PHILIPS

DATA HANDBOOK



ELECTRONIC COMPONENTS AND MATERIALS

ELECTRON TUBES

PART 9 JANUARY 1971

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

TRIODES

Associated accessories

ELECTRON TUBES

Part 9 **January 1971**

General section

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

TRIODES

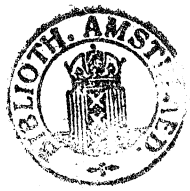
Associated accessories

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, identified by the colours noted, are:

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

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued annually; the contents of each series are summarized on the following pages.
We have made every effort to ensure that each series is as accurate, comprehensive and up-to-date as possible, and we hope you will find it to be a valuable source of reference. You will understand that we can not guarantee that all products listed in any one edition of the handbook will remain available, or that their specifications will not be changed, before the next edition is published. If you need confirmation that the published data about any of our products are the latest available, may we ask that you contact our representative. He is at your service and will be glad to answer your inquiries.



ELECTRON TUBES (BLUE SERIES)

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

Part 1 — **January 1971**

Transmitting tubes (Tetrodes, Pentodes)
Associated accessories

Part 2 — **February 1970**

Tubes for microwave equipment

Part 3 — **March 1970**

Special Quality tubes
Miscellaneous devices

Part 4 — **April 1970**

Receiving tubes

Part 5 — **May 1970**

Cathode-ray tubes
Photo tubes
Camera tubes
Photoconductive devices
Associated accessories

Part 6 — **June 1970**

Photomultiplier tubes
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Semiconductor radiation detectors
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Associated accessories

Part 7 — **July 1970**

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

Part 8 — **August 1970**

T.V. Picture tubes



Part 9 — **January 1971**

Transmitting tubes (Triodes)
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Tunnel diodes
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Voltage regulator diodes
Rectifier diodes
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Rectifier stacks
Accessories
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Part 2 Low frequency; Deflection — **October 1970**

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

Part 3 High frequency; Switching — **November 1970**

General
High frequency transistors
Switching transistors
Accessories

Part 4 Special types — **December 1970**

General
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Microwave devices
Field effect transistors
Dual transistors
Microminiature devices for thick- and thin-film circuits
Beam lead devices for thick- and thin-film circuits
Photo devices
Accessories

Part 5 Integrated Circuits — **February 1970**

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Digital integrated circuits
- FC family; standard temperature range
- FC family; extended temperature range
- FD family
- FJ family; standard temperature range

Linear integrated circuits

COMPONENTS AND MATERIALS (GREEN SERIES)

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

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Circuit blocks 1-Series
Circuit blocks 10-Series
Circuit blocks 20-Series
Circuit blocks 40-Series
Counter modules 50-Series
Norbits 60-Series, 61-Series
Circuit blocks 90-Series
Circuit blocks for ferrite core memory drive
Input/output devices

Part 2 Resistors, Capacitors — **December 1970**

Fixed resistors
Variable resistors
Non-linear resistors
Ceramic capacitors
Polyester, polycarbonate, polystyrene, paper capacitors
Electrolytic capacitors
Variable capacitors

Part 3 Radio, Audio, Television — **January 1970**

FM tuners
Coils
Piezoelectric ceramic resonators and filters
Loudspeakers
Television tuners
Components for black and white television
Components for colour television
Deflection assemblies for camera tubes
Audio and mains transformers

Part 4 Magnetic Materials, White Ceramics — **March 1970**

Ferrites for radio, audio and television
Ferroxcube potcores and square cores
Microchokes
Ferroxcube transformer cores
Piezoxide
Permanent magnet materials

Part 5 Memory Products, Magnetic Heads, Quartz Crystals, Microwave Devices, Variable Transformers, Electro-mechanical Components — **June 1970**

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

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General section

List of symbols

General operational recommendations

Bases

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

1. Symbols denoting electrodes and electrode connections

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

Remarks

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

2. Symbols denoting voltages

Remarks

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

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

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2. Symbols denoting voltages (continued)

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

3. Symbols denoting currents

Remarks

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

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

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

4. Symbols denoting powers

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

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5. Symbols denoting capacitances

In general the published capacitance values refer to the cold tube

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

6. Symbols denoting resistances

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

7. Symbols denoting various quantities

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

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7. Symbols denoting various quantities (continued)

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

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

1. GENERAL

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

1.2 The tubes are classified into three groups

Preferred types – to be considered when designing new equipment

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

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

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

2. CHARACTERISTIC DATA

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

2.2 Filament/heater supply

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

2.2.1 Pure tungsten cathodes (filaments)

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

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

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

2.2.2 Thoriated tungsten cathodes (filaments)

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

2.2.3 Quick heating cathodes (filaments)

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

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

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

2.2.4 Indirectly heated oxide coated cathodes

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

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

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

2.2.5 Switching on the filament voltage

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

transformer. If necessary this choke or resistor may be short circuited by means of a relay after a delay of, say, 15 seconds.

2.2.6 By-passing the filament

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

2.3 Switching on of the electrode voltages

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

2.4 Anode return

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

2.5 Inter-electrode capacitances

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

2.6 Amplification factor μ and transconductance S

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

2.7 Saturation current I_{sat}

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

2.8 Accessories

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

3. LIMITING VALUES

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

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

3.3 Derating the limiting values

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

Wo = tungsten filament Th = thoriated tungsten filament

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

[1]) or 1.5 W_a.

3.4 Rating system

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

3.5 Absolute maximum rating system

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

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

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

3.7 Electrode voltages

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

3.8 Anode dissipation

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

3.9 Anode input power

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

account.

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

3.11 Control-grid dissipation

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

3.12 Grid resistance

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

4. OPERATING CONDITIONS

4.1 General

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

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

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

greater than the cut-off voltage so that anode current flows for less than one half of each cycle of the alternating grid voltage. Working to the values published in the data sheets will ensure good output power and efficiency.
If a grid resistor is used for obtaining automatic bias, care must be taken that the anode current does not become too high if the r.f. driving power should fail. A safety device in the anode or screen-grid lead should be incorporated for this purpose.

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

In an r.f. class C anode modulated stage the anode voltage is modulated with a.f., and at 100% modulation the voltage is varied from zero to twice the d.c. value. With tetrodes or pentodes the screen-grid should also be modulated to prevent it being overloaded. The average values of the grid bias and r.f. driving voltage remain constant during modulation. With 100% modulation the average anode dissipation is 1.5 times the value without modulation and this is taken into account although the published limiting value of anode dissipation refers to the unmodulated power. Automatic grid bias by means of a grid leak can be used, but, to obtain minimum distortion, some fixed bias is recommended.
The modulation power published is the power required by the modulated r.f. stage. When the modulating stage is being calculated 5% to 10% must be added to allow for losses in transformer and choke.

4.4 R.F. class B telephony

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

4.5 R.F. class AB SSB amplifier

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

4.6 A.F. class B amplifier

With this amplifier the anode dissipation is dependent on the input signal voltage so that maximum anode dissipation is obtained when the signal is about 60% of the value at full drive. When this is not present continuously, as is the case with broadcast and telephony services, it is permissible for the limiting value of

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

4.7 Industrial operating conditions

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

4.8 Intermittent service

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

5. APPLICATION OF THE OPERATING CONDITIONS

5.1 General

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

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

5.2 Fixed transmitters

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

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

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

5.3 Mobile transmitters

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

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

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

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

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

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

5.4.1 Multiple tube operation

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

5.5 Amateur transmitters and special adjustments

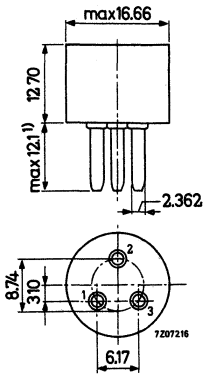
The maximum permissible load of a tube is determined by the physical maxima

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

5.6 Pulsed operation

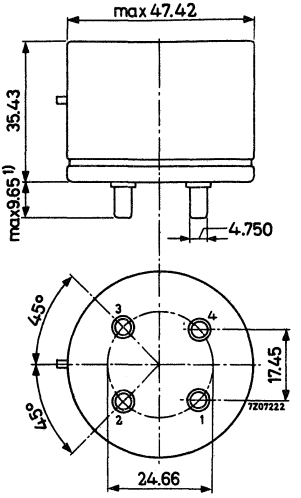
When a tube is used under pulsed operation the pulse duration must be so short that no part of the tube reaches an abnormally high temperature and flash-overs do not develop. In general the average load will be considerably less than the maximum limiting load value.
General information on this kind of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

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



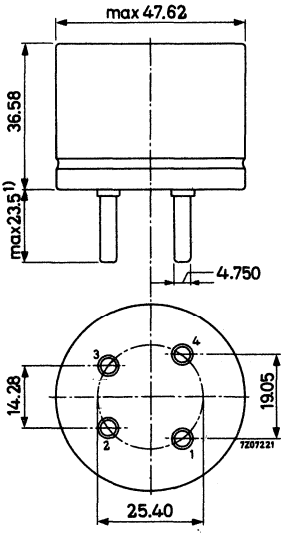
1) Including solder

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



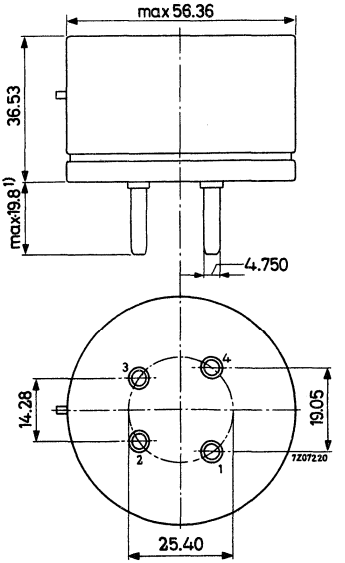
1) Including solder

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



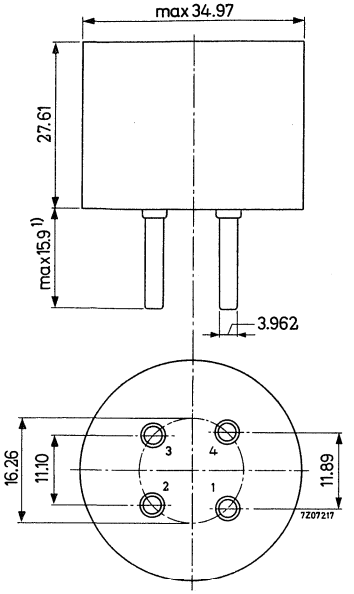
1) Including solder

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



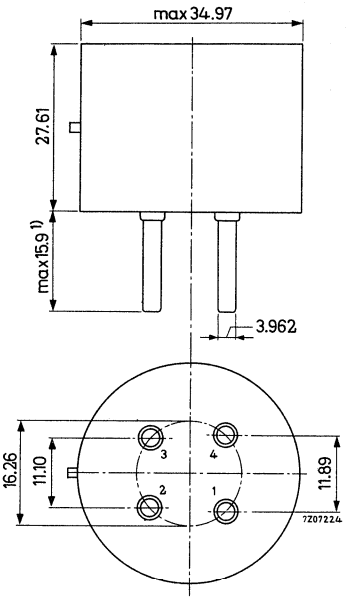
1) Including solder

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



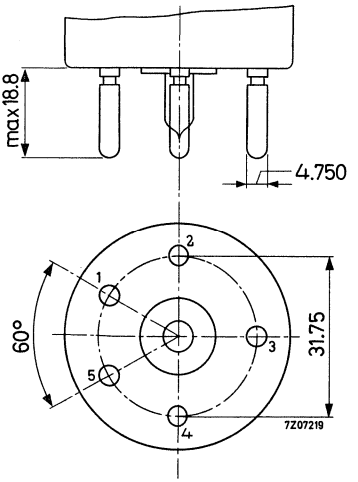
1) Including solder

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

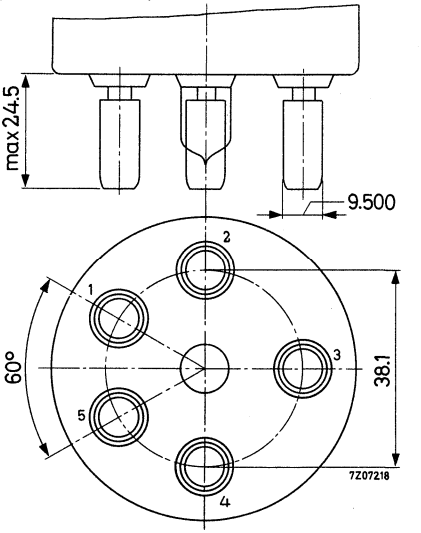


1) Including solder

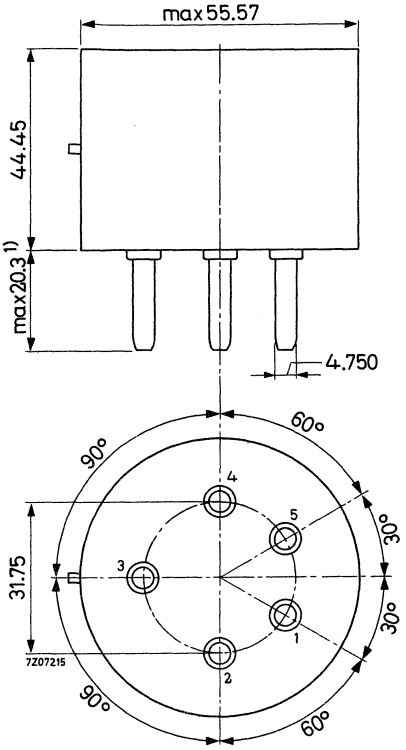
Giant 5-pin base
(IEC 67-I-21c)



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

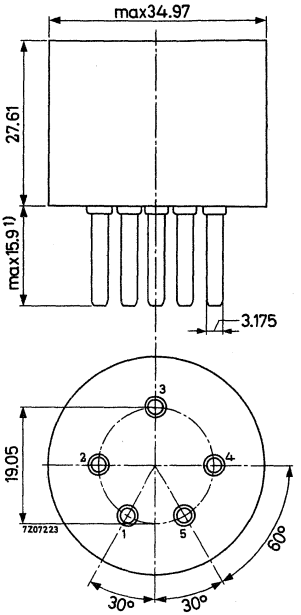


Medium shell Giant 5-pin base
with bayonet
(IEC 67-I-21a)



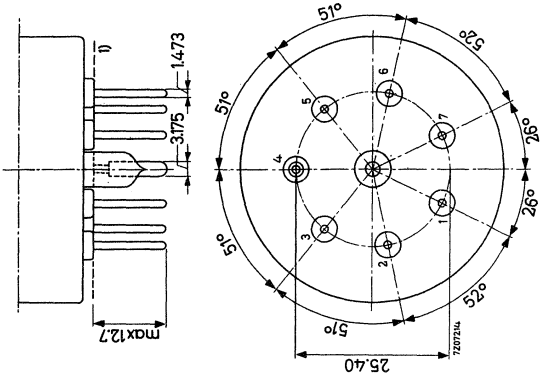
1) Including solder

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



1) Including solder

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



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

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

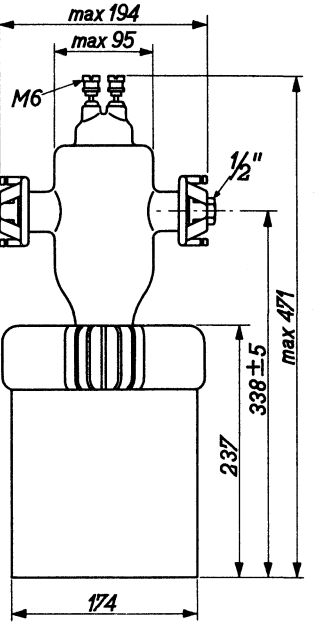
Filament bracket : 40604

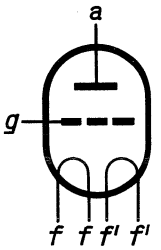
Protective cap for grid seals: 40632

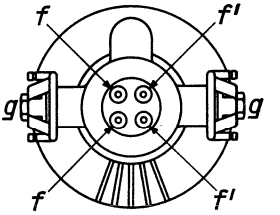
Supporting ring : 40603

Foot : K501

Net weight : 13.5 kg







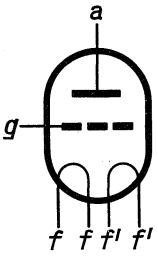
Mounting position: exactly vertical with anode down

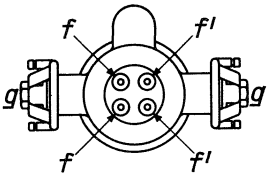
Pressure loss		p_i	=	117	mm H_2O
at	Inlet temperature	t_i	=	20	^oC
and	Cooling air flow	q	=	5.4	m^3/min

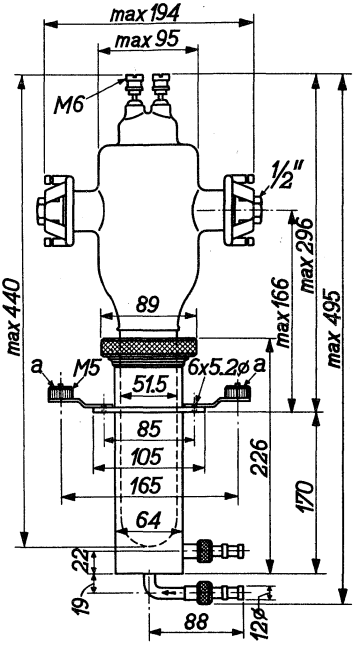
MECHANICAL DATA — TAW12/10

Dimensions in mm

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







Mounting position: exactly vertical with anode down

Pressure loss — p_i = 0.3 atm

with cooling water flow — q = 12 l/min

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 (t_i = 20 °C; W_a = 4 kW)	=	min. 5.4	–	m^3/min
Inlet temperature of cooling air	t_i	=	max. 45	–	°C
Anode temperature	t_a	=	max. 150	–	°C
Required cooling water flow	q (W_a = 7.5 kW)	=	–	min. 12	l/min
Outlet temperature of cooling water	t_o	=	–	max. 50	°C
Temperature rise of cooling water	$t_o - t_i$	=	–	max. 11	°C
Temperature of bulb and seals		=	max. 150	max. 150	°C

R.F. POWER TRIODES

QUICK REFERENCE DATA									
λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C_a mod.		B mod. [1])	
		V_a (kV)	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

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[1]) Two tubes

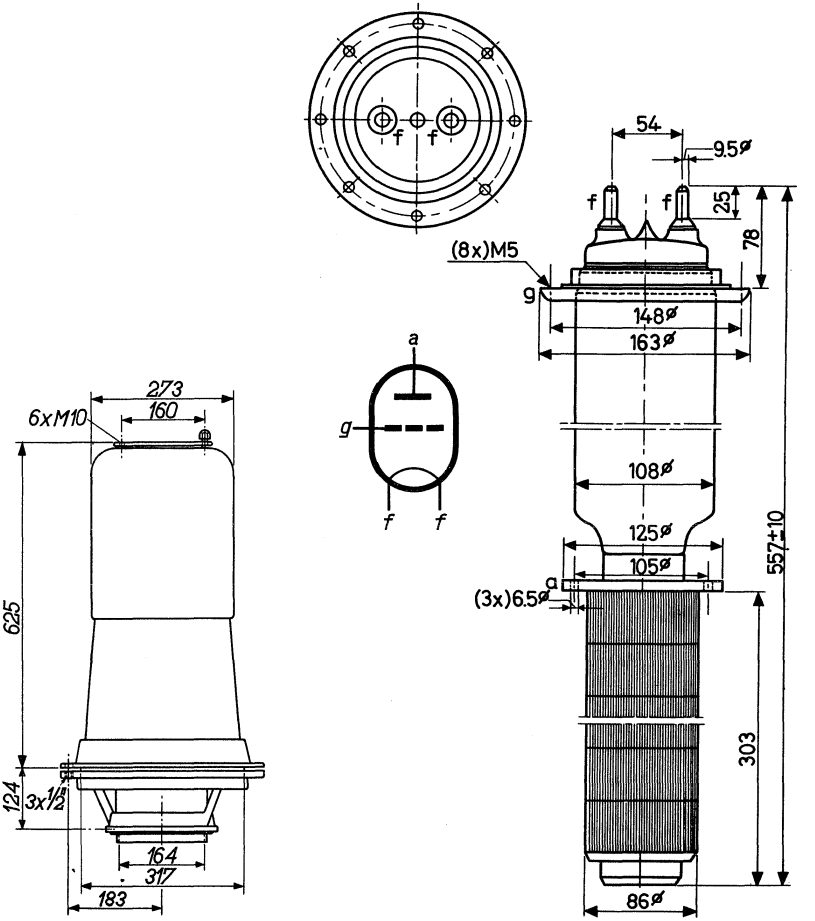
MECHANICAL DATA **TAL12/20** Dimensions in mm

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

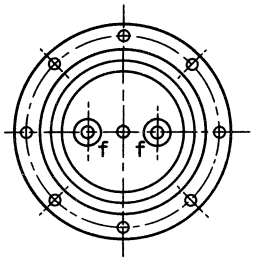
Pressure loss

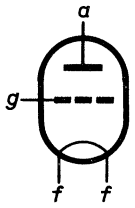
at	Inlet temperature	p_i =	130	mm H_2O
and	Cooling air flow	t_i =	20	^oC
		q =	21.2	m^3/min

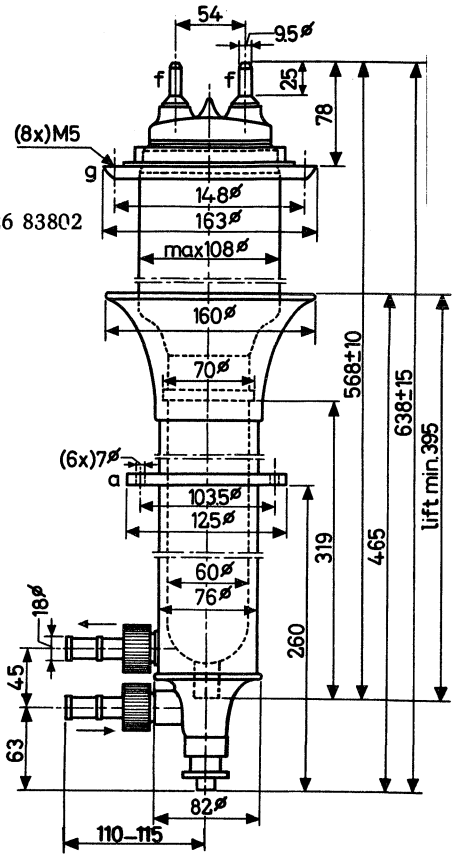
MECHANICAL DATA — TAW12/20

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
O-ring	: 3322 026 83802







Mounting position: exactly vertical with anode down

Pressure loss — p_i = 0.5 atm

with Cooling water flow — q = 20 l/min

LIMITING VALUES (Absolute limits)

			TAL12/20	TAW12/20	
Anode voltage	V_a	=	max. 12	max. 12	kV
Anode dissipation	W_a	=	max. 18	max. 18	kW
Grid dissipation	W_g	=	max. 500	max. 500	W
Grid circuit resistance	R_g	=	max. 10	max. 20	kΩ
Required cooling air flow	$q\{t_i = 20\ ^oC;\ W_a = 18\ kW\}$	=	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

OPERATING CONDITIONS R.F. CLASS C

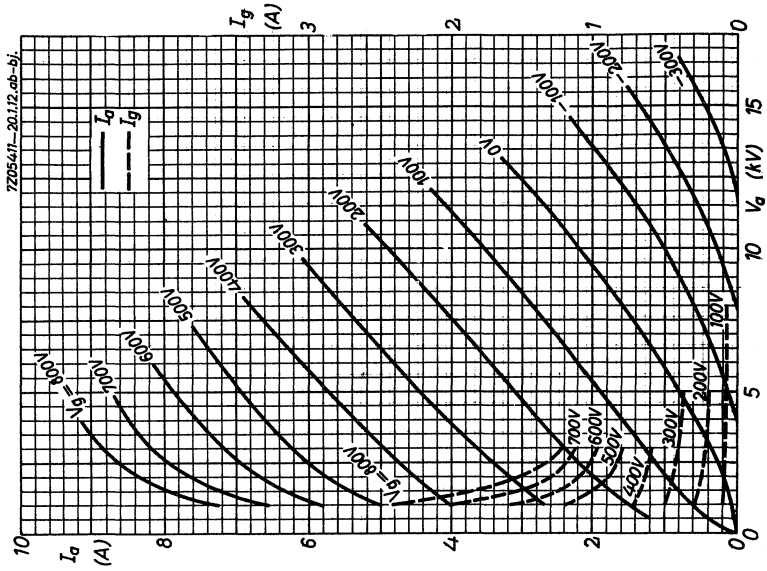
			Telegraphy		Anode modulation	
Wavelength	λ		>11	>11	>11	m
Anode voltage	V_a	=	12	10	10	kV
Grid voltage	V_g	=	-600	-500	-900	V
Anode current	I_a	=	2.7	2.7	1.4	A
Grid current	I_g	=	0.4	0.42	0.5	A
Peak grid A.C. voltage	V_{gp}	=	1800	1600	2100	V
Grid input power	W_{ig}	=	720	670	1050	W
Anode input power	W_{ia}	=	32.4	27	14	kW
Anode dissipation	W_a	=	10.4	9	4.5	kW
Output power	W_o	=	22	18	9.5	kW
Efficiency	η	=	68	67	68	%
Modulation depth	m	=			100	%
Modulation power	W_{mod}	=			7	kW

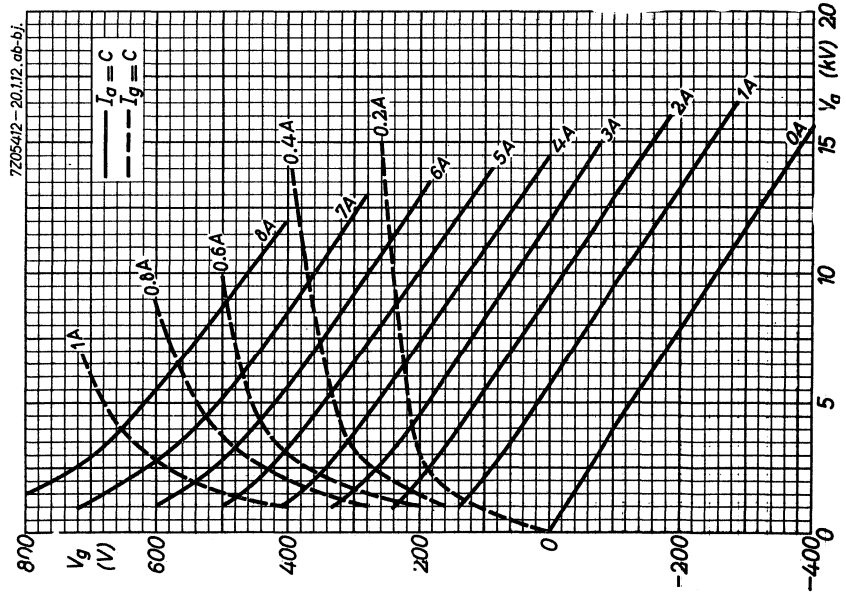
OPERATING CONDITIONS R.F. CLASS B TELEPHONY

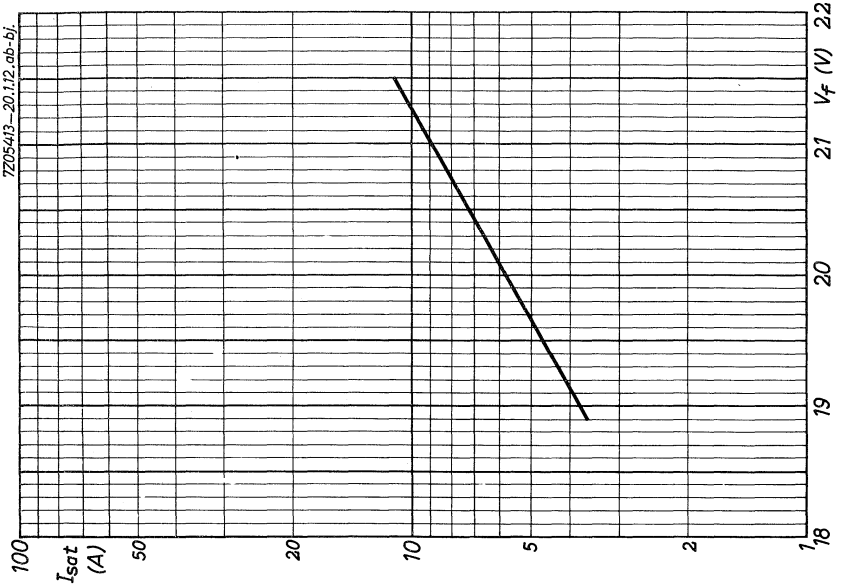
Wavelength	λ	>	11	m
Anode voltage	V_a	=	12	kV
Grid voltage	V_g	=	-200	V
Anode current	I_a	=	1.54	A
Peak grid A.C. voltage	V_{gp}	=	435	V
Anode input power	W_{ia}	=	18.5	kW
Anode dissipation	W_a	=	13.5	kW
Output power	W_o	=	5	kW
Efficiency	η	=	27	%
Modulation depth	m	=	100	%
Grid current	I_g	=	0.24	A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

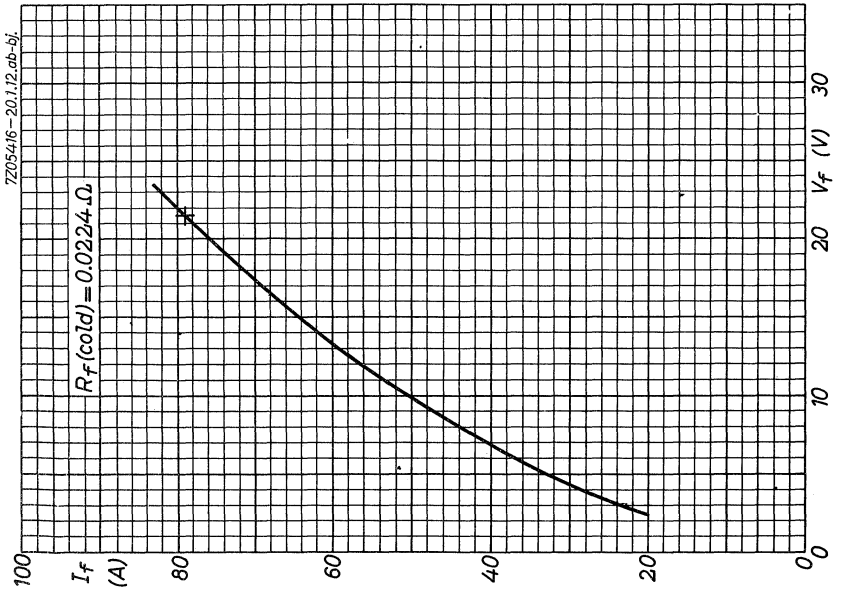
OPERATING CONDITIONS AS A.F. CLASS B AMPLIFIER AND MODULATOR
two tubes

Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	−250		−200		V
Load resistance	$R_{aa\sim}$	=	5.6		10.5		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	1900	0	1100	V
Anode current	I_a	=	2x0.32	2x2.45	2x0.25	2x1.1	A
Grid current	I_g	=	0	2x0.33	0	2x0.17	A
Grid input power	W_{ig}	=	0	2x280	0	2x85	W
Anode input power	W_{ia}	=	2x3.8	2x29	2x2.5	2x11	kW
Anode dissipation	W_a	=	2x3.8	2x8	2x2.5	2x3	kW
Output power	W_o	=	0	42	0	16	kW
Efficiency	η	=	–	72.5	–	73	%
Total harmonic distortion	d_{tot}	=	–	3.1	–	1.7	%


7Z05411—20.12.ab-bj.
Ig (A)
Ia (A)
Va (kV)
Ia
Ig
Vg=800V
700V
600V
500V
400V
300V
200V
100V
0V


7Z05412—20.12.ab-bj.
Ia = C
Ig = C
Vg (V)
Va (kV)
1A
0.8A
0.6A
0.4A
0.2A
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 Ω
100
I_f (A)
80
60
40
20
0
10
20
30
V_F (V)

AIR COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (MHz)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	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
11	27	15	45			12	26	10	32
						10	20.5		
8	37.5	10	26						

HEATING: direct; filament tungsten, three-phase

Filament voltage, per phase	V_f	max. 28.3 V
Filament current, per phase	I_f	48.5 A
Cold filament resistance, per phase	R_{fo}	0.046 Ω

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

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

CAPACITANCES

Anode to all other elements except grid	C_a	2.6 pF
Grid to all other elements except anode	C_g	72 pF
Anode to grid	C_{ag}	31 pF

COOLING: forced air

[1]) Two tubes

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMIT (Absolute limit)

Temperature of seals	max.	180	^{o}C

LIMITING VALUES (Absolute limits)

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

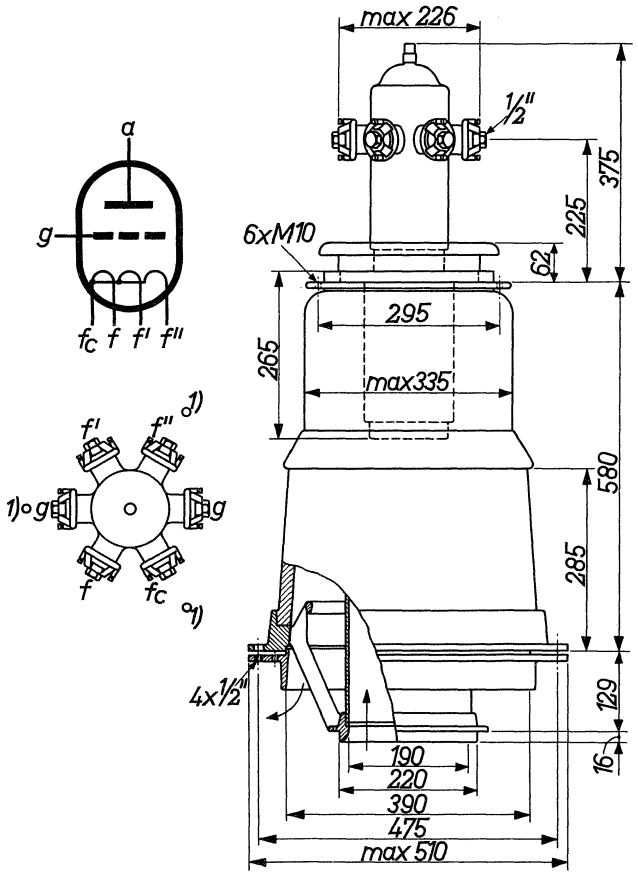
MECHANICAL DATA

Dimensions in mm

Protective caps for grid- and filament seals: 40632

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

Net weight : 20 kg



Tube mounted in cooler housing type K505

Mounting position: vertical with anode down

[1]) Holes for locating pins

WATER COOLED R.F. POWER TRIODE

QUICK REFERENCE DATA									
λ (m)	Freq. (Mc/s)	C telegr.		B teleph.		C_a mod.		B mod. [1]	
		V_a (kV)	W_o (kW)	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
11	27	15	45			12	26	10	32
						10	20.5		
8	37.5	10	26						

HEATING: direct; filament tungsten, three-phase

Filament voltage, per phase	V_f	=	max. 28.3	V
Filament current, per phase	I_f	=	48.5	A
Cold filament resistance, per phase	R_{fo}	=	0.046	Ω

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

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

CAPACITANCES

Anode to all other elements except grid	C_a	=	2.6	pF
Grid to all other elements except anode	C_g	=	72	pF
Anode to grid	C_{ag}	=	31	pF

COOLING: water/air flow to seals

[1]) Two tubes

7Z2 8624

TYPICAL CHARACTERISTICS

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

COOLING CHARACTERISTICS

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

See also the cooling curves

COOLING

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

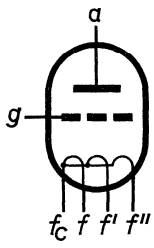
TEMPERATURE LIMITS (Absolute limits)

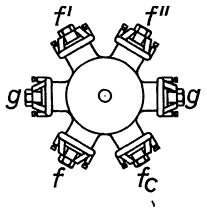
Temperature of seals		= max.	180	°C
Inlet temperature of cooling water	t_i	= max.	50	°C

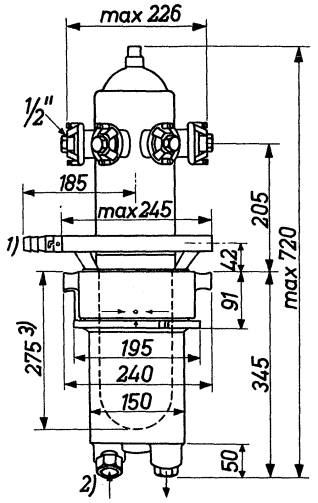
1) At temperatures t_i between 20 and 50 °C the required quantity of water can be found by proportional interpolation

MECHANICAL DATA Dimensions in mm

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







Tube mounted in water-jacket type K715

Mounting position: vertical with anode down

---

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

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

3) For removing the tube from its water-jacket the free height above the tube must be at least 275 mm

7Z2 3774

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

R.F. 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

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

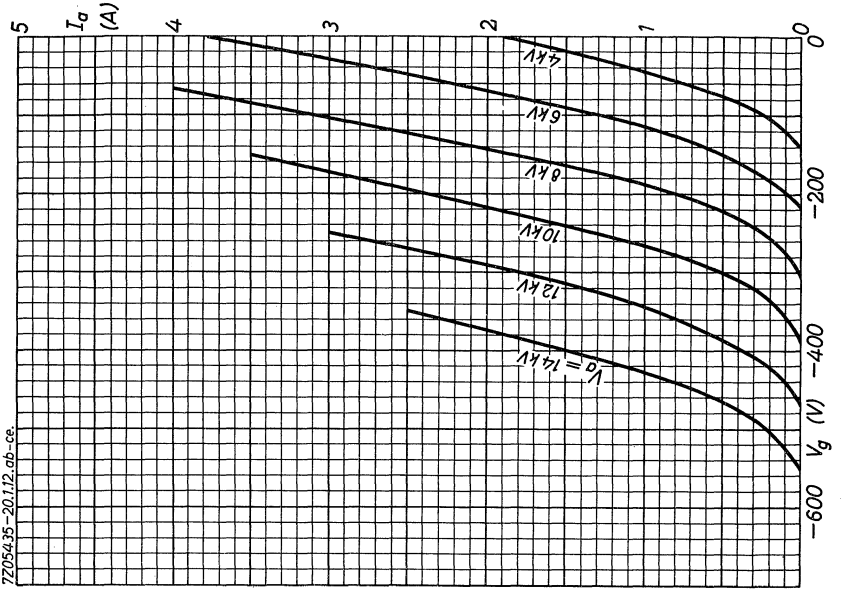
Anode voltage	V_a	=	max. 15	kV
Anode current	I_a	=	max. 6	A
Anode input power	W_{ia}	=	max. 90	kW
Anode dissipation	W_a	=	max. 30	kW

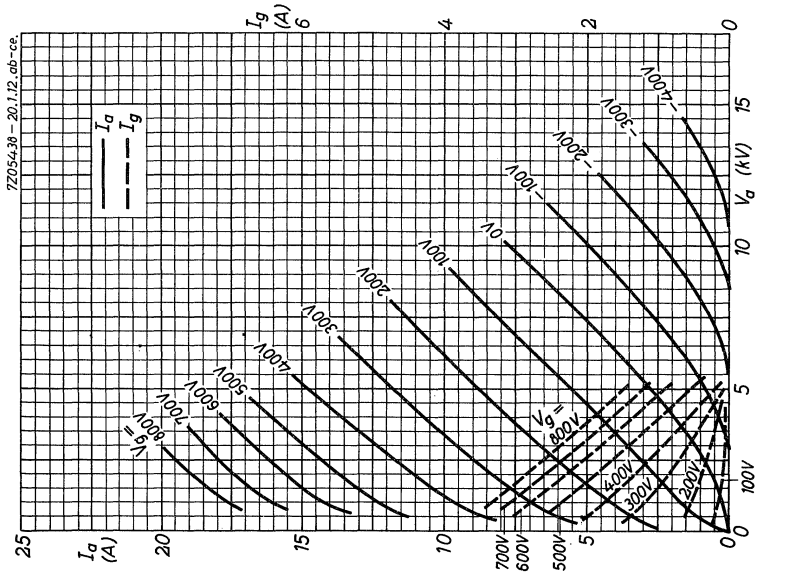
OPERATING CONDITIONS, two tubes in push-pull

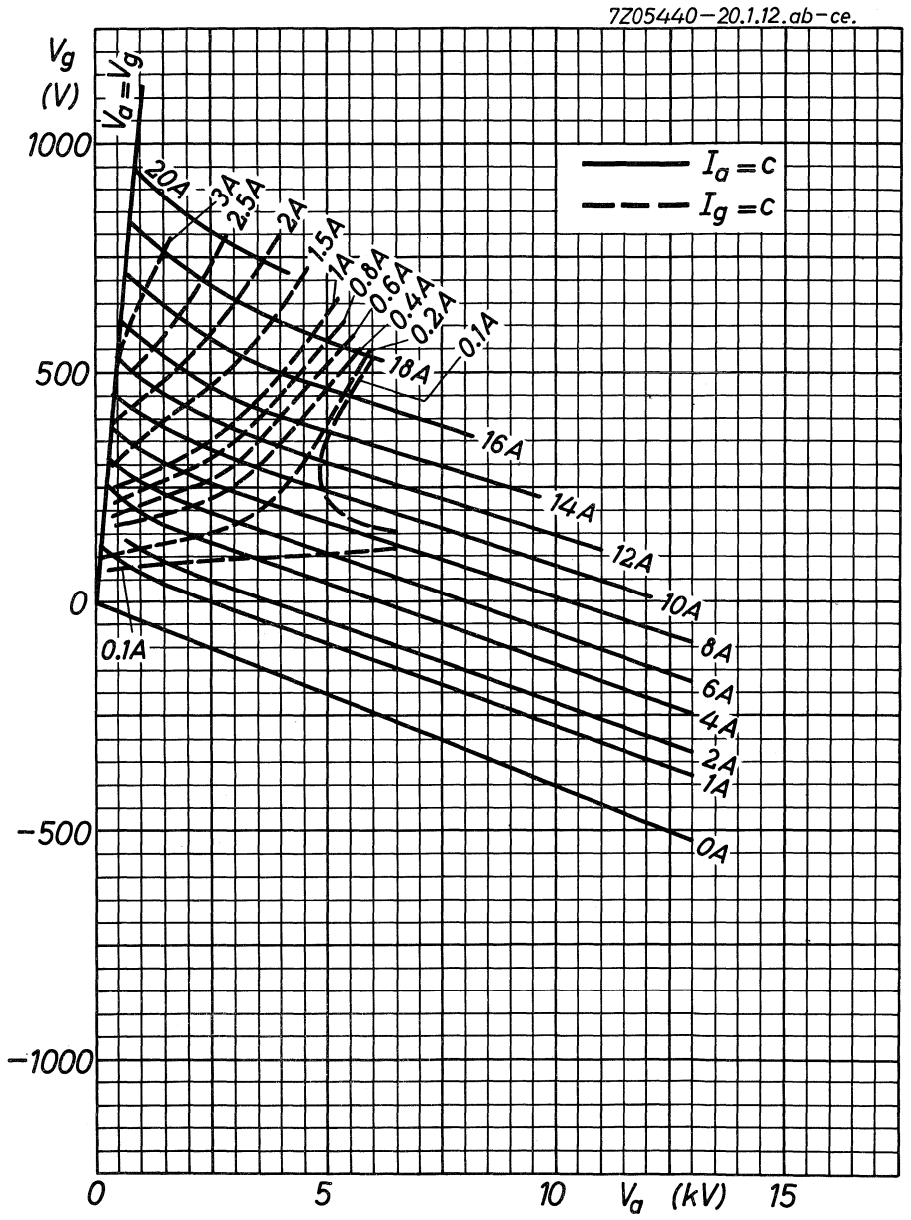
Anode voltage	V_a	=	12		12		kV
Grid voltage	V_g	=	−400		−425		V
Load resistance	$R_{aa\sim}$	=	2.4		5.8		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	2400	0	1480	V
Anode current	I_a	=	2x0.35	2x6	2x0.15	2x2.25	A
Grid current	I_g	=	0	2x0.6	0	2x0.19	A
Peak grid current	I_{gp}	=	0	2x3.3	0	2x1.25	A
Grid input 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	%

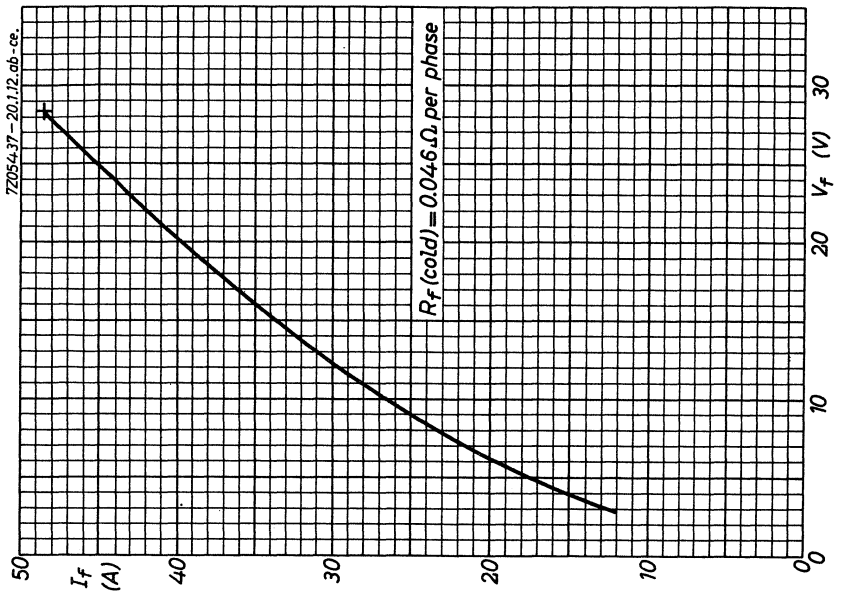
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	−325		−345		V
Load resistance	$R_{aa\sim}$	=	2.1		5		kΩ
Peak grid to grid voltage	V_{ggp}	=	0	2050	0	1330	V
Anode current	I_a	=	2x0.3	2x5.4	2x0.14	2x2.25	A
Grid current	I_g	=	0	2x0.6	0	2x0.2	A
Peak grid current	I_{gp}	=	0	2x3	0	2x1.35	A
Grid input power	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	%

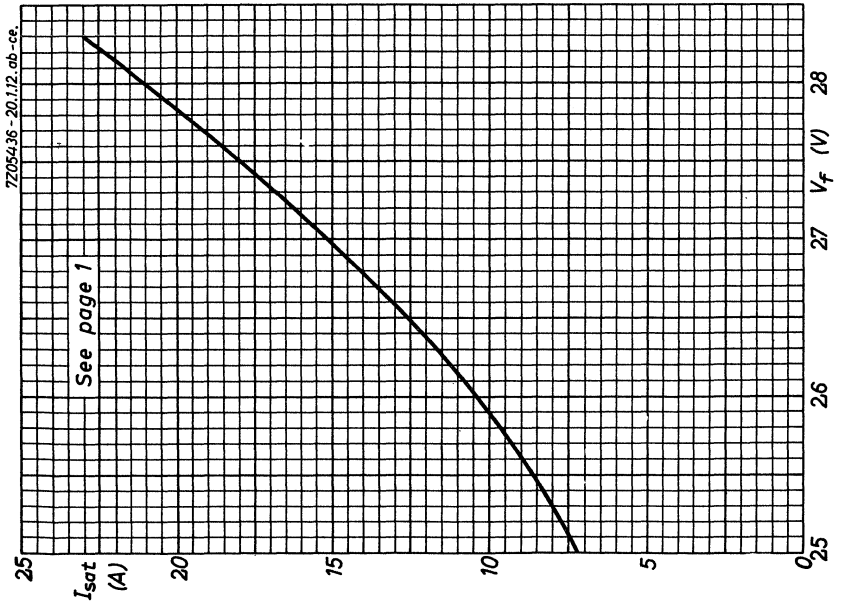
7Z2 3778


I_a (A)
5
4
3
2
1
0
4 kV
6 kV
8 kV
10 kV
12 kV
V_a = 14 kV
−200
−400
−600
V_g (V)
72054.35 − 20.1.12. ab-ce.


I_g (A)
6
4
2
0
I_a
I_g
V_g = 800V
700V
600V
500V
400V
300V
200V
100V
0
−100V
−200V
−300V
−400V
V_a (kV)
15
10
5
0
I_a (A)
25
20
15
10
5
0
72054.38 − 20.1.12. ab-ce.


7Z05440-20.1.12.ab-ce.
V_g (V)
$V_a = V_g$
1000
500
0
−500
−1000
0
5
10
V_a (kV)
15
$I_a = c$
$I_g = c$
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


7Z0543 7 – 20.1.12. ab - ce.
R_f (cold) = 0.046 Ω per phase
I_f (A)
V_f (V)
50
40
30
20
10
0
0
10
20
30


7Z0543 6 - 20.1.12. ab - ce.
See page 1
I_{sat} (A)
V_f (V)
25
20
15
10
5
0
25
26
27
28

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

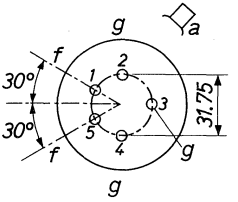
Base : giant 5p

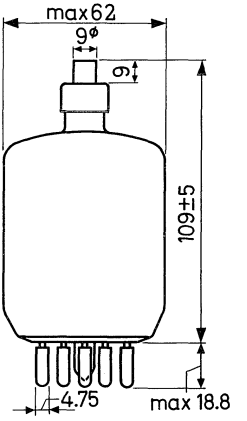
Anode connector : 40624

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_{gp}	=	390	340	300	260	V
Grid input power	W_{ig}	=	14	13	11	10	W
Anode input power	W_{ia}	=	512	410	308	205	W
Anode dissipation	W_a	=	122	115	98	79	W
Output power	W_o	=	390	295	210	126	W
Efficiency	η	=	76	72	68	61.5	%

OPERATING CONDITIONS R.F. CLASS B TELEPHONY

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

7Z2 3781

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

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

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

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

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

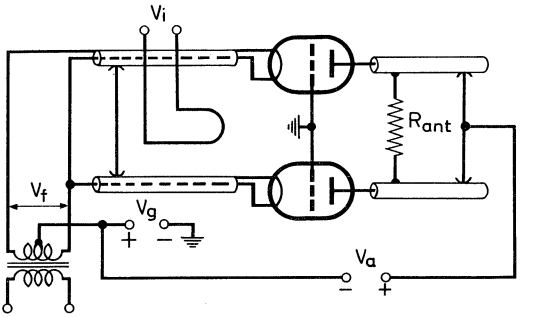
Wavelength	λ	=	7.3	m
Anode voltage	V_a	=	2500	V_{RMS}
Anode current	I_a	=	90	mA
Grid current	I_g	=	20	mA
Grid resistor	R_g	=	1700	Ω
Grid voltage	V_g	=	85	V_{RMS}
Anode input power	W_{ia}	=	255	W
Anode dissipation	W_a	=	85	W
Output power	W_o	=	170	W
Efficiency	η	=	67	%

[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)

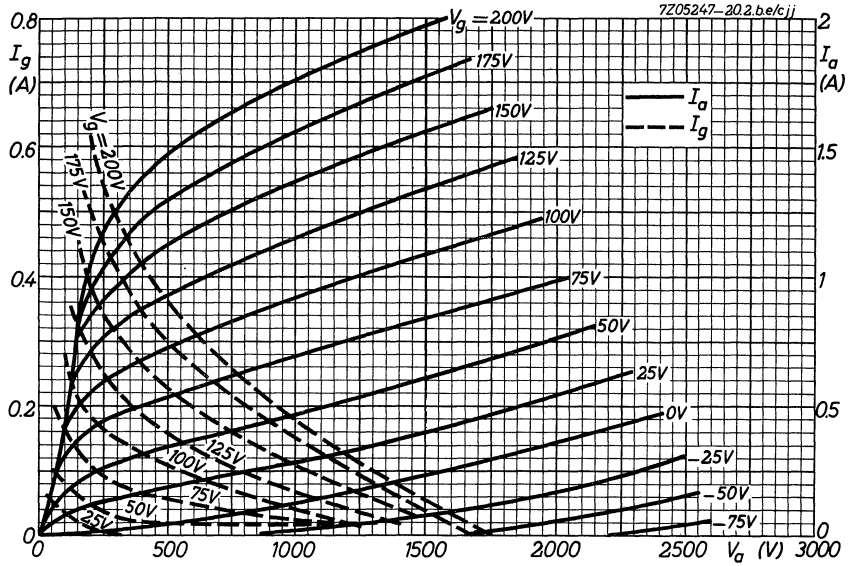
Anode voltage	V_a	= max.	2500	V
Anode dissipation	W_a	= max.	135	W
Grid dissipation	W_g	= max.	16	W
Cathode current	I_k	= max.	250	mA
Peak cathode current	I_{kp}	= max.	1.6	A

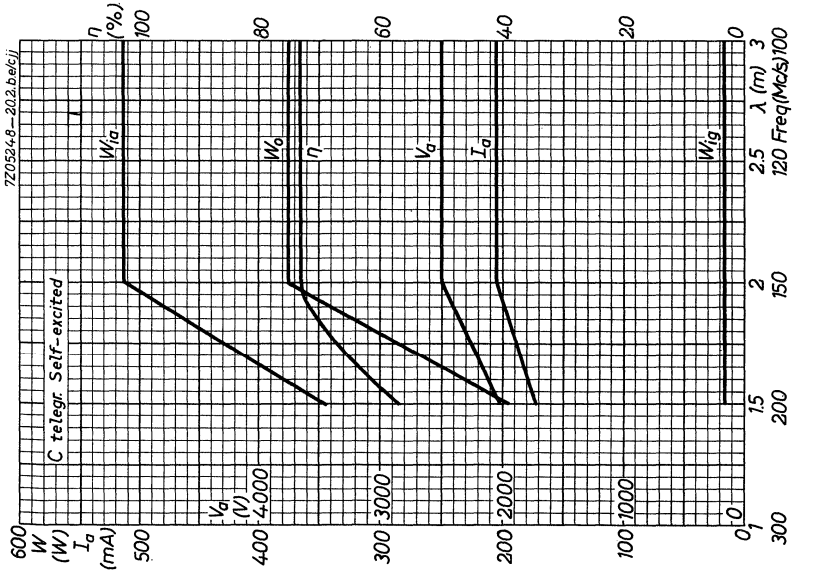
OPERATING CONDITIONS, two tubes

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
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}
I_a (mA)
V_a (V)
λ (m)
Freq(Mc/s)

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

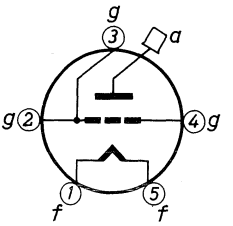
Dimensions in mm

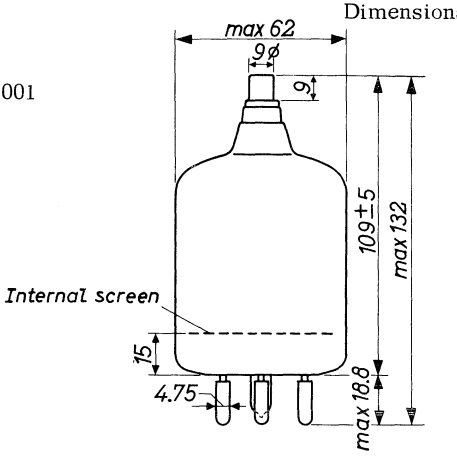
Base : giant 5p

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_{gp}	=	100	100	100	V
Anode input power	W_{ia}	=	193	194	180	W
Anode dissipation	W_a	=	128	130	121	W
Output power	W_o	=	65	64	59	W
Efficiency	η	=	34	33	33	%
Modulation factor	m	=	100	100	100	%
Grid current	I_g	=	20	28	52	mA
Grid input power	W_{ig}	=	3.6	5.1	9.4	W

7Z2 3443

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

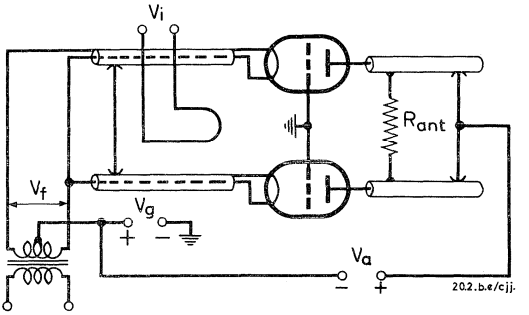
7Z2 3444

R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes



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

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

7Z2 3445

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

[1]) Mean value

7Z2 3446

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

7Z2 3447

A.F. CLASS B AMPLIFIER AND MODULATOR

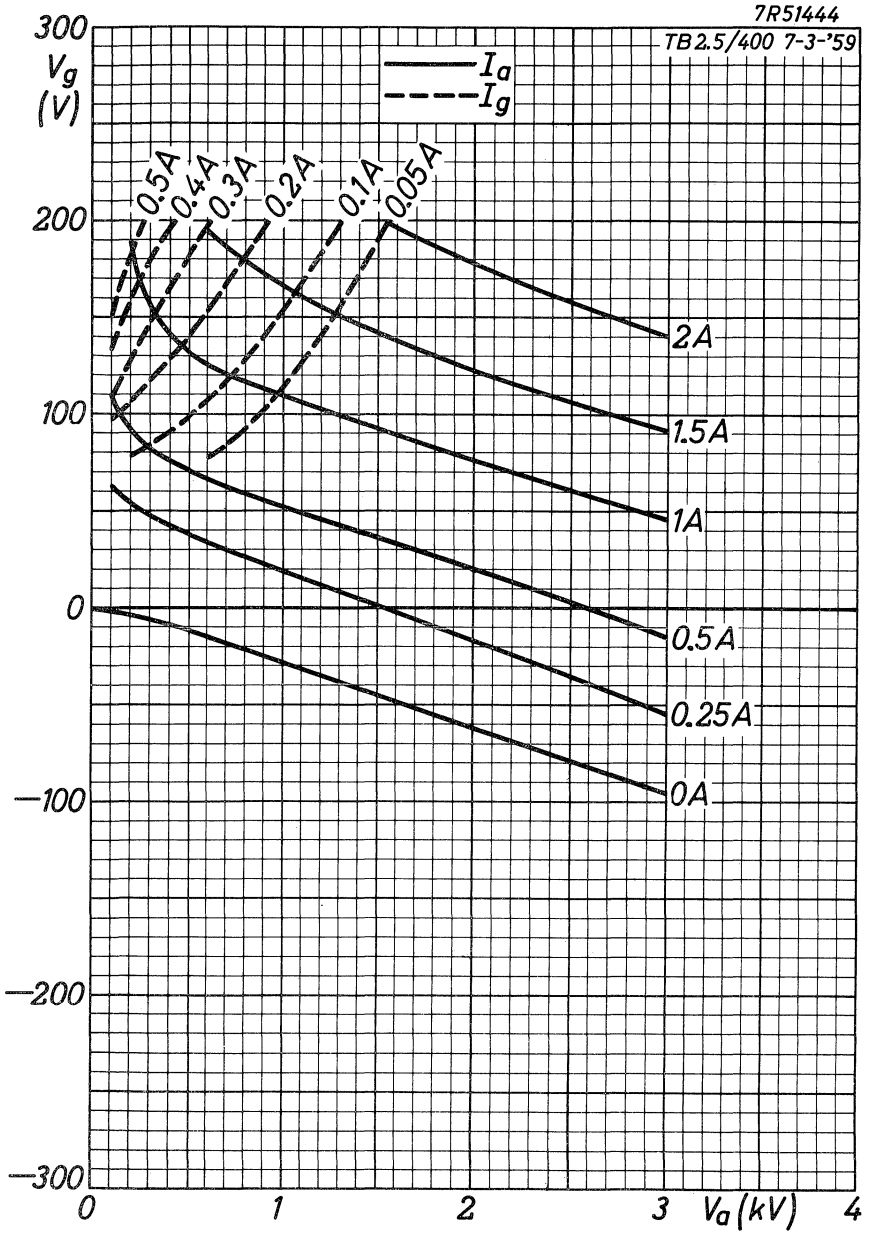
LIMITING VALUES (Absolute limits)

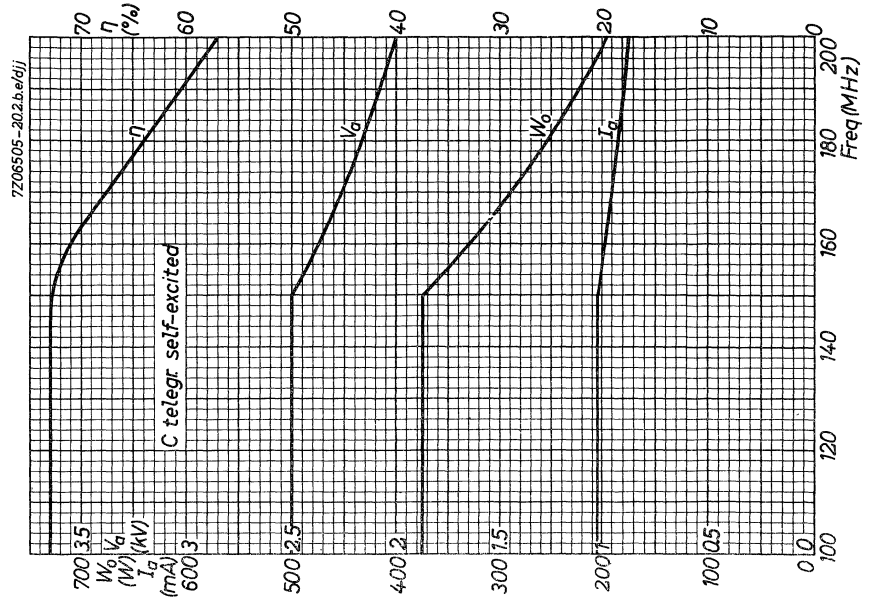
Anode voltage	V_a	= max.	3000	V
Anode current	I_a	= max.	210	mA
Anode dissipation	W_a	= max.	150	W
Anode input power	W_{ia}	= max.	512	W
Grid current	I_g	= max.	45	mA

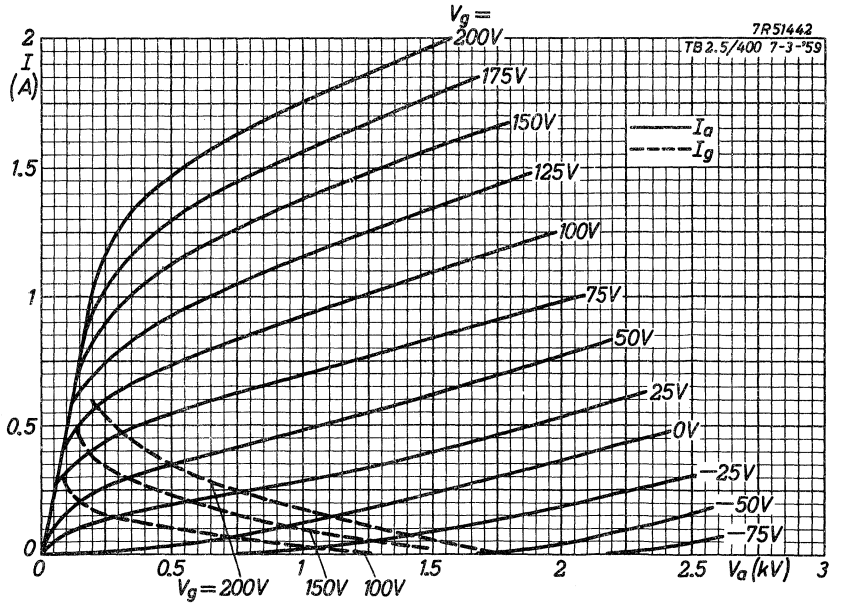
OPERATING CONDITIONS, two tubes

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

7Z2 3448


7R51444
TB2.5/400 7-3-'59
300
Vg
(V)
200
100
0
−100
−200
−300
Ia
Ig
0.5A
0.4A
0.3A
0.2A
0.1A
0.05A
2A
1.5A
1A
0.5A
0.25A
0A
0
1
2
3
Va (kV)
4


7206505-202.b.eldji
C telegr. self-excited
η (%)
Va (kV)
Wo (W)
Ia (mA)
Ig
Freq (MHz)


7R51442
TB 2.5/400 7-3-'59
Vg =
200V
175V
150V
125V
100V
75V
50V
25V
0V
−25V
−50V
−75V
Ia
Ig
I (A)
Va (kV)
Vg = 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

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

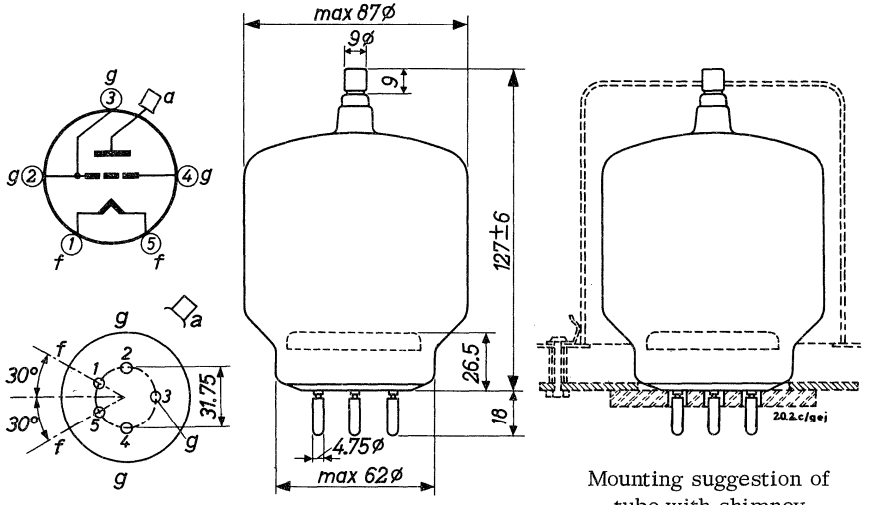
Socket : 2422 512 01001

Anode connector (clip) : 40624

Chimney : 40666

Base : Giant 5p.

Net weight : 190 g



Mounting suggestion of tube with shimney

Mounting position: vertical with base up or down

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

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

LIMITING VALUES (Absolute limits)

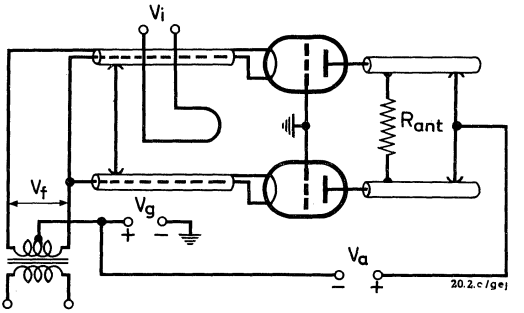
Frequency		f		up to	100	Mc/s
Anode voltage		V_a	=	max.	4	kV
Anode input power		W_{ia}	=	max.	1550	W
Anode dissipation		W_a	=	max.	350	W
Negative grid voltage		$-V_g$	=	max.	500	V
Grid dissipation		W_g	=	max.	40	W
Grid circuit resistance		R_g	=	max.	100	kΩ
Cathode current		I_k	=	max.	500	mA

OPERATING CONDITIONS

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

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

OPERATING CONDITIONS, grounded grid, two tubes



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

[1]) Power transferred from driving stage included

R.F. CLASS C OSCILLATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes

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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

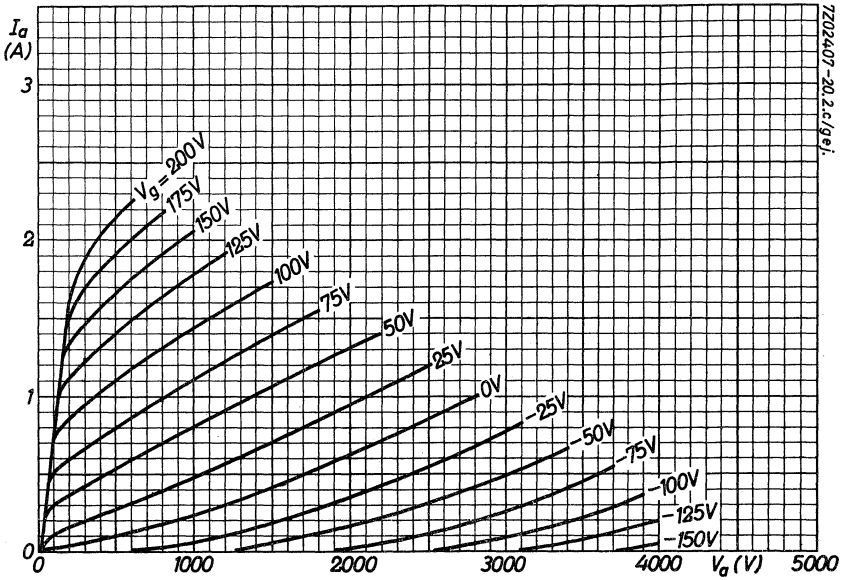
LIMITING VALUES (Absolute limits)

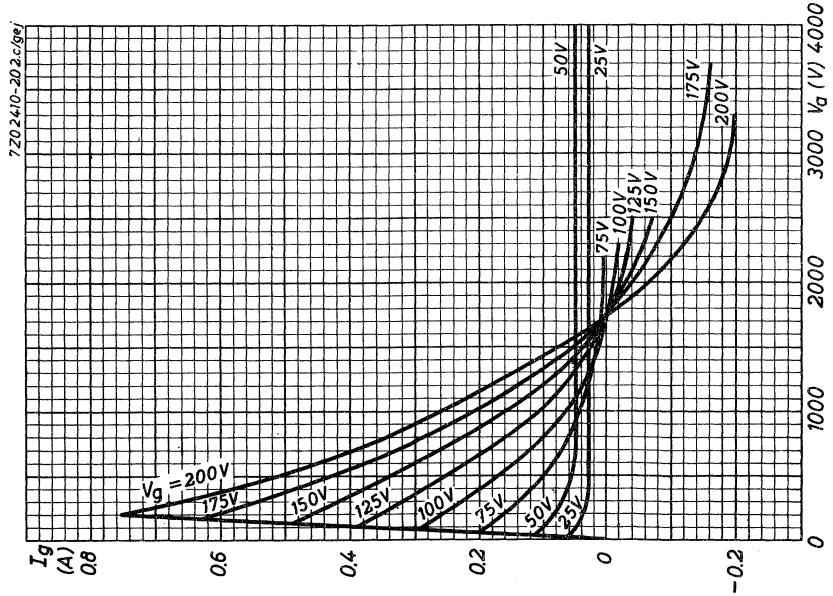
Anode voltage	V_a	=	max. 4	kV
Anode input power	W_{ia}	=	max. 1550	W
Anode dissipation	W_a	=	max. 350	W
Negative grid voltage	$-V_g$	=	max. 500	V
Grid dissipation	W_g	=	max. 40	W
Grid circuit resistance	R_g	=	max. 100	kΩ
Cathode current	I_k	=	max. 500	mA

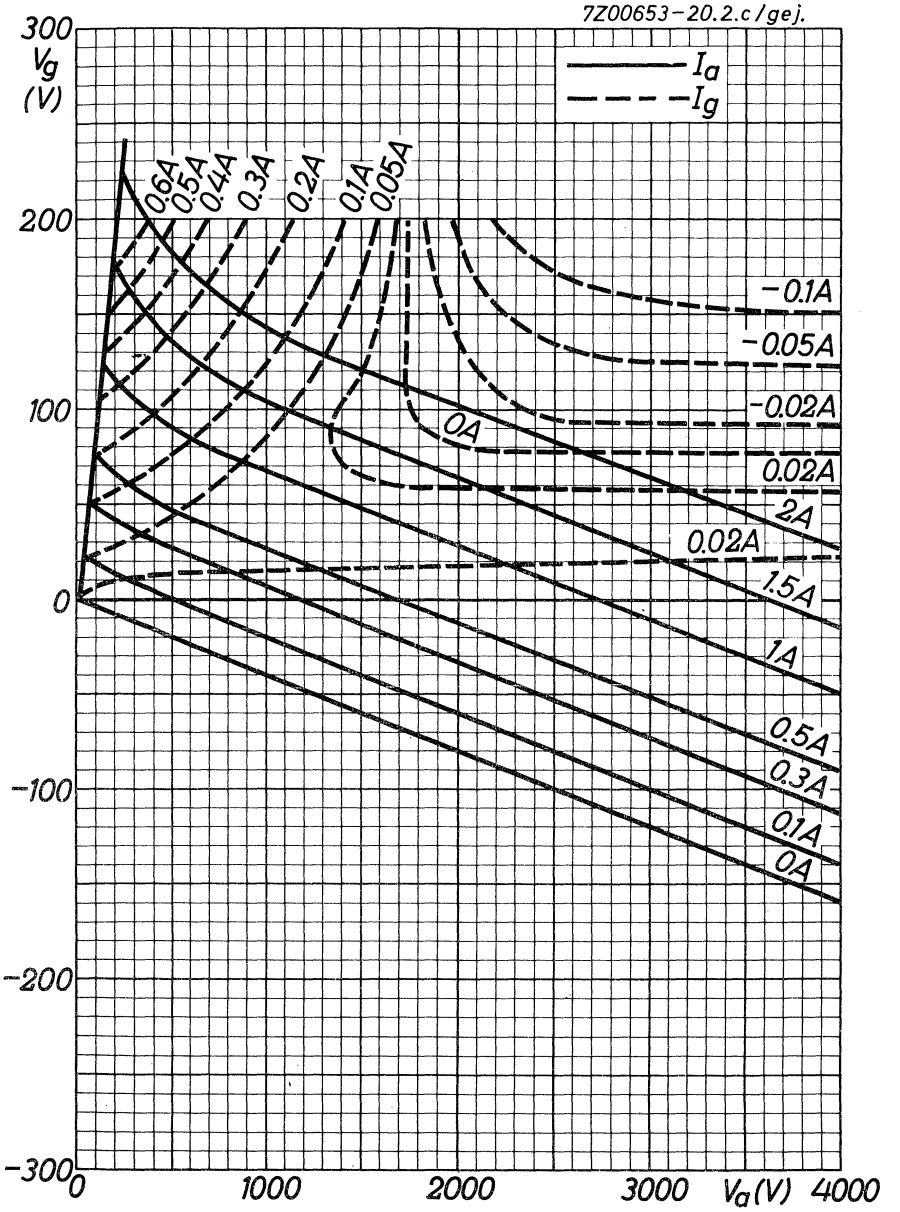
OPERATING CONDITIONS

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

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


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


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


7Z00653-20.2.c/gej.
I_a
I_g
V_g (V)
300
200
100
0
−100
−200
−300
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
0
1000
2000
3000
V_a (V)
4000

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	1690	4000	1950	3000	1050	4000	2290
		3500	1430	3500	1650			3500	2440
		3000	1175	3000	1375			3000	2310
		2500	950	2500	1120			2500	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

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

COOLING

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

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

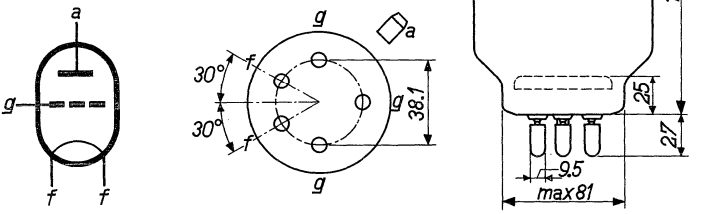
MECHANICAL DATA

Dimensions in mm

Socket : 2422 512 00001

Anode connector: 40626

Net weight : 420 g



Mounting position: vertical with base up or down

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

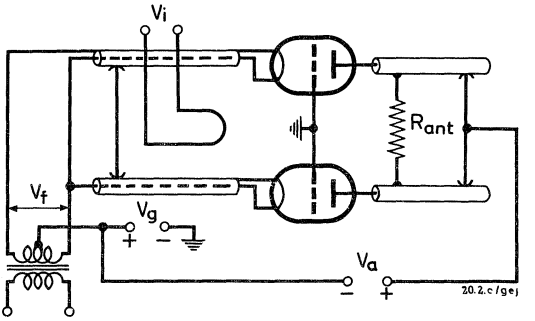
OPERATING CONDITIONS (controlled)

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

OPERATING CONDITIONS (self excited)

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

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



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

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes

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

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

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

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

[3]) D.C. value

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

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

3) D.C. value.

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

LIMITING VALUES (Absolute limits)

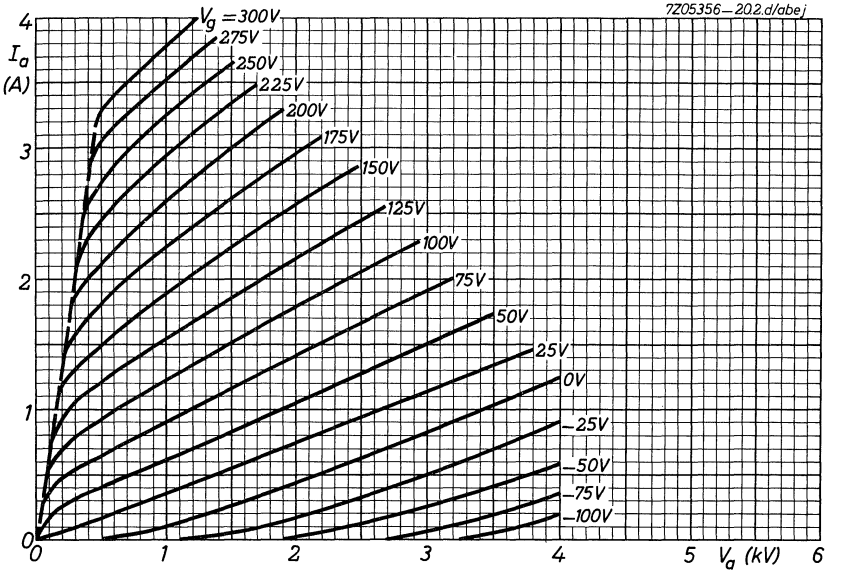
Frequency					
	f		up to	100	Mc/s
Transformer voltage	V_{tr}	=	max.	4500	V_{RMS}
Negative grid voltage	$-V_g$	=	max.	500	V
Anode current	I_a	=	max.	280	mA
Grid current	I_g	=	max.	55	mA
Anode input power	W_{ia}	=	max.	1450	W
Anode dissipation	W_a	=	max.	450	W
Grid dissipation	W_g	=	max.	50	W

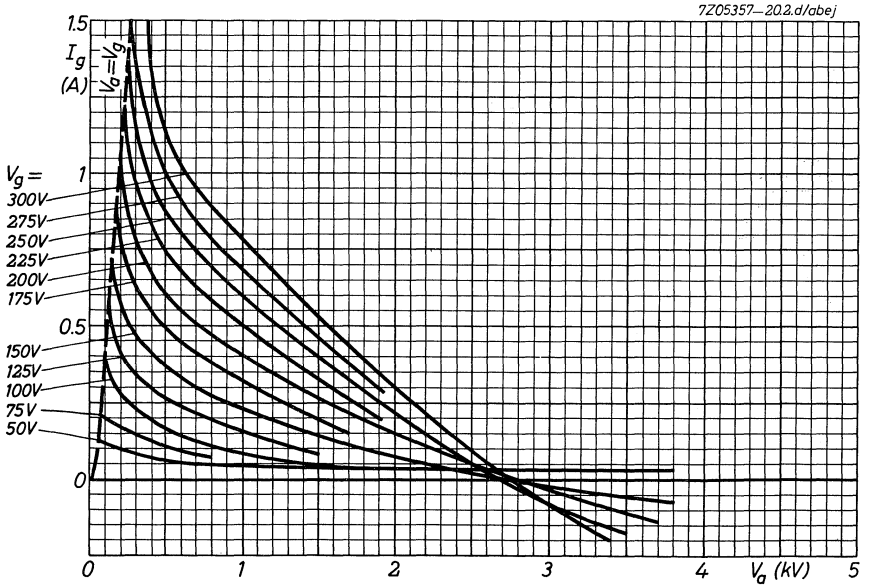
OPERATING CONDITIONS

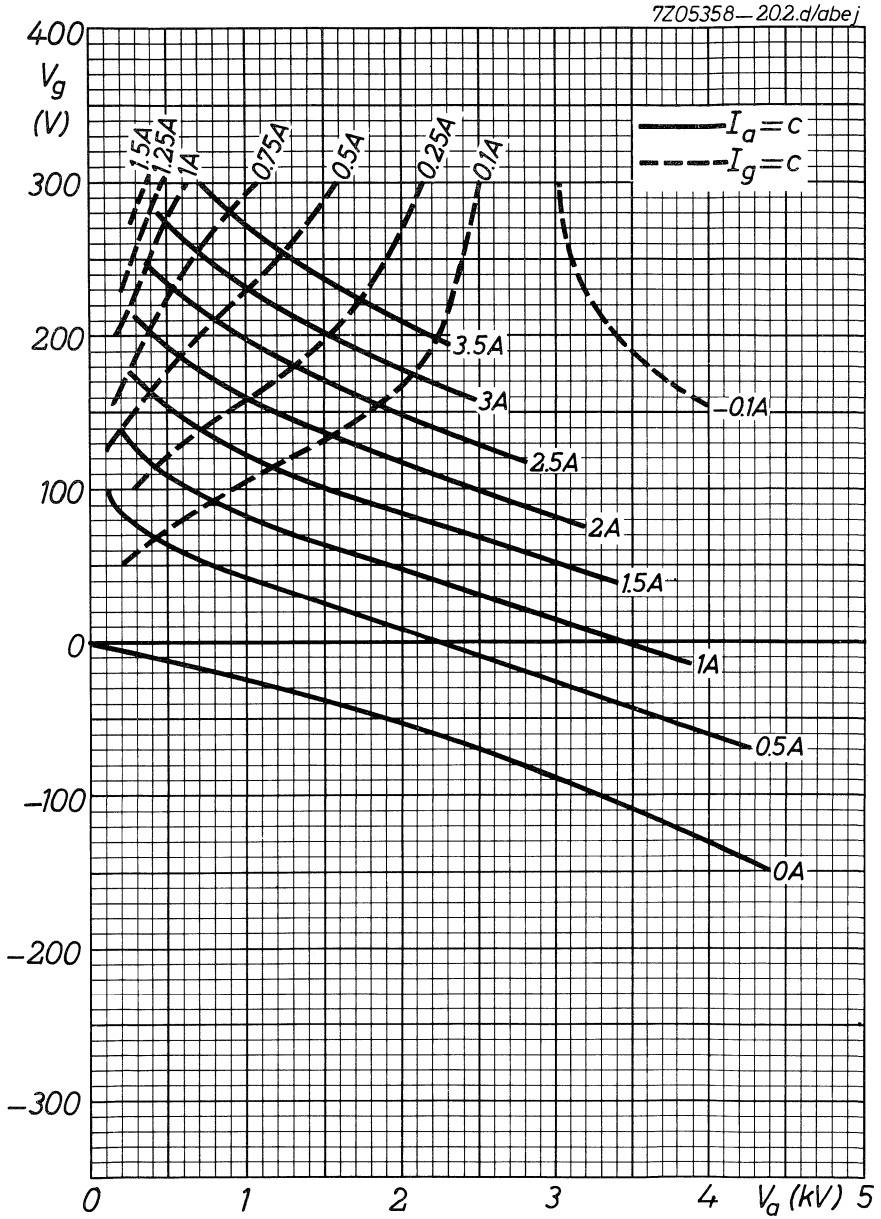
Transformer voltage	V_{tr}	=	4500[1])	3800[2])	V_{RMS}
Anode current	I_a	=	280	240	mA
Grid current	I_g	=	55	47	mA
Grid resistor	R_g	=	3.4	3.4	kΩ
Anode input power	W_{ia}	=	1400	1010	W
Anode dissipation	W_a	=	350	295	W
Output power	W_o	=	1000	670	W
Efficiency	η	=	71.5	66	%

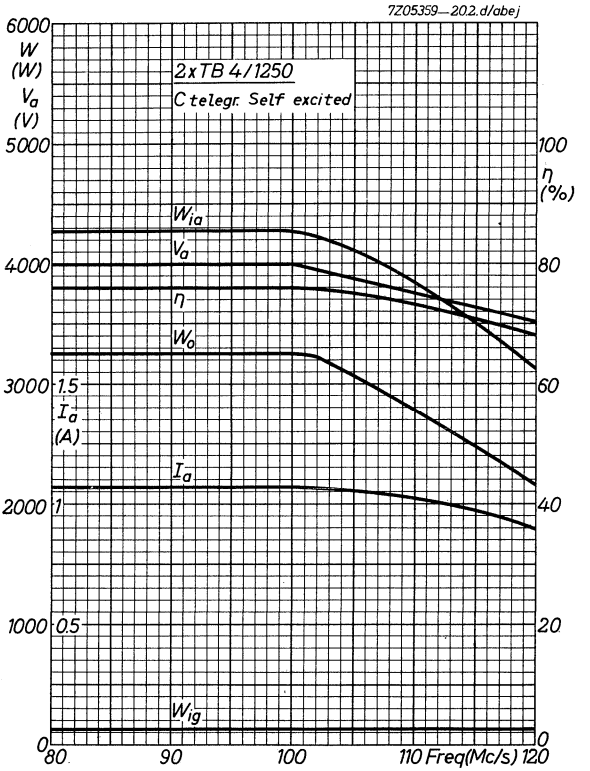
1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements.

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


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_g =
300V
275V
250V
225V
200V
175V
150V
125V
100V
75V
50V
V_a (kV)


7Z05358—202.d/abej
400
V_g
(V)
300
200
100
0
−100
−200
−300
0
1
2
3
4
V_a (kV)
5
$I_a = c$
$I_g = c$
1.5A
1.25A
1A
0.75A
0.5A
0.25A
0.1A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0A
0.1A


7Z05359—202.d/abej
2xTB 4/1250
C telegr. Self excited
6000
W
(W)
V_a
(V)
5000
4000
3000
2000
1000
0
1.5
I_a
(A)
1
0.5
100
η
(%)
80
60
40
20
0
W_{ia}
V_a
η
W_o
I_a
W_{ig}
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)		V_a (V)	W_o(W)	V_a (V_{RMS})	W_o(W)
		CCS	ICAS		CCS		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	=	7.5	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	°C
Bulb temperature	=	max. 350	°C

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.

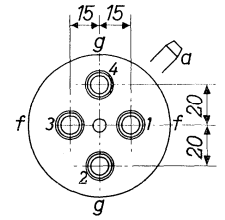
MECHANICAL DATA

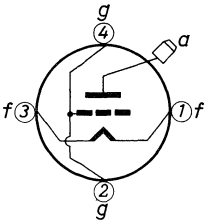
Dimensions in mm

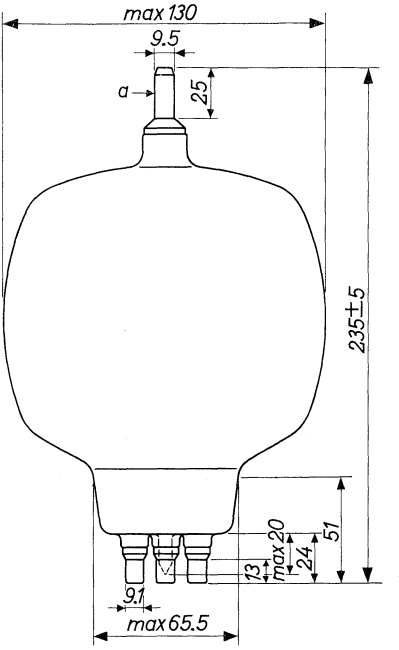
Socket : 2422 511 05001

Anode connector: 40665

Net weight : 450 g







Mounting position: vertical

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%.

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 8	
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%.

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%.

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

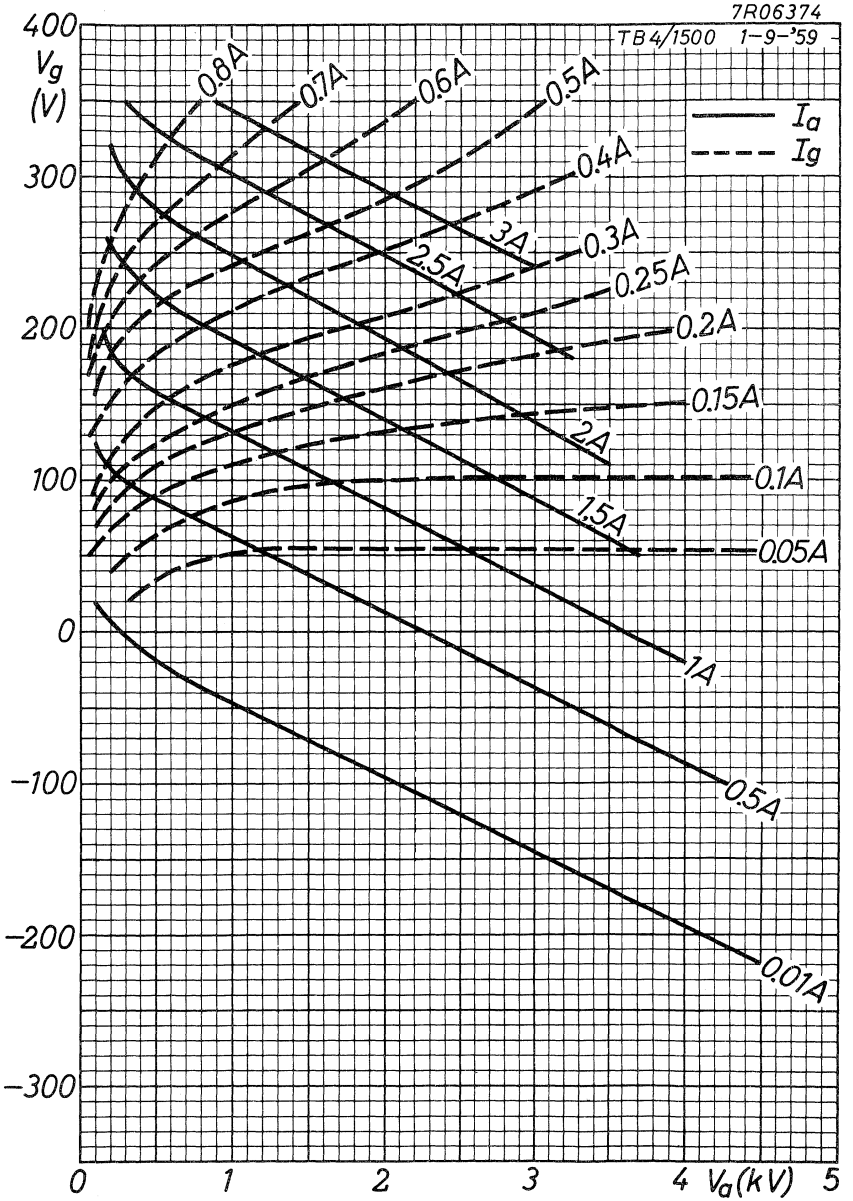
C.C.S. LIMITING VALUES (Absolute limits), continuous service

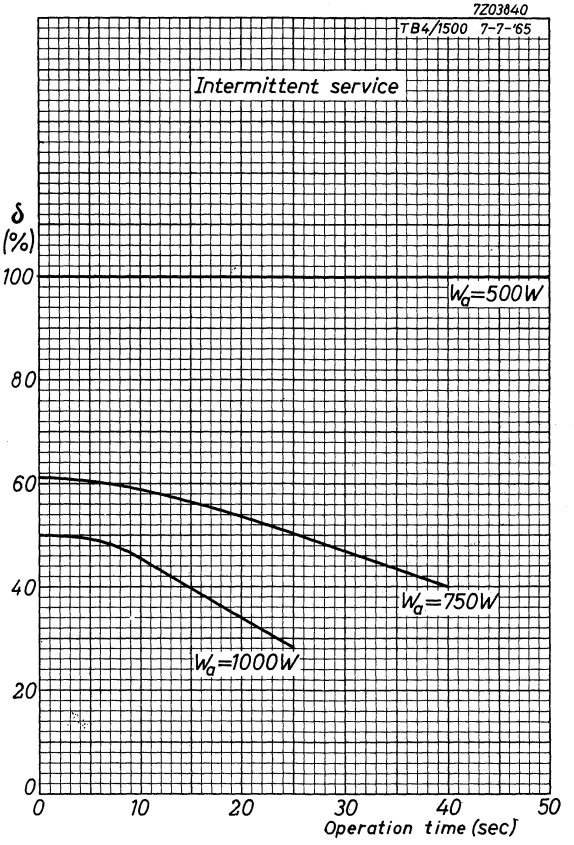
Frequency	f		up to	50	Mc/s
Transformer voltage	V_{tr}	=	max.	5000	V_{RMS}
Anode current	I_a	=	max.	320	mA [1]
Anode input power	W_{ia}	=	max.	1600	W
Anode dissipation	W_a	=	max.	500	W
Negative grid voltage	$-V_g$	=	max.	1350	V [2]
Grid current, loaded	I_g	=	max.	110	mA [1]
Grid current, unloaded	I_g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


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


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

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)		V_a (V)	W_o(W)	V_a (V_{RMS})	W_o(W)
		CCS	ICAS		CCS		CCS
50	6000 5000 4000 3000	2840 2720 2160 1560	4400 3375	5400 4500	2750 2550	5200	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

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.

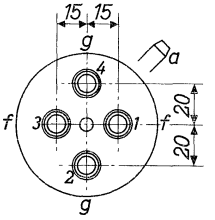
MECHANICAL DATA

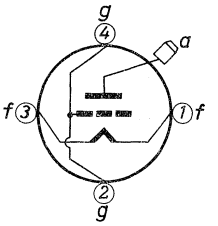
Dimensions in mm

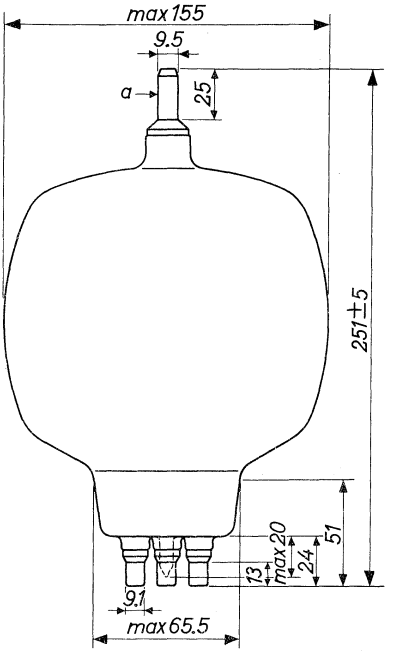
Socket : 2422 511 05001

Anode connector: 40665

Net weight : 600 g







Mounting position: vertical

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%.

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 8		
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%.

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%.

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

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

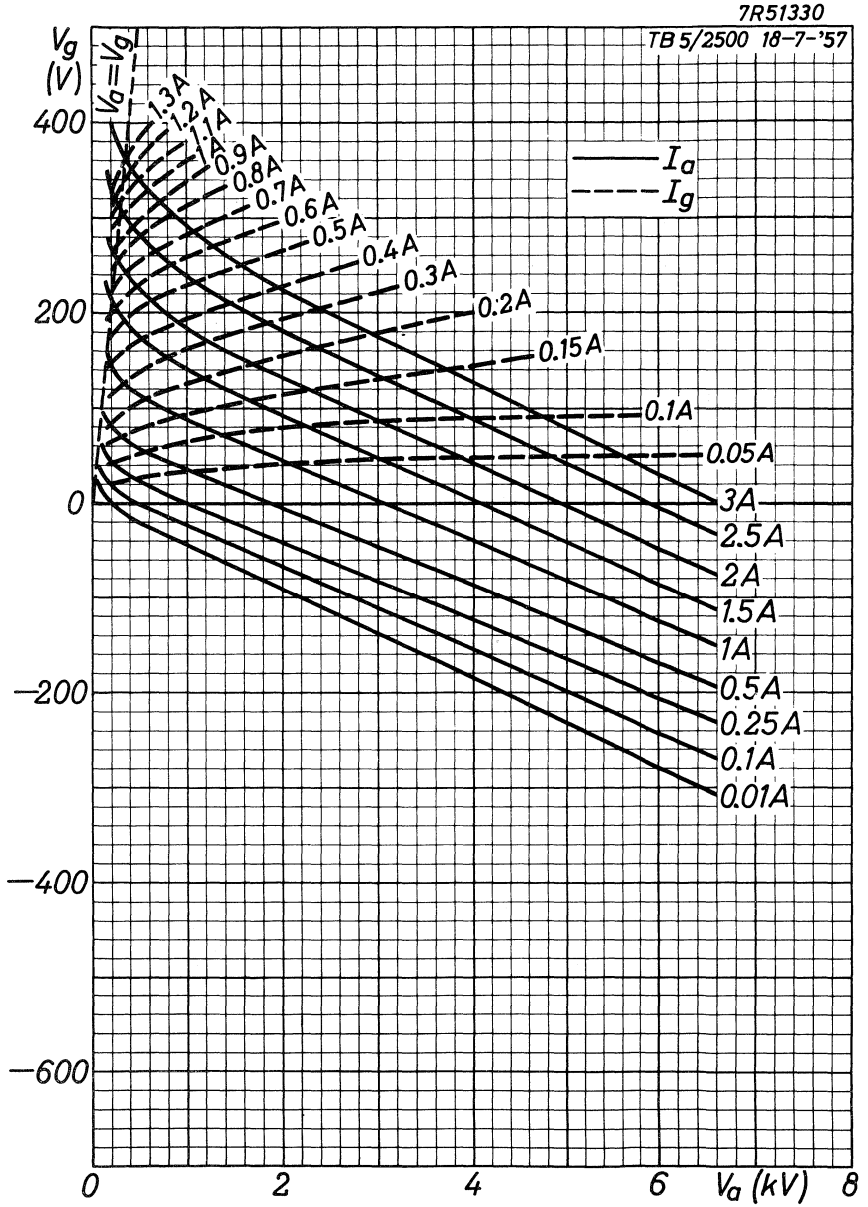
Frequency	f		up to	50	Mc/s
Transformer voltage	V_{tr}	=	max.	5600	V_{RMS}
Anode current	I_a	=	max.	400	mA [1]
Anode input power	W_{ia}	=	max.	2250	W
Anode dissipation	W_a	=	max.	800	W
Negative grid voltage	$-V_g$	=	max.	1250	V [2]
Grid current, loaded	I_g	=	max.	160	mA [1]
Grid current, unloaded	I_g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

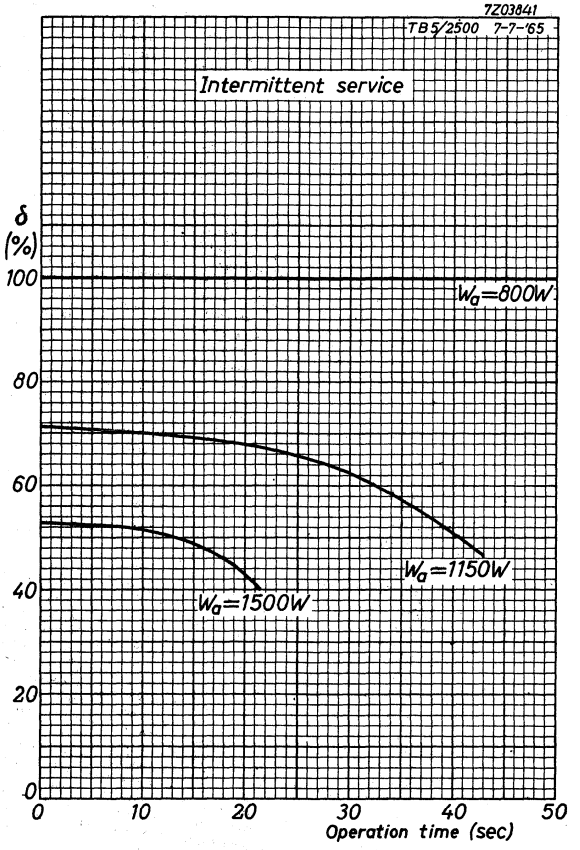
C.C.S. OPERATING CONDITIONS, continuous service

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%.


7R51330
TB 5/2500 18-7-'57
Vg (V)
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
400
200
0
−200
−400
−600
0
2
4
6
8
Va (kV)


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

WATER COOLING CHARACTERISTICS

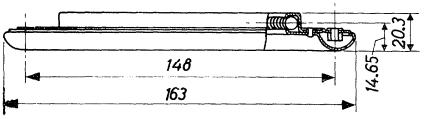
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
5	20	2.3	0.02	56
	50	4.6	0.07	68
10	20	4.5	0.06	55
	50	9.0	0.21	67
15	20	7.0	0.14	53
	50	14.0	0.45	66

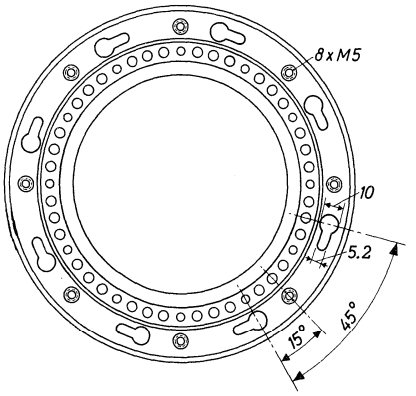
Water inlet temperature t_i = max. 50 °C

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

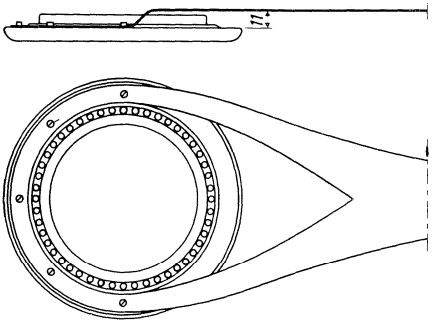
MECHANICAL DATA

Dimensions in mm





Grid connector 40664



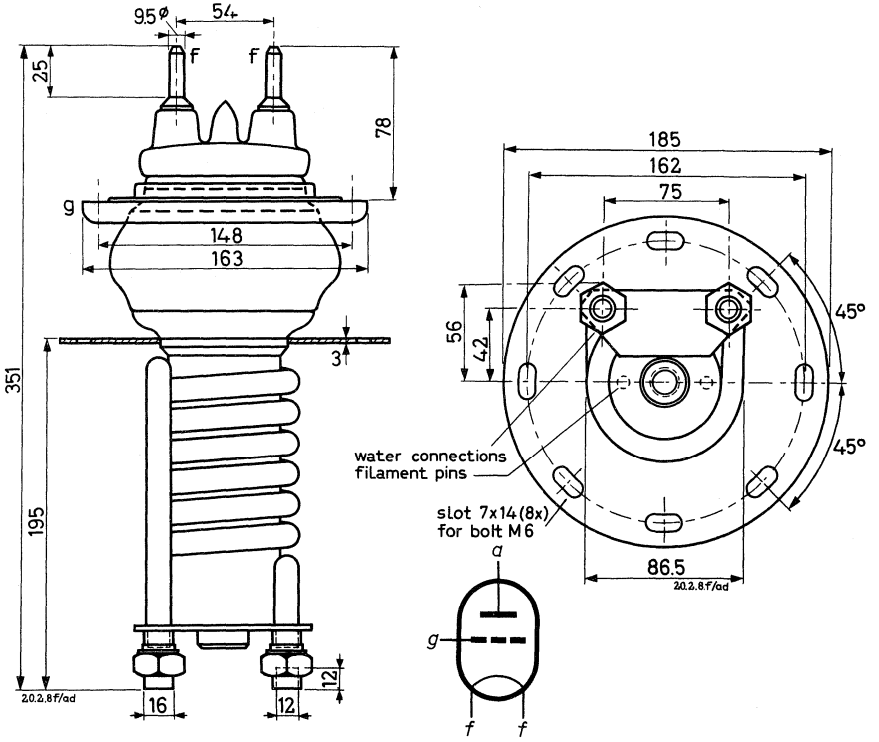
Connection of the grid lead

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

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

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

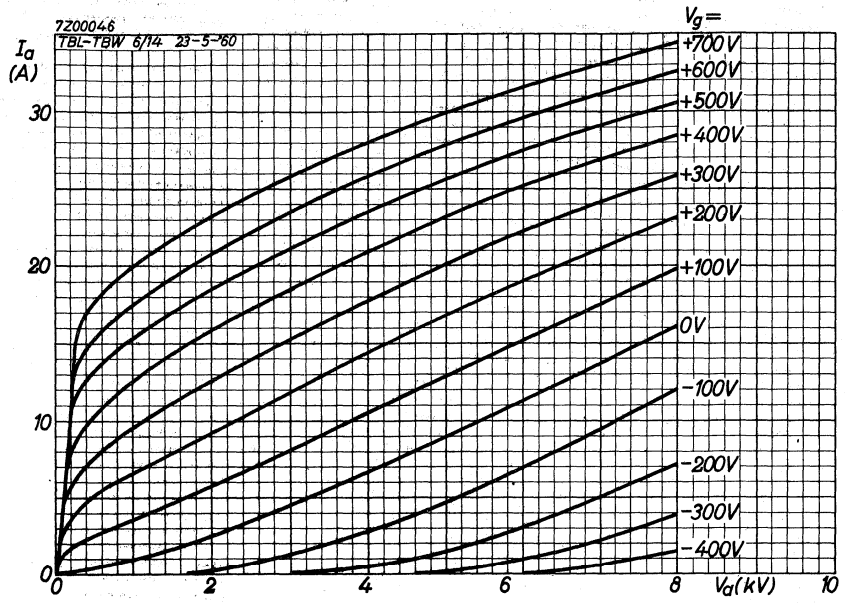
LIMITING VALUES (Absolute limits)

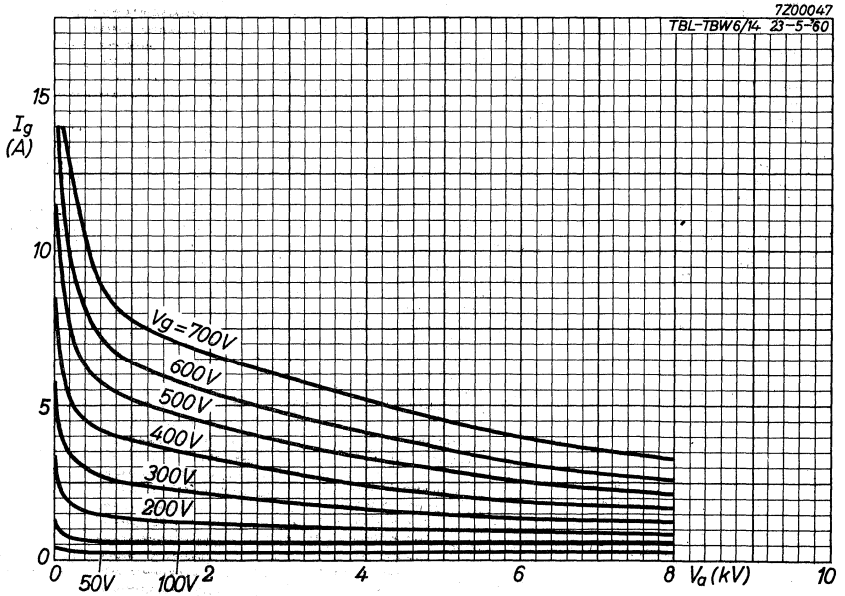
Frequency		f	up to	30	MHz
Anode voltage		V_a	max.	8	kV
Anode input power		W_{ia}	max.	30	kW
Anode dissipation		W_a	max.	15	kW
Anode current		I_a	max.	4.0	A
Negative grid voltage		$-V_g$	max.	1600	V
Grid current, loaded		I_g	max.	1.5	A
Grid current, unloaded		I_g	max.	2.0	A
Grid circuit resistance		R_g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

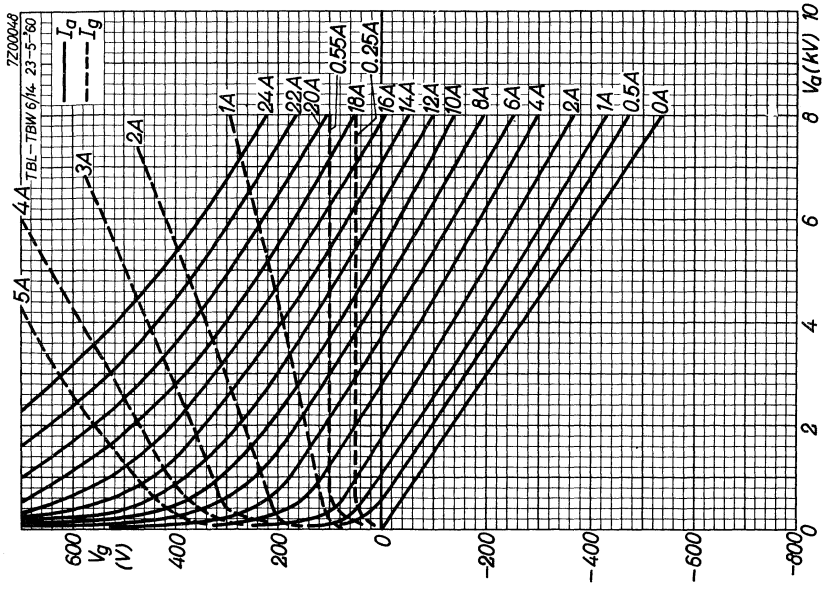
OPERATING CONDITIONS

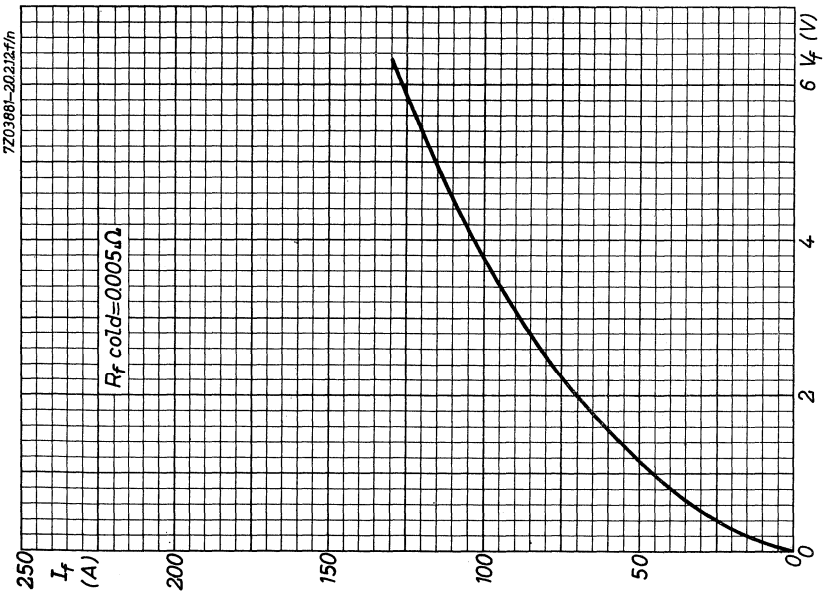
Frequency	f	30	30	MHz
Anode voltage	V_a	7	6	kV
Anode current, loaded	I_a	3.5	3.3	A
Anode current, unloaded	I_a	0.7	0.51	A
Grid current, loaded	I_g	0.95	0.8	A
Grid current, unloaded	I_g	1.35	1.1	A
Grid resistor	R_g	950	1000	Ω
Load resistance	$R_{a\sim}$	1000	870	Ω
Feedback ratio under loaded conditions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

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


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
30
20
10
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
50V
100V
2
4
6
8
V_a(kV)
10


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


7Z03881-20212f/n
Rf cold=0.005Ω
250
200
150
100
50
0
If (A)
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	°C
Temperature of filament seals		max.	210	°C
Temperature of anode and grid seals		max.	180	°C

WATER COOLING CHARACTERISTICS

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

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

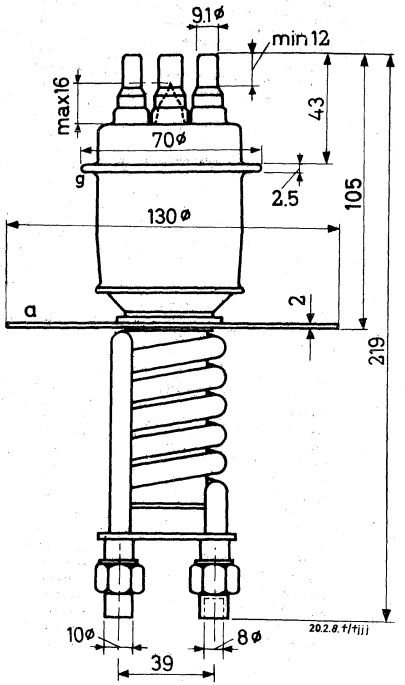
In general no air cooling will be required at ambient temperatures below 35 °C. At higher temperatures a low velocity air flow to the grid and filament seals will be necessary.

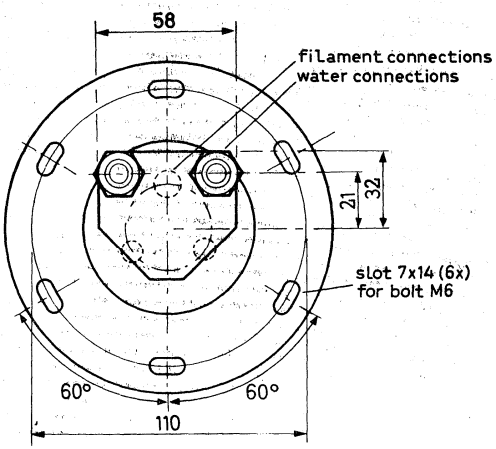
7Z2 8642

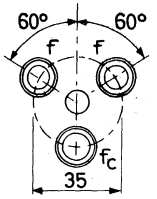
MECHANICAL DATA

Dimensions in mm

Filament connectors	40634	
Grid connector	40622	
Net weight	0.8	kg







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

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

Mounting position: vertical with anode down

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

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

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.

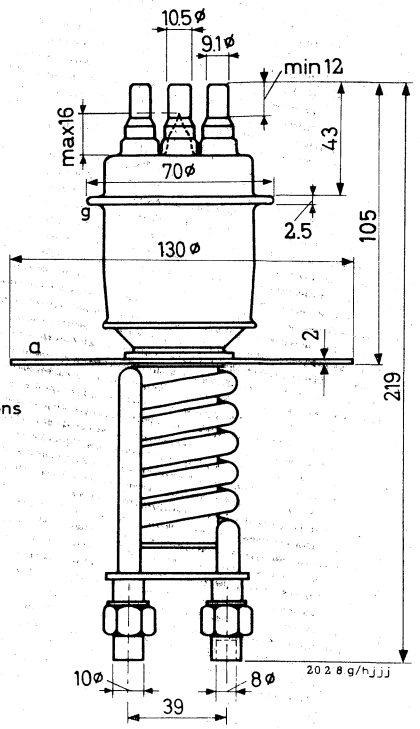
The grid connector 40650 must not be used at frequencies higher than 30 Mc/s.

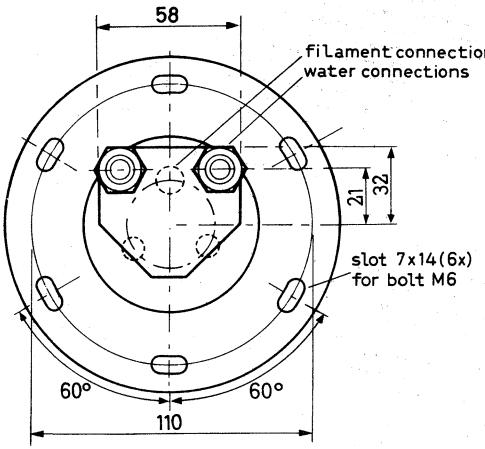
7Z2 8645

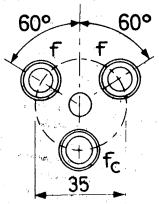
MECHANICAL DATA

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

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

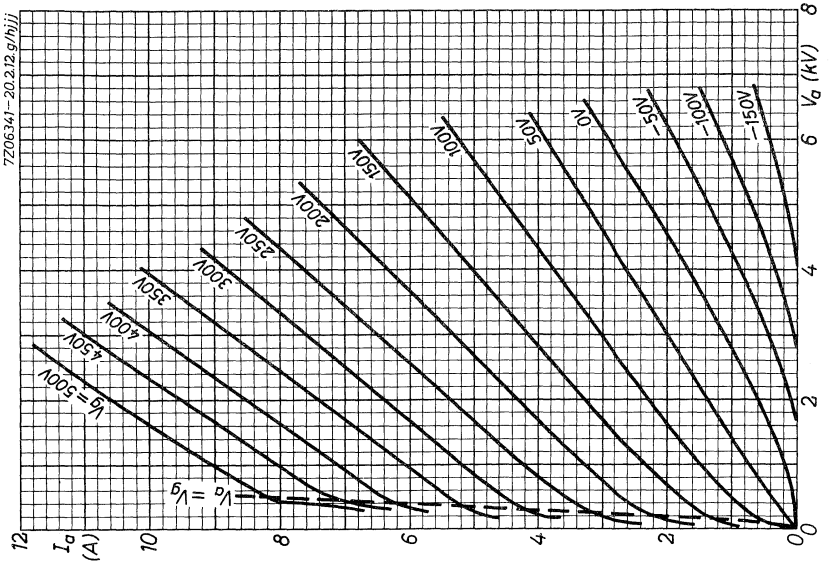
LIMITING VALUES (Absolute limits)

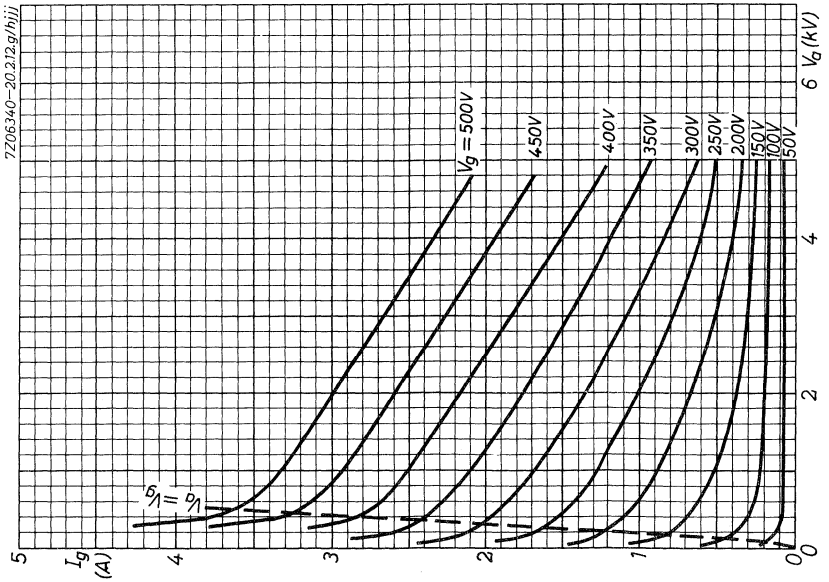
Frequency	f		up to	55	Mc/s
Anode voltage	V_a	=	max.	7	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	1.8	A
Grid current, loaded	I_g	=	max.	0.5	A
Grid current, unloaded	I_g	=	max.	0.7	A
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid resistor	R_g	=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

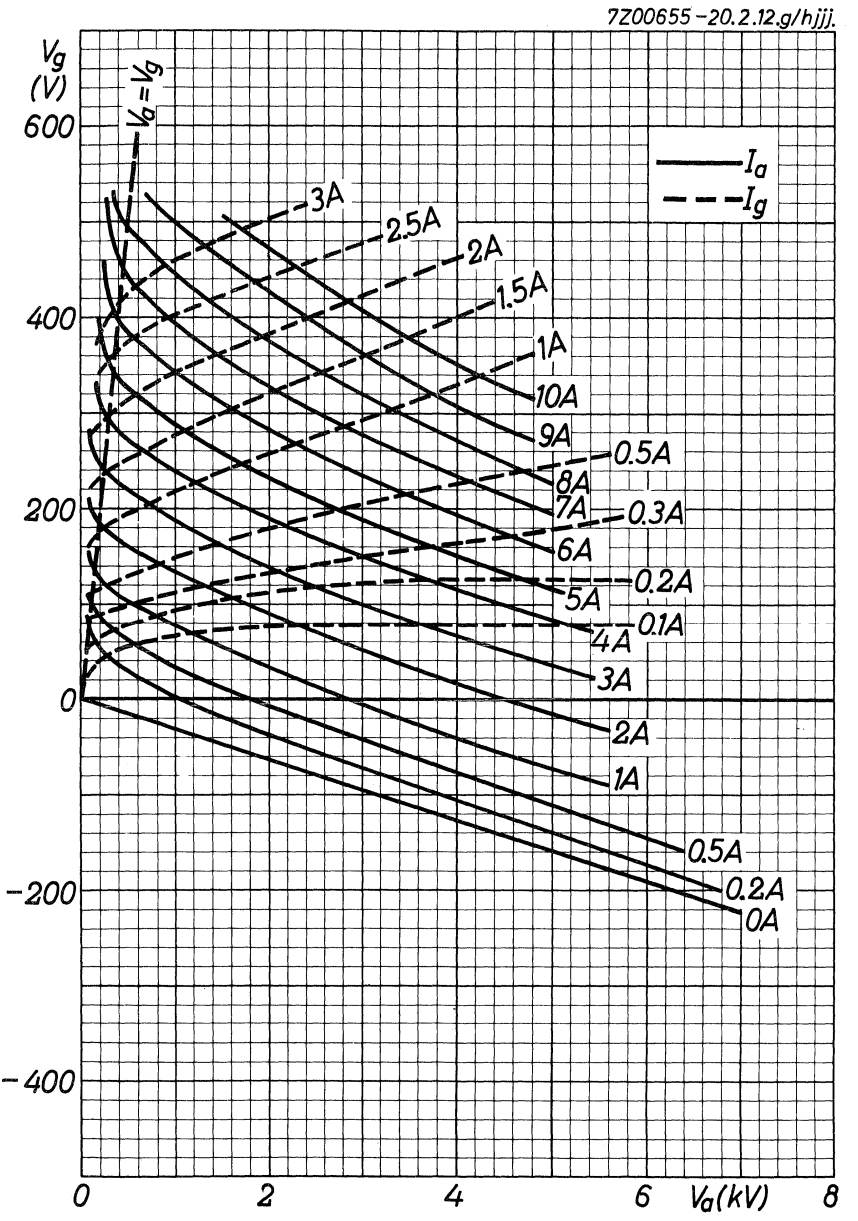
OPERATING CONDITIONS

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/hjj
I_a (A)
V_a (kV)
$V_a = V_g$
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
-50V
-100V
-150V


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


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
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.3A
0.2A
0.1A
0.5A
0.2A
0A
0
2
4
6
8
Va(kV)

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

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Useful power in the load

7Z2 8646

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of the seals = max. 220 °C

WATER COOLING CHARACTERISTICS

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

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

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

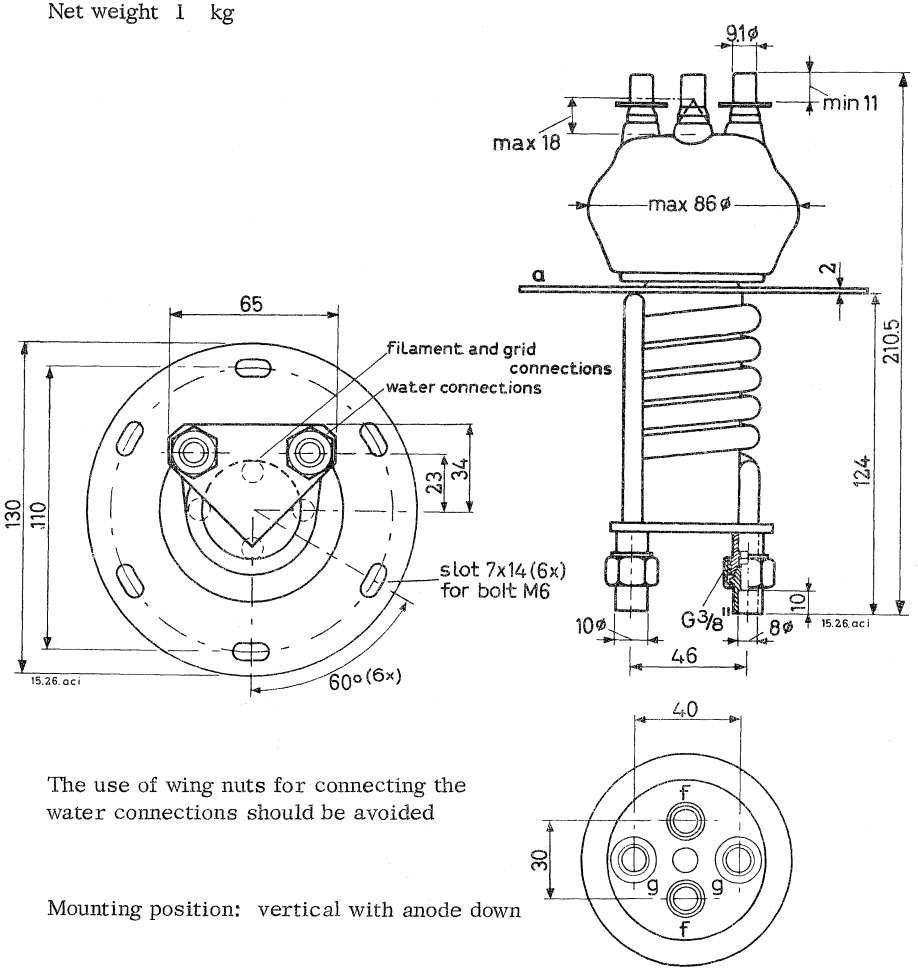
At frequencies above 4 MHz both grid terminals should be connected in parallel and care should be taken to distribute the R.F. current equally over both grid terminals to avoid excessive temperatures.

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

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

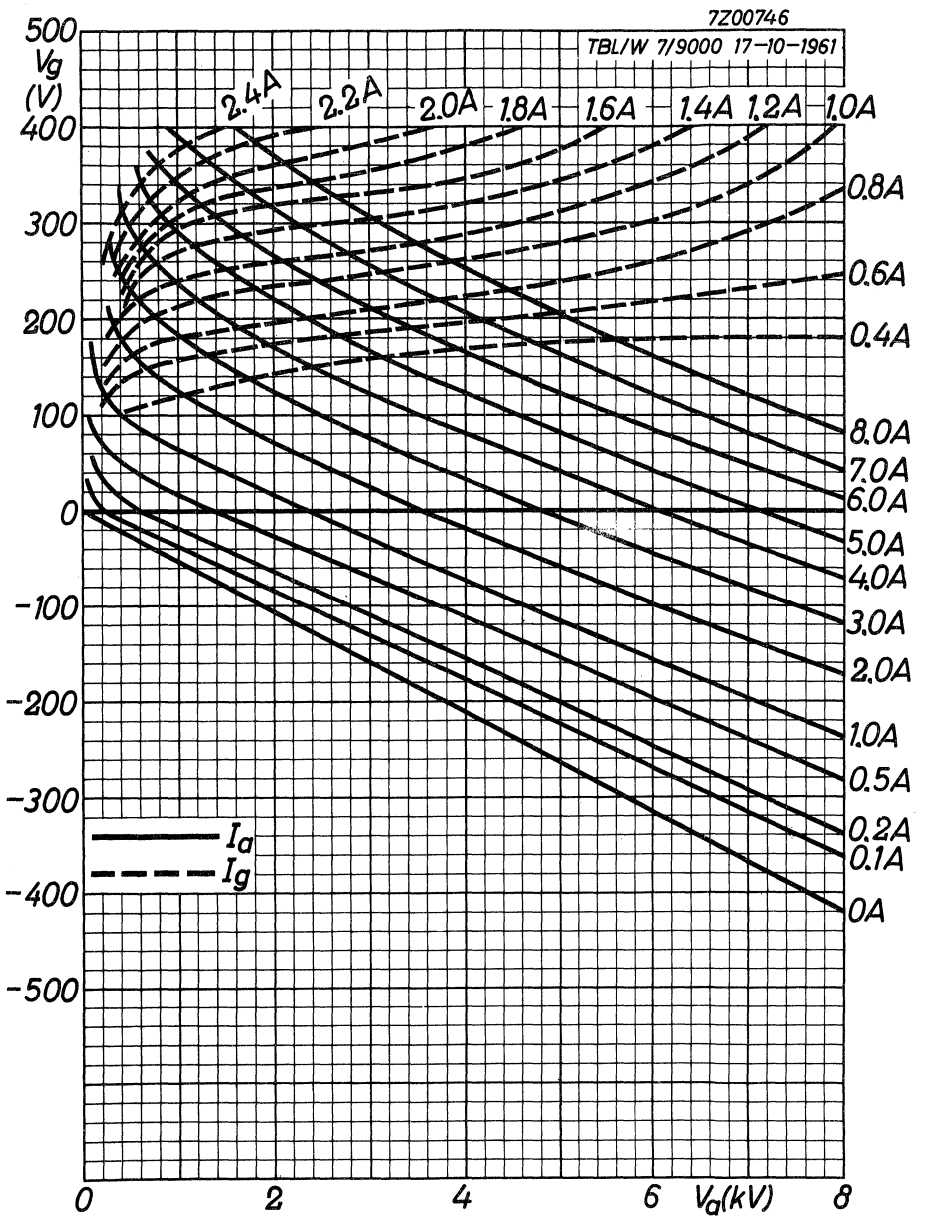
LIMITING VALUES (Absolute limits), continuous service

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 %


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

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

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

7Z2 8647

TEMPERATURE LIMITS (Absolute limits)

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

WATER COOLING CHARACTERISTICS

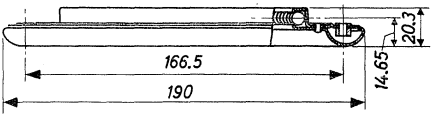
W_a (kW)	t_i (°C)	qmin (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.50
20	20	9.3	0.30
	50	18.6	1.0

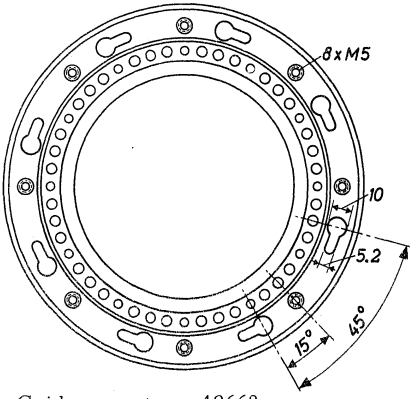
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation

Generally a low velocity air flow to the seals is required

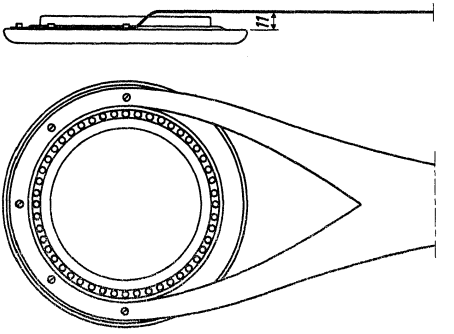
MECHANICAL DATA

Dimensions in mm





Grid connector 40663



Connection of the grid lead

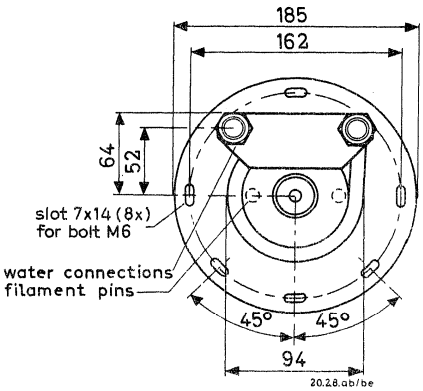
The rounded side of the grid connector should face the anode. To ensure a uniform R.F. current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown at right.

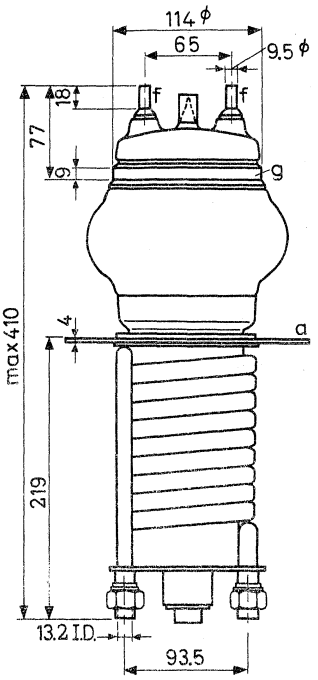
7Z2 3556

MECHANICAL DATA (continued)

Dimensions in mm

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





Mounting position: vertical with anode down

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

LIMITING VALUES (Absolute limits)

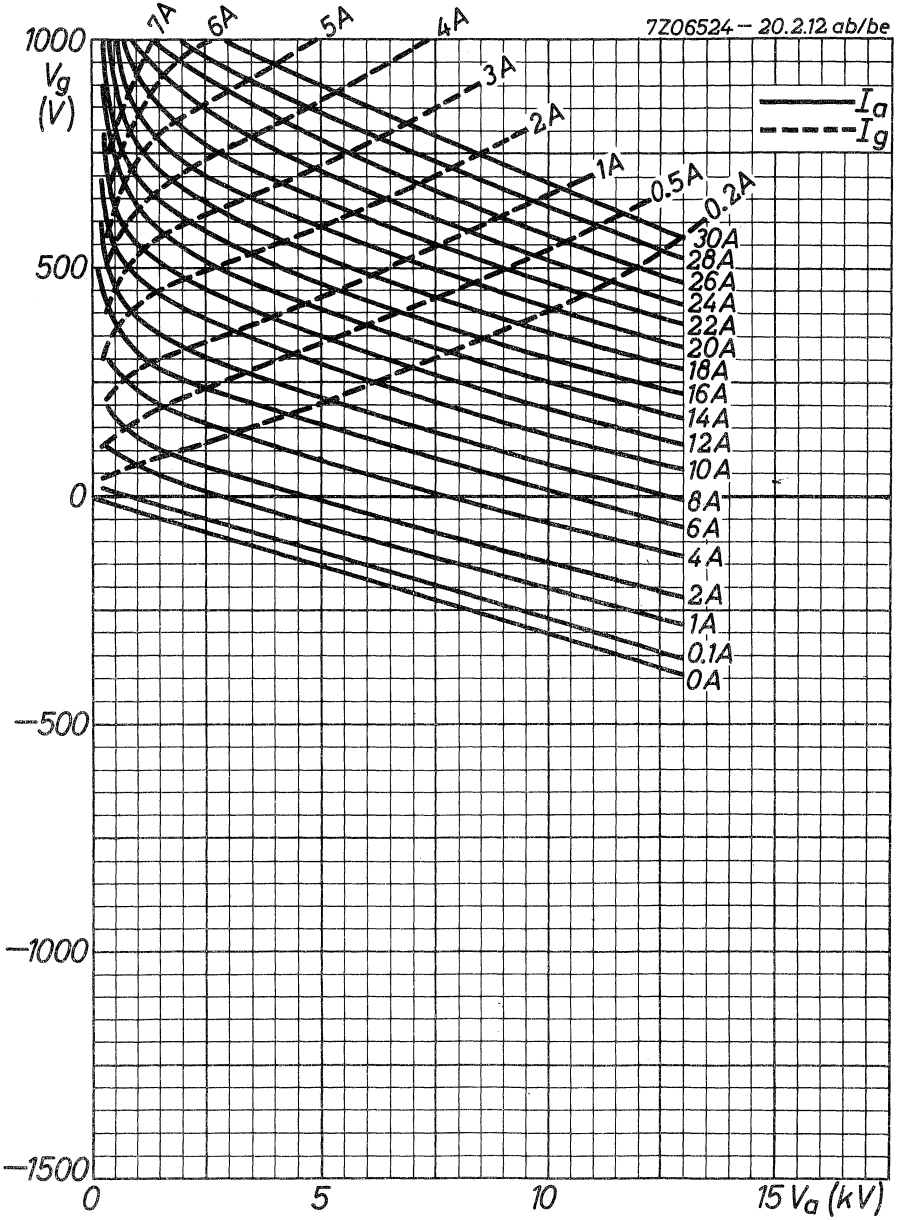
Frequency		f		up to	30	MHz
Anode voltage		V_a	=	max.	13	kV
Anode current		I_a	=	max.	4.8	A
Anode dissipation		W_a	=	max.	20	kW
Anode input power		W_{ia}	=	max.	60	kW
Negative grid voltage		$-V_g$	=	max.	1500	V
Grid current		I_g	=	max.	0.8	A
Grid circuit resistance		R_g	=	max.	10	kΩ

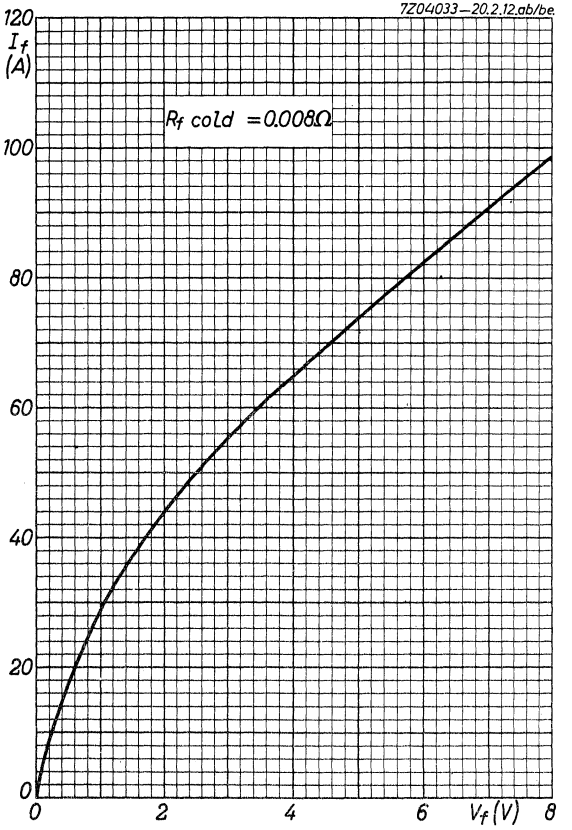
OPERATING CONDITIONS

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

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

7Z2 3554


7Z06524 – 20.2.12 ab/be
1000
Vg
(V)
500
0
−500
−1000
−1500
0
5
10
15 Va (kV)
Ia
Ig
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

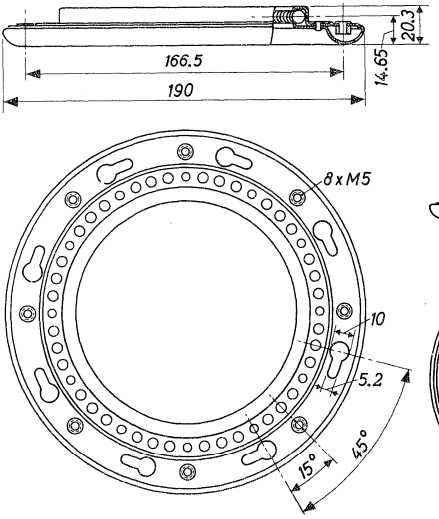
COOLING: Generally a low velocity air flow to the seals is required

WATER COOLING CHARACTERISTICS

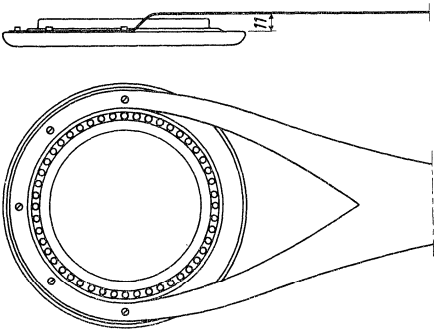
W_a (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm.)
10	20	4.2	0.08
	50	8.4	0.27
15	20	6.5	0.16
	50	13.0	0.5
20	20	9.3	0.3
	50	18.6	1.0

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

MECHANICAL DATA Dimensions in mm



Grid connector 40663



Connection of the grid lead

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

7Z2 3567

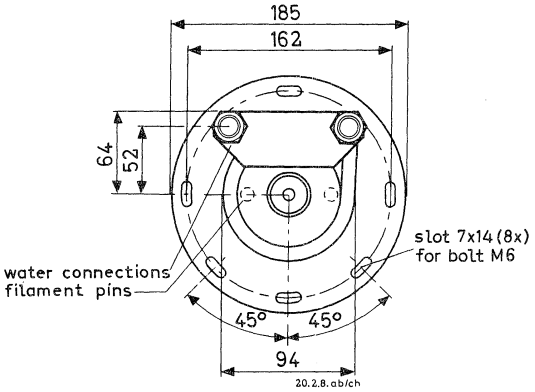
MECHANICAL DATA (continued)

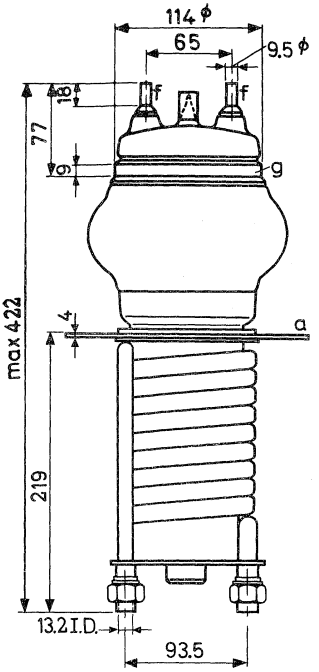
Dimensions in mm

Connectors with cable for filament : 40662

Grid connector 40663

Net weight : 5.4 kg





Mounting position: vertical with anode down

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

LIMITING VALUES (Absolute limits)

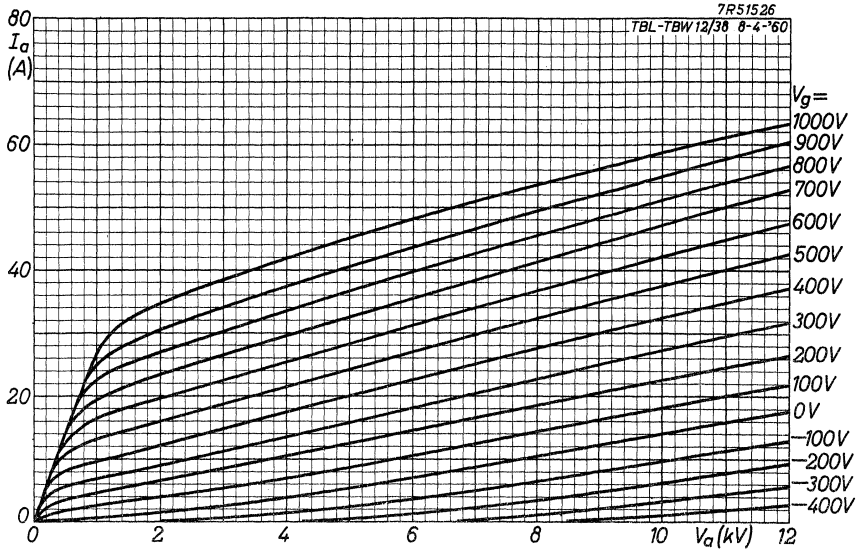
Frequency		f	up to	30	MHz
Anode voltage		V_a	= max.	18	kV
Anode current		I_a	= max.	5	A
Anode dissipation		W_a	= max.	20	kW
Anode input power		W_{ia}	= max.	60	kW
Negative grid voltage		$-V_g$	= max.	2	kV
Grid current, loaded		I_g	= max.	1.5	A
Grid current, unloaded		I_g	= max.	2.0	A
Grid circuit resistance		R_g	= max.	10	kΩ

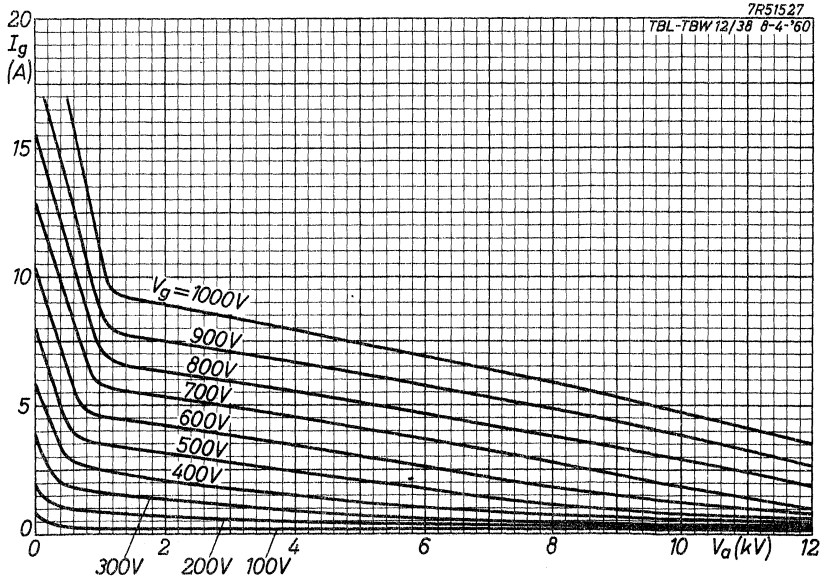
OPERATING CONDITIONS

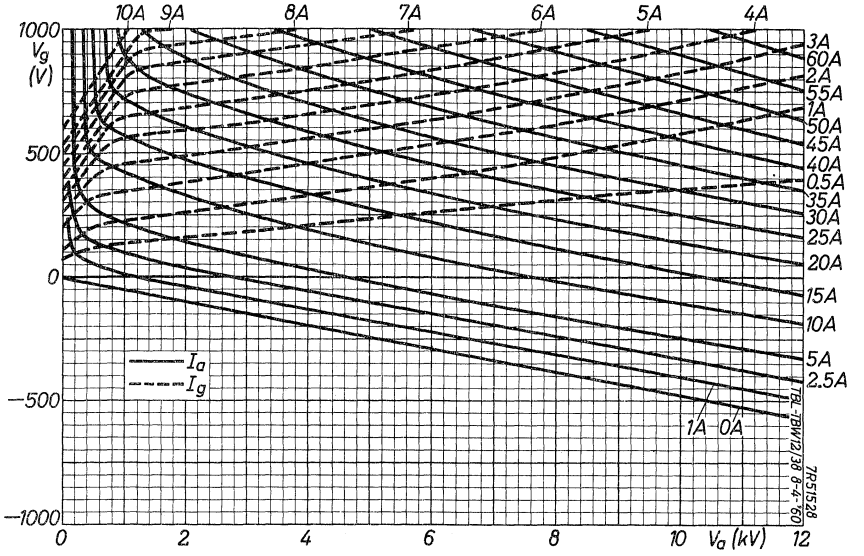
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	4.5	4.5	4.5	A
Anode current, unloaded	I_a	=	0.65	0.63	0.62	A
Grid current, loaded	I_g	=	0.9	0.9	0.9	A
Grid current, unloaded	I_g	=	1.22	1.3	1.35	A
Grid resistor	R_g	=	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	=	1450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

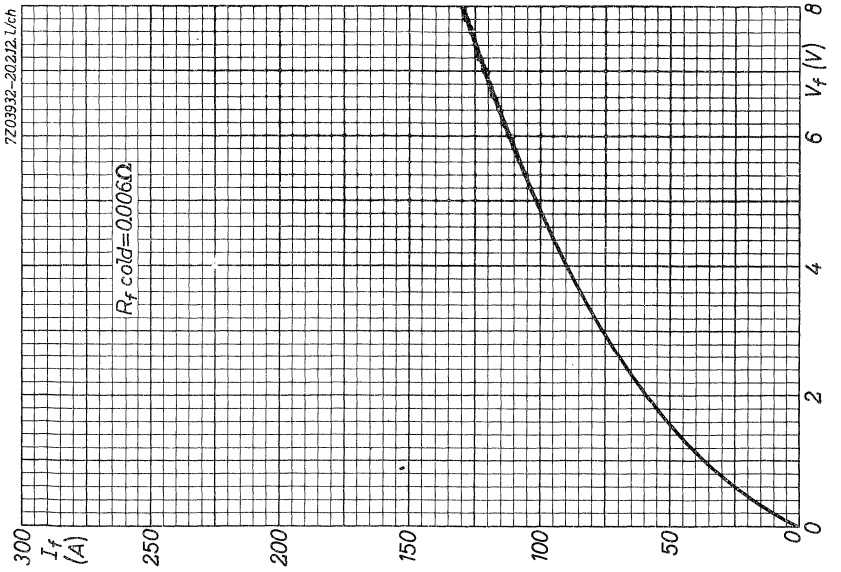
[1]) Useful power in the load, measured in a circuit having an efficiency of about 85%.

7Z2 3565


7R51526
TBL-TBW12/38 8-4-'60
80
Ia
(A)
60
40
20
0
0
2
4
6
8
10
Va(kV)
12
Vg=
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
-100V
-200V
-300V
-400V


7R51527
TBL-TBW12/38 8-4-'60
20
Ig
(A)
15
10
5
0
0
2
4
6
8
10
Va(kV)
12
Vg=1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V


10A 9A 8A 7A 6A 5A 4A
1000
V_g (V)
500
0
−500
−1000
0 2 4 6 8 10 12
V_a (kV)
I_a
I_g
3A
60A
2A
55A
1A
50A
45A
40A
0.5A
35A
30A
25A
20A
15A
10A
5A
2.5A
1A 0A
7Z91528
TBH12/38 8-4-80


7Z03932-2012.1/ch
R_f cold=0.006Ω
300
I_f (A)
250
200
150
100
50
0
0
2
4
6
8
V_f (V)

AIR COOLED COAXIAL R.F. POWER TRIODE

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

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

AIR COOLING CHARACTERISTICS

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

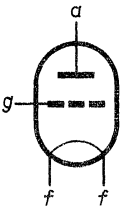
Temperature of envelope = max. 200 °C

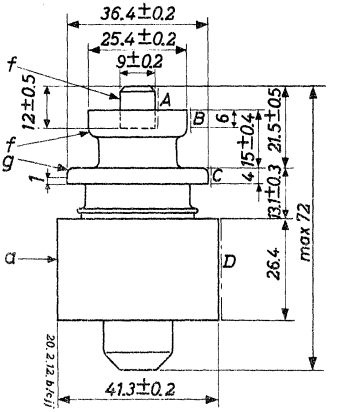
Generally it will be necessary to direct an air flow to the centre filament seal.

MECHANICAL DATA

Dimensions in mm

Net weight: 143 g





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

Mounting position: vertical with anode up or down

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

[1]) With respect to cathode

[2]) Partially fixed bias

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

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

[2] Measured by a calorimetric method

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

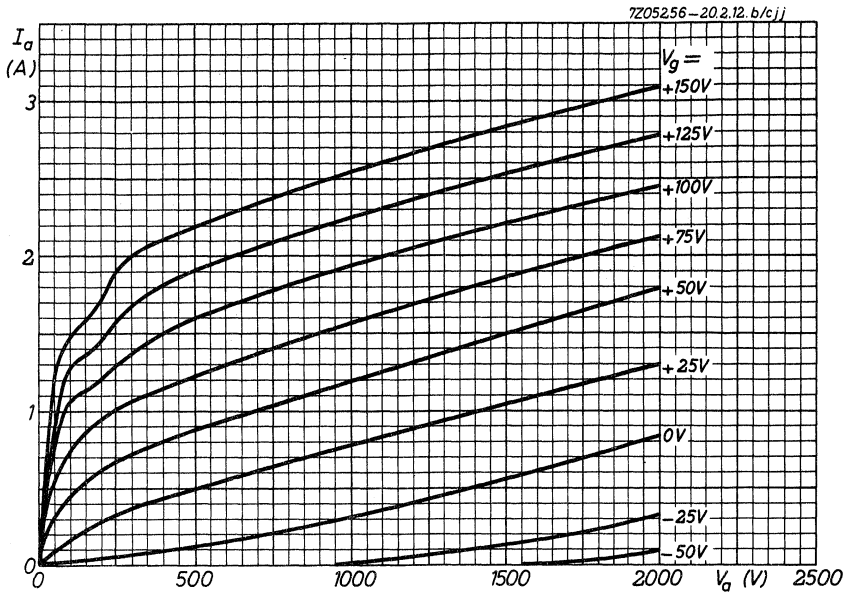
LIMITING VALUES (Absolute limits)

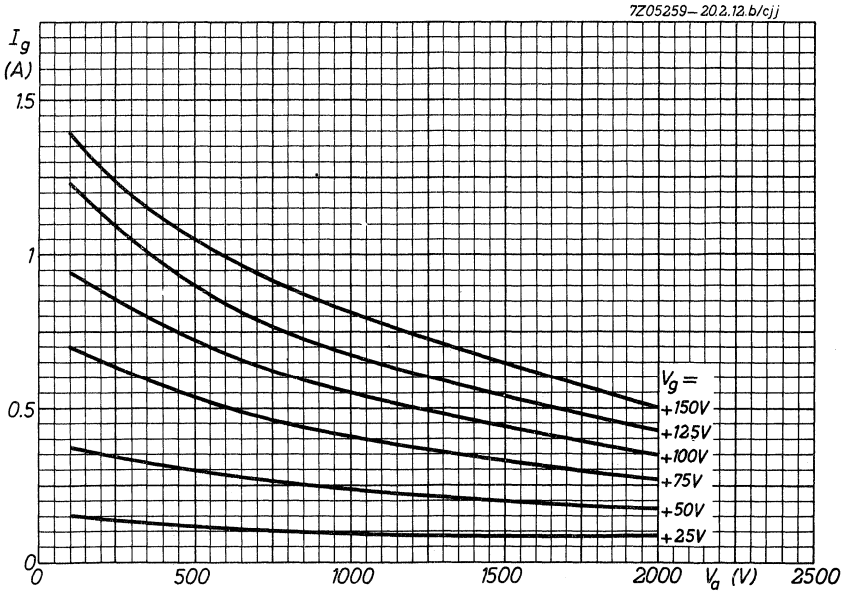
Frequency	f		up to 470	MHz
Anode voltage	V_a	= max.	1800	V
Anode current	I_a	= max.	400	mA
Anode input power	W_{i_a}	= max.	700	W
Anode dissipation	W_a	= max.	300	W
Negative grid voltage	$-V_g$	= max.	300	V
Grid current, loaded	I_g	= max.	110	mA
Grid current, unloaded	I_g	= max.	120	mA
Grid circuit resistance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

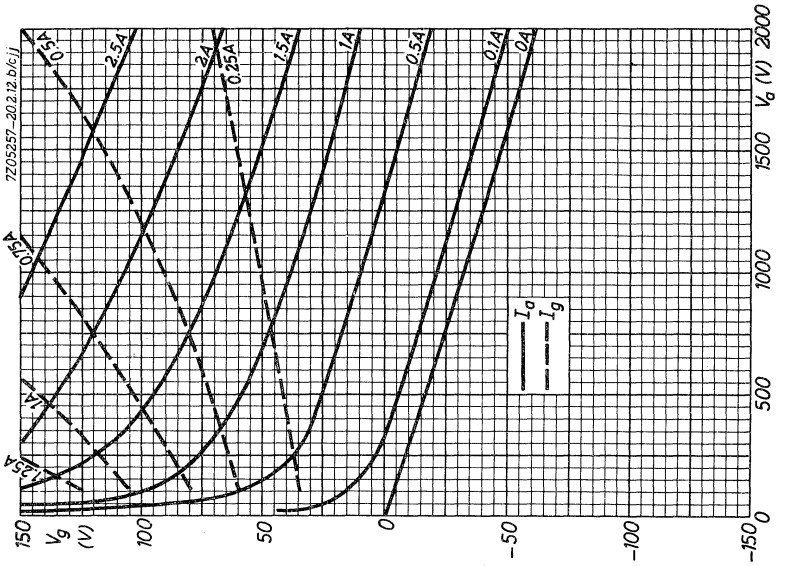
OPERATING CONDITIONS

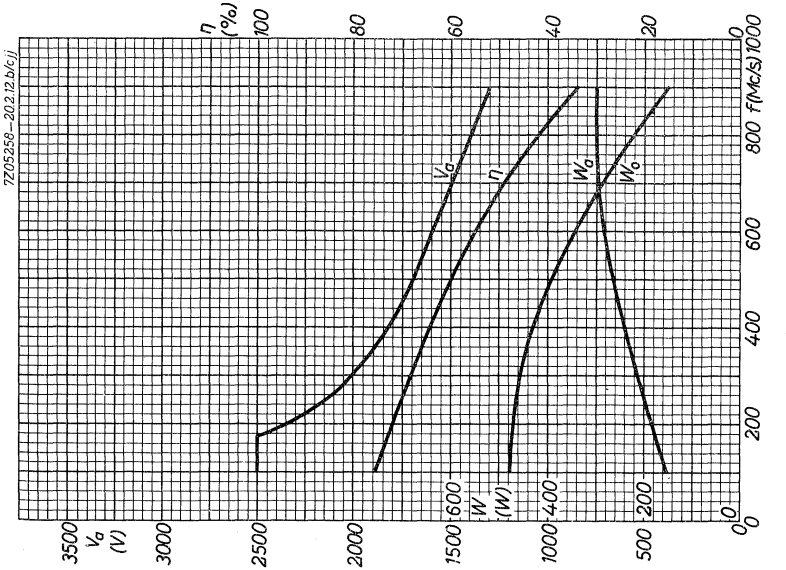
Frequency	f	=	470	MHz
Anode voltage	V_a	=	1750	V
Anode current, loaded	I_a	=	340	mA
Anode current, unloaded	I_a	=	170	mA
Grid current, loaded	I_g	=	95	mA
Grid current, unloaded [1])	I_g	=	100	mA
Grid circuit resistance under matched conditions	R_g	=	1000	Ω
Anode input power	W_{i_a}	=	595	W
Anode dissipation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

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


7Z05256–20.2.12.b/cjj
I_a (A)
3
2
1
0
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


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


7Z05256–202.12.b/c/j
V_a
η
W_a
W_o
η (%)
V_a (V)
W (W)
f (Mc/s)

AIR COOLED COAXIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

Temperature of other seals = max. 250 °C

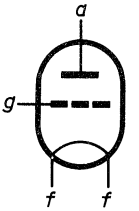
COOLING CHARACTERISTICS

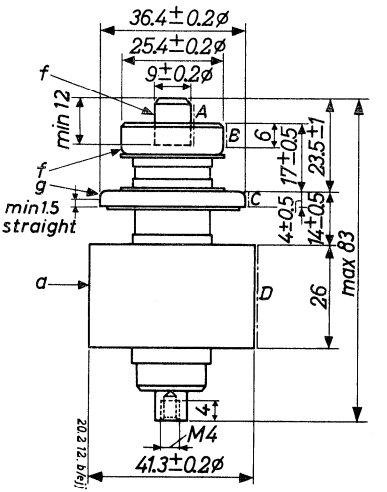
W_a (W)	h (m)	t_i (°C)	qmin (m^3/min)	p_i (mm H_2O)
400	0	45	0.65	12
	1500	35	0.65	12
	3000	25	0.65	12

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

MECHANICAL DATA Dimensions in mm

Net weight: 157 g





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

Mounting position: vertical with the anode up or down.

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS in grounded grid circuit

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

[1]) With respect to cathode

[2]) Power transferred from driving stage included

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

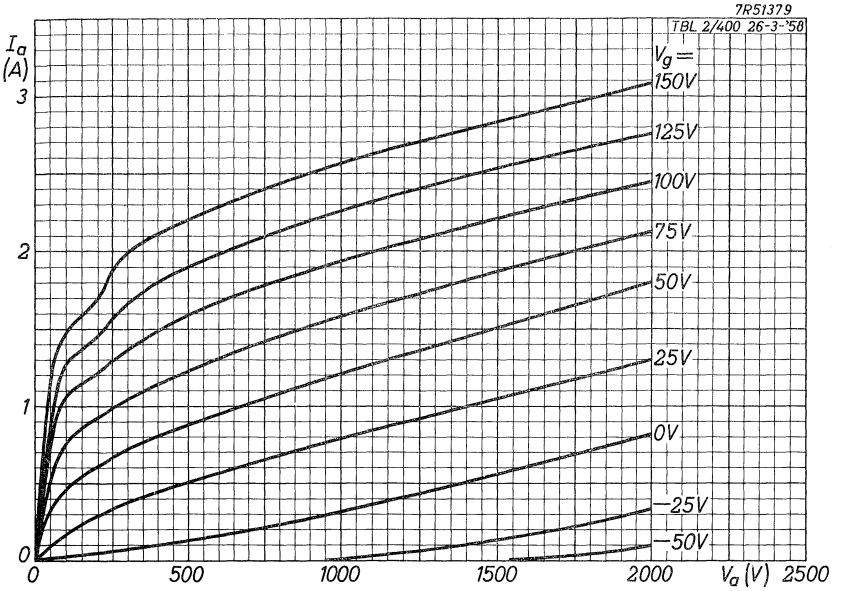
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE in grounded grid circuit with self rectification

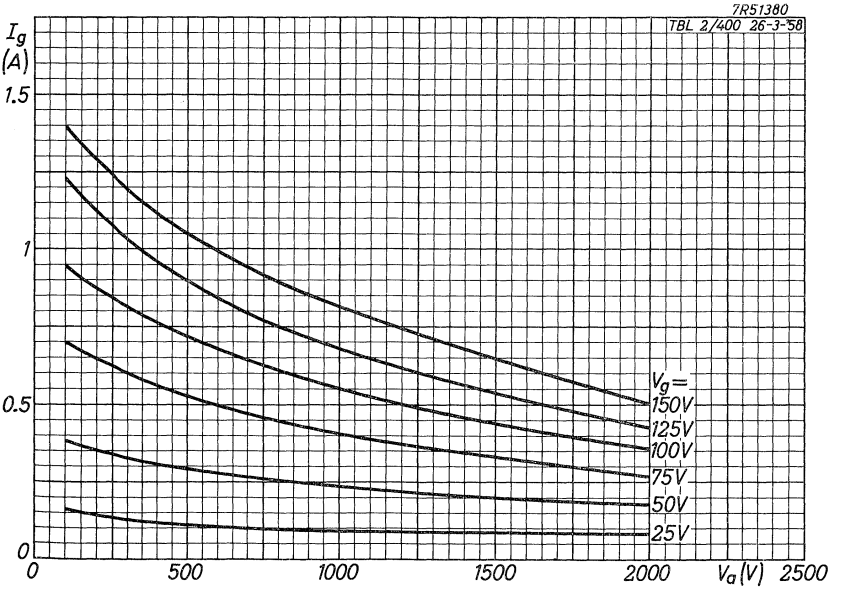
LIMITING VALUES (Absolute limits)

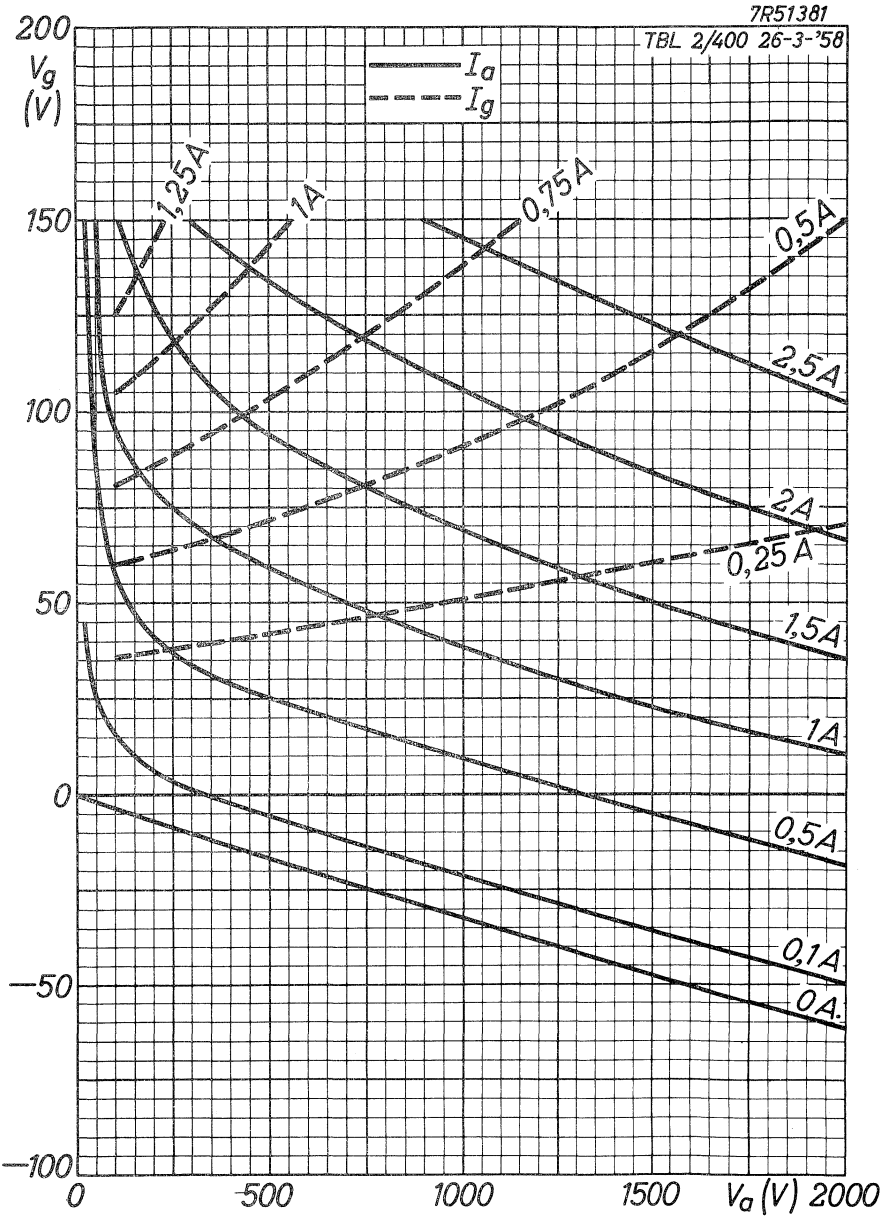
	Voltages with respect to cathode				
Frequency	f		up to	470	MHz
Transformer voltage	V_{tr}	=	max.	2000	V(RMS)
Anode current	I_a	=	max.	210	mA
Anode input power	W_{i_a}	=	max.	450	W
Anode dissipation	W_a	=	max.	170	W
Negative grid voltage	$-V_g$	=	max.	300	V
Grid current, loaded	I_g	=	max.	85	mA
Grid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

OPERATING CHARACTERISTICS

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


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


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


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

AIR COOLED COAXIAL R.F. POWER TRIODE

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

HEATING : direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of envelope = max. 200 °C

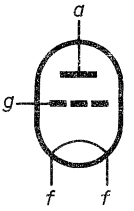
COOLING CHARACTERISTICS

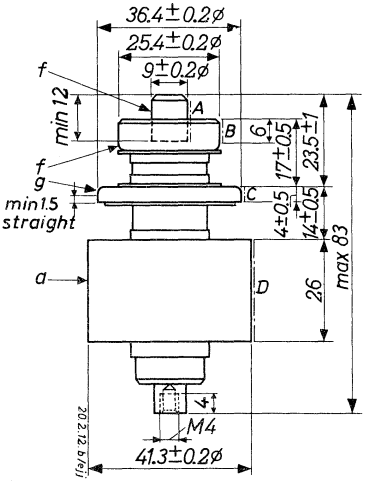
W_a (W)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
500	0	45	0.9	24
	1500	35	0.9	20
	3000	25	1.0	21

MECHANICAL DATA

Dimensions in mm

Net weight: 157 g





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

Mounting position: vertical with the anode up or down

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

LIMITING VALUES (Absolute limits)

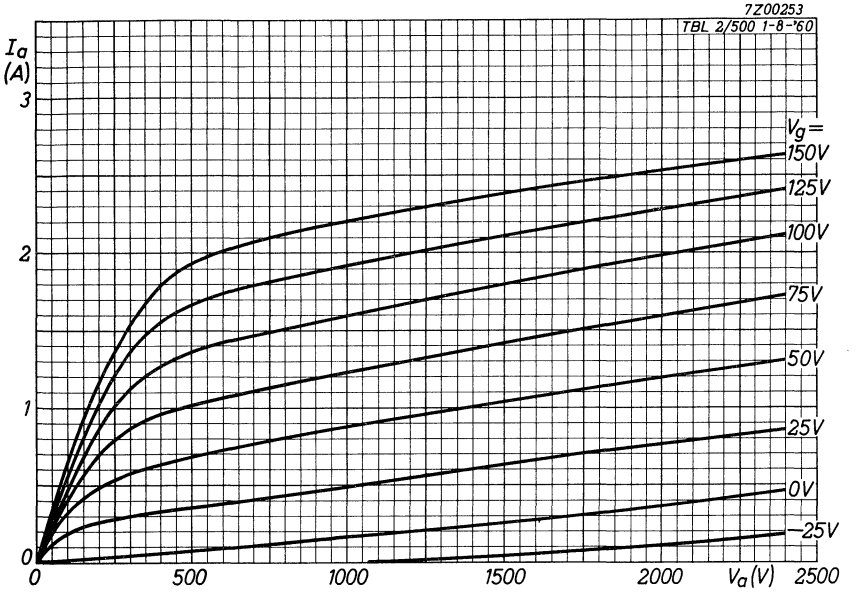
Frequency	f		up to 400	625	940	MHz
Anode voltage	V_a	=	max. 2700	2500	2000	V
Anode current	I_a	=	max. 400	400	400	mA
Anode input power	W_{i_a}	=	max. 1000	880	800	W
Anode dissipation	W_a	=	max. 500	500	500	W
Negative grid voltage	$-V_g$	=	max. 300	300	300	V
Grid current	I_g	=	max. 175	175	160	mA

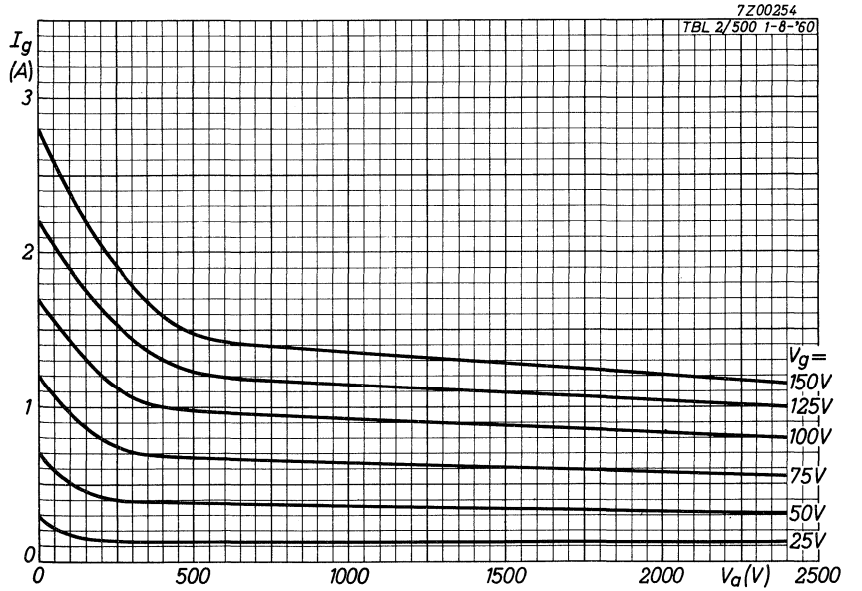
OPERATING CONDITIONS in grounded grid circuit

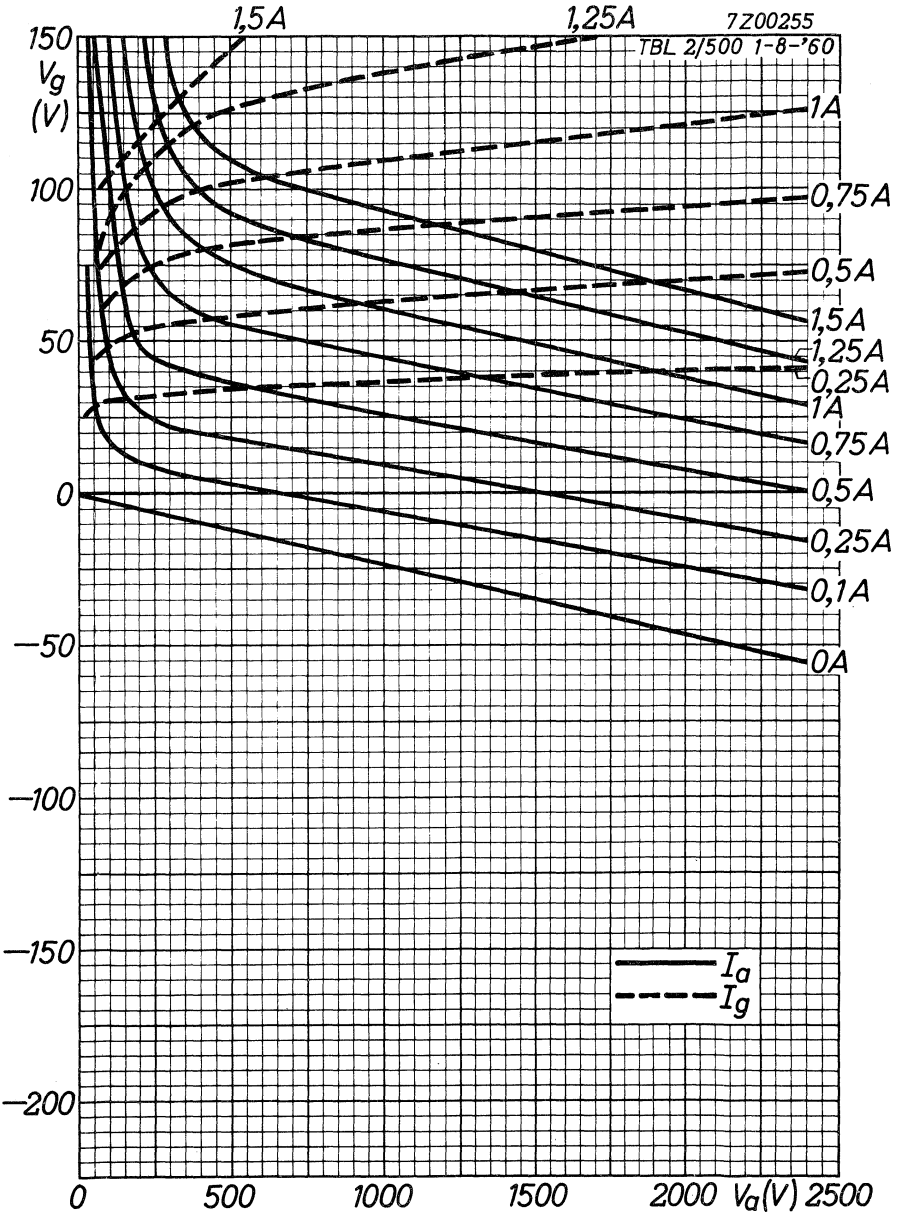
Frequency	f	=	400	625	MHz
Anode voltage	V_a	=	2500	2200	V
Negative grid voltage	$-V_g$	=	70	60	V
Anode current	I_a	=	380	380	mA
Grid current	I_g	=	160	170	mA
Grid input power	W_{i_g}	=	70	65	W
Anode input power	W_{i_a}	=	950	835	W
Anode dissipation	W_a	=	330	302	W
Tube output power	W_o	=	620+50	533+47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

[1]) Power transferred from driving stage included

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


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


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


7Z00255
TBL 2/500 1-8-'60
1,5A
1,25A
1A
0,75A
0,5A
1,5A
1,25A
0,25A
1A
0,75A
0,5A
0,25A
0,1A
0A
150
Vg
(V)
100
50
0
−50
−100
−150
−200
0
500
1000
1500
2000
Va(V)
2500
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	7 6	17.7 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)

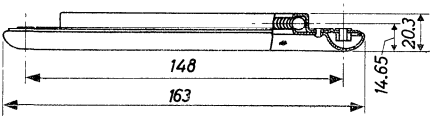
Temperature of all seals = max. 220 °C

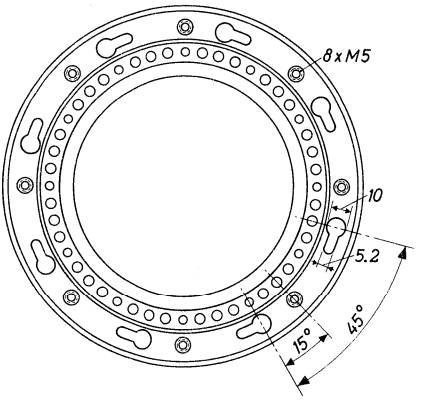
AIR COOLING CHARACTERISTICS

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

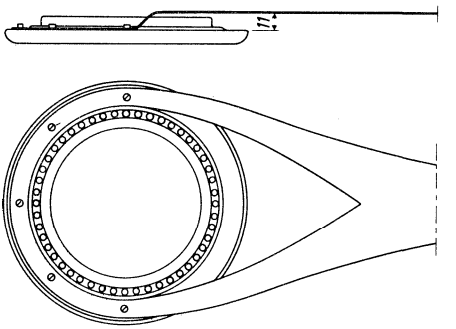
MECHANICAL DATA

Dimensions in mm





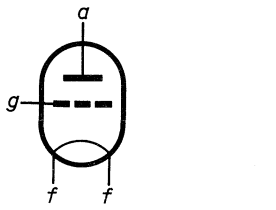
Grid connector 40664

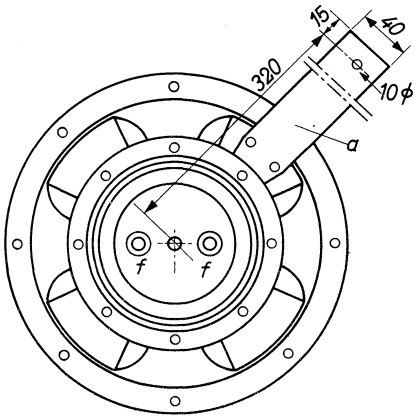


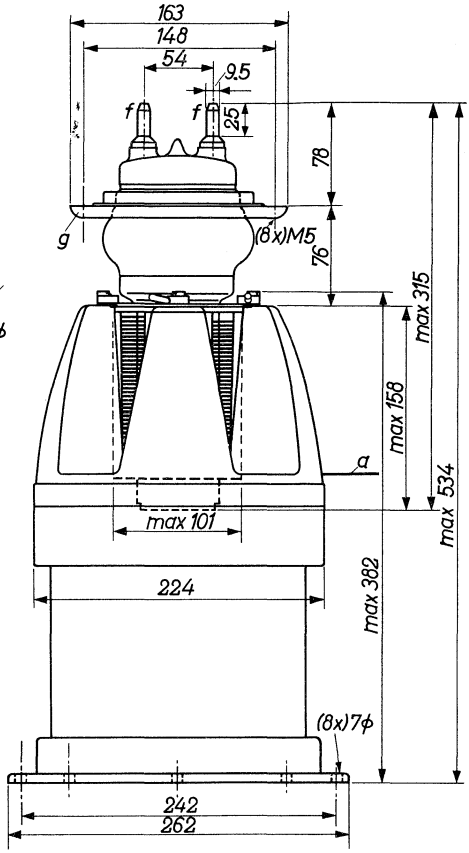
Connection of the grid lead

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

MECHANICAL DATA (continued)







Dimensions in mm

Mounting position: vertical with anode down

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

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

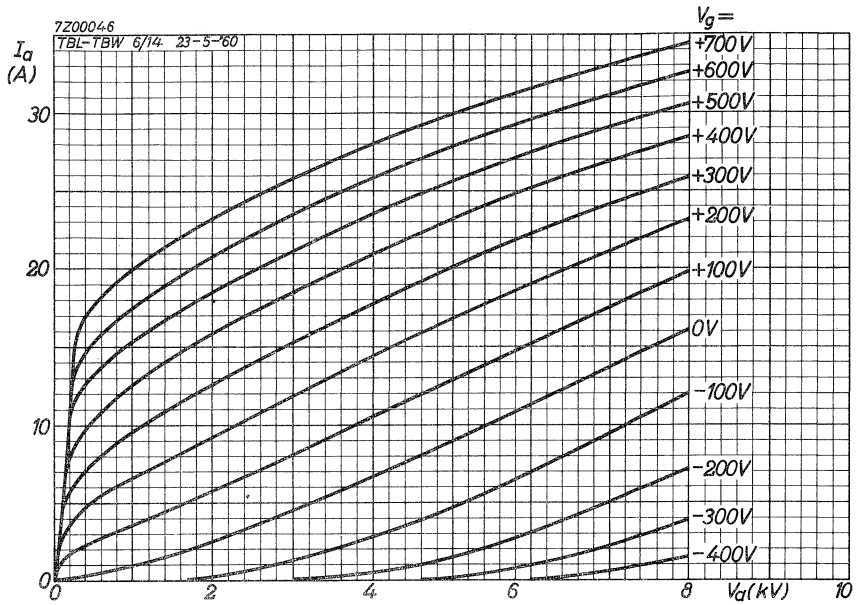
LIMITING VALUES (Absolute limits)

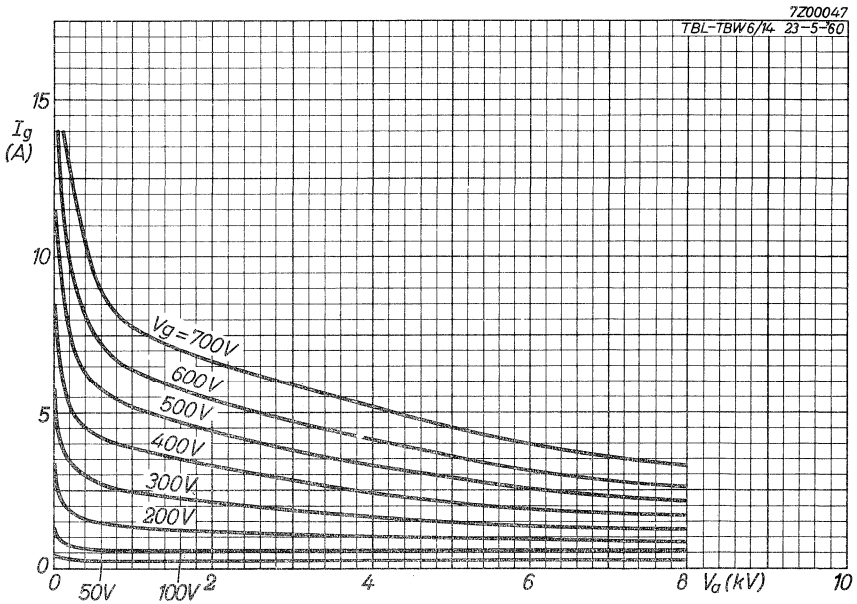
Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	30	kW
Anode dissipation	W_a	=	max.	10	kW [1]
Anode dissipation	W_a	=	max.	15	kW [2]
Anode current	I_a	=	max.	4.0	A
Negative grid voltage	$-V_g$	=	max.	1600	V
Grid current, loaded	I_g	=	max.	1.5	A
Grid current, unloaded	I_g	=	max.	2.0	A
Grid circuit resistance	R_g	=	max.	10	kΩ

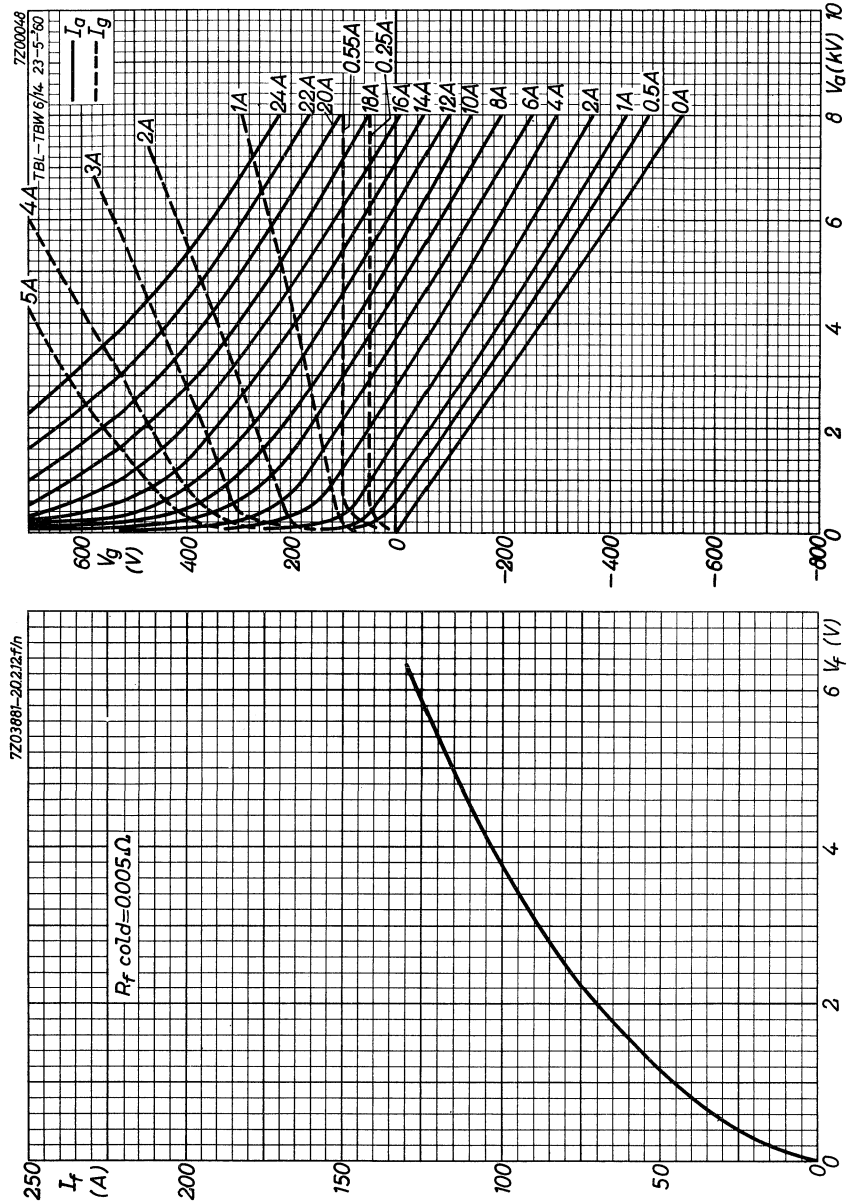
OPERATING CONDITIONS

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]

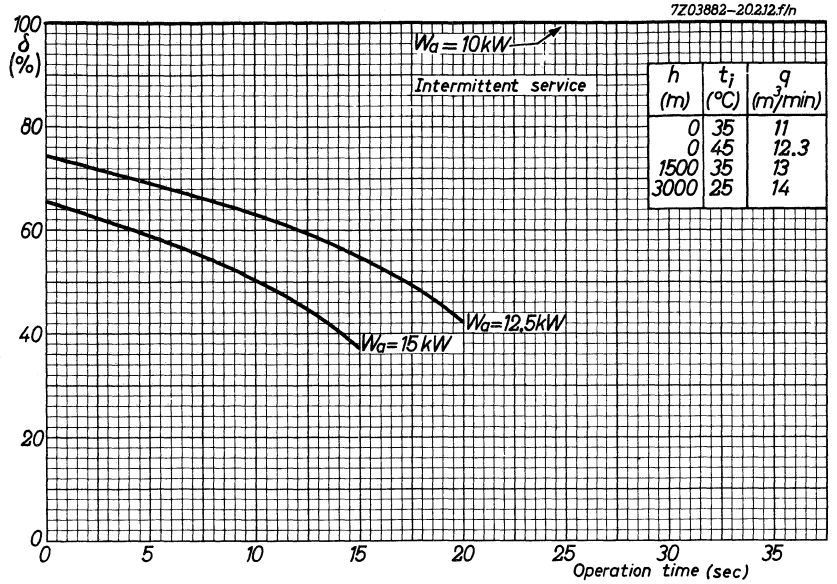
1) Continuous service with adequate cooling.
2) Intermittent service. See also page 7.
3) Useful power in the load, measured in a circuit having an efficiency of about 85%.


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
30
20
10
0
0
2
4
6
8
10
V_a(kV)

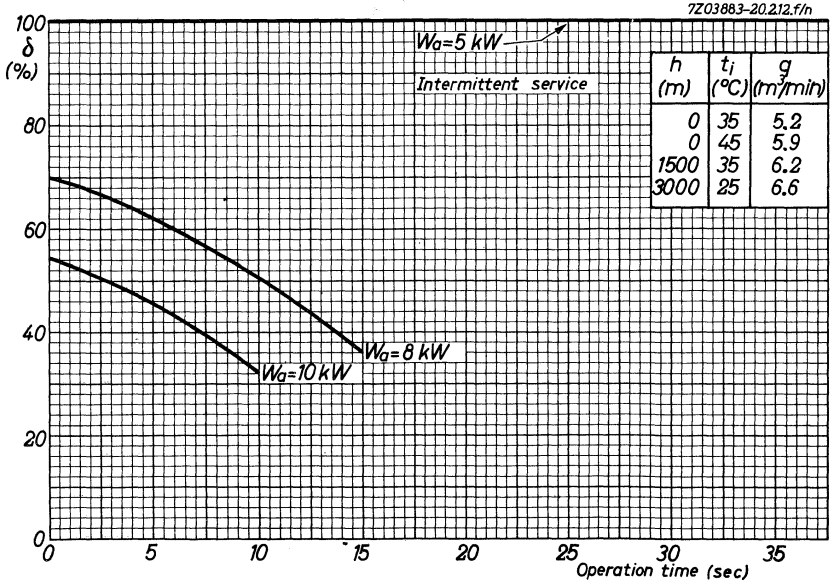

7Z00047
TBL-TBW6/14 23-5-'60
I_g (A)
15
10
5
0
V_g=700V
600V
500V
400V
300V
200V
50V
100V
0
2
4
6
8
10
V_a(kV)

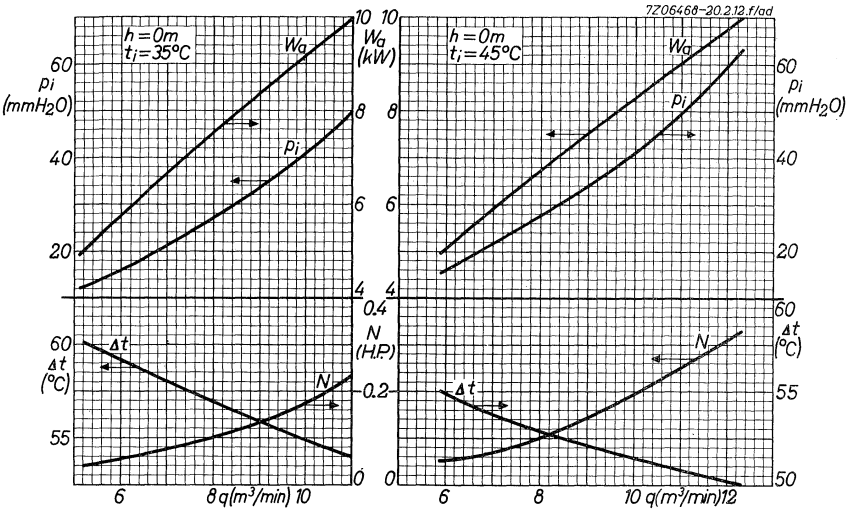

TZ00048
TBL-TBW 6/14 23-5-80
I_a
I_g
5A
4A
3A
2A
1A
24A
22A
20A
18A
16A
14A
12A
10A
8A
6A
4A
2A
1A
0.5A
0A
0.55A
0.25A
600
400
200
0
−200
−400
−600
−800
V_g (V)
0
2
4
6
8 10
V_a(KV)
TZ03881-2021212fin
R_f cold=0005Ω
250
200
150
100
50
0
I_f (A)
0
2
4
6 V_f (V)

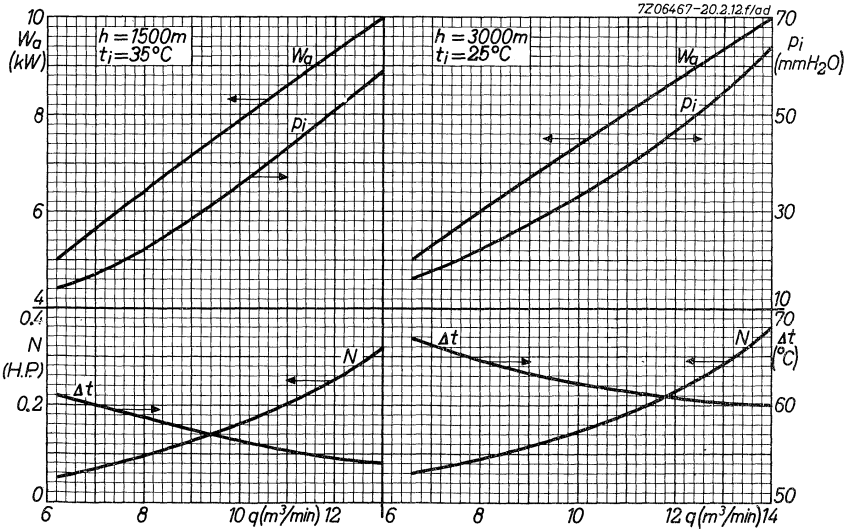
7Z03882-20.212.f/n



7Z03883-20.212.f/n




7Z06468-20.2.12.f/ad
h = 0m
t_i = 35°C
W_a
p_i
Δt
N
h = 0m
t_i = 45°C
W_a (kW)
p_i (mmH2O)
Δt (°C)
N (H.P)
q(m³/min)


7Z06467-20.2.12.f/ad
h = 1500m
t_i = 35°C
W_a
p_i
Δt
N
h = 3000m
t_i = 25°C
W_a (kW)
p_i (mmH2O)
Δt (°C)
N (H.P)
q(m³/min)

AIR COOLED
COAXIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

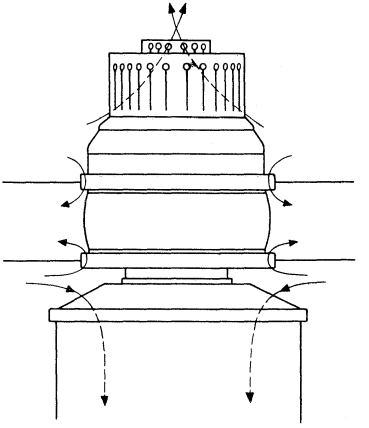
Anode current	I_a	=	1 A
Anode voltage	V_a	=	4 kV
Amplification factor	μ	=	60
Mutual conductance	S	=	60 mA/V

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

AIR COOLING CHARACTERISTICS. See also cooling curves

W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_20)
5.5	0	35	5.0	16
	1500	35	5.9	16
	3000	25	5.7	16
8	0	35	7.7	35
	1500	35	9	40
	3000	25	9	36
10	0	35	11	65
	1500	35	13	75
	3000	25	13	66

Recommended direction of air flow



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

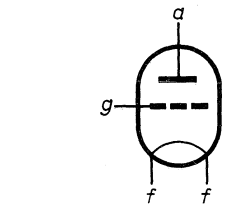
TEMPERATURE LIMITS (Absolute limits)

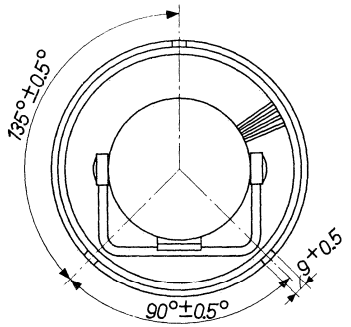
Temperature of seals = max. 180 °C

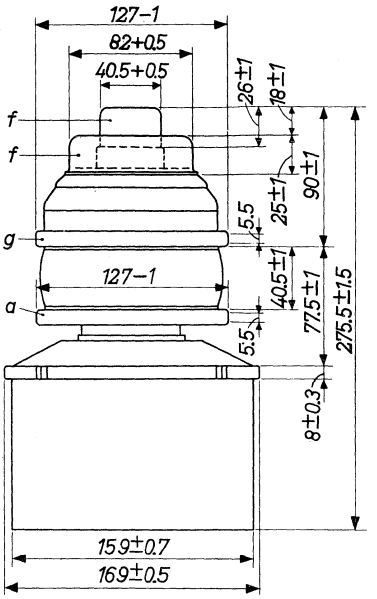
MECHANICAL DATA

Dimensions in mm

Net weight: 9.5 kg







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

Mounting position: vertical with anode up or down

ACCESSORIES

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

R.F. CLASS C TELEGRAPHY, grounded grid

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

[1]) Power transferred from driving stage included

[2]) Pure tube efficiency

R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE; linear, grounded-grid amplifier

Negative modulation, positive synchronisation (CCIR and FCC system)

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS (at centre frequency of the resonance curve)

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

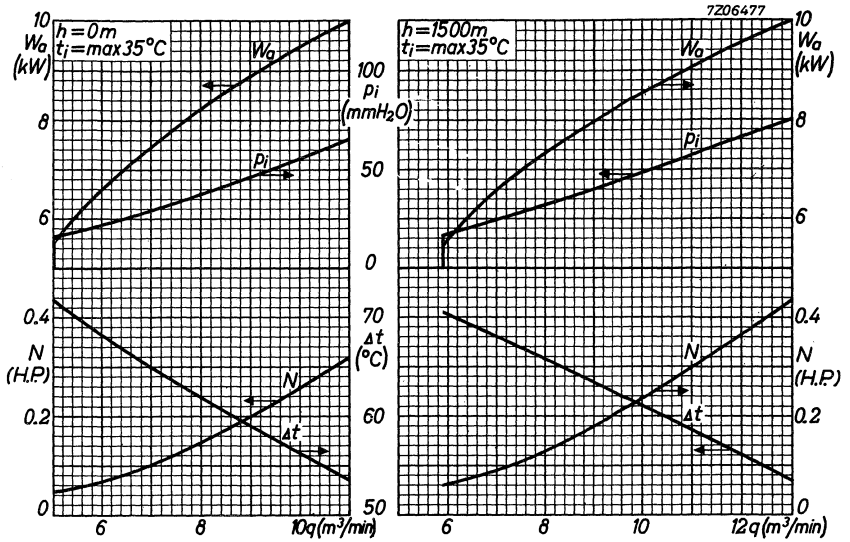
R.F. CLASS B TELEPHONY FOR TELEVISION SERVICE ; linear, grounded-grid amplifier
Positive modulation, negative synchronisation (RTF and BBC system)

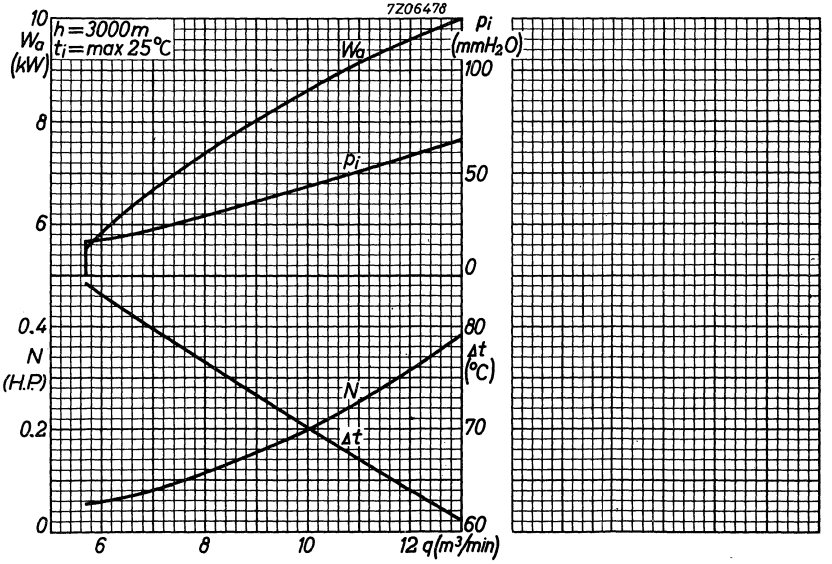
LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS (at centre frequency of the resonance curve)

Frequency	f	=	48 to 88	170 to 220	MHz
Bandwidth	B (−3 dB)	=	6	12	MHz
Anode voltage	V_a	=	5	4	kV
Grid voltage	V_g	=	−90	−75	V
Peak grid A.C. voltage	V_{gp} white	=	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


7Z06477
h=0m
ti=max35°C
Wa
pi
N
Δt
Wa (kW)
pi (mmH2O)
N (H.P)
Δt (°C)
10
8
6
0.4
0.2
0
100
50
0
70
60
50
6
8
10q(m3/min)
h=1500m
ti=max35°C
12q(m3/min)


7Z06478
h=3000m
ti=max 25°C
Wa
pi
N
Δt
Wa (kW)
pi (mmH2O)
N (H.P)
Δt (°C)
10
8
6
0.4
0.2
0
100
50
0
80
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 6	4.85 4.1	6	5.9

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

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

7Z2 3531

COOLING

Continuous service

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

For intermittent service see figure page A

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

RECOMMENDED COOLING DEVICE

(1) = metal housing (see page 3)

(2) = glass cylinder

(3) = socket 2422 511 05001

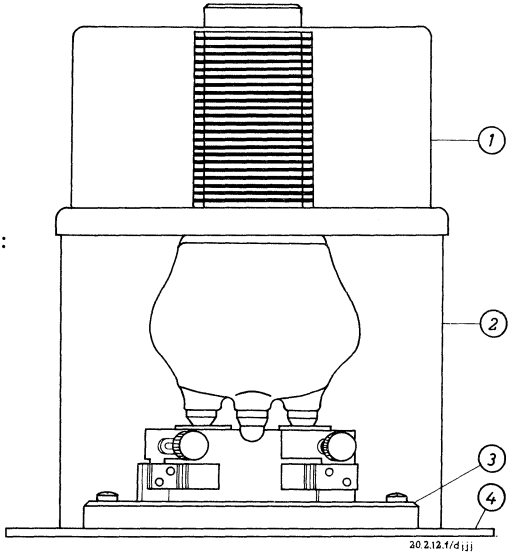
(4) = ground plate (see page 3)

Dimensions of the glass cylinder:

Height : 118 mm

Outside diameter : 150 mm

Inside diameter : 144 mm



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

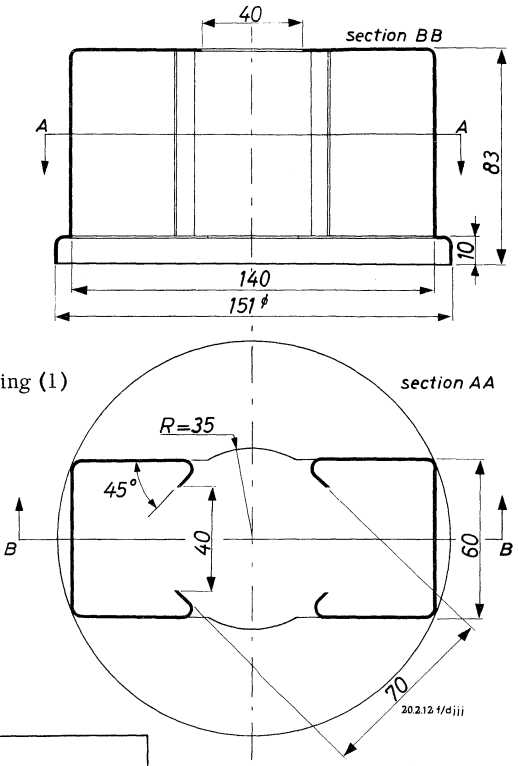
The housing (1) should be connected to the anode connector. At frequencies above 4 MHz both grid terminals should be connected in parallel. At the highest frequencies care should be taken to distribute the R.F. current equally between both grid terminals to avoid excessive grid seal temperatures.

7Z2 8655

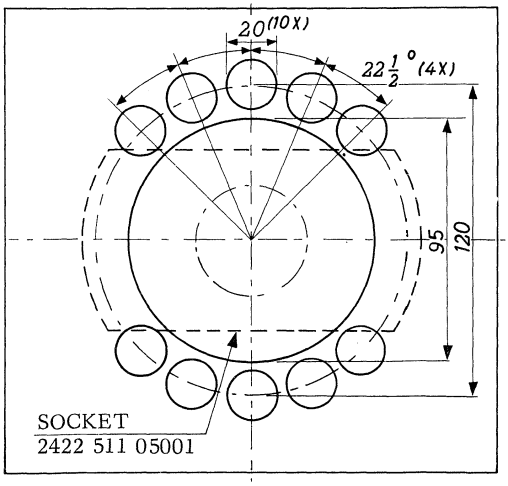
RECOMMENDED COOLING DEVICE (continued)

Dimensions in mm

Metal housing (1)



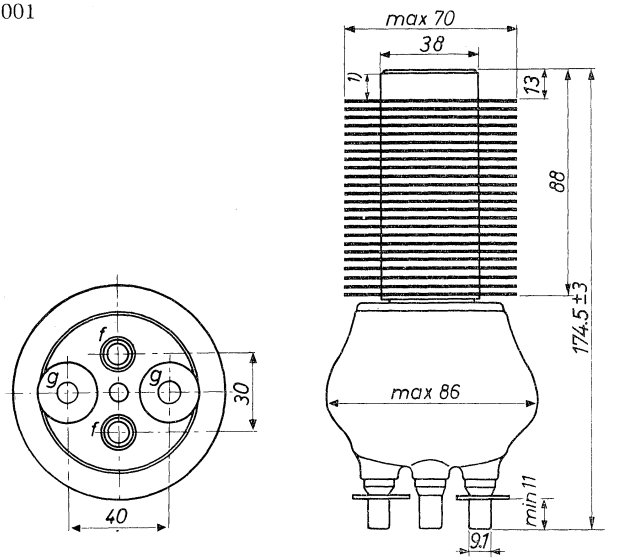
Ground plate (4)



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

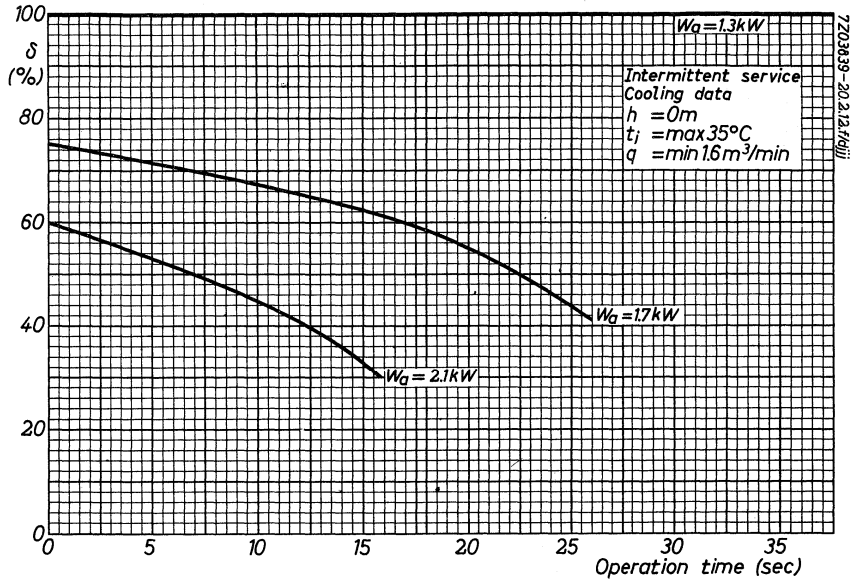
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5.1	kV_{RMS}
Anode voltage	V_a	=	6	kV
Anode current, loaded	I_a	=	1.33	A
Anode current, unloaded	I_a	=	0.33	A [2]
Grid current, loaded	I_g	=	0.38	A
Grid current, unloaded	I_g	=	0.48	A [2]
Grid resistor	R_g	=	1450	Ω
Load resistance	$R_{a\sim}$	=	2200	Ω
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]

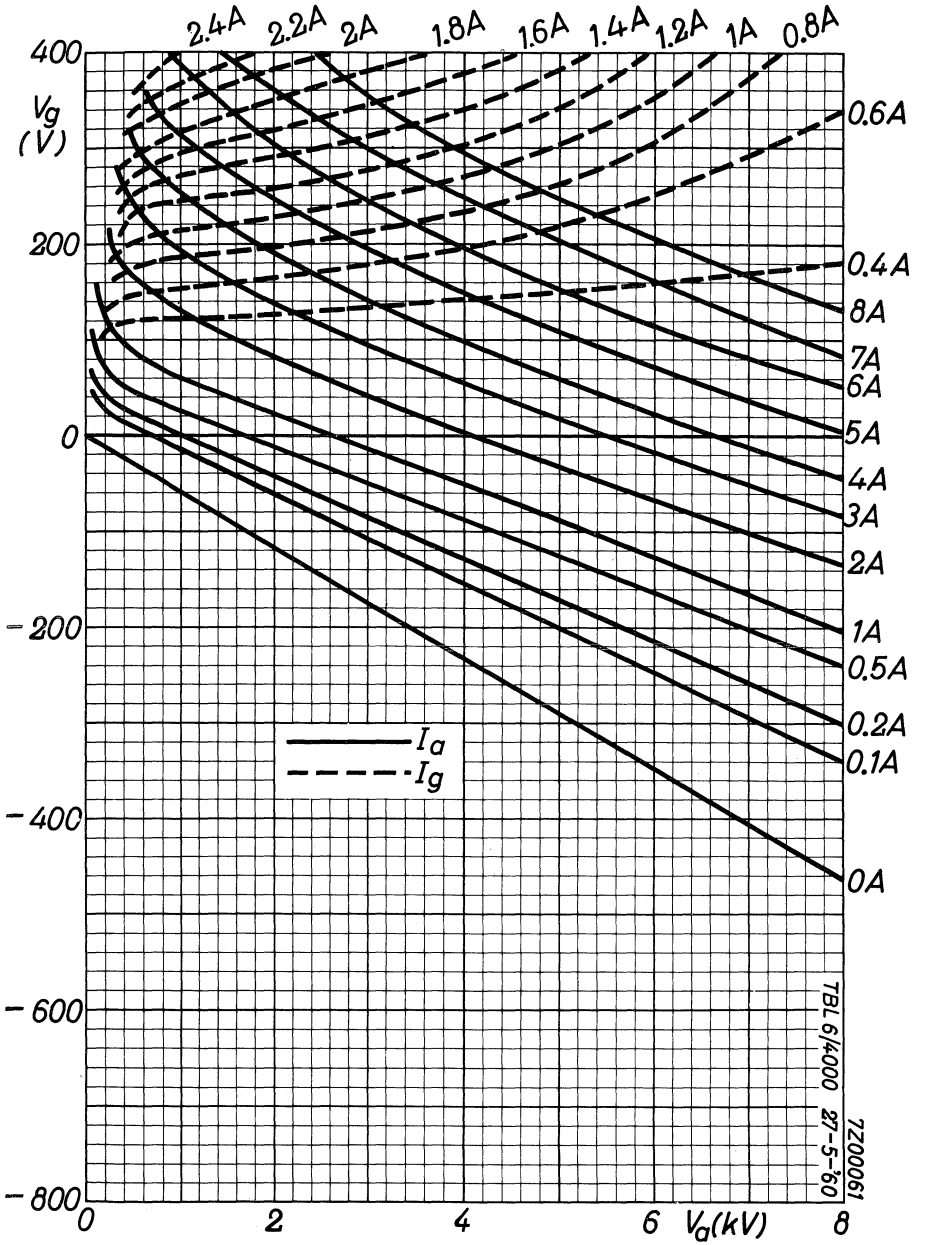
[1]) See figure page A

[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)
W_a = 1.3 kW
Intermittent service
Cooling data
h = 0m
t_i = max 35°C
q = min 1.6 m³/min
W_a = 1.7 kW
W_a = 2.1 kW
7203839-20.2.12.1fdjj


2.4A
2.2A
2A
1.8A
1.6A
1.4A
1.2A
1A
0.8A
400
Vg
(V)
200
0
-200
-400
-600
-800
0.6A
0.4A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0.1A
0A
Ia
Ig
0
2
4
6
Va(kV)
8
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. (^oC)	$q_{min.}$ (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

MECHANICAL DATA

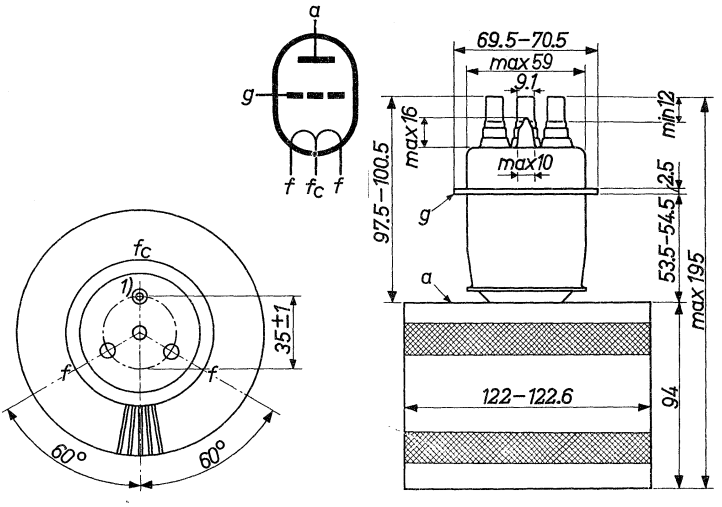
Dimensions in mm

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

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_{gp}	=	740	640	500	V
Grid input power	W_{ig}	=	210	190	160	W
Anode input power	W_{ia}	=	9	7.5	5.5	kW
Anode dissipation	W_a	=	2.1	1.9	1.5	kW
Output power	W_o	=	6.9	5.6	4	kW
Efficiency	η	=	76.5	75	73	%

7Z2 8661

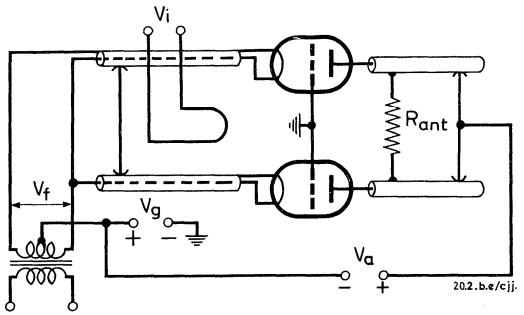
R.F. CLASS C TELEGRAPHY, grounded grid

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
	V_g black	=	-300	-225	V
	V_g white	=	-550	-500	V
Peak grid to grid voltage	V_{ggp} sync	=	1000	1000	V [3])
Anode current	I_a sync	=	3.8	3.2	A
	I_a black	=	2.8	2.6	A
Grid current	I_g sync	=	0.5	0.4	A
	I_g 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
	W_o 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_{ggp}	white	=	1000	V
Anode current	I_a	white	=	3.8	A
		black	=	0.8	A
Grid current	I_g	white	=	0.5	A
		black	=	0	A
Grid input power	W_{ig}	white	=	250	W
Output power	W_o	white	=	9	kW
		black	=	0.6	kW

7Z2 8667

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 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

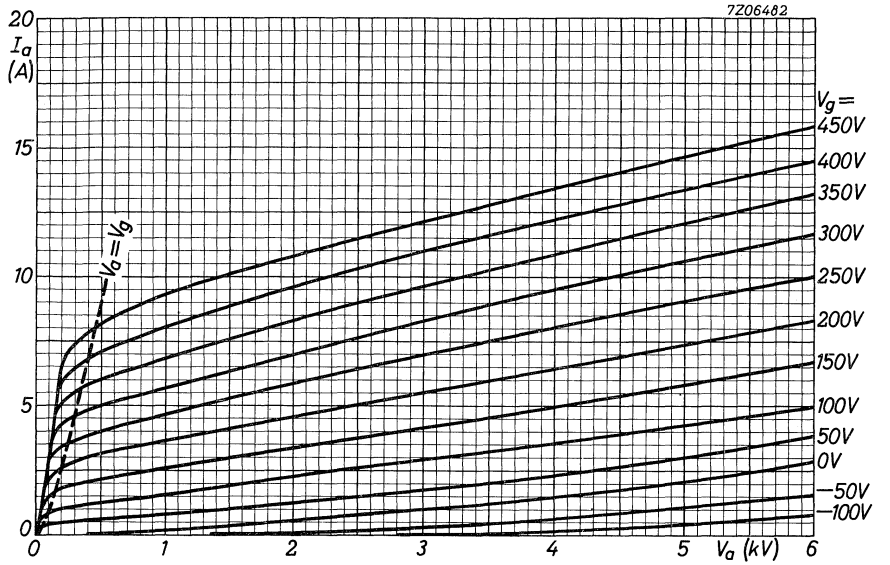
OPERATING CONDITIONS

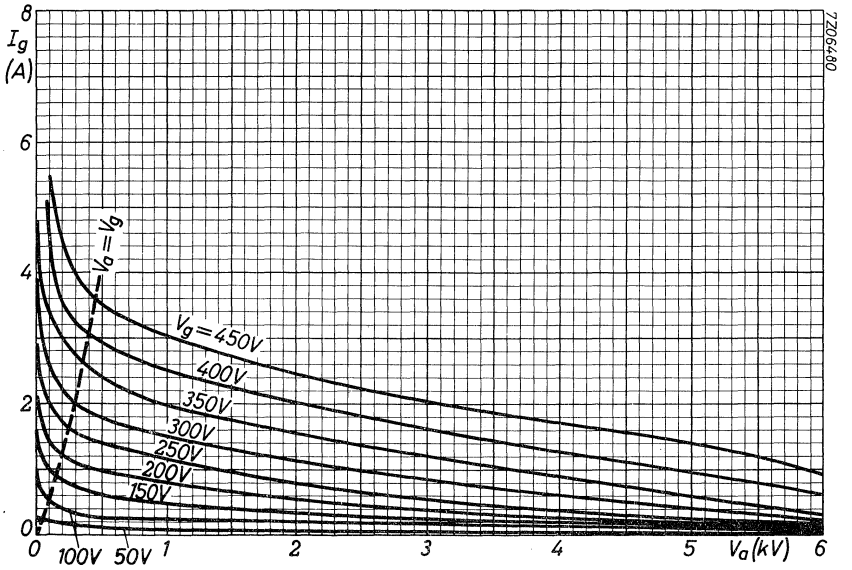
Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	6.8[1])	5.9[2])	kV_{RMS}
Anode current	I_a	=	0.8	0.7	A
Grid current	I_g	=	0.19	0.165	A
Grid resistor	R_g	=	1050	1050	Ω
Grid input power	W_{ig}	=			W
Anode input power	W_{ia}	=	6.05	4.6	kW
Anode dissipation	W_a	=	1.5	1.24	kW
Output power	W_o	=	4.55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

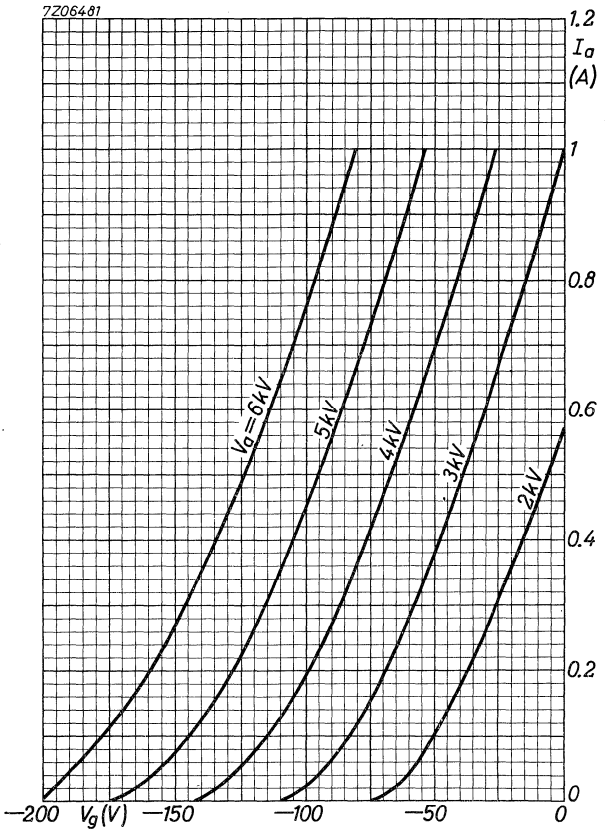
1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

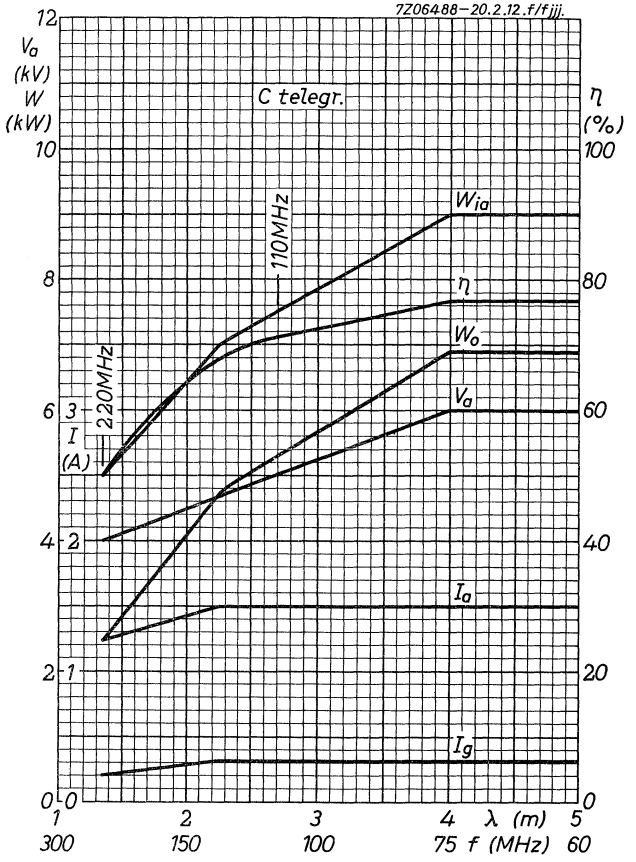
2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

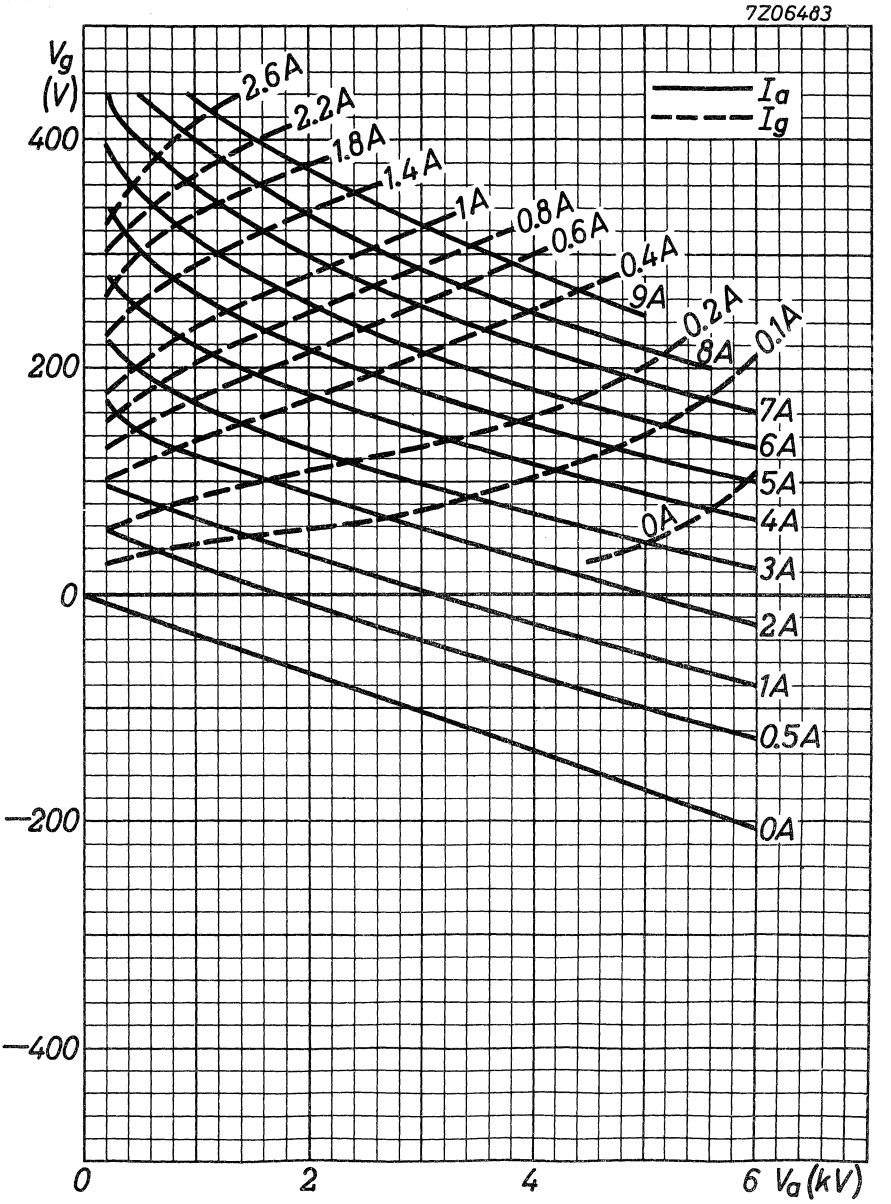
7Z2 8671

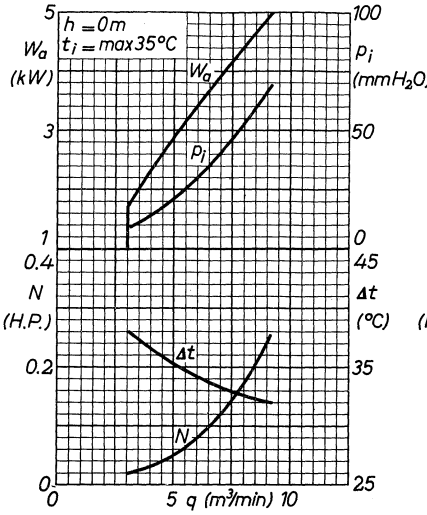

7Z06482
20
I_a (A)
15
10
5
0
$V_a = V_g$
$V_g =$
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
0
1
2
3
4
5
V_a (kV)
6

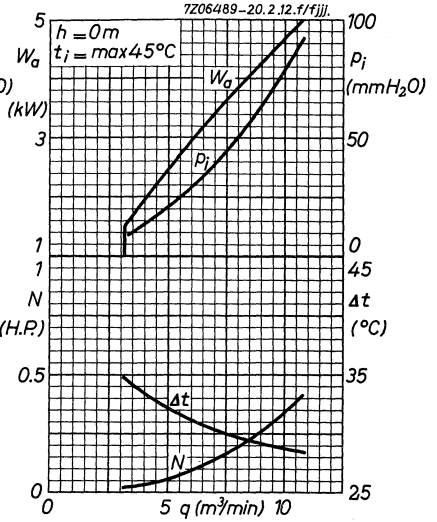

8
I_g (A)
6
4
2
0
7Z06480
$V_a = V_g$
V_g = 450V
400V
350V
300V
250V
200V
150V
100V
50V
0
1
2
3
4
5
V_a (kV)
6

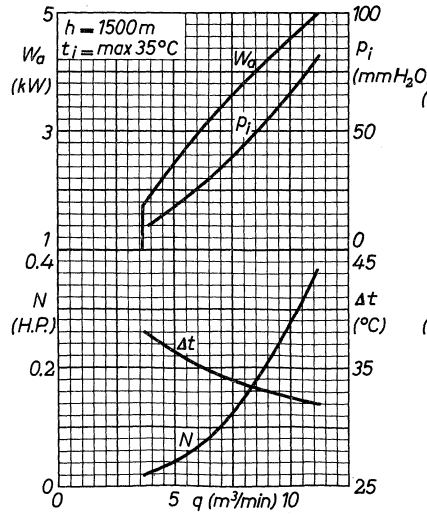

7Z06481
1.2
I_a
(A)
1
0.8
0.6
0.4
0.2
0
V_a=6kV
5kV
4kV
3kV
2kV
−200
V_g(V)
−150
−100
−50
0

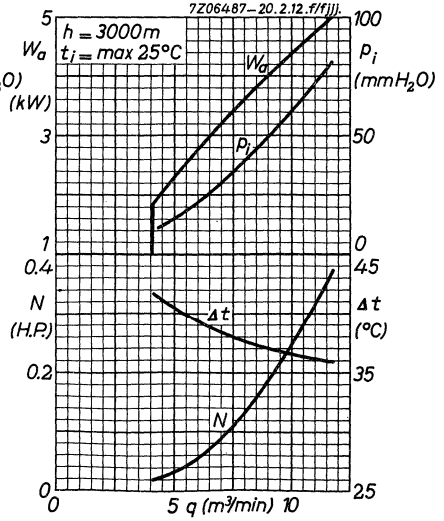

7Z06488-20.2.12.f/fjj.
C telegr.
Va (kV)
W (kW)
η (%)
110MHz
220MHz
I (A)
Wia
η
Wo
Va
Ia
Ig
λ (m)
f (MHz)


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


h = 0m
t_i = max 35°C
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10


7Z06489–20.2.12.f/fjj.
h = 0m
t_i = max 45°C
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10


h = 1500m
t_i = max 35°C
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10


7Z06487–20.2.12.f/fjj.
h = 3000m
t_i = max 25°C
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
5 q (m³/min) 10

AIR COOLED R.F. POWER TRIODE

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

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

COOLING : forced air

HEATING : direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

AIR COOLING CHARACTERISTICS

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

See cooling curves

Temperature of filament seals = max. 210 °C

Temperature of grid and anode seals = max. 180 °C

Filament connectors 40634

Connector for centre pin of filament 40649 [1])

Grid connector 40650 [2]) or 40622

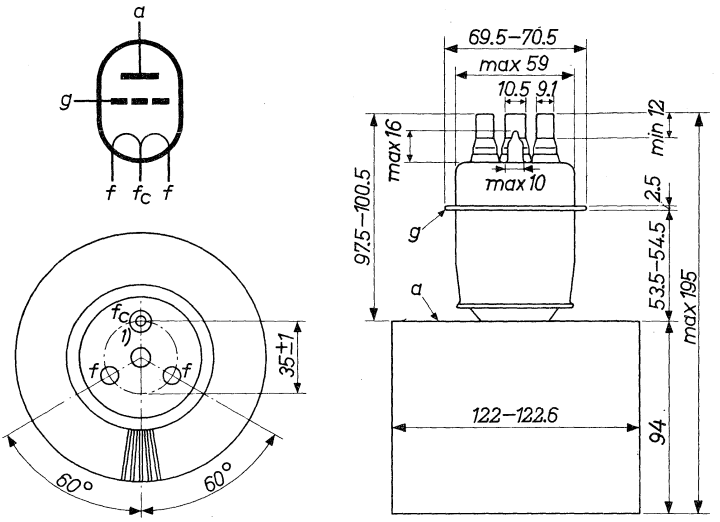
Insulating pedestal (see page 4) 40630

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

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

MECHANICAL DATA

Dimensions in mm



Mounting position: vertical with anode up or down.

[1]) See page 2

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

A.F. CLASS B AMPLIFIER AND MODULATOR

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS, two tubes

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

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

LIMITING VALUES (Absolute limits)

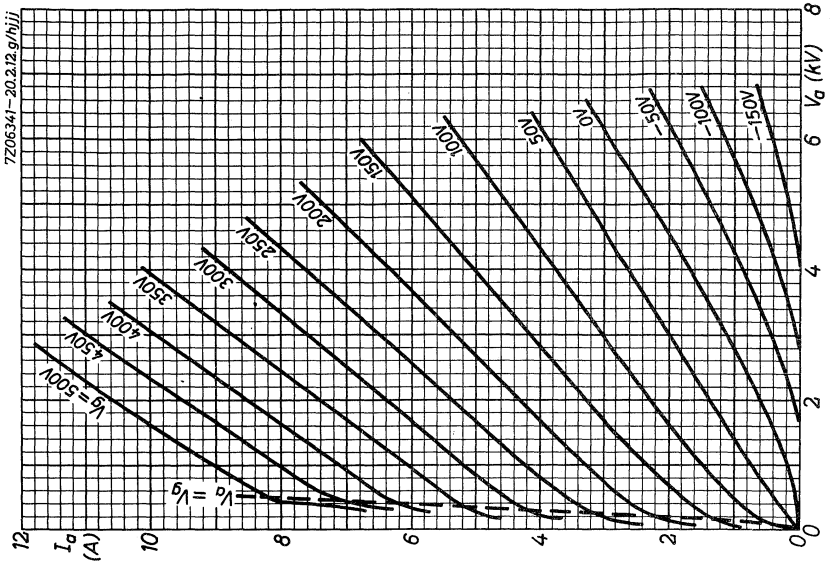
Frequency	f		up to	55	MHz
Anode voltage	V_a	=	max.	7	kV
Negative grid voltage	$-V_g$	=	max.	1250	V
Anode current	I_a	=	max.	1.8	A
Grid current	I_g	=	max.	0.5	A [1]
Anode input power	W_{ia}	=	max.	11	kW
Anode dissipation	W_a	=	max.	6	kW
Grid circuit resistance	R_g	=	max.	10	kΩ

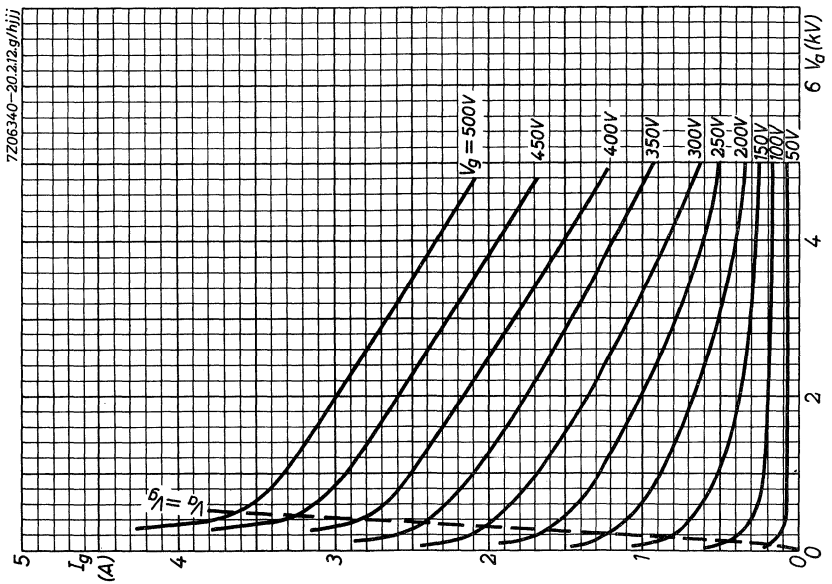
OPERATING CONDITIONS

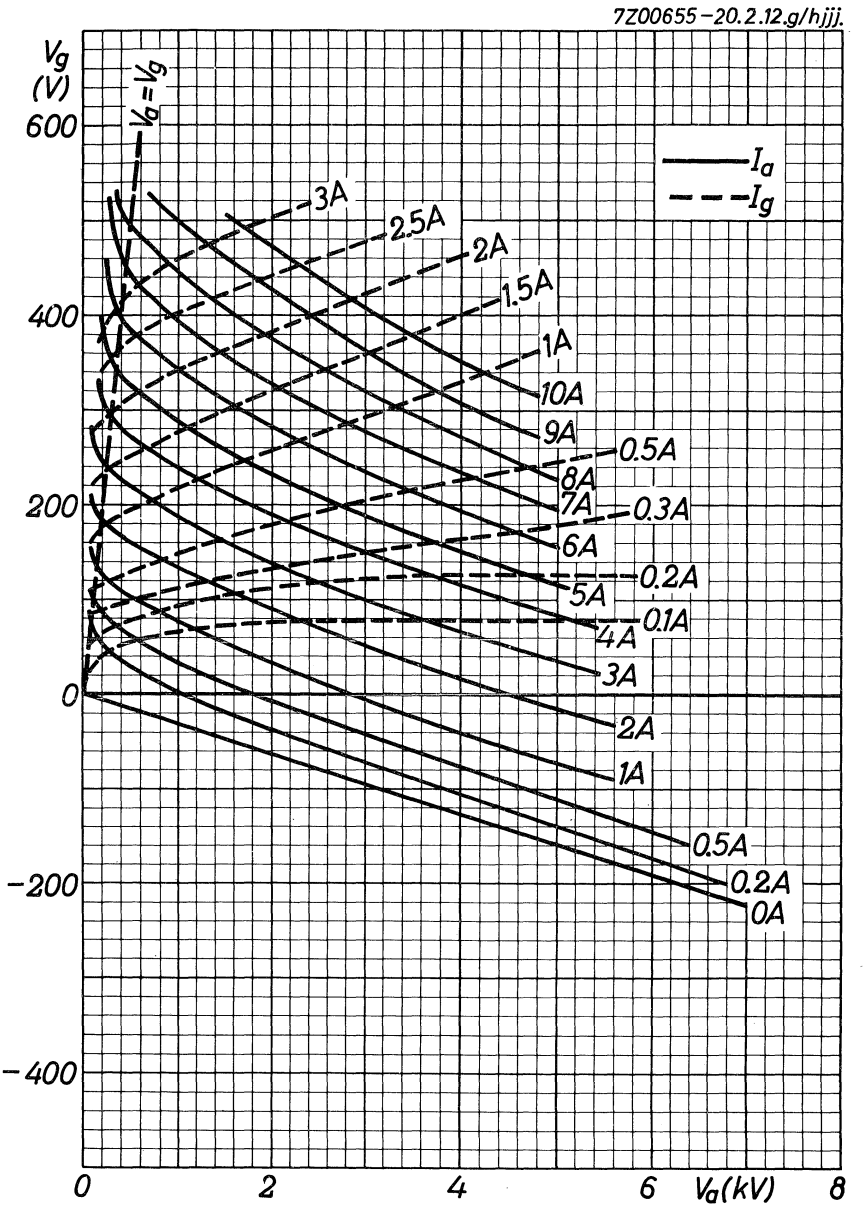
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5100	V_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A [1]
Grid resistor	R_g	=	1000	Ω
Grid input power	W_{ig}	=	300	W
Anode input power	W_{ia}	=	9	kW
Anode dissipation	W_a	=	2.7	kW
Output power	W_o	=	6	kW [2]
Efficiency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

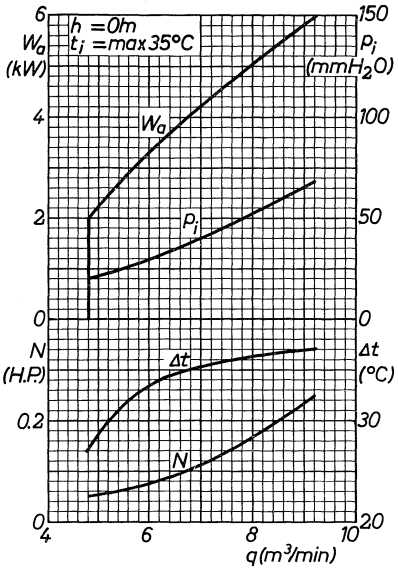
[1] Unloaded 0.7 A

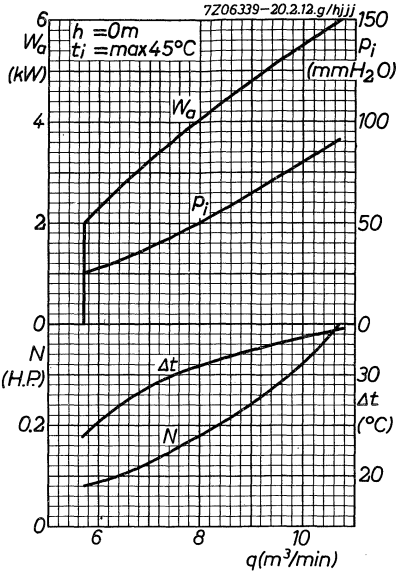
[2] Available power (load + circuit losses)

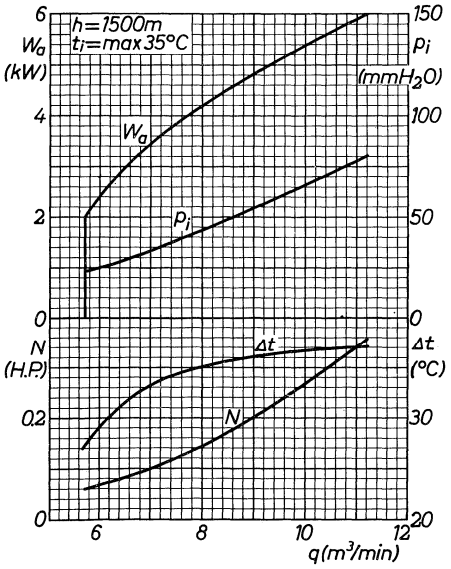

7Z06341-20.2.12.g/hjjj
I_a (A)
V_g (kV)
$V_a = V_g$
V_g=500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V

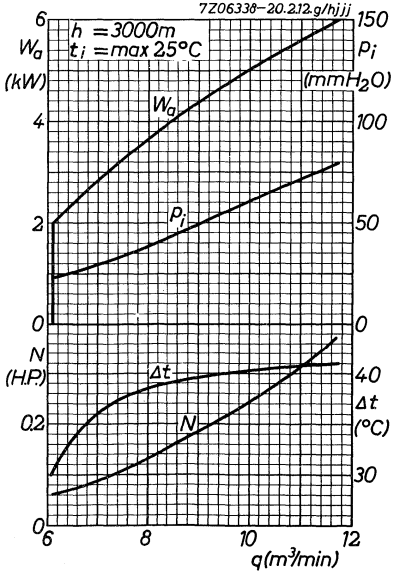

7Z06340-20.2.12.g/hjjj
I_g (A)
V_g (kV)
$V_a = V_g$
V_g = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V


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


h =0m
ti =max 35°C
Wa
(kW)
pi
(mmH2O)
N
(H.P.)
Δt
(°C)
q(m3/min)


7Z06339-20.2.12.g/hjjj
h =0m
ti =max 45°C
Wa
(kW)
pi
(mmH2O)
N
(H.P.)
Δt
(°C)
q(m3/min)


h=1500m
ti=max 35°C
Wa
(kW)
pi
(mmH2O)
N
(H.P.)
Δt
(°C)
q(m3/min)


7Z06338-20.2.12.g/hjjj
h =3000m
ti =max 25°C
Wa
(kW)
pi
(mmH2O)
N
(H.P.)
Δt
(°C)
q(m3/min)

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Temperature of anode and seals = max. 220 °C

AIR COOLING CHARACTERISTICS for continuous service

For intermittent service see figure page A

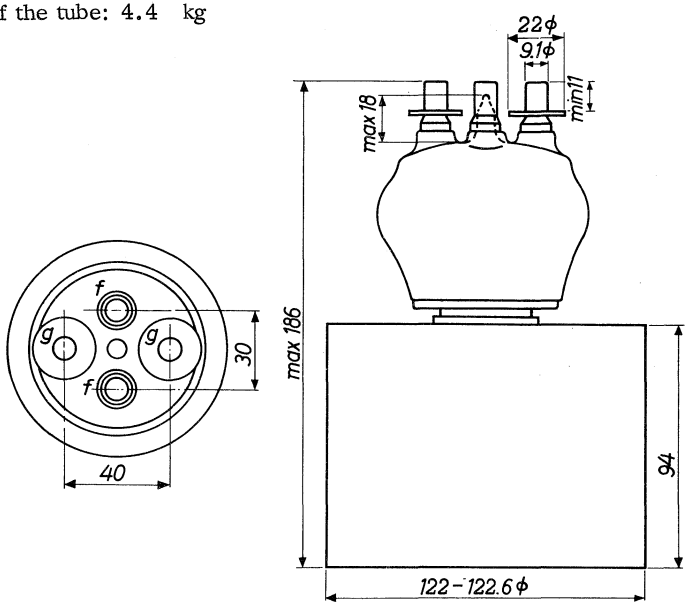
W_a (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
2	0	35	4.8	20
	0	45	5.7	25
	1500	35	5.7	23
	3000	25	6.1	23
4	0	35	6.8	38
	0	45	7.9	49
	1500	35	7.8	42
	3000	25	8.4	42
6	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.7	81

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

MECHANICAL DATA

Dimensions in mm

Net weight of the tube: 4.4 kg



Connectors for grid and filament	40634
Insulating pedestal	40630

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

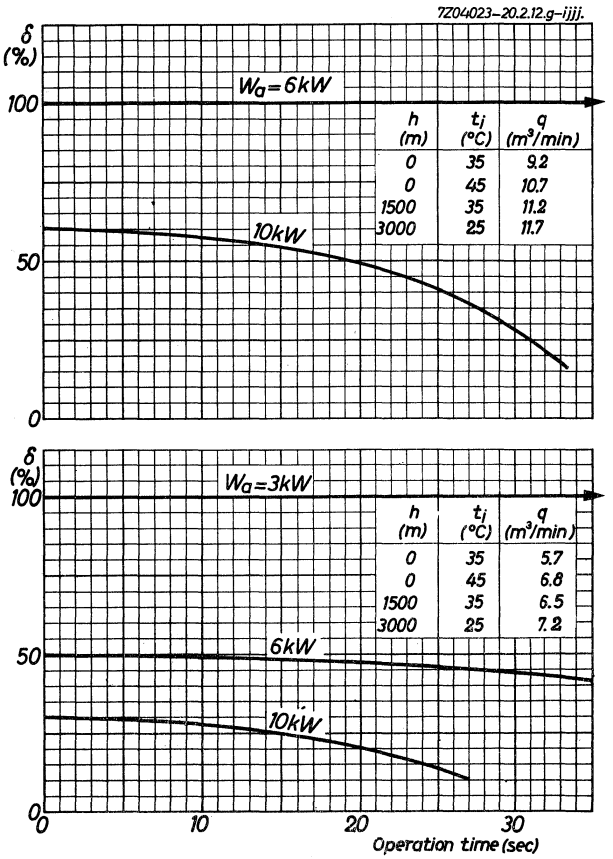
LIMITING VALUES (Absolute limits), continuous service

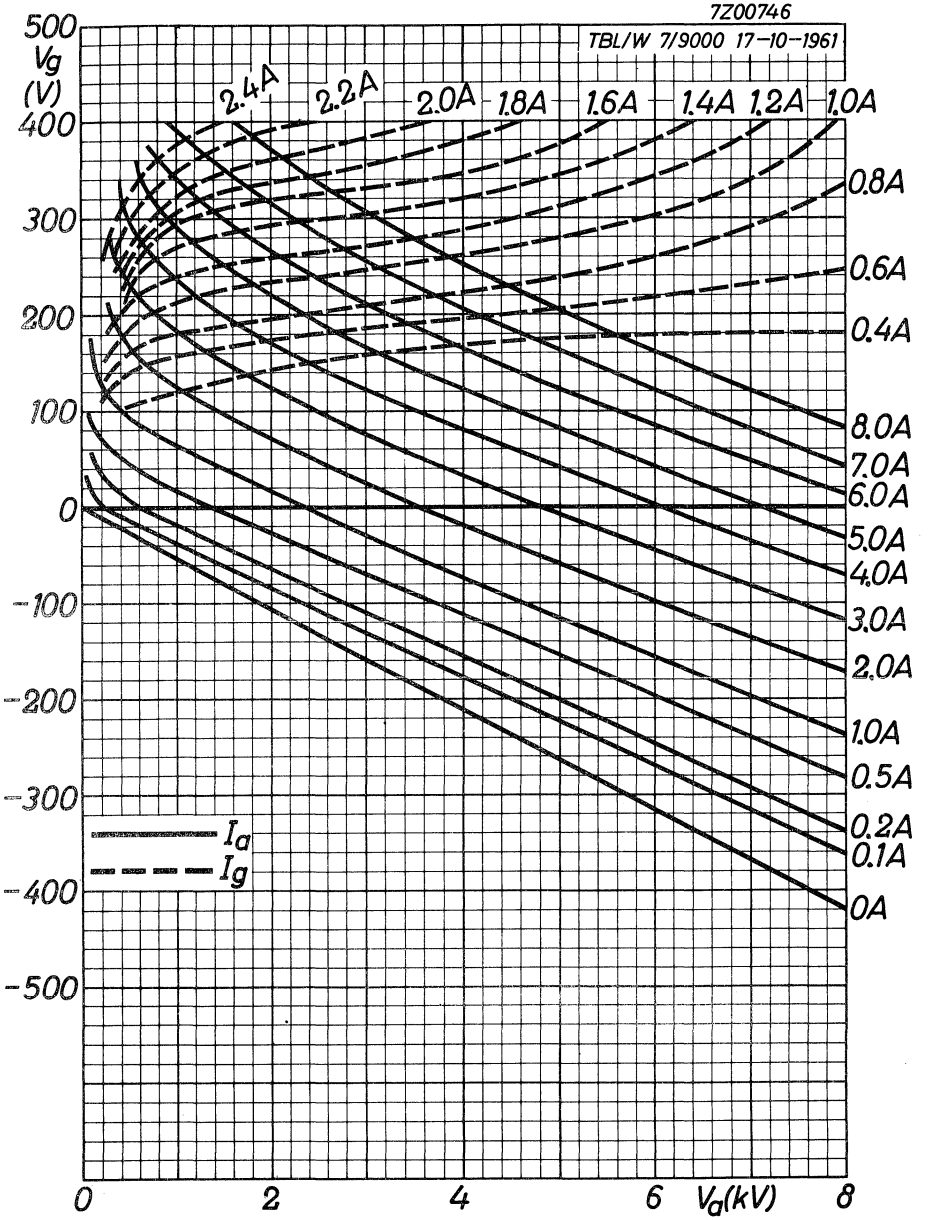
Frequency					
	f		up to	50	MHz
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	12	kW
Anode dissipation	W_a	=	max.	6	kW
Anode current	I_a	=	max.	1.8	A
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	0.4	A
Grid current, unloaded	I_g	=	max.	0.5	A
Grid circuit resistance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

OPERATING CHARACTERISTICS , continuous service

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

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


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


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

AIR COOLED
INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMIT (Absolute limit)

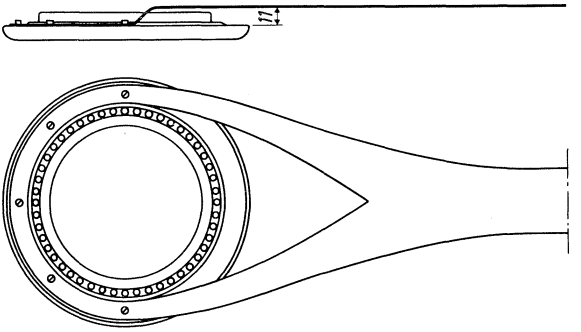
Seal temperature = max. 220 °C

7Z2 8674

AIR COOLING CHARACTERISTICS

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

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



7Z2 3548

MECHANICAL DATA

Dimensions in mm

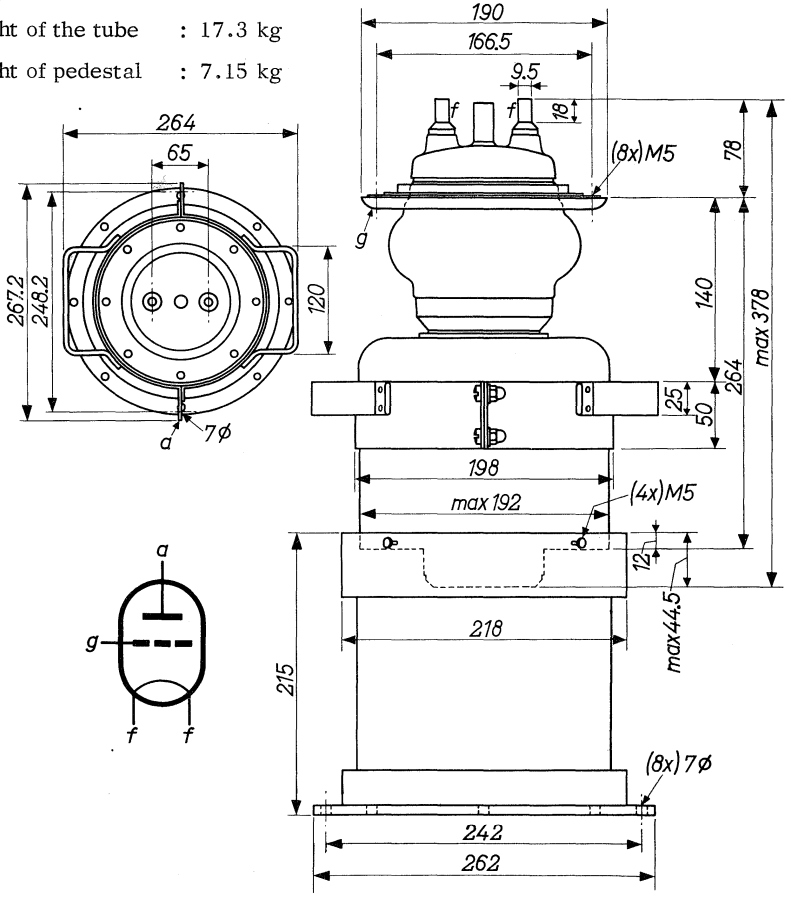
Filament connectors
with cable : 40662

Grid connector : 40663

Insulating pedestal : 40648

Net weight of the tube : 17.3 kg

Net weight of pedestal : 7.15 kg



Mounting position: vertical with anode down

7Z2 8675

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

LIMITING VALUES (Absolute limits)

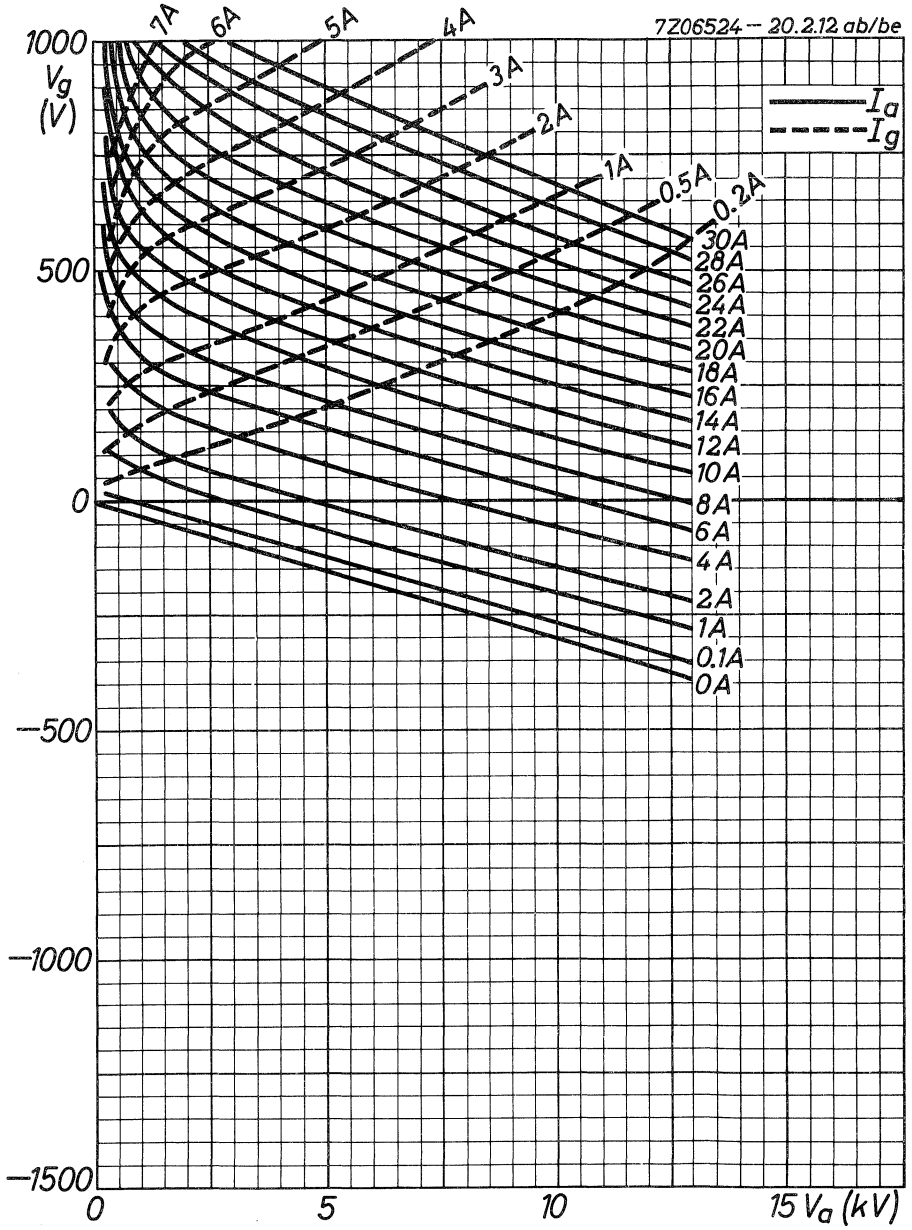
Frequency		f		up to	30	MHz
Anode voltage		V_a	=	max.	13	kV
Anode current		I_a	=	max.	4.8	A
Anode dissipation		W_a	=	max.	15	kW
Anode input power		W_{ia}	=	max.	60	kW
Negative grid voltage		$-V_g$	=	max.	1500	V
Grid current		I_g	=	max.	0.8	A
Grid circuit resistance		R_g	=	max.	10	kΩ

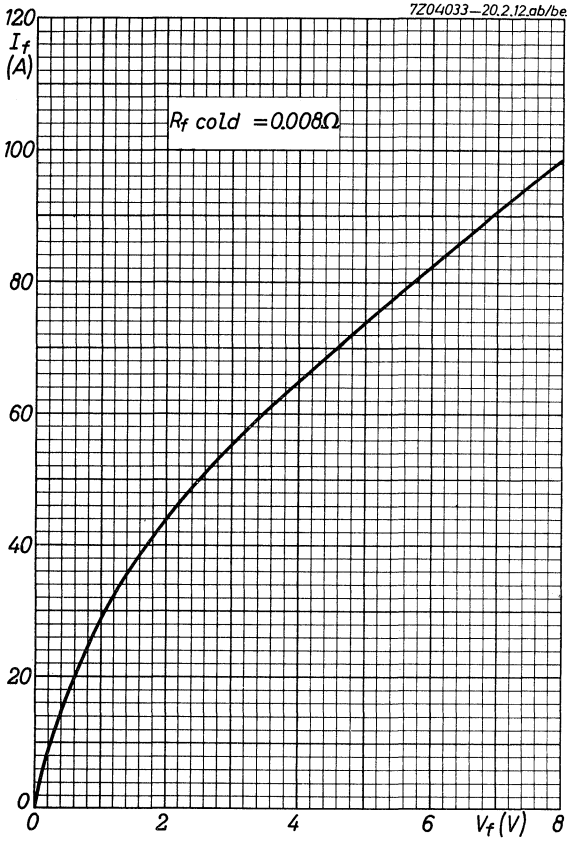
OPERATING CONDITIONS

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

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

7Z2 3550


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


7Z04033—20.2.12.ab/be
120
I_f (A)
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)

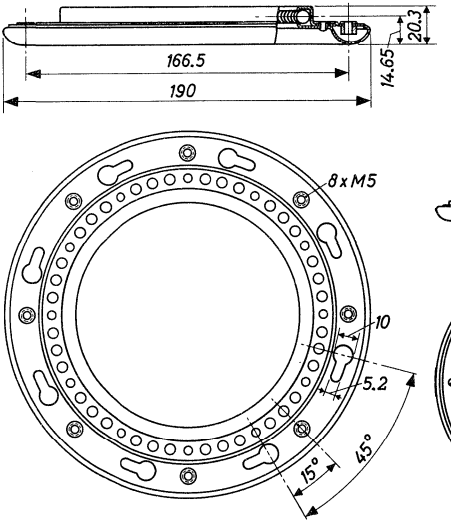
Temperature of all seals = max. 220 °C

AIR COOLING CHARACTERISTICS See also cooling curves on page 8

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

MECHANICAL DATA

Dimensions in mm



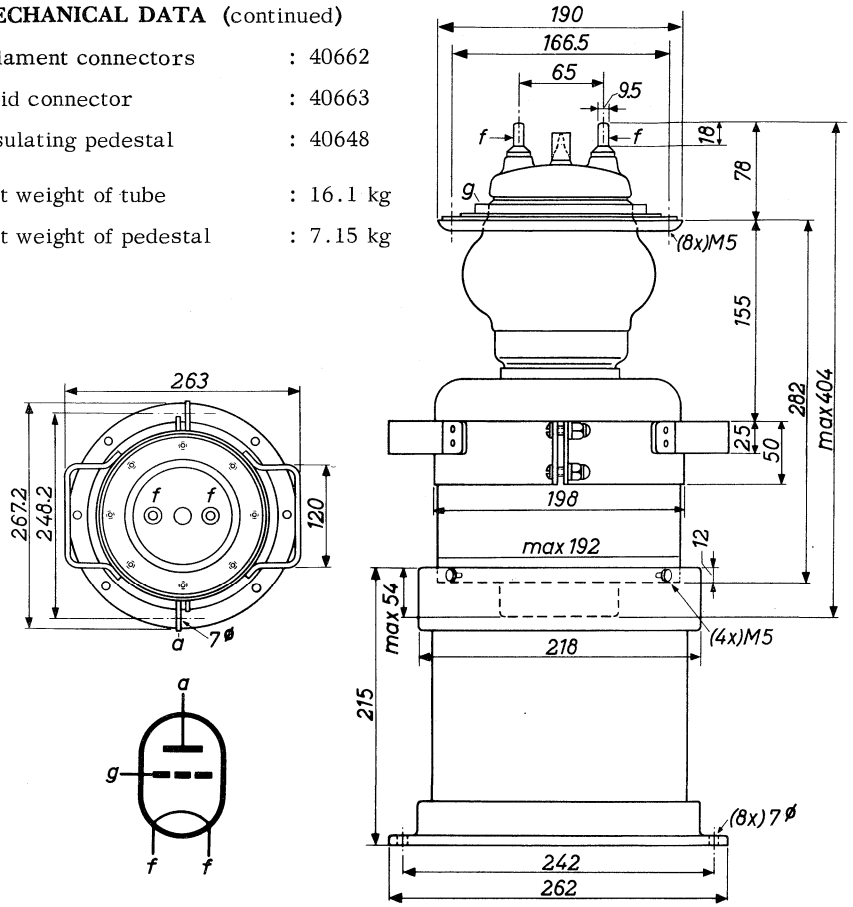
Grid connector 40663

Connection of the grid lead

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

MECHANICAL DATA (continued)

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

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

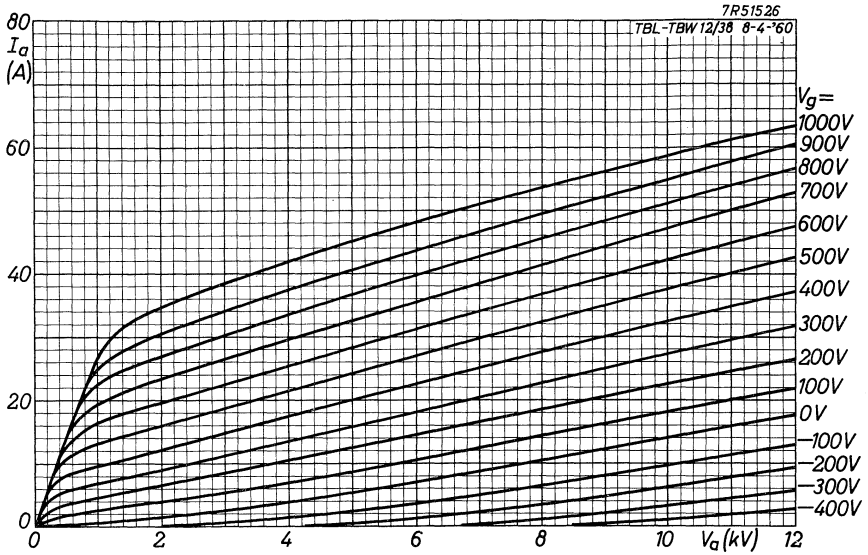
LIMITING VALUES (Absolute limits)

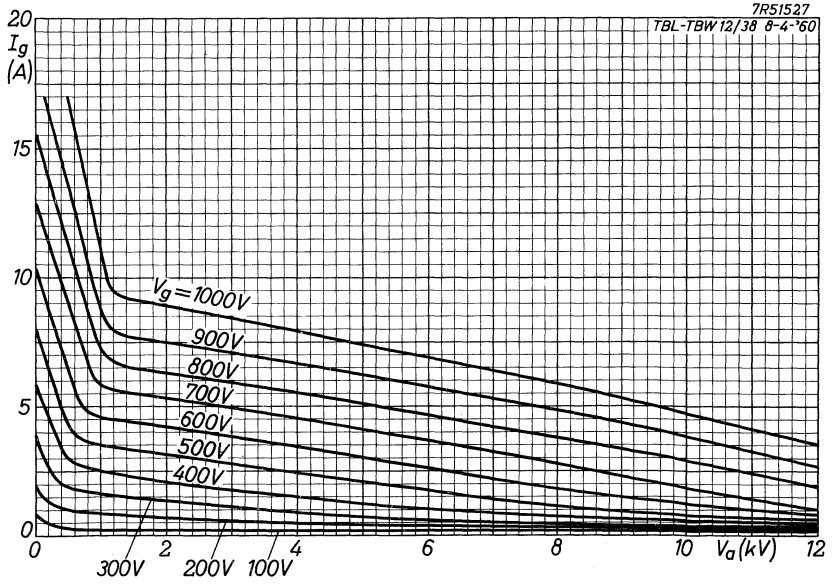
Frequency		f		up to	30	MHz
Anode voltage		V_a	=	max.	13	kV
Anode current		I_a	=	max.	5	A
Anode dissipation		W_a	=	max.	15	kW
Anode input power		W_{ia}	=	max.	60	kW
Negative grid voltage		$-V_g$	=	max.	2	kV
Grid current, loaded		I_g	=	max.	1.5	A
Grid current, unloaded		I_g	=	max.	2.0	A
Grid circuit resistance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

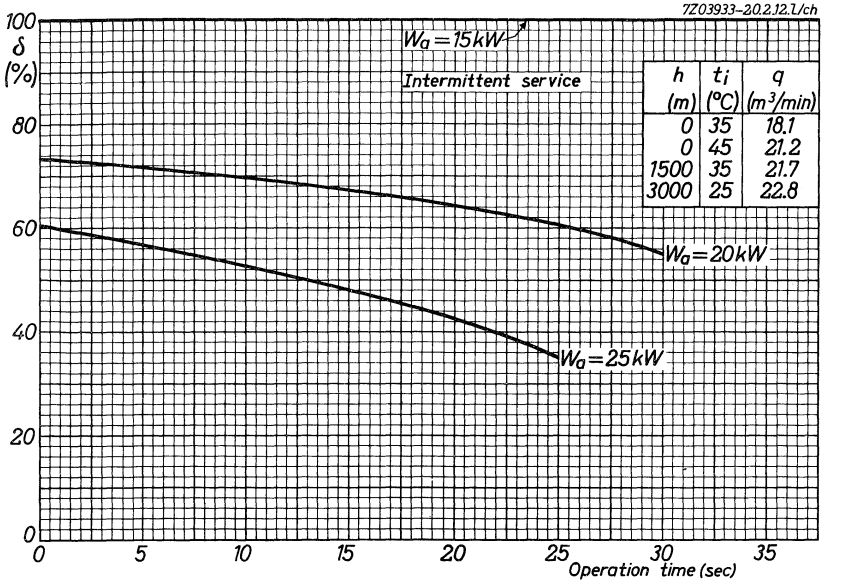
OPERATING CONDITIONS

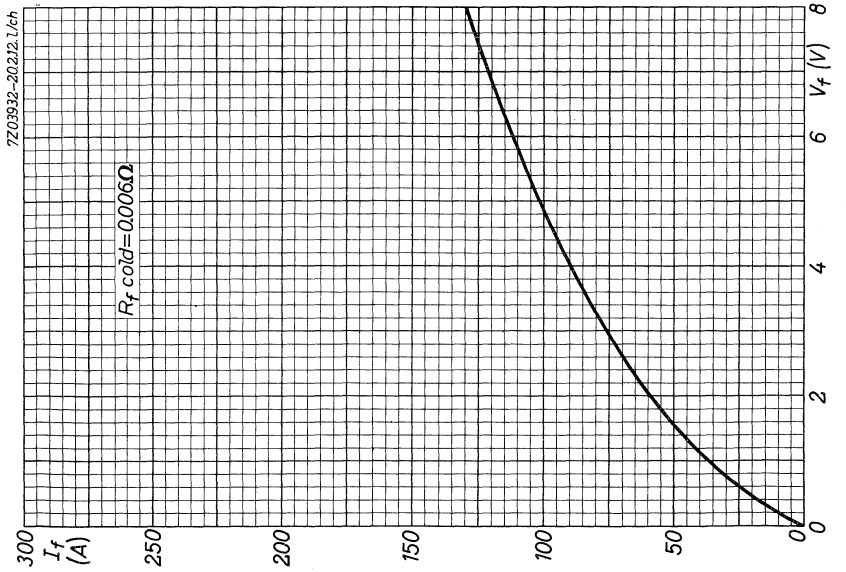
Frequency	f	=	30	30	30	MHz
Anode voltage	V_a	=	12	10	8	kV
Anode current, loaded	I_a	=	4.5	4.5	4.5	A
Anode current, unloaded	I_a	=	0.65	0.63	0.62	A
Grid current, loaded	I_g	=	0.9	0.9	0.9	A
Grid current, unloaded	I_g	=	1.22	1.3	1.35	A
Grid resistor	R_g	=	1100	1000	900	Ω
Load resistance	$R_{a\sim}$	=	1450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

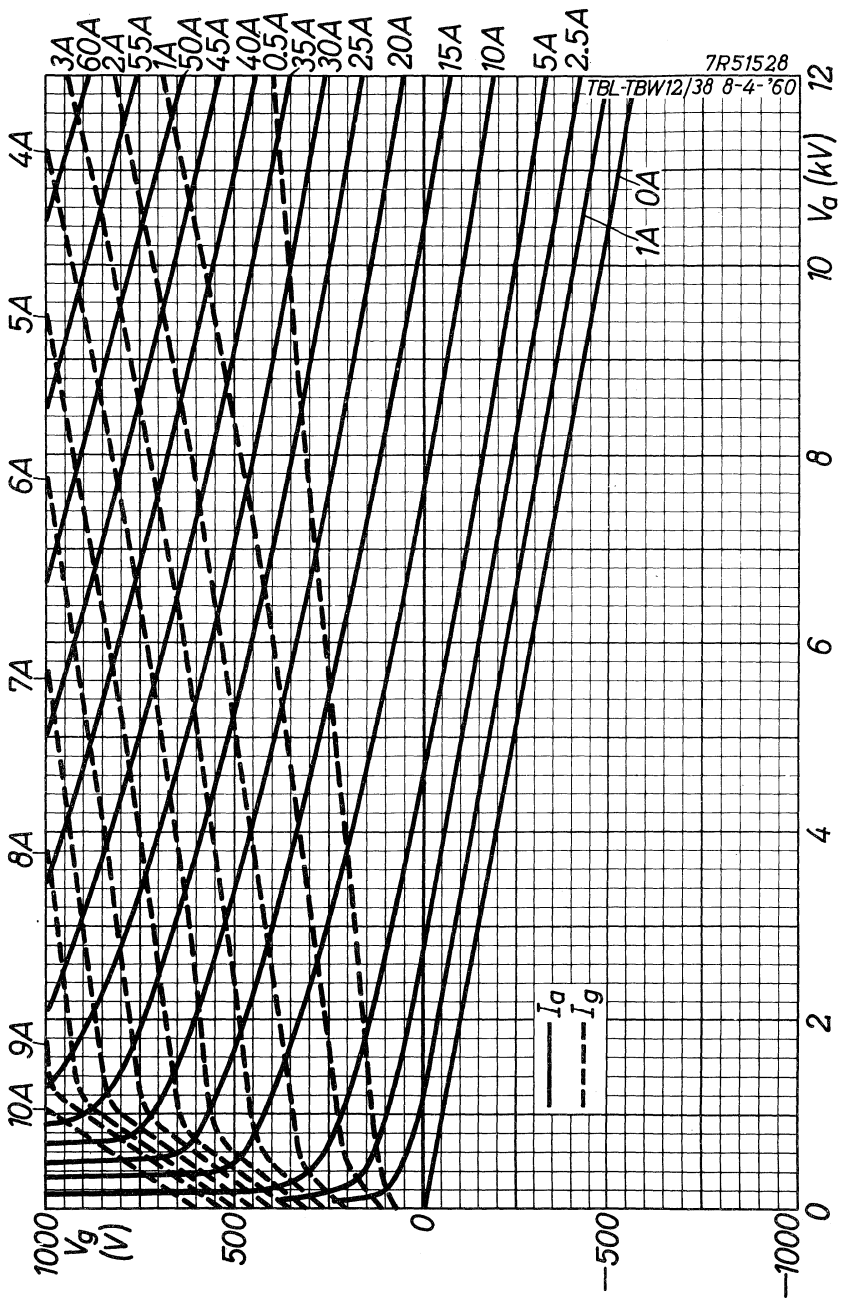
[1]) Useful power in the load, measured in a circuit having an efficiency of about 85%.

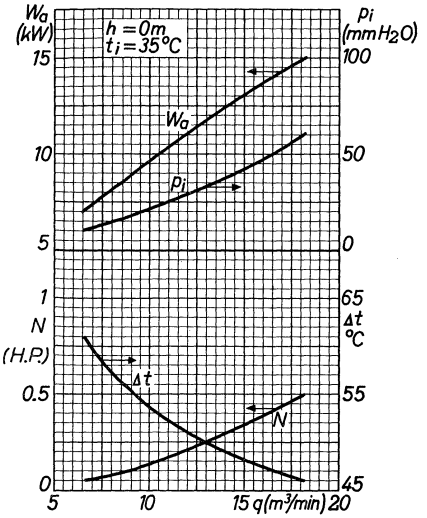

7R51526
TBL-TBW 12/38 8-4-760
I_a (A)
80
60
40
20
0
0
2
4
6
8
10
12
V_a (kV)
V_g =
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V

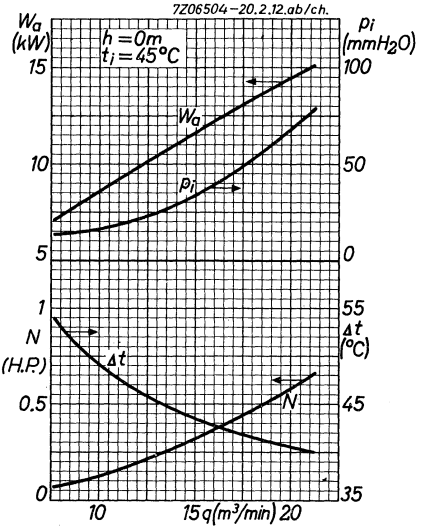

7R51527
TBL-TBW 12/38 8-4-760
I_g (A)
20
15
10
5
0
0
2
4
6
8
10
12
V_a (kV)
V_g = 1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V

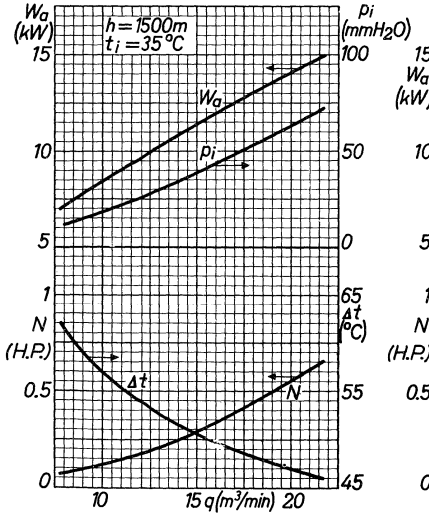

7Z03933-20.2.12.1/ch
δ (%)
100
80
60
40
20
0
W_a = 15 kW
Intermittent service
h (m) | t_i (°C) | q (m^3/min)
0 | 35 | 18.1
0 | 45 | 21.2
1500 | 35 | 21.7
3000 | 25 | 22.8
W_a = 20 kW
W_a = 25 kW
0
5
10
15
20
25
30
35
Operation time (sec)

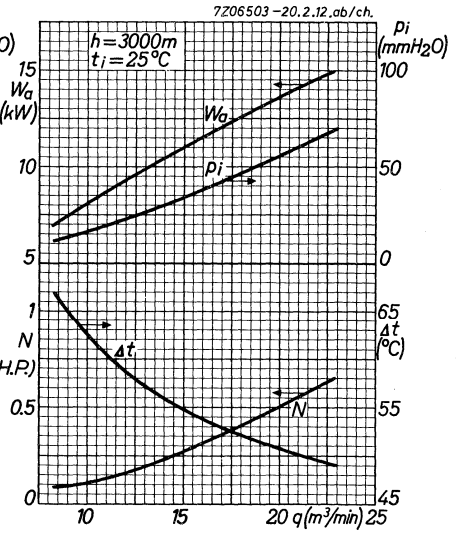

7Z03932-20.2.12.1/ch
R_f cold = 0.006 Ω
V_f (V)
8
6
4
2
0
300
I_f (A)
250
200
150
100
50
0


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
Ia
Ig
1000
Vg (V)
500
0
−500
−1000
0
2
4
6
8
10
12
Va (kV)


Wa (kW)
pi (mmH2O)
h = 0m
ti = 35°C
Wa
pi
Δt
N
N (H.P.)
Δt °C
15
10
5
1
0.5
0
100
50
0
65
55
45
5
10
15 q(m³/min) 20


7Z06504 - 20.2.12.ab/ch.
Wa (kW)
pi (mmH2O)
h = 0m
ti = 45°C
Wa
pi
Δt
N
N (H.P.)
Δt (°C)
15
10
5
1
0.5
0
100
50
0
55
45
35
10
15 q(m³/min) 20


Wa (kW)
pi (mmH2O)
h = 1500m
ti = 35°C
Wa
pi
Δt
N
N (H.P.)
Δt (°C)
15
10
5
1
0.5
0
100
50
0
65
55
45
10
15 q(m³/min) 20


7Z06503 - 20.2.12.ab/ch.
Wa (kW)
pi (mmH2O)
h = 3000m
ti = 25°C
Wa
pi
Δt
N
N (H.P.)
Δt (°C)
15
10
5
1
0.5
0
100
50
0
65
55
45
10
15
20 q(m³/min) 25

AIR COOLED R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

[1]) Two tubes

AIR COOLING CHARACTERISTICS

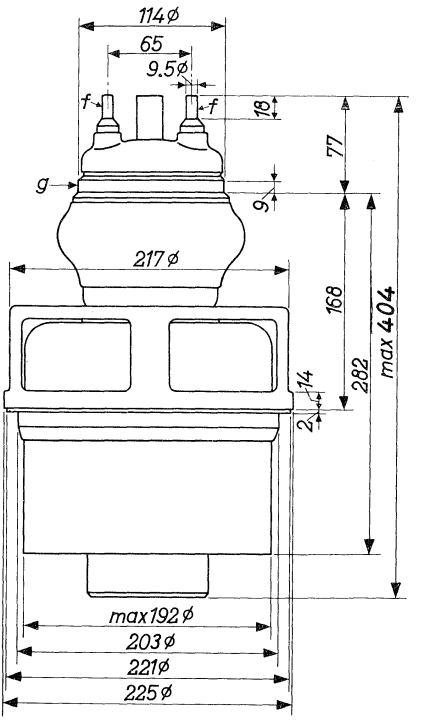
W_a (kW)	h (m)	t_i (^oC)	q_{min} (m^3/min)	p_i (mm H_2O)
7	0	35	6.6	10
	0	45	7.7	13
	1500	35	7.9	12
	3000	25	8.3	12
10	0	35	10.5	23
	0	45	12.3	31
	1500	35	12.6	28
	3000	25	13.2	27
15	0	35	18.1	60
	0	45	21.2	79
	1500	35	21.7	73
	3000	25	22.8	70

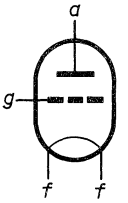
MECHANICAL DATA

Dimensions in mm

Net weight of tube : 19 kg

Net weight of pedestal: 7.15 kg





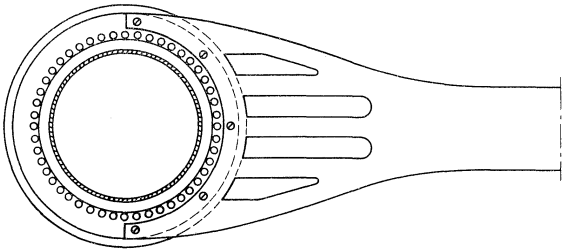
Mounting position: vertical

ACCESSORIES

Dimensions in mm

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

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



R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

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

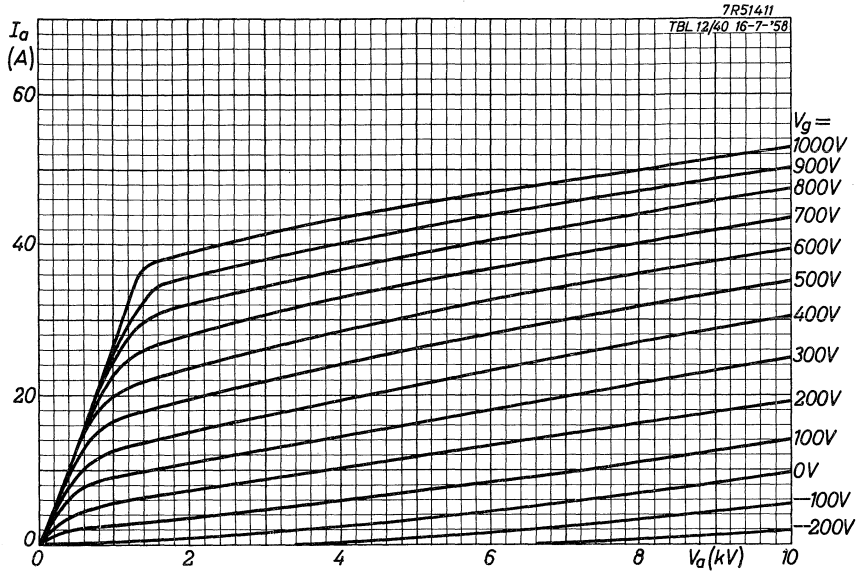
A.F. CLASS B AMPLIFIER AND MODULATOR (especially for use with a cathode-follower)

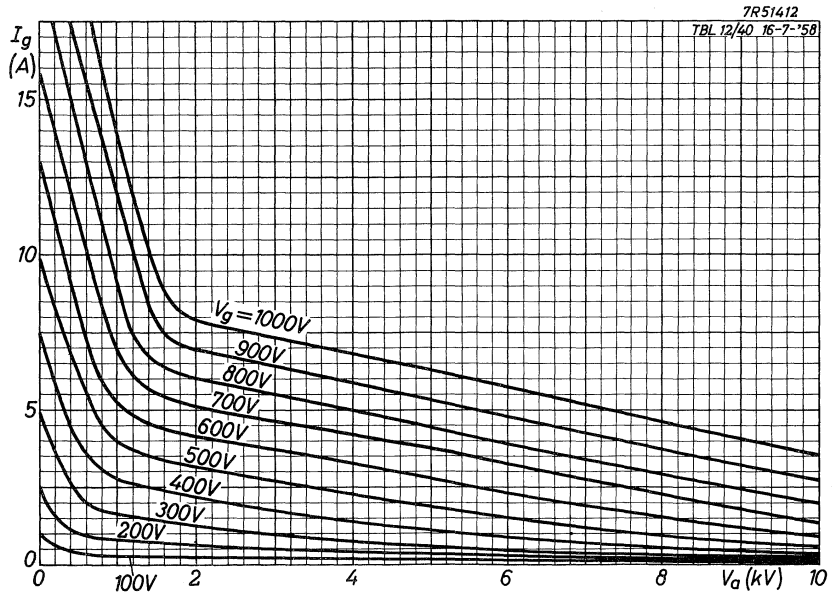
LIMITING VALUES (Absolute limits)

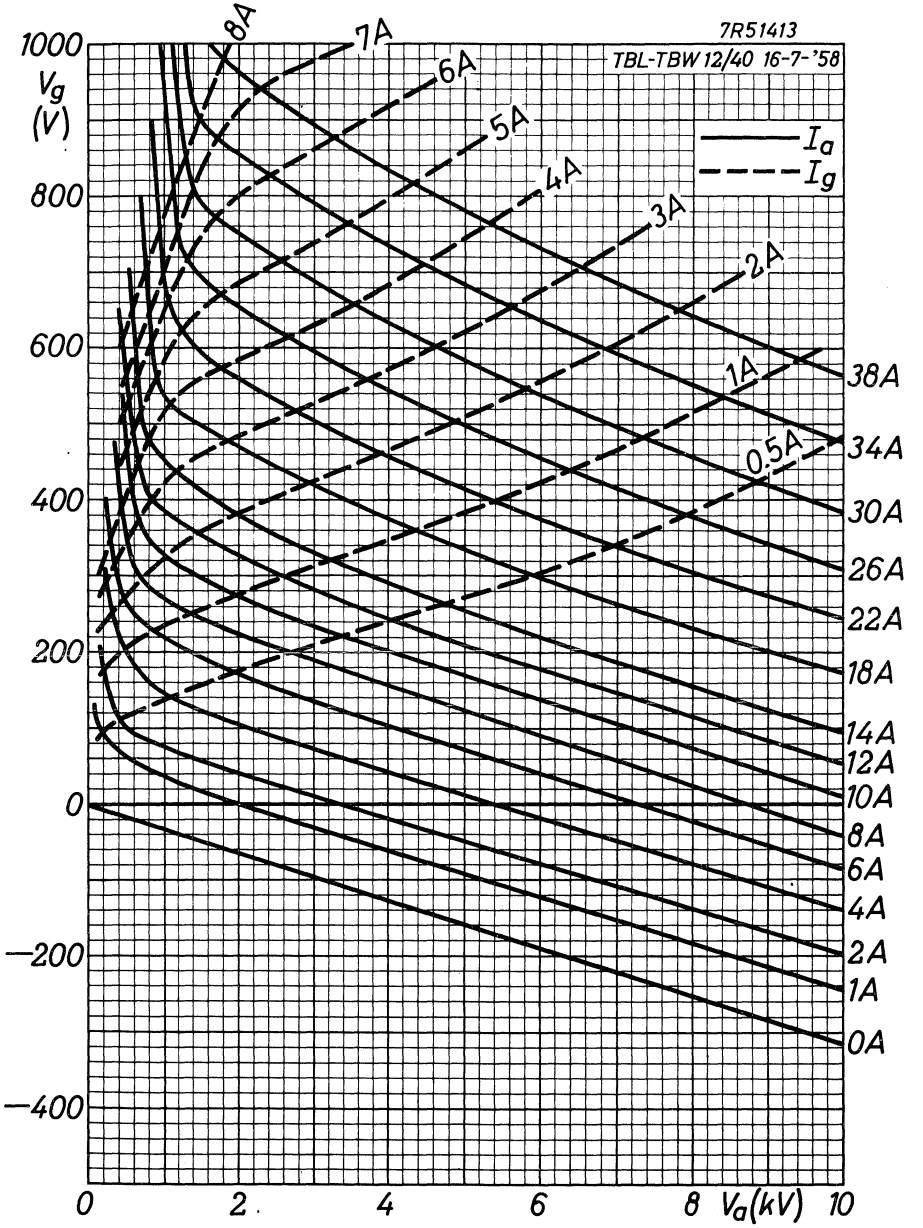
Anode voltage	V_a	= max.	13	kV
Anode input power	W_{ia}	= max.	60	kW
Anode dissipation	W_a	= max.	15	kW
Anode current	I_a	= max.	4.5	A
Grid circuit resistance	R_g	= max.	10	kΩ

OPERATING CONDITIONS, two tubes

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


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


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


7R51413
TBL-TBW 12/40 16-7-'58
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
1000
V_g (V)
800
600
400
200
0
−200
−400
0
2
4
6
8
V_a(kV)
10

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

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

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

MECHANICAL DATA

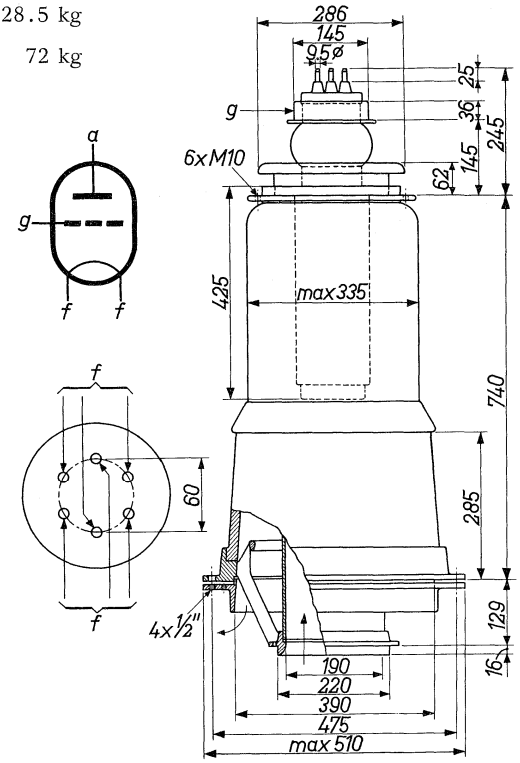
Dimensions in mm

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_{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 3584

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

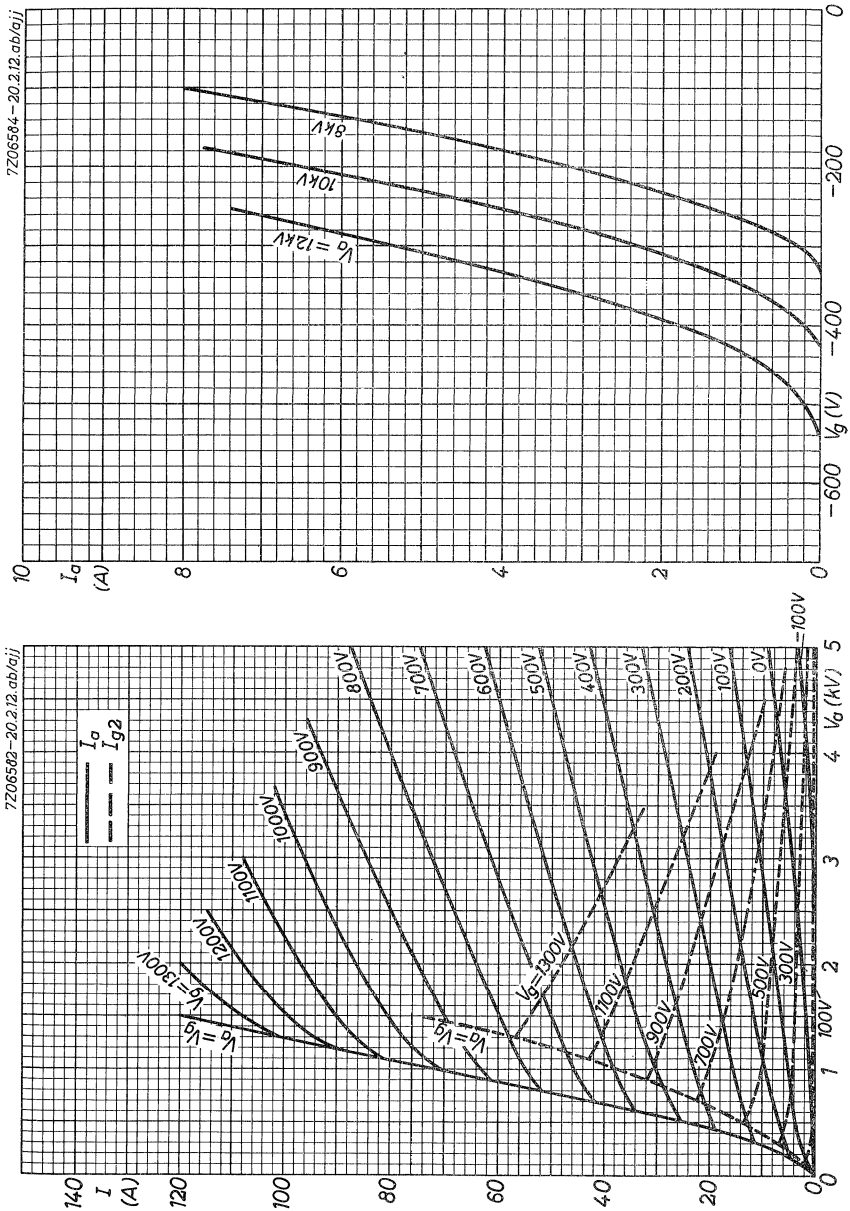
LIMITING VALUES (Absolute limits)

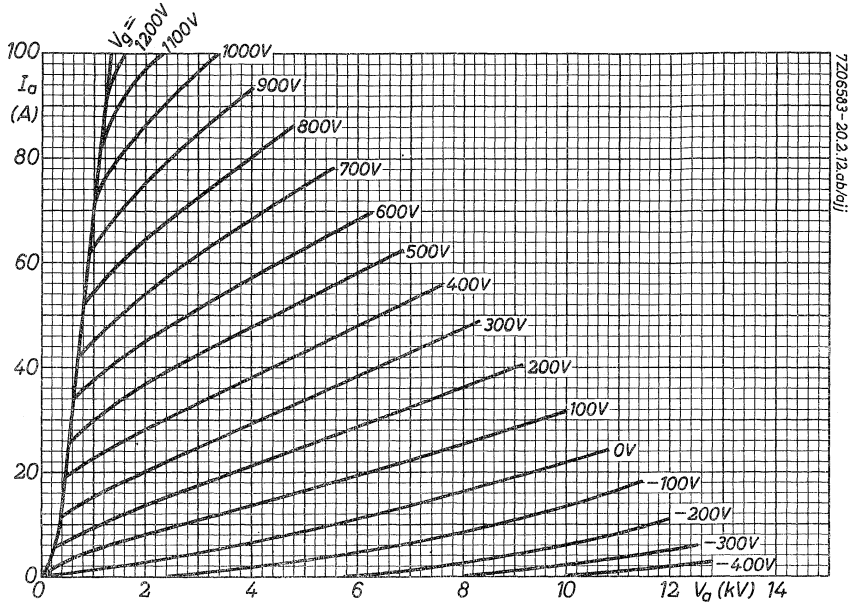
Frequency	f		up to	68	MHz
Anode voltage	V_a		max.	6.5	kV
Anode current	I_a	sync	max.	16	A
Anode input power	W_{ia}	sync	max.	100	kW
Anode dissipation	W_a	sync	max.	50	kW
Grid current	I_g	sync	max.	2	A

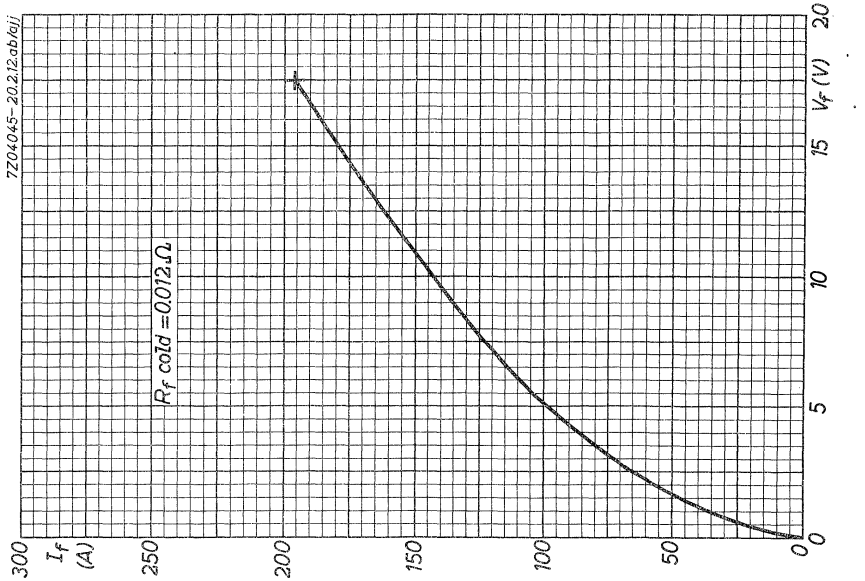
OPERATING CONDITIONS, two tubes in push-pull

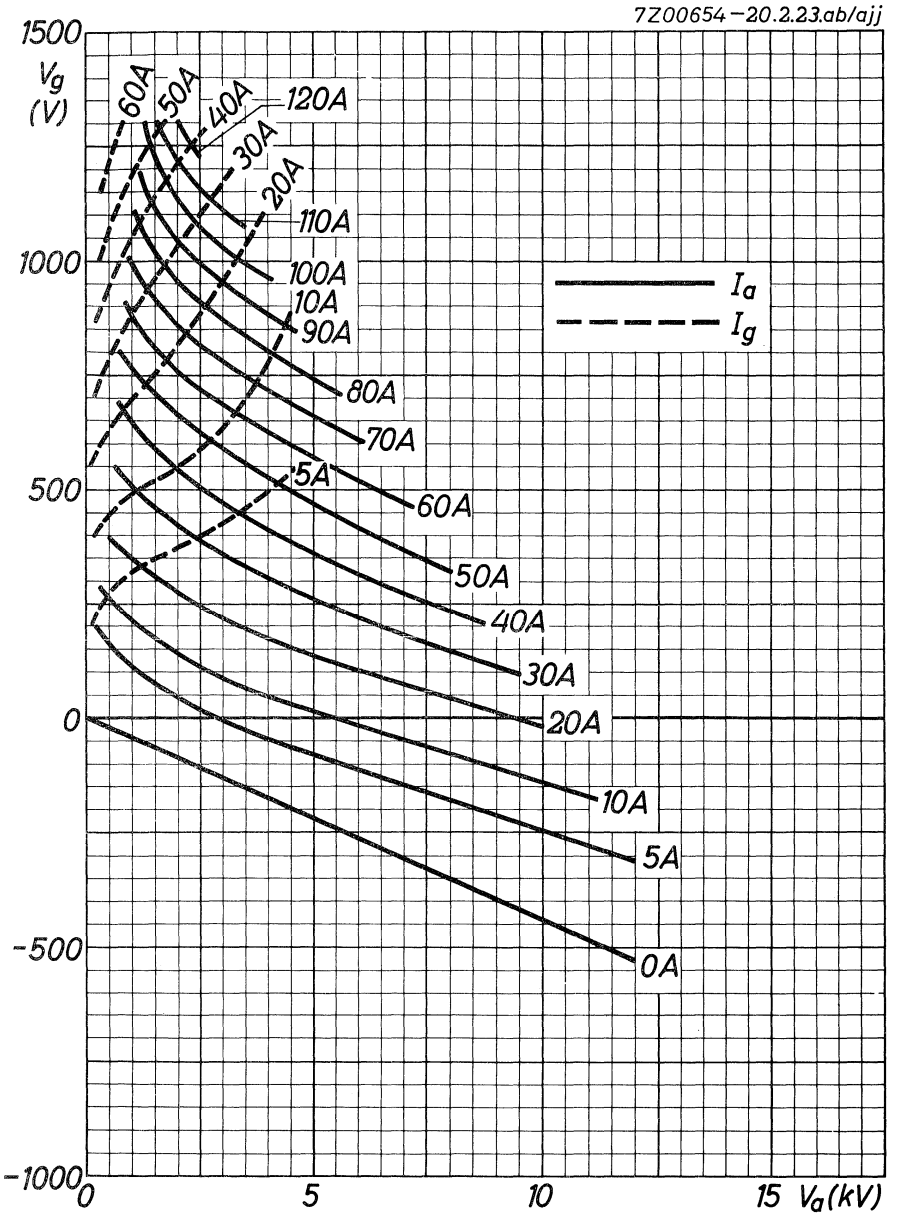
Frequency	f		=	48 to 68	MHz[1])
Bandwidth (-1.5 dB)	B		=	5.5	MHz[2])
Bandwidth (-3 dB)	B		=	7.5	MHz[2])
Anode voltage	V_a		=	6.5	kV
Grid voltage	V_g		=	-250	V
Peak grid to grid A.C. voltage	V_{ggp}	sync	=	1740	V [3])
		black	=	1300	V [3])
Anode current	I_a	sync	=	32	A
		black	=	24	A
Grid current	I_g	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])

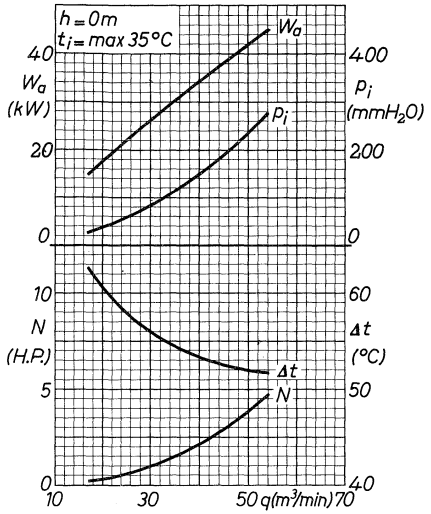
1) In the frequency range of 60 to 68 MHz a special version of the tube is necessary.
2) This value of bandwidth is based on measurements on a circuit with a single LC section
3) Measured by the slide back method
4) Driving power is accounted for largely by circuit losses. The indicated driving power 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


7206584-20.2.12.ab/ajj
Ia (A)
Vg (V)
Va = 12kV
10kV
8kV
7206583-20.2.12.ab/ajj
I (A)
Va (kV)
Ia
Ig2
Va = Vg
Vg = 130V
800V
700V
600V
500V
400V
300V
200V
100V
0V
-100V

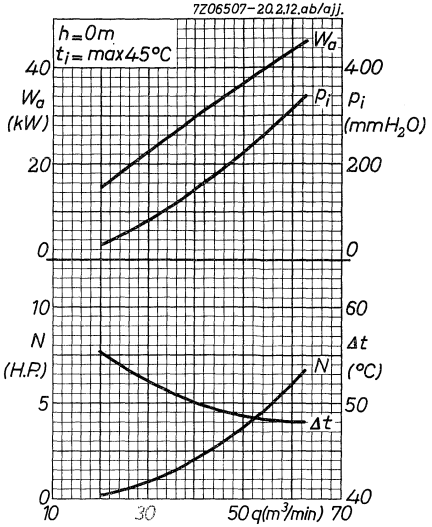

V_g= 1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
−100V
−200V
−300V
−400V
I_a (A)
100
80
60
40
20
0
0
2
4
6
8
10
12
V_a (kV)
14
7Z06583-20.2.12.ab/ajj

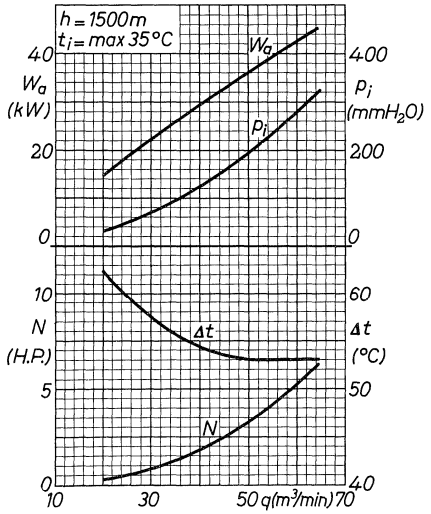

R_f cold = 0.012 Ω
I_f (A)
300
250
200
150
100
50
0
V_f (V)
20
15
10
5
0
7Z04045-20.2.12.ab/ajj


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

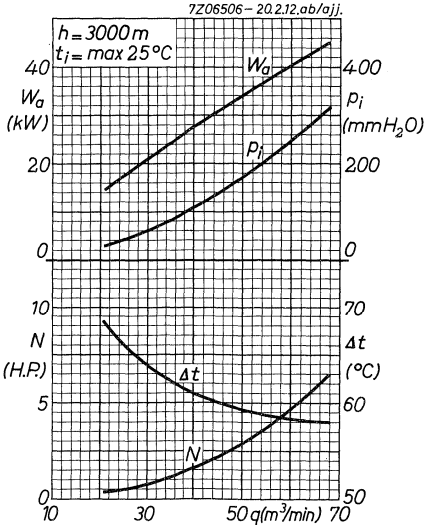


7Z06507–20.2.12.ab/ajj.



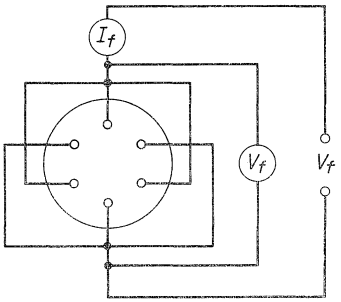


7Z06506–20.2.12.ab/ajj.



AIR COOLED R.F. POWER TRIODE

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

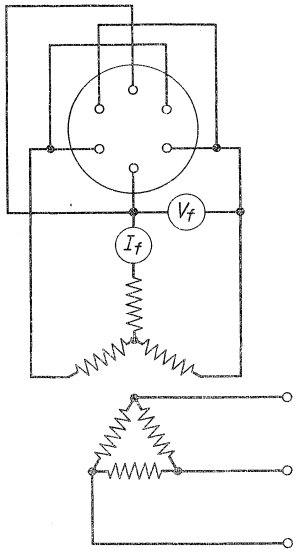


Single-phase filament energizing

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

WATER COOLING CHARACTERISTICS

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

MECHANICAL DATA

Dimensions in mm

Filament clips with cable : 40662

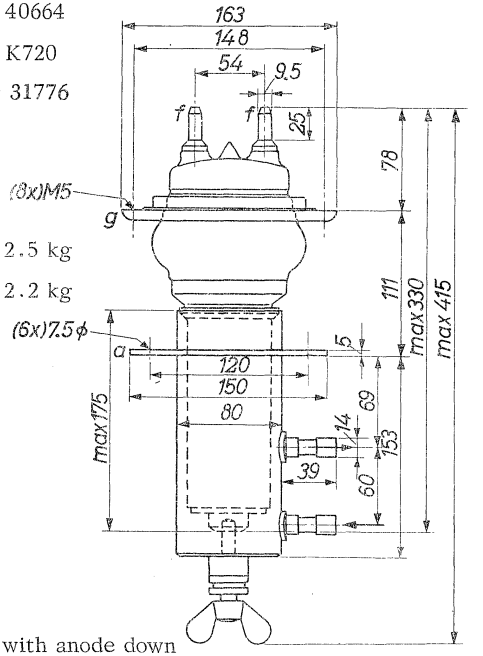
Grid connector : 40664

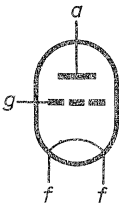
Water jacket : K720

O-ring : 2622 080 31776

Net weight of tube : 2.5 kg

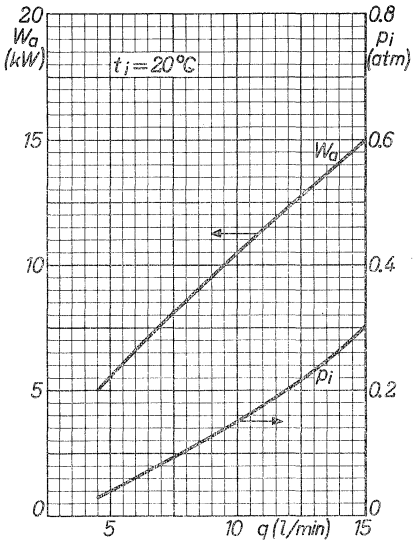
Net weight of water jacket: 2.2 kg

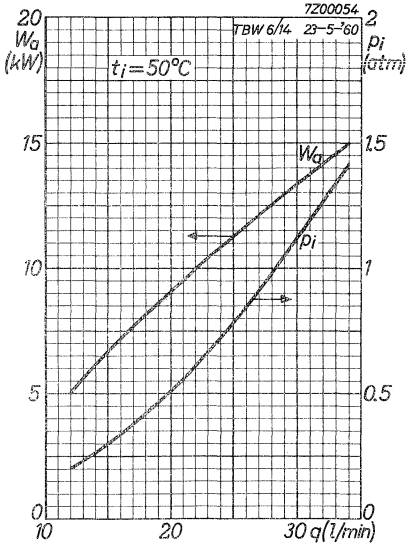




Mounting position: vertical with anode down

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


20
Wa
(kW)
15
10
5
0
0.8
pi
(atm)
0.6
0.4
0.2
0
$t_i = 20°C$
Wa
pi
5
10
q (l/min)
15


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

WATER COOLED R.F. POWER TRIODE

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

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

HEATING: direct, filament thoriated tungsten

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

CAPACITANCES

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

[1]) Two tubes

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 (^oC)	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	^oC
Temperature of seals	t	= max.	180	^oC

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

7Z2 8687

MECHANICAL DATA

Dimensions in mm

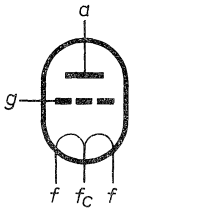
Filament connector: 40634

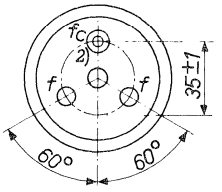
Grid connector : 40650[3]) or 40622

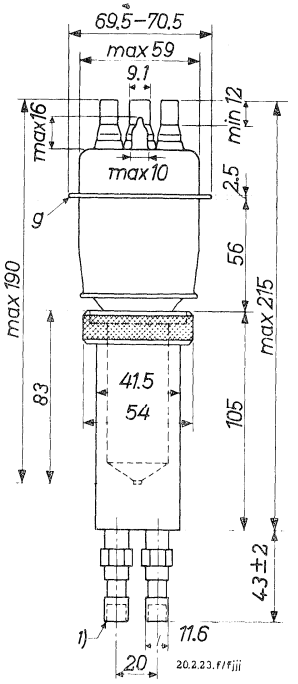
Net weight of tube : 0.45 kg

Net weight of K713 : 0.52 kg

→ O-ring : 3322 026 82801







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

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

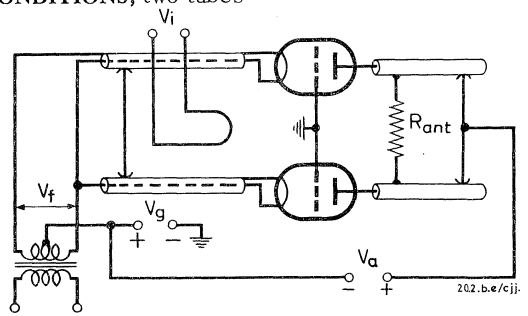
R.F. CLASS C TELEGRAPHY, grounded grid

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_{gp}	= 250	225	V
Anode input power	W_{ia}	= 5.9	4.5	kW
Anode dissipation	W_a	= 4	3.05	kW
Output power	W_o	= 1.9	1.45	kW
Efficiency	η	= 32	32	%
Modulation factor	m	= 100	100	%
Grid current	I_g	= 0.3	0.32	A
Grid input power	W_{ig}	= 140	130	W

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_{gp}	=	690	650	600	600	510	V
Grid input power	W_{ig}	=	190	180	165	165	140	W
Anode input power	W_{ia}	=	6	5.4	4.8	4.2	3	kW
Anode dissipation	W_a	=	1.3	1.3	1.3	1.2	0.8	kW
Output power	W_o	=	4.7	4.1	3.5	3.0	2.2	kW
Efficiency	η	=	78	76	73	71.5	73	%
Modulation 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	$\hat{I}_a$	= 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_{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 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_{ggp}	sync =	1000	1000	V [3])
Anode current	I_a	sync =	3.8	3.2	A
		black =	2.8	2.6	A
Grid current	I_g	sync =	0.5	0.4	A
		black =	0.35	0.22	A
Grid input power	W_{ig}	sync =	250	350 to 450	W [4])
Output power	W_o	sync =	9	6	kW
		black =	5.35	3.37	kW

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

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

3) Measured by the slide back method

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

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_{ggp}	white	=	1000	V
Anode current	I_a	white	=	3.8	A
		black	=	0.8	A
Grid current	I_g	white	=	0.5	A
		black	=	0	A
Grid input power	W_{ig}	white	=	250	W
Output power	W_o	white	=	9	kW
		black	=	0.6	kW

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	%

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

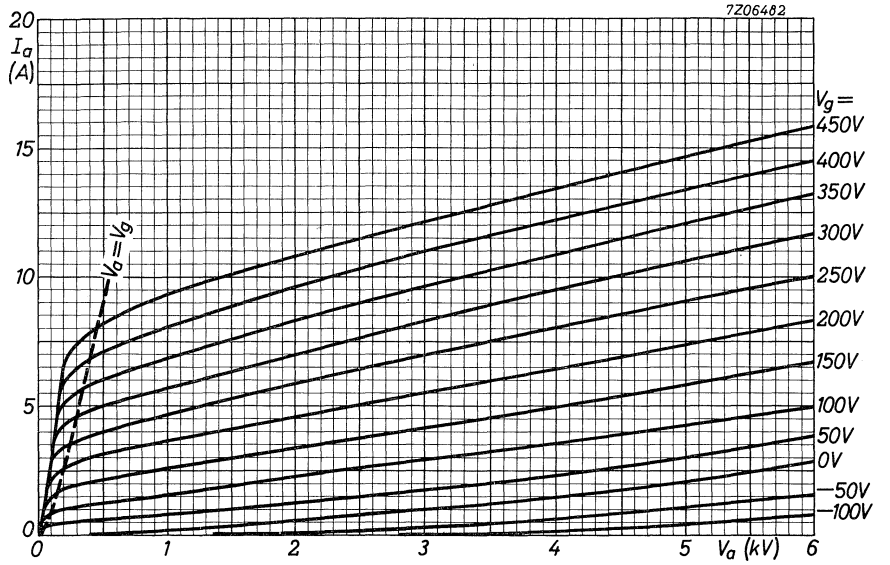
OPERATING CONDITIONS

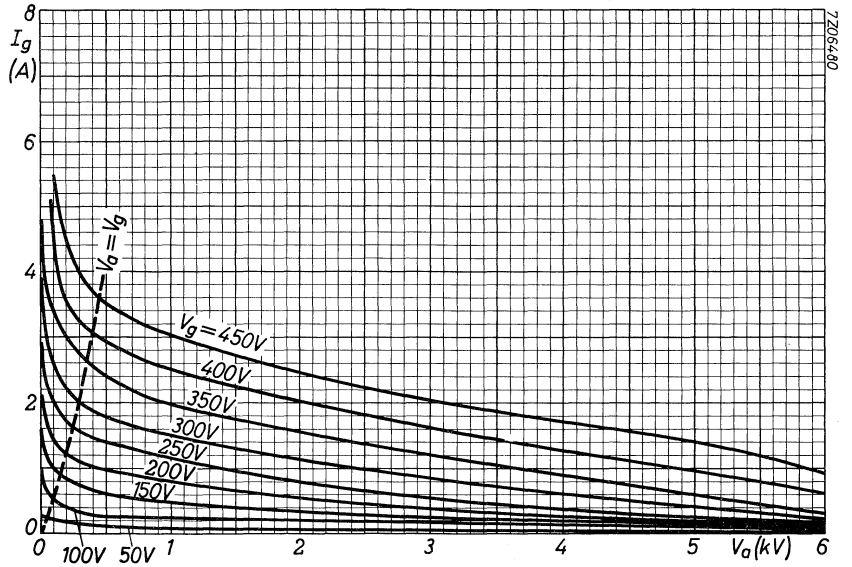
Frequency	f	=	75	75	MHz
Transformer voltage	V_{tr}	=	6.8[1])	5.9[2])	kV_{RMS}
Anode current	I_a	=	0.8	0.7	A
Grid current	I_g	=	0.19	0.165	A
Grid resistor	R_g	=	1050	1050	
Grid input power	W_{ig}	=			W
Anode input power	W_{ia}	=	6.05	4.6	kW
Anode dissipation	W_a	=	1.5	1.24	kW
Output power	W_o	=	4.55	3.36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

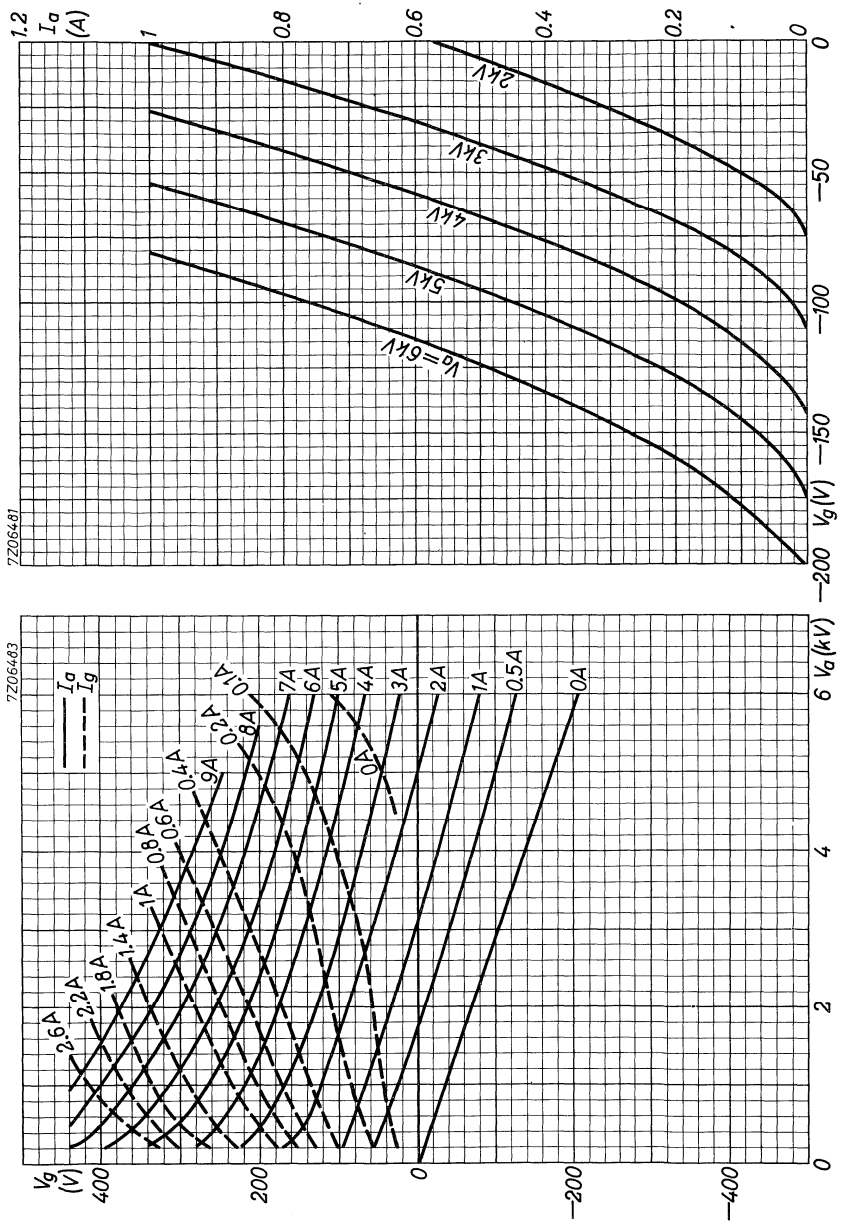
1) Care must be taken that under these operating conditions the absolute limiting values are not exceeded by variation of the supply voltage or the load or by tolerances in the circuit elements

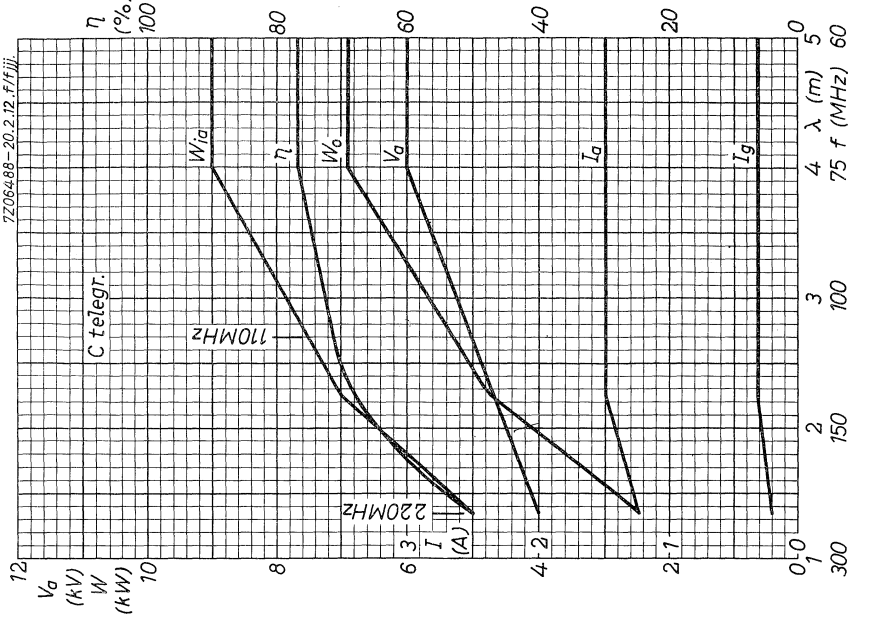
2) Under these conditions normal deviations of voltages and load are permissible. The absolute limiting values of the tube must, however, not be exceeded

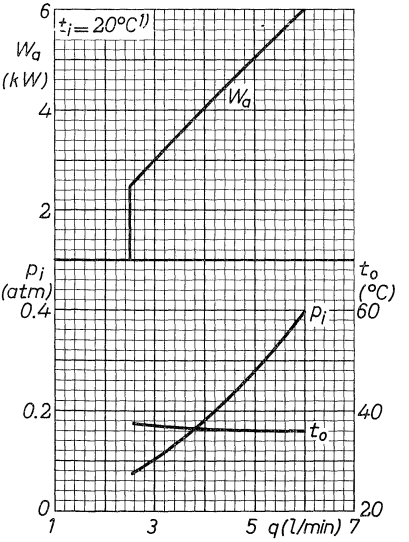
7Z2 8699

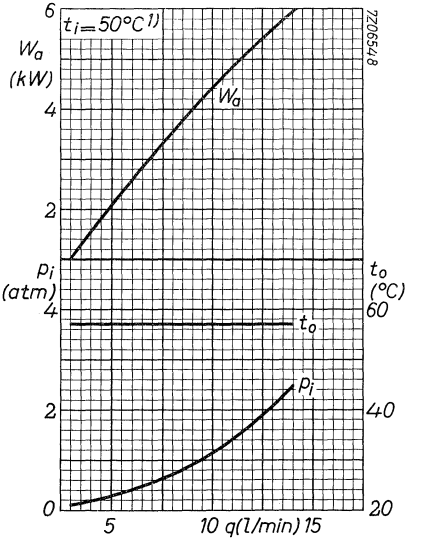

7Z06482
I_a (A)
20
15
10
5
0
$V_a = V_g$
$V_g =$
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
0
1
2
3
4
5
6
V_a (kV)


7Z06480
I_g (A)
8
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
6
V_a (kV)


Ia (A)
1.2
1
0.8
0.6
0.4
0.2
0
2kV
3kV
4kV
5kV
Va=6kV
—50
—100
—150
—200
Vg (V)
7206481
Ia
Ig
2.6A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
0.9A
0.2A
0.8A
1.0A
7A
6A
5A
4A
3A
2A
1A
0.5A
0A
Vg (V)
400
200
0
—200
—400
6 Va (kV)
4
2
0
7206483


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


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


t_i = 50°C 1)
7Z06541.8
W_a (kW)
W_a
p_i (atm)
t_o
p_i
t_o (°C)
q (l/min)

WATER COOLED R.F. POWER TRIODE

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

COOLING: water/low-velocity air flow

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Two tubes

WATER COOLING CHARACTERISTICS , see also the cooling curves

W_a (kW)	t_i (°C)	q_{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

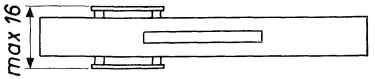
7Z2 8700

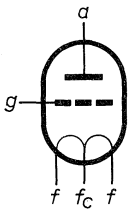
MECHANICAL DATA

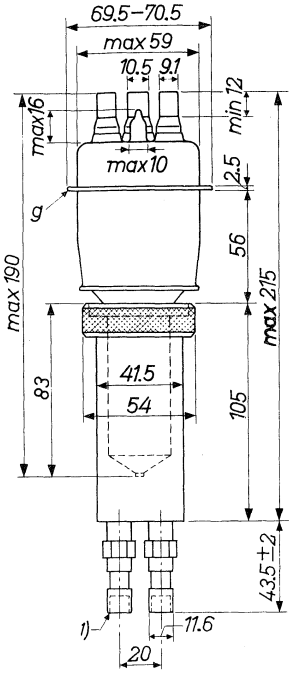
Dimensions in mm

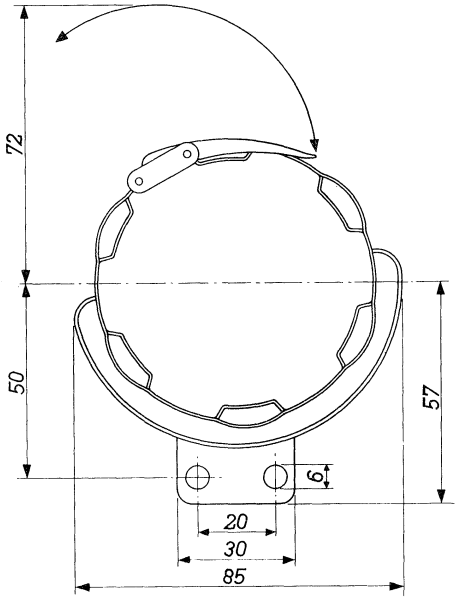
Net weight of the tube : 0.45 kg

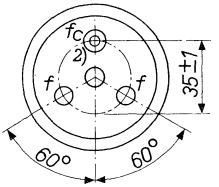
Net weight of water-jacket: 0.52 kg











Grid connector
40650

→ O-ring : 3322 026 82801

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

R.F. CLASS C TELEGRAPHY

LIMITING VALUES (Absolute limits)

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

OPERATING CONDITIONS

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

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

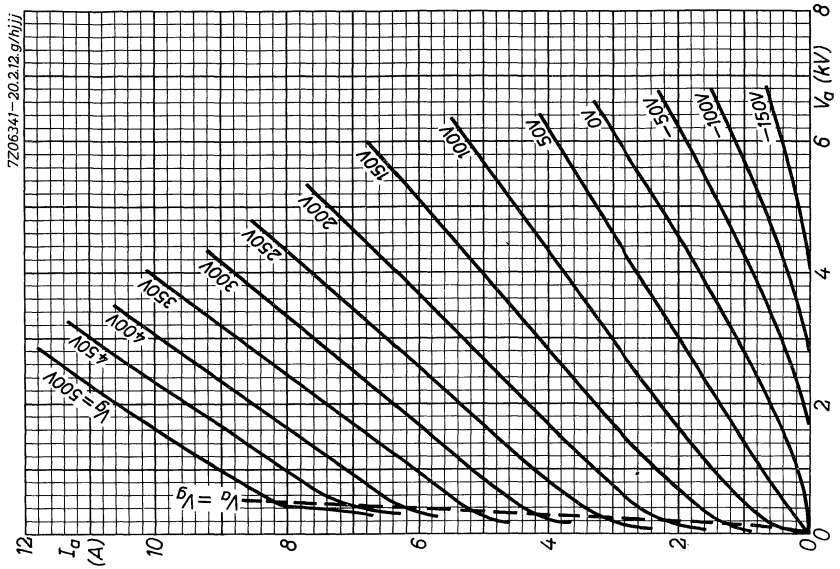
OPERATING CONDITIONS

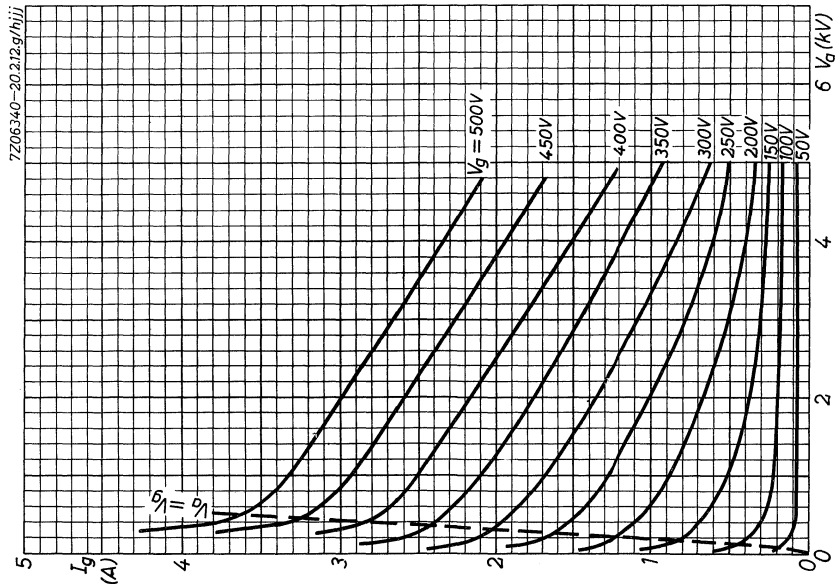
Frequency	f	=	50	MHz
Transformer voltage	V_{tr}	=	5100	V_{RMS}
Anode voltage	V_a	=	6.0	kV
Anode current	I_a	=	1.5	A
Grid current	I_g	=	0.4	A [1]
Grid resistor	R_g	=	1000	Ω
Grid input power	W_{ig}	=	300	W
Anode input power	W_{ia}	=	9	kW
Anode dissipation	W_a	=	2.7	kW
Output power	W_o	=	6	kW [2]
Efficiency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

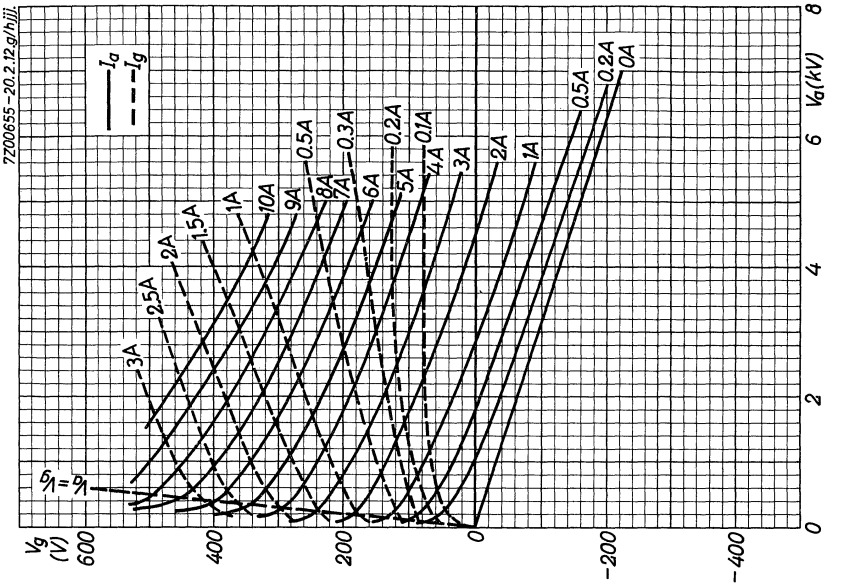
[1]) Unloaded 0.7 A

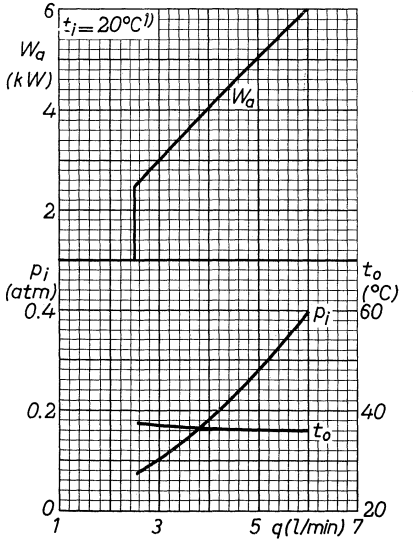
[2]) Available power (load + circuit losses)

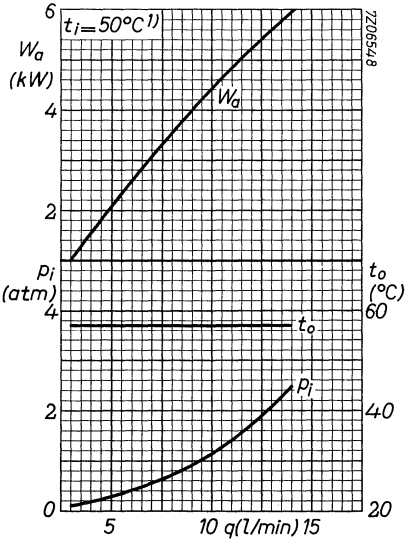
7Z2 3523


7Z06341-20.2.12.g/hjj
Ia (A)
Va (kV)
Vg = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
10
-50V
-100V
-150V
Va = Vg


7Z06340-20.2.12.g/hjj
Ig (A)
Vg (kV)
Vg = 500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
Va = Vg


7200655-20.2.12.g/hjjj.
Ia
Ig
Va(kV)
Vg (V)
600
400
200
0
-200
-400
0
2
4
6
8
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
0.2A
0A
0.1A
0.3A
0.4A
1.5A
2.5A
3A
10A


t_i=20°C 1)
Wa
(kW)
pi
(atm)
to
(°C)
q(l/min)
1
3
5
7
20
40
60
0
0.2
0.4
2
4
6


t_i=50°C 1)
Wa
(kW)
pi
(atm)
to
(°C)
q(l/min)
5
10
15
20
40
60
0
2
4
6
Z205548

WATER COOLED INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

[1]) Useful power in the load

TEMPERATURE LIMITS (Absolute limits)

Water inlet temperature t_i = max. 50 °C

Temperature of the seals = max. 220 °C

WATER COOLING CHARACTERISTICS

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

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

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

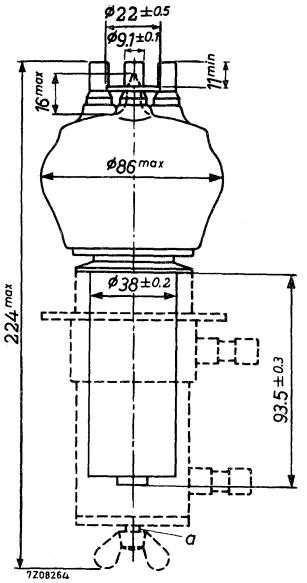
7Z2 3542

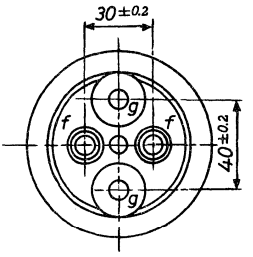
MECHANICAL DATA

Dimensions in mm

Net weight of the tube 0.57 kg

Net weight of water-jacket : 0.76 kg





	Grid and filament connectors	40634
	Water jacket	K721
→	O-ring	2622 080 31748

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

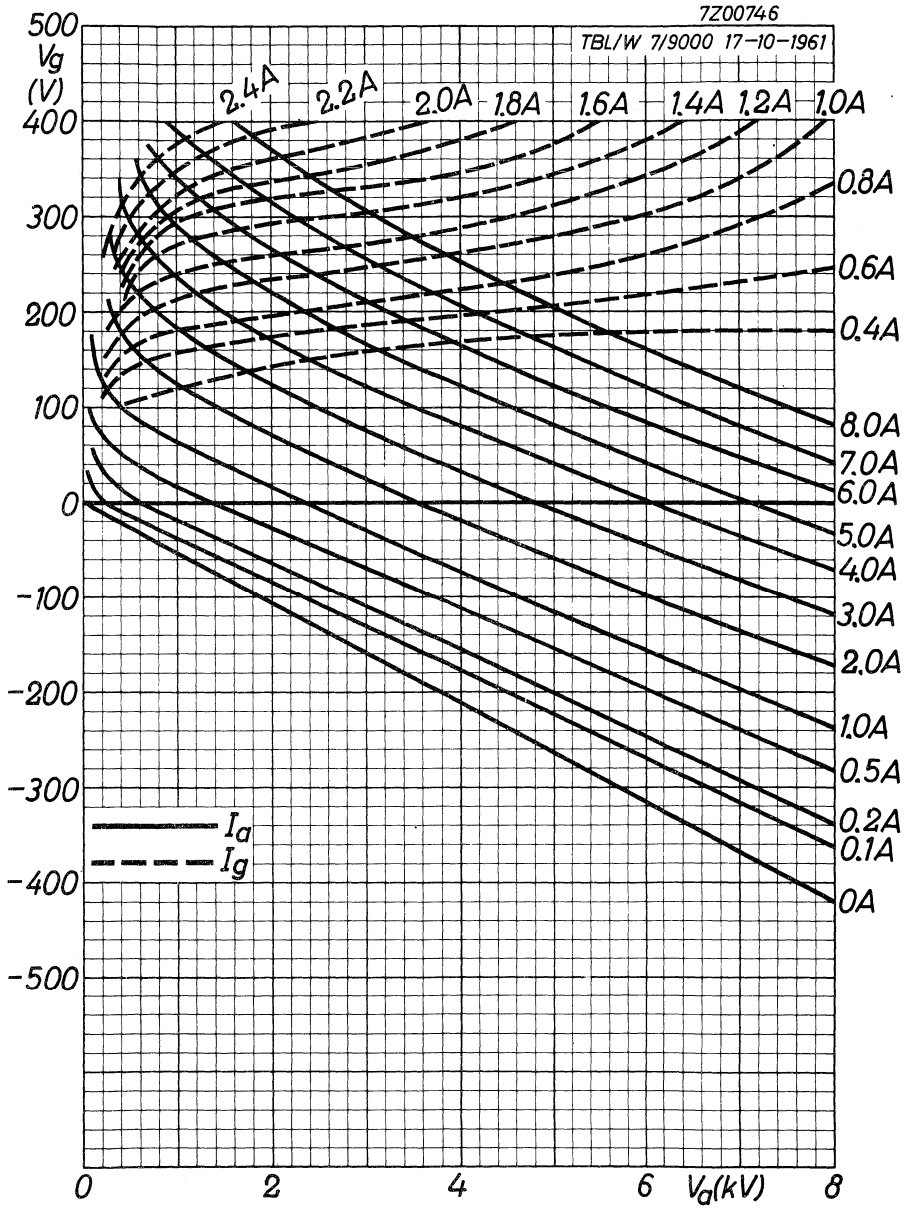
LIMITING VALUES (Absolute limits), continuous service

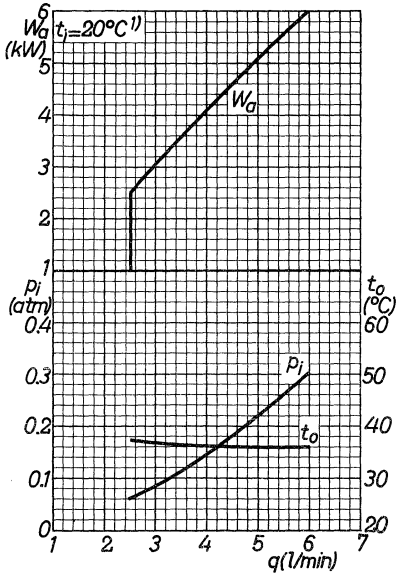
Frequency	f		up to	50	MHz
Anode voltage	V_a	=	max.	8	kV
Anode input power	W_{ia}	=	max.	12	kW
Anode dissipation	W_a	=	max.	6	kW
Anode current	I_a	=	max.	1.8	A
Negative grid voltage	$-V_g$	=	max.	1250	V
Grid current, loaded	I_g	=	max.	0.4	A
Grid current, unloaded	I_g	=	max.	0.5	A
Grid circuit resistance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

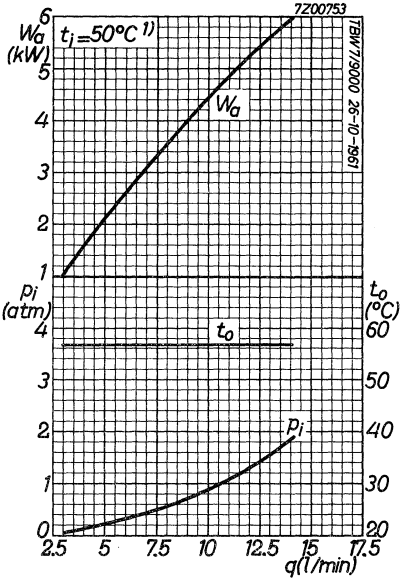
OPERATING CHARACTERISTICS , continuous service

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 %


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


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


7Z00753
TBW7/9000 26-10-1981
W_a (kW)
t_j=50°C 1)
W_a
p_i (atm)
t_o (°C)
t_o
p_i
q(l/min)

WATER COOLED INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMIT (Absolute limit)

Seal temperature = max. 220 °C

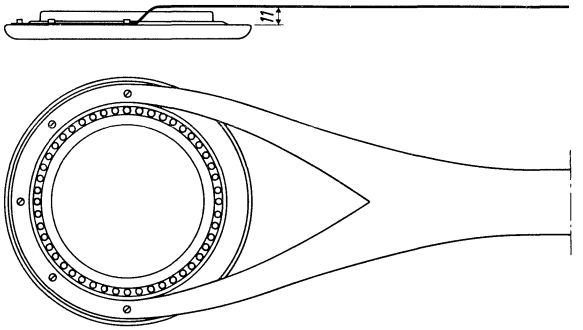
Generally a low velocity air flow to the seals is required

WATER COOLING CHARACTERISTICS

t_i = max. 50 °C

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

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



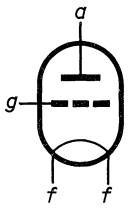
[1]) At inlet temperatures between 20 and 50 °C the required quantity of water can be found by proportional interpolation

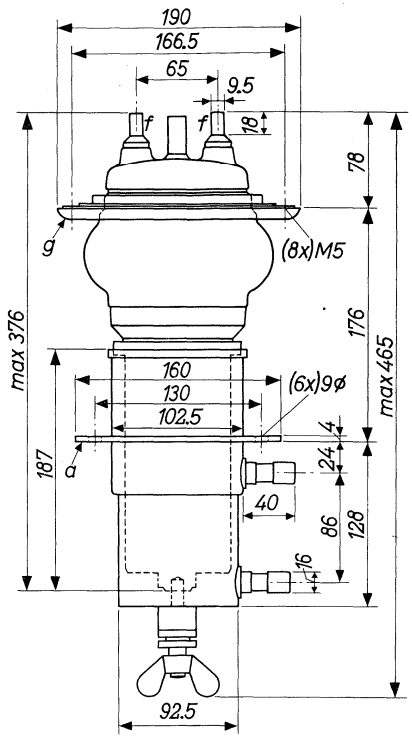
7Z2 3552

MECHANICAL DATA

Dimensions in mm

Net weight of the tube	: 2.8 kg
Net weight of water jacket	: 2.1 kg
Filament connectors with cable	: 40662
Grid connector	: 40663
Water jacket	: K717
→ O-ring	: 2622 080 31788





Tube with grid connector and water jacket

Mounting position: vertical with anode down

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

LIMITING VALUES (Absolute limits)

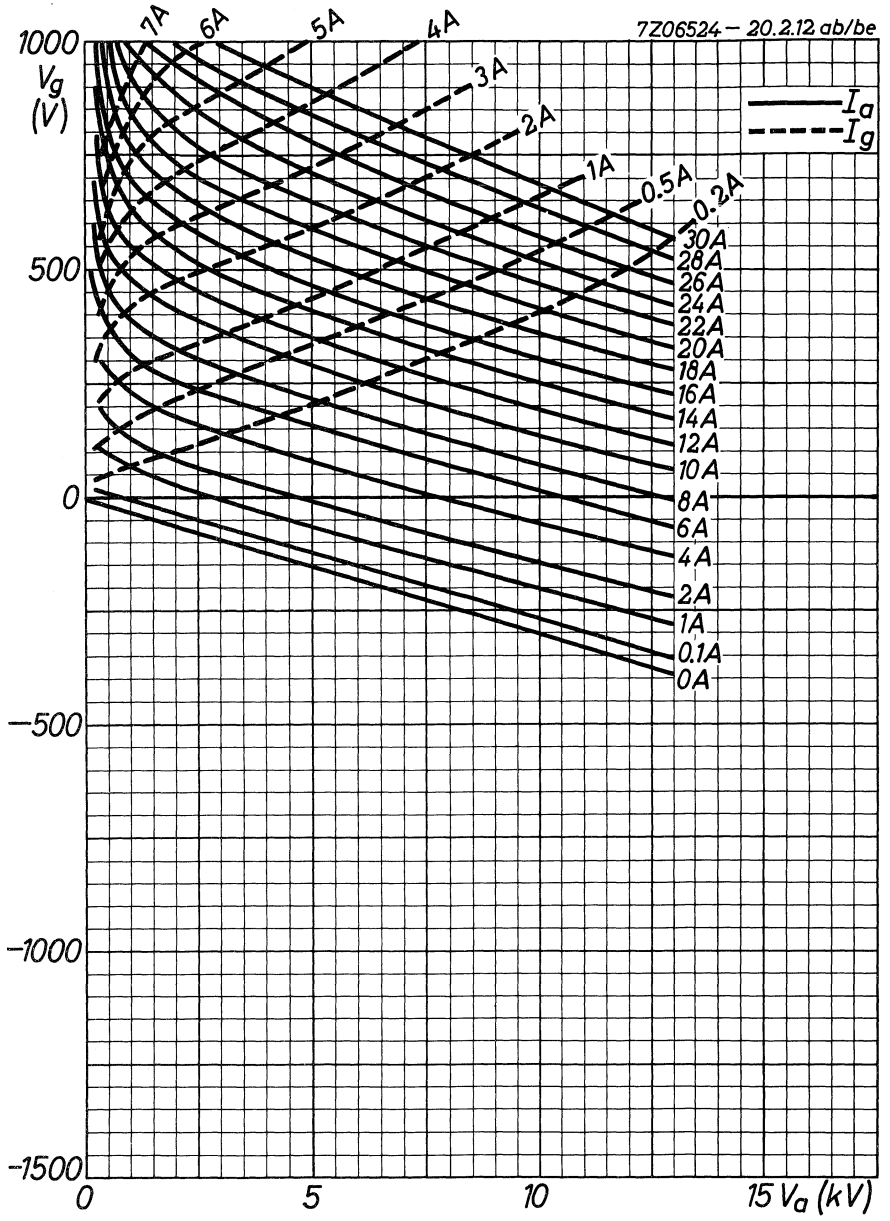
Frequency					
	f		up to	30	MHz
Anode voltage	V_a	=	max.	13	kV
Anode current	I_a	=	max.	4.8	A
Anode dissipation	W_a	=	max.	20	kW
Anode input power	W_{ia}	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1500	V
Grid current	I_g	=	max.	0.8	A
Grid circuit resistance	R_g	=	max.	10	kΩ

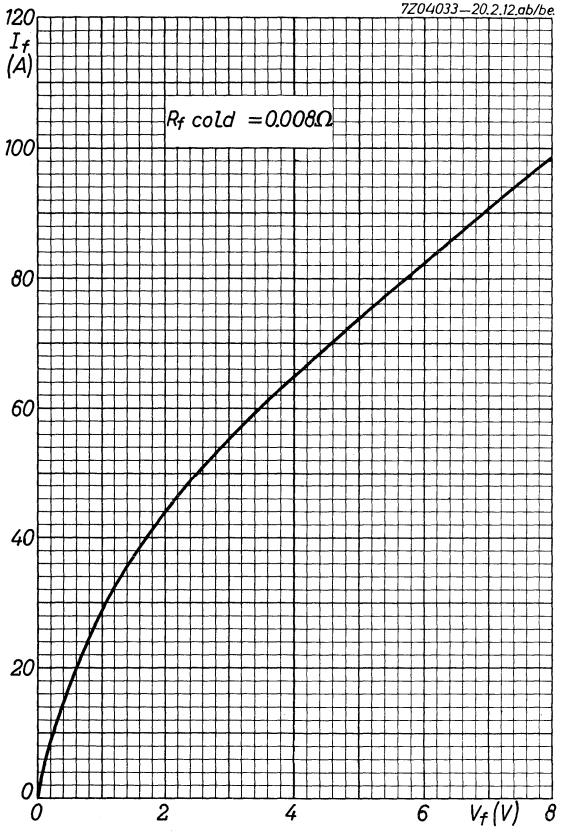
OPERATING CONDITIONS

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

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

7Z2 3554


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


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

WATER COOLED INDUSTRIAL R.F. POWER TRIODE

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

HEATING: direct; filament thoriated tungsten

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

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

CAPACITANCES

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

TYPICAL CHARACTERISTICS

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

TEMPERATURE LIMITS (Absolute limits)

Temperature of all seals = max. 220 °C

Water inlet temperature t_i = max. 50 °C

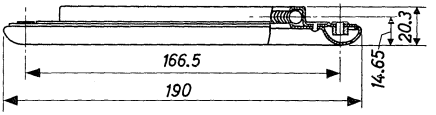
COOLING: Generally a low velocity air flow to the seals is required

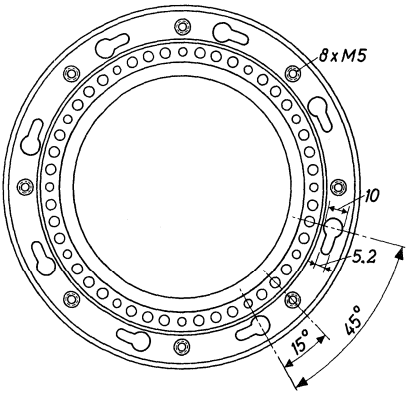
WATER COOLING CHARACTERISTICS. See also page A

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

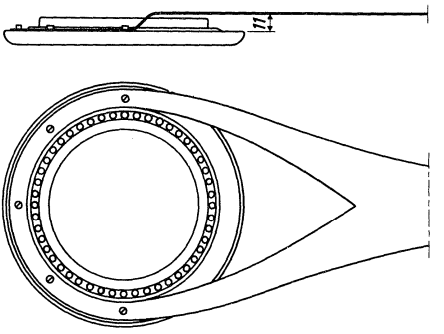
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation

MECHANICAL DATA Dimensions in mm





Grid connector 40663



Connection of the grid lead

The rounded side of the grid connector should face the anode. To ensure a uniform RF current distribution in the grid seal at frequencies higher than 4 MHz, the grid lead should be connected as shown in the figure at right. 7Z2 3563

MECHANICAL DATA (continued)

Dimensions in mm

Water jacket : K722

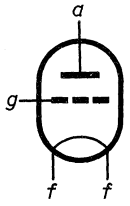
Filament connectors : 40662

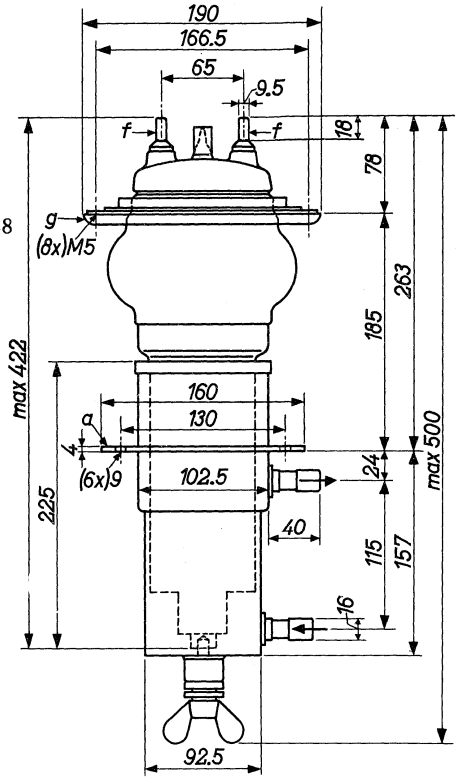
Grid connector : 40663

Net weight of the tube : 3.0 kg

Net weight of water jacket : 2.7 kg

→ O-ring : 2622 080 31788

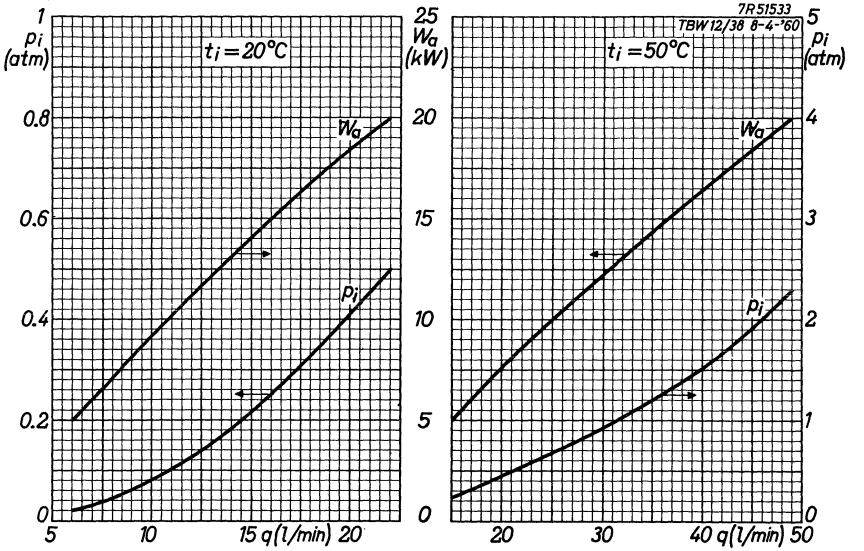




Tube mounted in water jacket

Mounting position: vertical with anode down

For further data and curves (except cooling curves) please refer to type TBH 12/38


7R51533
TBW12/38 8-4-'60
$t_i = 20°C$
$t_i = 50°C$
p_i (atm)
W_a (kW)
W_a
p_i
0
0.2
0.4
0.6
0.8
1
5
10
15
20
25
q (l/min)
20
30
40
50
2
3
4
5

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

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

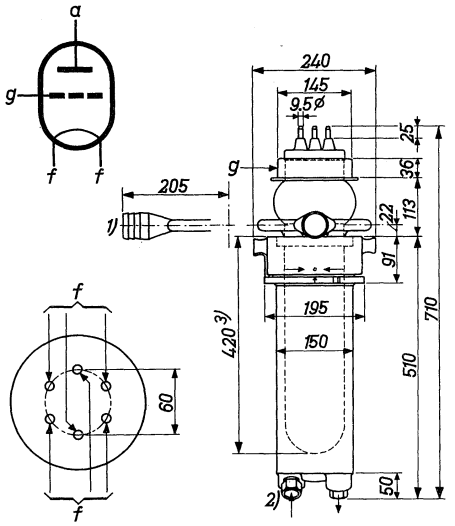
Water jacket : K714

Filament connectors: 40628

O-ring : 2622 080 31817

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 $1\frac{3}{4}$".

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.

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.

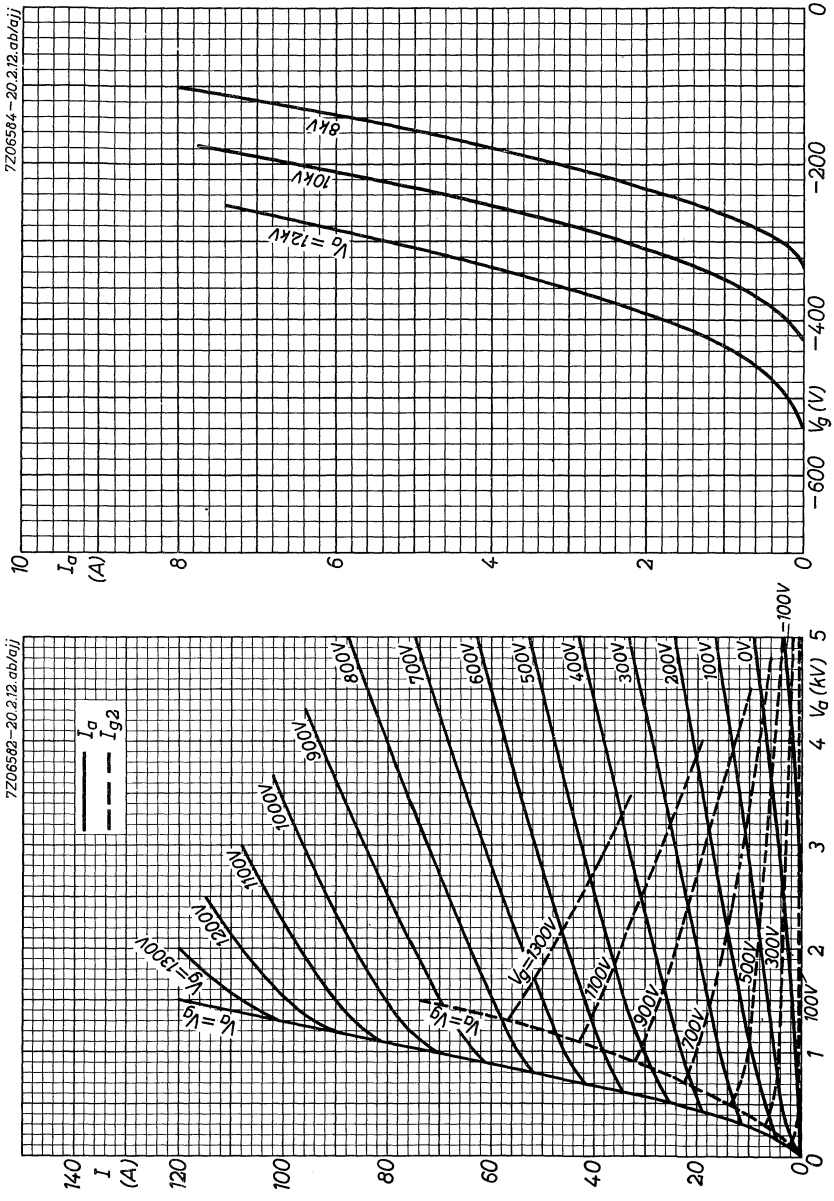
[2]) This value of bandwidth is based on measurements on a circuit with a single LC section

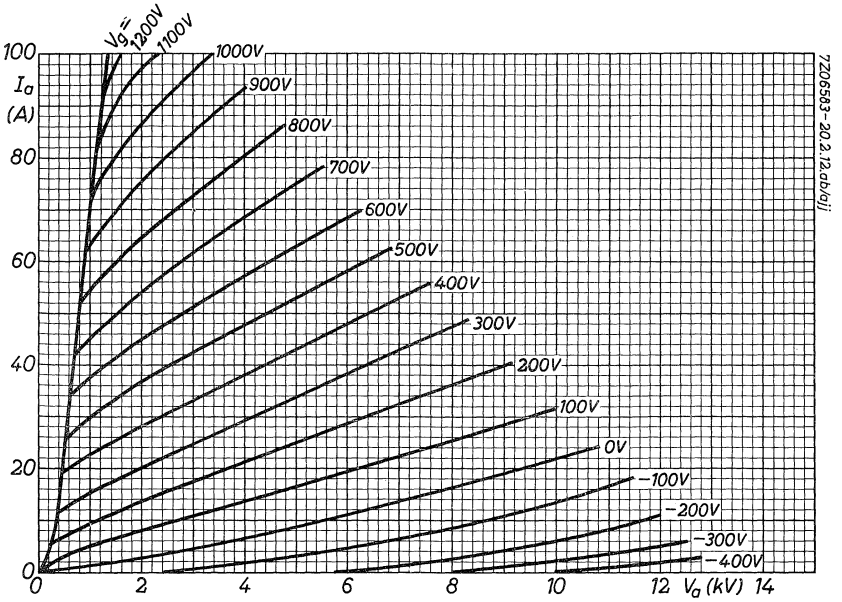
[3]) Measured by the slide back method

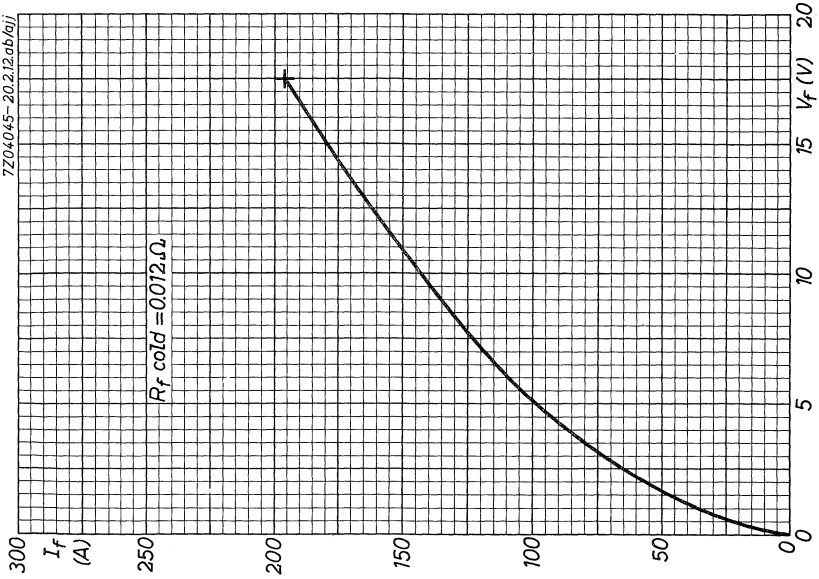
[4]) Driving power is accounted for largely by circuit losses. The indicated driving power is required to take care of losses in damping resistors, circuit losses and tube driving power.

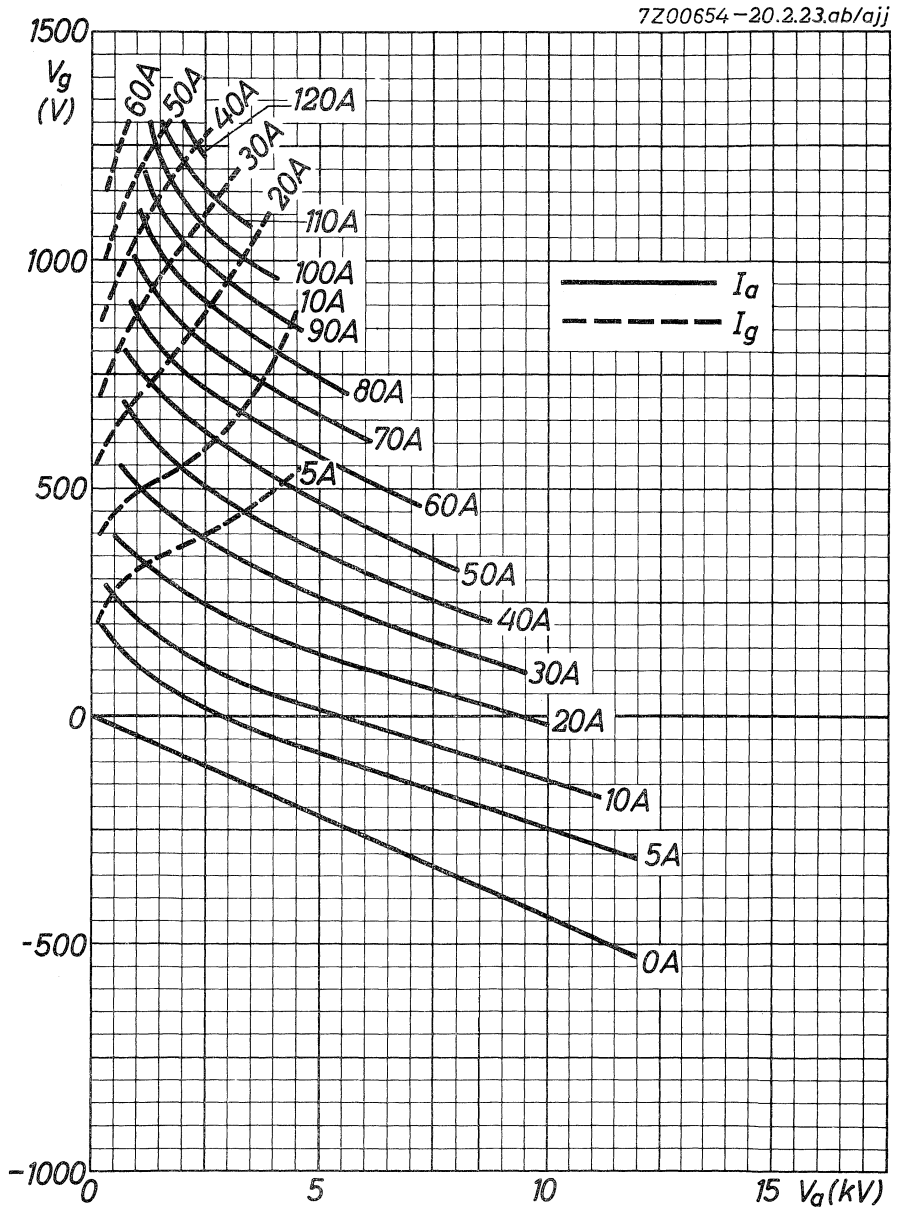
[5]) Power transferred from driving stage included.

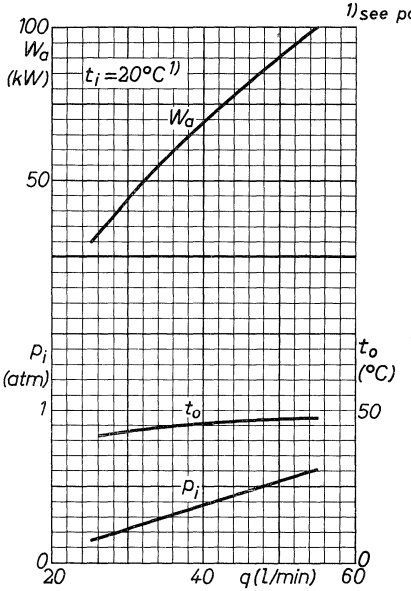
7Z2 8713

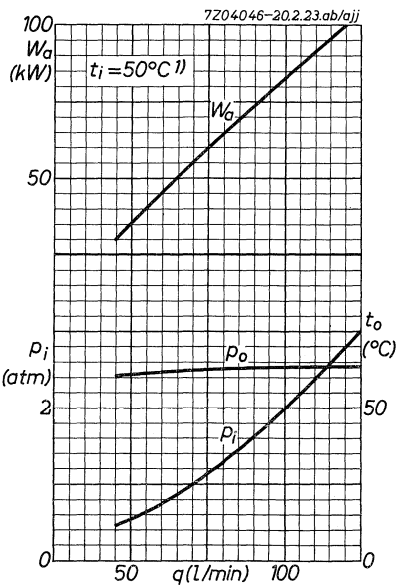

7Z06584-20.2.12.ab/ajj
I_a (A)
V_g (V)
V_a = 12kV
10kV
8kV
7Z06582-20.2.12.ab/ajj
I_a
I_{g2}
V_a (kV)
V_g=-100V
0V
100V
200V
300V
400V
500V
600V
700V
800V
900V
1000V
1100V
1200V
1300V
V_g=V_a


V_g=
1200V
1100V
1000V
900V
800V
700V
600V
500V
400V
300V
200V
100V
0V
-100V
-200V
-300V
-400V
I_a (A)
100
80
60
40
20
0
0
2
4
6
8
10
12
V_a (kV)
14
7Z06583-20.2.12.ab/ajj


R_f cold = 0.012 Ω
I_f (A)
300
250
200
150
100
50
0
V_f (V)
20
15
10
5
0
7Z04045-20.2.12.ab/ajj

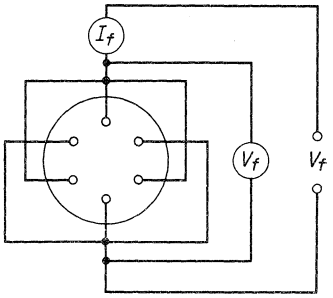

7Z00654-20.2.23.ab/ajj
1500
V_g (V)
1000
500
0
-500
-1000
0
5
10
15
V_a(kV)
60A
50A
40A
30A
20A
120A
110A
100A
10A
90A
80A
70A
5A
60A
50A
40A
30A
20A
10A
5A
0A
I_a
I_g


1) see page 2
100
W_a
(kW)
t_i = 20°C 1)
W_a
50
p_i
(atm)
1
t_o
t_o
(°C)
50
p_i
0
20
40
q (l/min)
60
0


7Z04046-20.2.23.ab/ajj
100
W_a
(kW)
t_i = 50°C 1)
W_a
50
t_o
p_i
(atm)
p_o
(°C)
2
50
p_i
0
50
q (l/min)
100
0

WATER COOLED R.F. POWER TRIODE

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

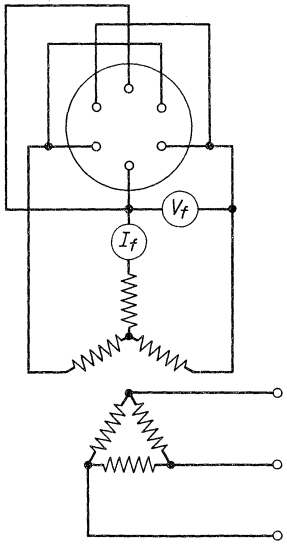


Single-phase filament energizing

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

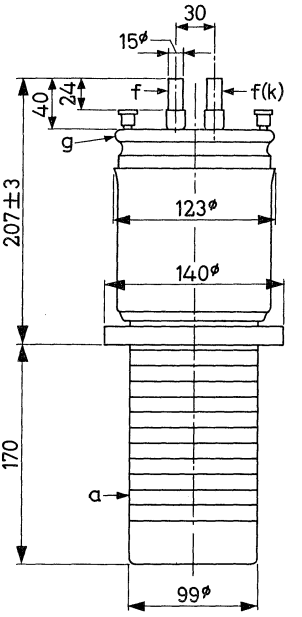
COOLING

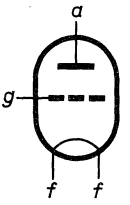
For cooling data see cooling curves.
For water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by proportional interpolation.
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

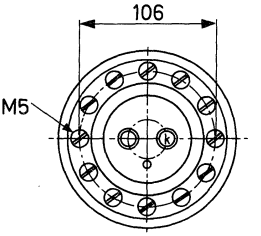
MECHANICAL DATA

Dimensions in mm

Net weight: 6.2 kg







Mounting position: vertical with anode down

ACCESSORIES

Water jacket	K724
Filament connector	40670
Grid connector	40671

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

LIMITING VALUES (Absolute limits)

Frequency		f		up to 10	up to 30	
Anode voltage	V_a	=	max.	16	max. 12.5	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	%

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency		f		up to 10	up to 30	MHz
Anode voltage	V_a	=	max.	16	max. 12.5	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_{gp}	=	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	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11.5	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.

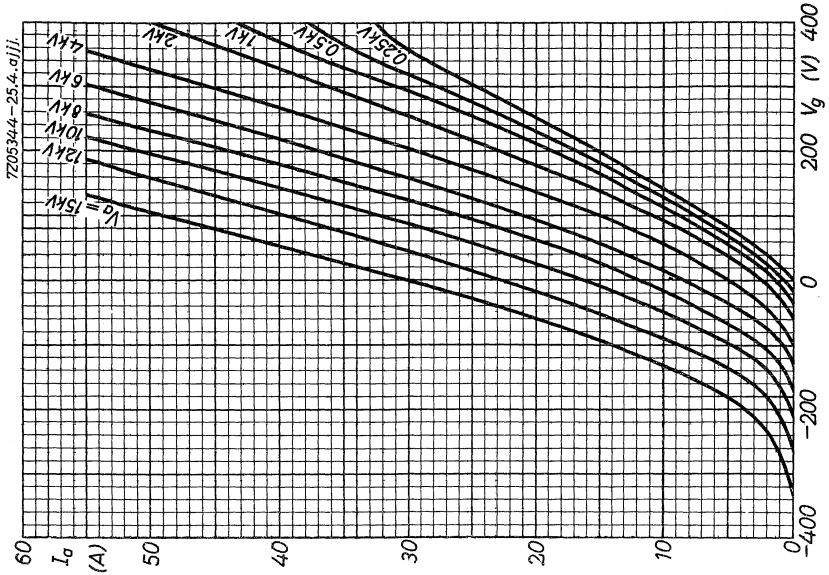
A.F. CLASS B AMPLIFIER AND MODULATOR

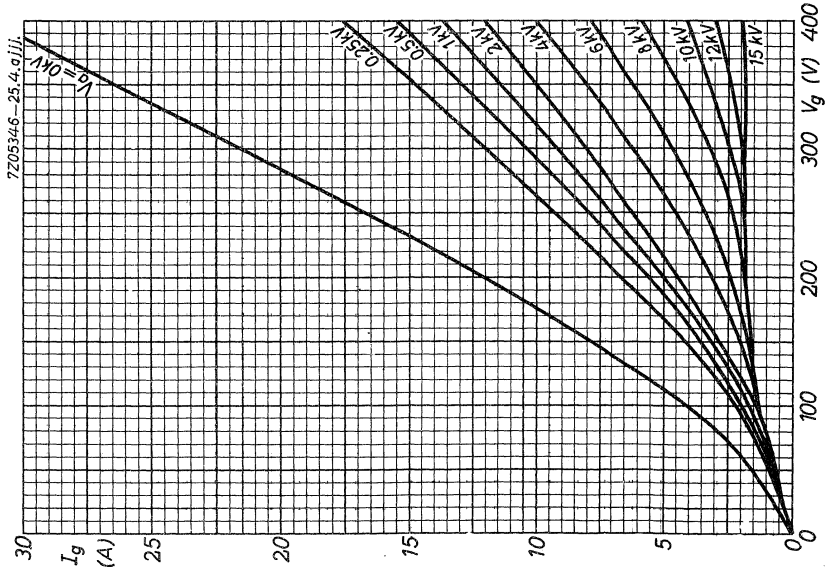
LIMITING VALUES (Absolute limits)

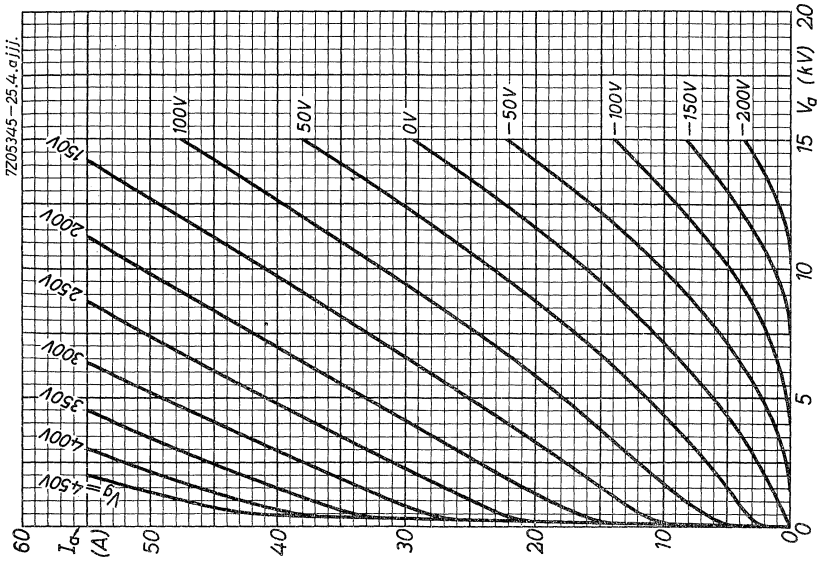
Anode voltage	V_a	= max.	12	kV
Anode dissipation	W_a	= max.	45	kW
Negative grid voltage	$-V_g$	= max.	1000	V
Grid dissipation	W_g	= max.	1.3	kW
Anode current	I_a	= max.	13	A
Grid current	I_g	= max.	3.3	A

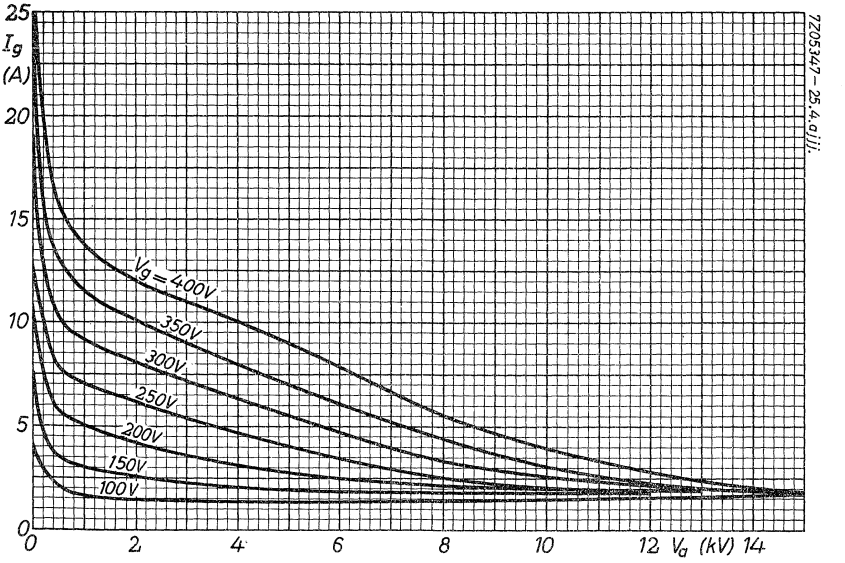
OPERATING CONDITIONS (two tubes in push-pull)

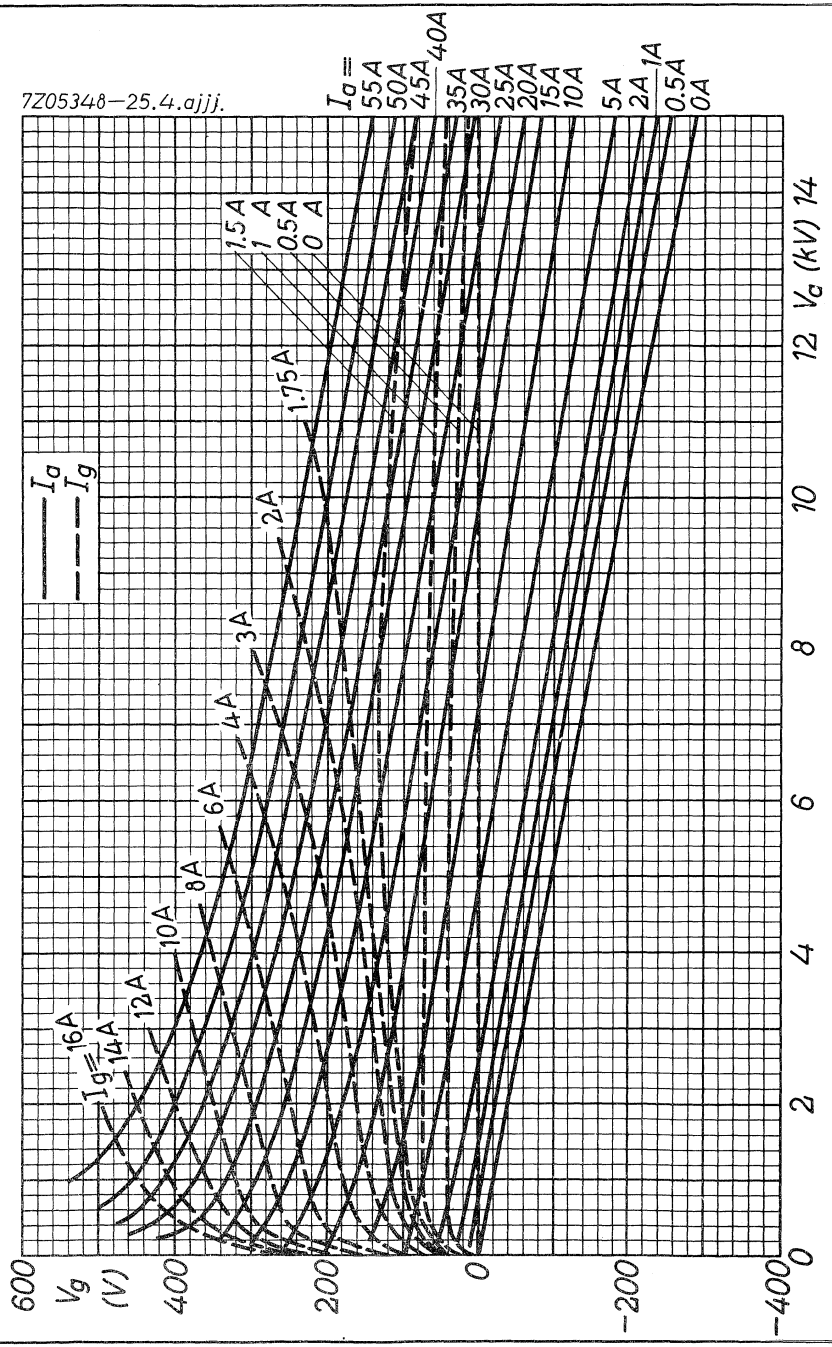
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	−205		−170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{ggp}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{gp}	=	0	2x2.9	0	2x4.0	A
Grid 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	%

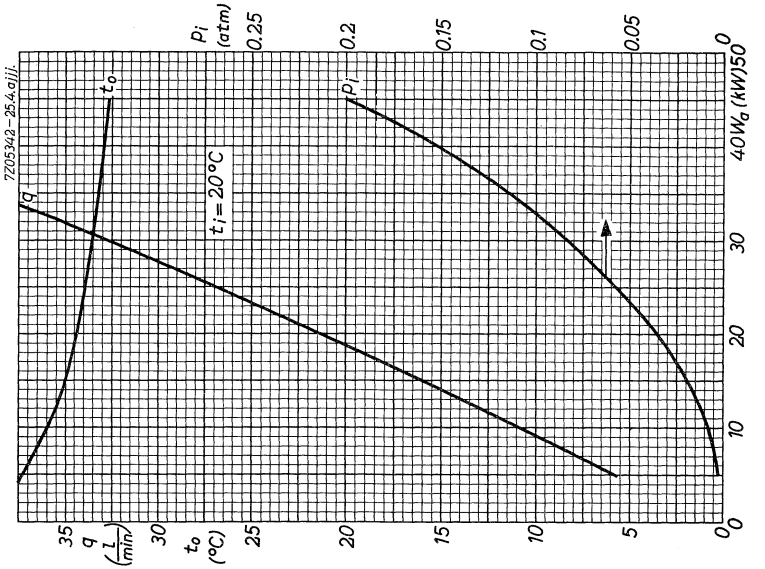

7205344-25.4.ajjj.
Vo = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV
Ia (A)
60
50
40
30
20
10
0
Vg (V)
400
200
0
-200
-400

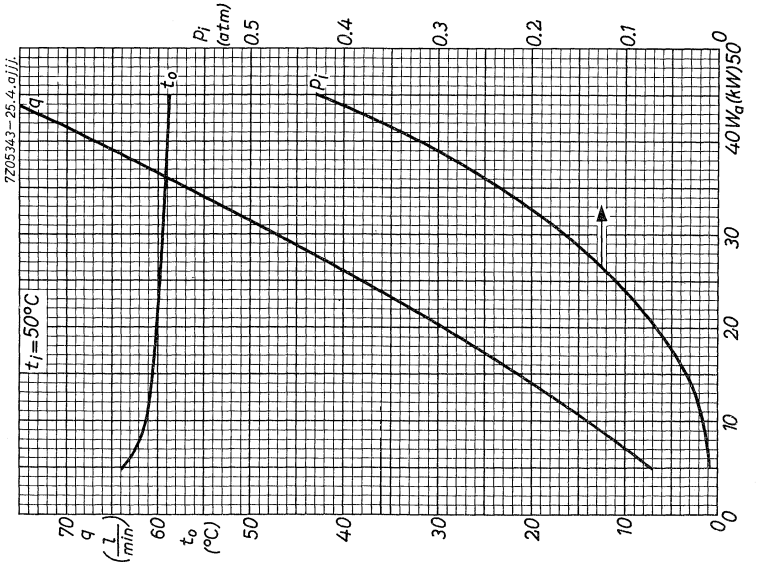

7205346-25.4.ajjj.
Vo = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15 kV
Ig (A)
30
25
20
15
10
5
0
Vg (V)
400
300
200
100
0


7205345-25.4.ai/i.
100V
50V
0V
−50V
−100V
−150V
−200V
150V
200V
250V
300V
350V
400V
Vg = 450V
60
Ia (A)
50
40
30
20
10
0
0
5
10
15
20
Va (kV)


7205347-25.4.ai/i.
25
Ig (A)
20
15
10
5
0
Vg = 400V
350V
300V
250V
200V
150V
100V
0
2
4
6
8
10
12
Va (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 1A 0.5A 0A
1.75A
2A
3A
4A
6A
8A
10A
12A
14A
16A
Ig =
Ia
Ig
Vg (V) 600 400 200 0 -200 -400
Va (kV) 0 2 4 6 8 10 12 14


7205342-25.4.ajjj
$t_i = 20°C$
t_o
q
p_i
p_i (atm)
0.25
0.2
0.15
0.1
0.05
0
$40W_a$ (kW)50
30
20
10
0
35
q $\left(\frac{l}{min}\right)$
30
t_o (°C)
25
20
15
10
5
0


7205343-25.4.ajjj
$t_i = 50°C$
t_o
q
p_i
p_i (atm)
0.5
0.4
0.3
0.2
0.1
0
$40W_a$ (kW)50
30
20
10
0
70
q $\left(\frac{l}{min}\right)$
60
t_o (°C)
50
40
30
20
10
0

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

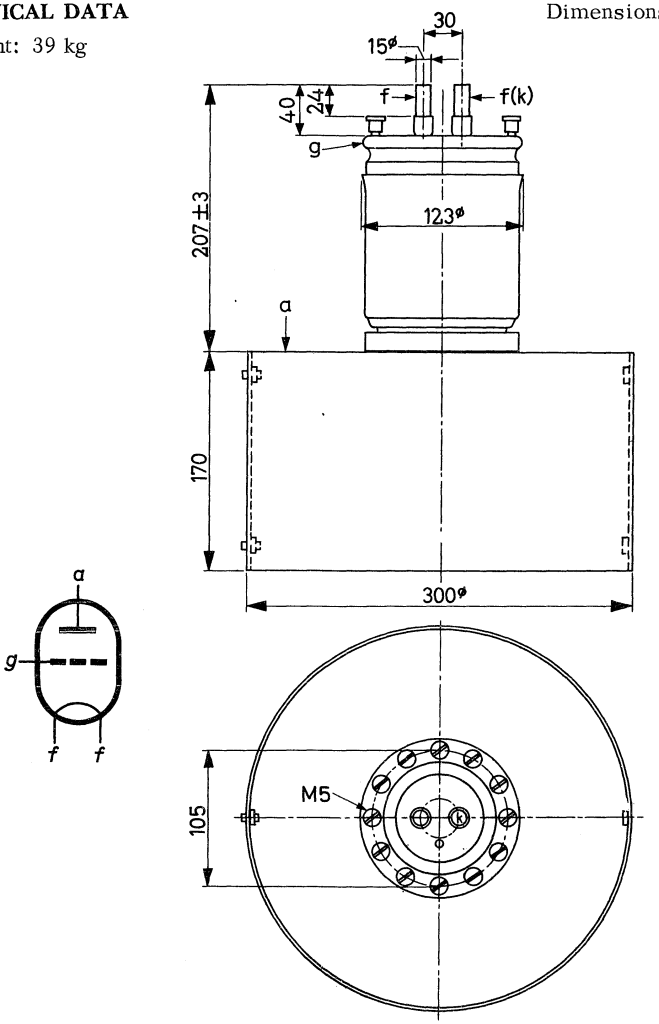
COOLING

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.

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

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.	16	max.	12.5	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_{gp}	=	1000	940	875	810	V
Grid driving power	W_{dr}	=	2.1	1.9	1.7	1.55	kW
Anode input power	Wi_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	%

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	16	max.	12.5	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	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11.5	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.

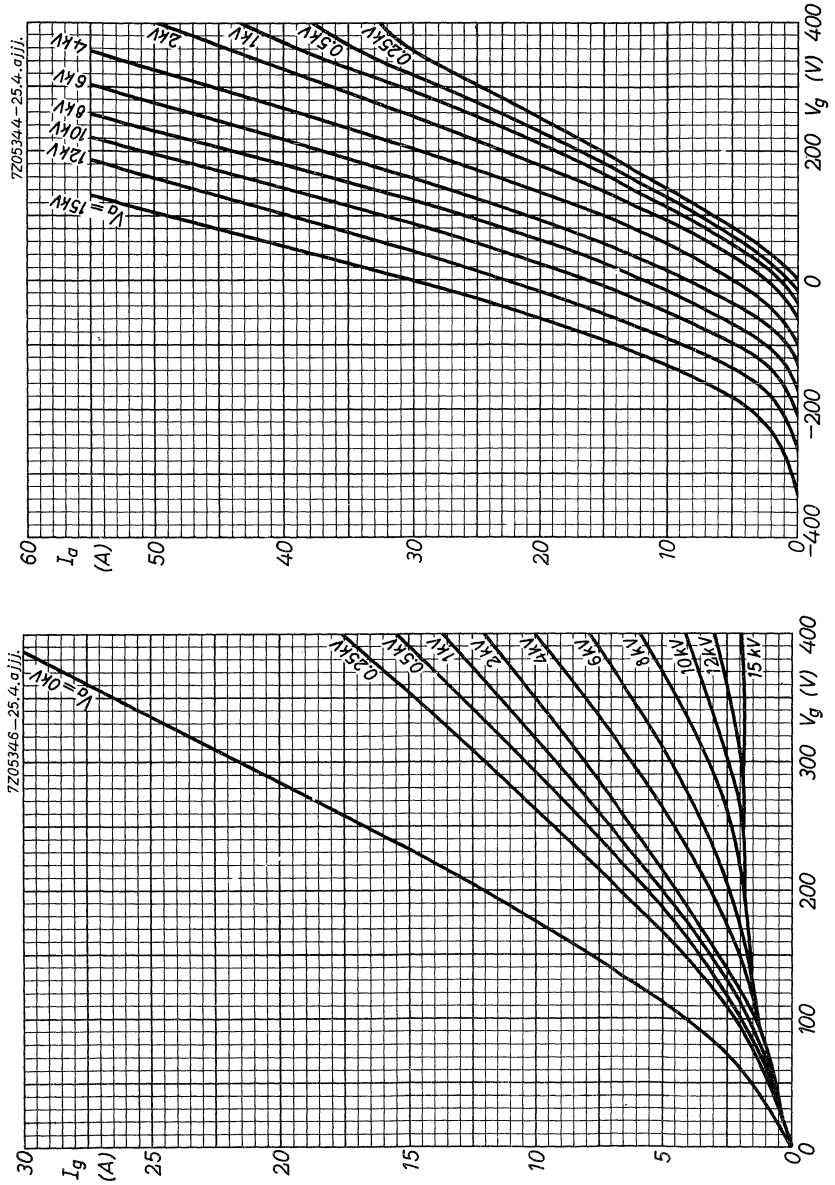
A.F. CLASS B AMPLIFIER AND MODULATOR

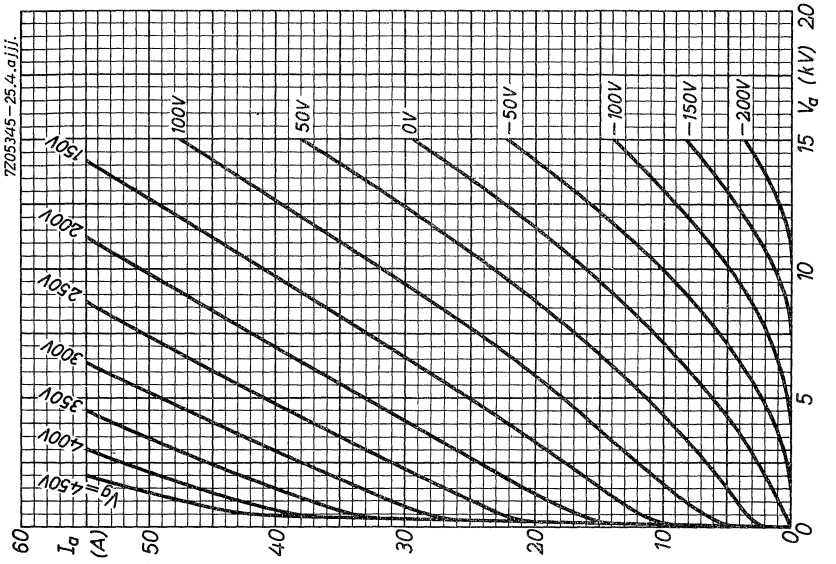
LIMITING VALUES (Absolute limits)

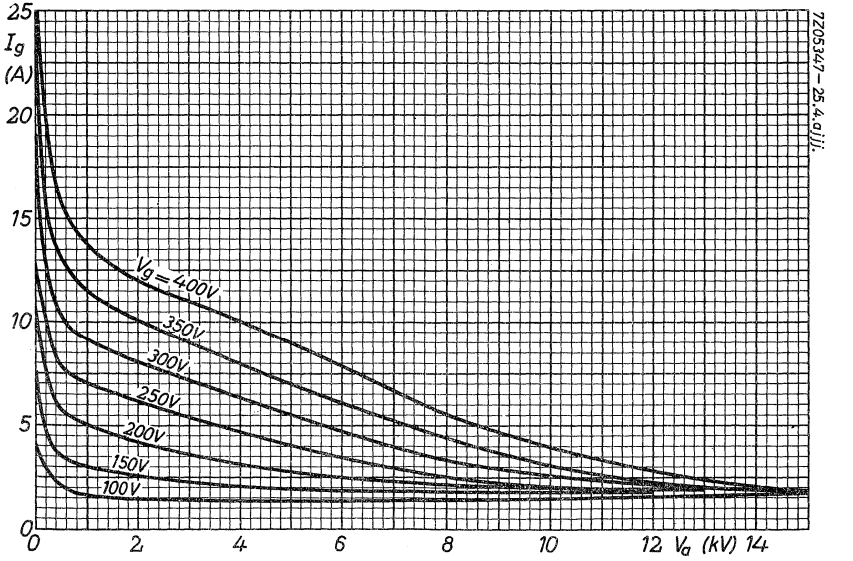
Anode voltage	V_a	= max.	12	kV
Anode dissipation	W_a	= max.	35	kW
Negative grid voltage	$-V_g$	= max.	1000	V
Grid dissipation	W_g	= max.	1.3	kW
Anode current	I_a	= max.	13	A
Grid current	I_g	= max.	3.3	A

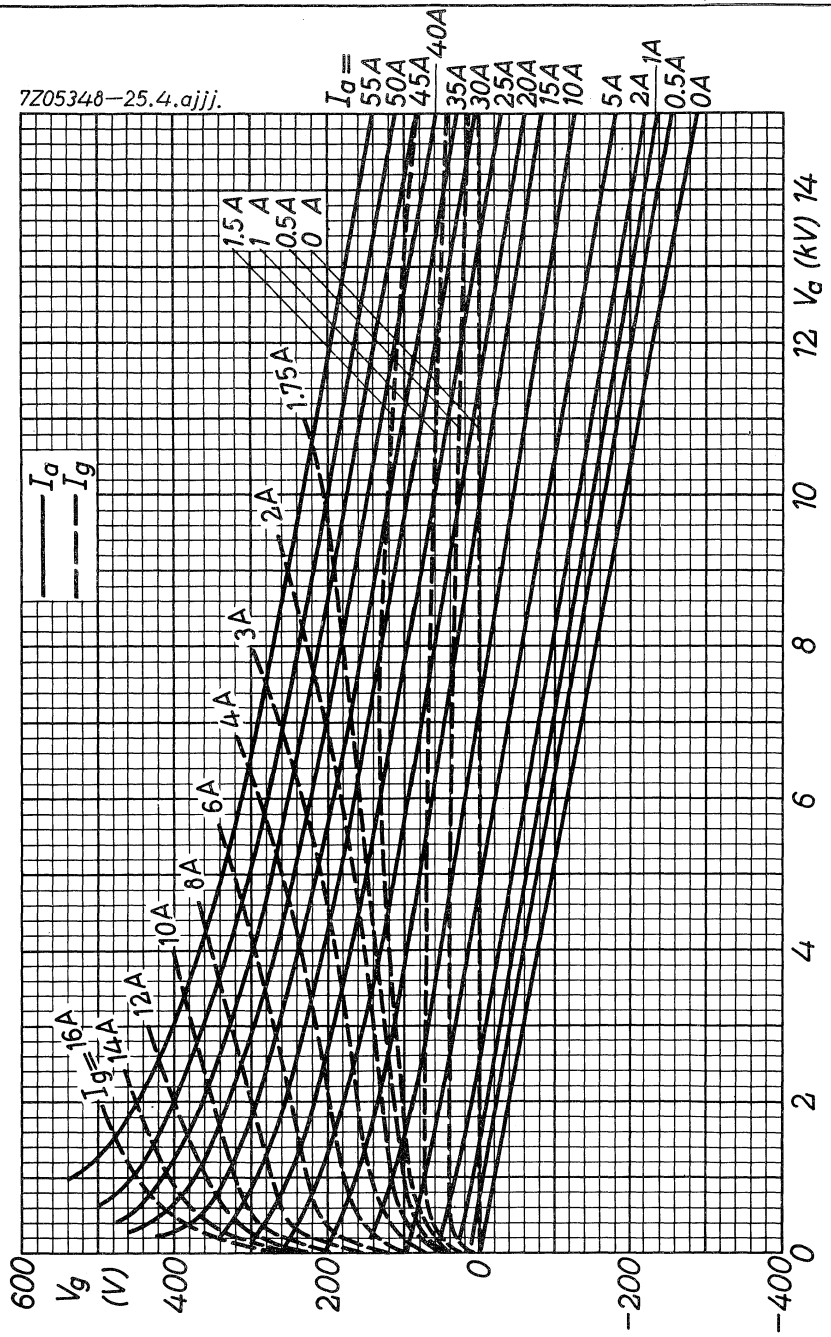
OPERATING CONDITIONS (two tubes in push-pull)

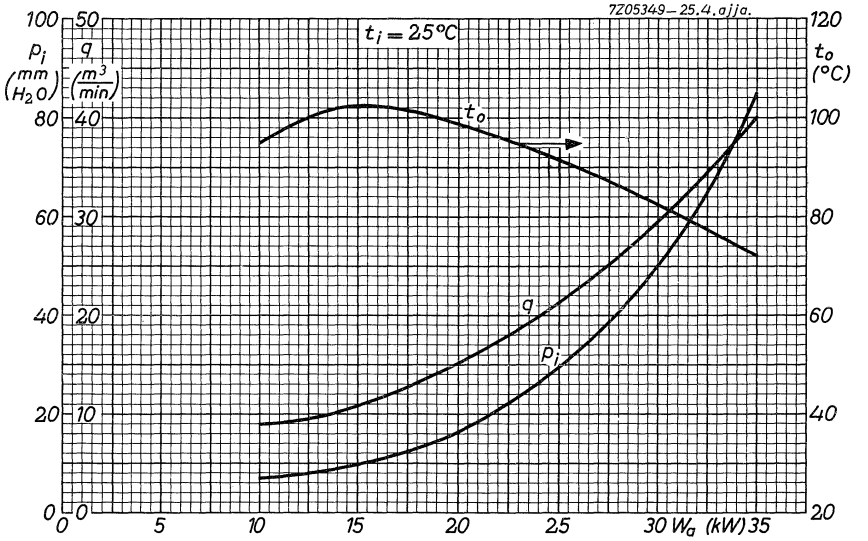
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	−205		−170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{ggp}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{gp}	=	0	2x2.9	0	2x4.0	A
Grid 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	%


7205344-25.4.ajjj.
Va = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV
Ia (A)
60
50
40
30
20
10
0
Vg (V)
400
200
0
-200
-400
7205346-25.4.ajjj.
Va = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15 kV
Ig (A)
30
25
20
15
10
5
0
Vg (V)
400
300
200
100
0


7205345-25.4.ajjj.
100V
50V
0V
-50V
-100V
-150V
-200V
150V
200V
250V
300V
350V
400V
Vg=450V
60
Ia (A)
50
40
30
20
10
0
0
5
10
15
Va (kV) 20


7205347-25.4.ajjj.
25
Ig (A)
20
15
10
5
0
Vg=400V
350V
300V
250V
200V
150V
100V
0
2
4
6
8
10
12 Va (kV) 14


7Z05348—25.4.ajjj.
Ia
Ig
Ia = 55A 50A 45A 40A 35A 30A 25A 20A 15A 10A 5A 2A 1A 0.5A 0A
1.5A 1A 0.5A 0A
1.75A
2A
3A
4A
6A
8A
10A
12A
14A
16A
Ig = 18A
Vg (V) 600 400 200 0 −200 −400
Va (kV) 0 2 4 6 8 10 12 14


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)
100
50
120
80
40
100
60
30
80
40
20
60
20
10
40
0
0
20
0
5
10
15
20
25
30
35

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	°C
Seal temperature	t	= max.	220	°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 °C	2.5	m^3/min
at back flow water temperature of 90 °C	2.8	m^3/min

COOLING (continued)

Amount of back flowing water

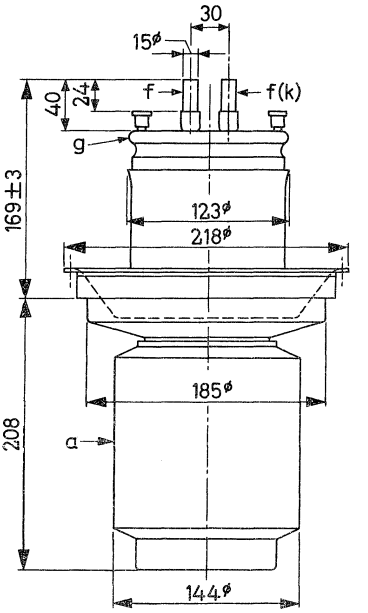
at back flow water temperature of 20 °C	1.5	l/min
at back flow water temperature of 90 °C	1.7	l/min

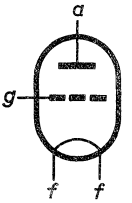
At frequencies higher than 10 MHz a low velocity air flow should be directed to the grid and filament seals.

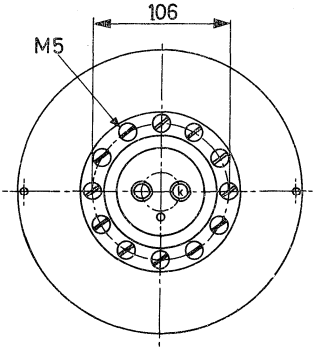
MECHANICAL DATA

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

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.	16	max.	12.5	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_{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	%

R.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

Frequency	f		up to	10	up to	30	MHz
Anode voltage	V_a	=	max.	16	max.	12.5	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_{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	%

R.F. CLASS C ANODE MODULATION

LIMITING VALUES (Absolute limits)

Frequency	f		up to	30	MHz
Anode voltage	V_a	=	max.	11.5	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.

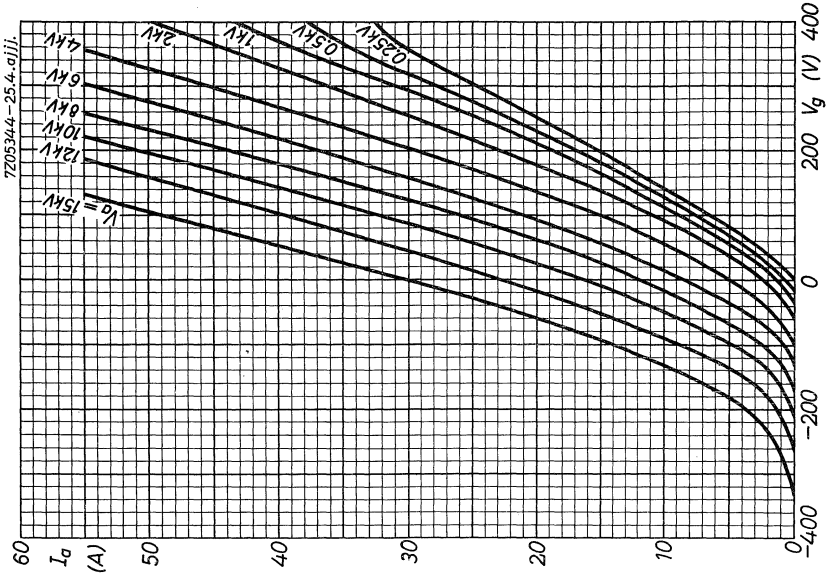
A.F. CLASS B AMPLIFIER AND MODULATOR

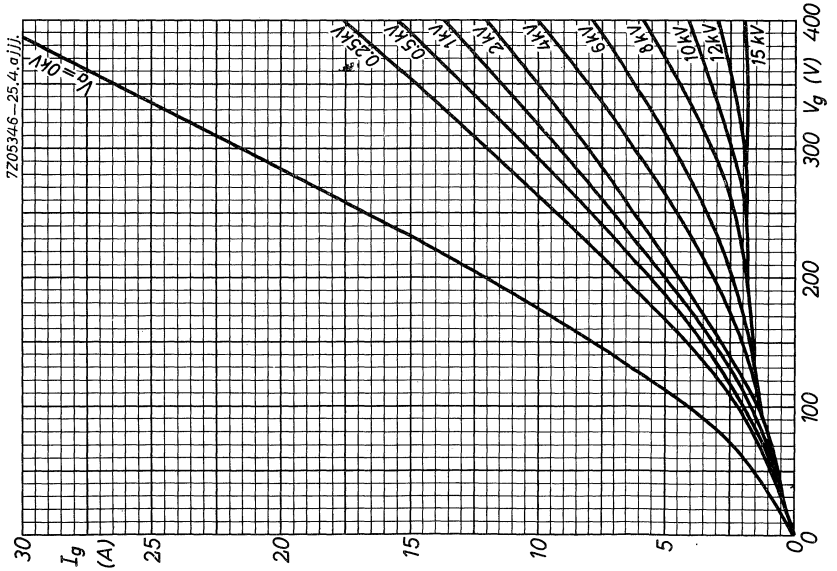
LIMITING VALUES (Absolute limits)

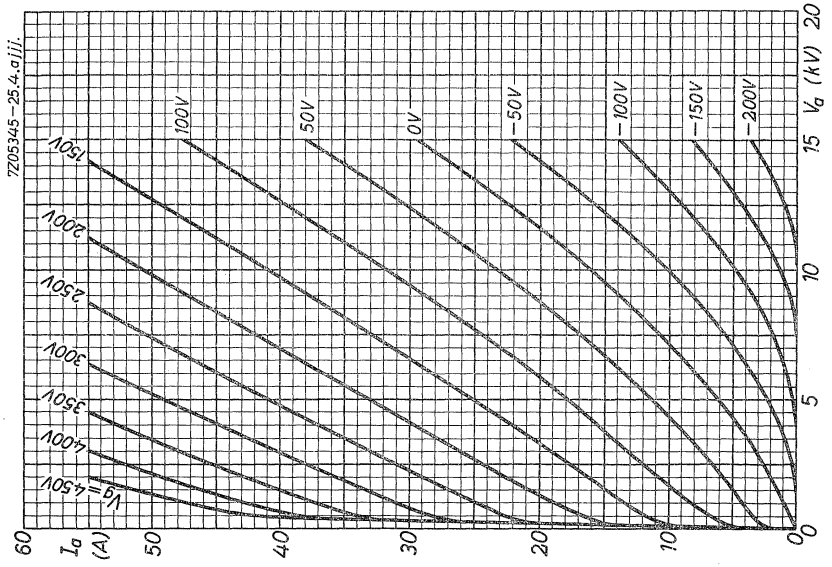
Anode voltage	V_a	=	max.	12	kV
Anode dissipation	W_a	=	max.	60	kW
Negative grid voltage	$-V_g$	=	max.	1000	V
Grid dissipation	W_g	=	max.	1.3	kW
Anode current	I_a	=	max.	13	A
Grid current	I_g	=	max.	3.3	A

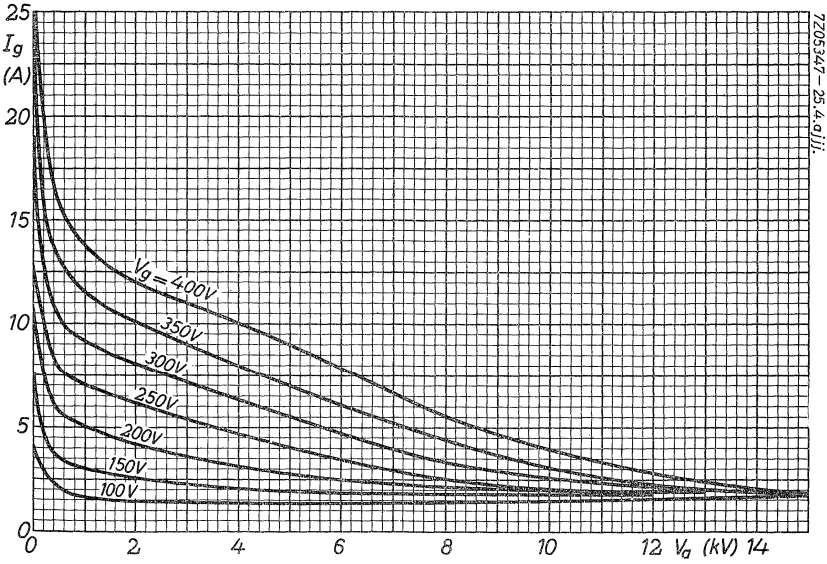
OPERATING CONDITIONS (two tubes in push-pull)

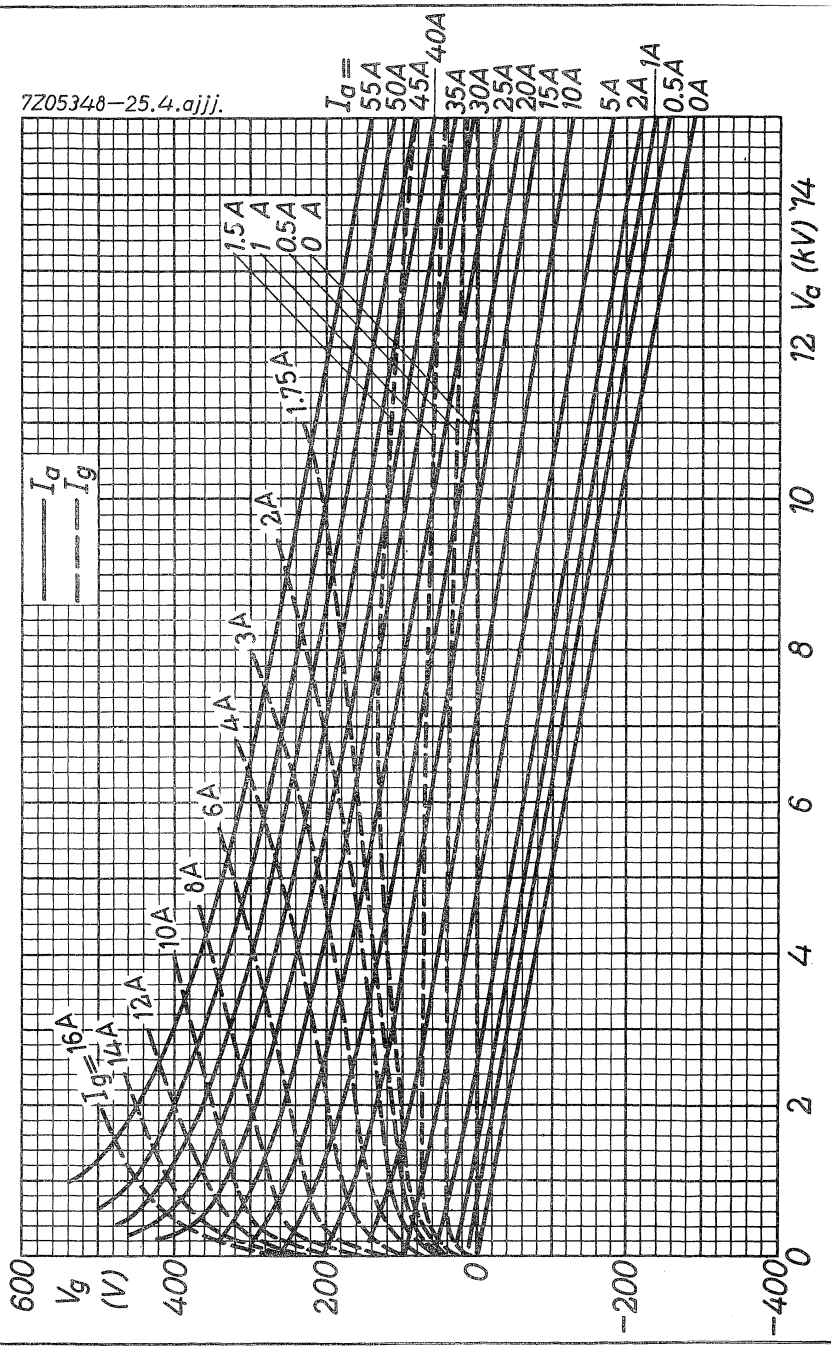
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	−205		−170		V
Load resistance	$R_{aa\sim}$	=	2720		1810		Ω
Peak grid driving voltage	V_{ggp}	=	0	710	0	710	V
Anode current	I_a	=	2x0.4	2x4.75	2x0.4	2x5.75	A
Average grid current	I_g	=	0	2x0.45	0	2x0.72	A
Peak grid current	I_{gp}	=	0	2x2.9	0	2x4.0	A
Grid 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	%


7Z05344-25.4.ajjj.
Va = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
0.25kV
Ia (A)
60
50
40
30
20
10
0
Vg (V)
400
200
0
-200
-400


7Z05346-25.4.ajjj.
Va = 0kV
0.25kV
0.5kV
1kV
2kV
4kV
6kV
8kV
10kV
12kV
15 kV
Ig (A)
30
25
20
15
10
5
0
Vg (V)
400
300
200
100
0


7Z05345-25.4.ajjj.
150V
100V
50V
0V
-50V
-100V
-150V
-200V
200V
250V
300V
350V
400V
V_g = 450V
60
I_a (A)
50
40
30
20
10
0
20
15 V_a (kV)
10
5
0


7Z05347-25.4.ajjj.
25
I_g (A)
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
14A
16A
Ig =
Ia
Ig
Vg (V)
600
400
200
0
−200
−400
0
2
4
6
8
10
12 Va (kV) 14

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

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.

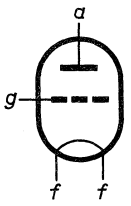
At frequencies higher than 10 MHz a low velocity air flow should be directed to the seals of grid and filament.

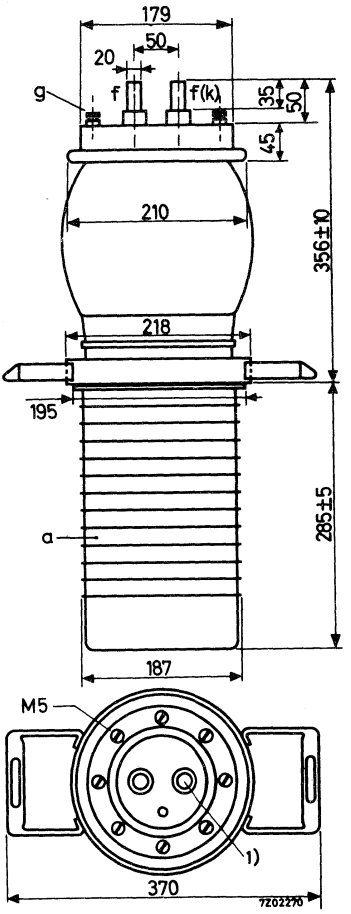
MECHANICAL DATA

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.

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_{g_p}	=	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	%

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

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_{gp}	=	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

A.F. CLASS B AMPLIFIER

LIMITING VALUES (Absolute limits)

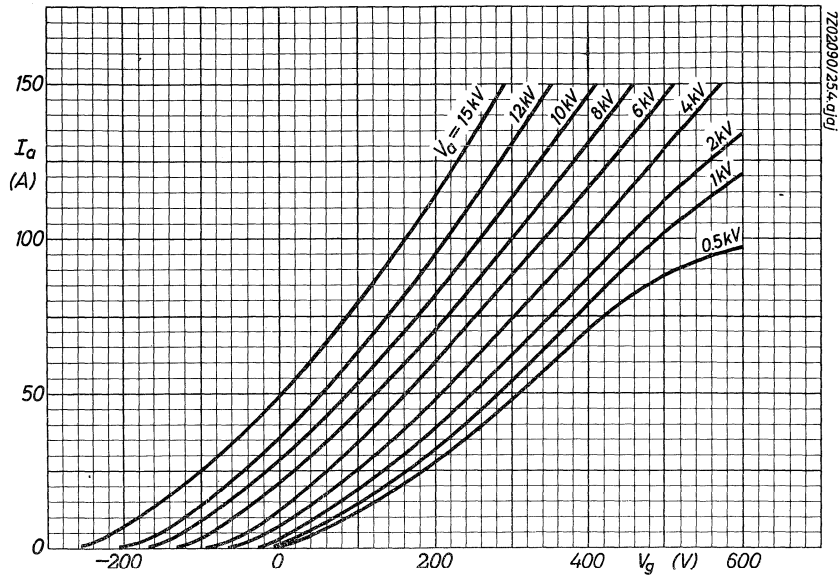
Anode voltage	V_a	= max.	12	kV
Anode dissipation	W_a	= max.	120	kW
Negative grid voltage	$-V_g$	= max.	800	V
Grid dissipation	W_g	= max.	4	kW
Anode current	I_a	= max.	33	A
Grid current	I_g	= max.	8	A

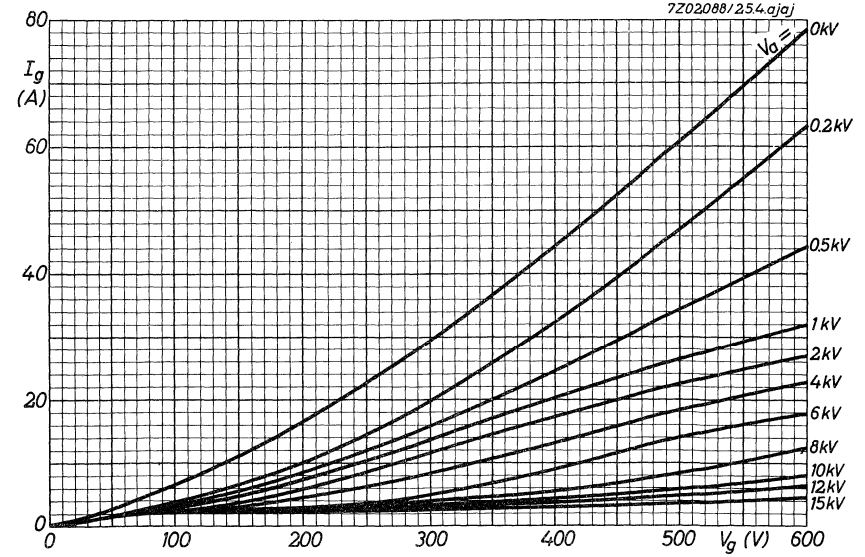
OPERATING CONDITIONS, two tubes in push-pull

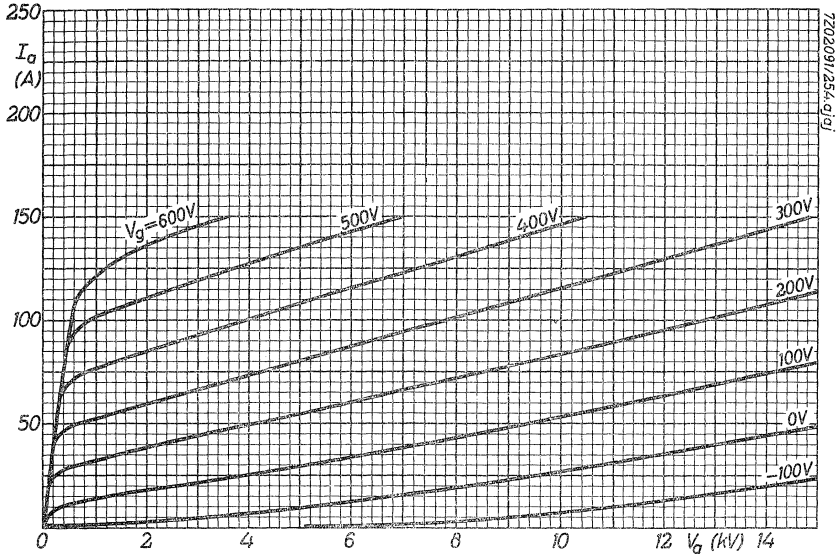
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-180		-150		V
Load resistance	$R_{aa\sim}$	=	552		410		Ω
Peak driving voltage	V_{ggp}	=	0	1210	0	1205	V
Anode current	I_a	=	2x2	2x26	2x1.8	2x28	A
Grid current	I_g	=	0	2x4.4	0	2x4.8	A
Peak grid current	$I_{g\,p}$	=	0	2x23	0	2x24	A
Driving power	W_{dr}	=	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	%

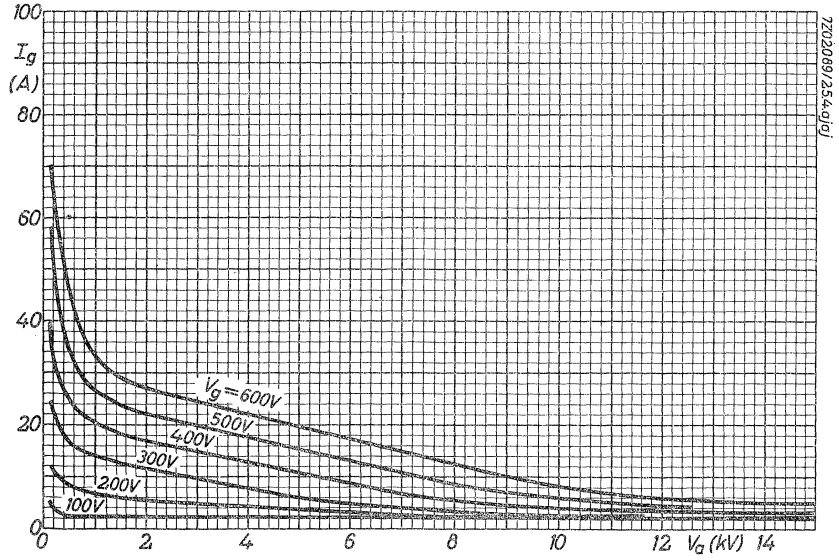
OPERATING CONDITIONS, two tubes in push-pull (continued)

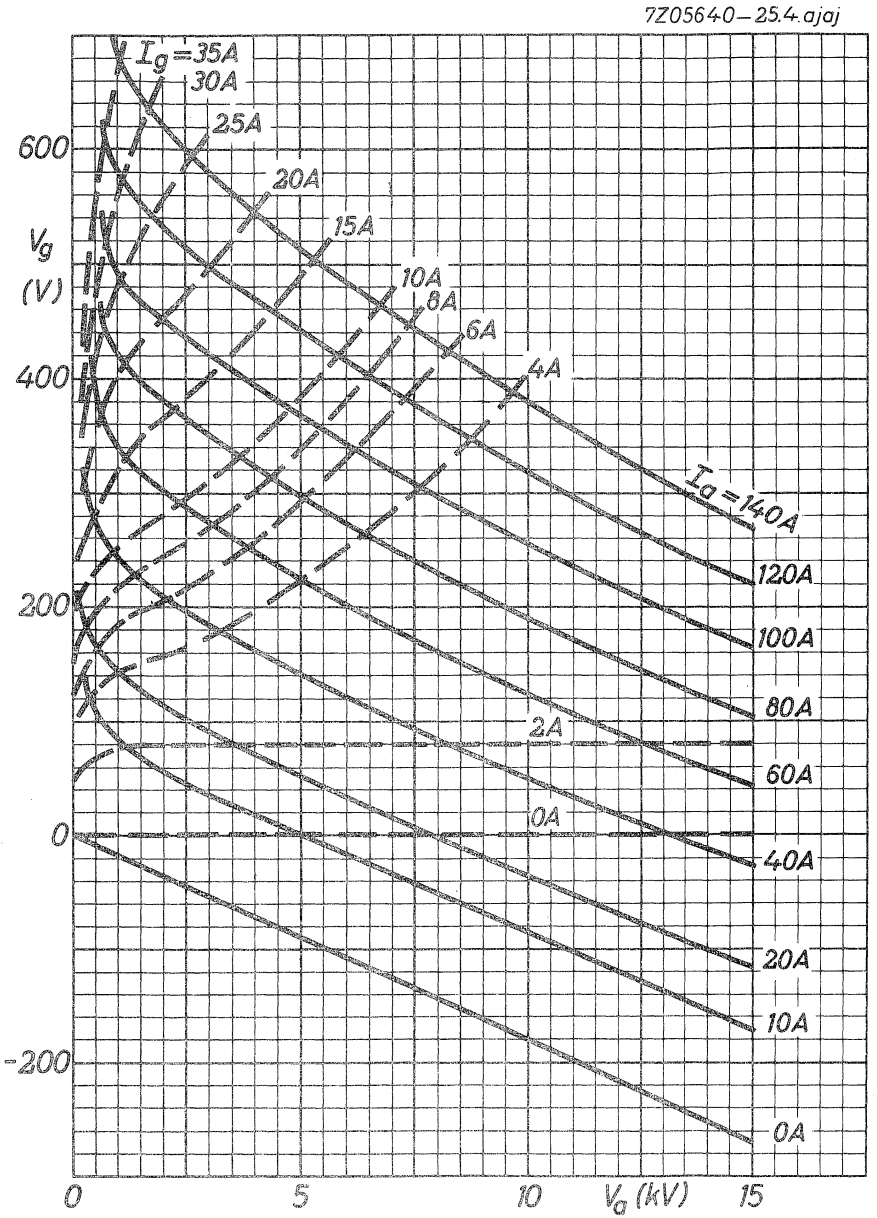
Anode voltage	V_a	=	8		6		kV
Grid voltage	V_g	=	-115		-82		V
Load resistance	$R_{aa\sim}$	=	338		268		Ω
Peak driving voltage	V_{ggp}	=	0	1110	0	990	V
Anode current	I_a	=	2x1.6	2x27	2x1.4	2x25	A
Grid current	I_g	=	0	2x5	0	2x4.9	A
Peak grid current	I_{gp}	=	0	2x24	0	2x22	A
Driving power	W_{dr}	=	0	2x2.5	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	%

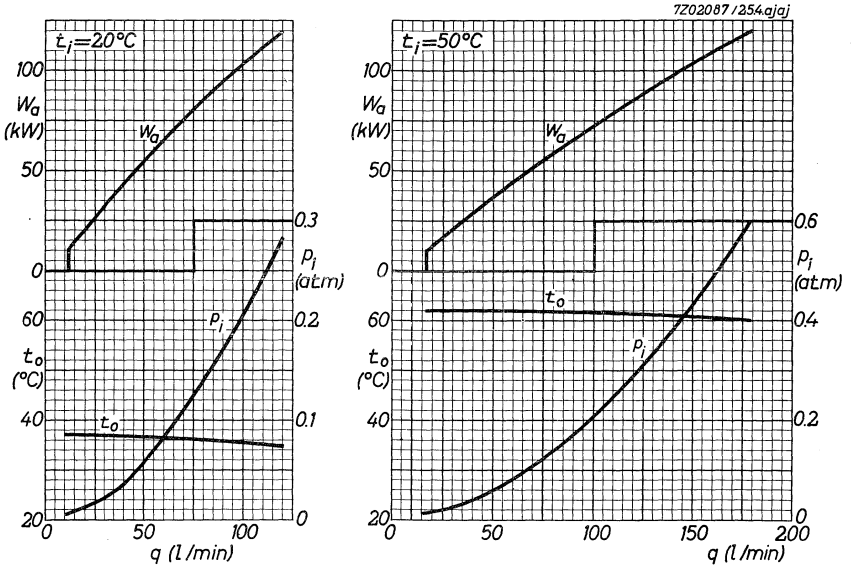

7Z02090/254.ajaj
150
I_a
(A)
100
50
0
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV
−200
0
200
400
V_g (V)
600


7Z02088/254.ajaj
80
I_g
(A)
60
40
20
0
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
2
4
6
8
10
12
V_a (kV)
14
V_g=600V
500V
400V
300V
200V
100V
0V
−100V
7202091/254.a/aj


100
I_g
(A)
80
60
40
20
0
2
4
6
8
10
12
V_a (kV)
14
V_g=600V
500V
400V
300V
200V
100V
7202069/254.a/aj


7Z05640—25.4.ajaj
I_g = 35A
30A
25A
20A
15A
10A
8A
6A
4A
I_a = 140A
120A
100A
80A
60A
40A
20A
10A
0A
2A
0A
600
400
200
0
-200
V_g (V)
0
5
10
15
V_a (kV)


7Z02087/254ajaj
t_i=20°C
100
W_a (kW)
50
0
60
t_o (°C)
40
20
W_a
p_i
t_o
0.3
p_i (atm)
0.2
0.1
0
0
50
100
q (l/min)
t_i=50°C
100
W_a (kW)
50
0
60
t_o (°C)
40
20
W_a
t_o
p_i
0.6
p_i (atm)
0.4
0.2
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	°C
Seal temperature	t	=	max. 180	°C

COOLING

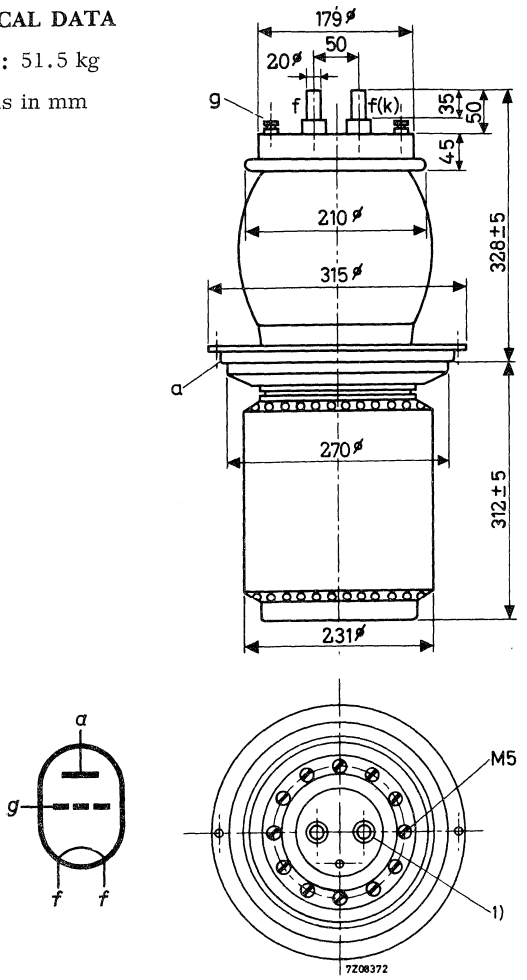
Cooling data for anode dissipation W_a = 180 kW

Total dissipation to be transferred by cooling system ($W_a + W_g + 0.8\ W_f$)	188	kW
equivalent to	2700	k cal/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

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

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

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_α	=	360	310	285	245	kW
Efficiency	η	=	81.8	83.5	80.8	82.6	%

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_{g_p}	=	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

R.F. CLASS B TELEPHONY

LIMITING VALUES (Absolute limits)

Frequency			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

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

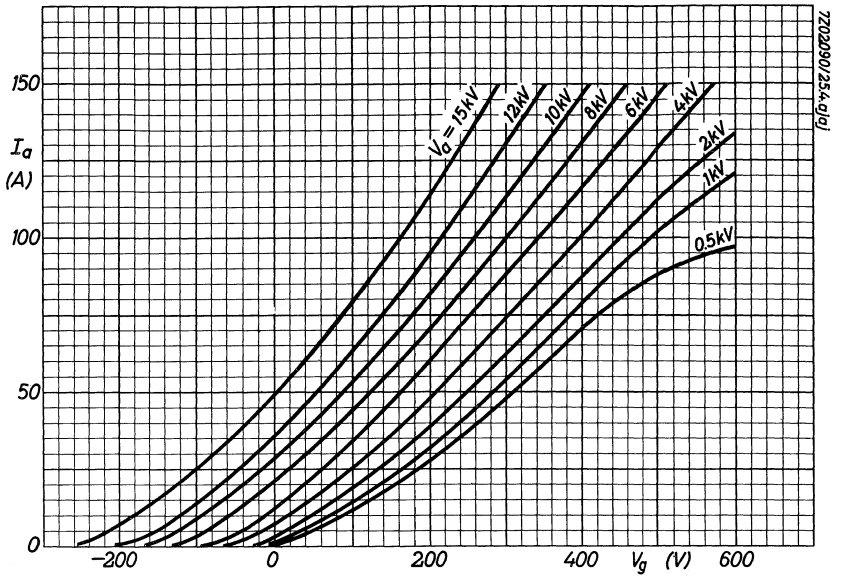
OPERATING CONDITIONS (Two tubes in push-pull)

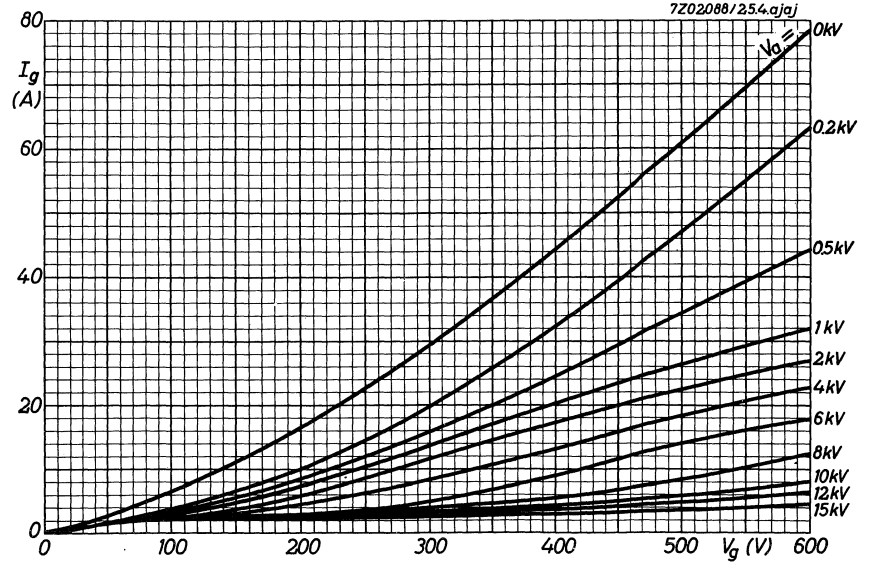
Anode voltage	V_a	=	12		10		kV
Grid voltage	V_g	=	-180		-150		V
Load resistance	$R_{aa\sim}$	=	552		410		Ω
Peak driving voltage	V_{ggp}	=	0	1210	0	1205	V
Anode current	I_a	=	2x2.0	2x26	2x1.8	2x28	A
Average grid current	I_g	=	0	2x4.4	0	2x4.8	A
Peak grid current	I_{gp}	=	0	2x23	0	2x24	A
Driving power	W_{dr}	=	0	2x2.4	0	2x2.6	kW
Anode input power	W_{i_a}	=	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	%

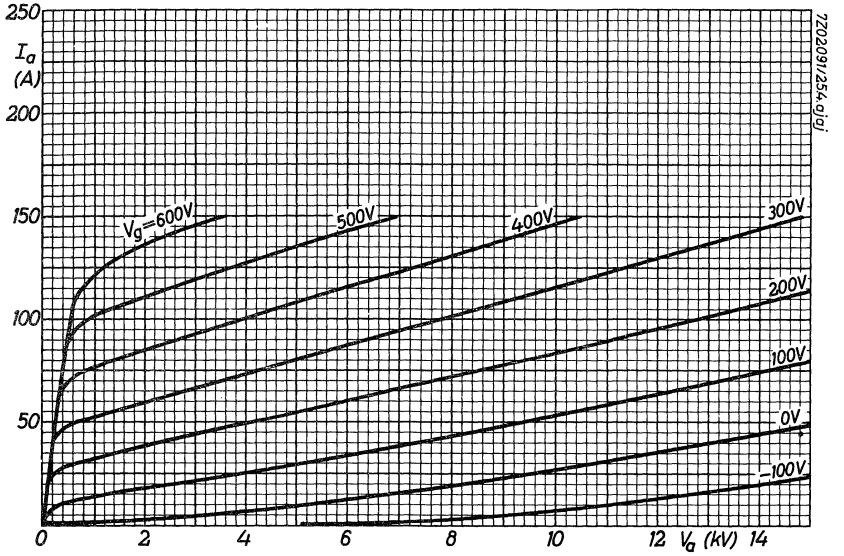
A.F. CLASS B AMPLIFIER AND MODULATOR

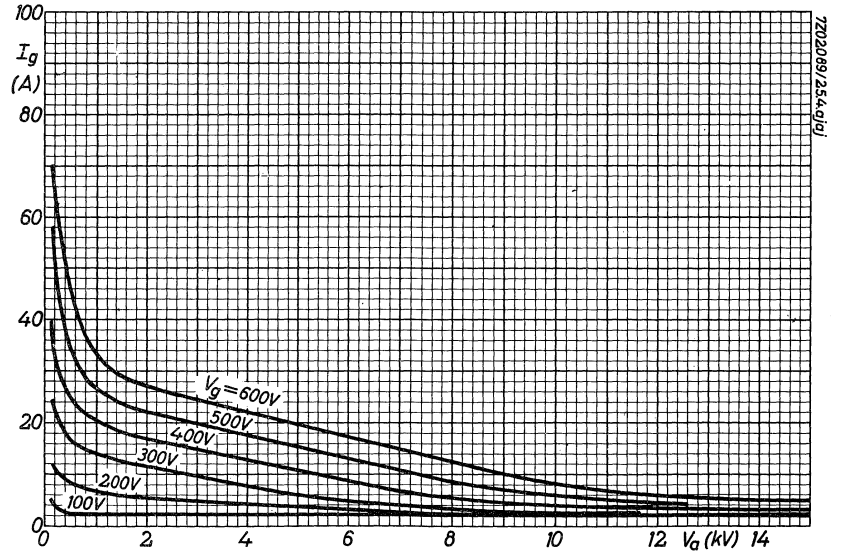
OPERATING CONDITIONS (Two tubes in push-pull; continued)

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_{i_a}	=	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	%

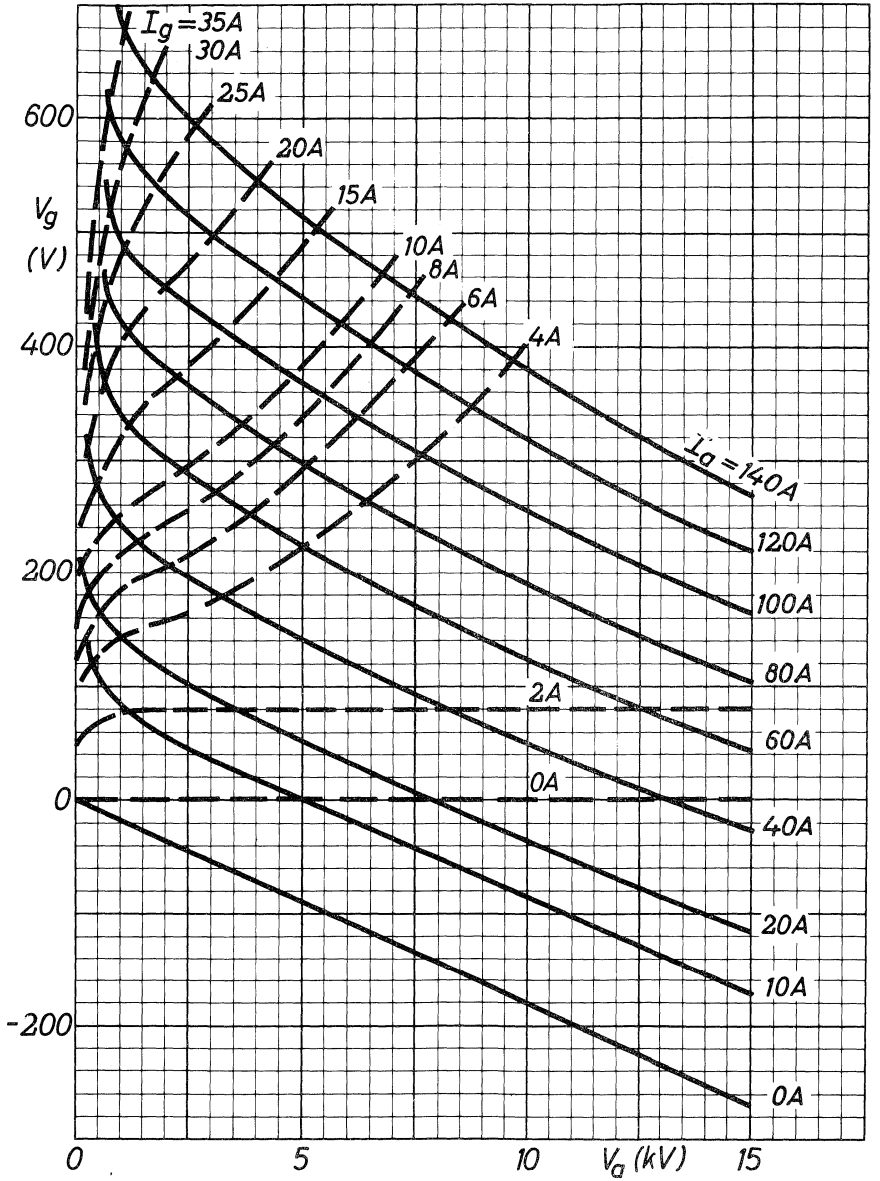

7Z02088/254.ajaj
150
I_a
(A)
100
50
0
−200
0
200
400
V_g (V)
600
V_a = 15kV
12kV
10kV
8kV
6kV
4kV
2kV
1kV
0.5kV


7Z02088/254.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
2
4
6
8
10
12
V_a (kV)
14
V_g=600V
500V
400V
300V
200V
100V
0V
−100V
7Z02091/254.a/aj


100
I_g
(A)
80
60
40
20
0
2
4
6
8
10
12
V_a (kV)
14
V_g=600V
500V
400V
300V
200V
100V
7Z02089/254.a/aj

7Z05640–25.4.ajaj



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

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

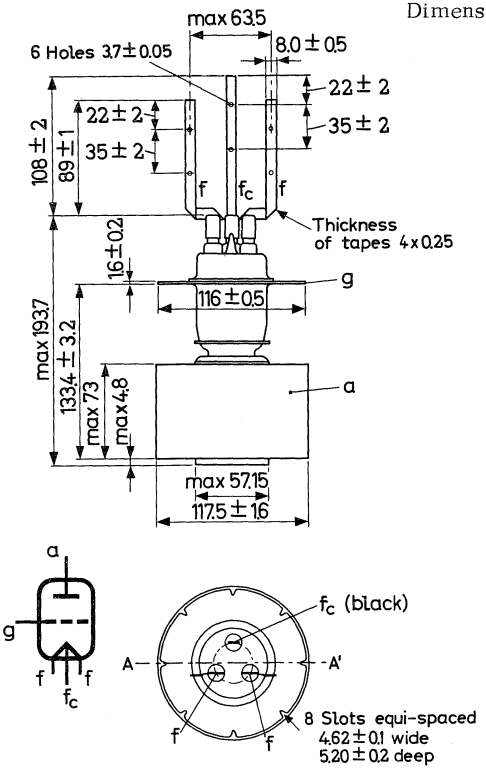
W_a (kW)	h (m)	t_i (°C)	qmin (m^3/min)	p_i (mm H_2O)
1	0	35	3.0	8
	0	45	3.1	8
	1500	35	3.7	9
	3000	25	4.1	10
3	0	35	5.2	23
	0	45	6.1	29
	1500	35	6.2	26
	3000	25	6.6	26
5	0	35	9.2	68
	0	45	10.7	90
	1500	35	11.2	81
	3000	25	11.6	79

It may be necessary to direct an air flow to the seals to keep them within the temperature limits.

MECHANICAL DATA

Dimensions in mm

Net weight: 3.4 kg



The plane of the filament is parallel to AA' to within $3\frac{1}{2}^{o}$

Mounting position: vertical with base up or down

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_{i_a}	=	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_{i_a}	=	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

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

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	Wi_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

A.F. CLASS B AMPLIFIER AND MODULATOR

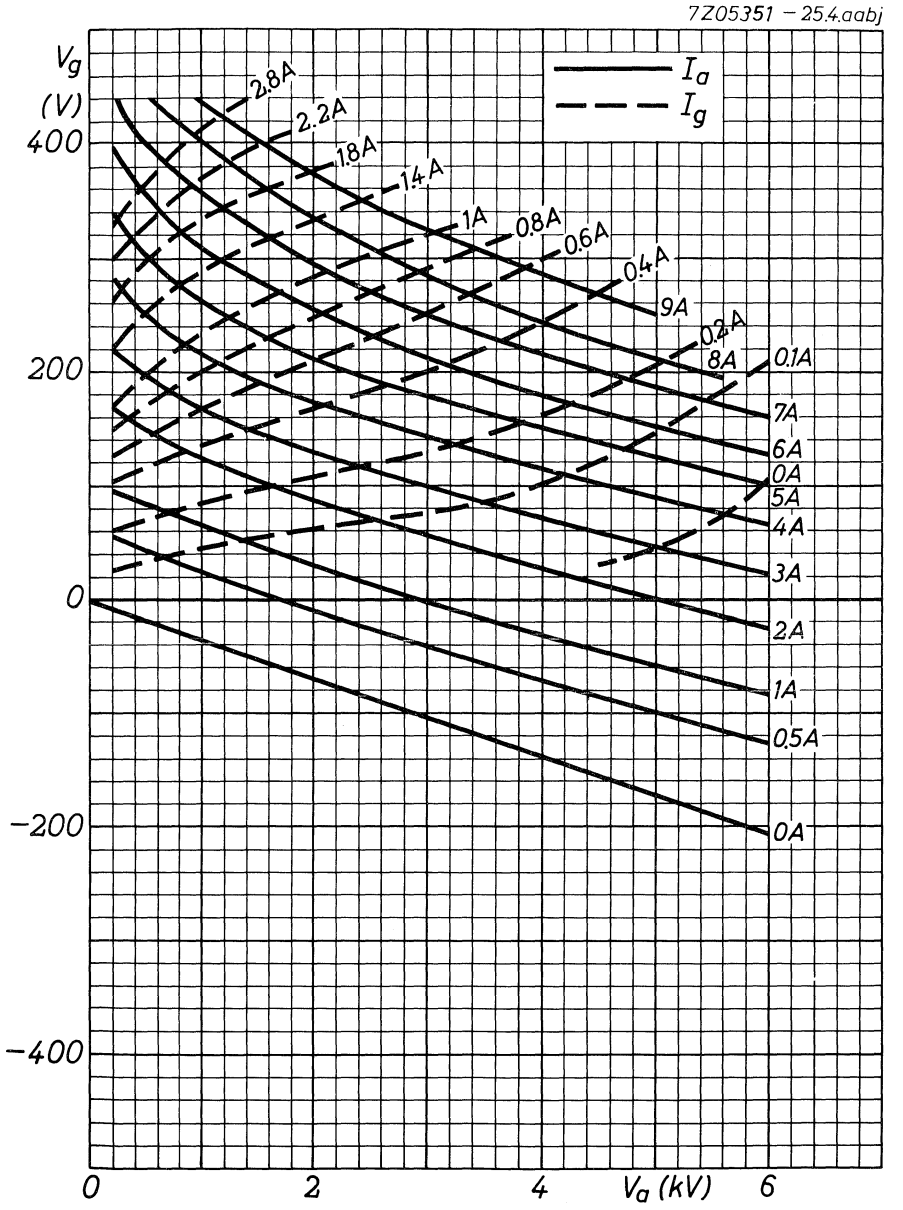
LIMITING VALUES (Absolute limits)

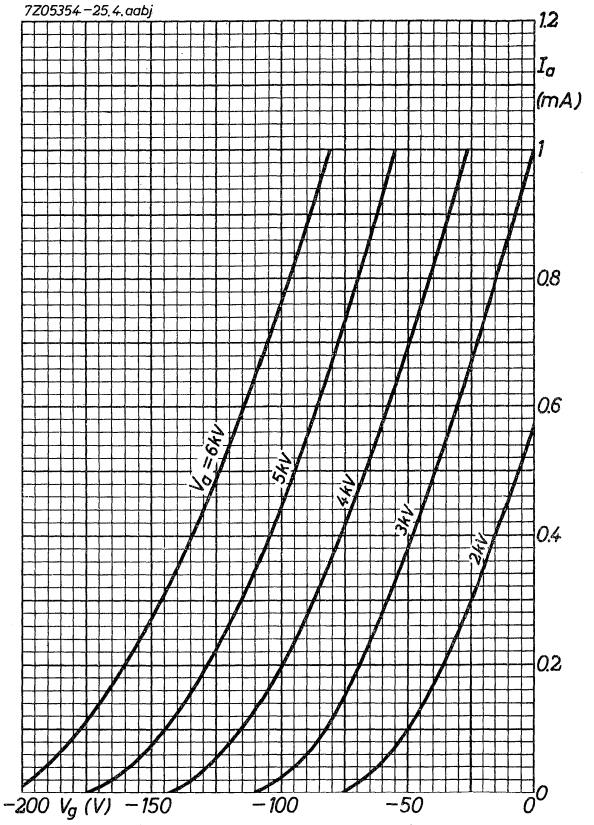
Anode voltage	V_a	=	max.	6.0	kV
Anode current	I_a	=	max.	1.8	A
Anode input power	W_{i_a}	=	max.	10.5	kW
Anode dissipation	W_a	=	max.	5.0	kW

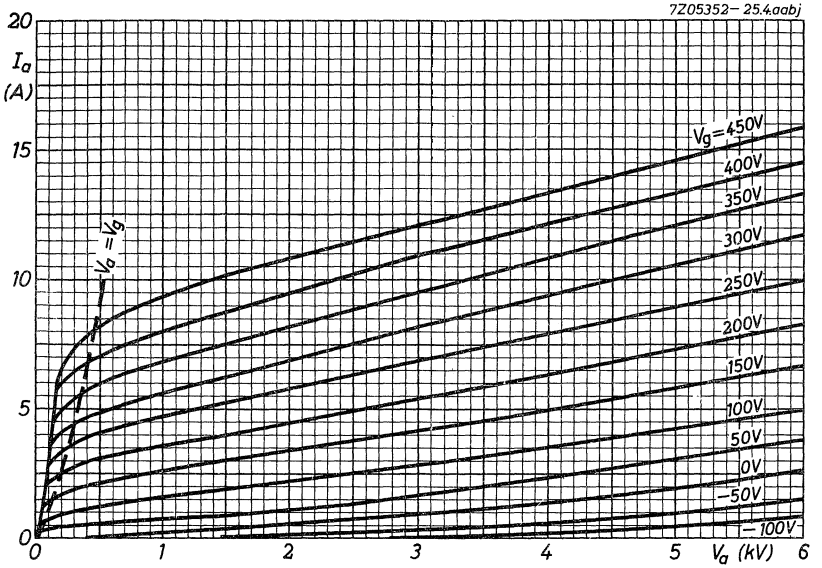
OPERATING CONDITIONS (Two tubes in push-pull)

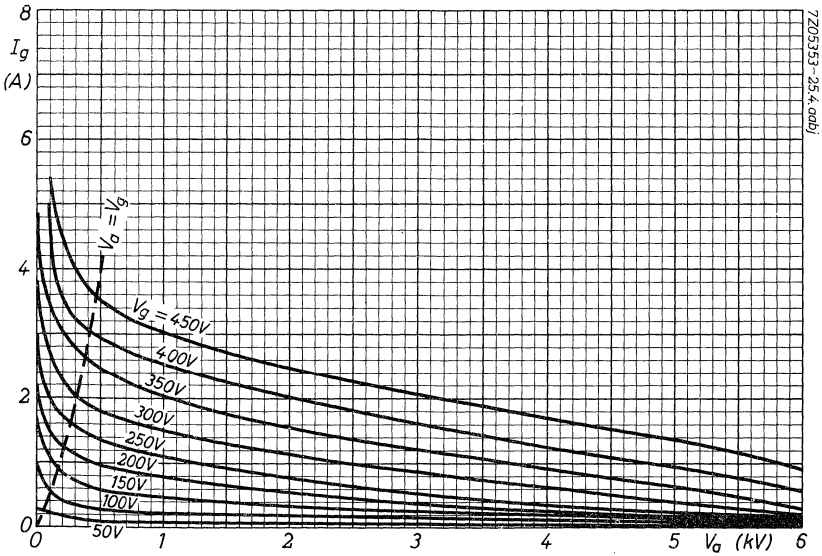
Anode voltage	V_a	=	6.0		kV
Grid voltage	V_g	=	−165		V [1])
Load resistance	$R_{aa\sim}$	=	4.9		kΩ
Grid driving voltage	V_{gg}	=	0	645	V(RMS)
Anode current	I_a	=	2x125	2x1500	mA
Grid current	I_g	=	0	2x280	mA
Driving power	W_{dr}	=	0	2x115	W
Anode input power	W_{i_a}	=	2x0.75	2x9.0	kW
Anode dissipation	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.


7Z05351 – 25.4.aabj
V_g (V)
400
200
0
−200
−400
I_a
I_g
2.8A
2.2A
1.8A
1.4A
1A
0.8A
0.6A
0.4A
9A
0.2A
8A
0.1A
7A
6A
0A
5A
4A
3A
2A
1A
0.5A
0A
0
2
4
V_a (kV)
6


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


7Z05352-25.4aabj
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


7Z05353-25.4aabj
8
I_g
(A)
6
4
2
0
0
50V
1
2
3
4
5
V_a (kV)
6
$V_a = V_g$
V_g = 450V
400V
350V
300V
250V
200V
150V
100V

R.F. POWER TRIODE

R.F. zero bias power triode intended for use as linear S.S.B. amplifier and A.F. class B amplifier

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 °C
Pin seal temperature	t	=	max. 180 °C
Bulb temperature	t	=	max. 350 °C

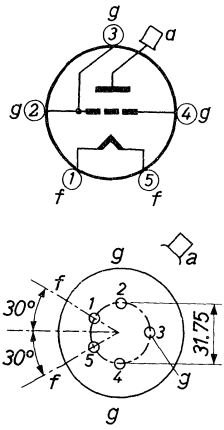
COOLING

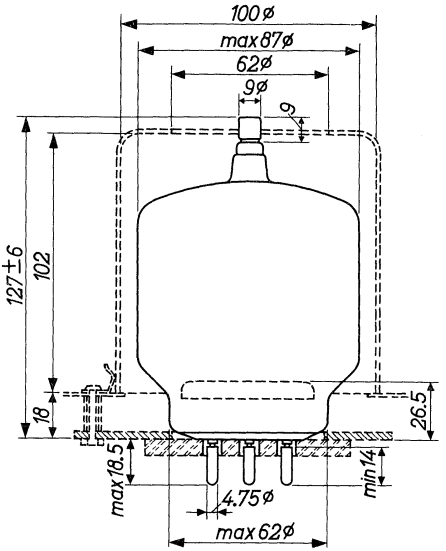
Radiation and low velocity air flow

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

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

Frequency	f	=		30		MHz
Anode voltage	V_a	=		2500		V
Grid voltage	V_g	=		0		V
			zero signal	single tone signal	double tone signal	
Peak cathode driving voltage	V_{kp}	=	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.

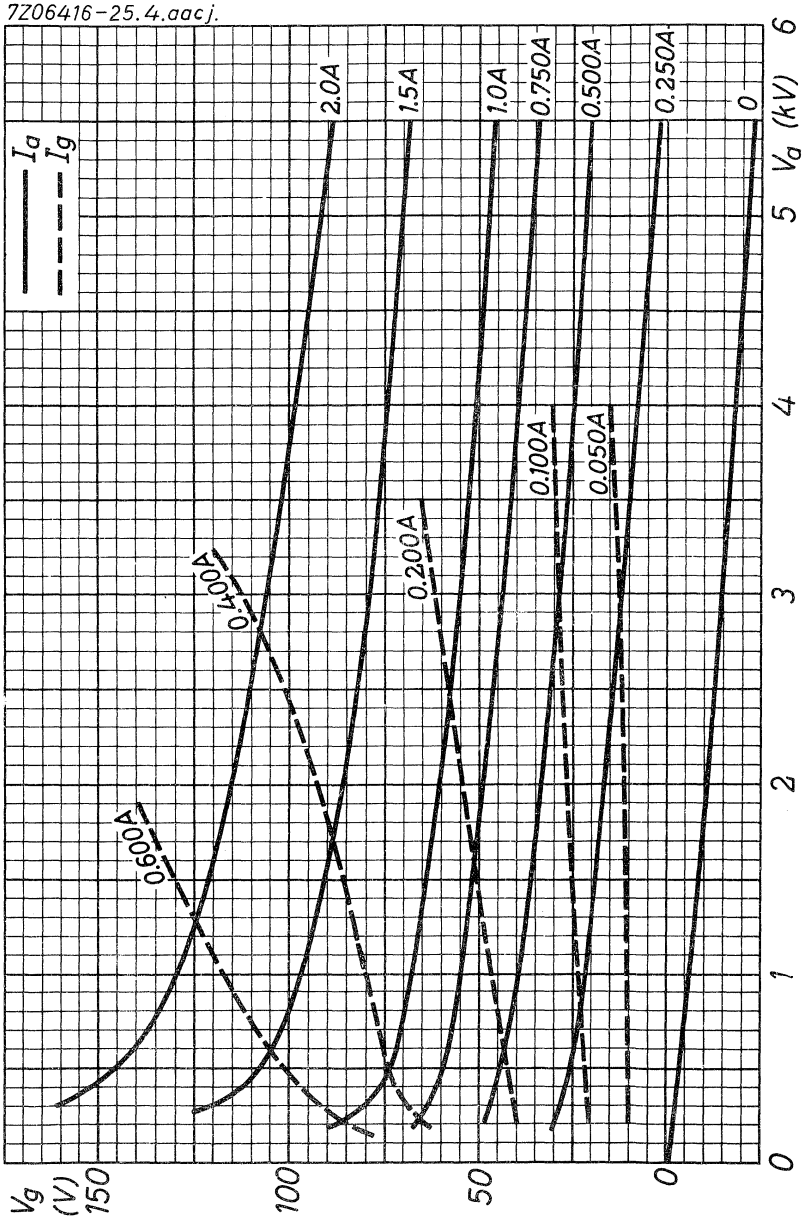
A.F. CLASS B AMPLIFIER AND MODULATOR

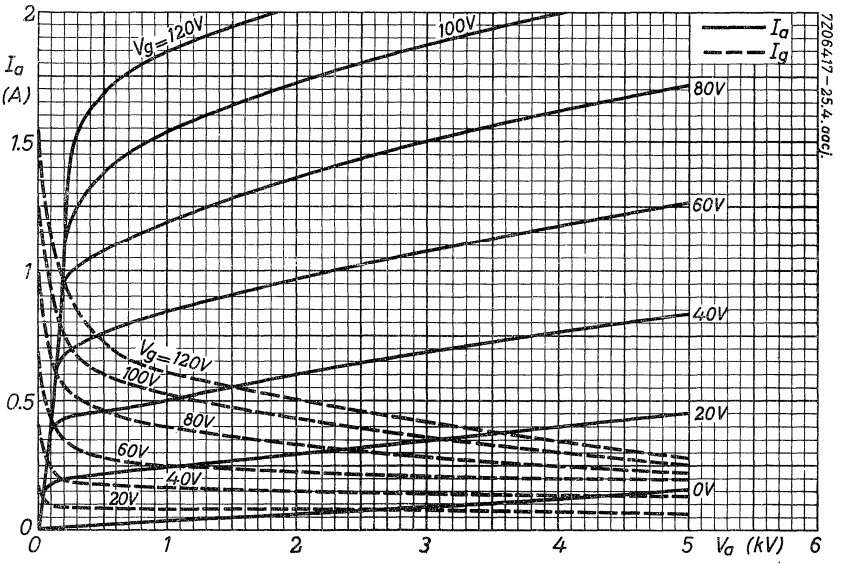
LIMITING VALUES (Absolute limits)

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_{ggp}	=	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	%


7Z06416-25.4.aacj.
Ia
Ig
2.0A
1.5A
1.0A
0.750A
0.500A
0.250A
0
0.100A
0.050A
0.200A
0.400A
0.600A
Va (kV)
0
1
2
3
4
5
6
Vg (V)
150
100
50
0


I_a
I_g
I_a (A)
V_a (kV)
V_g=120V
100V
80V
60V
40V
20V
0V
7206417-254.oec

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

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.

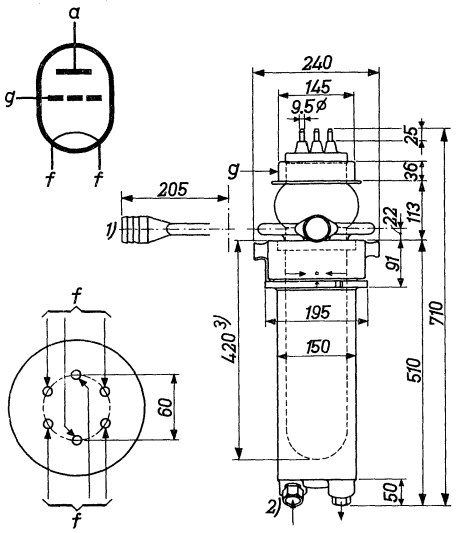
At frequencies below 6 MHz forced air cooling of the seals will, as a rule, not be necessary. Above 6 MHz air cooling must be used to keep the anode and grid seal temperatures below 180 °C. The seals can be cooled by connecting a blower of suitable size to the air inlet of the anti-corona ring, attached 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.

MECHANICAL DATA Dimensions in mm

Water-jacket	: K714	Net weight of tube	: 14 kg
Filament connectors	: 40628	Net weight of water-jacket	: 20.5 kg
O-ring	: 2622 080 31817		



Mounting position: vertical with anode down

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

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.

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_{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_{i_a}	=	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	%

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

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%.

A.F. CLASS B AMPLIFIER AND MODULATOR

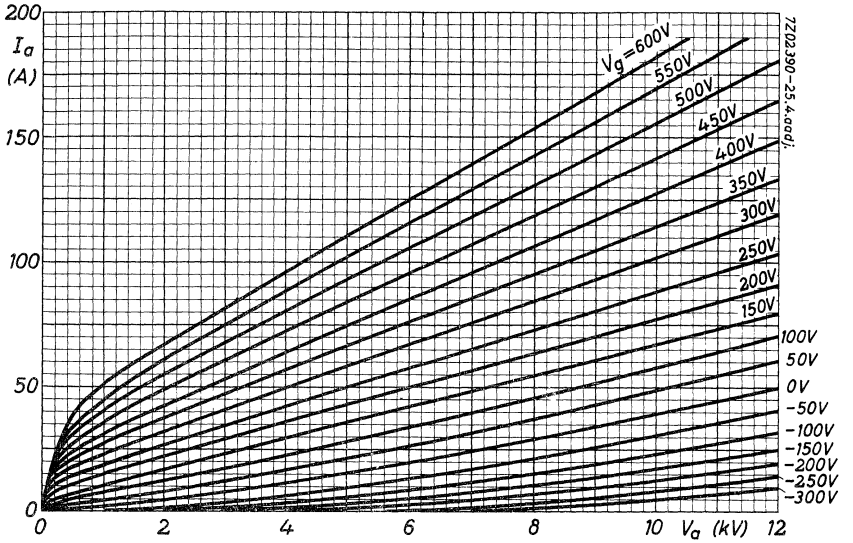
LIMITING VALUES (Absolute limits)

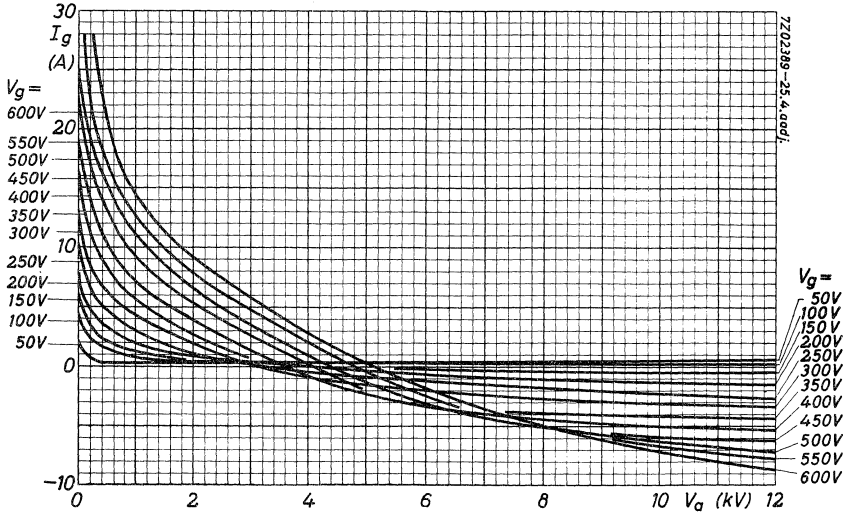
Anode voltage	V_a	= max.	15	kV
Anode current	I_a	= max.	12	A
Anode input power	W_{i_a}	= max.	162	kW
Anode dissipation	W_a	= max.	100	kW
Negative grid voltage	$-V_g$	= max.	1200	V
Grid current	I_g	= max.	1.2	A

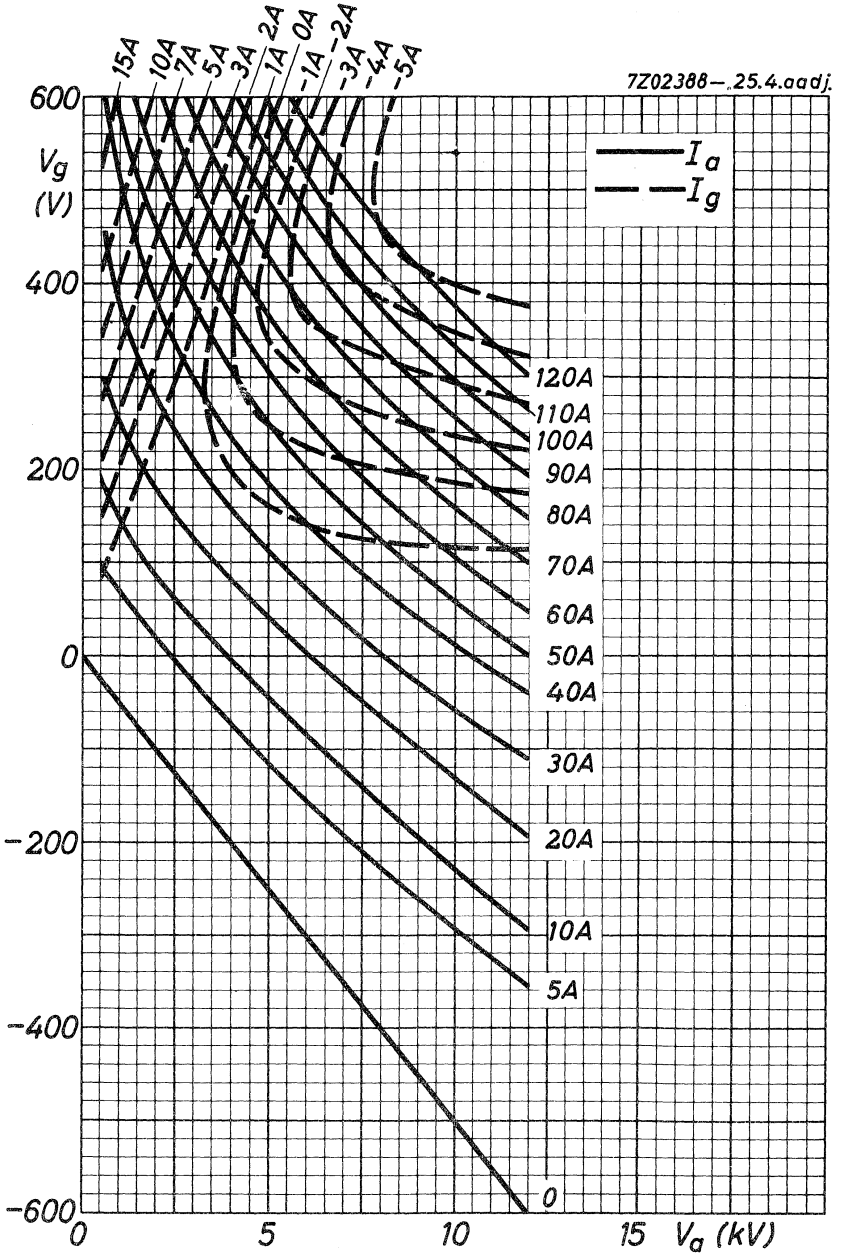
OPERATING CONDITIONS, two tubes in push-pull

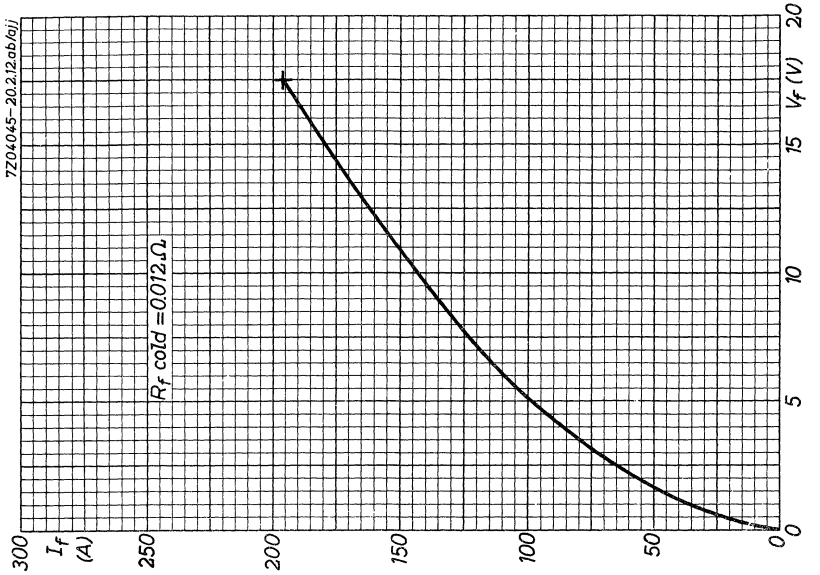
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	−540		−540		V [1]
Load resistance	$R_{aa\sim}$	=	1360		1440		Ω
Driving voltage	V_{gg_p}	=	0	1550	0	1300	V
Anode current	I_a	=	2x0.3	2x8	2x0.3	2x5.8	A
Grid current	I_g	=	0	2x0.2	0	2x0.15	A
Anode input power	W_{i_a}	=	2x3	2x80	2x3	2x58	kW
Anode dissipation	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	%

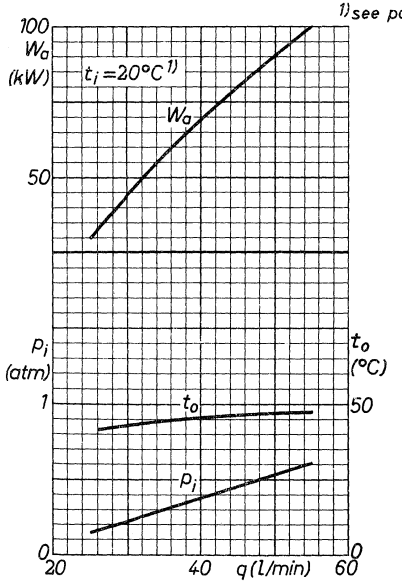
1) To be adjusted for a zero signal anode current of 0.3 A

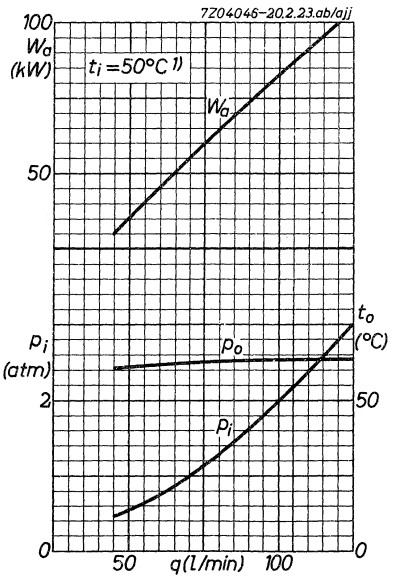

200
I_a
(A)
150
100
50
0
0
2
4
6
8
10
V_a (kV)
12
V_g=600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
−200V
−250V
−300V
7Z02390−25.4.oadj.


30
I_g
(A)
20
10
0
−10
V_g=
600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
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.oadj.


7Z02388—.25.4.aadj.
I_a
I_g
15A
10A
7A
5A
3A
2A
1A
0A
-1A
-2A
-3A
-4A
-5A
600
V_g
(V)
400
200
0
-200
-400
-600
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0
0
5
10
15
V_a (kV)


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
20
15
10
5
0


1) see page 2
W_a (kW)
t_i = 20°C 1)
W_a
p_i (atm)
t_o (°C)
t_o
p_i
q (l/min)


7Z04046-20.2.23.ab/ajj
W_a (kW)
t_i = 50°C 1)
W_a
p_i (atm)
t_o (°C)
p_o
p_i
q (l/min)

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_{fp}	max.	420	A
Cold filament resistance	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

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.

MECHANICAL DATA

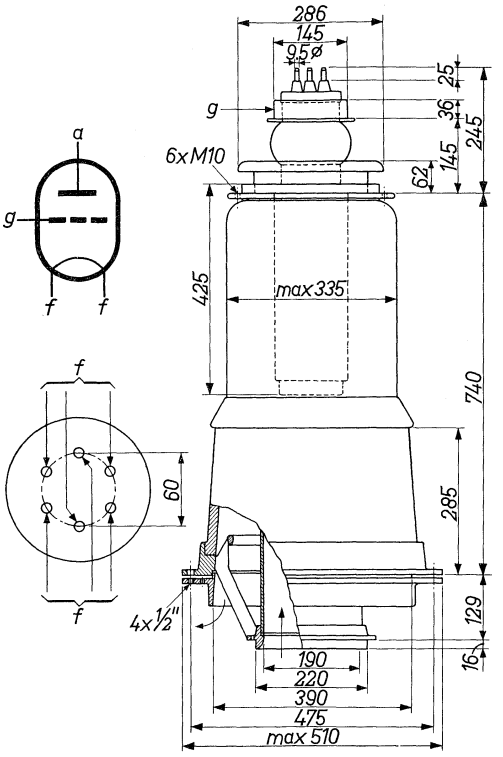
Dimensions in mm

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 K506

Mounting position: vertical with anode down

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

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_{i_a}	=	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	%

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

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%

A.F. CLASS B AMPLIFIER AND MODULATOR

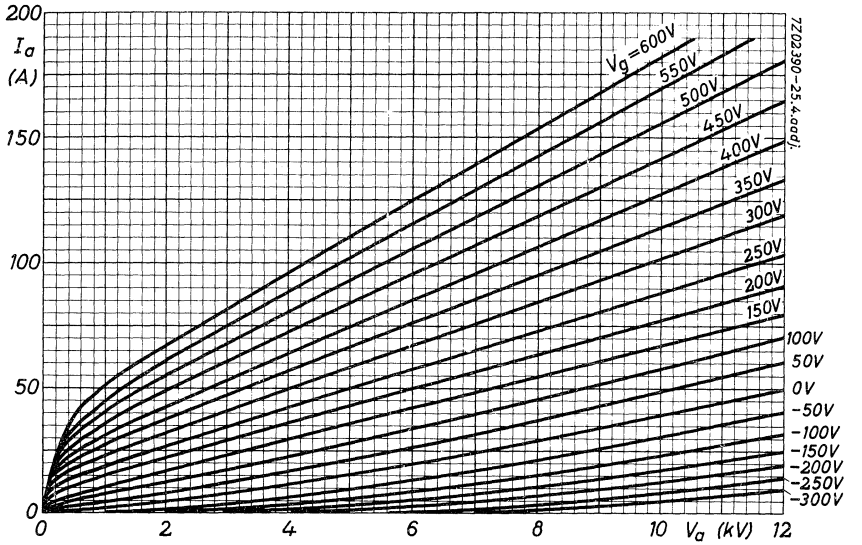
LIMITING VALUES (Absolute limits)

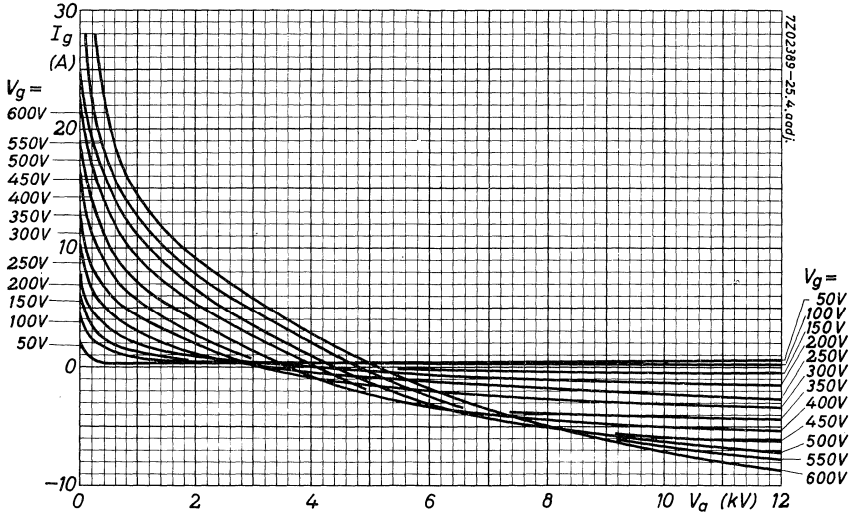
Anode voltage	V_a	= max.	15	kV
Anode current	I_a	= max.	12	A
Anode input power	W_{i_a}	= max.	162	kW
Anode dissipation	W_a	= max.	45	kW
Negative grid voltage	$-V_g$	= max.	1200	V
Grid current	I_g	= max.	1.2	A

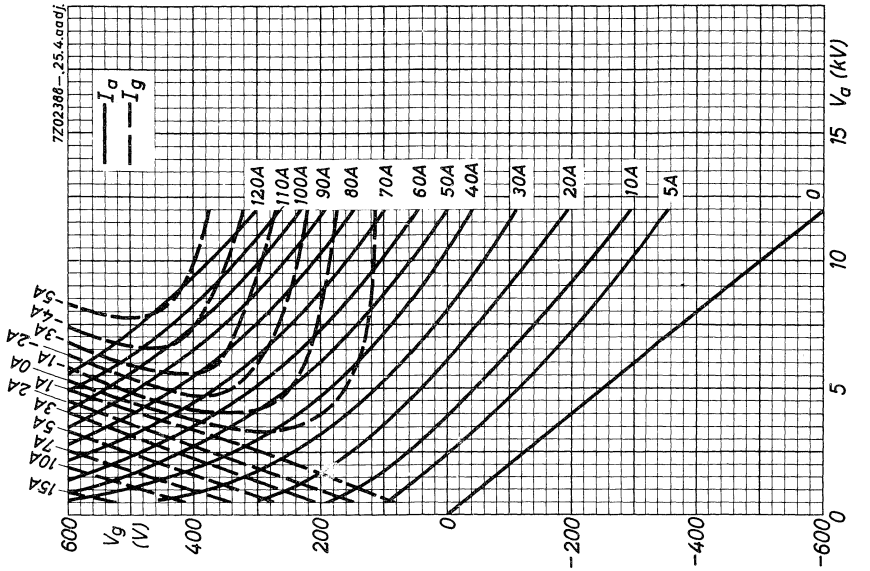
OPERATING CONDITIONS, two tubes in push-pull

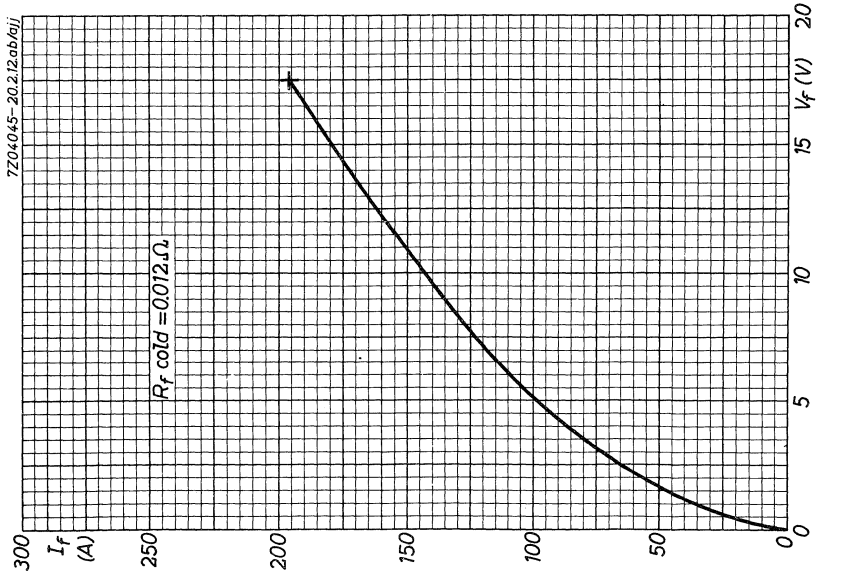
Anode voltage	V_a	=	10		10		kV
Grid voltage	V_g	=	-540		-540		V [1]
Load resistance	$R_{aa\sim}$	=	1360		1440		Ω
Driving voltage	V_{gg_p}	=	0	1550	0	1300	V
Anode current	I_a	=	2x0.3	2x8	2x0.3	2x5.8	A
Grid current	I_g	=	0	2x0.2	0	2x0.15	A
Anode input power	W_{i_a}	=	2x3	2x80	2x3	2x58	kW
Anode dissipation	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	%

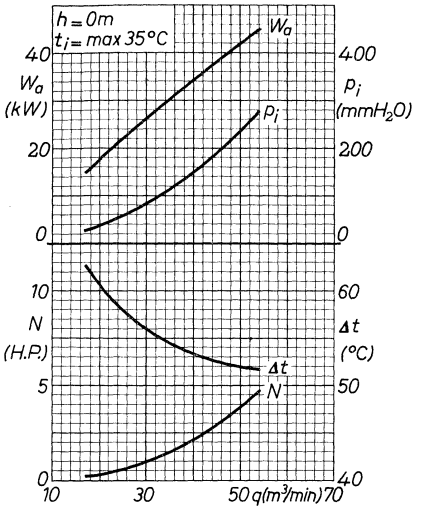
[1]) To be adjusted for a zero signal anode current of 0.3 A

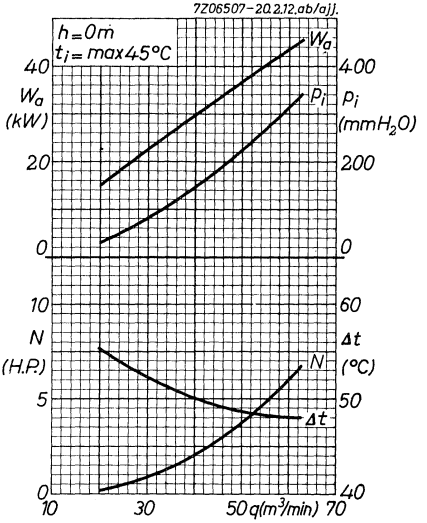

200
I_a
(A)
150
100
50
0
0
2
4
6
8
10
V_a (kV)
12
V_g=600V
550V
500V
450V
400V
350V
300V
250V
200V
150V
100V
50V
0V
−50V
−100V
−150V
−200V
−250V
−300V
7Z02390-25.4.oodj

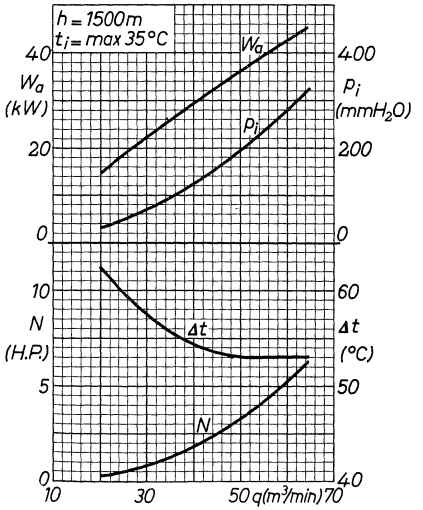

30
I_g
(A)
V_g=
600V
20
550V
500V
450V
400V
350V
300V
10
250V
200V
150V
100V
50V
0
−10
0
2
4
6
8
10
V_a (kV)
12
V_g=
50V
100V
150V
200V
250V
300V
350V
400V
450V
500V
550V
600V
7Z02389-25.4.oodj

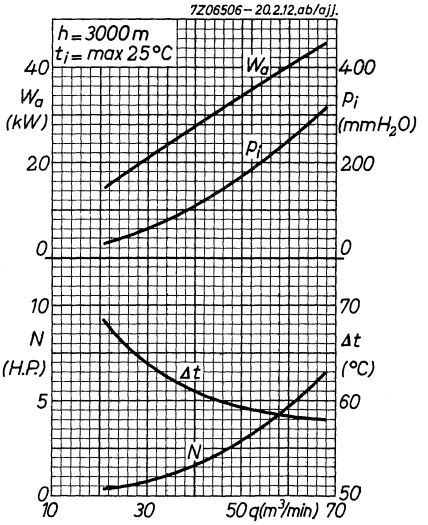

7Z02388—25.4.aadj
I_a
I_g
120A
110A
100A
90A
80A
70A
60A
50A
40A
30A
20A
10A
5A
0
15A
10A
7A
5A
3A
2A
1A
0A
-1A
-2A
-3A
-4A
-5A
600
400
200
0
-200
-400
-600
V_g (V)
15
10
5
0
V_a (kV)


7Z04045—20.2.12aabdj
R_f cold = 0.012 Ω
300
250
200
150
100
50
0
I_f (A)
20
15
10
5
0
V_f (V)


h = 0m
t_i = max 35°C
W_a
p_i
Δt
N
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
q(m^3/min)


7Z06507-20.2.12.ab/ajj.
h = 0m
t_i = max 45°C
W_a
p_i
N
Δt
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
q(m^3/min)


h = 1500m
t_i = max 35°C
W_a
p_i
Δt
N
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
q(m^3/min)


7Z06506-20.2.12.ab/ajj.
h = 3000m
t_i = max 25°C
W_a
p_i
Δt
N
W_a (kW)
p_i (mmH$_2$O)
N (H.P.)
Δt (°C)
q(m^3/min)

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	27.12	160	MHz
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Oscillator output power	W_{osc}	3.85	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	°C
Recommended max. envelope temperature under continuously loaded conditions	$t_{env.}$	max. 200	°C

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

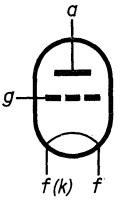
Filament connector	40688	
Filament/cathode connector	40689	
Grid connector (f < 30 MHz)	40686	
(f > 30 MHz)	40687	
Insulating pedestal	40630	net weight 2.1 kg

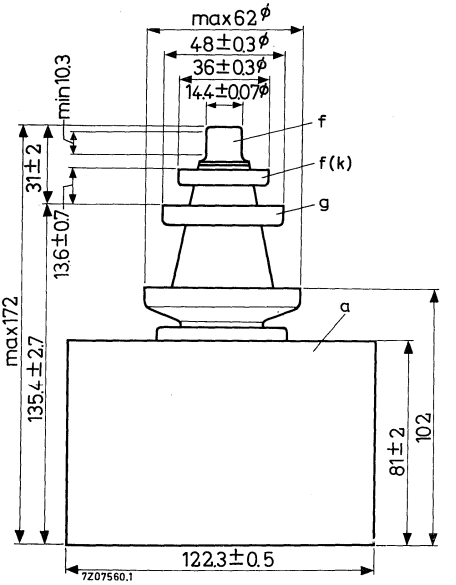
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical with anode up or down

Net weight: 3.0 kg





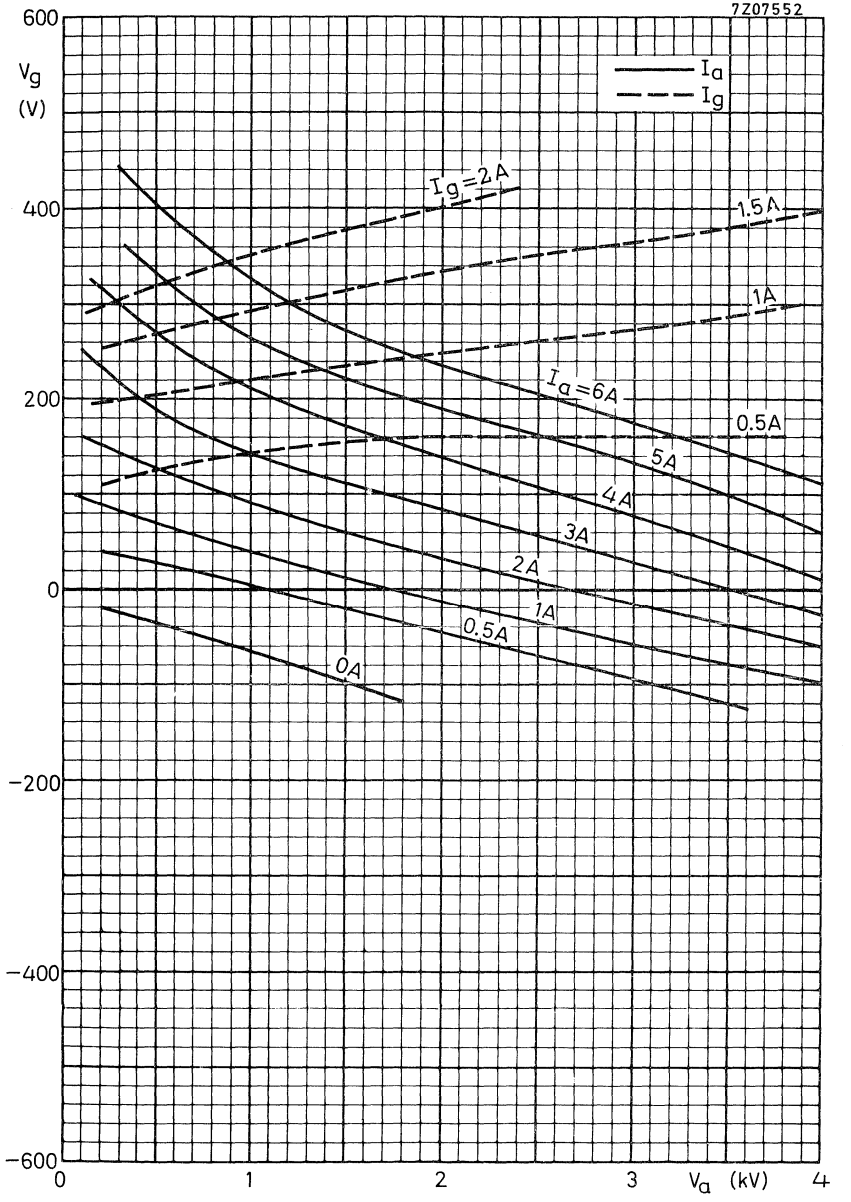
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

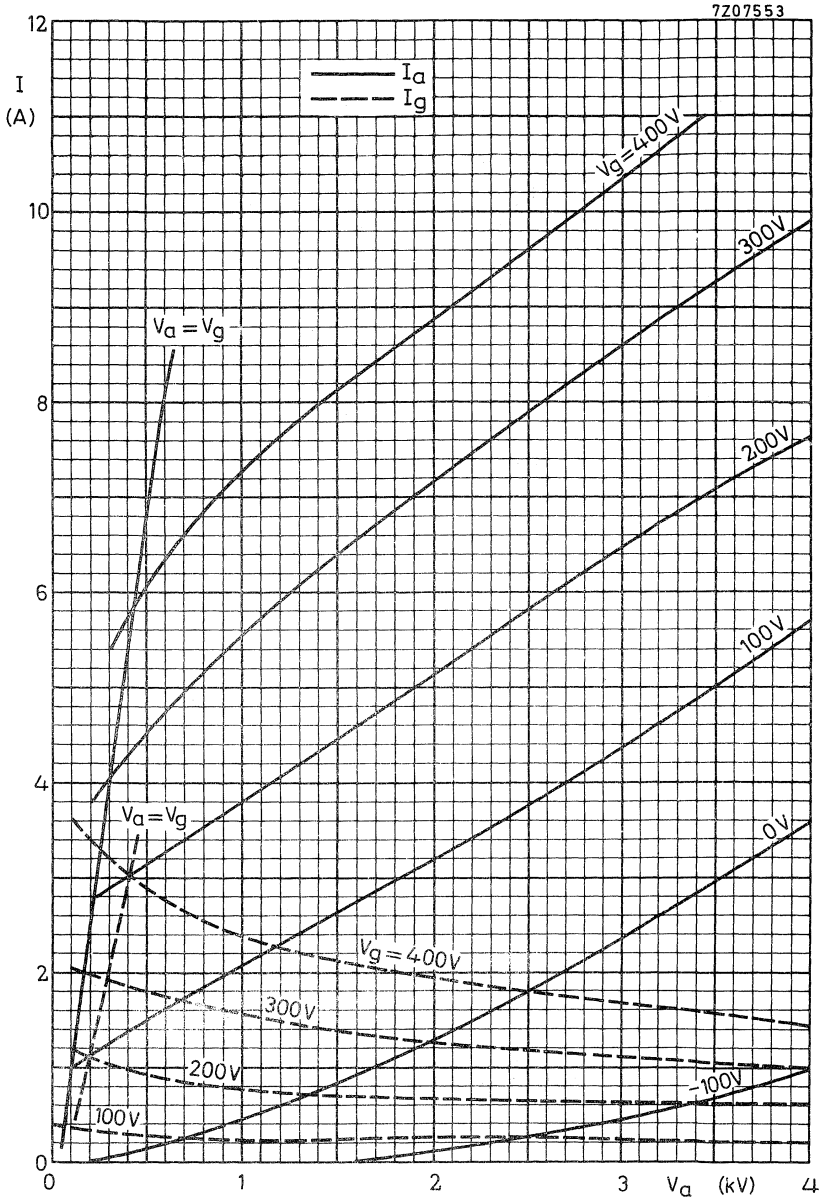
LIMITING VALUES (Absolute max. rating system)

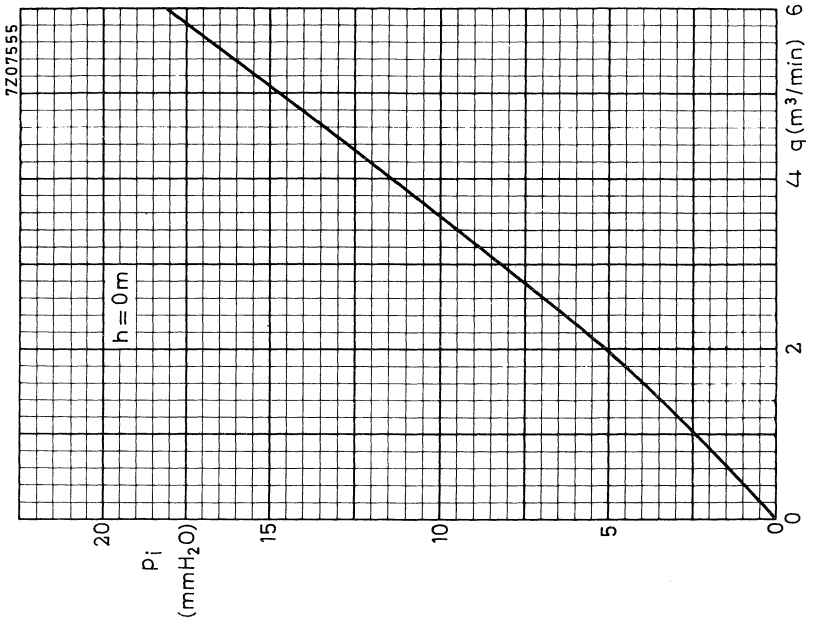
Frequency	f	up to	85	160	MHz
Anode voltage	V_a	max.	7.2	6.0	kV
Anode current	I_a	max.	1.1	1.1	A
Anode input power	W_{i_a}	max.	6.5	6.0	kW
Anode dissipation	W_a	max.	2.5	2.5	kW
Grid voltage	$-V_g$	max.	1.0	1.0	kV
Grid current, loaded	I_g	max.	280	280	mA
unloaded	I_g	max.	400	400	mA
Grid dissipation	W_g	max.	150	150	W
Grid circuit resistance	R_g	max.	20	20	kΩ
Cathode current	I_k	max.	1.4	1.4	A

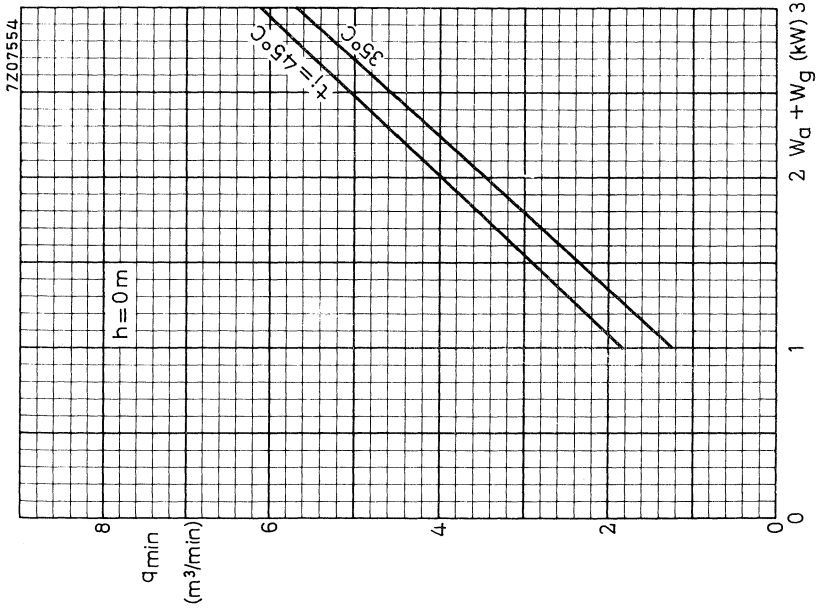
OPERATING CONDITIONS

Frequency	f	160	27.12	27.12	MHz
Filament voltage	V_f	6.0	6.3	6.3	V
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Anode input power	W_{i_a}	5.0	6.0	5.0	kW
Anode dissipation	W_a	1.03	1.0	0.93	kW
Anode output power	W_o	3.97	5.0	4.07	kW
Anode efficiency	η	79.4	83.3	81.4	%
Grid resistor	R_g	2.0	2.5	2.0	kΩ
Grid current, loaded	I_g	260	250	260	mA
Grid dissipation	W_g	80	90	80	W
Grid resistor dissipation	W_{R_g}	135	156	135	W
Oscillator output power	W_{osc}	3.75	4.75	3.85	kW
Oscillator efficiency	η_{osc}	75.0	79.1	77.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	17	17	17	%


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)


7Z07553
I
(A)
I_a
I_g
$V_g = 400V$
300V
200V
100V
0V
$V_a = V_g$
$V_g = 400V$
300V
200V
100V
-100V
V_a (kV)
0
1
2
3
4
0
2
4
6
8
10
12


7Z07555
h = 0 m
p_i (mmH_2O)
20
15
10
5
0
0
2
4
6
q (m³/min)


7Z07554
h = 0 m
q_{min} (m³/min)
8
6
4
2
0
t_i = 45°C
35°C
0
1
2
3
$W_a + W_g$ (kW)

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	27.12	160	MHz
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Oscillator output power	W_{osc}	3.85	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
O-ring	3322 026 82801

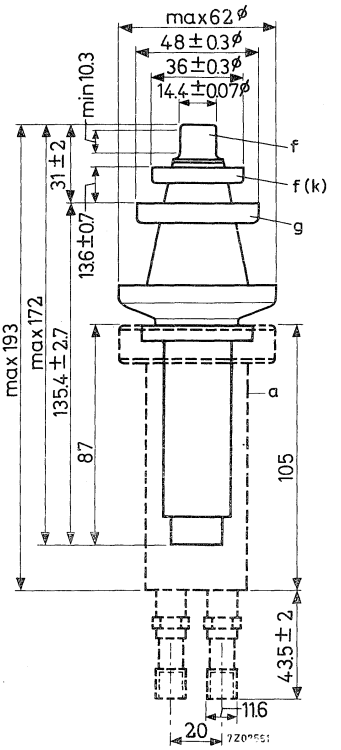
For further data and curves please refer to YD1150

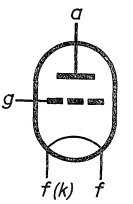
MECHANICAL DATA

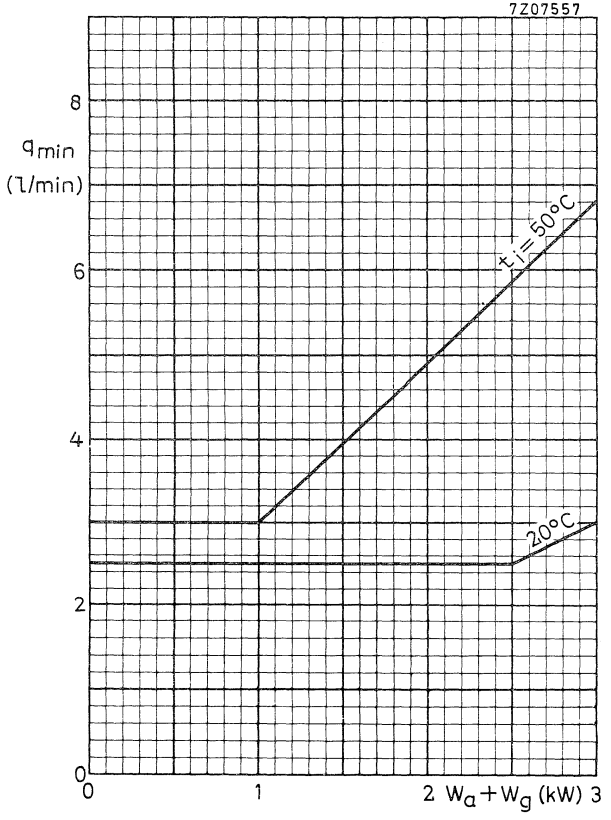
Dimensions in mm

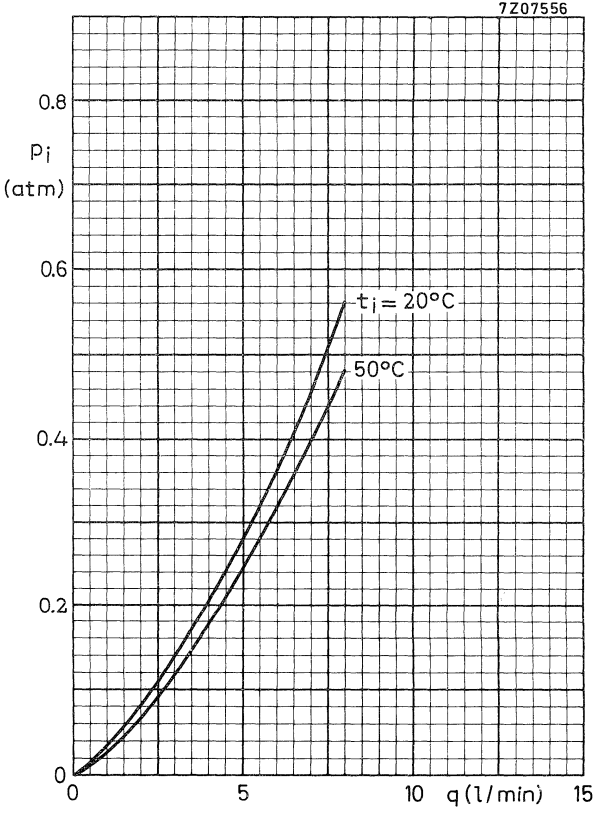
Mounting position: vertical anode down

Net weight: 0.65 kg






7Z07557
8
q_{min}
(l/min)
6
4
2
0
0
1
2 W_a+W_g (kW) 3
t_i=50°C
20°C


7Z07556
0.8
p_i
(atm)
0.6
0.4
0.2
0
0
5
10 q (l/min) 15
t_i = 20°C
50°C

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	27.12	160	MHz
Anode voltage	V_a	5.0	6.0	5.0	kV
Anode current	I_a	1.0	1.0	1.0	A
Oscillator output power	W_{osc}	3.85	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 (^oC)	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	4.1	0.27

ACCESSORIES

Filament connector	40688
Filament/cathode connector	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687

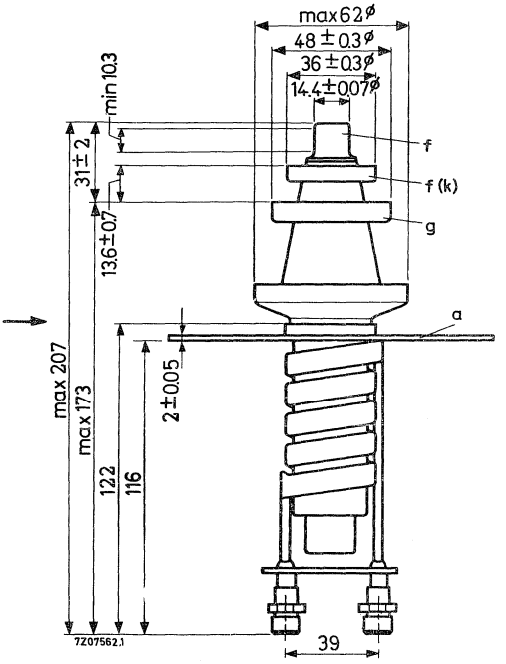
For further data and curves please refer to YD1150

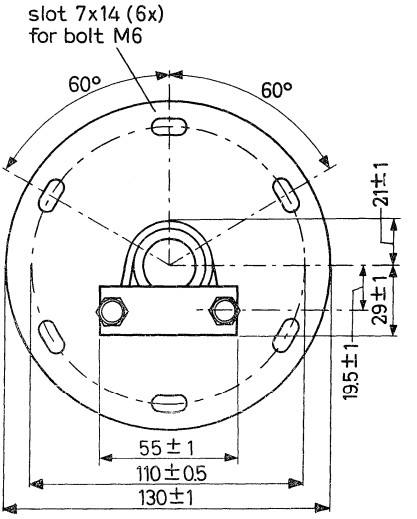
MECHANICAL DATA

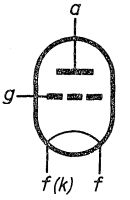
Dimensions in mm

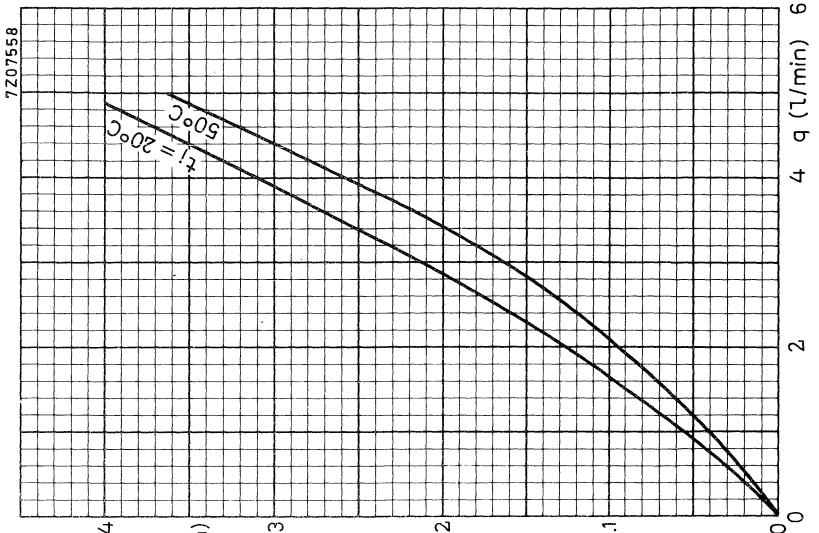
Mounting position: vertical anode down

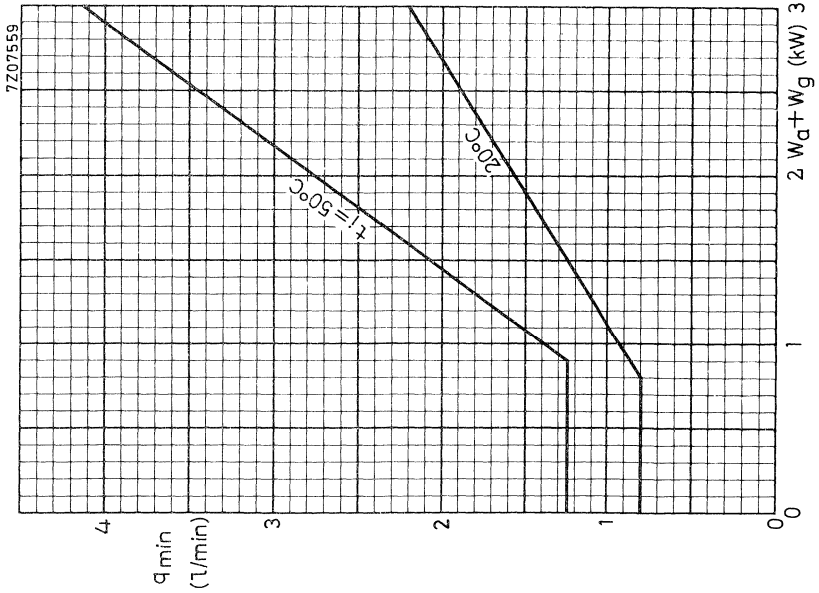
Net weight: 0.85 kg








7Z07558
0.4
0.3
0.2
0.1
0
p_i (atm)
t_i = 50°C
t_i = 20°C
0
2
4
6
q (l/min)


7Z07559
4
3
2
1
0
q_{min} (l/min)
t_i = 50°C
20°C
0
1
2
3
$2\,W_a + W_g$ (kW)

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	27.12	150	MHz
Anode voltage	V_a	6.5	6.0	5.0	kV
Anode current	I_a	1.8	1.6	2.0	A
Oscillator output power	W_{osc}	8.8	7.5	7.15	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	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max. 200	°C

AIR COOLING CHARACTERISTICS (See also cooling curves)

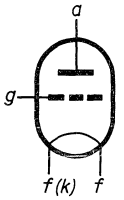
W_a+W_g (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)
3	0	35	3.6	9
3	0	45	4.2	11

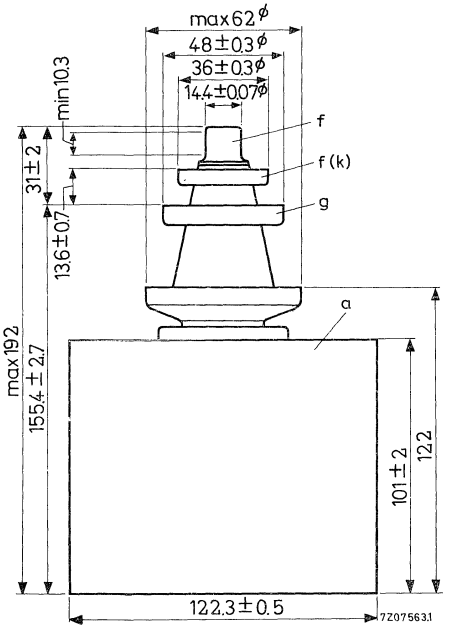
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical, with anode up or down

Net weight: 3.9 kg





ACCESSORIES

Filament connector	40688	
Filament/cathode connector (f < 30 MHz)	40689	
Grid connector (f < 30 MHz)	40686	
Grid connector (f > 30 MHz)	40687	
Insulating pedestal	40630	net weight 2.1 kg

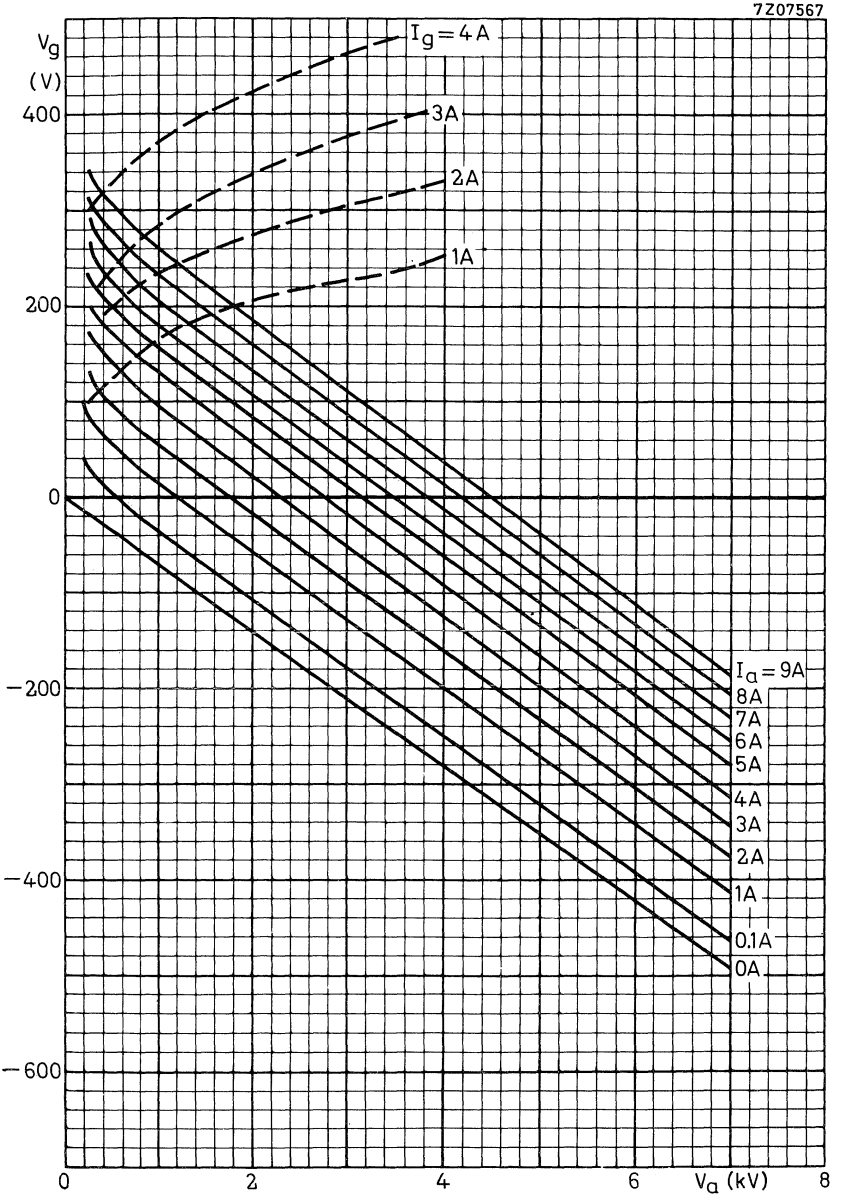
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

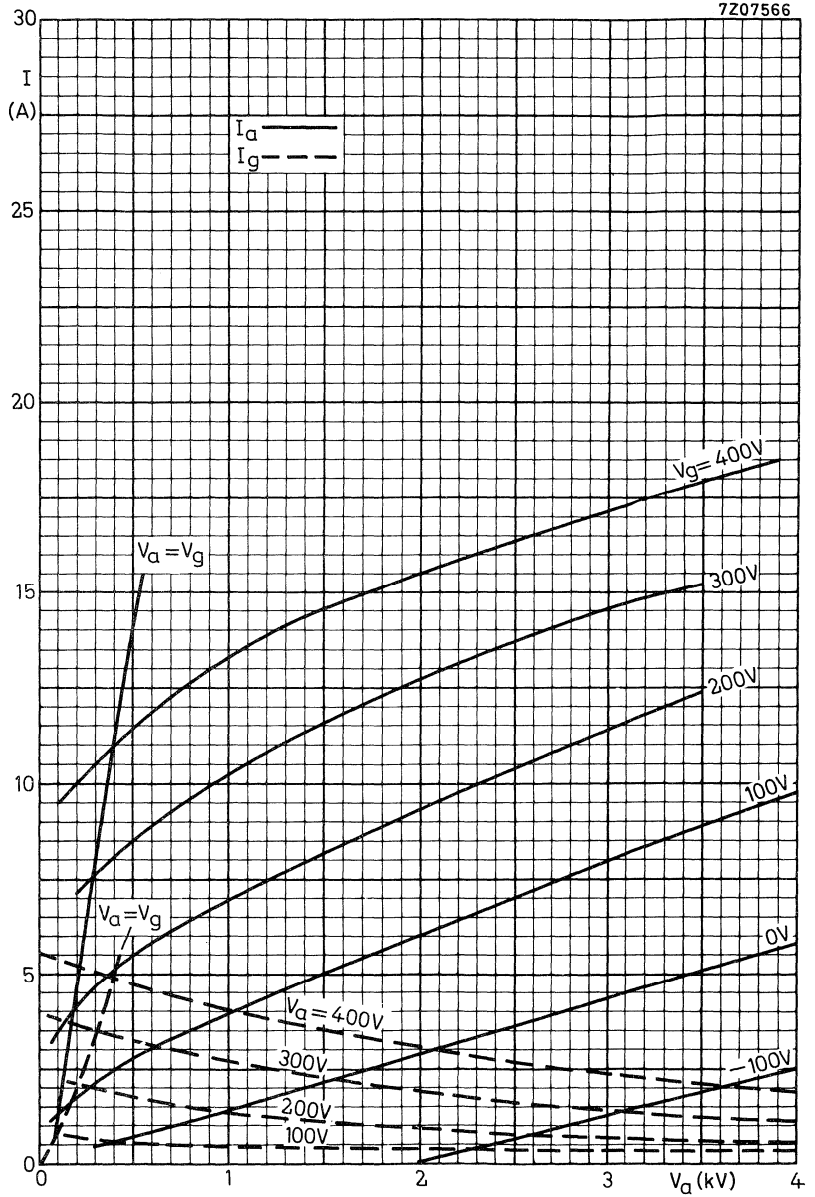
LIMITING VALUES (Absolute max. rating system)

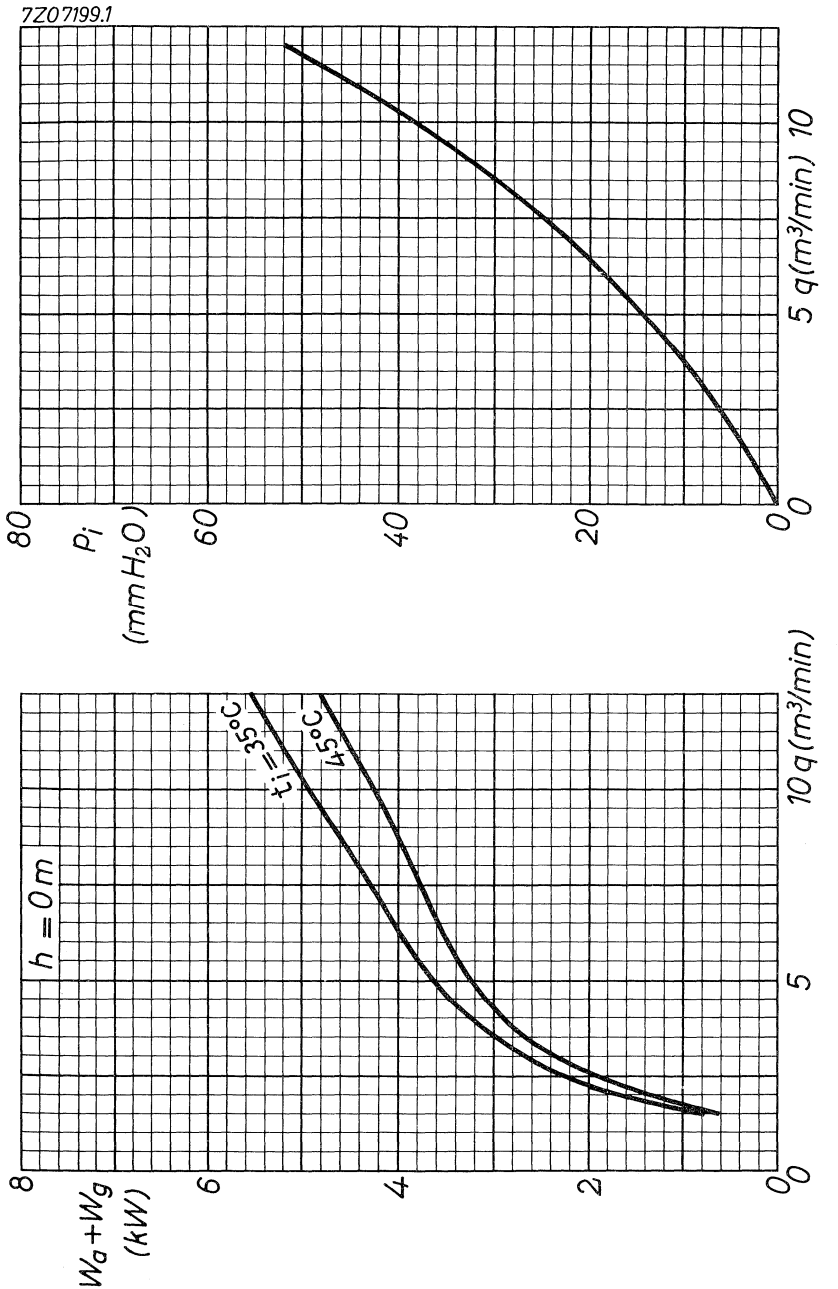
Frequency	f	up to	85	150	MHz
Anode voltage	V_a	max.	7.2	6.0	kV
Anode current	I_a	max.	2.2	2.2	A
Anode input power	W_{i_a}	max.	12.5	11.0	kW
Anode dissipation	W_a	max.	5.0	5.0	kW
Grid voltage	$-V_g$	max.	1.0	1.0	kV
Grid current, loaded	I_g	max.	550	550	mA
unloaded	I_g	max.	750	750	mA
Grid dissipation	W_g	max.	250	250	W
Grid circuit resistance	R_g	max.	20	20	kΩ
Cathode current	I_k	max.	2.8	2.8	A

OPERATING CONDITIONS

Frequency	f	150	27.12	27.12	MHz
Filament voltage	V_f	5.8	6.3	6.3	V
Anode voltage	V_a	5.0	6.5	6.0	kV
Anode current	I_a	2.0	1.8	1.6	A
Anode input power	W_{i_a}	10.0	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
Anode efficiency	η	75.5	78.6	82.3	%
Grid resistor	R_g	1.0	1.6	1.3	kΩ
Grid current, loaded	I_g	480	430	480	mA
Grid dissipation	W_g	100	110	120	W
Grid resistor dissipation	W_{R_g}	230	296	300	W
Oscillator output power	W_{osc}	7.15	8.8	7.5	kW
Oscillator efficiency	η_{osc}	71.5	75.2	78.1	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	15	16	15	%


7Z07567
V_g (V)
400
200
0
−200
−400
−600
I_g = 4A
3A
2A
1A
I_a = 9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
0A
0
2
4
6
8
V_a (kV)


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


7Z07199.1
80
60
40
20
0
p_i
$(mm\,H_2O)$
0
5
10
$q\,(m^3/min)$
8
6
4
2
0
W_a+W_g
(kW)
h = 0 m
t: 35°C
45°C
0
5
10
$q\,(m^3/min)$

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	27.12	150	MHz
Anode voltage	V_a	6.5	6.0	5.0	kV
Anode current	I_a	1.8	1.6	2.0	A
Oscillator output power	W_{osc}	8.8	7.5	7.15	kW

COOLING CHARACTERISTICS (See also cooling curves)

Anode	Water cooled using jacket K726
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 (f < 30 MHz)	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687
Water jacket	K726 net weight 0.73 kg
O-ring	3322 026 82801

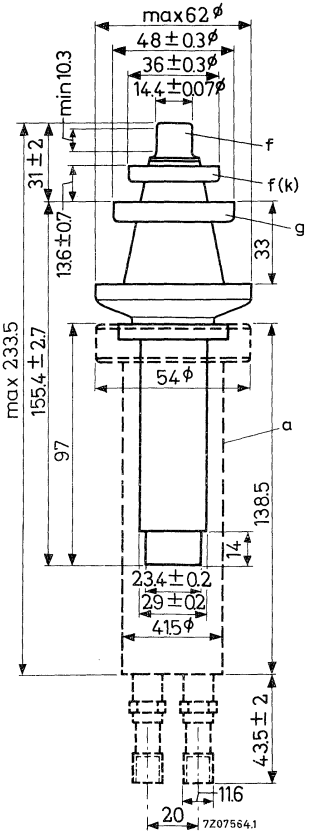
For further data and curves please refer to YD1160

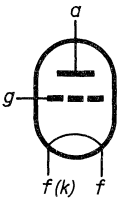
MECHANICAL DATA

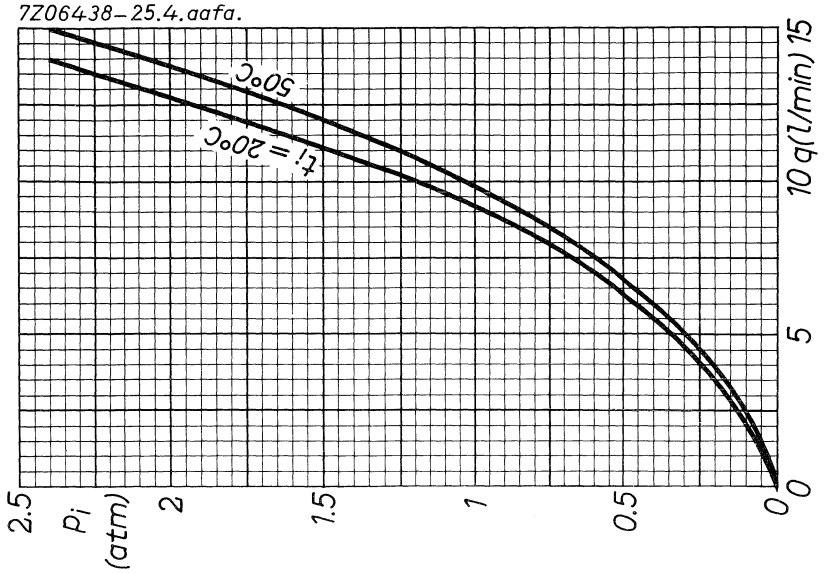
Dimensions in mm

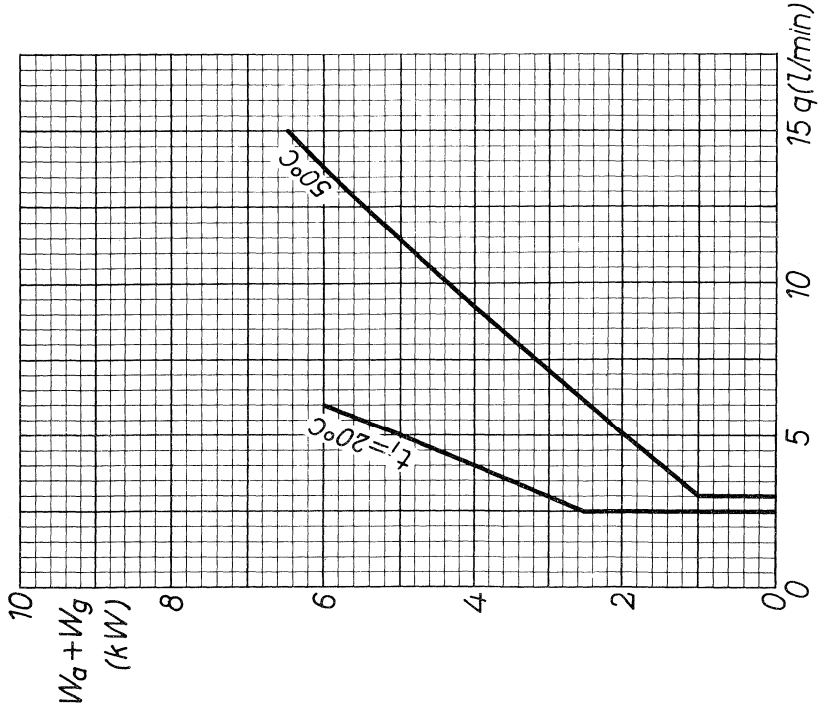
Mounting position: vertical, anode down

Net weight: 0.66 kg






7Z06438-25.4.aafa.
50°C
t_i = 20°C
2.5
p_i (atm)
2
1.5
1
0.5
0
10 q(l/min) 15
5
0


50°C
t_i = 20°C
10
$W_a + W_g$ (kW)
8
6
4
2
0
15 q(l/min)
10
5
0

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	27.12	150	MHz
Anode voltage	V_a	6.5	6.0	5.0	kV
Anode current	I_a	1.8	1.6	2.0	A
Oscillator output power	W_{osc}	8.8	7.5	7.15	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 (f < 30 MHz)	40689
Grid connector (f < 30 MHz)	40686
Grid connector (f > 30 MHz)	40687

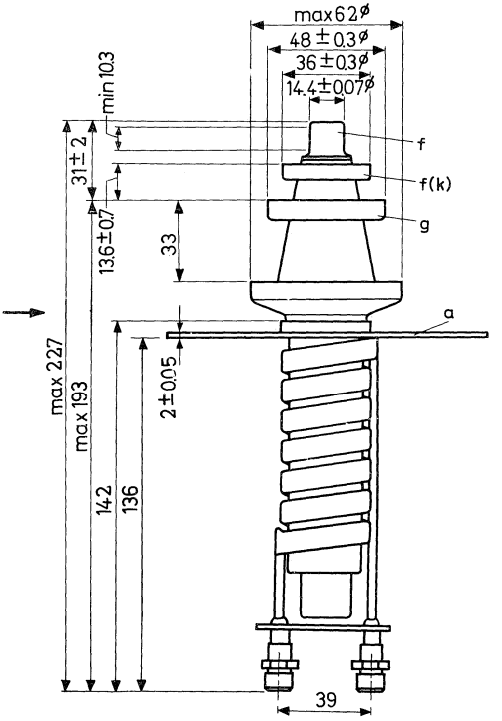
For further data and curves please refer to YD1160

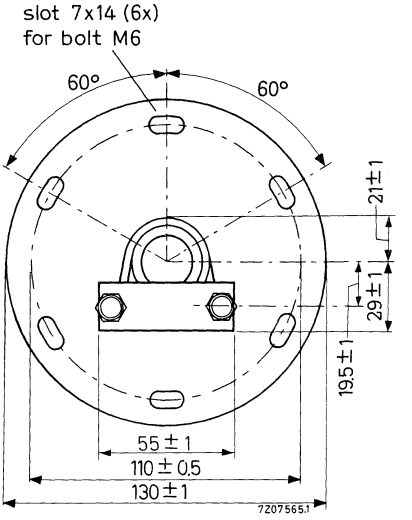
MECHANICAL DATA

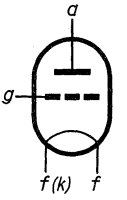
Dimensions in mm

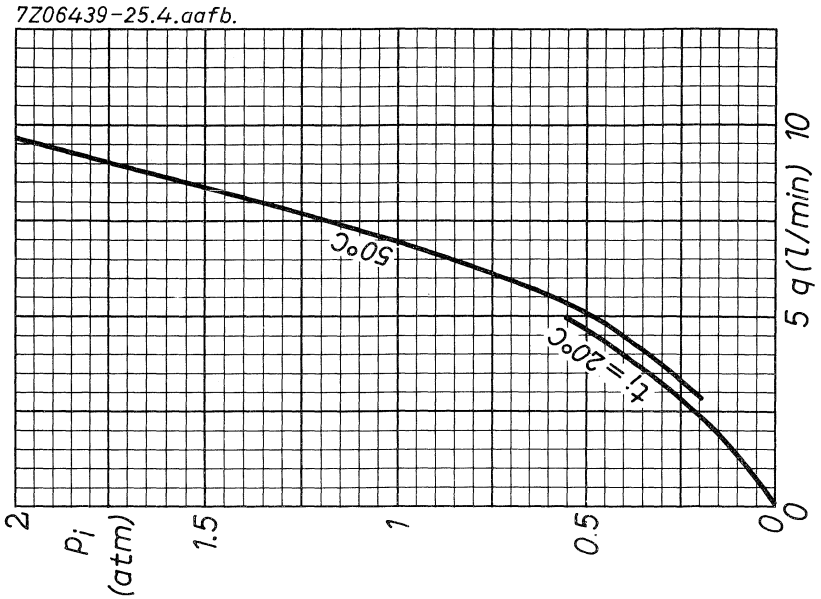
Mounting position: vertical, anode up or down

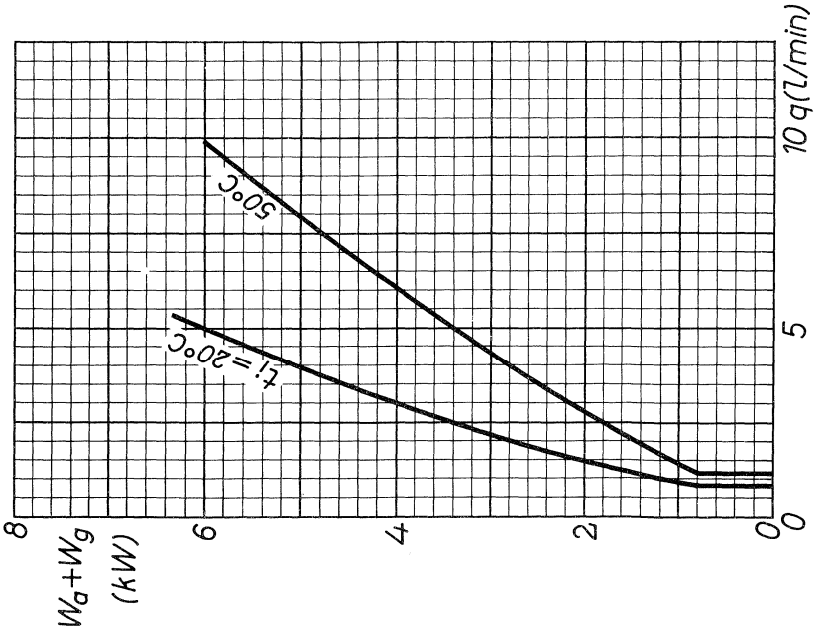
Net weight: 1.03 kg








7Z06439-25.4.aafb.
50°C
t_i = 20°C
p_i (atm)
2
1.5
1
0.5
0
5 q (l/min) 10
0


50°C
t_i = 20°C
W_a+W_g (kW)
8
6
4
2
0
10 q (l/min)
5
0

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	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 quotient 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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. air inlet temperature	t_i	max.	45	°C

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)	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	5.5	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

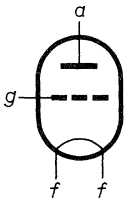
At the lower values of anode dissipation and at the highest operating frequencies additional cooling of the seals is required.

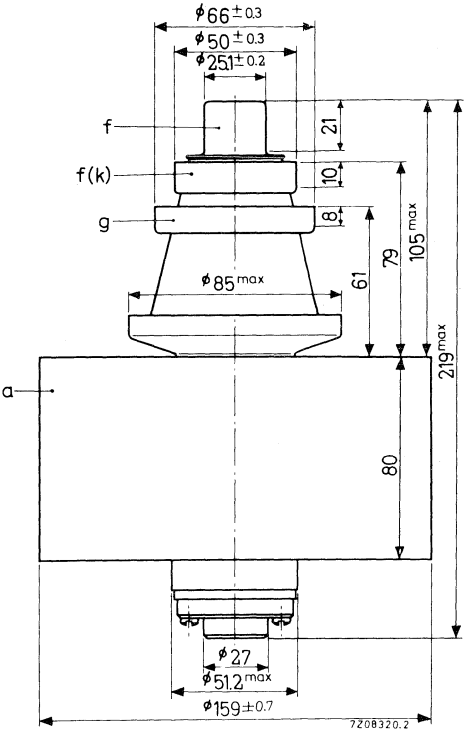
Direction of air flow: arbitrary

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

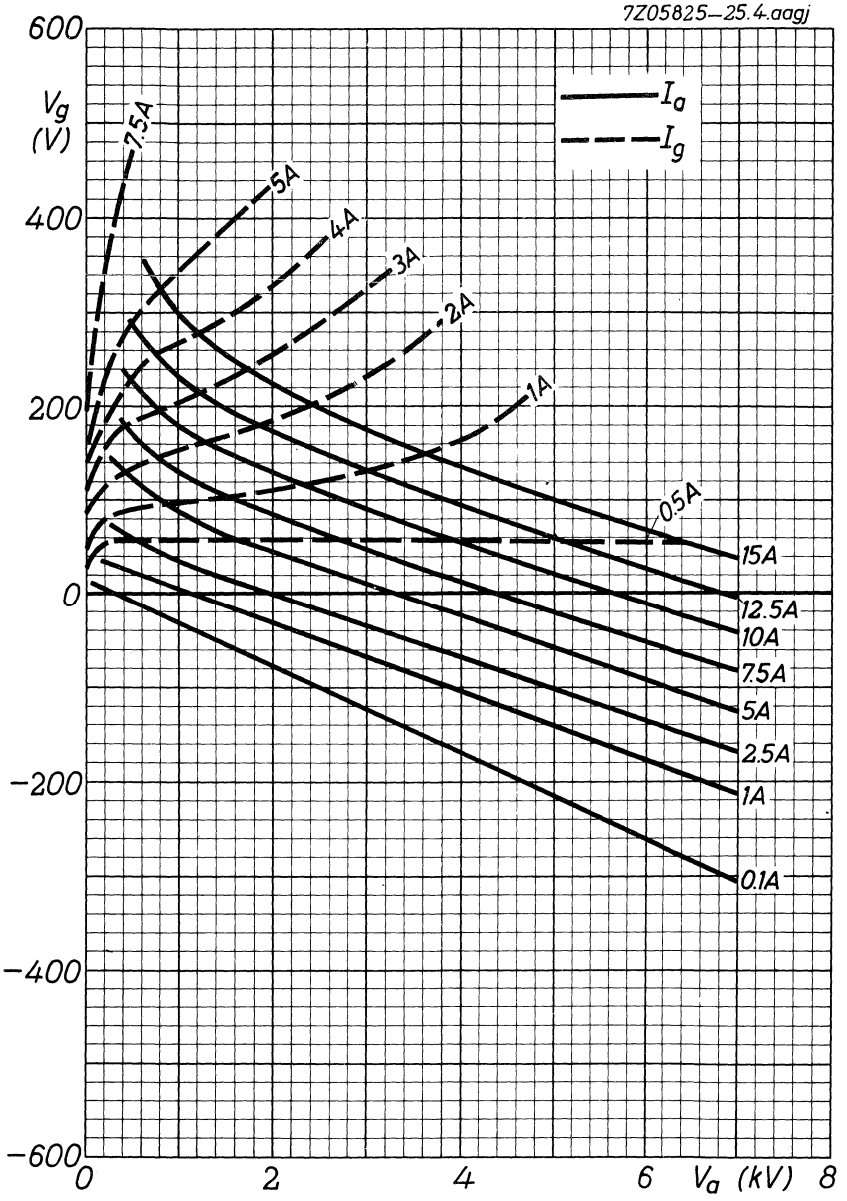
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

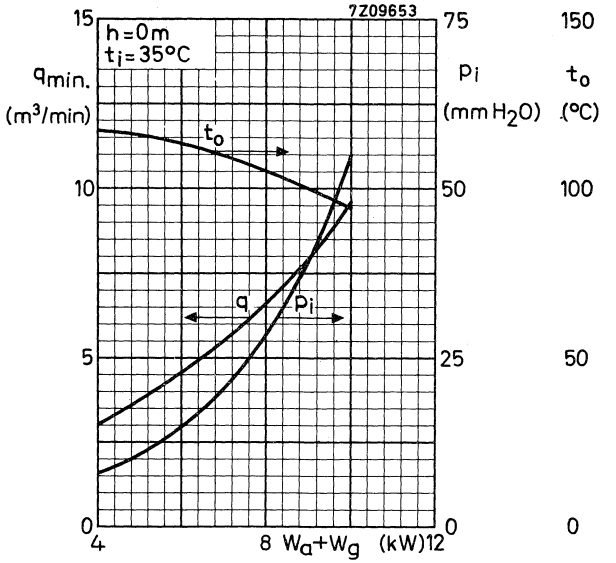
LIMITING VALUES (Absolute max. rating system)

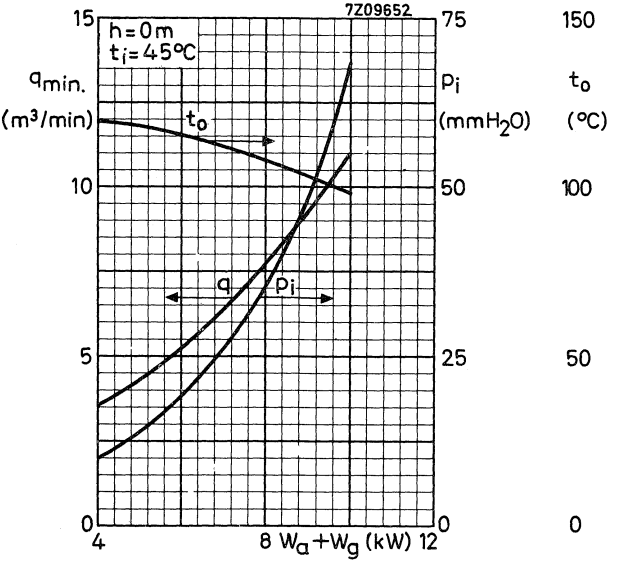
Frequency	f	up to	120	MHz
Anode voltage	V_a	max.	7.2	kV
Anode current	I_a	max.	4.0	A
Anode input power	W_{i_a}	max.	24	kW
Anode dissipation	W_a	max.	10	kW
Grid voltage	V_g	max.	1.5	kV
Grid current, loaded	I_g	max.	1.0	A
unloaded	I_g	max.	1.5	A
Grid dissipation	W_g	max.	350	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	5.0	A

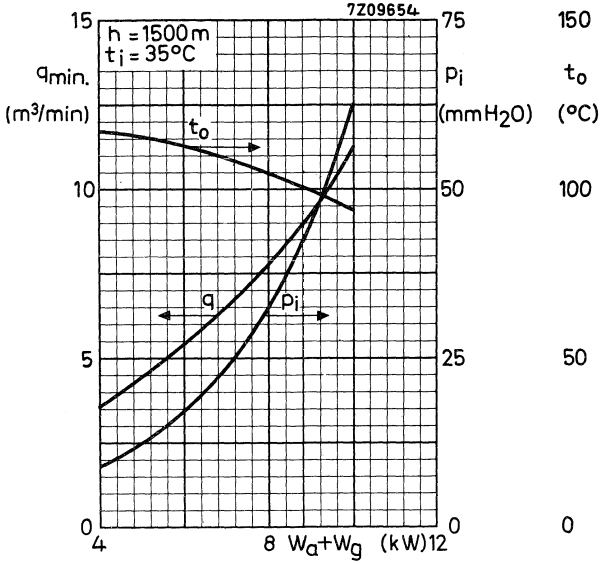
OPERATING CONDITIONS

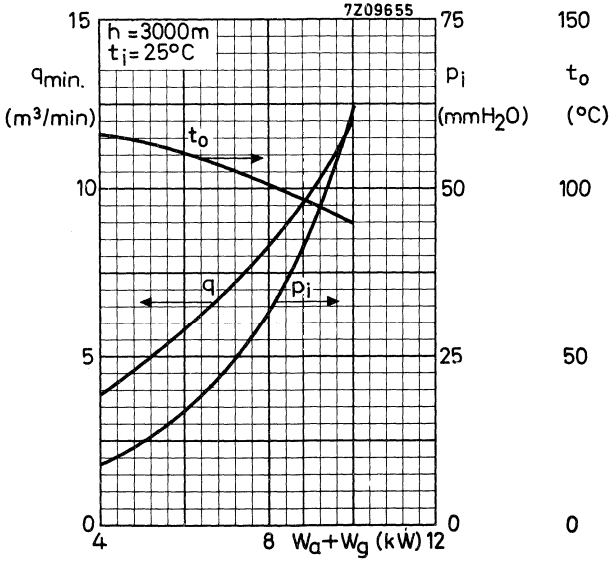
Frequency	f	120	MHz
Filament voltage	V_f	see under "HEATING"	V
Anode voltage	V_a	6.0	kV
Anode current	I_a	3.4	A
Anode input power	W_{i_a}	20.4	kW
Anode dissipation	W_a	4.3	kW
Anode output power	W_o	16.1	kW
Anode efficiency	η	78.9	%
Grid resistor	R_g	500	Ω
Grid current, loaded	I_g	920	mA
Grid dissipation	W_g	280	W
Grid resistor dissipation	W_{R_g}	423	W
Oscillator output power	W_{osc}	15.4	kW
Oscillator efficiency	N_{osc}	75.5	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	15.5	%


7Z05825—25.4.aagj
600
400
200
0
−200
−400
−600
V_g (V)
I_a
I_g
7.5A
5A
4A
3A
2A
1A
0.5A
15A
12.5A
10A
7.5A
5A
2.5A
1A
0.1A
0
2
4
6
V_a (kV)
8


7Z09653
h=0m
t_i=35°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
($mm H_2O$)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8
12
W_a+W_g (kW)


7Z09652
h=0m
t_i=45°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
($mm H_2O$)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8
12
W_a+W_g (kW)


7Z09654
h = 1500 m
t_i = 35°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
(mmH_2O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8
12
W_a+W_g (kW)


7Z09655
h = 3000 m
t_i = 25°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
(mmH_2O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8
12
W_a+W_g (kW)

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	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_{fp}	max. 800	A
Cold filament resistance	R_{fo}	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 quotient 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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

WATER COOLING CHARACTERISTICS (See also cooling curves)

W_a+W_g (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)	t_o (°C)
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

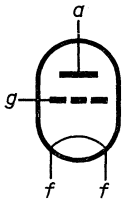
For water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

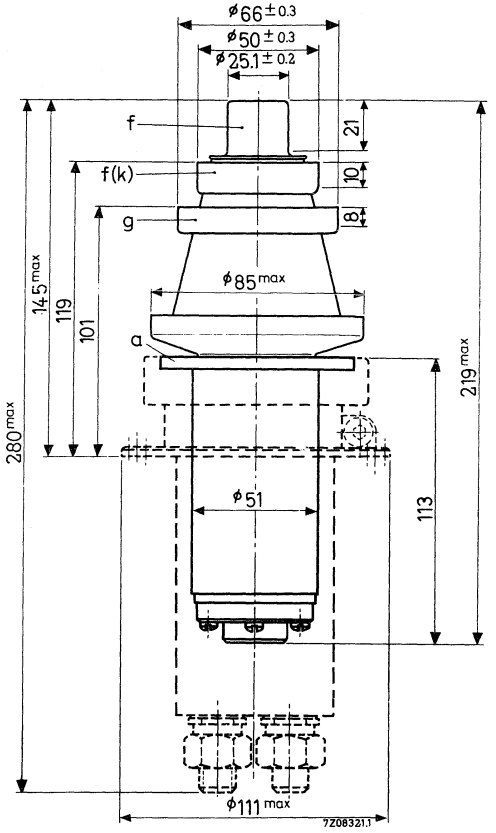
At frequencies higher than 4 MHz air cooling of the seals is required.

MECHANICAL DATA

Net weight: approx. 1.5 kg

Dimensions in mm



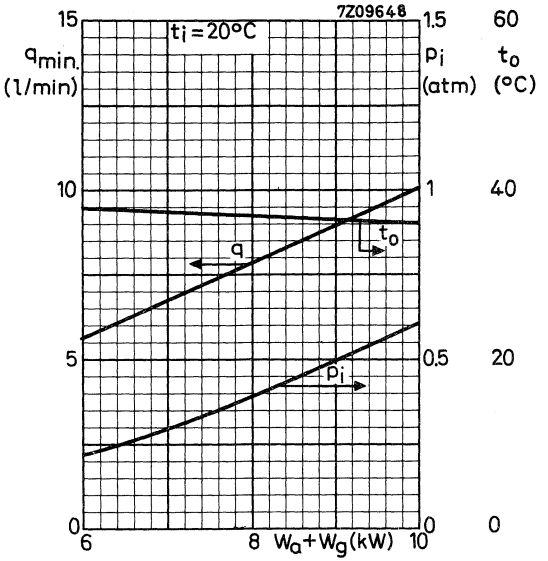


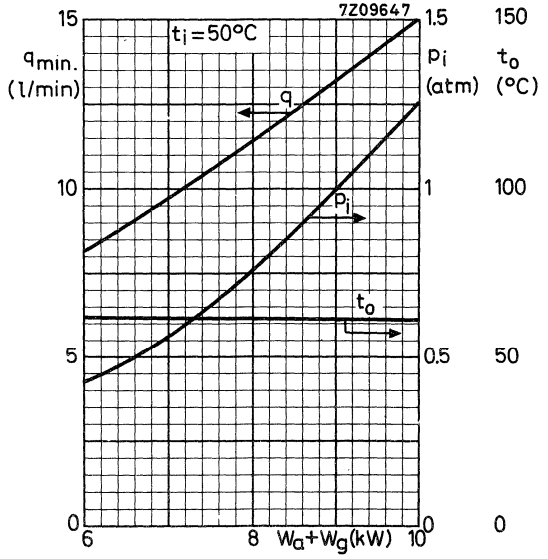
Mounting position: vertical with anode down

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
→ O-ring		2622 080 31776			

For further data and curves please refer to type YD1170


7Z09648
$t_i = 20°C$
$q_{min.}$ (l/min)
p_i (atm)
t_o (°C)
15
10
5
0
1.5
1
0.5
0
60
40
20
0
q
p_i
t_o
6
8
10
$W_a + W_g$ (kW)


7Z09647
$t_i = 50°C$
$q_{min.}$ (l/min)
p_i (atm)
t_o (°C)
15
10
5
0
1.5
1
0.5
0
150
100
50
0
q
p_i
t_o
6
8
10
$W_a + W_g$ (kW)

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	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 quotient 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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

WATER COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (ℓ/min)	p_i (atm)	t_o (°C)
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

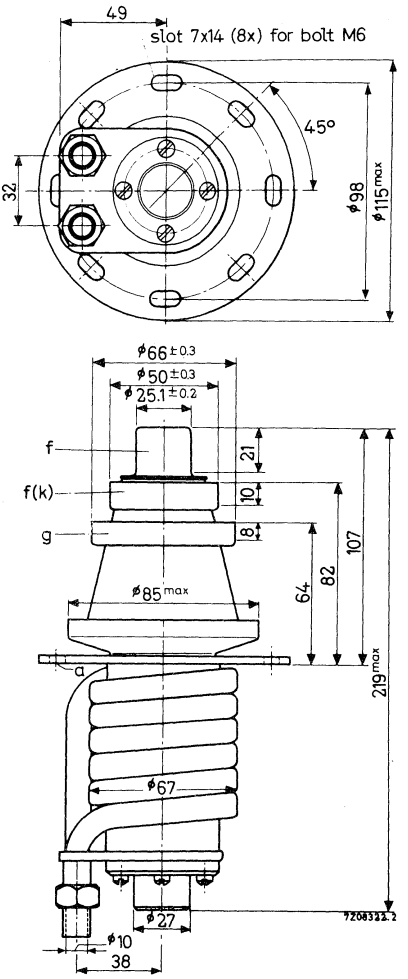
At water inlet temperatures between 20 °C and 50 °C the required quantity of water can be found by linear interpolation.

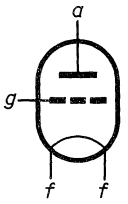
At frequencies higher than 4 MHz air cooling of the seals is required.

MECHANICAL DATA

Dimensions in mm

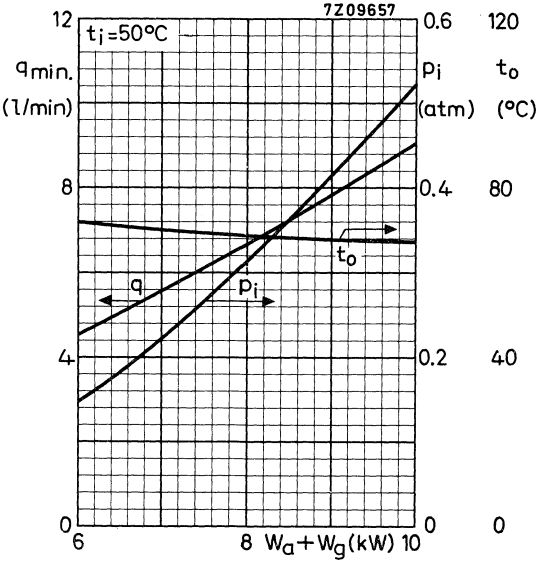
Net weight approx. 2 kg

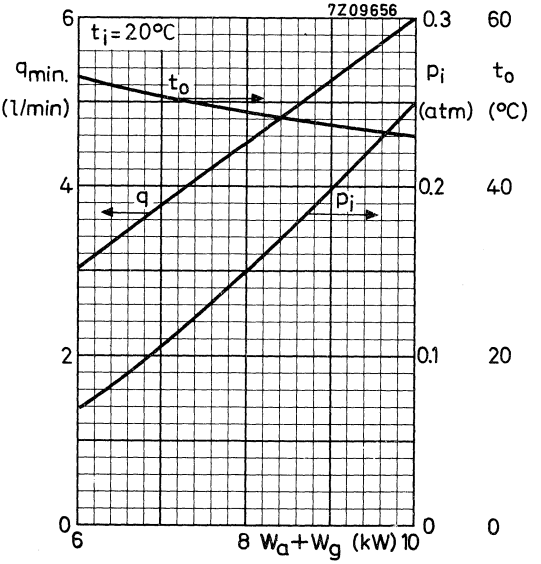




Mounting position: vertical with anode up or down

For further data and curves please refer to type YD1170


7Z09657
t_i=50°C
$q_{min.}$ (l/min)
p_i (atm)
t_o (°C)
12
8
4
0
0.6
0.4
0.2
0
120
80
40
0
q
p_i
t_o
6
8
10
W_a+W_g (kW)


7Z09656
t_i=20°C
$q_{min.}$ (l/min)
p_i (atm)
t_o (°C)
6
4
2
0
0.3
0.2
0.1
0
60
40
20
0
t_o
q
p_i
6
8
10
W_a+W_g (kW)

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	up to 50	MHz
Anode voltage	V_a	10	kV
Anode current	I_a	1.75	A
Oscillator output power	W_{osc}	13.22	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_{fp}	max. 400	A	
Cold filament resistance	R_{fo}	0.01	Ω	

CAPACITANCES

Anode to filament	C_{af}	0.4	pF
Grid 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	

TEMPERATURE LIMITS (Absolute limits)

Envelope temperature	t_{env}	= max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	= max.	200	°C
Air inlet temperature	t_i	= max.	45	°C

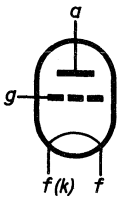
COOLING CHARACTERISTICS (See also cooling curves)

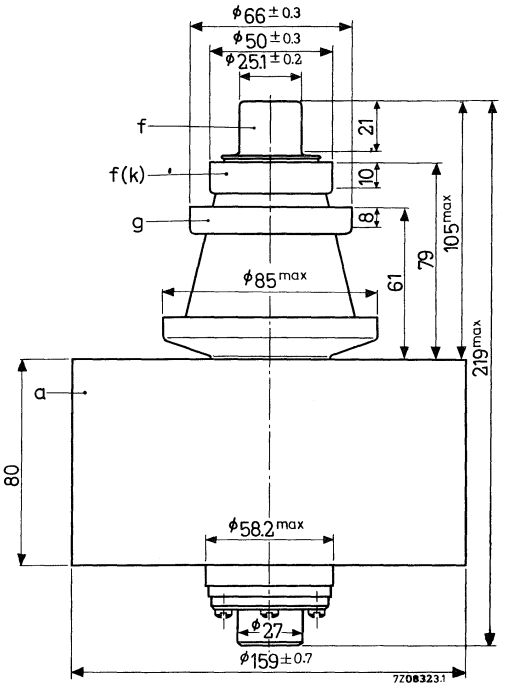
W_a+W_g (kW)	h (m)	t_i (°C)	q_{min} (m^3/min)	p_i (mm H_2O)	t_o (°C)
10	0	35	9.5	55	94
8	0	35	6.5	28	105
6	0	35	4.5	15	113
4	0	35	3.0	8	117
10	0	45	11	69	98
8	0	45	7.6	35	108
6	0	45	5.2	19	115
4	0	45	3.5	10	119
10	1500	35	11.4	63	94
8	1500	35	7.8	32	105
6	1500	35	5.5	17	113
4	1500	35	3.6	9	117
10	3000	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

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

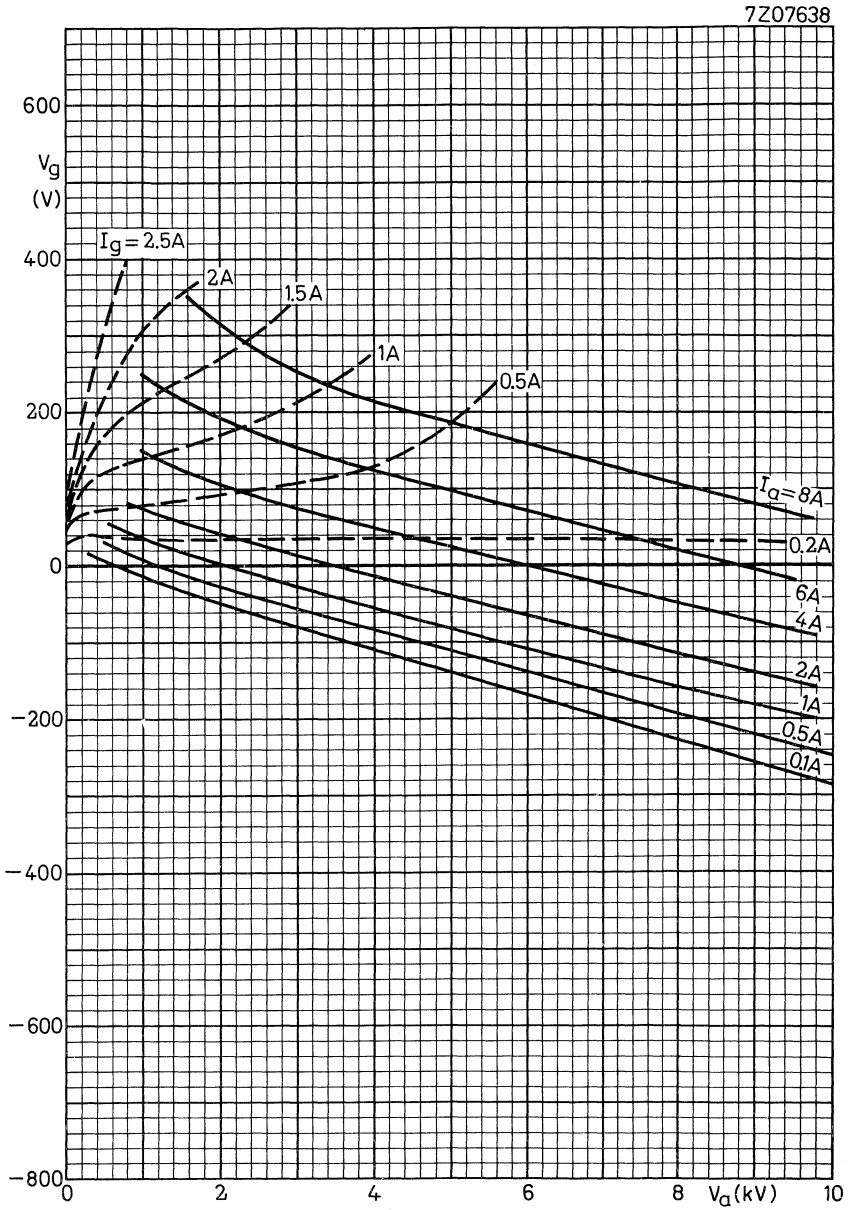
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

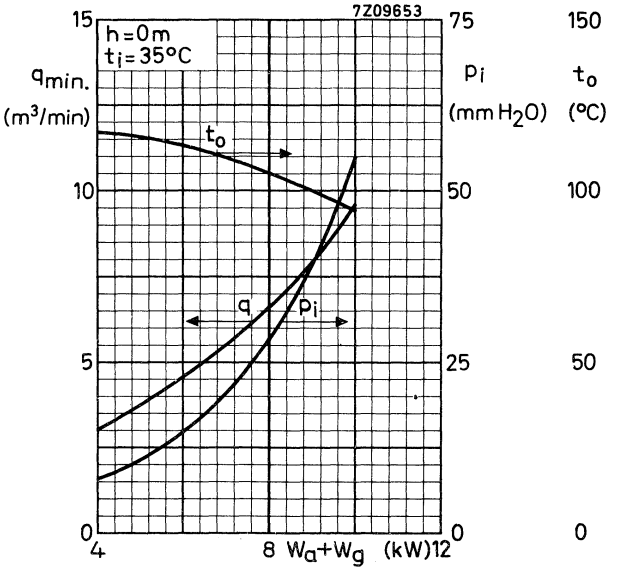
LIMITING VALUES (Absolute max. rating system)

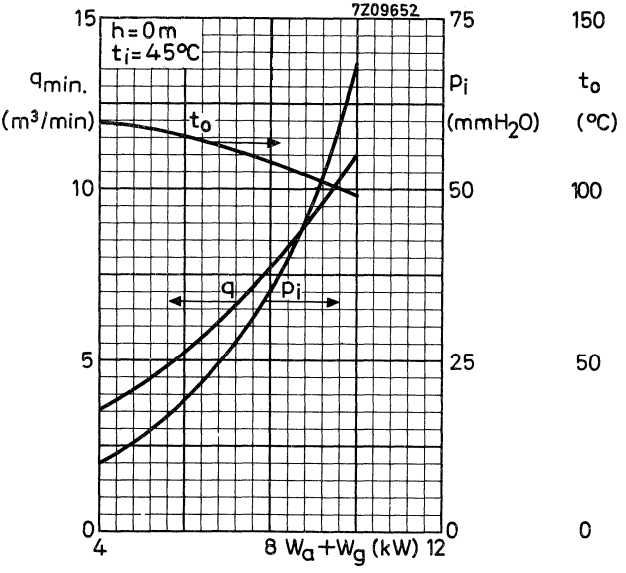
Frequency	f	up to	50	MHz
Anode voltage	V_a	max.	12	kV
Anode current	I_a	max.	2.0	A
Anode input power	W_{i_a}	max.	20	kW
Anode dissipation	W_a	max.	10	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, loaded	I_g	max.	0.6	A
unloaded	I_g	max.	0.8	A
Grid dissipation	W_g	max.	250	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	2.5	A

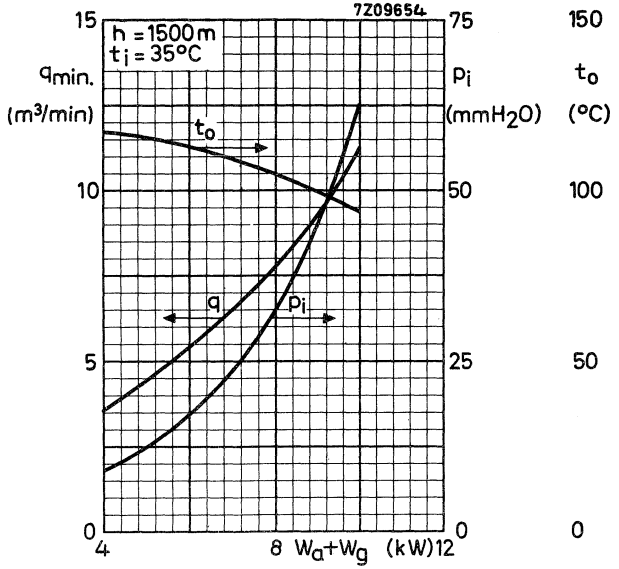
OPERATING CONDITIONS

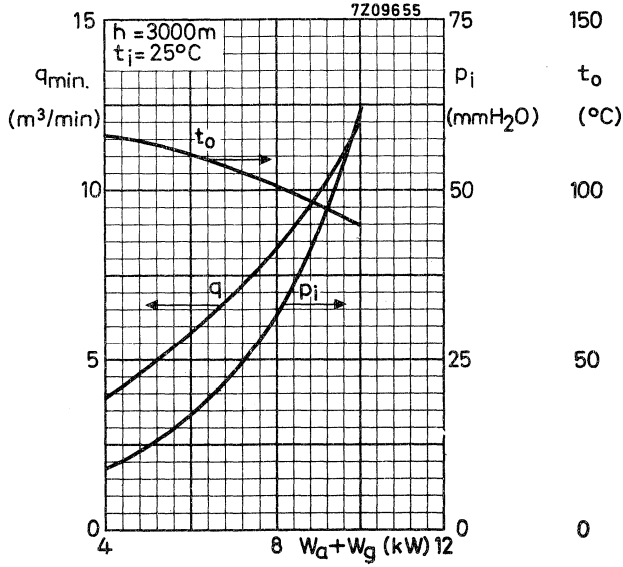
Frequency	f	50	MHz
Anode voltage	V_a	10.0	kV
Anode current	I_a	1.75	A
Anode input power	W_{i_a}	17.5	kW
Anode dissipation	W_a	3.8	kW
Anode output power	W_o	13.7	kW
Anode efficiency	η	78.3	%
Grid resistor	R_g	1.5	kΩ
Grid current, loaded	I_g	450	mA
Grid dissipation	W_g	180	W
Grid resistor dissipation	W_{R_g}	304	W
Oscillator output power	W_{osc}	13.22	kW
Oscillator efficiency	η_{osc}	75.6	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	12.0	%


7Z07638
600
V_g
(V)
400
200
0
−200
−400
−600
−800
$I_g = 2.5A$
2A
1.5A
1A
0.5A
$I_a = 8A$
6A
4A
2A
1A
0.5A
0.1A
0.2A
0
2
4
6
8
V_a(kV)
10


7Z09653
h=0m
t_i=35°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
(mm H_2O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8
W_a+W_g (kW)
12


7Z09652
h=0m
t_i=45°C
$q_{min.}$
(m^3/min)
t_o
q
p_i
p_i
(mm H_2O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
4
8
W_a+W_g (kW)
12


7Z09654
h = 1500m
t_i = 35°C
$q_{min.}$
(m^3/min)
t_o
p_i
(mmH_2O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
q
p_i
4
8
W_a+W_g (kW)
12


7Z09655
h = 3000m
t_i = 25°C
$q_{min.}$
(m^3/min)
t_o
p_i
(mmH_2O)
t_o
(°C)
15
10
5
0
75
50
25
0
150
100
50
0
q
p_i
4
8
W_a+W_g (kW)
12

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	up to 100	MHz
Anode voltage	V_a	7.5	kV
Anode current	I_a	5.4	A
Oscillator output power	W_{osc}	31.6	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

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 quotient 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}	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	

TEMPERATURE LIMITS (Absolute limits)

Absolute max. envelope temperature	t_{env}	max. 240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max. 200	°C
Absolute max. air inlet temperature	t_i	max. 45	°C

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_2 O)	t_o (°C)
15	0	35	15	85	92
10	0	35	9.3	32	99
8	0	35	7	20	104
15	0	45	17.3	106	98
10	0	45	10.7	40	104
8	0	45	8,1	25	108
15	1500	35	18	97	93
10	1500	35	11,2	46	100
8	1500	35	8.4	23	104
15	3000	25	19	95	90
10	3000	25	11.8	45	95
8	3000	25	8.9	23	99

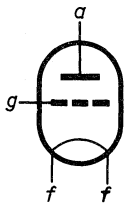
No additional cooling of the seals is required at frequencies < 4 MHz.

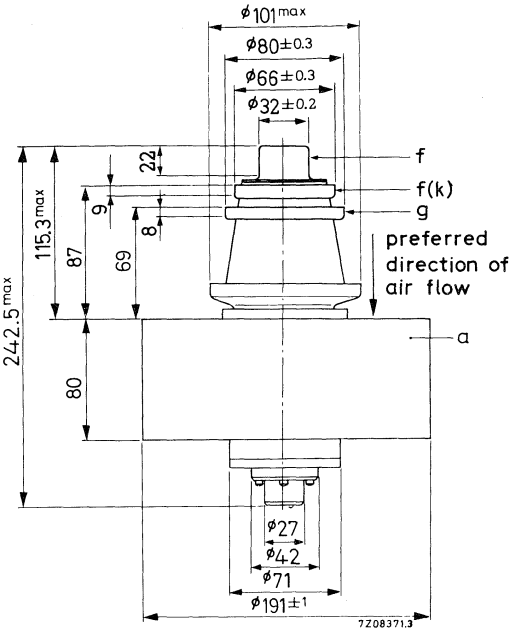
Preferred direction of air flow, especially at the higher operating frequencies: see outline drawing

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

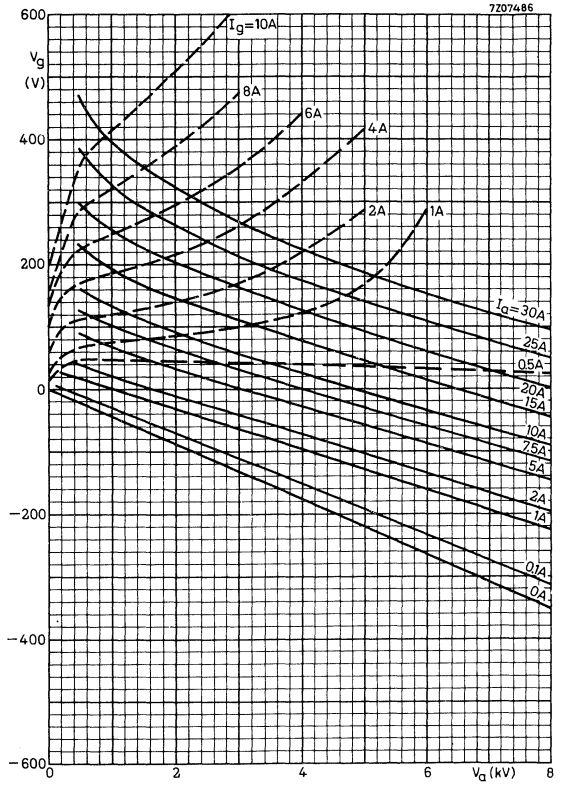
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

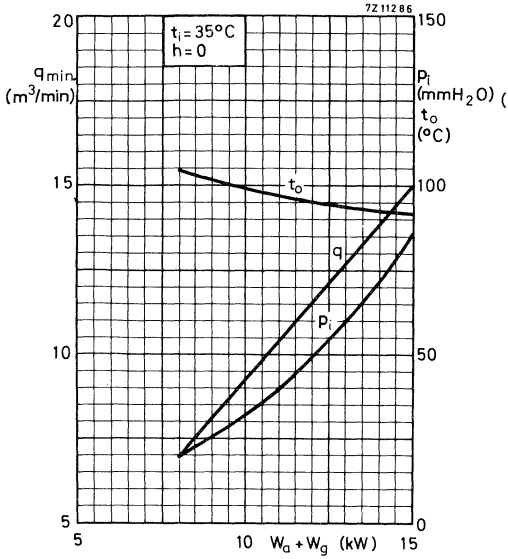
LIMITING VALUES (Absolute max. rating system)

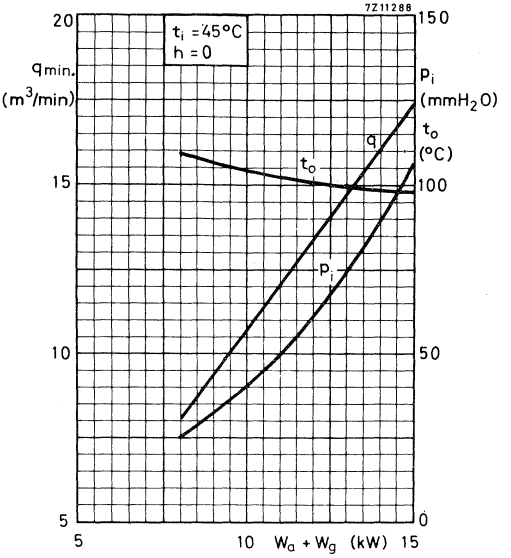
Frequency	f	up to	100	MHz
Anode voltage	V_a	max.	9.0	kV
Anode current	I_a	max.	6.0	A
Anode input power	W_{i_a}	max.	45	kW
Anode dissipation	W_a	max.	15	kW
Grid voltage	$-V_g$	max.	1.25	kV
Grid current, loaded	I_g	max.	1.6	A
unloaded	I_g	max.	2.4	A
Grid dissipation	W_g	max.	500	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	7.5	A

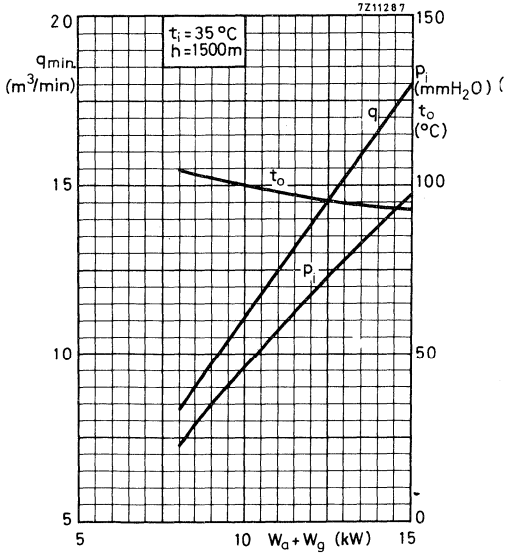
OPERATING CONDITIONS

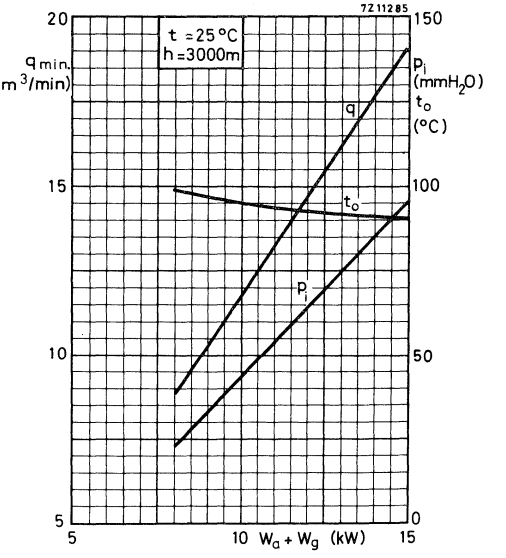
Frequency	f	90	MHz
Filament voltage	V_f	see under "HEATING"	V
Anode voltage	V_a	7.5	kV
Anode current	I_a	5.4	A
Anode input power	W_{i_a}	40.5	kW
Anode dissipation	W_a	7.5	kW
Anode output power	W_o	33.0	kW
Anode efficiency	η	81.5	%
Grid resistor	R_g	450	Ω
Grid currrent, loaded	I_g	1.45	A
Grid dissipation	W_g	450	W
Grid resistor dissipation	W_{R_g}	946	W
Oscillator output power	W_{osc}	31.6	kW
Oscillator efficiency	η_{osc}	78.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.8	%


7Z07486
600
V_g
(V)
400
200
0
−200
−400
−600
0
2
4
6
8
V_a (kV)
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


7Z11286
t_i = 35°C
h = 0
q_{min} (m^3/min)
p_i (mmH$_2$O)
t_o (°C)
t_o
q
p_i
20
15
10
5
150
100
50
0
5
10
$W_a + W_g$ (kW)
15


7Z11288
t_i = 45°C
h = 0
q_{min} (m^3/min)
p_i (mmH$_2$O)
t_o (°C)
t_o
q
p_i
20
15
10
5
150
100
50
0
5
10
$W_a + W_g$ (kW)
15


7Z11287
t_i = 35°C
h = 1500m
q_{min} (m^3/min)
p_i (mmH$_2$O)
t_o (°C)
q
t_o
p_i
20
15
10
5
150
100
50
0
5
10
$W_a + W_g$ (kW)
15


7Z11285
t = 25°C
h = 3000m
q_{min} (m^3/min)
p_i (mmH$_2$O)
t_o (°C)
q
t_o
p_i
20
15
10
5
150
100
50
0
5
10
$W_a + W_g$ (kW)
15

WATER COOLED
R.F. INDUSTRIAL POWER TRIODE

Water cooled triode of ceramic-metal construction with integral water cooler. The tube is intended for use as industrial oscillator.

QUICK REFERENCE DATA				
Frequency	f	up to	100	MHz
Anode voltage	V_a	=	7.5	kV
Anode current	I_a	=	5.4	A
Oscillator output power	W_{osc}	=	31.6	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	

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 quotient 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}	=	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	

TEMPERATURE LIMITS (Absolute limits)

Absolute max. envelope temperature	t_{env}	max. 240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max. 200	°C
Absolute max. water inlet temperature	t_i	max. 50	°C

WATER COOLING CHARACTERISTICS (See also cooling curves)

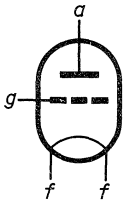
W_a+W_g (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
20	20	10	0.7	51
	50	15	1.3	71
15	20	7	0.37	54
	50	10.5	0.7	73
10	20	4.5	0.17	58
	50	6.7	0.32	75

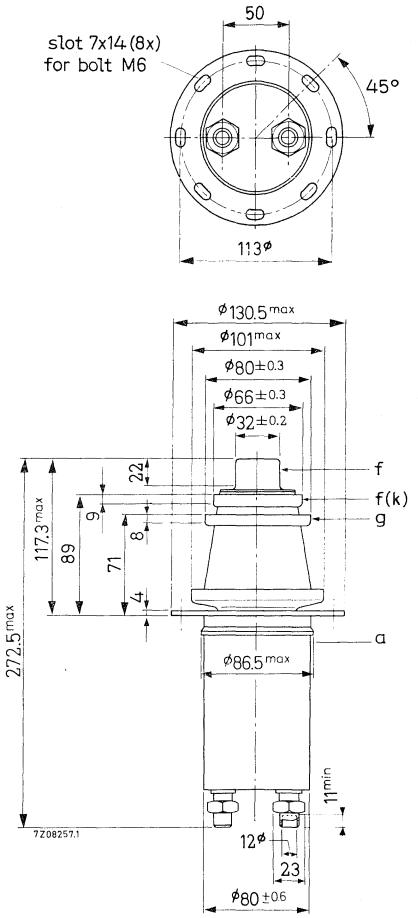
No additional cooling of the seals is required at frequencies < 4 MHz.

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

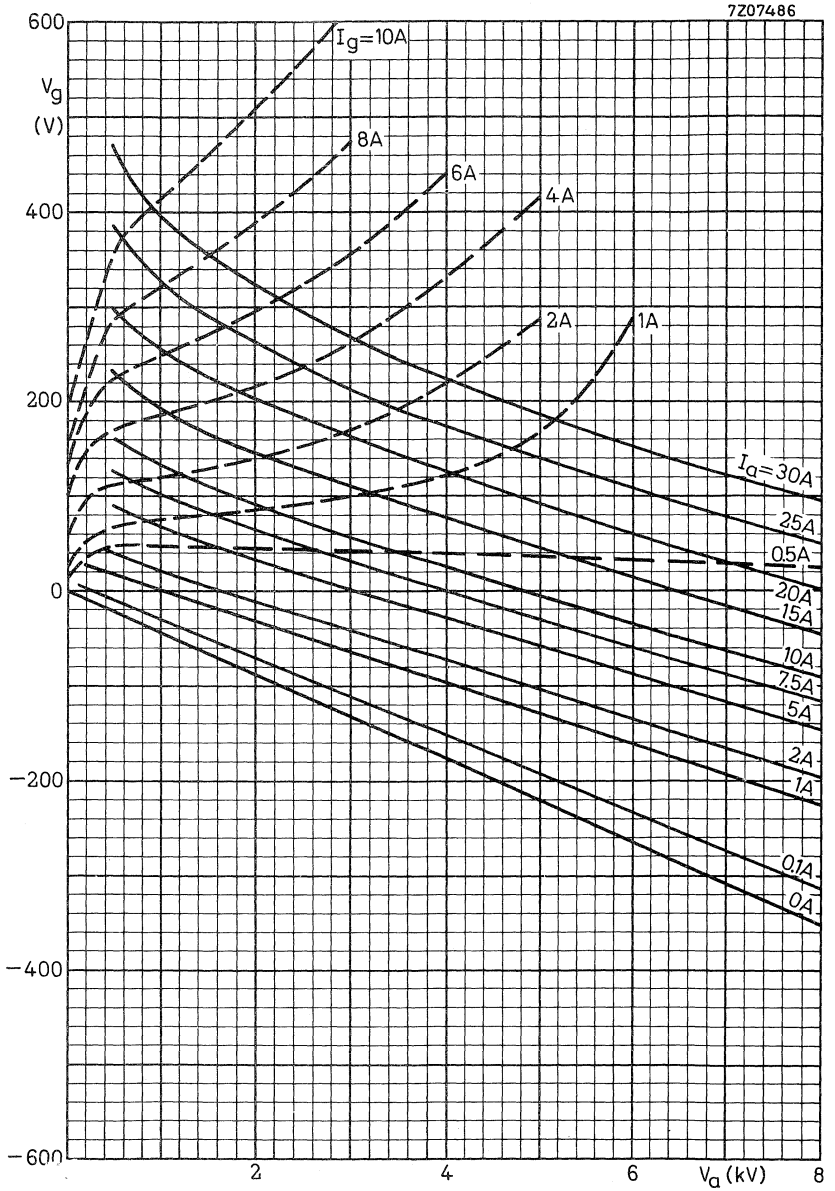
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

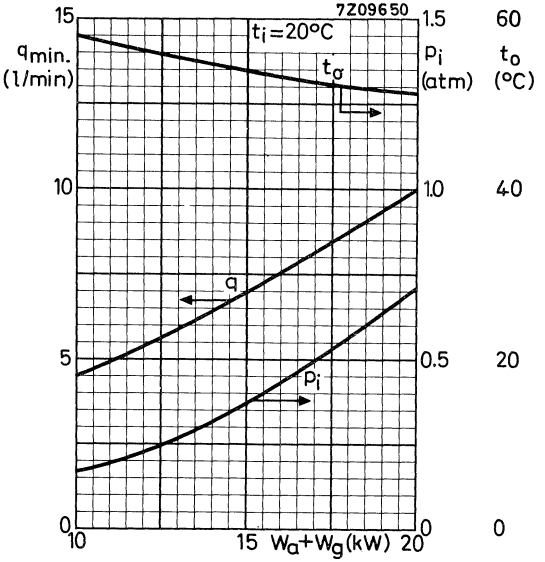
LIMITING VALUES (Absolute max. rating system)

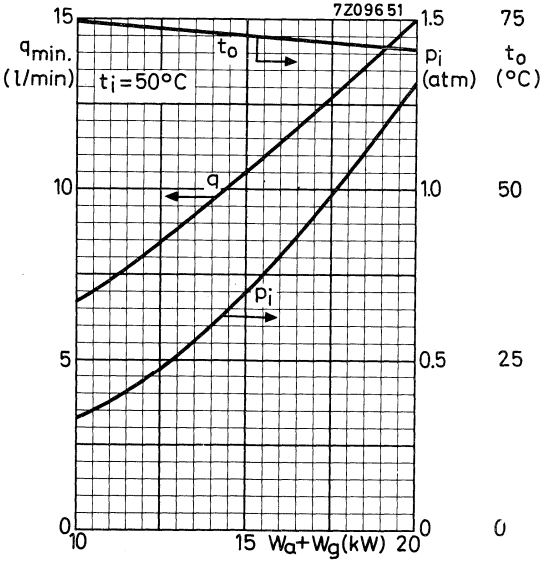
Frequency	f	up to	100	MHz
Anode voltage	V_a	max.	9.0	kV
Anode current	I_a	max.	6.0	A
Anode input power	W_{i_a}	max.	45	kW
Anode dissipation	W_a	max.	20	kW
Grid voltage	$-V_g$	max.	1.25	kV
Grid current, loaded	I_g	max.	1.6	A
unloaded	I_g	max.	2.4	A
Grid dissipation	W_g	max.	500	W
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	7.5	A

OPERATING CONDITIONS

Frequency	f	90	MHz
Filament voltage	V_f	see under "HEATING"	V
Anode voltage	V_a	7.5	kV
Anode current	I_a	5.4	A
Anode input power	W_{i_a}	40.5	kW
Anode dissipation	W_a	7.5	kW
Anode output power	W_o	33.0	kW
Anode efficiency	η	81.5	%
Grid resistor	R_g	450	Ω
Grid current, loaded	I_g	1.45	A
Grid dissipation	W_g	450	W
Grid resistor dissipation	W_{R_g}	946	W
Oscillator output power	W_{osc}	31.6	kW
Oscillator efficiency	η_{osc}	78.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.8	%


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
2
4
6
8
V_a (kV)


7Z09650
15
10
5
0
qmin.
(l/min)
ti=20°C
tg
q
pi
1.5
1.0
0.5
0
pi
(atm)
60
40
20
0
to
(°C)
10
15 Wa+Wg(kW) 20


7Z09651
15
10
5
0
qmin.
(l/min)
ti=50°C
to
q
pi
1.5
1.0
0.5
0
pi
(atm)
75
50
25
0
to
(°C)
10
15 Wa+Wg(kW) 20

AIR COOLED
R.F. INDUSTRIAL POWER TRIODE

Forced air cooled triode in metal-ceramic construction. The tube is intended for use as industrial oscillator.

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}	62.7	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_{g_f}	100	pF
Anode to grid	C_{a_g}	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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max. 240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max. 200	°C
Absolute max. air inlet temperature	t_i	max. 45	°C

COOLING CHARACTERISTICS (See also cooling curves)

$W_a + W_g$ (kW)	h (m)	t_i (°C)	$q_{min.}$ (m^3/min)	p_i (mmH_2O)
30	0	25	36	190
20	0	25	15	40
30	0	35	42	265
20	0	35	17	50

For frequencies > 4 MHz air cooling of the seals is required.

Preferred direction of air flow: see outline drawing.

ACCESSORIES

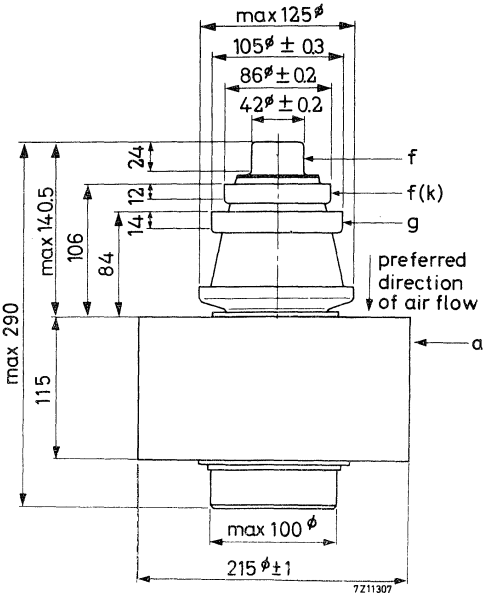
Grid connector	< 4 MHz	type 40707	net weight 75 g
Grid connector	> 4 MHz	type 40736	net weight 450 g
Filament connectors (both types required)		type 40706	net weight 390 g
		and type 40705	net weight 330 g
Filament cables		type 40718	net weight 460 g
		and type 40719	net weight 475 g
Insulating pedestal		type 40729	net weight 8.2 kg

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 20 kg

Mounting position: vertical with anode up or down



R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

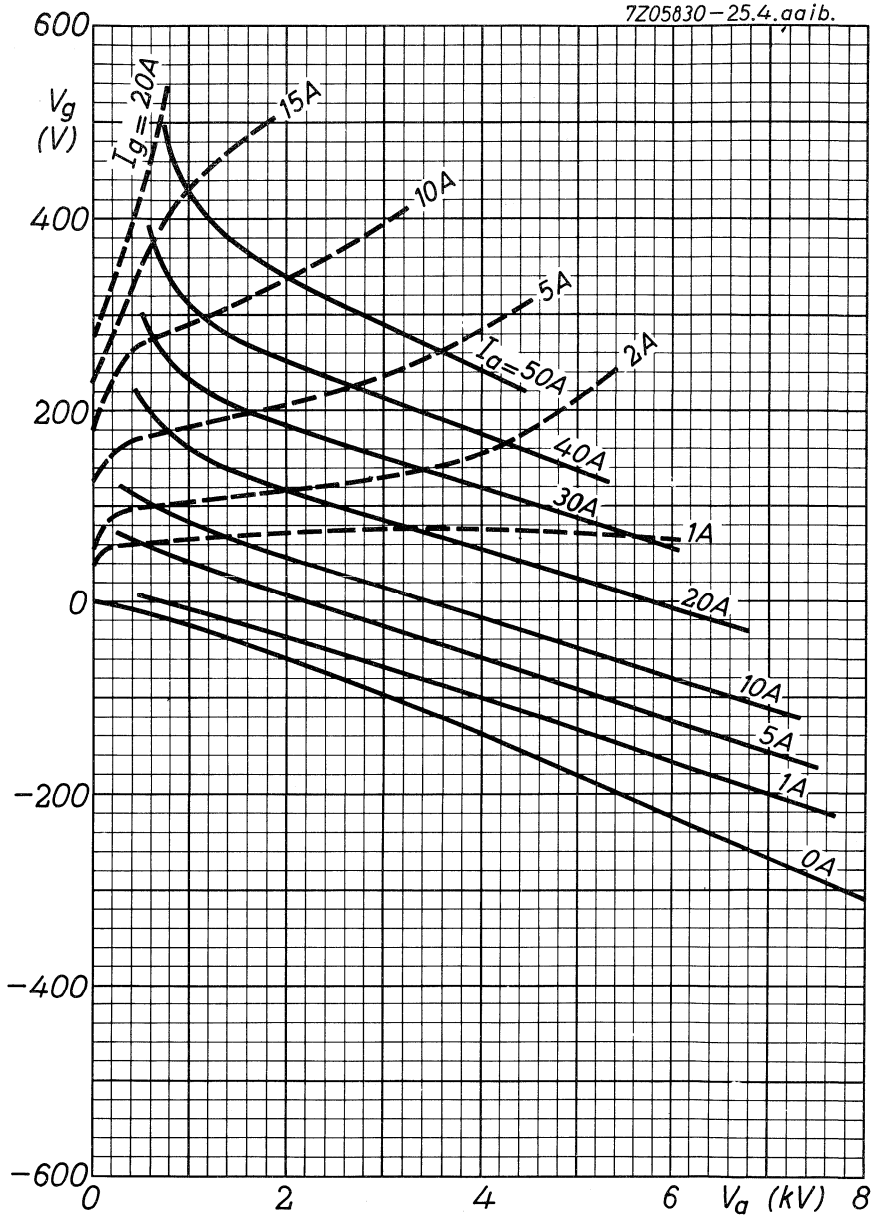
LIMITING VALUES (Absolute max. rating system)

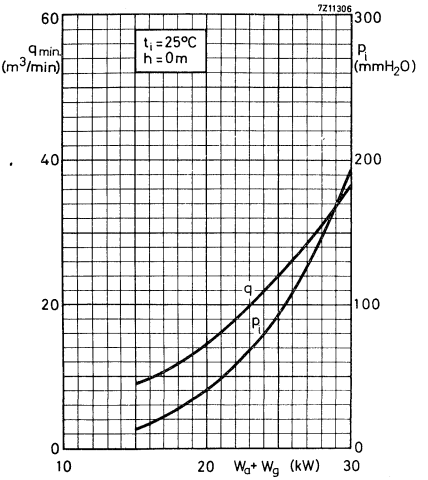
Frequency	f	up to 100	MHz [1])
Anode voltage	V_a	max. 9.6	kV
Anode current	I_a	max. 12	A
Anode input power	W_{ia}	max. 96	kW
Anode dissipation	W_a	max. 30	kW
Grid voltage	$-V_g$	max. 1.5	kV
Grid current, loaded	I_g	max. 2.5	A
unloaded	I_g	max. 3.5	A
Grid dissipation	W_g	max. 1.0	kW
Grid circuit resistance	R_g	max. 10	kΩ
Cathode current	I_k	max. 14	A

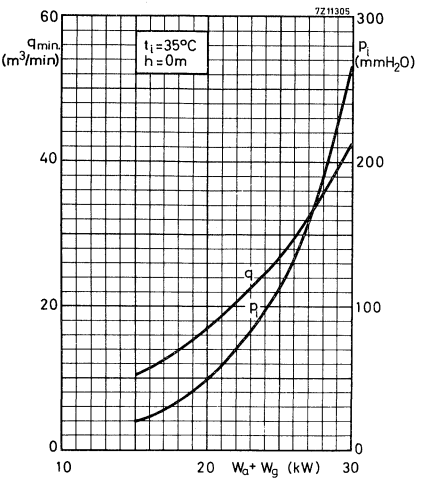
OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	8.0	kV
Anode current	I_a	10	A
Anode input power	W_{i_a}	80.0	kW
Anode dissipation	W_a	15.0	kW
Anode output power	W_o	65.0	kW
Anode efficiency	η	81.2	%
Grid resistor	R_g	300	Ω
Grid current, loaded	I_g	2.25	A
Grid dissipation	W_g	750	W
Grid resistor dissipation	WR_g	1.52	kW
Oscillator output power	W_{osc}	62.7	kW
Oscillator efficiency	η_{osc}	78.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.6	%

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z05830-25.4.aaib.
600
400
200
0
-200
-400
-600
Vg (V)
0
2
4
6
Va (kV)
8
Ig=20A
15A
10A
5A
2A
Ig=50A
40A
30A
1A
20A
10A
5A
1A
0A


7Z11306
60
40
20
0
$q_{min.}$ (m^3/min)
t_i = 25°C
h = 0m
300
200
100
0
P_i (mmH_2O)
q
P_i
10
20
30
$W_a + W_g$ (kW)


7Z11305
60
40
20
0
$q_{min.}$ (m^3/min)
t_i = 35°C
h = 0m
300
200
100
0
P_i (mmH_2O)
q
P_i
10
20
30
$W_a + W_g$ (kW)

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.

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}	62.7	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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

COOLING CHARACTERISTICS (See also cooling curves)

W_a+W_g (kW)	t_i (°C)	q_{min} (l/min.)	p_i (atm)	t_o (°C)
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 (both types required)		type	40706	net weight	390 g
		and type	40705	net weight	330 g
Filament cables		type	40718	net weight	460 g
		and type	40719	net weight	475 g

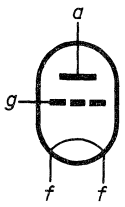
MECHANICAL DATA

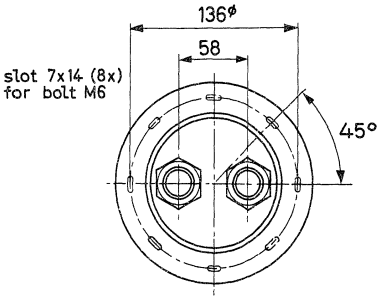
Dimensions in mm

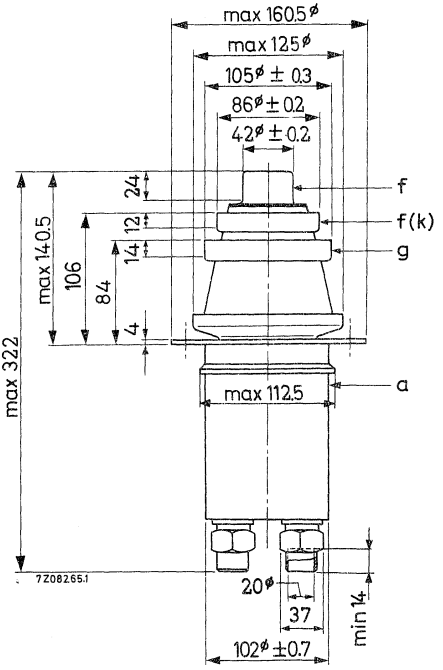
Net weight approx. 6 kg

Mounting position: vertical with anode up or down

With anode up the water inlet and outlet connections should be interchanged.







R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

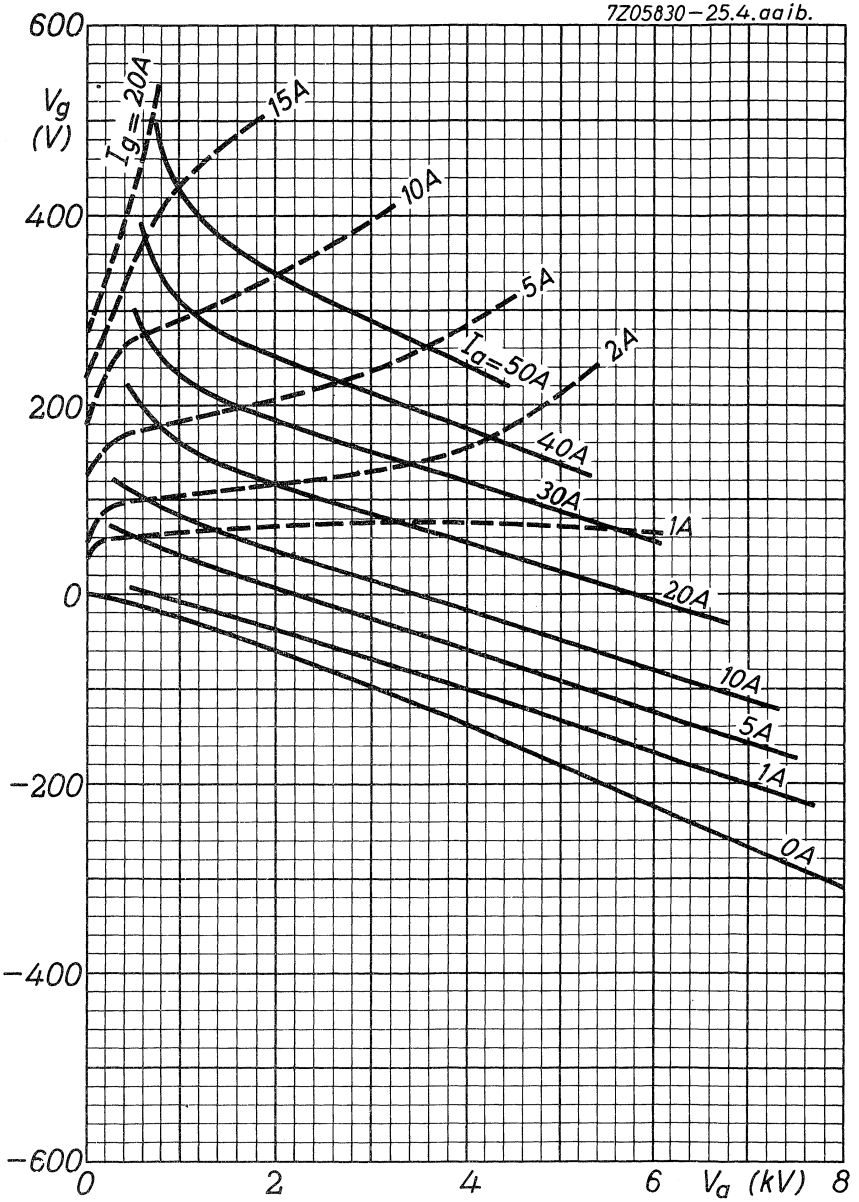
LIMITING VALUES (Absolute max. rating system)

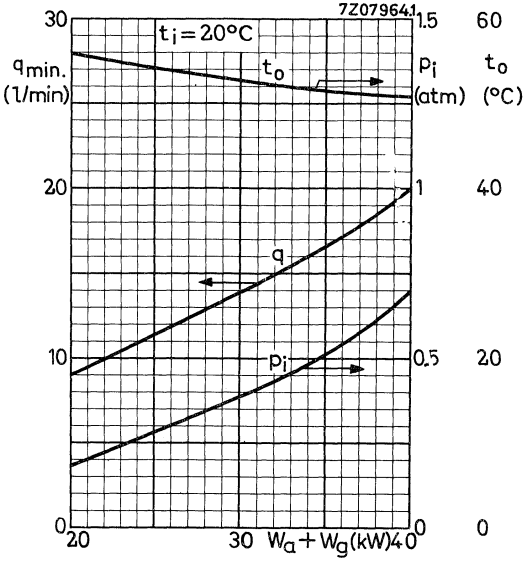
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	9.6	kV
Anode current	I_a	max.	12	A
Anode input power	W_{i_a}	max.	96	kW
Anode dissipation	W_a	max.	40	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, loaded	I_g	max.	2.5	A
unloaded	I_g	max.	3.5	A
Grid dissipation	W_g	max.	1.0	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	14	A

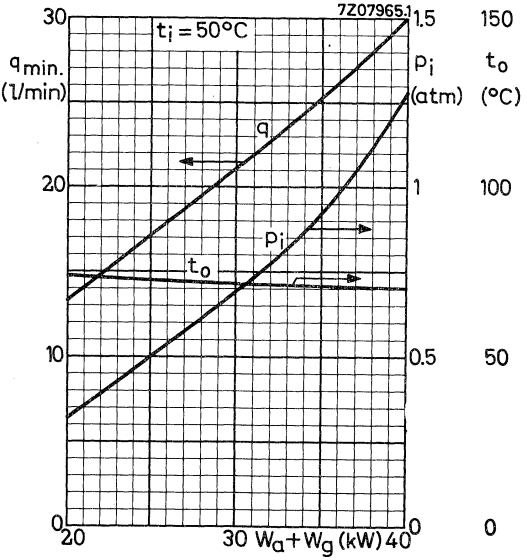
OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	8.0	kV
Anode current	I_a	10	A
Anode input power	W_{ia}	80.0	kW
Anode dissipation	W_a	15.0	kW
Anode output power	W_o	65.0	kW
Anode efficiency	η	81.2	%
Grid resistor	R_g	300	Ω
Grid current, loaded	I_g	2.25	A
Grid dissipation	W_g	750	W
Grid resistor dissipation	W_{R_g}	1.52	kW
Oscillator output power	W_{osc}	62.7	kW
Oscillator efficiency	η_{osc}	78.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.6	%

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z05830-25.4.aaib.
600
400
200
0
−200
−400
−600
Vg (V)
Ig = 20A
15A
10A
5A
2A
Ig=50A
40A
30A
1A
20A
10A
5A
1A
0A
0
2
4
6
Va (kV)
8


7Z07964.1
$t_i = 20°C$
$q_{min.}$ (l/min)
t_o
p_i (atm)
t_o (°C)
q
p_i
30
20
10
0
1.5
1
0.5
0
60
40
20
0
20
30
$W_a + W_g$ (kW)
40


7Z07965.1
$t_i = 50°C$
$q_{min.}$ (l/min)
p_i (atm)
t_o (°C)
q
p_i
t_o
30
20
10
0
1.5
1
0.5
0
150
100
50
0
20
30
$W_a + W_g$ (kW)
40

VAPOUR COOLED R.F. INDUSTRIAL POWER TRIODE

Vapour cooled triode 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 output power	W_{osc}		62.7	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_{fp}	max.	1500	A
Cold filament resistance	R_{f_o}		3.9	mΩ

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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	°C

COOLING CHARACTERISTICS (see also cooling curves)

With integrated boiler-condensor type K735

W_a+W_g (kW)	t_i (^oC)	$q_{min.}$ (l/min)	t_o (^oC)	p_i (atm)
40	20	11	74	0.05
	35	15	74	0.07
	50	25	74	0.16
30	20	8	76	0.03
	35	11	76	0.05
	50	17	76	0.09
20	20	5	80	0.02
	35	6.7	80	0.03
	50	10	80	0.04

Low velocity air cooling of the seals is required.

ACCESSORIES

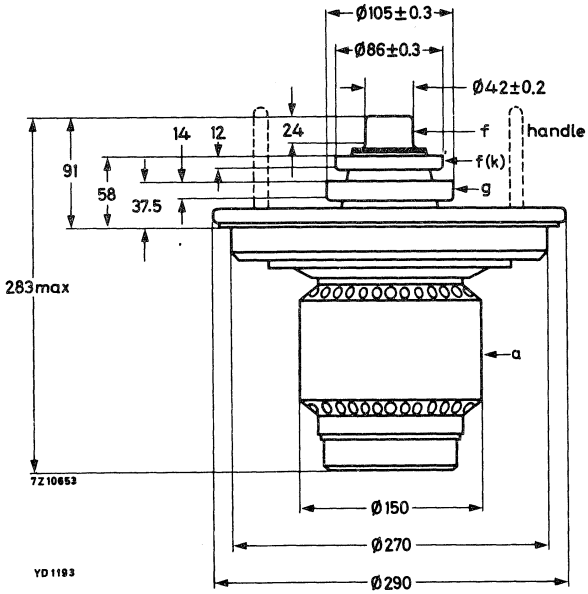
Grid connector	f < 4 MHz	type 40707 net weight	75	g
Grid connector	f > 4 MHz	type 40736 net weight	450	g
Filament connectors		type 40706 net weight	390	g
(both types required)		and type 40705 net weight	330	g
Filament cables		type 40718 net weight	460	g
(both types required)		and type 40719 net weight	475	g
Boiler-condensor		type K735 net weight approx.	70	kg

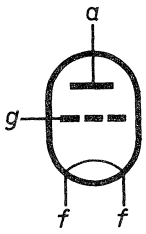
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 15.7 kg

Mounting position: Vertical with anode down.





Note: The handles should be removed before switching on the tube.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

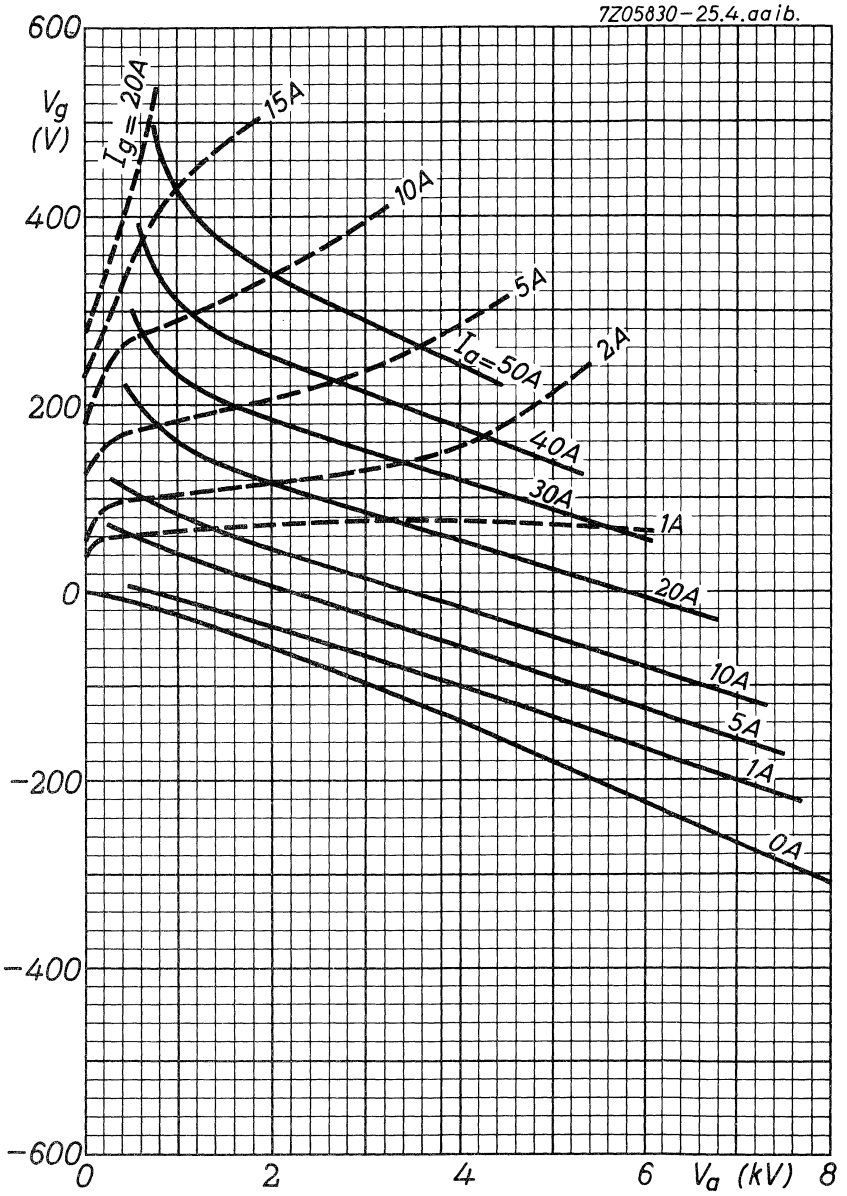
LIMITING VALUES (Absolute max. rating system)

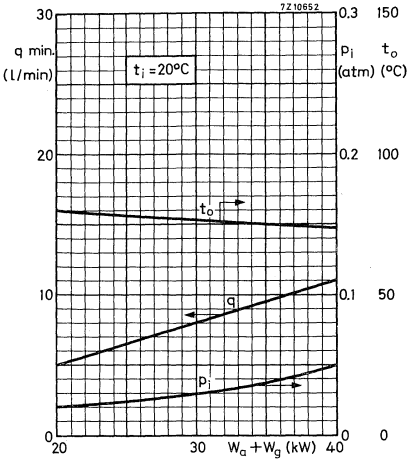
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	9.6	kV
Anode current	I_a	max.	12	A
Anode input power	W_{i_a}	max.	96	kW
Anode dissipation	W_a	max.	40	kW
Grid voltage	$-V_g$	max.	1.5	kV
Grid current, loaded	I_g	max.	2.5	A
unloaded	I_g	max.	3.5	A
Grid dissipation	W_g	max.	1.0	kW
Cathode current	I_k	max.	14	A
Grid circuit resistance	R_g	max.	10	kΩ

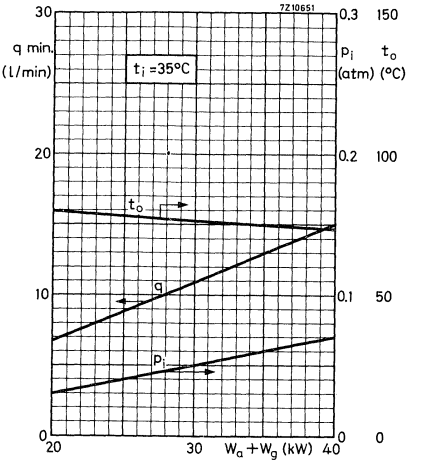
OPERATING CONDITIONS

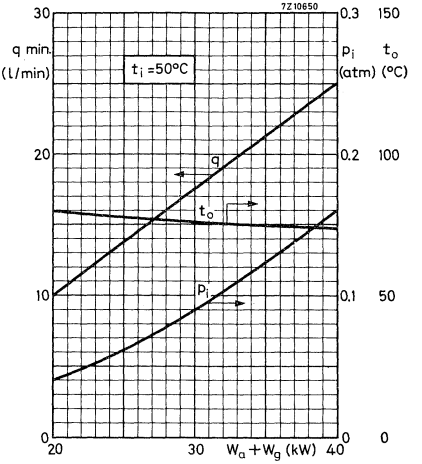
Frequency	f	30	MHz
Anode voltage	V_a	8.0	kV
Anode current	I_a	10	A
Anode input power	W_{i_a}	80.0	kW
Anode dissipation	W_a	15.0	kW
Anode output power	W_o	65.0	kW
Anode efficiency	η	81.2	%
Grid resistor	R_g	300	Ω
Grid current, loaded	I_g	2.25	A
Grid dissipation	W_g	750	W
Grid resistor dissipation	W_{R_g}	1.52	kW
Oscillator output power	W_{osc}	62.7	kW
Oscillator efficiency	osc	78.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	14.6	%

[1]) When the tube has to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z05830-25.4.aaib.
600
400
200
0
-200
-400
-600
V_g (V)
I_g = 20A
15A
10A
5A
2A
1A
0A
I_a=50A
40A
30A
20A
10A
5A
1A
0
2
4
6
8
V_a (kV)


7Z10652
q min. (l/min)
t_i =20°C
p_i (atm)
t_o (°C)
t_o
q
p_i
$W_a + W_g$ (kW)


7Z10651
q min. (l/min)
t_i =35°C
p_i (atm)
t_o (°C)
t_o
q
p_i
$W_a + W_g$ (kW)


7Z10650
q min. (l/min)
t_i =50°C
p_i (atm)
t_o (°C)
q
t_o
p_i
$W_a + W_g$ (kW)

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.

QUICK REFERENCE DATA			
Frequency	f	up to 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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

COOLING CHARACTERISTICS (See also cooling curves)

W_a+W_g (kW)	t_i (°C)	qmin (l/min.)	p_i (atm)	t_o (°C)
80	20	40	0.35	50
	50	60	0.65	70
60	20	28	0.18	52
	50	42	0.32	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

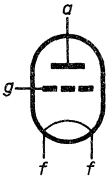
MECHANICAL DATA

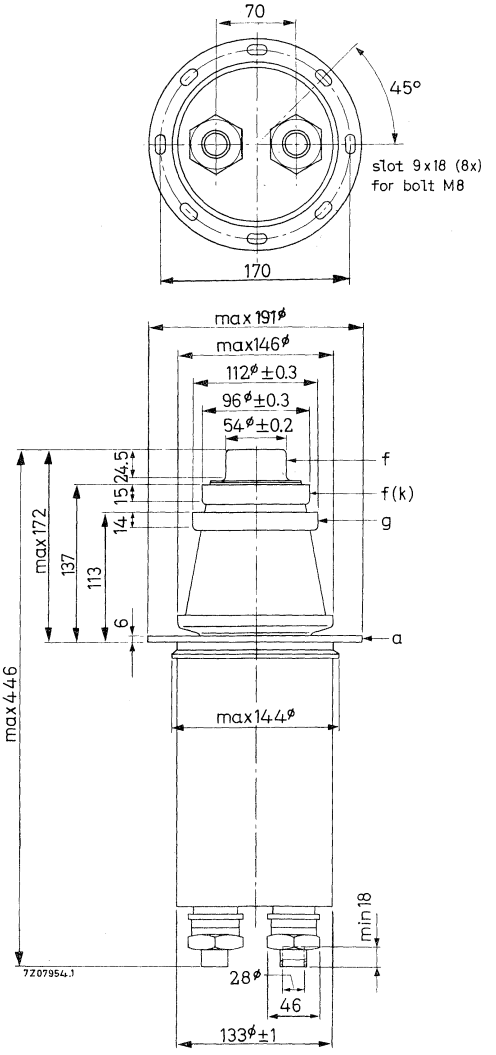
Dimensions in mm

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.





R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

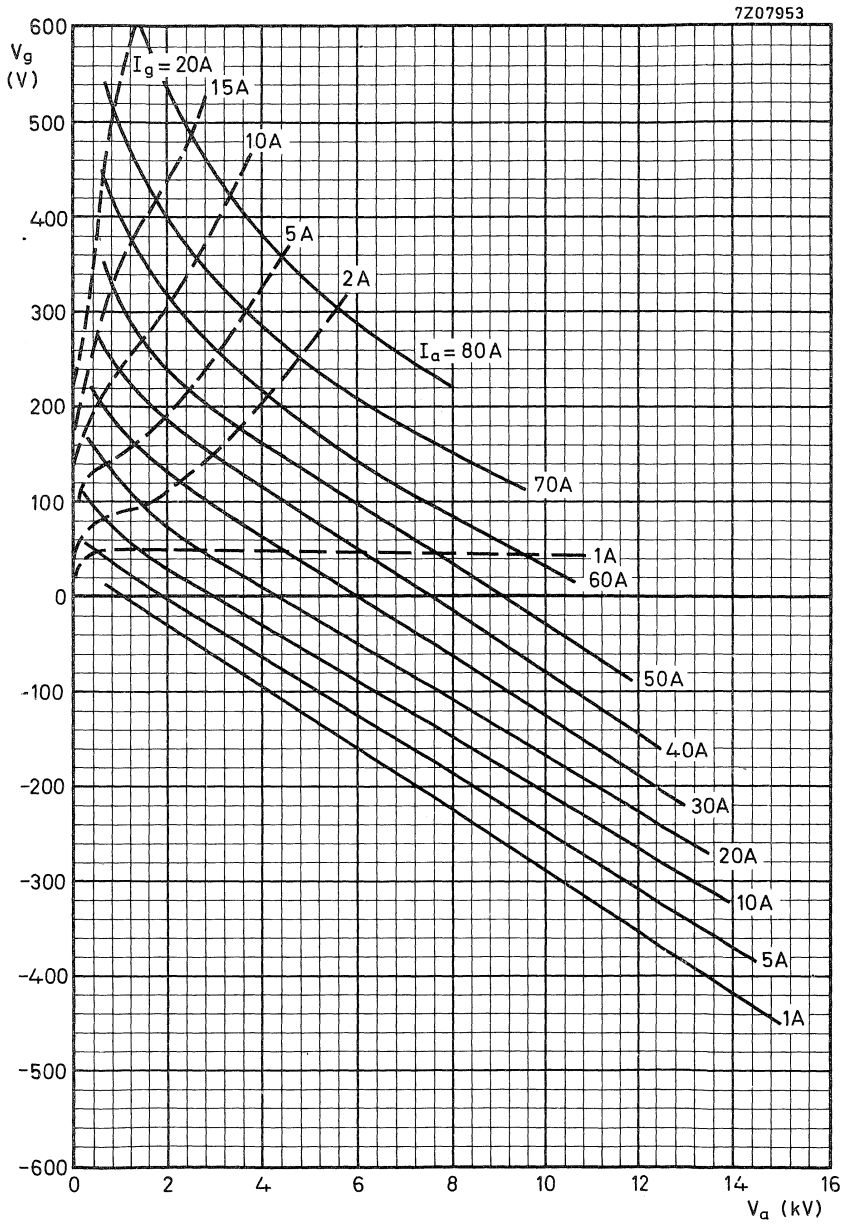
LIMITING VALUES (Absolute max. rating system)

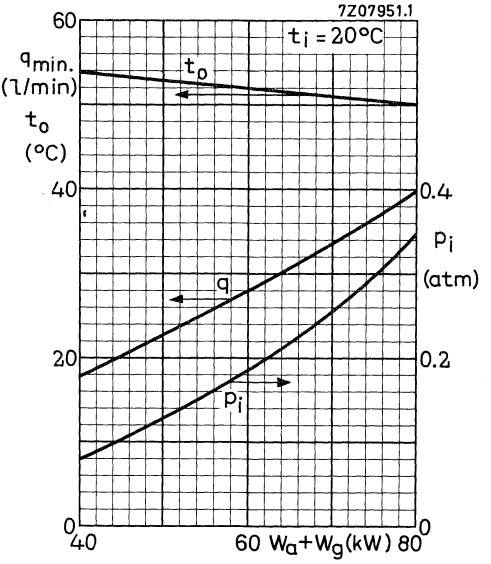
Frequency	f	up to	100	MHz 1)
Anode voltage	V_a	max.	14.4	kV
Anode current	I_a	max.	18.0	A
Anode input power	W_{i_a}	max.	220	kW
Anode dissipation	W_a	max.	80	kW
Grid voltage	$-V_g$	max.	2.0	kV
Grid current, loaded	I_g	max.	4.0	A
unloaded	I_g	max.	5.5	A
Grid dissipation	W_g	max.	2.0	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	22	A

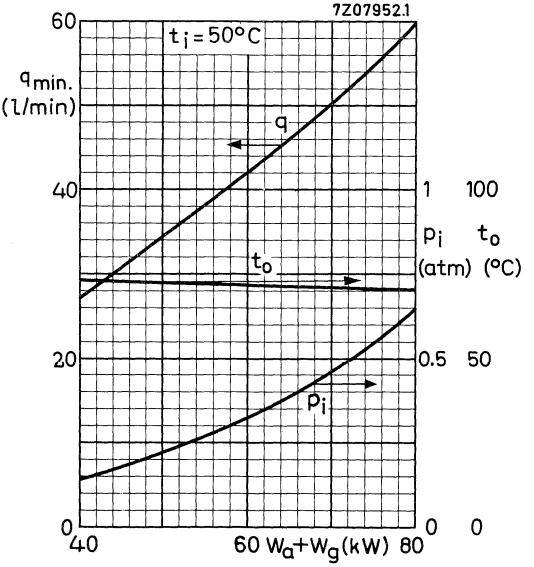
OPERATING CONDITIONS

Frequency	f	30	30	MHz
Anode voltage	V_a	10.0	12.0	kV
Anode current	I_a	16.0	13.0	A
Anode input power	W_{i_a}	160	156	kW
Anode dissipation	W_a	36.0	32.5	kW
Anode output power	W_o	124	123.5	kW
Anode efficiency	η	77.5	79.2	%
Grid resistor	R_g	200	330	Ω
Grid current, loaded	I_g	3.5	2.7	A
Grid dissipation	W_g	1.5	1.1	kW
Grid resistor dissipation	W_{R_g}	2.45	2.40	kW
Oscillator output power	W_{osc}	120	120	kW
Oscillator efficiency	η_{osc}	75.0	77.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	12.8	11.6	%

1) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z07953
V_g (V)
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
I_g = 20A
15A
10A
5A
2A
I_a = 80A
70A
60A
1A
50A
40A
30A
20A
10A
5A
1A
0
2
4
6
8
10
12
14
16
V_a (kV)


7Z07951.1
t_i = 20°C
$q_{min.}$ (l/min)
t_o (°C)
t_o
q
p_i
p_i (atm)
60
40
20
0
0.4
0.2
0
40
60 W_a+W_g(kW) 80


7Z07952.1
t_i = 50°C
$q_{min.}$ (l/min)
q
t_o
p_i
p_i (atm)
t_o (°C)
60
40
20
0
1
100
0.5
50
0
0
40
60 W_a+W_g(kW) 80

VAPOUR COOLED R.F. INDUSTRIAL POWER TRIODE

Vapour cooled triode for use as industrial oscillator for frequencies up to 30 MHz.

QUICK REFERENCE DATA				
Frequency	f	up to	30	MHz
Anode voltage	V_a		10	kV
Anode current	I_a		16	A
Oscillator output power	W_{osc}		120	kW

HEATING: direct, filament thoriated tungsten

Filament voltage	V_f		12.2	$V^{+5\%}_{-10\%}$
Filament current	I_f		255	A
Peak filament starting current	I_{fp}	max.	1500	A
Cold filament resistance	R_{fo}		5.3	mΩ

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	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max.	200	°C

COOLING CHARACTERISTICS

With integrated boiler-condensor type K735

W_a+W_g (kW)	t_i (°C)	$q_{min.}$ (l/min)	t_o (°C)	P_i (atm)
80	20	29	60	0.20
	35	48	59	0.51
60	20	16	75	0.08
	35	24	72	0.14
	50	45	70	0.45
40	20	10	80	0.04
	35	13.5	80	0.06
	50	20	80	0.10

Cooling of the seals can be accomplished by a low velocity air flow or by watercooling of the filament connectors. The cooling circuit of these accessories may be connected in series. A water flow of approximately 0.5 l/min. will be sufficient.

ACCESSORIES

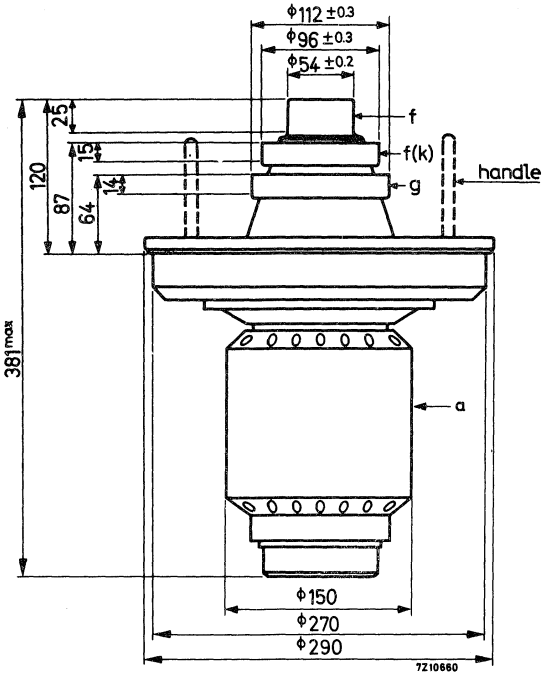
Grid connector	type 40737 net weight	525 g
Filament connectors	type 40695 net weight	710 g
(both types required)	and type 40696 net weight	860 g
Filament cables	type 40716 net weight	975 g
(both types required)	and type 40717 net weight	980 g
Boiler-condensor	type K735 net weight approx.	70 kg

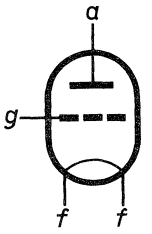
MECHANICAL DATA

Dimensions in mm

Net weight: approx. 16.7 kg

Mounting position: Vertical with anode down





Note: The handles should be removed before switching on the tube.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

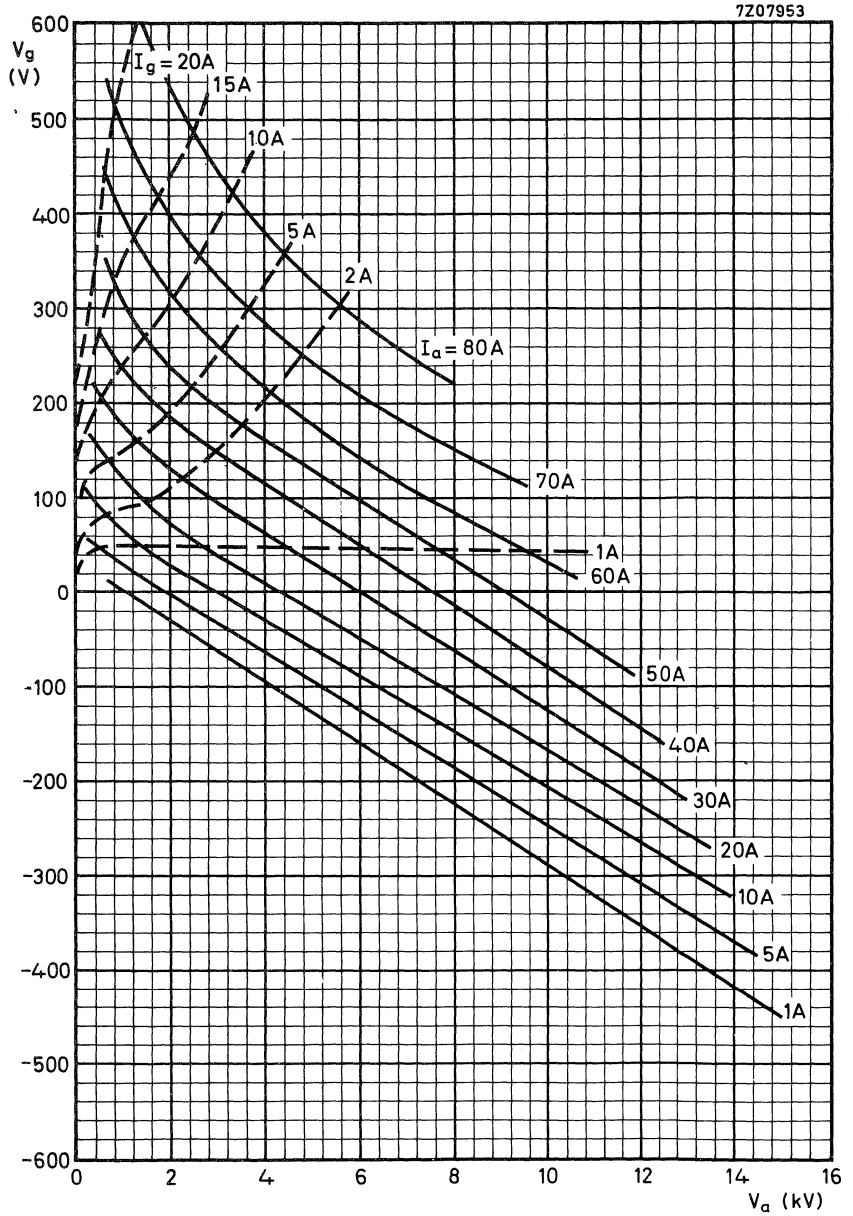
LIMITING VALUES (Absolute max. rating system)

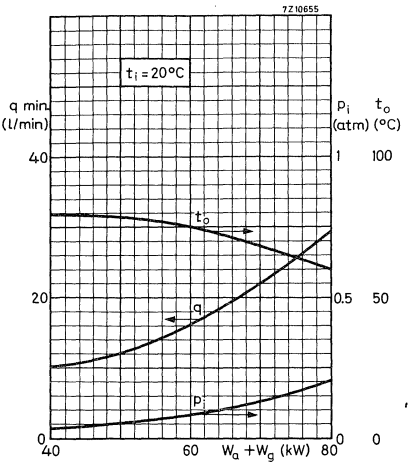
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	14.4	kV
Anode current	I_a	max.	18	A
Anode input power	W_{ia}	max.	220	kW
Anode dissipation	W_a	max.	80	kW
Grid voltage	$-V_g$	max.	2	kV
Grid current, loaded	I_g	max.	4	A
unloaded	I_g	max.	5.5	A
Grid dissipation	W_g	max.	2	kW
Cathode current	I_k	max.	22	A
Grid circuit resistance	R_g	max.	10	kΩ

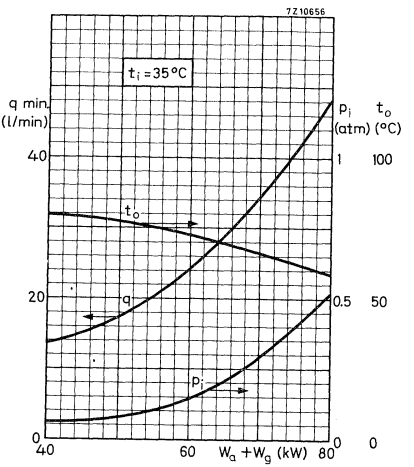
OPERATING CONDITIONS

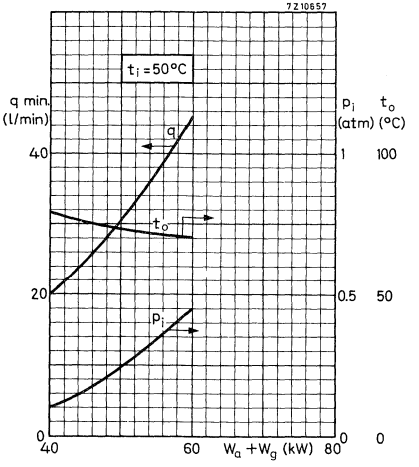
Frequency	f	30	30	MHz
Anode voltage	V_a	10.0	12.0	kV
Anode current	I_a	16.0	13.0	A
Anode input power	W_{ia}	160	156	kW
Anode dissipation	W_a	36.0	32.5	kW
Anode output power	W_o	124	123.5	kW
Anode efficiency	ηa	77.5	79.2	%
Grid resistor	R_g	200	330	Ω
Grid current, loaded	I_g	3.5	2.7	A
Grid dissipation	W_g	1.5	1.1	kW
Grid resistor dissipation	W_{Rg}	2.45	2.4	kW
Oscillator output power	W_{osc}	120	120	kW
Oscillator efficiency	ηosc	75	77	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	12.8	11.6	%

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


7Z07953
V_g (V)
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
I_g = 20A
15A
10A
5A
2A
I_a = 80A
70A
60A
50A
40A
30A
20A
10A
5A
1A
1A
0
2
4
6
8
10
12
14
16
V_a (kV)


7Z10655
t_i = 20°C
q min.
(l/min)
p_i t_o
(atm) (°C)
40
1 100
t_o
20
q
0.5 50
p_i
0
0 0
40 60 $W_a + W_g$ (kW) 80


7Z10656
t_i = 35°C
q min.
(l/min)
p_i t_o
(atm) (°C)
40
1 100
t_o
20
q
0.5 50
p_i
0
0 0
40 60 $W_a + W_g$ (kW) 80


7Z10657
t_i = 50°C
q min.
(l/min)
p_i t_o
(atm) (°C)
40
q
1 100
t_o
20
0.5 50
p_i
0
0 0
40 60 $W_a + W_g$ (kW) 80

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.

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	=	190	mA/V
Amplification factor	μ	=	41	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max.	240	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C
Absolute max. water inlet temperature	t_i	max.	50	°C

COOLING CHARACTERISTICS (See also cooling curves)

W_a+W_g (kW)	t_i (°C)	q_{min} (l/min)	p_i (atm)	t_o (°C)
120	20	60	0.7	50
	50	90	1.3	77
80	20	34	0.3	54
	50	54	0.55	72
40	20	15	0.07	60
	50	24	0.13	70

At frequencies below 4 MHz cooling of the metal-ceramic seals can be accomplished by a low-velocity air flow, or by watercooling of the filament connnectors. A water flow of approximately 0.5 l/min will be sufficient.
At frequencies above 4 MHz it is recommended to cool the seals by means of an air flow of approximately 4 m^3/min from a 50 mm diameter nozzle placed at a distance of 250 mm from the tube header.

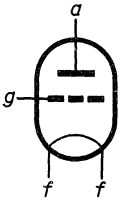
ACCESSORIES

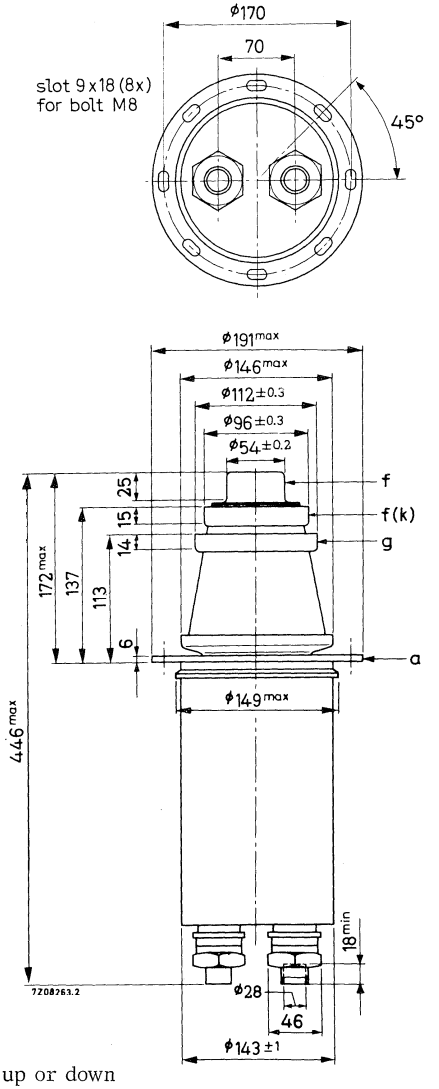
Grid connector	< 4 MHz	type	40694	net weight	270 g
Grid connector	> 4 MHz	type	40737	net weight	525 g
Filament connectors (both types required)		type and type	40695 40696	net weight net weight	710 g 860 g
Filament cables (both types required)		type and type	40716 40717	net weight net weight	975 g 980 g

MECHANICAL DATA

Net weigth approx. 15.6 kg

Dimensions in mm





Mounting position: vertical with anode up or down

With anode up inlet and outlet connections should be interchanged.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

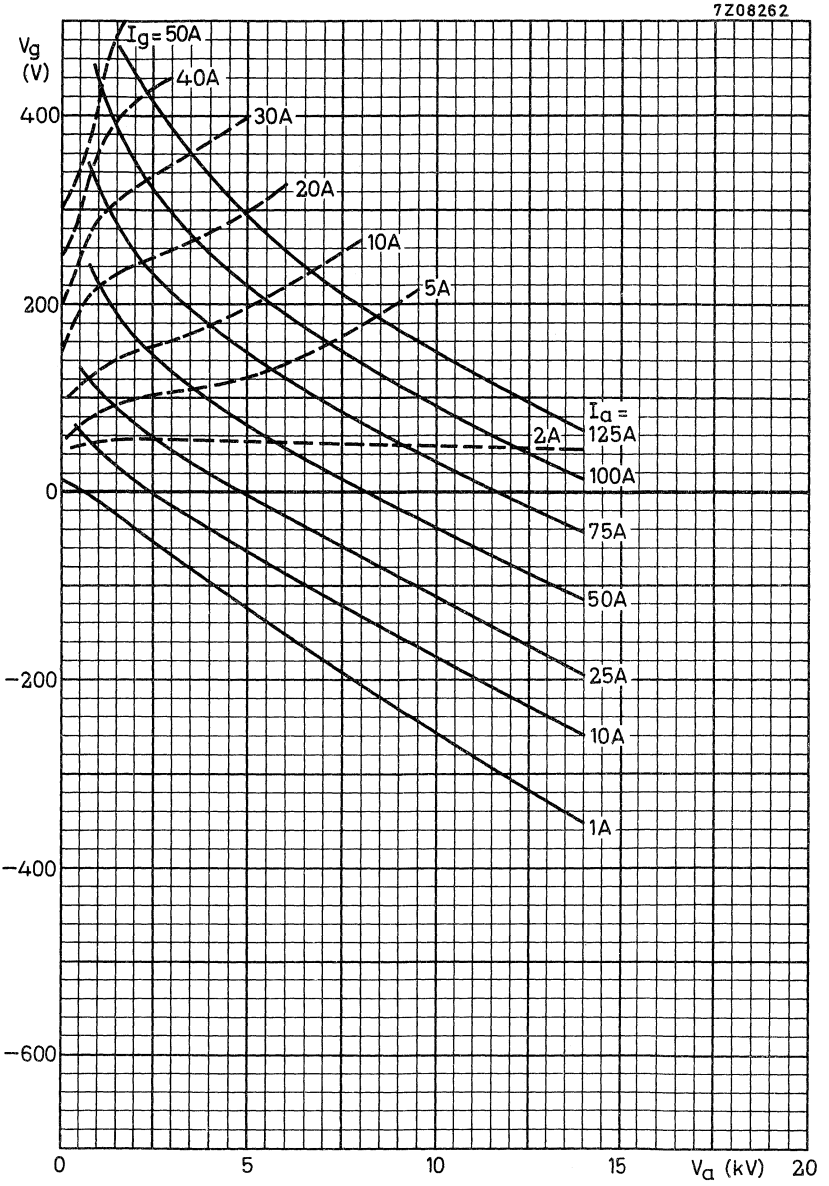
LIMITING VALUES (Absolute max. rating system)

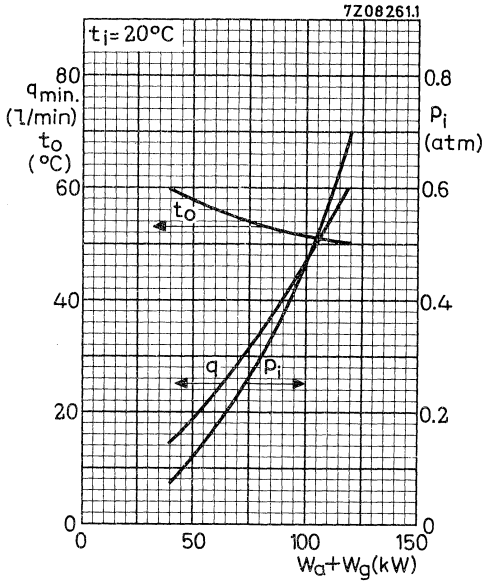
Frequency	f	up to	100	MHz [1]
Anode voltage	V_a	max.	16.8	kV
Anode current	I_a	max.	25	A
Anode input power	W_{i_a}	max.	375	kW
Anode dissipation	W_a	max.	120	kW
Grid voltage	$-V_g$	max.	2.0	kV
Grid current, loaded	I_g	max.	7.0	A
unloaded	I_g	max.	8.5	A
Grid dissipation	W_g	max.	3.0	kW
Grid circuit resistance	R_g	max.	10	kΩ
Cathode current	I_k	max.	31	A

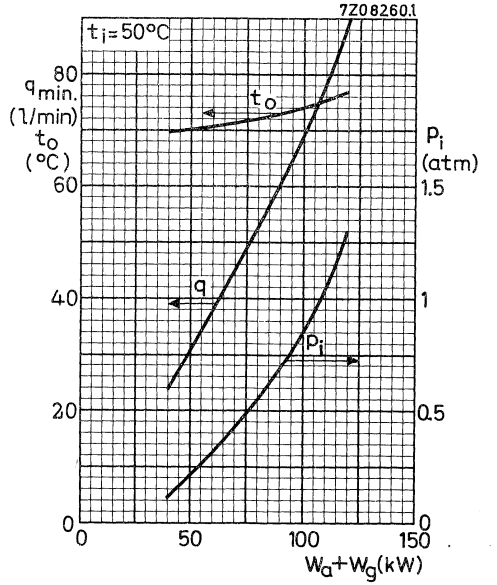
OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	14.0	kV
Anode current	I_a	23.5	A
Anode input power	W_{i_a}	329	kW
Anode dissipation	W_a	81.5	kW
Anode output power	W_o	247.5	kW
Anode efficiency	η	75.2	%
Grid resistor	R_g	135	Ω
Grid current, loaded	I_g	6.0	A
Grid dissipation	W_g	2.6	kW
Grid resistor dissipation	W_{R_g}	4.86	kW
Oscillator output power	W_{osc}	240	kW
Oscillator efficiency	η_{osc}	73.0	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	10.4	%

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


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


7Z08261.1
t_i= 20°C
80
$q_{min.}$
(l/min)
t_o
(°C)
60
40
20
0
0.8
P_i
(atm)
0.6
0.4
0.2
0
t_o
q
P_i
0
50
100
150
W_a+W_g(kW)


7Z08260.1
t_i= 50°C
80
$q_{min.}$
(l/min)
t_o
(°C)
60
40
20
0
t_o
P_i
(atm)
1.5
1
0.5
0
q
P_i
0
50
100
150
W_a+W_g(kW)

VAPOUR COOLED R.F. INDUSTRIAL POWER TRIODE

Vapour cooled triode of metal-ceramic construction intended for use as industrial oscillator.

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_{fp}	max. 2000	A
Cold filament resistance	R_{fo}	3.6	mΩ

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
Transconductance	S	190	mA/V
Amplification factor	μ	41	

TEMPERATURE LIMITS

Absolute max. envelope temperature	t_{env}	max. 240	°C
Recommended max. envelope temperature under continuous loaded conditions	t_{env}	max. 200	°C

At frequencies below 4 MHz cooling of the metal-ceramic seals can be accomplished by a low-velocity air flow, or by watercooling of the filament connectors. A water flow of approximately 0.5 l/min will be sufficient.
At frequencies above 4 MHz it is recommended to cool the seals by means of an air flow of approximately 4 m^3/min from a 50 mm diameter nozzle placed at a distance of 250 mm from the tube header.

COOLING CHARACTERISTICS

With integrated boiler/condensor type K733

$W_a + W_g$ (kW)	t_i (°C)	q_{min} (l/min)	t_o (°C)	P_i (atm)
120	20	59	50	0.84
80	20	29	61	0.20
	35	48	61	0.51
40	20	10	81	0.04
	35	13.5	81	0.06
	50	20	81	0.10

ACCESSORIES

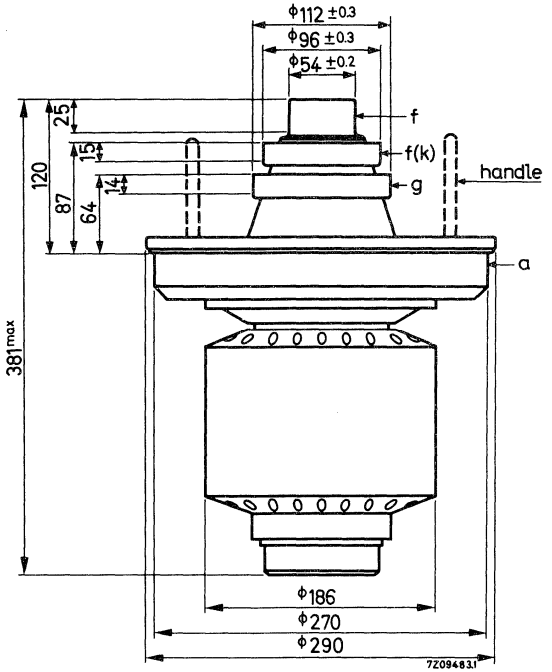
Grid connector	type 40737	net weight	525 g
Filament connectors	type 40695	net weight	710 g
(both types required)	and type 40696	net weight	860 g
Filament cable	type 40716	net weight	975 g
(both types required)	and type 40717	net weight	980 g
Boiler/condensor	type K733	net weight approx.	70 kg

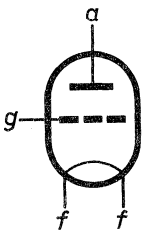
MECHANICAL DATA

Dimensions in mm

Net weight: 27 kg

Mounting position: vertical with anode down





Note: The handles should be removed before switching on the tube.

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

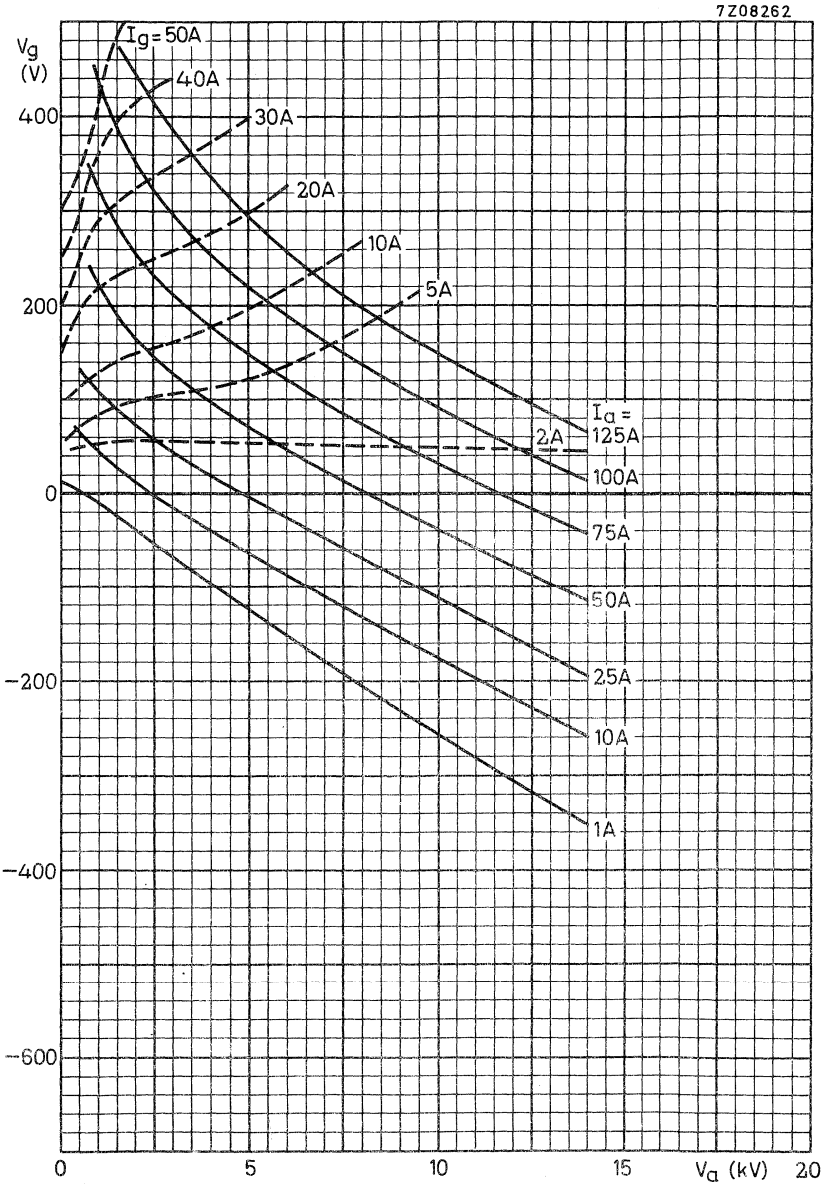
LIMITING VALUES (Absolute max. rating system)

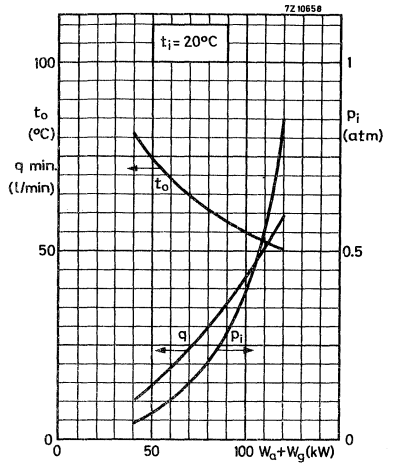
Frequency	f	up to	100	MHz
Anode voltage	V_a	max.	16.8	kV
Anode current	I_a	max.	25	A
Anode input power	W_{i_a}	max.	375	kW
Anode dissipation	W_a	max.	120	kW
Grid voltage	$-V_g$	max.	2000	V
Grid current, loaded	I_g	max.	7	A
unloaded	I_g	max.	8.5	A
Grid dissipation	W_g	max.	3.0	kW
Cathode current	I_k	max.	31	A
Grid circuit resistance	R_g	max.	10	kΩ

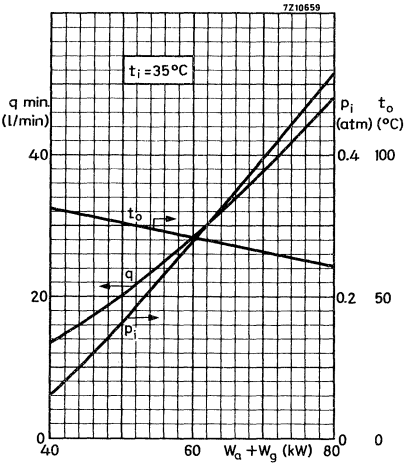
OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	14	kV
Anode current	I_a	23.5	A
Anode input power	W_{i_a}	329	kW
Anode dissipation	W_a	81.5	kW
Anode output power	W_o	247.5	kW
Anode efficiency	η	75.2	%
Grid resistor	R_g	139	Ω
Grid current, loaded	I_g	6	A
Grid dissipation	W_g	2.6	kW
Grid resistor dissipation	W_{R_g}	4.86	kW
Oscillator output power	W_{osc}	240	kW
Oscillator efficiency	η_{osc}	73.0	%
Feedback ratio	V_g / V_a	10.4	%

[1]) When the tubes are to be used at frequencies above 30 MHz the manufacturer should be consulted for more detailed information.


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


7Z10658
t_i = 20°C
100
t_o (°C)
q min. (l/min)
50
0
0
50
100 W_a+W_g(kW)
1
p_i (atm)
0.5
0
t_o
q
p_i


7Z10659
t_i = 35°C
q min. (l/min)
40
20
0
40
60
W_a+W_g (kW)
80
p_i (atm)
0.4
0.2
0
t_o (°C)
100
50
0
t_o
q
p_i

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	5.0	4.5	kV
Anode current	I_a	750	700	mA
Oscillator output power	W_{osc}	2670	2220	W

HEATING : indirect; filament thoriated tungsten

Filament voltage (f < 120 MHz)	V_f	6.3	$V^{+5\%}_{-10\%}$
(f > 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	°C
Recommended max. envelope temperature under continuously loaded conditions	t_{env}	max.	200	°C

AIR COOLING CHARACTERISTICS

See cooling curves

A low velocity air flow directed to the filament and grid seals may be required.

ACCESSORIES

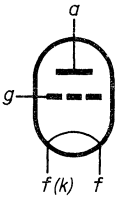
Filament connector	40688
Filament/cathode connector	40689
Grid connector (f < 30 MHz)	40686
(f > 30 MHz)	40687

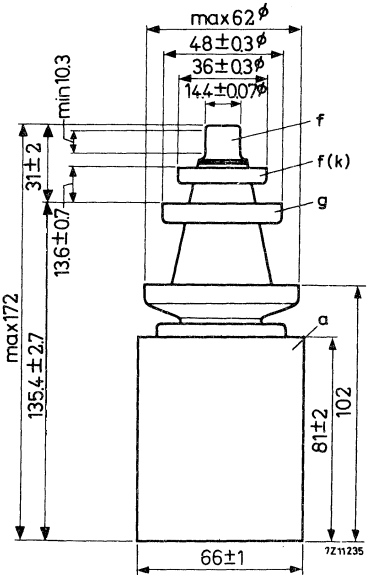
MECHANICAL DATA

Dimensions in mm

Mounting position: vertical with anode up or down.

Net weight: approx. 1.13 kg





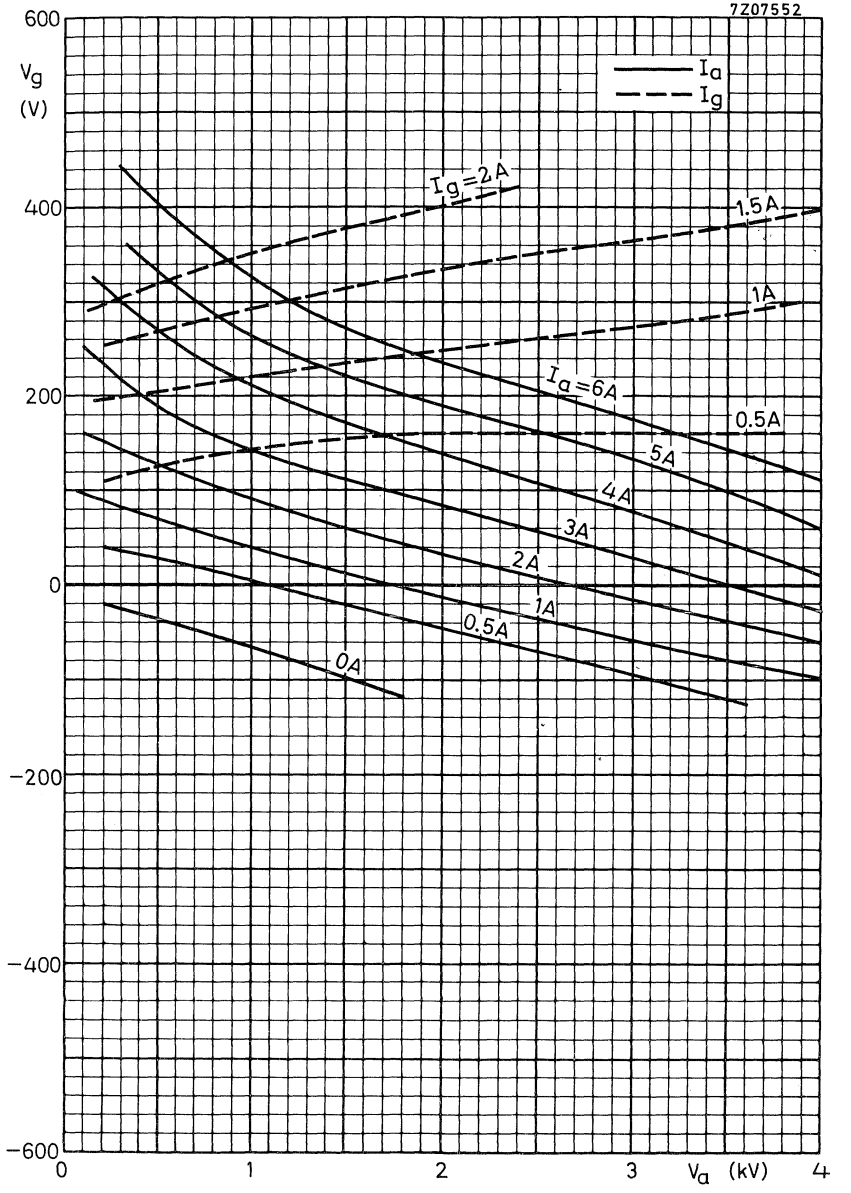
R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

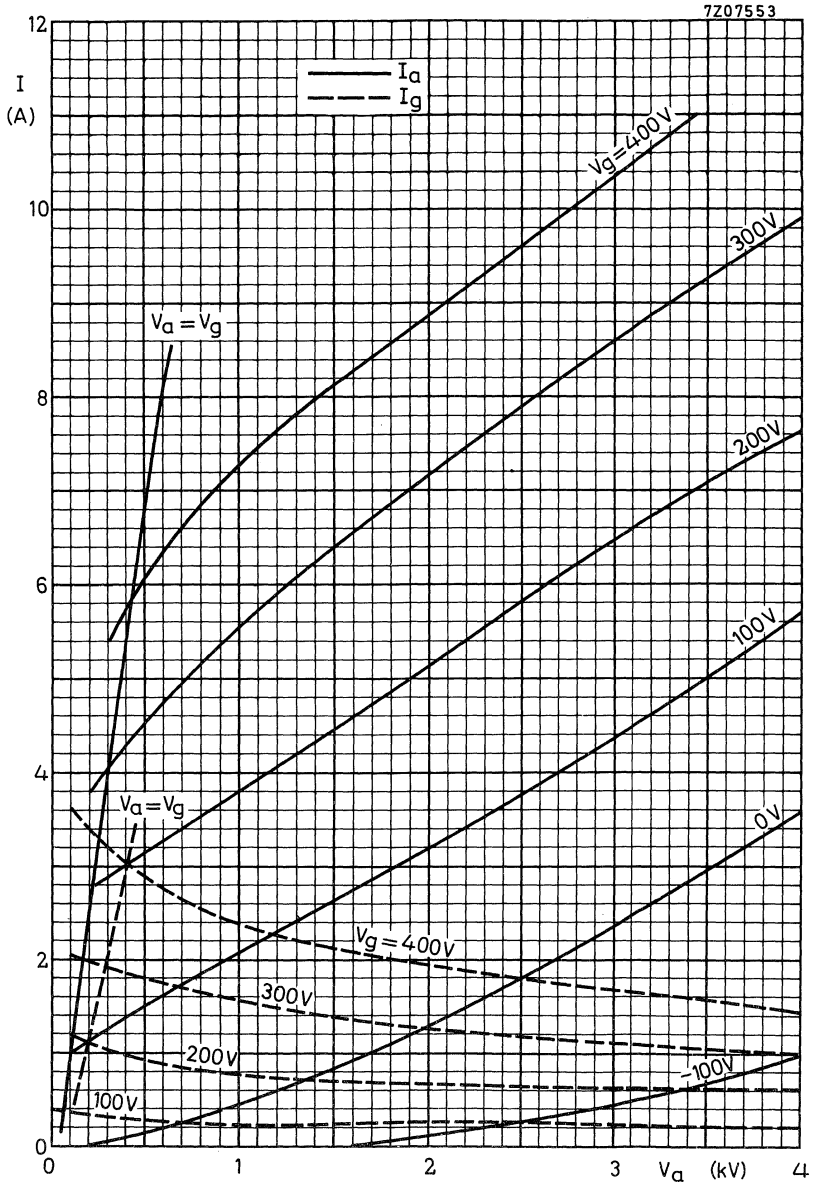
LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	250	MHz
Anode voltage	V_a	max.	5.5	kV
Anode current	I_a	max.	1.1	A
Anode input power	W_{i_a}	max.	6.0	kW
Anode dissipation	W_a	max.	1.5	kW
Grid voltage	$-V_g$	max.	1.0	kV
Grid current, loaded	I_g	max.	280	mA
unloaded	I_g	max.	400	mA
Grid dissipation	W_g	max.	150	W
Grid circuit resistance	R_g	max.	20	kΩ
Cathode current	I_k	max.	1.4	A

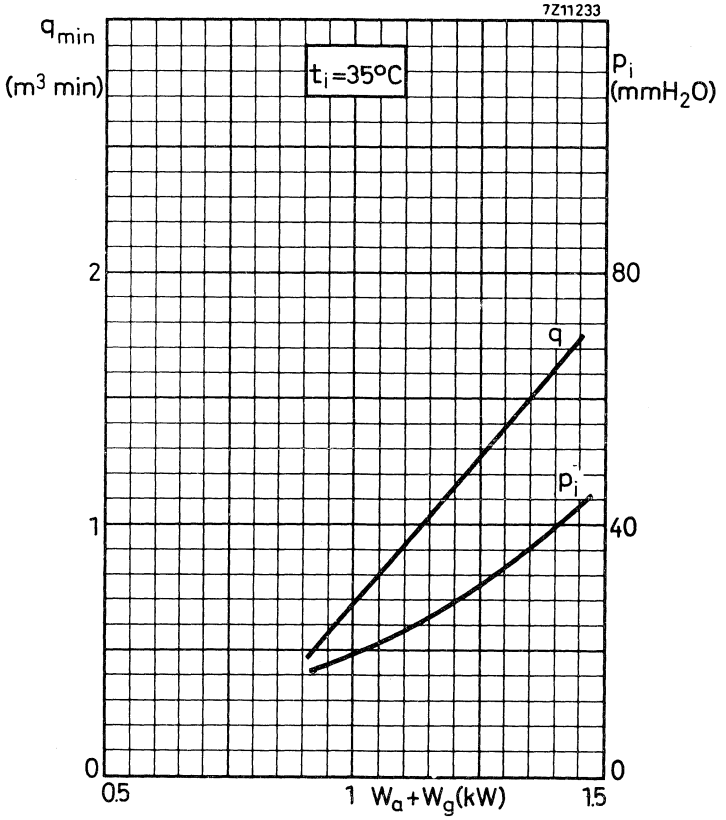
OPERATING CONDITIONS

Frequency	f	160	27.12	MHz
Filament voltage	V_f	6.0	6.3	V
Anode voltage	V_a	4.5	5.0	kV
Anode current	I_a	700	750	mA
Anode input power	W_{i_a}	3150	3750	W
Anode dissipation	W_a	750	830	W
Anode output power	W_o	2400	2900	W
Anode efficiency	η	76	78	%
Grid resistor	R_g	2.2	2.2	kΩ
Grid current, loaded	I_g	225	235	mA
Grid dissipation	W_g	70	80	W
Grid resistor dissipation	W_{R_g}	111	121	W
Oscillator output power	W_{osc}	2220	2670	W
Oscillator efficiency	η_{osc}	71	71	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	17	17	%

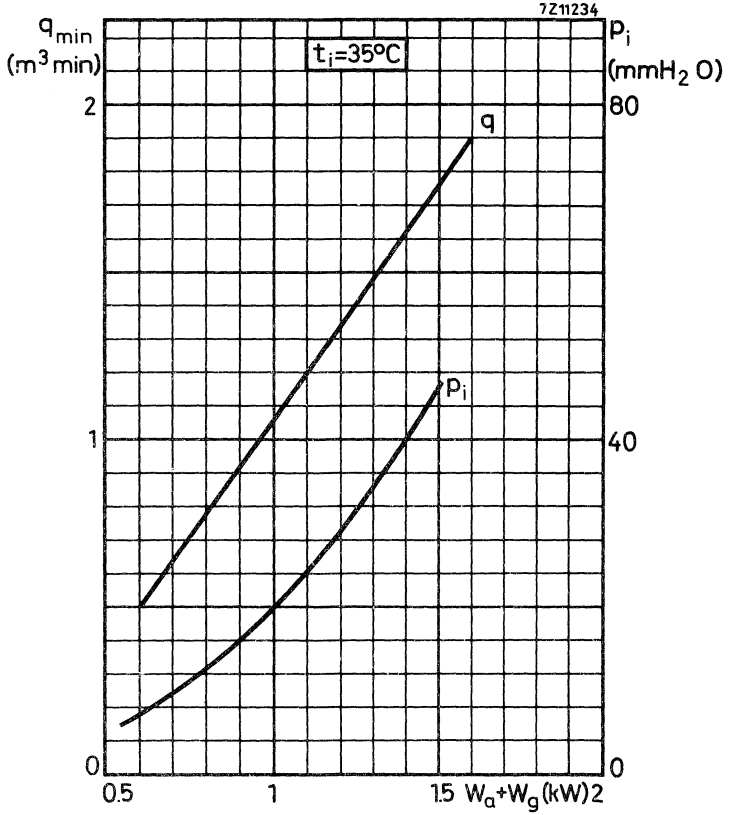

7Z07552
600
400
200
0
−200
−400
−600
Vg
(V)
Ia
Ig
Ig=2A
1.5A
1A
Ig=6A
0.5A
5A
4A
3A
2A
1A
0.5A
0A
0
1
2
3
Va (kV)
4


7Z07553
I
(A)
Ia
Ig
Vg=400V
300V
200V
100V
0V
Va=Vg
Va=Vg
Vg=400V
300V
200V
100V
Va (kV)
0
1
2
3
4
0
2
4
6
8
10
12

Air flow to header



Air flow from header



WATER COOLED MAGNETICALLY BEAMED TRIODE

Rugged water cooled magnetically focused power triode with integral water jacket intended for use as industrial oscillator for frequencies up to 5 MHz.

QUICK REFERENCE DATA			
Frequency	f	5	MHz
Anode voltage	V_a	4.5	kV
Anode current	I_a	720	mA
Oscillator output power	W_{osc}	3094	W

HEATING: indirect; nickel-oxide cathode, dispenser type

Heater voltage	V_f	5	V ±10%
Heater current	I_f	6.1	A
Waiting time	T_w min.	2	min

CAPACITANCES

Anode to cathode	C_{ak}	0.3	pF
Grid to cathode	C_{gk}	9.8	pF
Anode to grid	C_{ag}	11.5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3000	V
Anode current	I_a	500	mA
Transconductance	S	4	mA/V
Amplification factor	μ	25	
Magnetic flux density	B min.	115 (= 1150	mT Gs)

Care should be taken that the magnetic flux density is not influenced by external magnetic materials.

Data based on pre-production tubes.

TEMPERATURE LIMITS

Absolute max. seal temperature t_s max. 200 °C

COOLING

W_a (kW)	t_i (°C)	$q_{min.}$ (l/min)	p_i (atm)
2	20	3.8	0.31
	50	5.7	0.62

The waterflow must be maintained for at least 1 minute after anode power is removed.

Additional air cooling of the seals may be necessary to keep the temperature below the limiting value.

→ The direction of the water flow must be such that the inflow is below the outlet for either of the two vertical mounting positions.

ACCESSORIES

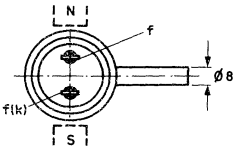
Magnet assembly (magnetic nest) type 40765 net weight 2.3 kg

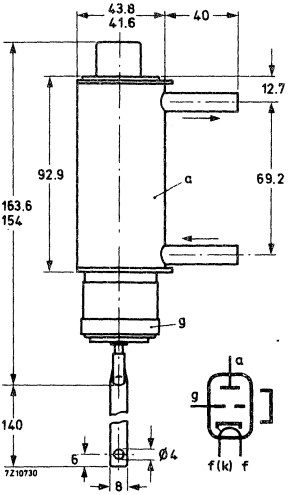
Grid connector 40766

MECHANICAL DATA

Dimensions in mm

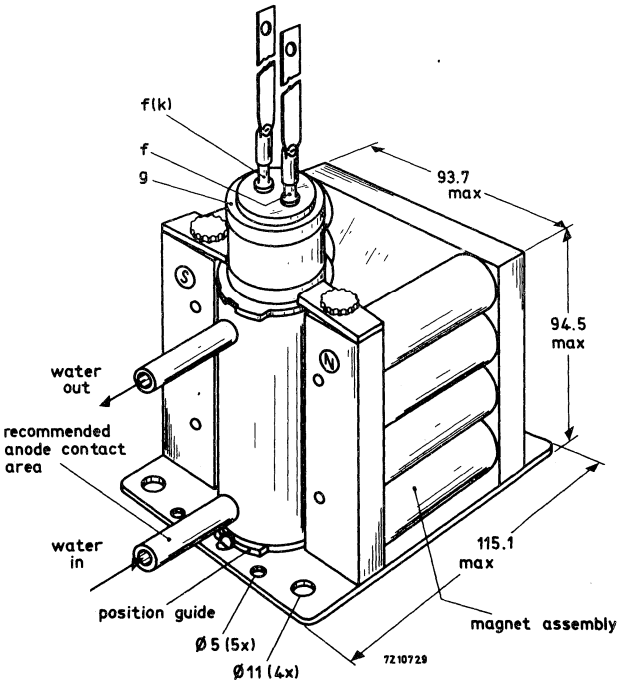
Net weight: approx. 0.45 kg





Mounting position: vertical

Due to the very rugged construction of this type, generally it can be shipped mounted in the equipment



Tube mounted in magnet assembly

R.F. CLASS C OSCILLATOR FOR INDUSTRIAL USE

Anode voltage single phase, full-wave rectified, unfiltered.

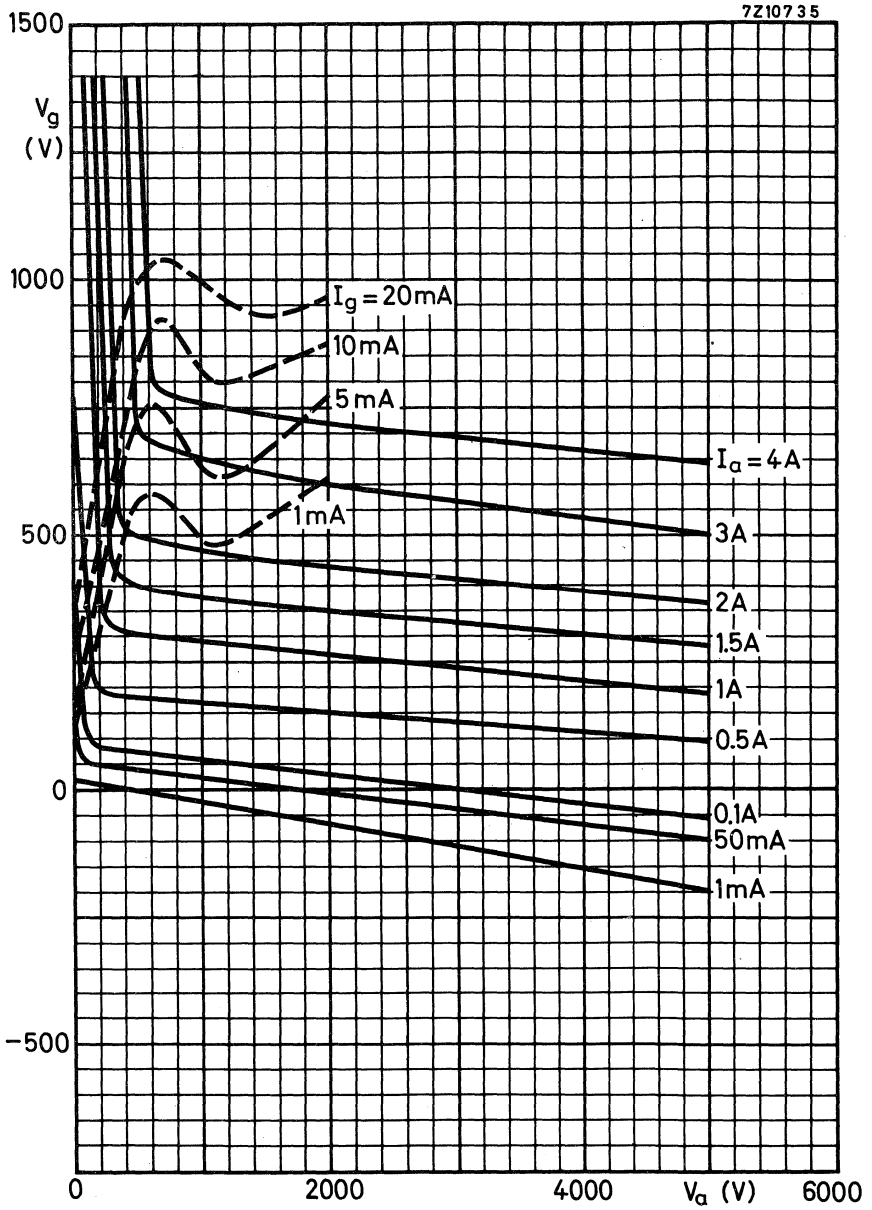
LIMITING VALUES (Absolute max. rating system)

Frequency	f	up to	5	MHz
Anode voltage	V_a	max.	4500	V [1]
Anode current	I_a	max.	725	mA [1]
Anode input power	Wi_a	max.	4	kW
Anode dissipation	W_a	max.	2	kW
Grid voltage	V_g	max.	2400	V
Grid current	I_g	see note 2		
Grid dissipation	W_g	max.	25	W
Cathode current	I_k	max.	730	mA [1]
Grid circuit resistor	R_g	max.	88	kΩ

OPERATING CONDITIONS

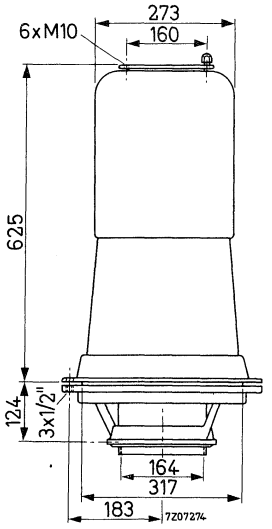
Frequency	f	5	MHz
Transformer voltage	V_{tr}	5000	V_{rms}
Anode voltage	V_a	4500	V [1]
Anode current	I_a	720	mA [1]
Anode input power	Wi_a	4000	W
Anode dissipation	W_a	900	W
Anode output power	W_o	3100	W
Anode efficiency	η	78	%
Grid resistor	R_g	80	kΩ
Grid voltage	V_g	-360	V [3]
Grid current, loaded	I_g	4.5	mA
unloaded	I_g	9	mA
Grid dissipation	W_g	4.4	W
Grid resistor dissipation	W_{R_g}	1.6	W
Oscillator output power	W_{osc}	3094	W
Oscillator efficiency	η_{osc}	77.4	%
Feedback ratio	$V_{g\sim}/V_{a\sim}$	33	%

1) Mean value.
2) Limited by W_g max. and I_k max.
3) Max. -565 V.

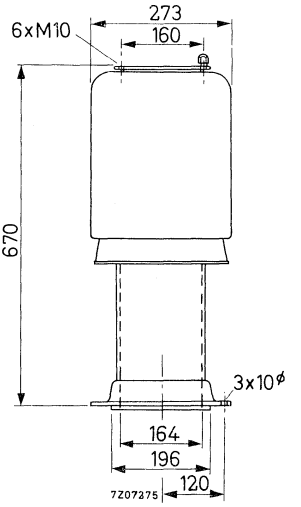

7Z10735
1500
V_g (V)
1000
500
0
−500
I_g = 20mA
10mA
5mA
1mA
I_a = 4A
3A
2A
1.5A
1A
0.5A
0.1A
50mA
1mA
0
2000
4000
V_a (V)
6000

Associated accessories

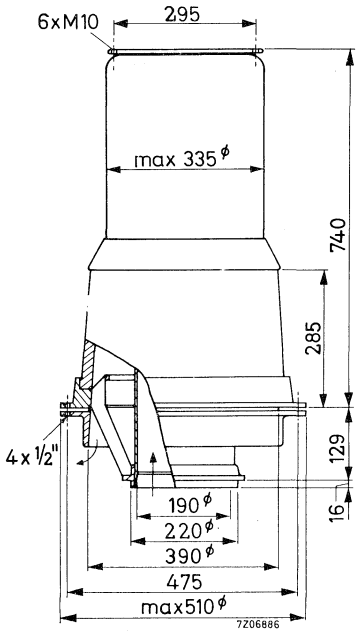
COOLER HOUSING FOR AIR COOLING



COOLER HOUSING FOR AIR COOLING

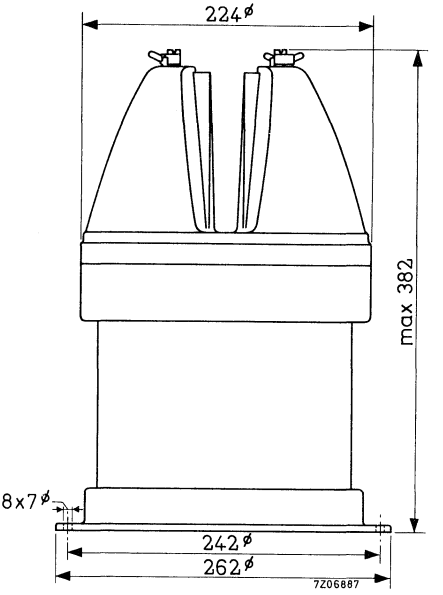


COOLER HOUSING FOR AIR COOLING



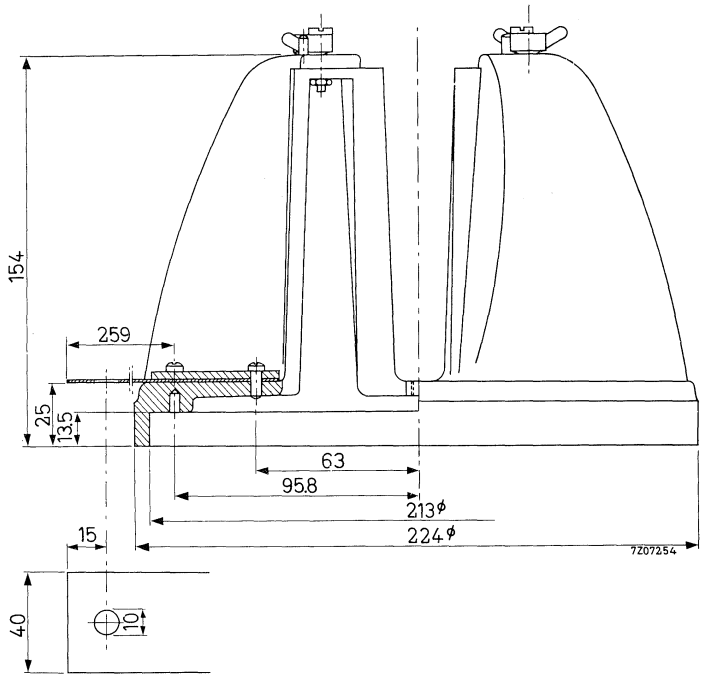
Net weight 72 kg

COOLER HOUSING FOR AIR COOLING

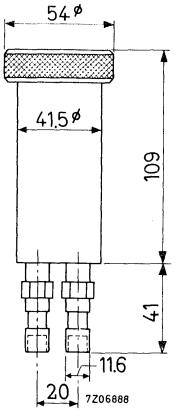


Net weight 7.4 kg

AIR DISTRIBUTOR
UPPER PART OF K508

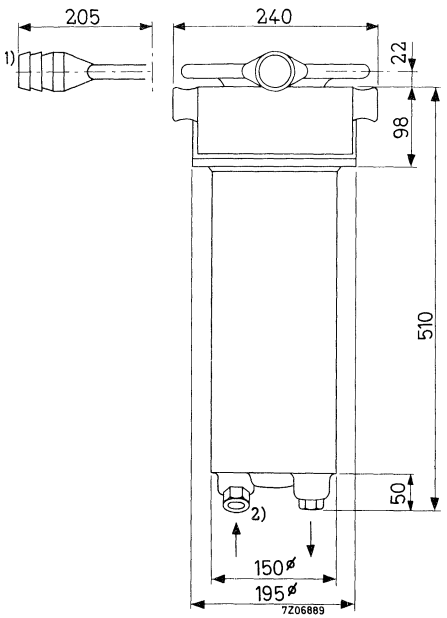


WATER JACKET



Net weight 0.52 kg

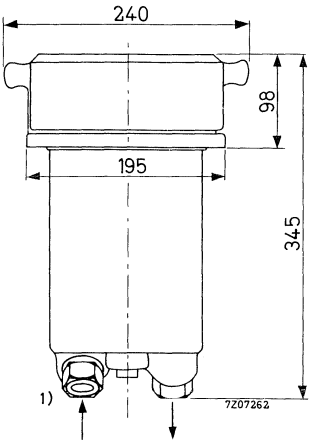
WATER JACKET



1) Use connecting hose with an inner diameter of $1\frac{3}{4}$"
2) Coupling for metal tubing with an outer diameter of 28mm

Net weight 20.5 kg

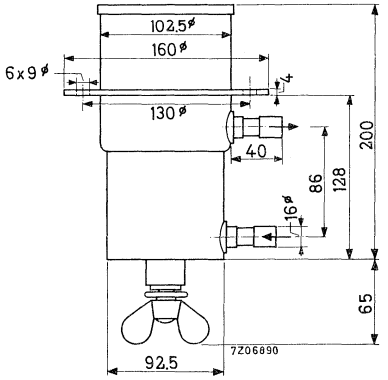
WATER JACKET



1) coupling for metal tubing with an outer diameter of 28mm

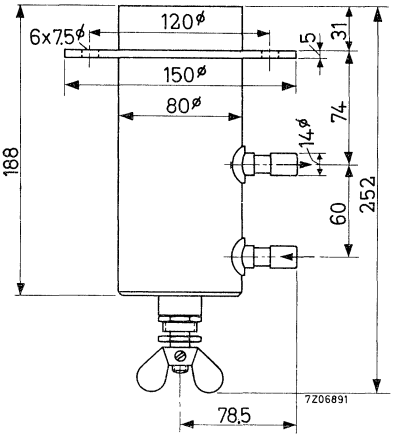
Net weight 16.7 kg

WATER JACKET



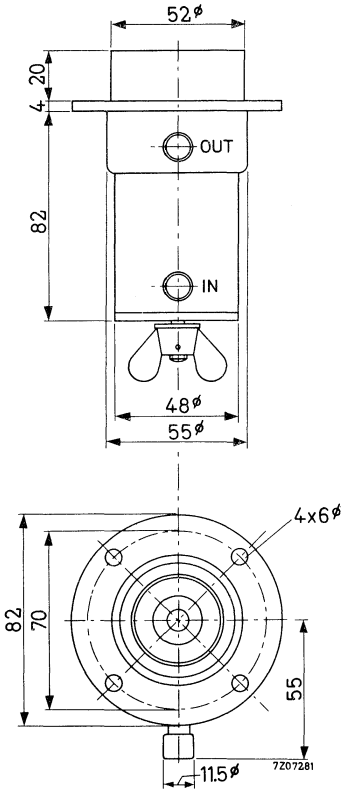
Net weight 2.1 kg

WATER JACKET



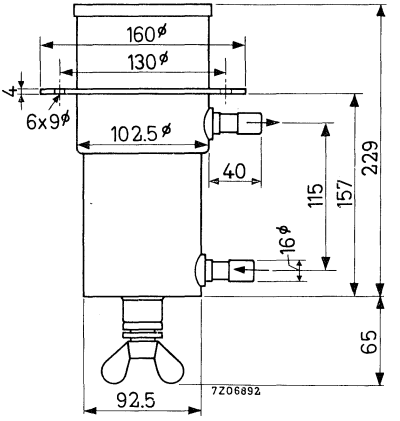
Net weight 2.2 kg

WATER JACKET



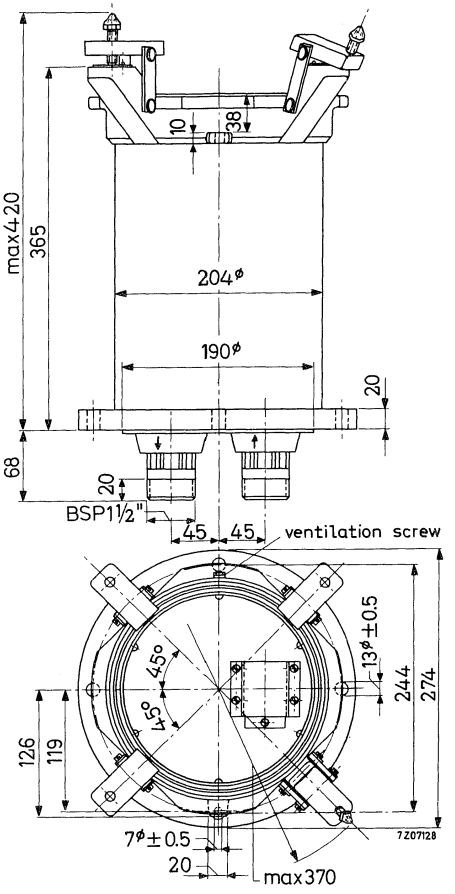
Net weight 0.76 kg

WATER JACKET



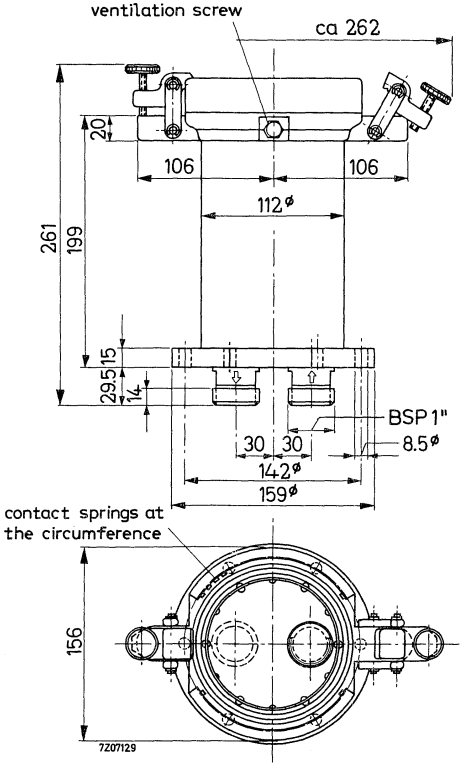
Net weight 2.7 kg

WATER JACKET



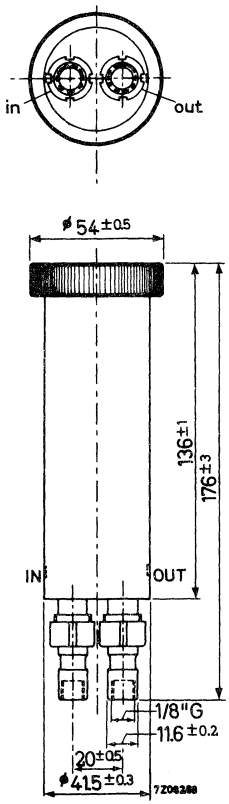
Water pressure	max.	5	ATO
Net weight		30.5	kg

WATER JACKET

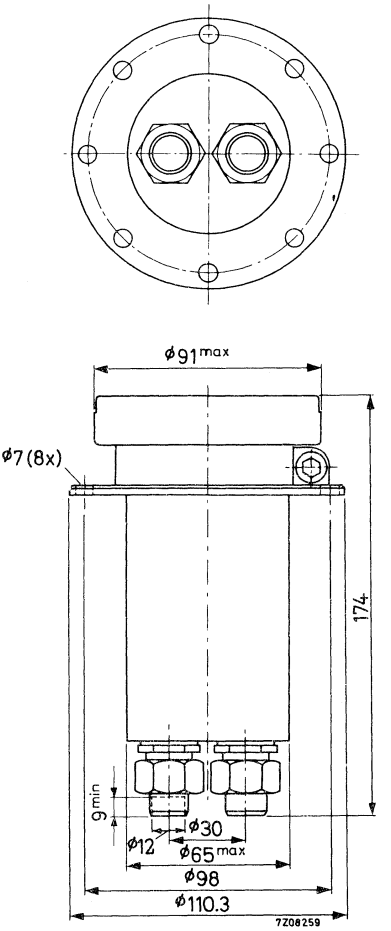


Water pressure	max. 5	ATO
Net weight	5	kg

WATER JACKET

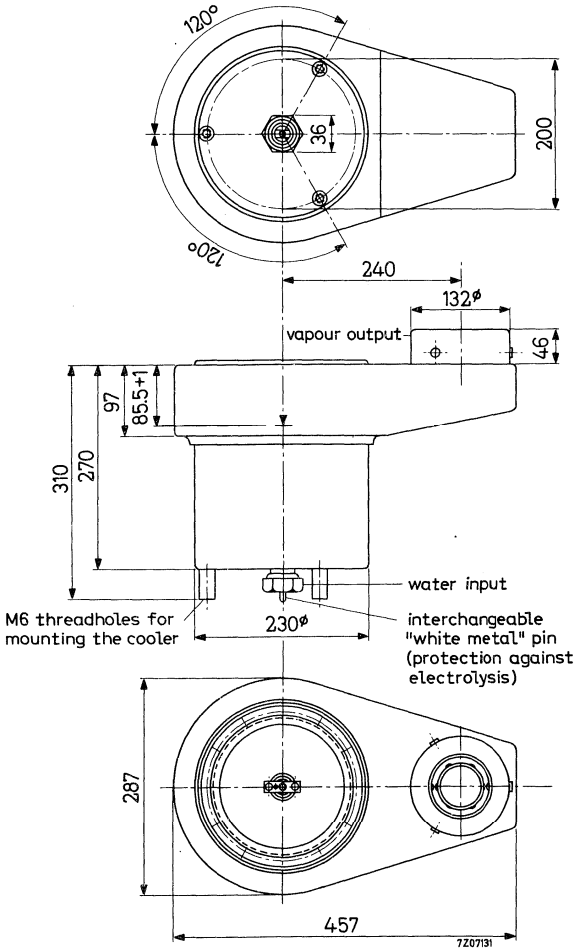


WATER JACKET



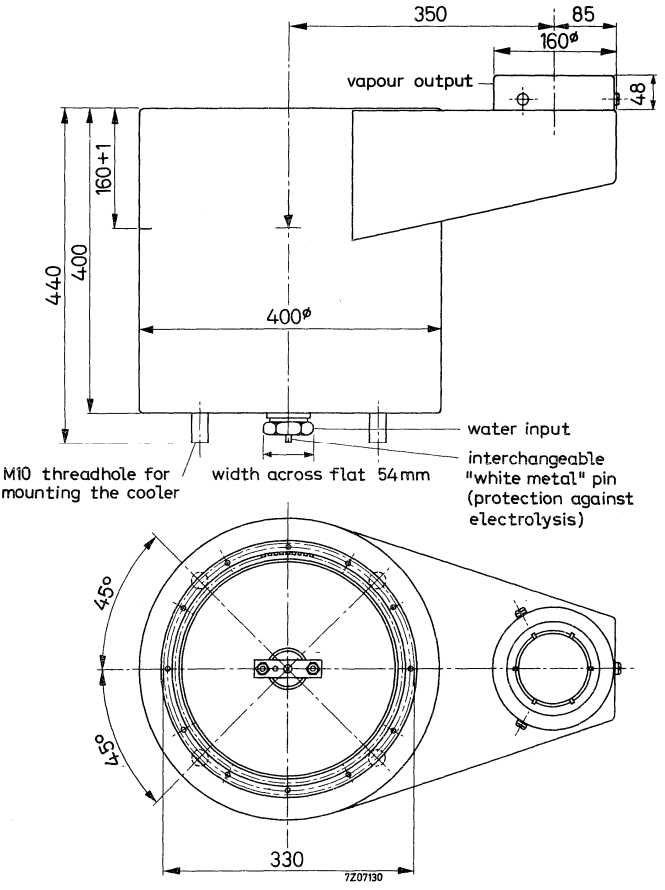
Net weight 2 kg

VAPOUR JACKET



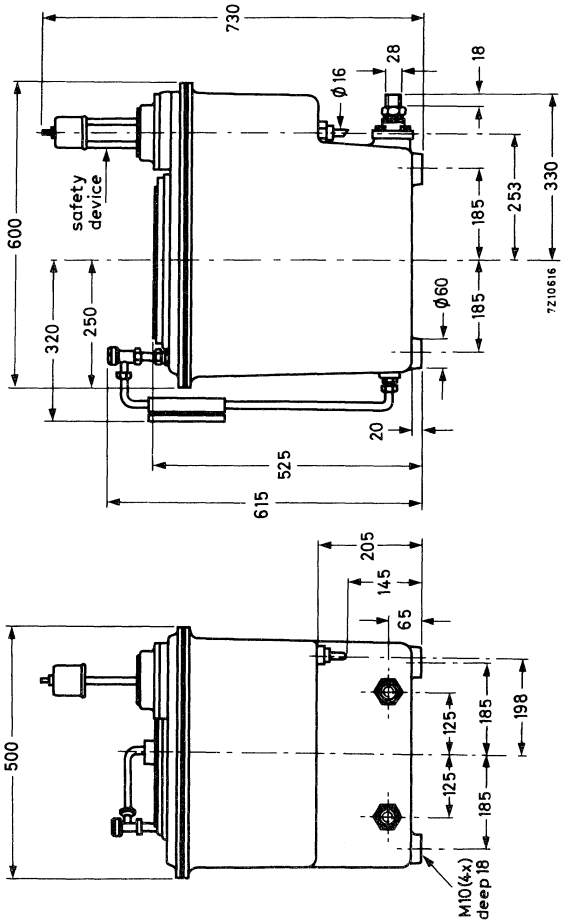
Net weight 8 kg

VAPOUR JACKET

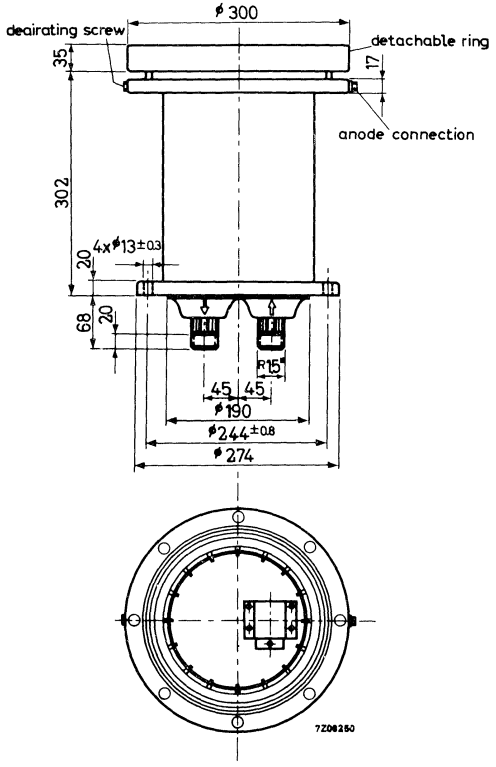


Net weight 22 kg

BOILER—CONDENSOR

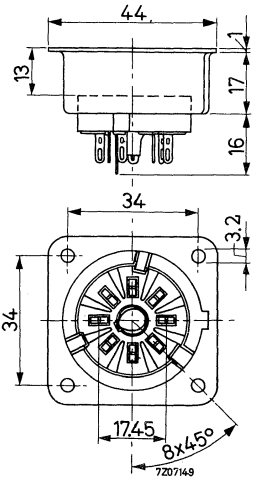


WATER JACKET



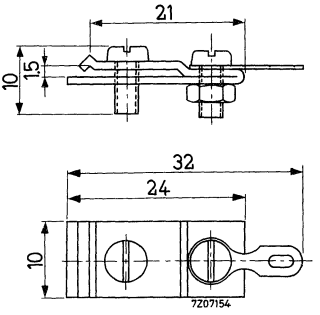
TUBE SOCKET

WITH 8 SPRING CONTACTS AND CENTRAL LOCATING AND LOCKING DEVICE



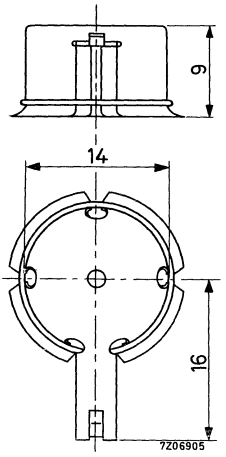
Chassis hole 42 mm

ANODE CONNECTOR



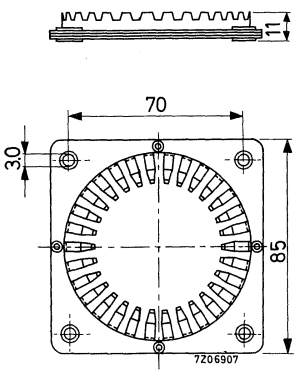
TOP CAP CONNECTOR

FOR TOP CAPS WITH 14.38 mm Ø (IEC 67-III-1b, type 3).



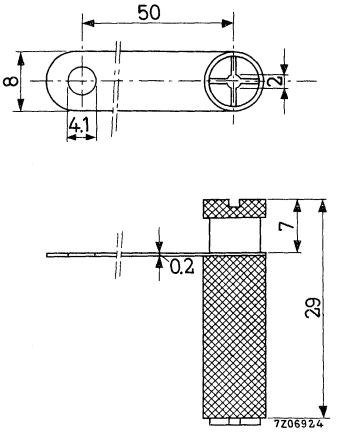
Material: brass, nickel plated

GRID CONNECTOR



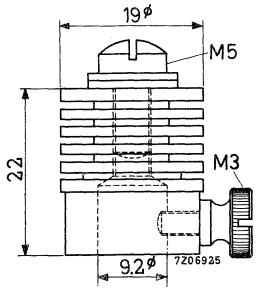
Material: brass, silver plated

ANODE CONNECTOR



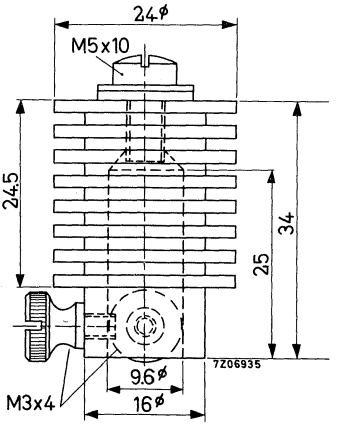
Material: brass, silver plated

ANODE CONNECTOR



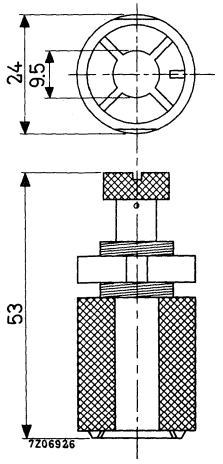
Material: brass, nickel plated

ANODE CONNECTOR



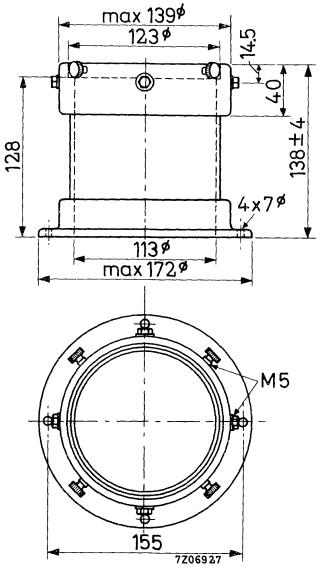
Material: brass, nickel plated

FILAMENT CONNECTOR



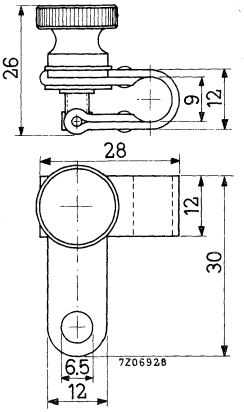
Material: brass, silver plated

INSULATING PEDESTAL

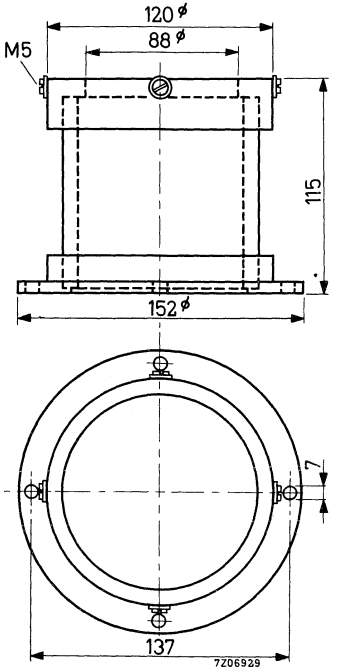


Material: ceramic
Net weight: 2.1 kg

FILAMENT CONNECTOR

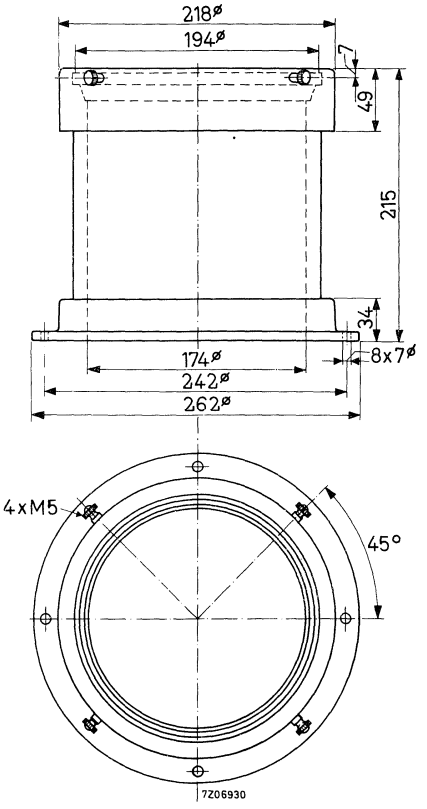


INSULATING PEDESTAL



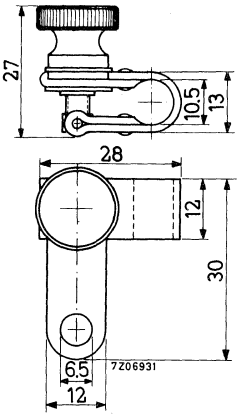
Material: ceramic
Net weight: 1.6 kg

INSULATING PEDESTAL



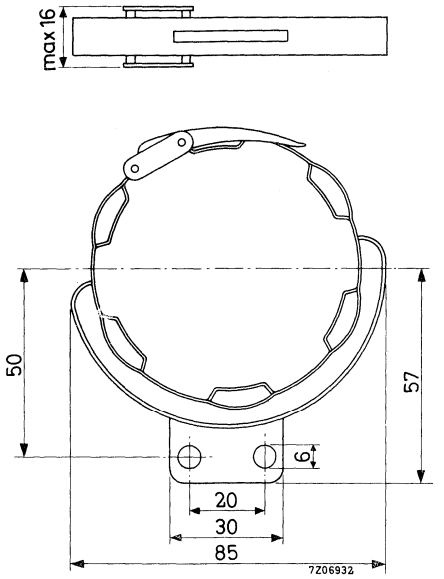
Material: ceramic

FILAMENT CONNECTOR



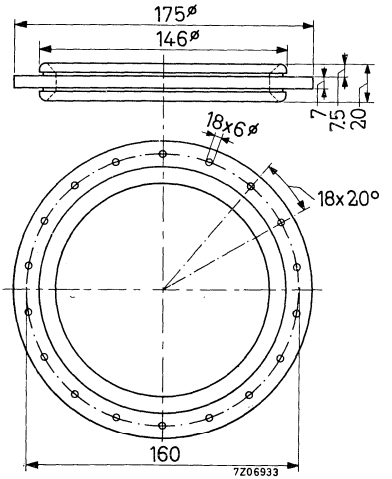
Material: brass, silver plated

GRID CONNECTOR



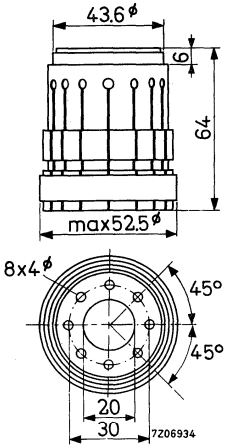
Material: brass, silver plated

GRID AND ANODE CONNECTOR



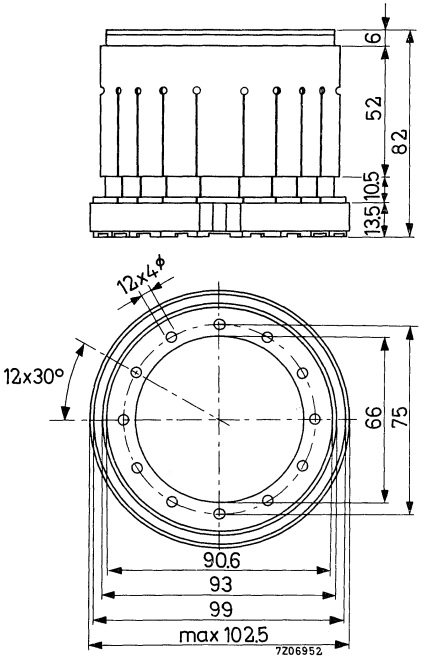
Material: brass, silver plated

FILAMENT CONNECTOR



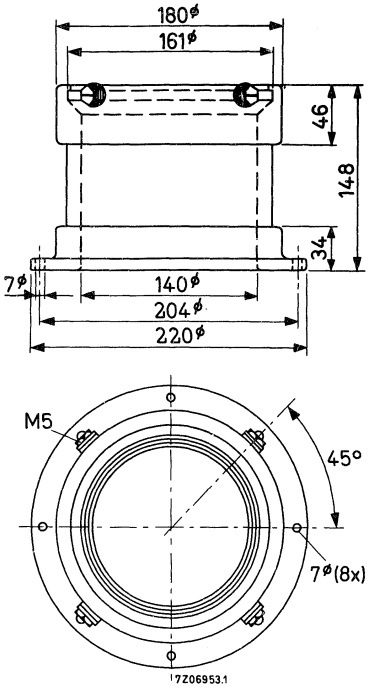
Material: brass, silver plated

FILAMENT CONNECTOR



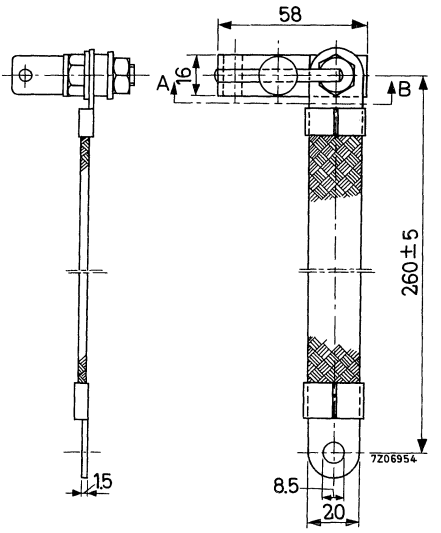
Material: brass, silver plated

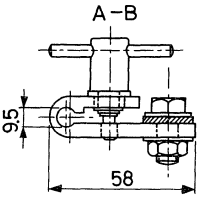
INSULATING PEDESTAL



Material: ceramic
Net weight: 4.25 kg

FILAMENT CONNECTOR WITH CABLE

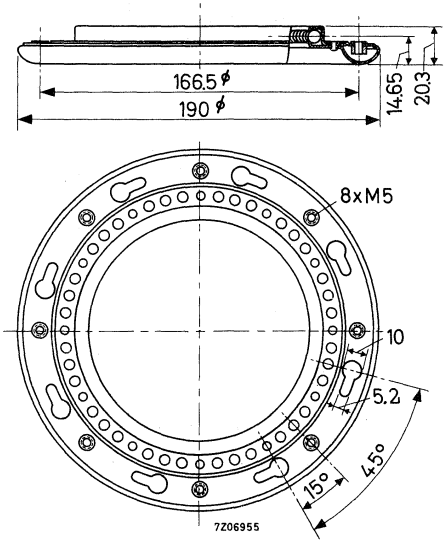




Material: cable - twined copper

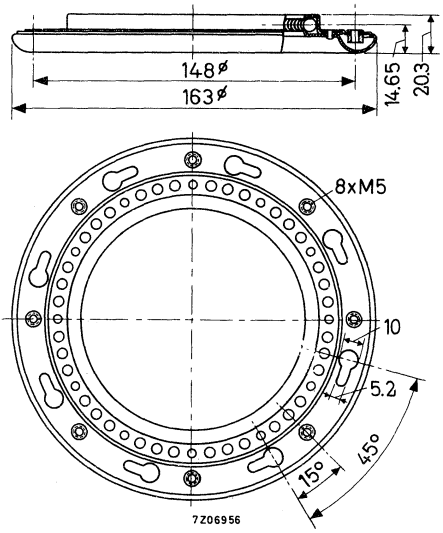
connector - brass, nickel plated

GRID CONNECTOR



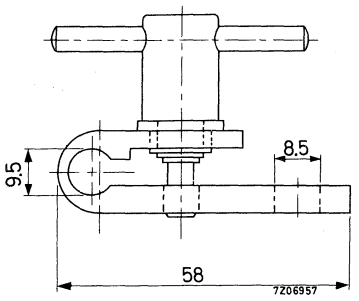
Material: brass, silver plated

GRID CONNECTOR



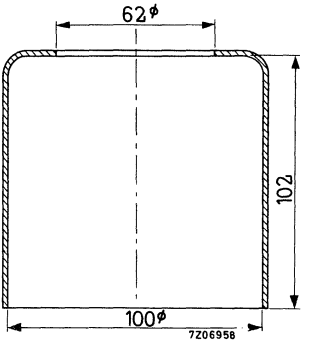
Material: brass, silver plated

ANODE CONNECTOR



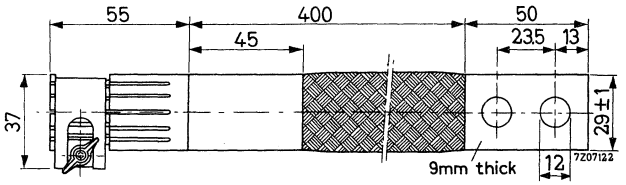
Material: brass, nickel plated

CHIMNEY

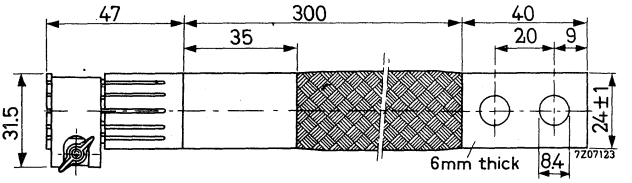


Material: glass

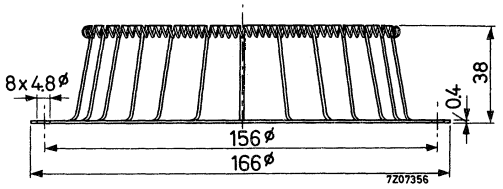
FILAMENT CONNECTOR WITH CABLE



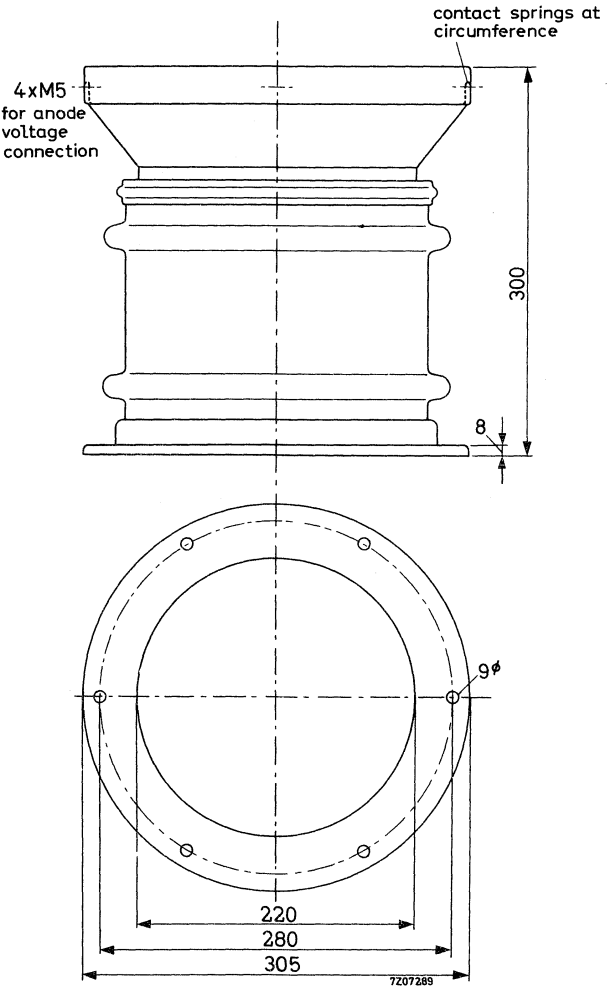
FILAMENT CONNECTOR WITH CABLE



GRID CONNECTOR

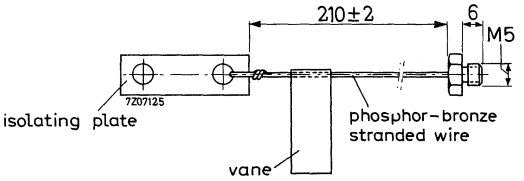


INSULATING PEDESTAL

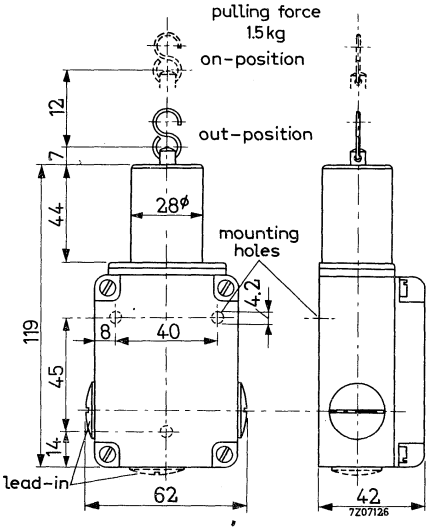


Net weight 9.2 kg

FUSE

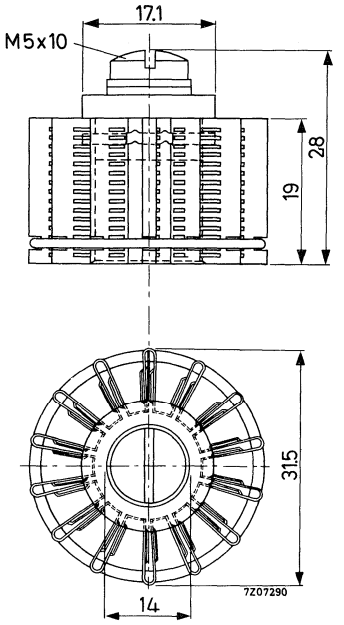

210±2
6
M5
7207125
isolating plate
phosphor-bronze
stranded wire
vane

PULL SWITCH FOR TUBE CUT-OUT



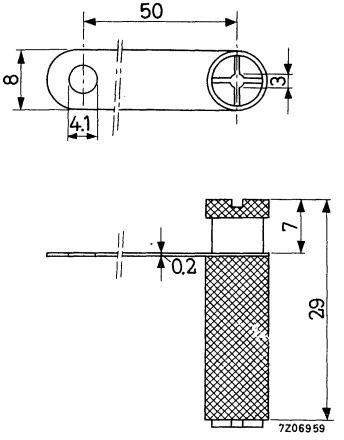
ANODE CONNECTOR

FOR TOP CAPS WITH 14..38 mm ϕ (IEC67-III-1b, type 3)



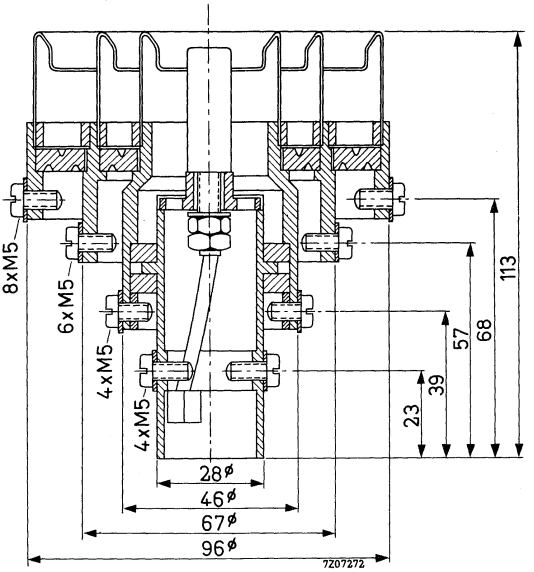
Material: brass, nickel plated

ANODE CONNECTOR



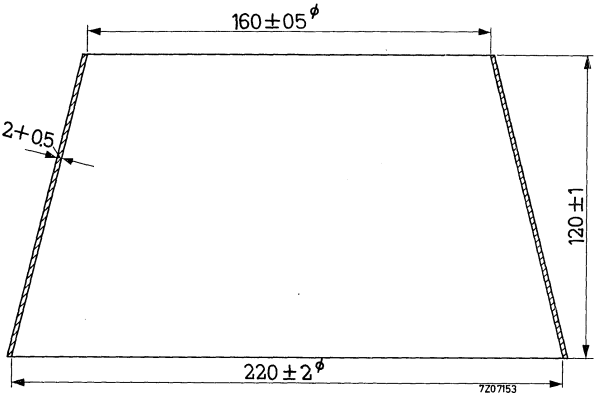
Material: brass, silver plated

TUBE SOCKET

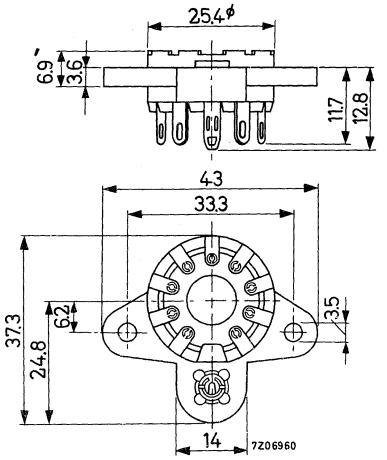


Material: synthetic resin insulating material
silver plated contacts

CHIMNEY



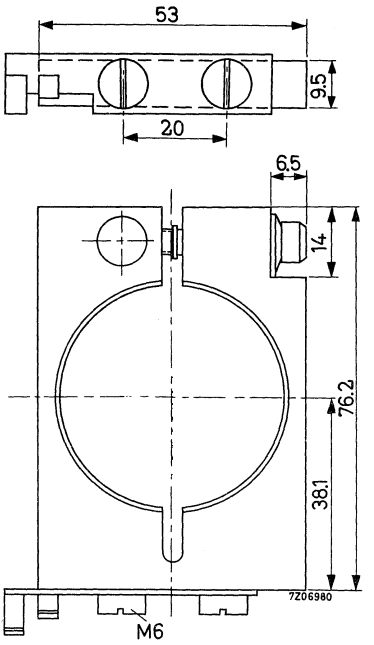
TUBE SOCKET FOR MAGNOVAL BASES



Material: synthetic resin insulating material
9 silver plated cup-shaped contacts

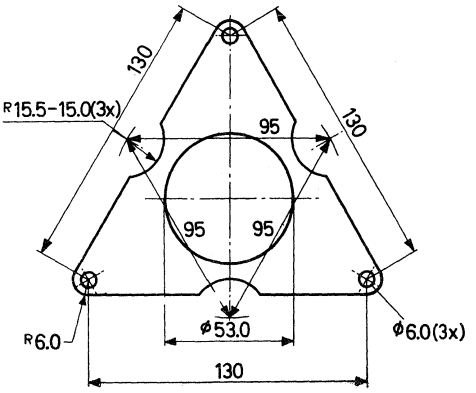
GRID CONNECTOR

FOR 48 mm ϕ TERMINALS



Material: brass, silver plated

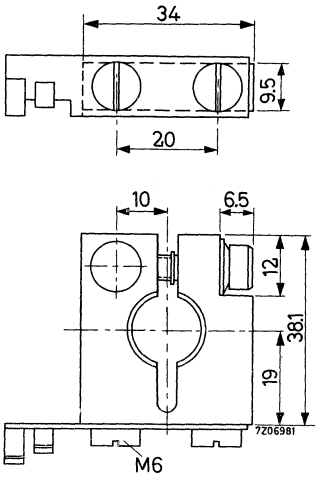
GRID CONNECTOR



Material: Brass

FILAMENT CONNECTOR

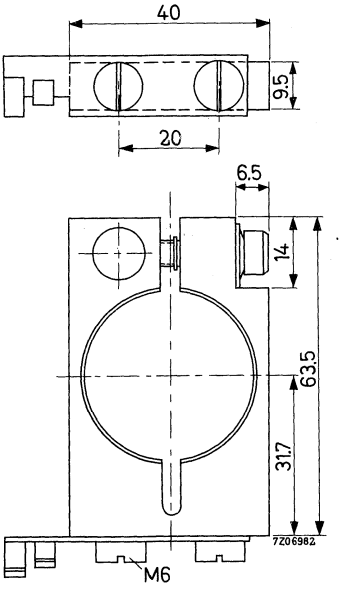
FOR 14.4 mm ϕ TERMINALS



Material: brass, nickel plated

FILAMENT CONNECTOR

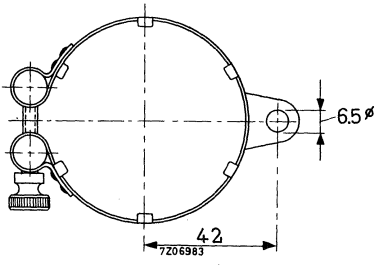
FOR 36 mm ϕ TERMINALS



Material: brass, nickel plated

GRID CONNECTOR

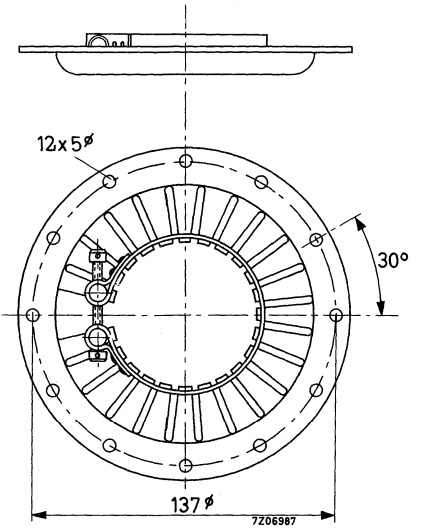
FOR 66 mm ϕ TERMINALS



Material: brass, silver plated
Net weight: 55 g

GRID CONNECTOR

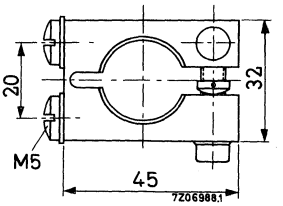
FOR 66 mm ϕ TERMINALS



Material: brass, silver plated
Net weight: 240 g

FILAMENT CONNECTOR

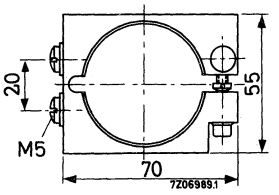
FOR 25.1 mm ϕ TERMINALS



Material: brass, nickel plated
Net weight: 140 g

FILAMENT CONNECTOR

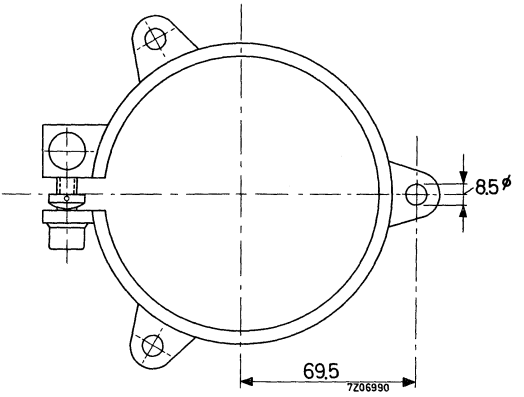
FOR 50 mm ϕ TERMINALS



Material: brass, nickel plated
Net weight: 165 g

GRID CONNECTOR

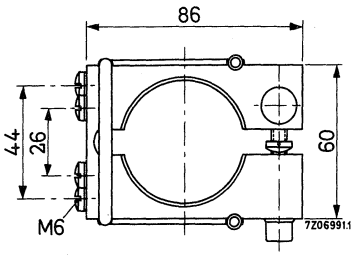
FOR 112 mm ϕ TERMINALS



Material: brass, silver plated
Net weight: 270 g

FILAMENT CONNECTOR

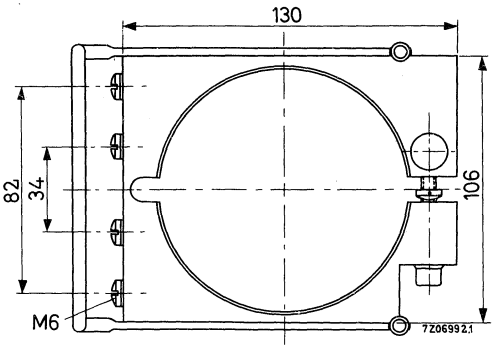
FOR 54 mm ϕ TERMINALS



Material: brass, nickel plated
Net weight: 710 g

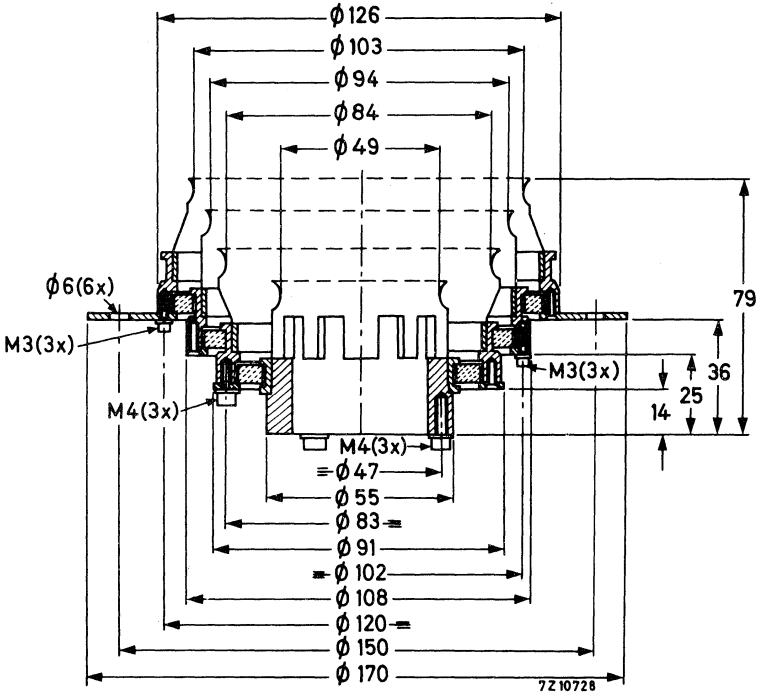
FILAMENT CONNECTOR

FOR 96 mm ϕ TERMINALS



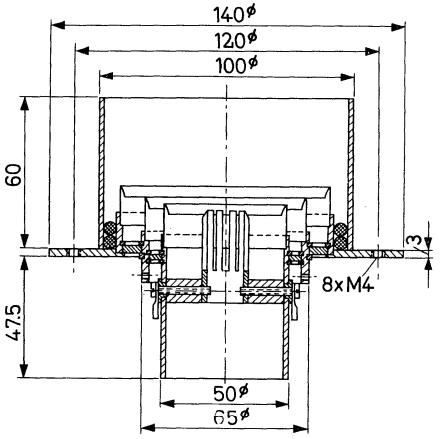
Material: brass, nickel plated
Net weight: 860 g

TUBE SOCKET FOR COAXIAL TUBES



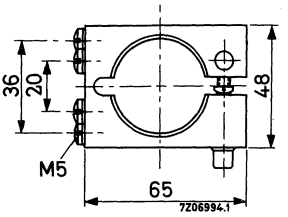
Material: teflon insulating material
silver plated contact springs

TUBE SOCKET FOR COAXIAL TETRODES



FILAMENT CONNECTOR

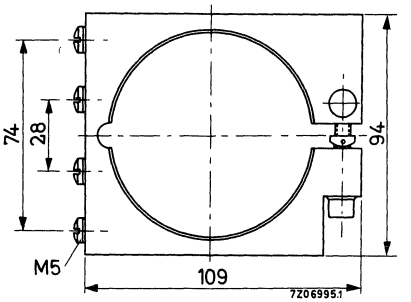
FOR 42 mm ϕ TERMINALS



Material: brass, nickel plated

FILAMENT CONNECTOR

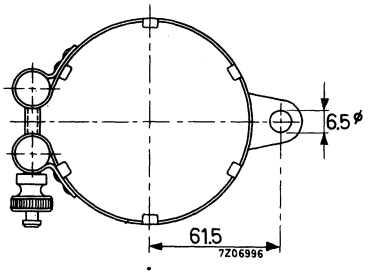
FOR 86 mm ϕ TERMINALS



Material: brass, nickel plated

GRID CONNECTOR

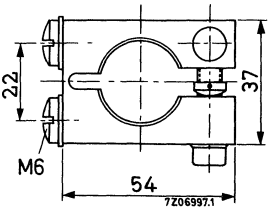
FOR 105 mm ϕ TERMINALS



Material: brass, silver plated

FILAMENT CONNECTOR

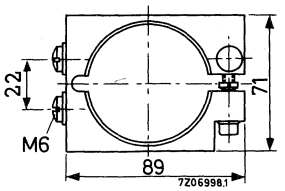
FOR 32 mm ϕ TERMINALS



Material: brass, nickel plated
Net weight: 230 g

FILAMENT CONNECTOR

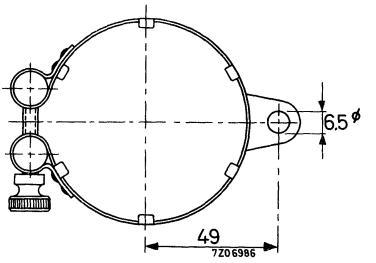
FOR 66 mm ϕ TERMINALS



Material: brass, nickel plated
Net weight: 265 g

GRID CONNECTOR

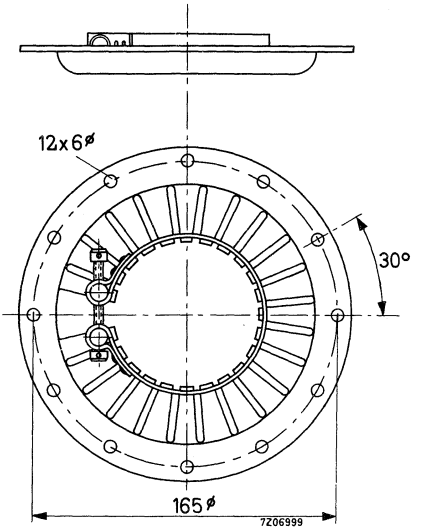
FOR 80 mm ϕ TERMINALS



Material: brass, silver plated
Net weight: 60 g

GRID CONNECTOR

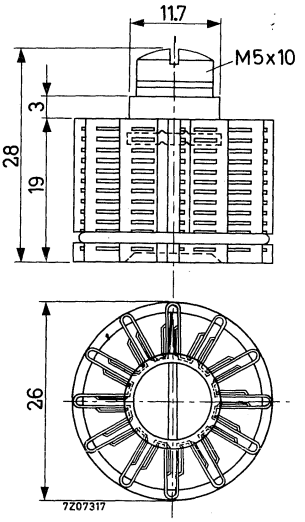
FOR 80 mm ϕ TERMINALS



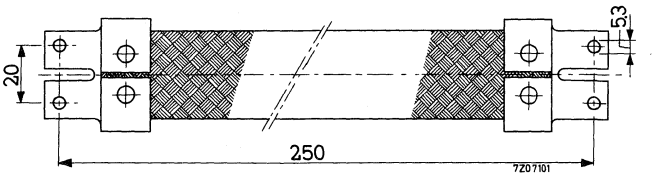
Material: brass, silver plated
Net weight: 310 g

ANODE CONNECTOR

→ FOR TOP CAPS WITH 9.14 mm ϕ (IEC67-III-1b, type 2)

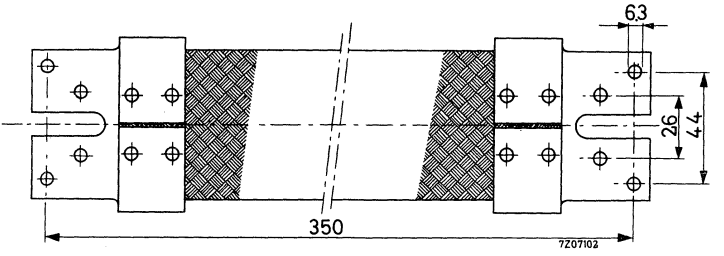


FILAMENT CABLE
TO BE USED WITH 40692 AND 40693



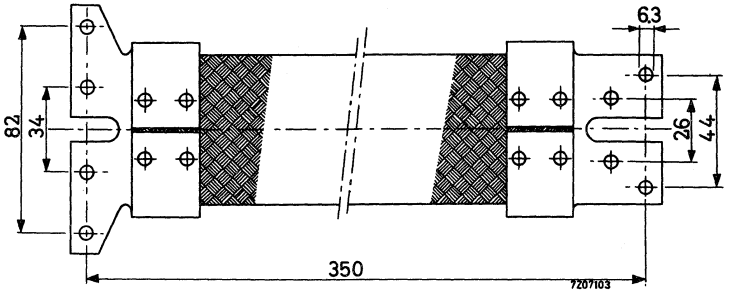
Net weight: 200 g

FILAMENT CABLE
TO BE USED WITH 40695



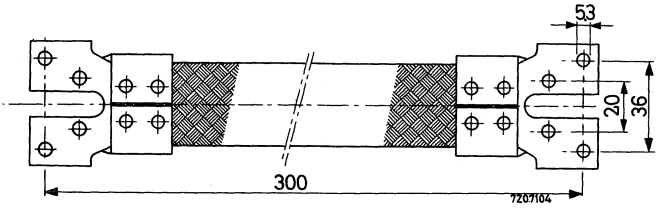
Net weight: 975 g

FILAMENT CABLE
TO BE USED WITH 40696

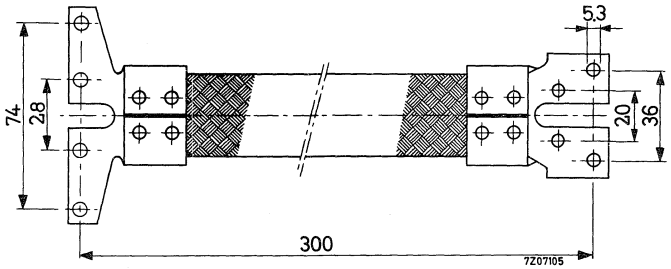


Net weight: 980 g

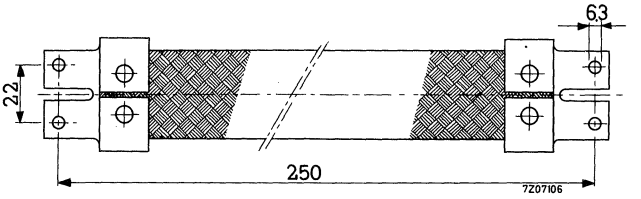
FILAMENT CABLE
TO BE USED WITH 40705



FILAMENT CABLE
TO BE USED WITH 40706

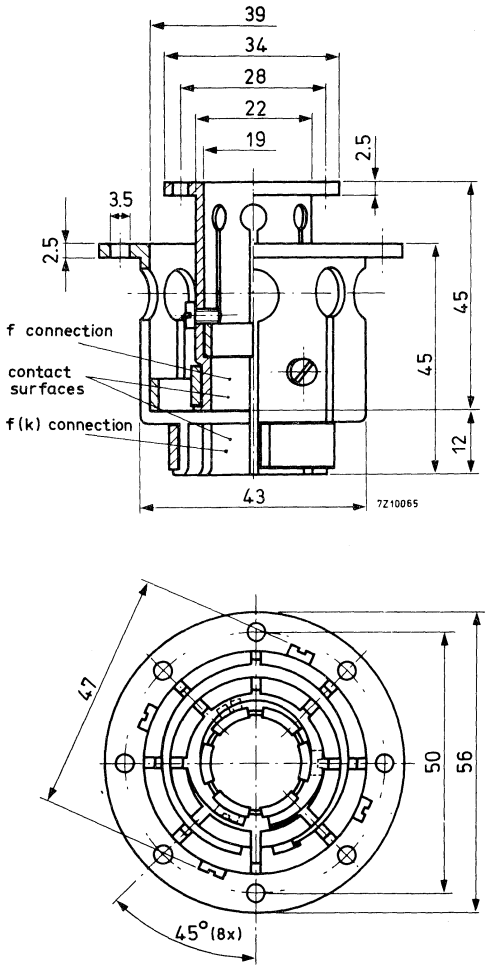


FILAMENT CABLE
TO BE USED WITH 40708 AND 40709



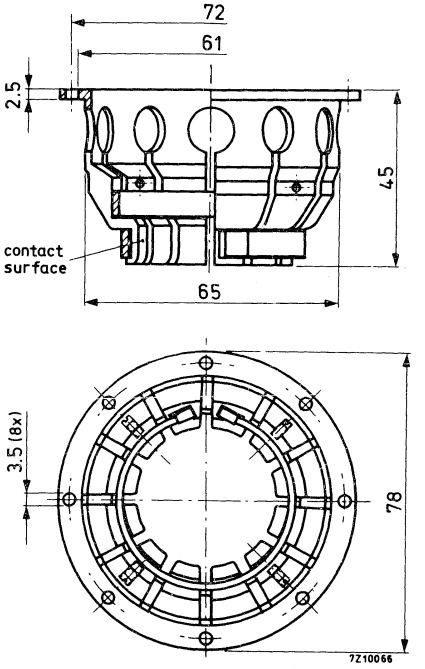
Net weight: 215 g

FILAMENT CONNECTOR



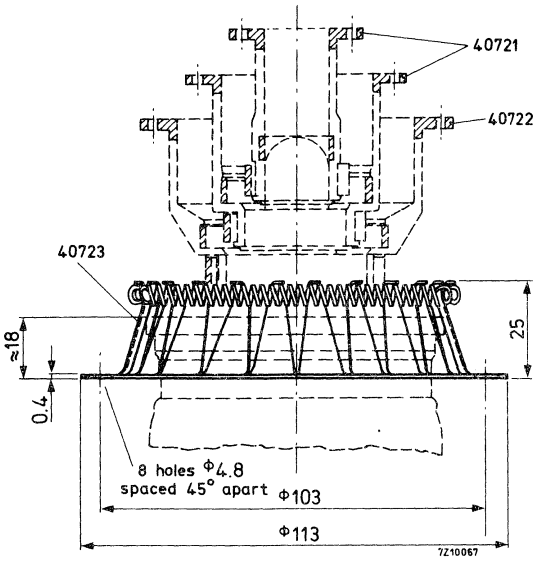
Net weight: approx. 0.2 kg

GRID CONNECTOR



Net weight: approx. 0.2 kg

SCREEN GRID CONNECTOR

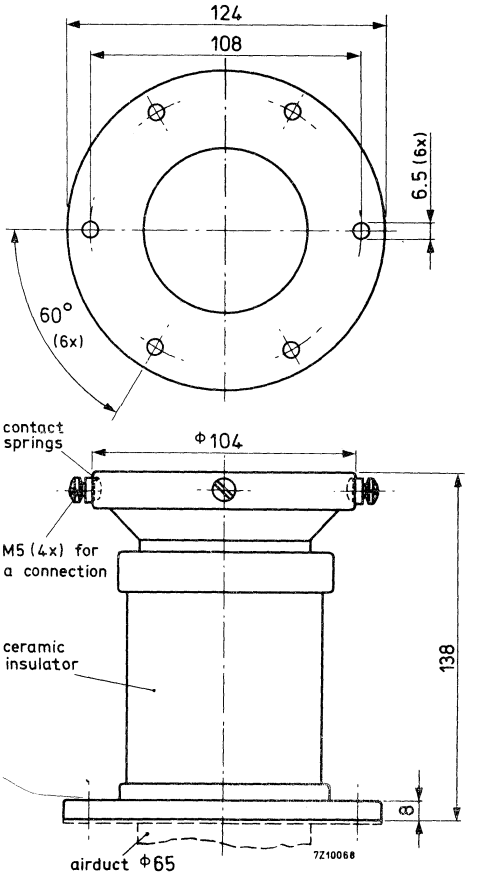


Net weight: approx. 0.1 kg

Caution

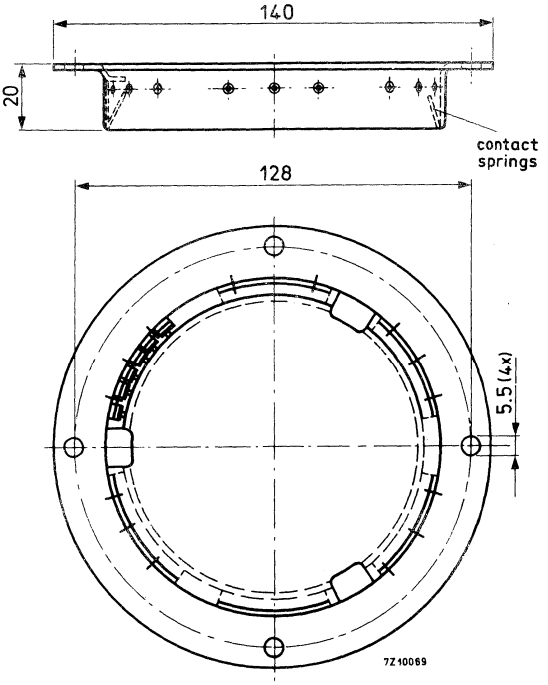
The tube must never be pulled through the spring ring.
So, if it has to be inserted from above, this should be done first, before the screen grid connection is made. Similarly, the tube can only be taken out after the screen grid connector has been removed.

INSULATING PEDESTAL



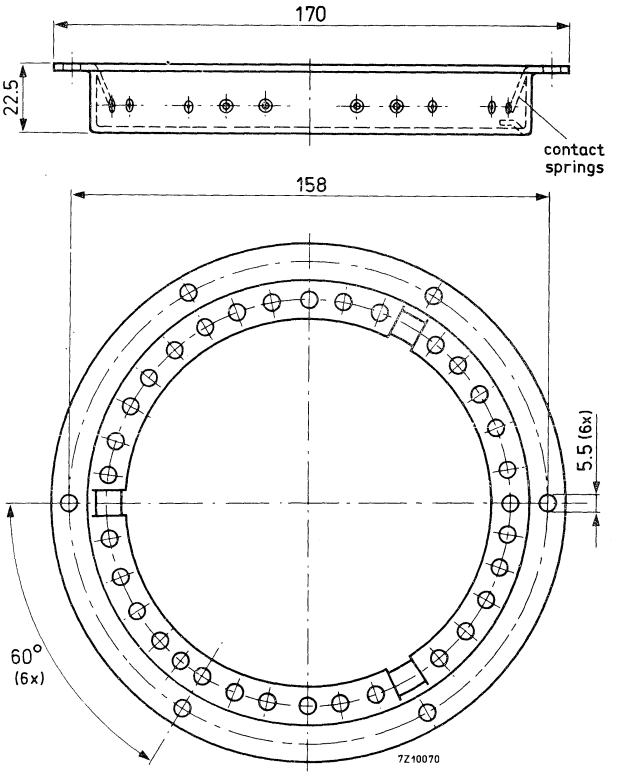
Net weight: approx. 1.3 kg

GRID CONNECTOR



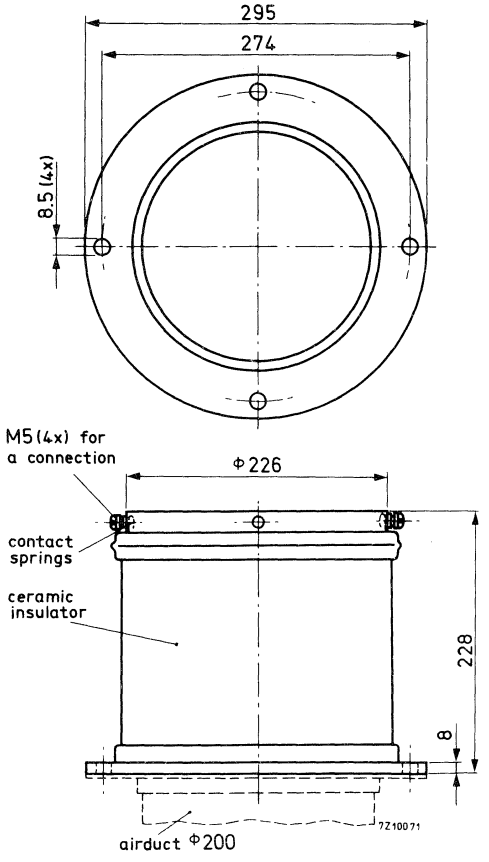
Net weight: approx. 0.14 kg

SCREEN GRID CONNECTOR



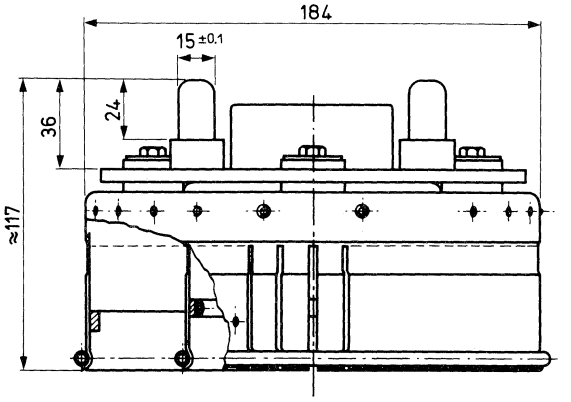
Net weight: approx. 0.2 kg

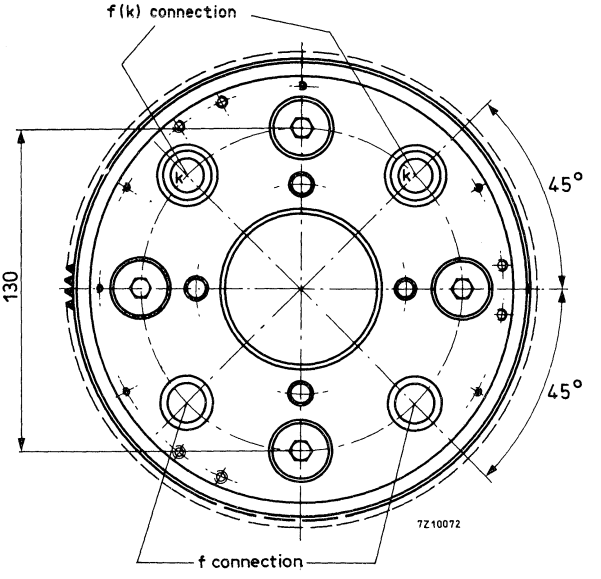
INSULATING PEDESTAL



Net weight: approx. 8.2 kg

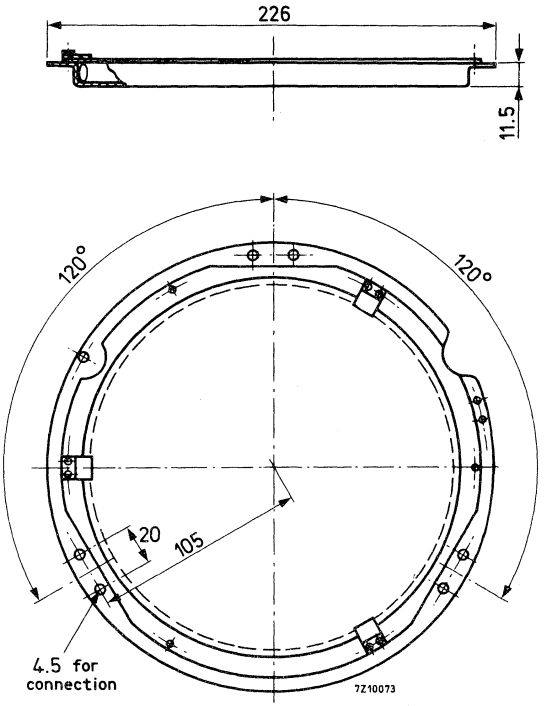
FILAMENT CONNECTOR





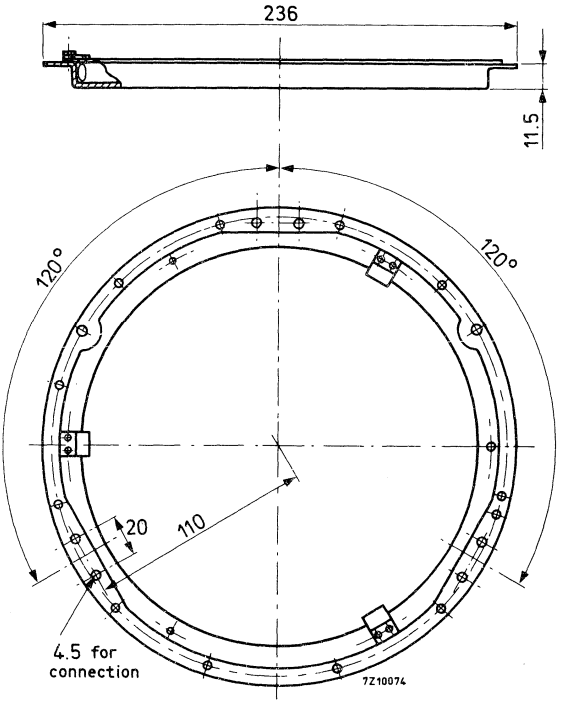
Net weight: approx. 2.5 kg

GRID CONNECTOR



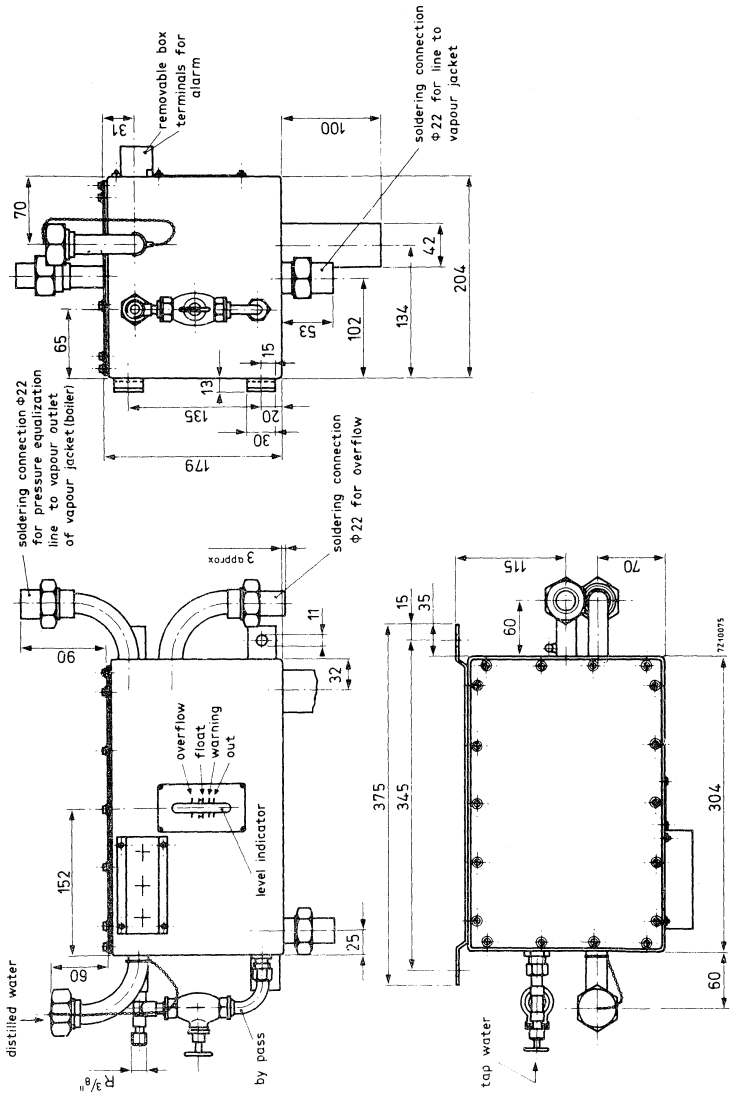
Net weight: approx. 0.35 kg

SCREEN GRID CONNECTOR



Net weight: approx. 0.4 kg

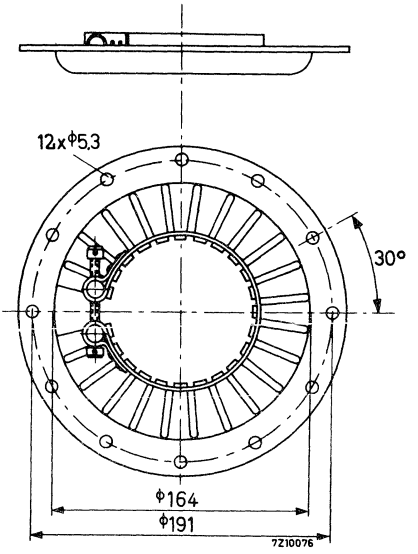
WATER LEVEL CONTROL



Material: Copper
Net weight: approx. 8.5 kg

GRID CONNECTOR

FOR 105 mm ϕ TERMINALS

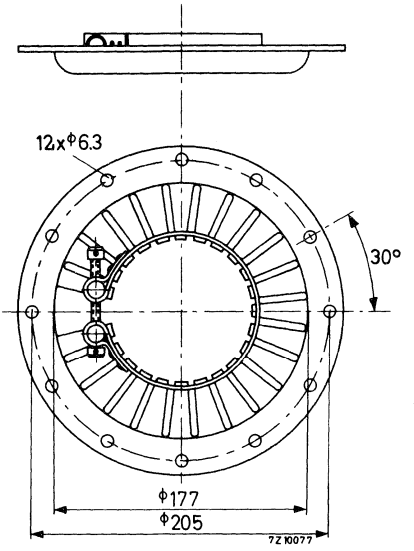


Material: brass, silver plated

Net weight: 450 g

GRID CONNECTOR

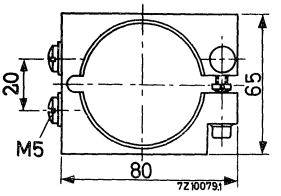
FOR 112 mm ϕ TERMINALS



Material: brass, silver plated
Net weight: 525 g

GRID OR FILAMENT CONNECTOR

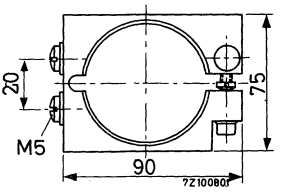
FOR 50 mm ϕ TERMINALS



Material: brass, nickel plated

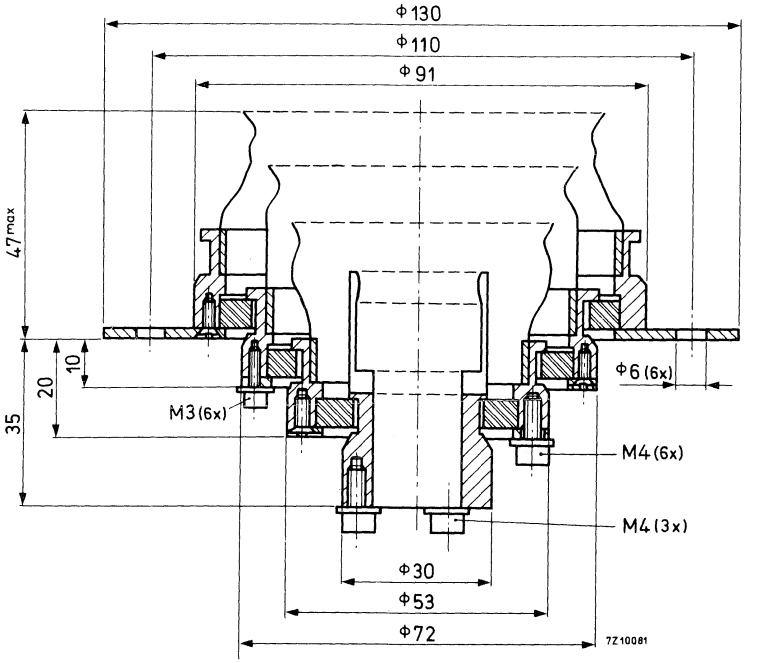
SCREEN GRID CONNECTOR

FOR 70.1 mm ϕ TERMINALS



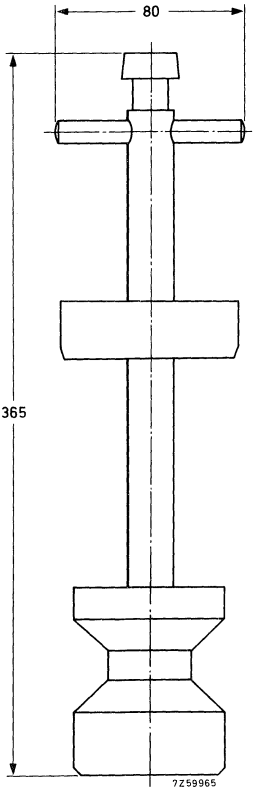
Material: brass, nickel plated

SOCKET



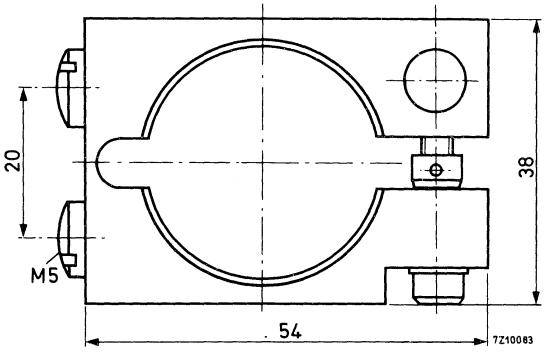
Material: brass and polytetra fluoroethylene

TUBE EXTRACTOR



GRID CONNECTOR

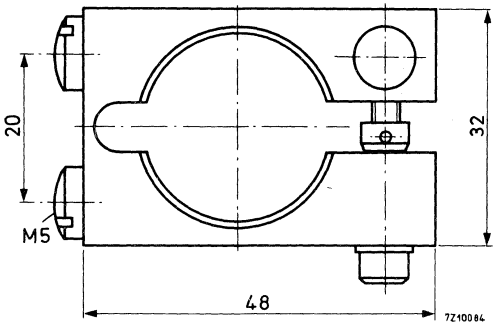
FOR 33.5 mm ϕ TERMINALS



Material: brass

FILAMENT/CATHODE CONNECTOR

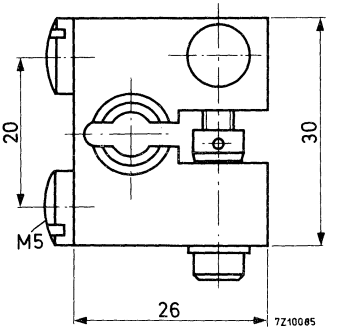
FOR 27 mm ϕ TERMINALS



Material: brass

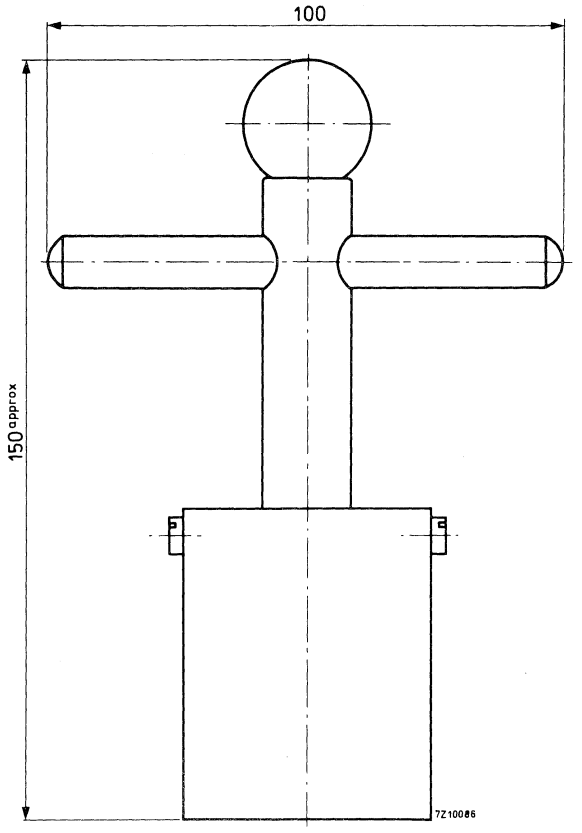
GRID OR FILAMENT CONNECTOR

FOR 9 mm ϕ TERMINALS



Material: brass

TUBE EXTRACTOR



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TAW12/35G	Tr.T.
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Acc. = Accessories
Tr.T. = Transmitting tubes, Triodes

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Acc. = Accessories
Tr.T. = Transmitting tubes, Triodes

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Acc. = Accessories

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Type No.	Section

Acc. = Accessories

General section

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

TRIODES

Associated accessories

Printed in The Netherlands

9399 241 15501