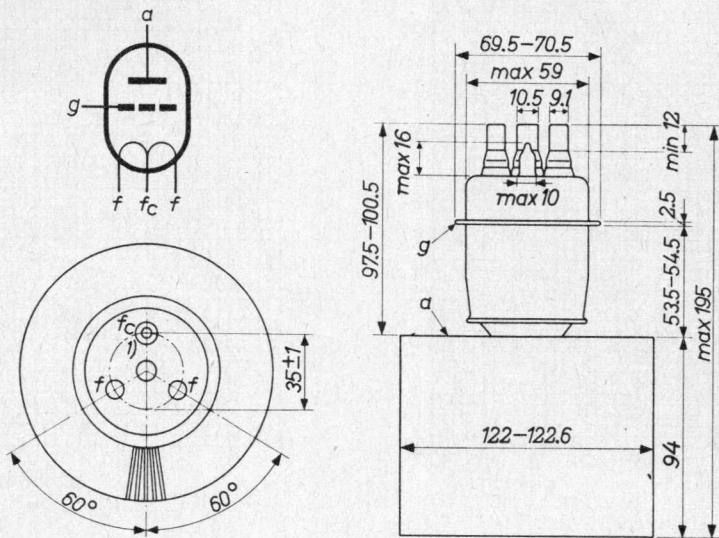
¹⁾ The centre tap f_C (diameter 10.5 mm; marked O) must not be used for filament current supply. The connector type 40649, however, must be used for the cooling of this pin.

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

MECHANICAL DATA

Dimensions in mm

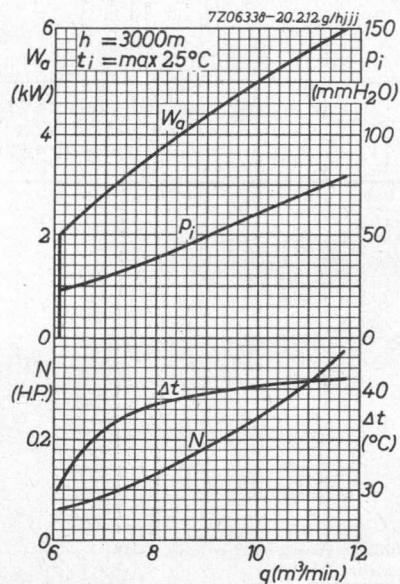
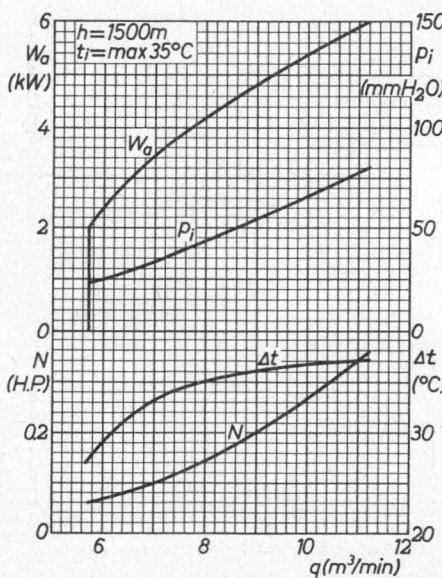
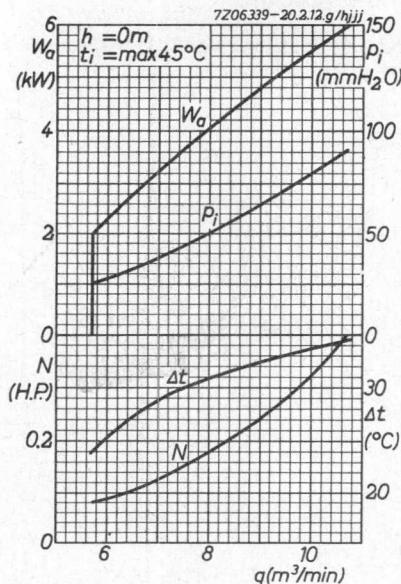
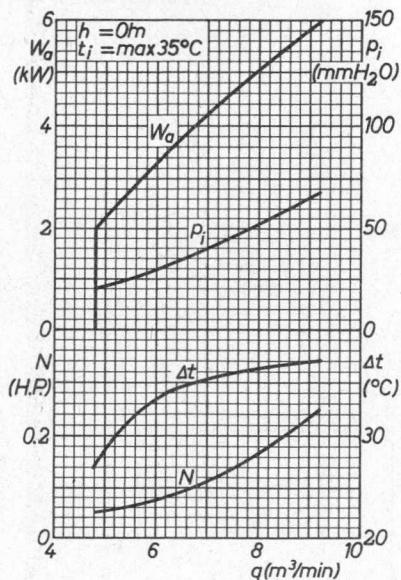
Mounting position: vertical with anode up or down



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

¹⁾ See page 2

TBL 7/8000



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

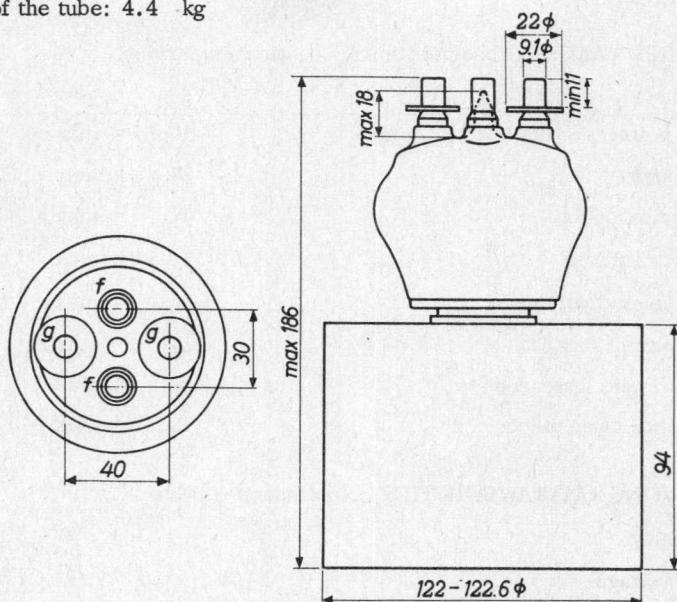
W_a (kW)	h (m)	t_i (°C)	q_{\min} (m^3/min)	p_i (mm H ₂ O)
2	0	35	4.8	20
	0	45	5.7	25
	1500	35	5.7	23
	3000	25	6.1	23
4	0	35	6.8	38
	0	45	7.9	49
	1500	35	7.8	42
	3000	25	8.4	42
6	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.7	81

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

Net weight of the tube: 4.4 kg

Dimensions in mm



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

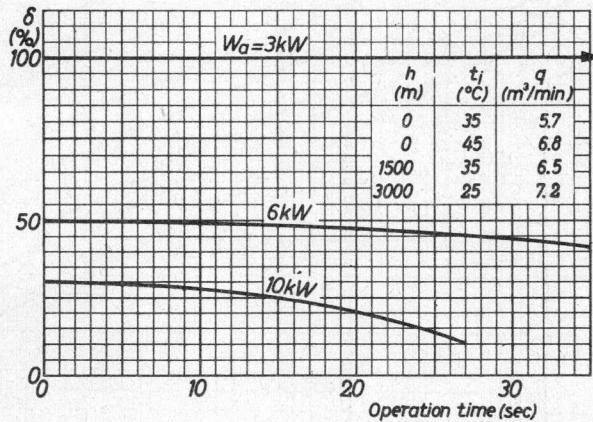
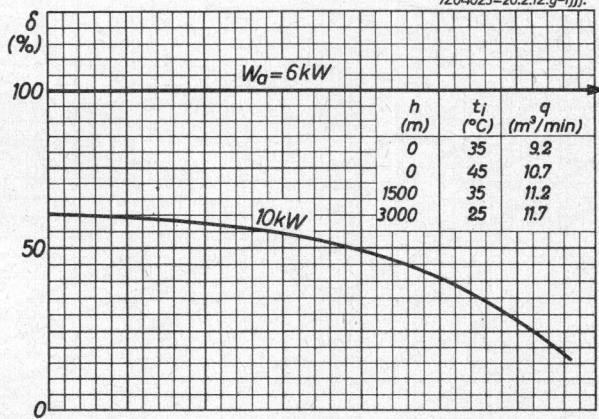
Frequency	f	up to	50	MHz
Anode voltage	V _a	= max.	8	kV
Anode input power	W _{ia}	= max.	12	kW
Anode dissipation	W _a	= max.	6	kW
Anode current	I _a	= max.	1.8	A
Negative grid voltage	-V _g	= max.	1250	V
Grid current, loaded	I _g	= max.	0.4	A
Grid current, unloaded	I _g	= max.	0.5	A
Grid circuit resistance	R _g	= max.	10	kΩ

OPERATING CHARACTERISTICS, continuous service

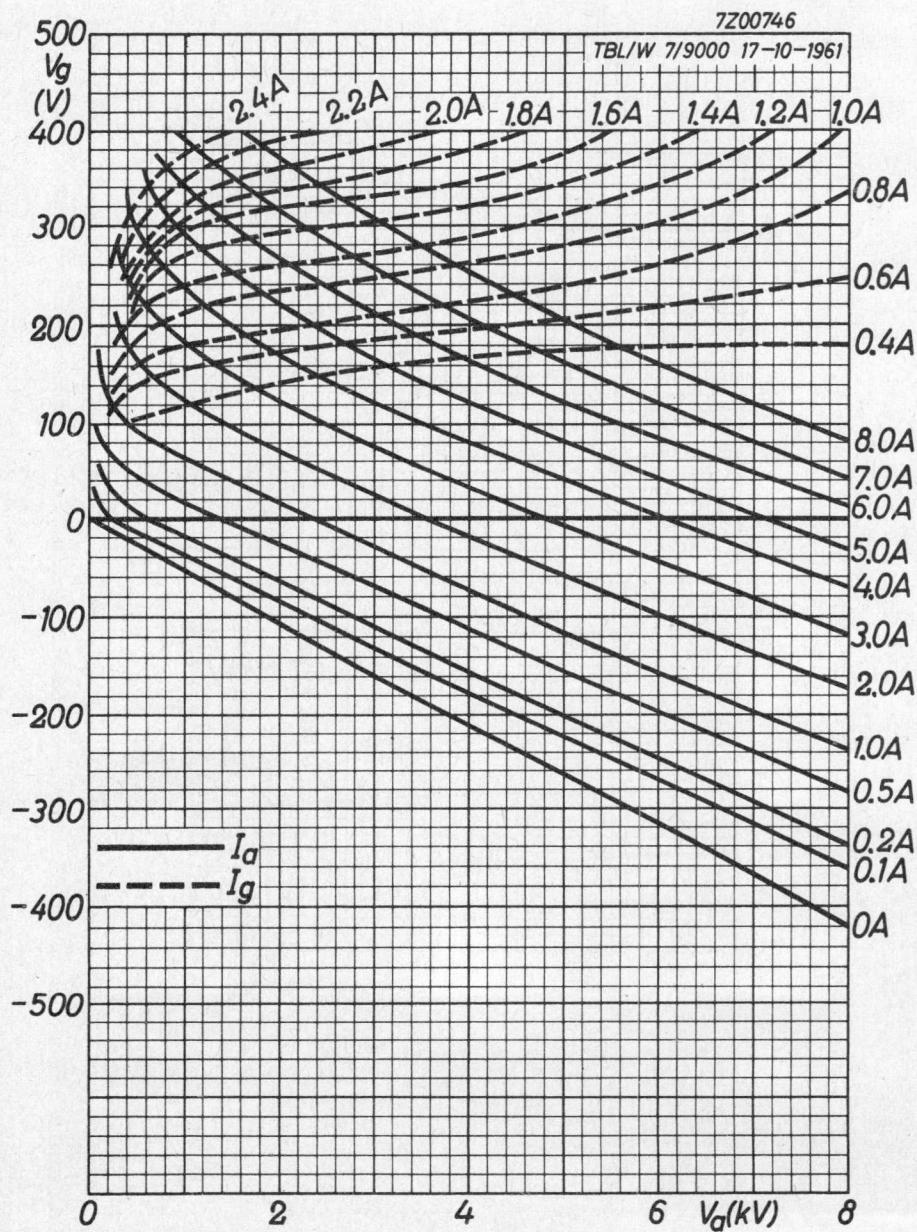
Frequency	f	=	50	50	MHz
Anode voltage	V _a	=	7200	6200	V
Anode current, loaded	I _a	=	1.5	1.4	A
Anode current, unloaded	I _a	=	0.37	0.40	A
Grid current, loaded	I _g	=	0.36	0.37	A
Grid current, unloaded	I _g	=	0.47	0.47	A
Grid resistor	R _g	=	1850	1500	Ω
Load resistance	R _{a~}	=	2300	2100	Ω
Feedback ratio under loaded conditions	V _{g~} /V _{a~}	=	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 %

TZ04023-20.2.12.g-ijjj.



7Z00746



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 10 8	29.0 23.3 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

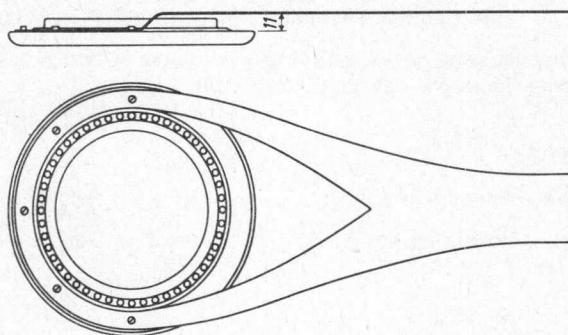
TEMPERATURE LIMIT (Absolute limit)

Seal temperature = max. 220 $^{\circ}\text{C}$ 7Z2 8674

AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (°C)	q_{min} (m³/min)	P_i (mm H₂O)
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



MECHANICAL DATA

Dimensions in mm

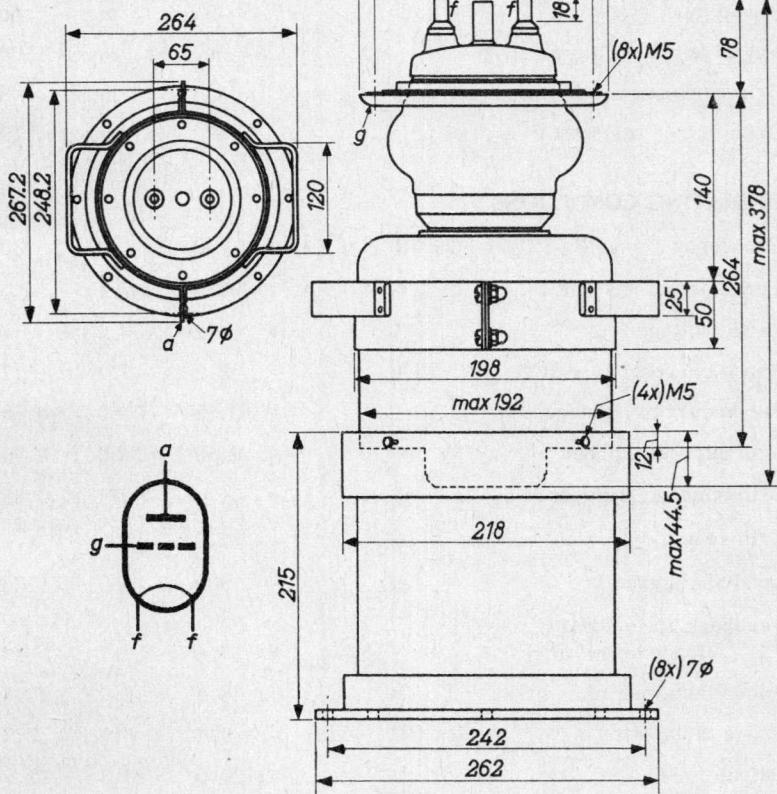
Filament connectors
with cable : 40662

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

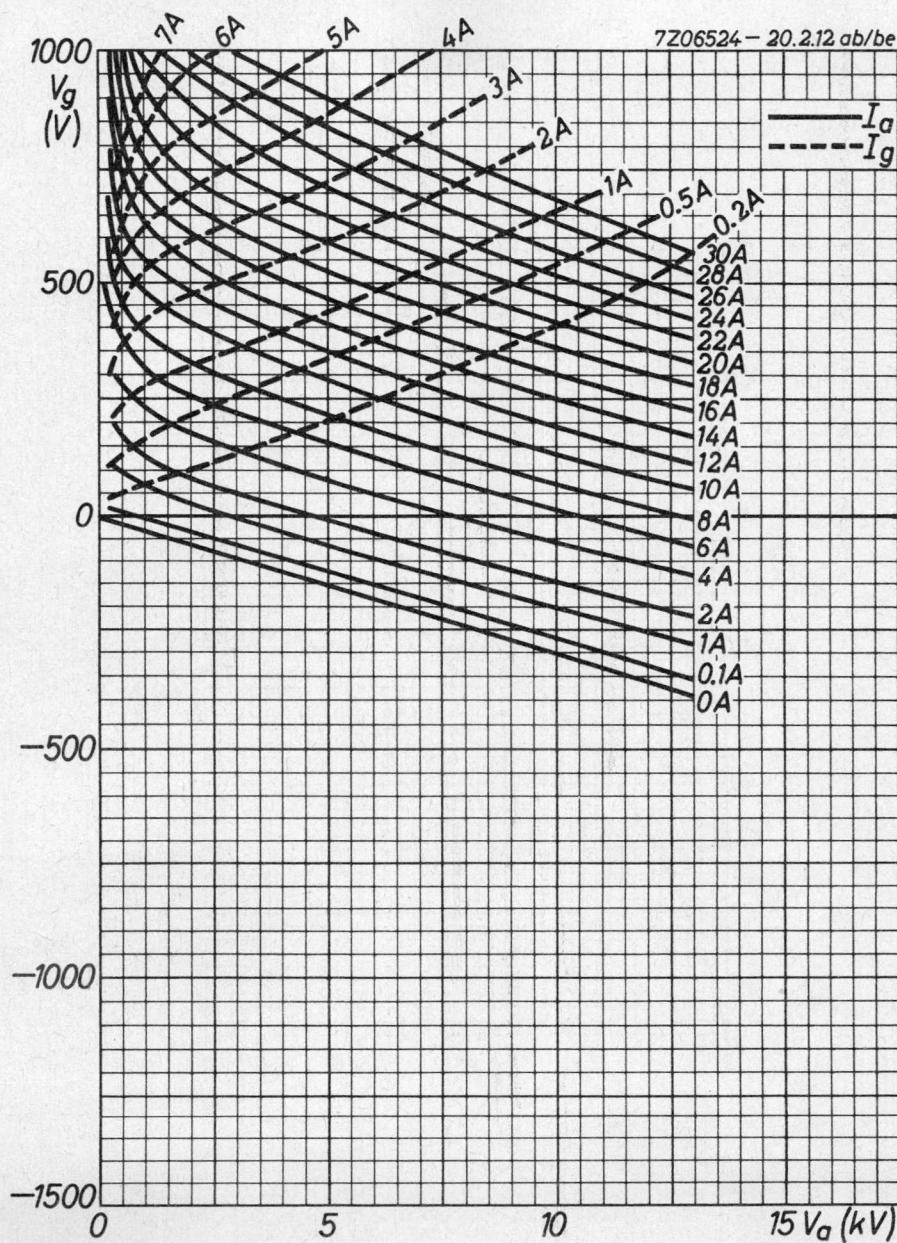
LIMITING VALUES (Absolute limits)

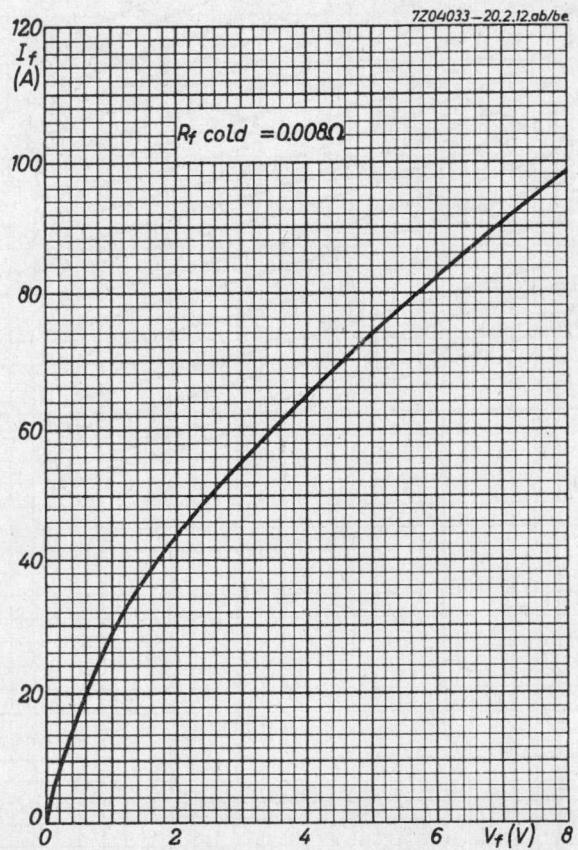
Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	4.8	A
Anode dissipation	W_a	= max.	15	kW
Anode input power	W_{ia}	= max.	60	kW
Negative grid voltage	$-V_g$	= max.	1500	V
Grid current	I_g	= max.	0.8	A
Grid circuit resistance	R_g	= max.	10	k Ω

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	k Ω
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





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 10 8	39 31.3 23.2

HEATING: direct; filament thoriated tungsten

Filament voltage	V _f	8 V	+ 5 %
Filament current	I _f	130 A	-10 %
Cold filament resistance	R _{f0}	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)

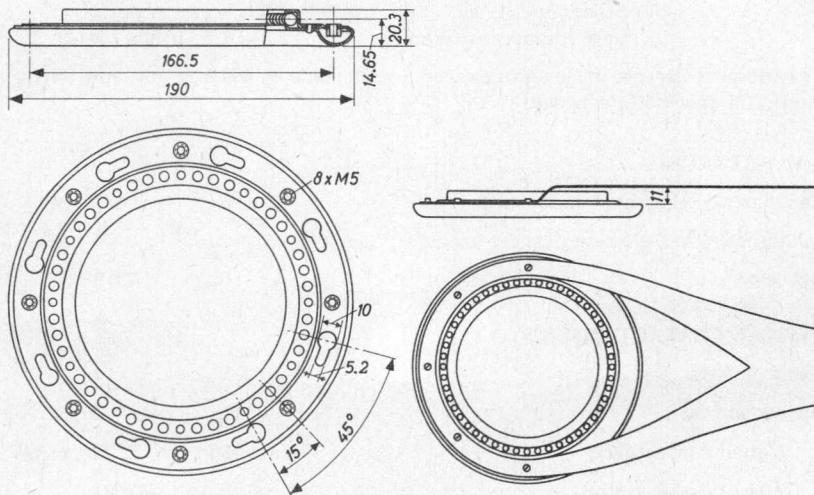
Temperature of all seals max. 220 °C

COOLING See also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m ³ /min)	p_i (mm H ₂ O)
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

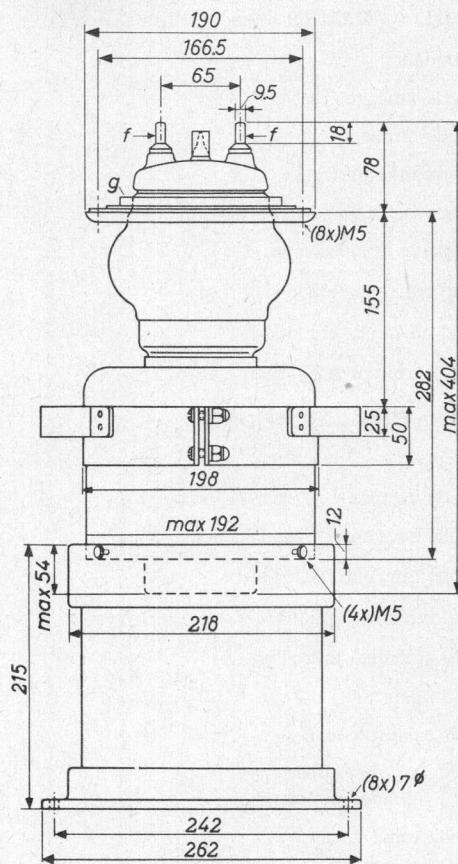
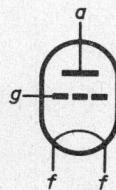
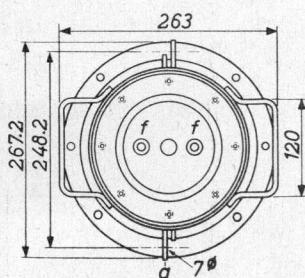
The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right.

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

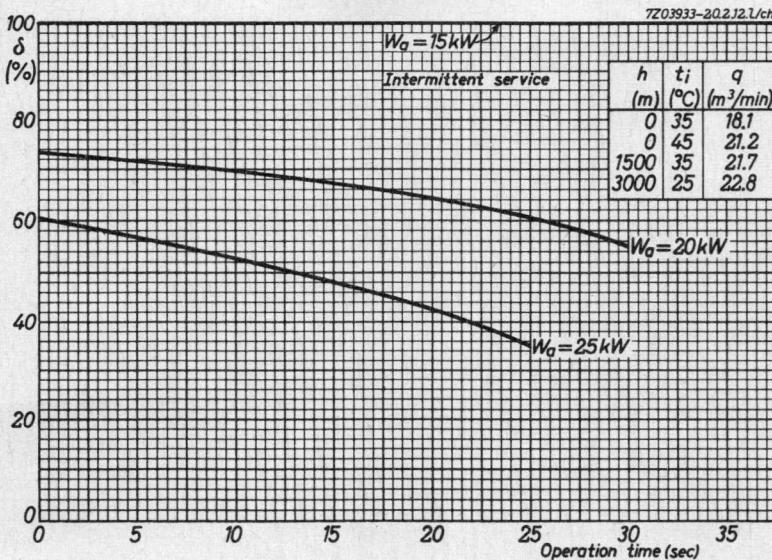
LIMITING VALUES (Absolute limits)

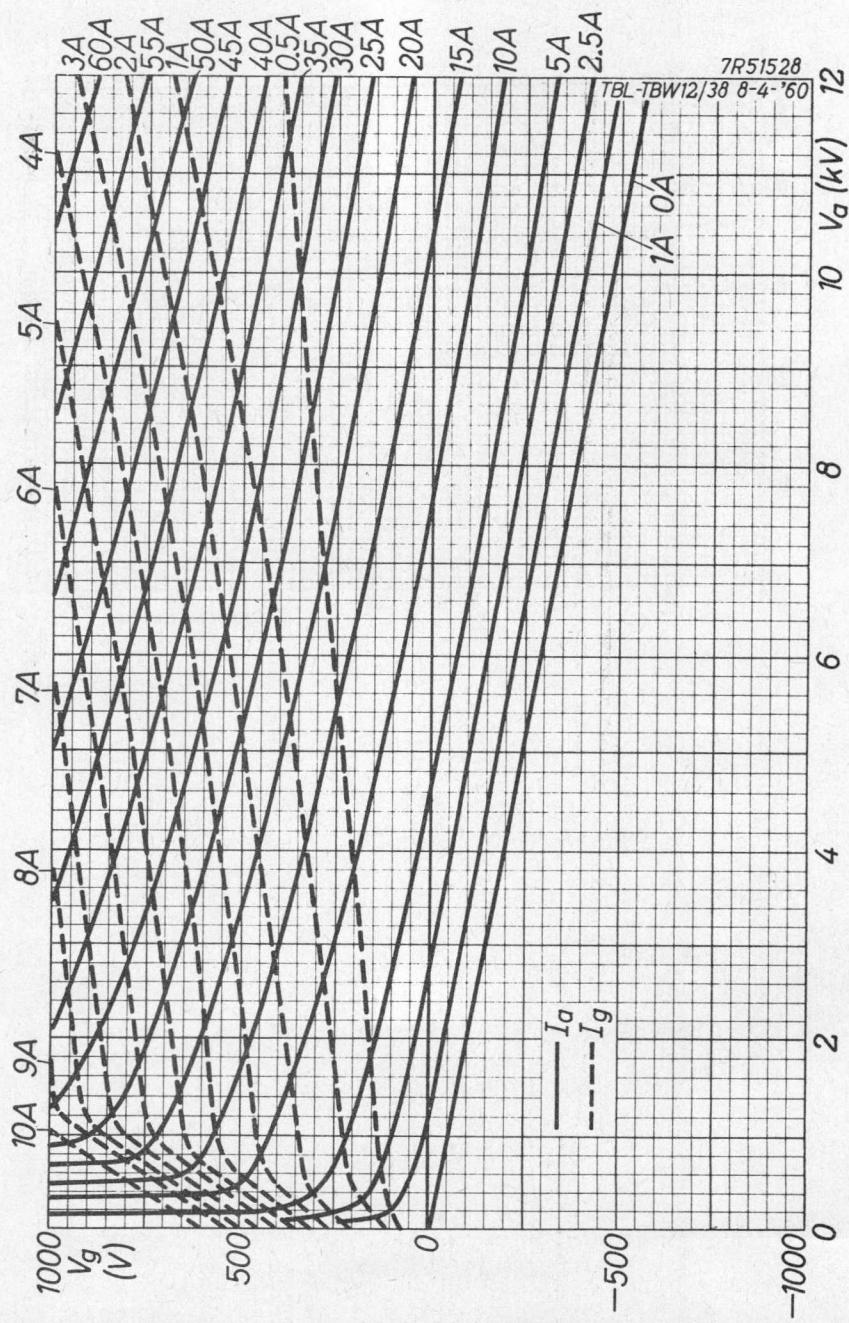
Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	13	kV
Anode current	I_a	max.	5	A
Anode dissipation	W_a	max.	15	kW
Anode input power	W_{ia}	max.	60	kW
Negative grid voltage	$-V_g$	max.	2	kV
Grid current, loaded	I_g	max.	1.5	A
Grid current, unloaded	I_g	max.	2.0	A
Grid circuit resistance	R_g	max.	10	$k\Omega$

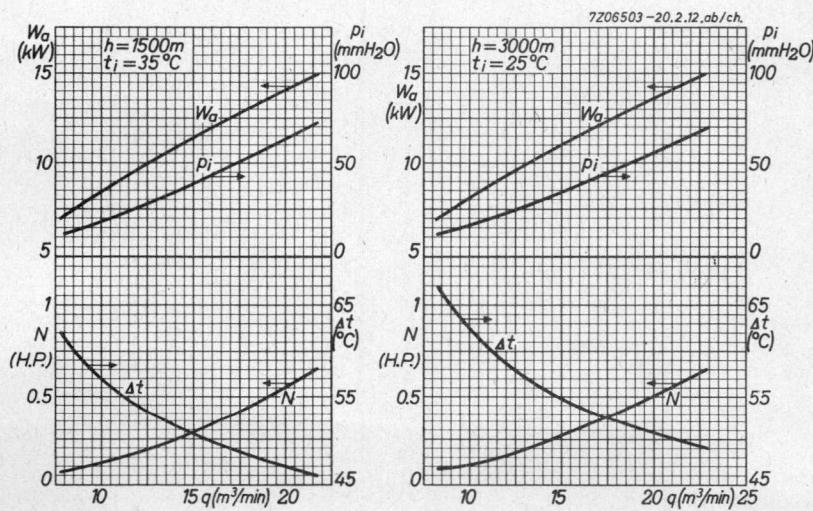
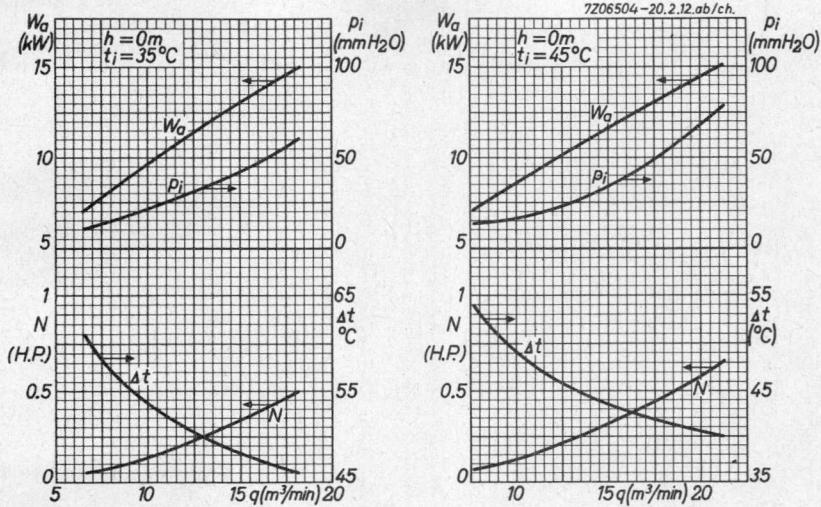
OPERATING CONDITIONS

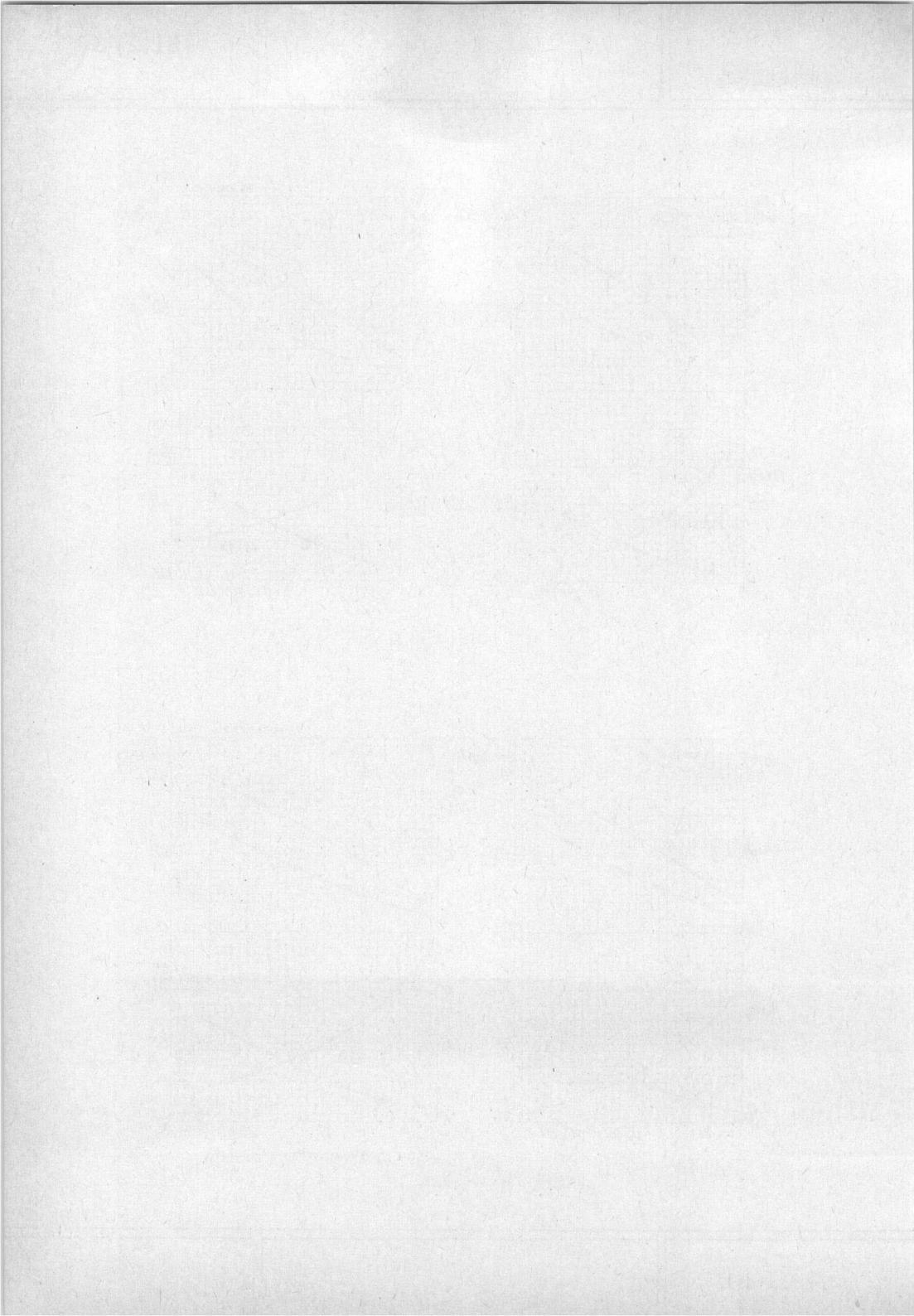
Frequency	f	30	30	30	MHz
Anode voltage	V_a	12	10	8	kV
Anode current, loaded	I_a	4.5	4.5	4.5	A
Anode current, unloaded	I_a	0.65	0.63	0.62	A
Grid current, loaded	I_g	0.9	0.9	0.9	A
Grid current, unloaded	I_g	1.22	1.3	1.35	A
Grid resistor	R_g	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	1450	1100	800	Ω
Feedback 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%.









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

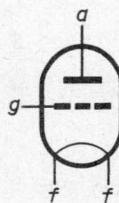
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H ₂ O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

MECHANICAL DATA

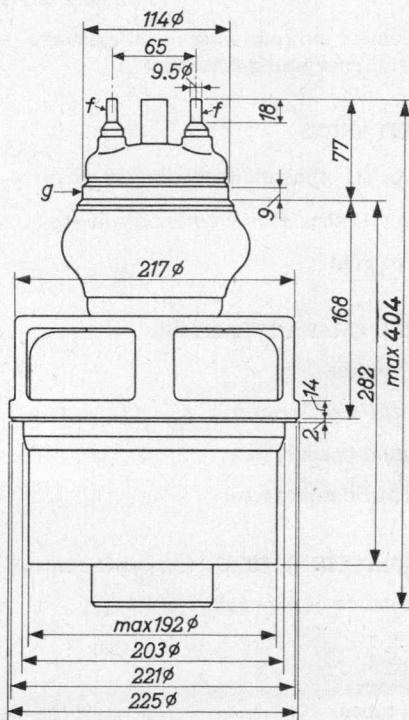
Dimensions in mm

Net weight of tube : 19 kg

Net weight of pedestal: 7.15 kg



Mounting position: vertical



ACCESSORIES

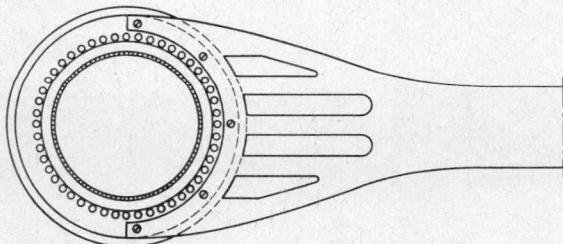
Dimensions in mm

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	k Ω

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 level²⁾ Grid bias partially obtained by a grid resistor

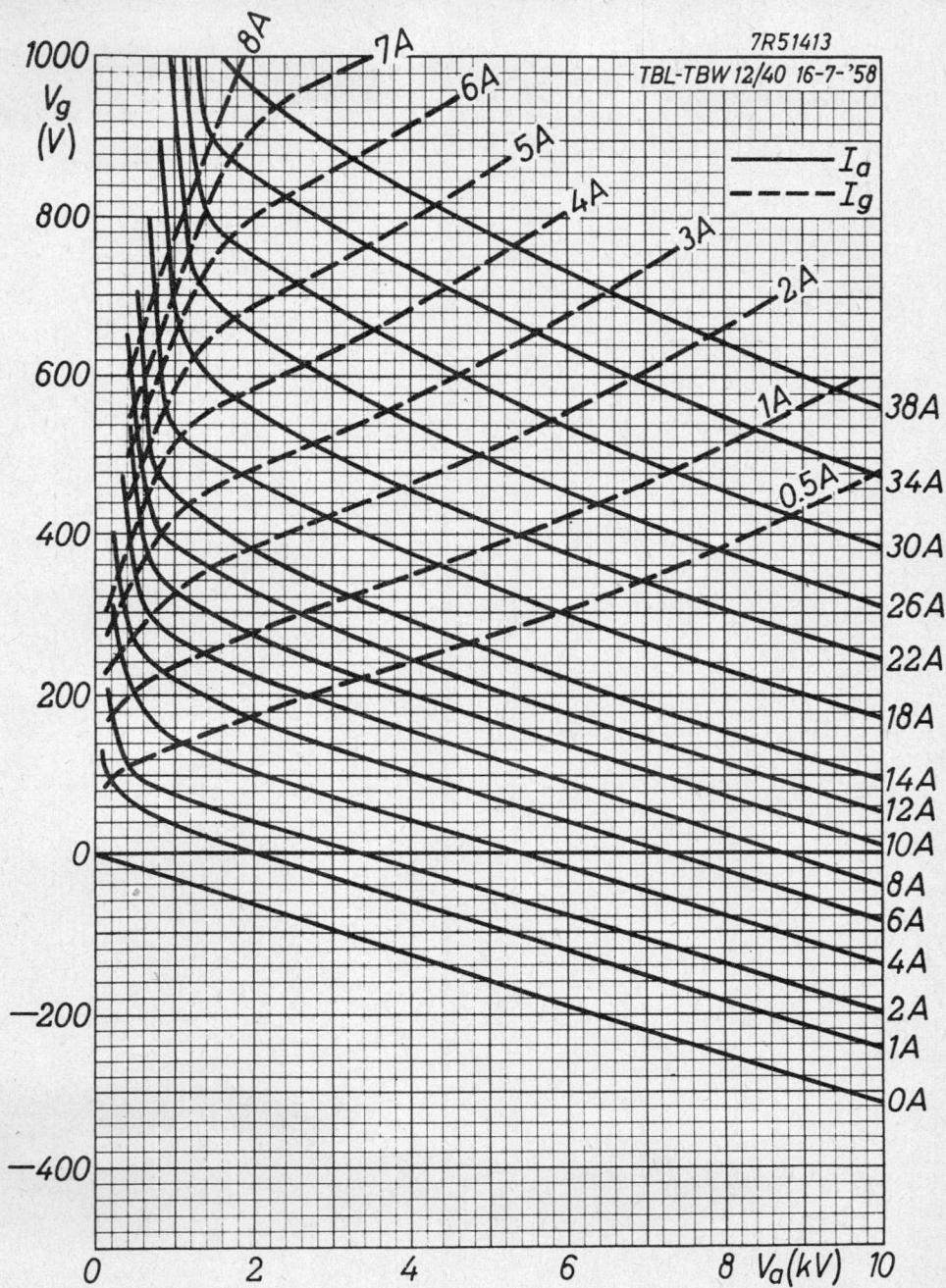
A.F. CLASS B AMPLIFIER AND MODULATOR (especially for use with a cathode-follower)

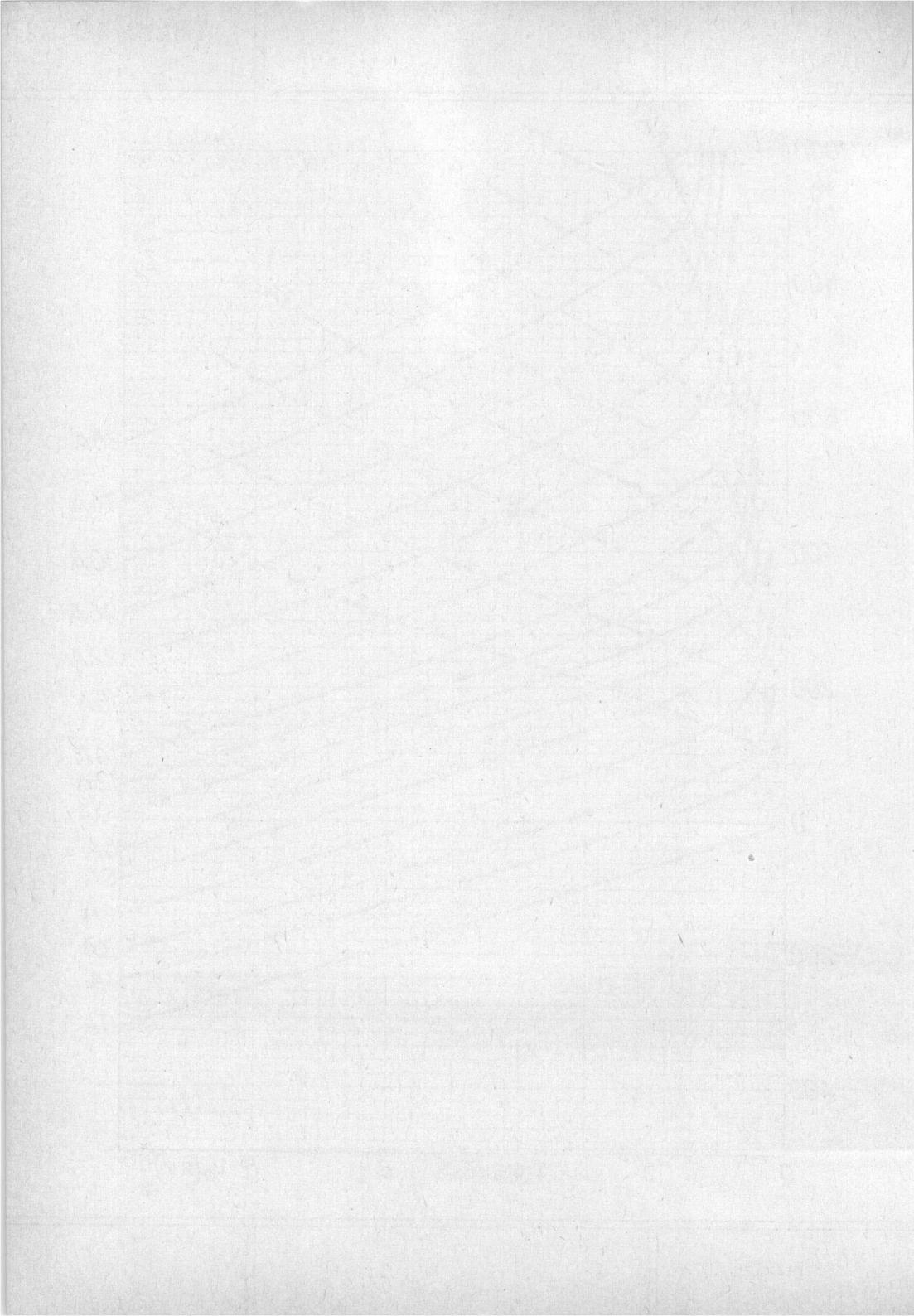
LIMITING VALUES (Absolute limits)

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	k Ω

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	%





AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA							
General purposes							
λ (m)	Freq. (MHz)	C telegr.		C an. 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 - 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 _{f₀}	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	°C
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COOLING

W _a (kW)	h (m)	t _i (°C)	q _{min} (m ³ /min)	p _i (mm H ₂ O)
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.

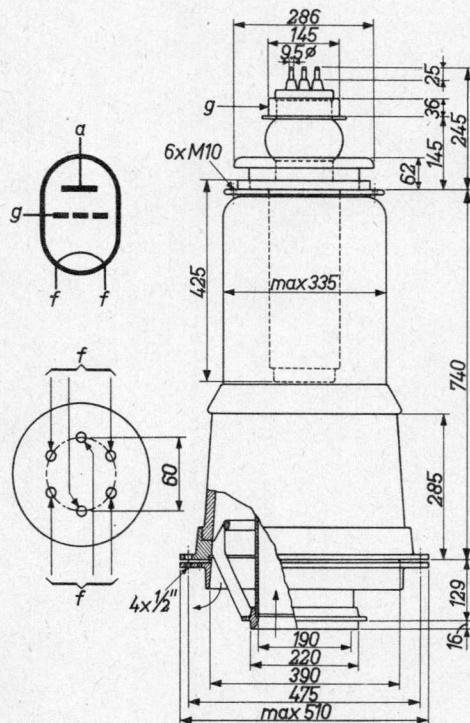
MECHANICAL DATA

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

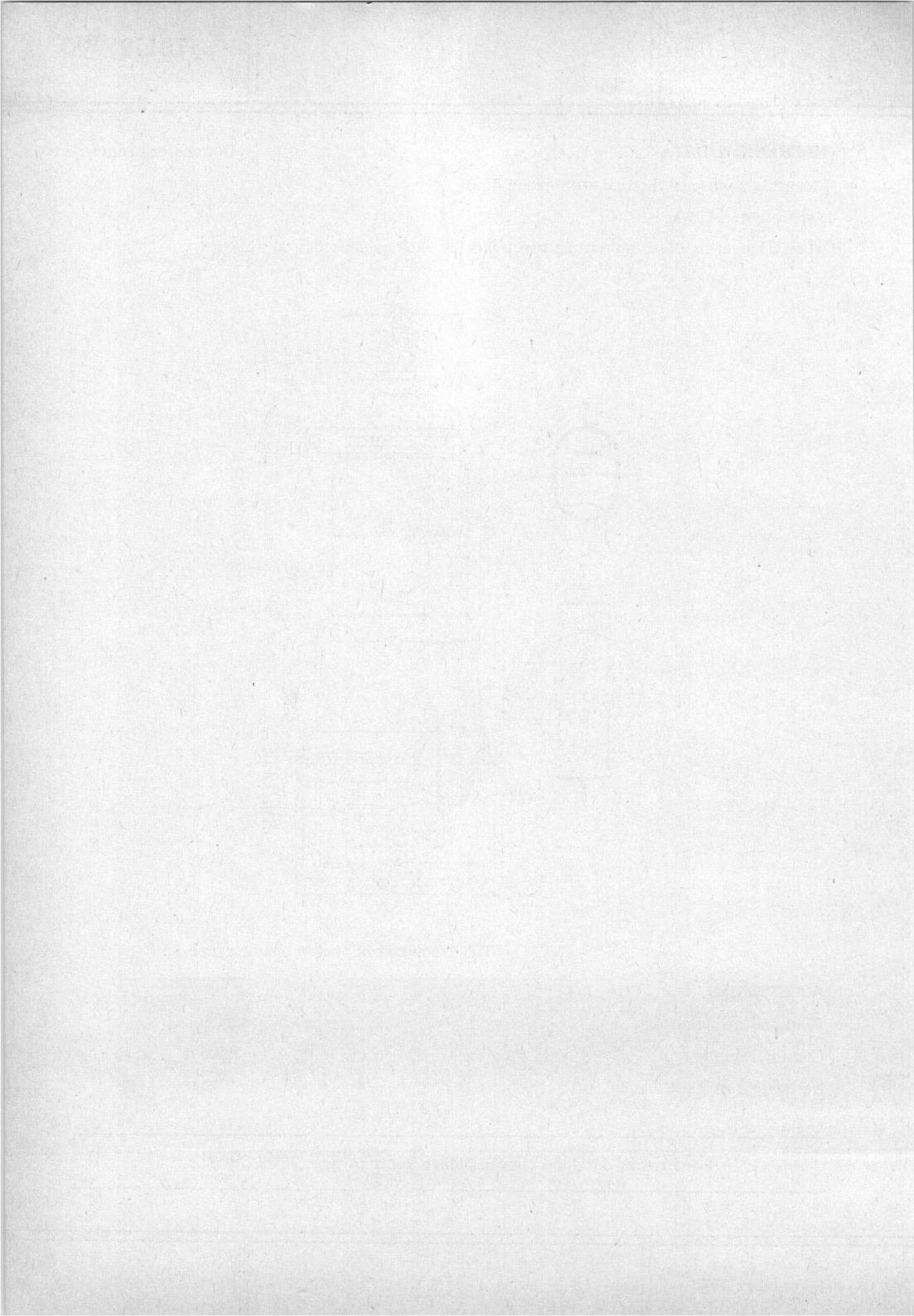
Cooler housing

K506

Net weight of K506

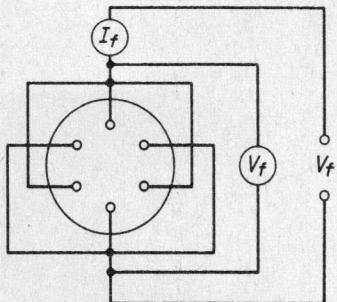
72 kg

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



AIR COOLED R.F. POWER TRIODE

This type is equivalent to type TBL12/100 except for the filament data

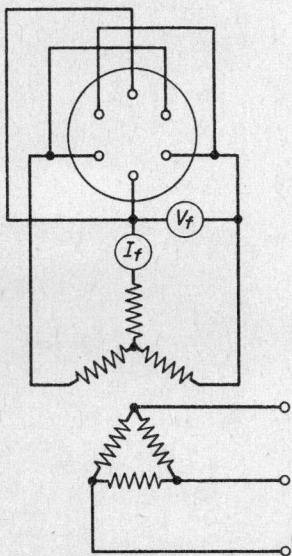


Single-phase filament energizing

$$V_f = 17.5 \text{ V}$$

$$I_f = 196 \text{ A}$$

Filament current must never exceed a peak value of 420 A at any time during the initial energizing schedule



Three-phase filament energizing

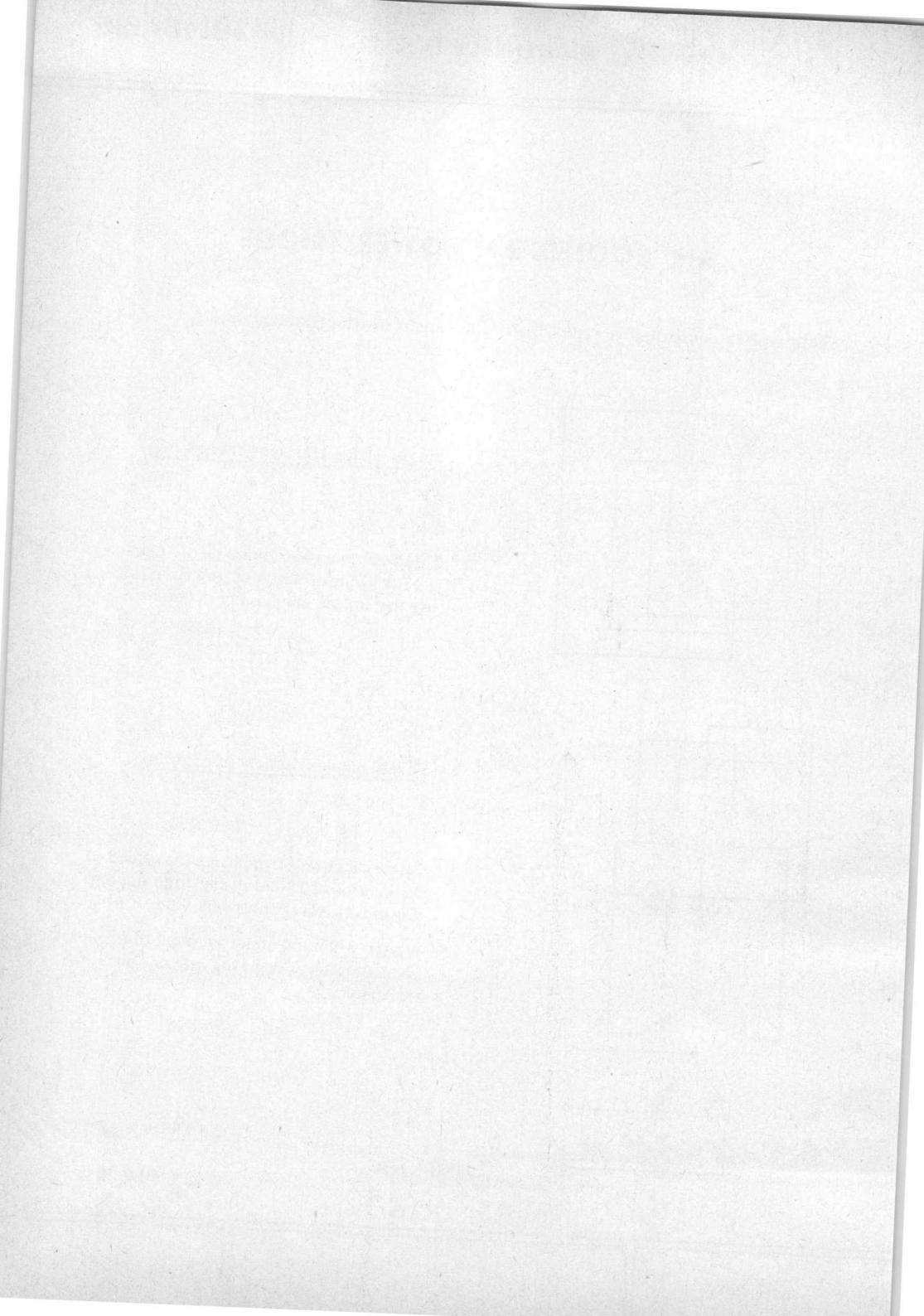
$$V_f = 15.5 \text{ V}$$

$$I_f = 131 \text{ A}$$

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 3595



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	17.7
	6	14.3

HEATING: direct, filament thoriated tungsten

Filament voltage	V _f =	6.3 V	+ 5 %
Filament current	I _f =	136 A	
Cold filament resistance	R _{f0} =	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 °C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	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

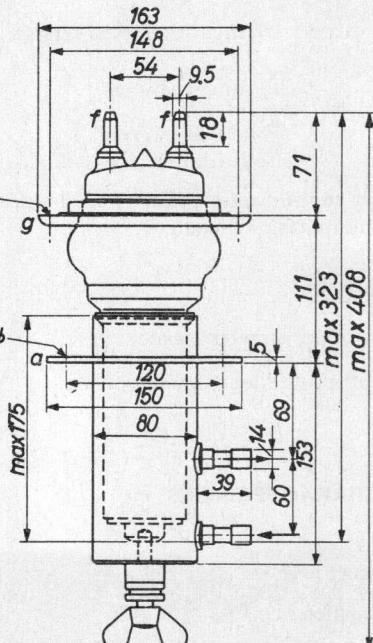
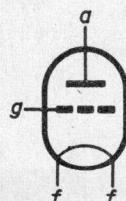
Water jacket : K720

O-ring large : 2622 080 30889

small : 2622 080 30736

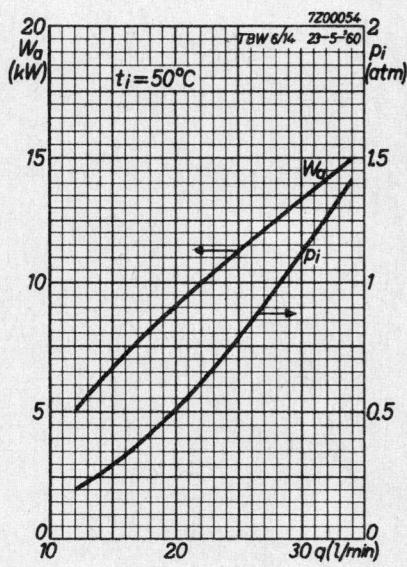
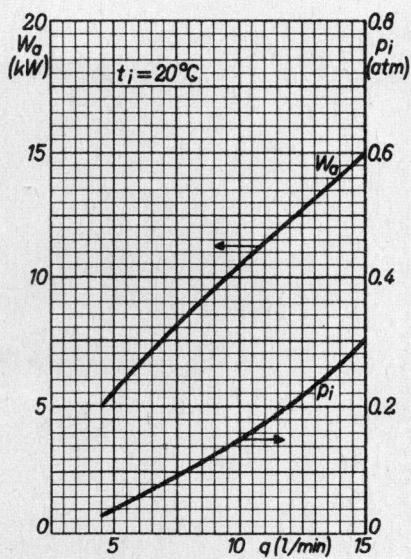
Net weight of tube : 2.5 kg

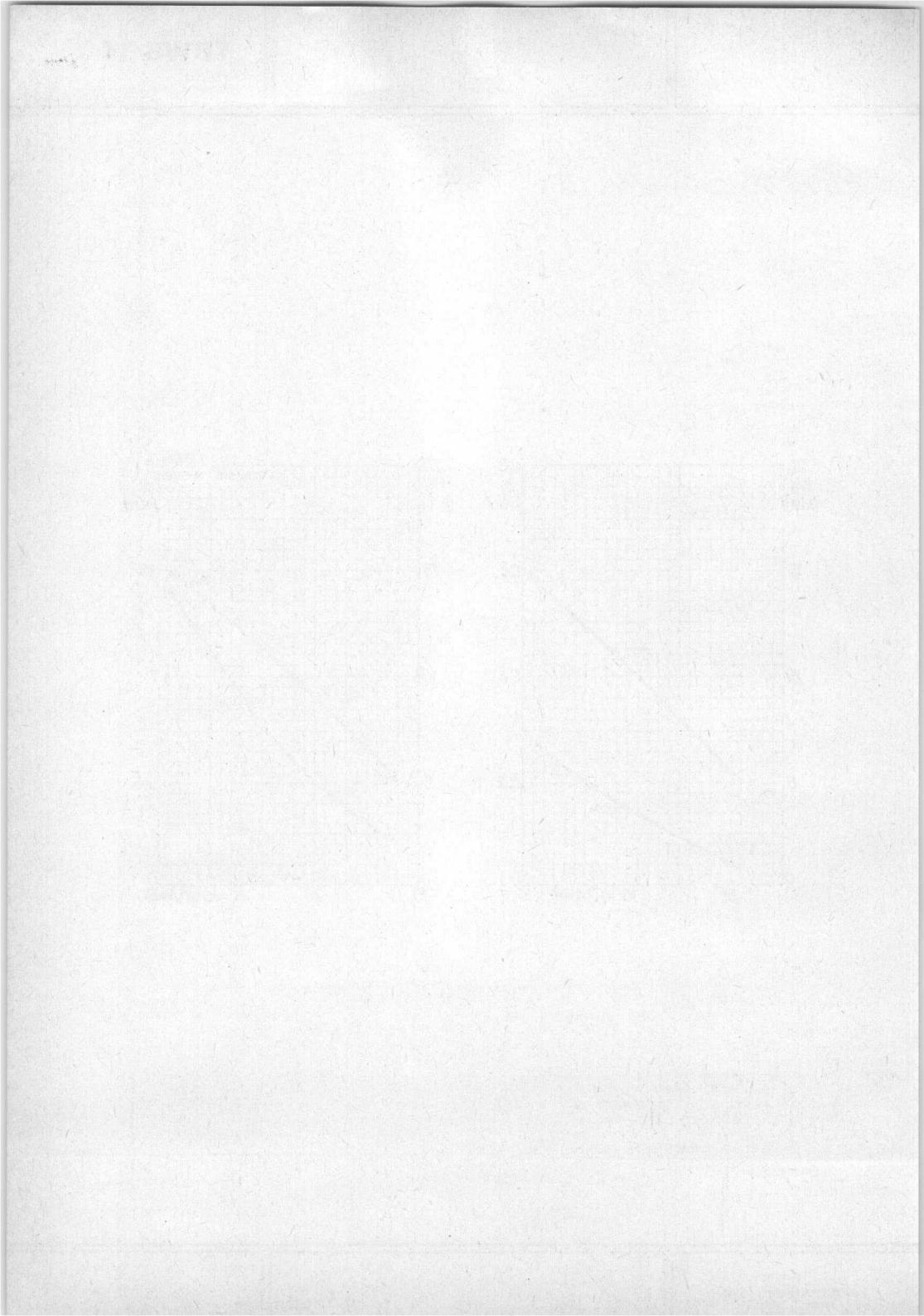
Net weight of water jacket: 2.2 kg



Mounting position: vertical with anode down

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





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 5 4	6.9 5.6 4	6 5	1.9 1.45	5 4.5 4 3.5 3	4.7 4.1 3.5 3 2.2	6 5 4.5 3.5 3	13.3 6.6 6.0 5.3 4.6 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

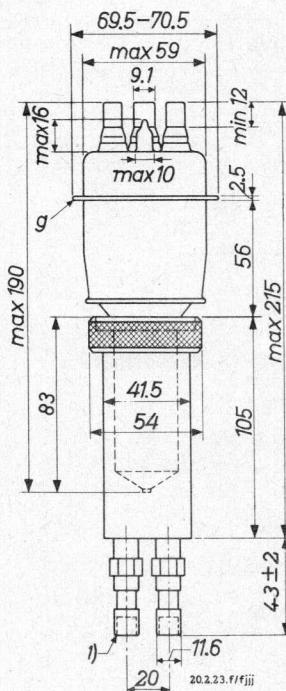
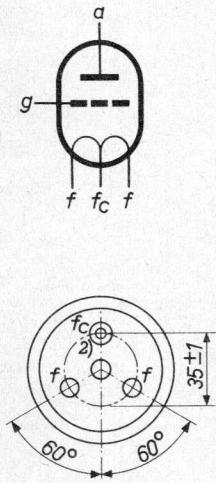
1) At inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

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 _{gp}	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

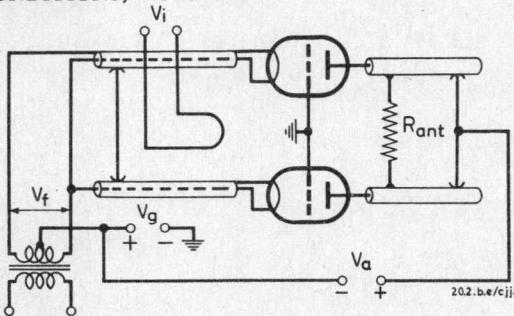
R.F. CLASS C TELEGRAPHY, grounded grid

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)**

	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 _{gp}	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 _{gp}	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 _{gp}	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 factor	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	kW ¹⁾
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~}	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~}	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 black -300 white -550	-150 -225 -500	V
Peak grid to grid voltage	V_{ggp}	sync 1000	1000	V ³⁾
Anode current	I_a	sync 3.8 black 2.8	3.2 2.6	A
Grid current	I_g	sync 0.5 black 0.35	0.4 0.22	A
Grid input power	W_{ig}	sync 250	350 to 450	W ⁴⁾
Output power	W_o	sync 9 black 5.35	6 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
(I _{ant} = 70 %)		8	MHz
Anode voltage	V _a	5	kV
	white	-200	V
Grid voltage	V _g	-460	V
	black	-580	V
	sync		
Peak grid to grid voltage	V _{ggp}	1000	V
Anode current	I _a	3.8	A
	white	0.8	A
	black		
Grid current	I _g	0.5	A
	white	0	A
Grid input power	W _{ig}	250	W
Output power	W _o	9	kW
	white	0.6	kW
	black		

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_{ggp}	sync black white	1000 800 0	V ³⁾ V ³⁾ V ³⁾
Anode current	I_a	sync black white	3.8 3 0.2	A A A
Grid current	I_g	sync black white	0.5 0.22 0	A A A
Grid input power	W_{ig}	sync	250	350 to 450 W ⁴⁾
Output power	W_o	sync black	9 5.35	6 kW 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
Grid dissipation	W _g	max.	120	W

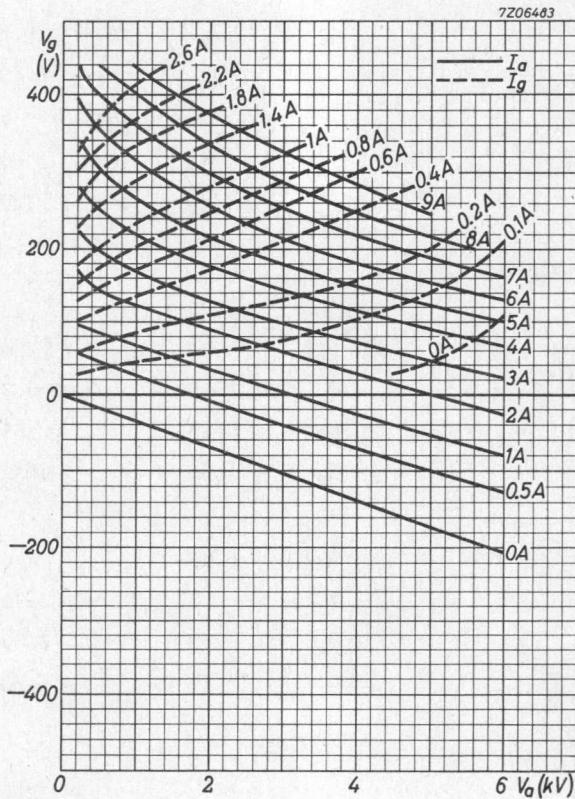
OPERATING CONDITIONS

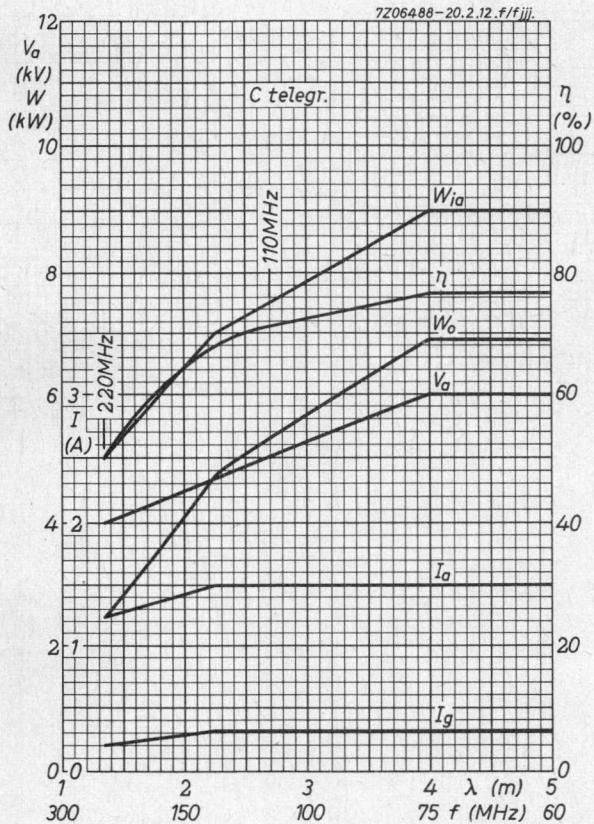
Frequency	f	75	75	MHz
Transformer voltage, RMS	V _{tr}	6.8 ¹⁾	5.9 ²⁾	kV
Anode current	I _a	0.8	0.7	A
Grid current	I _g	0.19	0.165	A
Grid resistor	R _g	1050	1050	
Grid input power	W _{ig}			W
Anode input power	W _{ia}	6.05	4.6	kW
Anode dissipation	W _a	1.5	1.24	kW
Output power	W _o	4.55	3.36	kW
Efficiency	η	75	73	%

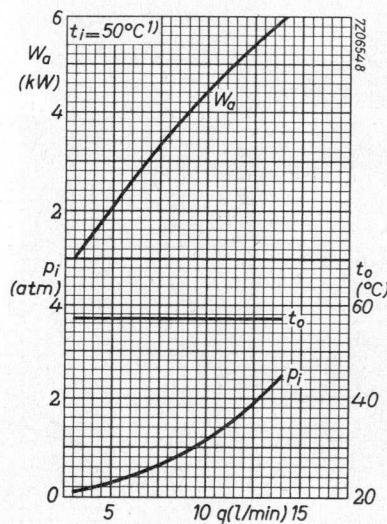
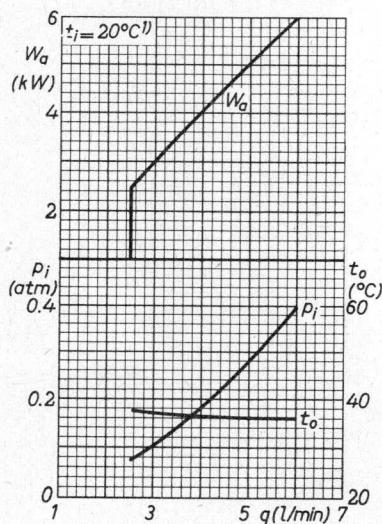
¹⁾ Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

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







WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA							
λ (m)	Freq. (MHz)	C telegr.		C osc.		B mod. ¹⁾	
		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)	$q_{\text{min}}^1)$ (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

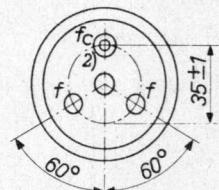
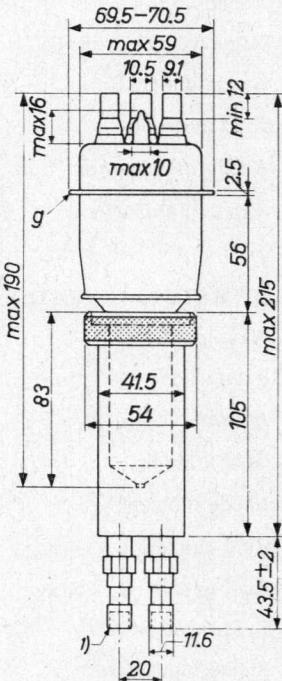
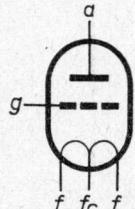
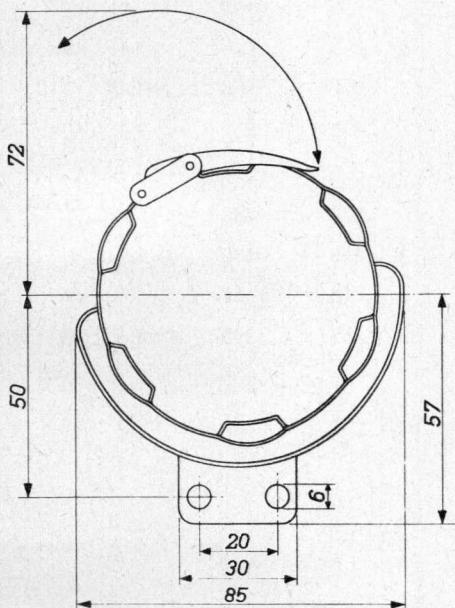
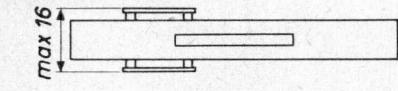
Dimensions in mm

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_{gp}	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	k Ω

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_{ggp}	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_{gp}	-	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

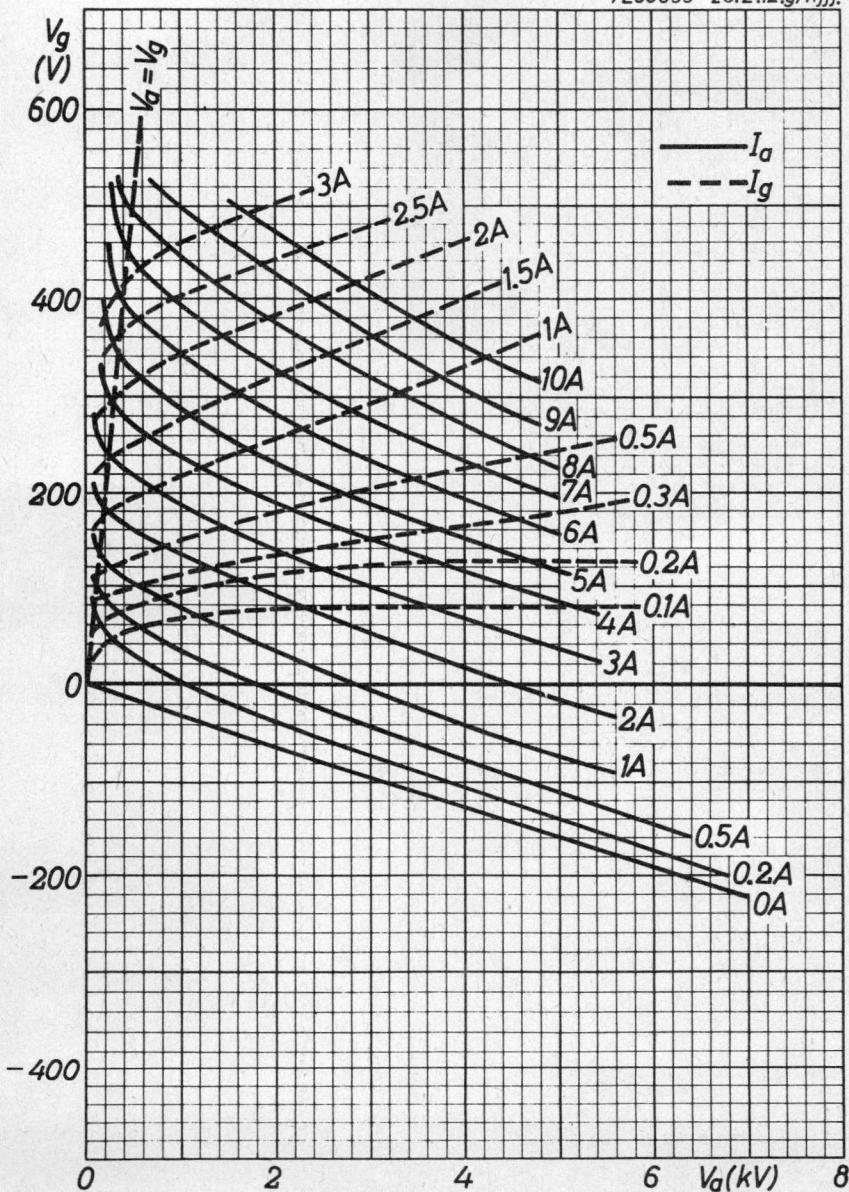
OPERATING CONDITIONS

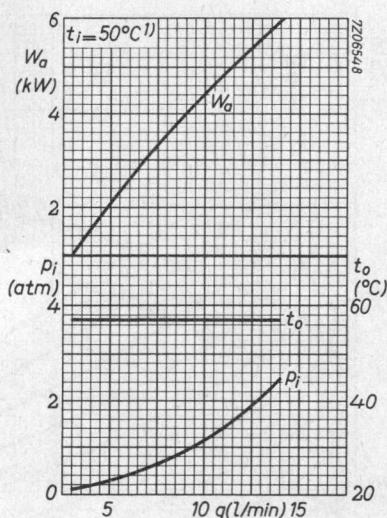
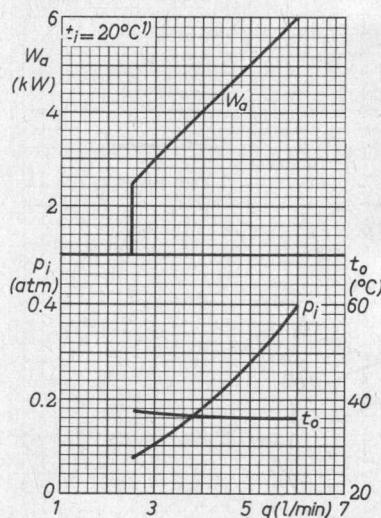
Frequency	f	50	MHz
Transformer voltage	V_{tr}	5100	VRMS
Anode voltage	V_a	6.0	kV
Anode current	I_a	1.5	A
Grid current , on load	I_g	0.4	A
Grid resistor	R_g	1000	Ω
Grid input power	W_{ig}	300	W
Anode input power	W_{ia}	9	kW
Anode dissipation	W_a	2.7	kW
Output power	W_o	6	kW ²⁾
Efficiency	η	67	%

¹⁾Off load max. 0.7 A

²⁾Available power (load + circuit losses)

7Z00655 - 20.2.12.g/h/jjj.





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 $^{\circ}\text{C}$ Temperature of the seals = max. 220 $^{\circ}\text{C}$ **WATER COOLING CHARACTERISTICS**

W_a (kW)	t_i ($^{\circ}\text{C}$)	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 $^{\circ}\text{C}$ the required quantity of water can be found by proportional interpolation.

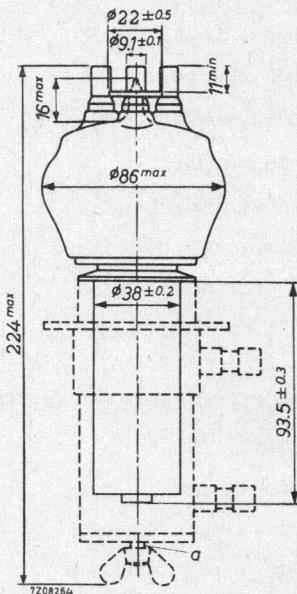
At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive grid seal temperatures.

MECHANICAL DATA

Net weight of the tube 0.57 kg

Net weight of water-jacket : 0.76 kg

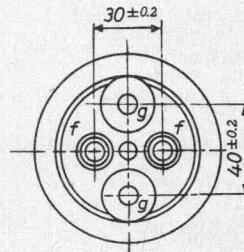
Dimensions in mm



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

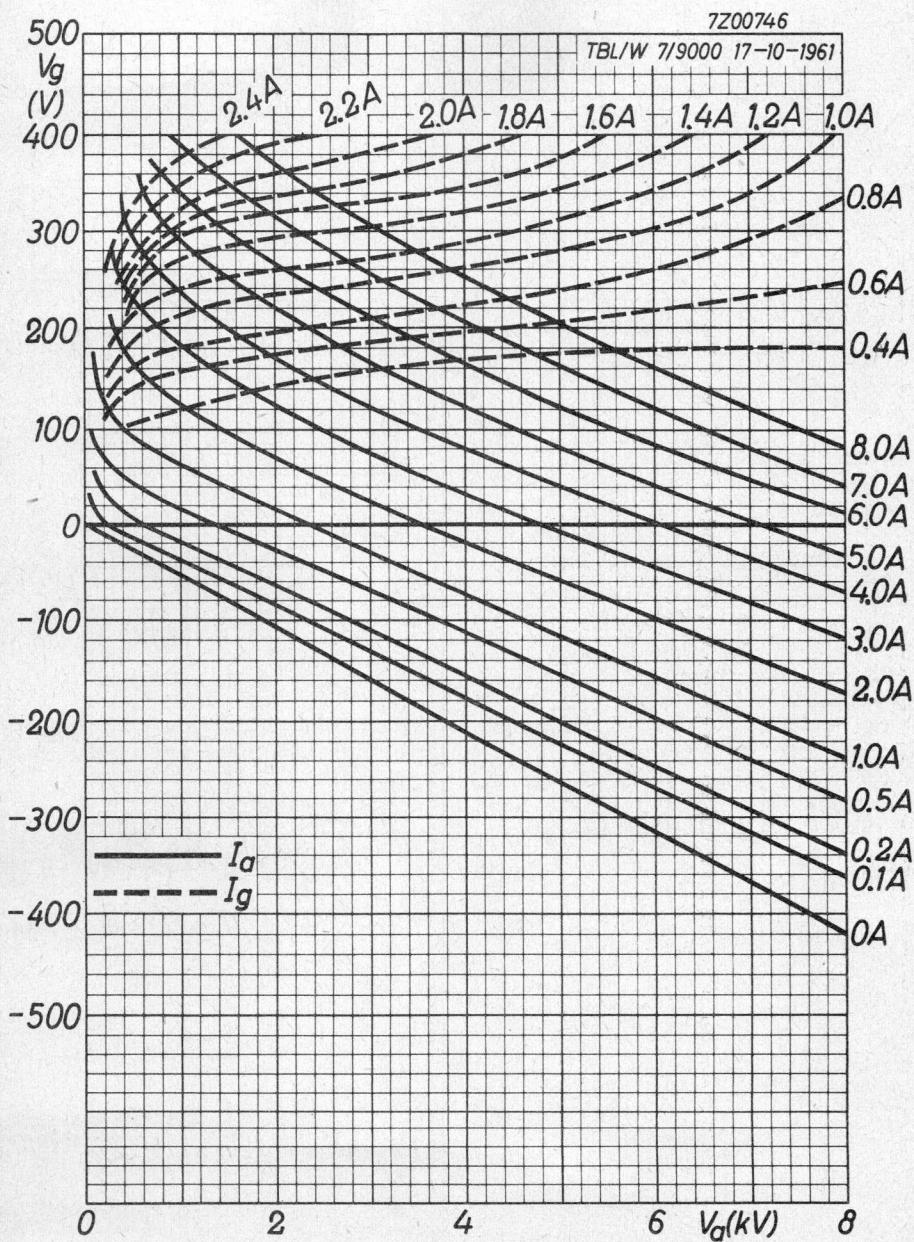
LIMITING VALUES (Absolute limits), continuous service

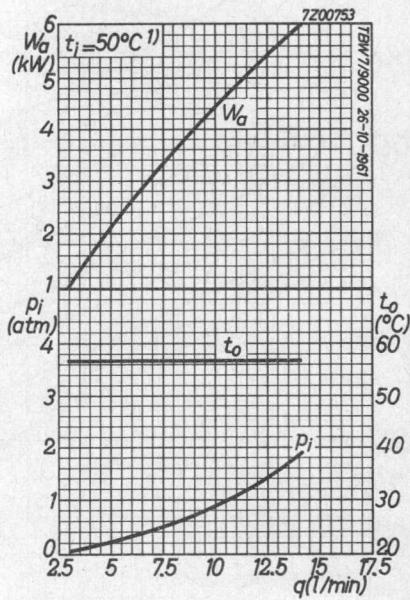
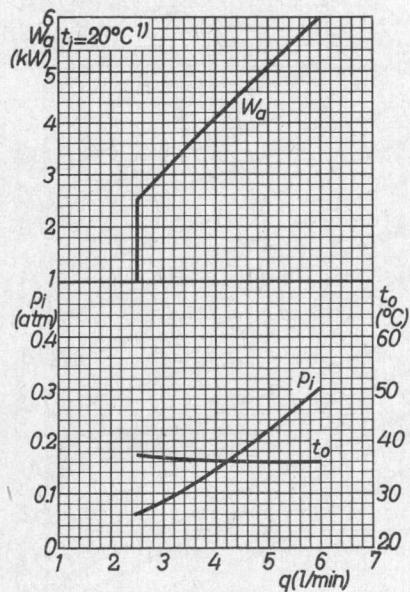
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance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

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_f	=	6.1	5.0	kW ¹⁾

¹⁾ Useful power in the load, measured in a circuit having an efficiency of 85 %
7Z2 3540





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 10 8	29.0 23.3 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

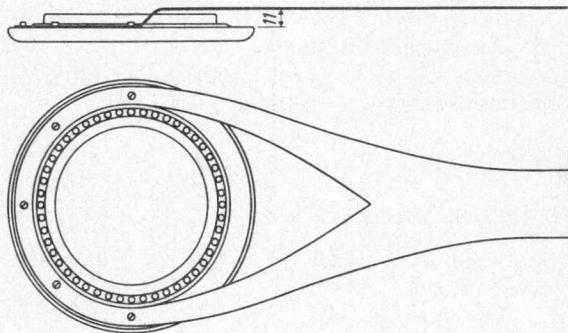
Generally a low velocity air flow to the seals is required

WATER COOLING CHARACTERISTICS

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

W_a (kW)	t_i ($^\circ\text{C}$)	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.

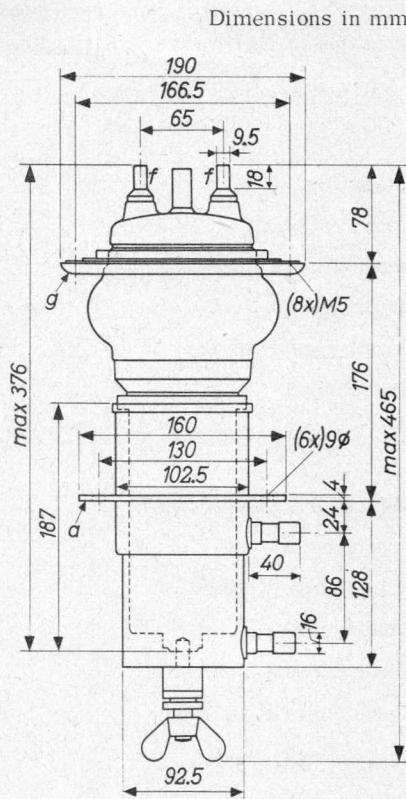
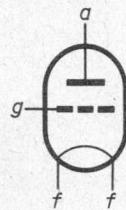


1) At inlet temperatures between 20 and 50 $^\circ\text{C}$ the required quantity of water can be found by proportional interpolation

7Z2 3552

MECHANICAL DATA

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

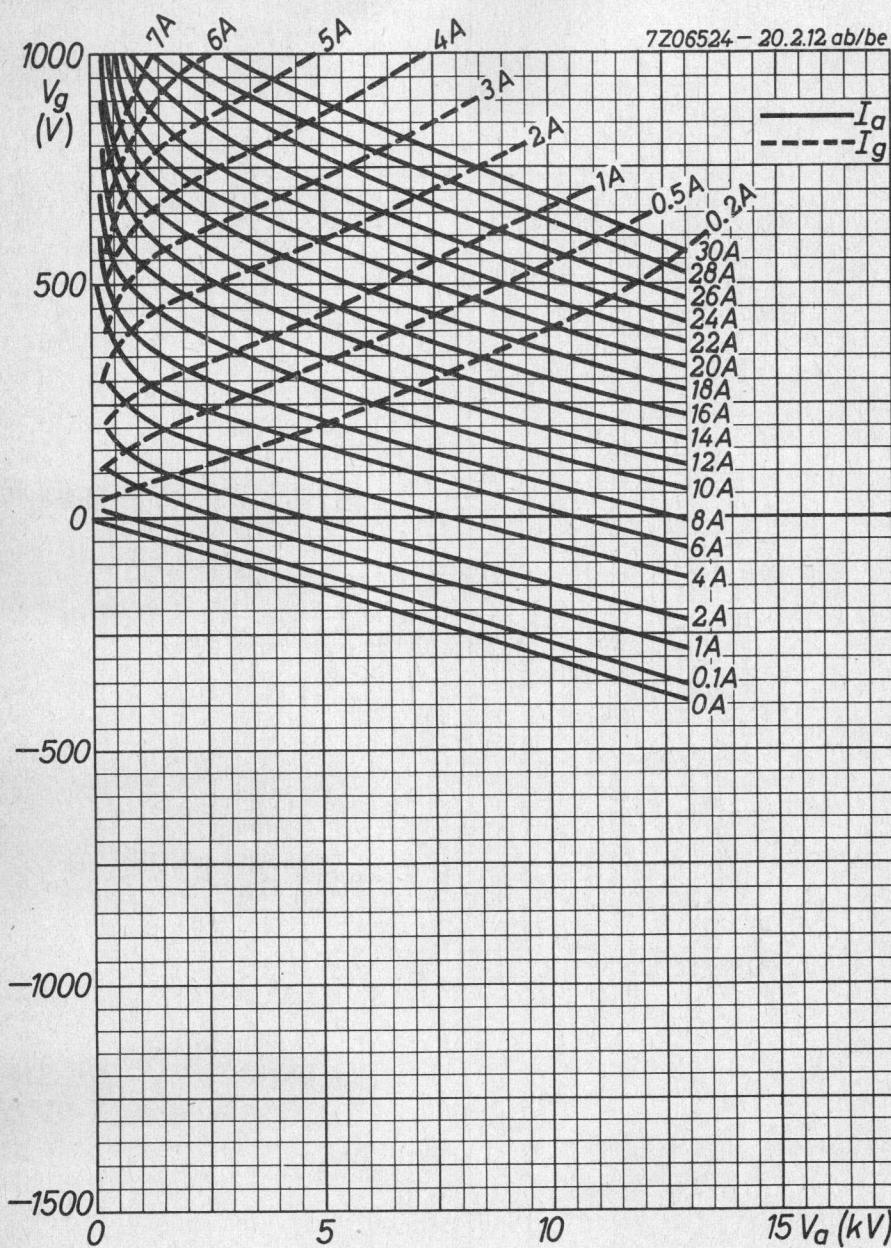
LIMITING VALUES (Absolute limits)

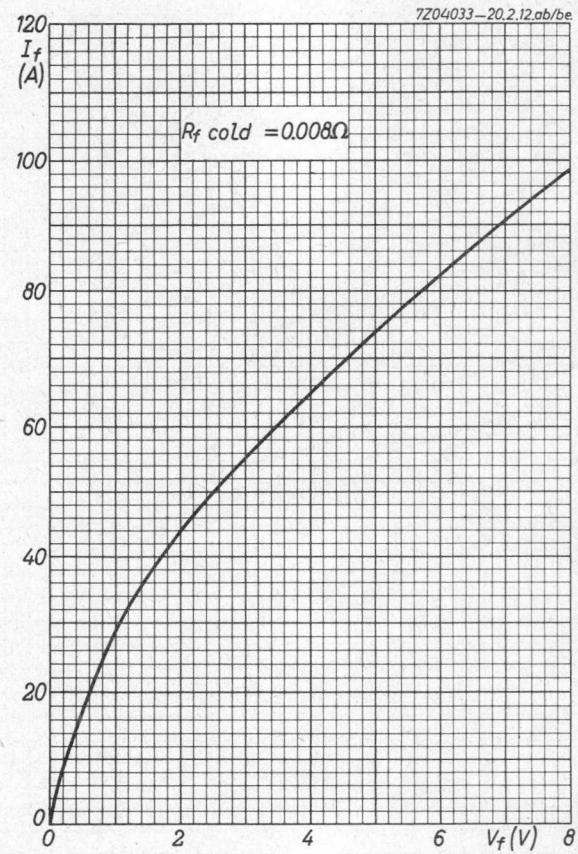
Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	4.8	A
Anode dissipation	W_a	= max.	20	kW
Anode input power	W_{ia}	= max.	60	kW
Negative grid voltage	$-V_g$	= max.	1500	V
Grid current	I_g	= max.	0.8	A
Grid circuit resistance	R_g	= max.	10	kΩ

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%





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_{f0} = 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

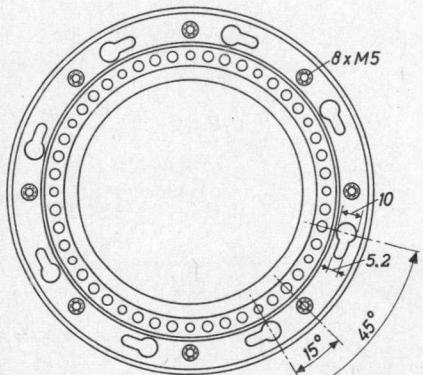
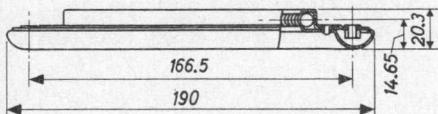
WATER COOLING CHARACTERISTICS. See also page A

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

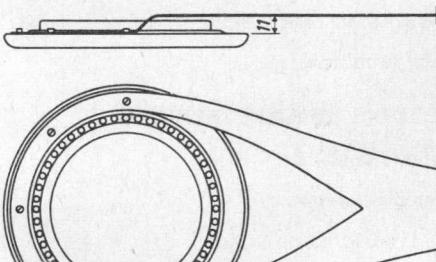
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation

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

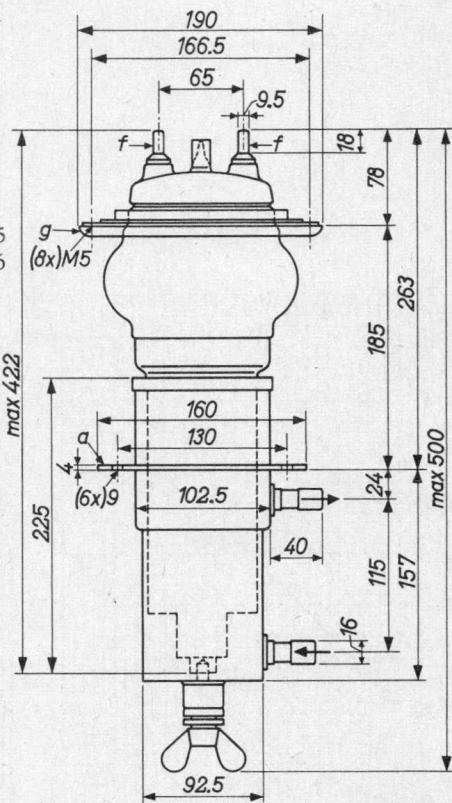
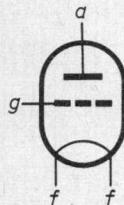
Filament connectors : 40662

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
 small : 2622 080 30736

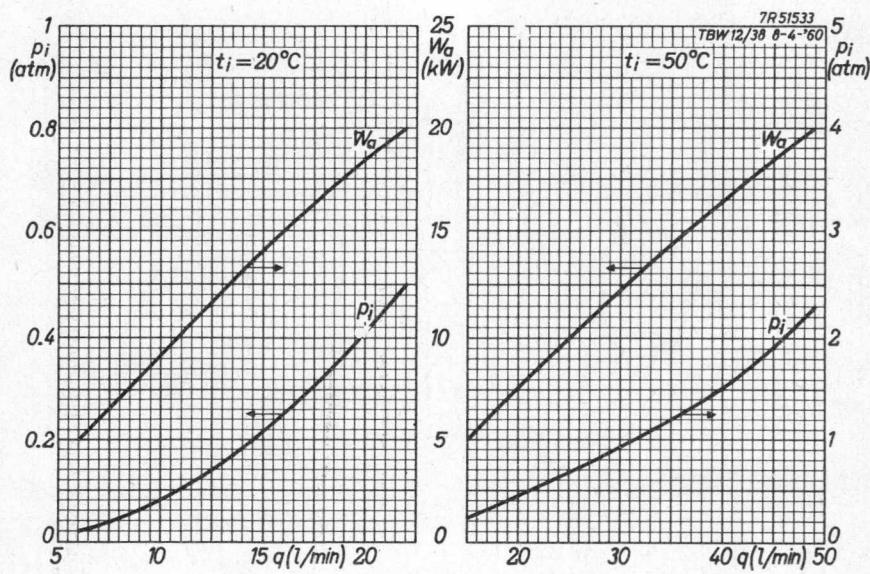


Tube mounted in water jacket

Mounting position: vertical with anode down

For further data and curves (except cooling curves)

please refer to type TBH 12/38



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 _{f0}	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 anticontra 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 m³ per minute is required with a pressure loss of about 500 mm water column.

MECHANICAL DATA

Water jacket : K714

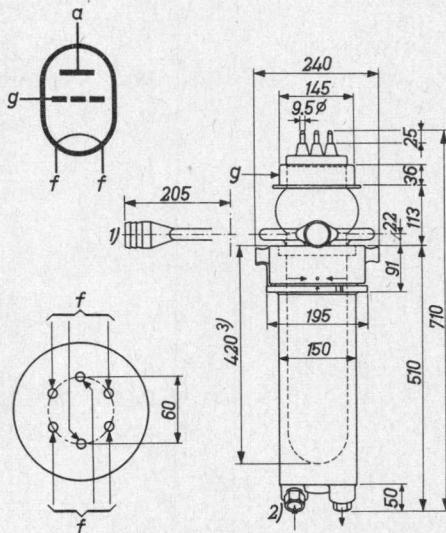
Filament connectors: 40628

O-ring : 2622 080 31817

Dimensions in mm

Net weight of tube : 14 kg

Net weight of water-jacket: 20.5 kg



Mounting position: vertical with anode down

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

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 form contact of the filament terminals in order to obtain equal distribution of current over these terminals.

1) Use connecting hose with an inner diameter of 13/4".

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

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

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (absolute limits)

Frequency	f	up to	4	15	30	MHz
Anode voltage	V _a	max.	15	13.5	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) TBW12/100 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~}	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~}	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_{gg}	sync black	1740 V ³⁾ 1300 V ³⁾
Anode current	I_a	sync black	32 A 24 A
Grid current	I_g	sync black	3.4 A 2.2 A
Grid input power	W_{ig}	sync	22.4 kW ⁴⁾
Output power	W_o	sync black	80+20 kW ⁵⁾ 45+11 kW ⁵⁾

¹⁾ In the frequency range of 60 to 68 MHz a special version of the tube is necessary.

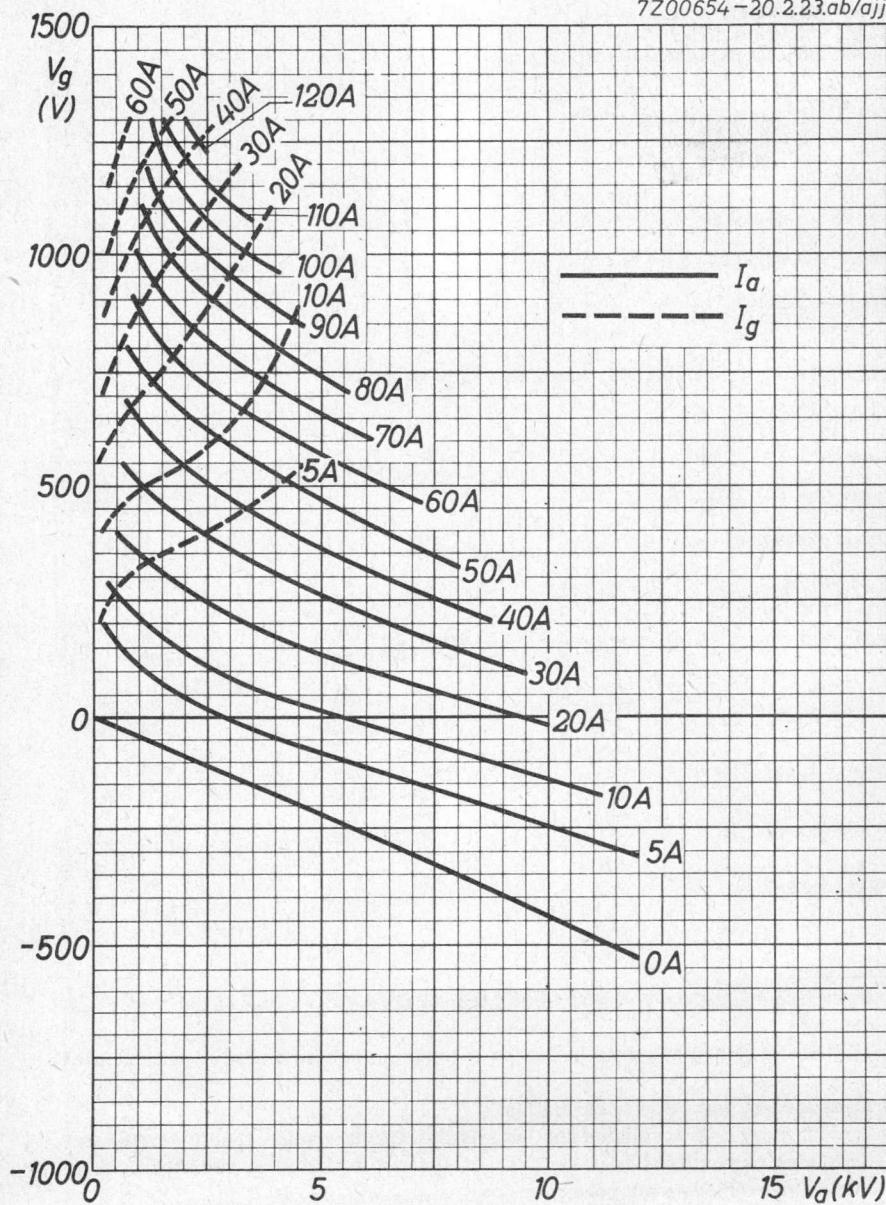
²⁾ This value of bandwidth is based on measurements on a circuit with a single LC section

³⁾ Measured by the slide back method

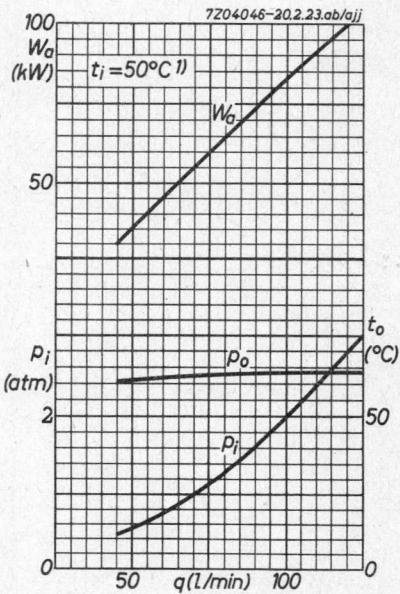
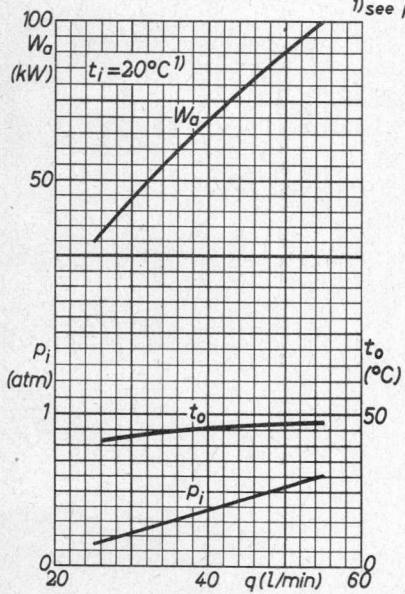
⁴⁾ Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

⁵⁾ Power transferred from driving stage included.

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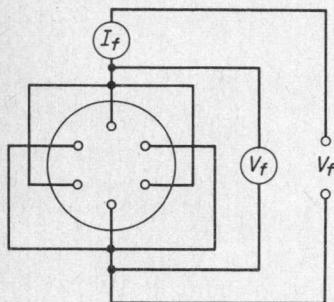


1) see page 2



WATER COOLED R.F. POWER TRIODE

This type is equivalent to type TBW12/100 except for the filament data

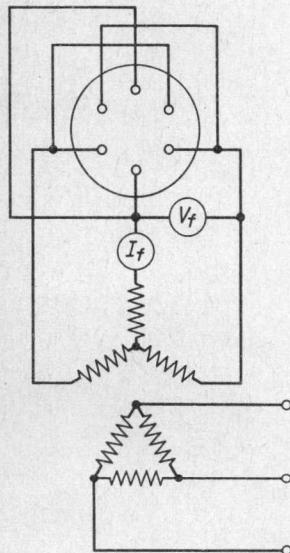


Single-phase filament energizing

$V_f = 17.5 \text{ V}$

$I_f = 196 \text{ A}$

Filament current must never exceed a peak value of 420 A at any time during the initial energizing schedule



Three-phase filament energizing

$V_f = 15.5 \text{ V}$

$I_f = 131 \text{ A}$

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.

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QB3/300	TB2.5/400
QB3/300GA	TB3/750
QB3.5/750	TB4/1250
QB3.5/750GA	TB4/1500
QB4/1100	TB5/2500
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		8610	TBL6/6000

General section

Transmitting tubes for communication

Tubes for r.f. heating

**Types PB2/500 ÷
TBW15/125**





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