PHILIPS

DATA HANDBOOK

PHILIPS ELECTRONIC COMPONENTS AND MATERIALS DIVISION

ELECTRON TUBES

PART 1 DECEMBER 1967

Transmitting tubes for communication

Tubes for R. F. heating

High-voltage rectifiers

Associated accessories

ELECTRON TUBES

Part 1 **December 1967**

General section

Transmitting tubes for communication and Tubes for R.F. heating

Triodes

Tetrodes, Pentodes

High-voltage rectifiers

Associated accessories

DATA HANDBOOK SYSTEM

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

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

Electron tubes blue

Semiconductors and Integrated circuits red

Components and Materials green

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

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7Z2 8883

This volume is Part 1 of the (blue) series "Electron Tubes" issue 1967/68. The complete series will contain the following parts:

PART 1	Transmitting tubes Tubes for R.F. heating High voltage rectifiers Associated accessories
PART 2	Tubes for microwave equipment
PART 3	Special Quality tubes Miscellaneous devices
PART 4	Receiving tubes T.V. Picture tubes
PART 5	Cathode-ray tubes Photo tubes Camera tubes Photoconductive devices Associated accessories
PART 6	Photomultiplier tubes Geiger-Müller tubes Scintillators Semiconductor detectors Miscellaneous nuclear devices
PART 7	Voltage stabilizing and reference tubes Counter-, selector-, and indicator tubes Trigger tubes Switching diodes Thyratrons Ignitrons Industrial rectifying tubes High voltage rectifiers

This Handbook does not give information on delivery or terms

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General section

List of symbols

Application directions

Bases

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

1. Symbols denoting electrodes and electrode connections

Anode	a
Beam plates	bp
Filament or heater	f
Filament or heater tap or star point of three star connected filaments	f_c
Grid	g
Tube pin which must not be connected externally	i.c.
Cathode	k
External conductive coating	m
Internal shield	s

Remarks

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

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

2. Symbols denoting voltages

Remarks

a. In the case of indirectly heated tubes the voltages on the various electrodes are with respect to the cathode, in the case of d.c. fed, directly heated tubes with respect to the negative side of the filament, and in the case of a.c. fed, directly heated tubes with respect to the electrical centre of the filament, unless otherwise stated.

b. The symbols quoted below represent the average values of the concerning voltages, unless otherwise stated.

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

7Z2 8633

2. Symbols denoting voltages (continued)

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

3. Symbols denoting currents

Remarks

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

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

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

4. Symbols denoting powers

Anode dissipation	W_a
Driver output power	W_{dr}
Grid dissipation	W_g
Input power	W_i
Anode supply d.c. power	W_{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}

7Z2 4155

5. Symbols denoting capacitances

In general the published capacitance values refer to the cold tube

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

6. Symbols denoting resistances

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

7. Symbols denoting various quantities

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

7Z2 4156

7. Symbols denoting various quantities (continued)

Intermodulation distortion	d_i
n-th order intermodulation distortion	d_{i_n}
Frequency	f
Pulse repetition rate	f_{imp}
Height above sea level	h
Modulation factor	m
Pressure drop of cooling air or cooling water	p_i
Required flow of cooling air or cooling water	q
Thermal resistance	R_{th}
Mutual conductance	S
Temperature of anode or anode block	t_a
Ambient temperature	t_{amb}
Bulb temperature	t_{bulb}
Cathode heating time	T_h
Inlet temperature of cooling air or cooling water	t_i
Pulse duration	T_{imp}
Outlet temperature of cooling air or cooling water	t_o
Seal temperature	t_s
Waiting time (= time which has to pass between switching on of the filament or heater voltage and switching on of the other voltages)	T_w
Duty factor	δ
Efficiency	η
Wavelength	λ
Amplification factor	μ
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$

7Z2 4157

APPLICATION DIRECTIONS
TRANSMITTING TUBES FOR COMMUNICATION
TUBES FOR R.F. HEATING

1. GENERAL

1.1 In this section of the Electronic Tube Handbook, data and curves are given for transmitting and generating tubes.

1.2 The tubes of this section may be classified in three groups.

a. preferred types, recommended for use in newly designed equipment.

b. maintenance types, although in production, these tubes are not recommended for newly designed equipment.

c. stock-only types, in general these types can only be delivered from stock. After some time they may no longer be available.

In this Handbook full particulars are given of preferred and maintenance types; data of stock-only types are given only in condensed form, omitting operating conditions. Data on obsolete types are not submitted at all.

2. CHARACTERISTIC DATA

2.1 The characteristic data on each type of tube comprise various general information independent of any specific kind of operation. These data, e.g. that on filament current, amplification factor, mutual conductance, capacitances, etc. should be regarded as pertaining to an average tube representative of that particular type.

2.2 The published nominal value of the filament (heater) voltage is generally the value to which the voltage should be adjusted, measured directly at the terminals of the tube. The published filament current is an average value, consequently deviations from this value may occur in practice.
If series feed of the filaments of transmitting tubes is desired, the user is invited to apply to us for the necessary information.
In the case of d.c. fed filaments the polarity of the filament voltage must be changed regularly for instance each month. This ensures uniform wear of the filament and consequently longer life.

2.2.1 Pure tungsten cathodes

The published filament voltage is the maximum voltage that can be required for a new tube to supply the rated output power. In most cases, however, a lower filament voltage will suffice, which will result in a

7Z2 8634

longer life. In order to facilitate the adjustment of the filament voltage, every tube with pure tungsten cathode is supplied with a list stating the saturation current of that tube as a function of the filament voltage. Provided the necessary emission current is known, the filament voltage can be simply adjusted to the exact value required in each particular case.
Another method of adjusting the filament voltage of each tube with pure tungsten cathode is to decrease the voltage until the desired output power or the maximum permissible distortion is reached. When modulation is applied the voltage should be adjusted so as to obtain the peak output power.
Adjustment of the filament voltage will have to be repeated regularly, for instance monthly, or as soon as the output has reached too low a value or the distortion becomes inadmissibly high. If necessary the filament voltage may be raised even above the nominal value.
In order to allow for mains voltage fluctuations it will be necessary to apply automatic control or control by hand of the filament voltage when the tube is used with nominal or higher than nominal filament voltage. When the tube is used with lower filament voltage without control, this will be permissible only when the mains voltage fluctuations do not cause the nominal filament voltage to be exceeded.

2.2.2 Thoriated tungsten cathodes

In order to attain the maximum life of these cathodes, the filament voltage should be adjusted to within 1% of its nominal value. Both under and overheating may be harmful and temporary deviations from the published nominal filament voltage must therefore never exceed ±5%.

2.2.3 Quick-heating cathodes

In general tubes with quick-heating cathodes should be used in parallel connection only. When sinusoidal voltages are used for heating of the filament, the frequency must not be in the range from 200 to 5000 Hz.
When non-sinusoidal voltages from a d.c.-a.c. converter are used, the r.m.s. value of the voltage should be adjusted to the published value of the filament voltage.
If necessary the heating time of the filament can be further reduced by applying an over-voltage of short duration.

2.2.4 Indirectly heated oxide coated cathodes

For maximum life the heater voltage should be as near as possible to its nominal value. The maximum permissible temporary deviation is ±10%. The occurrence of r.f. voltages between heater and cathode may give rise to faulty r.f. insulation and high r.f. losses, necessitating high driving power and increased cathode temperature. These voltages should therefore be avoided by by-passing the heater to cathode insulation and decoupling the heater at v.h.f. and u.h.f. The d.c. voltage between heater and cathode should be as low as possible and definitely below the relevant limiting value.

2.2.5 Switching on the filament voltage

If a maximum switching-on value of the filament current is not stated in the publications, switching on at full filament voltage is permissible. It should be stressed that the published values of the maximum permissible filament current during switching on, refer to the absolute maximum of the instantaneous value under the most unfavourable conditions. In the case of a.c. feed this will exist when switching on is performed 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. This choke or resistor may be short-circuited, or not, by means of a relay after a delay of, say, 15 seconds. Generally one switching stage will suffice.

2.2.6 By-passing of the filament

Where tubes with directly heated cathodes are concerned provision has to be made for the filament terminals to have the same h.f. potential. In the v.h.f. and u.h.f. range by-passing with capacitors will, therefore, be particularly necessary.

2.3 Switching on of the anode voltage

Unless prescribed otherwise, simultaneous switching on of filament and anode, grid and screen-grid voltages is permissible for tubes with internal anode. Where tubes with external anode are concerned the positive voltages should be applied only when the cathode has reached its operating temperature, which can be checked by means of the filament current.

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

2.5 Inter-electrode capacitances

The published values of the various capacitances are average values measured on the cold tube, without operating voltages; individual deviations may, however, occur.
The meaning of the various symbols for capacitances can be found in the appertaining list.
The capacitances of each system, as well as the inter-electrode capacitances across the anode and grid circuits in push-pull connection are published in respect of tubes with double electrode systems intended specially for push-pull operation. These latter capacitances are indicated by C_o and C_i respectively.

7Z2 4086

2.6 Amplification factor μ and mutual conductance S

The published values are average values, and individual deviations may occur. Normally the anode current at which the values have been measured, is mentioned.

2.7 Saturation current I_{sat}

Each one of the large tubes with pure tungsten cathode is marked with the value of the filament voltage at which the saturation current has a specific value.

2.8 Accessories

Proper functioning of the transmitting tubes can be guaranteed only if accessories have been supplied by the tube manufacturer or have been approved by same. This applies to sockets, cooling clips, etc.

3. LIMITING VALUES

3.1 By limiting values are meant the maximum permissible values of the various tube data. They are given either for all operating conditions together, or for each particular application.
In the former case the limiting values should be considered as general physical maxima, in the latter case the maxima have been fixed with reference to the particular kind of operation. If for instance the limiting value of the anode dissipation for anode modulation is in question then a value that refers to the unmodulated condition is given. This value is, however, lower than the physical maximum, since at 100% modulation the anode dissipation is higher than that in the unmodulated state.

3.2 The limiting values are applicable only up to a maximum frequency mentioned in each case. When operating at higher frequencies the limiting values should be decreased in accordance with the published data or curves.

3.3 Derating of the limiting values

If no limiting values have been published for a specific application use can be made of the following table, mentioning the derating factors which have to be applied in each case.
The values valid for class C telegraphy have been expressed as unity; the limiting values for other applications have been expressed as the ratio to this unity.
The voltage supply with the aid of a 3-phase rectifier with or without filter is equivalent to d.c. supply.
The above-mentioned derating factors are determined only by the special conditions appertaining to the physical limits of the tube, and do not therefore contain any safety margins. Where mains voltage fluctuations can be expected the actual derating must go on, until the derated values are not exceeded at maximum mains voltage (see section 3.5). The nature of oper-

7Z2 4087

ation, e.g. the industrial application of h.f. heating generators, may also require a further safety derating because of the rough nature of the operation (see section 5.5).

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 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.   7Z2 4088

3.6 Each "limiting value" should be regarded independently of other values, so that under no circumstances it is permitted that any "limiting value" be exceeded. If, for instance, the anode voltage is decreased to a value lower than its limiting value, it is unpermissible to exceed the limiting value of anode current or anode dissipation.
Unless explicitly mentioned otherwise, the limiting values are referred to d.c.

3.7 The voltages (V_a, V_g, V_{g_2}, etc.) mentioned under limiting values should not be exceeded, not even with the cold tube. Special attention should be paid to this point in regard to screen-grid supply with a series resistor. When designing equipment intended for non-stabilized mains voltages, the maximum mains voltage occurring will determine the nominal operating voltages of the tubes; these have to be lower than the limiting values.
Should it occur that the transmitting tubes, and thus, too, the voltage supply unit, are temporarily under a lower load, their voltages will increase and these increased values occurring at the highest mains voltage will determine the nominal operating voltages.
The limiting values of the voltages are d.c. values. If a.c. voltage supply is used or supply with unsmoothed voltage, the limiting values must be decreased in accordance with the derating factors shown in the table in section 3.3. The publications of some types of tube contain a special table with limiting values for these industrial applications.

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

3.9 In most cases the published limiting value of the input power W_{ia} is smaller than the product of the limiting values of anode voltage and anode current; the latter should not then 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. When secondary emission occurs, this can be ignored.

3.11 The control grid dissipation W_g or W_{g_1} can be calculated by taking the power supplied to the grid bias source ($-V_g \times I_g$) from the grid driving power ($0.9 \times V_{g_p} \times I_g$). When a.c. voltage supply or supply with unsmoothed voltage is used the form factor should be taken into account. Secondary emission of the control grid can be ignored. 7Z2 4089

3.12 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

Tables of operating conditions for the current applications of transmitting tubes such as for instance class C telegraphy, r.f. class B, a.f. class B, etc., have been published. The values for these tables have been measured or calculated from average tubes under optimum conditions. The values measured from a particular tube may therefore show small deviations from the published data. Some of the voltages or currents have to be adjusted to the published values, while others have to be considered as the outcome of measurements and may therefore show deviations from the published data. The published value of the output power, for instance, will be an average value, which, however, can be approximated in practice by correcting e.g. the r.f. or a.f. input voltage V_{g_p} when the published value of the output power is not obtained at the nominal value of V_{gp}. In connection with the preceding paragraphs it will be useful when designing a transmitter with several stages to leave a margin in the output power and the input voltages.

The published output power 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 grounded grid circuit, the published value for the output power includes the power transferred from the input.

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

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

On short wavelengths where reduced ratings will have to be applied, the required driving power will often be considerably higher than the grid input power, and in some cases it may even be determined almost exclusively by circuit losses.

In the published data for transmitting tubes operating conditions for the various applications have been given. Each column mentions the maximum frequency at which the anode voltage concerned and other data are permitted to be applied. For application of a tube at frequencies, higher than those mentioned in the publication, the tube manufacturer should be contacted.

7Z2 4090

5. APPLICATION OF THE OPERATING CONDITIONS

5.1 The published "Operating conditions" cannot be applied in all circumstances, the nature of some services being such, that deviations from the required values will occur, resulting in an infringement of the limiting values. Depending on the kind of service the following classification can be made:

a. Fixed transmitters for broadcasting and telecommunication service operated by a trained staff.
b. Mobile transmitters.
c. Devices for industrial applications, diathermy, supersonics, etc.
d. Amateur transmitters and special applications.
e. Pulsed operation.

5.2 Fixed transmitters

With fixed transmitters it is in general permissible to use the tube under optimum operating conditions at values of V_a, W_a, etc. near the limiting values. The main reasons applying in most cases for this may be summarized as follows: stabilization of the mains voltage automatically or by hand, only very small deviations in the mains voltage owing to the supply being effected via a special high tension line, transmitter load which is practically constant and optimum, the presence of a well-trained staff for immediate repair of faults which might damage the tube, or the presence of automatically functioning safety devices preventing damage to the tube in any circumstances arising in practice.

5.3 Mobile transmitters are transmitters operating in circumstances affected by this mobility. This category includes ship, portable, motorcycle, car and aircraft transmitters. These transmitters will very often have to function with strongly varying supply voltages and with a load that is neither constant nor optimum. Safety devices will be only very imperfect, especially in the smaller types of mobile transmitters, and therefore use of the tube with the published maximum operating conditions is not at all desirable.

The actual operating conditions chosen will depend upon the performance of the transmitter and upon the specific circumstances such as for instance the safety devices, the voltage constancy, the desired life, duty factor, etc. Because of the inconstancy and uncontrolled operation of transmitters in mobile devices, it will generally be impossible to guarantee the tubes, except for factory defects unrelated to the nature of operation of the tube. The smaller transmitting tubes with quick-heating cathodes and with oxide-cathode have been designed especially for mobile devices. The oxide cathode is rather insensitive to heater voltage variations, and the high specific emission permits of rather low anode voltages. The cathode and the electrode system have been constructed so as to form a rugged unit that can be used in non-resilient apparatus.

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The vibrations occurring in normal vehicles are of the order of 1 g, whereas shocks of 2.5 g will very seldom occur. In aircraft and in vehicles used over rough ground it will as a rule be necessary to install the tubes in a resilient fitting.
In general, when installed in vehicles, tubes with thoriated tungsten cathode will require a resilient installation. In some cases such an installation will also be required in ships. In movable apparatus such as r.f. generators on wheels, when a special clamping device is used for preventing the tube from falling out of the socket, care should be taken that no metal parts touch the bulb and that the maximum permissible temperature is not exceeded in any part of the bulb.

5.4 Intermittent service

When data concerning intermittent service are published on a transmitting tube, it is understood that the on-period of operating does not last longer than 5 minutes and that every on-period is followed by an equally long or longer off-period. The cathode, however, may be heated continuously during this kind of operation. Generally only the published or lower adjustments for intermittent service are permissible.

5.5 Industrial applications, diathermy, supersonics, etc. Industrial electronic apparatus may in many respects be distinguished from fixed broadcast and telecommunication transmitters in so far as the use of the tube is involved. The differences result from:

1. The personnel servicing the equipment being, as a rule, untrained.
2. The variable and, mostly, adjustable load.
3. The mains voltage fluctuations, which normally are considerable and not compensated.
4. The voltage supply without provision against hum.
5. The relative unimportance of the frequency.
6. The intermittent service.

The design for industrial apparatus will for these reasons differ fundamentally from that of normal transmitting apparatus, and generally demands the application of self-oscillating triodes.
In order to obtain a fool-proof apparatus, that cannot be damaged internally by faulty manipulation, the nominal anode voltage has to be chosen so that the limiting values are not exceeded at the maximum occurring mains voltage.
In the case of voltage supply without rectifier or of two-phase half-wave rectification without filter, the positive voltages will be of a pulsating character and the average values of voltages and currents will therefore have to be chosen lower than in the case of normal d.c. supply.
In general the design of industrial apparatus should be such that the limiting values at the highest occurring mains voltage are not exceeded. Special attention should be paid to the grid dissipation and the grid current, since in most cases these values are critical. 7Z2 4092

In special cases of intermittent service it will be possible to increase the limiting values. Information concerning these possibilities will be supplied on request by the tube manufacturer.
Preference is given to one tube in each r.f. generator. If one tube does not give sufficient output two tubes in parallel can be used. Push-pull operation is not recommended as equal load of the tubes is barely obtained when load and earth capacitance are variable. When two tubes are operated in parallel the use of separate grid resistors and a common grid fuse is recommended.

5.6 Amateur transmitters and special adjustments.

The maximum permissible load of a tube is naturally determined by the physical maxima of the tube, incorporated in the limiting values. No guarantee in respect of the tube life can be given if the limiting values are exceeded. This does not imply that exceeding the limiting values will always result in an immediate breakdown of the tube, and in the case of i.c.a.s. (Intermittent Commercial and Amateur Service), for instance, higher operating conditions have been given (see section 5.4). As a rule no guarantee of tube life is given in these cases.
Information with regard to special circuits, adjustments and operating conditions will willingly be supplied on request.

5.7 Pulsed operation

When a tube is used with pulsed operation the pulse time has to be so short that neither will any part of the tube reach an abnormal temperature nor the contingency of flashing-over has any opportunity to develop into an actual flashing-over. In general the average load will be considerably lower than the maximum load, according to the limiting values.
General information on this kind of operation is not yet available. Information, however, will gladly be given on each specific case.

5.8 R.F. class C telegraphy

A class C amplifier or oscillator is an amplifier in which the grid bias is appreciably greater than the cut-off voltage of the I_a/V_g-characteristic concerned, so that plate current flows only for less than one half of each cycle of the alternating grid voltage. In practice, a grid bias of 2 to 2.5 times the cut-off voltage will give good results.
The data published are such as will ensure favourable results as to output power and efficiency.
If a grid resistor is used for obtaining automatic grid bias, care should be taken that the anode current does not become too high when the r.f. driving power fails. A safety device in the anode or screen-grid lead will be desirable for this purpose.

7Z2 4093

5.9 R.F. class C anode modulation

For r.f. class C anode modulation the anode voltage of an r.f. class C amplifier is modulated with a.f. For 100% modulation the anode voltage is varied from zero to twice the d.c. value of the voltage. With screen-grid tubes the screen grid should also be modulated to prevent it from being overloaded. The average value of the grid bias and the r.f. driving voltage remain constant during the modulation. With 100% modulation the average anode dissipation is 1.5 times its value without modulation.
The published limiting value of the anode dissipation refers to the value without modulation. The higher dissipation with modulation is, however, taken into consideration.
In this application automatic grid bias by means of a grid leak can be applied. In order to prevent damage to the tube when the driving voltage fails, partly fixed bias is recommended.
The modulation power published in the data sheets is the power supplied to the modulated r.f. stage. When the modulating stage is being calculated, 5 to 10% will have to be added for losses in transformer and choke.

5.10 R.F. class B telephony

A class B amplifier is an amplifier in which the grid bias is approximately equal to the cut-off voltage of the relative I_a/V_g-characteristic, so that plate current flows for approximately one half of each cycle of the alternating grid voltage. If a telephony amplifier is concerned, a modulated r.f. signal will have to be amplified.
In order to obtain a straight modulation characteristic the published data for r.f. class B telephony have been determined by the method of trial and error.

5.11 R.F. class AB SSB amplifier

The given operating conditions show the most favourable compromise between output power and linearity. The measurements are carried out in a neutralised circuit without any feedback and with constant screen grid voltage.
Linearity is measured at 1 MHz and 30 MHz with a double tone test signal of which the two tones have equal amplitudes and lie 400 Hz apart in frequency. The amplitudes of the distortion products d3 and d5 are referred to the amplitude of either of the two tones at full drive and are given in dB.
The given figures for d3 and d5 are the worst encountered at any driving level. This worst point lies in general slightly below the full output point. Distortion products of another order than d3 and d5 are in general negligibly small. If the amplitudes of the distortion products are referred to the peak envelope amplitude, the figures for d3 and d5 go 6 dB down.

7Z2 4094

5.12 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 at a signal strength of about 60% of the value at full drive. When this signal strength of 60% is not present continuously, as is the case e.g. in broadcast and telephony service, it is permissible for the limiting value of the anode dissipation to be exceeded by 10% at the point of maximum dissipation. To suppress the occurrence of even harmonics separate controllable grid bias for both tubes can be applied or use can be made of a balancing circuit.
The published data in a.f. class B amplifier service normally give one table for maximum output and other tables for modulating the same type of tube in a published anode-modulation circuit. These published data are rather arbitrary, i.e., the same output can also be obtained with less modulation of the anode current (with smaller load resistance and lower peak grid current), although the efficiency is then smaller. It depends on the circuit of the entire a.f. amplifier which kind of operation is to be preferred.

5.13 Industrial operating conditions

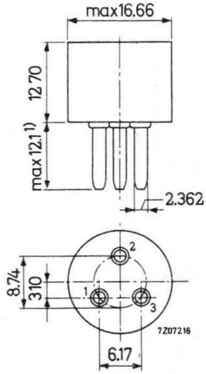
In section 5.5 some general remarks have been given concerning the application of transmitting tubes in industrial apparatus (diathermy, inductive and capacitive heating, supersonics, etc.). With single-phase mains connection a hum filter will sometimes be omitted; this omission is usual with three-phase mains connection. Operating conditions have therefore been published giving derating factors for this kind of operation (see chapter 3.3).
Care must be taken that under the operating conditions the limiting values are not exceeded by fluctuations in the mains voltage, or in the load, or by tolerances in the circuit elements.
The published value of the output power W_o is the actual tube output power. Where a self-oscillating circuit is concerned, the tube output power W_o should be diminished by the grid input power and, if present, by the losses in the input circuit, to obtain the oscillator output power W_{osc}. The actual output power in the load W_ℓ is obtained by diminishing the tube output power W_o or the oscillator power W_{osc} by the losses in the output circuit.
A favourable load-output characteristic may be obtained by a method of automatic control of the grid voltage and grid current, depending on the matching. Since the grid current is limited in this type of circuit, it may at the same time serve for preventing overloading of the grid. A non-linear element in the grid circuit, e.g. a tungsten lamp or an NTC resistor may help in preventing overloading the grid.
Moreover, where self-oscillating circuits are concerned, measures may be taken to maintain the frequency within the available frequency band. These measures may consist of a large circuit capacitance, small stable self-inductance, undercritical inductive coupling with the output circuit,

7Z2 4095

electrostatic screening between generator and output circuit, etc.
If the frequency of industrial generators has to be limited to a small frequency band, crystal-controlled driving stages may be used. Then, however, matching between the tube input and output is rather difficult to obtain. A higher safety margin in the tube load will be necessary with still a high dependence of the output on the load, or special measures such as automatic tuning and/or matching control will have to be taken.
For smaller tubes operating conditions for industrial applications have been given for supply from a two-phase, half-wave rectifier, for supply with raw a.c. voltage and for supply with three-phase half-wave rectifier. The latter case practically coincides with d.c. supply for this purpose.
A.C. supply without rectifier will give about 0.6 times the output obtained with d.c. supply. It should be taken into account that supply without rectifier results in a peak inverse voltage equal to the full anode voltage. This is of special importance when the grid voltage is in counterphase to the anode voltage.
With two-phase, half-wave rectification of the supply voltage, the useful output is about equal to that with d.c. supply. In order to obtain a favourable loading of the mains when using a self-rectifying oscillator, a quasi push-pull circuit can be used, in which two tubes function alternately on each half wave. A favourable loading of the mains for three-phase, self-rectification will be obtained by the use of 6 tubes in a triple push-pull circuit.

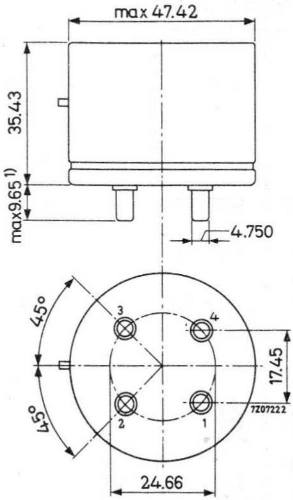
7Z2 4096

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



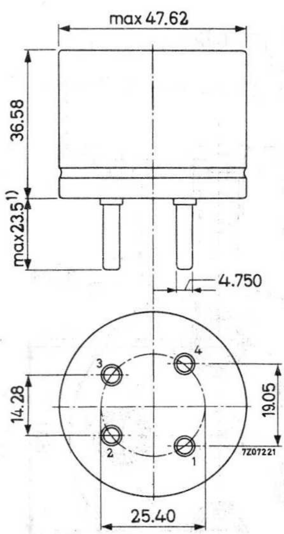
1) Including solder

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



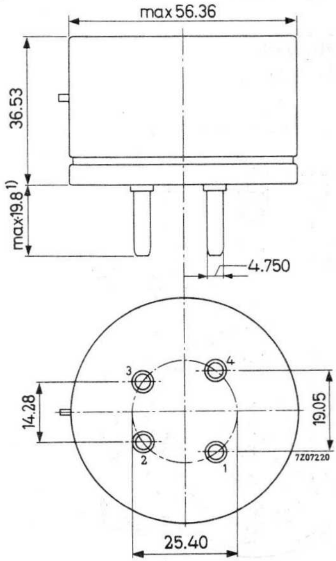
1) Including solder

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



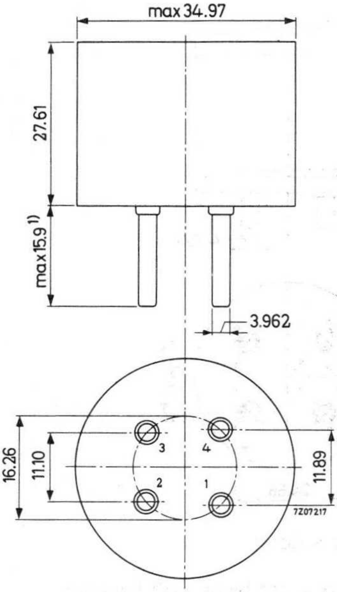
1) Including solder

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



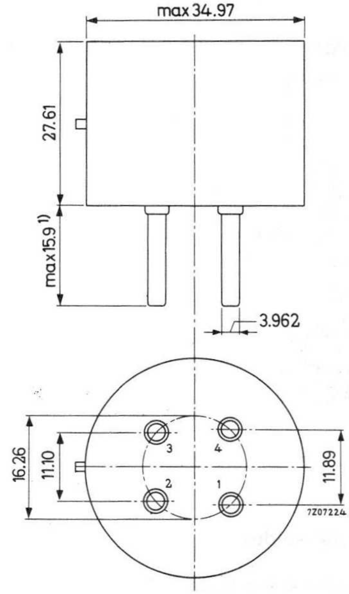
1) Including solder

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



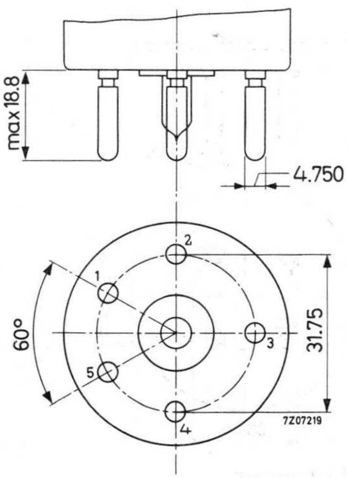
1) Including solder

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

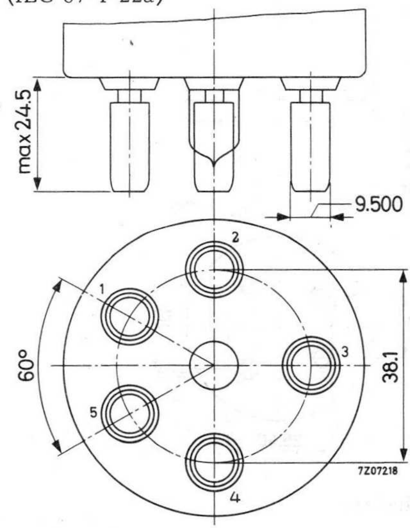


1) Including solder

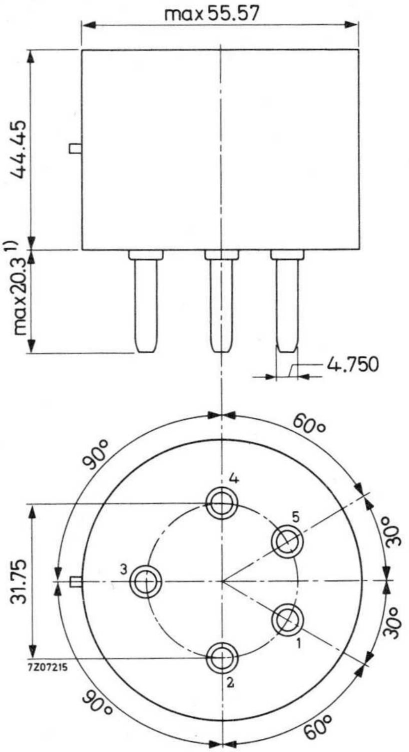
Giant 5-pin base
(IEC 67-I-21c)



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

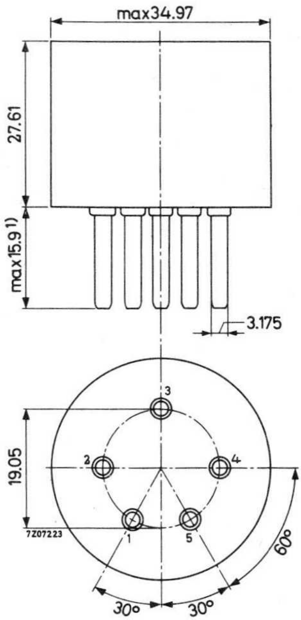


Medium shell Giant 5-pin base
with bayonet
(IEC 67-I-21a)



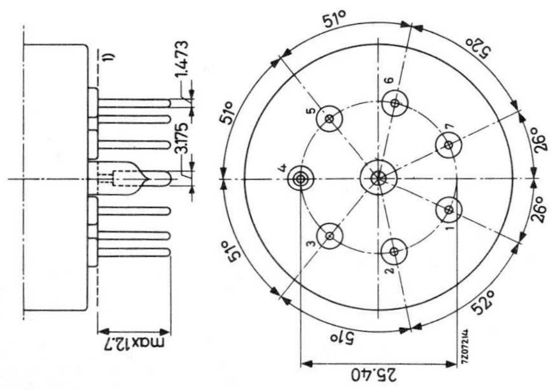
1) Including solder

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



1) Including solder

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



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

Triodes

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)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	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)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	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 V

Filament 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 pF

Grid to all other elements except anode C_g = 24.8 pF

Anode to grid C_{ag} = 22 pF

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

[1]) Two tubes

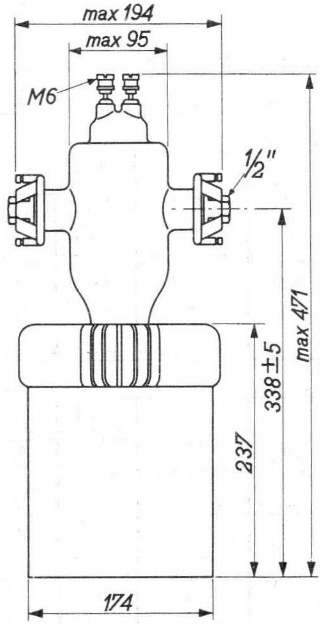
7Z2 3754

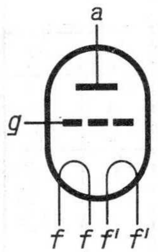
MECHANICAL DATA

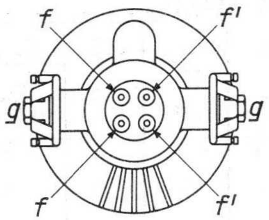
TAL12/10

Dimensions in mm

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







Mounting position: exactly vertical with anode down

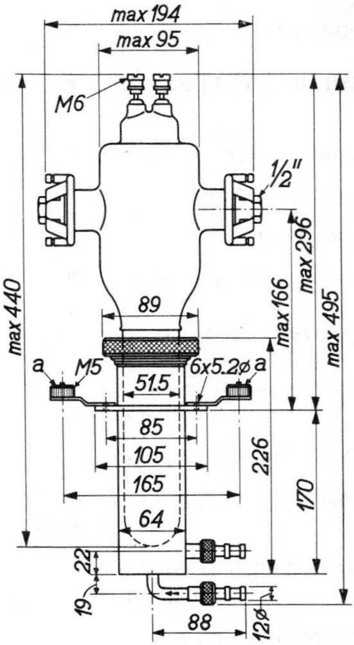
Pressure loss

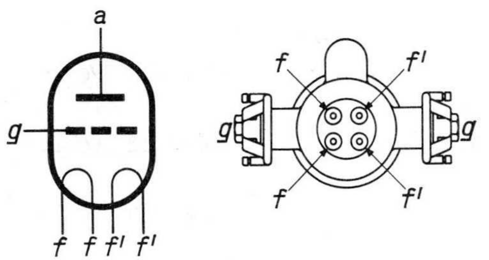
		p_i	=	117	mm H_2O
at	Inlet temperature	t_i	=	20	^oC
and	Cooling air flow	q	=	5.4	m^3/min

7Z2 3755

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





Mounting position: exactly vertical with anode down

Pressure loss p_i = 0.3 atm

with cooling water flow q = 12 l/min

7Z2 3756

TYPICAL CHARACTERISTICS

Amplification factor	μ	=	22	
Mutual conductance	S (I_a = 0.5 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	$q\left\{\begin{matrix} t_i = 20\ ^oC \\ W_a = 4\ kW \end{matrix}\right\}$	=	min. 5.4	–	m^3/min
Inlet temperature of cooling air	t_i	=	max. 45	–	^{o}C
Anode temperature	t_a	=	max. 150	–	^{o}C
Required cooling water flow	q (W_a = 7.5 kW)	=	–	min. 12	l/min
Outlet temperature of cooling water	t_o	=	–	max. 50	^{o}C
Temperature rise of cooling water	$t_o - t_i$	=	–	max. 11	^{o}C
Temperature of bulb and seals		=	max. 150	max. 150	^{o}C

7Z2 3757

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)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
>11	<28	12 10	22 18	12	5	10	9.5	12 10	42 16

HEATING: direct; filament tungsten

Filament voltage	V_f =	21.5	V
Filament current	I_f =	78	A
Cold filament resistance	R_{fo} =	0.0224	Ω

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 CHARACTERISTICS

Amplification factor	μ	=	38	
Mutual conductance	S (I_a = 1 A)	=	10	mA/V
Saturation current	I_{sat}	=	11	A

CAPACITANCES			TAL12/20	TAW12/20	
Filament to anode	C_{af}	=	1.9	1.4	pF
Grid to filament	C_{gf}	=	23.5	23.5	pF
Grid to anode	C_{ag}	=	25	25	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

7Z2 8620

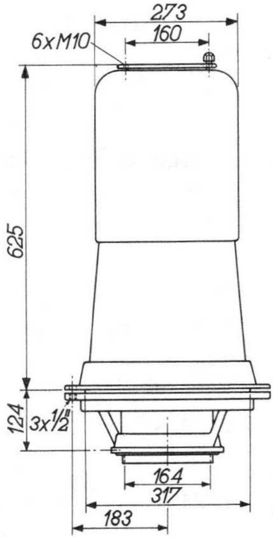
MECHANICAL DATA **TAL12/20** Dimensions in mm

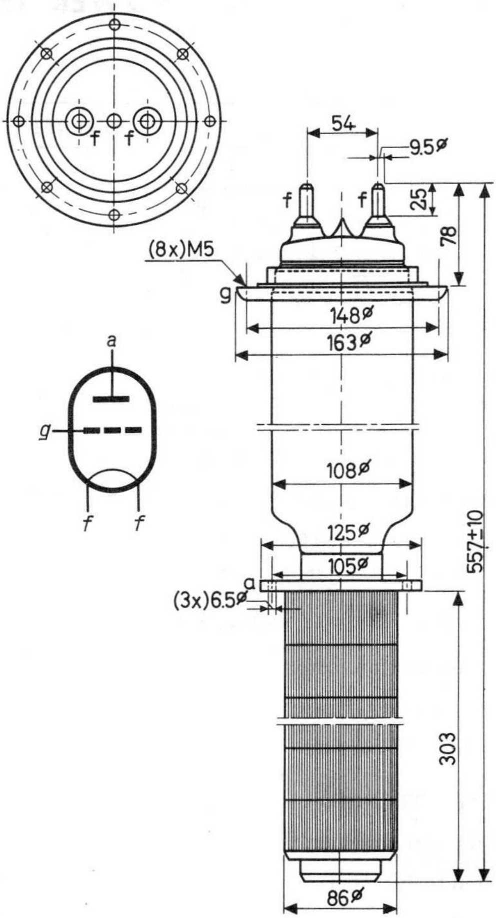
→ Grid connector : 40664

→ Filament connector with cable : 40662

Cooling house : K503

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 mm H_2O

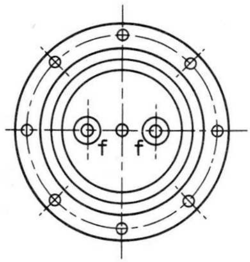
at Inlet temperature t_i = 20 °C

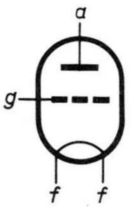
and Cooling air flow q = 21.2 m^3/min

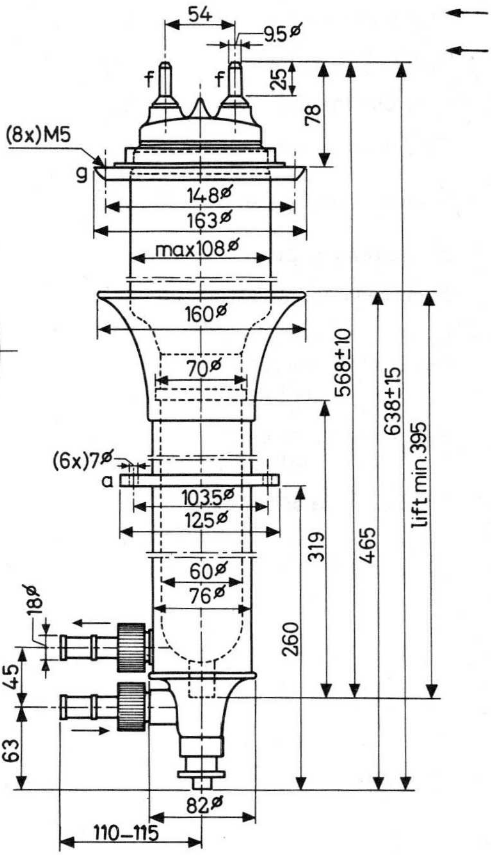
7Z2 8621

MECHANICAL DATA **TAW12/20** Dimensions in mm

Grid connector	: 40664
Filament connector with cable	: 40662
Water-jacket	: K707
Net weight of the tube	: 3.6 kg
Net weight of water-jacket	: 4.3 kg







Mounting position: exactly vertical with anode down

<u>Pressure loss</u> p_i = 0.5 atm

with Cooling water flow q = 20 l/min

7Z2 8622

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	$q \begin{Bmatrix} t_i = 20\ ^oC \\ W_a = 18\ kW \end{Bmatrix}$	=	min. 21.2	–	m^3/min
Anode temperature	t_a	=	max. 180	–	^oC
Required cooling water flow	$q(W_a = 18\ kW)$	=	–	min. 20	l/min
Outlet temperature of cooling water	t_o	=	–	max. 60	^oC
Temperature rise of cooling water	$t_o - t_i$	=	–	max. 14	^oC
Temperature of bulb and seals		=	max. 150	max. 150	^oC

7Z2 3761

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

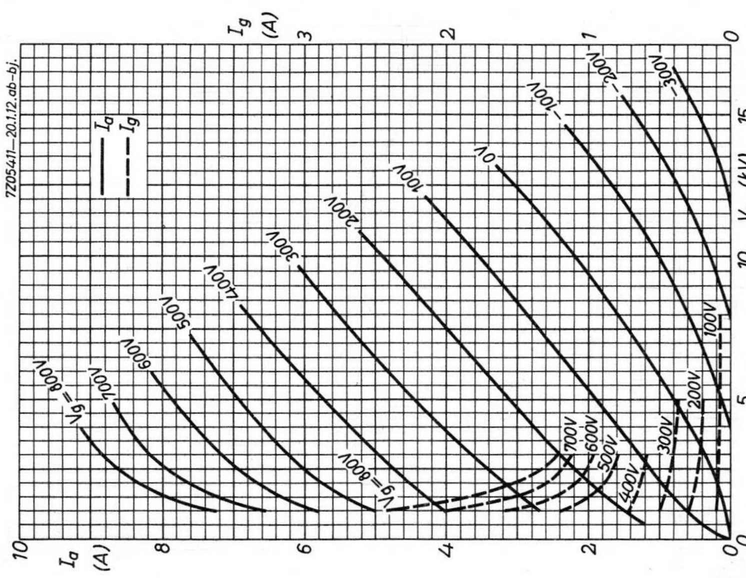
7Z2 3762

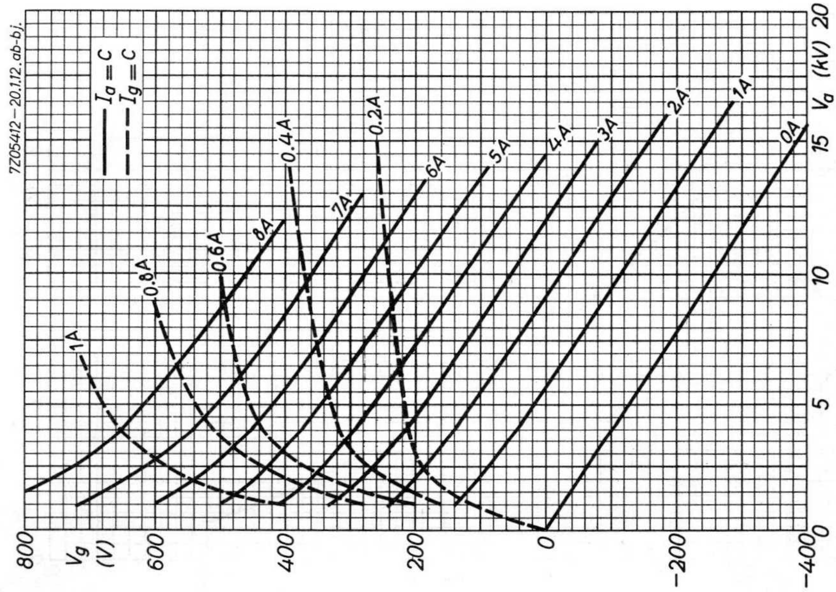
OPERATING CONDITIONS AS A.F. CLASS B AMPLIFIER AND MODULATOR

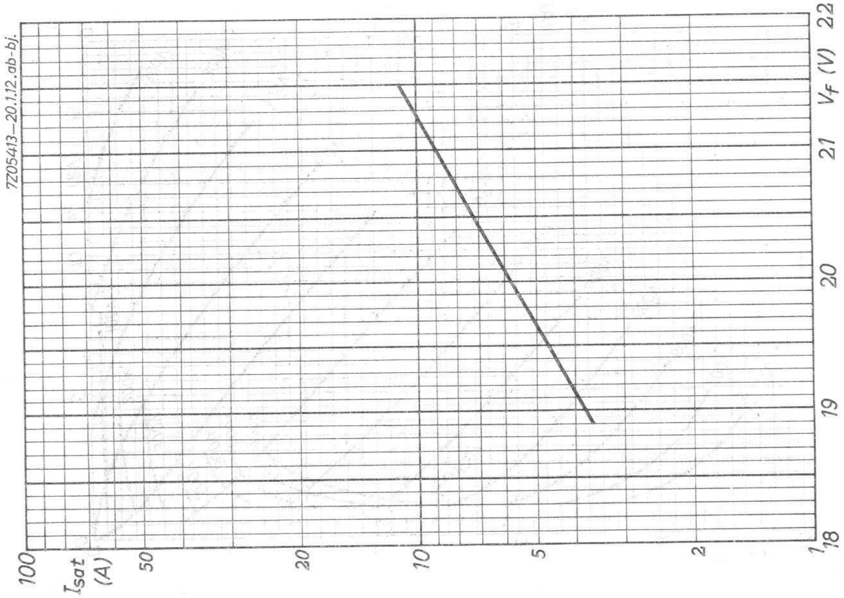
two tubes

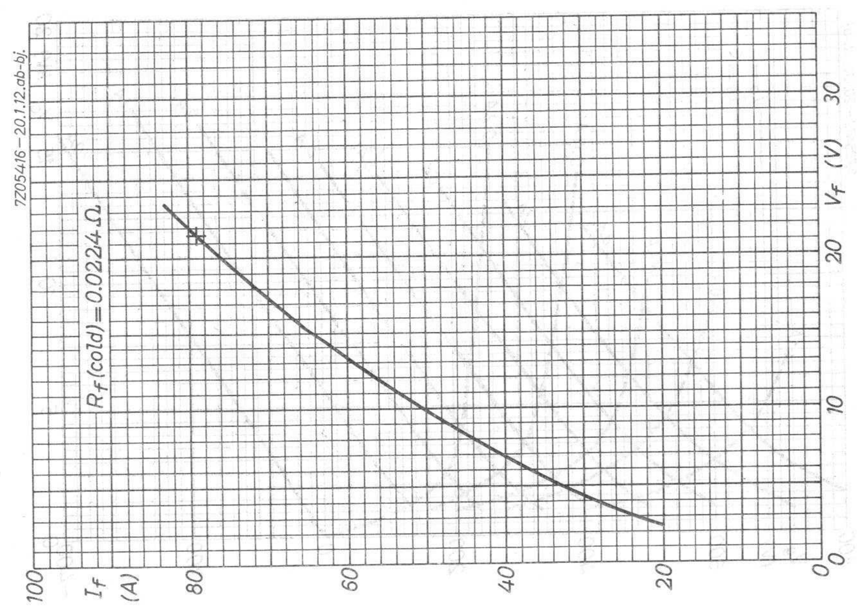
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-250		-200		V
Load resistance	$R_{aa\sim}$	=	5.6		10.5		kΩ
Peak grid to grid voltage	V_{gg_p}	=	0	1900	0	1100	V
Anode current	I_a	=	2x0.32	2x2.45	2x0.25	2x1.1	A
Grid current	I_g	=	0	2x0.33	0	2x0.17	A
Grid input power	W_{ig}	=	0	2x280	0	2x85	W
Anode input 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	%

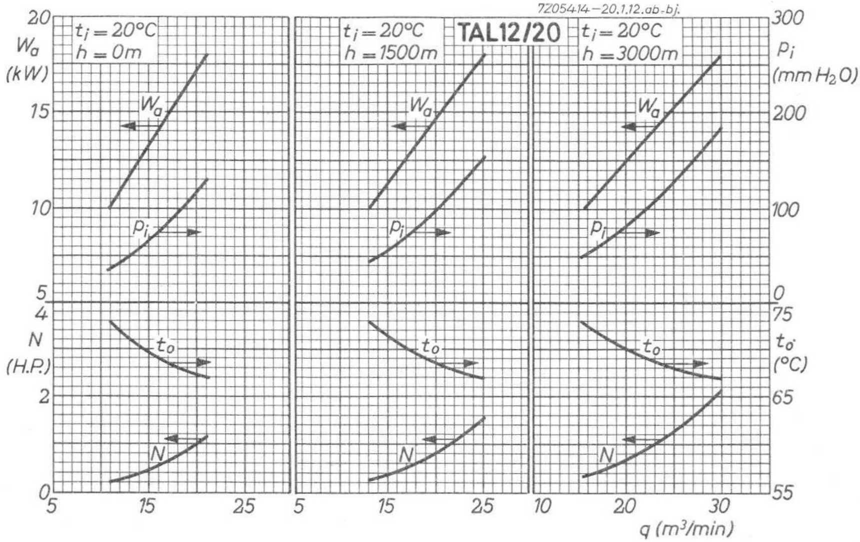
7Z2 3763

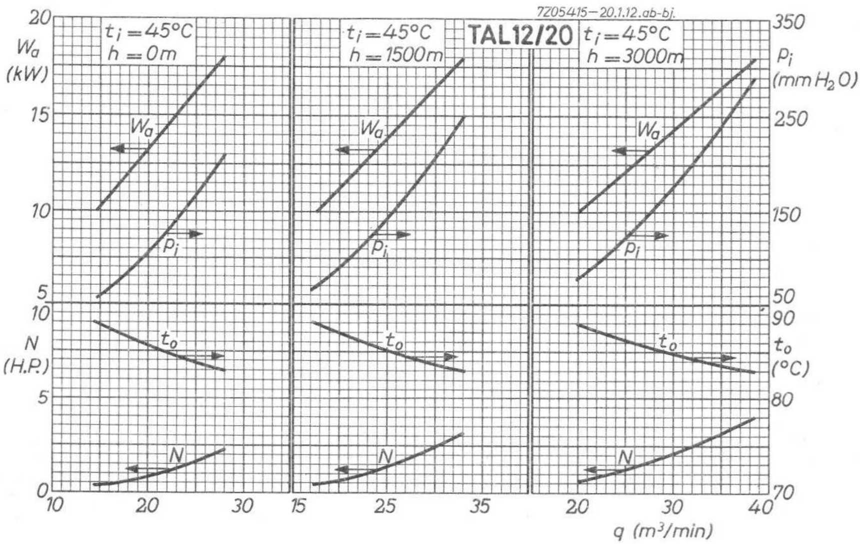

7Z05411—20.1.12.ab-bj.
I_a
I_g
I_a (A)
I_g (A)
V_a (kV)
V_g = 800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V


7Z05412—20.1.12.ab-bj.
I_a = C
I_g = C
V_g (V)
V_a (kV)
1A
0.8A
0.6A
0.4A
0.2A
8A
7A
6A
5A
4A
3A
2A
1A
0A


7Z05413—20.1.12.ab-bj.
100
I_{sat} (A)
50
20
10
5
2
1
18
19
20
21
22
V_f (V)


7Z05416—20.1.12.ab-bj.
$R_f(cold) = 0.0224\,\Omega$
100
I_f (A)
80
60
40
20
0
0
10
20
30
V_f (V)


7Z05414–20.1.12.ab-bj.
TAL12/20
$t_i = 20°C$ $h = 0m$
$t_i = 20°C$ $h = 1500m$
$t_i = 20°C$ $h = 3000m$
W_a (kW)
p_i (mm H_2O)
N (H.P.)
t_o (°C)
q (m³/min)


7Z05415–20.1.12.ab-bj.
TAL12/20
$t_i = 45°C$ $h = 0m$
$t_i = 45°C$ $h = 1500m$
$t_i = 45°C$ $h = 3000m$
W_a (kW)
p_i (mm H_2O)
N (H.P.)
t_o (°C)
q (m³/min)

AIR 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)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	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
								10	32
11	27	15	45			12	26		
						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

7Z2 8623

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

AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i max. (°C)	q min. (m^3/min)	p_i (mm H_2O)
18	0	35	25.5	130
	0	45	29.5	170
	1500	35	30.5	155
	3000	25	32.5	155
12	0	35	17.5	65
	0	45	20	80
	1500	35	20.5	75
	3000	25	22	75

See also cooling curves

COOLING

When the tube is used at frequencies above 10 Mc/s, special attention must be paid to the anode and grid seal temperatures

Cooling of the grid seals can be effected by means of the caps 40632

Cooling of the anode seal is effected by air flowing through the slots 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 seal may not be sufficient to maintain the seal temperature below the maximum permissible value at frequencies above 10 Mc/s. Consequently, in these cases, a larger quantity of air must be supplied

TEMPERATURE LIMIT (Absolute limit)

Temperature of seals = max. 180 °C

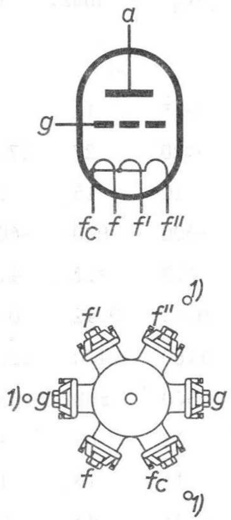
7Z2 3765

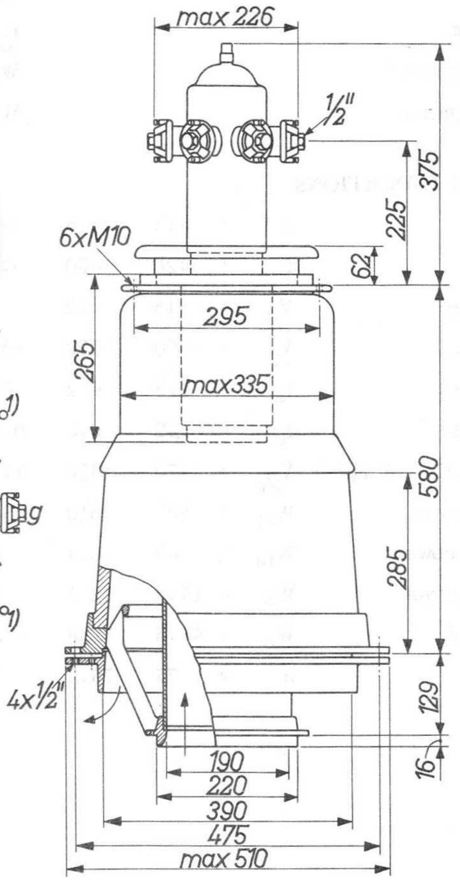
MECHANICAL DATA Dimensions in mm

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

7Z2 3766

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.	18	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_{g_p}	=	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	%

7Z2 3767

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	2.5	A
Anode input power	W_{ia}	=	max.	37.5	kW
Anode dissipation	W_a	=	max.	18	kW

OPERATING CONDITIONS

Wavelength	λ		>15	>15	>15	m
Frequency	f		<20	<20	<20	Mc/s
Anode voltage	V_a	=	15	12	10	kV
Grid voltage	V_g	=	-500	-400	-315	V
Anode current	I_a	=	1.8	2.2	2.5	A
Peak grid A.C. voltage	V_{gp}	=	500	470	440	V
Anode input power	W_{ia}	=	27	26.5	25	kW
Anode dissipation	W_a	=	18	18	17	kW
Output power	W_o	=	9	8.5	8	kW
Efficiency	η	=	33	32	32	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	0.3	0.36	0.4	A
Grid input power	W_{ig}	=	270	305	317	W

7Z2 3768

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	12	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	2.9	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	35	kW
Anode dissipation	W_a	=	max.	12	kW

OPERATING CONDITIONS

Wavelength	λ	=	>15	>15	11	11	m
Frequency	f	=	<20	<20	27	27	Mc/s
Anode voltage	V_a	=	12	10	12	10	kV
Grid voltage	V_g	=	-1000	-900	-1000	-900	V [1]
Anode current	I_a	=	2.9	2.9	2.9	2.9	A
Grid current	I_g	=	0.4	0.45	0.45	0.5	A
Peak grid A.C. voltage	V_{gp}	=	1600	1550	1650	1600	V
Grid input power	W_{ig}	=	580	630	670	700	W
Anode input power	W_{ia}	=	35	29	35	29	kW
Anode dissipation	W_a	=	8	7.5	9	8.5	kW
Output power	W_o	=	27	21.5	26	20.5	kW
Efficiency	η	=	77	74	74	70.5	%
Modulation depth	m	=	100	100	100	100	%
Modulation power	W_{mod}	=	17.5	14.5	17.5	14.5	kW

[1]) Grid bias partially obtained by the grid resistor

7Z2 3769

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	6	A
Anode input power	W_{ia}	=	max.	90	kW
Anode dissipation	W_a	=	max.	18	kW

OPERATING CONDITIONS two tubes in push-pull

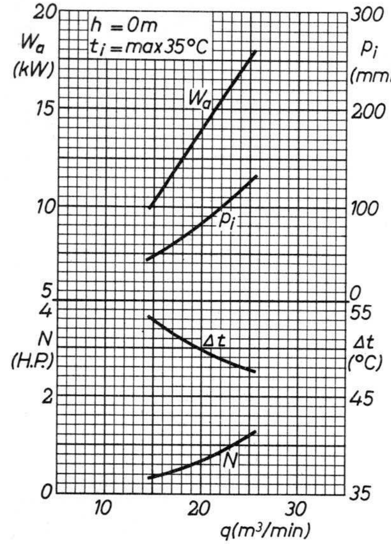
Anode voltage	V_a	=	12		12		kV
Grid voltage	V_g	=	-400		-425		V
Load resistance	$R_{aa\sim}$	=	3.2		5.8		kΩ
Peak grid to grid voltage	V_{gg_p}	=	0	2000	0	1480	V
Anode current	I_a	=	2x0.35	2x4.5	2x0.15	2x2.25	A
Grid current	I_g	=	0	2x0.55	0	2x0.19	A
Peak grid current	I_{gp}	=	0	2x3	0	2x1.25	A
Grid input power	W_{ig}	=	0	2x500	0	2x127	W
Anode input power	W_{ia}	=	2x4.2	2x54	2x1.8	2x27	kW
Anode dissipation	W_a	=	2x4.2	2x14	2x1.8	2x7.7	kW
Output power	W_o	=	0	80	0	38.5	kW
Total distortion	d_{tot}	=	–	3.5	–	3.7	%
Efficiency	η	=	–	74	–	71.5	%

Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	-325		-345		V
Load resistance	$R_{aa\sim}$	=	2.1		5		kΩ
Peak grid to grid voltage	V_{gg_p}	=	0	2050	0	1330	V
Anode current	I_a	=	2x0.3	2x5.4	2x0.14	2x2.25	A
Grid current	I_g	=	0	2x0.6	0	2x0.2	A
Peak grid current	I_{gp}	=	0	2x3	0	2x1.35	A
Grid input power	W_{ig}	=	0	2x555	0	2x120	W
Anode input power	W_{ia}	=	2x3	2x54	2x1.4	2x22.5	kW
Anode dissipation	W_a	=	2x3	2x15.5	2x1.4	2x6.5	kW
Output power	W_o	=	0	77	0	32	kW
Total distortion	d_{tot}	=	–	3.5	–	4	%
Efficiency	η	=	–	71.5	–	71	%

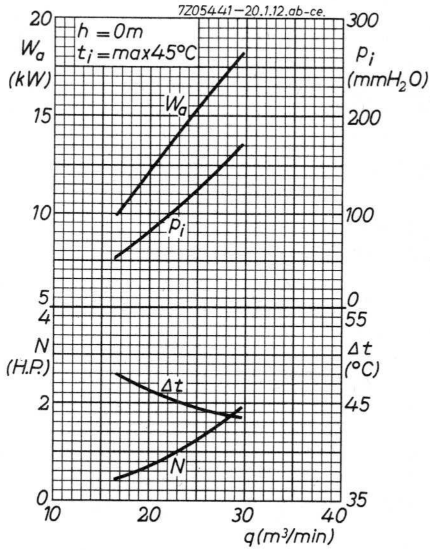
7Z2 3770

For curves of type TAL12/35 (except for the cooling curves)
please refer to type TAW12/35G

7Z2 3771



h = 0m
t_i = max 35°C
20
W_a
(kW)
15
10
5
4
N
(H.P.)
2
0
300
p_i
(mmH_2O)
200
100
0
55
Δt
(°C)
45
35
W_a
p_i
Δt
N
10
20
30
q(m^3/min)



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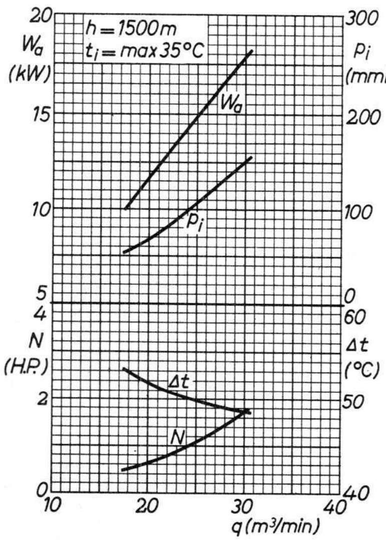
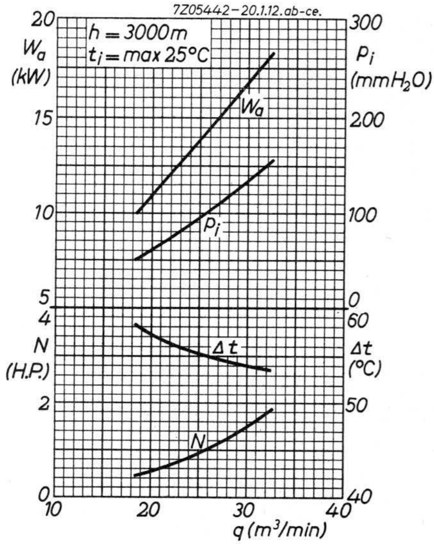
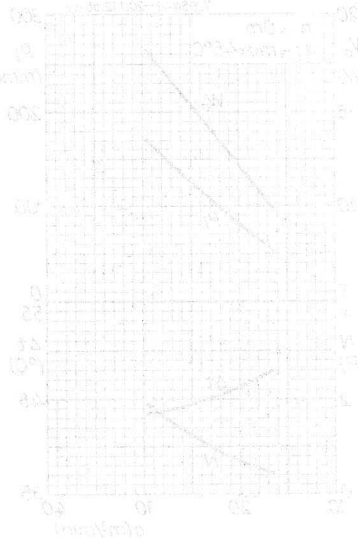
h = 0m
t_i = max 45°C
20
W_a
(kW)
15
10
5
4
N
(H.P.)
2
0
300
p_i
(mmH_2O)
200
100
0
55
Δt
(°C)
45
35
W_a
p_i
Δt
N
10
20
30
40
q(m^3/min)

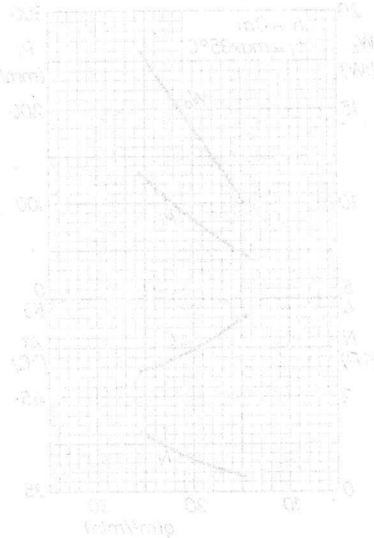


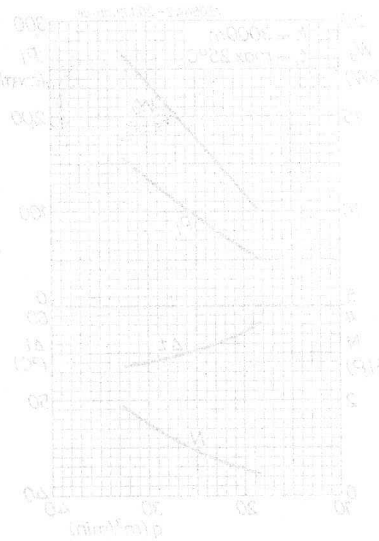
h = 1500m
t_i = max 35°C
20
W_a
(kW)
15
10
5
4
N
(H.P.)
2
0
300
p_i
(mmH_2O)
200
100
0
60
Δt
(°C)
50
40
W_a
p_i
Δt
N
10
20
30
40
q(m^3/min)

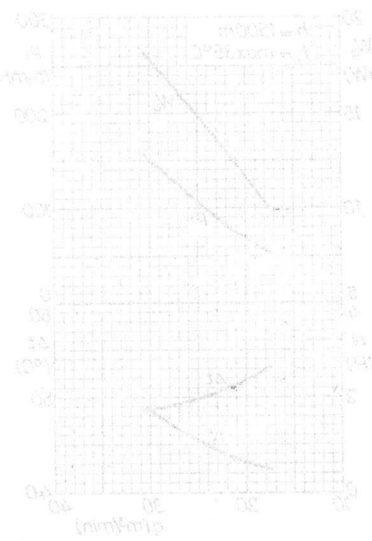


7Z05442−20.1.12.ab-ce.
h = 3000m
t_i = max 25°C
20
W_a
(kW)
15
10
5
4
N
(H.P.)
2
0
300
p_i
(mmH_2O)
200
100
0
60
Δt
(°C)
50
40
W_a
p_i
Δt
N
10
20
30
40
q(m^3/min)









WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA										
		C telegr.		B teleph.		C_a mod.		B mod. [1]	
λ (m)	Freq. (Mc/s)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	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
								10	32
11	27	15	45			12	26		
						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: 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

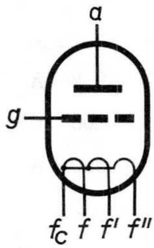
1) At temperatures t_i between 20 and 50 °C the required quantity of water can be found by proportional interpolation

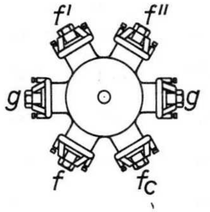
7Z2 3773

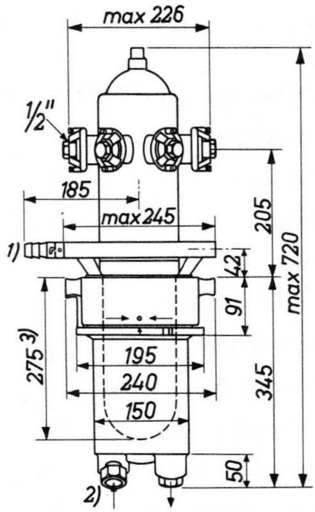
MECHANICAL DATA

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	%

7Z2 3775

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	2.5	A
Anode input power	W_{ia}	=	max.	37.5	kW
Anode dissipation	W_a	=	max.	30	kW

OPERATING CONDITIONS

Wavelength	λ		>15	>15	>15	m
Frequency	f		<20	<20	<20	Mc/s
Anode voltage	V_a	=	15	12	10	kV
Grid voltage	V_g	=	−500	−400	−315	V
Anode current	I_a	=	1.8	2.2	2.5	A
Peak grid A.C voltage	V_{gp}	=	500	470	440	V
Anode input power	W_{ia}	=	27	26.5	25	kW
Anode dissipation	W_a	=	18	18	17	kW
Output power	W_o	=	9	8.5	8	kW
Efficiency	η	=	33	32	32	%
Modulation depth	m	=	100	100	100	%
Grid current	I_g	=	0.3	0.36	0.4	A
Grid input power	W_{ig}	=	270	305	317	W

7Z2 3776

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	12	kV
Negative grid voltage	$-V_g$	=	max.	1000	V
Anode current	I_a	=	max.	2.9	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	35	kW
Anode dissipation	W_a	=	max.	20	kW

OPERATING CONDITIONS

Wavelength	λ	=	>15	>15	11	11	m
Frequency	f	=	<20	<20	27	27	Mc/s
Anode voltage	V_a	=	12	10	12	10	kV
Grid voltage	V_g	=	-1000	-900	-1000	-900	V [1])
Anode current	I_a	=	2.9	2.9	2.9	2.9	A
Grid current	I_g	=	0.4	0.45	0.45	0.5	A
Peak grid A.C. voltage	V_{gp}	=	1600	1550	1650	1600	V
Grid input power	W_{ig}	=	580	630	670	700	W
Anode input power	W_{ia}	=	35	29	35	29	kW
Anode dissipation	W_a	=	8	7.5	9	8.5	kW
Output power	W_o	=	27	21.5	26	20.5	kW
Efficiency	η	=	77	74	74	70.5	%
Modulation depth	m	=	100	100	100	100	%
Modulation power	W_{mod}	=	17.5	14.5	17.5	14.5	kW

[1]) Grid bias partially obtained by the grid resistor

7Z2 3777

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

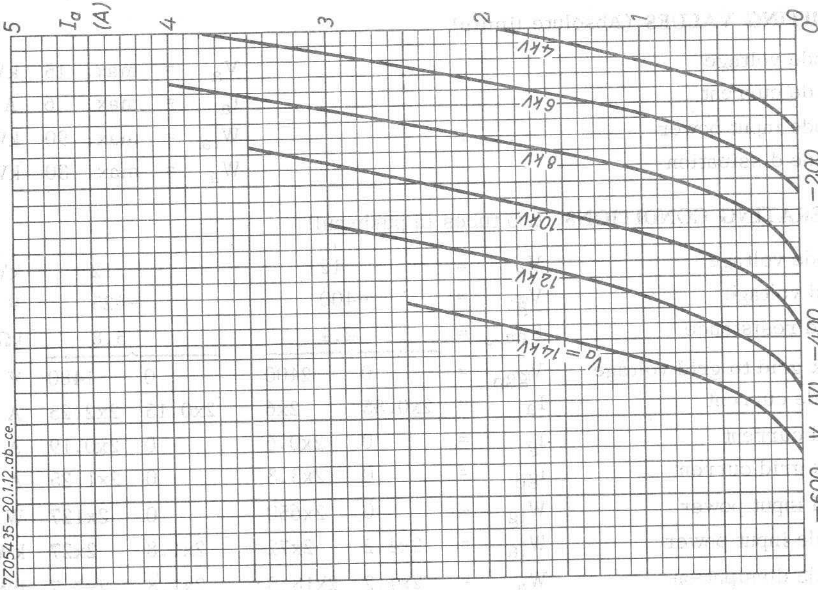
Anode voltage	V_a	=	max.	15	kV
Anode current	I_a	=	max.	6	A
Anode input power	W_{ia}	=	max.	90	kW
Anode dissipation	W_a	=	max.	30	kW

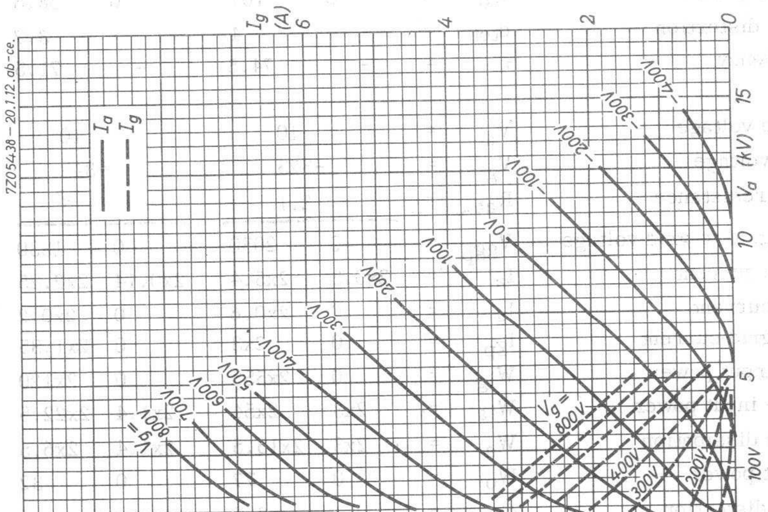
OPERATING CONDITIONS, two tubes in push-pull

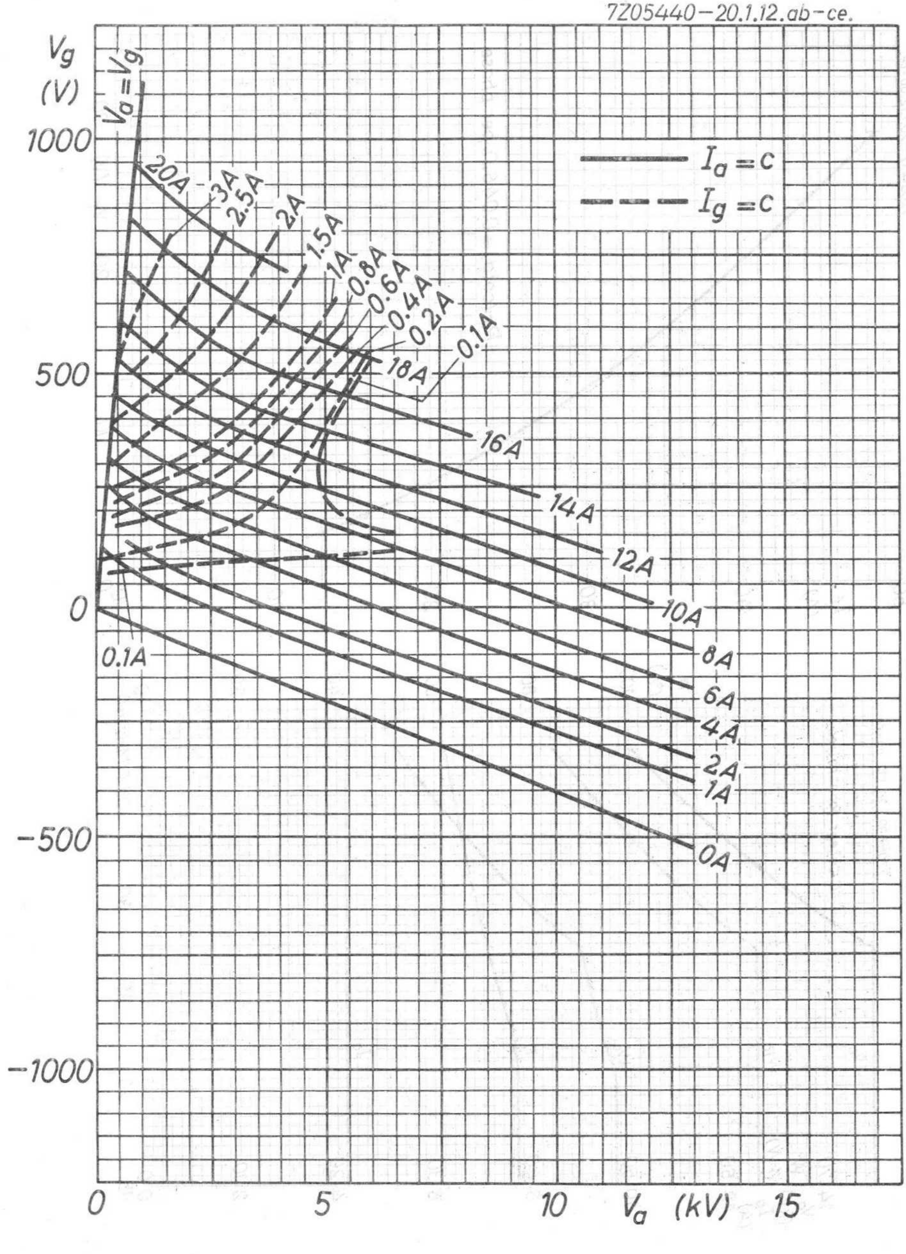
Anode voltage	V_a	=	12		12		kV
Grid voltage	V_g	=	−400		−425		V
Load resistance	$R_{aa\sim}$	=	2.4		5.8		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	2400	0	1480	V
Anode current	I_a	=	2x0.35	2x6	2x0.15	2x2.25	A
Grid current	I_g	=	0	2x0.6	0	2x0.19	A
Peak grid current	I_{gp}	=	0	2x3.3	0	2x1.25	A
Grid input power	W_{ig}	=	0	2x650	0	2x127	W
Anode input power	W_{ia}	=	2x4.2	2x72	2x1.8	2x27	kW
Anode dissipation	W_a	=	2x4.2	2x18.5	2x1.8	2x7.7	kW
Output power	W_o	=	0	107	0	38.5	kW
Total distortion	d_{tot}	=	–	4	–	3.7	%
Efficiency	η	=	–	74.5	–	71.5	%

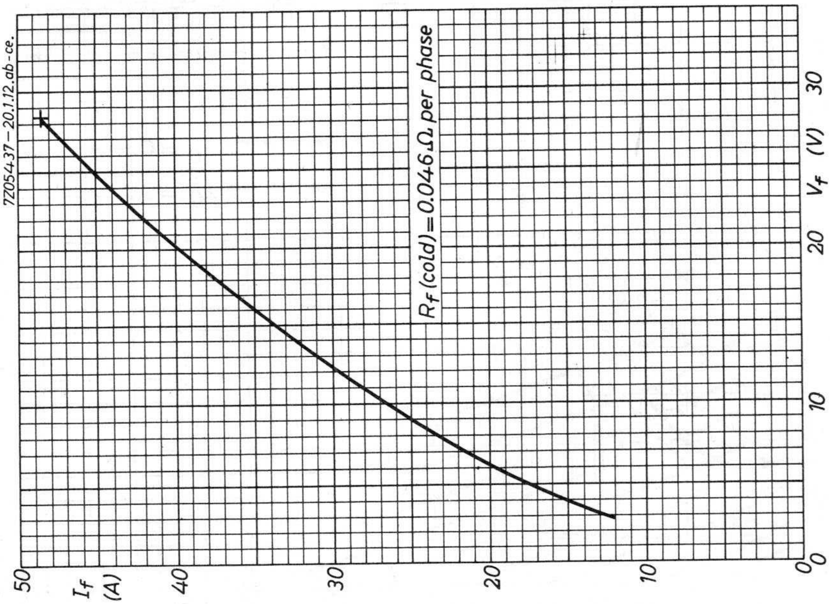
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	−325		−345		V
Load resistance	$R_{aa\sim}$	=	2.1		5		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	2050	0	1330	V
Anode current	I_a	=	2x0.3	2x5.4	2x0.14	2x2.25	A
Grid current	I_g	=	0	2x0.6	0	2x0.2	A
Peak grid current	I_{gp}	=	0	2x3	0	2x1.35	A
Grid input power	W_{ig}	=	0	2x555	0	2x120	W
Anode input power	W_{ia}	=	2x3	2x54	2x1.4	2x22.5	kW
Anode dissipation	W_a	=	2x3	2x15.5	2x1.4	2x6.5	kW
Output power	W_o	=	0	77	0	32	kW
Total distortion	d_{tot}	=	–	3.5	–	4	%
Efficiency	η	=	–	71.5	–	71	%

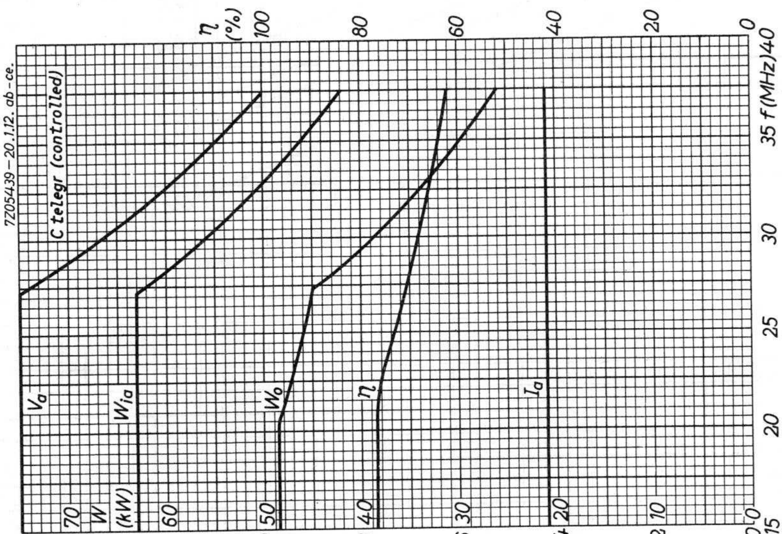
7Z2 3778

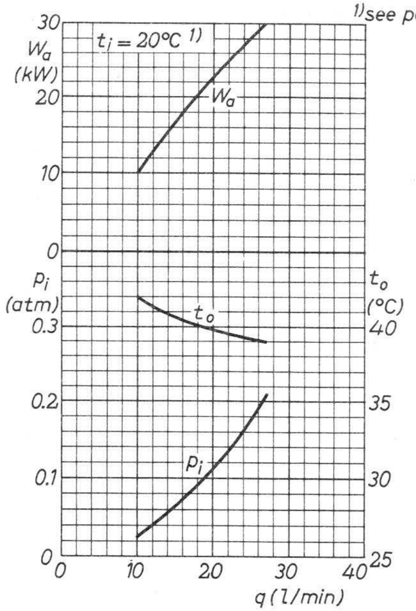

7Z05435-20.1.12.ab-ce.
I_a (A)
V_g (V)
V_a = 14 kV
12 kV
10 kV
8 kV
6 kV
4 kV

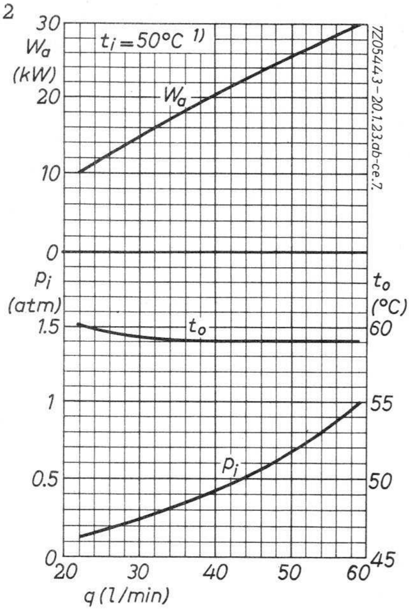

7Z05438-20.1.12.ab-ce.
I_a
I_g
I_g (A)
I_a (A)
V_a (kV)
V_g = 800V
700V
600V
500V
400V
300V
200V
100V
0V
-100V
-200V
-300V
-400V

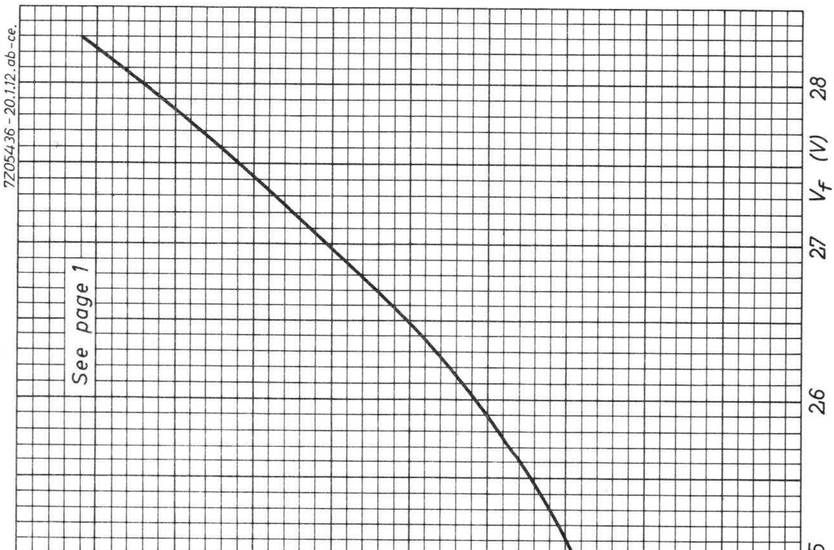

7Z05440-20.1.12.ab-ce.
Vg
(V)
1000
500
0
-500
-1000
Va=Vg
Ia=c
Ig=c
20A
3A
2.5A
2A
1.5A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0A
0.1A
0
5
10
Va (kV)
15


7Z05437 – 20.1.12.ab-ce.
R_f (cold) = 0.046 Ω per phase
I_f (A)
V_f (V)
0
10
20
30
40
50


7Z05439 – 20.1.12. ab-ce.
C telegr (controlled)
V_a
W_{ia}
W_o
η
I_a
14 V_a (kV)
I_a (A)
70 W (kW)
η (%)
f (MHz)
15
20
25
30
35
40


1)see page 2
$t_i = 20°C$ 1)
W_a (kW)
30
20
10
0
W_a
p_i (atm)
0.3
0.2
0.1
0
t_o (°C)
40
35
30
25
t_o
p_i
0
10
20
30
40
q (l/min)


$t_i = 50°C$ 1)
W_a (kW)
30
20
10
0
W_a
p_i (atm)
1.5
1
0.5
0
t_o (°C)
60
55
50
45
t_o
p_i
20
30
40
50
60
q (l/min)
7Z05443-20.1.23.ab-ce.7.


7Z05436-20.1.12.ab-ce.
See page 1
I_{sat} (A)
25
20
15
10
5
0
V_f (V)
28
27
26
25

R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegr.		B teleph.		C an.mod.		B mod. 1)	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
20 100	2000 1700	635 400	2000	124	1800	430	2000	900

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

Anode to all except grid	C_a	=	6 pF
Grid to all except anode	C_g	=	12.5 pF
Anode to grid	C_{ag}	=	6 pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	125 mA
Amplification factor	μ	=	32
Mutual conductance	S	=	7.5 mA/V

1) Two tubes

7Z2 3815

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	2000	V
Anode dissipation	W_a	=	max.	300	W
Grid dissipation	W_g	=	max.	20	W
Grid circuit resistance					
with fixed bias	R_g	=	max.	10	kΩ
with automatic bias	R_g	=	max.	20	kΩ
Cathode current	I_k	=	max.	600	mA
Peak cathode current	I_{kp}	=	max.	2400	mA

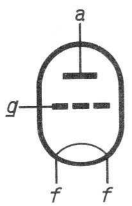
TEMPERATURE LIMITS (Absolute limits)

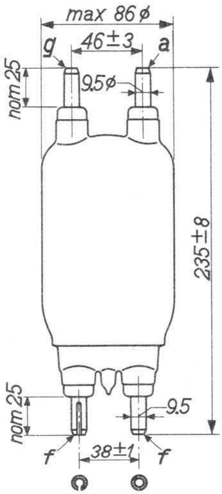
Temperature of pin seals	=	max.	220	°C
Bulb temperature	=	max.	250	°C

MECHANICAL DATA

Net weight: 0.34 kg

Dimensions in mm





Mounting position: vertical with base up or down
The tube should be supported when it is mounted with the base up

ACCESSORIES

Socket: 40204
Anode and grid connectors: 40626
Key : 40608

7Z2 8625

R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

COOLING: radiation/low-velocity air flow

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

7Z2 3779

LIMITING VALUES (Absolute limits)

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

MECHANICAL DATA

Dimensions in mm

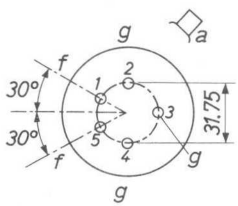
Base : giant 5p

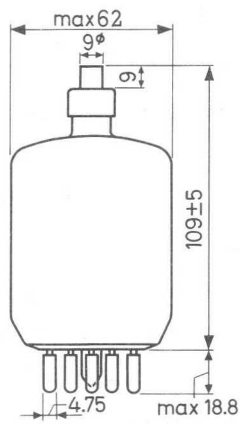
Anode connector : 40624

→ Socket : 2422 512 01001

Socket with grounded grid connections: 40215/01

Net weight : 110 g





Mounting position: vertical with base up or down

1) Anode red hot, temperature = 850 °C

7Z2 8626

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

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

OPERATING CONDITIONS R.F. CLASS B TELEPHONY

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

7Z2 3781

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

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

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

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

7Z2 3782

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

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

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

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

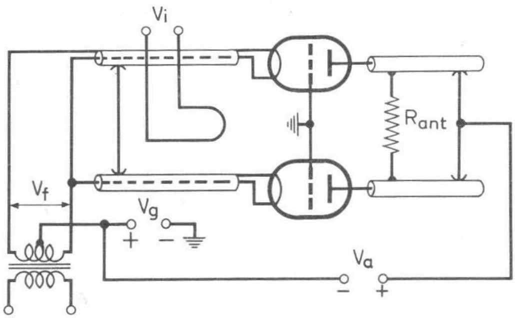
Wavelength	λ	=	7.3	m
Anode voltage	V_a	=	2500	V_{RMS}
Anode current	I_a	=	90	mA
Grid current	I_g	=	20	mA
Grid resistor	R_g	=	1700	Ω
Grid voltage	V_g	=	85	V_{RMS}
Anode input power	W_{ia}	=	255	W
Anode dissipation	W_a	=	85	W
Output power	W_o	=	170	W
Efficiency	η	=	67	%

[1]) Mean value

7Z2 3783

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

grounded grid, two tubes



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

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

7Z2 3784

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

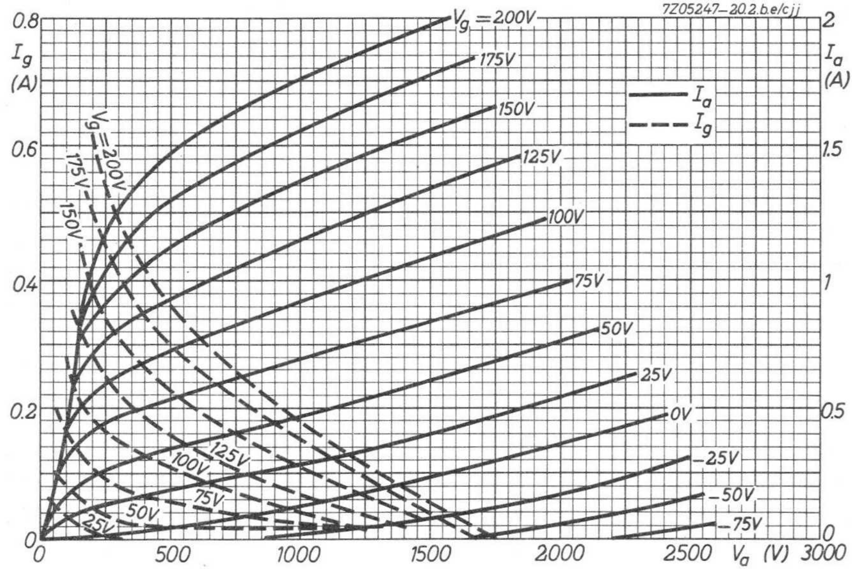
Anode voltage	V_a	=	max.	2500	V
Anode dissipation	W_a	=	max.	135	W
Grid dissipation	W_g	=	max.	16	W
Cathode current	I_k	=	max.	250	mA
Peak cathode current	I_{kp}	=	max.	1.6	A

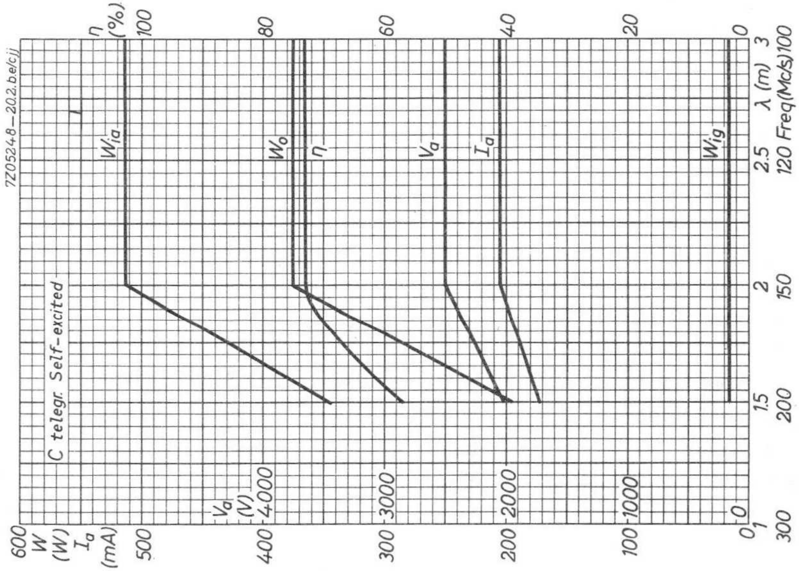
OPERATING CONDITIONS, two tubes

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

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

7Z2 3785


7Z05247-20.2.b.e/cjj
I_g (A)
I_a (A)
V_g = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
I_a
I_g
0.8
0.6
0.4
0.2
0
2
1.5
1
0.5
0
500
1000
1500
2000
2500
3000
V_a (V)


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

R.F. POWER TRIODE

QUICK REFERENCE DATA

λ (m)	Freq. (Mc/s)	C telegr.		C grounded grid		B teleph.		C_a mod.	
		V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
2	150	2500	390			2500	65		
		2000	295			2000	64	2000	205
		1500	210			1500	59	1500	154
		1000	126					1000	96
3	100			2500	910				
				2000	700				
				1500	516				
				1000	332				
		C osc. industrial						B mod. two tubes	
		V_a ∩∩ (V)	W_o (W)	V_a ∼ (V)	W_o (W)			V_a (V)	W_o (W)
6	50	2000	290	2500	170			2500	700
								1000	274

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

7Z2 3440

TEMPERATURE LIMITS (Absolute limits)

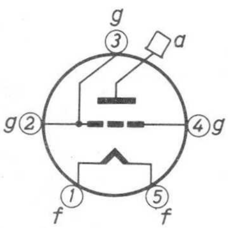
Temperature of anode seal	=	max. 220 °C
Bottom temperature	=	max. 180 °C

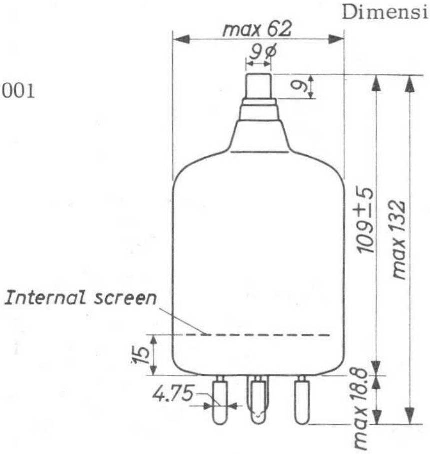
It is recommended to direct a low-velocity air flow on bottom and top seal if the tube is used at or near the limiting values at frequencies above 50 Mc/s

MECHANICAL DATA

Dimensions in mm

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





Mounting position: vertical with base up or down

COOLING: radiation/low-velocity air flow

7Z2 8627

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

Frequency	f	=	150	150	150	150	Mc/s
Anode voltage	V_a	=	2500	2000	1500	1000	V
Grid voltage	V_g	=	−200	−150	−110	−80	V
Anode current	I_a	=	205	205	205	205	mA
Grid current	I_g	=	40	40	40	40	mA
Peak grid A.C. voltage	V_{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_{g_p} =	100	100	100	V
Anode input power	W_{ia} =	193	194	180	W
Anode dissipation	W_a =	128	130	121	W
Output power	W_o =	65	64	59	W
Efficiency	η =	34	33	33	%
Modulation factor	m =	100	100	100	%
Grid current	I_g =	20	28	52	mA
Grid input power	W_{ig} =	3.6	5.1	9.4	W

7Z2 3443

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

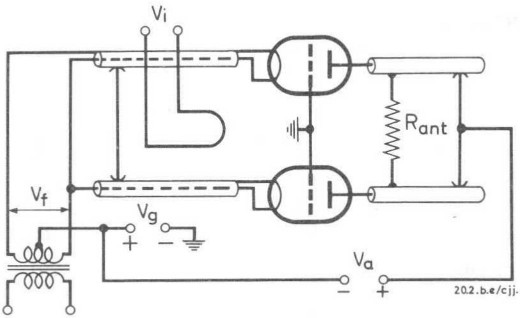
7Z2 3444

R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes



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

[1]) Power transferred from driving stage included
[2]) Pure tube efficiency

7Z2 3445

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

[1]) Mean value

7Z2 3446

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 3447

A.F. CLASS B AMPLIFIER AND MODULATOR

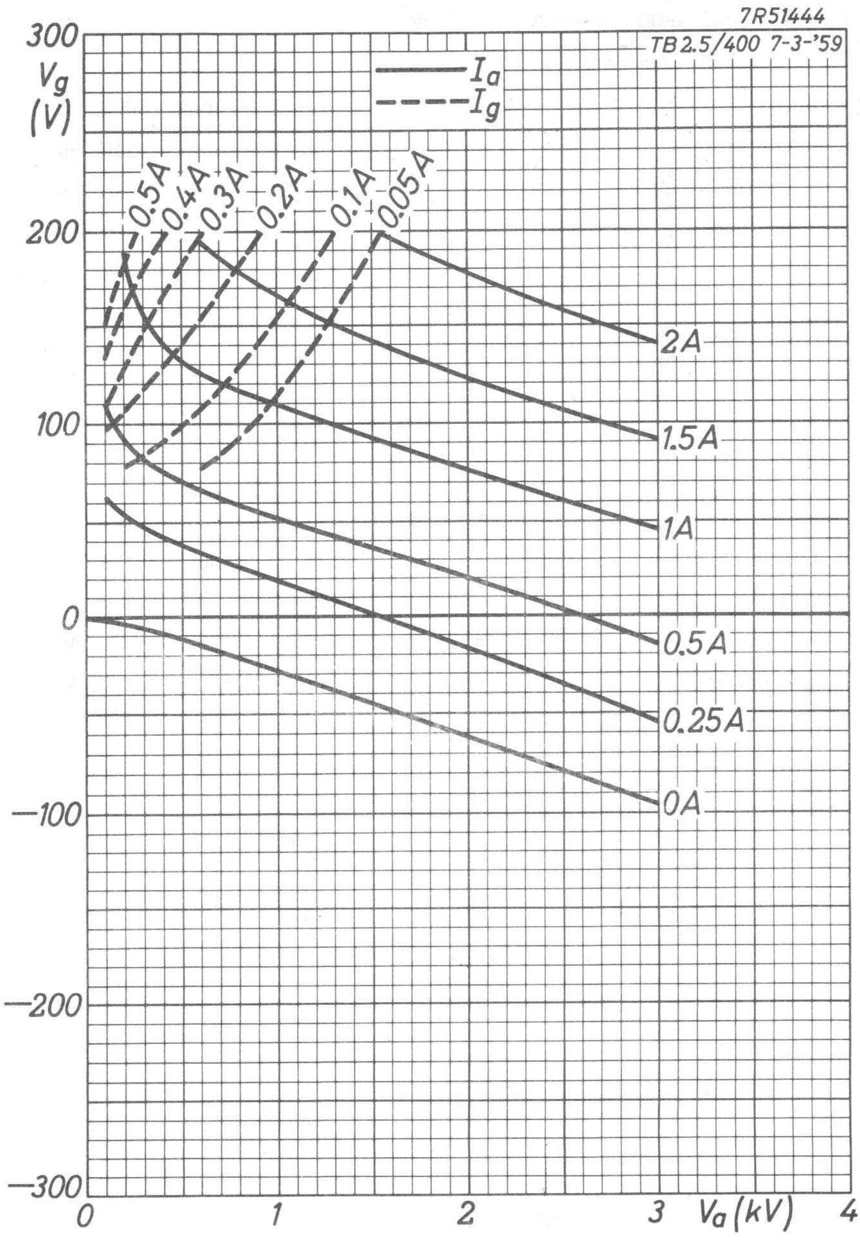
LIMITING VALUES (Absolute limits)

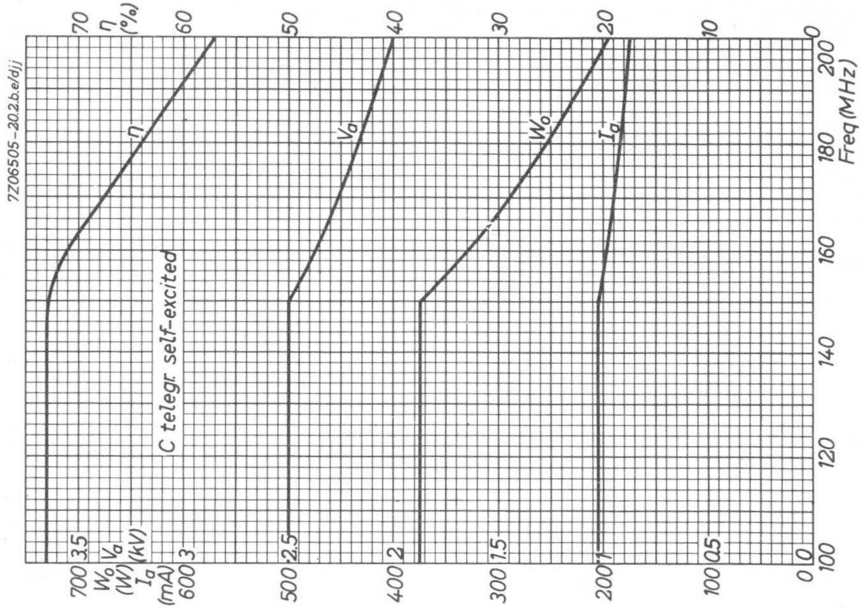
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	210	mA
Anode dissipation	W_a	=	max.	150	W
Anode input power	W_{ia}	=	max.	512	W
Grid current	I_g	=	max.	45	mA

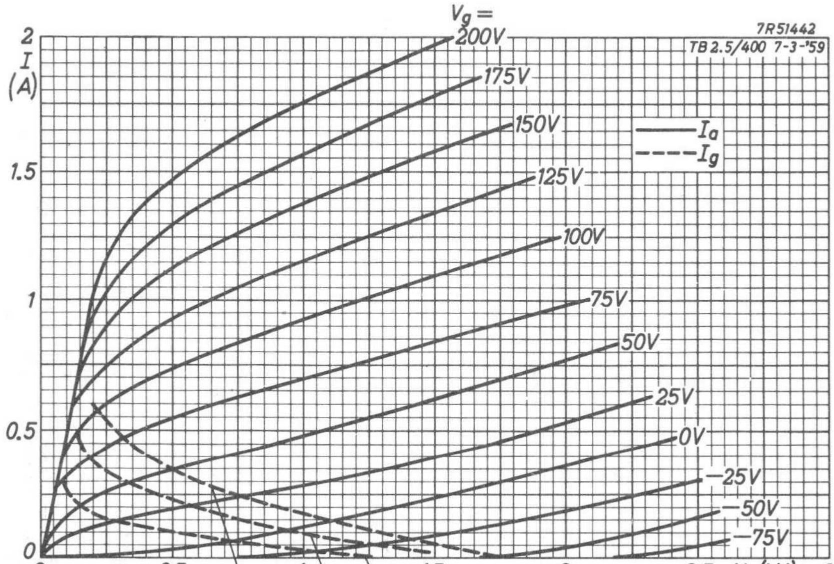
OPERATING CONDITIONS, two tubes

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

7Z2 3448


7R51444
TB 2.5/400 7-3-'59
300
Vg
(V)
200
100
0
−100
−200
−300
0
1
2
3
4
Va (kV)
Ia
Ig
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
2A
1.5A
1A
0.5A
0.25A
0A


7Z06505-20.2.b.e/djj
C telegr. self-excited
η
V_a
W_o
I_a
70
η (%)
60
50
40
30
20
10
0
Freq (MHz)
200
180
160
140
120
100
700 3.5
W_o (W) V_a (kV)
I_a (mA)
600 3
500 2.5
400 2
300 1.5
200 1
100 0.5
0 0


V_g =
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
7R51442
TB 2.5/400 7-3-'59
I_a
I_g
I (A)
2
1.5
1
0.5
0
0
0.5
1
1.5
2
2.5
V_a (kV)
3
V_g=200V
150V
100V

R.F. POWER TRIODE

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

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

HEATING: direct, parallel supply; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 2967

TEMPERATURE LIMITS (Absolute limits)

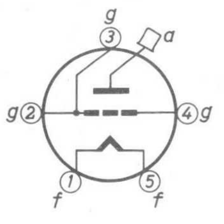
Bulb temperature	t_{bulb}	= max. 350 °C
Anode seal temperature	t_a	= max. 220 °C
Pin temperature	t_{pin}	= max. 180 °C

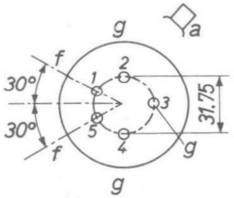
COOLING

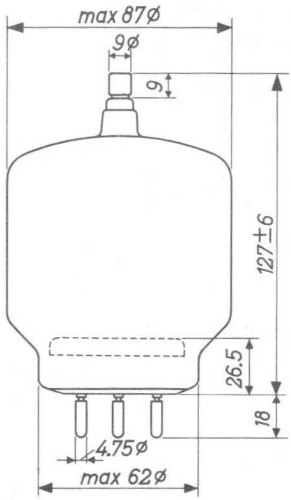
In cases where the maximum permissible temperatures are likely to be exceeded, as would normally be the case at frequencies above 30 Mc/s with full ratings, a low-velocity air flow has to be directed onto the anode seal and the bottom of the envelope. The cooling will be facilitated by the use of a blower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

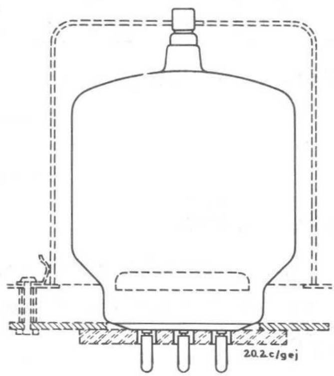
MECHANICAL DATA Dimensions in mm

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









Mounting suggestion of tube with shimney

Mounting position: vertical with base up or down

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

7Z2 8628

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

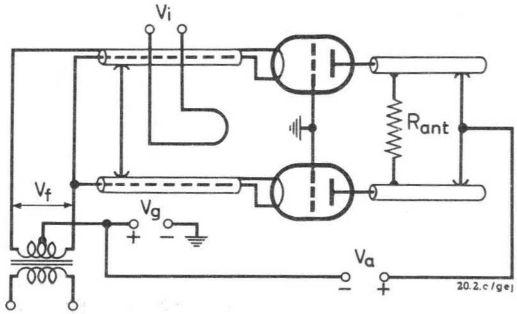
OPERATING CONDITIONS

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	%

7Z2 2969

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

7Z2 2970

R.F. CLASS C OSCILLATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes

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

7Z2 2971

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

7Z2 2972

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 2973

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

LIMITING VALUES (Absolute limits)

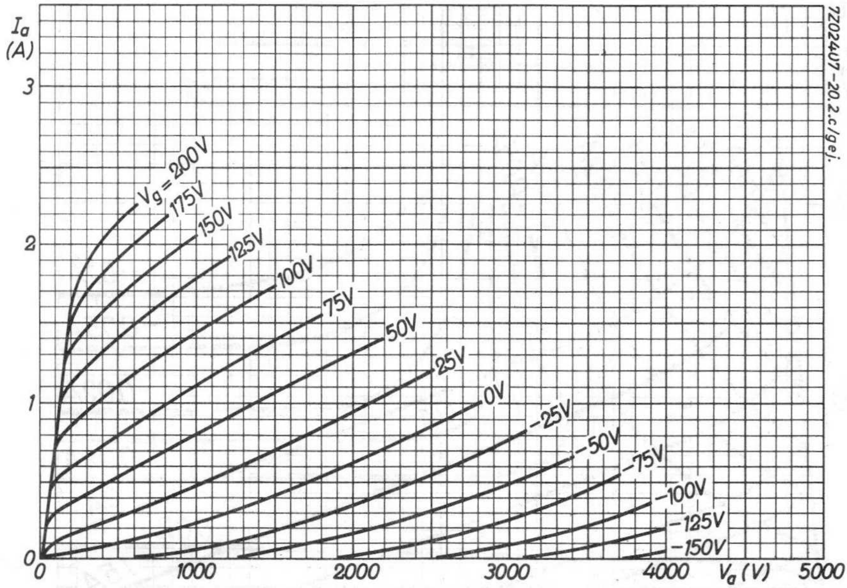
Anode voltage	V_a	= max.	4	kV
Anode input power	W_{ia}	= max.	1550	W
Anode dissipation	W_a	= max.	350	W
Negative grid voltage	$-V_g$	= max.	500	V
Grid dissipation	W_g	= max.	40	W
Grid circuit resistance	R_g	= max.	100	kΩ
Cathode current	I_k	= max.	500	mA

OPERATING CONDITIONS

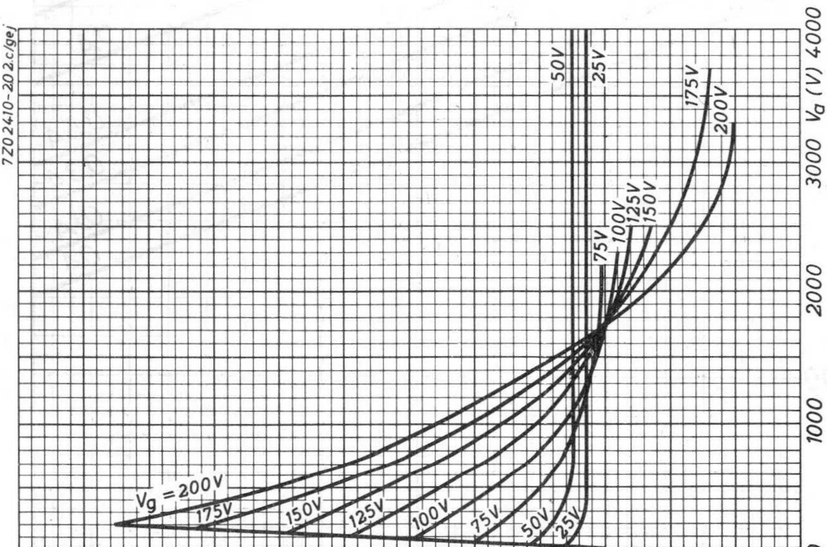
V_a	=	4		3		2.5		kV
V_g	=	-135		-102		-77.5		V[1]
$R_{aa\sim}$	=	20		14.5		12		kΩ
V_{gg_p}	= 0	485	0	475	0	400		V
I_a	= 2x88	2x270	2x60	2x290	2x90	2x300		mA
I_g	= 0	2x30	0	2x60	0	2x55		mA
W_{dr}	= 0	2x7	0	2x13	0	2x10		W
W_{ia}	= 2x350	2x1080	2x180	2x870	2x225	2x750		W
W_a	= 2x350	2x305	2x180	2x190	2x225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

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

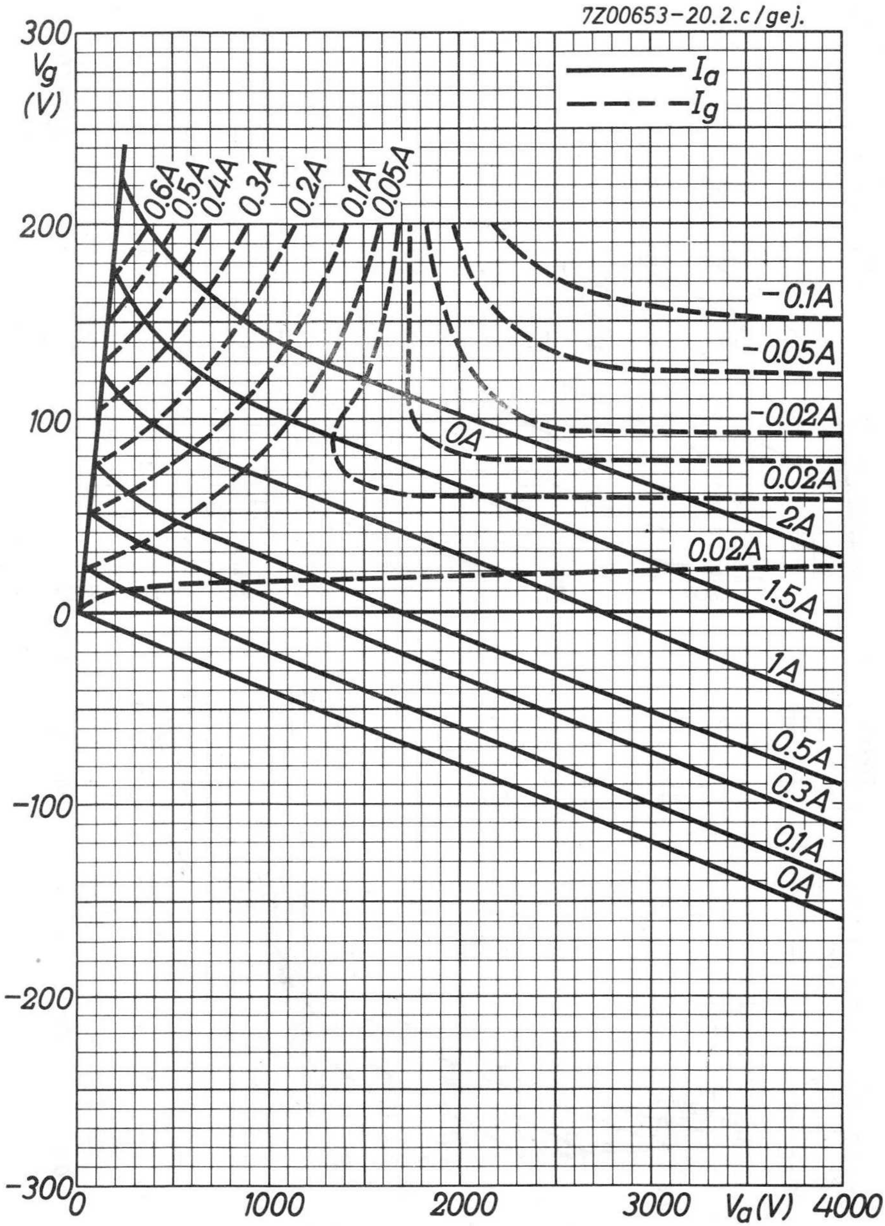
7Z2 2974



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



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


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

R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegr.		B teleph.		C an.mod.		B mod. [1]	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
2	3.5	2.9	3.5	0.60	3.0	1.63	3.0	3.3
20	3.0	2.6	3.0	0.52	2.5	1.30	2.5	2.5

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f	= 12	V
Filament current	I_f	= 17	A

CAPACITANCES

Anode to all except grid	C_a	= 10.5	pF
Grid to all except anode	C_g	= 26	pF
Anode to grid	C_{ag}	= 13	pF

TYPICAL CHARACTERISTICS

Anode current	I_a	= 300	mA
Amplification factor	μ	= 34	
Mutual conductance	S	= 18	mA/V

[1]) Two tubes

7Z2 3817

LIMITING VALUES (Absolute limits)

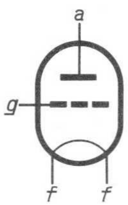
Anode voltage	V_a	= max.	3.5	kV
Anode dissipation	W_a	= max.	1.1	kW
Grid dissipation	W_g	= max.	60	W
Grid circuit resistance	R_g	= max.	5	kΩ
Cathode current	I_k	= max.	1.4	A
Peak cathode current	I_{k_p}	= max.	5.6	A

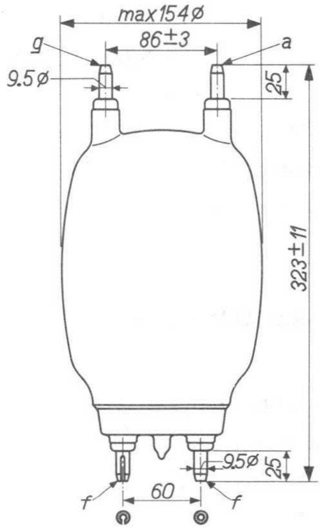
TEMPERATURE LIMITS (Absolute limits)

Temperature of pin seals	= max.	220	°C
Bulb temperature	= max.	300	°C

MECHANICAL DATA Dimensions in mm

Net weight: 0.9 kg





Mounting position: arbitrary with plane of anode vertical
The tube should be supported if it is mounted with the base up.

ACCESSORIES

Socket: 40205
→ Anode and grid connectors: 40626
Key : 40608

7Z2 8635

R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

---

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

7Z2 3787

COOLING

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

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

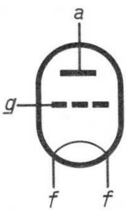
MECHANICAL DATA

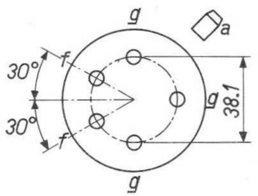
Dimensions in mm

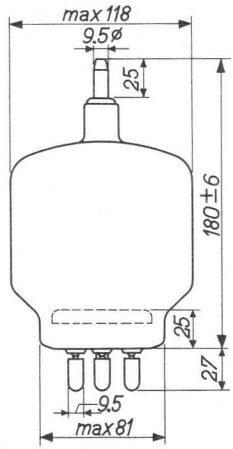
→ Socket : 2422 512 00001

Anode connector: 40626

Net weight : 420 g







Mounting position: vertical with base up or down

7Z2 8636

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS (controlled)

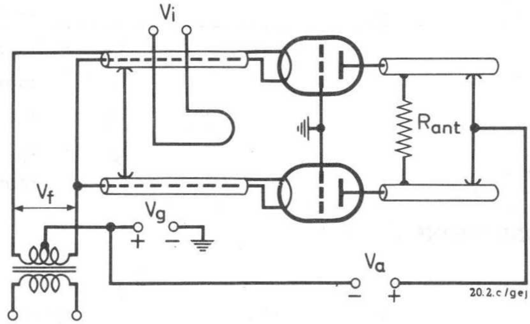
Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid voltage	V_g	=	-350	-300	-250	-200	V
Anode current	I_a	=	535	535	535	535	mA
Grid current	I_g	=	115	115	115	115	mA
Peak grid A.C. voltage	V_{g_p}	=	580	520	460	405	V
Grid input power	W_{ig}	=	60	54	48	42	W
Anode input power	W_{ia}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

OPERATING CONDITIONS (self excited)

Wavelength	λ	=	3	3	3	3	m
Anode voltage	V_a	=	4000	3500	3000	2500	V
Grid resistor	R_g	=	3000	2600	2200	1800	Ω
Anode current	I_a	=	535	535	535	535	mA
Grid current	I_g	=	115	115	115	115	mA
Peak grid A.C. voltage	V_{g_p}	=	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	%

7Z2 3789

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

7Z2 3790

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

7Z2 3791

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes

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

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

7Z2 3792

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

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

[3]) D.C. value

7Z2 3793

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

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

[3]) D.C. value.

7Z2 3794

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

LIMITING VALUES (Absolute limits)

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

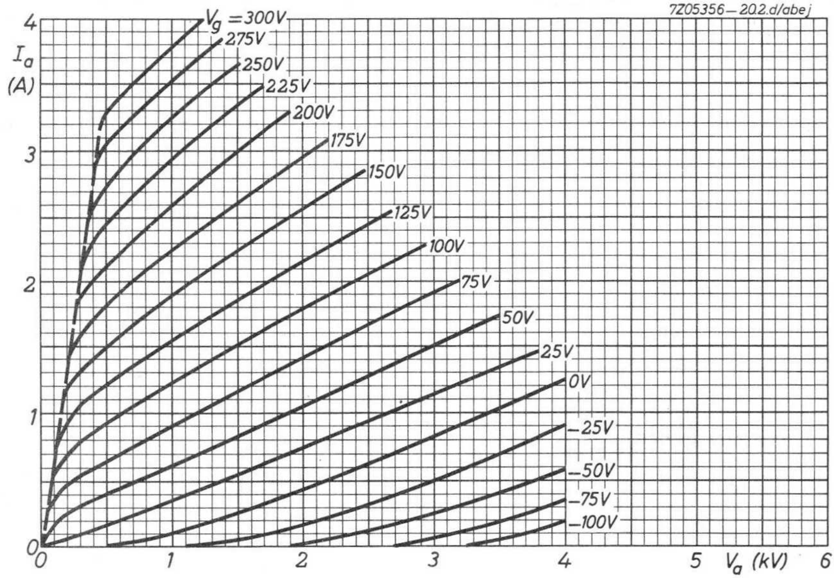
OPERATING CONDITIONS

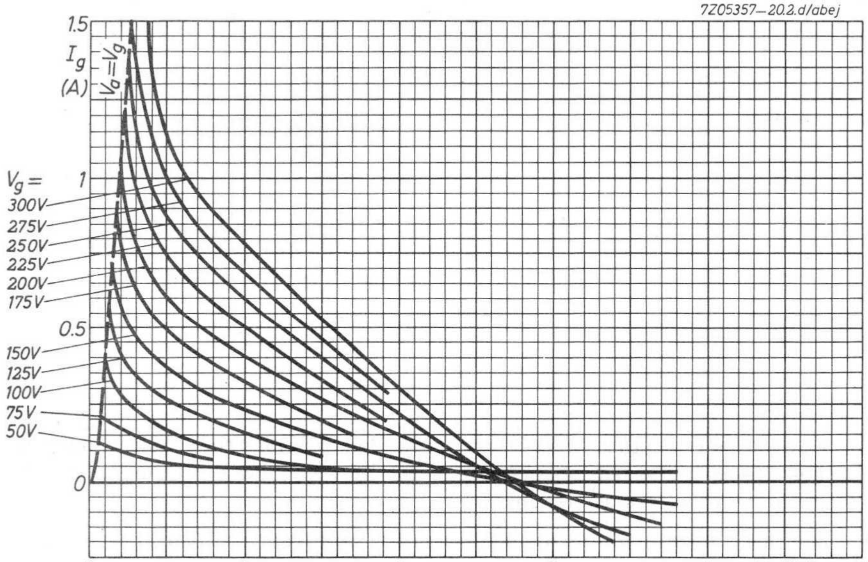
Transformer voltage	V_{tr}	=	4500[1])	3800[2])	V_{RMS}
Anode current	I_a	=	280	240	mA
Grid current	I_g	=	55	47	mA
Grid resistor	R_g	=	3.4	3.4	kΩ
Anode input power	W_{ia}	=	1400	1010	W
Anode dissipation	W_a	=	350	295	W
Output power	W_o	=	1000	670	W
Efficiency	η	=	71.5	66	%

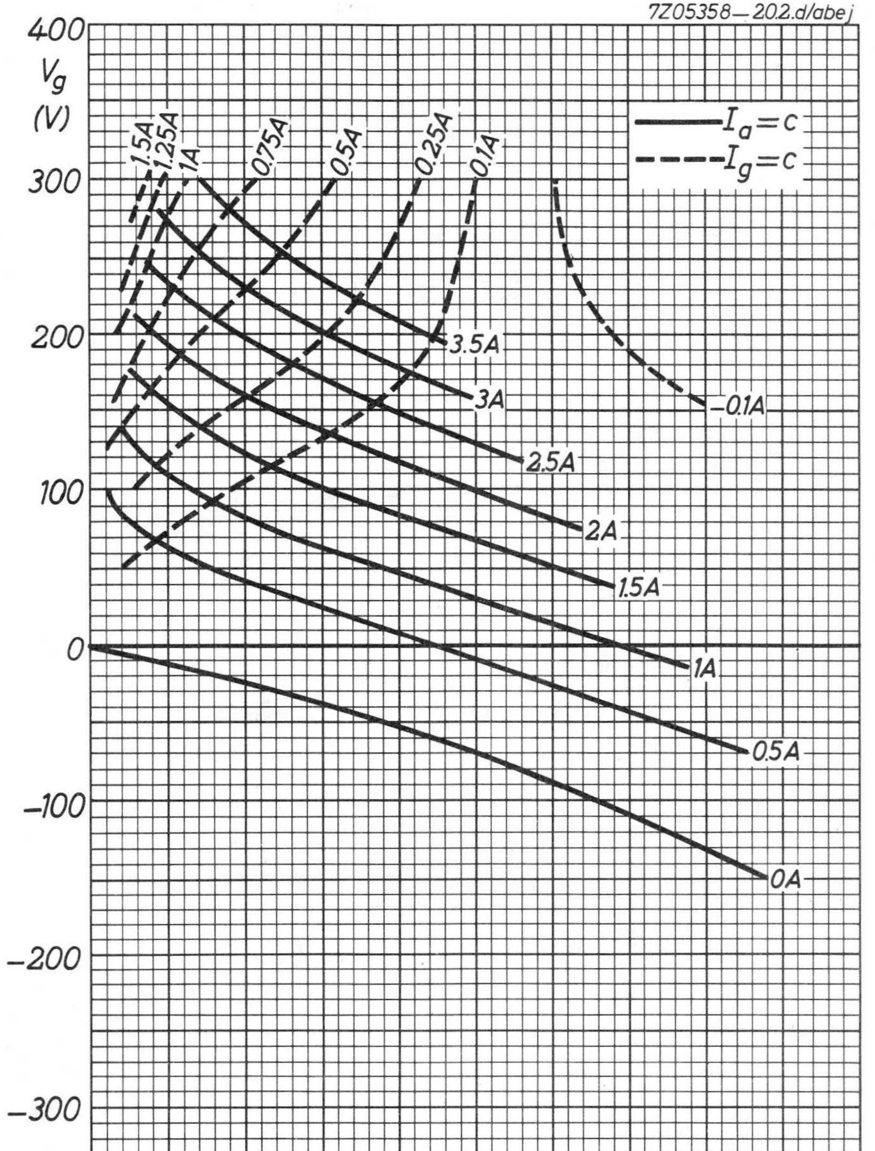
[1]) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

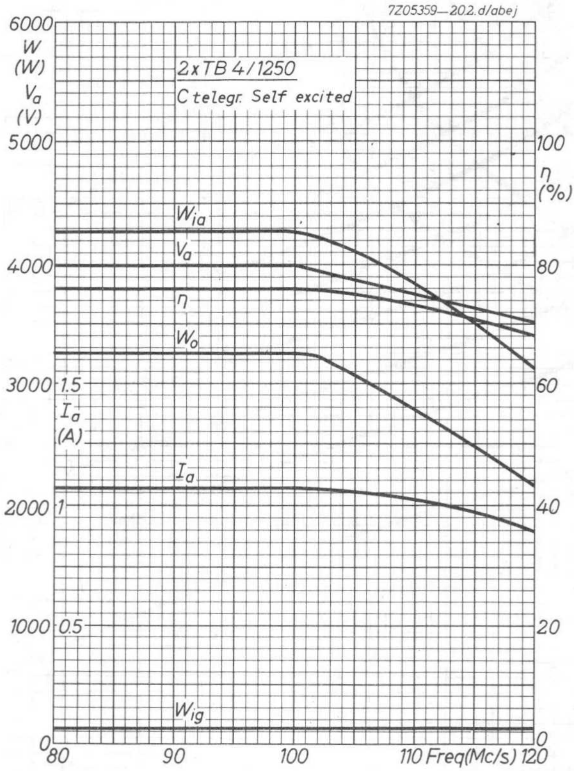
[2]) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded.

7Z2 3795


7Z05356—20.2.d/abej
I_a (A)
V_g = 300V
275V
250V
225V
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
V_a (kV)


7Z05357—20.2.d/abej
I_g (A)
$V_a = V_g$
V_g =
300V
275V
250V
225V
200V
175V
150V
125V
100V
75V
50V
V_a (kV)


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


7Z05359—20.2.d/abej
2xTB 4/1250
C telegr. Self excited
6000
W
(W)
Va
(V)
5000
4000
3000
2000
1000
0
1.5
Ia
(A)
1
0.5
100
η
(%)
80
60
40
20
0
Wia
Va
η
Wo
Ia
Wig
80
90
100
110 Freq(Mc/s) 120

INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA							
Industrial R.F. oscillator class C							
Freq. (Mc/s)	three phase			single phase		A.C operation	
	V_a (V)	W_o(W) CCS	W_o(W) ICAS	V_a (V)	W_o(W) CCS	V_a (V_{RMS})	W_o(W) CCS
50	6000 5000 4000	1640 1670 1650	3200 2400	5400 4500	1635 1600	4500	1020

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	5.0	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	32.5	A

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.2	pF
Grid to all other elements except anode	C_g	=	9.2	pF
Anode to grid	C_{ag}	=	5.1	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4000	V
Anode current	I_a	=	120	mA
Amplification factor	μ	=	21	
Mutual conductance	S	=	3.3	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	=	max. 220	^{o}C
Bulb temperature	=	max. 350	^{o}C

7Z2 3449

COOLING

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

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

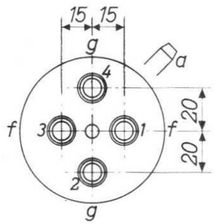
MECHANICAL DATA

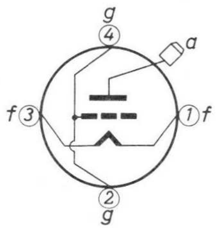
Dimensions in mm

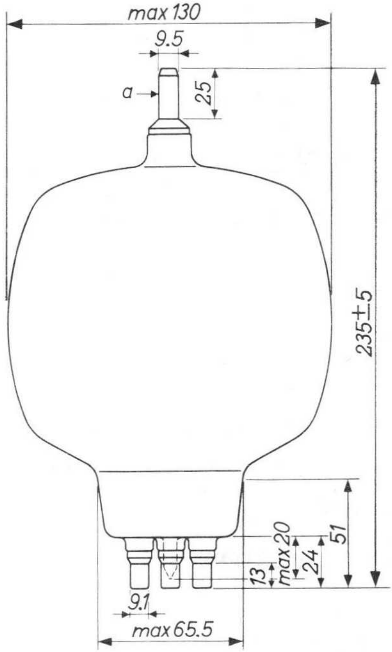
→ Socket : 2422 511 05001

Anode connector: 40665

Net weight : 450 g







Mounting position: vertical

7Z2 8637

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier.

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

Frequency	f	up to	50	Mc/s
Anode voltage	V_a	= max.	7000	V
Anode current	I_a	= max.	560	mA
Anode input power	W_{ia}	= max.	2500	W
Anode dissipation	W_a	= max.	500	W
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	210	mA
Grid current, unloaded	I_g	= max.	280	mA
Grid circuit resistance	R_g	= max.	15	kΩ

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

Frequency	f	=	50	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	4000	V
Anode current, loaded	I_a	=	350	430	535	mA
Anode current, unloaded	I_a	=	90	100	150	mA
Grid current, loaded	I_g	=	120	130	150	mA
Grid current, unloaded	I_g	=	180	200	225	mA
Grid resistor	R_g	=	4200	3500	2700	Ω
Load resistance	$R_{a\sim}$	=	9000	6400	3800	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	15	15.5	20	%
Anode input power	W_{ia}	=	2100	2150	2140	W
Anode dissipation	W_a	=	460	480	490	W
Output power	W_o	=	1640	1670	1650	W
Efficiency	η	=	78	77.5	77	%
Output power in the load	W_ℓ	=	1300	1350	1325	W [1]

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

7Z2 3451

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier.

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

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	7000	V
Anode current	I_a	=	max.	750	mA
Anode input power	W_{ia}	=	max.	5000	W
Anode dissipation	W_a		See page B		
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	185	mA
Grid current, unloaded	I_g	=	max.	300	mA
Grid circuit resistance	R_g	=	max.	15	kΩ

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

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	V
Anode current, loaded	I_a	=	700	630	mA
Anode current, unloaded	I_a	=	130	150	mA
Grid current, loaded	I_g	=	170	160	mA
Grid current, unloaded	I_g	=	290	280	mA
Grid resistor	R_g	=	3300	2700	Ω
Load resistance	$R_{a\sim}$	=	6500	4500	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	16	17	%
Anode input power	W_{ia}	=	4200	3150	W
Anode dissipation	W_a	=	1000	750	W
Output power	W_o	=	3200	2400	W
Efficiency	η	=	76	76	%
Output power in the load	W_ℓ	=	2650	1950	W [1])

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

7Z2 3452

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

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

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	6300	V
Anode current	I_a	=	max.	500	mA
Anode input power	W_{ia}	=	max.	2500	W
Anode dissipation	W_a	=	max.	500	W
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	185	mA
Grid current, unloaded	I_g	=	max.	280	mA
Grid circuit resistance	R_g	=	max.	15	kΩ

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

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	5400	4500	V
Anode current, loaded	I_a	=	320	380	mA
Anode current, unloaded	I_a	=	80	90	mA
Grid current, loaded	I_g	=	110	120	mA
Grid current, unloaded	I_g	=	170	190	mA
Grid resistor	R_g	=	4200	3500	Ω
Load resistance	$R_{a\sim}$	=	9	6.4	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	13	15.5	%
Anode input power	W_{ia}	=	2125	2100	W
Anode dissipation	W_a	=	490	500	W
Output power	W_o	=	1635	1600	W
Efficiency	η	=	77	76	%
Output power in the load	W_ℓ	=	1350	1300	W [1]

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

7Z2 3453

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

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

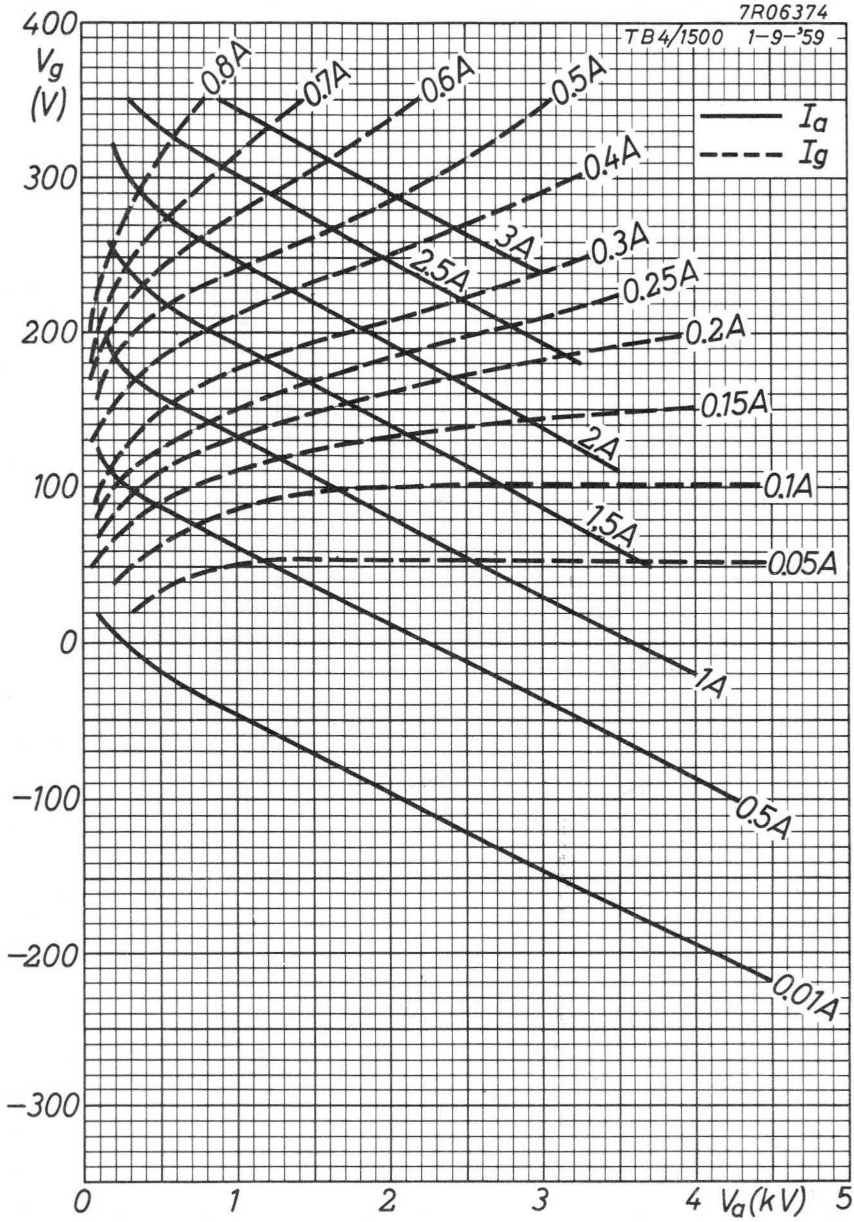
Frequency	f		up to	50	Mc/s
Transformer voltage	V_{tr}	=	max.	5000	V_{RMS}
Anode current	I_a	=	max.	320	mA [1])
Anode input power	W_{ia}	=	max.	1600	W
Anode dissipation	W_a	=	max.	500	W
Negative grid voltage	$-V_g$	=	max.	1350	V [2])
Grid current, loaded	I_g	=	max.	110	mA [1])
Grid current, unloaded	I_g	=	max.	150	mA [1])
Grid circuit resistance	R_g	=	max.	15	kΩ

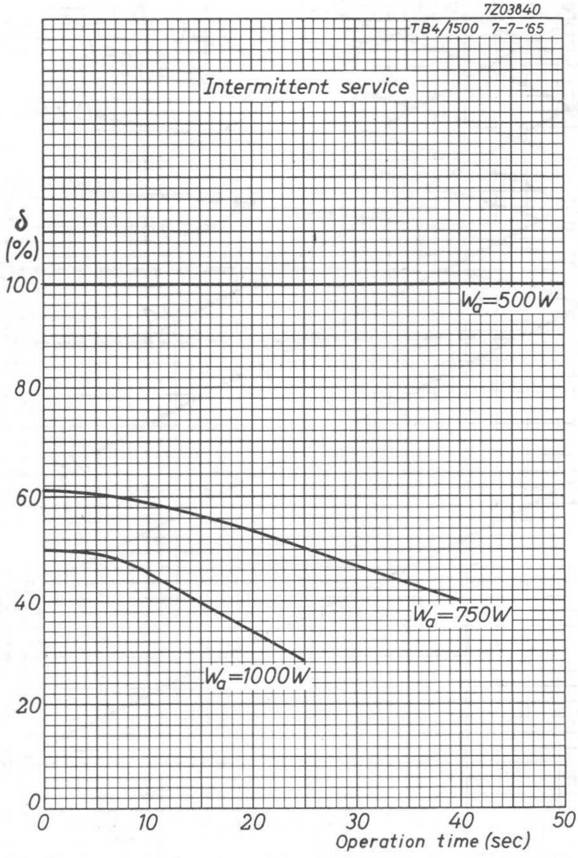
C.C.S. **OPERATING CONDITIONS**, continuous service

Frequency	f	=	50	Mc/s
Transformer voltage	V_{tr}	=	4500	V_{RMS}
Anode current, loaded	I_a	=	280	mA [1])
Anode current, unloaded	I_a	=	70	mA [1])
Grid current, loaded	I_g	=	80	mA [1])
Grid current, unloaded	I_g	=	125	mA [1])
Grid resistor	R_g	=	2700	Ω
Load resistance	$R_{a\sim}$	=	3300	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	18	%
Anode input power	W_{ia}	=	1400	W
Anode dissipation	W_a	=	380	W
Output power	W_o	=	1020	W
Efficiency	η	=	73	%
Output power in the load	W_ℓ	=	820	W [3])

[1]) Averaged over any mains frequency cycle
[2]) At peak of mains frequency sine-wave
[3]) Useful power in the load measured in a circuit having an efficiency of 85%.

7Z2 3454


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


7Z03840
TB4/1500 7-7-'65
Intermittent service
δ
(%)
100
80
60
40
20
0
0
10
20
30
40
50
Operation time (sec)
W_a=500W
W_a=750W
W_a=1000W

INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA								
Industrial R.F. oscillator class C								
Freq. (Mc/s)	three phase			single phase		A.C. operation		
	V_a (V)	W_o(W) CCS	W_o(W) ICAS	V_a (V)	W_o(W) CCS	V_a (V_{RMS})	W_o(W) CCS	
50	6000	2840	4400	5400	2750	5200	1560	
	5000	2720	3375	4500	2550			
	4000	2160						
	3000	1560						

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3 V	+5 % −10 %
Filament current	I_f	=	32.5 A	

CAPACITANCES

Anode to all other elements except grid	C_a	=	0.25	pF
Grid to all other elements except anode	C_g	=	10.5	pF
Anode to grid	C_{ag}	=	6.2	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4	kV
Anode current	I_a	=	190	mA
Amplification factor	μ	=	22	
Mutual conductance	S	=	5.1	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals	=	max. 220 °C
Bulb temperature	=	max. 350 °C

7Z2 3455

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.

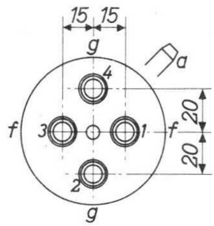
MECHANICAL DATA

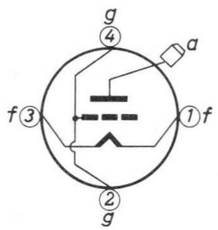
Dimensions in mm

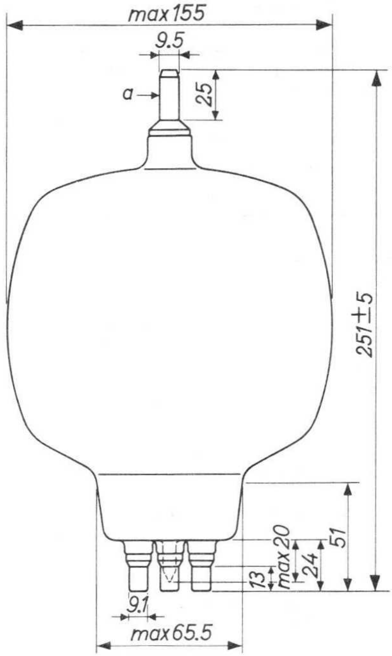
→ Socket : 2422 511 05001

Anode connector: 40665

Net weight : 600 g







Mounting position: vertical

7Z2 8638

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier

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

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	7000	V
Anode current	I_a	=	max.	750	mA
Anode input power	W_{ia}	=	max.	4000	W
Anode dissipation	W_a	=	max.	800	W
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	300	mA
Grid current, unloaded	I_g	=	max.	400	mA
Grid circuit resistance	R_g	=	max.	10	kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Recommended grid blocking capacitor: at high frequencies about 100 pF
at about 1 Mc/s about 1000 pF

Frequency	f	=	50	50	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	4000	3000	V
Anode current, loaded	I_a	=	600	700	700	700	mA
Anode current, unloaded	I_a	=	120	150	170	200	mA
Grid current, loaded	I_g	=	150	160	180	200	mA
Grid current, unloaded	I_g	=	260	280	300	340	mA
Grid resistor	R_g	=	3	2.5	2	1.5	kΩ
Load resistance	$R_{a\sim}$	=	5.4	3.8	3	2.25	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	13	17	20	25	%
Anode input power	W_{ia}	=	3600	3500	2800	2100	W
Anode dissipation	W_a	=	760	780	640	540	W
Output power	W_o	=	2840	2720	2160	1560	W
Efficiency	η	=	79	78	77	74	%
Output power in the load	W_ℓ	=	2350	2250	1750	1250	W [1])

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

7Z2 3457

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE with anode voltage from three-phase rectifier.

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

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	7000	V
Anode current	I_a	=	max.	1000	mA
Anode input power	W_{ia}	=	max.	7000	W
Anode dissipation	W_a		See page B		
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	300	mA
Grid current, unloaded	I_g	=	max.	400	mA
Grid circuit resistance	R_g	=	max.	10	kΩ

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

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	6000	5000	V
Anode current, loaded	I_a	=	950	900	mA
Anode current, unloaded	I_a	=	180	200	mA
Grid current, loaded	I_g	=	190	190	mA
Grid current, unloaded	I_g	=	390	390	mA
Grid resistor	R_g	=	2500	2000	Ω
Load resistance	$R_{a\sim}$	=	3200	2700	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	20	%
Anode input power	W_{ia}	=	5700	4500	W
Anode dissipation	W_a	=	1300	1125	W
Output power	W_o	=	4400	3375	W
Efficiency	η	=	77	75	%
Output power in the load	W_ℓ	=	3600	2800	W [1]

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

7Z2 3458

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

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

Frequency	f		up to	50	Mc/s
Anode voltage	V_a	=	max.	6300	V
Anode current	I_a	=	max.	670	mA
Anode input power	W_{ia}	=	max.	4000	W
Anode dissipation	W_a	=	max.	800	W
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	270	mA
Grid current, unloaded	I_g	=	max.	400	mA
Grid circuit resistance	R_g	=	max.	10	kΩ

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

Frequency	f	=	50	50	Mc/s
Anode voltage	V_a	=	5400	4500	V
Anode current, loaded	I_a	=	530	600	mA
Anode current, unloaded	I_a	=	100	120	mA
Grid current, loaded	I_g	=	140	150	mA
Grid current, unloaded	I_g	=	240	260	mA
Grid resistor	R_g	=	3	2.5	kΩ
Load resistance	$R_{a\sim}$	=	5.4	3.8	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	13	15.5	%
Anode input power	W_{ia}	=	3520	3320	W
Anode dissipation	W_a	=	770	770	W
Output power	W_o	=	2750	2550	W
Efficiency	η	=	78	77	%
Output power in the load	W_ℓ	=	2250	2100	W [1]

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

7Z2 3459

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

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

Frequency	f		up to	50	Mc/s
Transformer voltage	V_{tr}	=	max.	5600	V_{RMS}
Anode current	I_a	=	max.	400	mA [1]
Anode input power	W_{ia}	=	max.	2250	W
Anode dissipation	W_a	=	max.	800	W
Negative grid voltage	$-V_g$	=	max.	1250	V [2]
Grid current, loaded	I_g	=	max.	160	mA [1]
Grid current, unloaded	I_g	=	max.	210	mA [1]
Grid circuit resistance	R_g	=	max.	10	kΩ

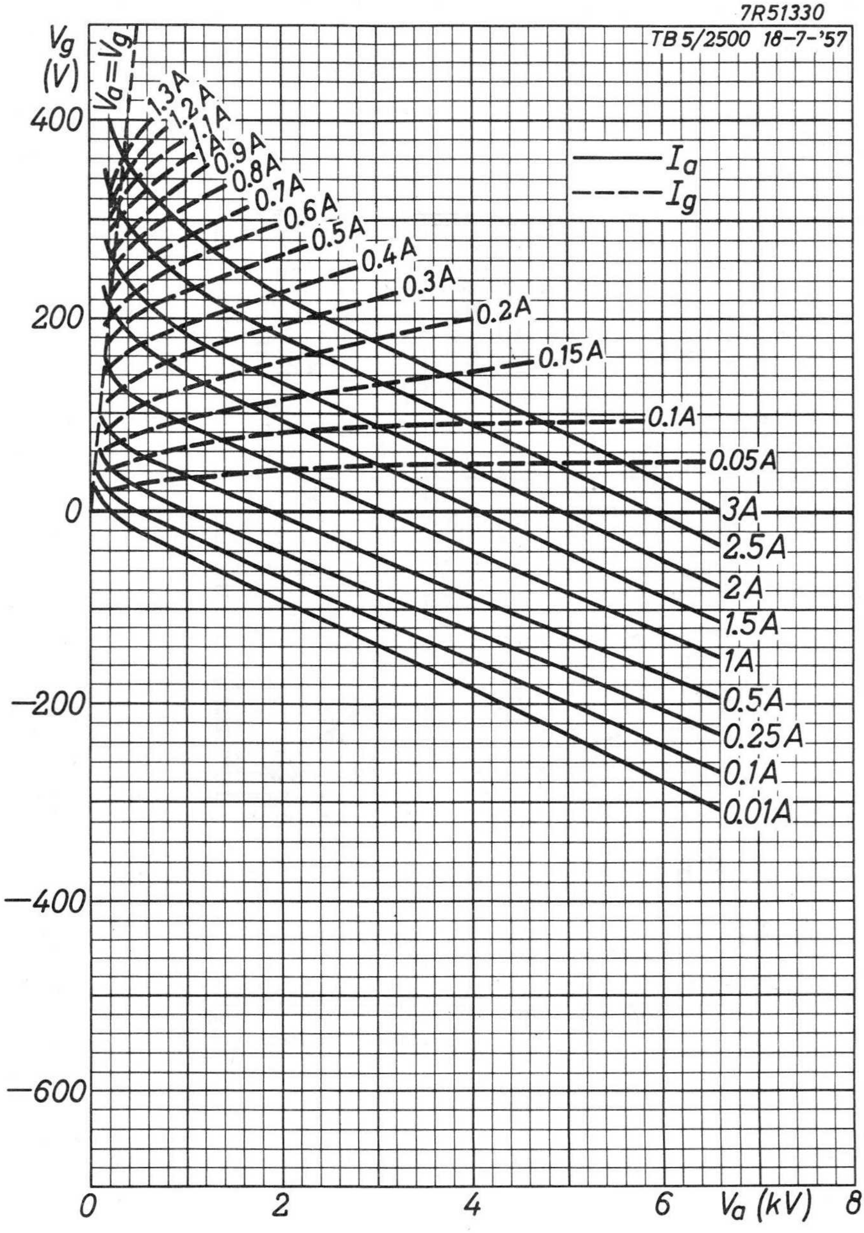
C.C.S. **OPERATING CONDITIONS**, continuous service

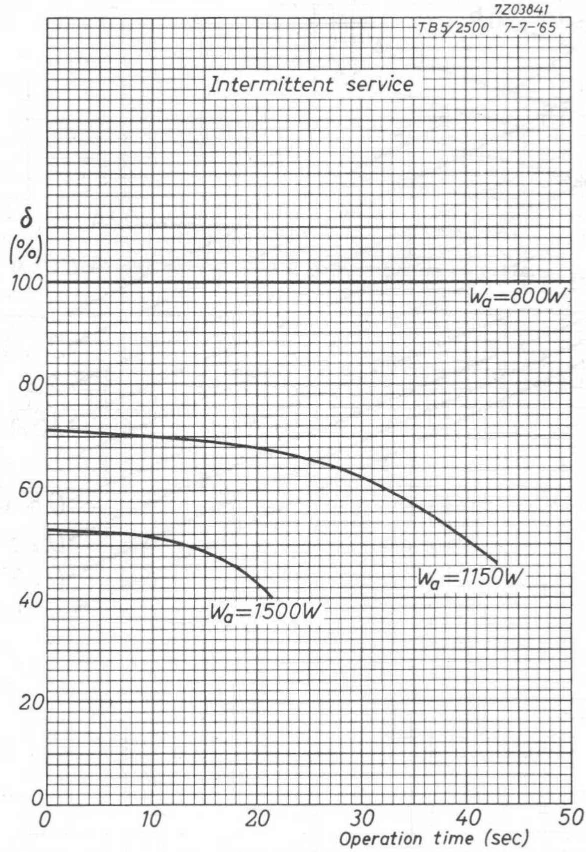
Recommended grid blocking capacitor: at high frequencies about 100 pF; at about 1 Mc/s about 1000 pF

Frequency	f	=	50	Mc/s
Transformer voltage	V_{tr}	=	5200	V_{RMS}
Anode current, loaded	I_a	=	360	mA [1]
Anode current, unloaded	I_a	=	90	mA [1]
Grid current, loaded	I_g	=	100	mA [1]
Grid current, unloaded	I_g	=	140	mA [1]
Grid resistor	R_g	=	1.8	kΩ
Load resistance	$R_{a\sim}$	=	3.2	kΩ
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	17	%
Anode input power	W_{ia}	=	2080	W
Anode dissipation	W_a	=	520	W
Output power	W_o	=	1560	W
Efficiency	η	=	75	%
Output power in the load	W_ℓ	=	1300	W [3]

1) Averaged over any mains frequency cycle
2) At peak of mains frequency sine-wave
3) Useful power in the load measured in a circuit having an efficiency of 85%.

7Z2 3460


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


7Z03841
TB5/2500 7-7-'65
Intermittent service
δ
(%)
100
80
60
40
20
0
W_a=800W
W_a=1150W
W_a=1500W
0
10
20
30
40
50
Operation time (sec)

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

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq. (Mc/s)	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 $^{+5\%}_{-10\%}$
Filament current	I_f	=	130	A
Cold filament resistance	R_{fo}	=	0.005	Ω

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

7Z2 8639

WATER COOLING CHARACTERISTICS

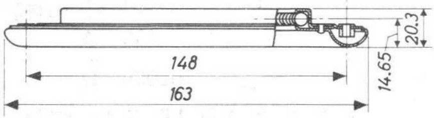
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
5	20	2.3	0.02	56
	50	4.6	0.07	68
10	20	4.5	0.06	55
	50	9.0	0.21	67
15	20	7.0	0.14	53
	50	14.0	0.45	66

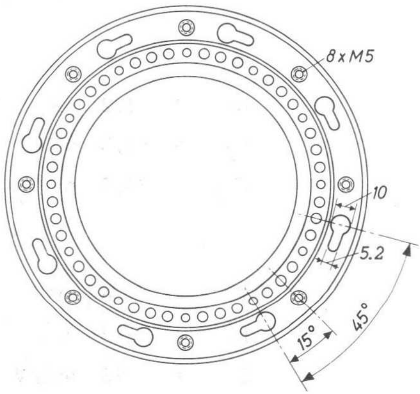
Water inlet temperature t_i = max. 50 °C

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

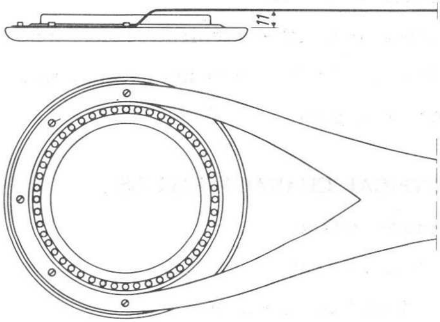
MECHANICAL DATA

Dimensions in mm





Grid connector 40664



Connection of the grid lead

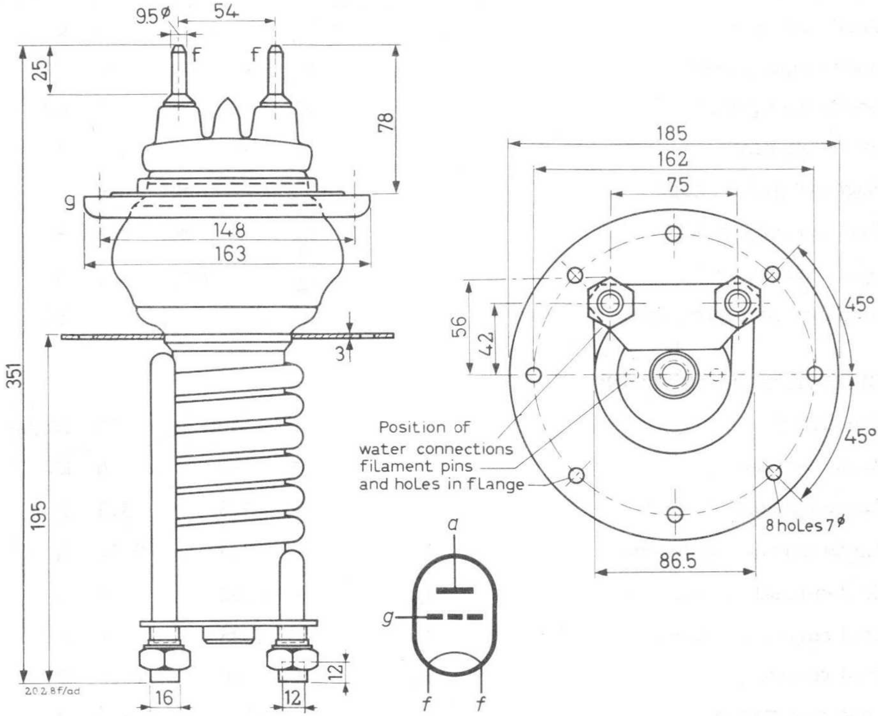
The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 Mc/s, the grid lead should be connected as shown in the figure at right

7Z2 3469

MECHANICAL DATA (continued) Dimensions in mm

Filament connectors with cable 40662 Net weight 3.8 kg

Grid connector 40664



Mounting position: vertical with anode down

7Z2 8640

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

LIMITING VALUES (Absolute limits)

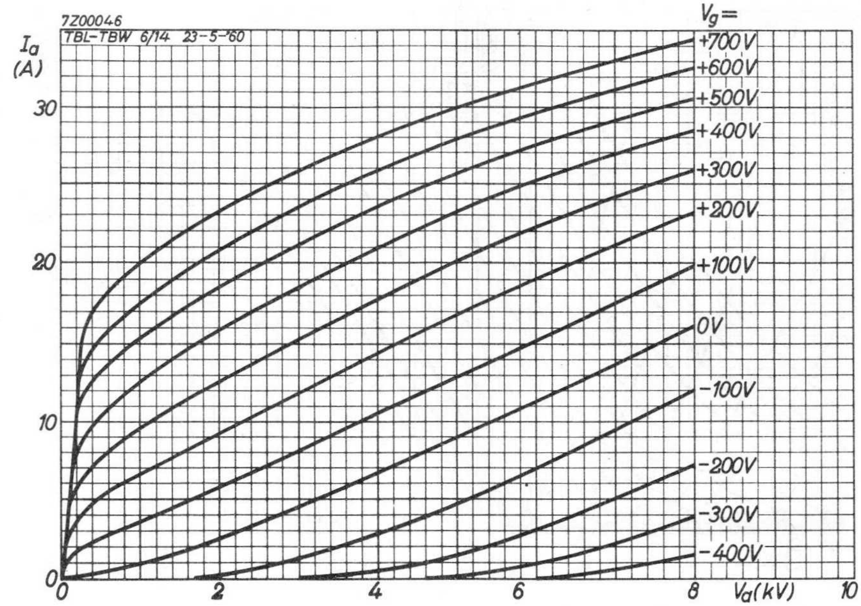
Frequency	f		up to	30	Mc/s
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	30	kW
Anode dissipation	W_a	=	max.	15	kW
Anode current	I_a	=	max.	4.0	A
Negative grid voltage	$-V_g$	=	max.	1600	V
Grid current, loaded	I_g	=	max.	1.5	A
Grid current, unloaded	I_g	=	max.	2.0	A
Grid circuit resistance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

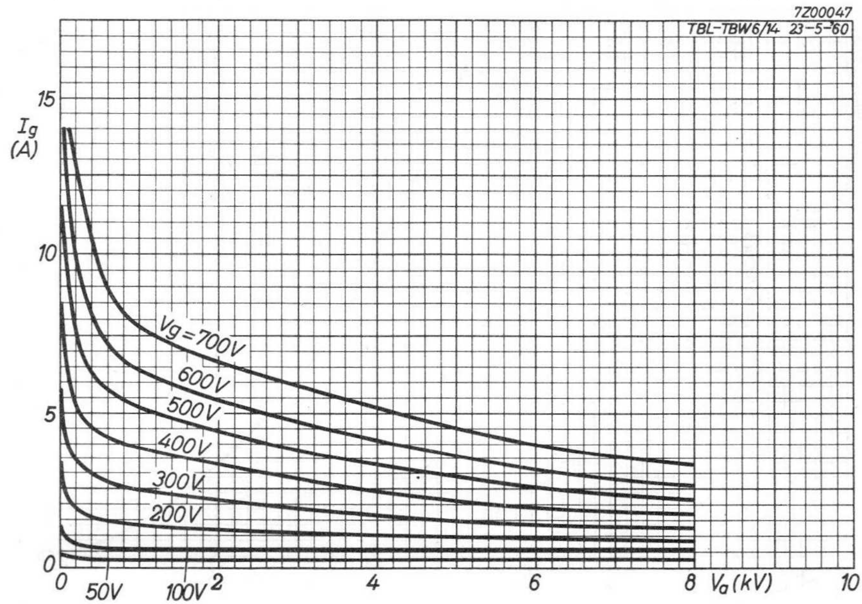
OPERATING CONDITIONS

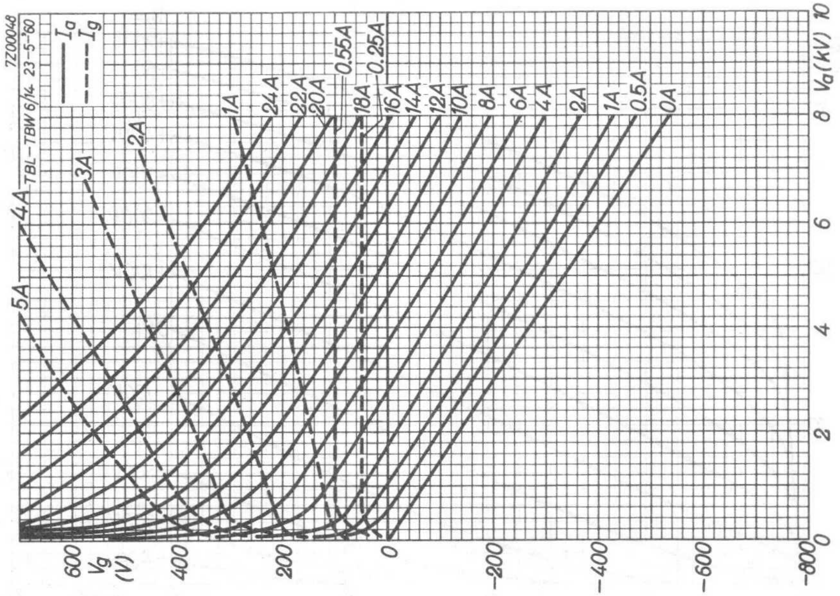
Frequency	f	=	30	30	Mc/s
Anode voltage	V_a	=	7	6	kV
Anode current, loaded	I_a	=	3.5	3.3	A
Anode current, unloaded	I_a	=	0.7	0.51	A
Grid current, loaded	I_g	=	0.95	0.8	A
Grid current, unloaded	I_g	=	1.35	1.1	A
Grid resistor	R_g	=	950	1000	Ω
Load resistance	$R_{a\sim}$	=	1000	870	Ω
Feedback ratio under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

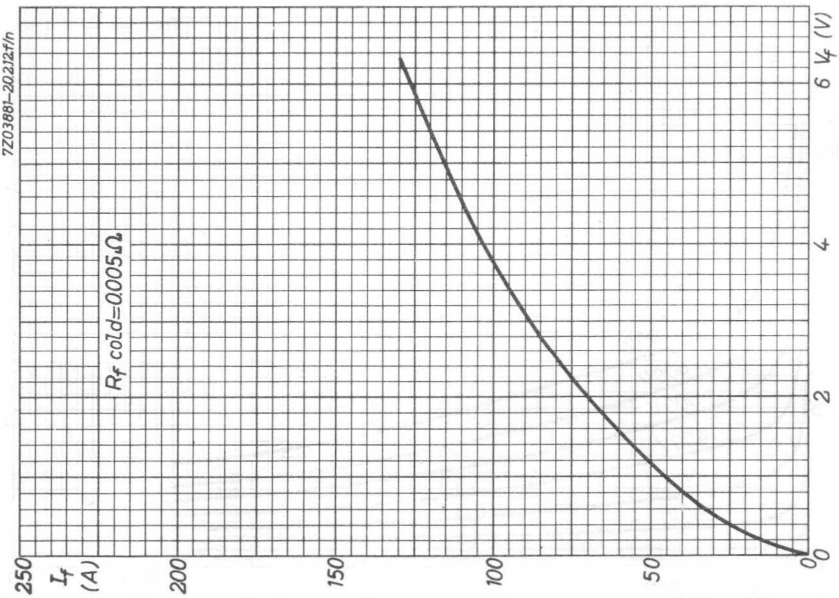
[1]) Useful power in the load, measured in a circuit having an efficiency of about 85%.

7Z2 3471


7Z00046
TBL-TBW 6/14 23-5-'60
I_a (A)
V_g =
+700V
+600V
+500V
+400V
+300V
+200V
+100V
0V
−100V
−200V
−300V
−400V
V_a (kV)
0
2
4
6
8
10
10
20
30


7Z00047
TBL-TBW6/14 23-5-'60
I_g (A)
Vg = 700V
600V
500V
400V
300V
200V
50V
100V
V_a (kV)
0
2
4
6
8
10
5
10
15


7Z00048
TBL-TBW 6/14 23-5-'60
Ia
Ig
5A
4A
3A
2A
1A
24A
22A
20A
0.55A
18A
0.25A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.5A
0A
Vg (V)
600
400
200
0
-200
-400
-600
-800
0
2
4
6
8
10
Va (kV)


7Z03881-20.2.12f/n
Rf cold=0.005Ω
If (A)
250
200
150
100
50
0
0
2
4
6
Vf (V)

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

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

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

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	12.6	V
Filament current	I_f	33	A

CAPACITANCES

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

1) Two tubes

7Z2 8641

TYPICAL CHARACTERISTICS

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

COOLING : Water and low velocity air flow

TEMPERATURE LIMITS (Absolute limits)

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

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm)	t_o (^oC)
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 ^oC and 50 ^oC the required quantity of water can be found by linear interpolation.

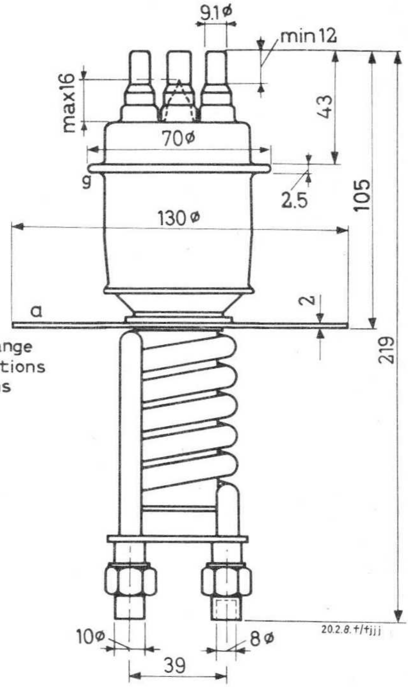
In general no air cooling will be required at ambient temperatures below 35 ^oC. At higher temperatures a low velocity air flow to the grid and filament seals will be necessary.

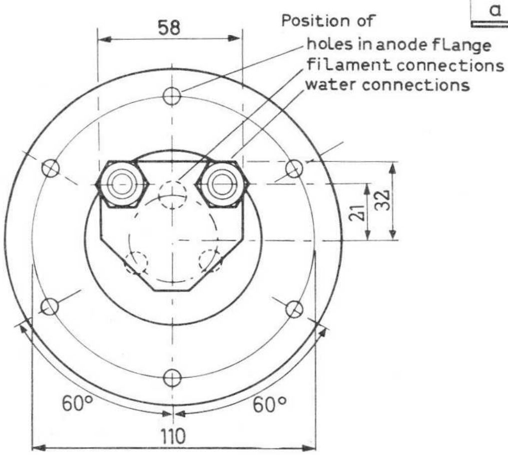
7Z2 8642

MECHANICAL DATA

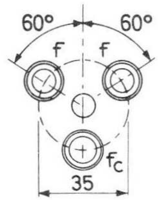
Dimensions in mm

Filament connectors	40634	
Grid connector	40622	
Net weight	0.8	kg





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



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

Mounting position: vertical with anode down

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

7Z2 8643

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

QUICK REFERENCE DATA		
Freq. (Mc/s)	Class C oscillator	
	V_a (kV)	W_o (kW)
50	6.0	6.0

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

7Z2 8644

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 frequencies up to 30 Mc/s 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.

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

ACCESSORIES

Filament connectors	40634
Connector for centre pin of the filament	40649
Grid connector	40650 or 40622

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

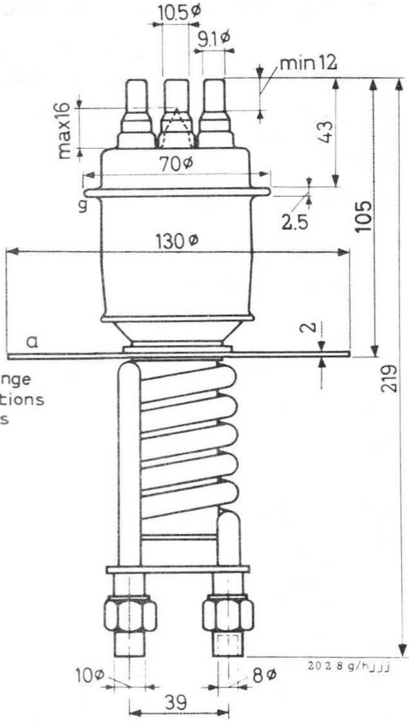
The grid connector 40650 must not be used at frequencies higher than 30 Mc/s.

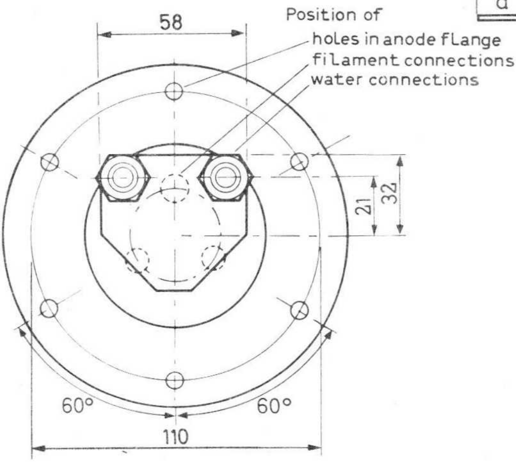
7Z2 8645

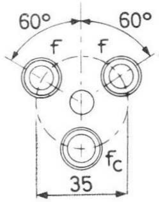
MECHANICAL DATA

Dimensions in mm

Net weight 0.8 kg







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

Mounting position: Vertical with anode down

7Z2 3529

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

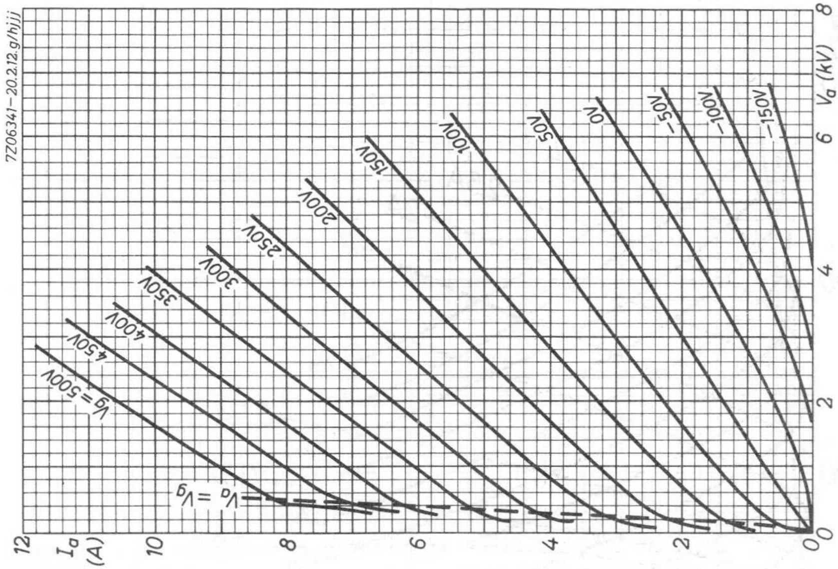
LIMITING VALUES (Absolute limits)

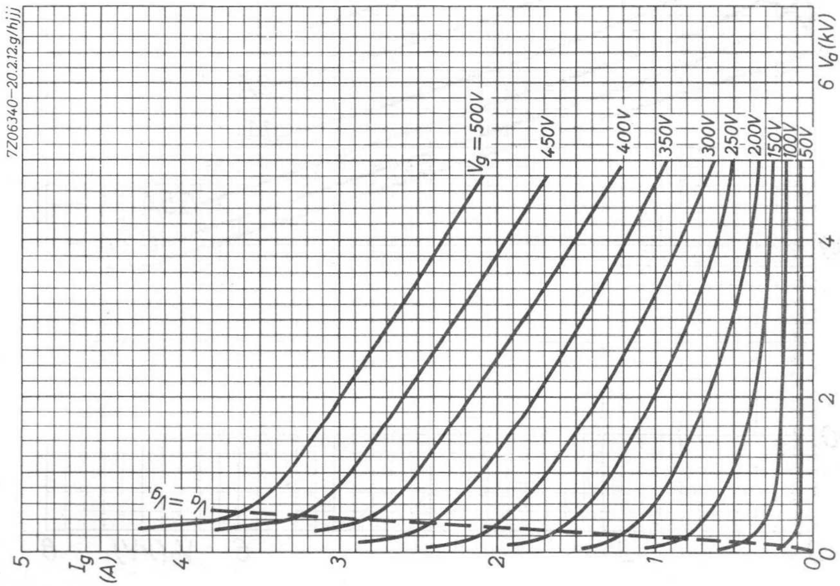
Frequency	f		up to	55	Mc/s
Anode voltage	V_a	=	max.	7	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	1.8	A
Grid current, loaded	I_g	=	max.	0.5	A
Grid current, unloaded	I_g	=	max.	0.7	A
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid resistor	R_g	=	max.	10	kΩ

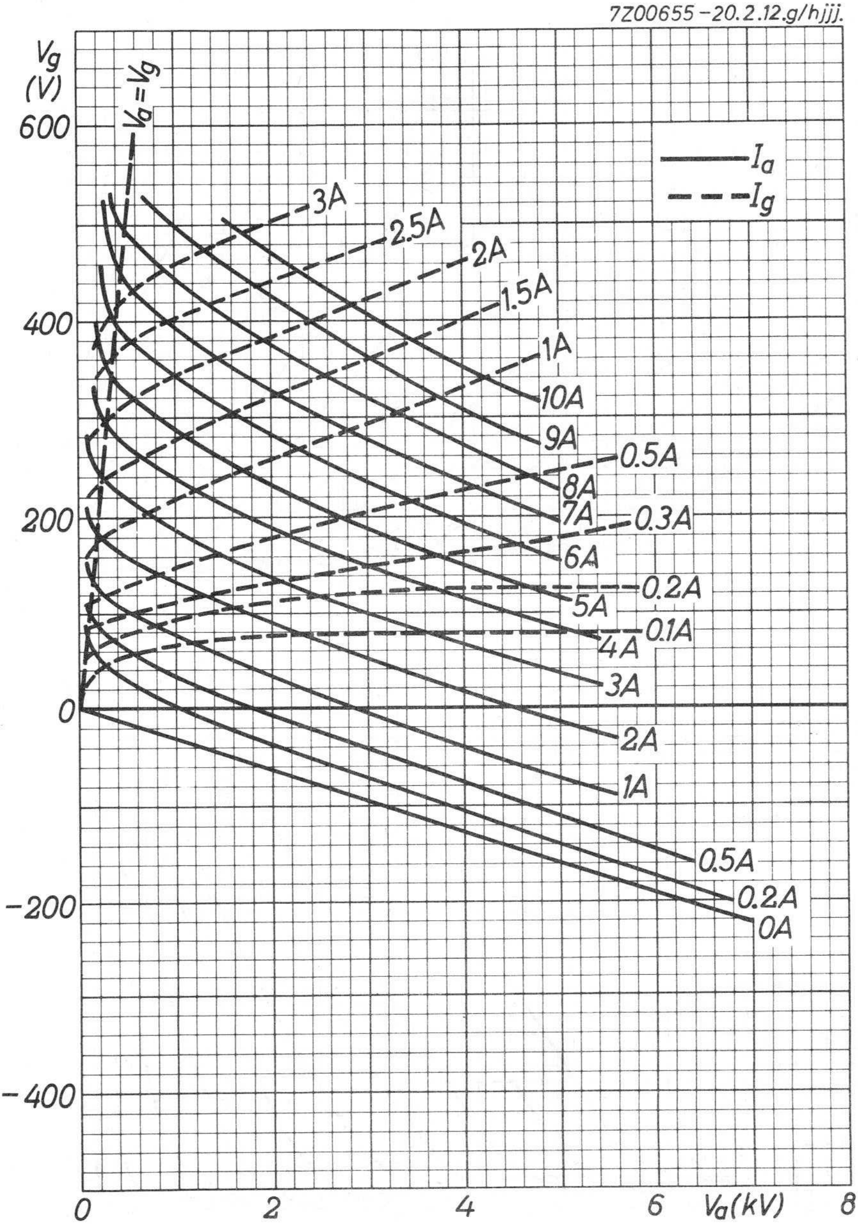
OPERATING CONDITIONS

Frequency	f	=	50	Mc/s
Transformer voltage	V_{tr}	=	5.1	kV_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A
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
Efficiency	η	=	67	%

7Z2 3530


7Z06341−20.2.12.g/hjjj
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
$V_a = V_g$
I_a (A)
V_a (kV)
0
2
4
6
8
10
12


7Z06340−20.2.12.g/hjjj
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
$V_a = V_g$
I_g (A)
V_a (kV)
0
1
2
3
4
5
6


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

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

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

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V	+5 % -10 %
Filament current	I_f	=	33	A	

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Useful power in the load

7Z2 8646

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 ^oC

Temperature of the seals = max. 220 ^oC

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm)	t_o (^oC)
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 ^oC 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.

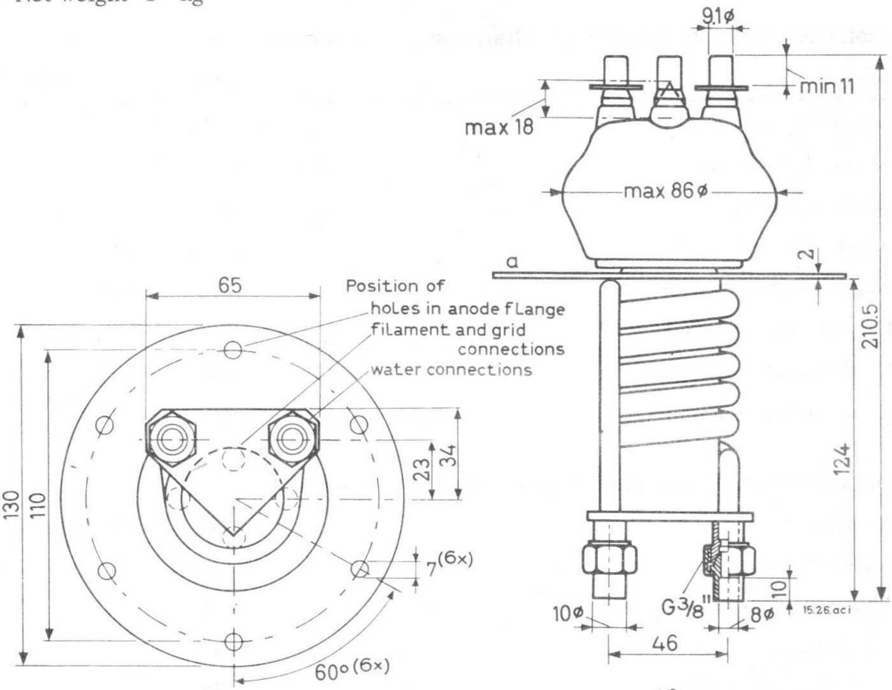
At frequencies above 4 MHz both grid terminals should be connected in parallel and care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive temperatures.

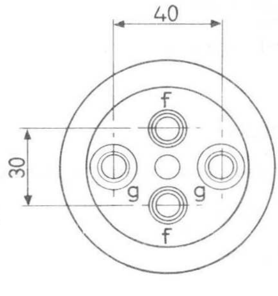
7Z2 3545

MECHANICAL DATA

Dimensions in mm

Net weight 1 kg





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

Mounting position: vertical with anode down

7Z2 3546

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

LIMITING VALUES (Absolute limits), continuous service

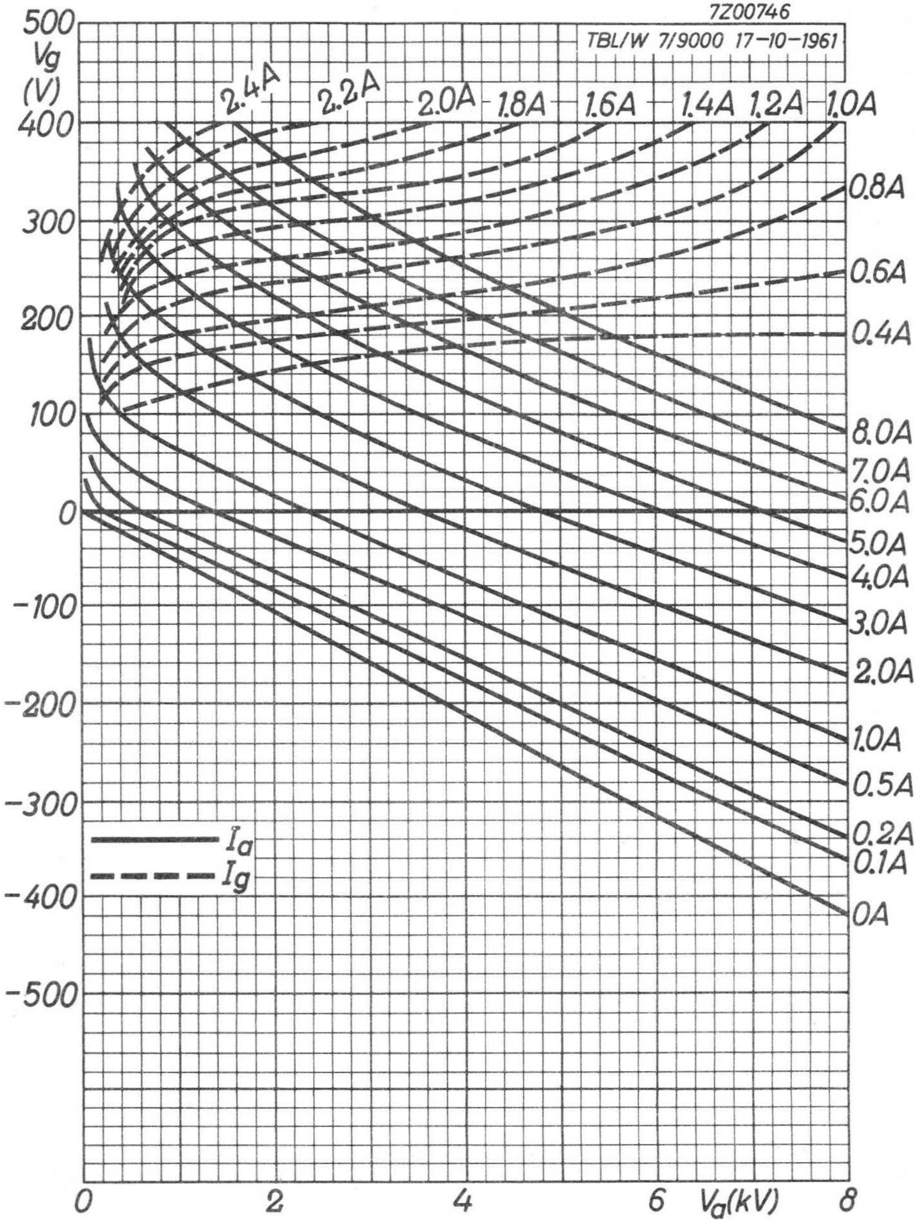
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance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

OPERATING CHARACTERISTICS , continuous service

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

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

7Z2 3540


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

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

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

7Z2 8647

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	= max.	50	^oC
Temperature off all seals		= max.	220	^oC

WATER COOLING CHARACTERISTICS

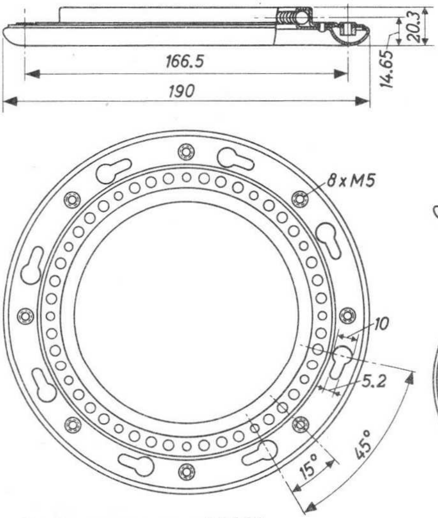
W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.50
20	20	9.3	0.30
	50	18.6	1.0

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

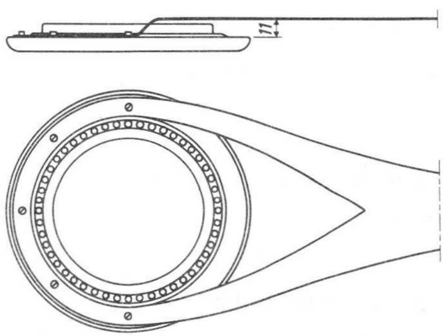
Generally a low velocity air flow to the seals is required

MECHANICAL DATA

Dimensions in mm



Grid connector 40663



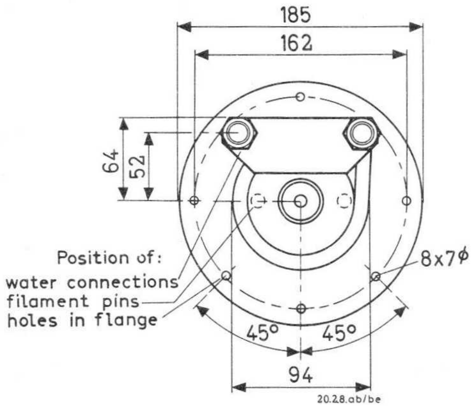
Connection of the grid lead

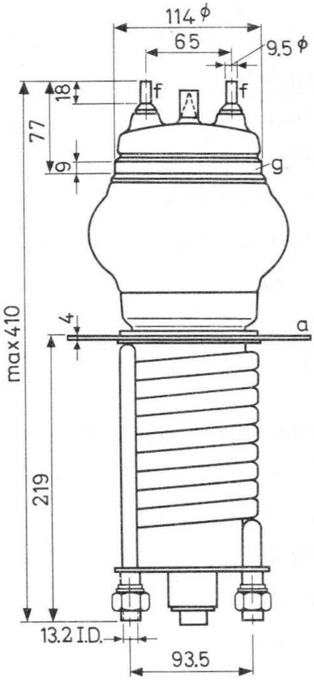
The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown at right.

7Z2 3556

MECHANICAL DATA (continued) Dimensions in mm

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





Mounting position: vertical with anode down

7Z2 8648

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

LIMITING VALUES (Absolute limits)

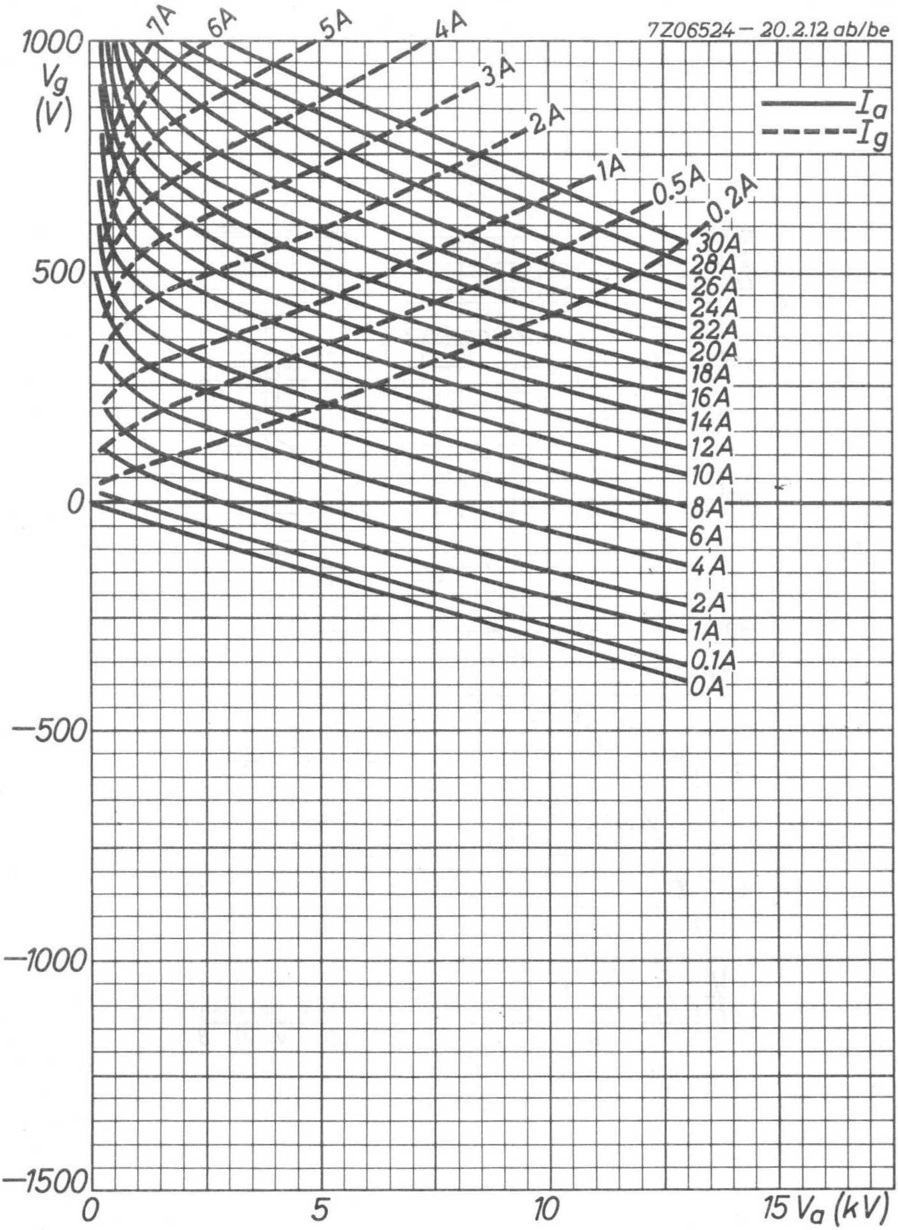
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	20	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

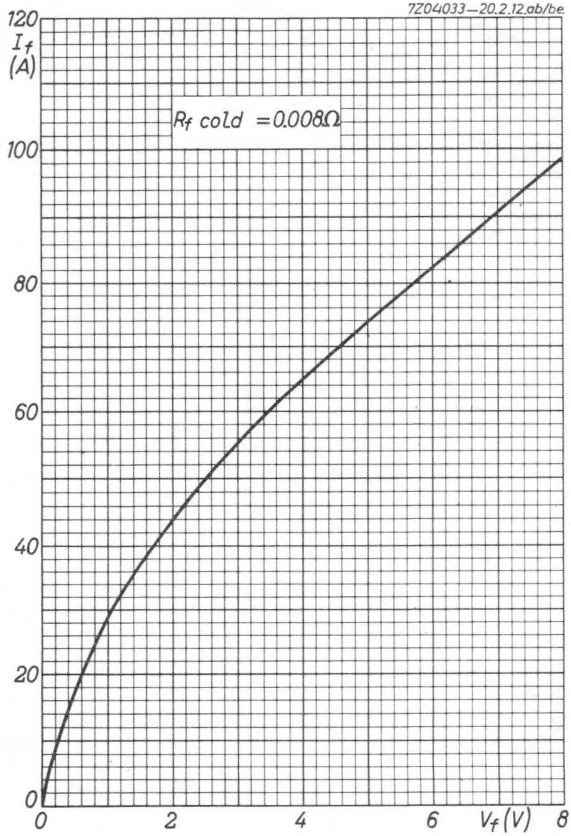
OPERATING CONDITIONS

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

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

7Z2 3554


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


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

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

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

Water inlet temperature t_i = max. 50 °C

7Z2 8649

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

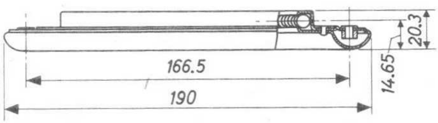
WATER COOLING CHARACTERISTICS

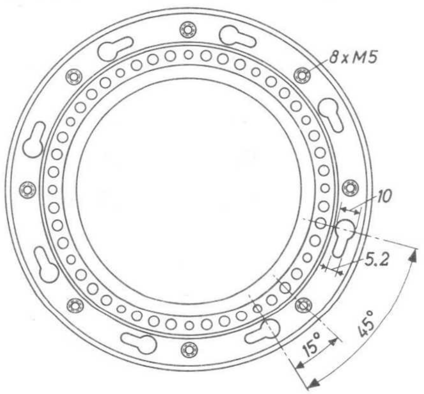
W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.5
20	20	9.3	0.3
	50	18.6	1.0

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

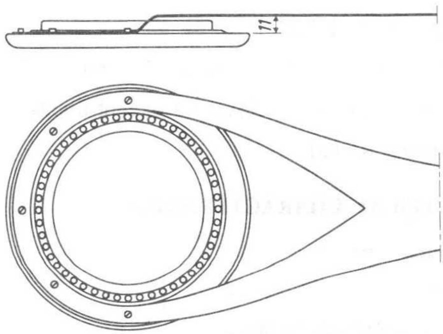
MECHANICAL DATA

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.

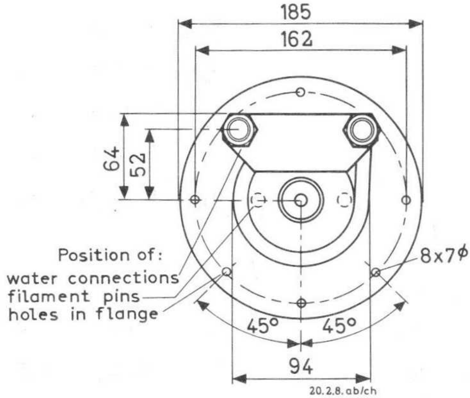
7Z2 3567

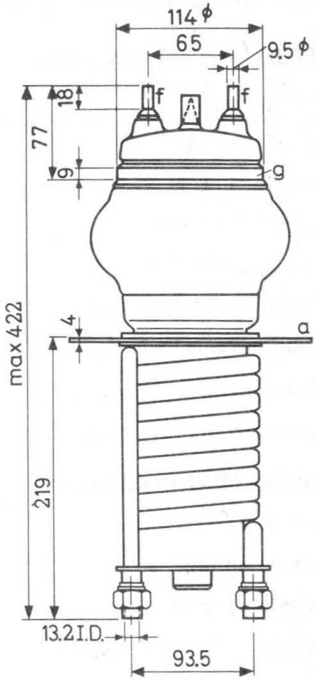
MECHANICAL DATA (continued) Dimensions in mm

Connectors with cable for filament : 40662

Grid connector 40663

Net weight : 5.4 kg





Mounting position: vertical with anode down

7Z2 8650

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

LIMITING VALUES (Absolute limits)

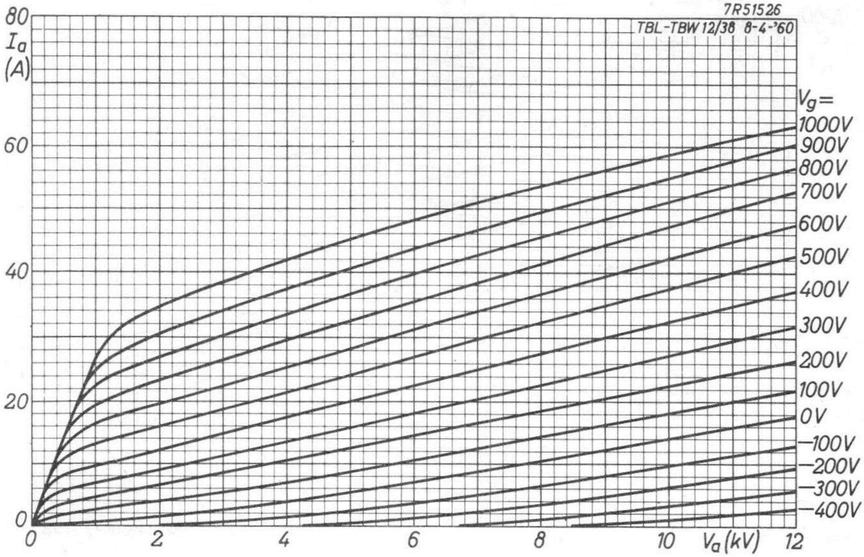
Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	13	kV
Anode current	I_a	= max.	5	A
Anode dissipation	W_a	= max.	20	kW
Anode input power	W_{ia}	= max.	60	kW
Negative grid voltage	$-V_g$	= max.	2	kV
Grid current, loaded	I_g	= max.	1.5	A
Grid current, unloaded	I_g	= max.	2.0	A
Grid circuit resistance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

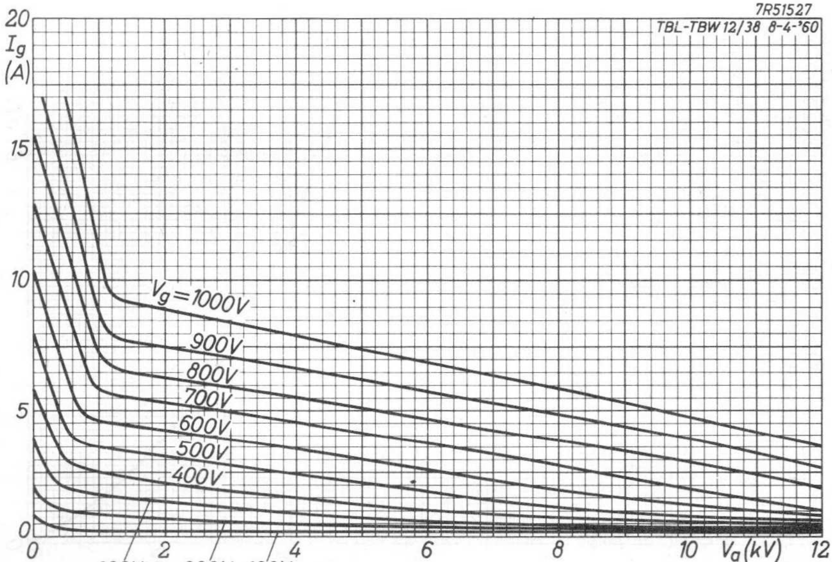
OPERATING CONDITIONS

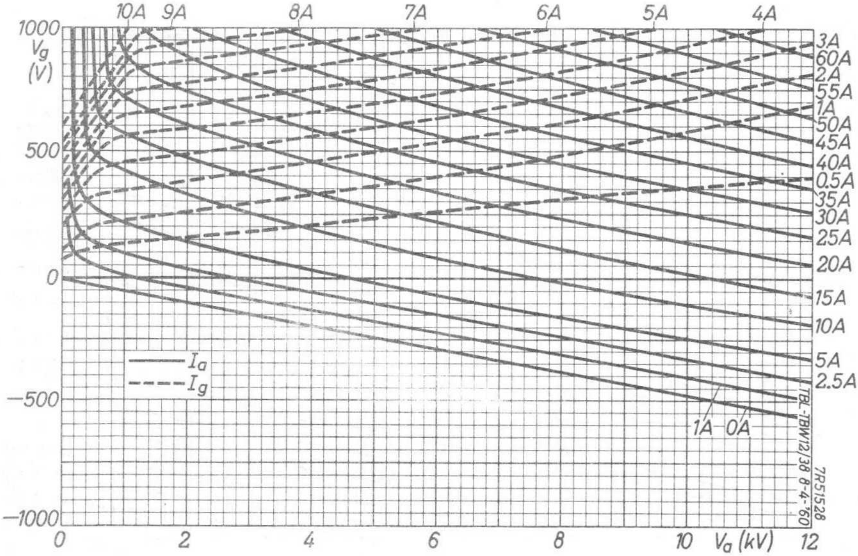
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	4.5	4.5	4.5	A
Anode current, unloaded	I_a	=	0.65	0.63	0.62	A
Grid current, loaded	I_g	=	0.9	0.9	0.9	A
Grid current, unloaded	I_g	=	1.22	1.3	1.35	A
Grid resistor	R_g	=	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	=	1450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

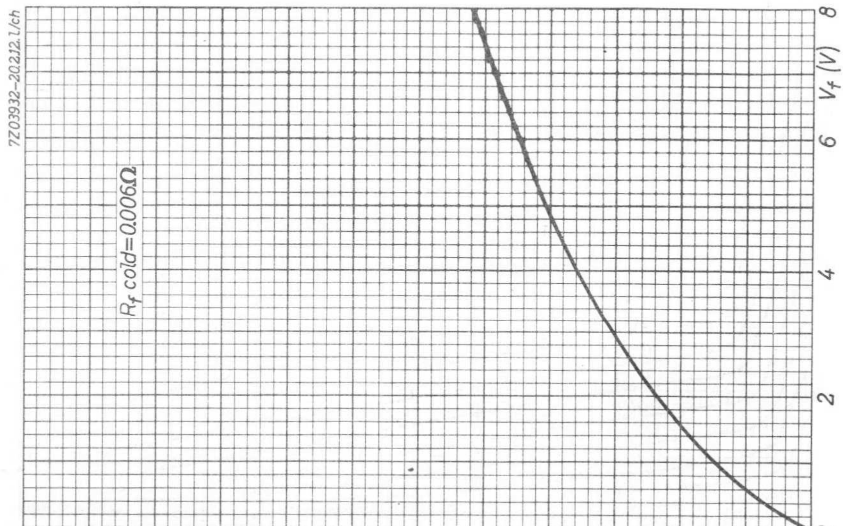
[1]) Useful power in the load, measured in a circuit having an efficiency of about 85%.

7Z2 3565


7R51526
TBL-TBW 12/38 8-4-'60
80
I_a
(A)
60
40
20
0
V_g=
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
0
2
4
6
8
10
V_a(kV)
12


7R51527
TBL-TBW 12/38 8-4-'60
20
I_g
(A)
15
10
5
0
V_g=1000V
900V
800V
700V
600V
500V
400V
0
2
4
6
8
10
V_a(kV)
12
300V
200V
100V


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


7Z03932-20.2.12.1/ch
R_f cold=0.006Ω
V_f (V)
8
6
4
2
0
300
I_f (A)
250
200
150
100
50
0

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

QUICK REFERENCE DATA									
General purposes									
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C an.mod.		B mod. 1)	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
20	15	12	108	12	51.5	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_f	=	0.012	Ω

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

7Z2 8651

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	-	27	
Mutual conductance	S	=	92	50	mA/V

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature	t_i	=	max.	50	^oC
Temperature of seals		=	max.	180	^oC

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	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 ^oC the required quantity of water can be found by linear interpolation.

At frequencies below 6 MHz forced air cooling of the seals will, as a rule, not be necessary. Above 6 MHz air cooling must be used to keep the anode and grid seal temperatures below 180 ^oC. This air flow must be started upon or before the application of the filament voltage.

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

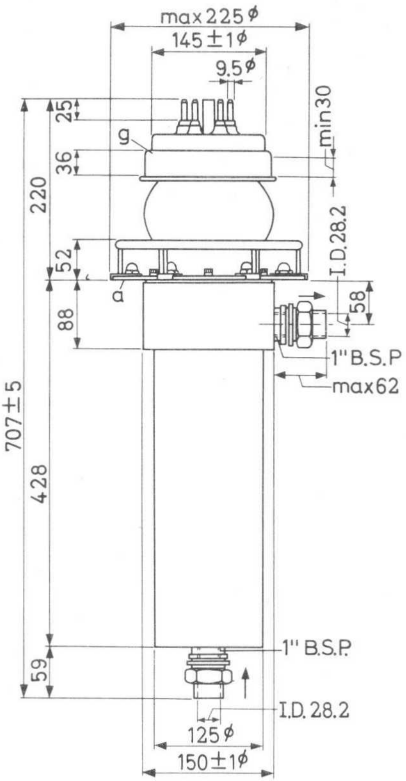
Care should be taken to ensure firm contact of the filament terminals in order to obtain equal distribution of current over these terminals.

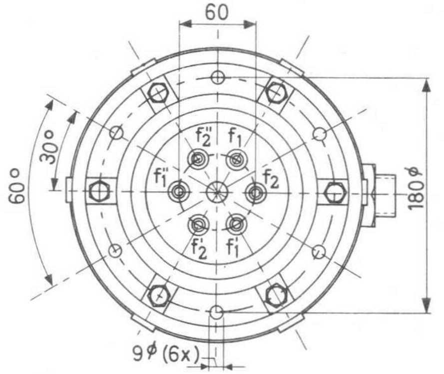
7Z2 3593

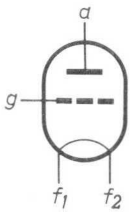
MECHANICAL DATA

Dimensions in mm

Filament connector	40628
Net weight of tube	19 kg







Mounting position: vertical with anode down

For further data and curves please refer to TBW12/100

7Z2 3594

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

7Z2 3796

AIR COOLING CHARACTERISTICS

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

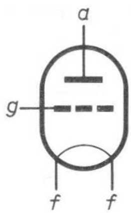
Temperature of envelope = max. 200 °C

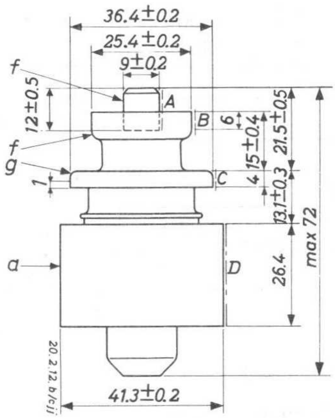
Generally it will be necessary to direct an air flow to the centre filament seal.

MECHANICAL DATA

Dimensions in mm

Net weight: 143 g





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

Mounting position: vertical with anode up or down

7Z2 3797

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

7Z2 3798

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

[1]) With respect to cathode

[2]) Partially fixed bias

7Z2 3799

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

[2]) Measured by a calorimetric method

7Z2 3800

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

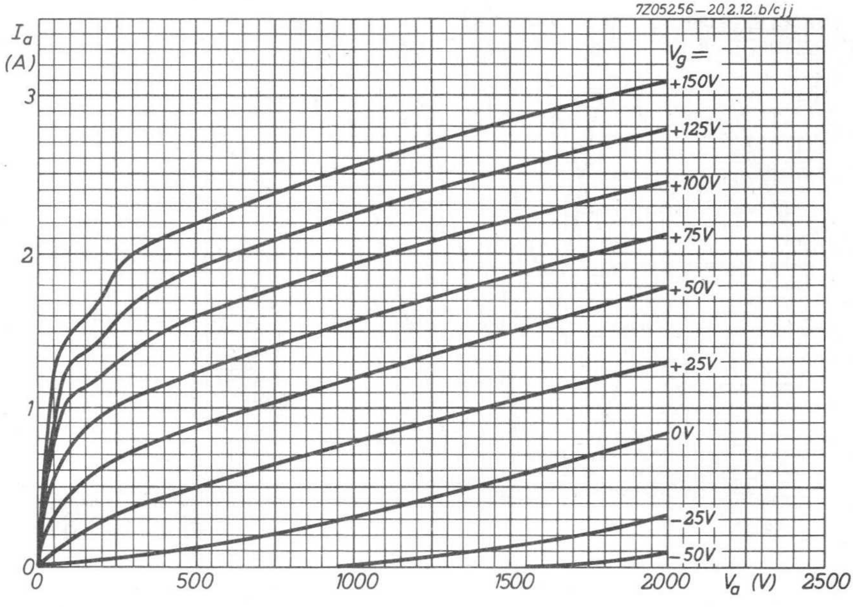
LIMITING VALUES (Absolute limits)

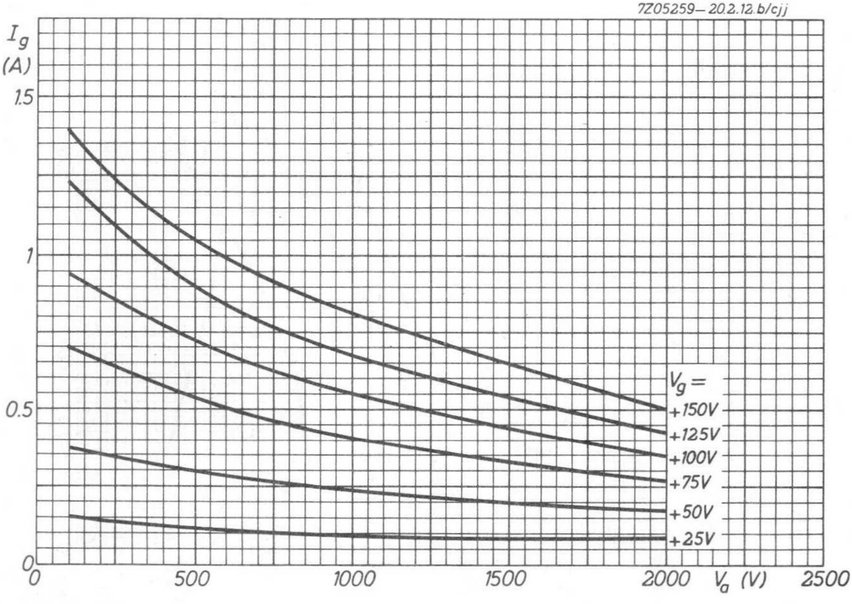
Frequency	f	up to	470	MHz
Anode voltage	V_a	= max.	1800	V
Anode current	I_a	= max.	400	mA
Anode input power	W_{i_a}	= max.	700	W
Anode dissipation	W_a	= max.	300	W
Negative grid voltage	$-V_g$	= max.	300	V
Grid current, loaded	I_g	= max.	110	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance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

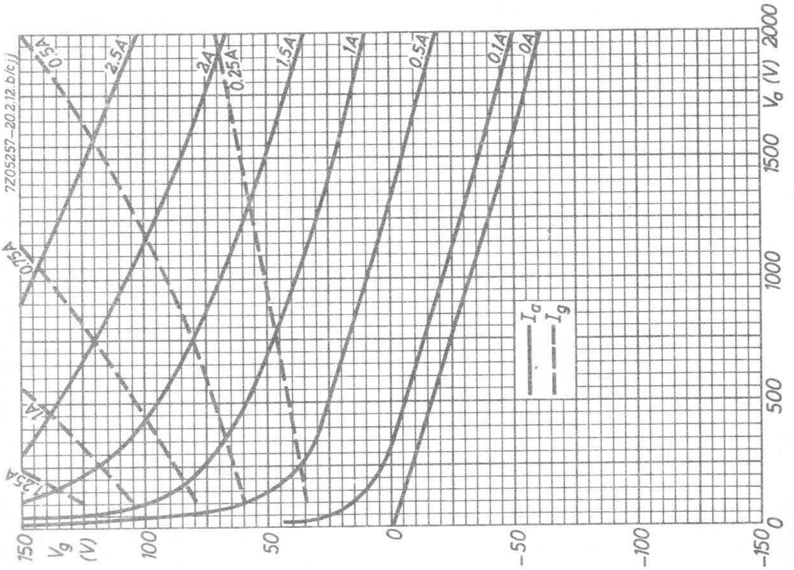
OPERATING CONDITIONS

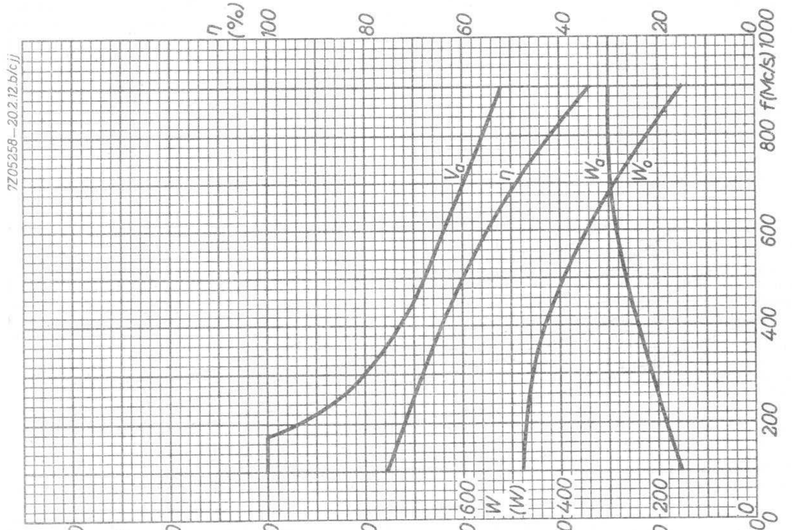
Frequency	f	=	470	MHz
Anode voltage	V_a	=	1750	V
Anode current, loaded	I_a	=	340	mA
Anode current, unloaded	I_a	=	170	mA
Grid current, loaded	I_g	=	95	mA
Grid current, unloaded [1]	I_g	=	100	mA
Grid circuit resistance under matched conditions	R_g	=	1000	Ω
Anode input power	W_{i_a}	=	595	W
Anode dissipation	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.   7Z2 3801


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


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


7Z05257-20.2.12.b/cjj
I_a
I_g
V_g (V)
V_a (V)
2.5A
2A
1.5A
1A
0.5A
0.1A
0A
0.5A
0.25A
0.75A
1A
1.25A
150
100
50
0
−50
−100
−150
0
500
1000
1500
2000


7Z05258-20.2.12.b/cjj
V_a (V)
η (%)
W (W)
f(Mc/s)
V_a
η
W_a
W_o
3500
3000
2500
2000
1500
1000
500
0
600
400
200
0
100
80
60
40
20
0
200
400
600
800
1000

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

7Z2 3802

TEMPERATURE LIMITS (Absolute limits)

Temperature of seal between filament terminals	= max. 200 °C
Temperature of other seals	= max. 250 °C

COOLING CHARACTERISTICS

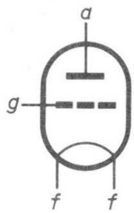
W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
400	0	45	0.65	12
	1500	35	0.65	12
	3000	25	0.65	12

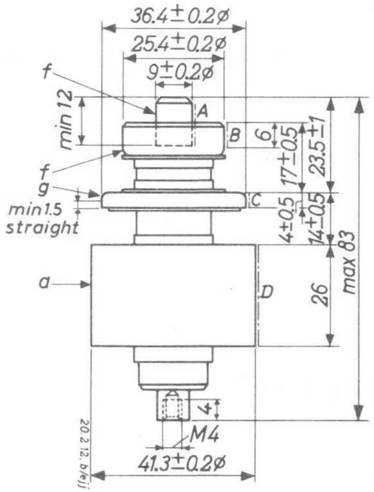
The required quantity of air is independent of the anode dissipation and the frequency.

MECHANICAL DATA

Dimensions in mm

Net weight: 157 g





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

Mounting position: vertical with the anode up or down.

7Z2 3803

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

7Z2 3804

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

7Z2 3805

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

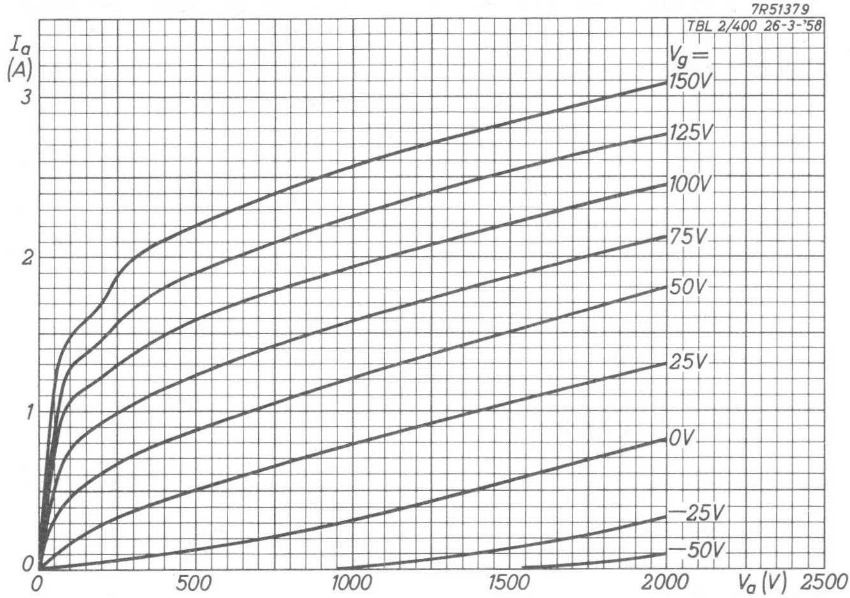
OPERATING CHARACTERISTICS

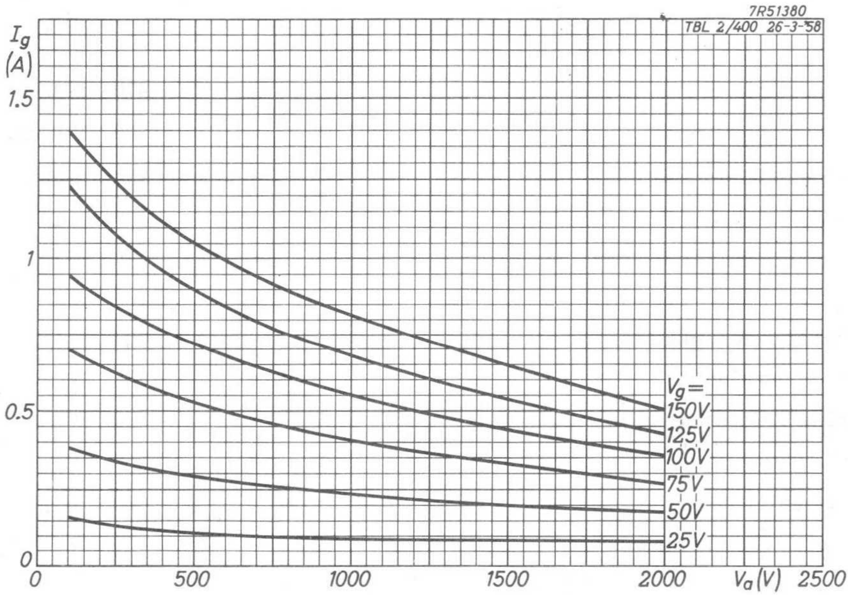
Voltages with respect to cathode

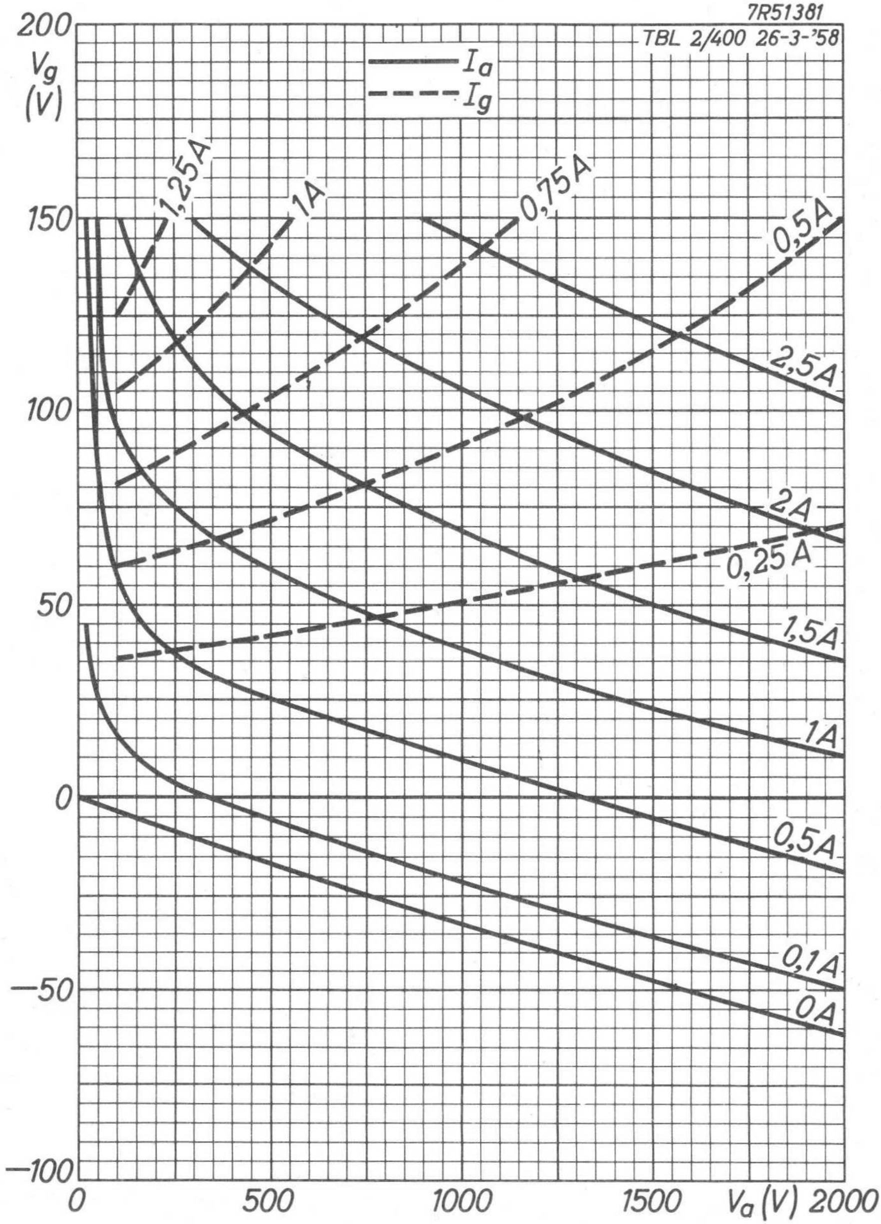
Frequency	f	=	470	MHz
Transformer voltage	V_{tr}	=	1800	V(RMS)
Anode current, loaded	I_a	=	190	mA
Anode current, unloaded	I_a	=	110	mA
Grid current, loaded	I_g	=	70	mA
Grid current, unloaded	I_g	=	100	mA
Grid circuit resistance	R_g	=	400	Ω
Anode input power	W_{i_a}	=	380	W
Anode dissipation	W_a	=	150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

7Z2 3806

TBL2/400


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


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


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

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

7Z2 3833

TEMPERATURE LIMITS (Absolute limits)

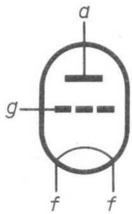
Temperature of envelope = max. 200 °C

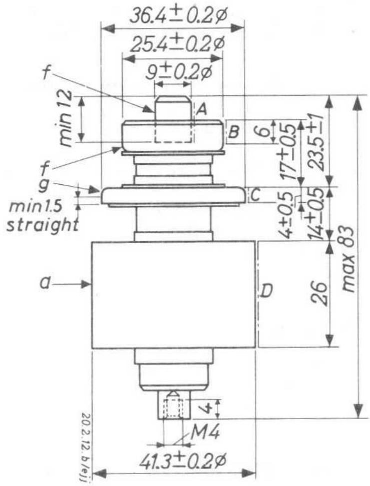
COOLING CHARACTERISTICS

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

MECHANICAL DATA Dimensions in mm

Net weight: 157 g





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

Mounting position: vertical with the anode up or down

7Z2 3834

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

LIMITING VALUES (Absolute limits)

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

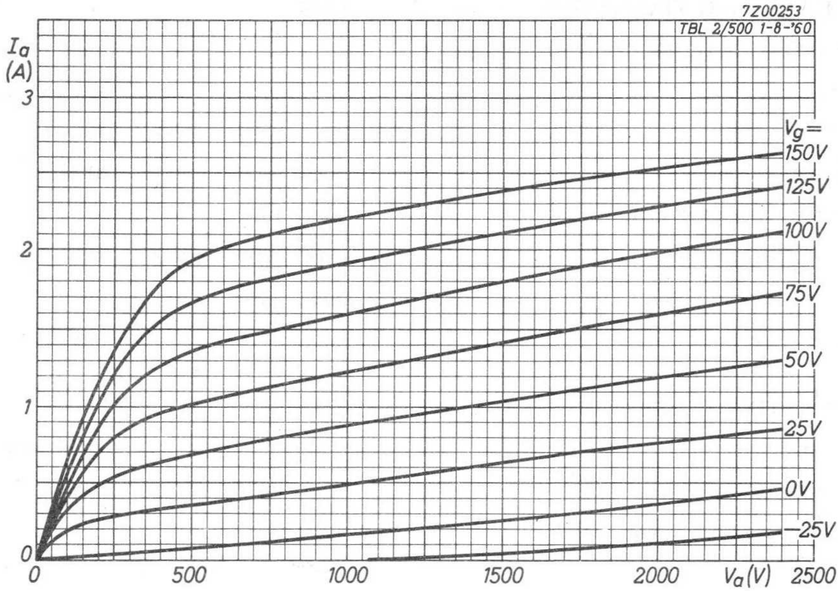
OPERATING CONDITIONS in grounded grid circuit

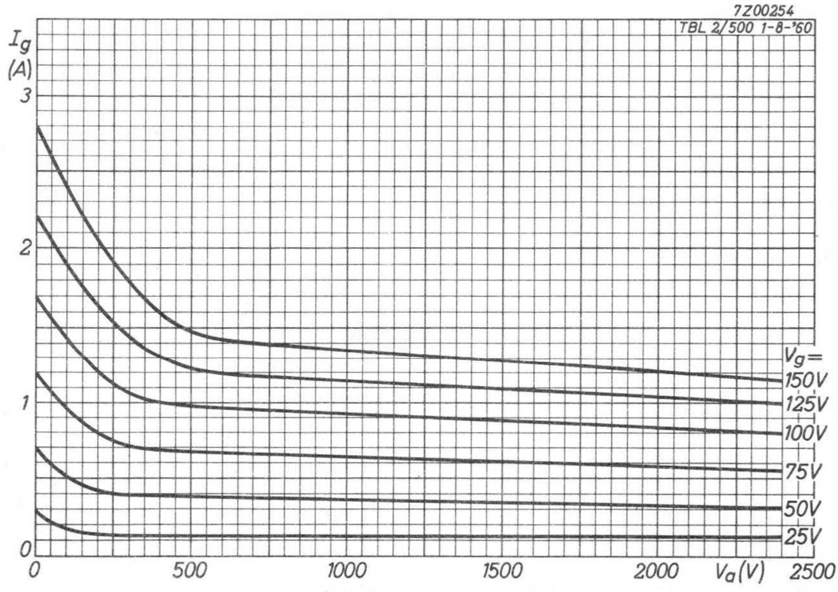
Frequency	f	=	400	625	MHz
Anode voltage	V_a	=	2500	2200	V
Negative grid voltage	$-V_g$	=	70	60	V
Anode current	I_a	=	380	380	mA
Grid current	I_g	=	160	170	mA
Grid input power	W_{i_g}	=	70	65	W
Anode input power	W_{i_a}	=	950	835	W
Anode dissipation	W_a	=	330	302	W
Tube output power	W_o	=	620+50	533+47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

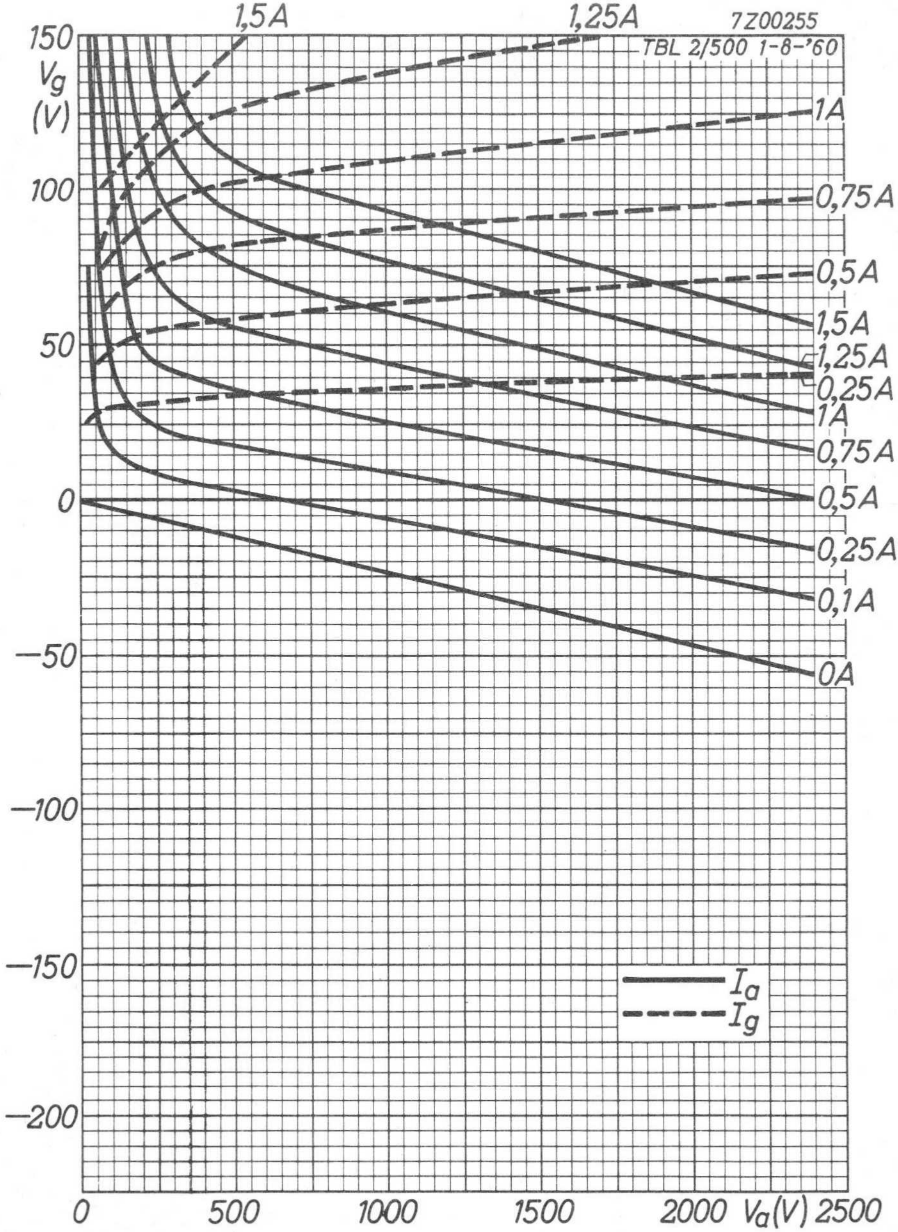
[1]) Power transferred from driving stage included

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

7Z2 3835


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


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


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

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	6.3	V	+5 % −10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_{fo}	=	0.005	Ω	

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

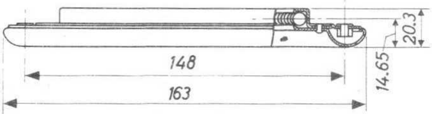
7Z2 8652

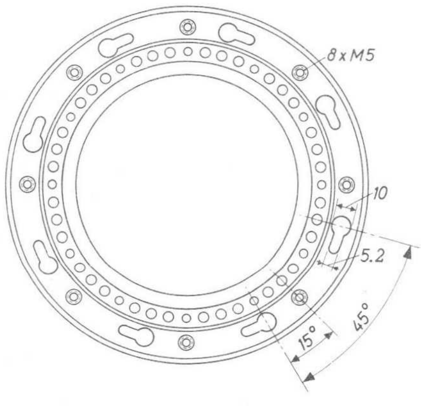
AIR COOLING CHARACTERISTICS

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

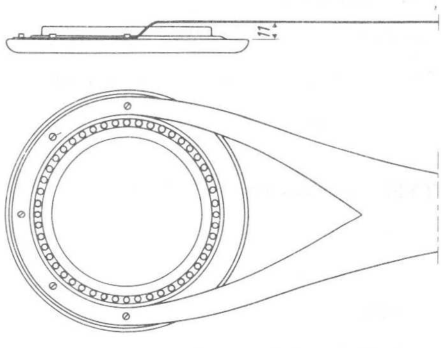
MECHANICAL DATA

Dimensions in mm





Grid connector 40664

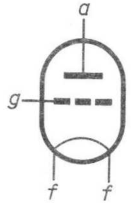


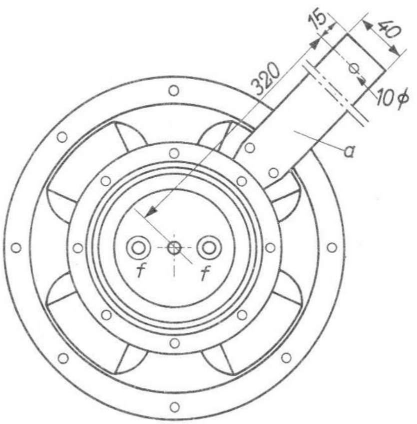
Connection of the grid lead

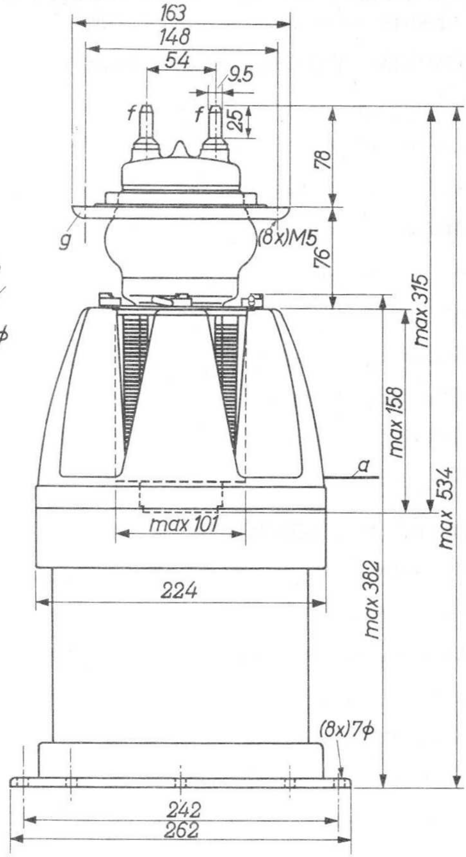
The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz , the grid lead should be connected as shown in the figure at right

7Z2 3463

MECHANICAL DATA (continued)







ACCESSORIES

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

Dimensions in mm

Mounting position: vertical with anode down

7Z2 8653

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.	10	kW [1]
Anode dissipation	W_a	=	max.	15	kW [2]
Anode current	I_a	=	max.	4.0	A
Negative grid voltage	$-V_g$	=	max.	1600	V
Grid current, loaded	I_g	=	max.	1.5	A
Grid current, unloaded	I_g	=	max.	2.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

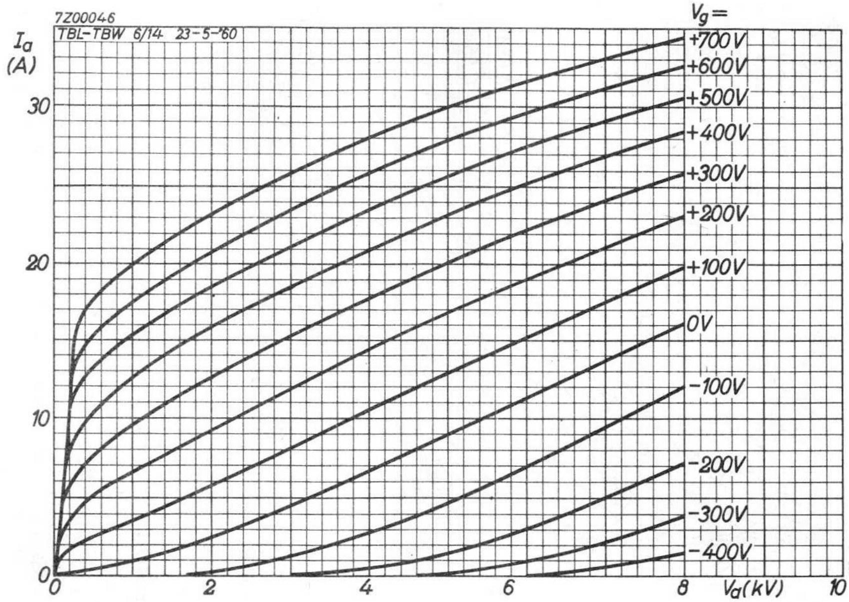
Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	7	6	kV
Anode current, loaded	I_a	=	3.5	3.3	A
Anode current, unloaded	I_a	=	0.7	0.51	A
Grid current, loaded	I_g	=	0.95	0.8	A
Grid current, unloaded	I_g	=	1.35	1.1	A
Grid resistor	R_g	=	950	1000	Ω
Load resistance	$R_{a\sim}$	=	1000	870	Ω
Feedback ratio under loaded conditions	$V_{g\sim}/V_{a\sim}$	=	25	26	%
Anode input power	W_{ia}	=	24.5	19.8	kW
Anode dissipation	W_a	=	6.8	5.5	kW
Output power	W_o	=	17.7	14.3	kW
Efficiency	η	=	72	72	%
Output power in the load	W_ℓ	=	14	11	kW [3]

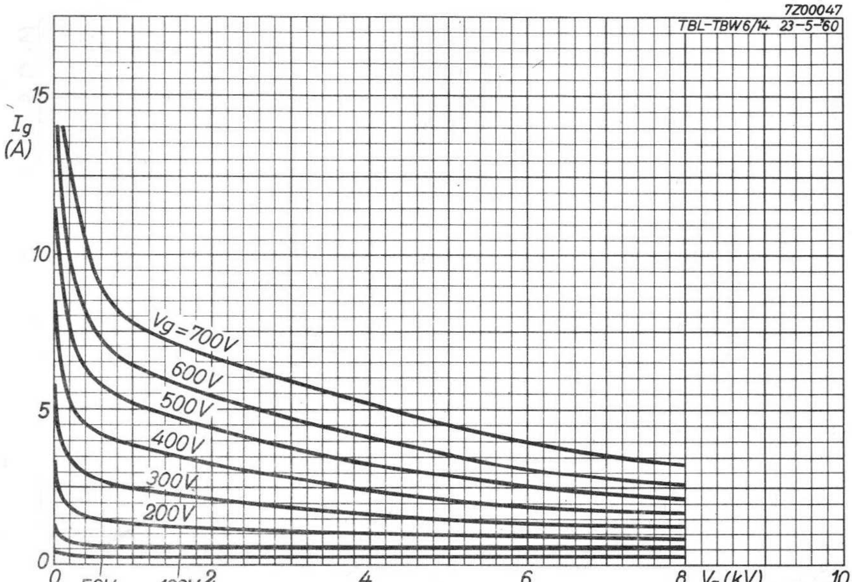
[1] Continuous service with adequate cooling.

[2] Intermittent service. See also page C.

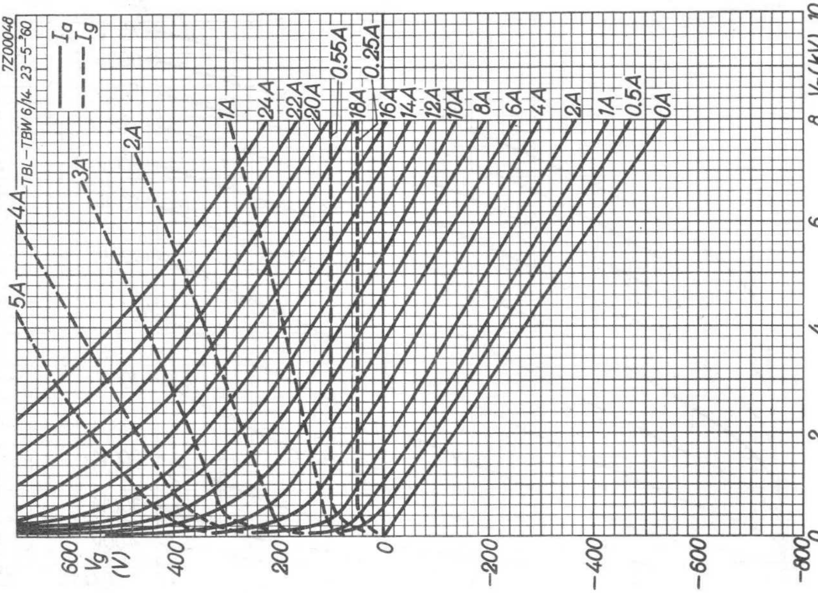
[3] Useful power in the load, measured in a circuit having an efficiency of about 85%.

7Z2 4047

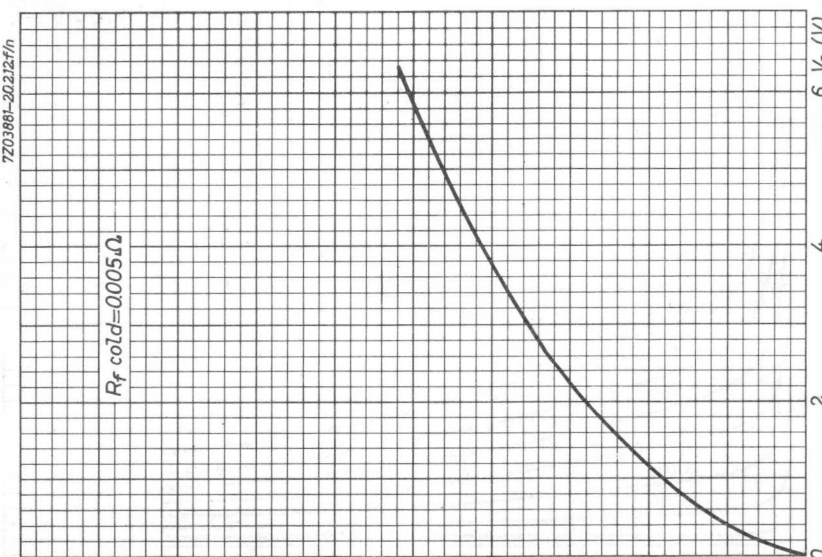

7Z00046
TBL-TBW 6/14 23-5-'60
I_a (A)
30
20
10
0
V_g=
+700V
+600V
+500V
+400V
+300V
+200V
+100V
0V
−100V
−200V
−300V
−400V
0
2
4
6
8
V_a(kV)
10


7Z00047
TBL-TBW6/14 23-5-'60
I_g (A)
15
10
5
0
Vg=700V
600V
500V
400V
300V
200V
0
50V
100V
2
4
6
8
V_a(kV)
10

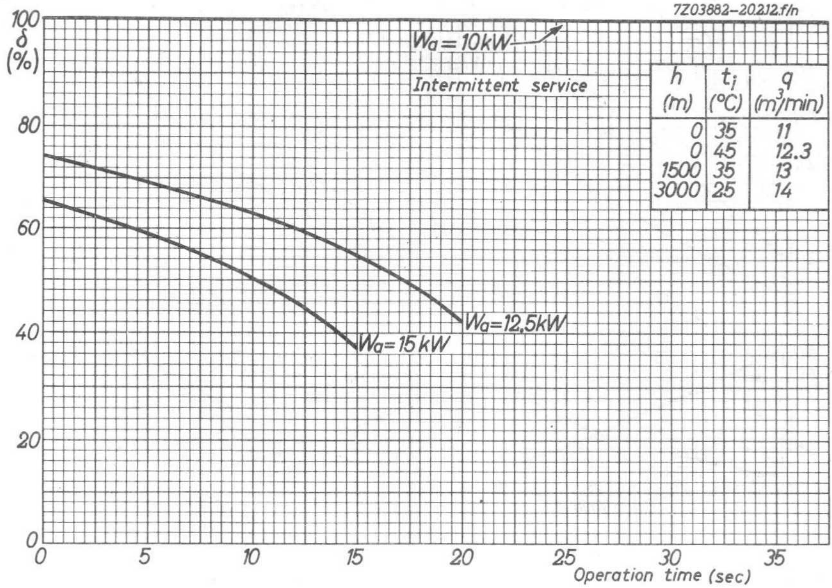
TBL6/14

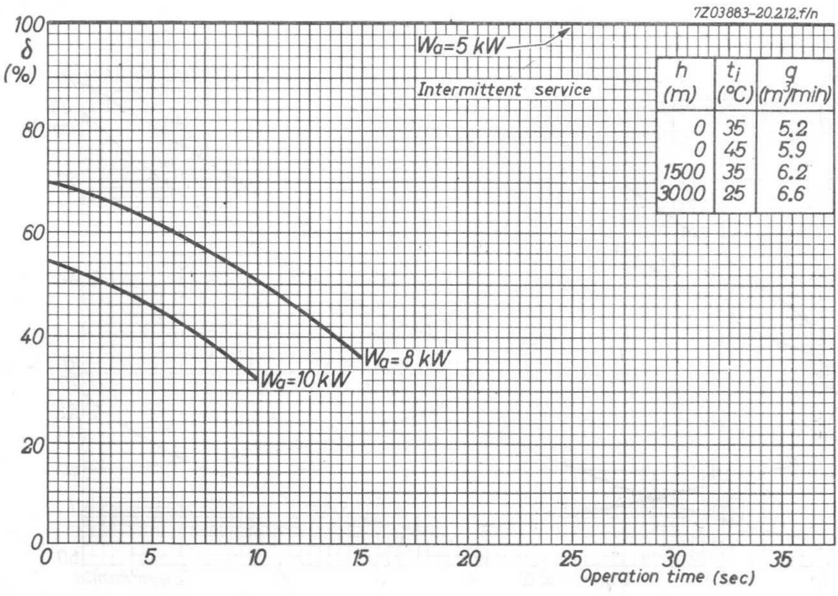


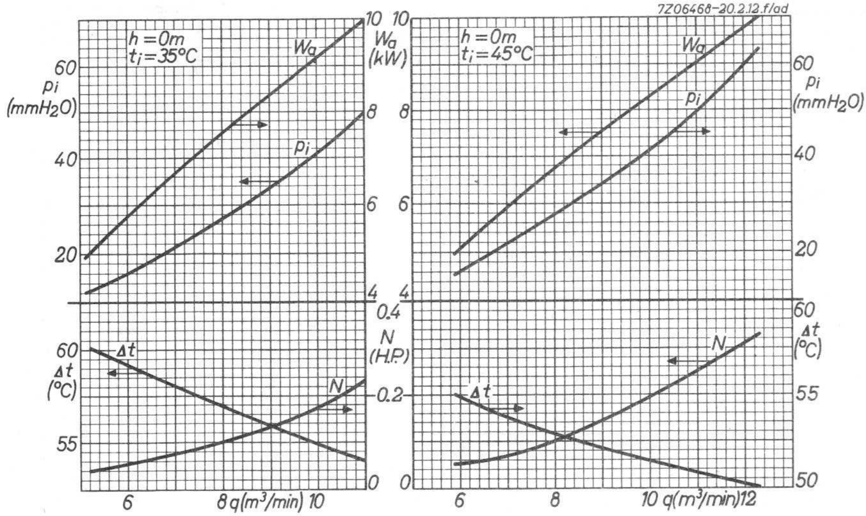
7Z00048
TBL–TBW 6/14 23-5-'60
I_a
I_g
5A
4A
3A
2A
1A
24A
22A
20A
0.55A
18A
0.25A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.5A
0A
V_g (V)
600
400
200
0
−200
−400
−600
−800
0
2
4
6
8
V_a (kV) 10

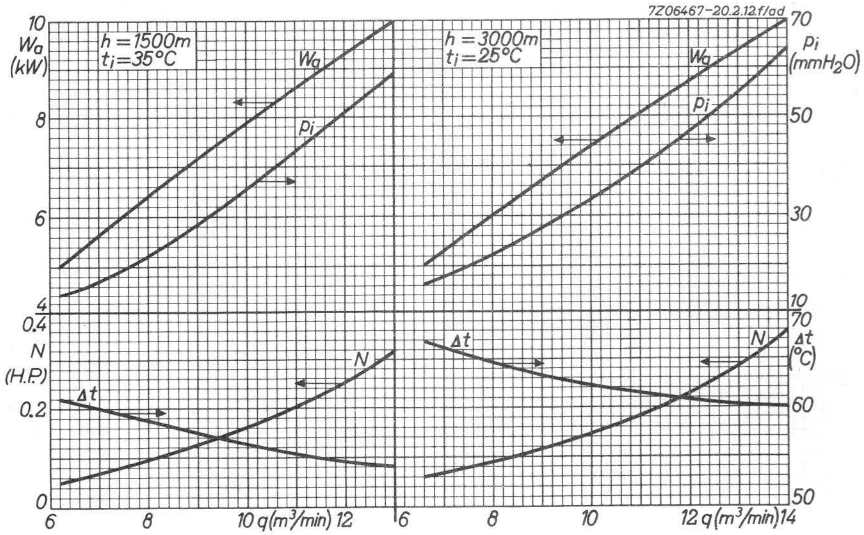


7Z03881–20.2.12f/n
R_f cold=0.005Ω
I_f (A)
250
200
150
100
50
0
0
2
4
6 V_f (V)


7Z03882-20.2.12.f/n
δ (%)
Wa = 10kW
Intermittent service
h (m) | ti (°C) | q (m3/min)
0 | 35 | 11
0 | 45 | 12.3
1500 | 35 | 13
3000 | 25 | 14
Wa=12,5kW
Wa=15 kW
Operation time (sec)


7Z03883-20.2.12.f/n
δ (%)
Wa=5 kW
Intermittent service
h (m) | ti (°C) | q (m3/min)
0 | 35 | 5.2
0 | 45 | 5.9
1500 | 35 | 6.2
3000 | 25 | 6.6
Wa=8 kW
Wa=10 kW
Operation time (sec)


7Z06468-20.2.12.f/ad
h = 0m
t_i = 35°C
h = 0m
t_i = 45°C
W_a
p_i
W_a (kW)
p_i (mmH_2O)
N (H.P)
Δt (°C)
N
Δt
q (m^3/min)


7Z06467-20.2.12.f/ad
h = 1500m
t_i = 35°C
h = 3000m
t_i = 25°C
W_a
p_i
W_a (kW)
p_i (mmH_2O)
N (H.P)
Δt (°C)
N
Δt
q (m^3/min)

AIR COOLED
COAXIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

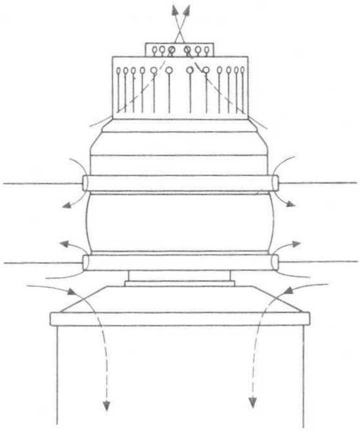
[1]) Anode fully screened from filament terminals by a flat metal screen connected to the grid terminal

7Z2 8654

AIR COOLING CHARACTERISTICS. See also the cooling curves on page D

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
5.5	0	35	5.0	16
	1500	35	5.9	16
	3000	25	5.7	16
8	0	35	7.7	35
	1500	35	9	40
	3000	25	9	36
10	0	35	11	65
	1500	35	13	75
	3000	25	13	66

Recommended direction of air flow



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

TEMPERATURE LIMITS (Absolute limits)

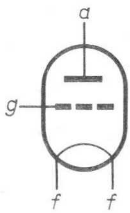
Temperature of seals = max. 180 °C

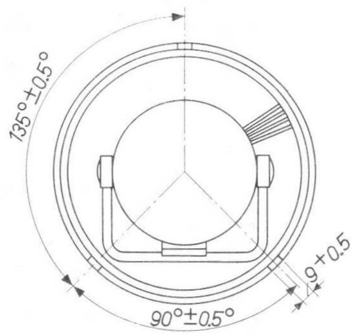
7Z2 4048

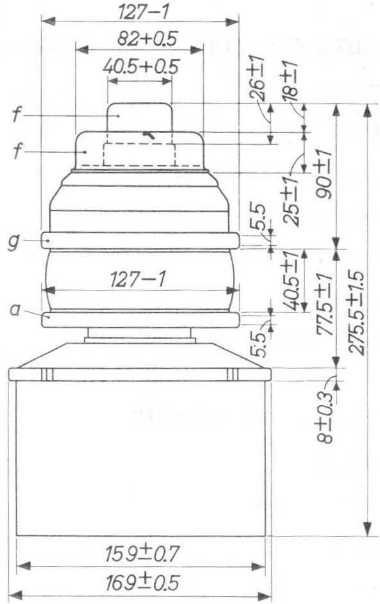
MECHANICAL DATA

Dimensions in mm

Net weight: 9.5 kg







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

Mounting position: vertical with anode up or down

ACCESSORIES

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

7Z2 3474

R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

7Z2 3475

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

[1]) See lower figure page B

7Z2 4049

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

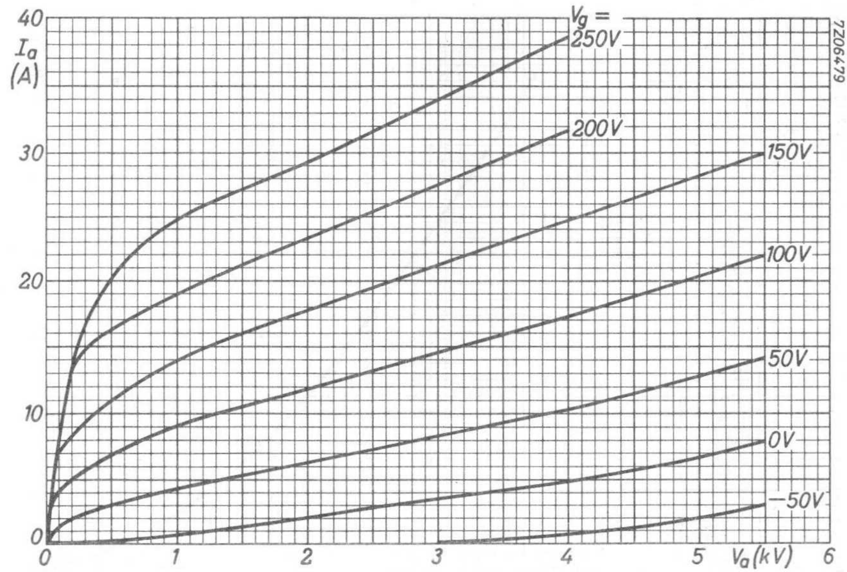
LIMITING VALUES (Absolute limits)

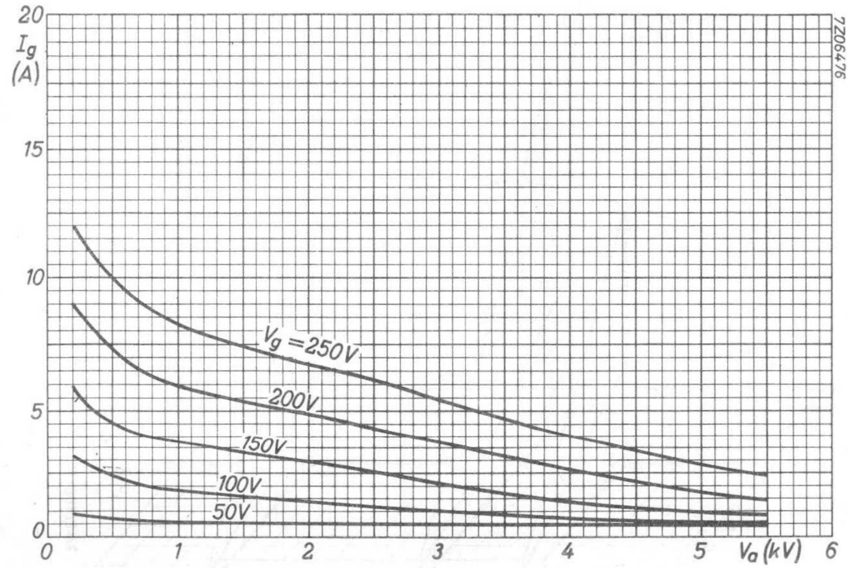
Frequency	f			up to 88	up to 220	MHz
Anode voltage	V_a		=	max. 5.5	max. 4.5	kV
Anode input power	W_{ia}	white	=	max. 25	max. 22	kW
Anode current	I_a	white	=	max. 6	max. 6	A
Grid current	I_g	white	=	max. 1.2	max. 1.2	A
Anode dissipation	W_a	white	=	max. 10	max. 10	kW

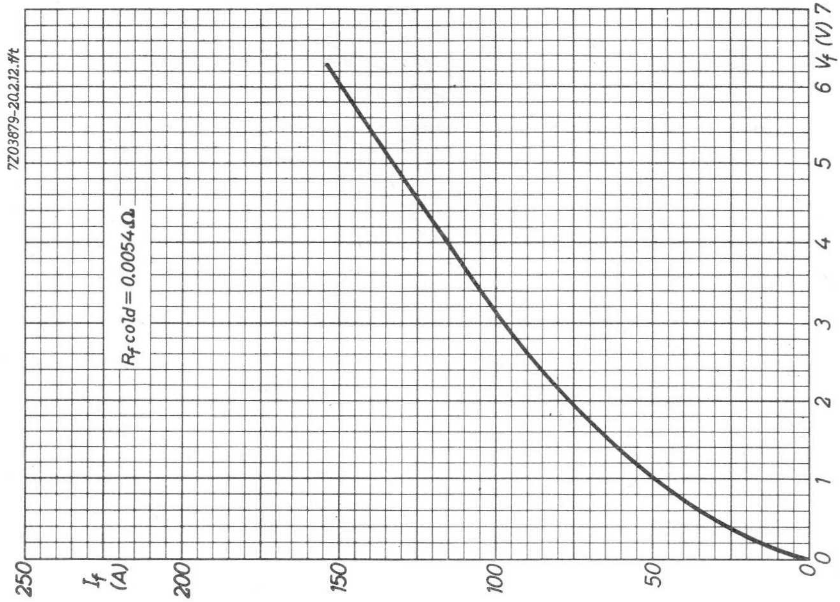
OPERATING CONDITIONS (at centre frequency of the resonance curve)

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

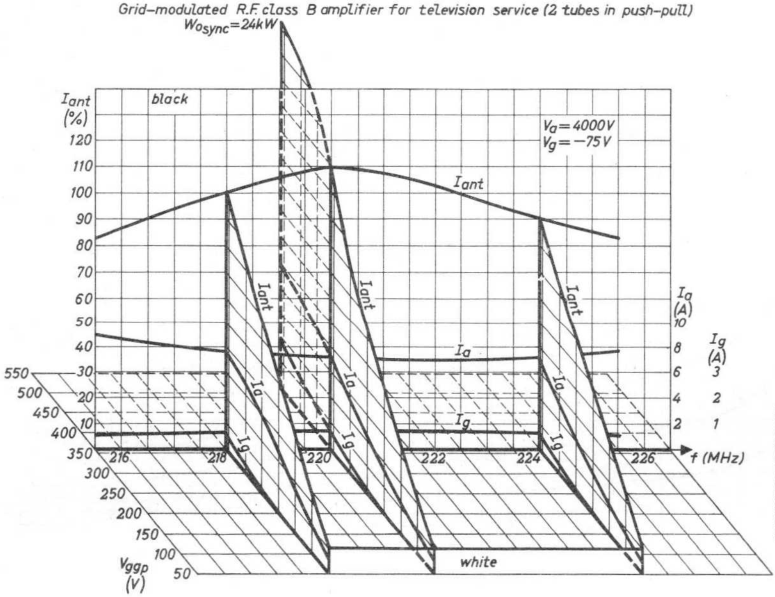
7Z2 3477

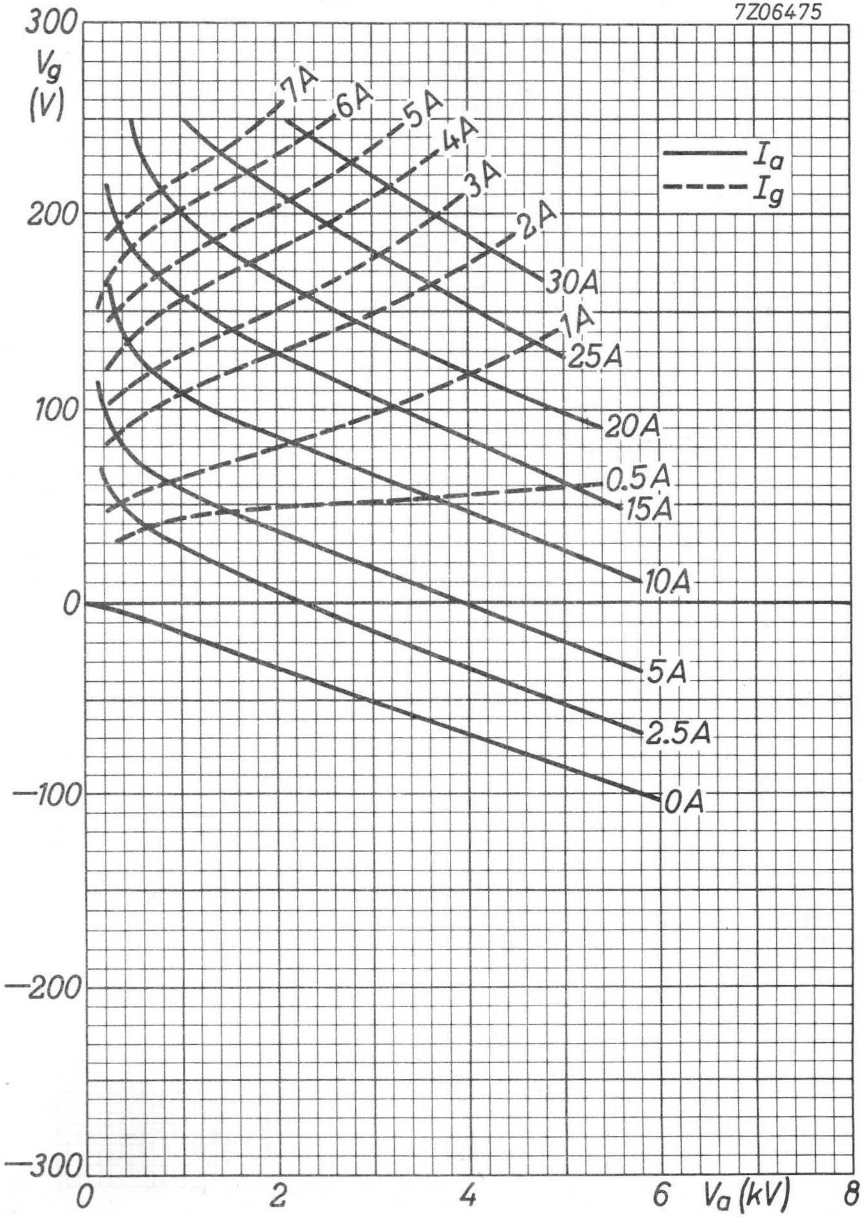

7Z06479
40
30
20
10
0
I_a
(A)
V_g =
250V
200V
150V
100V
50V
0V
−50V
0
1
2
3
4
5
6
V_a(kV)


7Z06476
20
15
10
5
0
I_g
(A)
V_g = 250V
200V
150V
100V
50V
0
1
2
3
4
5
6
V_a(kV)

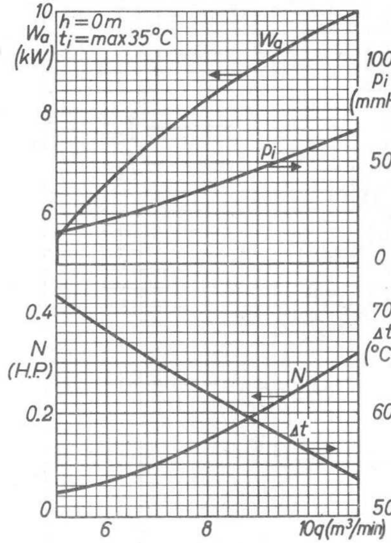


Grid-modulated R.F. class B amplifier for television service (2 tubes in push-pull)

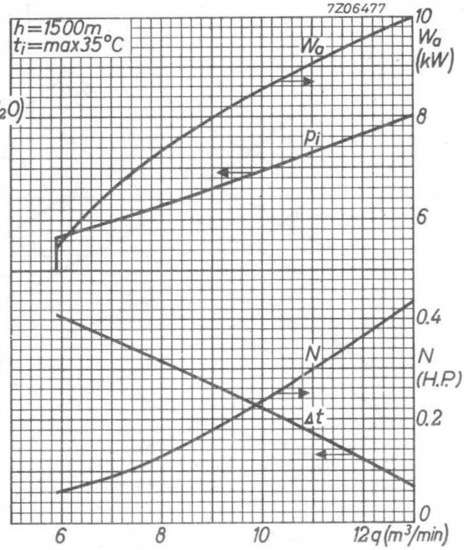



7Z06475
300
V_g
(V)
200
100
0
−100
−200
−300
0
2
4
6
V_a (kV)
8
I_a
I_g
7A
6A
5A
4A
3A
2A
1A
0.5A
30A
25A
20A
15A
10A
5A
2.5A
0A

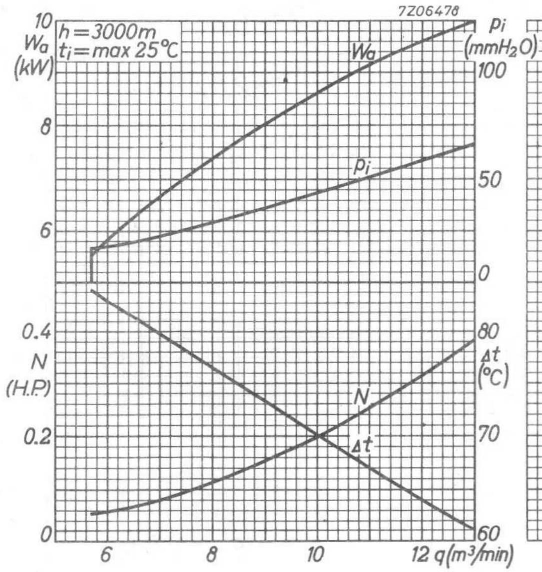
TBL6/20



h=0m
tᵢ=max35°C
10
Wₐ
(kW)
8
6
0.4
N
(H.P.)
0.2
0
Wₐ
pᵢ
N
Δt
100
pᵢ
(mmH₂O)
50
0
70
Δt
(°C)
60
50
6
8
10q(m³/min)



7Z06477
h=1500m
tᵢ=max35°C
Wₐ
pᵢ
N
Δt
10
Wₐ
(kW)
8
6
0.4
N
(H.P.)
0.2
0
6
8
10
12 q(m³/min)



7Z06478
h=3000m
tᵢ=max 25°C
10
Wₐ
(kW)
8
6
0.4
N
(H.P.)
0.2
0
Wₐ
pᵢ
N
Δt
pᵢ
(mmH₂O)
100
50
0
80
Δt
(°C)
70
60
6
8
10
12 q(m³/min)

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	4.85		
	6	4.1	6	5.9

HEATING : direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

7Z2 3531

COOLING

Continuous service

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

For intermittent service see figure page A

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

RECOMMENDED COOLING DEVICE

(1) = metal housing (see page 3)

(2) = glass cylinder

→ (3) = socket 2422 511 05001

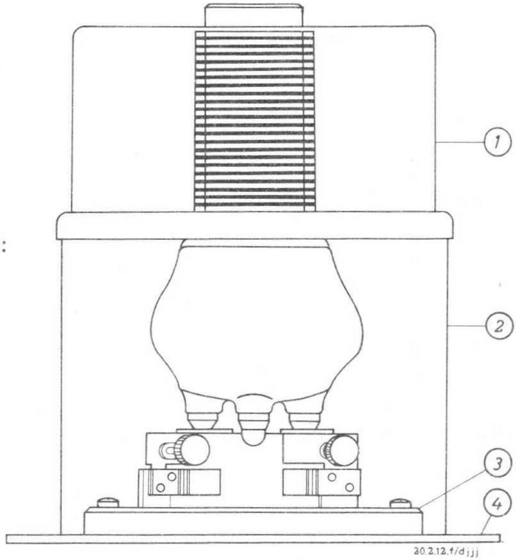
(4) = ground plate (see page 3)

Dimensions of the glass cylinder:

Height : 118 mm

Outside diameter : 150 mm

Inside diameter : 144 mm



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

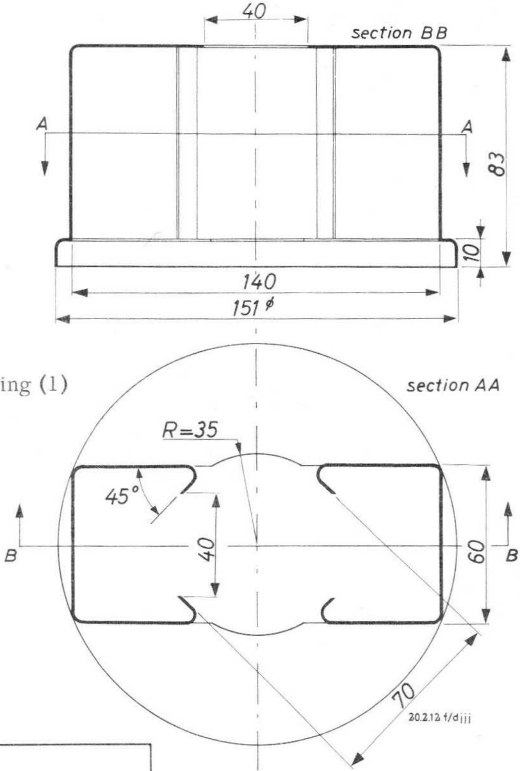
The housing (1) should be connected to the anode connector. At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally between both grid terminals to avoid excessive grid seal temperatures.

7Z2 8655

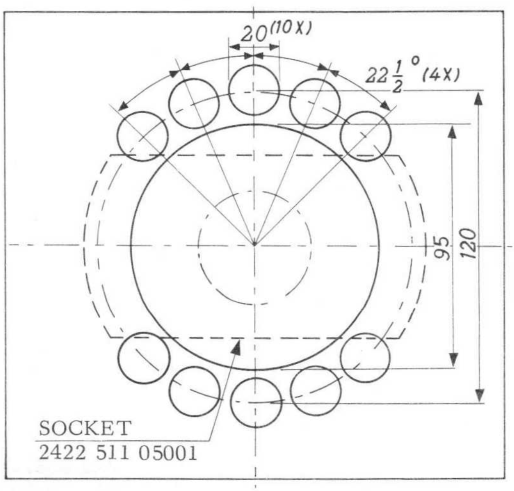
RECOMMENDED COOLING DEVICE (continued)

Dimensions in mm

Metal housing (1)



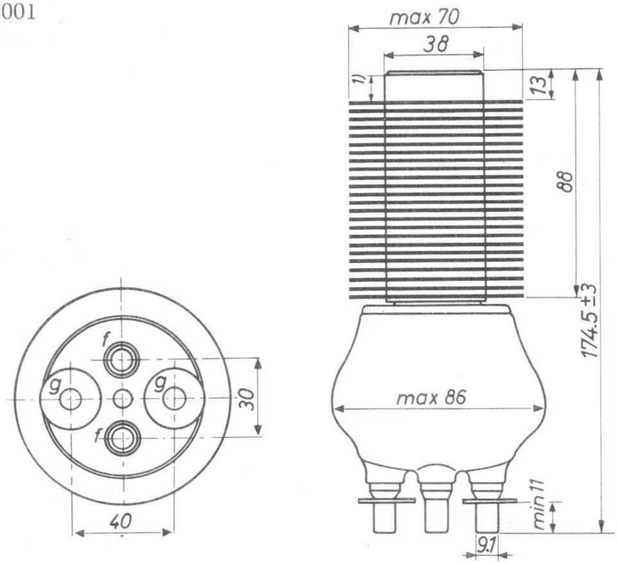
Ground plate (4)



7Z2 8656

MECHANICAL DATA (dimensions in mm)

→ Socket: 2422 511 05001



Mounting position: vertical with anode up or down

1) Area for anode connector

7Z2 8657

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

LIMITING VALUES (Absolute limits) continuous service

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

OPERATING CONDITIONS, continuous service

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

1) In a typical circuit

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

7Z2 3535

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

LIMITING VALUES (Absolute limits) intermittent service

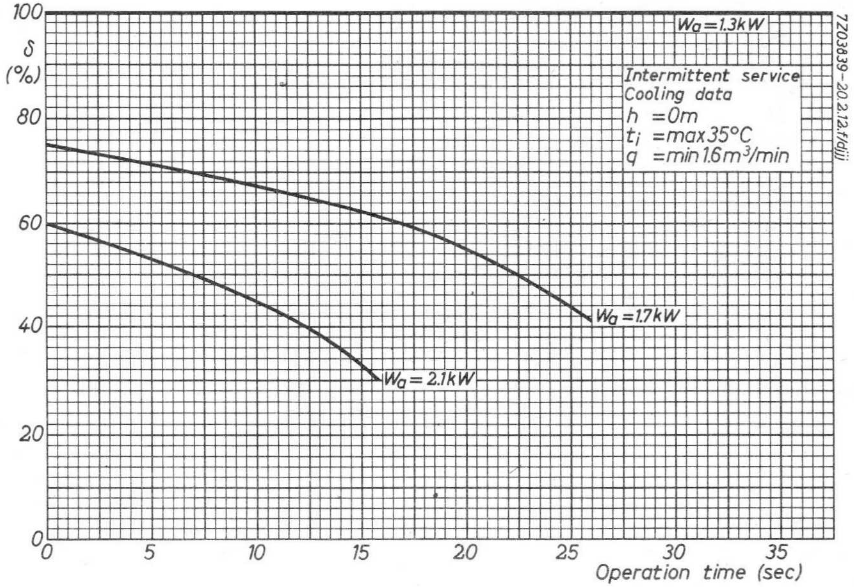
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode current	I_a	= max.	1.5	A
Anode input power	W_{ia}	= max.	9	kW
Anode dissipation	W_a	= max.	2.1	kW 1)
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid resistor	R_g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

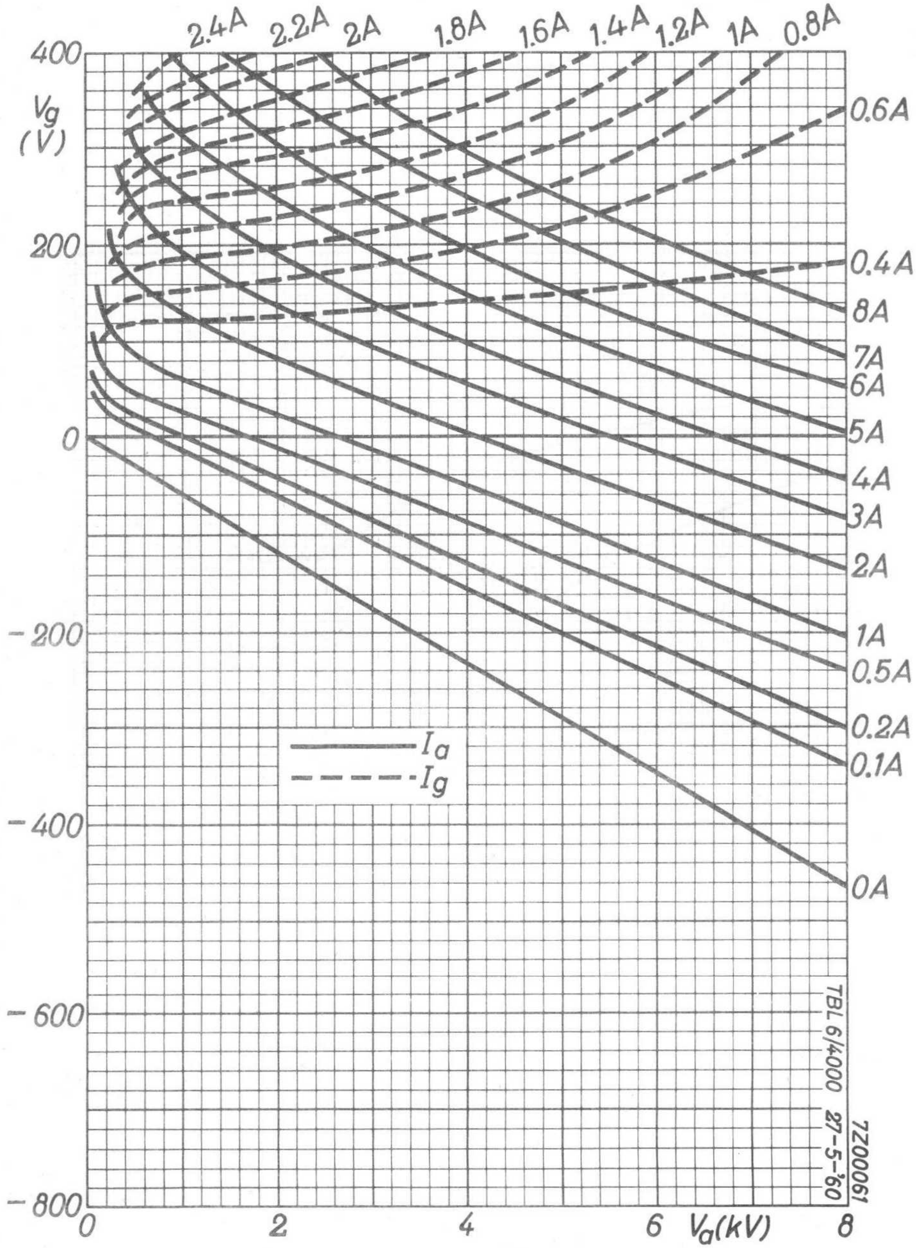
OPERATING CONDITIONS, intermittent service

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

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

7Z2 4051


100
δ
(%)
80
60
40
20
0
0
5
10
15
20
25
30
35
Operation time (sec)
Wa=1.3kW
Intermittent service
Cooling data
h =0m
ti =max 35°C
q =min 1.6m3/min
Wa=1.7kW
Wa=2.1kW
7Z03839-20.2.12.f(dji)



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

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			6	13.3
		5	5.6	5	1.45	5	4.7	5	6.6
		4	4			4.5	4.1	4.5	6.0
						4	3.5	4	5.3
						3.5	3	3.5	4.6
						3	2.2	3	3.3

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

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

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

COOLING: forced air

[1]) Two tubes

7Z2 8658

TYPICAL CHARACTERISTICS

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

AIR COOLING CHARACTERISTICS, see also the cooling curves

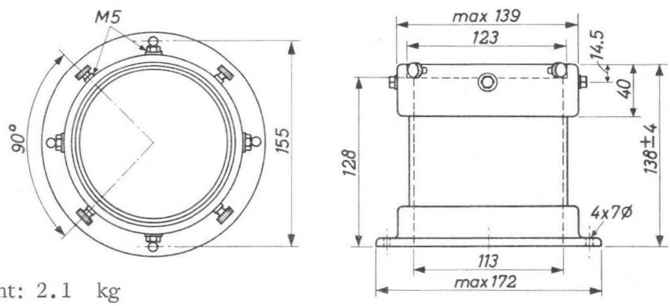
W_a (kW)	h (m)	t_i max. (°C)	$q_{min.}$ (m^3/min)	p_i (mm H_2O)
1	0	35	3	8
	0	45	3.1	8
	1500	35	3.7	9
	3000	25	4.1	10
3	0	35	5.2	23
	0	45	6.1	29
	1500	35	6.2	26
	3000	25	6.6	26
5	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.6	79

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals = max. 180 °C

MECHANICAL DATA

Dimensions in mm



Net weight: 2.1 kg

Insulating pedestal 40630

7Z2 8659

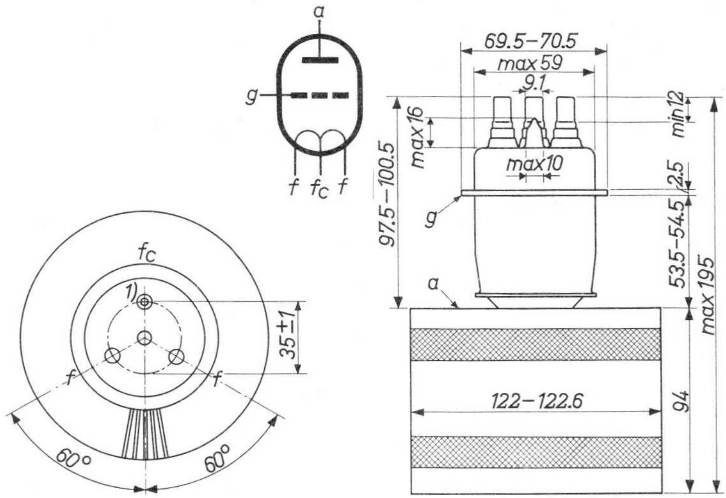
MECHANICAL DATA (continued) Dimensions in mm

Grid connector : 40650 [2]
or 40622

Filament connectors: 40634

Insulating pedestal : 40630

Tube net weight : 4.6 kg



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 the cooling of all three filament pins, thus also of pin f_c

[1] This pin is marked "O"

[2] The connector 40650 should be used only below 30 MHz

7Z2 8660

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.	5	kW

OPERATING CONDITIONS

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

7Z2 8661

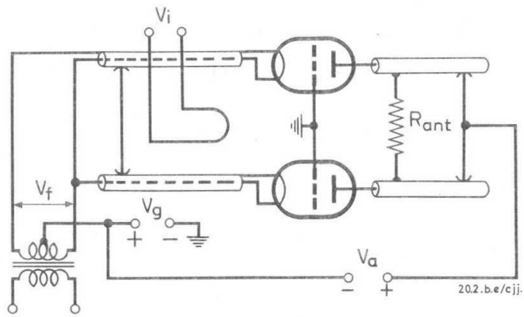
R.F. CLASS C TELEGRAPHY, grounded grid

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.	5	kW

For frequencies from 75 MHz tap to 220 MHz See page C

OPERATING CONDITIONS, two tubes



For data please refer to page 6

7Z2 8662

R.F. CLASS C TELEGRAPHY, grounded grid (continued)

OPERATING CONDITIONS, two tubes (continued)

λ	=	4	2.7[1]	2.7[1]	1.36[1]	m
f	=	75	110	110	220	MHz
V_a	=	6	5	4	4	kV
V_g	=	-400	-300	-200	-200	V
I_a	=	2x1.5	2x1.5	2x1.37	2x1.25	A
I_g	=	2x0.31	2x0.33	2x0.35	2x0.2	A
V_{g_p}	=	740	640	500	450	V
W_{ig}	=	2x1120	2x920	2x675	2x380	W
W_{ia}	=	2x9	2x7.5	2x5.5	2x5	kW
W_a	=	2x2.1	2x2.2	2x1.7	2x2.5	kW
W_o	=	13.8+1.82	10.6+1.46	7.6+1.03	5+0.6	kW [2]
η	=	76.5	71	69	50	% [3]

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation.

[2]) Power transferred from driving stage included.

[3]) Pure tube efficiency.

7Z2 8663

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.	5	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	m
Frequency	f	=	75	75	MHz
Anode voltage	V_a	=	6	5	kV
Grid voltage	V_g	=	-180	-145	V
Anode current	I_a	=	0.99	0.9	A
Peak grid A.C. voltage	V_{g_p}	=	250	225	V
Anode input power	W_{ia}	=	5.9	4.5	kW
Anode dissipation	W_a	=	4	3.05	kW
Output power	W_o	=	1.9	1.45	kW
Efficiency	η	=	32	32	%
Modulation factor	m	=	100	100	%
Grid current	I_g	=	0.3	0.32	A
Grid input power	W_{ig}	=	140	130	W

7Z2 8664

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.	3.4	kW

OPERATING CONDITIONS

Wavelength	λ	=	4	4	4	4	4	m
Frequency	f	=	75	75	75	75	75	MHz
Anode voltage	V_a	=	5	4.5	4	3.5	3	kV
Grid voltage	V_g	=	-400	-350	-300	-300	-250	V [1])
Anode current	I_a	=	1.2	1.2	1.2	1.2	1	A
Grid current	I_g	=	0.3	0.3	0.3	0.3	0.3	A
Peak grid A.C. voltage	V_{g_p}	=	690	650	600	600	510	V
Grid input power	W_{ig}	=	190	180	165	165	140	W
Anode input power	W_{ia}	=	6	5.4	4.8	4.2	3	kW
Anode dissipation	W_a	=	1.3	1.3	1.3	1.2	0.8	kW
Output power	W_o	=	4.7	4.1	3.5	3.0	2.2	kW
Efficiency	η	=	78	76	73	71.5	73	%
Modulation fator	m	=	100	100	100	100	100	%
Modulation power	W_{mod}	=	3.0	2.7	2.4	2.1	1.5	kW

[1]) Grid bias partially obtained by the grid resistor

7Z2 8665

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.	5	kW
Grid circuit resistance	R_g	=	max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	6		5		4.5		kV
V_g	=	-165		-138		-125		V
$R_{aa\sim}$	=	4900		6400		6100		Ω
V_{ggp}	=	0	910	0	661	0	655	V
I_a	=	2x0.125	2x1.5	2x0.11	2x0.91	2x0.1	2x0.92	A
I_g	=	0	2x0.28	0	2x0.14	0	2x0.09	A
W_{ig}	=	0	2x115	0	2x42	0	2x27	W
W_{ia}	=	2x0.75	2x9	2x0.55	2x4.55	2x0.45	2x4.15	kW
W_a	=	2x0.75	2x2.35	2x0.55	2x1.25	2x0.45	2x1.15	kW
W_o	=	0	13.3	0	6.6	0	6	kW
d_{tot}	=	-	4.3	-	3.3	-	3.7	%
η	=	-	74	-	73	-	72	%

V_a	=	4		3.5		3		kV
V_g	=	-112		-100		-90		V
$R_{aa\sim}$	=	4900		4200		4400		Ω
V_{ggp}	=	0	632	0	618	0	570	V
I_a	=	2x0.1	2x0.94	2x0.075	2x0.95	2x0.065	2x0.8	A
I_g	=	0	2x0.19	0	2x0.18	0	2x0.2	A
W_{ig}	=	0	2x54	0	2x50	0	2x52	W
W_{ia}	=	2x0.4	2x3.75	2x0.26	2x3.3	2x0.2	2x2.4	kW
W_a	=	2x0.4	2x1.1	2x0.26	2x1	2x0.2	2x0.75	kW
W_o	=	0	5.3	0	4.6	0	3.3	kW
d_{tot}	=	-	2.6	-	2.9	-	3.3	%
η	=	-	71	-	70	-	69	%

7Z2 3495

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; negative modulation, positive synchronisation (American and European system)

LIMITING VALUES (Absolute limits)

Frequency	f			up to 75	up to 220	MHz
Anode voltage	V_a		=	max. 5	max. 4	kV
Anode input power	W_{ia}	sync	=	max. 9.5	max. 6.5	kW
Anode dissipation	W_a	sync	=	max. 5	max. 4	kW
Anode current	I_a	sync	=	max. 1.9	max. 1.6	A
Grid dissipation	W_g	sync	=	max. 120	max. 120	W
Negative grid voltage	$-V_g$		=	max. 1000	max. 1000	V

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 75	170 to 220[1]	MHz
Bandwidth (−1.5 db)	B		=	5.25	6.5	MHz [2]
Bandwidth (−3 db)	B		=	8	10	MHz [2]
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g	sync	=	−200	−150	V
		black	=	−300	−225	V
		white	=	−550	−500	V
Peak grid to grid voltage	V_{gg_p}	sync	=	1000	1000	V [3]
Anode current	I_a	sync	=	3.8	3.2	A
		black	=	2.8	2.6	A
Grid current	I_g	sync	=	0.5	0.4	A
		black	=	0.35	0.22	A
Grid input power	W_{ig}	sync	=	250	350 to 450	W [4]
Output power	W_o	sync	=	9	6	kW
		black	=	5.35	3.37	kW

---

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

[2]) These values are based on measurements on a circuit with a single LC section

[3]) Measured by the slide back method

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

7Z2 8666

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.	5	kW
Grid dissipation	W_g	white	=	max.	120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48-75	MHz
Bandwidth (I_{ant} = 85 %)	B		=	5.25	MHz
Bandwidth (I_{ant} = 70 %)	B		=	8	MHz
Anode voltage	V_a		=	5	kV
Grid voltage	V_g	white	=	-200	V
		black	=	-460	V
		sync	=	-580	V
Peak grid to grid voltage	V_{gg_p}	white	=	1000	V
Anode current	I_a	white	=	3.8	A
		black	=	0.8	A
Grid current	I_g	white	=	0.5	A
		black	=	0	A
Grid input power	W_{ig}	white	=	250	W
Output power	W_o	white	=	9	kW
		black	=	0.6	kW

7Z2 8667

R.F. CLASS B TELEPHONY for television service (American and European system

LIMITING VALUES (Absolute limit)

Frequency	f			up to 75	up to 220	MHz
Anode voltage	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	=	1000	1000	V [3])
		black	=	800	750	V [3])
		white	=	0	200	V [3])
Anode current	I_a	sync	=	3.8	3.2	A
		black	=	3	2.6	A
		white	=	0.2	-	A
Grid current	I_g	sync	=	0.5	0.4	A
		black	=	0.22	0.22	A
		white	=	0	-	A
Grid input power	W_{ig}	sync	=	250	350 to 450	W [4])
Output power	W_o	sync	=	9	6	kW
		black	=	5.35	3.37	kW

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

[2]) These values are based on measurements on a circuit with a single LC section

[3]) Measured by the slide back method

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

7Z2 8668

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.	5	kW
Grid dissipation	W_g	= max.	120	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	6.0[1]	5.1[2]	kV_{RMS}
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

7Z2 8669

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.	5	kW
Grid dissipation	W_g	=	max.	120	W

OPERATING CONDITIONS

Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	5.1[1]	4.4[2]	kV_{RMS}
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

7Z2 8670

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

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Transformer voltage	V_{tr}	= max.	6800	V_{RMS}
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.	5	kW
Grid dissipation	W_g	= max.	120	W

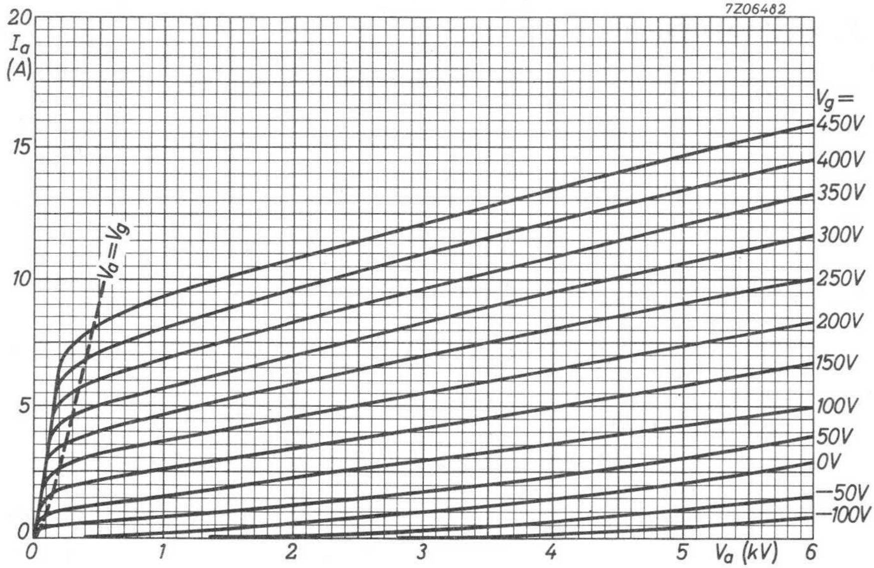
OPERATING CONDITIONS

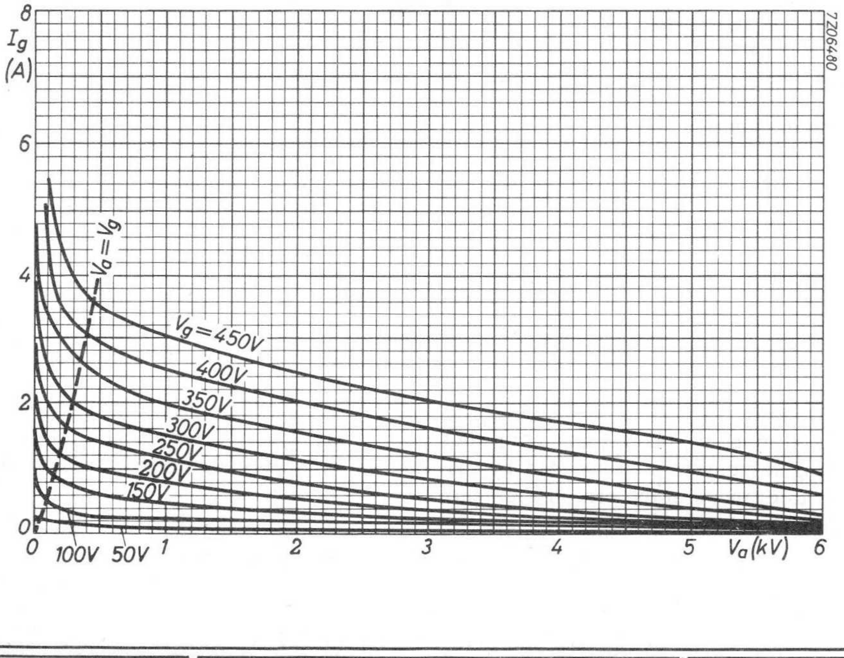
Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	6.8[1]	5.9[2]	kV_{RMS}
Anode current	I_a	=	0.8	0.7	A
Grid current	I_g	=	0.19	0.165	A
Grid resistor	R_g	=	1050	1050	Ω
Grid input power	W_{ig}	=			W
Anode input power	W_{ia}	=	6.05	4.6	kW
Anode dissipation	W_a	=	1.5	1.24	kW
Output power	W_o	=	4.55	3.36	kW
Efficiency	η	=	75	73	%

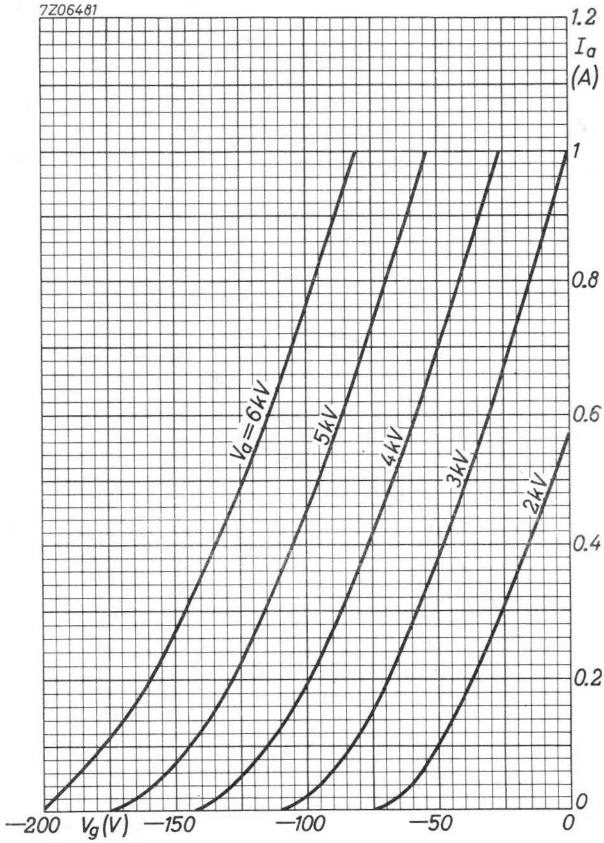
[1]) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

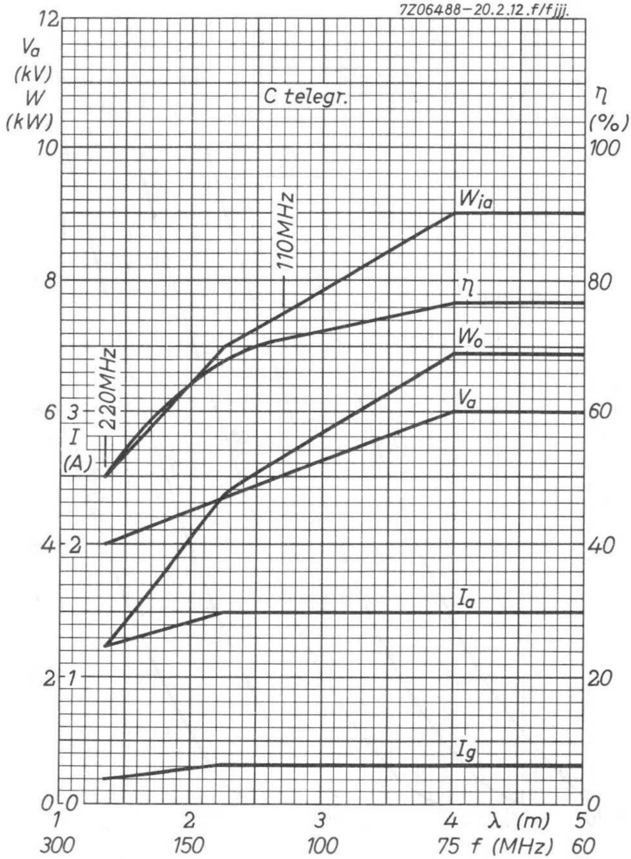
[2]) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

7Z2 8671

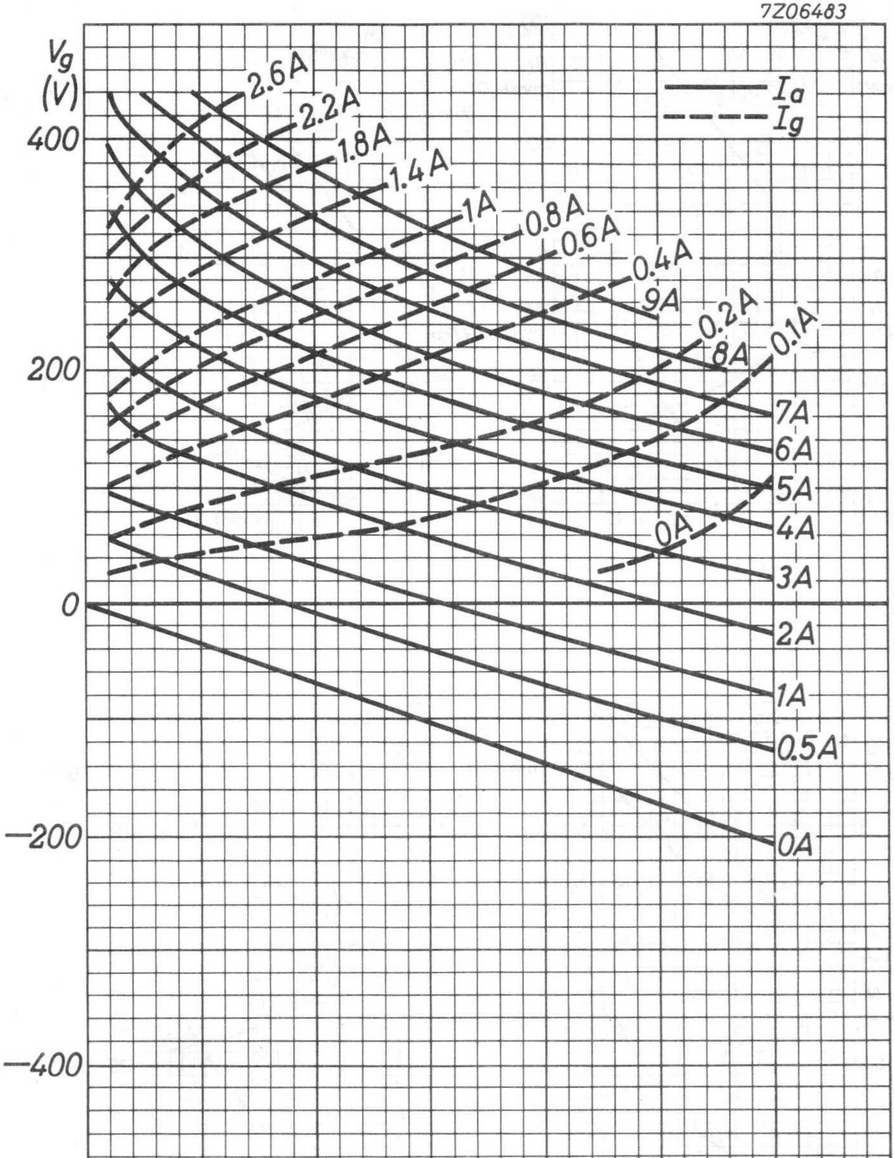

7Z06482
20
I_a
(A)
15
10
5
0
$V_a = V_g$
$V_g =$
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
0
1
2
3
4
5
V_a (kV)
6

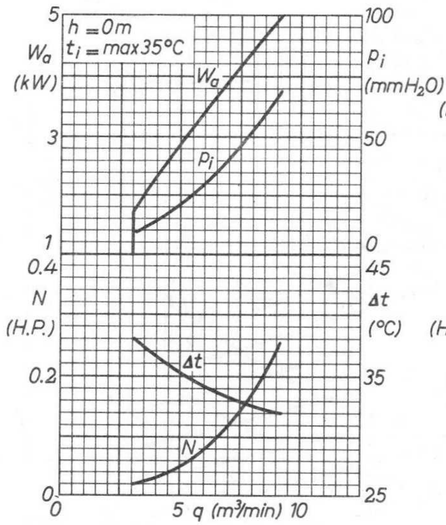

7Z06480
8
I_g
(A)
6
4
2
0
$V_a = V_g$
$V_g = 450V$
400V
350V
300V
250V
200V
150V
100V
50V
0
1
2
3
4
5
V_a (kV)
6

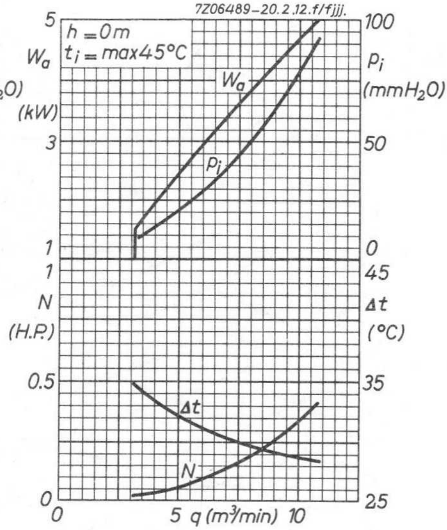

7Z06481
1.2
I_a
(A)
1
0.8
0.6
0.4
0.2
0
V_a=6kV
5kV
4kV
3kV
2kV
−200
V_g(V)
−150
−100
−50
0



7Z06488-20.2.12.f/fjjj.
12
Va
(kV)
W
(kW)
10
8
6
4
2
0
3
I
(A)
2
1
0
C telegr.
η
(%)
100
80
60
40
20
0
110MHz
220MHz
Wia
η
Wo
Va
Ia
Ig
1
2
3
4
λ (m)
5
300
150
100
75
f (MHz)
60


7Z06483
V_g (V)
400
200
0
−200
−400
0
2
4
6 V_a (kV)
I_a
I_g
2.6A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0A


h = 0m
t_i = max 35°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q (m³/min)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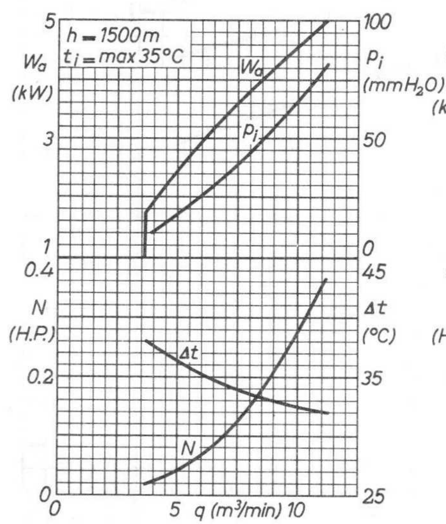
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q (m³/min)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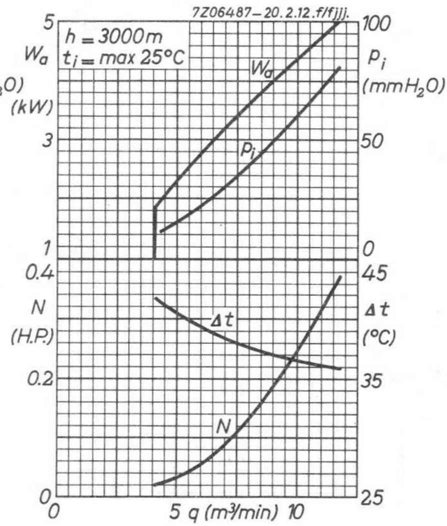
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q (m³/min)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h = 3000m
t_i = max 25°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
q (m³/min)

AIR COOLED R.F. POWER TRIODE

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

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

COOLING : forced air

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 3517

AIR COOLING CHARACTERISTICS

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

See cooling curves

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

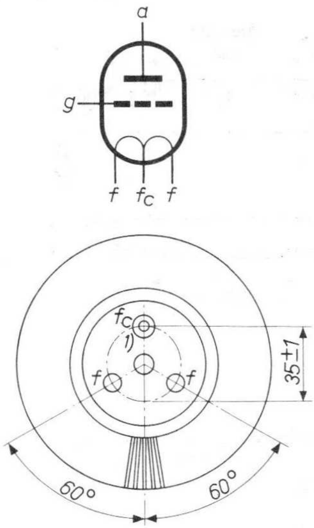
1) The centre tap f_c (diameter 10.5 mm; marked O) must not be used for filament current supply. The connector type 40649, however, must be used for the cooling of this pin.

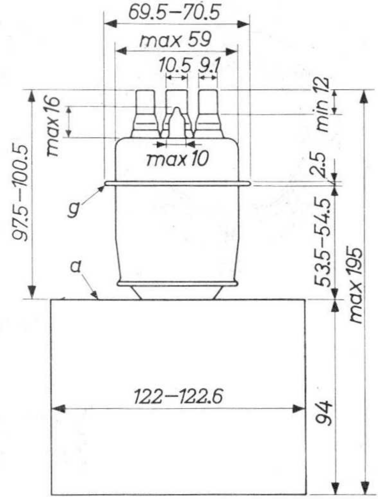
2) See page 4. The connector 40650 should only be used below 30 MHz.

7Z2 8672

MECHANICAL DATA

Dimensions in mm



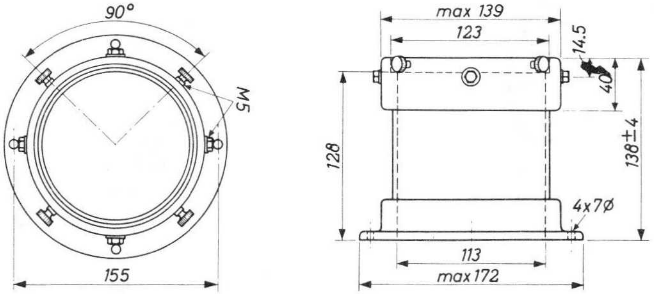


Mounting position: vertical with anode up or down.

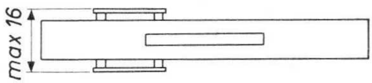
1) See page 2

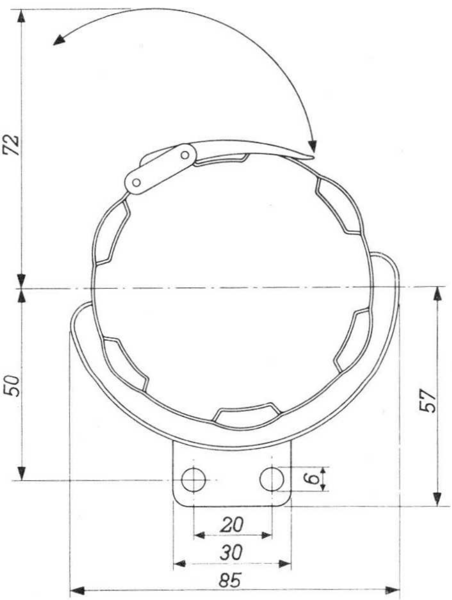
7Z2 3519

Dimensions in mm



40630





Tube

Net weight 4.6 kg

40630

Net weight 2.1 kg

40650

7Z2 3520

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	7.2	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	2.2	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	14	kW
Anode dissipation	W_a	=	max.	6	kW

OPERATING CONDITIONS

Wavelength	λ	=	10	10	10	m
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	6.5	6.0	5.0	kV
Grid voltage	V_g	=	-450	-400	-300	V
Anode current	I_a	=	2.0	2.0	2.0	A
Grid current	I_g	=	0.5	0.5	0.5	A
Peak grid A.C. voltage	V_{g_p}	=	820	780	660	V
Grid input power	W_{ig}	=	370	350	297	W
Anode input power	W_{ia}	=	13	12	10	kW
Anode dissipation	W_a	=	3.5	3.5	2.9	kW
Output power	W_o	=	9.5	8.5	7.1	kW
Efficiency	η	=	73	71	71	%

7Z2 3521

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	= max.	7.2	kV
Anode current	I_a	= max.	2.2	A
Anode input power	W_{ia}	= max.	14	kW
Anode dissipation	W_a	= max.	6	kW
Grid circuit resistance	R_g	= max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a =	7		5		5		4		kV
V_g =	-250		-165		-165		-135		V
$R_{aa\sim}$ =	4150		4800		5500		3800		Ω
V_{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	%

7Z2 3522

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	I_g	=	max.	0.5	A [1]
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid circuit resistance	R_g	=	max.	10	kΩ

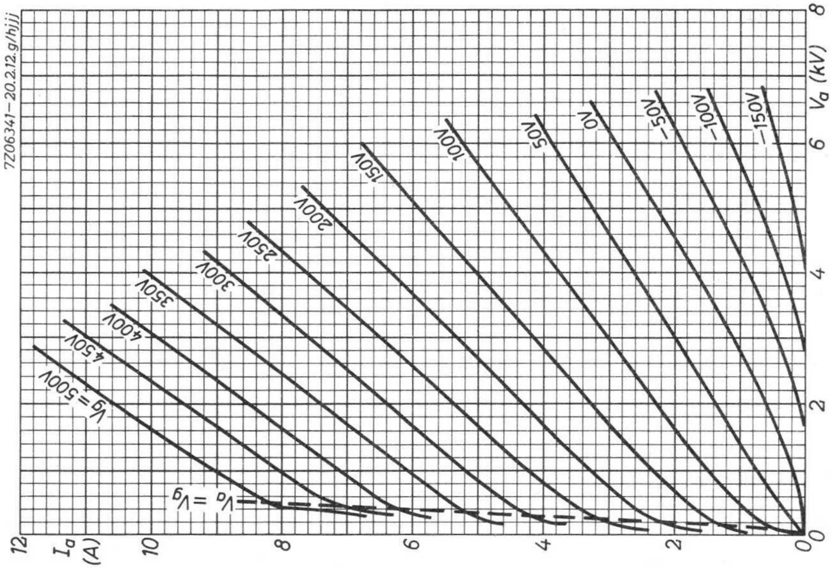
OPERATING CONDITIONS

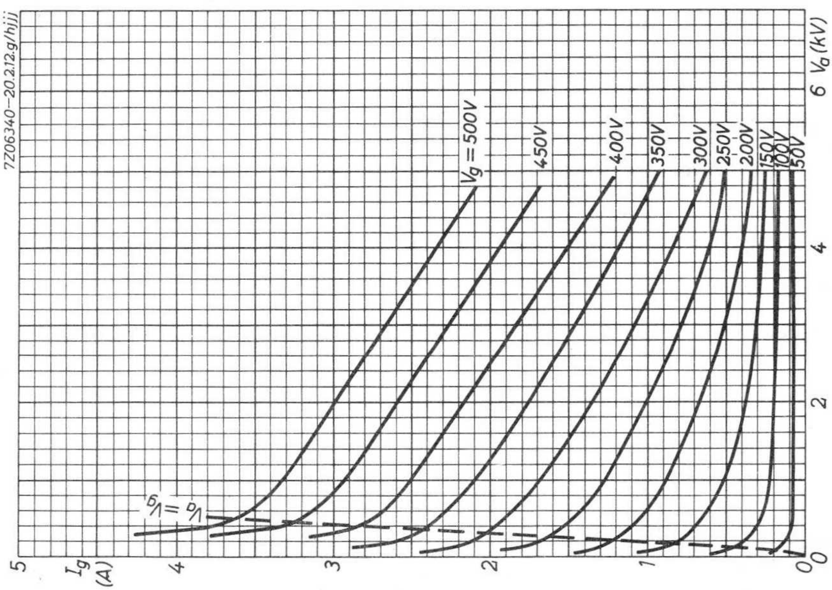
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5100	V_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A [1]
Grid resistor	R_g	=	1000	Ω
Grid input power	W_{ig}	=	300	W
Anode input power	W_{ia}	=	9	kW
Anode dissipation	W_a	=	2.7	kW
Output power	W_o	=	6	kW [2]
Efficiency	η	=	67	%

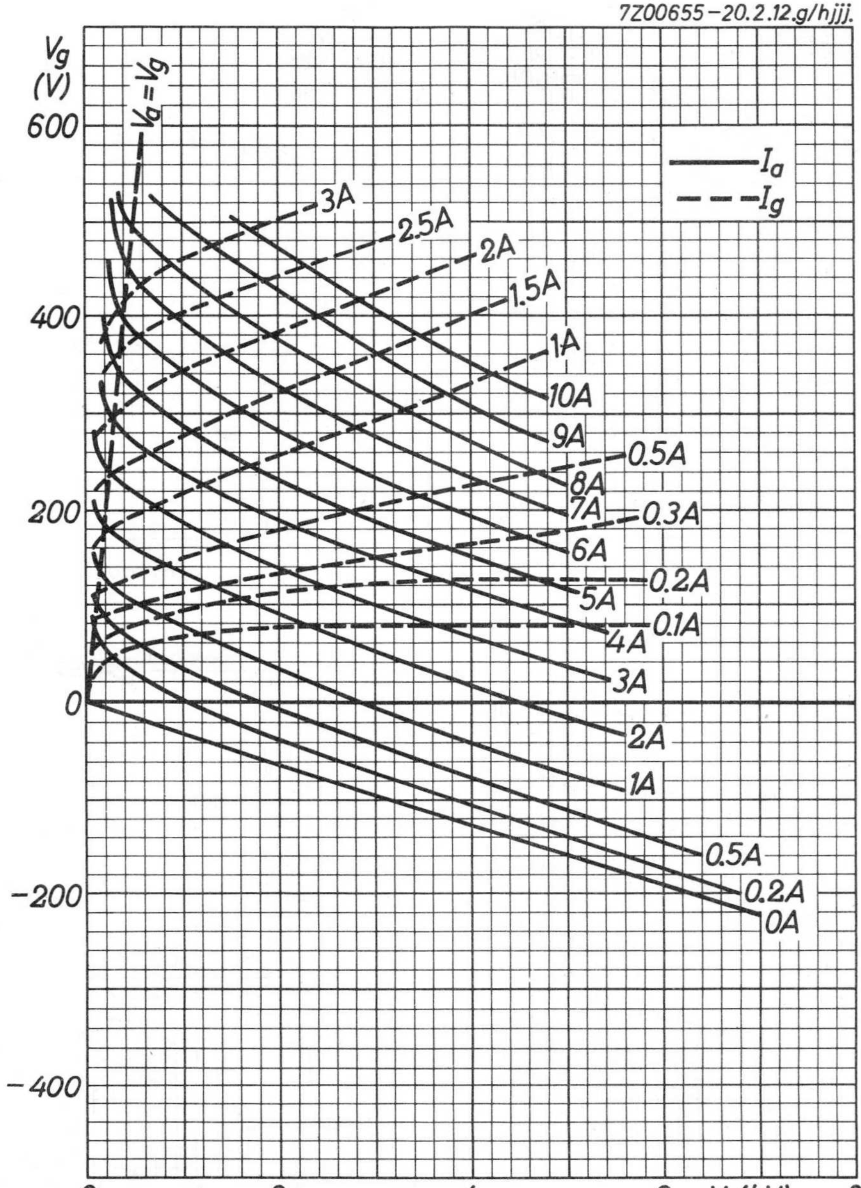
[1]) Unloaded 0.7 A

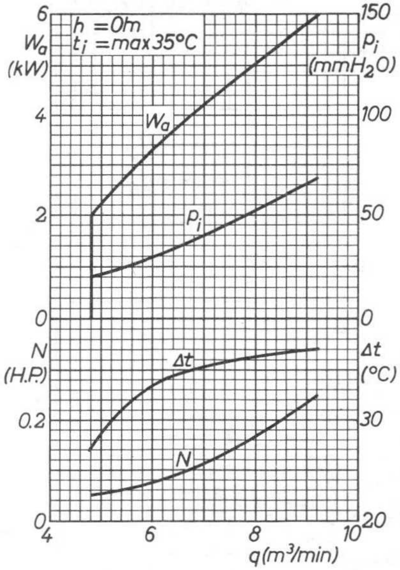
[2]) Available power (load + circuit losses)

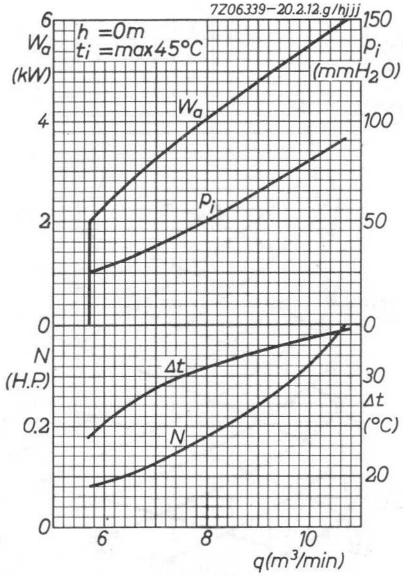
7Z2 3523

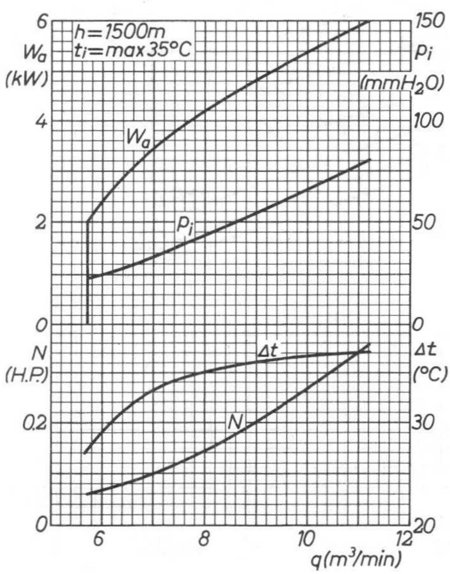

7Z06341−20.2.12.g/hjjj
I_a (A)
V_a (kV)
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
$V_a = V_g$

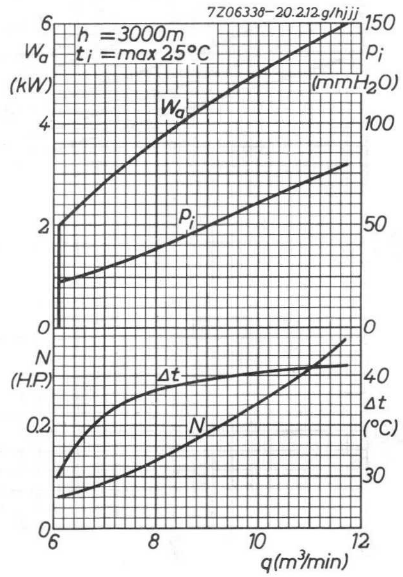

7Z06340−20.2.12.g/hjjj
I_g (A)
V_a (kV)
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
$V_a = V_g$


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


h = 0m
t_i = max 35°C
W_a (kW)
p_i (mmH$_2$O)
W_a
p_i
N (H.P.)
Δt (°C)
Δt
N
q(m³/min)


7Z06339-20.2.12.g/hjjj
h = 0m
t_i = max 45°C
W_a (kW)
p_i (mmH$_2$O)
W_a
p_i
N (H.P.)
Δt (°C)
Δt
N
q(m³/min)


h = 1500m
t_i = max 35°C
W_a (kW)
p_i (mmH$_2$O)
W_a
p_i
N (H.P.)
Δt (°C)
Δt
N
q(m³/min)


7Z06338-20.2.12.g/hjjj
h = 3000m
t_i = max 25°C
W_a (kW)
p_i (mmH$_2$O)
W_a
p_i
N (H.P.)
Δt (°C)
Δt
N
q(m³/min)

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V	+5 % -10 %
Filament current	I_f	=	32	A	

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Useful power in the load

7Z2 3537

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and seals = max. 220 °C

AIR COOLING CHARACTERISTICS for continuous service

For intermittent service see figure page A

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

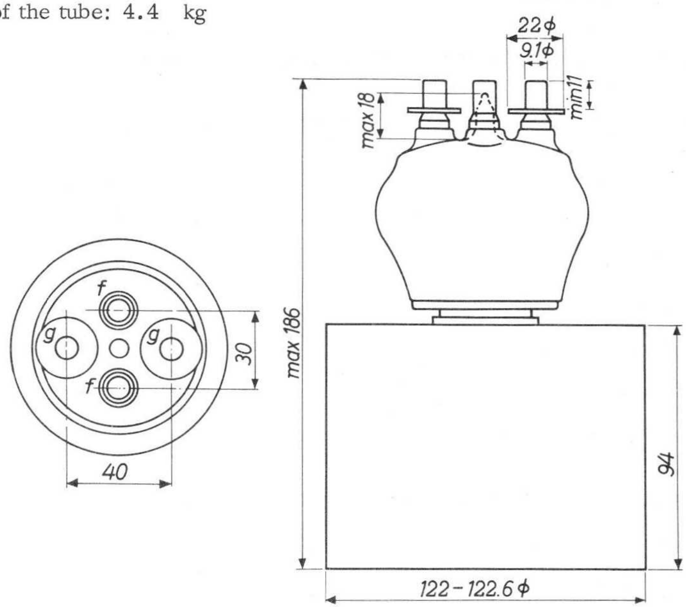
At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive grid seal temperatures.

7Z2 4052

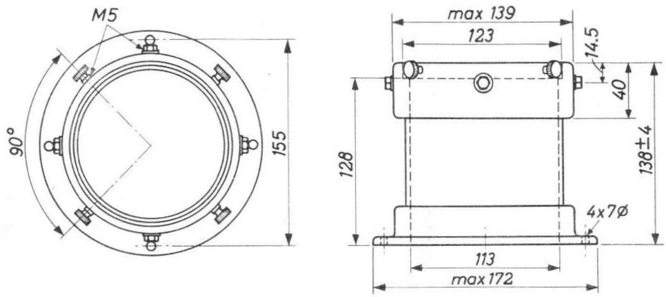
MECHANICAL DATA

Dimensions in mm

Net weight of the tube: 4.4 kg



Connectors for grid and filament	40634
Insulating pedestal (See figure below)	40630
Net weight of the insulating pedestal :	2.1 kg



7Z2 8673

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

LIMITING VALUES (Absolute limits), continuous service

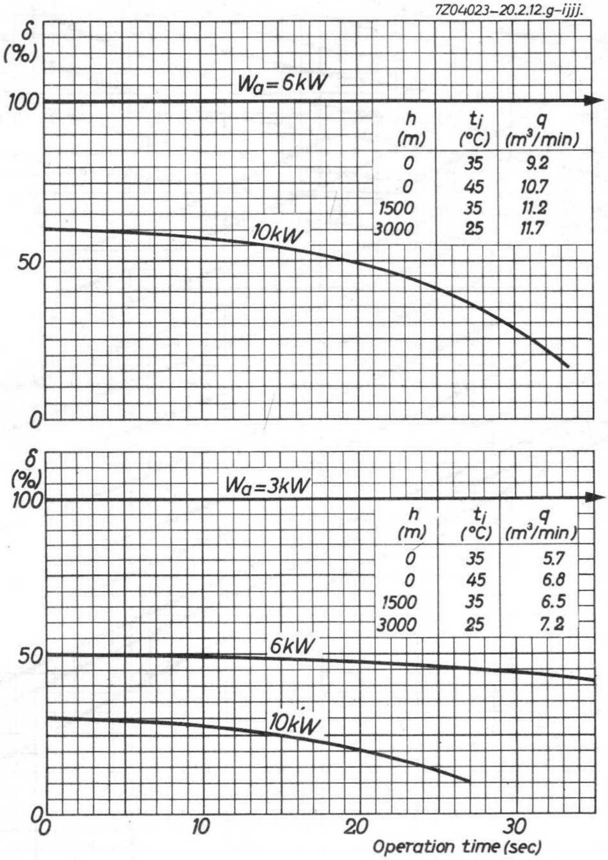
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance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

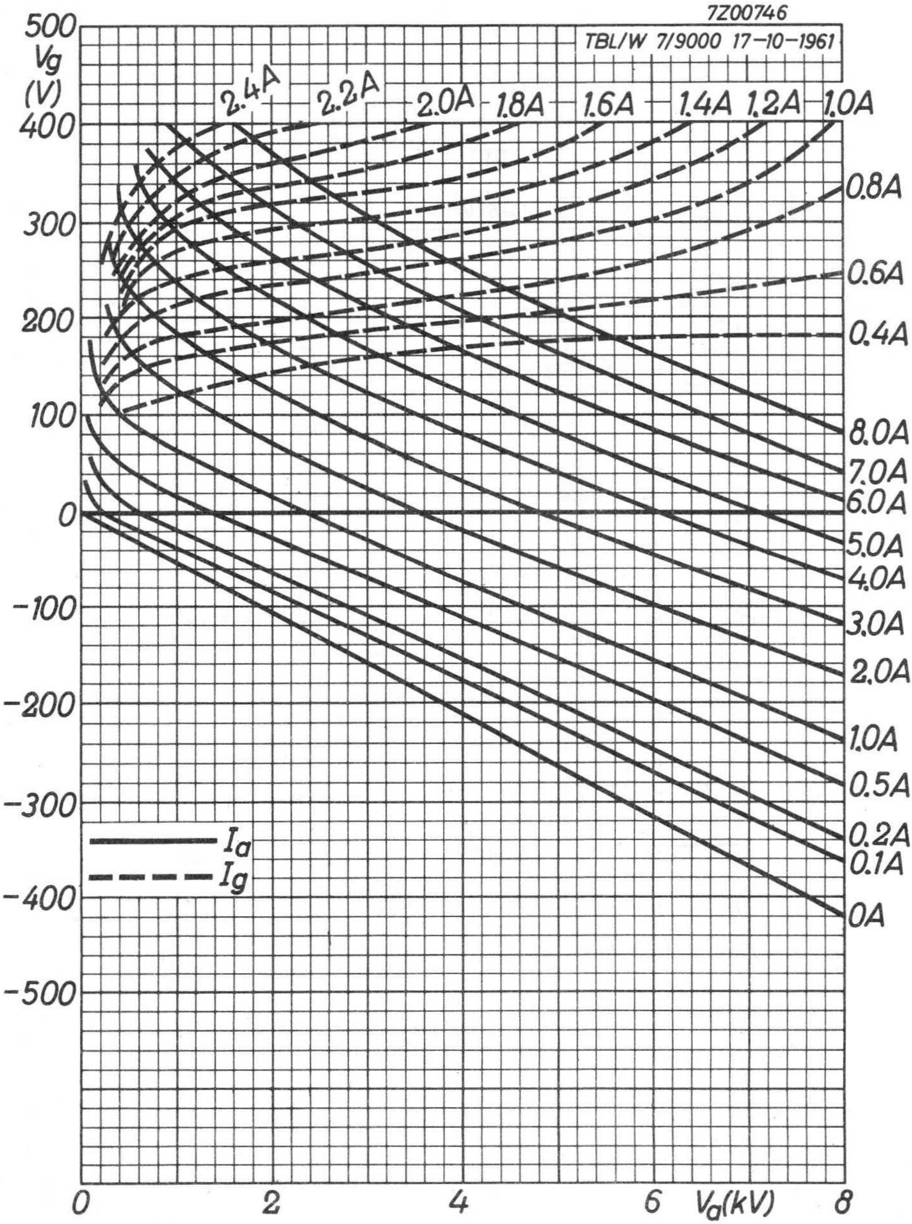
OPERATING CHARACTERISTICS , continuous service

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

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

7Z2 3540


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


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

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMIT (Absolute limit)

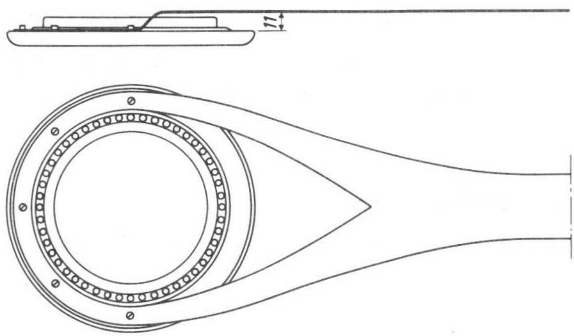
Seal temperature = max. 220 °C

7Z2 8674

AIR COOLING CHARACTERISTICS

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

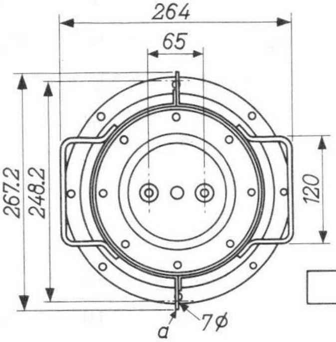
To ensure a uniform R.F. current distribution in the grid seal especially at frequencies higher than 4 MHz, the grid lead should be connected as shown below

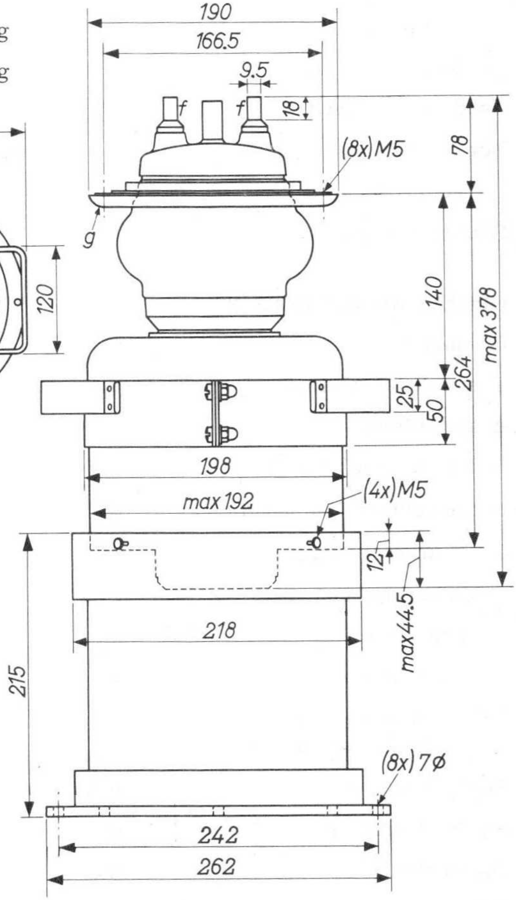


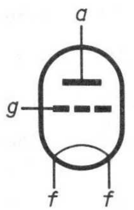
7Z2 3548

MECHANICAL DATA Dimensions in mm

Filament connectors with cable	: 40662
Grid connector	: 40663
Insulating pedestal	: 40648
Net weight of the tube	: 17.3 kg
Net weight of pedestal	: 7.15 kg







Mounting position: vertical with anode down

7Z2 8675

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

LIMITING VALUES (Absolute limits)

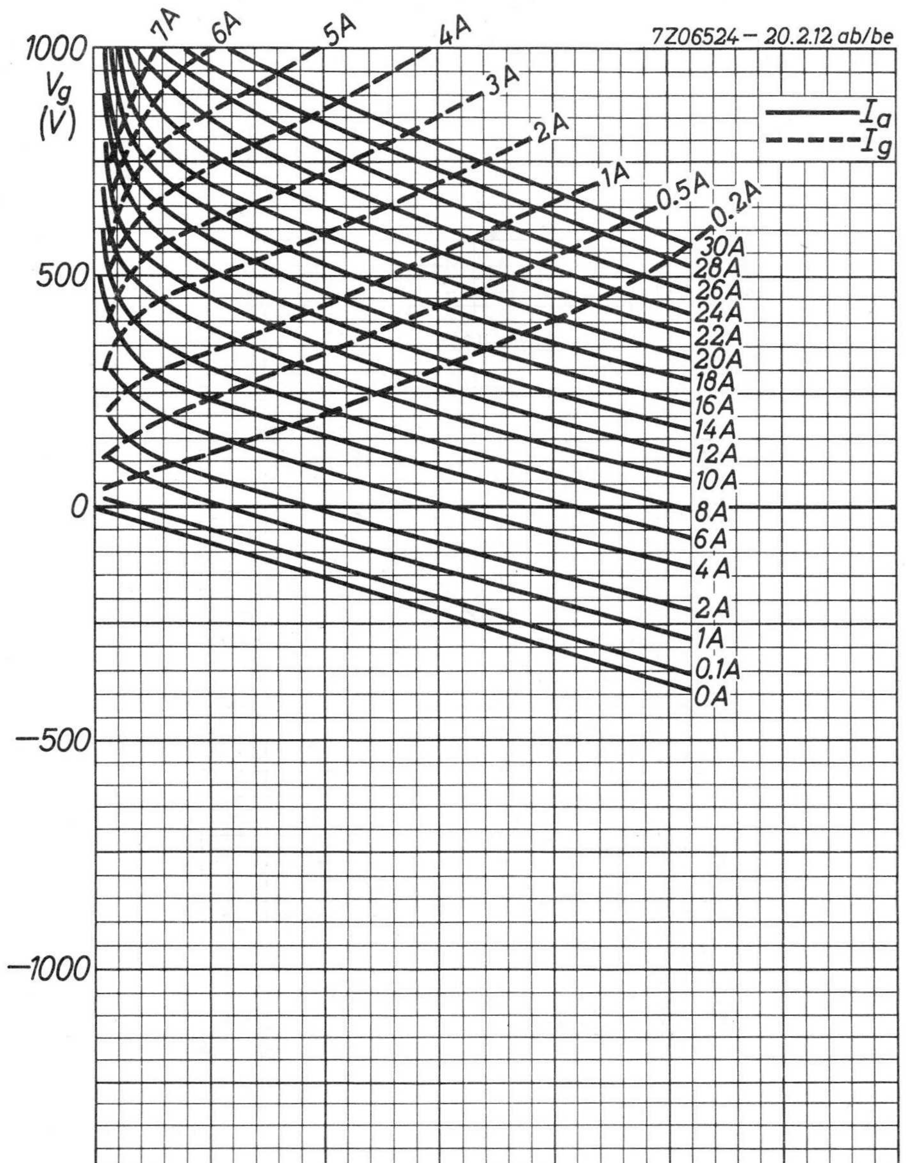
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	15	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

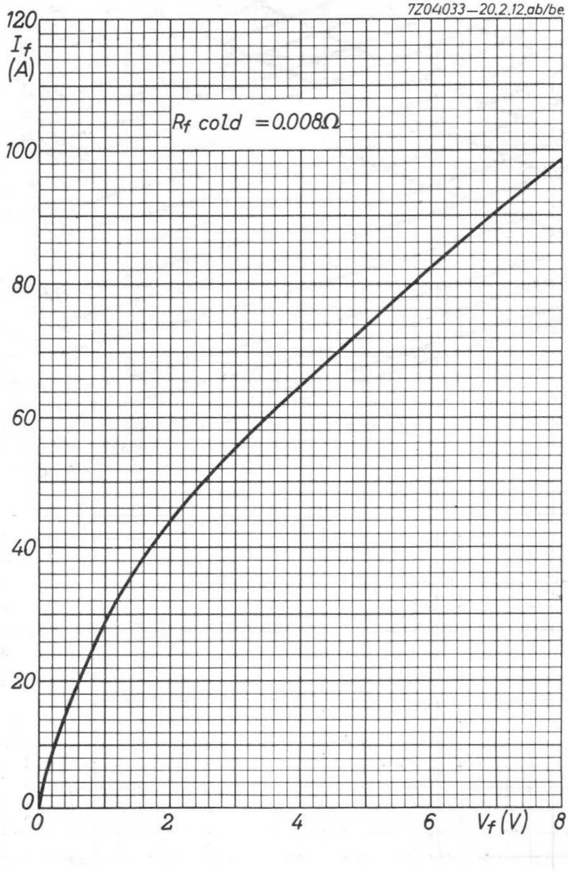
OPERATING CONDITIONS

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

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

7Z2 3550


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


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

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

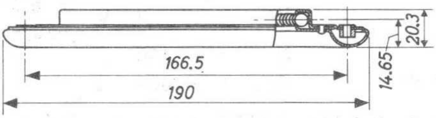
7Z2 8676

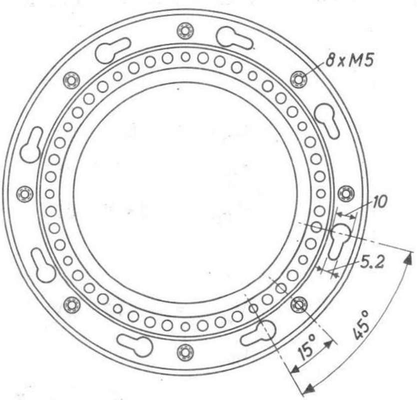
AIR COOLING CHARACTERISTICS See also cooling curves on page D

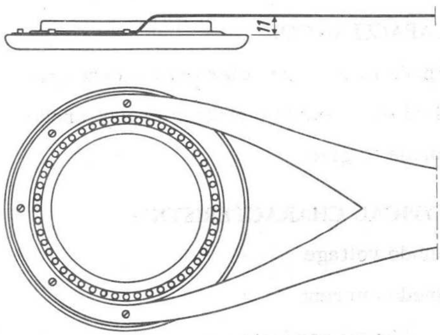
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

MECHANICAL DATA

Dimensions in mm







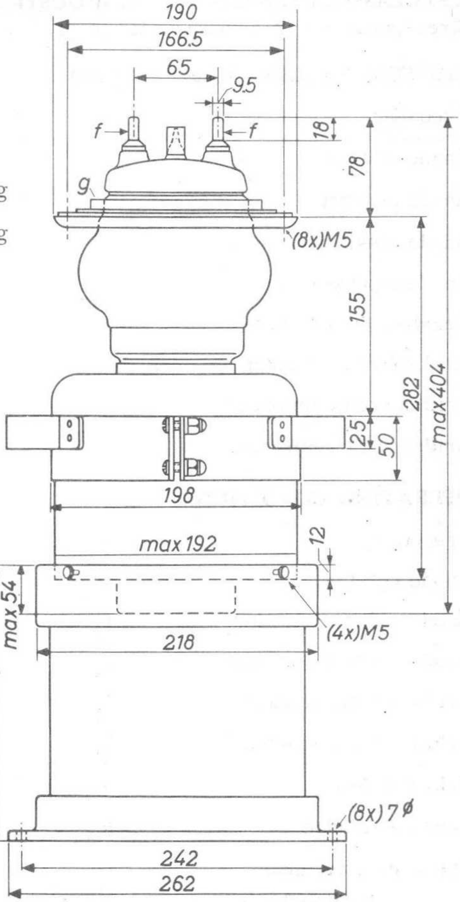
Grid connector 40663 Connection of the grid lead

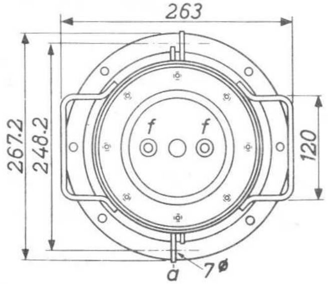
The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz , the grid lead should be connected as shown in the figure at right.

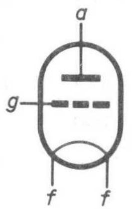
7Z2 4053

MECHANICAL DATA (continued)

Filament connectors	: 40662
Grid connector	: 40663
Insulating pedestal	: 40648
Net weight of tube	: 16.1 kg
Net weight of pedestal	: 7.15 kg







Mounting position: vertical

Dimensions in mm

7Z2 8677

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

LIMITING VALUES (Absolute limits)

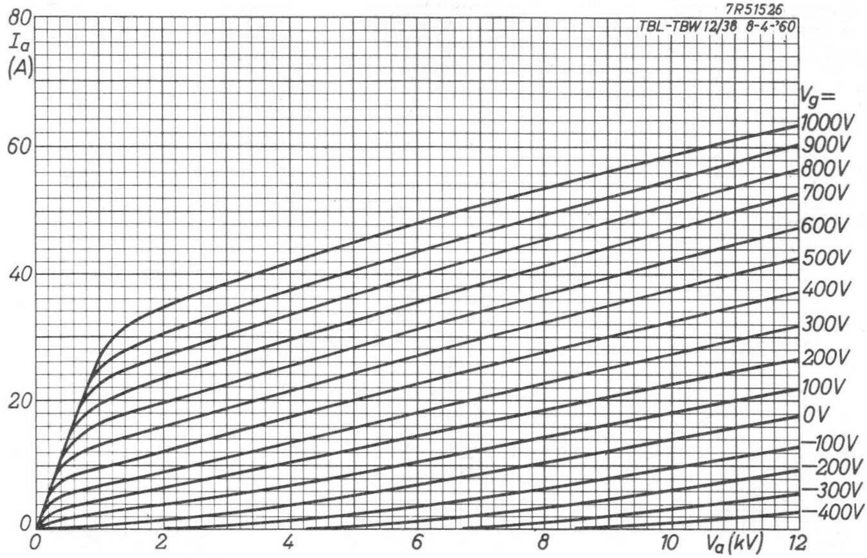
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	5	A
Anode dissipation	W_a	=	max.	15	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	2	kV
Grid current, loaded	I_g	=	max.	1.5	A
Grid current, unloaded	I_g	=	max.	2.0	A
Grid circuit resistance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

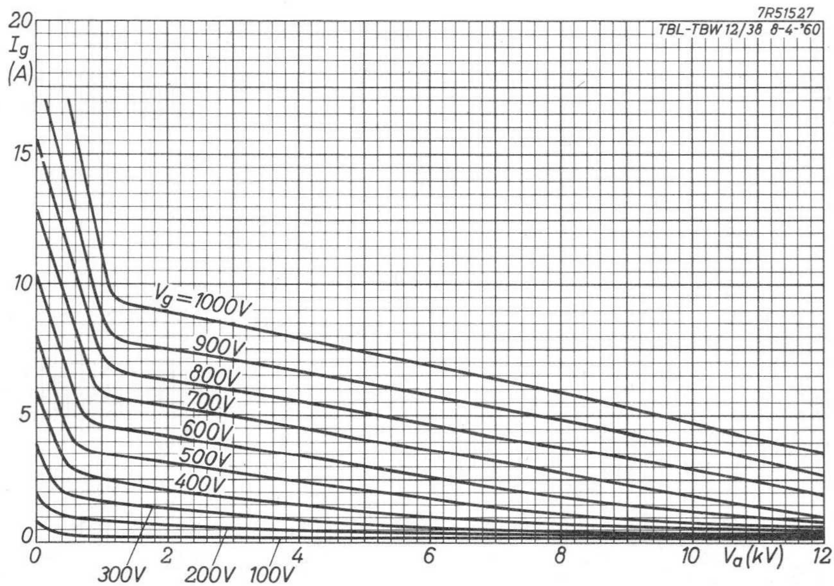
OPERATING CONDITIONS

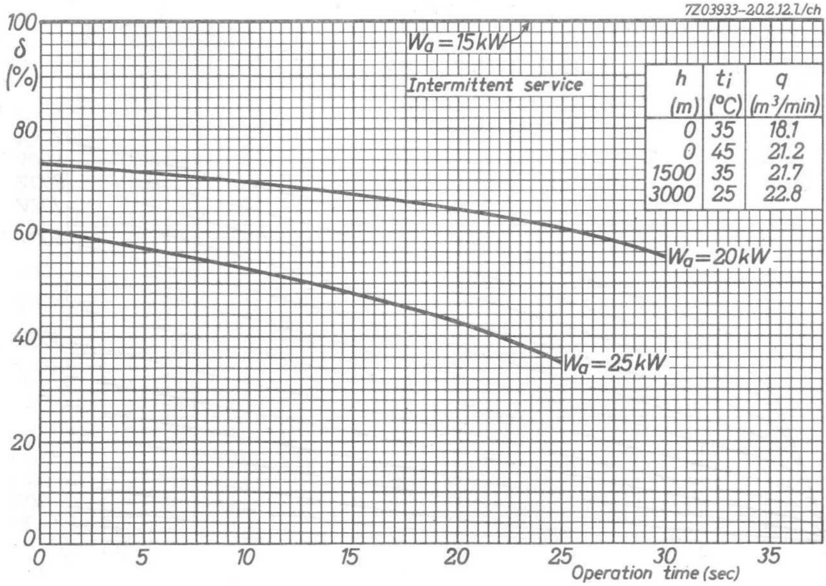
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	4.5	4.5	4.5	A
Anode current, unloaded	I_a	=	0.65	0.63	0.62	A
Grid current, loaded	I_g	=	0.9	0.9	0.9	A
Grid current, unloaded	I_g	=	1.22	1.3	1.35	A
Grid resistor	R_g	=	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	=	1450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

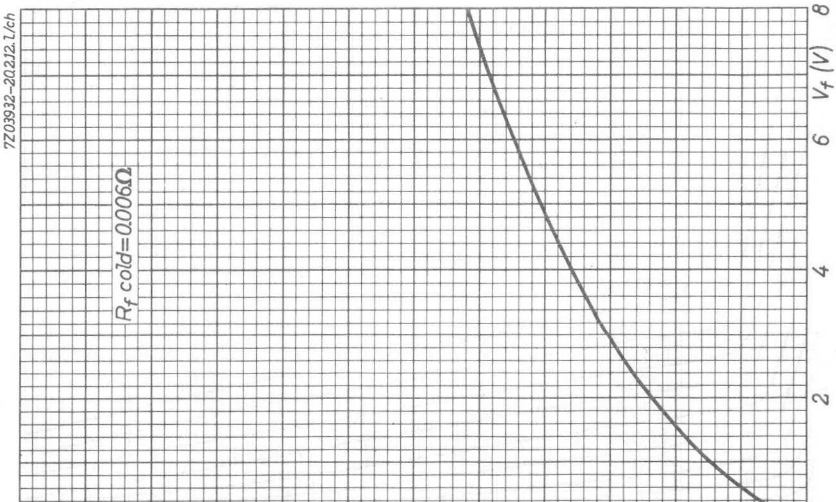
[1]) Useful power in the load, measured in a circuit having an efficiency of about 85%.

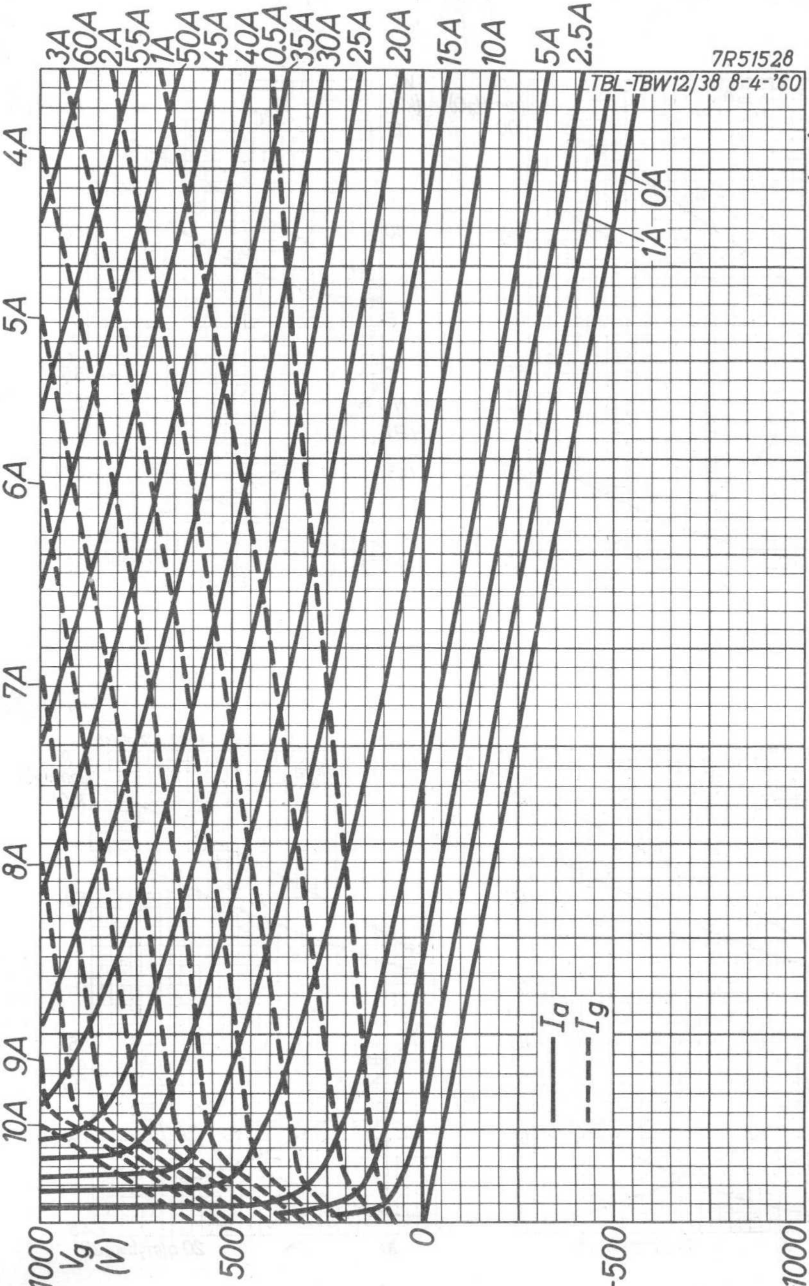
7Z2 3561


7R51526
TBL-TBW 12/38 8-4-'60
80
I_a
(A)
60
40
20
0
0
2
4
6
8
10
V_a (kV)
12
V_g=
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V


7R51527
TBL-TBW 12/38 8-4-'60
20
I_g
(A)
15
10
5
0
0
2
4
6
8
10
V_a (kV)
12
V_g=1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V

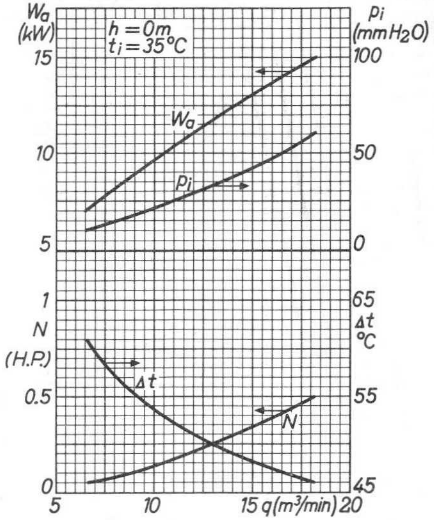

7Z03933-20.2.12.1/ch
100
δ
(%)
80
60
40
20
0
$W_a = 15kW$
Intermittent service
$W_a = 20kW$
$W_a = 25kW$
h (m) | t_i (°C) | q (m^3/min)
0 | 35 | 18.1
0 | 45 | 21.2
1500 | 35 | 21.7
3000 | 25 | 22.8
0
5
10
15
20
25
30
35
Operation time (sec)

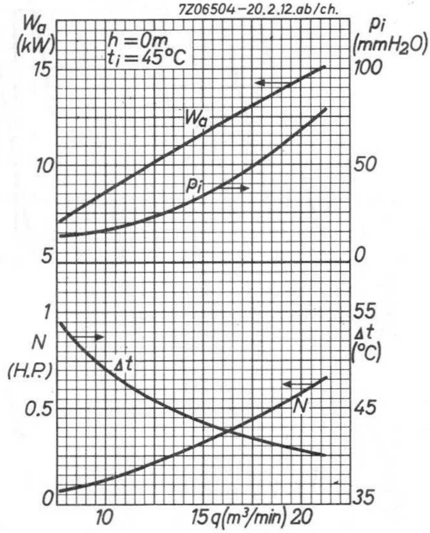

7Z03932-20.2.12.1/ch
R_f cold=0.006Ω
V_f (V)
8
6
4
2
0
300
I_f (A)
250
200
150
100
50
0


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

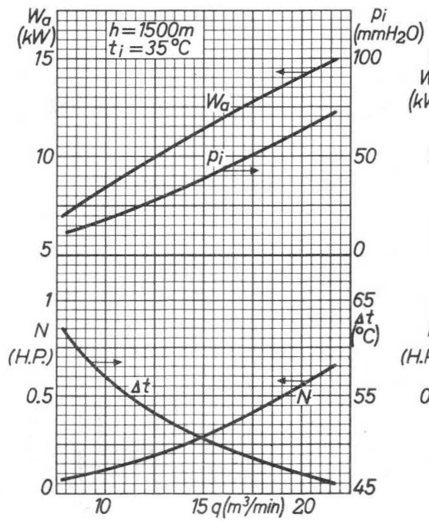
TBL12/38

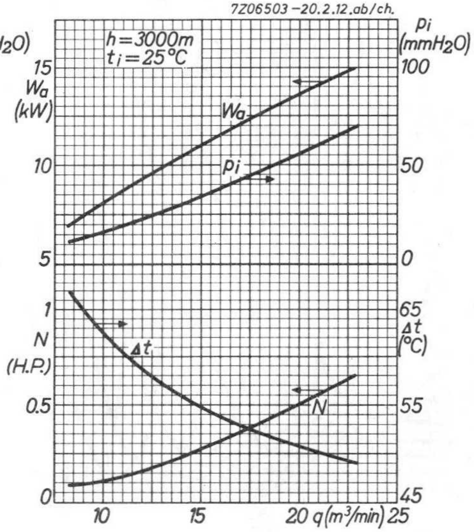
7Z06504-20.2.12.ab/ch.





7Z06503-20.2.12.ab/ch.





AIR COOLED R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

[1]) Two tubes

7Z2 3597

AIR COOLING CHARACTERISTICS

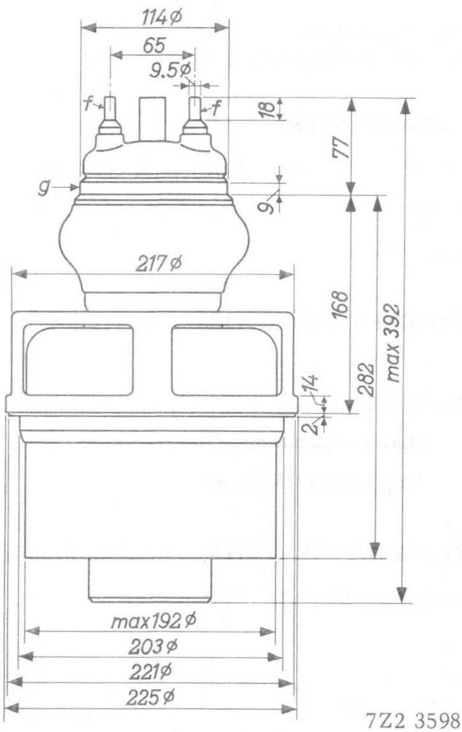
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

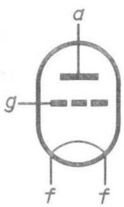
MECHANICAL DATA

Dimensions in mm

Net weight of tube : 19 kg

Net weight of pedestal: 7.15 kg





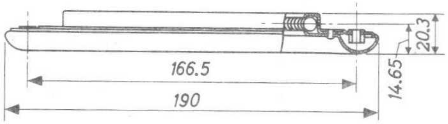
Mounting position: vertical

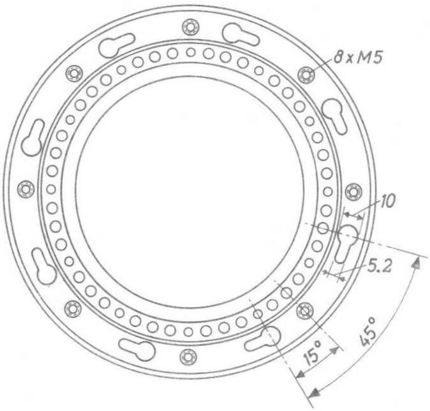
7Z2 3598

ACCESSORIES

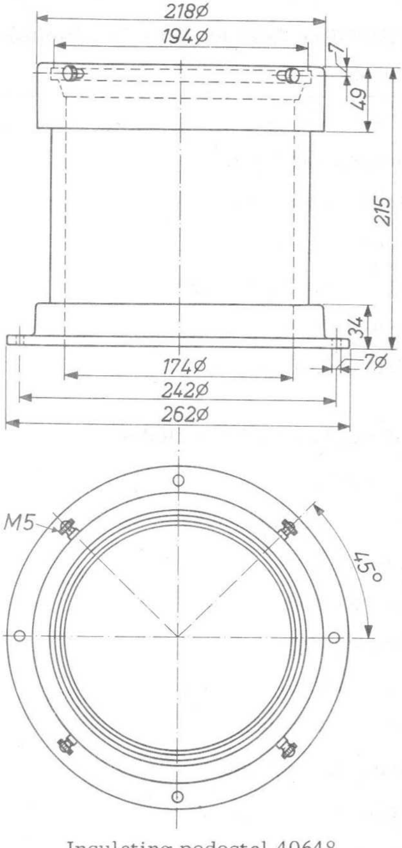
Dimensions in mm

Connectors with cable for filament: 40662



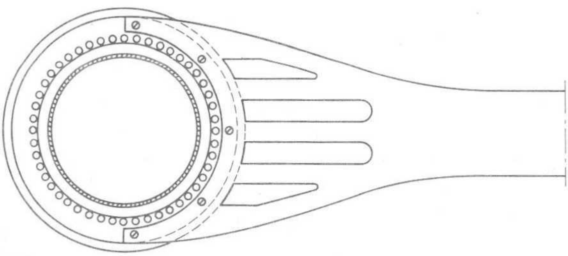


Grid connector 40663



Insulating pedestal 40648

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



7Z2 8678

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 3600

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

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

7Z2 3601

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

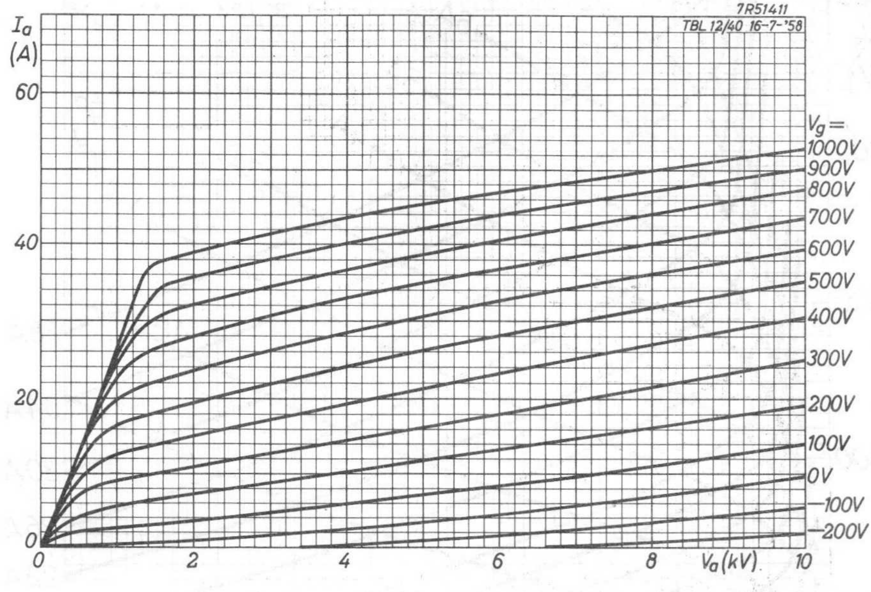
LIMITING VALUES (Absolute limits)

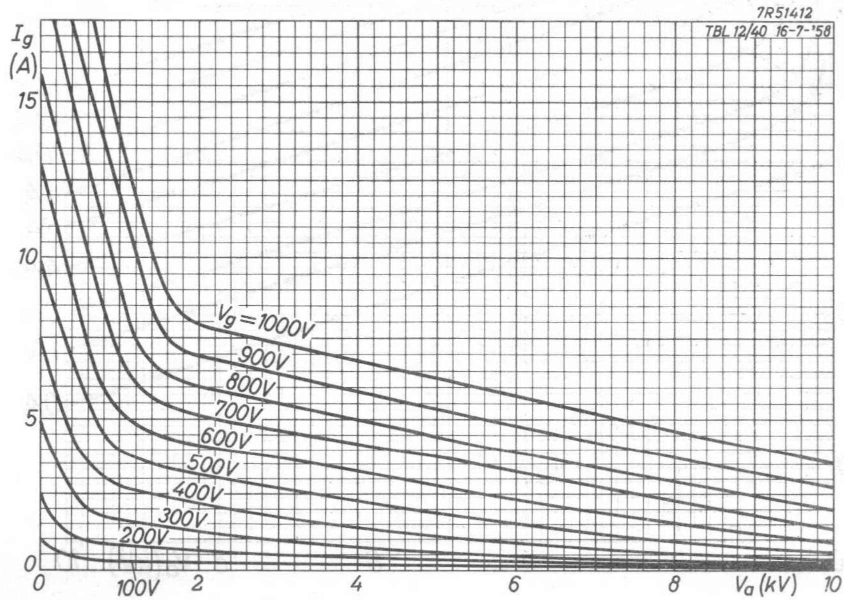
Anode voltage	V_a	=	max.	13	kV
Anode input power	W_{ia}	=	max.	60	kW
Anode dissipation	W_a	=	max.	15	kW
Anode current	I_a	=	max.	4.5	A
Grid circuit resistance	R_g	=	max.	10	kΩ

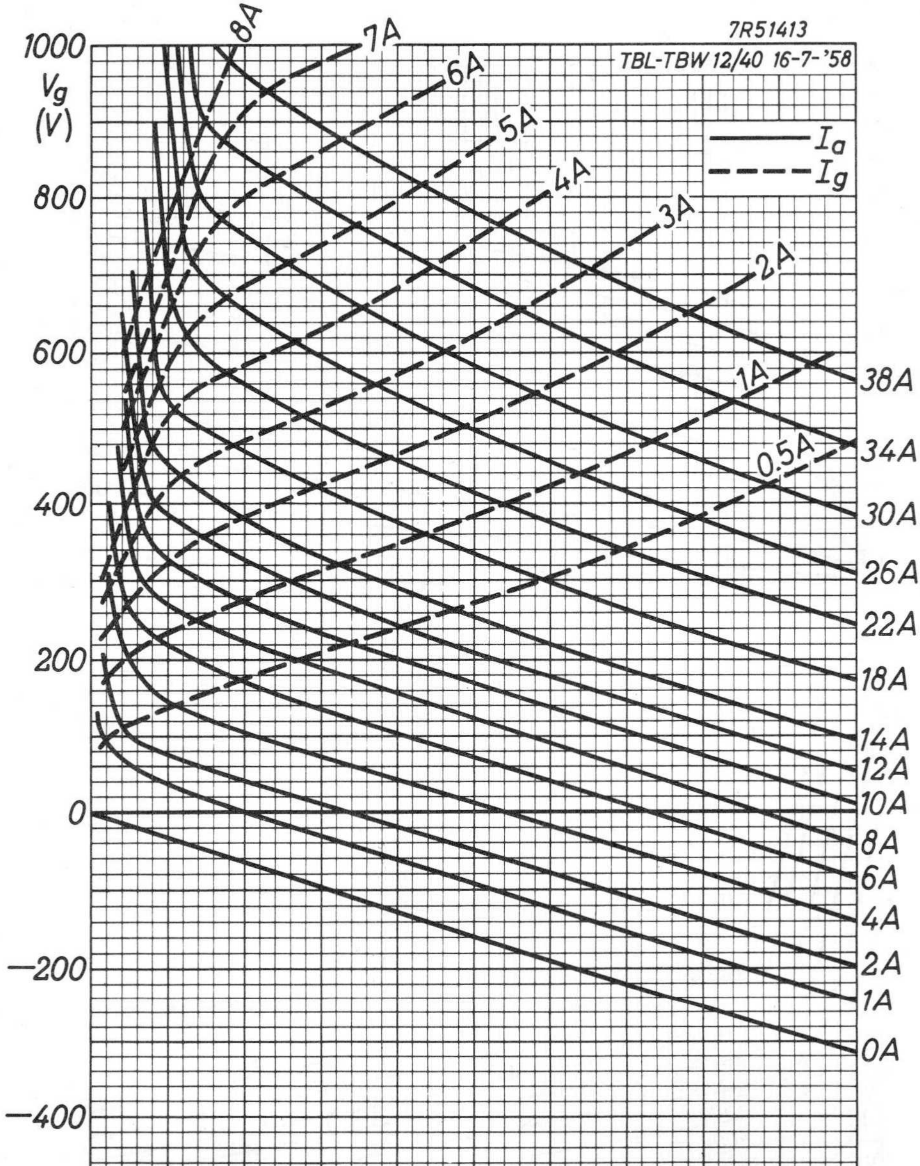
OPERATING CONDITIONS, two tubes

Anode voltage	V_a	=	10		kV
Grid voltage	V_g	=	−290		V
Load resistance	$R_{aa\sim}$	=	6240		Ω
Peak grid to grid A.C. voltage	V_{gg_p}	=	0	900	V
Anode current	I_a	=	2x0.1	2x1.6	A
Grid current	I_g	=	0	2x0.035	A
Peak grid current	I_{g_p}	=	–	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	%

7Z2 3602


7R51411
TBL 12/40 16-7-'58
Ia
(A)
60
40
20
0
0
2
4
6
8
Va(kV)
10
Vg=
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V


7R51412
TBL 12/40 16-7-'58
Ig
(A)
15
10
5
0
0
2
4
6
8
Va(kV)
10
Vg=1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V


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

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

General purposes

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_{fo}	=	0.012	Ω

The filament current must never exceed a peak value of 420 A at any time during the intial 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

7Z2 8679

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 = max. 180 ^oC

AIR COOLING CHARACTERISTICS; see also cooling curves

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

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

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

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

7Z2 8680

MECHANICAL DATA

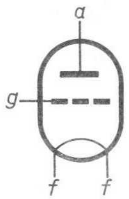
Dimensions in mm

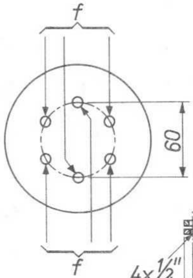
Clips for filament : 40628

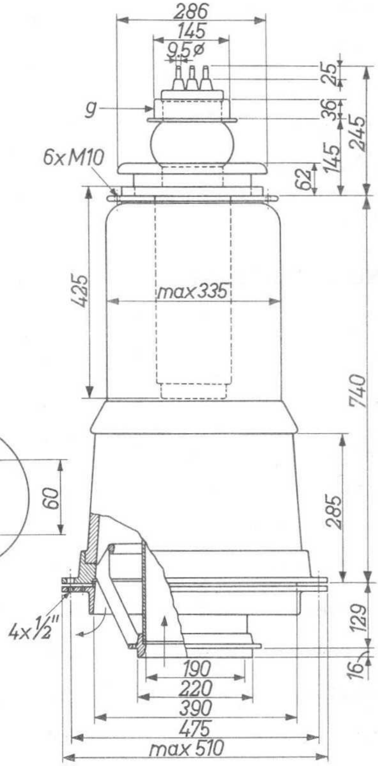
Cooler housing : K506

Net weight of the tube: 28.5 kg

Net weight of K506 : 72 kg







Tube mounted in cooler housing type K506

Mounting position: vertical with anode down

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

7Z2 3581

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.		45		kW
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_{g_p}	=	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	%

7Z2 8681

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

7Z2 8682

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.	45	kW
Grid circuit resistance	R_g	=	max.	20	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	12		10		10		kV
V_g	=	−450		−375		−400		V
$R_{aa\sim}$	=	1200		1500		2060		Ω
V_{gg_p}	=	0	2060	0	1680	0	1460	V
I_a	=	2x0.65	2x12	2x0.5	2x7.9	2x0.2	2x5.4	A
I_g	=	0	2x2.5	0	2x1.9	0	2x0.7	A
W_{ig}	=	0	2x2.4	0	2x1.44	0	2x0.5	kW
W_{ia}	=	2x7.8	2x144	2x5	2x79	2x2	2x54	kW
W_a	=	2x7.8	2x43	2x5	2x21	2x2	2x15.5	kW
W_o	=	0	202	0	116	0	77	kW
η	=	–	70	–	75	–	71	%

V_a	=	9		8.5		8		kV
V_g	=	−350		−325		−300		V
$R_{aa\sim}$	=	2080		2120		2210		Ω
V_{gg_p}	=	0	1300	0	1200	0	1120	V
I_a	=	2x0.25	2x4.8	2x0.25	2x4.4	2x0.25	2x4.1	A
I_g	=	0	2x0.65	0	2x0.55	0	2x0.4	A
W_{ig}	=	0	2x0.4	0	2x0.3	0	2x0.25	kW
W_{ia}	=	2x2.25	2x43.2	2x2.1	2x37.4	2x2	2x32.8	kW
W_a	=	2x2.25	2x12.2	2x2.1	2x10.4	2x2	2x9.4	kW
W_o	=	0	62	0	54	0	46.8	kW
η	=	–	72	–	72	–	71	%

7Z2 3584

R.F. CLASS B AMPLIFIER for television service, negative modulation, positive synchronisation

LIMITING VALUES (Absolute limits)

Frequency	f			up to	68	MHz
Anode voltage	V_a		=	max.	6.5	kV
Anode current	I_a	sync	=	max.	16	A
Anode input power	W_{ia}	sync	=	max.	100	kW
Anode dissipation	W_a	sync	=	max.	50	kW
Grid current	I_g	sync	=	max.	2	A

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 68	MHz[1]
Bandwidth (-1.5 dB)	B		=	5.5	MHz[2]
Bandwidth (-3 dB)	B		=	7.5	MHz[2]
Anode voltage	V_a		=	6.5	kV
Grid voltage	V_g		=	-250	V
Peak grid to grid A.C. voltage	V_{ggp}	sync	=	1740	V [3]
		black	=	1300	V [3]
Anode current	I_a	sync	=	32	A
		black	=	24	A
Grid current	I_g	sync	=	3.4	A
		black	=	2.2	A
Grid input power	W_{ig}	sync	=	22.4	kW [4]
Output power	W_o	sync	=	80+20	kW [5]
		black	=	45+11	kW [5]

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

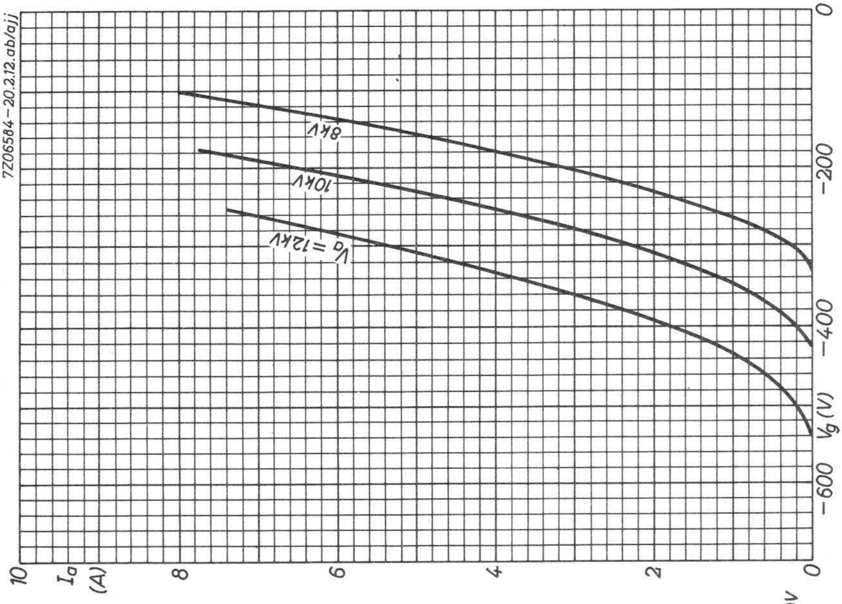
2) This value of bandwidth is based on measurements on a circuit with a single LC section

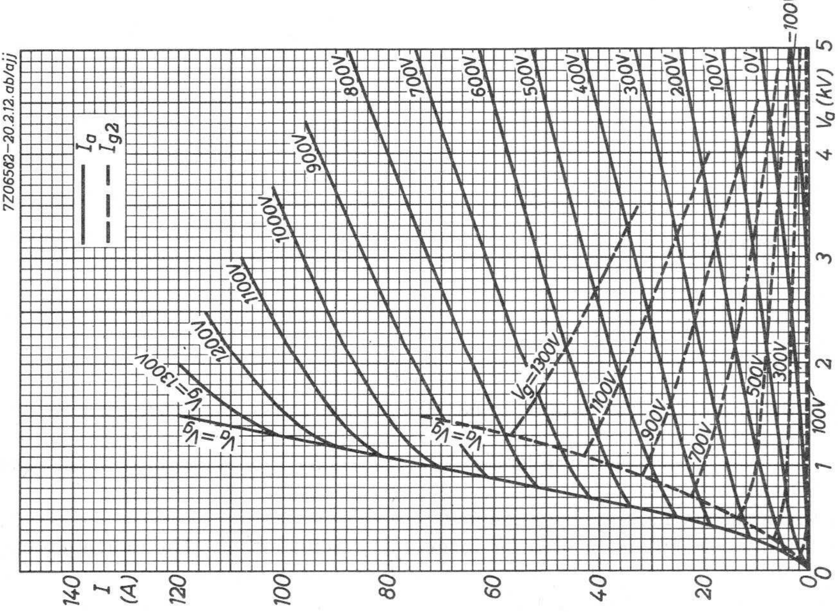
3) Measured by the slide back method

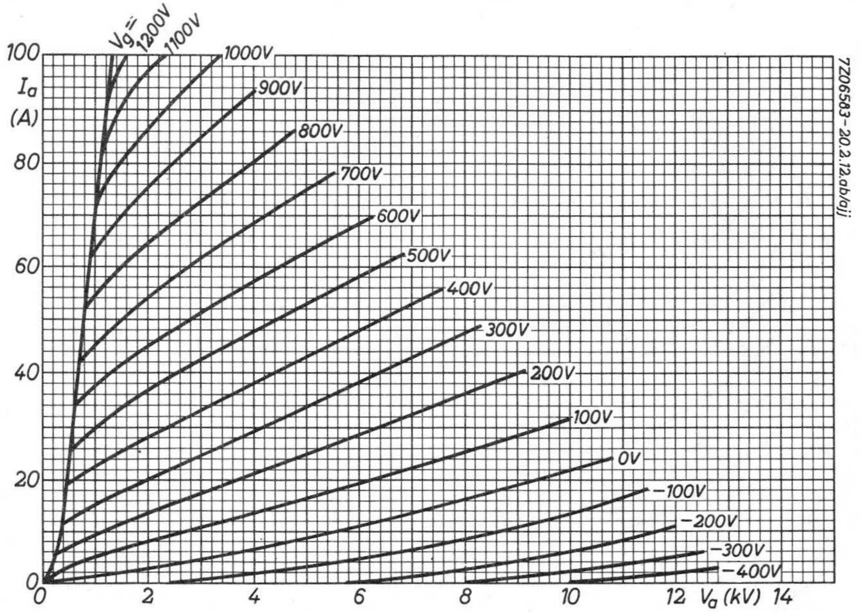
4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

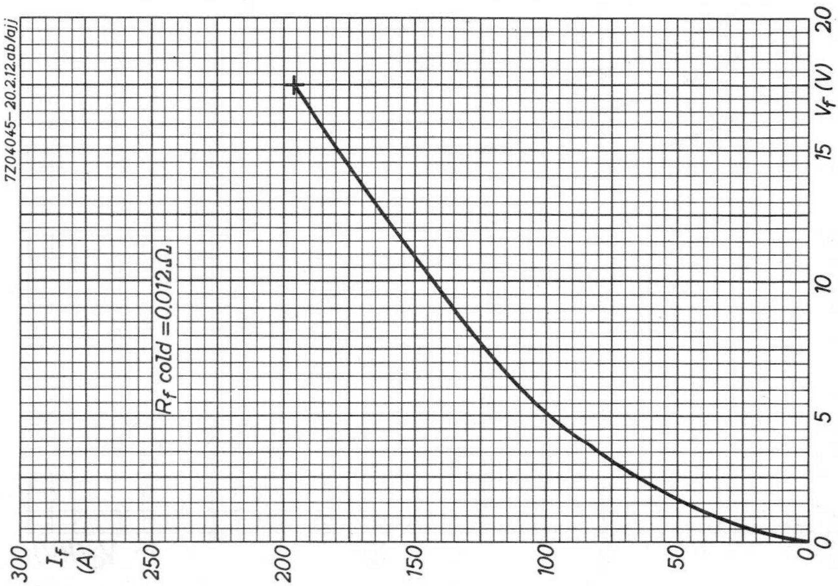
5) Power transferred from driving stage included.

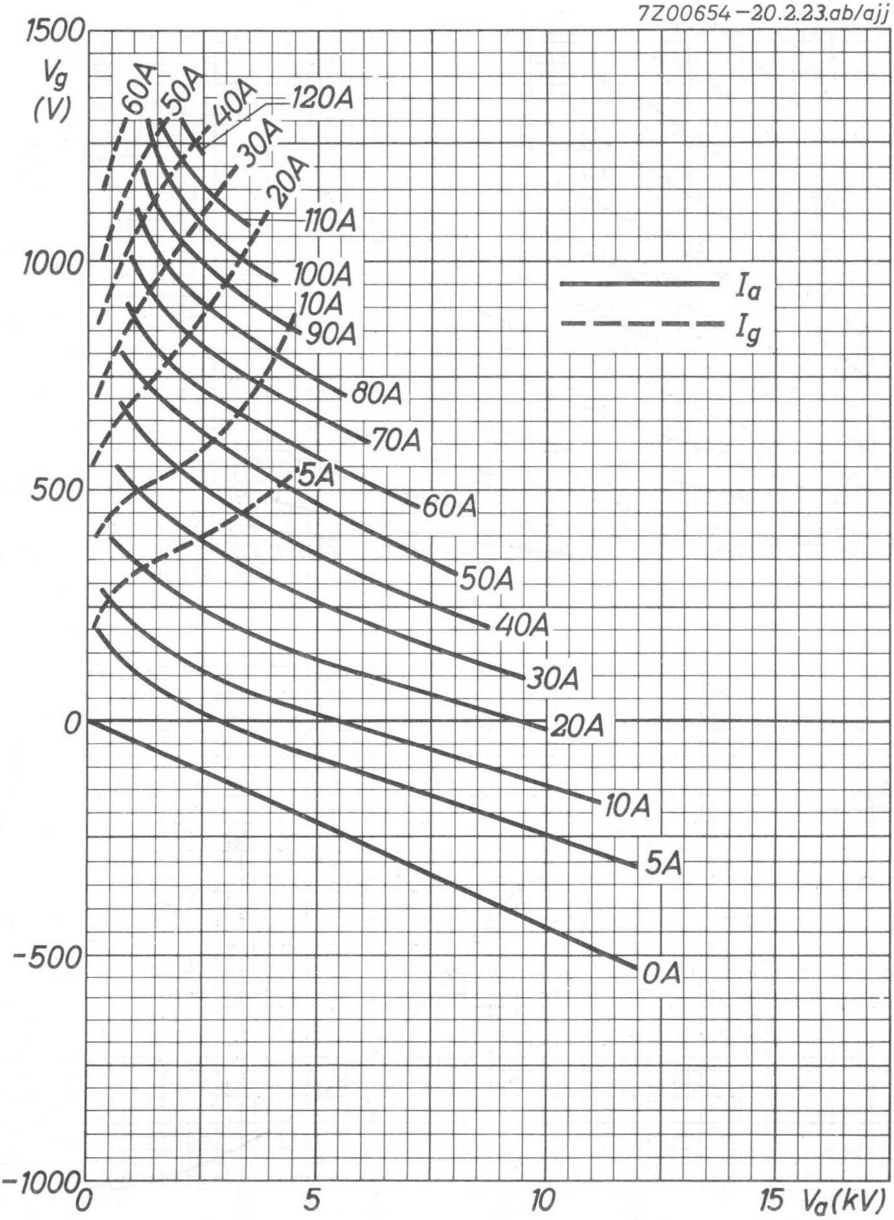
7Z2 8683

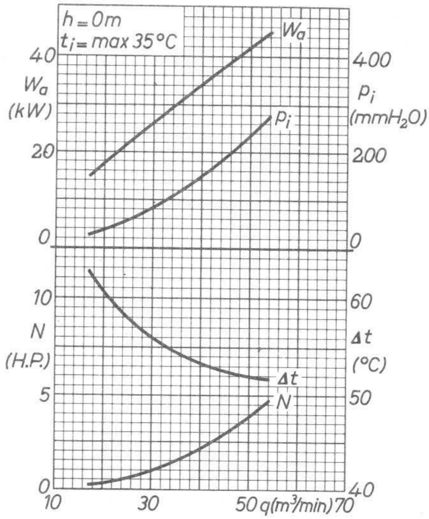

7Z06584-20.2.12.ab/ajj
$V_a = 12kV$
10kV
8kV
I_a (A)
V_g (V)
10
8
6
4
2
0
−600
−400
−200
0


7Z06582-20.2.12.ab/ajj
I_a
I_{g2}
I (A)
V_a (kV)
140
120
100
80
60
40
20
0
1
2
3
4
5
$V_a = V_g$
$V_g = 1300V$
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V

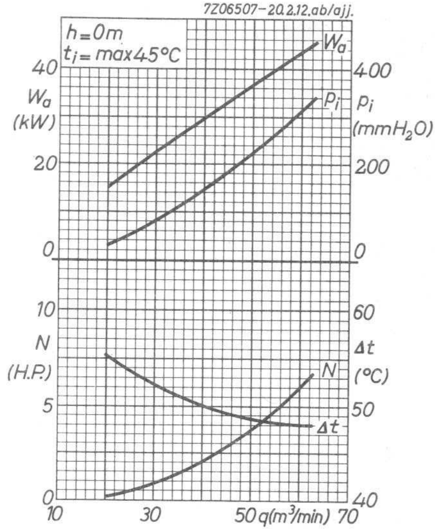

Vg=
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
Ia
(A)
Va (kV)
7Z06583−20.2.12.ab/ajj

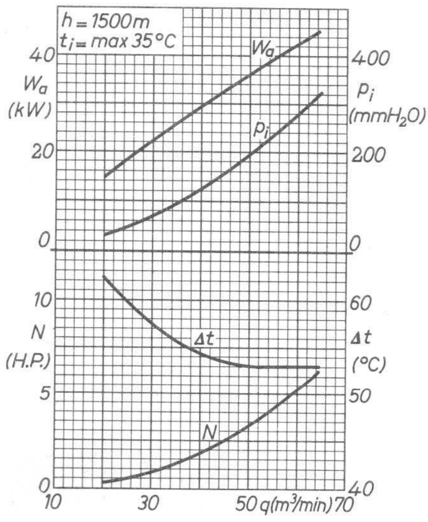

7Z04045−20.2.12.ab/ajj
Rf cold =0.012Ω
If
(A)
Vf (V)


7Z00654−20.2.23.ab/ajj
1500
V_g
(V)
1000
500
0
-500
−1000
0
5
10
15 V_a(kV)
60A
50A
40A
120A
30A
20A
110A
100A
10A
90A
80A
70A
5A
60A
50A
40A
30A
20A
10A
5A
0A
I_a
I_g

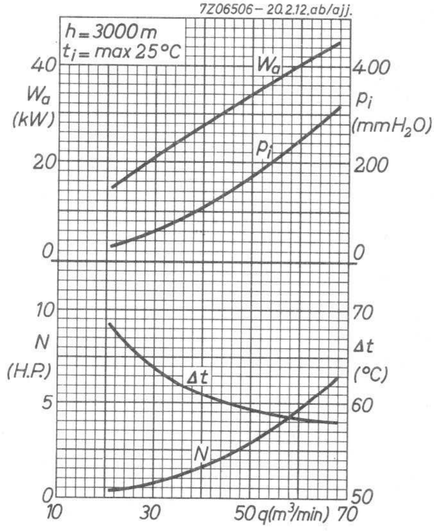


7Z06507 – 20.2.12.ab/ajj.



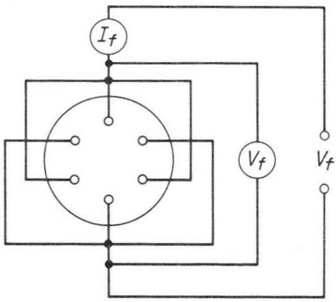


7Z06506 – 20.2.12.ab/ajj.



AIR COOLED R.F. POWER TRIODE

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

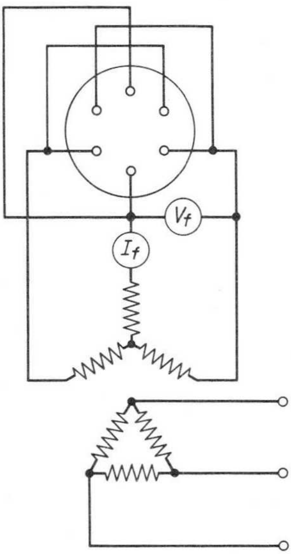


Single-phase filament energizing

V_f = 17.5 V

I_f = 196 A

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



Three-phase filament energizing

V_f = 15.5 V

I_f = 131 A

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

A safety device must be used to prevent filament energizing with one phase interrupted.

7Z2 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 % -10 %
Filament current	I_f	=	130	A	
Cold filament resistance	R_{fo}	=	0.005	Ω	

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

7Z2 8684

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

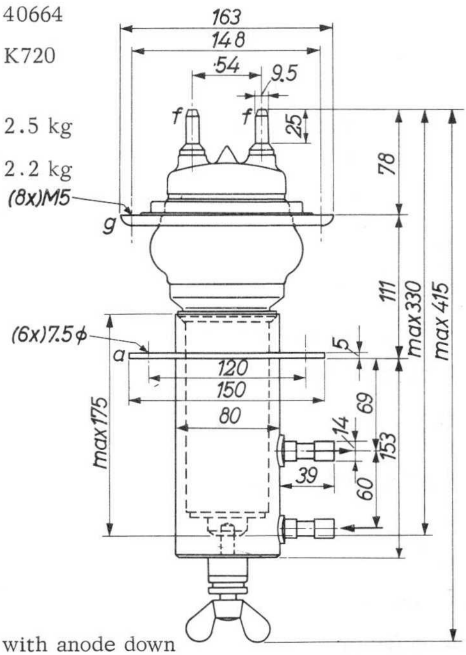
Filament clips with cable : 40662

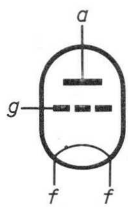
Grid connector : 40664

Water jacket : K720

Net weight of tube : 2.5 kg

Net weight of water jacket: 2.2 kg

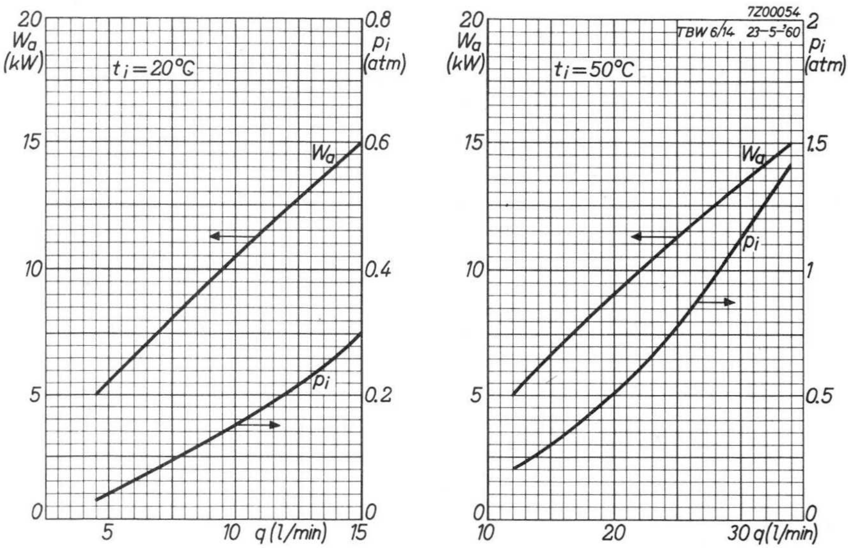




Mounting position: vertical with anode down

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

7Z2 3467


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

WATER COOLED
COAXIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

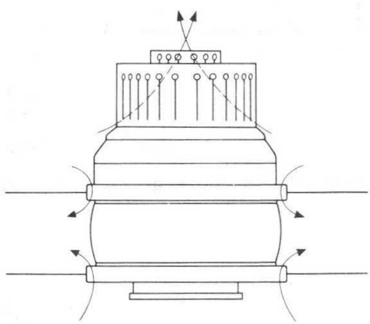
[1]) Anode fully screened from filament terminals by a flat metal screen connected to the grid terminal

7Z2 8685

WATER COOLING CHARACTERISTICS See also the cooling curves on page C

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
6	20	6	0.08
	50	12	0.30
8	20	8	0.13
	50	16	0.54
10	20	10	0.21
	50	20	0.84
12	20	12	0.30
	50	24	1.20

Recommended direction of additional air flow



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

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals = max. 180 °C

7Z2 4054

MECHANICAL DATA

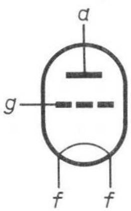
Dimensions in mm

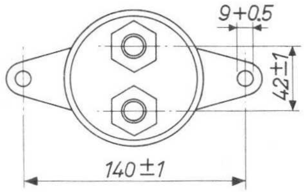
Water jacket : K718

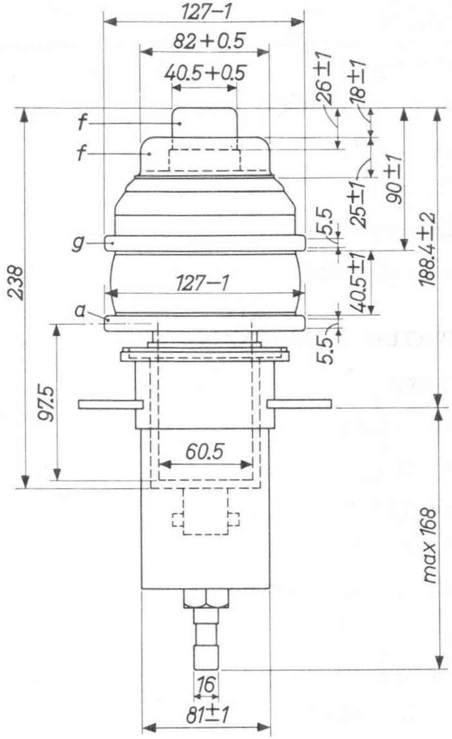
Grid and anode connector: 40651

Inner filament connector : 40652

Outer filament connector : 40653







Tube mounted in water-jacket type K718

Eccentricity of outer diameters of the grid and filament terminals with respect to the outer diameter of the anode terminal is max. 1 mm

Mounting position: vertical with anode down

7Z2 3480

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.	12	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 included

[2]) Pure tube efficiency

7Z2 3481

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. 12	max. 12	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[1])	MHz
Bandwidth	B (−1.5 dB)		=	–	7	MHz
Bandwidth	B (−3 dB)		=	6	12	MHz
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g		=	−90	−75	V
Peak grid A.C. voltage	V_{g_p}	sync	=	270	255	V
		black	=	200	180	V
Anode current	I_a	sync	=	4.8	4.8	A
		black	=	3.6	3.6	A
Grid current	I_g	sync	=	1.0	1.0	A
		black	=	0.35	0.35	A
Grid input power	W_{ig}	sync	=	1.4	1.3	kW
Output power	W_o	sync	=	17	12	kW
		black	=	9.6	6.75	kW

[1]) See lower figure page B

7Z2 4055

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

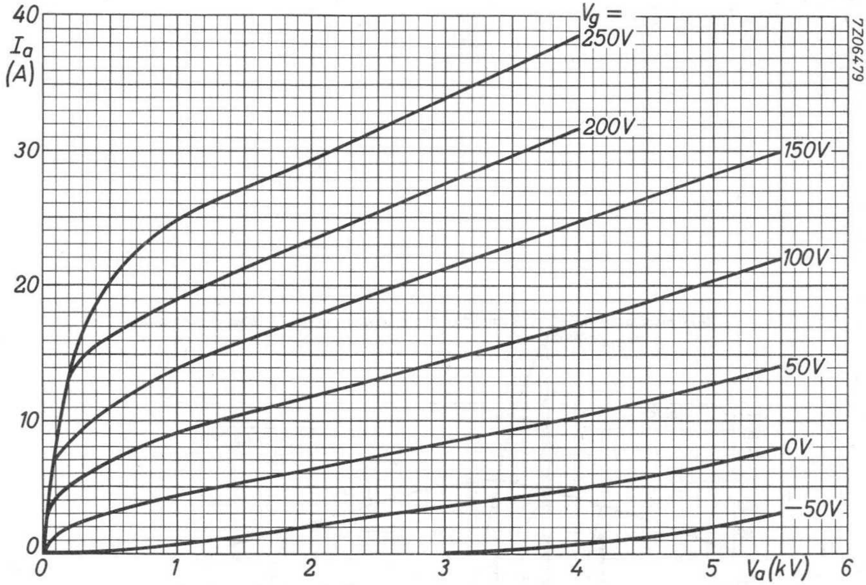
LIMITING VALUES (Absolute limits)

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. 12	max. 12	kW

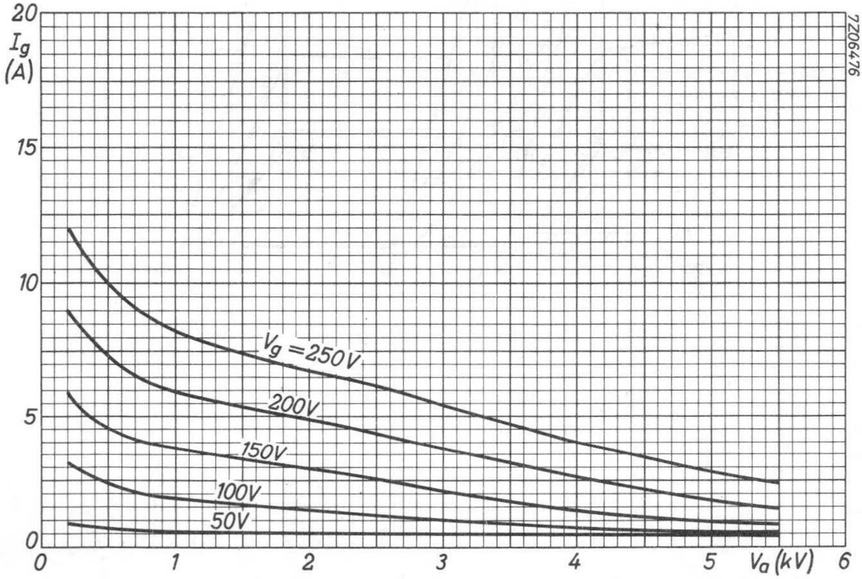
OPERATING CONDITIONS (at centre frequency of the resonance curve)

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	=	270	255	V
	V_{gp} black	=	110	95	V
Anode current	I_a white	=	4.8	4.8	A
	I_a black	=	1.45	1.45	A
Grid current	I_g white	=	1	1	A
	I_g black	=	0.2	0.2	A
Grid input power	W_{ig} white	=	1.4	1.3	kW
Output power	W_o white	=	17	12	kW
	W_o black	=	1.7	1.2	kW

7Z2 3483

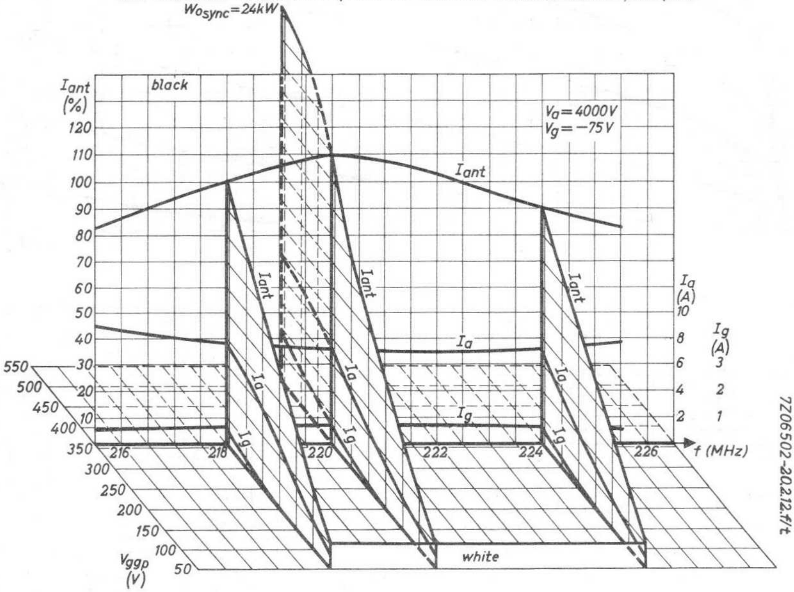


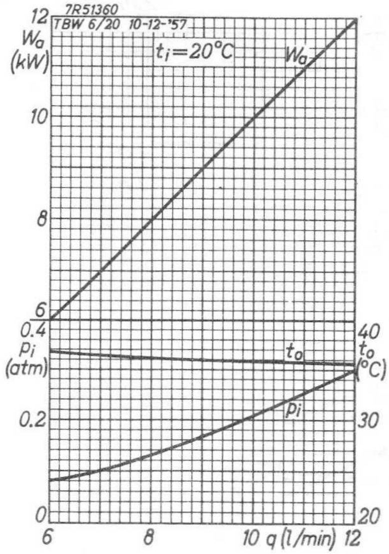
40
I_a
(A)
30
20
10
0
0
1
2
3
4
5
V_a(kV)
6
V_g =
250V
200V
150V
100V
50V
0V
−50V
7Z06479

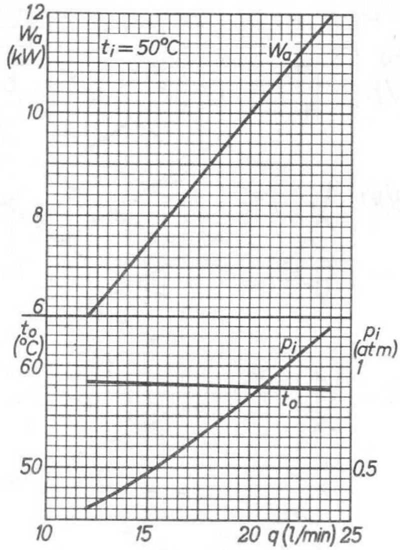


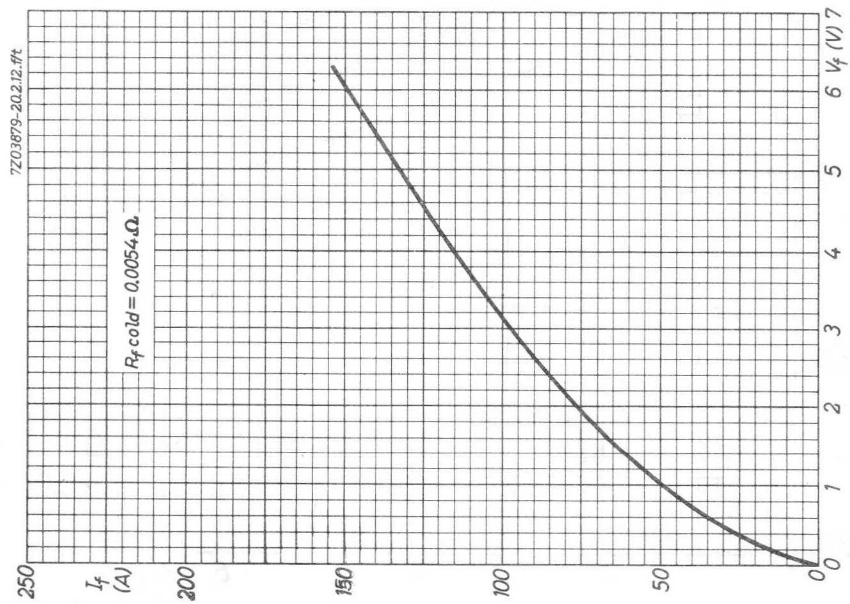
20
I_g
(A)
15
10
5
0
0
1
2
3
4
5
V_a(kV)
6
V_g = 250V
200V
150V
100V
50V
7Z06476

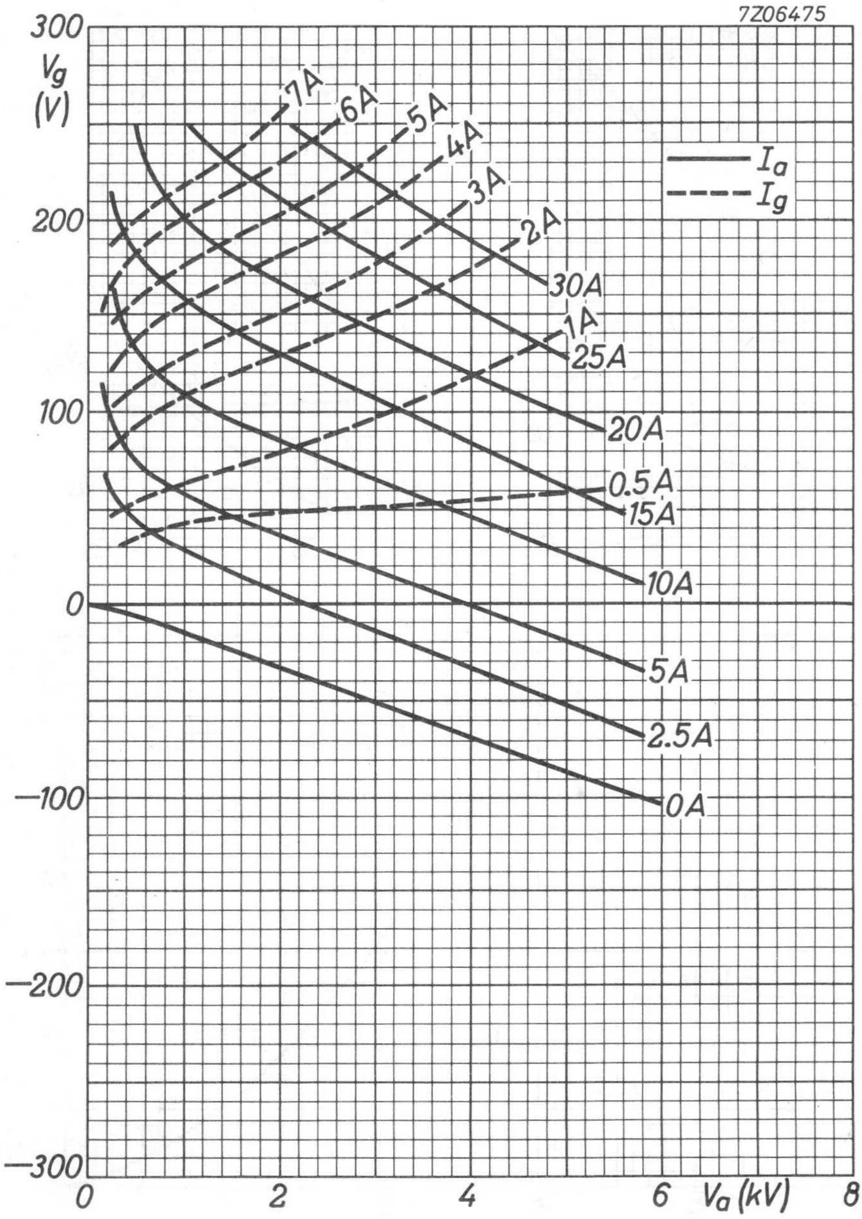
Grid-modulated R.F. class B amplifier for television service (2 tubes in push-pull)




7R51360
TBW 6/20 10-12-'57
$t_i = 20°C$
W_a
W_a (kW)
t_o
p_i
p_i (atm)
t_o (°C)
q (l/min)
12
10
8
6
0.4
0.2
0
40
30
20
6
8
10
12


$t_i = 50°C$
W_a
W_a (kW)
t_o (°C)
p_i (atm)
p_i
t_o
q (l/min)
12
10
8
6
60
50
1
0.5
10
15
20
25


7Z03879-20.2.12.flt
R_f cold = 0.0054 Ω
I_f (A)
V_f (V)
250
200
150
100
50
0
0
1
2
3
4
5
6
7


7Z06475
300
V_g
(V)
200
100
0
−100
−200
−300
0
2
4
6
V_a (kV)
8
I_a
I_g
7A
6A
5A
4A
3A
2A
1A
0.5A
30A
25A
20A
15A
10A
5A
2.5A
0A

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

General purposes

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

Television service

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

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

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

[1]) Two tubes

7Z2 8686

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

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1) At inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation 7Z2 8687

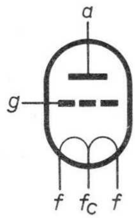
MECHANICAL DATA Dimensions in mm

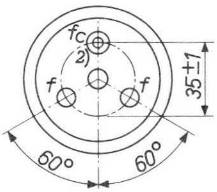
Filament connector: 40634

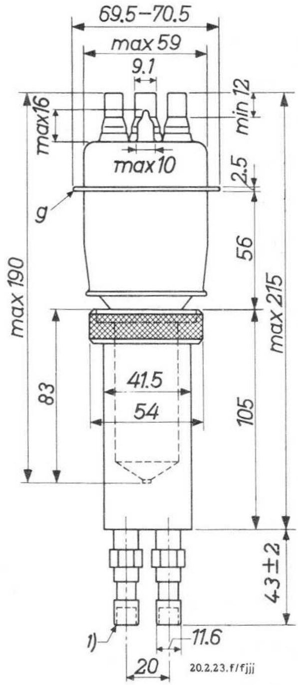
Grid connector : 40650[3]) or 40622

Net weight of tube : 0.45 kg

Net weight of K713 : 0.52 kg







Tube mounted in water jacket type K713

Mounting position: vertical with anode down

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

[1]) 1/8" 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 seal will be required 7Z2 8688

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

OPERATING CONDITIONS

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

7Z2 8689

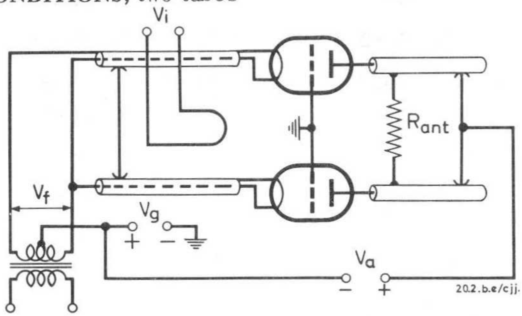
R.F. CLASS C TELEGRAPHY, grounded grid

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

For frequencies from 75 MHz up to 220 MHz See page C

OPERATING CONDITIONS, two tubes



For data please refer to page 6

7Z2 8690

R.F. CLASS C TELEGRAPHY, grounded grid (continued)

OPERATING CONDITIONS, two tubes (continued)

λ	=	4	2.7[1]	2.7[1]	1.36[1]	m
f	=	75	110	110	220	MHz
V_a	=	6	5	4	4	kV
V_g	=	-400	-300	-200	-200	V
I_a	=	2x1.5	2x1.5	2x1.37	2x1.25	A
I_g	=	2x0.31	2x0.33	2x0.35	2x0.2	A
V_{g_p}	=	740	640	500	450	V
W_{ig}	=	2x1120	2x920	2x675	2x380	W
W_{ia}	=	2x9	2x7.5	2x5.5	2x5	kW
W_a	=	2x2.1	2x2.2	2x1.7	2x2.5	kW
W_o	=	13.8+1.82	10.6+1.46	7.6+1.03	5+0.6	kW [2]
η	=	76.5	71	69	50	% [3]

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation.

[2]) Power transferred from driving stage included.

[3]) Pure tube efficiency.

7Z2 8691

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

OPERATING CONDITIONS

Wavelength	λ	=	4	4	m
Frequency	f	=	75	75	MHz
Anode voltage	V_a	=	6	5	kV
Grid voltage	V_g	=	-180	-145	V
Anode current	I_a	=	0.99	0.9	A
Peak grid A.C. voltage	V_{g_p}	=	250	225	V
Anode input power	W_{ia}	=	5.9	4.5	kW
Anode dissipation	W_a	=	4	3.05	kW
Output power	W_o	=	1.9	1.45	kW
Efficiency	η	=	32	32	%
Modulation factor	m	=	100	100	%
Grid current	I_g	=	0.3	0.32	A
Grid input power	W_{ig}	=	140	130	W

7Z2 8692

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

OPERATING CONDITIONS

Wavelength	λ	=	4	4	4	4	4	m
Frequency	f	=	75	75	75	75	75	MHz
Anode voltage	V_a	=	5	4.5	4	3.5	3	kV
Grid voltage	V_g	=	-400	-350	-300	-300	-250	V [1])
Anode current	I_a	=	1.2	1.2	1.2	1.2	1	A
Grid current	I_g	=	0.3	0.3	0.3	0.3	0.3	A
Peak grid A.C. voltage	V_{g_p}	=	690	650	600	600	510	V
Grid input power	W_{ig}	=	190	180	165	165	140	W
Anode input power	W_{ia}	=	6	5.4	4.8	4.2	3	kW
Anode dissipation	W_a	=	1.3	1.3	1.3	1.2	0.8	kW
Output power	W_o	=	4.7	4.1	3.5	3.0	2.2	kW
Efficiency	η	=	78	76	73	71.5	73	%
Modulation fator	m	=	100	100	100	100	100	%
Modulation power	W_{mod}	=	3.0	2.7	2.4	2.1	1.5	kW

[1]) Grid bias partially obtained by the grid resistor

7Z2 8693

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
Grid circuit resistance	R_g	=	max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	6		5		4.5		kV
V_g	=	−165		−138		−125		V
$R_{aa\sim}$	=	4900		6400		6100		Ω
V_{gg_p}	=	0	910	0	661	0	655	V
I_a	=	2x0.125	2x1.5	2x0.11	2x0.91	2x0.1	2x0.92	A
I_g	=	0	2x0.28	0	2x0.14	0	2x0.09	A
W_{ig}	=	0	2x115	0	2x42	0	2x27	W
W_{ia}	=	2x0.75	2x9	2x0.55	2x4.55	2x0.45	2x4.15	kW
W_a	=	2x0.75	2x2.35	2x0.55	2x1.25	2x0.45	2x1.15	kW
W_o	=	0	13.3	0	6.6	0	6	kW
d_{tot}	=	-	4.3	-	3.3	-	3.7	%
η	=	-	74	-	73	-	72	%

V_a	=	4		3.5		3		kV
V_g	=	−112		−100		−90		V
$R_{aa\sim}$	=	4900		4200		4400		Ω
V_{gg_p}	=	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	%

7Z2 3509

GRID MODULATED R.F. CLASS C AMPLIFIER for television service; negative modulation, positive synchronisation (American and European system)

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 220	MHz
Anode voltage	V_a		= max. 5	max. 4	kV
Anode input power	W_{ia}	sync	= max. 9.5	max. 6.5	kW
Anode dissipation	W_a	sync	= max. 5	max. 4	kW
Anode current	I_a	sync	= max. 1.9	max. 1.6	A
Grid dissipation	W_g	sync	= max. 120	max. 120	W
Negative grid voltage	$-V_g$		= max. 1000	max. 1000	V

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 75	170 to 220[1])	MHz
Bandwidth (−1.5 db)	B		=	5.25	6.5	MHz [2])
Bandwidth (−3 db)	B		=	8	10	MHz [2])
Anode voltage	V_a		=	5	4	kV
Grid voltage	V_g	sync	=	−200	−150	V
		black	=	−300	−225	V
		white	=	−550	−500	V
Peak grid to grid voltage	V_{gg_p}	sync	=	1000	1000	V [3])
Anode current	I_a	sync	=	3.8	3.2	A
		black	=	2.8	2.6	A
Grid current	I_g	sync	=	0.5	0.4	A
		black	=	0.35	0.22	A
Grid input power	W_{ig}	sync	=	250	350 to 450	W [4])
Output power	W_o	sync	=	9	6	kW
		black	=	5.35	3.37	kW

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[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

7Z2 8694

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
Grid dissipation	W_g	white	=	max.	120	W

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48-75	MHz
Bandwidth (I_{ant} = 85 %)	B		=	5.25	MHz
Bandwidth (I_{ant} = 70 %)	B		=	8	MHz
Anode voltage	V_a		=	5	kV
Grid voltage	V_g	white	=	-200	V
		black	=	-460	V
		sync	=	-580	V
Peak grid to grid voltage	V_{gg_p}	white	=	1000	V
Anode current	I_a	white	=	3.8	A
		black	=	0.8	A
Grid current	I_g	white	=	0.5	A
		black	=	0	A
Grid input power	W_{ig}	white	=	250	W
Output power	W_o	white	=	9	kW
		black	=	0.6	kW

7Z2 8695

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	=	1000	1000	V [3])
		black	=	800	750	V [3])
		white	=	0	200	V [3])
Anode current	I_a	sync	=	3.8	3.2	A
		black	=	3	2.6	A
		white	=	0.2	-	A
Grid current	I_g	sync	=	0.5	0.4	A
		black	=	0.22	0.22	A
		white	=	0	-	A
Grid input power	W_{ig}	sync	=	250	350 to 450	W [4])
Output power	W_o	sync	=	9	6	kW
		black	=	5.35	3.37	kW

[1]) When using the tube above 108 MHz, particular attention must be paid to a careful design of the installation, otherwise the tube may be damaged. Therefore, our guarantee for the tubes operating at frequencies above 108 MHz can only be given after approval of the installation

[2]) These values are based on measurements on a circuit with a single LC section

[3]) Measured by the slide back method

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

7Z2 8696

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
Grid dissipation	W_g	= max.	120	W

OPERATING CONDITIONS

Transformer voltage	V_{tr}	=	6.0 [1]	5.1 [2]	kV_{RMS}
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	%

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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

7Z2 8697

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
Grid dissipation	W_g	=	max.	120	W

OPERATING CONDITIONS

Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	5.1[1]	4.4[2]	kV_{RMS}
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

7Z2 8698

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

LIMITING VALUES (Absolute limits)

Frequency	f	up to	75	MHz
Transformer voltage	V_{tr}	= max.	6800	V_{RMS}
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

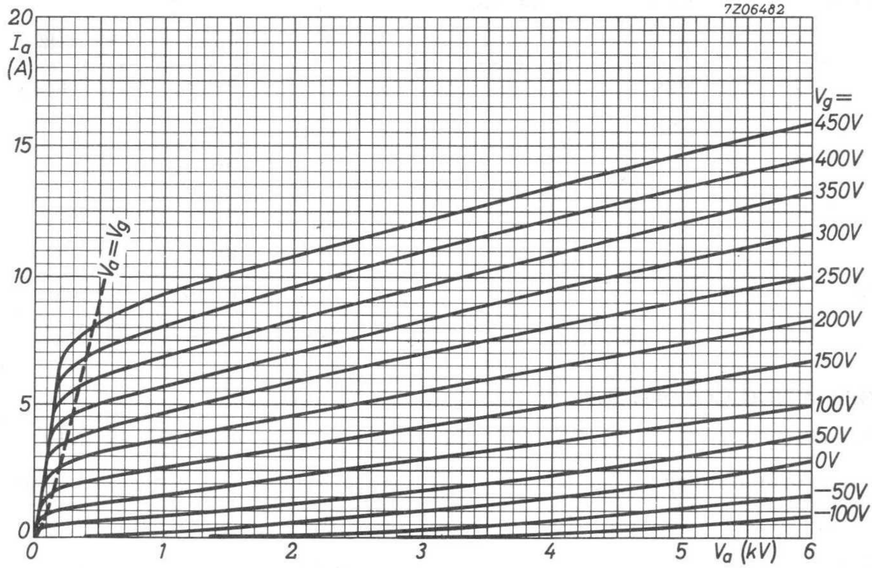
OPERATING CONDITIONS

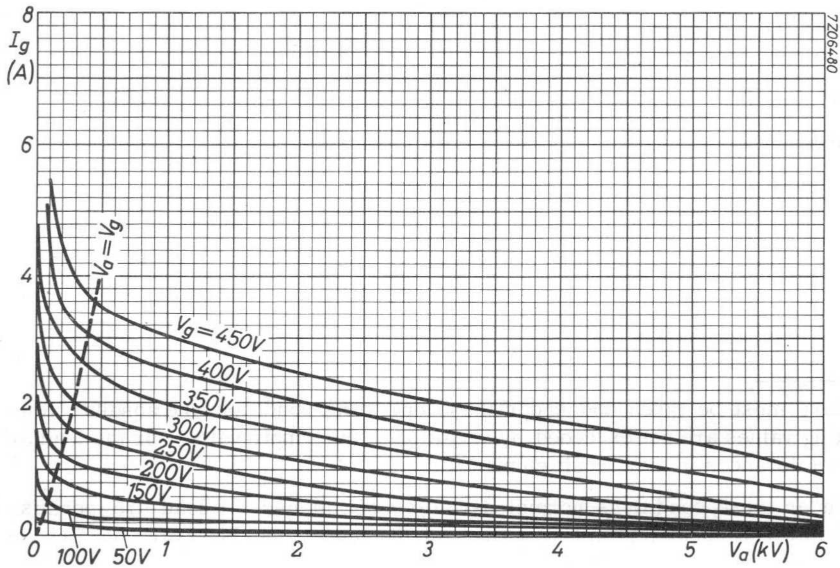
Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	6.8[1]	5.9[2]	kV_{RMS}
Anode current	I_a	=	0.8	0.7	A
Grid current	I_g	=	0.19	0.165	A
Grid resistor	R_g	=	1050	1050	
Grid input power	W_{ig}	=			W
Anode input power	W_{ia}	=	6.05	4.6	kW
Anode dissipation	W_a	=	1.5	1.24	kW
Output power	W_o	=	4.55	3.36	kW
Efficiency	η	=	75	73	%

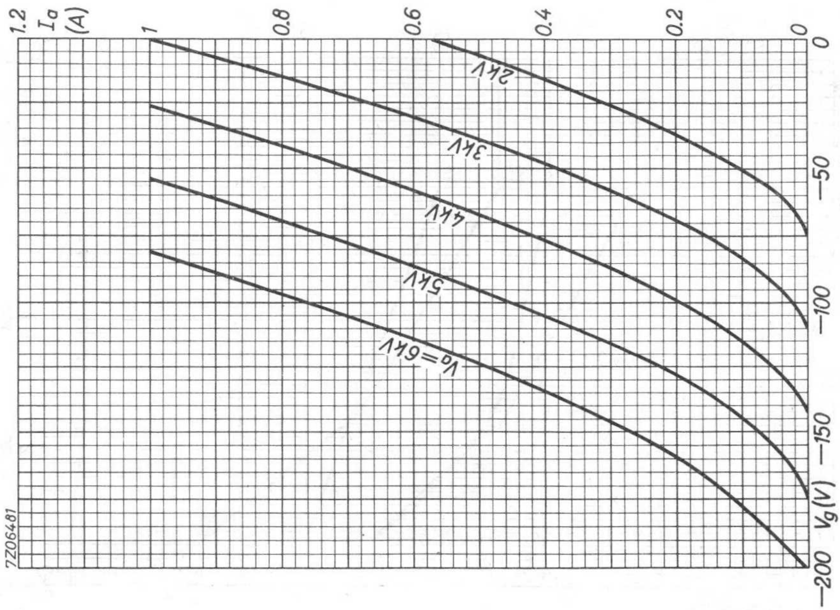
[1]) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

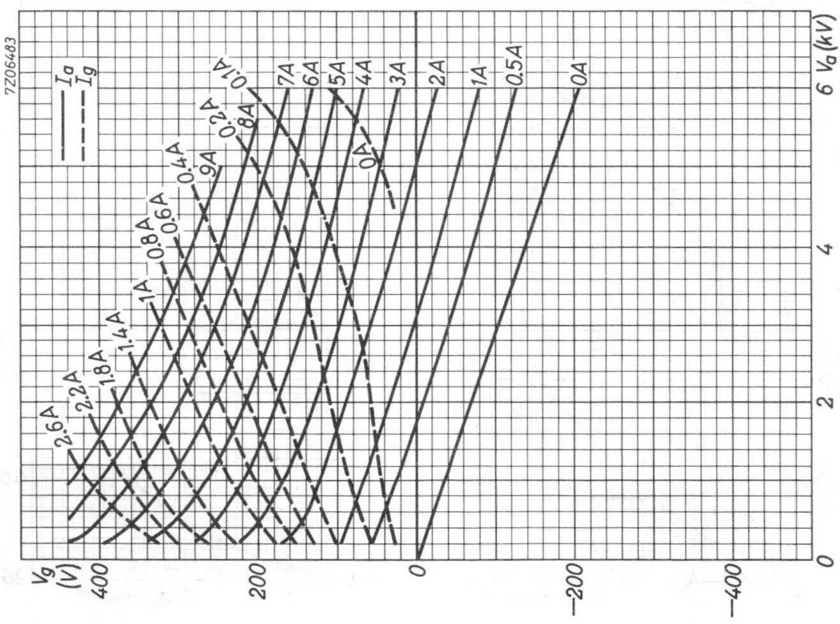
[2]) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

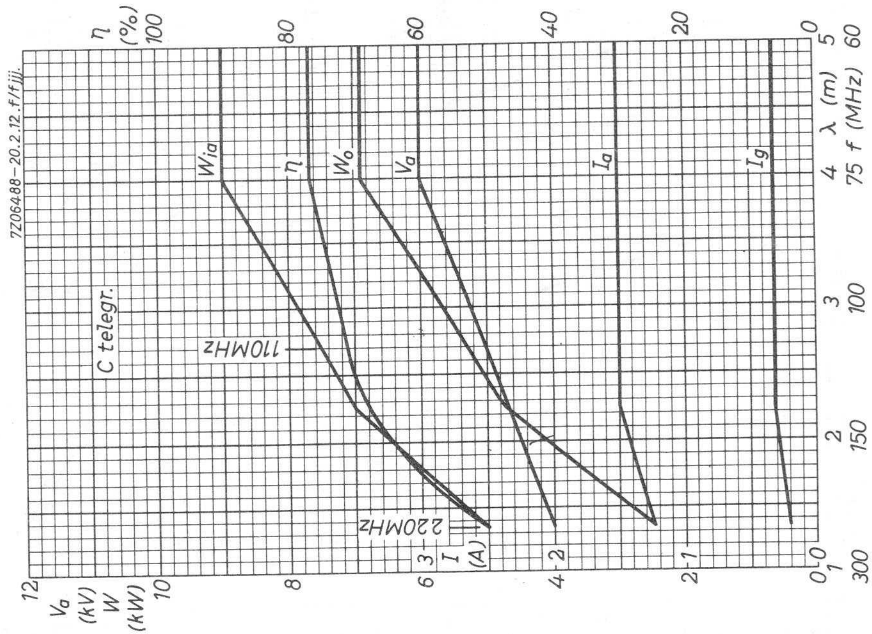
7Z2 8699

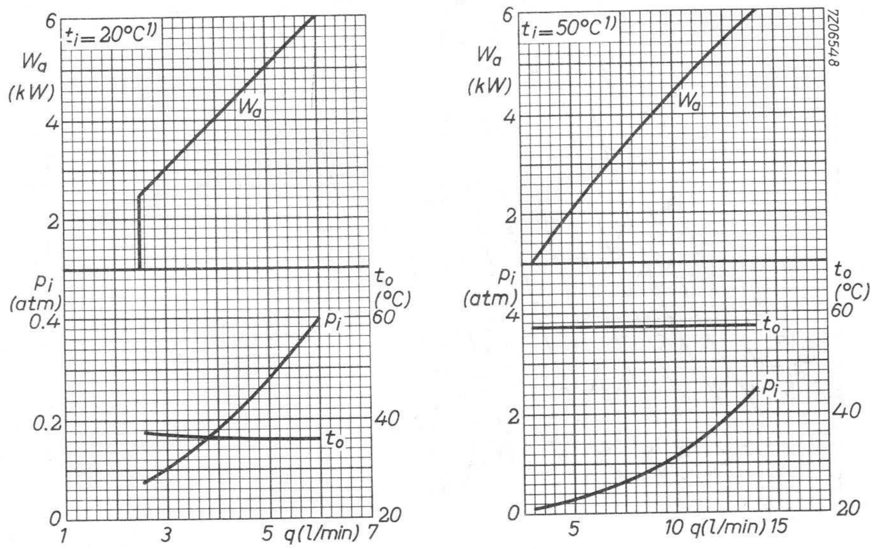

7Z06482
20
I_a
(A)
15
10
5
0
0
1
2
3
4
5
V_a (kV)
6
$V_a = V_g$
$V_g =$
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V


7Z06480
8
I_g
(A)
6
4
2
0
0
100V
50V
1
2
3
4
5
V_a(kV)
6
$V_a = V_g$
$V_g = 450V$
400V
350V
300V
250V
200V
150V


7Z06481
Ia (A)
1.2
1
0.8
0.6
0.4
0.2
0
Va=6kV
5kV
4kV
3kV
2kV
Vg (V)
0
−50
−100
−150
−200


7Z06483
Ia
Ig
Vg (V)
400
200
0
−200
−400
Va (kV)
0
2
4
6
2.6A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0A


7Z06488-20.2.12.f/fjjj.
C telegr.
110MHz
220MHz
W_{ia}
η
W_o
V_a
I_a
I_g
η (%)
V_a (kV)
W (kW)
I (A)
λ (m)
f (MHz)


$t_i = 20°C$ 1)
W_a (kW)
W_a
p_i (atm)
t_o (°C)
p_i
t_o
q (l/min)
$t_i = 50°C$ 1)
7Z06548

WATER COOLED R.F. POWER TRIODE

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

COOLING: water/low-velocity air flow

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 3524

WATER COOLING CHARACTERISTICS, see also the cooling curves

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

TEMPERATURE LIMITS (Absolute limits)

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

ACCESSORIES

Filament connectors	40634
Connector centre pin of filament	40649 [2])
Grid connector	40650 [3]) or 40622
Water jacket	K713

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

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

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

[3]) See page 3. The connector 40650 should only be used below 30 MHz

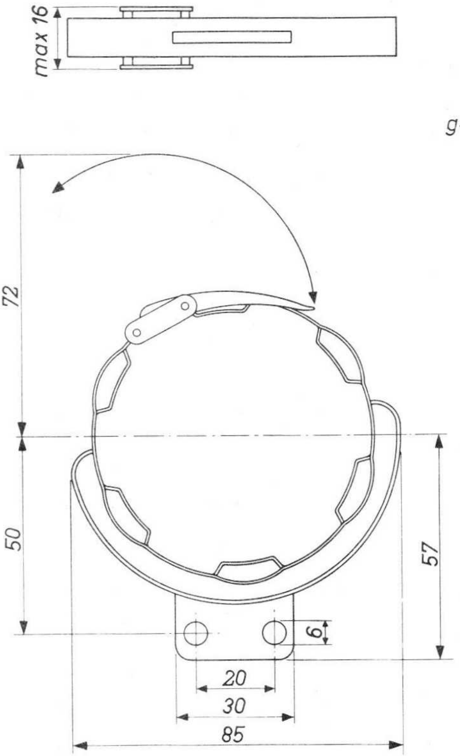
7Z2 8700

MECHANICAL DATA

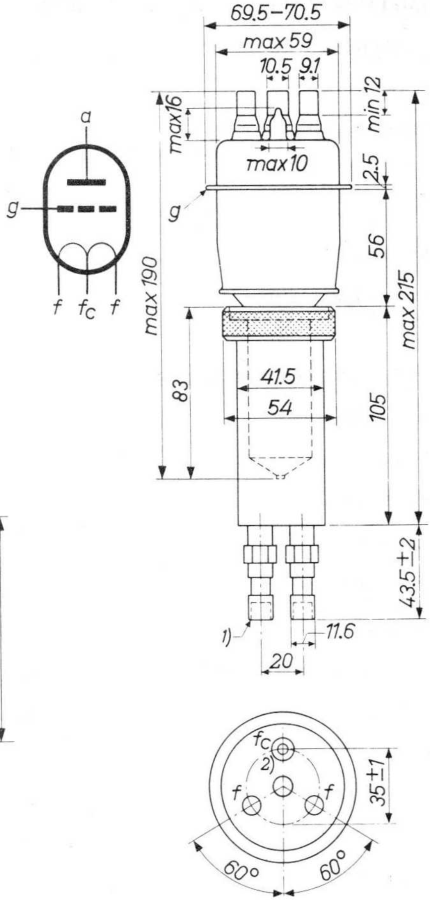
Dimensions in mm

Net weight of the tube : 0.45 kg

Net weight of water-jacket: 0.52 kg



Grid connector
40650



Mounting position: vertical with anode down

[1]) 1/8" pipe thread

[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

7Z2 8701

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	7.2	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	2.2	A
Grid current	I_g	=	max.	0.6	A
Anode input power	W_{ia}	=	max.	14	kW
Anode dissipation	W_a	=	max.	6	kW

OPERATING CONDITIONS

Wavelength	λ	=	10	10	10	m
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	6.5	6.0	5.0	kV
Grid voltage	V_g	=	-450	-400	-300	V
Anode current	I_a	=	2.0	2.0	2.0	A
Grid current	I_g	=	0.5	0.5	0.5	A
Peak grid A.C. voltage	V_{g_p}	=	820	780	660	V
Grid input power	W_{ig}	=	370	350	297	W
Anode input power	W_{ia}	=	13	12	10	kW
Anode dissipation	W_a	=	3.5	3.5	2.9	kW
Output power	W_o	=	9.5	8.5	7.1	kW
Efficiency	η	=	73	71	71	%

7Z2 3521

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	= max.	7.2	kV
Anode current	I_a	= max.	2.2	A
Anode input power	W_{ia}	= max.	14	kW
Anode dissipation	W_a	= max.	6	kW
Grid circuit resistance	R_g	= max.	15	kΩ

OPERATING CONDITIONS, two tubes

V_a =	7		5		5		4		kV
V_g =	−250		−165		−165		−135		V
$R_{aa\sim}$ =	4150		4800		5500		3800		Ω
V_{gg_p} =	0	1300	0	880	0	730	0	930	V
I_a =	2x0.2	2x2.0	2x0.15	2x1.25	2x0.15	2x1.1	2x0.1	2x1.25	A
I_g =	0	2x0.53	0	2x0.33	0	2x0.22	0	2x0.36	A
I_{g_p} =	−	2x2.8	−	2x1.75	−	2x1.2	−	2x1.8	A
W_{ig} =	0	2x310	0	2x130	0	2x70	0	2x135	W
W_{ia} =	2x1.4	2x14	2x0.75	2x6.2	2x0.75	2x5.5	2x0.4	2x5.0	kW
W_a =	2x1.4	2x4.0	2x0.75	2x1.7	2x0.75	2x1.5	2x0.4	2x1.45	kW
W_o =	0	20	0	9	0	8.0	0	7.1	kW
η =	−	71.5	−	72.5	−	72.5	−	71	%

7Z2 3522

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	I_g	=	max.	0.5	A [1])
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid circuit resistance	R_g	=	max.	10	kΩ

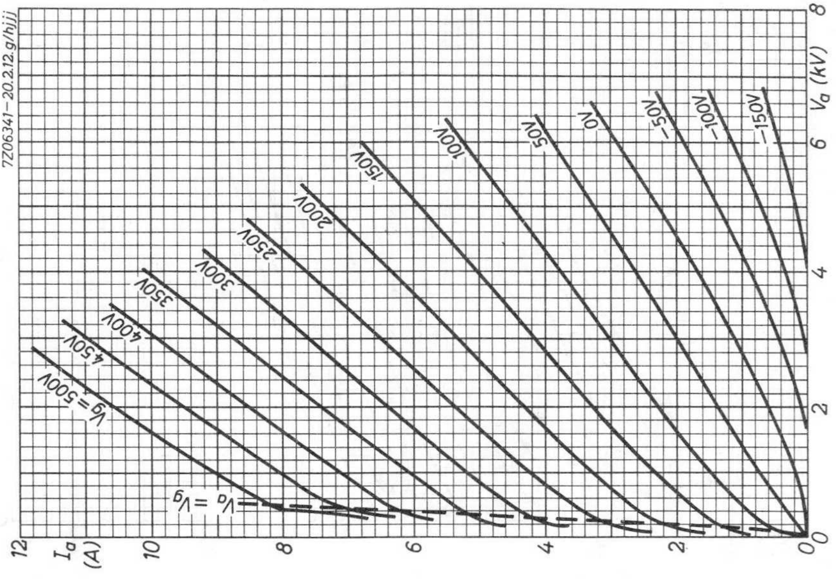
OPERATING CONDITIONS

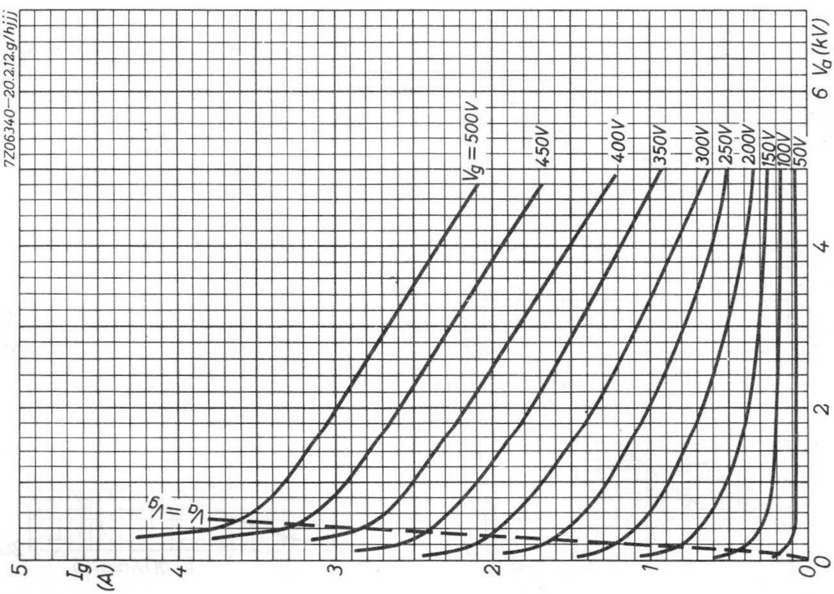
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5100	V_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A [1])
Grid resistor	R_g	=	1000	Ω
Grid input power	W_{ig}	=	300	W
Anode input power	W_{ia}	=	9	kW
Anode dissipation	W_a	=	2.7	kW
Output power	W_o	=	6	kW [2])
Efficiency	η	=	67	%

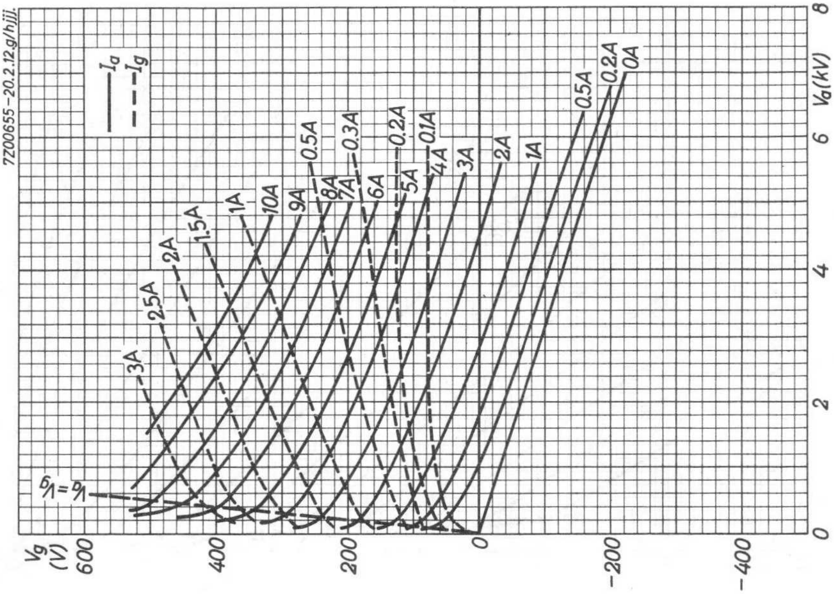
[1]) Unloaded 0.7 A

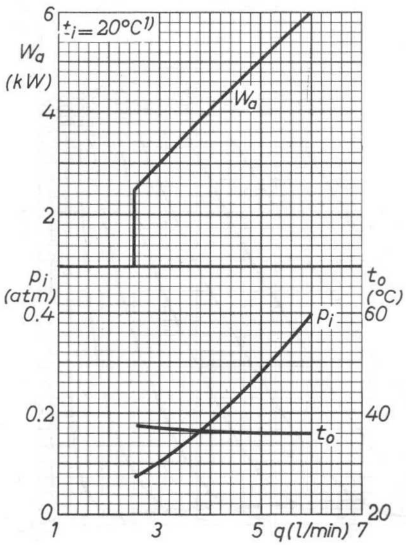
[2]) Available power (load + circuit losses)

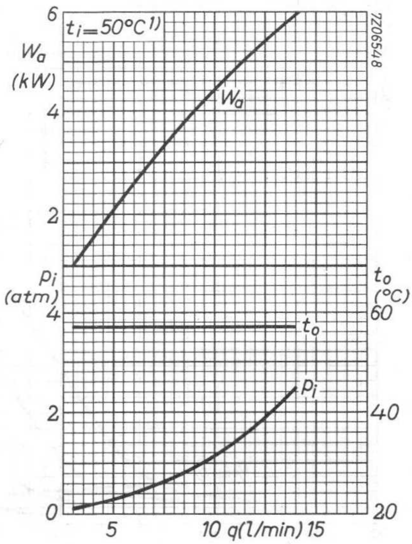
7Z2 3523


7Z06341−20.2.12.g/hjjj
I_a (A)
12
10
8
6
4
2
0
0
2
4
6
8
V_a (kV)
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
$V_a = V_g$


7Z06340−20.2.12.g/hjjj
I_g (A)
5
4
3
2
1
0
0
2
4
6
V_a (kV)
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
$V_a = V_g$


7Z00655-20.2.12.g/hjjj.
I_a
I_g
V_a(kV)
V_g (V)
$V_a = V_g$
0.5A
0.2A
0A
1A
2A
3A
4A
5A
6A
7A
8A
9A
10A
0.1A
0.3A
1.5A
2.5A


t_i = 20°C 1)
W_a (kW)
W_a
p_i (atm)
t_o (°C)
p_i
t_o
q(l/min)


t_i = 50°C 1)
7Z06548
W_a (kW)
W_a
p_i (atm)
t_o (°C)
t_o
p_i
q(l/min)

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

QUICK REFERENCE DATA		
Industrial R.F. oscillator class C		
Freq.	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

7Z2 3541

TEMPERATURE LIMITS (Absolute limits)

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

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
2	20	2.5	0.06
	50	5	0.2
4	20	4	0.14
	50	9	0.7
6	20	6	0.3
	50	14	1.9

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

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

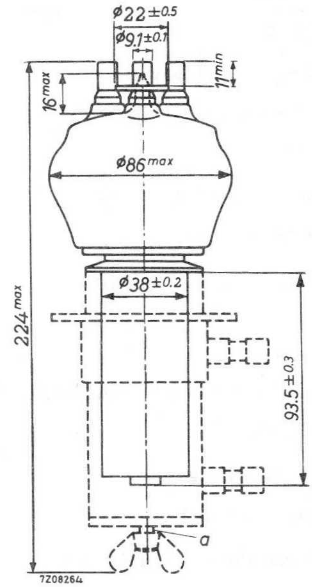
7Z2 3542

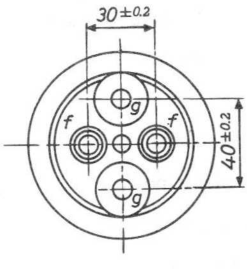
MECHANICAL DATA

Dimensions in mm

Net weight of the tube 0.57 kg

Net weight of water-jacket : 0.76 kg





Grid and filament connectors 40634

Water jacket K721

7Z2 8702

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

LIMITING VALUES (Absolute limits), continuous service

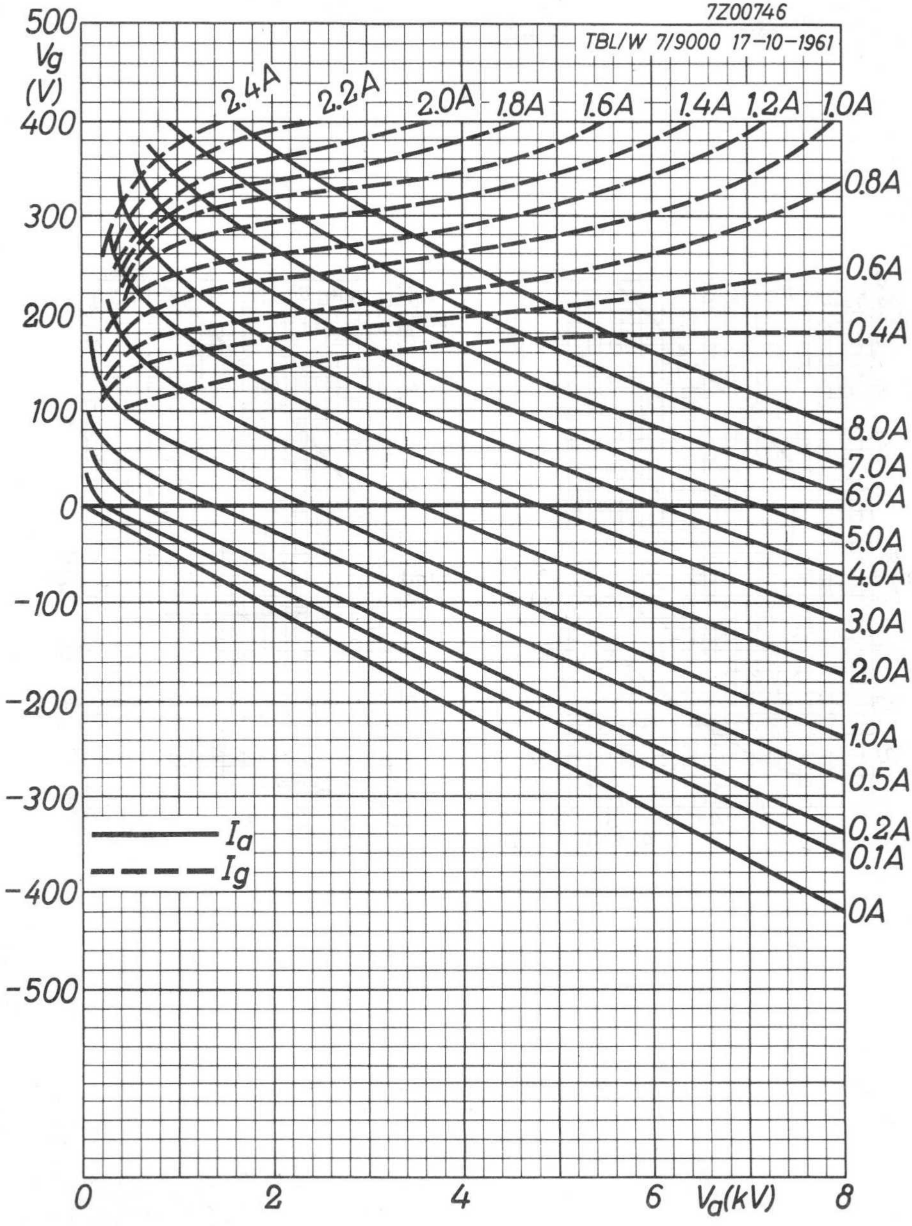
Frequency	f	up to	50	MHz
Anode voltage	V_a	= max.	8	kV
Anode input power	W_{ia}	= max.	12	kW
Anode dissipation	W_a	= max.	6	kW
Anode current	I_a	= max.	1.8	A
Negative grid voltage	$-V_g$	= max.	1250	V
Grid current, loaded	I_g	= max.	0.4	A
Grid current, unloaded	I_g	= max.	0.5	A
Grid circuit resistance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

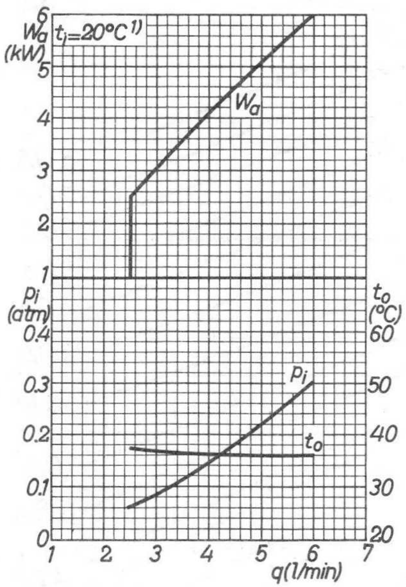
OPERATING CHARACTERISTICS, continuous service

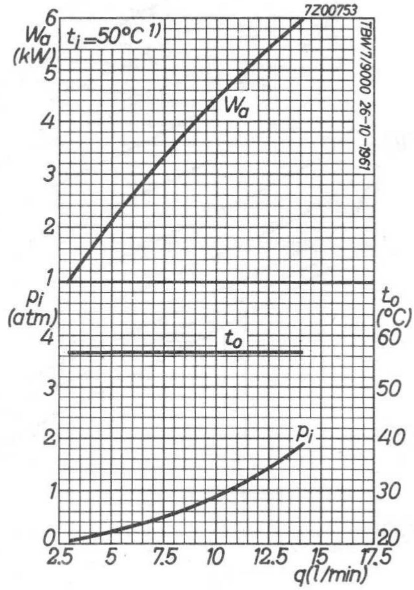
Frequency	f	=	50	50	MHz
Anode voltage	V_a	=	7200	6200	V
Anode current, loaded	I_a	=	1.5	1.4	A
Anode current, unloaded	I_a	=	0.37	0.40	A
Grid current, loaded	I_g	=	0.36	0.37	A
Grid current, unloaded	I_g	=	0.47	0.47	A
Grid resistor	R_g	=	1850	1500	Ω
Load resistance	$R_{a\sim}$	=	2300	2100	Ω
Feedback ratio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

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

7Z2 3540


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


t_i=20°C 1)
W_a (kW)
W_a
p_i (atm)
t_o (°C)
p_i
t_o
q(l/min)


7Z00753
TBW7/9000 26-10-1961
t_i=50°C 1)
W_a (kW)
W_a
p_i (atm)
t_o (°C)
t_o
p_i
q(l/min)

WATER COOLED INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMIT (Absolute limit)

Seal temperature = max. 220 °C

Generally a low velocity air flow to the seals is required

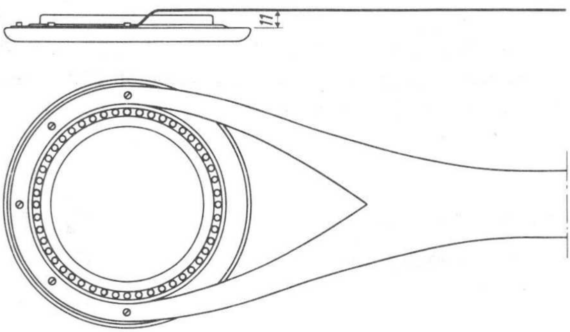
7Z2 8703

WATER COOLING CHARACTERISTICS

t_i = max. 50 °C

W_a (kW)	t_i (°C)	q_{min}[1] (l/min)	p_i (atm.)
5	20	6	0.02
	50	15	0.22
10	20	11	0.1
	50	25	0.7
15	20	16	0.25
	50	37	1.3
20	20	22	0.5
	50	49	2.3

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



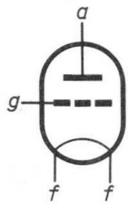
[1]) At inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

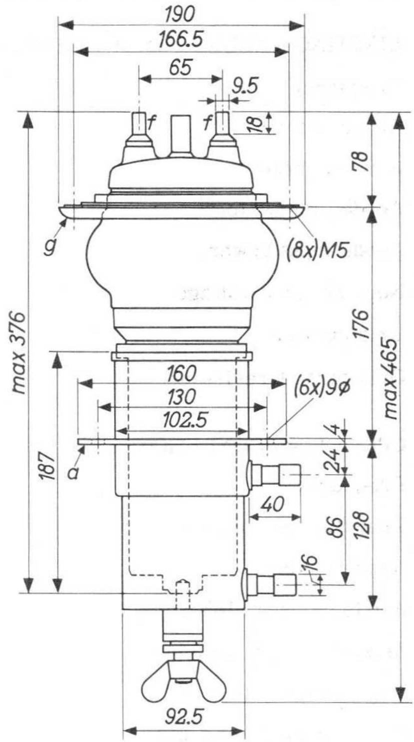
7Z2 3552

MECHANICAL DATA

Dimensions in mm

Net weight of the tube	: 2.8 kg
Net weight of water jacket	: 2.1 kg
Filament connectors with cable	: 40662
Grid connector	40663
Water jacket	K717





Tube with grid connector and water jacket

Mounting position: vertical with anode down

7Z2 8704

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

LIMITING VALUES (Absolute limits)

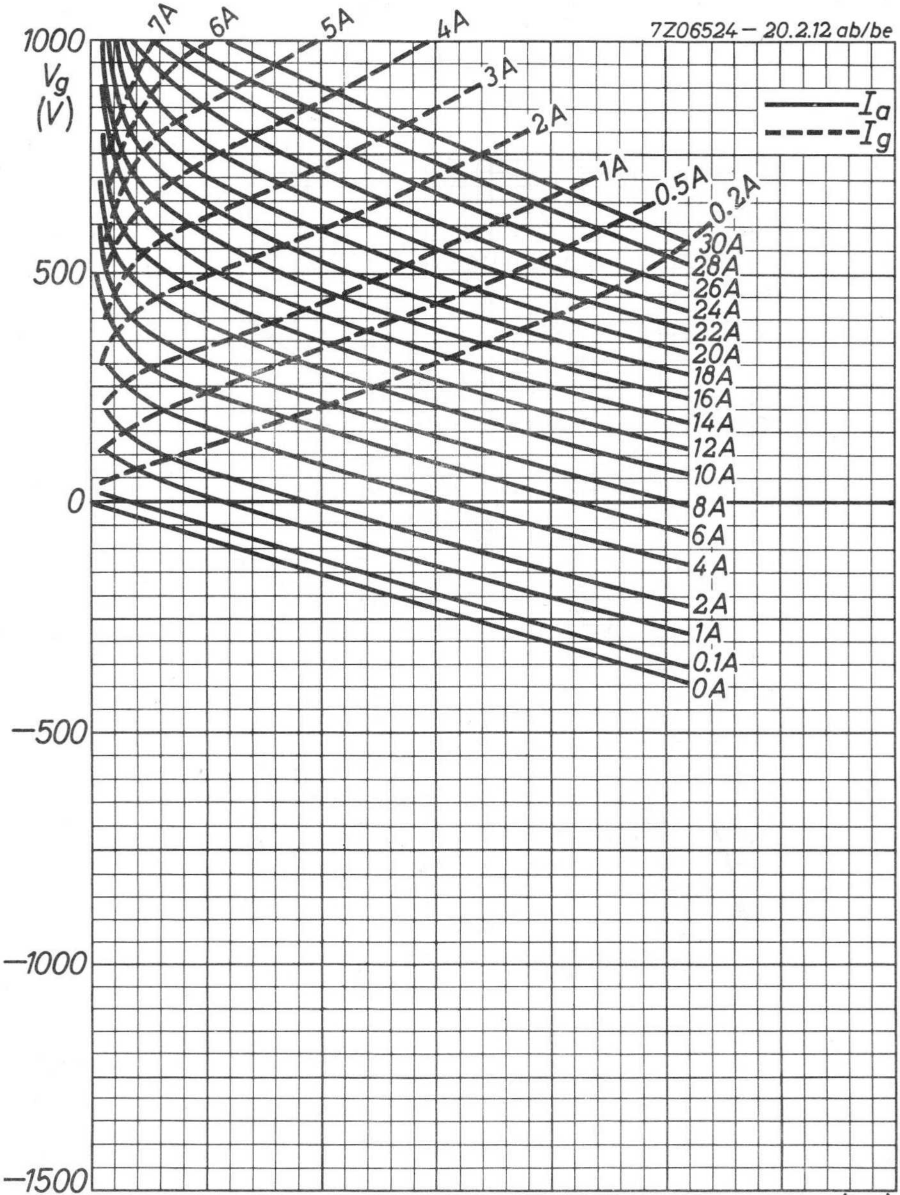
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	20	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

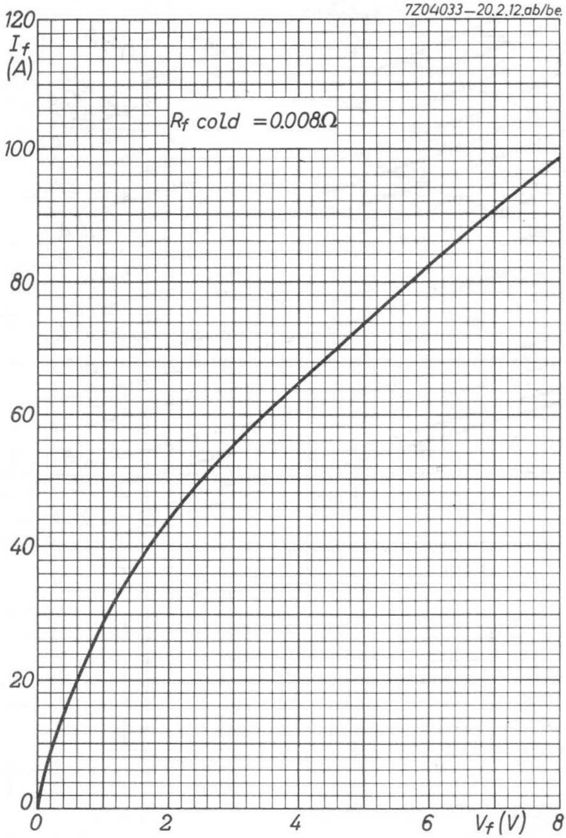
OPERATING CONDITIONS

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

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

7Z2 3554


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


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

WATER COOLED
INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

7Z2 8705

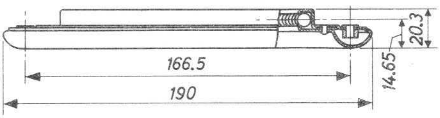
COOLING: Generally a low velocity air flow to the seals is required

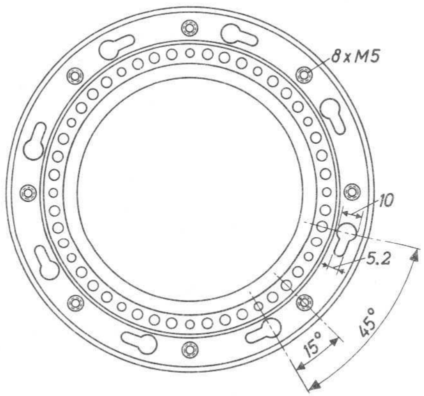
WATER COOLING CHARACTERISTICS. See also page A

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

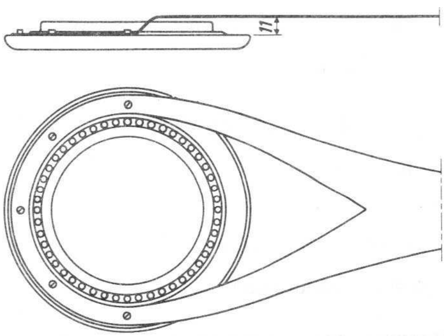
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation

MECHANICAL DATA Dimensions in mm





Grid connector 40663



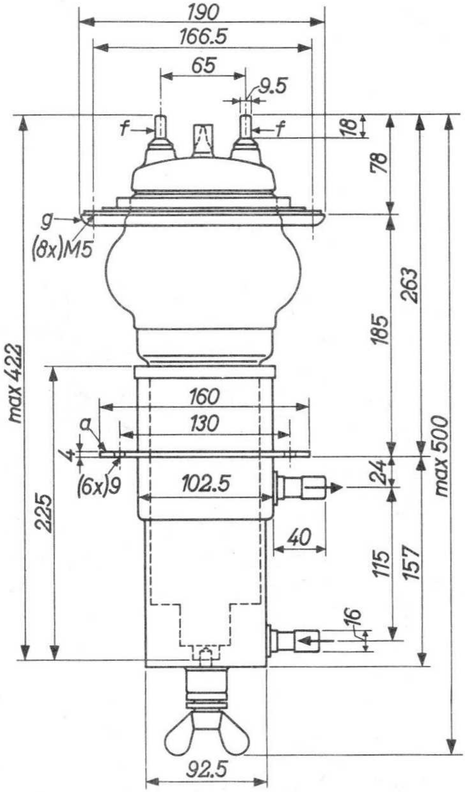
Connection of the grid lead

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

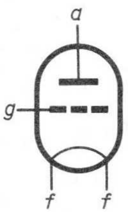
MECHANICAL DATA (continued)

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



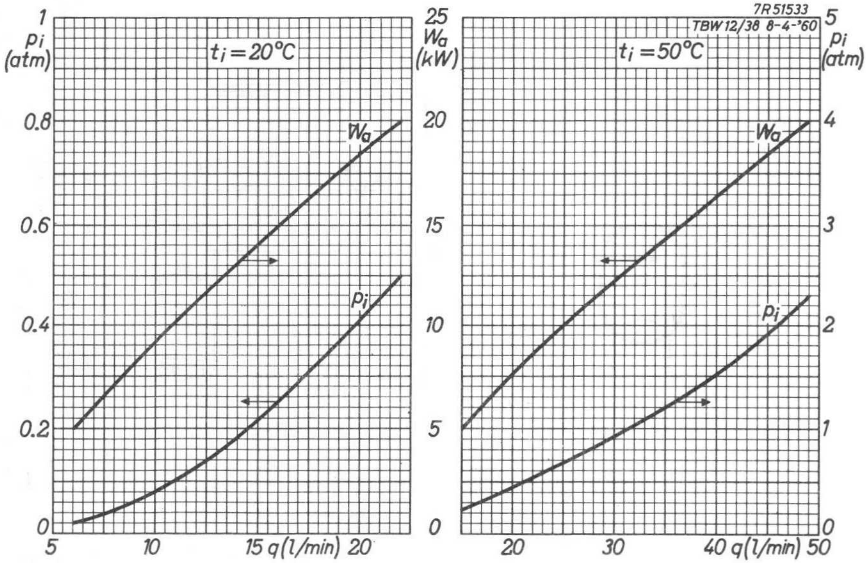
Tube mounted in water jacket



Mounting position: vertical with anode down

For further data and curves (except cooling curves) please refer to type TBH 12/38

7Z2 8706


7R51533
TBW 12/38 8-4-'60
1
p_i
(atm)
0.8
0.6
0.4
0.2
0
5
10
15 q (l/min) 20
$t_i = 20°C$
W_a
p_i
25
W_a
(kW)
20
15
10
5
0
$t_i = 50°C$
W_a
p_i
20
30
40 q (l/min) 50
5
p_i
(atm)
4
3
2
1
0

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA										
General purposes										
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C an.mod.		B mod. 1)		
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	
20	15	12	108	12	51.5	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_{fo}	=	0.012	Ω

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

7Z2 8707

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

WATER COOLING CHARACTERISTICS; see also cooling curves

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

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

To keep the seal temperatures below 180 °C it will often be necessary to direct an air flow of sufficient velocity to the seals. This air flow must be started upon or before the application of the filament voltage.
Anode and grid seals can be cooled by connecting a blower of suitable size to the air inlet of the anticorona ring, attached to the tube. At frequencies below 6 MHz air cooling will, as a rule, not be necessary. Above 6 MHz air cooling must be used in order to prevent overheating of anode and grid seals.
At maximum frequency (30 MHz) and at the published operating conditions at least 2.5 m^3 per minute is required with a pressure loss of about 500 mm water column.

7Z2 8708

MECHANICAL DATA

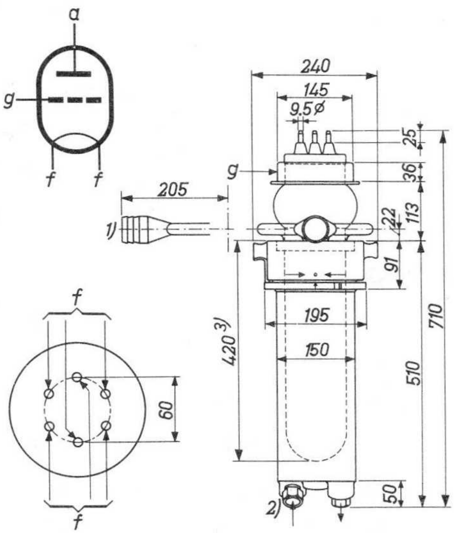
Dimensions in mm

Water jacket : K714

Filament connectors: 40628

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 1 3/4".

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

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

7Z2 8709

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
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	%

7Z2 8710

R.F. CLASS B TELEPHONY (two tubes)

LIMITING VALUES (Absolute limits)

Frequency	f		up to 4	up to 15	MHz
Anode voltage	V_a	=	max. 15	max. 13.5	kV
Anode current	I_a	=	max. 12.5		A
Anode input power	W_{i_a}	=	max. 150		kW
Anode dissipation	W_a	=	max. 100		kW

OPERATING CONDITIONS (two tubes)

Wavelength	λ	=	20	m
Frequency	f	=	15	MHz
Anode voltage	V_a	=	12	kV
Grid voltage	V_g	=	-420	V
Anode current	I_a	=	12.2	A
Peak grid A.C. voltage	V_{g_p}	=	700	V
Anode input power	W_{i_a}	=	146	kW
Anode dissipation	W_a	=	94.5	kW
Output power	W_o	=	51.5	kW
Efficiency	η	=	35	%
Modulation depth	m	=	100	%
Grid current	I_g	=	4.5	A
Grid input power	W_{ig}	=	5.7	kW

7Z2 8711

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

7Z2 8712

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
Grid circuit resistance	R_g	=	max.	20	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	12		10		10		kV
V_g	=	-450		-375		-400		V
$R_{aa\sim}$	=	1200		1500		2060		Ω
V_{ggp}	=	0	2060	0	1680	0	1460	V
I_a	=	2x0.65	2x12	2x0.5	2x7.9	2x0.2	2x5.4	A
I_g	=	0	2x2.5	0	2x1.9	0	2x0.7	A
W_{ig}	=	0	2x2.4	0	2x1.44	0	2x0.5	kW
W_{ia}	=	2x7.8	2x144	2x5	2x79	2x2	2x54	kW
W_a	=	2x7.8	2x43	2x5	2x21	2x2	2x15.5	kW
W_o	=	0	202	0	116	0	77	kW
η	=	–	70	–	75	–	71	%

V_a	=	9		8.5		8		kV
V_g	=	-350		-325		-300		V
$R_{aa\sim}$	=	2080		2120		2210		Ω
V_{ggp}	=	0	1300	0	1200	0	1120	V
I_a	=	2x0.25	2x4.8	2x0.25	2x4.4	2x0.25	2x4.1	A
I_g	=	0	2x0.65	0	2x0.55	0	2x0.4	A
W_{ig}	=	0	2x0.4	0	2x0.3	0	2x0.25	kW
W_{ia}	=	2x2.25	2x43.2	2x2.1	2x37.4	2x2	2x32.8	kW
W_a	=	2x2.25	2x12.2	2x2.1	2x10.4	2x2	2x9.4	kW
W_o	=	0	62	0	54	0	46.8	kW
η	=	–	72	–	72	–	71	%

7Z2 3591

R.F. CLASS B AMPLIFIER for television service, negative modulation, positive synchronisation

LIMITING VALUES (Absolute limits)

Frequency	f			up to	68	MHz
Anode voltage	V_a		=	max.	6.5	kV
Anode current	I_a	sync	=	max.	16	A
Anode input power	W_{ia}	sync	=	max.	100	kW
Anode dissipation	W_a	sync	=	max.	50	kW
Grid current	I_g	sync	=	max.	2	A

OPERATING CONDITIONS, two tubes in push-pull

Frequency	f		=	48 to 68	MHz 1)
Bandwidth (-1.5 dB)	B		=	5.5	MHz 2)
Bandwidth (-3 dB)	B		=	7.5	MHz 2)
Anode voltage	V_a		=	6.5	kV
Grid voltage	V_g		=	-250	V
Peak grid to grid A.C. voltage	V_{ggp}	sync	=	1740	V 3)
		black	=	1300	V 3)
Anode current	I_a	sync	=	32	A
		black	=	24	A
Grid current	I_g	sync	=	3.4	A
		black	=	2.2	A
Grid input power	W_{ig}	sync	=	22.4	kW 4)
Output power	W_o	sync	=	80+20	kW 5)
		black	=	45+11	kW 5)

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

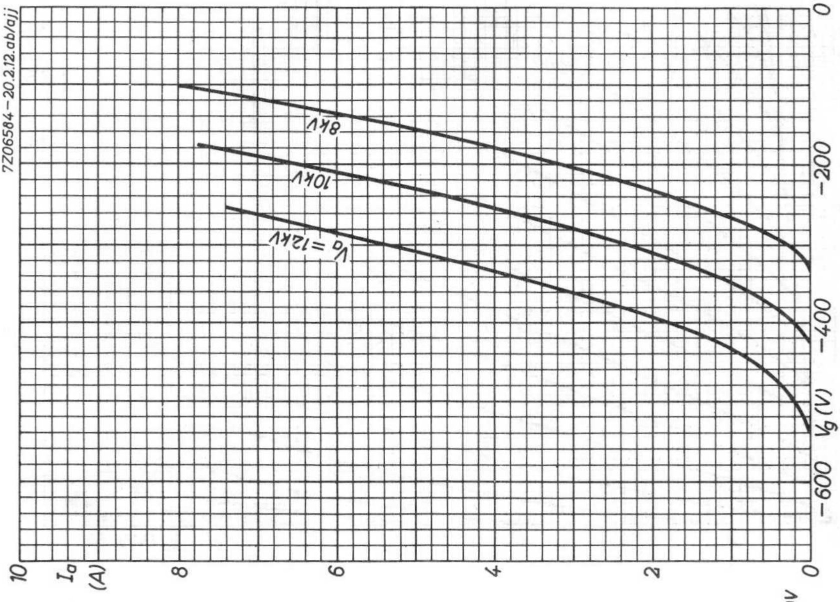
2) This value of bandwidth is based on measurements on a circuit with a single LC section

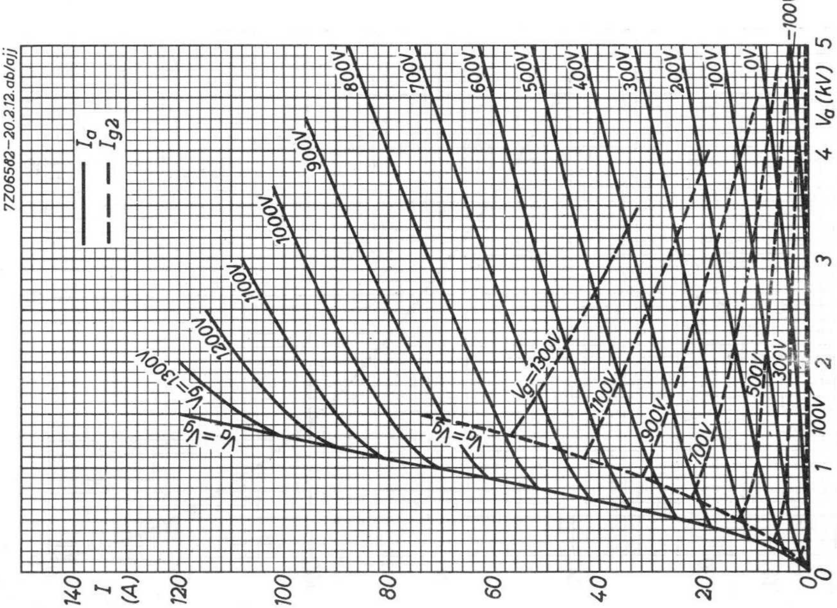
3) Measured by the slide back method

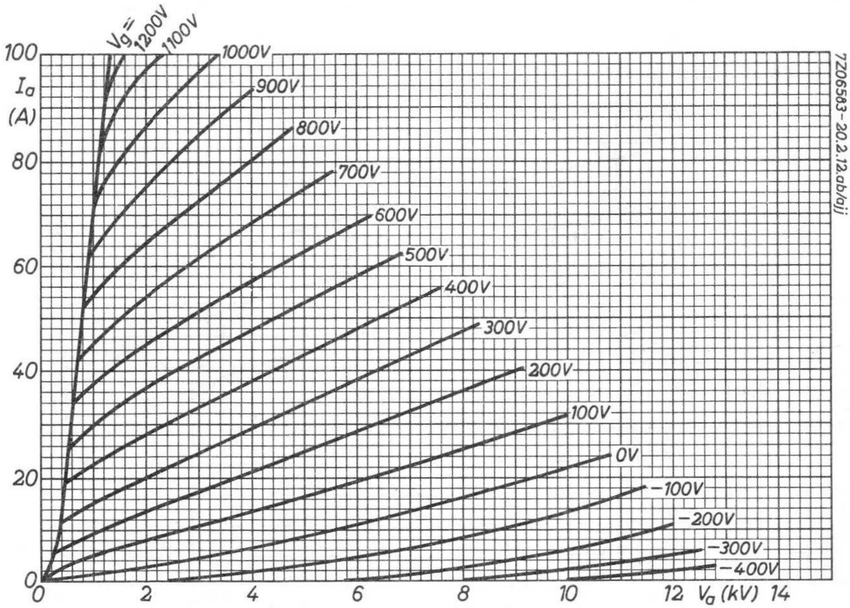
4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

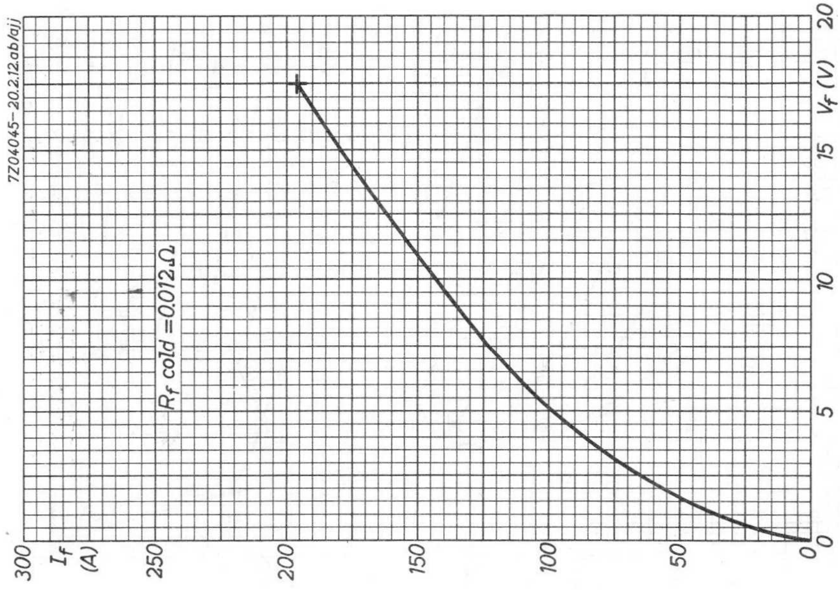
5) Power transferred from driving stage included.

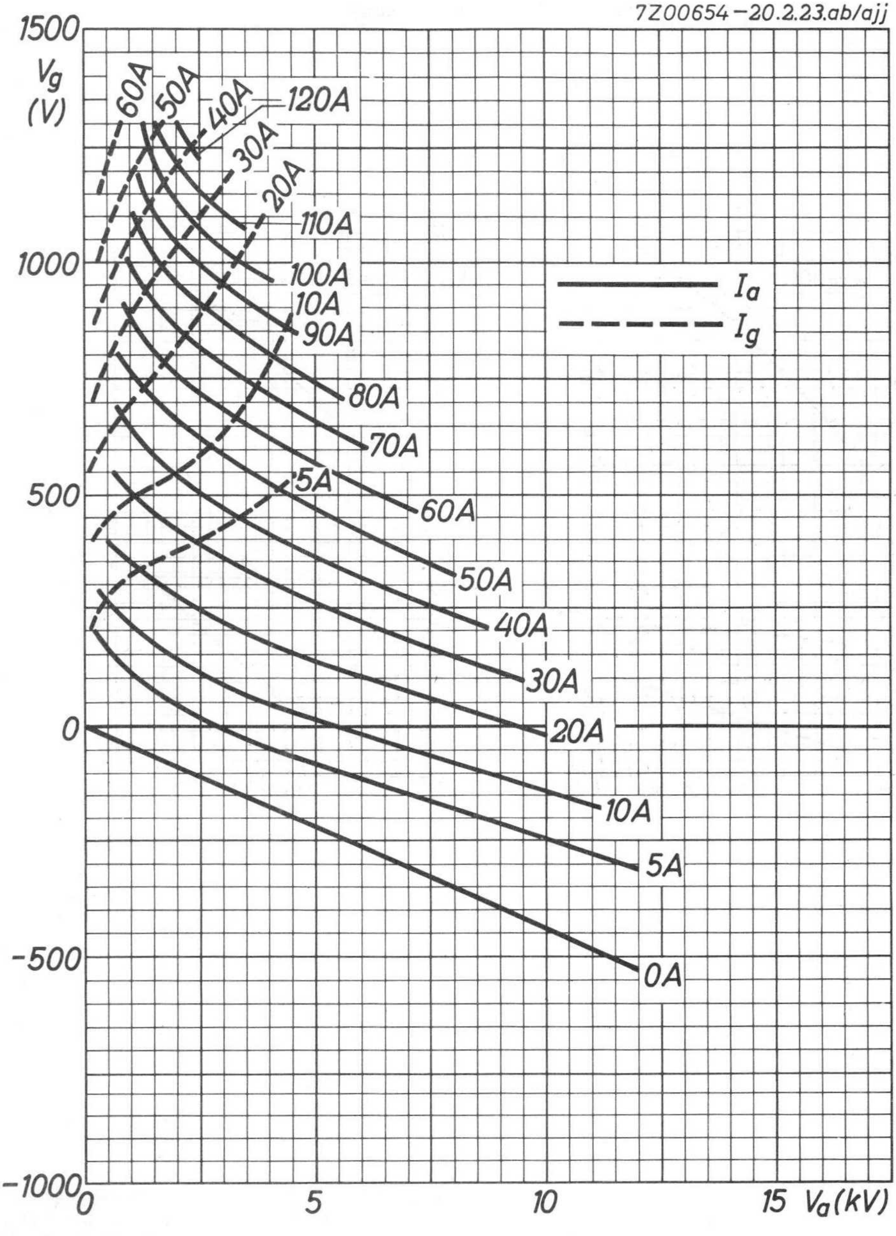
7Z2 8713


7Z06584-20.2.12.ab/ajj
Va =12kV
10kV
8kV
Vg (V)
Ia (A)
0
-200
-400
-600
10
8
6
4
2
0

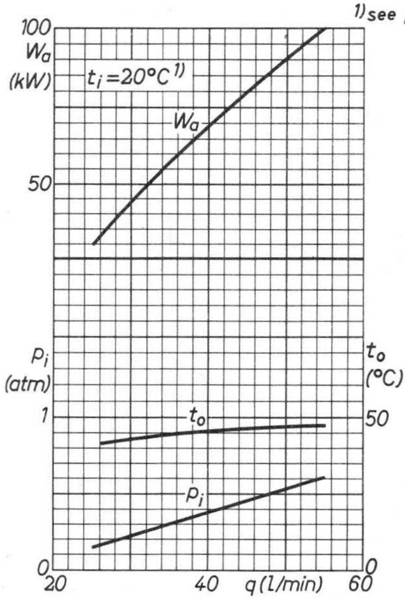

7Z06582-20.2.12.ab/ajj
Ia
Ig2
Va (kV)
I (A)
Vg=1300V
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
-100V
Va=Vg
Vg=1300V
1100V
900V
700V
500V
300V
100V
140
120
100
80
60
40
20
0
1
2
3
4
5

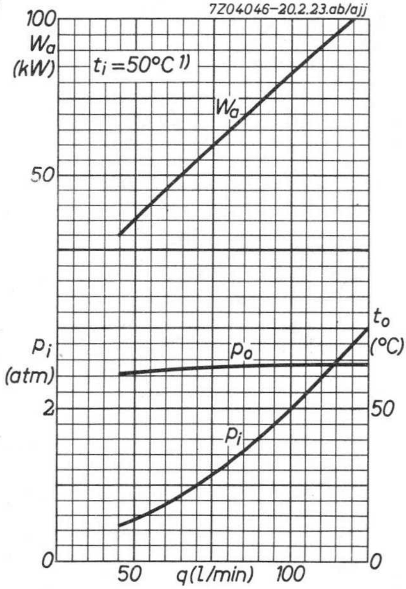

V_g =
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
100
I_a
(A)
80
60
40
20
0
0
2
4
6
8
10
12
V_a (kV)
14
7Z06583-20.2.12.ab/aij


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


7Z00654−20.2.23.ab/ajj
1500
V_g
(V)
1000
500
0
-500
−1000
0
5
10
15 V_a(kV)
60A
50A
40A
120A
30A
20A
110A
100A
10A
90A
80A
70A
5A
60A
50A
40A
30A
20A
10A
5A
0A
I_a
I_g

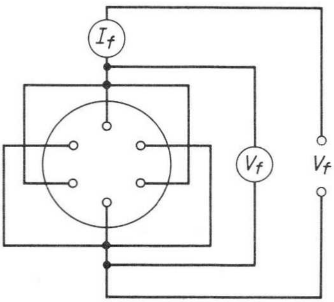
1) see page 2


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


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

WATER COOLED R.F. POWER TRIODE

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

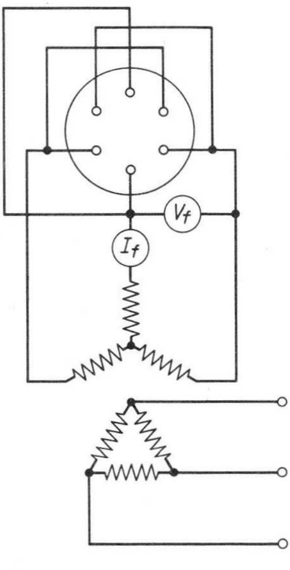


Single-phase filament energizing

V_f = 17.5 V

I_f = 196 A

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



Three-phase filament energizing

V_f = 15.5 V

I_f = 131 A

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

A safety device must be used to prevent filament energizing with one phase interrupted.

7Z2 3596

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		RF class B		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	120			15	110	12	78
30	12	90	11	66	12	110	10	78

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

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	160	A

CAPACITANCES

Grid to filament	C_{gf}	=	120	pF
Anode to filament	C_{af}	=	1.4	pF
Anode to grid	C_{ag}	=	50	pF

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	t	= max.	220	°C
Seal temperature	t	= max.	220	°C

COOLING

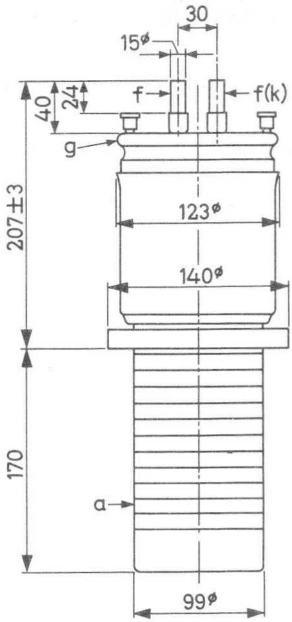
For cooling data see cooling curves.
For water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation.
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

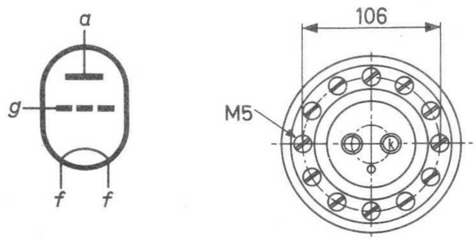
7Z2 3884

MECHANICAL DATA

Dimensions in mm

Net weight: 6.2 kg





Mounting position: vertical with anode down

ACCESSORIES

Water jacket	K724
Filament connector	40670
Grid connector	40671

7Z2 8714

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to 10	up to 30	MHz
Anode voltage	V_a	=	max. 15	max. 12	kV
Anode dissipation	W_a	=	max. 45	max. 45	kW
Negative grid voltage	$-V_g$	=	max. 1000	max. 1000	V
Grid dissipation	W_g	=	max. 1.3	max. 1.3	kW
Anode current	I_a	=	max. 13	max. 13	A
Grid current	I_g	=	max. 3.3	max. 3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	30	30	30	MHz
Anode voltage	V_a	=	15	12	10	8	kV
Grid voltage	V_g	=	-600	-550	-500	-450	V
Anode current	I_a	=	9.75	9.25	9.0	8.75	A
Grid current	I_g	=	2.2	2.2	2.1	1.85	A
Peak grid driving voltage	V_{gp}	=	1000	940	875	810	V
Grid driving power	W_{dr}	=	2.1	1.9	1.7	1.55	kW
Anode input power	W_{i_a}	=	146	111	90	70	kW
Anode dissipation	W_a	=	26	21	18	15	kW
Output power	W_o	=	120	90	72	55	kW
Efficiency	η	=	82	81	80	78.5	%

7Z2 8715

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	15	max.	12	kV
Anode dissipation	W_a	=	max.	45	max.	45	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
→ Anode current	I_a	=	max.	13	max.	13	A
→ Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	−260	−260	−210	−210	V
Anode current	I_a	=	10.1	7.75	12.7	9.85	A
Grid current	I_g	=	2.0	1.3	3.0	1.9	A
Peak grid driving voltage	V_{g_p}	=	600	520	650	520	V
Grid driving power	W_{dr}	=	1080	610	1770	880	W
Anode input power	W_{i_a}	=	151	116.3	153	118	kW
Anode dissipation	W_a	=	41	31.3	43	33	kW
Output power	W_o	=	110	85	110	85	kW
Efficiency	η	=	73	73	72	72	%

7Z2 8716

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11	kV
Anode dissipation	W_a	=	max.	30	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	9	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	11	10	kV
Grid voltage	V_g	=	−480	−440	V [1]
Anode current	I_a	=	7.6	6.9	A
Grid current	I_g	=	3.1	3.1	A
Grid resistor	R_g	=	90	80	Ω
Peak grid driving voltage	V_{g_p}	=	880	810	V
Grid driving power	W_{dr}	=	2.7	2.4	kW
Anode input power	W_{i_a}	=	83.6	69	kW
Anode dissipation	W_a	=	17.6	14	kW
Output power	W_o	=	66	55	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	41.8	34.5	kW

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

7Z2 8717

A.F. CLASS B AMPLIFIER AND MODULATOR

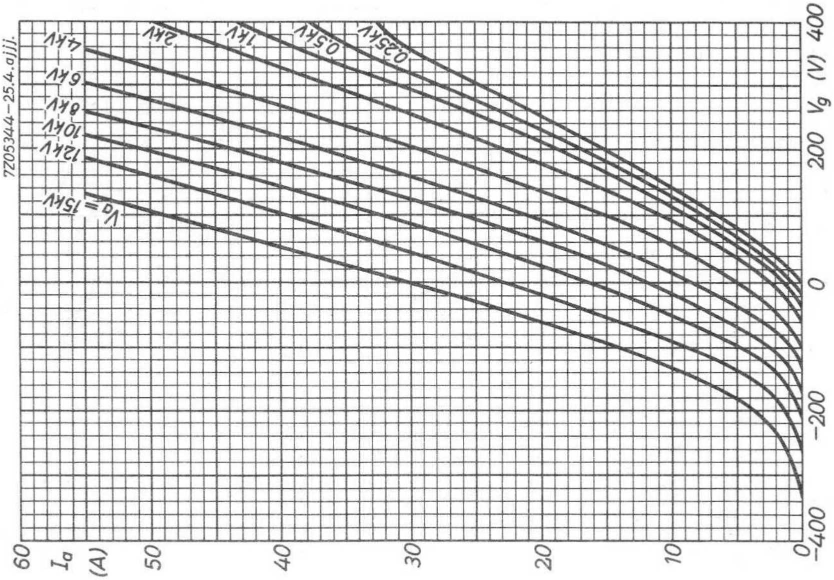
LIMITING VALUES (Absolute limits)

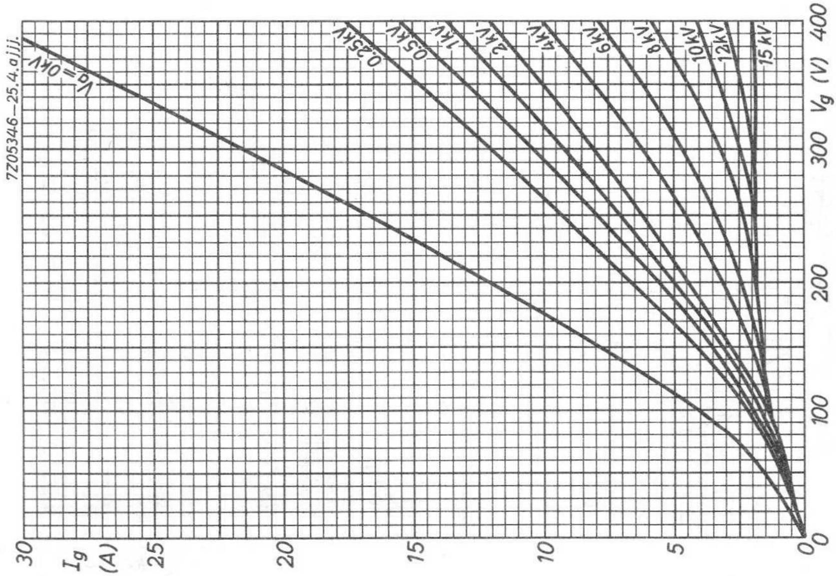
Anode voltage	V_a	= max.	12	kV
Anode dissipation	W_a	= max.	45	kW
Negative grid voltage	$-V_g$	= max.	1000	V
Grid dissipation	W_g	= max.	1.3	kW
→ Anode current	I_a	= max.	13	A
→ Grid current	I_g	= max.	3.3	A

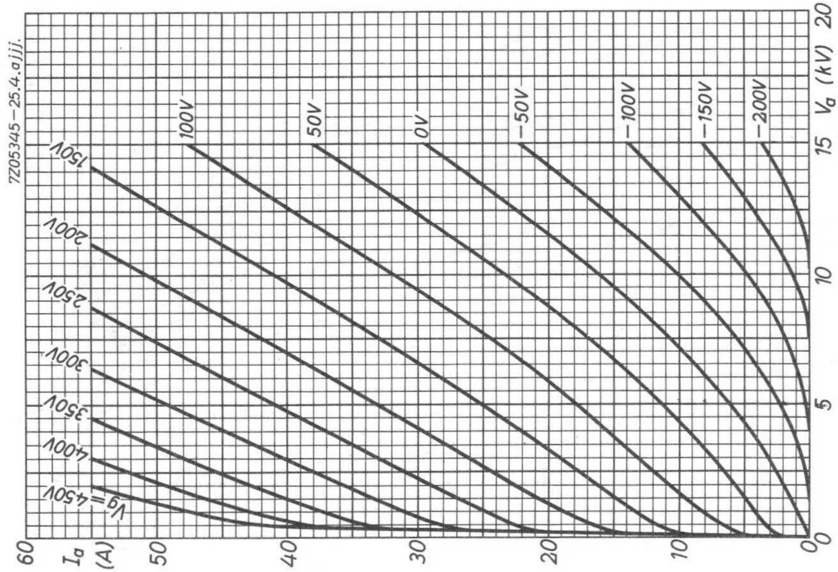
OPERATING CONDITIONS (two tubes in push-pull)

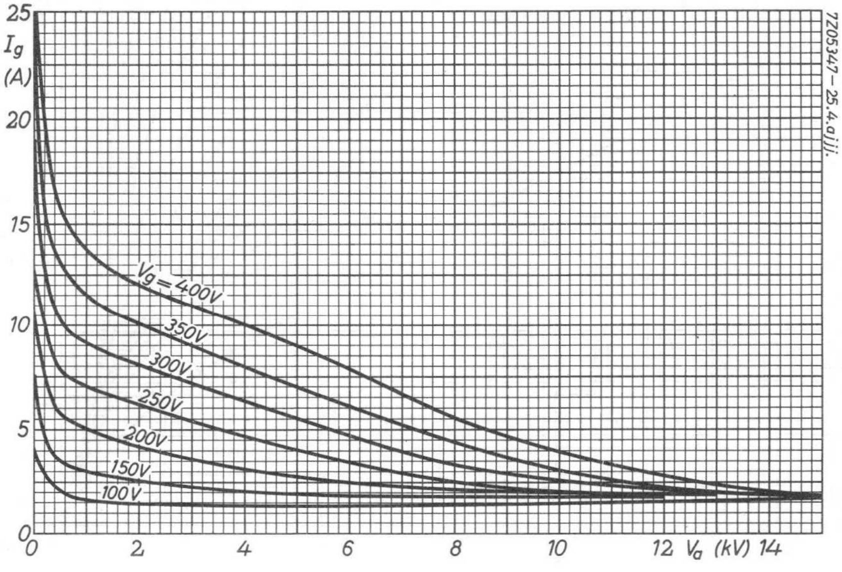
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	−205		−170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{gg_p}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{g_p}	=	0	2x2.9	0	2x4.0	A
Grid driving power	W_{dr}	=	0	2x150	0	2x235	W
Anode input power	W_{i_a}	=	2x4.0	2x57	2x4.0	2x57.5	kW
Anode dissipation	W_a	=	2x4.0	2x18	2x4.0	2x18.5	kW
Output power	W_o	=	0	78	0	78	kW
Efficiency	η	=	–	68.5	–	68	%

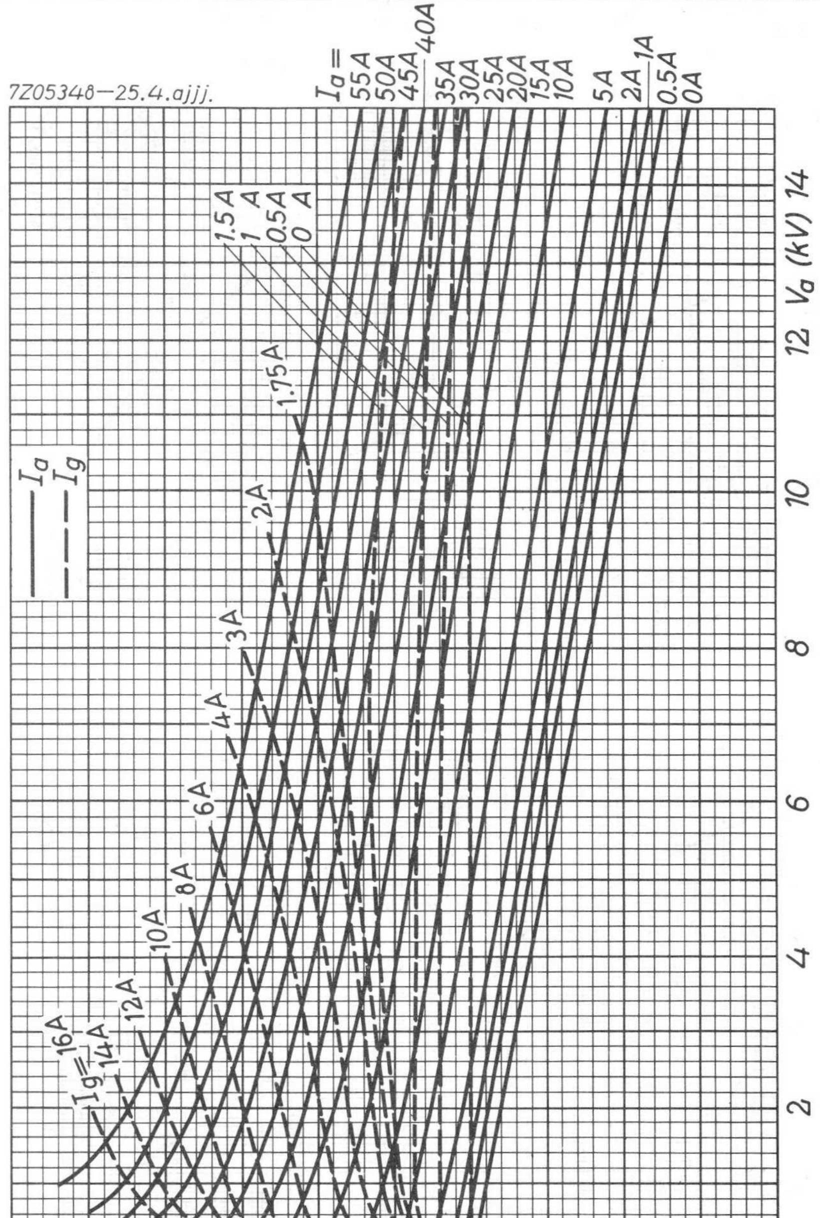
7Z2 8718

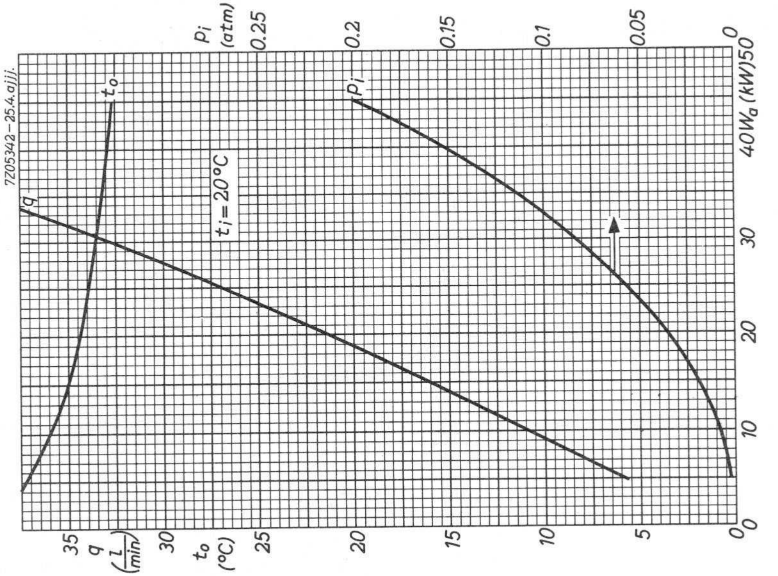

7Z05344-25.4.ajjj.
I_a (A)
V_g (V)
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0,5kV
0,25kV
60
50
40
30
20
10
0
−400
−200
0
200
400

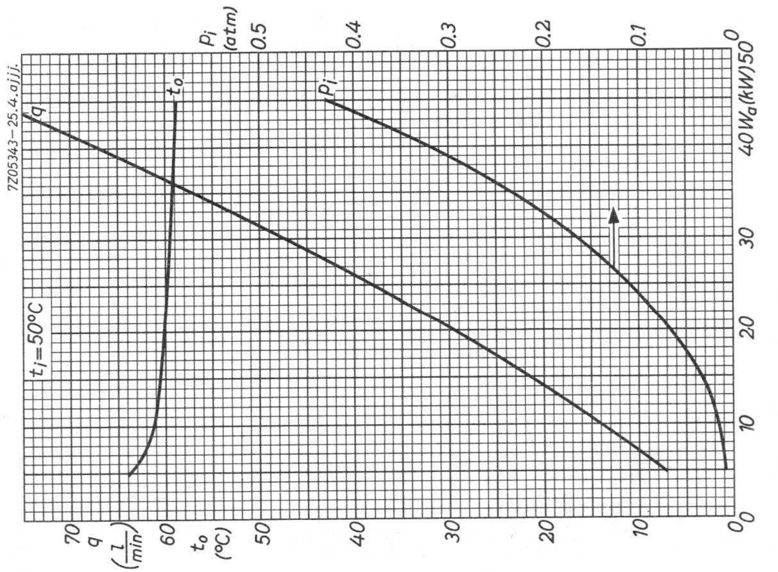

7Z05346-25.4.ajjj.
I_g (A)
V_g (V)
V_a = 0kV
0,25kV
0,5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15kV
30
25
20
15
10
5
0
0
100
200
300
400


7Z05345 – 25.4.a jjj.
I_a (A)
60
50
40
30
20
10
0
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
−200V
0
5
10
15
20
V_a (kV)


I_g (A)
25
20
15
10
5
0
V_g = 400V
350V
300V
250V
200V
150V
100V
0
2
4
6
8
10
12
14
V_a (kV)
7Z05347 – 25.4.a jjj.


7Z05348—25.4.ajjj.
Ia =
55A
50A
45A
40A
35A
30A
25A
20A
15A
10A
5A
2A
1A
0.5A
0A
Ig = 16A
14A
12A
10A
8A
6A
4A
3A
2A
1.75A
1.5A
1 A
0.5A
0 A
Ia
Ig
Vg (V)
600
400
200
0
-200
-400
Va (kV)
0
2
4
6
8
10
12
14


7Z05342-25.4.ajjj.
t_i = 20°C
q
t_o
p_i
p_i (atm)
0.25
0.2
0.15
0.1
0.05
0
q (l/min)
35
30
t_o (°C)
25
20
15
10
5
0
0
10
20
30
40 W_a (kW) 50


7Z05343-25.4.ajjj.
t_i = 50°C
q
t_o
p_i
p_i (atm)
0.5
0.4
0.3
0.2
0.1
0
q (l/min)
70
60
t_o (°C)
50
40
30
20
10
0
0
10
20
30
40 W_a (kW) 50

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		RF class B		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
10	15	120			15	110	12	78
30	12	90	11	66	12	110	10	78

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

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	160	A

CAPACITANCES

Grid to filament	C_{gf}	=	120	pF
Anode to filament	C_{af}	=	1.4	pF
Anode to grid	C_{ag}	=	50	pF

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	t	=	max. 220	°C
Seal temperature	t	=	max. 220	°C

COOLING

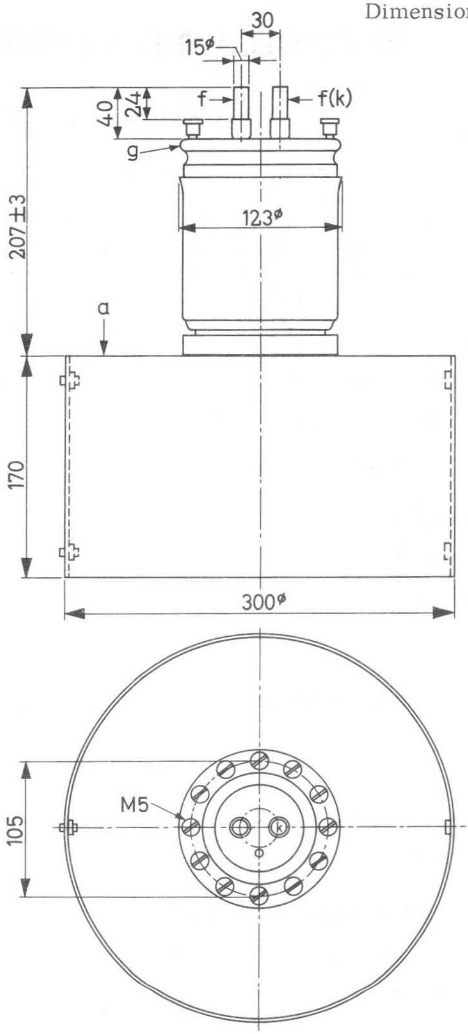
For cooling data see cooling curves. These curves are for an air inlet temperature of 25 °C.
At lower temperatures the amount of air should be the same.
At higher temperatures the amount of air should be increased so that the outlet air temperature is not higher than at t_i = 25 °C.
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

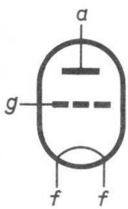
7Z2 3890

MECHANICAL DATA

Net weight: 39 kg

Dimensions in mm





ACCESSORIES

Insulating pedestal	40672
Filament connector	40670
Grid connector	40671

Mounting position: vertical with anode down

7Z2 8719

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	15	max.	12	kV
Anode dissipation	W_a	=	max.	35	max.	35	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
Anode current	I_a	=	max.	13	max.	13	A
Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	30	30	30	MHz
Anode voltage	V_a	=	15	12	10	8	kV
Grid voltage	V_g	=	-600	-550	-500	-450	V
Anode current	I_a	=	9.75	9.25	9.0	8.75	A
Grid current	I_g	=	2.2	2.2	2.1	1.85	A
Peak grid driving voltage	V_{g_p}	=	1000	940	875	810	V
Grid driving power	W_{dr}	=	2.1	1.9	1.7	1.55	kW
Anode input power	W_{i_a}	=	146	111	90	70	kW
Anode dissipation	W_a	=	26	21	18	15	kW
Output power	W_o	=	120	90	72	55	kW
Efficiency	η	=	82	81	80	78.5	%

7Z2 8720

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f	up to	10	up to	30	MHz
Anode voltage	V_a	= max.	15	max.	12	kV
Anode dissipation	W_a	= max.	35	max.	35	kW
Negative grid voltage	$-V_g$	= max.	1000	max.	1000	V
Grid dissipation	W_g	= max.	1.3	max.	1.3	kW
→ Anode current	I_a	= max.	13	max.	13	A
→ Grid current	I_g	= max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	= 10	10	30	30	MHz
Anode voltage	V_a	= 15	15	12	12	kV
Grid voltage	V_g	= −260	−260	−210	−210	V
Anode current	I_a	= 10.1	7.75	12.7	9.85	A
Grid current	I_g	= 2.0	1.3	3.0	1.9	A
Peak grid driving voltage	V_{g_p}	= 600	520	650	520	V
Grid driving power	W_{dr}	= 1080	610	1770	880	W
Anode input power	W_{i_a}	= 151	116.3	153	118	kW
Anode dissipation	W_a	= 41	31.3	43	33	kW
Output power	W_o	= 110	85	110	85	kW
Efficiency	η	= 73	73	72	72	%

7Z2 8721

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11	kV
Anode dissipation	W_a	=	max.	30	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	9	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	11	10	kV
Grid voltage	V_g	=	−480	−440	V [1]
Anode current	I_a	=	7.6	6.9	A
Grid current	I_g	=	3.1	3.1	A
Grid resistor	R_g	=	90	80	Ω
Peak grid driving voltage	V_{g_p}	=	880	810	V
Grid driving power	W_{dr}	=	2.7	2.4	kW
Anode input power	W_{i_a}	=	83.6	69	kW
Anode dissipation	W_a	=	17.6	14	kW
Output power	W_o	=	66	55	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	41.8	34.5	kW

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

7Z2 8722

A.F. CLASS B AMPLIFIER AND MODULATOR

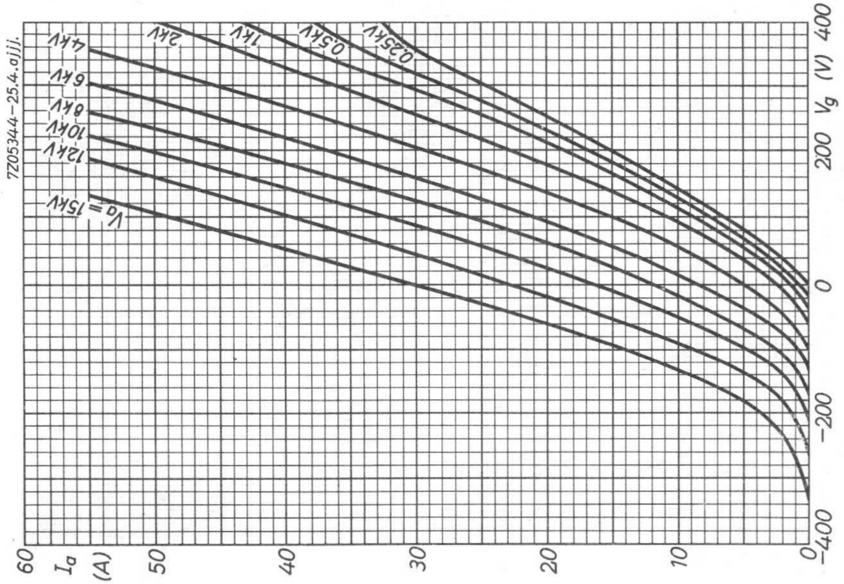
LIMITING VALUES (Absolute limits)

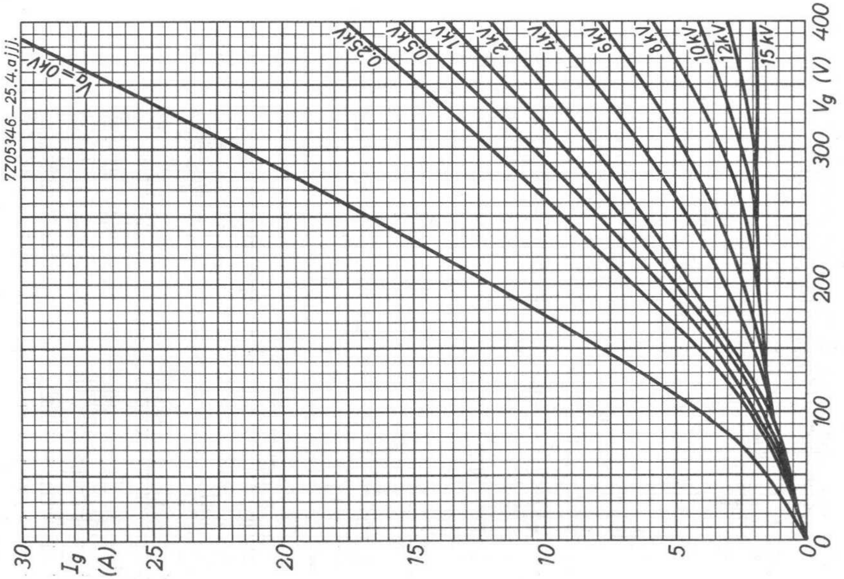
Anode voltage	V_a	=	max.	12	kV
Anode dissipation	W_a	=	max.	35	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
→ Anode current	I_a	=	max.	13	A
→ Grid current	I_g	=	max.	3.3	A

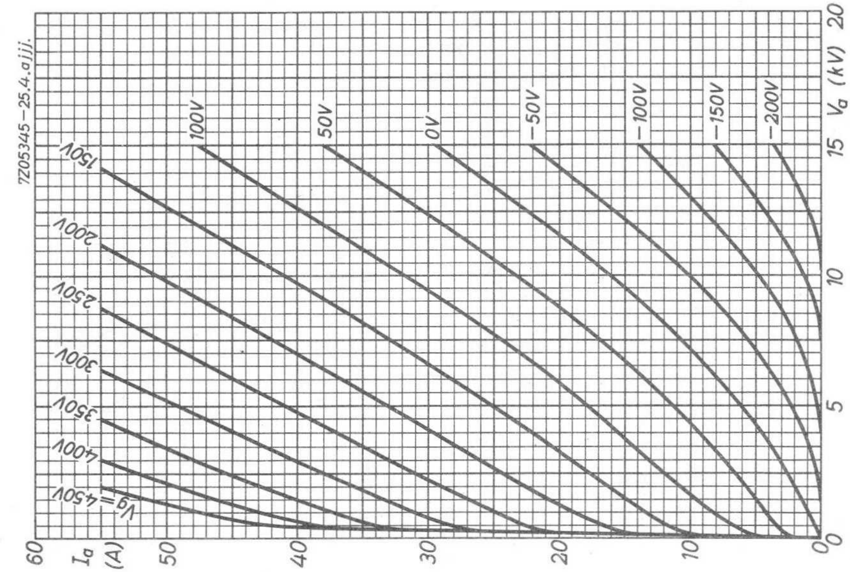
OPERATING CONDITIONS (two tubes in push-pull)

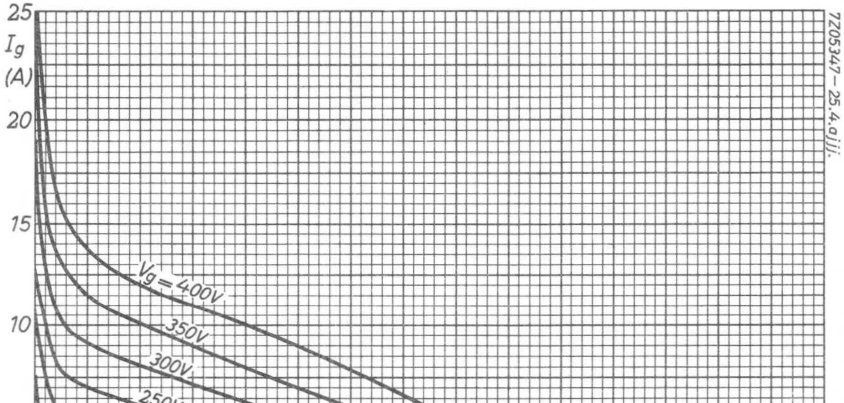
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-205		-170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{ggp}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{gp}	=	0	2x2.9	0	2x4.0	A
Grid driving power	W_{dr}	=	0	2x150	0	2x235	W
Anode input power	W_{i_a}	=	2x4.0	2x57	2x4.0	2x57.5	kW
Anode dissipation	W_a	=	2x4.0	2x18	2x4.0	2x18.5	kW
Output power	W_o	=	0	78	0	78	kW
Efficiency	η	=	-	68.5	-	68	%

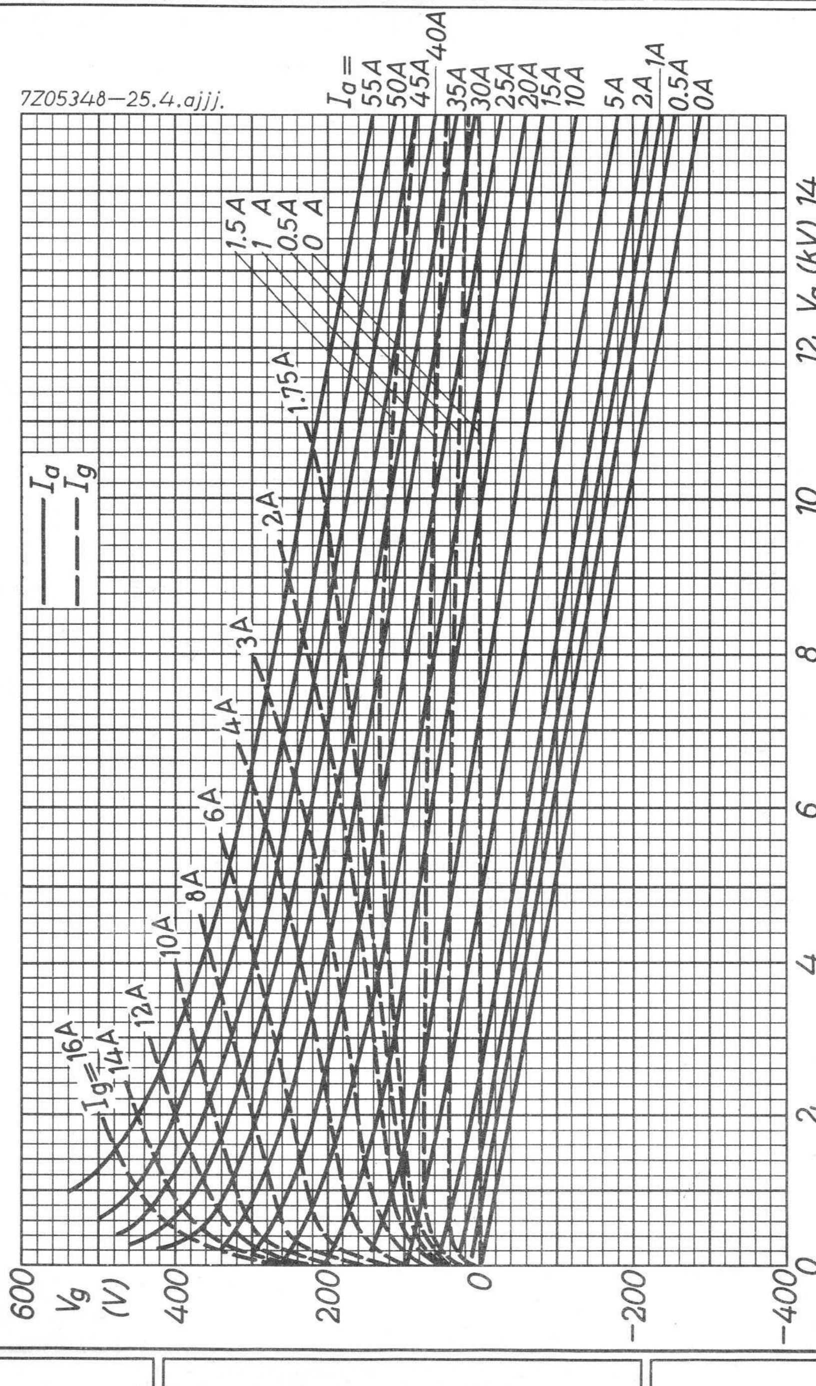
7Z2 8723

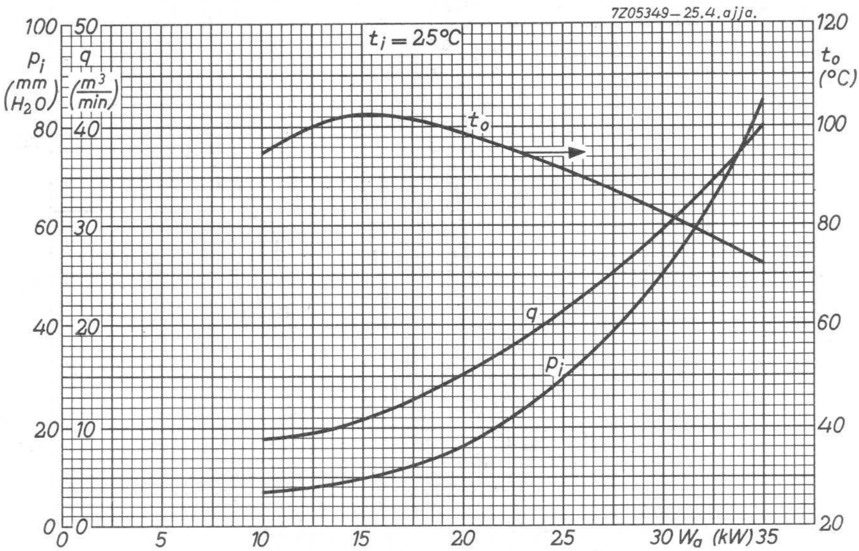

7Z05344-25.4.ajjj.
I_a (A)
V_g (V)
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV
0
10
20
30
40
50
60
−400
−200
0
200
400


7Z05346-25.4.ajjj.
I_g (A)
V_g (V)
V_a = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15 kV
0
5
10
15
20
25
30
0
100
200
300
400


7Z05345−25.4.ajjj.
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
−200V
I_a (A)
V_a (kV)
60
50
40
30
20
10
0
0
5
10
15
20


7Z05347−25.4.ajjj.
I_g (A)
25
20
15
10
5
0
V_g = 400V
350V
300V
250V
200V
150V
100V
0
2
4
6
8
10
12
V_a (kV)
14


7Z05348—25.4.ajjj.
Ia =
55A
50A
45A
40A
35A
30A
25A
20A
15A
10A
5A
2A
1A
0.5A
0A
1.5A
1 A
0.5A
0 A
1.75A
2A
3A
4A
6A
8A
10A
12A
Ig = 16A
14A
Ia
Ig
Va (kV)
0
2
4
6
8
10
12
14
Vg (V)
600
400
200
0
−200
−400


7Z05349—25.4.ajja.
$t_i = 25\,°C$
p_i (mm H_2O)
q (m^3/min)
t_o (°C)
t_o
q
p_i
W_a (kW)
0
5
10
15
20
25
30
35
20
40
60
80
100
120
10
30
50

VAPOUR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA

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

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

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	160	A

CAPACITANCES

Grid to filament	C_{gf}	=	120	pF
Anode to filament	C_{af}	=	1.4	pF
Anode to grid	C_{ag}	=	50	pF

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS

Bulb temperature	t	= max.	220	^{o}C
Seal temperature	t	= max.	220	^{o}C

COOLING

Cooling data for anode dissipation W_a = 60 kW

Total dissipation to be transferred by cooling system

$(W_a + W_g + 0.8\ W_f)$ = 63 kW

equivalent to 900 kcal/min

Volume of produced vapour

at back flow water temperature of 20 ^{o}C 2.5 m^3/min

at back flow water temperature of 90 ^{o}C 2.8 m^3/min

7Z2 3895

COOLING (continued)

Amount of back flowing water

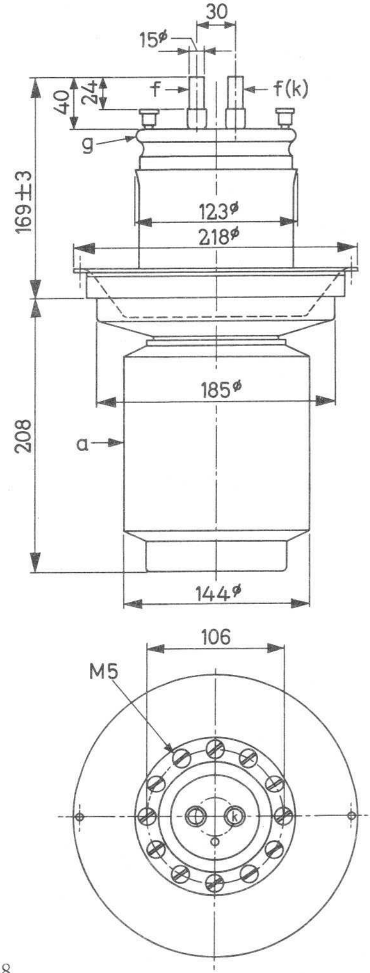
at back flow water temperature of 20 °C	1.5	l/min
at back flow water temperature of 90 °C	1.7	l/min

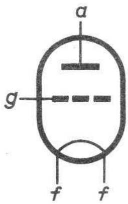
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

MECHANICAL DATA

Net weight: 17 kg

Dimensions in mm





Mounting position: vertical
with anode down

ACCESSORIES

Vapour cooling system	K728
Filament connectors with cable	40670
Grid connector	40671

7Z2 8724

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	15	max.	12	kV
Anode dissipation	W_a	=	max.	60	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
Anode current	I_a	=	max.	13	max.	13	A
Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	30	30	30	MHz
Anode voltage	V_a	=	15	12	10	8	kV
Grid voltage	V_g	=	−600	−550	−500	−450	V
Anode current	I_a	=	9.75	9.25	9.0	8.75	A
Grid current	I_g	=	2.2	2.2	2.1	1.85	A
Peak grid driving voltage	V_{gp}	=	1000	940	875	810	V
Grid driving power	W_{dr}	=	2.1	1.9	1.7	1.55	kW
Anode input power	W_{ia}	=	146	111	90	70	kW
Anode dissipation	W_a	=	26	21	18	15	kW
Output power	W_o	=	120	90	72	55	kW
Efficiency	η	=	82	81	80	78.5	%

7Z2 8725

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	15	max.	12	kV
Anode dissipation	W_a	=	max.	60	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1000	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	max.	1.3	kW
→ Anode current	I_a	=	max.	13	max.	13	A
→ Grid current	I_g	=	max.	3.3	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	10	10	30	30	MHz
Anode voltage	V_a	=	15	15	12	12	kV
Grid voltage	V_g	=	−260	−260	−210	−210	V
Anode current	I_a	=	10.1	7.75	12.7	9.85	A
Grid current	I_g	=	2.0	1.3	3.0	1.9	A
Peak grid driving voltage	V_{gp}	=	600	520	650	520	V
Grid driving power	W_{dr}	=	1080	610	1770	880	W
Anode input power	W_{ia}	=	151	116.3	153	118	kW
Anode dissipation	W_a	=	41	31.3	43	33	kW
Output power	W_o	=	110	85	110	85	kW
Efficiency	η	=	73	73	72	72	%

7Z2 8726

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11	kV
Anode dissipation	W_a	=	max.	30	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	9	A
Grid current	I_g	=	max.	3.3	A

OPERATING CONDITIONS

Frequency	f	=	30	30	MHz
Anode voltage	V_a	=	11	10	kV
Grid voltage	V_g	=	−480	−440	V [1])
Anode current	I_a	=	7.6	6.9	A
Grid current	I_g	=	3.1	3.1	A
Grid resistor	R_g	=	90	80	Ω
Peak grid driving voltage	V_{g_p}	=	880	810	V
Grid driving power	W_{dr}	=	2.7	2.4	kW
Anode input power	W_{i_a}	=	83.6	69	kW
Anode dissipation	W_a	=	17.6	14	kW
Output power	W_o	=	66	55	kW
Efficiency	η	=	79	79	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	41.8	34.5	kW

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

7Z2 8727

A.F. CLASS B AMPLIFIER AND MODULATOR

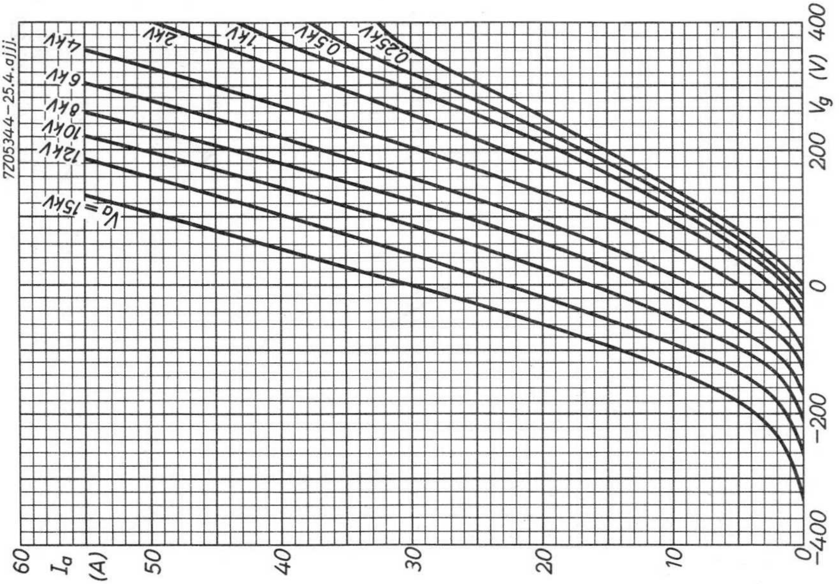
LIMITING VALUES (Absolute limits)

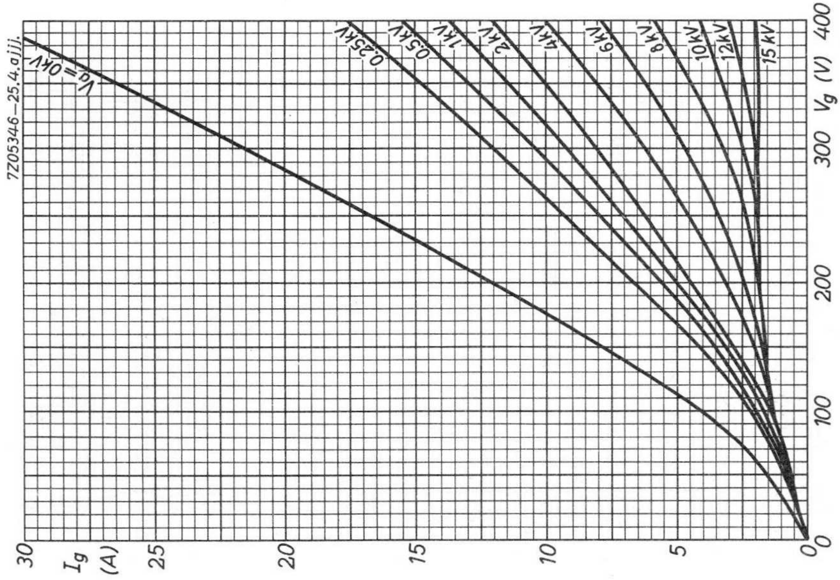
Anode voltage	V_a	=	max.	12	kV
Anode dissipation	W_a	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
→ Anode current	I_a	=	max.	13	A
→ Grid current	I_g	=	max.	3.3	A

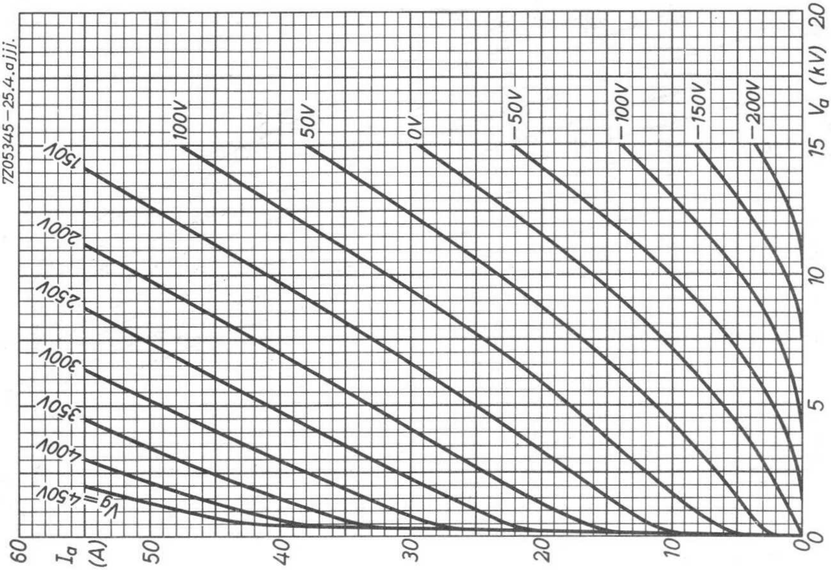
OPERATING CONDITIONS (two tubes in push-pull)

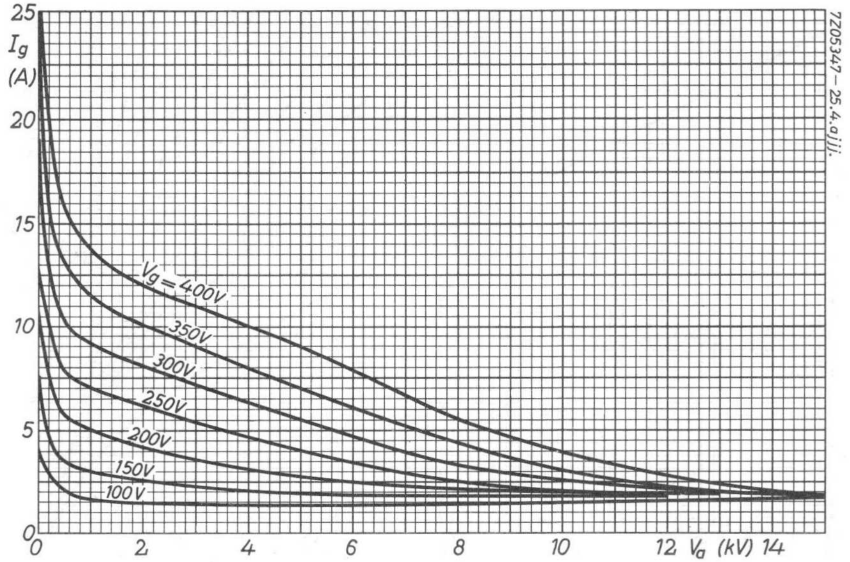
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-205		-170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{gg_p}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{g_p}	=	0	2x2.9	0	2x4.0	A
Grid driving power	W_{dr}	=	0	2x150	0	2x235	W
Anode input power	W_{ia}	=	2x4.0	2x57	2x4.0	2x57.5	kW
Anode dissipation	W_a	=	2x4.0	2x18	2x4.0	2x18.5	kW
Output power	W_o	=	0	78	0	78	kW
Efficiency	η	=	–	68.5	–	68	%

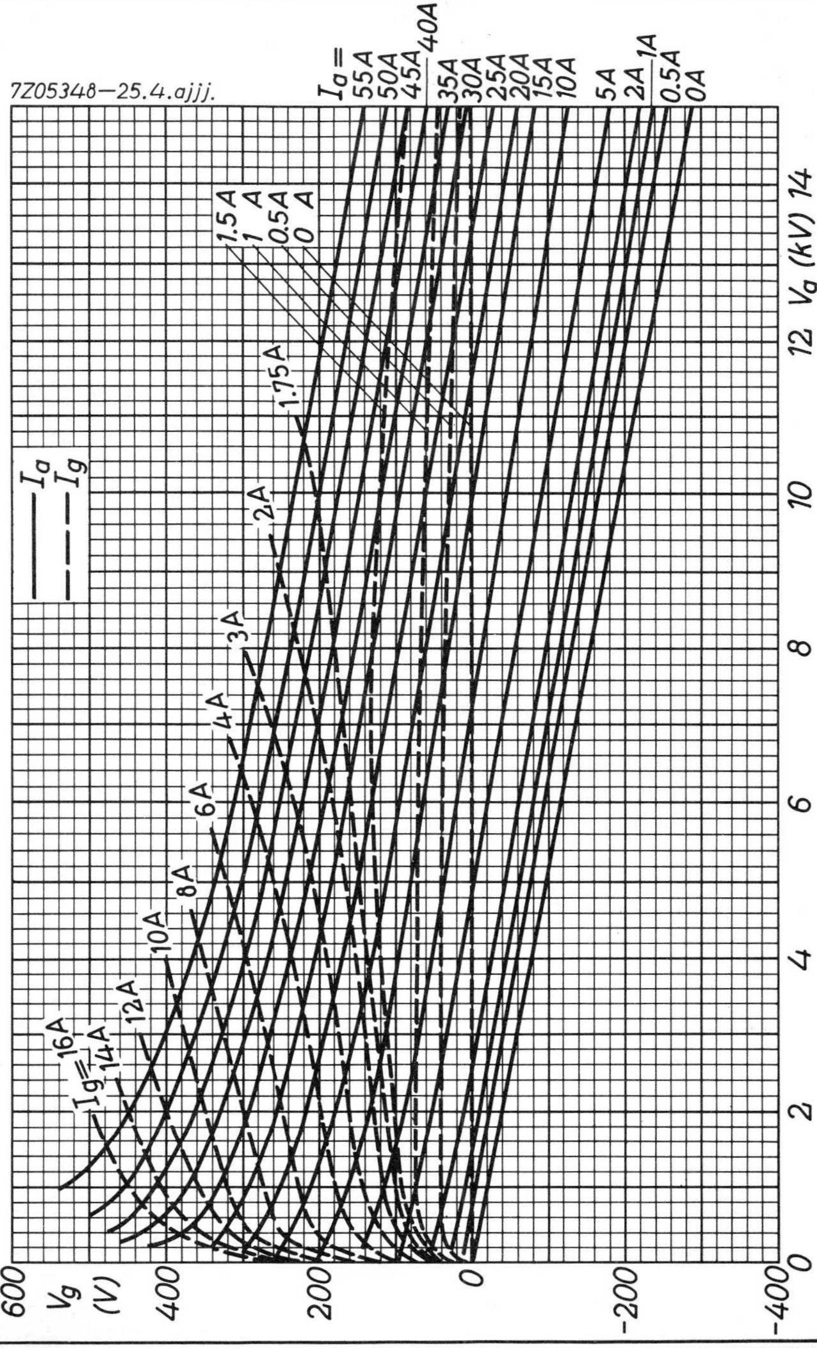
7Z2 8728


7Z05344-25.4.ajjj.
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV
I_a (A)
60
50
40
30
20
10
0
V_g (V)
−400
−200
0
200
400


7Z05346-25.4.ajjj.
V_a = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8 kV
10kV
12kV
15 kV
I_g (A)
30
25
20
15
10
5
0
V_g (V)
0
100
200
300
400


7Z05345-25.4.ajjj.
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
-50V
-100V
-150V
-200V
I_a (A)
60
50
40
30
20
10
0
V_a (kV)
0
5
10
15
20


7Z05347-25.4.ajjj.
I_g (A)
25
20
15
10
5
0
V_g = 400V
350V
300V
250V
200V
150V
100V
0
2
4
6
8
10
12
V_a (kV)
14


7Z05348—25.4.ajjj.
I_a=
55A
50A
45A
40A
35A
30A
25A
20A
15A
10A
5A
2A
1A
0.5A
0A
1.5A
1 A
0.5A
0 A
1.75A
2A
3A
4A
6A
8A
10A
12A
I_g=16A
14A
I_a
I_g
V_a (kV)
0
2
4
6
8
10
12
14
V_g (V)
600
400
200
0
-200
-400

WATER COOLED R.F. POWER TRIODE

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

HEATING : direct by AC or DC; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 3849

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 180 °C

Seal temperature = max. 180 °C

COOLING CHARACTERISTICS . See also cooling curves

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

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

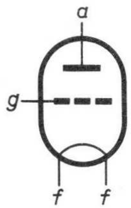
7Z2 3850

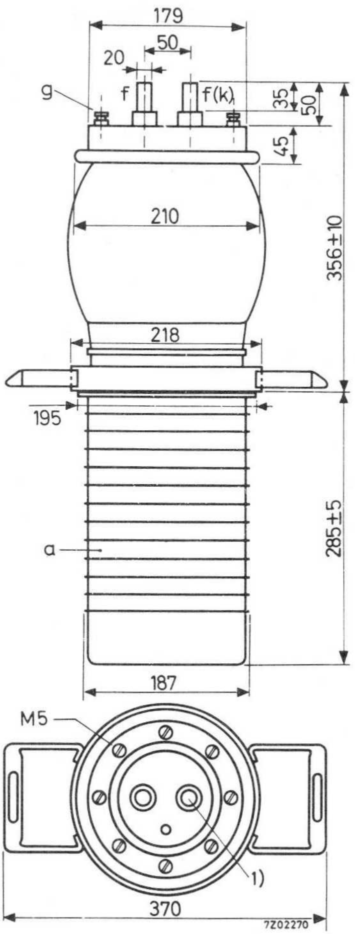
MECHANICAL DATA

Dimensions in mm

Net weight of tube : 32.5 kg

Net weight of water jacket: 30.5 kg





Mounting position: vertical with anode down

ACCESSORIES

Water jacket : K723

Filament connectors with cable: 40667

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

7Z2 8729

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 8730

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 8731

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 8732

A.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes in push-pull

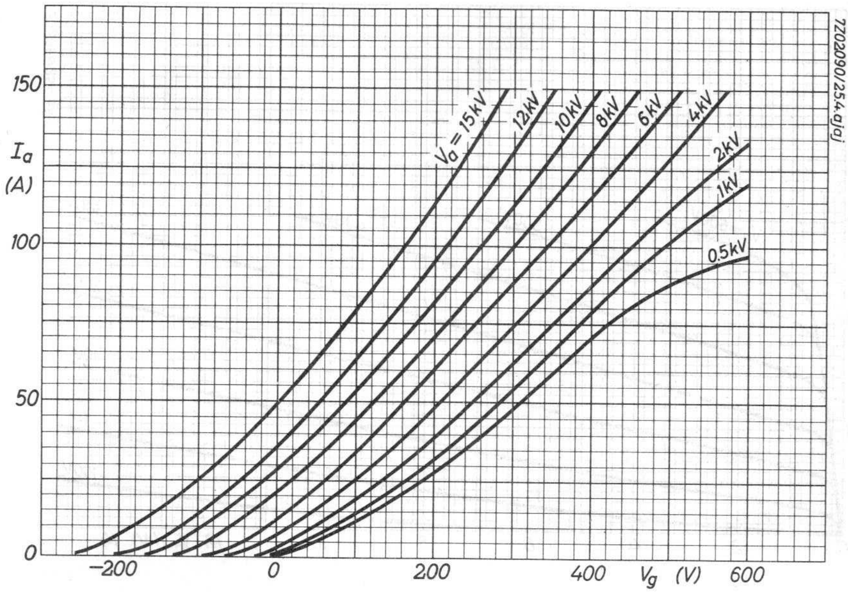
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-180		-150		V
Load resistance	$R_{aa\sim}$	=	552		410		Ω
Peak driving voltage	V_{ggp}	=	0	1210	0	1205	V
Anode current	I_a	=	2x2	2x26	2x1.8	2x28	A
Grid current	I_g	=	0	2x4.4	0	2x4.8	A
Peak grid current	$I_{g\,p}$	=	0	2x23	0	2x24	A
Driving power	W_{dr}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

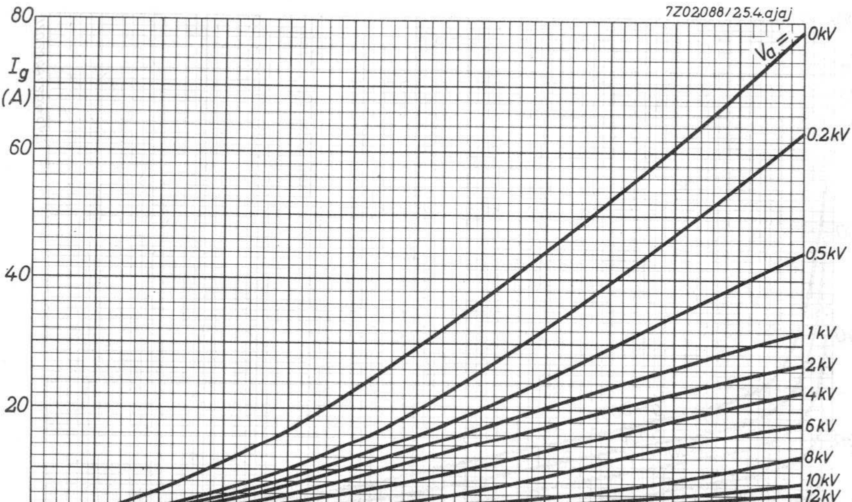
7Z2 8733

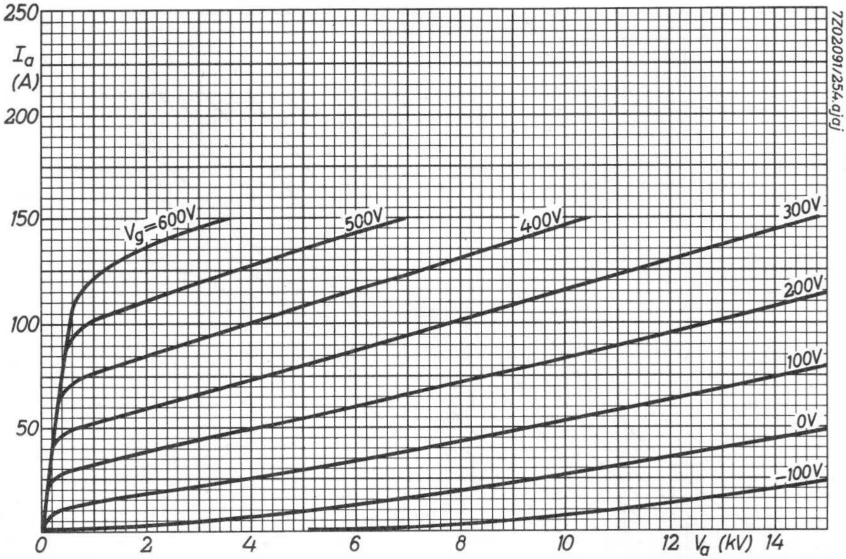
OPERATING CONDITIONS, two tubes in push-pull (continued)

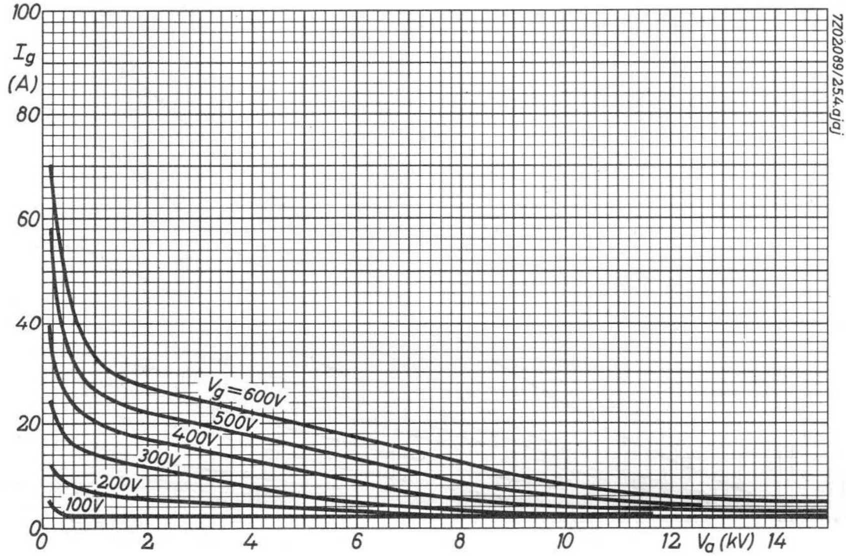
Anode voltage	V_a	=	8		6		kV
Grid voltage	V_g	=	-115		-82		V
Load resistance	$R_{aa\sim}$	=	338		268		Ω
Peak driving voltage	V_{gg_p}	=	0	1110	0	990	V
Anode current	I_a	=	2x1.6	2x27	2x1.4	2x25	A
Grid current	I_g	=	0	2x5	0	2x4.9	A
Peak grid current	I_{gp}	=	0	2x24	0	2x22	A
Driving power	W_{dr}	=	0	2x2.5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

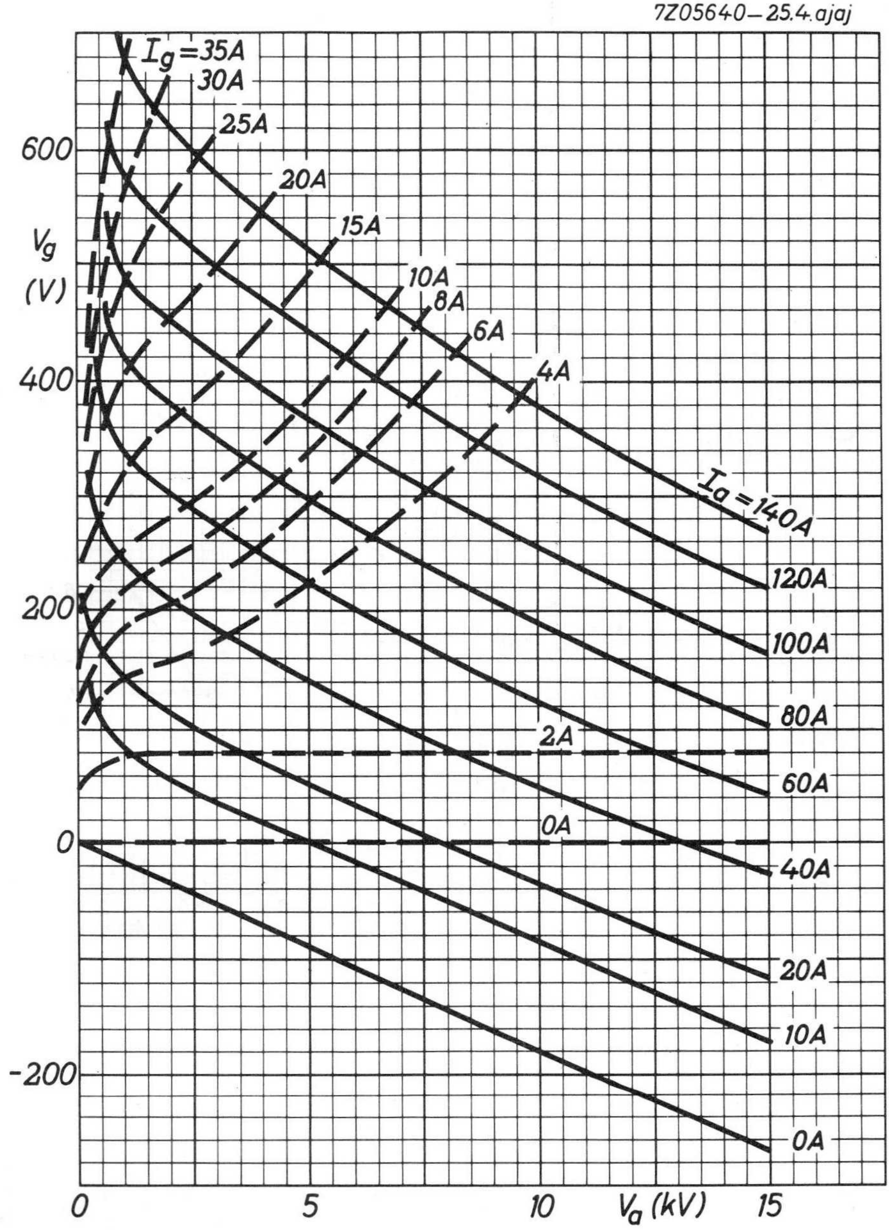
7Z2 3856

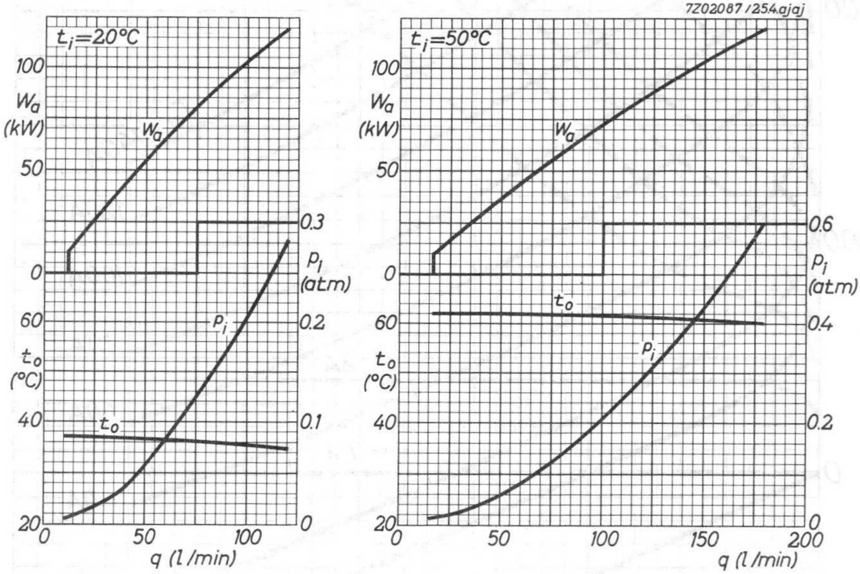

7Z02090/25.4.ajaj
150
100
50
0
I_a
(A)
V_a = 15 kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
−200
0
200
400
V_g (V)
600


7Z02088/25.4.ajaj
80
60
40
20
0
I_g
(A)
V_a =
0kV
0.2kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15kV
0
100
200
300
400
500
V_g (V)
600


250
I_a
(A)
200
150
100
50
0
V_g=600V
500V
400V
300V
200V
100V
0V
−100V
0
2
4
6
8
10
12
V_a (kV)
14
7Z02091/254.ajaj


100
I_g
(A)
80
60
40
20
0
V_g=600V
500V
400V
300V
200V
100V
0
2
4
6
8
10
12
V_a (kV)
14
7Z02089/254.ajaj


7Z05640-25.4.ajaj
Ig=35A
30A
25A
20A
15A
10A
8A
6A
4A
2A
0A
Ia=140A
120A
100A
80A
60A
40A
20A
10A
0A
600
400
200
0
-200
Vg
(V)
0
5
10
Va (kV)
15


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

VAPOUR COOLED R.F. POWER TRIODE

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

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	t	=	max. 180	^{o}C
Seal temperature	t	=	max. 180	^{o}C

7Z2 3875

COOLING

Cooling data for anode dissipation W_a = 180 kW

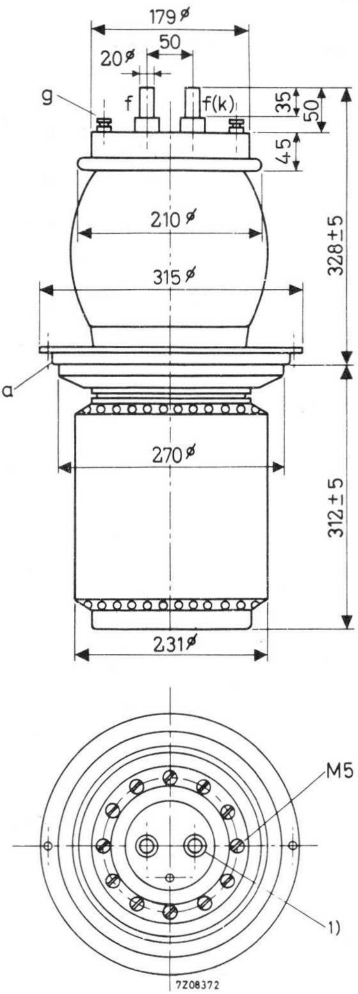
Total dissipation to be transferred by cooling system ($W_a + W_g + 0.8\ W_f$)	188	kW
equivalent to	2700	kcal/min
Volume of produced vapour		
at back flow water temperature of 20 °C	7.3	m^3/min
at back flow water temperature of 90 °C	8.3	m^3/min
Amount of back flowing water		
at back flow water temperature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

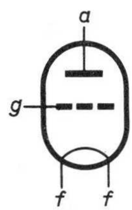
7Z2 3876

MECHANICAL DATA

Net weight: 51.5 kg

Dimensions in mm





Mounting position: vertical with anode down

ACCESSORIES

Vapour cooling system	K729
Filament connectors with cable	40667

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

7Z2 8734

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 8735

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 8736

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 8737

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS (Two tubes in push-pull)

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

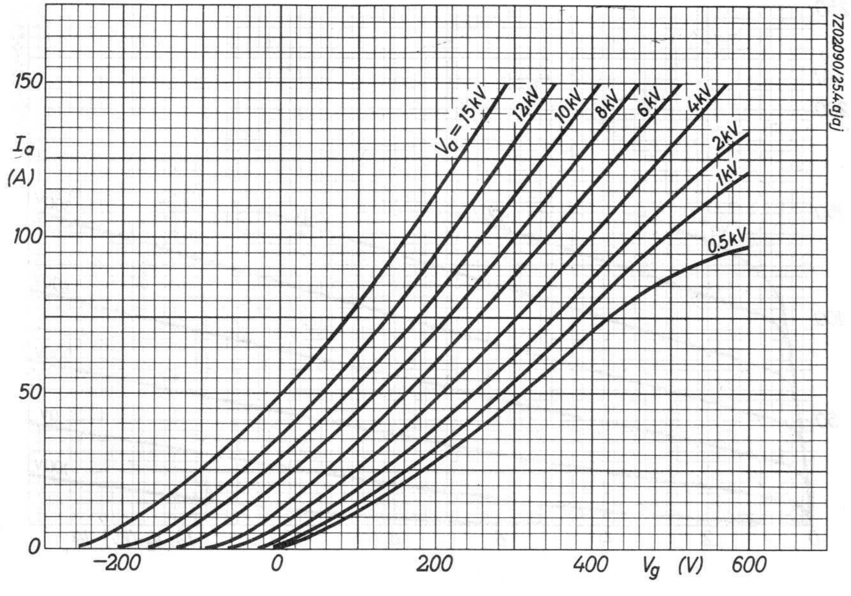
7Z2 8738

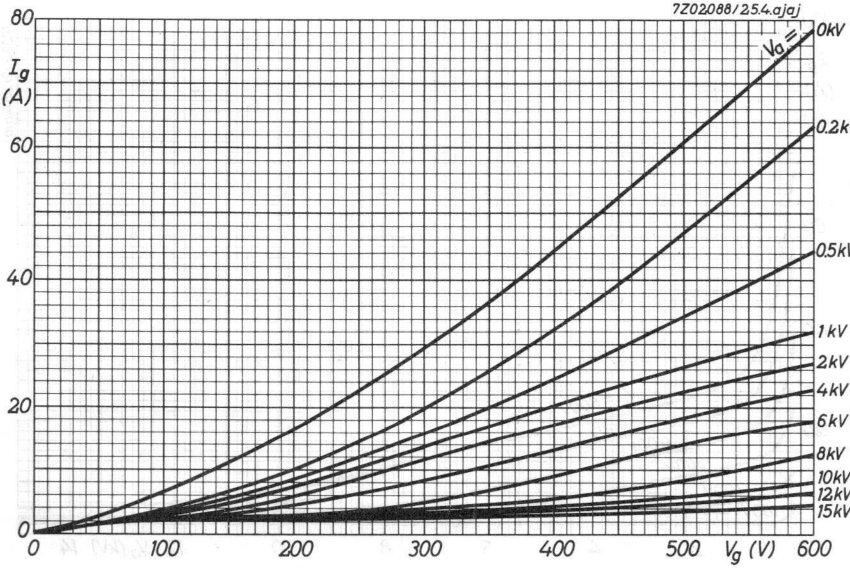
A.F. CLASS B AMPLIFIER AND MODULATOR

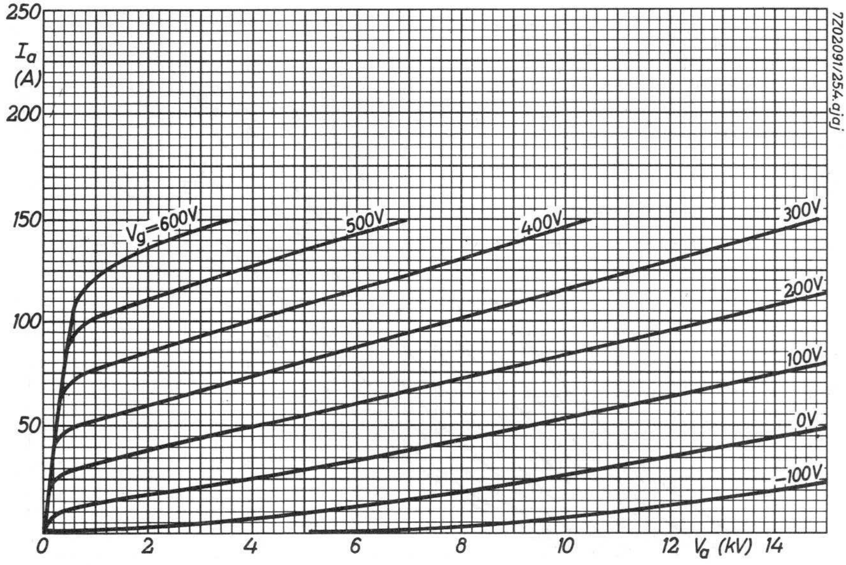
OPERATING CONDITIONS (Two tubes in push-pull; continued)

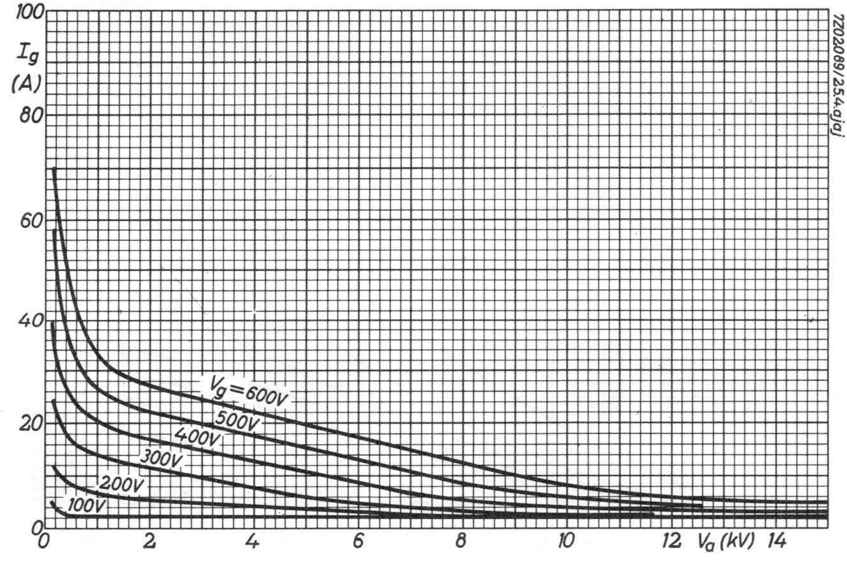
Anode voltage	V_a	=	8		6		kV
Grid voltage	V_g	=	-115		-82		V
Load resistance	$R_{aa\sim}$	=	338		268		Ω
Peak driving voltage	V_{ggp}	=	0	1110	0	990	V
Anode current	I_a	=	2x1.6	2x27	2x1.4	2x25	A
Average grid current	I_g	=	0	2x5.0	0	2x4.9	A
Peak grid current	I_{gp}	=	0	2x24	0	2x22	A
Driving power	W_{dr}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

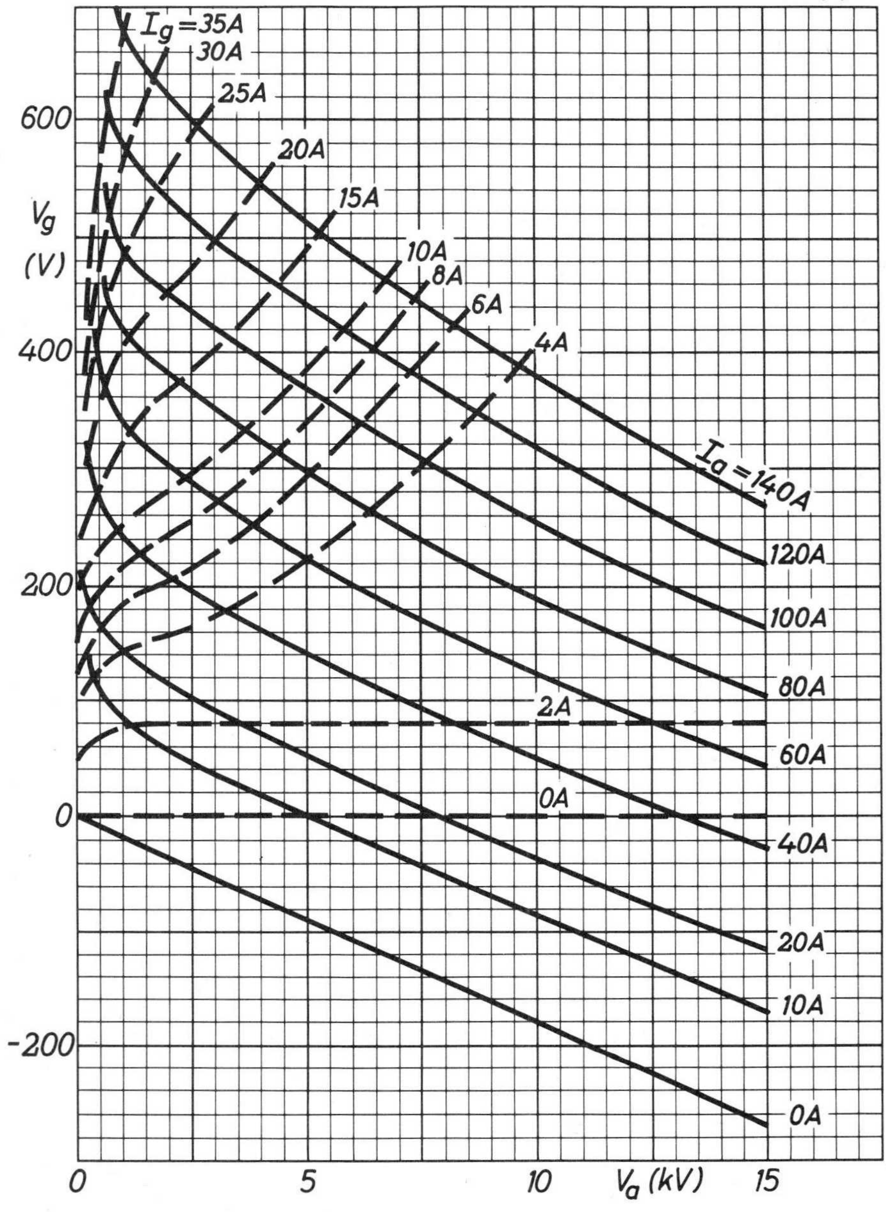
7Z2 3900


7Z02090/25.4.ajaj
150
I_a
(A)
100
50
0
−200
0
200
400
V_g (V)
600
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV


7Z02088/25.4.ajaj
80
I_g
(A)
60
40
20
0
0
100
200
300
400
500
V_g (V)
600
V_a = 0kV
0.2kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15kV


250
I_a
(A)
200
150
100
50
0
V_g=600V
500V
400V
300V
200V
100V
0V
−100V
2
4
6
8
10
12
V_a (kV)
14
7Z02091/25.4.ajaj


100
I_g
(A)
80
60
40
20
0
V_g=600V
500V
400V
300V
200V
100V
2
4
6
8
10
12
V_a (kV)
14
7Z02089/25.4.ajaj


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

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegraphy		C anode mod.		C television Two tubes		AF class B Two tubes	
	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
30	4	4.0					6	13.3
	5	5.6						
	6	6.9						
75			5	4.7				
110	5	4.8	4	2.8				
220	3	2.65						
48 to 75					5	9.5		

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V
Filament current	I_f	=	33	A

The connection f_c is intended for use as cathode return. It is not an electrical centre tap and must not be used for filament current supply. At frequencies above 30 MHz the three filament leads should be interconnected by suitable capacitors.

CAPACITANCES

Anode to filament	C_{af}	=	0.3	pF
Grid to filament	C_{gf}	=	16	pF
Anode to grid	C_{ag}	=	11	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	4.0	kV
Anode current	I_a	=	1.0	A
Amplification factor	μ	=	32	
Mutual conductance	S	=	17	mA/V

7Z2 3857

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and grid seals	t	=	max. 180	°C
Temperature of pin seals	t	=	max. 220	°C
Air inlet temperature	t_i	=	max. 45	°C

AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
1	0	35	3.0	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

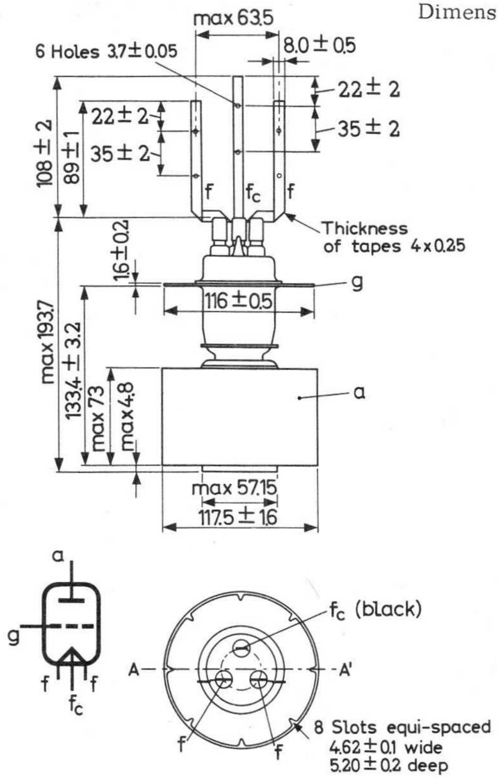
It may be necessary to direct an air flow to the seals to keep them within the temperature limits.

7Z2 3858

MECHANICAL DATA

Dimensions in mm

Net weight: 3.4 kg



The plane of the filament is parallel to AA' to within $3\frac{1}{2}^{\circ}$

Mounting position: vertical with base up or down

7Z2 3859

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	110	220	MHz
Anode voltage	V_a	=	max. 6.2	5.5	4.0	kV
Anode current	I_a	=	max. 1.5	1.5	1.5	A
Anode input power	W_{ia}	=	max. 9.3	8.2	6.0	kW
Anode dissipation	W_a	=	max. 5.0	5.0	5.0	kW
Negative grid voltage	$-V_g$	=	max. 1000	1000	1000	V
Grid current	I_g	=	max. 350	350	350	mA

OPERATING CONDITIONS

Frequency	f	=	30	30	30	110	220[1]	MHz
Anode voltage	V_a	=	6.0	5.0	4.0	5.0	3.0	kV
Grid voltage	V_g	=	-400	-300	-200	-300	-160	V
Anode current	I_a	=	1.5	1.5	1.37	1.25	1.25	A
Grid current	I_g	=	310	330	300	300	250	mA
Driver output power	W_{dr}	=	275	240	190	250	510	W
Anode input power	W_{ia}	=	9.0	7.5	5.5	6.25	3.75	kW
Anode dissipation	W_a	=	2.1	1.9	1.5	1.45	1.6	kW
Output power	W_o	=	6.9	5.6	4.0	4.8	2.65	kW
Tube efficiency	η	=	76.5	75	73	77	70	%
Output power in the load	W_ℓ	=	5.5	4.5	3.2	3.9	2.15	kW

[1]) In grounded grid circuit

7Z2 3860

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	110	220	MHz
Anode voltage	V_a	=	max.	5.0	4.5	3.2	kV
Anode current	I_a	=	max.	1.3	1.3	1.3	A
Anode input power	W_{i_a}	=	max.	6.5	5.8	4.0	kW
Anode dissipation	W_a	=	max.	3.4	3.4	3.4	kW
Negative grid voltage	$-V_g$	=	max.	1000	1000	1000	V
Grid current	I_g	=	max.	350	350	350	mA

OPERATING CONDITIONS

Frequency	f	=	75	110	MHz
Anode voltage	V_a	=	5.0	4.0	kV
Grid voltage	V_g	=	-400	-350	V
Anode current	I_a	=	1.2	0.93	A
Grid current	I_g	=	300	240	mA
Driver output power	W_{dr}	=	205	130	W
Anode input power	W_{i_a}	=	6.0	3.72	kW
Anode dissipation	W_a	=	1.3	0.92	kW
Output power	W_o	=	4.7	2.8	kW
Tube efficiency	η	=	78.5	75	%
Output power in the load	W_ℓ	=	3.75	2.25	kW
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	2.4	1.4	kW

7Z2 3861

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

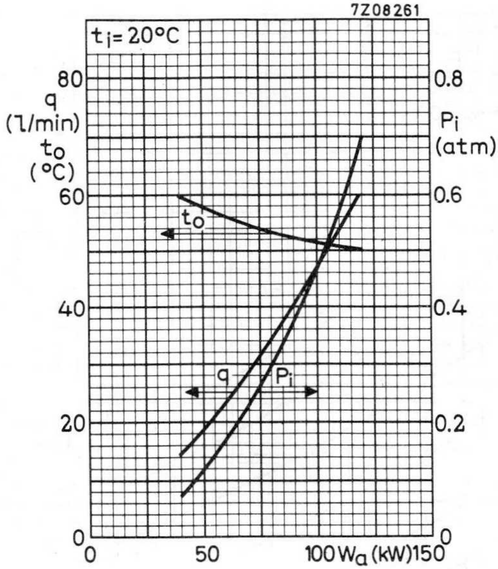
LIMITING VALUES (Absolute limits)

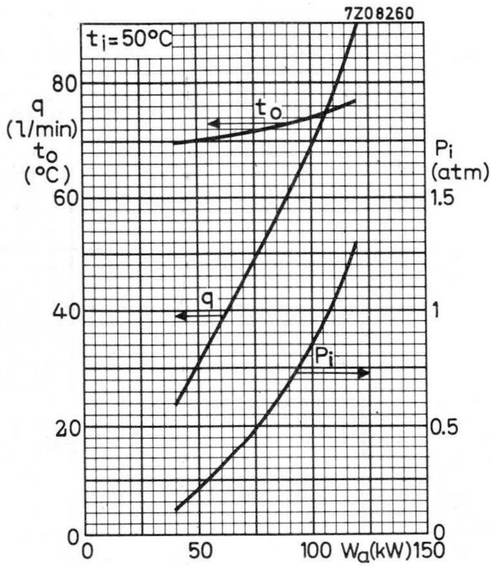
Frequency	f		up to	75	up to	220	MHz
Anode voltage	V_a	=	max.	5.0	max.	4.0	kV
Anode current	I_a sync	=	max.	2.0	max.	1.6	A
Anode input power	W_{i_a}	=	max.	10	max.	6.4	kW
Anode dissipation	W_a sync	=	max.	4.0	max.	4.0	kW
Negative grid voltage	$-V_g$ sync	=	max.	1000	max.	1000	V
Grid dissipation	W_g sync	=	max.	120	max.	120	W

OPERATING CONDITIONS (Two tubes in push-pull, common cathode bias modulated)

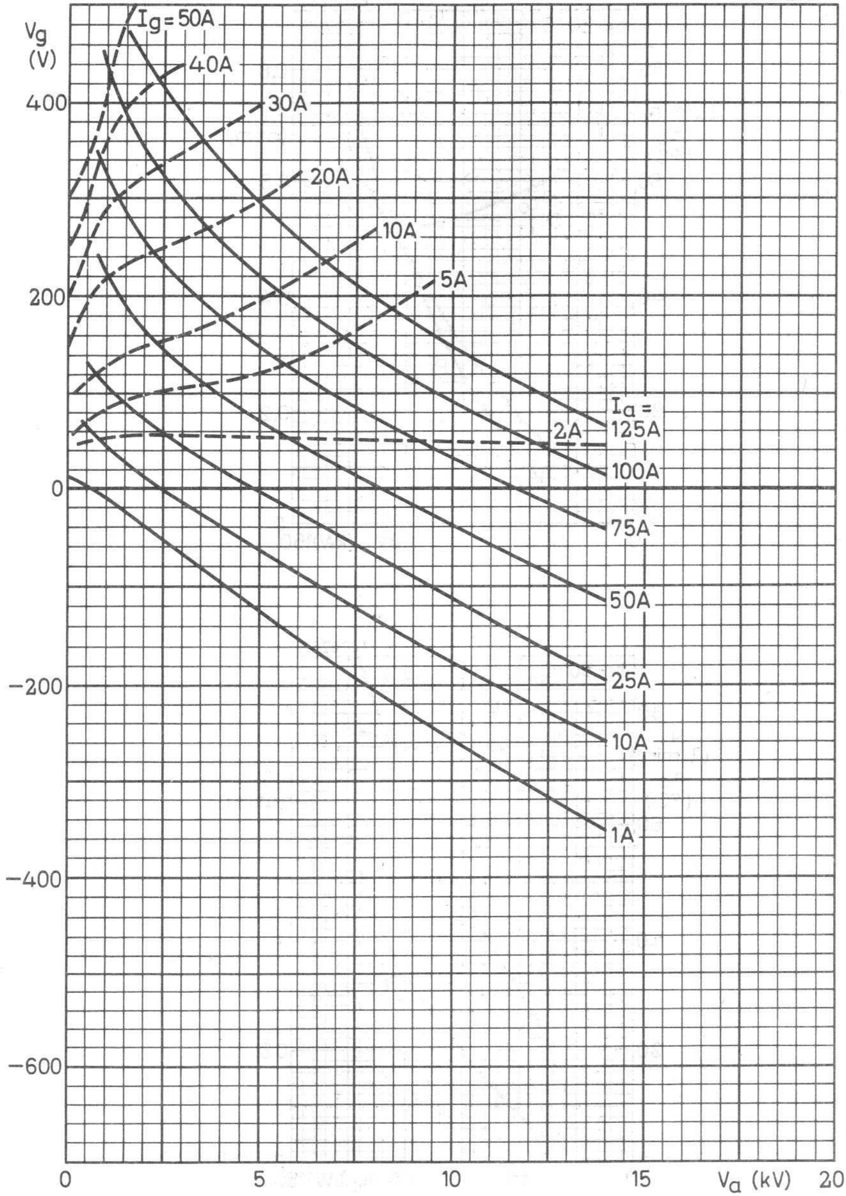
Frequency	f		=	48 to 75	MHz
Bandwidth (– 3 dB)	B		=	8.0	MHz
Anode voltage	V_a		=	5.0	kV
Grid voltage	V_g	sync	=	-200	V
	V_g	black	=	-300	V
	V_g	white	=	-550	V
Anode current	I_a	sync	=	2x1.9	A
	I_a	black	=	2x1.3	A
Grid current	I_g	sync	=	2x250	mA
	I_g	black	=	2x175	mA
Driver output power	W_{dr}	sync	=	250	W
Output power	W_o	sync	=	9.5	kW
Output power in the load	W_ℓ	sync	=	6.3	kW

7Z2 3862


7Z08261
t_i= 20°C
q
(l/min)
t_o
(°C)
80
60
40
20
0
0.8
0.6
0.4
0.2
0
P_i
(atm)
t_o
q
P_i
0
50
100 W_a (kW) 150


7Z08260
t_i=50°C
q
(l/min)
t_o
(°C)
80
60
40
20
0
P_i
(atm)
1.5
1
0.5
0
t_o
q
P_i
0
50
100 W_a(kW) 150

7Z08262


Vg
(V)
400
200
0
−200
−400
−600
Ig = 50A
40A
30A
20A
10A
5A
2A
Ia =
125A
100A
75A
50A
25A
10A
1A
0
5
10
15
Va (kV)
20

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL SERVICE

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	16.8	kV
Anode input power	W_{i_a}	=	max.	375	kW
Anode dissipation	W_a	=	max.	120	kW
Anode current	I_a	=	max.	28	A
Negative grid voltage	$-V_g$	=	max.	2000	V
Grid current, loaded	I_g	=	max.	7	A
Grid current, unloaded	I_g	=	max.	8.5	A
Grid circuit resistance	R_g	=	max.	10	kΩ

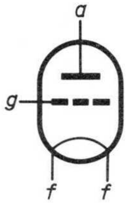
OPERATING CONDITIONS

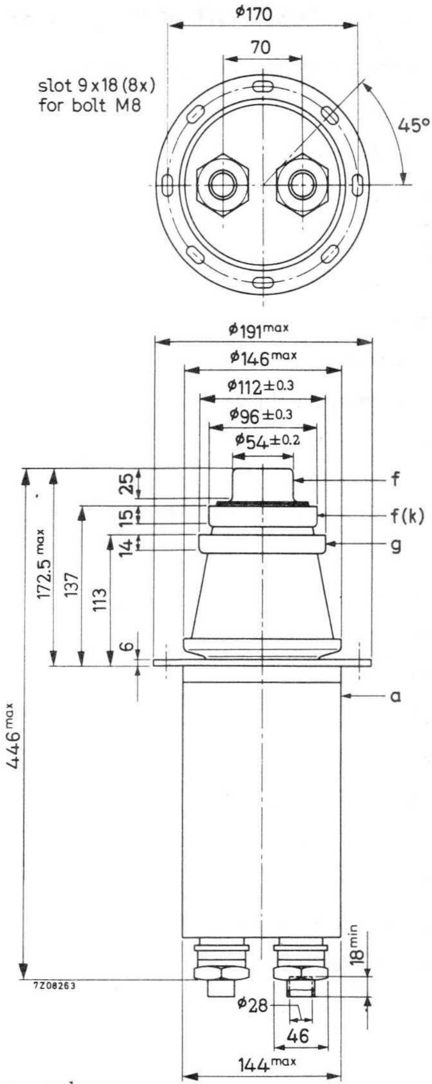
Frequency	f	up to	30	MHz
Anode voltage	V_a	=	14	kV
Anode current	I_a	=	23.5	A
Grid resistor	R_g	=	135	Ω
Grid current	I_g	=	6	A
Anode input power	W_{i_a}	=	329	kW
Anode dissipation	W_a	=	81.5	kW
Tube output power	W_o	=	247.5	kW
Tube efficiency	η	=	75.2	%
Oscillator output power (W_o-W_{drive})	W_{osc}	=	240	kW
Oscillator efficiency	η_{osc}	=	73	%

7Z2 8632

MECHANICAL DATA

Dimensions in mm





Mounting position: vertical with anode up or down

With anode up inlet and outlet connections should be interchanged.

7Z2 8631

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max. 240	^oC
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max. 200	^oC
Absolute max. water inlet temperature	t_i	max. 50	^oC

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (l/min)	p_i (atm)	t_o (^oC)
120	20	60	0.7	50
	50	90	1.3	70
80	20	36	0.3	54
	50	54	0.55	73
40	20	16	0.07	60
	50	24	0.13	77

Cooling of the seals can be accomplished by a low velocity air flow or by water cooling of the filament connectors.
The cooling circuits of these accessories may be connected in series. Care should be taken of sufficient electrical isolation especially between the filament connectors on one side and the grid connector on the other side. A water flow of approximately 0.5 l/min will be sufficient.

ACCESSORIES

Grid connector < 4 MHz	type	40694	net weight	270 g
Grid connector > 4 MHz	type	40737	net weight	525 g
Filament connectors	type	40695	net weight	710 g
(both types required)	and type	40696	net weight	860 g
Filament cables	type	40716	net weight	975 g
(both types required)	and type	40717	net weight	980 g

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

QUICK REFERENCE DATA				
Frequency	f	up to	30	MHz
Anode voltage	V_a	=	14	kV
Anode current	I_a	=	23.5	A
Oscillator output power	W_{osc}	=	240	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12.6	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	380	A
Peak filament starting current	I_{f_p}	=	max. 2000	A
Cold filament resistance	R_{f_o}	=	0.0036	Ω

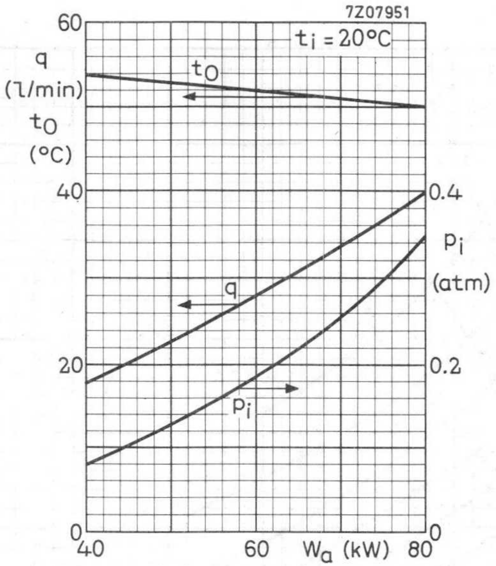
CAPACITANCES

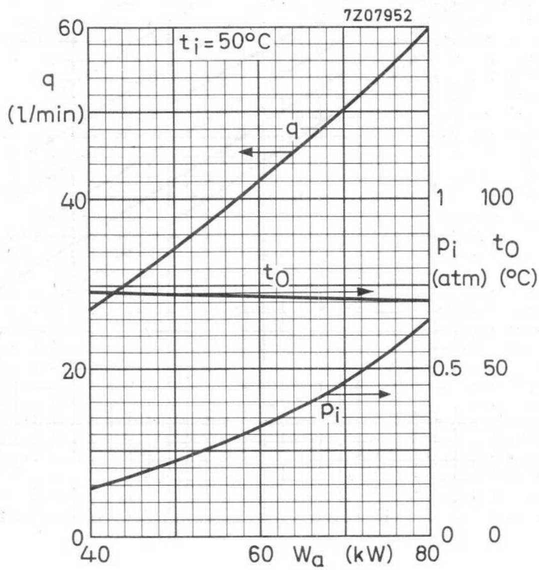
Anode to filament	C_{af}	=	3.0	pF
Grid to filament	C_{gf}	=	185	pF
Anode to grid	C_{ag}	=	60	pF

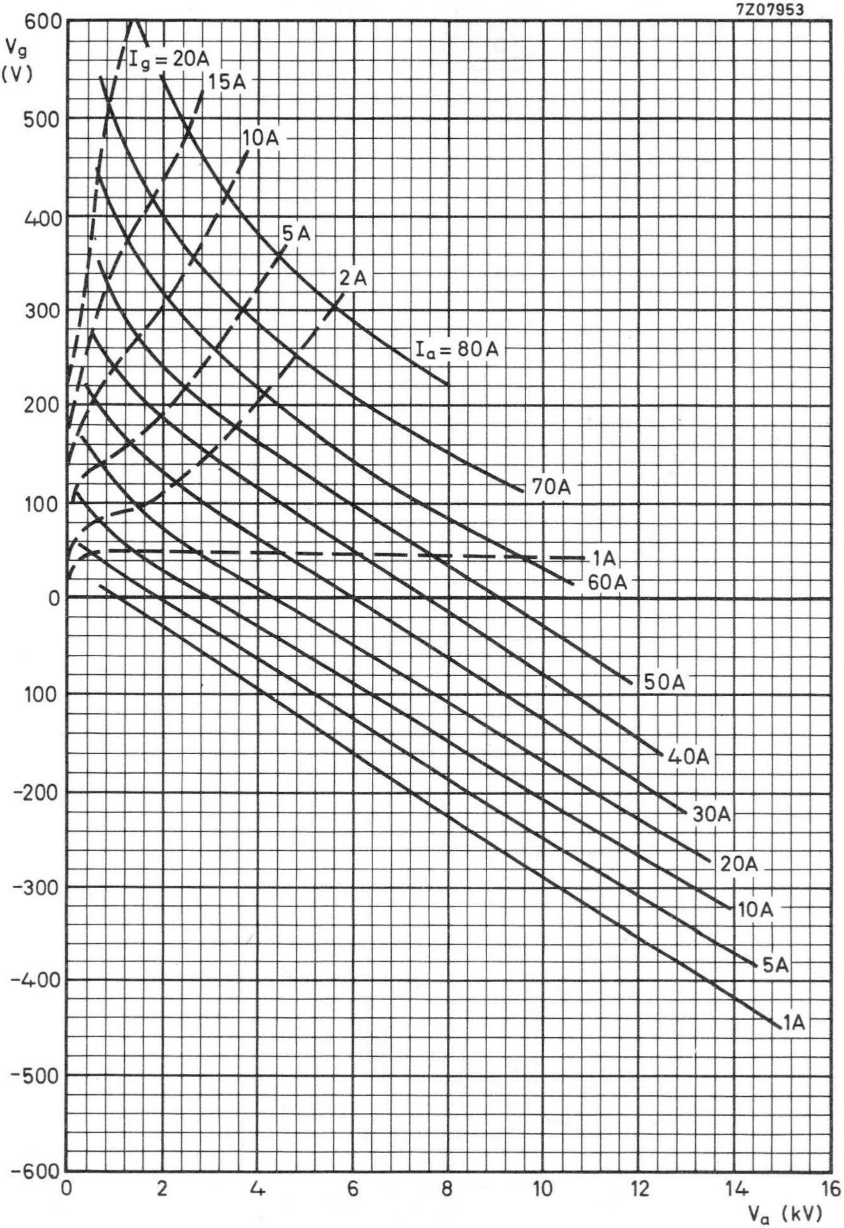
TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	14	kV
Anode current	I_a	=	10	A
Mutual conductance	S	=	160	mA/V
Amplification factor	μ	=	33	

7Z2 8629


7Z07951
t_i = 20°C
q
(l/min)
t_o
(°C)
t_o
q
p_i
p_i
(atm)
0.4
0.2
0
60
40
20
0
40
60
W_a (kW)
80


7Z07952
t_i = 50°C
q
(l/min)
q
t_o
p_i
1
100
p_i
t_o
(atm)
(°C)
0.5
50
0
0
60
40
20
0
40
60
W_a (kW)
80



7Z07953
600
Vg
(V)
500
400
300
200
100
0
100
-200
-300
-400
-500
-600
0
2
4
6
8
10
12
14
16
Va (kV)
Ig = 20A
15A
10A
5A
2A
1A
Ia = 80A
70A
60A
50A
40A
30A
20A
10A
5A
1A

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL SERVICE

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	14.4	kV
Grid voltage	$-V_g$	max.	2000	V
Anode current	I_a	max	18	A
Grid current, loaded	I_g	max.	4	A
unloaded	I_g	max.	5.5	A
Anode input power	W_{i_a}	max.	220	kW
Anode dissipation	W_a	max.	80	kW
Grid resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	up to 30		MHz
Anode voltage	V_a	10	12	kV
Anode current	I_a	16	13	A
Grid resistor	R_g	200	330	Ω
Grid current	I_g	3.5	2.7	A
Anode input power	W_{i_a}	160	156	kW
Anode dissipation	W_a	37.5	33.5	kW
Tube output power	W_o	122.5	122.5	kW
Tube efficiency	η_a	76.5	78.5	%
Oscillator output power	W_{osc}	120	120	kW
Oscillator efficiency	η_{osc}	75	77	%

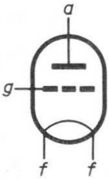
7Z2 8573

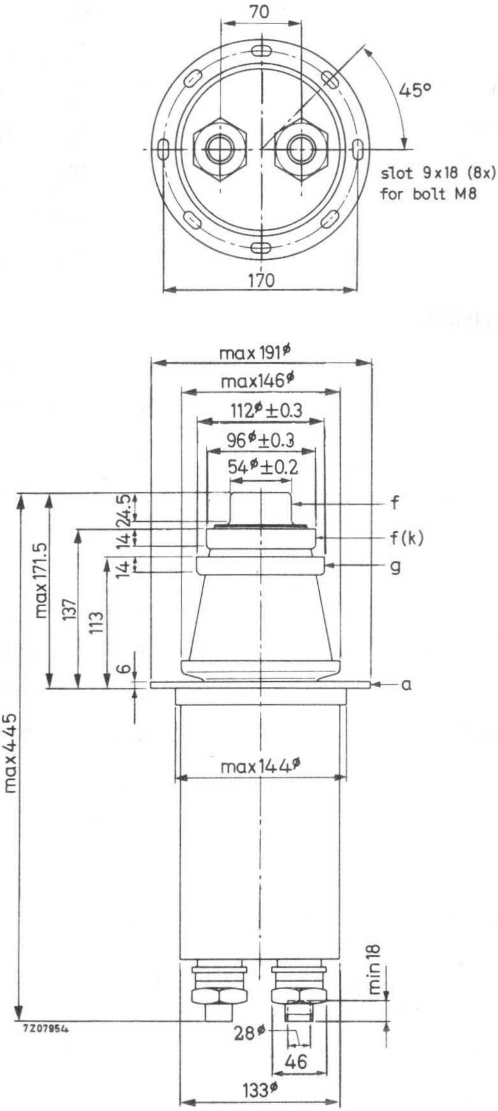
MECHANICAL DATA Dimensions in mm

Net weight approx. 11.5 kg

Mounting position: vertical, anode up or down

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





7Z2 8572

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max. 240	^oC
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max. 200	^oC
Absolute max. water inlet temperature	t_i	max. 50	^oC

COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (l/min.)	p_i (atm)	t_o (^oC)
80	20	40	0.35	50
	50	60	0.65	70
60	20	28	0.18	52
	50	42	0.38	72
40	20	18	0.08	54
	50	27	0.15	73

Cooling of the seals can be accomplished by a low velocity air flow, or by water cooling of the filament connectors.
The cooling circuits of these accessories may be connected in series.
A water flow of approximately 0.5 l/min. will be sufficient.

ACCESSORIES

Grid connector < 4 MHz	type 40694	net weight	270 g
Grid connector > 4 MHz	type 40737	net weight	525 g
Filament connectors	type 40695	net weight	710 g
(both types required)	and type 40696	net weight	860 g
Filament cables	type 40716	net weight	975 g
(both types required)	and type 40717	net weight	980 g

7Z2 8571

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode in metal ceramic construction with integral water cooler. The tube is intended for use as industrial oscillator for frequencies up to 30 MHz.

QUICK REFERENCE DATA				
Frequency	f	up	30	MHz
Anode voltage	V_a		10	kV
Anode current	I_a		16	A
Oscillator power output	W_{osc}		120	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f		12.2	V $^{+5\%}_{-10\%}$
Filament current	I_f		250	A
Filament peak starting current	I_{f_p}	max.	1500	A
Cold filament resistance	R_{f_o}		0.0053	Ω

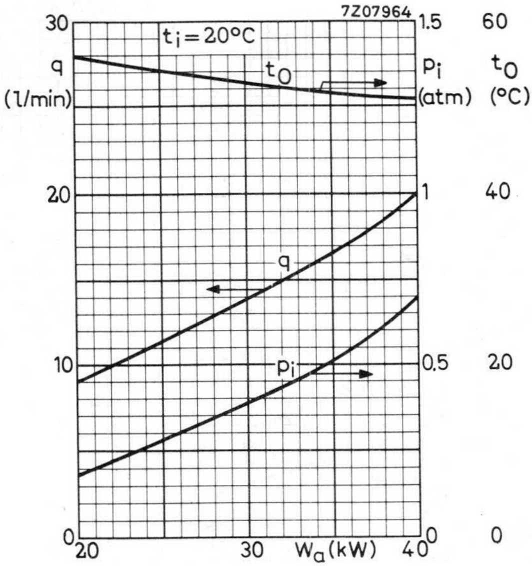
CAPACITANCES

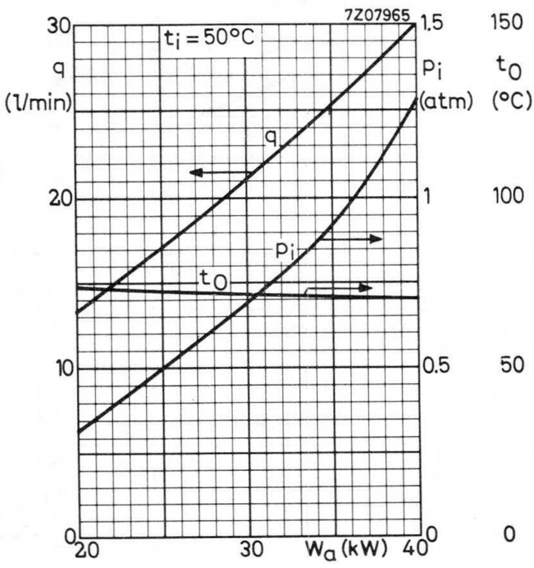
Anode to filament	C_{af}	2.7	pF
Grid to filament	C_{gf}	170	pF
Anode to grid	C_{ag}	55	pF

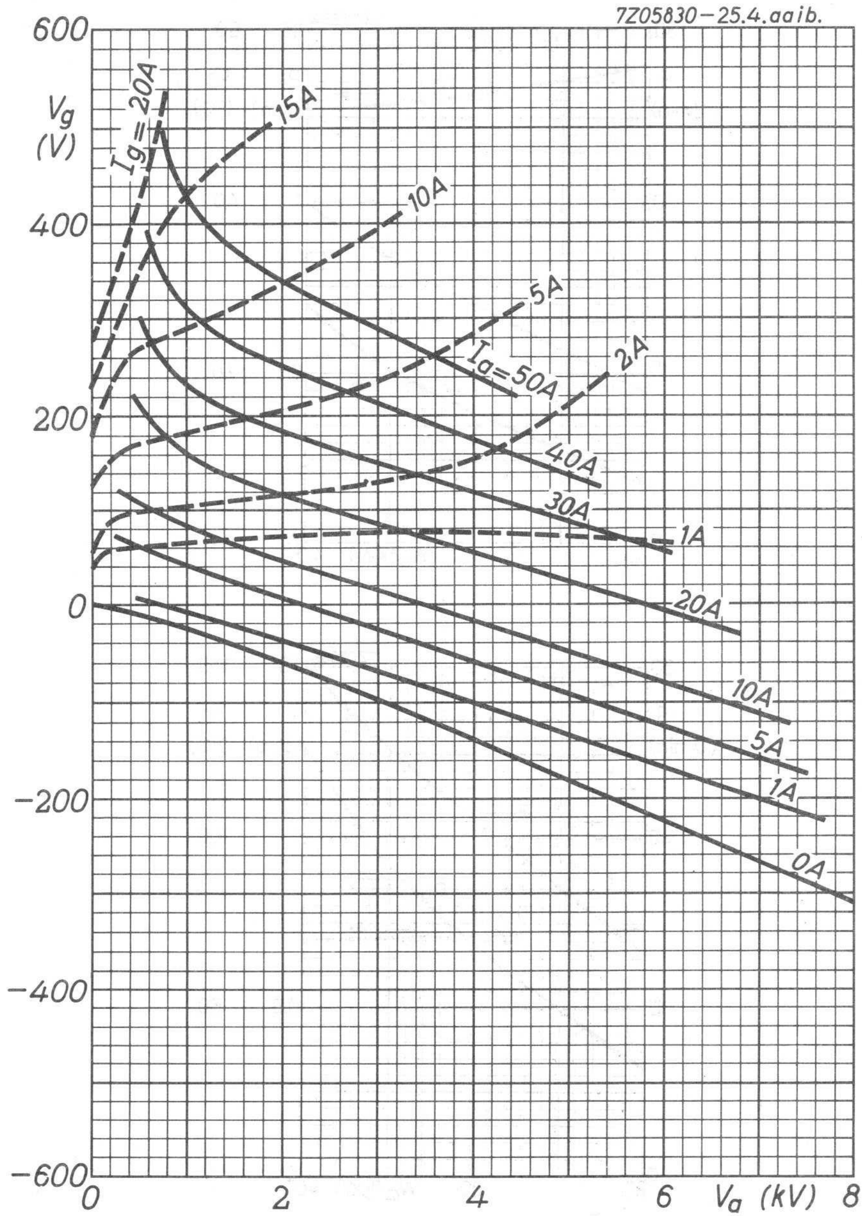
TYPICAL CHARACTERISTICS

Anode voltage	V_a	10	kV
Anode current	I_a	8	A
Transconductance	S	150	mA/V
Amplification factor	μ	30	

7Z2 8570


7Z07964
$t_i = 20°C$
30
q
(l/min)
20
10
0
20
30
W_a (kW)
40
1.5
p_i
(atm)
1
0.5
0
60
t_o
(°C)
40
20
0
t_o
q
p_i


7Z07965
$t_i = 50°C$
30
q
(l/min)
20
10
0
20
30
W_a (kW)
40
1.5
p_i
(atm)
1
0.5
0
150
t_o
(°C)
100
50
0
q
p_i
t_o


7Z05830-25.4.aaib.
600
400
200
0
-200
-400
-600
V_g (V)
0
2
4
6
V_a (kV)
8
I_g = 20A
15A
10A
5A
2A
1A
I_a = 50A
40A
30A
20A
10A
5A
1A
0A

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL SERVICE

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	9.6	kV
Grid voltage	$-V_g$	max.	1500	V
Anode current	I_a	max.	12	A
Grid current, loaded	I_g	max.	2.5	A
unloaded	I_g	max.	3.5	A
Anode input power	W_{i_a}	max.	96	kW
Anode dissipation	W_a	max.	40	kW
Grid resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	up to	30	MHz
Anode voltage	V_a		8	kV
Anode current	I_a		10	A
Grid resistor	R_g		300	Ω
Grid current	I_g		2.25	A
Anode input power	W_{i_a}		80	kW
Anode dissipation	W_a		16	kW
Tube output power	W_o		64	kW
Tube efficiency	η_a		80	%
Oscillator output power	W_{osc}		62.4	kW
Oscillator efficiency	η_{osc}		78.5	%

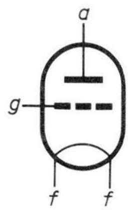
7Z2 8609

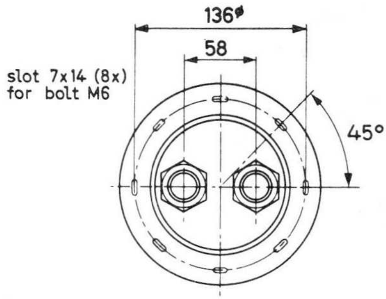
MECHANICAL DATA Dimensions in mm

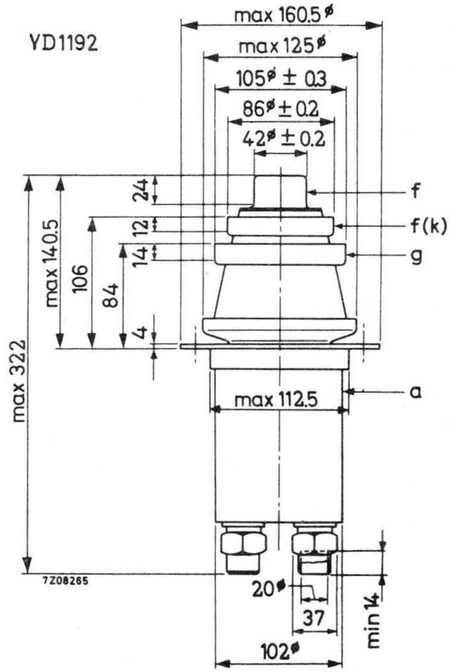
Net weight approx. 6 kg

Mounting position: vertical with anode up or down

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







7Z2 8769

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	^oC
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	^oC
Absolute max. water inlet temperature	t_i	max.	50	^oC

COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (l/min.)	p_i (atm)	t_o (^oC)
40	20	20	0.7	51
	50	30	1.3	70
30	20	14	0.37	53
	50	21	0.7	72
20	20	9	0.17	56
	50	13.5	0.32	74

For frequencies > 4 MHz air cooling of the seals is required.

ACCESSORIES

Grid connector < 4 MHz	type	40707	net weight	75 g
Grid connector > 4 MHz	type	40736	net weight	450 g
Filament connectors	type	40706	net weight	390 g
(both types required)	and type	40705	net weight	330 g
Filament cables	type	40718	net weight	460 g
	and type	40719	net weight	475 g

7Z2 8607

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode in metal-ceramic construction with integral water cooler. The tube is intended for use as industrial oscillator for frequencies up to 30 MHz.

QUICK REFERENCE DATA			
Frequency	f	up to 30	MHz
Anode voltage	V_a	8	kV
Anode current	I_a	10	A
Oscillator power output	W_{osc}	62.4	kW

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f		8.4	V $^{+5\%}_{-10\%}$
Filament current	I_f		235	A
Filament peak starting current	I_{f_p}	max.	1500	A
Cold filament resistance	R_{f_o}		0.0039	Ω

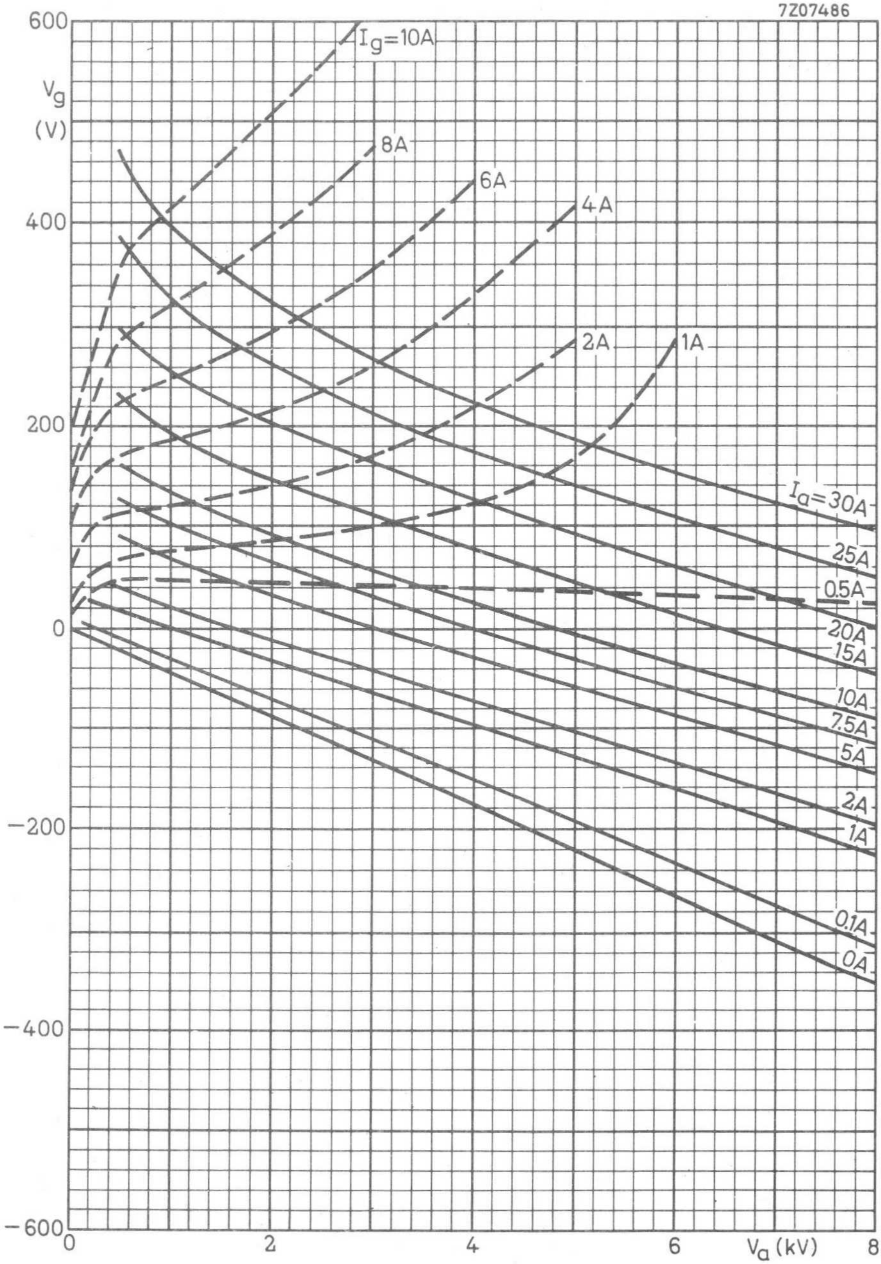
CAPACITANCES

Anode to filament	C_{af}	1.3	pF
Grid to filament	C_{gf}	100	pF
Anode to grid	C_{ag}	45	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	8	kV
Anode current	I_a	6	A
Transconductance	S	90	mA/V
Amplification factor	μ	35	

7Z2 8606


7Z07486
600
400
200
0
−200
−400
−600
V_g
(V)
I_g=10A
8A
6A
4A
2A
1A
I_a=30A
25A
0.5A
20A
15A
10A
7.5A
5A
2A
1A
0.1A
0A
0
2
4
6
8
V_a (kV)

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL SERVICE

LIMITING VALUES (Absolute limits)

Frequency	f	up to	90	MHz
Anode voltage	V_a	max.	9.0	kV
Anode input power	W_{i_a}	max.	45	kW
Anode dissipation	W_a	max.	20	kW
Anode current	I_a	max.	6.0	A
Negative grid voltage	$-V_g$	max.	1250	V
Grid current, loaded	I_g	max.	1.6	A
Grid current, unloaded	I_g	max.	2.4	A
Grid circuit resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

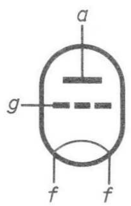
Frequency	f	up to	90	MHz
Anode voltage	V_a		7.5	kV
Anode current	I_a		5.4	A
Grid resistor	R_g		450	Ω
Grid current	I_g		1.45	A
Anode input power	W_{i_a}		40.5	kW
Anode dissipation	W_a		8.1	kW
Tube output power	W_o		32.4	kW
Tube efficiency	η		80	%
Oscillator output power	W_{osc}		31.45	kW
Oscillator efficiency	η_{osc}		77.6	%

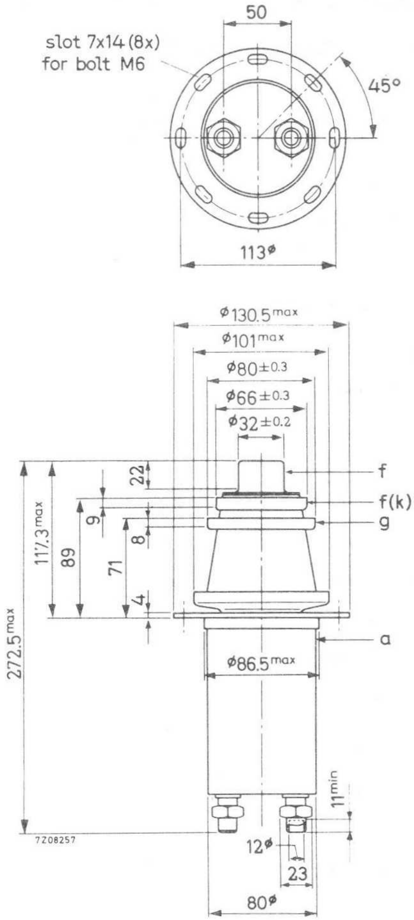
7Z2 8768

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 3 kg





Mounting position: vertical with anode up or down

ACCESSORIES

Grid connector	f ≦ 4 MHz	40710	net weight	60 g
	f > 4 MHz	40711		310 g
Filament connectors (both types required)		40708		230 g
	and	40709		265 g
Filament cables (2x)		40720		215 g

7Z2 8767

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t_{env} = max. 240 °C
Water inlet temperature	t_i = max. 50 °C
Recommended max. envelope temperature under continuous loaded conditions	t_{env} = max. 200 °C

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
20	20	10	0.7	51
	50	15	1.3	71
15	20	7	0.37	54
	50	10.5	0.7	73
10	20	4.5	0.17	58
	50	6.7	0.32	75

No additional cooling of the seals is required at frequencies < 4 MHz.

7Z2 8393

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

QUICK REFERENCE DATA				
Frequency	f	up to	90	MHz
Anode voltage	V_a	=	7.5	kV
Anode current	I_a	=	5.4	A
Oscillator output power	W_{osc}	=	31.45	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	7	V $^{+5\%}_{-10\%}$
Filament current	I_f	=	175	A
Peak filament starting current	I_{f_p}	=	max. 1000	A
Cold filament resistance	R_{f_o}	=	0.0042	Ω

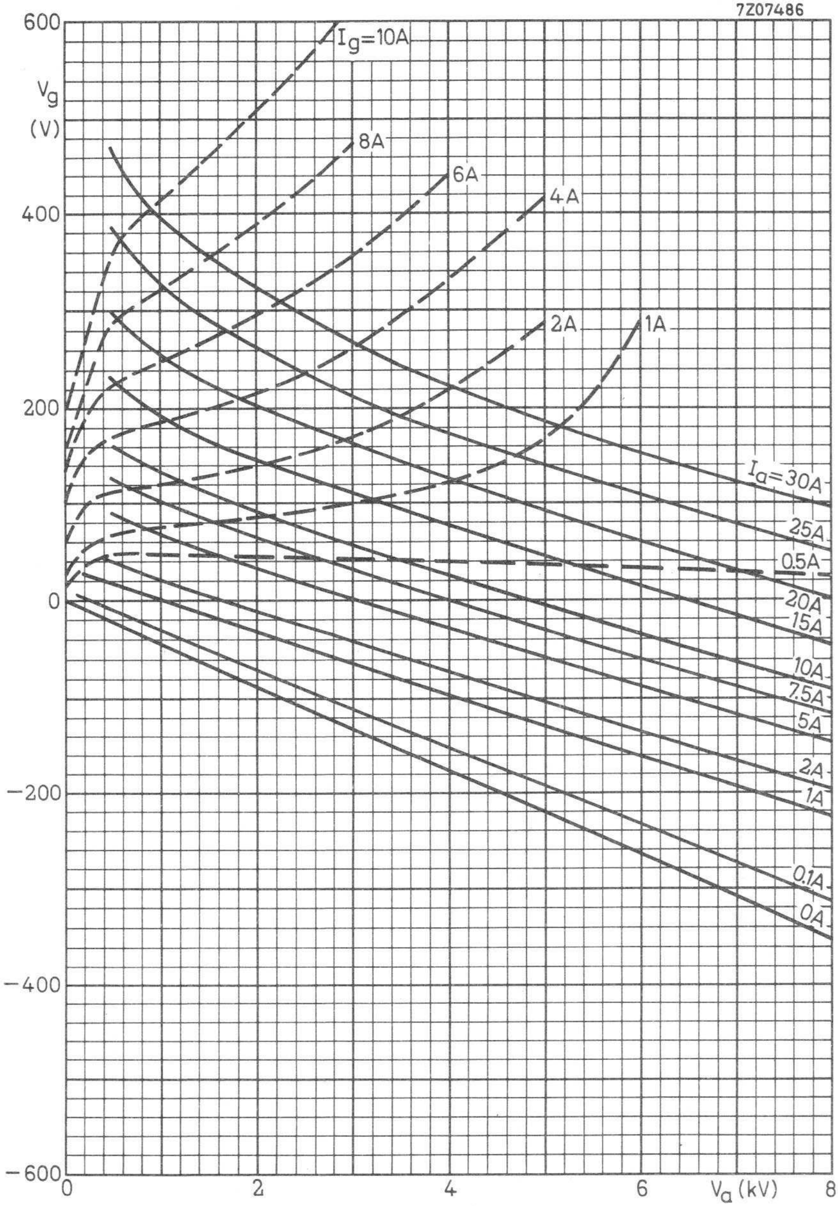
CAPACITANCES

Anode to filament	C_{af}	=	1	pF
Grid to filament	C_{gf}	=	61	pF
Anode to grid	C_{ag}	=	32	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	7.5	kV
Anode current	I_a	=	3.2	A
Mutual conductance	S	=	60	mA/V
Amplification factor	μ	=	34	

7Z2 8766


7Z07486
600
400
200
0
−200
−400
−600
Vg
(V)
Ig=10A
8A
6A
4A
2A
1A
Ia=30A
25A
0.5A
20A
15A
10A
7.5A
5A
2A
1A
0.1A
0A
0
2
4
6
Va (kV)
8

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL SERVICE

LIMITING VALUES (Absolute limits)

Frequency	f	up to	90	MHz
Anode voltage	V_a	max.	9.0	kV
Anode input power	W_{i_a}	max.	45	kW
Anode dissipation	W_a	max.	15	kW
Anode current	I_a	max.	6.0	A
Negative grid voltage	$-V_g$	max.	1250	V
Grid current, loaded	I_g	max.	1.6	A
Grid current, unloaded	I_g	max.	2.4	A
Grid circuit resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

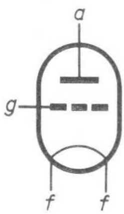
Frequency	f	up to	90	MHz
Anode voltage	V_a		7.5	kV
Anode current	I_a		5.4	A
Grid resistor	R_g		450	Ω
Grid current	I_g		1.45	A
Anode input power	W_{i_a}		40.5	kW
Anode dissipation	W_a		8.1	kW
Tube output power	W_o		32.4	kW
Tube efficiency	η		80	%
Oscillator output power	W_{osc}		31.45	kW
Oscillator efficiency	η_{osc}		77.6	%

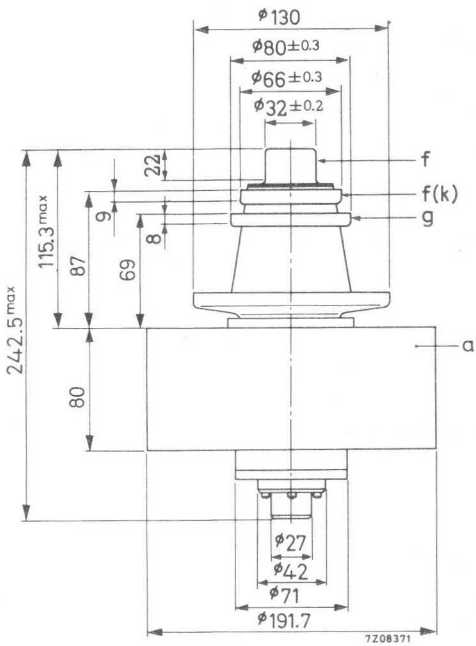
7Z2 8926

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 12.1 kg





Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal		40648	net weight 7.15 kg
Grid connector	f ≤ 4 MHz	40710	60 g
	f > 4 MHz	40711	310 g
Filament connectors (both types required)		40708	230 g
	and	40709	265 g
Filament cables (2x)		40720	215 g

7Z2 8925

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	°C
Air inlet temperature	t_i	max.	35	°C

WATER COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
15	0	35	15	85
10	0	35	10	40
8	0	35	8	21

No additional cooling of the seals is required at frequencies < 4 MHz.

7Z2 8924

AIR COOLED
R.F INDUSTRIAL POWER TRIODE

QUICK REFERENCE DATA			
Frequency	f	up to 90	MHz
Anode voltage	V_a	7.5	kV
Anode current	I_a	5.4	A
Oscillator output power	W_{osc}	31.45	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	7	V $^{+5\%}_{-10\%}$
Filament current	I_f	175	A
Peak filament starting current	I_{f_p}	max. 1000	A
Cold filament resistance	R_{f_o}	0.0042	Ω

The filament current must never exceed a peak value of 1000 A at any time during the initial energizing schedule.

CAPACITANCES

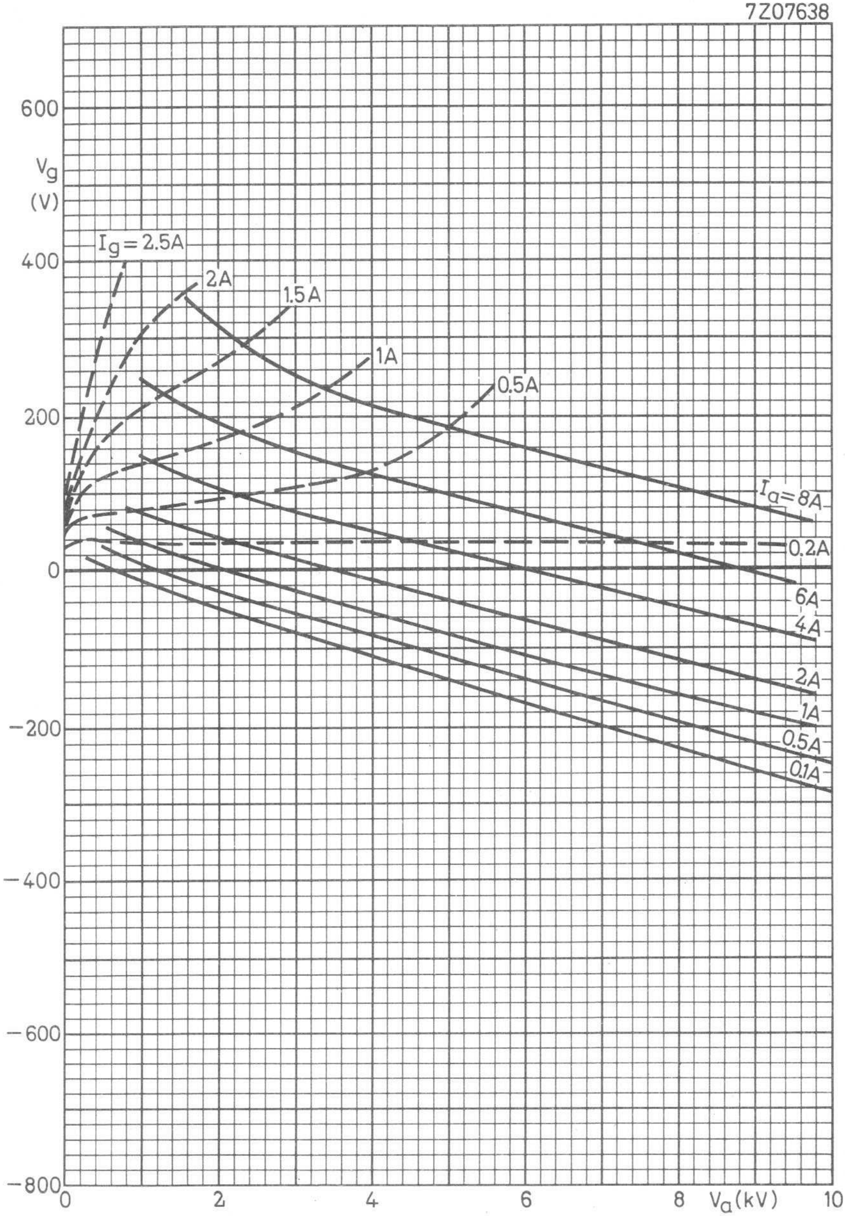
Anode to filament	C_{af}	1	pF
Grid to filament	C_{gf}	61	pF
Anode to grid	C_{ag}	32	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	7.5	kV
Anode current	I_a	3.2	A
Mutual conductance	S	60	mA/V
Amplification factor	μ	34	

Data based on pre-production tubes

7Z2 8923


7Z07638
600
V_g
(V)
400
200
0
−200
−400
−600
−800
I_g = 2.5A
2A
1.5A
1A
0.5A
I_a = 8A
0.2A
6A
4A
2A
1A
0.5A
0.1A
0
2
4
6
8
V_a (kV)
10

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute limits)

Frequency	f		up to	50	MHz
Anode voltage	V_a	=	max.	12	kV
Anode input power	W_{i_a}	=	max.	20	kW
Anode dissipation	W_a	=	max.	10	kW
Anode current	I_a	=	max.	2	A
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current, loaded	I_g	=	max.	0.6	A
Grid current, unloaded	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

OPERATING CONDITIONS

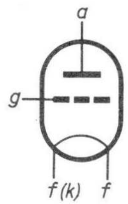
Frequency	f	up to	50	MHz
Anode voltage	V_a	=	10	kV
Anode current	I_a	=	1.75	A
Grid resistor	R_g	=	1500	Ω
Grid current, loaded	I_g	=	0.45	A
Grid current, unloaded	I_g	=	0.61	A
Anode input power	W_{i_a}	=	17.5	kW
Anode dissipation	W_a	=	4.0	kW
Anode output power	W_o	=	13.5	kW
Tube efficiency	η	=	77.3	%
Oscillator output power	W_{osc}	=	13.2	kW
Oscillator efficiency	η_{osc}	=	76	%

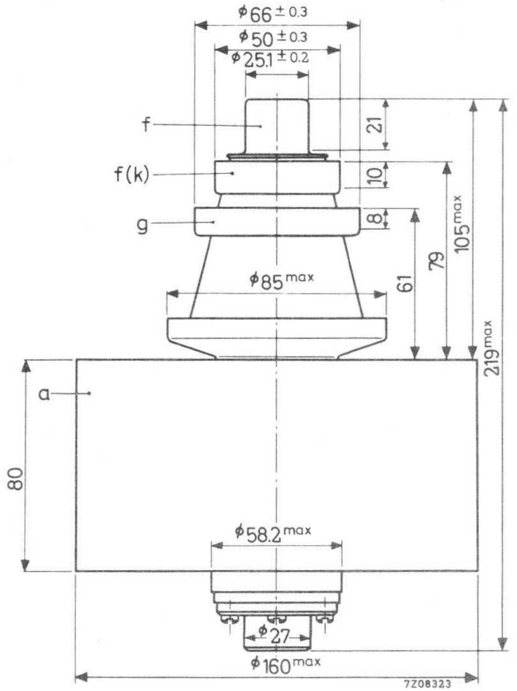
7Z2 8291

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 7.5 kg





Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal		40654	net weight 4.25 kg
Grid connector	f ≦ 4 MHz	40690	55 g
	f > 4 MHz	40691	240 g
Filament connector (both types required)		40692	140 g
	and	40693	165 g
Filament cables (2x)		40715	200 g

7Z2 8760

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t_{env}	=	max. 240	^oC
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	=	max. 200	^oC
Air inlet temperature	t_i	=	max. 45	^oC

AIR COOLING CHARACTERISTICS

W_a (kW)	h (m)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)	t_o (^oC)
10	0	35	9.5	55	94
8	0	35	6.5	28	105
6	0	35	4.5	15	113
4	0	35	3.0	8	117
10	0	45	11	69	98
8	0	45	7.6	35	108
6	0	45	5.2	19	115
4	0	45	3.5	10	119
10	1500	35	11.4	63	94
8	1500	35	7.8	32	105
6	1500	35	5.4	17	113
4	1500	35	3.6	9	117
10	3000	25	12	62	90
8	3000	25	8.2	32	102
6	3000	25	5.7	17	111
4	3000	25	3.8	9	116

7Z2 8289

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

QUICK REFERENCE DATA			
Frequency	f	up to 50	MHz
Anode voltage	V_a	10	kV
Anode current	I_a	1.75	A
Oscillator output power	W_{osc}	13.2	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	5.4	V $^{+5\%}_{-10\%}$
Filament current	I_f	65	A
Peak filament starting current	I_{f_p}	max. 400	A
Cold filament resistance	R_{f_o}	0.01	Ω

CAPACITANCES

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

TYPICAL CHARACTERISTICS

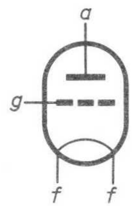
Anode voltage	V_a	10	kV
Anode current	I_a	0.8	A
Mutual conductance	S	14	mA/V
Amplification factor	μ	45	

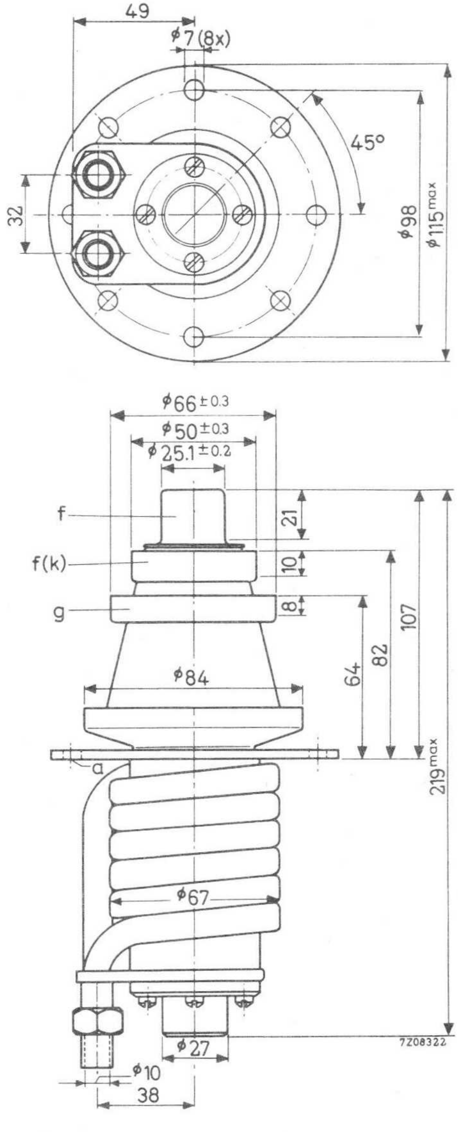
7Z2 8759

MECHANICAL DATA

Dimensions in mm

Net weight approx. 2 kg





Mounting position: vertical with anode up or down

For further data and curves please refer to type YD1170

7Z2 8758

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	^oC
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	^oC
Absolute max. water inlet temperature	t_i	max.	50	^oC

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (ℓ/min)	p_i (atm)	t_o (^oC)
10	20	6.0	0.25	46
8	20	4.5	0.15	49
6	20	3.0	0.07	53
10	50	9.0	0.52	67
8	50	6.7	0.31	69
6	50	4.5	0.15	72

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

At frequencies higher than 4 MHz air cooling of the seals is required.

7Z2 8757

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

QUICK REFERENCE DATA			
Frequency	f	up to 120	MHz
Anode voltage	V_a	6	kV
Anode current	I_a	3.4	A
Oscillator output power	W_{osc}	15.4	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	5.8	V $^{+5\%}_{-10\%}$
Filament current	I_f	130	A
Peak filament starting current	I_{f_p}	max. 800	A
Cold filament resistance	R_{f_o}	0.0056	Ω

To maintain a constant cathode temperature as a function of the operating frequency of the tube, it may be necessary to decrease the filament voltage at higher frequencies. The product of the filament voltage and -current should be the same as that when only the filament voltage is applied.

CAPACITANCES

Anode to filament	C_{af}	0.6	pF
Grid to filament	C_{gf}	47	pF
Anode to grid	C_{ag}	24	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6000	V
Anode current	I_a	2	A
Mutual conductance	S	33	mA/V
Amplification factor	μ	29	

7Z2 8756

ACCESSORIES

Water jacket		K727	net weight	2	kg
Grid connector	f ≦ 4 MHz	40690	" "	55	g
	f > 4 MHz	40691	" "	240	g
Filament connectors (both types required)		40692	" "	140	g
	and	40693	" "	165	g
Filament cables (2x)		40715	" "	200	g

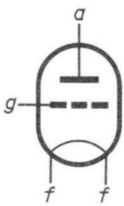
For further data and curves please refer to type YD1170

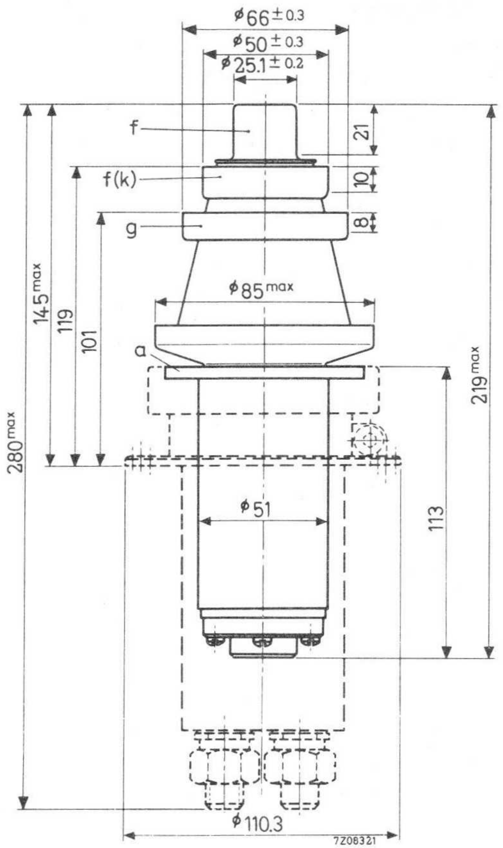
7Z2 8755

MECHANICAL DATA

Net weight: approx. 1.5 kg

Dimensions in mm





Mounting position: vertical with anode down

7Z2 8754

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	^oC
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	^oC
Absolute max. water inlet temperature	t_i	max.	50	^oC

WATER COOLING CHARACTERISTICS

W_a (kW)	t_i (^oC)	q_{min} (ℓ/min)	p_i (atm)	t_o (^oC)
10	20	10.0	0.60	36
8	20	7.8	0.38	37
6	20	5.7	0.22	38
10	50	15.0	1.25	61
8	50	11.3	0.75	62
6	50	8.2	0.42	62

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

At frequencies higher than 4 MHz air cooling of the seals is required.

7Z2 8753

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

QUICK REFERENCE DATA			
Frequency	f	up to 120	MHz
Anode voltage	V_a	6	kV
Anode current	I_a	3.4	A
Oscillator output power	W_{osc}	15.4	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	5.8	V $^{+5\%}_{-10\%}$
Filament current	I_f	130	A
Peak filament starting current	I_{f_p}	max. 800	A
Cold filament resistance	R_{f_o}	0.0056	Ω

To maintain a constant cathode temperature as a function of the operating frequency of the tube, it may be necessary to decrease the filament voltage at higher frequencies. The product of the filament voltage and -current should be the same as that when only the filament voltage is applied.

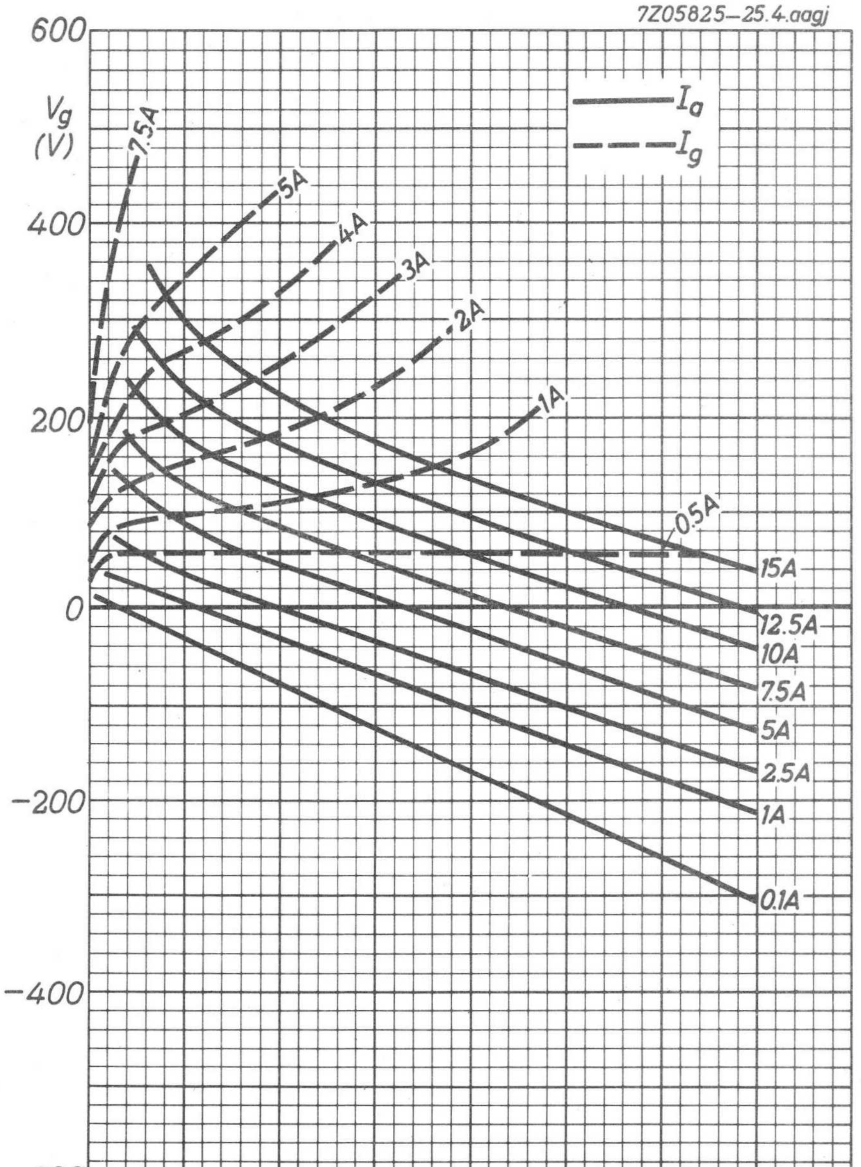
CAPACITANCES

Anode to filament	C_{af}	0.6	pF
Grid to filament	C_{gf}	47	pF
Anode to grid	C_{ag}	24	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6000	V
Anode current	I_a	2	A
Mutual conductance	S	33	mA/V
Amplification factor	μ	29	

7Z2 8752


7Z05825–25.4.aagj
600
400
200
0
−200
−400
−600
Vg
(V)
0
2
4
6
Va (kV)
8
Ia
Ig
7.5A
5A
4A
3A
2A
1A
0.5A
15A
12.5A
10A
7.5A
5A
2.5A
1A
0.1A

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL SERVICE

LIMITING VALUES (Absolute limits)

Frequency	f	up to	120	MHz
Anode voltage	V_a	max.	7.2	kV
Anode input power	W_{i_a}	max.	24	kW
Anode dissipation	W_a	max.	10	kW
Anode current	I_a	max.	4	A
Negative grid voltage	$-V_g$	max.	1500	V
Grid current loaded	I_g	max.	1.0	A
Grid current unloaded	I_g	max.	1.5	A
Grid circuit resistance	R_g	max.	10	kΩ

OPERATING CONDITIONS

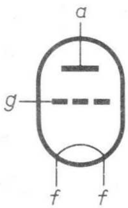
Frequency	f	up to	120	MHz
Anode voltage	V_a		6	kV
Anode current	I_a		3.4	A
Grid resistor	R_g		500	Ω
Grid current	I_g		0.92	A
Anode input power	W_{i_a}		20.4	kW
Anode dissipation	W_a		4.6	kW
Anode output power	W_o		15.8	kW
Tube efficiency	η		77.4	%
Oscillator output power	W_{osc}		15.4	kW
Oscillator efficiency	η_{osc}		75.5	%

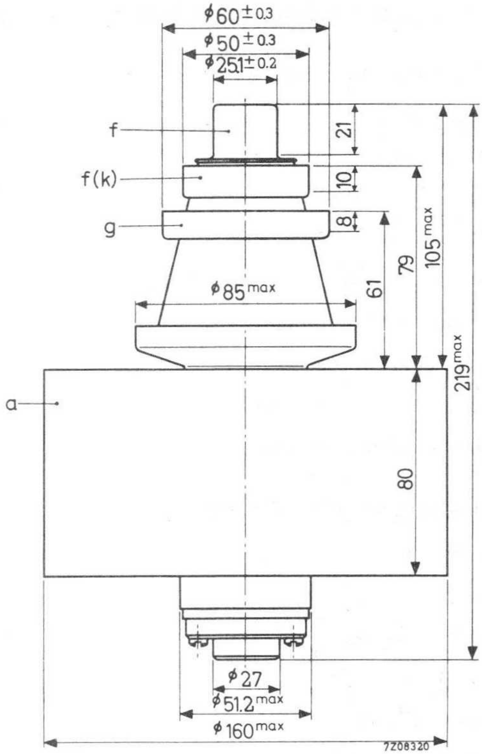
7Z2 8751

MECHANICAL DATA

Net weight approx. 7.5 kg

Dimensions in mm





Mounting position: vertical with anode up or down

ACCESSORIES

Insulating pedestal		40654	net weight		4.25 kg
Grid connector	f ≦ 4 MHz	40690	"	"	55 g
	f > 4 MHz	40691	"	"	240 g
Filament connectors (both types required)		40692	"	"	140 g
and		40693	"	"	165 g
Filament cables (2x)		40715	"	"	200 g

7Z2 8750

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max. 240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max. 200	°C
Absolute max. air inlet temperature	t_i	max. 45	°C

AIR COOLING CHARACTERISTICS

W_a (kW)	h m	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)	t_o (°C)
10	0	35	9.5	55	94
8	0	35	6.5	28	105
6	0	35	4.5	15	113
4	0	35	3.0	8	117
10	0	45	11.0	69	98
8	0	45	7.6	35	108
6	0	45	5.2	19	115
4	0	45	3.5	10	119
10	1500	35	11.4	63	94
8	1500	35	7.8	32	105
6	1500	35	5.4	17	113
4	1500	35	3.6	9	117
10	3000	25	12.0	62	90
8	3000	25	8.2	32	102
6	3000	25	5.7	17	111
4	3000	25	3.8	9	116

At the lower values of anode dissipation and at the highest operating frequencies additional cooling of the seals is required.

7Z2 8749

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

QUICK REFERENCE DATA			
Frequency	f	up to 120	MHz
Anode voltage	V_a	6	kV
Anode current	I_a	3.4	A
Oscillator output power	W_{osc}	15.4	kW

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	5.8	V $^{+5\%}_{-10\%}$
Filament current	I_f	130	A
Peak filament starting current	I_{f_p}	max. 800	A
Cold filament resistance	R_{f_o}	0.0056	Ω

To maintain a constant cathode temperature as a function of the operating frequency of the tube it may be necessary to decrease the filament voltage at higher frequencies. The product of the filament voltage and current should be the same as that when only the filament voltage is applied to the tube.

CAPACITANCES

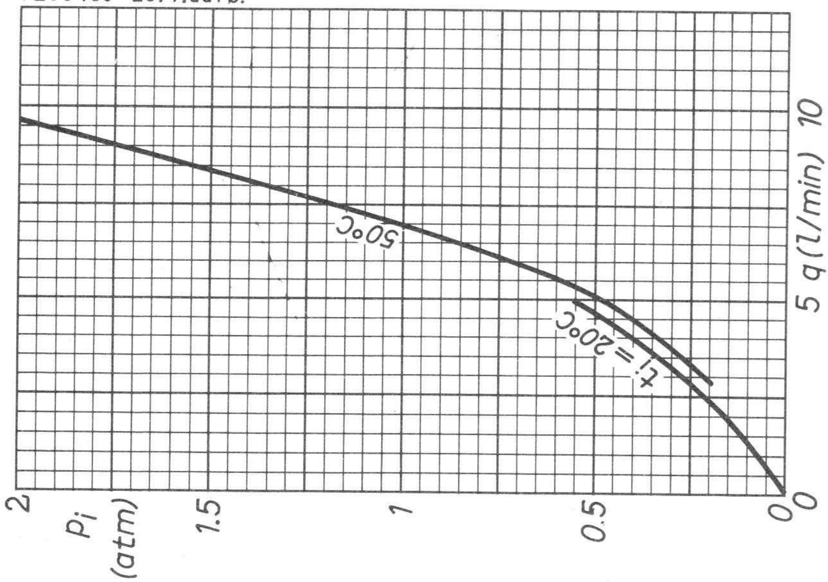
Anode to filament	C_{af}	=	0.6	pF
Grid to filament	C_{gf}	=	47	pF
Anode to grid	C_{ag}	=	24	pF

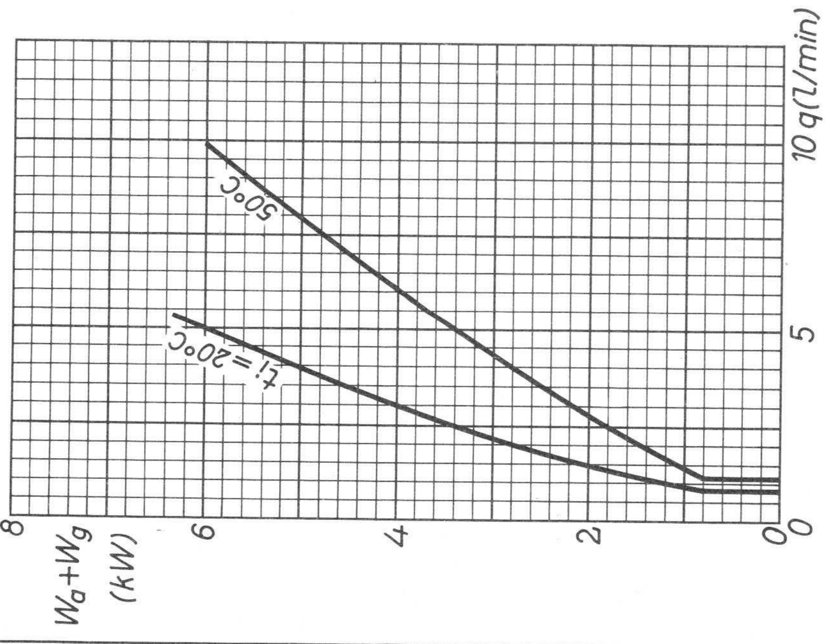
TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	6000	V
Anode current	I_a	=	2	A
Mutual conductance	S	=	33	mA/V
Amplification factor	μ	=	29	

7Z2 8748

7Z06439-25.4.aafb.



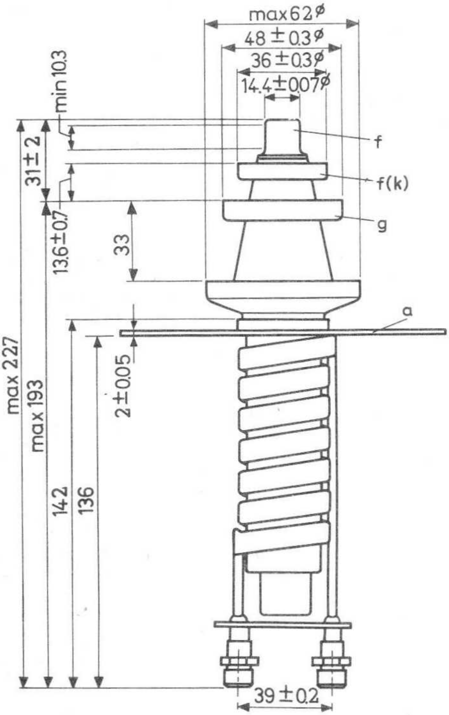


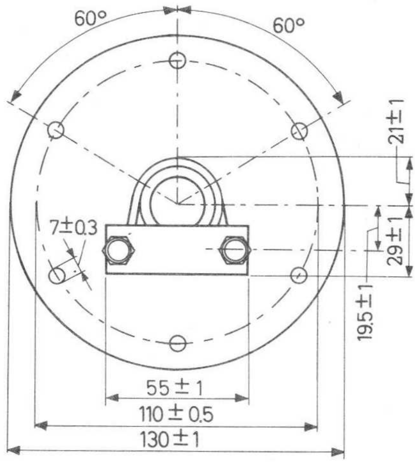
MECHANICAL DATA

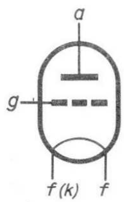
Dimensions in mm

Mounting position: vertical, anode up or down

Net weight: 1.03 kg







7Z2 8387

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

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube has an integral helical cooler.

QUICK REFERENCE DATA				
Frequency	f	27.12	150	MHz
Anode voltage	V_a	6.0	5.0	kV
Anode current	I_a	1.6	2.0	A
Oscillator output power	W_{osc}	7.6	7.3	kW

COOLING CHARACTERISTICS (See also cooling curves)

Anode — Water cooled with integral helical cooler

Seals — Low velocity air flow may be required

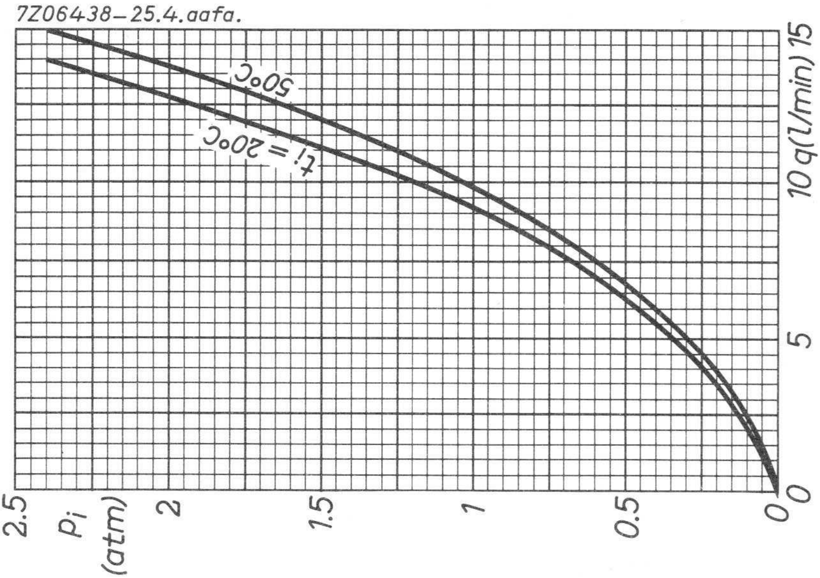
W_a+W_g (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)
3	20	2.2	0.18
3	50	4.3	0.38
5	20	4.0	0.40
5	50	8.0	1.4

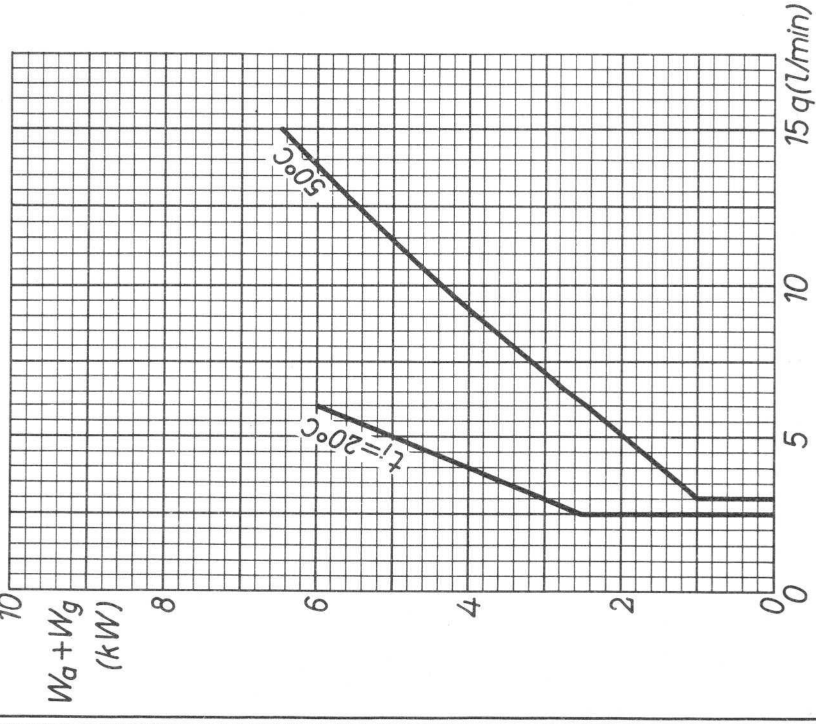
ACCESSORIES

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

For further data and curves please refer to YD1160

7Z2 8747


7Z06438–25.4.aafa.
50°C
t_i = 20°C
15
10 q (l/min)
5
0
0
0.5
1
1.5
2
p_i
(atm)
2.5

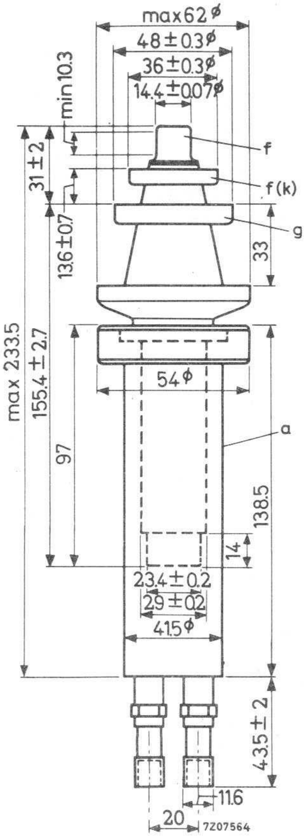

15 q (l/min)
10
5
0
50°C
t_i=20°C
0
2
4
6
8
$W_a + W_g$
(kW)
10

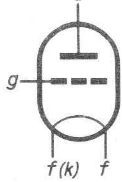
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical, anode down

Net weight: 0.66 kg





7Z2 8385

WATER COOLED R.F. INDUSTRIAL POWER TRIODE

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube is cooled by means of a separate jacket.

QUICK REFERENCE DATA				
Frequency	f	27.12	150	MHz
Anode voltage	V_a	6.0	5.0	kV
Anode current	I_a	1.6	2.0	A
Oscillator output power	W_{osc}	7.6	7.3	kW

COOLING CHARACTERISTICS (See also cooling curves)

Anode: Water cooled using jacket K 726

Seals: Low velocity air flow may be required

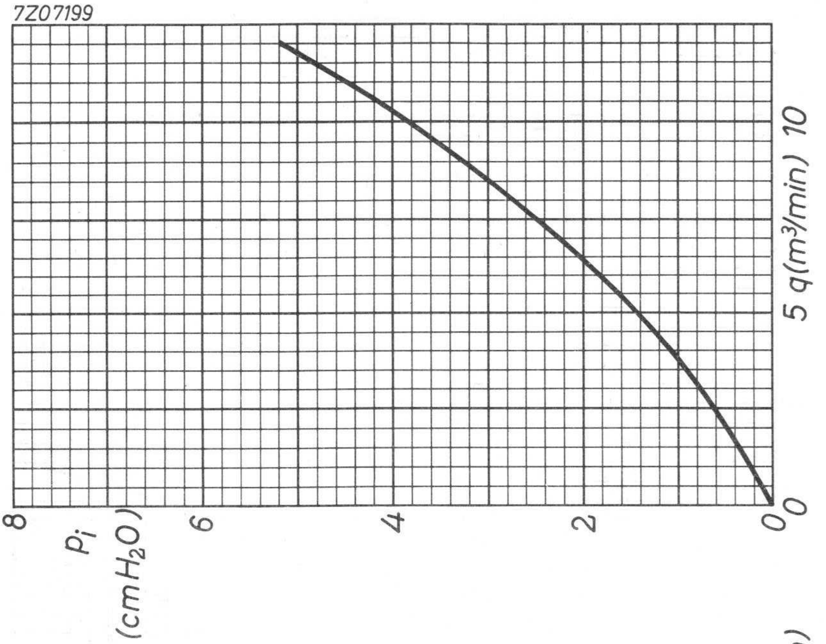
W_a+W_g (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)
3	20	3	0.16
3	50	7	0.52
5	20	5	0.34
5	50	11.5	1.4

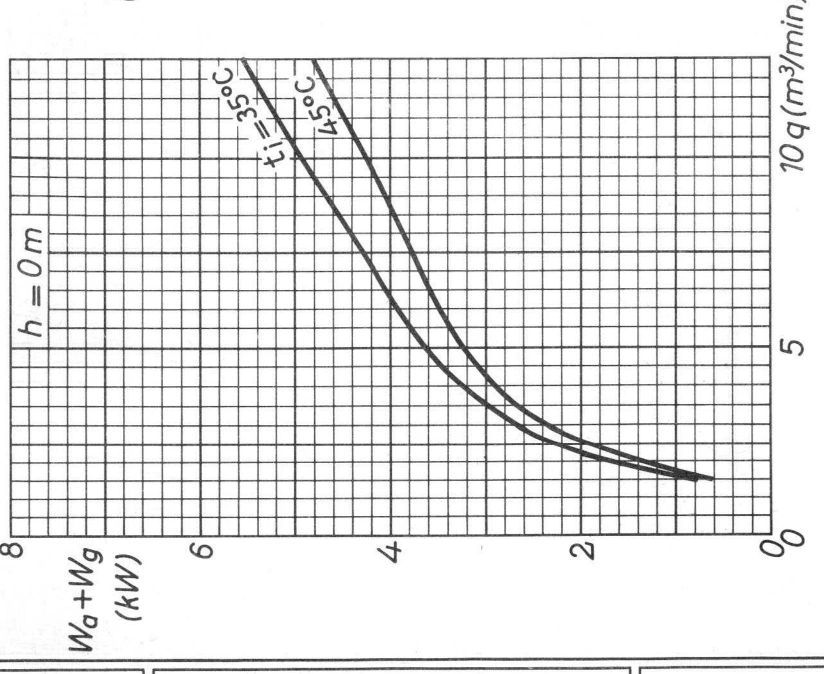
ACCESSORIES

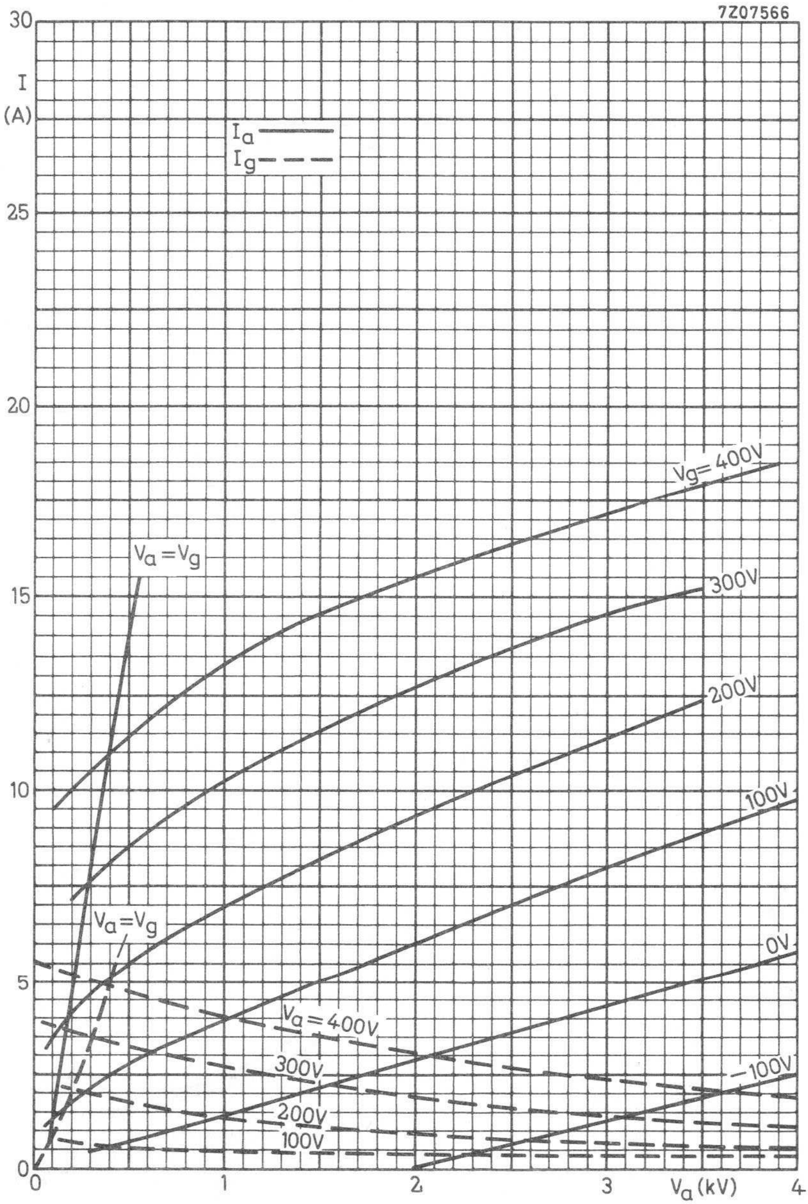
Filament connector	40688	
Filament/cathode connector	40689	
Grid connector (f < 30 MHz)	40686	
Grid connector (f > 30 MHz)	40687	
Water jacket	K 726	net weight 0.73 kg

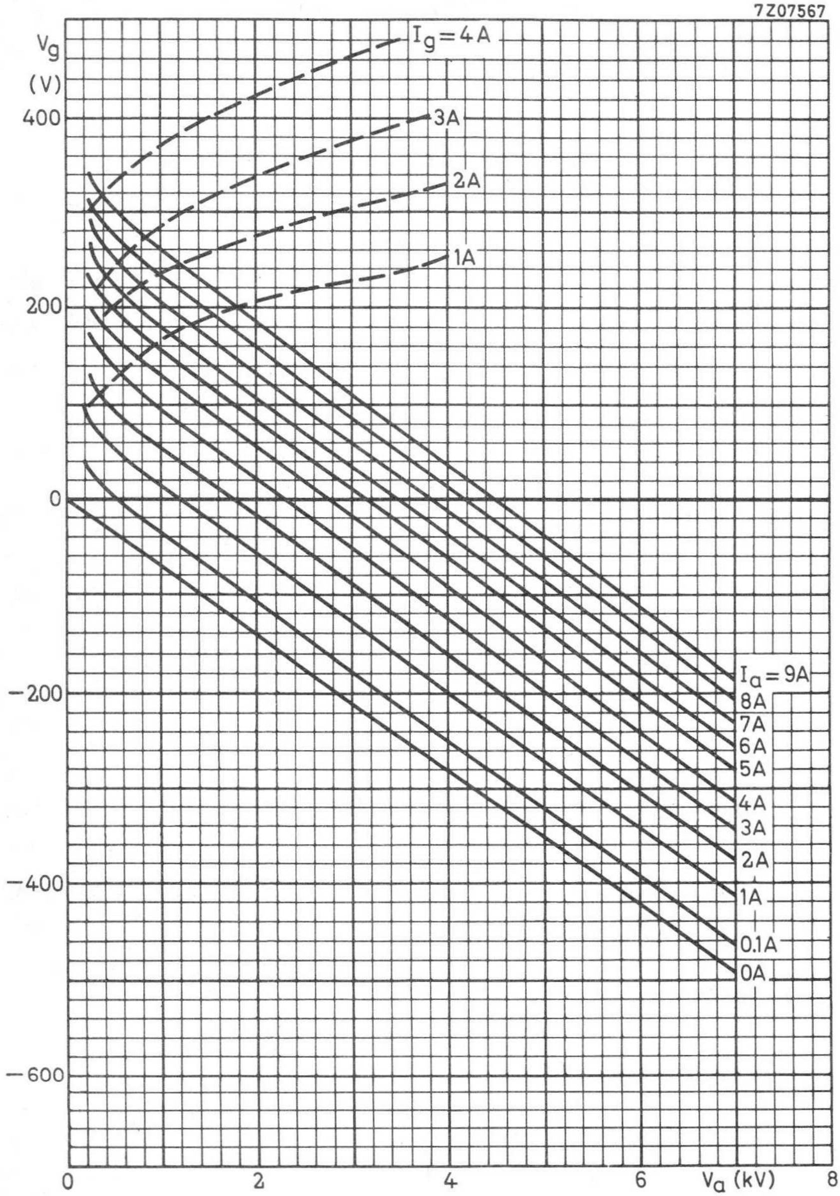
For further data and curves please refer to YD1160

7Z2 8384


7Z07199
p_i (cmH_2O)
8
6
4
2
0
0
5
10
q (m^3/min)


$W_a + W_g$ (kW)
8
6
4
2
0
0
5
10
q (m^3/min)
h = 0 m
t_i = 35 °C
45 °C


7Z07566
30
I
(A)
25
20
15
10
5
0
0
1
2
3
4
V_a (kV)
I_a
I_g
V_g= 400V
300V
200V
100V
0V
−100V
$V_a = V_g$
$V_a = V_g$
V_a = 400V
300V
200V
100V


7Z07567
Vg
(V)
400
200
0
−200
−400
−600
Ig = 4 A
3A
2A
1A
Ia = 9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
0A
0
2
4
6
Va (kV)
8

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	85	150	MHz
Anode voltage	V_a	max.	7.2	6.0	kV
Anode input power	W_{ia}	max.	12.5	11.0	kW
Anode dissipation	W_a	max.	5.0	5.0	kW
Cathode current	I_k	max.	2.8	2.8	A
Grid voltage	$-V_g$	max.	1.0	1.0	kV
Grid current, loaded	I_g	max.	550	550	mA
unloaded	I_g	max.	750	750	mA
Grid dissipation	W_g	max.	250	250	W
Grid circuit resistance	R_g	max.	20	20	kΩ

OPERATING CONDITIONS

Filament voltage	V_f	5.8	6.3	6.3	V
Frequency	f	150	27.12	27.12	MHz
Anode voltage	V_a	5.0	6.5	6.0	kV
Anode current	I_a	2.0	1.8	1.6	A
Grid resistor	R_g	1.0	1.6	1.3	kΩ
Grid current, loaded	I_g	480	430	480	mA
unloaded	I_g	650	580	600	mA
Anode input power	W_{ia}	10	11.7	9.6	kW
Anode dissipation	W_a	2.45	2.5	1.7	kW
Anode output power	W_o	7.55	9.2	7.9	kW
Tube efficiency	η	75.5	78.5	82.5	%
Oscillator output power	W_{osc}	7.3	8.9	7.6	kW
Oscillator efficiency	η_{osc}	73	76	79	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	15	16	15	%

7Z2 8383

AIR COOLING CHARACTERISTICS (See also cooling curves)

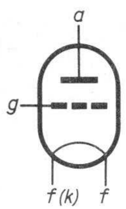
W_a+W_g (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
3	0	35	3.6	9
3	0	45	4.2	11

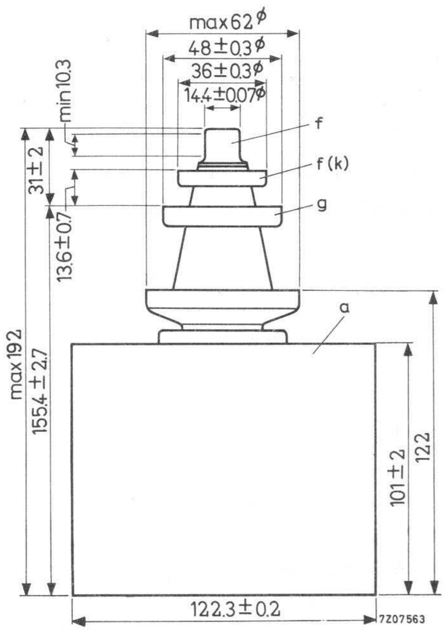
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical, with anode up or down

Net weight: 3.9 kg





ACCESSORIES

Filament connector	40688	
Filament/cathode connector	40689	
Grid connector (f < 30 MHz)	40686	
Grid connector (f > 30 MHz)	40687	
Insulating pedestal	40630	net weight 2.1 kg

7Z2 8382

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA				
Frequency	f	27.12	150	MHz
Anode voltage	V_a	6.0	5.0	kV
Anode current	I_a	1.6	2.0	A
Oscillator output power	W_{osc}	7.6	7.3	kW

HEATING: direct; filament thoriated tungsten

Filament voltage (f = 150 MHz)	V_f	5.8	V	+5% −10%
(f < 150 MHz)	V_f	6.3	V	+5% −10%
Filament current at V_f = 6.3 V	I_f	66	A	

CAPACITANCES

Anode to filament	C_{af}	0.5	pF
Grid to filament	C_{gf}	16	pF
Anode to grid	C_{ag}	19	pF

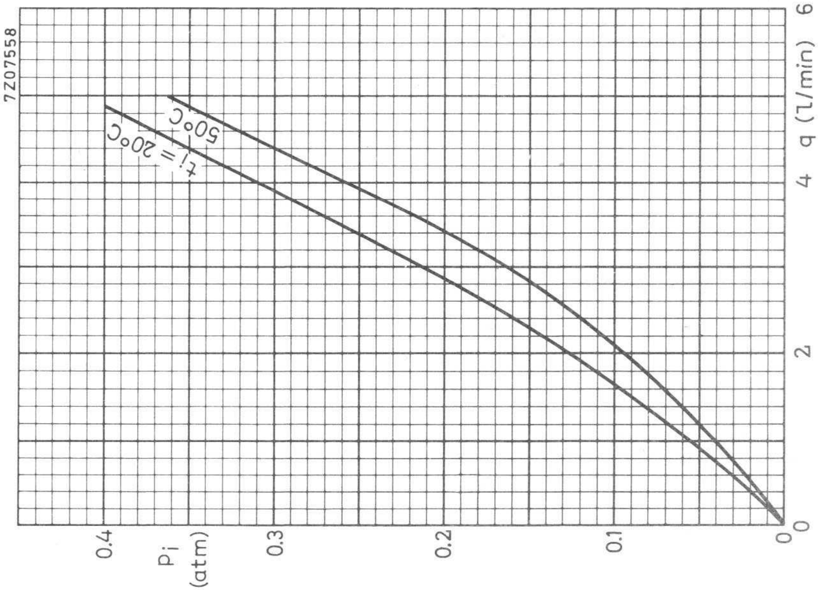
TYPICAL CHARACTERISTICS

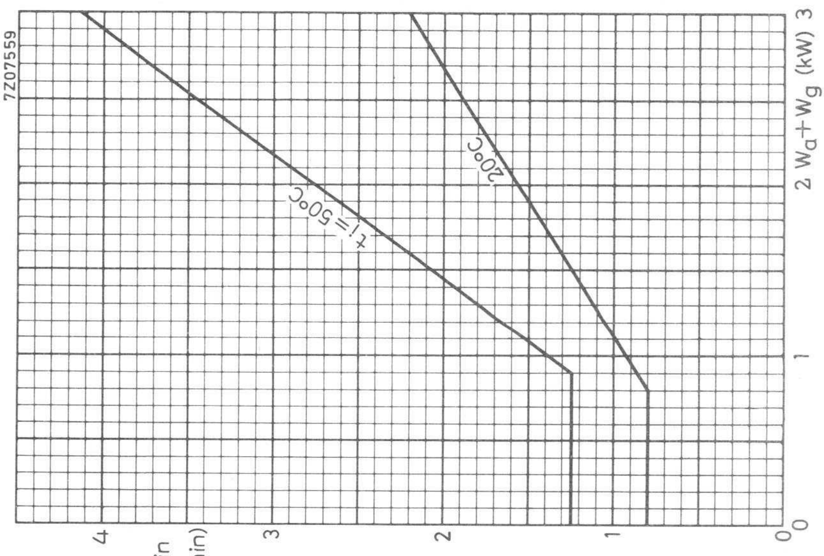
Anode voltage	V_a	2	kV
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	μ	20	–

TEMPERATURE LIMITS (Absolute max.)

Absolute max. envelope temperature	t_{env}	max. 240	^{o}C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max. 200	^{o}C

7Z2 8381


7Z07558
q (l/min)
0
2
4
6
p_i (atm)
0
0.1
0.2
0.3
0.4
t_i = 20°C
50°C

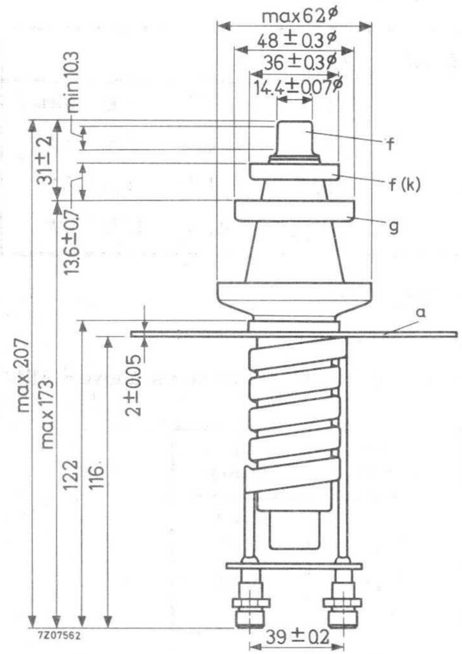

7Z07559
2 $W_a + W_g$ (kW)
0
1
2
3
q_{min} (l/min)
0
1
2
3
4
t_i = 50°C
20°C

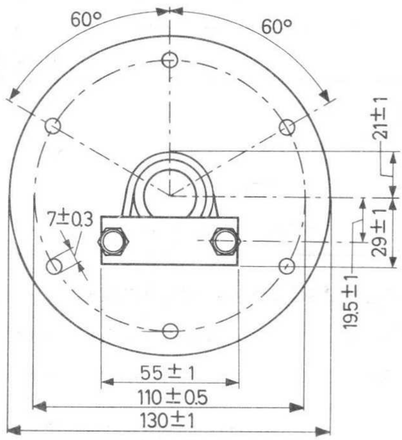
MECHANICAL DATA

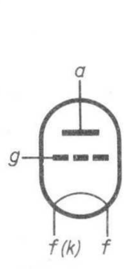
Dimensions in mm

Mounting position: vertical anode down

Net weight: 0.85 kg







7Z2 8374

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

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube has an integral helical cooler.

QUICK REFERENCE DATA				
Frequency	f	27.12	160	MHz
Anode voltage	V_a	6.0	5.0	kV
Anode current	I_a	1.0	1.0	A
Oscillator output power	W_{osc}	4.75	3.75	kW

COOLING CHARACTERISTICS See also cooling curves

Anode — Water cooled with integral helical cooler

Seals — Low velocity air flow may be required at frequencies above 4 MHz

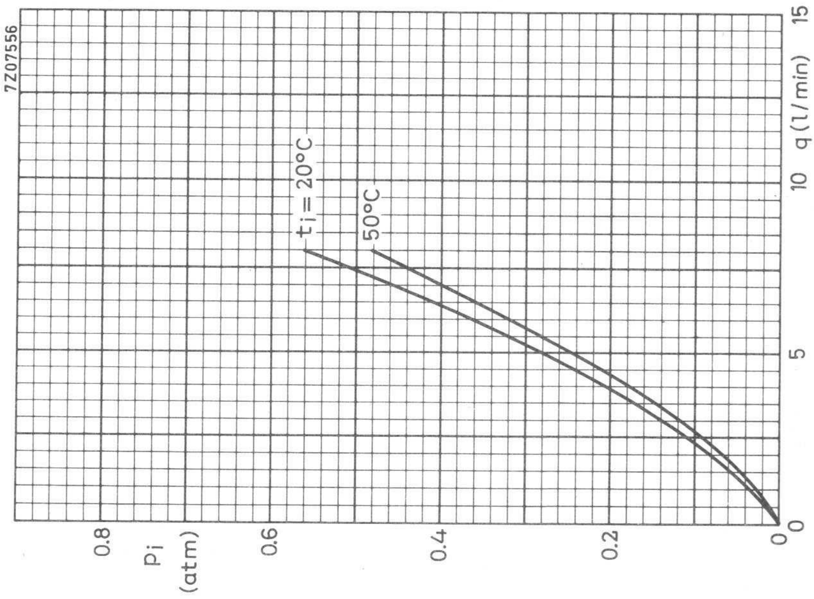
$W_a + W_g$ (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)
1	20	0.9	0.05
1	50	1.4	0.06
3	20	2.2	0.14
3	50	4.3	0.29

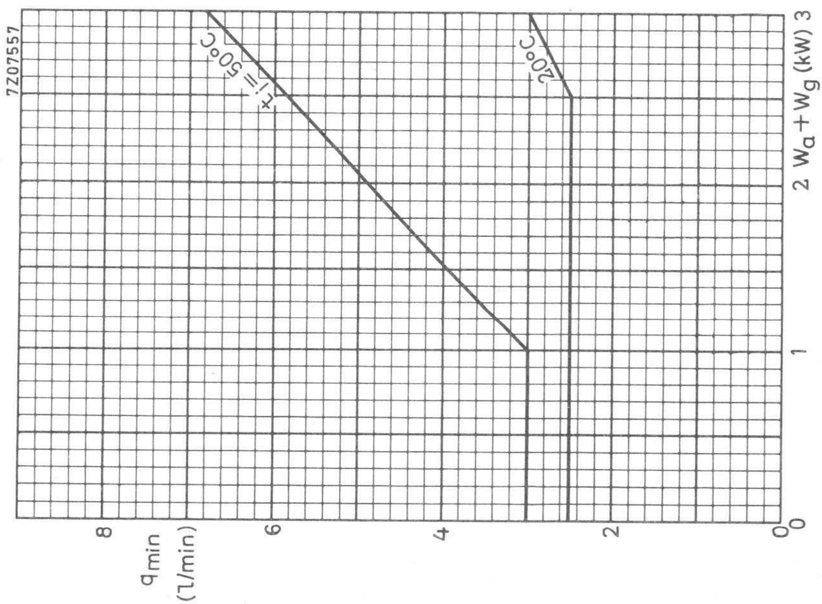
ACCESSORIES

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

For further data and curves please refer to YD1150

7Z2 8746


7Z07556
t_i = 20°C
50°C
p_i (atm)
0
0.2
0.4
0.6
0.8
0
5
10
15
q (l/min)

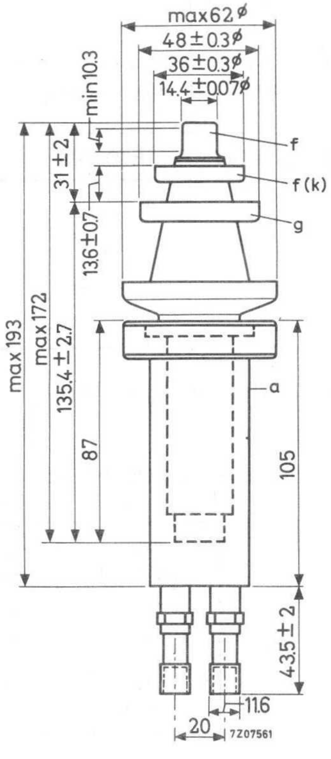

7Z07557
t_i = 50°C
20°C
q_{min} (l/min)
0
2
4
6
8
0
1
2
3
$W_a + W_g$ (kW)

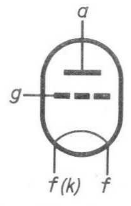
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical anode down

Net weight: 0.65 kg





7Z2 8376

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode of ceramic-metal construction, intended for use as industrial oscillator. The tube is cooled by means of a separate jacket.

QUICK REFERENCE DATA				
Frequency	f	27.12	160	MHz
Anode voltage	V_a	6.0	5.0	kV
Anode current	I_a	1.0	1.0	A
Oscillator output power	W_{osc}	4.75	3.75	kW

COOLING CHARACTERISTICS See also cooling curves

Anode Water cooled using jacket K713

Seals Low velocity air flow may be required at frequencies above 4 MHz.

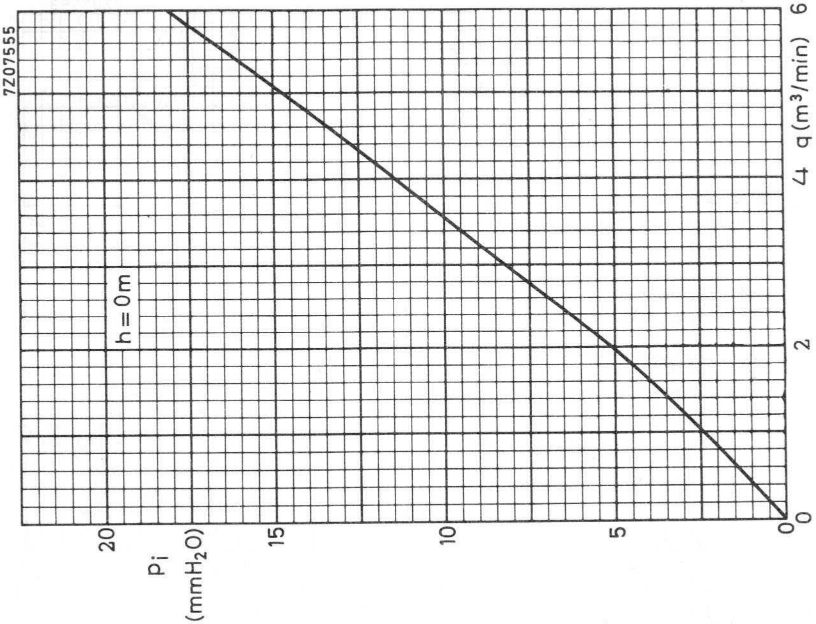
$W_a + W_g$ (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)
1	20	2.5	0.11
1	50	3.0	0.12
3	20	3.0	0.14
3	50	6.8	0.38

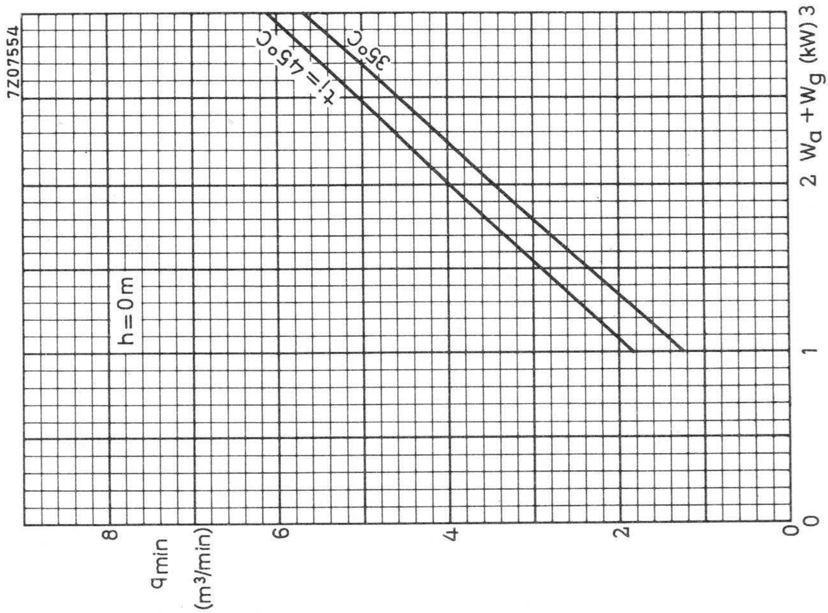
ACCESSORIES

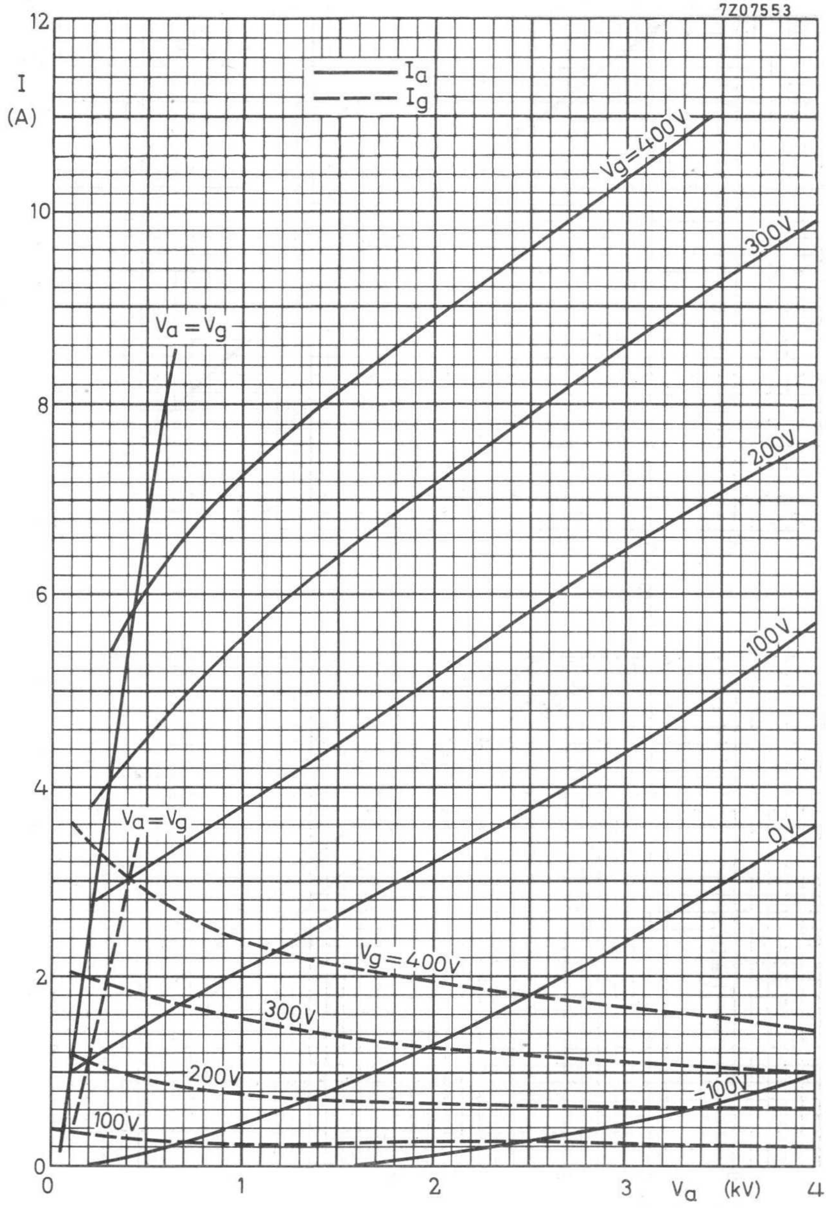
Filament connector	40688
Filament/cathode connector	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687
Water jacket	K713

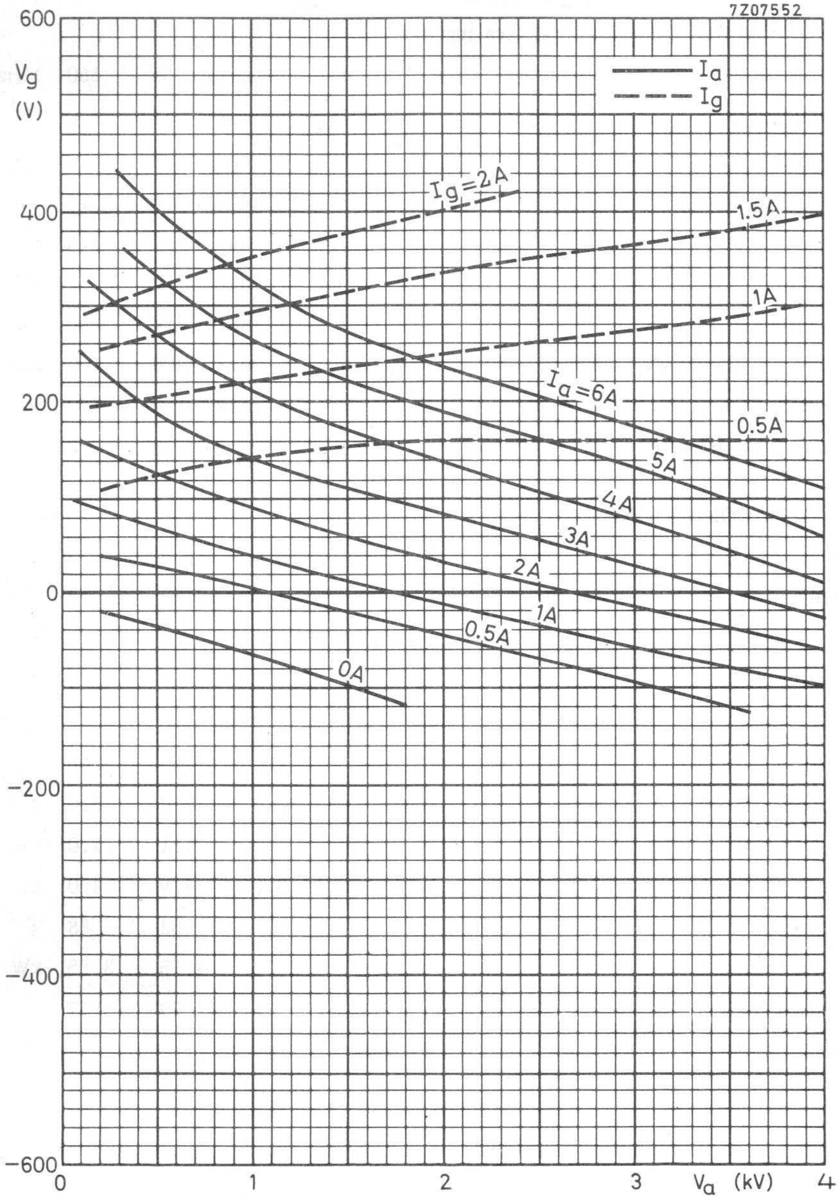
For further data and curves please refer to YD1150

7Z2 8375


7Z07555
h = 0 m
p_i (mmH$_2$O)
20
15
10
5
0
0
2
4
6
q (m^3/min)


7Z07554
h = 0 m
t_i = 45 °C
35 °C
q_{min} (m^3/min)
8
6
4
2
0
0
1
2
3
$W_a + W_g$ (kW)


7Z07553
I
(A)
Ia
Ig
Vg=400V
300V
200V
100V
0V
−100V
Va=Vg
Va=Vg
Vg=400V
300V
200V
100V
Va (kV)
0
2
4
6
8
10
12
0
1
2
3
4


7Z07552
600
400
200
0
−200
−400
−600
Vg
(V)
Ia
Ig
Ig=2A
1.5A
1A
0.5A
Ia=6A
5A
4A
3A
2A
1A
0.5A
0A
0
1
2
3
4
Va (kV)

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	85	160	MHz
Anode voltage	V_a	max.	7.2	6.0	kV
Anode input power	W_{ia}	max.	6.5	6.0	kW
Anode dissipation	W_a	max.	2.5	2.5	kW
Cathode current	I_k	max.	1.4	1.4	A
Grid voltage	$-V_g$	max.	1.0	1.0	kV
Grid current, loaded	I_g	max.	280	280	mA
unloaded	I_g	max.	400	400	mA
Grid dissipation	W_g	max.	150	150	W
Grid circuit resistance	R_g	max.	20	20	kΩ

OPERATING CONDITIONS

Filament voltage	V_f	6.0	6.3	6.3	V
Frequency	f	160	27.12	27.12	MHz
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Grid resistor	R_g	2.0	2.5	2.0	kΩ
Grid current, loaded	I_g	260	250	260	mA
Anode input power	W_{ia}	5.0	6.0	5.0	kW
Anode dissipation	W_a	1.1	1.1	1.0	kW
Anode output power	W_o	3.9	4.9	4.0	kW
Tube efficiency	η	78	82	88	%
Oscillator output power	W_{osc}	3.75	4.75	3.85	kW
Oscillator efficiency	η_{osc}	75	79	77	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	17	17	17	%

7Z2 8380

AIR COOLING CHARACTERISTICS (see also cooling curves)

$W_a + W_g$ (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
1	0	35	1.25	3.2
1	0	45	1.9	5.0
3	0	35	5.7	17
3	0	45	6.1	18.4

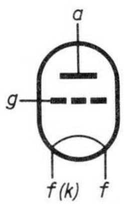
ACCESSORIES

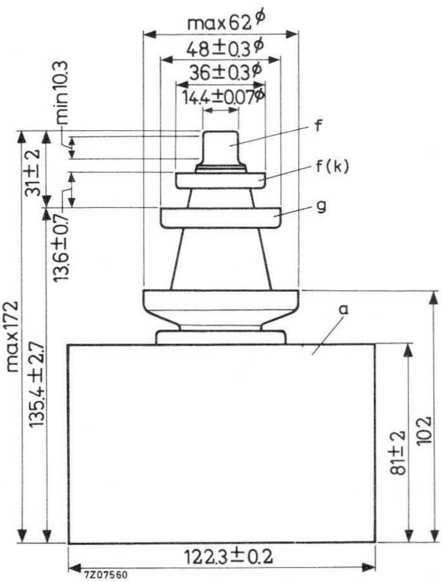
Filament connector	40688	
Filament/cathode connector	40689	
Grid connector (f < 30 MHz)	40686	
(f > 30 MHz)	40687	
Insulating pedestal	40630	net weight 2.1 kg

MECHANICAL DATA Dimensions in mm

Mounting position: vertical with anode up or down

Net weight: 3.0 kg





7Z2 8378

AIR COOLED R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode of ceramic-metal construction, intended for use as industrial oscillator.

QUICK REFERENCE DATA				
Frequency	f	27.12	160	MHz
Anode voltage	V_a	6.0	5.0	kV
Anode current	I_a	1.0	1.0	A
Oscillator output power	W_{osc}	4.75	3.75	kW

HEATING: direct; filament thoriated tungsten

Filament voltage (< 120 MHz)	V_f	6.3	V	$^{+5\%}_{-10\%}$
(> 120 MHz)	V_f	6.0	V	$^{+5\%}_{-10\%}$
Filament current at V_f = 6.3 V	I_f	33	A	

CAPACITANCES

Anode to filament	C_{af}	0.4	pF
Grid to filament	C_{gf}	17	pF
Anode to grid	C_{ag}	14	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2.0	kV
Anode current	I_a	0.5	A
Transconductance	S	10	mA/V
Amplification factor	μ	20	

TEMPERATURE LIMITS (Absolute max.)

Absolute max. envelope temperature	$t_{env.}$	max. 240	^{o}C
Recommended max. envelope temperature under continuous loaded conditions	$t_{env.}$	max. 200	^{o}C

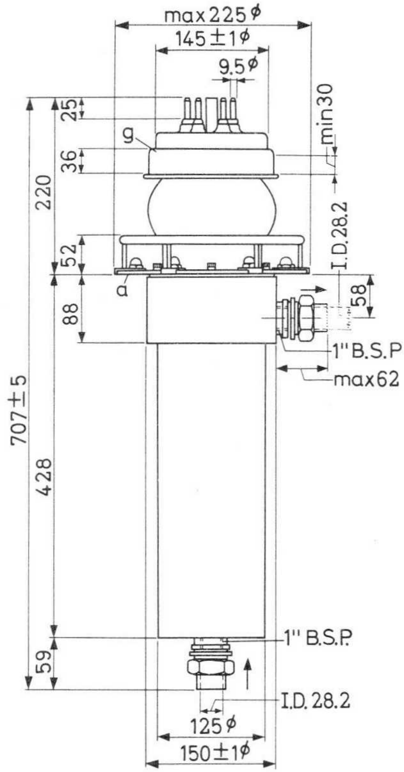
7Z2 8377

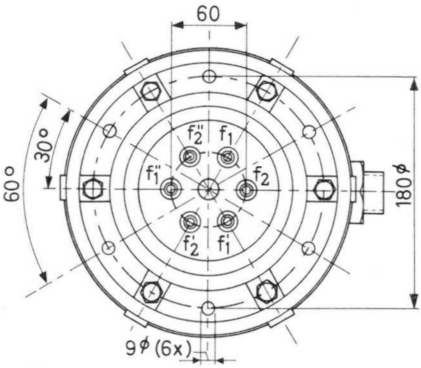
MECHANICAL DATA

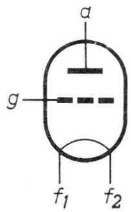
Dimensions in mm

Filament connector: 40628

Net weight of tube : 19 kg







Mounting position: vertical with anode down

For further data and curves please refer to type YD1140

7Z2 3635

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 linear interpolation.

At frequencies below 6 MHz forced air cooling of the seals will, as a rule, not be necessary. Above 6 MHz air cooling must be used to keep the anode and grid seal temperature below 180 °C. This air flow must be started upon or before the application of the filament voltage.

When using the filament connectors type 40628 together with leads of adequate cross-section, additional 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.

7Z2 3634

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

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

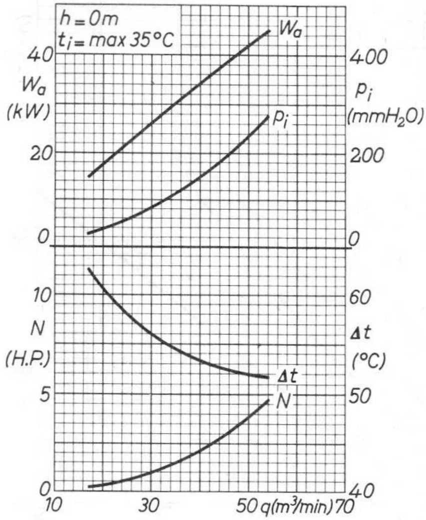
Anode to all other elements except grid	C_a	=	2.2	pF
Grid to all other elements except anode	C_g	=	122	pF
Anode to grid	C_{ag}	=	75	pF

TYPICAL CHARACTERISTICS

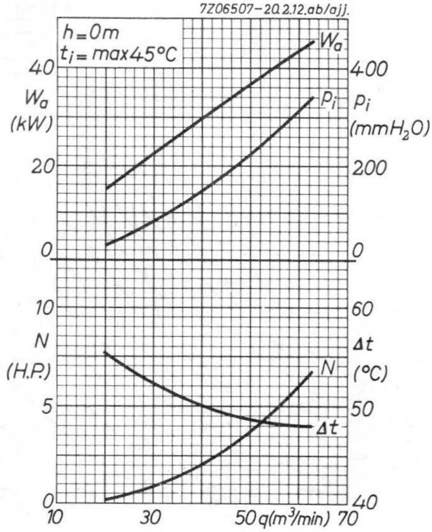
Anode voltage	V_a	=	3	10	kV
Anode current	I_a	=	50	5	A
Amplification factor	μ	=	-	25	
Mutual conductance	S	=	140	60	mA/V

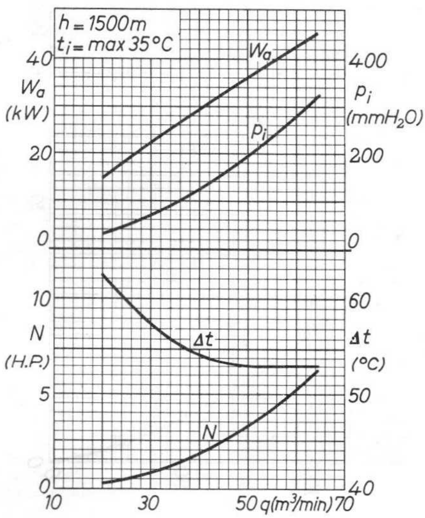
[1]) Two tubes

7Z2 8745

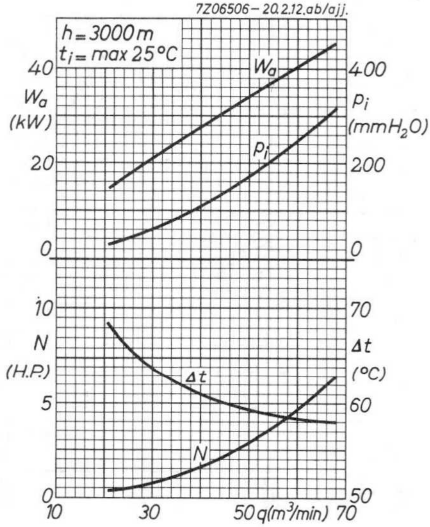


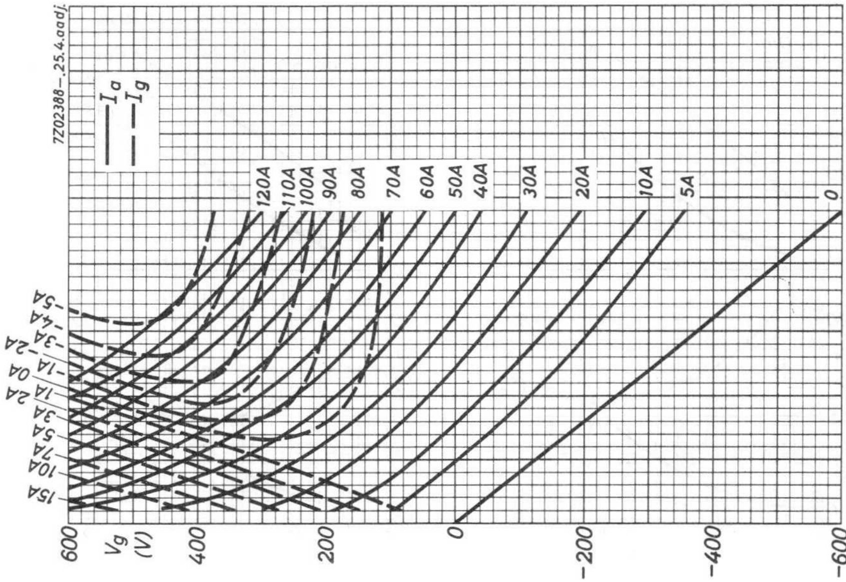
7Z06507–20.2.12.ab/ajj.

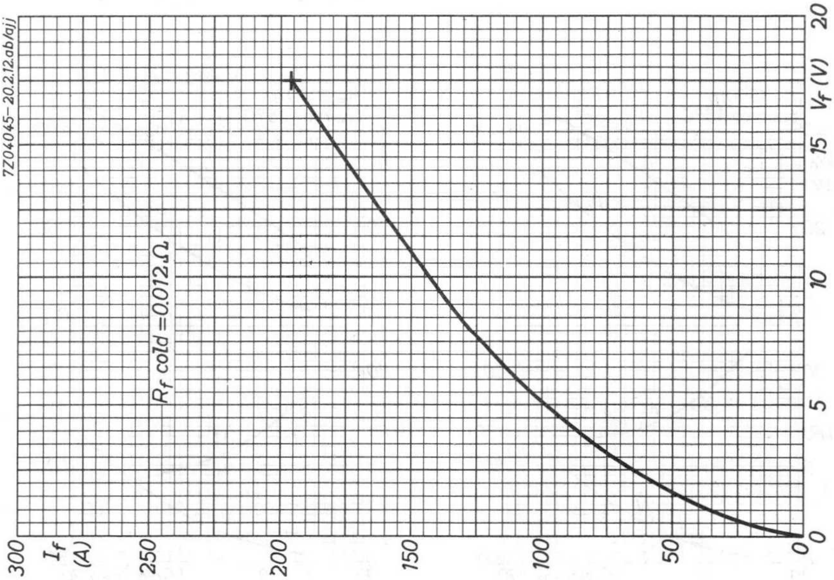


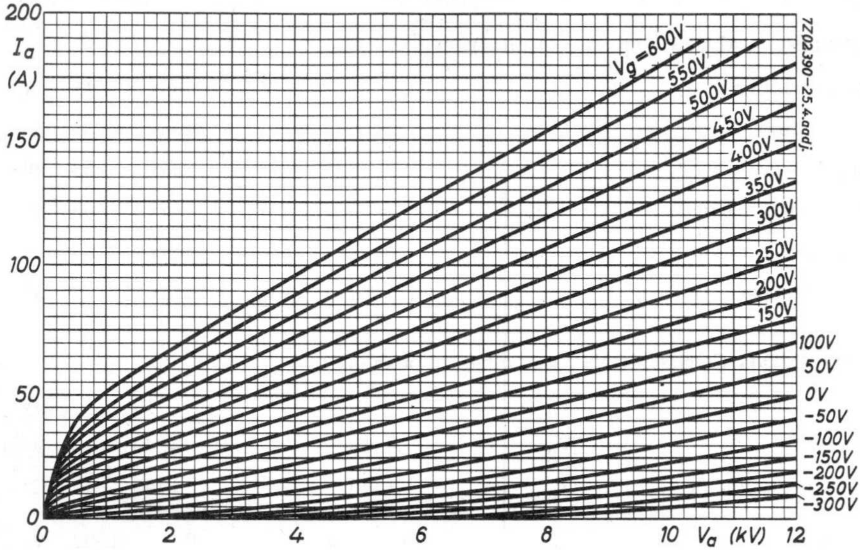


7Z06506–20.2.12.ab/ajj.

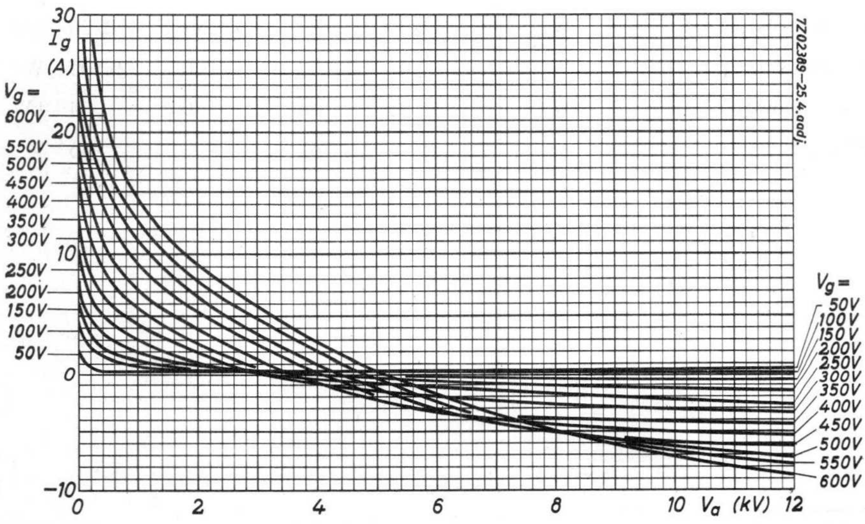



7Z02388-.25.4.aadj.
I_a
I_g
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0
-5A
-4A
-3A
-2A
-1A
0A
1A
2A
3A
5A
7A
10A
15A
V_g (V)
600
400
200
0
-200
-400
-600
0
5
10
15
V_a (kV)


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



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



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

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes in push-pull

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

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

7Z2 3632

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

7Z2 3631

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

7Z2 3630

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 3629

MECHANICAL DATA

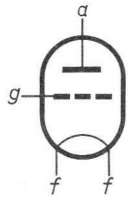
Dimensions in mm

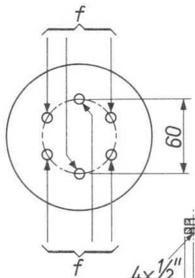
Filament connectors: 40628

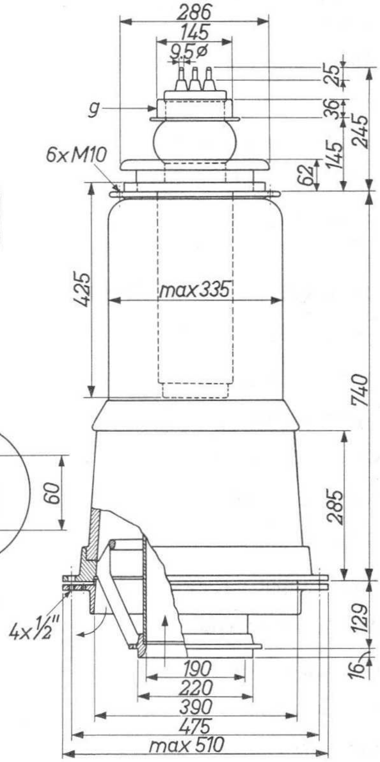
Cooler housing : K506

Net weight of tube : 28.5 kg

Net weight of K506 : 72 kg







Tube mounted in cooler housing type K 506

Mounting position: vertical with anode down

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

7Z2 8744

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 180 °C

AIR COOLING CHARACTERISTICS ; see also cooling curves

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

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

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

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

7Z2 3627

AIR COOLED R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

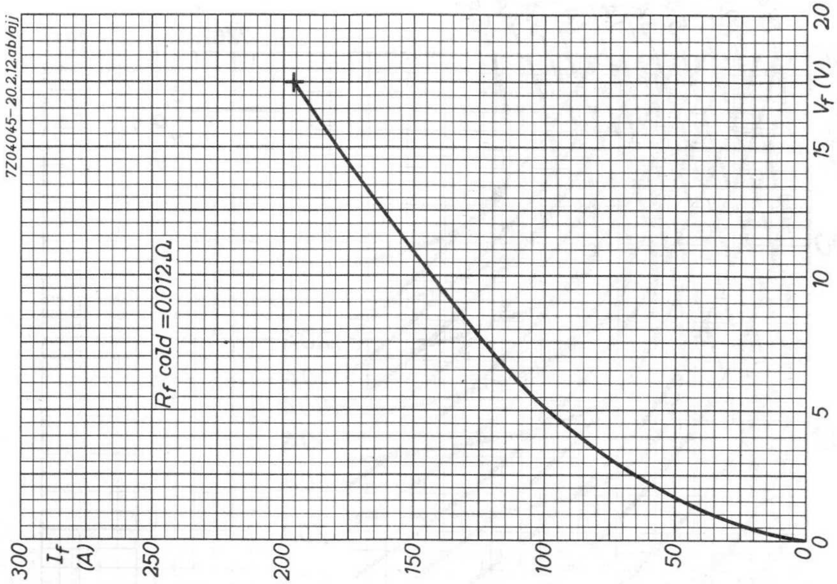
Anode to all other elements except grid	C_a	=	2.2	pF
Grid to all other elements except anode	C_g	=	122	pF
Anode to grid	C_{ag}	=	75	pF

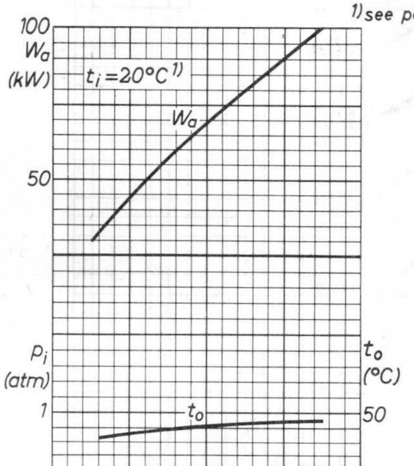
TYPICAL CHARACTERISTICS

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

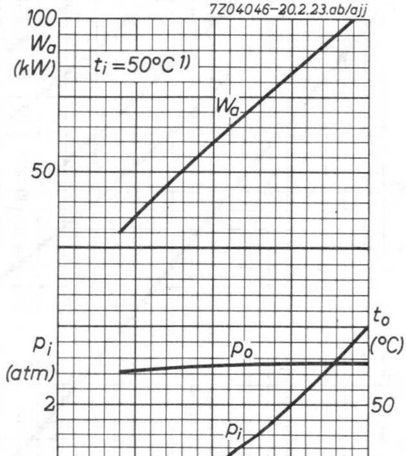
[1]) Two tubes

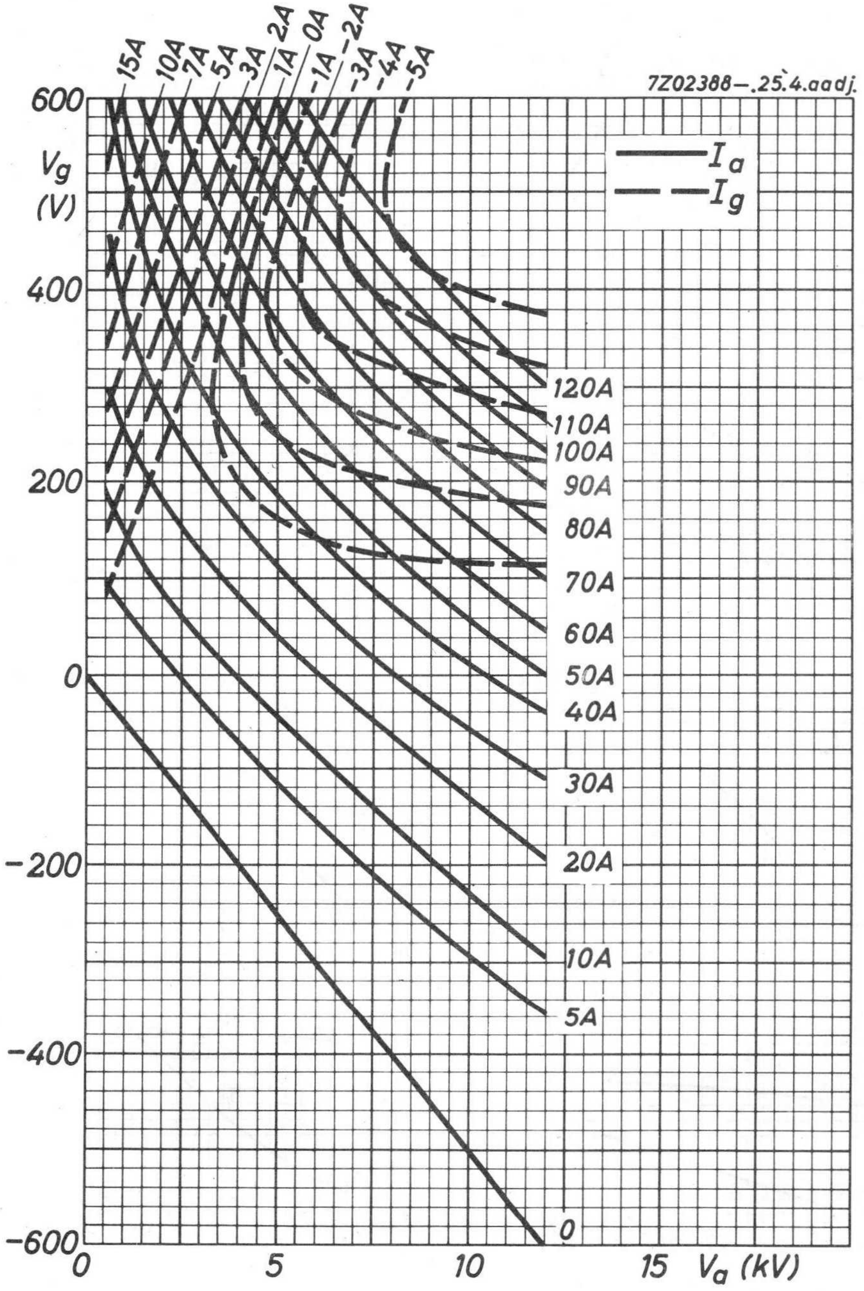
7Z2 8743


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

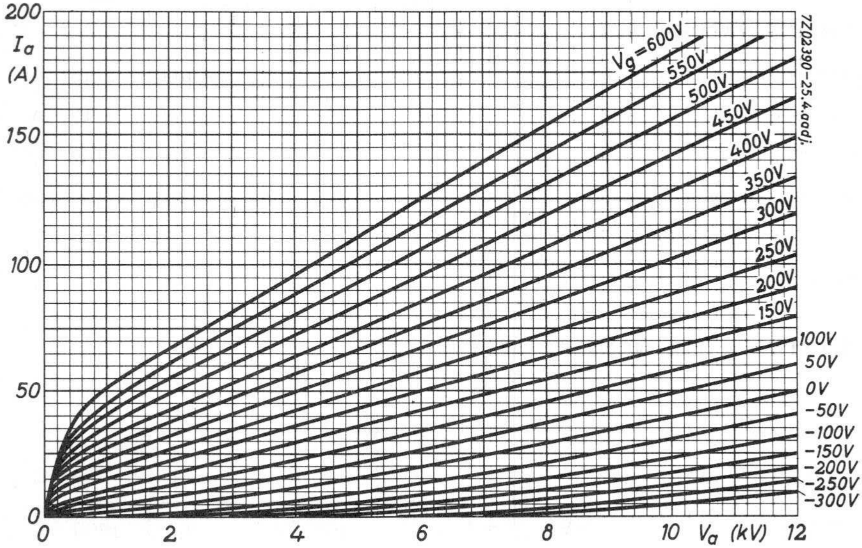

100
W_a (kW)
t_i = 20°C 1)
W_a
50
p_i (atm)
1
0
t_o (°C)
50
0
t_o
p_i
20
40
q (l/min)
60

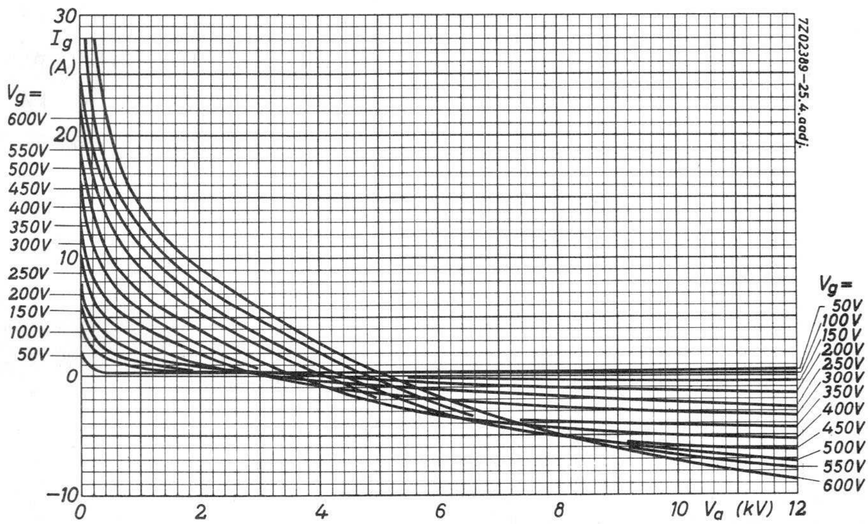
1) see page 2


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



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


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


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

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes in push-pull

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

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

7Z2 3625

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

7Z2 3624

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

7Z2 3623

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 3622

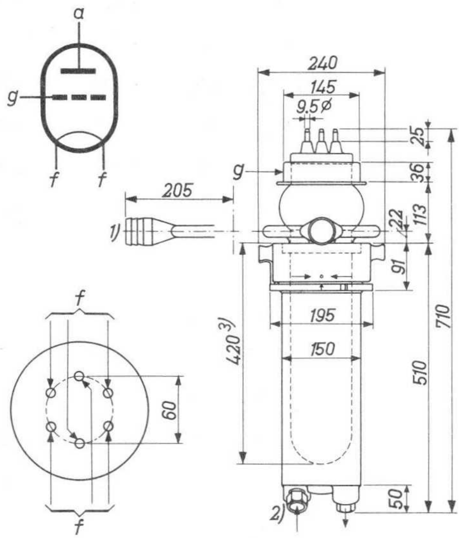
MECHANICAL DATA Dimensions in mm

Water-jacket : K714

Filament connectors: 40628

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.

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1) Use connecting hose with an inner diameter of 1¾".

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.

7Z2 8742

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 linear interpolation.

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

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

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

7Z2 3620

WATER COOLED R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

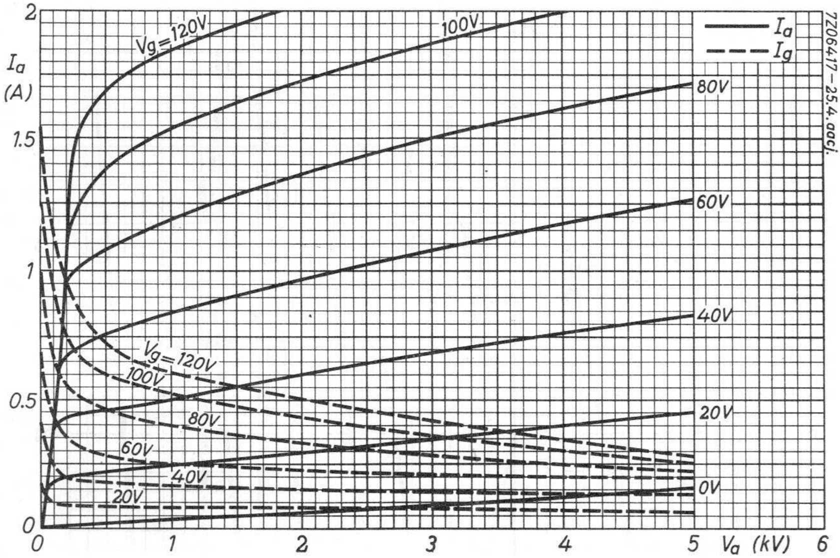
Anode to all other elements except grid	C_a	=	2.2	pF
Grid to all other elements except anode	C_g	=	122	pF
Anode to grid	C_{ag}	=	75	pF

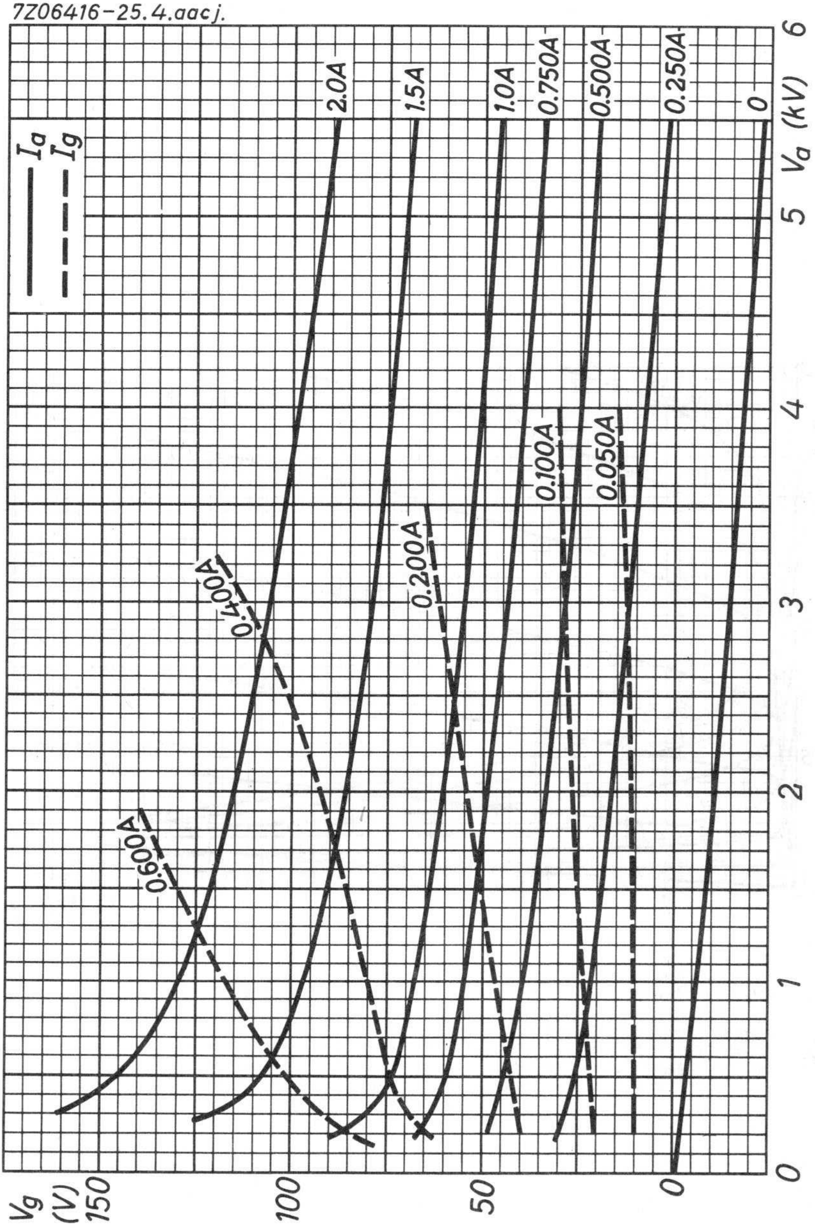
TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 8741


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


7Z06416-25.4.aacj.
I_a
I_g
2.0A
1.5A
1.0A
0.750A
0.500A
0.250A
0
0.600A
0.400A
0.200A
0.100A
0.050A
V_a (kV)
0
1
2
3
4
5
6
V_g (V)
150
100
50
0

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS Class B, two tubes in push-pull

Anode voltage	V_a	=	3000		V
Load resistance	$R_{aa\sim}$	=	9500		Ω
Peak grid driving voltage	V_{gg_p}	=	0	176	V
Anode current	I_a	=	2x90	2x333	mA
Grid current	I_g	=	0	2x120	mA
Driving power	W_{dr}	=	0	26	W
Anode input power	W_{i_a}	=	2x270	2x1000	W
Anode dissipation	W_a	=	2x270	2x345	W
Output power	W_o	=	0	1310	W
Efficiency	η	=	–	65	%

7Z2 4130

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

LIMITING VALUES (Absolute limits)

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

OPERATING CHARACTERISTICS

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

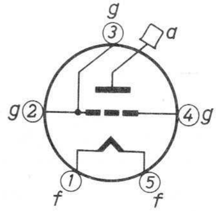
1) Inclusive 25 W feedthrough power
2) Inclusive 25 W peak envelope feedthrough power
3) Measured in a circuit having an efficiency of 91 %
4) Maximum distortion level encountered at any driving level up to full drive, referred to the amplitude of either of the two tones in a double tone test signal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

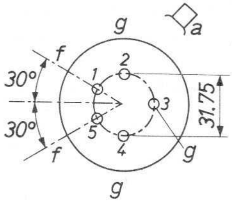
7Z2 4129

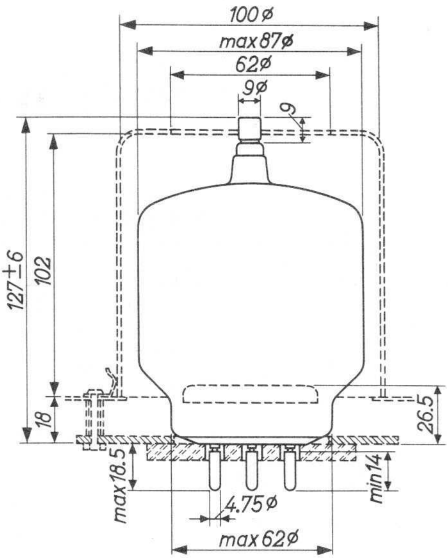
MECHANICAL DATA

Net weight: 210 g

Base : Giant 5p.







Dimensions in mm

Mounting suggestion of tube with chimney

Mounting position: vertical with base up or down

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

ACCESSORIES

Anode connector	40624
→ Socket	2422 512 01001
Chimney	40666

7Z2 8740

R.F. POWER TRIODE

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

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

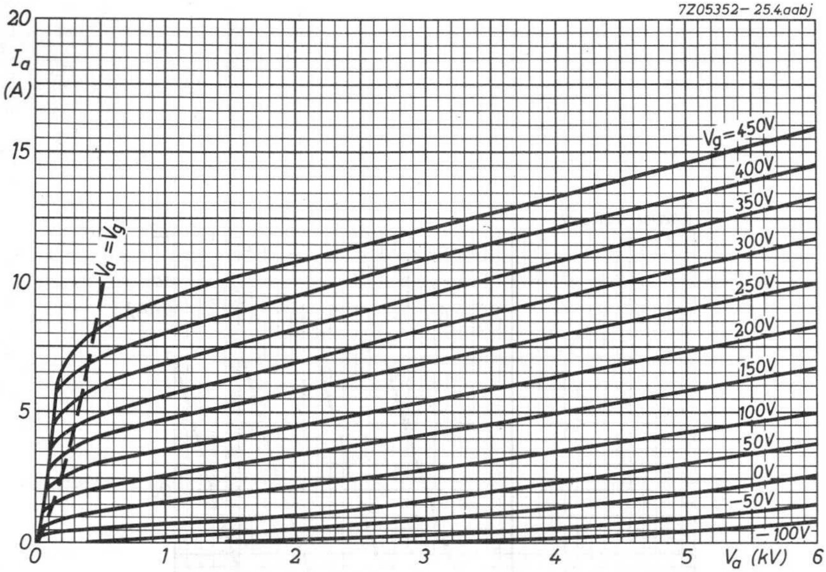
TEMPERATURE LIMITS (Absolute limits)

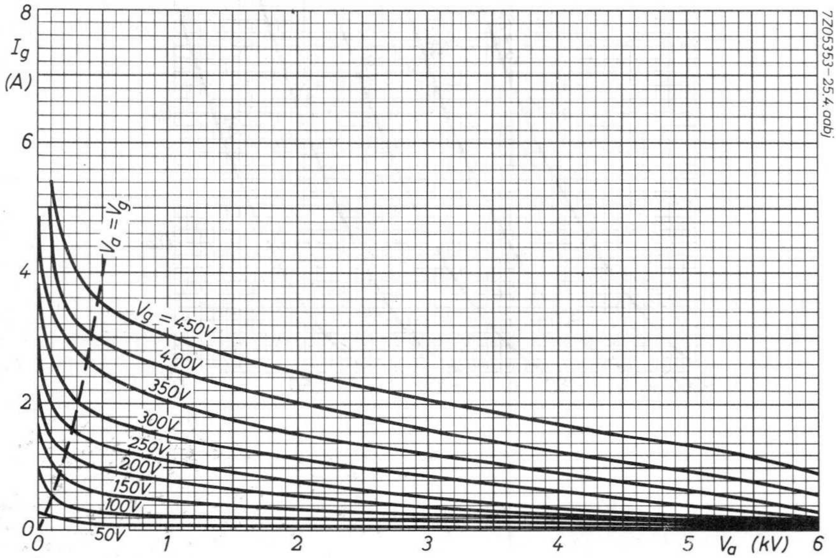
Anode seal temperature	t	=	max. 220	^{o}C
Pin seal temperature	t	=	max. 180	^{o}C
Bulb temperature	t	=	max. 350	^{o}C

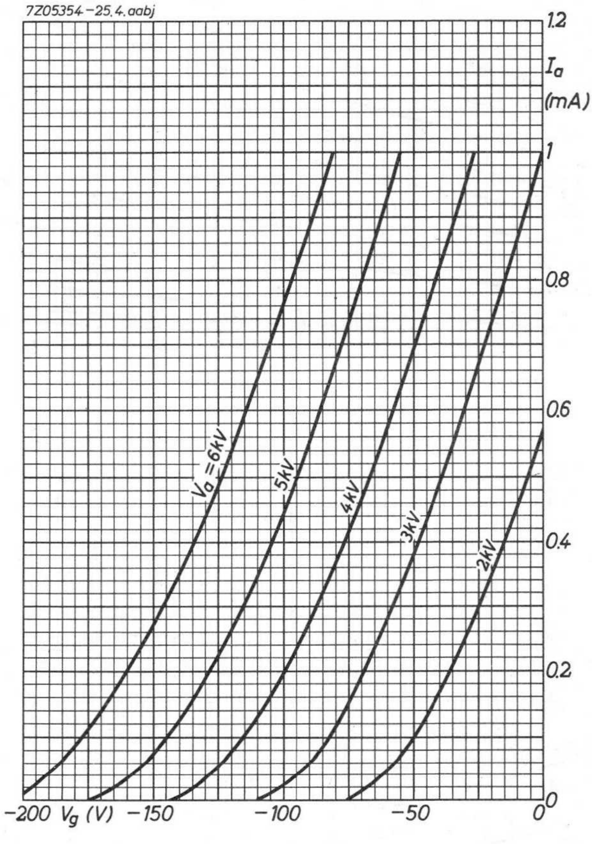
COOLING

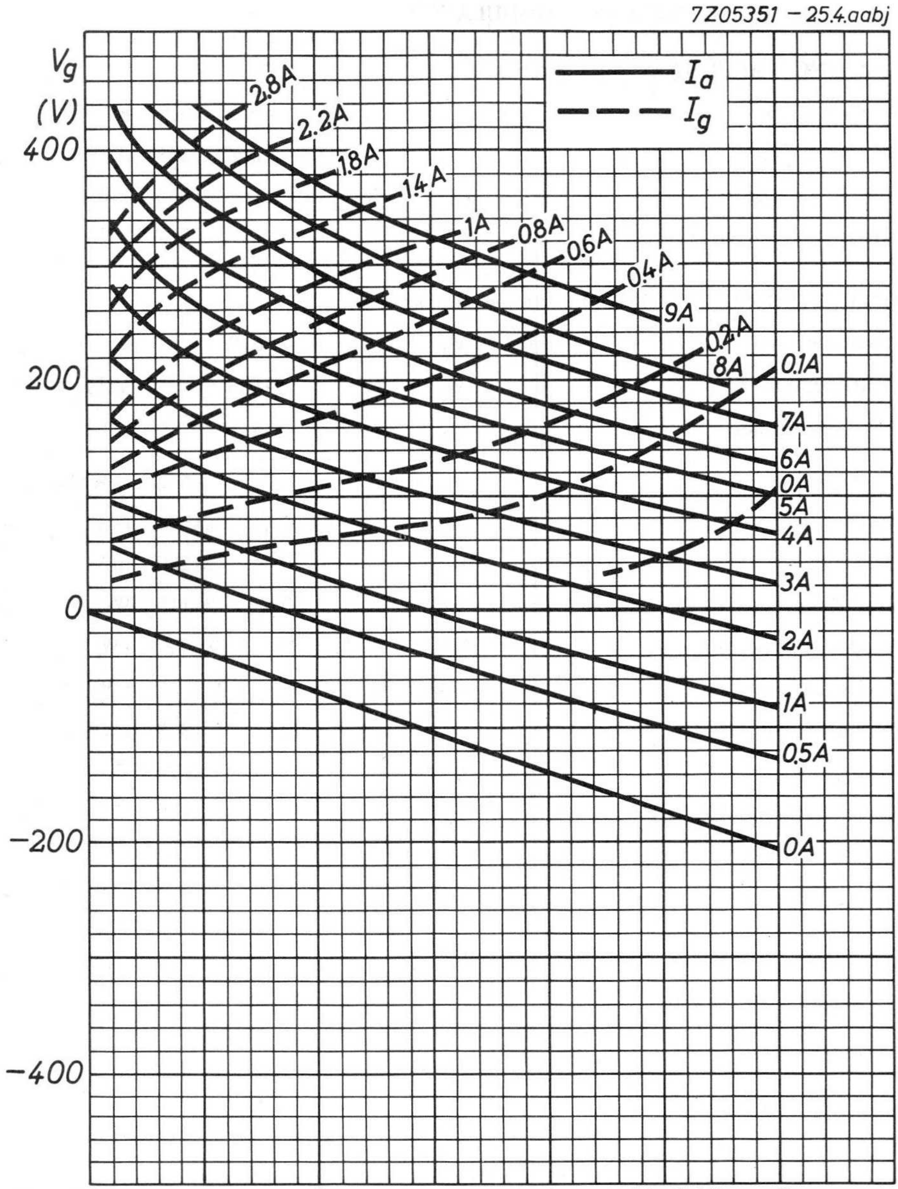
Radiation and low velocity air flow

7Z2 4127


7Z05352– 25.4.aabj
20
I_a
(A)
15
10
5
0
0
1
2
3
4
5
V_a (kV)
6
$V_a = V_g$
V_g=450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
–50V
–100V


7Z05353–25.4.aabj
8
I_g
(A)
6
4
2
0
0
1
2
3
4
5
V_a (kV)
6
$V_a = V_g$
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V


7Z05354-25.4.aabj
1.2
I_a
(mA)
1
0.8
0.6
0.4
0.2
0
V_a = 6kV
5kV
4kV
3kV
2kV
-200 V_g (V) -150
-100
-50
0


7Z05351 – 25.4.aabj
V_g
(V)
400
200
0
−200
−400
0
2
4
V_a (kV)
6
I_a
I_g
2.8A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
0.2A
0.1A
0A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0A

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	6.0	kV
Anode current	I_a	=	max.	1.8	A
Anode input power	W_{i_a}	=	max.	10.5	kW
Anode dissipation	W_a	=	max.	5.0	kW

OPERATING CONDITIONS (Two tubes in push-pull)

Anode voltage	V_a	=	6.0		kV
Grid voltage	V_g	=	-165		V [1]
Load resistance	$R_{aa\sim}$	=	4.9		kΩ
Grid driving voltage	V_{gg}	=	0	645	V(RMS)
Anode current	I_a	=	2x125	2x1500	mA
Grid current	I_g	=	0	2x280	mA
Driving power	W_{dr}	=	0	2x115	W
Anode input power	W_{i_a}	=	2x0.75	2x9.0	kW
Anode dissipation	W_a	=	2x0.75	2x2.35	kW
Output power	W_o	=	0	13.3	kW
Efficiency	η	=	-	74	%
Total harmonic distortion	d_{tot}	=	-	4.3	%

[1]) To be adjusted for zero signal anode current of 125 mA.

7Z2 3863

Tetrodes, Pentodes

R.F. POWER PENTODE

QUICK REFERENCE DATA						
Frequency (MHz)	C telegr.		B teleph.		C an mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
< 20	2000	270	2000	45	1800	124
	1500	175	1500	37	1200	60
60 [1]	1500	305	1500	70	1200	149

Frequency (MHz)	C_{ag_2} mod.		C_{g_3} mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)
< 20	1800	147	2000	43
	1200	76	1500	35
60 [1]	1200	155	1500	65

HEATING : direct, filament thoriated tungsten

Filament voltage	V_f	=	12 V
Filament current	I_f	=	3.35 A

CAPACITANCES

Anode to all except grid No.1	C_a	=	14 pF
Grid No.1 to all except anode	C_{g_1}	=	13.7 pF
Anode to grid No.1	C_{ag_1}	=	0.15 pF

TYPICAL CHARACTERISTICS

Anode current	I_a	=	55 mA
Amplification factor	$\mu_{g_2g_1}$	=	5.9
Mutual conductance	S	=	3.3 mA/V

[1]) Two tubes

7Z2 3807

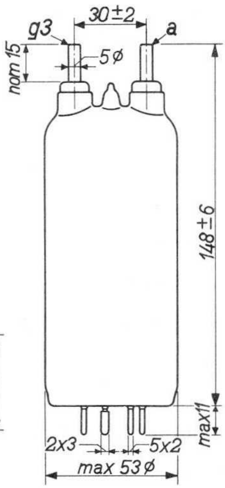
LIMITING VALUES (Absolute limits)

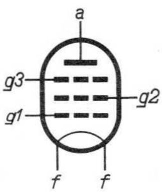
Anode voltage	V_a	= max.	2000	V
Anode dissipation	W_a	= max.	110	W
Grid No.3 circuit resistance	R_{g_3}	= max.	80	kΩ
Grid No.2 voltage	V_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	25	W
Grid No.1 dissipation	W_{g_1}	= max.	12	W
Grid No.1 circuit resistance				
with fixed bias	R_{g_1}	= max.	40	kΩ
with automatic bias	R_{g_1}	= max.	80	kΩ
Cathode current	I_k	= max.	285	mA
Peak cathode current	I_{k_p}	= max.	1400	mA
Pin temperature	t	= max.	180	^oC

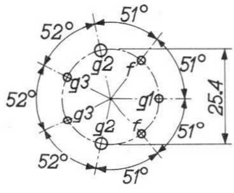
MECHANICAL DATA

Net weight: 150 g

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: 40207

Anode connectors: 40600

7Z2 8770

R.F. POWER PENTODE

QUICK REFERENCE DATA								
Frequency (MHz)	C telegr.		B teleph.		C_{ag_2} mod.		C_{g_3} mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
< 10	2500	600			2000	325		
< 20	2000	550	2000	90	1800	290	2000	100
60 [1])	1500	625	1500	100	1200	350	1500	90

HEATING : direct; filament thoriated tungsten

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

CAPACITANCES

Anode to all except grid No.1	C_a	= 20	pF
Grid No.1 to all except anode	C_{g_1}	= 23	pF
Anode to grid No.1	C_{ag_1}	= 0.2	pF

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 3813

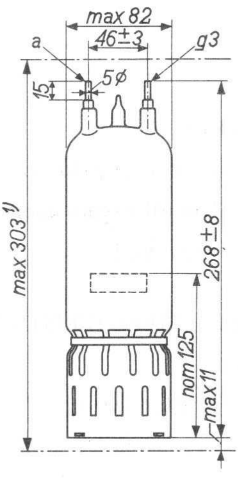
LIMITING VALUES (Absolute limits)

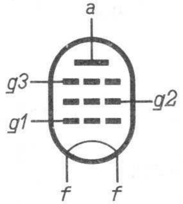
Anode voltage	V_a	= max.	2500	V
Anode dissipation	W_a	= max.	250	W
Grid No. 3 circuit resistance	R_{g_3}	= max.	40	kΩ
Grid No. 2 voltage	V_{g_2}	= max.	500	V
Grid No. 2 dissipation	W_{g_2}	= max.	60	W
Grid No. 1 dissipation	W_{g_1}	= max.	20	W
Grid No. 1 circuit resistance	R_{g_1}	= max.	40	kΩ
Cathode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

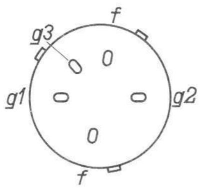
MECHANICAL DATA

Net weight: 0.63 kg

Dimensions in mm







Mounting position: vertical with base up or down
When the tube is mounted with the base up it is recommended to support the tube

ACCESSORIES

Socket: 40200
Anode connectors: 40600

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[1]) Required height in apparatus

7Z2 8771

R.F. POWER PENTODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr.		B teleph.		B mod. [1]	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
> 30	< 10	3000	1200	3000	190	3000	1600
> 15	< 20	2500	950	2500	130		
5	60	1800	485	1800	68		
		C_{ag_2} mod.		C_{g_3} mod.			
> 30	< 10	2500	580	3000	200		
> 15	< 20	2000	425	2500	150		

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	12 V
Filament current	I_f	=	8.5 A

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	21 pF
Grid No.1 to all other elements except anode	C_{g_1}	=	29 pF
Anode to grid No.1	C_{ag_1}	=	0.05 pF

TYPICAL CHARACTERISTICS

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

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

1) Two tubes

7Z2 3392

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

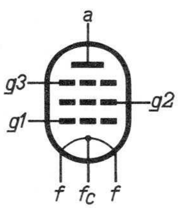
To ensure safe seal temperatures a low velocity air flow is required above 60 MHz

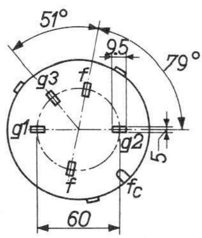
MECHANICAL DATA (Dimensions in mm)

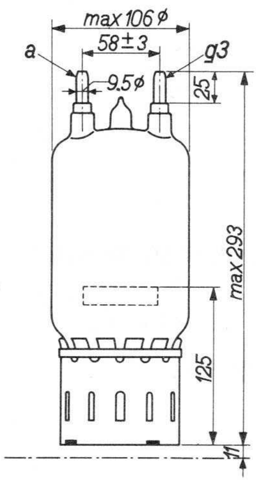
Socket : 40201

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

7Z2 8772

OPERATING CONDITIONS H.F. class C telegraphy

A. Grid No.3 connected to grid No.2

Wave length	λ	=	>30	>15	5 [1])	m
Anode voltage	V_a	=	3000	2500	1800	V
Grid No.1 voltage	V_{g_1}	=	−200	−200	−150	V
Grid No.2 voltage	V_{g_2}	=	300	300	300	V
Grid No.3 voltage	V_{g_3}	=	300	300	300	V
Anode current	I_a	=	550	550	985	mA
Grid No.1 current	I_{g_1}	=	25	20	30	mA
Grids No.2 and 3 current	$I_{g_2+g_3}$	=	100	100	200	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	370	360	300	V
Grid No.1 input power	W_{ig_1}	=	9	7	9	W
Grids No.2 and 3 input power	$W_{g_2+g_3}$	=	30	30	60	W
Anode input power	W_{ia}	=	1650	1375	1775	W
Anode dissipation	W_a	=	450	425	800	W
Output power	W_o	=	1200	950	975	W
Efficiency	η	=	72.5	69	55	%

B. Grid No.3 connected to cathode

Wave length	λ	=	>30	>15	5 [1])	m
Anode voltage	V_a	=	3000	2500	1800	V
Grid No.1 voltage	V_{g_1}	=	−300	−300	−200	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	465	470	945	mA
Grid No.1 current	I_{g_1}	=	20	20	30	mA
Grid No.2 current	I_{g_2}	=	200	200	320	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	450	450	350	V
Grid No.1 input power	W_{ig_1}	=	9	9	11	W
Grid No.2 dissipation	W_{g_2}	=	100	100	160	W
Anode input power	W_{ia}	=	1400	1175	1700	W
Anode dissipation	W_a	=	450	450	800	W
Output power	W_o	=	950	725	900	W
Efficiency	η	=	68	61.5	53	%

[1]) Two tubes

7Z2 3394

OPERATING CONDITIONS H.F. class B telephony

Wave length	λ	=	>30	>15	5 [1])	m
Anode voltage	V_a	=	3000	2500	1800	V
Grid No.1 voltage	V_{g_1}	=	−120	−115	−90	V
Grid No.2 voltage	V_{g_2}	=	500	500	420	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	215	230	350	mA
Grid No.2 current	I_{g_2}	=	30	30	50	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	80	75	60	V
Grid No.2 dissipation	W_{g_2}	=	15	15	21	W
Anode input power	W_{ia}	=	640	580	630	W
Anode dissipation	W_a	=	450	450	495	W
Output power	W_o	=	190	130	135	W
Efficiency	η	=	30	22	21	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	I_{g_1}	=	4	3	6	mA
Grid No.1 input power	W_{ig_1}	=	0.7	0.5	0.8	W

1) Two tubes

7Z2 3395

OPERATING CONDITIONS H.F. class C

		anode- and screen grid modulation		suppressor grid modulation				
λ		>30	>15	>30	>15	>30	>15	m
V_a	=	2500	2000	3000	2500	3000	2500	V
V_{g_1}	=	−300	−300	−300	−300	−300	−300	V
V_{g_2}	=	500	500	600	600	600	600	V
V_{g_3}	=	0	0	−190	−170	−210	−200	V
I_a	=	325	315	190	165	175	175	mA
I_{g_1}	=	7	7	5	5	5	5	mA
I_{g_2}	=	135	135	165	165	165	165	mA
$V_{g_{1p}}$	=	385	385	335	335	335	335	V
W_{ig_1}	=	2.7	2.7	1.7	1.7	1.7	1.7	W
W_{g_2}	=	67	67	100	100	100	100	W
W_{ia}	=	815	630	570	415	525	425	W
W_a	=	235	205	370	265	360	325	W
W_o	=	580	425	200	150	165	100	W
η	=	71	67.5	35	36	31	23.5	%
m	=	100	100	80	80	100	100	%
$V_{g_{2p}}$	=	500	500					V
$V_{g_{3p}}$	=			190	170	210	200	V
W_{mod}	=	440	350	0	0	0	0	W

7Z2 3396

OPERATING CONDITIONS as L.F. class B amplifier and modulator, two tubes

Anode voltage	V_a	=	3000		V
Grid No.1 voltage	V_{g_1}	=	−160		V
Grid No.2 voltage	V_{g_2}	=	600		V
Grid No.3 voltage	V_{g_3}	=	0		V
Load resistance	$R_{aa\sim}$	=	8.8		kΩ
Peak grid No.1 A.C. voltage	V_{g1g1p}	=	0	360	V
Anode current	I_a	=	2x50	2x385	mA
Grid No.1 current	I_{g_1}	=	0	2x6	mA
Grid No.2 current	I_{g_2}	=	2x8	2x105	mA
Grid No.1 input power	W_{ig_1}	=	0	2x1.1	W
Grid No.2 dissipation	W_{g_2}	=	2x4.8	2x63	W
Anode input power	W_{ia}	=	2x150	2x1155	W
Anode dissipation	W_a	=	2x150	2x355	W
Output power	W_o	=	0	1600	W
Efficiency	η	=	–	69	%

7Z2 3397

R.F. POWER PENTODE

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

λ (m)	Freq. (MHz)	C fr. mult.	
		V_a (V)	W_o (W)
5.4/1.8	55/165	400	9

HEATING: indirect; cathode oxide-coated

Heater voltage	V_f	=	12.6	V
Heater current	I_f	=	0.7	A

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	7.8	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	14.5	pF
Anode to grid No.1	C_{ag_1}	=	0.15	pF

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 3398

LIMITING VALUES (Absolute limits)

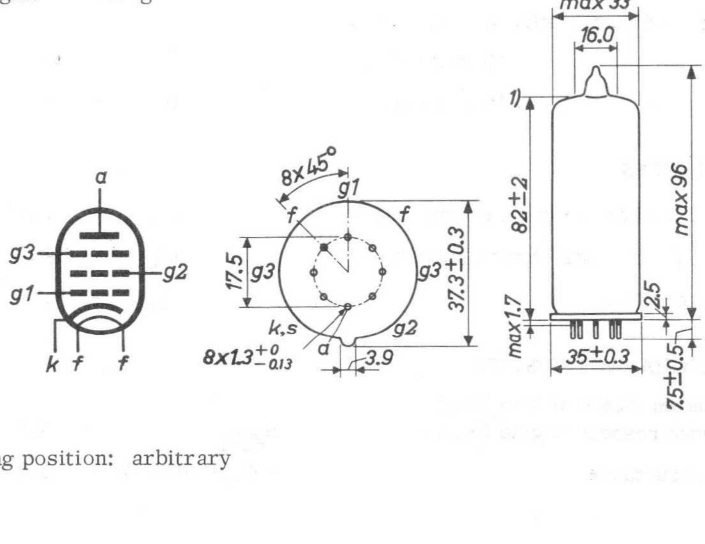
Anode voltage	V_a	=	max.	500	V
Anode dissipation	W_a	=	max.	12	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	5	W
Grid No.1 dissipation	W_{g_1}	=	max.	0.5	W
Grid No.1 resistor with fixed bias	R_{g_1}	=	max.	50	kΩ
Grid No.1 resistor with automatic bias	R_{g_1}	=	max.	100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

MECHANICAL DATA

Socket : 40210/02

Net weight: 50 g

Dimensions in mm



Mounting position: arbitrary

[1]) Reference line

7Z2 3399

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

Wavelength	λ		>3	>3	>3	m
Anode voltage	V_a	=	500	400	300	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	−80	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	90	100	117	mA
Grid No.1 current	I_{g_1}	=	3	3.5	4.5	mA
Grid No.2 current	I_{g_2}	=	5	5.5	8	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	96	103	110	V
Grid No.1 input power	W_{ig_1}	=	0.26	0.33	0.45	W
Grid No.2 dissipation	W_{g_2}	=	1.25	1.4	2	W
Anode input power	W_{ia}	=	45	40	35.1	W
Anode dissipation	W_a	=	12	12	11.1	W
Output power	W_o	=	33	28	24	W
Efficiency	η	=	73.5	70	68	%

OPERATING CONDITIONS R.F. CLASS B TELEPHONY

Wavelength	λ		>3	>3	m
Anode voltage	V_a	=	500	400	V
Grid No.1 voltage	V_{g_1}	=	−28	−28	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	36	42.5	mA
Grid No.2 current	I_{g_2}	=	3	3.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	17.5	21.25	V
Grid No.2 dissipation	W_{g_2}	=	0.75	0.9	W
Anode input power	W_{ia}	=	18	17	W
Anode dissipation	W_a	=	12	11.6	W
Output power	W_o	=	6	5.4	W
Efficiency	η	=	33.5	32	%
Modulation factor	m	=	100	100	%
Grid No.1 current	I_{g_1}	=	2	3.4	mA
Grid No.1 input power	W_{ig_1}	=	0.07	0.13	W

7Z2 3400

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

Wavelength	λ	=	>3	>3	m
Anode voltage	V_a	=	400	300	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	V
Grid No.2 voltage	V_{g_2}	=	200	200	V
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	70	77	mA
Grid No.1 current	I_{g_1}	=	2.5	3.5	mA
Grid No.2 current	I_{g_2}	=	4.5	7	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	100	105	V
Grid No.1 input power	W_{ig_1}	=	0.25	0.35	W
Grid No.2 dissipation	W_{g_2}	=	0.9	1.4	W
Anode input power	W_{ia}	=	28	23	W
Anode dissipation	W_a	=	8	7	W
Output power	W_o	=	20	16	W
Efficiency	η	=	71	69.5	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	190	190	V
Modulation power	W_{mod}	=	15	13	W

OPERATING CONDITIONS AS CLASS C FREQUENCY MULTIPLIER

Wavelength	λ	=	5.4/1.8	5.4/1.8	5.4/1.8	m
Anode voltage	V_a	=	400	400	400	V
Grid No.1 voltage	V_{g_1}	=	−175	−200	−250	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	47	50	52.5	mA
Grid No.1 current	I_{g_1}	=	0.9	1	1.2	mA
Grid No.2 current	I_{g_2}	=	2	2.5	3	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	200	220	270	V
Grid No.1 input power	W_{ig_1}	=	0.16	0.2	0.3	W
Grid No.2 dissipation	W_{g_2}	=	0.5	0.65	0.75	W
Anode input power	W_{ia}	=	18.8	20	21	W
Anode dissipation	W_a	=	12	12	12	W
Output power	W_o	=	6.8	8	9	W
Efficiency	η	=	36	40	43	%

7Z2 3401

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

TWO TUBES

Anode voltage	V_a	=	500		V
Grid No.1 voltage	V_{g_1}	=	−24		V
Grid No.2 voltage	V_{g_2}	=	250		V
Grid No.3 voltage	V_{g_3}	=	0		V
Load resistance	$R_{aa\sim}$	=	9		kΩ
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	70	V
Anode current	I_a	=	2x18	2x71	mA
Grid No.1 current	I_{g_1}	=	0	2x1.8	mA
Grid No.2 current	I_{g_2}	=	2x0.6	2x11.2	mA
Grid No.1 input power	W_{ig_1}	=	0	2x57	mW
Grid No.2 dissipation	W_{g_2}	=	2x0.15	2x2.8	W
Anode input power	W_{ia}	=	2x9	2x35.5	W
Anode dissipation	W_a	=	2x9	2x11	W
Output power	W_o	=	0	49	W
Total harmonic distortion	d_{tot}	=	-	5	%
Efficiency	η	=	-	69	%

Anode voltage	V_a	=	300		400		V
Grid No.1 voltage	V_{g_1}	=	−18		−18.5		V
Grid No.2 voltage	V_{g_2}	=	200		200		V
Grid No.3 voltage	V_{g_3}	=	0		0		V
Load resistance	$R_{aa\sim}$	=	3		5.5		kΩ
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	100	0	82	V
Anode current	I_a	=	2x15	2x108	2x15	2x89	mA
Grid No.1 current	I_{g_1}	=	0	2x6	0	2x4.4	mA
Grid No.2 current	I_{g_2}	=	2x0.5	2x13	2x0.5	2x10.5	mA
Grid No.1 input power	W_{ig_1}	=	0	2x270	0	2x165	mW
Grid No.2 dissipation	W_{g_2}	=	2x0.1	2x2.6	2x0.1	2x2.1	W
Anode input power	W_{ia}	=	2x4.5	2x32.5	2x6	2x35.5	W
Anode dissipation	W_a	=	2x4.5	2x12.5	2x6	2x11	W
Output power	W_o	=	0	40	0	49	W
Total harmonic distortion	d_{tot}	=	-	5	-	5	%
Efficiency	η	=	-	62	-	69	%

7Z2 3402

R.F. POWER PENTODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr.		B teleph.		C_{ag_2} mod.	
m	MHz	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
> 15	< 20	600	45	600	11	500	40
5	60	600	36	600	6.5	500	20

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

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

HEATING : indirect; cathode oxide-coated

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

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	8.7	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	15	pF
Anode to grid No.1	C_{ag_1}	=	0.1	pF

TYPICAL CHARACTERISTICS

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

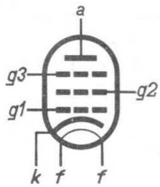
[1]) Two tubes

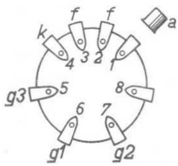
7Z2 3403

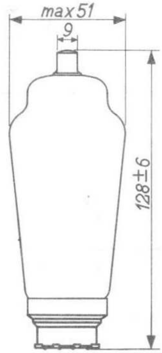
MECHANICAL DATA Dimensions in mm

→ **PE06/40 P**

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

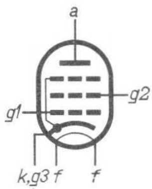


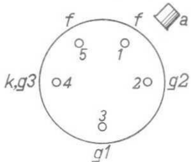


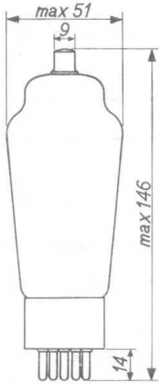


→ **PE06/40 N**

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

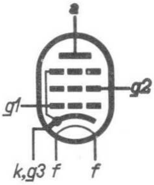


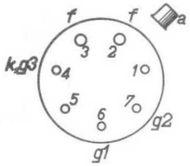


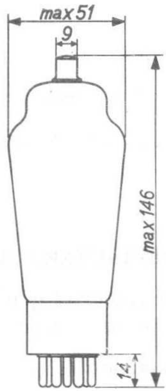


→ **PE06/40 E**

Base E
Cap 28 906 022
Net weight 65 g







Mounting position: arbitrary

7Z2 8773

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS ; R.F. CLASS C TELEGRAPHY

Wave length	λ	=	>15	>15	5 3)	m
Anode voltage	V_a	=	600	600	600	V
Grid No.1 voltage	V_{g_1}	=	-75	-40	-75	V
Grid No.2 voltage	V_{g_2}	=	300	300	300	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	109	109	195	mA
Grid No.1 current	I_{g_1}	=	2	0	0	mA
Grid No.2 current	I_{g_2}	=	11.5	11	20	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	90	40	75	V
Grid No.1 input power	W_{ig_1}	=	0.2	0	0	W
Grid No.2 dissipation	W_{g_2}	=	3.5	3.3	6	W
Anode input power	W_{ia}	=	65	65	117	W
Anode dissipation	W_a	=	20	25	45	W
Output power	W_o	=	45	40	72	W
Efficiency	η	=	69	62	62	%

1) With fixed grid bias

2) With automatic grid bias

3) Two tubes.

7Z2 3405

OPERATING CONDITIONS R.F. CLASS B TELEPHONY

Wavelength	λ	=	>15	5[1])	m
Anode voltage	V_a	=	600	600	V
Grid No.1 voltage	V_{g_1}	=	−40	−38	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	60	104	mA
Grid No.2 current	I_{g_2}	=	3	5.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	20	17.5	V
Grid No.2 dissipation	W_{g_2}	=	0.75	1.4	W
Anode input power	W_{ia}	=	36	63	W
Anode dissipation	W_a	=	25	50	W
Output power	W_o	=	11	13	W
Efficiency	η	=	30.5	20.5	%
Modulation factor	m	=	100	100	%
Grid No.1 current	I_{g_1}	=	0	0	mA
Grid No.1 input power	W_{ig_1}	=	0	0	W

OPERATING CONDITIONS AS CLASS C FREQUENCY MULTIPLIER

Wavelength	λ	=	150/75	m
Anode voltage	V_a	=	600	V
Grid No.1 voltage	V_{g_1}	=	-100	V
Grid No.2 voltage	V_{g_2}	=	300	V
Grid No.3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	87	mA
Grid No.1 current	I_{g_1}	=	1	mA
Grid No.2 current	I_{g_2}	=	11	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	110	V
Grid No.1 input power	W_{ig_1}	=	0.1	W
Grid No.2 dissipation	W_{g_2}	=	3.3	W
Anode input power	W_{ia}	=	52	W
Anode dissipation	W_a	=	25	W
Output power	W_o	=	27	W
Efficiency	η	=	52	%

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1) Two tubes

7Z2 3406

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

Wavelength	λ	=	>15	5 [1]	m
Anode voltage	V_a	=	500	500	V
Grid No.1 voltage	V_{g_1}	=	−75	−55	V
Grid No.2 voltage	V_{g_2}	=	300 [2]	160 [3]	V
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	114	146	mA
Grid No.1 current	I_{g_1}	=	1.4	2	mA
Grid No.2 current	I_{g2}	=	10	10	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	90	75	V
Grid No.1 input power	W_{ig_1}	=	0.1	0.15	W
Grid No.2 dissipation	W_{g_2}	=	3	1.6	W
Anode input power	W_{ia}	=	57	73	W
Anode dissipation	W_a	=	17	33	W
Output power	W_o	=	40	40	W
Efficiency	η	=	70	55	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	300	160	V
Modulation power	W_{mod}	=	30	40	W

[1]) Two tubes

[2]) R_{g_2} = 20 kΩ

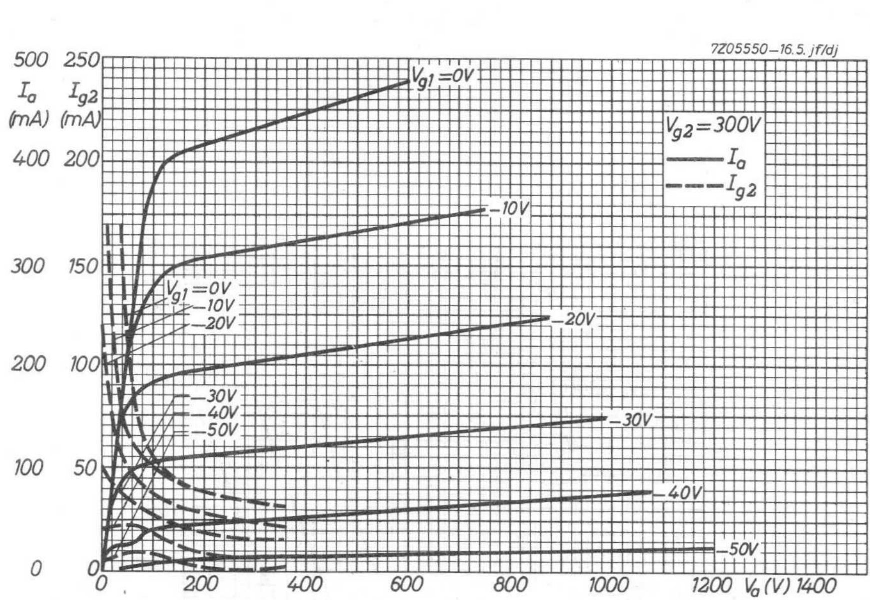
[3]) R_{g_2} = 34 kΩ

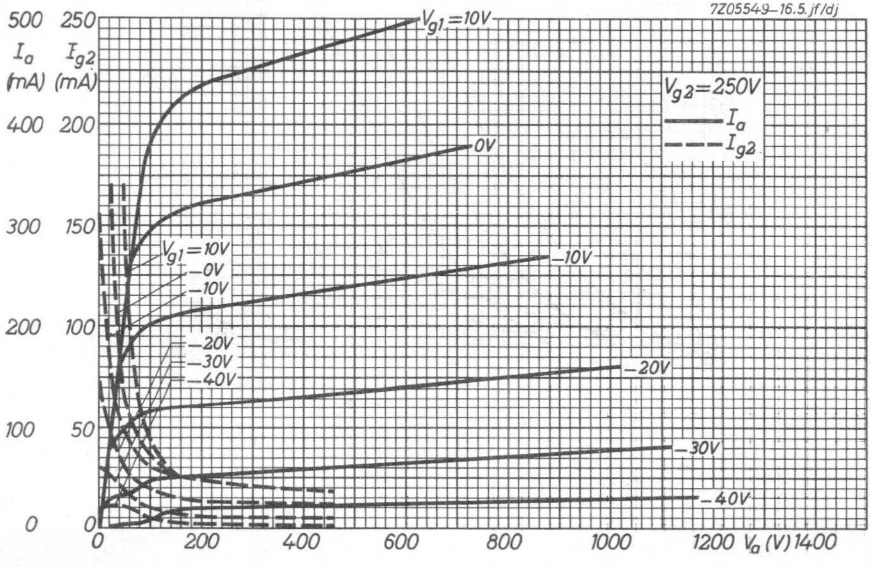
7Z2 3407

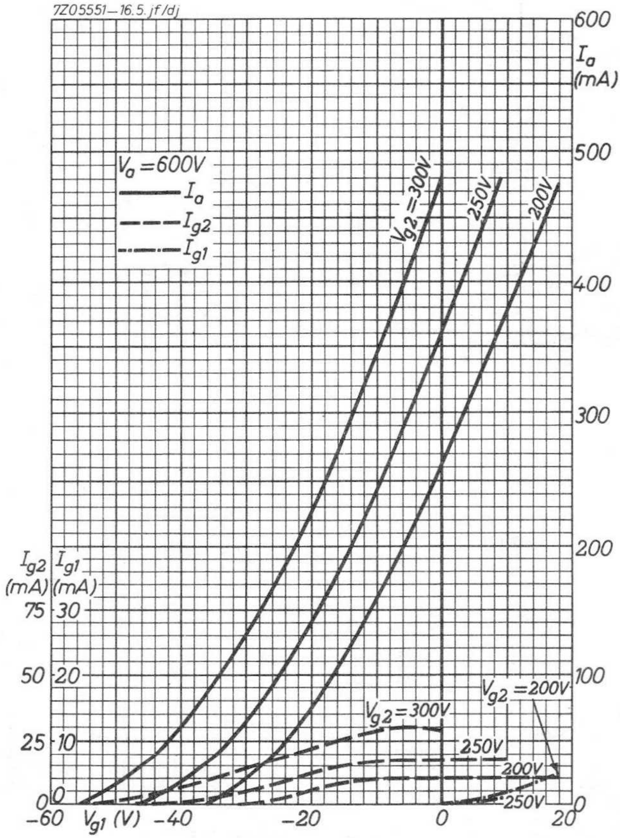
OPERATING CONDITIONS AS A.F. CLASS B AMPLIFIER AND MODULATOR
TWO TUBES

Anode voltage	V_a	=	600		V
Grid No.1 voltage	V_{g_1}	=	-45		V
Grid No.2 voltage	V_{g_2}	=	300		V
Grid No.3 voltage	V_{g_3}	=	0		V
Load resistance	$R_{aa\sim}$	=	6		kΩ
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	90	V
Anode current	I_a	=	2x34	2x115	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Grid No.2 current	I_{g_2}	=	2x3	2x18	mA
Grid No.1 input power	W_{ig_1}	=	0	0	W
Grid No.2 dissipation	W_{g_2}	=	2x0.9	2x5.4	W
Anode input power	W_{ia}	=	2x20.4	2x70	W
Anode dissipation	W_a	=	2x20.4	2x20	W
Output power	W_o	=	0	100	W
Total harmonic distortion	d_{tot}	=	–	4	%
Efficiency	η	=	–	71	%

7Z2 3408


7Z05550–16.5. jf/dj
500
250
I_a
I_{g2}
(mA)
(mA)
400
200
300
150
200
100
100
50
0
0
V_{g1}=0V
–10V
–20V
–30V
–40V
–50V
V_{g1}=0V
–10V
–20V
–30V
–40V
–50V
V_{g2}=300V
I_a
I_{g2}
0
200
400
600
800
1000
1200
V_a (V)
1400


7Z05549–16.5. jf/dj
500
250
I_a
I_{g2}
(mA)
(mA)
400
200
300
150
200
100
100
50
0
0
V_{g1}=10V
0V
–10V
–20V
–30V
–40V
V_{g1}=10V
–0V
–10V
–20V
–30V
–40V
V_{g2}=250V
I_a
I_{g2}
0
200
400
600
800
1000
1200
V_a (V)
1400


7Z05551–16.5. jf/dj
V_a = 600V
I_a
I_{g2}
I_{g1}
V_{g2} = 300V
250V
200V
600
I_a (mA)
500
400
300
200
100
0
I_{g2} (mA)
I_{g1} (mA)
75
30
50
20
25
10
0
0
V_{g2} = 300V
250V
200V
V_{g2} = 200V
250V
–60
V_{g1} (V)
–40
–20
0
20

R.F. POWER PENTODE

QUICK REFERENCE DATA

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

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

HEATING : indirect; oxide-coated cathode

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

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	12	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	20.5	pF
Anode to grid No.1	C_{ag_1}	=	0.1	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1000	V
Grid No.2 voltage	V_{g2}	=	250	V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	6.7	
Mutual conductance	S (I_a = 40 mA)	=	6	mA/V

[1]) Two tubes

7Z2 8774

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 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_{k_p}	=	max.	1.5	A
Cathode to heater voltage	V_{kf}	=	max.	100	V

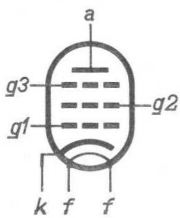
MECHANICAL DATA

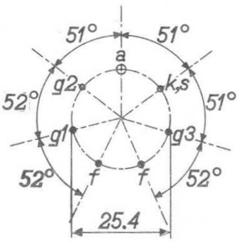
Dimensions in mm

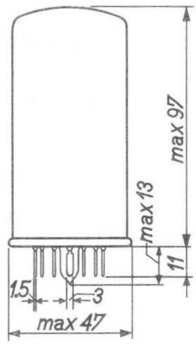
Base : Septar

→ Socket : 2422 513 00001

Net weight: 80 g







Mounting position: arbitrary

7Z2 8775

OPERATING CONDITIONS R.F. class C telegraphy

Wavelength	λ		>5	>5	>5	m
Anode voltage	V_a	=	1000	800	600	V
Grid No.1 voltage	V_{g_1}	=	−120	−110	−100	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	177	190	205	mA
Grid No.1 current	I_{g_1}	=	5	6	7.5	mA
Grid No.2 current	I_{g_2}	=	28	28	28	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	144	134	124	V
Grid No.1 input power	W_{ig_1}	=	0.65	0.73	0.84	W
Grid No.2 dissipation	W_{g_2}	=	7	7	7	W
Anode input power	W_{ia}	=	177	152	123	W
Anode dissipation	W_a	=	45	45	45	W
Output power	W_o	=	132	107	78	W
Efficiency	η	=	74.5	70.5	63.5	%

OPERATING CONDITIONS R.F. class B telephony

Wavelength	λ		>5	>5	>5	m
Anode voltage	V_a	=	1000	800	600	V
Grid No.1 voltage	V_{g_1}	=	−34	−33	−30.5	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	68	85	114	mA
Grid No.2 current	I_{g_2}	=	4.5	6	7.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	20.5	22.5	26.5	V
Grid No.2 dissipation	W_{g_2}	=	1.15	1.5	1.9	W
Anode input power	W_{ia}	=	68	68	68.4	W
Anode dissipation	W_a	=	45	45	45	W
Output power	W_o	=	23	23	23.4	W
Efficiency	η	=	34	34	34	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	I_{g_1}	=	2	4	8	mA
Grid No.1 input power	W_{ig_1}	=	0.08	0.17	0.38	W

7Z2 8344

OPERATING CONDITIONS R.F. class C

			anode and screen grid modulation		suppressor grid modulation	
Wavelength	λ		>5	>5	>5	m
Anode voltage	V_a	=	800	600	1000	V
Grid No.1 voltage	V_{g_1}	=	−120	−120	−100	V
Grid No.2 voltage	V_{g_2}	=	250	250	150	V
Grid No.3 voltage	V_{g_3}	=	0	0	−100	V
Anode current	I_a	=	120	120	72	mA
Grid No.1 current	I_{g_1}	=	6.5	6.5	10	mA
Grid No.2 current	I_{g_2}	=	23	23	24	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	150	150	140	V
Grid No.1 input power	W_{ig_1}	=	0.9	0.9	1.3	W
Grid No.2 dissipation	W_{g_2}	=	5.8	5.8	3.6	W
Anode input power	W_{ia}	=	96	72	72	W
Anode dissipation	W_a	=	21	21	45	W
Output power	W_o	=	75	51	27	W
Efficiency	η	=	78	71	37.5	%
Modulation factor	m	=	100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	250	250	-	V
Peak grid No.3 A.C. voltage	$V_{g_{3p}}$	=	-	-	100	V
Modulation power	W_{mod}	=	48	36	0	W

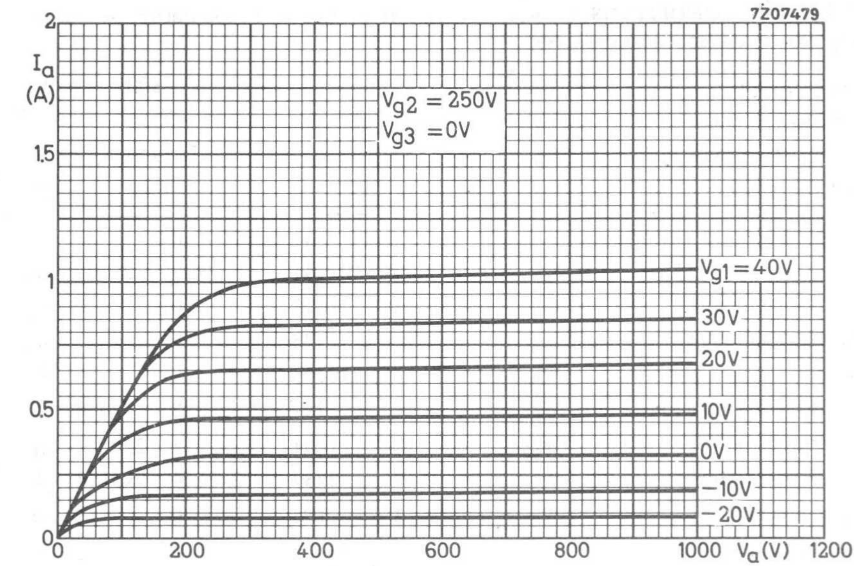
7Z2 2772

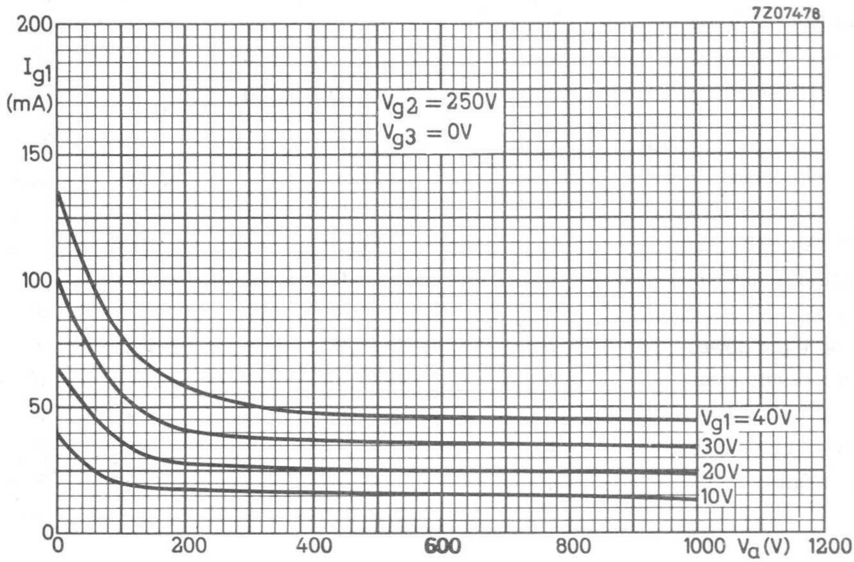
OPERATING CONDITIONS as A.F. class B amplifier and modulator, two tubes; (Grid No.3 connected to cathode)

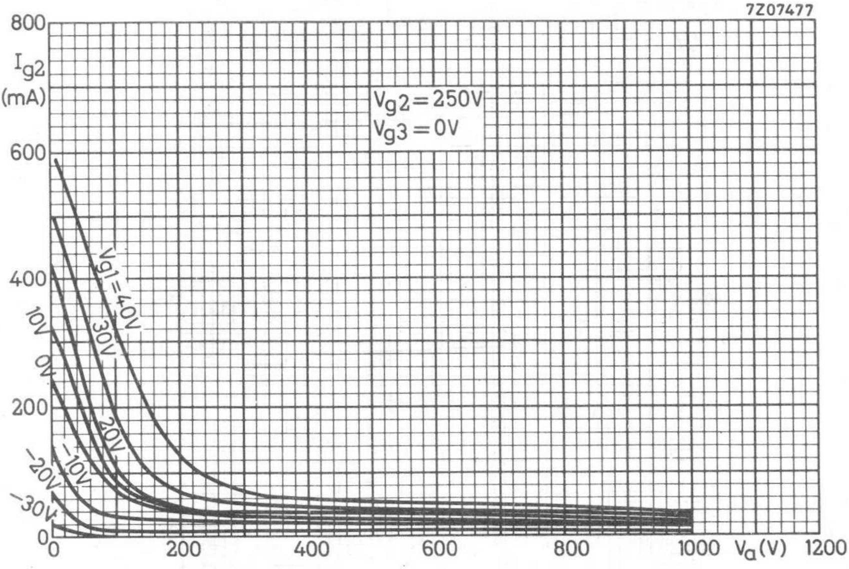
Anode voltage	V_a	=	1000		800		V
Grid No.1 voltage	V_{g_1}	=	−34		−33.5		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Load resistance	$R_{aa\sim}$	=	8800		7560		Ω
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	84	0	68	V
Anode current	I_a	=	2x26	2x134	2x28	2x108	mA
Grid No.1 current	I_{g_1}	=	0	2x0.8	0	0	mA
Grid No.2 current	I_{g_2}	=	2x5	2x28	2x8	2x27	mA
Grid No.1 input power	W_{ig_1}	=	0	2x0.03	0	0	W
Grid No.2 dissipation	W_{g_2}	=	2x1.3	2x7	2x2	2x6.8	W
Anode input power	W_{ia}	=	2x26	2x134	2x22.4	2x86.4	W
Anode dissipation	W_a	=	2x26	2x37	2x22.4	2x31.4	W
Output power	W_o	=	0	194	0	110	W
Total harmonic distortion	d_{tot}	=	-	5	-	4.5	%
Efficiency	η	=	-	72	-	63.5	%

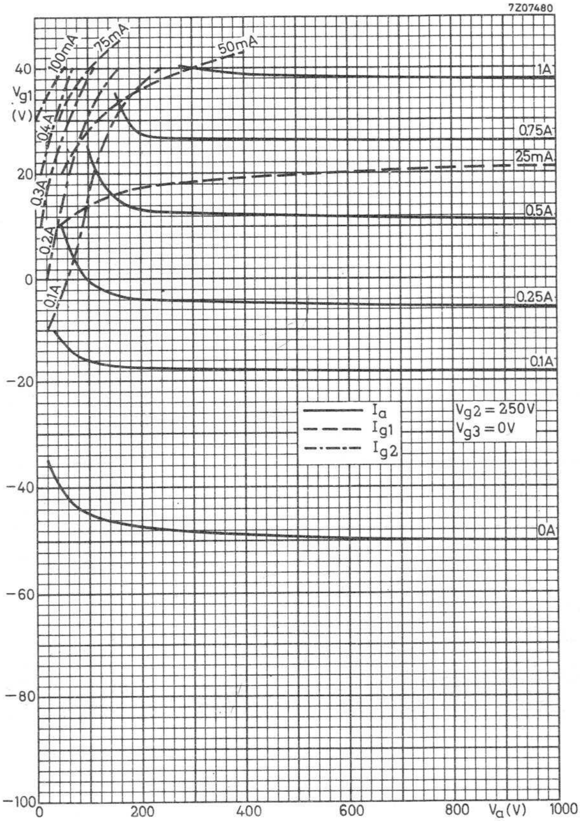
Anode voltage	V_a	=	600		V
Grid No.1 voltage	V_{g_1}	=	−33		V
Grid No.2 voltage	V_{g_2}	=	250		V
Load resistance	$R_{aa\sim}$	=	6320		Ω
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	66	V
Anode current	I_a	=	2x28	2x102	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Grid No.2 current	I_{g_2}	=	2x11	2x28	mA
Grid No.1 input power	W_{ig_1}	=	0	0	W
Grid No.2 dissipation	W_{g_2}	=	2x2.8	2x7	W
Anode input power	W_{ia}	=	2x16.8	2x61.2	W
Anode dissipation	W_a	=	2x16.8	2x20.2	W
Output power	W_o	=	0	82	W
Total harmonic distortion	d_{tot}	=	-	3.3	%
Efficiency	η	=	-	67	%

7Z2 8345


7Z07479
2
I_a
(A)
1.5
1
0.5
0
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0V
−10V
−20V
0
200
400
600
800
1000
V_a (V)
1200


7Z07478
200
I_{g1}
(mA)
150
100
50
0
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0
200
400
600
800
1000
V_a (V)
1200


7Z07477
800
I_{g2}
(mA)
600
400
200
0
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0V
-10V
-20V
-30V
0
200
400
600
800
1000
V_a(V)
1200


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

R.F. BEAM POWER TETRODE

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

QUICK REFERENCE DATA

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

λ (m)	Freq. (MHz)	C_{g_1} mod.			AB mod. [1]		
		V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
10	30	2000	50		2250	380	
		1500	40		2000	335	
		2250		75	1500	260	
					2500		490

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	10	V
Filament current	I_f	=	5	A

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	16.3	pF
Anode to all other elements except grid No.1	C_a	=	14.0	pF
Anode to grid No.1	C_{ag_1}	<	0.25	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	8.5	
Mutual conductance	S (I_a = 50 mA)	=	3.75	mA/V

[1]) Without grid current; two tubes

7Z2 8776

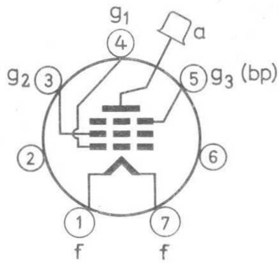
MECHANICAL DATA

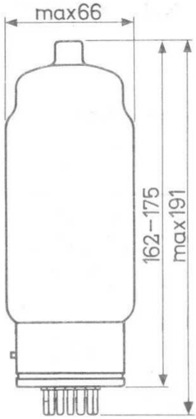
Dimensions in mm

Anode connector: 40619

Base : Giant 7-pin

Net weight : 230 g





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

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Pages 5, 6

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

27 kΩ at V_a = 1250 V
43 kΩ at V_a = 1600 V
41 kΩ at V_a = 2000 V

7Z2 8777

R.F. CLASS C TELEGRAPHY

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

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

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	30	60	60	MHz
Anode voltage	V_a	=	2000	1500	1250	V
Grid No.1 voltage	V_{g_1}	=	-120	-90	-75	V [1]
Grid No.2 voltage	V_{g_2}	=	400	300	300	V
Grid No.3 voltage	V_{g_3}	=	0	0	0	V
Anode current	I_a	=	180	180	180	mA
Grid No.1 current	I_{g_1}	=	10	12	12	mA
Grid No.2 current	I_{g_2}	=	45	30	35	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	205	175	160	V
Grid No.1 input power	W_{ig_1}	=	1.9	1.9	1.7	W
Grid No.2 dissipation	W_{g_2}	=	18	9.0	10.5	W
Anode input power	W_{ia}	=	360	270	225	W
Anode dissipation	W_a	=	85	60	55	W
Output power	W_o	=	275	210	170	W
Efficiency	η	=	76.5	78	75.5	%

[1]) For A.C. filament supply

7Z2 8778

R.F. CLASS C TELEGRAPHY

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

Frequency	f	up to	30	60	120	MHz
Anode voltage	V_a	= max.	2250	1700	1125	V
Anode input power	W_{ia}	= max.	500	375	250	W
Anode dissipation	W_a	=		max. 125		W
Anode current	I_a	=		max. 225		mA
Grid No.2 voltage	V_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 22		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 300		V
Grid No.1 current	I_{g_1}	=		max. 30		mA
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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

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

[1]) For A.C. filament supply

7Z2 8779

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

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

Frequency	f		up to 30	60	120	MHz
Anode voltage	V_a	=	max. 1600	1200	800	V
Anode input power	W_{ia}	=	max. 240	180	120	W
Anode dissipation	W_a	=		max. 67		W
Anode current	I_a	=		max. 150		mA
Grid No.2 voltage	V_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 15		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 300		V
Grid No.1 current	I_{g_1}	=		max. 25		mA
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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

Frequency	f	=	30	60	MHz
Anode voltage	V_a	=	1600	1250	V
Grid No.1 voltage	V_{g_1}	=	−160	−160	V [1]
Grid No.2 voltage	V_{g_2}	=	300	300	V [2]
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	150	150	mA
Grid No.1 current	I_{g_1}	=	12	13	mA
Grid No.2 current	I_{g_2}	=	30	35	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	250	250	V
Grid No.1 input power	W_{ig_1}	=	2.7	2.9	W
Grid No.2 dissipation	W_{g_2}	=	9	10.5	W
Anode input power	W_{ia}	=	240	187.5	W
Anode dissipation	W_a	=	60	47.5	W
Output power	W_o	=	180	140	W
Efficiency	η	=	75	74.5	%
Modulation factor	m	=	100	100	%
Modulation power	W_{mod}	=	120	94	W

[1]) For A.C. filament supply

[2]) See page 2

7Z2 8780

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

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

Frequency	f	up to	30	60	120	MHz
Anode voltage	V_a	= max.	2000	1500	1000	V
Anode input power	W_{ia}	= max.	400	300	200	W
Anode dissipation	W_a	=		max. 100		W
Anode current	I_a	=		max. 200		mA
Grid No.2 voltage	V_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 20		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 300		V
Grid No.1 current	I_{g_1}	=		max. 30		mA
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

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

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

[1]) For A.C. filament supply

[2]) See page 2

7Z2 8781

R.F. CLASS C GRID MODULATION

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

Frequency	f		up to	30	60	120	MHz
Anode voltage	V_a	=	max.	2000	1760	1520	V
Anode input power	W_{ia}	=	max.	150	132	114	W
Anode dissipation	W_a	=			max. 100		W
Anode current	I_a	=			max. 100		mA
Grid No.2 voltage	V_{g_2}	=			max. 400		V
Grid No.2 dissipation	W_{g_2}	=			max. 15		W
Negative grid No.1 voltage	$-V_{g_1}$	=			max. 200		V
Grid No.1 circuit resistance	R_{g_1}	=			max. 30		kΩ

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

Frequency	f	=	30	up to	120	MHz	
Anode voltage	V_a	=	2000		1500	V	
Grid No.1 voltage	V_{g_1}	=	−120		−140	V	1)
Grid No.2 voltage	V_{g_2}	=	400		400	V	
Grid No.3 voltage	V_{g_3}	=	0		0	V	
Anode current	I_a	=	75		70	mA	
Grid No.1 current	I_{g_1}	=					2)
Grid No.2 current	I_{g_2}	=	3		3	mA	
Peak A.C. input voltage, R.F.	$V_{g_{1p}}$	=	120		145	V	
Peak A.C. input voltage, A.F.	$V_{g_{1p}}$	=	60		60	V	
Grid No.1 input power	W_{ig_1}	=					3)
Grid No.2 dissipation	W_{g_2}	=	1.2		1.2	W	
Anode input power	W_{ia}	=	150		105	W	
Anode dissipation	W_a	=	100		65	W	
Output power	W_o	=	50		40	W	
Efficiency	η	=	33		38	%	

1) Fixed supply or cathode resistor bias, unbypassed for A.F., is recommended
2) Usually negligible
3) R.F. driving power is never more than 2 W
A.F. driving power is usually not more than 1 W

7Z2 8782

R.F. CLASS C GRID MODULATION

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

Frequency	f		up to	30	60	120	MHz
Anode voltage	V_a	=	max.	2250	1980	1710	V
Anode input power	W_{ia}	=	max.	200	176	152	W
Anode dissipation	W_a	=			max. 125		W
Anode current	I_a	=			max. 125		mA
Grid No.2 voltage	V_{g_2}	=			max. 400		V
Grid No.2 dissipation	W_{g_2}	=			max. 20		W
Negative grid No.1 voltage	$-V_{g_1}$	=			max. 200		V
Grid No.1 circuit resistance	R_{g_1}	=			max. 30		kΩ

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

Frequency	f	=	30	MHz	
Anode voltage	V_a	=	2250	V	
Grid No.1 voltage	V_{g_1}	=	-110	V	1)
Grid No.2 voltage	V_{g_2}	=	400	V	
Grid No.3 voltage	V_{g_3}	=	0	V	
Anode current	I_a	=	85	mA	
Grid No.1 current	I_{g_1}	=			2)
Grid No.2 current	I_{g_2}	=	2.5	mA	
Peak A.C. input voltage, R.F.	$V_{g_{1p}}$	=	135	V	
Peak A.C. input voltage, A.F.	$V_{g_{1p}}$	=	55	V	
Grid No.1 input power	W_{ig_1}	=			3)
Grid No.2 dissipation	W_{g_2}	=	1.0	W	
Anode input power	W_{ia}	=	191	W	
Anode dissipation	W_a	=	116	W	
Output power	W_o	=	75	W	
Efficiency	η	=	39	%	

1) Fixed supply or cathode resistor bias, unbypassed for A.F., is recommended
2) Usually negligible
3) R.F. driving power is never more than 2 W
A.F. driving power is usually not more than 1 W

7Z2 8783

R.F. CLASS B TELEPHONY

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

Frequency	f		up to 30	60	120	MHz
Anode voltage	V_a	=	max. 2000	1760	1520	V
Anode input power	W_{ia}	=	max. 150	132	114	W
Anode dissipation	W_a	=		max. 100		W
Anode current	I_a	=		max. 100		mA
Grid No.2 voltage	V_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 15		W

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	30 up to	120	MHz
Anode voltage	V_a	=	2000	1500	V
Grid No.1 voltage	V_{g_1}	=	−75	−60	V [1]
Grid No.2 voltage	V_{g_2}	=	400	400	V
Grid No.3 voltage	V_{g_3}	=	0	0	V
Anode current	I_a	=	75	100	mA
Grid No.2 current	I_{g_2}	=	3	4	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	80	70	V
Grid No.2 dissipation	W_{g_2}	=	1.2	1.6	W
Anode input power	W_{ia}	=	150	150	W
Anode dissipation	W_a	=	100	100	W
Output power	W_o	=	50	50	W
Efficiency	η	=	33	33	%
Modulation factor	m	=	100	100	%
Grid No.1 input power	W_{ig_1}		$\leqq 2$	$\leqq 2$	W

[1]) For A.C. filament supply

7Z2 8784

R.F. CLASS B TELEPHONY

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

Frequency	f		up to	30	60	120	MHz
Anode voltage	V_a	=	max.	2250	1980	1710	V
Anode input power	W_{ia}	=	max.	200	176	152	W
Anode dissipation	W_a	=			max. 125		W
Anode current	I_a	=			max. 125		mA
Grid No.2 voltage	V_{g_2}	=			max. 400		V
Grid No.2 dissipation	W_{g_2}	=			max. 20		W

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

Frequency	f	=	30	MHz
Anode voltage	V_a	=	2250	V
Grid No.1 voltage	V_{g_1}	=	−60	V [1]
Grid No.2 voltage	V_{g_2}	=	400	V
Grid No.3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	85	mA
Grid No.2 current	I_{g_2}	=	3	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	70	V
Grid No.2 dissipation	W_{g_2}	=	1.2	W
Anode input power	W_{ia}	=	191	W
Anode dissipation	W_a	=	121	W
Output power	W_o	=	70	W
Efficiency	η	=	36.5	%
Modulation factor	m	=	100	%
Grid No.1 input power	W_{ig_1}	≦	2	W

[1]) For A.C. filament supply

7Z2 8785

A.F. CLASS AB AMPLIFIER AND MODULATOR

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

Anode voltage	V_a	=	max.	2250	V
Anode current	I_a	=	max.	180	mA
Anode input power	W_{ia}	=	max.	360	W
Anode dissipation	W_a	=	max.	100	W
Grid No.2 voltage	V_{g_2}	=	max.	1100	V
Grid No.2 dissipation	W_{g_2}	=	max.	22	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1]

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

V_a	=	2250		2000		1500		V
V_{g_1}	=	−95		−90		−85		V [2]
V_{g_2}	=	750		750		750		V
V_{g_3}	=	0		0		0		V
$R_{aa\sim}$	=	20		16		9.3		kΩ
$V_{g_1g_1p}$	=	0	170	0	160	0	160	V
I_a	=	2x25	2x127.5	2x25	2x132.5	2x25	2x152.5	mA
I_{g_2}	=	2x1.0	2x26.5	2x1.0	2x21.5	2x1.0	2x22.5	mA
W_{ig_1}	=	0	0	0	0	0	0	W
W_{g_2}	=	2x0.75	2x19.9	2x0.75	2x16.1	2x0.75	2x16.9	W
W_{ia}	=	2x56	2x287	2x50	2x265	2x37.5	2x229	W
W_a	=	2x56	2x97	2x50	2x97.5	2x37.5	2x99	W
W_o	=	0	380	0	335	0	260	W
η	=	–	66	–	63	–	57	%

[1] With fixed grid bias. Cathode bias is not recommended

[2] For A.C. filament supply

7Z2 2639

A.F. CLASS AB AMPLIFIER AND MODULATOR

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

Anode voltage	V_a	=	max.	2500	V
Anode current	I_a	=	max.	225	mA
Anode input power	W_{ia}	=	max.	450	W
Anode dissipation	W_a	=	max.	125	W
Grid No.2 voltage	V_{g_2}	=	max.	1100	V
Grid No.2 dissipation	W_{g_2}	=	max.	22	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1])

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

Anode voltage	V_a	=	2500		V
Grid No.1 voltage	V_{g_1}	=	-95		V [2])
Grid No.2 voltage	V_{g_2}	=	750		V
Grid No.3 voltage	V_{g_3}	=	0		V
Load resistance	$R_{aa\sim}$	=	19		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_{1p}}$	=	0	180	V
Anode current	I_a	=	2x25	2x145	mA
Grid No.2 current	I_{g_2}	=	2x1.0	2x27	mA
Grid No.1 input power	W_{ig_1}	=	0	0	W
Grid No.2 dissipation	W_{g_2}	=	2x0.75	2x20.3	W
Anode input power	W_{ia}	=	2x62.5	2x362.5	W
Anode dissipation	W_a	=	2x62.5	2x117.5	W
Output power	W_o	=	0	490	W
Efficiency	η	=	–	67.5	%

[1]) With fixed grid bias. Cathode bias is not recommended
[2]) For A.C. filament supply

7Z2 2640

R.F. POWER TETRODE

QUICK REFERENCE DATA

Freq.	C telegr.		C_{ag_2} mod.		S.S.B.	
(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_ℓ (W)
50	3000	280	2500	230		
50	1500	165	1500	140		
50	600	45	600	45		
220	1500	110	1500	75		
30					2500	87
30					2000	77
30					1500	58

B mod. [1]			
$I_{g_1} = 0$		$I_{g_1} > 0$	
V_a (V)	W_o (W)	V_a (V)	W_o (W)
1750	175	1800	270
1500	145	1500	250
1000	80	1000	170
		600	90

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6	V
Filament current	I_f	=	3.5	A

COOLING: radiation/low-velocity air flow

CAPACITANCES

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

[1]) Two tubes

7Z2 2622

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	μ_{g2g1}	=	5	

MECHANICAL DATA

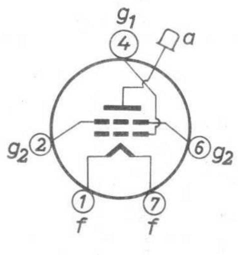
Dimensions in mm

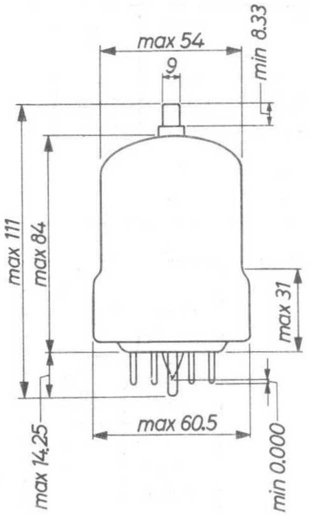
Base : Septar

→ Socket : 2422 513 00001

Anode connector: 40624

Net weight : 85 g





Mounting position: vertical with base up or down

TEMPERATURE LIMITS (Absolute limits)

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

7Z2 8786

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

Frequency	f	=	50	50	50	220	MHz
Anode voltage	V_a	=	3000	1500	600	1500	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	−100	−85	−75	−85	V
Anode current	I_a	=	115	150	150	117	mA
Grid No.2 current	I_{g_2}	=	8	24	40	24	mA
Grid No.1 current	I_{g_1}	=	5	12	15	12	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	180	185	170	190	V
Grid No.1 input power	W_{ig_1}	=	0.8	2.0	2.3	8	W
Grid No.2 dissipation	W_{g_2}	=	2.0	6	10	6	W
Anode input power	W_{ia}	=	345	225	90	175	W
Anode dissipation	W_a	=	65	60	45	65	W
Output power	W_o	=	280	165	45	110	W
Efficiency	η	=	81	73	50	63	%

7Z2 2624

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

7Z2 2625

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_{g_2}	= max.	600	V
Grid No.2 dissipation	W_{g_2}	= max.	10	W
Grid No.1 circuit resistance	R_{g_1}	= max.	250	kΩ

OPERATING CONDITIONS

Frequency	f	=	30		30		30		MHz
Anode voltage	V_a	=	2500		2000		1500		V
Grid No.2 voltage	V_{g_2}	=	405		450		480		V
Grid No.1 voltage 1)	V_{g_1}	=	-88		-100		-86		V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	165	0	190	0	150	V
Anode current	I_a	=	7	70	22	80	30	90	mA
Grid No.2 current	I_{g_2}	=	–	2	–	2	–	3	mA
Grid No.1 current	I_{g_1}	=	–	8	–	20	–	15	mA
Grid No.2 dissipation	W_{g_2}	=	–	22.5	–	26	–	13.5	W
Grid No.1 input power	W_{ig_1}	=	–	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 %.

7Z2 2626

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	150	mA
Anode dissipation	W_a	=	max.	65	W
Grid No.2 voltage	V_{g_2}	=	max.	600	V
Grid No.2 dissipation	W_{g_2}	=	max.	20	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 current	I_{g_1}	=	max.	20	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	250	kΩ

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

V_a	=	1750		1500		1000		V
V_{g_2}	=	500		500		500		V
V_{g_1}	=	−115		−110		−100		V
$R_{aa\sim}$	=	20		15		9		kΩ
$V_{g_1g_1p}$	=	0	180	0	170	0	170	V
I_a	=	2x20	2x85	2x30	2x90	2x30	2x85	mA
I_{g_2}	=	–	2x11.5	–	2x10	–	2x15	mA
W_{g_2}	=	–	2x6	–	2x5	–	2x7.5	W
W_{ia}	=	2x35	2x150	2x45	2x135	2x30	2x85	W
W_a	=	2x35	2x62.5	2x45	2x62.5	2x30	2x45	W
W_o	=	0	175	0	145	0	80	W
η	=	–	59	–	54	–	47	%
d_{tot}	=	–	4.5	–	3	–	3	%

7Z2 2627

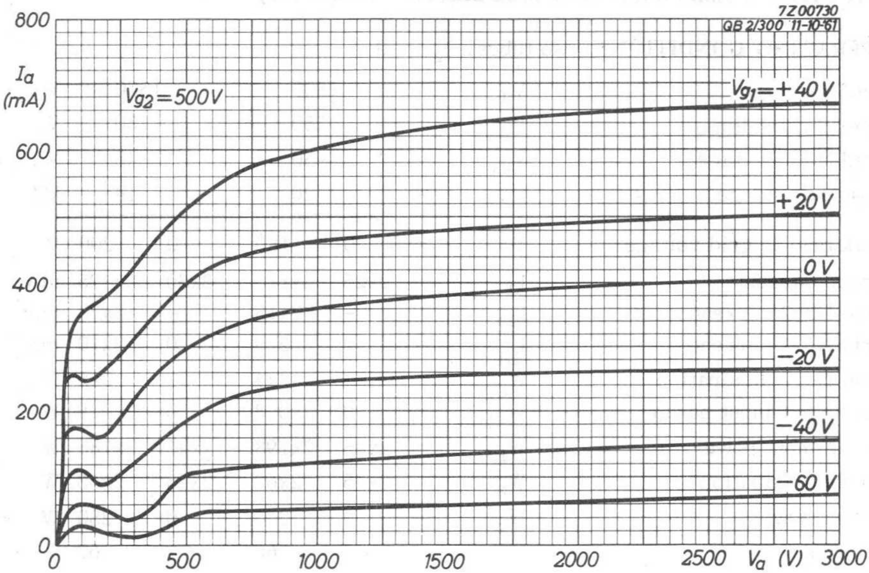
A.F. CLASS B AMPLIFIER AND MODULATOR (continued)

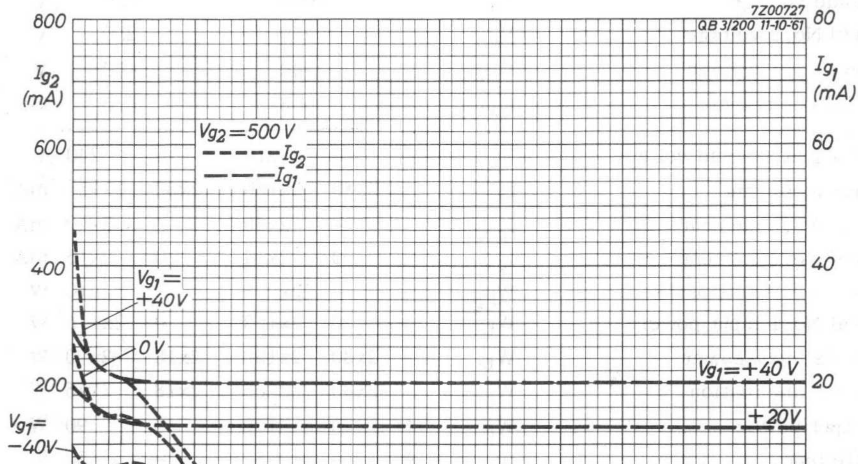
OPERATING CONDITIONS, two tubes. $I_{g_1} > 0$

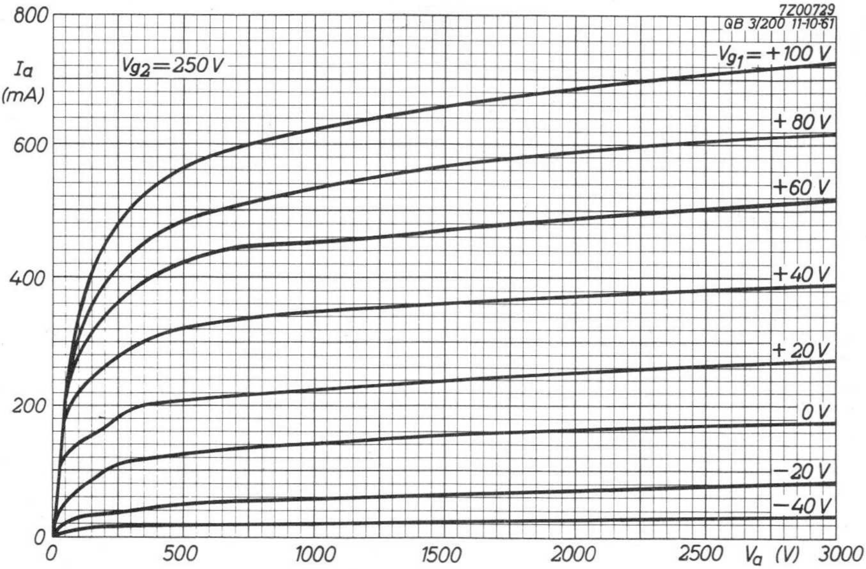
Anode voltage	V_a	=	1800		1500		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-50		-45		V
Load resistance	$R_{aa\sim}$	=	20		14		kΩ
Peak grid to grid voltage	$V_{g_1g_1p}$	=	0	180	0	200	V
Anode current	I_a	=	2x25	2x110	2x30	2x125	mA
Grid No.2 current	I_{g_2}	=	–	2x15	–	2x20	mA
Grid No.1 current	I_{g_1}	=	0	2x9	0	2x10	mA
Grid No.2 dissipation	W_{g_2}	=	–	2x4	–	2x5	W
Grid No.1 input power	W_{ig_1}	=	0	2x0.8	0	2x0.9	W
Anode input power	W_{ia}	=	2x45	2x198	2x45	2x188	W
Anode dissipation	W_a	=	2x45	2x63	2x45	2x63	W
Output power	W_o	=	0	270	0	250	W
Efficiency	η	=	–	68	–	67	%
Total harmonic distortion	d_{tot}	=	–	5	–	6	%

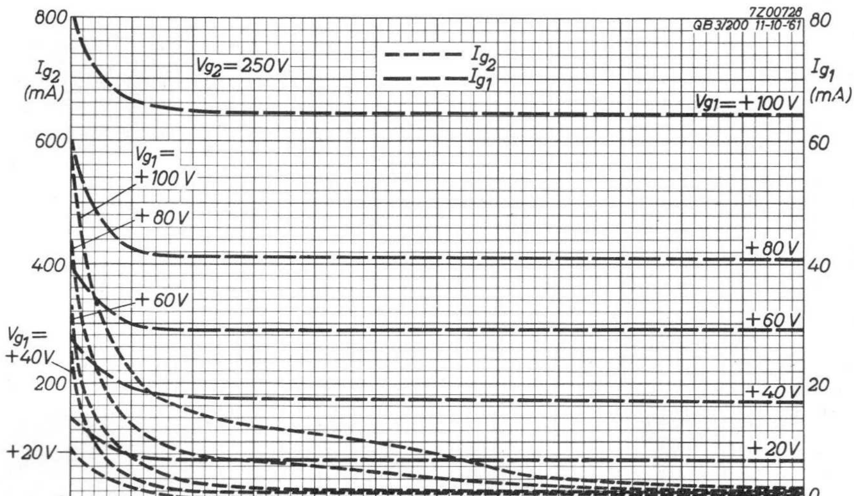
Anode voltage	V_a	=	1000		600		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-40		-40		V
Load resistance	$R_{aa\sim}$	=	6.8		3.6		kΩ
Peak grid to grid voltage	$V_{g_1g_1p}$	=	0	210	0	240	V
Anode current	I_a	=	2x30	2x150	2x30	2x150	mA
Grid No.2 current	I_{g_2}	=	–	2x30	–	2x40	mA
Grid No.1 current	I_{g_1}	=	0	2x14	0	2x15	mA
Grid No.2 dissipation	W_{g_2}	=	–	2x7.5	–	2x10	W
Grid No.1 input power	W_{ig_1}	=	0	2x1.3	0	2x1.6	W
Anode input power	W_{ia}	=	2x30	2x150	2x18	2x90	W
Anode dissipation	W_a	=	2x30	2x65	2x18	2x45	W
Output power	W_o	=	0	170	0	90	W
Efficiency	η	=	–	57	–	50	%
Total harmonic distortion	d_{tot}	=	–	6	–	10	%

7Z2 2628


7Z00730
QB 2/300 11-10-61
800
600
400
200
0
I_a (mA)
V_{g2}=500V
V_{g1}=+40V
+20V
0V
−20V
−40V
−60V
0
500
1000
1500
2000
2500
3000
V_a (V)


7Z00727
QB 3/200 11-10-61
800
600
400
200
0
I_{g2} (mA)
80
60
40
20
0
I_{g1} (mA)
V_{g2}=500V
I_{g2}
I_{g1}
V_{g1}= +40V
0V
V_{g1}= −40V
V_{g1}=+40V
+20V
0
500
1000
1500
2000
2500
3000
V_a (V)


7Z00729
QB 3/200 11-10-61
Ia
(mA)
Vg2=250 V
Vg1=+100 V
+80 V
+60 V
+40 V
+20 V
0 V
−20 V
−40 V
Va (V)
0
200
400
600
800
500
1000
1500
2000
2500
3000


7Z00728
QB3/200 11-10-61
Ig2
(mA)
Ig1
(mA)
Vg2=250V
Ig2
Ig1
Vg1=+100 V
+80 V
+60 V
+40 V
+20 V
Vg1=
+100 V
+80 V
+60V
Vg1=
+40V
+20V
Va (V)
0
200
400
600
800
20
40
60
80
500
1000
1500
2000
2500
3000

R.F. POWER TETRODE

QUICK REFERENCE DATA									
λ	Freq.	C telegr.		B teleph.		C_{ag_2} mod.		B mod.[1]	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
2.5	120	3000	375	3000	58	2500	300	2500	550
2.5	120	2500	375	2500	55	2000	225	2000	550
2.5	120	2000	275	2000	54	1500	157	1500	455
2.5	120	1500	110						
2	150	2500	360						
1.5	200	2000	225						

HEATING : direct; filament thoriated tungsten

Filament voltage	V_f	=	5	V
Filament current	I_f	=	6.5	A

COOLING: Radiation/low-velocity air flow

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

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

7Z2 2615

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.

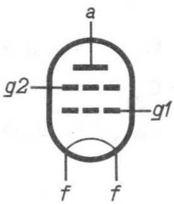
MECHANICAL DATA Dimensions in mm

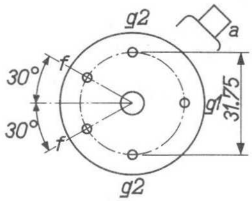
Base : giant 5 p

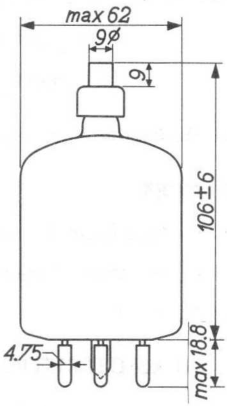
→ Socket : 2422 512 01001

Anode connector: 40624

Net weight : 120 g







Mounting position: vertical with base up or down

7Z2 8787

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to 120	up to 170	up to 200	MHz
Anode voltage	V_a =	max. 3000	max. 2500	max. 2200	V
Anode input power	W_{ia} =	max. 625	max. 560	max. 435	W
Anode current	I_a =		max. 225		mA
Anode dissipation	W_a =		max. 125 [1]		W
Grid No.2 voltage	V_{g_2} =		max. 400		V
Grid No.2 dissipation	W_{g_2} =		max. 20		W
Negative grid No.1 voltage	$-V_{g_1}$ =		max. 500		V
Grid No.1 current	I_{g_1} =		max. 15		mA

OPERATING CONDITIONS

Frequency	f		<120	<120	<120	<120	MHz
Anode voltage	V_a	=	3000	2500	2000	1500	V
Grid No.2 voltage	V_{g_2}	=	350	350	350	350	V
Grid No.1 voltage	V_{g_1}	=	−150	−150	−100	−150	V
Anode current	I_a	=	167	200	200	110	mA
Grid No.2 current	I_{g_2}	=	30	40	50	56	mA
Grid No.1 current	I_{g_1}	=	6.5	9	9	8	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	300	330	260	225	V
Grid No.1 input power	W_{ig_1}	=	2	3	2.4	1.7	W
Grid No.2 dissipation	W_{g_2}	=	10.5	14	17.5	19.6	W
Anode input power	W_{ia}	=	500	500	400	165	W
Anode dissipation	W_a	=	125	125	125	55	W
Output power	W_o	=	375	375	275	110	W
Efficiency	η	=	75	75	69	67	%

[1]) Anode red hot, temperature = 850 ^{o}C

7Z2 2617

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	up to 120	up to 170	up to 200	MHz
Anode voltage	V_a =	max.3000	max.2500	max.2200	V
Anode input power	W_{ia} =	max. 200	max. 190	max. 150	W
Anode current	I_a =		max. 135		mA
Anode dissipation	W_a =		max. 125 [1]		W
Grid No.2 voltage	V_{g_2} =		max. 400		V
Grid No.2 dissipation	W_{g_2} =		max. 14		W

OPERATING CONDITIONS

Frequency	f		<120	<120	<120	MHz
Anode voltage	V_a	=	3000	2500	2000	V
Grid No.2 voltage	V_{g_2}	=	350	350	350	V
Grid No.1 voltage	V_{g_1}	=	−50	−50	−50	V
Anode current	I_a	=	60	70	83	mA
Grid No.2 current	I_{g_2}	=	1	1	1.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	50	55	65	V
Grid No.2 dissipation	W_{g_2}	=	0.35	0.35	0.52	W
Anode input power	W_{ia}	=	180	175	166	W
Anode dissipation	W_a	=	122	120	112	W
Output power	W_o	=	58	55	54	W
Efficiency	η	=	32	31.5	32.5	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	I_{g_1}	=	4.5	4	4	mA
Grid No.1 input power	W_{ig_1}	=	0.45	0.44	0.52	W

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

7Z2 2618

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 120	up to 170	up to 200	MHz
Anode voltage	V_a	=	max.2500	max.2100	max.1800	V
Anode input power	W_{ia}	=	max. 415	max. 375	max. 290	W
Anode current	I_a	=		max. 200		mA
Anode dissipation	W_a	=		max. 83		W
Grid No.2 voltage	V_{g_2}	=		max. 400		V
Grid No.2 dissipation	W_{g_2}	=		max. 20		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 500		V
Grid No.1 current	I_{g_1}	=		max. 15		mA

OPERATING CONDITIONS

Frequency	f		<120	<120	<120	MHz
Anode voltage	V_a	=	2500	2000	1500	V
Grid No.2 voltage	V_{g_2}	=	350	350	300	V
Grid No.1 voltage	V_{g_1}	=	−210	−220	−150	V
Anode current	I_a	=	152	150	160	mA
Grid No.2 current	I_{g_2}	=	30	33	33	mA
Grid No.1 current	I_{g_1}	=	4.5	5	10	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	380	390	250	V
Grid No.1 input power	W_{ig_1}	=	1.7	2	2.5	W
Grid No.2 dissipation	W_{g_2}	=	10.5	11.5	10	W
Anode input power	W_{ia}	=	380	300	240	W
Anode dissipation	W_a	=	80	75	83	W
Output power	W_o	=	300	225	157	W
Efficiency	η	=	79	75	65	%
Modulation factor	m	=	100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	300	300	255	V
Modulation power	W_{mod}	=	190	150	120	W

7Z2 2619

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

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	225	mA
Anode dissipation	W_a	=	max.	125	W[1])
Grid No.2 voltage	V_{g_2}	=	max.	600	V
Grid No.2 dissipation	W_{g_2}	=	max.	20	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	150	kΩ

OPERATING CONDITIONS, two tubes

V_a	=	2500		2000		1500		V
V_{g_1}	=	-97		-95.5		-94		V
V_{g_2}	=	600		600		600		V
$R_{aa\sim}$	=	25		17.6		12		kΩ
$V_{g_1 g_{1p}}$	=	0	190	0	186	0	185	V
I_a	=	2x30	2x108	2x30	2x111	2x30	2x109	mA
I_{g_2}	=	2x0.1	2x13	2x0.1	2x12	2x0.15	2x13.5	mA
W_{g_2}	=	2x0.1	2x7.8	2x0.1	2x7.2	2x0.1	2x8.1	W
W_{ia}	=	2x75	2x270	2x60	2x222	2x45	2x163	W
W_a	=	2x75	2x97.5	2x60	2x92	2x45	2x78	W
W_o	=	0	345	0	260	0	170	W
η	=	–	64	–	58.5	–	52	%
d_{tot}	=	–	4.0	–	3.6	–	3.5	%

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

7Z2 2620

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

LIMITING VALUES (Absolute limits)

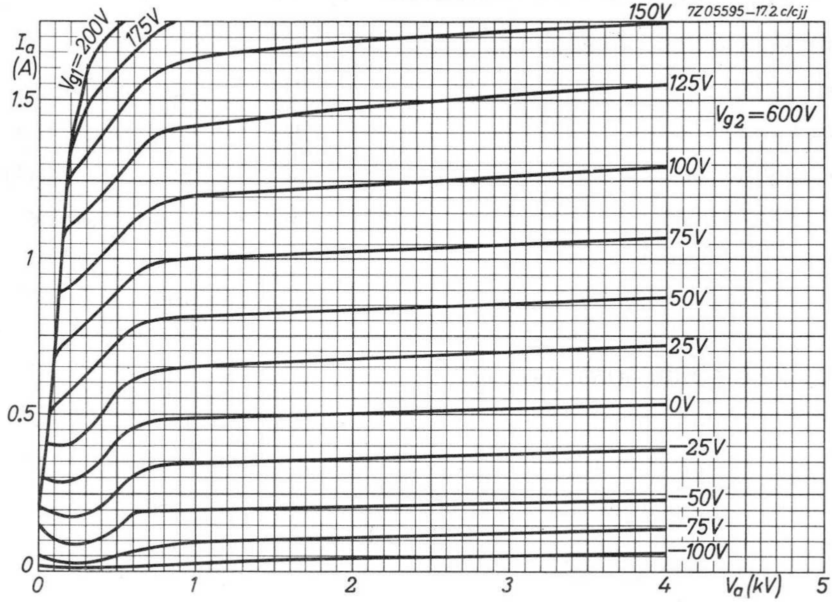
Anode voltage	V_a	=	max.	3000	V
Anode current	I_a	=	max.	225	mA
Anode dissipation	W_a	=	max.	125	W[1])
Grid No.2 voltage	V_{g_2}	=	max.	400	V
Grid No.2 dissipation	W_{g_2}	=	max.	20	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V

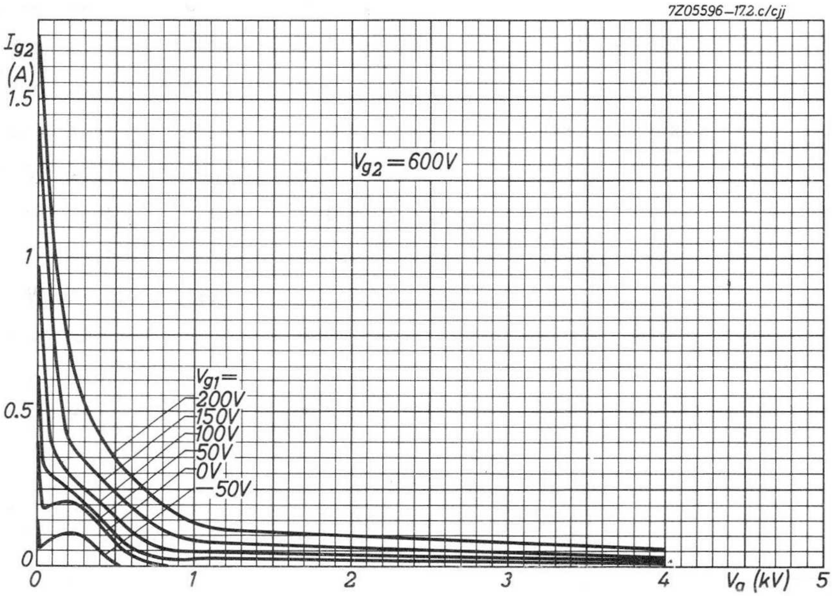
OPERATING CONDITIONS , two tubes

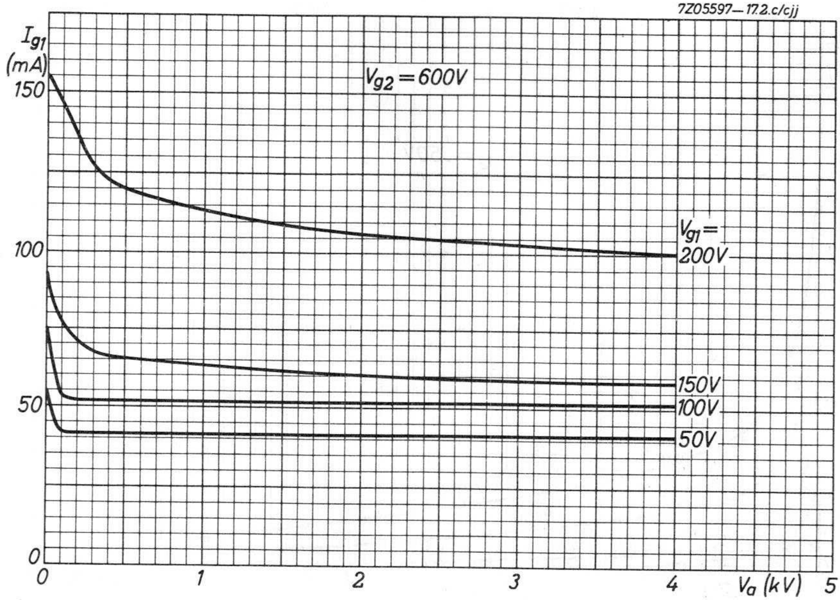
V_a	=	2500		2000		1500		V
V_{g_1}	=	-51		-50		-48		V
V_{g_2}	=	350		350		350		V
$R_{aa\sim}$	=	20		12		7.2		kΩ
$V_{g_1g_{1p}}$	=	0	240	0	296	0	330	V
I_a	=	2x30	2x151	2x30	2x197.5	2x30	2x227.5	mA
I_{g_1}	=	0	2x8.5	0	2x12	0	2x16	mA
I_{g_2}	=	2x0.1	2x18	2x0.15	2x32	2x0.25	2x42	mA
W_{ig_1}	=	0	2x0.9	0	2x1.6	0	2x2.4	W
W_{g_2}	=	0	2x6.3	2x0.1	2x11.2	2x0.1	2x15	W
W_{ia}	=	2x75	2x377.5	2x60	2x395	2x45	2x341.5	W
W_a	=	2x75	2x102.5	2x60	2x120	2x45	2x114	W
W_o	=	0	550	0	550	0	455	W
η	=	–	72.5	–	69.5	–	66.5	%
d_{tot}	=	–	5	–	5	–	5	%

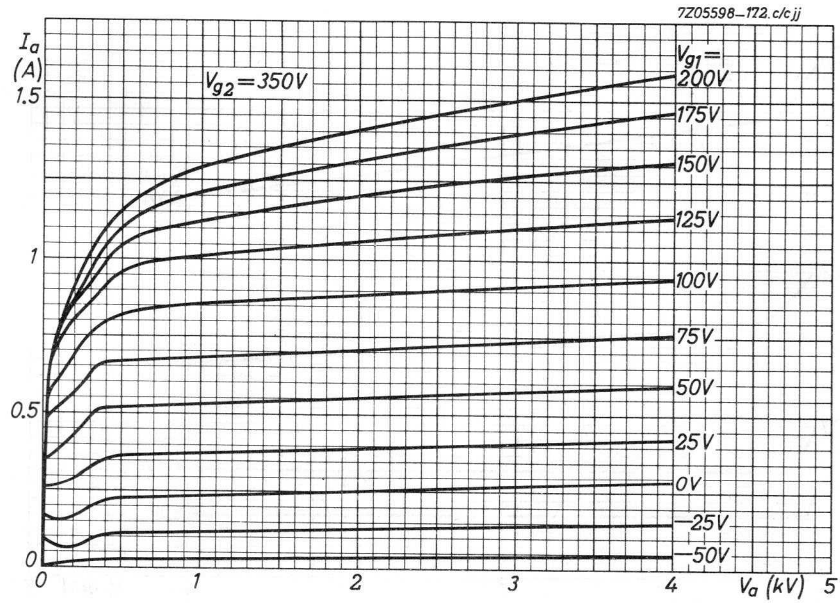
[1]) Anode red hot, temperature = 850 °C

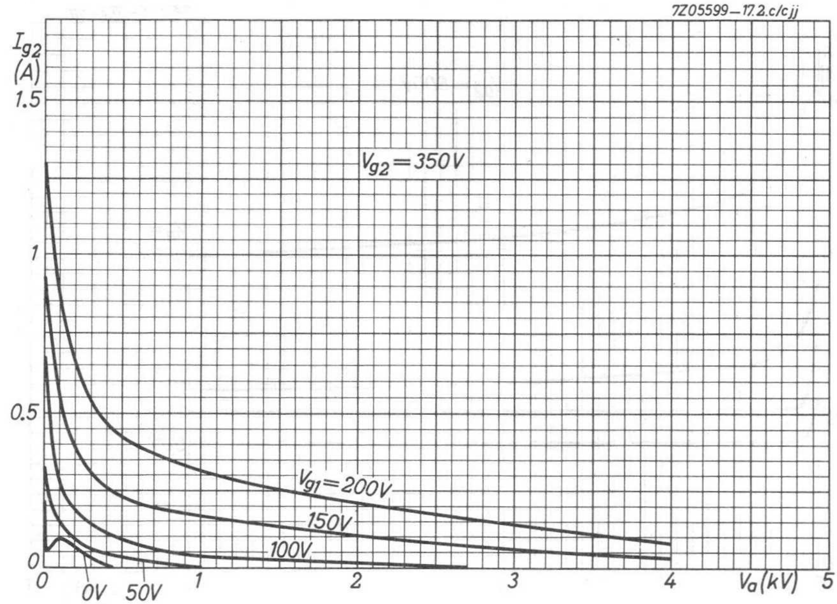
7Z2 2621

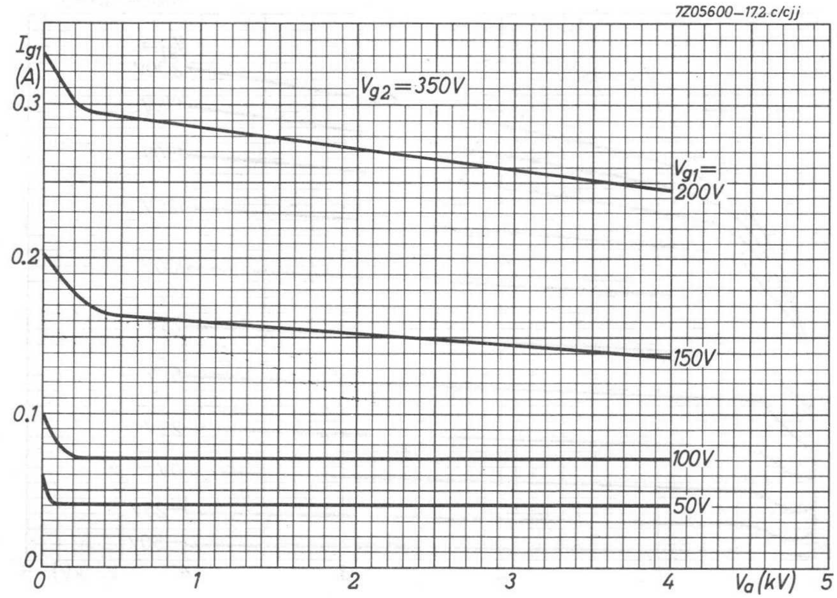

7Z05595-17.2.c/cjj
I_a (A)
1.5
1
0.5
0
V_{g1}=200V
175V
150V
125V
100V
75V
50V
25V
0V
—25V
—50V
—75V
—100V
V_{g2}=600V
0
1
2
3
4
V_a (kV)
5

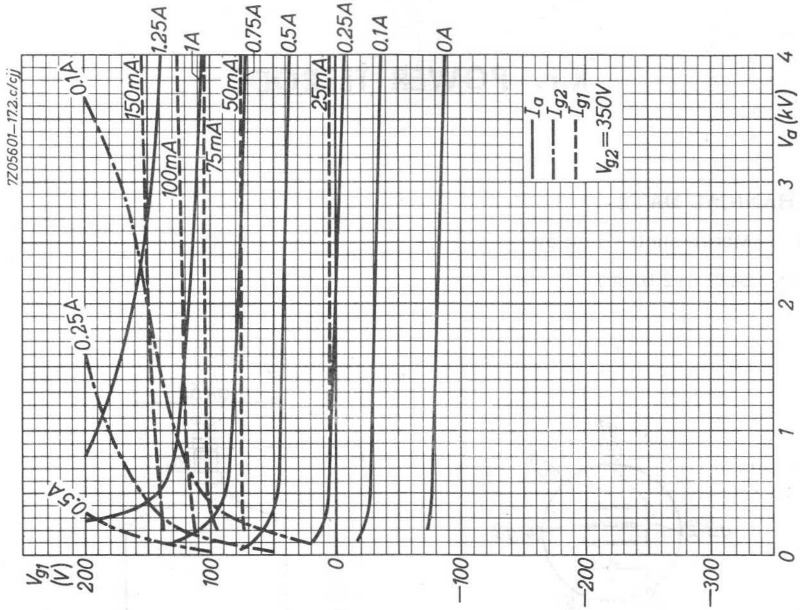

7Z05596-17.2.c/cjj
I_{g2} (A)
1.5
1
0.5
0
V_{g2}=600V
V_{g1}=
200V
150V
100V
50V
0V
—50V
0
1
2
3
4
V_a (kV)
5

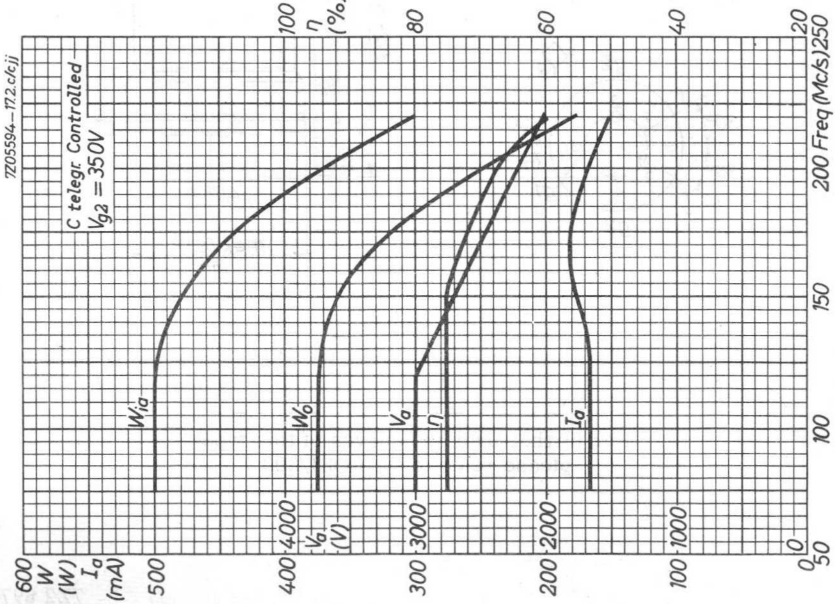

7Z05597—17.2.c/cjj
I_{g1} (mA)
150
100
50
0
V_{g2} = 600V
V_{g1} =
200V
150V
100V
50V
0
1
2
3
4
V_a (kV)
5


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


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


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


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


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

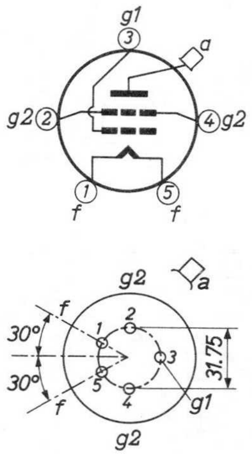
R.F. POWER TETRODE

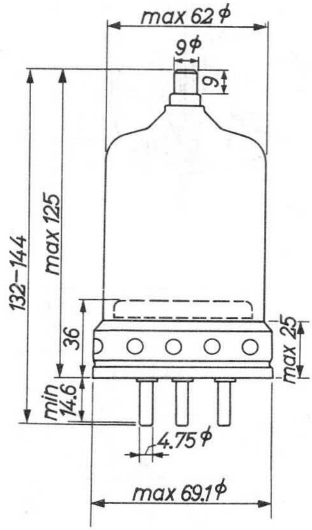
MECHANICAL DATA

Dimensions in mm

Base : Metal-shell Giant 5p

→ Socket: 2422 512 01001





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

7Z2 8977

R.F. POWER TETRODE

QUICK REFERENCE DATA									
λ	Freq.	C telegr.		B teleph.		C_{ag_2} mod.		B mod. [1]	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
> 4	< 75	4000	1000	4000	126	3000	510	3000	1240
		3000	800	3000	125	2500	375	2500	1140
		2500	575	2500	125			2000	974
2.5	120	2500	500					1500	660

HEATING: direct; filament thoriated tungsten

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

COOLING: radiation/low-velocity air flow

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	4.5	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	12.7	pF
Anode to grid No.1	C_{ag_1}	=	0.12	pF

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

7Z2 2779

TEMPERATURE LIMITS (Absolute limits)

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

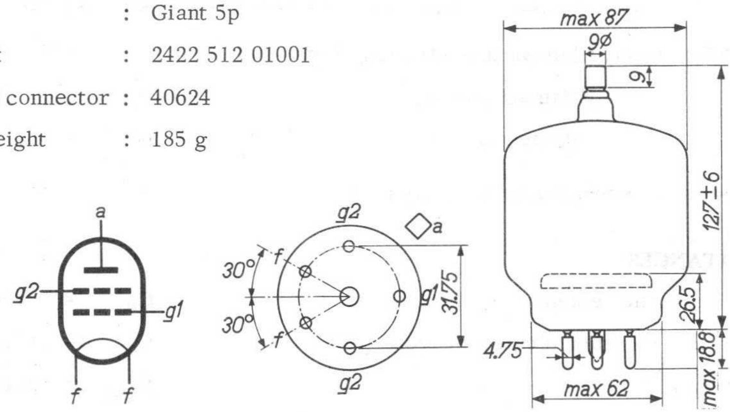
COOLING

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

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

MECHANICAL DATA Dimensions in mm

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



Mounting position: vertical with base up or down

7Z2 8788

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to 75	up to 100	up to 120	MHz
Anode voltage	V_a =	max. 4000	max. 3300	max. 2500	V
Anode input power	W_{ia} =	max. 1250	max. 1000	max. 750	W
Anode dissipation	W_a =		max. 250		W
Anode current	I_a =		max. 350		mA
Grid No.2 voltage	V_{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_{g_2}	=		max. 600		V
Grid No.2 dissipation	W_{g_2}	=		max. 23		W

OPERATING CONDITIONS

Frequency	f	=	75	75	75	MHz
Anode voltage	V_a	=	4000	3000	2500	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	−100	−90	−84	V
Anode current	I_a	=	94	125	150	mA
Grid No.2 current	I_{g_2}	=	0	0	0	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	55.5	61	66	V
Anode input power	W_{ia}	=	376	375	375	W
Anode dissipation	W_a	=	250	250	250	W
Output power	W_o	=	126	125	125	W
Efficiency	η	=	33.5	33	33	%
Modulation factor	m	=	100	100	100	%
Grid No.1 current	I_{g_1}	=	0.5	2	5.5	mA
Grid No.1 input power	W_{ig_1}	=	0.06	0.25	0.75	W
Grid No.2 dissipation	W_{g_2}	=	4	3.8	6	W

7Z2 2782

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 100	up to 120	MHz
Anode voltage	V_a	=	max. 3200	max. 2600	max. 2000	V
Anode input power	W_{ia}	=	max. 825	max. 660	max. 500	W
Anode dissipation	W_a	=		max. 165		W
Anode current	I_a	=		max. 275		mA
Grid No.2 voltage	V_{g_2}	=		max. 600		V
Grid No.2 dissipation	W_{g_2}	=		max. 35		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 500		V
Grid No.1 current	I_{g_1}	=		max. 20		mA

OPERATING CONDITIONS

Frequency	f	=	75	75	MHz
Anode voltage	V_a	=	3000	2500	V
Grid No.2 voltage	V_{g_2}	=	400	400	V
Grid No.1 voltage	V_{g_1}	=	−310	−200	V
Anode current	I_a	=	225	200	mA
Grid No.2 current	I_{g_2}	=	30	30	mA
Grid No.1 current	I_{g_1}	=	9	9	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	400	280	V
Grid No.1 input power	W_{ig_1}	=	3.3	2.3	W
Grid No.2 dissipation	W_{g_2}	=	12	12	W
Anode input power	W_{ia}	=	675	500	W
Anode dissipation	W_a	=	165	125	W
Output power	W_o	=	510	375	W
Efficiency	η	=	75.5	75	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	350	350	V
Modulation power	W_{mod}	=	344	256	W

7Z2 2783

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	4	kV
Anode current	I_a	=	max.	350	mA
Anode input power	W_{ia}	=	max.	1250	W
Peak anode dissipation	W_{a_p}	=	max.	275	W [1])
Anode dissipation	W_a	=	max.	250	W
(Averaging time	T_{av}	=	max.	5	sec)
Grid No.2 voltage	V_{g_2}	=	max.	600	V
Grid No.2 dissipation	W_{g_2}	=	max.	35	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	250	kΩ

OPERATING CONDITIONS

f	=	30		30		30		30		30		30	MHz
V_a	=	4		3.5		4		3.5		3		2.5	kV
V_{g_1}	=	−105		−110		−105		−98		−94		−91	V
V_{g_2}	=	550		600		500		500		500		500	V
$V_{g_{1p}}$	=	0	105	0	110	0	105	0	98	0	94	0	91 V
I_a	=	50	182	50	207	50	164	50	164	50	164	50	164 mA
I_{g_1}	=	0	0	0	0	0	0	0	0	0	0	0	0 mA
I_{g_2}	=	0	9	0	12	0	8	0	9	0	10	0	10.5 mA
W_{ig_1}	=	0	0	0	0	0	0	0	0	0	0	0	0 W
W_{g_2}	=	0	5	0	7.2	0	4	0	4.5	0	5	0	5.3 W
W_{ia}	=	200	730	175	725	200	660	175	575	150	490	125	410 W
W_a	=	200	220	175	235	200	200	175	175	150	157	125	140 W
W_o	=	–	510	–	490	–	460	–	400	–	333	–	270 W
η	=	–	69	–	67	–	70	–	69	–	68	–	66 %

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

7Z2 2784

A.F. CLASS B AMPLIFIER OR MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	4	kV
Anode dissipation	W_a	=	max.	250	W
Anode current	I_a	=	max.	350	mA
Grid No.2 voltage	V_{g2}	=	max.	600[1])	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.	30	mA
Grid No.1 circuit resistance	R_{g1}	=	max.	250	kΩ

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

V_a	=	3000		2500		2000		1500		V
V_{g2}	=	300		300		300		300		V
V_{g1}	=	−55		−51		−49		−45		V
$R_{aa\sim}$	=	14		9.2		6.6		4.55		kΩ
V_{g1g1p}	=	0	280	0	306	0	328	0	323	V
I_a	=	2x50	2x275	2x50	2x312	2x50	2x347	2x50	2x347	mA
I_{g2}	=	0	2x34.5	0	2x44	0	2x55	0	2x58	mA
I_{g1}	=	0	2x15	0	2x21	0	2x27	0	2x28	mA
W_{ig1}	=	0	2x1.9	0	2x2.9	0	2x4	0	2x4	W
W_{g2}	=	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_{g2} = max. 1000 V, when the temperature of the pin seals is max. 120 °C

7Z2 2785

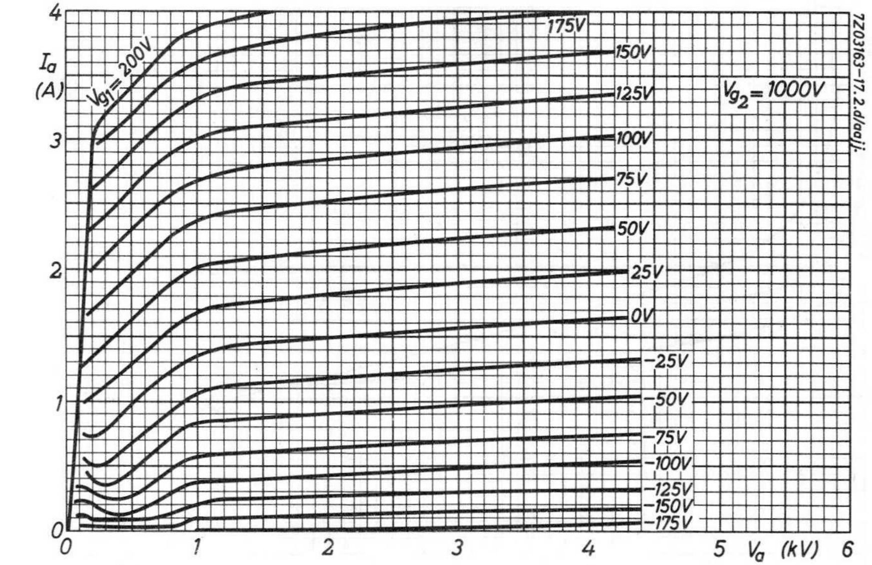
A.F. CLASS B AMPLIFIER OR MODULATOR

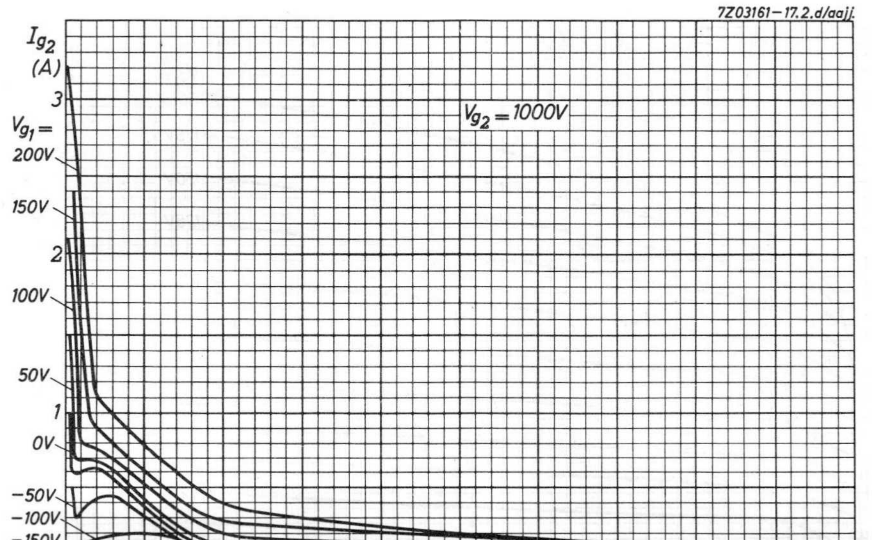
LIMITING VALUES. See page 7.

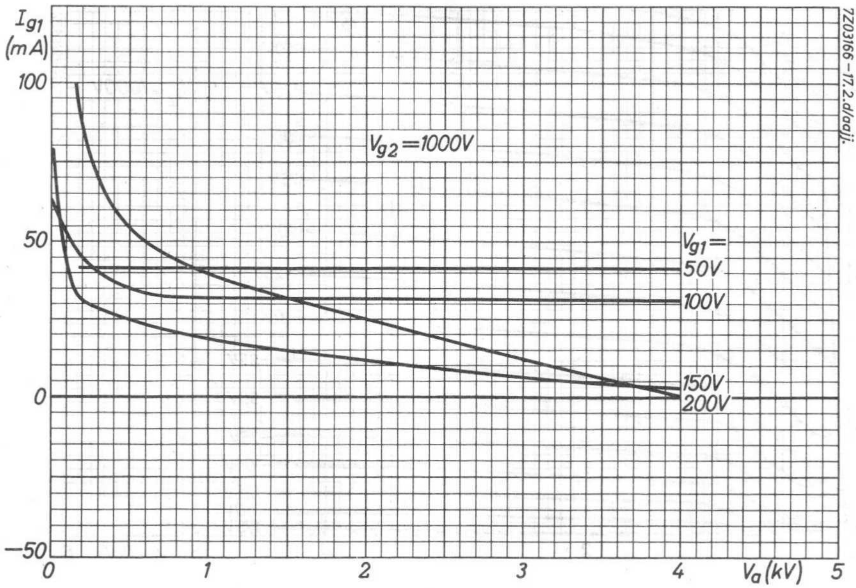
OPERATING CONDITIONS, two tubes. $I_{g_1} = 0$

V_a	=	3000		2500		2000		1500		V
V_{g_2}	=	500		500		500		500		V
V_{g_1}	=	−94		−91		−88		−85		V
$R_{aa\sim}$	=	22		18		14.5		10		kΩ
$V_{g_1g_{1p}}$	=	0	184	0	178	0	173	0	167	V
I_a	=	2x50	2x155	2x50	2x155	2x50	2x150	2x50	2x150	mA
I_{g_2}	=	0	2x10	0	2x10.5	0	2x14.5	0	2x15.5	mA
W_{g_2}	=	0	2x5	0	2x5.3	0	2x7.3	0	2x7.8	W
W_{ia}	=	2x150	2x465	2x125	2x387	2x100	2x300	2x75	2x225	W
W_a	=	2x150	2x147	2x125	2x132	2x100	2x105	2x75	2x91	W
W_o	=	0	635	0	510	0	390	0	268	W
d_{tot}	=	–	2.8	–	2.6	–	3.2	–	3	%
η	=	–	68	–	66	–	65	–	60	%

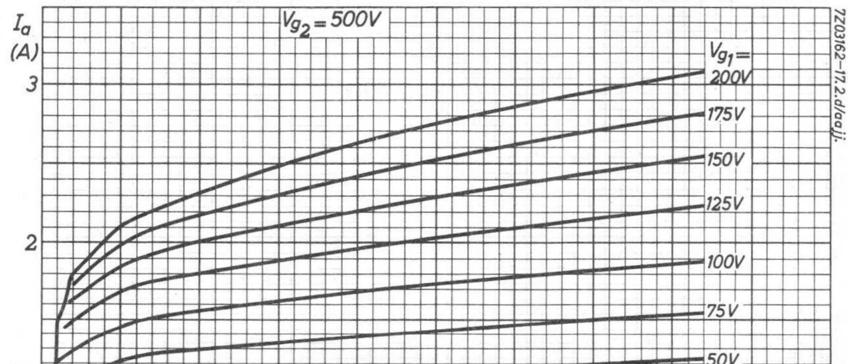
7Z2 2786


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

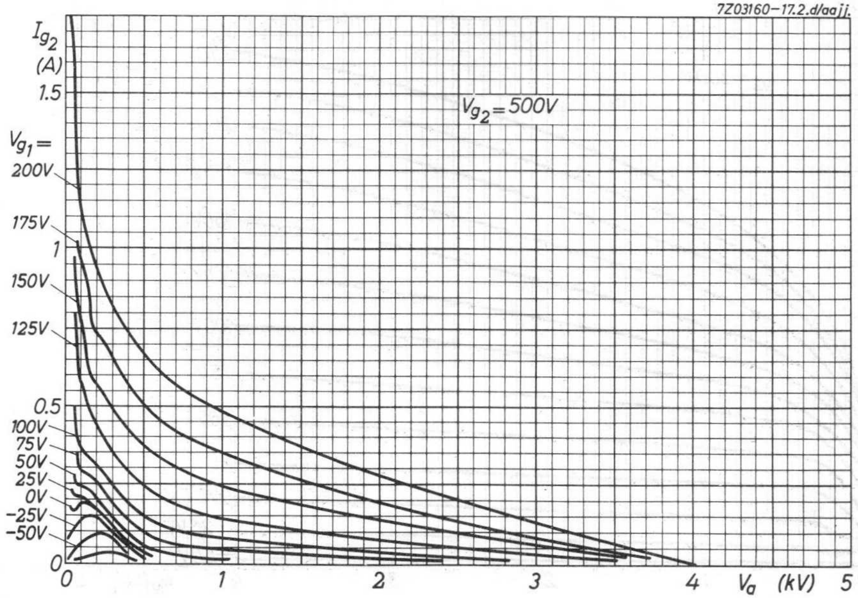

7Z03161-17.2.d/aajj.
I_{g_2} (A)
V_{g_1} =
200V
150V
100V
50V
0V
-50V
-100V
-150V
V_{g_2} = 1000V
V_a (kV)
0
1
2
3
4
5

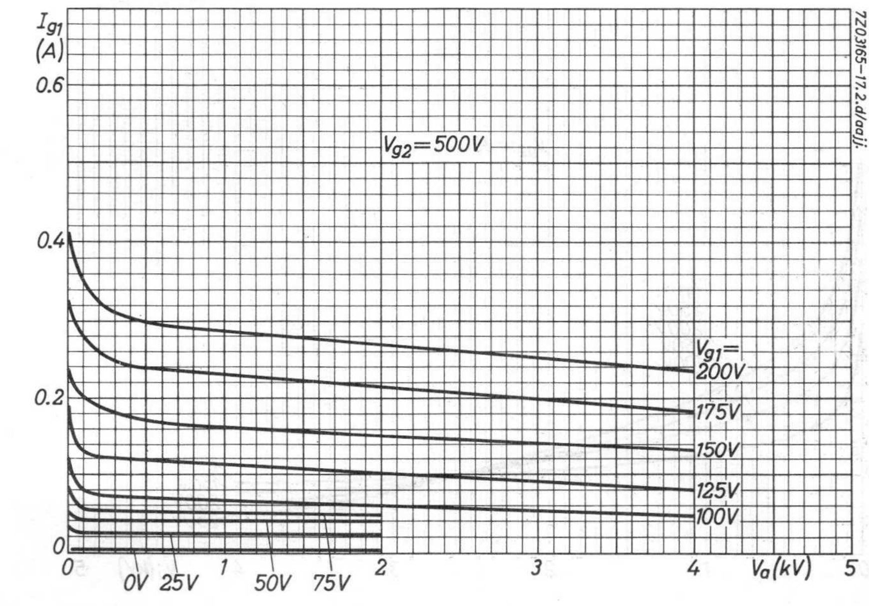


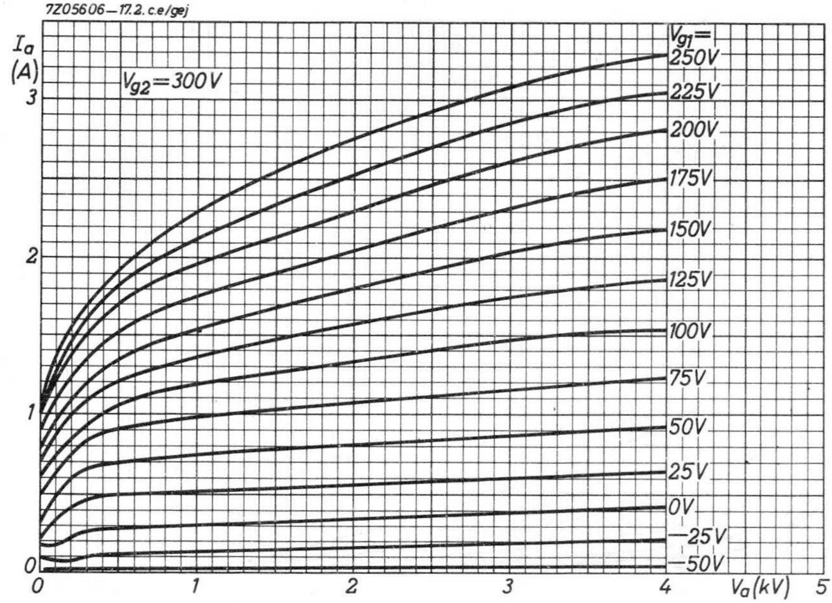
I_{g1} (mA)
100
50
0
−50
V_{g2}=1000V
V_{g1}=
50V
100V
150V
200V
0
1
2
3
4
V_a (kV)
5
7Z03166−17.2.d/aaj.

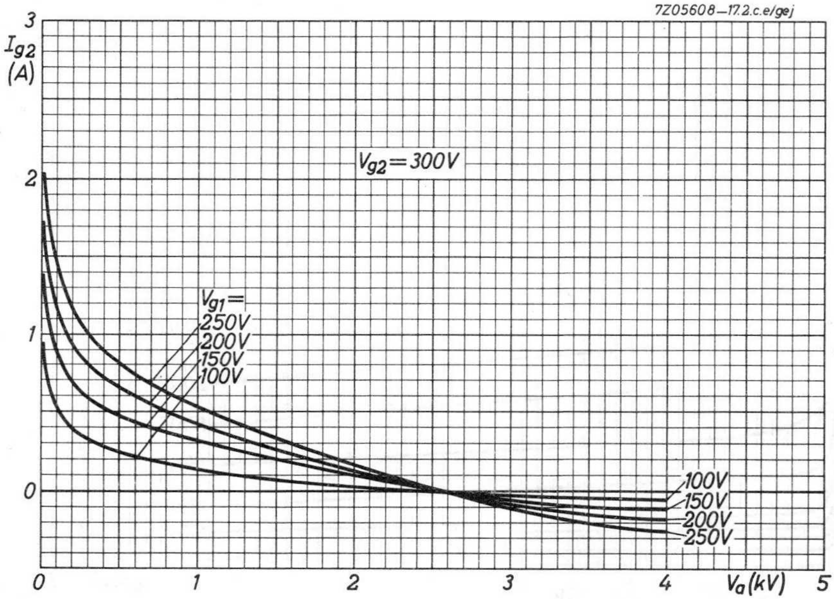


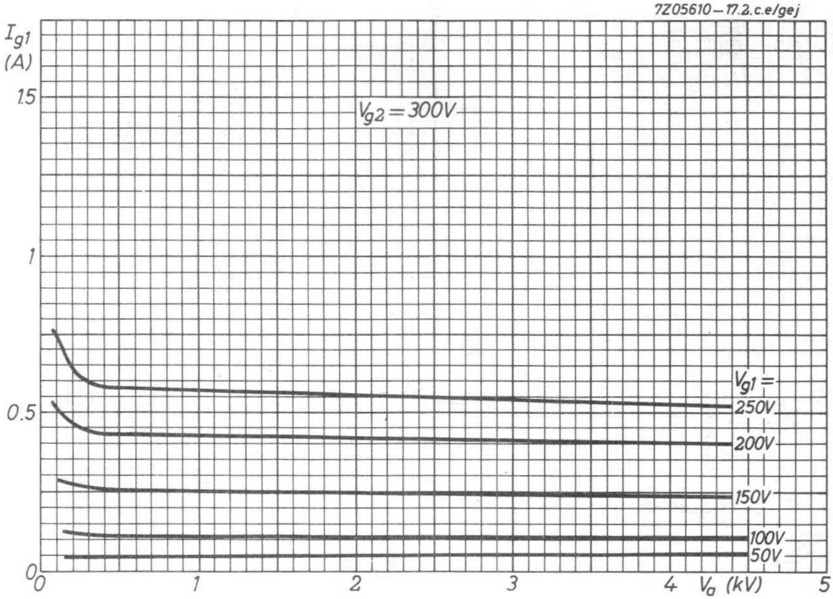
I_a (A)
3
2
1
0
V_{g2}=500V
V_{g1}=
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
0
1
2
3
4
V_a (kV)
5
7Z03162−17.2.d/aaj.

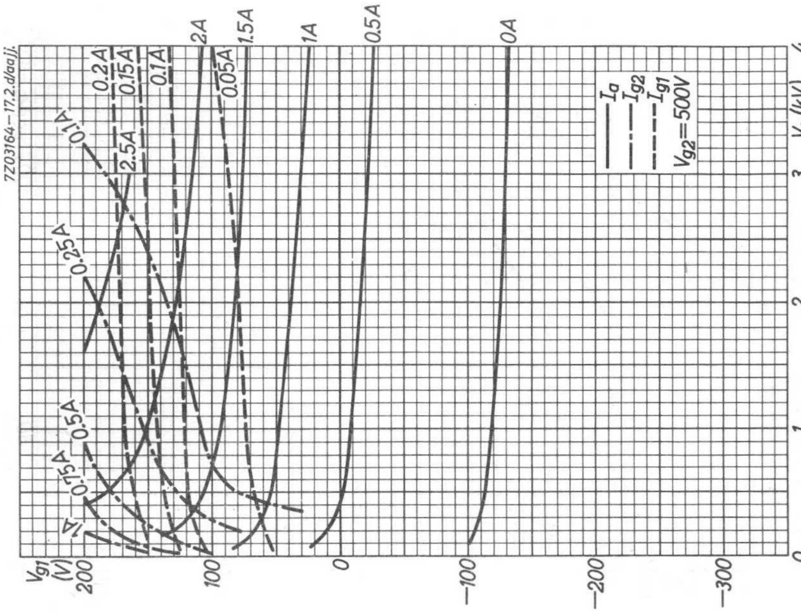

7Z03160-17.2.d/aajj.
I_{g_2} (A)
1.5
1
0.5
0
V_{g_2}=500V
V_{g_1}=
200V
175V
150V
125V
100V
75V
50V
25V
0V
-25V
-50V
0
1
2
3
4
V_a (kV)
5

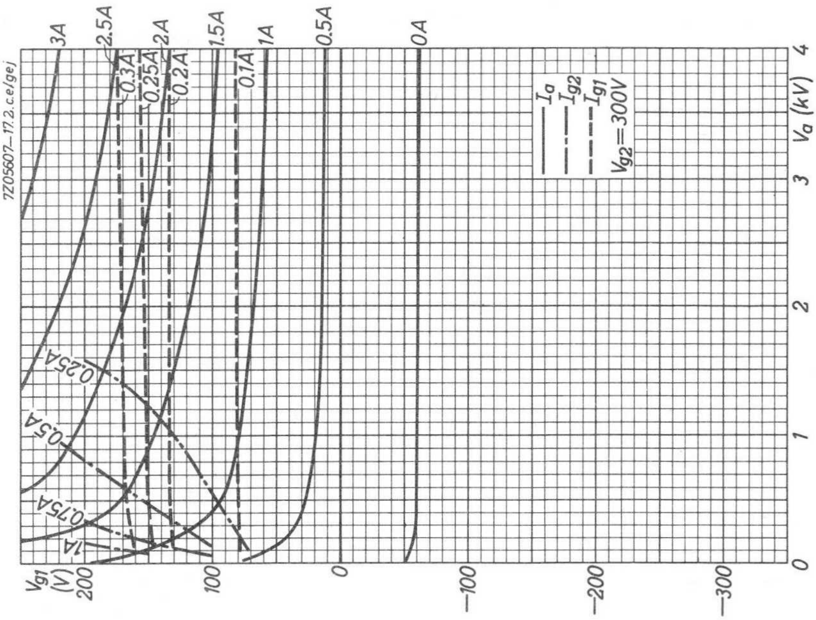

7Z03165-17.2.d/aajj.
I_{g_1} (A)
0.6
0.4
0.2
0
V_{g_2}=500V
V_{g_1}=
200V
175V
150V
125V
100V
0V
25V
50V
75V
0
1
2
3
4
V_a(kV)
5

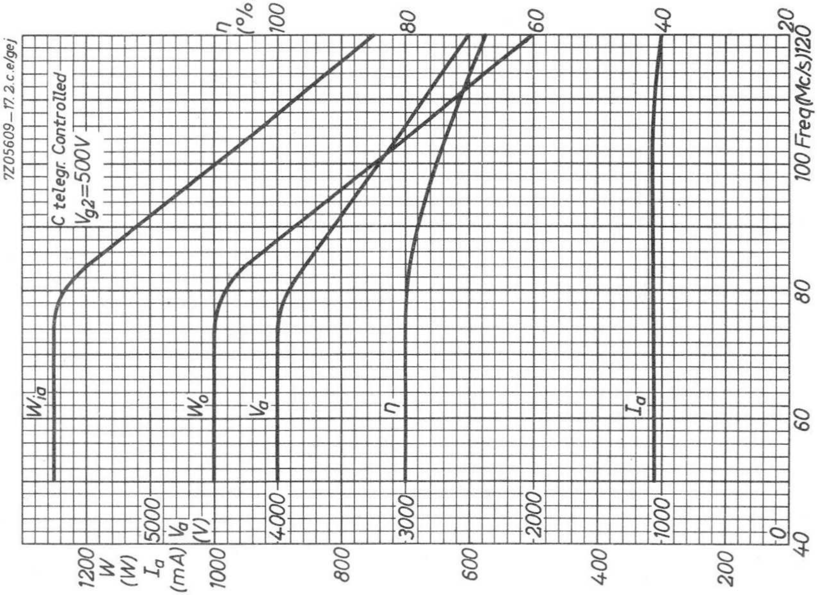

7Z05606—17.2.c.e/gej
I_a
(A)
V_{g2}=300V
V_{g1}=
250V
225V
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
0
1
2
3
0
1
2
3
4
V_a(kV)
5


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


7Z05610-17.2.c.e/gej
I_{g1} (A)
V_{g2} = 300V
V_{g1} =
250V
200V
150V
100V
50V
V_a (kV)


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


7Z05607—17.2.c.e/gej
V_{g1} (V)
200
100
0
−100
−200
−300
3A
2.5A
2A
1.5A
1A
0.5A
0A
0.3A
0.25A
0.2A
0.1A
0.25A
0.5A
0.75A
1A
I_a
I_{g2}
I_{g1}
V_{g2}=300V
V_a (kV)
0
1
2
3
4


7Z05609—17.2.c.e/gej
C telegr. Controlled
V_{g2}=500V
1200 W (W)
I_a (mA)
1000
800
600
400
200
5000 V_a (V)
4000
3000
2000
1000
0
η (%)
100
80
60
40
20
W_{ia}
W_o
V_a
η
I_a
40
60
80
100
Freq (Mc/s)
120

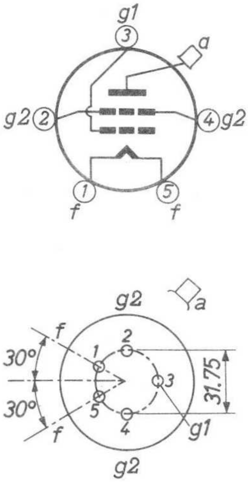
R.F. POWER TETRODE

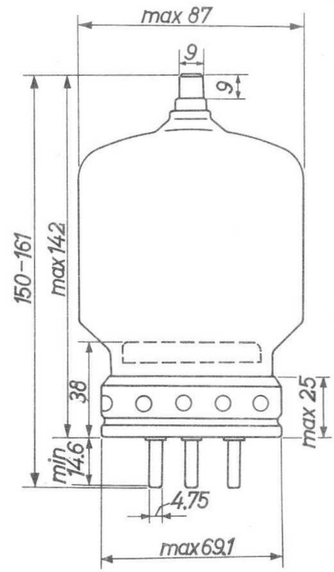
MECHANICAL DATA

Dimensions in mm

Base : Metal-shell Giant 5p

Socket: 2422 512 01001





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

7Z2 8789

R.F. POWER TETRODE

QUICK REFERENCE DATA

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

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

HEATING: direct; thoriated tungsten filament

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Intermittent service, ICAS

[2]) Two tubes

7Z2 2921

COOLING: radiation and forced air

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

TEMPERATURE LIMITS (Absolute limits)

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

MECHANICAL DATA

Dimensions in mm

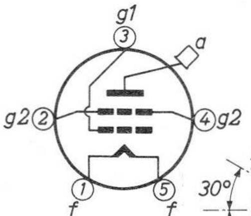
Base : Giant 5p.

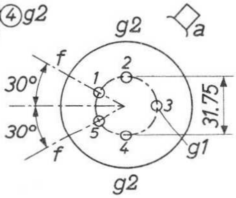
Socket : 2422 512 01001

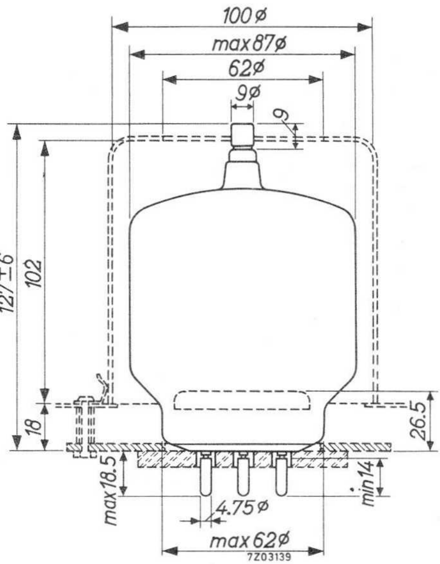
Anode connector: 40624

Chimney : 40666

Net weight : 190 g







Mounting position: vertical with base up or down

7Z2 8790

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	110	MHz
Anode voltage	V_a	= max.	4000	V
Anode input power	W_{ia}	= max.	1400	W
Anode dissipation	W_a	= max.	400	W
Anode current	I_a	= max.	350	mA
Grid No.2 voltage	V_{g_2}	= max.	600	V
Grid No.2 dissipation	W_{g_2}	= max.	35	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	500	V
Grid No.1 current	I_{g_1}	= max.	25	mA

OPERATING CONDITIONS

Frequency	f	=	75	75	75	100	100	MHz
Anode voltage	V_a	=	4000	3000	2500	4000	3500	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	−220	−220	−200	−170	−170	V
Anode current	I_a	=	350	350	350	270	250	mA
Grid No.2 current	I_{g_2}	=	25	30	35	16	17	mA
Grid No.1 current	I_{g_1}	=	6	6	6.5	9.5	9	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	305	305	290	240	235	V
Grid No.1 input power	W_{ig_1}	=	1.8	1.8	1.8	2	1.8	W
Grid No.2 dissipation	W_{g_2}	=	12.5	15	17.5	8	8.5	W
Anode input power	W_{ia}	=	1400	1050	875	1080	875	W
Anode dissipation	W_a	=	300	250	235	280	225	W
Output power	W_o	=	1100	800	640	800	650	W
Efficiency	η	=	78.5	76	73	74	74	%

7Z2 2923

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

CCS = continuous service ICAS = intermittent service

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

			CCS	ICAS	
Frequency	f	up to	75	30	MHz
Anode voltage	V_a	= max.	3200	4000	V
Anode input power	W_{ia}	= max.	880	1100	W
Anode dissipation	W_a	= max.	270	270	W
Anode current	I_a	= max.	275	275	mA
Grid No.2 voltage	V_{g_2}	= max.	600	600	V
Grid No.2 dissipation	W_{g_2}	= max.	35	35	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	500	500	V
Grid No.1 current	I_{g_1}	= max.	25	25	mA

OPERATING CONDITIONS Grid No.2 modulated with transformer

			CCS			ICAS	
Frequency	f	=	75	75	75	30	MHz
Anode voltage	V_a	=	3000	2500	2000	3650	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	−220	−220	−220	−225	V
Anode current	I_a	=	275	275	275	275	mA
Grid No.2 current	I_{g_2}	=	36	38	40	30	mA
Grid No.1 current	I_{g_1}	=	6	6	6	6	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	305	308	305	308	V
Grid No.1 input power	W_{ig_1}	=	1.6	1.7	1.6	1.7	W
Grid No.2 dissipation	W_{g_2}	=	18	19	20	15	W
Anode input power	W_{ia}	=	825	688	550	1000	W
Anode dissipation	W_a	=	195	178	170	235	W
Output power	W_o	=	630	510	380	765	W
Efficiency	η	=	76	74	69	76.5	%
Modulation depth	m	=	100	100	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	400	400	400	400	V
Modulation power	W_{mod}	=	413	344	275	500	W

7Z2 2924

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f	up to	110	MHz
Anode voltage	V_a	= max.	4000	V
Anode input power	W_{ia}	= max.	1400	W
Anode dissipation	W_a	= max.	400	W
Anode current	I_a	= max.	350	mA
Grid No.2 voltage	V_{g_2}	= max.	850	V
Grid No.2 dissipation	W_{g_2}	= max.	35	W

OPERATING CONDITIONS

Frequency	f	=		60		MHz
Anode voltage	V_a	=		4000		V
Grid No.1 voltage	V_{g_1}	=		-130		V
Grid No.2 voltage	V_{g_2}	=		705		V
			zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	130	–	V
Anode current	I_a	=	65	250	175	mA
Grid No.2 current	I_{g_2}	=	–	10	7	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Grid No.2 dissipation	W_{g_2}	=	–	7.05	4.95	W
Anode input power	W_{ia}	=	260	1000	700	W
Anode dissipation	W_a	=	260	350	375	W
Output power	W_o	=	0	650	325	W
Efficiency	η	=	–	65	46.5	%

7Z2 2925

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

OPERATING CONDITIONS (continued)

f	=		60			60		MHz
V_a	=		3500			3000		V
V_{g_1}	=		−135			−140		V
V_{g_2}	=		750			810		V
		zero signal	single tone signal	double tone signal	zero signal	single tone signal	double tone signal	
$V_{g_{1p}}$	=	0	135	–	0	140	–	V
I_a	=	75	280	200	90	300	215	mA
I_{g_2}	=	–	12	8.4	–	15	10.5	mA
I_{g_1}	=	0	0	0	0	0	0	mA
W_{g_2}	=	–	9	6.3	–	12.2	8.5	W
W_{ia}	=	263	980	700	270	900	645	W
W_a	=	263	380	400	270	400	395	W
W_o	=	0	600	300	0	500	250	W
η	=	–	61.2	43	–	55.5	38.8	%

A.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	= max.	4000	V
Anode dissipation	W_a	= max.	400	W
Anode current	I_a	= max.	350	mA
Grid No.2 voltage	V_{g_2}	= max.	800	V [1])
Grid No.2 dissipation	W_{g_2}	= max.	35	W
Grid No.1 current	I_{g_1}	= max.	25	mA

For Operating conditions please refer to pages 7 and 8

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

7Z2 2926

A.F. CLASS B AMPLIFIER (continued)

OPERATING CONDITIONS with grid current (two tubes)

Anode voltage	V_a	=	4000		3500		3000		2500		V
Grid No.2 voltage	V_{g_2}	=	500		500		500		500		V
Grid No.1 voltage	V_{g_1}	=	-90		-85		-80		-75		V
Load resistance	$R_{aa\sim}$	=	15000		11300		10000		8000		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_1p}$	=	0	290	0	305	0	292	0	290	V
Anode current	I_a	=	2x80	2x319	2x80	2x350	2x90	2x350	2x95	2x350	mA
Grid No.2 current	I_{g_2}	=	-	2x20	-	2x20	-	2x20	-	2x30	mA
Grid No.1 current	I_{g_1}	=	0	2x6	0	2x6.5	0	2x6.5	0	2x7	mA
Grid No.2 dissipation	W_{g_2}	=	-	2x10	-	2x10	-	2x10	-	2x15	W
Grid No.1 input power	W_{ig_1}	=	0	2x0.8	0	2x0.9	0	2x0.85	0	2x0.91	W
Anode input power	W_{ia}	=	2x320	2x1275	2x280	2x1225	2x270	2x1050	2x238	2x875	W
Anode dissipation	W_a	=	2x320	2x400	2x280	2x400	2x270	2x362	2x238	2x320	W
Output power	W_o	=	0	1750	0	1650	0	1375	0	1110	W
Efficiency	η	=	-	68.5	-	67.5	-	65.5	-	63.5	%

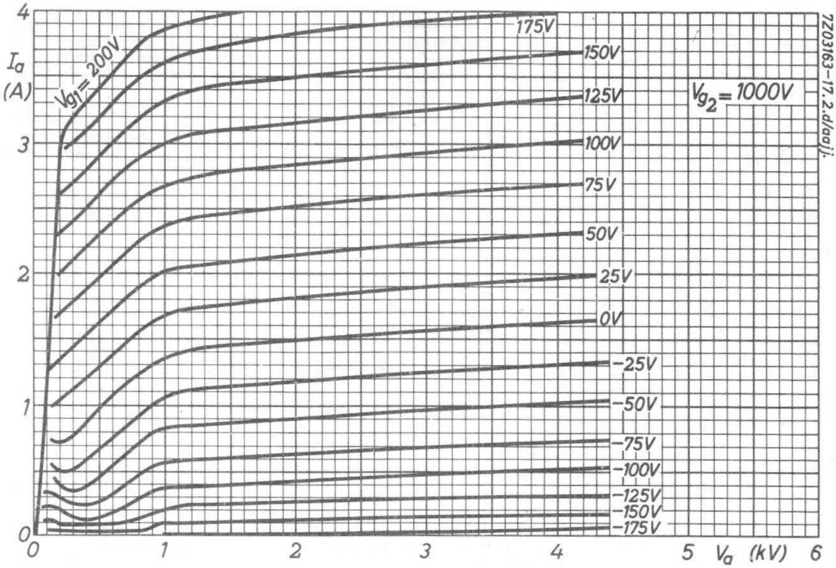
7Z2 2927

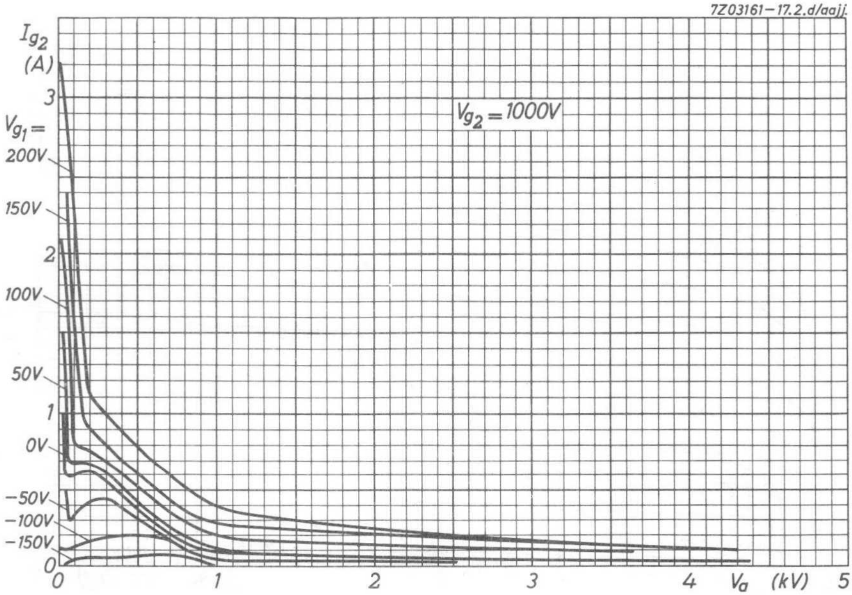
A.F. CLASS B AMPLIFIER (continued)

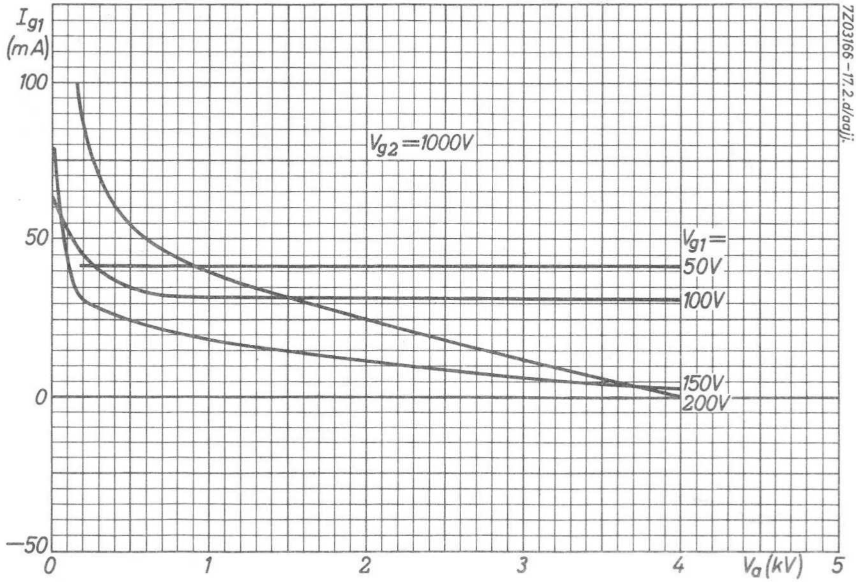
OPERATING CONDITIONS without grid current (two tubes)

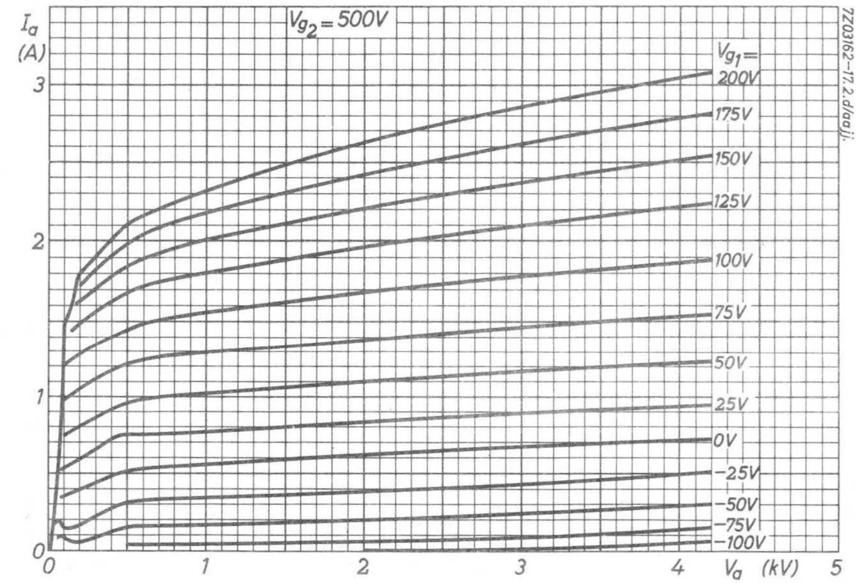
Anode voltage	V_a	=	4000		3500		3000		2500		V
Grid No.2 voltage	V_{g_2}	=	750		750		750		750		V
Grid No.1 voltage	V_{g_1}	=	-150		-145		-137		-130		V
Load resistance	$R_{aa\sim}$	=	14500		11500		8900		6800		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	300	0	290	0	274	0	260	V
Anode current	I_a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

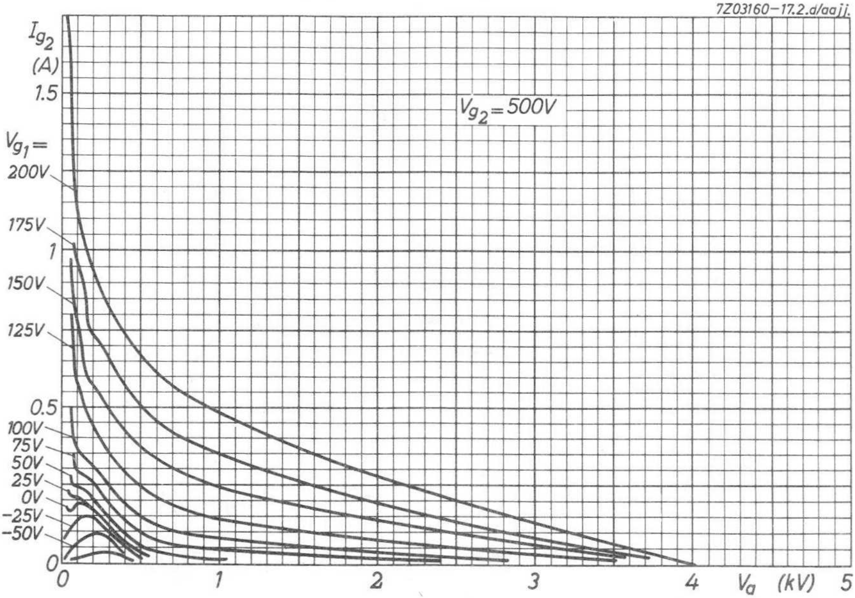
7Z2 2928

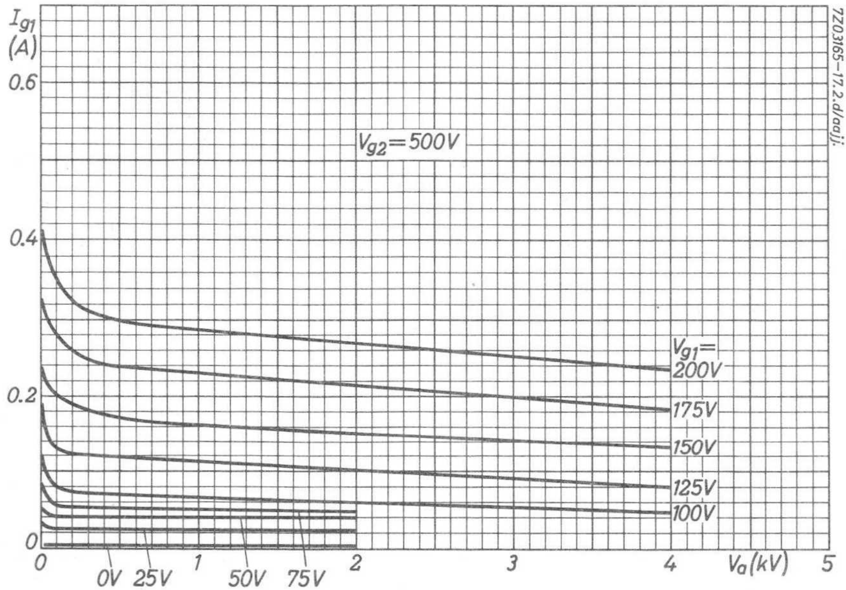

7Z03163-17.2.d/aajj.
I_a (A)
V_{g1} = 200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
V_{g2} = 1000V
V_a (kV)
0
1
2
3
4
5
6

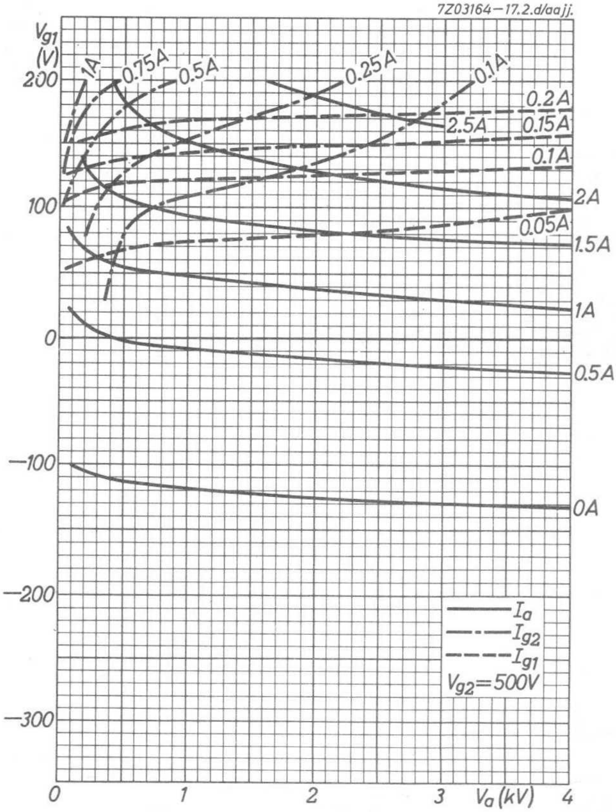

7Z03161−17.2.d/aajj.
I_{g2} (A)
V_{g1} =
200V
150V
100V
50V
0V
−50V
−100V
−150V
V_{g2} = 1000V
V_a (kV)
0
1
2
3
4
5


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


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


7Z03160−17.2.d/aajj.
I_{g2} (A)
1.5
1
0.5
0
V_{g2}=500V
V_{g1}=
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
0
1
2
3
4
V_a (kV)
5


7Z03165−17.2.d/aajj.
I_{g1} (A)
0.6
0.4
0.2
0
V_{g2}=500V
V_{g1}=
200V
175V
150V
125V
100V
0V
25V
50V
75V
0
1
2
3
4
V_a(kV)
5



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

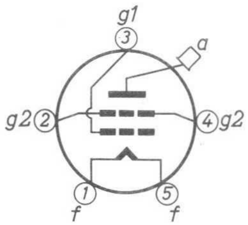
R.F. POWER TETRODE

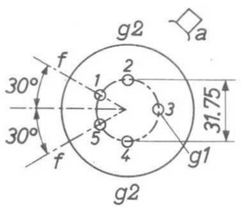
MECHANICAL DATA

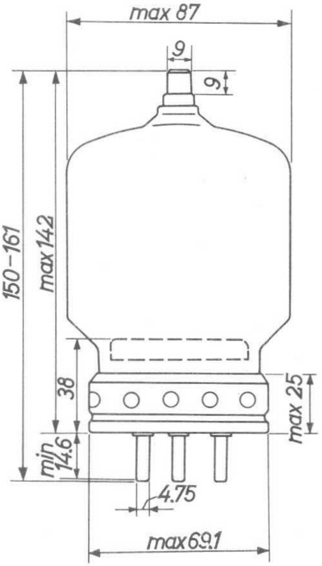
Base : Metal-shell Giant 5p

Socket: 2422 512 01001

Dimensions in mm







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

7Z2 8791

R.F. POWER TETRODE

QUICK REFERENCE DATA

For communication

λ	Freq.	C telegr.		C_{ag_2} mod		C_{g_1} mod	
(m)	(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
5	60	5000 4000	1760 1410	4000	1200	4500 4000	400 330

λ	Freq.	B single side band			B_{mod} 1)	
(m)	(MHz)	V_a (V)	W_o (W)		V_a (V)	W_o (W)
5	60	5000	900		5000 4000	2220 2250

For industrial application R.F. class C

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

HEATING direct; thoriated tungsten filament

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

TYPICAL CHARACTERISTICS at I_a = 120 mA

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

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

7Z2 8792

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	24	pF
Anode to all other elements except grid No.1	C_a	=	8.3	pF
Anode to grid No.1	C_{ag_1}	=	0.25	pF

COOLING: radiation/low-velocity air flow

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

TEMPERATURE LIMITS (Absolute limits)

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

MECHANICAL DATA

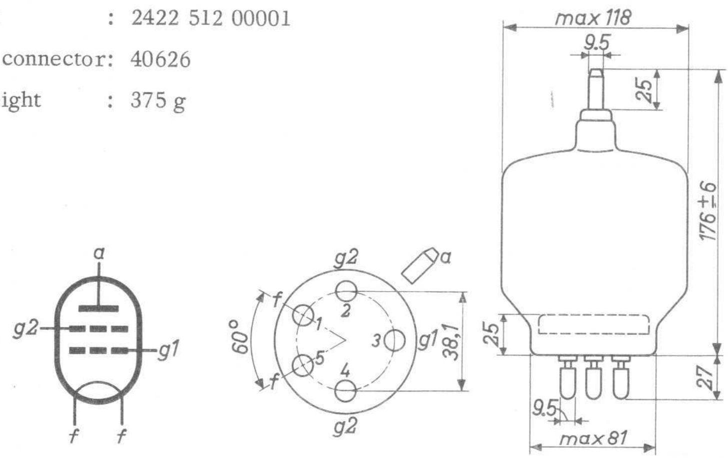
Dimensions in mm

Base : Super giant

→ Socket : 2422 512 00001

Anode connector: 40626

Net weight : 375 g



Mounting position: vertical with base up or down

7Z2 8793

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 110[1])	MHz
Anode voltage	V_a	=	max. 5	max. 4.5	kV
Anode input power	W_{ia}	=	max. 2250	max. 1800	W
Anode dissipation	W_a	=	max. 500		W
Anode current	I_a	=	max. 450		mA
Grid No.2 voltage	V_{g_2}	=	max. 700		V
Grid No.2 dissipation	W_{g_2}	=	max. 65		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 500		V
Grid No.1 dissipation	W_{g_1}	=	max. 25		W

OPERATING CONDITIONS

Frequency	f	$\leq$	60	60	60	60	MHz
Anode voltage	V_a	=	5	5	4	4	kV
Grid No.2 voltage	V_{g_2}	=	600	700	600	700	V
Grid No.1 voltage	V_{g_1}	=	−200	−200	−200	−200	V
Anode current	I_a	=	440	440	450	450	mA
Grid No.2 current	I_{g_2}	=	80	75	90	85	mA
Grid No.1 current	I_{g_1}	=	35	25	39	27	mA
Peak grid No.1 voltage	$V_{g_1 p}$	=	350	340	350	340	V
Anode input power	W_{ia}	=	2200	2200	1800	1800	W
Grid No.1 input power	W_{ig_1}	=	12	8	14	8.5	W
Grid No.2 dissipation	W_{g_2}	=	48	52.5	54	59.5	W
Anode dissipation	W_a	=	440	440	390	390	W
Output power	W_o	=	1760	1760	1410	1410	W
Efficiency	η	=	80	80	78	78	%

[1]) See page F

7Z2 8794

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

Screen grid modulated via a choke of 2 H

LIMITING VALUES (Absolute limits)

Frequency	f		up to	75	MHz
Anode voltage	V_a	=	max.	4	kV
Anode input power	W_{ia}	=	max.	1600	W
Anode dissipation	W_a	=	max.	330	W
Anode current	I_a	=	max.	400	mA
Grid No.2 voltage	V_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	50	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 dissipation	W_{g_1}	=	max.	25	W

OPERATING CONDITIONS

Frequency	f	$\leq$	60	MHz
Anode voltage	V_a	=	4	kV
Grid No.2 voltage	V_{g_2}	=	600	V
Grid No.1 voltage	V_{g_1}	=	-240	V
Peak grid No.2 voltage	$V_{g_2 p}$	=	340	V
Peak grid No.1 voltage	$V_{g_1 p}$	=	415	V
Anode current	I_a	=	380	mA
Grid No.2 current	I_{g_2}	=	80	mA
Grid No.1 current	I_{g_1}	=	20	mA
Anode input power	W_{ia}	=	1520	W
Grid No.1 input power	W_{ig_1}	=	7.5	W
Grid No.2 dissipation	W_{g_2}	=	48	W
Anode dissipation	W_a	=	320	W
Output power	W_o	=	1200	W
Efficiency	η	=	79	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	760	W

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

OPERATING CONDITIONS

Frequency	f	$\leq$	60	60	MHz
Anode voltage	V_a	=	4500	4000	V
Grid No.2 voltage	V_{g_2}	=	600	600	V
Grid No.1 voltage 1)	V_{g_1}	=	−180	−180	V
Grid No.1 circuit resistance	R_{g_1}	=	1400	1400	Ω
Peak grid No.1 voltage	$V_{g_1 p}$	=	220	210	V
Anode current	I_a	=	200	200	mA
Grid No.2 current	I_{g_2}	=	5	5	mA
Grid No.1 current	I_{g_1}	=	6.5	6.5	mA
Grid No.1 input power	W_{ig_1}	=	1.3	1.2	W
Anode input power	W_{ia}	=	900	800	W
Anode dissipation	W_a	=	500	470	W
Grid No.2 dissipation	W_{g_2}	=	3	3	W
Output power	W_o	=	400	330	W
Efficiency	η	=	44.5	41	%
Modulation factor	m	=	100	100	%
Peak grid No.1 modulation voltage	$V_{g_1 \, mod_p}$	=	100	100	V
Grid No.1 current 2)	I_{g_1}	=	26	27	mA
Grid No.1 input power 2)	W_{ig_1}	=	5	5	W

1) With −170 V from fixed bias supply included
2) At crest of modulation

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_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	65	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ

OPERATING CONDITIONS

→ Frequency	f	≦	30	MHz
Anode voltage	V_a	=	5000	V
Grid No.2 voltage	V_{g_2}	=	700	V
Grid No.1 voltage	V_{g_1}	=	−90	V

			zero signal	single tone signal	
Peak grid No.1 voltage	V_{g_1p}	=	0	130	V
Anode current	I_a	=	56	280	mA
Grid No.2 current	I_{g_2}	=	0	25	mA
Grid No.1 current	I_{g_1}	=	0	1	mA
Grid No.1 input power	W_{ig_1}	=	0	1	W
Anode input power	W_{ia}	=	280	1400	W
Anode dissipation	W_a	=	280	500	W
Grid No.2 dissipation	W_{g_2}	=	0	18	W
Output power	W_o	=	0	900	W
Efficiency	η	=	–	64.5	%

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	$\leq$	60	MHz
Anode transformer voltage [1])	$V_{tr\,a}$	=	4800	V(RMS)
Grid No.2 transformer voltage [1])	$V_{tr\,g_2}$	=	670	V(RMS)
Grid No.1 resistor	R_{g_1}	=	16	kΩ
Peak grid No.1 voltage	$V_{g_1 p}$	=	350	V
Anode current	I_a	=	200	mA
Grid No.2 current	I_{g_2}	=	32	mA
Grid No.1 current	I_{g_1}	=	11	mA
Grid No.1 input power	W_{ig_1}	=	3.5	W
Anode input power	W_{ia}	=	1060	W
Anode dissipation	W_a	=	310	W
Grid No.2 dissipation	W_{g_2}	=	24	W
Output power	W_o	=	750	W
Efficiency	η	=	71	%

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

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

7Z2 8798

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS [2]

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

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

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

7Z2 8799

A.F. CLASS B AMPLIFIER AND MODULATOR

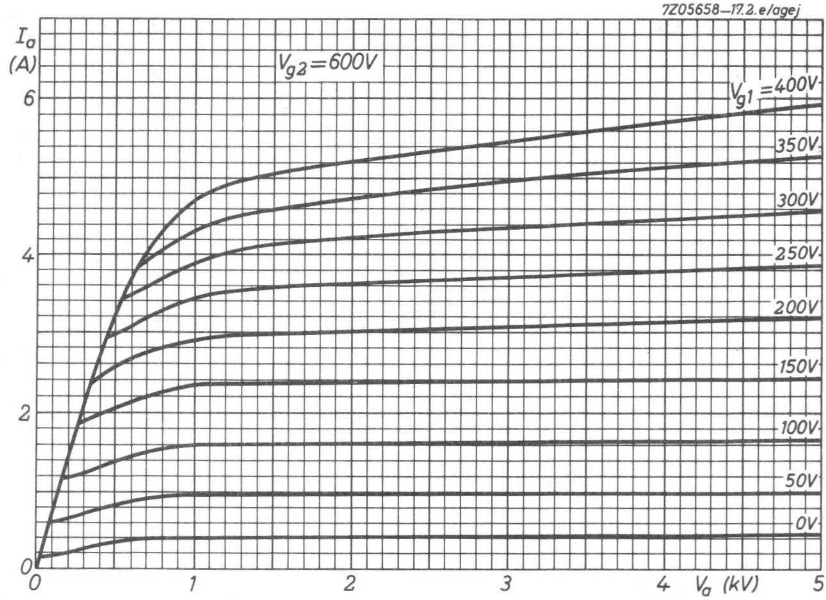
LIMITING VALUES (Absolute limits)

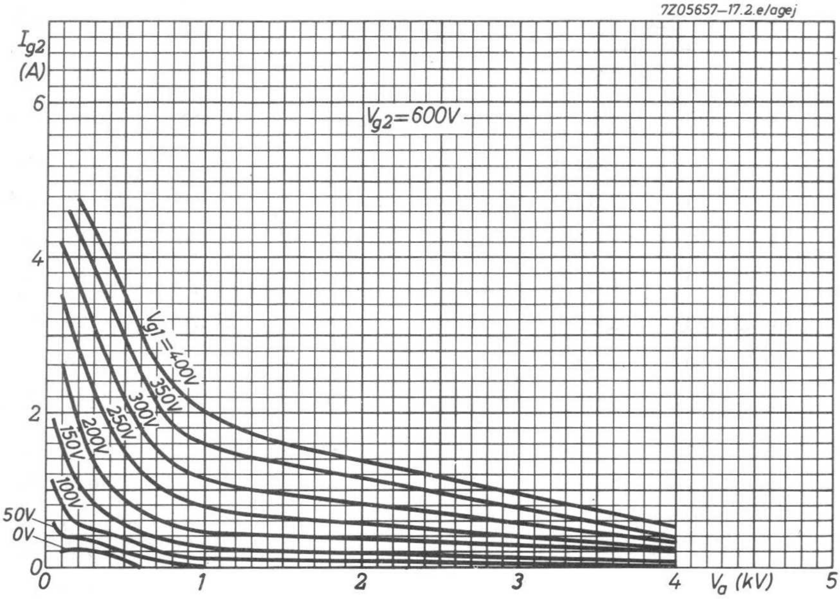
Anode voltage	V_a	=	max.	5000	V
Anode input power	W_{ia}	=	max.	2250	W
Anode dissipation	W_a	=	max.	500	W
Anode current	I_a	=	max.	450	mA
Grid No.2 voltage	V_{g_2}	=	max.	700	V
Grid No.2 dissipation	W_{g_2}	=	max.	65	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 current	I_{g_1}	=	max.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

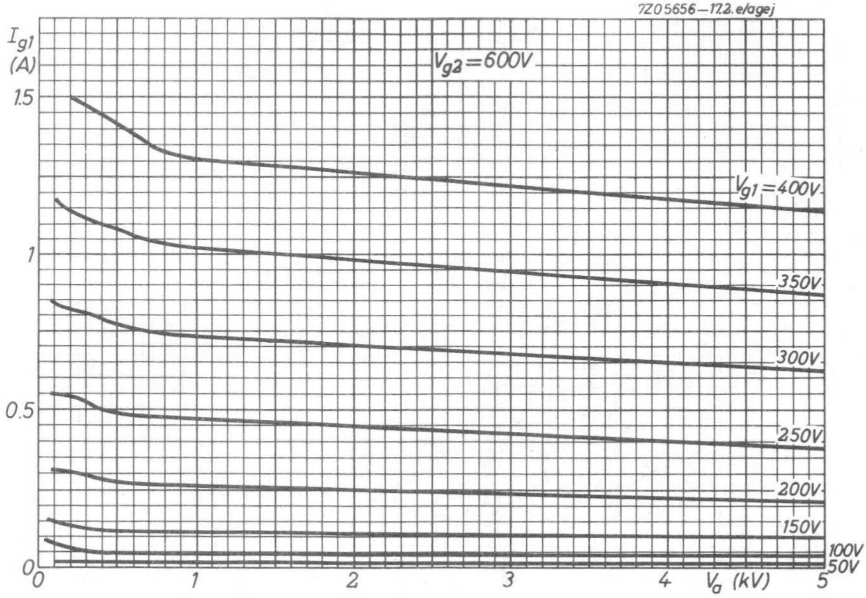
OPERATING CONDITIONS, two tubes

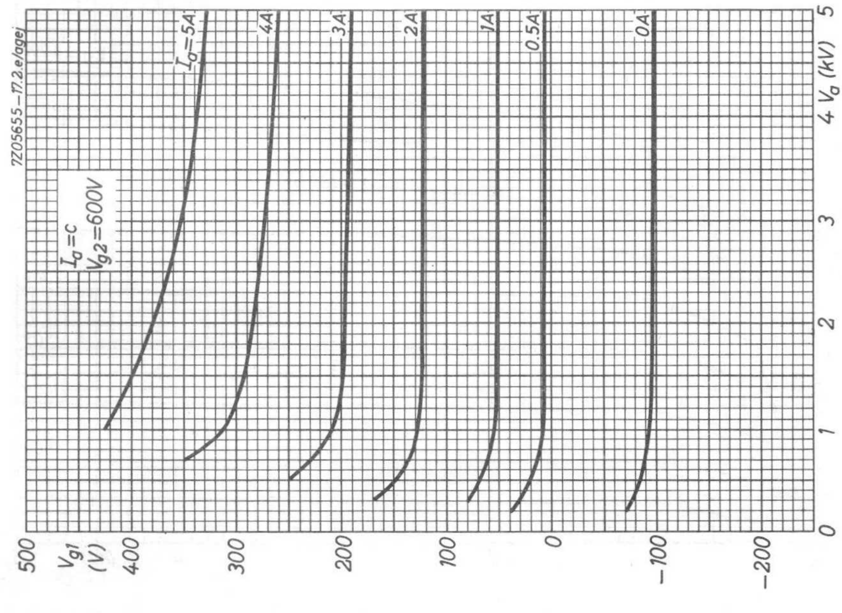
V_a	=	5000		4000		4000		V
V_{g_2}	=	600		600		600		V
V_{g_1}	=	-62.5		-62.5		-60		V
$R_{aa\sim}$	=	26		20		16		kΩ
$V_{g_1g_1p}$	=	0	260	0	254	0	305	V
I_a	=	2x50	2x290	2x45	2x285	2x55	2x366	mA
I_{g_2}	=	0	2x43	0	2x40	0	2x60	mA
I_{g_1}	=	0	2x13	0	2x13.5	0	2x18	mA
W_{ig_1}	=	0	2x1.5	0	2x1.5	0	2x2.5	W
W_{ia}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

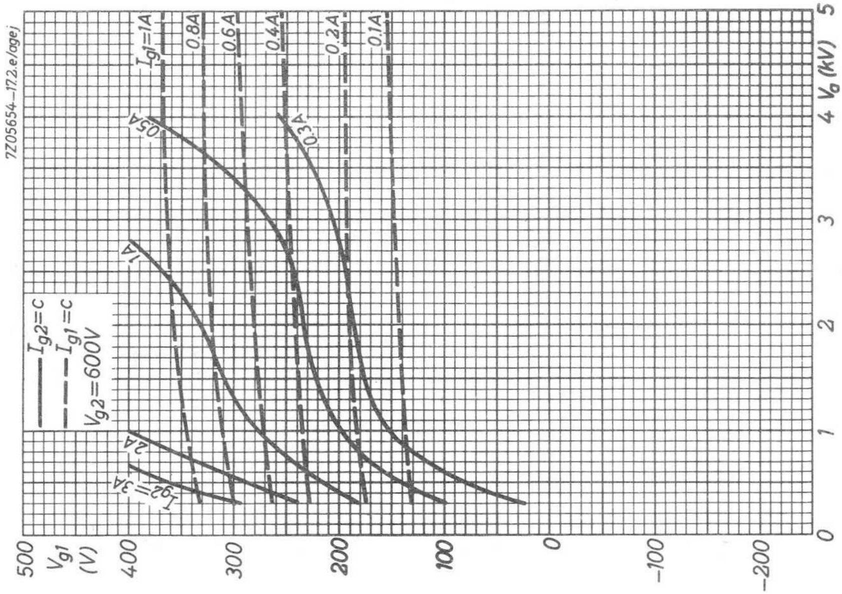
7Z2 2845

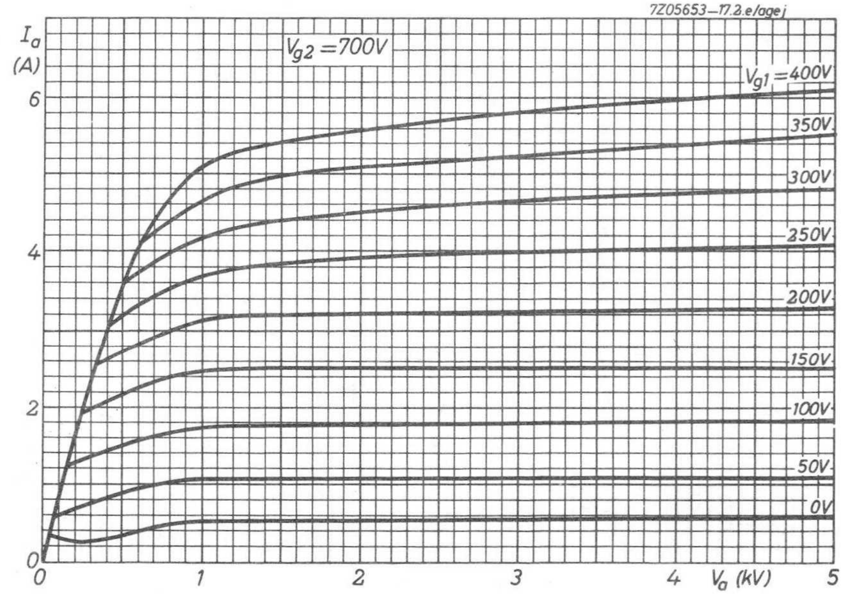

7Z05658—17.2.e/agej
I_a (A)
$V_{g2}=600V$
$V_{g1}=400V$
350V
300V
250V
200V
150V
100V
50V
0V
0
1
2
3
4
5
V_a (kV)
2
4
6


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

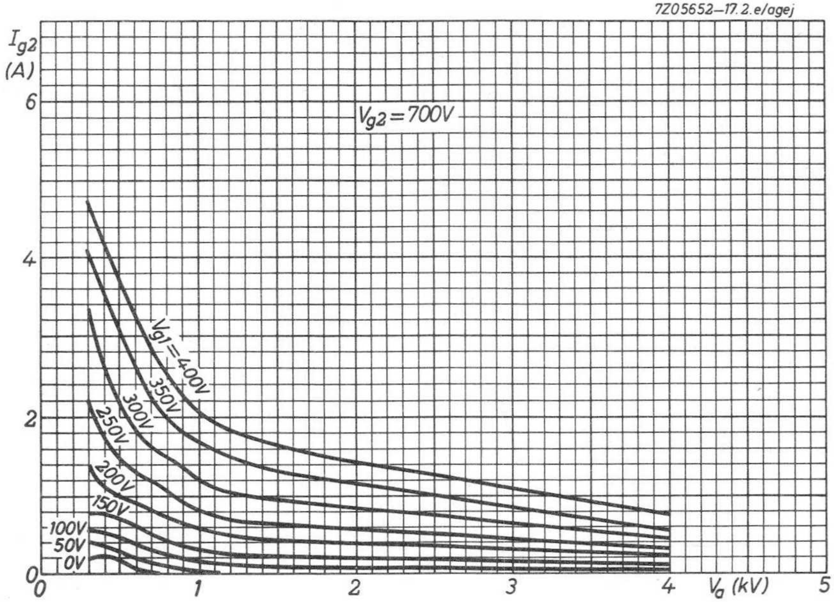

7Z05656-17.2.e/agej
I_{g1} (A)
V_{g2}=600V
V_{g1}=400V
350V
300V
250V
200V
150V
100V
50V
1.5
1
0.5
0
0
1
2
3
4
5
V_a (kV)


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

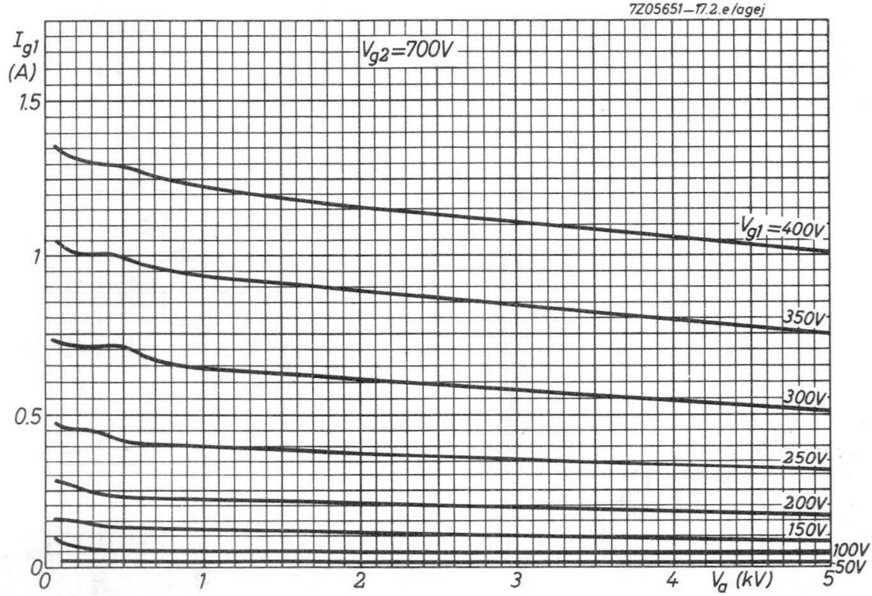

7Z05654–17.2.e/agej
I_{g1}=1A
0.8A
0.6A
0.4A
0.2A
0.1A
0.5A
0.3A
1A
2A
I_{g2}=3A
I_{g2}=c
I_{g1}=c
V_{g2}=600V
V_{g1} (V)
500
400
300
200
100
0
−100
−200
0
1
2
3
4
5
V_a (kV)

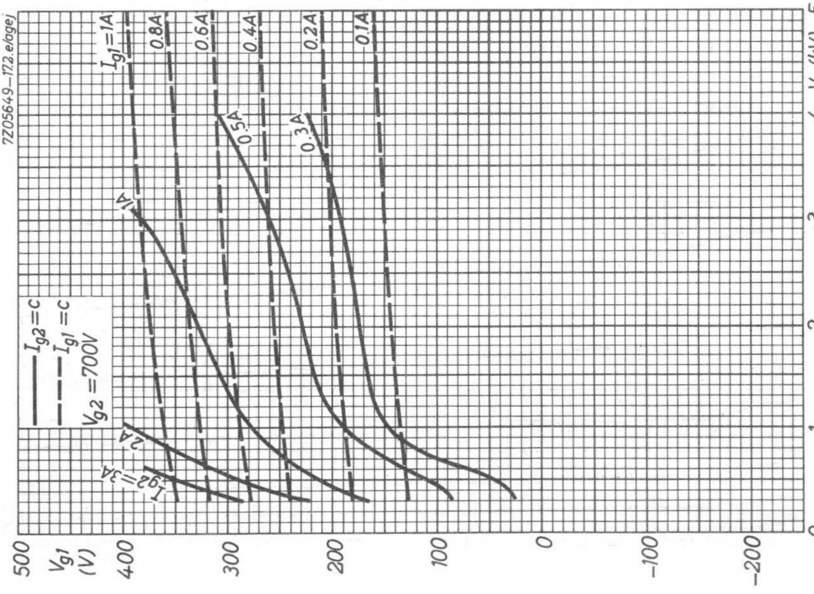

7Z05653–17.2.e/agej
I_a (A)
V_{g2} =700V
V_{g1}=400V
350V
300V
250V
200V
150V
100V
50V
0V
0
2
4
6
0
1
2
3
4
5
V_a (kV)

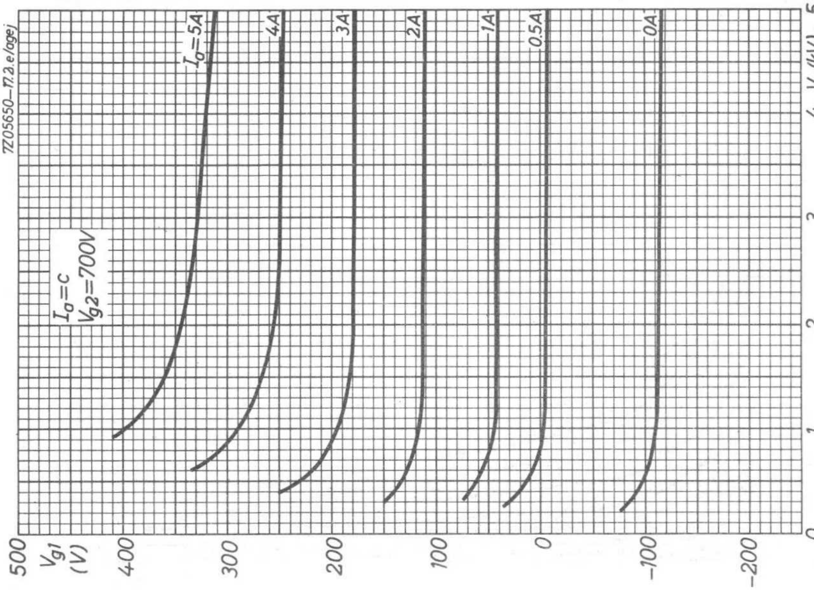
7Z05652-17.2.e/agej

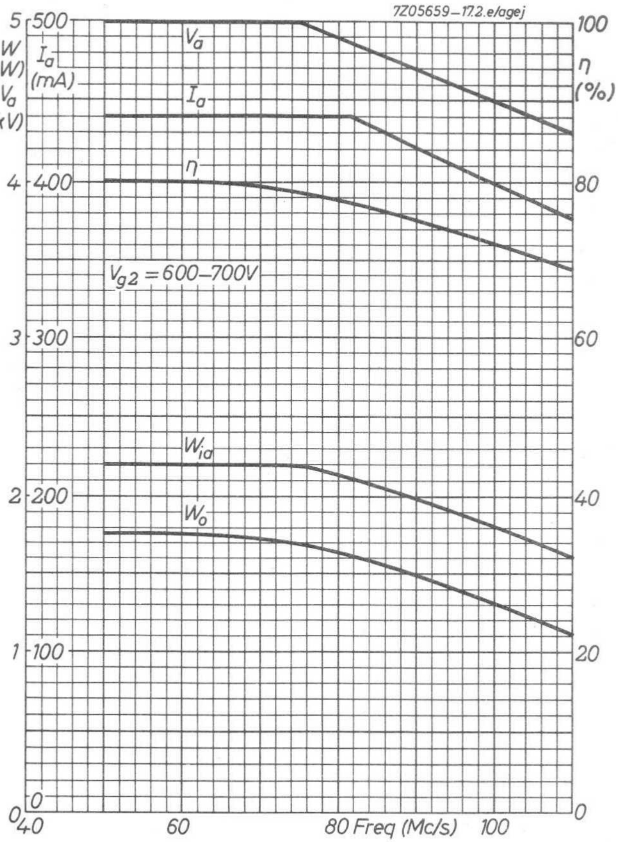


7Z05651-17.2.e/agej




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


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


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

R.F. POWER TETRODE

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

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f	=	7.5	V
Filament current	I_f	=	22.6	A

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

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	47.6	pF
Anode to all other elements except grid No.1	C_a	=	9.5	pF
Anode to grid No.1	C_{ag_1}	=	0.1	pF

TYPICAL CHARACTERISTICS

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

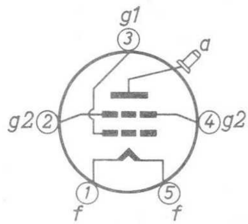
7Z2 2898

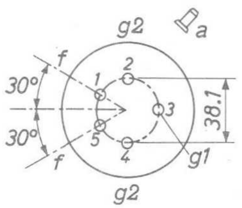
COOLING: radiation and convection; low velocity air flow

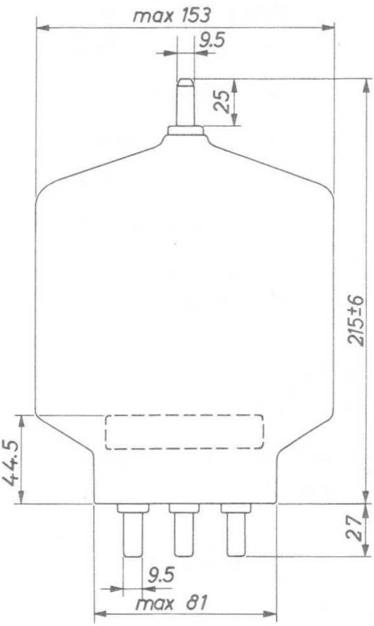
TEMPERATURE LIMITS (Absolute limits)

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

7Z2 8800

R.F. CLASS C AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	5.5	kV
Anode dissipation	W_a	= max.	800	W
Anode input power	W_{ia}	= max.	3.5	kW
Anode current	I_a	= max.	700	mA
Grid No.2 voltage	V_{g_2}	= max.	800	V
Grid No.2 dissipation	W_{g_2}	= max.	120	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	500	V
Grid No.1 current	I_{g_1}	= max.	35	mA

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V_a	=	5	kV
Grid No.2 voltage	V_{g_2}	=	600	V
Grid No.1 voltage	V_{g_1}	=	−240	V
Anode current	I_a	=	600	mA
Grid No.2 current	I_{g_2}	=	185	mA
Grid No.1 current	I_{g_1}	=	20	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	300	V
Driving power	W_{dr}	=	10	W
Anode input power	W_{ia}	=	3000	W
Grid No.2 dissipation	W_{g_2}	=	110	W
Anode dissipation	W_a	=	600	W
Output power	W_o	=	2400	W
Efficiency	η	=	80	%

Page 4

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

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

7Z2 2900

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

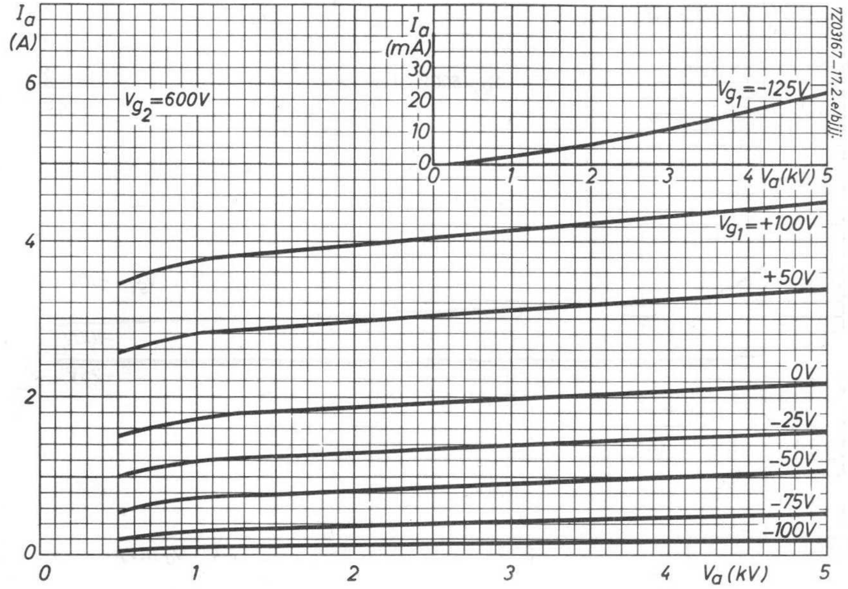
Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	5.5	kV
Anode dissipation	W_a	= max.	800	W
Anode input power	W_{ia}	= max.	2.5	kW
Anode current	I_a	= max.	600	mA
Grid No.2 voltage	V_{g_2}	= max.	800	V
Grid No.2 dissipation	W_{g_2}	= max.	120	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	500	V
Grid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

OPERATING CONDITIONS

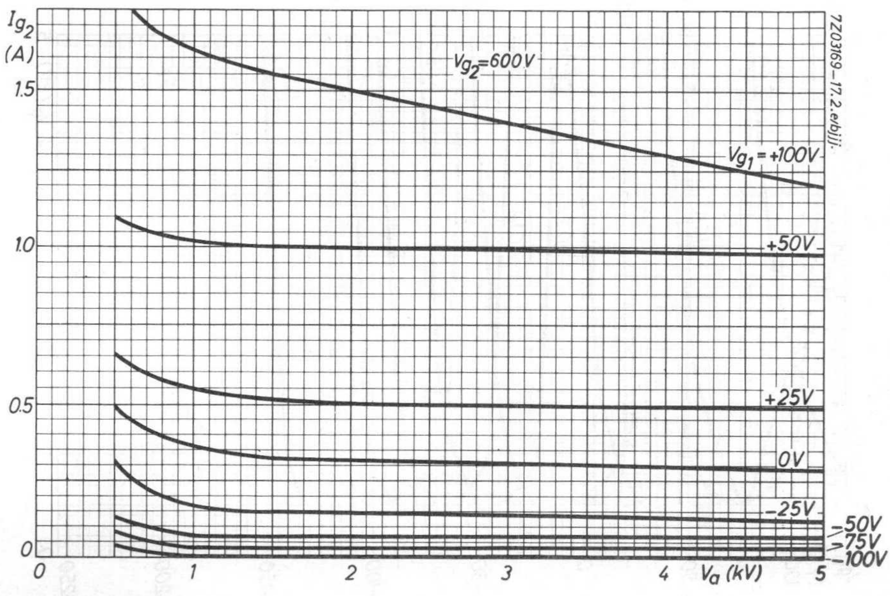
Frequency	f	=		30		MHz
Anode voltage	V_a	=		4		kV
Grid No.2 voltage	V_{g_2}	=		600		V
Grid No .1 voltage	V_{g_1}	=		−105		V [1]
			zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	100	100	V
Anode current	I_a	=	150	465	330	mA
Grid No.2 current	I_{g_2}	=	8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

1)2) See page 3

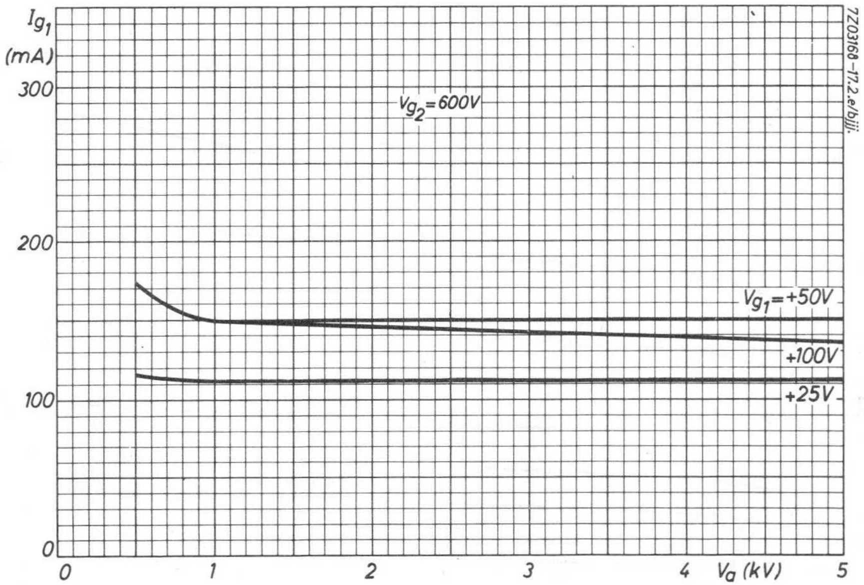
7Z2 2901

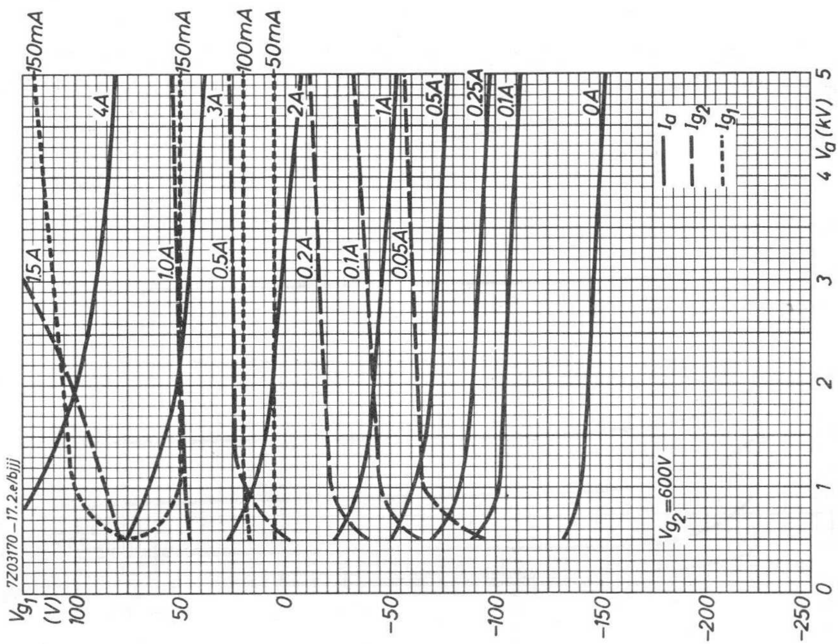


Ia (A)
6
4
2
0
Vg2=600V
Ia (mA)
30
20
10
0
Vg1=-125V
0 1 2 3 4 Va(kV) 5
Vg1=+100V
+50V
0V
-25V
-50V
-75V
-100V
0 1 2 3 4 Va (kV) 5
7Z03167-17.2.e/b/jj.



Ig2 (A)
1.5
1.0
0.5
0
Vg2=600V
Vg1=+100V
+50V
+25V
0V
-25V
-50V
-75V
-100V
0 1 2 3 4 Va (kV) 5
7Z03169-17.2.e/b/jj.


Ig1 (mA)
300
200
100
0
Vg2=600V
Vg1=+50V
+100V
+25V
0
1
2
3
4
5
Va (kV)
7Z03168-17.2.e/bjjj.


150mA
150mA
100mA
50mA
4A
3A
2A
1A
0.5A
0.25A
0.1A
0A
1.5A
1.0A
0.5A
0.2A
0.2A
0.1A
0.05A
Ia
Ig2
Ig1
Va (kV)
0
1
2
3
4
5
Vg2=600V
Vg1 (V)
100
50
0
-50
-100
-150
-200
-250
7Z03170-17.2.e/bjjj

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-g1} (kV)	W_o (W) [1]	V_{a-g1} (kV)	W_o (W) [1]
790			2.5	210
800	4.31	2100		

Television service

Freq. (MHz)	Neg. mod.	Pos. synchr.	
	V_{a-g1} (kV)	W_o sync [1] (W)	W_o black [1] (W)
800	4.32	2200	1300

HEATING: direct; filament thoriated tungsten

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

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

[1]) Useful power in the load

7Z2 8801

TYPICAL CHARACTERISTICS

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

CAPACITANCES

Grounded cathode

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

Grounded grids No.1 and 2

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

TEMPERATURE LIMITS (Absolute limits)

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

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

COOLING

Cooling data for the anode radiator

For recommended cooling arrangement see page 5.

Anode dissipation W_a (W)	Height h (m)	Max. air inlet temp. t_i (°C)	Min. air flow q(m³/min.)	Pressure p_i (mm H_2O)
1500	0	45	3.2	75

7Z2 2903

COOLING (continued)

Remarks

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

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

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

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

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

Page 8

1) The cathode voltage should be adjusted for a zero signal anode current I_a = 580 mA.

2) Peak envelope power. The driving signal consists of three independent H.F. signal voltages, i.e.

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

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

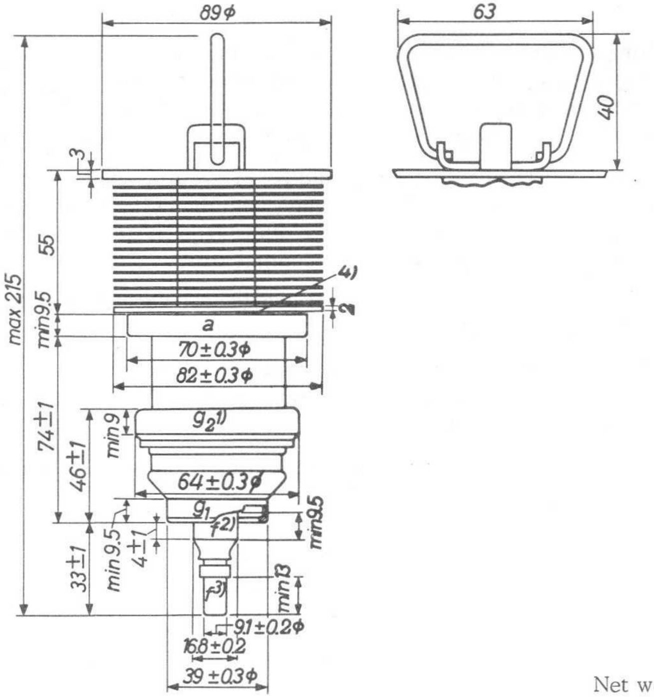
3) Peak envelope power. Typical value, measured in a circuit having an efficiency of about 85%.

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

7Z2 2904

MECHANICAL DATA

Dimensions in mm



Net weight 1900 g

Mounting position: vertical with anode up or down

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1) Eccentricity with respect to the axis through the anode and grid No.1 max. 0.3 mm

2) Cathode return terminal. Eccentricity with respect to the axis through anode and grid No.1 max. 0.4 mm

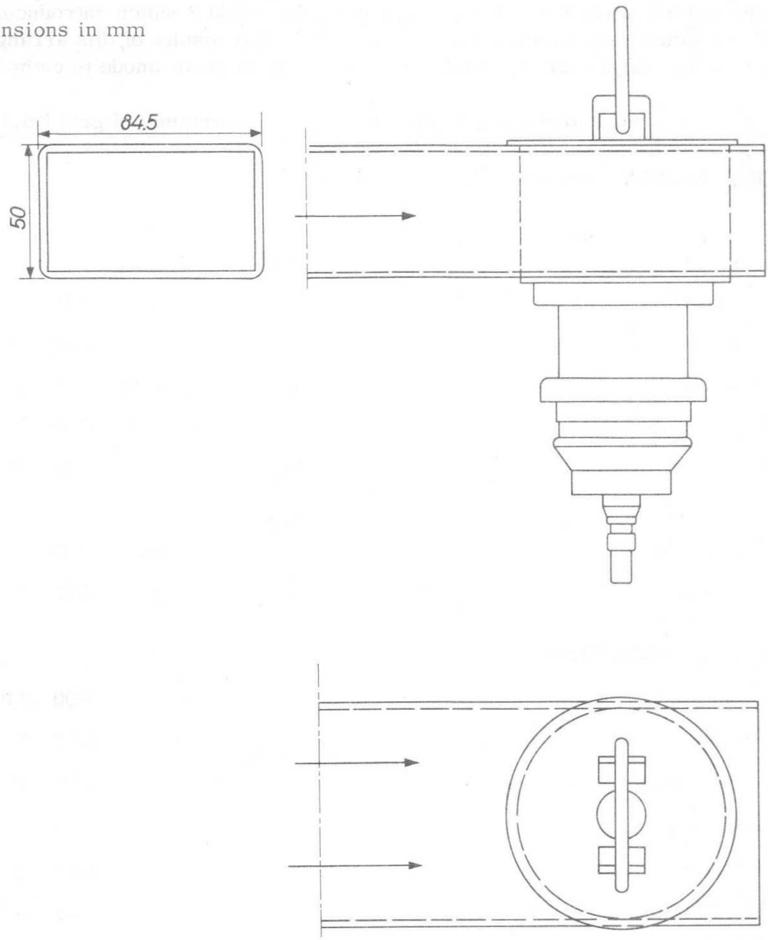
3) Eccentricity with respect to the axis through anode and grid No.1 max. 0.8 mm

4) Point for anode temperature measurement

7Z2 2905

Recommended anode cooling arrangement

Dimensions in mm



7Z2 2906

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

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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

7Z2 2907

U.H.F. CLASS C AMPLIFIER FOR TELEVISION SERVICE, grid modulated, cathode driven; negative modulation, positive synchronisation
A tunable coaxial circuit is built between grids No.1 and 2 which introduces a variable capacitive reactance between these grids. The results of this arrangement are better efficiency and negligible regeneration from anode to cathode.

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 2908

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

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

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

LIMITING VALUES (Absolute limits)

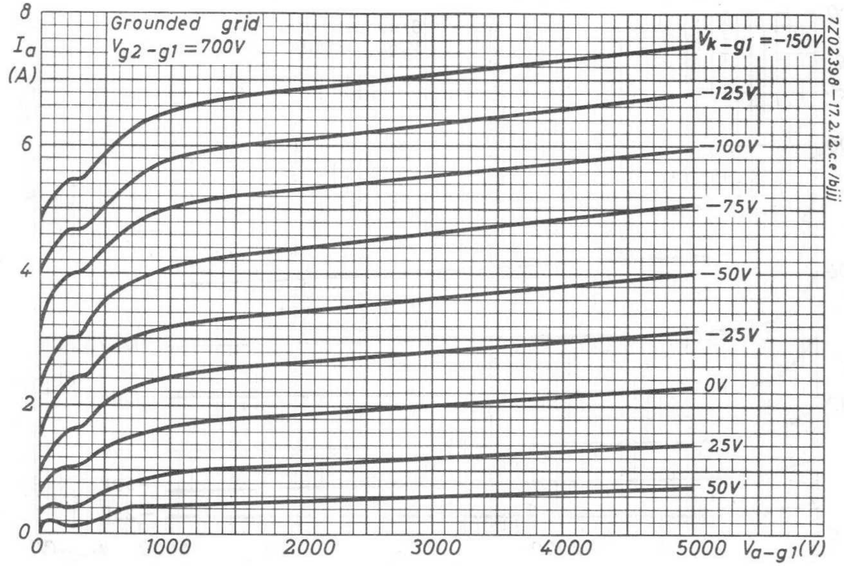
Frequency	f		up to 1000	MHz
Anode voltage	V_{a-g_1}	=	max. 3000	V
Anode dissipation	W_a	=	max. 1500	W
Anode input power	W_{ia}	=	max. 1800	W
Anode current	I_a	=	max. 800	mA
Grid No.2 voltage	$V_{g_2-g_1}$	=	max. 700	V
Grid No.2 dissipation	W_{g_2}	=	max. 50	W
Grid No.2 current	I_{g_2}	=	max. 75	mA
Grid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

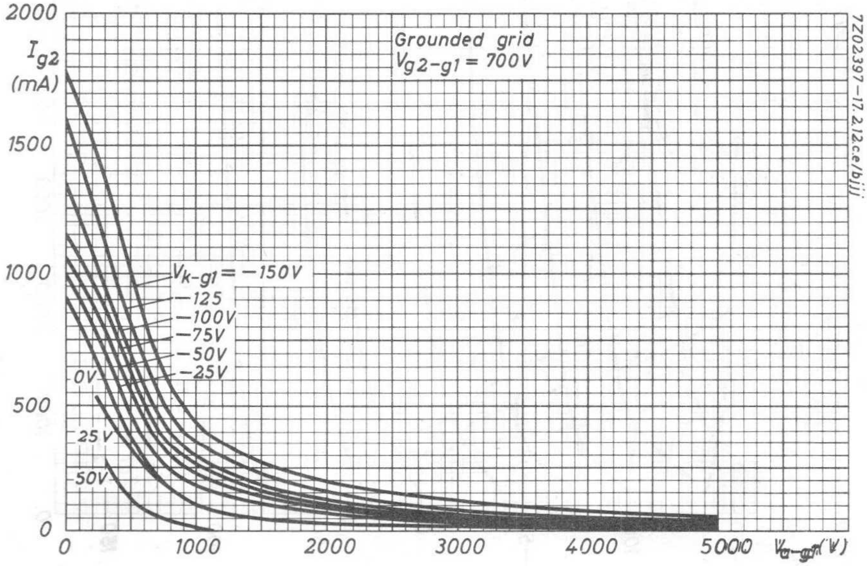
OPERATING CONDITIONS

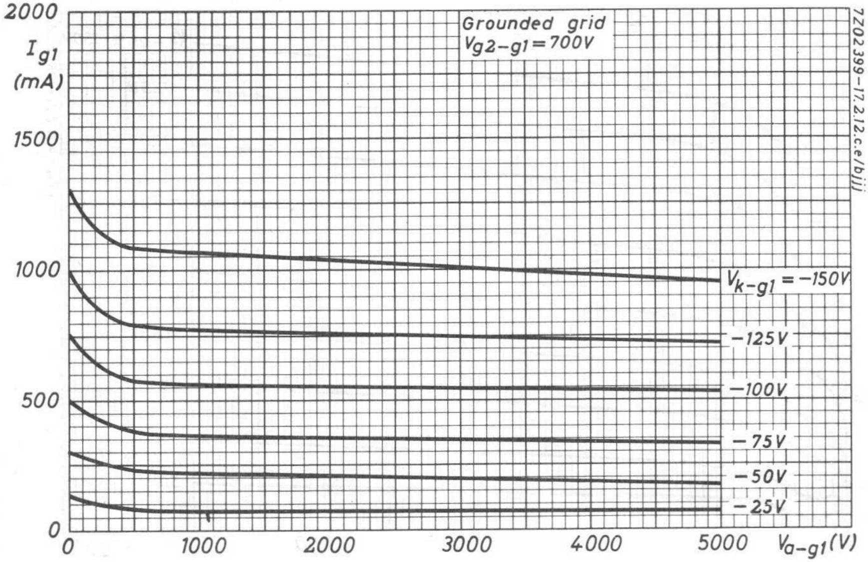
Frequency	f	=	790	MHz
Bandwidth at -1 dB	B	=	6	MHz
Anode voltage	V_{a-g_1}	=	2500	V
Grid No.2 voltage	$V_{g_2-g_1}$	=	500	V
Cathode voltage	V_{k-g_1}	=	28	V [1]
Anode current	I_a	=	580	mA
Grid No.2 current	I_{g_2}	=	5	mA
Grid No.1 current	I_{g_1}	=	0	mA
Driver output power	W_{dr}(PEP)	=	16	W [2]
Output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

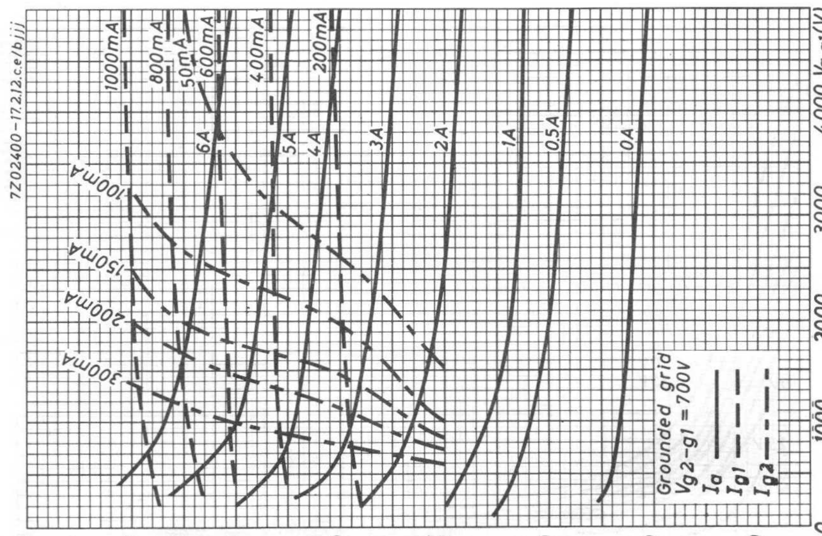
[1][2][3][4] See page 3

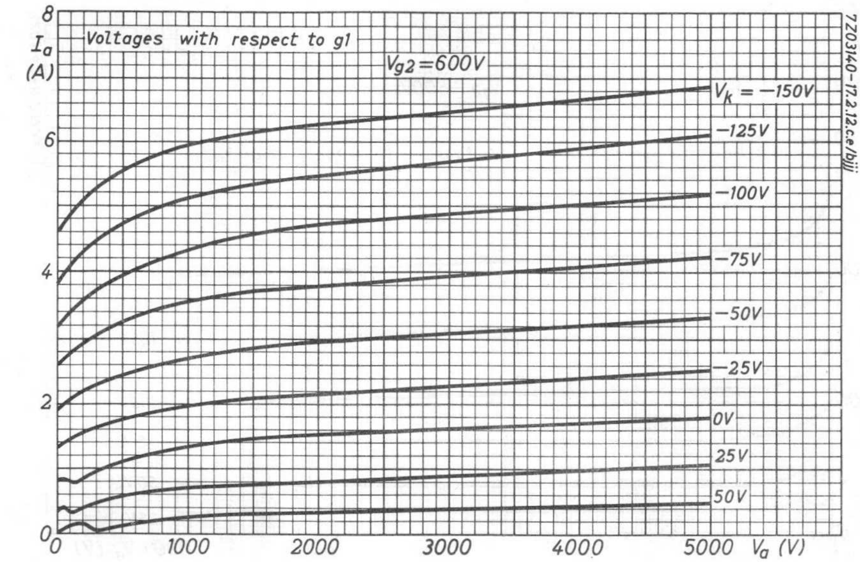
7Z2 2909

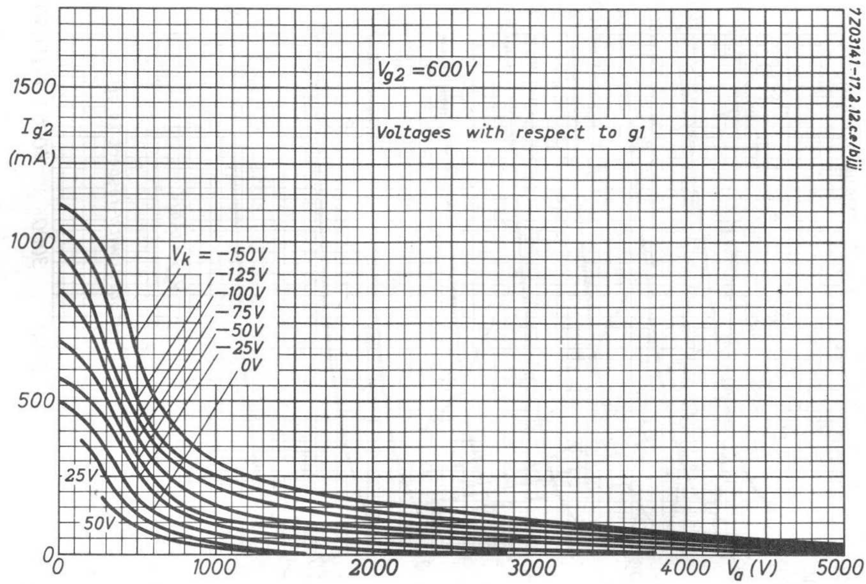

8
I_a
(A)
6
4
2
0
Grounded grid
V_{g2-g1} = 700V
V_{k-g1} = −150V
−125V
−100V
−75V
−50V
−25V
0V
25V
50V
0
1000
2000
3000
4000
5000
V_{a-g1}(V)
7Z02398−17.2.12.c.e/bjj

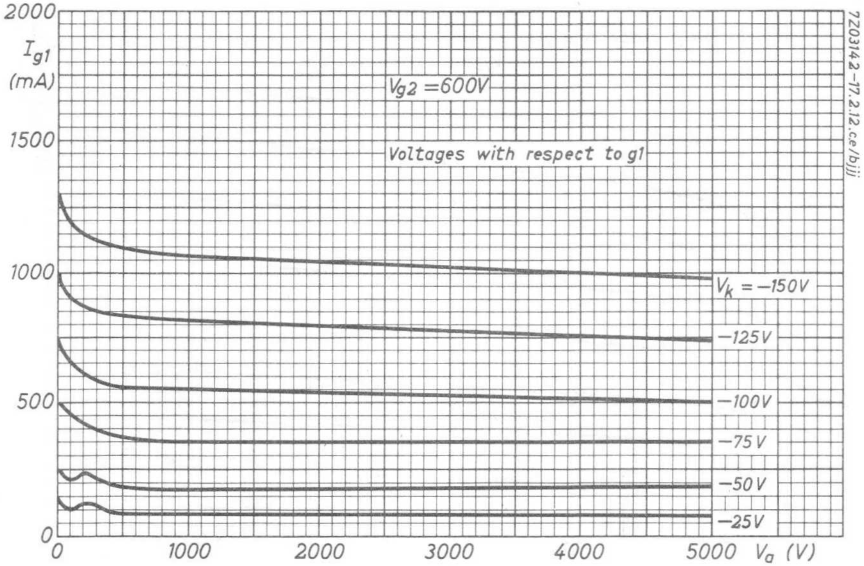

2000
I_{g2}
(mA)
1500
1000
500
0
Grounded grid
V_{g2-g1} = 700V
V_{k-g1} = −150V
−125
−100V
−75V
−50V
−25V
0V
25V
50V
0
1000
2000
3000
4000
5000
V_{a-g1}(V)
7Z02397−17.2.12.c.e/bjj

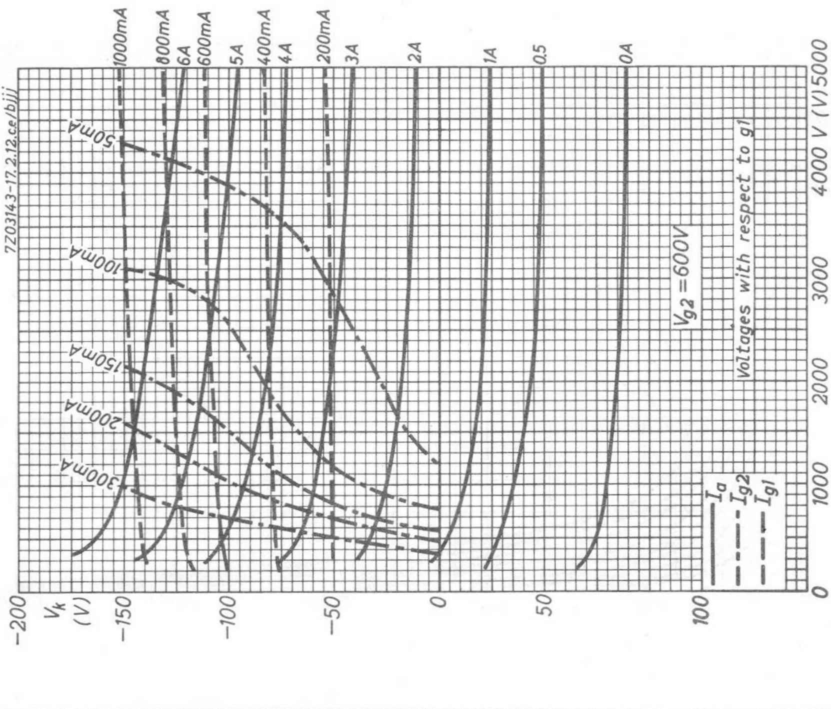

2000
I_{g1}
(mA)
1500
1000
500
0
0
1000
2000
3000
4000
5000
V_{a-g1}(V)
Grounded grid
V_{g2-g1} = 700V
V_{k-g1} = −150V
−125V
−100V
−75V
−50V
−25V
7Z02399-17.2.12.c.e/bjjj


7Z02400-17.2.12.c.e/bjjj
1000mA
800mA
50mA
600mA
400mA
200mA
100mA
150mA
200mA
300mA
6A
5A
4A
3A
2A
1A
0.5A
0A
V_{a-g1}(V)
4000
3000
2000
1000
0
Grounded grid
V_{g2-g1} = 700V
I_a
I_{g1}
I_{g2}
−200
V_{k-g1}
(V)
−150
100
−50
0
50
100
150


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


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


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


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

R.F. POWER TETRODE

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

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f	=	5	V
Filament current	I_f	=	13.5	A

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	5.6	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	12.8	pF
Anode to grid No.1	C_{ag_1}	=	0.05	pF

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

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

7Z2 2606

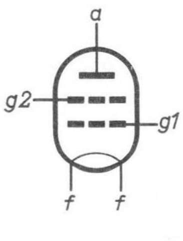
COOLING CHARACTERISTICS

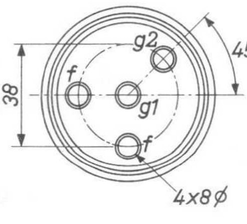
W_a (W)	h (m)	$t_{i max.}$ (°C)	$q_{min.}$ (m^3/min.)	p_i (mm H_2O)
300	0	35	0.50	9.8
	0	45	0.59	12.9
	1500	35	0.60	12.0
	3000	25	0.63	11.5
400	0	35	0.77	17.5
	0	45	0.90	23.0
	1500	35	0.93	21.3
	3000	25	0.97	20.5
500	0	35	1.13	35.5
	0	45	1.32	46.9
	1500	35	1.36	43.3
	3000	25	1.42	41.5

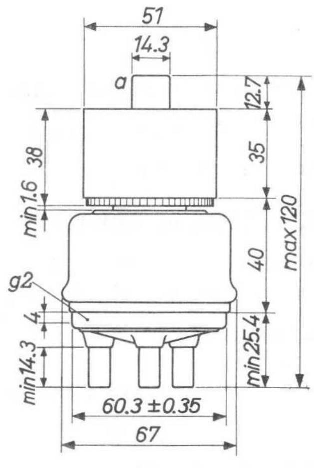
MECHANICAL DATA

Dimensions in mm

Net weight: 530 g







Mounting position: vertical with anode up or down

7Z2 2607

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	120	MHz
Anode voltage	V_a	=	max.	4000	V
Anode input power	W_{ia}	=	max.	1400	W
Anode dissipation	W_a	=	max.	500	W
Anode current	I_a	=	max.	350	mA
Grid No.2 voltage	V_{g_2}	=	max.	500	V
Grid No.2 dissipation	W_{g_2}	=	max.	30	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 current	I_{g_1}	=	max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

OPERATING CONDITIONS

Frequency	f	=	110	110	110	MHz
Anode voltage	V_a	=	4000	3000	2500	V
Grid No.2 voltage	V_{g_2}	=	500	500	500	V
Grid No.1 voltage	V_{g_1}	=	−150	−150	−150	V
Anode current	I_a	=	315	310	310	mA
Grid No.2 current	I_{g_2}	=	22	24	26	mA
Grid No.1 current	I_{g_1}	=	16	16	15	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	230	230	230	V
Grid No.1 input power	W_{ig_1}	=	5	5	5	W
Grid No.2 dissipation	W_{g_2}	=	11	12	13	W
Anode input power	W_{ia}	=	1260	930	775	W
Anode dissipation	W_a	=	330	260	245	W
Output power	W_o	=	930	670	530	W
Efficiency	η	=	73.5	72	68.5	%
Useful power in the load	W_ℓ	=	835	600	475	W

7Z2 2608

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

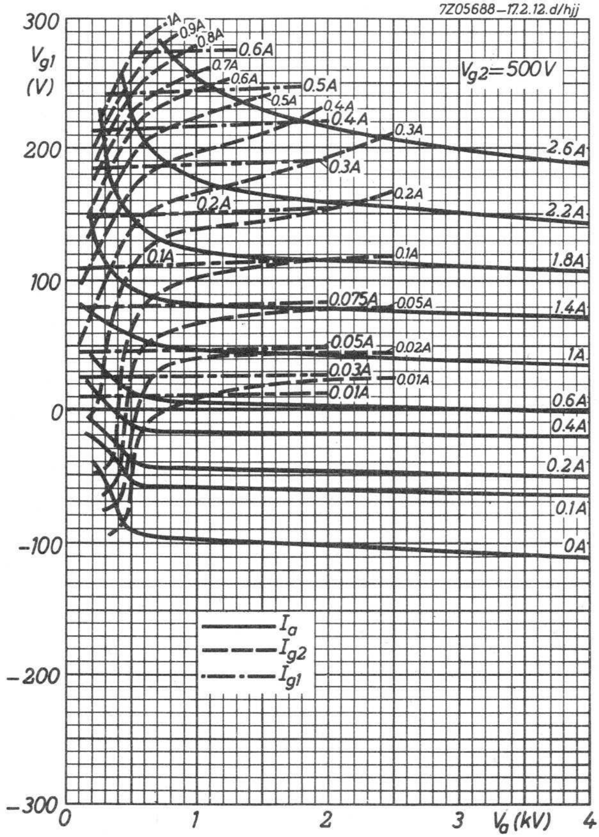
LIMITING VALUES (black level; absolute limits)

Frequency	f		up to	220	MHz
Anode voltage	V_a	=	max.	3000	V
Grid No.2 voltage	V_{g_2}	=	max.	500	V
Anode current	I_a	=	max.	350	mA
Anode input power	W_{ia}	=	max.	1050	W
Anode dissipation	W_a	=	max.	500	W
Grid No.2 dissipation	W_{g_2}	=	max.	30	W
Grid No.1 current	I_{g_1}	=	max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

OPERATING CONDITIONS , one tube

Frequency	f		=	220	220	MHz
Bandwidth	B		=	6	6	MHz
Anode voltage	V_a		=	2400	1850	V
Grid No.2 voltage	V_{g_2}		=	500	500	V
Grid No.1 voltage	V_{g_1}		=	-100	-100	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	sync	=	185	140	V
Anode current	I_a	sync	=	400	285	mA
		black	=	300	215	mA
Grid No.2 current	I_{g_2}	sync	=	35	20	mA
		black	=	3	2	mA
Grid No.1 current	I_{g_1}	sync	=	15	10	mA
		black	=	5	2	mA
Grid No.1 input power	W_{ig_1}	sync	=	25	15	W
Anode input power	W_{ia}	sync	=	960	525	W
		black	=	720	400	W
Output power	W_o	sync	=	600	300	W
		black	=	340	170	W

7Z2 2609


7Z05688–17.2.12.d/hjj
V_{g2}=500V
V_{g1} (V)
300
200
100
0
-100
-200
-300
0
1
2
3
4
V_a (kV)
2.6A
2.2A
1.8A
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0A
I_a
I_{g2}
I_{g1}

AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA

General purposes

λ (m)	Freq. (MHz)	C telegr.		C_{ag_2} mod.	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
4	75	5	4.1		
		4	3.15		
2.7	110	5	3.9	4	2.7
1.36	220	4	2.9		

Television service

	Freq. (MHz)	Neg.mod. Pos.sync.			Pos.mod. Neg.sync.	
		V_a (kV)	W_o (kW) sync	W_o (kW) black	V_a (kV)	W_o (kW) white
Narrow-band	170-220	4	5.9	3.3	4	4.0
Broad-band	54-88	5	8.0	4.5		
	170-220	4	5.0	2.8	4	2.8

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3 V
Filament current	I_f	=	32.5 A

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	8.4 pF
Grid No.1 to all other elements except anode	C_{g_1}	=	23.5 pF
Anode to grid No.1	C_{ag_1}	<	0.35 pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	8.5
Mutual conductance	$S (I_a = 2\ A)$	=	19 mA/V

7Z2 2847

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

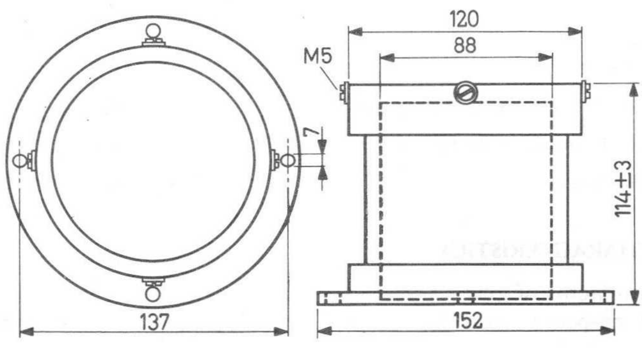
Anode cooling characteristics (see also cooling curves page A)

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

MECHANICAL DATA Dimensions in mm

Insulating pedestal: 40635

Net weight : 1.6 kg



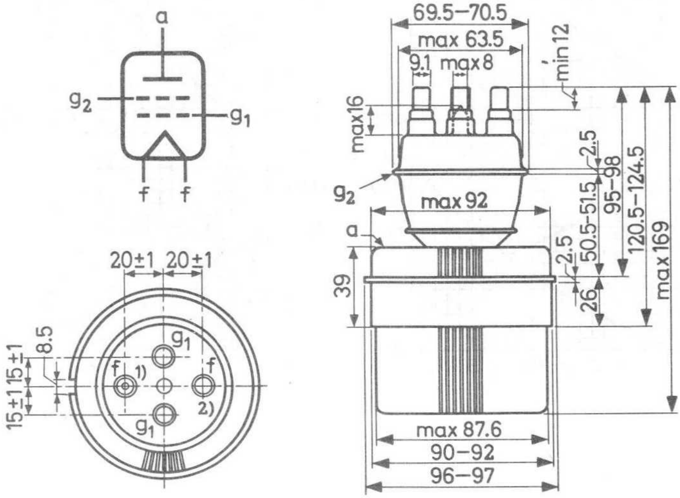
7Z2 4046

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 up or down

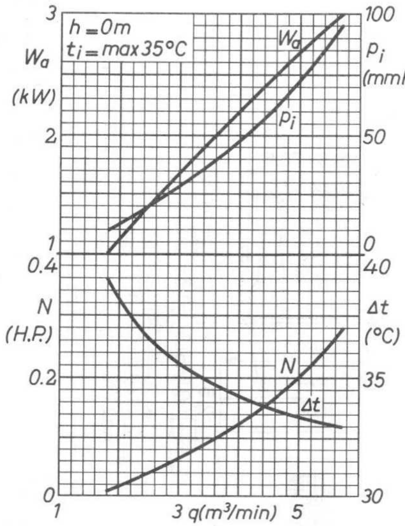
At frequencies above 30 MHz both connecting pins must be used when connecting the control grid

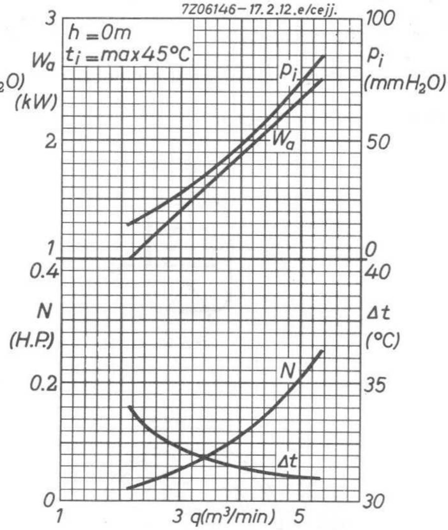
For further data and curves (except cooling curves) of this type please refer to type QBW5/3500

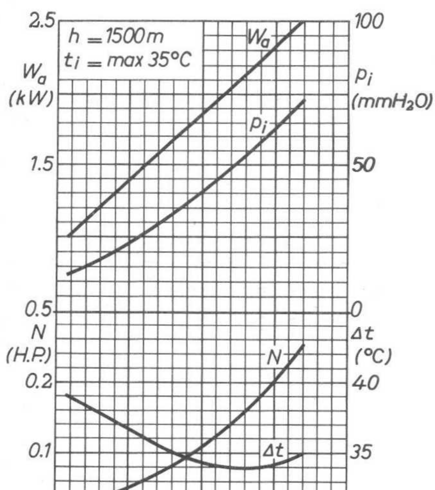
1) This pin is marked "O"

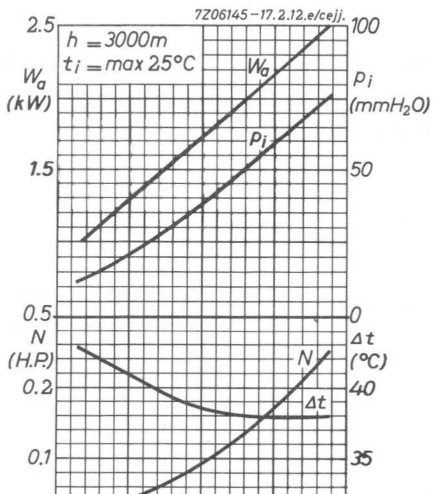
2) This pin should be used for connecting the anode return lead

7Z2 8802


h = 0m
t_i = max 35°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
W_a
p_i
N
Δt
3 q(m³/min) 5
1
0
0.4
0.2
2
3
100
50
40
35
30


7Z06146-17.2.12.e/cejj.
h = 0m
t_i = max 45°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
p_i
W_a
N
Δt
3 q(m³/min) 5
1
0
0.4
0.2
2
3
100
50
40
35
30


h = 1500m
t_i = max 35°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
W_a
p_i
N
Δt
2
4 q(m³/min)
6
0
0.1
0.2
0.5
1.5
2.5
100
50
0
40
35
30


7Z06145-17.2.12.e/cejj.
h = 3000m
t_i = max 25°C
W_a (kW)
p_i (mmH_2O)
N (H.P.)
Δt (°C)
W_a
p_i
N
Δt
2
4 q(m³/min)
6
0
0.1
0.2
0.5
1.5
2.5
100
50
0
40
35
30

WATER COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA					
General purposes					
λ (m)	Freq. (MHz)	C telegr.		C_{ag_2} mod.	
		V_a (kV)	W_o (kW)	V_a (kV)	W_o (kW)
4	75	5	4.1		
		4	3.15		
2.7	110	5	3.9	4	2.7
1.36	220	4	2.9		

Television service						
	Freq. (MHz)	Neg.mod. Pos.sync.			Pos.mod. Neg.sync.	
		V_a (kV)	W_o (kW) sync	W_o (kW) black	V_a (kV)	W_o (kW) white
Narrow-band	170-220	4	5.9	3.3	4	4.0
Broad-band	54-88	5	8.0	4.5		
	170-220	4	5.0	2.8	4	2.8

HEATING: direct; filament thoriated tungsten

Filament voltage	V_f	=	6.3	V
Filament current	I_f	=	32.5	A

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	8.4	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	23.5	pF
Anode to grid No.1	C_{ag_1}	<	0.35	pF

7Z2 8803

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	8.5	
Mutual conductance	S (I_a = 2 A)	=	19	mA/V

TEMPERATURE LIMITS (Absolute limits)

Temperature of seals	=	max.	180	^oC
Bulb temperature	=	max.	250	^oC

COOLING

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

COOLING CHARACTERISTICS . See also cooling curves on page E

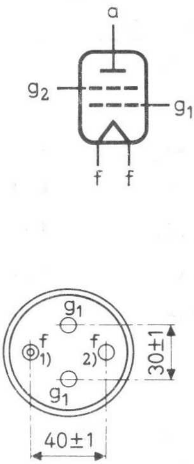
W_a (kW)	t_i (^oC)	q (l/min)	p_i (atm)
1	20 50	2.5 3.0	0.073 0.1
2	20 50	2.5 4.8	0.073 0.25
3	20 50	3.0 6.9	0.105 0.55

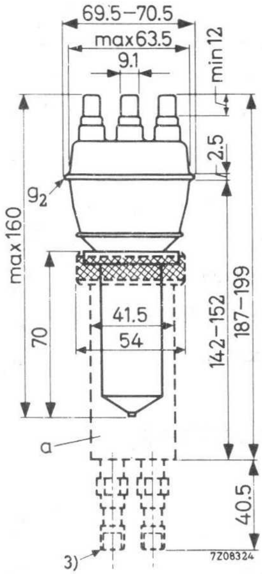
t_i = max. 50 ^oC

7Z2 8804

MECHANICAL DATA Dimensions in mm

Tube mounted in water jacket type K 713





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
K713: 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

7Z2 8805

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to 30	110	220	MHz
Anode voltage	V_a	=	max. 5.5	5	4	kV
Anode input power	W_{ia}	=	max.	5.5		kW
Anode dissipation	W_a	=	max.	3		kW
Anode current	I_a	=	max.	1.1		A
Grid No.2 voltage	V_{g_2}	=	max.	800		V
Grid No.2 dissipation	W_{g_2}	=	max.	100		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500		V
Grid No.1 dissipation	W_{g_1}	=	max.	30		W

OPERATING CONDITIONS

Frequency	f	=	75	110	75	220	MHz
Anode voltage	V_a	=	5	5	4	4	kV
Grid No.2 voltage	V_{g_2}	=	800	800	800	800	V
Grid No.1 voltage	V_{g_1}	=	-250	-250	-250	-250	V
Anode current	I_a	=	1.1	1.1	1.1	1.1	A
Grid No.2 current	I_{g_2}	=	100	100	120	120	mA
Grid No.1 current	I_{g_1}	=	70	70	80	80	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	480	480	500	500	V
Grid No.1 input power	W_{ig_1}	=	30	30	36	36	W
Grid No.2 dissipation	W_{g_2}	=	80	80	96	96	W
Anode input power	W_{ia}	=	5.5	5.5	4.4	4.4	kW
Anode dissipation	W_a	=	1.4	1.6	1.25	1.5	kW
Output power	W_o	=	4.1	3.9	3.15	2.9	kW
Efficiency	η	=	74.5	71	72	66	%

7Z2 8806

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

Screen grid modulated via a choke of 60 H

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	110	220	MHz
Anode voltage	V_a	=	max.	4.5	4	3.2	kV
Anode input power	W_{ia}	=	max.		3.6		kW
Anode dissipation	W_a	=	max.		2		kW
Anode current	I_a	=	max.		0.9		A
Grid No.2 voltage	V_{g_2}	=	max.		800		V
Grid No.2 dissipation	W_{g_2}	=	max.		100		W [1])
Negative grid No.1 voltage	$-V_{g_1}$	=	max.		500		V
Grid No.1 dissipation	W_{g_1}	=	max.		30		W

OPERATING CONDITIONS

Frequency	f	=	110	MHz
Anode voltage	V_a	=	4	kV
Grid No.2 voltage	V_{g_2}	=	800	V
Grid No.1 voltage	V_{g_1}	=	-375	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	625	V
Anode current	I_a	=	0.9	A
Grid No.2 current	I_{g_2}	=	120	mA
Grid No.1 current	I_{g_1}	=	85	mA
Anode input power	W_{ia}	=	3.6	kW
Anode dissipation	W_a	=	0.9	kW
Output power	W_o	=	2.7	kW
Grid No.2 dissipation	W_{g_2}	=	96	W
Grid No.1 input power	W_{ig_1}	=	48	W
Efficiency	η	=	75	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	1.8	kW

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

7Z2 8807

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	5	kV
Anode current	I_a	=	max.	1.3	A
Anode input power	W_{ia}	=	max.	6.5	kW
Anode dissipation	W_a	=	max.	3	kW
Grid No.2 voltage	V_{g_2}	=	max.	800	V
Grid No.2 dissipation	W_{g_2}	=	max.	100	W
Grid No.1 current	I_{g_1}	=	max.	80	mA

OPERATING CONDITIONS

Frequency	f	=	30		30		30		MHz
Anode voltage	V_a	=	5		4.5		4		kV
Grid No.2 voltage	V_{g_2}	=	800		800		800		V
Grid No.1 voltage	V_{g_1}	=	−107		−105		−104		V
			zero signal	single tone signal	zero signal	single tone signal	zero signal	single tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	277	0	275	0	274	V
Anode current	I_a	=	0.08	1.3	0.08	1.29	0.07	1.28	A
Grid No.2 current	I_{g_2}	=	0	75	0	75	0	78	mA
Grid No.1 current	I_{g_1}	=	0	55	0	55	0	54	mA
Grid No.1 input power	W_{ig_1}	=	0	15	0	15	0	15	W
Grid No.2 dissipation	W_{g_2}	=	0	60	0	60	0	62.5	W
Anode input power	W_{ia}	=	0.40	6.5	0.36	5.8	0.28	5.1	kW
Anode dissipation	W_a	=	0.40	2.1	0.36	1.95	0.28	1.8	kW
Output power	W_o	=	–	4.4	–	3.85	–	3.3	kW
Efficiency	η	=	–	68	–	66.5	–	65	%

7Z2 8808

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	5	kV
Anode input power	W_{ia}	=	max.	5.5	kW
Anode dissipation	W_a	=	max.	3	kW
Anode current	I_a	=	max.	1.1	A [1]
Grid No.2 voltage	V_{g_2}	=	max.	800	V
Grid No.2 dissipation	W_{g_2}	=	max.	100	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	500	V
Grid No.1 dissipation	W_{g_1}	=	max.	30	W

OPERATING CONDITIONS, two tubes

V_a	=	5		5		5		4		kV
V_{g_2}	=	800		800		800		800		V
V_{g_1}	=	-107		-107		-107		-103		V
$R_{aa\sim}$	=	3700		5000		17600		7000		Ω
$V_{g_1g_{1p}}$	=	0	714	0	594	0	214	0	366	V
I_a	=	2x0.1	2x1.46	2x0.1	2x1.1	2x0.1	2x0.32	2x0.1	2x0.6	A
I_{g_2}	=	0	2x120	0	2x50	0	2x10	0	2x60	mA
I_{g_1}	=	0	2x150	0	2x40	0	0	0	2x11	mA
$I_{g_{1p}}$	=	0	2x750	0	2x460	0	0	0	2x70	mA
W_{ig_1}	=	0	2x50	0	2x11	0	0	0	2x2	W
W_{g_2}	=	0	2x96	0	2x40	0	2x8	0	2x48	W
W_{ia}	=	2x0.5	2x7.3	2x0.5	2x5.5	2x0.5	2x1.6	2x0.4	2x2.4	kW
W_a	=	2x0.5	2x2.55	2x0.5	2x1.9	2x0.5	2x0.55	2x0.4	2x0.9	kW
W_o	=	0	9.5	0	7.2	0	2.1	0	3.0	kW
η	=	–	65	–	65	–	65	–	62	%

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

7Z2 2856

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to 110	up to 220	MHz
Anode voltage	V_a	=	max. 5	max. 4	kV
Anode input power	W_{ia} sync	=	max. 7	max. 6	kW
Anode current	I_a sync	=	max. 1.5		A
Anode dissipation	W_a sync	=	max. 3		kW
Grid No.2 voltage	V_{g_2}	=	max. 800		V
Grid No.2 dissipation	W_{g_2} sync	=	max. 100		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 500		V
Grid No.1 current	I_{g_1} sync	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

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

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

7Z2 8809

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

LIMITING VALUES (Absolute limits)

Frequency	f			up to 110	up to 220	MHz
Anode voltage	V_a		=	max. 5	max. 4	kV
Anode input power	W_{ia}	sync	=	max. 7	max. 6	kW
Grid No.2 voltage	V_{g_2}		=	max. 800		V
Anode current	I_a	sync	=	max. 1.5		A
Anode dissipation	W_a	sync	=	max. 3		kW
Grid No.2 dissipation	W_{g_2}	sync	=	max. 100		W
Grid No.1 current	I_{g_1}	sync	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

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

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

7Z2 8810

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

LIMITING VALUES (Absolute limits)

Frequency	f		up to 110	up to 220	MHz
Anode voltage	V_a	=	max. 5	max. 4	kV
Anode input power	W_{ia} white	=	max. 5.5	max. 4.4	kW
Grid No.2 voltage	V_{g_2}	=	max. 800		V
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 500		V
Anode current	I_a white	=	max. 1.1		A
Anode dissipation	W_a white	=	max. 3		kW
Grid No.2 dissipation	W_{g_2} white	=	max. 100		W
Grid No.1 current	I_{g_1} white	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

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

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

7Z2 8811

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

LIMITING VALUES (Absolute limits)

Frequency	f			up to 110	up to 220	MHz
Anode voltage	V_a		=	max. 5	max. 4	kV
Anode input power	W_{ia}	white	=	max. 5.5	max. 4.4	kW
Grid No.2 voltage	V_{g_2}		=	max. 800		V
Anode current	I_a	white	=	max. 1.1		A
Anode dissipation	W_a	white	=	max. 3		kW
Grid No.2 dissipation	W_{g_2}	white	=	max. 100		W
Grid No.1 current	I_{g_1}	white	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

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

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

7Z2 8812

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

LIMITING VALUES (Absolute limits)

Frequency	f			up to 110	up to 220	MHz
Anode voltage	V_a		=	max. 5	max. 4	kV
Anode input power	W_{ia}	sync	=	max. 7	max. 6	kW
Anode current	I_a	sync	=	max. 1.5		A
Anode dissipation	W_a	sync	=	max. 3		kW
Grid No.2 voltage	V_{g_2}		=	max. 800		V
Grid No.2 dissipation	W_{g_2}	sync	=	max. 100		W
Negative grid No.1 voltage	$-V_{g_1}$		=	max. 500		V
Grid No.1 current	I_{g_1}	sync	=	max. 80		mA

OPERATING CONDITIONS, two tubes in push-pull

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

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

7Z2 8813

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

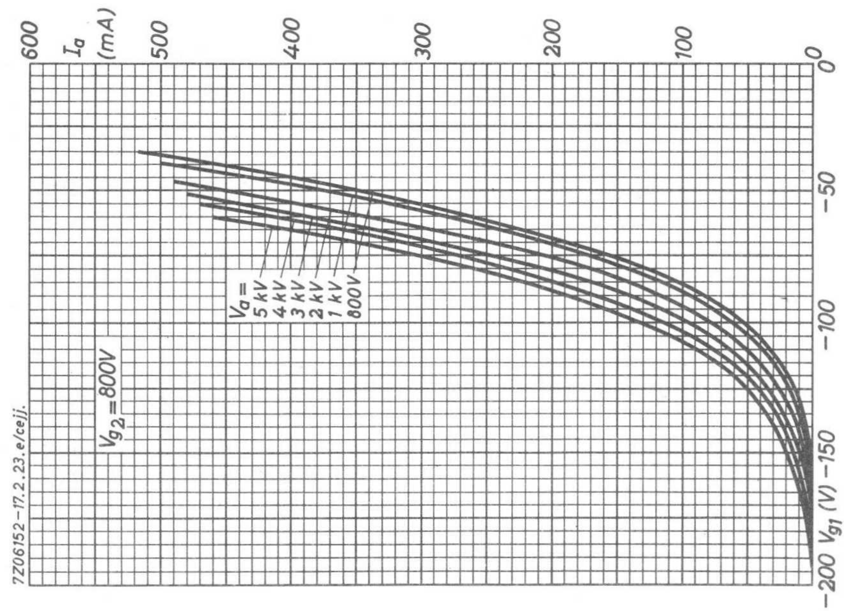
2) This value of bandwidth is based on measurements on a circuit with a single L.C. section.

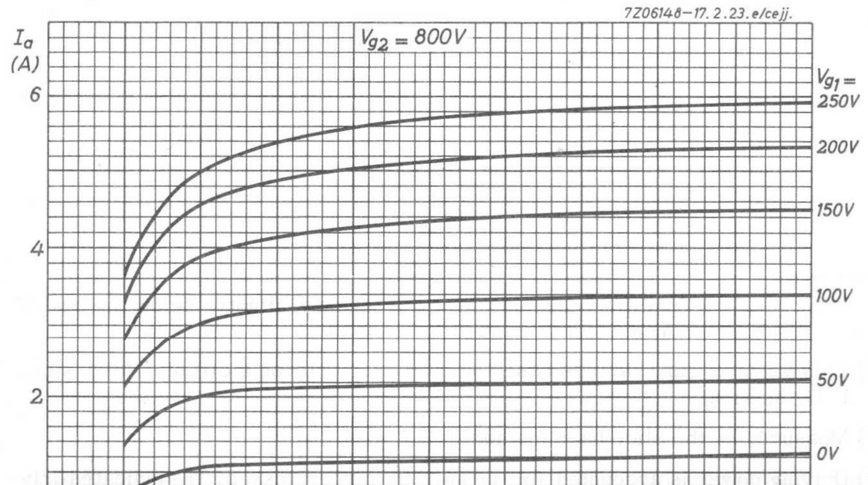
3) Measured by the slide back method.

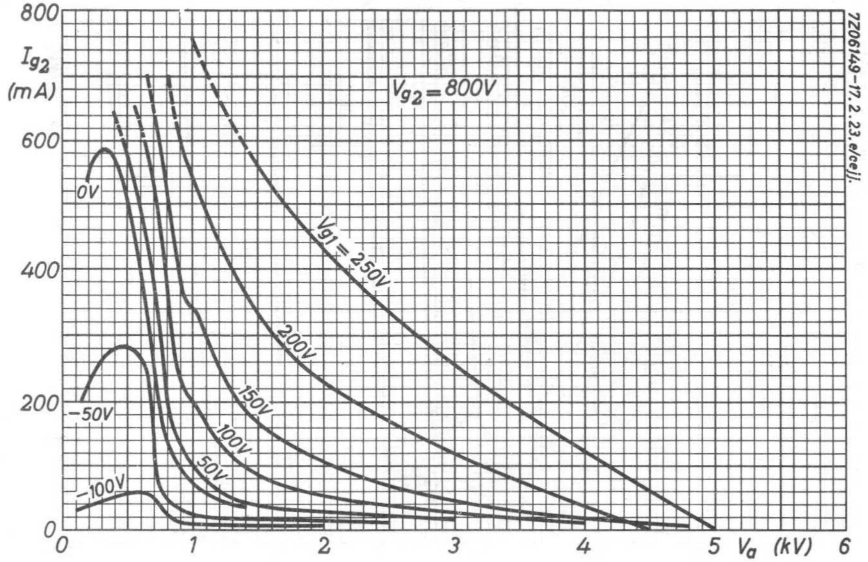
4) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

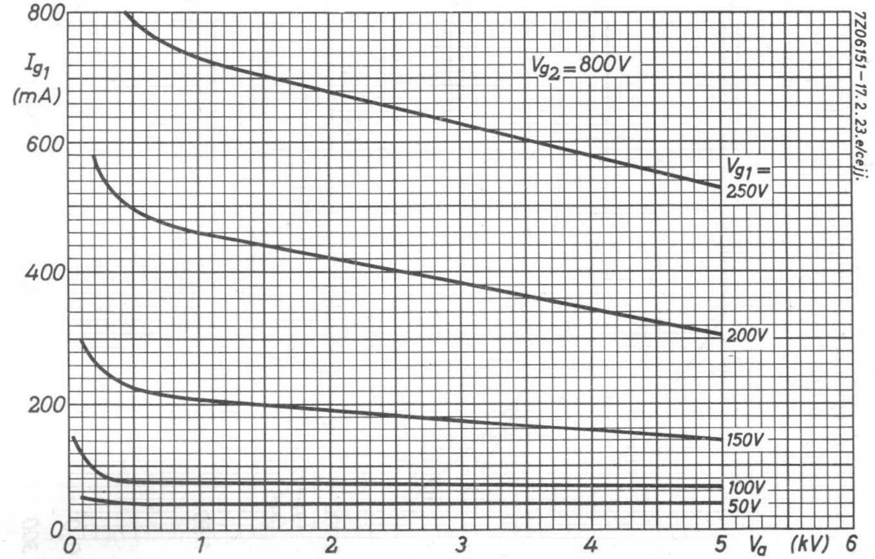
5) In the peak of the resonance curve W_o (white) = 3.3 kW

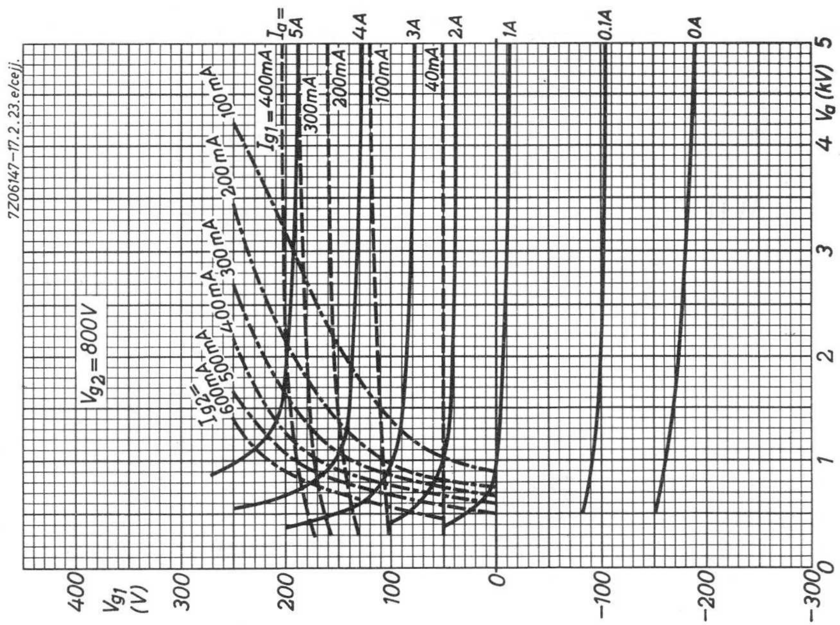
7Z2 2862

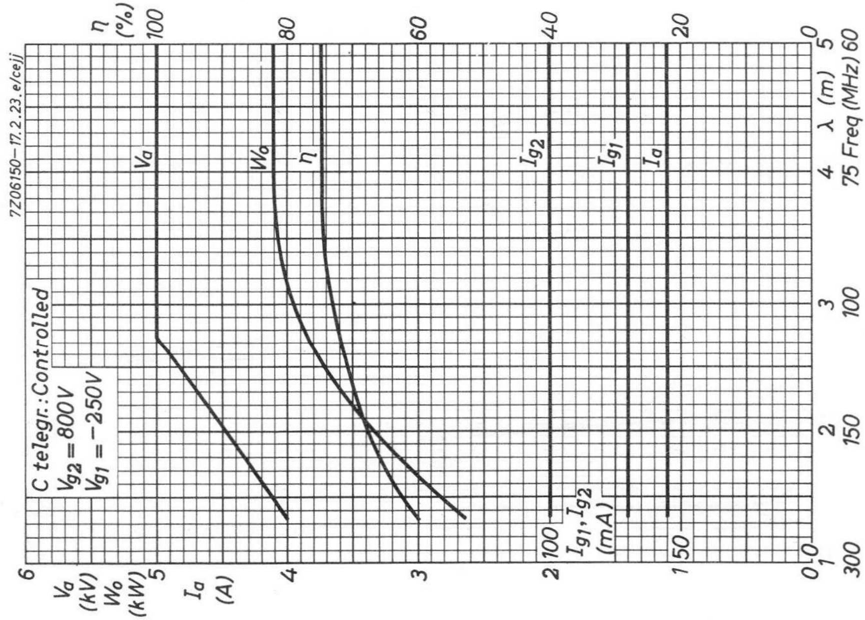

600
I_a (mA)
500
400
300
200
100
0
0
−50
−100
−150
−200 V_g1 (V)
V_a =
5 kV
4 kV
3 kV
2 kV
1 kV
800V
V_g2 = 800V
7Z06152−17.2.23.e/cejj.

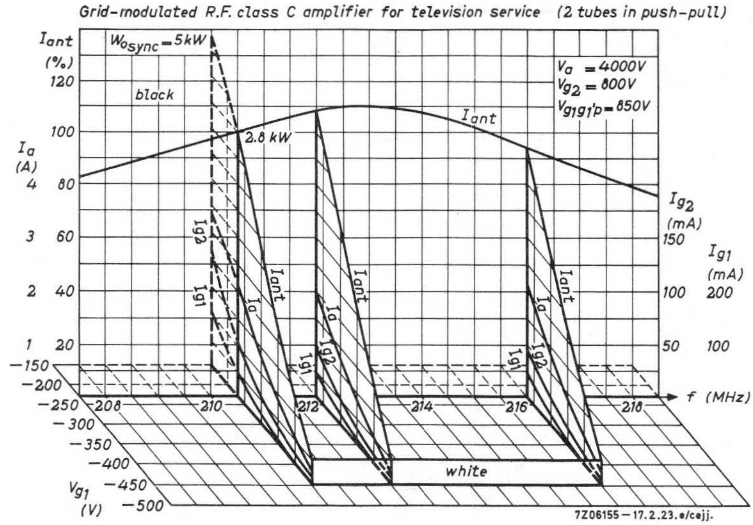

7Z06148−17.2.23.e/cejj.
I_a (A)
V_g2 = 800V
V_g1 =
250V
200V
150V
100V
50V
0V
−50V
−100V
6
4
2
0
0
1
2
3
4
V_a (kV)
5

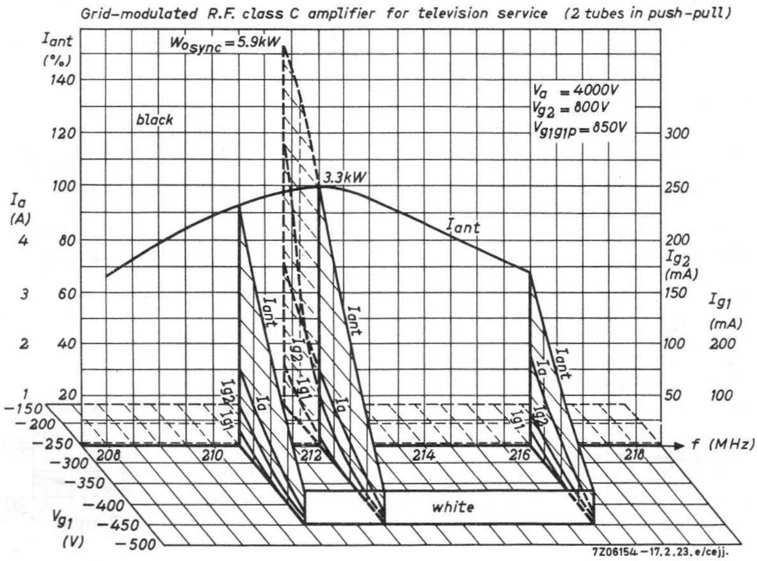

800
I_{g2}
(mA)
600
400
200
0
0
1
2
3
4
5
V_a (kV)
6
V_{g2} = 800V
V_{g1} = 250V
200V
150V
100V
50V
0V
−50V
−100V
7Z06149−17.2.23.e/ce/j.


800
I_{g1}
(mA)
600
400
200
0
0
1
2
3
4
5
V_a (kV)
6
V_{g2} = 800V
V_{g1} =
250V
200V
150V
100V
50V
7Z06151−17.2.23.e/ce/j.

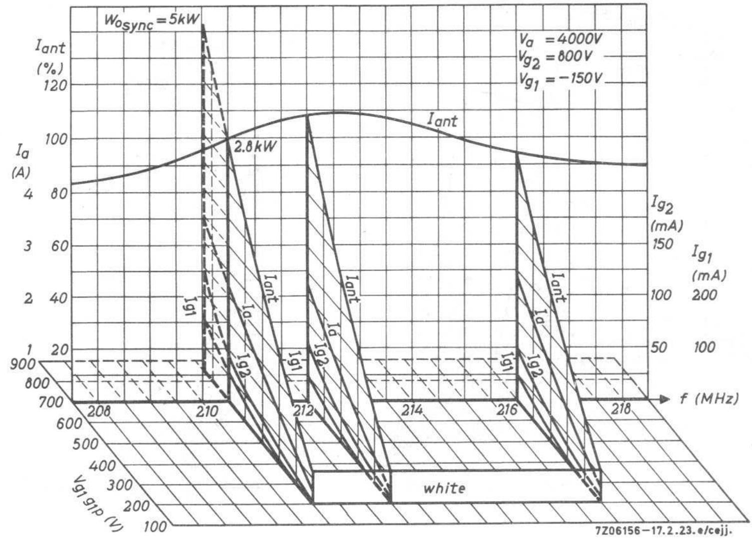

7Z06147-17.2.23.e/cejj.
V_{g2} = 800V
I_a = 5A
4A
3A
2A
1A
0.1A
0A
I_{g1} = 400mA
300mA
200mA
100mA
40mA
I_{g2} = A
600mA
500mA
400mA
300mA
200mA
100mA
V_{g1} (V)
V_a (kV)

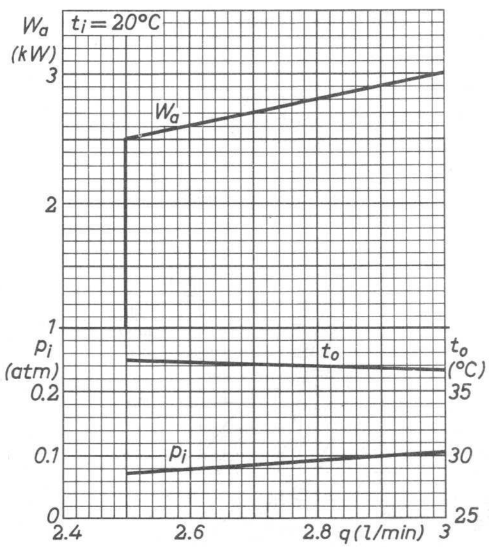

7Z06150-17.2.23.e/cejj
C telegr.: Controlled
V_{g2} = 800V
V_{g1} = −250V
V_a
W_o
η
I_{g2}
I_{g1}
I_a
V_a (kV)
W_o (kW)
I_a (A)
I_{g1}, I_{g2} (mA)
η (%)
λ (m)
Freq (MHz)

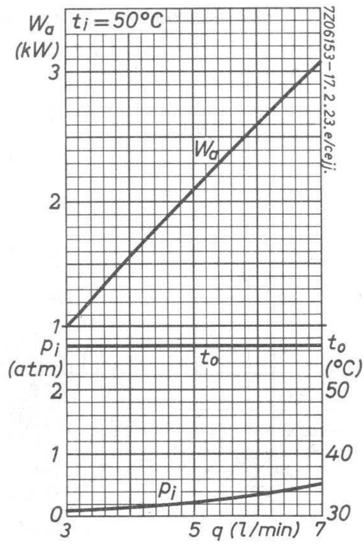

Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)
I_{ant} (%)
$W_{o_{sync}}$ = 5kW
black
2.8 kW
I_{ant}
V_a = 4000V
V_{g_2} = 800V
$V_{g_1g_1'p}$ = 850V
I_a (A)
I_{g_2} (mA)
I_{g_1} (mA)
I_{g_1} I_{g_2} I_a I_{ant}
white
f (MHz)
208 210 212 214 216 218
V_{g_1} (V)
-150 -200 -250 -300 -350 -400 -450 -500
7Z06155 — 17.2.23.e/cejj.


Grid-modulated R.F. class C amplifier for television service (2 tubes in push-pull)
I_{ant} (%)
$W_{o_{sync}}$ = 5.9kW
black
3.3kW
I_{ant}
V_a = 4000V
V_{g_2} = 800V
$V_{g_1g_1p}$ = 850V
I_a (A)
I_{g_2} (mA)
I_{g_1} (mA)
I_{g_1} I_{g_2} I_a I_{ant}
white
f (MHz)
208 210 212 214 216 218
V_{g_1} (V)
-150 -200 -250 -300 -350 -400 -450 -500
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

Filament voltage	V_f	=	1.6	V ±15%
Filament current	I_f	=	3.2	A

The cathode heating time for $W_o > 70\%$ of $W_{o\,max.}$ = 0.4 sec.

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	8.5	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	13.5	pF
Anode to grid No.1	C_{ag_1}	<	0.24	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	200	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	100	mA
Mutual conductance	S	=	7	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	4.5	

[1]) Intermittent mobile service

7Z2 2953

MECHANICAL DATA

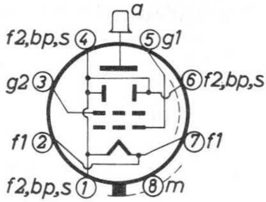
Dimensions in mm

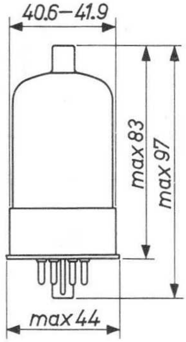
Base : Octal 8p

Socket : 2422 501 03001

Anode connector : 28 906 022

Net weight : 57 g





Mounting position: When the tube is mounted with its main axis deviating from the vertical it is recommended that the pins 3 and 7 be placed in a vertical plane.

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature max. 220 °C

DERATING TABLE of the limiting values of V_a and W_{ia} as a function of the operating frequency

Freq. (MHz)	V_a (%)	W_{ia} (%)
60	100	100
80	84	92
125	65	78
150	58	72
160	56	70
175	53	67

7Z2 8814

R.F.CLASS C TELEGRAPHY AND F.M. TELEPHONY , intermittent mobile service

LIMITING VALUES (Absolute limits) See also page 2 for derating table

Frequency	f		up to	60	MHz
Anode voltage	V_a	=	max.	650	V
Anode input power	W_{ia}	=	max.	90	W
Anode dissipation	W_a	=	max.	25	W
Anode current	I_a	=	max.	160	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 current	I_{g_1}	=	max.	5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1])

OPERATING CHARACTERISTICS

Frequency	f	=	60	175	MHz
Anode voltage	V_a	=	600	400	V
Grid No.2 voltage	V_{g_2}	=	180	190	V [2])
Grid No.1 voltage	V_{g_1}	=	-71	-54	V [3])
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	91	68	V
Anode current	I_a	=	150	150	mA
Grid No.2 current	I_{g_2}	=	15	15	mA
Grid No.1 current	I_{g_1}	=	2.8	2.2	mA
Grid No.1 input power	W_{ig_1}	=	0.3	3	W
Anode input power	W_{ia}	=	90	60	W
Anode dissipation	W_a	=	25	25	W
Output power	W_o	=	65	35	W
Efficiency	η	=	73.5	58	%

---

[1]) For operation at maximum ratings

[2]) Obtained preferably from the anode supply through a series resistor

[3]) V_{g_1} may be obtained by means of a grid resistor or from a combination of grid resistor and fixed supply.

7Z2 2955

R.F. CLASS C ANODE AND SCREEN GRID MODULATION, intermittent mobile service

LIMITING VALUES (Absolute limits) See also page 2 for derating table

Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	480	V
Anode input power	W_{ia}	= max.	45	W
Anode dissipation	W_a	= max.	14	W
Anode current	I_a	= max.	120	mA
Grid No.2 voltage	V_{g_2}	= max.	250	V
Grid No.2 dissipation	W_{g_2}	= max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	3.5	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	30	kΩ [1]

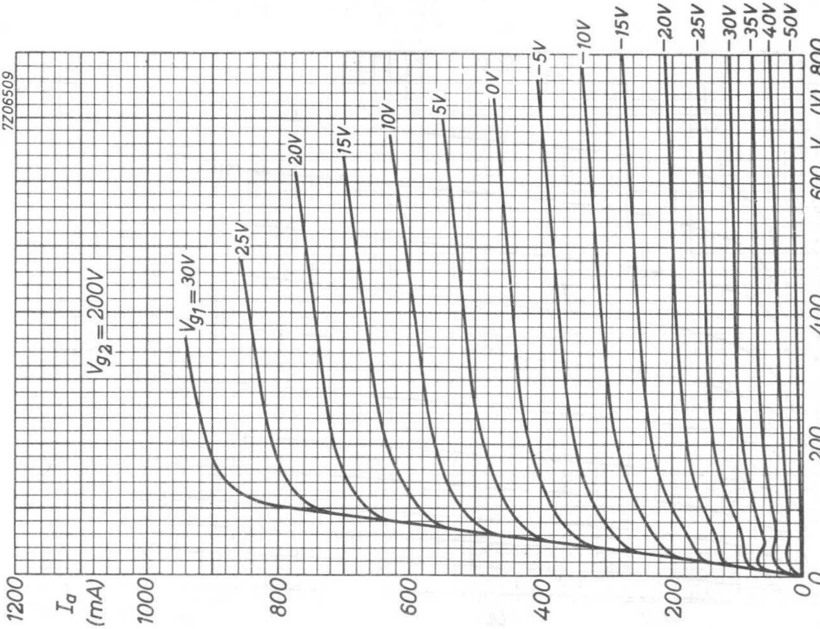
OPERATING CHARACTERISTICS

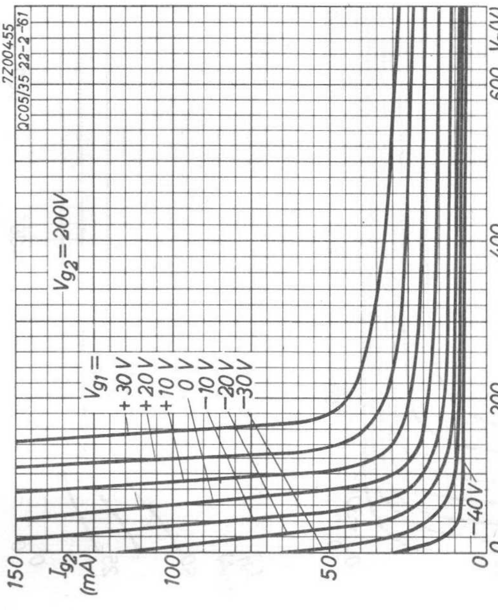
Frequency	f	=	60	60	MHz
Anode voltage	V_a	=	475	400	V
Grid No.2 voltage	V_{g_2}	=	135	150	V [4]
Grid No.1 voltage	V_{g_1}	=	−77	−87	V [3]
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	95	107	V
Anode current	I_a	=	94	112	mA
Grid No.2 current	I_{g_2}	=	9	12	mA
Grid No.1 current	I_{g_1}	=	2.8	3.4	mA
Grid No.1 input power	W_{ig_1}	=	0.3	0.4	W
Anode input power	W_{ia}	=	45	45	W
Anode dissipation	W_a	=	11	13	W
Output power	W_o	=	34	32	W
Efficiency	η	=	75	71	%
Modulation factor	m	=	100	100	%
Modulation power	W_{mod}	=	23	23	W

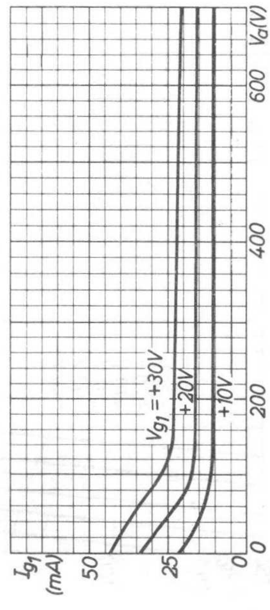
[1][3]) See page 3

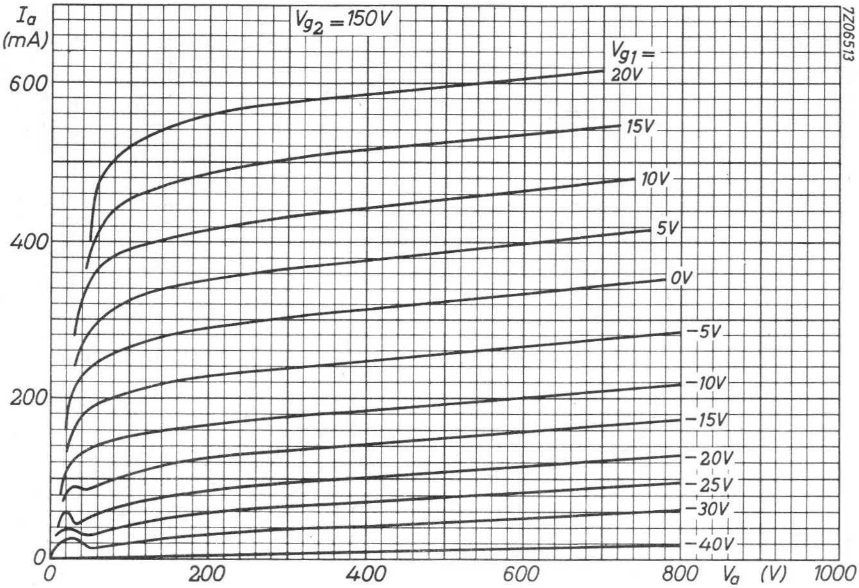
[4]) Obtained preferably from a separate source modulated by the anode supply or from the modulated anode supply through a series resistor.

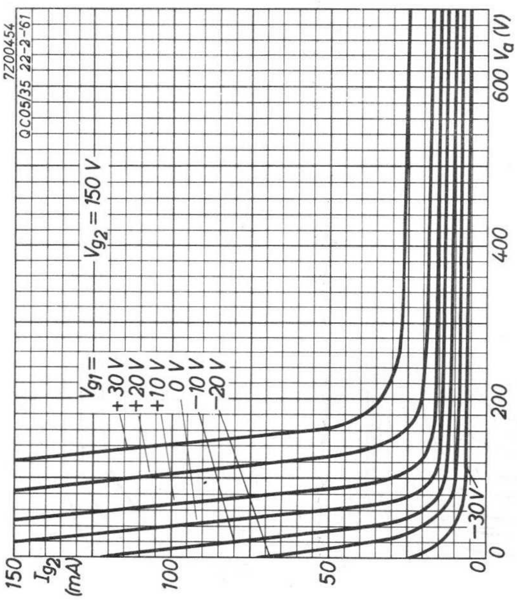
7Z2 2956

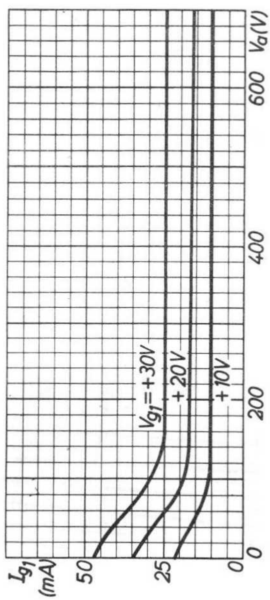

7Z06509
$V_{g2} = 200V$
$V_{g1} = 30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−50V
I_a (mA)
V_a (V)


7Z00455
QC05/35 22-2-'61
$V_{g2} = 200V$
V_{g1} =
+ 30 V
+ 20 V
+ 10 V
0 V
−10 V
−20 V
−30 V
−40V
I_{g2} (mA)
V_a(V)


$V_{g1} = +30V$
+20V
+10V
I_{g1} (mA)
V_a(V)


I_a (mA)
$V_{g_2} = 150V$
7Z06513
$V_{g_1} =$
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−40V
600
400
200
0
0
200
400
600
800
V_a (V)
1000


7Z00454
QC05/35 22-2-'61
$V_{g_2} = 150$ V
$V_{g_1} =$
+30 V
+20 V
+10 V
0 V
−10 V
−20 V
−30V
I_{g_2} (mA)
150
100
50
0
0
200
400
600
V_a (V)


$V_{g_1} = +30V$
+20V
+10V
I_{g_1} (mA)
50
25
0
0
200
400
600
V_a(V)

R.F. TETRODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr.		λ	Freq.	C fr.mult.	
m	MHz	V_a (V)	W_o (W)	m	MHz	V_a (V)	W_o (W)
>5	<60	300	8	8/4	37.5/75	300	5.6
3	100	300	7.4	6/3	50/100	300	4.4
2	150	300	6.3	4/2	75/150	250	2.3
1.7	175	280	5.4	12/4	25/75	300	3.2
		C_{ag_2} mod.		9/3	33.3/100	275	2.8
>5	<60	250	5.8	6/2	50/150	225	1.5

HEATING : indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	V
Heater current	I_f	=	0.6	A
Cathode heating time	T_{hk}	=	22	sec

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	5.4	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	8	pF
Anode to grid No.1	C_{ag_1}	<	0.1	pF

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.6	
Mutual conductance (I_a = 25 mA)	S	=	1.9	mA/V
Internal resistance	R_i	=	67	kΩ

7Z2 3051

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	400	V
Anode dissipation	W_a	=	max.	7.5	W
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2	W
Grid No.1 dissipation	W_{g_1}	=	max.	0.25	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	0.1	MΩ
Grid No.1 current	I_{g_1}	=	max.	6	mA
Cathode current	I_k	=	max.	50	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

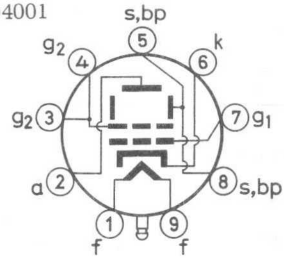
MECHANICAL DATA

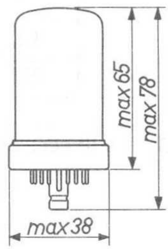
Dimensions in mm

Base : B9G

Socket : 2422 502 04001

Net weight: 40 g





Mounting position: arbitrary

7Z2 8815

OPERATING CONDITIONS R.F. CLASS C TELEGRAPHY

λ	=	>5	>5	3	2	2	1.7[1])	m
V_a	=	300	300	300	300	300	280	V
V_{g_1}	=	−60	−35	−60	−50	−30	−50	V
V_{g_2}	=	250	150	250	250	150	250	V
I_a	=	43	40	44.5	46	44	2x46	mA
I_{g_1}	=	0.5	2.8	0.4	0.4	1.5	2x0.3	mA
I_{g_2}	=	6.7	7.2	5.3	4	4.5	2x3.5	mA
$V_{g_{1p}}$	=	68	58	68	57	52	55	V
W_{ig_1}	=	31	150	25	21	70	2x15	mW
W_{g_2}	=	1.7	1.1	1.4	1	0.7	2x0.9	W
W_{ia}	=	12.9	12	13.4	13.8	13.2	2x12.9	W
W_a	=	4.9	4.9	6	7.5	6.9	2x7.5	W
W_o	=	8	7.1	7.4	6.3	6.3	10.8	W
η	=	62	59	55	46	48	42	%

OPERATING CONDITIONS CLASS C ANODE AND SCREEN GRID MODULATION

Wavelength	λ	>	5	m
Anode voltage	V_a	=	250	V
Grid No.1 voltage	V_{g_1}	=	−50	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	38.5	mA
Grid No.1 current	I_{g_1}	=	1.5	mA
Grid No.2 current	I_{g_2}	=	10	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	72	V
Grid No.1 input power	W_{ig_1}	=	0.1	W
Grid No.2 dissipation	W_{g_2}	=	2	W
Anode input power	W_{ia}	=	9.6	W
Anode dissipation	W_a	=	3.8	W
Output power	W_o	=	5.8	W
Efficiency	η	=	60	%
Modulation factor	m	=	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	176	V
Modulation power	W_{mod}	=	5	W

[1]) Two tubes in push-pull

7Z2 3053

OPERATING CONDITIONS AS CLASS C FREQUENCY DOUBLER

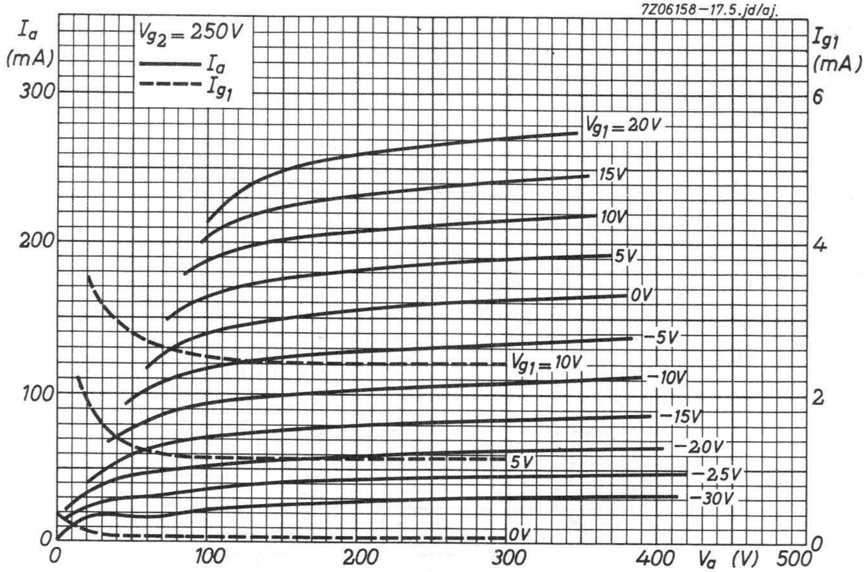
Wavelength	λ	=	8/4	6/3	4/2	m
Anode voltage	V_a	=	300	300	250	V
Grid No.1 voltage	V_{g_1}	=	−120	−120	−120	V
Grid No.2 voltage	V_{g_2}	=	250	200	200	V
Anode current	I_a	=	43.3	38.4	36.8	mA
Grid No.1 current	I_{g_1}	=	1.2	1.5	1.1	mA
Grid No.2 current	I_{g_2}	=	5.5	2.6	2.1	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	124	120	144	V
Grid No.1 input power	W_{ig_1}	=	134	162	143	mW
Grid No.2 dissipation	W_{g_2}	=	1.4	0.52	0.42	W
Anode input power	W_{ia}	=	13	11.5	9.2	W
Anode dissipation	W_a	=	7.4	7.1	6.9	W
Output power	W_o	=	5.6	4.4	2.3	W
Efficiency	η	=	43	38	25	%

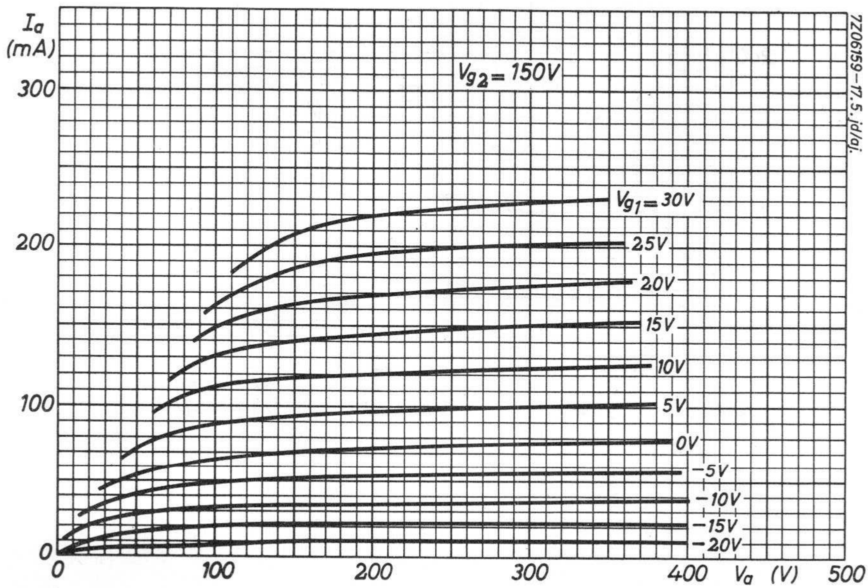
OPERATING CONDITIONS AS CLASS C FREQUENCY TRIPLER

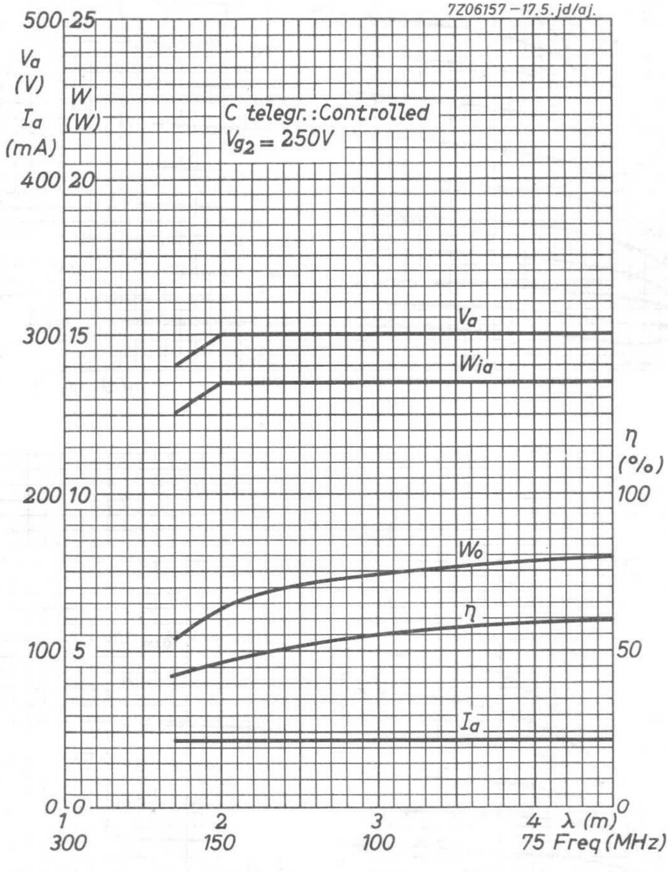
Wavelength	λ	=	12/4	9/3	6/2[1])	m
Anode voltage	V_a	=	300	275	225	V
Grid No.1 voltage	V_{g_1}	=	−140	−140	−140	V
Grid No.2 voltage	V_{g_2}	=	250	200	200	V
Anode current	I_a	=	34.3	36	2x36	mA
Grid No.1 current	I_{g_1}	=	0	1.5	2x1.3	mA
Grid No.2 current	I_{g_2}	=	2.8	2.5	2x2.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	130	142	152	V
Grid No.1 input power	W_{ig_1}	=	0	192	2x180	mW
Grid No.2 dissipation	W_{g_2}	=	0.7	0.5	2x0.5	W
Anode input power	W_{ia}	=	10.3	9.9	2x8.1	W
Anode dissipation	W_a	=	7.1	7.1	2x6.6	W
Output power	W_o	=	3.2	2.8	3	W
Efficiency	η	=	31	28.5	18.5	%

1) Two tubes in push-pull

7Z2 3054


7Z06158-17.5.jd/aj.
I_a (mA)
I_{g1} (mA)
$V_{g2} = 250V$
I_a
I_{g1}
$V_{g1} = 20V$
15V
10V
5V
0V
−5V
$V_{g1} = 10V$
−10V
−15V
−20V
5V
−25V
−30V
0V
300
200
100
0
6
4
2
0
0
100
200
300
400
V_a (V)
500


I_a (mA)
7Z06159-17.5.jd/aj.
$V_{g2} = 150V$
$V_{g1} = 30V$
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
300
200
100
0
0
100
200
300
400
V_a (V)
500


7Z06157 −17.5.jd/aj.
C telegr.:Controlled
V_{g2} = 250V
500
V_a
(V)
I_a
(mA)
400
300
200
100
0
25
W
(W)
20
15
10
5
0
V_a
W_{ia}
W_o
η
I_a
η
(%)
100
50
0
1
300
2
150
3
100
4 λ (m)
75 Freq (MHz)

R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA							
λ (m)	Freq. (MHz)	C telegr.			C_{ag_2} mod.		
		V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
5	60	750		70	600		52
		600	52	66	475	34	
		500	48		400	32	
1.7	175	400		35			
		320	25				

AB mod. 1)2)			AB mod. 1)3)			AB mod. 1)4)		
V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
750		120	750		131	400	22	22
600	82	95	600	90	113	250	10	
500	70		500	83				
400	55		400	62				

HEATING: indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	V
Heater current	I_f	=	1.25	A

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	13.5	pF
Anode to all other elements except grid No.1	C_a	=	8.5	pF
Anode to grid No.1	C_{ag_1}	<	0.24	pF

1) Two tubes

2) Without grid current

3) With grid current

4) In triode connection

7Z2 2957

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	200	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	100	mA
Mutual conductance	S	=	7	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	4.5	

MECHANICAL DATA

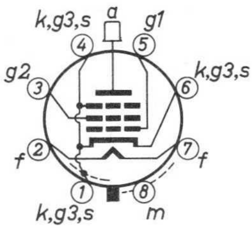
Dimensions in mm

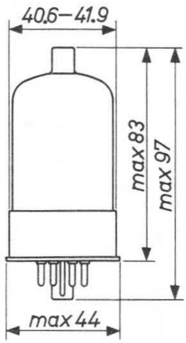
Base : Octal 8p

Socket : 2422 501 03001

→ Anode connector: 28 906 022

Net weight : 57 g





Mounting position: arbitrary

TEMPERATURE LIMIT (Absolute limits)

Bulb temperature = max. 220 °C

7Z2 8816

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

7Z2 2959

R.F. CLASS C TELEGRAPHY See also page 3 for derating table

LIMITING VALUES (Absolute limits)

			Continuous C.C.S.		Intermittent I.C.A.S.		
Frequency	f		up to	60	up to	60	MHz
Anode voltage	V_a	=	max.	600	max.	750	V
Anode input power	W_{ia}	=	max.	67.5	max.	90	W
Anode dissipation	W_a	=	max.	20	max.	25	W
Anode current	I_a	=	max.	140	max.	150	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	max.	3	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	max.	150	V
Grid No.1 current	I_{g_1}	=	max.	3.5	max.	4	mA
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	max.	30	kΩ[1]

OPERATING CONDITIONS

			Continuous service C.C.S.			Intermittent service I.C.A.S.			
Frequency	f	=	60	60	175	60	60	175	MHz
Anode voltage	V_a	=	600	500	320	750	600	400	V
Grid No.1 voltage	V_{g_1}	=	-58	-66	-51	-62	-71	-54	V [2]
Grid No.2 voltage	V_{g_2}	=	150	170	180	160	180	190	V [3]
Anode current	I_a	=	112	135	140	120	150	150	mA
Grid No.1 current	I_{g_1}	=	2.8	2.5	2.0	3.1	2.8	2.2	mA
Grid No.2 current	I_{g_2}	=	9	9	10	11	10	10.4	mA
Peak grid No.1 voltage	$V_{g_{1p}}$	=	73	84	64	79	91	68	V
Grid No.1 input power	W_{ig_1}	=	0.2	0.2	3	0.2	0.3	3	W
Grid No.2 dissipation	W_{g_2}	=	1.4	1.6	1.8	1.8	1.8	2.0	W
Anode input power	W_{ia}	=	67.5	67.5	45	90	90	60	W
Anode dissipation	W_a	=	15.5	19.5	20	20	24	25	W
Output power	W_o	=	52	48	25	70	66	35	W
Efficiency	η	=	77	71	55.5	78	73.5	58	%

[1][2][3] See page 3

7Z2 2960

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits) See also page 3 for derating table

			Continuous C.C.S.		Intermittent I.C.A.S.		
Frequency	f		up to	60	up to	60	MHz
Anode voltage	V_a	=	max.	480	max.	600	V
Anode input power	W_{ia}	=	max.	45	max.	67.5	W
Anode dissipation	W_a	=	max.	13.3	max.	16.7	W
Anode current	I_a	=	max.	117	max.	125	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2	max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	max.	150	V
Grid No.1 current	I_{g_1}	=	max.	3.5	max.	4	mA
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	max.	30	kΩ 1)

OPERATING CONDITIONS

			Continuous service C.C.S.		Intermittent service I.C.A.S.	
Frequency	f	=	60	60	60	MHz
Anode voltage	V_a	=	475	400	600	V
Grid No.1 voltage	V_{g_1}	=	-77	-87	-87	V 4)
Grid No.2 voltage	V_{g_2}	=	135	150	150	V 5)
Anode current	I_a	=	94	112	112	mA
Grid No.1 current	I_{g_1}	=	2.8	3.4	3.4	mA
Grid No.2 current	I_{g_2}	=	6.4	7.8	7.8	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	95	107	107	V
Grid No.1 input power	W_{ig_1}	=	0.3	0.4	0.4	W
Grid No.2 dissipation	W_{g_2}	=	1.0	1.2	1.2	W
Anode input power	W_{ia}	=	45	45	67.5	W
Anode dissipation	W_a	=	11	13	15.5	W
Output power	W_o	=	34	32	52	W
Efficiency	η	=	75.5	71	77	%
Modulation factor	m	=	100	100	100	%
Modulation power	W_{mod}	=	23	23	34	W

1)4)5) See page 3

7Z2 2961

A.F. CLASS AB AMPLIFIER AND MODULATOR without grid current

C.C.S. **LIMITING VALUES** (Absolute limits), continuous service

Anode voltage	V_a	= max.	600	V
Anode input power	W_{ia}	= max.	60	W
Anode dissipation	W_a	= max.	20	W
Anode current	I_a	= max.	125	mA
Grid No.2 voltage	V_{g_2}	= max.	250	V
Grid No.2 dissipation	W_{g_2}	= max.	3	W
Peak heater to cathode voltage	V_{kf_p}	= max.	135	V
Grid No.1 circuit resistance	R_{g_1}	= max.	100	kΩ

C.C.S. **OPERATING CONDITIONS**, continuous service; two tubes

V_a	=	600		500		400		V
V_{g_2}	=	180		185		190		V 1)
V_{g_1}	=	-45		-40		-40		V 2)
$R_{aa\sim}$	=	7000		5500		4000		Ω
$V_{g_1g_{1p}}$	=	0	90	0	80	0	80	V
I_a	=	2x13	2x100	2x29	2x108	2x32	2x114	mA
I_{g_2}	=	2x0.5	2x12	2x1	2x13	2x1.3	2x13	mA
W_{ig_1}	=	0	0	0	0	0	0	W
W_{g_2}	=	2x0.1	2x2	2x0.2	2x2.4	2x0.25	2x2.5	W
W_{ia}	=	2x7.8	2x60	2x14.5	2x54	2x12.8	2x45.5	W
W_a	=	2x7.8	2x19	2x14.5	2x19	2x12.8	2x18	W
W_o	=	0	82	0	70	0	55	W
η	=	–	68	–	65	–	60	%

1) Obtained preferably from a separate source or from the anode supply using a voltage divider

2) Under these conditions only fixed bias is recommended

7Z2 2962

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_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	W
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	kΩ[1])

I.C.A.S. **OPERATING CONDITIONS**, intermittent service; two tubes

Anode voltage	V_a	=	750		600		V
Grid No.2 voltage	V_{g_2}	=	195		200		V [2])
Grid No.1 voltage	V_{g_1}	=	-50		-50		V [1])
Load resistance	$R_{aa\sim}$	=	8000		6000		Ω
Input A.C. voltage peak to peak	$V_{g_1g_1p}$	=	0	100	0	100	V
Anode current	I_a	=	2x12	2x110	2x14	2x115	mA
Grid No.2 current	I_{g_2}	=	2x0.5	2x13	2x0.5	2x13.5	mA
Grid No.1 input power	W_{ig_1}	=	0	0	0	0	W
Grid No.2 dissipation	W_{g_2}	=	2x0.1	2x2.5	2x0.1	2x2.7	W
Anode input power	W_{ia}	=	2x8.7	2x82.5	2x8.4	2x69	W
Anode dissipation	W_a	=	2x8.7	2x22.5	2x8.4	2x21.5	W
Output power	W_o	=	0	120	0	95	W
Efficiency	η	=	-	72.5	-	69	%

1) Under these conditions only fixed bias is recommended

2) Obtained preferably from a separate source or from the anode supply using a voltage divider

7Z2 2963

A.F. CLASS AB AMPLIFIER AND MODULATOR with grid current

C.C.S. **LIMITING VALUES** (Absolute limits), continuous service

Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	62.5	W
Anode dissipation	W_a	=	max.	20	W
Anode current	I_a	=	max.	125	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	W
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ[1]

C.C.S. **OPERATING CONDITIONS**, continuous service; two tubes ($I_{g_1} > 0$)

V_a	=	600		500		400		V
V_{g_2}	=	165		175		175		V[2]
V_{g_1}	=	-44		-44		-41		V[1]
$R_{aa\sim}$	=	6800		4600		3700		Ω
$V_{g_1g_{1p}}$	=	0	97	0	102	0	95	V
I_a	=	2x11	2x103	2x13	2x121	2x16	2x116	mA
I_{g_2}	=	2x0.3	2x8.5	2x0.3	2x9	2x0.5	2x9	mA
I_{g_1}	=	0	2x0.5	0	2x1.0	0	2x0.8	mA
W_{ig_1}	=	0	2x0.1	0	2x0.15	0	2x0.1	W
W_{g_2}	=	2x0.05	2x1.4	2x0.06	2x1.6	2x0.1	2x1.6	W
W_{ia}	=	2x6.6	2x62	2x6.5	2x60.5	2x6.4	2x46.5	W
W_a	=	2x6.6	2x17	2x6.5	2x19	2x6.4	2x15.5	W
W_o	=	0	90	0	83	0	62	W
η	=	–	72.5	–	68.5	–	66.5	%

[1]) Under these conditions only fixed bias is recommended

[2]) Obtained preferably from a separate source or from the anode supply using a voltage divider

7Z2 2964

A.F. CLASS AB AMPLIFIER AND MODULATOR with grid current (continued)

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Anode voltage	V_a	=	max.	750	V
Anode input power	W_{ia}	=	max.	90	W
Anode dissipation	W_a	=	max.	25	W
Anode current	I_a	=	max.	135	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	W
Peak heater to cathode voltage	V_{kf_p}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1]

I.C.A.S. OPERATING CONDITIONS, intermittent service; two tubes ($I_{g_1} > 0$)

Anode voltage	V_a	=	750		600		V
Grid No.2 voltage	V_{g_2}	=	165		190		V [2]
Grid No.1 voltage	V_{g_1}	=	-46		-48		V [1]
Load resistance	$R_{aa\sim}$	=	7400		5000		Ω
Input A.C. voltage peak to peak	$V_{g_1g_{1p}}$	=	0	108	0	109	V
Anode current	I_a	=	2x11	2x120	2x14	2x135	mA
Grid No.2 current	I_{g_2}	=	2x0.15	2x10	2x0.6	2x10	mA
Grid No.1 current	I_{g_1}	=	0	2x1.3	0	2x1.0	mA
Grid No.1 input power	W_{ig_1}	=	0	2x0.2	0	2x0.15	W
Grid No.2 dissipation	W_{g_2}	=	2x0.03	2x1.7	2x0.1	2x1.9	W
Anode input power	W_{ia}	=	2x8.3	2x90	2x8.4	2x81	W
Anode dissipation	W_a	=	2x8.3	2x24.5	2x8.4	2x24.5	W
Output power	W_o	=	0	131	0	113	W
Efficiency	η	=	–	73	–	70	%

[1]) Under these conditions only fixed bias is recommended

[2]) Obtained preferably from a separate source or from the anode supply using a voltage divider

7Z2 2965

A.F. CLASS AB AMPLIFIER AND MODULATOR IN TRIODE CONNECTION without grid current (screen grid connected to anode)

LIMITING VALUES (Absolute limits)

			C.C.S.	I.C.A.S.	
Anode voltage	V_a	=	max. 400	max. 400	V
Anode current	I_a	=	max. 90	max. 90	mA
Anode input power	W_{ia}	=	max. 35	max. 35	W
Anode dissipation	W_a	=	max. 20	max. 25	W
Peak heater to cathode voltage	V_{kf_p}	=	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 100	max. 100	kΩ[1]
Grid No.1 circuit resistance	R_{g_1}	=	max. 500	max. 500	kΩ[1]

C.C.S. OPERATING CONDITIONS, continuous service; two tubes (I_{g_1} = 0)

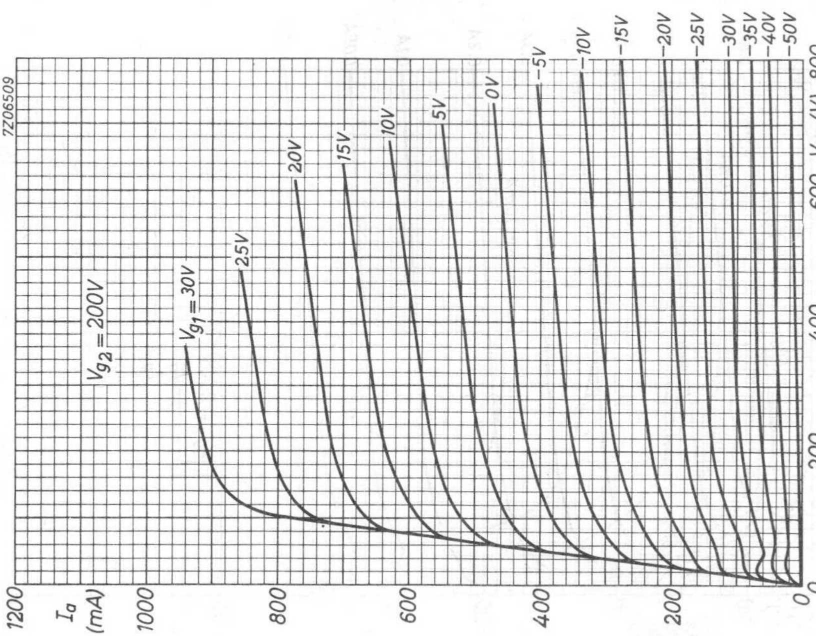
Anode voltage	V_a	=	400		250		V
Grid No.1 voltage	V_{g_1}	=	−100		−50		V
Load resistance	$R_{aa\sim}$	=	8000		5000		Ω
Peak grid to grid voltage	V_{gg_p}	=	0	200	0	100	V
Anode current	I_a	=	2x20	2x50	2x60	2x62	mA
Anode input power	W_{ia}	=	2x8	2x20	2x15	2x15.5	W
Anode dissipation	W_a	=	2x8	2x9	2x15	2x10.5	W
Output power	W_o	=	0	22	0	10	W
Efficiency	η	=	–	55	–	32	%

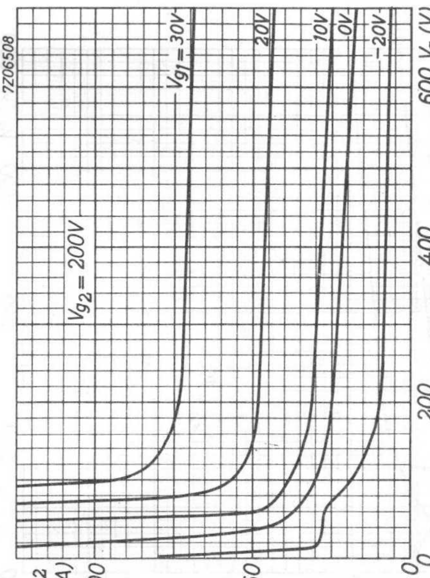
I.C.A.S. OPERATING CONDITIONS, intermittent service; two tubes

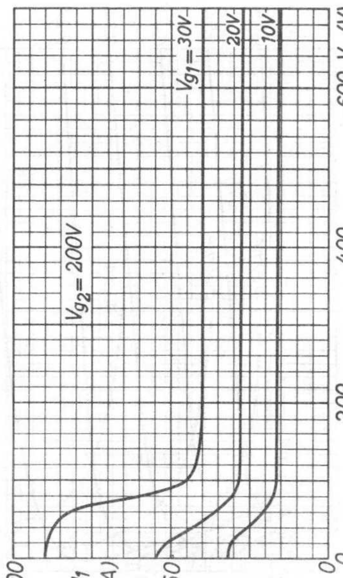
Anode voltage	V_a	=	400		V
Grid No.1 voltage	V_{g_1}	=	−100		V
Load resistance	$R_{aa\sim}$	=	8000		Ω
Peak grid to grid voltage	V_{gg_p}	=	0	200	V
Anode current	I_a	=	2x20	2x50	mA
Anode input power	W_{ia}	=	2x8	2x20	W
Anode dissipation	W_a	=	2x8	2x9	W
Output power	W_o	=	0	22	W
Efficiency	η	=	–	55	%

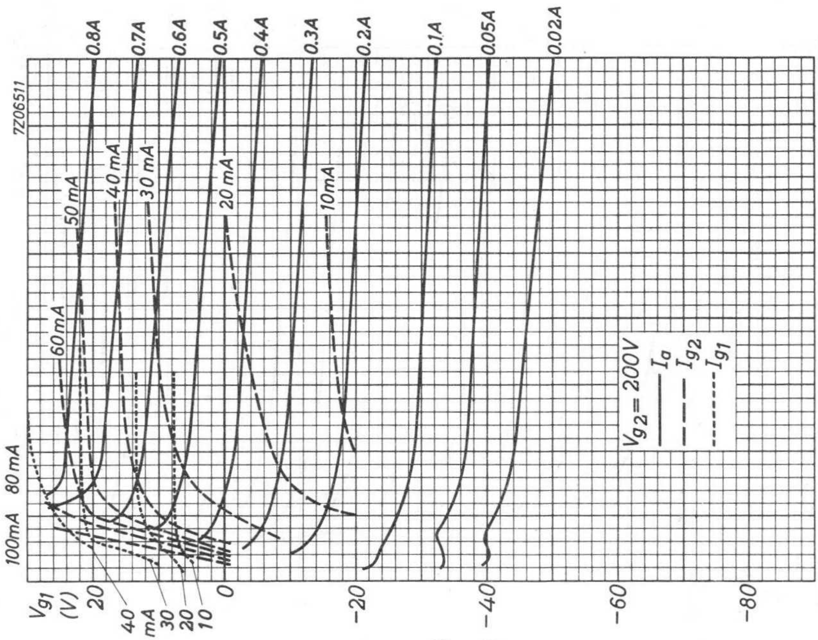
[1]) For values of R_{g_1} exceeding 100 kΩ, cathode bias is required

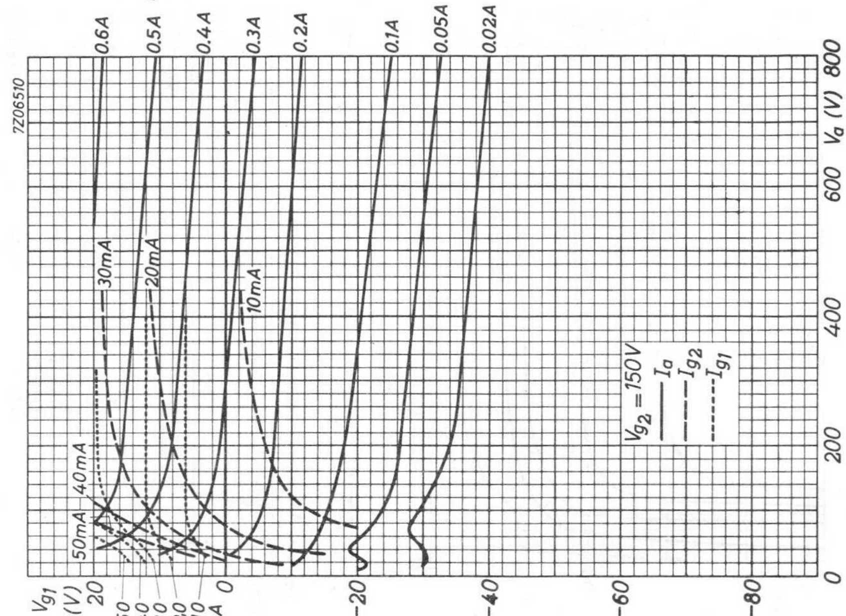
7Z2 2966

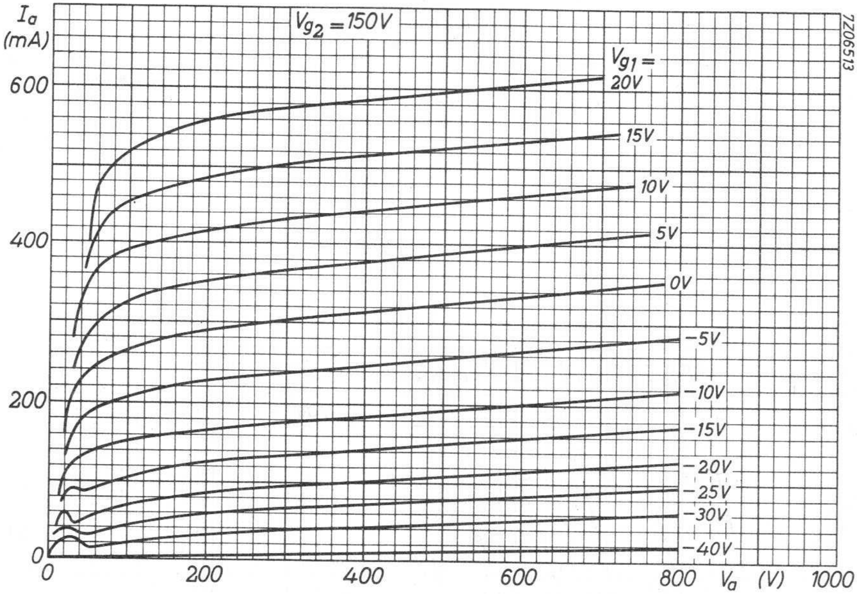

7Z06509
V_{g2} = 200V
V_{g1} = 30V
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−50V
I_a (mA)
1200
1000
800
600
400
200
0
0
200
400
600
800
V_a (V)

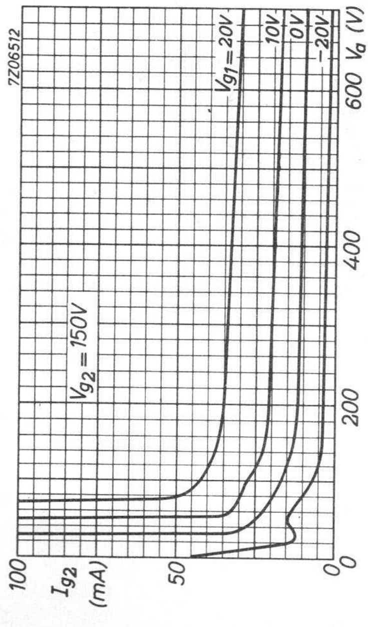

7Z06508
V_{g2} = 200V
V_{g1} = 30V
20V
10V
0V
−20V
I_{g2} (mA)
100
50
0
0
200
400
600
V_a (V)

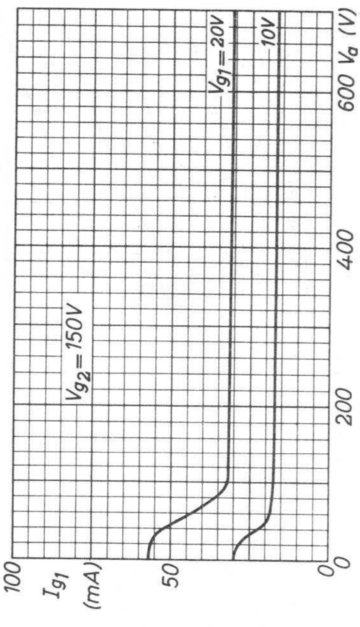

V_{g2} = 200V
V_{g1} = 30V
20V
10V
I_{g1} (mA)
100
50
0
0
200
400
600
V_a (V)

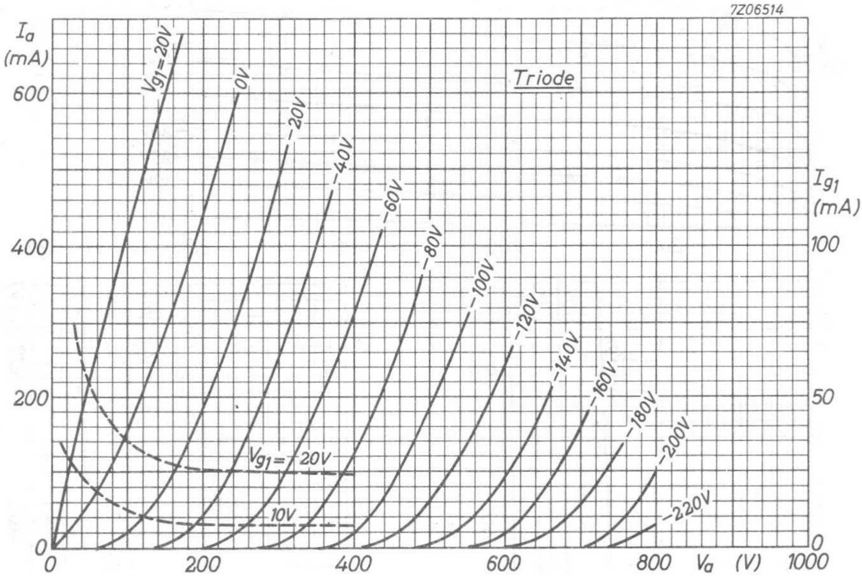

7Z06511
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
0.02A
60mA
50 mA
40 mA
30 mA
20 mA
10mA
80 mA
100mA
V_{g2} = 200V
I_a
I_{g2}
I_{g1}
V_{g1} (V)
40 mA 30 20 10
V_a (V)

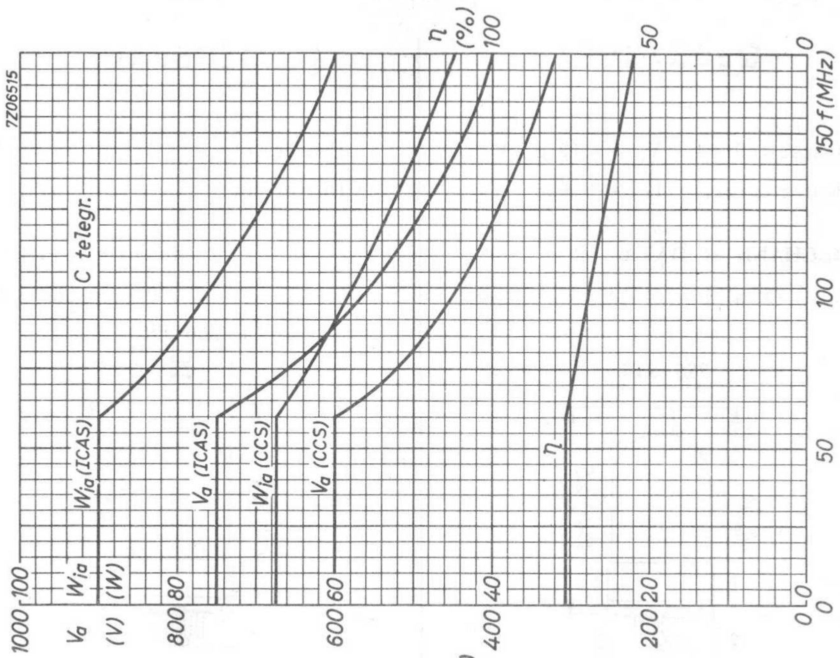

7Z06510
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
0.02A
30mA
20mA
10mA
40mA
50mA
V_{g2} = 150V
I_a
I_{g2}
I_{g1}
V_{g1} (V)
50 40 30 20 10 mA
V_a (V)

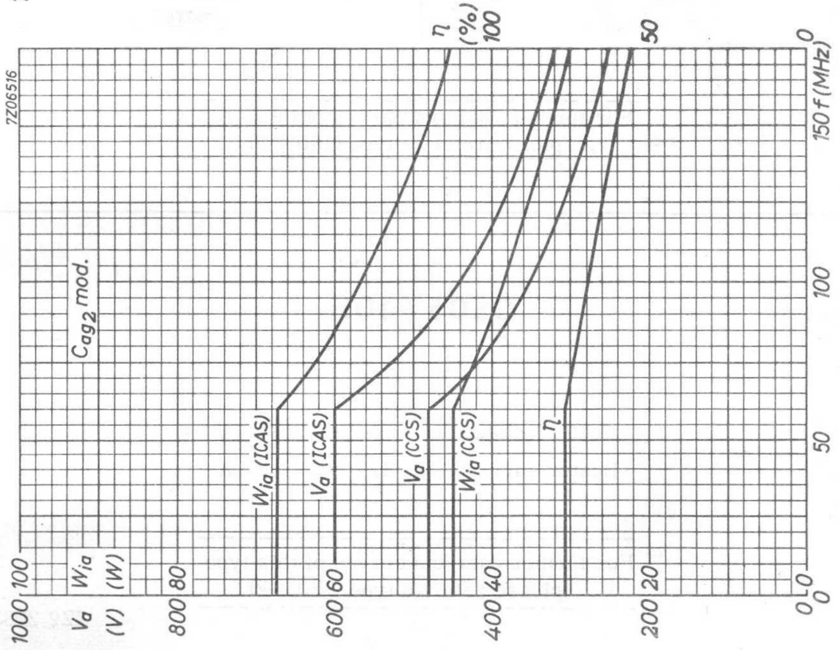

I_a
(mA)
600
400
200
0
$V_{g_2} = 150V$
$V_{g_1} =$ 20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−40V
0
200
400
600
800
V_a (V)
1000
7Z06513


7Z06512
$V_{g_1} = 20V$
10V
0V
−20V
600 V_a (V)
400
200
0
$V_{g_2} = 150V$
100
I_{g_2}
(mA)
50
0


$V_{g_1} = 20V$
10V
600 V_a (V)
400
200
0
$V_{g_2} = 150V$
100
I_{g_1}
(mA)
50
0


7Z06514
I_a (mA)
Triode
V_{g1}=20V
0V
-20V
-40V
-60V
-80V
-100V
-120V
-140V
-160V
-180V
-200V
-220V
V_{g1}= 20V
10V
I_{g1} (mA)
600
400
200
0
100
50
0
0
200
400
600
800
V_a (V)
1000


7Z06515
C telegr.
Va (V)
Wia (W)
η (%)
Wia (ICAS)
Va (ICAS)
Wia (CCS)
Va (CCS)
η
f (MHz)

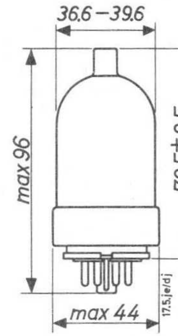

7Z06516
Cag2 mod.
Va (V)
Wia (W)
η (%)
Wia (ICAS)
Va (ICAS)
Va (CCS)
Wia (CCS)
η
f (MHz)

QE05/40F

Heater voltage	V_f	=	12.6	V
Heater current	I_f	=	0.625	A

MECHANICAL DATA

Base: Octal 8 p.

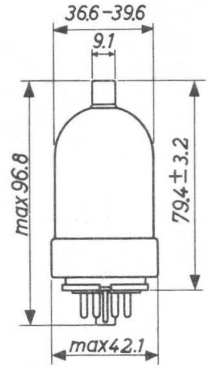


QE05/40K

Heater voltage	V_f	=	13.5	V
Heater current	I_f	=	0.585	A

Dimensions in mm

Base: Octal 8 p.



For further data and curves of these types please refer to type QE05/40

QE05/40H

Heater voltage	V_f	=	26.5	V
Heater current	I_f	=	0.3	A

For further data and curves of this type please refer to type QE05/40

7Z2 2983

R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA

λ	Freq.	C telegr.			B teleph.			C_{ag_2} mod.		
		V_a	W_o (W)		V_a	W_o (W)		V_a	W_o (W)	
(m)	(MHz)	(V)	CCS	ICAS	(V)	CCS	ICAS	(V)	CCS	ICAS
5	60	600	40		600	12.5		475	28	
		500	32		500	11		400	22	
		400	25		400	9		325	17	
		750		54	750		15	600		44

AB mod 1)2)			AB mod 1)3)		
V_a	W_o (W)		V_a	W_o (W)	
(V)	CCS	ICAS	(V)	CCS	ICAS
600	56		600	80	
500	46		500	75	
400	36		400	55	
750		72	750		120
400	15 4)	15 4)			

HEATING: indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3 V
Heater current	I_f	=	0.9 A

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	7 pF
Grid No.1 to all other elements except anode	C_{g_1}	=	12 pF
Anode to grid No.1	C_{ag_1}	<	0.2 pF 5)

---

1) Two tubes
2) Without grid current
3) With grid current
4) Two tubes in triode connection
5) With external shield connected to cathode

7Z2 8817

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	8
Mutual conductance	$S\ (I_a = 72\ mA)$	=	6 mA/V

MECHANICAL DATA

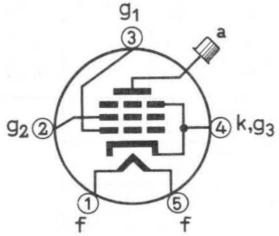
Dimensions in mm

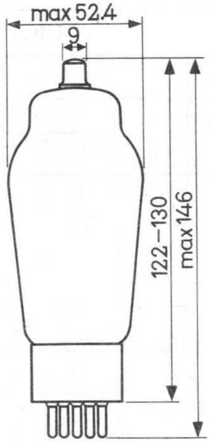
Base : Medium 5-p

→ Socket : 2422 512 03001

Anode connector: 28 906 022

Net weight : 60 g





Mounting position: arbitrary

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1) Page 5 and 6
Obtained preferably from a separate source modulated with the anode supply or from the modulated anode supply through a series resistor of

12.5 kΩ at V_a = 325 V

25 kΩ at V_a = 400 V

28 kΩ at V_a = 475 V

37.5 kΩ at V_a = 600 V

7Z2 8818

R.F. CLASS C TELEGRAPHY

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to 60	80	125	MHz
Anode voltage	V_a	=	max. 600	480	330	V
Anode input power	W_{ia}	=	max. 60	48	33	W
Anode dissipation	W_a	=		max. 25		W
Anode current	I_a	=		max. 100		mA
Grid No.2 voltage	V_{g_2}	=		max. 300		V
Grid No.2 dissipation	W_{g_2}	=		max. 3.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 200		V
Grid No.1 current	I_{g_1}	=		max. 5		mA
Heater to cathode voltage	V_{kf}	=		max. 135		V
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Frequency			60	60	80	MHz
Anode voltage	V_a	=	600	500	400	V
Grid No.1 voltage	V_{g_1}	=	−45	−45	−45	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Anode current	I_a	=	100	100	100	mA
Grid No.1 current	I_{g_1}	=	4	4	4	mA
Grid No.2 current	I_{g_2}	=	8	8	8	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	65	65	65	V
Grid No.1 input power	W_{ig_1}	=	0.3	0.3	0.3	W
Grid No.2 dissipation	W_{g_2}	=	2	2	2	W
Anode input power	W_{ia}	=	60	50	40	W
Anode dissipation	W_a	=	20	18	15	W
Output power	W_o	=	40	32	25	W
Efficiency	η	=	66.5	64	62.5	%

7Z2 8819

R.F. CLASS C TELEGRAPHY

I.C.A.S. **LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f		up to 60	80	125	MHz
Anode voltage	V_a	=	max. 750	600	415	V
Anode input power	W_{ia}	=	max. 75	60	41.5	W
Anode dissipation	W_a	=		max. 30		W
Anode current	I_a	=		max. 100		mA
Grid No.2 voltage	V_{g_2}	=		max. 300		V
Grid No.2 dissipation	W_{g_2}	=		max. 3.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 200		V
Grid No.1 current	I_{g_1}	=		max. 5		mA
Heater to cathode voltage	V_{kf}	=		max. 135		V
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

I.C.A.S. **OPERATING CONDITIONS**, intermittent service

Frequency	f	=	60	MHz
Anode voltage	V_a	=	750	V
Grid No.1 voltage	V_{g_1}	=	−45	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	100	mA
Grid No.1 current	I_{g_1}	=	4	mA
Grid No.2 current	I_{g_2}	=	8	mA
Peak grid No.1 A.C voltage	$V_{g_{1p}}$	=	65	V
Grid No.1 input power	W_{ig_1}	=	0.3	W
Grid No.2 dissipation	W_{g_2}	=	2	W
Anode input power	W_{ia}	=	75	W
Anode dissipation	W_a	=	21	W
Output power	W_o	=	54	W
Efficiency	η	=	72	%

7Z2 8820

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to 60	80	125	MHz
Anode voltage	V_a	=	max. 475	380	260	V
Anode input power	W_{ia}	=	max. 40	32	22	W
Anode dissipation	W_a	=		max. 16.5		W
Anode current	I_a	=		max. 83		mA
Grid No.2 voltage	V_{g_2}	=		max. 300		V
Grid No.2 dissipation	W_{g_2}	=		max. 2.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 200		V
Grid No.1 current	I_{g_1}	=		max. 5		mA
Heater to cathode voltage	V_{kf}	=		max. 135		V
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f		60	80	80	MHz
Anode voltage	V_a	=	475	400	325	V
Grid No.1 voltage	V_{g_1}	=	−85	−75	−75	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V [1])
Anode current	I_a	=	83	80	80	mA
Grid No.1 current	I_{g_1}	=	4	3.5	3.5	mA
Grid No.2 current	I_{g_2}	=	8	6	6	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	108	95	95	V
Grid No.1 input power	W_{ig_1}	=	0.4	0.3	0.3	W
Grid No.2 dissipation	W_{g_2}	=	2	1.5	1.5	W
Anode input power	W_{ia}	=	39.5	32	26	W
Anode dissipation	W_a	=	11.5	10	9	W
Output power	W_o	=	28	22	17	W
Efficiency	η	=	71	69	65.5	%
Modulation factor	m	=	100	100	100	%
Modulation power	W_{mod}	=	20	16	13	W

[1]) See page 2

7Z2 8821

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f		up to 60	80	125	MHz
Anode voltage	V_a	=	max. 600	480	330	V
Anode input power	W_{ia}	=	max. 60	48	33	W
Anode dissipation	W_a	=	max. 25			W
Anode current	I_a	=	max. 100			mA
Grid No.2 voltage	V_{g_2}	=	max. 300			V
Grid No.2 dissipation	W_{g_2}	=	max. 2.5			W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200			V
Grid No.1 current	I_{g_1}	=	max. 5			mA
Heater to cathode voltage	V_{kf}	=	max. 135			V
Grid No.1 circuit resistance	R_{g_1}	=	max. 30			kΩ

I.C.A.S. OPERATING CONDITIONS, intermittent service

Frequency	f	=	60	MHz
Anode voltage	V_a	=	600	V
Grid No.1 voltage	V_{g_1}	=	−85	V
Grid No.2 voltage	V_{g_2}	=	300	V [1])
Anode current	I_a	=	100	mA
Grid No.1 current	I_{g_1}	=	4	mA
Grid No.2 current	I_{g_2}	=	8	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	107	V
Grid No.1 input power	W_{ig_1}	=	0.4	W
Grid No.2 dissipation	W_{g_2}	=	2.4	W
Anode input power	W_{ia}	=	60	W
Anode dissipation	W_a	=	16	W
Output power	W_o	=	44	W
Efficiency	η	=	73	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	30	W

[1]) See page 2

7Z2 8822

R.F. CLASS B TELEPHONY

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to 60	80	125	MHz
Anode voltage	V_a	=	max. 600	540	450	V
Anode input power	W_{ia}	=	max. 37.5	34	28	W
Anode dissipation	W_a	=		max. 25		W
Anode current	I_a	=		max. 80		mA
Grid No.2 voltage	V_{g_2}	=		max. 300		V
Grid No.2 dissipation	W_{g_2}	=		max. 2.5		W
Heater to cathode voltage	V_{kf}	=		max. 135		V
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

C.C.S. OPERATING CONDITIONS, continuous service

Frequency	f	=	60	80	80	MHz
Anode voltage	V_a	=	600	500	400	V
Grid No.1 voltage	V_{g_1}	=	−40	−40	−40	V
Grid No.2 voltage	V_{g_2}	=	300	300	300	V
Anode current	I_a	=	62.5	70	75	mA
Grid No.2 current	I_{g_2}	=	4	4	5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	36	38	40	V
Grid No.2 dissipation	W_{g_2}	=	1.2	1.2	1.5	W
Anode input power	W_{ia}	=	37.5	35	30	W
Anode dissipation	W_a	=	25	24	21	W
Output power	W_o	=	12.5	11	9	W
Efficiency	η	=	33	31.5	30	%
Modulation factor	m	=	100	100	100	%
Grid No.1 input power	W_{ig_1}	=	0.2	0.3	0.4	W

7Z2 8823

R.F. CLASS B TELEPHONY

I.C.A.S. **LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f		up to 60	80	125	MHz
Anode voltage	V_a	=	max. 750	675	562	V
Anode input power	W_{ia}	=	max. 45	40.5	34	W
Anode dissipation	W_a	=		max. 30		W
Anode current	I_a	=		max. 90		mA
Grid No.2 voltage	V_{g_2}	=		max. 300		V
Grid No.2 dissipation	W_{g_2}	=		max. 2.5		W
Heater to cathode voltage	V_{kf}	=		max. 135		V
Grid No.1 circuit resistance	R_{g_1}	=		max. 30		kΩ

I.C.A.S. **OPERATING CONDITIONS**, intermittent service

Frequency	f	=	60	MHz
Anode voltage	V_a	=	750	V
Grid No.1 voltage	V_{g_1}	=	−40	V
Grid No.2 voltage	V_{g_2}	=	300	V
Anode current	I_a	=	60	mA
Grid No.2 current	I_{g_2}	=	3	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	35	V
Grid No.2 dissipation	W_{g_2}	=	0.9	W
Anode input power	W_{ia}	=	45	W
Anode dissipation	W_a	=	30	W
Output power	W_o	=	15	W
Efficiency	η	=	33	%
Modulation factor	m	=	100	%
Grid No.1 input power	W_{ig_1}	=	0.2	W

7Z2 8824

A.F. CLASS AB AMPLIFIER AND MODULATOR ($I_{g_1} > 0$)

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.	25	W
Anode current	I_a	=	max.	120	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3.5	W
Heater to cathode voltage	V_{kf}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1]

C.C.S. OPERATING CONDITIONS, continuous service; two tubes

V_a	=	600		500		400		V
V_{g_2}	=	300		300		300		V
V_{g_1}	=	-32		-30		-28		V
$R_{aa\sim}$	=	6900		4600		3700		Ω
$V_{g_1g_1p}$	=	0	90	0	86	0	80	V
I_a	=	2x24	2x100	2x30	2x120	2x36	2x120	mA
I_{g_2}	=	2x0.35	2x9	2x0.45	2x10	2x1	2x10	mA
W_{ig_1}	=	0	0.1	0	0.2	0	0.2	W
W_{g_2}	=	2x0.11	2x2.7	2x0.14	2x3	2x0.3	2x3	W
W_{ia}	=	2x14.4	2x60	2x15	2x60	2x14.4	2x48	W
W_a	=	2x14.4	2x20	2x15	2x22.5	2x14.4	2x20.5	W
W_o	=	0	80	0	75	0	55	W
η	=	-	66.5	-	62.5	-	57	%
d	=	-	2	-	2	-	2	% [2]

[1]) With fixed bias. Cathode bias is not recommended

[2]) Distortion with zero-impedance driver

7Z2 3076

A.F. CLASS AB AMPLIFIER AND MODULATOR ($I_{g_1} > 0$)

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.	30	W
Anode current	I_a	=	max.	120	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3.5	W
Heater to cathode voltage	V_{kf}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ [1]

I.C.A.S. OPERATING CONDITIONS, intermittent service; two tubes

Anode voltage	V_a	=	750		V
Grid No.2 voltage	V_{g_2}	=	300		V
Grid No.1 voltage	V_{g_1}	=	-35		V
Load resistance	$R_{aa\sim}$	=	7300		Ω
Input A.C. voltage, peak to peak	$V_{g_1g_{1p}}$	=	0	96	V
Anode current	I_a	=	2x15	2x120	mA
Grid No.2 current	I_{g_2}	=	2x0.25	2x10	mA
Grid No.1 input power	W_{ig_1}	=	0	0.2	W
Grid No.2 dissipation	W_{g_2}	=	2x0.08	2x3	W
Anode input power	W_{ia}	=	2x11.25	2x90	W
Anode dissipation	W_a	=	2x11.25	2x30	W
Output power	W_o	=	0	120	W
Efficiency	η	=	–	66.5	%
Distortion	d	=	–	2	% [2]

[1]) With fixed bias. Cathode bias is not recommended

[2]) Distortion with zero-impedance driver

7Z2 3077

A.F. CLASS AB AMPLIFIER AND MODULATOR (I_{g_1} = 0)

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.	25	W
Anode current	I_a	=	max.	120	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3.5	W
Heater to cathode voltage	V_{kf}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	kΩ [1]

C.C.S. OPERATING CONDITIONS, continuous service; two tubes

V_a	=	600		500		400		V
V_{g_2}	=	300		300		300		V
V_{g_1}	=	−34		−32		−30		V
$R_{aa\sim}$	=	10000		8200		6800		Ω
$V_{g_1g_{1p}}$	=	0	68	0	64	0	60	V
I_a	=	2x18	2x69.5	2x22	2x70.5	2x28	2x71.5	mA
I_{g_2}	=	2x0.3	2x7.5	2x0.5	2x7.5	2x1	2x8	mA
W_{ig_1}	=	0	0	0	0	0	0	W
W_{g_2}	=	2x0.09	2x2.25	2x0.15	2x2.25	2x0.3	2x2.4	W
W_{ia}	=	2x10.8	2x41.7	2x11	2x35.3	2x11.2	2x28.6	W
W_a	=	2x10.8	2x13.7	2x11	2x12.3	2x11.2	2x10.6	W
W_o	=	0	56	0	46	0	36	W
η	=	−	67	−	65	−	63	%

[1]) With fixed bias. Cathode bias is not recommended

7Z2 3078

A.F. CLASS AB AMPLIFIER AND MODULATOR (I_{g_1} = 0)

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.	30	W
Anode current	I_a	=	max.	120	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3.5	W
Heater to cathode voltage	V_{kf}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	kΩ [1]

I.C.A.S. **OPERATING CONDITIONS**, intermittent service; two tubes

Anode voltage	V_a	=	750		V
Grid No.2 voltage	V_{g_2}	=	300		V
Grid No.1 voltage	V_{g_1}	=	−35		V
Load resistance	$R_{aa\sim}$	=	12000		Ω
Input A.C. voltage, peak to peak	$V_{g_1g_1p}$	=	0	70	V
Anode current	I_a	=	2x15	2x69.5	mA
Grid No.2 current	I_{g_2}	=	2x0.25	2x8	mA
Grid No.1 input power	W_{ig_1}	=	0	0	W
Grid No.2 dissipation	W_{g_2}	=	2x0.075	2x2.4	W
Anode input power	W_{ia}	=	2x11.25	2x52	W
Anode dissipation	W_a	=	2x11.25	2x16	W
Output power	W_o	=	0	72	W
Efficiency	η	=	–	69	%

[1]) With fixed bias. Cathode bias is not recommended

7Z2 3079

A.F. CLASS AB AMPLIFIER AND MODULATOR in triode connection
(g_2 connected to a; $I_{g_1} = 0$)

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Anode voltage	V_a	=	max.	400	V
Anode current	I_a	=	max.	125	mA
Anode input power	W_{ia}	=	max.	50	W
Anode dissipation	W_a	=	max.	25	W
Heater to cathode voltage	V_{kf}	=	max.	135	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	0.1	MΩ [1]
Grid No.1 circuit resistance	R_{g_1}	=	max.	0.5	MΩ [2]

C.C.S. OPERATING CONDITIONS, continuous service; two tubes

Anode voltage	V_a	=	400		V
Grid No.1 voltage	V_{g_1}	=	−45		V
Load resistance	$R_{aa\sim}$	=	3		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1p}$	=	0	90	V
Anode current	I_a	=	2x32	2x70	mA
Anode input power	W_{ia}	=	2x12.8	2x28	W
Anode dissipation	W_a	=	2x12.8	2x20.5	W
Output power	W_o	=	0	15	W
Efficiency	η	=	-	27	%

[1]) With fixed bias

[2]) With cathode bias

7Z2 3080

A.F. CLASS AB AMPLIFIER AND MODULATOR in triode connection
(g_2 connected to a; I_{g_1} = 0)

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Anode voltage	V_a	= max.	400	V
Anode current	I_a	= max.	125	mA
Anode input power	W_{ia}	= max.	50	W
Anode dissipation	W_a	= max.	30	W
Heater to cathode voltage	V_{kf}	= max.	135	V
Grid No.1 circuit resistance	R_{g_1}	= max.	0.1	MΩ [1]
Grid No.1 circuit resistance	R_{g_1}	= max.	0.5	MΩ [2]

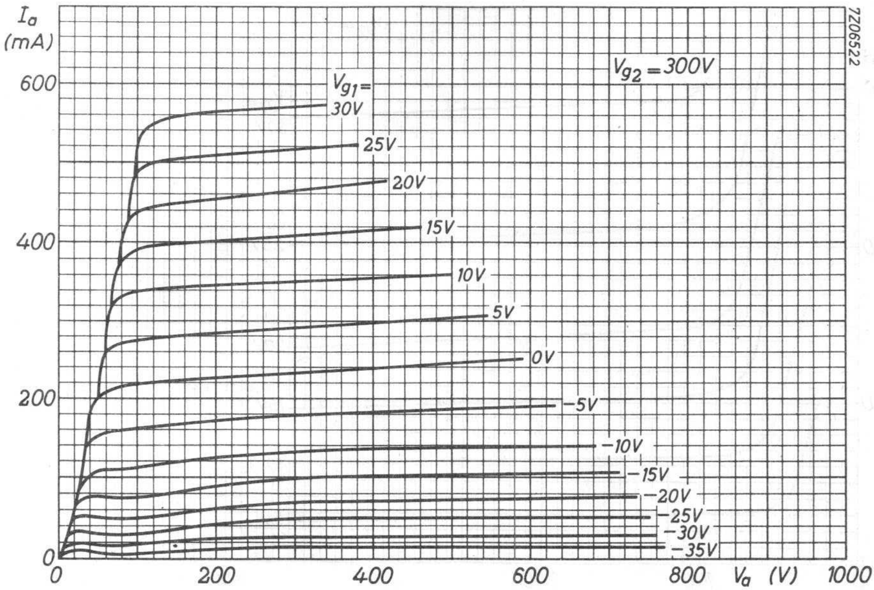
I.C.A.S. OPERATING CONDITIONS, intermittent service; two tubes

Anode voltage	V_a	=	400		V
Grid No.1 voltage	V_{g_1}	=	−45		V
Load resistance	$R_{aa\sim}$	=	3		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_{1p}}$	=	0	90	V
Anode current	I_a	=	2x32	2x70	mA
Anode input power	W_{ia}	=	2x12.8	2x28	W
Anode dissipation	W_a	=	2x12.8	2x20.5	W
Output power	W_o	=	0	15	W
Efficiency	η	=	−	27	%

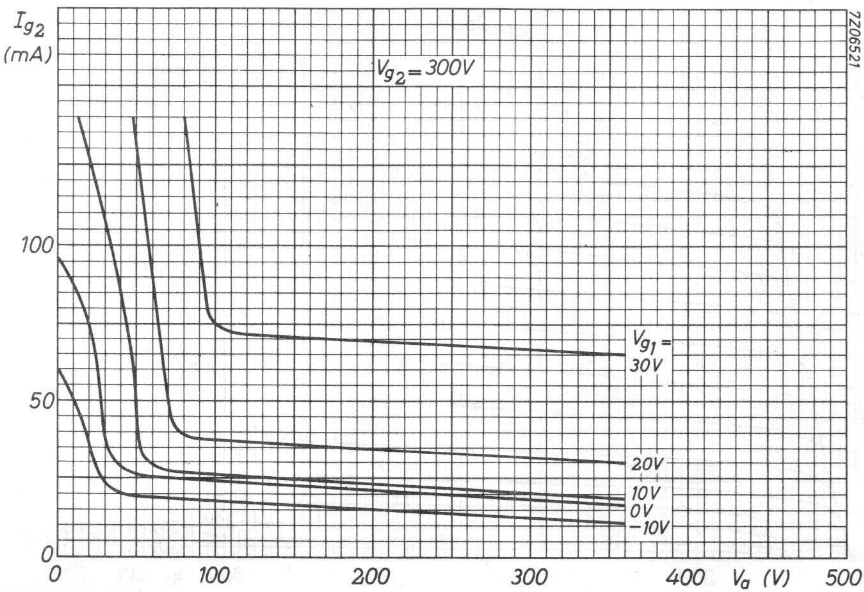
1) With fixed bias

2) With cathode bias

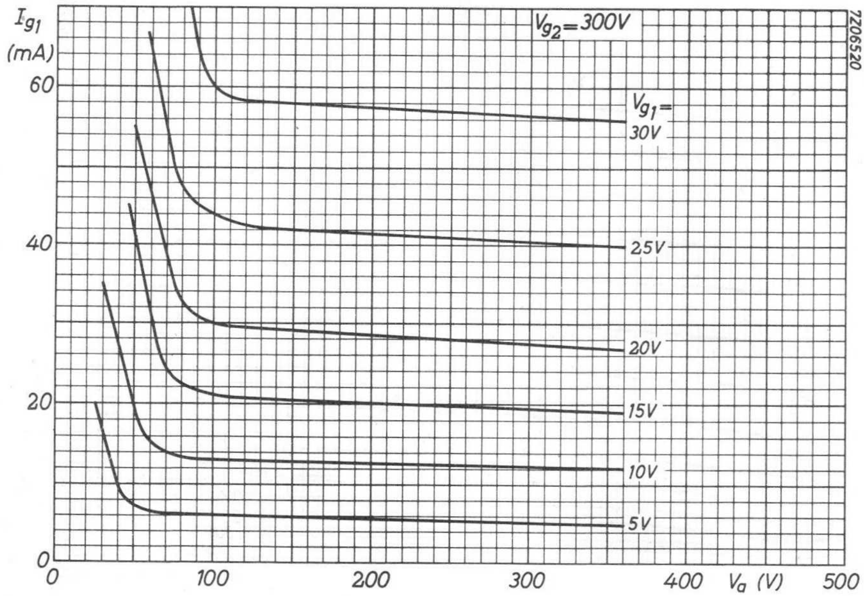
7Z2 3081

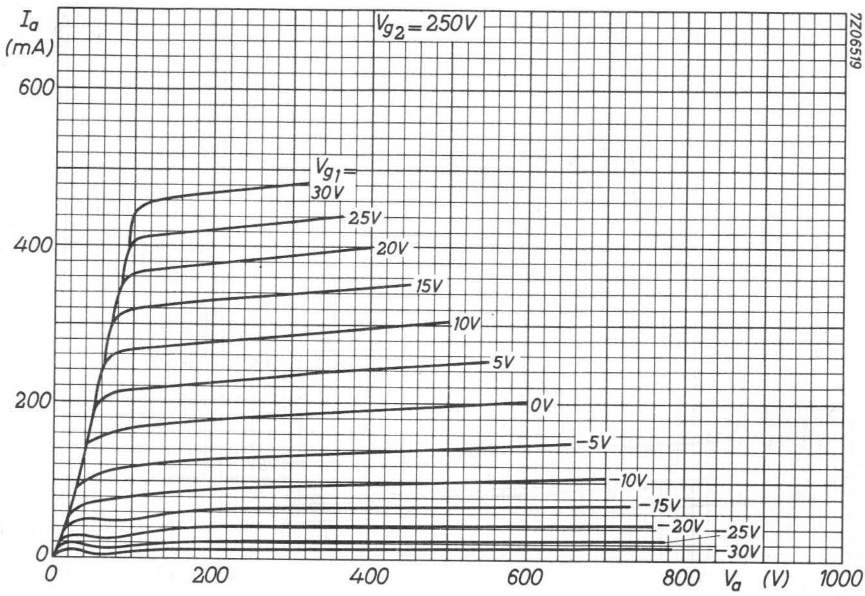


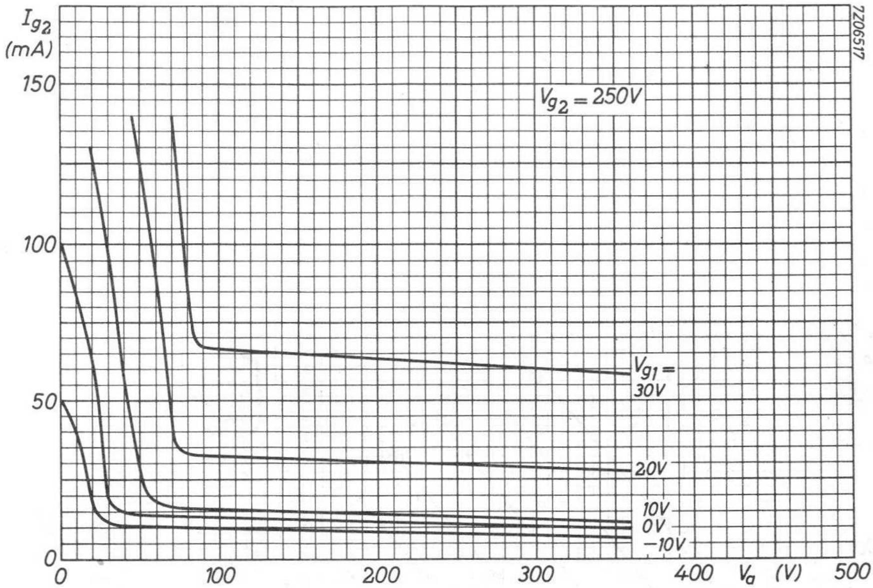
I_a (mA)
600
400
200
0
7Z06522
$V_{g2} = 300V$
$V_{g1} =$ 30V
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
0
200
400
600
800
V_a (V)
1000



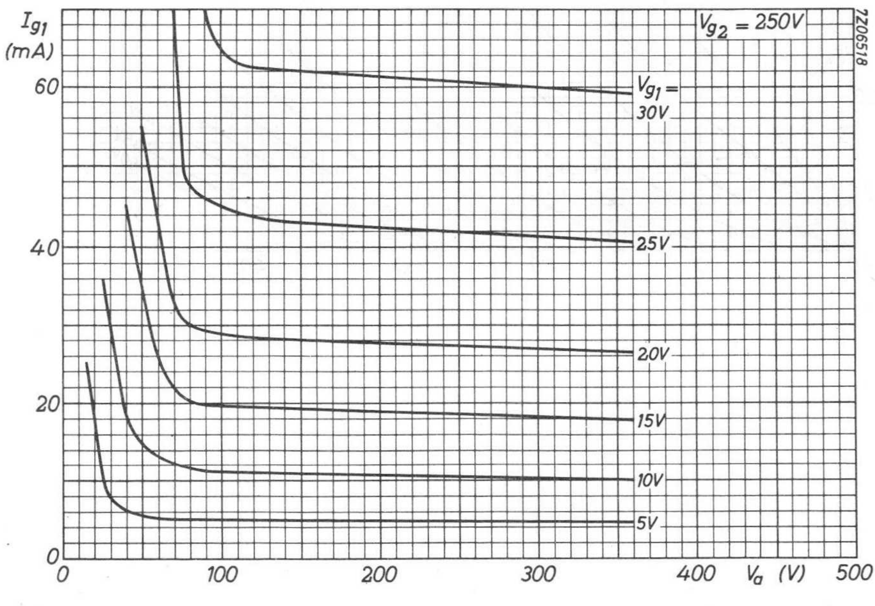
I_{g2} (mA)
100
50
0
7Z06521
$V_{g2} = 300V$
$V_{g1} =$ 30V
20V
10V
0V
−10V
0
100
200
300
400
V_a (V)
500


I_{g1} (mA)
60
40
20
0
0
100
200
300
400
V_a (V)
500
V_{g2}=300V
V_{g1}= 30V
25V
20V
15V
10V
5V
7Z06520

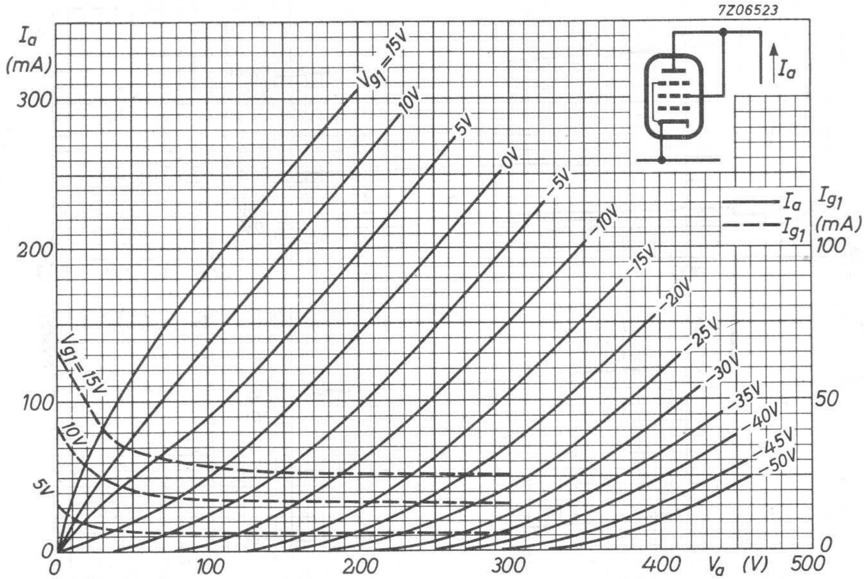

I_a (mA)
600
400
200
0
0
200
400
600
800
V_a (V)
1000
V_{g2}=250V
V_{g1}= 30V
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
7Z06519



I_{g2} (mA)
150
100
50
0
0
100
200
300
400
500
V_a (V)
$V_{g2} = 250V$
$V_{g1} =$ 30V
20V
10V
0V
−10V
7Z06517



I_{g1} (mA)
60
40
20
0
0
100
200
300
400
500
V_a (V)
$V_{g2} = 250V$
$V_{g1} =$ 30V
25V
20V
15V
10V
5V
7Z06518


7Z06523
I_a (mA)
300
200
100
0
I_{g1} (mA)
100
50
0
V_{g1} = 15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
V_{g1} = 15V
10V
5V
—— I_a
– – – I_{g1}
I_a
0
100
200
300
400
V_a (V)
500

R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA								
Freq.	C telegr.		C_{ag_2} mod.		B S.S.B.		B mod. 2)	
(MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o 1) (W)	V_a (V)	W_o (W)
30	750	200	600	130	750	220	750 600	300 200

HEATING : indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	V
Heater current	I_f	=	3.9	A

COOLING : radiation and convection

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	12.7	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	30	pF
Anode to grid No.1	C_{ag_1}	<	0.9	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	750	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	100	mA
Mutual conductance	S	=	9	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5.7	

1) Peak envelope power with double tone signal

2) Two tubes

7Z2 2946

TEMPERATURE LIMITS (Absolute limits)

Anode seal temperature	= max. 220 °C
Pin temperature	= max. 180 °C
Bulb temperature	= max. 300 °C

MECHANICAL DATA

Dimensions in mm

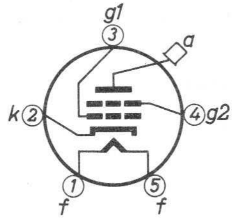
Base : giant 5p

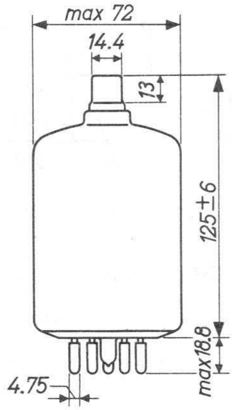
→ Socket : 2422 512 01001

Top cap : IEC 67-III-1b, type 3

Anode connector : 40680

Net weight: 220 g





Mounting position: vertical, or horizontal with plane of anodes vertical.

7Z2 2947

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	%

7Z2 4057

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	30	MHz
Anode voltage	V_a	= max.	650	V
Anode input power	W_{ia}	= max.	200	W
Anode dissipation	W_a	= max.	67	W
Anode current	I_a	= max.	350	mA
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	10	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
Heater to cathode voltage	V_{kf}	= max.	125	V

OPERATING CONDITIONS

Frequency	f	=	30	MHz
Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	−100	V
Anode current	I_a	=	300	mA
Grid No.2 current	I_{g_2}	=	20	mA
Grid No.1 current	I_{g_1}	=	4	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	110	V
Anode input power	W_{ia}	=	180	W
Grid No.1 input power	W_{ig_1}	=	0.4	W
Grid No.2 dissipation	W_{g_2}	=	5	W
Anode dissipation	W_a	=	50	W
Output power	W_o	=	130	W
Efficiency	η	=	72	%
Modulation factor	m	=	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	220	V [1]
Modulation power	W_{mod}	=	90	W

[1]) Obtained from a separate winding on the modulation transformer

7Z2 2949

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	825	V
Anode input power	W_{ia}	=	max.	250	W
Anode dissipation	W_a	=	max.	100	W
Anode current	I_a	=	max.	400	mA
Grid No.2 voltage	V_{g_2}	=	max.	350	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	kΩ
Heater to cathode voltage	V_{kf}	=	max.	125	V

OPERATING CONDITIONS, with double tone modulation

The R.F. voltage is modulated with two sinusoidal A.F. signals of equal strength but different frequency.

Frequency	f	=	30		MHz
Anode voltage	V_a	=	750		V
Grid No.2 voltage	V_{g_2}	=	310		V
Grid No.1 voltage	V_{g_1}	=	-45		V [1]
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	45[2]	V
Anode current	I_a	=	130	270	mA
Grid No.2 current	I_{g_2}	=	<5	26	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Anode input power	W_{ia}	=	98	200	W
Grid No.1 dissipation	W_{g_1}	=	0	0	W
Grid No.2 dissipation	W_{g_2}	=	1.5	8	W
Anode dissipation	W_a	=	98	90	W
Output power	W_o	=	0	220	W [3]
Efficiency	η	=	-	55	%

[1] To be adjusted so that I_a = 130 mA at $V_{g_{1p}} = 0$
[2] To be adjusted so that $I_{g_1} = 0$
[3] Peak envelope power

7Z2 2950

A.F. CLASS B AMPLIFIER

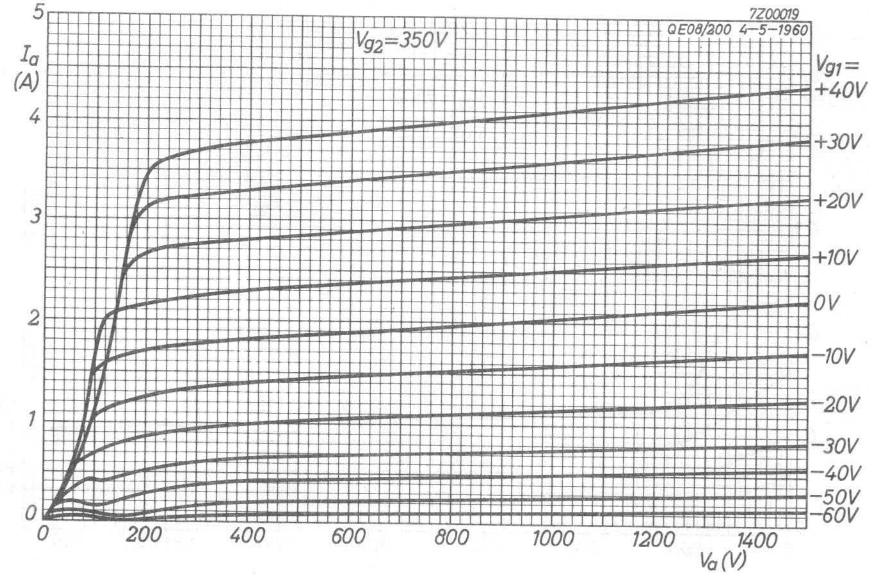
LIMITING VALUES (Absolute limits)

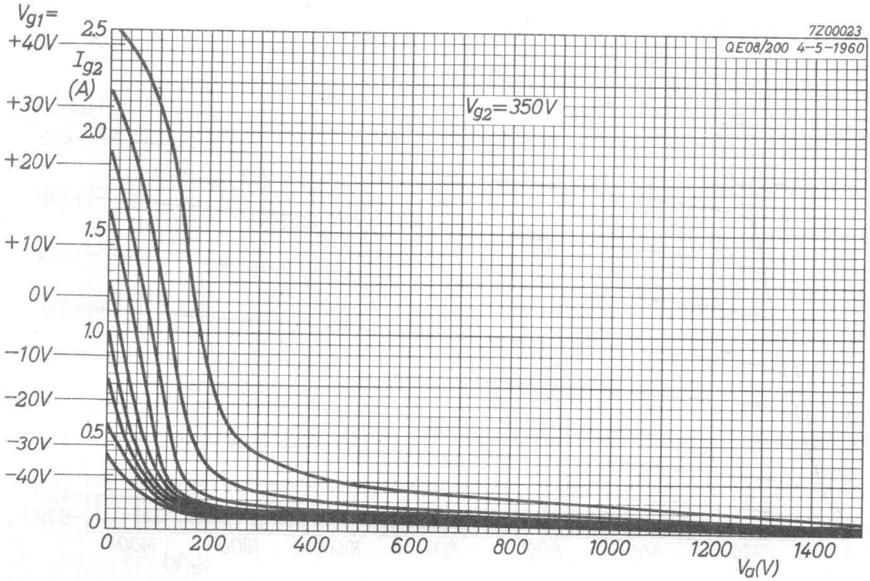
Anode voltage	V_a	= max.	825	V
Anode dissipation	W_a	= max.	100	W
Anode current	I_a	= max.	400	mA
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	15	kΩ
Heater to cathode voltage	V_{kf}	= max.	125	V

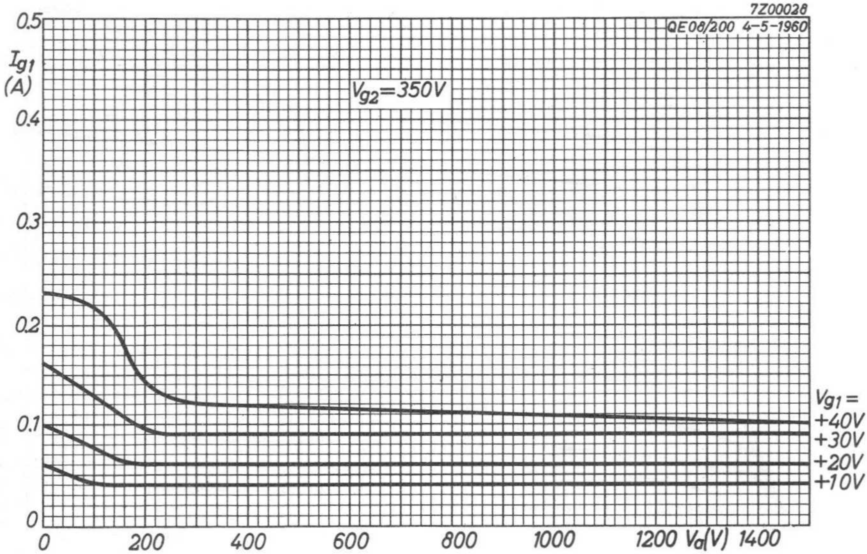
OPERATING CONDITIONS, two tubes

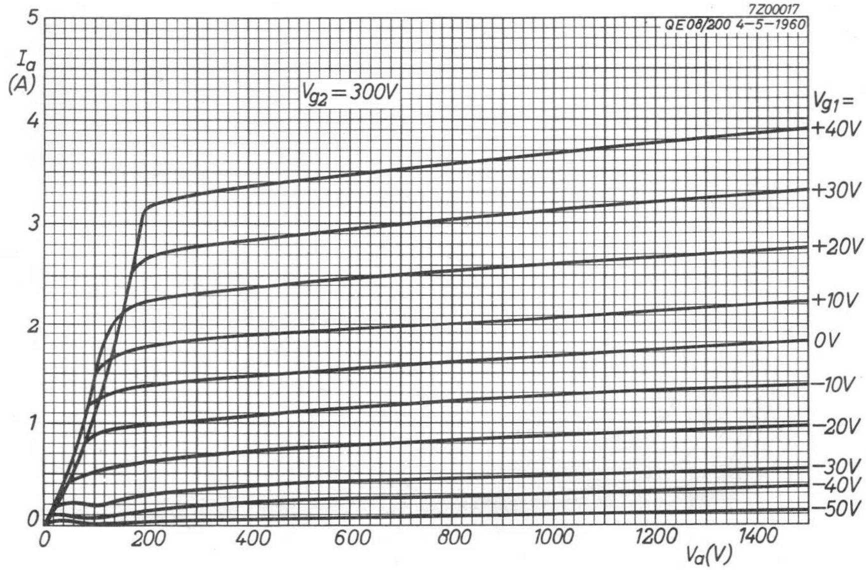
Anode voltage	V_a	=	750		600		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	-45		-45		V
Load resistance	$R_{aa\sim}$	=	3600		3500		Ω
Peak grid to grid voltage	$V_{g_1g_{1p}}$	=	0	110	0	105	V
Anode current	I_a	=	2x45	2x280	2x25	2x235	mA
Grid No.2 current	I_{g_2}	=	0	2x40	2x0.5	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	%

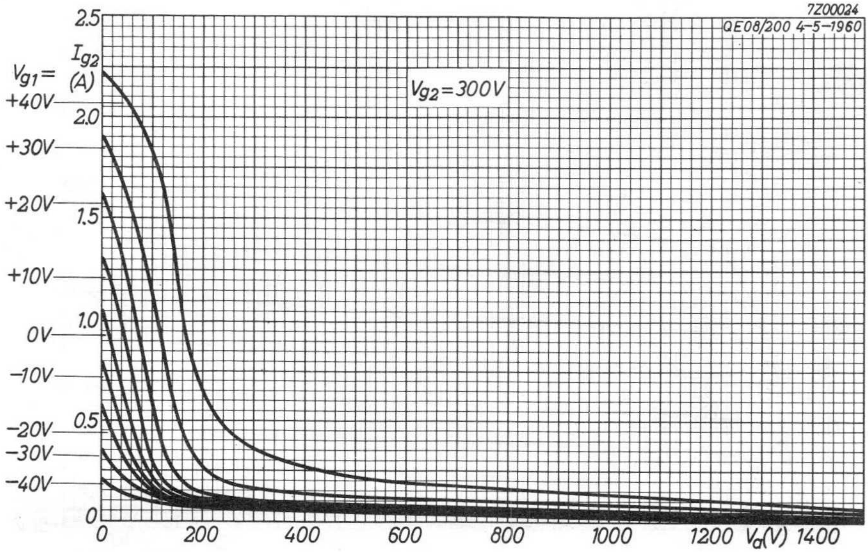
7Z2 2951

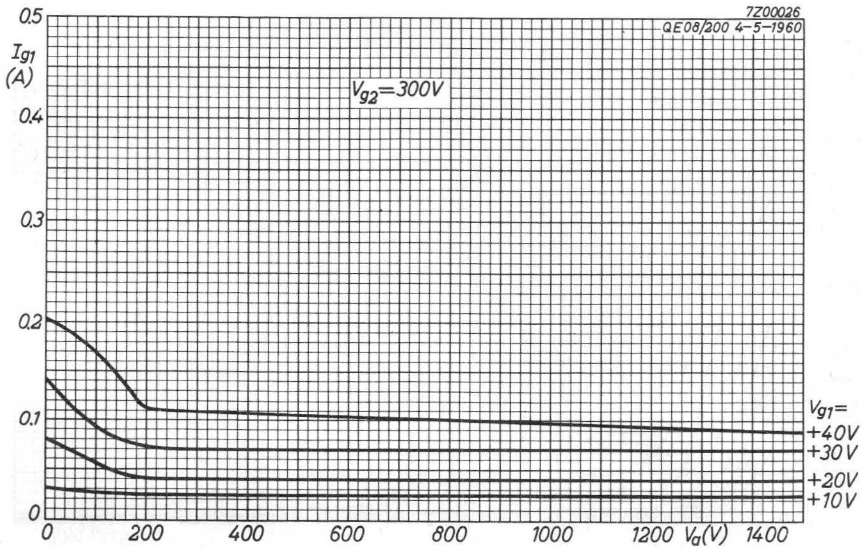

7Z00019
QE08/200 4-5-1960
V_{g2}=350V
I_a (A)
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
−50V
−60V
0
200
400
600
800
1000
1200
1400
V_a (V)

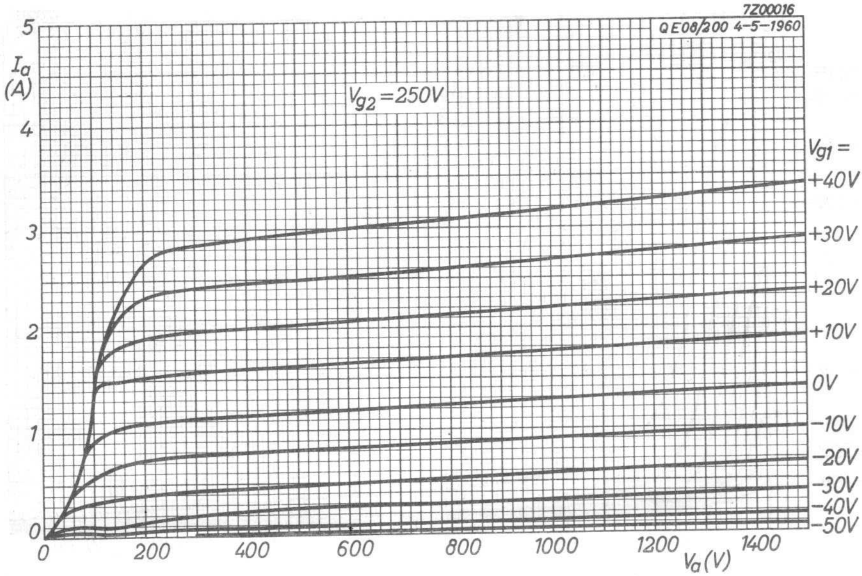

7Z00023
QE08/200 4-5-1960
V_{g2}=350V
I_{g2} (A)
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
0
200
400
600
800
1000
1200
1400
V_a(V)

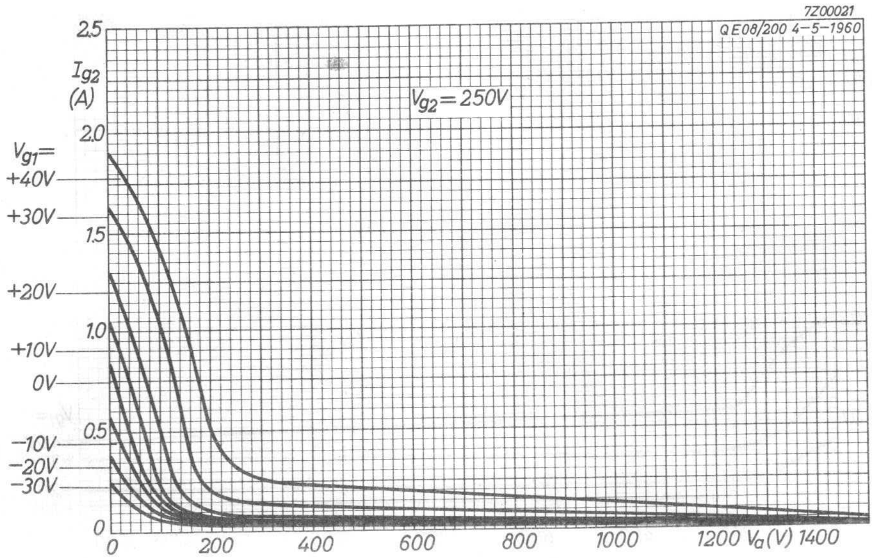

7Z00028
QE08/200 4-5-1960
I_{g1} (A)
V_{g2}=350V
V_{g1}=
+40V
+30V
+20V
+10V
0
0.1
0.2
0.3
0.4
0.5
0
200
400
600
800
1000
1200
V_a(V)
1400

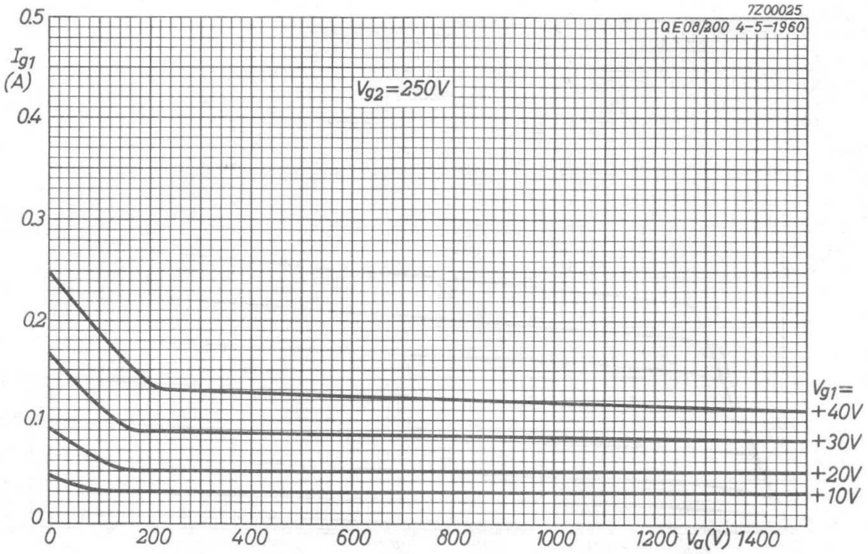

7Z00017
QE08/200 4-5-1960
I_a (A)
V_{g2}=300V
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
−50V
0
1
2
3
4
5
0
200
400
600
800
1000
1200
1400
V_a(V)

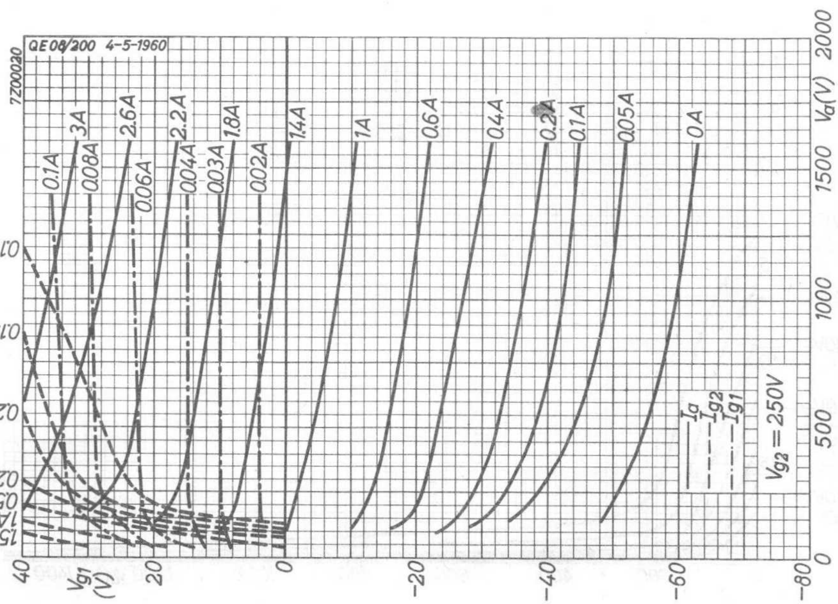

7Z00024
QE08/200 4-5-1960
I_{g2} (A)
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
V_{g2}=300V
2.5
2.0
1.5
1.0
0.5
0
0
200
400
600
800
1000
1200
V_a(V)
1400

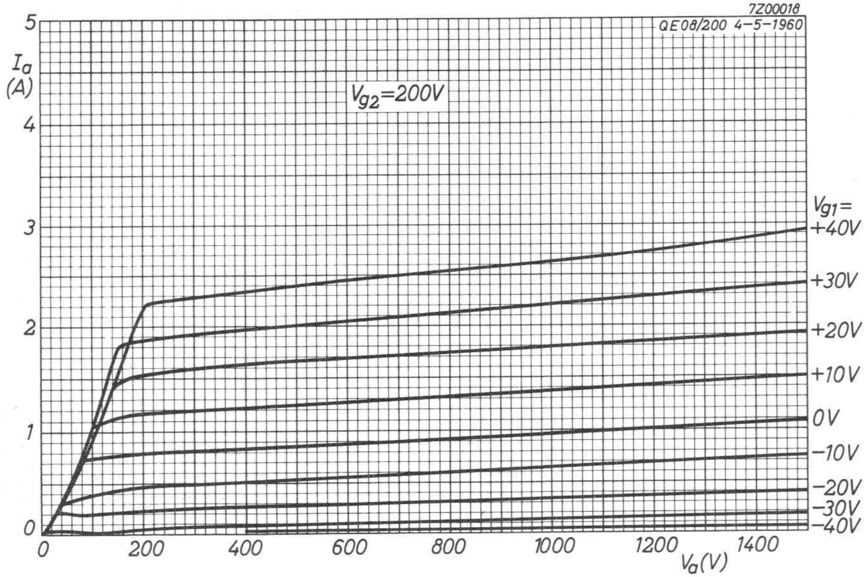

7Z00026
QE08/200 4-5-1960
I_{g1} (A)
V_{g2}=300V
V_{g1}=
+40V
+30V
+20V
+10V
0.5
0.4
0.3
0.2
0.1
0
0
200
400
600
800
1000
1200
V_a(V)
1400

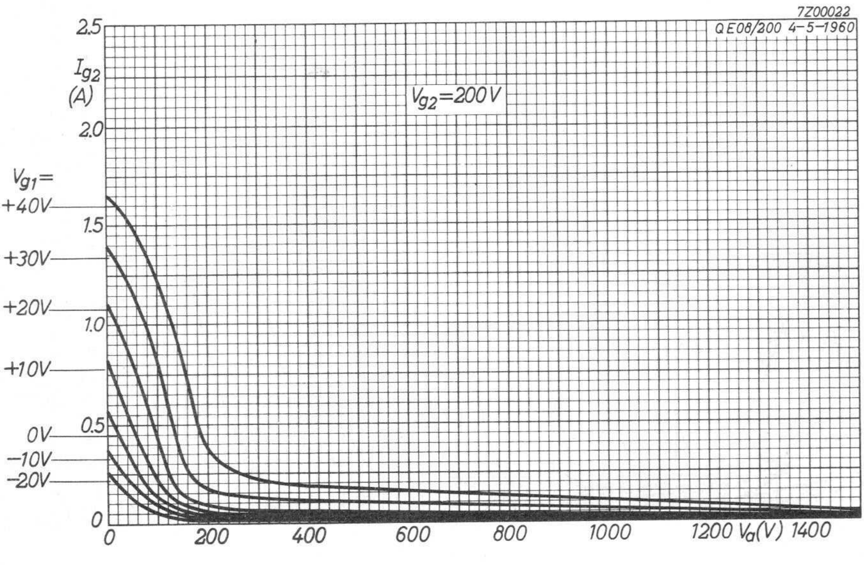

7Z00016
QE08/200 4-5-1960
I_a (A)
V_{g2}=250V
V_{g1} =
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
−50V
0
1
2
3
4
5
200
400
600
800
1000
1200
1400
V_a(V)

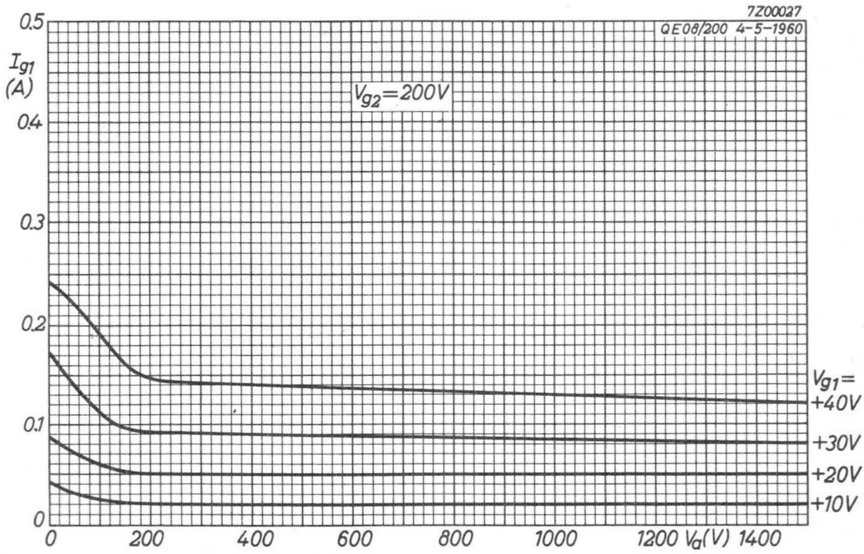

7Z00021
QE08/200 4-5-1960
I_{g2} (A)
V_{g2}=250V
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
0
0.5
1.0
1.5
2.0
2.5
200
400
600
800
1000
1200 V_a(V) 1400


7Z00025
QE08/200 4-5-1960
I_{g1} (A)
V_{g2}=250V
V_{g1}=
+40V
+30V
+20V
+10V
V_a(V)
0
200
400
600
800
1000
1200
1400
0
0.1
0.2
0.3
0.4
0.5


7Z00030
QE08/200 4-5-1960
V_a(V)
V_{g1} (V)
V_{g2} = 250V
I_a
I_{g2}
I_{g1}
3A
2.6A
2.2A
1.8A
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0A
0.1A
0.08A
0.06A
0.04A
0.03A
0.02A
0.1A
0.15A
0.2A
0.25A
0.5A
1A
1.5A
40
20
0
-20
-40
-60
-80
0
500
1000
1500
2000


7Z00018
QE08/200 4-5-1960
I_a (A)
V_{g2}=200V
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
−30V
−40V
0 1 2 3 4 5
0 200 400 600 800 1000 1200 1400
V_a(V)


7Z00022
QE08/200 4-5-1960
I_{g2} (A)
V_{g2}=200V
V_{g1}=
+40V
+30V
+20V
+10V
0V
−10V
−20V
0 0.5 1.0 1.5 2.0 2.5
0 200 400 600 800 1000 1200 1400
V_a(V)


7Z00027
QE08/200 4-5-1960
0.5
I_{g1}
(A)
0.4
0.3
0.2
0.1
0
V_{g2}=200V
V_{g1}=
+40V
+30V
+20V
+10V
0
200
400
600
800
1000
1200
V_a(V)
1400

R.F. BEAM POWER TETRODE

HEATING: indirect

Heater voltage	V_f	=	26.5	V
Heater current	I_f	=	0.85	A

- - - - - - - - - - - - - -

For further data and curves of this type
please refer to type QE08/200

- - - - - - - - - - - - - -

7Z2 2952

FORCED AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA

Freq. (MHz)	C telegr. V_a (V)	C telegr. W_o (W)	C_{ag_2} mod. V_a (V)	C_{ag_2} mod. W_o (W)	AB mod. V_a (V)	AB mod. W_o[1] (W)	AB mod. W_o[2] (W)
< 150	2000	370	1600	230	2000	580	630
	1500	260	1200	160	1500	400	440
165	1250	195	1000	140	1000	230	270
	1000	150	800	100	800	170	215
	750	110	600	80			
	600	85	400	55			
500	1250	170					
	1000	120					
	800	95					
	600	50					

Freq. (MHz)	B SSB V_a (V)	B SSB W_o (PEP) (W)
175	2000	300
	1500	220
	1000	130

Freq. (MHz)	B television V_a (V)	B television W_o (sync) (W)
216	1250	250
	1000	200
	750	135

HEATING: indirect by A.C. or D.C.; cathode oxide-coated

Heater voltage	V_f	=	6.0 V
Heater current	I_f	=	2.6 A
Waiting time	T_w	=	min. 30 sec

When the tube is driven to max. input as a straight through class C amplifier the heater voltage should be reduced according to the following table

f	≦ 300 MHz	300-400 MHz	400-500 MHz
V_f	6.0 V	5.75 V	5.5 V

[1]) Without grid current, two tubes

[2]) With grid current, two tubes

7Z2 2799

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	4.4	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	16	pF
Anode to grid No.1	C_{ag_1}	=	0.03	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	500	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	200	mA
Mutual conductance	S	=	12	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	5	

COOLING

The use of the air-system socket with chimney is recommended, since a standard loctal socket does not ensure an adequate cooling of the base

With the air-system socket air is directed over the base seals, past grid No.2 seal, glass envelope and anode seal and through the radiator to provide effective cooling with minimum air flow. All four cathode connections should be used

The figures in the table below apply to the simultaneous cooling of the radiator and the base, making use of the socket 2422 513 01001 with air chimney → 4322 026 11701

W_a	h	t_i	q_{min}	p_i [1]
250 W	0 m	20 °C	0.16 m^3/min	12 mm H_2O

TEMPERATURE LIMITS (Absolute limits)

Anode temperature	max.	250	°C [2]
Anode seal temperature	max.	200	°C
Base seals and grid No.2 seal temperature	max.	175	°C

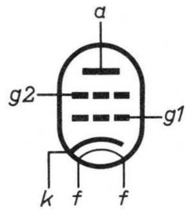
[1]) Pressure drop in caveties etc. excluded

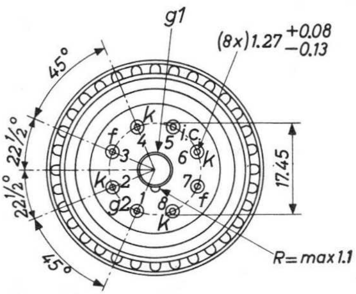
[2]) Measured on base end of anode surface at the junction with the radiator fins

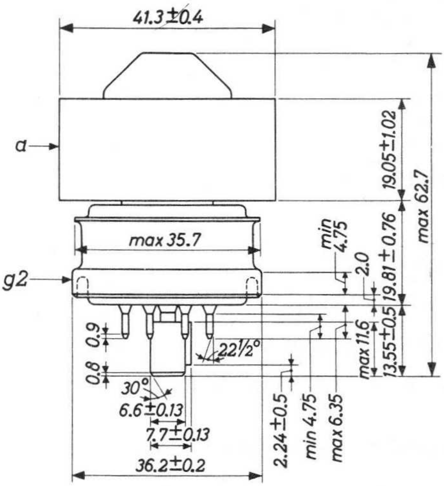
7Z2 2800

MECHANICAL DATA (Dimensions in mm)

Net weight : 130 g

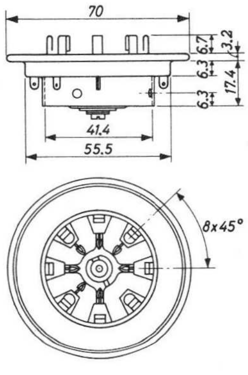


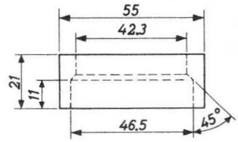




Mounting position: arbitrary

At higher frequencies the ring-surface terminal should be used for connecting the screen grid





→ Chimney 4322 026 11701

→ Socket 2422 513 01001

→ The socket 2422 513 01001 is intended for circuits where the cathode is at chassis potential

→ The type number 2422 513 01001 includes the chimney 4322 026 11701

7Z2 8827

R.F. AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY OR F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	150	500	MHz
Anode voltage	V_a	= max.	2000	1250	V
Anode current	I_a	= max.	250	250	mA
Anode input power	W_{ia}	= max.	500	320	W
Anode dissipation	W_a	= max.	250	250	W
Grid No.2 voltage	V_{g_2}	= max.	300	300	V
Grid No.2 dissipation	W_{g_2}	= max.	12	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	250	V
Grid No.1 dissipation	W_{g_1}	= max.	2	2	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	= max.	150	150	V

OPERATING CONDITIONS

Frequency	f	<	150	150	MHz
Anode voltage	V_a	=	2000	1500	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−88	−88	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	110	110	V
Anode current	I_a	=	250	250	mA
Grid No.2 current	I_{g_2}	=	24	24	mA
Grid No.1 current	I_{g_1}	=	8	8	mA
Grid No.1 input power	W_{ig_1}	=	2.5	1.5	W
Anode input power	W_{ia}	=	500	375	W
Anode dissipation	W_a	=	130	115	W
Output power	W_o	=	370	260	W

7Z2 2802

R.F. AMPLIFIER AND OSCILLATOR CLASS C TELEGRAPHY OR F.M. TELEPHONY (continued)

OPERATING CONDITIONS (continued)

Frequency	f	=	165	165	165	165	MHz
Anode voltage	V_a	=	1250	1000	750	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-90	-80	-80	-75	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	106	95	96	91	V
Anode current	I_a	=	200	200	200	200	mA
Grid No.2 current	I_{g_2}	=	20	31	37	37	mA
Grid No.1 current	I_{g_1}	=	11	10	11	11	mA
Grid No.1 input power	W_{ig_1}	=	1.2	1.0	1.0	1.0	W
Anode input power	W_{ia}	=	250	200	150	120	W
Anode dissipation	W_a	=	55	50	40	35	W
Output power	W_o	=	195	150	110	85	W

			With coaxial cavity				
Frequency	f	=	500	500	500	500	MHz
Anode voltage	V_a	=	1250	1000	800	600	V
Grid No.2 voltage	V_{g_2}	=	280	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-90	-110	-110	-110	V
Anode current	I_a	=	250	200	200	170	mA
Grid No.2 current	I_{g_2}	=	6	7	7	6	mA
Grid No.1 current	I_{g_1}	=	12	10	10	6	mA
Driver output power	W_{dr}	=	30	25	20	15	W
Anode input power	W_{ia}	=	312	200	160	102	W
Anode dissipation	W_a	=	142	80	65	52	W
Output power	W_o	=	170	120	95	50	W

7Z2 2803

R.F. AMPLIFIER CLASS C TELEPHONY, ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	150	500	MHz
Anode voltage	V_a	=	max.	1600	1000	V
Anode current	I_a	=	max.	200	200	mA
Anode input power	W_{ia}	=	max.	480	300	W
Anode dissipation	W_a	=	max.	165	165	W
Grid No.2 voltage	V_{g_2}	=	max.	300	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	10	10	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	250	V
Grid No.1 dissipation	W_{g_1}	=	max.	2	2	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	=	max.	150	150	V

OPERATING CONDITIONS

Frequency	f		<150	<150	MHz
Anode voltage	V_a	=	1600	1200	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-118	-118	V 1)
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	136	136	V
Anode current	I_a	=	200	200	mA
Grid No.2 current	I_{g_2}	=	23	23	mA
Grid No.1 current	I_{g_1}	=	5	5	mA
Grid No.1 input power	W_{ig_1}	=	3	2	W
Anode input power	W_{ia}	=	320	240	W
Anode dissipation	W_a	=	90	80	W
Output power	W_o	=	230	160	W
Modulation depth	m	=	100	100	%
Peak grid No.2 modulation voltage	$V_{g_{2p}}$	=	200	180	V
Modulation power	W_{mod}	=	115	80	W

1) Obtained from grid No.1 resistor or from a combination of grid No.1 resistor with either fixed supply or cathode resistor

7Z2 2804

R.F. AMPLIFIER CLASS C TELEPHONY,
ANODE AND SCREEN GRID MODULATION (continued)

OPERATING CONDITIONS (continued)

Frequency	f	=	165	165	165	165	MHz
Anode voltage	V_a	=	1000	800	600	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	−105	−100	−95	−90	V [1])
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	125	120	120	110	V
Anode current	I_a	=	200	200	200	200	mA
Grid No.2 current	I_{g_2}	=	20	25	30	35	mA
Grid No.1 current	I_{g_1}	=	15	10	8	7	mA
Grid No.1 input power	W_{ig_1}	=	2	1.5	1.0	1.0	W
Anode input power	W_{ia}	=	200	160	120	80	W
Anode dissipation	W_a	=	60	60	40	25	W
Output power	W_o	=	140	100	80	55	W
Modulation depth	m	=	100	100	100	100	%
Peak grid No.2 modulation voltage	$V_{g_{2p}}$	=	170	160	150	140	V
Modulation power	W_{mod}	=	70	50	40	27.5	W

[1]) Obtained from grid No. 1 resistor or from a combination of grid No.1 resistor with either fixed supply or cathode resistor

7Z2 2805

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f	up to	175	500	MHz
Anode voltage	V_a	= max.	2000	1250	V
Anode current	I_a	= max.	250	250	mA
Anode input power	W_{ia}	= max.	500	315	W
Anode dissipation	W_a	= max.	250	250	W
Grid No.2 voltage	V_{g_2}	= max.	400	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	250	V
Grid No.1 circuit resistance (with fixed bias)	R_{g_1}	= max.	25	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	= max.	150	150	V

OPERATING CONDITIONS Operation with cathode bias is not recommended

Frequency	f	=		175		MHz
Anode voltage	V_a	=		2000		V
Grid No.2 voltage	V_{g_2}	=		300		V
Grid No.1 voltage	V_{g_1}	=		−47		V
Load resistance	$R_{a\sim}$	=		4200		Ω
			zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	47	47	V
Anode current	I_a	=	75	250	160	mA
Grid No.2 current	I_{g_2}	=	−1	−7	−5	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Grid No.1 input power	W_{ig_1}	=	0	0	0	W
Anode input power	W_{ia}	=	150	500	320	W
Anode dissipation	W_a	=	150	200	170	W
Output power	W_o	=	0	300	150	W
Peak envelope power	W_o(PEP)	=	–	–	300	W
Third order intermodulation distortion	d_3	=	–	–	−32	dB

7Z2 2806

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER (continued)

OPERATING CONDITIONS (continued)

Operation with cathode bias is not recommended

Frequency	f	=		175			175		MHz
Anode voltage	V_a	=		1500			1000		V
Grid No.2 voltage	V_{g_2}	=		300			315		V
Grid No.1 voltage	V_{g_1}	=		−45			−44.5		V
Load resistance	$R_{a\sim}$	=		2900			1850		Ω
			zero signal	single tone signal	double tone signal	zero signal	single tone signal	double tone signal	
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	0	45	45	0	44.5	44.5	V
Anode current	I_a	=	75	250	165	100	250	180	mA
Grid No.2 current	I_{g_2}	=	−2	−4	−5	−4	20	0	mA
Grid No.1 current	I_{g_1}	=	0	0	0	0	0	0	mA
Grid No.1 input power	W_{ig_1}	=	0	0	0	0	0	0	W
Anode input power	W_{ia}	=	115	375	250	100	250	180	W
Anode dissipation	W_a	=	115	155	140	100	120	115	W
Output power	W_o	=	0	220	110	0	130	65	W
Peak envelope power	W_o(PEP)	=	–	–	220	–	–	130	W
Third order intermodulation distortion	d_3	=	–	–	−31	–	–	−30	dB

7Z2 2807

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

7Z2 2808

A.F. POWER AMPLIFIER AND MODULATOR , CLASS AB WITHOUT GRID CURRENT (continued)

OPERATING CONDITIONS (two tubes; continued)

Anode voltage	V_a	=	1500		V
Grid No.2 voltage	V_{g_2}	=	300		V
Grid No.1 voltage	V_{g_1}	=	-50		V
Load resistance	$R_{aa\sim}$	=	6570		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_1p}$	=	0	100	V
Anode current	I_a	=	2x50	2x228	mA
Grid No.2 current	I_{g_2}	=	-	2x21	mA
Grid No.2 dissipation	W_{g_2}	=	-	2x6.3	W
Anode input power	W_{ia}	=	2x75	2x340	W
Anode dissipation	W_a	=	2x75	2x140	W
Output power	W_o	=	0	400	W

Anode voltage	V_a	=	1000		800		V
Grid No.2 voltage	V_{g_2}	=	300		300		V
Grid No.1 voltage	V_{g_1}	=	-43		-40		V
Load resistance	$R_{aa\sim}$	=	4250		4400		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_1p}$	=	0	86	0	80	V
Anode current	I_a	=	2x82.5	2x225	2x105	2x218	mA
Grid No.2 current	I_{g_2}	=	-	2x26	-	2x38	mA
Grid No.2 dissipation	W_{g_2}	=	-	2x7.8	-	2x11.4	W
Anode input power	W_{ia}	=	2x82.5	2x225	2x84	2x174	W
Anode dissipation	W_a	=	2x82.5	2x110	2x84	2x89	W
Output power	W_o	=	0	230	0	170	W

7Z2 2809

A.F. POWER AMPLIFIER AND MODULATOR, CLASS AB WITH GRID CURRENT

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	2000	V
Anode current	I_a	=	max.	250	mA
Anode dissipation	W_a	=	max.	250	W
Anode input power	W_{ia}	=	max.	500	W
Grid No.2 voltage	V_{g_2}	=	max.	400	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W
Grid No.1 dissipation	W_{g_1}	=	max.	2	W
Grid No.1 circuit resistance (each tube)	R_{g_1}	=	max.	100	kΩ
Peak cathode to heater voltage	V_{kf_p}	=	max.	150	V

OPERATING CONDITIONS (two tubes)

Anode voltage	V_a	=	2000		V
Grid No.2 voltage	V_{g_2}	=	300		V
Grid No.1 voltage	V_{g_1}	=	−50		V
Load resistance	$R_{aa\sim}$	=	8100		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	106	V
Driving power	W_{dr}	=	0	0.2	W
Anode current	I_a	=	2x50	2x250	mA
Grid No.2 current	I_{g_2}	=	–	2x18	mA
Grid No.2 dissipation	W_{g_2}	=	–	2x5.4	W
Anode input power	W_{ia}	=	2x100	2x500	W
Anode dissipation	W_a	=	2x100	2x185	W
Output power	W_o	=	–	630	W

7Z2 2810

A.F. POWER AMPLIFIER AND MODULATOR, CLASS AB WITH GRID CURRENT (continued)

OPERATING CONDITIONS (two tubes; continued)

Anode voltage	V_a	=	1500		V
Grid No.2 voltage	V_{g_2}	=	300		V
Grid No.1 voltage	V_{g_1}	=	-50		V
Load resistance	$R_{aa\sim}$	=	5970		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	106	V
Driving power	W_{dr}	=	0	0.2	W
Anode current	I_a	=	2x50	2x250	mA
Grid No.2 current	I_{g_2}	=	–	2x18	mA
Grid No.2 dissipation	W_{g_2}	=	–	2x5.4	W
Anode input power	W_{ia}	=	2x75	2x375	W
Anode dissipation	W_a	=	2x75	2x155	W
Output power	W_o	=	0	440	W

Anode voltage	V_a	=	1000		800		V
Grid No.2 voltage	V_{g_2}	=	300		300		V
Grid No.1 voltage	V_{g_1}	=	-45		-40		V
Load resistance	$R_{aa\sim}$	=	3950		3140		Ω
Peak grid to grid A.C. voltage	$V_{g_1g_{1p}}$	=	0	98	0	90	V
Driving power	W_{dr}	=	0	0.15	0	0.15	W
Anode current	I_a	=	2x83	2x247	2x105	2x250	mA
Grid No.2 current	I_{g_2}	=	–	2x29	–	2x40	mA
Grid No.2 dissipation	W_{g_2}	=	–	2x8.7	–	2x12	W
Anode input power	W_{ia}	=	2x83	2x247	2x84	2x200	W
Anode dissipation	W_a	=	2x83	2x112	2x84	2x93	W
Output power	W_o	=	0	270	0	215	W

7Z2 2811

R.F. AMPLIFIER, CLASS B TELEVISION SERVICE
Negative modulation, positive synchronisation

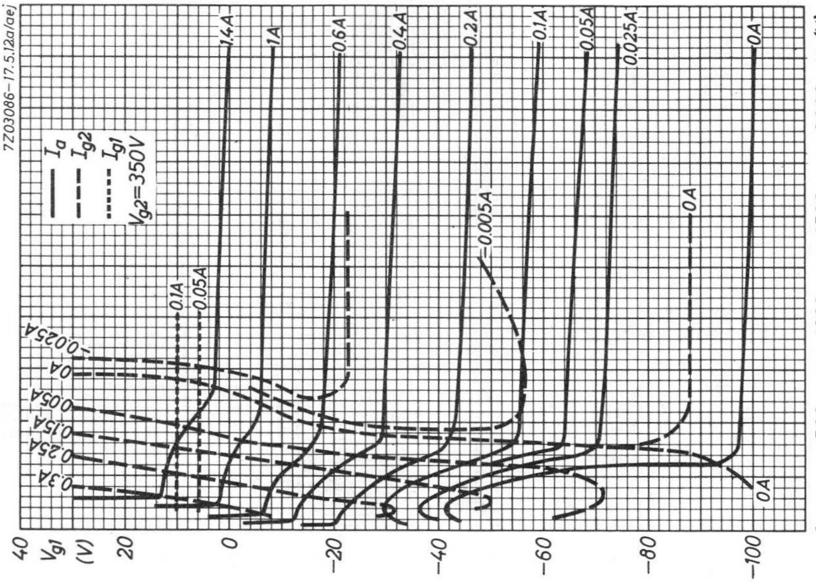
LIMITING VALUES (Absolute limits)

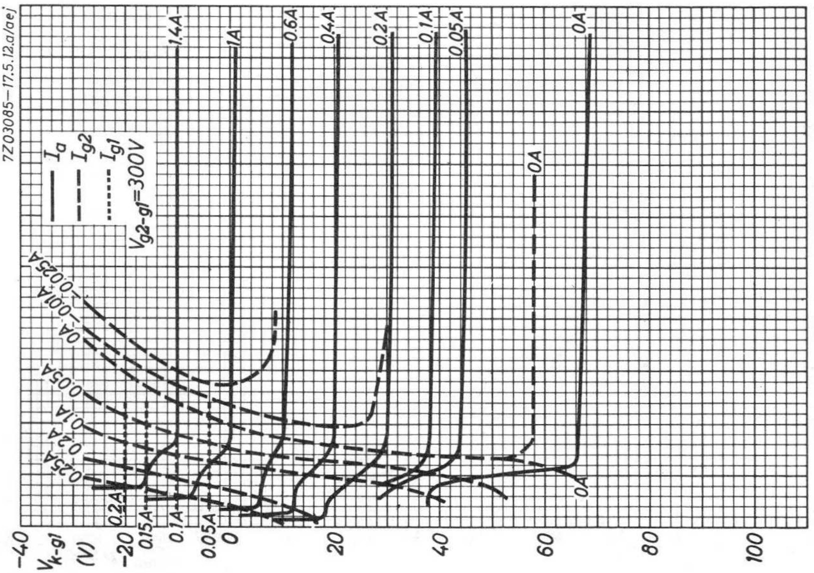
Frequency	f	=	54 to	216	MHz
Anode voltage	V_a	=	max.	1250	V
Anode current	I_a	=	max.	250	mA
Anode dissipation	W_a	=	max.	250	W
Anode input power	W_{ia}	=	max.	500	W
Grid No.2 voltage	V_{g_2}	=	max.	400	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 dissipation	W_{g_1}	=	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ
Peak cathode to heater voltage	V_{kf_p}	=	max.	150	V

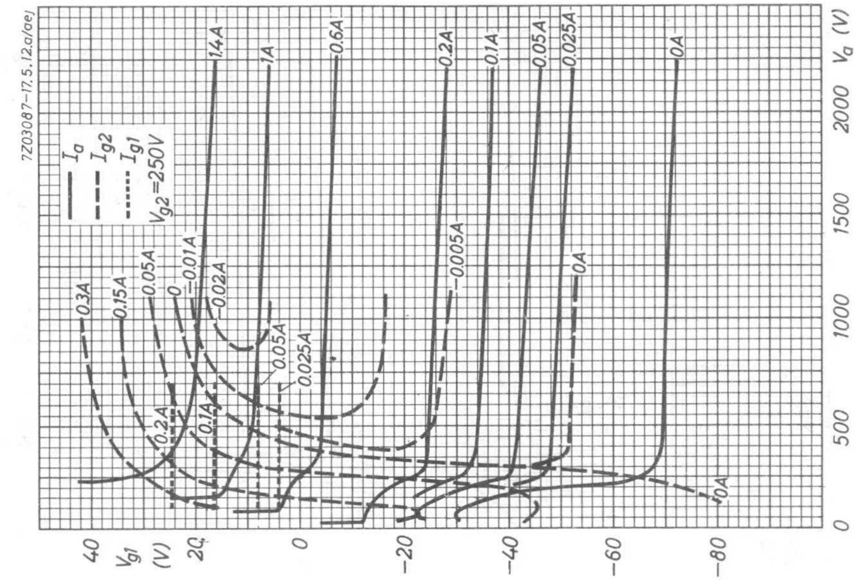
OPERATING CONDITIONS at centre frequency of resonance curve

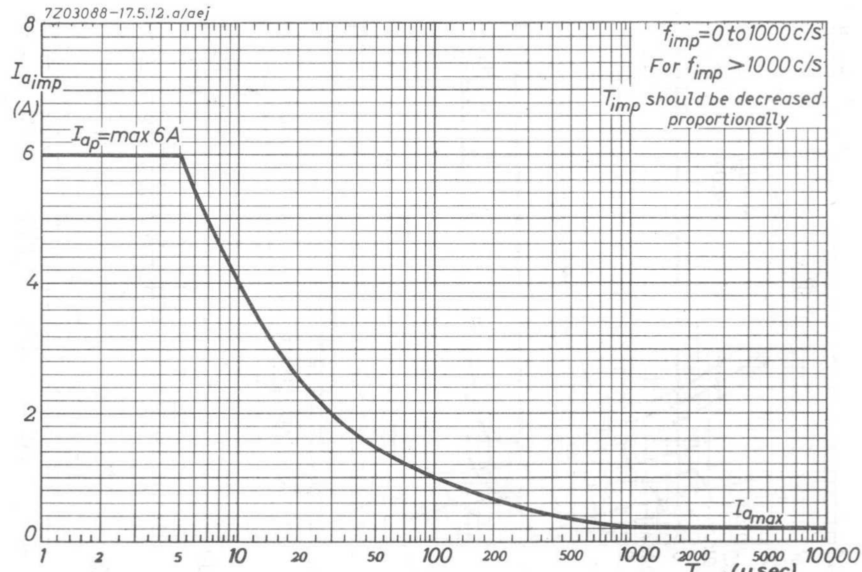
Frequency	f		=	216	216	216	MHz
Bandwidth at −1.5 dB	B		=	5	5	5	MHz
Anode voltage	V_a		=	1250	1000	750	V
Grid No.2 voltage	V_{g_2}		=	300	300	300	V
Grid No.1 voltage	V_{g_1}		=	−70	−65	−60	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	sync	=	100	95	85	V
		black	=	75	70	65	V
Anode current	I_a	sync	=	305	330	335	mA
		black	=	230	240	245	mA
Grid No.2 current	I_{g_2}	sync	=	45	45	50	mA
		black	=	10	15	20	mA
Grid No.1 current	I_{g_1}	sync	=	25	20	15	mA
		black	=	4	4	4	mA
Grid No.1 input power	W_{ig_1}	sync	=	9	8	7	W
		black	=	5.5	4.7	4.25	W
Output power	W_o	sync	=	250	200	135	W
		black	=	140	110	75	W

7Z2 2812


7Z03086-17.5.12a/aej
Ia
Ig2
Ig1
Vg2=350V
Va (V)
Vg1 (V)


7Z03085-17.5.12.a/aej
Ia
Ig2
Ig1
Vg2-g1=300V
Va-g1 (V)
Vk-g1 (V)


7Z03087–17.5.12.a/aej
I_a
I_{g2}
I_{g1}
V_{g2}=250V
1.4A
1A
0.6A
0.2A
0.1A
0.05A
0.025A
0A
0.3A
0.15A
0.05A
0
0.01A
0.02A
0.005A
0A
0.2A
0.1A
0.05A
0.025A
0A
V_a (V)
2000
1500
1000
500
0
V_{g1} (V)
40
20
0
−20
−40
−60
−80


7Z03088–17.5.12.a/aej
$I_{a_{imp}}$ (A)
8
6
4
2
0
I_{a_p}=max 6 A
f_{imp}=0 to 1000 c/s
For f_{imp} > 1000 c/s
T_{imp} should be decreased proportionally
$I_{a_{max}}$
1
2
5
10
20
50
100
200
500
1000
2000
5000
10000
T_{imp} (μ sec)

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

7Z2 3841

V.H.F./U.H.F. TRANSMITTING TETRODE

Forced air cooled beam power tetrode with ceramic to metal seals for use as linear R.F. power amplifier for frequencies up to 500 MHz and designed for S.S.B. transmitters

QUICK REFERENCE DATA				
Freq. (MHz)	S.S.B		A.M. teleph.	
	V_a (V)	W_ℓ (W) PEP	V_a (V)	W_o (W)
30	2000	400	2000	105
500			2000	106

HEATING: indirect by A.C. or D.C.; cathode oxide-coated

Heater voltage	V_f	=	6.0	V ±10 %
Heater current at V_f = 6 V	I_f	=	2.6	A
Cathode heating time	T_w	=	min. 30	s

The heater voltage should be reduced according to the following table:

Frequency	V_f
300 MHz or lower	6.0 V
300 to 400 MHz	5.75 V
400 to 500 MHz	5.5 V

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	500	V	-	
Grid No.2 voltage	V_{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	

7Z2 7983

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	4.5	pF
Grid No.1 to all other elements except anode	C_{g1}	=	17	pF
Anode to grid No.1	C_{ag1}	=	0.065	pF

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode core and all seals max. 250 ^{o}C

COOLING

Accessories

→ Air system socket 2422 513 01001 (air system chimney included)

→ Air system chimney 4322 026 11701

By means of the air system socket forced air is directed to the base seals, past the screen grid seal, the ceramic envelope and the anode seal and through the radiator

The use of the air system socket is recommended since a standard lock-in socket does not ensure adequate cooling of the base. All four cathode connections should be used

Required air flow with air system socket

Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a	h	t_i	q_{min}	p_i
250 W	0 m	20 ^{o}C	0.11 m^3/min	8 mm H_20

At higher altitudes and/or temperatures the air flow must be increased to maintain the anode and seal temperatures within the limits

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1) (Page 4) The limiting value for a signal having a minimum peak to average power ratio less than 2, such as is obtained in single tone operation, is 250 mA. During short periods of circuit adjustment under single tone conditions, the average anode current may be as high as 350 mA

2) (Page 4) Automatic bias is not recommended

3) (Page 4) Driver output power measured at grid No.1 circuit of the QEL2/200

4) (Pages 4 and 5) Average output power measured in the load of an output circuit having an efficiency of 95%

→ 5) (Page 5) Average output power measured in the load of an output circuit having an efficiency of 85%

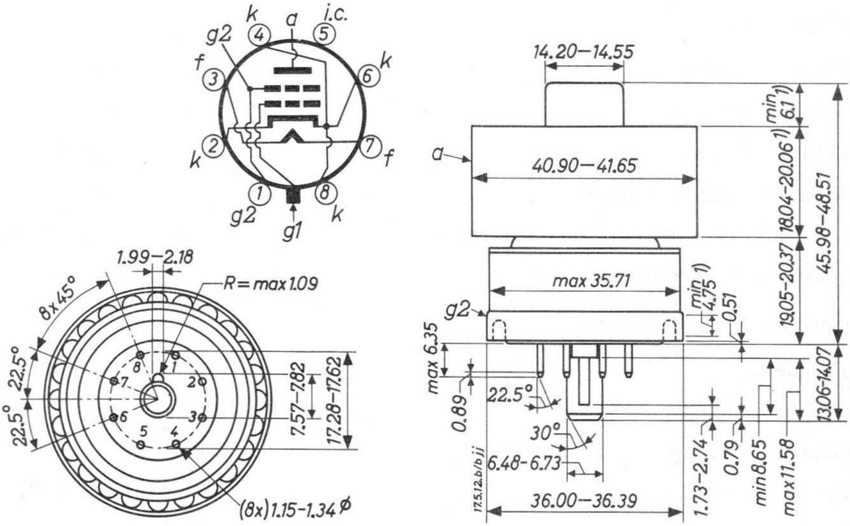
→ 6) (Page 4) To be adjusted for zero signal anode current

7Z2 7984

MECHANICAL DATA

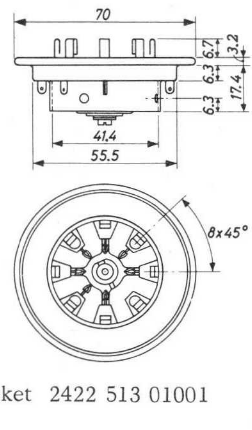
Dimensions in mm

Net weight   120 g

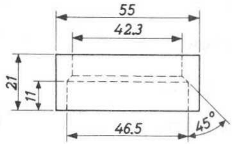


Mounting position: arbitrary

At higher frequencies the outer cylindrical surface of the ring terminal should be used for connecting the screen grid.



Socket 2422 513 01001



Chimney 4322 026 11701

1) Contact surface

7Z2 7996

R.F. SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	500	MHz
Anode voltage	V_a	max.	2000	V
Anode current	I_a	max.	350	mA 1)
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	500	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	max.	250	V
Grid No.1 circuit resistance with fixed bias	R_{g_1}	max.	25	kΩ 2)
Peak heater to cathode voltage	V_{kf_p}	max.	150	V

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		2000		V
Grid No.2 voltage	V_{g_2}		400		V
Grid No.1 voltage	V_{g_1}		-77		V 6)
Load resistance	$R_{a\sim}$		3050		Ω
		zero signal	single tone	double tone	
Anode current	I_a	70	350	225	mA
Grid No.2 current	I_{g_2}	-	35	16	mA
Grid No.1 current	I_{g_1}	-	-	0.05	mA
Driving power (PEP)	W_{dr}	-	1	1	W 3)
Grid No.2 dissipation	W_{g_2}	-	-	6.4	W
Anode dissipation	W_a	140	280	240	W
Output power in load	W_ℓ (PEP)	0	400	400	W 4)
Third order intermodulation distortion	d_3	-	-	-21	dB
Fifth order intermodulation distortion	d_5	-	-	-29	dB

1)2)3)4)6) See page 2.

7Z2 7985

LINEAR R.F. POWER AMPLIFIER - A.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	up to	500	MHz
Anode voltage	V_a	= max.	2000	V
Anode current	I_a	= max.	180	mA
Anode dissipation	W_a	= max.	250	W
Grid No.2 voltage	V_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 dissipation	W_{g_1}	= max.	2	W
Grid No.1 circuit resistance with fixed bias	R_{g_1}	= max.	25	kΩ 1)
Peak heater to cathode voltage	V_{kf_p}	= max.	150	V

OPERATING CONDITIONS

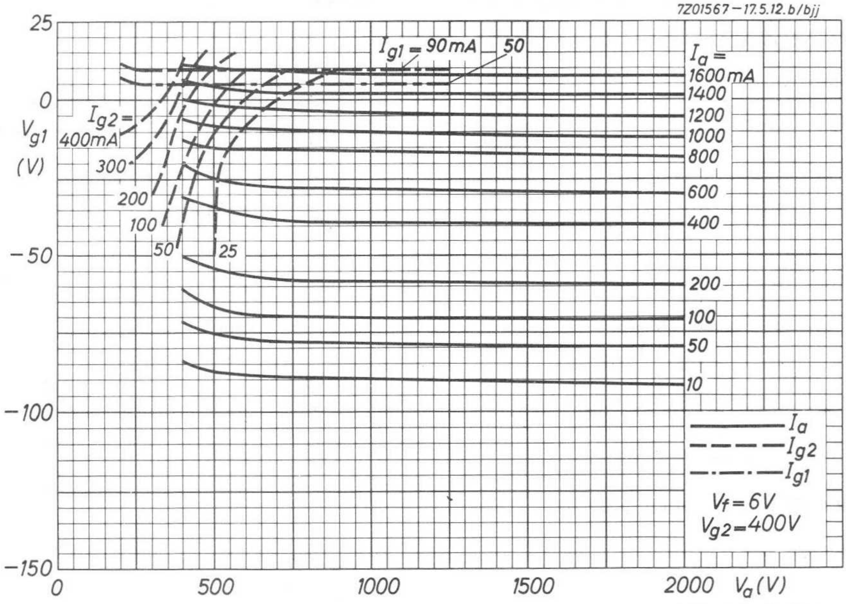
Frequency	f	= 30	500	MHz
Anode voltage	V_a	= 2000	2000	V
Grid No.2 voltage	V_{g_2}	= 400	400	V
Grid No.1 voltage	V_{g_1}	= −77	−77	V
Anode current	I_a	= 175	175	mA
Grid No.2 current	I_{g_2}	= 6	4	mA
Load resistance	$R_{a\sim}$	= 3050	3050	Ω
Driver output power	W_{dr}	= 0.25	3	W 2)
Anode input power	W_{ia}	= 350	350	W
Anode dissipation	W_a	= 245	244	W
Tube output power	W_o	= 105	106	W
Output power in the load	W_{load}	= 100 4)	90 5)	W

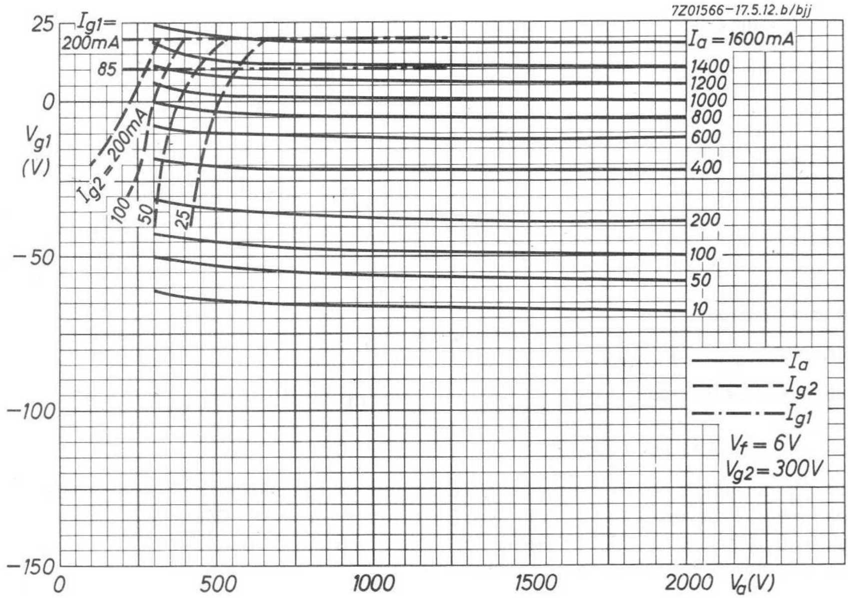
1) Automatic bias is not recommended

2) The driver output power represents the circuit losses and is the actual power measured at the input to the grid No.1 circuit of the tube. The actual power required depends on the operating frequency and the circuit used. The tube driving power is approximately zero watts

4)5) See page 2

7Z2 7986


7Z01567-17.5.12.b/bjj
I_{g1} = 90 mA
50
I_a =
1600 mA
1400
1200
1000
800
600
400
200
100
50
10
I_{g2} =
400mA
300
200
100
50
25
V_{g1} (V)
25
0
-50
-100
-150
0
500
1000
1500
2000
V_a (V)
I_a
I_{g2}
I_{g1}
V_f = 6V
V_{g2} = 400V


7Z01566-17.5.12.b/bjj
I_{g1} =
200mA
85
I_a = 1600 mA
1400
1200
1000
800
600
400
200
100
50
10
I_{g2} = 200mA
100
50
25
V_{g1} (V)
25
0
-50
-100
-150
0
500
1000
1500
2000
V_a (V)
I_a
I_{g2}
I_{g1}
V_f = 6V
V_{g2} = 300V

V.H.F./U.H.F. TRANSMITTING TETRODE

Forced air cooled tetrode with ceramic to metal seals and coaxial arrangement of the terminals for R.F. amplifier, oscillator and frequency multiplier service and for single side band operation

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		C_{ag_2} mod.		AB SSB		AB mod [1])	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
175	2000	390			2000	300	2000	600
	1500	280	1500	235	1500	215	1500	430
	1000	190	1000	145	1000	120	1000	240
	500	70	500	60				
500	2000	250						

Freq. (MHz)	B television Neg.mod. Pos.synchr.	
	V_a (V)	W_o sync (W)
216	2000	440
	1500	300
	1000	160

HEATING: indirect by A.C. or D.C.; cathode oxide-coated

Heater voltage	V_f	=	6.0 V ±10 %
Heater current at V_f = 6 V	I_f	=	2.6 A
Cathode heating time	T_w	= min.	30 sec

The heater voltage should be reduced according to the following table:

Frequency	V_f
300 MHz or lower	6.0 V
300 to 400 MHz	5.75 V
400 to 500 MHz	5.5 V

[1]) Two tubes

7Z2 2890

CAPACITANCES

		Control grid screen grid grounded	Cathode grounded
Anode to all other elements except grid No.1	C_a	= 4.5 pF	4.5 pF
Grid No.1 to all other elements except anode	C_{g_1}	= 13.0 pF	15.7 pF
Anode to grid No.1	C_{ag_1}	= 0.01 pF	<0.06 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	= 500 V	–
Grid No.2 voltage	V_{g_2}	= 250 V	300 V
Anode current	I_a	= 200 mA	–
Grid No.2 current	I_{g_2}	= –	50 mA
Mutual conductance	S	= 12 mA/V	–
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	= –	5.2

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode core and all seals max. 250 °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

7Z2 8828

COOLING (continued)

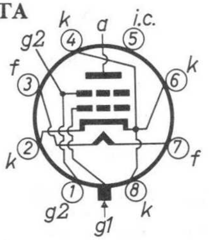
Required air flow with air system socket

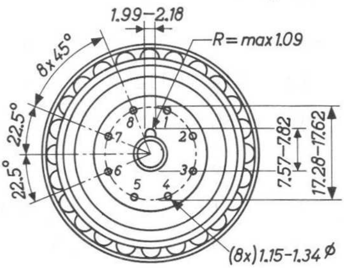
Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a	h	t_i	q_{min}	p_i
250 W	0 m	20 °C	0.11 m^3/min	8 mm H_2O

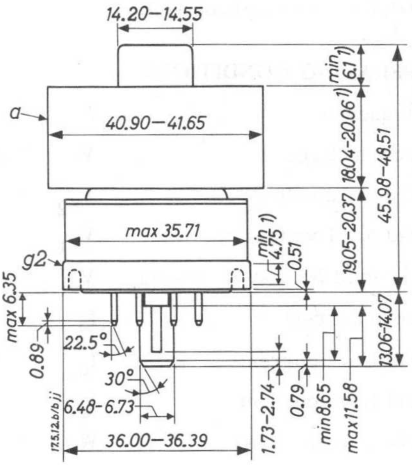
At higher altitudes and/or temperatures the air flow must be increased to maintain the anode and seal temperature within the limits

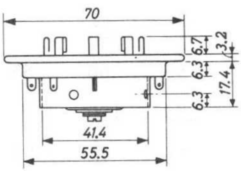
MECHANICAL DATA

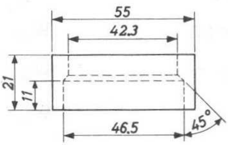
Dimensions in mm



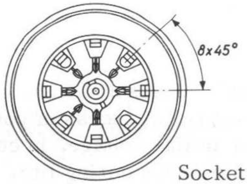








Chimney 4322 026 11701



Socket 2422 513 01001

7Z2 8829

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	500	MHz
Anode voltage	V_a	=	max.	2000	V
Anode current	I_a	=	max.	250	mA
Anode dissipation	W_a	=	max.	250	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 dissipation	W_{g_1}	=	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	=	max.	150	V

OPERATING CONDITIONS

Frequency	f	=	175	175	175	175	500[1]	MHz
Anode voltage	V_a	=	2000	1500	1000	500	2000	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	300	V
Grid No.1 voltage	V_{g_1}	=	−90	−90	−90	−90	−90	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	112	112	114	114	−	V
Anode current	I_a	=	250	250	250	250	250	mA
Grid No.2 current	I_{g_2}	=	19	21	38	45	10	mA
Grid No.1 current	I_{g_1}	=	26	28	31	35	25	mA
Driver output power	W_{dr}	=	2.9	3.2	3.5	4	18[2]	W
Grid No.2 dissipation	W_{g_2}	=	7.5	9	11	12	−	W
Anode input power	W_{ia}	=	500	375	250	125	−	W
Anode dissipation	W_a	=	110	95	60	55	−	W
Output power	W_o	=	390	280	190	70	250	W
Efficiency	η	=	80	75	76	56	−	%

1) With coaxial cavity

2) The driver stage is required to supply tube losses and R.F. circuit losses. The driver stage should be designed to provide an excess of power above the indicated value to take care of variations in line voltage, in components, in initial tube characteristics, and in characteristics during life.

7Z2 2893

R.F. CLASS C AMPLIFIER, ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f	up to	500	MHz
Anode voltage	V_a	= max.	1500	V
Anode current	I_a	= max.	200	mA
Anode dissipation	W_a	= max.	165	W
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 dissipation	W_{g_1}	= max.	2	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
Peak heater to cathode voltage	V_{kf_p}	= max.	150	V

OPERATING CONDITIONS

Frequency	f	=	175	175	175	MHz
Anode voltage	V_a	=	1500	1000	500	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V [1]
Grid No.1 voltage	V_{g_1}	=	−100	−100	−100	V [3]
Anode current	I_a	=	200	200	200	mA
Grid No.2 current	I_{g_2}	=	20	22	31	mA
Grid No.1 current	I_{g_1}	=	14	14	15	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	117	177	118	V
Driver output power	W_{dr}	=	1.7	1.7	1.8	W [2]
Anode input power	W_{ia}	=	300	200	100	W
Anode dissipation	W_a	=	65	55	40	W
Output power	W_o	=	235	145	60	W
Efficiency	η	=	78	-	60	%

[1]) The D.C. grid No.2 voltage must be modulated approximately 55% in phase with the anode modulation in order to obtain 100% modulation.

[2]) See page 4.

[3]) Obtained from grid No.1 resistor or from a combination of grid No.1 resistor with either fixed supply or cathode resistor.

7Z2 2894

R.F. CLASS AB SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	500	MHz
Anode voltage	V_a	=	max.	2000	V
Anode current	I_a	=	max.	250	mA
Anode dissipation	W_a	=	max.	250	W
Grid No.2 voltage	V_{g_2}	=	max.	400	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	kΩ
Heater to cathode voltage	V_{kf}	=	max.	150	V

OPERATING CONDITIONS (single tone signal)

Frequency	f	=	175		175		175		MHz
Anode voltage	V_a	=	1000		1500		2000		V
Grid No.2 voltage	V_{g_2}	=	350		350		350		V
Grid No.1 voltage	V_{g_1}	=	−55		−55		−55		V
Peak grid No.1 voltage	$V_{g_{1p}}$	=	0	50	0	50	0	50	V
Anode current	I_a	=	100	250	100	250	100	250	mA
Grid No.2 current	I_{g_2}	=	0	10	0	8	0	5	mA
Grid No.1 current	I_{g_1}	=	0	0	0	0	0	0	mA
Anode input power	W_{ia}	=	100	250	150	375	200	500	W
Grid No.2 input power	W_{ig_2}	=	0	1.75	0	1.4	0	1.4	W
Anode dissipation	W_a	=	100	130	150	160	200	200	W
Output power	W_o	=	0	120	0	215	0	300	W
Anode current	I_a	=	–	190	–	190	–	190	mA[1]
Grid No.2 current	I_{g_2}	=	–	2	–	−1	–	−2	mA[1]

[1]) Double tone signal

7Z2 2895

TYPICAL CHARACTERISTICS (each system)

Anode voltage	V_a	=	300	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Mutual conductance	S	=	4.0	mA/V
Amplification factor	$\mu_{g_2g_1}$	=	9	

TEMPERATURE LIMITS (Absolute limits)

Bulb and anode seal temperature	=	max.	250	^oC
Base seal temperature	=	max.	180	^oC

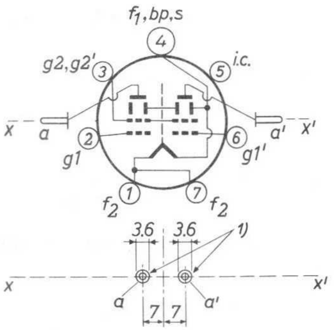
Anode connectors providing a high degree of heat transfer by radiation or conduction should be used

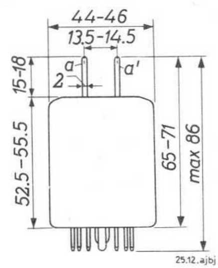
MECHANICAL DATA

Dimensions in mm

Net weight 50 g

Base	: Septar
Socket	: 2422 513 00001
Anode connector	: 40623





Mounting position: any

If the tube is mounted with its main axis horizontally it is recommended that the plane of the anodes be vertical

Contacts 1 and 7 should be strapped together externally to reduce the effective contact resistance

1) Location of the anode pins within these circles.

7Z2 8841

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating double tetrode for use as R.F. amplifier and frequency multiplier up to 500 MHz. Designed for intermittent service in transistorised mobile equipment.

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		C_{a-g_2} mod.		C freq. tripler	
	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_ℓ 1) (W)
200	300	16	300	13		
	400	22	500	22		
	600	35				
460	400	17				
66.7/200					300	7
153/460					300	5.5

HEATING: Direct by A.C. or D.C. Filament oxide coated

Filament voltage	V_f	=	1.6	V
Filament current	I_f	=	4.25	A
Heating time for W_o = 70% of full output power	T_h	<	0.5	sec

The filament has been designed to accept temporary variations in supply voltage of ± 15 %.

The frequency of the A.C. filament supply may be

for sinusoidal supply voltages	max.	200	Hz
for square wave supply voltages		any	

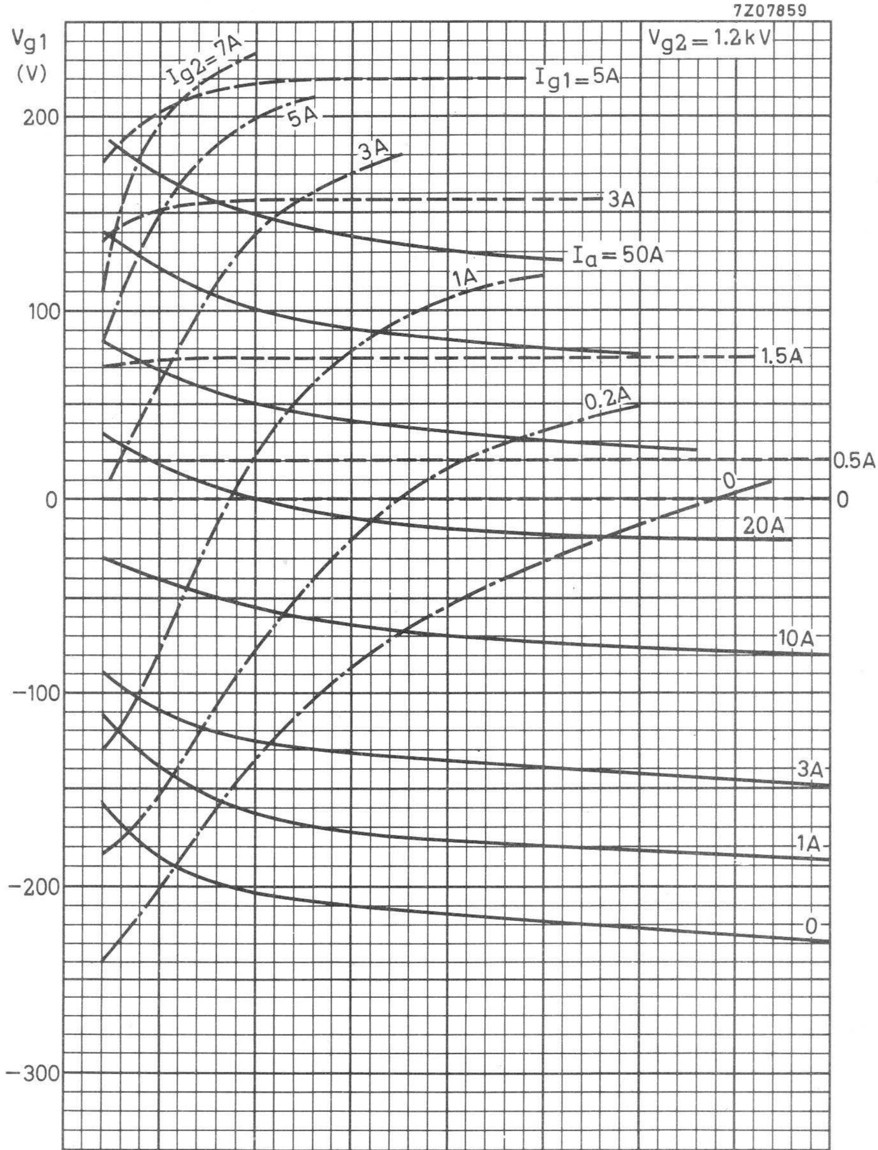
CAPACITANCES in push-pull connection

Input capacitance	C_i	=	4.0	pF
Output capacitance	C_o	=	1.5	pF

The tube is internally neutralised

1) Useful power in the load

7Z2 3644


7Z07859
V_{g1} (V)
$V_{g2} = 1.2$ kV
$I_{g2} = 7A$
$I_{g1} = 5A$
5A
3A
3A
$I_a = 50A$
1A
1.5A
0.2A
0.5A
0
0
20A
10A
3A
1A
0
200
100
0
−100
−200
−300
0
2
4
6
V_a (kV)
8

R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	10	kV
Anode input power	W_{i_a}	max.	74	kW
Anode dissipation	W_a	max.	30	kW
Anode current	I_a	max.	8.5	A
Grid No.2 voltage	V_{g_2}	max.	900	V
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Grid No.1 dissipation	W_{g_1}	max.	300	W

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	10	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-150	V
Grid No.1 resistor	R_{g_1}	500	Ω
Anode current	I_a	7.4	A
Grid No.2 current	I_{g_2}	340	mA
Grid No.1 current	I_{g_1}	310	mA
Driver output power	W_{dr}	120	W
Anode input power	W_{i_a}	74	kW
Anode dissipation	W_a	19	kW
Output power	W_o	55	kW
Efficiency	η	74.4	%
Modulation depth	m	100	%
Modulation power	W_{mod}	37	kW
Grid No.2 voltage, peak	V_{g2p}	700	V

7Z2 8524

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY, grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	5.6	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	45	kW
Grid No.2 dissipation	W_{g_2}	max.	300	W
Grid No.1 dissipation	W_{g_1}	max.	200	W

OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	V_a	5.5	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-200	V
Anode current	I_a	7	A
Grid No.2 current	I_{g_2}	250	mA
Grid No.1 current	I_{g_1}	150	mA
Driver output power	W_{dr}	2	kW
Anode input power	W_{i_a}	38.5	kW
Anode dissipation	W_a	9	kW
Output power in load	W_ℓ	25	kW [1])
Efficiency	η	77	%

[1]) Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

7Z2 8523

OPERATING CONDITIONS (continued)

Frequency	f		30		MHz
Anode voltage	V_a		10		kV
Grid No.2 voltage	V_{g_2}		1.2		kV
Grid No.1 voltage	V_{g_1}		-185		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	185	185	V
Anode current	I_a	2	5.2	3.3	A
Grid No.2 current	I_{g_2}	0	250	80	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	20	52	33	kW
Anode dissipation	W_a	20	19	16.5	kW
Grid No.2 dissipation	W_{g_2}	0	300	96	W
Output power (P.E.P.)	W_o	0	33	33	kW
Efficiency	η	-	63	50	%
Intermodulation distortion					
3^d order	d_3	-	-	-41	dB [2]
5^{th} order	d_5	-	-	-54	dB [2]

[1]) Adjust to give the zero signal anode current.

[2]) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.

7Z2 8522

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	12	kV
Grid No.2 voltage	V_{g_2}	max.	1.4	kV
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	45	kW
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 dissipation	W_{g_1}	max.	300	W

OPERATING CONDITIONS

		zero signal	single tone	double tone	
Frequency	f		30		MHz
Anode voltage	V_a		8		kV
Grid No.2 voltage	V_{g_2}		1.2		kV
Grid No.1 voltage	V_{g_1}		-175		V 1)
Grid No.1 driving voltage	$V_{g_{1p}}$	0	175	175	V
Anode current	I_a	2	5.9	3.8	A
Grid No.2 current	I_{g_2}	0	250	100	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	16	47.2	30.4	kW ←
Anode dissipation	W_a	16	17.2	15.4	kW ←
Grid No.2 dissipation	W_{g_2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η	-	63.5	49	%
Intermodulation distortion					
3d order	d_3	-	-	41	dB 2)
5th order	d_5	-	-	54	dB 2)

1) 2) See page 4

7Z2 8840

TEMPERATURE LIMITS AND COOLING

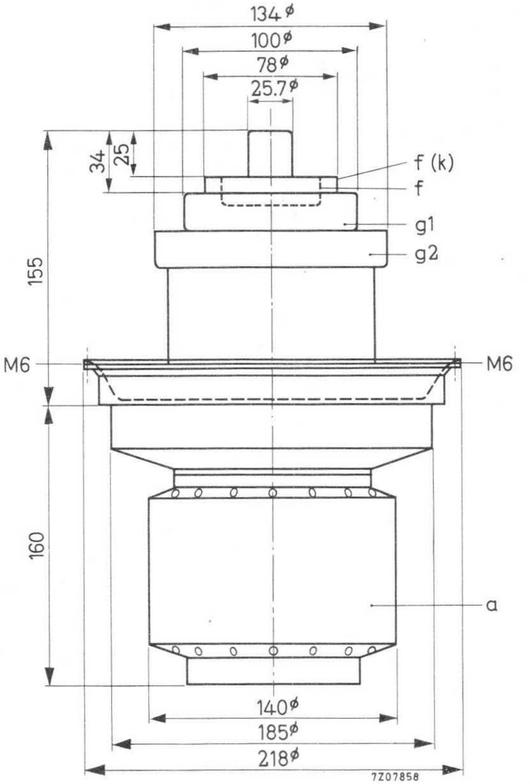
Absolute max. envelope and seal temperature	$t_{env.}$	max. 220	^{o}C

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 14.7 kg

Mounting position: Vertical with anode down



ACCESSORIES

Boiler	type K 728
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid No.1 connector	type 40727
Grid No.2 connector	type 40728

7Z2 8520

VAPOUR COOLED R.F. POWER TETRODE

Vapour cooled R.F. power tetrode in coaxial metal-ceramic construction intended for use as V.H.F. amplifier and S.S.B. amplifier.

QUICK REFERENCE DATA						
Frequency (MHz)	S.S.B.		C telegr. FM teleph.		C_{ag_2} mod.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_o (kW)
30	8	30				
	10	33			10	55
220			5.5	25		

HEATING Direct; filament thoriated tungsten

Filament voltage	V_f	10	V
Filament current	I_f	200	A

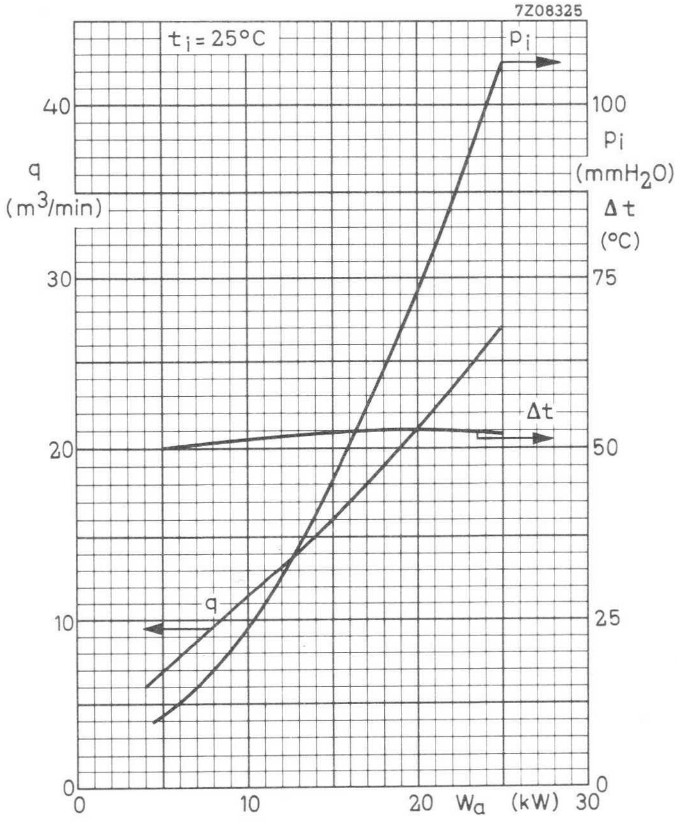
CAPACITANCES

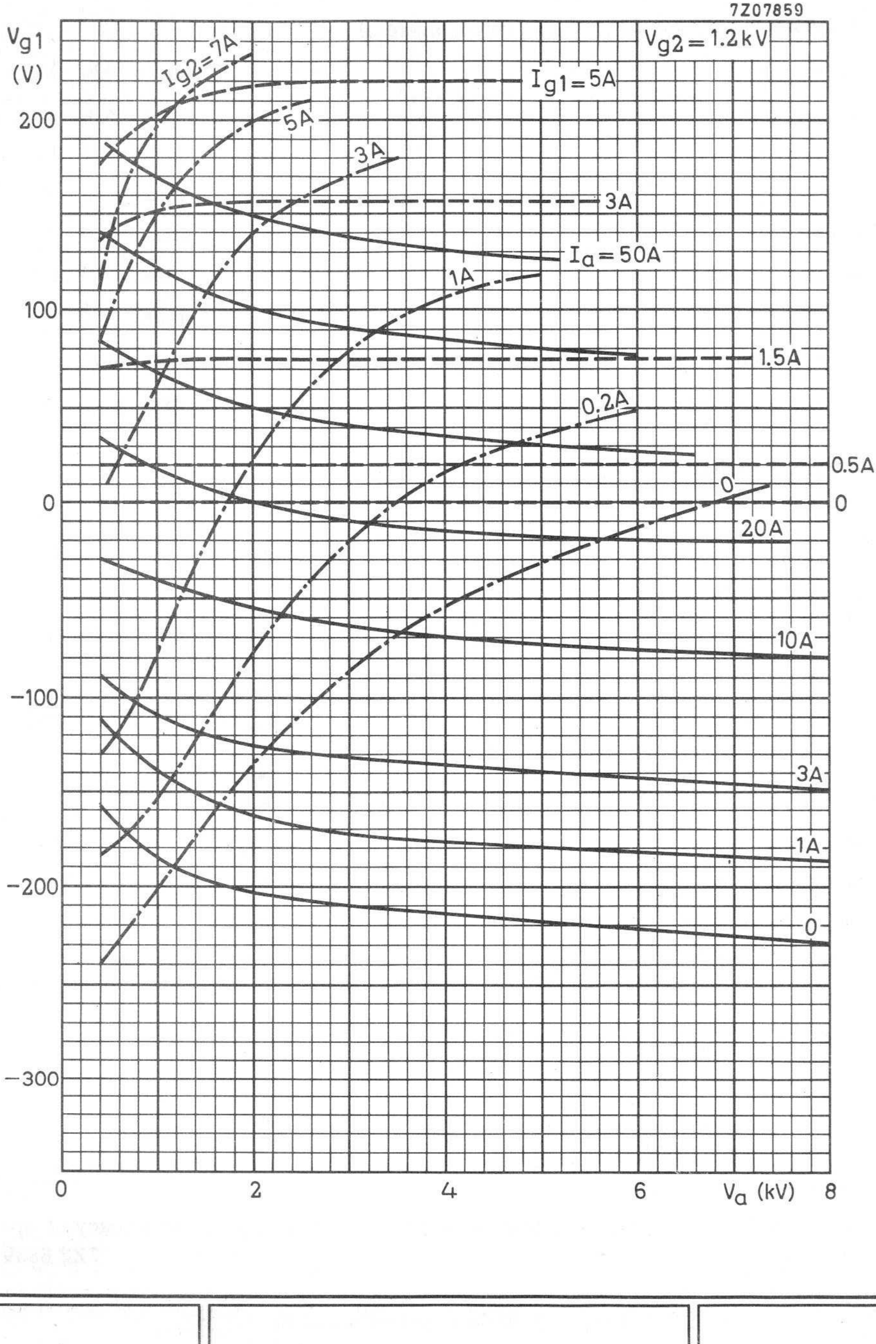
Anode to all except grid No.1	$C_{a(g_1)}$	42	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	260	pF
Anode to grid No.1	C_{ag_1}	1.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	1.2	kV
Anode current	I_a	2.5	A
Transconductance	S	65	mA/V
Amplification factor	$\mu_{g_2g_1}$	6.6	-

7Z2 8519


7Z08325
$t_i = 25°C$
p_i
40
30
20
10
0
q
(m^3/min)
100
75
50
25
0
p_i
(mmH_2O)
Δt
(°C)
Δt
q
0
10
20
W_a (kW)
30


7Z07859
V_{g1} (V)
$V_{g2} = 1.2$ kV
$I_{g2} = 7$A
5A
3A
1A
0.2A
0
$I_{g1} = 5$A
3A
1.5A
0.5A
0
$I_a = 50$A
20A
10A
3A
1A
0
200
100
0
−100
−200
−300
0
2
4
6
8
V_a (kV)

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY , grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	5.6	kV
Grid No.2 voltage	V_{g2}	max.	1	kV
Grid No.1 voltage	$-V_{g1}$	max.	250	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW ←
Grid No.2 dissipation	W_{g2}	max.	300	W
Grid No.1 dissipation	W_{g1}	max.	200	W

OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	V_a	5.5	kV
Grid No.2 voltage	V_{g2}	800	V
Grid No.1 voltage	V_{g1}	-200	V
Anode current	I_a	7	A
Grid No.2 current	I_{g2}	250	mA
Grid No.1 current	I_{g1}	150	mA
Driver output power	W_{dr}	2	kW
Anode input power	W_{i_a}	38.5	kW
Anode dissipation	W_a	9	kW
Output power in load	W_ℓ	25	kW [1]
Efficiency	η	77	%

[1]) Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

7Z2 8839

OPERATING CONDITIONS(continued)

Frequency	f		30		MHz
Anode voltage	V_a		10		kV
Grid No.2 voltage	V_{g2}		1.2		kV
Grid No.1 voltage	V_{g1}		-185		V 1)
		zero signal	single tone	double tone	
Grid No.1 driving voltage	V_{g1p}	0	185	185	V
Anode current	I_a	2	5.2	3.3	A
Grid No.2 current	I_{g2}	0	250	80	mA
Grid No.1 current	I_{g1}	0	0	0	mA
Anode input power	W_{i_a}	20	52	33	kW
Anode dissipation	W_a	20	19	16.5	kW
Grid No.2 dissipation	W_{g2}	0	300	96	W
Output power (P.E.P.)	W_o	0	33	33	kW
Efficiency	η	-	63	50	%
Intermodulation distortion					
3^d order	d_3	-	-	-41	dB 2)
5^{th} order	d_5	-	-	-54	dB 2)

1) Adjust to give the zero signal anode current.

2) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.

7Z2 8511

R.F. CLASS AB LINEAR AMPLIFIER , SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	12	kV
Grid No.2 voltage	V_{g2}	max.	1.4	kV
Grid No.1 voltage	$-V_{g1}$	max.	350	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW ←
Grid No.2 dissipation	W_{g2}	max.	600	W
Grid No.1 dissipation	W_{g1}	max.	300	W

OPERATING CONDITIONS

		zero signal	single tone	double tone	
Frequency	f		30		MHz
Anode voltage	V_a		8		kV
Grid No.2 voltage	V_{g2}		1.2		kV
Grid No.1 voltage	V_{g1}		-175		V [1]
Grid No.1 driving voltage	V_{g1p}	0	175	175	V
Anode current	I_a	2	5.9	3.8	A
Grid No.2 current	I_{g2}	0	250	100	mA
Grid No.1 current	I_{g1}	0	0	0	mA
Anode input power	W_{i_a}	16	47.2	30.4	kW ←
Anode dissipation	W_a	16	17.2	15.4	kW ←
Grid No.2 dissipation	W_{g2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η	-	63.5	49	%
Intermodulation distortion					
3d order	d_3	-	-	41	dB 2)
5th order	d_5	-	-	54	dB [2]

[1] [2] See page 4

7Z2 8838

TEMPERATURE LIMITS AND COOLING

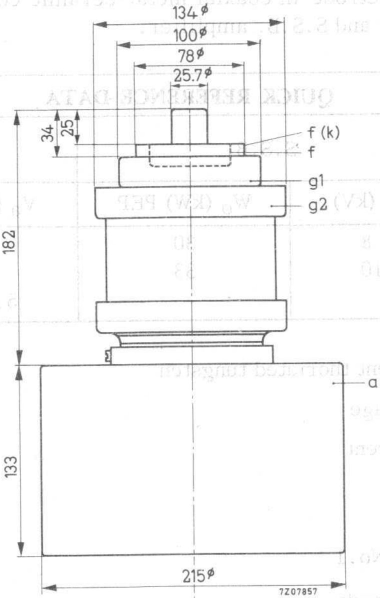
Absolute max. envelope and seal temperature $t_{env.}$ max. 220 °C

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 13.5 kg

Mounting position: Vertical with anode down



ACCESSORIES

Insulating pedestal	type 40729
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid No. 1 connector	type 40727
Grid No. 2 connector	type 40728

7Z2 8515

AIR COOLED R.F. POWER TETRODE

Air cooled R.F. power tetrode in coaxial metal-ceramic construction intended for use as V.H.F. amplifier and S.S.B. amplifier.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		C telegr. FM teleph.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)
30	8	30		
	10	33		
220			5.5	25

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	10	V
Filament current	I_f	200	A

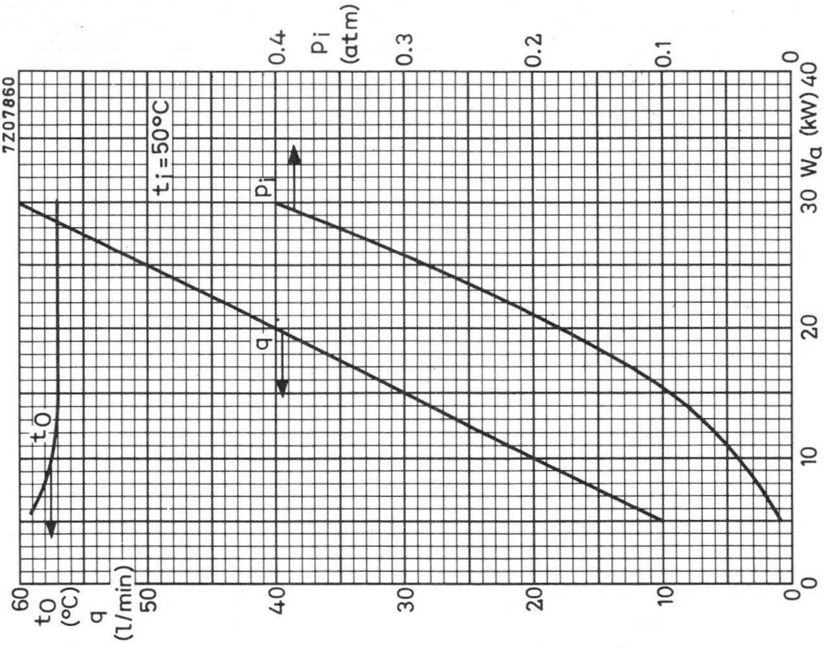
CAPACITANCES

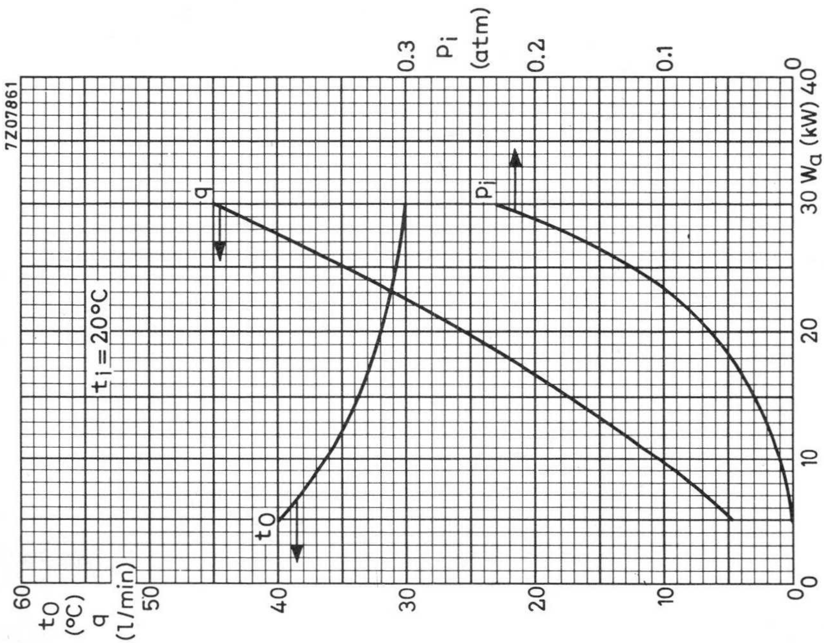
Anode to all except grid No.1	$C_{a(g_1)}$	42	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	260	pF
Anode to grid No.1	C_{ag_1}	1.5	pF

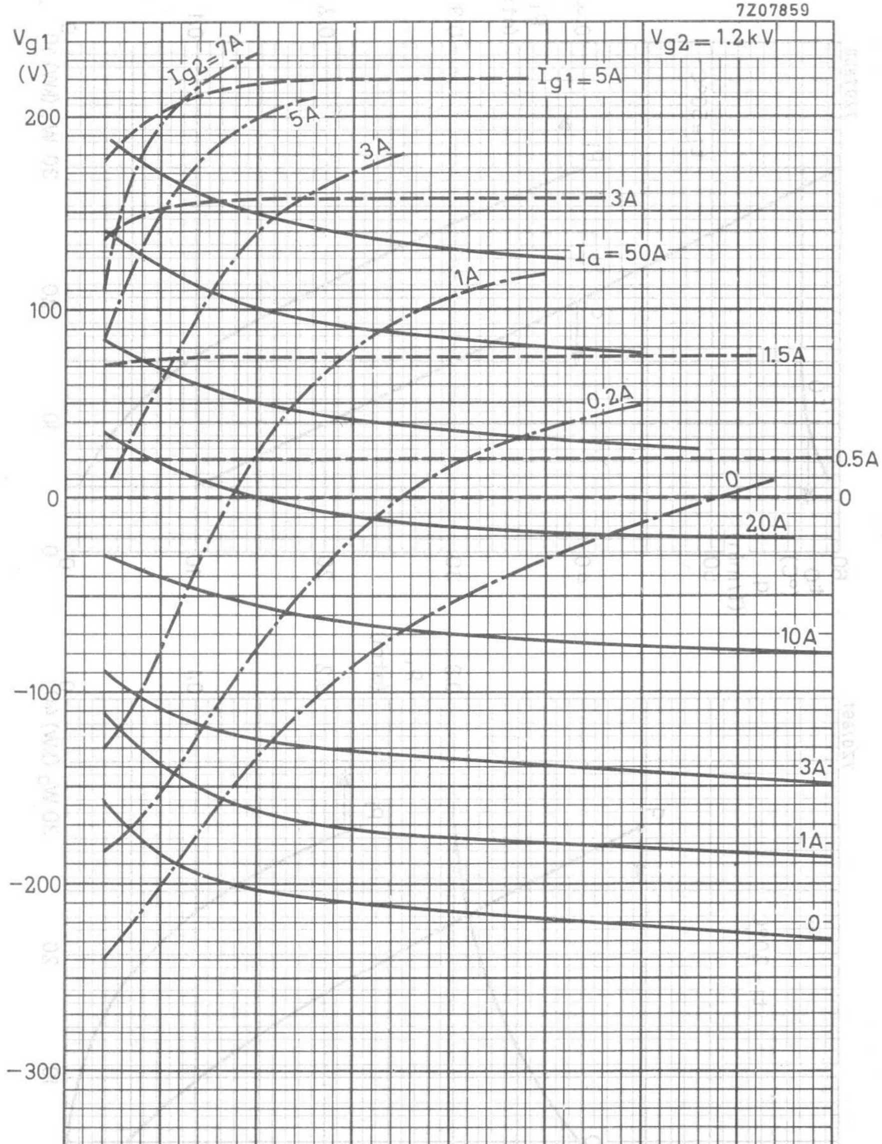
TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	1.2	kV
Anode current	I_a	2.5	A
Transconductance	S	65	mA/V
Amplification factor	$\mu_{g_2g_1}$	6.6	-

7Z2 8514


7Z07860
$t_i = 50°C$
t_O
(°C)
q
(l/min)
p_i
(atm)
W_a (kW)
q
p_i
t_O
0
10
20
30
40
50
60
0.1
0.2
0.3
0.4


7Z07861
$t_i = 20°C$
t_O
(°C)
q
(l/min)
p_i
(atm)
W_a (kW)
q
p_i
t_O
0
10
20
30
40
50
60
0.1
0.2
0.3


7Z07859
V_{g1} (V)
200
100
0
−100
−200
−300
$V_{g2} = 1.2$ kV
$I_{g2} = 7$A
$I_{g1} = 5$A
5A
3A
3A
$I_a = 50$A
1A
1.5A
0.2A
0.5A
0
0
20A
10A
3A
1A
0
0
2
4
6
V_a (kV)
8

R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	10	kV
Anode input power	W_{i_a}	max.	74	kW
Anode dissipation	W_a	max.	20	kW
Anode current	I_a	max.	8.5	A
Grid No.2 voltage	V_{g_2}	max.	900	V
Grid No.2 dissipation	W_{g_2}	max.	600	W
Grid No.1 voltage	$-V_{g_1}$	max.	350	V
Grid No.1 dissipation	W_{g_1}	max.	300	W

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	10	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	−150	V
Grid No.1 resistor	R_{g_1}	500	Ω
Anode current	I_a	7.4	A
Grid No.2 current	I_{g_2}	340	mA
Grid No.1 current	I_{g_1}	310	mA
Driver output power	W_{dr}	120	W
Anode input power	W_{i_a}	74	kW
Anode dissipation	W_a	19	kW
Output power	W_o	55	kW
Efficiency	η	74.4	%
Modulation depth	m	100	%
Modulation power	W_{mod}	37	kW
Grid No.2 voltage, peak	V_{g_2p}	700	V

7Z2 8513

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY, grounded grid

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max.	5.6	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	250	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW
Grid No.2 dissipation	W_{g_2}	max.	300	W
Grid No.1 dissipation	W_{g_1}	max.	200	W

OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	V_a	5.5	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-200	V
Anode current	I_a	7	A
Grid No.2 current	I_{g_2}	250	mA
Grid No.1 current	I_{g_1}	150	mA
Driver output power	W_{dr}	2	kW
Anode input power	W_{i_a}	38.5	kW
Anode dissipation	W_a	9	kW
Output power in load	W_ℓ	25	kW[1])
Efficiency	η	77	%

[1]) Feedthrough power inclusive. Measured in a circuit having an efficiency of approx. 85%.

7Z2 8512

OPERATING CONDITIONS (continued)

Frequency	f		30		MHz
Anode voltage	V_a		10		kV
Grid No.2 voltage	V_{g_2}		1.2		kV
Grid No.1 voltage	V_{g_1}		-185		V 1)
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	185	185	V
Anode current	I_a	2	5.2	3.3	A
Grid No.2 current	I_{g_2}	0	250	80	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	20	52	33	kW
Anode dissipation	W_a	20	19	16.5	kW
Grid No.2 dissipation	W_{g2}	0	300	96	W
Output power (P.E.P.)	W_o	0	33	33	kW
Efficiency	η	-	63	50	%
Intermodulation distortion					
3[d] order	d_3	-	-	-41	dB 2)
5[th] order	d_5	-	-	-54	dB 2)

1) Adjust to give the zero signal anode current.

2) Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.

7Z2 8511

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	12	kV
Grid No.2 voltage	V_{g2}	max.	1.4	kV
Grid No.1 voltage	$-V_{g1}$	max.	350	V
Anode current	I_a	max.	10	A
Anode input power	W_{i_a}	max.	72	kW
Anode dissipation	W_a	max.	30	kW
Grid No.2 dissipation	W_{g2}	max.	600	W
Grid No.1 dissipation	W_{g1}	max.	300	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		8		kV
Grid No.2 voltage	V_{g2}		1.2		kV
Grid No.1 voltage	V_{g1}		-175		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	V_{g1P}	0	175	175	V
Anode current	I_a	2	5.9	3.8	A
Grid No.2 current	I_{g2}	0	250	100	mA
Grid No.1 current	I_{g1}	0	0	0	mA
Anode input power	W_{i_a}	16	47.2	30.4	kW ←
Anode dissipation	W_a	16	17.2	15.4	kW ←
Grid No.2 dissipation	W_{g2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η	-	63.5	49	%
Intermodulation distortion					
3[d] order	d_3	-	-	41	dB [2]
5[th] order	d_5	-	-	54	dB [2]

1) 2) See page 4

7Z2 8837

TEMPERATURE LIMITS AND COOLING

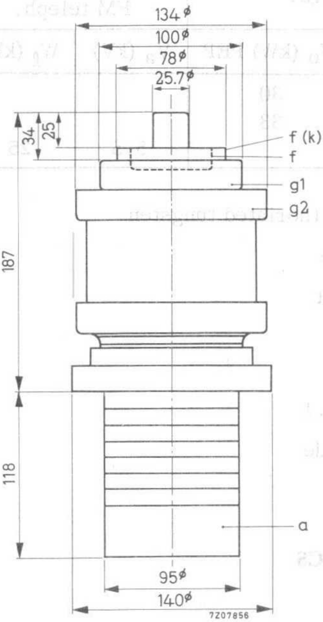
Absolute max. envelope and seal temperature	$t_{env.}$	max. 220 °C
Absolute max. water inlet temperature	t_i	max. 50 °C
Required quantity of water		see cooling curves

For temperatures t_i between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

MECHANICAL DATA Dimensions in mm

Net weight: approx. 7 kg

Mounting position: Vertical with anode down



ACCESSORIES

Water-jacket	type K732
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid No.1 connector	type 40727
Grid No.2 connector	type 40728

7Z2 8509

WATER COOLED R.F. POWER TETRODE

Water cooled R.F. power tetrode in coaxial metal-ceramic construction intended for use as V.H.F. amplifier and S.S.B. amplifier.

QUICK REFERENCE DATA

Frequency (MHz)	S.S.B.		C telegr. FM teleph.		C_{ag_2} mod.	
	V_a (kV)	W_o (kW) PEP	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_o (kW)
30	8	30				
	10	33			10	55
220			5.5	25		

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	10	V
Filament current	I_f	200	A

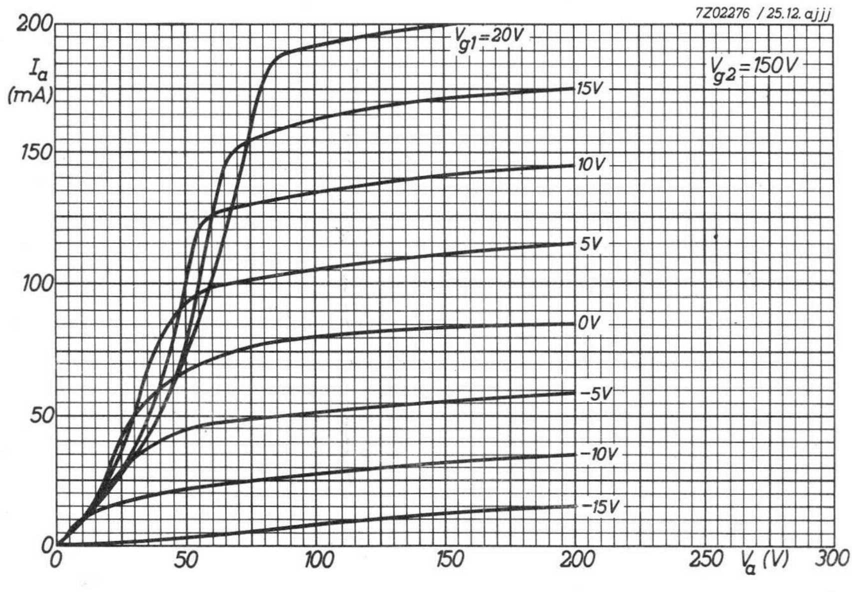
CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	42	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	260	pF
Anode to grid No.1	C_{ag_1}	1.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g2}	1.2	kV
Anode current	I_a	2.5	A
Transconductance	S	65	mA/V
Amplification factor	μ_{g2g1}	6.6	-

7Z2 8508


7Z02276 / 25.12.ajjj
200
150
100
50
0
I_a (mA)
V_{g1}=20V
15V
10V
5V
0V
−5V
−10V
−15V
V_{g2}=150V
0
50
100
150
200
250
300
V_a (V)

R.F. CLASS C FREQUENCY TRIPLER

LIMITING VALUES (Absolute limits)

Frequency	f	=	up to 50	up to 175	MHz
Anode voltage	V_a	= max.	300	300	V
Anode input power	W_{i_a}	= max.	7.5	6	W
Anode dissipation	W_a	= max.	5	5	W
Anode current	I_a	= max.	30	30	mA
Grid No. 2 voltage	V_{g_2}	= max.	300	300	V
Grid No. 2 dissipation	W_{g_2}	= max.	1	1	W
Negative grid No. 1 voltage	$-V_{g_1}$	= max.	100	100	V
Grid No. 1 current	I_{g_1}	= max.	2.5	2.5	mA

OPERATING CONDITIONS

f	=	16.3/50			58.3/175			MHz
V_a	=	250	200	150	250	200	150	V
V_{g_2}	=	150	150	150	150	150	150	V
V_{g_1}	=	-100	-100	-100	-100	-100	-100	V
I_a	=	30	30	30	20	30	30	mA
I_{g_2}	=	2.3	2.45	2.8	1.1	1.7	1.9	mA
I_{g_1}	=	0.7	0.72	0.75	0.18	0.6	0.7	mA
$V_{g_{1p}}$	=	117	117.5	118				V
W_{g_2}	=	0.4	0.4	0.42	0.16	0.25	0.3	W
W_{i_a}	=	7.5	6	4.5	5	6	4.5	W
W_a	=	3.9	3.0	2.3	3.2	3.7	2.8	W
W_{load}	=	3.2	2.7	2.0	1.0	1.4	1.1	W

7Z2 3868

R.F. CLASS C FREQUENCY DOUBLER

LIMITING VALUES (Absolute limits)

Frequency	f	=	up to 50	up to 175	MHz
Anode voltage	V_a	= max.	300	300	V
Anode input power	W_{i_a}	= max.	10	7.5	W
Anode dissipation	W_a	= max.	5	5	W
Anode current	I_a	= max.	35	35	mA
Grid No.2 voltage	V_{g_2}	= max.	300	300	V
Grid No.2 dissipation	W_{g_2}	= max.	1	1	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	100	100	V
Grid No.1 current	I_{g_1}	= max.	2.5	2.5	mA

OPERATING CONDITIONS

f	=	25/50			87.5/175			MHz
V_a	=	300	250	200	300	250	200	V
V_{g_2}	=	150	150	150	150	150	150	V
V_{g_1}	=	-90	-90	-90	-90	-90	-90	V
I_a	=	30	30	30	25	30	35	mA
I_{g_2}	=	2.6	3.2	3.6	1.22	1.62	1.85	mA
I_{g_1}	=	0.73	0.8	0.85	0.34	0.6	0.66	mA
$V_{g_{1p}}$	=	105	106	106.5				V
W_{g_2}	=	0.39	0.48	0.54	0.18	0.25	0.28	W
W_{i_a}	=	9	7.5	6	7.5	7.5	7	W
W_a	=	3.5	2.7	2.3	4.4	4.5	3.6	W
W_{load}	=	5.15	4.45	3.5	2.1	2.4	2.55	W

7Z2 3867

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f	=	up to 50	up to 175	MHz
Anode voltage	V_a	= max.	300	300	V
Anode input power	W_{i_a}	= max.	12	9	W
Anode dissipation	W_a	= max.	5	5	W
Anode current	I_a	= max.	40	40	mA
Grid No. 2 voltage	V_{g_2}	= max.	300	300	V
Grid No. 2 dissipation	W_{g_2}	= max.	1	1	W
Negative grid No. 1 voltage	$-V_{g_1}$	= max.	100	100	V
Grid No. 1 current	I_{g_1}	= max.	2.5	2.5	mA

OPERATING CONDITIONS

f	=	50			175			MHz
V_a	=	300	250	200	300	250	200	V
V_{g_2}	=	150	150	150	150	150	150	V
V_{g_1}	=	-35	-35	-35	-35	-35	-35	V
I_a	=	40	40	40	30	35	40	mA
I_{g_2}	=	3.5	5	6	2	2.5	3	mA
I_{g_1}	=	0.85	0.95	1.05	0.07	0.2	0.5	mA
$V_{g_{1p}}$	=	49.5	52	53				V
W_{g_2}	=	0.53	0.75	0.9	0.3	0.38	0.45	W
W_{i_a}	=	12	10	8	9	8.75	8	W
W_a	=	3.6	3.0	2.5	4.6	4.2	3.5	W
W_{load}	=	8	6.7	5.2	3.3	3.6	3.6	W

7Z2 3866

TYPICAL CHARACTERISTICS

Anode voltage	V_a	= 120 V
Grid No.2 voltage	V_{g_2}	= 120 V
Anode current	I_a	= 30 mA
Amplification factor	$\mu_{g_2g_1}$	= 8
Mutual conductance	S	= 4.5 mA/V
Modulation hum		= −60 dB relative to carrier (with centre tapped filament supply on a single stage

TEMPERATURE LIMITS (Absolute limits)

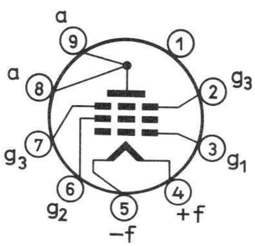
Bulb temperature	= max. 200 °C
Pin seal temperature	= max. 120 °C

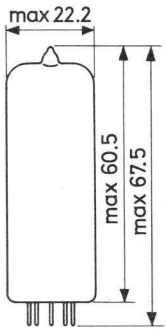
MECHANICAL DATA

Dimensions in mm

Base : Noval

Net weight: 15 g





Mounting position: any

ACCESSORIES

→ Socket: 2422 502 01003

7Z2 8836

QUICK HEATING R.F. PENTODE

Quick-heating pentode for use as RF amplifier, oscillator or frequency multiplier up to 200 MHz and as AF modulator. Designed for intermittent or continuous filament operation in transistorised mobile transmitters.

QUICK REFERENCE DATA						
Frequency (MHz)	C telegraphy			C freq.mult.		
	V_a (V)	W_{drive} (W)	W_{load} (W)	V_a (V)	W_{drive} (W)	W_{load} (W)
50	300	0.2	8	300		
175	250	1.0	3.6			
25/50				300	1.5	5.0
87.5/175				200	1.5	2.5
58.3/175				200	1.5	1.4

HEATING: direct by AC or DC; parallel supply

Filament oxide-coated

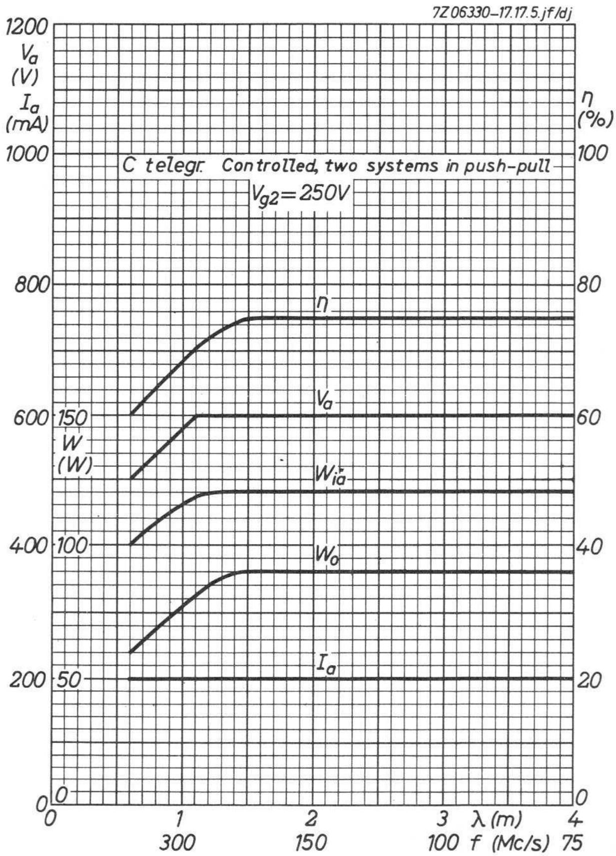
Filament voltage	V_f	=	1.1 V ± 15%
Filament current	I_f	=	0.88 A
Frequency of filament supply			
with sinusoidal voltage	f	=	max. 200 Hz
with square-wave voltage	f		any

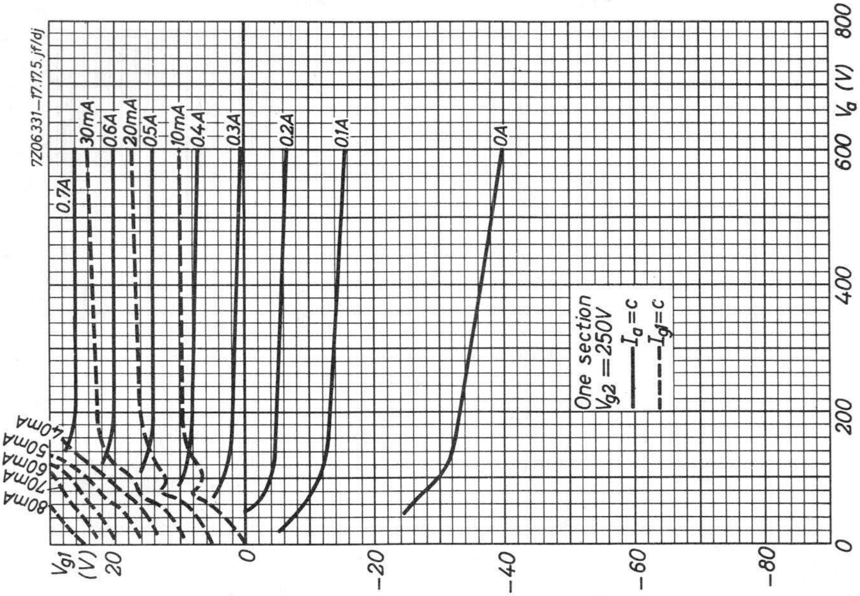
70% of the full output power will be reached within 0.5 sec after switching-on.

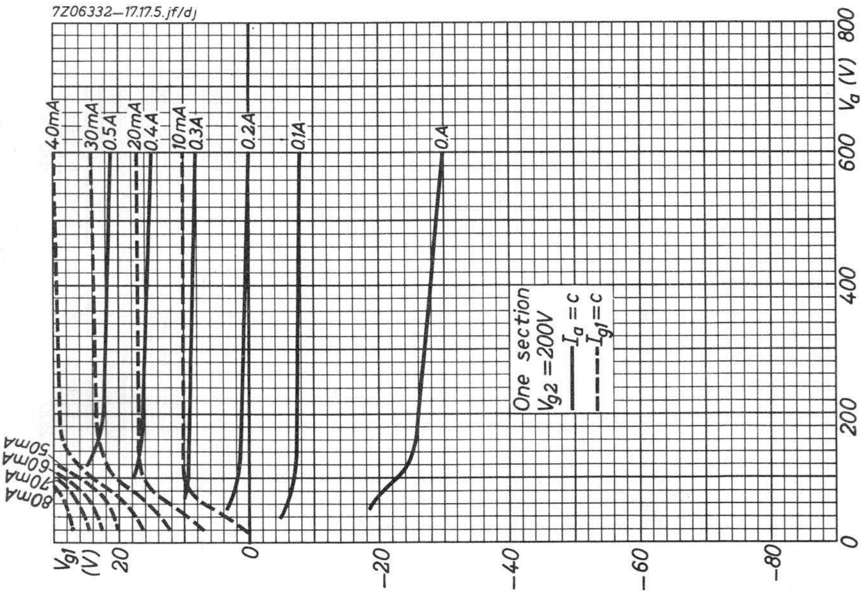
CAPACITANCES

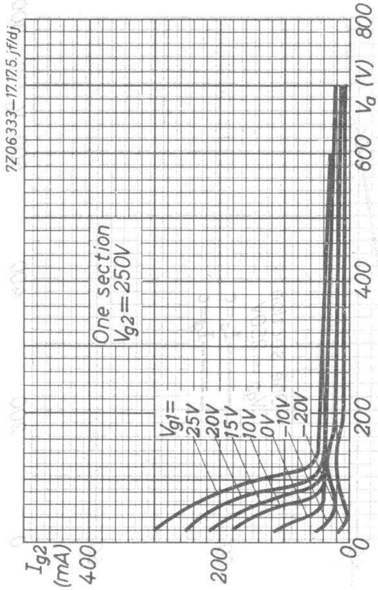
Anode to all except grid No.1	C_a	=	3.8 pF
Grid No.1 to all except anode	C_{g1}	=	6.5 pF
Anode to grid No.1	C_{ag1}	=	0.15 pF

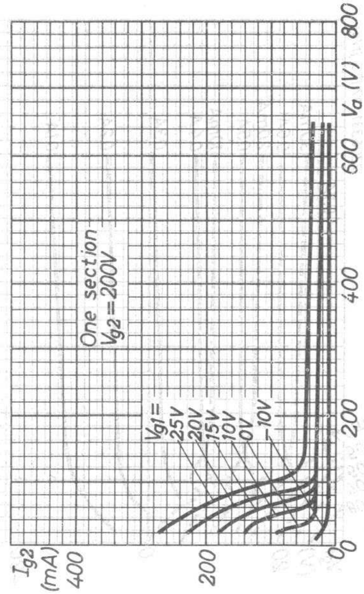
7Z2 3864

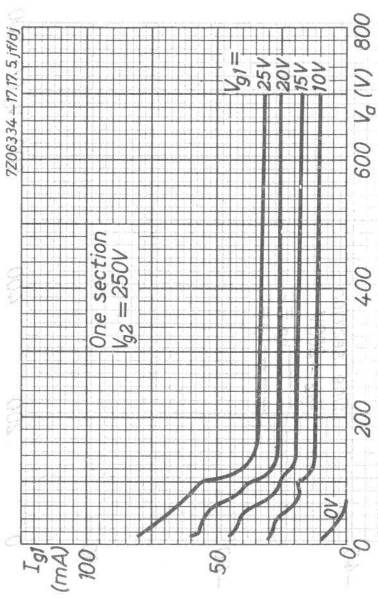

7Z 06330-17.17.5.jf/dj
1200
Va
(V)
Ia
(mA)
1000
800
600
400
200
0
150
W
(W)
100
50
0
η
(%)
100
80
60
40
20
0
C telegr. Controlled, two systems in push-pull
Vg2=250V
η
Va
Wia
Wo
Ia
0
1
2
3
λ (m)
4
300
150
100
f (Mc/s)
75

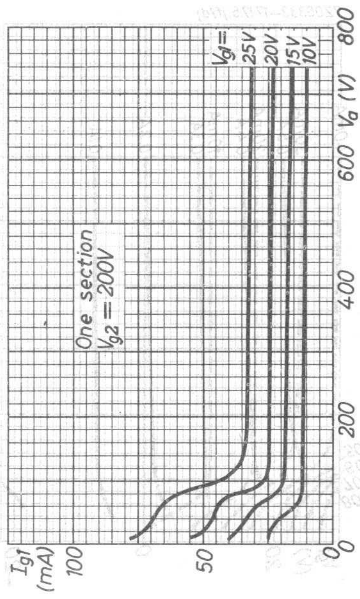

7Z06331—17.17.5.jf/dj
0.7A
30mA
0.6A
20mA
0.5A
10mA
0.4A
0.3A
0.2A
0.1A
0A
40mA
50mA
60mA
70mA
80mA
One section
Vg2 = 250V
Ia = c
Ig1 = c
Vg1 (V)
20
0
−20
−40
−60
−80
0
200
400
600
800
Va (V)

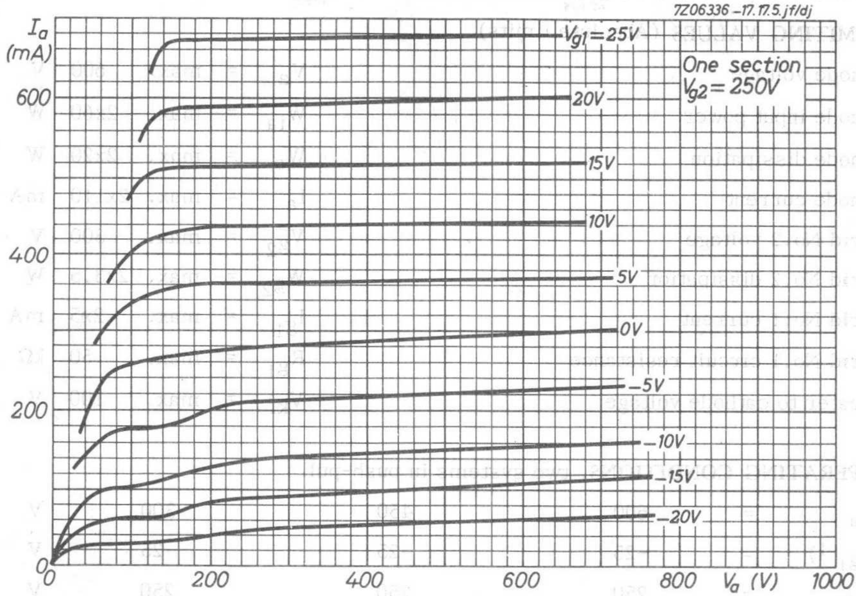

7Z06332—17.17.5.jf/dj
40mA
30mA
0.5A
20mA
0.4A
10mA
0.3A
0.2A
0.1A
0A
50mA
60mA
70mA
80mA
One section
Vg2 = 200V
Ia = c
Ig1 = c
Vg1 (V)
20
0
−20
−40
−60
−80
0
200
400
600
800
Va (V)

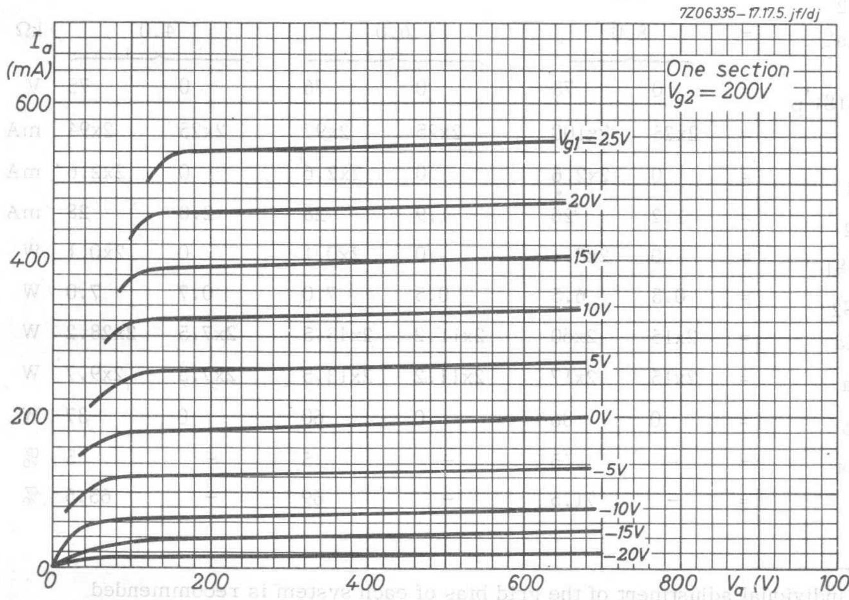

7Z06333–17.17.5.jf/dj
I_{g2} (mA)
One section
V_{g2} = 250V
V_{g1} =
25V
20V
15V
10V
0V
−10V
−20V
V_a (V)


I_{g2} (mA)
One section
V_{g2} = 200V
V_{g1} =
25V
20V
15V
10V
0V
−10V
V_a (V)


7Z06334–17.17.5.jf/dj
I_{g1} (mA)
One section
V_{g2} = 250V
V_{g1} =
25V
20V
15V
10V
0V
V_a (V)


I_{g1} (mA)
One section
V_{g2} = 200V
V_{g1} =
25V
20V
15V
10V
V_a (V)


7Z06336-17.17.5.jf/dj
I_a (mA)
600
400
200
0
V_{g1}=25V
20V
15V
10V
5V
0V
-5V
-10V
-15V
-20V
One section
V_{g2}=250V
0
200
400
600
800
V_a (V)
1000


7Z06335-17.17.5.jf/dj
I_a (mA)
600
400
200
0
One section
V_{g2}=200V
V_{g1}=25V
20V
15V
10V
5V
0V
-5V
-10V
-15V
-20V
0
200
400
600
800
V_a (V)
1000

A.F. CLASS B AMPLIFIER AND MODULATOR with grid current

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x60	W
Anode dissipation	W_a	=	max.	2x20	W
Anode current	I_a	=	max.	2x110	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x3.5	W
Grid No.1 current	I_{g_1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS, two systems in push-pull

V_a	=	600		450		300		V
V_{g_1} 1)	=	-25		-25		-25		V
V_{g_2}	=	250		250		250		V
$R_{aa'\sim}$	=	8.0		6.0		4.0		kΩ
$V_{g_1g_1'p}$	=	0	78	0	76	0	75	V
I_a	=	2x25	2x100	2x25	2x97	2x25	2x94	mA
I_{g_1}	=	0	2x2.6	0	2x2.6	0	2x2.6	mA
I_{g_2}	=	1.2	26	1.9	28	2.8	28	mA
W_{ig_1}	=	0	2x0.1	0	2x0.1	0	2x0.1	W
W_{g_2}	=	0.3	6.5	0.5	7.0	0.7	7.0	W
W_{ia}	=	2x15	2x60	2x11.2	2x43.5	2x7.5	2x28.2	W
W_a	=	2x15	2x17	2x11.2	2x13.5	2x7.5	2x9.7	W
W_o	=	0	86	0	60	0	37	W
d_{tot}	=	-	5	-	5	-	5	%
η	=	-	71.5	-	69	-	65.5	%

1) Individual adjustment of the grid bias of each system is recommended

7Z2 3025

A.F. CLASS B AMPLIFIER AND MODULATOR without grid current

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x60	W
Anode dissipation	W_a	=	max.	2x20	W
Anode current	I_a	=	max.	2x110	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x3.5	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS; two systems in push-pull

V_a	=	600		450		300		V
V_{g_1} 1)	=	-27.5		-27.5		-26		V
V_{g_2}	=	250		250		250		V
$R_{aa'\sim}$	=	12.5		10		6.5		kΩ
$V_{g_1g_1'p}$	=	0	55	0	55	0	52	V
I_a	=	2x20	2x62	2x20	2x58	2x20	2x56	mA
I_{g_2}	=	0.9	23	1.4	27	2.2	28	mA
W_{g_2}	=	0.2	5.8	0.4	6.7	0.6	7.0	W
W_{ia}	=	2x12	2x37	2x9.0	2x26	2x6.0	2x16.8	W
W_a	=	2x12	2x12	2x9.0	2x8.5	2x6.0	2x5.6	W
W_o	=	0	50	0	35	0	22.5	W
d_{tot}	=	–	2.4	–	3.1	–	2.9	%
η	=	–	67.5	–	67.5	–	67	%

1) Individual adjustment of the grid bias of each system is recommended

7Z2 3024

R.F. CLASS C FREQUENCY TRIPLER

LIMITING VALUES (Absolute limits)

Frequency	f		up to 250	up to 500	MHz
Anode voltage	V_a	=	max. 750	max. 600	V
Anode input power	W_{ia}	=	max. 2x60	max. 2x50	W
Anode dissipation	W_a	=	max. 2x20		W
Anode current	I_a	=	max. 2x110		mA
Grid No.2 voltage	V_{g_2}	=	max. 300		V
Grid No.2 dissipation	W_{g_2}	=	max. 2x3.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ
Heater to cathode voltage	V_{kf}	=	max. 100		V

OPERATING CONDITIONS two systems in push-pull

Wavelength	λ	=	6/2	6/2	4/1.3	m
Anode voltage	V_a	=	500	400	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-150	-150	-150	V
Anode current	I_a	=	2x60	2x73	2x65	mA
Grid No.2 current	I_{g_2}	=	10	16	20	mA
Grid No.1 current	I_{g_1}	=	2x3	2x2.5	2x1.5	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	360	360	360	V
Grid No.1 input power	W_{ig_1}	=	2x0.6	2x0.5	2x0.3	W
Grid No.2 dissipation	W_{g_2}	=	2.5	4	5	W
Anode input power	W_{ia}	=	2x30	2x29	2x26	W
Anode dissipation	W_a	=	2x20	2x20	2x20	W
Output power	W_o	=	20	18	12	W
Efficiency	η	=	33	31	23	%

7Z2 3023

R.F. CLASS C ANODE AND SCREEN GRID MODULATION (continued)

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f		up to	250	up to	500	MHz
Anode voltage	V_a	=	max.	600	max.	480	V
Anode input power	W_{ia}	=	max.	2x50	max.	2x40	W
Anode dissipation	W_a	=	max.	2x15	max.	2x15	W
Anode current	I_a	=	max.	2x100	max.	2x100	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x4	max.	2x4	W [1])
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	max.	50	kΩ [2])
Heater to cathode voltage	V_{kf}	=	max.	100	max.	100	V

I.C.A.S. OPERATING CONDITIONS, intermittent service;
two systems in push-pull

Frequency	f	=	60	250	MHz
Anode voltage	V_a	=	600	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	V
Anode current	I_a	=	2x83	2x83	mA
Grid No.2 current	I_{g_2}	=	16	16	mA
Grid No.1 current	I_{g_1}	=	2x4	2x1.7	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	105	130	V
Grid No.2 dissipation	W_{g_2}	=	4	4	W
Anode input power	W_{ia}	=	2x50	2x50	W
Anode dissipation	W_a	=	2x10.5	2x14.5	W
Output power	W_o	=	79	71	W
Efficiency	η	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	90	90	V
Modulation power	W_{mod}	=	50	50	W

[1]) Screen grid modulated via a choke. For all other modulation methods W_{g_2} = max. 2x2.6 W

[2]) Per system. When a common grid resistor is used R_{g_1} = max. 25 kΩ

7Z2 3022

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to	250	up to	500	MHz
Anode voltage	V_a	=	max.	600	max.	480	V
Anode input power	W_{ia}	=	max.	2x45	max.	2x33.5	W
Anode dissipation	W_a	=	max.	2x14	max.	2x14	W
Anode current	I_a	=	max.	2x92	max.	2x92	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x3.5	max.	2x3.5	W [1])
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	max.	50	kΩ [2])
Heater to cathode voltage	V_{kf}	=	max.	100	max.	100	V

C.C.S. OPERATING CONDITIONS, continuous service
two systems in push-pull

Frequency	f	=	60	250	MHz
Anode voltage	V_a	=	600	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	V
Anode current	I_a	=	2x75	2x75	mA
Grid No.2 current	I_{g_2}	=	20	18	mA
Grid No.1 current	I_{g_1}	=	2x3.8	2x1.6	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	105	130	V
Grid No.2 dissipation	W_{g_2}	=	5	4.5	W
Anode input power	W_{ia}	=	2x45	2x45	W
Anode dissipation	W_a	=	2x9.5	2x13	W
Output power	W_o	=	71	64	W
Efficiency	η	=	79	71	%
Modulation factor	m	=	100	100	%
Peak grid No.2 A.C. voltage	$V_{g_{2p}}$	=	90	90	V
Modulation power	W_{mod}	=	45	45	W

[1]) Screen grid modulated via a choke. For all other modulation methods W_{g_2} = max. 2x2.3 W

[2]) Per system. When a common grid resistor is used R_{g_1} = max. 25 kΩ

7Z2 3021

R.F. CLASS C TELEGRAPHY (continued)

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f		up to 250	up to 500	MHz
Anode voltage	V_a	=	max. 750	max. 600	V
Anode input power	W_{ia}	=	max. 2x75	max. 2x60	W
Anode dissipation	W_a	=	max. 2x22.5		W
Anode current	I_a	=	max. 2x120		mA
Grid No.2 voltage	V_{g_2}	=	max. 300		V
Grid No.2 dissipation	W_{g_2}	=	max. 2x4		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ
Heater to cathode voltage	V_{kf}	=	max. 100		V

I.C.A.S. OPERATING CONDITIONS, intermittent service
two systems in push-pull

Frequency	f	=	250	MHz
Anode voltage	V_a	=	750	V
Grid No.1 voltage	V_{g_1}	=	-80	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	2x90	mA
Grid No.1 current	I_{g_1}	=	2x1.7	mA
Grid No.2 current	I_{g_2}	=	14	mA
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	=	260	V
Grid No.2 dissipation	W_{g_2}	=	3.5	W
Anode input power	W_{ia}	=	2x67.5	W
Anode dissipation	W_a	=	2x19.5	W
Output power	W_o	=	96	W
Efficiency	η	=	71	%

7Z2 3020

R.F. CLASS C TELEGRAPHY

C.C.S. **LIMITING VALUES** (Absolute limits), continuous service

Frequency	f		up to 250	up to 500	MHz
Anode voltage	V_a	=	max. 750	max. 600	V
Anode input power	W_{ia}	=	max. 2x60	max. 2x50	W
Anode dissipation	W_a	=	max. 2x20		W
Anode current	I_a	=	max. 2x110		mA
Grid No.2 voltage	V_{g_2}	=	max. 300		V
Grid No.2 dissipation	W_{g_2}	=	max. 2x3.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ
Heater to cathode voltage	V_{kf}	=	max. 100		V

C.C.S. **OPERATING CONDITIONS**, continuous service
two systems in push-pull

Frequency	f	=	200	250	430	500	MHz
Anode voltage	V_a	=	600	750	520	500	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	−80	−	V
Grid No.1 resistor	R_{g_1}	=	−	−	−	20	kΩ
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	V
Anode current	I_a	=	2x100	2x80	2x100	2x100	mA
Grid No.1 current	I_{g_1}	=	2x2.5	2x1.5	2x2.8	2x3	mA
Grid No.2 current	I_{g_2}	=	16	17	18	20	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1p}$	=	200	250	−	−	V
Grid No.2 dissipation	W_{g_2}	=	4	4.25	4.5	5	W
Anode input power	W_{ia}	=	2x60	2x60	2x52	2x50	W
Anode dissipation	W_a	=	2x15	2x17.5	2x19	2x20	W
Output power	W_o	=	90	85	66	60	W
Efficiency	η	=	75	71	64	60	%

7Z2 3019

CAPACITANCES

			per system	
Anode to all other elements except grid No.1	C_a	=	3.2	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	10.5	pF
Anode to grid No.1	C_{ag_1}	<	0.09	pF
	$C_{ag_1} - C_n$	<	0.035	pF

See electrode arrangement for internal neutralisation by C_n and C_n'

			in push-pull	
Output capacitance	C_o	=	2.1	pF
Input capacitance	C_i	=	6.7	pF

TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and anode seals	max.	250 °C
Temperature of bottom pin seals	max.	180 °C

MECHANICAL DATA

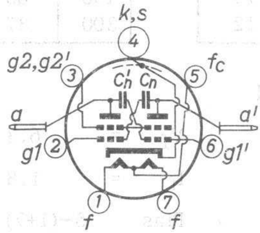
Dimensions in mm

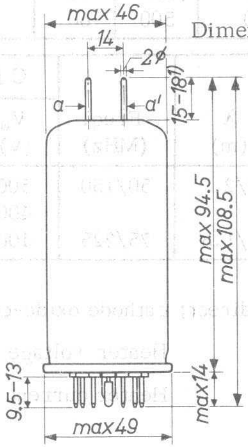
Base : Septar

→ Socket : 2422 513 00001

Anode connector : 40623

Net weight : 60 g





Mounting position: vertical with base up or down
horizontal with anode pins in a horizontal plane

---

[1]) Max. 3 mm glass included

7Z2 8835

R.F. DOUBLE POWER TETRODE

QUICK REFERENCE DATA									
		C telegr.				C_{ag_2} mod.			
		C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
λ (m)	Freq. (MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
5	60					600	71	600	79
1.5	200	600	90						
1.2	250	750	85	750	96	600	64	600	71
0.7	430	520	66						
0.6	500	500	60						

		C fr.mult.	
λ (m)	Freq. (MHz)	V_a (V)	W_o (W)
6/2	50/150	500	20
		400	18
4/1.3	75/225	400	12

B mod.	
V_a (V)	W_o (W)
600	86
450	60
300	37

HEATING: indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6 V
Heater current	I_f	=	1.8	0.9 A
	Pins		5-(1+7)	1-7

TYPICAL CHARACTERISTICS

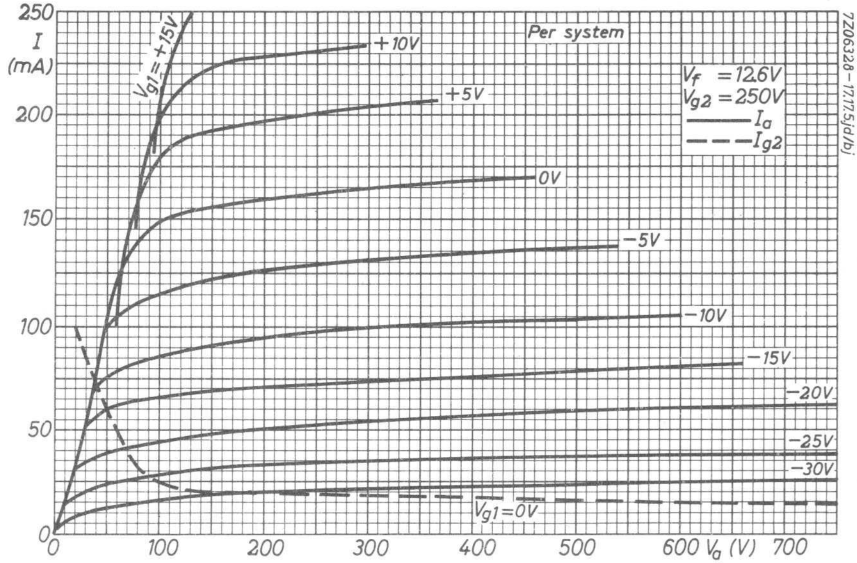
Amplification factor of grid No.2 with respect to grid No.1 $\mu_{g_2 g_1}$ = 8.2

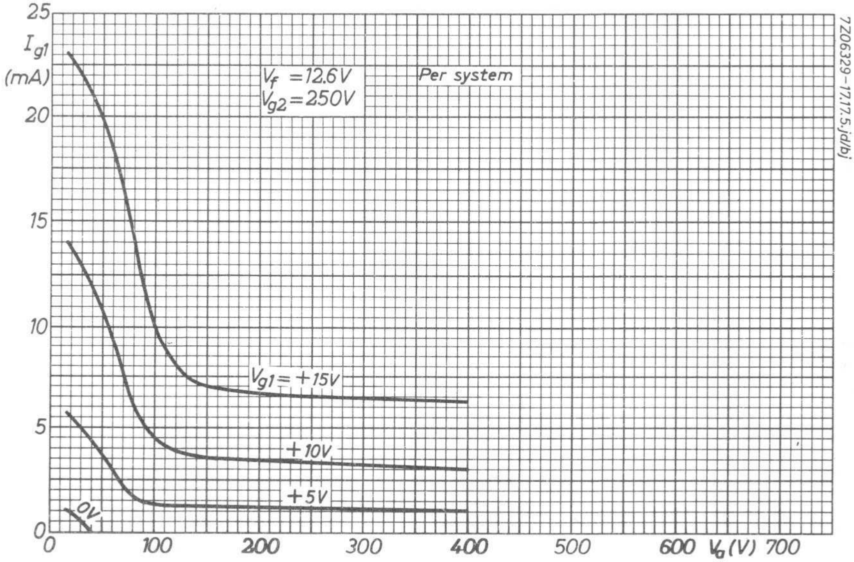
Mutual conductance (per system) S (I_a = 30 mA) = 4.5 mA/V

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

7Z2 3017


250
I
(mA)
200
150
100
50
0
0
100
200
300
400
500
600 V_a (V) 700
Per system
V_f = 12.6V
V_{g2} = 250V
I_a
I_{g2}
V_{g1} = +15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
−25V
−30V
V_{g1} = 0V
7Z06328-17.17.5.jd/bj


25
I_{g1}
(mA)
20
15
10
5
0
0
100
200
300
400
500
600 V_a (V) 700
V_f = 12.6V
V_{g2} = 250V
Per system
V_{g1} = +15V
+10V
+5V
0V
7Z06329-17.17.5.jd/bj

R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull; continued

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x18	W
Anode dissipation	W_a	=	max.	2x7.5	W
Anode current	I_a	=	max.	2x47.5	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ [1])
Grid No.1 circuit resistance	R_{g_1}	=	max.	25	kΩ [2])
Heater to cathode voltage	V_{kf}	=	max.	100	V

I.C.A.S. OPERATING CONDITIONS, intermittent service

Frequency	f	=	200	MHz
Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g_2}	=	200	V
Grid No.1 voltage	V_{g_1}	=	-70	V
Anode current	I_a	=	2x30	mA
Grid No.2 current	I_{g_2}	=	20	mA
Grid No.1 current	I_{g_1}	=	2x1.5	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	160	V
Grid No.1 input power	W_{ig_1}	=	2x0.105	W
Grid No.2 dissipation	W_{g_2}	=	4.0	W
Anode input power	W_{ia}	=	2x18	W
Anode dissipation	W_a	=	2x5	W
Output power	W_o	=	26	W
Efficiency	η	=	72	%
Modulation factor	m	=	100	%
Modulation power	W_{mod}	=	20	W

[1]) Per system [2]) Per tube

7Z2 3060

R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull

C.C.S. **LIMITING VALUES** (Absolute limits), continuous service

Frequency	f		up to 200	up to 250	MHz
Anode voltage	V_a	=	max. 600	max. 530	V
Anode input power	W_{ia}	=	max. 2x11	max. 2x10	W
Anode dissipation	W_a	=	max. 2x5		W
Anode current	I_a	=	max. 2x37.5		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 3.4		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ 1)
Grid No.1 circuit resistance	R_{g_1}	=	max. 25		kΩ 2)
Heater to cathode voltage	V_{kf}	=	max. 100		V

C.C.S. **OPERATING CONDITIONS**, continuous service

Frequency	f	=	200	200	MHz
Anode voltage	V_a	=	600	425	V
Grid No.2 voltage	V_{g_2}	=	200	200	V
Grid No.1 voltage	V_{g_1}	=	-65	-60	V
Anode current	I_a	=	2x18	2x26	mA
Grid No.2 current	I_{g_2}	=	16	16	mA
Grid No.1 current	I_{g_1}	=	2x1.3	2x1.2	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	150	140	V
Grid No.1 input power	W_{ig_1}	=	2x0.09	2x0.075	W
Grid No.2 dissipation	W_{g_2}	=	3.2	3.2	W
Anode input power	W_{ia}	=	2x10.8	2x11	W
Anode dissipation	W_a	=	2x2.3	2x3	W
Output power	W_o	=	17	16	W
Efficiency	η	=	79	72	%
Modulation factor	m	=	100	100	%
Modulation power	W_{mod}	=	13.5	13.5	W

1) Per system 2) Per tube

7Z2 3059

R.F. CLASS C TELEGRAPHY, two systems in push-pull; continued

I.C.A.S. **LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f		up to 200	up to 250	MHz
Anode voltage	V_a	=	max. 750	max. 670	V
Anode input power	W_{ia}	=	max. 2x25	max. 2x22	W
Anode dissipation	W_a	=	max. 2x10		W
Anode current	I_a	=	max. 2x57.5		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ 1)
Grid No.1 circuit resistance	R_{g_1}	=	max. 25		kΩ 2)
Heater to cathode voltage	V_{kf}	=	max. 100		V

I.C.A.S. **OPERATING CONDITIONS**, intermittent service

Frequency	f	=	200	MHz
Anode voltage	V_a	=	750	V
Grid No.2 voltage	V_{g_2}	=	200	V
Grid No.1 voltage	V_{g_1}	=	-50	V
Anode current	I_a	=	2x32.5	mA
Grid No.2 current	I_{g_2}	=	22	mA
Grid No.1 current	I_{g_1}	=	2x2.0	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	130	V
Grid No.1 input power	W_{ig_1}	=	2x0.12	W
Grid No.2 dissipation	W_{g_2}	=	4.4	W
Anode input power	W_{ia}	=	2x24.4	W
Anode dissipation	W_a	=	2x6.9	W
Output power	W_o	=	35	W
Efficiency	η	=	72	%

1) Per system   2) Per tube

7Z2 3058

R.F. CLASS C TELEGRAPHY , two systems in push-pull

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to 200	up to 250	MHz
Anode voltage	V_a	=	max. 750	max. 670	V
Anode input power	W_{ia}	=	max. 2x18	max. 2x16	W
Anode dissipation	W_a	=	max. 2x7.5		W
Anode current	I_a	=	max. 2x45		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50		kΩ [1]
Grid No.1 circuit resistance	R_{g_1}	=	max. 25		kΩ [2]
Heater to cathode voltage	V_{kf}	=	max. 100		V

C.C.S. OPERATING CONDITIONS , continuous service

f	=	200	200	200	250	250	MHz
V_a	=	750	500	400	500	400	V
V_{g_2}	=	200	200	200	200	200	V
V_{g_1}	=	−65	−65	−65	−65	−65	V
I_a	=	2x24	2x36	2x45	2x32	2x40	mA
I_{g_2}	=	15	14	14	12	14	mA
I_{g_1}	=	2x1.4	2x1.3	2x1.4	2x0.9	2x1.0	mA
$V_{g_1g_1'p}$	=	150	150	150	140	140	V
W_{ig_1}	=	2x0.10	2x0.09	2x0.10	2x0.06	2x0.07	W
W_{g_2}	=	3.0	2.8	2.8	2.4	2.8	W
W_{ia}	=	2x18	2x18	2x18	2x16	2x16	W
W_a	=	2x5	2x5	2x5.25	2x7.0	2x7.5	W
W_o	=	26	26	25.5	18	17	W
η	=	72	72	71	56	53	%

1) Per system 2) per tube

7Z2 3057

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and pin seals	max. 180 °C
Bulb temperature	max. 220 °C

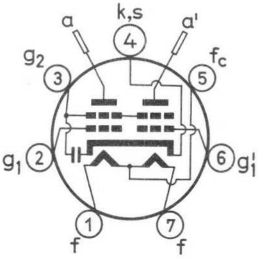
MECHANICAL DATA Dimensions in mm

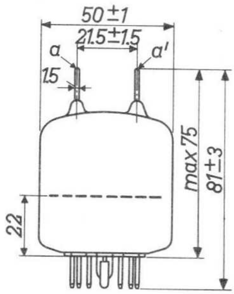
Base : Septar

→ Socket : 2422 513 00001

Anode connector : 40615

Net weight : 60 g





Mounting position: arbitrary

7Z2 8834

R.F. DOUBLE POWER TETRODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr. [1]			C_{ag_2} mod. [1]		
(m)	(MHz)	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
1.5	200	750	26	35	600	17	26
		500	26		425	16	
1.2	250	500	23				

HEATING : indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6	V
Heater current	I_f	=	1.6	0.8	A
	Pins		5-(1+7)	1-7	

CAPACITANCES per system

Anode to all other elements except grid No.1	C_a	=	3.8	pF
Grid No.1 to all other elements except anode	C_{g1}	=	8	pF
Anode to grid No.1	C_{ag1}	<	0.07	pF
Cathode to grid No.2	C_{kg2}	=	65	pF [2]

TYPICAL CHARACTERISTICS

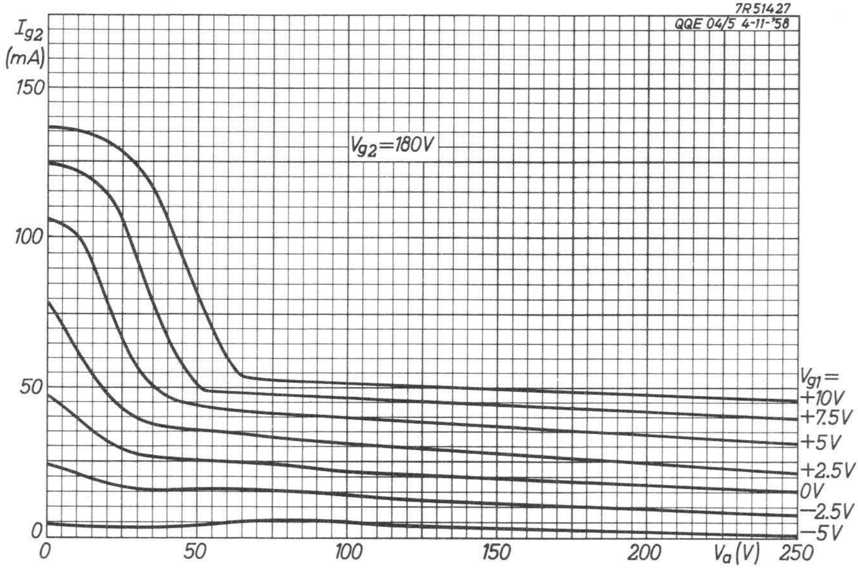
Amplification factor of grid No.2 with respect to grid No.1	μ_{g2g1}	=	6.5	
Mutual conductance	S (I_a = 30 mA)	=	3	mA/V [3]

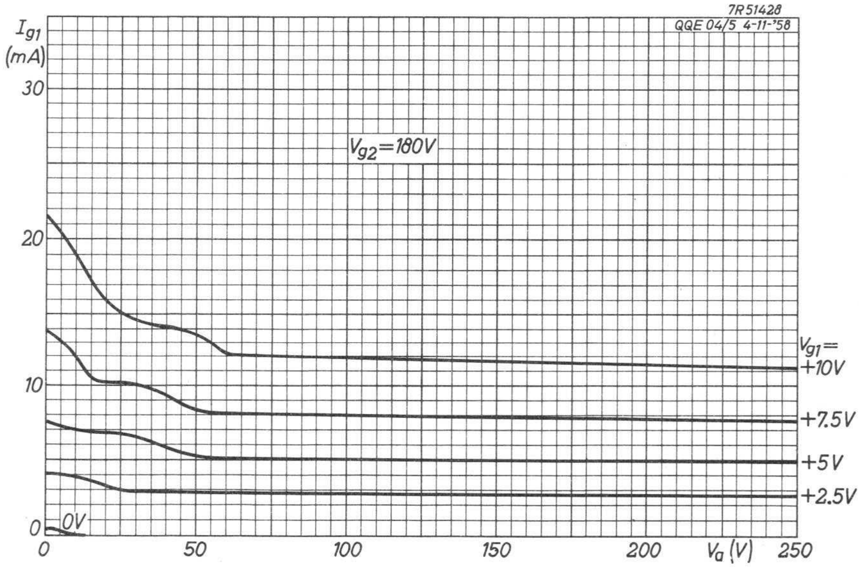
[1]) Two systems in push-pull

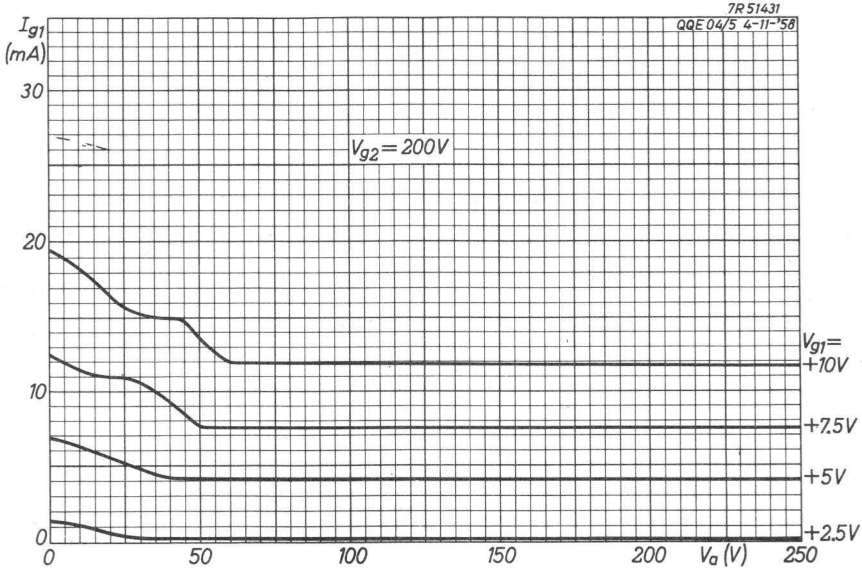
[2]) Including internal capacitor between grid No.2 and cathode

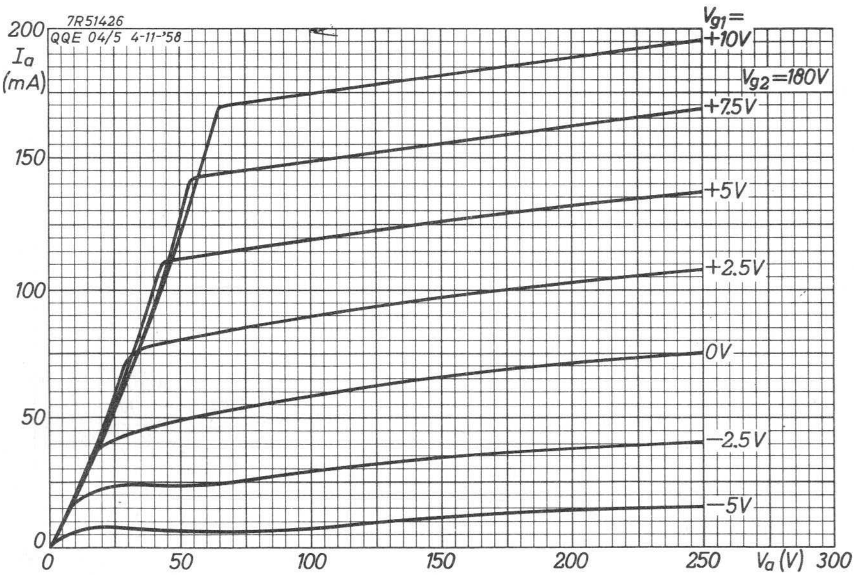
[3]) Per system

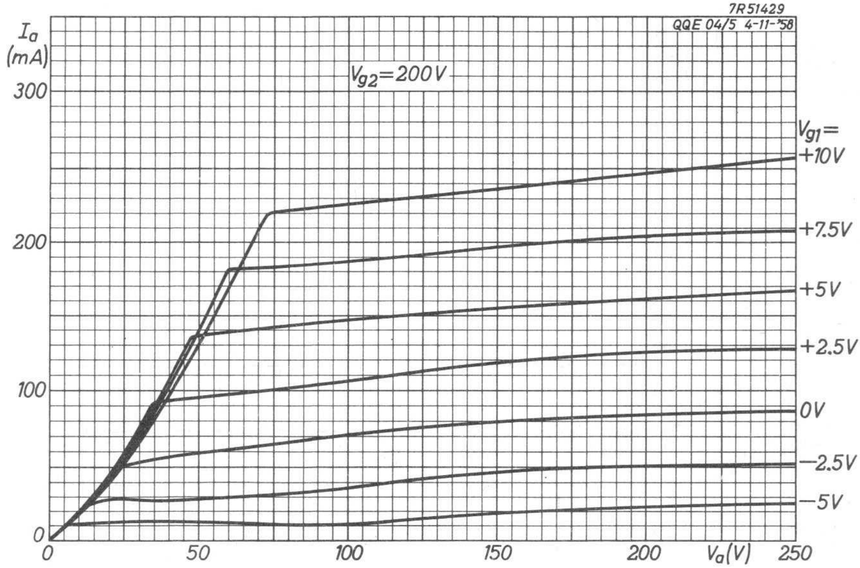
7Z2 3055

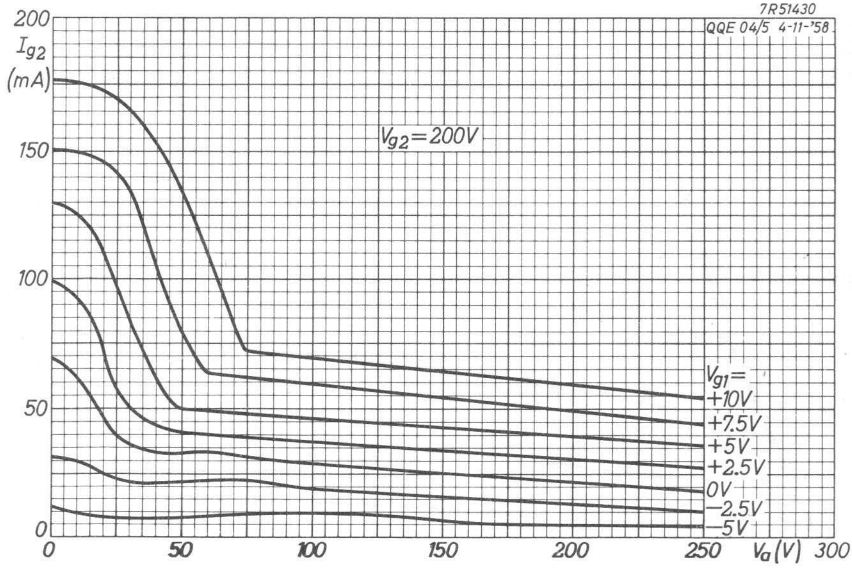

7R51427
QQE 04/5 4-11-'58
I_{g2} (mA)
150
100
50
0
V_{g2}=180V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
V_a(V)
250


7R51428
QQE 04/5 4-11-'58
I_{g1} (mA)
30
20
10
0
V_{g2}=180V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
0
50
100
150
200
V_a(V)
250


7R51431
QQE 04/5 4-11-'58
I_{g1} (mA)
30
20
10
0
V_{g2} = 200V
V_{g1} =
+10V
+7.5V
+5V
+2.5V
0
50
100
150
200
V_a (V)
250


7R51426
QQE 04/5 4-11-'58
200
I_a (mA)
150
100
50
0
V_{g1} =
+10V
V_{g2} = 180V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
V_a (V)
300


7R51429
QQE 04/5 4-11-'58
I_a (mA)
300
200
100
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
V_a(V)
250


7R51430
QQE 04/5 4-11-'58
200
I_{g2} (mA)
150
100
50
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
V_a(V)
300

R.F. CLASS C FREQUENCY TRIPLER

LIMITING VALUES (Absolute limits)

			C.C.S.		I.C.A.S.		
Frequency	f		up to	960	up to	960	MHz
Anode voltage	V_a	=	max.	400	max.	400	V
Anode input power	W_{ia}	=	max.	2x10	max.	2x12	W
Anode dissipation	W_a	=	max.	2x8	max.	2x10	W
Anode current	I_a	=	max.	2x40	max.	2x40	mA
Grid No.2 voltage	V_{g_2}	=	max.	225	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	max.	2x1.75	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x4	max.	2x5	mA

OPERATING CONDITIONS , two systems in push-pull

			C.C.S.	I.C.A.S.	
Frequency	f	=	320/960	320/960	MHz
Anode voltage	V_a	=	250	250	V
Grid No.2 voltage	V_{g_2}	=	150	170	V
Grid No.1 resistor	R_{g_1}	=	20	20	kΩ
Anode current	I_a	=	2x37.5	2x40	mA
Grid No.2 current	I_{g_2}	=	15	16	mA
Grid No.1 current	I_{g_1}	=	2x2.25	2x2.25	mA
Anode input power	W_{ia}	=	2x9.5	2x10	W
Anode dissipation	W_a	=	2x8	2x8.5	W
Grid No.2 dissipation	W_{g_2}	=	2.25	2.8	W
Driver output power	W_{dr}	=	3	3	W
Output power	W_o	=	2.75	3	W
Output power in the load	W_ℓ	=	1.5	1.8	W
Efficiency	η	=	14.7	15	%

7Z2 3064

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	%

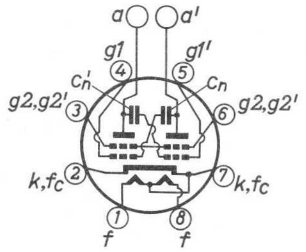
1) Adjust V_{g_2} until I_a = 2x35 mA at W_o max.

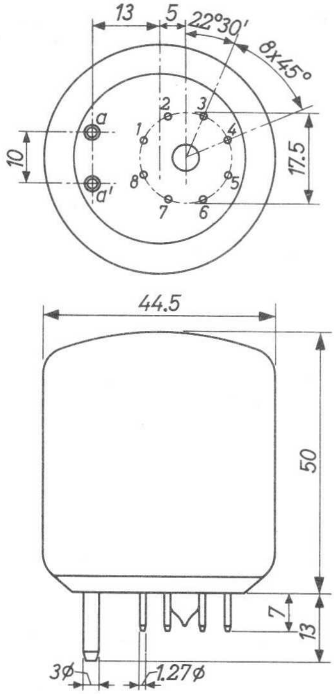
2) Adjust V_{g_2} until I_a = 2x40 mA at W_o max.

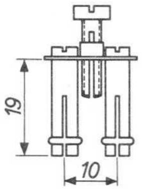
7Z2 3063

MECHANICAL DATA

Dimensions in mm







Example of anode-tank
circuit connector at 960 MHz

Socket assembly : B8 700 71

Net weight : 35 g

Mounting position: arbitrary

7Z2 3062

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA								
	C telegr.				C freq. tripler			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
Freq. (MHz)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)
960	250	7	250	8				
320/960					250	2.75	250	3

HEATING : indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6	V ± 10 %
Heater current	I_f	=	0.6	0.3	A
	Pins		7-(1+8)	1-8	

CAPACITANCES (each system)

Anode to all other elements except grid No.1	C_a	=	1.35	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	4.5	pF
Anode to grid No.1	C_{ag_1}	=	0.145	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	350	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	25	mA
Mutual conductance	S	=	10.5	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	26	

TEMPERATURE LIMIT (Absolute limit)

Temperature of pin seals	max.	220	°C
Bulb temperature	max.	220	°C

7Z2 3061

R.F. DOUBLE TETRODE

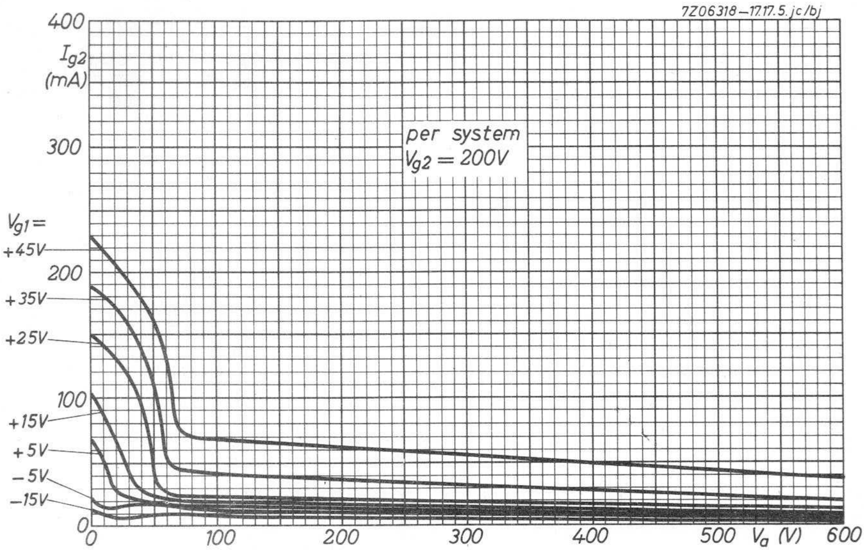
Double tetrode for use as class C amplifier at frequencies up to 600 MHz in continuous tunable transmitters for a large frequency range.

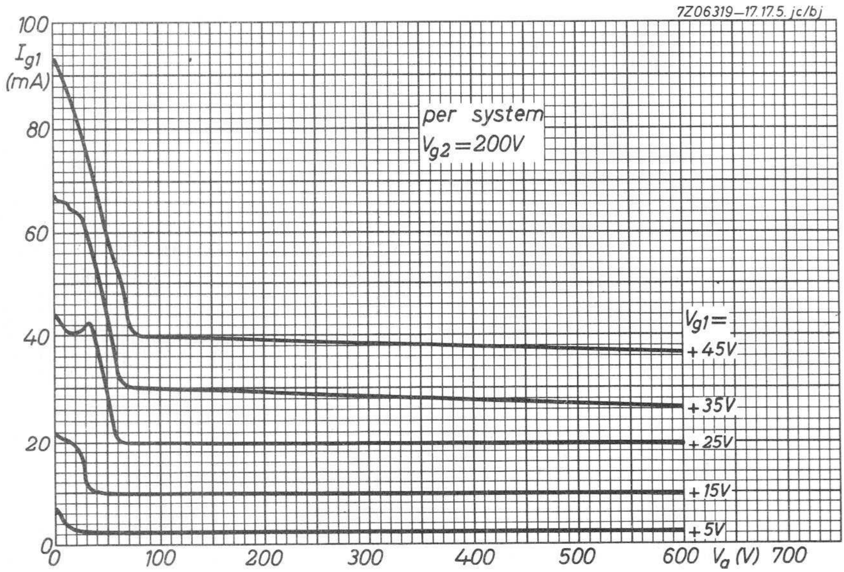
CAPACITANCES

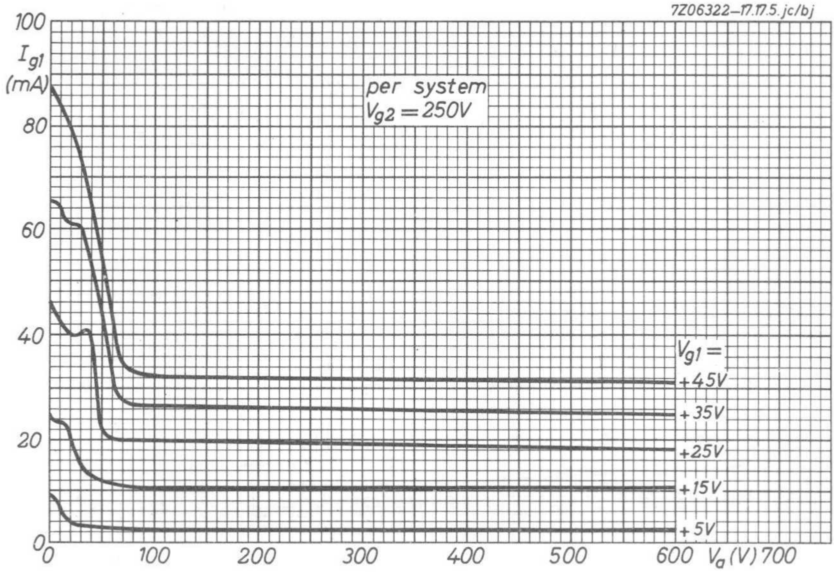
Anode to all other elements except grid No.1	C_a	=	2.6	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	6.2	pF
Anode to grid No.1	C_{ag_1}	=	0.04 to 0.07	pF
Neutralizing capacitances	$C_n = C_n'$	=	0.015 to 0.04	pF

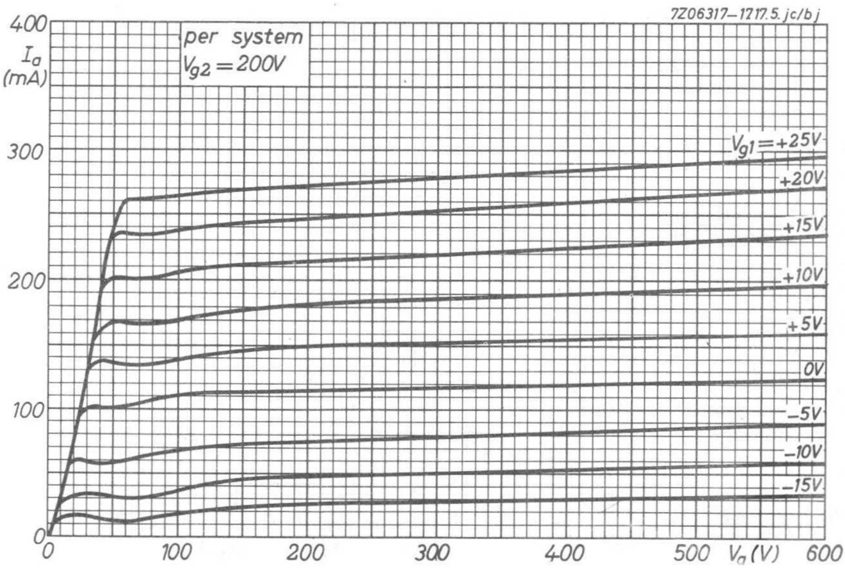
For further data and curves of this type please refer to type QQE03/20

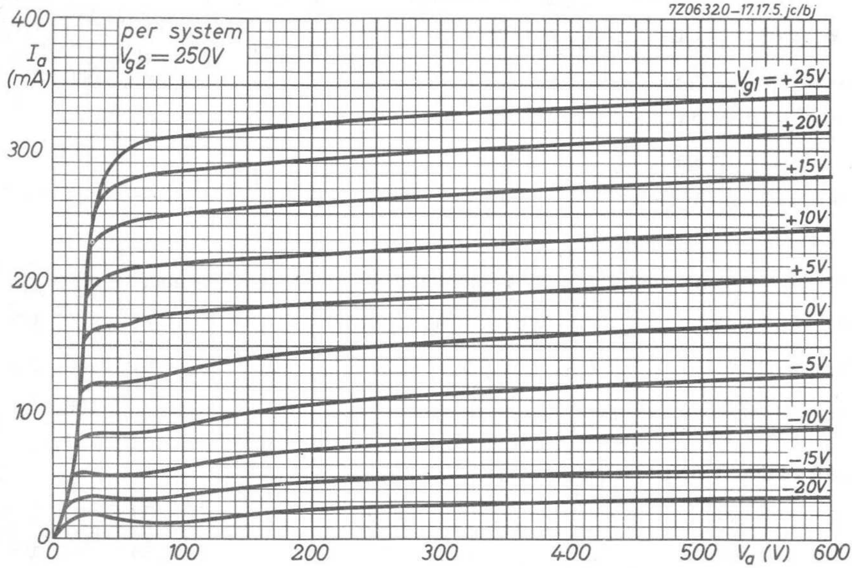
7Z2 3016

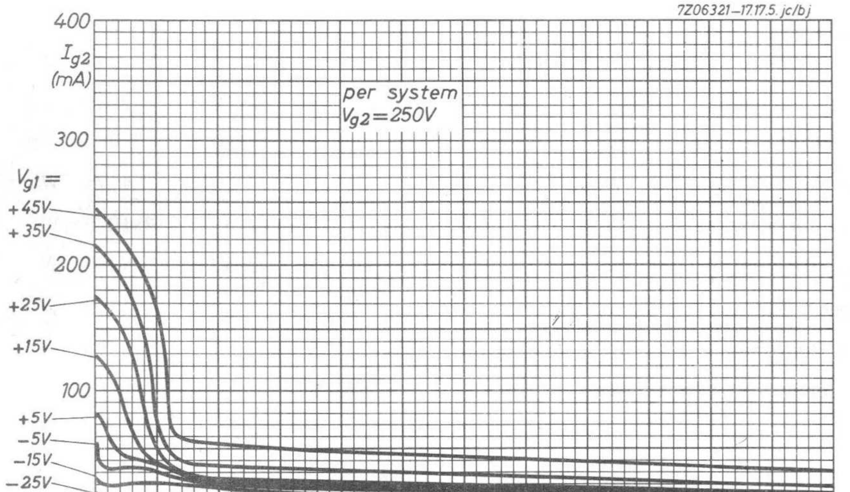

7Z06318–17.17.5. jc/bj
400
I_{g2} (mA)
300
200
100
0
per system
V_{g2} = 200V
V_{g1} =
+45V
+35V
+25V
+15V
+5V
−5V
−15V
0
100
200
300
400
500
V_a (V)
600


7Z06319–17.17.5. jc/bj
100
I_{g1} (mA)
80
60
40
20
0
per system
V_{g2} = 200V
V_{g1} =
+45V
+35V
+25V
+15V
+5V
0
100
200
300
400
500
600
V_a (V)
700


7Z06322–17.17.5. jc/bj
100
I_{g1}
(mA)
80
60
40
20
0
per system
$V_{g2} = 250V$
$V_{g1} =$
+45V
+35V
+25V
+15V
+5V
0
100
200
300
400
500
600
V_a (V) 700


7Z06317–1717.5. jc/bj
400
I_a
(mA)
300
200
100
0
per system
$V_{g2} = 200V$
$V_{g1} = +25V$
+20V
+15V
+10V
+5V
0V
–5V
–10V
–15V
0
100
200
300
400
500
V_a (V)
600


7Z06320–17.17.5. jc/bj
400
I_a
(mA)
300
200
100
0
per system
V_{g2} = 250V
V_{g1} = +25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
0
100
200
300
400
500
V_a (V)
600


7Z06321–17.17.5. jc/bj
400
I_{g2}
(mA)
300
200
100
0
per system
V_{g2} = 250V
V_{g1} =
+45V
+35V
+25V
+15V
+5V
−5V
−15V
−25V
0
100
200
300
400
500
V_a (V)
600

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	600	V
Anode dissipation	W_a	=	max.	2x10	W
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	75	V
Grid No.1 circuit resistance with fixed bias	R_{g_1}	=	max.	50	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g_1}	=	max.	100	kΩ
Cathode current	I_k	=	max.	2x55	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS, two systems in push-pull

Anode voltage	V_a	=	500		300		V
Grid No.2 voltage	V_{g_2}	=	250		250		V
Grid No.1 voltage	V_{g_1}	=	−26		−25		V
Load resistance	$R_{aa'\sim}$	=	20		11		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	0	52	0	50	V
Anode current	I_a	=	2x12.5	2x36.5	2x12.5	2x35	mA
Grid No.2 current	I_{g_2}	=	2x0.35	2x8.1	2x0.6	2x9.5	mA
Grid No.2 dissipation	W_{g_2}	=	0.18	4.05	0.3	4.75	W
Anode input power	W_{ia}	=	2x6.25	2x18.25	2x3.75	2x10.5	W
Anode dissipation	W_a	=	2x6.25	2x6.5	2x3.75	2x3.9	W
Output power	W_o	=	0	23.5	0	13.2	W
Total distortion	d_{tot}	=	−	3.5	−	3.5	%
Efficiency	η	=	−	63.5	−	63	%

7Z2 3015

R.F. CLASS C FREQUENCY TRIPLER

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	600	V
Anode dissipation	W_a	=	max.	2x10	W
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	200	V
Grid No.1 circuit resistance with fixed bias	R_{g_1}	=	max.	50	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g_1}	=	max.	100	kΩ
Grid No.1 current	I_{g_1}	=	max.	2x2.5	mA
Cathode current	I_k	=	max.	2x50	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS, two systems in push-pull

Wavelength	λ	=	4.5/1.5	2.25/0.75	m
Frequency	f	=	66.7/200	133/400	MHz
Anode voltage	V_a	=	300	300	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−175	−175	V
Anode current	I_a	=	2x45	2x45	mA
Grid No.2 current	I_{g_2}	=	2x3.0	2x2.8	mA
Grid No.1 current	I_{g_1}	=	2x1.5	2x1.2	mA
Anode input power	W_{ia}	=	2x13.5	2x13.5	W
Anode dissipation	W_a	=	2x8.5	2x9.5	W
Grid No.2 dissipation	W_{g_2}	=	2x0.75	2x0.7	W
Grid No.1 input power	W_{ig_1}	=	2x1	2x2	W
Output power	W_o	=	10	8.0	W
Efficiency	η	=	37	29.5	%

7Z2 3014

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	500	V
Anode dissipation	W_a	=	max.	2x10	W
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x2.5	mA
Cathode current	I_k	=	max.	2x50	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS, two systems in push-pull

Wavelength	λ	=	1.5	1.5	0.75	m
Frequency	f	=	200	200	400	MHz
Anode voltage	V_a	=	500	300	300	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-80	-50	-50	V
Anode current	I_a	=	2x40	2x40	2x40	mA
Grid No.2 current	I_{g_2}	=	2x4	2x4	2x3	mA
Grid No.1 current	I_{g_1}	=	2x1.0	2x1.0	2x1.0	mA
Anode input power	W_{ia}	=	2x20	2x12	2x12	W
Anode dissipation	W_a	=	2x4.5	2x3.5	2x5.5	W
Grid No.2 dissipation	W_{g_2}	=	2x1	2x1	2x0.75	W
Grid No.1 input power	W_{ig_1}	=	2x5	2x2.5		W
Output power	W_o	=	31	17	13	W
Efficiency	η	=	77.5	71	54	%
Modulation factor	m	=	100	100	100	%
Modulation power	W_{mod}	=	20	12	12	W

7Z2 3013

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	%

7Z2 3012

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	= max.	600	V
Anode dissipation	W_a	= max.	2x10	W
Grid No.2 voltage	V_{g_2}	= max.	250	V
Grid No.2 dissipation	W_{g_2}	= max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	75	V
Grid No.1 circuit resistance with fixed bias	R_{g_1}	= max.	50	kΩ
Grid No.1 circuit resistance with automatic bias	R_{g_1}	= max.	100	kΩ
Grid No.1 current	I_{g_1}	= max.	2x2.5	mA
Cathode current	I_k	= max.	2x55	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

OPERATING CONDITIONS, two systems in push-pull

Wavelength	λ	=	1.5	1.5	1.5	1.5	m
Frequency	f	=	200	200	200	200	MHz
Anode voltage	V_a	=	600	400	300	200	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	200	V
Grid No.1 voltage	V_{g_1}	=	−60	−50	−40	−30	V
Anode current	I_a	=	2x50	2x50	2x50	2x50	mA
Grid No.2 current	I_{g_2}	=	2x4	2x4	2x4.5	2x4	mA
Grid No.1 current	I_{g_1}	=	2x0.7	2x0.7	2x0.7	2x1	mA
Anode input power	W_{ia}	=	2x30	2x20	2x15	2x10	W
Anode dissipation	W_a	=	2x6	2x5	2x4.5	2x3.5	W
Grid No.2 dissipation	W_{g_2}	=	2x1.0	2x1.0	2x1.1	2x0.8	W
Grid No.1 input power	W_{ig_1}	=	1.5	1	< 1	< 1	W
Output power	W_o	=	48	30	21	13	W
Efficiency	η	=	80	75	70	65	%

7Z2 3011

TYPICAL CHARACTERISTICS

Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$ (I_a = 20 mA)	=	8	
Mutual conductance	S (I_a = 20 mA)	=	2.5	mA/V

MECHANICAL DATA

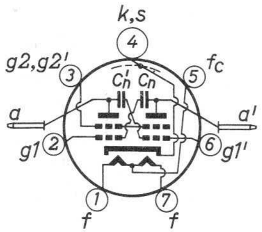
Dimensions in mm

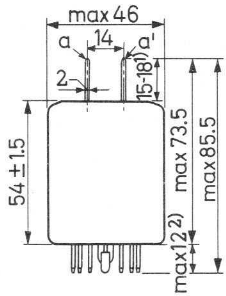
Base : Septar

→ Socket : 2422 513 00001

Anode connector: 40623

Net weight : 55 g





Mounting position: arbitrary

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode seals and bulb	max. 220	°C
Temperature of bottom seals	max. 180	°C

COOLING

Generally natural cooling is sufficient with:

V_a = 600 V up to 150 MHz

V_a = 500 V up to 200 MHz

V_a = 300 V up to 430 MHz

Above these limits or with high ambient temperatures it may be necessary to direct an air flow of about 15 l/min. on top of the bulb to keep the seal temperatures within the stated limits

[1]) Max. 3 mm glass included

[2]) Max. 2.5 mm glass included

7Z2 8833

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA (two systems)

λ (m)	Freq. (MHz)	C telegr.		C_{ag_2} mod.	
		V_a (V)	W_o (W)	V_a (V)	W_o (W)
1.5	200	600	48	500	31
		400	30	300	17
		300	21		
		200	13		
0.75	400	400	24	300	13
		300	17		
		200	11		
0.5	600	400	20		

λ (m)	Freq. (MHz)	C fr.mult.	
		V_a (V)	W_o (W)
4.5/1.5	67/200	300	10
2.25/0.75	133/400	300	8

B mod.	
V_a (V)	W_o (W)
500	23.5
400	13.2

HEATING: indirect, series or parallel supply; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6	V
Heater current	I_f	=	1.3	0.65	A
	Pins		5-(1+7)	1-7	

CAPACITANCES

per system

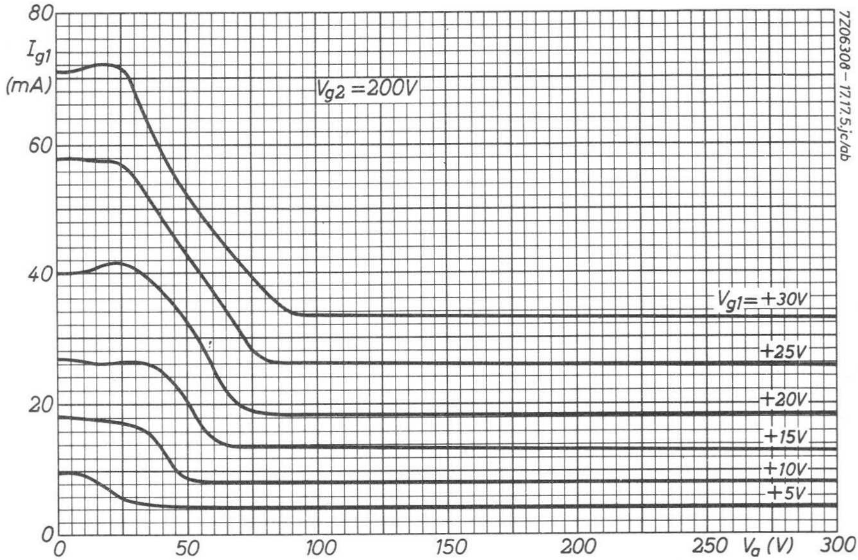
Anode to all other elements except grid No.1	C_a	=	2.6	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	7.0	pF
Anode to grid No.1	C_{ag_1}	<	0.08	pF
	$C_{ag_1} - C_n$	<	0.035	pF

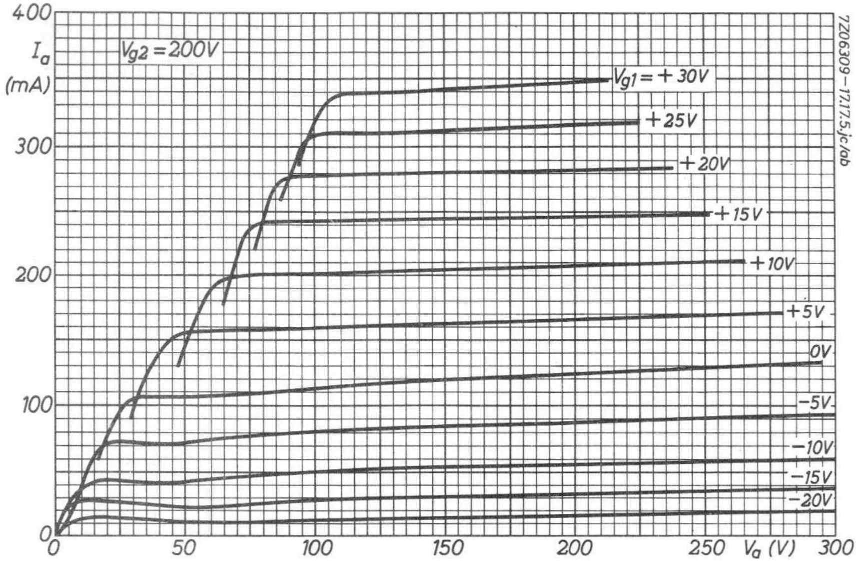
See electrode arrangement (page 2) for internal neutralisation by C_n and C_n'

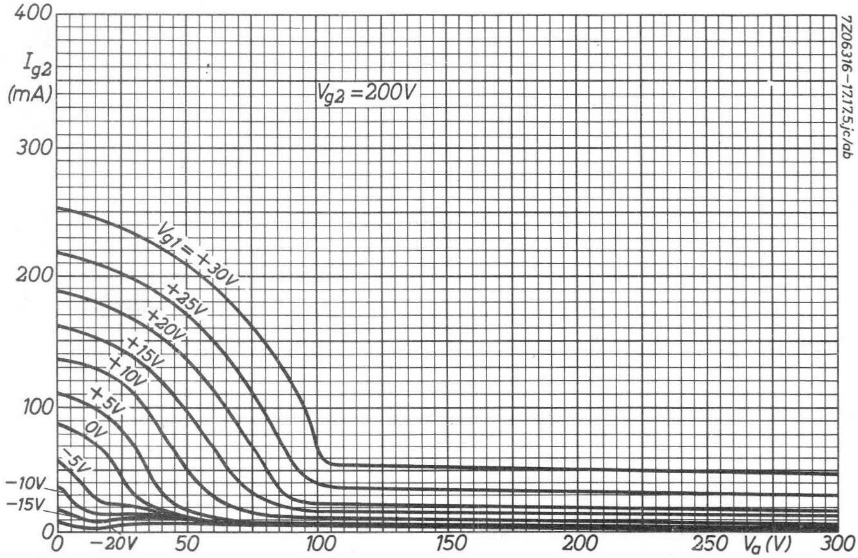
in push-pull

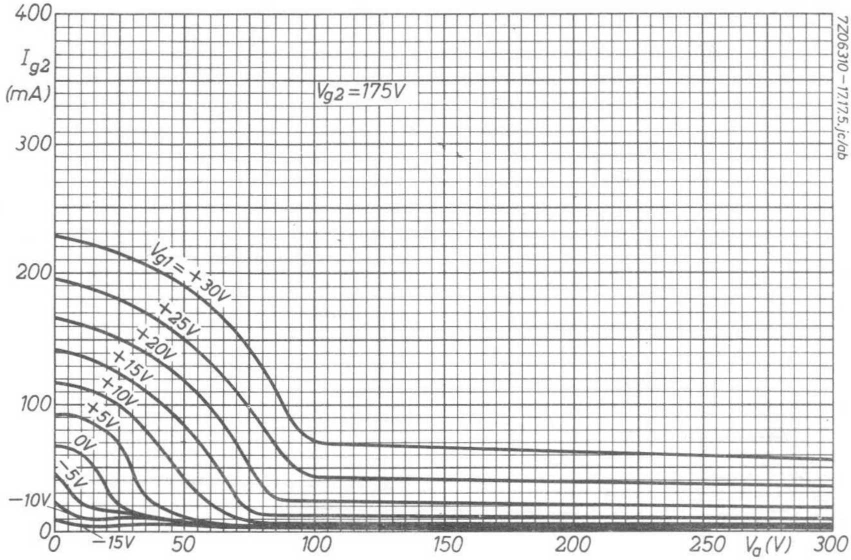
Output capacitance	C_o	=	1.6	pF
Input capacitance	C_i	=	4.4	pF

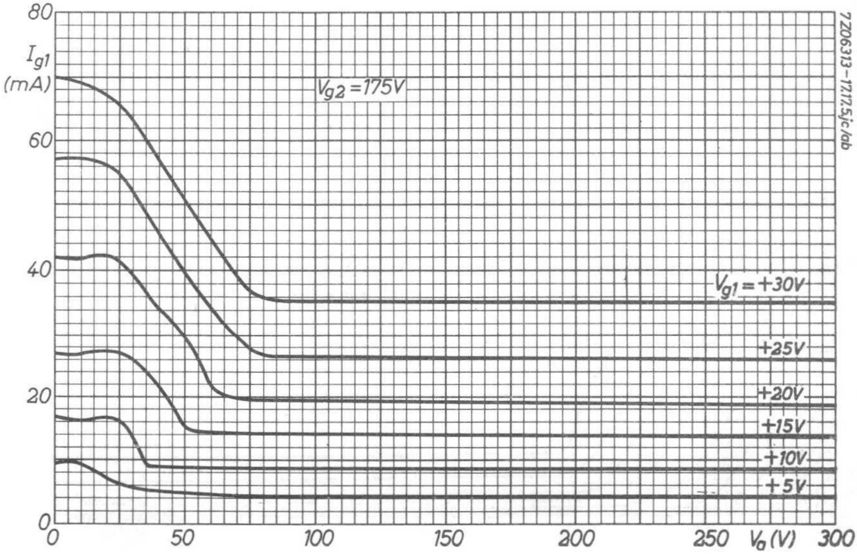
7Z2 3009

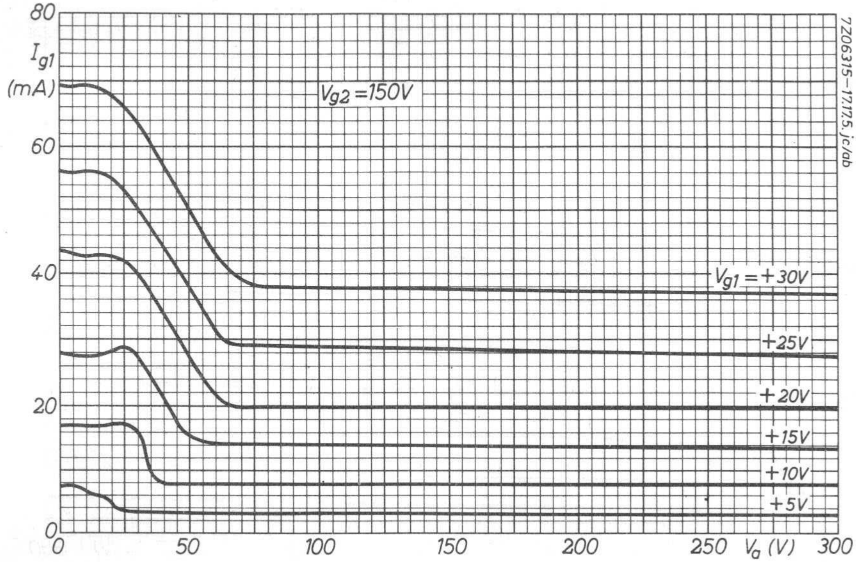

80
I_{g1}
(mA)
60
40
20
0
V_{g2} =200V
V_{g1}=+30V
+25V
+20V
+15V
+10V
+5V
0
50
100
150
200
250
V_a (V)
300
7Z06308 - 17.17.5.jc/ab

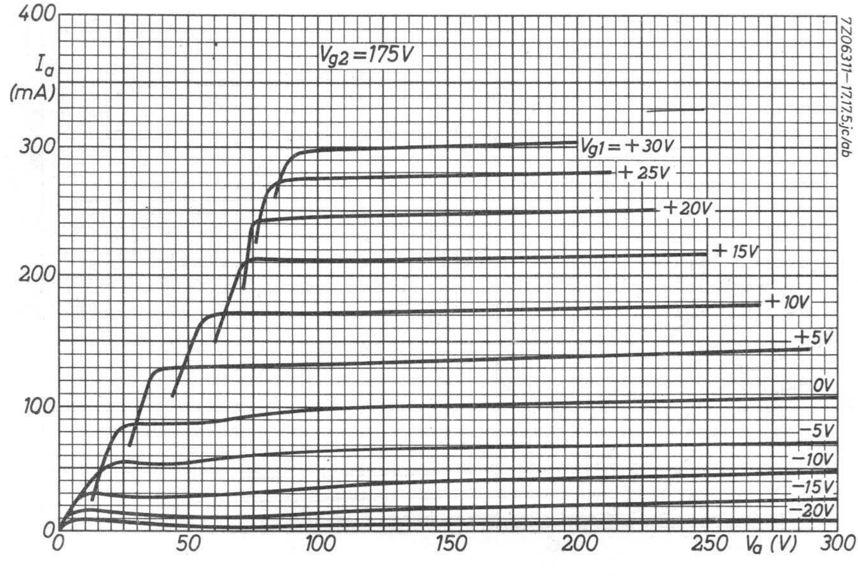

400
I_a
(mA)
300
200
100
0
V_{g2} = 200V
V_{g1} = + 30V
+ 25V
+ 20V
+ 15V
+ 10V
+ 5V
0V
−5V
−10V
−15V
−20V
0
50
100
150
200
250
V_a (V)
300
7Z06309−17.17.5.jc/ab

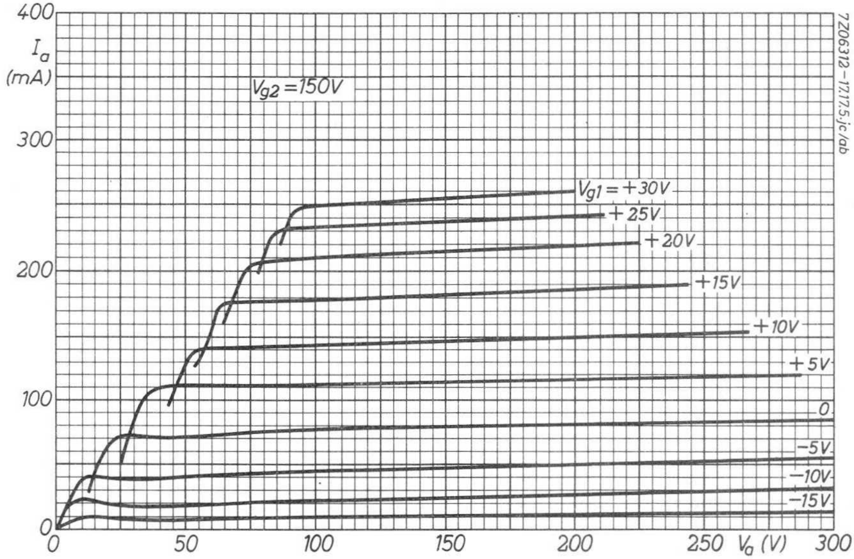

400
I_{g2}
(mA)
300
200
100
0
V_{g2} = 200V
V_{g1} = + 30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
0
50
100
150
200
250
V_a (V)
300
7Z06316−17.17.5.jc/ab

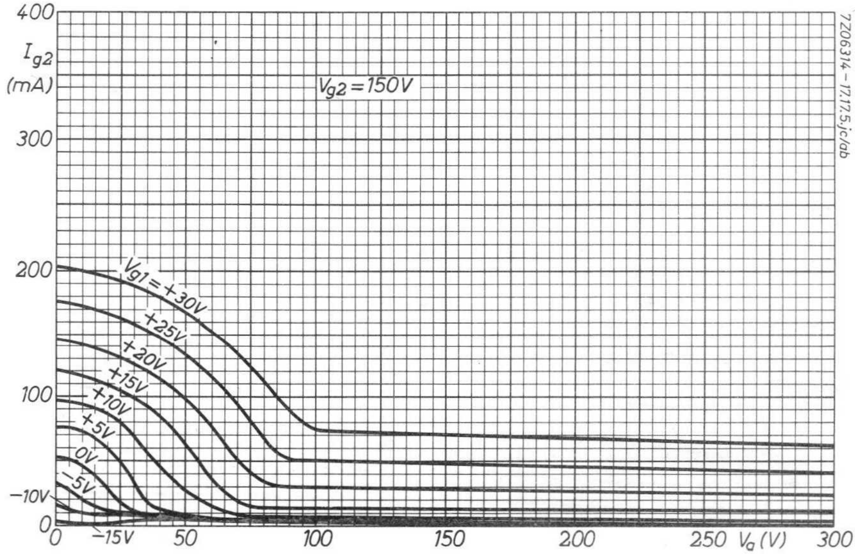

400
I_{g2}
(mA)
300
200
100
0
V_{g2}=175V
V_{g1}=+30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
0
50
100
150
200
250
V_a(V)
300
7Z06310−17.17.5.jc/ab


80
I_{g1}
(mA)
60
40
20
0
V_{g2}=175V
V_{g1}=+30V
+25V
+20V
+15V
+10V
+5V
0
50
100
150
200
250
V_a(V)
300
7Z06313−17.17.5.jc/ab


7Z06315-17.7.5.jc/ab
80
I_{g1}
(mA)
60
40
20
0
V_{g2} =150V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0
50
100
150
200
250
V_a (V)
300


7Z06311-17.7.5.jc/ab
400
I_a
(mA)
300
200
100
0
V_{g2} =175V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
−20V
0
50
100
150
200
250
V_a (V)
300


400
I_a
(mA)
300
200
100
0
V_{g2} = 150V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
0
50
100
150
200
250
V_a (V)
300
7Z06312−17.17.5.jc/ab


400
I_{g2}
(mA)
300
200
100
0
V_{g2} = 150V
V_{g1} = +30V
+25V
+20V
+15V
+10V
+5V
0V
−5V
−10V
−15V
0
50
100
150
200
250
V_a (V)
300
7Z06314−17.17.5.jc/ab

A.F. CLASS AB AMPLIFIER AND MODULATOR WITH GRID CURRENT

LIMITING VALUES (Absolute limits) only for speech and music

Anode voltage	V_a	= max.	300	V
Anode dissipation	W_a	= max.	2x7	W
Anode input power	W_{ia}	= max.	2x15	W
Anode current	I_a	= max.	2x50	mA
Grid No.2 voltage	V_{g2}	= max.	200	V
Grid No.2 dissipation	W_{g2}	= max.	2x1	W
Peak grid No.2 dissipation	W_{g2p}	= max.	2x2	W
Negative grid No.1 voltage	$-V_{g1}$	= max.	150	V
Grid No.1 dissipation	W_{g1}	= max.	2x0.2	W
Grid No.1 current	I_{g1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x60	mA
Peak cathode current	I_{kp}	= max.	2x300	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

OPERATING CONDITIONS

V_a	=	300		250		200		V
V_{g2}	=	200		200		200		V
V_{g1} 1)	=	−21.5		−21.5		−21.5		V
$R_{aa'\sim}$	=	6.5		5.0		5.0		kΩ
$V_{g1g1'p}$	=	0	64	0	67	0	54	V
I_a	=	2x15	2x50	2x15	2x50	2x15	2x41.1	mA
I_{g2}	=	1.2	11.4	1.4	13	2.4	19	mA
I_{g1}	=	0	2x0.56	0	2x0.62	0	2x0.22	mA
W_{g2}	=	0.24	2.3	0.28	2.6	0.48	3.8	W
W_{ig1}	=	0	2x0.02	0	2x0.02	0	2x0.01	W
W_{ia}	=	2x4.5	2x15	2x3.75	2x12.5	2x3.0	2x8.22	W
W_a	=	2x4.5	2x6.25	2x3.75	2x5.5	2x3.0	2x3.87	W
W_o	=	0	17.5	0	14	0	8.7	W
η	=	–	58	–	56	–	53	%
d_{tot}	=	–	5.0	–	5.5	–	6.0	%

1) Individual adjustment of the grid bias of each system is recommended

7Z2 3008

A.F. CLASS AB AMPLIFIER AND MODULATOR WITHOUT GRID CURRENT

LIMITING VALUES (Absolute limits) only for speech and music

Anode voltage	V_a	= max.	300	V
Anode dissipation	W_a	= max.	2x7	W
Anode input power	W_{ia}	= max.	2x15	W
Anode current	I_a	= max.	2x50	mA
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	2x1	W
Peak grid No.2 dissipation	$W_{g_{2p}}$	= max.	2x2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x60	mA
Peak cathode current	I_{k_p}	= max.	2x300	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

OPERATING CONDITIONS

V_a	=	300		250		200		V
V_{g_2}	=	200		200		200		V
V_{g_1} 1)	=	−21.5		−21.5		−21.5		V
$R_{aa'\sim}$	=	10		8		6.5		kΩ
$V_{g_1g_1'p}$	=	0	43.5	0	44.5	0	43.5	V
I_a	=	2x15	2x36	2x15	2x34.5	2x15	2x33	mA
I_{g_2}	=	1.2	12.6	1.4	12.4	2.4	14	mA
W_{g_2}	=	0.24	2.5	0.28	2.5	0.48	2.8	W
W_{ia}	=	2x4.5	2x10.8	2x3.75	2x8.65	2x3.0	2x6.6	W
W_a	=	2x4.5	2x4.8	2x3.75	2x4.0	2x3.0	2x3.1	W
W_o	=	0	12	0	9.3	0	7.0	W
η	=	–	56	–	54	–	53	%
d_{tot}	=	–	2.5	–	2.7	–	3.2	%

1) Individual adjustment of the grid bias of each system is recommended

7Z2 3007

R.F. CLASS C FREQUENCY TRIPLER, two systems in push-pull; continued

I.C.A.S. **LIMITING VALUES** (Absolute limits) intermittent service

Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	300	V
Anode dissipation	W_a	=	max.	2x7	W
Anode input power	W_{ia}	=	max.	2x10	W
Anode current	I_a	=	max.	2x42	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.2	W
Grid No.1 current	I_{g_1}	=	max.	2x3	mA
Cathode current	I_k	=	max.	2x45	mA
Peak cathode current	I_{kp}	=	max.	2x300	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

I.C.A.S. **OPERATING CONDITIONS**, intermittent service

f	=	67/200	67/200	67/200	67/200	MHz
$V_a = V_b$	=	300	300	250	200	V
V_{g_2}	=	150	175	176	175	V
R_{g_2}	=	–	–	18	4.7	kΩ
V_{g_1}	=	-100	-100	–	–	V
R_{g_1} 1)	=	–	–	27	22	kΩ
$V_{g_1g_1'p}$	=	240	230	230	230	V
I_a	=	2x32.5	2x32.5	2x36	2x39	mA
I_{g_2}	=	3.5	2.7	4.1	5.2	mA
I_{g_1}	=	2x1.9	2x1.2	2x1.9	2x2.3	mA
W_{ia}	=	2x9.7	2x9.7	2x9	2x7.8	W
W_a	=	2x5.8	2x6.1	2x5.9	2x5.55	W
W_{g_2}	=	0.53	0.47	0.72	0.91	W
W_{ig_1}	=	0.45	0.28	0.43	0.52	W
W_o	=	7.8	7.2	6.2	4.5	W
η	=	40	37	34.5	29	%
W_o 2)	=	4.8	4.2	4.2	3.5	W

1) Common resistor for both systems

2) Useful power output in load

7Z2 3006

R.F. CLASS C FREQUENCY TRIPLER, two systems in push-pull

C.C.S. **LIMITING VALUES** (Absolute limits) continuous service

Frequency	f		up to 200	MHz
Anode voltage	V_a	= max.	300	V
Anode dissipation	W_a	= max.	2x5	W
Anode input power	W_{ia}	= max.	2x7.5	W
Anode current	I_a	= max.	2x30	mA
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	2	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= max.	2x2	mA
Cathode current	I_k	= max.	2x35	mA
Peak cathode current	I_{k_p}	= max.	2x225	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

C.C.S. **OPERATING CONDITIONS**, continuous service

Frequency	f	=	67/200	67/200	67/200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	V_{g_2}	=	150	161	155	V
Grid No.2 resistor	R_{g_2}	=	–	47	15	kΩ
Grid No.1 voltage	V_{g_1}	=	−100	–	–	V
Grid No.1 resistor	R_{g_1} 1)	=	–	47	33	kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	230	230	230	V
Anode current	I_a	=	2x24	2x25	2x28.5	mA
Grid No.2 current	I_{g_2}	=	2.0	1.9	3.0	mA
Grid No.1 current	I_{g_1}	=	2x1.0	2x1.0	2x1.6	mA
Anode input power	W_{ia}	=	2x7.2	2x6.25	2x5.7	W
Anode dissipation	W_a	=	2x4.0	2x3.75	2x3.8	W
Grid No.2 dissipation	W_{g_2}	=	0.30	0.31	0.46	W
Grid No.1 input power	W_{ig_1}	=	0.23	0.23	0.35	W
Output power	W_o	=	6.5	5.0	3.8	W
Efficiency	η	=	45	40	33.5	%
Output power	W_o 2)	=	3.5	3.0	2.8	W

1) Common resistor for both systems

2) Useful power output in load

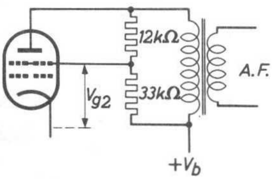
7Z2 3005

R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull; continued

I.C.A.S. **LIMITING VALUES** (Absolute limits) intermittent service

Frequency	f	up to	200	MHz
Anode voltage	V_a	= max.	240	V
Anode dissipation	W_a	= max.	2x4.6	W
Anode input power	W_{ia}	= max.	2x10	W
Anode current	I_a	= max.	2x46	mA
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	1.3	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= max.	2x4	mA
Cathode current	I_k	= max.	2x52	mA
Peak cathode current	I_{k_p}	= max.	2x240	mA
Heater to cathode voltage	V_{kf}	= max.	100	V

I.C.A.S. **OPERATING CONDITIONS**, intermittent service



f	=	200	MHz
$V_a = V_b$	=	200	V
V_{g_2} 1)	=		
R_{g_1} 2)	=	15	kΩ
$V_{g_1g_1'p}$	=	130	V
I_a	=	2x43	mA
I_{g_2}	=	3.1	mA
I_{g_1}	=	3.3	mA
W_{ia}	=	2x8.6	W
W_a	=	2x3.7	W
W_{g_2}	=	0.54	W
W_{ig_1}	=	0.2	W
W_o	=	9.8	W
η	=	57	%
W_o 3)	=	8.8	W
m	=	100	%
W_{mod}	=	8.6	W

1) See diagram
2) Common resistor for both systems
3) Useful power output in load

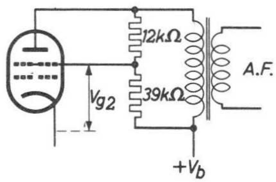
7Z2 3004

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_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	1.3	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 dissipation	W_{g_1}	= max.	2x0.2	W
Grid No.1 current	I_{g_1}	= max.	2x3	mA
Cathode current	I_k	= max.	2x40	mA
Peak cathode current	I_{k_p}	= 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_{g_2} 1)	=		
R_{g_1} 2)	=	33	kΩ
$V_{g_1 g_1'p}$	=	130	V
I_a	=	2x33.5	mA
I_{g_2}	=	2.6	mA
I_{g_1}	=	1.5	mA
W_{ia}	=	2x6.7	W
W_a	=	2x2.65	W
W_{g_2}	=	0.46	W
W_{ig_1}	=	0.1	W
W_o	=	8.1	W
η	=	60	%
W_ℓ 3)	=	7.1	W
m	=	100	%
W_{mod}	=	6.7	W

1) See diagram
2) Common resistor for both systems
3) Useful power output in load

7Z2 3003

R.F. CLASS C TELEGRAPHY, two systems in push-pull; continued

I.C.A.S. **LIMITING VALUES** (Absolute limits) intermittent service

Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	300	V
Anode dissipation	W_a	=	max.	2x7	W
Anode input power	W_{ia}	=	max.	2x15	W
Anode current	I_a	=	max.	2x55	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.2	W
Grid No.1 current	I_{g_1}	=	max.	2x4	mA
Cathode current	I_k	=	max.	2x65	mA
Peak cathode current	I_{k_p}	=	max.	2x300	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

I.C.A.S. **OPERATING CONDITIONS**, intermittent service

Frequency	f	=	200	200	200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	V_{g_2}	=	200	–	–	V
Grid No.2 resistor	R_{g_2}	=	–	27	8.2	kΩ
Grid No.1 voltage	V_{g_1}	=	−45			V
Grid No.1 resistor	R_{g_1} 1)	=	–	18	15	kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	130	120	130	V
Anode current	I_a	=	2x50	2x40	2x42	mA
Grid No.2 current	I_{g_2}	=	3.0	2.4	3.1	mA
Grid No.1 current	I_{g_1}	=	2x1.5	2.5	3.0	mA
Anode input power	W_{ia}	=	2x15	2x10	2x8.4	W
Anode dissipation	W_a	=	2x6	2x3.5	2x3.4	W
Grid No.2 dissipation	W_{g_2}	=	0.6	0.45	0.55	W
Grid No.1 input power	W_{ig_1}	=	2x0.1	0.15	0.18	W
Output power	W_o	=	18.5	13	10	W
Efficiency	η	=	62	65	60	%
Output power	W_o 2)	=	16	11.2	9	W

1) Common resistor for both systems

2) Useful power output in load

7Z2 3002

R.F. CLASS C TELEGRAPHY ; two systems in push-pull

C.C.S. **LIMITING VALUES** (Absolute limits) continuous service

Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	300	V
Anode dissipation	W_a	=	max.	2x5	W
Anode input power	W_{ia}	=	max.	2x11.25	W
Anode current	I_a	=	max.	2x45	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.2	W
Grid No.1 current	I_{g_1}	=	max.	2x3	mA
Cathode current	I_k	=	max.	2x50	mA
Peak cathode current	I_{k_p}	=	max.	225	mA
Heater to cathode voltage	V_{kf}	=	max.	100	V

C.C.S. **OPERATING CONDITIONS**, continuous service

Frequency	f	=	200	200	200	MHz
Anode supply voltage	$V_a = V_b$	=	300	250	200	V
Grid No.2 voltage	V_{g_2}	=	175	–	–	V
Grid No.2 resistor	R_{g_2}	=	–	47	22	kΩ
Grid No.1 voltage	V_{g_1}	=	−40	–	–	V
Grid No.1 resistor	R_{g_1} 1)	=	–	18	15	kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	110	110	115	V
Anode current	I_a	=	2x37.5	2x33.5	2x35	mA
Grid No.2 current	I_{g_2}	=	2.3	1.8	2.2	mA
Grid No.1 current	I_{g_1}	=	2x0.9	2.2	2.7	mA
Anode input power	W_{ia}	=	2x11.25	2x8.4	2x7	W
Anode dissipation	W_a	=	2x4	2x2.9	2x2.8	W
Grid No.2 dissipation	W_{g_2}	=	0.4	0.3	0.33	W
Grid No.1 input power	W_{ig_1}	=	2x0.05	0.12	0.14	W
Output power	W_o	=	14.5	11	8.4	W
Efficiency	η	=	65	65	60	%
Output power	W_o 2)	=	12	9	7.4	W

1) Common resistor for both systems

2) Useful power output in load

7Z2 3001

CAPACITANCES

	per system			
Anode to all other elements except grid No.1	C_a	=	2.6	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	6.2	pF
Anode to grid No.1	C_{ag_1}	<	0.1	pF
	in push-pull			
Output capacitance	C_o	=	1.4	pF
Input capacitance	C_i	=	5.1	pF

The tube is internally neutralized

MECHANICAL DATA

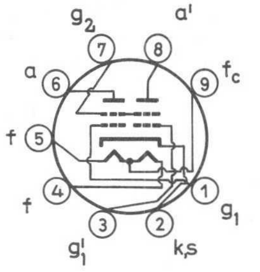
Dimensions in mm

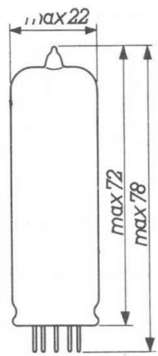
Base : Noval

→ Socket : 2422 502 01003

Tube retainer: 40647

Net weight : 17 g





Mounting position: arbitrary; if the tube is mounted horizontally, it is recommended that pins 2 and 7 are placed in a vertical plane.

COOLING

Cooling: radiation and convection. The use of a closed can is not allowed

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	max.	225	^{o}C
Temperature of pin seals	max.	120	^{o}C

7Z2 8832

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA							
λ (m)	Freq. (MHz)	C telegr.			C_{ag_2} mod.		
		V_a (V)	W_o (W) 1) CCS	W_o (W) 1) ICAS	V_a (V)	W_o (W) 1) CCS	W_o (W) 1) ICAS
1.5	200	300	12	16	200	7.1	8.8
		250	9.0	11.2			
		200	7.4	9.0			

λ (m)	Freq. (MHz)	C fr. mult.			B mod.	
		V_a (V)	W_o (W) 1) CCS	W_o (W) 1) ICAS	V_a (V)	W_o 1) (W)
4.5/1.5	67/200	300	3.5	4.8	300	17.5
		250	3.0	4.2	250	14
		200	2.8	3.5	200	8.7

HEATING : indirect; cathode oxide-coated

Heater voltage	V_f	=	6.3	12.6	V 2)
Heater current	I_f	=	0.82	0.41	A
	Pins	=	9-(4+5)	4-5	

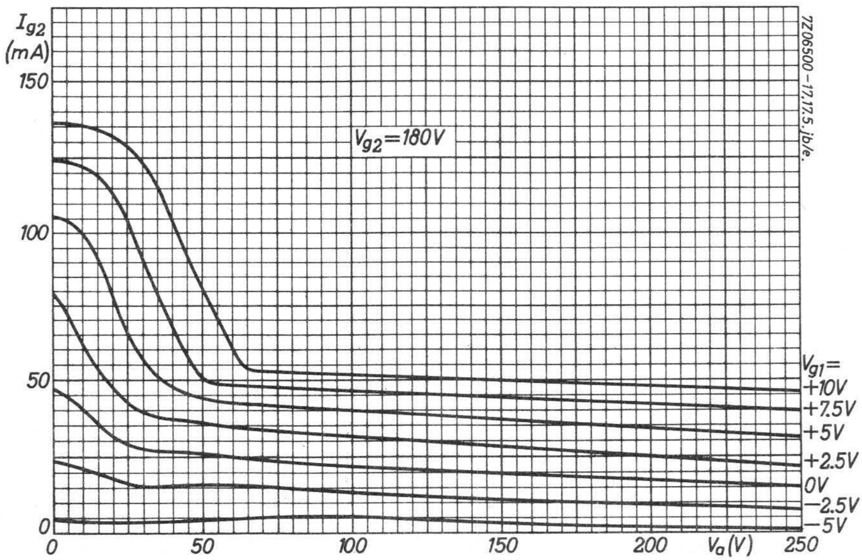
TYPICAL CHARACTERISTICS per system

Amplification factor of grid No.2 with respect to grid No.1	μ_{g2g1}		=	7.5	
Mutual conductance	S	(I_a = 30 mA)	=	3.3	mA/V

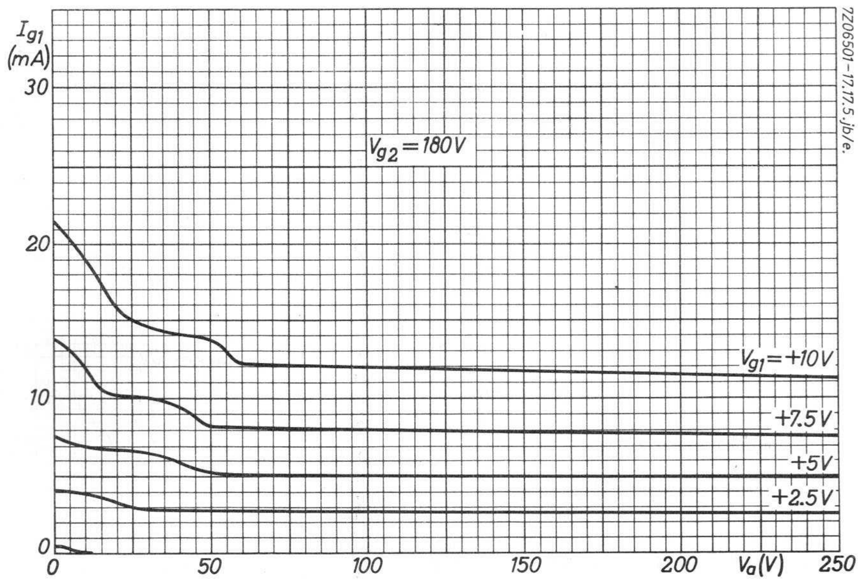
1) Two systems in push-pull; useful power output in load

2) Occasional operation at 5.3 V or 7.8 V (resp. 10.6 V or 15.6 V) is acceptable. The tube may be used with only half the heater energized during the stand-by period of a transmitter in order to reduce heater current consumption during this time.

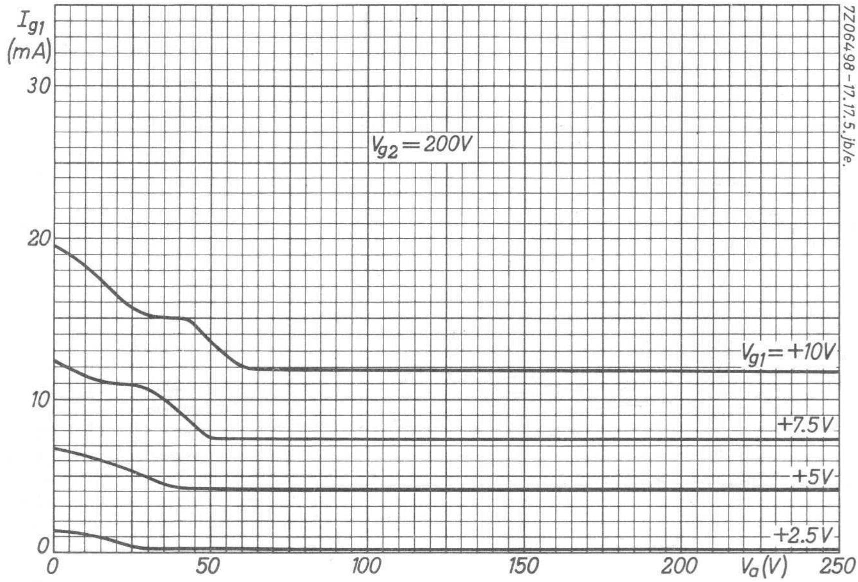
7Z2 2999

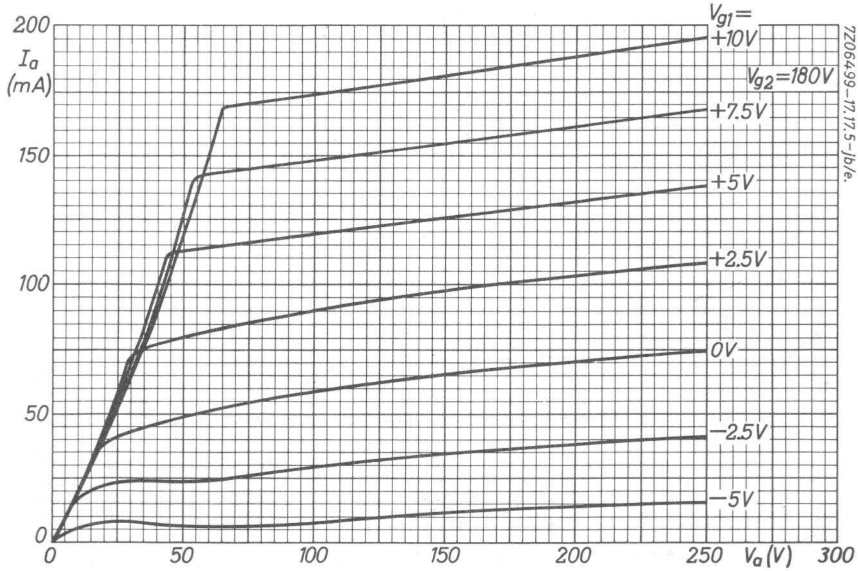


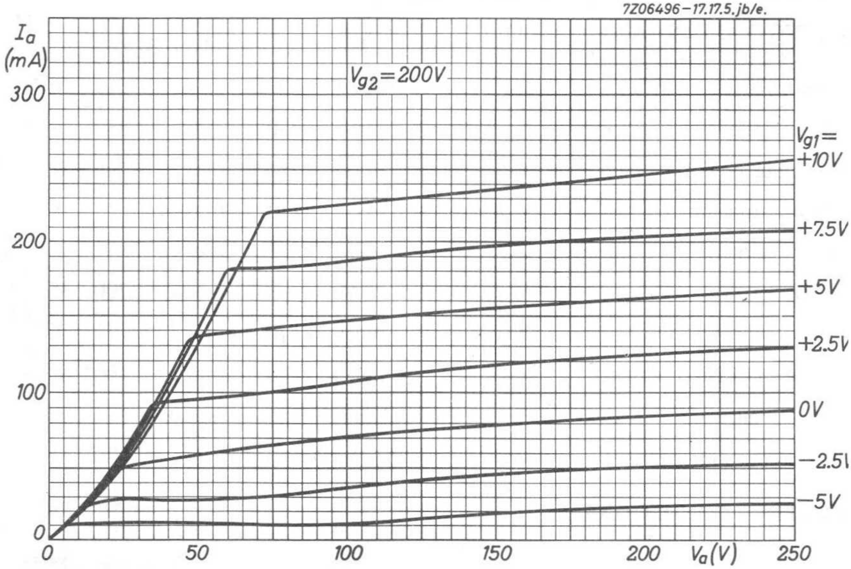
I_{g2} (mA)
150
100
50
0
V_{g2}=180V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
V_a(V)
250
7Z06500-17.17.5.jb/e.

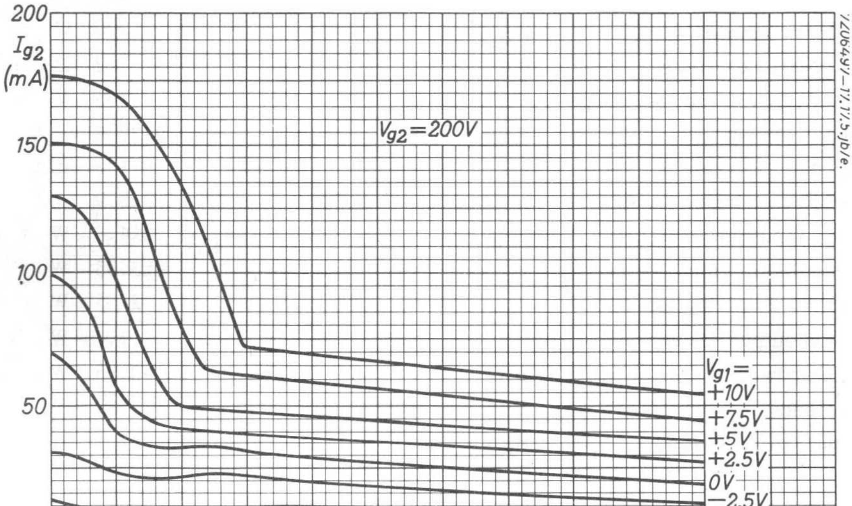


I_{g1} (mA)
30
20
10
0
V_{g2}=180V
V_{g1}=+10V
+7.5V
+5V
+2.5V
0
50
100
150
200
V_a(V)
250
7Z06501-17.17.5.jb/e.


Ig1 (mA)
30
20
10
0
Vg2 = 200V
Vg1 = +10V
+7.5V
+5V
+2.5V
0
50
100
150
200
Va(V)
250
7Z06498-17.17.5.jb/e.


200
Ia (mA)
150
100
50
0
Vg1 =
+10V
Vg2 = 180V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
Va(V)
300
7Z06499-17.17.5-jb/e.


7Z06496-17.17.5.jb/e.
I_a (mA)
300
200
100
0
V_{g2}=200V
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
V_a(V)
250


200
I_{g2} (mA)
150
100
50
0
V_{g2}=200V
7Z06497-17.17.5.jb/e.
V_{g1}=
+10V
+7.5V
+5V
+2.5V
0V
−2.5V
−5V
0
50
100
150
200
250
V_a(V)
300

R.F. CLASS C FREQUENCY TRIPLER, two systems in push-pull

LIMITING VALUES (Absolute limits)

			C.C.S.		I.C.A.S.		
Frequency	f		up to	500	up to	500	MHz
Anode voltage	V_a	=	max.	250	max.	250	V
Anode input power	W_{ia}	=	max.	2x4	max.	2x5	W
Anode dissipation	W_a	=	max.	2x3	max.	2x3.75	W
Anode current	I_a	=	max.	2x30	max.	2x40	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	max.	2x1.75	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x3	max.	2x4	mA
Heater to cathode voltage	V_{kf}	=	max.	100	max.	100	V

OPERATING CONDITIONS

			C.C.S.	I.C.A.S.	
Frequency	f	=	167/500	167/500	MHz
Anode voltage	V_a	=	180	200	V
Grid No.2 supply voltage	V_{bg_2}	=	180	200	V
Grid No.2 resistor	R_{g_2}	=	1200	1200	Ω
Grid No.1 resistors	R_{g_1}	=	82	82	kΩ [1]
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	165	165	V
Anode current	I_a	=	2x20	2x22.5	mA
Grid No.2 current	I_{g_2}	=	9.7	11.0	mA
Grid No.1 current	I_{g_1}	=	2x0.9	2x0.9	mA
Anode input power	W_{ia}	=	2x3.6	2x4.5	W
Anode dissipation	W_a	=	2x2.45	2x3.05	W
Grid No.2 dissipation	W_{g_2}	=	1.65	2.05	W
Driver output power	W_{dr}	=	1.1	1.1	W
Output power	W_o	=	2.35	2.95	W
Efficiency	η	=	33	33	%
Output power in load	W_ℓ	=	1.8	2.2	W

---

[1]) Each system. Fixed bias or a combination of fixed bias and grid current biasing is not recommended.

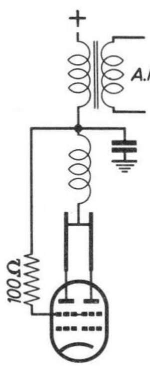
7Z2 2614

R.F. CLASS C ANODE AND SCREEN GRID MODULATION; two systems in push-pull

LIMITING VALUES (Absolute limits)

			C.C.S.		I.C.A.S.		
Frequency	f		up to	500	up to	500	MHz
Anode voltage	V_a	=	max.	200	max.	200	V
Anode input power	W_{ia}	=	max.	2x4	max.	2x5	W
Anode dissipation	W_a	=	max.	2x2	max.	2x2.5	W
Anode current	I_a	=	max.	2x32	max.	2x40	mA
Grid No.2 voltage	V_{g_2}	=	max.	200	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.0	max.	2x1.15	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x3	max.	2x4	mA
Heater to cathode voltage	V_{kf}	=	max.	100	max.	100	V

OPERATING CONDITIONS



		C.C.S.	I.C.A.S.	
f	=	500	500	MHz
V_a	=	180	180	V
V_{g_2}	=	see circuit diagram		
V_{g_1}	=	−20	−20	V
R_{g_1}	=	68	27	kΩ 1)
$V_{g_1 g_1' p}$	=	45	50	V
I_a	=	2x20	2x27.5	mA
I_{g_2}	=	9.5	12.5	mA
I_{g_1}	=	2x0.3	2x0.75	mA
W_{ia}	=	2x3.6	2x5.0	W
W_a	=	2x1.5	2x2.1	W
W_{g_2}	=	1.7	2.25	W
W_{dr}	=	1.0	1.2	W
W_o	=	4.2	5.8	W
η	=	58	58	%
W_ℓ	=	3.5	5.0	W
m	=	100	100	%
W_{mod}	=	4.5	6.1	W

1) Each system

7Z2 2613

R.F. CLASS C TELEGRAPHY; two systems in push-pull

LIMITING VALUES (Absolute limits)

			C.C.S.	I.C.A.S.	
Frequency	f		up to 500	up to 500	MHz
Anode voltage	V_a	=	max. 250	max. 250	V
Anode input power	W_{ia}	=	max. 2x6	max. 2x7	W
Anode dissipation	W_a	=	max. 2x3	max. 2x3.75	W
Anode current	I_a	=	max. 2x45	max. 2x50	mA
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{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	=	500	500	MHz
Anode voltage	V_a	=	180	200	V
Grid No.2 voltage	V_{g_2}	=	180	200	V
Grid No.1 voltage	V_{g_1}	=	−20	−20	V
Grid No.1 resistors	R_{g_1}	=	27	27	kΩ [1])
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	=	50	50	V
Anode current	I_a	=	2x27.5	2x31	mA
Grid No.2 current	I_{g_2}	=	12.5	14	mA
Grid No.1 current	I_{g_1}	=	2x0.75	2x0.75	mA
Anode input power	W_{ia}	=	2x5	2x6.2	W
Anode dissipation	W_a	=	2x2.1	2x2.6	W
Grid No.2 dissipation	W_{g_2}	=	2.25	2.8	W
Driver output power	W_{dr}	=	1.2	1.2	W
Output power	W_o	=	5.8	7.2	W
Efficiency	η	=	58	58	%
Output power in load	W_ℓ	=	5	6	W

[1]) Each system

7Z2 2612

CAPACITANCES

	per system			
Anode to all other elements except grid No.1	C_a	=	1.6	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	6.4	pF
Anode to grid No.1	C_{ag_1}	=	0.16	pF
	in push-pull			
Output	C_o	=	0.95	pF
Input	C_i	=	3.8	pF

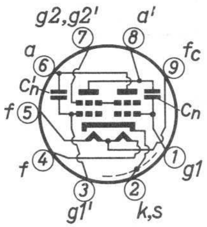
The tube is internally neutralized

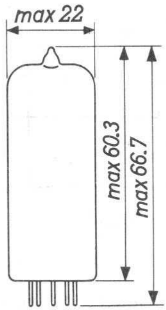
MECHANICAL DATA

Dimensions in mm

Base : Noval

Socket: 2422 502 01003





Mounting position: arbitrary

Low loss socket without collar is recommended. At high frequencies use of a metal retaining device is not recommended due to loss of output power.

COOLING

Radiation and convection. The use of a closed can is not allowed.

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature (at hottest point)	max.	225	°C
Pin seal temperature	max.	120	°C

7Z2 8831

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA							
λ	Freq.	C telegr.			Cag_2 mod.		
(m)	(MHz)	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	Freq.	C fr.mult.		
(m)	(MHz)	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	

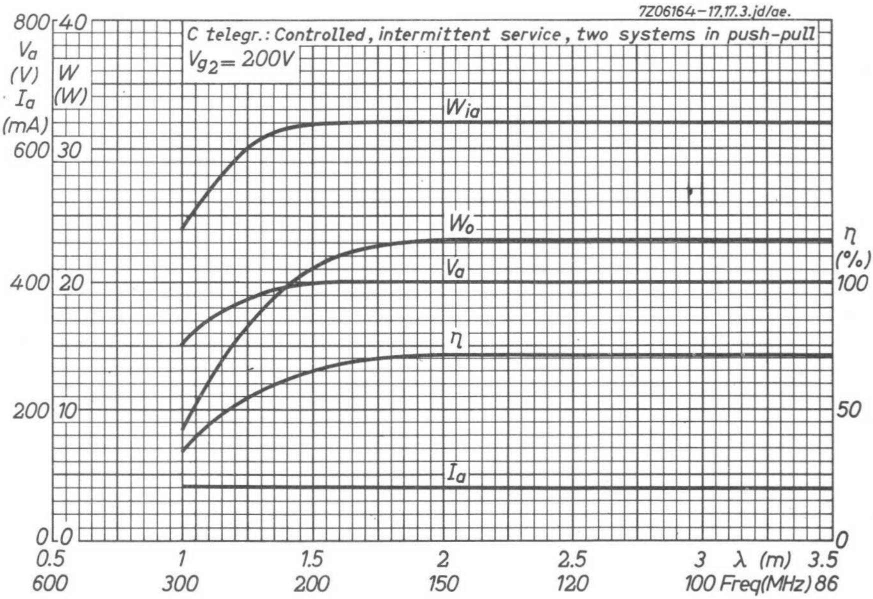
TYPICAL CHARACTERISTICS per system

Anode voltage	V_a	=	150	V
Grid No.2 voltage	V_{g_2}	=	150	V
Anode current	I_a	=	25	mA
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	31	
Mutual conductance	S	=	10.5	mA/V

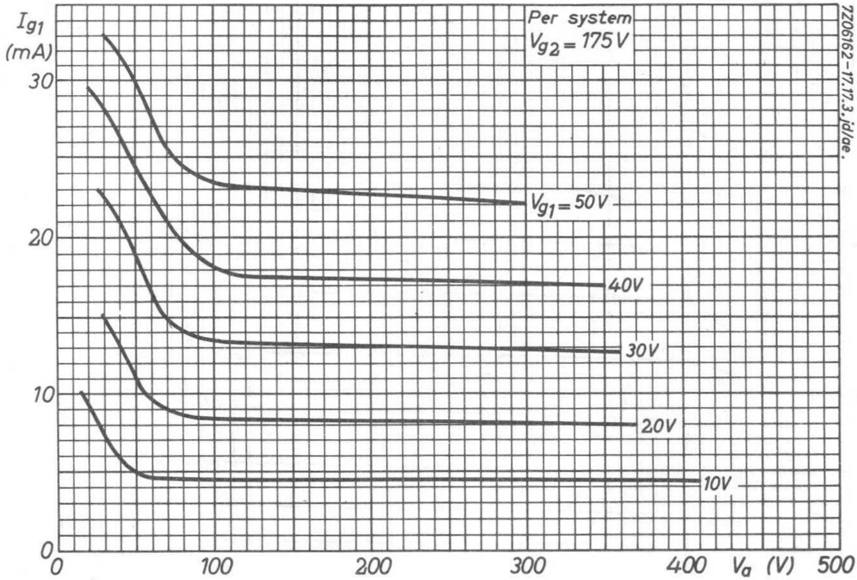
1) Two systems

2) A temporary deviation of 10% of V_f is permissible; e.g. when the tube is fed from an accumulator, the actual V_f should not exceed 7 V or 14 V and the accumulator may be used until its voltage has decreased to such an extent that V_f is 5.7 V or 11.4 V

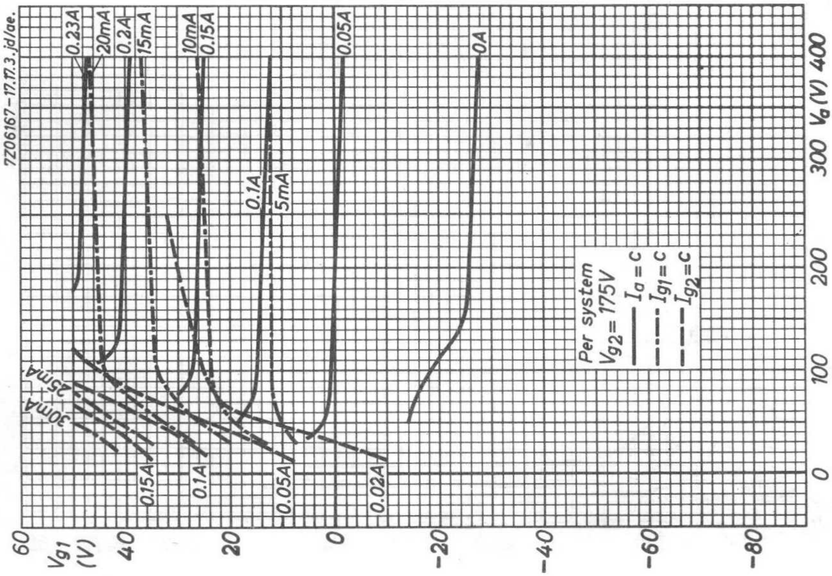
7Z2 2610


7Z06164-17.17.3.jd/ae.
C telegr.: Controlled, intermittent service, two systems in push-pull
Vg2 = 200V
800
Va
(V)
Ia
(mA)
600
400
200
0
40
W
(W)
30
20
10
0
Wia
Wo
Va
η
Ia
η
(%)
100
50
0
0.5
1
1.5
2
2.5
3
λ (m)
3.5
600
300
200
150
120
100
Freq(MHz)
86

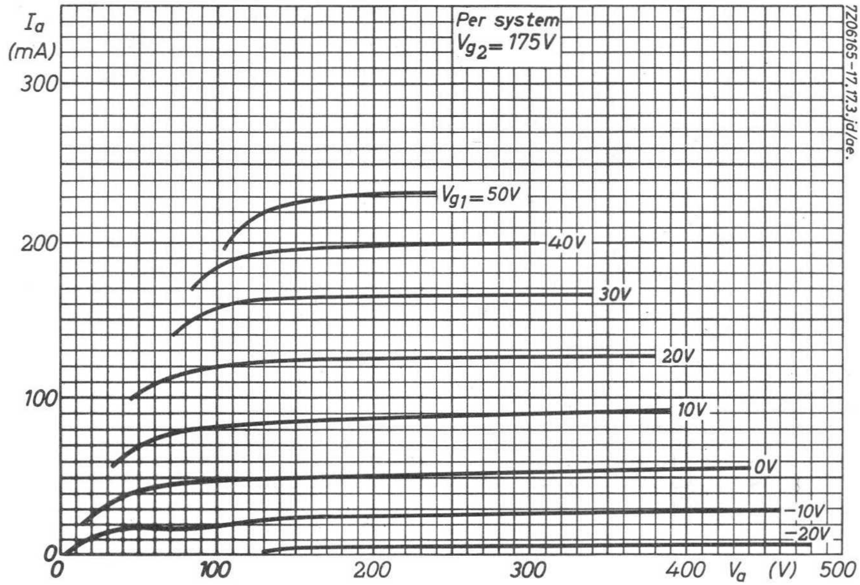
QQC04/15



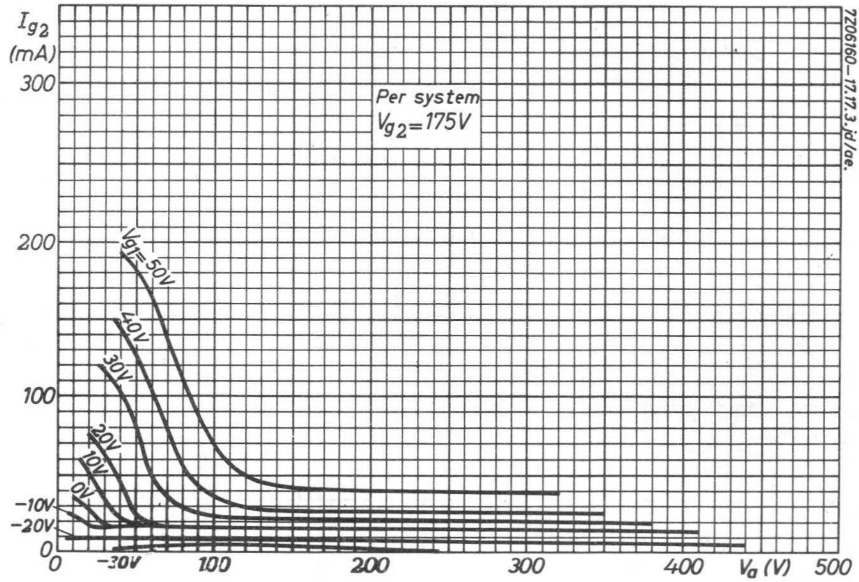
I_{g1} (mA)
30
20
10
0
0
100
200
300
400
V_a (V)
500
Per system
$V_{g2} = 175$ V
$V_{g1} = 50$ V
40V
30V
20V
10V
7Z06162-17.17.3.jd/ae.



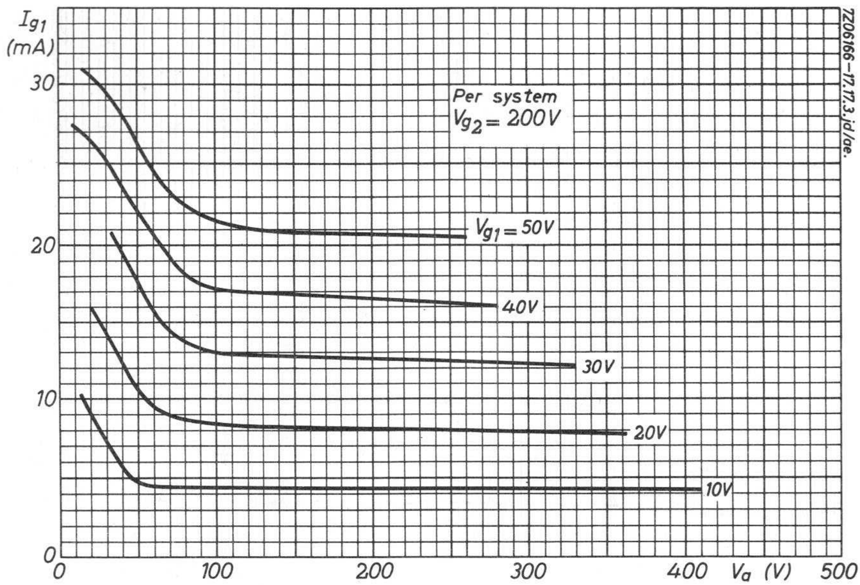
7Z06167-17.17.3.jd/ae.
0.23A
20mA
0.2A
15mA
10mA
0.15A
0.05A
0A
0.1A
5mA
25mA
30mA
0.15A
0.1A
0.05A
0.02A
Per system
$V_{g2} = 175$V
$I_a = c$
$I_{g1} = c$
$I_{g2} = c$
400
V_a (V)
300
200
100
0
60
V_{g1} (V)
40
20
0
-20
-40
-60
-80

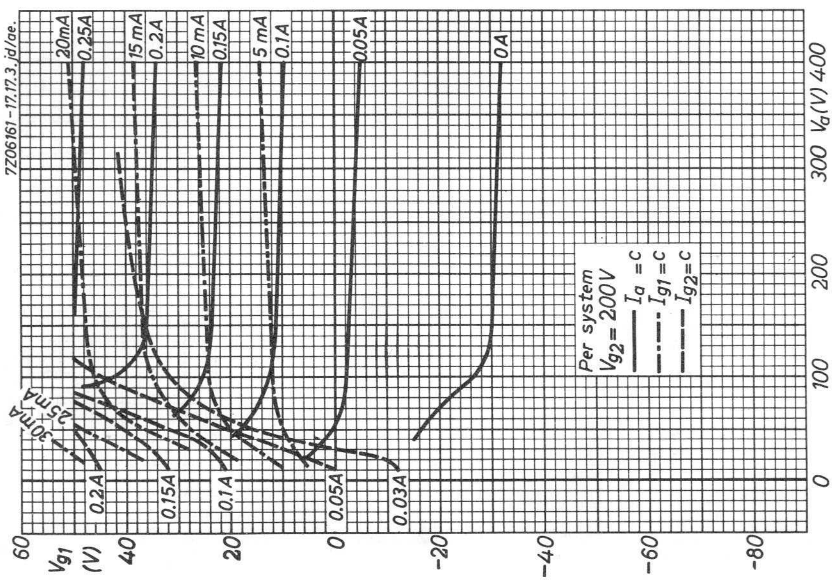


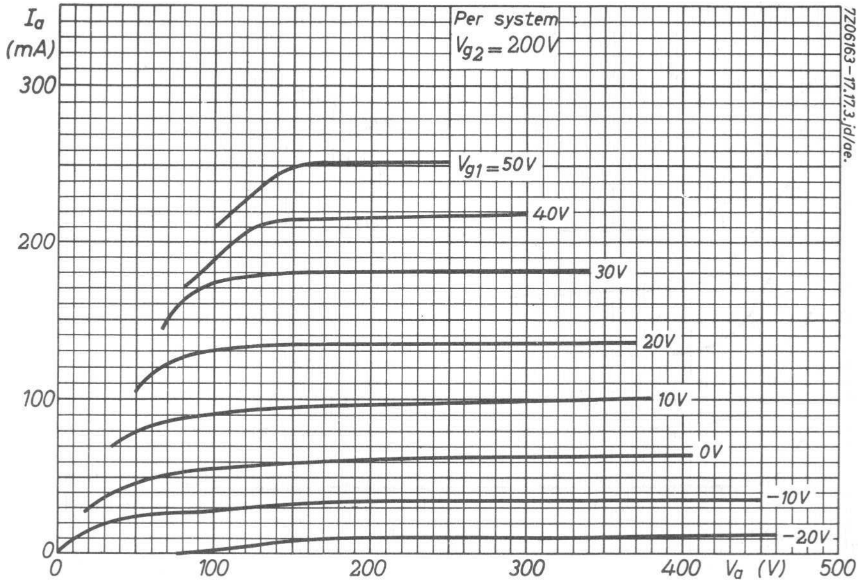
Ia (mA)
Per system
Vg2 = 175V
Vg1 = 50V
40V
30V
20V
10V
0V
−10V
−20V
0
100
200
300
400
500
Va (V)
7Z06165-17.17.3.id/ae.



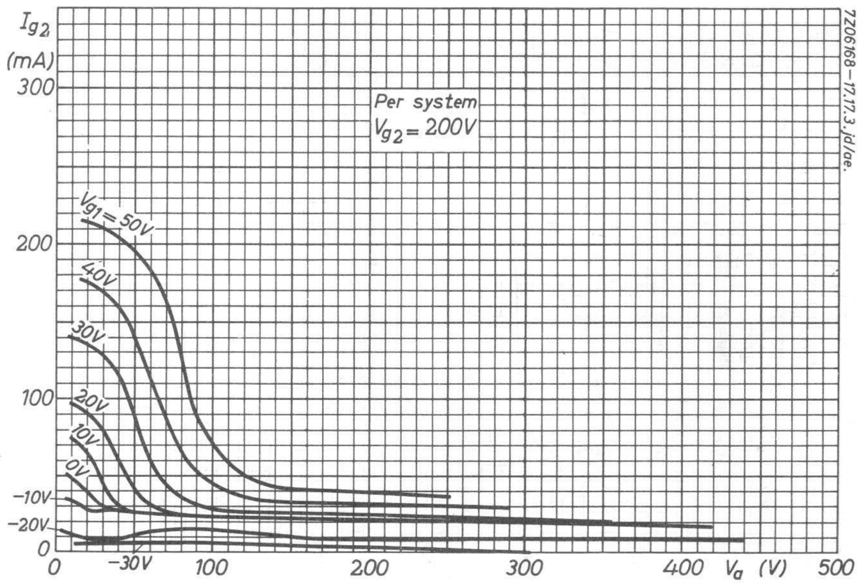
Ig2 (mA)
Per system
Vg2 = 175V
Vg1 = 50V
40V
30V
20V
10V
0V
−10V
−20V
−30V
0
100
200
300
400
500
Va (V)
7Z06160-17.17.3.id/ae.


I_{g1}
(mA)
30
20
10
0
Per system
V_{g2} = 200V
V_{g1} = 50V
40V
30V
20V
10V
0
100
200
300
400
V_a (V)
500
7Z06166-17.17.3.jd/ae.


7Z06161-17.17.3.jd/ae.
20mA
0.25A
15 mA
0.2A
10mA
0.15A
5 mA
0.1A
0.05A
0A
30mA
25mA
0.2A
0.15A
0.1A
0.05A
0.03A
Per system
V_{g2} = 200V
I_a = c
I_{g1} = c
I_{g2} = c
400
V_a (V)
300
200
100
0
60
V_{g1}
(V)
40
20
0
-20
-40
-60
-80



Ia
(mA)
300
200
100
0
Per system
Vg2 = 200V
Vg1 = 50V
40V
30V
20V
10V
0V
−10V
−20V
0
100
200
300
400
Va (V)
500
7Z06163−17.17.3.jd/ae.



Ig2
(mA)
300
200
100
0
Per system
Vg2 = 200V
Vg1 = 50V
40V
30V
20V
10V
0V
−10V
−20V
−30V
0
100
200
300
400
Va (V)
500
7Z06168−17.17.3.jd/ae.

A.F. CLASS B AMPLIFIER AND MODULATOR (continued)

I.C.A.S. **LIMITING VALUES** (Absolute limits), intermittent service

Anode voltage	V_a	=	max.	600	V
Anode input power	W_{ia}	=	max.	2x24	W
Anode dissipation	W_a	=	max.	2x8	W
Anode current	I_a	=	max.	2x40	mA
Grid No.2 voltage	V_{g_2}	=	max.	250	V
Grid No.2 dissipation	W_{g_2}	=	max.	7	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	200	V

I.C.A.S. **OPERATING CONDITIONS**, intermittent service
two systems in push-pull

Heater voltage	V_f	=	6.3 [1]		V
Anode voltage	V_a	=	600		V
Grid No.2 voltage	V_{g_2}	=	200		V
Grid No.1 voltage	V_{g_1}	=	−24		V
Load resistance	$R_{aa'\sim}$	=	25		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	0	85	V
Anode current	I_a	=	2x3.0	2x33.5	mA
Grid No.2 current	I_{g_2}	=	2x0.18	2x4.5	mA
Grid No.1 current	I_{g_1}	=	0	2x1.2	mA
Anode input power	W_{ia}	=	2x1.8	2x20.1	W
Anode dissipation	W_a	=	2x1.8	2x6	W
Output power	W_o	=	0	28.2	W
Total harmonic distortion	d_{tot}	=	−	5	%
Efficiency	η	=	−	70	%

[1]) D.C. voltage

7Z2 2998

A.F. CLASS B AMPLIFIER AND MODULATOR (continued)

C.C.S. OPERATING CONDITIONS, continuous service
two systems in push-pull

Heater voltage	V_f	=	6.3 [1]		6.3 [1]		V
Anode voltage	V_a	=	350		250		V
Grid No.2 voltage	V_{g_2}	=	200		175		V
Grid No.1 voltage	V_{g_1}	=	−24		−20		V
Load resistance	$R_{aa'\sim}$	=	12		8		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	0	104	0	100	V
Anode current	I_a	=	2x2.5	2x37.5	2x2.9	2x36	mA
Grid No.2 current	I_{g_2}	=	2x0.14	2x5.5	2x0.2	2x5	mA
Grid No.1 current	I_{g_1}	=	0	2x1.4	0	2x1.5	mA
Anode input power	W_{ia}	=	2x0.88	2x13.1	2x0.71	2x9	W
Anode dissipation	W_a	=	2x0.88	2x5.1	2x0.71	2x4.5	W
Output power	W_o	=	0	16	0	9	W
Total distortion	d_{tot}	=	–	5	–	5	%
Efficiency	η	=	–	61	–	50	%

[1]) D.C. voltage

7Z2 2997

A.F. CLASS B AMPLIFIER AND MODULATOR

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]		6.3 [1]		V
Anode voltage	V_a	=	450		400		V
Grid No.2 voltage	V_{g_2}	=	200		200		V
Grid No.1 voltage	V_{g_1}	=	-24		-24		V
Load resistance	$R_{aa'\sim}$	=	20		16		kΩ
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	0	94	0	94	V
Anode current	I_a	=	2x2.8	2x32.5	2x2.7	2x35	mA
Grid No.2 current	I_{g_2}	=	2x0.16	2x5	2x0.15	2x5.3	mA
Grid No.1 current	I_{g_1}	=	0	2x1.1	0	2x1.3	mA
Anode input power	W_{ia}	=	2x1.3	2x14.6	2x1.1	2x14	W
Anode dissipation	W_a	=	2x1.3	2x5.6	2x1.1	2x5.5	W
Output power	W_o	=	0	18	0	17	W
Total distortion	d_{tot}	=	-	5	-	5	%
Efficiency	η	=	-	61.5	-	60.5	%

[1]) D.C. voltage

7Z2 2996

R.F. CLASS C FREQUENCY DOUBLER (continued)

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f		up to 186	up to 300	MHz
Anode voltage	V_a	=	max. 600	max. 450	V
Anode input power	W_{ia}	=	max. 2x16	max. 2x12	W
Anode dissipation	W_a	=	max. 2x8		W
Anode current	I_a	=	max. 2x40		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 7		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA

I.C.A.S. OPERATING CONDITIONS, intermittent service; one system

Frequency	f	=	93/186	93/186	MHz
Anode voltage	V_a	=	400	250	V
Grid No.2 voltage	V_{g_2}	=	200	200	V
Grid No.1 voltage	V_{g_1}	=	-175	-175	V
Anode current	I_a	=	40	40	mA
Grid No.2 current	I_{g_2}	=	2.5	3	mA
Grid No.1 current	I_{g_1}	=	1.5	2	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	220	230	V
Grid No.1 input power	W_{ig_1}	=	0.3	0.42	W
Grid No.2 dissipation	W_{g_2}	=	0.5	0.6	W
Anode input power	W_{ia}	=	16	10	W
Anode dissipation	W_a	=	8	5.1	W
Output power	W_o	=	8	4.9	W
Efficiency	η	=	50	49	%

7Z2 2995

R.F. CLASS C FREQUENCY DOUBLER

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to 186	up to 300	MHz
Anode voltage	V_a	=	max. 600	max. 450	V
Anode input power	W_{ia}	=	max. 2x12	max. 2x9	W
Anode dissipation	W_a	=	max. 2x6		W
Anode current	I_a	=	max. 2x30		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 7		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA

C.C.S. OPERATING CONDITIONS, continuous service; one system

Frequency	f	=	93/186	93/186	MHz
Anode voltage	V_a	=	400	250	V
Grid No.1 voltage	V_{g_1}	=	-175	-175	V
Grid No.2 voltage	V_{g_2}	=	200	200	V
Anode current	I_a	=	30	30	mA
Grid No.1 current	I_{g_1}	=	1.2	1.5	mA
Grid No.2 current	I_{g_2}	=	1.5	2	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	210	220	V
Grid No.1 input power	W_{ig_1}	=	0.23	0.3	W
Grid No.2 dissipation	W_{g_2}	=	0.3	0.4	W
Anode input power	W_{ia}	=	12	7.5	W
Anode dissipation	W_a	=	5.5	3.5	W
Output power	W_o	=	6.5	4	W
Efficiency	η	=	54	53	%

7Z2 2994

R.F. CLASS C FREQUENCY TRIPLER (continued)

I.C.A.S. **LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f		up to 186	up to 300	MHz
Anode voltage	V_a	=	max. 600	max. 450	V
Anode input power	W_{ia}	=	max. 2x16	max. 2x12	W
Anode dissipation	W_a	=	max. 2x8		W
Anode current	I_a	=	max. 2x40		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 7		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA

I.C.A.S. **OPERATING CONDITIONS**, intermittent service
two systems in push-pull

Frequency	f	=	62/186	62/186	MHz
Anode voltage	V_a	=	400	250	V
Grid No.2 voltage	V_{g_2}	=	200	200	V
Grid No.1 voltage	V_{g_1}	=	−175	−175	V
Anode current	I_a	=	2x32.5	2x40	mA
Grid No.2 current	I_{g_2}	=	4	6.5	mA
Grid No.1 current	I_{g_1}	=	2x1.1	2x1.5	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	430	430	V
Grid No.1 input power	W_{ig_1}	=	2x0.22	2x0.3	W
Grid No.2 dissipation	W_{g_2}	=	0.8	1.3	W
Anode input power	W_{ia}	=	2x13	2x10	W
Anode dissipation	W_a	=	2x8	2x6.9	W
Output power	W_o	=	10	6.2	W
Efficiency	η	=	38.5	31	%

7Z2 2993

R.F. CLASS C FREQUENCY TRIPLER

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to 186	up to 300	MHz
Anode voltage	V_a	=	max. 600	max. 450	V
Anode input power	W_{ia}	=	max. 2x12	max. 2x9	W
Anode dissipation	W_a	=	max. 2x6		W
Anode current	I_a	=	max. 2x30		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 7		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA

C.C.S. OPERATING CONDITIONS, continuous service
two systems in push-pull

Frequency	f	=	62/186	62/186	MHz
Anode voltage	V_a	=	400	250	V
Grid No.2 voltage	V_{g_2}	=	200	200	V
Grid No.1 voltage	V_{g_1}	=	-175	-175	V
Anode current	I_a	=	2x24	2x30	mA
Grid No.2 current	I_{g_2}	=	3	6	mA
Grid No.1 current	I_{g_1}	=	2x0.6	2x1.1	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	430	430	V
Grid No.1 input power	W_{ig_1}	=	2x0.12	2x0.22	W
Grid No.2 dissipation	W_{g_2}	=	0.6	1.2	W
Anode input power	W_{ia}	=	2x9.6	2x7.5	W
Anode dissipation	W_a	=	2x6	2x5.2	W
Output power	W_o	=	7.2	4.6	W
Efficiency	η	=	37.5	31	%

7Z2 2992

R.F. CLASS C ANODE AND SCREEN GRID MODULATION (continued)

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f		up to 186	up to 300	MHz
Anode voltage	V_a	=	max. 480	max. 360	V
Anode input power	W_{ia}	=	max. 2x15.5	max. 2x7	W
Anode dissipation	W_a	=	max. 2x5		W
Anode current	I_a	=	max. 2x32		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 4.5		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA

I.C.A.S. OPERATING CONDITIONS, intermittent service
two systems in push-pull

Frequency	f	=	60	186	MHz
Anode voltage	V_a	=	250	250	V
Grid No.2 resistor	R_{g_2}	=	10	10	kΩ
Grid No.1 voltage	V_{g_1}	=	−70	−70	V
Anode current	I_a	=	2x26.5	2x26.5	mA
Grid No.2 current	I_{g_2}	=	9	9	mA
Grid No.1 current	I_{g_1}	=	2x1.8	2x1.5	mA
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	=	110	110	V
Grid No.1 input power	W_{ig_1}	=	2x0.18	2x0.15	W
Grid No.2 dissipation	W_{g_2}	=	1.5	1.5	W
Anode input power	W_{ia}	=	2x6.6	2x6.6	W
Anode dissipation	W_a	=	2x2.5	2x2.7	W
Output power	W_o	=	8.2	7.8	W
Efficiency	η	=	62	59	%
Modulation factor	m	=	100	100	%
Modulation power	W_{mod}	=	7	7	W

7Z2 2991

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f		up to	186	up to	300	MHz
Anode voltage	V_a	=	max.	480	max.	360	V
Anode input power	W_{ia}	=	max.	2x11.5	max.	2x5.25	W
Anode dissipation	W_a	=		max. 2x4			W
Anode current	I_a	=		max. 2x25			mA
Grid No.2 voltage	V_{g_2}	=		max. 250			V
Grid No.2 dissipation	W_{g_2}	=		max. 4.5			W
Negative grid No.1 voltage	$-V_{g_1}$	=		max. 200			V
Grid No.1 current	I_{g_1}	=		max. 2x5			mA

C.C.S. OPERATING CONDITIONS, continuous service
two systems in push-pull

Frequency	f	=	60	60	60	186	MHz
Anode voltage	V_a	=	450	400	250	250	V
Grid No.2 resistor	R_{g_2}	=	18	18	10	10	kΩ
Grid No.1 voltage	V_{g_1}	=	−80	−80	−70	−70	V
Anode current	I_a	=	2x25	2x25	2x19.5	2x19.5	mA
Grid No.2 current	I_{g_2}	=	14	11	11	11	mA
Grid No.1 current	I_{g_1}	=	2x1.0	2x0.8	2x1.5	2x1.5	mA
Peak grid No.1 voltage	$V_{g_{1p}}$	=	83	83	110	110	V
Grid No.1 input power	W_{ig_1}	=	2x0.08	2x0.06	2x0.15	2x0.15	W
Grid No.2 dissipation	W_{g_2}	=	2.8	2.2	1.6	1.6	W
Anode input power	W_{ia}	=	2x11.25	2x10	2x4.9	2x4.9	W
Anode dissipation	W_a	=	2x2.5	2x2.3	2x1.8	2x1.9	W
Output power	W_o	=	17.5	15.4	6.2	6.0	W
Efficiency	η	=	77.5	77	63	61	%
Modulation factor	m	=	100	100	100	100	%
Modulation power	W_{mod}	=	11.5	10	5	5	W

7Z2 2990

R.F. CLASS C TELEGRAPHY (continued)

I.C.A.S. OPERATING CONDITIONS, intermittent service
two systems in push-pull

Frequency	f	=	60	60	60	MHz
Anode voltage	V_a	=	600	400	250	V
Grid No.2 voltage	V_{g_2}	=	200	200	175	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	−70	V
Anode current	I_a	=	2x40	2x40	2x40	mA
Grid No.2 current	I_{g_2}	=	5.5	6.0	7.5	mA
Grid No.1 current	I_{g_1}	=	2x1.2	2x2.0	2x2.5	mA
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	=	220	220	230	V
Grid No.1 input power	W_{ig_1}	=	2x0.12	2x0.22	2x0.26	W
Grid No.2 dissipation	W_{g_2}	=	1.1	1.2	1.3	W
Anode input power	W_{ia}	=	2x24	2x16	2x10	W
Anode dissipation	W_a	=	2x6.5	2x4.4	2x3.0	W
Output power	W_o	=	35	23.2	14.0	W
Efficiency	η	=	73	72.5	70	%

Frequency	f	=	186	186	186	MHz
Anode voltage	V_a	=	600	400	250	V
Grid No.2 voltage	V_{g_2}	=	200	200	175	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	−70	V
Anode current	I_a	=	2x40	2x40	2x40	mA
Grid No.2 current	I_{g_2}	=	4.5	5.0	7.5	mA
Grid No.1 current	I_{g_1}	=	2x1.3	2x1.5	2x2.0	mA
Input A.C. voltage, peak to peak	$V_{g_1 g_1' p}$	=	220	220	230	V
Grid No.1 input power	W_{ig_1}	=	2x0.13	2x0.15	2x0.26	W
Grid No.2 dissipation	W_{g_2}	=	0.9	1.0	1.3	W
Anode input power	W_{ia}	=	2x24	2x16	2x10	W
Anode dissipation	W_a	=	2x7.2	2x5	2x3.4	W
Output power	W_o	=	33.6	22	13.2	W
Efficiency	η	=	70[1]	69	66	%

[1]) In order to prevent overheating a low-velocity air flow should be directed on the bulb and the base

7Z2 2989

R.F. CLASS C TELEGRAPHY (continued)

C.C.S. **OPERATING CONDITIONS**, continuous service
two systems in push-pull

Frequency	f	=	186	186	186	MHz
Anode voltage	V_a	=	600	400	250	V
Grid No.1 voltage	V_{g_1}	=	−80	−80	−70	V
Grid No.2 voltage	V_{g_2}	=	200	200	175	V
Anode current	I_a	=	2x30	2x30	2x30	mA
Grid No.1 current	I_{g_1}	=	2x1.0	2x1.0	2x1.5	mA
Grid No.2 current	I_{g_2}	=	3.0	3.5	4.5	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	=	210	210	220	V
Grid No.1 input power	W_{ig_1}	=	2x0.1	2x0.1	2x0.15	W
Grid No.2 dissipation	W_{g_2}	=	0.6	0.7	0.8	W
Anode input power	W_{ia}	=	2x18	2x12	2x7.5	W
Anode dissipation	W_a	=	2x5.2	2x3.6	2x2.4	W
Output power	W_o	=	25.6	16.8	10.2	W
Efficiency	η	=	71[1])	70	68	%

I.C.A.S. **LIMITING VALUES** (Absolute limits), intermittent service

Frequency	f		up to 186	up to 300	MHz
Anode voltage	V_a	=	max. 600	max. 450	V
Anode input power	W_{ia}	=	max. 2x24	max. 2x12	W
Anode dissipation	W_a	=	max. 2x8		W
Anode current	I_a	=	max. 2x40		mA
Grid No.2 voltage	V_{g_2}	=	max. 250		V
Grid No.2 dissipation	W_{g_2}	=	max. 7		W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200		V
Grid No.1 current	I_{g_1}	=	max. 2x5		mA

[1]) In order to prevent overheating a low-velocity air flow should be directed on the bulb and the base

7Z2 2988

R.F. CLASS C TELEGRAPHY

C.C.S. LIMITING VALUES (Absolute limits), continuous service

Frequency	f	up to 186	up to 300	MHz
Anode voltage	V_a	= max. 600	max. 450	V
Anode input power	W_{ia}	= max. 2x18	max. 2x9	W
Anode dissipation	W_a	= max. 2x6		W
Anode current	I_a	= max. 2x30		mA
Grid No.2 voltage	V_{g_2}	= max. 250		V
Grid No.2 dissipation	W_{g_2}	= max. 7		W
Negative grid No.1 voltage	$-V_{g_1}$	= max. 200		V
Grid No.1 current	I_{g_1}	= max. 2x5		mA

C.C.S. OPERATING CONDITIONS, continuous service
two systems in push-pull

Frequency	f	= 60	60	60	MHz
Anode voltage	V_a	= 600	400	250	V
Grid No.2 voltage	V_{g_2}	= 200	200	175	V
Grid No.1 voltage	V_{g_1}	= −80	−80	−70	V
Anode current	I_a	= 2x30	2x30	2x30	mA
Grid No.2 current	I_{g_2}	= 6	6	6.5	mA
Grid No.1 current	I_{g_1}	= 2x1.0	2x1.2	2x1.8	mA
Input A.C. voltage, peak to peak	$V_{g_1g_1'p}$	= 210	210	210	V
Grid No.1 input power	W_{ig_1}	= 2x0.1	2x0.11	2x0.17	W
Grid No.2 dissipation	W_{g_2}	= 1.2	1.2	1.1	W
Anode input power	W_{ia}	= 2x18	2x12	2x7.5	W
Anode dissipation	W_a	= 2x4.7	2x3.2	2x2.2	W
Output power	W_o	= 26.6	17.6	10.6	W
Efficiency	η	= 74	73	71	%

7Z2 2987

CAPACITANCES

	per system			
Anode to all other elements except grid No.1	C_a	=	3.3	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	8.5	pF
Anode to grid No.1	C_{ag_1}	=	0.05	pF
	in push-pull			
Output capacitance	C_o	=	1.7	pF
Input capacitance	C_i	=	5.7	pF

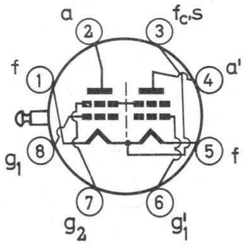
MECHANICAL DATA

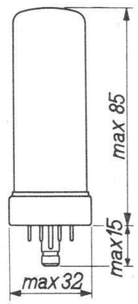
Dimensions in mm

Base : loctal

Socket : 40213

Net weight: 40 g





Mounting position: Vertical with base up or down
Horizontal with pins 1 and 5 in a horizontal plane

TEMPERATURE LIMITS (Absolute limits)

Pin temperature	=	max.	100	°C
Bulb temperature	=	max.	200	°C

7Z2 2986

R.F. DOUBLE TETRODE FOR MOBILE EQUIPMENT

QUICK REFERENCE DATA

λ	Freq.	C telegr.			C_{ag_2} mod.		
		V_a	W_o [1]		V_a	W_o [1]	
(m)	(MHz)	(V)	(W)		(V)	(W)	
			CCS	ICAS		CCS	ICAS
5	60	600	26.6	35	450	17.5	
		400	17.6	23.2	400	15.4	
		250	10.6	14.0	250	6.2	8.2
1.6	186	600	25.6	33.6	250	6.0	7.8
		400	16.8	22.0			
		250	10.2	13.2			
		C fr.mult.					
4.8/1.6	62/186	400	7.2	10	Tripler		
		250	4.6	6.2			
3.2/1.6	93/186	400	6.5	8.0	Doubler [2]		
		250	4.0	4.9			

B mod. [1]	
V_a (V)	W_o (W)
C.C.S.	
450	18
400	17
350	16
250	9
I.C.A.S.	
600	28.2

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=	3-3.15	6-6.3	V
Filament current	I_f	=	1.36	0.68	A
Pins			3-(1+5)	1-5	

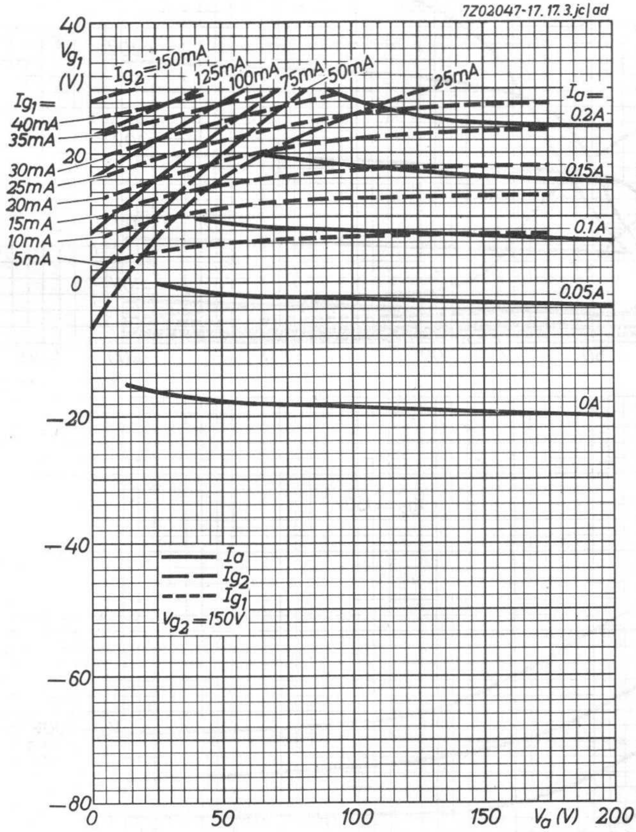
TYPICAL CHARACTERISTICS

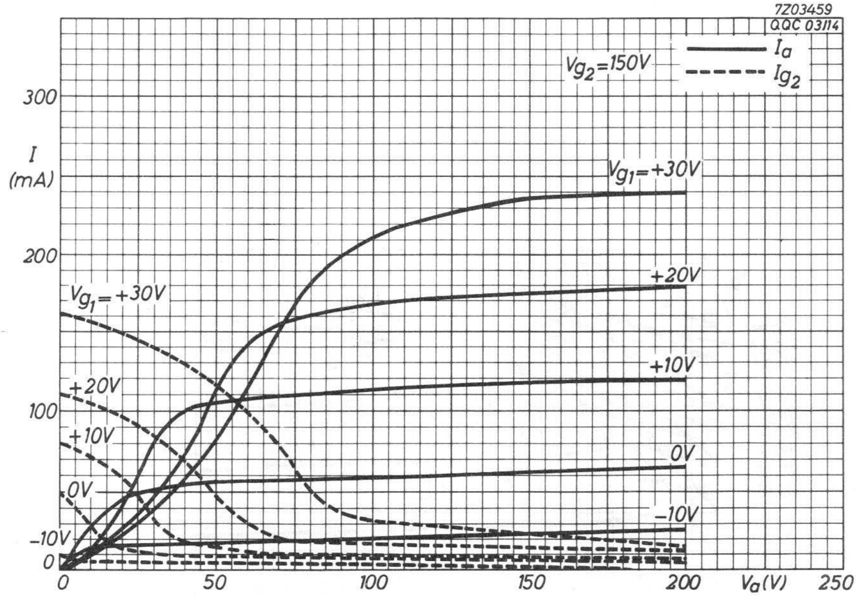
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	7.5	
Mutual conductance [2]	S (I_a = 20 mA)	=	2	mA/V

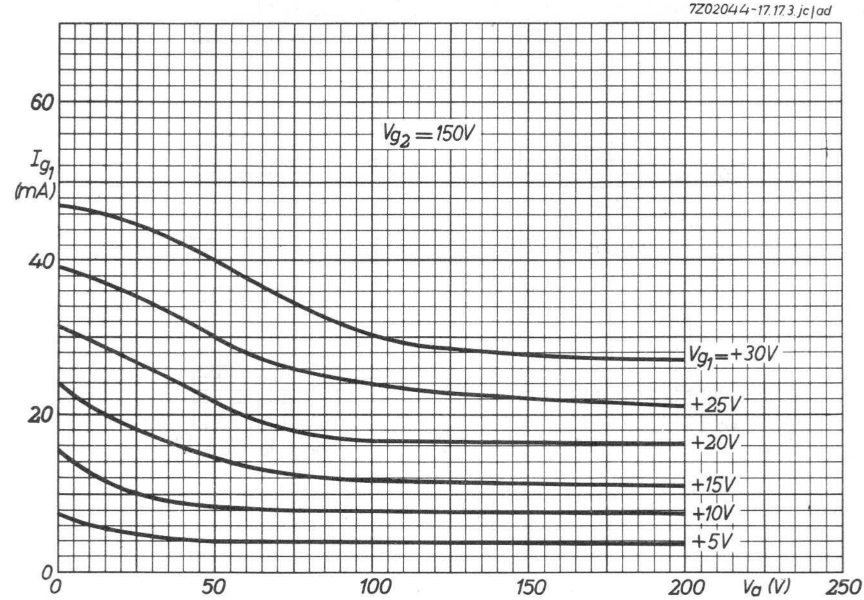
[1] C.C.S. = continuous service
I.C.A.S. = intermittent service

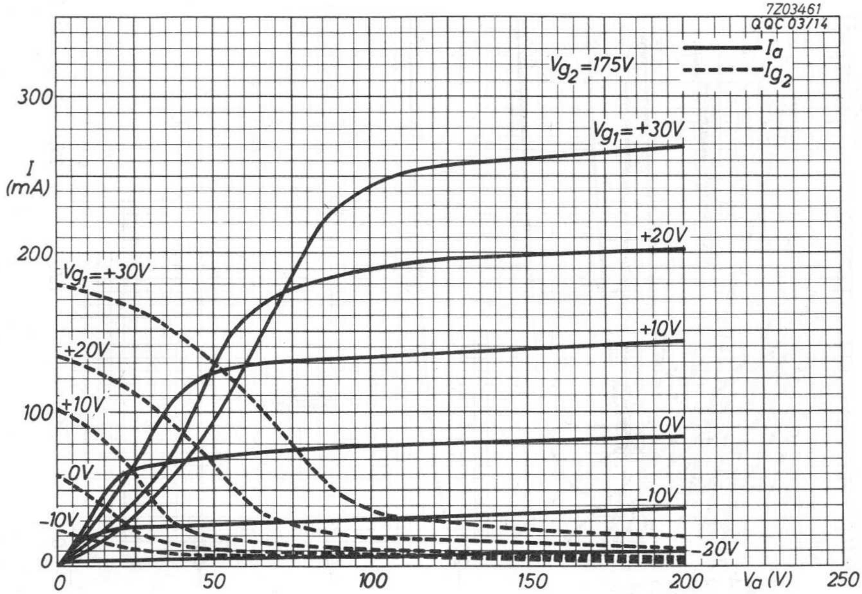
[2] One system

7Z2 2985


7Z02047-17.17.3.jc|ad
40
V_{g1}
(V)
I_{g1}=
40mA
35mA
20
30mA
25mA
20mA
15mA
10mA
5mA
0
−20
−40
−60
−80
I_{g2}=150mA
125mA
100mA
75mA
50mA
25mA
I_a=
0.2A
0.15A
0.1A
0.05A
0A
I_a
I_{g2}
I_{g1}
V_{g2}=150V
0
50
100
150
V_a (V)
200


7Z03459
QQC 03/14
V_{g2}=150V
I_a
I_{g2}
300
I
(mA)
200
100
-10V
0
V_{g1}=+30V
+20V
+10V
0V
-10V
V_{g1}=+30V
+20V
+10V
0V
0
50
100
150
200
V_a(V)
250


7Z02044-17.17.3.jc|ad
60
I_{g1}
(mA)
40
20
0
V_{g2}=150V
V_{g1}=+30V
+25V
+20V
+15V
+10V
+5V
0
50
100
150
200
V_a (V)
250



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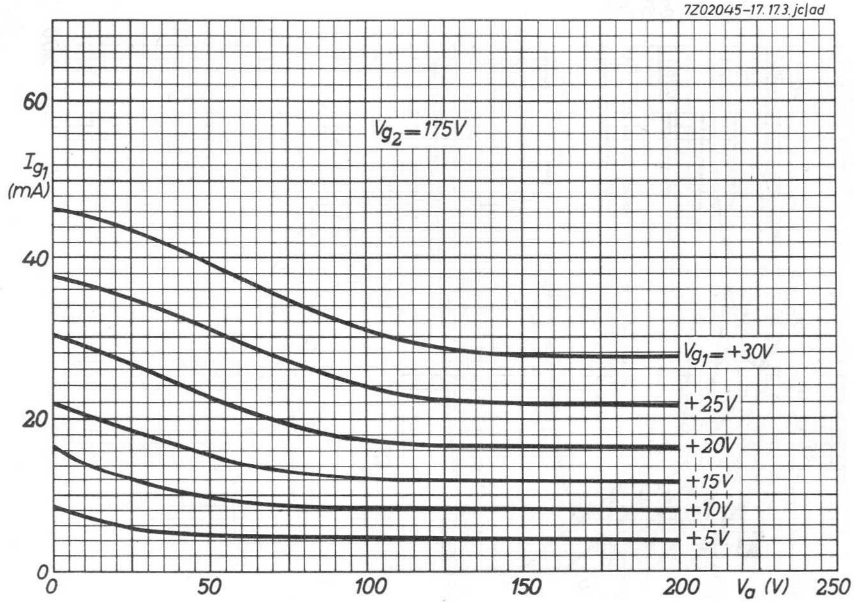
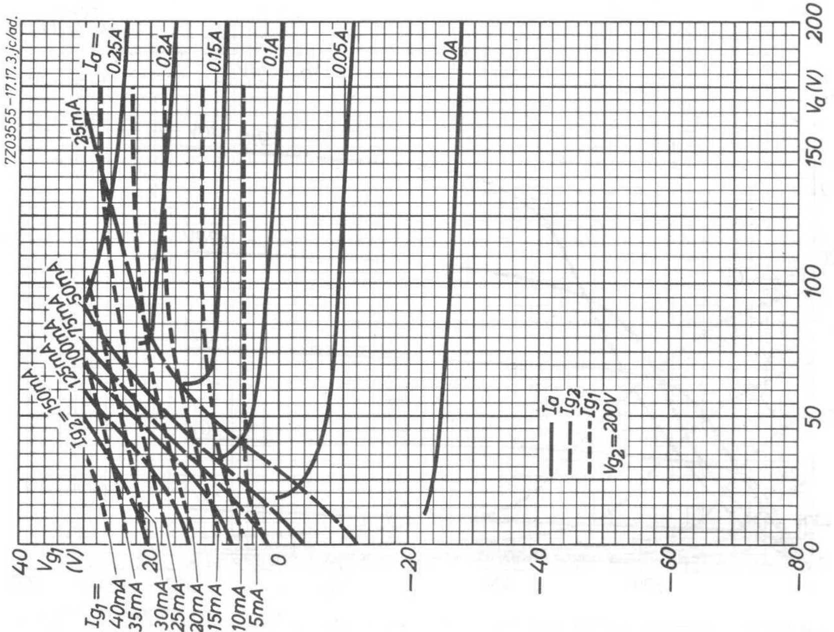
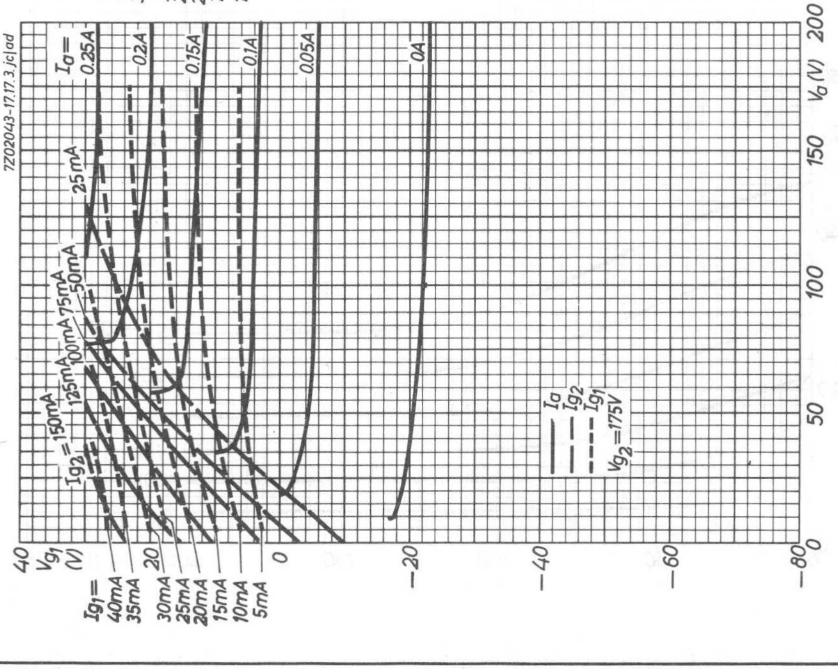
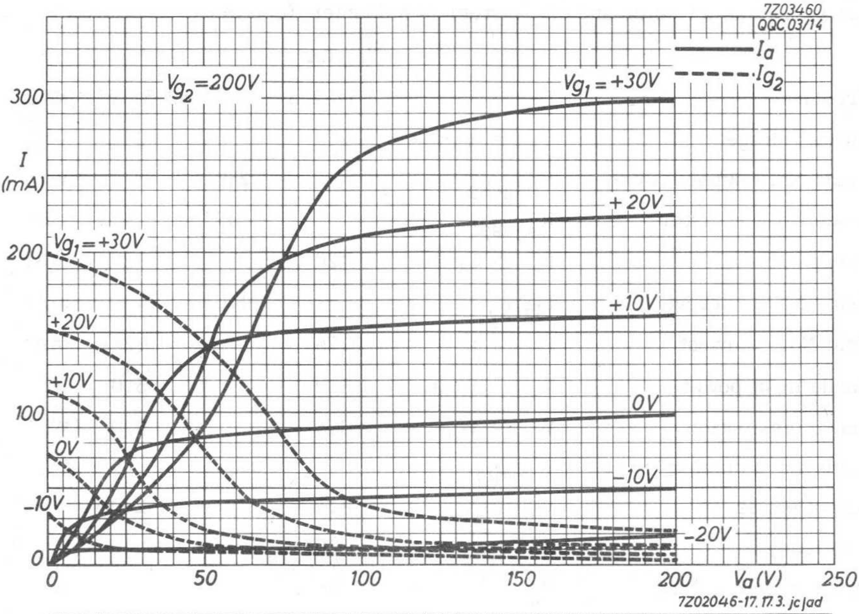
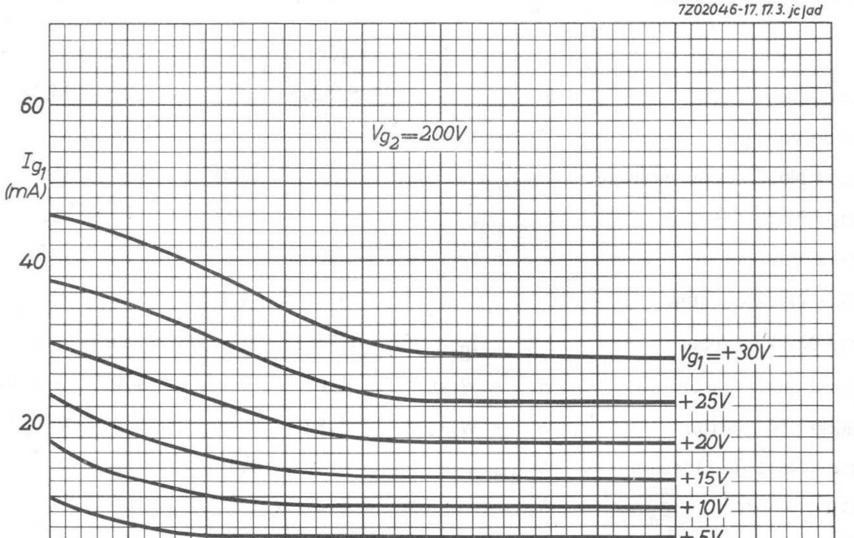



7Z03555-17.17.3.jc/ad.
I_a =
0.25A
0.2A
0.15A
0.1A
0.05A
0A
I_{g2} = 150mA
125mA
100mA
75mA
50mA
25mA
I_{g1} =
40mA
35mA
30mA
25mA
20mA
15mA
10mA
5mA
I_a
I_{g2}
I_{g1}
V_{g2}=200V
V_{g1} (V)
V_a (V)


7Z02043-17.17.3.jc|ad
I_a =
0.25A
0.2A
0.15A
0.1A
0.05A
0A
I_{g2} = 150mA
125mA
100mA
75mA
50mA
25mA
I_{g1} =
40mA
35mA
30mA
25mA
20mA
15mA
10mA
5mA
I_a
I_{g2}
I_{g1}
V_{g2}=175V
V_{g1} (V)
V_a (V)



7Z03460
QQC 03/14
I_a
I_{g2}
V_{g2}=200V
V_{g1} = +30V
+20V
+10V
0V
−10V
−20V
V_{g1}=+30V
+20V
+10V
0V
−10V
I (mA)
300
200
100
0
0
50
100
150
200
V_a (V)
250
7Z02046-17. 17.3. jc/ad



V_{g2}=200V
I_{g1} (mA)
60
40
20
0
0
50
100
150
200
V_a (V)
250
V_{g1}=+30V
+25V
+20V
+15V
+10V
+5V

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

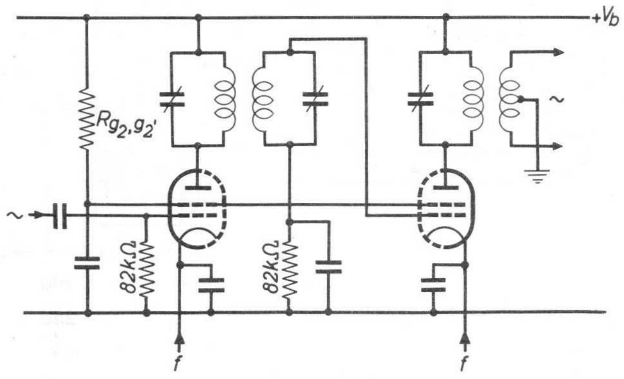
7Z2 3031

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.

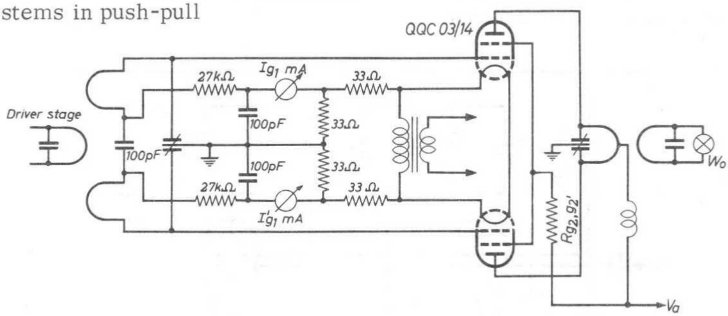
7Z2 3030

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY

I.C.A.S. LIMITING VALUES (Absolute limits), intermittent service

Frequency	f				up to	200	MHz
Anode voltage	V_a	=	$V_{a'}$	=	max.	300	V
Anode dissipation	W_a	=	$W_{a'}$	=	max.	7	W
Anode current	I_a	=	$I_{a'}$	=	max.	55	mA
Grids No.2 voltage	$V_{g_2, g_2'}$			=	max.	200	V
Grids No.2 dissipation	$W_{g_2+g_2'}$			=	max.	2x1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	$-V_{g_1'}$	=	max.	150	V
Grid No.1 dissipation	W_{g_1}	=	$W_{g_1'}$	=	max.	0.2	W
Grid No.1 current	I_{g_1}	=	$I_{g_1'}$	=	max.	4	mA
Grid No.1 circuit resistance	R_{g_1}	=	$R_{g_1'}$	=	max.	100	kΩ
Cathode current	I_k			=	max.	2x65	mA
Peak cathode current	I_{kp}			=	max.	2x300	mA

I.C.A.S. OPERATING CONDITIONS, intermittent service; two systems in push-pull



Frequency	f			=	200	200	MHz
Anode voltage	V_a	=	$V_{a'}$	=	250	200	V
Grids No.2 supply voltage	$V_{bg_2, g_2'}$			=	250	200	V
Grids No.2 resistor	$R_{g_2, g_2'}$			=	22	6.8	kΩ
Anode current	I_a	=	$I_{a'}$	=	45	45	mA
Grids No.2 current	$I_{g_2+g_2'}$			=	4.2	5.1	mA
Grid No.1 current	I_{g_1}	=	$I_{g_1'}$	=	1.5	1.5	mA
Anode input power	W_{ia}	=	$W_{ia'}$	=	11.2	9.0	W
Anode dissipation	W_a	=	$W_{a'}$	=	4.5	3.5	W
Grids No.2 dissipation	$W_{g_2+g_2'}$			=	0.65	0.85	W
Output power in load	W_ℓ			=	11	9.5	W

7Z2 3029

CAPACITANCES (without external shield)

Anode to all other elements except grid No.1	C_a	$= C_{a'}$	=	3.2 pF
Grid No.1 to all other elements except anode	C_{g_1}	$= C_{g_{1'}}$	=	6.8 pF
Anode to grid No.1	C_{ag_1}	$= C_{a'g_{1'}}$	<	0.1 pF
Anode of one system to grid No.1 of the other system	$C_{ag_{1'}}$	$= C_{a'g_1}$	<	0.13 pF
Between the grids No.1	$C_{g_1g_{1'}}$		=	1.9 pF
Between the anodes	$C_{aa'}$		=	0.09 pF

The tube has been internally neutralized up to 200 Mc/s

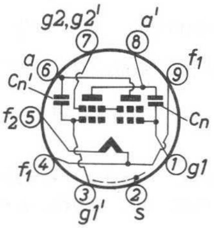
MECHANICAL DATA Dimensions in mm

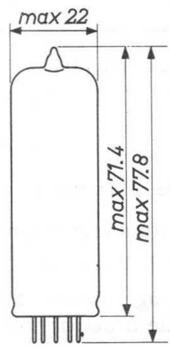
Base : Noval

→ Socket : 2422 502 01003

Tube retainer: 40647

Net weight : 16 g





Mounting position: If the tube is mounted with its main axis deviating from the vertical, it is recommended that the pins 2 and 7 be placed in a vertical plane

COOLING: radiation and convection
The use of a closed tube shield is not allowed

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	= max.	225 °C
Pin temperature	= max.	120 °C

7Z2 8830

R.F. QUICK HEATING DOUBLE TETRODE FOR MOBILE EQUIPMENT

QUICK REFERENCE DATA, intermittent service				
Freq. (MHz)	C telegr. / F.M. teleph. 1)		Tripler - doubler	
	V_a (V)	W_ℓ (W) 2)	V_a (V)	W_ℓ (W) 3)
200	250 200	11 9.5		
27.5/165			250 200	1.25 1.0

HEATING: direct; parallel supply; filament oxide-coated

Filament voltage	V_f	=	3.15	V ±10 %
Filament current	I_f	=	1.65	A

It is recommended that the filament be fed from a D.C.-A.C. converter

Cathode heating time for obtaining an output power of more than 70% of the ultimate power T_h = max. 1 sec.

The filament voltage should be switched on during the whole conversation period. Interruption of the filament voltage during this period is not recommended.

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	200	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	30	mA
Mutual conductance	S	=	3.2	mA/V
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	7.5	

1) Two systems in push-pull

2) Output power in the load according to circuit diagram on page 3

3) Output power in the load according to circuit diagram on page 4

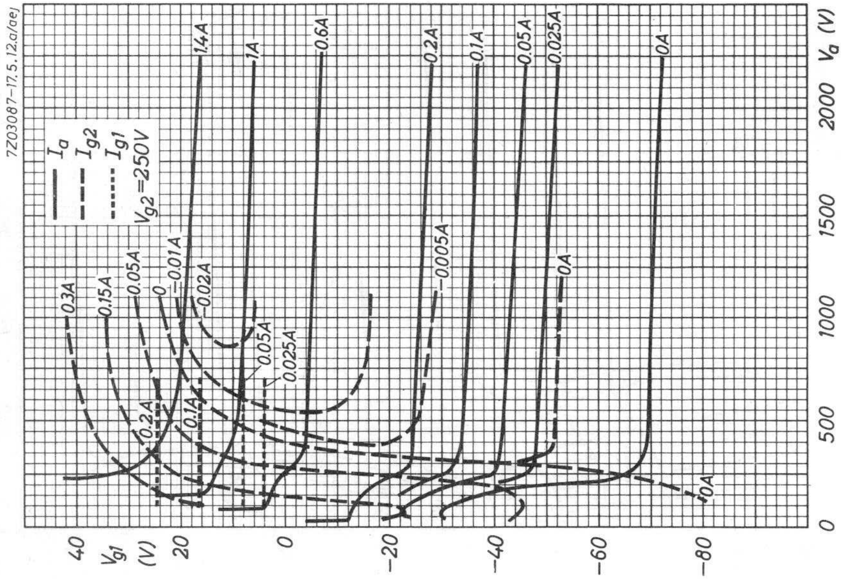
7Z2 3027

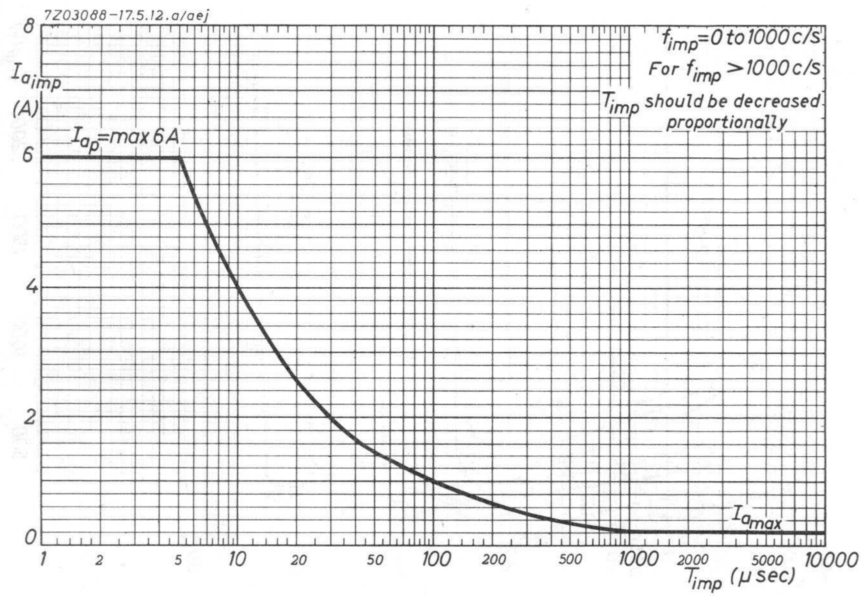
COAXIAL R.F. POWER TETRODE

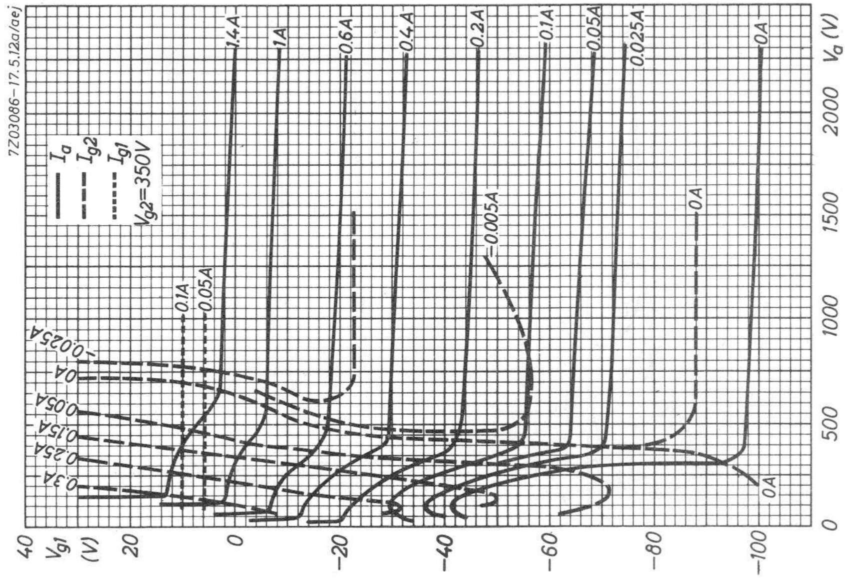
Heater voltage	V_f	=	26.5	V ± 10%
Heater current	I_f	=	0.58	A

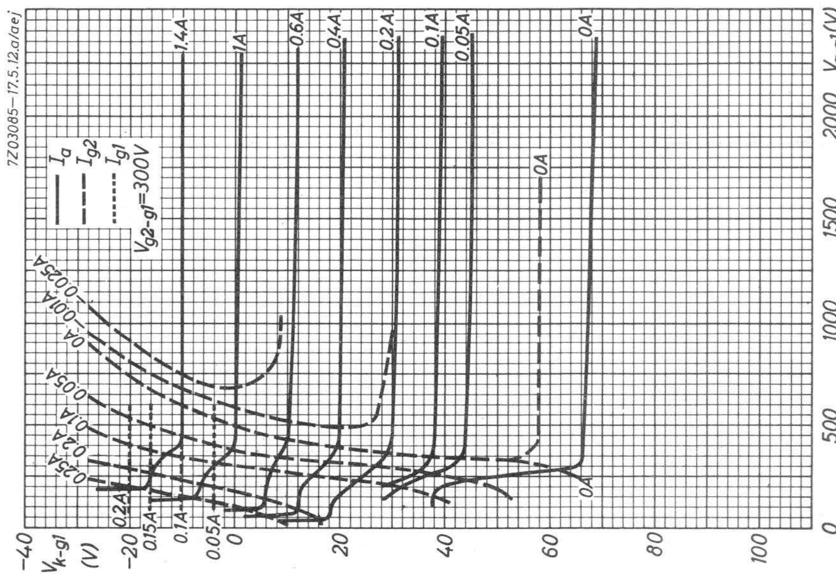
For further data and curves of this type
please refer to type QEL2/275

7Z2 2984


7Z03087-17.5.12.a/aej
I_a
I_{g2}
I_{g1}
V_{g2}=250V
1.4A
1A
0.6A
0.2A
0.1A
0.05A
0.025A
0A
0.3A
0.15A
0.05A
0
0.01A
0.02A
0.05A
0.025A
0.005A
0.2A
0.1A
V_a (V)
0
500
1000
1500
2000
V_{g1} (V)
40
20
0
−20
−40
−60
−80


7Z03088-17.5.12.a/aej
$I_{a_{imp}}$ (A)
I_{ap}=max 6A
f_{imp}=0 to 1000 c/s
For f_{imp} >1000 c/s
T_{imp} should be decreased proportionally
$I_{a_{max}}$
0
2
4
6
8
1
2
5
10
20
50
100
200
500
1000
2000
5000
10000
T_{imp} (μ sec)


7Z03086-17.5.12a/aej
I_a
I_{g2}
I_{g1}
V_{g2}=350V
V_{g1} (V)
V_a (V)
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0.025A
0A
-0.005A
0.3A
0.25A
0.15A
0.05A
0A
0.025A
0.1A
0.05A


7Z03085-17.5.12a/aej
I_a
I_{g2}
I_{g1}
V_{g2-g1}=300V
V_{k-g1} (V)
V_{a-g1} (V)
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0A
0.25A
0.2A
0.1A
0.05A
0A
0.01A
0.025A
0.2A
0.15A
0.1A
0.05A

A.F. POWER AMPLIFIER AND MODULATOR CLASS AB

LIMITING VALUES (Absolute limits)

Anode voltage	V_a	=	max.	2000	V
Anode current	I_a	=	max.	250	mA [1])
Anode input power	W_{ia}	=	max.	250	W [1])
Grid No.2 voltage	V_{g_2}	=	max.	400	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W [1])
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	kΩ
Peak heater to cathode voltage	V_{kf_p}	=	max.	150	V

OPERATING CONDITIONS (values for two tubes)

V_a	=	1000		1500		2000		V
V_{g_2}	=	350		350		350		V
V_{g_1}	=	-55		-55		-55		V
$R_{aa\sim}$	=	3500		6200		9500		Ω
$V_{g_1g_{1p}}$	=	0	100	0	100	0	100	V
I_{g_1}	=	0	0	0	0	0	0	mA
I_a	=	2x100	2x250	2x100	2x250	2x100	2x250	mA
I_{g_2}	=	0	2x10	0	2x8	0	2x5	mA
W_{ia}	=	2x100	2x250	2x150	2x375	2x200	2x500	W
W_a	=	2x100	2x130	2x150	2x160	2x200	2x200	W
W_o	=	0	240	0	430	0	600	W

[1]) Averaged over any low-frequency cycle of sine wave form.

7Z2 2897

R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE

Negative modulation, positive synchronisation

LIMITING VALUES (Absolute limits)

Frequency	f		54 to 216	MHz
Anode voltage	V_a	= max.	2000	V
Anode current	I_a	= max.	250	mA[1])
Anode dissipation	W_a	= max.	250	W
Grid No.2 voltage	V_{g_2}	= max.	400	V
Grid No.2 dissipation	W_{g_2}	= max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 dissipation	W_{g_1}	= max.	2	W
Peak heater to cathode voltage	V_{kf_p}	= max.	150	V

OPERATING CONDITIONS

Frequency	f		=	216	216	216	MHz
Bandwidth	B		=	5	5	5	MHz
Anode voltage	V_a		=	1000	1500	2000	V
Grid No.2 voltage	V_{g_2}		=	350	350	350	V
Grid No.1 voltage	V_{g_1}		=	−60	−65	−70	V
Peak grid No.1 A.C. voltage	$V_{g_{1p}}$	sync	=	65	71	76	V
		black	=	52	57	62	V
Anode current	I_a	sync	=	355	360	360	mA
		black	=	250	250	250	mA
Grid No.2 current	I_{g_2}	sync	=	27	29	29	mA
		black	=	4	0	0	mA
Grid No.1 current	I_{g_1}	sync	=	2	5	5	mA
		black	=	0	0	0	mA
Grid No.1 input power	W_{ig_1}	sync	=	0.4	1.2	1.2	W [2])
		black	=	0	0	0	W
Output power	W_o	sync	=	160	300	440	W
		black	=	90	170	250	W

[1]) Averaged over any frame

[2]) See page 4

7Z2 2896

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY. Two systems in push-pull intermittent mobile service

LIMITING VALUES (Absolute limits)

Frequency	f		up to	200	up to	500	MHz
Anode voltage	V_a	=	max.	600	max.	450	V
Anode input power	W_{ia}	=	max.	70	max.	50	W
Anode dissipation	W_a	=	max.	2x10	max.	2x10	W
Grid No.2 voltage	V_{g_2}	=	max.	300	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.5	max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	75	max.	75	V
Grid No.1 current	I_{g_1}	=	max.	2x2.5	max.	2x2.5	mA
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.5	max.	2x0.5	W
Cathode current	I_k	=	max.	2x60	max.	2x60	mA

OPERATING CHARACTERISTICS

Frequency	f	=	200	200	200	460	MHz
Anode voltage	V_a	=	300	400	600	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	−40	−50	−60	−50	V
Driving voltage	$V_{g_1 g_1' p}$	=	106	136	156	–	V
Anode current	I_a	=	2x50	2x50	2x50	2x50	mA
Grid No.2 current	I_{g_2}	=	2x4	2x3.5	2x3.0	2x3.0	mA
Grid No.1 current	I_{g_1}	=	2x1.5	2x1.5	2x1.0	2x0.6	mA
Driver output power	W_{dr}	=	1.2	1.3	1.5	5.0	W
Anode input power	W_{ia}	=	30	40	60	40	W
Anode dissipation	W_a	=	2x5.5	2x6.0	2x7.5	9.5	W
Output power	W_o	=	19	28	45	21	W
Efficiency	η	=	63	70	75	52.5	%
Output power in load	W_ℓ	=	16	22	35	17	W

7Z2 3646

R.F. CLASS C ANODE AND SCREEN GRID MODULATION. Two systems in push-pull; intermittent mobile service

LIMITING VALUES (Absolute limits)

Frequency	f		up to	200	up to	500	MHz
Anode voltage	V_a	=	max.	500	max.	373	V
Anode input power	W_{ia}	=	max.	50	max.	37	W
Anode dissipation	W_a	=	max.	2x7	max.	2x7	W
Grid No.2 voltage	V_{g_2}	=	max.	300	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	2x1.2	max.	2x1.2	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	2x2.5	max.	2x2.5	mA
Grid No.1 dissipation	W_{g_1}	=	max.	2x0.5	max.	2x0.5	W
Cathode current	I_k	=	max.	2x55	max.	2x55	mA

OPERATING CHARACTERISTICS

Frequency	f	=	200	200	MHz
Anode voltage	V_a	=	300	500	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-50	-80	V
Driving voltage	$V_{g_1g_1'p}$	=	166	220	V
Anode current	I_a	=	2x40	2x40	mA
Grid No.2 current	I_{g_2}	=	2x3.5	2x4.0	mA
Grid No.1 current	I_{g_1}	=	2x1.5	2x1.5	mA
Anode input power	W_{ia}	=	24	40	W
Anode dissipation	W_a	=	2x4	2x5.5	W
Output power	W_o	=	16	29	W
Efficiency	η	=	67	73	%
Output power in load	W_ℓ	=	13	22	W

7Z2 3647

R.F. CLASS C FREQUENCY TRIPLER. Two systems in push-pull, intermittent mobile service.

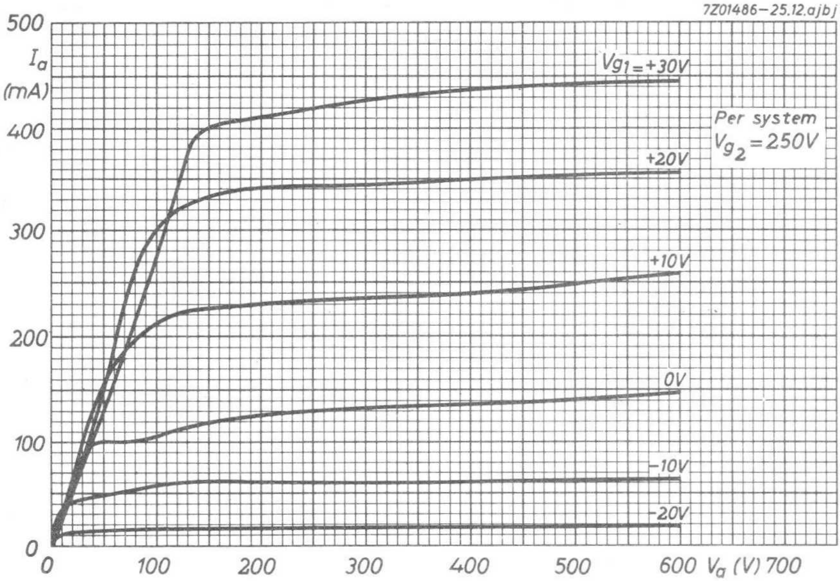
LIMITING VALUES (Absolute limits)

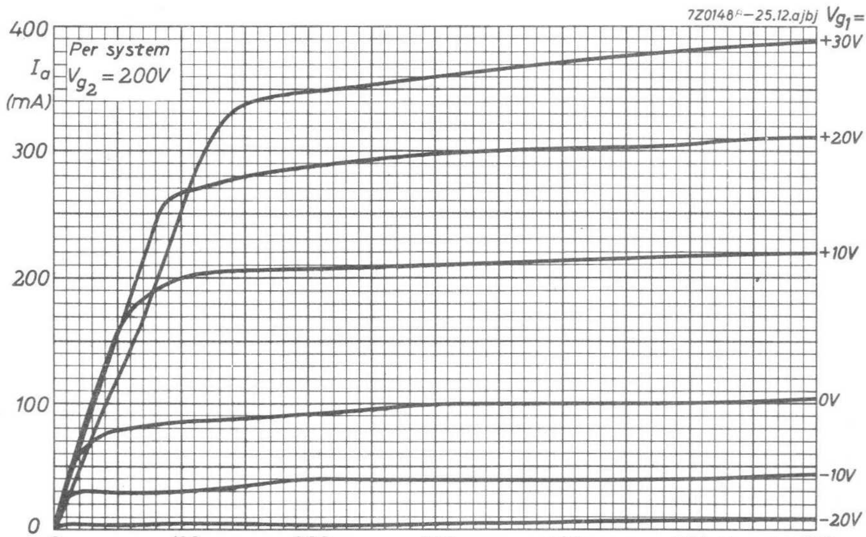
Frequency	f	up to	500	MHz
Anode voltage	V_a	= max.	600	V
Anode input power	W_{ia}	= max.	54	W
Anode dissipation	W_a	= max.	2x10	W
Grid No.2 voltage	V_{g_2}	= max.	250	V
Grid No.2 dissipation	W_{g_2}	= max.	2x1.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	200	V
Grid No.1 current	I_{g_1}	= max.	2x4.5	mA
Grid No.1 dissipation	W_{g_1}	= max.	2x0.5	W
Cathode current	I_k	= max.	2x55	mA

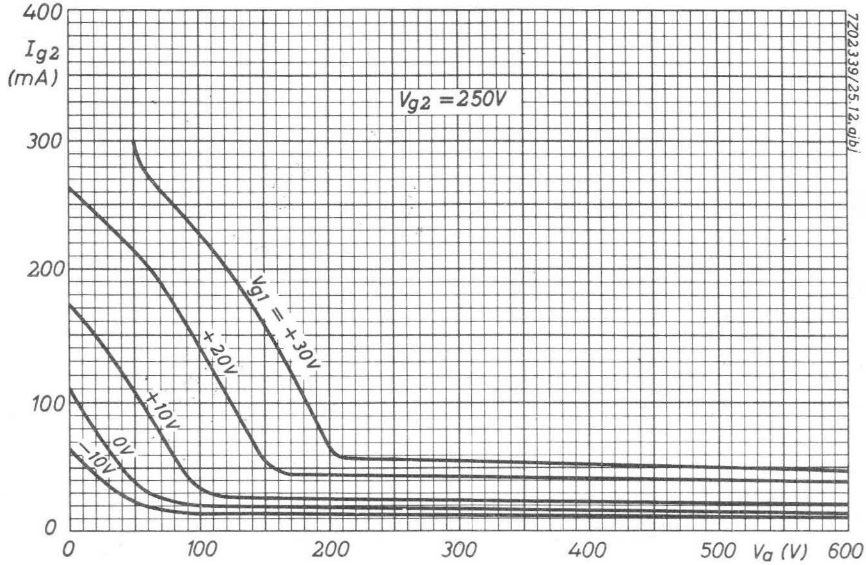
OPERATING CHARACTERISTICS

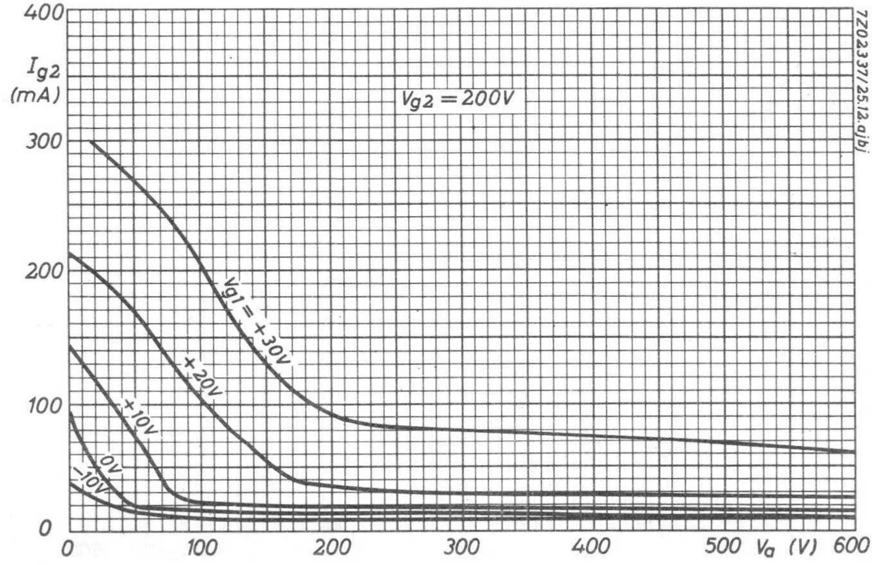
Frequency	f	=	66.7/200	153/460	MHz
Anode voltage	V_a	=	300	300	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	-175	-175	V
Driving voltage	$V_{g_1g_1'p}$	=	410	410	V
Anode current	I_a	=	2x45	2x45	mA
Grid No.2 current	I_{g_2}	=	2x4.0	2x3.5	mA
Grid No.1 current	I_{g_1}	=	2x3.0	2x2.5	mA
Driver output power	W_{dr}	=	3	5	W
Anode input power	W_{ia}	=	27	27	W
Anode dissipation	W_a	=	2x9	2x10	W
Output power	W_o	=	9	7	W
Efficiency	η	=	33	26	%
Output power in load	W_ℓ	=	7	5.5	W

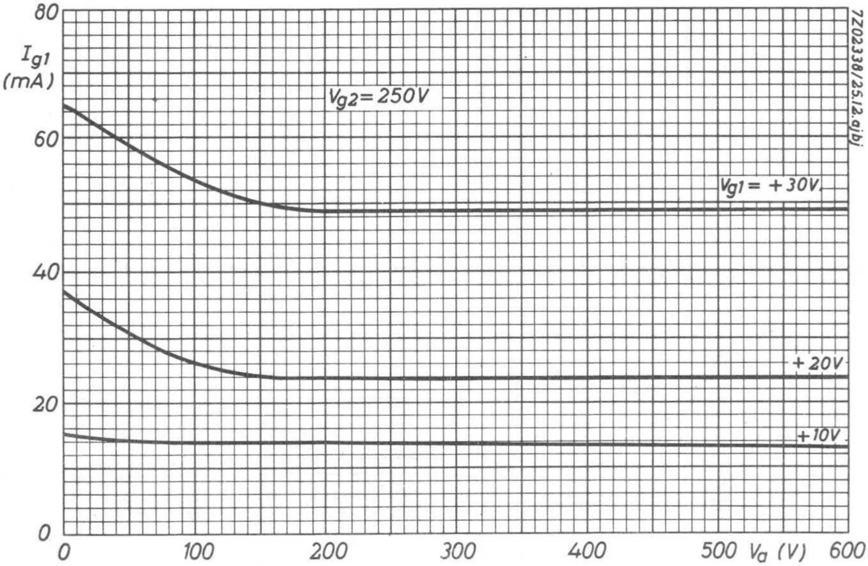
7Z2 3648

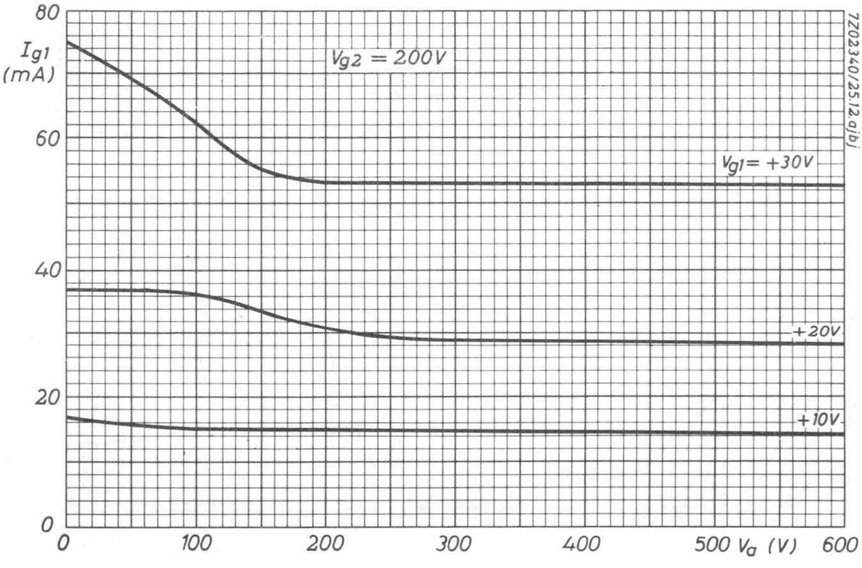

7Z01486–25.12.ajbj
500
I_a
(mA)
400
300
200
100
0
V_{g1} = +30V
+20V
+10V
0V
−10V
−20V
Per system
V_{g2} = 250V
0
100
200
300
400
500
600 V_a (V) 700

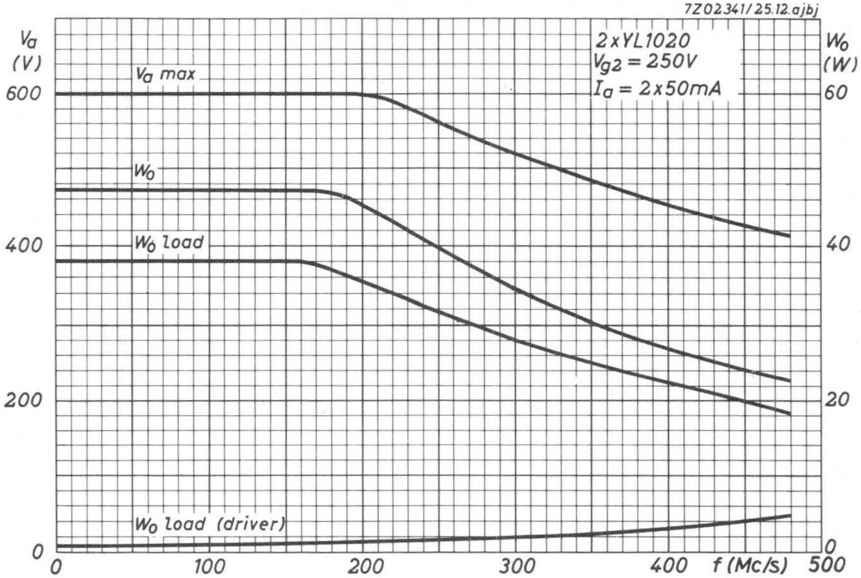

7Z0148?–25.12.ajbj
V_{g1} =
+30V
+20V
+10V
0V
−10V
−20V
400
I_a
(mA)
300
200
100
0
Per system
V_{g2} = 200V
0
100
200
300
400
500 V_a (V) 600

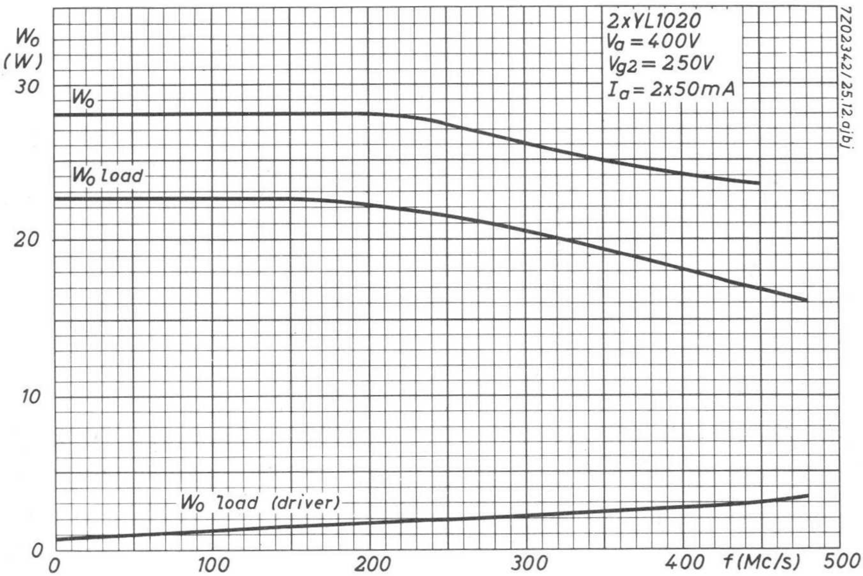

400
I_{g2}
(mA)
300
200
100
0
V_{g2} = 250V
V_{g1} = +30V
+20V
+10V
0V
−10V
0
100
200
300
400
500
V_a (V)
600
7Z02339/25.12.a(b)


400
I_{g2}
(mA)
300
200
100
0
V_{g2} = 200V
V_{g1} = +30V
+20V
+10V
0V
−10V
0
100
200
300
400
500
V_a (V)
600
7Z02337/25.12.a(b)


80
I_{g1}
(mA)
V_{g2} = 250V
60
V_{g1} = +30V
40
+20V
20
+10V
0
0
100
200
300
400
500 V_a (V) 600
7Z02338/25.12.a|b|


80
I_{g1}
(mA)
V_{g2} = 200V
60
V_{g1} = +30V
40
+20V
20
+10V
0
0
100
200
300
400
500 V_a (V) 600
7Z02340/25.12.a|b|


7Z02341/25.12.ajbj
2xYL1020
Vg2 = 250V
Ia = 2x50mA
Va
(V)
Wo
(W)
Va max
Wo
Wo load
Wo load (driver)
600
400
200
0
60
40
20
0
0
100
200
300
400
f (Mc/s)
500


7Z02342/25.12.ajbj
2xYL1020
Va = 400V
Vg2 = 250V
Ia = 2x50mA
Wo
(W)
Wo
Wo load
Wo load (driver)
30
20
10
0
0
100
200
300
400
f (Mc/s)
500

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating, radiation and convection cooled double tetrode for use as R.F. power amplifier or frequency multiplier in mobile transmitters.

QUICK REFERENCE DATA						
Freq. (MHz)	R.F. class C telegr.		R.F. class C ag_2 mod.		Frequency multiplier	
	C.C.S. W_ℓ (W)[1]	I.C.A.S. W_ℓ (W)[1]	C.C.S. W_ℓ (W)[1]	I.C.A.S. W_ℓ (W)[1]	C.C.S. W_ℓ (W)[1]	I.C.A.S. W_ℓ (W)[1]
180	45	75	32	53		
50/150					16	
157/470						12

HEATING: direct by A.C. or D.C.; filament oxide coated

Filament voltage	V_f	=	2.1	V
Filament current	I_f	=	4.5	A
Heating time for W_o = 70 % of $W_{o\,max.}$	T_h	<	0.5	sec

The frequency of the A.C. filament supply may be

with sinusoidal supply voltages	max. 200	Hz
with square-wave supply voltages	any	

The filament has been designed to accept temporary fluctuations of supply voltage of ± 15 %.

CAPACITANCES ; two sections in push-pull connection

Input capacitance	C_i	=	6.0	pF
Output capacitance	C_o	=	2.0	pF

TYPICAL CHARACTERISTICS ; each section

Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Mutual conductance	S	=	4.5	mA/V
Amplification factor	$\mu_{g_2g_1}$	=	8	

[1]) Output power in the load

7Z2 3745

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250 °C
Temperature of all seals	=	max. 250 °C
Pin temperature	=	max. 180 °C

COOLING

Radiation and convection
Anode connectors providing a high degree of heat transfer by radiation or conduction should be used.

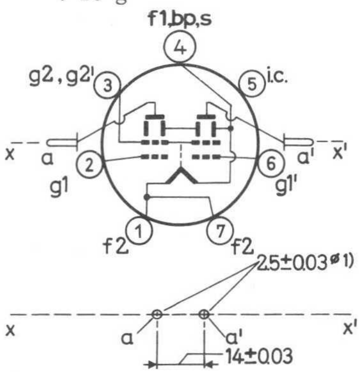
MECHANICAL DATA Dimensions in mm

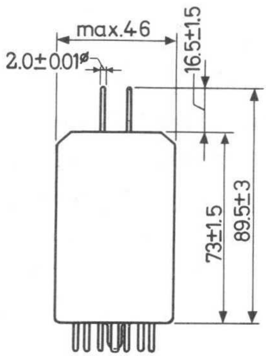
Base : Septar

→ Socket : 2422 513 00001

Anode connector : 40623

Net weight : 16 g





Mounting position: any

Contacts 1 and 7 should be strapped together externally to reduce the effective contact resistance.

[1]) Location of anode pins within these circles.

7Z2 8842

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY

LIMITING VALUES (Each system; absolute limits)

Frequency	f		up to 200	500	MHz
Anode voltage	V_a	=	max. 750	500	V
Anode input power	W_{ia}	=	max. 72	48	W
Anode dissipation	W_a	=	max. 20	20	W
Grid No.2 voltage	V_{g_2}	=	max. 300	300	V
Grid No.2 dissipation	W_{g_2}	=	max. 3.5	3.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 100	100	V
Grid No.1 current	I_{g_1}	=	max. 5.0	5.0	mA
Grid No.1 dissipation	W_{g_1}	=	max. 1.0	1.0	W
Grid No.1 circuit resistance					
with fixed bias	R_{g_1}	=	max. 50	50	kΩ
with automatic bias	R_{g_1}	=	max. 100	100	kΩ
Cathode current	I_k	=	max. 120	120	mA

OPERATING CONDITIONS; two systems in push-pull

			CCS		ICAS	
Frequency	f	=	180	475	180	MHz
Anode voltage	V_a	=	400	350	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	-60	-45	-80	V
Anode current	I_a	=	2x100	2x100	2x100	mA
Grid No.2 current	I_{g_2}	=	2x8	2x4.5	2x9	mA
Grid No.1 current	I_{g_1}	=	2x3.0	2x2.0	2x3.5	mA
Driving power	W_{dr}	=	3	10	4	W
Anode input power	W_{ia}	=	2x40	2x35	2x60	W
Anode dissipation	W_a	=	2x13.5	2x16	2x17.5	W
Output power	W_o	=	53	38	85	W
Tube efficiency	η	=	66	54	71	%
Output power in the load	W_ℓ	=	45	-	75	W

7Z2 3747

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Each system; absolute limits)

Frequency	f		up to 200	500	MHz
Anode voltage	V_a	=	max. 600	400	V
Anode input power	W_{i_a}	=	max. 57.5	38.5	W
Anode dissipation	W_a	=	max. 14	14	W
Grid No.2 voltage	V_{g_2}	=	max. 300	300	V
Grid No.2 dissipation	W_{g_2}	=	max. 2.3	2.3	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	175	V
Grid No.1 current	I_{g_1}	=	max. 5.0	5.0	mA
Grid No.1 dissipation	W_{g_1}	=	max. 1.0	1.0	W
Grid No.1 circuit resistance					
with fixed bias	R_{g_1}	=	max. 50	50	kΩ
with automatic bias	R_{g_1}	=	max. 100	100	kΩ
Cathode current	I_k	=	max. 120	120	mA

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	
Frequency	f	=	180	180	MHz
Anode voltage	V_a	=	400	600	V
Grid No.2 voltage	V_{g_2}	=	250	250	V
Grid No.1 voltage	V_{g_1}	=	−70	−80	V
Anode current	I_a	=	2x75	2x75	mA
Grid No.2 current	I_{g_2}	=	2x9	2x9	mA
Grid No.1 current	I_{g_1}	=	2x2	2x2	mA
Driving power	W_{dr}	=	4	5	W
Anode input power	W_{i_a}	=	2x30	2x45	W
Anode dissipation	W_a	=	2x10.5	2x13	W
Output power	W_o	=	39	64	W
Tube efficiency	η	=	65	71	%
Output power in the load	W_ℓ	=	32	53	W
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	47	47	W
Grid No.2 peak voltage	$V_{g_{2p}}$	=	185	185	V

7Z2 3748

R.F. CLASS C FREQUENCY MULTIPLIER

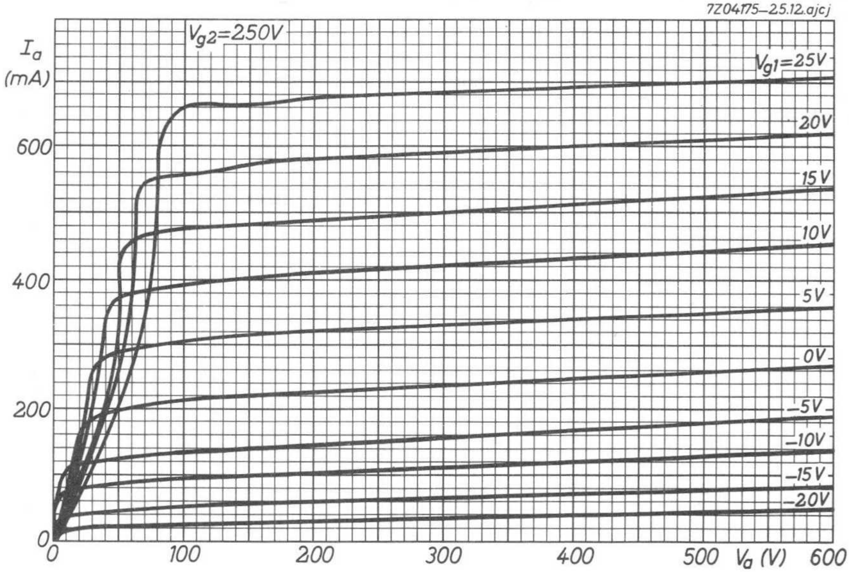
LIMITING VALUES (Each system; absolute limits)

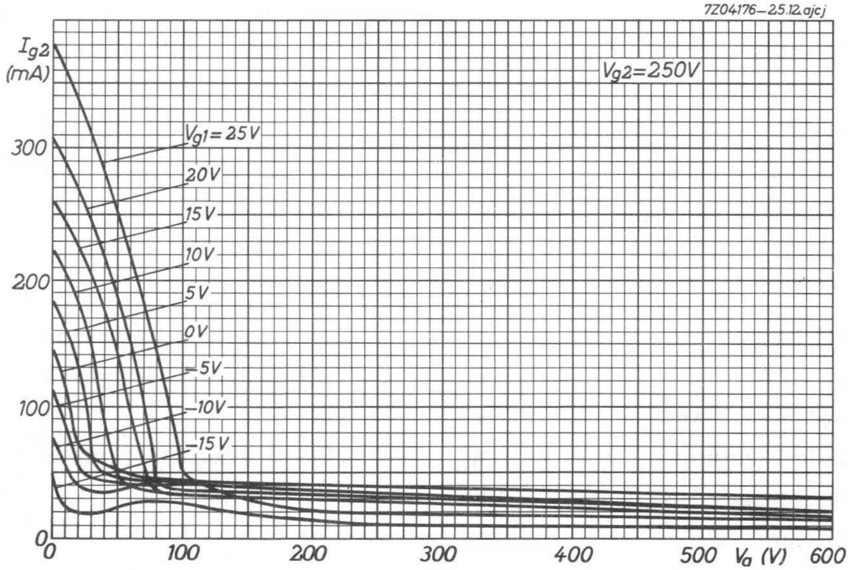
Output frequency	f_{out}		up to 500	MHz
Anode voltage	V_a	=	max. 750	V
Anode input power	W_{ia}	=	max. 60	W
Anode dissipation	W_a	=	max. 20	W
Grid No.2 voltage	V_{g_2}	=	max. 300	V
Grid No.2 dissipation	W_{g_2}	=	max. 3.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	V
Grid No.1 dissipation	W_{g_1}	=	max. 1.0	W
Grid No.1 circuit resistance				
with fixed bias	R_{g_1}	=	max. 50	kΩ
with automatic bias	R_{g_1}	=	max. 100	kΩ
Cathode current	I_k	=	max. 100	mA

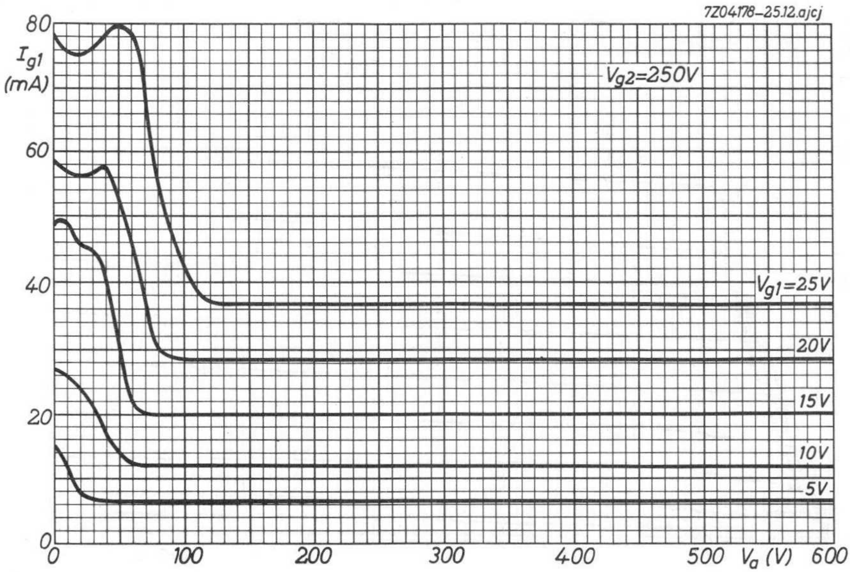
OPERATING CONDITIONS; two systems in push-pull

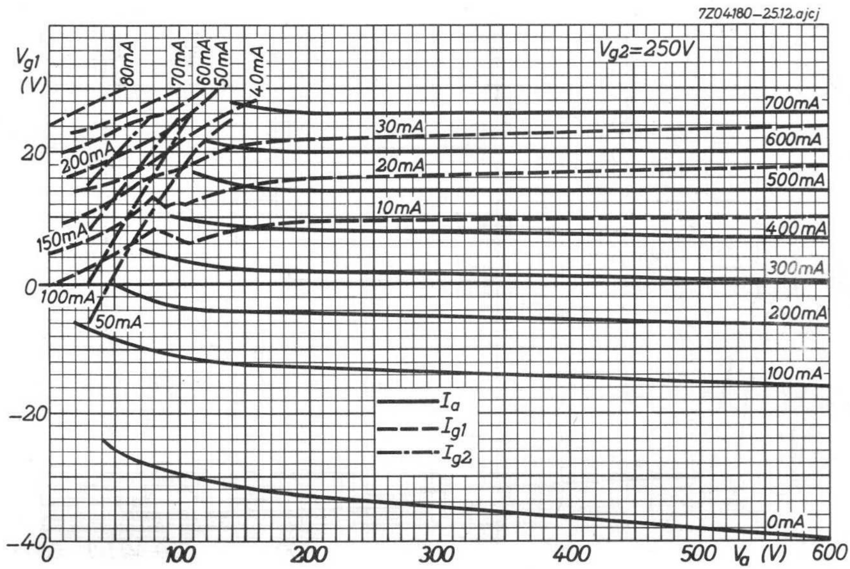
			CCS		ICAS	
Frequency	f	=	50/150	50/150	157/470	MHz
Anode voltage	V_a	=	400	500	400	V
Grid No.2 voltage	V_{g_2}	=	250	250	250	V
Grid No.1 voltage	V_{g_1}	=	−150	−150	−175	V
Peak grid No.1 driving voltage	$V_{g_1 p}$	=	360	360	360	V
Anode current	I_a	=	2x72	2x60	2x65	mA
Grid No.2 current	I_{g_2}	=	2x8	2x5	2x6	mA
Grid No.1 current	I_{g_1}	=	2x2.5	2x3.0	2x2.9	mA
Driving power	W_{dr}	=	9	10	8	W
Anode input power	W_{ia}	=	2x29	2x30	2x26	W
Anode dissipation	W_a	=	2x20	2x20	2x18	W
Output power	W_o	=	18	20	16	W
Tube efficiency	η	=	31	33	31	%
Output power in the load	W_ℓ	=	14.5	16	12	W

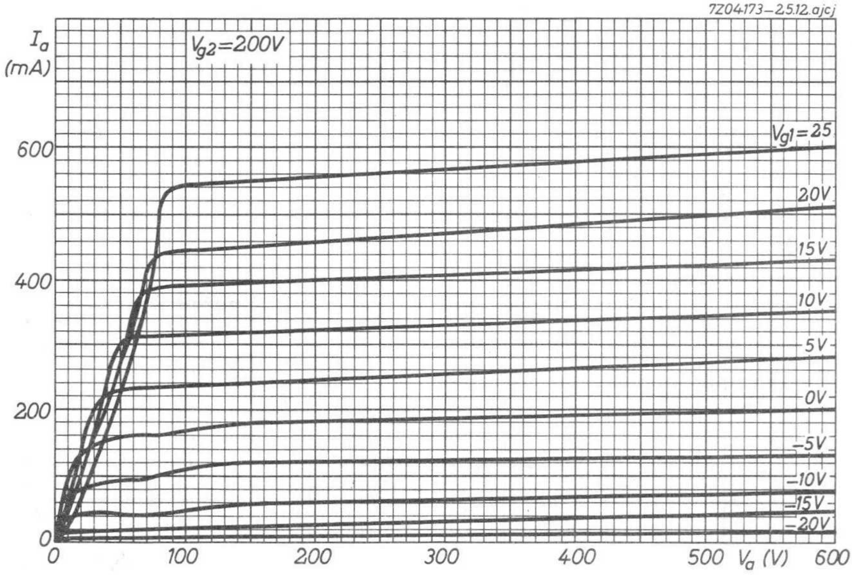
7Z2 3749

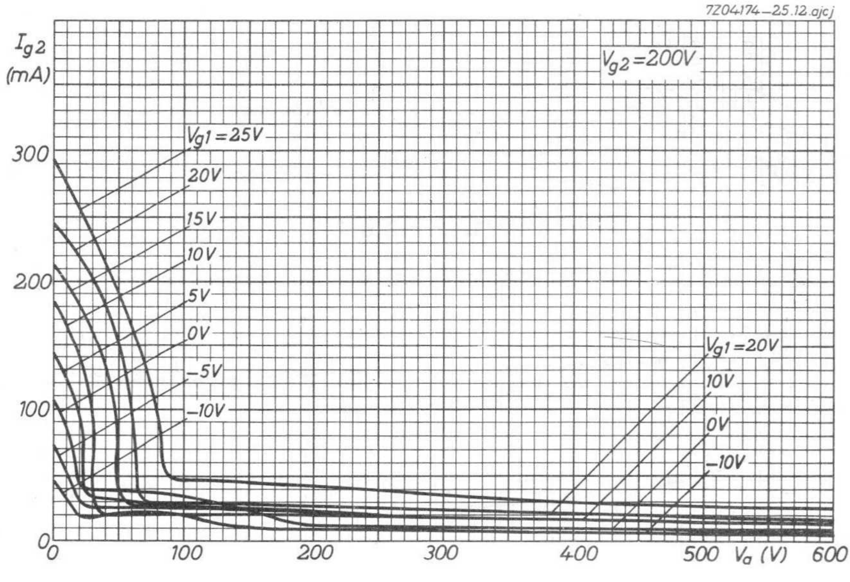

7Z04175—25.12.ajcj
I_a (mA)
V_{g2}=250V
V_{g1}=25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
0
200
400
600
0
100
200
300
400
500
V_a (V)
600

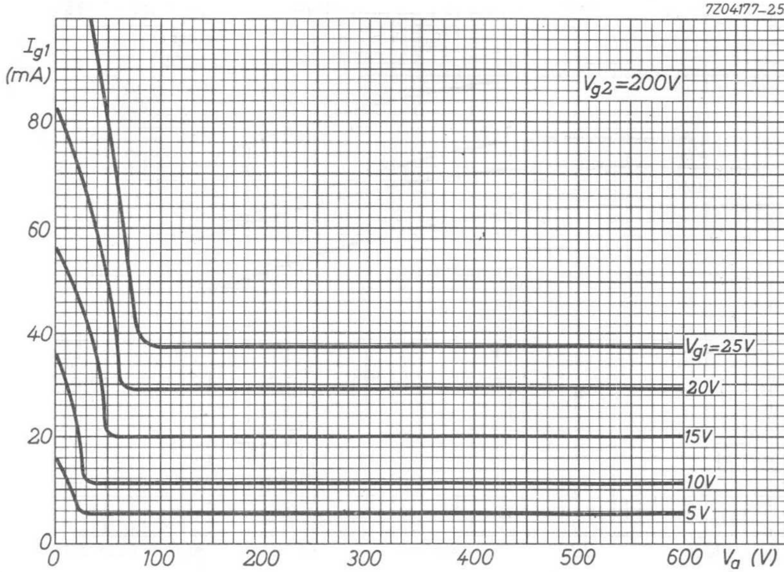

7Z04176—25.12.ajcj
I_{g2} (mA)
V_{g2}=250V
V_{g1}= 25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
0
100
200
300
0
100
200
300
400
500
V_a (V)
600

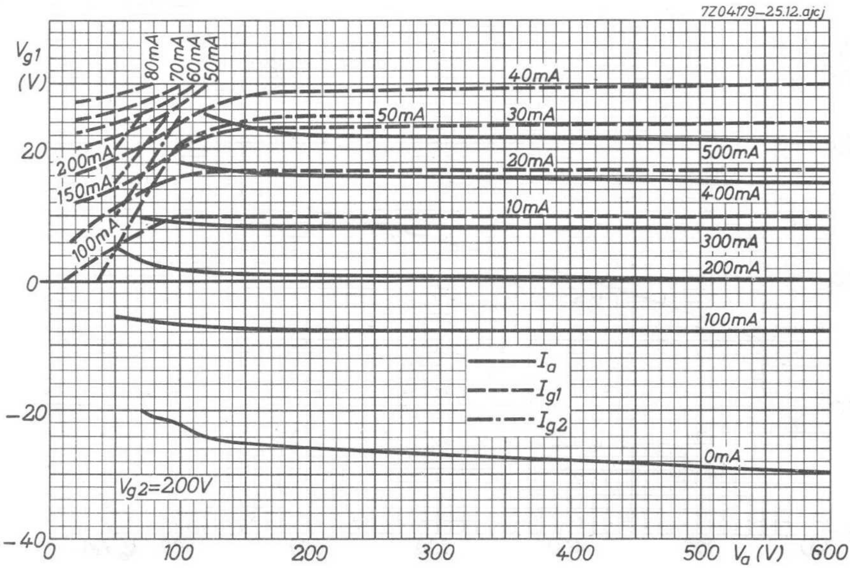

7Z04178-25.12.ajcj
I_{g1} (mA)
V_{g2}=250V
V_{g1}=25V
20V
15V
10V
5V
V_a (V)
0
20
40
60
80
100
200
300
400
500
600

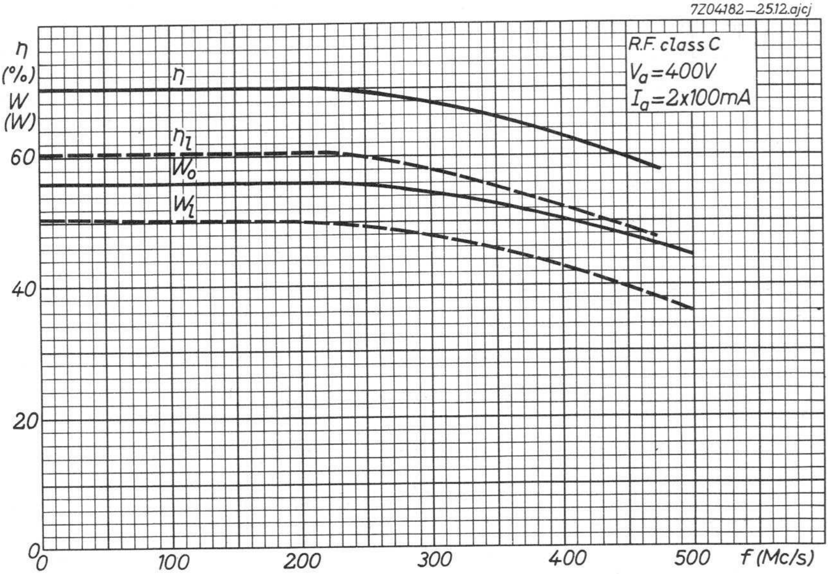

7Z04180-25.12.ajcj
V_{g1} (V)
V_{g2}=250V
80mA
70mA
60mA
50mA
40mA
700mA
30mA
600mA
200mA
20mA
500mA
10mA
400mA
150mA
300mA
100mA
200mA
50mA
100mA
I_a
I_{g1}
I_{g2}
0mA
V_a (V)
-40
-20
0
20
100
200
300
400
500
600

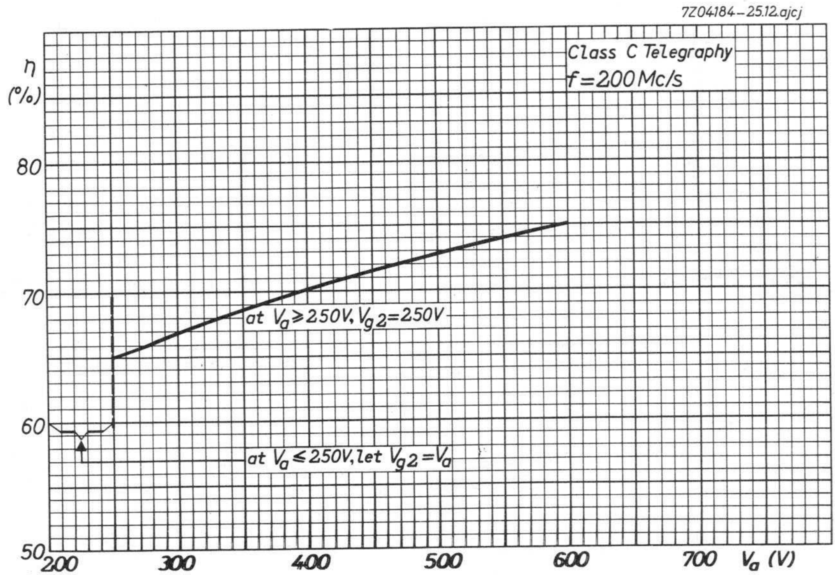

7Z04173–2.5.12.ajcj
I_a (mA)
V_{g2}=200V
V_{g1}=25
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
0
200
400
600
0
100
200
300
400
500
V_a (V)
600

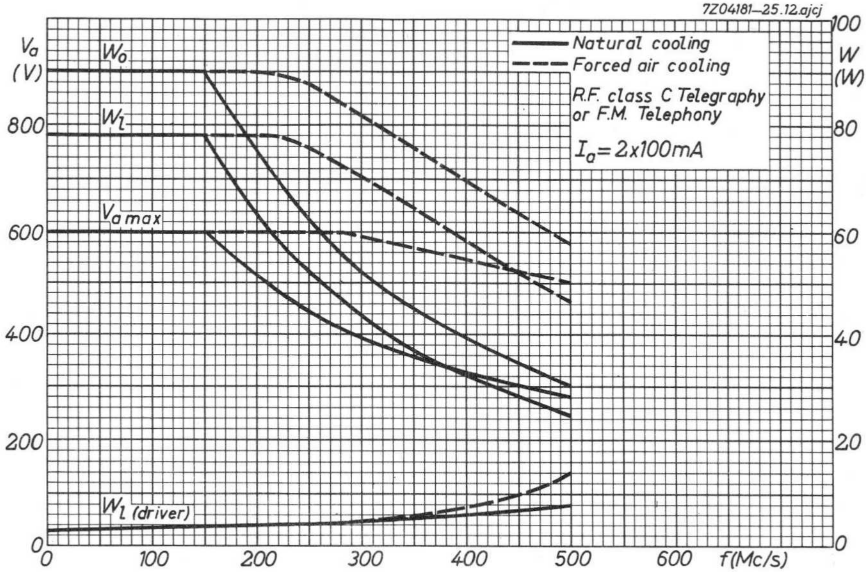

7Z04174–2.5.12.ajcj
I_{g2} (mA)
V_{g2}=200V
V_{g1}=25V
20V
15V
10V
5V
0V
−5V
−10V
V_{g1}=20V
10V
0V
−10V
0
100
200
300
0
100
200
300
400
500
V_a (V)
600

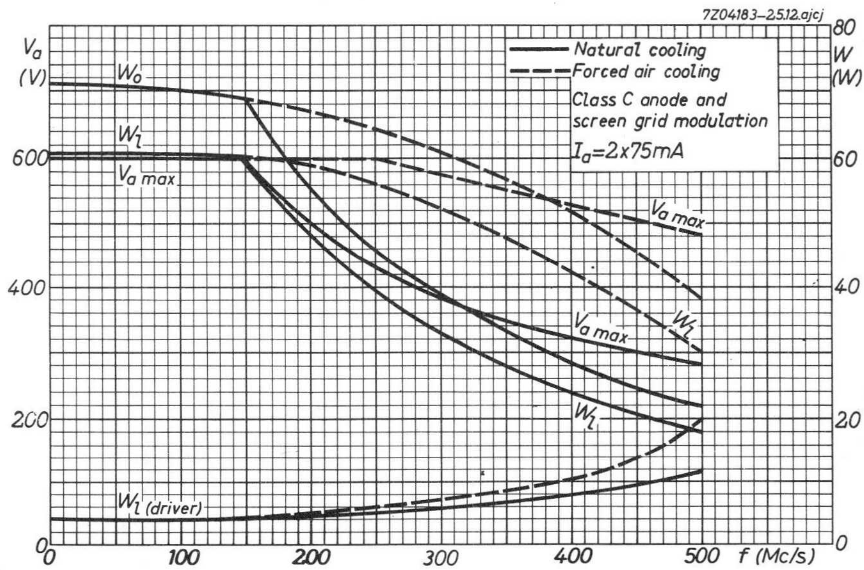

7Z04177–25.12.ajcj
I_{g1} (mA)
80
60
40
20
0
V_{g2}=200V
V_{g1}=25V
20V
15V
10V
5V
0
100
200
300
400
500
600
V_a (V)


7Z04179–25.12.ajcj
V_{g1} (V)
20
0
−20
−40
80mA
70mA
60mA
50mA
40mA
50mA
30mA
200mA
150mA
20mA
100mA
10mA
500mA
400mA
300mA
200mA
100mA
0mA
I_a
I_{g1}
I_{g2}
V_{g2}=200V
0
100
200
300
400
500
V_a (V)
600


7Z04182—25.12.ajcj
R.F. class C
Va=400V
Ia=2x100mA
η
(%)
W
(W)
η
ηl
Wo
Wl
60
40
20
0
0
100
200
300
400
500
f (Mc/s)


7Z04184—25.12.ajcj
Class C Telegraphy
f=200 Mc/s
η
(%)
80
70
60
50
at Va≥250V, Vg2=250V
at Va≤250V, let Vg2=Va
200
300
400
500
600
700
Va (V)


7Z04181–25.12.ajcj
Natural cooling
Forced air cooling
R.F. class C Telegraphy or F.M. Telephony
I_a= 2x100mA
V_a (V)
W (W)
W_o
W_l
$V_{a\,max}$
W_l (driver)
f(Mc/s)
0
100
200
300
400
500
600
800
20
40
60
80
100


7Z04183–25.12.ajcj
Natural cooling
Forced air cooling
Class C anode and screen grid modulation
I_a=2x75mA
V_a (V)
W (W)
W_o
W_l
$V_{a\,max}$
W_l (driver)
f (Mc/s)
0
100
200
300
400
500
600
20
40
60
80

R.F. DOUBLE TETRODE

QUICK REFERENCE DATA								
Freq. (MHz)	C telegr.				C_{ag_2} mod.			
	C.C.S.		I.C.A.S.		C.C.S.		I.C.A.S.	
	V_a (V)	W_ℓ [1] (W)	V_a (V)	W_ℓ [1] (W)	V_a (V)	W_ℓ [1] (W)	V_a (V)	W_ℓ [1] (W)
175	900	132	1000	163	750	85	800	107

HEATING: indirect by A.C. or D.C. Cathode oxide coated

Heater voltage	V_f	=	6.3 V	12.6 V
Heater current	I_f	=	1.8 A	0.9 A
Pins			5-(1+7)	1-7

CAPACITANCES (each system, the elements of the other system being earthed)

Anode to all other elements except grid No.1	C_a	=	3.2	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	10.5	pF
Anode to grid No.1	C_{ag_1}	<	0.09	pF

For internal neutralization (C_n, C_n') please refer to the electrode connections

TYPICAL CHARACTERISTICS (each system)

Anode current	I_a	=	30	mA
Mutual conductance	S	=	4.5	mA/V
Amplification factor	$\mu_{g_2g_1}$	=	8.2	

[1]) Useful power in the load

7Z2 3649

COOLING: radiation

When the tube is used near its limiting values it may be necessary to direct an air flow on the bulb and the anode seals. In general an air flow of approximately 0.56 m^3/min. will be sufficient.

TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and anode seals	= max.	250	°C
Temperature of base pin seals	= max.	180	°C

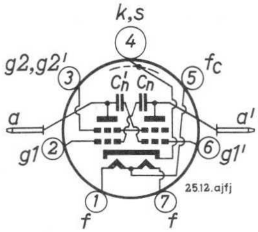
MECHANICAL DATA Dimensions in mm

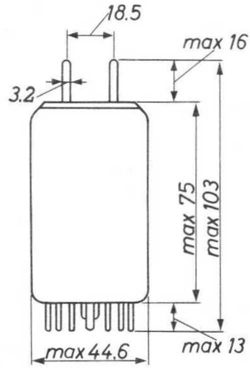
Base : Septar

→ Socket : 2422 513 00001

Anode connector: 40681

Net weight : 71 g





Mounting position: Vertical with base up or down
or horizontal with the anode pins in a horizontal plane

7Z2 8843

R.F. CLASS C TELEGRAPHY, two systems in push-pull

LIMITING VALUES (continuous service; absolute limits)

			C. C. S.		
Frequency	f		up to	175	MHz
Anode voltage	V_a	=	max.	1000	V
Anode current	I_a	=	max.	2x110	mA
Anode dissipation	W_a	=	max.	2x30	W
Anode input power	W_{ia}	=	max.	2x100	W
Grids No. 2 voltage	$V_{g_2, g_2'}$	=	max.	300	V
Grids No. 2 dissipation	$W_{g_2+g_2'}$	=	max.	7	W
Negative grid No. 1 voltage	$-V_{g_1}$	=	max.	175	V
Grid No. 1 current	I_{g_1}	=	max.	2x5	mA
Grid No. 1 circuit resistance	R_{g_1}	=	max.	50	kΩ 1)
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS (continuous service)

			C. C. S.		
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	1000	900	V
Grids No. 2 voltage	$V_{g_2, g_2'}$	=	230	245	V
Grid No. 1 voltage	V_{g_1}	=	−85	−90	V
Common grids No. 1 resistor	$R_{g_1, g_1'}$	=	15	15	kΩ
Anode current	I_a	=	2x100	2x110	mA
Grids No. 2 current	$I_{g_2+g_2'}$	=	11.2	12.5	mA
Grids No. 1 current	$I_{g_1+g_1'}$	=	5.7	5.9	mA
Anode input power	W_{ia}	=	200	198	W
Anode dissipation	W_a	=	2x27	2x25	W
Grids No. 2 dissipation	$W_{g_2+g_2'}$	=	2.5	3.0	W
Driver output power	W_{dr}	=	3.5	3.5	W
Output power	W_o	=	146	150	W
Efficiency	η	=	73	75	%
Useful power in the load	W_ℓ	=	125	132	W

1) Each section

7Z2 3651

R.F. CLASS C TELEGRAPHY, two systems in push-pull (continued)

LIMITING VALUES (Intermittent service; absolute limits)

				I. C. A. S.	
Frequency	f		up to	175	MHz
Anode voltage	V_a	=	max.	1000	V
Anode current	I_a	=	max.	2x120	mA
Anode dissipation	W_a	=	max.	2x34	W
Anode input power	W_{ia}	=	max.	2x120	W
Grids No.2 voltage	$V_{g_2,g_2'}$	=	max.	300	V
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	max.	8	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	175	V
Grid No.1 current	I_{g_1}	=	max.	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	50	kΩ 1)
Heater to cathode voltage	V_{kf}	=	max.	100	V

OPERATING CONDITIONS (Intermittent service)

			I. C. A. S.		
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	1000	900	V
Grids No.2 voltage	$V_{g_2,g_2'}$	=	260	260	V
Grid No.1 voltage	V_{g_1}	=	-85	-85	V
Common grids No.1 resistor	$R_{g_1,g_1'}$	=	15	15	kΩ
Anode current	I_a	=	2x120	2x120	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	16.5	17.0	mA
Grids No.1 current	$I_{g_1+g_1'}$	=	5.7	5.7	mA
Anode input power	W_{ia}	=	240	216	W
Anode dissipation	W_a	=	2x30	2x25	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	4.3	4.5	W
Driver output power	W_{dr}	=	3.5	3.5	W
Output power	W_o	=	180	166	W
Efficiency	η	=	75	77	%
Useful power in the load	W_{ℓ}	=	163	147	W

1) Each section

7Z2 3652

R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two systems in push-pull

LIMITING VALUES (Absolute limits)

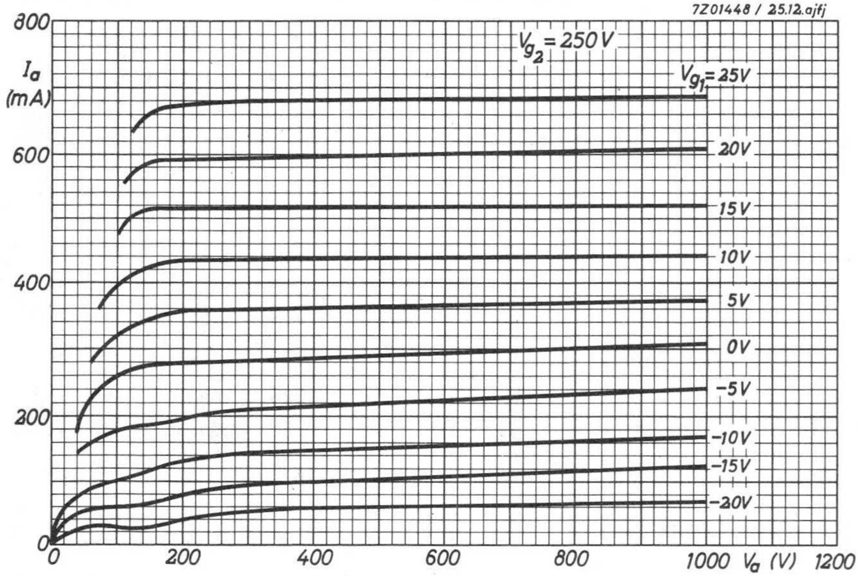
			C. C. S.	I. C. A. S.	
Frequency	f		up to 175	up to 175	MHz
Anode voltage	V_a	=	max. 800	max. 800	V
Anode current	I_a	=	max. 2x90	max. 2x100	mA
Anode dissipation	W_a	=	max. 2x21	max. 2x23.5	W
Anode input power	W_{ia}	=	max. 140	max. 160	W
Grids No.2 voltage	$V_{g_2,g_2'}$	=	max. 250	max. 250	V
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	max. 5.0	max. 5.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	max. 175	V
Grid No.1 current	I_{g_1}	=	max. 2x5	max. 2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 50	max. 50	kΩ 1)
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

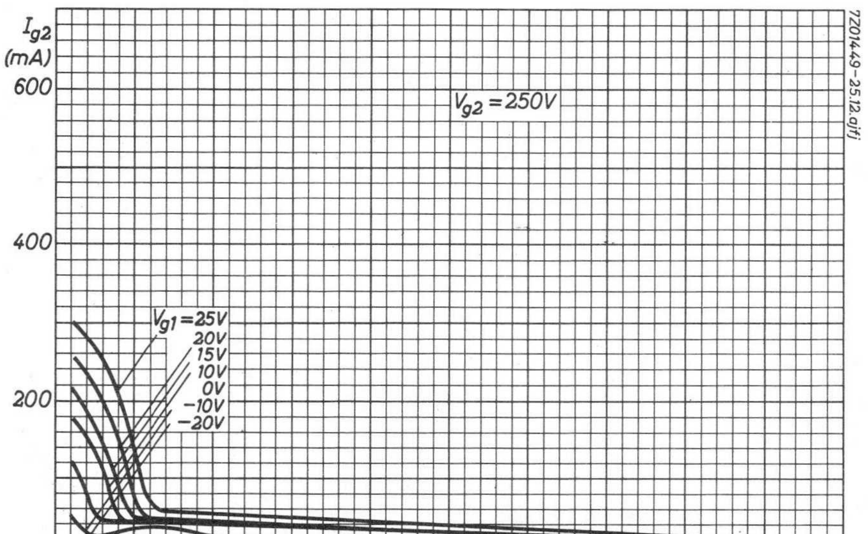
OPERATING CONDITIONS

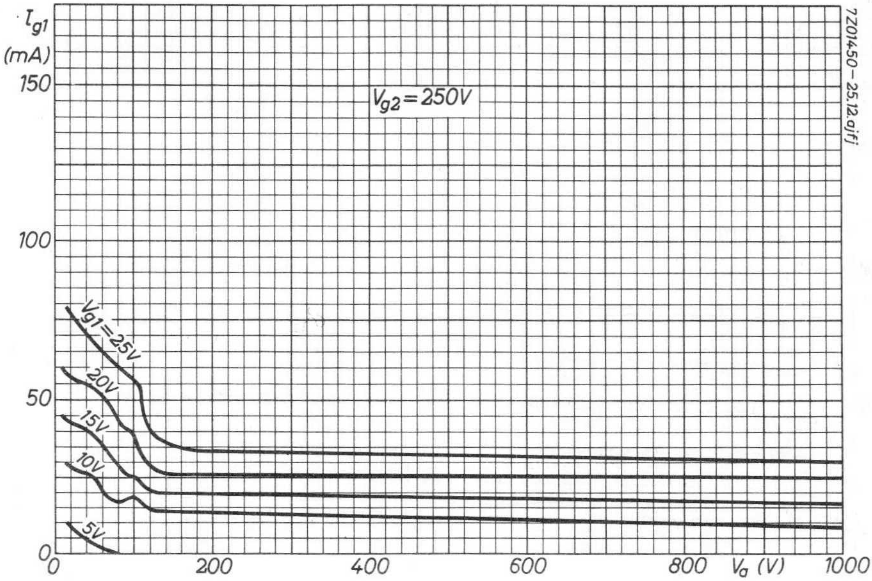
			C. C. S.	I. C. A. S.	
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	750	800	V
Grids No.2 voltage	$V_{g_2,g_2'}$	=	250	225	V
Grid No.1 voltage	V_{g_1}	=	-66	-75	V
Common grids No.1 resistor	$R_{g_1,g_1'}$	=	15	15	kΩ
Anode current	I_a	=	2x90	2x100	mA
Grids No.2 current	$I_{g_2+g_2'}$	=	10.2	8.8	mA
Grids No.1 current	$I_{g_1+g_1'}$	=	4.4	5.0	mA
Anode input power	W_{ia}	=	135	160	W
Anode dissipation	W_a	=	2x19	2x21	W
Grids No.2 dissipation	$W_{g_2+g_2'}$	=	2.6	2.0	W
Driver output power	W_{dr}	=	3.4	3.0	W
Output power	W_o	=	97	122	W
Efficiency	η	=	72	74	%
Useful power in the load	W_ℓ	=	85	107	W
Modulation depth	m	=	100	100	%
Peak grids No.2 modulation voltage	$V_{g_2,g_2'p}$	=	90	80	V
Modulation power	W_{mod}	=	68	80	W

1) Each section

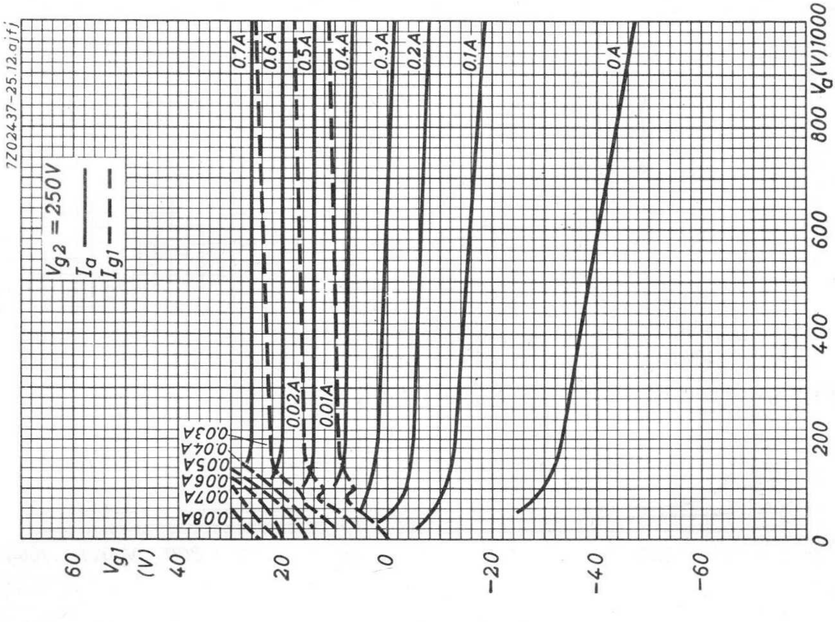
7Z2 3653


7Z01448 / 25.12.ajfj
V_{g_2} = 250 V
V_{g_1} = 25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
I_a (mA)
800
600
400
200
0
200
400
600
800
1000
V_a (V)
1200

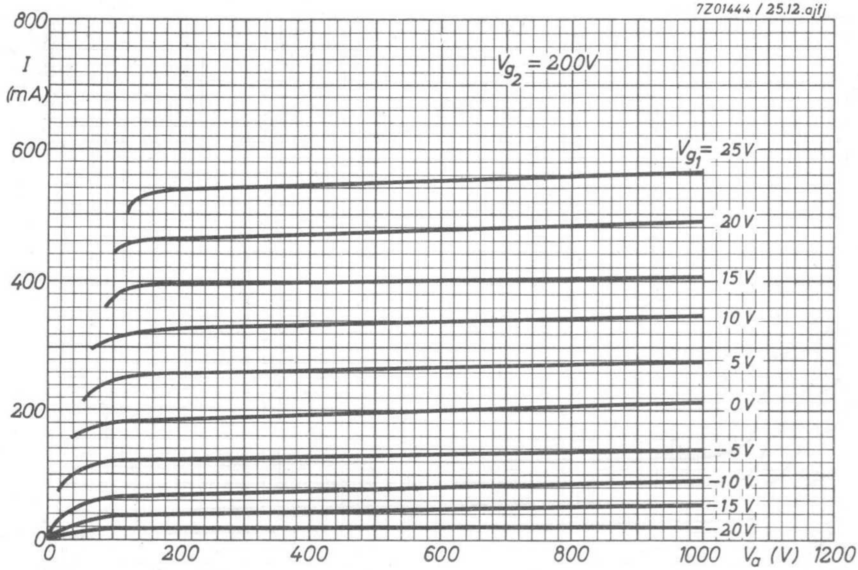

7Z01449−25.12.ajfj
V_{g2} = 250V
I_{g2} (mA)
600
400
200
0
V_{g1} = 25V
20V
15V
10V
0V
−10V
−20V
200
400
600
800
V_a(V)
1000

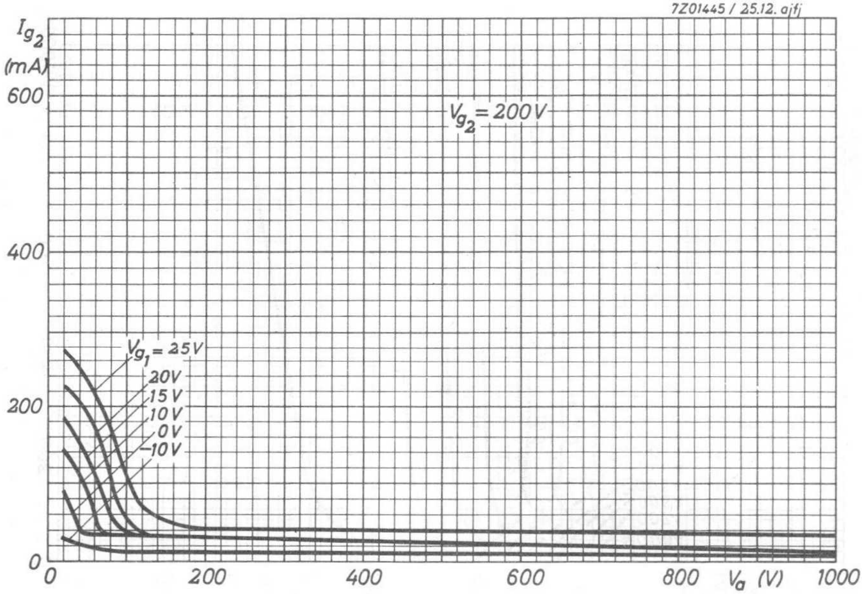


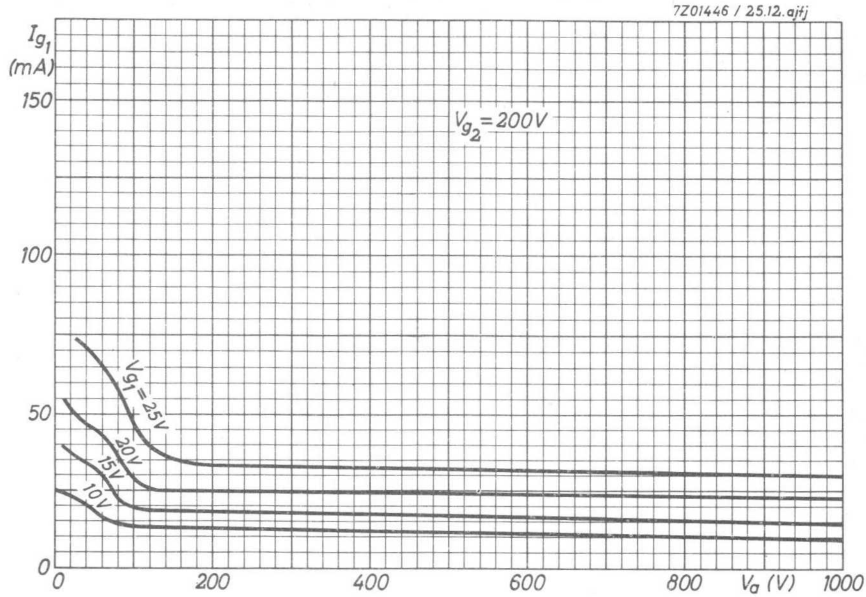
I_{g1} (mA)
150
100
50
0
V_{g2}=250V
V_{g1}=25V
20V
15V
10V
5V
0
200
400
600
800
V_a (V)
1000
7Z01450-25.12.ajfj

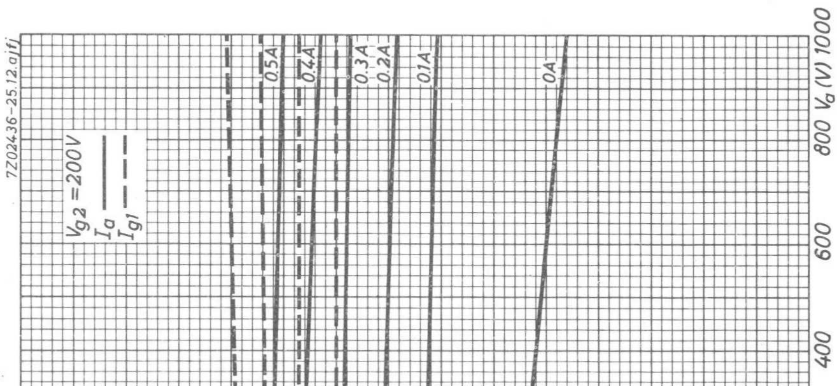


7Z02437-25.12.ajfj
V_{g2} = 250V
I_a
I_{g1}
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
0A
0.02A
0.01A
0.03A
0.04A
0.05A
0.06A
0.07A
0.08A
60
V_{g1} (V)
40
20
0
-20
-40
-60
0
200
400
600
800
V_a (V) 1000


7Z01444 / 25.12.ajfj
800
I
(mA)
600
400
200
0
V_{g_2} = 200V
V_{g_1} = 25 V
20 V
15 V
10 V
5 V
0 V
-5 V
-10 V
-15 V
-20 V
0
200
400
600
800
1000
V_a (V)
1200


7Z01445 / 25.12. ajfj
I_{g_2}
(mA)
600
400
200
0
V_{g_2} = 200V
V_{g_1} = 25V
20V
15 V
10 V
0 V
-10 V
0
200
400
600
800
V_a (V)
1000


7Z01446 / 25.12.ajfj
I_{g_1} (mA)
V_{g_2}=200V
V_{g_1}=25V
20V
15V
10V
V_a (V)
0
50
100
150
200
400
600
800
1000


7Z02436-25.12.ajfj
V_{g2}=200V
I_a
I_{g1}
0.5A
0.4A
0.3A
0.2A
0.1A
0A
0.04A
0.03A
0.02A
0.01A
0.05A
0.06A
0.07A
0.08A
V_{g1} (V)
V_a (V)

DOUBLE TETRODES

Double tetrodes for use as linear single side band amplifier.

The YL1071 is electrically identical to the YL1070 except for the heater, and has been designed to fit into heatsink cooling equipment.

QUICK REFERENCE DATA				
	AB1 linear S.S.B. amplifier, sections in parallel			
Freq. (MHz)	C.C.S.		I.C.A.S.	
	V_a (V)	W_{oPEP} (W)	V_a (V)	W_{oPEP} (W)
7	1000	141	1000	158

HEATING:

Indirect by A.C. or D.C.; parallel supply; oxide coated cathode

		Pins		5-(1+7)	1-7	
YL1070:	Heater voltage	V_f	=	6.3	12.6	V
	Heater current	I_f	=	1.8	0.9	A
YL1071:	Heater voltage	V_f	=	13.25	26.5	V
	Heater current	I_f	=	0.866	0.433	A

CAPACITANCES (each section)

Anode to all other elements except grid No.1	C_a	=	3.15	pF
Grid No.1 to all other elements except anode	C_{g_1}	=	10.6	pF
Anode to grid No.1	C_{ag_1}	<	0.09	pF

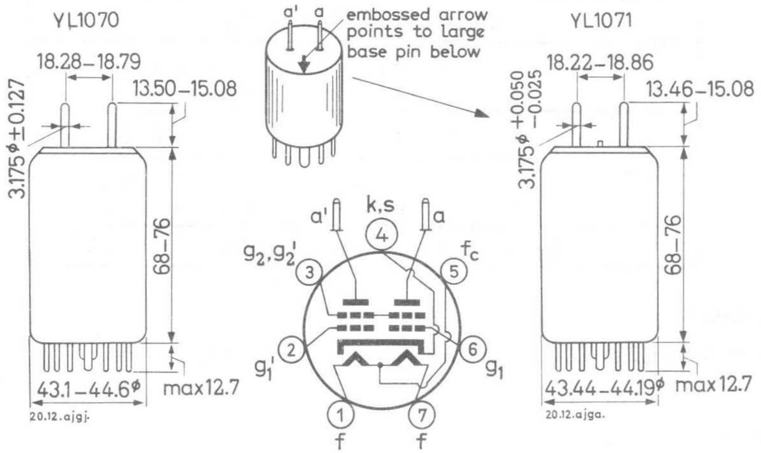
7Z2 2883

TYPICAL CHARACTERISTICS (each section)

Anode voltage	V_a	=	600	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	7	

MECHANICAL DATA

Dimensions in mm



Base:	Septar	
Accessories:	Anode connector	40681
→	Socket	2422 513 00001
Mounting position:	Vertical with base up or down Horizontal with anode pins in a horizontal plane	
Net weight:	70 g	

COOLING: Radiation and convection

When the tube is used at maximum permissible values it may be necessary to direct an air flow of approx. 0.6 m^3/min to the bulb and to the anode seals. The YL1071 has a calibrated bulb held to close tolerances. This permits an accurate fit into heatsink cooling equipment. 7Z2 8844

TEMPERATURE LIMITS (Absolute limits)

Temperature of bulb and all seals	max. 250	°C

R.F. CLASS C TELEGRAPHY AND F.M. TELEPHONY

LIMITING VALUES (Absolute limits) (each section)

Frequency	f		up to 60	up to 175	MHz
Anode voltage	V_a	=	max. 850	max. 750	V
Anode input power	W_{ia}	=	max. 90	max. 75	V
Anode dissipation	W_a	=	max. 30	max. 30	W
Anode current	I_a	=	max. 110	max. 110	mA
Grid No.2 voltage	V_{g_2}	=	max. 300	max. 300	V
Grid No.2 dissipation	W_{g_2}	=	max. 7	max. 7	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	max. 175	V
Grid No.1 current	I_{g_1}	=	max. 5	max. 5	mA
Cathode to heater voltage	V_{kf}	=	max. 100	max. 100	V

R. F. CLASS AB1 LINEAR S. S. B. AMPLIFIER suppressed carrier

LIMITING VALUES (Absolute limits) (each section)

Frequency	f		up to 60		MHz
			C.C.S.	I.C.A.S.	
Anode voltage	V_a	=	max. 1000	max. 1000	V
Anode input power	W_{ia}	=	max. 100	max. 110	W
Anode dissipation	W_a	=	max. 30	max. 34	W
Anode current	I_a	=	max. 110	max. 110	mA
Grid No.2 voltage	V_{g_2}	=	max. 360	max. 360	V
Grid No.2 dissipation	W_{g_2}	=	max. 3.5	max. 4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 175	max. 175	V
Grid No.1 current	I_{g_1}	=	max. 5	max. 5	mA
Cathode to heater voltage	V_{kf}	=	max. 100	max. 100	V

7Z2 2885

OPERATING CONDITIONS (two sections in parallel)

Table A

			C.C.S.			
Frequency	f	=		7		MHz
Anode voltage	V_a	=		1000		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-34		V 1)
Load resistance	$R_{a\sim}$	=		3100		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	34	34	V
Anode current	$I_{a+a'}$	=	50	195	131	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1.2	26	11.5	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.01	0.01	mA
Anode input power	$W_{ia+a'}$	=	50	195	131	W
Anode dissipation	$W_{a+a'}$	=	50	54	61	W
Output power	W_o	=	-	141	141 2)	W
Intermodulation distortion						
of the third order	d_{i_3}	=	-	-	< -30	dB 3)
of the fifth order	d_{i_5}	=	-	-	< -45	dB 3)

1) Adjust to obtain the stated zero signal anode current.

2) Peak envelope power value.

3) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

7Z2 2886

OPERATING CONDITIONS (two sections in parallel) (continued)

Table B

Frequency	f	=		7		MHz
Anode voltage	V_a	=		800		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-34		V [1]
Load resistance	R_a	=		2300		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	34	34	V
Anode current	$I_{a+a'}$	=	50	197	130	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1.2	26	12.5	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.01	0	mA
Anode input power	$W_{ia+a'}$	=	40	158	104	W
Anode dissipation	$W_{a+a'}$	=	40	46	43	W
Output power	W_o	=	-	112	112 [2]	W
Intermodulation distortion						
of the third order	d_{i_3}	=	-	-	< -30	dB [3]
of the fifth order	d_{i_5}	=	-	-	< -45	dB [3]

[1]) Adjust to obtain the stated zero signal anode current.

[2]) Peak envelope power value

[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

7Z2 2887

OPERATING CONDITIONS (two sections in parallel) (continued)

Table C

				C.C.S.		
Frequency	f	=		7		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-32.5		V [1]
Load resistance	R_a	=		1410		Ω
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	32.5	32.5	V
Anode current	$I_{a+a'}$	=	60	212	144	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1.9	25	13.5	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.01	0	mA
Anode input power	$W_{ia+a'}$	=	36	127	86	W
Anode dissipation	$W_{a+a'}$	=	36	88	48	W
Output power	W_o	=	–	76	76 [2]	W
Intermodulation distortion						
of the third order	d_{i_3}	=	–	–	< -30	dB [3]
of the fifth order	d_{i_5}	=	–	–	< -45	dB [3]

[1]) Adjust to obtain the stated zero signal anode current.

[2]) Peak envelope power value.

[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

7Z2 2888

OPERATING CONDITIONS (two sections in parallel) (continued)

Table D

			I.C.A.S.	
Frequency	f	=	7	MHz
Anode voltage	V_a	=	1000	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-36	V [1]
Load resistance	R_a	=	3000	Ω

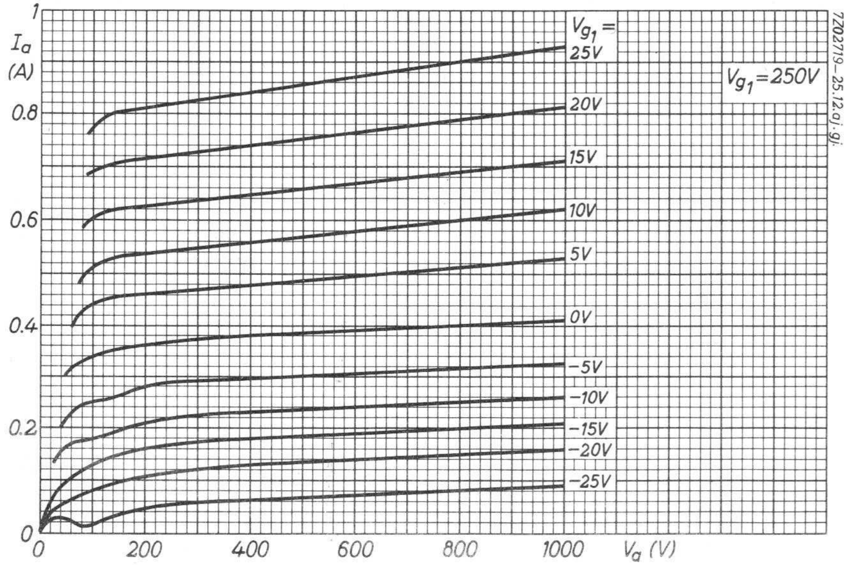
			zero signal	single tone	two tone	
Peak grid No.1 driving voltage	$V_{g_{1\sim p}}$	=	0	36	36	V
Anode current	$I_{a+a'}$	=	55	216	144	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	1	25	13	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	0	0.05	0.02	mA
Anode input power	$W_{ia+a'}$	=	55	216	144	W
Anode dissipation	$W_{a+a'}$	=	55	58	65	W
Output power	W_o	=	–	158	158 [2]	W
Intermodulation distortion						
of the third order	d_{i_3}	=	–	–	< -30	dB [3]
of the fifth order	d_{i_5}	=	–	–	< -45	dB [3]

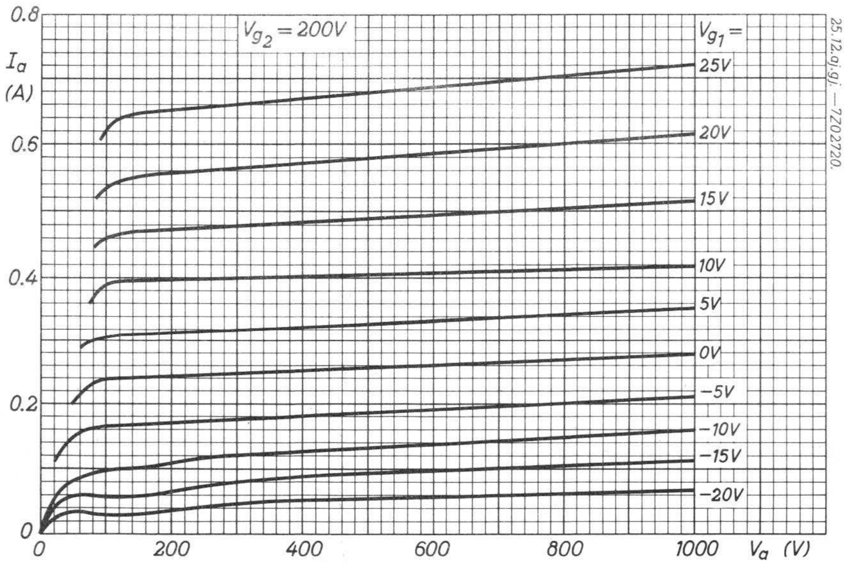
[1]) Adjust to obtain the stated zero signal anode current.

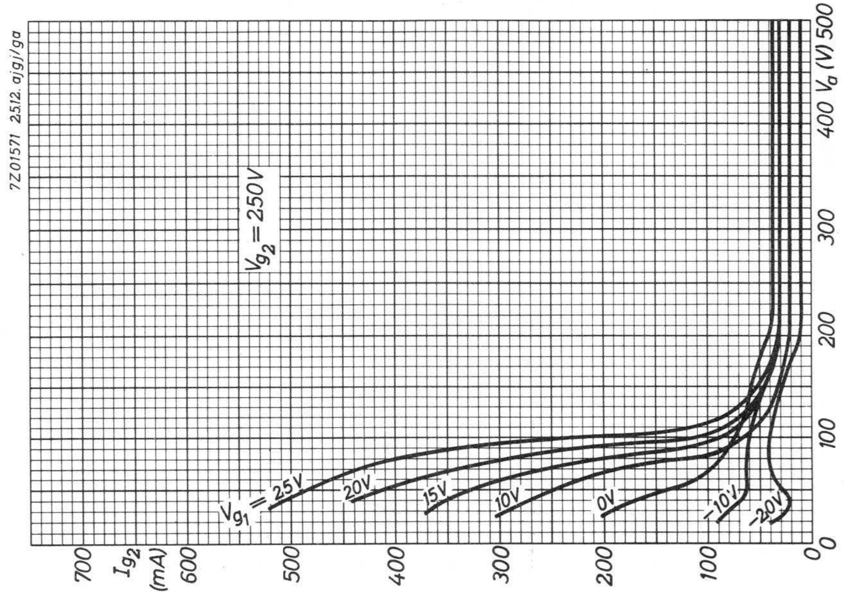
[2]) Peak envelope power value.

[3]) Distortion level, referred to the amplitude of either of the tones, at full drive; also highest distortion encountered at any driving level up to full drive.

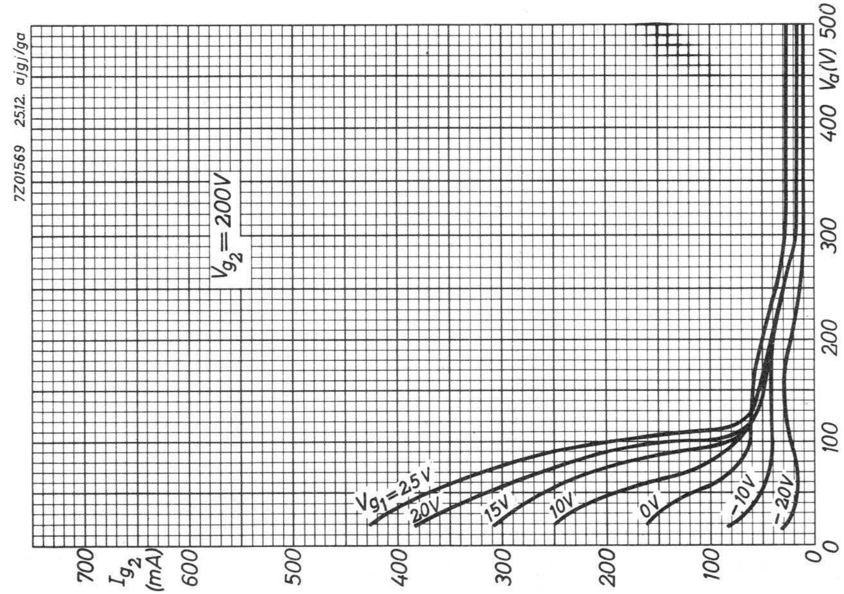
7Z2 2889


1
I_a
(A)
0.8
0.6
0.4
0.2
0
V_{g_1} =
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
−25V
V_{g_1}=250V
7Z02719−25.12.aj.gj.
0
200
400
600
800
1000
V_a (V)

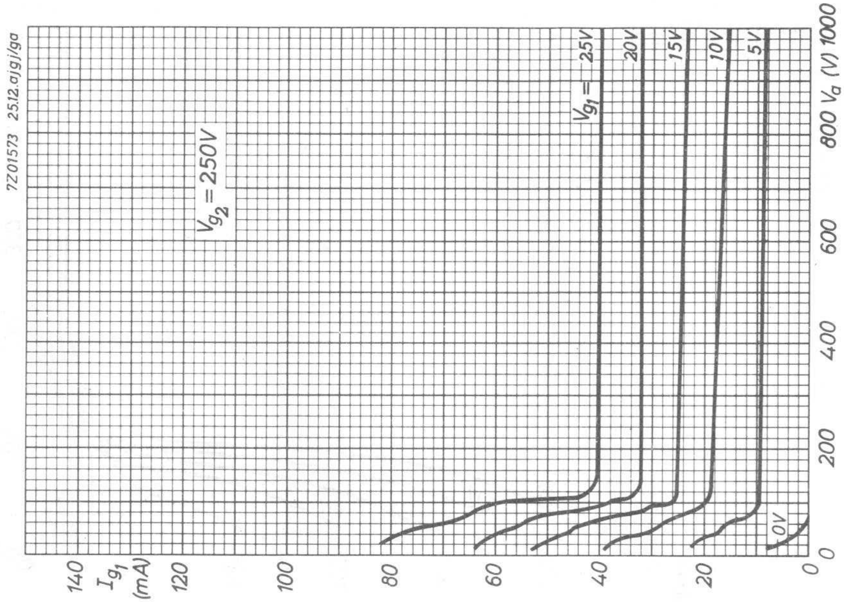

0.8
I_a
(A)
0.6
0.4
0.2
0
V_{g_2} = 200V
V_{g_1} =
25V
20V
15V
10V
5V
0V
−5V
−10V
−15V
−20V
25.12.aj.gj.—7Z02720.
0
200
400
600
800
1000
V_a (V)

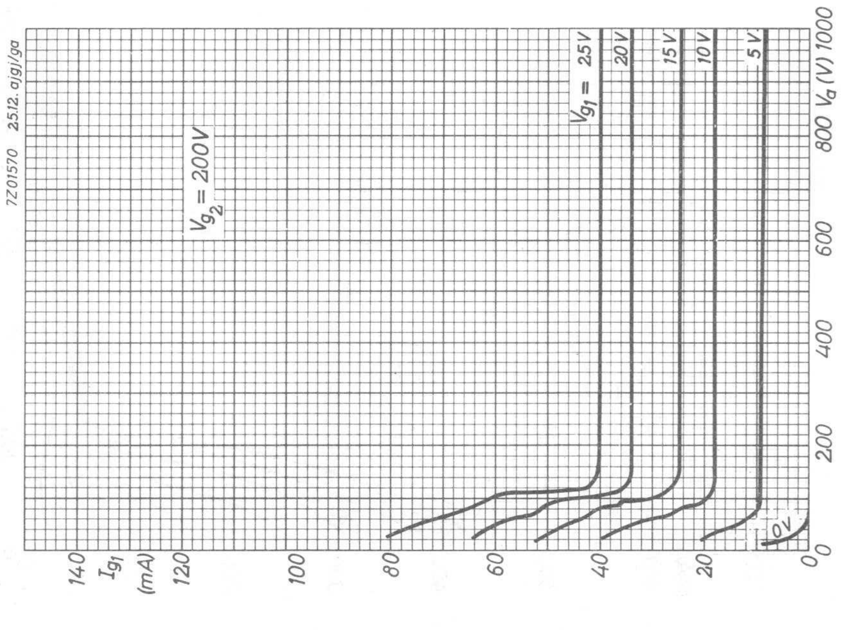


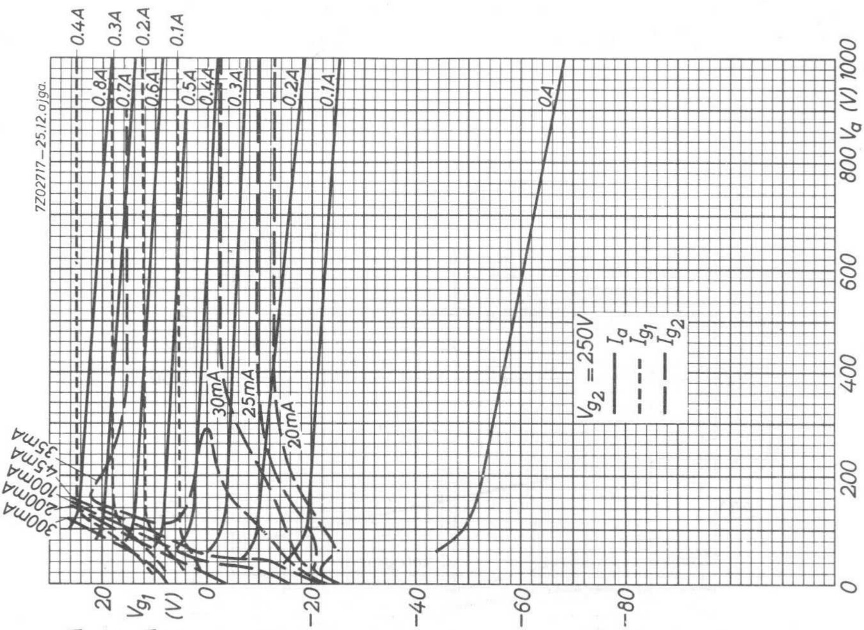
7Z01571 25.12. ajgj/ga
Vg2 = 250V
Vg1 = 25V
20V
15V
10V
0V
−10V
−20V
Va (V)
0
100
200
300
400
500
Ig2 (mA)
0
100
200
300
400
500
600
700

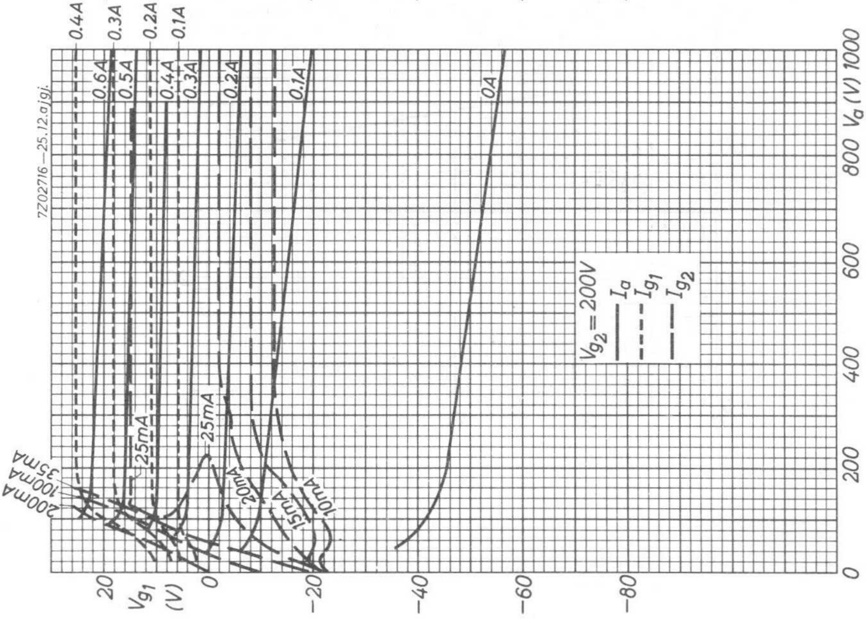


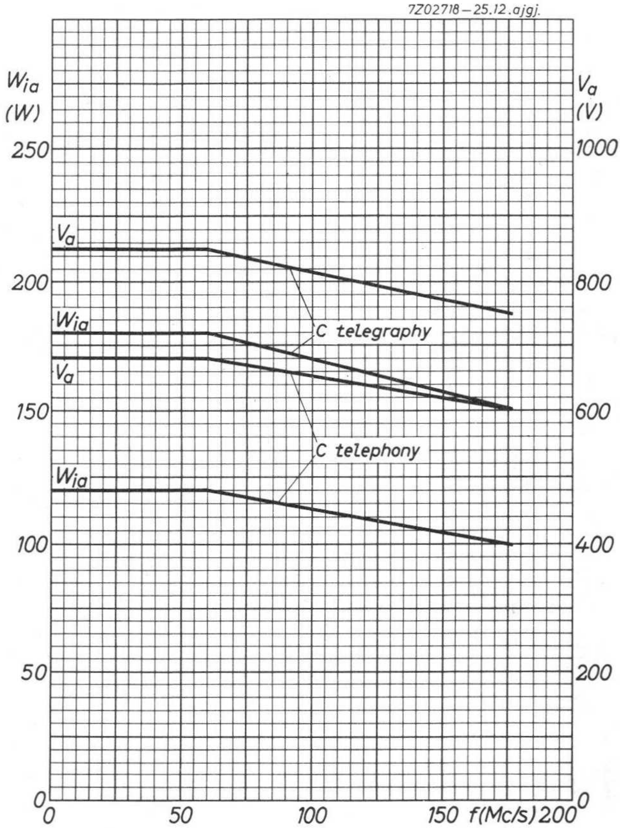
7Z01569 25.12. ajgj/ga
Vg2 = 200V
Vg1 = 25V
20V
15V
10V
0V
−10V
−20V
Va (V)
0
100
200
300
400
500
Ig2 (mA)
0
100
200
300
400
500
600
700


7Z01573 25.12.ajgj/ga
V_{g_2} = 250V
V_{g_1} = 25V
20V
15V
10V
5V
0V
I_{g_1} (mA)
140
120
100
80
60
40
20
0
0
200
400
600
800 V_a (V) 1000


7Z01570 25.12. ajgj/ga
V_{g_2} = 200V
V_{g_1} = 25V
20V
15V
10V
5V
0V
I_{g_1} (mA)
140
120
100
80
60
40
20
0
0
200
400
600
800 V_a (V) 1000


7Z02717—25.12.ajga.
V_{g_2} = 250V
I_a
I_{g_1}
I_{g_2}
V_{g_1} (V)
V_a (V)
0.4A
0.3A
0.2A
0.1A
0.8A
0.7A
0.6A
0.5A
0A
30mA
25mA
20mA
35mA
45mA
100mA
200mA
300mA
0
200
400
600
800
1000
20
-20
-40
-60
-80


7Z02716—25.12.ajgj.
V_{g_2} = 200V
I_a
I_{g_1}
I_{g_2}
V_{g_1} (V)
V_a (V)
0.4A
0.3A
0.2A
0.1A
0.6A
0.5A
0A
25mA
20mA
15mA
10mA
35mA
100mA
200mA
0
200
400
600
800
1000
20
-20
-40
-60
-80


7Z02718-25.12.ajgj.
W_{ia} (W)
V_a (V)
V_a
W_{ia}
V_a
W_{ia}
C telegraphy
C telephony
0
50
100
150
200
250
0
200
400
600
800
1000
0
50
100
150
f(Mc/s)
200

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating double tetrode intended for use in mobile equipment as R.F. amplifier or frequency multiplier up to 200 MHz or as modulator.

QUICK REFERENCE DATA

Freq. (MHz)	R.F. class C telegraphy			R.F. class C a-g_2 modulator			R.F. class C freq. multiplier		
	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)
200	300	1.0	12	200	1.0	7.0			
67/200							300	1.0	3.5

HEATING: direct by A.C. or D.C.; parallel or series supply
Filament oxide coated, harp type.

Frequency of the filament supply:

for sinusoidal supply voltage 50 to 60 Hz

for square wave supply voltage
(e.g. from a D.C.-A.C. converter) any

Sinusoidal supply voltages within the frequency range from 200 to 5000 Hz shall not be used.

Filament voltage	V_f	=	1.6	V ± 15% 3)
Filament current	I_f	=	2.5	A
Heating time for W_o = 70% of full output power	T_h	<	0.5	sec

COOLING: radiation and convection
The use of a closed tube shield is not recommended.

1) Driver output power

2) Useful power in the load

3) Total permissible variation due to variations of supply voltage and setting of V_f.

7Z2 3786

CAPACITANCES

Anode to all other elements except grid No.1	C_a	$= C_{a'}$	=	3.1	pF
Grid No.1 to all other elements except anode	C_{g_1}	$= C_{g_1'}$	=	7.5	pF
Anode to grid No.1	C_{ag_1}	$= C_{a'g'_1}$	<	0.1	pF
Anode of one system to grid No.1 of the other system	$C_{ag_1'}$	$= C_{a'g_1}$	<	0.1	pF
Between the grids No.1	$C_{g_1g_1'}$		=	2	pF
Between the anodes	$C_{aa'}$		=	0.06	pF

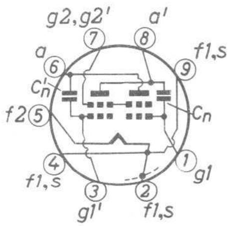
The tube is internally neutralised up to 200 MHz

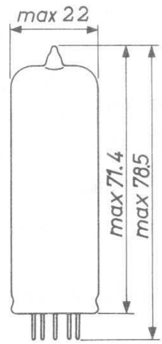
TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	200	V
Grid No.2 voltage	V_{g_2}	=	200	V
Anode current	I_a	=	30	mA
Amplification factor	$\mu_{g_2g_1}$	=	7	
Mutual conductance	S	=	3.3	mA/V

MECHANICAL DATA (Dimensions in mm)

Base	:	Noval
→ Socket	:	2422 502 01003
Tube retainer	:	40647
Net weight	:	16 g





Mounting position: any. If the tube is mounted with its main axis deviating from the vertical, it is recommended that pins 2 and 7 be in a vertical plane.

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	= max.	250	^{o}C
Pin temperature	= max.	120	^{o}C

7Z2 8845

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY

LIMITING VALUES (each system; absolute limits)

Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	300	V
Anode current	I_a	=	max.	45	mA
Anode dissipation	W_a	=	max.	5	W
Grid No.2 voltage	V_{g_2}	=	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No.1 current	I_{g_1}	=	max.	3	mA
Grid No.1 dissipation	W_{g_1}	=	max.	0.2	W
Grid No.1 circuit resistance	R_{g_1}	=	max.	100	kΩ
Cathode current	I_k	=	max.	50	mA
Peak cathode current	I_{k_p}	=	max.	225	mA

OPERATING CONDITIONS, two systems in push-pull

Frequency	f	=	200	200	200	MHz
Anode voltage	V_a	=	300	250	200	V
Grid No.2 supply voltage	V_{bg_2}	=	300	250	200	V
Grid No.2 resistor	R_{g_2}	=	56	47	22	kΩ
Grid No.1 voltage	V_{g_1}	=	-40	-	-	V
Common grid No.1 resistor	R_{g_1}	=	-	18	15	kΩ
Peak grid-to-grid A.C. voltage	$V_{g_1 g_1'\,p}$	=	110	110	115	V
Anode current	I_a	=	2 x 37.5	2 x 33.5	2 x 35	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	2.3	1.8	2.2	mA
Grid No.1 current	$I_{g_1+g_1'}$	=	2 x 0.9	2.2	2.7	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.4	0.3	0.33	W
Driver output power	W_{dr}	=	1.0	1.0	1.0	W
Anode input power	W_{i_a}	=	2 x 11.3	2 x 8.4	2 x 7.0	W
Anode dissipation	W_a	=	2 x 4.0	2 x 2.9	2 x 2.8	W
Tube efficiency	η	=	65	65	60	%
Output power in the load	W_ℓ	=	12	9.0	7.4	W

7Z2 3675

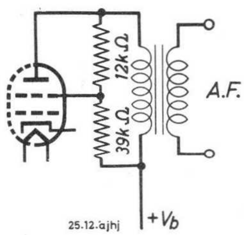
R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (each system; absolute limits)

Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	240	V
Anode current	I_a	=	max.	37.5	mA
Anode input power	W_{ia}	=	max.	7.5	W
Anode dissipation	W_a	=	max.	3.3	W
Grid No. 2 voltage	V_{g_2}	=	max.	200	V
Grid No. 2 dissipation	W_{g_2}	=	max.	0.65	W
Negative grid No. 1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No. 1 current	I_{g_1}	=	max.	3	mA
Grid No. 1 dissipation	W_{g_1}	=	max.	0.2	W
Cathode current	I_k	=	max.	40	mA
Peak cathode current	I_{k_p}	=	max.	180	mA

OPERATING CONDITIONS, two systems in push-pull

Frequency	f	=	200	MHz
Anode voltage	V_a	=	200	V
Grid No. 2 supply voltage (see fig. below)	V_{bg_2}	=	200	V
Common grid No. 1 resistor	R_{g_1}	=	33	kΩ
Peak grid-to-grid A.C. voltage	$V_{g_1 g_1' p}$	=	130	V
Anode current	I_a	=	2 x 33.5	mA
Grid No. 2 current	$I_{g_2+g_2'}$	=	2.6	mA
Grid No. 1 current	$I_{g_1+g_1'}$	=	1.5	mA
Grid No. 2 dissipation	W_{g_2}	=	0.46	W
Driver output power	W_{dr}	=	1.0	W
Anode input power	W_{ia}	=	2 x 6.7	W
Anode dissipation	W_a	=	2 x 2.65	W
Tube efficiency	η	=	60	%
Useful power in the load	W_ℓ	=	7.0	W
Modulation depth	m	=	100	%
Modulation power	W_{mod}	=	6.7	W



7Z2 3676

R.F. CLASS C FREQUENCY TRIPLER

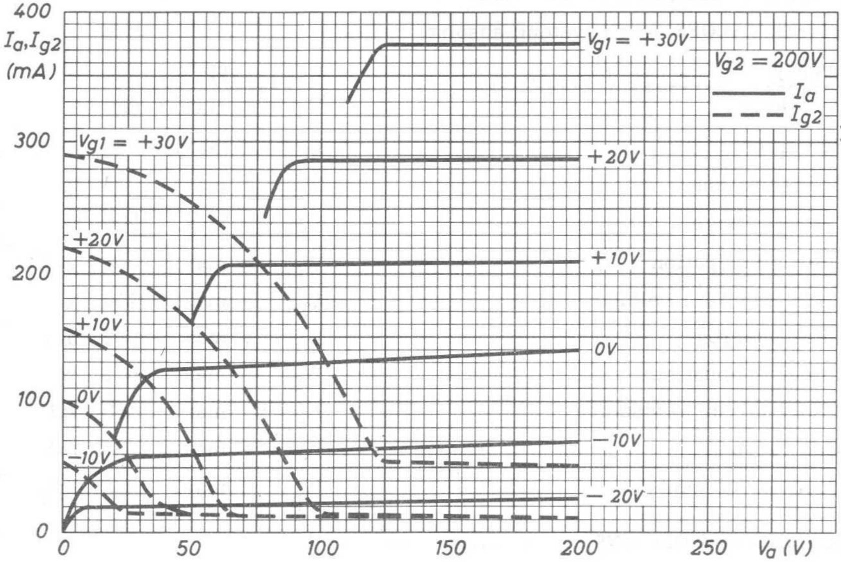
LIMITING VALUES (each system; absolute limits)

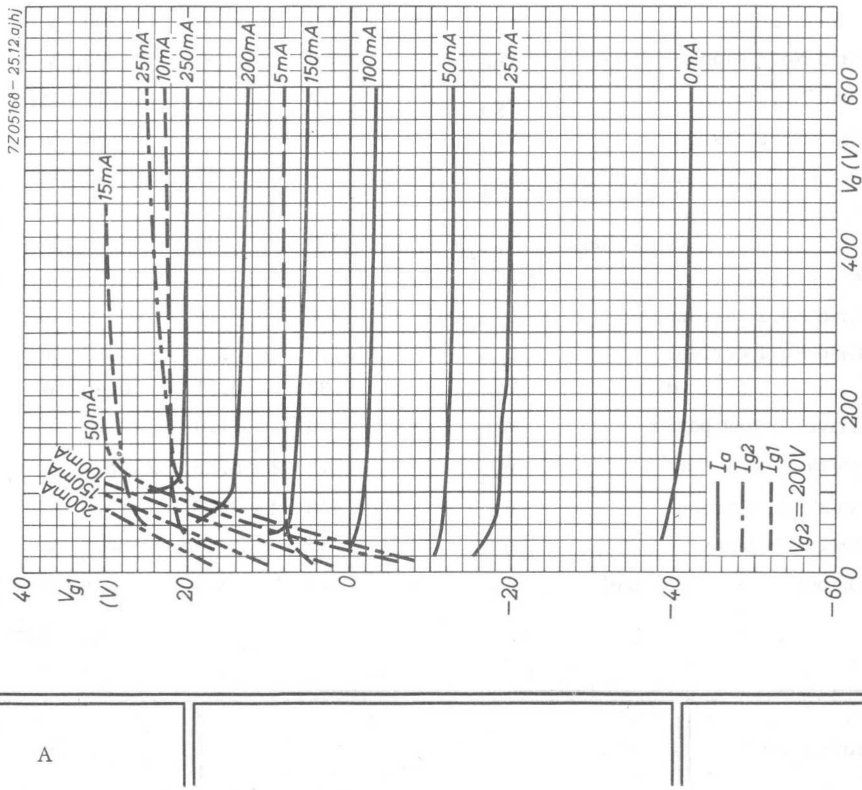
Frequency	f		up to	200	MHz
Anode voltage	V_a	=	max.	300	V
Anode current	I_a	=	max.	30	mA
Anode dissipation	W_a	=	max.	5	W
Grid No. 2 voltage	V_{g_2}	=	max.	200	V
Grid No. 2 dissipation	W_{g_2}	=	max.	1	W
Negative grid No. 1 voltage	$-V_{g_1}$	=	max.	150	V
Grid No. 1 current	I_{g_1}	=	max.	2	mA
Grid No. 1 dissipation	W_{g_1}	=	max.	0.2	W
Grid No. 1 circuit resistance	R_{g_1}	=	max.	100	kΩ
Cathode current	I_k	=	max.	35	mA
Peak cathode current	I_{k_p}	=	max.	225	mA

OPERATING CONDITIONS, two systems in push-pull

Frequency	f	=	67/200	67/200	67/200	MHz
Anode voltage	V_a	=	300	250	200	V
Grid No. 2 supply voltage	V_{bg_2}	=	300	250	200	V
Grid No. 2 resistor	R_{g_2}	=	72	47	15	kΩ
Grid No. 1 voltage	V_{g_1}	=	-100	-	-	V
Common grid No. 1 resistor	R_{g_1}	=	-	47	33	kΩ
Peak grid-to-grid A.C. voltage	$V_{g_1g_1'p}$	=	230	230	230	V
Anode current	I_a	=	2 x 24	2 x 25	2 x 28.5	mA
Grid No. 2 current	$I_{g_2+g_2'}$	=	2.0	1.9	3.0	mA
Grid No. 1 current	$I_{g_1+g_1'}$	=	2 x 1.0	2.0	3.2	mA
Grid No. 2 dissipation	$W_{g_2+g_2'}$	=	0.30	0.31	0.46	W
Driver output power	W_{dr}	=	1.0	1.0	2.0	W
Anode input power	W_{i_a}	=	2 x 7.2	2 x 6.25	2 x 5.7	W
Anode dissipation	W_a	=	2 x 4.0	2 x 3.75	2 x 3.8	W
Tube efficiency	η	=	45	40	33.5	%
Output power in the load	W_ℓ	=	3.5	3.0	2.8	W

7Z2 3677


400
I_a, I_{g2}
(mA)
300
200
100
0
0
50
100
150
200
250
V_a (V)
V_{g1} = +30V
+20V
+10V
0V
−10V
− 20V
V_{g1} = +30V
+20V
+10V
0V
−10V
V_{g2} = 200V
I_a
I_{g2}
7Z02325-25.12.ajhj


7Z05168-25.12.ajhj
15mA
25mA
10mA
250mA
200mA
5mA
150mA
100mA
50mA
25mA
0mA
50mA
100mA
150mA
200mA
I_a
I_{g2}
I_{g1}
V_{g2} = 200V
40
V_{g1} (V)
20
0
−20
−40
−60
0
200
400
V_a (V)
600

WATER COOLED R.F. POWER TETRODE

Water cooled power tetrode in coaxial construction intended for use as R.F. amplifier in SSB transmitters and as A.M. amplifier.

QUICK REFERENCE DATA				
Frequency MHz	S.S.B.		C_{a-g_2} mod.	
	V_a(kV)	W_o(kW) P.E.P.	V_a(kV)	W_o(kW)
30	9	120	11	220

HEATING : Direct, filament thoriated tungsten

Filament voltage	V_f	21	V
Filament current	I_f	350	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	120	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	600	pF
Anode to grid No.1	C_{ag_1}	8.5	pF [1])

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	1	kV
Anode current	I_a	10	A
Transconductance	S	130	mA/V
Amplification factor	$\mu_{g_2g_1}$	4	–

[1]) Measured with a flat shield of 500 mm diameter in the plane of grid No.2

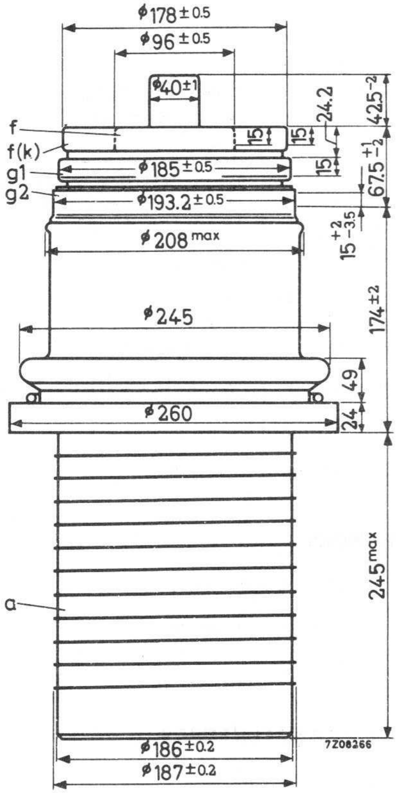
7Z2 8562

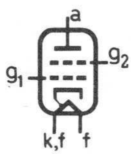
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 33 kg

Mounting position: vertical with anode down





ACCESSORIES

Water jacket	type K734
Filament connector (one required)	type 40732
Grid No.1 connector	type 40733
Grid No.2 connector	type 40734

7Z2 8618

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	15	kV
Grid No.2 voltage	V_{g_2}	max.	1.6	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	40	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	360	kW
Anode dissipation	W_a	max.	120	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		9		kV
Grid No.2 voltage	V_{g_2}		1.5		kV
Grid No.1 voltage	V_{g_1}		-450		V [1]
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	450	450	V
Anode current	I_a	5	21	13.2	A
Grid No.2 current	I_{g_2}	0	0.8	0.5	A
Anode input power	W_{i_a}	45	189	118.8	kW
Anode dissipation	W_a	45	69	58.8	kW
Grid No.2 dissipation	W_{g_2}	0	1.2	0.75	kW
Output power (P.E.P.)	W_o	-	120	120	kW

[1]) Adjust to give the zero signal anode current.

7Z2 8564

R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

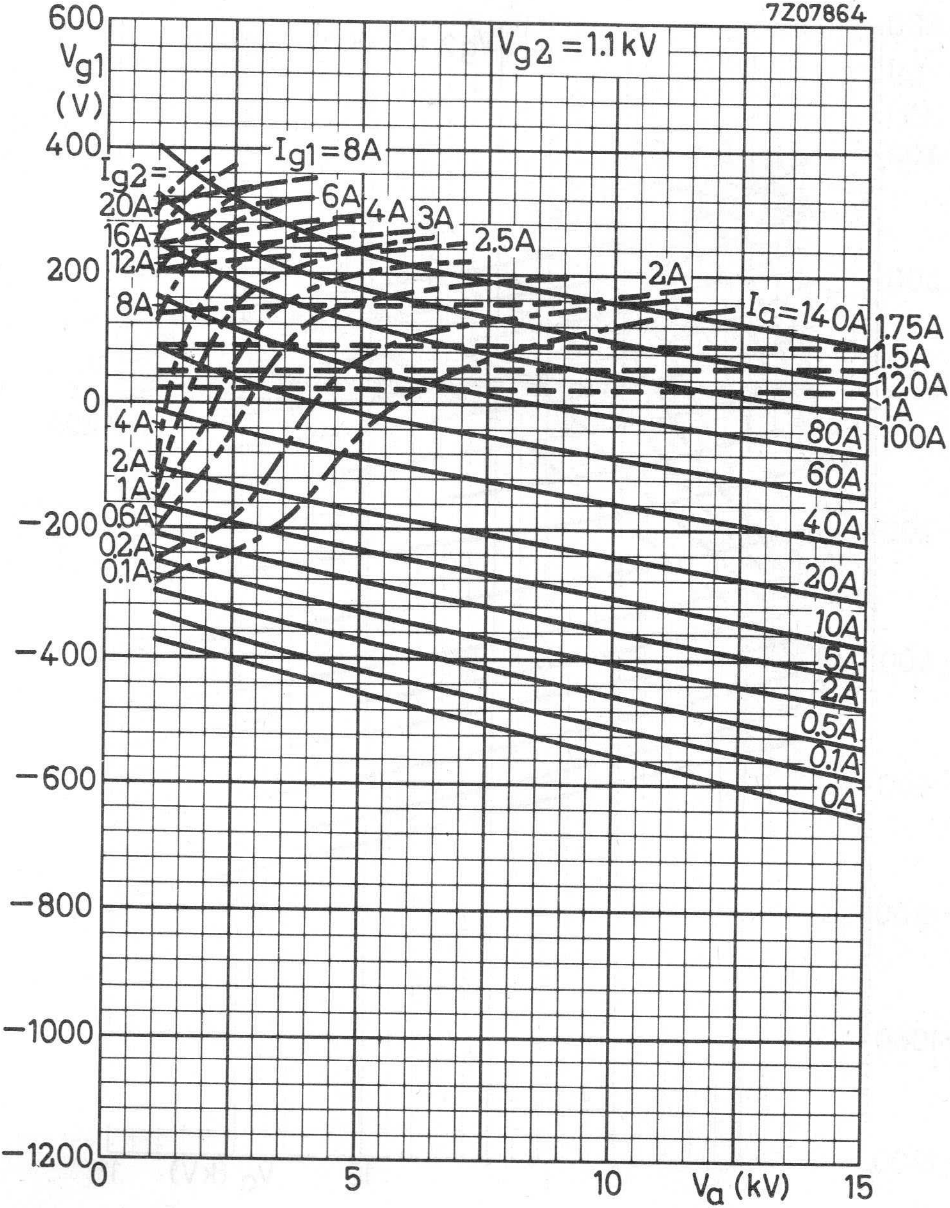
LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	11.5	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	32	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	300	kW
Anode dissipation	W_a	max.	80	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

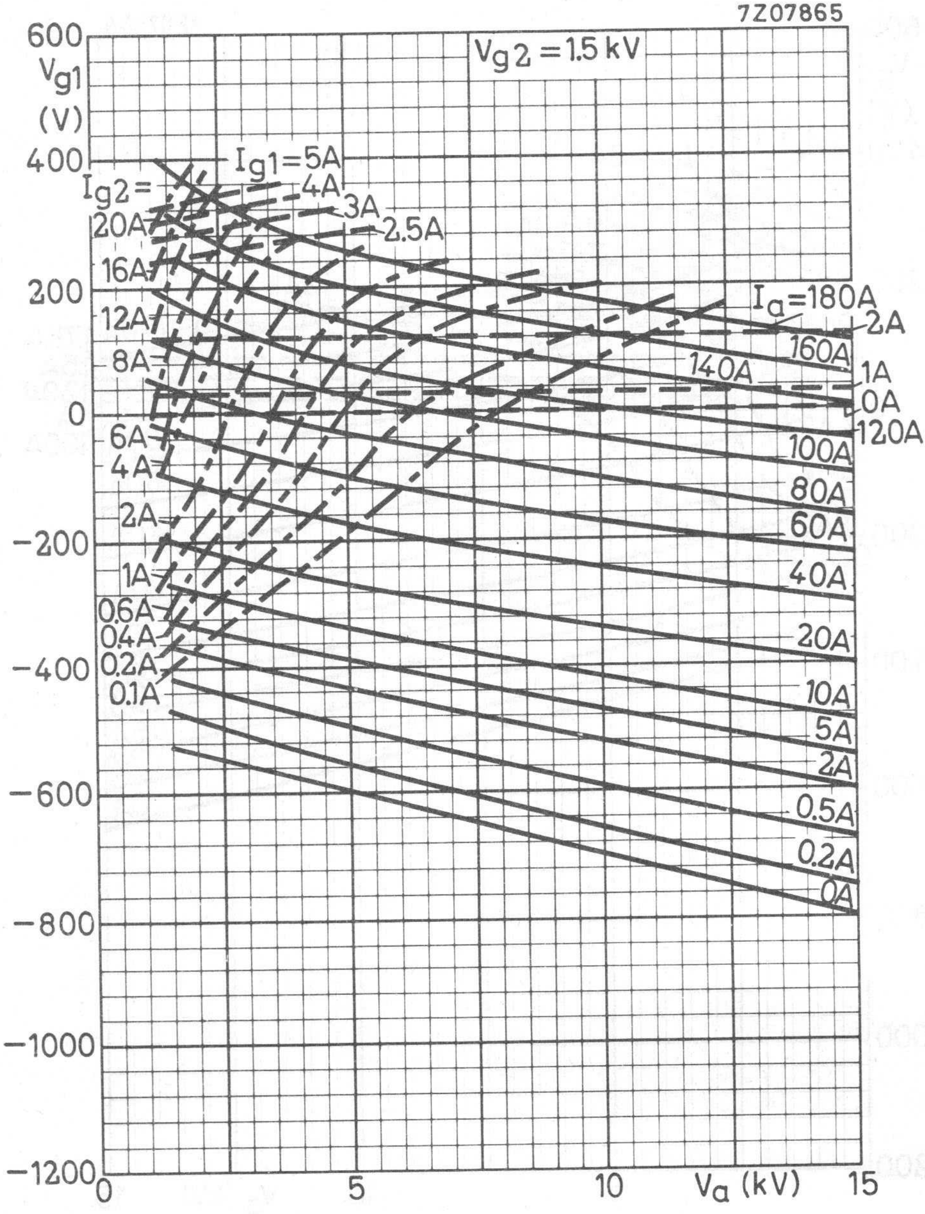
OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	11	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-590	V
Grid No.1 resistor	R_{g_1}	60	Ω
Grid No.1 driving voltage	$V_{g_{1p}}$	960	V
Anode current	I_a	25	A
Grid No.2 current	I_{g_2}	3	A
Grid No.1 current	I_{g_1}	1.6	A
Driving power	W_{dr}	1.4	kW
Grid No.2 dissipation	W_{g_2}	2.4	kW
Anode input power	W_{i_a}	275	kW
Output power	W_o	220	kW
Anode dissipation	W_a	55	kW
Efficiency	η	80	%
Modulation depth	m	100	%
Modulation power	W_{mod}	140	kW
Grid No.2 voltage, peak	$V_{g_{2p}}$	700	V

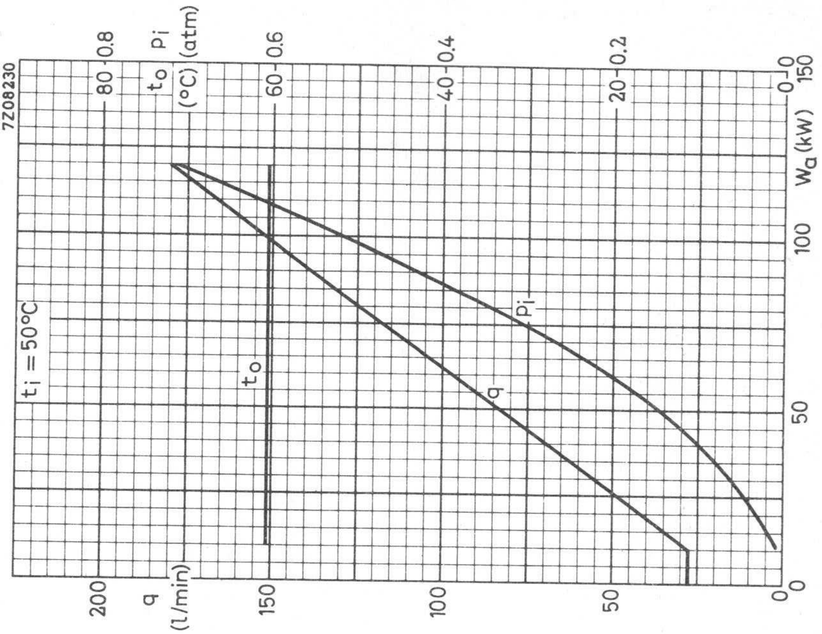
7Z2 8565

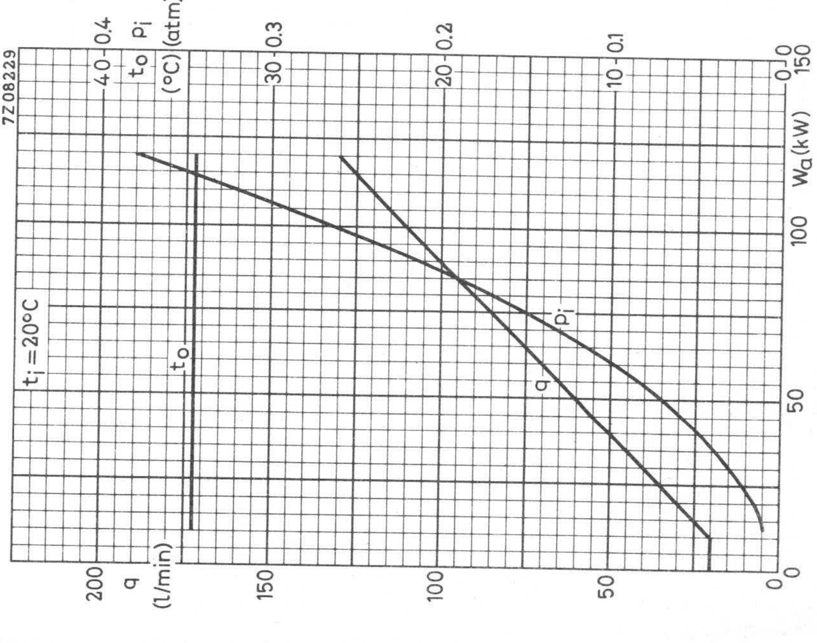

7Z07864
V_{g2} = 1.1 kV
V_{g1} (V)
600
400
200
0
−200
−400
−600
−800
−1000
−1200
I_{g1} = 8A
6A
4A
3A
2.5A
2A
I_{g2} =
20A
16A
12A
8A
4A
2A
1A
0.6A
0.2A
0.1A
I_a = 140A
120A
100A
80A
60A
40A
20A
10A
5A
2A
0.5A
0.1A
0A
1.75A
1.5A
1A
0
5
10
15
V_a (kV)

YL1090



7Z07865
V_{g2} = 1.5 kV
V_{g1} (V)
600
400
200
0
−200
−400
−600
−800
−1000
−1200
I_{g1}=5A
4A
3A
2.5A
I_{g2}=
20A
16A
12A
8A
6A
4A
2A
1A
0.6A
0.4A
0.2A
0.1A
I_a=180A
2A
160A
140A
1A
0A
120A
100A
80A
60A
40A
20A
10A
5A
2A
0.5A
0.2A
0A
0
5
10
15
V_a (kV)


7Z08230
$t_i = 50°C$
t_o
p_i
q
W_a (kW)
q (l/min)
t_o (°C)
p_i (atm)


7Z08229
$t_i = 20°C$
t_o
p_i
q
W_a (kW)
q (l/min)
t_o (°C)
p_i (atm)

VAPOUR COOLED R.F. POWER TETRODE

Vapour cooled power tetrode in coaxial construction intended for use as R.F. amplifier in SSB transmitters and as A.M. amplifier.

QUICK REFERENCE DATA				
Frequency MHz	S.S.B.		C_{a}-g_2 mod.	
	V_a(kV)	W_o(kW) P.E.P.	V_a(kV)	W_o(kW)
30	9	120	11	220

HEATING: Direct, filament thoriated tungsten

Filament voltage	V_f	21	V
Filament current	I_f	350	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	120	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	600	pF
Anode to grid No.1	C_{ag_1}	8.5	pF [1])

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	1	kV
Anode current	I_a	10	A
Transconductance	S	130	mA/V
Amplification factor	$\mu_{g_2g_1}$	4	-

[1]) Measured with a flat shield of 500 mm diameter in the plane of grid No.2

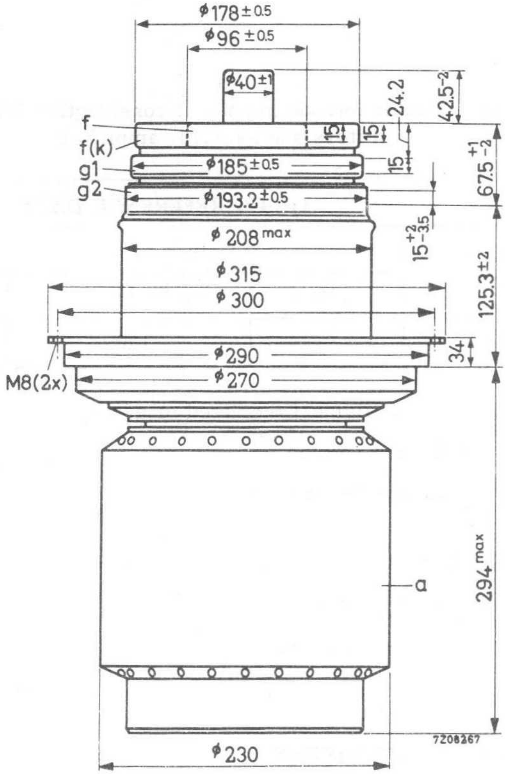
7Z2 8566

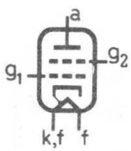
MECHANICAL DATA Dimensions in mm

Net weight: approx. 51 kg

Mounting position: vertical with anode down

→





ACCESSORIES

Boiler	type K729
Filament connector (one required)	type 40732
Grid No.1 connector	type 40733
Grid No.2 connector	type 40734

7Z2 8619

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	15	kV
Grid No.2 voltage	V_{g_2}	max.	1.6	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	40	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	360	kW
Anode dissipation	W_a	max.	150	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		9		kV
Grid No.2 voltage	V_{g_2}		1.5		kV
Grid No.1 voltage	V_{g_1}		-450		V [1])
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	450	450	V
Anode current	I_a	5	21	13.2	A
Grid No.2 current	I_{g_2}	0	0.8	0.5	A
Anode input power	W_{i_a}	45	189	118.8	kW
Anode dissipation	W_a	45	69	58.8	kW
Grid No.2 dissipation	W_{g_2}	0	1.2	0.75	kW
Output power (P.E.P.)	W_o	-	120	120	kW

[1]) Adjust to give the zero signal anode current.

7Z2 8568

R.F. CLASS C ANODE AND SCREEN GRID MODULATION (carrier conditions)

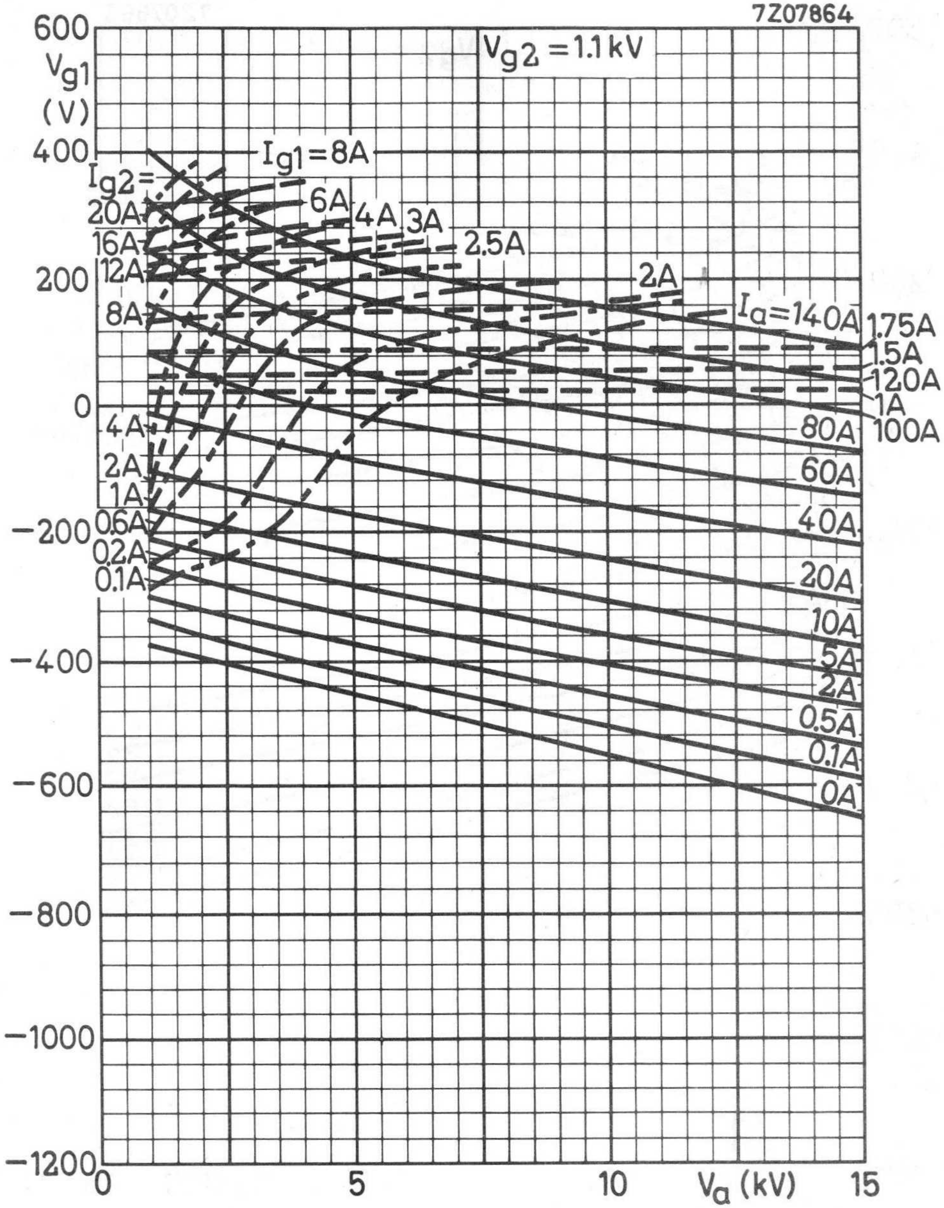
LIMITING VALUES (Absolute max. rating system)

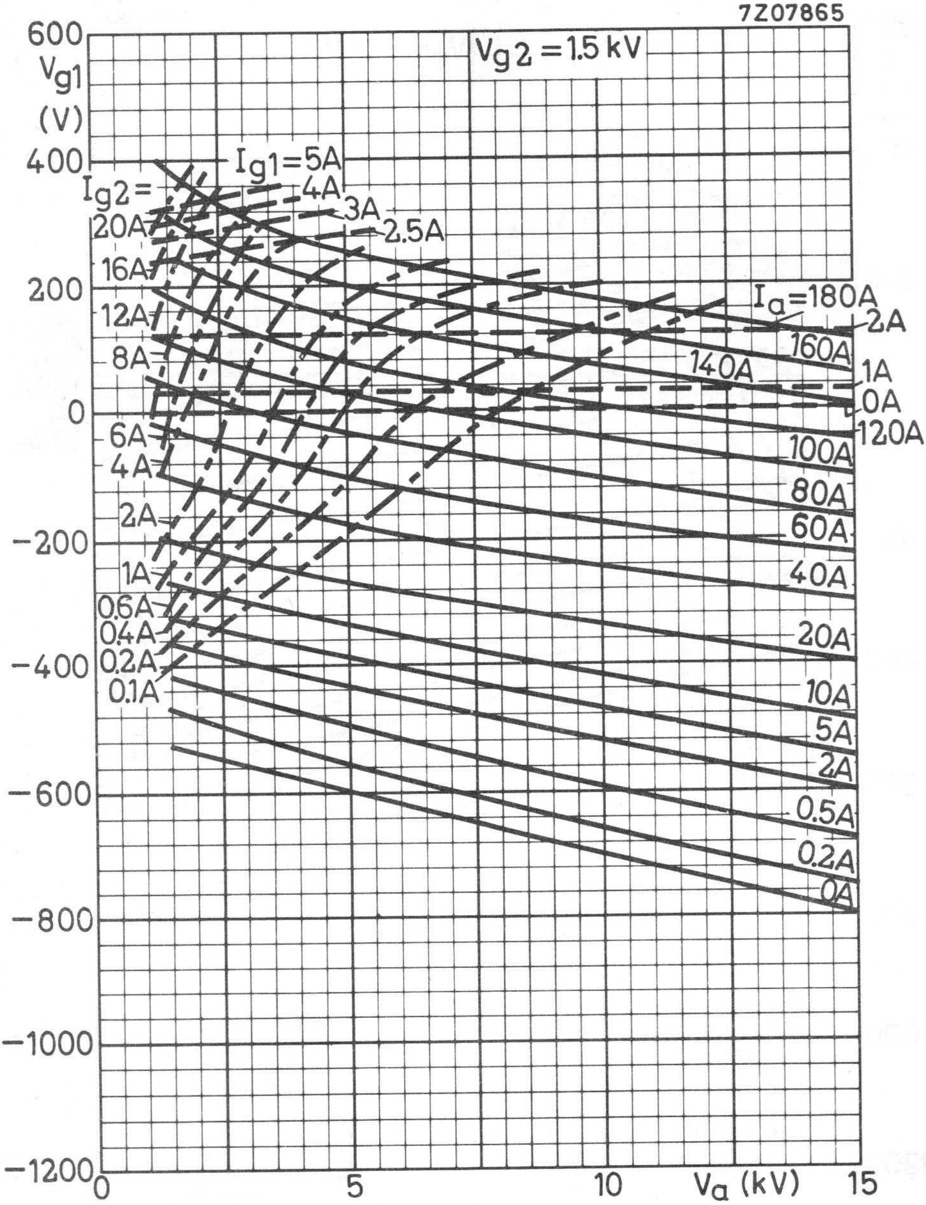
Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	11.5	kV
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.1 voltage	$-V_{g_1}$	max.	800	V
Anode current	I_a	max.	32	A
Grid No.1 current	I_{g_1}	max.	3	A
Anode input power	W_{i_a}	max.	300	kW
Anode dissipation	W_a	max.	100	kW
Grid No.2 dissipation	W_{g_2}	max.	2.7	kW
Grid No.1 dissipation	W_{g_1}	max.	1.2	kW

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	11	kV
Grid No.2 voltage	V_{g_2}	800	V
Grid No.1 voltage	V_{g_1}	-590	V
Grid No.1 resistor	R_{g_1}	60	Ω
Grid No.1 driving voltage	$V_{g_{1p}}$	960	V
Anode current	I_a	25	A
Grid No.2 current	I_{g_2}	3	A
Grid No.1 current	I_{g_1}	1.6	A
Driving power	W_{dr}	1.4	kW
Grid No.2 dissipation	W_{g_2}	2.4	kW
Anode input power	W_{i_a}	275	kW
Output power	W_o	220	kW
Anode dissipation	W_a	55	kW
Efficiency	η	80	%
Modulation depth	m	100	%
Modulation power	W_{mod}	140	kW
Grid No.2 voltage, peak	$V_{g_{2p}}$	700	V

7Z2 8569


7Z07864
V_{g2} = 1.1 kV
600
V_{g1}
(V)
400
200
0
−200
−400
−600
−800
−1000
−1200
I_{g1}=8A
6A
4A
3A
2.5A
2A
I_{g2}=
20A
16A
12A
8A
4A
2A
1A
0.6A
0.2A
0.1A
I_a=140A
1.75A
1.5A
120A
1A
100A
80A
60A
40A
20A
10A
5A
2A
0.5A
0.1A
0A
0
5
10
V_a (kV)
15


7Z07865
V_{g2} = 1.5 kV
600
V_{g1}
(V)
400
200
0
−200
−400
−600
−800
−1000
−1200
I_{g1}=5A
4A
3A
2.5A
I_{g2}=
20A
16A
12A
8A
6A
4A
2A
1A
0.6A
0.4A
0.2A
0.1A
I_a=180A
2A
160A
140A
1A
0A
120A
100A
80A
60A
40A
20A
10A
5A
2A
0.5A
0.2A
0A
0
5
10
V_a (kV)
15

COAXIAL BEAM POWER TETRODES

Beam power tetrodes with ceramic to metal seals and coaxial arrangement of the terminals. The tubes are intended for use as RF power amplifier, oscillator and frequency multiplier and as AF amplifier and modulator in AM, FM and SSB transmitters for frequencies up to 2000 MHz.

QUICK REFERENCE DATA						
Frequency (MHz)	C telegr.		C_{ag_2} mod.		SSB	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)[1]
1200	900	40				
400	900	80	700	45		
60					850	40

COOLING

YL1100 and YL1101: forced air cooling of radiator and seals

YL1102 and YL1103: heatsink cooling

HEATING: indirect by A.C. or D.C.; cathode oxide coated

YL1100 and YL1102	Heater voltage	V_f	= 26.5	V
	Heater current	I_f	= 0.52	A
	Heating time	T_h	= min. 60	sec
YL1101 and YL1103	Heater voltage	V_f	= 6.3	V
	Heater current	I_f	= 2.1	A
	Heating time	T_h	= min. 60	sec

The heater voltage must be reduced dependent on the operating conditions and the frequency.

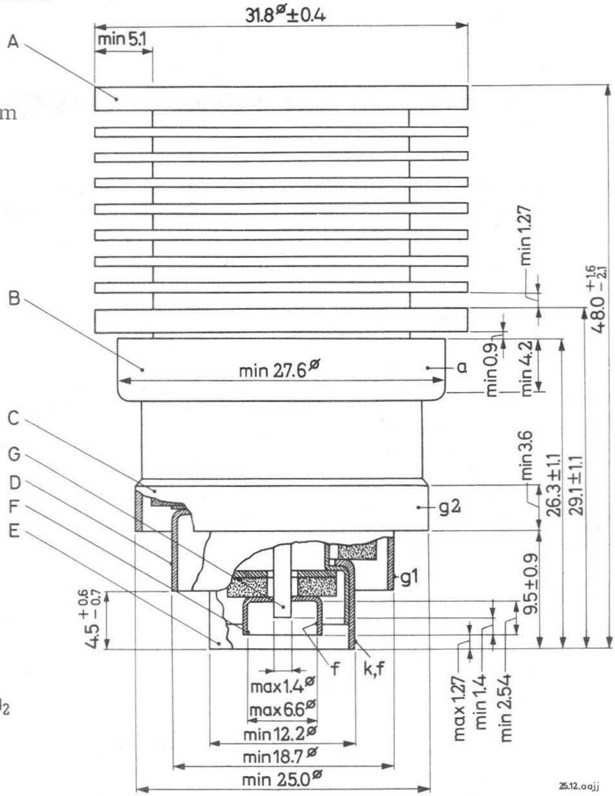
[1]) Single tone operation

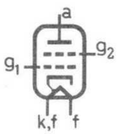
7Z2 3842

MECHANICAL DATA

Dimensions in mm

YL1100
YL1101





Radiator and terminals lie inside or outside concentric cylinders with the following diameters:

Radiator	:	A	inside	33.40 mm diameter
Anode terminal	:	B	inside	28.40 mm diameter
g_2 terminal	:	C	inside	25.86 mm diameter
g_1 terminal	:	D	inside	19.38 mm diameter
Cathode terminal	:	E	inside	13.16 mm diameter
Heater terminal	:	F	outside	6.07 mm diameter
		G	inside	1.78 mm diameter

Mounting position : any

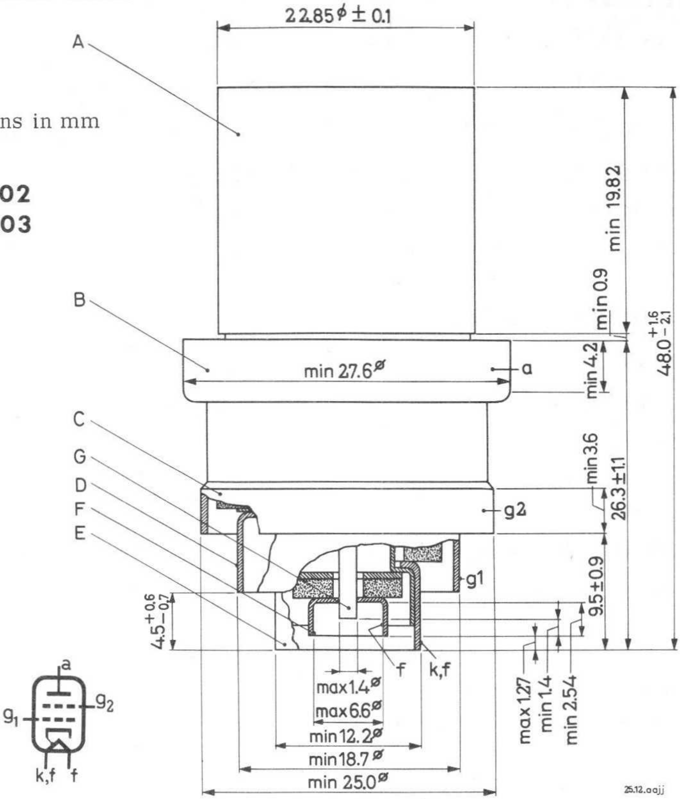
Net weight : 60 g

7Z2 3843

MECHANICAL DATA

Dimensions in mm

YL1102
YL1103



Cooling cylinder and terminals lie inside or outside concentric cylinders with the following diameters:

Cooling cylinder	: A	inside	24.15	mm diameter
Anode terminal	: B	inside	28.40	mm diameter
g_2 terminal	: C	inside	25.86	mm diameter
g_1 terminal	: D	inside	19.38	mm diameter
Cathode terminal	: E	inside	13.16	mm diameter
Heater terminal	: F	outside	6.07	mm diameter
	: G	inside	1.78	mm diameter

Mounting position : any

Net weight : 60 g

7Z2 3844

CAPACITANCES

Anode to grid No.1	C_{ag_1}	<	0.065	pF
Grid No.1 to cathode and heater	$C_{g_1-(k+f)}$	=	14	pF
Anode to cathode and heater	$C_{a-(k+f)}$	<	0.015	pF
Grid No.2 to grid No.1	$C_{g_2g_1}$	=	19	pF
Anode to grid No.2	C_{ag_2}	=	4.4	pF
Grid No.2 to cathode and heater	$C_{g_2-(k+f)}$	<	0.4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1000	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	100	mA
Amplification factor	μ_{g2g1}	=	18	

TEMPERATURE LIMITS (Absolute limits)

Anode seal temperature	t	= max.	250	°C

7Z2 3845

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1200	MHz
Anode voltage	V_a	=	max.	1000	V
Anode input power	W_{ia}	=	max.	180	W
Anode dissipation	W_a	=	max.	115	W
Anode current	I_a	=	max.	180	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	4.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

OPERATING CONDITIONS (grid drive)

Frequency	f	=	400	1200	MHz
Anode voltage	V_a	=	900	900	V
Grid No.2 voltage	V_{g_2}	=	300	300	V [1])
Grid No.1 voltage	V_{g_1}	=	−30	−22	V
Anode current	I_a	=	170	170	mA
Grid No.2 current	I_{g_2}	=	1	1	mA
Grid No.1 current	I_{g_1}	=	10	4	mA
Driving power	W_{dr}	=	3	5	W
Output power in load	W_{load}	=	80	40	W

OPERATING CONDITIONS (cathode drive)

Frequency	f	=	1200	MHz
Anode voltage	V_a	=	900	V
Grid No.2 voltage	V_{g_2}	=	300	V
Grid No.1 voltage	V_{g_1}	=	−31	V
Anode current	I_a	=	170	mA
Grid No.2 current	I_{g_2}	=	3.2	mA
Grid No.1 current	I_{g_1}	=	3.4	mA
Driving power	W_{dr}	=	8	W
Output power in load	W_{load}	=	40	W [2])

[1]) Fixed supply or supply derived from the anode supply by means of a voltage divider.

[2]) Power transferred from driving stage included.

7Z2 3846

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

(Carrier conditions with modulation up to 100%)

Frequency	f		up to	1200	MHz
Anode voltage	V_a	=	max.	800	V
Anode input power	W_{ia}	=	max.	120	W
Anode dissipation	W_a	=	max.	75	W
Anode current	I_a	=	max.	150	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	3	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	30	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

OPERATING CONDITIONS

Frequency	f	=	400	MHz
Anode voltage	V_a	=	700	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-50	V
Anode current	I_a	=	130	mA
Grid No.2 current	I_{g_2}	=	10	mA
Grid No.1 current	I_{g_1}	=	10	mA
Driving power	W_{dr}	=	3	W
Output power in load	W_{load}	=	45	W

7Z2 3847

R. F. CLASS AB1 SINGLE SIDE BAND AMPLIFIER

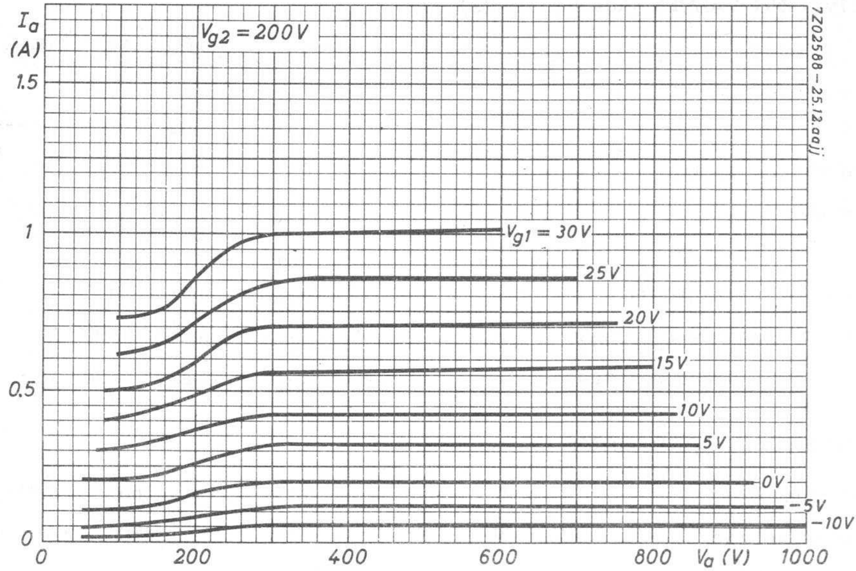
LIMITING VALUES (Absolute limits)

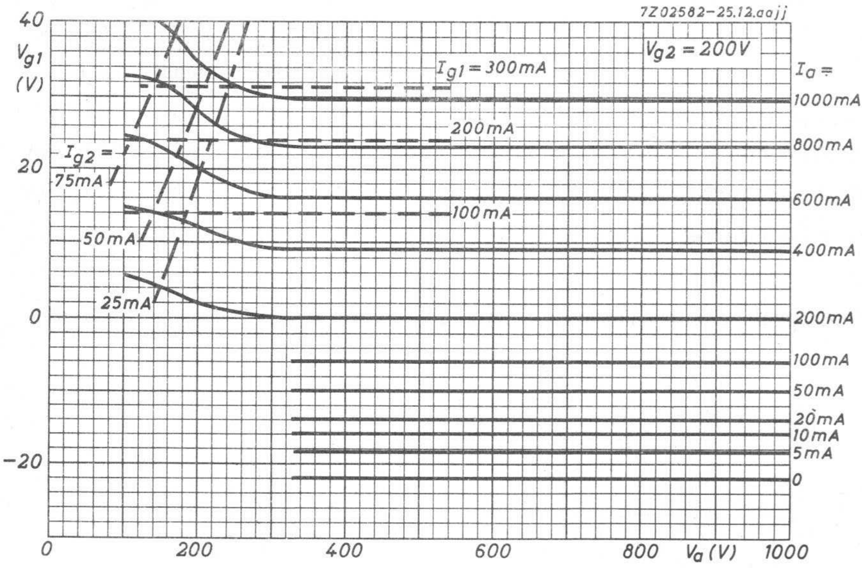
Frequency	f		up to	1200	MHz
Anode voltage	V_a	=	max.	1000	V
Anode input power	W_{ia}	=	max.	180	W
Anode dissipation	W_a	=	max.	115	W
Anode current	I_a	=	max.	180	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	4.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 circuit resistance	R_{g_1}	=	max.	30	kΩ

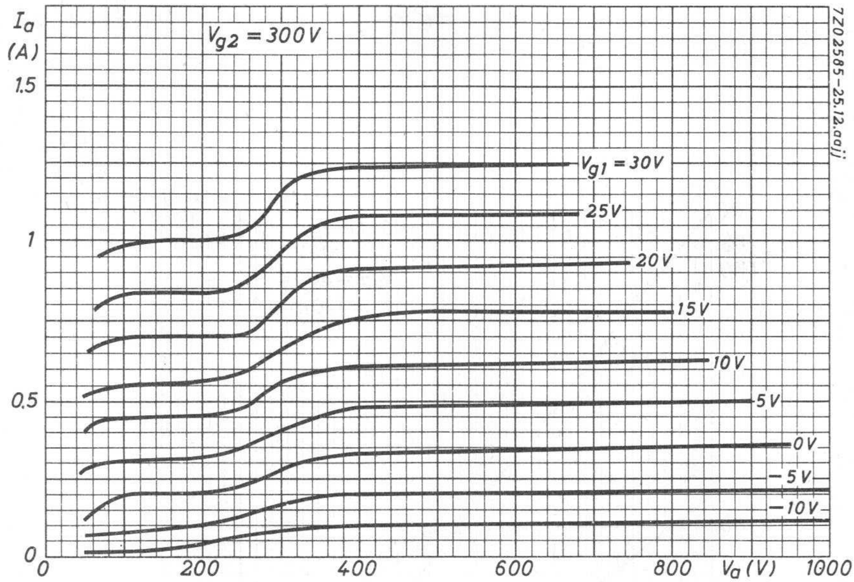
OPERATING CONDITIONS

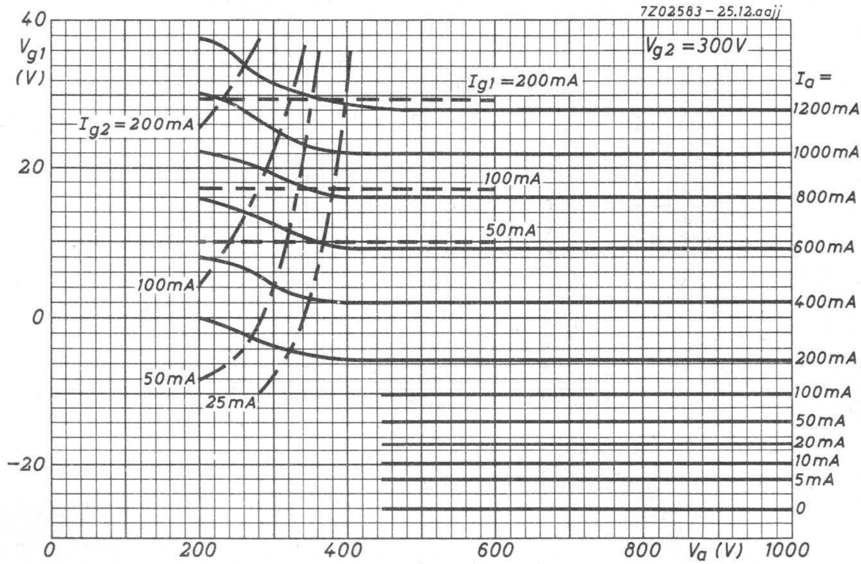
Frequency	f	=	60		60		MHz
Anode voltage	V_a	=	650		850		V
Grid No.2 voltage	V_{g_2}	=	300		300		V
Grid No.1 voltage	V_{g_1}	=	−15		−15		V
			zero signal	double tone	zero signal	double tone	
Peak driving voltage	$V_{g_{1p}}$	=	0	15	0	15	V
Anode current	I_a	=	40	100	40	100	mA
Grid No.2 current	I_{g_2}	=	0	10	0	10	mA
Grid No.1 current	I_{g_1}	=	0	0	0	0	mA
Driving power	W_{dr}	=	0	0	0	0	W
Peak envelope output power	$W_{o_{PEP}}$	=	0	25	0	40	W

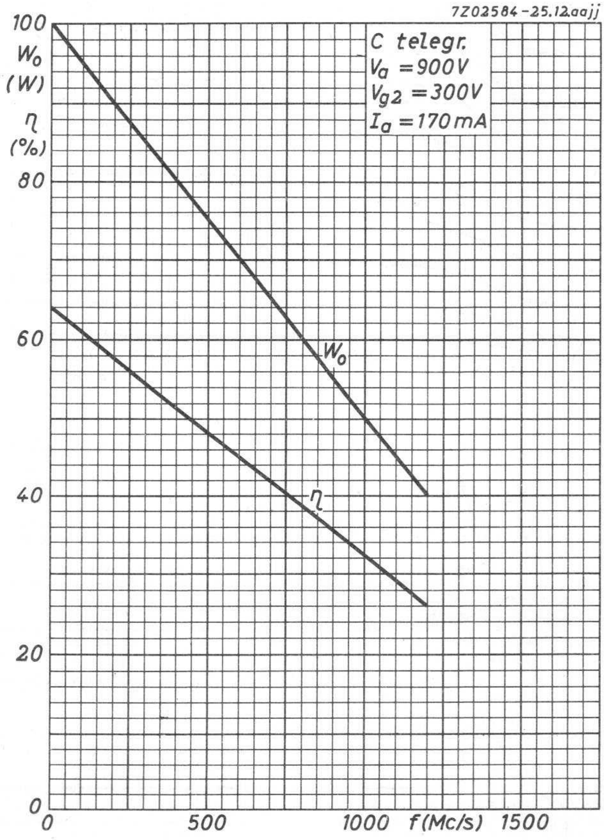
7Z2 8846

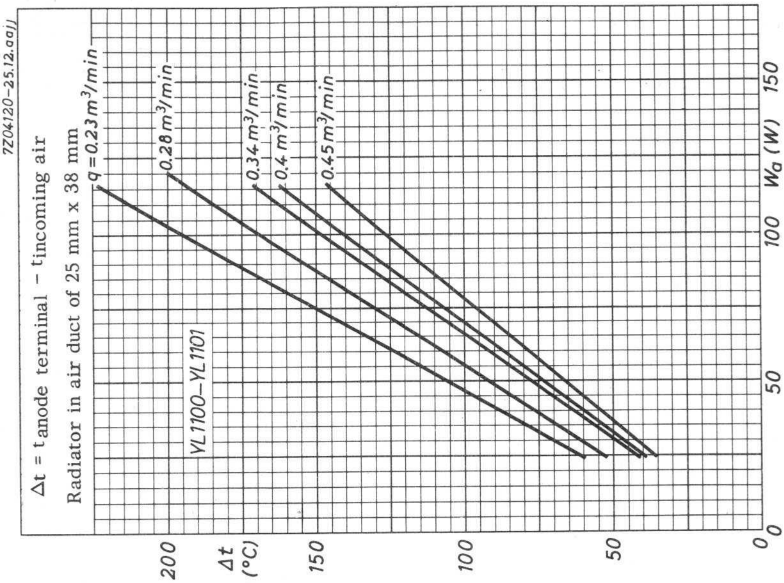

I_a
(A)
1.5
1
0.5
0
$V_{g2} = 200\,V$
7Z02588−25.12.aajj
$V_{g1} = 30\,V$
25 V
20 V
15 V
10 V
5 V
0 V
−5 V
−10 V
0
200
400
600
800
V_a (V)
1000

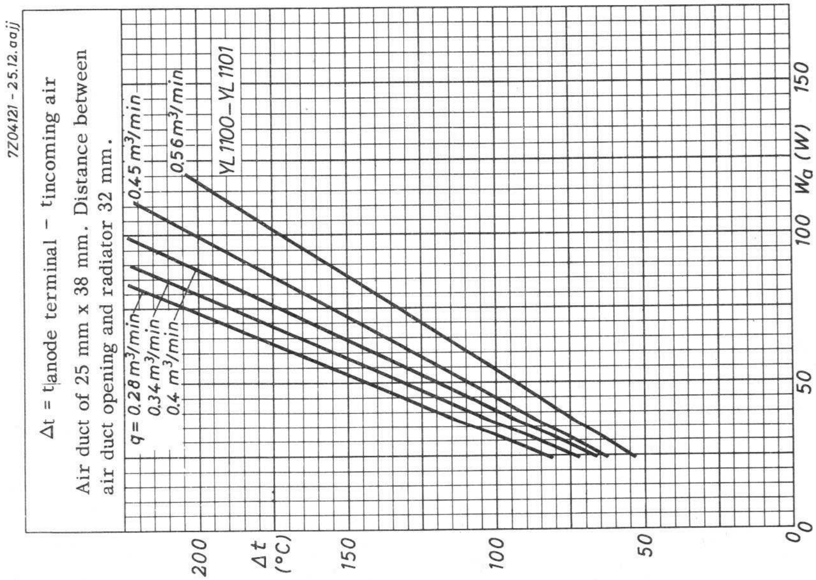

7Z02582−25.12.aajj
40
V_{g1}
(V)
20
0
−20
$V_{g2} = 200\,V$
$I_{g1} = 300\,mA$
200 mA
100 mA
$I_{g2} =$
75 mA
50 mA
25 mA
$I_a =$
1000 mA
800 mA
600 mA
400 mA
200 mA
100 mA
50 mA
20 mA
10 mA
5 mA
0
0
200
400
600
800
V_a (V)
1000


I_a
(A)
1.5
1
0.5
0
V_{g2} = 300 V
V_{g1} = 30 V
25 V
20 V
15 V
10 V
5 V
0 V
−5 V
−10 V
0
200
400
600
800
V_a (V)
1000
7Z02585−25.12.aajj


7Z02583−25.12.aajj
40
V_{g1}
(V)
20
0
−20
V_{g2} = 300 V
I_{g1} = 200 mA
100 mA
50 mA
I_{g2} = 200 mA
100 mA
50 mA
25 mA
I_a =
1200 mA
1000 mA
800 mA
600 mA
400 mA
200 mA
100 mA
50 mA
20 mA
10 mA
5 mA
0
0
200
400
600
800
V_a (V)
1000


7Z02584-25.12.aajj
100
W_o
(W)
η
(%)
80
60
40
20
0
0
500
1000
f(Mc/s)
1500
C telegr.
V_a =900V
V_{g2} =300V
I_a =170mA
W_o
η


7Z04120-25.12.aajj
Δt = t anode terminal − t incoming air
Radiator in air duct of 25 mm x 38 mm
q = 0.23 m³/min
0.28 m³/min
0.34 m³/min
0.4 m³/min
0.45 m³/min
YL1100–YL1101
Δt (°C)
Wa (W)
0
50
100
150
200


7Z04121 - 25.12.aajj
Δt = t anode terminal − t incoming air
Air duct of 25 mm x 38 mm. Distance between air duct opening and radiator 32 mm.
q = 0.28 m³/min
0.34 m³/min
0.4 m³/min
0.45 m³/min
0.56 m³/min
YL1100–YL1101
Δt (°C)
Wa (W)
0
50
100
150
200

AIR COOLED
COAXIAL BEAM POWER TETRODE

Forced air cooled beam power tetrode with integral radiator and coaxial, ceramic insulated terminals. Intended for use as UHF amplifier or oscillator at frequencies up to 1215 MHz.

QUICK REFERENCE DATA					
Frequency (MHz)	Anode voltage	RF class C telegraphy	RF class A linear ampl.	RF class B SSB	RF class C ag_2 mod.
	V_a (V)	W_{load} (W)	W_{load} (W)	$W_{o\ PEP}$ (W)	W_{load} (W)
790	2500	590			
	1400		55		
470	2500	730			
400	2000				600
30	2500			680	

HEATING: indirect by A.C. or D.C.; cathode oxide coated, matrix type

Heater voltage	V_f	=	6.3	V ±10%
Heater current	I_f	=	7.85	A
Heating time	T_h	= min.	120	sec

The heater voltage must be reduced dependent on the operating conditions and the frequency.

CAPACITANCES

Anode to grid No.1	C_{ag_1}	<	0.11	pF
Grid No.1 to cathode and heater	$C_{g_1/kf}$	=	29	pF
Anode to cathode and heater	$C_{a/kf}$	<	0.011	pF
Grid No.1 to grid No.2	$C_{g_1g_2}$	=	37	pF
Grid No.2 to cathode and heater	$C_{g_2/kf}$	<	1.1	pF

7Z2 8847

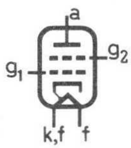
TYPICAL CHARACTERISTICS

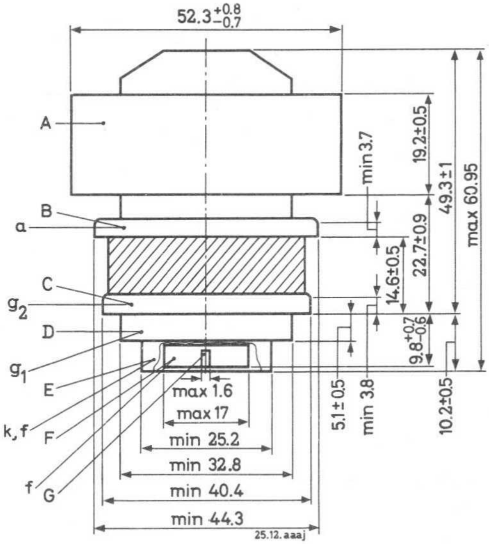
Anode voltage	V_a	=	225	2500	V
Grid No.2 voltage	V_{g_2}	=	225	400	V
Anode current	I_a	=	100	240	mA
Amplification factor	$\mu_{g_2g_1}$	=	13	–	
Mutual conductance	S	=	–	22	mA/V

MECHANICAL DATA

Dimensions in mm

Net weight: 340 g





Radiator and terminals lie inside or outside concentric cylinders with the following diameters:

Radiator	:	A	inside	53.54 mm diameter
Anode terminal	:	B	inside	45.69 mm diameter
g_2 terminal	:	C	inside	40.87 mm diameter
g_1 terminal	:	D	inside	33.50 mm diameter
Cathode terminal	:	E	inside	25.88 mm diameter
Heater terminal	:	F	outside	15.72 mm diameter
		G	inside	2.51 mm diameter

Mounting position: any

7Z2 3870

TEMPERATURE LIMITS (Absolute limits)

Anode temperature	=	max. 250 °C
Temperature of all seals	=	max. 250 °C

COOLING CHARACTERISTICS

Forced air cooling of the anode at an air inlet temperature of 25 °C:

Anode dissipation	W_a	=	100	300	600	700	W
Min. required air flow	q_{min}	=	0.06	0.12	0.32	0.46	m^3/min
Pressure loss	p_i	=	2	4	17	25	mm H_2O

A low velocity air flow is required for all electrodes and seals.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2500	V
Anode input power	W_{i_a}	=	max.	1250	W
Anode dissipation	W_a	=	max.	700	W
Anode current	I_a	=	max.	500	mA
Grid No.2 voltage	V_{g_2}	=	max.	1200	V
Grid No.2 dissipation	W_{g_2}	=	max.	25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	15	kΩ

OPERATING CONDITIONS in grounded grid circuit

Frequency	f	=	790	470	MHz
Anode voltage	V_a	=	2500	2500	V
Grid No.2 voltage	V_{g_2}	=	400	400	V
Grid No.1 voltage	V_{g_1}	=	−45	−35	V
Anode current	I_a	=	500	500	mA
Grid No.2 current	I_{g_2}	=	7	8	mA
Grid No.1 current	I_{g_1}	=	10	12	mA
Driving power	W_{dr}	=	60	35	W
Output power in load	W_{load}	=	590	730	W

7Z2 3871

R.F. CLASS A LINEAR AMPLIFIER, T.V. TRANSLATOR SERVICE, SOUND AND VISION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 1215	MHz
Anode voltage	V_a	=	max. 2500	V
Anode input power	W_{ia}	=	max. 1250	W
Anode dissipation	W_a	=	max. 600	W
Anode current	I_a	=	max. 500	mA
Grid No.2 voltage	V_{g_2}	=	max. 1200	V
Grid No.2 dissipation	W_{g_2}	=	max. 25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 current	I_{g_1}	=	max. 100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 15	kΩ

OPERATING CONDITIONS

Frequency	f	=	790	MHz
Bandwidth	B	>	6.5	MHz
Anode voltage	V_a	=	1400	V
Grid No.2 voltage	V_{g_2}	=	400	V
Grid No.1 voltage	V_{g_1}	=	-30	V
Anode current	I_a	=	400	mA
Grid No.2 current	I_{g_2}	=	-10	mA
Driving power	W_{dr}	=	5	W
Output power in load	W_{load}	=	55	W

7Z2 3872

R.F. CLASS B SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2500	V
Anode input power	W_{ia}	=	max.	1250	W
Anode dissipation	W_a	=	max.	600	W
Anode current	I_a	=	max.	500	mA
Grid No.2 voltage	V_{g_2}	=	max.	1200	V
Grid No.2 dissipation	W_{g_2}	=	max.	25	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 current	I_{g_1}	=	max.	100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	15	kΩ

OPERATING CONDITIONS

Frequency	f	=	30		MHz
Anode voltage	V_a	=	2500		V
Grid No.2 voltage	V_{g_2}	=	450		V
Grid No.1 voltage	V_{g_1}	=	−37		V
			zero signal	double tone signal	
Anode current	I_a	=	160	350	mA
Grid No.2 current	I_{g_2}	=	0	2.5	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Driving power	W_{dr}	=	0	1	W
Peak envelope power output	W_{oPEP}	=	–	680	W
Intermodulation distortion:					
of the third order	d_{i_3}	=	–	−31	dB
of the fifth order	d_{i_5}	=	–	−36	dB

7Z2 3873

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to 1215	MHz
Anode voltage	V_a	=	max. 2000	V
Anode input power	W_{ia}	=	max. 1000	W
Anode dissipation	W_a	=	max. 400	W
Anode current	I_a	=	max. 500	mA
Grid No.2 voltage	V_{g_2}	=	max. 1200	V
Grid No.2 dissipation	W_{g_2}	=	max. 17	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 current	I_{g_1}	=	max. 100	mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 15	kΩ

OPERATING CONDITIONS (cathode drive)

Frequency	f	=	400	MHz
Anode voltage	V_a	=	2000	V
Grid No.2 voltage	V_{g_2}	=	400	V 1)
Grid No.1 voltage	V_{g_1}	=	-35	V 2)
Anode current	I_a	=	500	mA
Grid No.2 current	I_{g_2}	=	8	mA
Grid No.1 current	I_{g_1}	=	12	mA
Driving power	W_{dr}	=	35	W
Output power in load	W_{load}	=	600	W

1) Obtained preferably from a separate source, modulated along with the anode supply.

2) Obtained from the grid resistor or from a combination of the grid resistor and either a fixed supply or a cathode resistor.

7Z2 3874

AIR COOLED
COAXIAL R.F. POWER TETRODE

QUICK REFERENCE DATA		
Freq. (MHz)	Class AB1 linear SSB amplifier	
	V_a (V)	W_ℓ [1] (kW, PEP)
13	5000	5.1
28	5000	5.1

HEATING: indirect. Cathode oxide-coated

Heater voltage	V_f	=	16	V ±10 %
Heater current	I_f	=	16.5	A
Heating time	T_w	= min.	10	min.

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	115	pF
Anode to all other elements except grid No.1	C_a	=	41	pF
Anode to grid No.1	C_{ag_1}	=	0.2	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	5	1	kV
Grid No.2 voltage	V_{g_2}	=	700	700	V
Anode current	I_a	=	0.7	6	A
Amplification factor	$\mu_{g_2g_1}$	=	3.5	–	
Mutual conductance	S	=	–	45	mA/V

[1]) Useful power in the load

7Z2 3694

TEMPERATURE LIMITS (Absolute limits)

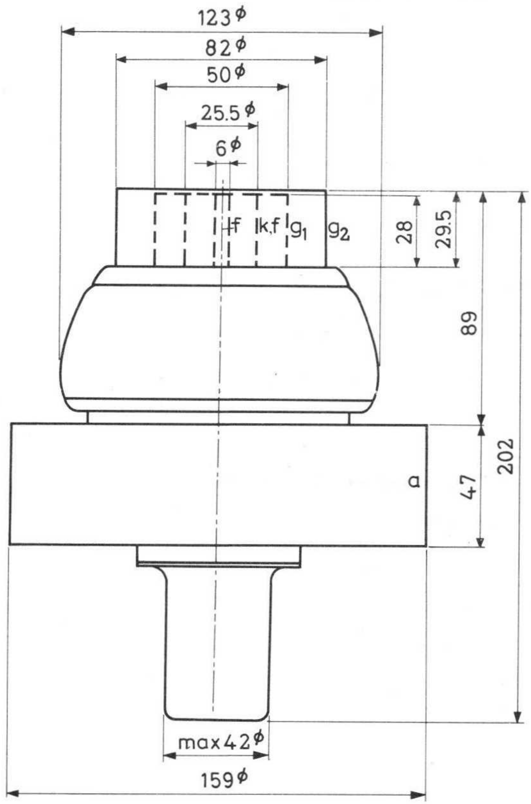
Envelope temperature	= max. 200 °C
Air inlet temperature	= max. 45 °C

AIR COOLING CHARACTERISTICS

	W_a (kW)	q_{min} (m^3/min)	p_i (mm H_2O)
Anode radiator	4	6	20
Socket		0.5	20

MECHANICAL DATA Dimensions in mm

Socket	40682
Air duct	40683
or	
Insulating pedestal	40654
Net weight of tube	4.5 kg



Mounting position: vertical with anode up or down

7Z2 3695

CLASS AB LINEAR S. S. B. AMPLIFIER, suppressed carrier service

LIMITING VALUES (Absolute limits)

Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	5.5	kV
Anode current	I_a	= max.	2	A
Anode input power	W_{i_a}	= max.	10	kW
Anode dissipation	W_a	= max.	4	kW
Grid No.2 voltage	V_{g_2}	= max.	1	kV
Grid No.2 dissipation	W_{g_2}	= max.	150	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	250	V
Grid No.1 current	I_{g_1}	= max.	25	mA

OPERATING CHARACTERISTICS

Frequency	f	=		13		MHz
Anode voltage	V_a	=		5		kV
Grid No.2 voltage	V_{g_2}	=		700		V
Grid No.1 voltage	V_{g_1}	=		−150		V [1]
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	150	150	V
Anode current	I_a	=	0.7	1.8	1.26	A
Grid No.2 current	I_{g_2}	=	−10 to +10	120	40	mA
Grid No.1 current	I_{g_1}	=	0	−1	−0.3	mA
Anode input power	W_{i_a}	=	3.5	9	6.3	kW
Anode dissipation	W_a	=	3.5	2.85	3.2	kW
Output power in the load (PEP)	W_ℓ	=	–	5.1	5.1	kW
Total efficiency	η	=	–	57	45	%
3rd order intermodulation distortion	d_3	=	–	–	<−35	dB [2]
5th order intermodulation distortion	d_5	=	–	–	<−40	dB [2]

[1][2]) See page 4

7Z2 3696

CLASS AB LINEAR S. S. B. AMPLIFIER, suppressed carrier service

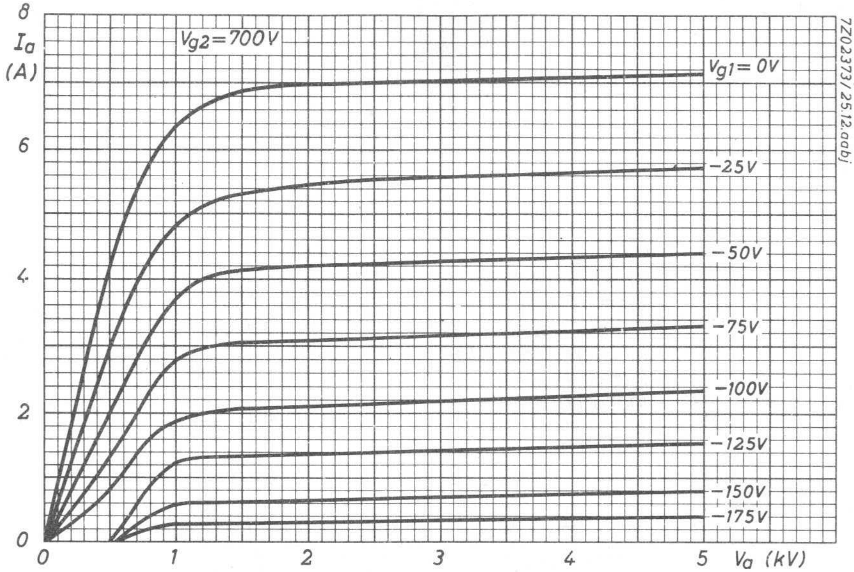
OPERATING CHARACTERISTICS (continued)

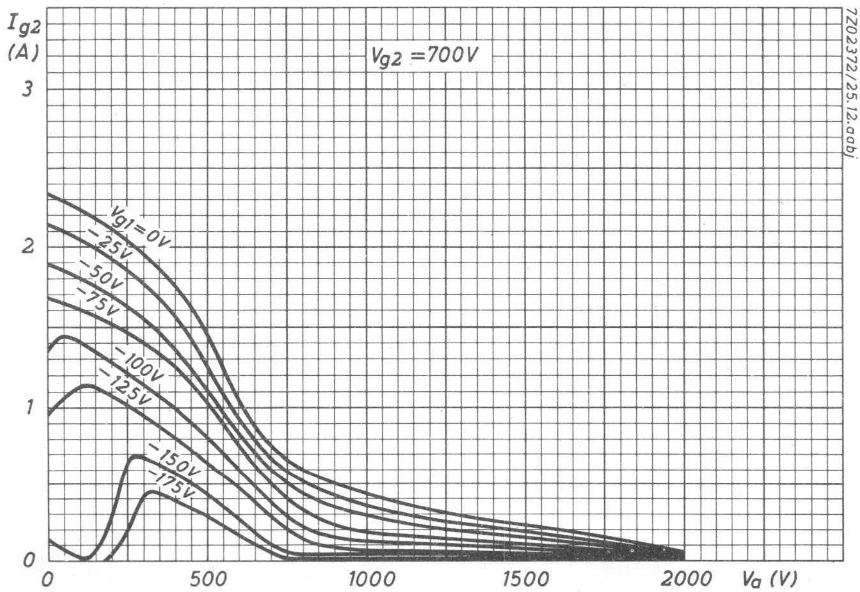
Frequency	f	=		28		MHz
Anode voltage	V_a	=		5		kV
Grid No.2 voltage	V_{g_2}	=		700		V
Grid No.1 voltage	V_{g_1}	=		-150		V 1)
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	150	150	V
Anode current	I_a	=	0.7	1.8	1.26	A
Grid No.2 current	I_{g_2}	=	-10 to +10	120	40	mA
Grid No.1 current	I_{g_1}	=	0	-4	-1	mA
Anode input power	W_{i_a}	=	3.5	9	6.3	kW
Anode dissipation	W_a	=	3.5	2.85	3.2	kW
Output power in the load (PEP)	W_ℓ	=	-	5.1	5.1	kW
Total efficiency	η	=	-	57	45	%
3rd order intermodulation distortion	d_3	=	-	-	<-35	dB 2)
5th order intermodulation distortion	d_5	=	-	-	<-40	dB 2)

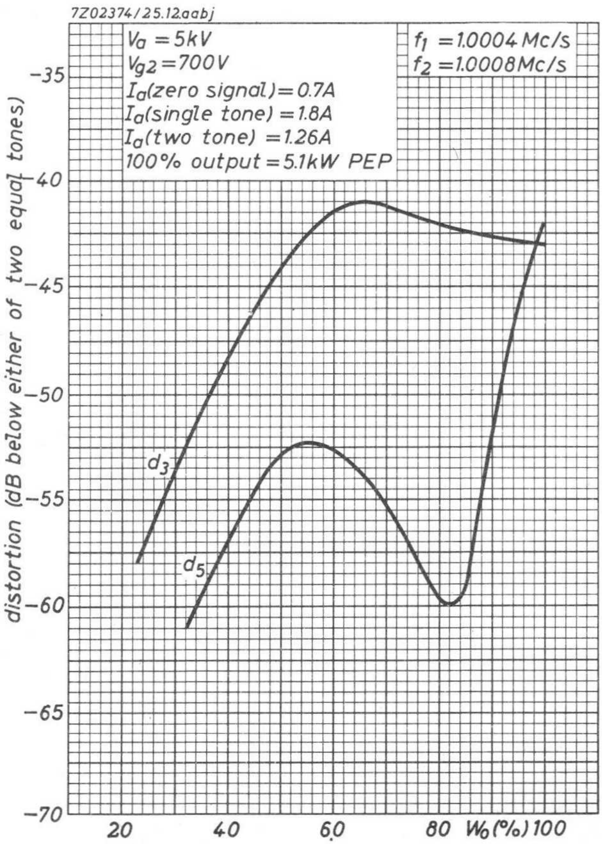
1) To be adjusted for zero signal anode current.

2) Stated figures are maxima encountered at any driving level up to 100 % and are referred to the according level of either of the equal tones. Considerably better distortion figures can be achieved with I_a at zero signal = 0.8 A at the cost of higher zero signal anode dissipation. Efficiency for full drive is hardly deteriorated by this higher value of zero signal anode current.

7Z2 3697


8
I_a
(A)
6
4
2
0
V_{g2}=700V
V_{g1}= 0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
1
2
3
4
5
V_a (kV)
7Z02373/25.12.aabj


I_{g2}
(A)
3
2
1
0
V_{g2} =700V
V_{g1}=0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
0
500
1000
1500
2000
V_a (V)
7Z02372/25.12.aabj


7Z02374/25.12.aabj
$V_a = 5kV$
$V_{g2} = 700V$
I_a(zero signal) = 0.7A
I_a(single tone) = 1.8A
I_a(two tone) = 1.26A
100% output = 5.1kW PEP
f_1 = 1.0004 Mc/s
f_2 = 1.0008 Mc/s
distortion (dB below either of two equal tones)
-35
-40
-45
-50
-55
-60
-65
-70
d_3
d_5
20
40
60
80
W_o(%)
100

AIR COOLED R.F. POWER TETRODE

Forced air cooled coaxial tetrode intended for use as linear amplifier for single side band, suppressed carrier service.

QUICK REFERENCE DATA

Frequency (MHz)	Class AB1 SSB		Class B anode mod.	
	V_a (kV)	W_o PEP (kW)	V_a (kV)	W_o (kW)
1	5.0	5.7	5.0	5.1
30	5.0	5.0		

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=		12.6	V
Heater current	I_f	=		14.5	A
Waiting time	T_w	=	min.	10	min.

CAPACITANCES

Anode to all except grid No.1	C_a	=	33	pF
Grid No.1 to all except anode	C_{g_1}	=	156	pF
Anode to grid No.1	C_{ag_1}	=	0.16	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1	5	kV
Grid No.2 voltage	V_{g_2}	=	650	650	V
Anode current	I_a	=	6	0.7	A
Amplification factor	$\mu_{g_2g_1}$	=		3	
Mutual conductance	S	=	45		mA/V

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t	=	max.	200	^oC
Air inlet temperature	t_i	=	max.	45	^oC

7Z2 3913

COOLING DATA

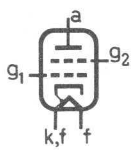
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
4.0	0	45	5	23

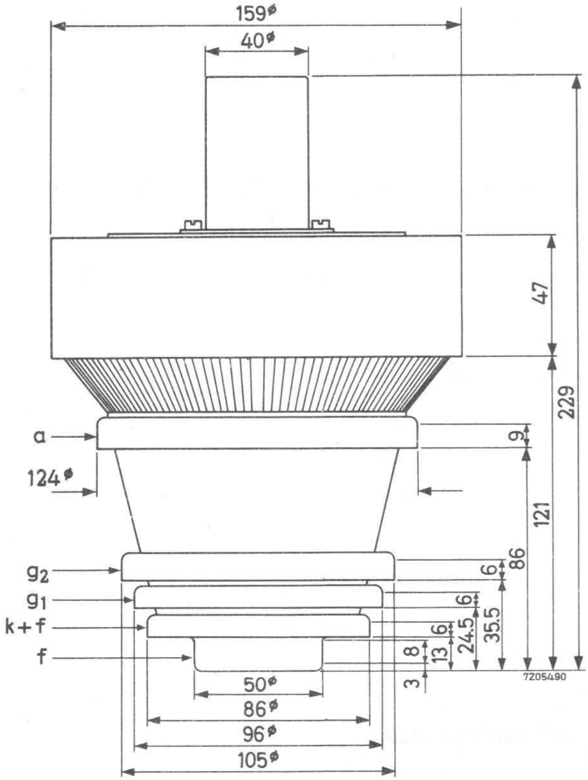
Required air flow on socket q = min. 0.55 m^3/min
at a pressure loss p_i = 16 mm H_2O

MECHANICAL DATA

Net weight : 5.8 kg

Dimensions in mm





ACCESSORIES

Socket	40699
Chimney	40683

Mounting position : vertical
with anode up or down

7Z2 4056

R. F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute limits)

Frequency	f		up to 30	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{ia}	=	max. 9.5	kW
Anode dissipation	W_a	=	max. 4	kW
Anode current	I_a	=	max. 2	A
Grid No.2 voltage	V_{g_2}	=	max. 1	kV
Grid No.2 dissipation	W_{g_2}	=	max. 140	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

Frequency	f	=		1		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		−185		V 1)
			zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160 2)	160 2)	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	−10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Anode input power	W_{ia}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.25	3.5	kW
Output power in load	W_ℓ	=	0	5.7	−	kW 3)
PEP output power in load	W_ℓ	=	0	−	5.7	kW 3)
Total efficiency	η	=	−	61.5	43.5	%
Intermodulation distortion						
of the 3rd order	d_3	=	−	−	−40	dB 4)
of the 5th order	d_5	=	−	−	−40	dB 4)

1) 2) 3) 4) See page 4.

7Z2 3915

R. F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

OPERATING CONDITIONS (continued)

Frequency	f	=		30		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		−185		V [1]
			zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160 [2]	160 [2]	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	−10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	< 5	< 5	mA
Anode input power	W_{ia}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.35	3.55	kW
Output power in load	W_ℓ	=	0	5.0	–	kW [5]
PEP output power in load	W_ℓ	=	0	–	5.0	kW [5]
Total efficiency	η	=	–	54	38	%
Intermodulation distortion						
of the 3rd order	d_3	=	–	–	−38	dB [4]
of the 5th order	d_5	=	–	–	−40	dB [4]

[1] To be adjusted for zero signal anode current of 0.7 A; characteristic range values 150 to 215 V.

[2] Maximum 175 V.

[3] Measured in a circuit having an efficiency of 95 %.

[4] Maximum distortion level encountered at any driving level up to full drive referred to the amplitude of either of the two tones in a two tone test signal at full drive.

[5] Measured in a circuit having an efficiency of 85 %.

7Z2 3916

R.F. CLASS B ANODE MODULATION

LIMITING VALUES (Absolute limits)

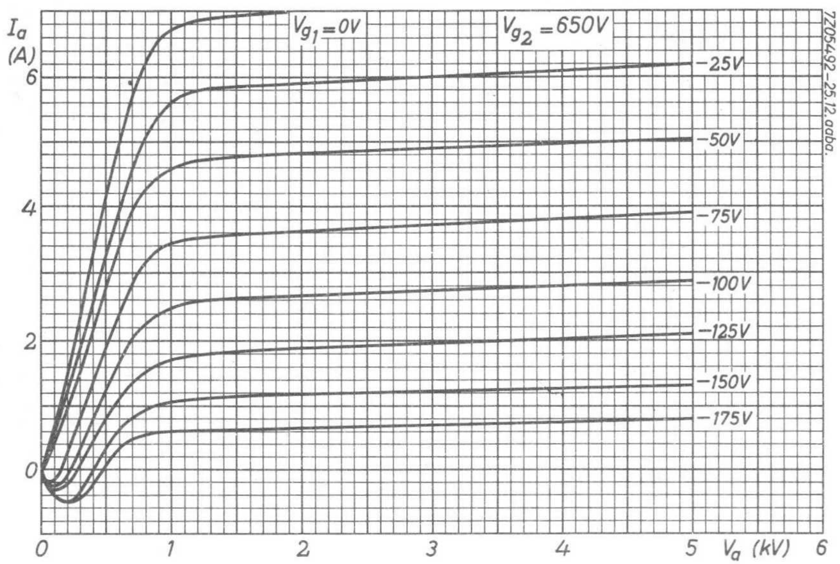
Frequency	f		up to 60	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{ia}	=	max. 7.5	kW
Anode dissipation	W_a	=	max. 2.6	kW
Anode current	I_a	=	max. 1.6	A
Grid No.2 voltage	V_{g_2}	=	max. 800	V
Grid No.2 dissipation	W_{g_2}	=	max. 140	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

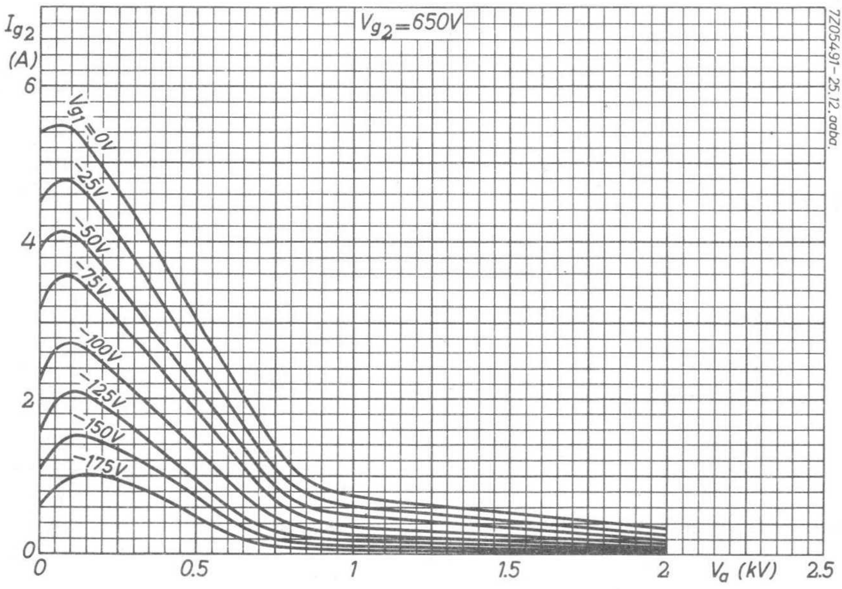
Frequency	f	=	1	MHz
Anode voltage	V_a	=	5.0	kV
Grid No.2 voltage	V_{g_2}	=	600	V
Grid No.1 voltage	V_{g_1}	=	-230	V
Peak grid No.1 driving voltage	$V_{g_{1p}}$	=	230	V
Anode current	I_a	=	1.46	A
Grid No.2 current	I_{g_2}	=	100	mA
Grid No.1 current	I_{g_1}	=	0	mA
Grid No.2 dissipation	W_{g_2}	=	60	W
Driving power	W_{dr}	=	0	W
Anode input power	W_{ia}	=	7.3	kW
Anode dissipation	W_a	=	2.2	kW
Output power in the load	W_ℓ	=	4.6	kW [1]
Tube efficiency	η	=	70	%
Modulation depth	m	=	100	%
Modulation power	W_{mod}	=	3.65	kW

[1]) Measured in a circuit having an efficiency of 90 %.

7Z2 3917



Ia
(A)
6
4
2
0
0
1
2
3
4
5
Va (kV)
6
Vg1 = 0V
Vg2 = 650V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
7Z05492-25.12.aaba.



Ig2
(A)
6
4
2
0
0
0.5
1
1.5
2
Va (kV)
2.5
Vg2 = 650V
Vg1 = 0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
7Z05491-25.12.aaba.

WATER COOLED R.F. POWER TETRODE

Water cooled coaxial tetrode intended for use as linear amplifier for single side band, suppressed carrier service. The tube is provided with an integral jacket.

QUICK REFERENCE DATA				
Frequency (MHz)	Class AB1 SSB		Class B anode mod.	
	V_a (kV)	W_o PEP (kW)	V_a (kV)	W_o (kW)
1 30	5.0 5.0	5.7 5.0	5.0	5.1

HEATING: Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=		12.6	V
Heater current	I_f	=		14.5	A
Waiting time	T_w	=	min.	10	min.

CAPACITANCES

Anode to all except grid No.1	C_a	=	33	pF
Grid No.1 to all except anode	C_{g_1}	=	156	pF
Anode to grid No.1	C_{ag_1}	=	0.16	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1	5	kV
Grid No.2 voltage	V_{g_2}	=	650	650	V
Anode current	I_a	=	6	0.7	A
Amplification factor	$\mu_{g_2g_1}$	=	–	3	
Mutual conductance	S	=	45	–	mA/V

TEMPERATURE LIMIT (Absolute limit)

Envelope temperature	t	=	max.	200	^oC

7Z2 4032

COOLING DATA

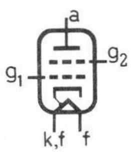
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)
4.0	20	2.5	0.15

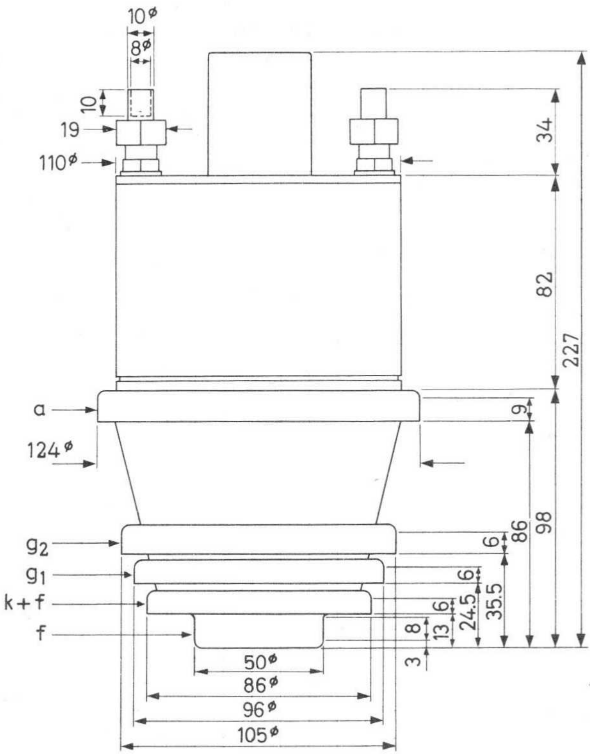
Required air flow on socket q = min. 0.5 m^3/min
at a pressure loss p_i = 20 mm H_2O

MECHANICAL DATA

Net weight 4.3 kg

Dimensions in mm





Mounting position: vertical with anode up or down

ACCESSORIES

Socket 40699

7Z2 4033

R. F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute limits)

Frequency	f		up to 30	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{ia}	=	max. 9.5	kW
Anode dissipation	W_a	=	max. 4	kW
Anode current	I_a	=	max. 2	A
Grid No.2 voltage	V_{g_2}	=	max. 1	kV
Grid No.2 dissipation	W_{g_2}	=	max. 140	W
Negative grid No.1 voltage	V_{g_1}	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

			zero signal	single tone signal	double tone signal	
Frequency	f	=		1		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		−185		V [1]
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160[2]	160[2]	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	−10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA
Anode input power	W_{ia}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.25	3.5	kW
Output power in load	W_ℓ	=	0	5.7	–	kW [3]
PEP output power in load	W_ℓ	=	0	–	5.7	kW [3]
Total efficiency	η	=	–	61.5	43.5	%
Intermodulation distortion						
of the 3rd order	d_3	=	–	–	−40	dB [4]
of the 5th order	d_5	=	–	–	−40	dB [4]

[1][2][3][4] See page 4.

7Z2 3915

R. F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

OPERATING CONDITIONS (continued)

Frequency	f	=		30		MHz
Anode voltage	V_a	=		5.0		kV
Grid No.2 voltage	V_{g_2}	=		650		V
Grid No.1 voltage	V_{g_1}	=		-185		V [1]
			zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	=	0	160[2]	160[2]	V
Anode current	I_a	=	0.7	1.85	1.30	A
Grid No.2 current	I_{g_2}	=	-10 to +10	140	40	mA
Grid No.1 current	I_{g_1}	=	0	< 5	< 5	mA
Anode input power	W_{i_a}	=	3.5	9.25	6.5	kW
Anode dissipation	W_a	=	3.5	3.35	3.55	kW
Output power in load	W_ℓ	=	0	5.0	-	kW[5]
PEP output power in load	W_ℓ	=	0	-	5.0	kW[5]
Total efficiency	η	=	-	54	38	%
Intermodulation distortion						
of the 3rd order	d_3	=	-	-	-38	dB [4]
of the 5th order	d_5	=	-	-	-40	dB [4]

[1] To be adjusted for zero signal anode current of 0.7 A; characteristic range values 150 to 215 V.

[2] Maximum 175 V.

[3] Measured in a circuit having an efficiency of 95 %.

[4] Maximum distortion level encountered at any driving level up to full drive referred to the amplitude of either of the two tones in a two tone test signal at full drive.

[5] Measured in a circuit having an efficiency of 85 %.

7Z2 3916

R.F. CLASS B ANODE MODULATION

LIMITING VALUES (Absolute limits)

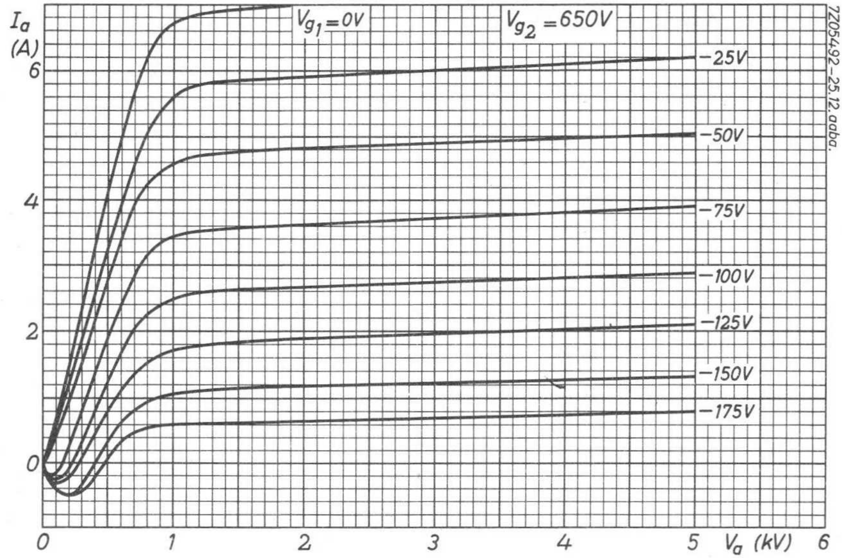
Frequency	f		up to 60	MHz
Anode voltage	V_a	=	max. 5.5	kV
Anode input power	W_{ia}	=	max. 7.5	kW
Anode dissipation	W_a	=	max. 2.6	kW
Anode current	I_a	=	max. 1.6	A
Grid No.2 voltage	V_{g_2}	=	max. 800	V
Grid No.2 dissipation	W_{g2}	=	max. 140	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 250	V
Grid No.1 circuit resistance	R_{g_1}	=	max. 10	kΩ

OPERATING CONDITIONS

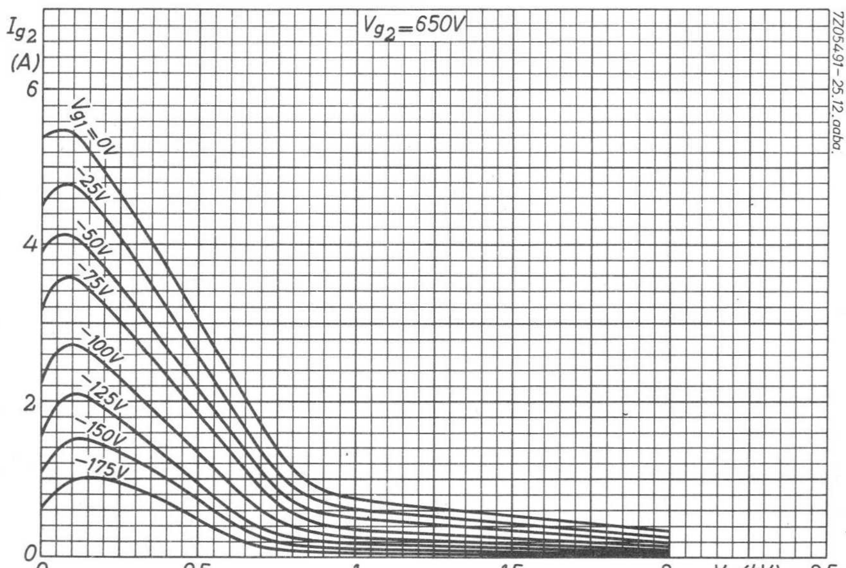
Frequency	f	=	1	MHz
Anode voltage	V_a	=	5.0	kV
Grid No.2 voltage	V_{g2}	=	600	V
Grid No.1 voltage	V_{g1}	=	−230	V
Peak grid No.1 driving voltage	V_{g1p}	=	230	V
Anode current	I_a	=	1.46	A
Grid No.2 current	I_{g2}	=	100	mA
Grid No.1 current	I_{g1}	=	0	mA
Grid No.2 dissipation	W_{g_2}	=	60	W
Driving power	W_{dr}	=	0	W
Anode input power	W_{ia}	=	7.3	kW
Anode dissipation	W_a	=	2.2	kW
Output power in the load	W_ℓ	=	4.6	kW [1]
Tube efficiency	η	=	70	%
Modulation depth	m	=	100	%
Modulation power	W_{mod}	=	3.65	kW

[1]) Measured in a circuit having an efficiency of 90 %.

7Z2 3917



I_a (A)
6
4
2
0
0
1
2
3
4
5
V_a (kV)
6
V_{g_1}=0V
V_{g_2}=650V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
7Z05492-25.12.aaba.



I_{g_2} (A)
6
4
2
0
0
0.5
1
1.5
2
V_a (kV)
2.5
V_{g_2}=650V
V_{g_1}=0V
−25V
−50V
−75V
−100V
−125V
−150V
−175V
7Z05491-25.12.aaba.

QUICK HEATING R.F. DOUBLE TETRODE

Quick heating radiation and convection cooled double tetrode for use as R.F. amplifier and frequency multiplier up to 500 MHz, designed for intermittent filament operation in transistorised mobile transmitters.

QUICK REFERENCE DATA

Freq. (MHz)	Class C telegraphy			Class C frequency multiplier		
	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)	V_a (V)	W_{dr} 1) (W)	W_ℓ 2) (W)
200	275	0.7	12.5			
500	175	1.5	6.0			
167/500				175	1.5	2.0

HEATING: direct by A.C. or D.C.; series or parallel supply
Filament oxide coated

Filament voltage	V_f	=	1.1	V ±15%
Filament current	I_f	=	2.9	A
Heating time for W_o = 70% of full output power	T_h	<	0.5	sec

The frequency of the A.C. filament supply may be

for sinusoidal supply voltage	max.	200	Hz
for square wave supply voltage		any	

CAPACITANCES, two systems in push-pull connection

Input capacitance	C_i	=	4.1	pF
Output capacitance	C_o	=	1.2	pF

The tube is internally neutralised for frequencies up to 500 MHz

1) Driver output power

2) Useful power in the load

7Z2 3698

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	175	V
Grid No.2 voltage	V_{g_2}	=	175	V
Anode current	I_a	=	40	mA
Amplification factor	$\mu_{g_2g_1}$	=	22	
Mutual conductance	S	=	7	mA/V

COOLING: Radiation and convection

The use of a closed tube shield is not recommended

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 230 °C

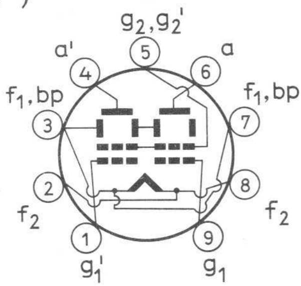
MECHANICAL DATA

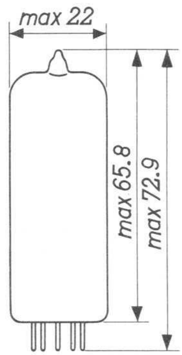
Dimensions in mm

Base : Noval

→ Socket : 2422 502 01004 [1])

Net weight: 16 g





Mounting position: any

If the tube is mounted with its main axis horizontally, it is recommended that the pins 3 and 7 be in a horizontal plane.

The filament connections (tags 3-7 and 2-8) should be connected in parallel on the socket.

[1]) Or equivalent type suitable for the high filament current

7Z2 8848

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY; two systems in push-pull

LIMITING VALUES (Absolute limits)

Frequency	f		up to 200	500	MHz
Anode voltage	V_a	=	max. 300	200	V
Anode current	I_a	=	max. 2x50	2x50	mA
Anode input power	W_{i_a}	=	max. 30	20	W
Anode dissipation	W_a	=	max. 2x4	2x4	W
Grid No.2 voltage	V_{g_2}	=	max. 200	200	V
Grid No.2 dissipation	W_{g_2}	=	max. 3	3	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	150	V
Grid No.1 current	I_{g_1}	=	max. 2x5	2x5	mA
Grid No.1 circuit resistance	R_{g_1}	=	max. 100	100	kΩ

OPERATING CONDITIONS

Frequency	f	=	200	500	MHz
Anode voltage	V_a	=	275	175	V
Grid No.2 supply voltage	V_{bg_2}	=	275	175	V
Grid No.2 series resistor	R_{g_2}	=	6.8	0.1	kΩ
Grid No.1 voltage	V_{g_1}	=	-20	-22	V
Grid No.1 resistor	R_{g_1}	=	3.9 [1]	9.4 [2]	kΩ
Driving voltage	$V_{g_1g_1'p}$	=	65	65	V
Anode current	I_a	=	2x42.5	2x40	mA
Grid No.2 current	I_{g_2}	=	14	12	mA
Grid No.1 current	I_{g_1}	=	2x2.6	2x2.3	mA
Grid No.2 dissipation	W_{g_2}	=	2.5	2.1	W
Driver output power	W_{dr}	=	0.7	1.5	W
Anode input power	W_{i_a}	=	23.4	14	W
Anode dissipation	W_a	=	2x3.5	2x3	W
Output power	W_o	=	~16	8	W
Efficiency	η	=	68	57	%
Output power in the load	W_ℓ	=	13	6.5	W [3]

[1] Common for both units.

[2] It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[3] For optimum conditions R_{g_1} should be adjusted to obtain the desired anode current.

7Z2 3700

R.F. CLASS C FREQUENCY TRIPLER , two systems in push-pull

LIMITING VALUES (Absolute limits)

Frequency	f	up to	500	MHz
Anode voltage	V_a	= max.	200	V
Anode current	I_a	= max.	2x35	mA
Anode input power	W_{i_a}	= max.	12	W
Anode dissipation	W_a	= max.	2x4	W
Grid No.2 voltage	V_{g_2}	= max.	200	V
Grid No.2 dissipation	W_{g_2}	= max.	2.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	150	V
Grid No.1 current	I_{g_1}	= max.	2x3	mA
Grid No.1 circuit resistance	R_{g_1}	= max.	100	kΩ

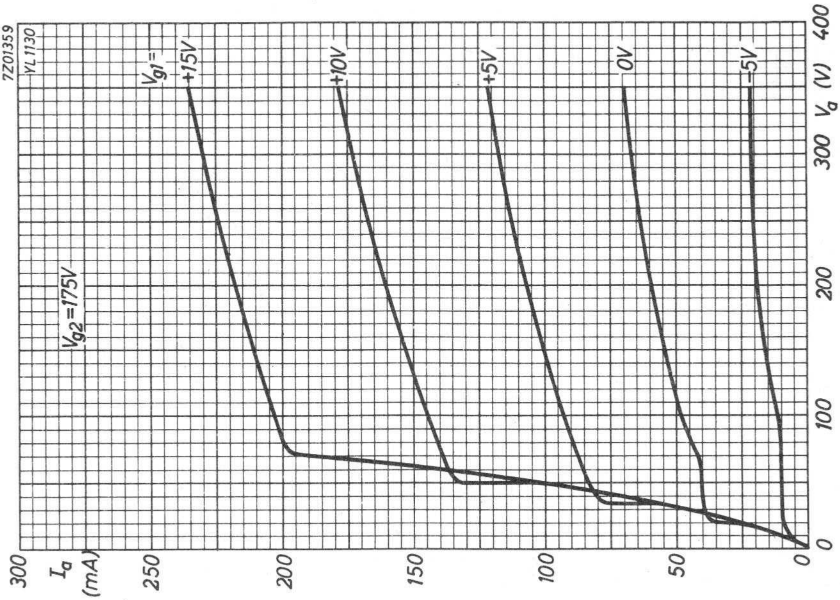
OPERATING CONDITIONS

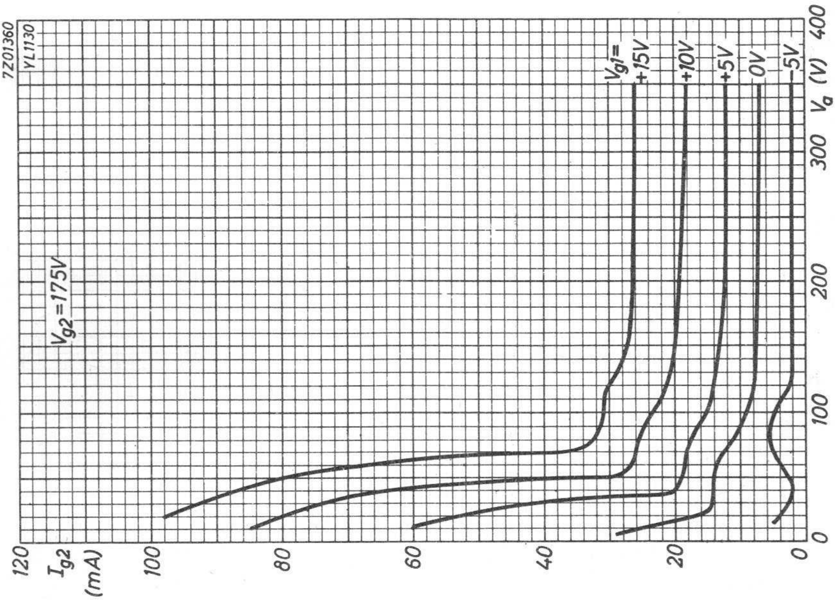
Frequency	f	=	167/500	MHz
Anode voltage	V_a	=	175	V
Grid No.2 supply voltage	V_{bg_2}	=	175	V
Grid No.2 series resistor	R_{g_2}	=	100	Ω
Grid No.1 resistor	R_{g_1}	=	56	kΩ 1)
Driving voltage	$V_{g_1g_1'p}$	=	175	V
Anode current	I_a	=	2x30	mA
Grid No.2 current	I_{g_2}	=	9	mA
Grid No.1 current	I_{g_1}	=	2x1.2	mA
Grid No.2 dissipation	W_{g_2}	=	1.6	W
Driver output power	W_{dr}	=	1.5	W
Anode input power	W_{i_a}	=	10.5	W
Anode dissipation	W_a	=	2x3.5	W
Output power	W_o	=	3.5	W
Efficiency	η	=	33	%
Output power in the load	W_ℓ	=	2	W 2)

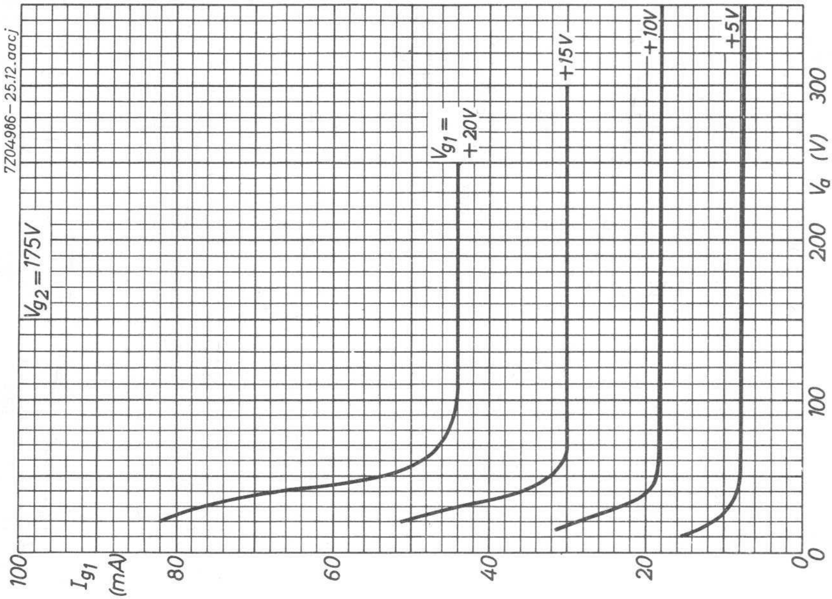
1) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

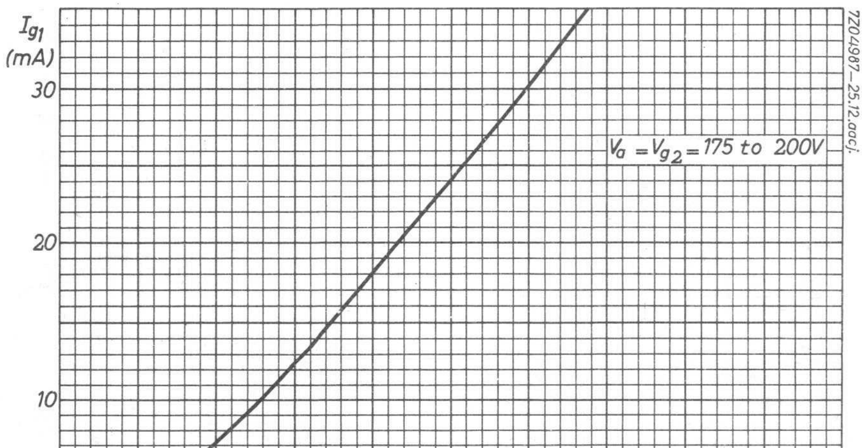
2) For optimum conditions R_{g_1} should be adjusted to obtain the desired anode current.

7Z2 3701


7Z01359
YL 1130
Vg2=175V
Vg1=
+15V
+10V
+5V
0V
-5V
Ia
(mA)
300
250
200
150
100
50
0
100
200
300
400
Va (V)


7Z01360
YL 1130
Vg2=175V
Vg1=
+15V
+10V
+5V
0V
-5V
120
Ig2
(mA)
100
80
60
40
20
0
100
200
300
400
Va (V)


7Z04986-25.12.aacj
Vg2 = 175V
Vg1 = +20V
+15V
+10V
+5V
Ig1 (mA)
100
80
60
40
20
0
Va (V)
0
100
200
300


Ig1 (mA)
30
20
10
0
Va = Vg2 = 175 to 200V
7Z04987-25.12.aacj
0
5
10
15
20
25
Vg1 (V)

R.F. BEAM POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	Class AB Single sideband		Class AB mod. Two tubes	
	V_a (V)	W_ℓ 1) (W)	V_a (V)	W_o (W)
30 60	600 600	110 100	600	200

HEATING: Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=	6.3 V	12.6 V
Heater current	I_f	=	1.62 A	0.81 A
Pins			(5+6)-2	5-6
Heating time	T_h	=	min. 30 sec	

CAPACITANCES

Anode to all other elements except grid No.1	C_a	=	10.7 pF
Grid No.1 to all other elements except anode	C_{g_1}	=	22 pF
Anode to grid No.1	C_{ag_1}	=	0.2 pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	600 V
Grid No.2 voltage	V_{g_2}	=	250 V
Anode current	I_a	=	100 mA
Amplification factor	$\mu_{g_2g_1}$	=	4.7
Mutual conductance	S	=	10 mA/V

1) Peak envelope power. Useful power in the load.

7Z2 4031

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250 °C
Base pin seal temperature	=	max. 180 °C
Anode seal temperature	=	max. 220 °C

COOLING

Radiation and convection. In order to keep the temperatures below the maximum permitted values it may be necessary to direct an air flow to the bulb or seals.

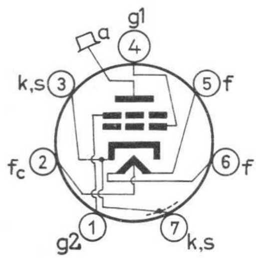
MECHANICAL DATA Dimensions in mm

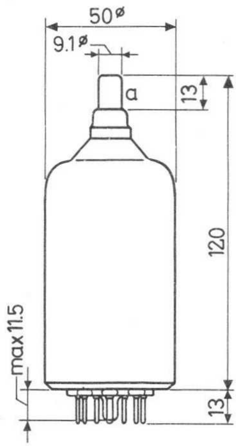
Base : Septar

→ Socket : 2422 513 00001

Anode connector: 40634

Net weight : 110 g





Mounting position: any

7Z2 8849

R. F. CLASS AB LINEAR AMPLIFIER , single sideband, suppressed carrier

LIMITING VALUES (Absolute limits)

Frequency	f	up to	60	MHz
Anode voltage	V_a	= max.	750	V
Anode current	I_a	= max.	350	mA
Anode dissipation	W_a	= max.	75	W
Grid No.2 voltage	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	7.5	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	100	V
Grid No.1 dissipation	W_{g_1}	= max.	0.5	W
Grid No.1 circuit resistance	R_{g_1}	= max.	10	kΩ

OPERATING CONDITIONS

Frequency	f	=		30		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		−50		V [1]
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	50	50	V
Anode current	I_a	=	100	325	220	mA
Grid No.2 current	I_{g_2}	=	3	22	12	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA [2]
Grid No.2 dissipation	W_{g_2}	=	0.75	7	3.5	W
Driving power	W_{dr}	=	–	2	2	W
Anode input power	W_{i_a}	=	60	195	132	W
Anode dissipation	W_a	=	60	71	70	W
Output power in the load	W_ℓ	=	–	110	110 [3]	W
Efficiency	η	=	–	57	42	%
Intermodulation products third order	d_3	=	–	–	< 30	dB [4]
fifth order	d_5	=	–	–	< 40	dB [4]

[1][2][3][4] See page 4

7Z2 3705

R. F. CLASS AB LINEAR AMPLIFIER , single sideband, suppressed carrier (continued)

OPERATING CONDITIONS (continued)

Frequency	f	=		60		MHz
Anode voltage	V_a	=		600		V
Grid No.2 voltage	V_{g_2}	=		250		V
Grid No.1 voltage	V_{g_1}	=		-50		V [1]
			zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	=	0	50	50	V
Anode current	I_a	=	100	325	220	mA
Grid No.2 current	I_{g_2}	=	3	22	12	mA
Grid No.1 current	I_{g_1}	=	0	0	0	mA [2]
Grid No.2 dissipation	W_{g_2}	=	0.75	7	3.5	W
Driving power	W_{dr}	=	–	2	2	W
Anode input power	W_{i_a}	=	60	195	132	W
Anode dissipation	W_a	=	60	75	72	W
Output power in the load	W_ℓ	=	–	100	100 [3]	W
Efficiency	η	=	–	51	38	%
Intermodulation products third order	d_3	=	–	–	< 30	dB [4]
fifth order	d_5	=	–	–	< 40	dB [4]

1) To be adjusted for the stated value of the zero-signal anode current.

2) Due to transit-time effects this value can differ from 0 mA and vary between +1 mA and -1 mA. This value will increase with increasing frequency.

3) Peak envelope power.

4) The voltage amplitude of the intermodulation products are below these levels which are referred to the amplitude of either of the two tone frequencies. Relative to the peak envelope power these figures will be increased by 6 dB. The stated figures are maxima encountered at any driving level from 0 to 100 %.

7Z2 3706

A.F. CLASS AB AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

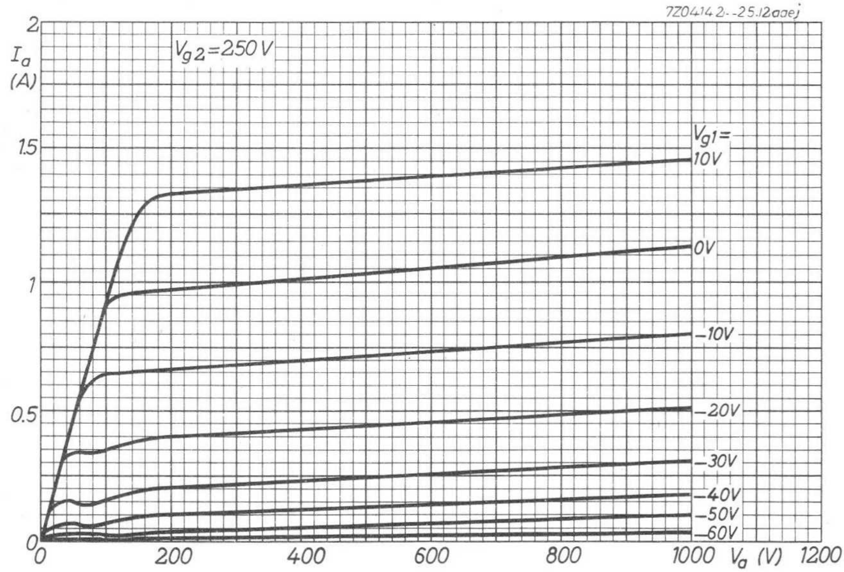
Anode voltage	V_a	=	max.	750	V
Anode current	I_a	=	max.	350	mA
Anode dissipation	W_a	=	max.	75	W
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	7.5	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	100	V
Grid No.1 current	I_{g_1}	=	max.	10	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	10	kΩ

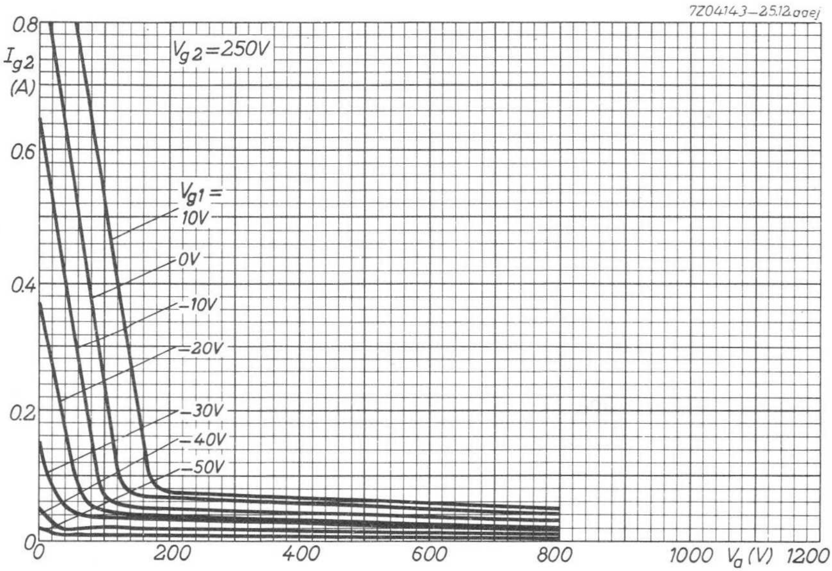
OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a	=	600		V
Grid No.2 voltage	V_{g_2}	=	250		V
Grid No.1 voltage	V_{g_1}	=	-50		V [1])
Load resistance	$R_{aa\sim}$	=	2.8		kΩ
Peak driving voltage	$V_{g_1g_{1p}}$	=	0	100	V
Anode current	I_a	=	2x100	2x260	mA
Grid No.2 current	I_{g_2}	=	2x3	2x24	mA
Grid No.1 current	I_{g_1}	=	0	0	mA
Grid No.2 dissipation	W_{g_2}	=	2x0.75	2x6	W
Anode input power	W_{i_a}	=	2x60	2x156	W
Anode dissipation	W_a	=	2x60	2x56	W
Output power	W_o	=	0	200	W
Efficiency	η	=	-	64	%
Total harmonic distortion	d_{tot}	=	-	< 2	%

1) To be adjusted for the stated value of the zero-signal anode current

7Z2 3707


7Z04142--25.12aaej
V_{g2}=250V
I_a (A)
2
1.5
1
0.5
0
V_{g1}=
10V
0V
−10V
−20V
−30V
−40V
−50V
−60V
0
200
400
600
800
1000
V_a (V)
1200


7Z04143—25.12aaej
V_{g2}=250V
I_{g2} (A)
0.8
0.6
0.4
0.2
0
V_{g1} =
10V
0V
−10V
−20V
−30V
−40V
−50V
0
200
400
600
800
1000
V_a (V)
1200

R.F. POWER TETRODE

Forced-air cooled beam power tetrode with ceramic to metal seals intended for use as linear R.F. power amplifier for frequencies up to 500 MHz and for use in S.S.B. transmitters. The YL1170 is shock and vibration resistant.

SHOCK AND VIBRATION RESISTANCE

Samples of production are periodically selected at random and tested under the following conditions:

Shock With maximum rated anode and grid No.2 voltages and the grid No.1 voltage at $V_{g1} = -200$ V:

a. The tubes are subjected to 6 shocks of a minimum of 90 g approximate half sine wave motion.
b. The duration of the shocks is 11 $\pm$ 2 ms in each of the three major axes.

Vibration With maximum rated anode and grid No.2 voltages applied and the grid No.1 voltage adjusted to maintain an anode current of 100 mA through an anode resistor $R_a = 4.9$ kΩ:

a. The tubes are subjected to vibration in 3 major axes through the range of 10 to 1000 to 10 Hz in a period of min. 6 min. per axis.
b. The vibration level is maintained at 10 g from 28 Hz to 1000 Hz and at 6.3 mm double amplitude from 10 to 28 Hz.
c. During this test a noise voltage of max. 30 V_{RMS} may develop across the anode resistor.

For further data please refer to data of type QEL2/200

7Z2 7987

AIR COOLED R.F. POWER TETRODE

Forced air cooled power tetrode in coaxial metal-glass construction intended for use as S.S.B. amplifier and amplifier in T.V. transmitters.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		Class B television service	
	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_ℓ sync (kW)
30	4.5	3		
230			4	5.5

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	5	V
Filament current	I_f	64	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	14	pF
Grid No.1 to all except anode	$C_{g1(a)}$	78	pF
Anode to grid No.1	C_{ag_1}	0.23	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	600	V
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	$\mu_{g_2g_1}$	5.2	

7Z2 8546

TEMPERATURE LIMITS AND COOLING

Absolute max. envelope temperature t_{env} max. 220 °C

Cooling data

W_a (kW)	h (m)	t_i (°C)	q (m^3/min.)	p_i mm H_2O
2.5	0	25	2.7	50
4	0	25	4.3	130

See also cooling curve.

A low velocity air flow (> 0.5 m^3/min) should be directed to the filament and grid seals.

MECHANICAL DATA

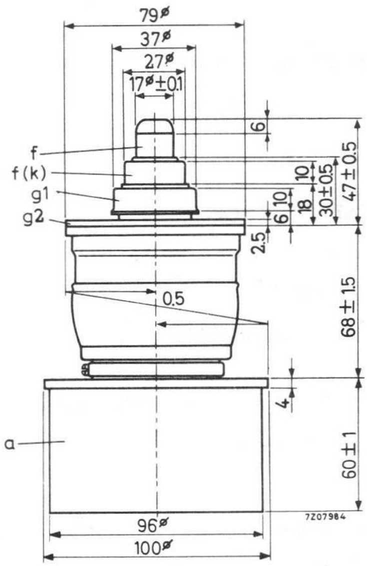
Dimensions in mm

Mounting position: vertical, anode up or down

Net weight: approx. 2.5 kg

Accessories:

Filament connector (one required)	type 40721
Grid No.1 connector	type 40722
Grid No.2 connector	type 40723
Insulating pedestal	type 40724



7Z2 8547

H.F. CLASS AB LINEAR POWER AMPLIFIER, SINGLE SIDE BAND, suppressed carrier.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	max.	30	MHz
Anode voltage	V_a	max.	6	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g_1}	max.	0.2	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	4	kW
Grid No.2 dissipation	W_{g_2}	max.	120	W
Grid No.1 dissipation	W_{g_1}	max.	40	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		4.5		kV
Grid No.2 voltage	V_{g_2}		800		V
Grid No.1 voltage	V_{g_1}		-140		V 1)
		zero signal	single tone	double tone	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	140	140	V
Anode current	I_a	0.5	1.33	0.93	A
Grid No.2 current	I_{g_2}	0	30	8	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	2.25	6	4.2	kW
Anode dissipation	W_a	2.25	2.8	2.6	kW
Grid No.2 dissipation	W_{g_2}	0	24	6.4	W
Driver output power	W_{dr}	0	30	30	W 3)
Output power in load (P.E.P.)	W_ℓ	-	3	3	kW 2)

1) Adjust to give the zero signal anode current.

2) Measured in a circuit having an efficiency of 95%.

3) The indicated driver output power is required to take care of losses in damping resistors and circuit losses.

7Z2 8548

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE; linear grounded-grid amplifier. Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute max. rating system)

Frequency	f	max.	230	MHz
Anode voltage	V_a	max.	4.2	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g_1}	max.	200	mA
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	4	kW
Grid No.2 dissipation	W_{g_2}	max.	100	W
Grid No.1 dissipation	W_{g_1}	max.	30	W

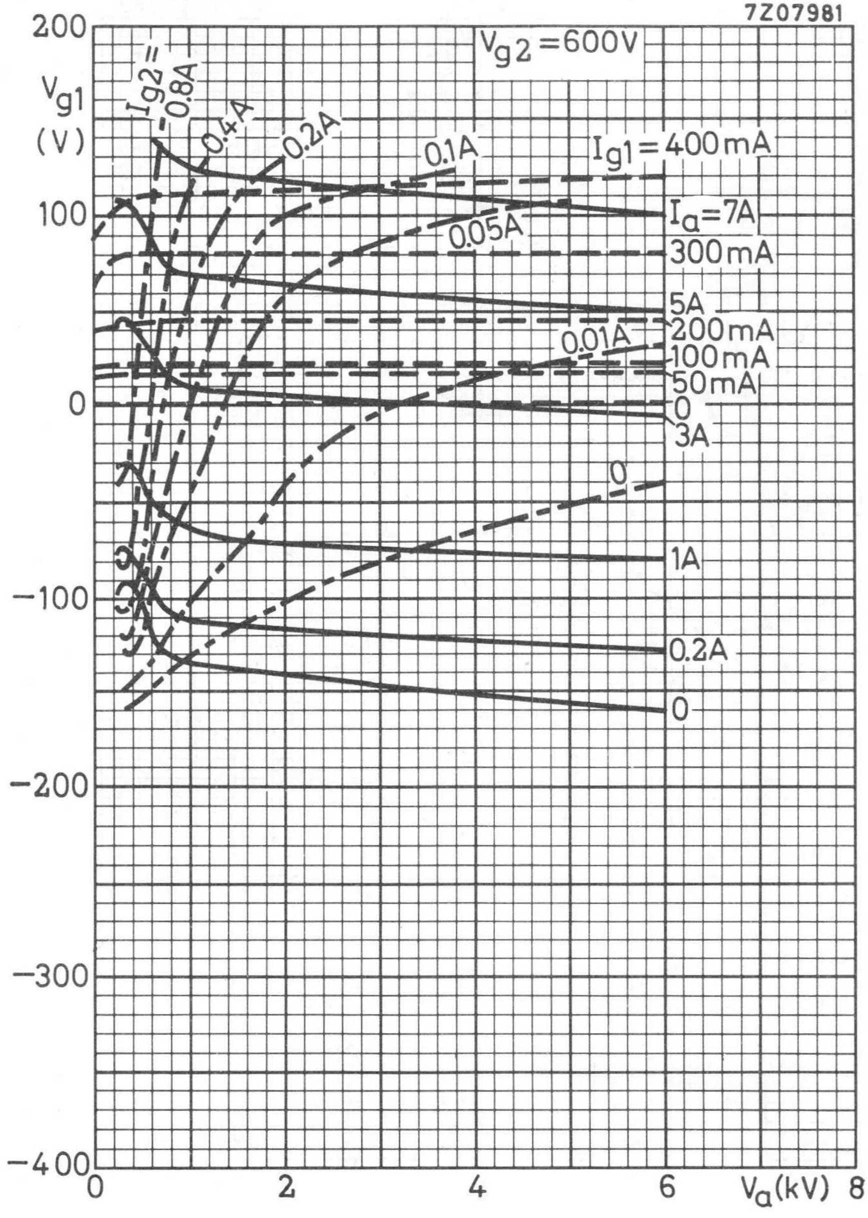
OPERATING CONDITIONS

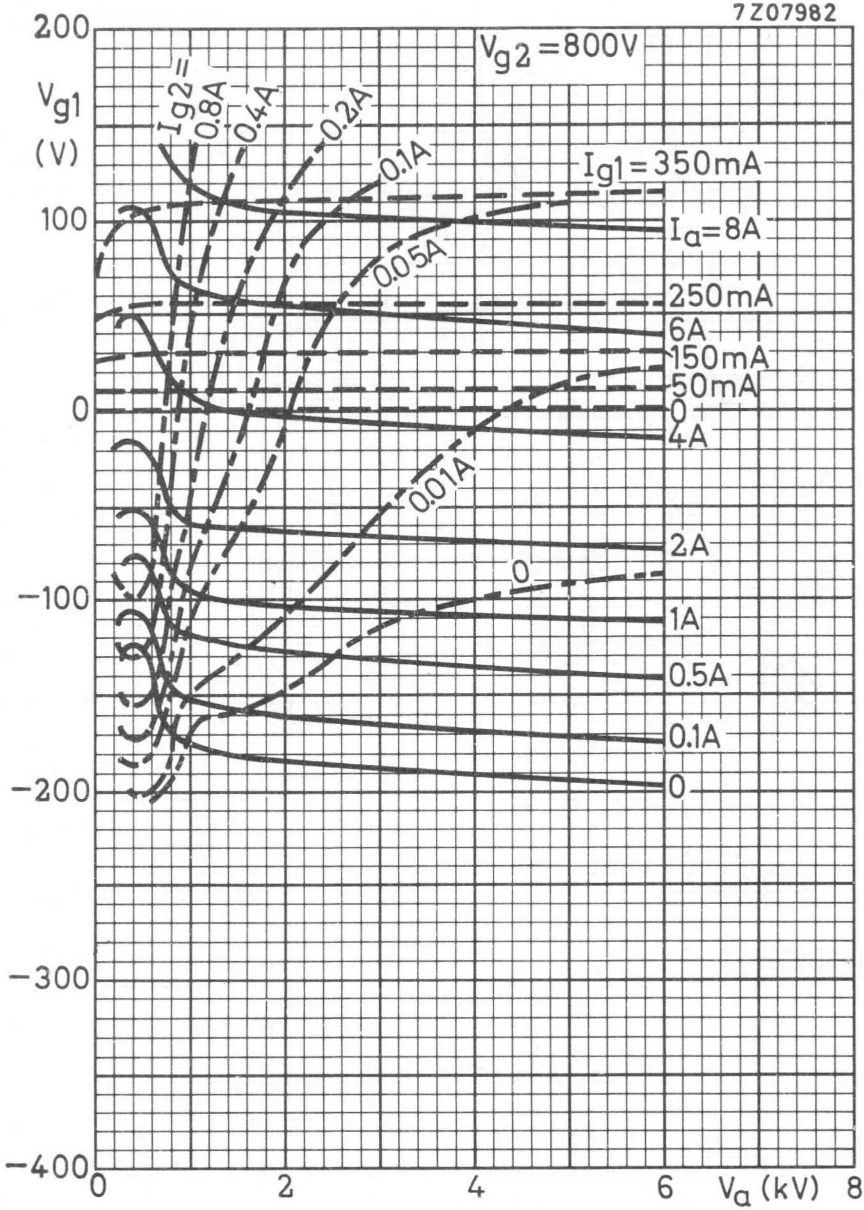
Frequency	f		230	MHz
Bandwidth (−3 dB)	B (−3 dB)		10	MHz [1]
Anode voltage	V_a		4	kV
Grid No.2 voltage	V_{g_2}		600	V
Grid No.1 voltage	V_{g_1}		−115	V
Input A.C. voltage, peak	V_{g1p}	sync	280	V
Anode current	I_a	black	1.5	A
Grid No.2 current	I_{g_2}	black	40	mA
Grid No.1 current	I_{g_1}	black	60	mA
Driver output power	W_{dr}	sync	550	W
Output power in load	W_ℓ	sync	5.5	kW [2]
		black	3	kW [2]
Anode dissipation	W_a	black	3	kW

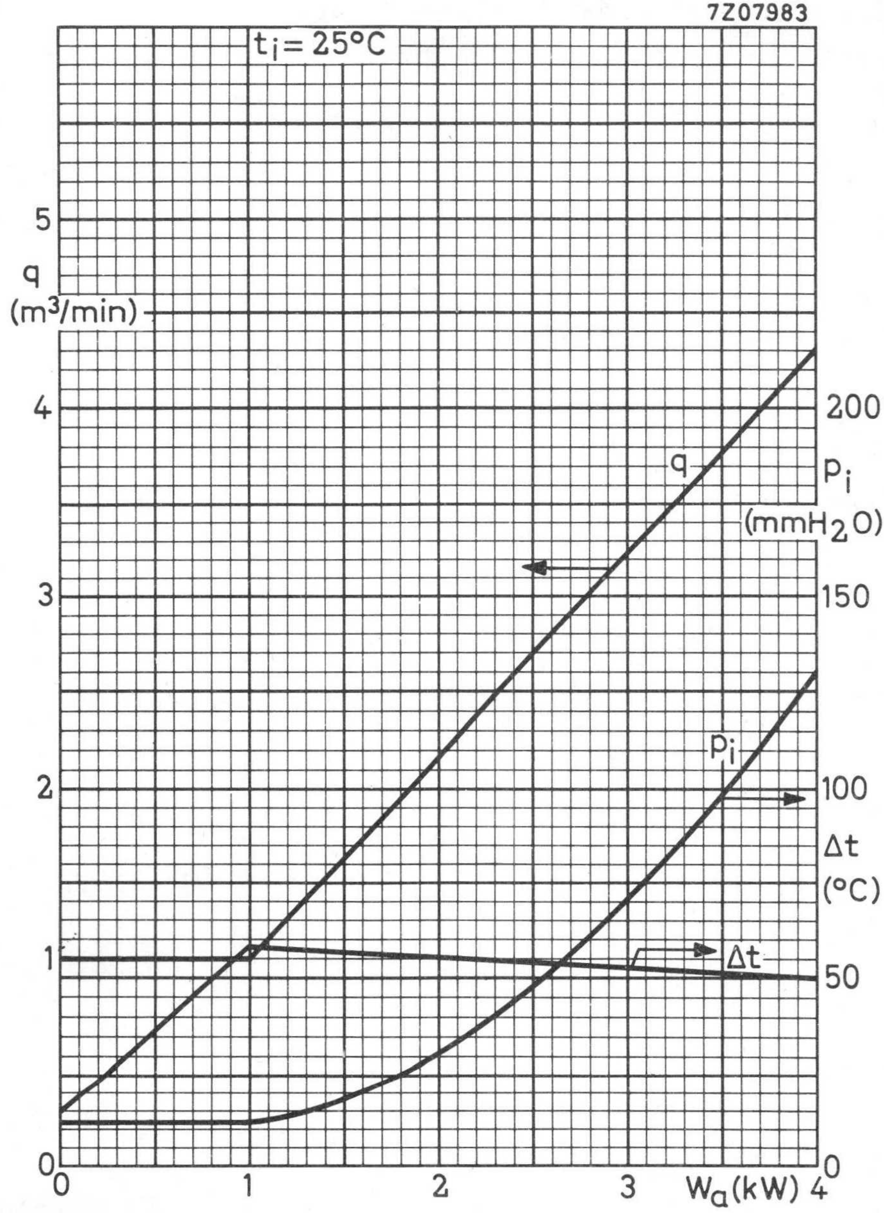
[1]) Bandwidth obtained with secondary circuit.

[2]) W_ℓ represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%.

7Z2 8549


7Z07981
V_{g2} = 600V
V_{g1} (V)
200
100
0
−100
−200
−300
−400
0
2
4
6
8
V_a (kV)
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 400 mA
300 mA
200 mA
100 mA
50 mA
0
I_a = 7A
5A
3A
1A
0.2A
0


7Z07982
200
V_{g1}
(V)
100
0
−100
−200
−300
−400
V_{g2} = 800V
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 350mA
I_a = 8A
250mA
6A
150mA
50mA
0
4A
2A
1A
0.5A
0.1A
0
0
2
4
6
V_a (kV)
8


7Z07983
tᵢ = 25°C
q
(m³/min)
q
pᵢ
(mmH₂O)
pᵢ
Δt
(°C)
Δt
Wₐ(kW)
0
1
2
3
4
5
0
50
100
150
200
0
1
2
3
4

VAPOUR COOLED R.F. POWER TETRODE

Vapour cooled power tetrode in coaxial metal-glass construction intended for use as S.S.B. amplifier and amplifier in T.V. transmitters.

QUICK REFERENCE DATA				
Frequency (MHz)	S.S.B.		Class B television service	
	V_a (kV)	W_ℓ (kW)	V_a (kV)	W_ℓ sync (kW)
30	4.5	3		
230			4	5.5

HEATING: Direct; filament thoriated tungsten

Filament voltage	V_f	5	V
Filament current	I_f	64	A

CAPACITANCES

Anode to all except grid No.1	$C_{a(g_1)}$	14	pF
Grid No.1 to all except anode	$C_{g_1(a)}$	78	pF
Anode to grid No.1	C_{ag_1}	0.23	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	600	V
Anode current	I_a	1	A
Transconductance	S	22	mA/V
Amplification factor	$\mu_{g_2g_1}$	5.2	

7Z2 8550

TEMPERATURE LIMITS AND COOLING

Absolute max. envelope temperature t_{env} max. 220 °C

A low velocity air flow (> 0.5 m^3/min) should be directed to the filament and grid seals.

MECHANICAL DATA

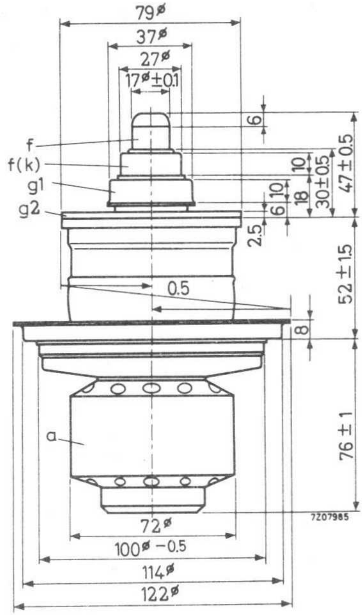
Dimensions in mm

Mounting position: vertical, anode down

Net weight: approx. 1.7 kg

Accessories

Filament connector (one required)	type 40721
Grid No.1 connector	type 40722
Grid No.2 connector	type 40723
Boiler	type K 731



7Z2 8551

H.F. CLASS AB LINEAR POWER AMPLIFIER, SINGLE SIDE BAND, suppressed carrier.

LIMITING VALUES (Absolute max. rating system)

Frequency	f	max.	30	MHz
Anode voltage	V_a	max.	6	kV
Grid No.2 voltage	V_{g_2}	max.	800	V
Grid No.1 voltage	$-V_{g_1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	6	kW
Grid No.2 dissipation	W_{g_2}	max.	120	W
Grid No.1 dissipation	W_{g_1}	max.	40	W

OPERATING CONDITIONS

		zero signal	single tone	double tone	
Frequency	f		30		MHz
Anode voltage	V_a		4.5		kV
Grid No.2 voltage	V_{g_2}		800		V
Grid No.1 voltage	V_{g_1}		-140		V [1])
Grid No.1 driving voltage	$V_{g_{1p}}$	0	140	140	V
Anode current	I_a	0.5	1.33	0.93	A
Grid No.2 current	I_{g_2}	0	30	8	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	2.25	6	4.2	kW
Anode dissipation	W_a	2.25	2.8	2.6	kW
Grid No.2 dissipation	W_{g_2}	0	24	6.4	W
Driver output power	W_{dr}	0	30	30	W [3])
Output power in load (P.E.P.)	W_ℓ	-	3	3	kW [2])

[1]) Adjust to give the zero signal anode current.

[2]) Measured in a circuit having an efficiency of 95%.

[3]) The indicated driver output power is required to take care of losses in damping resistors and circuit losses.

7Z2 8552

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE ; linear grounded-grid amplifier.
Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute max. rating system)

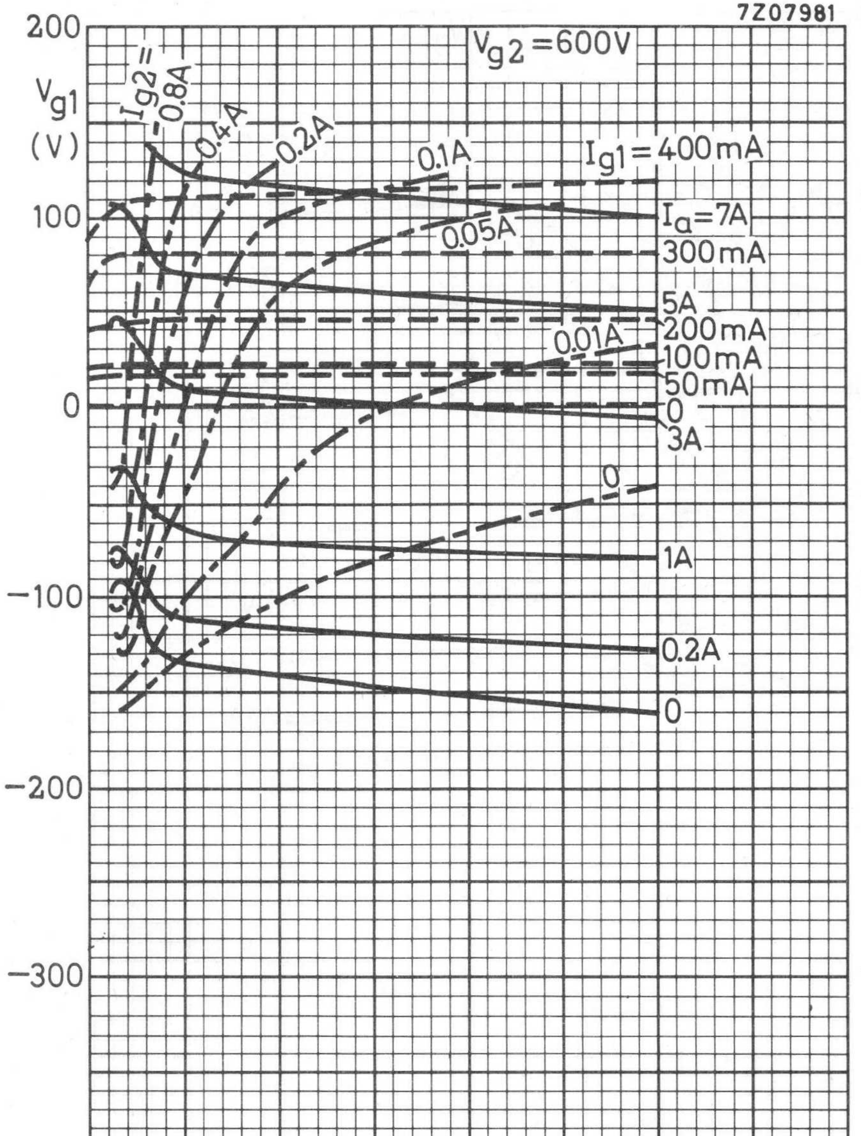
Frequency	f	max.	230	MHz
Anode voltage	V_a	max.	4.2	kV
Grid No.2 voltage	V_{g2}	max.	800	V
Grid No.1 voltage	$-V_{g1}$	max.	400	V
Anode current	I_a	max.	2.5	A
Grid No.1 current	I_{g1}	max.	0.2	A
Anode input power	W_{i_a}	max.	8	kW
Anode dissipation	W_a	max.	6	kW
Grid No.2 dissipation	W_{g2}	max.	100	W
Grid No.1 dissipation	W_{g1}	max.	30	W

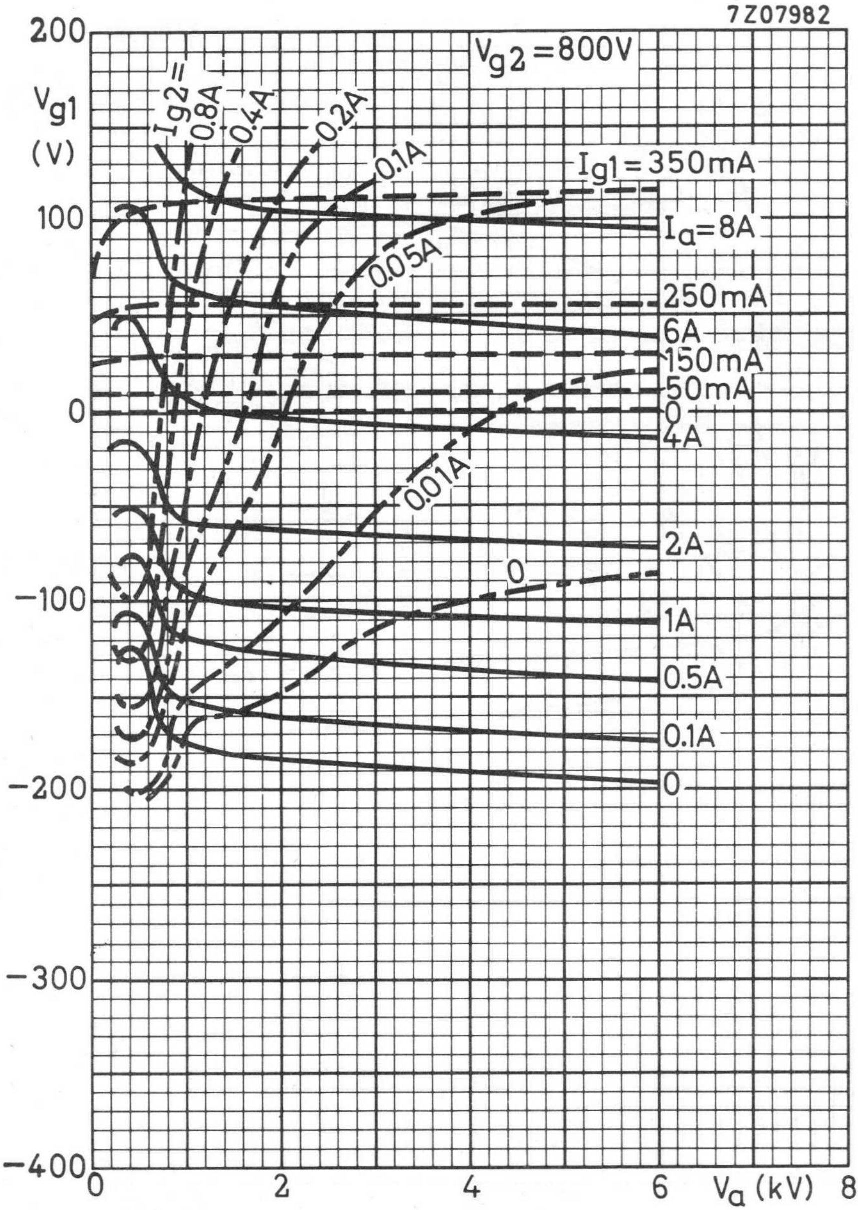
OPERATING CONDITIONS

Frequency	f		230	MHz
Bandwidth (−3 dB)	B (−3 dB)		10	MHz [1]
Anode voltage	V_a		4	kV
Grid No.2 voltage	V_{g2}		600	V
Grid No.1 voltage	V_{g1}		−115	V
Input A.C. voltage, peak	V_{g1p}	sync	280	V
Anode current	I_a	black	1.5	A
Grid No.2 current	I_{g2}	black	40	mA
Grid No.1 current	I_{g1}	black	60	mA
Driver output power	W_{dr}	sync	550	W
Output power in load	W_ℓ	sync	5.5	kW [2]
		black	3	kW [2]
Anode dissipation	W_a	black	3	kW

[1]) Bandwidth obtained with secondary circuit.

[2]) W_ℓ represents the useful power in the load inclusive feedthrough power and assumes a circuit transfer efficiency of 90%. 7Z2 8553


7Z07981
V_{g2} = 600V
V_{g1} (V)
I_{g2} = 0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 400 mA
300 mA
200 mA
100 mA
50 mA
0
I_a = 7A
5A
3A
1A
0.2A
0
V_a (kV)
200
100
0
−100
−200
−300
−400
0
2
4
6
8


7Z07982
V_{g2} = 800V
V_{g1} (V)
200
100
0
−100
−200
−300
−400
I_{g2} =
0.8A
0.4A
0.2A
0.1A
0.05A
0.01A
0
I_{g1} = 350mA
I_a = 8A
250mA
6A
150mA
50mA
0
4A
2A
1A
0.5A
0.1A
0
0
2
4
6
8
V_a (kV)

QUICK HEATING DOUBLE TETRODE

Radiation and convection cooled double tetrode intended for use as RF amplifier and frequency multiplier up to 500 MHz, designed for intermittent filament operation in transistorized mobile transmitters.

QUICK REFERENCE DATA							
RF class C telegraphy	f	200	MHz	V_a	350	V
	W_{dr}	1.0	W	$W_{o\ell}$	26	W
RF class C telegraphy	f	500	MHz	V_a	250	V
	W_{dr}	2.5	W	$W_{o\ell}$	14.5	W
RF class C frequency multiplier	f	167/500	MHz	V_a	250	V
	W_{dr}	2.2	W	$W_{o\ell}$	2.5	W
RF class C a/g_2 mod.	f	175	MHz	V_a	280	V
	W_{dr}	1.5	W	$W_{o\ell}$	15	W

FILAMENT oxide coated

HEATING: Direct by A.C. or D.C.; series and parallel supply

The frequency of A.C. filament supply may be:

sinusoidal supply voltage max. 200 Hz

square wave supply voltage: any

Filament voltage	V_f	1.1	V	±15 %
Filament current	I_f	4.2	A	
Heating time for W_o = 70 % of $W_{o\,max}$.		max. 0.5	s	

CAPACITANCES

Units in push-pull

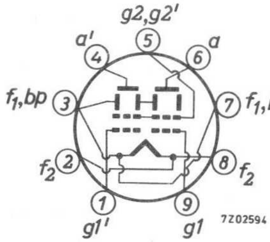
Input	C_i	4.7	pF
Output	C_o	1.2	pF

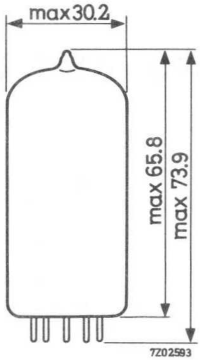
The tube is internally neutralized for frequencies up to 500 MHz

7Z2 8850

DIMENSIONS AND CONNECTIONS

Base: Magnoval





TYPICAL CHARACTERISTICS, each unit

Amplification factor

at V_a = 150 V, V_{g2} = 150 V, I_a = 45 mA	μ_{g2g1}	22

Transconductance

at V_a = 150 V, V_{g2} = 150 V, I_a = 45 mA	S	9.5 mA/V

MOUNTING POSITION any

If the tube is mounted with its main axis horizontally it is recommended that the pins 3 and 7 be in a horizontal plane.

ACCESSORIES

→ Socket: magnoval 2422 502 05001 or equivalent type suitable for the high filament current.
Filament connections (tags 3-7 and 2-8) should be connected in parallel on the socket.

WEIGHT

Net weight 27 g

TEMPERATURE LIMITS AND COOLING

Radiation and convection cooling. The use of a closed tube shield is not recommended.

Absolute maximum bulb temperature t_{bulb} max. 230 °C

7Z2 8851

R.F. CLASS C TELEGRAPHY AND F.M. TELEPHONY, two units in push-pull

LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	200	500	MHz
Anode voltage	V_a	max.	400	300	V
Grid No.2 voltage	V_{g_2}	max.	200	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	100	V
Anode current	I_a	max.	2x75	2x75	mA
Grid No.1 current	I_{g_1}	max.	2x7	2x7	mA
Anode input power	W_{ia}	max.	56	42	W
Anode dissipation	W_a	max.	2x8	2x8	W
Grid No.2 dissipation	W_{g_2}	max.	3.5	3.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	100	kΩ

OPERATING CONDITIONS Intermittent service, **ICAS**

Frequency	f	200	500	MHz
Anode voltage	V_a	350	260	V
Grid No.2 supply voltage	$V_{b_{g_2}}$	350	260	V
Grid No.2 series resistor	R_{g_2}	9	4.3	kΩ
Grid No.1 voltage	V_{g_1}	-13	-22.5	V
Grid No.1 circuit resistance	R_{g_1}	2 [1]	6.9 [2]	kΩ
Driving voltage	$V_{g_1 g_1' p}$	85	65	V
Anode current	I_a	2x70	2x70	mA
Grid No.2 current	I_{g_2}	23.5	20	mA
Grid No.1 current	I_{g_1}	2x6.5	2x3.25	mA
Anode input power	W_{ia}	49	36.5	W
Anode dissipation	W_a	2x8	2x8	W
Grid No.2 dissipation	W_{g_2}	3.1	2.7	W
Driver output power	W_{dr}	1.0	2.5	W
Output power	W_o	33	19	W
Efficiency	η	67	52	%
Output power in load	$W_{o\ell}$	26	14	W [3]

[1]) Common for both units.

[2]) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

[3]) For optimal conditions R_{g_1} should be adjusted to obtain the desired anode current.

7Z2 8852

R.F. CLASS C FREQUENCY TRIPLER, two units in push-pull

LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

Frequency	f	max.	500	MHz
Anode voltage	V_a	max.	300	V
Grid No.2 voltage	V_{g_2}	max.	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	V
Anode current	I_a	max.	2x50	mA
Grid No.1 current	I_{g_1}	max.	2x3	mA
Anode input power	W_{ia}	max.	27	W
Anode dissipation	W_a	max.	2x8	W
Grid No.2 dissipation	W_{g_2}	max.	3.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	kΩ

OPERATING CONDITIONS Intermittent service, **ICAS**

Frequency	f	167/500	MHz
Anode voltage	V_a	250	V
Grid No.2 supply voltage	V_{bg_2}	250	V
Grid No.2 series resistor	R_{g_2}	5.6	kΩ
Grid No.1 circuit resistance-each unit	R_{g_1}	27	kΩ 1)
Driving voltage	$V_{g_1g_1'p}$	170	V
Anode current	I_a	2x45	mA
Grid No.2 current	I_{g_2}	14	mA
Grid No.1 current	I_{g_1}	2x2.5	mA
Anode input power	W_{ia}	22.5	W
Anode dissipation	W_a	2x8	W
Grid No.2 dissipation	W_{g_2}	2.4	W
Driver output power	W_{dr}	2.2	W
Output power	W_o	6.5	W
Efficiency	η	29	%
Output power in load	$W_{o\ell}$	3	W 2)

1) It is recommended to use two fixed resistors, one for each unit, in series with a common adjustable resistor.

2) For optimal conditions R_{g_1} should be adjusted to obtain the desired anode current.

7Z2 4119

R.F. CLASS C ANODE AND SCREEN GRID MODULATION, two units in push-pull

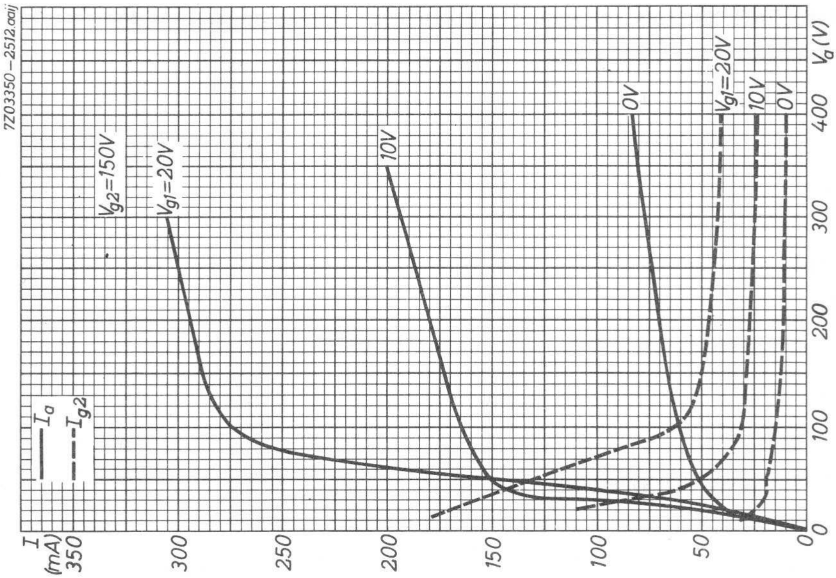
LIMITING VALUES (Absolute limits). Intermittent service, **ICAS**

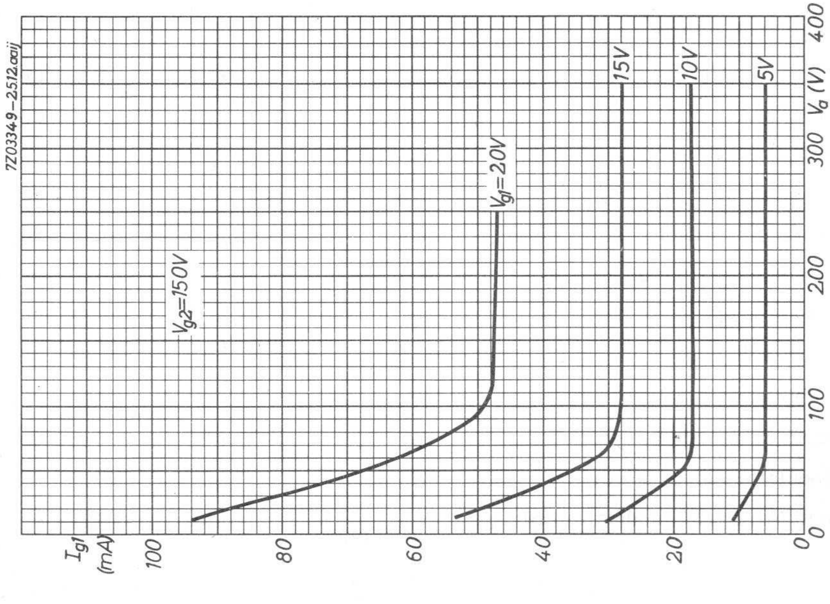
Frequency	f	max.	200	500	MHz
Anode voltage	V_a	max.	330	260	V
Grid No.2 voltage	V_{g_2}	max.	200	200	V
Grid No.1 voltage	$-V_{g_1}$	max.	150	150	V
Anode current	I_a	max.	2x56	2x56	mA
Grid No.1 current	I_{g_1}	max.	2x5	2x5	mA
Anode input power	W_{ia}	max.	40	40	W
Anode dissipation	W_a	max.	2x5.5	2x5.5	W
Grid No.2 dissipation	W_{g_2}	max.	2x1.5	2x1.5	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	100	kΩ

OPERATING CONDITIONS ; intermittent service, **ICAS**

Frequency	f	175	500	MHz
Anode voltage	V_a	280	225	V
Grid No.2 voltage	V_{g_2}	150	150	V
Grid No.1 voltage	$-V_{g_1}$	35	25	V
Anode current	I_a	2x50	2x50	mA
Grid No.2 current	I_{g_2}	19	17	mA
Grid No.1 current	I_{g_1}	2x4	2x3	mA
Anode input power	W_{ia}	28	22.5	W
Anode dissipation	W_a	2x4.5	2x4.5	W
Driver output power	W_{dr}	1.5	3.0	W
Output power	W_o	19	13	W
Efficiency	η	68	58	%
Output power in load	W_{o_ℓ}	15	10	W
Depth of modulation	m	100	100	%
Modulator output power	$W_{o\ mod}$	16	12.5	W
Grid No.2 peak modulator voltage	$V_{g_{2p}\ mod}$	120	120	V

7Z2 4120


7Z03350−2512.aaij
V_{g2}=150V
V_{g1}=20V
10V
0V
V_{g1}=20V
10V
0V
I_a
I_{g2}
I (mA)
350
300
250
200
150
100
50
0
0
100
200
300
400
V_a (V)


7Z03349−2512.aaij
V_{g2}=150V
V_{g1}=20V
15V
10V
5V
I_{g1} (mA)
100
80
60
40
20
0
0
100
200
300
400
V_a (V)

R.F. POWER PENTODE

QUICK REFERENCE DATA				
Heater voltage	V_f	=	12.6	V
Amplification factor	$\mu_{g_2g_1}$	=	6.7	
Mutual conductance	S	=	6	mA/V

HEATING: indirect by A.C. or D.C.; parallel supply
Cathode oxide coated

Heater voltage	V_f	=	12.6	V
Heater current	I_f	=	1.3	A

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1}	=	20.5	pF
Anode to all other elements except grid No.1	C_a	=	12	pF
Anode to grid No.1	C_{ag_1}	=	0.1	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	1000	V
Grid No.2 voltage	V_{g_2}	=	250	V
Anode current	I_a	=	40	mA
Amplification factor	$\mu_{g_2g_1}$	=	6.7	
Mutual conductance	S	=	6	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	= max.	300	^{o}C
Pin seal temperature	= max.	180	^{o}C

COOLING

Radiation and convection

7Z2 8855

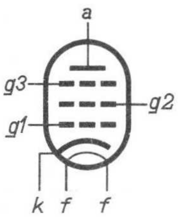
MECHANICAL DATA

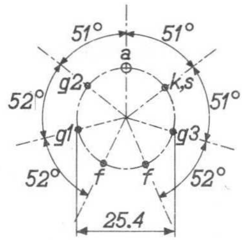
Dimensions in mm

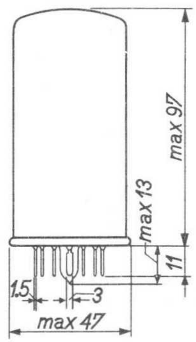
Base : Septar

→ Socket : 2422 513 00001

Net weight : 80 g







Mounting position: any

LIMITING VALUES (Absolute limits)

Anode voltage without cathode current	V_{a_o}	= max.	3	kV
Anode voltage at W_a = 45 W	V_a	= max.	1	kV
Anode dissipation	W_a	= max.	45	W
Positive grid No.3 voltage	V_{g_3}	= max.	200	V
Negative grid No.3 voltage	$-V_{g_3}$	= max.	200	V
Grid No.3 dissipation	W_{g_3}	= max.	1	W
Grid No.3 circuit resistance	R_{g_3}	= max.	50	kΩ
Grid No.2 voltage without cathode current	$V_{g_{2o}}$	= max.	1	kV
Grid No.2 voltage at W_{g_2} = 7 W	V_{g_2}	= max.	300	V
Grid No.2 dissipation	W_{g_2}	= max.	7	W
Negative grid No.1 voltage	$-V_{g_1}$	= max.	300	V
Grid No.1 dissipation	W_{g_1}	= max.	0.5	W
Grid No.1 circuit resistance	R_{g_1}	= max.	25	kΩ
Average cathode current	I_k	= max.	240	mA
Peak cathode current	I_{k_p}	= max.	1.5	A
Cathode to heater voltage	V_{kf}	= max.	100	V
Heater voltage	V_f	= max.	13.9	V
		= min.	11.3	V

7Z2 8856

CHARACTERISTICS AND RANGE VALUES

Column I : Setting of the tube and typical (average) measuring results of new tubes
II : Characteristic range values for equipment design
III : Data indicating the end point of life

			I	II	III	
Heater current						
Heater voltage	V_f	=	12.6			V
Heater current	I_f	=	1.3	1.1-1.5	1.1-1.5	A
Characteristics						
Heater voltage	V_f	=	12.6			V
Anode voltage	V_a	=	100			V
Grid No.3 voltage	V_{g_3}	=	0			V
Grid No.2 voltage	V_{g_2}	=	250			V
Anode current	I_a	=	100			mA
Grid No.1 voltage	$-V_{g_1}$	=	18	14 - 20	12 - 22	V
Grid No.2 current	I_{g_2}	=		12 - 25	8 - 30	mA
Grid No.1 current	$-I_{g_1}$	=			20	μA
Cut-off voltage						
Heater voltage	V_f	=	12.6			V
Anode voltage	V_a	=	100			V
Grid No.3 voltage	V_{g_3}	=	0			V
Grid No.2 voltage	V_{g_2}	=	250			V
Anode current	I_a	=	0.2			mA
Cut-off voltage	$-V_{g_1}$	=		<60	65	V
Capacitances						
Anode to all other elements except grid No.1	$C_{a(g_1)}$	=	12	11 - 13		pF
Grid No.1 to all other elements except anode	$C_{g_1(a)}$	=	20.5	19 - 22		pF
Anode to grid No.1	C_{ag_1}	=		<0.22		pF

7Z2 8295

CHARACTERISTICS AND RANGE VALUES (continued)

Insulation between the electrodes

A leakage current of 10 μA is not exceeded when the following voltages, with polarity as indicated are applied to the indicated electrodes via a series resistor of 10 MΩ

		I	II	III	
Grid No.1 (-) to grids No.2 and 3 and anode (+)	$V_{g_1}(-)/a, g_2, g_3(+)$	= 1000		550	V
Grid No.2 (+) to grid No.3 (-)	$V_{g_2}(+)/g_3(-)$	= 1000		550	V
Anode (+) to grid No.3 (-)	$V_{a}(+)/g_3(-)$	= 3000		1200	V
Cathode (+) to grid No.1 (-)	$V_{k}(+)/g_1(-)$	= 200		150	V

LIFE EXPECTANCY

3000 hours under the following conditions:

Heater voltage	V_f	= 12.6	V
Anode voltage	V_a	= 100	V
Grid No.3 voltage	V_{g_3}	= 0	V
Grid No.2 voltage	V_{g_2}	= 250	V
Grid No.1 voltage	V_{g_1}	= -20	V
Grid No.1 pulse voltage (pulse substantially square)	$V_{g_{1p}}$	= 40	V
Pulse repetition frequency	f_{imp}	= 80	Hz
Pulse duration	T_{imp}	= 8	ms

AGEING

In order to detect "early failures" and to ensure that the tubes are properly stabilised, all tubes are aged prior to testing during 200 hours under the following conditions:

Heater voltage	V_f	= 12.6	V
Anode current	I_a	= 70	mA
Anode dissipation	W_a	= 20	W
Peak anode voltage	V_{a_p}	= 515	V

7Z2 8296

STAND-BY PERFORMANCE [1]

After 200 hours of operation with V_f = 14 V only, the tubes are criticised for

Cathode interface resistance >10 Ω (continuous wave method IEC Publ. 151-9, two frequency method)

LIFE PERFORMANCE [1]

After 3000 hours of operation under the following conditions

Heater voltage	V_f	=	12.6	V
Anode voltage	V_a	=	100	V
Grid No.3 voltage	V_{g_3}	=	0	V
Grid No.2 voltage	V_{g_2}	=	250	V
Grid No.1 voltage	V_{g_1}	=	-20	V
Grid No.1 pulse voltage (pulse substantially square)	$V_{g_{1p}}$	=	40	V
Pulse repetition frequency	f_{imp}	=	80	Hz
Pulse duration	T_{imp}	=	8	ms

the tubes are critised for

Inoperatives

Control grid voltage for cut-off Control grid current Leakage current	See section "Characteristics and range values".

[1]) This test is performed on a sample taken from each production run.

7Z2 8297

VIBRATIONAL NOISE OUTPUT [1][2]

Conditions:

Anode voltage	V_a	=	100	V
Grid No. 2 voltage	V_{g_2}	=	150	V
Grid No. 3 voltage	V_{g_3}	=	0	V
Anode current	I_a	=	10	mA
Vibrational acceleration		=	10	g
Duration	T	=	60	sec in each of the three directions X_1, X_2 and Y
Frequency	f	=	25	Hz
Anode load resistance	R_a	=	2	kΩ

Limit of the vibrational noise output V_{noise} = max. 750 mV(RMS)

FATIGUE : 2.5 g [1][2]

Vibrational forces for a period of 32 hours at a frequency of 50 Hz in each of the three directions X_1, X_2 and Y

VIBRATION: 5 g [1][2]

Vibrational forces for a period of 2 hours at a frequency of 25 Hz in each of the three directions X_1, X_2 and Y

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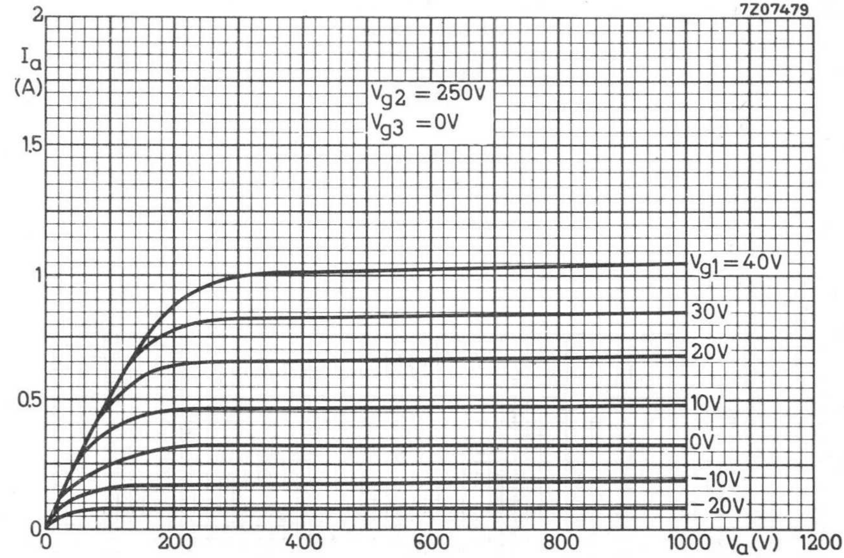
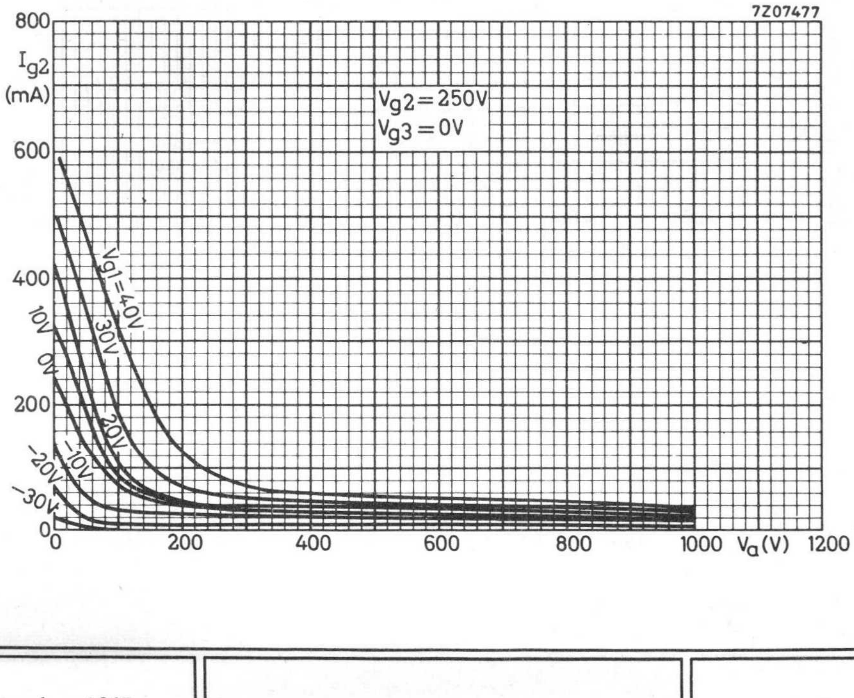
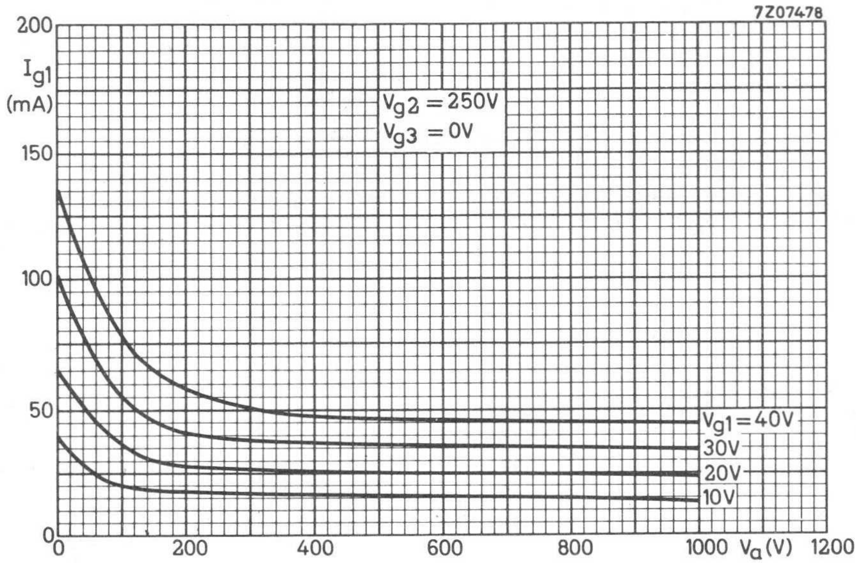
1) This test is performed on a sample taken from each production run.

2) These test conditions are only given for evaluation of the ruggedness of the tube and should by no means be interpreted as suitable operating conditions. Fatigue and vibration are destructive tests.

7Z2 8298


7Z07479
I_a
(A)
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0V
−10V
−20V
V_a (V)


7Z07477
I_{g2}
(mA)
$V_{g2} = 250V$
$V_{g3} = 0V$
$V_{g1} = 40V$
30V
20V
10V
0V
−10V
−20V
−30V
V_a (V)


7Z07478
200
I_{g1}
(mA)
150
100
50
0
V_{g2} = 250V
V_{g3} = 0V
V_{g1} = 40V
30V
20V
10V
0
200
400
600
800
1000
V_a (V)
1200

R.F. DOUBLE TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	6.75	V	13.5	V
Heater current	I_f	=	720	mA	360	mA
Pin connections			9-(4+5)		4-5	

- - - - - - - - - - - - - - - - - - - -

For further data and curves of this type
please refer to type QQE03/12

- - - - - - - - - - - - - - - - - - - -

7Z2 3708

R.F. DOUBLE TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	6.75	V	13.5	V
Heater current	I_f	=	560	mA	280	mA
Pin connections			9-(4+5)		4-5	

For further data and curves of this type please refer to type QQE02/5

7Z2 3709

AIR COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA				
Freq. (MHz)	B amplifier		Class AB SSB	
	V_a (V)	W_{load} (W)	V_a (V)	W_o PEP (W)
220	3000	1000		
30			3000	> 1050

HEATING: indirect by A.C. or D.C.; cathode oxide-coated, matrix type

Heater voltage	V_f	5.0	V ± 3%
Heater current	I_f	18	A (< 20 A)
Waiting time	T_w	min. 5	min.

CAPACITANCES

Anode to cathode and heater	$C_{a-k,f}$	< 0.08	pF
Anode to grid No.1	C_{ag_1}	< 0.1	pF
Anode to grid No.2	C_{ag_2}	13 to 17	pF
Grid No.1 to cathode and heater	$C_{g_1-k,f}$	33 to 42	pF
Grid No.1 to grid No.2	$C_{g_1-g_2}$	48 to 64	pF
Grid No.2 to cathode and heater	$C_{g_2-k,f}$	< 1.7	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid No.2 voltage	V_{g_2}	550	V
Anode current	I_a	500	mA
Mutual conductance	S	20	mA/V
Amplification factor	$\mu_{g_2g_1}$	7.5	-

7Z2 8388

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals (see also outline drawing)	t_s	max. 200	°C
Air inlet temperature	t_i	max. 45	°C

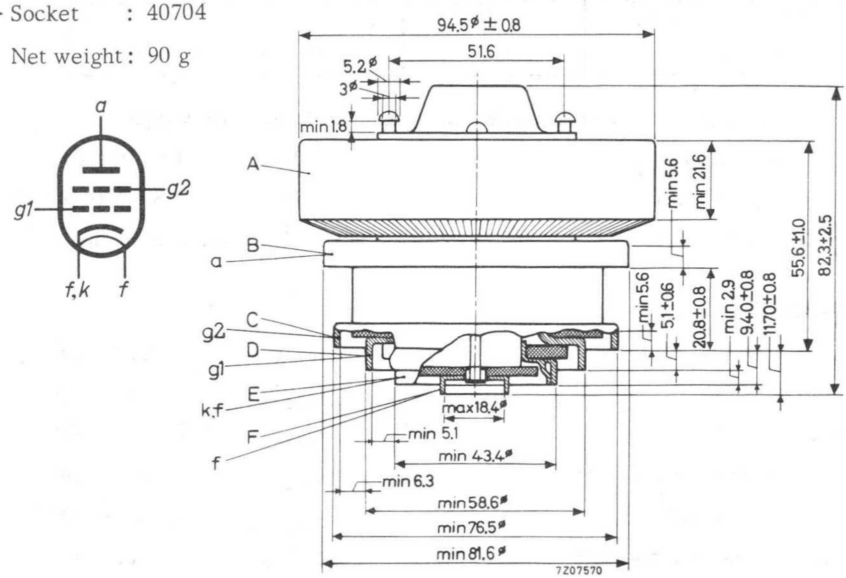
COOLING

Forced air cooling for the anode. For cooling characteristics see page A. Low velocity air flow for the ceramic to metal seals.
Cooling will also be necessary when only the heater voltage is applied to the tube.

MECHANICAL DATA Dimensions in mm

→ Socket : 40704

Net weight: 90 g



The radiator and the terminals lie inside or outside concentric cylinders with the following dimensions:

Radiator	A :	inside	96.0 mm
Anode	B :	inside	82.8 mm
Grid No.2 connection	C :	inside	77.7 mm
Grid No.1 connection	D :	inside	59.4 mm
Cathode and heater connection	E :	inside	44.3 mm
Heater connection	F :	outside	17.6 mm

Mounting position: any

7Z2 8389

CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max. max.	3500 2500	V V 1)
Anode input power	W_{i_a}	max. max.	3 2	kW kW 1)
Anode dissipation	W_a	max.	1.5	kW
Anode current	I_a	max.	1	A
Grid No.2 voltage	V_{g_2}	max.	1000	V
Grid No.2 input power	$W_{i_{g_2}}$	max.	50	W
Grid No.2 current	I_{g_2} $-I_{g_2}$	max. max.	50 50	mA mA
Negative grid No.1 voltage	$-V_{g_1}$	max.	300	V
Grid No.1 current	I_{g_1}	max.	10	mA
Grid No.1 circuit resistance	R_{g_1}	max.	5	kΩ

OPERATING CHARACTERISTICS

Frequency	f	220		MHz
Anode voltage	V_a	3000		V
Grid No.2 voltage	V_{g_2}	450		V
Grid No.1 voltage	V_{g_1}	-60		V
Anode current	I_a	150	830	mA
Grid No.2 current	I_{g_2}	-5	-20	mA
Grid No.1 current	I_{g_1}	–	5	mA
Driver output power	W_{dr}	–	40	W
Anode input power	W_{i_a}	0.45	2.49	kW
Anode dissipation	W_a	0.45	1.35	kW
Output power in the load	W_ℓ	0	1.0	kW

1) For AM.

2) Page 4.
Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level. 7Z2 8390

R.F. CLASS A.B. - LINEAR AMPLIFIER SINGLE SIDE BAND suppressed carrier

LIMITING VALUES (Absolute limits)

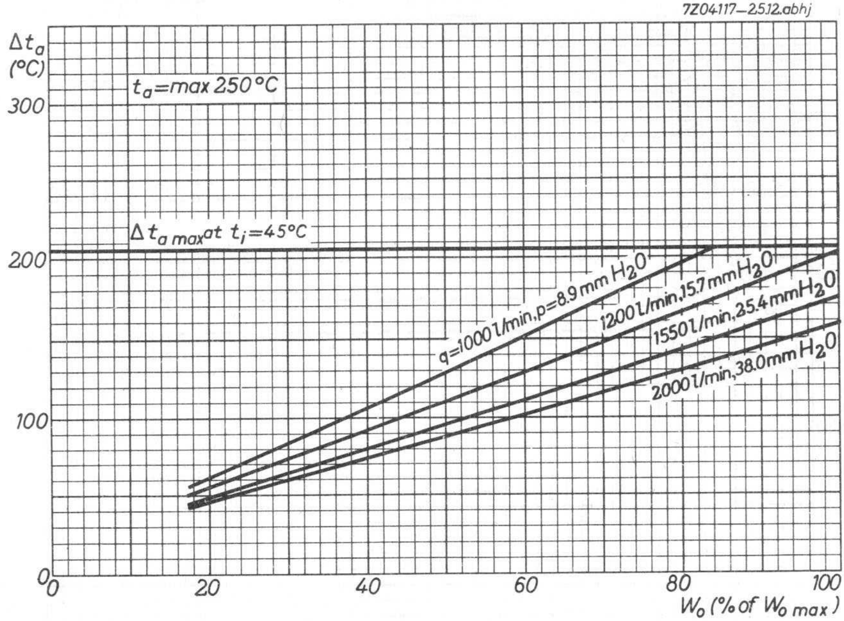
Frequency	f	up to	60	MHz
Anode voltage	V_a	max.	3.5	kV
Anode input power	W_{i_a}	max.	3.0	kW
Anode dissipation	W_a	max.	1.5	kW
Anode current	I_a	max.	1.0	A
Grid No.2 voltage	V_{g_2}	max.	1	kV
Grid No.2 dissipation	W_{ig_2}	max.	50	W
Grid No.2 current	I_{g_2}	max.	50	mA
	$-I_{g_2}$	max.	50	mA
Negative grid No.1 voltage	$-V_{g_1}$	max.	300	V
Grid No.1 current	I_{g_1}	max.	0	mA
Grid No.1 circuit resistance	R_{g_1}	max.	5	kΩ

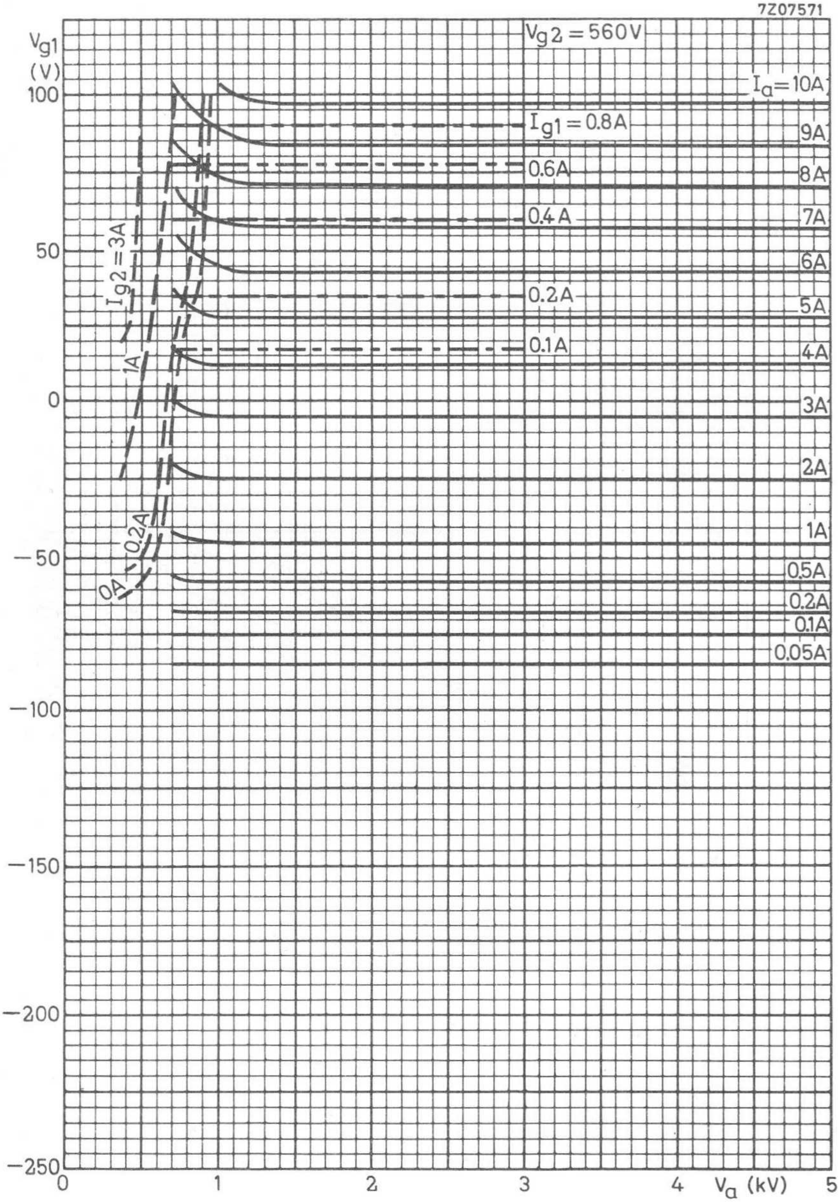
OPERATING CONDITIONS

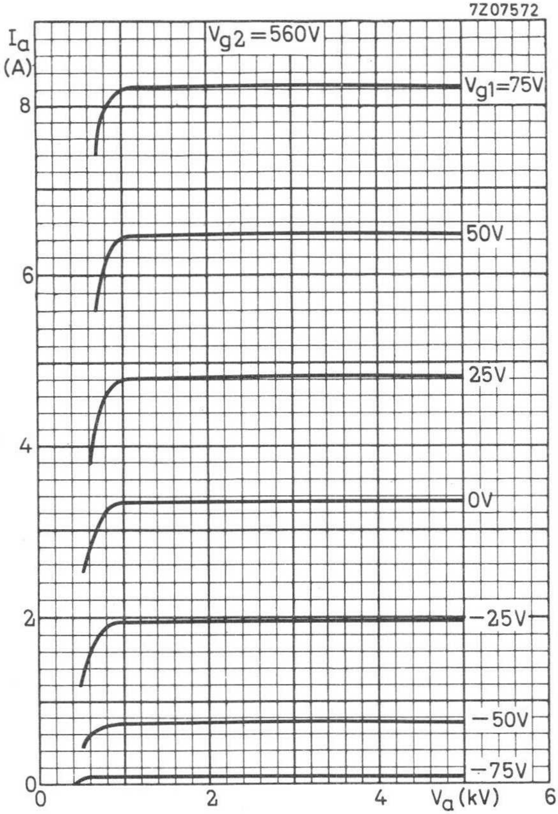
Frequency	f		1 to 30		MHz
Anode voltage	V_a		3.0		kV
Grid No.2 voltage	V_{g_2}		560		V
Grid No.1 voltage	V_{g_1}		−55		V
		zero signal	single tone signal	double tone signal	
Peak driving voltage	$V_{g_{1p}}$	0	48 (< 53)	46 (< 51)	V
Anode current	I_a	380	750	570	mA
Grid No.2 current	I_{g_2}	−5	−20	−15	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Grid No.1 resistor	R_{g_1}	2	2	2	kΩ
Driver output power	W_{dr}	0	< 5	< 5	W
Anode input power	W_{i_a}	1140	2250	1710	W
Anode dissipation	W_a	1140	1080	1100	W
Output power in load	W_ℓ	0	1050	–	W
→ PEP output power in load	W_ℓ	0	–	1050	W
Intermodulation distortion					
1 MHz. of the 3rd order	d_3	–	–	< −38	dB 2)
1 MHz. of the 5th order	d_5	–	–	< −38	dB 2)
30 MHz. of the 3rd order	d_3	–	–	< −36	dB 2)
30 MHz. of the 5th order	d_5			< −36	dB 2)

2) See page 3.

7Z2 8391


7Z04117—2.5.12.abhj
Δt_a (°C)
t_a=max 250 °C
$\Delta t_{a\,max}$ at t_i=45°C
q=1000 l/min, p=8.9 mm H_2O
1200 l/min, 15.7 mm H_2O
1550 l/min, 25.4 mm H_2O
2000 l/min, 38.0 mm H_2O
300
200
100
0
0
20
40
60
80
100
W_o (% of $W_{o\,max}$)


7Z07571
$V_{g2} = 560V$
V_{g1} (V)
100
50
0
−50
−100
−150
−200
−250
$I_a = 10A$
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0.1A
0.05A
$I_{g1} = 0.8A$
0.6A
0.4 A
0.2A
0.1A
$I_{g2} = 3A$
1A
0.2A
0A
0
1
2
3
4
5
V_a (kV)


7Z07572
I_a
(A)
8
6
4
2
0
$V_{g2} = 560V$
$V_{g1}=75V$
50V
25V
0V
−25V
−50V
−75V
0
2
4
V_a (kV)
6

R.F. DOUBLE TETRODE

Single-ended double tetrode, indirectly heated, with novar base. Designed for mobile service as class C amplifier, oscillator or frequency multiplier up to 200 MHz. The tube is internally neutralised.

QUICK REFERENCE DATA			
	R.F. class C telegraphy or F.M. telephony	R.F. class C a-g_2 modulator	R.F. class C freq. tripler
	ICAS	ICAS	ICAS
Frequency f =	up to 200 MHz	up to 200 MHz	up to 200 MHz
Anode voltage V_a = max.	450 V	360 V	450 V
Anode dissipation W_a = max.	2 x 10 W	2 x 6.5 W	2 x 10 W
Frequency f =	175 MHz	175 MHz	58/174 MHz
Output power in load W_ℓ =	30 W	19 W	10 W

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	=	6.75 V	13.5 V
Heater current	I_f	=	0.8 A	0.4 A
Pins			9-(4+5)	4-5

CAPACITANCES

Input capacitance, each system	C_i	=	6.2	pF
Output capacitance, each system	C_o	=	2.7	pF
Anode to grid No.1, each system	C_{ag_1}	<	0.1	pF
Input capacitance, push-pull connection	C_i	=	5.1	pF
Output capacitance, push-pull connection	C_o	=	1.5	pF

7Z2 3711

TYPICAL CHARACTERISTICS

Anode current	I_a	=	30	mA
Amplification factor	$\mu_{g_2g_1}$	=	7.5	
Mutual conductance	S	=	3.3	mA/V

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature = max. 225 ^{o}C

Pin seal temperature = max. 120 ^{o}C

COOLING: radiation and convection

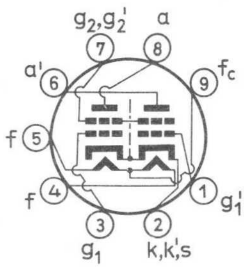
The use of a closed tube shield is not recommended

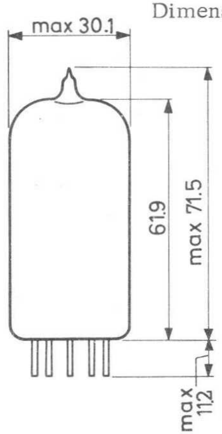
MECHANICAL DATA

Dimensions in mm

Base : Novar

Net weight: 28.5 g





Mounting position: any

7Z2 8858

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY

LIMITING VALUES (Each system; absolute limits)

			CCS	ICAS	
Frequency	f		up to 200	up to 200	MHz
Anode voltage	V_a	=	max. 400	max. 450	V
Anode current	I_a	=	max. 45	max. 55	mA
Anode input power	W_{ia}	=	max. 18	max. 25	W
Anode dissipation	W_a	=	max. 7.5	max. 10	W
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 1	max. 1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	=	max. 3	max. 4	mA
Grid No.1 dissipation	W_{g_1}	=	max. 0.2	max. 0.2	W
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	ICAS	
Frequency	f	=	175	175	175	MHz
Anode voltage	V_a	=	400	400	450	V
Grid No.2 voltage	V_{g_2}	=	180	190	190	V
Grid No.1 voltage	V_{g_1}	=	−50	−50	−50	V
Grid No.1 resistor	R_{g_1}	=	31	28	26	kΩ
Anode current	I_a	=	2x45	2x55	2x55	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	3.8	5.0	4.5	mA
Grid No.1 current	I_{g_1}	=	2x0.8	2x0.9	2x0.95	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.68	0.95	0.85	W
Driving power	W_{dr}	=	1.0	1.1	1.2	W
Output power in the load	W_ℓ	=	21	26.5	30	W
Overall efficiency	η	=	58	60	61	%

7Z2 3713

R.F. CLASS C ANODE AND SCREEN GRID MODULATION. Grid No.3 modulated by a tertiary winding with a number of turns equal to 44% of that of the anode winding.

LIMITING VALUES (Each system; absolute limits)

			CCS		ICAS		
Frequency	f		up to	200	up to	200	MHz
Anode voltage	V_a	=	max.	320	max.	360	V
Anode current	I_a	=	max.	37.5	max.	46	mA
Anode input power	W_{ia}	=	max.	12	max.	16.5	W
Anode dissipation	W_a	=	max.	5.0	max.	6.5	W
Grid No.2 voltage	V_{g_2}	=	max.	200	max.	200	V
Grid No.2 dissipation	W_{g_2}	=	max.	0.65	max.	0.65	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	150	max.	150	V
Grid No.1 current	I_{g_1}	=	max.	3	max.	4	mA
Heater to cathode voltage	V_{kf}	=	max.	100	max.	100	V

OPERATING CONDITIONS; two systems in push-pull

			CCS	ICAS	
Frequency	f	=	175	175	MHz
Anode voltage	V_a	=	320	360	V
Grid No.2 voltage	V_{g_2}	=	140	160	V
Grid No.1 voltage	V_{g_1}	=	-20	-25	V
Anode current	I_a	=	2x37.5	2x46	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	5.0	6.0	mA
Grid No.1 current	I_{g_1}	=	2x1.25	2x1.5	mA
Grid No.2 dissipation	$W_{g_2+g_2'}$	=	0.7	1.0	W
Driving power	W_{dr}	=	2.0	2.5	W
Output power in the load	W_ℓ	=	13.5	19	W [1]
Overall efficiency	η	=	56	57	%
Modulation depth	m	=	100	100	%
Modulation power	W_{mod}	=	12.5	17	W

[1]) Measured in a circuit having an efficiency of 80%.

7Z2 3714

R.F. CLASS C FREQUENCY TRIPLER

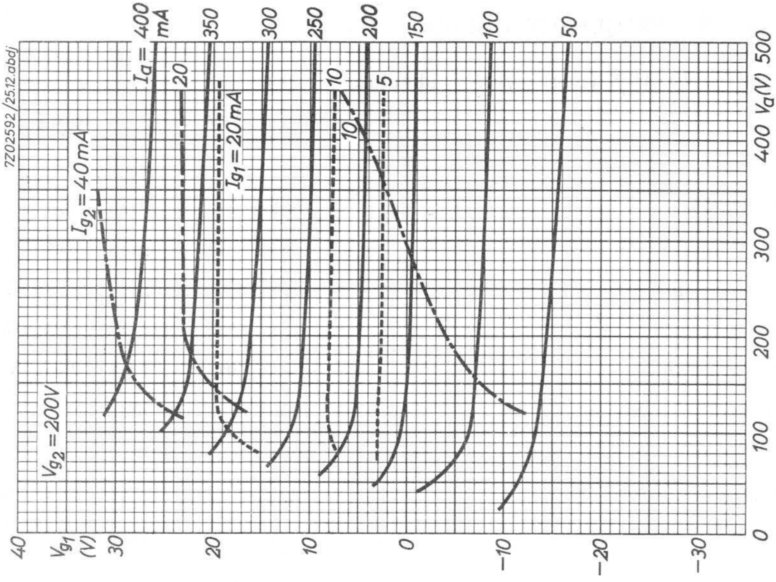
LIMITING VALUES (Each system; absolute limits)

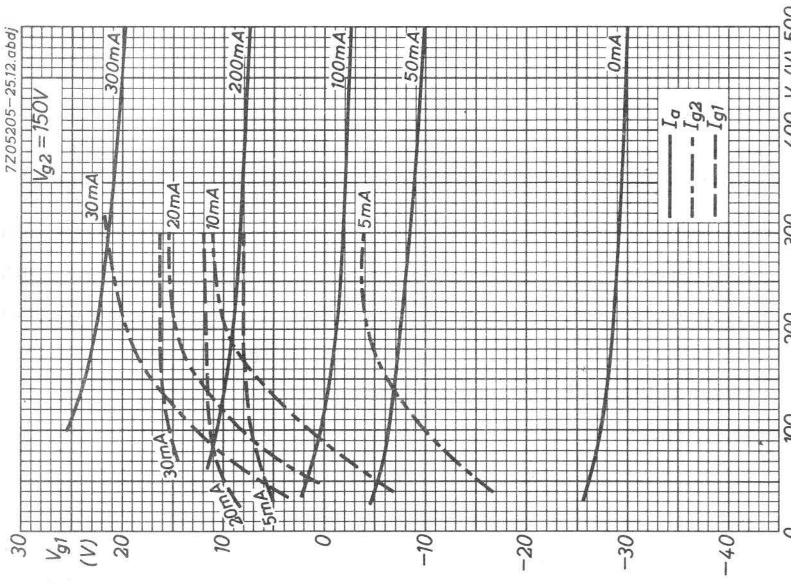
			CCS	ICAS	
Frequency	f		up to 200	up to 200	MHz
Anode voltage	V_a	=	max. 400	max. 450	V
Anode current	I_a	=	max. 30	max. 44	mA
Anode input power	W_{ia}	=	max. 11	max. 15	W
Anode dissipation	W_a	=	max. 7.5	max. 10	W
Grid No.2 voltage	V_{g_2}	=	max. 200	max. 200	V
Grid No.2 dissipation	W_{g_2}	=	max. 1	max. 1	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	=	max. 2	max. 3	mA
Heater to cathode voltage	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS; two systems in push-pull

			ICAS	
Frequency	f	=	58/174	MHz
Anode voltage	V_a	=	350	V
Grid No.2 voltage	V_{g_2}	=	165	V
Grid No.1 voltage	V_{g_1}	=	-150	V
Grid No.1 resistor	R_{g_1}	=	34	kΩ
Anode current	I_a	=	2x43	mA
Grid No.2 current	$I_{g_2+g_2'}$	=	5.0	mA
Grid No.1 current	I_{g_1}	=	2x2.2	mA
Driving power	W_{dr}	=	2.0	W
Output power in the load	W_ℓ	=	10	W
Overall efficiency	η	=	33	%

7Z2 3715


7Z02592 /25.12.abdj
V_{g2}=200V
I_{g2}=40mA
I_a = 400 mA
350
300
250
200
150
100
50
20
I_{g1}=20mA
10
5
V_{g1} (V)
V_a(V)


7Z05205–25.12.abdj
V_{g2} =150V
300mA
200mA
100mA
50mA
0mA
30mA
20mA
10mA
5mA
I_a
I_{g2}
I_{g1}
V_{g1} (V)
V_a (V)

R.F. BEAM POWER TETRODE

Indirectly heated beam power tetrode designed for use as R.F. power amplifier, oscillator, frequency multiplier and A.F. amplifier or modulator for fixed or mobile equipment.

QUICK REFERENCE DATA			
Freq. (MHz)	R.F. class C telegraphy		
	V_a (V)	W_o (W)	
		CCS	ICAS
75	550	52	
	600		58.5
175	400	38	
	450	38	
	500		46
250	400		32

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f =	6.75 V	13.5 V
Heater current	I_f =	1.2 A	0.6 A
Pins		3-(6+7)	6-7

CAPACITANCES

Grid No.1 to all other elements except anode	C_{g_1} =	11.5 pF
Anode to all other elements except grid No.1	C_a =	5.0 pF

TYPICAL CHARACTERISTICS

Anode current	I_a =	80 mA
Amplification factor	$\mu_{g_2g_1}$ =	8
Mutual conductance	S =	7 mA/V

7Z2 3716

TEMPERATURE LIMITS (Absolute limits)

Bulb temperature	=	max. 250 °C
Seal temperature	=	max. 230 °C

MECHANICAL DATA

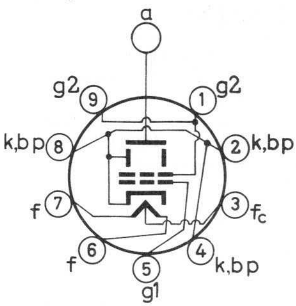
Dimensions in mm

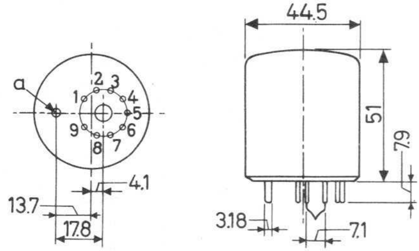
Base : Magnoval

The anode pin is brought out through the base separated from the magnoval pin circle for convenient under-chassis circuitry.

Socket : 40685

Net weight: 36 g





Mounting position: any

7Z2 3717

R.F. AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY

CCS Continuous service

LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	up to 175	MHz
Anode voltage	V_a	=	max. 550	max. 450	V
Anode current	I_a	=	max. 150	max. 150	mA
Anode input power	W_{ia}	=	max. 75	max. 60	W
Anode dissipation	W_a	=	max. 25	max. 25	W
Grid No.2 voltage	V_{g_2}	=	max. 300	max. 300	V
Grid No.2 input power	W_{ig_2}	=	max. 4	max. 4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200	max. 200	V
Grid No.1 circuit resistance					
with fixed bias	R_{g_1}	=	max. 50	max. 50	kΩ
with automatic bias	R_{g_1}	=	max. 100	max. 100	kΩ
Cathode current	I_k	=	max. 165	max. 165	mA
Heater to cathode voltage (any polarity)	V_{kf}	=	max. 100	max. 100	V

OPERATING CONDITIONS **CCS** Continuous service

Frequency	f	=	75	175	175	MHz
Anode voltage	V_a	=	550	450	400	V
Grid No.2 voltage	V_{g_2}	=	235	250	230	V
Grid No.1 voltage	V_{g_1}	=	-50	-55	-51	V
Grid No.1 resistor	R_{g_1}	=	10	21	11	kΩ
Anode current	I_a	=	136	134	150	mA
Grid No.2 current	I_{g_2}	=	11	11	10	mA
Grid No.1 current	I_{g_1}	=	5.0	2.6	4.6	mA
Driving power	W_{dr}	=	0.5	1.5	1.5	W
Anode input power	W_{ia}	=	75	60	60	W
Output power in the load	W_ℓ	=	52	38	38	W
Overall efficiency	η	=	69	63.5	63.5	%

7Z2 3718

R.F. AMPLIFIER AND OSCILLATOR, CLASS C TELEGRAPHY

ICAS Intermittent service

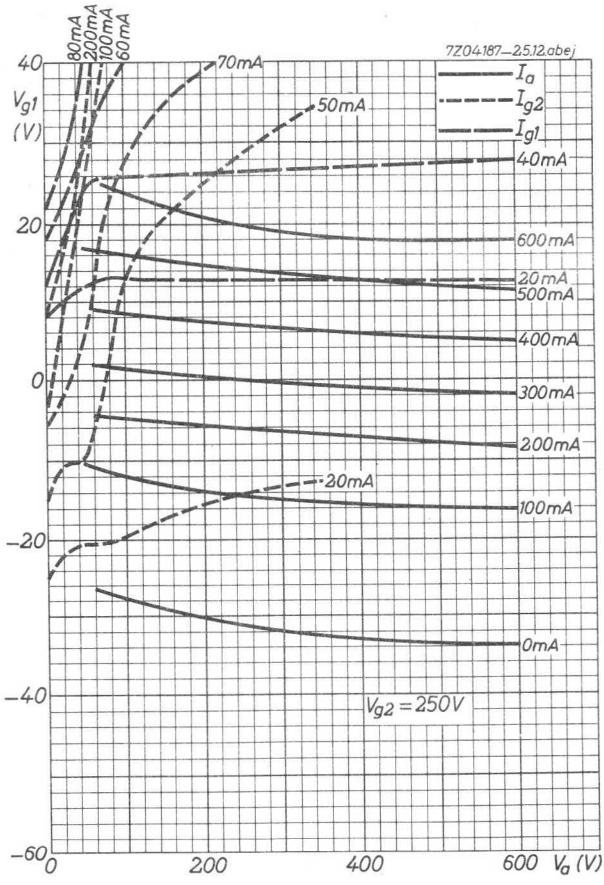
LIMITING VALUES (Absolute limits)

Frequency	f		up to 75	175	250	MHz
Anode voltage	V_a	=	max. 600	500	400	V
Anode current	I_a	=	max. 150	150	150	mA
Anode input power	W_{ia}	=	max. 90	75	60	W
Anode dissipation	W_a	=	max. 30	30	30	W
Grid No.2 voltage	V_{g_2}	=	max. 300	300	300	V
Grid No.2 input power	W_{ig_2}	=	max. 4	4	4	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max. 200	200	200	V
Grid No.1 circuit resistance						
with fixed bias	R_{g_1}	=	max. 50	50	50	kΩ
with automatic bias	R_{g_1}	=	max. 100	100	100	kΩ
Cathode current	I_k	=	max. 165	165	165	mA
Heater to cathode voltage (any polarity)	V_{kf}	=	max. 100	100	100	V

OPERATING CONDITIONS **ICAS** Intermittent service

Frequency	f	=	75	175	250	MHz
Anode voltage	V_a	=	600	500	400	V
Grid No.2 voltage	V_{g_2}	=	255	225	235	V
Grid No.1 voltage	V_{g_1}	=	-50	-55	-54	V
Grid No.1 resistor	R_{g_1}	=	10	11	11	kΩ
Anode current	I_a	=	150	150	150	mA
Grid No.2 current	I_{g_2}	=	10	10	4	mA
Grid No.1 current	I_{g_1}	=	5.0	5.0	4.9	mA
Driving power	W_{dr}	=	0.7	1.5	2.0	W
Anode input power	W_{ia}	=	90	75	60	W
Output power in the load	W_ℓ	=	58.5	46	32	W
Overall efficiency	η	=	65	61.5	53.5	%

7Z2 3719


7Z04187—2.5.12.abej
I_a
I_{g2}
I_{g1}
80mA
200mA
100mA
60mA
70mA
50mA
40mA
600mA
20mA
500mA
400mA
300mA
200mA
20mA
100mA
0mA
$V_{g2} = 250V$
V_{g1} (V)
40
20
0
−20
−40
−60
0
200
400
600
V_a (V)

AIR COOLED R.F. BEAM POWER TETRODE

Forced air cooled beam power tetrode with ceramic to metal seals and coaxial arrangement of the terminals. The tube is intended for use as R.F. amplifier for frequencies up to 1215 MHz.

QUICK REFERENCE DATA				
Freq. (MHz)	C telegr. FM teleph.		C_{ag_2} mod.	
	V_a (V)	W_o (W)	V_a (V)	W_o (W)
600	2500	1600	2000	940

HEATING: Indirect by A.C. or D.C.; cathode oxide coated, matrix type

Heater voltage	V_f	=	5.5	V
Heater current	I_f	=	17.3	A
Heating time	T_W	= min.	300	sec

At higher frequencies the heater voltage should be reduced depending on operation conditions.

CAPACITANCES

Grid No.1 to cathode and heater	$C_{g_1-k,f}$	=	42	pF
Anode to cathode and heater	$C_{a-k,f}$	<	0.017	pF
Anode to grid No.1	C_{a-g_1}	<	0.170	pF
Anode to grid No.2	C_{a-g_2}	=	16	pF
Grid No.1 to grid No.2	$C_{g_1-g_2}$	=	55	pF
Grid No.2 to cathode and heater	$C_{g_2-k,f}$	<	1.4	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	2500	V
Grid No.2 voltage	V_{g_2}	=	600	V
Anode current	I_a	=	600	mA
Amplification factor of grid No.2 with respect to grid No.1	$\mu_{g_2g_1}$	=	17	

7Z2 3809

COOLING

Forced air cooling for the anode

Low velocity air flow for the ceramic to metal seals

TEMPERATURE LIMITS (Absolute limits)

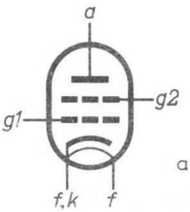
Anode temperature	= max. 250 °C
Temperature of all seals	= max. 250 °C

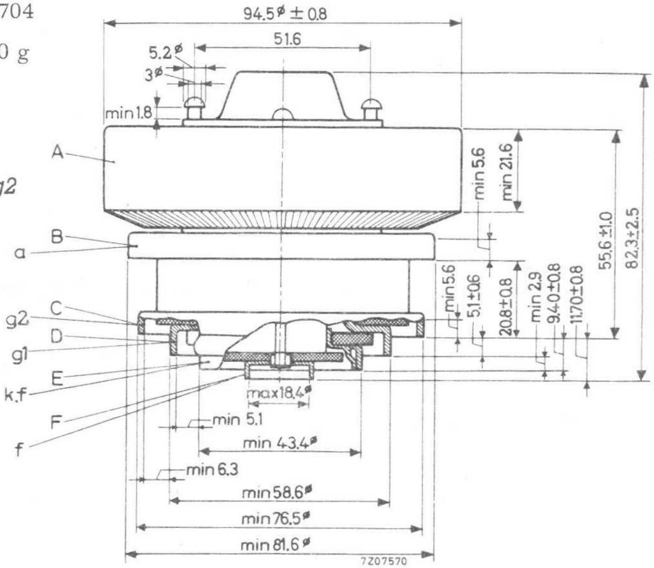
MECHANICAL DATA

Dimensions in mm

Socket : 40704

Net weight: 900 g





The radiator and the terminals lie inside or outside concentric cylinders with the following dimensions:

Radiator	A :	inside	96.00	mm
Anode connection	B :	inside	82.79	mm
Grid No.2 connection	C :	inside	77.71	mm
Grid No.1 connection	D :	inside	59.35	mm
Cathode and heater connection	E :	inside	44.28	mm
Heater connection	F :	outside	17.67	mm

Mounting position: any

7Z2 8859

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2500	V
Anode input power	W_{i_a}	=	max.	2.5	kW
Anode dissipation	W_a	=	max.	1.5	kW
Anode current	I_a	=	max.	1	A
Grid No.2 voltage	V_{g_2}	=	max.	1000	V
Grid No.2 input power	W_{ig_2}	=	max.	50	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	300	V
Grid No.1 current	I_{g_1}	=	max.	200	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	5	kΩ

OPERATING CONDITIONS

Frequency	f	=	600	600	MHz
Anode voltage	V_a	=	2250	2500	V
Grid No.2 voltage	V_{g_2}	=	500	500	V [1])
Grid No.1 voltage	V_{g_1}	=	−30	−30	V
Anode current	I_a	=	0.9	1.0	A
Grid No.2 current	I_{g_2}	=	20	20	mA
Grid No.1 current	I_{g_1}	=	70	70	mA
Driver output power	W_{dr}	=	70	75	W
Anode input power	W_{i_a}	=	2025	2500	W
Anode dissipation	W_a	=	785	900	W
Output power	W_o	=	1240	1600	W
Tube efficiency	η	=	61	64	%
Useful power in the load	W_ℓ	=	1050	1350	W [2])

1) Obtained preferably from a fixed supply or from the anode supply with a voltage divider.

2) Typical value measured in a circuit having an efficiency of 85%.

7Z2 3811

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	1215	MHz
Anode voltage	V_a	=	max.	2000	V
Anode input power	W_{i_a}	=	max.	1.7	kW
Anode dissipation	W_a	=	max.	1.0	kW
Anode current	I_a	=	max.	850	mA
Grid No.2 voltage	V_{g_2}	=	max.	1000	V
Grid No.2 input power	W_{ig_2}	=	max.	35	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	300	V
Grid No.1 current	I_{g_1}	=	max.	200	mA
Grid No.1 circuit resistance	R_{g_1}	=	max.	5	kΩ

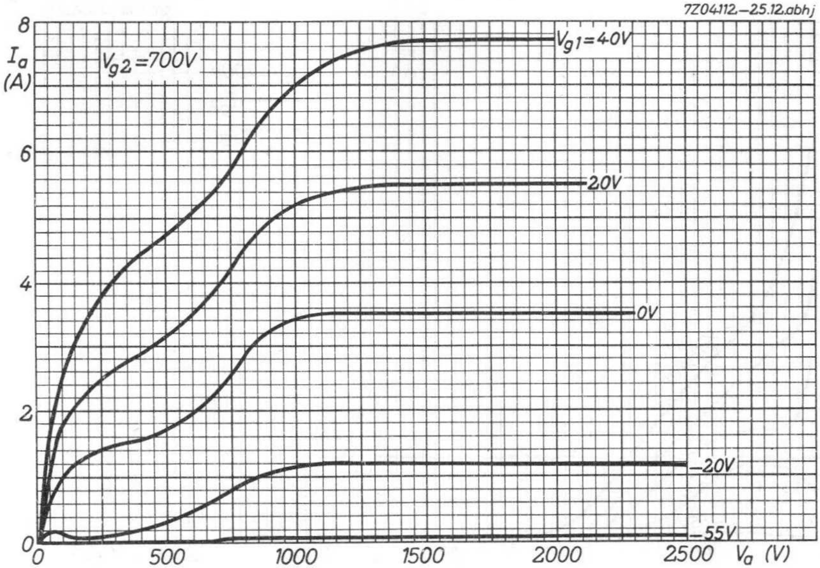
OPERATING CONDITIONS

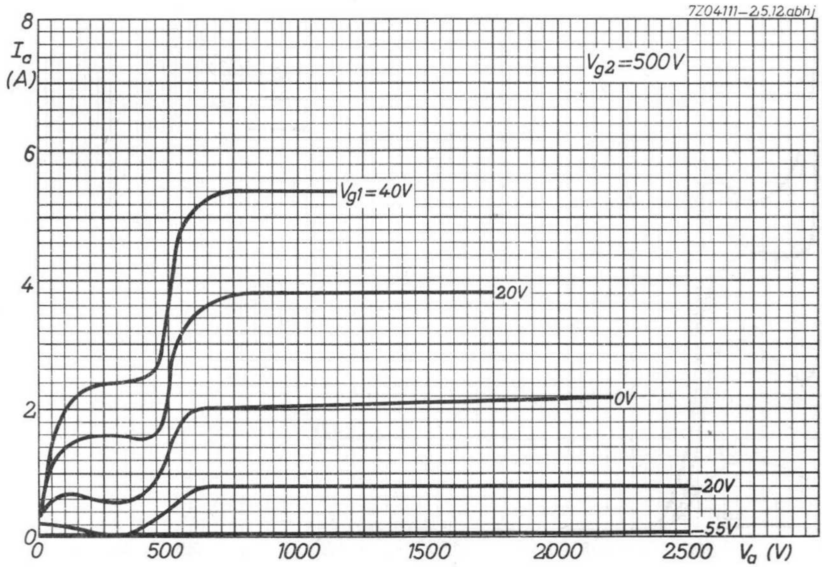
Frequency	f	=	600	600	MHz
Anode voltage	V_a	=	1800	2000	V
Grid No.2 voltage	V_{g_2}	=	500	500	V [1]
Grid No.1 voltage	V_{g_1}	=	-30	-30	V
Anode current	I_a	=	750	830	mA
Grid No.2 current	I_{g_2}	=	15	15	mA
Grid No.1 current	I_{g_1}	=	40	40	mA
Driver output power	W_{dr}	=	50	55	W
Anode input power	W_{i_a}	=	1350	1660	W
Anode dissipation	W_a	=	585	720	W
Output power	W_o	=	765	940	W
Tube efficiency	η	=	56	57	%
Useful power in the load	W_ℓ	=	650	800	W [2]

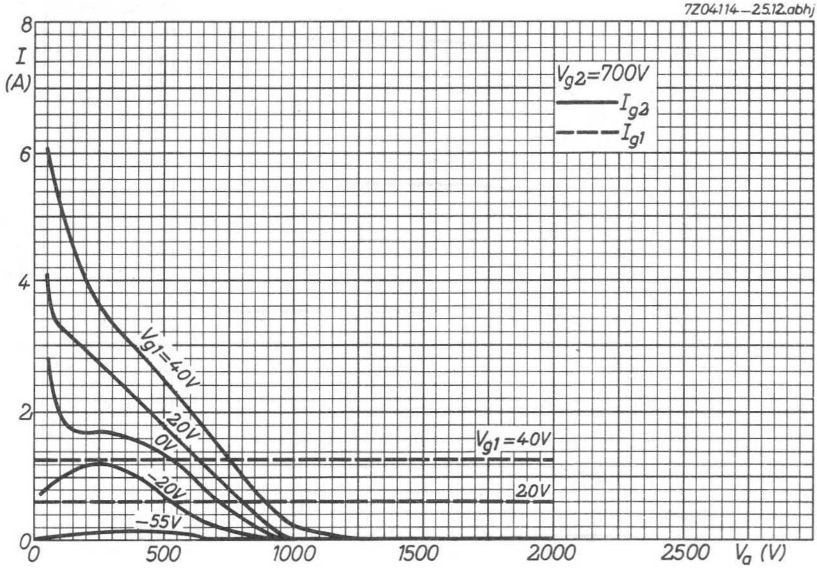
[1] Obtained preferably from a separate source modulated along with the anode supply.

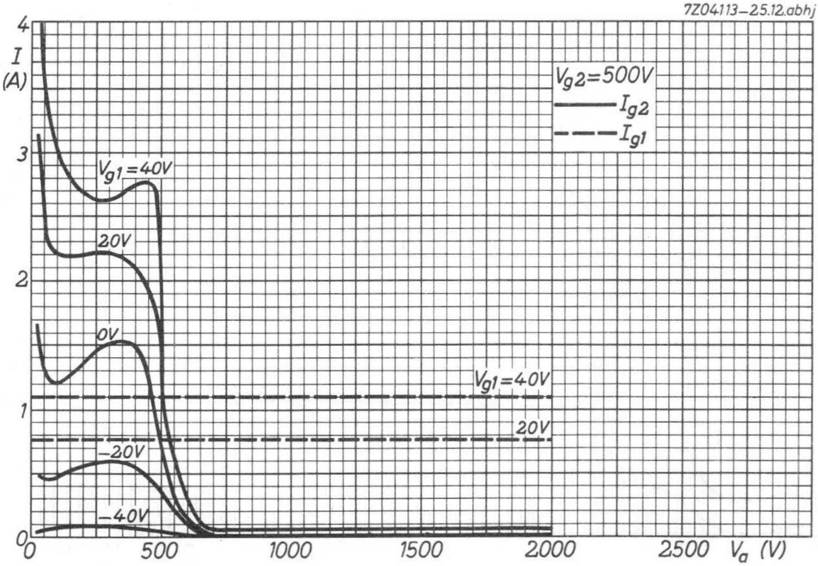
[2] Typical value measured in a circuit having an efficiency of 85%.

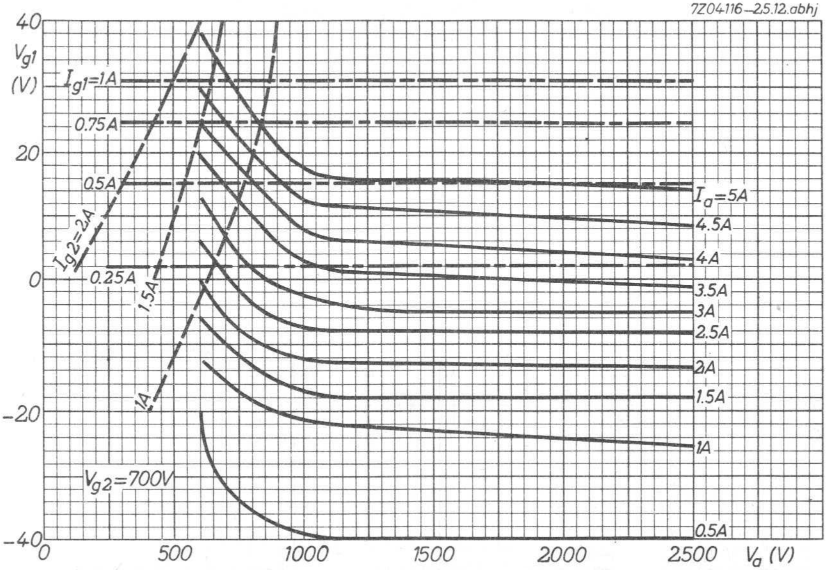
7Z2 3812

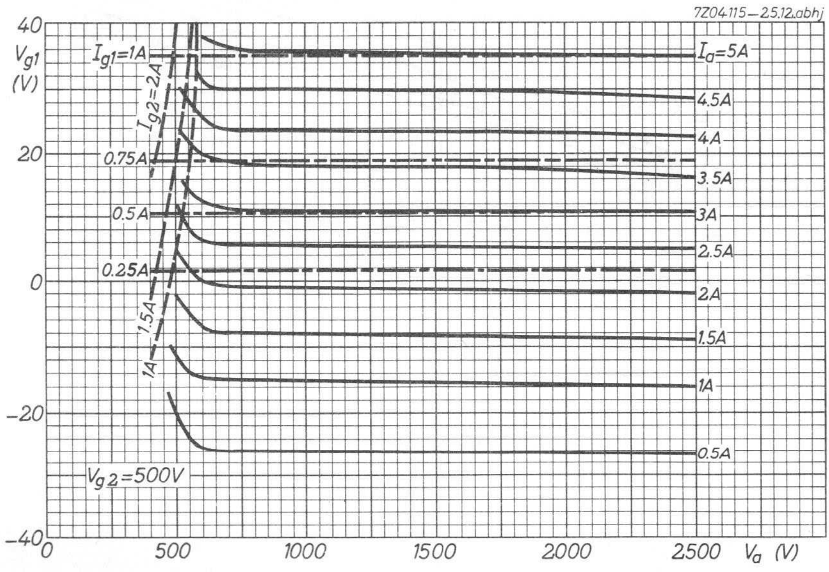

7Z04112.–25.12.abhj
8
I_a
(A)
6
4
2
0
V_{g2}=700V
V_{g1}=40V
20V
0V
–20V
–55V
0
500
1000
1500
2000
2500
V_a (V)

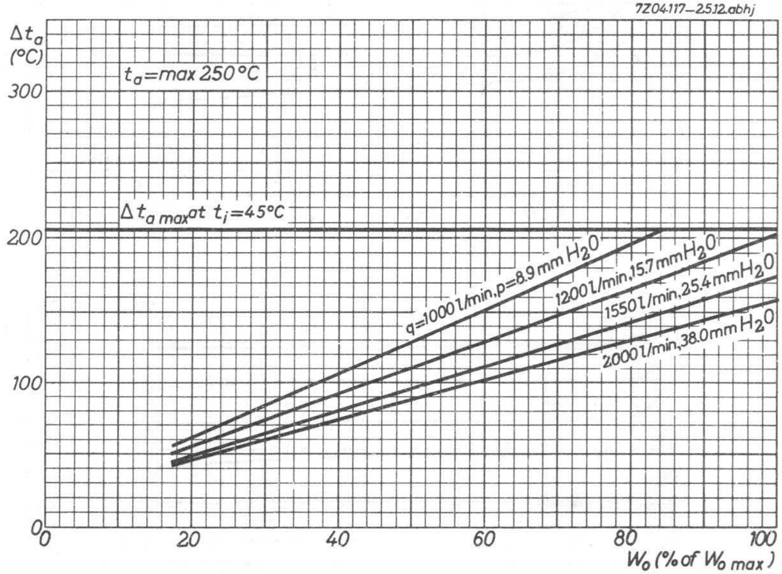

7Z04111–25.12.abhj
8
I_a
(A)
6
4
2
0
V_{g2}=500V
V_{g1}=40V
20V
0V
–20V
–55V
0
500
1000
1500
2000
2500
V_a (V)


7Z04114–2.5.12.abhj
I (A)
V_{g2}=700V
I_{g2}
I_{g1}
V_{g1}=40V
20V
0V
–20V
–55V
V_{g1}=40V
20V
V_a (V)
0
500
1000
1500
2000
2500


7Z04113–2.5.12.abhj
I (A)
V_{g2}=500V
I_{g2}
I_{g1}
V_{g1}=40V
20V
0V
–20V
–40V
V_{g1}=40V
20V
V_a (V)
0
500
1000
1500
2000
2500


7Z04116–2.5.12.abhj
40
V_{g1}
(V)
20
0
−20
−40
I_{g1}=1A
0.75A
0.5A
0.25A
I_{g2}=2A
1.5A
1A
I_a=5A
4.5A
4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
V_{g2}=700V
0
500
1000
1500
2000
2500
V_a (V)


7Z04115–2.5.12.abhj
40
V_{g1}
(V)
20
0
−20
−40
I_{g1}=1A
I_{g2}=2A
0.75A
0.5A
0.25A
1.5A
1A
I_a=5A
4.5A
4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
V_{g2}=500V
0
500
1000
1500
2000
2500
V_a (V)


7Z04117—25.12.abhj
Δ t_a (°C)
t_a=max 250 °C
Δ $t_{a\,max}$ at t_i=45°C
q=1000 l/min, p=8.9 mm H_2O
1200 l/min, 15.7 mm H_2O
1550 l/min, 25.4 mm H_2O
2000 l/min, 38.0 mm H_2O
0
100
200
300
0
20
40
60
80
100
W_o (% of $W_{o\,max}$)

R.F. BEAM POWER TETRODE

HEATING: indirect; cathode oxide coated

Heater voltage	V_f	=	19	V
Heater current	I_f	=	1.4	A

For further data and curves of this type please refer to type QE08/200

7Z2 3710

HEATSINK COOLED R.F. POWER TETRODE

QUICK REFERENCE DATA		
Frequency (MHz)	Class C telegraphy	
	V_a (V)	W_o (W)
175	2000	270
470	800	100

HEATING: indirect by AC or DC; cathode oxide coated

Heater voltage	V_f	=	6.0	V
Heater current	I_f	=	2.6	A
Waiting time	T_w	= min.	30	sec

At frequencies between 400 MHz and 500 MHz the heater voltage should be reduced to 5.0 V.

CAPACITANCES

Anode to all except grid No.1	C_a	=	4.5	pF
Grid No.1 to all except anode	C_{g_1}	=	15.7	pF
Anode to grid No.1	C_{ag_1}	=	0.03	pF

TYPICAL CHARACTERISTICS

Anode and grid No.2 voltage (interconnected)	$V_a = V_{g_2}$	=	300	V
Cathode current	I_k	=	50	mA
Amplification factor	$\mu_{g_2g_1}$	=	5.2	

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals	t_s	= max.	250	^oC

COOLING DATA

Thermal contact area		=	3.2	cm^2
Thermal resistance from seal to thermal contact area	R_{th}	=	0.03	$^oC/W$

See also operating notes

7Z2 3907

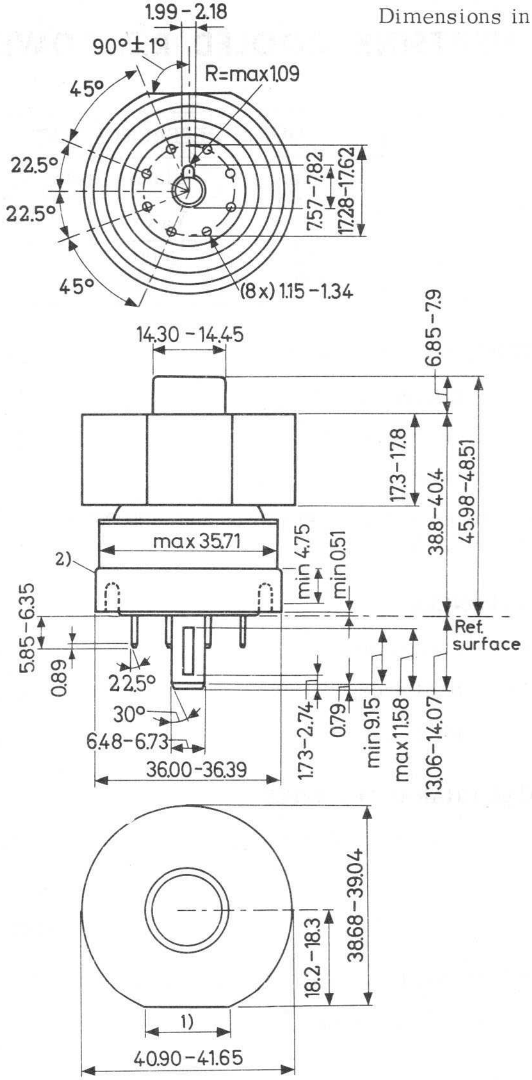
MECHANICAL DATA

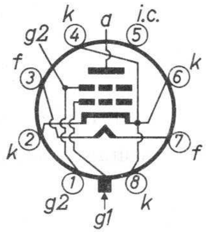
Dimensions in mm

Net weight: 230 g

Accessories

Socket 40739





Mounting position: any

1) Heat sink contact area

2) Grid No.2 contact

7Z2 8292

R.F. CLASS C TELEGRAPHY or F.M. TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency	f		up to	500	MHz
Anode voltage	V_a	=	max.	2000	V
Anode input power	W_{i_a}	=	max.	500	W
Anode dissipation			See operating notes		
Anode current	I_a	=	max.	250	mA
Grid No.2 voltage	V_{g_2}	=	max.	300	V
Grid No.2 dissipation	W_{g_2}	=	max.	12	W
Negative grid No.1 voltage	$-V_{g_1}$	=	max.	250	V
Grid No.1 dissipation	W_{g_1}	=	max.	2	W

OPERATING CONDITIONS

Frequency	f	=	175	470[1]	MHz
Anode voltage	V_a	=	2000	800	V
Grid No.2 voltage	V_{g_2}	=	200	[2]	V
Grid No.1 voltage	V_{g_1}	=	-90	-60	V
Anode current	I_a	=	250	250	mA
Grid No.2 current	I_{g_2}	=	8	-4 to +10	mA
Grid No.1 current	I_{g_1}	=	16	3	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	=	112	[2]	V
Driving power	W_{dr}	=	4	11	W
Anode input power	W_{i_a}	=	400	200	W
Output power	W_o	=	270	100	W
Efficiency	η	=	67.5	50	%

[1]) V_f should be reduced to 5.0 V at f = 470 MHz

[2]) To be adjusted for operating conditions

7Z2 3909

OPERATING NOTES

Heatsink or conduction cooling

Through the properties of beryllia (beryllium oxide), it is possible to remove heat directly from the anode of a tube to a safe point or "sink" while still maintaining the electrical insulation between the anode and the "sink", which is usually grounded. The path between the anode of the tube and the point of dissipation is known as a thermal system. This includes the anode of the tube, the beryllia insulating material, and the heatsink, plus all thermal compounds used to reduce the heat resistance between these parts. Consequently it is evident that a conduction cooled tube does not have an anode dissipation rating by itself. Only the entire thermal system has a dissipation rating. The purpose of this note is to assist in the understanding of the thermodynamics involved in a system of this type.

Thermal considerations

Page A shows a set of curves relating anode dissipation and ambient temperature to the maximum thermal resistance that will permit operation within the maximum allowable seal temperature. It is assumed that the equipment designer knows the anode power that must be dissipated (from circuit efficiencies) and the maximum ambient temperature in which his equipment must function. The problem is simply to devise a thermal circuit whose total thermal resistance is not more than that allowed. In order to determine the maximum thermal resistance of the system, the following equation may be used:

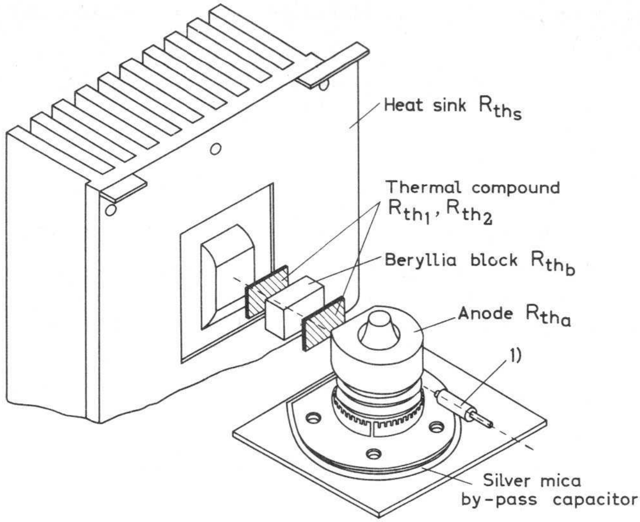
$$R_{th\ max} = \frac{t_{s\ max} - t_{amb}}{W_d} \qquad (1)$$

where $t_{s\ max}$ = max. seal temperature (^{o}C)
t_{amb} = ambient temperature (^{o}C)
W_d = power to be dissipated (W)

The graphs on page A illustrate a plot of this equation assuming the maximum seal temperature to be 250 ^{o}C. To use these graphs all that need be known is the maximum occurring anode dissipation and the ambient temperature.

As an example, suppose we wish to dissipate 100 W at an ambient temperature of 50 ^{o}C and a maximum allowable seal temperature of 250 ^{o}C. Through the use of either equation (1) or the curves of page A we see that the maximum allowable thermal resistance is 2.0 $^{o}C/W$.

7Z2 3910



According to the figure above the entire cooling system may be considered as the series circuit of a number of components, viz.:

The anode with a thermal resistance R_{th_a},

the compound, if used, between anode and beryllia block with thermal resistance R_{th_1},

the beryllia block with thermal resistance R_{th_b},

the compound between the beryllia block and the heat sink with thermal resistance R_{th_2}

and the heatsink with thermal resistance R_{th_s}.

The total thermal resistance of these components must be less than the maximum allowable thermal resistance $R_{th_{max}}$ of the entire system. This can be summarized in the following equation:

$$R_{th_a} + R_{th_1} + R_{th_b} + R_{th_2} + R_{th_s} \leqq R_{th_{max}} \qquad (2)$$

[1]) In order to assure a good thermal connection to the heat sink, it is necessary to apply a force of approximately 11.5 kg to the side of the tube opposite the heat sink. The method shown uses a small ceramic cylinder to apply this pressure while maintaining the high voltage insulation necessary for proper operation.

7Z2 3911

The thermal resistance of the beryllia block and the compounds may be calculated from

$$R_{th_x} = \frac{\text{thickness}}{\text{standard thickness}} \times \frac{\text{standard area}}{\text{area}} \times R_{th} \qquad (3)$$

where R_{th_x} is either R_{th_b} or R_{th_1} or R_{th_2}

and R_{th} is the specific thermal resistance of the material involved.

The specific thermal resistance of a number of materials is given in table 1.

The standard thickness in this table is taken as 1 cm for cubes and as 0.001 cm for films; the standard area for cubes as well as for films is 1 cm^2. The same values should be used for the standard thickness and the standard area in formula (3).

For the thermal resistance of a beryllia block of 3.2 cm^2 x 4.45 cm is found in this way:

$$R_{th_b} = \frac{4.45}{1} \times \frac{1}{3.2} \times 0.635 = 0.88\ ^{\circ}C/W.$$

The value of R_{th_a} is given in the data sheets as 0.03 °C/W.

Assuming a value of 0.2 °C/W for the sum of R_{th_1} and R_{th_2} and the previous found value of 2.0 °C/W for $R_{th_{max}}$, equation (2) yields:

$$0.03 + 0.2 + 0.88 + R_{th_s} \leqq 2.0$$

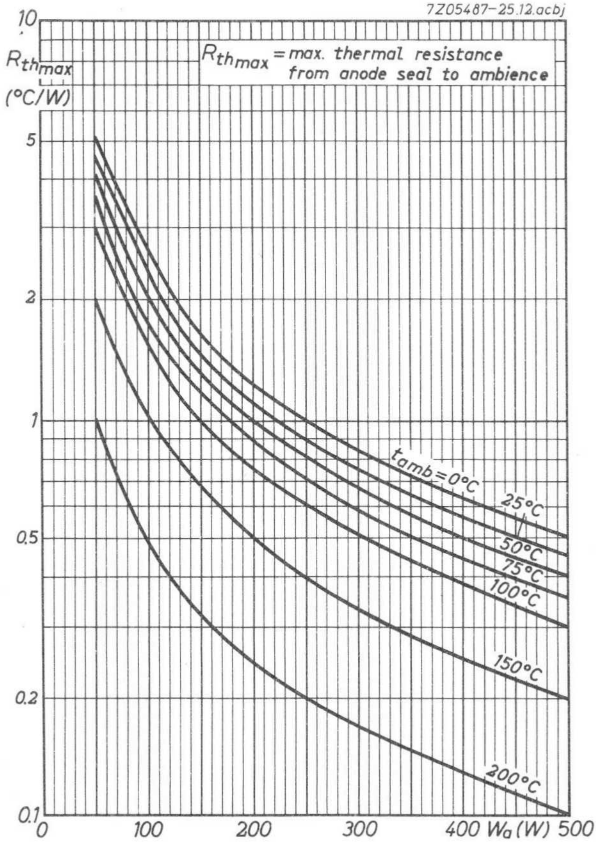
thus leaving for R_{th_s} a value of max. 0.89 °C/W.

With this figure a convenient heat sink can be selected from standard heat sink catalogues.

Table 1. Approximate thermal resistance R_{th} of typical materials

Films 0.001 cm x 1 cm^2		Cubes 1 cm x 1 cm^2	
Item	°C/W	Item	°C/W
Wakefield	0.127	Copper	0.28
Mica	0.254	Aluminium	0.51
Silicone	0.51	Beryllia	0.635
Mylar	0.61	Brass	0.89
Air (still)	3.1	Molybdenum	1.02
		Alumina	3.56

7Z2 3912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10
$R_{th_{max}}$
(°C/W)
5
2
1
0.5
0.2
0.1
0
100
200
300
400 W_a (W) 500
$R_{th_{max}}$ = max. thermal resistance from anode seal to ambience
t_{amb} = 0°C
25°C
50°C
75°C
100°C
150°C
200°C

HEATING: Indirect; cathode oxide-coated

Heater voltage	V_f	=	13.5	V
Heater current	I_f	=	280	mA
Pin connections			1 - 8	

For further data and curves of this type please refer to type QQE04/5

7Z2 4012

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. power amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

QUICK REFERENCE DATA

C telegr.				C_{ag_2} mod.			Class AB SSB			
Freq. (MHz)	V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS	Freq. (MHz)	V_a (V)	W_o PEP (W) CCS	W_o PEP (W) ICAS
60	750		85	600		62	30	750		61
60	600	63		475	42		30	600	49	
175	400		40							
175	320	29								

A.F. class AB 1)2)			A.F. class AB 1)3)		
V_a (V)	W_o (W) CCS	W_o (W) ICAS	V_a (V)	W_o (W) CCS	W_o (W) ICAS
750		124	750		150
600	96		600	110	130
			500	100	

HEATING: indirect by A.C, or D.C.; cathode oxide-coated

Heater voltage	V_f		6.3	V
Heater current at V_f = 6.3 V	I_f		1.125	A
Cathode heating time	T_h	min.	60	s

See "Special performance data" for heater operation in stationary and mobile equipment.

1) Two tubes
2) Without grid current
3) With grid current

7Z2 8533

CAPACITANCES

Grid No.1 to all except anode	$C_{g1(a)}$	13.0	pF
Anode to all except grid No.1	$C_{a(g1)}$	8.5	pF
Anode to grid No.1	C_{ag1}	< 0.22	pF

TYPICAL CHARACTERISTICS

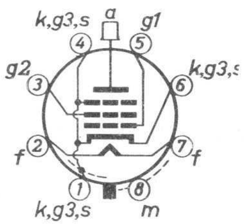
Anode voltage	V_a	200	V
Grid No.2 voltage	V_{g2}	200	V
Anode current	I_a	100	mA
Transconductance	S	7	mA/V
Amplification factor	μ_{g2g1}	4.5	-

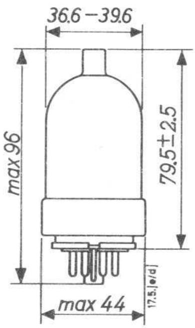
MECHANICAL DATA Dimensions in mm

Base: octal 8 pin

Socket: 2422 501 03001

Net weight: 65 g





Mounting position: any

TEMPERATURE LIMIT (Absolute limit)

Bulb temperature t_{bulb} max. 260 °C

7Z2 8534

R.F. CLASS C TELEGRAPHY AND FM TELEPHONY

LIMITING VALUES (Absolute max. rating system)
(For maximum anode voltage and maximum anode input power at f > 60 MHz see page E)

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	max. 600	max. 750	V
Anode input power	W_{i_a}	max. 90	max. 120	W
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1]

OPERATING CONDITIONS

Frequency	f	up to 60		MHz
Anode voltage	V_a	600	750	V
Grid No.2 voltage	V_{g_2}	200	200	V [2]
Grid No.1 voltage	V_{g_1}	−70	−77	V [3]
Grid No.1 resistor	R_{g_1}	24	28	kΩ
Grid No.1 current	I_{g_1}	2.8	2.7	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	90	95	V
Driving power	W_{dr}	0.3	0.3	W
Anode current	I_a	150	160	mA
Anode input power	W_{i_a}	90	120	W
Anode dissipation	W_a	27	35	W
Output power	W_o	63	85	W
Efficiency	η	70	71	%

Notes see page 11

7Z2 8535

R.F. CLASS C TELEGRAPHY AND FM TELEPHONY

OPERATING CONDITIONS (continued)

Frequency	f	up to	175	MHz
Anode voltage	V_a	320	400	V
Grid No.2 voltage	V_{g_2}	210	220	V [2])
Grid No.1 voltage	V_{g_1}	-52	-55	V [3])
Grid No.1 resistor	R_{g_1}	26	30	kΩ
Grid No.1 current	I_{g_1}	2	1.9	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	65	67	V
Driving power	$W_{dr.}$	2	2	W
Anode current	I_a	170	180	mA
Anode input power	W_{i_a}	55	72	W
Anode dissipation	W_a	26	32	W
Output power	W_o	29	40	W
Efficiency	η	53	56	%

Notes see page 11

7Z2 8536

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute max. rating system)
(For maximum anode voltage and maximum anode input power at f > 60 MHz see page A)

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	max. 480	max. 600	V
Anode input power	W_{i_a}	max. 60	max. 85	W
Anode dissipation	W_a	max. 18	max. 23	W
Anode current	I_a	max. 145	max. 180	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 2	max. 2	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1]

OPERATING CONDITIONS

		C.C.S.	I.C.A.S.	
Frequency	f	up to 60		MHz
Anode voltage	V_a	475	600	V
Grid No.2 voltage	V_{g_2}	165	175	V [4]
Grid No.1 voltage	V_{g_1}	−86	−92	V [3]
Grid No.1 resistor	R_{g_1}	26	27	kΩ
Grid No.1 current	I_{g_1}	3.3	3.4	mA
Grid No.1 driving voltage	$V_{g_{1p}}$	106	114	V
Driving power	W_{dr}	0.4	0.5	W
Anode current	I_a	125	140	mA
Anode input power	W_{i_a}	60	84	W
Anode dissipation	W_a	18	22	W
Output power	W_o	42	62	W
Efficiency	η	70	74	%
Modulation factor	m	100	100	%
Modulation power	W_{mod}	25	37	W

Notes see page 11

7Z2 8537

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Frequency	f	up to 30		MHz
Anode voltage	V_a	max. 600	max. 750	V
Anode input power	W_{i_a}	max. 90	max. 126	W
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V
Grid No.1 circuit resistance (fixed bias)	R_{g_1}	max. 30	max. 30	kΩ

OPERATING CONDITIONS C.C.S.

Frequency	f		30		MHz
Anode voltage	V_a		600		V
Grid No.2 voltage	V_{g_2}		200		V [5])
Grid No.1 voltage	V_{g_1}		-47		V [5])
		zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	47	47	V
Anode current	I_a	24	125	86	mA
Grid No.2 current	I_{g_2}		7.4	5	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	14.4	75	51.5	W
Anode dissipation	W_a	14.4	26	27	W
Output power (PEP)	W_o	-	49	49	W
Efficiency	η	-	65.5	47.5	%
Intermodulation distortion					
of the 3rd order	d_3			24.5	dB [6])
of the 5th order	d_5			30	dB [6])

Notes see page 11

7Z2 8538

R.F. CLASS AB LINEAR AMPLIFIER, SINGLE SIDE BAND, suppressed carrier

OPERATING CONDITIONS (continued)

		I.C.A.S.	
Frequency	f	30	MHz
Anode voltage	V_a	750	V
Grid No.2 voltage	V_{g_2}	200	V [5]
Grid No.1 voltage	V_{g_1}	−48	V [5]

		zero signal	single tone signal	double tone signal	
Grid No.1 driving voltage	$V_{g_{1p}}$	0	48	48	V
Anode current	I_a	25	125	86	mA
Grid No.2 current	I_{g_2}		6.3	3.9	mA
Grid No.1 current	I_{g_1}	0	0	0	mA
Anode input power	W_{i_a}	18.8	94	64.5	W
Anode dissipation	W_a	18.8	33	34	W
Output power (PEP)	W_o	-	61	61	W
Efficiency	η	-	65	47	%
Intermodulation distortion					
of the 3rd order	d_3			26	dB [6]
of the 5th order	d_5			31	dB [6]

Notes see page 11

7Z2 8539

A.F. CLASS AB AMPLIFIER (without grid current)

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Anode voltage	V_a	max. 600	max. 750	V
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g1}$	max. 150	max. 150	V
Grid No.1 current	I_{g1}	max. 0	max. 0	mA
Grid No.1 circuit resistance	R_{g1}	max. 100	max. 100	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V

OPERATING CONDITIONS two tubes in push-pull

		C.C.S.		I.C.A.S.		
Anode voltage	V_a	600		750		V
Grid No.2 voltage	V_{g2}	200		200		V [7])
Grid No.1 voltage	V_{g1}	-47		-48		V
Load resistance	$R_{aa\sim}$	5600		7200		Ω
Grid to grid voltage, peak	V_{g1g1p}	0	94	0	96	V
Anode current	I_a	2 x 24	2 x 125	2 x 25	2 x 125	mA
Grid No.2 current	I_{g2}	-	2 x 7.4	-	2 x 6.3	mA
Anode input power	W_{i_a}	2 x 14.4	2 x 75	2 x 19	2 x 94	W
Anode dissipation	W_a	2 x 14.4	2 x 27	2 x 19	2 x 32	W
Output power	W_o	0	96	0	124	
Efficiency	η	-	64	-	66	%

Notes see page 11

7Z2 8540

A.F. CLASS AB AMPLIFIER (with grid current)

LIMITING VALUES (Absolute max. rating system)

		C.C.S.	I.C.A.S.	
Anode voltage	V_a	max. 600	max. 750	V
Anode dissipation	W_a	max. 27	max. 35	W
Anode current	I_a	max. 175	max. 220	mA
Grid No.2 voltage	V_{g_2}	max. 250	max. 250	V
Grid No.2 dissipation	W_{g_2}	max. 3	max. 3	W
Grid No.1 voltage	$-V_{g_1}$	max. 150	max. 150	V
Grid No.1 current	I_{g_1}	max. 3.5	max. 4	mA
Grid No.1 circuit resistance	R_{g_1}	max. 30	max. 30	kΩ [1])
Cathode to heater voltage, peak	V_{kf_p}	max. 135	max. 135	V

OPERATING CONDITIONS, two tubes in push-pull

		C.C.S.				
Anode voltage	V_a	500		600		V
Grid No.2 voltage	V_{g_2}	200		200		V [7])
Grid No.1 voltage	V_{g_1}	−46		−48		V
Load resistance	$R_{aa\sim}$	3620		5200		Ω
Grid to grid voltage, peak	$V_{g_1g_{1p}}$	0	108	0	106	V
Anode current	I_a	2 x 25	2 x 154	2 x 20	2 x 135	mA
Grid No.2 current	I_{g_2}	-	2 x 13	-	2 x 13.5	mA
Grid No.1 current	I_{g_1}	0	2x1.35	0	2 x 0.65	mA
Driving power	W_{dr}	0	0.2	0	0.7	W
Anode input power	W_{i_a}	2 x 12.5	2 x 77	2 x 12	2 x 81	W
Anode dissipation	W_a	2 x 12.5	2 x 27	2 x 12	2 x 26	W
Output power	W_o	0	100	0	110	W
Efficiency	η	-	65	-	68	%

Notes see page 11

7Z2 8541

OPERATING CONDITIONS(continued)

		I.C.A.S.				
Anode voltage	V_a	600		750		V
Grid No.2 voltage	V_{g2}	200		150		V
Grid No.1 voltage	V_{g1}	-47		-39		V
Load resistance	$R_{aa\sim}$	4160		6050		Ω
Grid to grid voltage, peak	V_{g1g1p}	0	114	0	110	V
Anode current	I_a	2 x 25	2 x 164	2 x 20	2 x 147	mA
Grid No.2 current	I_{g2}	-	2 x 13	-	2 x 14	mA
Grid No.1 current	I_{g1}	0	2 x 1.7	0	2 x 3.8	mA
Driving power	W_{dr}	0	0.2	0	0.5	W
Anode input power	W_{i_a}	2 x 12	2 x 98	2 x 15	2 x 110	W
Anode dissipation	W_a	2 x 12	2 x 33	2 x 15	2 x 35	W
Output power	W_o	0	130	0	150	W
Efficiency	η	-	66	-	68	%

7Z2 8542

Notes pages 3 through 9

1. For operation at maximum ratings.
   For operation at less than maximum ratings:
   R_{g_1} = max. 100 kΩ.
2. Obtained preferably from a separate source, or from the anode supply voltage with a voltage divider, or through a series resistor.
   A series resistor should be used only when the tube is used in a circuit which is not keyed. Grid No.2 voltage must not exceed 435 V under key-up conditions.
3. V_{g_1} may be obtained from a separate supply, or from R_{g_1} or R_k, or by combination methods.
4. Obtained preferably from a separate source modulated with the anode supply, or from the anode supply through a series resistor.
5. Obtained from a separate source.
6. Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.
7. Obtained preferably from a separate source or from the anode voltage supply with a voltage divider.

7Z2 8543

SPECIAL PERFORMANCE DATA

Stationary equipment operation

		min.	nom.	max.	
Heater voltage	V_f	-	6.3	-	V [1]
Heater current at V_f = 6.3 V	I_f	1050	-	1200	mA
Grid No.2 current	I_{g2}	-	-	15	mA [2]
Output power in load	W_ℓ	59	-	-	W [2]

Mobile equipment operation

		min.	design range	max.	
Heater voltage	V_f	-	6.0 to 7.5	-	V [3]
Heater current at V_f = 6.75 V	I_f	1100	-	1230	mA
Grid No.2 current	I_{g2}	-	-	15	mA [2]
Output power in load	W_ℓ	59			W [2]
Decrease output power in load	ΔW_ℓ			10	% [4]

Notes

1. Recommended design centre heater voltage 6.3 V. To ensure long life the heater voltage should not fluctuate more than 10%.

2. In a self-excited oscillator circuit and

Heater voltage	V_f	6.3	V
Anode voltage	V_a	600	V
Grid No.2 voltage	V_{g2}	200	V
Grid No.1 resistor	R_{g1}	24	kΩ ±10%
Anode current	I_a	max. 150	mA
Grid No.1 current	I_{g1}	2.5 to 3	mA
Frequency	f	15	MHz

3. Recommended heater voltage within the range V_f 6.0 to 7.5 V
   In battery operation within the range V_f 5.0 to 8.0 V

4. With the conditions of note 2, reduce the heater voltage to 5.0 V. The decrease in output power ΔW_ℓ = max. 10%.

7Z2 8544

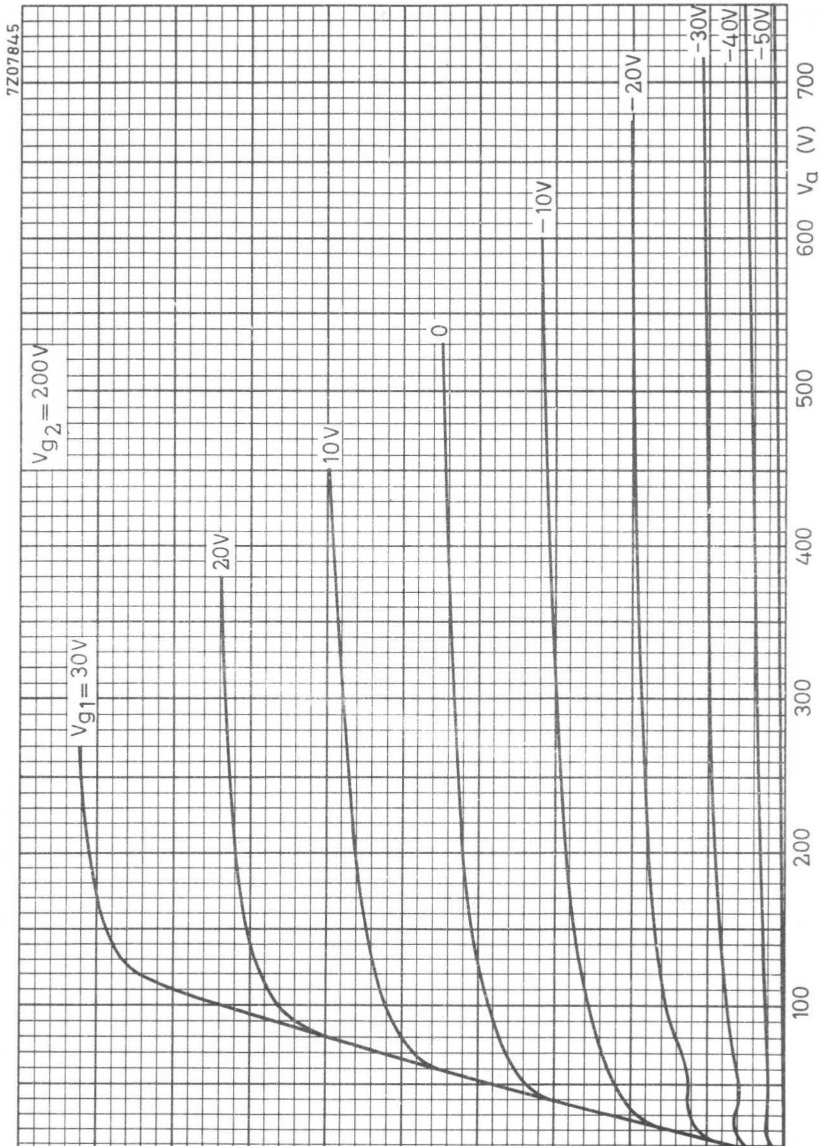
Over voltage heater life tests

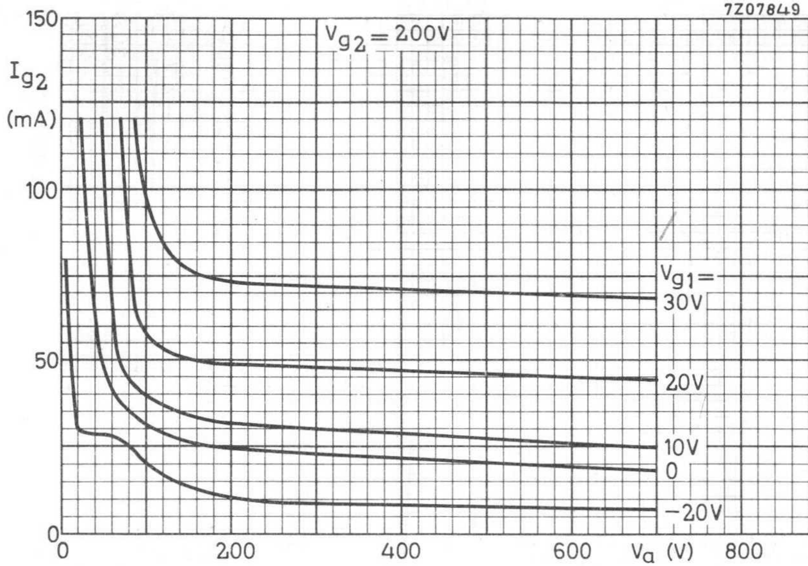
Continuous heater life tests are performed periodically on sample lots of tubes with 8 V on the heater, all electrodes floating.

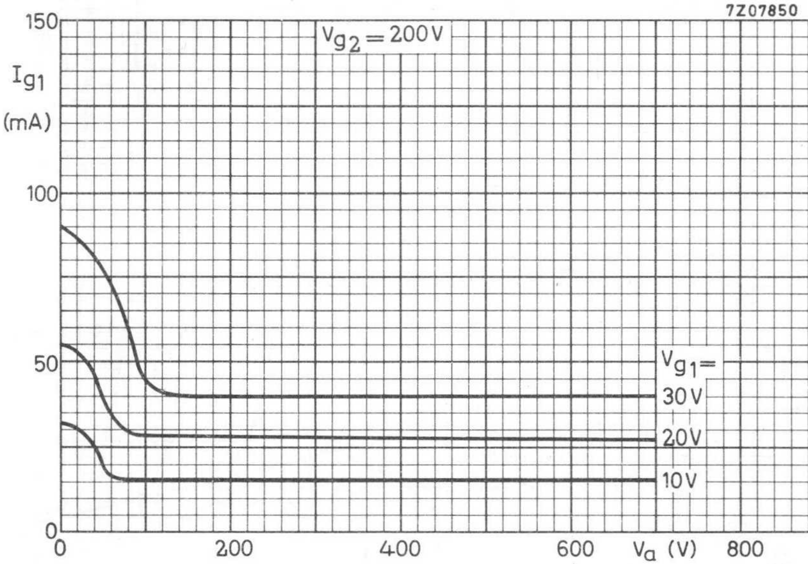
Intermittent heater life tests are performed periodically on sample lots of tubes with 11 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of entermittent life test the following measurements are performed:

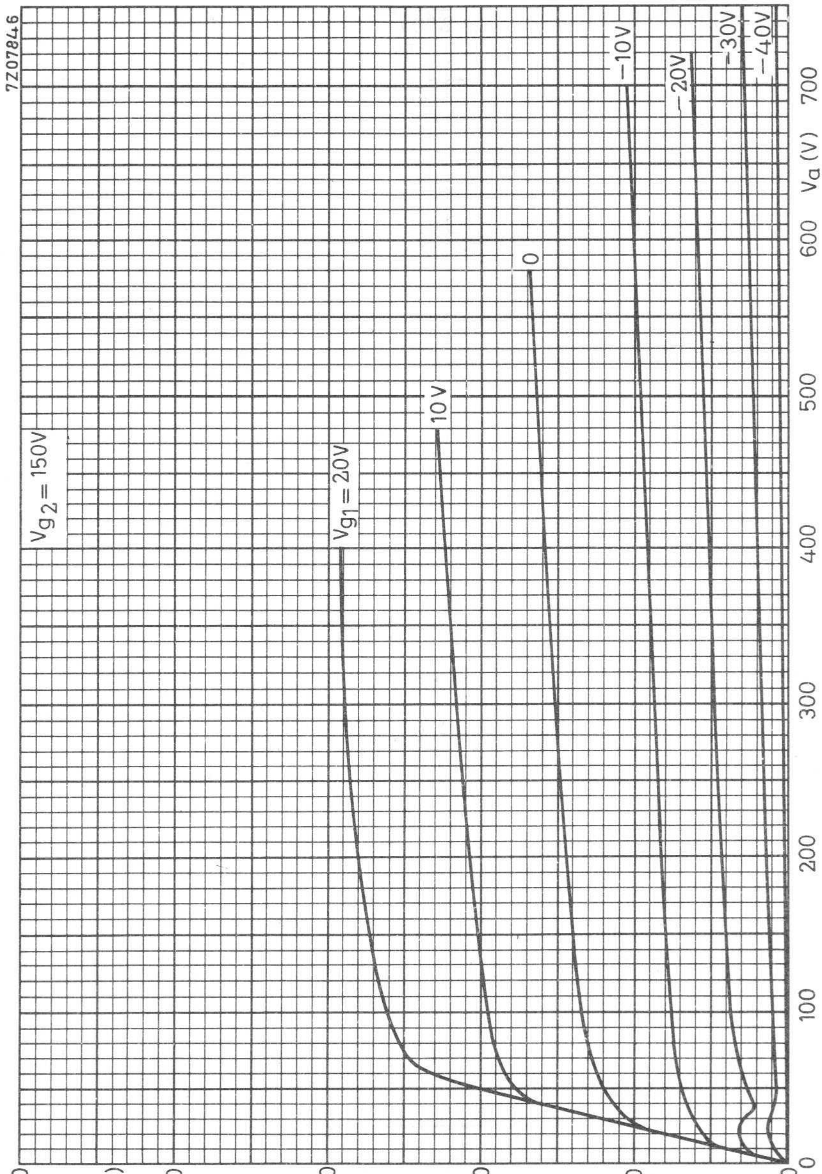
Cathode to heater leakage at V_f = 6.75 V; V_{kf} = ± 100 V	I_{kf}	max.	100	µA
Leakage resistance grid No.1 at V_f = 6.75 V; V_{g1} = −200 V; V_a = V_{g2} = V_k = 0 V	r_{ins}	min.	10	MΩ
Leakage resistance anode at V_f = 6.75 V; V_a = −200 V V_{g2}, V_{g1}, V_k = 0 V	r_{ins}	min.	10	MΩ

7Z2 8545

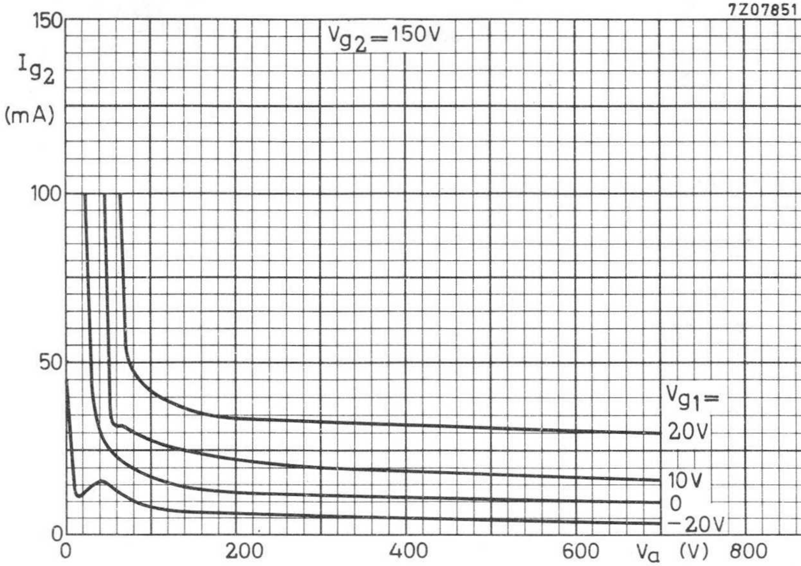

7Z07845
$V_{g2} = 200V$
$V_{g1} = 30V$
20V
10V
0
−10V
−20V
−30V
−40V
−50V
I_a (mA)
1000
800
600
400
200
0
V_a (V)
0
100
200
300
400
500
600
700

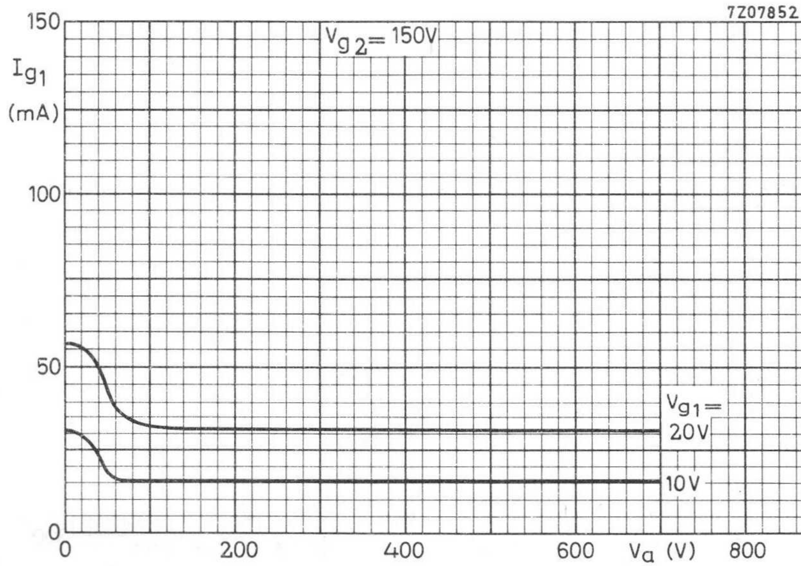

7Z07849
$V_{g2} = 200V$
I_{g2} (mA)
150
100
50
0
V_{g1}=
30V
20V
10V
0
−20V
0
200
400
600
800
V_a (V)

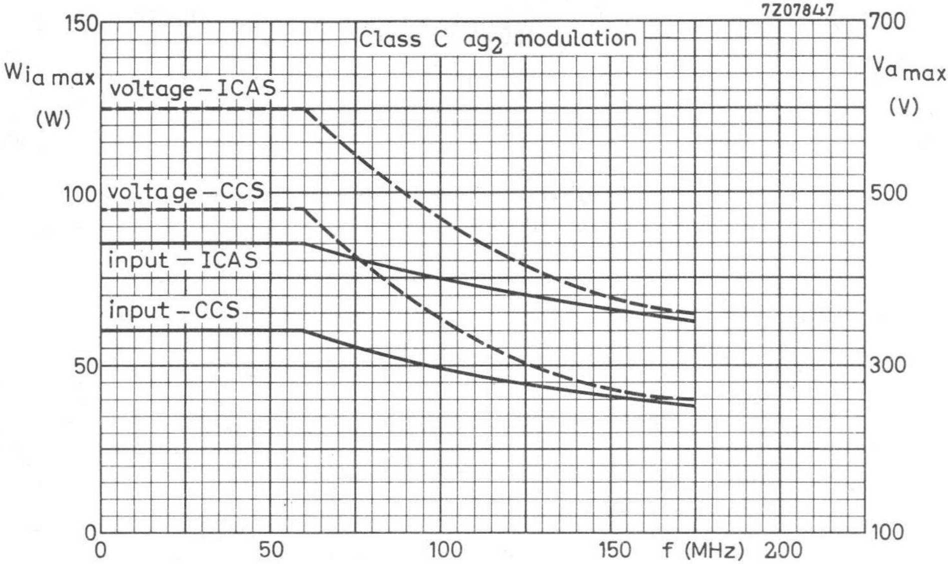

7Z07850
$V_{g2} = 200V$
I_{g1} (mA)
150
100
50
0
V_{g1}=
30V
20V
10V
0
200
400
600
800
V_a (V)

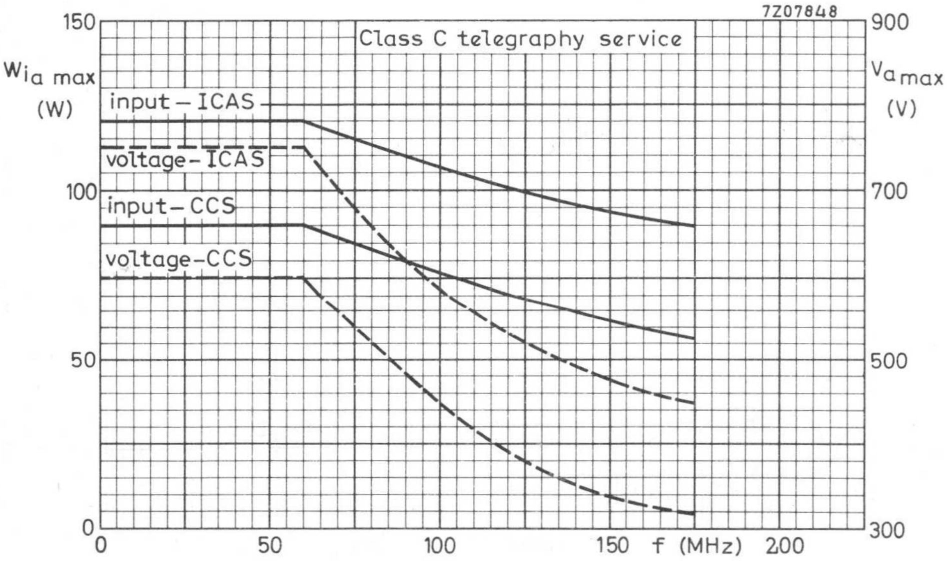


7Z07846
V_{g2} = 150V
V_{g1} = 20V
10V
0
−10V
−20V
−30V
−40V
I_a
(mA)
1000
800
600
400
200
0
0
100
200
300
400
500
600
700
V_a (V)


7Z07851
150
I_{g_2}
(mA)
100
50
0
V_{g_2} = 150V
V_{g_1} =
20V
10V
0
−20V
0
200
400
600
V_a (V)
800


7Z07852
150
I_{g_1}
(mA)
100
50
0
V_{g_2} = 150V
V_{g_1} =
20V
10V
0
200
400
600
V_a (V)
800


7Z07847
Class C ag2 modulation
150
100
50
0
Wia max
(W)
voltage – ICAS
voltage – CCS
input – ICAS
input – CCS
700
500
300
100
Va max
(V)
0
50
100
150
f (MHz)
200


7Z07848
Class C telegraphy service
150
100
50
0
Wia max
(W)
input – ICAS
voltage – ICAS
input – CCS
voltage – CCS
900
700
500
300
Va max
(V)
0
50
100
150
f (MHz)
200

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. power amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f		12.6	V
Heater current at V_f = 12.6 V	I_f		562	mA
Cathode heating time	T_h	min.	60	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1(a)}$		13.0	pF
Anode to all except grid No.1	$C_{a(g_1)}$		8.5	pF
Anode to grid No.1	C_{ag1}	max.	0.24	pF

SPECIAL PERFORMANCE DATA

Stationary equipment operation		Min.	Nom.	Max.	
Heater voltage	V_f	-	12.6	-	V 1)
Heater current at V_f = 12.6 V	I_f	525	-	600	mA
Output power in load	W_ℓ	59	-	-	W 2)

Mobile equipment operation		Min.	Design range	Max.	
Heater voltage	V_f	-	12 to 15	-	V 3)
Heater current at V_f = 13.5 V	I_f	550	-	620	mA
Output power in load	W_ℓ	59	-	-	W 2)
Decrease output power in load	ΔW_ℓ	-	-	10	% 4)

1) 2) 3) 4) See page 2

7Z2 8503

NOTES

1. Recommended design centre heater voltage 12.6 V.
   To ensure long life the heater voltage should not fluctuate more than 10%.

2. In a self-excited oscillator circuit and

Heater voltage	V_f	12.6	V
Anode voltage	V_a	600	V
Grid No.2 voltage	V_{g_2}	200	V
Grid No.1 resistor	R_{g_1}	24	kΩ ±10%
Anode current	I_a	max. 150	mA
Grid No.1 current	I_{g_1}	2.5 to 3	mA
Frequency	f	15	MHz

3. Recommended heater voltage within the range 12.0 to 15.0 V.
   In battery operation within the range 10 to 15 V.

4. With the conditions of note 2, reduce the heater voltage to 10 V. The decrease in output power ΔW_ℓ = max. 10%.

Overvoltage life tests

Continuous heater life tests are performed periodically on sample lots of tubes with 16 V on the heater, all electrodes floating.

Intermittent heater life tests are performed periodically on sample lots of tubes with 22 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of intermittent life test the following measurements are performed:

Cathode to heater leakage at V_f = 13.5 V; V_{kf} = ± 100 V	I_{kf}	max.	100	μA
Leakage resistance grid No.1 at V_f = 13.5 V; V_{g_1} = − 200 V, $V_a = V_{g_2} = V_k$ = 0 V	r_{ins}	min.	10	MΩ
Leakage resistance anode at V_f = 13.5 V; V_a = −200 V, $V_{g_2} = V_{g_1} = V_k$ = 0 V	r_{ins}	min.	10	MΩ

For further data and curves please refer to type YL1370

7Z2 8504

R.F. BEAM POWER TETRODE

R.F. Beam power tetrode intended for use as R.F. amplifier, oscillator, A.F. power amplifier and modulator in both mobile and fixed equipment.

HEATING: indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f		26.5	V
Heater current at V_f = 26.5 V	I_f		300	mA
Cathode heating time	T_h	min.	60	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1(a)}$		13.0	pF
Anode to all except grid No.1	$C_{a(g1)}$		8.5	pF
Anode to grid No.1	C_{ag_1}	min.	0.24	pF

SPECIAL PERFORMANCE DATA

Stationary equipment operation		Min.	Nom.	Max.	
Heater voltage	Vf	-	26.5	-	V [1]
Heater current at V_f = 26.5 V	If	280	-	320	mA
Output power in load	W_ℓ	59	-	-	W [2]

Mobile equipment operation		Min.	Design range	Max.	
Heater voltage	Vf	-	24 to 29	-	V [3]
Heater current at V_f = 26.5 V	If	280	-	320	mA
Output power in load	W_ℓ	59	-	-	[2]
Decrease output power in load	ΔW_ℓ	-	-	10	% [4]

[1] [2] [3] [4] See page 2.

7Z2 8505

NOTES

1. Recommended design centre heater voltage 26.5 V.
   To ensure long life the heater voltage should not fluctuate more than 10%.

2. In a self excited oscillator circuit and

Heater voltage	V_f		26.5	V
Anode voltage	V_a		600	V
Grid No.2 voltage	V_{g_2}		200	V
Grid No.1 resistor	R_{g_1}		24	kΩ ± 10%
Anode current	I_a	max.	150	mA
Grid No.1 current	I_{g_1}		2.5 to 3	mA
Frequency	f		15	MHz

3. Recommended heater voltage within the range 24 to 29 V.
   In battery operation within the range 21 to 31 V.

4. With the conditions of note 2, reduce the heater voltage to 10 V. The decrease in output power ΔW_ℓ = max. 10%.

Overvoltage life tests

Continuous heater life tests are performed periodically on sample lots of tubes with 31 V on the heater, all electrodes floating.

Intermittent heater life tests are performed periodically on sample lots of tubes with 43 V on the heater, a cycle of 1 minute "on" and 4 minutes "off".
After 1000 h of continuous heater life test, and after 48 h of intermittent life test the following measurements are performed:

Cathode to heater leakage at V_f = 26.5 V; V_{kf} = ± 100 V	I_{kf}	max.	150	μA
Leakage resistance grid No.1 at V_f = 26.5 V; V_{g_1} = − 200 V $V_a = V_{g_2} = V_k$ = 0 V	r_{ins}	min.	10	MΩ
Leakage resistance anode at V_f = 26.5 V; V_a = −200 V $V_{g_2} = V_{g_1} = V_k$ = 0 V	r_{ins}	min.	10	MΩ

For further data and curves please refer to type YL1370

7Z2 8506

R.F. POWER TETRODE

Forced-air cooled tetrode intended for use as R.F. power amplifier and oscillator. The 7609 is shock and vibration resistant.

QUICK REFERENCE DATA

Freq. (MHz)	C telegr.		Cag_2 mod.		AB mod.		
	V_a (V)	W_o (W)	V_a (V)	W_o (W)	V_a (V)	W_o (W)[1]	W_o (W)[2]
< 150	2000	370	1600	230	2000	580	630
	1500	260	1200	160	1500	400	440
165	1250	195	1000	140	1000	230	270
	1000	150	800	100	800	170	215
	750	110	600	80			
	600	85	400	55			
500	1250	140					
	1000	120					
	800	95					
	600	50					

Freq. (MHz)	B television	
	V_a (V)	$W_o$sync (W)
216	1250	250
	1000	200
	750	135

HEATING: Indirect by A.C. or D.C.; cathode oxide coated

Heater voltage	V_f	26.5	V
Heater current	I_f	570	mA
Waiting time	T_w	min. 30	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1(a)}$	15.5	pF
Anode to all except grid No.1	$C_{a(g_1)}$	4.0	pF ←
Anode to grid No.1	C_{ag_1}	0.03	pF

[1]) Without grid current, two tubes.
[2]) With grid current, two tubes.

7Z2 8860

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500	V
Grid No. 2 voltage	V_{g_2}	250	V
Anode current	I_a	200	mA
Transconductance	S	12	mA/V
Amplification factor	$\mu_{g_2 g_1}$	5	-

TEMPERATURE LIMITS (Absolute max. rating system)

Anode temperature measured on base end of anode surface at junction with fins	t_a	max. 250	°C
Anode seal temperature	t_s	max. 200	°C
Base seals and grid No. 2 seal temperature	t_s	max. 175	°C

COOLING air inlet temperature t_i = 20 °C, altitude h = 0 m [1])

With an air system socket			
Air flow	q	0.16	m^3/min
Pressure drop	p_i	7	mm H_2O
Without an air system socket			
Air flow	q	0.15	m^3/min
Pressure drop	p_i	7	mm H_2O

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[1]) At higher altitudes and ambient temperatures, an increase in air flow is necessary to maintain the respective seal temperatures and the anode temperature within the maximum ratings.

With an air system socket

The air is directed over the base seals, past the grid No. 2 seal, glass envelope and anode seal, and through the radiator to provide effective cooling with minimum air flow.

Without air system socket

Adequate cooling air must be directed over the base seals, past the envelope, and through the radiator.

7Z2 8006

ACCESSORIES

Socket	2422 513 01001
Chimney	type 56590 81/40

←

SHOCK AND VIBRATION RESISTANCE

Shock

The tube is subjected 5 times in each of 4 positions to an acceleration of 500 g supplied by an NRL shock machine with the hammer lifted over an angle of 30°.

Vibration

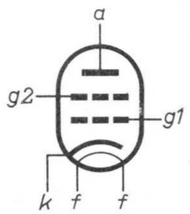
The tube is subjected to vibration frequencies from 25 Hz to 2000 Hz with an acceleration of 10 g.

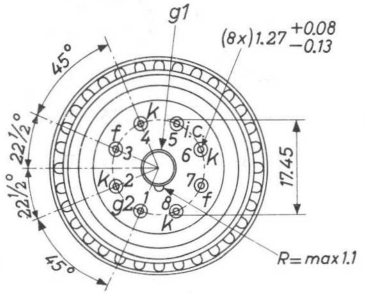
MECHANICAL DATA

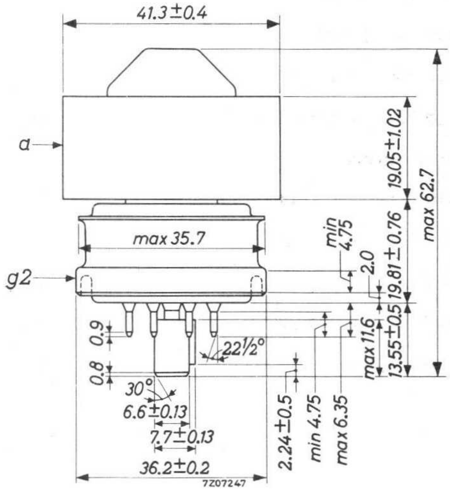
Dimensions in mm

Net weight : approx. 140 g

Mounting position: any







7Z2 8861

R.F. CLASS C TELEGRAPHY OR F.M. TELEPHONY

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to 150	150 to 500	MHz
Anode voltage	V_a	max. 2000	1250	V
Anode current	I_a	max. 250	250	mA
Anode dissipation	W_a	max. 250	250	W
Grid No. 2 voltage	V_{g_2}	max. 300	300	V
Grid No. 2 dissipation	W_{g_2}	max. 12	12	W
Grid No. 1 voltage, negative	$-V_{g_1}$	max. 250	250	V
Grid No. 1 dissipation	W_{g_1}	max. 2	2	W
Grid No. 1 circuit resistance	R_{g_1}	max. 25	25	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 150	150	V

OPERATING CONDITIONS

Frequency	f	up to 150	150	MHz
Anode voltage	V_a	2000	1500	V
Grid No. 2 voltage	V_{g_2}	250	250	V
Grid No. 1 voltage	V_{g_1}	-88	-88	V
Grid No. 1 driving voltage	$V_{g_{1p}}$	110	110	V
Anode current	I_a	250	250	mA
Grid No. 2 current	I_{g_2}	24	24	mA
Grid No. 1 current	I_{g_1}	8	8	mA
Driving power	W_{dr}	2.5	1.5	W
Anode input power	W_{i_a}	500	375	W
Output power	W_o	370	260	W

7Z2 8008

OPERATING CONDITIONS (continued)

Frequency	f	165	165	165	165	MHz
Anode voltage	V_a	1250	1000	750	600	V
Grid No.2 voltage	V_{g_2}	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	-90	-80	-80	-75	V
Grid No.1 driving voltage	$V_{g_{1p}}$	106	95	96	91	V
Anode current	I_a	200	200	200	200	mA
Grid No.2 current	I_{g_2}	20	31	37	37	mA
Grid No.1 current	I_{g_1}	11	10	11	11	mA
Driving power	W_{dr}	1.2	1	1	1	W
Anode input power	W_{i_a}	315	250	190	150	W
Output power	W_o	195	150	110	85	W

OPERATING CONDITIONS with coaxial cavity

Frequency	f	500	500	500	500	MHz
Anode voltage	V_a	1250	1000	800	600	V
Grid No.2 voltage	V_{g_2}	280	250	250	250	V
Grid No.1 voltage	V_{g_1}	-115	-110	-110	-110	V
Anode current	I_a	200	200	200	170	mA
Grid No.2 current	I_{g_2}	5	7	7	6	mA
Grid No.1 current	I_{g_1}	10	10	10	6	mA
Driving power	W_{dr}	30	25	20	15	W
Anode input power	W_{i_a}	250	200	160	100	W
Output power	W_o	140	120	95	50	W

7Z2 8009

R.F. CLASS C ANODE AND SCREEN GRID MODULATION

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to 150	150 to 500	MHz
Anode voltage	V_a	max. 1600	1000	V
Anode current	I_a	max. 200	200	mA
Anode dissipation	W_a	max. 165	165	W
Grid No. 2 voltage	V_{g_2}	max. 300	300	V
Grid No. 2 dissipation	W_{g_2}	max. 10	10	W
Grid No. 1 voltage, negative	$-V_{g_1}$	max. 250	250	V
Grid No. 1 dissipation	W_{g_1}	max. 2	2	W
Grid No. 1 circuit resistance	R_{g_1}	max. 25	25	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max. 150	150	V

OPERATING CONDITIONS

Frequency	f	up to 150	150	MHz
Anode voltage	V_a	1600	1200	V
Grid No. 2 voltage	V_{g_2}	250	250	V
Grid No. 1 voltage	V_{g_1}	-118	-118	V [1])
Anode current	I_a	200	200	mA
Grid No. 2 current	I_{g_2}	23	23	mA
Grid No. 1 current	I_{g_1}	5	5	mA
Driving power	W_{dr}	3	2	W
Anode input power	W_{i_a}	320	240	W
Output power	W_o	230	160	W
Modulation depth	m	100	100	%
Modulator output power	$W_{o\,mod}$	115	80	W
Grid No. 2 mod. voltage, peak	$V_{g2_p\,mod}$	200	180	V

[1]) Obtained from a grid resistor or from a combination of grid resistor with either fixed supply or cathode resistor.

7Z2 8010

OPERATING CONDITIONS (continued)

Frequency	f	165	165	165	165	MHz
Anode voltage	V_a	1000	800	600	400	V
Grid No.2 voltage	V_{g_2}	250	250	250	250	V
Grid No.1 voltage	V_{g_1}	-105	-100	-95	-90	V
Anode current	I_a	200	200	200	200	mA
Grid No.2 current	I_{g_2}	20	25	35	40	mA
Grid No.1 current	I_{g_1}	15	10	8	7	mA
Driving power	W_{dr}	2	1.5	1	1	W
Anode input power	W_{ia}	200	160	120	80	W
Output power	W_o	140	100	80	55	W
Modulation depth	m	100	100	100	100	%
Modulator output power	$W_{o\,mod}$	70	50	40	27.5	W
Grid No.2 mod.voltage, peak	$V_{g_{2p}\,mod}$	170	160	150	140	V

A.F. CLASS AB AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute max. rating system)

Anode voltage	V_a	max.	2000	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	400	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Grid No.1 dissipation	W_{g_1}	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	max.	100	kΩ
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

7Z2 8011

OPERATING CONDITIONS two tubes in push-pull

Anode voltage	V_a	1000		800		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	-43		-40		V
Load resistance	$R_{aa\sim}$	4250		4400		Ω
Driving voltage	V_{gg_p}	0	86	0	80	V
Anode current	I_a	2x82.5	2x225	2x105	2x218	mA
Grid No.2 current	I_{g_2}	-	2x26	-	2x38	mA
Grid No.1 current	I_{g_1}	0	0	0	0	mA
Anode input power	W_{i_a}	2x82.5	2x225	2x84	2x175	W
Anode dissipation	W_a	2x82.5	2x110	2x84	2x90	W
Output power	W_o	0	230	0	170	W

Anode voltage	V_a	2000		1500		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	-50		-50		V
Load resistance	$R_{aa\sim}$	8760		6570		Ω
Driving voltage	V_{gg_p}	0	100	0	100	V
Anode current	I_a	2x50	2x235	2x50	2x228	mA
Grid No.2 current	I_{g_2}	-	2x18	-	2x21	mA
Grid No.1 current	I_{g_1}	0	0	0	0	mA
Anode input power	W_{i_a}	2x100	2x470	2x75	2x340	W
Anode dissipation	W_a	2x100	2x180	2x75	2x140	W
Output power	W_o	0	580	0	400	W

7Z2 8012

OPERATING CONDITIONS (continued)

Anode voltage	V_a	1000		800		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	-45		-40		V
Load resistance	$R_{aa\sim}$	3950		3140		Ω
Driving voltage	V_{gg_p}	0	98	0	90	V
Driving power	W_{dr}	-	0.15	-	0.15	W
Anode current	I_a	2x83	2x247	2x105	2x250	mA
Grid No.2 current	I_{g_2}	-	2x29	-	2x40	mA
Anode input power	W_{i_a}	2x83	2x247	2x84	2x200	W
Anode dissipation	W_a	2x83	2x112	2x84	2x93	W
Output power	W_o	0	270	0	215	W
Anode voltage	V_a	2000		1500		V
Grid No.2 voltage	V_{g_2}	300		300		V
Grid No.1 voltage	V_{g_1}	-50		-50		V
Load resistance	$R_{aa\sim}$	8100		5970		Ω
Driving voltage	V_{gg_p}	0	106	0	106	V
Driving power	W_{dr}	-	0.2	-	0.2	W
Anode current	I_a	2x50	2x250	2x50	2x250	mA
Grid No.2 current	I_{g_2}	-	2x18	-	2x18	mA
Anode input power	W_{i_a}	2x100	2x500	2x75	2x375	W
Anode dissipation	W_a	2x100	2x185	2x75	2x155	W
Output power	W_o	0	630	0	440	W

7Z2 8013

R.F. CLASS B AMPLIFIER FOR TELEVISION SERVICE , negative modulation, positive synchronisation

LIMITING VALUES (Absolute max. rating system)

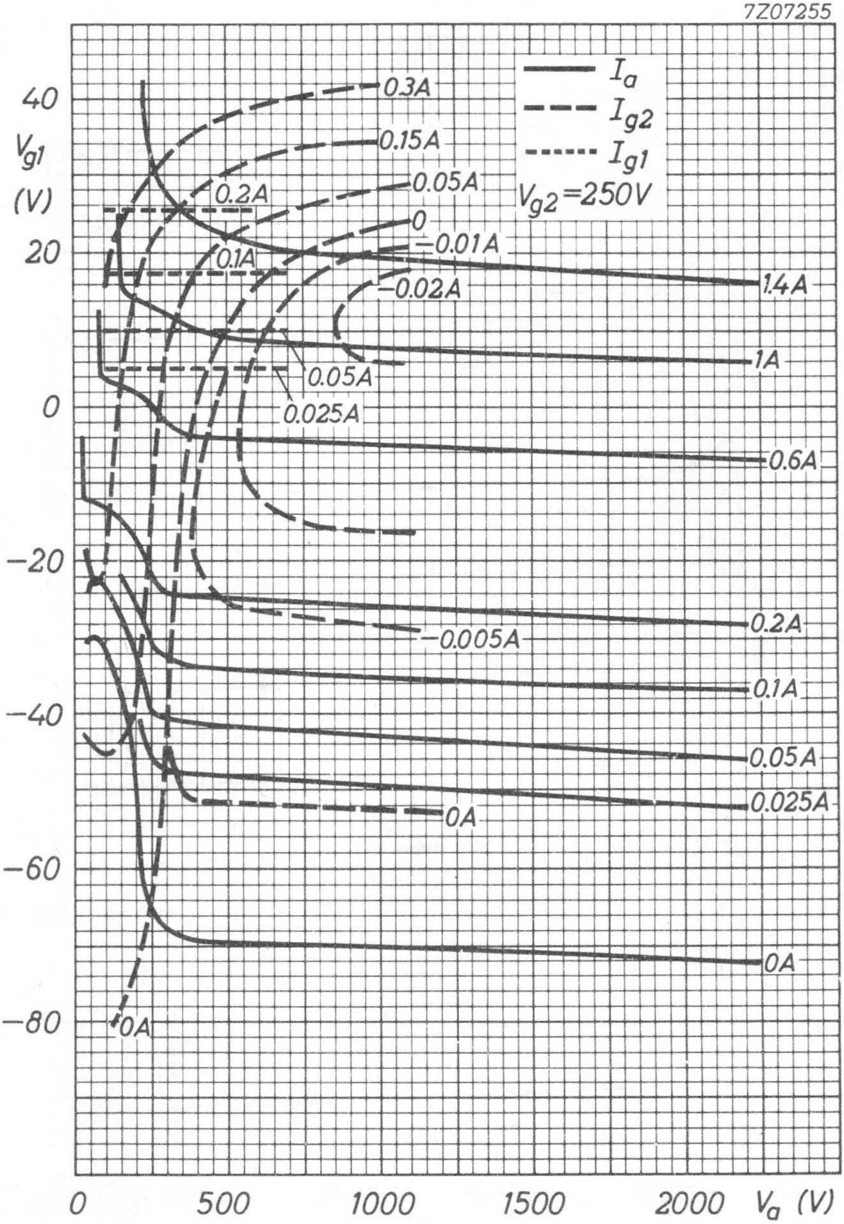
Frequency	f		54 to 216	MHz
Anode voltage	V_a	max.	1250	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No.2 voltage	V_{g_2}	max.	250	V
Grid No.2 dissipation	W_{g_2}	max.	12	W
Grid No.1 voltage, negative	$-V_{g_1}$	max.	400	V
Grid No.1 dissipation	W_{g_1}	max.	2	W
Grid No.1 circuit resistance	R_{g_1}	max.	25	kΩ [1]
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

OPERATING CONDITIONS

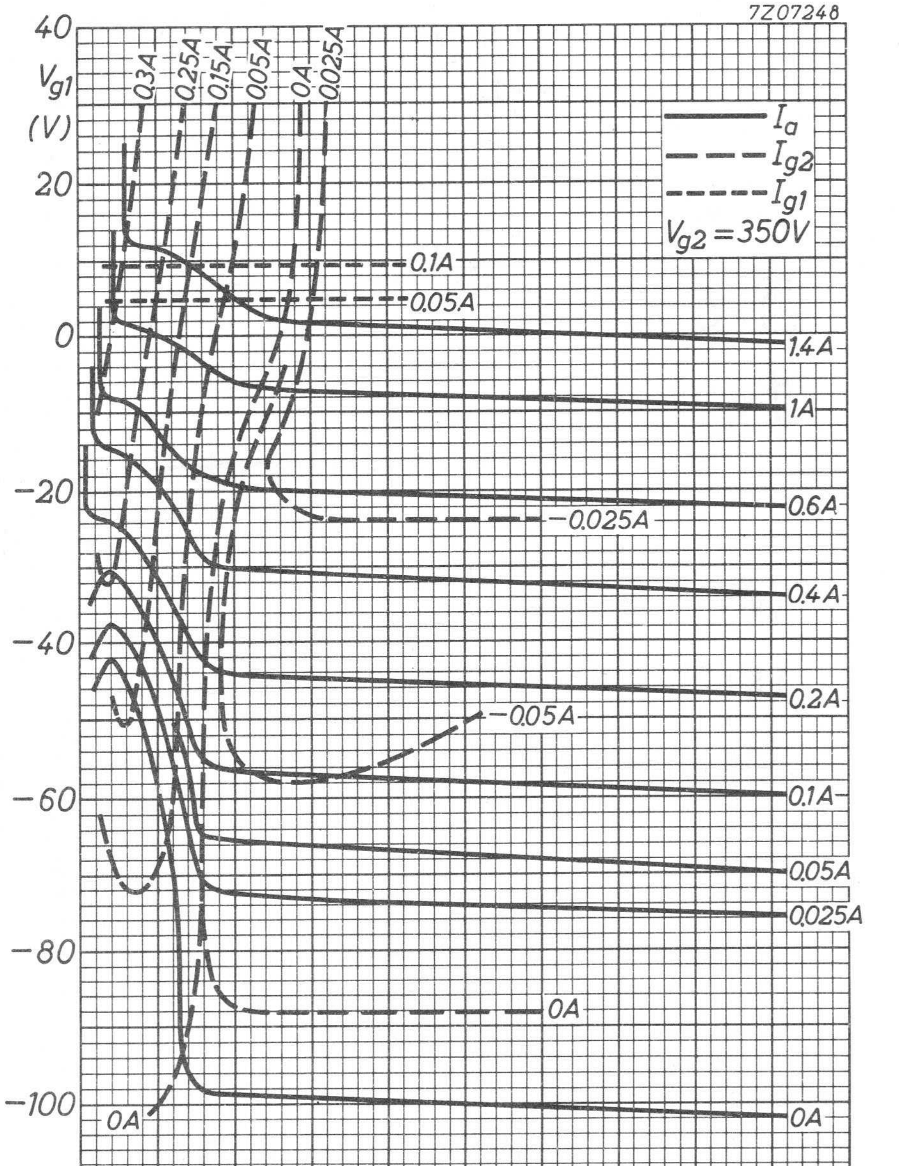
Bandwidth	B (-1.5 dB)		5	5	5	MHz
Anode voltage	V_a		1250	1000	750	V
Grid No.2 voltage	V_{g_2}		300	300	300	V
Grid No.1 voltage	V_{g_1}		-70	-65	-60	V
Driving voltage, peak to peak	$V_{g_{1pp}}$	sync	100	95	85	V
		black	75	70	65	V
Anode current	I_a	sync	305	330	335	mA
		black	230	240	245	mA
Grid No.2 current	I_{g_2}	sync	45	45	50	mA
		black	10	15	20	mA
Grid No.1 current	I_{g_1}	sync	25	20	15	mA
		black	4	4	4	mA
Driving power	W_{dr}	sync	9	8	7	W
		black	5.5	4.7	4.25	W
Output power in load	W_ℓ	sync	250	200	135	W
		black	140	110	75	W

[1]) Cathode bias is not recommended.

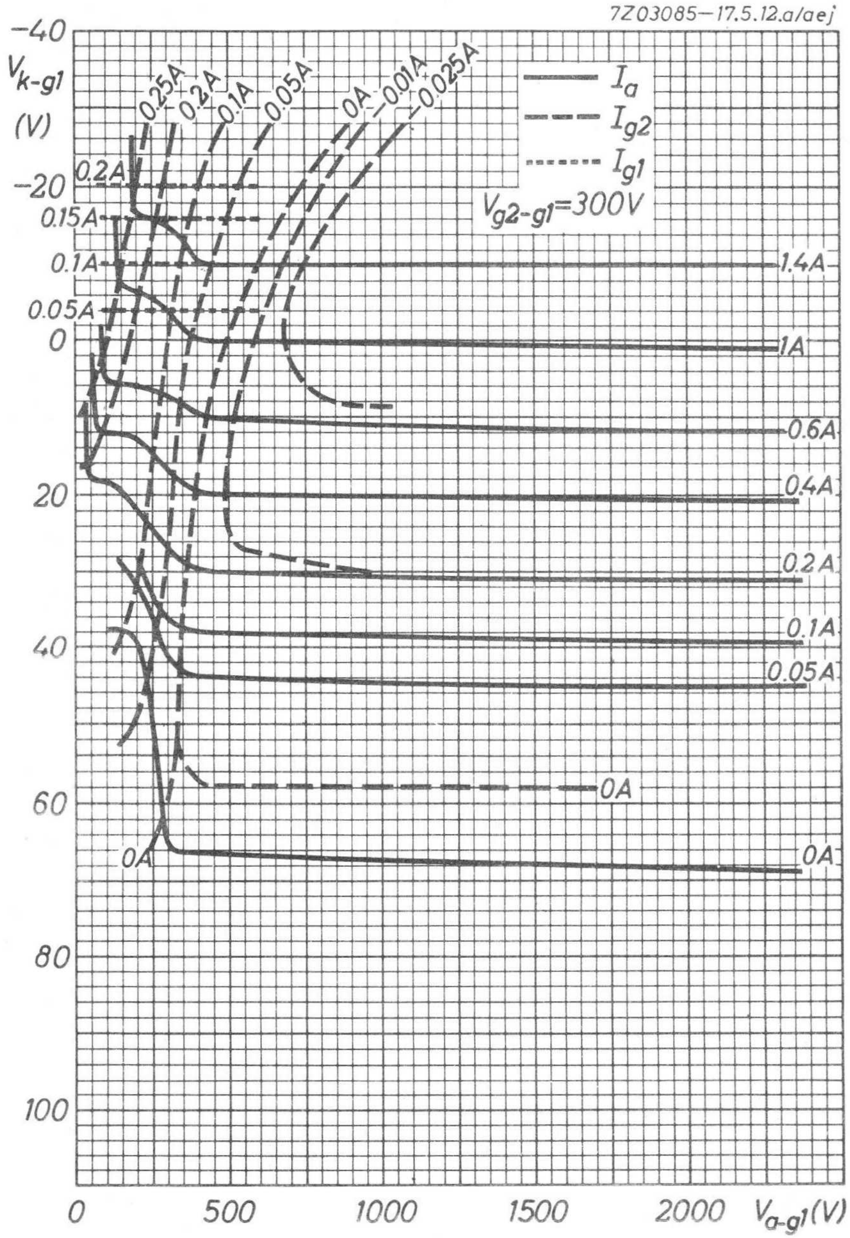
7Z2 8014



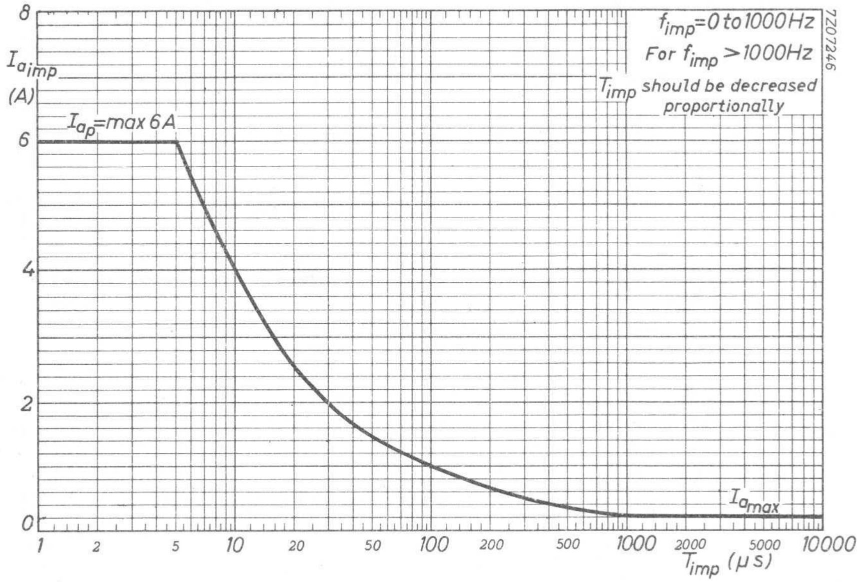
7Z07255
I_a
I_{g2}
I_{g1}
V_{g2}=250V
40
V_{g1}
(V)
20
0
−20
−40
−60
−80
0
500
1000
1500
2000
V_a (V)
0.3A
0.15A
0.05A
0
−0.01A
−0.02A
0.2A
0.1A
0.05A
0.025A
1.4A
1A
0.6A
0.2A
−0.005A
0.1A
0.05A
0.025A
0A
0A
0A



7Z07248
V_{g1} (V)
40
20
0
−20
−40
−60
−80
−100
0
500
1000
1500
2000
V_a (V)
2500
I_a
I_{g2}
I_{g1}
V_{g2} = 350V
0.3A
0.25A
0.15A
0.05A
0A
0.025A
0.1A
0.05A
1.4A
1A
0.6A
−0.025A
0.4A
0.2A
−0.05A
0.1A
0.05A
0.025A
0A
0A
0A



7Z03085—17.5.12.a/aej
V_{k-g1} (V)
I_a
I_{g2}
I_{g1}
V_{g2-g1}=300V
0.25A
0.2A
0.1A
0.05A
0A
0.01A
0.025A
0.2A
0.15A
0.1A
0.05A
1.4A
1A
0.6A
0.4A
0.2A
0.1A
0.05A
0A
0A
0A
−40
−20
0
20
40
60
80
100
0
500
1000
1500
2000
V_{a-g1}(V)



8
6
4
2
0
$I_{a_{imp}}$ (A)
I_{ap}=max 6A
f_{imp}=0 to 1000Hz
For f_{imp} > 1000Hz
T_{imp} should be decreased proportionally
7Z07246
$I_{a_{max}}$
1 2 5 10 20 50 100 200 500 1000 2000 5000 10000
T_{imp} (μs)

R.F. POWER TETRODE

Forced-air cooled tetrode in ceramic-metal construction intended for use in S.S.B. transmitters.

	QUICK REFERENCE DATA		
Freq. (MHz)	S.S.B.		
	V_a (V)	W_ℓ (W)PEP	d_3 (dB)
7	2000	271	-26
7	2000	436	-23

HEATING: indirect; oxide coated cathode

Heater voltage	V_f	25.6	V ± 5% [1]
Heater current	I_f	560	mA
Waiting time	T_w	min. 30	s

CAPACITANCES

Grid No.1 to all except anode	$C_{g_1(a)}$	17.0	pF
Anode to all except grid No.1	$C_{a(g_1)}$	4.7	pF
Anode to grid No.1	C_{ag_1}	0.06	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	500		V
Grid No.2 voltage	V_{g_2}	250	300	V
Anode current	I_a	200		mA
Grid No.2 current	I_{g_2}	-	50	mA
Transconductance	S	12	-	mA/V
Amplification factor	$\mu_{g_2g_1}$		5.2	

TEMPERATURE LIMITS (Absolute max. rating system)

Temperature of all seals	t_s	max. 250	°C
Temperature of anode core	t_a	max. 250	°C

[1]) Short term variations of ± 10% will not damage the tube, but variations in performance must be expected.

7Z2 8015

COOLING: Forced air

Anode dissipation	Height above sea level	Inlet temperature	Min. required air flow	Pressure drop
W_a	h	t_i	q min	p_i
250 W 250 W	0 m 3000 m	50 °C 50 °C	0.15 m^3/min 0.19 m^3/min	15 mm H_2O 22 mm H_2O

ACCESSORIES

→ Socket 2422 513 01001

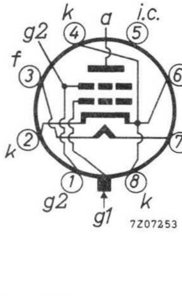
Chimney type 5659081/40

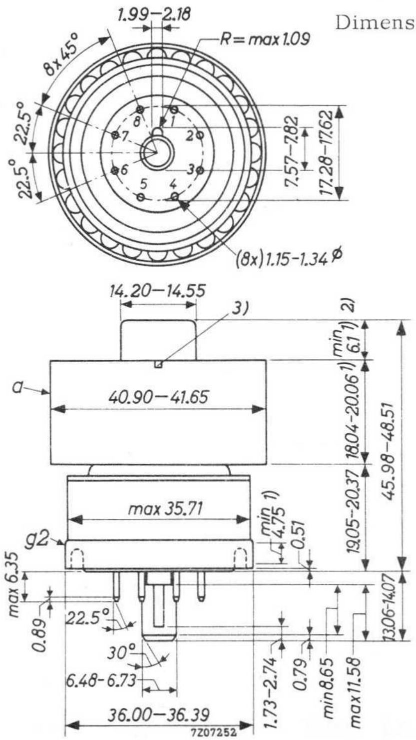
MECHANICAL DATA

Net weight: 120 g

Mounting position: any

Dimensions in mm





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1) Contact surface

2) Use this contact surface for frequencies up to 30 MHz only

3) Index aligned with grid No.1 guide lug

7Z2 8862

R.F. SINGLE SIDE BAND AMPLIFIER

LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	500	MHz
Anode voltage	V_a	max.	2000	V
Anode current	I_a	max.	250	mA
Anode dissipation	W_a	max.	250	W
Grid No. 2 voltage	V_{g_2}	max.	400	V
Grid No. 2 dissipation	W_{g_2}	max.	12	W
Grid No. 1 voltage, negative	$-V_{g_1}$	max.	150	V
Cathode to heater voltage, peak	V_{kf_p}	max.	150	V

OPERATING CONDITIONS

Frequency	f		7		MHz
Anode voltage	V_a		2000		V
Grid No. 2 voltage	V_{g_2}		350		V
Grid No. 1 voltage	V_{g_1}		-57.5		V
Load resistance	$R_{a\sim}$		4000		Ω
		zero signal	single tone	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	45.3	45.3	V
Anode current	I_a	100	250	174	mA
Grid No. 2 current	I_{g_2}	-1.22	-4.1	-31.5	mA
Anode input power	W_{i_a}	200	500	348	W
Output power in the load	W_ℓ (PEP)	-	271	271	W
Third order intermodulation distortion	d_3	-	-	-26	dB
Fifth order intermodulation distortion	d_5	-	-	-54	dB

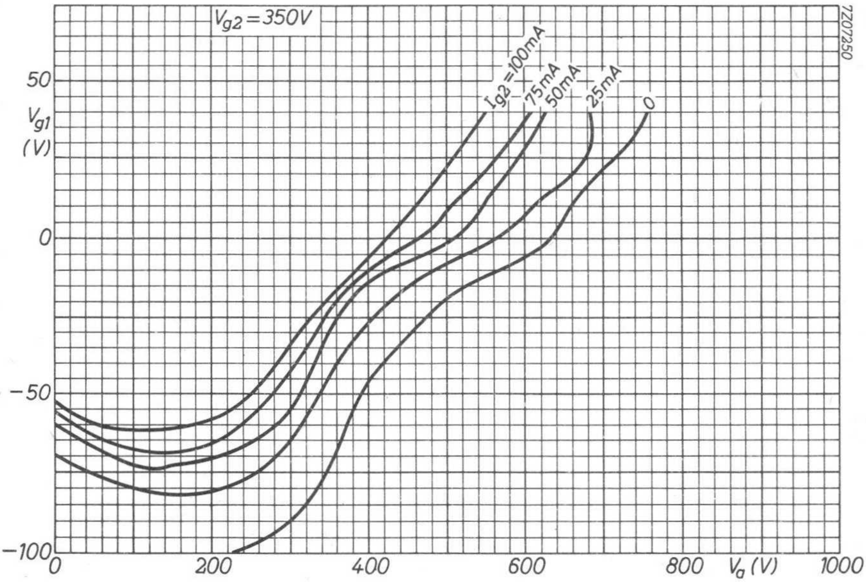
7Z2 8017

OPERATING CONDITIONS (continued)

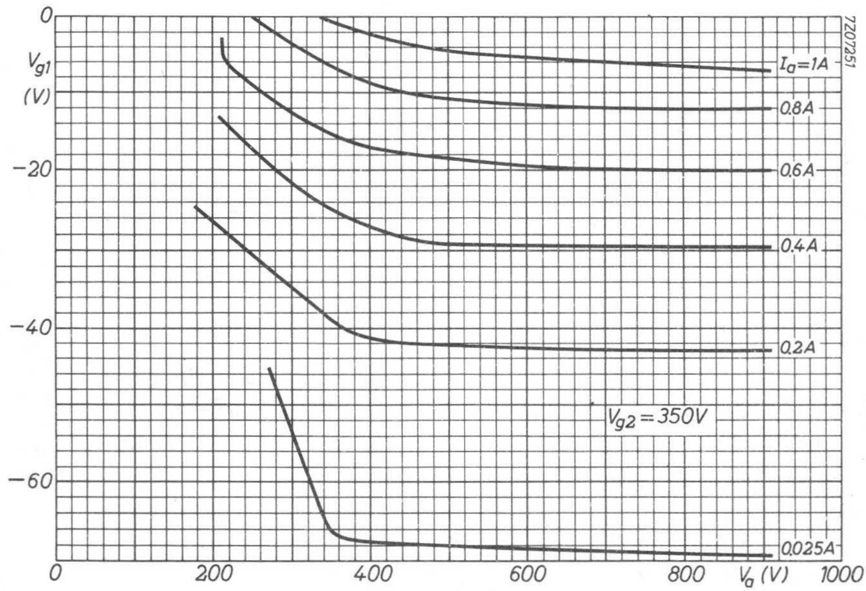
Frequency	f		7		MHz
Anode voltage	V_a		2000		V
Grid No.2 voltage	V_{g_2}		350		V
Grid No.1 voltage	V_{g_1}		-72		V
Load resistance	$R_{a\sim}$		3570		Ω
		zero signal	single tone [1]	double tone	
Driving voltage, peak	$V_{g_{1p}}$	0	62	62	V
Anode current	I_a	75	310	204	mA
Grid No.2 current	I_{g_2}	-0.85	14	2.4	mA
Anode input power	W_{i_a}	150	620	407	W
Output power in the load	W_ℓ (PEP)	-	436	436	W
Third order intermodulation distortion	d_3	-	-	-23	dB
Fifth order intermodulation distortion	d_5	-	-	-37	dB

[1]) Conditions in this column are permissible only for a signal having a peak to average power ratio which equals or exceeds 2 to 1 (e.g. two tone conditions) and for tune up during maximum 2 min.

7Z2 8018



Vg2 = 350V
7Z07250
Ig2 = 100mA
75mA
50mA
25mA
0
50
Vg1 (V)
0
−50
−100
0
200
400
600
800
Va (V)
1000



7Z07251
Ia = 1A
0.8A
0.6A
0.4A
0.2A
0.025A
Vg2 = 350V
0
Vg1 (V)
−20
−40
−60
0
200
400
600
800
Va (V)
1000

High-voltage rectifiers

HIGH-VOLTAGE RECTIFYING TUBES

LIST OF SYMBOLS

Remarks

a. In the case of indirectly heated tubes the voltages on the various electrodes are with respect to the cathode, in the case of a.c. fed, directly heated tubes with respect to the electrical centre of the filament, unless otherwise stated.
b. The symbols for voltages and currents quoted below represent the average values of the concerning voltages and currents, unless otherwise stated.
c. The positive electrical current is directed opposite to the direction of the electron current

Anode	a
Capacitance between anode and grid (the other elements being earthed)	C_{ag}
Capacitance between grid and all other elements except anode	C_g
Frequency	f
Filament or heater	f
Grid	g
Anode current	I_a
Filament or heater current	I_f
Grid current	I_g
D.C. output current of a rectifying tube	I_o
Peak value of a current	I_p
Fault current	I_{surge}
Cathode	k
Resistance in grid lead	R_g
Ambient temperature	t_{amb}
Averaging time	T_{av}
Deionisation time	T_{dion}
Temperature of condensed mercury	t_{Hg}
Ionisation time	T_{ion}

7Z2 4158

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
Anode voltage	V_a
Arc voltage	V_{arc}
Heater voltage	V_f
Grid voltage	V_g
Inverse voltage	V_{inv}
D.C. voltage supplied by a rectifying tube	V_o
Secondary transformer voltage	V_{tr}
Output power	W_o

7Z2 4159

APPLICATION DIRECTIONS
HIGH-VOLTAGE RECTIFYING TUBES

The following instructions apply in general to all types of high-voltage rectifying tubes. If there are additional instructions for any type of tube it will be indicated on the technical data sheets of the concerning type.

MOUNTING

The mercury-vapour filled types must be mounted vertically with the base or filament strips at the lower end. The mounting position of the gas-filled types is in general arbitrary.

The tubes must be mounted so that air can circulate freely around them. Therefore the clearance between the tubes and other components of the circuit and between the tubes and the cabinet walls should be at least half the maximum bulb diameter. The minimum clearance between tubes should be 3/4 the maximum bulb diameter.

It should be realised that a minimum clearance is also required for reasons of high voltage insulation.

When a tube is operating and the cooling is only obtained by natural convection the temperature distribution along the bulb will be such that the lowest temperature occurs at the bottom. This distribution is of special importance in the case of mercury-vapour filled types in order to condense the mercury-vapour in the lower part of the tube. Where additional cooling is necessary this cooling should not disturb this normal temperature distribution along the bulb.

Generally if shock or vibration exceeds 0.5 g a shock absorbing device should be used.

The electrode connections, except those of the tube socket, must be flexible. The nuts (e.g. of the anode connections) should be well tightened but care must be taken to ensure that no undue forces are exerted on the tube. The contacts must be checked at regular intervals and their surfaces kept clean in order to avoid excessive heating of the glass-metal seals. The cross section of the conductors should be sufficient to avoid overheating by the current. However, to maintain the normal temperature distribution along the bulb the conductors should not conduct too much heat away from the tube. (It should be noted that in rectifier circuits the r.m.s. value of the anode current may reach 2.5 times the average value.)

7Z2 4097

FILAMENT SUPPLY

In order to obtain the maximum life of a directly heated cathode, a filament transformer with centre-tap and a phase shift of $90^{o} \pm 30^{o}$ between V_a and V_f is recommended. Series connection of filaments is not allowable.

The filament voltage at nominal mains voltage must be measured at the terminals of the tube. Permanent deviations up to 2.5% from the published value can be accepted. It is therefore recommended that the filament transformer be equipped with suitable tappings. Temporary variations should not exceed 5%.

However to ensure maximum life it is important to keep the filament voltage as near as possible to the nominal value.

In calculating the rating of the filament transformer a spread in the filament current of $\pm$10% form tube to tube should be taken into account, whilst for directly heated tubes the d.c. current flowing through the heater winding should also be considered. It is recommended to furnish the filament transformer with several taps on the primary especially in case of h.t.-insulated high magnetic leakage transformers.

TEMPERATURE

1. Tubes filled with mercury vapour

In the technical data of these tube types temperature limits for the condensed mercury are given. During operation the condensed mercury should only be visible in the neighbourhood of the socket or the lowest part of the bulb. Care should be taken to ensure that the condensed mercury temperature during operation is between the published temperature limits. Too low a temperature gives low gas pressure which results in a low current carrying capability, high arc drop and consequently shortening of life. Too high a temperature gives high gas pressure which results in a reduction of the permissible peak inverse and forward voltage.

Accurate values of the condensed mercury temperature can be measured by means of a thermocouple placed against the envelope, but good technique and instruments are necessary for this measurement. In general temperature values of sufficient accuracy can be obtained by using a normal mercury thermometer the mercury vessel of which is wrapped in staniol strips and that can be fixed against the bulb by means of a cotton thread.

The temperature measurements should be made at the coldest part of the bulb where the mercury vapour condenses which in general will be just above the base or the lower connections.

In addition to the temperature limits for the condensed mercury sometimes limits for the ambient temperature are given. For each type there is a specific difference between ambient and condensed mercury temperature. High ambient temperature can make it desirable to decrease this difference, which can be

7Z2 4098

obtained by directing a low velocity air flow of ambient temperature or less to the glass just above the base.

The condensed mercury temperature is decisive in all cases.

The ambient temperature can be measured by a thermometer which has been screened against direct heat radiation. The measurement should be carried out at a distance of max. once and min. half the tube diameter from the tube at the same height as the condensed mercury or just above the base.

2. Tubes with inert gas filling.

For these tubes only the limits of the ambient temperature are given. These limits are in general minimum -55 °C and maximum +75 °C.

SWITCHING ON

If switching on of the rectifier takes place twice a day or less the allowable peak anode current when switching on may amount up to twice the maximum published value for I_{a_p}.

1. Tubes filled with mercury vapour.

It is necessary to allow time for the cathode to reach its operating temperature before drawing anode current. Therefore the minimum cathode heating time is given in the published data sheets of each type. After the cathode heating time the high voltage may be switched on provided the temperature of the condensed mercury is not too low and all the condensed mercury is confined to the lower part of the bulb.

Sometimes a heat conserving hood is prescribed for the tube. The purpose of this hood is to avoid condensation of the mercury vapour on the electrodes and upper part of the bulb whilst the tube is cooling.

Switching on (not after transport) may be done at a condensed mercury temperature which lies 5 to 10 °C below the published minimum temperature (minimum waiting time required). However, it is good practice to switch on after the temperature has reached its minimum published value (recommended waiting time).

The waiting times, the minimum required and the recommended one can be read from the curve representing the condensed mercury temperature rise as a function of time with only the filament voltage applied to the tube.

Switching on after transport or after a considerable interruption of operation should be done according to the instructions on the published data sheets.

In order to avoid long preheating times it is recommended to leave the filament supply on during standby periods (e.g. overnight) at 60 to 80% of the nominal value.

7Z2 4099

Standby position for mercury vapour filled tubes.

In order to have a spare tube always ready for immediate operation it is recommended to have a spare position where a tube stands with continuously a filament voltage of 60-80% of the nominal voltage applied.

When for a certain type a heat conserving hood is prescribed this hood should be fitted on the tube.

2. Tubes with inert gas-filling

It is necessary to allow the cathode to reach operating temperature before drawing anode current. The relevant minimum cathode heating time is given in the technical data sheets of each type. After warming up the anode voltage may be applied provided that the ambient temperature is not below the minimum published value.

No other delays apart from the cathode heating delay are required.

LIMITING VALUES

The limiting values should be used in accordance with the "Absolute maximum rating system" as defined by IEC publication 134.
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.

For some ratings of average current a maximum averaging time is quoted. This is to ensure that an anode current greater than the maximum continuously permissible average value is not drawn for such a length of time as would give rise to an excessive temperature within the tube.

The maximum peak anode current is determined by the available safe cathode emission whereas the average current is limited by its heating effects. During normal operation or frequent switching the peak current should not exceed its maximum published value.

For the determination of the actual value of the peak inverse voltage and the peak anode current, the measured values with an oscilloscope or otherwise are decisive.

The I_{surge} is the maximum fault current which should ever be allowed to pass through the tube. (See section "Short circuit protection".)

DESIGN VALUES

1. V_{arc}

The value published for V_{arc} applies to average operating conditions.

2. Frequency

Unless otherwise stated the maximum frequency at which the tubes may run under full load is 150 Hz. Under special conditions (derating of voltage and current) higher frequencies may be used; details should be obtained from the manufacturer.

TYPICAL OPERATING CONDITIONS

Sometimes 2 columns of operating conditions are given viz. one giving theoretical values based on the absolute maxima and one giving more practical values in which mains fluctuations of max. 10% and a voltage drop in tube, transformer, filter etc. of max. 8% are incorporated.

SHORT CIRCUIT PROTECTION

In order to prevent the tube from being damaged by passing too high a fault current a value for the maximum permissible surge current is given.

The figure given for the maximum surge current is intended as a guide to equipment designers. It indicates the maximum value of a transient current resulting from a sudden overload or short circuit which the rectifier can pass for a period not exceeding 0.1 second without resulting in its immediate destruction. Several overloads of this nature will, however, considerably reduce the life of the tube.

The equipment designer has to take into account this maximum surge current rating when calculating the short-circuit impedance of the equipment.

This surge current value is not intended as a peak current that may occur during switching-on or during operation.

A simple method to limit the surge current to the maximum rating is to put a series resistance in the anode circuit which in most cases will also be necessary because the relation between the ohmic and the inductive resistance of the short circuit path should be at least 0.3.

7Z2 4101

SCREENING AND INTERFERENCE

In order to prevent unwanted ionisation of the gas filling (and consequent flash over) due to strong r.f. fields, it may be necessary to enclose the rectifier in a separate earthed screening box. Of course r.f. should be prevented from reaching the rectifier by r.f. chokes and condensers.

In circuits with gas filled tubes oscillation in the transformer windings can occur especially in grid controlled circuits. These oscillations should be reduced by suitable circuits as excessive peak inverse voltages may occur, causing arc back. The use of two parallel RC circuits is advisable.

An air choke in the order of 100 μH should be connected in series with and close to the anode connection. This choke can advantageously be wound from resistance wire in order to help short circuit protection.

SMOOTHING CIRCUITS

In order to limit the peak anode current in a rectifying tube it is necessary to use a choke-input filter.

If switching on of the rectifier takes place twice a day or less the allowable peak anode current when switching on may reach a value of twice the published max. value for I_{ap}.

To ensure good voltage regulation on fluctuating loads the inductance value of the choke should be large enough to give uninterrupted current at minimum load. The choke and capacitor must not resonate at the supply or ripple frequency. Damping of this choke will be necessary.

In grid controlled rectifier circuits under "phased back" conditions the harmonic content of the d.c. output will be large unless the inductance is adequate.

PARALLEL OPERATION OF MERCURY-VAPOUR OF GAS-FILLED TUBES

As individual gas or mercury-vapour filled tubes may have slightly different characteristics two or more tubes must not be connected directly in parallel.

Parallel operation is permissible when series resistances are used and the peak voltage drop over this series resistance is at least the ignition voltage. Coupling transformers in the anode leads of parallel connected tubes can serve the same purpose.

GRID CONTROLLED RECTIFIERS

When a thyratron is conducting, a positive ion current of a magnitude proportional to the cathode current is generated. This current will, in general, flow to that electrode which is at the most negative potential during conduction (e.g. the grid). In order to prevent damage to the tube it is necessary to ensure that

7Z2 4102

the voltage of this electrode is less negative than -10 volts during this phase. This precaution will prevent an increase in electrode emission due to excessive electrode dissipation, sputtering of electrode material, changes in the control characteristics caused by shift in contact potential and, in the case of inert gas-filled tubes, a rapid gas clean-up. The minimum allowable value of the grid resistor is 0.1 x the recommended one.

In circuits where the anode potential changes from a positive to a negative value and the control grid is at a positive potential, thereby drawing grid current, a small positive ion current flows to the anode. At high negative anode voltages it is therefore essential to limit the magnitude of the positive ion current by severely restricting the current flowing from cathode to grid.

This may be effected by using fixed negative grid bias and narrow positive firing pulses.

However, for bridge circuits the minimum width of these pulses should be sufficiently large to secure safe "take-over" of the discharge.

In those circuits where the anode potential changes very rapidly from a positive to a high negative value, such as with inductive loads fed from polyphase supplies, there will be residual positive ions within the tube which will be drawn towards the anode with considerable energy. In the case of an inert gas-filled tube this would result in excessive gas clean-up and it is therefore necessary to observe the limitations imposed by the commutation factor.

CONTROL CHARACTERISTICS

In most cases the control characteristic given on the data sheets is shown by upper and lower boundary curves within which all tubes may be expected to remain at all temperatures of the published range and during life.

In multitube circuits where the tubes are operating under the same conditions the spread will in general be smaller.

The published boundaries are therefore to be considered as extreme limits. This should be taken into consideration when designing grid excitation circuits.

GRID EXCITATION CIRCUITS

To keep the instant of ignition as constant as possible a large value of excitation voltage is recommended.

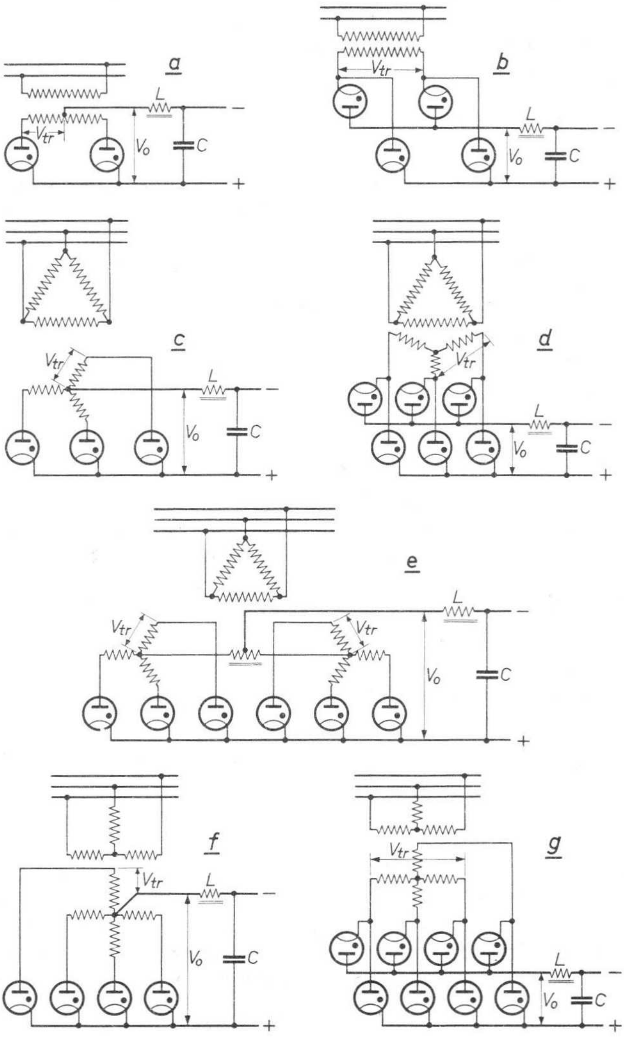
The use of a negative grid bias (50 to 120 volts) and a sharp positive grid pulse is recommended. The magnitude of the grid pulse should be 100 to 200 volts with a grid series resistor of 10 kΩ and a maximum impedance of the peaking transformer of 10 kΩ. If a sinusoidal grid voltage is used r.m.s. values of 50 to 120 volts in combination with a negative grid bias of 50 to 120 volts are recommended.

7Z2 4103

BRIDGE CIRCUITS (diagrams b, d and g)

For output voltages of more than 6 kV bridge circuits are recommended because of the lower peak inverse anode voltage and the larger range of applicable ambient temperatures.

The current angle of the grid should be for 2 phase bridge circuits > 90°, for 3 phase > 60°, and for 4 phase > 45°.



7Z2 4104

GRID-CONTROLLED HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA				
Peak inverse voltage	$V_{a\ inv_p}$	max.	13	kV
Peak forward voltage	V_{a_p}	max.	13	kV
Output current	I_o	max.	1	A
Peak anode current	I_{a_p}	max.	4	A
Negative grid voltage	$-V_g$	max.	300	V
Peak grid current	I_{g_p}	max.	50	mA

For electrical data please refer to type DCG6/6000

MECHANICAL DATA (Dimensions in mm)

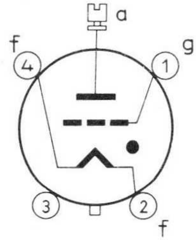
Base : Jumbo 4 p, with bayonet

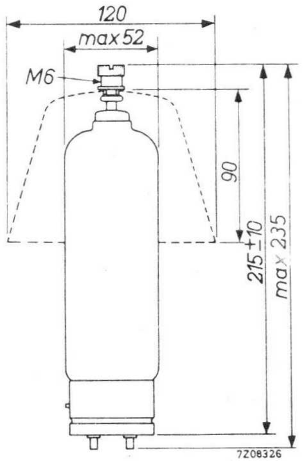
Socket : 2422 511 02001

Anode cap : 40616

This cap must always be mounted on the tube, thus also during preheating

Net weight: 240 g





Mounting position: vertical with base down

7Z2 8897

HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA				
Peak inverse voltage	$V_{a\,inv_p}$	= max.	3000	V
Output current	I_o	= max.	250	mA
Peak anode current	I_{a_p}	= max.	1250	mA

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=	4	V
Filament current	I_f	=	2.5	A

In order to ameliorate the life of the tube a preheating time of the filament of at least 15 sec. is recommended

Phase shift of $90^o \pm 30^o$ between V_a and V_f and use of a centre-tapped filament transformer are recommended

TYPICAL CHARACTERISTICS

Arc voltage	V_{arc} (I_a = 250 mA)	=	12	V

LIMITING VALUES (Absolute limits)

Frequency	f	= max.	500	Hz
Peak inverse voltage up to 150 Hz	$V_{a\,inv_p}$	= max.	3000	V
Peak inverse voltage up to 500 Hz	$V_{a\,inv_p}$	= max.	2550	V
Output current	I_o	= max.	250	mA
Peak anode current	I_{a_p}	= max.	1250	mA
Ambient temperature	t_{amb}	=	10 to 40	^oC

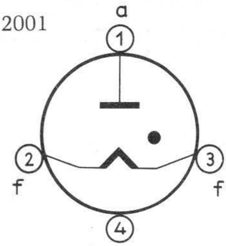
7Z2 2441

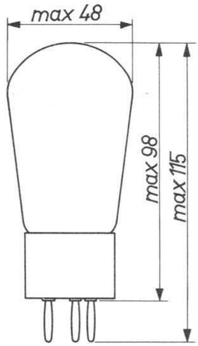
→ **MECHANICAL DATA** Dimensions in mm

Base : A

Socket : 2422 512 02001

Net weight : 45 g





Mounting position : vertical with base down

OPERATING CONDITIONS

Transformer regulation and voltage drops in the tubes are neglected

Peak inverse voltage $V_{a\,inv_p}$ = 3 kV				
Circuit [1]	Transformer voltage V_{tr} (V_{RMS})	Output voltage V_o (V)	Output current I_o (A)	Power output W_o (kW)
a	1060	950	0.5	0.48
b	2120	1910	0.5	0.95
c	1220	1430	0.75	1.07
d	2120	2870	0.75	2.15
e	1060	1240	1.5	1.86
f	1060	1350	1.0	1.35
g	2120	2700	1.0	2.70

[1]) For circuits see page 8 in front of this section.

7Z2 8898

HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA								
Peak inverse voltage	$V_{a\,inv_p}$	=	max.	10	kV	max.	2	kV
Output current	I_o	=	max.	0.25	A	max.	0.5	A
Peak anode current	I_{a_p}	=	max.	1	A	max.	2	A

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=		2.5	V
Filament current	I_f	=		4.8	A
Cathode heating time	T_w	=	min.	30	sec

Phase shift of $90^o \pm 30^o$ between V_a and V_f and use of a centre-tapped filament transformer is recommended

After transport and after a long interruption of service a waiting time of at least 30 minutes between the switching on of the filament voltage and the switching on of the anode voltage should be observed

TYPICAL CHARACTERISTICS

Arc voltage V_{arc} (I_a = 0.25 A) = 12 V

LIMITING VALUES (Absolute limits)

Output current	I_o	=	max.	0.25	A	max.	0.5	A
Peak anode current	I_{ap}	=	max.	1	A	max.	2	A
Peak inverse voltage	$V_{a\,invp}$	=	max.	10	kV	max.	2	kV
(Frequency	f	=	max.	150	c/s	max.	150	c/s)
Condensed mercury temperature [1])	t_{Hg}	=		25 to 60	^oC		25 to 70	^oC
Ambient temperature [2])	t_{amb}	=		15 to 40	^oC		15 to 50	^oC

[1]) If the equipment is started not more than twice daily it is permitted to apply the high tension at a condensed mercury temperature of 20 ^oC

[2]) With convection cooling only

7Z2 2443

→ **MECHANICAL DATA** Dimensions in mm

Mounting position: vertical with base down

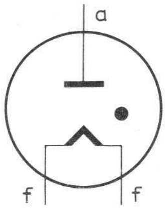
DCG4/1000 ED

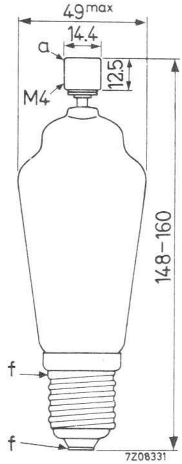
Base : Edison

Socket : E3 000 22

Anode connector : 40619

Net weight : 65 g





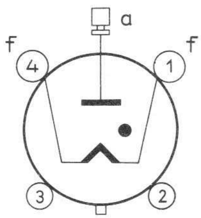
DCG4/1000 G

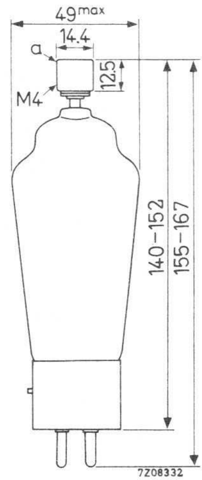
Base : Medium 4p with bayonet

Socket : 2422 511 04001

Anode connector : 40619

Net weight : 80 g





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[1]) At voltages above 2 kV the socket must be insulated from the chassis.

7Z2 8899

OPERATING CONDITIONS

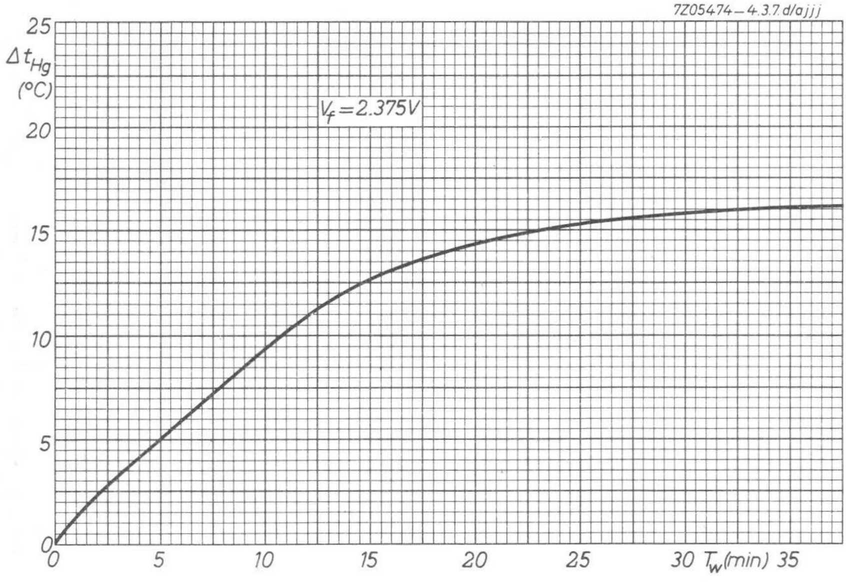
Transformer regulation and voltage drops in the tubes are neglected

Peak inverse voltage $V_{a\,invp}$ = 10 kV				
Circuit [1])	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (W)
a	3.5	3.2	0.5	1590
b	7.1	6.4	0.5	3180
c	4.1	4.8	0.75	3600
d	7.1	9.6	0.75	7200
e	3.5	4.1	1.5	6200
f	3.5	4.5	1	4500
g	7.1	9.0	1	9000

Peak inverse voltage $V_{a\,invp}$ = 2 kV				
Circuit [1])	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (W)
a	0.71	0.63	1	630
b	1.41	1.27	1	1270
c	0.82	0.96	1.5	1430
d	1.41	1.91	1.5	2870
e	0.71	0.83	3	2480
f	0.71	0.90	2	1800
g	1.41	1.80	2	3600

[1]) For circuits see page 8 in front of this section.

7Z2 4138


7Z05474—4.3.7.d/ajjj
25
Δt_{Hg}
(°C)
20
15
10
5
0
V_f = 2.375V
0
5
10
15
20
25
30
T_w(min)
35

HIGH-VOLTAGE
MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA					
Peak inverse voltage	$V_{a\,inv_p}$	=	max.	13	kV
Output current	I_o	=	max.	1.25	A
Peak anode current	I_{ap}	=	max.	5	A

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=		4	V
Filament current	I_f	=		7	A
Cathode heating time	T_w	=	min.	30	sec

Phase shift of $90^{\circ} \pm 30^{\circ}$ between V_a and V_f and/or use of a centre-tapped filament transformer are recommended.

After transport and after a long interruption of service a waiting time of at least 30 minutes between the switching on of the filament voltage and the switching on of the anode voltage should be observed.

TYPICAL CHARACTERISTICS

Arc voltage V_{arc} (I_a = 1.25 A) = 12 V

LIMITING VALUES (Absolute limits)

Peak inverse voltage	$V_{a\,inv_p}$	=	max.	13	kV	max.	10	kV
(Frequency	f	=	max.	150	c/s	max.	150	c/s)
Output current	I_o	=	max.	1.25	A	max.	1.25	A
(Averaging time	T_{av}	=	max.	10	sec	max.	10	sec)
Peak anode current	I_{ap}	=	max.	5	A	max.	5	A
Surge current	I_{surge}	=	max.	40	A	max.	40	A
(Duration	T	=	max.	0.1	sec	max.	0.1	sec)
Condensed mercury temperature [1])	t_{Hg}	=		25 to 55	$^{\circ}$C		25 to 60	$^{\circ}$C
Ambient temperature [2])	t_{amb}	=		10 to 35	$^{\circ}$C		10 to 40	$^{\circ}$C

[1])[2]) See page 2

7Z2 2446

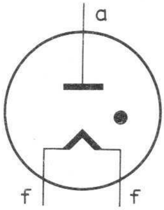
→ **MECHANICAL DATA** (Dimensions in mm)

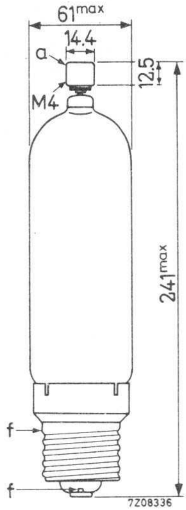
Base : Goliath

Socket : 65909BG/01

Anode connector : 40619

Net weight : 200 g





Mounting position: vertical with base down

OPERATING CONDITIONS

Transformer regulation and voltage drops in the tubes are neglected.

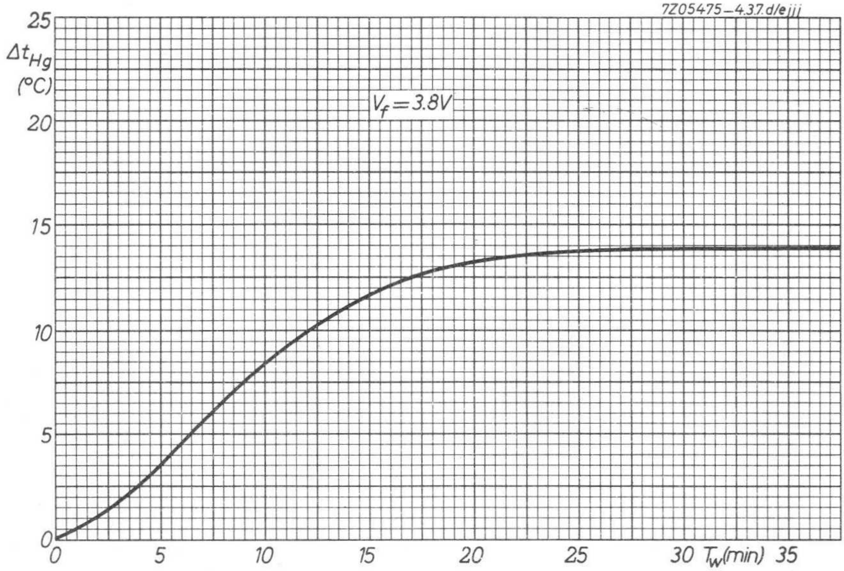
Peak inverse voltage $V_{a\,inv\,p}$ = 13 kV				
Circuit 3)	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	4.6	4.1	2.5	10.3
b	9.2	8.3	2.5	20.7
c	5.3	6.2	3.75	23.3
d	9.2	12.4	3.75	46.6
e	4.6	5.4	7.5	40.4
f	4.6	5.8	5.0	29
g	9.2	11.6	5.0	58

1) If the equipment is started not more than twice daily it is permitted to apply the high tension at a condensed mercury temperature of 20 °C.

2) With natural cooling.

3) For circuit see page 8 in front of this section.

7Z2 8900


7Z05475-4.3.7.d/ejjj
25
Δt_Hg
(°C)
20
15
10
5
0
V_f = 3.8V
0
5
10
15
20
25
30
T_w(min)
35

HIGH VOLTAGE
MERCURY VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA					
Peak inverse voltage	$V_{a\ inv_p}$	=	max.	13	kV
Peak forward voltage	V_{a_p}	=	max.	13	kV
Output current	I_o	=	max.	6	A
Peak anode current	I_{a_p}	=	max.	25	A
Peak grid current	I_{g_p}	=	max.	250	mA

HEATING: indirect; cathode oxide-coated, connected to heater

Heater voltage	V_f	=	5	V
Heater current	I_f	=	30	A
Cathode heating time	T_w	= min.	10	min.

CAPACITANCES

Anode to grid	C_{ag}	=	4	pF
Grid to cathode	C_g	=	15	pF

TYPICAL CHARACTERISTICS

Arc voltage	V_{arc} (I_o = 6 A)	=	12	V
Ionization time	T_{ion}	<	50	μsec
De-ionization time	T_{dion}	<	1000	μsec

LIMITING VALUES (Absolute limits)

Peak inverse anode voltage	$V_{a\ inv_p}$	=	max.	13	kV
(Frequency	f	=	max.	150	Hz)
Peak forward anode voltage	V_{a_p}	=	max.	13	kV
Output current	I_o	=	max.	6	A
(Averaging time	T_{av}	=	max.	5	sec)
Peak anode current	I_{a_p}	=	max.	25	A

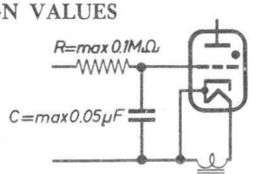
7Z2 3882

LIMITING VALUES (continued)

Surge current	I_{surge}	=	max.	250	A
(Duration	T	=	max.	0.1	sec)
Grid current	I_g	=	max.	50	mA
(Averaging time	T_{av}	=	max.	5	sec)
Peak grid current	I_{g_p}	=	max.	250	mA
Condensed mercury temperature	t_{Hg}	=		25 to 55	^{o}C
Ambient temperature	t_{amb}	=		20 to 45	^{o}C [1])

During continuous operation V_g must never be positive when V_a is negative. Use of grid control for continuous reduction of the output voltage is not recommended.

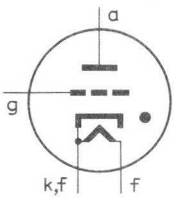
CIRCUIT DESIGN VALUES

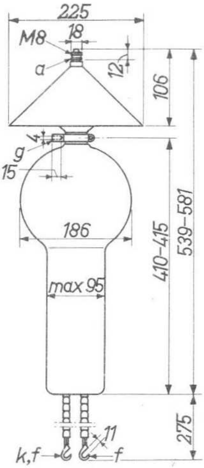


MECHANICAL DATA

Net weight: 2.3 kg

Dimensions in mm





The red marked filament lead is connected to the cathode

Mounting position: vertical with anode terminal up

ACCESSORIES

Plug pin for grid connection: 08 281 72

Anode cap: 40612

1) With natural cooling; approximate values

7Z2 3883

HIGH-VOLTAGE
MERCURY-VAPOUR RECTIFYING TUBE

DCG5/5000GB replaced by type ZY1000
DCG5/5000GS replaced by type ZY1001
DCG5/5000EG replaced by type ZY1002

7Z2 8901

HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA				
Peak inverse voltage	$V_{a\,inv_p}$	= max. 15 kV	max. 2.5 kV
Output current	I_o	= max. 3 A	max. 5 A
Peak anode current	I_{ap}	= max. 12 A	max. 20 A

HEATING: direct; filament oxide-coated

Filament voltage	V_f	= 5 V
Filament current	I_f	= 11.5 A
Cathode heating time	T_w	= min. 60 sec

Phase shift of $90^o \pm 30^o$ between V_a and V_f and use of a centre-tapped filament transformer is recommended.

After transport and after a long interruption of service a waiting time of at least 30 minutes between the switching on of the filament voltage and the switching on of the anode voltage should be observed.

TYPICAL CHARACTERISTICS

Arc voltage	V_{arc} (I_a = 3 A) =	12 V
Equilibrium condensed mercury temperature rise over ambient temperature	no load	19 ^oC
	full load	21 ^oC

LIMITING VALUES (Absolute limits)

Peak inverse voltage	$V_{a\,inv_p}$	= max. 15 kV	max. 2.5 kV
(Frequency	f	= max. 150 Hz	max. 150 Hz)
Output current	I_o	= max. 3 A	max. 5 A
(Averaging time	T_{av}	= max. 10 sec	max. 10 sec)
Peak anode current	I_{ap}	= max. 12 A	max. 20 A
Surge current	I_{surge}	= max. 120 A	max. 200 A
(Duration	T	= max. 0.1 sec	max. 0.1 sec)

7Z2 2465

LIMITING VALUES (Absolute limits) (continued)

Peak inverse voltage	$V_{a\,invp}$		15	10	2.5	kV
Condensed mercury temperature	t_{Hg}	1)	25-55	25-60	25-75	°C
Ambient temperature	t_{amb}	2)	15-35	15-40	15-55	°C

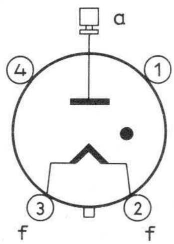
→ **MECHANICAL DATA** (Dimensions in mm)

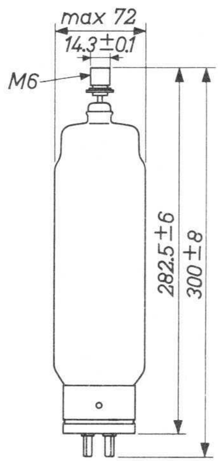
Base : Super Jumbo with bayonet

Anode connector : 40619

Socket : 2422 511 01001

Net weight : 450 g





Mounting position : vertical with base down

1) If the equipment is started not more than twice daily, it is permitted to apply high tension at a condensed mercury temperature of 20 °C

2) With natural cooling

7Z2 8902

MAXIMUM OPERATING CONDITIONS

Transformer regulation and voltage drops in the tubes are neglected.

Peak inverse voltage $V_{a\,inv_p}$ = 15 kV				
Circuit [1]	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	5.3	4.8	6	28.8
b	10.6	9.6	6	57.6
c	6.1	7.2	9	64.8
d	10.6	14.4	9	130
e	5.3	6.2	18	112
f	5.3	6.7	12	80.4
g	10.6	13.5	12	162

Peak inverse voltage $V_{a\,inv_p}$ = 2.5 kV				
Circuit [1]	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	0.88	0.79	10	7.9
b	1.76	1.58	10	15.8
c	1.02	1.19	15	17.9
d	1.76	2.38	15	35.8
e	0.88	1.03	30	30.9
f	0.88	1.13	20	22.6
g	1.76	2.26	20	45.2

[1]) For circuits see page 8 in front of this section.

7Z2 2467

TYPICAL OPERATING CHARACTERISTICS

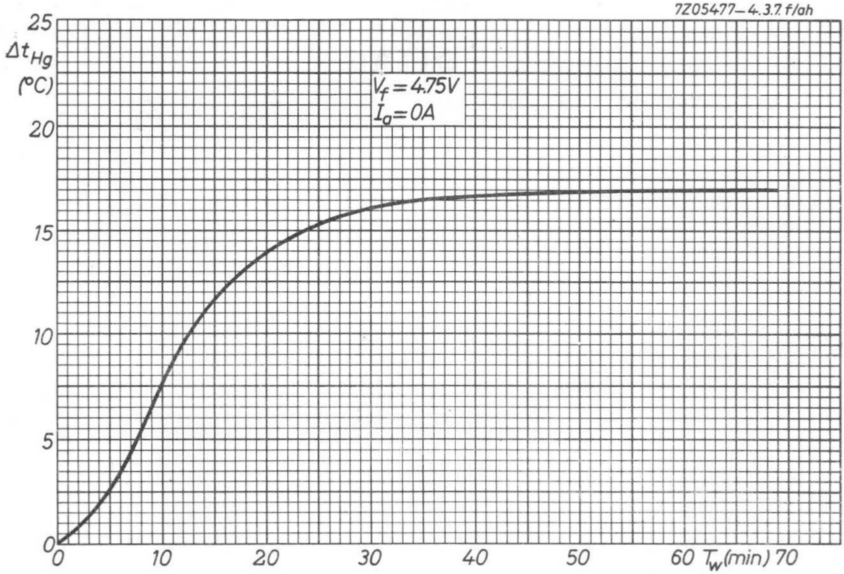
Peak inverse voltage $V_{a\,inv_p}$ = max. 15 kV 2)				
Circuit 1)	Transformer voltage V_{tr} (kV_{RMS})	Output 3) voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	4.8	4.0	6	24
b	9.6	8.0	6	48
c	5.55	6.0	9	54
d	9.6	12.0	9	108
e	4.8	5.15	18	93
f	4.8	5.6	12	67
g	9.6	11.2	12	134

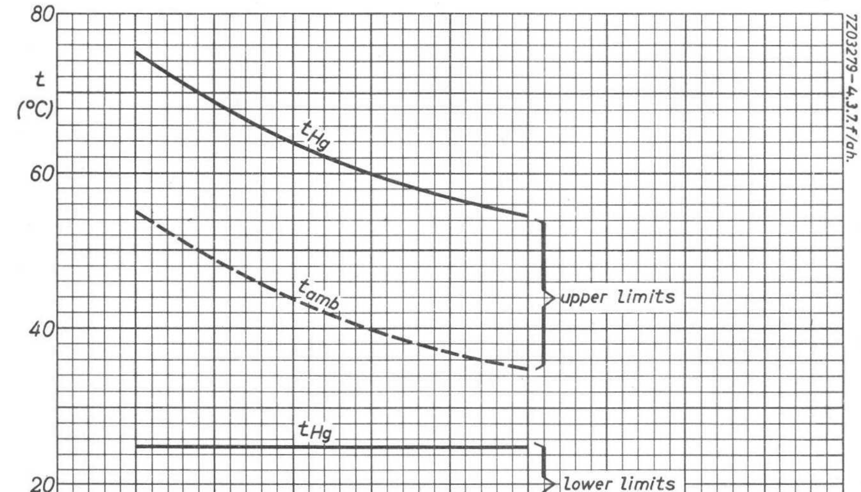
1) For circuits see page 8 in front of this section

2) This value corresponds to a nominal peak inverse anode voltage of 13.6 kV, allowing a mains voltage fluctuation of ± 10 %

3) Tube voltage drop and losses in transformer, filter, etc., amounting to 8% of the output voltage across the load, have already been deducted

7Z2 2468


7Z05477—4.3.7.f/ah
25
Δt_Hg
(°C)
20
15
10
5
0
V_f = 4.75V
I_a = 0A
0
10
20
30
40
50
60 T_w(min) 70


7Z03279—4.3.7.f/ah.
80
t
(°C)
60
40
20
t_Hg
t_amb
upper limits
t_Hg
t_amb
lower limits
0
5
10
15
20 V_ainvp (kV) 25

HIGH-VOLTAGE
MERCURY-VAPOUR RECTIFYING TUBE

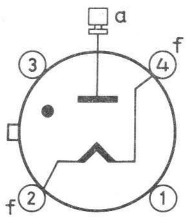
→ **MECHANICAL DATA**

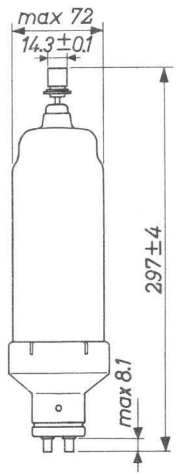
Dimensions in mm

Base : Jumbo 4p with bayonet

Socket : 2422 511 02001

Anode
connector : 40619





For further data and curves of this type
please refer to type DCG6/18

7Z2 8903

GRID-CONTROLLED HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA					
Peak inverse voltage	$V_{a\,inv_p}$	=	max.	13	kV
Peak forward voltage	V_{a_p}	=	max.	13	kV
Output current	I_o	=	max.	1	A
Peak anode current	I_{a_p}	=	max.	4	A
Negative grid voltage	$-V_g$	=	max.	300	V
Peak grid current	I_{g_p}	=	max.	50	mA

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=		5	V
Filament current	I_f	=		6.5	A
Cathode heating time	T_w	=	min.	60	sec

Phase shift of $90^o \pm 30^o$ between V_a and V_f and use of a centre-tapped filament transformer are recommended.

After transport and after a long interruption of service a waiting time of at least 60 minutes between the switching on of the filament voltage and the switching on of the anode voltage should be observed.

CAPACITANCES

Anode to grid	C_{ag}	=	3	pF
Grid to cathode	C_g	=	8	pF

TYPICAL CHARACTERISTICS

Arc voltage	V_{arc} (I_a = 1 A)	=	12	V
Ionization time	T_{ion}	=	10	μsec
Deionization time	T_{dion}	=	250	μsec

7Z2 2459

LIMITING VALUES (Absolute limits)

When the anode voltage V_a is negative,
the grid voltage must never be positive

Peak inverse voltage	$V_{a\,inv_p}$	= max.	13	kV
(Frequency	f	= max.	150	Hz)
Peak anode voltage	V_{a_p}	= max.	13	kV
Output current	I_o	= max.	1	A
(Averaging time	T_{av}	= max.	10	sec)
Peak anode current	I_{a_p}	= max.	4	A
Surge current	I_{surge}	= max.	40	A
(Duration	T	= max.	0.1	sec)
Negative grid voltage [1]	$-V_g$	= max.	300	V
Grid current	I_g	= max.	10	mA
(Averaging time	T_{av}	= max.	10	sec)
Peak grid current	I_{g_p}	= max.	50	mA
{ Peak inverse voltage	$V_{a\,inv_p}$	=	13	kV
{ Condensed mercury temperature [2]	t_{Hg}	=	25 to 55	^oC
{ Ambient temperature [3]	t_{amb}	=	15 to 30	^oC
{ Peak inverse voltage	$V_{a\,inv_p}$	=	10	kV
{ Condensed mercury temperature [2]	t_{Hg}	=	25 to 60	^oC
{ Ambient temperature [3]	t_{amb}	=	15 to 35	^oC

---

[1]) Before conduction

[2]) If the equipment is started not more than twice daily it is permitted to apply high tension at a condensed mercury temperature of 20^{o}C

[3]) With natural cooling

7Z2 2460

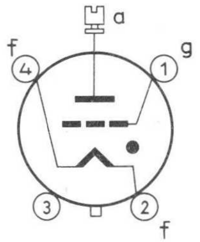
MECHANICAL DATA (Dimensions in mm)

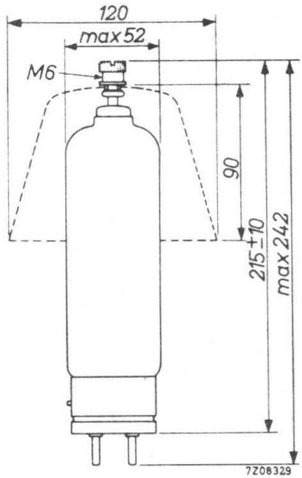
Base : Special Jumbo with bayonet

Socket : 2422 511 01001

Anode cap : 40616 1)

Net weight : 240 g





Mounting position: vertical with base down

1) This cap must always be mounted on the tube, thus also during preheating

7Z2 8904

OPERATING CONDITIONS

Transformer regulation and voltage drops in the tubes are neglected.

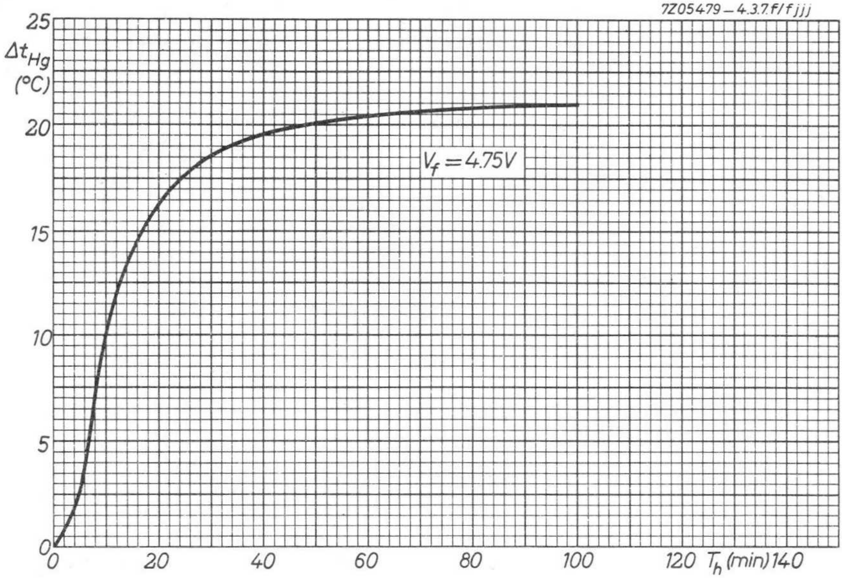
Grid voltage	V_g ($V_{a\,inv_p}$ = 13 kV)	= −100	V
Grid voltage	V_g ($V_{a\,inv_p}$ = 10 kV)	= −50	V
Grid current	I_g	= 1	mA

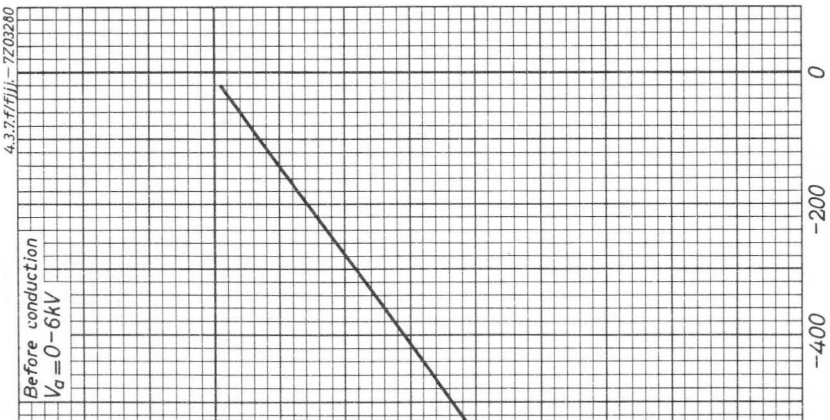
Peak inverse voltage $V_{a\,inv_p}$ = 13 kV				
Circuit [1]	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	4.6	4.1	2	8.3
b	9.2	8.3	2	16.6
c	5.3	6.2	3	18.6
d	9.2	12.4	3	37.2
e	4.6	5.4	6	32.4
f	4.6	5.8	4	23.4
g	9.2	11.7	4	46.8

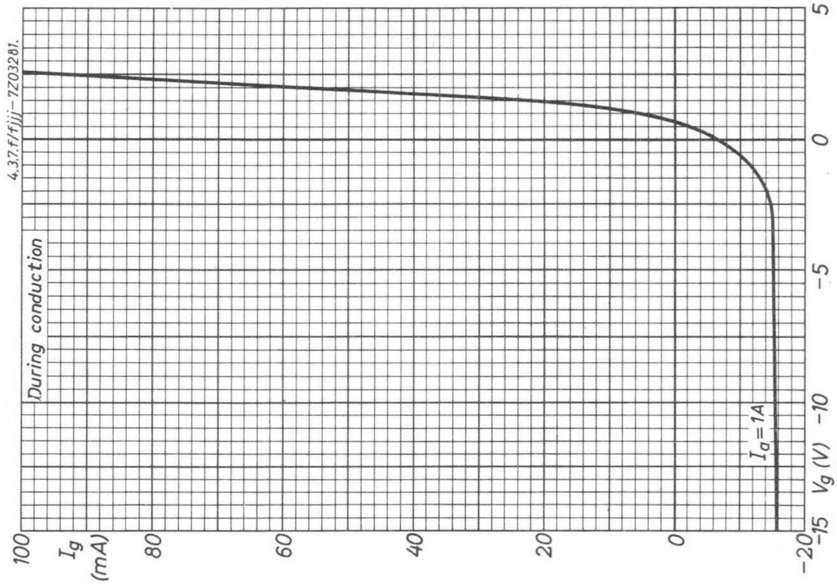
Peak inverse voltage $V_{a\,inv_p}$ = 10 kV				
Circuit [1]	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	3.5	3.2	2	6.4
b	7	6.4	2	12.8
c	4.1	4.8	3	14.4
d	7	9.6	3	28.8
e	3.5	4.1	6	24.8
f	3.5	4.5	4	18
g	7	9	4	36

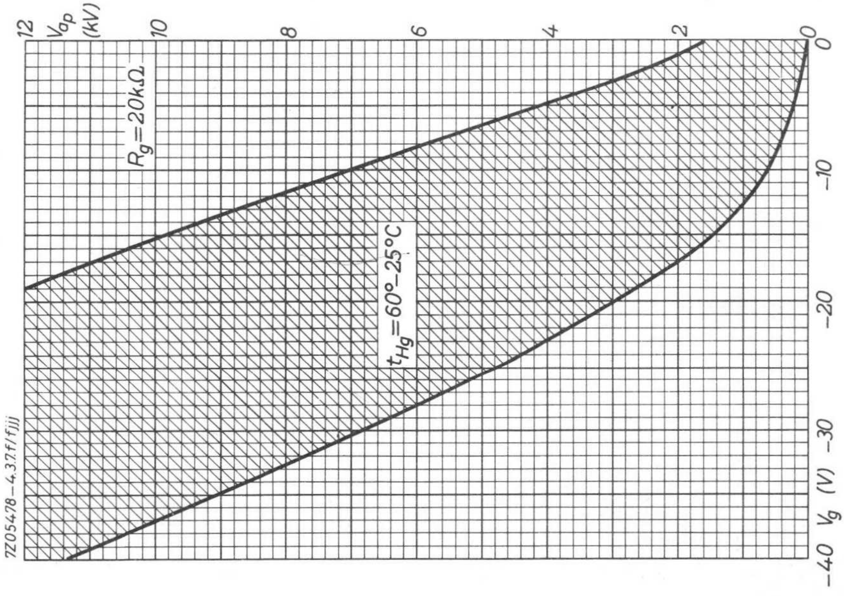
[1]) For circuits see page 8 in front of this section

7Z2 2462


7Z05479 – 4.3.7.f/f jjj
25
Δt_Hg
(°C)
20
15
10
5
0
0
20
40
60
80
100
120 T_h (min) 140
V_f = 4.75V


4.3.7.f/fjjj.–7Z03280
Before conduction
V_a = 0 – 6kV
I_g (μA)
5
0
-5
-10
-15
-20
V_g (V)
0
-200
-400
-600


4.3.7.f/fjjj–7Z03281.
During conduction
Ia=1A
Ig (mA)
Vg (V)
100
80
60
40
20
0
−20
−15
−10
−5
0
5


7Z05478–4.3.7.f/fjjj
Rg=20kΩ
tHg=60°–25°C
Vap (kV)
Vg (V)
12
10
8
6
4
2
0
−40
−30
−20
−10
0

GRID-CONTROLLED HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA					
Peak inverse voltage	$V_{a\,inv_p}$	=	max.	15	kV
Peak forward voltage	V_{a_p}	=	max.	15	kV
Output current	I_o	=	max.	10	A
Peak anode current	I_{a_p}	=	max.	45	A
Peak grid voltage	V_{g_p}	=	max.	600	V

CATHODE: oxide-coated

HEATING: indirect, cathode connected to heater

Heater voltage	V_f	=		5	V
Heater current	I_f	=		14	A
Cathode heating time	T_w	=	min.	10	min.

After transport and after a long interruption of service a waiting time of at least 45 minutes between the switching on of the heater voltage and the switching on of the anode voltage should be observed. Moreover, 10 minutes after having switched on the heater voltage, preheating of the anode must be started by connecting the anode to a supply voltage V_b = max. 500 V via a resistor limiting the current I_o to 6 A.

TYPICAL CHARACTERISTICS

Arc voltage	V_{arc} (I_a = 15 A) =	12	V
Equilibrium condensed mercury temperature rise over ambient temperature	no load	27	°C
	full load	30	°C

7Z2 2452

LIMITING VALUES (Absolute limits)

Peak inverse voltage	$V_{a\,inv_p}$	= max.		15	kV
(Frequency	f	= max.		150	Hz)
Peak anode voltage	V_{a_p}	= max.		15	kV
Output current for continuous operation	I_o	= max.		10	A
(Averaging time	T_{av}	= max.		10	sec)
Output current for intermittent operation	I_o	= max.		15	A
(Averaging time	T_{av}	= max.		10	sec)
Peak anode current	I_{a_p}	= max.		45	A
Surge current	I_{surge}	= max.		600	A
(Duration	T	= max.		0.1	sec)
Peak grid voltage	V_{g_p}	= max.		600	V
Grid resistor	R_g	= max.		20	kΩ
Peak inverse voltage	$V_{a\,inv_p}$	=	15	10	kV
Condensed mercury temperature [1]	t_{Hg}	=	25 to 60	25 to 65	°C
Ambient temperature [2]	t_{amb}	=	10 to 30	10 to 35	°C

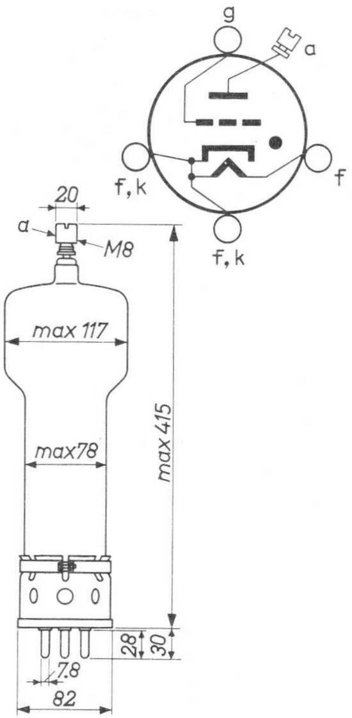
[1] If the equipment is started not more than twice daily it is permitted to apply high tension at a condensed mercury temperature of 20 °C.

[2] With natural cooling. The tube can be operated at higher ambient temperatures than the stated maxima, when the difference between the ambient and the condensed mercury temperature (30 °C with natural cooling) is reduced by an air flow directed at the bulb just above the base. A reduction to less than 10 °C can easily be obtained with a simple airjet.

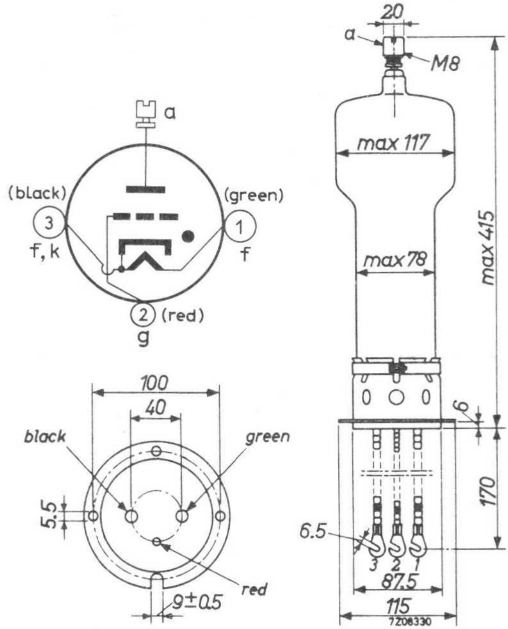
7Z2 2453

MECHANICAL DATA

Dimensions in mm ←



DCG7/100



DCG7/100B

Socket	:	40409
Anode connector	:	40620

Mounting position: vertical with anode terminal up

Net weight: 1200 g

7Z2 8905

MAXIMUM OPERATING CONDITIONS

Peak inverse voltage $V_{a\,inv_p}$ = 15 kV [2]				
Circuit [1]	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	5.3	4.8	20	96
b	10.6	9.6	20	192
c	6.1	7.2	30	216
d	10.6	14.4	30	432
e	5.3	6.2	60	372
f	5.3	6.7	40	268
g	10.6	13.5	40	540

TYPICAL OPERATING CONDITIONS

Peak inverse voltage $V_{a\,inv_p}$ = 15 kV [3]				
Circuit [1]	Transformer voltage V_{tr} (kV_{RMS})	Output [4] voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	4.8	4	20	80
b	9.6	8	20	160
c	5.55	6	30	180
d	9.6	12	30	360
e	4.8	5.15	60	309
f	4.8	5.6	40	224
g	9.6	11.2	40	448

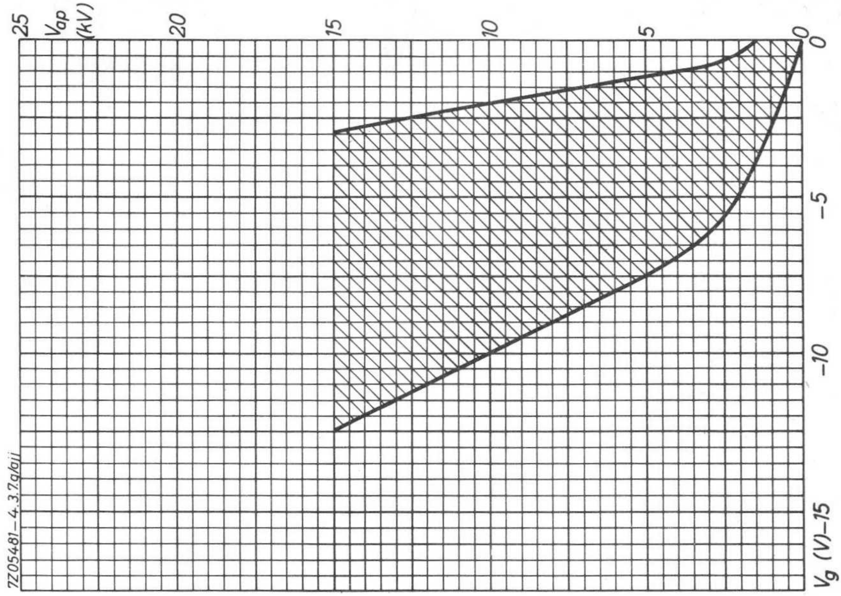
1) For circuits see page 8 in front of this section

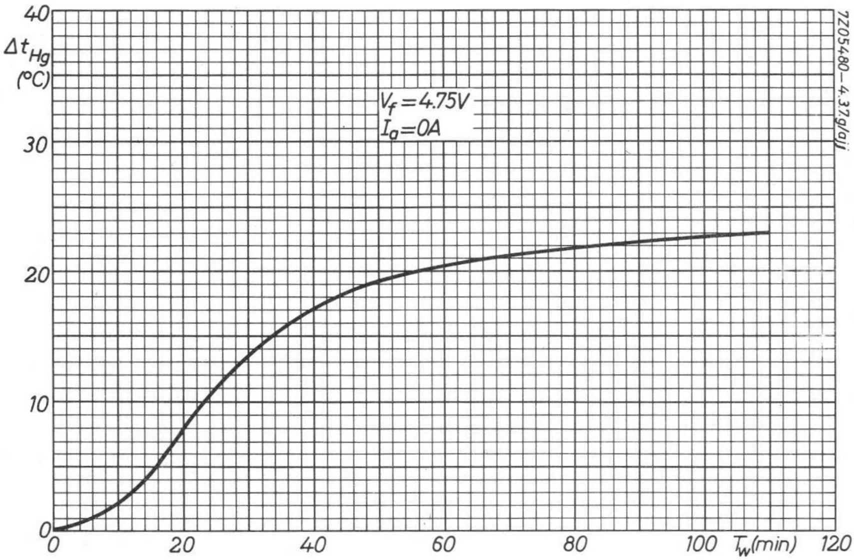
2) Transformer regulation and voltage drops in the tubes are neglected

3) This value corresponds to a nominal peak inverse anode voltage of 13.6 kV, allowance being made for mains voltage fluctuations of ± 10 %

4) Tube voltage drop and losses in transformer, filter, etc., amounting to 8% of the output voltage across the load, have already been deducted

7Z2 2455


25
Vap
(kV)
20
15
10
5
0
0
−5
−10
Vg (V)−15
7Z05481−4.3.7.g/aji


40
Δt Hg
(°C)
30
20
10
0
0
20
40
60
80
100
Tw(min)
120
Vf = 4.75V
Ia = 0A
7Z05480−4.3.7.g/aji

HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA				
Peak inverse voltage	$V_{a\,inv_p}$	= max.	21	kV
Output current	I_o	= max.	2.5	A
Peak anode current	I_{a_p}	= max.	10	A

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=	5	V
Filament current	I_f	=	13.5	A
Cathode heating time	T_w	= min.	90	sec

Phase shift of $90^{o} \pm 30^{o}$ between V_a and V_f and/or use of a centre-tapped filament transformer are recommended

After transport and after a long interruption of service a waiting time of at least 60 minutes between the switching on of the filament voltage and the switching on of the anode voltage should be observed

LIMITING VALUES (Absolute limits)

Peak inverse voltage	$V_{a\,inv_p}$	= max.	21	15	10	kV
(Frequency	f	= max.	150	150	150	c/s)
Output current	I_o	= max.	2.5	2.5	2.5	A
(Averaging time	T_{av}	= max.	30	30	30	sec)
Peak anode current	I_{a_p}	= max.	10	10	10	A
Surge current	I_{surge}	= max.	100	100	100	A
(Duration	T	= max.	0.1	0.1	0.1	sec)
Condensed mercury temperature [1])	t_{Hg}	=	25-45	25-50	25-60	°C
Ambient temperature [2])	t_{amb}	=	15-30	15-35	15-45	°C

[1]) If the equipment is started not more than twice daily it is permitted to apply high tension at a condensed mercury temperature of 20°C.

[2]) With natural cooling

7Z2 2456

TYPICAL CHARACTERISTICS

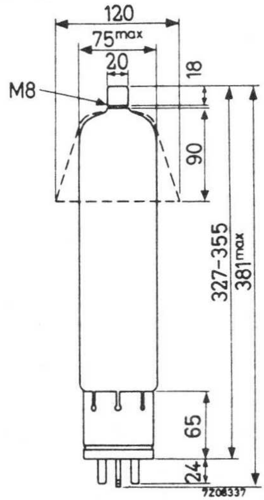
Deionization time	T_{dion}	< 500 µsec
Ionization time	T_{ion}	< 10 µsec
Arc voltage	V_{arc} (I_a = 2.5 A)	= 12 V

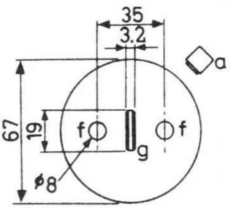
MECHANICAL DATA Dimensions in mm

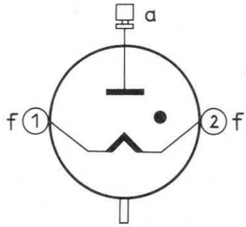
Anode connector: 40620

Anode cap : 40616

Net weight : 0.75 g







Mounting position: vertical with base down

The anode cap 40616 must always be mounted on the tube, thus also during pre-heating

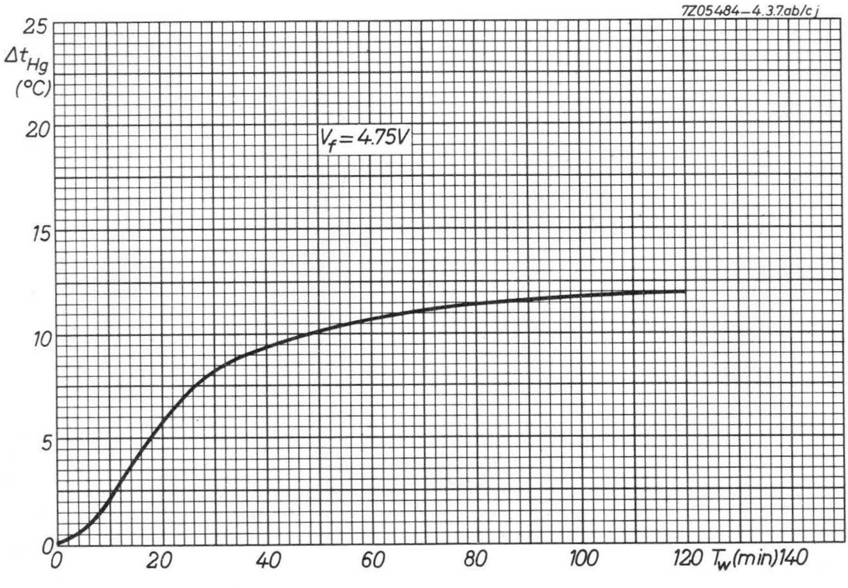
OPERATING CONDITIONS

Transformer regulation and voltage drops in the tubes are neglected

Peak inverse voltage $V_{a\ inv_p}$ = 21 kV				
Circuit 1)	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	7.4	6.7	5	33.5
b	14.8	13.4	5	67
c	8.6	10	7.5	75
d	14.8	20	7.5	150
e	7.4	8.7	15	130
f	7.4	9.5	10	95
g	14.8	19	10	190

1) For circuits see page 8 in front of this section

7Z2 8906


7Z05484–4.3.7.ab/cj
25
Δt_{Hg}
(°C)
20
15
10
5
0
$V_f = 4.75V$
0
20
40
60
80
100
120
T_w(min)
140

GRID-CONTROLLED HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBE

QUICK REFERENCE DATA					
Peak inverse voltage	$V_{a\,inv_p}$	=	max.	27	kV
Peak forward voltage	V_{a_p}	=	max.	27	kV
Output current	I_o	=	max.	2.5	A
Peak anode current	I_{a_p}	=	max.	10	A
Negative grid voltage	$-V_g$	=	max.	300	V
Peak grid current	I_{g_p}	=	max.	125	mA

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=		5	V
Filament current	I_f	=		13.5	A
Cathode heating time	T_w	=	min.	90	sec

Phase shift of $90^o \pm 30^o$ between V_a and V_f and use of a centre-tapped filament transformer are recommended

After transport and after a long interruption of service a waiting time of at least 60 minutes between the switching on of the filament voltage and the switching on of the anode voltage should be observed

CAPACITANCES

Anode to grid	C_{ag}	=	4	pF
Grid to cathode	C_g	=	13	pF

TYPICAL CHARACTERISTICS

Deionization time	T_{dion}	<	500	µsec
Ionization time	T_{ion}	<	10	µsec
Arc voltage	V_{arc} (I_a = 2.5 A)	=	12	V

7Z2 2469

LIMITING VALUES (Absolute limits)

When the anode voltage V_a is negative, the grid voltage must never be positive

Peak inverse voltage	$V_{a\,inv_p}$	=	max.	27	kV
(Frequency	f	=	max.	150	c/s)
Peak anode voltage	V_{a_p}	=	max.	27	kV
Output current	I_o	=	max.	2.5	A
(Averaging time	T_{av}	=	max.	30	sec)
Peak anode current	I_{a_p}	=	max.	10	A
Surge current	I_{surge}	=	max.	100	A
(Duration	T	=	max.	0.1	sec)
Negative grid voltage	$-V_g$	=	max.	300	V [1])
Grid current	I_g	=	max.	25	mA
(Averaging time	T_{av}	=	max.	30	sec)
Peak grid current	I_{g_p}	=	max.	125	mA

$V_{a\,inv_p}$	27	21	15	13	10	kV
t_{Hg} [2])	30-40	30-45	25-50	25-55	25-60	°C
t_{amb} [3])	20-25	20-30	15-35	15-40	15-45	°C

[1]) Direct voltage; before conduction

[2]) If the equipment is started not more than twice daily it is permitted to apply high tension at a condensed mercury temperature which is 5 °C less than the values mentioned in the table

[3]) With natural cooling

7Z2 2470

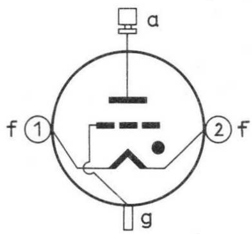
MECHANICAL DATA (Dimensions in mm)

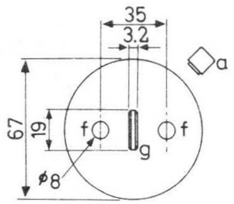
Anode connector: 40620

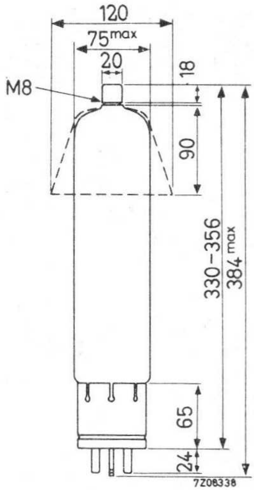
Anode cap : 40616

This cap must always be mounted on the tube, thus also during preheating

Net weight: 0.75 kg







Mounting position: vertical with base down

OPERATING CONDITIONS

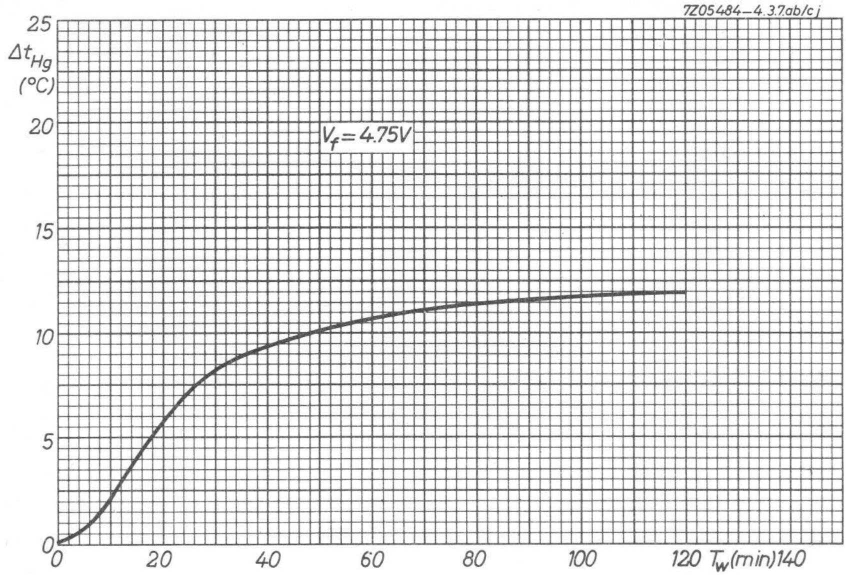
Transformer regulation and voltage drops in the tubes are neglected

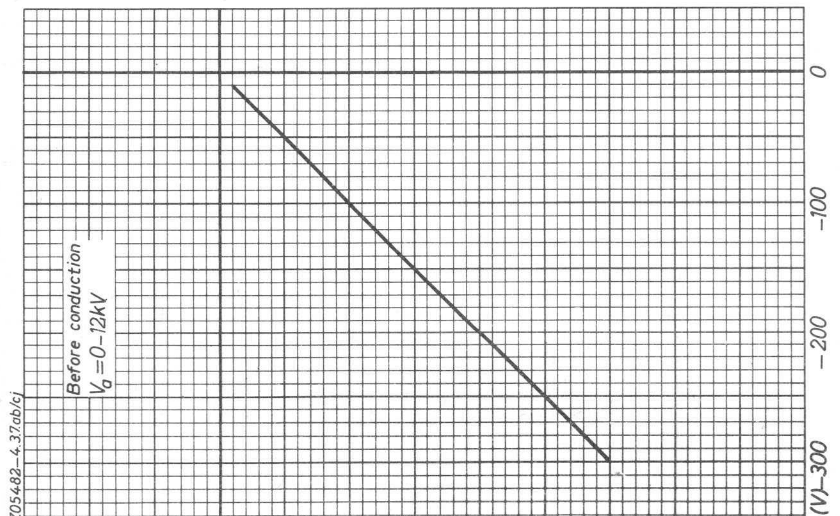
Grid voltage	V_g ($V_{a\,inv_p}$ = 27 kV)	= -100	V
Grid voltage	V_g ($V_{a\,inv_p}$ = 10 kV)	= -50	V
Grid current	I_g	= 2	mA

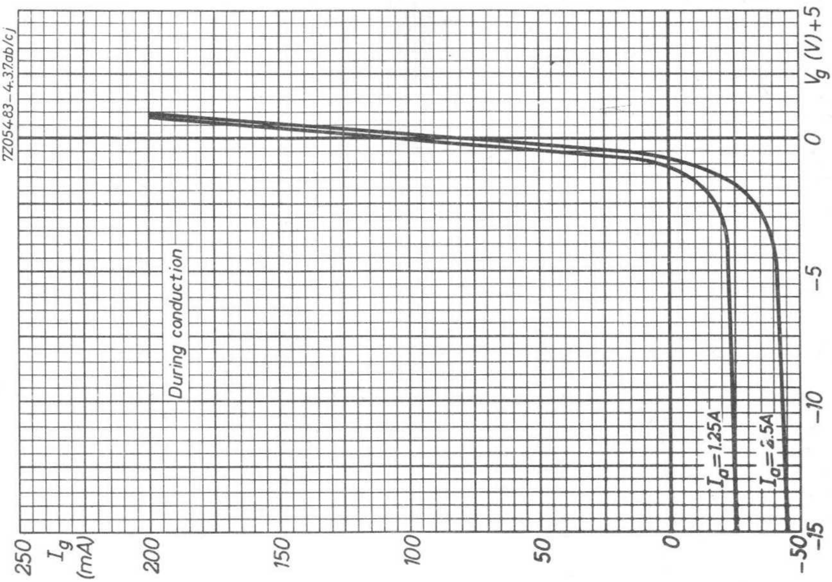
Peak inverse voltage $V_{a\,inv_p}$ = 27 kV				
Circuit [1]	Transformer voltage	Output voltage	Output current	Power output
	V_{tr} (kV RMS)	V_o (kV)	I_o (A)	W_o (kW)
a	9.5	8.6	5	43
b	19.1	17.2	5	86
c	11	12.9	7.5	97
d	19.1	25.8	7.5	194
e	9.5	11.2	15	168
f	9.5	12.1	10	121
g	19.1	24.3	10	243

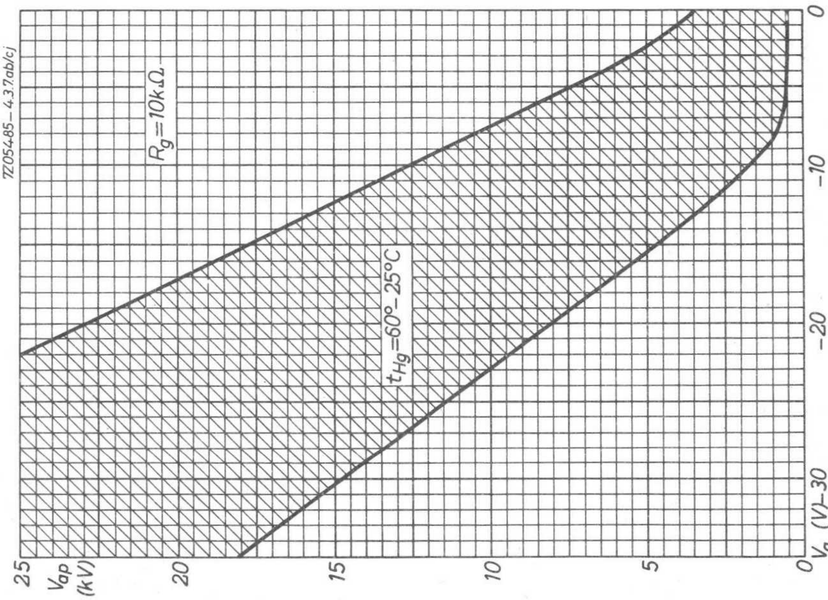
[1]) For circuits see page 8 in front of this section

7Z2 8907


7Z05484–4.3.7.ab/cj
25
Δt_{Hg}
(°C)
20
15
10
5
0
V_f = 4.75V
0
20
40
60
80
100
120
T_w(min)
140


Before conduction
V_a = 0–12kV
7Z05482–4.3.7.ab/cj
5
I_g
(μA)
0
–5
–10
–15
–20
V_g (V)
0
–100
–200
–300


7Z05483-4.37ab/cj
During conduction
I_a=1.25A
I_a=2.5A
I_g (mA)
250
200
150
100
50
0
-50
V_g (V)
-15
-10
-5
0
+5


7Z05485-4.37ab/cj
R_g=10kΩ
t_{Hg}=60°-25°C
V_{ap} (kV)
25
20
15
10
5
0
V_g (V)
-30
-20
-10
0

HIGH-VOLTAGE XENON-FILLED RECTIFYING TUBE

QUICK REFERENCE DATA					
Peak inverse voltage	$V_{a\,inv_p}$	= max. 10	kV	max. 5	kV
Output current	I_o	= max. 0.25	A	max. 0.5	A
Peak anode current	I_{a_p}	= max. 1	A	max. 2	A

HEATING: direct; filament oxide-coated

Filament voltage	V_f	= 2.5	V
Filament current	I_f	= 5	A
Cathode heating time	T_w	= min. 10	sec

Phase shift of $90^o \pm 30^o$ between V_a and V_f and use of a centre-tapped filament transformer are recommended. In order to obtain a low ignition voltage the voltage on pin 4 should be positive with respect to pin 1 at the moment of ignition.

TYPICAL CHARACTERISTICS

Arc voltage V_{arc} (I_a = 0.5 A) = 12 V

LIMITING VALUES (Absolute limits)

Peak inverse voltage	$V_{a\,inv_p}$	= max. 10	kV	max. 5	kV
(Frequency	f	= max. 150	Hz	max. 500	Hz)
Output current	I_o	= max. 0.25	A	max. 0.5	A
(Averaging time	T_{av}	= max. 15	sec	max. 15	sec)
Peak anode current	I_{a_p}	= max. 1	A	max. 2	A
Surge current	I_{surge}	= max. 20	A	max. 20	A
(Duration	T	= max. 0.1	sec	max. 0.1	sec)
Ambient temperature	t_{amb}	= −55 to +75	^oC	−55 to +75	^oC

7Z2 3098

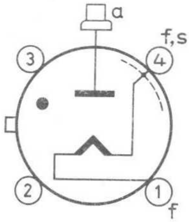
→ **MECHANICAL DATA** (Dimensions in mm)

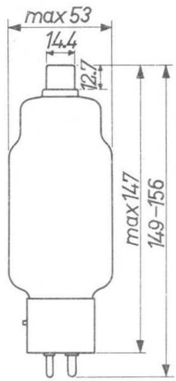
Base : medium 4p with bayonet

Socket : 2422 511 04001 [1])

Anode connector : 40619

Net weight : 100 g





Mounting position : arbitrary

[1]) At voltages above 2 kV the socket must be insulated from the chassis.

7Z2 8908

OPERATING CONDITIONS

Transformer regulation and voltage drops in the tubes are neglected.

Peak inverse voltage $V_{a\,inv_p}$ = 10 kV				
Circuit [1])	Transformer voltage V_{tr} (kVRMS)	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	3.5	3.2	0.5	1.6
b	7.1	6.4	0.5	3.2
c	4.1	4.8	0.75	3.6
d	7.1	9.6	0.75	7.2
e	3.5	4.1	1.5	6.2
f	3.5	4.5	1.0	4.5
g	7.1	9.0	1.0	9.0

Peak inverse voltage $V_{a\,inv_p}$ = 5 kV				
Circuit [1])	Transformer voltage V_{tr} (kV$_{RMS}$)	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	1.8	1.6	1.0	1.6
b	3.5	3.2	1.0	3.2
c	2.0	2.4	1.5	3.6
d	3.5	4.8	1.5	7.2
e	1.8	2.1	3.0	6.2
f	1.8	2.2	2.0	4.5
g	3.5	4.5	2.0	9.0

[1]) For circuits see page 8 in front of this section

7Z2 3100

HIGH-VOLTAGE
XENON-FILLED RECTIFYING TUBE

QUICK REFERENCE DATA				
Peak inverse voltage	$V_{a\,inv_p}$	= max.	10	kV
Output current	I_o	= max.	1.25	A
Peak anode current	I_{a_p}	= max.	5	A

HEATING: direct; filament oxide-coated

Filament voltage	V_f	=	5	V
Filament current	I_f	=	7.1	A
Cathode heating time	T_w	= min.	30	sec

Phase shift of $90^o \pm 30^o$ between V_a and V_f and use of a centre-tapped filament transformer are recommended. In order to obtain a low ignition voltage the voltage on pin 4 should be positive with respect to pin 2 at the moment of ignition.

TYPICAL CHARACTERISTICS

Arc voltage V_{arc} (I_a = 1.25 A) = 12 V

LIMITING VALUES (Absolute limits)

Peak inverse voltage	$V_{a\,inv_p}$	= max.	10	kV
(Frequency	f	= max.	150	c/s)
Output current	I_o	= max.	1.25	A
(Averaging time	T_{av}	= max.	15	sec)
Peak anode current	I_{a_p}	= max.	5	A
Surge current	I_{surge}	= max.	50	A
(Duration	T	= max.	0.1	sec)
Ambient temperature	t_{amb}	=	−55 to +70	^oC

7Z2 2463

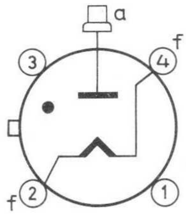
MECHANICAL DATA (Dimensions in mm)

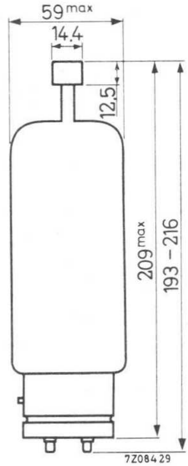
Base : Jumbo 4p

Socket : 2422 511 02001

Anode connector : 40619

Net weight : 190 g





Mounting position : arbitrary

OPERATING CONDITIONS

Transformer regulation and voltage drops in the tubes are neglected.

Peak inverse voltage $V_{a\,inv_p}$ = 10 kV				
Circuit [1]	Transformer voltage V_{tr} (kV_{RMS})	Output voltage V_o (kV)	Output current I_o (A)	Power output W_o (kW)
a	3.5	3.2	2.5	8
b	7.1	6.4	2.5	16
c	4.1	4.8	3.75	18
d	7.1	9.6	3.75	36
e	3.5	4.1	7.5	31
f	3.5	4.5	5.0	22.5
g	7.1	9.0	5.0	45

[1]) For circuits see page 8 in front of this section

7Z2 8909

GRID-CONTROLLED HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBES

QUICK REFERENCE DATA						
Peak inverse voltage	$V_{a\,inv_p}$	= max.	21	15	2.5	kV
Peak forward voltage	V_{a_p}	= max.	21	15	2.5	kV
Output current	I_o	= max.	2.5	3	5	A
Peak anode current	I_{a_p}	= max.	10	12	20	A

HEATING : direct; filament oxide coated

Filament voltage	V_f	=	5	V	1)
Filament current	I_f	=	13	A	
Waiting time	T_w	= min.	90	sec	2)

TYPICAL CHARACTERISTICS

Deionization time	T_{dion}	< 500	μsec
Ionization time	T_{ion}	< 10	μsec
Arc voltage	V_{arc} (I_o = 3 A)	= 12	V

LIMITING VALUES (Absolute limits)

Peak inverse voltage	$V_{a\,inv_p}$	=	max. 21	15	2.5	kV	3)
Peak forward voltage	V_{a_p}	=	max. 21	15	2.5	kV	
Output current	I_o	=	max. 2.5	max. 3	max. 5	A	4)
Peak anode current	I_{a_p}	=	max. 10	max. 12	max. 20	A	
Surge current	I_{surge}	=	max. 100	max. 120	max. 200	A	5)
Negative grid voltage	$-V_g$	=	max. 300	max. 300	max. 300	V	6)
Grid circuit resistance	R_g	=	min. 10 max. 100	min. 10 max. 100	min. 10 max. 100	kΩ kΩ	7)

1) 2) 3) 4) 5) 6) 7) See page 2

7Z2 3829

TEMPERATURE LIMITS (Absolute limits)

Peak inverse voltage	$V_{a\ inv_p}$	=	21	15	10	2.5	kV
Condensed mercury temperature	t_{Hg}	=	25-45	25-55	25-60	25-75	°C [8]
Ambient temperature	t_{amb}	=	15-30	15-35	15-40	15-55	°C [9]

---

1) Phase shift of $90^o \pm 30^o$ between V_a and V_f and/or use of a centre-tapped filament transformer are recommended.

2) For average conditions, i.e. temperature within limits and proper distribution of mercury (see page A).
After transport and also after a long interruption of service a longer waiting time is required before anode voltage is applied to ensure proper distribution of the mercury. In general, a time of 60 minutes will be sufficient.

3) f = max. 150 c/s

4) T_{av} = max. 30 sec

5) T = max. 0.1 sec

6) Direct voltage; before conduction

7) Recommended value 33 kΩ

8) If the equipment is started not more than twice daily it is permitted to apply high tension at a condensed mercury temperature of 20 °C.

9) Approximate values with natural cooling.
The ambient temperature is defined as the temperature of the surrounding air and should be measured under the following conditions:
a. normal atmospheric pressure
b. the tube should be adjusted to the worst probable operating conditions
c. the temperature should be measured when thermal equilibrium has been reached
d. the distance of the thermometer from the envelope shall be 75 mm (measured in the plane perpendicular to the main axis of the tube at the height of the condensed mercury boundary)
e. the thermometer shall be shielded to avoid direct heat radiation.

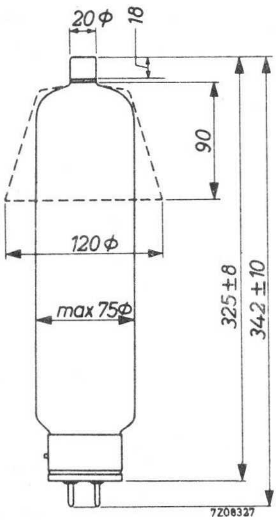
7Z2 3901

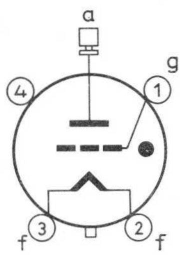
→ MECHANICAL DATA

Dimensions in mm

Net weight: 0.75 kg

ZT 1000





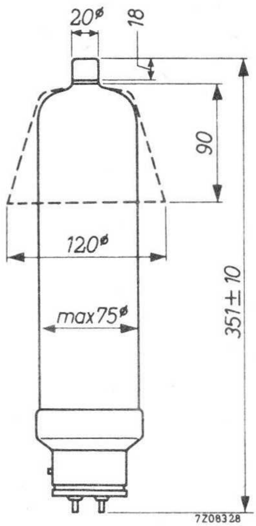
Base: Super Jumbo with bayonet

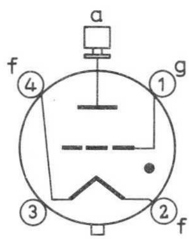
Socket : 2422 511 01001

Anode connector: 40620

Anode cap : 40616

ZT 1001





Base: Jumbo 4p with bayonet

Socket : 2422 511 02001

Anode connector: 40620

Anode cap : 40616

Mounting position: vertical with base down

The anode cap 40616 is not delivered with the tube but must always be mounted on the tube, thus also during preheating.

7Z2 8910

OPERATING CONDITIONS

Transformer regulation and voltage drop in the tubes have been neglected

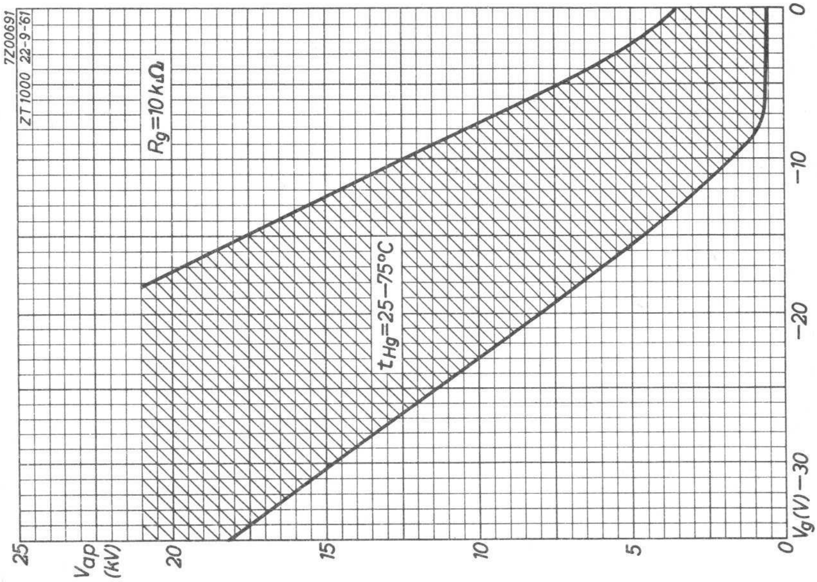
Grid voltage	V_g ($V_{a\ invp}$ = 21 kV)	= -100	V
Grid voltage	V_g ($V_{a\ invp}$ = 10 kV)	= -50	V
Grid current	I_g	= 2	mA

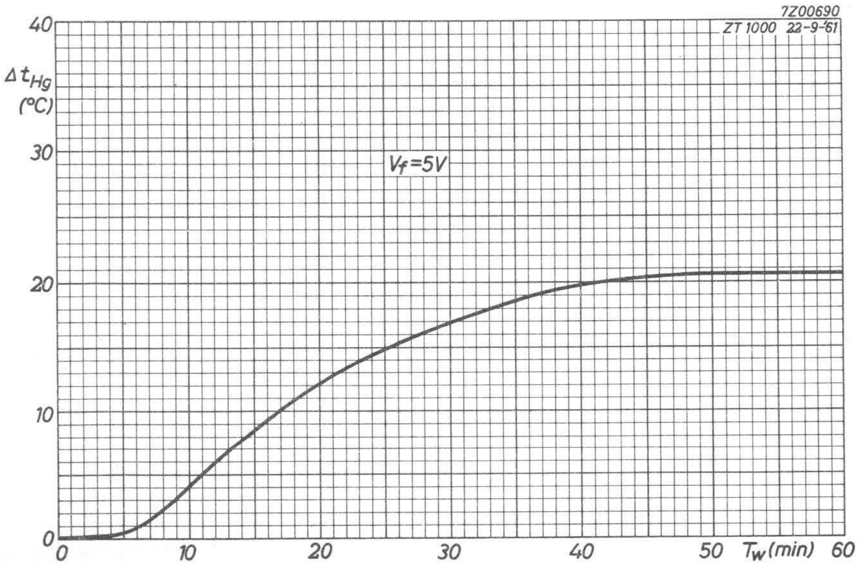
Peak anode inverse voltage $V_{a\ invp}$ = 21 kV				
Circuit [1]	Transformer voltage	Output voltage	Output current	Output power
	V_{tr} (kV_{RMS})	V_o (kV)	I_o (A)	W_o (kW)
a	7.4	6.7	5	33.5
b	14.8	13.4	5	67
c	8.5	10	7.5	75
d	14.8	20	7.5	150

Peak anode inverse voltage $V_{a\ invp}$ = 15 kV				
Circuit [1]	Transformer voltage	Output voltage	Output current	Output power
	V_{tr} (kV_{RMS})	V_o (kV)	I_o (A)	W_o (kW)
a	5.3	4.8	6	28.8
b	10.6	9.6	6	57.6
c	6.1	7.2	9	64.8
d	10.6	14.4	9	130

[1]) See page 8 in front of this section

7Z2 4139


7Z00691
ZT 1000 22-9-'61
R_g=10 kΩ
t_{Hg}=25−75°C
V_{ap} (kV)
25
20
15
10
5
0
V_g(V)
−30
−20
−10
0


7Z00690
ZT 1000 22-9-'61
Δt_{Hg} (°C)
40
30
20
10
0
V_f=5V
0
10
20
30
40
50
T_w(min)
60

HIGH-VOLTAGE MERCURY-VAPOUR RECTIFYING TUBES

QUICK REFERENCE DATA						
Peak inverse voltage	$V_{a\ invp}$	= max.	13.5	7	kV
Output current	I_o	= max.	1.5	1.75	A
Peak anode current	I_{ap}	= max.	6	7	A

HEATING: direct; filament oxide coated

Filament voltage	V_f	=	5	V
Filament current	I_f	=	7	A
Waiting time (t_{Hg} > 25 °C)	T_w	= min.	30	sec

A phase shift of 90° ± 30° between V_a and V_f and the use of a centre-tapped filament transformer are recommended.

When the condensed mercury temperature t_{Hg} < 25 °C the waiting time can be found with the aid of the curve on page A.

After transport or after long interruptions of operation the waiting time need not be prolonged.

TYPICAL CHARACTERISTICS

Arc voltage V_{arc} (I_o = 1.5 A) = 12 V

7Z2 3836

LIMITING VALUES (Absolute limits)

Mains frequency	f		up to 150	150	Hz
Peak inverse anode voltage	$V_{a\,inv_p}$	=	max. 13.5	7	kV
Output current	I_o	=	max. 1.5	1.75	A
(Averaging time	T_{av}	=	max. 10	10	sec)
Peak anode current	I_{a_p}	=	max. 6	7	A
Peak surge current	$I_{surge\,p}$	=	max. 50	50	A
(Duration	T	=	max. 0.1	0.1	sec)
Condensed mercury temperature	t_{Hg}	=	25 to 55	25 to 70	^oC [1])
Ambient temperature	t_{amb}	=	10 to 30	10 to 45	^oC [2])

[1]) If the equipment is started not more than twice daily, it is permitted to apply the high tension at a condensed mercury temperature of 20 ^oC.

[2]) Approximate values with natural cooling. The tube may be operated at higher ambient temperatures than the stated maxima, provided the difference between ambient and condensed mercury temperature (approximately 25 ^oC with natural cooling) is reduced by an air flow directed to the bulb just above the base. A reduction of the difference to less than 10 ^oC can easily be obtained with a simple air jet. Maximum life and best performance will be obtained when the condensed mercury temperature is kept at approx. 35 ^oC.

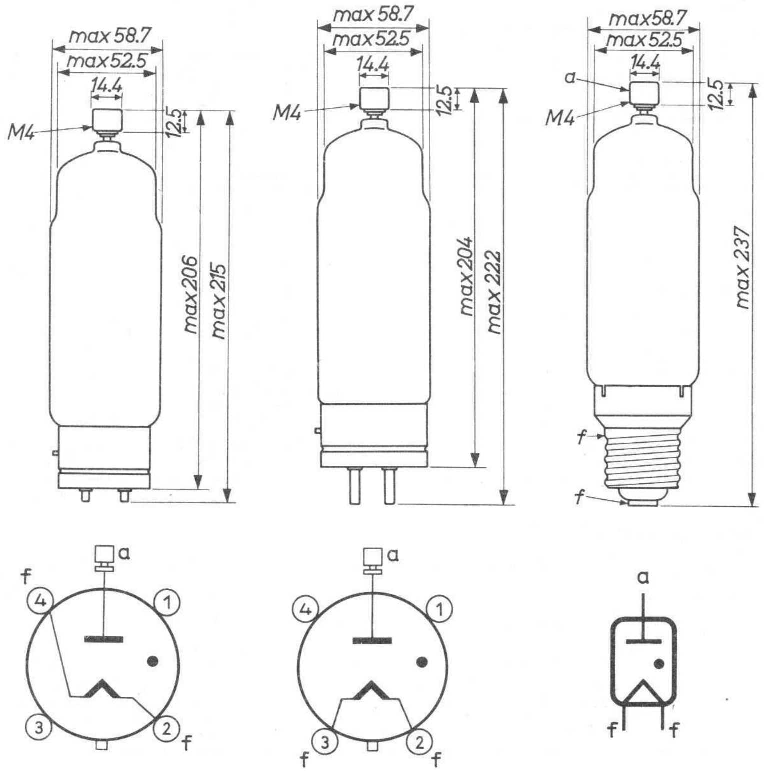
7Z2 3837

MECHANICAL DATA

Dimensions in mm

Net weight: 200 g

ZY1000 | **ZY1001** | **ZY1002**



Base : Jumbo 4p with bayonet

Socket: 2422 511 02001

Anode connector: 40619

Base : Super Jumbo with bayonet

Socket: 2422 511 01001

Anode connector: 40619

Base : Goliath

Socket: 65909 BG/01

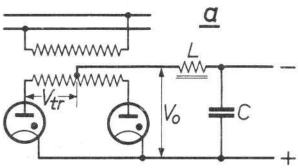
Anode connector: 40619

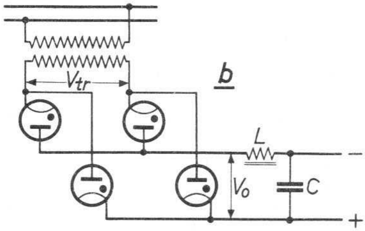
Mounting position: vertical with base down

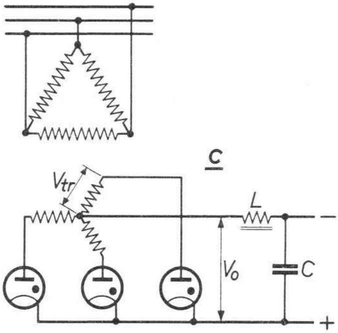
7Z2 8911

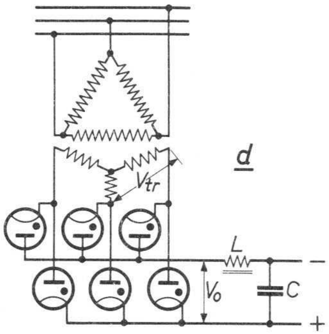
OPERATING CONDITIONS

Rectifier circuits









Maximum operating conditions

Transformer losses and voltage drops in the tubes have been neglected.

Peak inverse voltage $V_{a\ inv_p}$ = 13.5 kV				
Circuit	Transformer voltage	Output voltage	Output current	Output power
	V_{tr} (kV, RMS)	V_o (kV)	I_o (A)	W_o (kW)
a	4.75	4.3	3.0	12.9
b	9.55	8.6	3.0	25.8
c	5.50	6.45	4.5	29
d	9.55	12.9	4.5	58

7Z2 3839

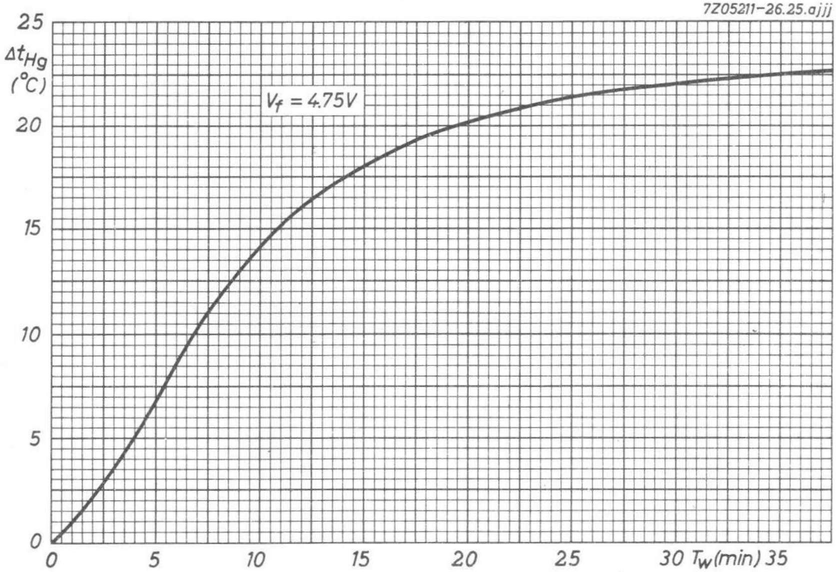
OPERATING CONDITIONS (continued)

Typical operating conditions

Peak inverse voltage $V_{a\ inv_p}$ = 12.3 kV (max. 13.5 kV [1])				
Circuit	Transformer voltage	Output voltage [2]	Output current	Output power
	V_{tr} (kV, RMS)	V_o (kV)	I_o (A)	W_o (kW)
a	4.35	3.6	3.0	10.8
b	8.7	7.2	3.0	21.6
c	5.0	5.4	4.5	24.3
d	8.7	10.8	4.5	48.6

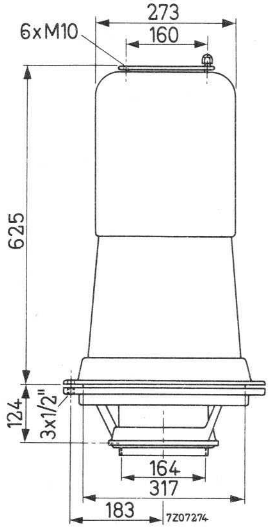
[1]) Corresponding with mains voltage fluctuations of 10%

[2]) Tube voltage drops and losses in transformer, filter, etc., amounting to 8% of the voltage across the load, have already been deducted. 7Z2 3840


7Z05211-26.25.ajjj
25
Δt_{Hg}
(°C)
20
15
10
5
0
V_f = 4.75V
0
5
10
15
20
25
30 T_W(min) 35

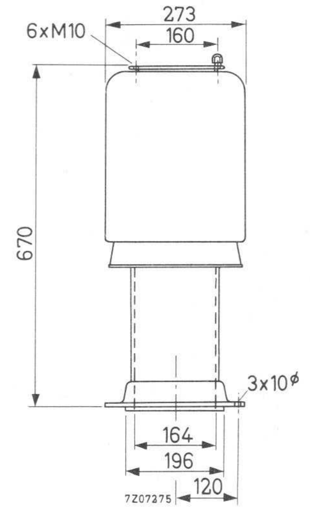
Associated accessories

COOLER HOUSING FOR AIR COOLING



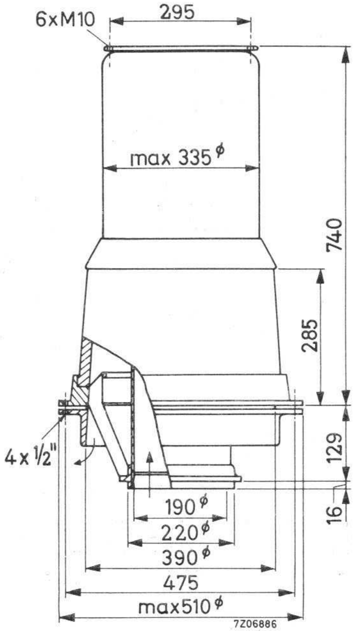
7Z2 8104

COOLER HOUSING FOR AIR COOLING



7Z2 8105

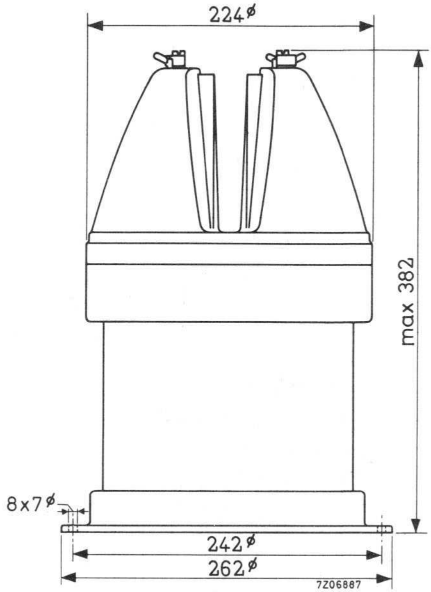
COOLER HOUSING FOR AIR COOLING



Net weight 72 kg

7Z2 8106

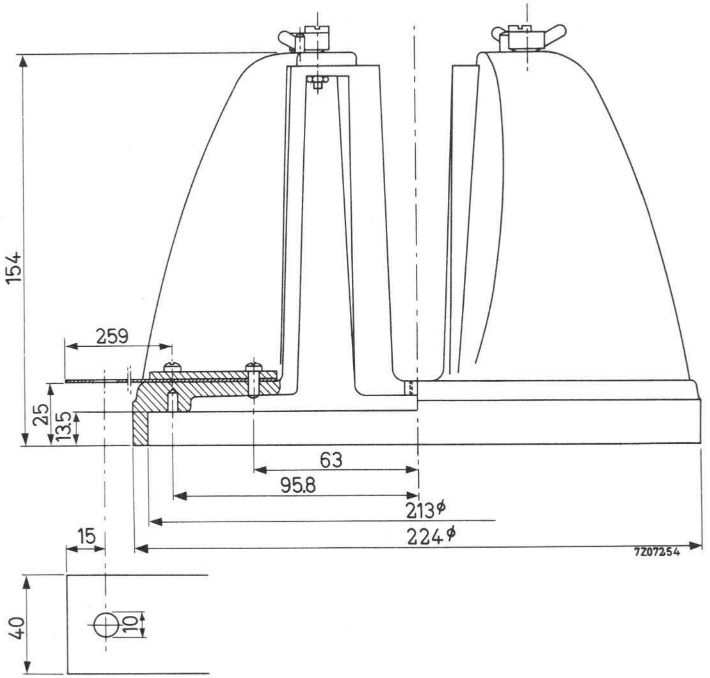
COOLER HOUSING FOR AIR COOLING



Net weight 7.4 kg

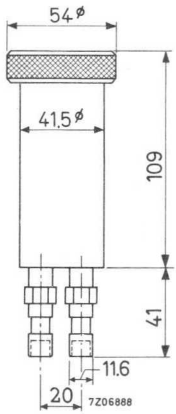
7Z2 1807

AIR DISTRIBUTOR
UPPER PART OF K508



7Z2 8108

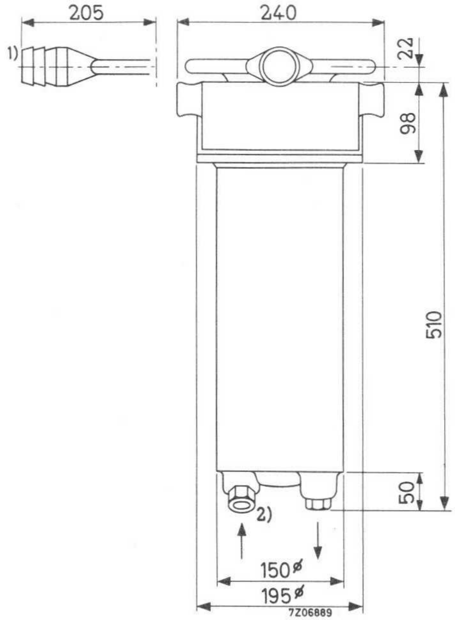
WATER JACKET



Net weight 0.52 kg

7Z2 8109

WATER JACKET

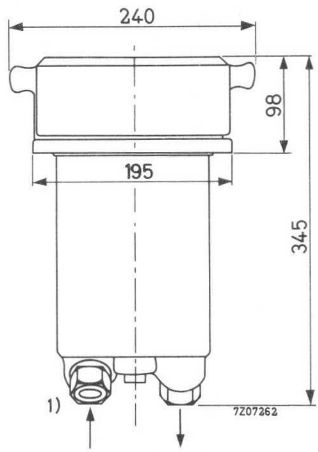


1) Use connecting hose with an inner diameter of 1 3/4"
2) Coupling for metal tubing with an outer diameter of 28mm

Net weight 20.5 kg

7Z2 8110

WATER JACKET

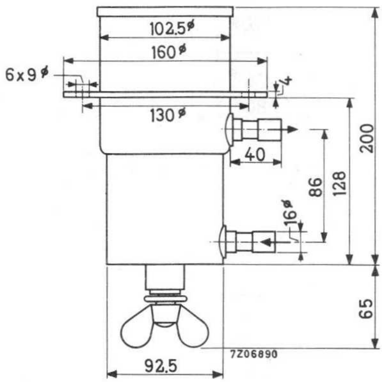


1) coupling for metal tubing with an outer diameter of 28mm

Net weight 16.7 kg

7Z2 8111

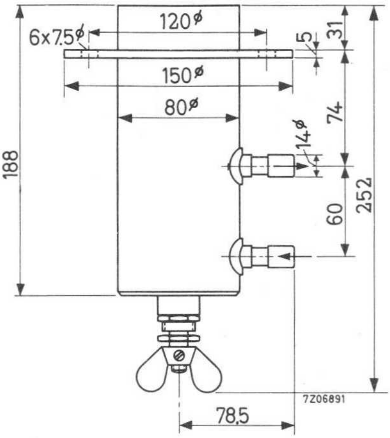
WATER JACKET



Net weight 2.1 kg

7Z2 8112

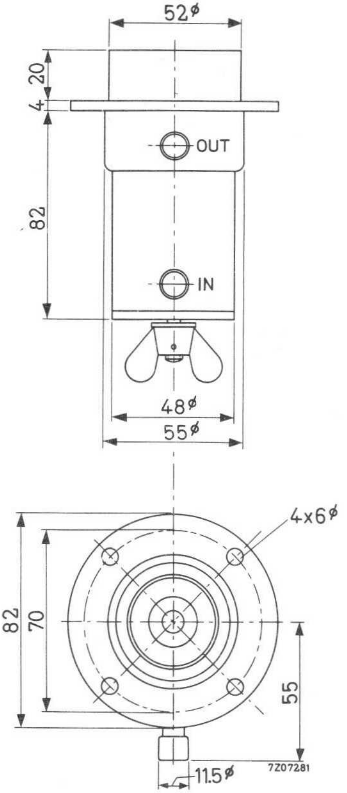
WATER JACKET



Net weight 2.2 kg

7Z2 8113

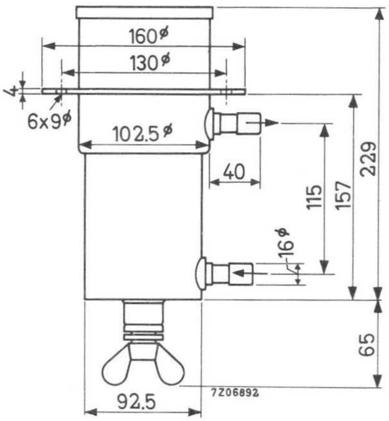
WATER JACKET



Net weight 0.76 kg

7Z2 8114

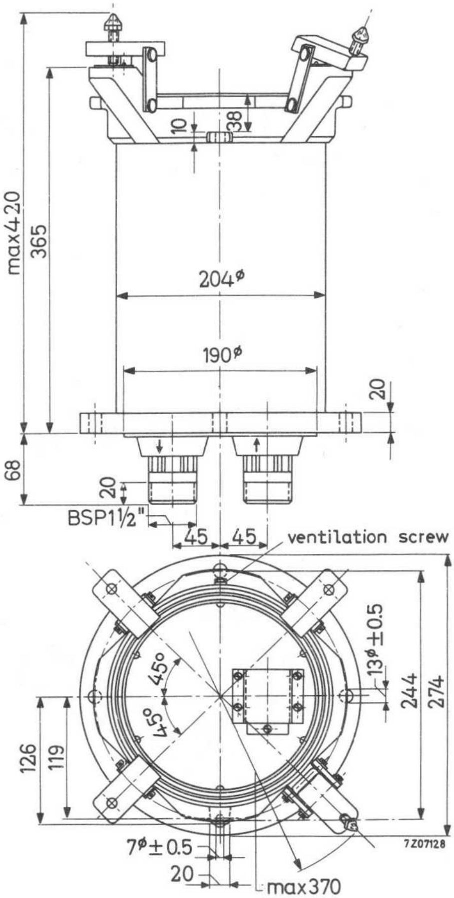
WATER JACKET



Net weight 2.7 kg

7Z2 8115

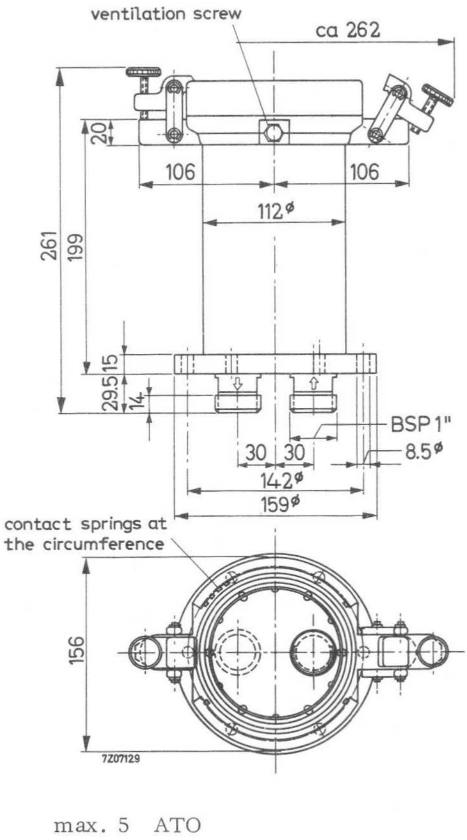
WATER JACKET



Water pressure	max.	5	ATO
Net weight		30.5	kg

7Z2 8116

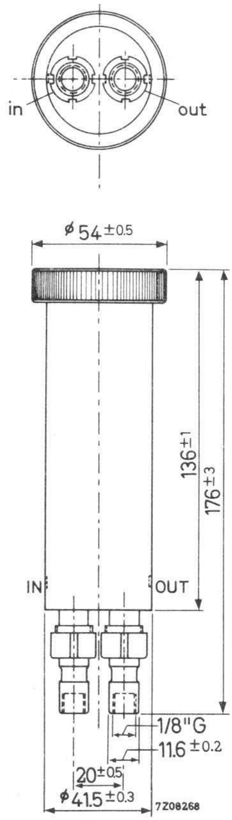
WATER JACKET



Water pressure	max. 5	ATO
Net weight	5	kg

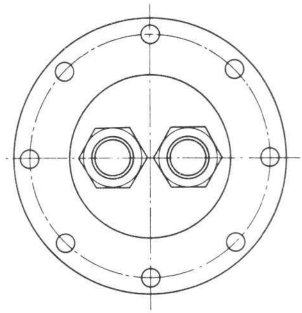
7Z2 8117

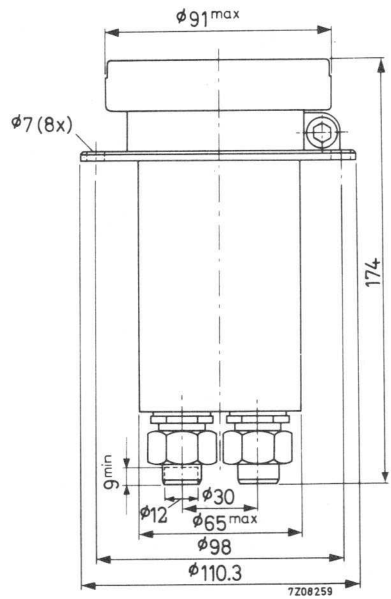
WATER JACKET



7Z2 8739

WATER JACKET

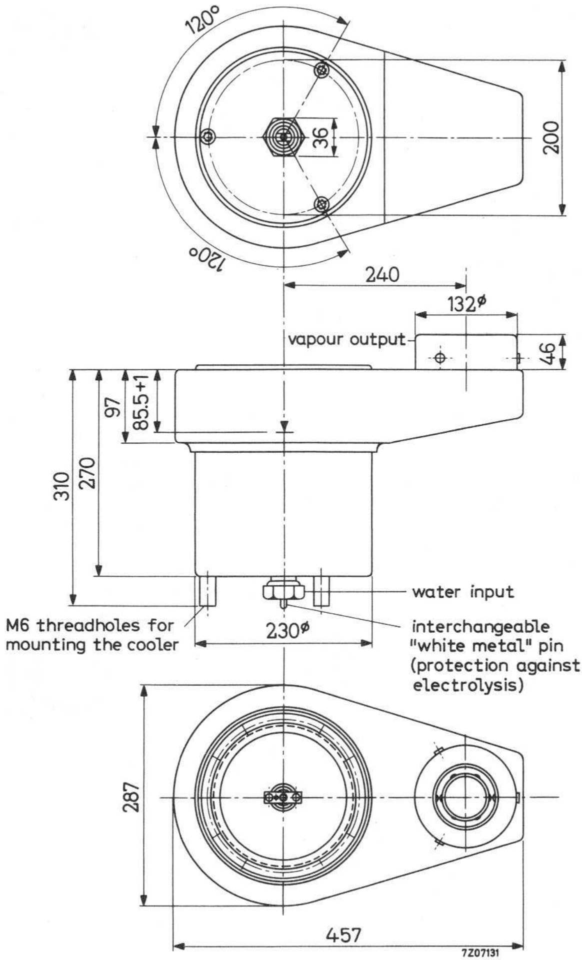




Net weight 2 kg

7Z2 8863

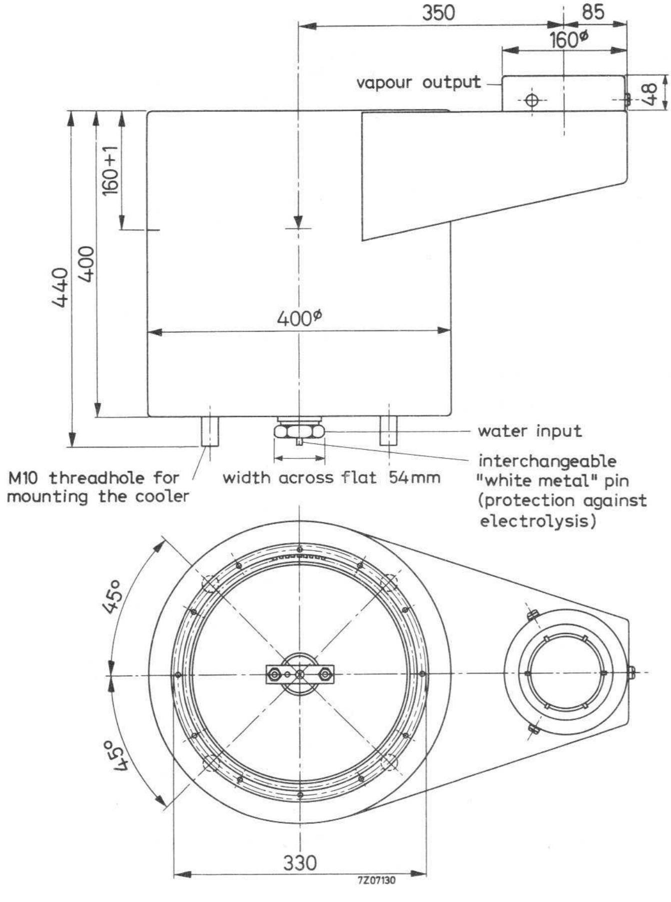
VAPOUR JACKET



Net weight 8 kg

7Z2 8119

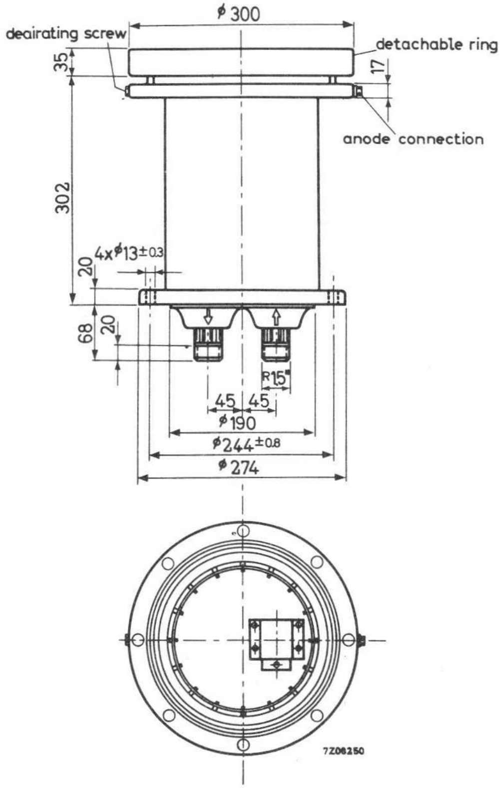
VAPOUR JACKET



Net weight 22 kg

7Z2 8120

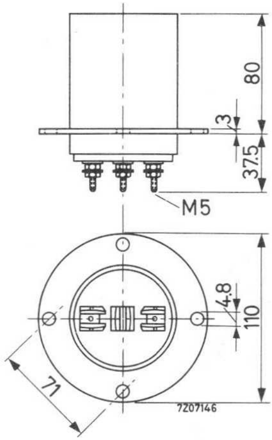
WATER JACKET



7Z2 8511

TUBE SOCKET

WITH 3 SPRING CONTACTS AND METAL SHIELD

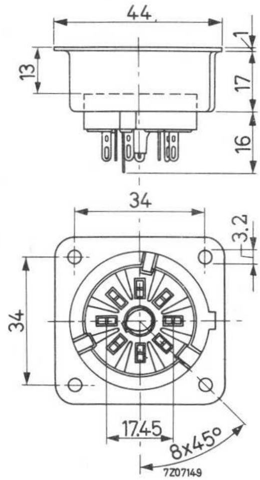


Chassis hole	78	mm
Max. test voltage (50 Hz)	3000	V_{rms}
Min. insulation resistance	10^3	MΩ
Max. working temperature	100	^oC
Max. capacitance (between one contact and all other contacts and the shield)	15	pF
Max. contact resistance	10	mΩ
Min. parallel damping at 1 MHz (between one contact and all other contacts and the shield)	0.3	MΩ
Max. insertion force	9	kg
Withdrawal force	4 to 8	kg
Weight	670	g

7Z2 8122

TUBE SOCKET

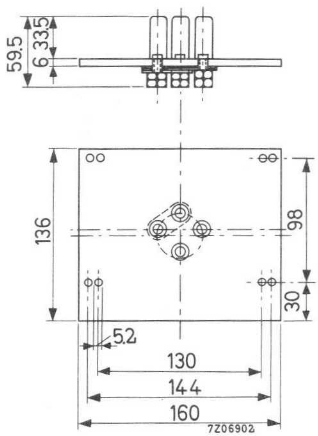
WITH 8 SPRING CONTACTS AND CENTRAL LOCATING
AND LOCKING DEVICE



Chassis hole 42 mm

7Z2 8123

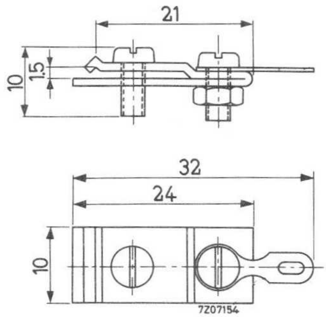
TUBE SOCKET



Material: Pertinax Insulating Material

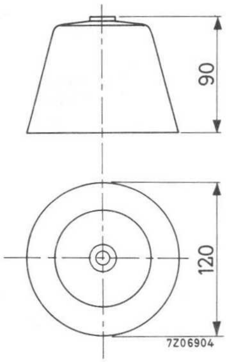
7Z2 8124

ANODE CONNECTOR



7Z2 8126

ANODE CAP

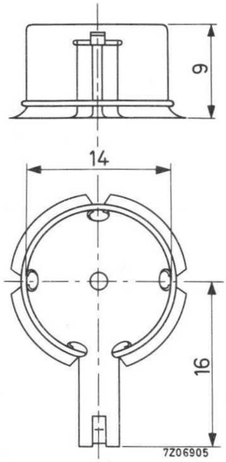


Material: Phenolic

7Z2 8127

TOP CAP CONNECTOR

FOR TOP CAPS WITH 14.38 mm Ø (IEC 67-III-1b, type 3).

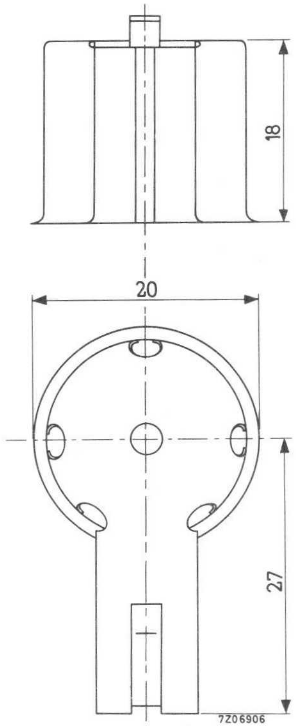


Material: brass, nickel plated

7Z2 8128

TOP CAP CONNECTOR

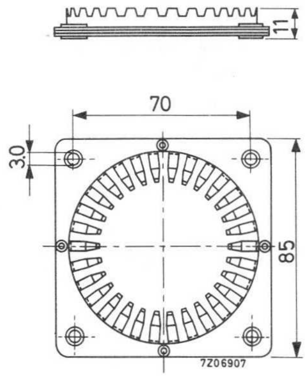
FOR TOP CAPS WITH 20.32 mm Ø (IEC 67-III-1b, type 4).



Material: brass, nickel plated

7Z2 8129

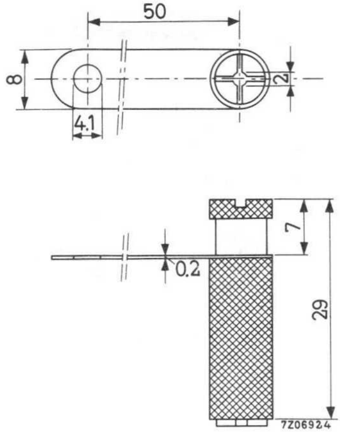
GRID CONNECTOR



Material: brass, silver plated

7Z2 8130

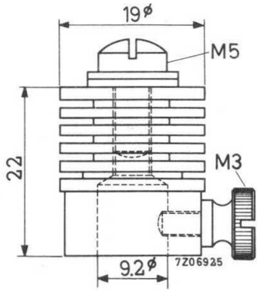
ANODE CONNECTOR



Material: brass, silver plated

7Z2 8131

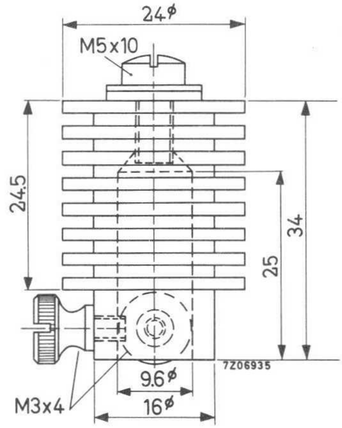
ANODE CONNECTOR



Material: brass, nickel plated

7Z2 8132

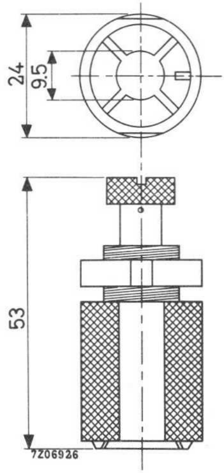
ANODE CONNECTOR



Material: brass, nickel plated

7Z2 8133

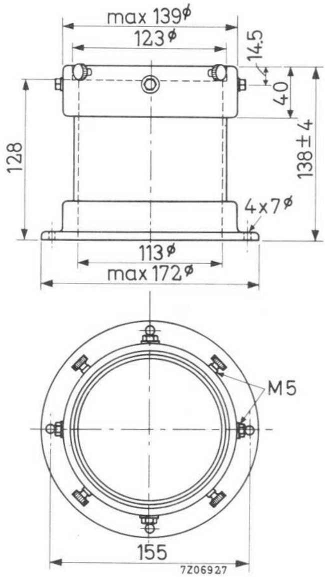
FILAMENT CONNECTOR



Material: brass, silver plated

7Z2 8134

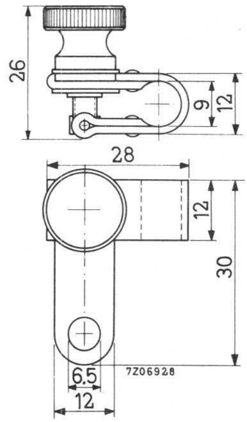
INSULATING PEDESTAL



Material: ceramic
Net weight: 2.1 kg

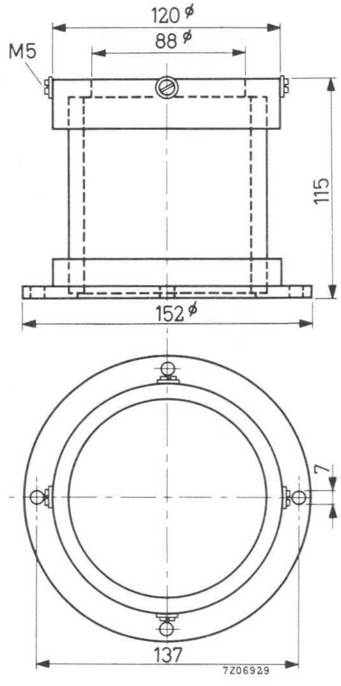
7Z2 8864

FILAMENT CONNECTOR



7Z2 8136

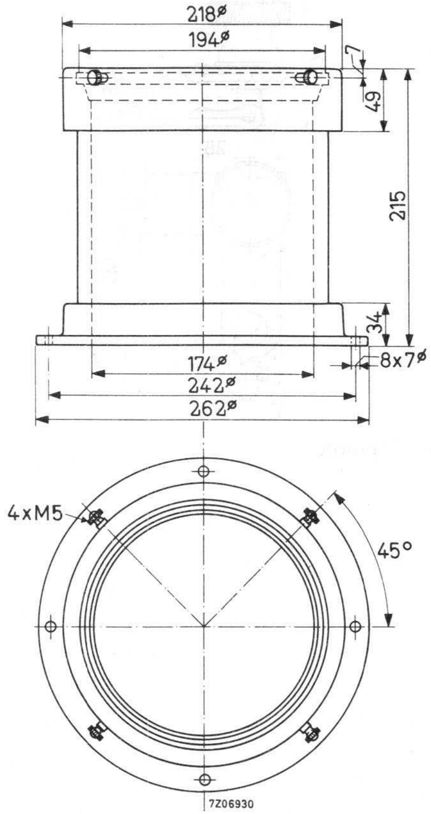
INSULATING PEDESTAL



Material: ceramic
Net weight: 1.6 kg

7Z2 8865

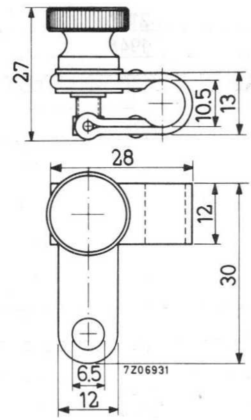
INSULATING PEDESTAL



Material: ceramic

7Z2 8138

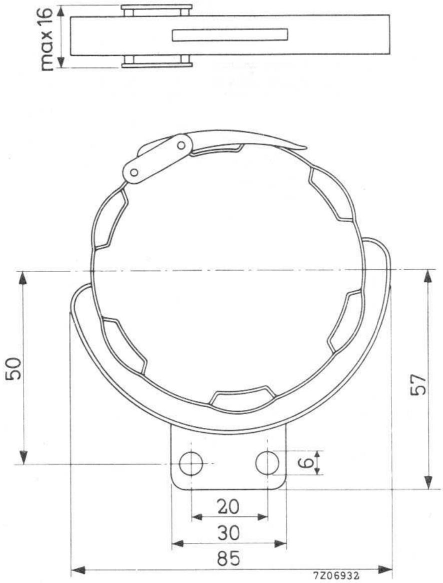
FILAMENT CONNECTOR



Material: brass, silver plated

7Z2 8139

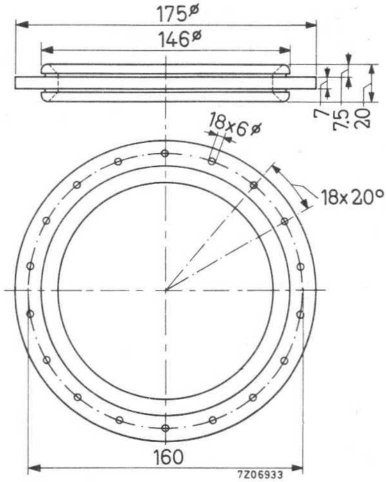
GRID CONNECTOR



Material: brass, silver plated

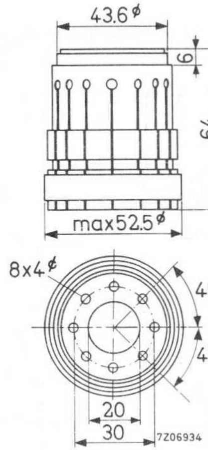
7Z2 8140

GRID AND ANODE CONNECTOR



Material: brass, silver plated

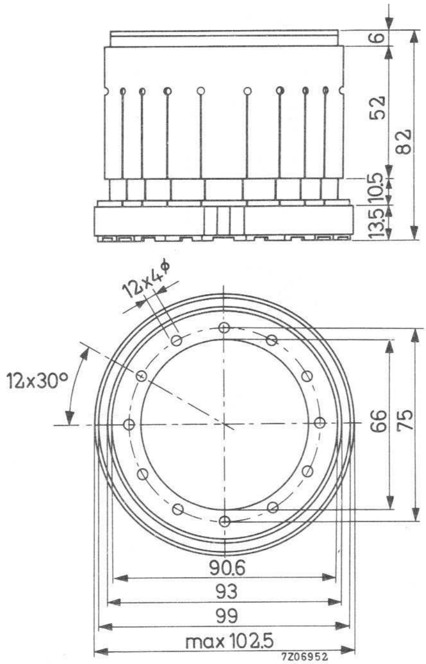
FILAMENT CONNECTOR



Material: brass, silver plated

7Z2 8142

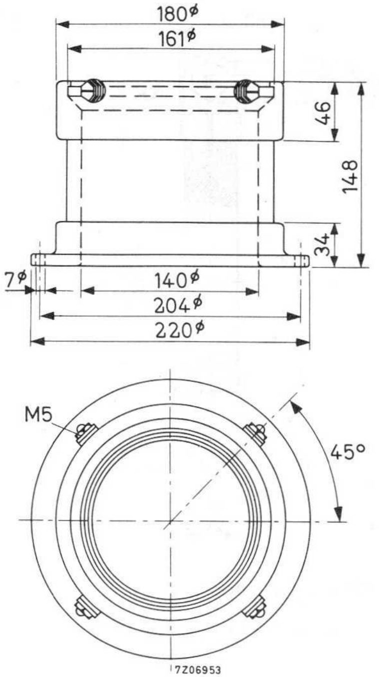
FILAMENT CONNECTOR



Material: brass, silver plated

7Z2 8143

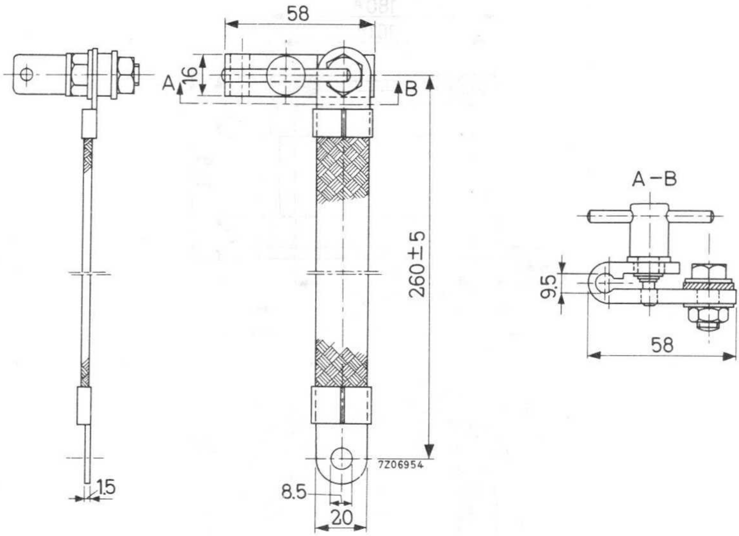
INSULATING PEDESTAL



Material: ceramic
Net weight: 4.25 kg

7Z2 8866

FILAMENT CONNECTOR WITH CABLE

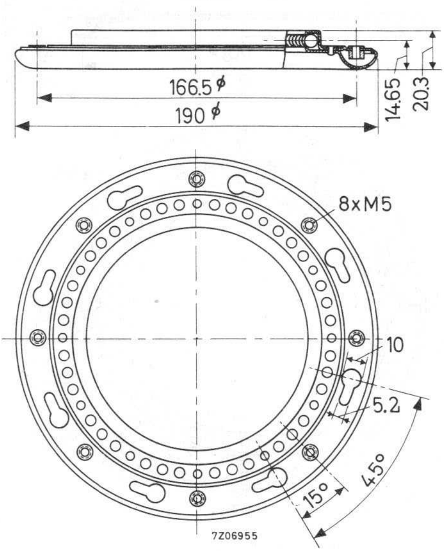


Material: cable - twined copper

connector - brass, nickel plated

7Z2 8145

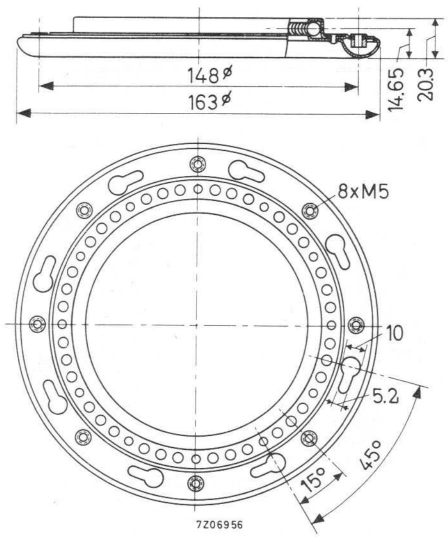
GRID CONNECTOR



Material: brass, silver plated

7Z2 8146

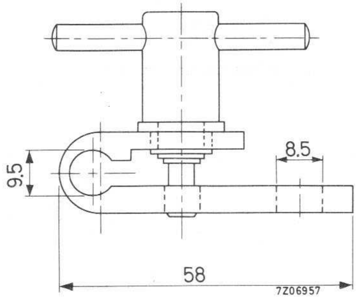
GRID CONNECTOR



Material: brass, silver plated

7Z2 8147

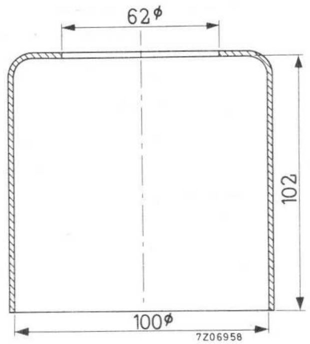
ANODE CONNECTOR



Material: brass, nickel plated

7Z2`8148

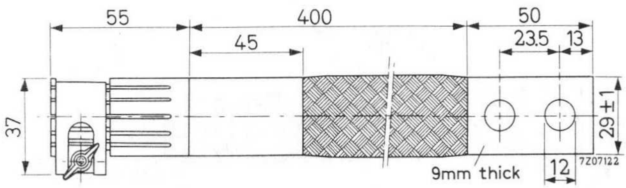
CHIMNEY



Material: glass

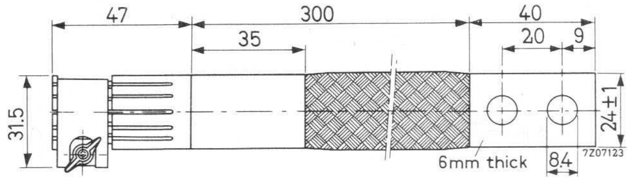
7Z2 8149

FILAMENT CONNECTOR WITH CABLE



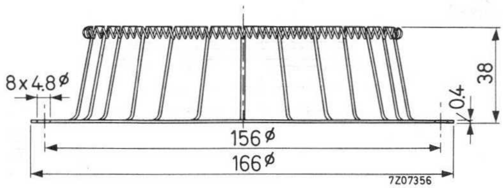
7Z2 8150

FILAMENT CONNECTOR WITH CABLE



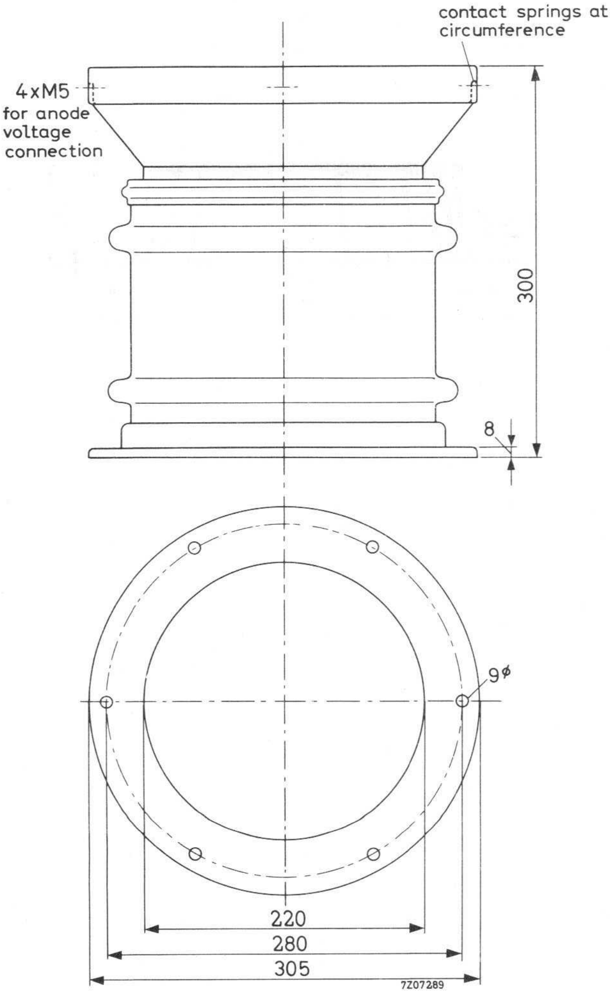
7Z2 8151

GRID CONNECTOR



7Z2 8152

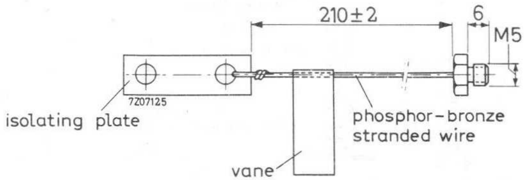
INSULATING PEDESTAL



Net weight 9.2 kg

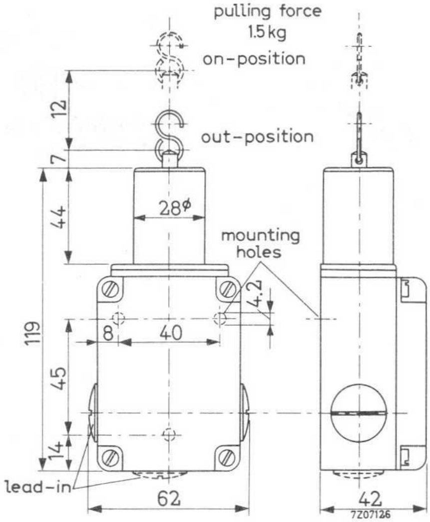
7Z2 8153

FUSE



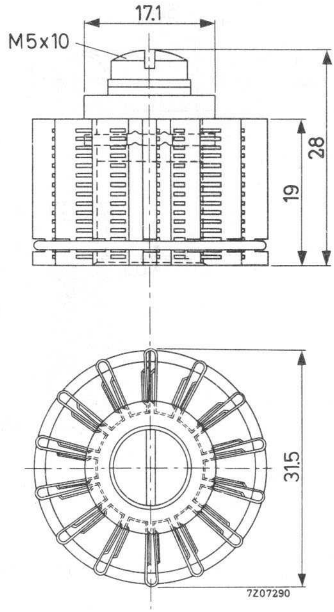
7Z2 8154

PULL SWITCH FOR TUBE CUT-OUT



7Z2 8155

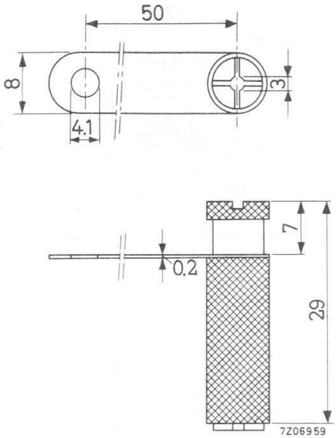
ANODE CONNECTOR



Material: brass, nickel plated

7Z2 8156

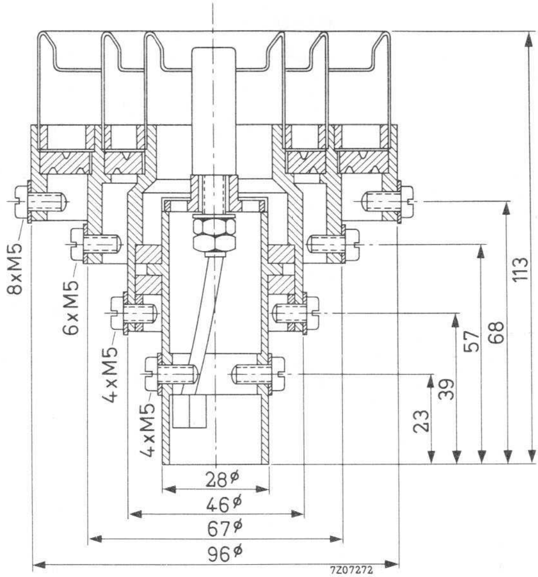
ANODE CONNECTOR



Material: brass, silver plated

7Z2 8157

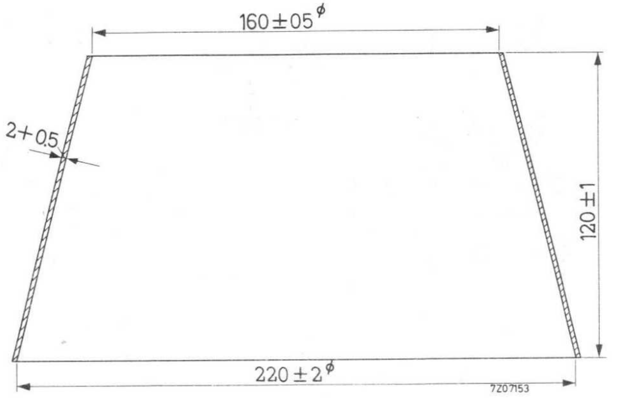
TUBE SOCKET



Material: synthetic resin insulating material
silver plated contacts

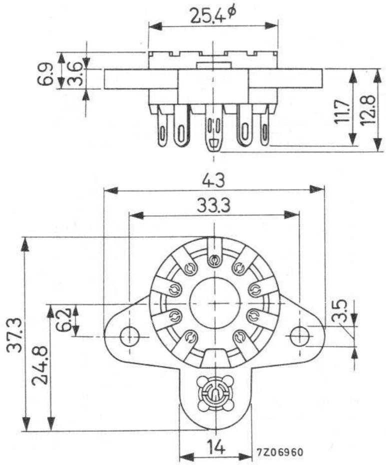
7Z2 8158

CHIMNEY



7Z2 8159

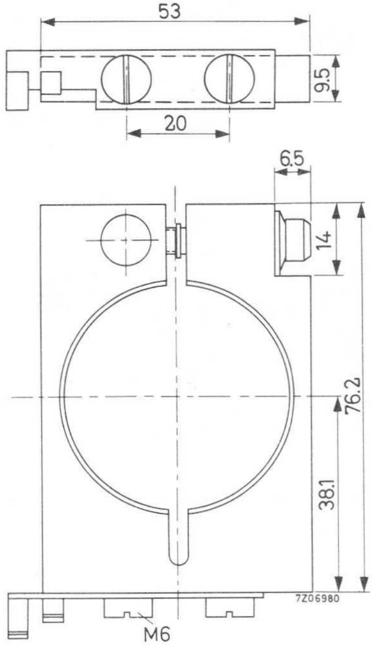
TUBE SOCKET FOR MAGNOVAL BASES



Material: synthetic resin insulating material
9 silver plated cup-shaped contacts

7Z2 8160

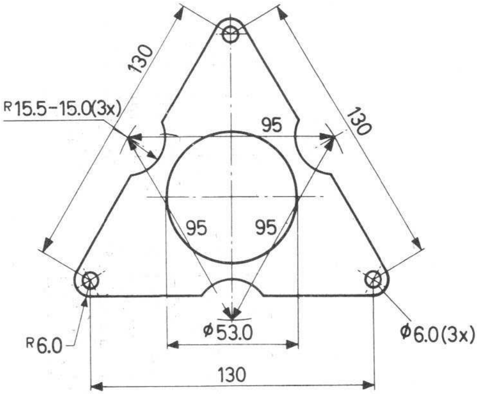
GRID CONNECTOR



Material: brass, silver plated

7Z2 8161

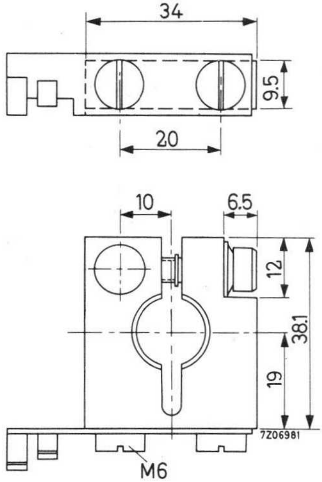
GRID CONNECTOR



Material: Brass

7Z2 8867

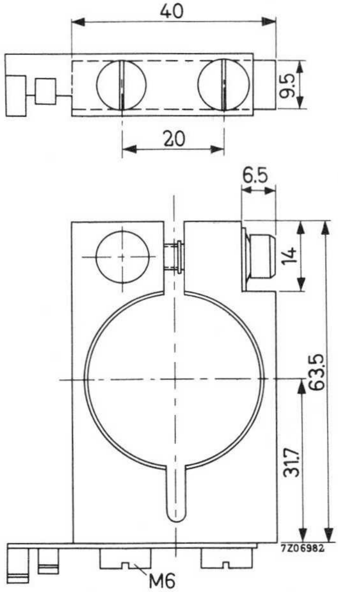
FILAMENT CONNECTOR



Material: brass, nickel plated

7Z2 8162

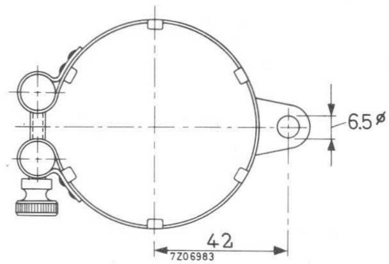
FILAMENT CONNECTOR



Material: brass, nickel plated

7Z2 8163

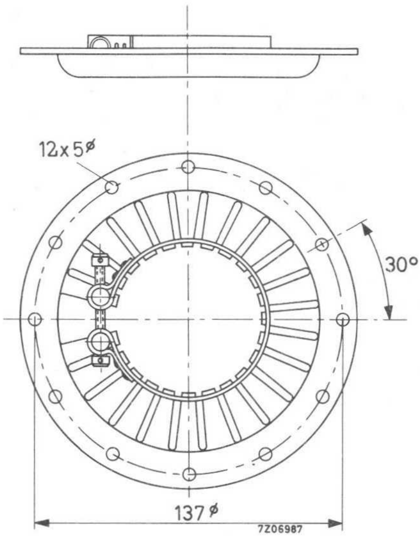
GRID CONNECTOR



Material: brass, silver plated
Net weight: 55 g

7Z2 8868

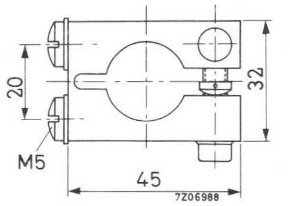
GRID CONNECTOR



Material: brass, silver plated
Net weight: 240 g

7Z2 8869

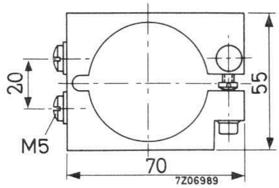
FILAMENT CONNECTOR



Material: brass, nickel plated
Net weight: 140 g

7Z2 8870

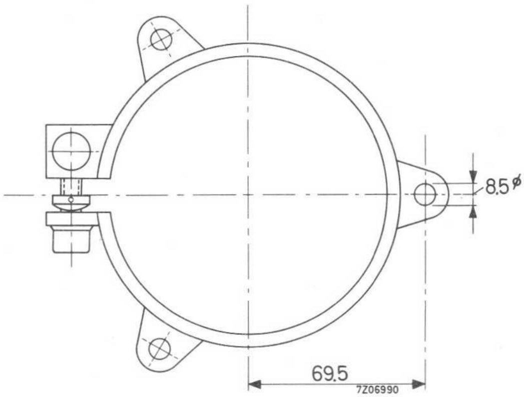
FILAMENT CONNECTOR



Material: brass, nickel plated
Net weight: 165 g

7Z2 8871

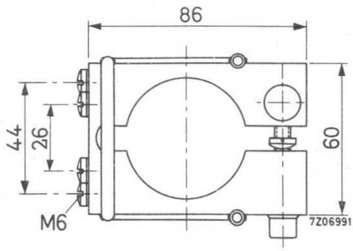
GRID CONNECTOR



Material: brass, silver plated
Net weight: 270 g

7Z2 8872

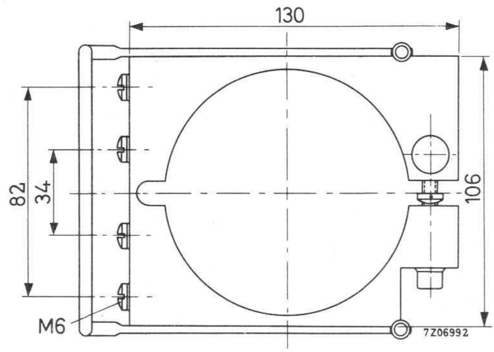
FILAMENT CONNECTOR



Material: brass, nickel plated
Net weight: 710 g

7Z2 8873

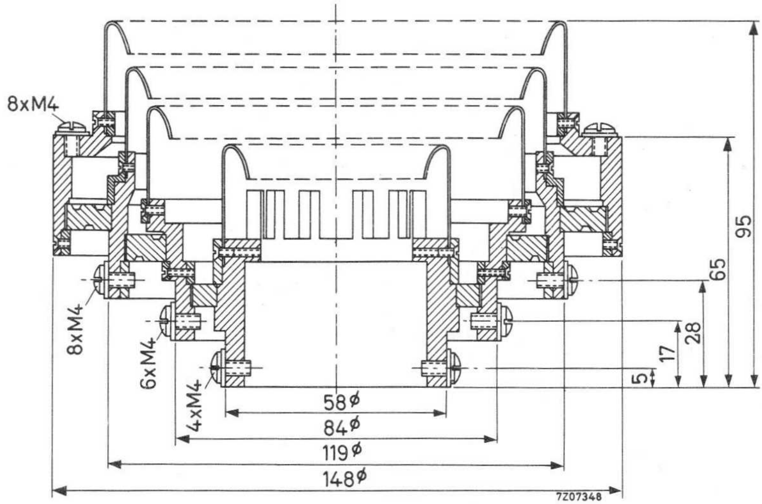
FILAMENT CONNECTOR



Material: brass, nickel plated
Net weight: 860 g

7Z2 8874

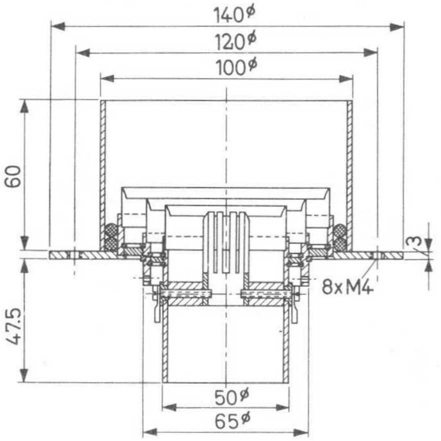
TUBE SOCKET FOR COAXIAL TUBES



Material: teflon insulating material
silver plated contact springs

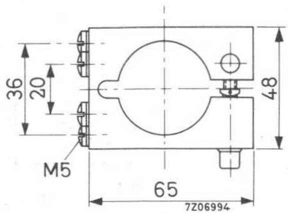
7Z2 8171

TUBE SOCKET FOR COAXIAL TRIODES



7Z2 8175

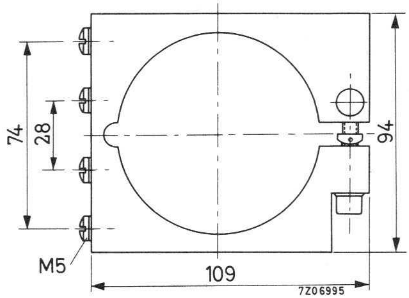
FILAMENT CONNECTOR



Material: brass, nickel plated

7Z2 8176

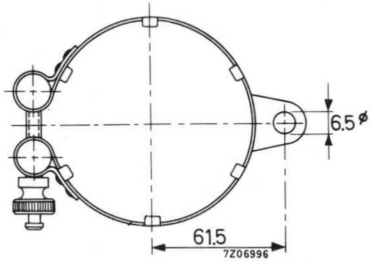
FILAMENT CONNECTOR



Material: brass, nickel plated

7Z2 8177

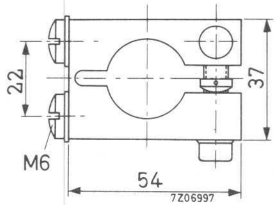
GRID CONNECTOR



Material: brass, silver plated

7Z2 8178

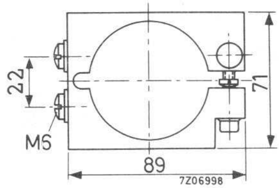
FILAMENT CONNECTOR



Material: brass, nickel plated
Net weight: 230 g

7Z2 8875

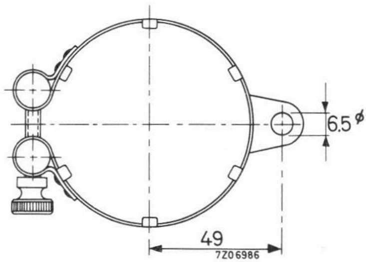
FILAMENT CONNECTOR



Material: brass, nickel plated
Net weight: 265 g

7Z2 8876

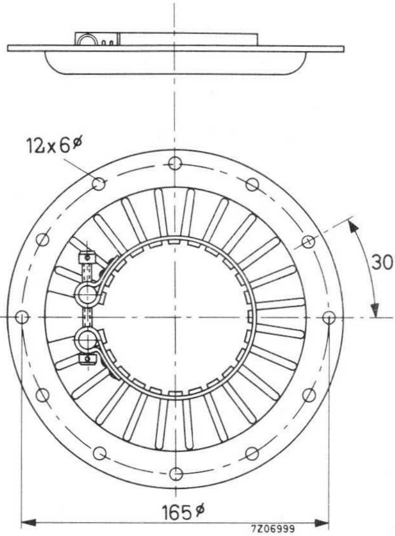
GRID CONNECTOR



Material: brass, silver plated
Net weight: 60 g

7Z2 8877

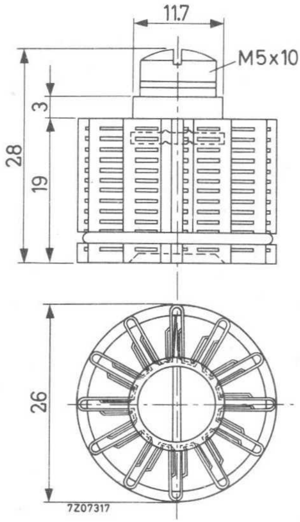
GRID CONNECTOR



Material: brass, silver plated
Net weight: 310 g

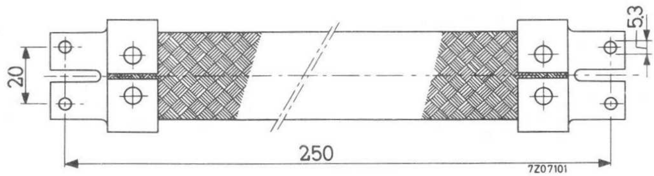
7Z2 8878

ANODE CONNECTOR



7Z2 8183

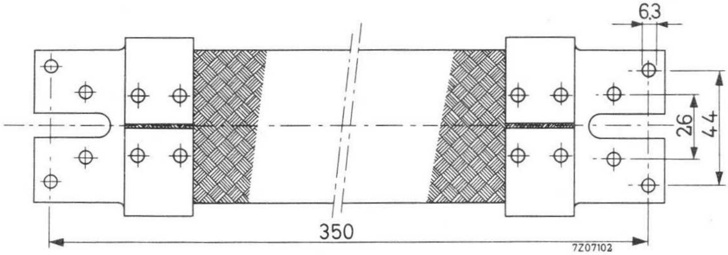
FILAMENT CABLE
TO BE USED WITH 40692 AND 40693



Net weight: 200 g

7Z2 8879

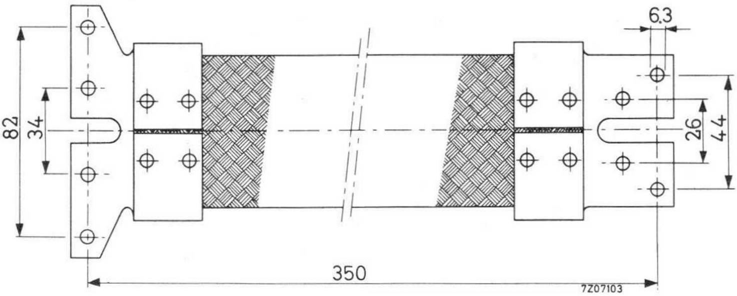
FILAMENT CABLE
TO BE USED WITH 40695



Net weight: 975 g

7Z2 8880

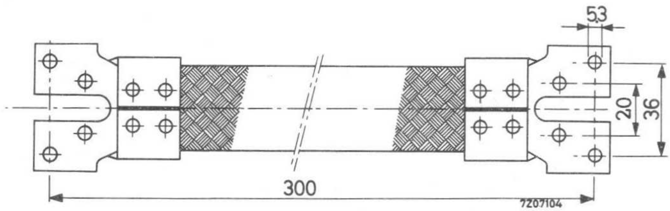
FILAMENT CABLE
TO BE USED WITH 40696



Net weight: 980 g

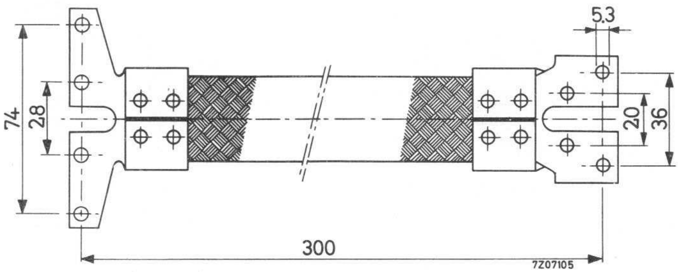
7Z2 8881

FILAMENT CABLE
TO BE USED WITH 40705



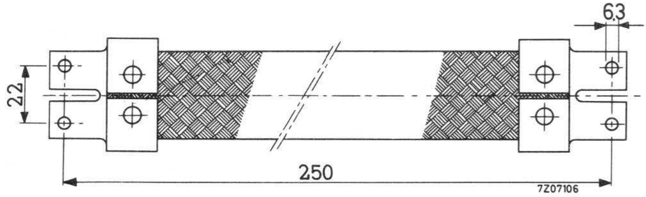
7Z2 8189

FILAMENT CABLE
TO BE USED WITH 40706



7Z2 8192

FILAMENT CABLE
TO BE USED WITH 40708 AND 40709



Net weight: 215 g

7Z2 8882

INDEX OF TYPE NUMBERS

Acc. = Accessories

H.V. = High-voltage rectifiers

Tr. = Transmitting tubes for communication and tubes for R.F. heating

Tr.T. = Triodes

Tr.P. = Tetrodes, double tetrodes, pentodes

7Z2 8998

Type No.	Section	Type No.	Section	Type No.	Section
TB5/2500	Tr.T.	YD1142	Tr.T.	YL1182	Tr.P.
TBH6/14	Tr.T.	YD1150	Tr.T.	YL1190	Tr.P.
TBH6/6000	Tr.T.	YD1151	Tr.T.	YL1200	Tr.P.
TBH7/8000	Tr.T.	YD1152	Tr.T.	YL1210	Tr.P.
TBH7/9000	Tr.T.	YD1160	Tr.T.	YL1220	Tr.P.
TBH12/25	Tr.T.	YD1161	Tr.T.	YL1230	Tr.P.
TBH12/38	Tr.T.	YD1162	Tr.T.	YL1240	Tr.P.
TBH12/100	Tr.T.	YD1170	Tr.T.	YL1250	Tr.P.
TBL2/300	Tr.T.	YD1171	Tr.T.	YL1280	Tr.P.
TBL2/400	Tr.T.	YD1172	Tr.T.	YL1290	Tr.P.
TBL2/500	Tr.T.	YD1173	Tr.T.	YL1320	Tr.P.
TBL6/14	Tr.T.	YD1180	Tr.T.	YL1360	Tr.P.
TBL6/20	Tr.T.	YD1182	Tr.T.	YL1370	Tr.P.
TBL6/4000	Tr.T.	YD1192	Tr.T.	YL1371	Tr.P.
TBL6/6000	Tr.T.	YD1202	Tr.T.	YL1372	Tr.P.
TBL7/8000	Tr.T.	YD1212	Tr.T.	ZT1000	H.V.
TBL7/9000	Tr.T.	YL1000	Tr.P.	ZT1001	H.V.
TBL12/25	Tr.T.	YL1010	Tr.P.	ZY1000	H.V.
TBL12/38	Tr.T.	YL1011	Tr.P.	ZY1001	H.V.
TBL12/40	Tr.T.	YL1012	Tr.P.	ZY1002	H.V.
TBL12/100	Tr.T.	YL1020	Tr.P.	7609	Tr.P.
TBL15/125	Tr.T.	YL1030	Tr.P.	8621	Tr.P.
TBW6/14	Tr.T.	YL1060	Tr.P.	40209	Acc.
TBW6/20	Tr.T.	YL1070	Tr.P.	40210/02	Acc.
TBW6/6000	Tr.T.	YL1071	Tr.P.	40409	Acc.
TBW7/8000	Tr.T.	YL1080	Tr.P.	40615	Acc.
TBW7/9000	Tr.T.	YL1090	Tr.P.	40616	Acc.
TBW12/25	Tr.T.	YL1091	Tr.P.	40619	Acc.
TBW12/38	Tr.T.	YL1100	Tr.P.	40620	Acc.
TBW12/100	Tr.T.	YL1101	Tr.P.	40622	Acc.
TBW15/125	Tr.T.	YL1102	Tr.P.	40623	Acc.
YD1000	Tr.T.	YL1103	Tr.P.	40624	Acc.
YD1001	Tr.T.	YL1110	Tr.P.	40626	Acc.
YD1002	Tr.T.	YL1120	Tr.P.	40628	Acc.
YD1010	Tr.T.	YL1121	Tr.P.	40630	Acc.
YD1012	Tr.T.	YL1122	Tr.P.	40634	Acc.
YD1120	Tr.T.	YL1130	Tr.P.	40635	Acc.
YD1130	Tr.T.	YL1150	Tr.P.	40648	Acc.
YD1140	Tr.T.	YL1170	Tr.P.	40649	Acc.
YD1141	Tr.T.	YL1181	Tr.P.	40650	Acc.

7Z2 8999

Type No.	Section	Type No.	Section	Type No.	Section
40651	Acc.	40707	Acc.		
40652	Acc.	40708	Acc.		
40653	Acc.	40709	Acc.		
40654	Acc.	40710	Acc.		
40662	Acc.	40711	Acc.		
40663	Acc.	40712	Acc.		
40664	Acc.	40715	Acc.		
40665	Acc.	40716	Acc.		
40666	Acc.	40717	Acc.		
40667	Acc.	40718	Acc.		
40670	Acc.	40719	Acc.		
40671	Acc.	40720	Acc.		
40672	Acc.				
40675	Acc.				
40679	Acc.				
40680	Acc.				
40681	Acc.				
40682	Acc.				
40683	Acc.				
40685	Acc.				
40686	Acc.				
40687	Acc.				
40688	Acc.				
40689	Acc.				
40690	Acc.				
40691	Acc.				
40692	Acc.				
40693	Acc.				
40694	Acc.				
40695	Acc.				
40696	Acc.				
40699	Acc.				
40704	Acc.				
40705	Acc.				
40706	Acc.				

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7Z2 9000

Printed in Holland

9399 241 00201