PHILIPS

Data handbook

PHILIPS Electronic components and materials

Electron tubes

Part 2b February 1984

Transmitting tubes for communications

Ceramic types

Amplifier circuit assemblies

ELECTRON TUBES

PART 2b - FEBRUARY 1984

TRANSMITTING TUBES FOR COMMUNICATIONS

ceramic types and amplifier circuit assemblies

SEE ALSO PART 1 AND PART 2a

DATA HANDBOOK SYSTEM

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

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

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

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

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

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks is comprised of the following parts:

IC1	**Bipolar ICs for radio and audio equipment**
IC2	**Bipolar ICs for video equipment**
IC3	**ICs for digital systems in radio, audio and video equipment**
IC4	**Digital integrated circuits** CMOS HE4000B family
IC5	**Digital integrated circuits – ECL** ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs
IC6	**Professional analogue integrated circuits**
IC7	**Signetics bipolar memories**
IC8	**Signetics analogue circuits**
IC9	**Signetics TTL logic**
IC10	**Signetics Integrated Fuse Logic (IFL)**
IC11	**Microprocessors, microcomputers and peripheral circuitry**

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks is comprised of the following parts:

S1 **Diodes**
Small-signal germanium diodes, small-signal silicon diodes, voltage regulator diodes(< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes

S2 **Power diodes, thyristors, triacs**
Rectifier diodes, voltage regulator diodes (> 1,5 W), rectifier stacks, thyristors, triacs

S3 **Small-signal transistors**

S4a **Low-frequency power transistors and hybrid modules**

S4b **High-voltage and switching power transistors**

S5 **Field-effect transistors**

S6 **R.F. power transistors and modules**

S7 **Microminiature semiconductors for hybrid circuits**

S8 **Devices for optoelectronics**
Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.

S9 **Power MOS transistors**

S10 **Wideband transistors and wideband hybrid IC modules**

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks is comprised of the following parts:

T1 Tubes for r.f. heating

T2a Transmitting tubes for communications, glass types

T2b Transmitting tubes for communications, ceramic types

T3 Klystrons, travelling-wave tubes, microwave diodes

ET3 Special Quality tubes, miscellaneous devices (will not be reprinted)

T4 Magnetrons

T5 Cathode-ray tubes
Instrument tubes, monitor and display tubes, C.R. tubes for special applications

T6 Geiger-Müller tubes

T7 Gas-filled tubes
Segment indicator tubes, indicator tubes, dry reed contact units, thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes, associated accessories

T8 Picture tubes and components
Colour TV picture tubes, black and white TV picture tubes, colour monitor tubes for data graphic display, monochrome monitor tubes for data graphic display, components for colour television, components for black and white television and monochrome data graphic display

T9 Photo and electron multipliers
Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates

T10 Camera tubes and accessories, image intensifiers

T11 Microwave semiconductors and components

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks is comprised of the following parts:

C1 **Assemblies for industrial use**
PLC modules, PC20 modules, HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices, hybrid ICs

C2 **Television tuners, video modulators, surface acoustic wave filters**

C3 **Loudspeakers**

C4 **Ferroxcube potcores, square cores and cross cores**

C5 **Ferroxcube for power, audio/video and accelerators**

C6 **Electric motors and accessories**
Permanent magnet synchronous motors, stepping motors, direct current motors

C7 **Variable capacitors**

C8 **Variable mains transformers**

C9 **Piezoelectric quartz devices**
Quartz crystal units, temperature compensated crystal oscillators, compact integrated oscillators, quartz crystal cuts for temperature measurements

C10 **Connectors**

C11 **Non-linear resistors**
Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)

C12 **Variable resistors and test switches**

C13 **Fixed resistors**

C14 **Electrolytic and solid capacitors**

C15 **Film capacitors, ceramic capacitors**

C16 **Piezoelectric ceramics, permanent magnet materials**

RATING SYSTEM

(in accordance with IEC Publication 134)

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which 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 variation, equipment component 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.

GENERAL SECTION

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

a	Anode
B	Bandwidth; magnetic flux density
bp	Beam plates
C_a	Capacitance between anode and all other electrodes
C_{af}	Capacitance between anode and filament (all other electrodes being earthed)
C_{ag}	Capacitance between anode and grid (all other electrodes being earthed)
C_{ak}	Capacitance between anode and cathode (all other electrodes being earthed)
C_{gf}	Capacitance between grid and filament (all other electrodes being earthed)
C_{g1g2}	Capacitance between these two grids (all other electrodes being earthed)
C_{gk}	Capacitance between grid and cathode (all other electrodes being earthed)
C_i	Input capacitance
C_n	Neutralizing capacitance
C_o	Output capacitance
d	Harmonic distortion factor
d_n	n-th order intermodulation products
d_{tot}	Total harmonic distortion
f	Filament or heater; frequency
f_c	Filament or heater centre tap
f(k)	Filament (and cathode) r.f. connection
g	Grid
G	Power gain
h	Height above sea level
I_a	D.C. anode current
i.c.	Tube pin which must not be connected externally
I_f	Filament or heater current
I_g	D.C. grid current
I_k	D.C. cathode current
IMP	Inter modulation products
I_p	Peak value of a current
k	Cathode
m	Modulation factor
p	Pressure
p_i	Pressure drop of cooling air or cooling water
q	Rate of flow of cooling air or cooling water
R_a	Anode output a.c. resistance
R_{aa}	Anode to anode a.c. resistance
R_{fo}	Filament or heater resistance in cold condition
R_g	External grid resistor

R_k	External cathode resistor
R_{th}	Thermal resistance
s	Internal shield
S	Transconductance
t_p	Pulse duration
t_w	Waiting time (time which has to elapse between switching on the filament or heater voltage and switching on of the other voltages)
T	Duration
T	Temperature
T_a	Temperature of anode body
T_{amb}	Ambient temperature
T_{bulb}	Bulb temperature
T_{env}	Envelope temperature
T_i	Inlet temperature of cooling air or cooling water
T_o	Outlet temperature of cooling air or cooling water
T_{pin}	Pin temperature
T_s	Seal temperature
V_a	D.C. anode voltage
$V_{a\sim}$	Amplitude anode a.c. voltage
V_f	Filament or heater voltage
V_g	D.C. grid voltage
$V_{g\sim}$	Amplitude grid a.c. voltage
V_{kf}	Voltage between cathode and heater
V_p	Peak value of a voltage
V_{rms}	Root mean square value of a voltage
V_{tr}	Secondary transformer voltage
W_a	Anode dissipation
W_{dr}	Driving power
W_g	Grid dissipation
W_i	Input power
W_ℓ	Output power in the load
W_{mod}	Modulation power
W_o	Anode output power
W_{oPEP}	Peak envelope output power
W_{osc}	Oscillator output power
W_{Rg}	Grid resistor dissipation
δ	Duty factor
η	Efficiency
η_a	Anode efficiency
η_{osc}	Oscillator efficiency
λ	Wavelength
μ	Amplification factor
μ_{g2g1}	Amplification factor of grid 2 with respect to grid 1.

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

1 PREFACE

1.1 In this handbook, data and curves are given for transmitting tubes for communications and tubes for r.f. heating.

1.2 The tubes are classified as follows:

D = **Design type.** Recommended for equipment design; production quantities available at date of publication.

C = **Current type.** No longer recommended for equipment design; available for equipment production and for use in existing equipment.

M = **Maintenance type.** No longer recommended for equipment production; available for maintenance of existing equipment.

O = **Obsolescent type.** Available until present stocks are exhausted.

Obsolescent types of which all stocks are exhausted are called **obsolete**; any data still published on these types is for reference purposes only.

The status of all types is given in a type survey at the end of the general section, together with data in condensed form. Full details are given of design and current types, divided into chapters as mentioned on the title page.

1.3 The characteristic data is general and independent of specific applications. This data, such as filament/heater current, amplification factor, transconductance and capacitances is given for a typical tube.

2 CHARACTERISTIC DATA

2.1 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 IEC publication 100.

2.2 Amplification factor μ and transconductance S

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

2.3 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 FILAMENT/HEATER SUPPLY

3.1 General

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

3.2 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 may be selected. Alternatively the filament voltage may be adjusted until the required output power, or maximum permissible signal, is reached and further adjusted after modulation is applied in order to obtain peak output power.
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 used, especially when operating at nominal, or higher than nominal, filament voltage.

→ 3.3 Thoriated tungsten cathodes (filaments)

To achieve satisfactory life the desired dynamic tube performance should be obtained at the nominal voltage specified in the relevant data sheet. Generally, in order to obtain prolonged tube life, the desired dynamic tube performance should initially be obtained at the nominal voltage. Then (e.g. after approximately 50 h), without changing anything else, the filament voltage may be reduced to the lowest value where satisfactory dynamic tube performance is still obtained. The heater voltage has to be closely regulated (about 1 per cent) and to be rechecked from time to time to avoid influence of the mains. The filament voltage should be checked with a precision instrument (with 1 per cent accuracy) of the iron-vane or thermo-couple type directly across the tube terminals. Deviations, even for short periods, in excess of +5% and −10% are not allowed under any circumstances. Reset filament voltage to the nominal value before running a new tube.

Waiting time should be read in conjunction with section 4.2 of these General Operational Recommendations.

3.4 Quick heating cathodes (filaments)

In general, tubes with quick heating cathodes should have their filaments only in parallel. When a sinusoidal voltage is used for heating the filament, the frequency must not be in the range 200 Hz to 5000 Hz. In addition, if 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 may be further reduced by applying a higher value for a short time. The manufacturer should be consulted before doing so.

3.5 Indirectly heated oxide coated cathodes

To achieve satisfactory life, the heater voltage should be maintained within +1% and −3% of the published value. Excessive deviation over a long period from these limits will be harmful. Occasional temporary deviations should not exceed ±10%. In order to avoid heater cathode r.f. damage, the heater to cathode insulation and the heater itself should be decoupled for r.f.

3.6 Switching on the filament

Switching on at full filament voltage is permissible unless a maximum switch-on value of filament current is stated in the data sheet. For the published values of maximum permissible filament current during switch-on, refer to the absolute maximum of the instantaneous value under worst case conditions.

3.7 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 which has low reactance with respect to the operating frequency, close to and between the filament terminals. As an added safety precaution, it should be ensured that the resonance of this capacitor together with the inductance of the filament structure, falls well below the operating frequency.

3.8 Switching on electrode voltages

Unless stated otherwise (e.g. cathode heating time t_W), simultaneous switching on of filament, control grid, anode 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.

3.9 Effective cathode

If both filament limbs are marked 'f' in the data sheets, the filament may be regarded as being symmetrical in its function as cathode. If such a filament is fed with d.c. the anode return lead should be connected to the negative end of the filament. All other decoupling and circuit returns must then also be connected to this point.
If the filament is fed with a.c., the anode return lead should be connected to the centre-tap of the filament transformer or to a tapped resistor shunted across the filament. The filament decoupling will then be symmetrical with regard to this point and all other circuit returns must also be made to this point.
If one filament limb is marked 'f' and the other 'f(k)', only the one marked 'f(k)' may be used as the circuit cathode. If such a filament is fed with d.c., the negative side of the filament supply should be connected to this point.
For either d.c. or a.c. filament supply, the anode supply, as well as decoupling and other circuit returns, must be connected to 'f(k)' only.

4 INITIAL OPERATION OF TUBE

4.1 Switching on the heater voltage

Ensure that any necessary cooling system is operative.
Sections 3.6 and 3.8 are applicable. The grid bias may be applied simultaneously.

4.2 Conditioning a tube

Conditioning is recommended for new tubes, after transit and after a period of storage. It is carried out by running the filament/heater only for at least 15 minutes before energizing the other electrodes see also section 5.6.
Industrial tubes with anode voltages above 5 kV should also be operated for approximately 15 minute at reduced anode voltage before applying full input ($V_a \times I_a$).
Television triodes and tetrodes may be operated for 15 minutes with the specified anode current in a no-signal condition. This treatment will remove any traces of gases which could cause premature failure of the tube.

4.3 Application of screen grid voltage to tetrodes

The screen grid voltage, V_{g2}, should be applied only when the anode voltage is present. If the anode voltage is removed, a safety circuit in the anode supply should cause the simultaneous removal of drive and screen grid voltages. If high voltage transients are present, it may be necessary to protect the cathode and control grid from arcing by means of a spark gap or protection diode across the relevant electrodes.

5 LIMITING VALUES

5.1 Notation

Limiting values are the maximum or minimum permissible values of the parameters listed. These limits are given either for all operating conditions together, or for an individual application.
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 figures or curves.

5.2 Derating of 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 5.4). The nature of operation, e.g. industrial applications of heating generators, may necessitate further safety derating.

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	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	

5.3 Rating system

The limiting values should be used in accordance with the 'Absolute maximum rating system' as defined by IEC publication 134.

5.4 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, which 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 component 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.

5.5 Limiting values

Each limiting value should be regarded independently of other values; under no circumstance 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).

5.6 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 operated from an unstabilized mains supply, the maximum mains voltage which occurs determines the nominal operating voltages of the tube. These nominal voltages must be lower than the limiting values. Should the tube and thus the voltage supply, be temporarily under a lower load, these voltages may rise 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 5.2.).

5.7 Anode dissipation

The limiting value of the anode dissipation, W_a, should not be exceeded when fluctuations in the mains supply voltage 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.

5.8 Anode input power

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

5.9 Screen grid dissipation, W_{g2}

The screen grid dissipation is the product of screen grid voltage and current. The screen grid should be protected against failure of anode voltage, see also section 4.3.

5.10 Control grid dissipation

The control grid dissipation W_g or W_{g1} can be approximated by subtracting the power supplied to the grid bias source ($-V_g \times I_g$) from the grid driving power (approx. $0.95 \times V_{gp} \times I_g$). When an a.c. or unsmoothed d.c. voltage supply is used, the form factor should be taken into account, see table in section 5.2 with the necessary derating factors.

5.11 Grid resistor

The maximum value of grid resistor, R_g max. (when published) should not be exceeded. This value is the maximum d.c. resistance in the grid circuit. A higher value may cause instability.

6 OPERATING CONDITIONS

6.1 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 a number of tubes of the same type, operating at optimum conditions.

Thus, small deviations from the published value may occur if measurements are made on an individual tube. However, some of the measured values of voltage or current must be adjusted to give the published figure. For example, the published value of output power is an average value which can be reached in practice by adjusting the r.f. or a.f. input voltage V_{gp}, when the published value of output power is not obtained at the nominal value of V_{gp}. When designing a multi-stage transmitter it is good practice to leave a margin in the output power and input voltage to allow for adjustments similar to that just described.

The published output power W_o of transmitting tubes is the tube's output, which may be determined by subtracting the anode dissipation W_a from the anode input W_{ia}. When a tube is used in a common grid circuit (grounded grid), the published value of the output power includes the power transferred from the driver.

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 0.95 x the product of the average grid current I_g and the positive amplitude of the grid voltage $V_{g\sim}$. 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, due to circuit losses.

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

A class C amplifier or oscillator is one in which the grid bias is appreciably greater than the cut-off voltage so that current flows for less than one half of each cycle of the alternating grid voltage. Working to the published operating conditions 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.

6.3 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 voltage may also be modulated. The average values of 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.

6.4 R.F. class B telephony

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

6.5 R.F. class AB SSB amplifier

The given operating conditions are obtained 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 two-tone test signal in which both tones have equal amplitude and are 1 kHz 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 are improved by 6 dB.

6.6 A.F. class B push-pull amplifier

With this method of amplification, 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 determine the choice of operation.

6.7 V.H.F and U.H.F. broadband conditions

The operating conditions for TV vision amplifiers, sound amplifiers and transposers (combined amplification of vision and sound) are compiled from measurements in tunable amplifiers which are available as accessories for the tubes concerned. These conditions generally show the nominal amplifier output (with v.s.w.r. of the load 1.1 max.) and a guaranteed linearity performance as differential phase, differential gain, l.f. linearity and intermodulation products as obtained in a 3-tone test.

6.8 Industrial operating conditions

With a single phase mains supply, smoothing will sometimes be omitted as is normal in a three phase mains supply. Operating conditions and derating factors are given for this kind of operation (section 5.2.). 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 subtracting 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 subtracting 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 a PTC thermistor may be used to 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 generator is restricted to a very narrow band, crystal controlled driver stages may have to be used. It will then, however, be difficult to maintain a good match between tube and load over the whole of the processing cycle. Greater safety margins will have to be set for the tube, with the tube output very dependent on variations in the load. Special measures, such as automatic tuning and/or load matching, may have to be taken.
For smaller tubes in industrial applications, operating conditions have been given for an anode supply from a single phase full-wave rectifier, a three phase half-wave rectifier (which is nearly equivalent

6.8 Industrial operating conditions (continued)

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. With a single-phase, full-wave rectified anode voltage the useful output is nearly equal to that with a d.c. supply.

6.9 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.

7 COOLING

7.1 Temperature limits

The maximum temperatures given in the data should be heeded and operating temperatures should be kept well below these values in the interest of tube life. Surface (envelope) temperatures may be checked with the help of suitable thermocouples, thermocrayons, thermopaints or stick-on markers.

7.2 Cooling of the tube header

In order to maintain all parts of the tube header, i.e. contact surfaces and ceramic to metal or glass to metal seals, at temperatures below the limits given in the data, it may be necessary, depending on the surroundings and ambient temperatures, to provide some extra cooling even at low frequencies. At frequencies above 4 MHz such extra cooling becomes mandatory for all types. For this purpose an axial air stream is preferred since this will ensure a more even temperature around the circumference of the individual electrodes. This will already be assisted by also ensuring an even distribution of the high frequency currents around the seals.

7.2.1 Forced air cooled tubes

The anode cooler air will in most cases also effectively cool the seals, provided it is directed in such a way that the seals are not protected from this air stream.

7.2.2 Water cooled tubes

Unless environmental conditions make it necessary, additional cooling of the seals will be mandatory only at frequencies above 4 MHz. If some of the cooling water can be branched off, this may also serve as coolant through pipes that are in good thermal contact with the respective connectors. Such pipes are already integral with the filament connectors of industrial types YD1192 to YD1432. Their use with a reliable water flow is strongly recommended.

7.3 Minimum coolant quantities

When determining the minimum coolant flow through the cooler, account must be taken of the maximum inlet temperature and the maximum anode dissipation that may occur under the prevailing circumstances.

7.3.1 Minimum forced air flow

The temperature, dissipation and flow relationships are given in the published data, tables and curves. The temperature rise of the cooling air may be found from the following formula:

$$\Delta T = \frac{50 \times W_{tot}}{Q}$$

where Q = air flow in m^3/min

W_{tot} = anode + grid + filament dissipation in kW

ΔT = temperature rise in K

This formula holds for an ambient temperature of 20 °C at sea level. Whenever the ambient conditions (temperature, altitude) are beyond those shown in the published data, the tube supplier must be consulted.

7 **COOLING** (continued)

7.3.2 Minimum cooling water flow

The amount of cooling water required is given in the published data. The temperature rise of the cooling water may be found from the following formula:

$$\Delta T = \frac{14.4 \times W_{tot}}{Q}$$

where Q = water flow in litres/min

W_{tot} = anode + grid + filament dissipation in kW

ΔT = temperature rise in K

7.4 Natural cooling

This is applicable only to internal anode glass envelope tubes with a maximum anode dissipation of up to about 1 kW. A chimney around and extending above the tube will assist natural convection. For operation at higher frequencies additional cooling of the electrode pins, the tube socket and the bulb is often required. Temperature checks may be carried out as noted in section 7.1.

7.5 Forced air cooling

When using air as a cooling medium the intake must be properly filtered to prevent blockage of the anode radiator. All electrical supplies to the tube should be interlocked with a flow sensor in the exhaust stream. Temperature checks may be carried out as noted in section 7.1.

7.6 Water cooling

The direction of water flow, indicated by arrows near the water inlets and outlets of the tube are for when the tube is mounted 'anode down'. When reversing the position of the tube, i.e. 'anode up', the direction of flow should also be reversed. Re-circulating systems are preferred, since, apart from saving water, they help to ensure a high standard of purity.

Some of the requirements for satisfactory cooling water are that it should not be corrosive or deposit scale, should not contain insoluble material that might cause blockages and should have a high electrical resistance to prevent electrolysis. Its mineral content and electrical conductivity should therefore be periodically checked, especially when it is not drawn from a circulating system. A non-corrosive water should be low in chlorides, oxygen and carbon dioxide.

Scale formation may be avoided by maintaining a low amount of silica and bicarbonates, especially calcium bicarbonate. No exact figures can be given for impurities as they are interdependent.

The cooling water must also be free from all traces of greasy substances since a small amount may form a dangerous heat barrier on the anode cooler, causing excessive anode temperatures despite an apparently adequate water flow. These greasy or oily films may be removed by repeated flushing of the cooling channels with a domestic liquid detergent or slightly soapy water to which a small quantity of industrial alcohol and 33% ammonia has been added (approx. 10 cc/l of each). The cleaning process should be completed by repeated flushing with demineralized water. The cause of such greasy deposits will usually be found elsewhere in the cooling system as the result of, for example, leaky pump glands. After the necessary repairs have been carried out, the whole system must be cleaned in a similar manner to prevent deposits forming again. The cooling water system must be interlocked with all electrical supplies to the tube. As an added safeguard, the interlocks should be activated if the water outlet temperature exceeds the indicated upper limit. To prevent the tube from running dry in the event of minor leakages in the system, the reservoir should always be above the level of the tube.

8 CHECKING PROTECTION OF THE TUBE

To verify the operation of the safety circuits noted in section 4.3, as well as safeguarding against high and possibly destructive currents resulting from excessive transients, the following functional check is recommended.

With the tube removed, the anode supply lines (anode - cathode) are shorted at the tube position with a copper wire that is of a specified diameter for the tube type used (see table below) and has a length of approx. 2.5 cm per kV of applied anode potential. If this test wire does not fuse upon application of the full high tension, the speed of the safety circuit is adequate to protect the tube.

Industrial tubes	test wire diameter, mm
YD1150/52	0,12
YD1160/61/62	0,12
TB4/1500	0,14
TB5/2500	0,14
TB6/14	0,23
TB6/4000	0,14
TB6/6000	0,18
TB7/8000	0,14
TB7/9000	0,14
TB12/25	0,11
TB12/38	0,23
TB12/40	0,12
YD1170 to YD1177	0,20
YD1180 to YD1187	0,20
YD1192 to YD1197	0,20
YD1202	0,25
YD1212	0,30
YD1342	0,32

Tubes for communications	
QB5/3500	0,25
QBL3.5/2000	0,11
YL1420/1421	0,17
YL1430	0,17
YL1440	0,11
YL1470	0,17
YL1520	0,17
YL1530/1531	0,17
YL1540/1541	0,12
YL1560	0,11
YL1590	0,11
YL1610	0,10
YL1630/1631	0,12
YL1640	0,20
YL1680	0,20
YL1690	0,17

9 CONNECTORS

9.1 Clean contact surface

Attention must be paid to a good fit on a clean contact surface of all electrode connectors as well as an even r.f. current distribution around their circumference.

9.2 Fastening the filament connector on industrial tubes

To ensure good seating of the filament connectors on industrial tubes, care should be taken that they are not crooked and that the applied clamping force is within the specified limits.
In the following table the minimum and maximum torque values are given for the different tubes concerned and the corresponding connector at room temperature.

Tube type	Cap dia. mm	Bolt size	Connector type	Min. torque Ncm	Max. torque Ncm
YD1170/77	25	M6	40692A	400	600
YD1180/87	32	M6	40708A	500	700
YD1190/97	42	M6	40705A	600	700
YD1202 YD1212 YD1342 YD1432	54	M8	40695A	800	1000

After the system has been warmed up and cooled down several times, it is advisable to check the bolts for correct tightness and if necessary re-tighten to the correct value.

10 STORAGE AND MAINTENANCE

10.1 General

Whenever possible, the tubes should be transported and stored in their original packing in an upright position. If the tubes are to be stored in an unpacked condition they should be kept in a dry room placed in an upright position in a rack that is not subject to excessive vibration and does not exert any mechanical stress on other parts of the tube except those that normally serve for the support of the tube, e.g. the anode cooler or the anode mounting flange.
If a tube is stored for an extended period it should be subjected to the conditioning schedule outlined in section 4.2.
Care should be taken that the glass or ceramic parts of a tube are kept clean and do not contact metallic objects since a scratch on glass may initiate a fracture and metal rubbed against ceramic may leave a metallic trace that can lead to surface arcing when high tension is applied to the tube.
Soiled glass parts may be cleaned with conventional non-abrasive window cleaning agents and thoroughly rinsed and dried afterwards. Soiled ceramic parts are best cleaned with domestic cleaning powders applied with a moistened tooth brush. A final thorough rinse with clean water is essential to remove all traces of the cleaning powder and the loosened dirt.

10.2 Cleaning integrally water cooled tubes

If the water cooling channels or the helix of a tube become partially blocked (reduced flow and increased back pressure) by floating particles, these can be removed with compressed air or high pressure water, taking care that the water outlet of the tube is open to air and the maximum applied inlet pressure does not exceed 50 Pa. If the impurities adhere to the cooling channel walls or are of a sedimentary nature the cleaning will have to be assisted by a solvent. In the majority of cases these will be calcium deposits. They may be removed by flushing the tube, if necessary repeatedly, with a 5 to 10% solution of hydrochloric acid or 15% citric acid. This procedure should be followed by thoroughly rinsing with distilled or demineralized water.

11 SAFETY ASPECTS

11.1 X-radiation

Power electron tubes operating at voltages in excess of 5 kV are possible sources of X-radiation, progressively so with increasing voltage levels. The envelope of the tubes offers only a limited shielding for such radiation. The equipment manufacturer should provide suitable additional shielding in his design.

The level of X-radiation should be checked periodically.

11.2 R.F.-radiation

Exposure to strong r.f. fields may cause health-hazard, progressively so with increasing frequency. As such fields will exist in the vicinity of power electron tubes, the equipment manufacturer should provide suitable shielding in his design to reduce r.f. fields, in the neighbourhood of the equipment, to acceptable levels.

SURVEY

Triodes — YD types

type	status	cooling	W_o kW	V_f V	I_f A	V_a kV	I_a A	V_a max kV	W_a max kW		h x dia max mm
YD1330	C	FA	0,22	6,3	5,3	3	0,42	3,5	1,8		106 x 71
YD1333	C	FA	0,11	6,3	5,3	2	0,25	3,5	0,9		88,5 x 71
YD1334	D	FA	0,11	6,3	5,3	2,5	0,25	3,5	1,8		96,5 x 96
YD1335	D	FA	0,55	6,3	5,3	3,5	0,25	3,8	1,9		96,5 x 96
YD1336	D	FA	0,22	6,3	5,3	3	0,42	3,5	1,8		96,5 x 96

Tetrodes — YL types

type	status	cooling	W_o kW	V_f V	I_f A	V_a kV	V_{g2} V	I_a mA	V_a max kV	W_a max W	h x dia max mm
YL1010	C	W	5,5	10	200	10	800	7400	10	2 kW	306,5 x 140
YL1011	C	FA	5,5	10	200	10	800	7400	10	2 kW	321,5 x 215
YL1012	C	V	5,5	10	200	10	800	7400	10	2 kW	315 x 218
YL1420	D	FA	11	6,3	120	7	600	2300	8,5	6 kW	174 x 125,1
YL1421	D	W	11	6,3	120	7	600	2300	8,5	6 kW	220 x 86,5
YL1430	D	FA	18	8	120	8	700	3500	9,5	12 kW	211 x 164,2
YL1440	D	FA	2,4	4,2	53	3	600	980	4	1500	125 x 63
YL1470	D	FA	11	6,3	120	7	600	2300	8,5	8 kW	174 x 125,1
YL1520	D	FA	25	10,4	120	8,5	700	4600	9,5	18 kW	225 x 164,2
YL1530	D	FA	35	7,5	180	10	900	2400	12	30 kW	264 x 215
YL1531	D	W	35	7,5	180	10	900	2400	12	30 kW	340 x 160,5
YL1540	D	FA	2,2	4,2	53	3	700	500	4,2	2 kW	122 x 63
YL1541	D	FA	2,1	4,2	53	4	700	500	4,5	2 kW	122 x 63
YL1560	D	FA	5,5	5	130	2	700	6000	6	7 kW	153 x 120,3
YL1590	D	FA	1,1	3,9	52	1	700	2000	4	2 kW	62,7 x 41,7
YL1610	D	FA	11	8	113	5	500	2000	7	14 kW	207 x 164
YL1630	D	FA	30	8	185	5,5	500	1200	8,5	26 kW	229 x 215
YL1640	D	W	125	10	280	1	1000	5000	13	150 kW	515 x 270
YL1680	D	W	110	12	265	10	900	10 A	14	100 kW	335 x 145
YL1690	D	FA	10	10,4	120	8	700	2400	9	18 kW	225 x 164

COOLING: FA = forced air; W = water; V = vapour; N = natural; WH = water (helix); H = heatsink

SURVEY

Instruction manuals for all cavities are available on request.

COOLING: forced air

type	band	output power kW	carrier frequency range MHz	power gain dB	tube used	dimensions in mm
Vision						
40782V	IV + V	0,6	470 to 860	15,4	YL1590	657 x 190 x 280
40776	III	1,1	170 to 230	20,0	YL1540	618 x 355 x 412
40755	I	1,2	55,25 to 67,25	11,5	YL1440	537 x 343 x 370
	I	1,5	77,25 to 83,25	12,0	YL1440	537 x 343 x 370
40743	III	1,55	170 to 250	14,1	YL1440	673 x 368 x 358
40783	IV + V	5,5	470 to 860	16,5	YL1560	745 x 490 x 286
40757	I	6,25	55,25 to 67,25	12,0	YL1420	712 x 530 x 569
	I	6,25	77,25 to 83,25	12,7	YL1420	712 x 530 x 569
40745	III	8,6	170 to 230	13,8	YL1420	620 x 610 x 420
40747	III	18,4	170 to 230	14,0	YL1430	620 x 610 x 420
40759	I	13,2	55,25 to 67,25	12,5	YL1430	712 x 530 x 569
	I	13,2	77,25 to 83,25	13,0	YL1430	712 x 530 x 569
	I	20	55,25 to 67,25	13,4	YL1520	700 x 500 x 500
	I	20	77,25 to 83,25	13,8	YL1520	700 x 500 x 500
40768	III	27,5	170 to 230	14,5	YL1520	647 x 680 x 490
40787	III	11	170 to 230	17,0	YL1610	500 x 400 x 400
40786	III	30	170 to 230	17,0	YL1630	500 x 400 x 400
Sound						
40782S	IV + V	1,1	470 to 860	16,4	YL1590	637 x 190 x 220
40778*	II	2,2	88 to 108	22,5	YL1540	330 x 300 x 300
40777	III	2,2	170 to 230	22,5	YL1540	618 x 355 x 412
40756	I	2,4	53 to 88	14,1	YL1440	537 x 343 x 370
40744	III	2,4	170 to 260	14,1	YL1440	673 x 368 x 358
40758	I	10,5	53 to 88	15,0	YL1420	712 x 530 x 569
40746	III	10,5	170 to 230	15,0	YL1420	620 x 610 x 420
40775	II	10,5	88 to 108	22	YL1470	393 x 400 x 632
40760	I	12	53 to 88	15,1	YL1430	712 x 530 x 569
40748	III	13	170 to 230	15,2	YL1430	620 x 610 x 420
40769	III	25	170 to 230	14,9	YL1520	647 x 680 x 490
40788*	II	10	80 to 108	19	YL1610	400 x 400 x 500
40789*	II	20	88 to 108	19	YL1630	400 x 400 x 500
Vision and sound						
40782V	IV + V	0,22	470 to 860	15,6	YL1590	657 x 190 x 280
40743	III	0,55	175 to 250	14,8	YL1440	673 x 368 x 358
40783	IV + V	2,2	470 to 860	16,5	YL1560	745 x 490 x 286
40745	III	2,5	175 to 225	14,8	YL1420	620 x 610 x 420
40747	III	7	175 to 225	15,0	YL1430	620 x 610 x 420
40768	III	10,5	175 to 225	16,2	YL1520	647 x 680 x 490
40786	III	10	175 to 225	18	YL1630	500 x 400 x 400

* Data available on request.

TRIODES, YD TYPES

AIR-COOLED R.F. POWER TRIODE

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class-AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Frequency	f	370 to 860	MHz
Anode voltage	V_a	3000	V
Output power in load	W_ℓ	220	W
Power gain	G	16,5	dB

HEATING: indirect, by a.c. (50 Hz to 400 Hz) or d.c.; oxide cathode.

Heater voltage	V_f	6,0 to 6,3	V
Heater current	I_f	4,8 to 5,8	A
Cathode heating time	t_h	min. 180	s

CAPACITANCES

Anode to grid	C_{ag}	6,8 to 8,0	pF
Grid to cathode and heater	$C_{g/kf}$	20 to 30	pF
Anode to cathode and heater	$C_{a/kf}$	90 to 180	fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Anode current	I_a	400	mA
Transconductance	S	70	mA/V
Amplification factor	μ	90	

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250	^oC

To obtain optimum life, this temperature should not exceed 200 ^oC.

* The heater voltage must be adjusted between 6,0 and 6,3 V.
For optimum performance (linearity) the voltage set must be maintained within ±2% for transposer service, or ±5% for other applications.

COOLING

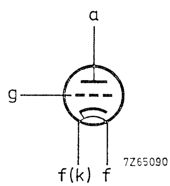
Anode: forced air

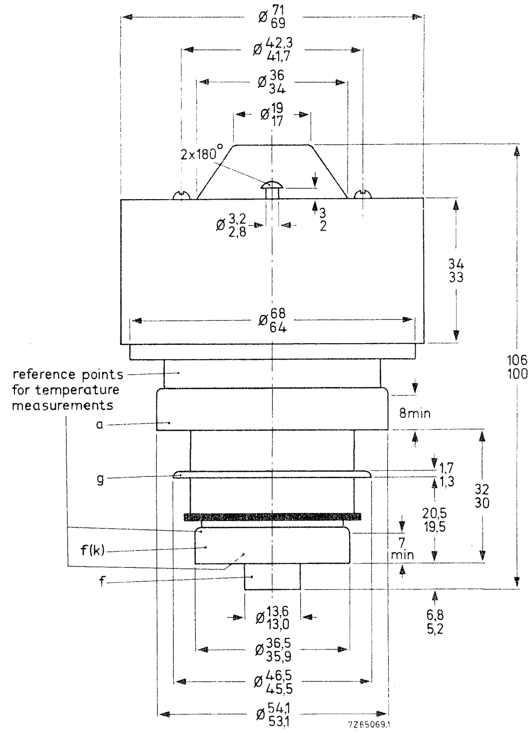
W_a W	T_i °C	q_{min} m^3/min	P_i kPa
1800	25	2	1,80

Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

MECHANICAL DATA

Net mass ≈ 1000 g





The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	72,0 dia
Anode terminal	55,1 dia
Grid terminal	47,0 dia
Heater/cathode terminal	37,0 dia
Heater terminal	14,5 dia

R.F. CLASS-AB AMPLIFIER FOR TV TRANSPOSER SERVICE

LIMITING VALUES (Absolute maximum rating system)

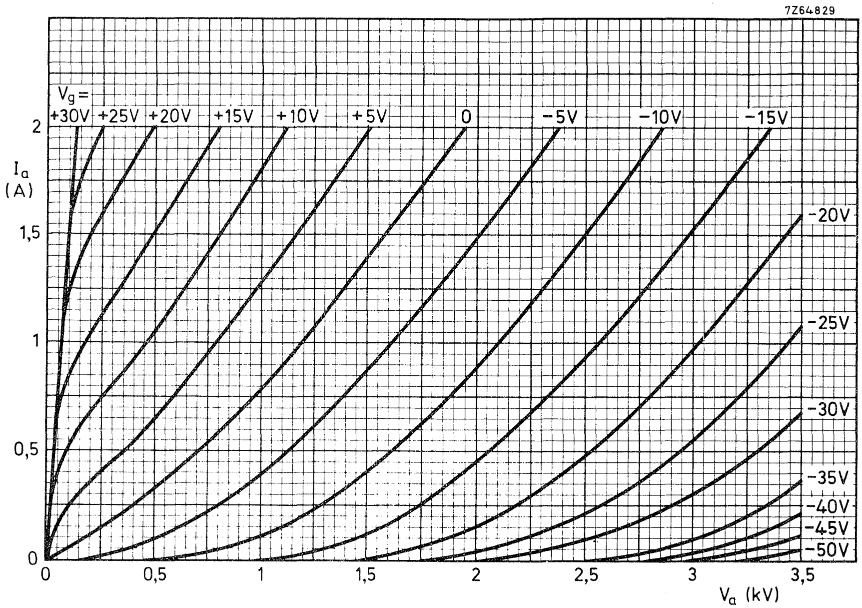
Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	1800	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	550	mA (note 1)

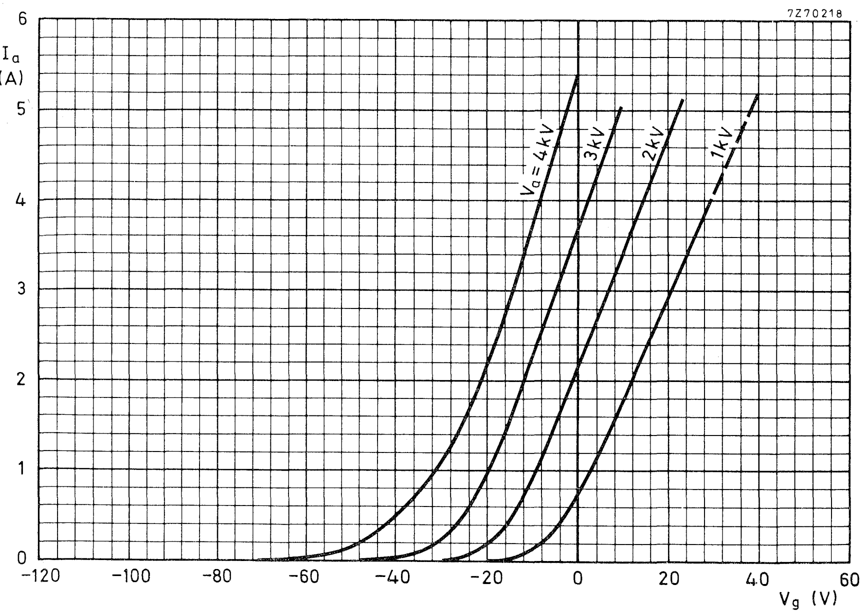
OPERATING CONDITIONS, grounded grid

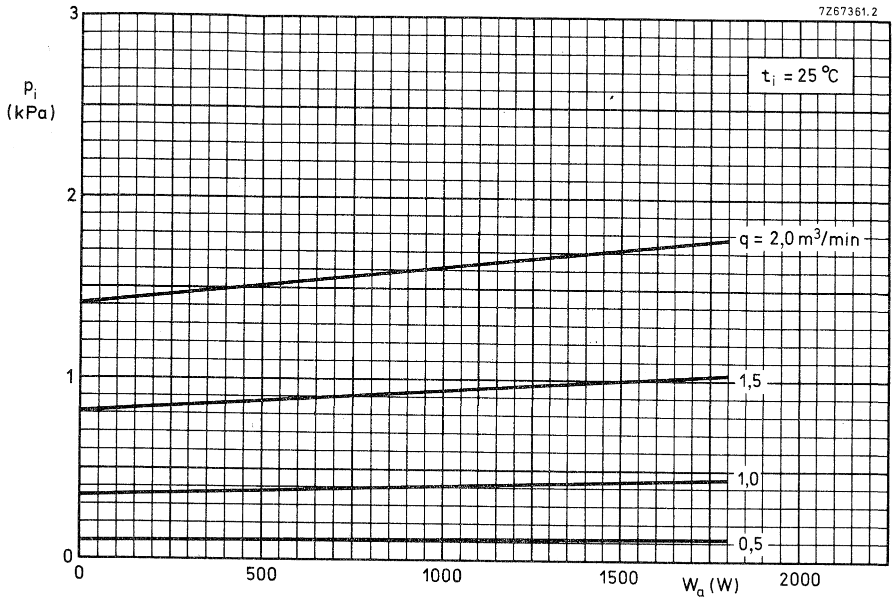
Standard		CCIR-G	(notes 2, 3)
Frequency	f	470 to 860	MHz
Bandwidth (−1 dB)	B	9	MHz
Anode voltage	V_a	3000	V
Grid voltage (note 4)	V_g	−30	V
Anode current, no signal	I_a	420	mA
Anode current at zero dB level (vision carrier)	I_a	650	mA
Grid current	I_g	≈ 0	mA
Driver output power (sync)	W_{dr}	7	W
Output power in load (sync)	W_ℓ	220	W
Power gain	G	16,5	dB
Intermodulation products (note 5)	d	−55	dB
		< −53	dB
Intermodulation products (note 6)	d	−57	dB
		< −55	dB

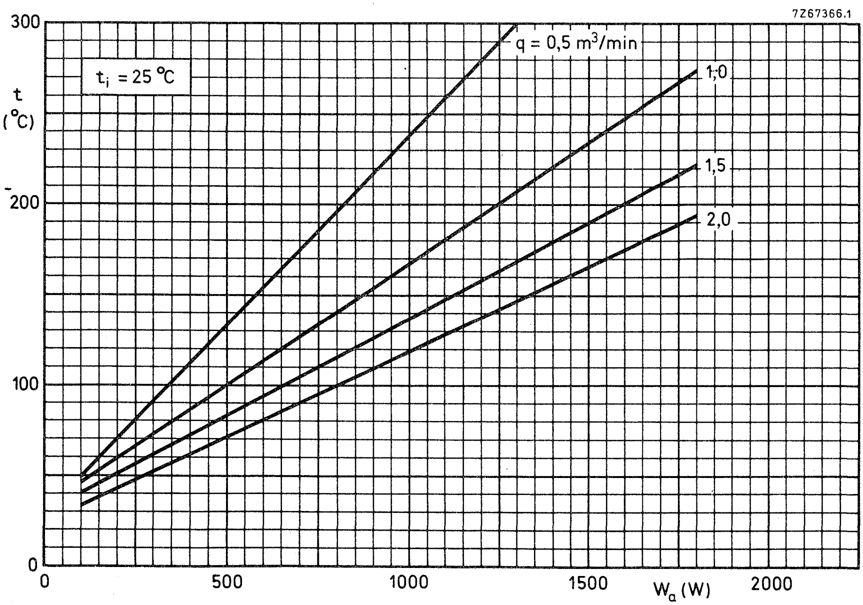
Notes

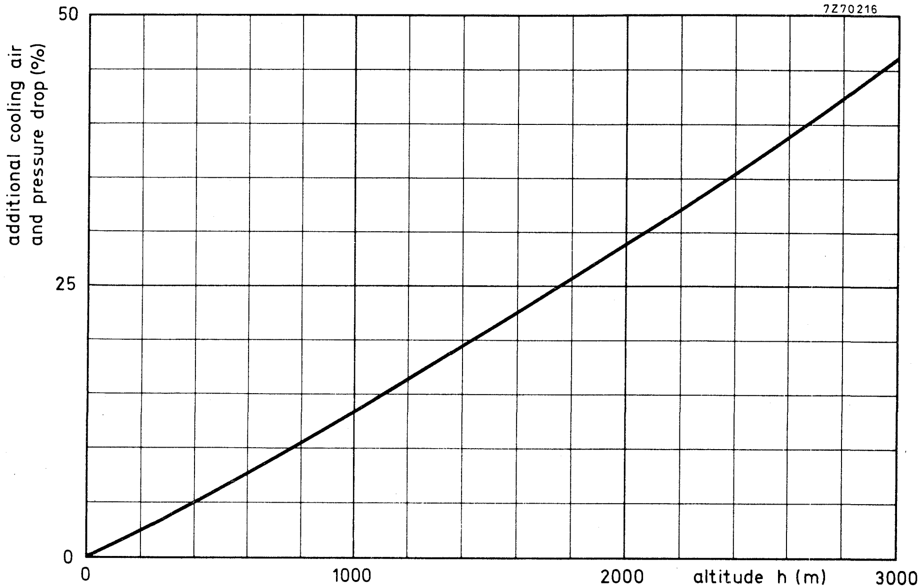
1. During a short period, for adjustment of the transmitter, I_k max. = 700 mA.
2. Negative modulation, positive synchronization, combined sound and vision.
3. R.F. driving power should be applied after the heater and electrode voltages.
4. To be adjusted for the stated no-signal anode current. Range values for equipment design −15 to −45 V.
5. Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −17 dB with respect to peak sync level = 0 dB).
6. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync level = 0 dB.

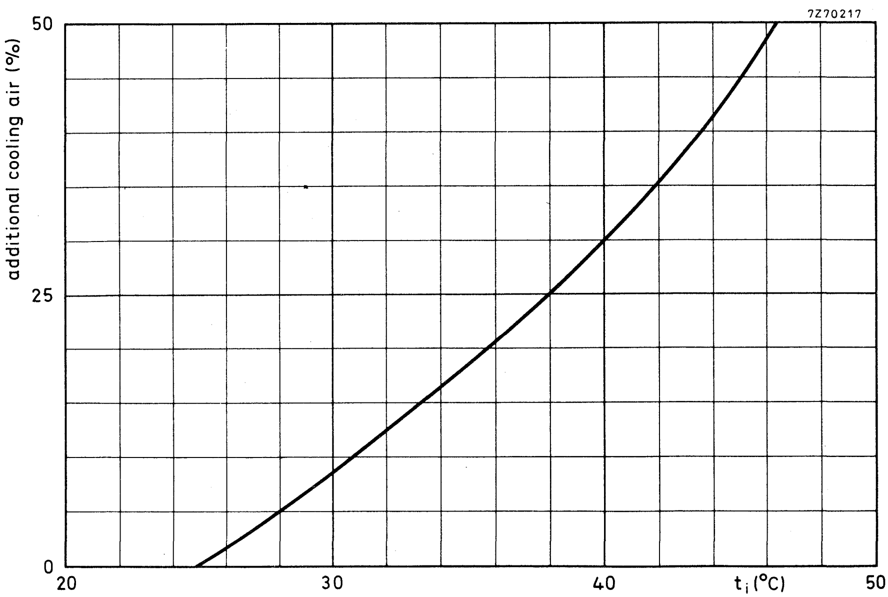

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


7Z70218
I_a (A)
6
5
4
3
2
1
0
V_a = 4kV
3kV
2kV
1kV
−120
−100
−80
−60
−40
−20
0
20
40
60
V_g (V)


7Z67361.2
3
2
1
0
p_i
(kPa)
t_i = 25 °C
q = 2,0 m³/min
1,5
1,0
0,5
0
500
1000
1500
2000
W_a (W)


7Z67366.1
300
200
100
0
t
(°C)
t_i = 25 °C
q = 0,5 m³/min
1,0
1,5
2,0
0
500
1000
1500
2000
W_a (W)


7Z70216
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000


7Z70217
additional cooling air (%)
50
25
0
20
30
40
t_i (°C)
50

AIR COOLED R.F. POWER TRIODE

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class-AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Transposer service (combined sound and vision)		
Frequency	f	470 to 860 MHz
Anode voltage	V_a	2500 V
Output power in load (sync)	W_ℓ	110 W
Power gain	G	16 dB

HEATING: indirect by a.c. (50 Hz to 400 Hz) or d.c.; oxide coated cathode.

Heater voltage	V_f	6,0 to 6,3 V *
Heater current	I_f	4,8 to 5,8 A
Cathode heating time	t_h	min. 180 s

CAPACITANCES

Anode to grid	C_{ag}	6,8 to 8,0 pF
Grid to cathode and heater	$C_{g/kf}$	20 to 30 pF
Anode to cathode and heater	$C_{a/kf}$	90 to 180 fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2 kV
Anode current	I_a	250 mA
Transconductance	S	45 mA/V
Amplification factor	μ	80

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250 ^oC

To obtain optimum life, this temperature should not exceed 200 ^oC.

* The heater voltage must be adjusted between 6,0 and 6,3 V. For optimum performance (linearity) the voltage set must be maintained within ± 2% for transposer service, or ± 5% for other applications.

COOLING

Anode: forced air

W_a W	T_i °C	q_{min} m^3/min	p_i Pa
900	25	1,5	310

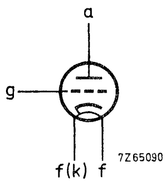
Other terminals: low velocity airflow.

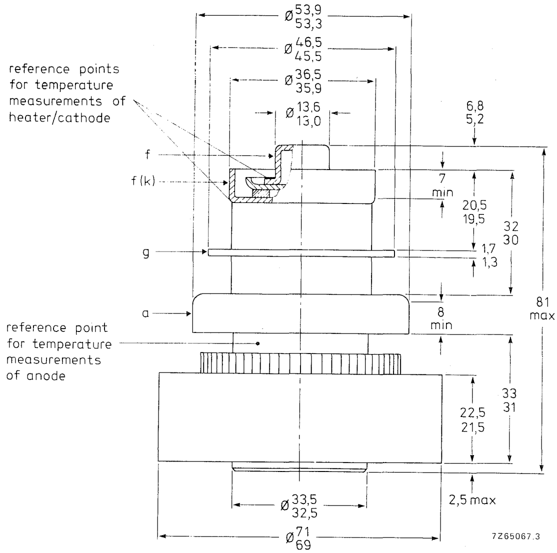
When only the heater voltage is applied the heater and heater/cathode terminals should also be cooled.

Cooling air and voltages may be switched off simultaneously.

MECHANICAL DATA

Net mass ≈ 1000 g





ACCESSORY:

Band IV and V amplifier circuit assembly type 40771.

The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	72,0 dia
Anode terminal	55,1 dia
Grid terminal	47,0 dia
Heater/cathode terminal	37,0 dia
Heater terminal	14,5 dia

R.F. CLASS-AB AMPLIFIER FOR TV TRANSPOSER SERVICE — grounded grid

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3000	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	900	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	550	mA

OPERATING CONDITIONS, grounded grid

Standard		CCIR-G	(notes 1,2)
Frequency	f	470 to 860	MHz
Bandwidth (−1 dB)	B	9	MHz
Anode voltage	V_a	1800	V
Grid voltage (note 3)	V_g	−14	V
Anode current, no signal	I_a	275	mA
Anode current at zero dB level (vision carrier)	I_a	420	mA
Grid current	I_g	≈0	mA
Driver output power (sync)	W_{dr}	3,5	W
Output power in load (sync)	W_ℓ	110	W
Power gain	G	16	dB
Intermodulation products (note 4)	d	−56 <−54	dB dB

Notes
1. Negative modulation, positive synchronization, combined sound and vision.
2. R.F. driving power should be applied after the heater and electrode voltages.
3. To be adjusted for the stated no-signal anode current. Range values for equipment design: −10 to −40 V, −5 to −35 V respectively.
4. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync level = 0 dB).

R.F. CLASS-AB AMPLIFIER FOR TV SOUND SERVICE

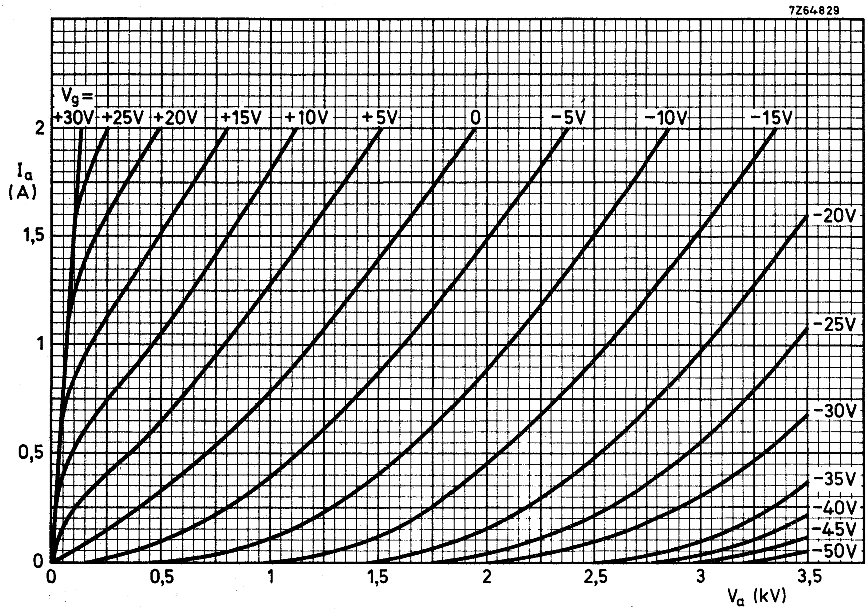
LIMITING VALUES (Absolute maxium rating system)

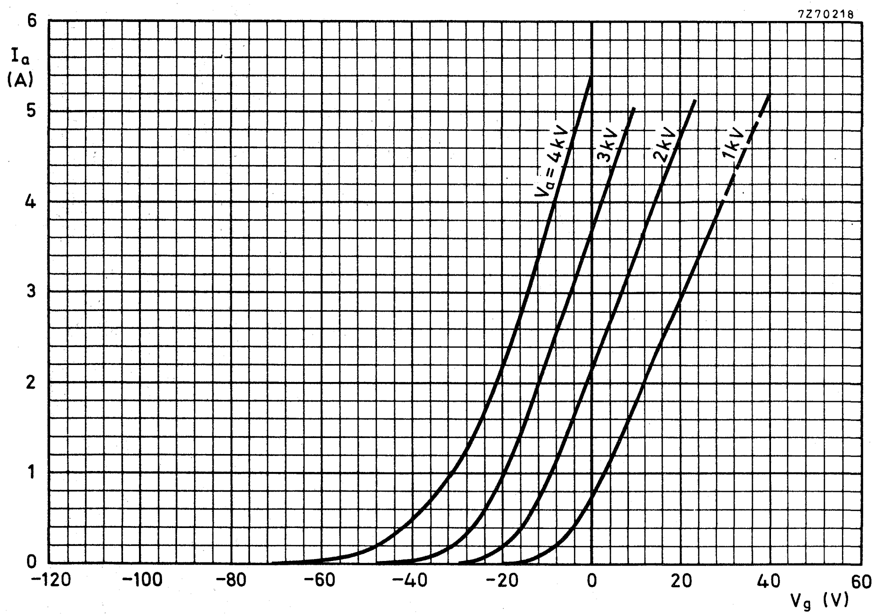
Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3000	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	900	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	550	mA

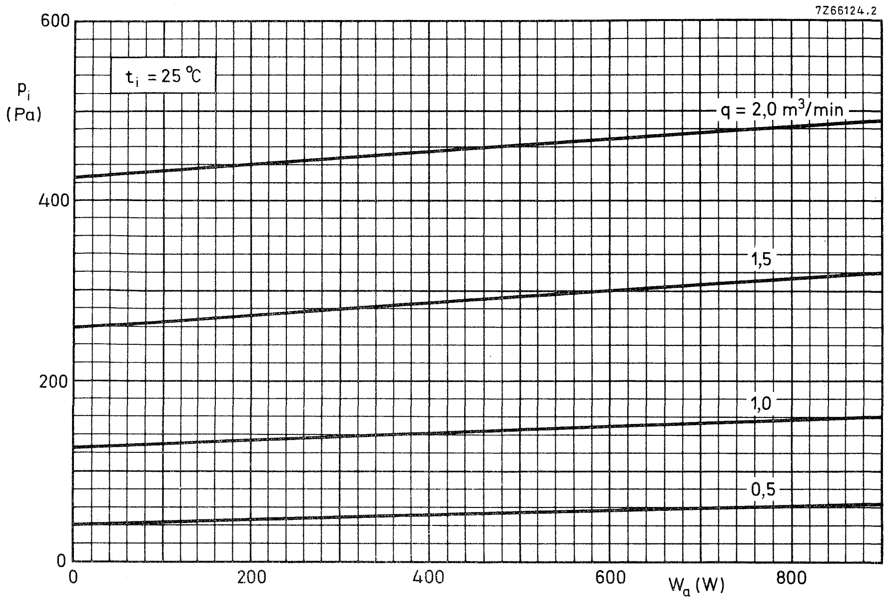
OPERATING CONDITIONS (note 1)

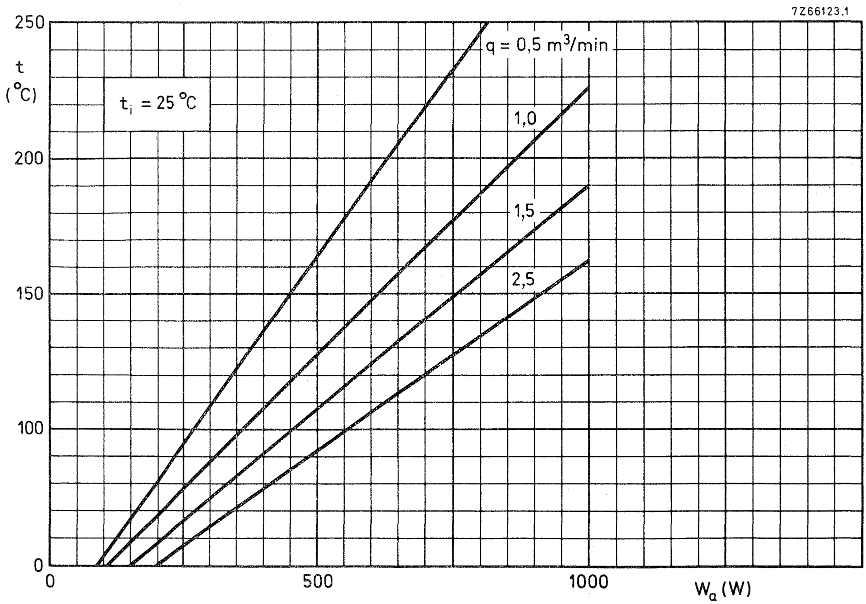
Frequency	f	174 to 860	MHz
Anode voltage	V_a	2700	V
Grid voltage (note 2)	V_g	−28	V
Anode current, no signal	I_a	200	mA
Anode current	I_a	350	mA
Grid current	I_g	0	mA
Driver output power	W_{dr}	8	W
Output power in load	W_ℓ	300	W
Power gain	G	16	dB

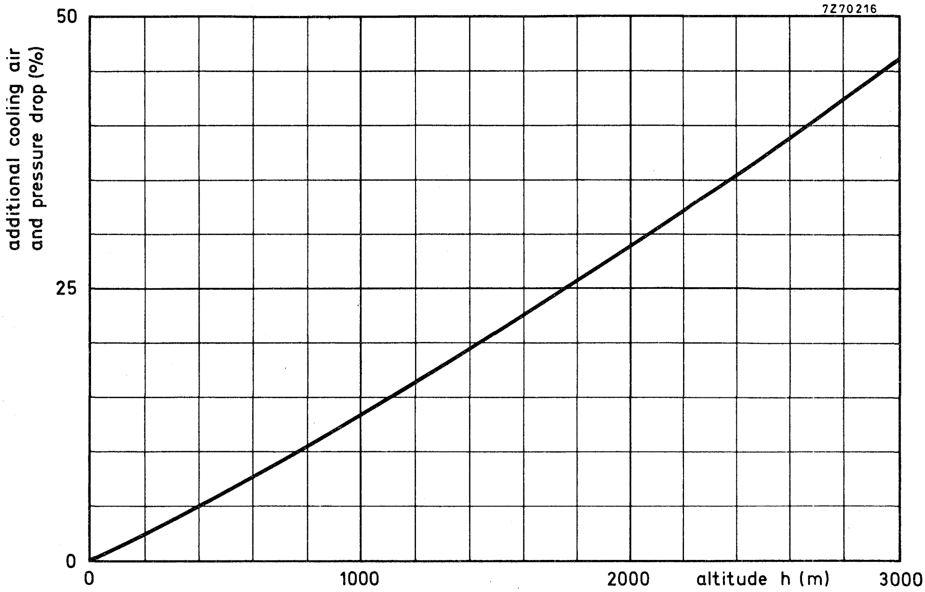
Notes
1. R.F. driving power should be applied after the heater and electrode voltages.
2. To be adjusted for the stated no-signal anode current. Range values for equipment design −15 to −40 V. For "automatic bias" the cathode resistor range is 80 to 180 Ω.

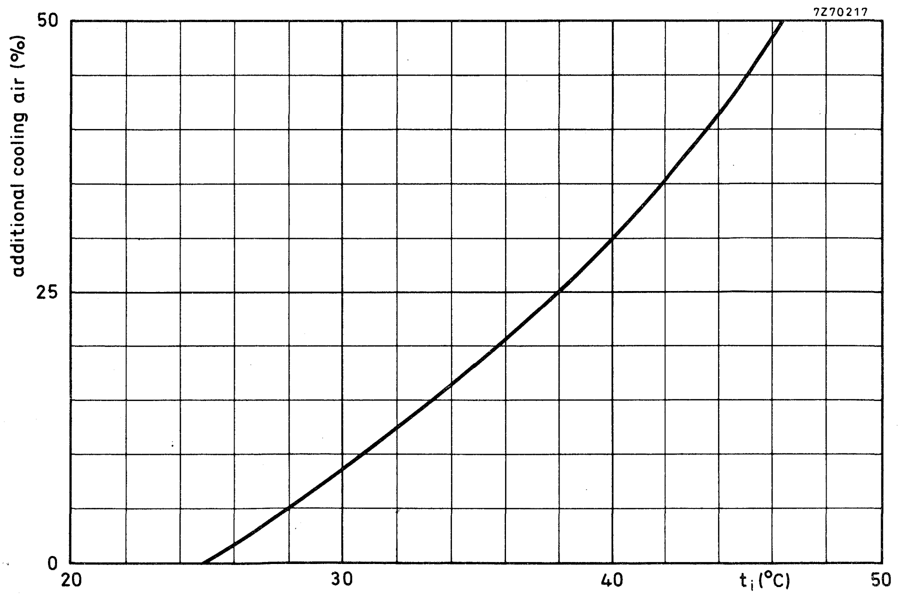

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


7Z70218
I_a (A)
6
5
4
3
2
1
0
V_a = 4 kV
3 kV
2 kV
1 kV
−120
−100
−80
−60
−40
−20
0
20
40
60
V_g (V)


7Z66124.2
t_i = 25 °C
p_i (Pa)
q = 2,0 m³/min
1,5
1,0
0,5
W_a (W)
0
200
400
600
800


7Z66123.1
t_i = 25 °C
t (°C)
q = 0,5 m³/min
1,0
1,5
2,5
W_a (W)
0
500
1000
100
150
200
250


7Z70216
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000


7Z70217
additional cooling air (%)
50
25
0
20
30
40
t_i (°C)
50

AIR COOLED R.F. POWER TRIODE

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class-AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Transposer service (combined sound and vision)			
Frequency	f	470 to 860	MHz
Anode voltage	V_a	2500	V
Output power in the load (sync)	W_ℓ	110	W
Power gain	G	16,5	dB

HEATING: indirect, by a.c. (50 Hz to 400 Hz) or d.c.; oxide coated cathode.

Heater voltage	V_f	6,0 to 6,3	V *
Heater current	I_f	4,8 to 5,8	A
Cathode heating time	t_h	min. 180	s

CAPACITANCES

Anode to grid	C_{ag}	6,8 to 8	pF
Grid to cathode and heater	C_{gf}	20 to 30	pF
Anode to cathode and heater	C_{af}	90 to 180	fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2	kV
Anode current	I_a	400	mA
Transconductance	S	70	mA/V
Amplification factor	μ	90	

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250	^{o}C

To obtain optimum life, this temperature should not exceed 200 ^{o}C.

* The heater voltage must be adjusted between 6,0 and 6,3 V. For optimum performance (linearity) the voltage set must be maintained within ± 2% for transposer service, or ± 5% for other applications.

COOLING

Anode: forced air

W_a W	T_i °C	q_{min} m³/min	p_i Pa
1000	25	0,7	20

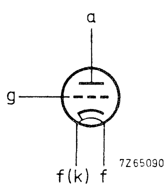
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

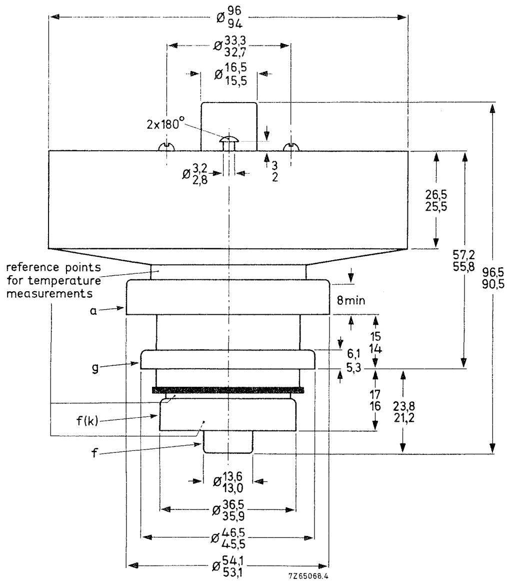
MECHANICAL DATA

Net mass: approx. 1000 g

Mounting position: any

Accessories: Band IV and V amplifier circuit assembly type 40771





The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	97,0 dia.
Anode terminal	55,1 dia.
Grid terminal	47,0 dia.
Heater/cathode terminal	37,0 dia.
Heater terminal	14,5 dia.

R.F. CLASS-AB AMPLIFIER FOR TV TRANSPOSER SERVICE, grounded grid

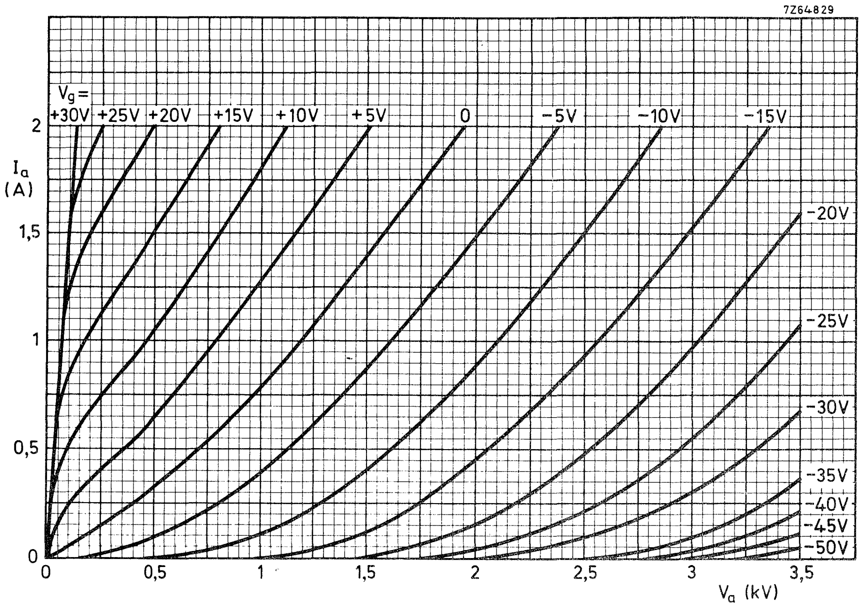
LIMITING VALUES (Absolute maximum rating system)

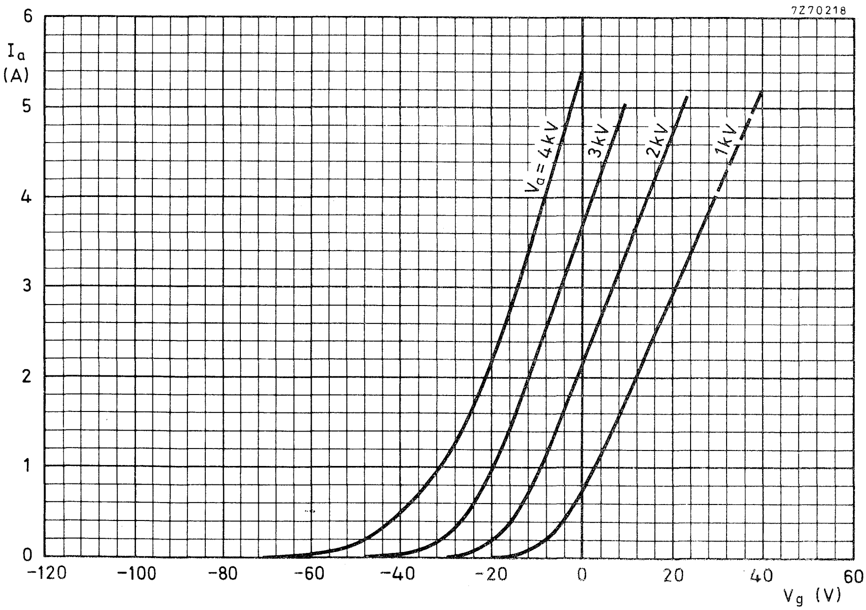
Frequency	f	, up to	1000	MHz	
Anode voltage	V_a	max.	3500	V	
Grid voltage	$-V_g$	max.	200	V	
Anode dissipation	W_a	max.	1800	W	
Grid current	I_g	max.	± 5	mA	
Cathode current	I_k	max.	550	mA	(note 1)

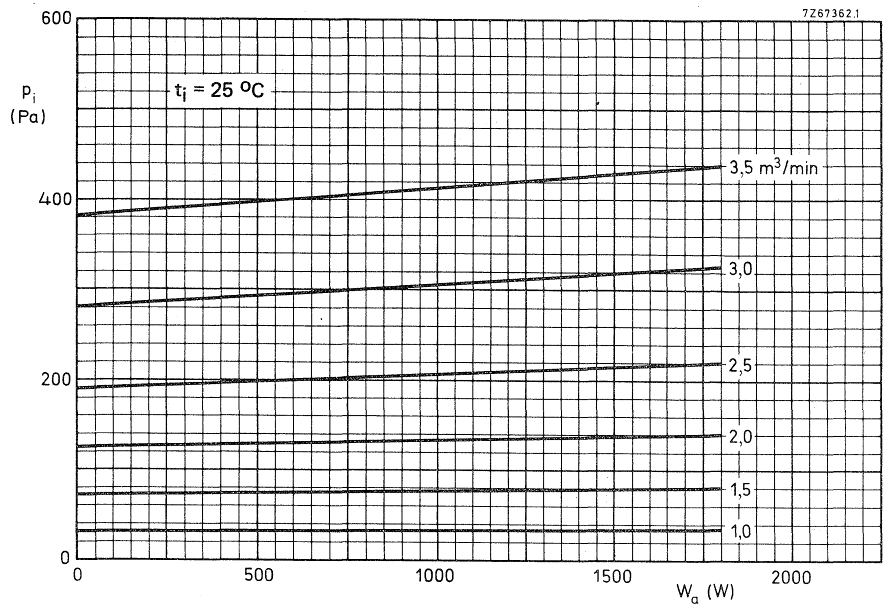
OPERATING CONDITIONS, grounded grid (notes 2, 3)

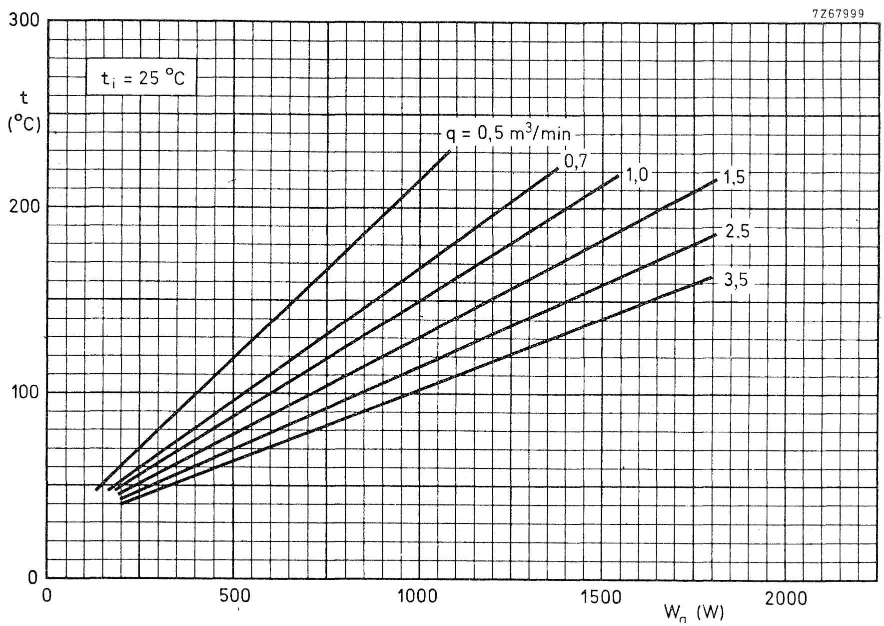
Standard		CCIR-G	
Frequency	f	470 to 860	MHz
Bandwidth (−1 dB)	B	9	MHz
Anode voltage	V_a	2500	V
Grid voltage (note 4)	V_g	−25	V
Anode current, no signal (note 5)	I_a	200 to 300	mA
Anode current at zero dB level (vision carrier)	I_a	420 (< 500)	mA
Grid current	I_g	≈ 0	mA
Driver output power (sync)	W_{dr}	4	W
Output power in load (sync)	W_ℓ	110	W
Power gain	G	16,5	dB
Intermodulation products	d	−60	dB
		< −58	dB

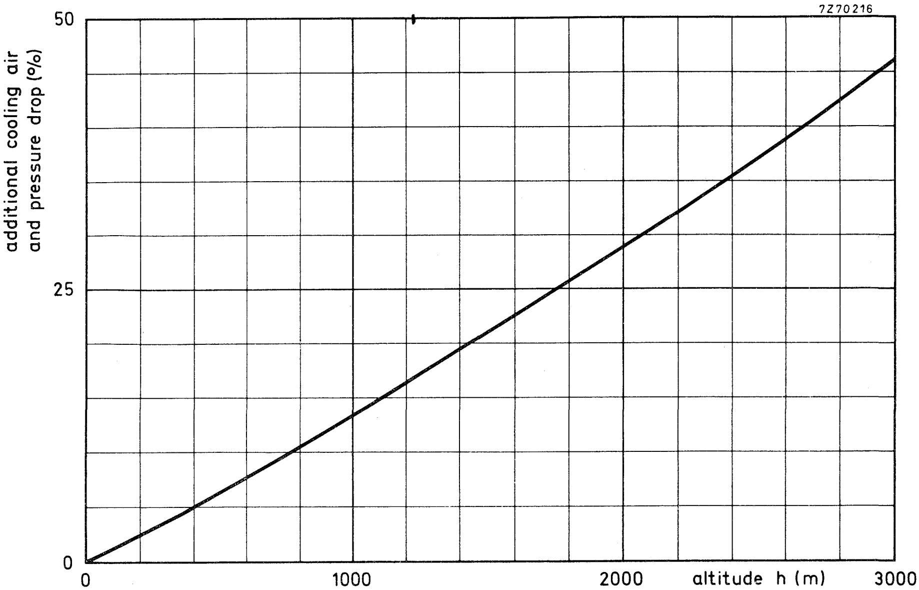
Notes
1. During a short period, for adjustment of the transmitter, I_k max. = 700 mA.
2. Negative modulation, positive synchronization, combined sound and vision.
3. R.F. driving power should be applied after the heater and electrode voltages.
4. To be adjusted for the zero-signal anode current stated on the measuring report supplied with each tube. Range values for equipment design −10 to −40 V. The stated no-signal anode current results in optimum linearity.
5. Three-tone method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync level = 0 dB).

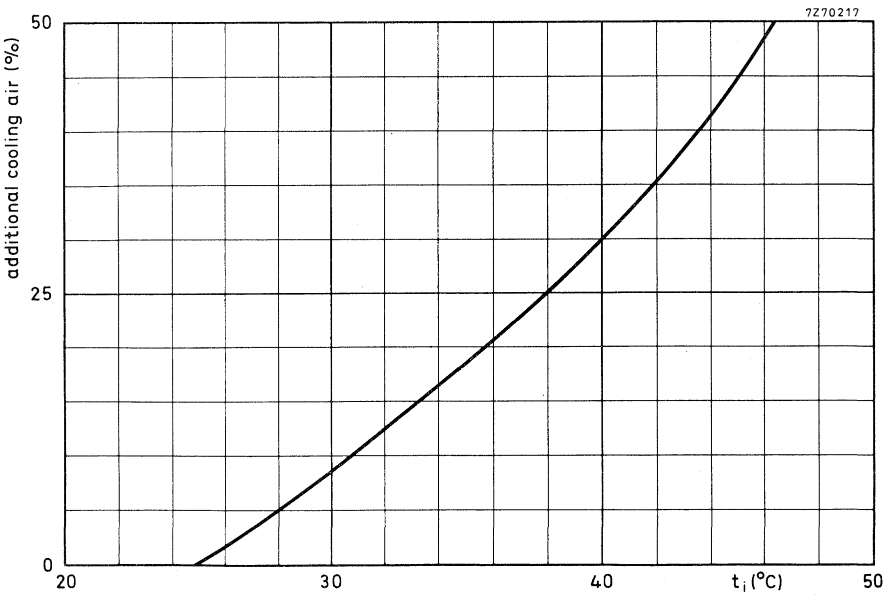

7Z64829
$V_g =$
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


7Z70218
I_a (A)
6
5
4
3
2
1
0
$V_a = 4$ kV
3 kV
2 kV
1 kV
−120
−100
−80
−60
−40
−20
0
20
40
60
V_g (V)


7Z67362.1
600
400
200
0
p_i
(Pa)
t_i = 25 °C
3,5 m³/min
3,0
2,5
2,0
1,5
1,0
0
500
1000
1500
2000
W_a (W)


7Z67999
300
200
100
0
t
(°C)
t_i = 25 °C
q = 0,5 m³/min
0,7
1,0
1,5
2,5
3,5
0
500
1000
1500
2000
W_a (W)


7Z70216
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000


7Z70217
additional cooling air (%)
50
25
0
20
30
40
t_i (°C)
50

AIR COOLED R.F. POWER TRIODE

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class AB linear broadband amplifier in TV sound and vision service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Frequency	f	470 to 860	MHz
Anode voltage	V_a	3500	V
Output power in the load (sync – CCIR-G)	W_ℓ	550	W
(peak white – CCIR-L)	W_ℓ	550	W
Power gain	G	15	dB

HEATING: indirect by a.c. (50 Hz to 400 Hz) or d.c.; oxide coated cathode.

Heater voltage	V_f	6,0 to 6,3	*
Heater current	I_f	4,8 to 5,8	A
Cathode heating time	t_h	min. 180	s

CAPACITANCES

Anode to grid	C_{ag}	6,8 to 8	pF
Grid to cathode and heater	C_{gf}	20 to 30	pF
Anode to cathode and heater	C_{af}	90 to 180	fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Anode current	I_a	400	mA
Transconductance	S	70	mA/V
Amplification factor	μ	90	

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250	^oC

To obtain optimum life this temperature should not exceed 200 ^oC.

* For optimum performance as TV broadband amplifier (linearity) the voltage set must be maintained within ±2%.

Data based on pre-production tubes.

COOLING

Anode: forced air

W_a W	T_i °C	q_{min} m³/min	P_i P_a
1800	25	2,5	220

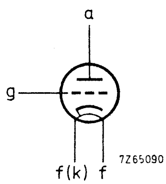
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

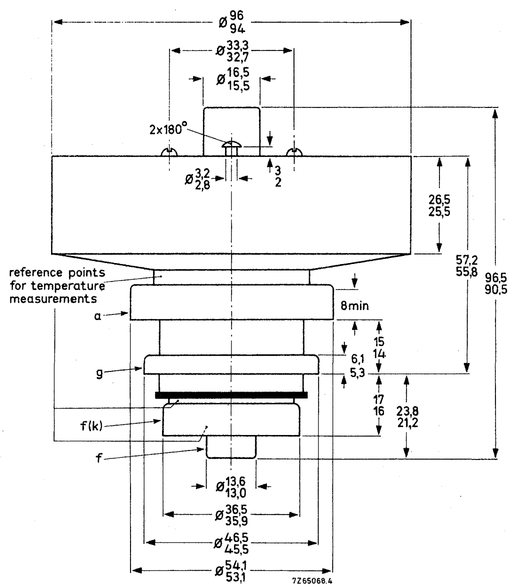
MECHANICAL DATA

Net mass: approx. 1000 g

Mounting position: any

Accessories:
Band IV and V amplifier circuit assembly type 40771





The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	97,0 dia
Anode terminal	55,1 dia
Grid terminal	47,0 dia
Heater/cathode terminal	37,0 dia
Heater terminal	14,5 dia

R.F. CLASS-AB AMPLIFIER FOR TELEVISION SERVICE, grounded grid

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3800	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	1900	W (note 1)
Grid current	I_g	max.	±5	mA
Cathode current	I_k	max.	700	mA (note 1)

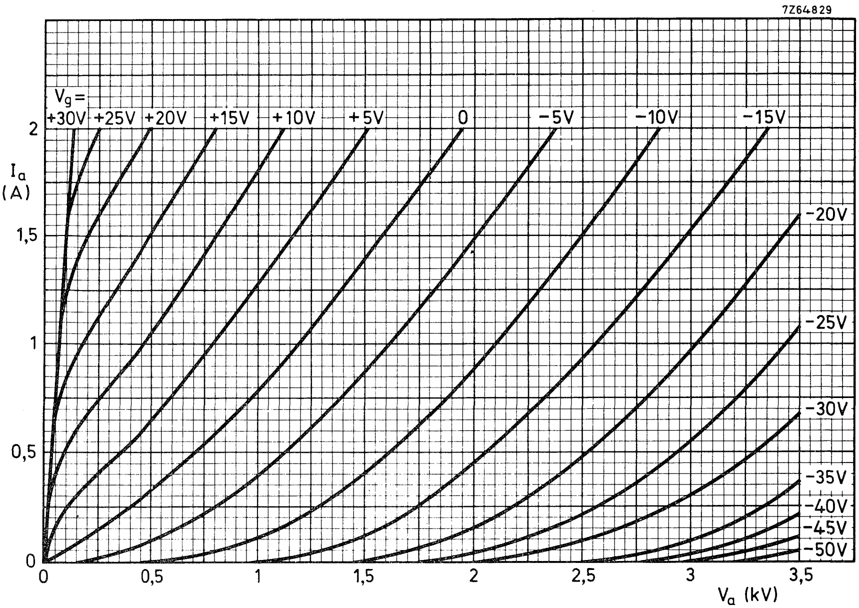
OPERATING CONDITIONS, grounded grid (note 2)

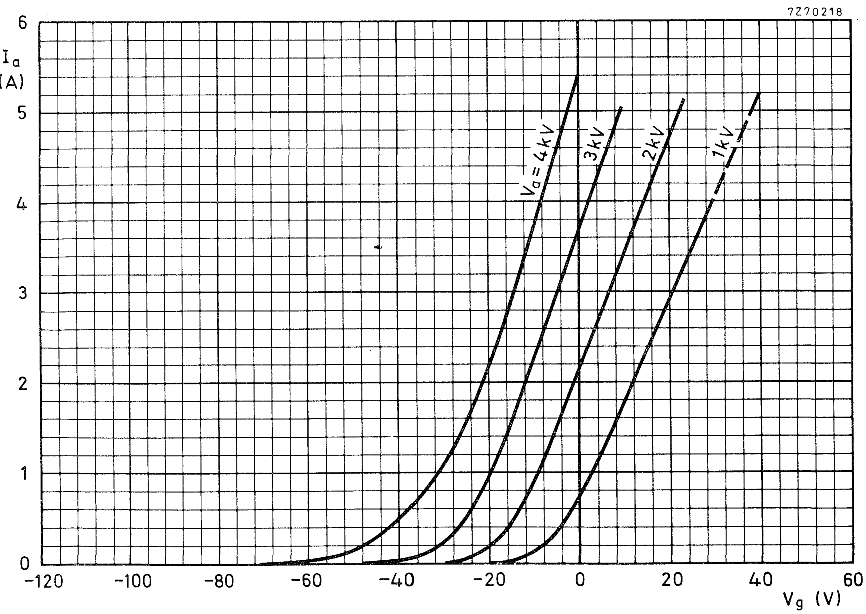
Standard		CCIR-G	CCIR-L	
Frequency	f	470 to 860	470 to 860	MHz
Bandwidth (−1 dB)	B	9	9	MHz
Anode voltage	V_a	3500	3500	V
Grid voltage (note 3)	V_g	−38	−38	V
Anode current, no signal	I_a	250	250	mA
Anode current at average grey level	I_a	≈ 500	≈ 500	mA
Grid current	I_g	≈ 0	≈ 0	mA
Driver output power, sync	W_{dr}	21		W
peak white	W_{dr}		21	W
Output power in load, sync	W_ℓ	550		W
peak white	W_ℓ		550	W
Power gain	G	15	15	dB
Differential gain		95	95	% (note 4)

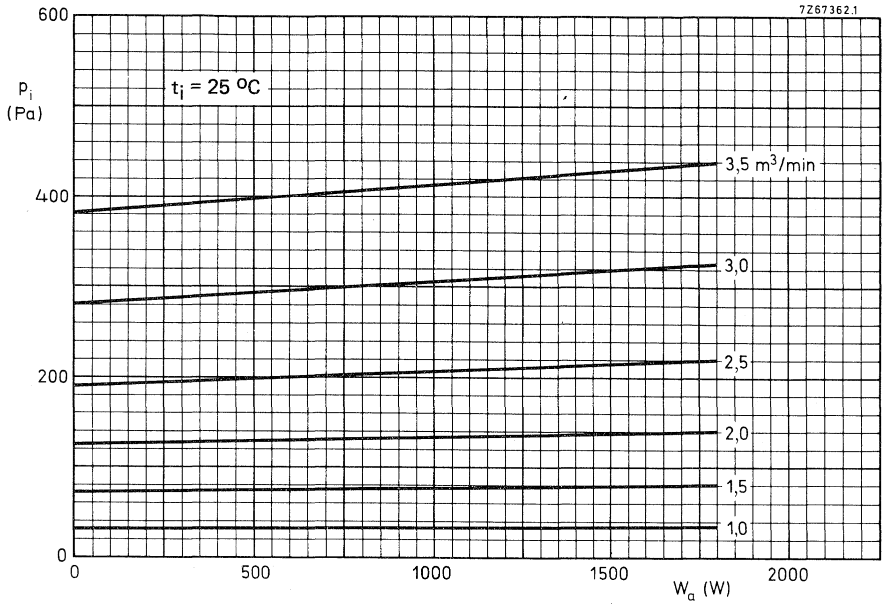
Notes

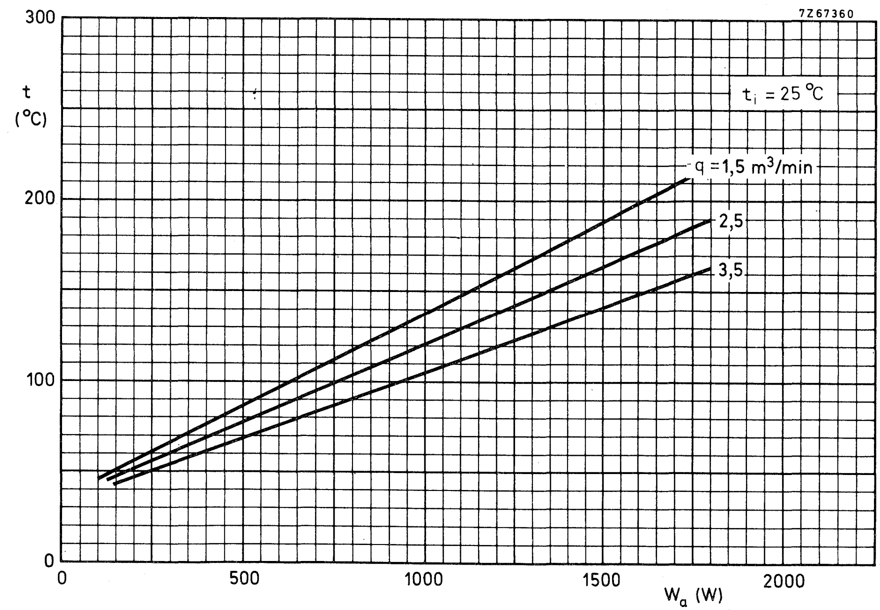
1. During a short period, for adjustment of the transmitter, W_a = max. 2200 W, and I_k = max. 800 mA.
2. R.F. driving power should be applied after the heater and electrode voltages.
3. To be adjusted for the stated no-signal anode current. Range values for equipment design −20 to −50 V.
4. Standard CCIR-G: Measured with a saw-tooth drive of 15% to 80% of peak sync amplitude with a superimposed 4,43 MHz signal with a peak-to-peak value of 10% of the peak sync amplitude adjusted at picture white level.

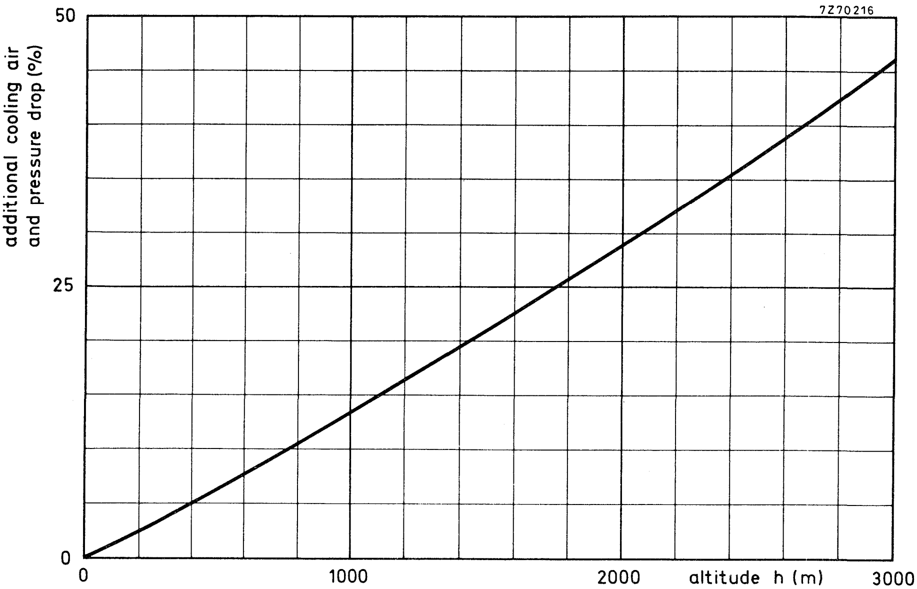
   Standard CCIR-L: Measured on white level with a sawtooth drive of 30% to 100% of peak white amplitude with a superimposed 3 MHz signal with a peak-to-peak value of 30% of the picture white amplitude.

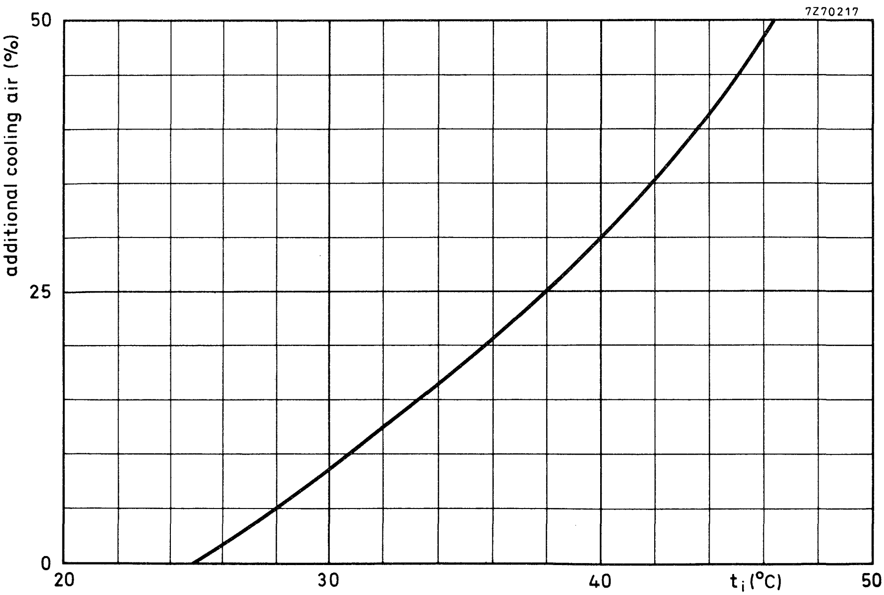

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
V_a (kV)
0
0,5
1
1,5
2
2,5
3
3,5


7Z70218
I_a (A)
V_a = 4 kV
3 kV
2 kV
1 kV
V_g (V)
−120
−100
−80
−60
−40
−20
0
20
40
60
0
1
2
3
4
5
6


7Z67362.1
600
400
200
0
p_i
(Pa)
t_i = 25 °C
3,5 m³/min
3,0
2,5
2,0
1,5
1,0
0
500
1000
1500
2000
W_a (W)


7Z67360
300
200
100
0
t
(°C)
t_i = 25 °C
q = 1,5 m³/min
2,5
3,5
0
500
1000
1500
2000
W_a (W)


7Z70216
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000


7Z70217
additional cooling air (%)
50
25
0
20
30
40
t_i (°C)
50

AIR COOLED R.F. POWER TRIODE

Forced-air cooled coaxial power triode in metal-ceramic construction primarily intended for use as R.F. class-AB linear broadband amplifier in TV transposer service at frequencies up to 1000 MHz.

QUICK REFERENCE DATA

Transposer service (combined sound and vision)			
Frequency	f	470 to 860	MHz
Anode voltage	V_a	3000	V
Output power in the load (sync)	W_ℓ	220	W
Power gain	G	16,5	dB

HEATING: indirect, by a.c. (50 Hz to 400 Hz) or d.c.; oxide coated cathode.

Heater voltage	V_f	6,0 to 6,3	V*
Heater current	I_f	4,8 to 5,8	A
Cathode heating time	t_h	min. 180	s

CAPACITANCES

Anode to grid	C_{ag}	6,8 to 8	pF
Grid to cathode and heater	C_{gf}	20 to 30	pF
Anode to cathode and heater	C_{af}	90 to 180	fF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Anode current	I_a	400	mA
Transconductance	S	70	mA/V
Amplification factor	μ	90	

TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250	^oC

To obtain optimum life, this temperature should not exceed 200 ^oC.

* The heater voltage must be adjusted between 6,0 and 6,3 V.
For optimum performance (linearity) the voltage set must be maintained within ±2% for transposer service, or ±5% for other applications.

COOLING

Anode: forced air

W_a W	T_i ^oC	q_{min} m^3/min	P_i P_a
1800	25	2,5	220

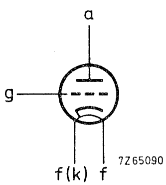
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

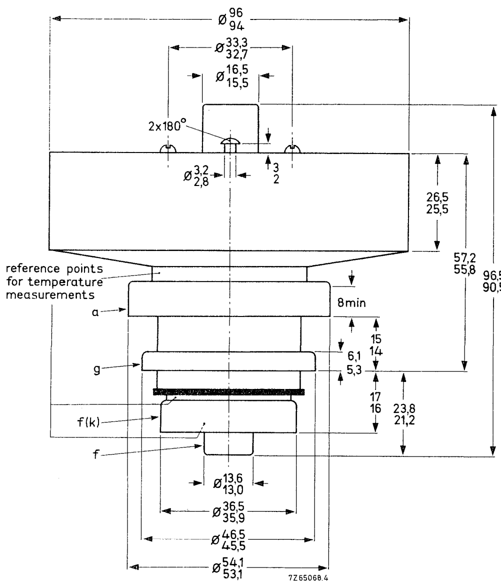
MECHANICAL DATA

Net mass: approx. 1000 g

Mounting position: any

Accessories:
Band IV and V amplifier circuit assembly type 40771





The radiator and the terminals are situated within concentric cylinders of the following dimensions:

Radiator	97,0 dia
Anode terminal	55,1 dia
Grid terminal	47,0 dia
Heater/cathode terminal	37,0 dia
Heater terminal	14,5 dia

R.F. CLASS-AB AMPLIFIER FOR TV TRANSPOSER SERVICE, grounded grid

LIMITING VALUES (Absolute maximum rating system)

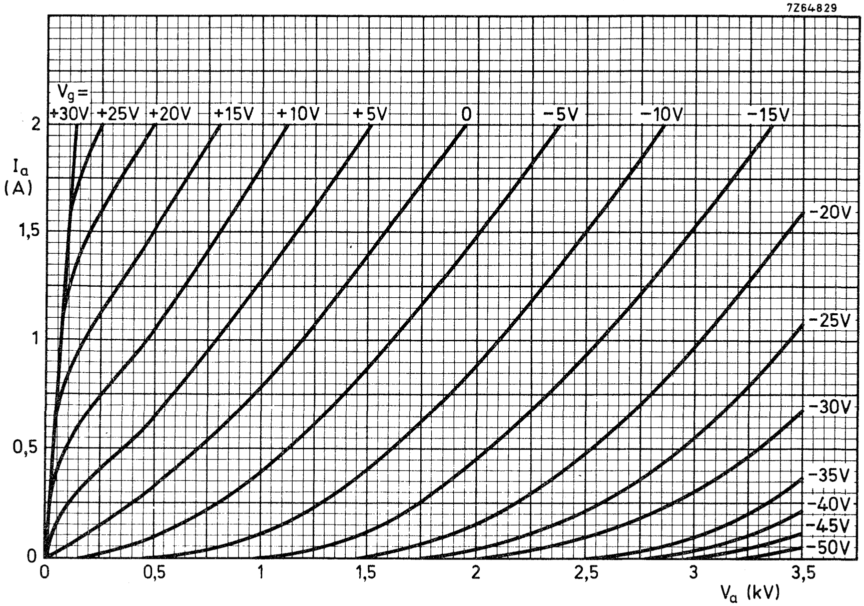
Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	1800	W
Grid current	I_g	max.	±5	mA
Cathode current	I_k	max.	550	mA (note 1)

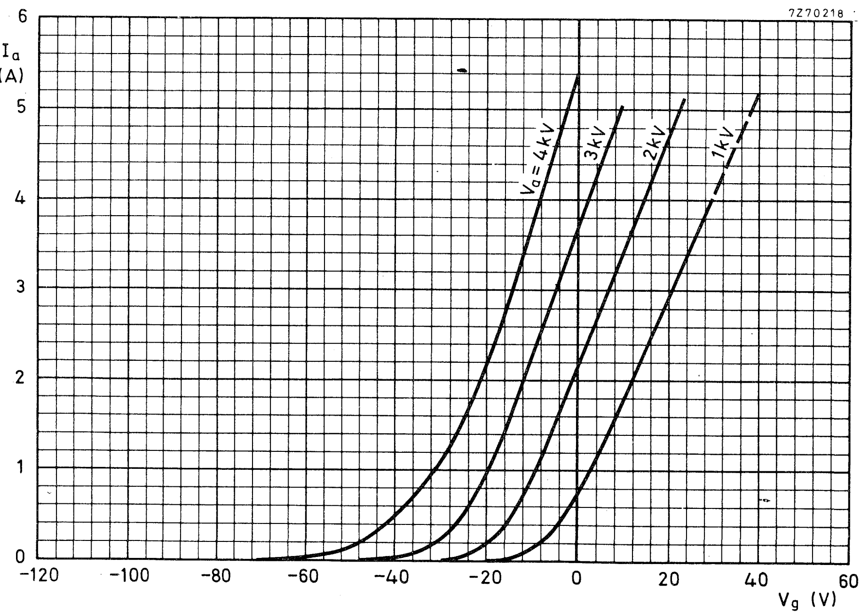
OPERATING CONDITIONS, grounded grid (notes 2,3)

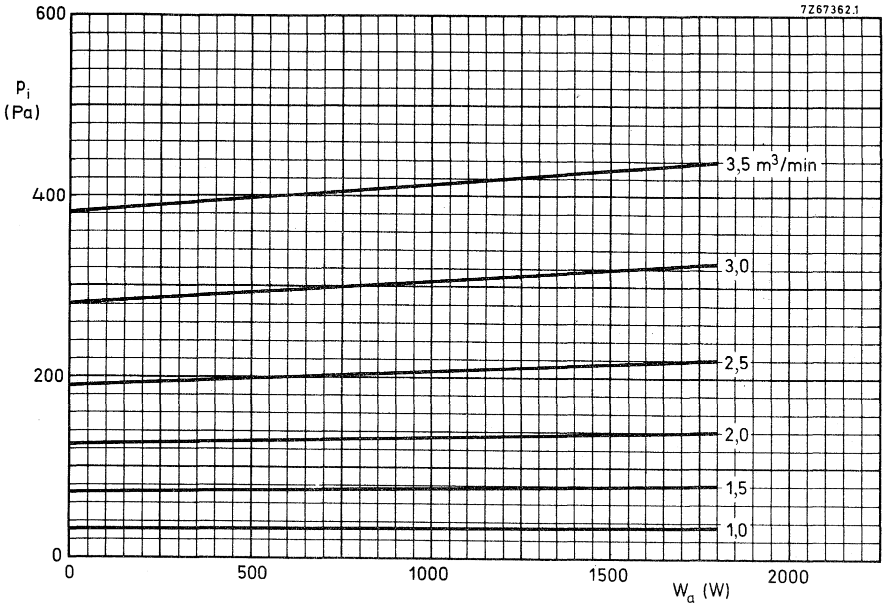
Standard		C.C.I.R-G	C.C.I.R-G	C.C.I.R-I	
Frequency	f	470 to 860	470 to 860	470 to 860	MHz
Bandwidth	B	9	9	9	MHz
Anode voltage	V_a	3000	3000	3000	V
Grid voltage (note 4)	V_g	−30	−30	−30	V
Anode current, no signal	I_a	420	350	420	mA
Anode current at zero dB level	I_a				
(vision carrier)	I_a	650	550	650	mA
Grid current	I_g	≈ 0	≈ 0	≈ 0	mA
Driver output power (sync)	W_{dr}	7	8	7	W
Output power in load (sync)	W_ℓ	220	220	220	W
Output power at $I_g = 0$	W_o	⩾ 390	⩾ 390	⩾ 390	W
Power gain	G	16,5	16,0	16,5	dB
Intermodulation products	d	−57 (note 5)	−56 (note 5)	−55 (note 6)	dB
		< −55	< −54	< −53	

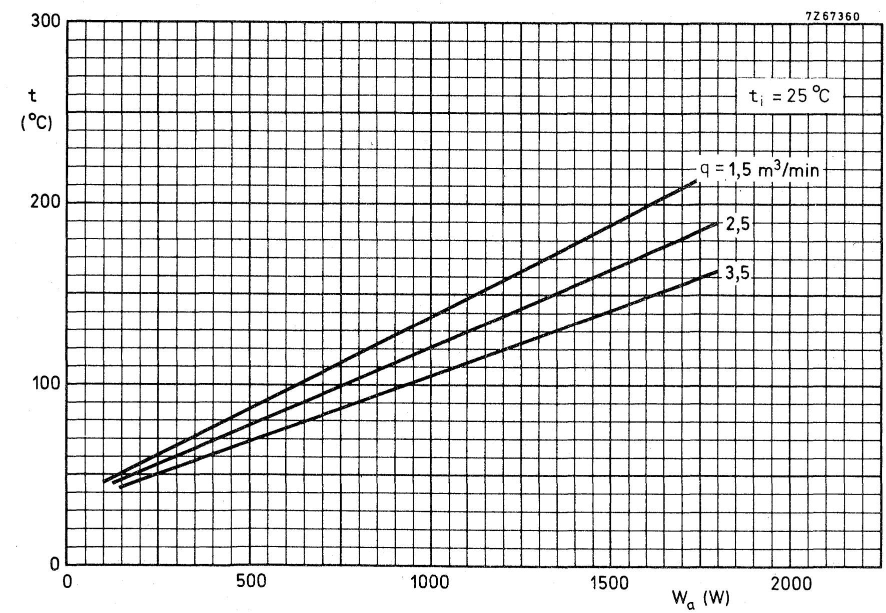
Notes

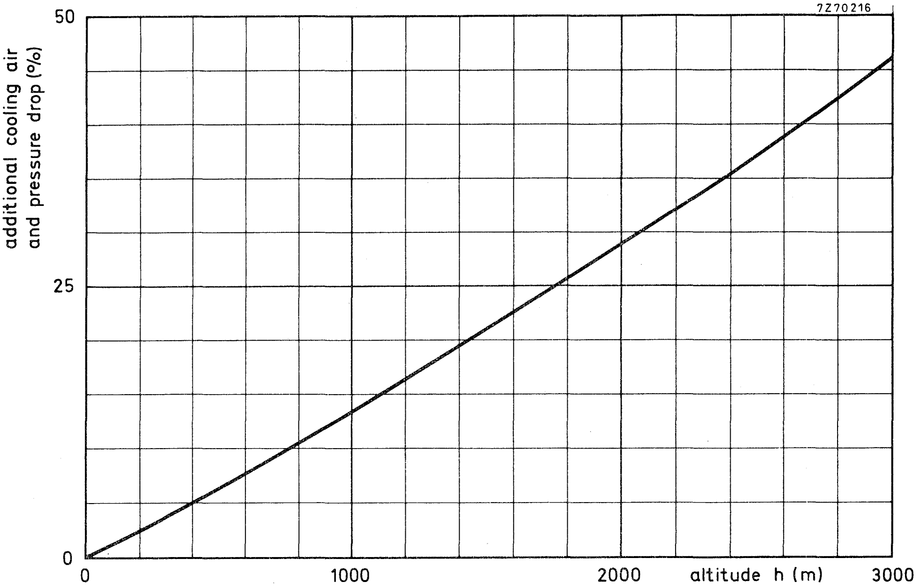
1. During a short period, for adjustment of the transmitter, I_k max. = 700 mA.
2. Negative modulation, positive synchronization, combined sound and vision.
3. R.F. driving power should be applied after the heater and electrode voltages.
4. To be adjusted for the stated no-signal anode current. Range values for equipment design −15 to −45 V.
5. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB sideband signal −16 dB with respect to peak sync level = 0 dB).
6. Three-tone test method (vision carrier −8 dB, sound carrier −7 dB, sideband signal −17 dB with respect to peak sync level = 0 dB).

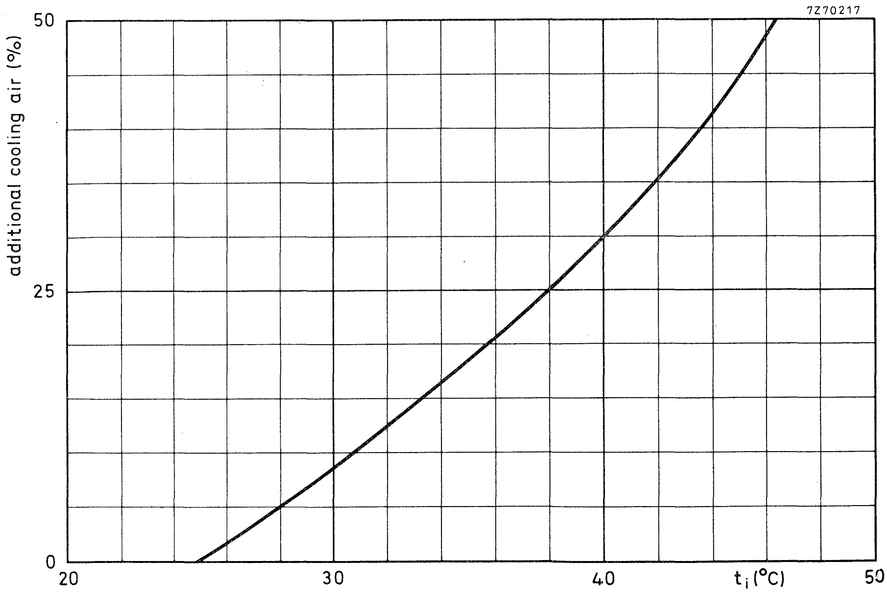

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


7Z70218
I_a (A)
6
5
4
3
2
1
0
V_a = 4 kV
3 kV
2 kV
1 kV
−120
−100
−80
−60
−40
−20
0
20
40
60
V_g (V)


7Z67362.1
600
p_i
(Pa)
400
200
0
3,5 m³/min
3,0
2,5
2,0
1,5
1,0
0
500
1000
1500
2000
W_a (W)


7Z67360
300
t
(°C)
200
100
0
t_i = 25 °C
q = 1,5 m³/min
2,5
3,5
0
500
1000
1500
2000
W_a (W)


7Z70216
additional cooling air and pressure drop (%)
50
25
0
0
1000
2000
altitude h (m)
3000


7Z70217
additional cooling air (%)
50
25
0
20
30
40
t_i (°C)
50

TETRODES, YL TYPES

R.F. POWER TETRODES

R.F. power tetrodes in coaxial metal-ceramic construction intended for use as v.h.f. amplifier and s.s.b. amplifier. The YL1010 is water cooled. The YL1011 is air cooled. The YL1012 is vapour cooled.

QUICK REFERENCE DATA

R.F. class-AB amplifier, single-sideband				
Frequency	f	30	30	MHz
Anode voltage	V_a	8	10	kV
Output power (P.E.P.)	W_o	30	33	kW
R.F. class-C telegraphy, F.M. telephony				
Frequency	f		220	MHz
Anode voltage	V_a		5,5	kV
Output power	W_o		25	kW
R.F. class-C anode and screen grid modulation				
Frequency	f		30	MHz
Anode voltage	V_a		10	kV
Output power	W_o		55	kW

HEATING: direct, thoriated tungsten filament

Filament voltage	V_f	9	V
Filament current	I_f	200	A

CAPACITANCES

Anode to all except grid 1	$C_{a(g1)}$	42	pF
Grid 1 to all except anode	$C_{g1(a)}$	260	pF
Anode to grid 1	C_{ag1}	1,5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid 2 voltage	V_{g2}	1,2	kV
Anode current	I_a	2,5	A
Transconductance	S	65	mA/V
Amplification factor	μ_{g2g1}	6,6	

TEMPERATURE LIMITS AND COOLING

YL1010

Absolute maximum envelope and seal temperature	T_{env}	max	220 °C
Absolute maximum water inlet temperature	T_i	max	50 °C
Required quantity of water	see cooling curves Fig.1, Fig.2		

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

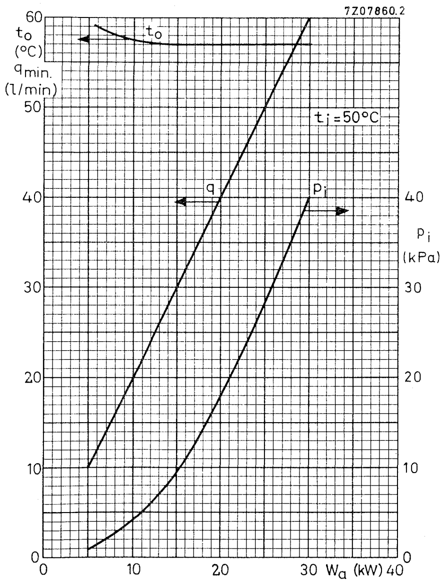


Fig.1.

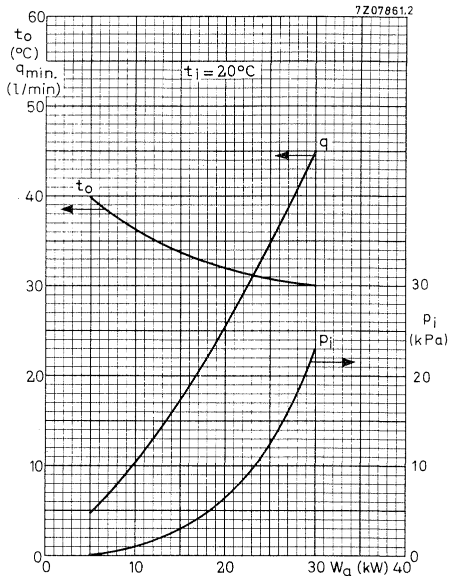


Fig.2.

YL1011

Absolute maximum envelope and seal temperature	T_{env}	max.	220 °C
Required quantity of air, at T_i = 25 °C	see cooling curve below		
At T_i = 35 °C; q_{min} is 15% higher			
At T_i = 45 °C; q_{min} is 35% higher			

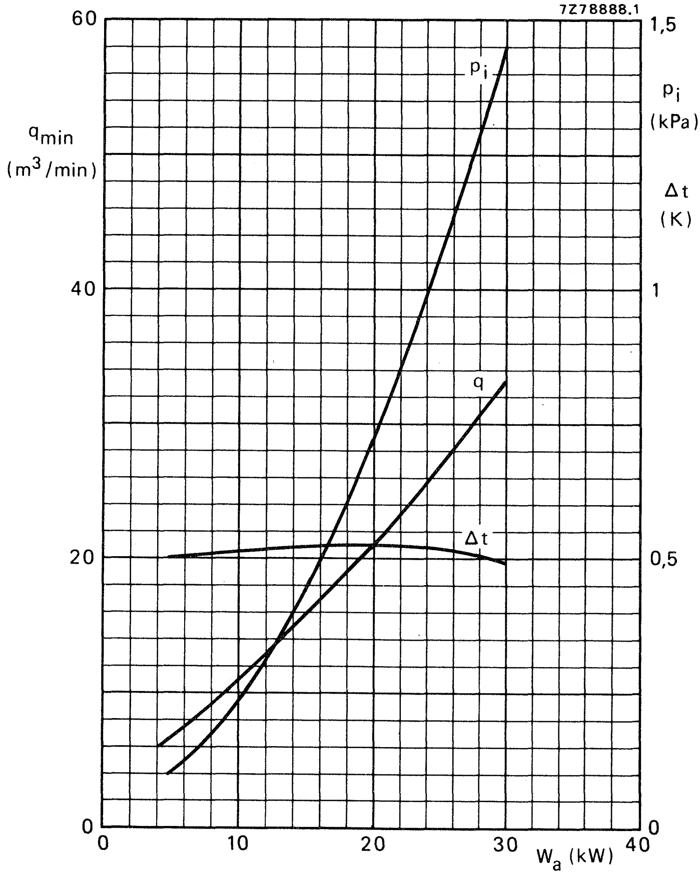


Fig. 3.

YL1012

Absolute maximum envelope and seal temperature	T_{env}	max.	220 °C

MECHANICAL DATA

Dimensions in mm

YL1010

Net mass: ≈ 7 kg

Mounting position: Vertical with anode down.

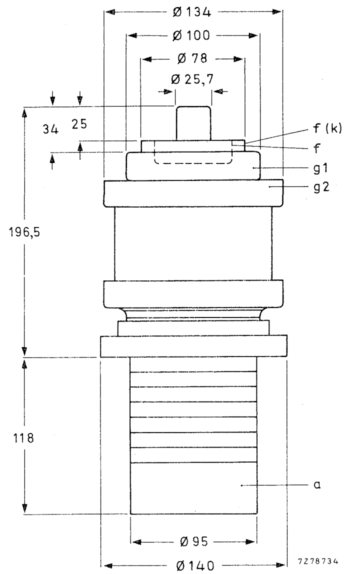


Fig. 4.

ACCESSORIES

Water-jacket	type K732
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid 1 connector	type 40727
Grid 2 connector	type 40728

YL1011

Net mass: ≈ 13,5 kg

Mounting position: Vertical with anode down

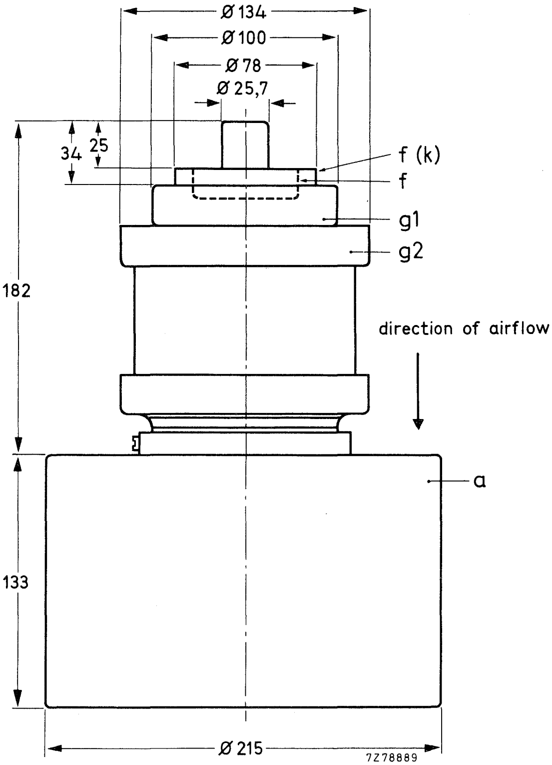


Fig. 5.

ACCESSORIES

Insulating pedestal	type 40729
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid 1 connector	type 40727
Grid 2 connector	type 40728

YL1012

Net mass: ≈ 14,7 kg

Mounting position: Vertical with anode down

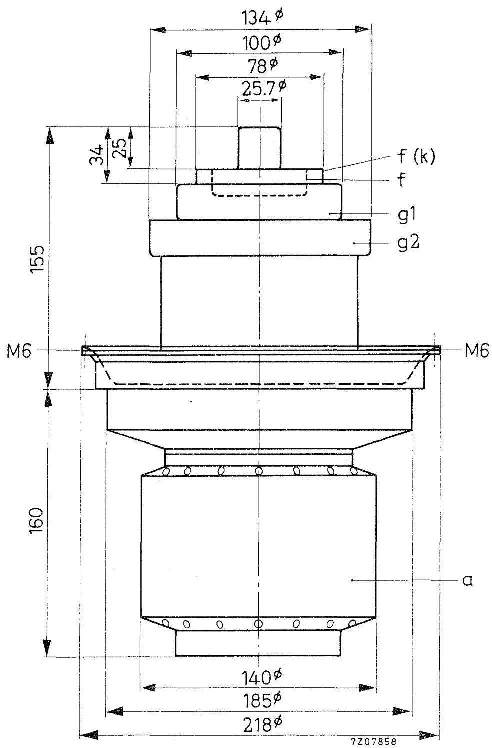


Fig. 6.

ACCESSORIES

Vapour jacket	type K728
Inner filament connector	type 40725
Outer filament connector	type 40726
Grid 1 connector	type 40727
Grid 2 connector	type 40728

R.F. CLASS-AB LINEAR AMPLIFIER, SINGLE-SIDEBAND, suppressed carrier

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max	12	kV
Grid 2 voltage	V_{g2}	max	1,4	kV
Grid 1 voltage	$-V_{g1}$	max	350	V
Anode current	I_a	max	10	A
Anode input power	W_{ia}	max	72	kW
Anode dissipation YL1010, YL1011	W_a	max	30	kW
Anode dissipation YL1012	W_a	max	45	kW
Grid 2 dissipation	W_{g2}	max	600	W
Grid 1 dissipation	W_{g1}	max	300	W

OPERATING CONDITIONS

Frequency	f		30		MHz
Anode voltage	V_a		8		kV
Grid 2 voltage	V_{g2}		1,2		kV
Grid 1 voltage	V_{g1}		−185		V *
		zero signal	single tone	double tone	
Grid 1 driving voltage, peak	V_{g1p}	0	175	175	V
Anode current	I_a	2	5,9	3,8	A
Grid 2 current	I_{g2}	0	250	100	mA
Grid 1 current	I_{g1}	0	0	0	mA
Anode input power	W_{ia}	16	47,2	30,4	kW
Anode dissipation	W_a	16	17,2	15,4	kW
Grid 2 dissipation	W_{g2}	0	300	120	W
Output power (P.E.P.)	W_o	0	30	30	kW
Efficiency	η		63,5	49	%
Intermodulation distortion					
3rd order	d_3			−36	dB **
5th order	d_5			−44	dB **

Notes see next page.

Frequency	f		30		MHz
Anode voltage	V_a		10		kV
Grid 2 voltage	V_{g2}		1,2		kV
Grid 1 voltage	V_{g1}		−195		V *
		zero signal	single tone	double tone	
Grid 1 driving voltage, peak	V_{g1p}	0	185	185	V
Anode current	I_a	2	5,2	3,3	A
Grid 2 current	I_{g2}	0	250	80	mA
Grid 1 current	I_{g1}	0	0	0	mA
Anode input power	W_{ia}	20	52	33	kW
Anode dissipation	W_a	20	19	16,5	kW
Grid 2 dissipation	W_{g2}	0	300	96	W
Output power (P.E.P.)	W_o	0	33	33	kW
Efficiency	η		63	50	%
Intermodulation distortion					
3rd order	d_3			−36	dB **
5th order	d_5			−44	dB **

* Adjust to give the zero signal anode current.
** Maximum values encountered at any level of drive voltage up to full drive referred to the amplitude of either of the two equal tones at that level.

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

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	220	MHz
Anode voltage	V_a	max	6	kV
Grid 2 voltage	V_{g2}	max	1	kV
Grid 1 voltage	$-V_{g1}$	max	250	V
Anode current	I_a	max	10	A
Anode input power	W_{ia}	max	72	kW
Anode dissipation YL1010, YL1011	W_a	max	30	kW
Anode dissipation YL1012	W_a	max	45	kW
Grid 2 dissipation	W_{g2}	max	300	W
Grid 1 dissipation	W_{g1}	max	200	W

OPERATING CONDITIONS

Frequency	f	220	MHz
Anode voltage	V_a	5,5	kV
Grid 2 voltage	V_{g2}	800	V
Grid 1 voltage	V_{g1}	−200	V
Anode current	I_a	7	A
Grid 2 current	I_{g2}	250	mA
Grid 1 current	I_{g1}	150	mA
Driver output power	W_{dr}	2	kW
Anode input power	W_{ia}	38,5	kW
Anode dissipation	W_a	9	kW
Output power in load	W_ℓ	25	kW *
Efficiency	η	77	%

* Feed-through power included. Measured in a circuit having an efficiency of approx. 85%.

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

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max	10,5	kV
Anode input power	W_{ia}	max	74	kW
Anode dissipation YL1010, YL1011	W_a	max	30	kW
Anode dissipation YL1012	W_a	max	45	kW
Anode current	I_a	max	8,5	A
Grid 2 voltage	V_{g2}	max	900	V
Grid 2 dissipation	W_{g2}	max	600	W
Grid 1 voltage	$-V_{g1}$	max	500	V
Grid 1 dissipation	W_{g1}	max	300	W

OPERATING CONDITIONS

Frequency	f	30	MHz
Anode voltage	V_a	10	kV
Grid 2 voltage	V_{g2}	800	V
Grid 1 voltage	V_{g1}	−340	V
Grid 1 resistor	R_{g1}	300	Ω
Anode current	I_a	6,9	A
Grid 2 current	I_{g2}	500	mA
Grid 1 current	I_{g1}	360	mA
Driver output power	W_{dr}	200	W
Anode input power	W_{ia}	69	kW
Anode dissipation	W_a	14	kW
Output power	W_o	55	kW
Efficiency	η	80	%
Modulation depth	m	100	%
Modulation power	W_{mod}	35	kW
Grid 2 voltage, peak	V_{g2p}	700	V

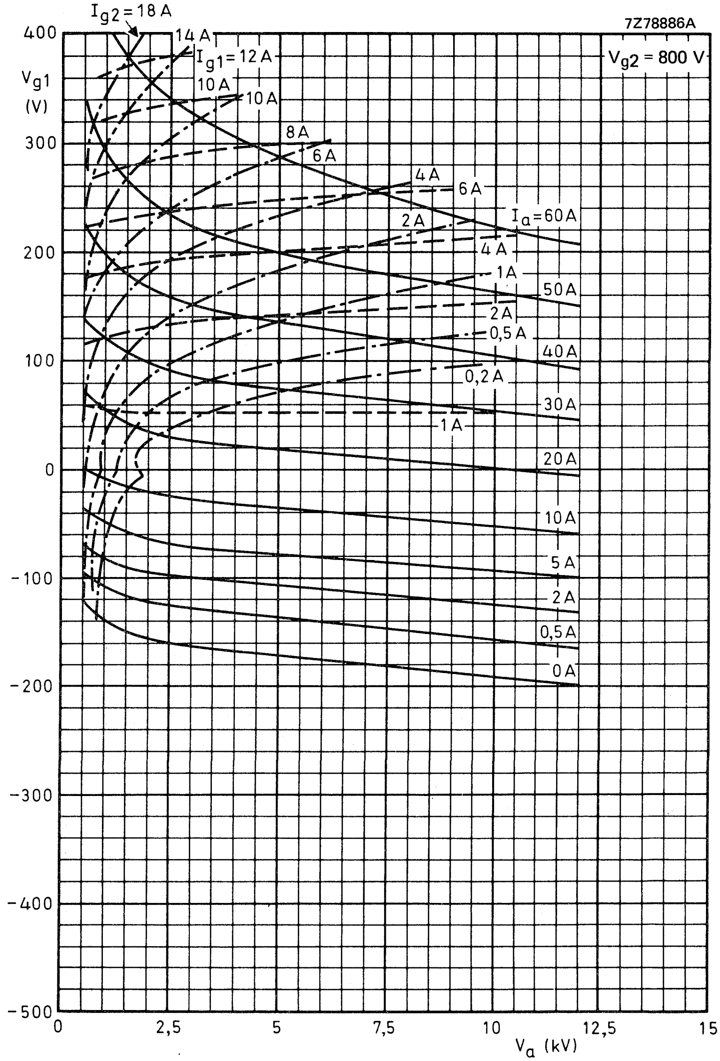

7Z78886A
V_{g2} = 800 V
I_{g2} = 18 A
14 A
I_{g1} = 12 A
10 A
10 A
8 A
6 A
4 A
6 A
2 A
I_a = 60 A
4 A
1 A
50 A
2 A
0,5 A
40 A
0,2 A
30 A
1 A
20 A
10 A
5 A
2 A
0,5 A
0 A
V_{g1} (V)
400
300
200
100
0
-100
-200
-300
-400
-500
0
2,5
5
7,5
10
12,5
15
V_a (kV)

Fig. 7.

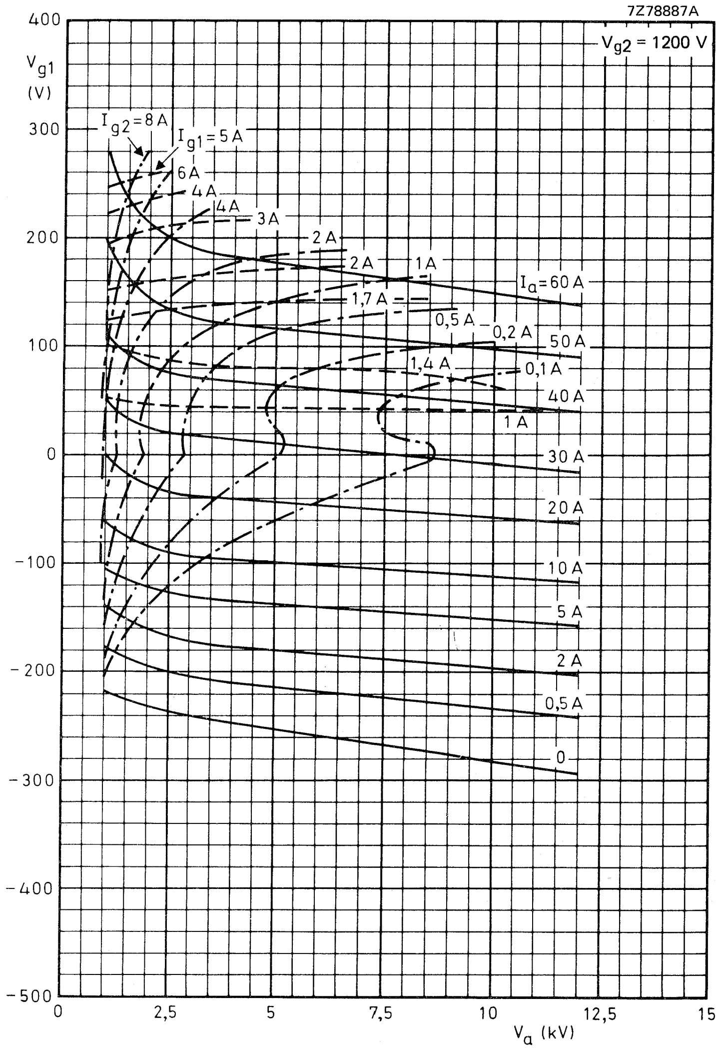

7Z78887A
V_{g2} = 1200 V
V_{g1} (V)
400
300
200
100
0
-100
-200
-300
-400
-500
I_{g2} = 8 A
I_{g1} = 5 A
6 A
4 A
4 A
3 A
2 A
2 A
1 A
1,7 A
0,5 A
0,2 A
1,4 A
0,1 A
1 A
I_a = 60 A
50 A
40 A
30 A
20 A
10 A
5 A
2 A
0,5 A
0
0
2,5
5
7,5
10
12,5
15
V_a (kV)

Fig. 8.

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in TV transmitters in the bands I and III. This type is also very suitable for a.m. and f.m. broadcast a.f. modulator applications and in TV transposer service.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)		
Frequency	f	175,25 MHz
Anode voltage	V_a	5 kV
Output power in load (sync)	W_ℓ	8,6 kW
Power gain (sync)	G	13,8 dB

Class-B amplifier		
Frequency	f	260 MHz
Anode voltage	V_a	7 kV
Output power in load	W_ℓ	10,5 kW
Power gain	G	15 dB

R.F. class-B f.m. telephony		
Frequency	f	260 MHz
Anode voltage	V_a	7 kV
Output power in load	W_ℓ	11 kW
Power gain	G	15 dB

TV transposer service		
Frequency	f	175 to 225 MHz
Anode voltage	V_a	4 kV
Output power in load, sync	W	2,5 kW
Power gain, sync	G	14,8 dB

HEATING: direct; thoriated tungsten filament, mesh type

Filament voltage	V_f		6,3 V $^{+1\%}_{-3\%}$
Filament current	I_f		118 A
Filament peak starting current	I_{fp}	max.	750 A
Cold filament resistance	R_{fo}		6 mΩ
Waiting time	t_w	min.	1 s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid 2 voltage	V_{g2}	600	V
Anode current	I_a	1,45	A
Transconductance	S	30	mA/V
Amplification factor	μ_{g2g1}	7,5	

CAPACITANCES

	(grounded cathode)		(grounded grid)		
Input	C_i	90		48	pF
Output	C_o	16		16,4	pF
Anode to grid 1	C_{ag1}	0,55			pF
Anode to filament			C_{af}	0,15	pF

TEMPERATURE LIMITIS

Absolute maximum envelope temperature	T_{env}	max.	240	°C
Recommended maximum seal temperature	T	max.	200	°C

COOLING

See curves
Direction of air flow: see drawing.

The air should be ducted so that sufficient air is directed to the seals to keep the temperature below the limits

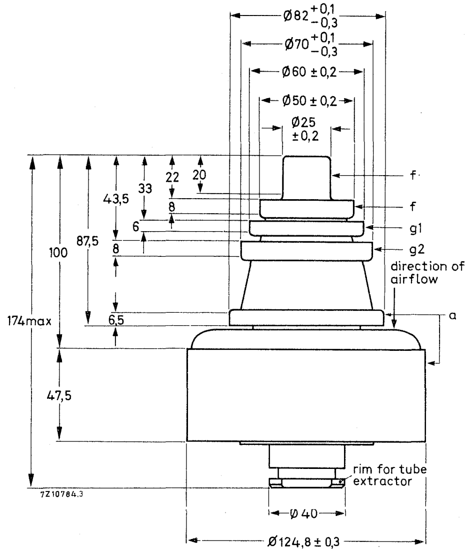
ACCESSORIES

Band I amplifier circuit assembly (vision)	type 40757
Band I amplifier circuit assembly (sound)	type 40758
Band III amplifier circuit assembly (vision)	type 40745
Band III amplifier circuit assembly (sound)	type 40746

MECHANICAL DATA

Net mass: approx. 3,1 kg

Mounting position: Vertical with anode up or down.



R.F. CLASS-AB AMPLIFIER FOR TELEVISION SERVICE

Negative modulation, positive synchronization (C.C.I.R. system)

Unless otherwise stated the voltages are specified with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	6,5	kV	
Grid 2 voltage	V_{g2}	max.	1	kV	
Anode current, black	$I_{a\ black}$	max.	2,25	A	
Anode input power, black	$W_{ia\ black}$	max.	12	kW	
Anode dissipation	W_a	max.	6	kW	
Grid 2 dissipation	W_{g2}	max.	80	W	
Grid 1 dissipation	W_{g1}	max.	40	W	
Cathode current	I_k	max.	4,5	A	

OPERATING CONDITIONS, grounded grid

					notes
Frequency of vision carrier	f	175,25	175,25	MHz	
Bandwidth (−1 dB)	B	7	7	MHz	1
Anode voltage	V_a	5	4	kV	
Grid 2 voltage	V_{g2}	600	600	V	
Grid 1 voltage	V_{g1}	−75	−65	V	2
Anode current, no signal condition	I_a	650	750	mA	
Anode current, black	$I_{a\ black}$	2,1	1,9	A	3
Grid 2 current, black	$I_{g2\ black}$	20	30	mA	3
Grid 1 current, black	$I_{g1\ black}$	75	55	mA	3
Output power in load, sync	$W_{\ell\ sync}$	8,6	6,25	kW	
Output power in load, black	$W_{\ell\ black}$	5,15	3,75	kW	3
Driving power, sync	$W_{dr\ sync}$	350	260	W	
Driving power, black	$W_{dr\ black}$	200	140	W	
Gain, sync	G_{sync}	13,8	13,8	dB	
Gain, black	G_{black}	14,1	14,3	dB	
Sync compression	sync in/out	27/25	29/25		4
Differential phase		$<$ 3	$<$ 3	$^{\circ}$	5
Differential gain		$\geqslant$ 85	$\geqslant$ 85	%	5
L.F. linearity		$\geqslant$ 85	$\geqslant$ 85	%	5

Notes see page 77.

OPERATING CONDITIONS (continued)

					notes
Frequency of vision carrier	f	83,25	55,25	MHz	
Bandwidth (−1 dB)	B	7	7	MHz	1
Anode voltage	V_a	4	4	kV	
Grid 2 voltage	V_{g2}	600	600	V	
Grid 1 voltage	V_{g1}	−65	−65	V	2
Anode current, no signal condition	I_a	750	750	mA	
Anode current, black	$I_{a\ black}$	2,1	2,3	A	3
Grid 2 current, black	$I_{g2\ black}$	45	45	mA	3
Grid 1 current, black	$I_{g1\ black}$	75	85	mA	3
Output power in load, sync	$W_{\ell\ sync}$	6,25	6,25	kW	
Output power in load, black	W_{ℓ} black	3,75	3,75	kW	
Driving power, sync	$W_{dr\ sync}$	340	385	W	
Driving power, black	$W_{dr\ black}$	180	210	W	
Gain, sync	G_{sync}	12,7	12,1	dB	
Gain, black	G_{black}	13,3	12,5	dB	
Sync compression	sync in/out	30/25	29/25		4
Differential phase		< 3	< 3	°	5
Differential gain		⩾ 85	⩾ 85	%	5
L.F. linearity		⩽ 85	⩽ 85	%	5

R.F. CLASS-AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE, grounded grid

LIMITING VALUES

see previous page.

OPERATING CONDITIONS, grounded grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

				notes
Frequency	f	175 to 225	MHz	
Bandwidth (−1 dB)	B	8	MHz	1
Anode voltage	V_a	4	kV	
Grid 2 voltage	V_{g2}	700	V	
Grid 1 voltage	V_{g1}	−65	V	2
Anode current, no signal condition	I_a	1	A	
Anode current	I_a	1,65	A	6
Grid 2 current	I_{g2}	25	mA	6
Grid 1 current	I_{g1}	10	mA	6
Driving power, sync	W_{dr}	85	W	
Output power in load, sync	W_{ℓ}	2,5	kW	
Power gain	G	14,8	dB	
Intermodulation products	d	⩽ −54	dB	7

Notes see page 77.

R.F. CLASS-B F.M. TELEPHONY

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	260	MHz
Anode voltage	V_a	max.	8,5	kV
Grid 2 voltage	V_{g2}	max.	1	kV
Grid 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	18,5	kW
Anode dissipation	W_a	max.	6	kW
Grid 2 dissipation	W_{g2}	max.	80	W
Grid 1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4,5	A

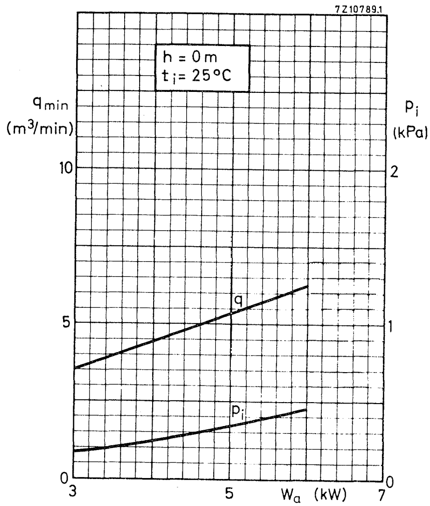
OPERATING CONDITIONS, grounded grid

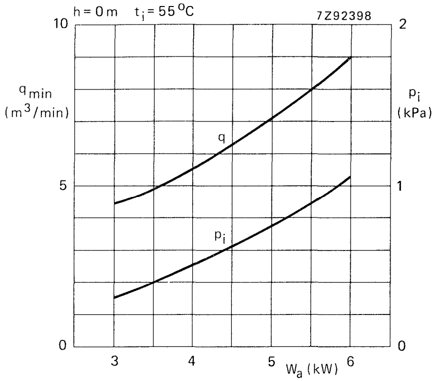
Frequency	f	260	MHz	
Anode voltage	V_a	7	kV	
Grid 2 voltage	V_{g2}	600	V	
Grid 1 voltage	V_{g1}	−120	V	(note 2)
Anode current, no signal condition	I_a	200	mA	
Anode current	I_a	2,3	A	
Grid 2 current	I_{g2}	80	mA	
Grid 1 current	I_{g1}	150	mA	
Anode input power	W_{ia}	16,1	kW	
Anode dissipation	W_a	5	kW	
Output power in load	W_ℓ	11	kW	
Efficiency, total	η	68	%	
Driving power	W_{dr}	340	W	←
Power gain	G	15	dB	

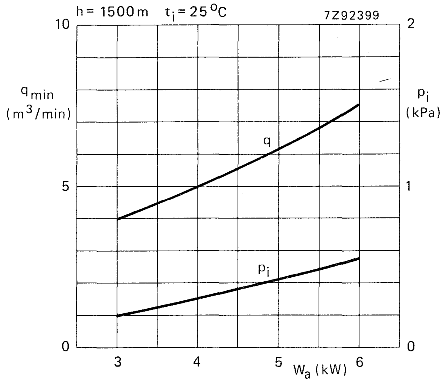
Notes see page 77.

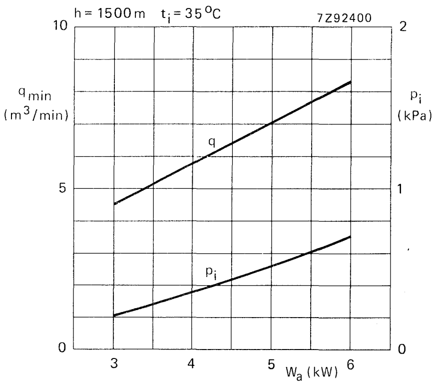
NOTES

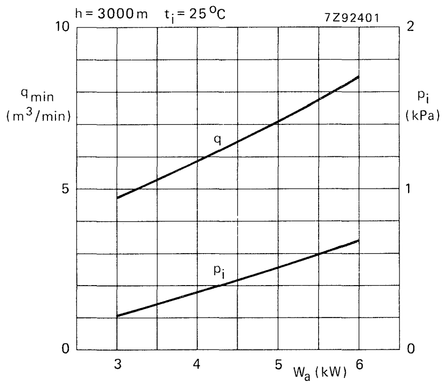
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5. Measured with a 9-step staircase amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4,43 MHz sine wave with a 10% peak to peak value.
6. At c.w. output power = 2,5 kW.
7. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync = 0 dB).

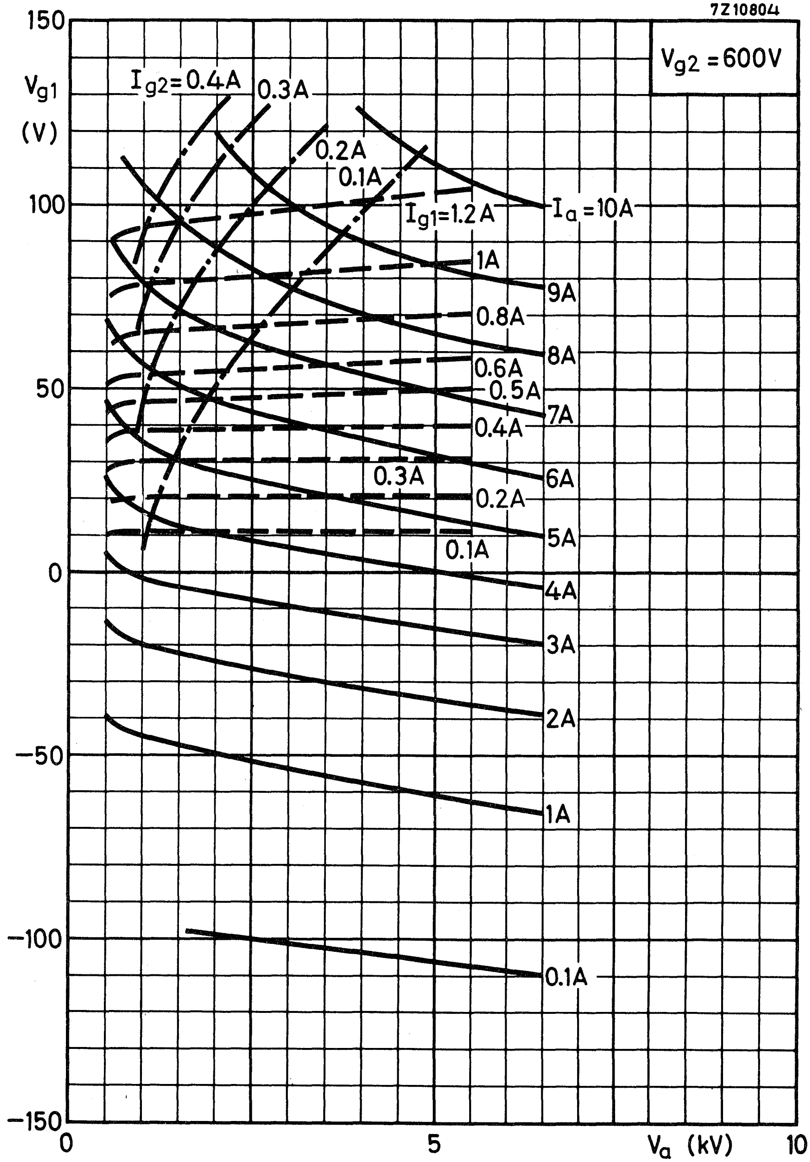


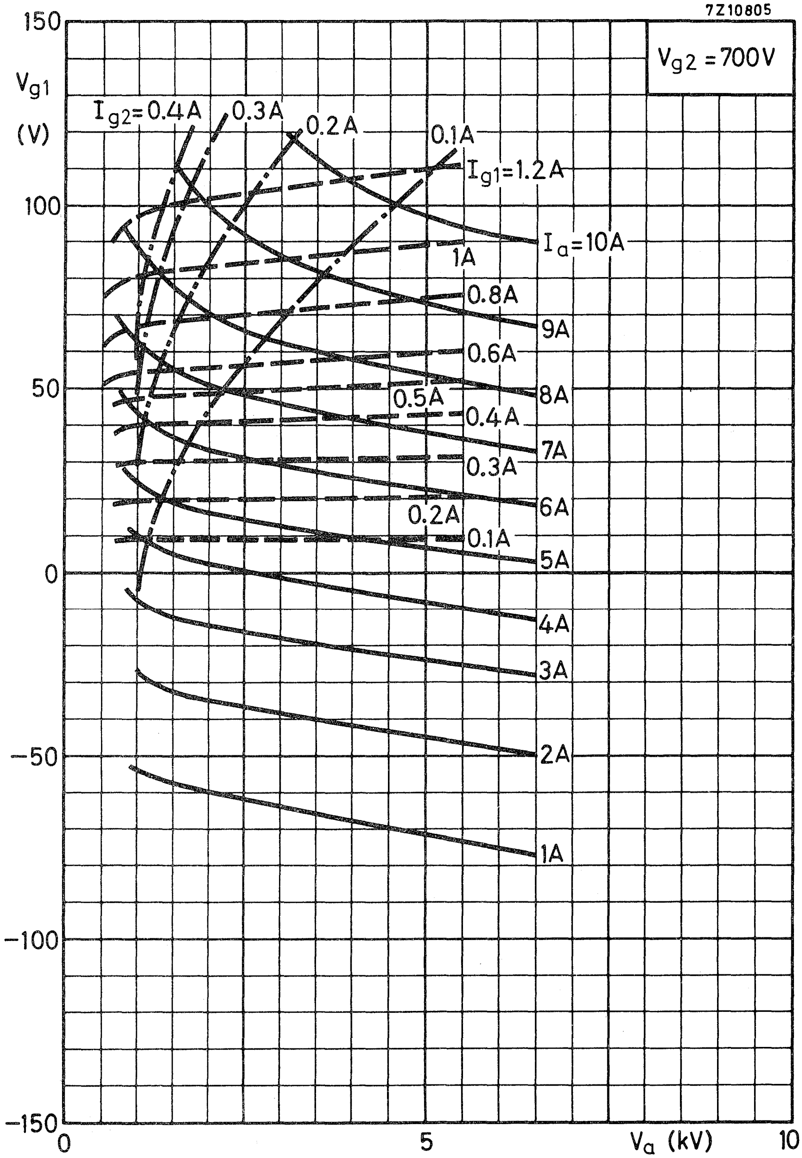

h = 0 m t$_i$ = 55 °C
7Z92398
q$_{min}$ (m^3/min)
p$_i$ (kPa)
q
p$_i$
W$_a$ (kW)
10
5
0
2
1
0
3
4
5
6

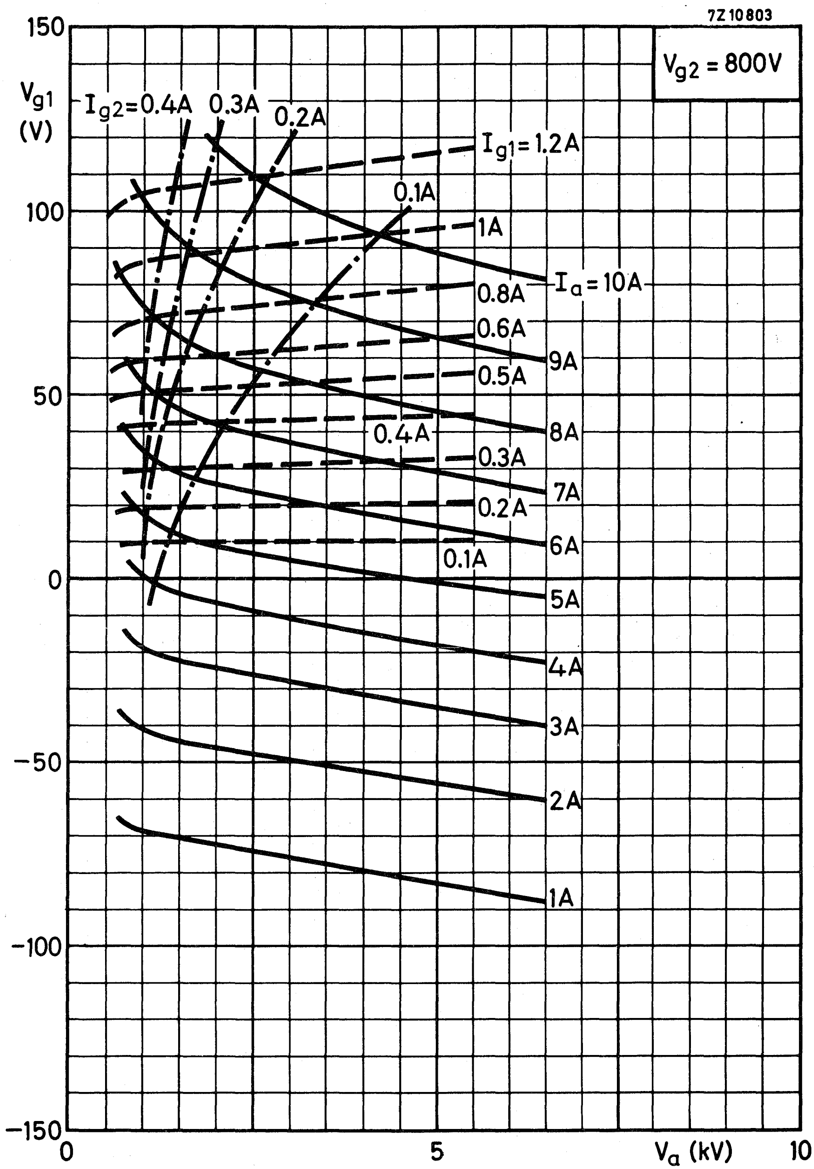

h = 1500 m t$_i$ = 25 °C
7Z92399
q$_{min}$ (m^3/min)
p$_i$ (kPa)
q
p$_i$
W$_a$ (kW)
10
5
0
2
1
0
3
4
5
6


h = 1500 m t$_i$ = 35 °C
7Z92400
q$_{min}$ (m^3/min)
p$_i$ (kPa)
q
p$_i$
W$_a$ (kW)
10
5
0
2
1
0
3
4
5
6


h = 3000 m t$_i$ = 25 °C
7Z92401
q$_{min}$ (m^3/min)
p$_i$ (kPa)
q
p$_i$
W$_a$ (kW)
10
5
0
2
1
0
3
4
5
6


7Z10804
V_{g2} = 600V
V_{g1} (V)
150
100
50
0
−50
−100
−150
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=1.2A
1A
0.8A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a=10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
0
5
10
V_a (kV)


7Z10805
V_{g2} = 700V
V_{g1} (V)
150
100
50
0
−50
−100
−150
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=1.2A
1A
0.8A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a=10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0
5
10
V_a (kV)


7Z10803
V_{g2} = 800V
V_{g1} (V)
150
100
50
0
−50
−100
−150
0
5
10
V_a (kV)
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=1.2A
1A
0.8A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a=10A
9A
8A
7A
6A
5A
4A
3A
2A
1A

WATER COOLED V.H.F. POWER TETRODE

The characteristics of this tetrode are identical to those of type YL1420. Type YL1421 is, however, water cooled.

COOLING

W_a k/W	T_i °C	q l/min	p_i kPa	T_o °C
8	20 50	5 7,5	7,3 14,5	45 67
5	20 50	3 4,5	3 6	48 69

Absolute maximum water inlet temperature T_i 50 °C

Absolute maximum water pressure p 600 kPa

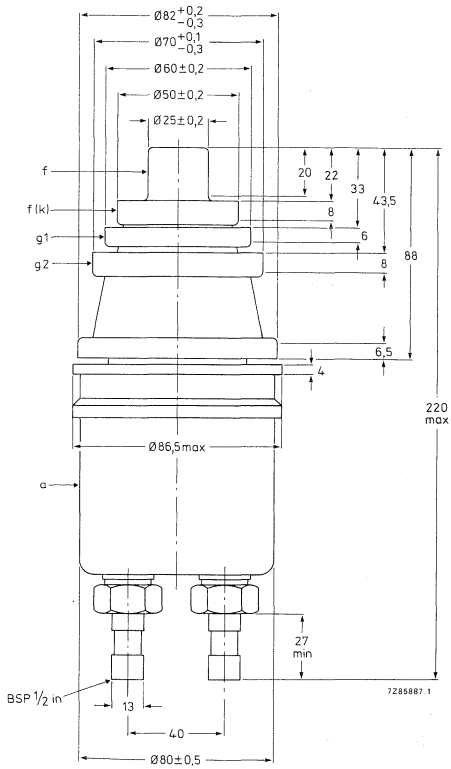
The temperature of the seals and envelope should be kept well below 200 °C.

An air flow of about 0,5 m³/min must be ducted along the seals from a 30 mm diameter nozzle positioned at a distance of 200 mm from the tube header.

MECHANICAL DATA

Net mass 3 kg

Mounting position vertical with anode up or down.



AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in TV transmitters in the bands I and III. This type is also very suitable for a.m. and f.m. broadcast, a.f. modulator applications, and TV transposer service.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)			
Frequency	f	175,25	MHz
Anode voltage	V_a	7	kV
Output power in load, sync	W_ℓ	18,4	kW
Power gain, sync	G	14	dB

Class-B amplifier			
Frequency	f	260	MHz
Anode voltage	V_a	7,5	kV
Output power in load	W_ℓ	13	kW
Power gain	G	15,1	dB

R.F. class-B f.m. telephony			
Frequency	f	260	MHz
Anode voltage	V_a	8	kV
Output power in load	W_ℓ	18	kW
Power gain	G	14,8	dB

TV transposer service			
Frequency	f	175 to 225	MHz
Anode voltage	V_a	6	kV
Output power in load, sync	W_ℓ	7	kW
Power gain, sync	G	15	dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		8	$V^{+1\%}_{-3\%}$
Filament current	I_f		116	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament starting current	R_{fo}		7,5	mΩ
Waiting time	t_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	6	kV
Grid 2 voltage	V_{g2}	650	V
Anode current	I_a	2,4	A
Transconductance	S	45	mA/V
Amplification factor	μ_{g2g1}	8,5	

CAPACITANCES

	grounded cathode		grounded grid		
Input	C_i	110	C_i	55	pF
Output	C_o	17,5	C_o	18	pF
Anode to grid 1	C_{ag1}	0,7			pF
Anode to filament			C_{af}	0,2	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240	°C
Recommended maximum seal temperature	T	max.	200	°C

COOLING

See curves.
Direction of air flow: see drawing.

The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

ACCESSORIES

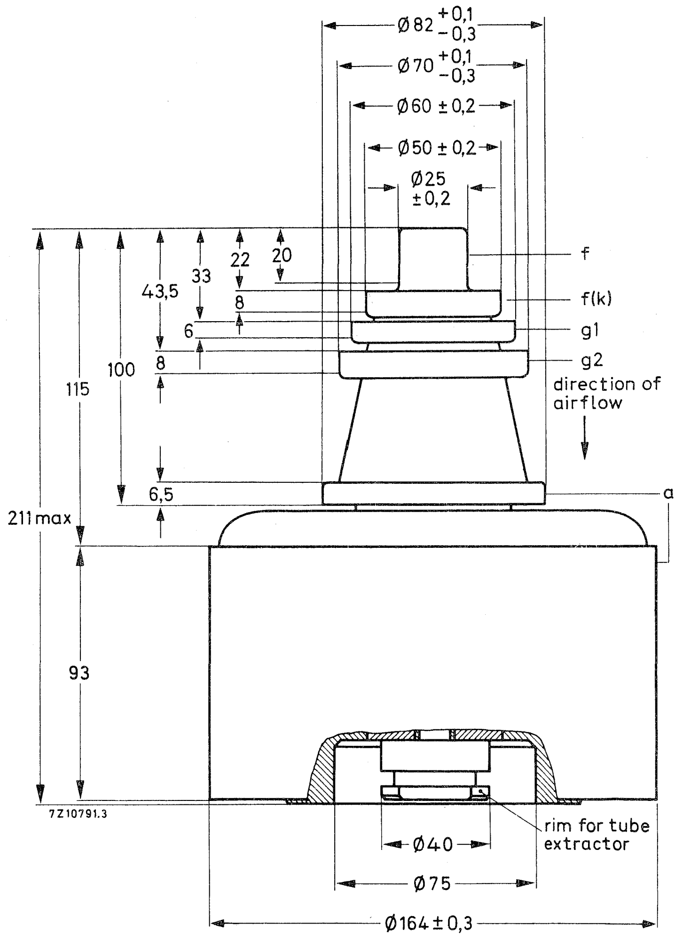
Band I amplifier circuit assembly (vision)	type 40759
Band II amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40747
Band III amplifier circuit assembly (sound)	type 40748

MECHANICAL DATA

Dimensions in mm

Net mass: 10,5 kg

Mounting position: vertical with anode up or down



R.F. CLASS-B SERVICE

Unless otherwise stated the voltages are specified with respect to cathode

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	9	kV	
Grid 2 voltage	V_{g2}	max.	1	kV	
Grid 1 voltage	$-V_{g1}$	max.	500	V	
Anode current	I_a	max.	5	A	
Anode input power	W_{ia}	max.	24	kW	
Anode dissipation	W_a	max.	12	kW	
Grid 2 dissipation	W_{g2}	max.	100	W	
Grid 1 dissipation	W_{g1}	max.	50	W	
Cathode current	I_k	max.	6	A	

OPERATING CONDITIONS, grounded grid

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a		7,5	kV	
Grid 2 voltage	V_{g2}		650	V	
Grid 1 voltage	V_{g1}		−125	V	2
Anode current, no signal condition	I_a		0,1	A	
Anode current	I_a		2,5	A	
Grid 2 current	I_{g2}		80	mA	
Grid 1 current	I_{g1}		90	mA	
Anode input power	W_{ia}		18,75	kW	
Anode dissipation	W_a		5	kW	
Output power in load	W_ℓ		13	kW	
Efficiency, total	η		69,3	%	
Driving power	W_{dr}		400	W	
Power gain	G		15,1	dB	

Note see page 91.

R.F. CLASS-AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

Negative modulation, positive synchronization (C.C.I.R. system)
Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

				notes
Frequency	f	up to	260 MHz	
Anode voltage	V_a	max.	9 kV	
Grid 2 voltage	V_{g2}	max.	1 kV	
Grid 1 voltage	$-V_{g1}$	max.	500 V	
Anode current, black	$I_{a\,black}$	max.	3,5 A	
Anode input power, black	$W_{ia\,black}$	max.	24 kW	
Anode dissipation	W_a	max.	12 kW	
Grid 2 dissipation	W_{g2}	max.	100 W	
Grid 1 dissipation	W_{g1}	max.	50 W	
Cathode current	I_k	max.	6 A	

OPERATING CONDITIONS, grounded grid

					notes
Frequency of vision carrier	f		175,25	MHz	
Bandwidth (−1 dB)	B	7	7	MHz	1
Anode voltage	V_a	7	6	kV	
Grid 2 voltage	V_{g2}	700	650	V	
Grid 1 voltage	V_{g1}	−85	−70	V	2
Anode current, no signal condition	I_a	750	900	mA	
Anode current, black	$I_{a\,black}$	2,9	2,5	A	3
Grid 2 current, black	$I_{g2\,black}$	45	25	mA	3
Grid 1 current, black	$I_{g1\,black}$	170	90	mA	3
Output power in load, sync	$W_{\ell\,sync}$	18,4	12,5	kW	
Output power in load, black	$W_{\ell\,black}$	11	7,5	kW	3
Driving power, sync	$W_{dr\,sync}$	720	415	W	
Driving power, black	$W_{dr\,black}$	370	225	W	
Gain, sync	G_{sync}	14	14,8	dB	
Gain, black	G_{black}	14,7	15,2	dB	
Sync compression	sync in/out	30/25	28/25		4
Differential phase		$<$ 3	$<$ 3	°	5
Differential gain		$\geqslant$ 85	$\geqslant$ 85	%	5
L.F. linearity		$\geqslant$ 85	$\geqslant$ 85	%	5

Notes see page 91.

OPERATING CONDITIONS (continued)

			notes
Frequency of vision carrier	f	83,25 MHz	
Bandwidth (−1 dB)	B	7 MHz	1
Anode voltage	V_a	5,5 kV	
Grid 2 voltage	V_{g2}	700 V	
Grid 1 voltage	V_{g1}	−72 V	2
Anode current, no signal condition	I_a	900 mA	
Anode current, black	$I_{a\ black}$	3,2 A	3
Grid 2 current, black	$I_{g2\ black}$	55 mA	3
Grid 1 current, black	$I_{g1\ black}$	165 mA	3
Output power in load, sync	$W_{\ell\ sync}$	13,2 kW	
Output power in load, black	$W_{\ell\ black}$	7,9 kW	3
Driving power, sync	$W_{dr\ sync}$	660 W	
Driving power, black	$W_{dr\ black}$	350 W	
Gain, sync	G_{sync}	13 dB	
Gain, black	G_{black}	13,4 dB	
Sync compression	sync in/out	30/25	4
Differential phase		< 3 °	5
Differential gain		⩾ 85 %	5
L.F. linearity		⩾ 85 %	5

				notes
Frequency of vision carrier	f		55,25 MHz	
Bandwidth (−1 dB)	B	7	7 MHz	1
Anode voltage	V_a	4	5,5 kV	
Grid 2 voltage	V_{g2}	700	700 V	
Grid 1 voltage	V_{g1}	−70	−72 V	2
Anode current, no signal condition	I_a	800	900 mA	
Anode current, black	$I_{a\ black}$	2,4	3,4 A	3
Grid 2 current, black	$I_{g2\ black}$	55	45 mA	3
Grid 1 current, black	$I_{g1\ black}$	60	175 mA	3
Output power in load, sync	$W_{\ell\ sync}$	6,4	13,2 kW	
Output power in load, black	$W_{\ell\ black}$	3,8	7,9 kW	3
Driving power, sync	$W_{dr\ sync}$	352	733 W	
Driving power, black	$W_{dr\ black}$	190	390 W	
Gain, sync	G_{sync}	12,5	12,5 dB	
Gain, black	G_{black}	13	13 dB	
Sync compression	sync in/out	28/25	30/25	4
Differential phase		< 3	< 3 °	5
Differential gain		⩾ 85	⩾ 85 %	5
L.F. linearity		⩾ 85	⩾ 85 %	5

Notes see page 91.

R.F. CLASS-AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE, grounded grid

LIMITING VALUES

See page F81

OPERATING CONDITIONS, grounded grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

				notes
Frequency	f	175 to 225	MHz	
Bandwidth (−1 dB)	B	8	MHz	1
Anode voltage	V_a	6	kV	
Grid 2 voltage	V_{g2}	800	V	
Grid 1 voltage	V_{g1}	−80	V	2
Anode current, no signal condition	I_a	1,2	A	
Anode current	I_a	2,5	A	6
Grid 2 current	I_{g2}	30	mA	6
Grid 1 current	I_{g1}	50	mA	6
Driving power, sync	W_{dr}	220	W	
Output power in load, sync	W_{ℓ}	7	kW	
Power gain	G	15	dB	
Intermodulation products	d	$\leqslant -54$	dB	7

Notes see page 91.

R.F. CLASS-B F.M. TELEPHONY

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	9,5	kV	
Grid 2 voltage	V_{g2}	max.	1	kV	
Grid 1 voltage	$-V_{g1}$	max.	500	V	
Anode current	I_a	max.	5	A	
Anode input power	W_{ia}	max.	30	kW	
Anode dissipation	W_a	max.	12	kW	
Grid 2 dissipation	W_{g2}	max.	100	W	
Grid 1 dissipation	W_{g1}	max.	50	W	
Cathode current	I_k	max.	6	A	

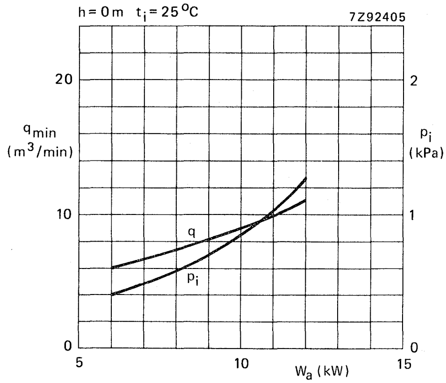
OPERATING CONDITIONS, grounded grid

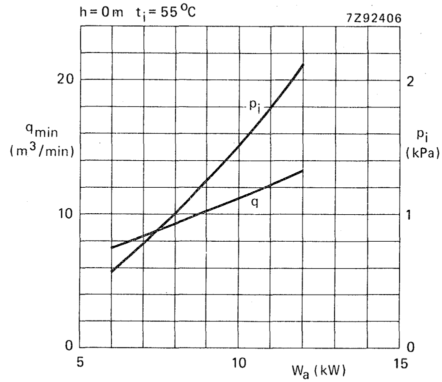
Frequency	f	260	MHz	
Anode voltage	V_a	8	kV	
Grid 2 voltage	V_{g2}	700	V	
Grid 1 voltage	V_{g1}	−115	V	2
Anode current, no signal condition	I_a	300	mA	
Anode current	I_a	3,5	A	
Grid 2 current	I_{g2}	100	mA	
Grid 1 current	I_{g1}	300	mA	
Anode input power	W_{ia}	28	kW	
Anode dissipation	W_a	10	kW	
Output power in load	W_ℓ	18	kW	
Efficiency, total	η	64,3	%	
Driving power	W_{dr}	600	W	
Power gain	G	14,8	dB	

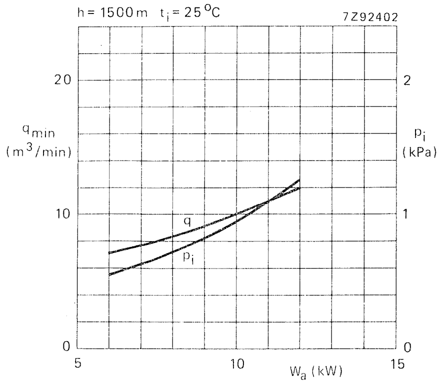
Note see page 91.

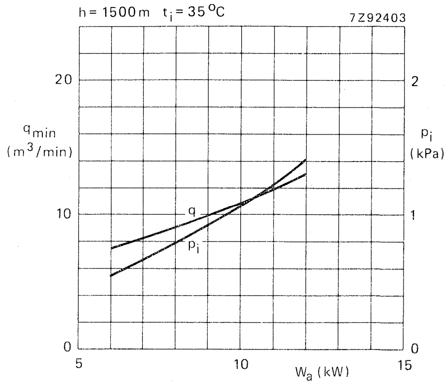
NOTES

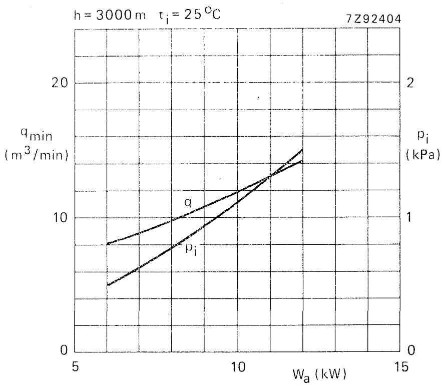
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 72/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5. Measured with a 9-step staircase amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4,43 MHz sine wave with a 10% peak to peak value.
6. At c.w. output power = 7 kW.
7. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync = 0 dB).

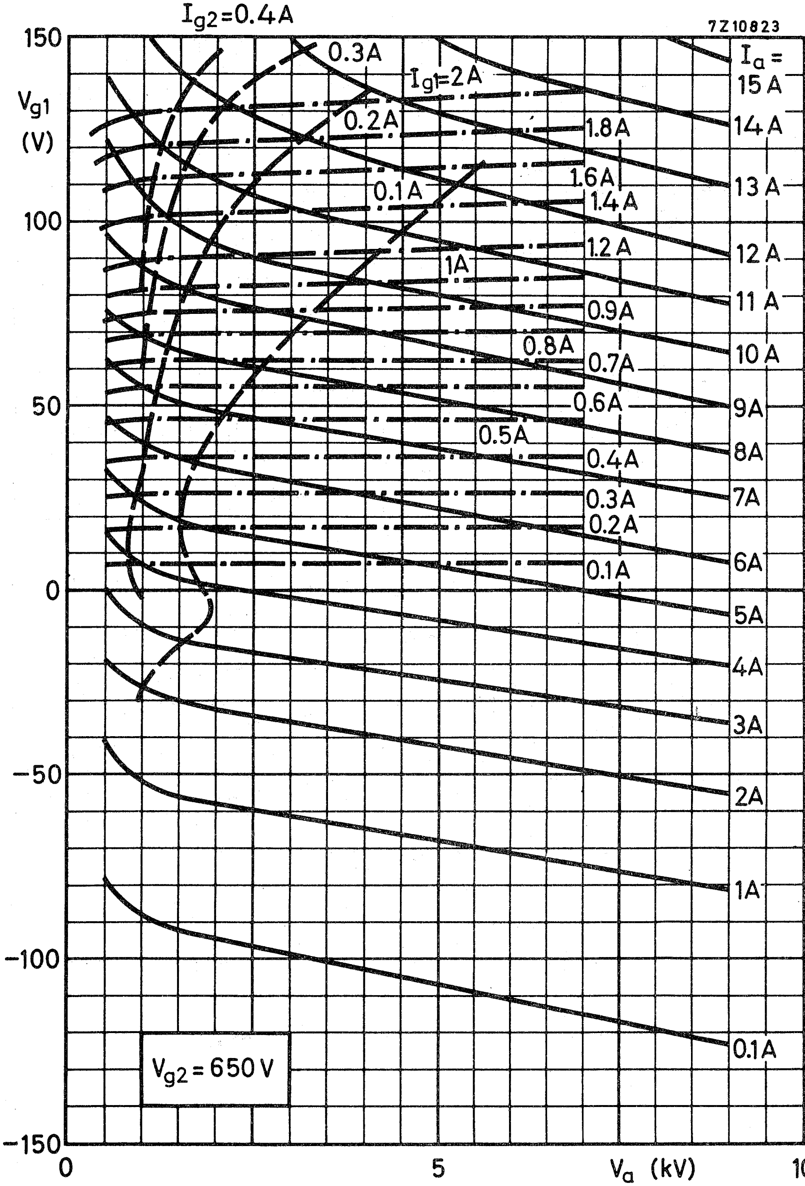


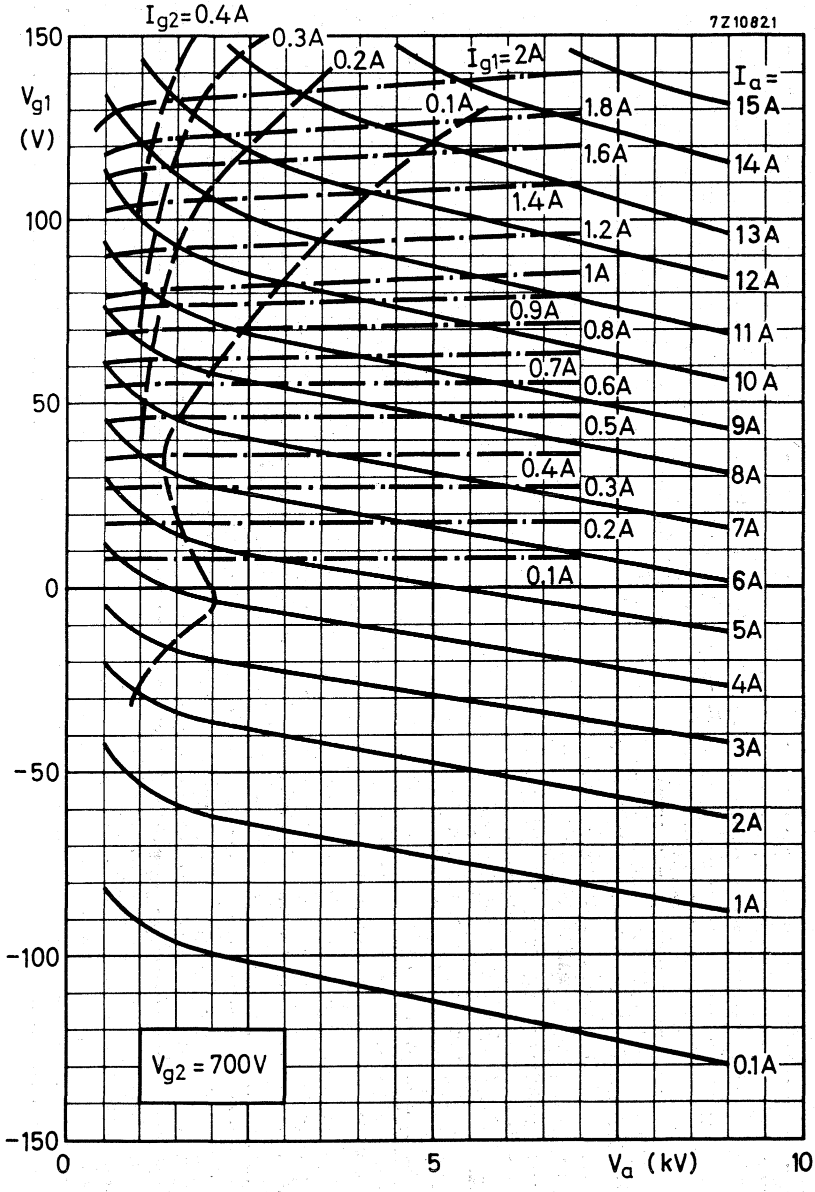


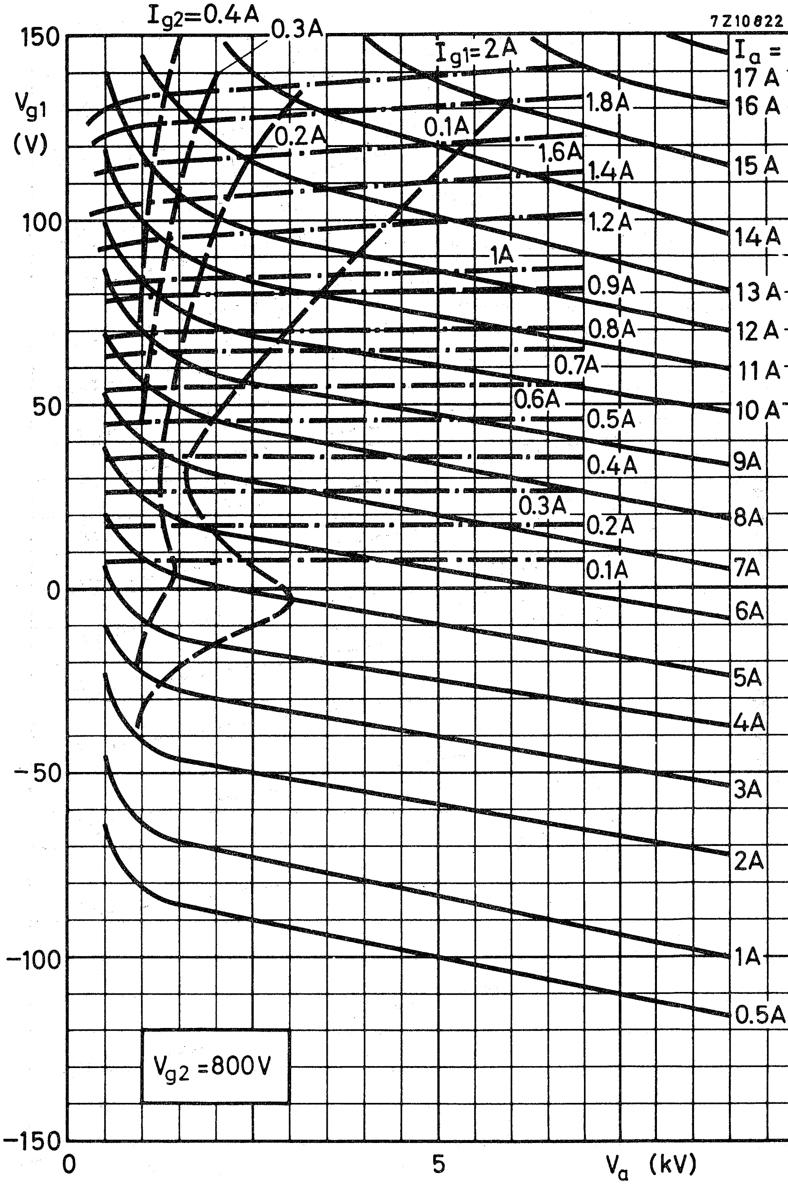

h = 1500 m t_i = 25 °C
7Z92402
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
0
10
20
0
1
2
5
10
15


h = 1500 m t_i = 35 °C
7Z92403
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
0
10
20
0
1
2
5
10
15


h = 3000 m t_i = 25 °C
7Z92404
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
0
10
20
0
1
2
5
10
15


7Z10823
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a =
15 A
14 A
13 A
12 A
11 A
10 A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
V_{g1}
(V)
150
100
50
0
−50
−100
−150
0
5
10
V_a (kV)
V_{g2} = 650 V


7Z10821
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=2A
1.8A
1.6A
1.4A
1.2A
1A
0.9A
0.8A
0.7A
0.6A
0.5A
0.4A
0.3A
0.2A
0.1A
I_a =
15A
14A
13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.1A
V_{g1}
(V)
150
100
50
0
−50
−100
−150
0
5
10
V_a (kV)
V_{g2} = 700V


7Z10822
I_{g2}=0.4 A
0.3 A
0.2 A
0.1 A
I_{g1}=2 A
1.8 A
1.6 A
1.4 A
1.2 A
1 A
0.9 A
0.8 A
0.7 A
0.6 A
0.5 A
0.4 A
0.3 A
0.2 A
0.1 A
I_a =
17 A
16 A
15 A
14 A
13 A
12 A
11 A
10 A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0.5A
V_{g1}
(V)
150
100
50
0
−50
−100
−150
0
5
10
V_a (kV)
V_{g2} =800 V

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in TV transmitters in the bands I and III. This type is also very suitable for a.m. and f.m. broadcast, a.f. modulator applications, and in TV transposer service.

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Frequency	f	175,25	MHz
Anode voltage	V_a	3	kV
Output power in load, sync	W_ℓ	1,55	kW
Power gain, sync	G	14,1	dB
Class-B amplifier			
Frequency	f	260	MHz
Anode voltage	V_a	3,5	kV
Output power in load	W_ℓ	2,4	kW
Power gain	G	14,1	dB
TV transposer service			
Frequency	f	175 to 225	MHz
Anode voltage	V_a	2,5	kV
Output power in load, sync	W_ℓ	0,55	kW
Power gain	G	14,8	dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		4,2	$V^{+1\%}_{-3\%}$
Filament current	I_f		53	A
Filament peak starting current	I_{fp}	max.	300	A
Cold filament resistance	R_{fo}		8,5	mΩ
Waiting time	t_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	4	kV
Grid 2 voltage	V_{g2}	500	V
Anode current	I_a	0,4	A
Transconductance	S	25	mA/V
Amplification factor	μ_{g2g1}	16	

CAPACITANCES

		grounded cathode			grounded grid	
Input	C_i	47			24	pF
Output	C_o	9			9	pF
Anode to grid 1	C_{ag1}	0,1				pF
Anode to filament			C_{af}	<	0,1	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240	^oC
Recommended maximum seal temperature	T	max.	200	^oC

COOLING

See curves.
Direction of air flow: see drawing.

The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

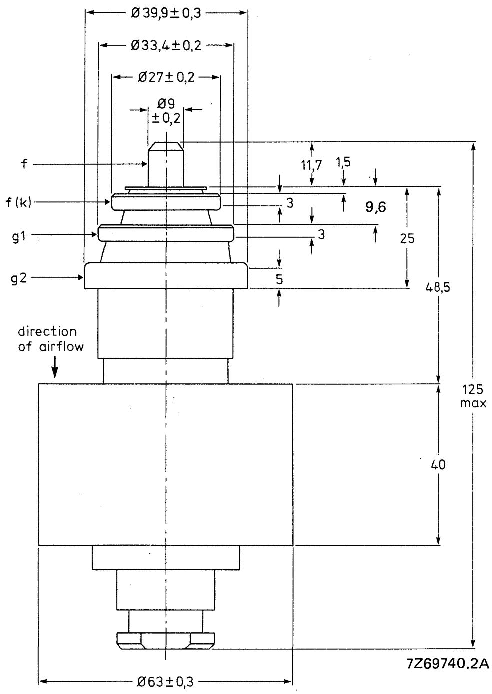
ACCESSORIES

Band I amplifier circuit assembly (vision)	type 40755
Band I amplifier circuit assembly (sound)	type 40756
Band III amplifier circuit assembly (vision)	type 40743
Band III amplifier circuit assembly (sound)	type 40744

MECHANICAL DATA

Net mass: 0,55 kg

Mounting position: vertical with anode up or down



R.F. CLASS-B SERVICE

Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	4	kV	
Grid 2 voltage	V_{g2}	max.	700	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current	I_a	max.	1,2	A	
Anode input power	W_{ia}	max.	4	kW	
Anode dissipation	W_a	max.	1,5	kW	
Grid 2 dissipation	W_{g2}	max.	50	W	
Grid 1 dissipation	W_{g1}	max.	30	W	
Cathode current	I_k	max.	1,5	A	

OPERATING CONDITIONS grounded grid

Frequency	f	up to	260	MHz	
Anode voltage	V_a		3,5	kV	
Grid 2 voltage	V_{g2}		600	V	
Grid 1 voltage	V_{g1}		−30	V	2
Anode current, no signal condition	I_a		100	mA	
Anode current	I_a		980	mA	
Grid 2 current	I_{g2}		70	mA	
Grid 1 current	I_{g1}		120	mA	
Anode input power	W_{ia}		3,43	kW	
Anode dissipation	W_a		0,9	kW	
Output power in load	W_ℓ		2,4	kW	
Efficiency, total	η		70	%	
Driving power	W_{dr}		90	W	
Power gain	G		14,1	dB	

Notes see page 104.

R.F. CLASS-AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

Negative modulation, positive synchronization (C.C.I.R. system).
Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	4	kV	
Grid 2 voltage	V_{g2}	max.	700	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current, black	$I_{a\ black}$	max.	1	A	
Anode input power, black	$W_{ia\ black}$	max.	4	kW	
Anode dissipation	W_a	max.	1,5	kW	
Grid 2 dissipation	W_{g2}	max.	50	W	
Grid 1 dissipation	W_{g1}	max.	30	W	
Cathode current	I_k	max.	1,5	A	

OPERATING CONDITIONS grounded grid

Frequency of vision carrier	f		175,25	MHz	
Bandwidth (−1 dB)	B	7	8	MHz	1
Anode voltage	V_a	3	2,5	kV	
Grid 2 voltage	V_{g2}	500	500	V	
Grid 1 voltage	V_{g1}	−23	−14	V	2
Anode current, no signal condition	I_a	200	400	mA	
Anode current, black	$I_{a\ black}$	700	600	mA	3
Grid 2 current, black	$I_{g2\ black}$	50	40	mA	3
Grid 1 current, black	$I_{g1\ black}$	60	30	mA	3
Output power in load, sync	$W_{\ell\ sync}$	1550	700	W	
Output power in load, black	$W_{\ell\ black}$	930	420	W	3
Driving power, sync	$W_{dr\ sync}$	60	30	W	
Driving power, black	$W_{dr\ black}$	32,5	17	W	
Gain, sync	G_{sync}	14,1	13,6	dB	
Gain, black	G_{black}	14,5	13,9	dB	
Sync compression	sync in/out	28/25	27/25		4
Differential phase		<3	<3	o	5
Differential gain		$\geqslant 85$	$\geqslant 85$	%	5
L.F. linearity		$\geqslant 85$	$\geqslant 85$	%	5

Notes see page 104.

OPERATING CONDITIONS (continued)

						notes
Frequency of vision carrier	f		55, 25		MHz	
Bandwidth (−1 dB)	B	7	7	6	MHz	1
Anode voltage	V_a	2,5	2	2,5	kV	
Grid 2 voltage	V_{g2}	600	600	600	V	
Grid 1 voltage	V_{g1}	−21	−20	−21	V	2
Anode current, no signal condition	I_a	200	200	200	mA	
Anode current, black	$I_{a\ black}$	820	650	900	mA	3
Grid 2 current, black	$I_{g2\ black}$	45	40	50	mA	3
Grid 1 current, black	$I_{g1\ black}$	80	50	90	mA	3
Output power in load, sync	$W_{\ell\ sync}$	1170	670	1500	W	
Output power in load, black	$W_{\ell\ black}$	700	400	900	W	3
Driving power, sync	$W_{dr\ sync}$	83	42	94	W	
Driving power, black	$W_{dr\ black}$	46	24	50	W	
Gain, sync	G_{sync}	11,5	12	12	dB	
Gain, black	G_{black}	11,8	12,2	12,6	dB	
Sync compression	sync in/out	28/25	27/25	30/25		4
Differential phase		<3	<3	<3	o	5
Differential gain		$\geqslant 85$	$\geqslant 85$	$\geqslant 85$	%	5
L.F. linearity		$\geqslant 85$	$\geqslant 85$	$\geqslant 85$	%	5

					notes
Frequency of vision carrier	f	83, 25		MHz	
Bandwidth (−1 dB)	B	7	7	MHz	1
Anode voltage	V_a	2,5	2	kV	
Grid 2 voltage	V_{g2}	600	600	V	
Grid 1 voltage	V_{g1}	−21	−20	V	2
Anode current, no signal condition	I_a	200	200	mA	
Anode current, black	$I_{a\ black}$	900	610	mA	3
Grid 2 current, black	$I_{g2\ black}$	50	45	mA	3
Grid 1 current, black	$I_{g1\ black}$	90	45	mA	3
Output power in load, sync	$W_{\ell\ sync}$	1500	670	W	
Output power in load, black	$W_{\ell\ black}$	900	400	W	3
Driving power, sync	$W_{dr\ sync}$	94	39	W	
Driving power, black	$W_{dr\ black}$	50	22	W	
Gain, sync	G_{sync}	12	12,3	dB	
Gain, black	G_{black}	12,6	12,6	dB	
Sync compression	sync in/out	30/25	28/25		4
Differential phase		<3	<3	o	5
Differential gain		$\geqslant 85$	$\geqslant 85$	%	5
L.F. linearity		$\geqslant 85$	$\geqslant 85$	%	5

Notes see page 104.

R.F. CLASS-AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE grounded grid

LIMITING VALUES

see page F95

OPERATING CONDITIONS grounded grid

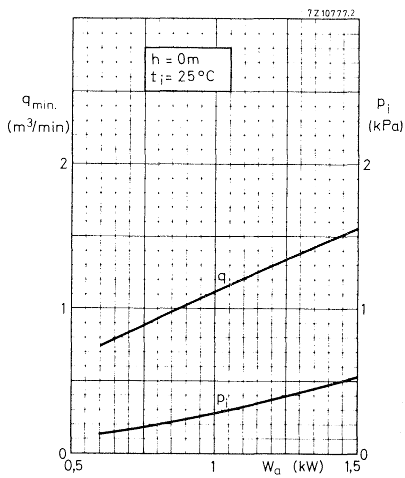
Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

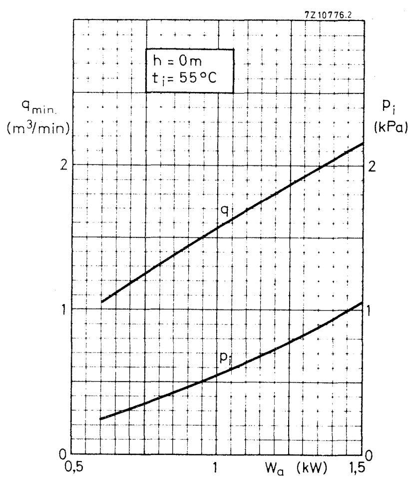
					notes
Frequency	f		175 to 225	MHz	
Bandwidth (−1 dB)	B		8	MHz	1
Anode voltage	V_a		2,5	kV	
Grid 2 voltage	V_{g2}		600	V	
Grid 1 voltage	V_{g1}		−13,5	V	2
Anode current, no signal condition	I_a		550	mA	
Anode current	I_a		730	mA	6
Grid 2 current	I_{g2}		50	mA	6
Grid 1 current	I_{g1}		35	mA	6
Driving power, sync	W_{dr}		18	W	
Output power in load, sync	W_ℓ		550	W	
Power gain	G		14,8	dB	
Intermodulation products	d	$\leqslant$	−54	dB	7

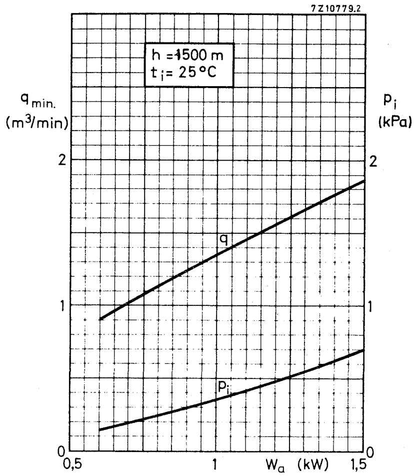
Notes see page 104.

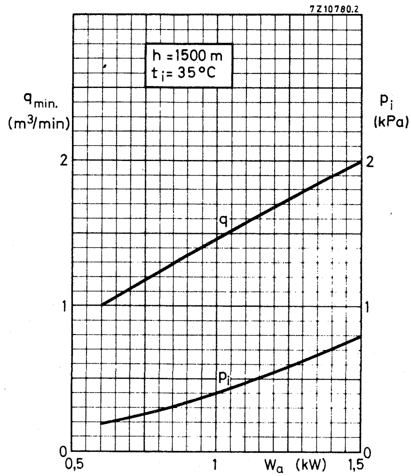
NOTES

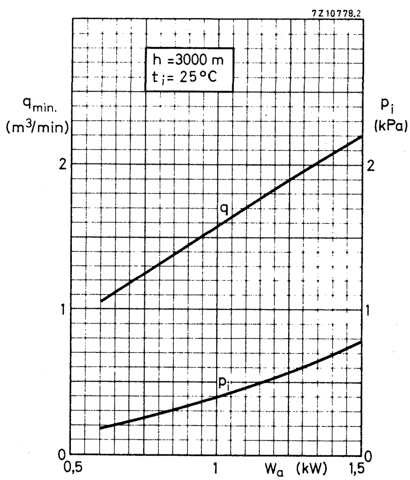
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5. Measured with a 9-step staircase amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4,43 MHz sine wave with a 10% peak to peak value.
6. At c.w. output power = 550 W.
7. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync = 0 dB).

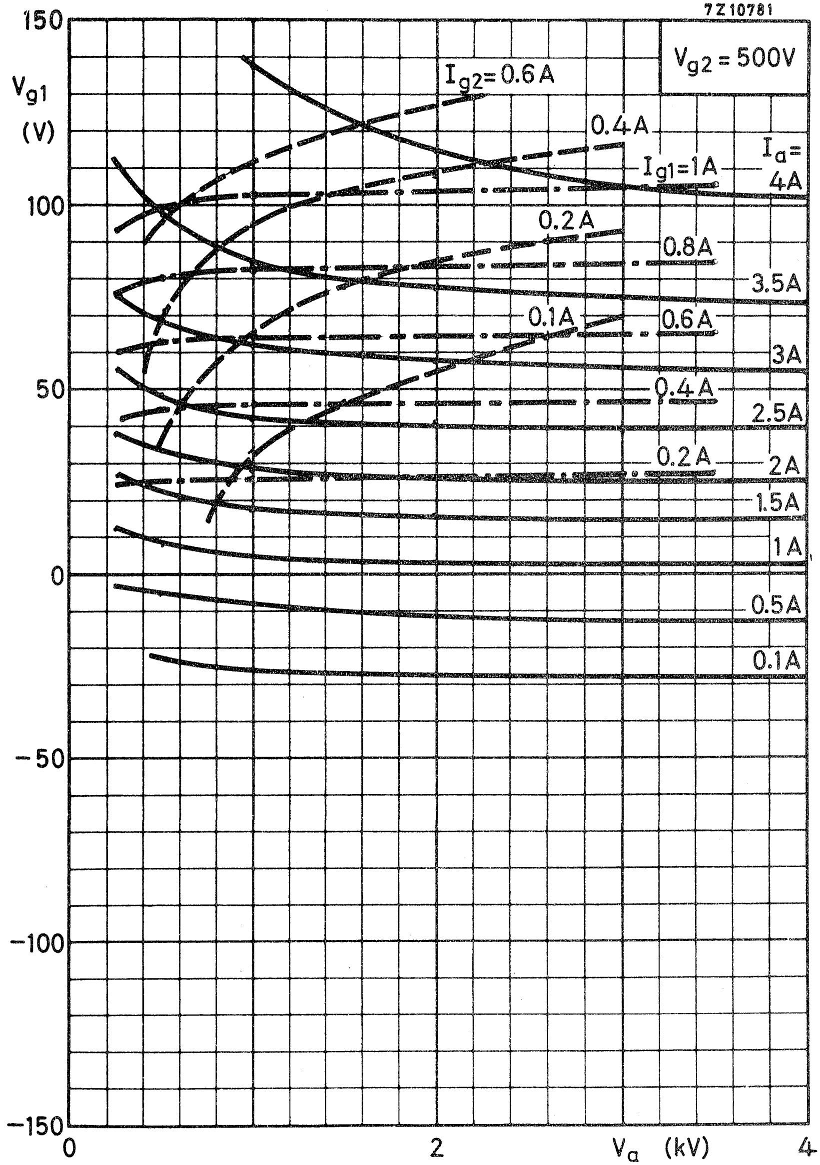


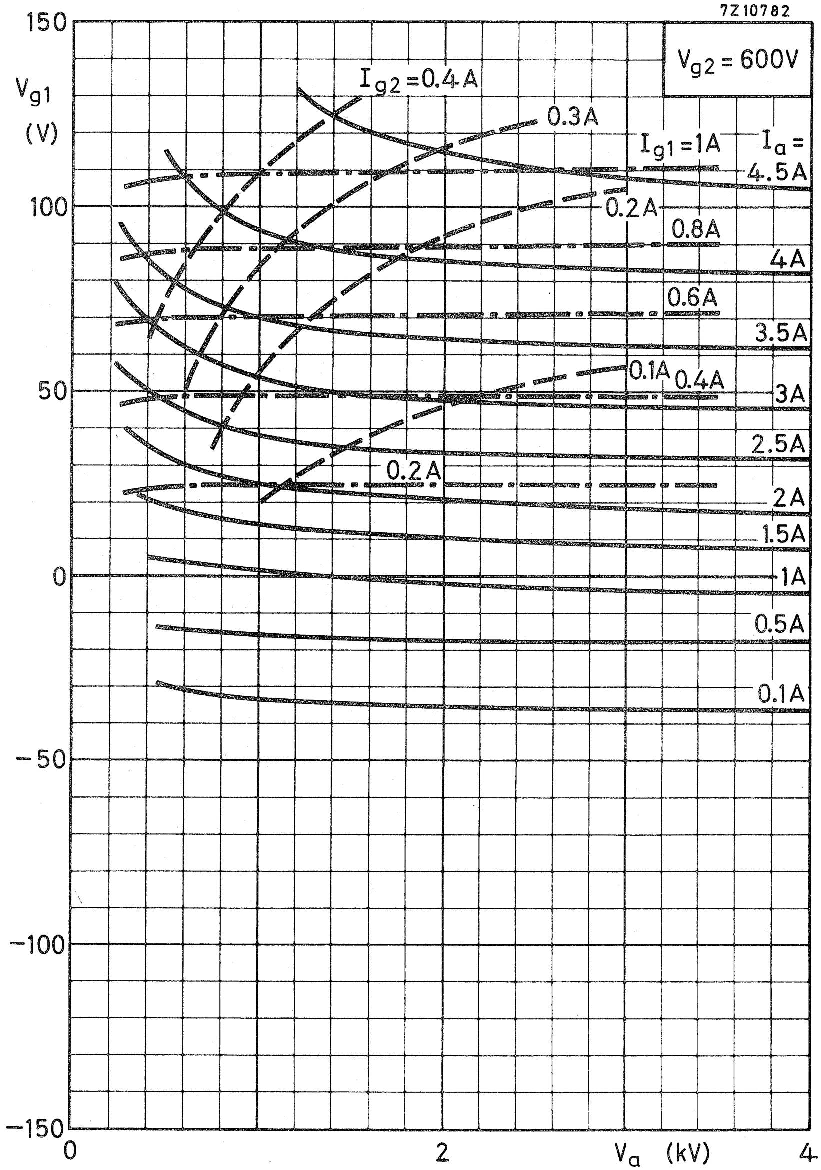


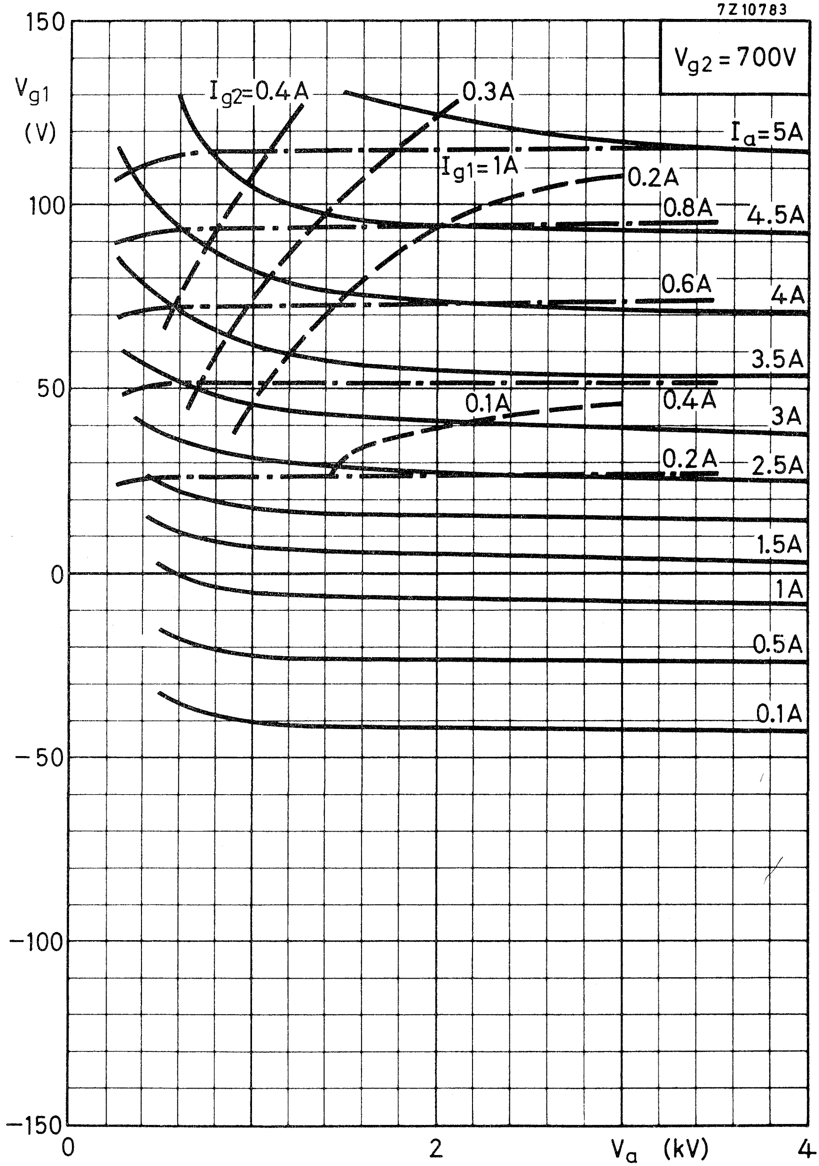

7Z10779.2
h = 1500 m
t_i = 25 °C
q_min. (m³/min)
p_i (kPa)
q
p_i
W_a (kW)
0
1
2
0,5
1,5


7Z10780.2
h = 1500 m
t_i = 35 °C
q_min. (m³/min)
p_i (kPa)
q
p_i
W_a (kW)
0
1
2
0,5
1,5


7Z10778.2
h = 3000 m
t_i = 25 °C
q_min. (m³/min)
p_i (kPa)
q
p_i
W_a (kW)
0
1
2
0,5
1,5


7Z10781
$V_{g2} = 500V$
V_{g1} (V)
150
100
50
0
−50
−100
−150
0
2
V_a (kV)
4
$I_{g2} = 0.6A$
0.4A
0.2A
0.1A
$I_{g1} = 1A$
0.8A
0.6A
0.4A
0.2A
$I_a =$ 4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0.1A


7Z10782
V_{g2} = 600V
V_{g1}
(V)
150
100
50
0
−50
−100
−150
I_{g2} = 0.4 A
0.3A
0.2A
0.1A
0.2A
I_{g1} = 1A
0.8A
0.6A
0.4A
0.2A
I_a =
4.5A
4A
3.5A
3A
2.5A
2A
1.5A
1A
0.5A
0.1A
0
2
V_a (kV)
4


7Z10783
$V_{g2} = 700V$
V_{g1} (V)
150
100
50
0
−50
−100
−150
I_{g2}=0.4A
0.3A
0.2A
0.1A
I_{g1}=1A
0.8A
0.6A
0.4A
0.2A
I_a=5A
4.5A
4A
3.5A
3A
2.5A
1.5A
1A
0.5A
0.1A
0
2
V_a (kV)
4

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as final amplifier in f.m. transmitters in band II in grounded cathode circuits.

QUICK REFERENCE DATA

H.F. Class-B amplifier

Frequency MHz	V_a kV	W_ℓ kW	Power gain dB
110	6	6	23
	7	11	22

HEATING: direct; thoriated tungsten filament, mesh type

Filament voltage	V_f		6,3	V $^{+1\%}_{-3\%}$
Filament current	I_f		118	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{fo}		6	mΩ
Waiting time	t_w	min.	1	s

CAPACITANCES, grounded cathode

Input	C_i	87	pF
Output	C_o	20	pF
Anode to grid 1	C_{ag1}	0,5	pF

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid 2 voltage	V_{g2}	600	V
Anode current	I_a	1,2	A
Transconductance	S	30	mA/V
Amplification factor	μ_{g2g1}	7,2	

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 °C
Recommended maximum seal temperature	T	max.	200 °C

COOLING

See curves.

Direction of air flow: see drawing.

The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

MECHANICAL DATA

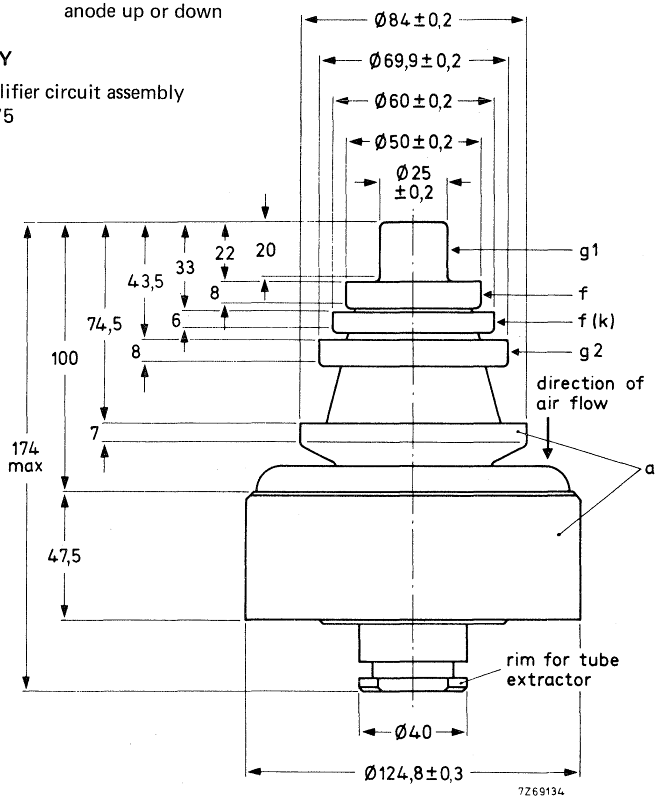
Dimensions in mm

Net mass: 3,1 kg

Mounting position: vertical with anode up or down

ACCESSORY

Band II amplifier circuit assembly type 40775



R.F. CLASS-B AMPLIFIER

Unless otherwise stated the voltages are specified with respect to cathode

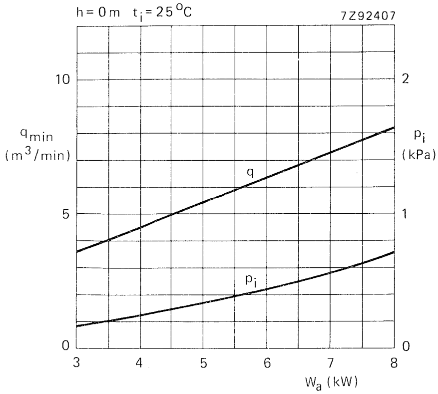
LIMITING VALUES (Absolute maximum rating system)

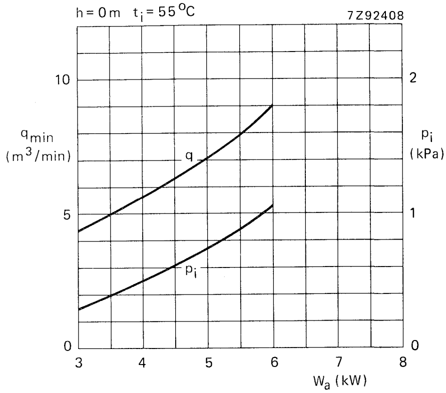
Frequency	f	up to	200	MHz
Anode voltage	V_a	max.	8,5	kV
Grid 2 voltage	V_{g2}	max.	1	kV
Grid 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	18,5	kW
Anode dissipation	W_a	max.	8	kW
Grid 2 dissipation	W_{g2}	max.	80	W
Grid 1 dissipation	W_{g1}	max.	40	W
Cathode current	I_k	max.	4,5	A

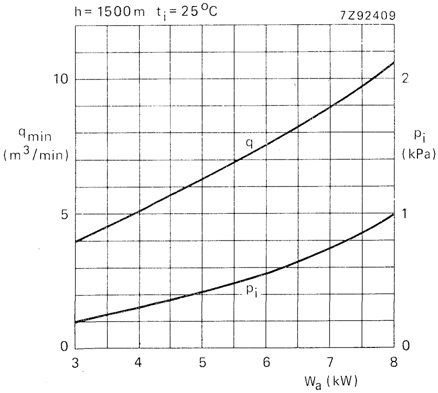
OPERATING CONDITIONS, grounded cathode, measured in amplifier assembly type 40775

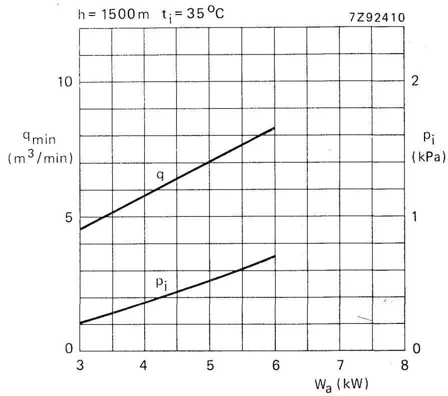
Frequency	f	87 to 100	87 to 110	MHz
Anode voltage	V_a	7	6	kV
Grid 2 voltage	V_{g2}	700	700	V
Grid 1 voltage*	V_{g1}	−105	−100	V
Anode current, no-signal condition	I_a	600	600	mA
Anode current	I_a	2,3	1,6	A
Grid 2 current	I_{g2}	40	70	mA
Grid 1 current	I_{g1}	150	90	mA
Anode input power	W_{ia}	16,1	9,6	kW
Anode dissipation	W_a	4,6	3,5	kW
Output power in load	W_ℓ	11	6	kW
Efficiency, total	η	68	63	%
Driving power	W_{dr}	70	30	W
Power gain	G	22	23	dB

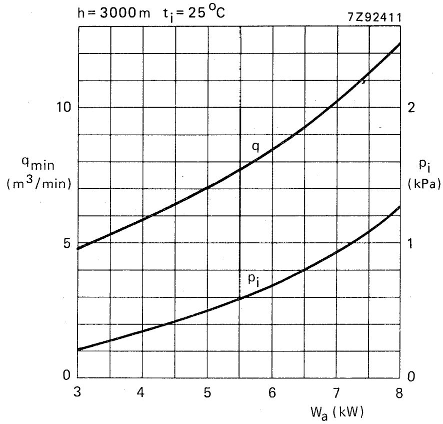
* To be adjusted for the stated no-signal anode current.

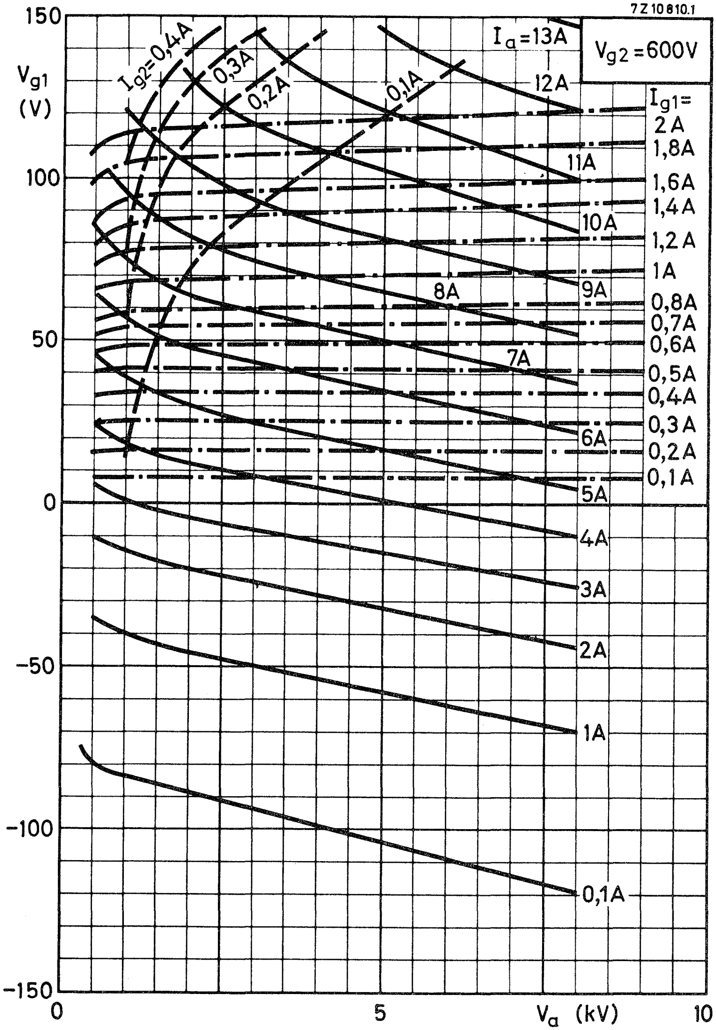

h = 0 m t$_i$ = 25 °C
7Z92407
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
0
5
10
0
1
2
3
4
5
6
7
8

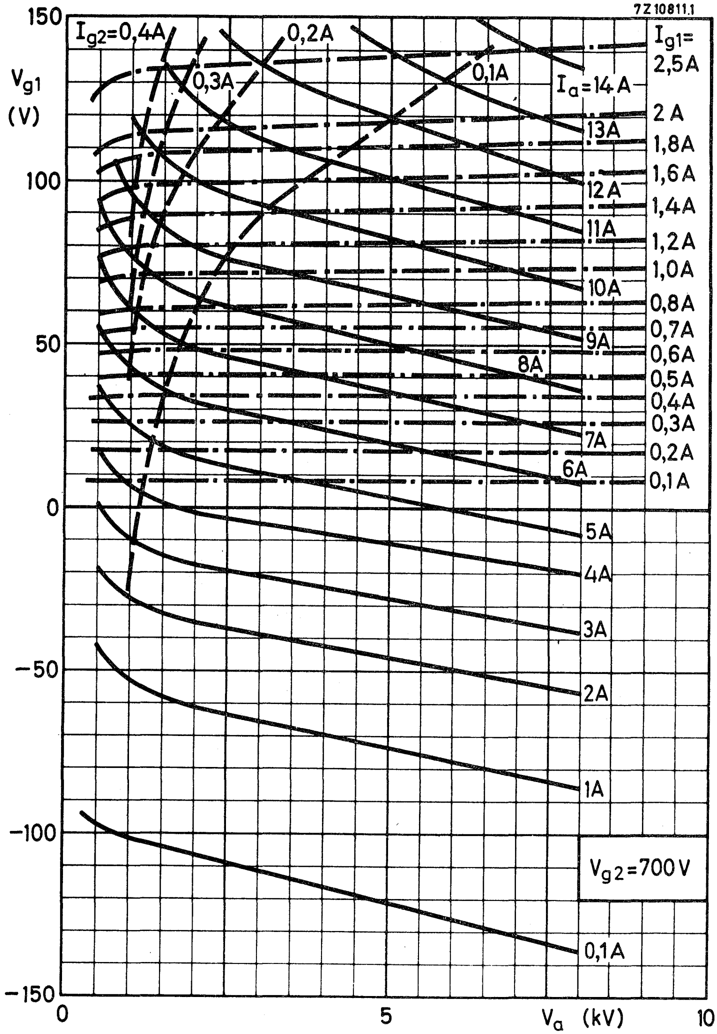

h = 0 m t$_i$ = 55 °C
7Z92408
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
0
5
10
0
1
2
3
4
5
6
7
8


h = 1500 m t$_i$ = 25 °C
7Z92409
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
0
5
10
0
1
2
3
4
5
6
7
8


h = 1500 m t$_i$ = 35 °C
7Z92410
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
0
5
10
0
1
2
3
4
5
6
7
8


h = 3000 m t_i = 25 °C
7Z92411
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
10
5
0
2
1
0
3
4
5
6
7
8


7Z10810.1
V_{g2} = 600V
V_{g1} (V)
I_{g2}=0,4A
0,3A
0,2A
0,1A
I_a=13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0,1A
I_{g1}=
2 A
1,8A
1,6A
1,4A
1,2A
1A
0,8A
0,7A
0,6A
0,5A
0,4A
0,3A
0,2A
0,1A
150
100
50
0
−50
−100
−150
0
5
10
V_a (kV)


7Z10811.1
150
100
50
0
−50
−100
−150
V_{g1} (V)
I_{g2}=0,4A
0,3A
0,2A
0,1A
I_a=14A
13A
12A
11A
10A
9A
8A
7A
6A
5A
4A
3A
2A
1A
0,1A
I_{g1}= 2,5A
2 A
1,8A
1,6A
1,4A
1,2A
1,0A
0,8A
0,7A
0,6A
0,5A
0,4A
0,3A
0,2A
0,1A
V_{g2}=700V
0
5
V_a (kV)
10

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a linear broad-band amplifier in TV transmitters in the bands I and III. This type is also very suitable for a.m. and f.m. broadcast and a.f. modulator applications, and in TV transposer service.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)			
Frequency	f	175,25	MHz
Anode voltage	V_a	8	kV
Output power in load, sync	W_ℓ	27,5	kW
Power gain, sync	G	14,5	dB
Class-B f.m. telephony			
Frequency	f	260	MHz
Anode voltage	V_a	8,5	kV
Output power in load	W_ℓ	25	kW
Power gain	G	14,9	dB
Television transposer service			
Frequency	f	175 to 225	MHz
Anode voltage	V_a	8	kV
Output power in load, sync	W_ℓ	10,5	kW
Power gain, sync	G	16,2	dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		10,4	$V^{+1\%}_{-3\%}$
Filament current	I_f		115	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{fo}		10,5	mΩ
Waiting time	t_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	8 kV
Grid 2 voltage	V_{g2}	700 V
Anode current	I_a	2,4 A
Transconductance	S	60 mA/V
→ Amplification factor	μ_{g2g1}	8,5

CAPACITANCES

	grounded cathode		grounded grid		
Input	C_i	135	C_i	69	pF
Output	C_o	23	C_o	23	pF
Anode to grid 1	C_{ag1}	0,85			pF
Anode to filament			C_{af}	0,25	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 ^oC
Recommended maximum seal temperature	T	max.	200 ^oC

COOLING

See cooling curves.
Direction of airflow: see outline drawing.

The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

ACCESSORIES

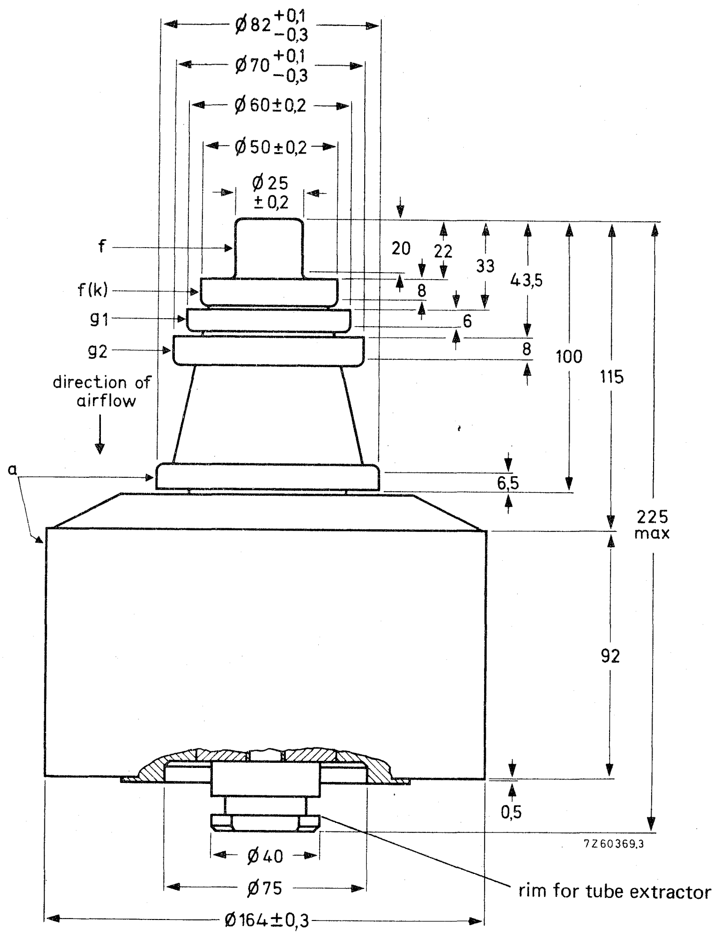
Band I amplifier circuit assembly (vision)	type 40759
Band I amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40768
Band III amplifier circuit assembly (sound)	type 40769

MECHANICAL DATA

Dimensions in mm

Net mass: approx. 11 kg

Mounting position: vertical with anode up or down



R.F. CLASS-AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

Negative modulation, positive synchronization (C.C.I.R. system).
Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	9	kV	
Grid 2 voltage	V_{g2}	max.	1	kV	
Grid 1 voltage	$-V_{g1}$	max.	500	V	
Anode current, black	$I_{a\ black}$	max.	7	A	
Anode input power, black	$W_{ia\ black}$	max.	40	kW	
Anode dissipation	W_a	max.	18	kW	
Grid 2 dissipation	W_{g2}	max.	100	W	
Grid 1 dissipation	W_{g1}	max.	50	W	
Cathode current	I_k	max.	9	A	

OPERATING CONDITIONS grounded grid

				notes
Frequency of vision carrier	f	175,25	MHz	
Bandwidth (−1 dB)	B	7,5	MHz	1
Anode voltage	V_a	8	kV	
Grid 2 voltage	V_{g2}	700	V	
Grid 1 voltage	V_{g1}	−84	V	2
Anode current, no-signal condition	I_a	900	mA	
Anode current, black	$I_{a\ black}$	3,9	A	3
Grid 2 current, black	$I_{g2\ black}$	55	mA	3
Grid 1 current, black	$I_{g1\ black}$	180	mA	3
Output power in load, sync	$W_{\ell\ sync}$	27,5	kW	
Output power in load, black	$W_{\ell\ black}$	16,5	kW	3
Anode dissipation, black	$W_{a\ black}$	14	kW	
Driving power, sync	$W_{dr\ sync}$	965	W	
Driving power, black	$W_{dr\ black}$	520	W	
Gain, sync	G_{sync}	14,5	dB	
Gain, black	G_{black}	15	dB	
Sync compression	sync in/out	30/25		4
Differential phase		<3	deg	5
Differential gain		$\geqslant 85$	%	5
L.F. linearity		$\geqslant 85$	%	5

Notes see page 121.

OPERATING CONDITIONS (continued)

					notes
Frequency of vision carrier	f	83,25	55,25	MHz	
Bandwidth (−1 dB)	B	7	7	MHz	1
Anode voltage	V_a	6,5	6,5	kV	
Grid 2 voltage	V_{g2}	700	700	V	
Grid 1 voltage	V_{g1}	−88	−88	V	2
Anode current, no signal condition	I_a	900	900	mA	
Anode current, black	$I_{a\,black}$	4,1	4,5	A	3
Grid 2 current, black	$I_{g2\,black}$	55	45	mA	3
Grid 1 current, black	$I_{g1\,black}$	160	175	mA	3
Output power in load, sync	$W_{\ell\,sync}$	20	20	kW	
Output power in load, black	$W_{\ell\,black}$	12	12	kW	3
Anode dissipation, black	$W_{a\,black}$	14,6	17,2	kW	
Driving power, sync	$W_{dr\,sync}$	835	910	W	
Driving power, black	$W_{dr\,black}$	444	520	W	
Gain, sync	G_{sync}	13,8	13,4	dB	
Gain, black	G_{black}	14,3	13,6	dB	
Sync compression	sync in/out	30/25	27/25		4
Differential phase		<3	<3	deg	5
Differential gain		$\geqslant 85$	$\geqslant 85$	%	5
L.F. linearity		$\geqslant 85$	$\geqslant 85$	%	5

NOTES

1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5. Measured with 9-step staircase amplitude, running from 17% to 75% of the peak sync value, with superimposed a 4,43 MHz sine wave with a 10% peak to peak value.
6. At c.w. output power = 10,5 kW.
7. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync = 0 dB).

R.F. CLASS-AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE grounded grid

LIMITING VALUES

See page 120.

OPERATING CONDITIONS grounded grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

				notes
Frequency	f	175 to 225	MHz	
Bandwidth (−1 dB)	B	8	MHz	1
Anode voltage	V_a	8	kV	
Grid 2 voltage	V_{g2}	900	V	
Grid 1 coltage	V_{g1}	−95	V	2
Anode current, no signal condition	I_a	1,8	A	
Anode current	I_a	3,3	A	6
Grid 2 current	I_{g2}	35	mA	6
Grid 1 current	I_{g1}	20	mA	6
Driving power, sync	W_{dr}	250	W	
Output power in load, sync	W_{ℓ}	10,5	kW	
Power gain	G	16,2	dB	
Intermodulation products	d	−56	dB	7

Notes see page 121.

R.F. CLASS-B F.M. TELEPHONY

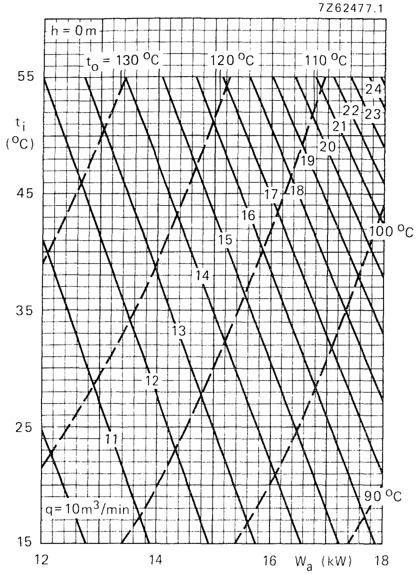
LIMITING VALUES (Absolute maximum rating system)

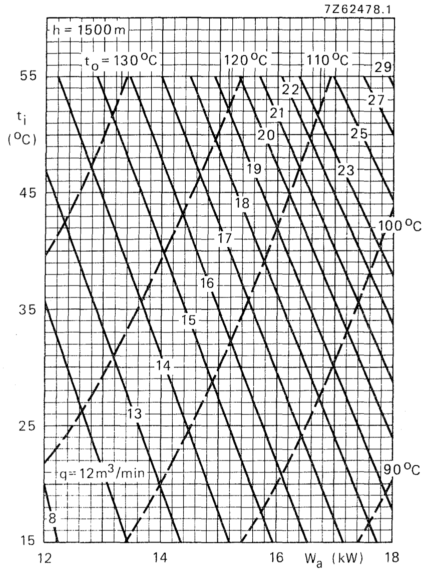
					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	9,5	kV	
Grid 2 voltage	V_{g2}	max.	1	kV	
Grid 1 voltage	$-V_{g1}$	max.	500	V	
Anode current	I_a	max.	7	A	
Anode input power	W_{ia}	max.	42	kW	
Anode dissipation	W_a	max.	18	kW	
Grid 2 dissipation	W_{g2}	max.	100	W	
Grid 1 dissipation	W_{g1}	max.	50	W	
Cathode current	I_k	max.	9	A	

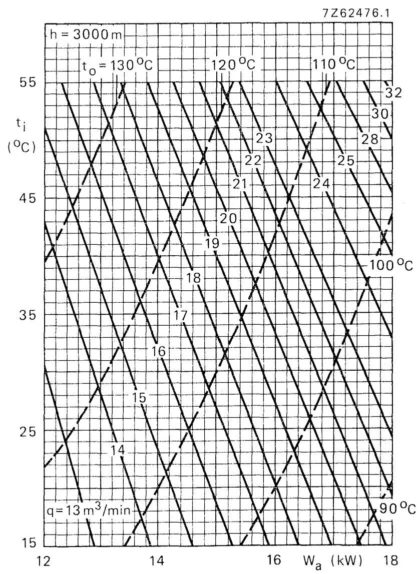
OPERATING CONDITIONS

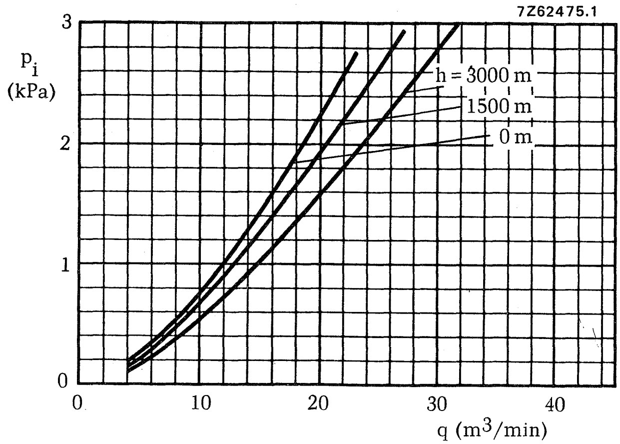
Frequency	f	260	MHz	
Anode voltage	V_a	8,5	kV	
Grid 2 voltage	V_{g2}	700	V	
Grid 1 voltage	V_{g1}	−106	V	2
Anode current, no signal condition	I_a	300	mA	
Anode current	I_a	4,6	A	
Grid 2 current	I_{g2}	100	mA	
Grid 1 current	I_{g1}	325	mA	
Anode input power	W_{ia}	39,1	kW	
Anode dissipation	W_a	14	kW	
Output power in load	W_ℓ	25	kW	
Efficiency, total		64	%	
Driving power	W_{dr}	800	W	
Power gain	G	14,9	dB	

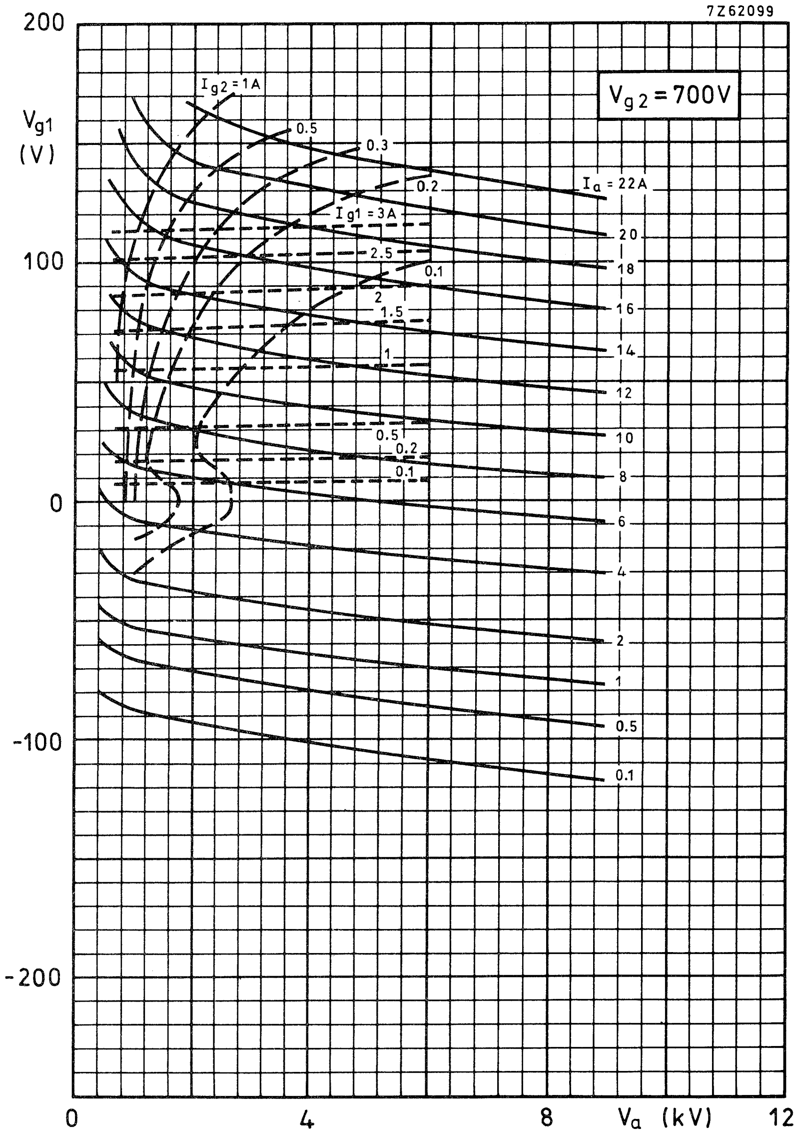
Note see page 121.


7Z62477.1
h = 0 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
t_i (°C)
55
45
35
25
15
24
23
22
21
20
19
18
17
16
15
14
13
12
11
q = 10 m³/min
12
14
16
W_a (kW)
18


7Z62478.1
h = 1500 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
t_i (°C)
55
45
35
25
15
29
27
25
23
22
21
20
19
18
17
16
15
14
13
8
q = 12 m³/min
12
14
16
W_a (kW)
18


7Z62476.1
h = 3000 m
t_o = 130 °C
120 °C
110 °C
100 °C
90 °C
t_i (°C)
55
45
35
25
15
32
30
28
25
24
23
22
21
20
19
18
17
16
15
14
q = 13 m³/min
12
14
16
W_a (kW)
18


7Z62475.1
3
2
1
0
p_i
(kPa)
h = 3000 m
1500 m
0 m
0
10
20
30
40
q (m^3/min)


7Z62099
200
100
0
-100
-200
V_{g1} (V)
V_{g2} = 700V
I_{g2} = 1A
0.5
0.3
0.2
0.1
I_{g1} = 3A
2.5
2
1.5
1
0.5
0.2
0.1
I_a = 22A
20
18
16
14
12
10
8
6
4
2
1
0.5
0.1
0
4
8
12
V_a (kV)

AIR COOLED V.H.F. POWER TETRODES

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use in R.F. power amplifier applications up to 250 MHz.

QUICK REFERENCE DATA

Class-B amplifier (C.W.)			
Frequency	f		170 - 230 MHz
Anode voltage	V_a		10 kV
Output power in load	W_ℓ		35 kW
Power gain	G		16 dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		7,5 V $^{+1\%}_{-3\%}$
Filament current	I_f		180 A
Filament peak starting current	I_{fp}	max.	1000 A
Cold filament resistance	R_{fo}		4,2 mΩ
Waiting time	t_w	min.	1 s

TYPICAL CHARACTERISTICS

Anode voltage	V_a		10 kV
Grid 2 voltage	V_{g2}		900 V
Anode current	I_a		2,4 A
Transconductance	S	≈	70 mA/V
Amplification factor	μ_{g2g1}		10

CAPACITANCES, grounded grid

			grounded grid
Input	C_i		86 pF
Output	C_o		29 pF
Anode to filament	C_{af}	<	0,3 pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 °C
Recommended maximum seal temperature	T	max.	200 °C

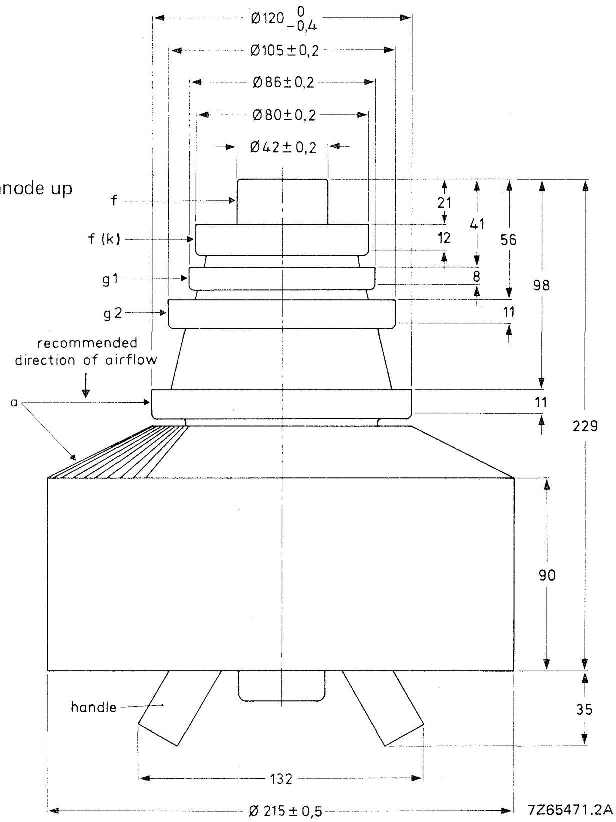
COOLING

$W_a + W_g$ kW	h m	T_i °C	q_{min} m³/min.	p_i, tube only Pa	p_i including circuit assembly Pa	max. T out °C
25	500	40	30	1000	1600	94

Direction of air flow: See outline drawing.
The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

MECHANICAL DATA

Net mass	approx. 17 kg
Mounting position	vertical with anode up or down.



R.F. CLASS-B POWER AMPLIFIER

Unless otherwise stated, the voltages are given with respect to the cathode.

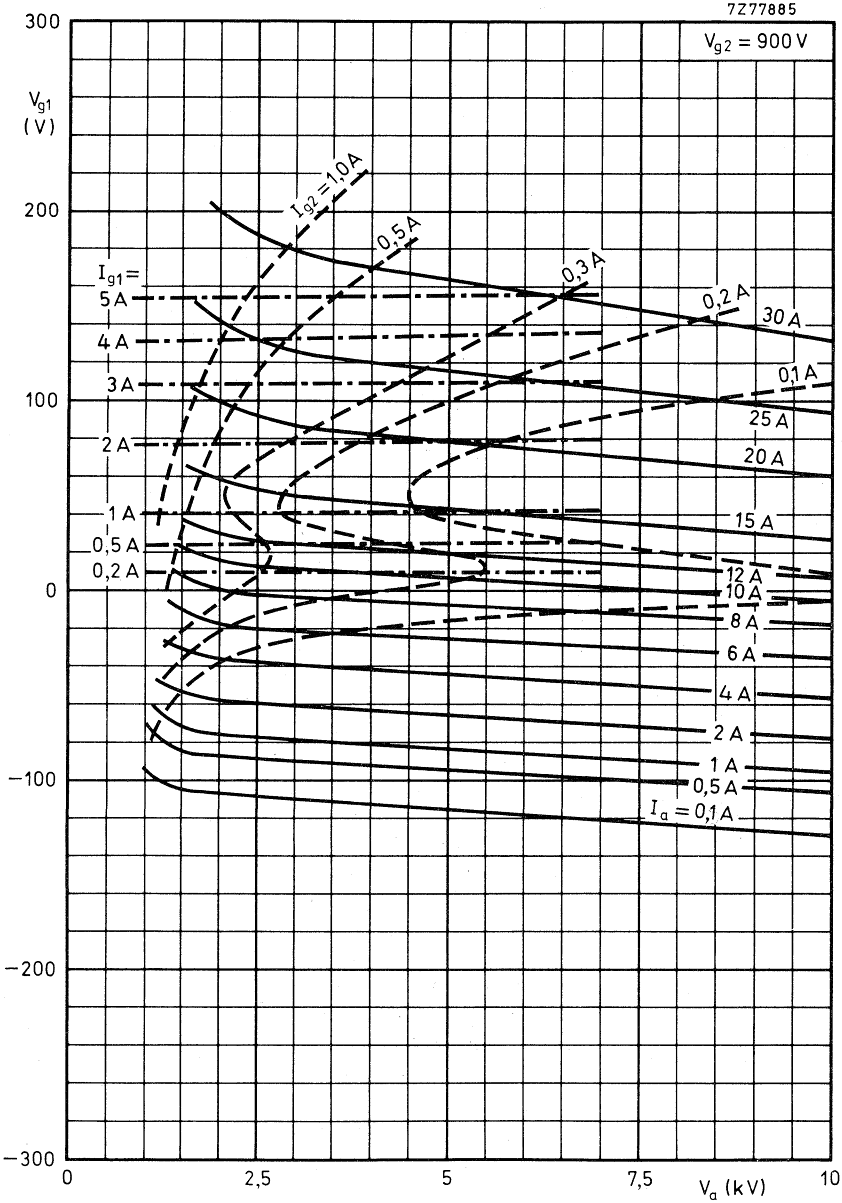
LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	250	MHz
Anode voltage	V_a	max.	12	kV
Grid 2 voltage	V_{g2}	max.	1200	V
Grid 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	8	A
Anode dissipation	W_a	max.	30	kW
Grid 2 dissipation	W_{g2}	max.	400	W
Grid 1 dissipation	W_{g1}	max.	300	W
Cathode current	I_k	max.	9	A

OPERATING CONDITIONS (grounded grid)

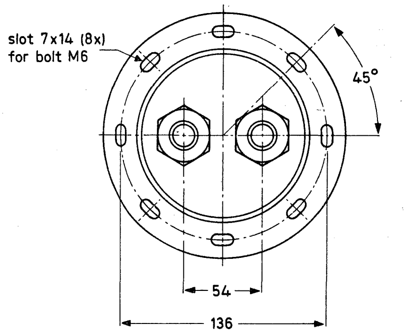
Frequency	f		200	MHz	
Anode voltage	V_a		10	kV	
Grid 2 voltage	V_{g2}		900	V	
Grid 1 voltage	V_{g1}	≈	−90	V	*
Anode current, no-signal condition	I_a		1,0	A	
Anode current	I_a		5,9	A	
Grid 2 current	I_{g2}		190	mA	
Grid 1 current	I_{g1}		370	mA	
Output power in load	W_ℓ	⩾	35	kW	
Driving power	W_{dr}		850	W	
Gain	G		16	dB	

* To be adjusted for the stated no-signal anode current.


7Z77885
V_{g2} = 900 V
V_{g1} (V)
300
200
100
0
−100
−200
−300
I_{g1} =
5 A
4 A
3 A
2 A
1 A
0,5 A
0,2 A
I_{g2} = 1,0 A
0,5 A
0,3 A
0,2 A
0,1 A
30 A
25 A
20 A
15 A
12 A
10 A
8 A
6 A
4 A
2 A
1 A
0,5 A
I_a = 0,1 A
0
2,5
5
7,5
10
V_a (kV)

WATER COOLED V.H.F. POWER TETRODE

The characteristics of this tetrode are identical to those of type YL1530. Type YL1531 is, however, water cooled.



COOLING

W_a kW	T_i °C	q l/min	pi kPa	T_o °C
30	20	21	34	42
	50	32	71	64
20	20	14	17	43
	50	20	31	66

Absolute maximum water inlet temperature T_i 50 °C

Absolute maximum water pressure p 600 kPa

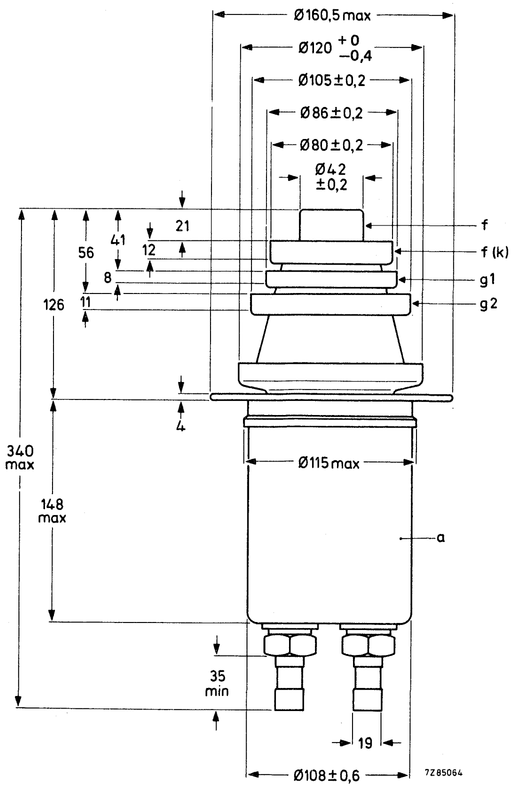
The temperature of the seals and envelope should be kept well below 200 °C.

An air flow of about 1 m^3/min must be ducted along the seals from a 30 mm diameter nozzle positioned at a distance of 200 mm from the tube header.

MECHANICAL DATA

Net mass 7 kg

Mounting position vertical with anode up or down.



AIR COOLED V.H.F. POWER TETRODE

for grounded cathode operation

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as grid-driven linear amplifier for single sideband, suppressed carrier service and grid-driven broadband amplifier with high power gain in TV band I and III transmitters and transposers. The type is also very suitable for f.m. broadcast applications. The electrode arrangement is specially designed for grounded cathode operation.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)

Frequency	f		175,25	MHz
Anode voltage	V_a		3	kV
Output power in load (sync)	W_ℓ		1,1	kW
Power gain	G		20	dB

Class-AB f.m. amplifier

Frequency	f	up to	260	MHz
Anode voltage	V_a		4	kV
Output power in load	W_ℓ		2,2	kW
Power gain	G		22	dB

HEATING: direct; thoriated tungsten filament, mesh type

Filament voltage	V_f		4,2	V $^{+1\%}_{-3\%}$
Filament current	I_f		53	A
Filament peak starting current	I_{fp}	max.	300	A
Cold filament resistance	R_{fo}		8,5	mΩ
Waiting time	t_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid 2 voltage	V_{g2}	700	V
Anode current	I_a	500	mA
Transconductance	S	25	mA/V
Amplification factor	μ_{g2g1}	10	

CAPACITANCES grounded cathode

Input	C_i	54 pF
Output	C_o	8 pF
Anode to grid 1	C_{ag1}	0,1 pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 °C
Recommended maximum seal temperature	T	max.	200 °C

COOLING

Direction of airflow: see drawing

$W_a + W_g$ W	h m	T_i °C	q_{min} m³/min	p_i Pa	T_o max. °C
2000	0	35	2,00	530	92
1500	0	35	1,30	280	103
1000	0	35	0,80	140	113
2000	0	55	2,40	670	107
1500	0	55	1,55	340	118
1000	0	55	0,95	180	127
2000	1500	35	2,58	670	89
1500	1500	35	1,68	340	99
1000	1500	35	1,03	180	109
2000	3000	25	2,78	690	81
1500	3000	25	1,80	350	91
1000	3000	25	1,11	190	101

The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

ACCESSORIES

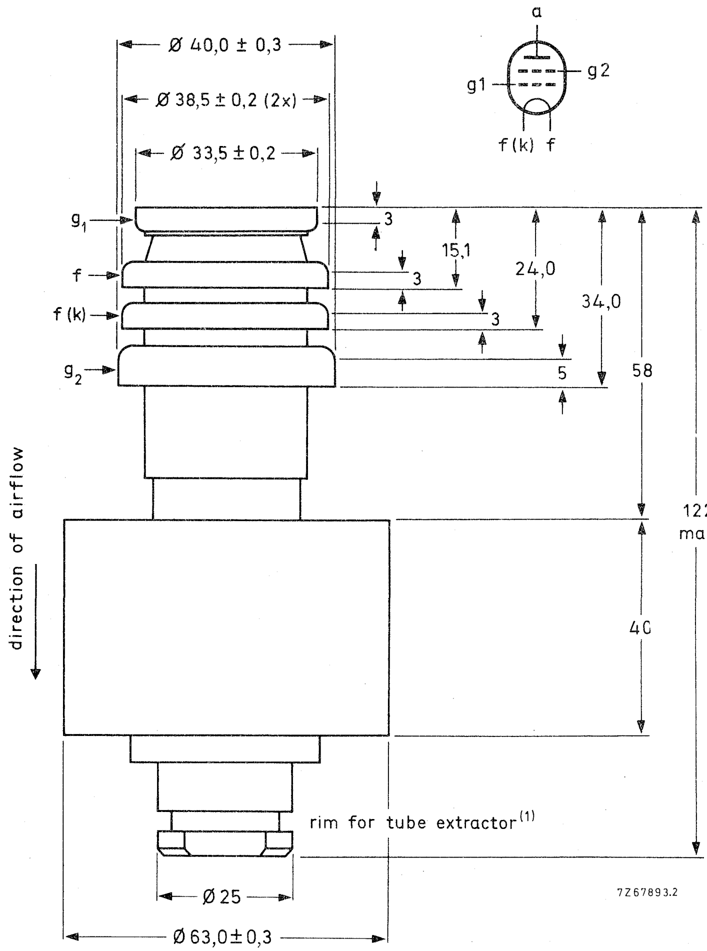
Band III amplifier circuit assembly (vision)	type 40776
Band III amplifier circuit assembly (sound)	type 40777
Band II amplifier circuit assembly (sound)	type 40778

MECHANICAL DATA

Dimensions in mm

Net mass: 0,55 kg

Mounting position: vertical with anode up or down



(1) Tube extractor type 40750; catalogue number 7322 120 02140.

RF CLASS-AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

Negative modulation, positive synchronization (C.C.I.R. system).
Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	4,2	kV	
Grid 2 voltage	V_{g2}	max.	750	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current, black	I_a	max.	1,2	A	
Anode input power, black	W_{ia}	max.	4	kW	
Anode dissipation	W_a	max.	2	kW	
Grid 2 dissipation	W_{g2}	max.	70	W	
Grid 1 dissipation	W_{g1}	max.	30	W	
Cathode current	I_k	max.	1,5	A	
Grid 1 circuit resistance	R_{g1}	max.	10	kΩ	

OPERATING CONDITIONS grid driven 4

Frequency of vision carrier	f	175,25	MHz	
Bandwidth (−1 dB)	B	7	MHz	1
Anode voltage	V_a	3	kV	
Grid 2 voltage	V_{g2}	700	V	
Grid 1 voltage	V_{g1}	−55	V	2
Anode current, no-signal condition	I_a	300	mA	
→ Anode current, black	$I_{a\ black}$	650	mA	3
Grid 2 current, black	$I_{g2\ black}$	20	mA	3
Grid 1 current, black	$I_{g1\ black}$	0	mA	3
Output power in load, sync	$W_{\ell\ sync}$	1100	W	
Output power in load, black	$W_{\ell\ black}$	660	W	3
Anode dissipation, black	$W_{a\ black}$	≈ 1200	W	
Gain, sync	G_{sync}	20	dB	
Gain, black	G_{black}	20	dB	
Sync compression	sync in/out	25/25		6
Differential phase		< 3	deg	7
Differential gain		⩾ 90	%	7
L.F. linearity		⩾ 90	%	7
Driving power sync	$W_{dr\ sync}$	11	W	

CLASS-AB F.M. AMPLIFIER

LIMITING VALUES (Absolute maximum rating system)

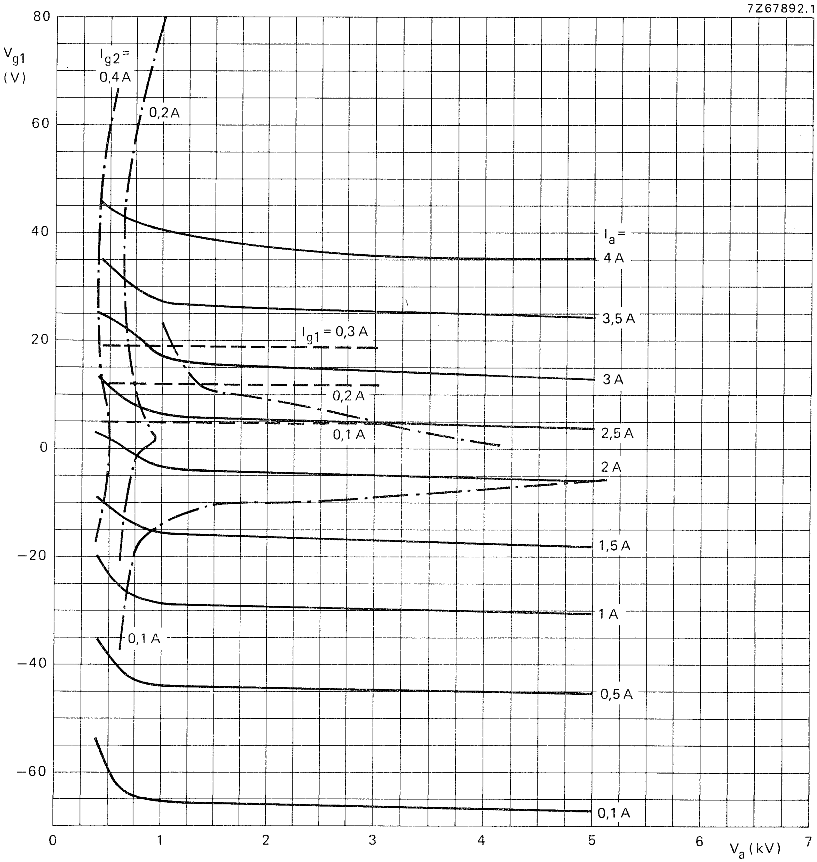
					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	4,2	kV	
Grid 2 voltage	V_{g2}	max.	750	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current, black	I_a	max.	1,2	A	
Anode input power, black	W_{ia}	max.	4	kW	
Anode dissipation	W_a	max.	2	kW	
Grid 2 dissipation	W_{g2}	max.	70	W	
Grid 1 dissipation	W_{g1}	max.	30	W	
Cathode current	I_k	max.	1,5	A	
Grid 1 circuit resistance	R_{g1}	max.	10	kΩ	

OPERATING CONDITIONS grid driven

					notes
					5
Frequency	f		80 to 230	MHz	
Anode voltage	V_a	3	4	kV	
Grid 2 voltage	V_{g2}	700	700	V	
Grid 1 voltage	V_{g1}	−60	−60	V	2
Anode current, no-signal condition	I_a	200	200	mA	
Anode current	I_a	700	900	mA	
Grid 2 current	I_{g2}	30	60	mA	
Grid 1 current	I_{g1}	10	20	mA	
Anode input power	W_{ia}	2,1	3,6	kW	
Anode dissipation	W_a	1,1	1,6	kW	
Output power in load	W_ℓ	1,1	2,2	kW	
Power gain	G	22,5	22,5	dB	
Driving power	W_{dr}	6	12	W	

Notes

1. With double-tuned circuit.
2. To be adjusted for the stated no-signal anode current.
3. Black signal including line sync pulses.
4. Measured in amplifier circuit assembly type 40776.
5. Measured in amplifier circuit assembly types 40778 (band II) and 40777 band III respectively.
6. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
7. Measured with 10-step staircase amplitude, running from 17% to 75% of the peak sync value, with a superimposed 4,43 MHz sinewave with a 10% peak to peak value.


7Z67892.1
V_{g1}
(V)
80
60
40
20
0
−20
−40
−60
I_{g2} =
0,4 A
0,2 A
0,1 A
I_a =
4 A
3,5 A
3 A
2,5 A
2 A
1,5 A
1 A
0,5 A
0,1 A
I_{g1} = 0,3 A
0,2 A
0,1 A
0
1
2
3
4
5
6
7
V_a (kV)

AIR-COOLED R.F. POWER TETRODE

Forced air-cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as grid-driven linear amplifier for single sideband, suppressed carrier service.

QUICK REFERENCE DATA

Class-AB1 linear SSB amplifier

Frequency	f	1 to 30	MHz
Anode voltage	V_a	4	kV
Output power in load	W_l	2100	W
Power gain	G	23	dB

HEATING: direct; thoriated tungsten filament, mesh type

Filament voltage	V_f	4,2	V $^{+1\%}_{-3\%}$
Filament current	I_f	53	A
Filament peak starting current	I_{fp} max	300	A
Cold filament resistance	R_{fo}	8,5	mΩ
Waiting time	t_w min	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid 2 voltage	V_{g2}	700	V
Anode current	I_a	500	mA
Transconductance	S	25	mA/V
Amplification factor	μ_{g2g1}	10	

CAPACITANCES

Input	C_i	54	pF
Output	C_o	8	pF
Anode to grid 1	C_{ag1}	0,1	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 °C
Recommended maximum seal temperature	T	max.	200 °C

COOLING

Direction of air flow: see drawing.

$W_a + W_g$ W	h m	T_i °C	q_{min} m^3/min	p_i Pa	T_o max °C
2000	0	35	2,00	530	92
1500	0	35	1,30	280	103
1000	0	35	0,80	140	113
2000	0	55	2,40	670	107
1500	0	55	1,55	340	118
1000	0	55	0,95	180	127

The air should be ducted so that sufficient air is directed to the seals.

ACCESSORIES

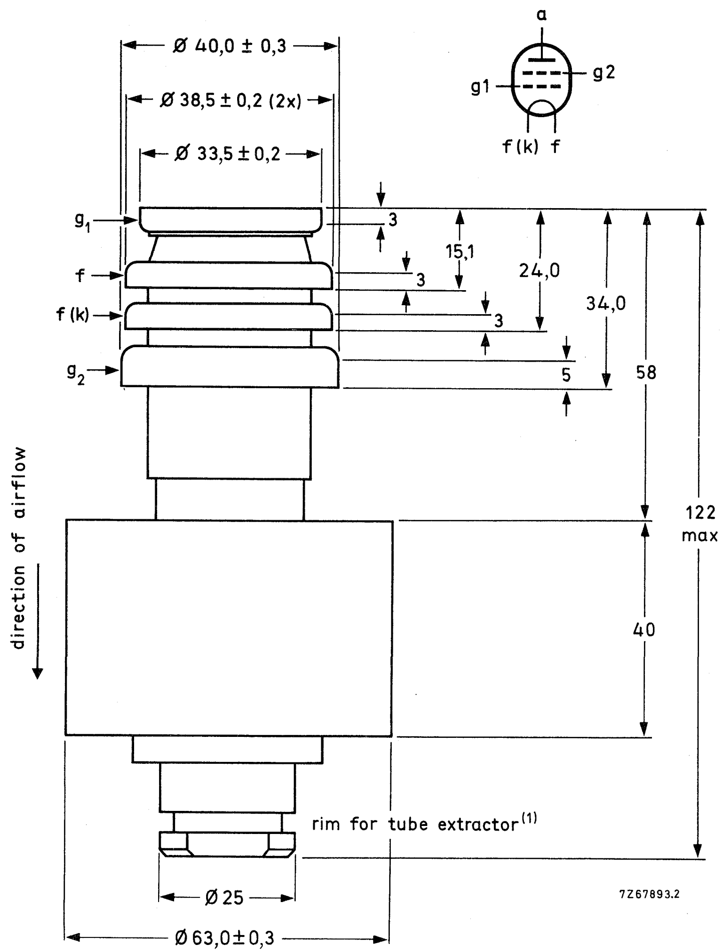
A drawing of the recommended socket construction is available on request.

MECHANICAL DATA

Dimensions in mm

Net mass: 0,55 kg

Mounting position: vertical with anode up or down



R.F. CLASS-AB LINEAR AMPLIFIER, SINGLE SIDEBAND, SUPPRESSED CARRIER

Unless otherwise specified the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	110	MHz	
Anode voltage	V_a	max	4,4	kV	
Grid 2 voltage	V_{g2}	max	750	V	
Grid 1 voltage	$-V_{g1}$	max	100	V	
Anode current	I_a	max	1,2	A	
Cathode current	I_k	max	1,5	A	
Anode input power	W_{ia}	max	4	kW	
Anode dissipation	W_a	max	2	kW	
Grid 2 dissipation	W_{g2}	max	70	W	
Grid 1 dissipation	W_{g1}	max	30	W	
Grid 1 circuit resistance	R_{g1}	max	10	kΩ	

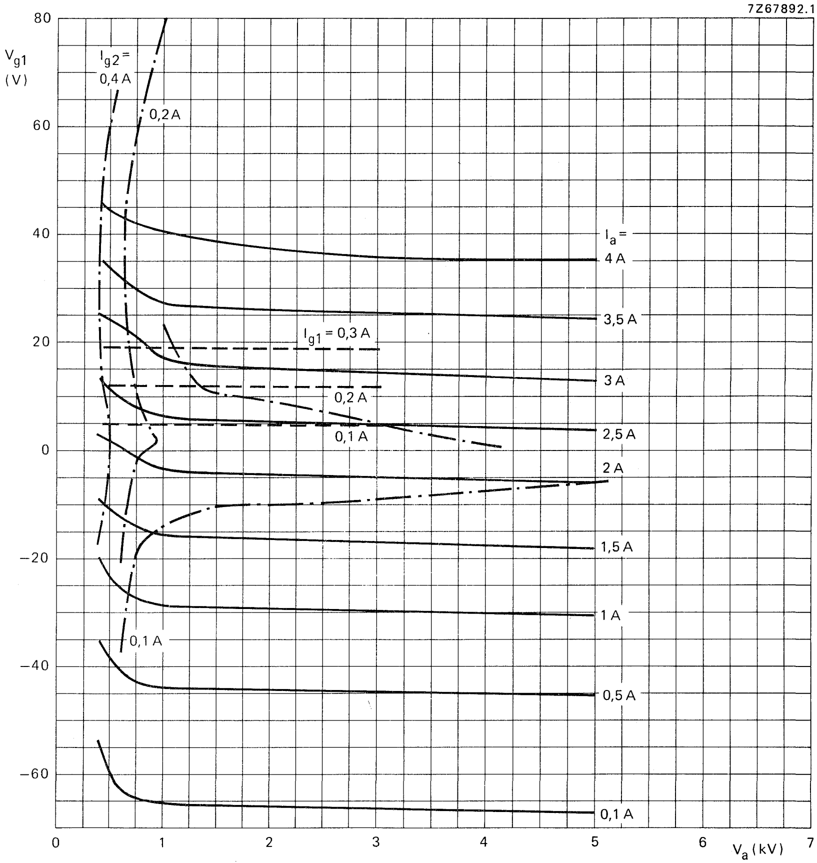
OPERATING CONDITIONS

						notes
Frequency	f		30		MHz	
Anode voltage	V_a		4		kV	
Grid 2 voltage	V_{g2}		700		V	
Grid 1 voltage	V_{g1}		~−67		V	1
Grid 1 circuit resistance (load)	R_{g1}		1		kΩ	
Load resistance	$R_{a\sim}$		2500		Ω	
		zero signal	single tone signal	double tone signal		
Grid 1 driving voltage	$V_{g1\,p}$	0	80	80	V	
Anode current	I_a	200	900	550	mA	
Grid 2 current	I_{g2}	0	90	34	mA	
Grid 1 current	I_{g1}	0	20	1,5	mA	
Driving power (PEP)	W_{dr}	0	10	10	W	2
Anode input power	W_{ia}	800	3600	2200	W	
Anode dissipation	W_a	800	1500	1150	W	
Power gain	G			23	dB	
Output in load	W_l	–	2100	–	W	
Output power in load (PEP)	W_l	–	–	2100	W	
Total efficiency	η	–	58,5	48	%	
Intermodulation distortion						
3rd order	d_3	–	–	< −30	dB	3
5th order	d_5	–	–	< −35	dB	3

						notes
Frequency	f		30		MHz	
Anode voltage	V_a		3		kV	
Grid 2 voltage	V_{g2}		700		V	
Grid 1 voltage	V_{g1}		≈ -66		V	1
Grid 1 circuit resistance (load)	R_{g1}		1		kΩ	
Load resistance	$R_{a\sim}$		1500		Ω	
		zero signal	single tone signal	double tone signal		
Grid 1 driving voltage	$V_{g1\,p}$	0	75	75	V	
Anode current	I_a	200	800	500	mA	
Grid 2 current	I_{g2}	0	90	40	mA	
Grid 1 current	I_{g1}	0	10	1	mA	
Driving power (PEP)	W_{dr}	0	10	10	W	2
Anode input power	W_{ia}	600	2400	1500	W	
Anode dissipation	W_a	600	800	700	W	
Power gain	G	–	–	22	dB	
Output power in load	W_l	–	1600	–	W	
Output power in load (PEP)	W_l	–	–	1600	W	
Total efficiency	η	–	66	53	%	
Intermodulation distortion						
3rd order	d_3	–	–	–30	dB	3
5th order	d_5	–	–	–30	dB	3

Notes

1. To be adjusted for the stated no-signal anode current.
2. Design value for output power of driver stage.
3. Maximum values encountered at any level of drive voltage referred to the amplitude of either of the two equal tones at that level.


7Z67892.1
V_{g1} (V)
80
60
40
20
0
−20
−40
−60
I_{g2} = 0,4 A
0,2 A
0,1 A
I_{g1} = 0,3 A
0,2 A
0,1 A
I_a =
4 A
3,5 A
3 A
2,5 A
2 A
1,5 A
1 A
0,5 A
0,1 A
0
1
2
3
4
5
6
7
V_a (kV)

AIR COOLED U.H.F. POWER TETRODE

Forced-air cooled coaxial power tetrode in metal-ceramic construction. The tube features a high gain and a high linearity and is primarily intended for use as linear broadband amplifier in band IV/V TV transmitters and transposers.

QUICK REFERENCE DATA

Class-AB linear amplifier			
Frequency	f	860	MHz
Anode voltage	V_a	5,5	kV
Output power in load, sync	$W_{\ell(sync)}$	5,5	kW
Power gain	G	16,5	dB
TV transposer service			
Frequency	f	470 to 860	MHz
Anode voltage	V_a	5,0	kV
Output power in load, sync	$W_{\ell(sync)}$	2,2	kW
Power gain	G	16,5	dB

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f		5	$V^{+1\%}_{-3\%}$
Filament current	I_f		130	A
Filament peak starting current	I_{fp}	max.	800	A
Cold filament resistance	R_{fo}		4,5	mΩ
Waiting time	t_w	min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	2	kV
Grid 2 voltage	V_{g2}	700	V
Anode current	I_a	6	A
Transconductance	S	140	mA/V
Amplification factor	μ_{g2g1}	8	

CAPACITANCES, grounded-grid

Input	C_i		62 pF
Output	C_o		13 pF
Anode to filament	C_{af}	<	0,1 pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	240 °C
Recommended maximum seal temperature	T_s	200 °C

→ **COOLING**

$W_a + W_g$ kW	h m	T_i °C	q_{min} m³/min	p_i Pa tube only	tube + cavity	T_o max. °C
7	0	35	7,5	660	1240	88
5	0	35	5,0	330	620	94
7	0	55	9,3	860	1700	101
5	0	55	6,2	430	850	106
7	1500	35	9,0	800	1450	88
5	1500	35	6,0	400	730	96
7	3000	25	9,6	800	1450	83
5	3000	25	6,4	400	730	90

The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

For direction of air flow see outline drawing. The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

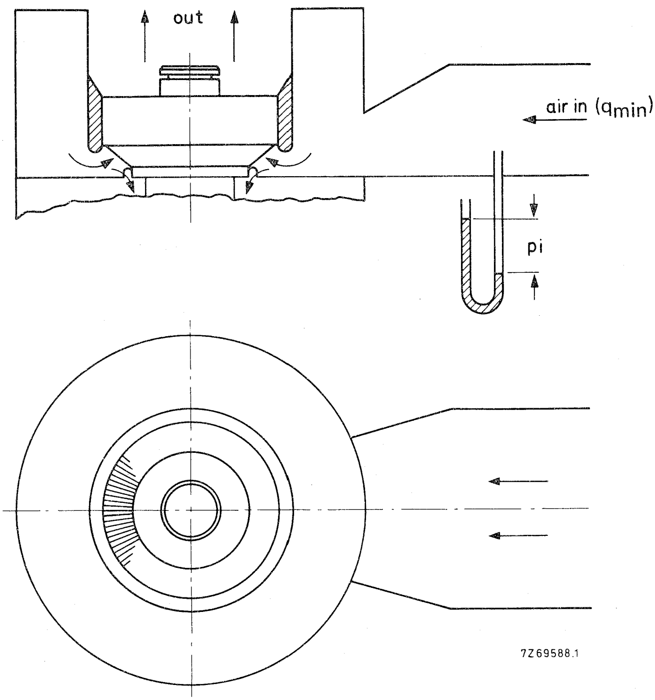


Fig. 1 Schematic of cooling air flow.

ACCESSORIES

Band IV/V amplifier circuit assembly type 40783.

MECHANICAL DATA

Dimensions in mm

Net mass: ≈ 3,5 kg

Mounting position: vertical with anode up or down

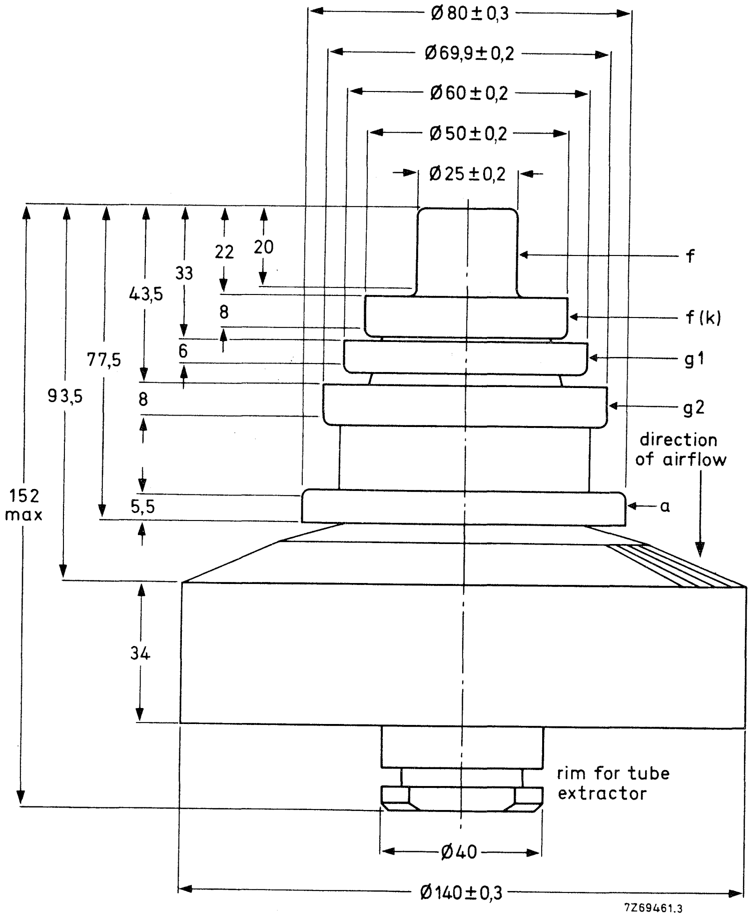


Fig. 2.

R.F. CLASS-AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

(Detailed information on definitions of terms and application suggestions are available on request.)

Negative modulation, positive synchronization (CCIR system).
Unless otherwise stated, the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

				notes
Frequency	f	up to	1000 MHz	
Anode voltage	V_a	max.	6 kV	
Grid 2 voltage	V_{g2}	max.	1000 V	
Grid 1 voltage	$-V_{g1}$	max.	200 V	
Anode current, black	$I_{a\,black}$	max.	2,5 A	
Anode input power, black	$W_{ia\,black}$	max.	10 kW	
Anode dissipation	W_a	max.	7 kW	
Grid 2 dissipation	W_{g2}	max.	100 W	
Grid 1 dissipation	W_{g1}	max.	50 W	←
Cathode current	I_k	max.	4 A	

OPERATING CONDITIONS, grounded grid, grounded screen grid

				notes
Frequency of vision carrier	f		470 to 860 MHz	
Bandwidth (−1 dB)	B		10 MHz	1
Anode voltage	V_a		5,5 kV	
Grid 2 voltage	V_{g2}		700 V	
Grid 1 voltage	V_{g1}		−65 V	2
Anode current, no-signal condition	I_a		1,0 A	
Anode current, black	$I_{a\,black}$		1,9 A	3
Grid 2 current, black	$I_{g2\,black}$	≈	30 mA	3
Grid 1 current, black	$I_{g1\,black}$	≈	0 mA	3
Output power in load, sync	$W_{\ell\,sync}$		5,5 kW	
Output power in load, black	$W_{\ell\,black}$		3,3 kW	3
Anode dissipation, black	$W_{a\,black}$	≈	6,8 kW	
Power gain, sync	G_{sync}		16,5 dB	
Power gain, black	G_{black}		17 dB	
Sync compression	sync in/out		30/25	4
Differential phase		≈	4 deg	5
Differential gain		⩾	92 %	5
L.F. linearity		⩾	92 %	5
Driving power, sync	$W_{dr\,sync}$		125 W	←

Notes see next page.

R.F. CLASS-AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE

LIMITING VALUES

Unless otherwise stated, the voltages are given with respect to the cathode.

				notes
Frequency	f	up to	1000 MHz	
Anode voltage	V_a	max.	6 kV	
Grid 2 voltage	V_{g2}	max.	1000 V	
Grid 1 voltage	$-V_{g1}$	max.	200 V	
Anode current, 0 dB	I_a	max.	2,5 A	
Anode input power, 0 dB	W_{ia}	max.	10 kW	
Anode dissipation	W_a	max.	7 kW	
Grid 2 dissipation	W_{g2}	max.	100 W	
Grid 1 dissipation	W_{g1}	max.	50 W	
Cathode current	I_k	max.	4 A	

OPERATING CONDITIONS

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

				notes
Frequency	f		470 to 860 MHz	
Bandwidth (−1 dB)	B		10 MHz	1
Anode voltage	V_a		5,0 kV	
Grid 2 voltage	V_{g2}		700 V	
Grid 1 voltage	V_{g1}		−60 V	2
Anode current, no-signal condition	I_a		1,2 A	
Anode current	I_a		1,8 A	6
Grid 2 current	I_{g2}	≈	20 mA	6
Grid 1 current	I_{g1}	≈	0 mA	6
Output power in load, sync	$W_{\ell\,sync}$		2,2 kW	
Power gain	G		16,5 dB	
Intermodulation products	d		−54 dB	7

Notes
1. With double-tuned circuit.
2. To be adjusted for the stated no-signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal, in which case the sync compression is 30/25.
5. Measured with a 9-step staircase amplitude, running from 17% to 75% of the peak sync value, with a superimposed 4,43 MHz sine-wave having a 10% peak-to-peak value.
6. At a C.W. output power = 2,2 kW.
7. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync = 0 dB).

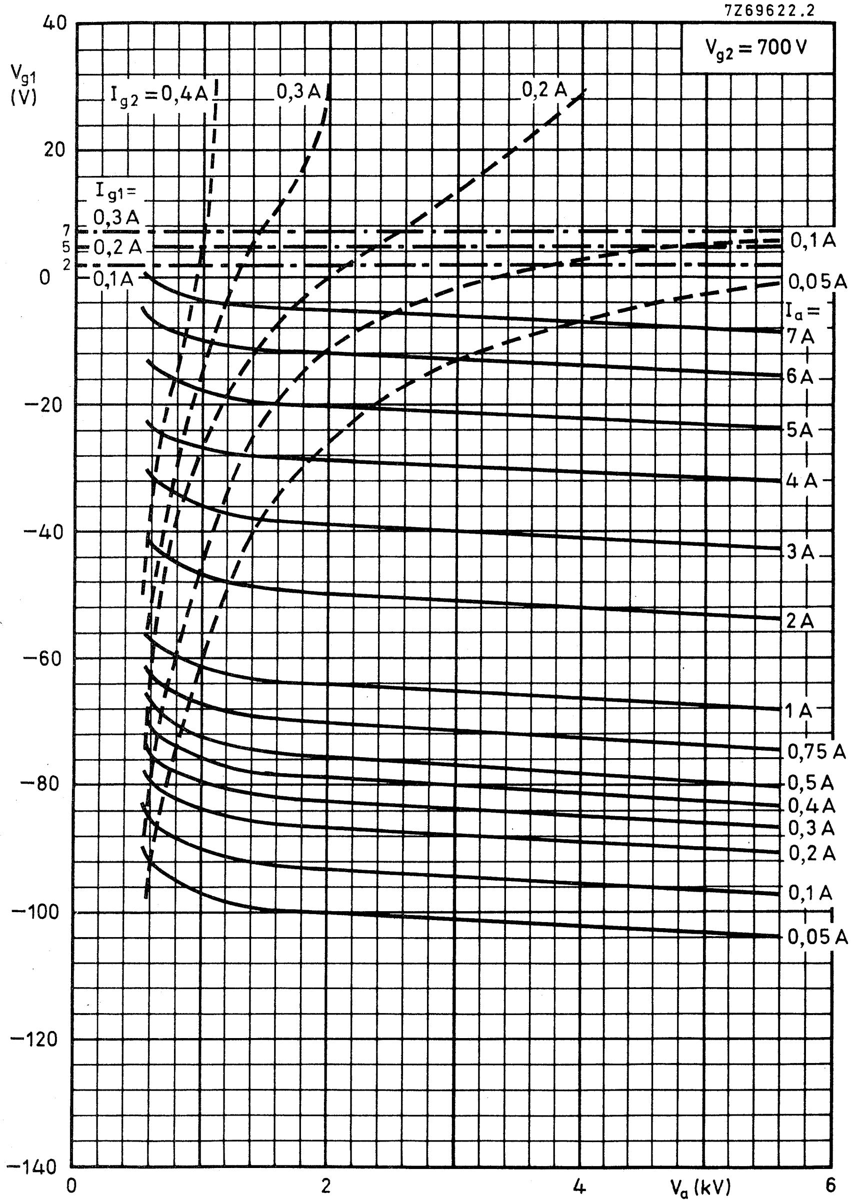

7Z69622.2
V_{g2} = 700 V
V_{g1} (V)
I_{g2} = 0,4 A
0,3 A
0,2 A
I_{g1} =
0,3 A
0,2 A
0,1 A
7
5
2
0,1 A
0,05 A
I_a =
7 A
6 A
5 A
4 A
3 A
2 A
1 A
0,75 A
0,5 A
0,4 A
0,3 A
0,2 A
0,1 A
0,05 A
40
20
0
−20
−40
−60
−80
−100
−120
−140
0
2
4
6
V_a (kV)

Fig. 3.

AIR COOLED U.H.F. POWER TETRODE

Forced-air cooled coaxial power tetrode in metal-ceramic construction. The tube features a high gain and a high linearity and is primarily intended for use as linear broadband amplifier in band IV/V TV transmitters and transposers.

QUICK REFERENCE DATA

Class-AB linear amplifier			
Frequency	f		860 MHz
Anode voltage	V_a		3,5 kV
Output power in load, sync	$W_{\ell(sync)}$		600 W
Power gain	G		15,4 dB
TV transposer service			
Frequency	f		860 MHz
Anode voltage	V_a		3,0 kV
Output power in load, sync	$W_{\ell(sync)}$		220 W
Power gain	G		15,6 dB
Class-AB f.m. amplifier			
Frequency	f		860 MHz
Anode voltage	V_a		4,0 kV
Output power in load	W_ℓ		1,1 kW
Power gain	G		16,4 dB

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f		3,9 V $^{+1\%}_{-3\%}$
Filament current	I_f		52 A
Filament peak starting current	I_{fp}	max.	300 A
Cold filament resistance	R_{fo}		10 mΩ
Waiting time	t_w	min.	1 s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	1 kV
Grid 2 voltage	V_{g2}	700 V
Anode current	I_a	2 A
Transconductance	S	60 mA/V
Amplification factor	μ_{g2g1}	13

CAPACITANCES, grounded-grid

Input	C_i		26 pF
Output	C_o		8,6 pF
Anode to filament	C_{af}	<	0,05 pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	240 °C
Recommended max. seal temperature	T_s	200 °C

COOLING

$W_a + W_g$ kW	h m	T_{in} °C	q_{min} m^3/min see Fig. 1	p_i Pa tube only	p_i Pa tube + cavity	T_{out} °C
2	0	35	2,5	450	600	79
2	0	55	3,0	800	1000	86
2	1500	35	3,0	550	720	79
2	3000	25	3,3	550	720	77

For direction of air flow see outline drawing. The air should be ducted so that sufficient air is directed to the seals.

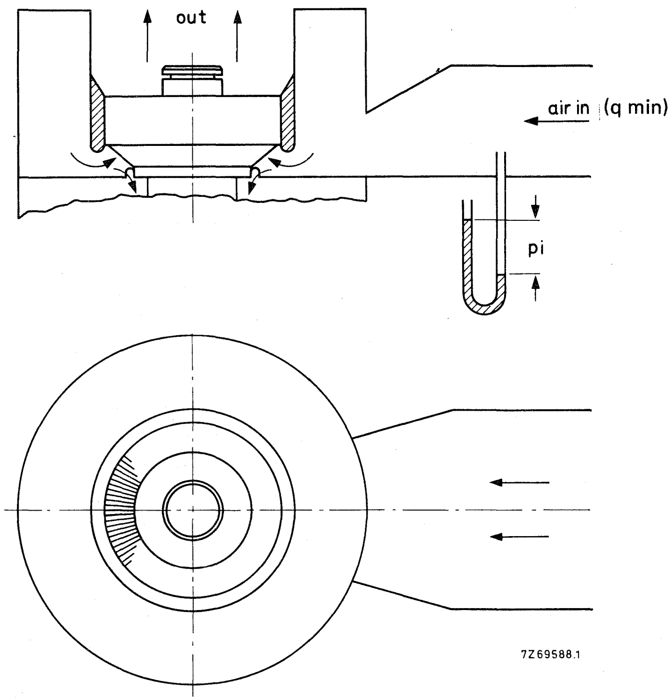


Fig. 1 Schematic of cooling air flow.

ACCESSORIES

Band IV/V amplifier circuit assembly (transposer), vision	type 40782V
Band IV/V amplifier circuit assembly, sound	type 40782S

MECHANICAL DATA

Dimensions in mm

Net mass: ≈ 0,85 kg

Mounting position: vertical with anode up or down

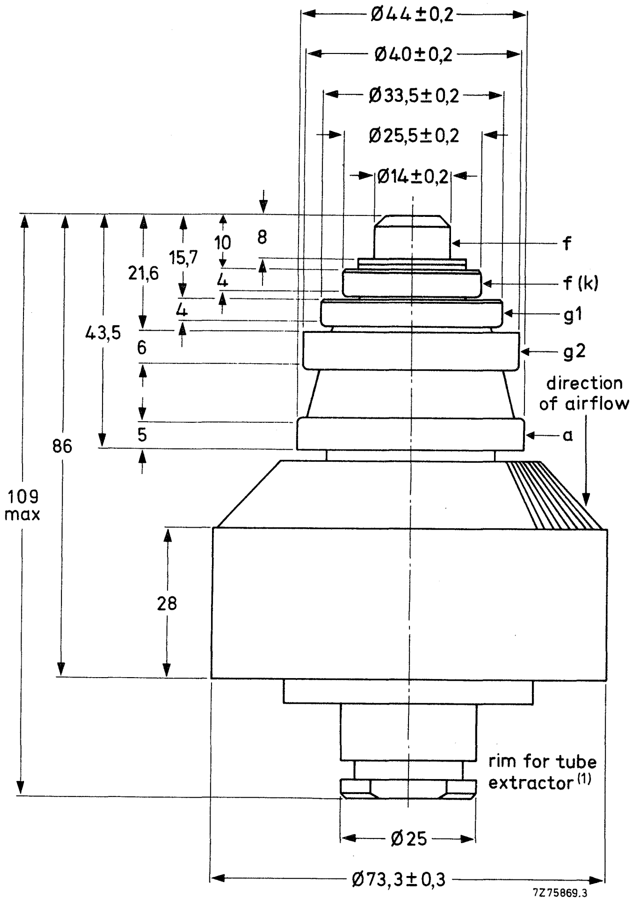


Fig. 2.

(1) Tube extractor type 40750; catalogue number 7322 120 02140.

R.F. CLASS-AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

(Detailed information on definitions of terms and application suggestions are available on request.)

Negative modulation, positive synchronization (CCIR system)

Unless otherwise stated, the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	1000	MHz	
Anode voltage	V_a	max.	4	kV	
Grid 2 voltage	V_{g2}	max.	800	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current, black	$I_{a\ black}$	max.	700	mA	
Anode input power, black	$W_{ia\ black}$	max.	2,5	kW	
Anode dissipation	W_a	max.	2	kW	
Grid 2 dissipation	W_{g2}	max.	25	W	
Grid 1 dissipation	W_{g1}	max.	25	W	
Cathode current	I_k	max.	1	A	

OPERATING CONDITIONS, grounded grid, grounded screen grid

Frequency of vision carrier	f		470 to 860	MHz	
Bandwidth (−1 dB)	B		9	MHz	1
Anode voltage	V_a		3,5	kV	
Grid 2 voltage	V_{g2}		700	V	
Grid 1 voltage	V_{g1}	≈	−36	V	2
Anode current, no-signal condition	I_a		400	mA	
Anode current, black	$I_{a\ black}$	≈	640	mA	3
Grid 2 current, black	$I_{g2\ black}$	≈	7	mA	3
Grid 1 current, black	$I_{g1\ black}$	≈	0	mA	3
Output power in load, sync	$W_{\ell\ sync}$		600	W	
Output power in load, black	$W_{\ell\ black}$		360	W	3
Anode dissipation, black	$W_{a\ black}$	≈	1,8	kW	
Power gain, sync	G_{sync}		15,4	dB	
Power gain, black	G_{black}		15,6	dB	
Sync compression	sync in/out		28/25		4
Differential phase		⩽	3	deg	5
Differential gain		⩾	90	%	5
L.F. linearity		⩾	90	%	5
Driving power, sync	$W_{dr\ sync}$		18	W	

Notes see next page.

R.F. CLASS-AB AMPLIFIER FOR TELEVISION TRANSPOSER SERVICE

Unless otherwise stated, the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	1000	MHz	
Anode voltage	V_a	max.	4	kV	
Grid 2 voltage	V_{g2}	max.	800	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current, 0 dB	I_a	max.	700	mA	
Anode input power, 0 dB	W_{ia}	max.	2,2	kW	
Anode dissipation	W_a	max.	2	kW	
Grid 2 dissipation	W_{g2}	max.	25	W	
Grid 1 dissipation	W_{g1}	max.	25	W	
Cathode current	I_k	max.	1	A	

OPERATING CONDITIONS, grounded grid, grounded screen grid

Negative modulation, positive synchronization, combined sound and vision (CCIR standard G)

Frequency	f		470 to 860	MHz	
Bandwidth (−1 dB)	B		10	MHz	1
Anode voltage	V_a		3,0	kV	
Grid 2 voltage	V_{g2}		700	V	
Grid 1 voltage	V_{g1}	≈	−32	V	2
Anode current, no-signal condition	I_a		500	mA	
Anode current	I_a	≈	620	mA	6
Grid 2 current	I_{g2}	≈	4	mA	6
Grid 1 current	I_{g1}	≈	0	mA	6
Output power in load, sync	$W_{\ell\ sync}$		220	W	
Power gain	G		15,6	dB	
Intermodulation products	d	⩽	−54	dB	7

Notes

1. With double-tuned circuit.
2. To be adjusted for the stated no-signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal, in which case the sync compression is 30/25.
5. Measured with a 10-step staircase amplitude, running from 17% to 75% of the peak sync value, with a superimposed 4,43 MHz sine-wave having a 10% peak-to-peak value.
6. At a C.W. output power is 220 W.
7. Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync = 0 dB).

CLASS-AB F.M. AMPLIFIER

Unless otherwise stated, the voltages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

					notes
Frequency	f	up to	1000	MHz	
Anode voltage	V_a	max.	4,2	kV	
Grid 2 voltage	V_{g2}	max.	800	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current	I_a	max.	800	mA	
Anode input power	W_{ia}	max.	3	kW	
Anode dissipation	W_a	max.	2	kW	
Grid 2 dissipation	W_{g2}	max.	25	W	
Grid 1 dissipation	W_{g1}	max.	25	W	
Cathode current	I_k	max.	1	A	

OPERATING CONDITIONS, grounded grid, grounded screen grid

Frequency	f		470 to 860	MHz	
Bandwidth (−3 dB)	B		4	MHz	
Anode voltage	V_a		4,0	kV	
Grid 2 voltage	V_{g2}		700	V	
Grid 1 voltage	V_{g1}	≈	−48	V	2
Anode current, no-signal condition	I_a		200	mA	
Anode current	I_a	≈	730	mA	
Grid 2 current	I_{g2}	≈	20	mA	
Grid 1 current	I_{g1}	≈	4	mA	
Anode input power	W_{ia}		2920	W	
Anode dissipation	W_a		1580	W	
Output power in load	W_ℓ		1,1	kW	
Power gain	G		16,4	dB	
Driving power			25	W	

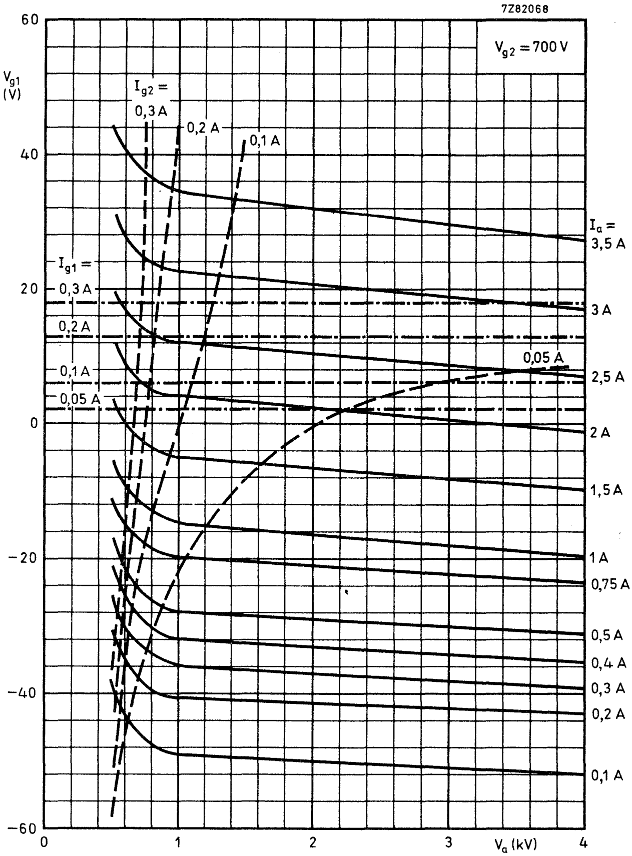

7Z82068
$V_{g2} = 700$ V
V_{g1} (V)
60
40
20
0
−20
−40
−60
I_{g2} =
0,3 A
0,2 A
0,1 A
I_{g1} =
0,3 A
0,2 A
0,1 A
0,05 A
0,05 A
I_a =
3,5 A
3 A
2,5 A
2 A
1,5 A
1 A
0,75 A
0,5 A
0,4 A
0,3 A
0,2 A
0,1 A
0
1
2
3
V_a (kV)
4

Fig. 3.

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as a high gain linear broadband amplifier in band III TV transmitters. This type is also recommended for f.m. broadcast applications.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)

Frequency	f		225	MHz
Anode voltage	V_a		5,5	kV
Output power in load, sync	W_ℓ		11	kW
Power gain, sync	G		17	dB

Class-AB f.m. amplifier

Frequency	f		230	MHz
Anode voltage	V_a	5,5	6,5	kV
Output power in load	W_ℓ	5	10	kW
Gain	G	19	19	dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		8	V $^{+1}_{-3}$ %
Filament current	I_f		113	A
Filament peak starting current	I_{fp}	max.	560	A
Cold filament resistance	R_{fo}		7,7	mΩ

Waiting time: procedure prior to switching subsequently $-V_{g1}$, V_a and V_{g2}:

$V_f = 2$ V	t_w	30	s
then $V_f = 8$ V	t_w	5	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid 2 voltage	V_{g2}	500	V
Anode current	I_a	2	A
Transconductance	S	115	mA/V
Amplification factor	μ_{g2g1}	8	

CAPACITANCES

Input	C_i	85	pF
Output	C_o	17,5	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	240 °C
Recommended maximum seal temperature	T_s	200 °C

COOLING

$W_a + W_g$ kW	h m	T_i °C	q_{min} m^3/min	P_i P_a tube only	tube + cavity	T_o max. °C
14	0	25	12	1040	1350	100
10	0	25	8	490	600	100
14	0	55	16	1680	2650	110
10	0	55	12	990	1350	110
14	1500	25	14	1190	1550	100
10	1500	25	10	640	800	100
14	1500	40	16	1500	2200	110
10	1500	40	12	900	1200	110
14	3000	25	16	1330	1750	100
10	3000	25	12	780	1000	100

For direction of air flow see outline drawing. The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

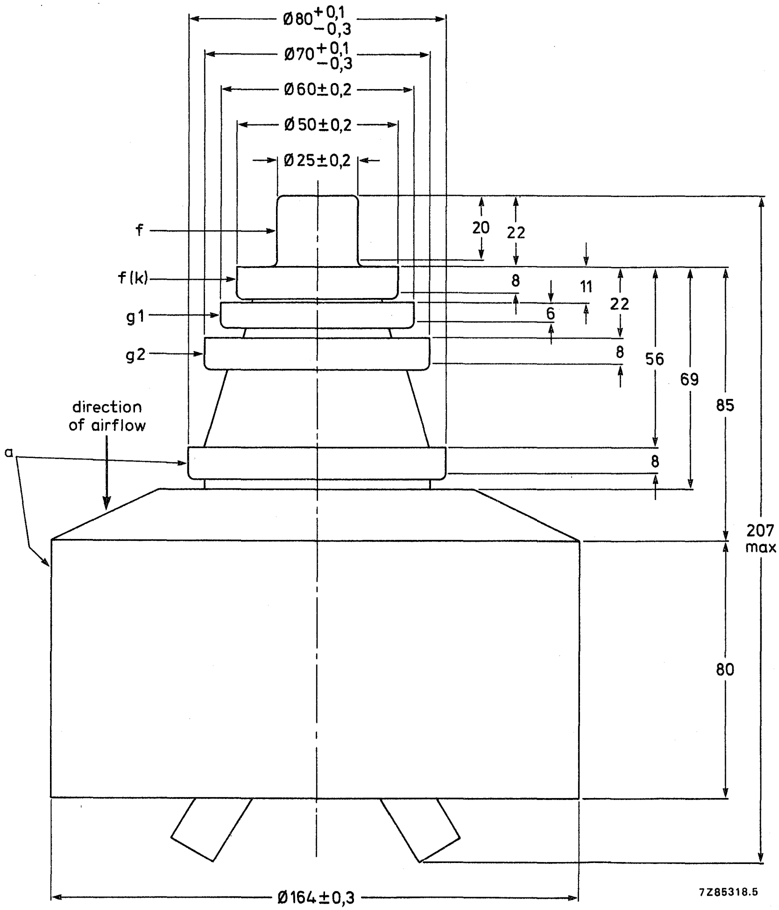
LIMITING VALUES

Frequency	f	up to	250 MHz
Anode voltage	V_a		7 kV
Grid 2 voltage	V_{g2}		800 V
Grid 1 voltage	$-V_{g1}$		250 V
Anode current, black	I_a		4 A
Anode input power, black	W_{ia}		20 kW
Anode dissipation	W_a		14 kW
Grid 2 dissipation	W_{g2}		80 W
Grid 1 dissipation	W_{g1}		80 W

MECHANICAL DATA

Net mass: approx. 9 kg

Mounting position: vertical with anode up or down.



DEVELOPMENT SAMPLE DATA

ACCESSORIES

Band II amplifier circuit assembly	type 40788
Band III amplifier circuit assembly (vision)	type 40787V
Band III amplifier circuit assembly (sound)	type 40787S

Input circuits of the cavities are broadbanded (no input tuning required)

OPERATING CONDITIONS, cathode driven

The voltages are given with respect to the cathode.

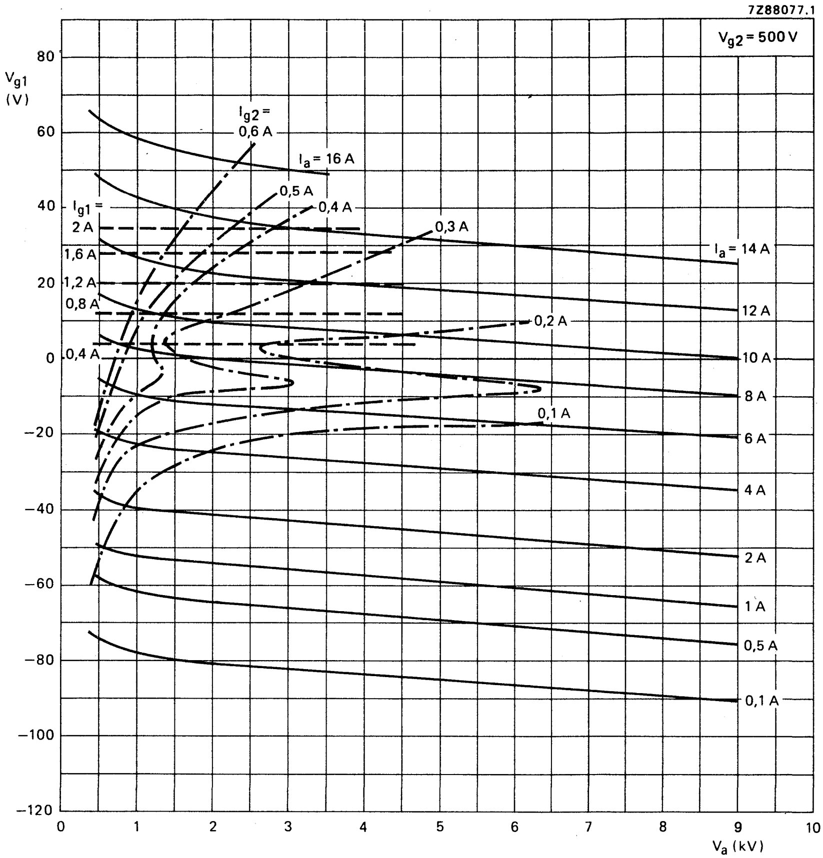
CLASS-AB AMPLIFIER FOR TELEVISION SERVICE

						notes
Frequency of vision carrier	f		175 to 225	175 to 225	MHz	
Bandwidth (−1 dB)	B		8	8	MHz	1
Anode voltage	V_a		4,5	5,5	kV	
Grid 2 voltage	V_{g2}		500	500	V	
Grid 1 voltage	$-V_{g1}$	≈	50	50	V	2
Anode current, zero signal	I_a		1,2	1,2	A	3
Anode current, black	I_a	≈	2,5	2,9	A	3
Grid 2 current, black	I_{g2}	≈	100	100	mA	3
Grid 1 current, black	I_{g1}	≈	0	20	mA	
Output power in load, sync	W_ℓ		5,5	11	kW	
Output power in load, black	W_ℓ		3,3	6,6	kW	
Gain, black	G		17	17	dB	
Sync compression	sync in/out	⩽	30/25	30/25		4
Differential phase		<	3	3	deg	6
Differential gain		⩾	90	90	%	6
L.F. linearity		⩾	90	90	%	5

CLASS-AB F.M. AMPLIFIER

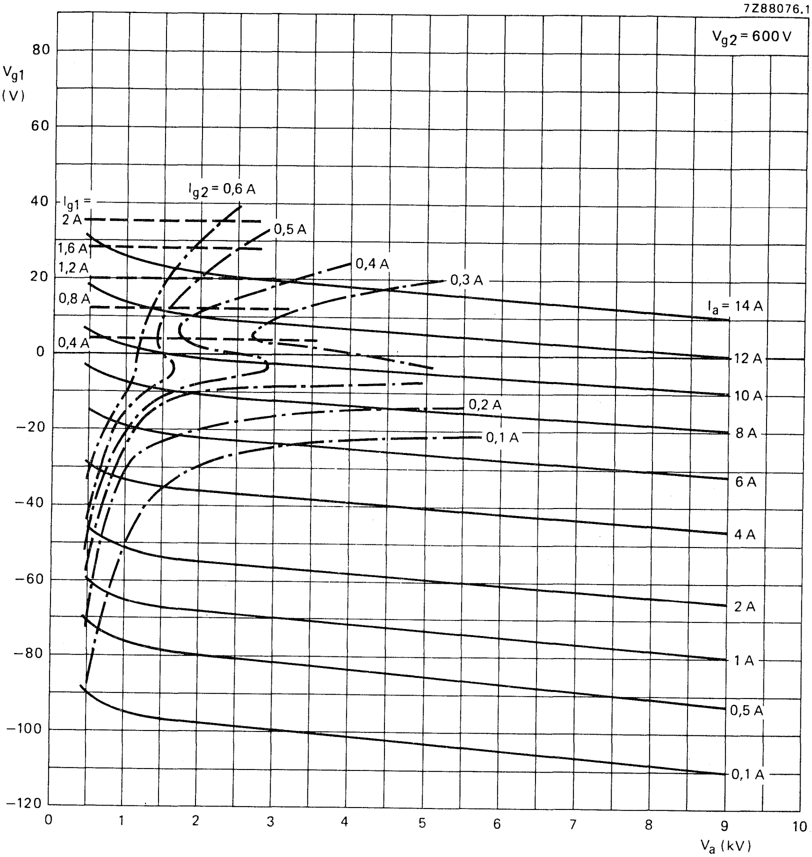
Frequency	f		80 - 230	80 - 230	MHz
Bandwidth (−3 dB) 80 MHz	B	≈	1,5	1,5	MHz
Bandwidth (−3 dB) 230 MHz	B	≈	4	4	MHz
Anode voltage	V_a		5,5	6,5	kV
Grid 2 voltage	V_{g2}		500	500	V
Grid 1 voltage	$-V_{g1}$	≈	60	60	V	2
Anode current, no-signal condition	I_a		1	1	A
Anode current	I_a	≈	2,2	2,7	A
Grid 2 current	I_{g2}	≈	100	125	mA
Grid 1 current	I_{g1}	≈	0	20	mA
Anode input power	W_{ia}		12	18	kW
Output power in load	W_ℓ		5	10	kW
Driving power	W_{dr}		65	100	W
Power gain	G		19	20	dB

Notes: see next page.



Notes

1. With double-tuned anode circuit.
2. To be adjusted for the stated zero signal anode current.
3. Black signal, including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal, in which case the sync. compression in 30/25.
5. Measured with a 10 step staircase, running from 17% to 75% of the peak sync value.
6. As 5 but with a superimposed 4,43 MHz sine-wave heaving a 10% peak-to-peak value.



7Z88076.1
V_{g2} = 600 V
V_{g1} (V)
80
60
40
20
0
−20
−40
−60
−80
−100
−120
I_{g1} =
2 A
1,6 A
1,2 A
0,8 A
0,4 A
I_{g2} = 0,6 A
0,5 A
0,4 A
0,3 A
0,2 A
0,1 A
I_a = 14 A
12 A
10 A
8 A
6 A
4 A
2 A
1 A
0,5 A
0,1 A
0
1
2
3
4
5
6
7
8
9
10
V_a (kV)

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as linear broadband amplifier in band III TV transmitters for vision.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)

Frequency	f	250	MHz
Anode voltage	V_a	7	kV
Output power in load (sync)	W_ℓ	30	kW
Power gain (sync)	G	18	dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		8	$V^{+1}_{-3}\%$
Filament current	I_f		185	A
Filament peak starting current	I_{fp}	max.	800	A
Cold filament resistance	R_{fo}		4,2	mΩ

Waiting time; procedure prior to switching on subsequently $-V_{g1}$, V_a and V_{g2}:

$V_f = 2$ V	t_w	30	s
then $V_f = 8$ V	t_w	5	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a		6 kV
Grid 2 voltage	V_{g2}		500 V
Anode current	I_a		4 A
Transconductance	S	≈	160 mA/V
Amplification factor	μ_{g2g1}	≈	8

CAPACITANCES, grounded grid

Input	C_i	≈	125 pF
Output	C_o	≈	28 pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 °C
Recommended maximum seal temperature	T_s	max.	200 °C

COOLING

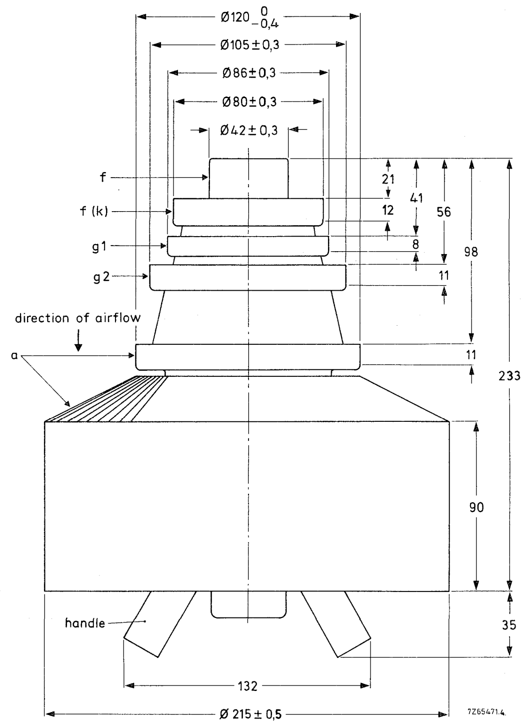
$W_a + W_g$ kW	h m	T_i °C	q_{min} m^3/min	p_i Pa tube only	p_i Pa tube + cavity	T_o max. °C
26	0	25	24	1320	2040	90
23	0	25	21	1030	1600	90
26	0	55	28	1660	2700	110
23	0	55	25	1340	2200	110
26	1500	25	24	1130	1700	100
23	1500	25	21	880	1250	100
26	3000	25	28	1300	2000	100
23	3000	25	25	1000	1500	100

For direction of air flow see outline drawing. The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

MECHANICAL DATA

Net mass approx. 17 kg

Mounting position vertical with anode up or down.



DEVELOPMENT SAMPLE DATA

ACCESSORIES

Band III amplifier circuit assembly (vision) type 40786V
Band III amplifier circuit assembly (sound) type 40786S

Input circuits of cavities are broadbanded (no input tuning required)

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	250	MHz
Anode voltage	V_a		8,5	kV
Grid 2 voltage	V_{g2}		800	V
Grid 1 voltage	$-V_{g1}$		250	V
Anode current	I_a		8	A
Anode input power, black	W_{ia}		50	kW
Anode dissipation	W_a		26	kW
Grid 2 dissipation	W_{g2}		200	W
Grid 1 dissipation	W_{g1}		200	W

OPERATING CONDITIONS, cathode driven

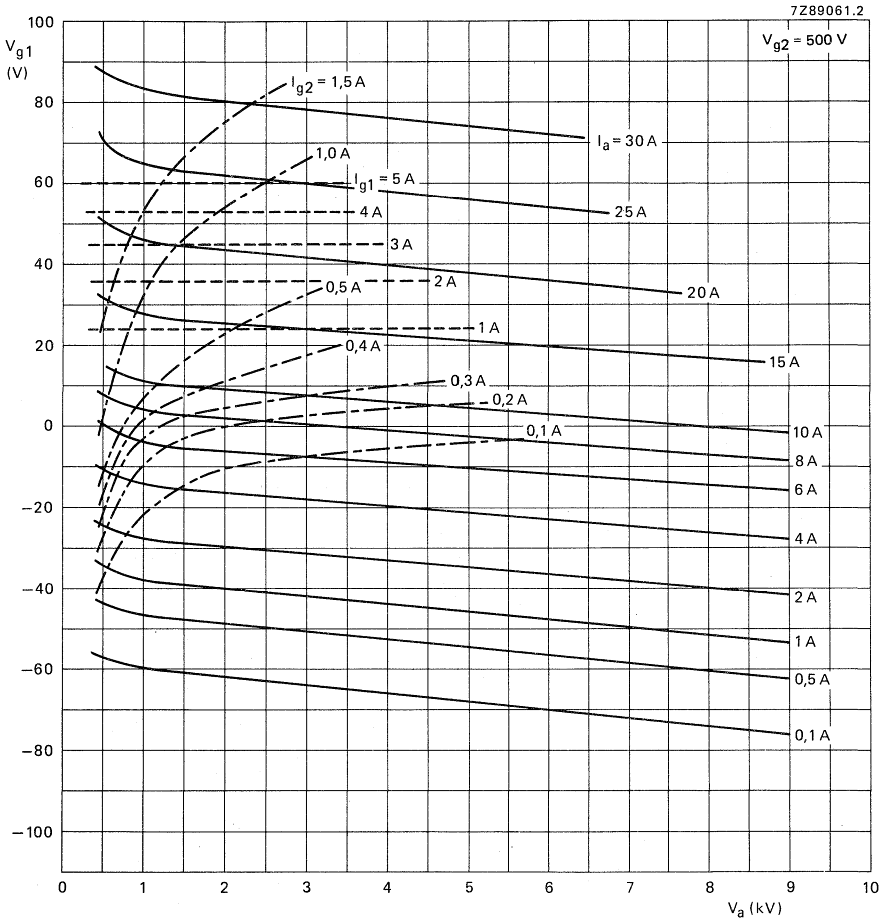
The voltages are given with respect to the cathode.

CLASS-AB AMPLIFIER FOR TELEVISION SERVICE

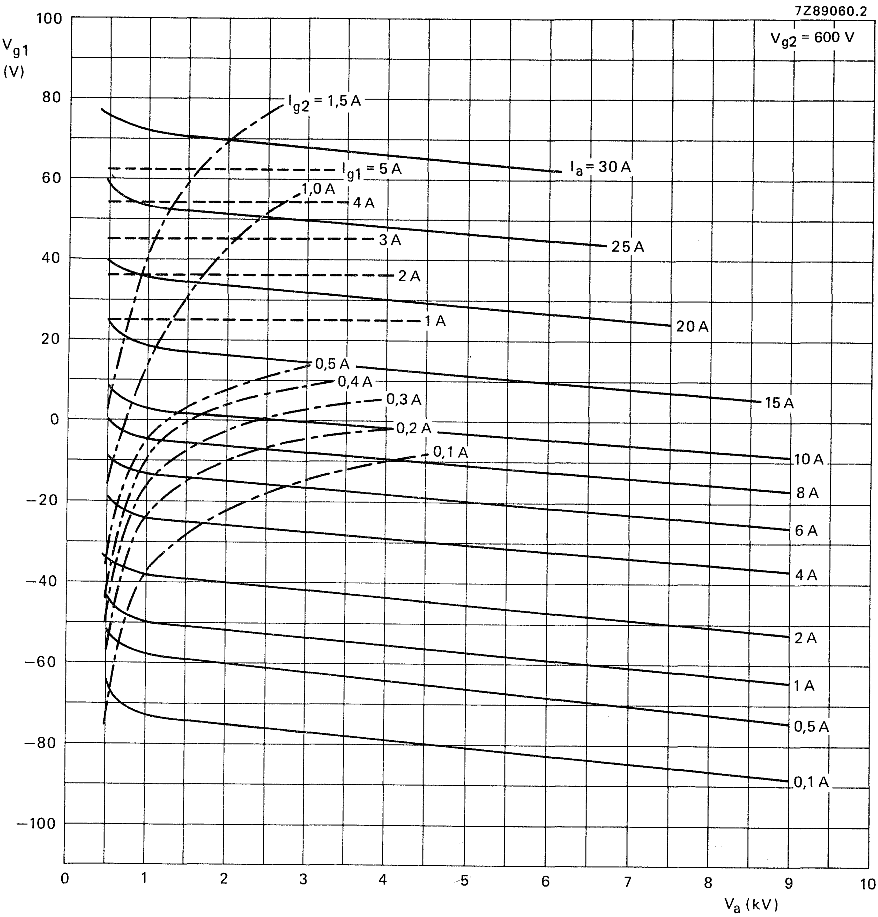
									notes
Frequency of vision carrier	f		175 to 225					MHz	
Bandwidth (−1 dB)	B		8	8	8	8	7,5	MHz	1
Anode voltage	V_a		5	5,5	6	6,5	7	kV	
Grid 2 voltage	V_{g2}		500	500	500	500	500	V	
Grid 1 voltage	$-V_{g1}$	≈	50	50	50	50	50	V	2
Anode current (zero signal)	I_a		1,2	1,2	1,2	1,2	1,2	A	
Anode current (black)	I_a	≈	3,5	4,0	4,6	5,2	5,7	A	
Grid 2 current (black)	I_{g2}	≈	100	120	150	150	150	mA	
Grid 1 current (black)	I_{g1}	≈	0	15	55	120	180	mA	
Output power in load, sync	W_ℓ		11	15	20	25	30	kW	
Output power in load, black	W_ℓ		6,6	9	12	15	18	kW	
Gain	G		18					dB	
Sync compression	sync in/out	<	30/25						
Diffferential phase		<	5					deg	
Differential gain		⩾	90					%	
L.F. linearity		⩾	90					%	

Notes

1. With double tuned anode circuit.
2. To be adjusted for the stated zero signal anode current.



DEVELOPMENT SAMPLE DATA


7Z89060.2
V_{g2} = 600 V
V_{g1} (V)
100
80
60
40
20
0
−20
−40
−60
−80
−100
I_{g2} = 1,5 A
1,0 A
I_{g1} = 5 A
4 A
3 A
2 A
1 A
0,5 A
0,4 A
0,3 A
0,2 A
0,1 A
I_a = 30 A
25 A
20 A
15 A
10 A
8 A
6 A
4 A
2 A
1 A
0,5 A
0,1 A
0
1
2
3
4
5
6
7
8
9
10
V_a (kV)

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as linear broadband amplifier in band III TV transmitters for combined vision and sound service.

QUICK REFERENCE DATA

TV service

Class-AB linear amplifier (vision and sound combined)

Frequency	f		225	MHz
Anode voltage	V_a		7	kV
Output power in load, sync	W_ℓ		10	kW
Power gain	G		16	dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		10,4	$V^{+1}_{-3}\%$
Filament current	I_f		115	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{fo}		10,5	mΩ
Waiting time	t_w		1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a		6	kV
Grid 2 voltage	V_{g2}		900	V
Anode current	I_a		3	A
Transconductance	S		70	mA/V
Amplification factor	μ_{g2g1}		8,5	

CAPACITANCES, grounded grid

Input	C_i	≈	70	pF
Output	C_o	≈	25	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240	°C
Recommended maximum seal temperature	T_s	max.	200	°C

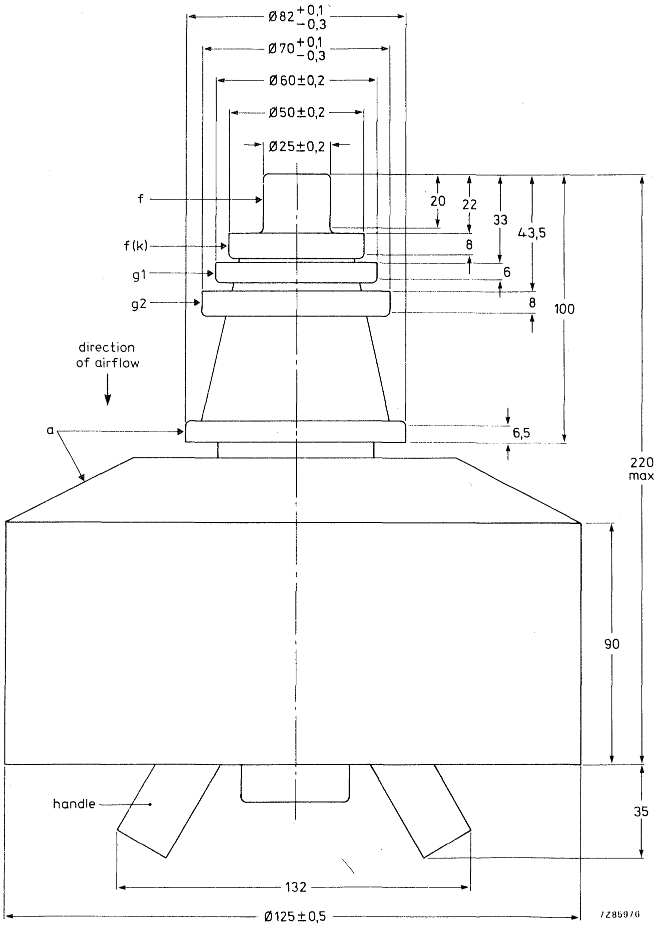
COOLING

$W_a + W_g$ kW	h m	T_i °C	q_{min} m³/min	p_i Pa tube only	p_i Pa tube + cavity	T_o max. °C
20	0	25	18	750	1100	90
14	0	25	12	470	700	90
20	0	55	22	1130	1700	110
14	0	55	16	600	900	110
20	1500	25	18	630	950	100
14	1500	25	12	400	600	100
20	3000	25	22	770	1150	100
14	3000	25	16	500	750	100

For direction of air flow see outline drawing. The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

MECHANICAL DATA

Net mass	approx. 17 kg
Mounting position	vertical with anode up or down.



ACCESSORIES

Band III amplifier circuit assembly type 40786A

Input circuits of cavities are broadbanded (no input tuning required).

R.F. CLASS-AB LINEAR AMPLIFIER FOR TELEVISION SERVICE

Vision and sound combined (10 : 1) cathode driven

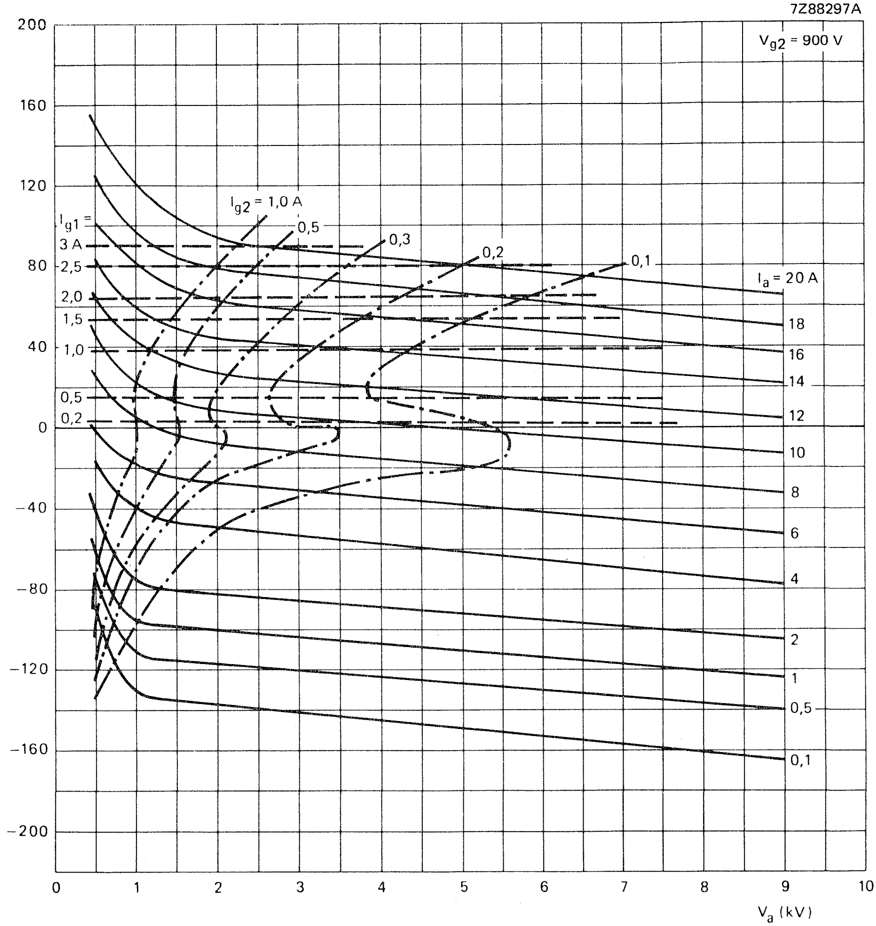
LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	250	MHz
Anode voltage	V_a		9	kV
Grid 2 voltage	V_{g2}		1	kV
Grid 1 voltage	$-V_{g1}$		500	V
Anode current	I_a		7	A
Anode input power, black	W_{ia}		40	kW
Anode dissipation	W_a		20	kW
Grid 2 dissipation	W_{g2}		100	W
Grid 1 dissipation	W_{g1}		50	W

OPERATING CONDITIONS

Frequency	f		225	MHz
Bandwidth (−1 dB)	B		8	MHz
Anode voltage	V_a	≈	7	kV
Grid 2 voltage	V_{g2}	≈	900	V
Grid 1 voltage	V_{g1}	≈	100	V
Anode current (zero signal)	I_a	≈	1,8	A
Anode current, black + line sync pulse	I_a	≈	3	A
Grid 2 current, black + line sync pulse	I_{g2}	≈	50	mA
Grid 1 current, black + line sync pulse	I_{g1}	≈	0	mA
Output power in load (sync)	W_ℓ		10	kW
Driving power (sync)	W_{dr}	≤	250	W
Power gain	G	≥	16	dB
Intermodulation products	d	≤	−54	dB*

* Three-tone test method (vision carrier −8 dB, sound carrier −10 dB, sideband signal −16 dB with respect to peak sync = 0 dB), with driver input intermodulation products < −70 dB.



DEVELOPMENT SAMPLE DATA

WATER COOLED 100 kW POWER TETRODE

Water cooled power tetrode in metal-ceramic coaxial construction for use as r.f. and a.f. amplifier in a.m. broadcast transmitters and scientific applications.

QUICK REFERENCE DATA

Class-C			
Frequency	f	30	MHz
Anode voltage	V_a	11	kV
Output power	W_o	125	kW
Class B			
Anode voltage	V_a	11	kV
Output power in load	W_ℓ	2 x 75	kW

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		10	$V^{+1\%}_{-3\%}$
Filament current	I_f		280	A
Filament peak starting current	I_{fp}	max.	1600	A
Cold filament resistance	R_{fo}		4,0	mΩ
Waiting time	t_w		10	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid 2 voltage	V_{g2}	1	kV
Anode current	I_a	25	A
Transconductance	S	140	mA/V
Amplification factor	μ_{g2g1}	5	

CAPACITANCES

Cathode to grid 1	C_{kg1}	≈	180	pF
Cathode to grid 2	C_{kg2}	≈	13	pF
Cathode to anode	C_{ka}	≈	0,3	pF
Grid 1 to grid 2	C_{g1g2}	≈	300	pF
Grid 1 to anode	C_{g1a}	≈	2,3	pF
Grid 2 to anode	C_{g2a}	≈	47	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 °C
Recommended maximum seal temperature	T	max.	200 °C

Low velocity air flow of at least 1 m^3/min should be directed to the grid and filament seals in order to keep the temperature below 200 °C.

COOLING

Maximum anode dissipation (water cooling, 80 l/min)	W_a	150 kW
Water cooling with 60 l/min	W_a	120 kW
Absolute maximum outlet temperature	T_o	100 °C
Pressure drop in the anode cooler		20 kPa
Absolute maximum water pressure		500 kPa

MECHANICAL DATA

Net mass	approx. 35 kg
Mounting position	vertical with anode up

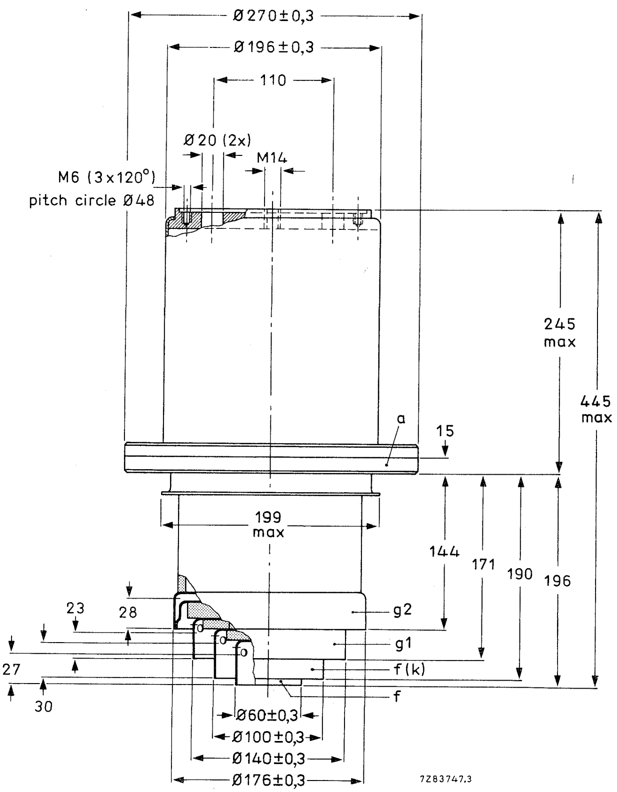


Fig. 1.

R.F. CLASS-C ANODE AND SCREEN GRID MODULATION (CARRIER CONDITIONS)

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	30	MHz
Anode voltage	V_a	max.	13	kV
Grid 2 voltage	V_{g2}	max.	1200	V
Grid 1 voltage	V_{g1}	max.	−800	V
Cathode current	I_k		17	A
Cathode current (peak)	I_k		160	A
Anode input power	W_{ia}	max.	200	kW
Anode dissipation	W_a	max.	150	kW
Grid 2 dissipation	W_{g2}	max.	2,2	kW
Grid 1 dissipation	W_{g1}	max.	1	kW

OPERATING CONDITIONS

Frequency	f		30	MHz
Anode voltage	V_a	≈	11	kV
Grid 2 voltage (modulation 80%)	V_{g2}	≈	1	kV
Grid 1 voltage	V_{g1}	≈	−550	V
Grid driving voltage peak	V_p		700	V
Anode current	I_a	≈	15	A
Grid 2 current	I_{g2}	≈	0,5	A
Grid 1 current	I_{g1}	≈	0,8	A
Driving power	W_{dr}		1	kW
Grid 2 dissipation	W_{g2}		500	W
Grid 1 dissipation	W_{g1}		120	W
Anode input power	W_{ia}		165	kW
Anode output power	W_{oa}		125	kW
Anode dissipation	W_a		40	kW
Efficiency	η		76	%

A.F. CLASS-B POWER AMPLIFIER AND MODULATOR

LIMITING VALUES, per tube (Absolute maximum rating system)

Anode voltage	V_a	15	kV
Grid 2 voltage	V_{g2}	1,6	kV
Grid 1 voltage	V_{g1}	–800	V
Anode input power	W_{ia}	200	kW
Anode dissipation	W_a	150	kW
Cathode current (peak)	I_k	160	A
Cathode current	I_k	20	A
Grid 2 dissipation	W_{g2}	2,2	kW
Grid 1 dissipation	W_{g1}	1	kW

OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a	≈	11	kV
Grid 2 voltage	V_{g2}	≈	1,6	kV
Grid 1 voltage, I_{ao} = 1 A	V_{g1}	≈	–350	V
Anode current	I_a		2 x 10	A
Grid 2 current	I_{g2}		2 x 0,3	A
Grid 1 current	I_{g1}	≈	0	A
Anode input power	W_{ia}		2 x 110	kW
Anode output power	W_{oa}		2 x 75	kW
Anode dissipation	W_a		2 x 35	kW
Efficiency	η		68	%

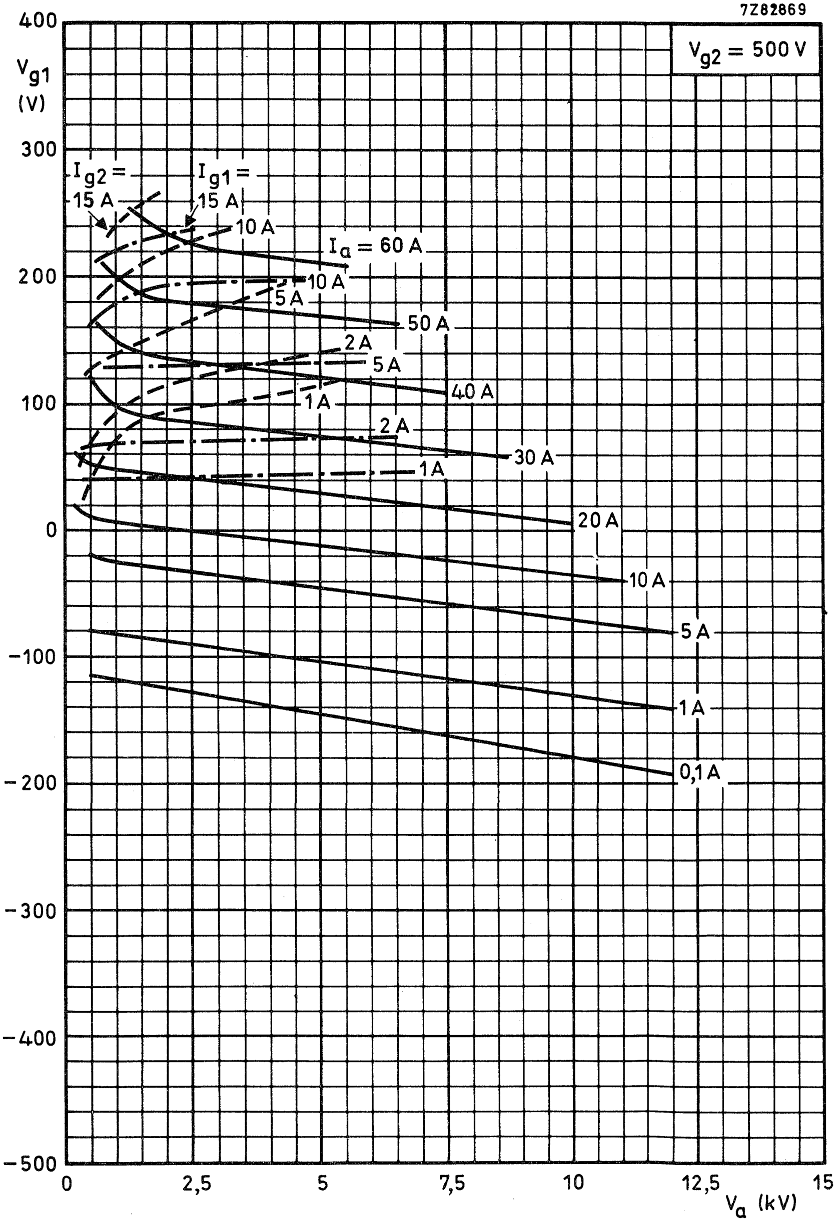

7Z82869
Vg2 = 500 V
Vg1 (V)
Ig2 =
15 A
Ig1 =
15 A
10 A
Ia = 60 A
10 A
5 A
50 A
2 A
5 A
40 A
1 A
2 A
30 A
1 A
20 A
10 A
5 A
1 A
0,1 A
400
300
200
100
0
−100
−200
−300
−400
−500
0
2,5
5
7,5
10
12,5
15
Va (kV)

Fig. 2.

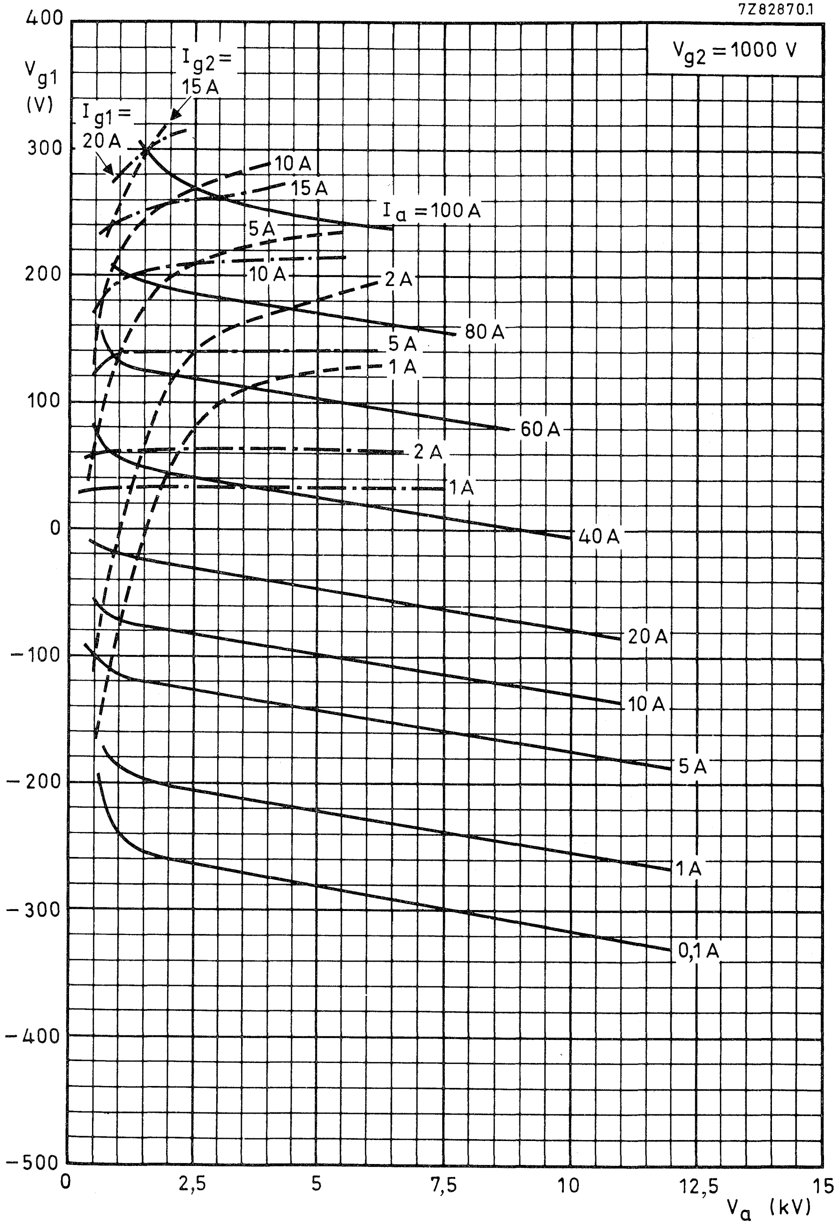

7Z82870.1
$V_{g2} = 1000$ V
V_{g1} (V)
$I_{g2} =$ 15 A
$I_{g1} =$ 20 A
10 A
15 A
$I_a = 100$ A
5 A
10 A
2 A
80 A
5 A
1 A
60 A
2 A
1 A
40 A
20 A
10 A
5 A
1 A
0,1 A
400
300
200
100
0
−100
−200
−300
−400
−500
0
2,5
5
7,5
10
12,5
15
V_a (kV)

Fig. 3.

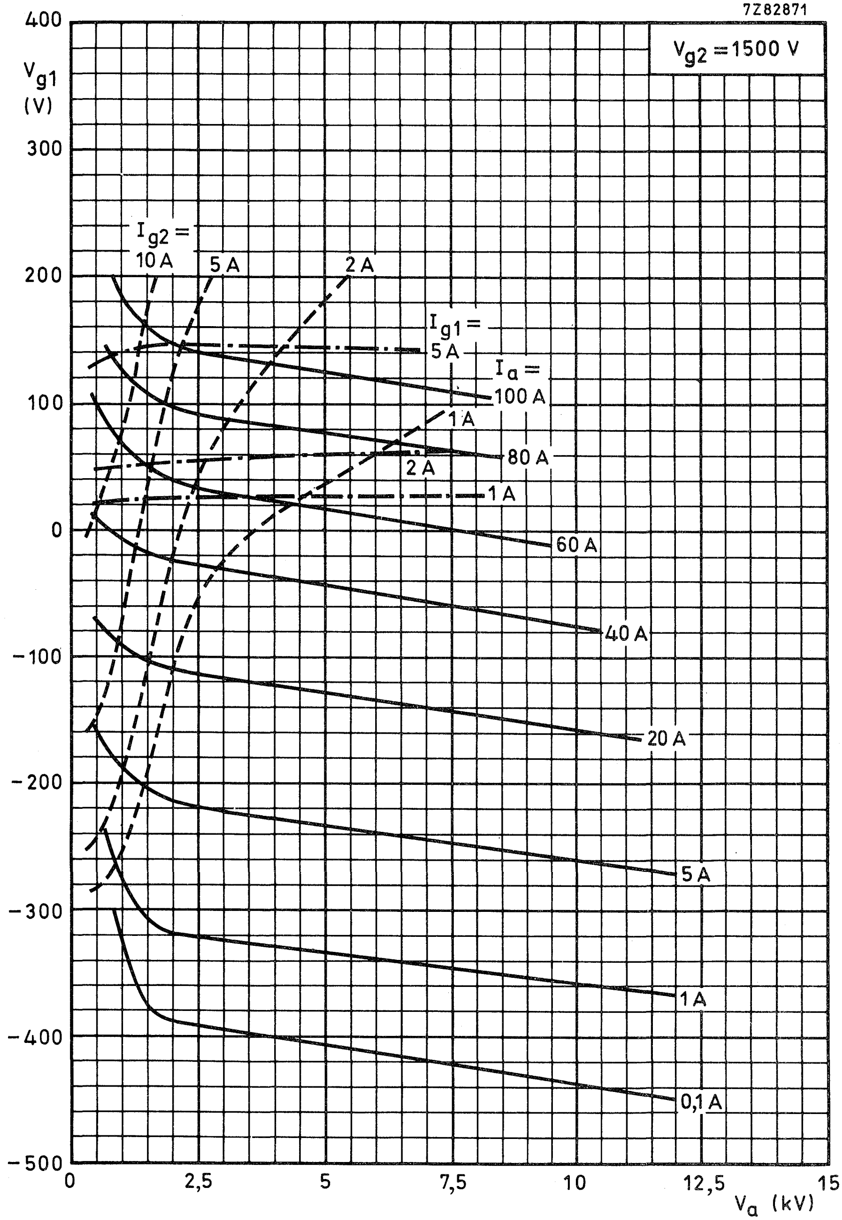

7Z82871
V_{g2} = 1500 V
V_{g1} (V)
400
300
200
100
0
-100
-200
-300
-400
-500
I_{g2} =
10 A
5 A
2 A
I_{g1} =
5 A
2 A
1 A
I_a =
100 A
80 A
60 A
40 A
20 A
5 A
1 A
0,1 A
0
2,5
5
7,5
10
12,5
15
V_a (kV)

Fig. 4.

WATER COOLED R.F. POWER TETRODE

Water cooled coaxial power tetrode in metal-ceramic construction primarily intended for use in r.f. power amplifier applications up to 250 MHz.

QUICK REFERENCE DATA

Class-AB amplifier				
Frequency	f	200	30	MHz
Anode voltage	V_a	10	10	kV
Output power in load	W_ℓ	65	120	kW

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		$12^{+1\%}_{-3\%}$	V
Filament current	I_f		265	A
Filament peak starting current	I_{fp}	max.	1500	A
Cold filament resistance	R_{fo}		4,6	mΩ
Waiting time	t_w		10	s

The filament is designed to accept temporary fluctuations of ± 5%

TYPICAL CHARACTERISTICS

Anode voltage	V_a		10	kV
Grid 2 voltage	V_{g2}		900	V
Anode current	I_a		10	A
Transconductance	S	≈	120	mA/V
Amplification factor	μ_{g2g1}		4,5	

CAPACITANCES

		grounded cathode	grounded grid	
Input	C_i	347	160	pF
Output	C_o	45	45	pF
Anode to grid 1	C_{ag1}	3,2	–	pF
Anode to filament	C_{ak}	–	0,8	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240	°C
Recommended maximum seal temperature	T	max.	200	°C

COOLING

$W_a + W_g$ kW	T_i °C	q ℓ/min.	p_i kPa	max. T_{out} °C
100	20	50	65	50
	50	80	120	70
80	20	34	30	54
	50	54	55	72
40	20	15	7	60
	50	24	13	75

Absolute maximum water inlet temperature	T_i	50 °C
Absolute maximum water pressure	p_i	600 kPa

An air flow of at least 2 m^3/min should be ducted to the seals to keep the seal temperature below 200 °C.

R.F. CLASS-AB POWER AMPLIFIER

Unless otherwise stated, the vo'tages are given with respect to the cathode.

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	250 MHz
Anode voltage	V_a	max.	14 kV
Grid 2 voltage	V_{g2}	max.	1200 V
Grid 1 voltage	$-V_{g1}$	max.	600 V
Anode dissipation	W_a	max.	100 kW
Grid 2 dissipation	W_{g2}	max.	1,8 kW
Grid 1 dissipation	W_{g1}	max.	0,8 kW
Cathode current	I_k	max.	22 A

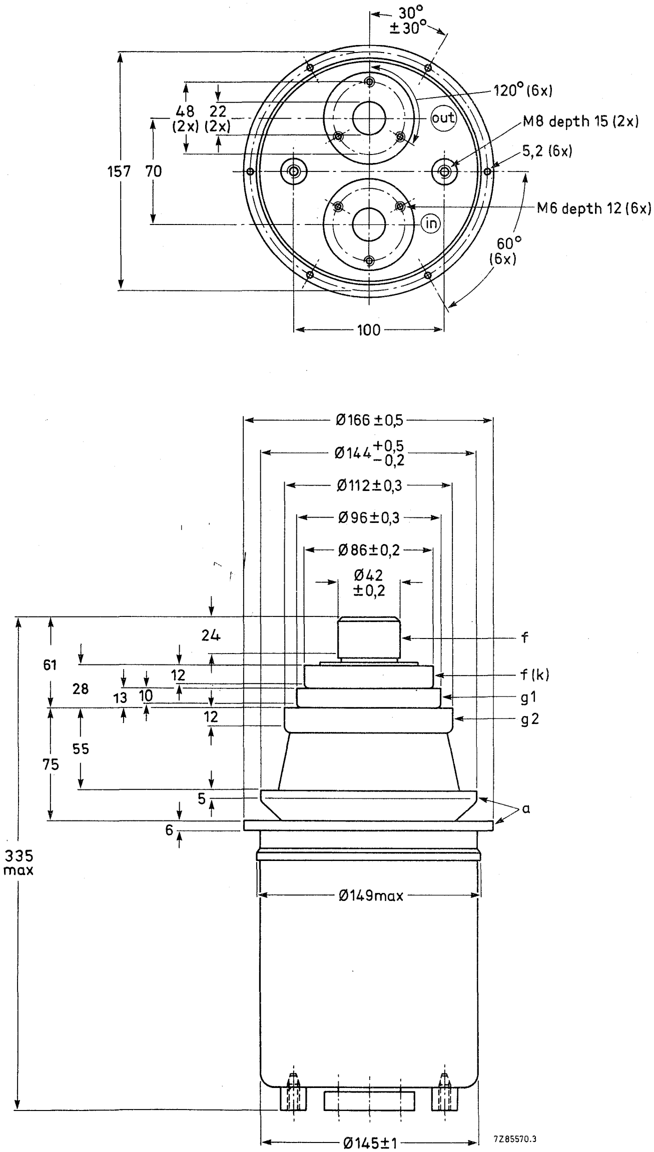
OPERATING CONDITIONS		grounded cathode	grounded grid	
Frequency	f	⩽ 30	200	MHz
Anode voltage	V_a	10	10	kV
Grid 2 voltage	V_{g2}	900	900	V
Grid 1 voltage	$-V_{g1}$*	330	400	V
Anode current, no-signal condition	I_a	1,0	0,5	A
Anode current	I_a	17	12	A
Grid 2 current	I_{g2}	0,9	0,5	A
Grid 1 current	I_{g1}	1,75	0,5	A
Output power in load	W_ℓ	⩾ 120	65	kW
Driving power	W_{dr}	≈ 1	3,5	kW

* To be adjusted for the stated no signal anode current.

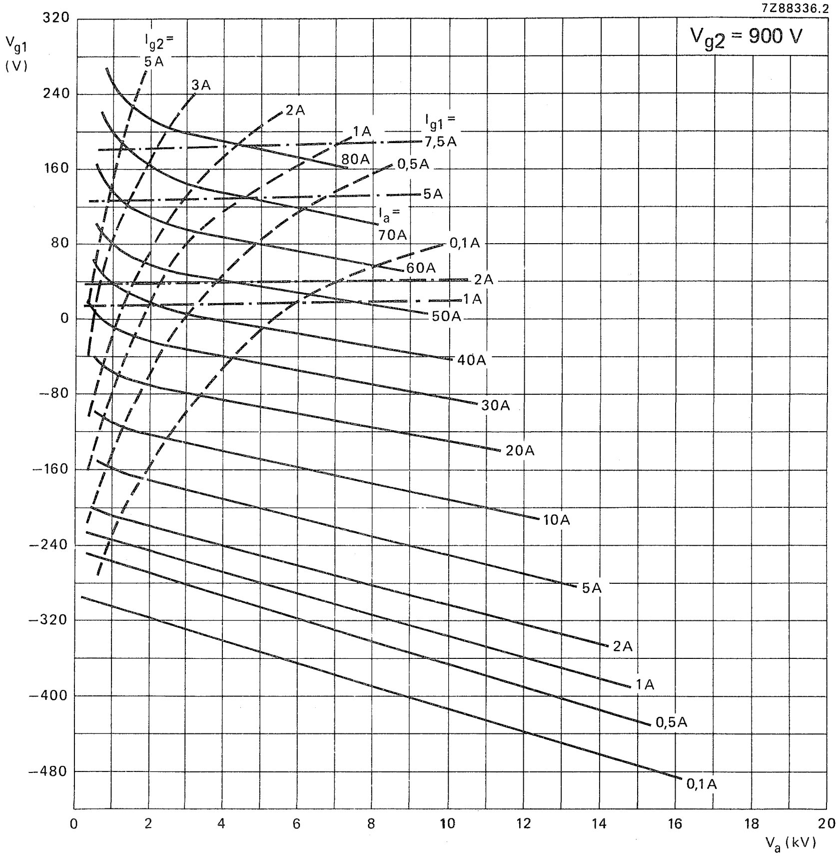
MECHANICAL DATA

Net mass approx. 12 kg

Mounting position vertical with anode up (normal position) or anode down with reversed direction of water flow.



DEVELOPMENT SAMPLE DATA


7Z88336.2
V_{g2} = 900 V
V_{g1} (V)
320
240
160
80
0
−80
−160
−240
−320
−400
−480
I_{g2} =
5A
3A
2A
1A
0,5A
0,1A
I_{g1} =
7,5A
5A
2A
1A
I_a =
80A
70A
60A
50A
40A
30A
20A
10A
5A
2A
1A
0,5A
0,1A
0
2
4
6
8
10
12
14
16
18
20
V_a (kV)

AIR-COOLED R.F. POWER TETRODE

for grounded cathode operation

Forced air-cooled coaxial power tetrode in metal-ceramic construction primarily intended for use as grid-driven linear amplifier for single sideband, suppressed carrier service. This type is also recommended for f.m. broadcast applications. The electrode arrangement is specially designed for grounded cathode operation.

QUICK REFERENCE DATA

Class-AB linear SSB amplifier

Frequency	f		1,5 to 30	MHz
Anode voltage	V_a		8	kV
Output power in load	W_l		10	kW
Power gain	G		23	dB

Class-AB FM amplifier

Frequency	f		110	MHz
Anode voltage	V_a	6,5	7,5	kV
Output power in load	W_l	10	20	kW
Power gain	G	23	22	dB

HEATING: direct; thoriated tungsten filament, mesh type

Filament voltage	V_f	10,4	$V^{+1\%}_{-3\%}$
Filament current	I_f	115	A
Filament peak starting current	I_{f_p} max.	750	A
Cold filament resistance	R_{f_o}	10,5	mΩ
Waiting time	t_w min.	1	s

TYPICAL CHARACTERISTICS

Anode voltage	V_a	8	kV
Grid 2 voltage	V_{g2}	700	V
Anode current	I_a	2,4	A
Transconductance	S	60	mA/V
Amplification factor	μ_{g2g1}	8,5	

CAPACITANCES, grounded cathode

Input	C_i	135	pF
Output	C_o	23	pF
Anode to grid 1	C_{ag1}	0,85	pF

TEMPERATURE LIMITS

Absolute maximum envelope temperature	T_{env}	max.	240 °C
Recommended maximum seal temperature	T	max.	200 °C

→ COOLING

$W_a + W_g$ kW	h m	T_i °C	q_{min} m^3/min	P_a P_i tube only	P_a P_i tube + cavity	T_o max °C
16	0	25	14	1300	1950	100
10	0	25	8	550	750	100
16	0	55	18	1900	2900	110
10	0	55	12	1000	1500	110
16	1500	25	16	1500	2200	100
10	1500	25	10	700	1000	100
16	3000	25	18	1500	2200	100
10	3000	25	12	800	1200	100

For direction of air flow see outline drawing. The air should be ducted so that sufficient air is directed to the seals to keep the seal temperature below the limit.

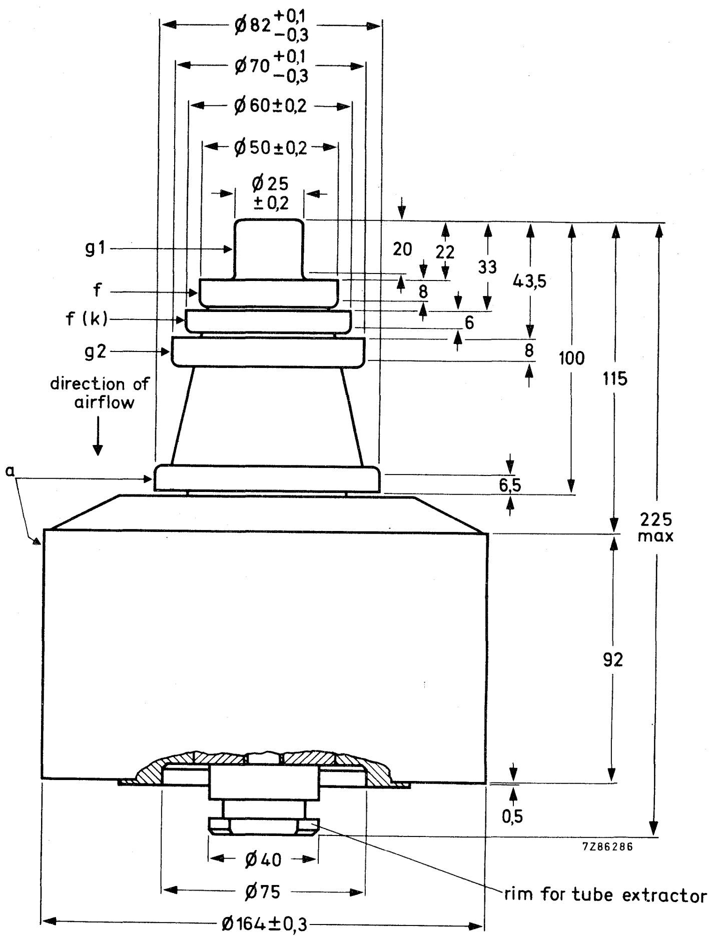
DEVELOPMENT SAMPLE DATA

MECHANICAL DATA

Dimensions in mm

Net weight: approx. 11 kg

Mounting position: vertical with anode up or down



ACCESSORIES

Band II amplifier circuit assembly | type 40788A

The electrode connection arrangement allows easy grounded cathode operation.

LIMITING VALUES (Absolute maximum rating system)				notes
Frequency	f	up to 120	MHz	
Anode voltage	V_a	9	kV	
Grid 2 voltage	V_{g2}	1	kV	
Grid 1 voltage	$-V_{g1}$	500	V	
Anode current	I_a	7	A	
Anode input power	W_{ia}	40	kW	
Anode dissipation	W_a	18	kW	
Grid 2 dissipation	W_{g2}	100	W	
→ Grid 1 dissipation	W_{g1}	50	W	

OPERATING CONDITIONS, grid driven

R.F. CLASS-AB LINEAR AMPLIFIER, SINGLE SIDEBAND, SUPPRESSED CARRIER

Unless otherwise specified the voltages are given with respect to the cathode.

Frequency	f		30			MHz	
Anode voltage	V_a		8			kV	
Grid 2 voltage	V_{g2}		900			V	
→ Grid 1 voltage	$-V_{g1}$	≈	100			V	1

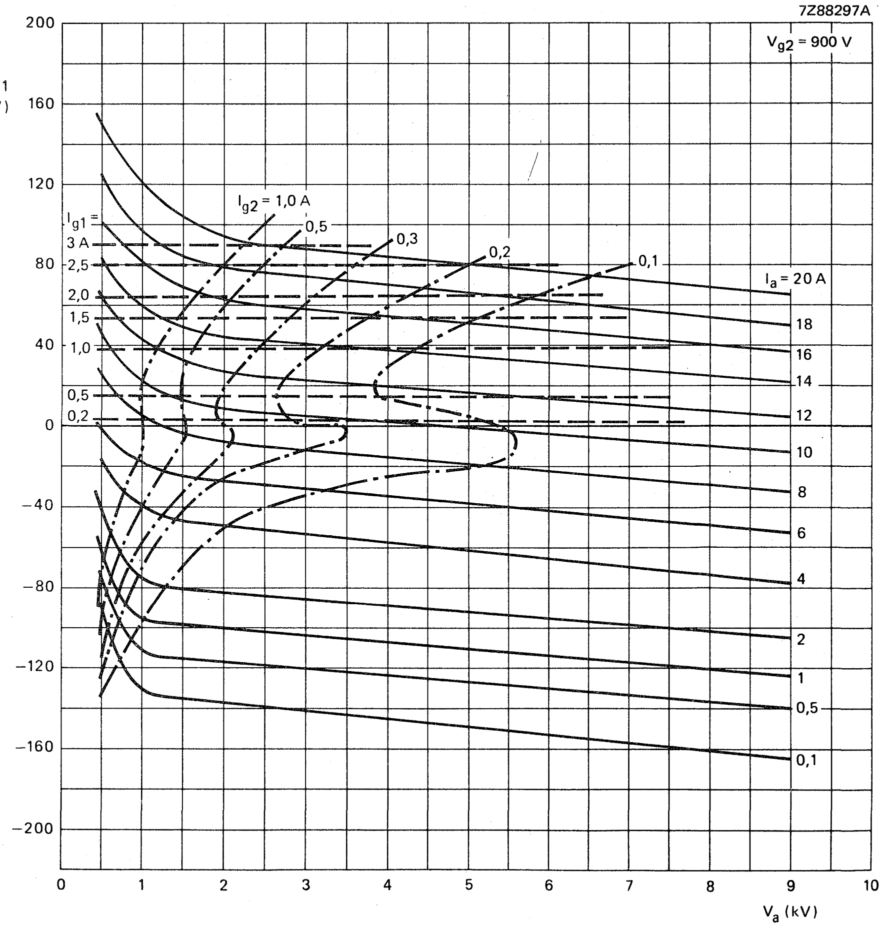
			zero signal	single tone signal	double tone signal		notes
Grid 1 driving voltage, peak	V_{g1p}		0	< 100	< 100	V	
Anode current	I_a		1,2	2,5	1,9	A	
Grid 2 current	I_{g2}	≈	10	50	15	mA	
Grid 1 current	I_{g1}	≈	0	0	0	mA	
Anode input power	W_{ia}		9,6	20	15,2	kW	
Anode dissipation	W_a		9,6	9,8	10	kW	
Output power in load (PEP)	W_ℓ		–	> 10	10	kW	
Total efficiency	η		–	50	33	%	
Intermodulation distortion							
3rd order	d_3		–	–	< –40	dB	2
5th order	d_5		–	–	< –60	dB	2

Notes

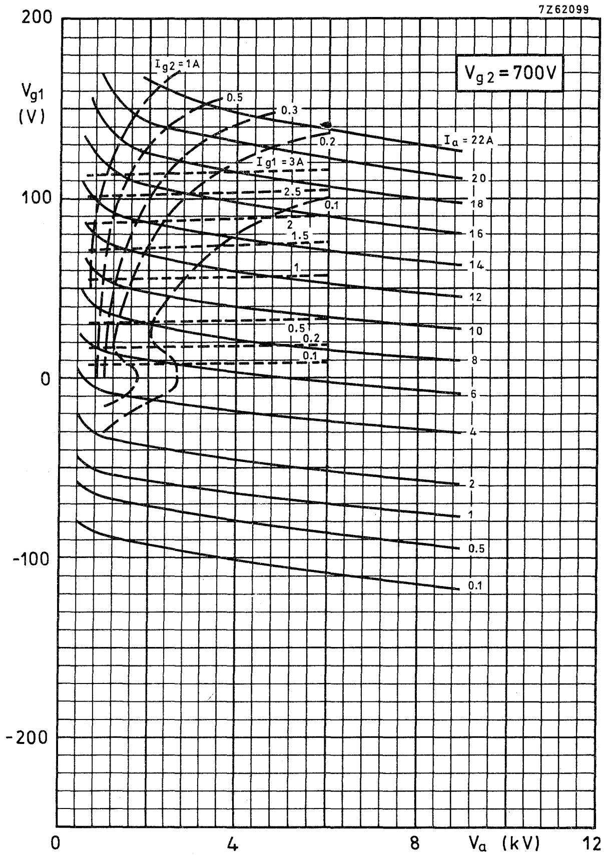
1. To be adjusted to zero signal current.
2. With reference to zero dB level.

CLASS-AB FM AMPLIFIER

Frequency	f		87-110		MHz
Anode voltage	V_a		6,5	7,5	kV
Grid 2 voltage	V_{g2}		700	900	V
Grid 1 voltage	$-V_{g1}$	≈	110	135	V (note 1)
Anode current, no signal conditions	I_a	≈	0,5	0,5	A
Anode current	I_a		2,4	4,1	A
Grid 2 current	I_{g2}	≈	100	100	mA
Grid 1 current	I_{g1}	≈	100	200	mA
Output power in load	W_{ℓ}		10	20	kW
Driving power	W_{dr}		50	130	W
Power gain	G		23	21	dB



DEVELOPMENT SAMPLE DATA


7Z62099
$V_{g2} = 700V$
V_{g1} (V)
200
100
0
-100
-200
0
4
8
12
V_a (kV)
$I_{g2} = 1A$
0.5
0.3
0.2
0.1
$I_{g1} = 3A$
2.5
2
1.5
1
0.5
0.2
0.1
$I_a = 22A$
20
18
16
14
12
10
8
6
4
2
1
0.5
0.1

AMPLIFIER CIRCUIT ASSEMBLIES

GENERAL DATA FOR AMPLIFIER CIRCUIT ASSEMBLIES

OPERATING CONDITIONS

For detailed operating conditions see DATA of the relevant tubes used in the assembly.

IMPEDANCES

Input and output impedance 50 Ω
Details on r.f. connector see page H22.

ENVIRONMENTAL CONDITIONS

Ambient temperature range	T_{amb}		0 to + 55	^{o}C
Altitude	h	max.	3000	m
Relative humidity		<	90	%
V S W R		max.	3	

COOLING CURVES

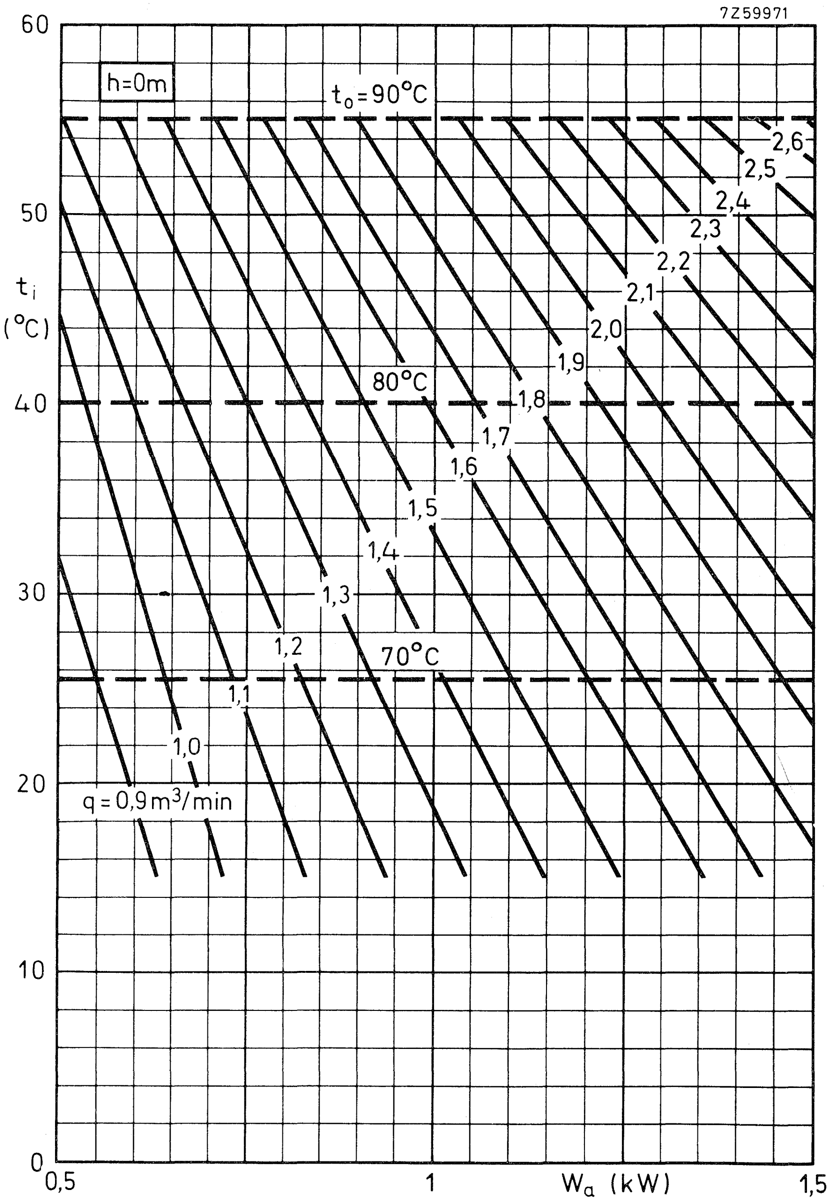
Cooling curves are given at three altitudes: h = sea level, h = 1500 m and h = 3000 m, see the following pages H4 to H21. Amounts of air quantities are minimum values.

APPLICATIONS

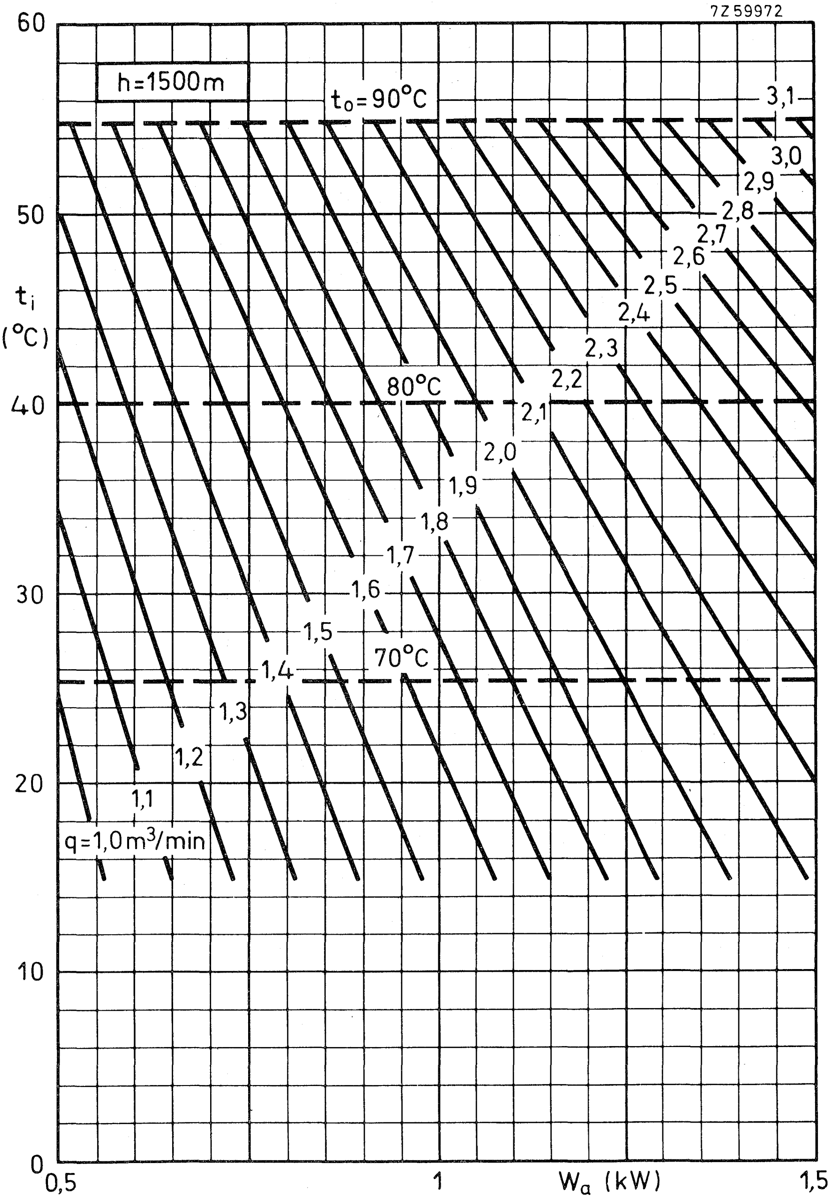
SOUND	VISION + SOUND/VISION
40744	40743
40746	40745
40748	40747
40756	40755
40758	40757
40760	40759
40775	40768
40777	40776
40778*	40782V
40782S*	40783
40769*	40786
40788*	40787

* Data available on request.

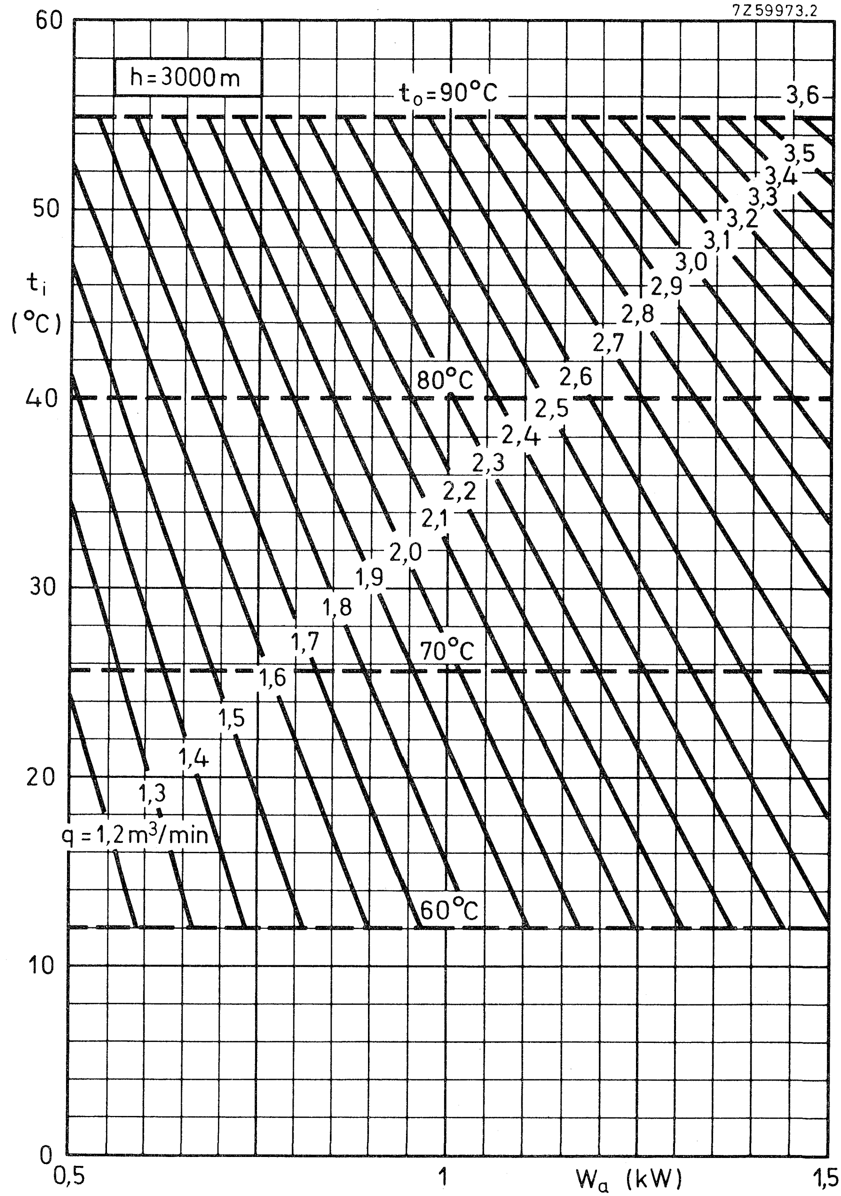
Cooling curves for assemblies 40743, 40744, 40755 and 40756 with tube YL1440.
Altitude: sea level



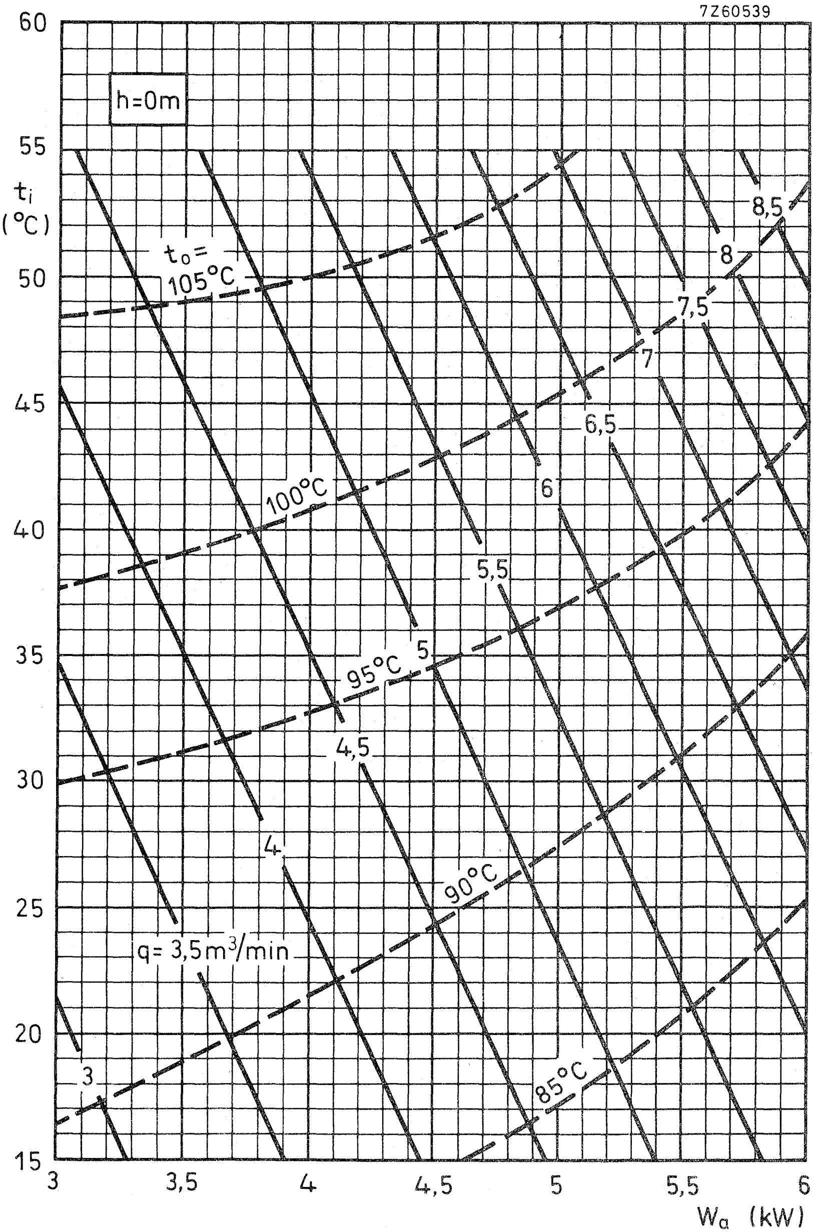
Cooling curves for assemblies 40743, 40744, 40755 and 40756 with tube YL1440.
Altitude: 1500 m



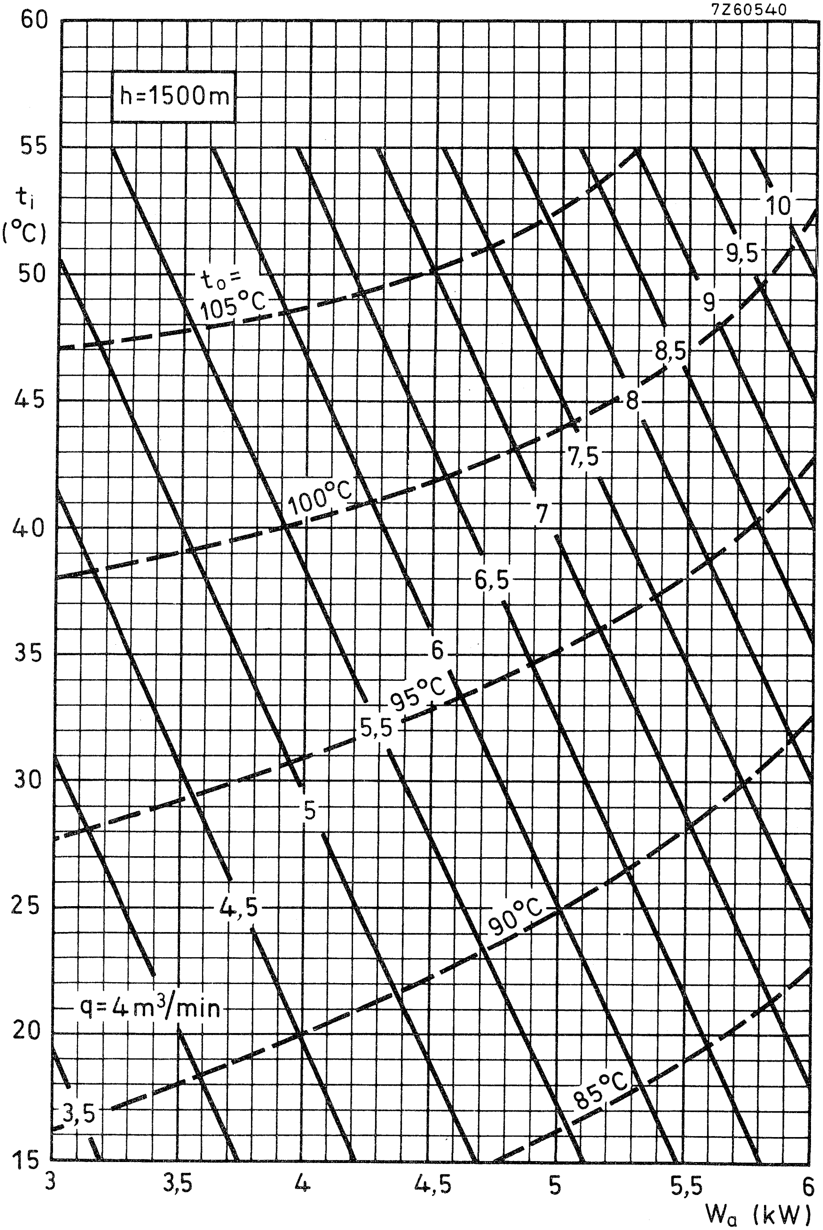
Cooling curves for assemblies 40743, 40744, 40755 and 40756 with tube YL1440.
Altitude: 3000 m



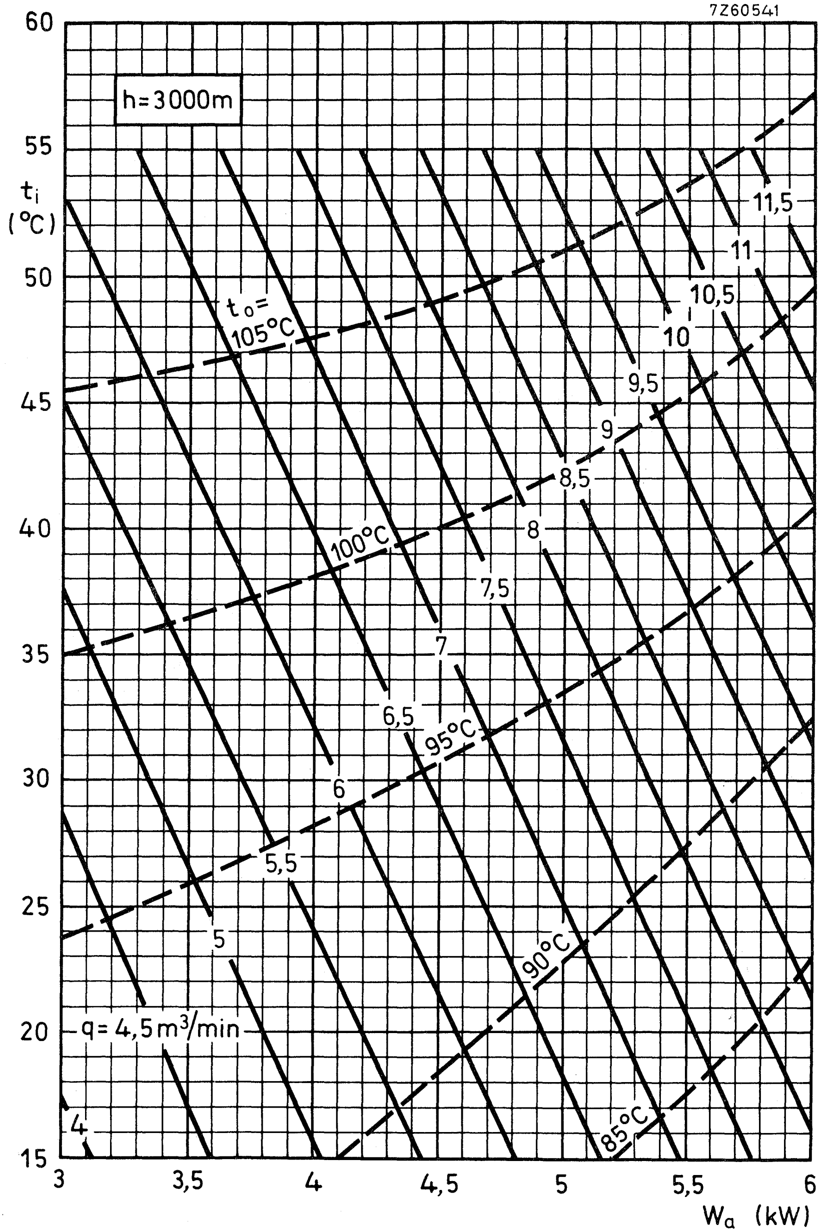
Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.
Altitude: sea level



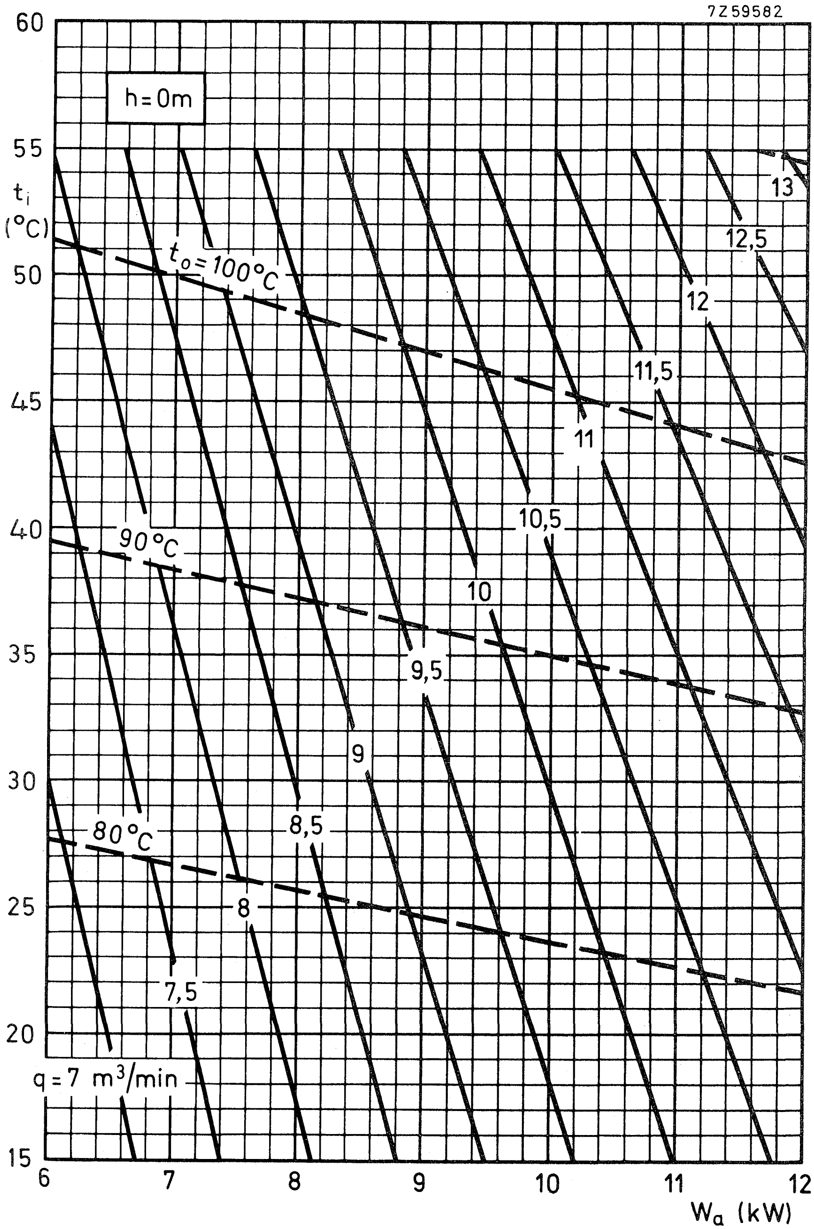
Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.
Altitude: 1500 m



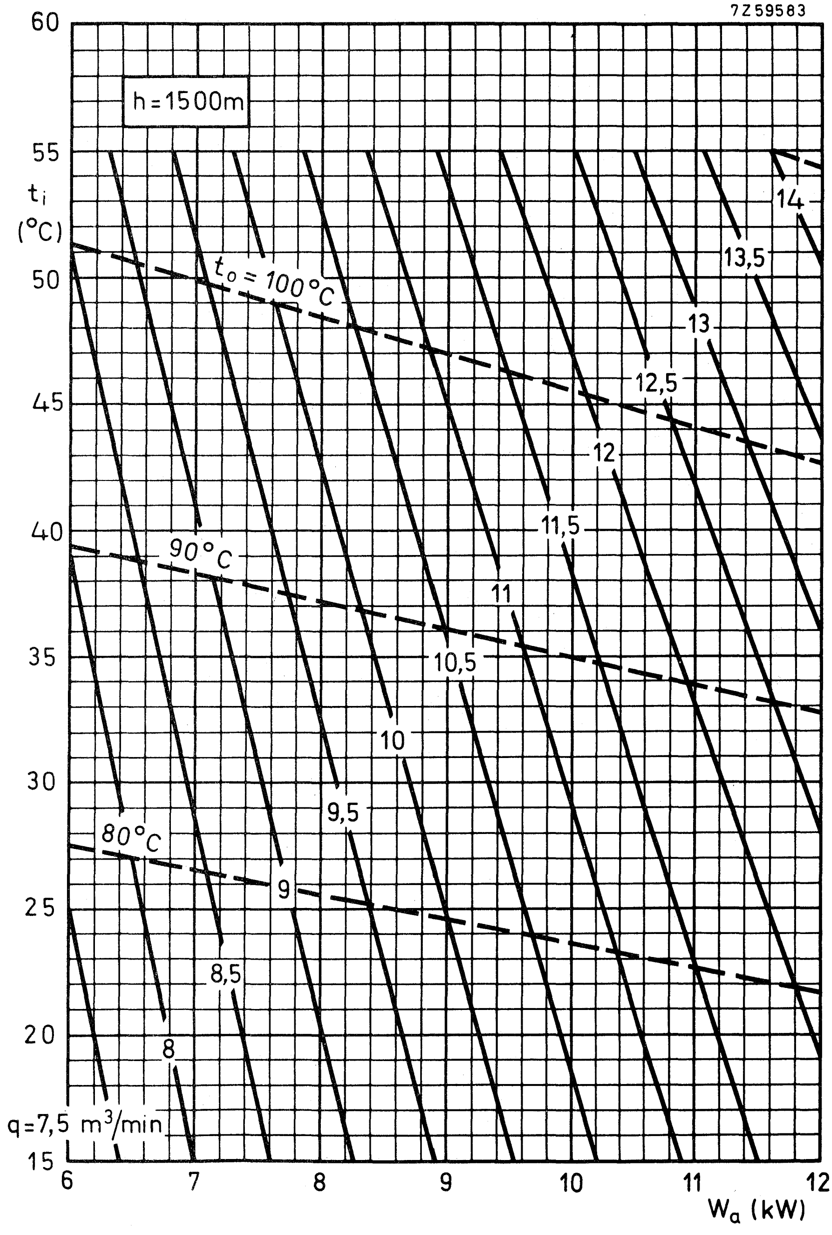
Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.
Altitude: 3000 m



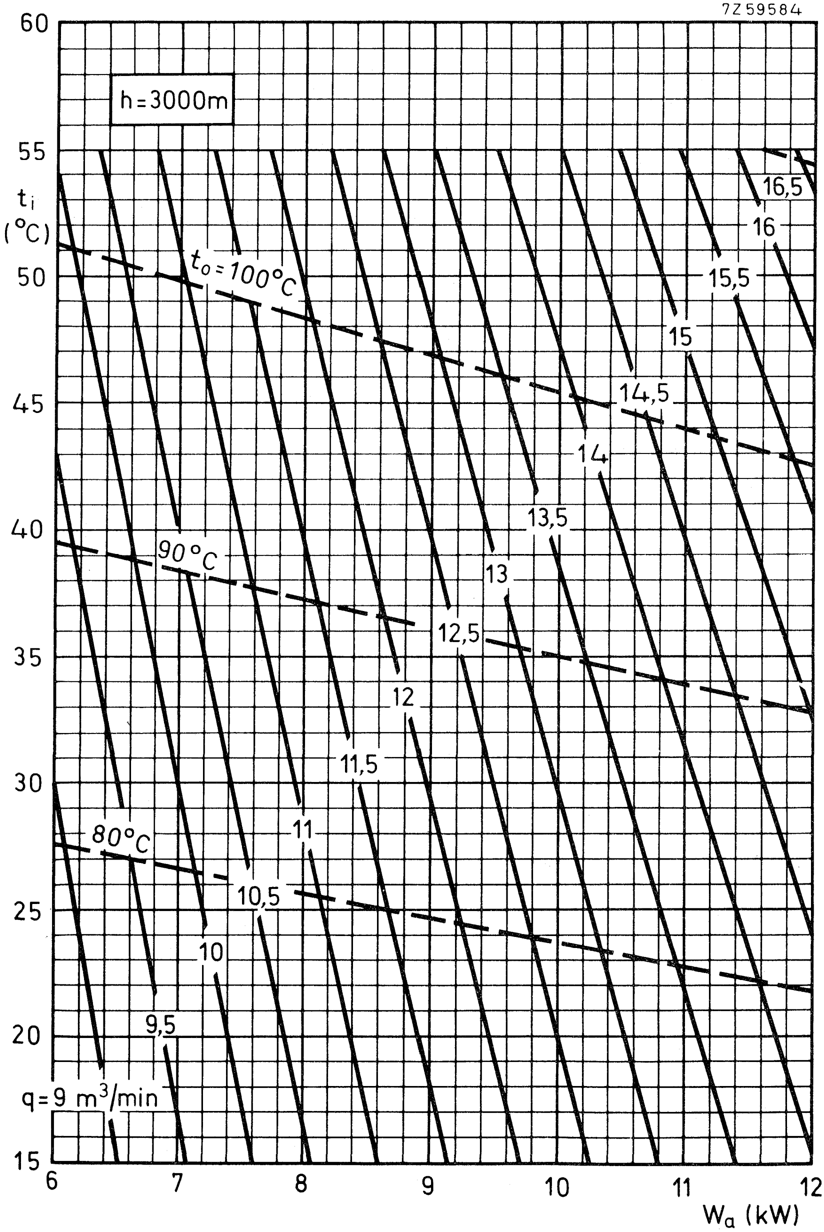
Cooling curves for assemblies 40747, 40748, 40759 and 40760 with tube YL1430.
Altitude: sea level



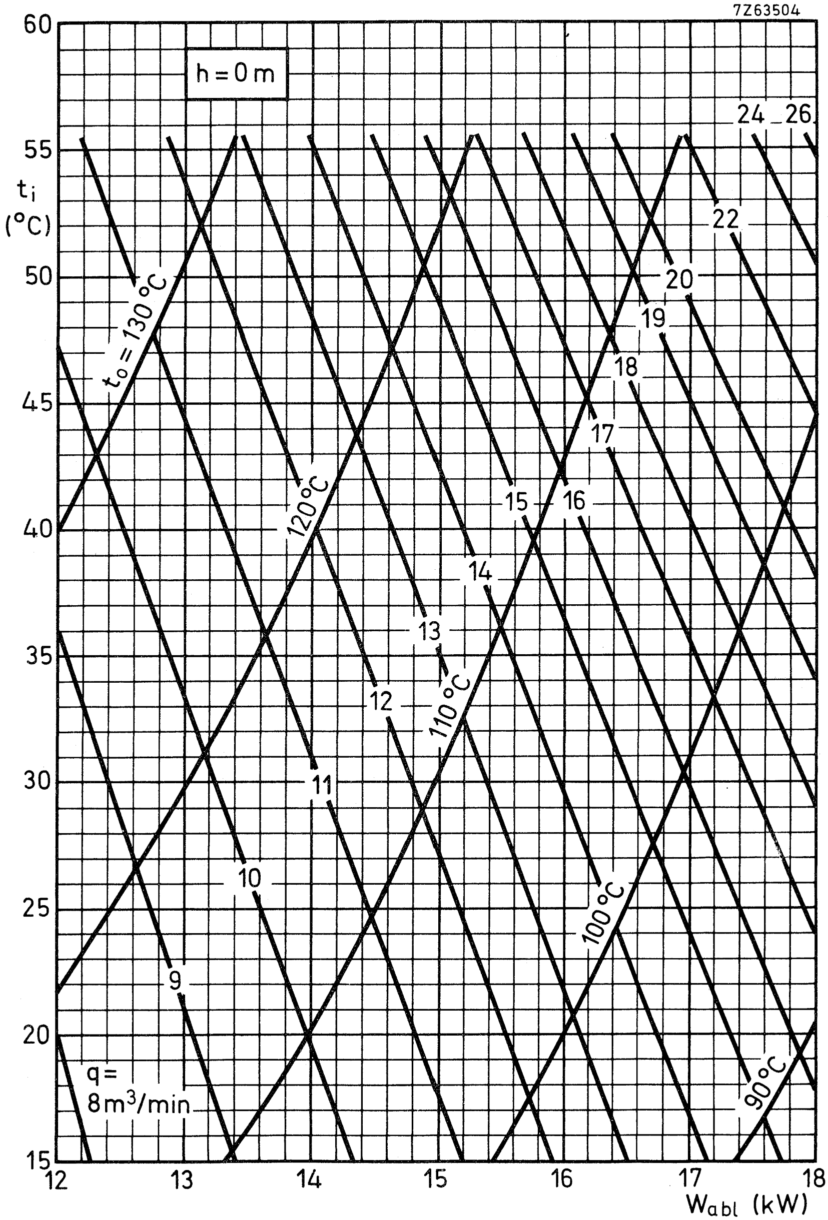
Cooling curves for assemblies 40747, 40748, 40759 and 40760 with tube YL1430.
Altitude: 1500 m



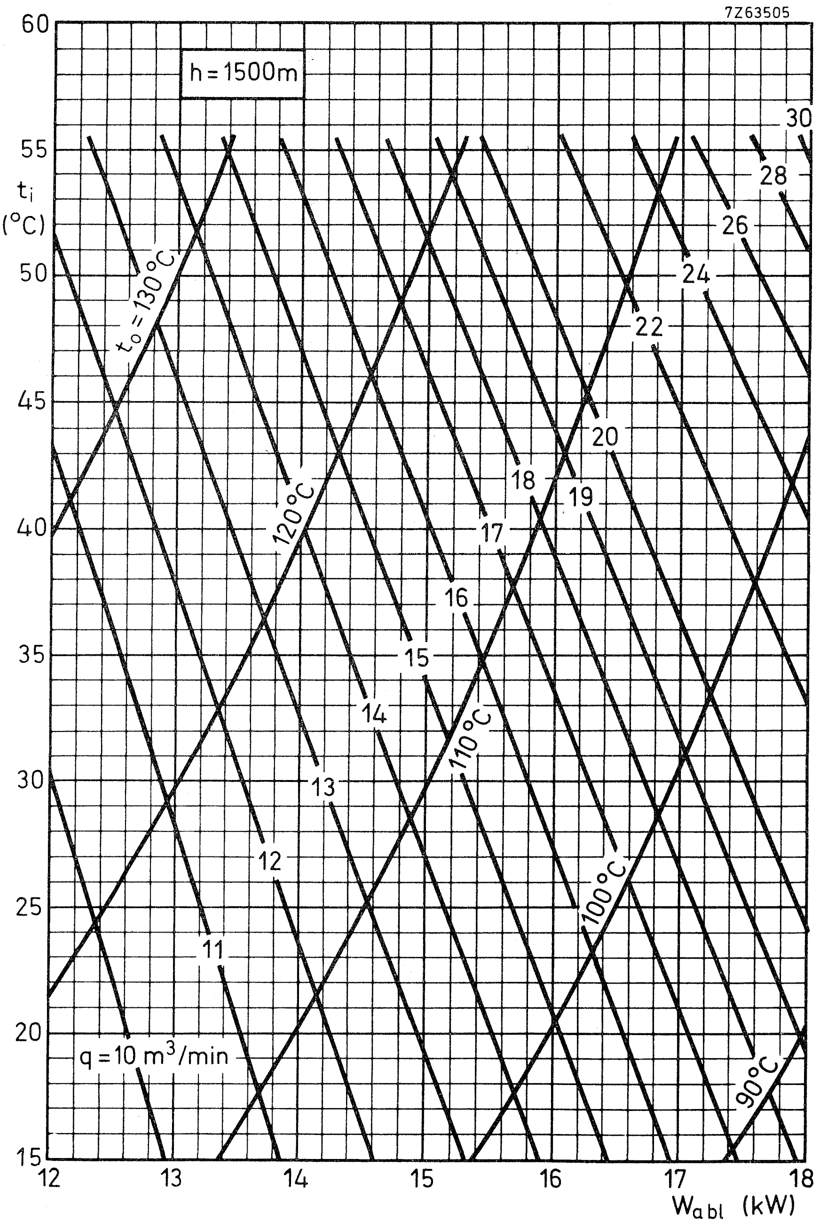
Cooling curves for assemblies 40747, 40748, 40759 and 40760 with tube YL1430.
Altitude: 3000 m



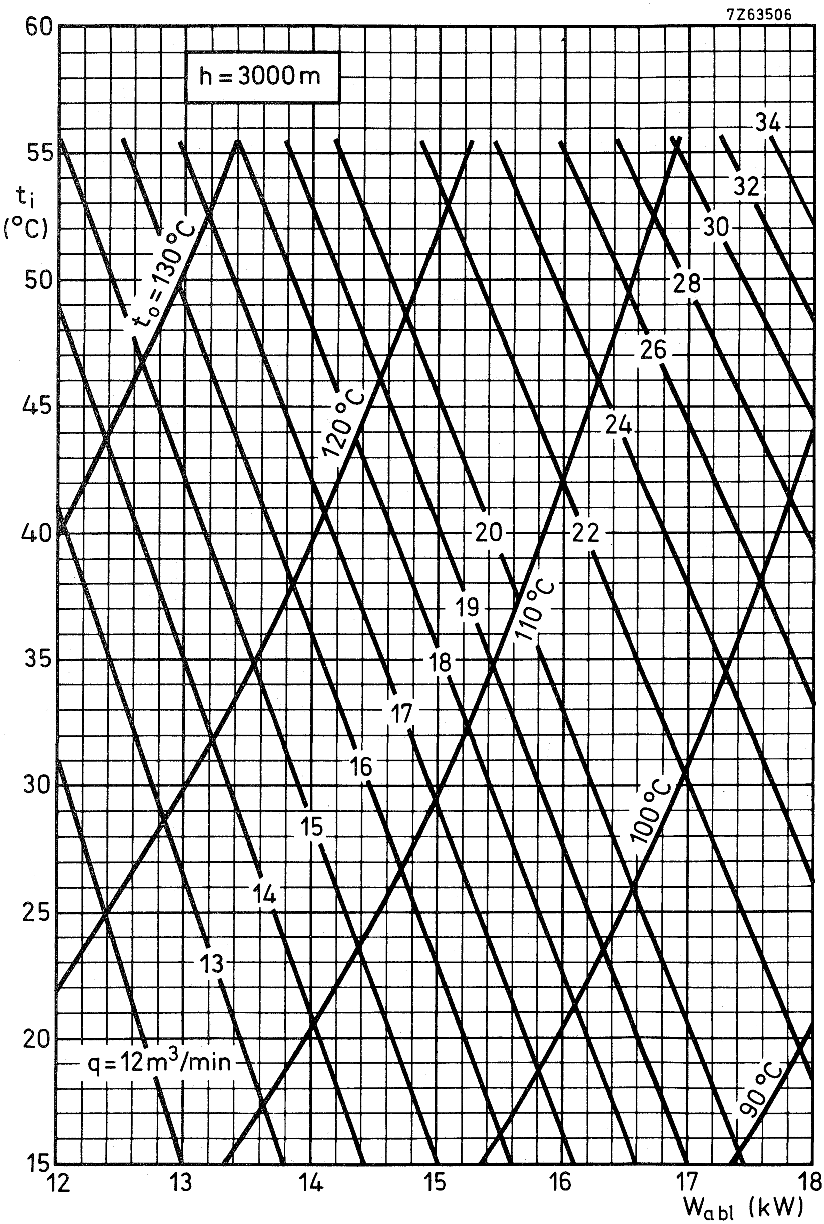
Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.
Altitude: sea level



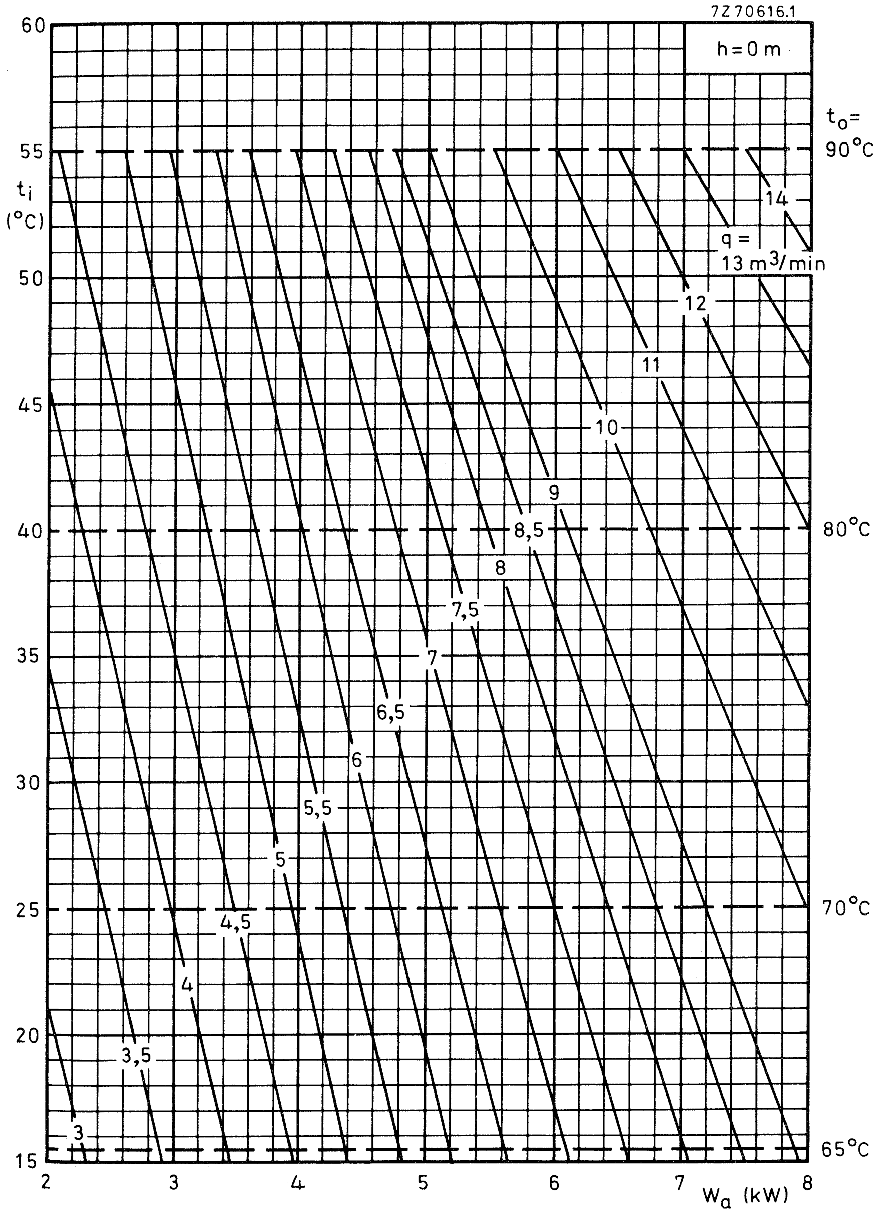
Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.
Altitude: 1500 m



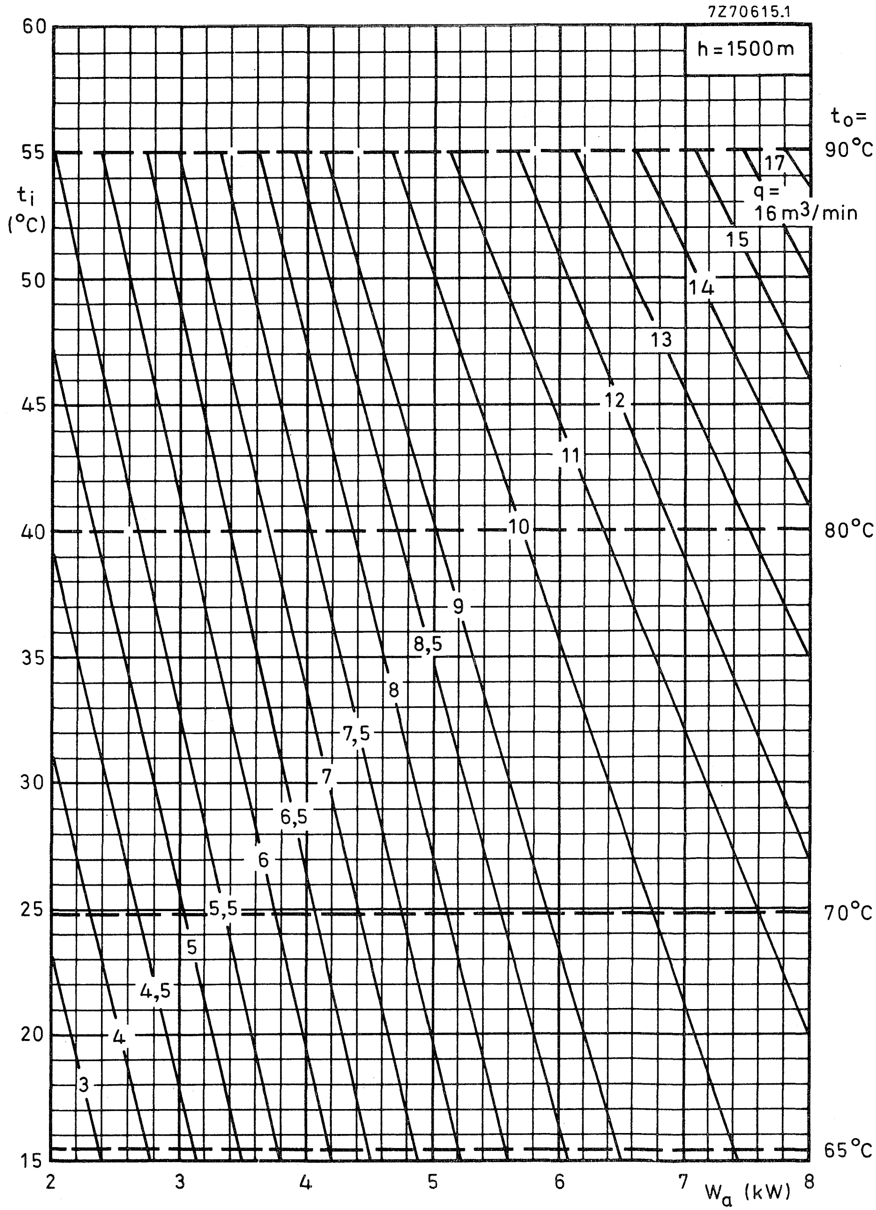
Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.
Altitude: 3000 m



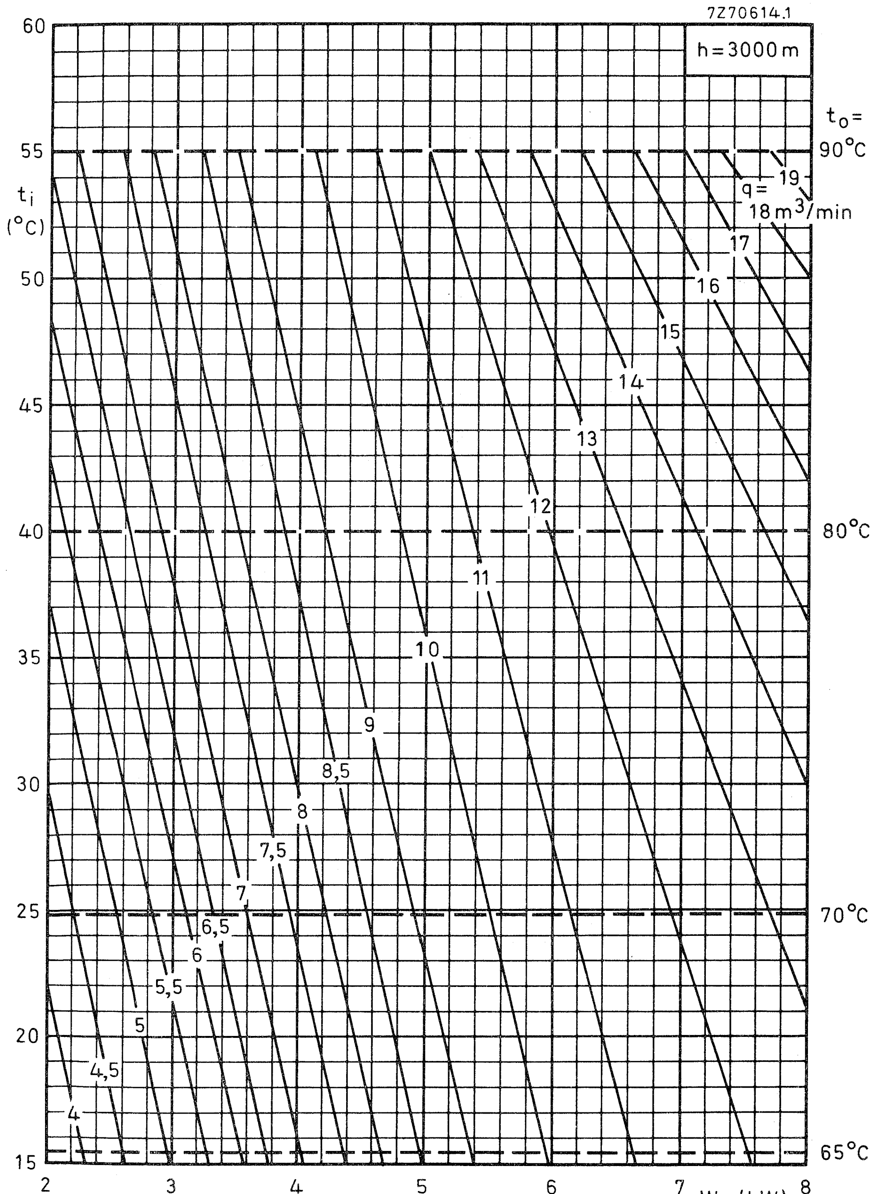
Cooling curves for assembly 40775 with tube YL1470.
Altitude: sea level



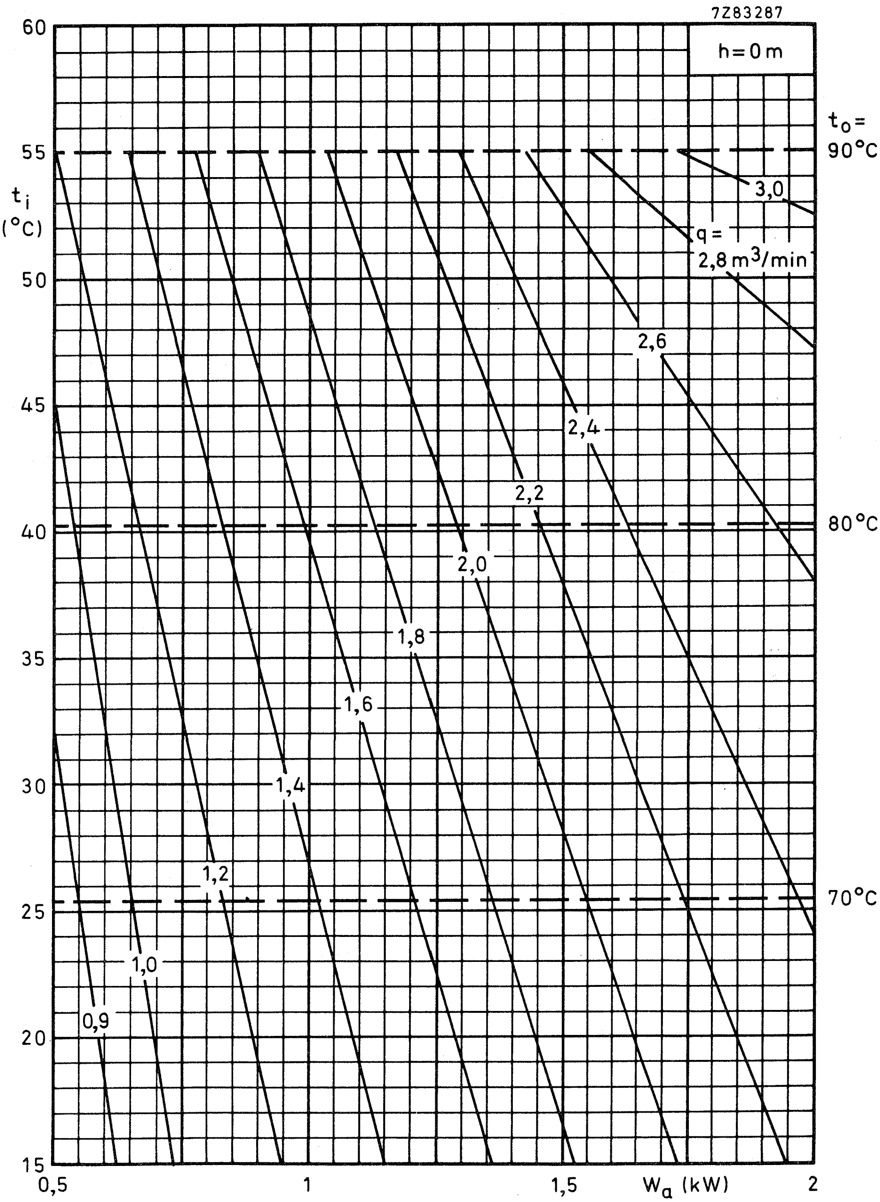
Cooling curves for assembly 40775 with tube YL1470.
Altitude: 1500 m



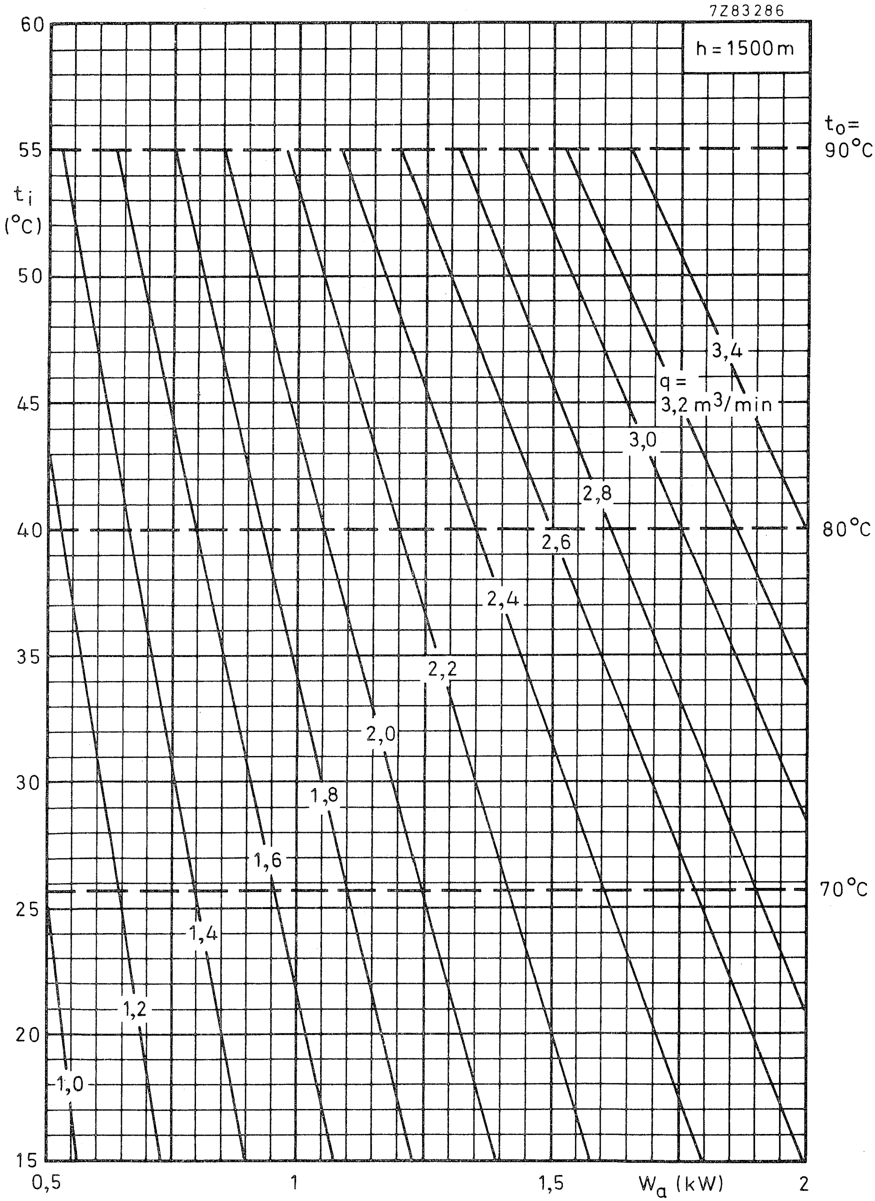
Cooling curves for assembly 40775 with tube YL1470.
Altitude: 3000 m



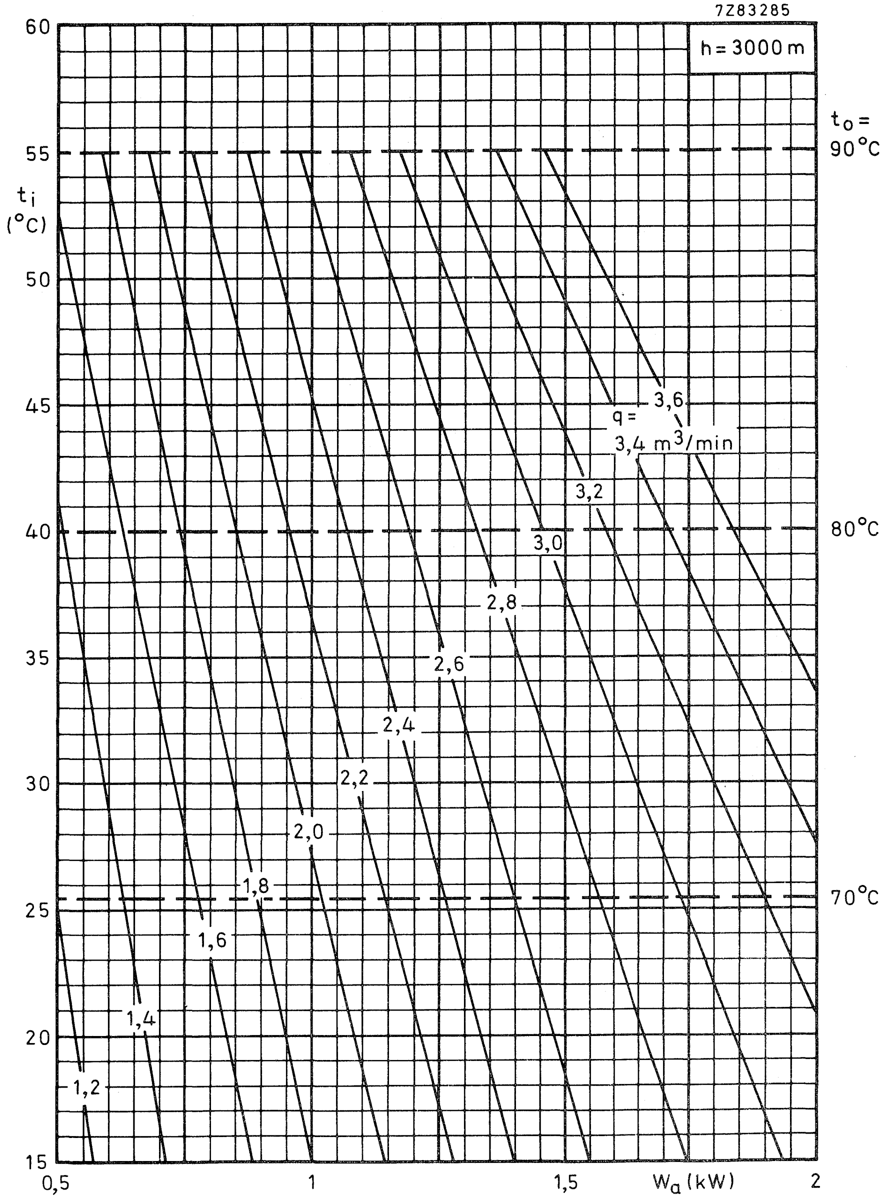
Cooling curves for assemblies 40776 and 40777 with tube YL1540.
Altitude: sea level



Cooling curves for assemblies 40776 and 40777 with tube YL1540.
Altitude: 1500 m

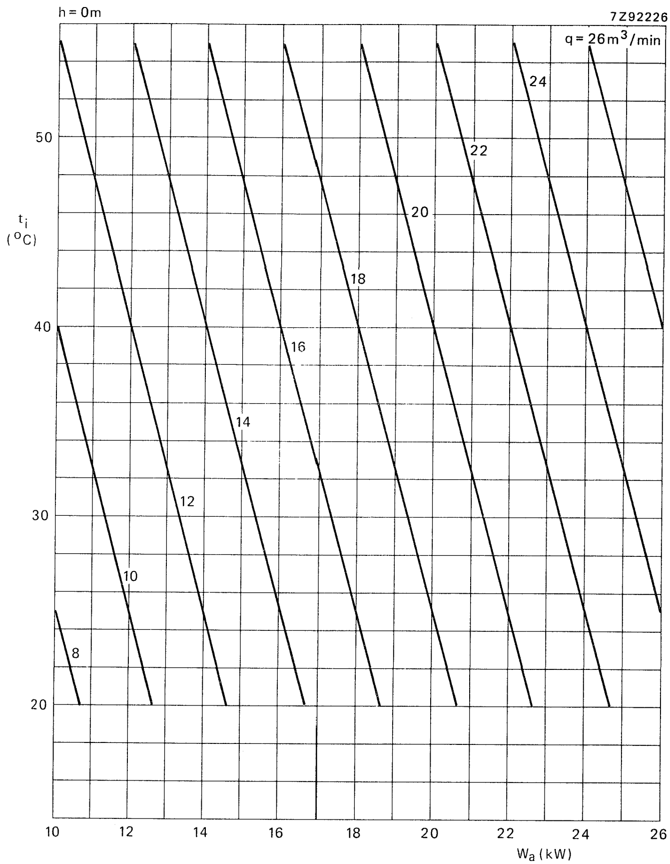


Cooling curves for assemblies 40776 and 40777 with tube YL1540.
Altitude: 3000 m

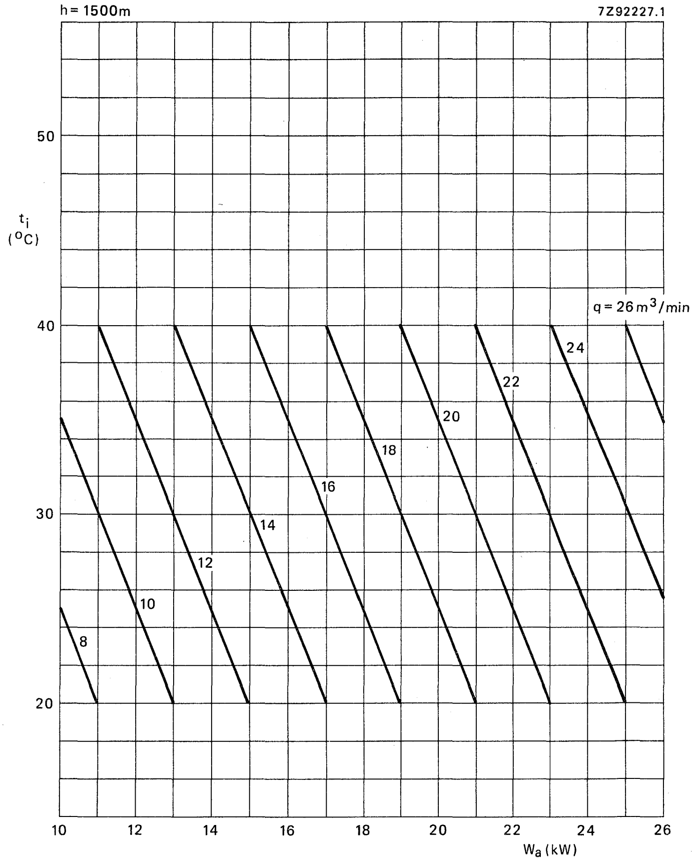


Cooling curves for assembly 40786 with tube YL1630 and YL1631.

Altitude: sea level.

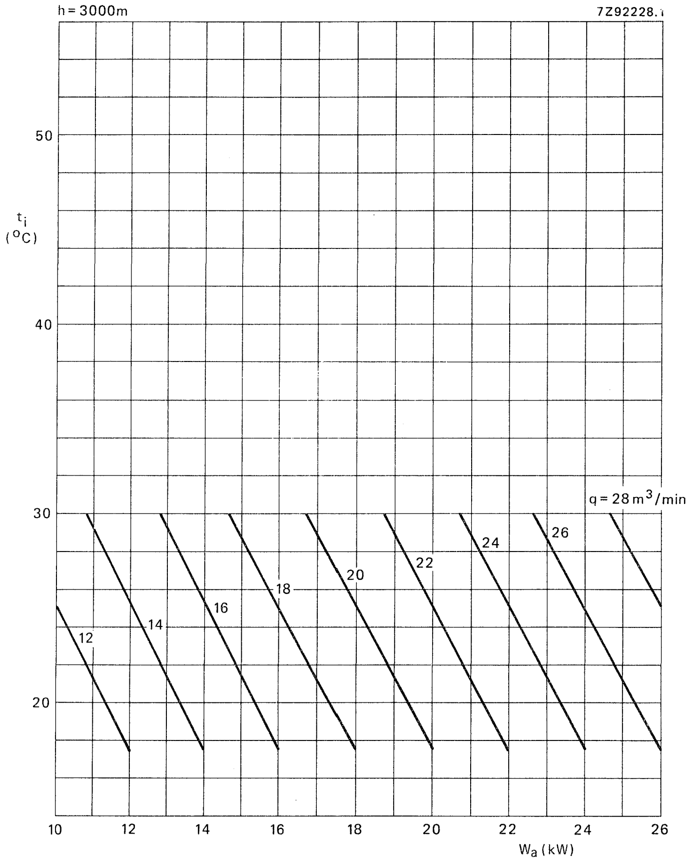


Cooling curves for assembly 40786 with tube YL1630 and YL1631.
Altitude: 1500 m



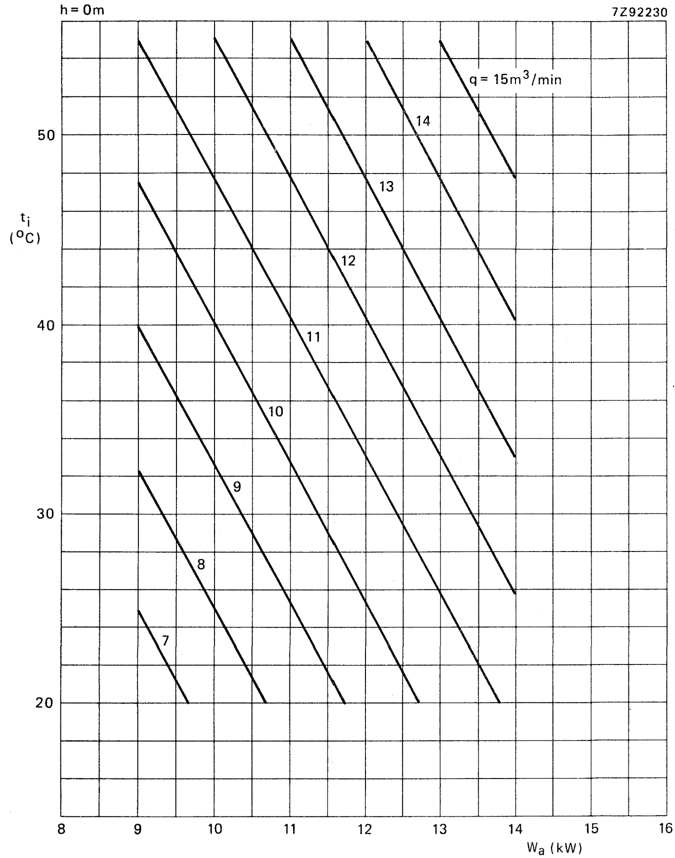
Cooling curves for assembly 40786 with tube YL1630 and YL1631.

Altitude: 3000 m

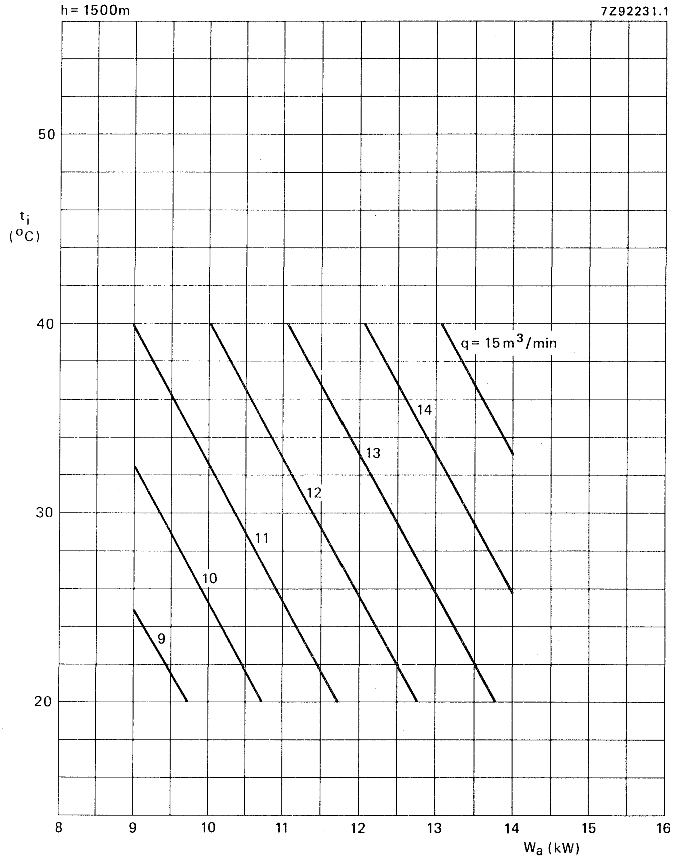


Cooling curves for assembly 40787 with tube YL1610.

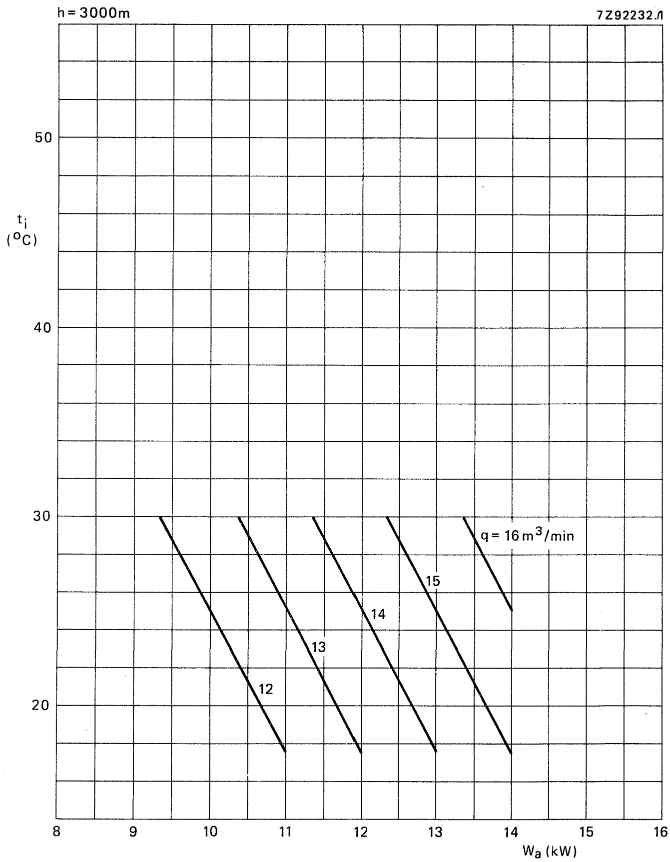
Altitude: sea level.



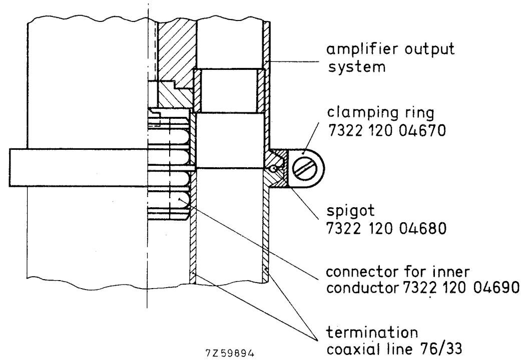
Cooling curves for assembly 40787 with tube YL1610.
Altitude: 1500 m.

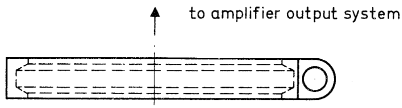


Cooling curves for assembly 40787 with tube YL1610.
Altitude: 3000 m.

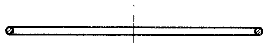


R.F. output connector to be used with assemblies 40745, 40746, 40747, 40748, 40757, 40758, 40759, 40760 and 40768.

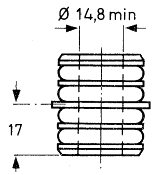




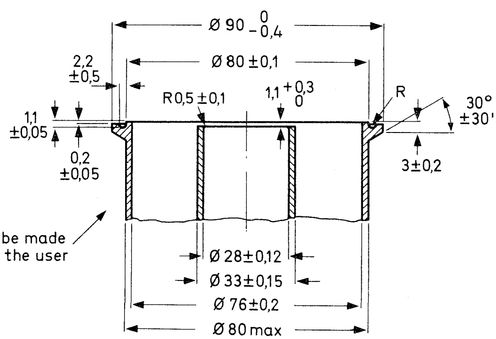
clamping ring 7322 120 04670



spigot 7322 120 04680



connector for inner conductor 7322 120 04690



termination coaxial line 76/33

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440

vision and combined sound/vision

Continuously tunable cavity-type circuit assembly to be used with YL1440 to form a broad-band grounded-grid linear amplifier of television signals in Band III.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)				
Frequency	f	170 to	250	MHz
Anode voltage	V_a	2,5	3	kV
Output power in load, sync	W_ℓ	0,7	1,55	kW
Power gain	G	13,6	14,1	dB
Class-AB amplifier for television transposer service				
Frequency	f	175 to	225	MHz
Anode voltage	V_a		2,5	kV
Output power in load, sync	W_ℓ		0,55	kW
Power gain	G		14,8	dB

FREQUENCY RANGE

Continuously tunable — from 170 to 230 MHz

Slight modification in secondary capacitance makes this cavity suitable in the range 228 to 250 MHz.

COOLING

See relevant curves on pages 200 to 202. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial female connector, type HN.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 02143
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

- Recommended circulators:

Frequency 160 to 178 MHz; type 2722 162 01781
173 to 204 MHz; type 2722 162 01861
200 to 230 MHz; type 2722 162 01851
225 to 270 MHz; type 2722 162 03171

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 673 x 368 x 358 mm
Net mass 38 kg

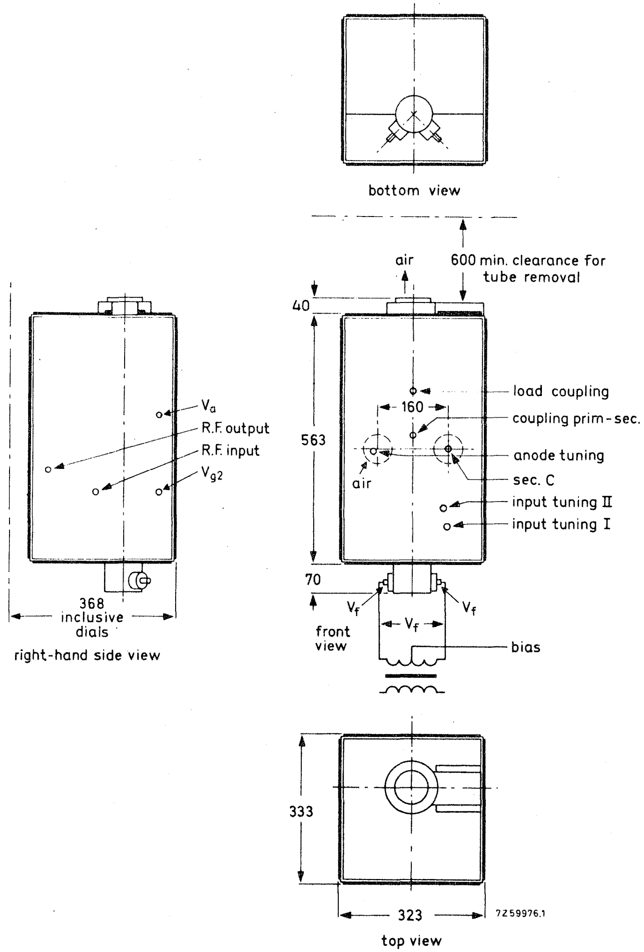


Fig. 1.

CIRCUIT DIAGRAM

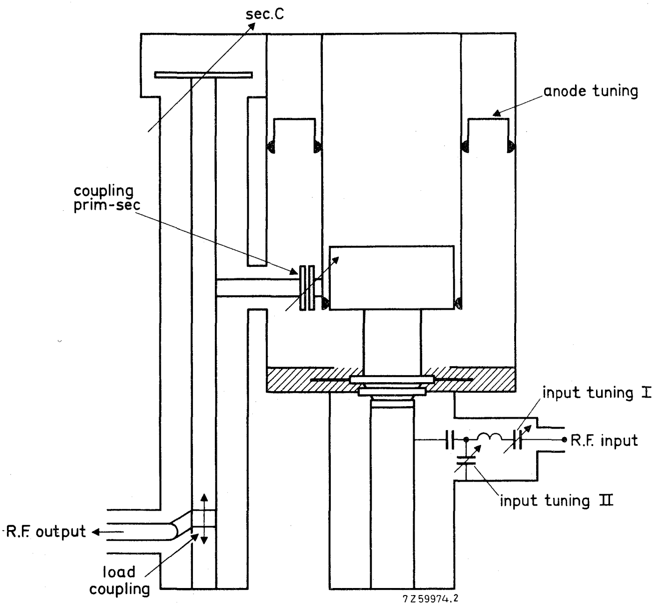


Fig. 2.

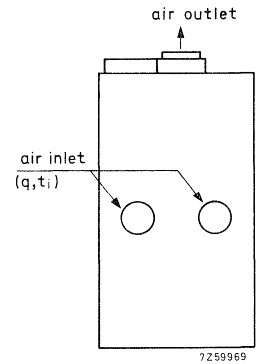


Fig. 3 Cooling air connector diagram.

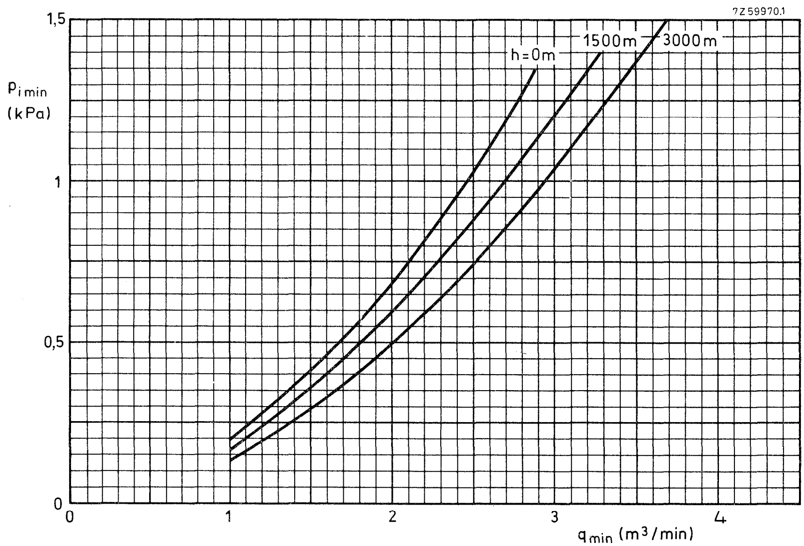


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440
sound

Continuously tunable cavity-type circuit assembly to be used with YL1440 to form a grounded-grid amplifier of f.m. signals in Band III.

QUICK REFERENCE DATA

Class-B amplifier (sound)			
Frequency	f	170 to 260	MHz
Anode voltage	V_a	3,5	kV
Output power in load	W_ℓ	2,4	kW
Power gain	G	14,1	dB

FREQUENCY RANGE

Continuously tunable — from 170 to 260 MHz

COOLING

See relevant curves on pages 200 to 202. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N
Output: 50 Ω coaxial female connector, type HN

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7222 120 02143
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

- Recommended circulators:

Frequency 160 to 178 MHz; type 2722 162 01781
173 to 204 MHz; type 2722 162 01861
200 to 230 MHz; type 2722 162 01851
225 to 270 MHz; type 2722 162 03171

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 673 x 368 x 358 mm
Net mass 33 kg

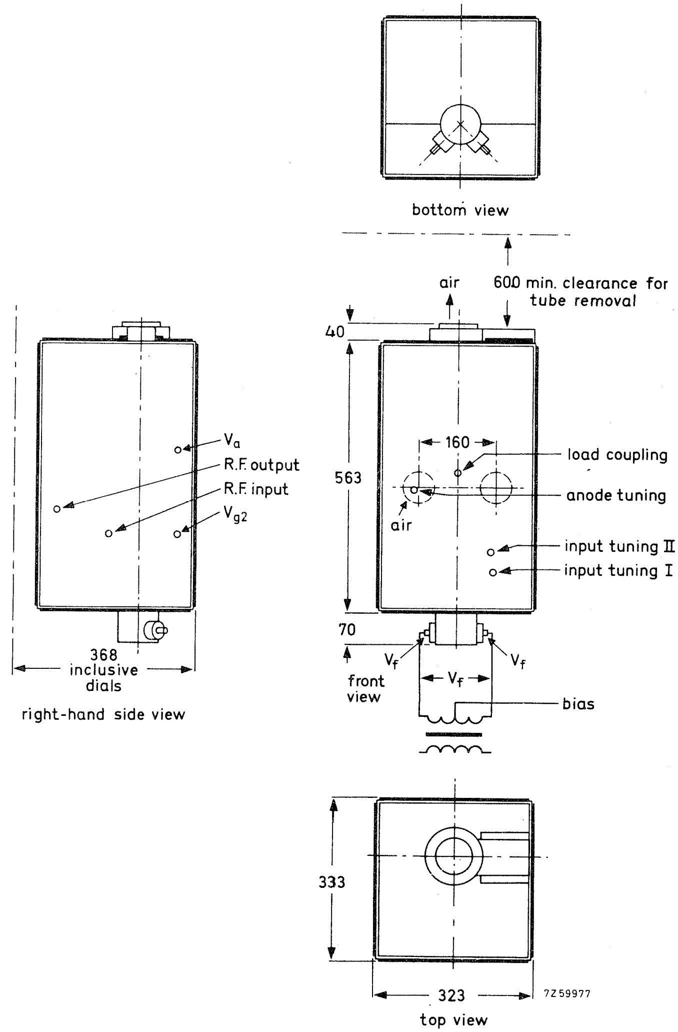


Fig. 1.

CIRCUIT DIAGRAM

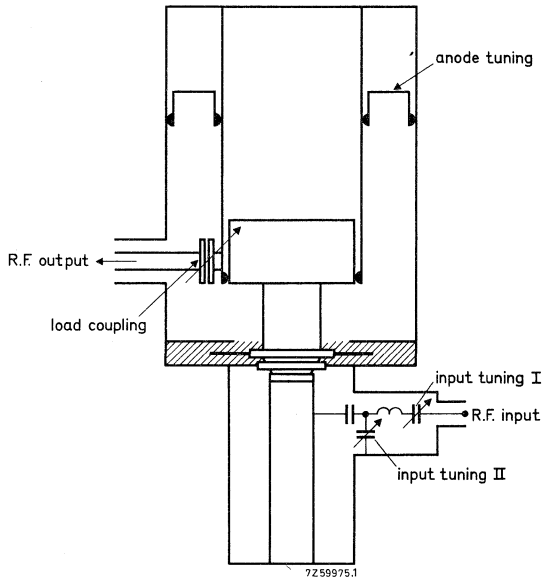


Fig. 2.

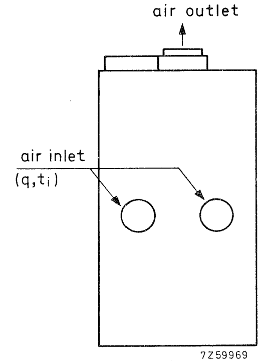


Fig. 3 Cooling air connector diagram.

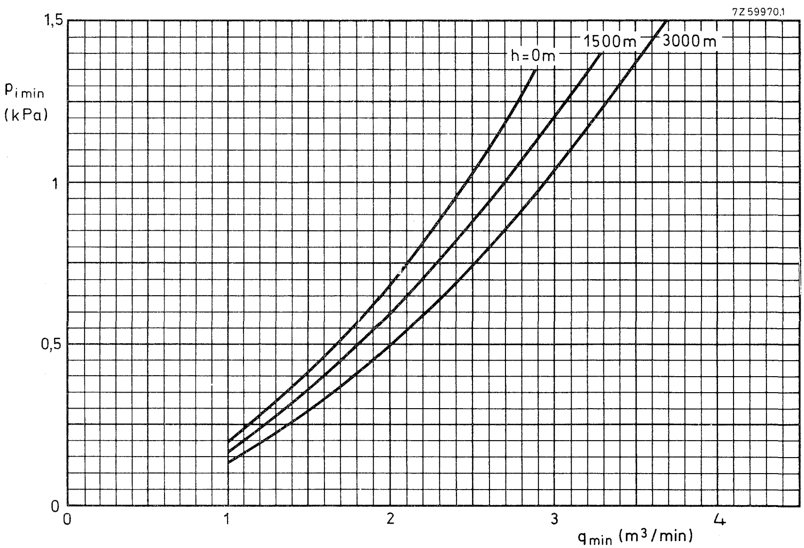


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420

vision and combined sound/vision

Continuously tunable cavity-type circuit assembly to be used with YL1420 to form a broad-band grounded-grid linear amplifier of television signals in Band III.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)				
Frequency	f	170 to 230		MHz
Anode voltage	V_a	4	5	kV
Output power in load, sync	W_ℓ	6,25	8,6	kW
Power gain	G	13,8	13,8	dB
Class-AB amplifier for television transposer service				
Frequency	f	175 to 225		MHz
Anode voltage	V_a		4	kV
Output power in load, sync	W_ℓ		25	kW
Power gain	G		14,8	dB

FREQUENCY RANGE

Continuously tunable from 170 to 230 MHz

COOLING

See relevant curves on pages 203 to 205. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175,25 MHz	8222 032 57140
Coupling loop for remaining frequencies except 223,25 MHz	8222 032 57150
Spanner for fitting the coupling loops	

- Recommended circulators:
  Frequency 160 to 178 MHz; type 2722 162 01781
  173 to 204 MHz; type 2722 162 01861
  200 to 230 MHz; type 2722 162 01851

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 620 x 610 x 420 mm
Net mass 67 kg

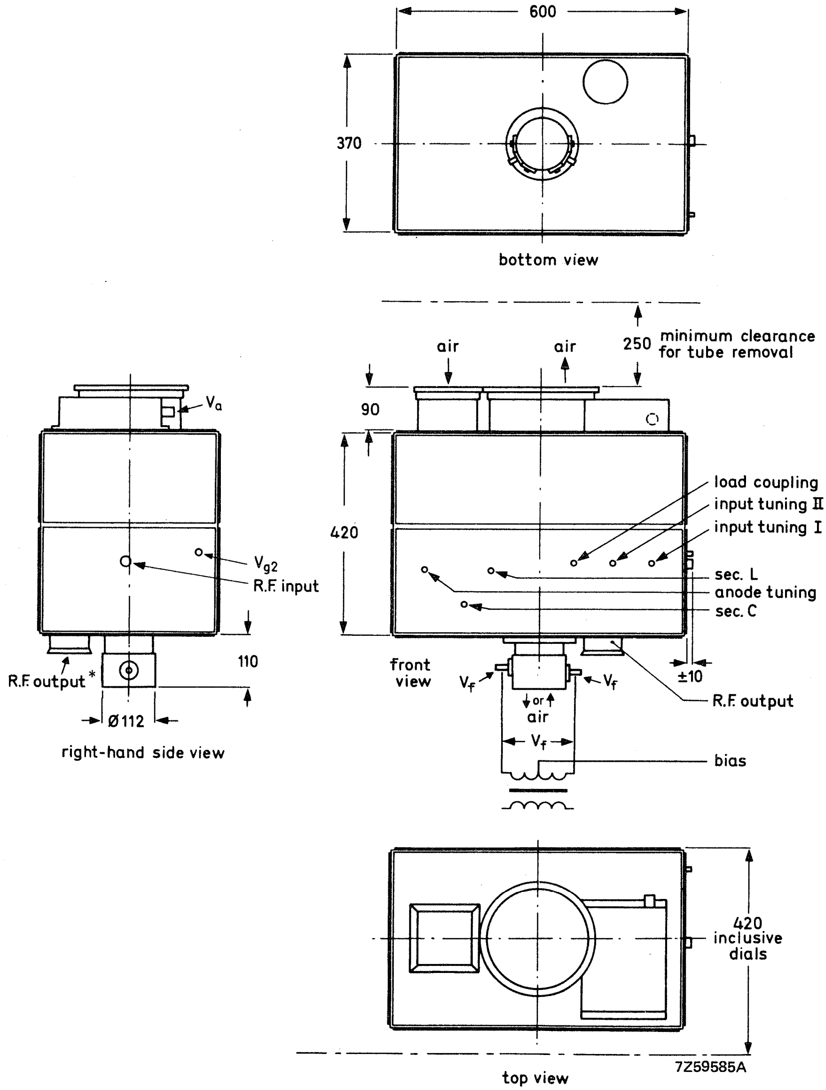


Fig. 1.

*See detail page 224.

CIRCUIT DIAGRAM

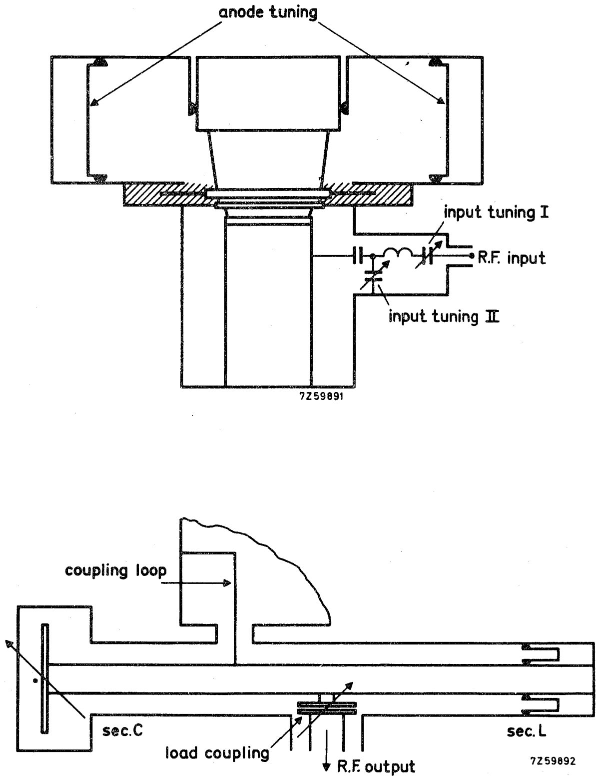


Fig. 2.

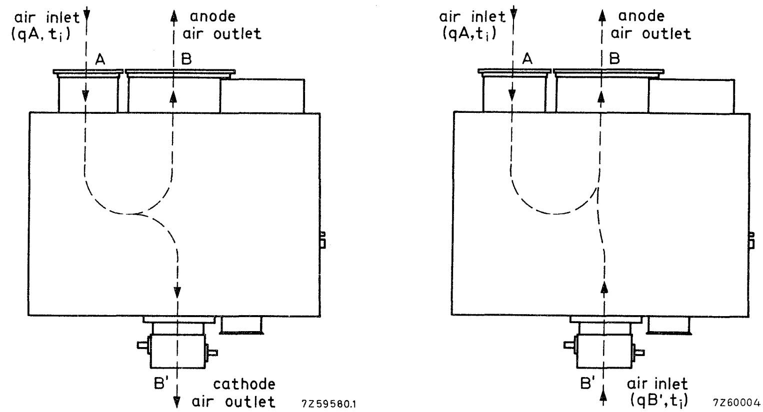


Fig. 3 Cooling air connector diagram.

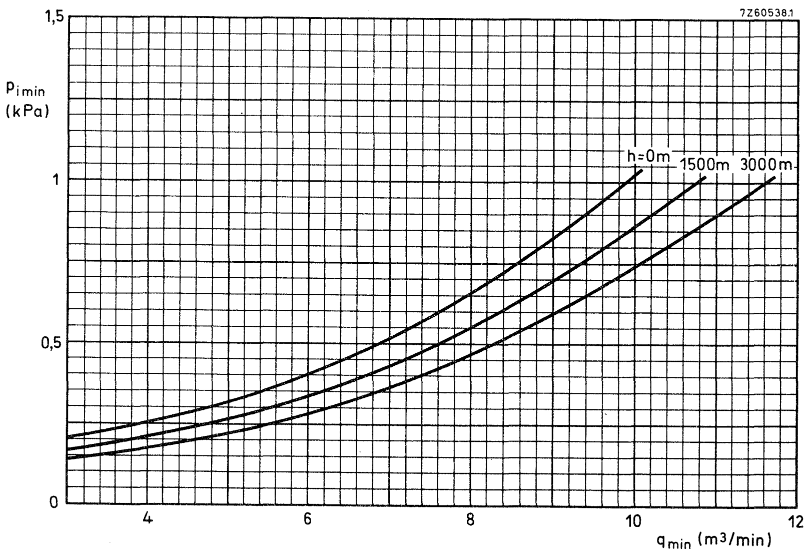


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B'; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420
sound

Continuously tunable cavity-type circuit assembly to be used with YL1420 to form a grounded-grid amplifier of f.m. signals in Band III.

QUICK REFERENCE DATA

Class-B amplifier (sound)			
Frequency	f	170 to 230	MHz
Anode voltage	V_a	7	kV
Output power in load	W_ℓ	10,5	kW
Power gain	G	15	dB

FREQUENCY RANGE

Continuously tunable — from 170 to 230 MHz

COOLING

See relevant curves on pages 203 to 205. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

- Recommended circulators:

Frequency 160 to 178 MHz; type 2722 162 01781
173 to 204 MHz; type 2722 162 01861
200 to 230 MHz; type 2722 162 01851

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 620 x 610 x 420 mm
Net mass 54 kg

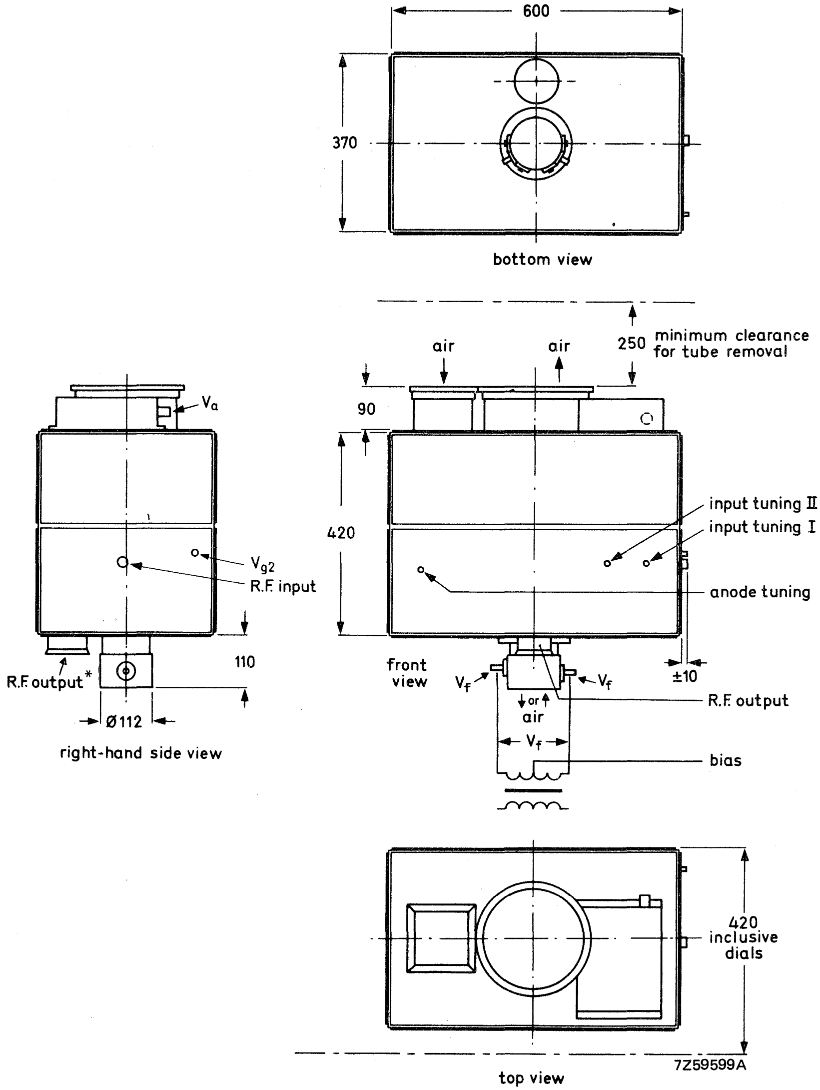
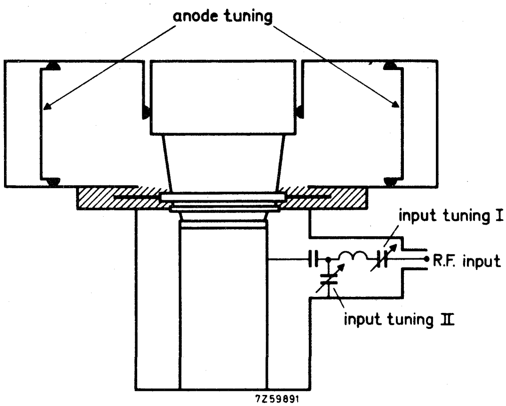


Fig. 1.

*See detail page 224.

CIRCUIT DIAGRAM



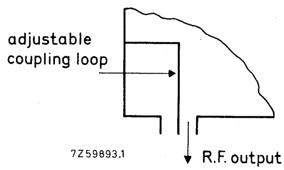
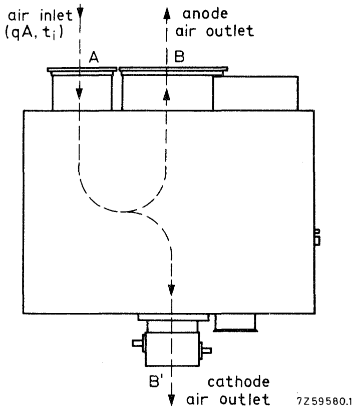


Fig. 2.



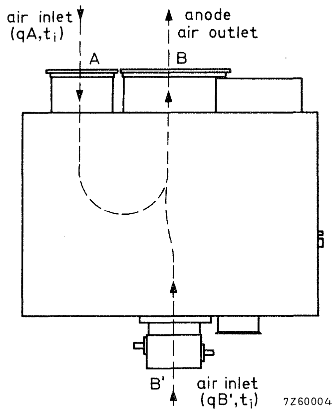


Fig. 3 Cooling air connector diagram.

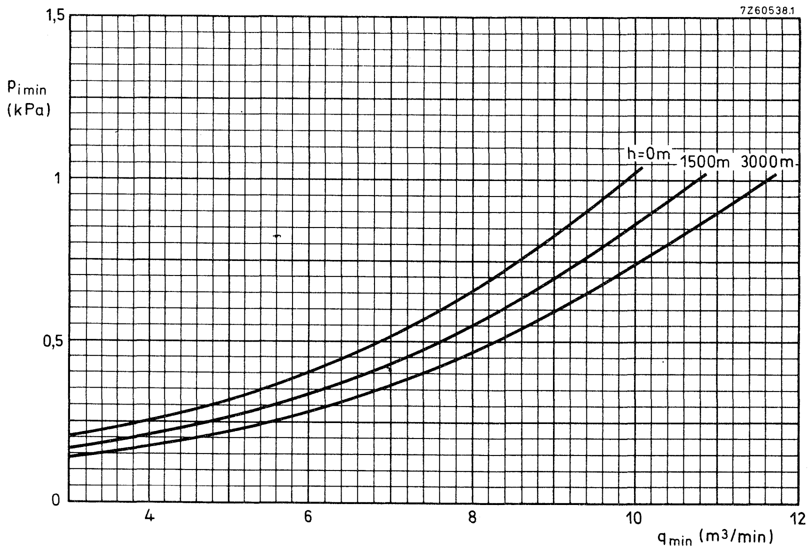


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B'; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430

vision and combined sound/vision

Continuously tunable cavity-type circuit assembly to be used with YL1430 to form a broad-band grounded-grid linear amplifier of television signals in Band III.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)

Frequency	f	170 to 230		MHz
Anode voltage	V_a	6	7	kV
Output power in load, sync	W_ℓ	12,5	18,4	kW
Power gain	G	14,8	14	dB

Class-AB amplifier for television transposer service

Frequency	f	175 to 225	MHz
Anode voltage	V_a	6	kV
Output power in load, sync	W_ℓ	7	kW
Power gain	G	32	dB

FREQUENCY RANGE

Continuously tunable from 170 to 230 MHz

COOLING

See relevant curves on pages 206 to 208. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175,25 MHz	7322 120 04730
Coupling loop for remaining frequencies except 224,25 MHz	7322 120 04750
Insulating protecting cap	7322 120 04760
Spanner for fitting the coupling loops	

- Recommended circulators:

  Frequency 160 to 178 MHz; type 2722 162 01781
  173 to 204 MHz; type 2722 162 01861
  200 to 230 MHz; type 2722 162 01851

- Available on request:
  Tube lifter 8222 032 12062

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 620 x 610 x 420 mm
Net mass 67 kg

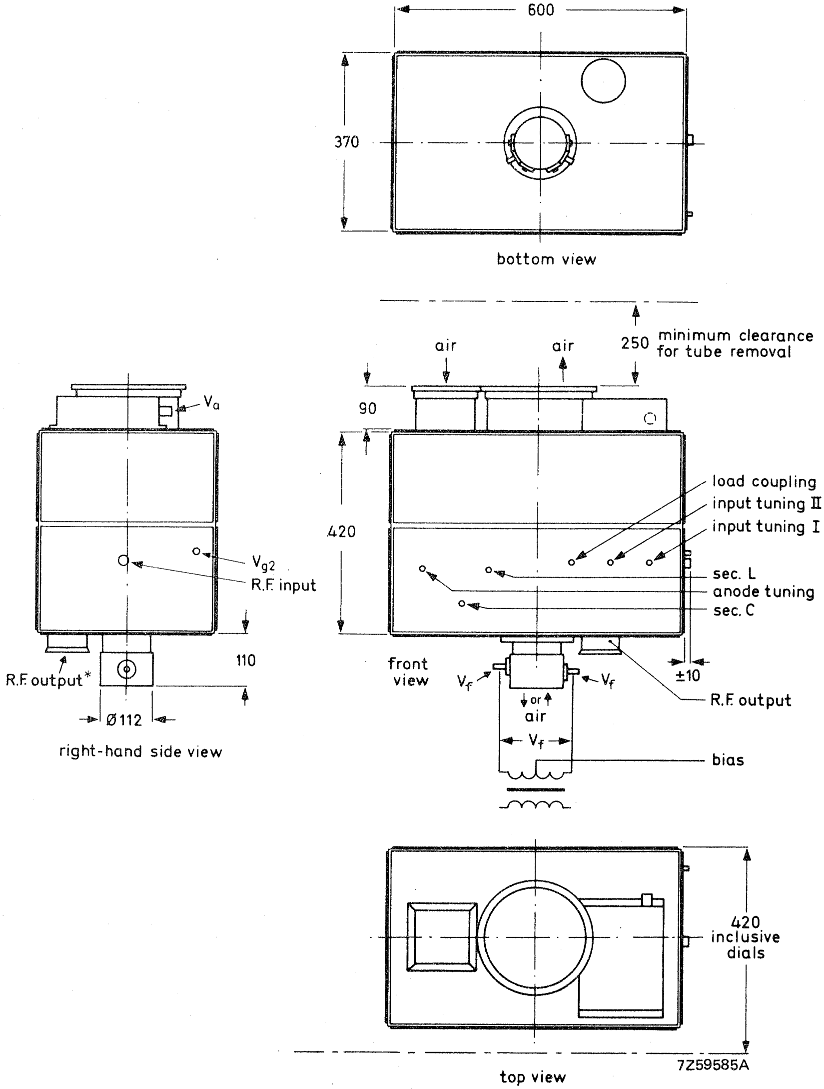
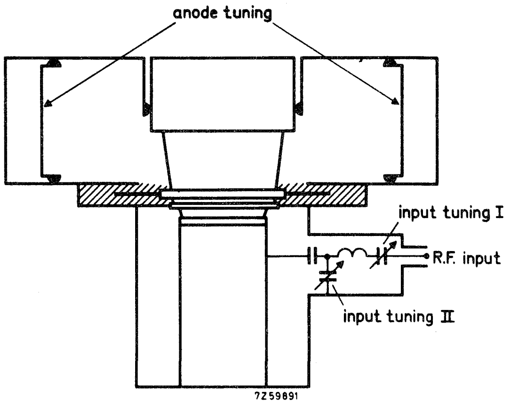


Fig. 1.

*See detail page 224.

CIRCUIT DIAGRAM



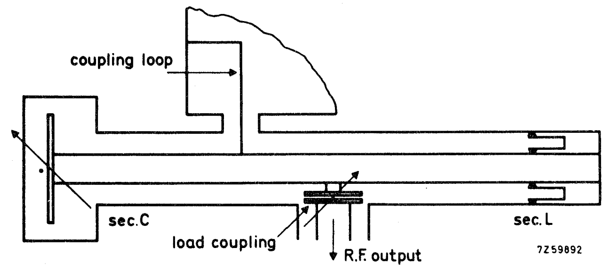


Fig. 2.

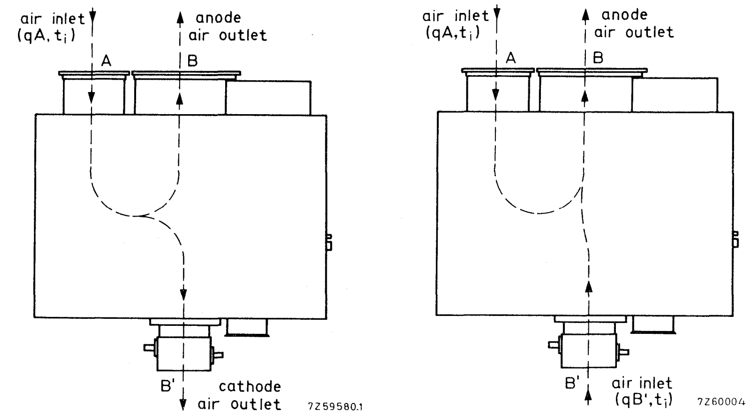


Fig. 3 Cooling air connector diagram.

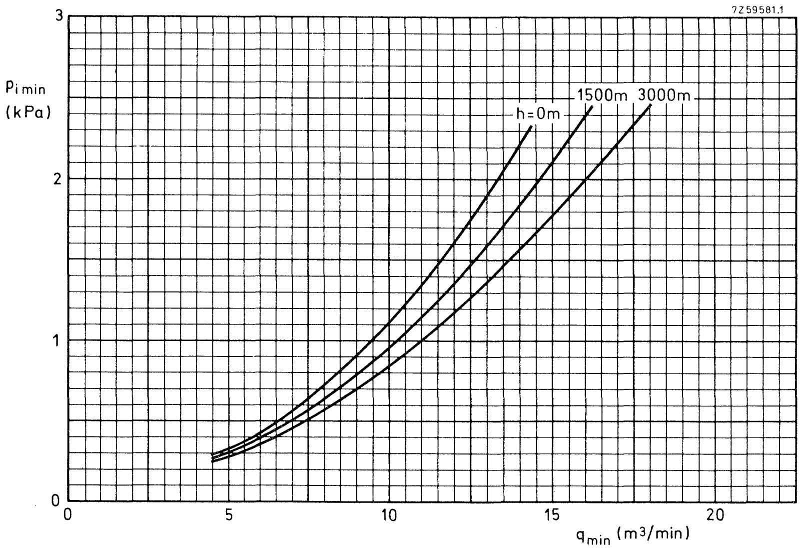


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.
p_i = pressure drop from plane A to plane B or B′; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430
sound

Continuously tunable cavity-type circuit assembly to be used with YL1430 to form a grounded-grid amplifier of f.m. signals in Band III.

QUICK REFERENCE DATA

Class-B amplifier (sound)		
Frequency	f	170 to 230 MHz
Anode voltage	V_a	7,5 kV
Output power in load	W_ℓ	13 kW
Power gain	G	15,2 dB

FREQUENCY RANGE

Continuously tunable — from 170 to 230 MHz

COOLING

See relevant curves on pages 206 to 208. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page 22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

- Recommended circulators:

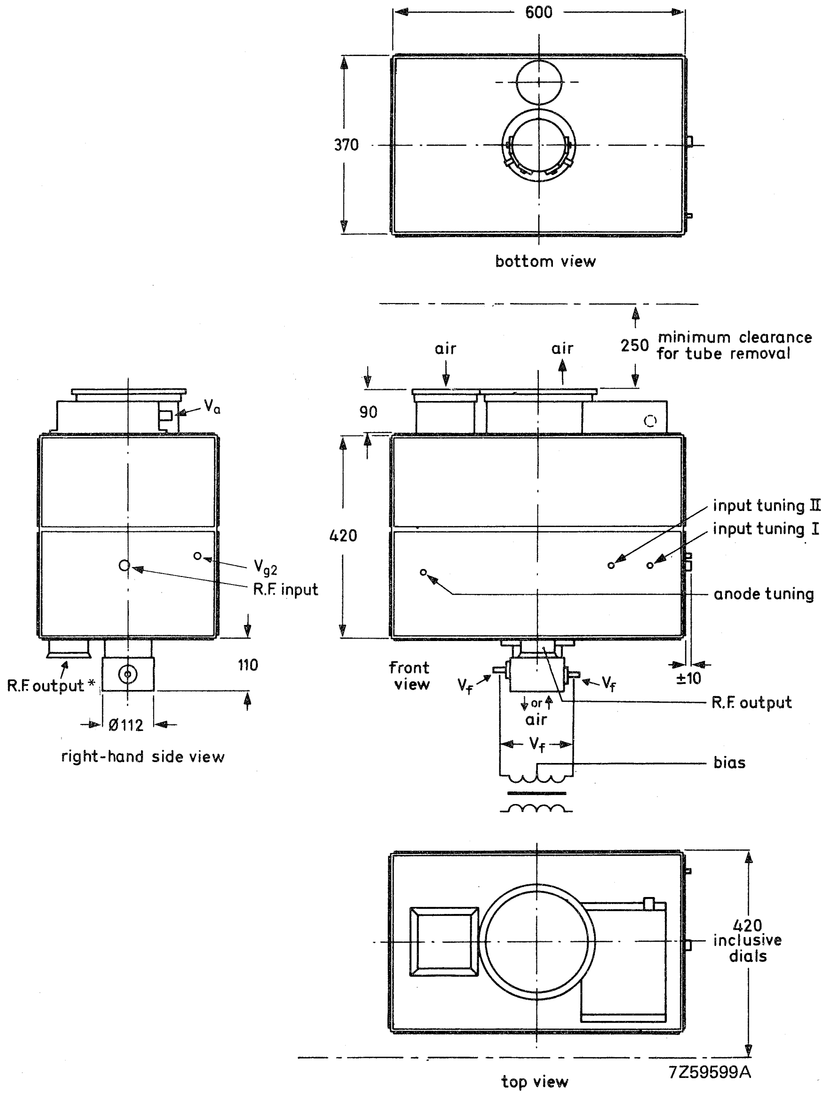
  Frequency 160 to 178 MHz; type 2722 162 01781
  173 to 204 MHz; type 2722 162 01861
  200 to 230 MHz; type 2722 162 01851

- Available on request:
  Tube lifter — 8222 032 12062

OUTLINE DRAWING

Dimensions in mm

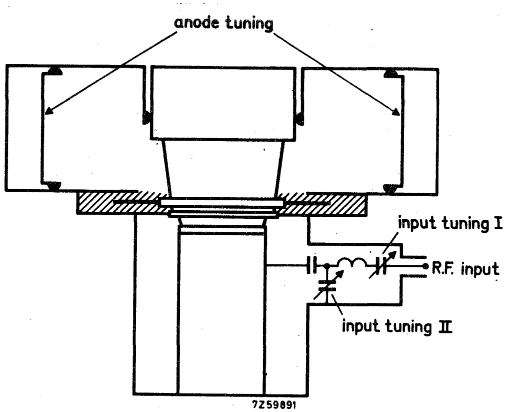
Overall dimensions	620 x 610 x 420 mm
Net mass	54 kg



* See detail page 224.

Fig. 1.

CIRCUIT DIAGRAM



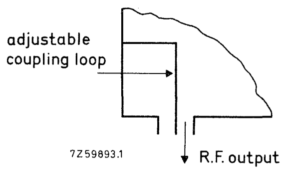


Fig. 2.

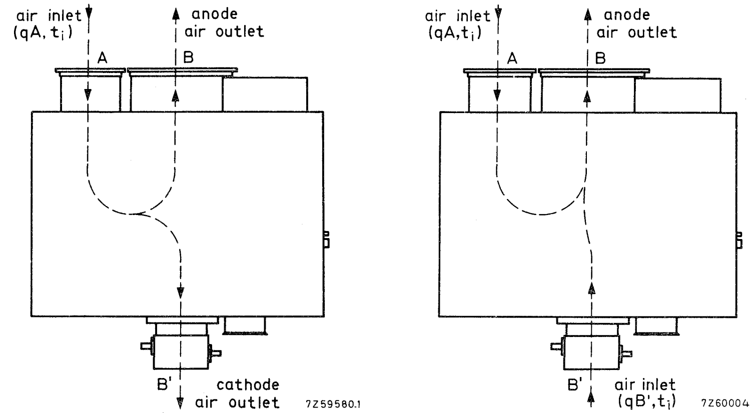


Fig. 3 Cooling air connector diagram.

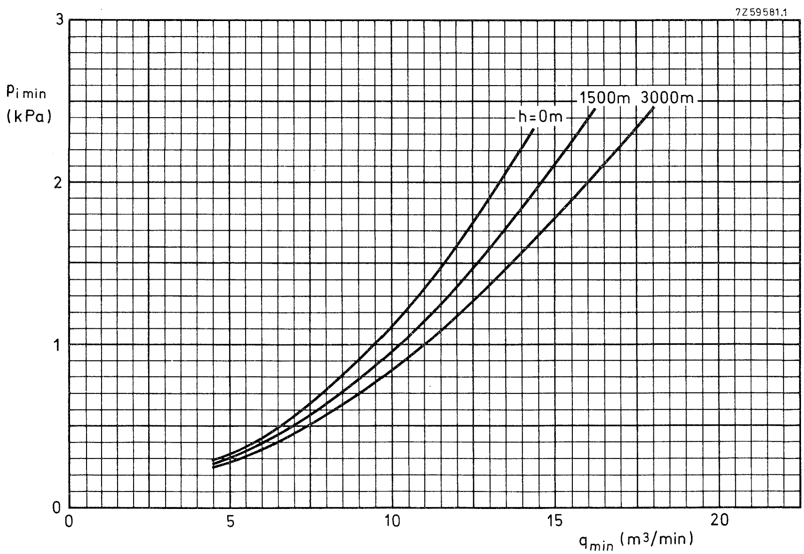


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B'; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440

vision

Channel tuned cavity-type circuit assembly to be used with YL1440 to form a broad-band grounded-grid linear amplifier of television signals in Band I.

QUICK REFERENCE DATA

Class-AB amplifier (vision)

Frequency	f	48 to	83	MHz
Anode voltage	V_a	2	2,5	kV
Output power in load, sync	W_ℓ	0,67	1,17	kW
Power gain	G	12,3	11,5	dB

FREQUENCY RANGE

Channel tuned — from 48,25 to 69,25 MHz and from 77,25 to 83,25 MHz

COOLING

See relevant curves on pages 200 to 202. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial female connector, type HN.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9560

5 coils for vision carrier frequencies:
55,25 MHz; 61,25 to 62,25 MHz; 67,25 MHz; 77,25 MHz and 83,25 MHz

Spanner for fitting the coils

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 537 x 343 x 370 mm

Net mass 23 kg

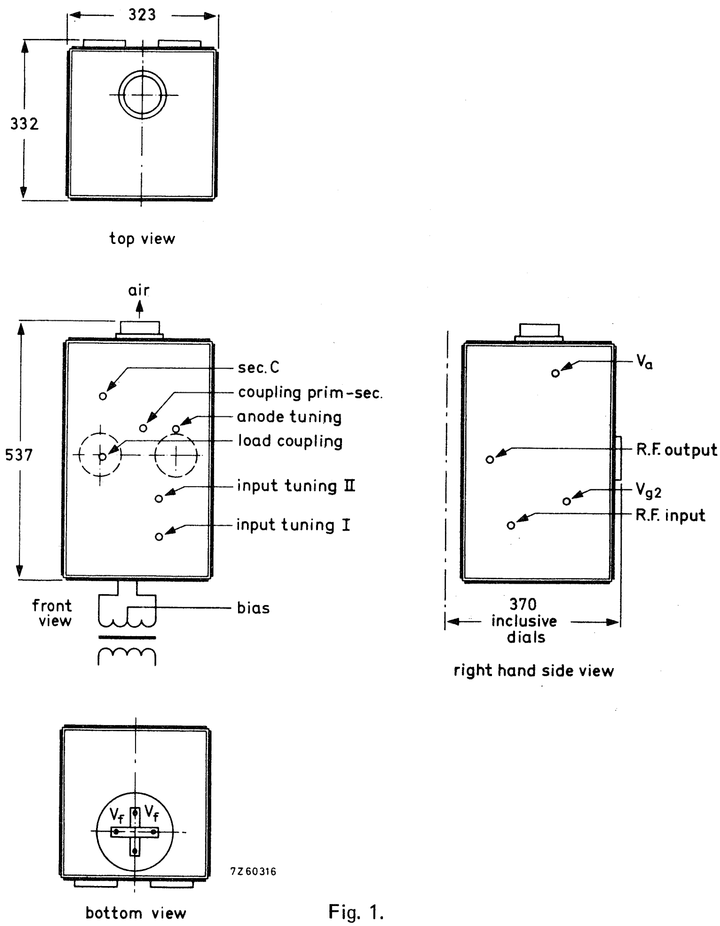


Fig. 1.

CIRCUIT DIAGRAM

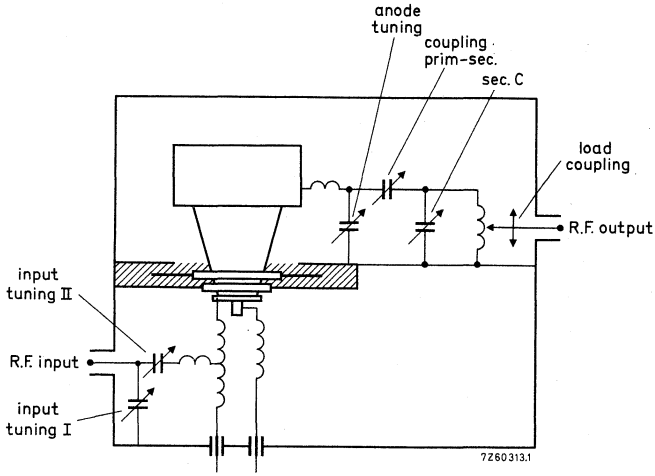


Fig. 2.

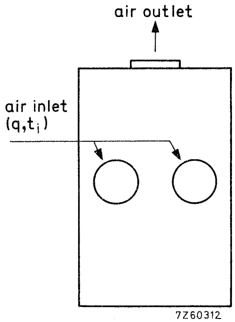


Fig. 3 Cooling air connector diagram.

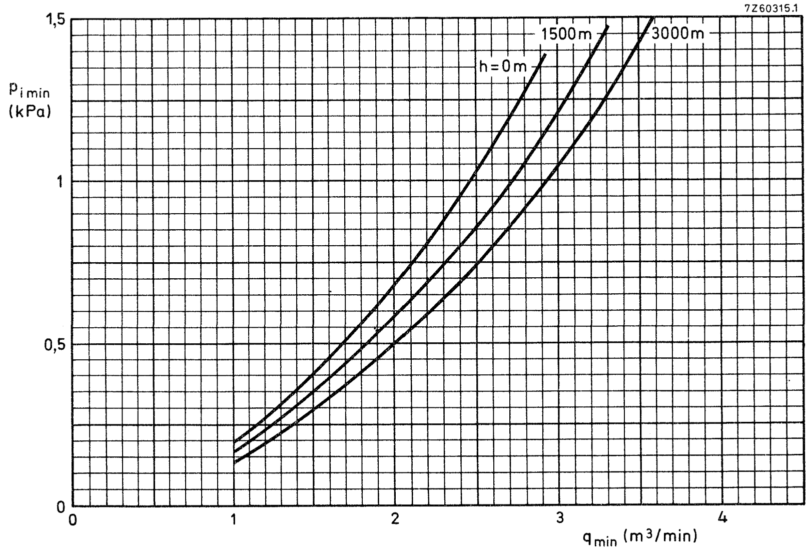


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1440
sound

Channel tuned circuit assembly to be used with YL1440 to form a grounded-grid amplifier of f.m. signals in Band I.

QUICK REFERENCE DATA

Class-B amplifier (sound)

Frequency	f	up to	88 MHz
Anode voltage	V_a		3,5 kV
Output power in load	W_ℓ		2,4 kW
Power gain	G		26 dB

FREQUENCY RANGE

Channel tuned	from 53 to 72 MHz
	and from 82 to 88 MHz

COOLING

See relevant curves on pages 200 to 202. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial female connector, type HN.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 02140
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

5 coils for sound carrier frequencies:
59,75 to 60,75 MHz; 65,75 to 67,75 MHz; 71,75 MHz; 81,75 MHz and 87,75 MHz

Spanner for fitting the coils

OUTLINE DRAWING

Dimensions in mm

Overall dimensions	573 x 343 x 370 mm
Net mass	22,5 kg

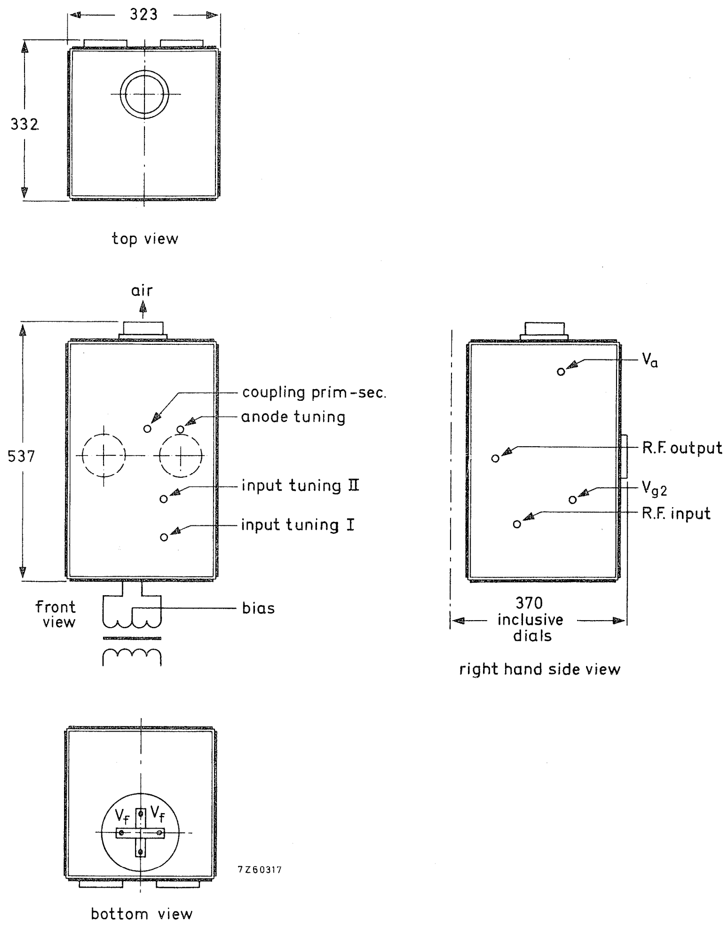


Fig. 1.

CIRCUIT DIAGRAM

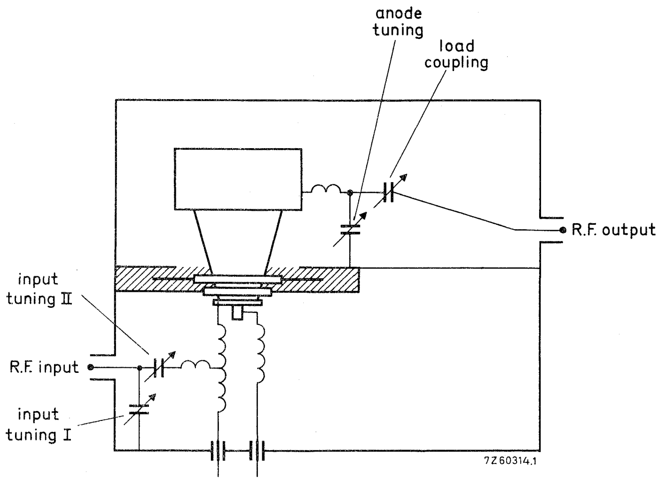


Fig. 2.

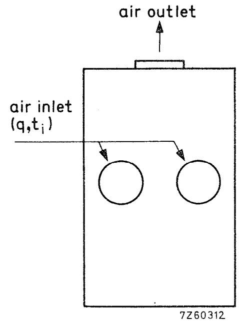


Fig. 3 Cooling air connector diagram.

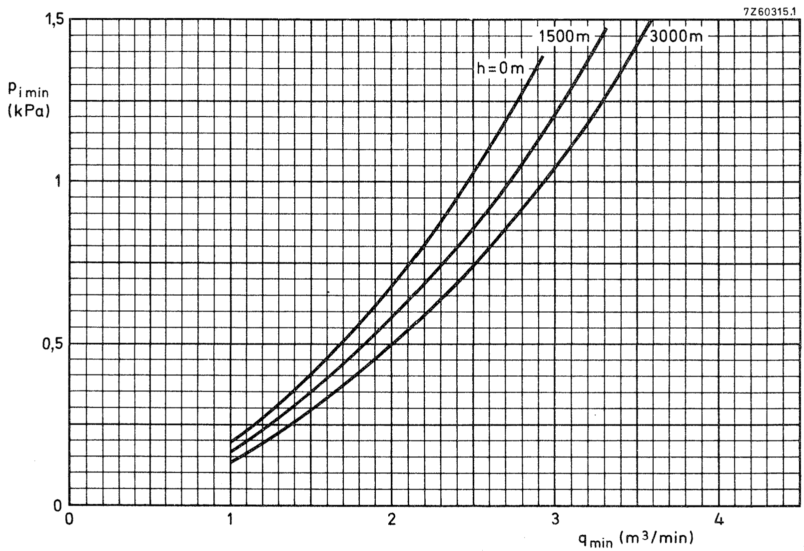


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420
vision

Channel tuned circuit assembly to be used with YL1420 to form a broad-band grounded-grid linear amplifier of television signals in Band I.

QUICK REFERENCE DATA

Class-AB amplifier (vision)

Frequency	f	83,25	55,25	MHz
Anode voltage	V_a	4	4	kV
Output power in load, sync	W_ℓ	6,25	6,25	kW
Power gain	G	12,7	12,0	dB

FREQUENCY RANGE

Channel tuned — from 55,25 to 67,25 MHz and from 77,25 to 83,25 MHz

COOLING

See relevant curves on pages 203 to 205. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

  Anode coil for frequency range 55,25 to 67,25 MHz
  Elbow for secondary circuit covering frequency range 55,25 to 67,25 MHz

- Available upon request:

  Anode coil for frequency range 77,25 to 83,25 MHz
  Elbow for secondary circuit covering frequency range 77,25 to 83,25 MHz.

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 712 x 530 x 569 mm

Net mass 70 kg

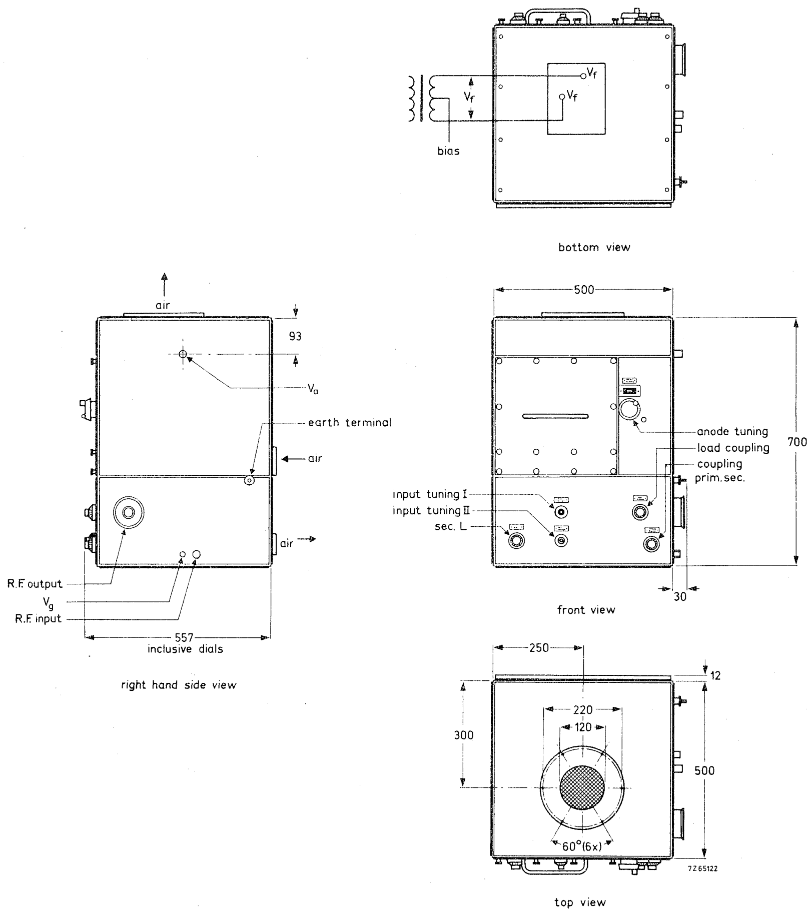


Fig. 1.

CIRCUIT DIAGRAM

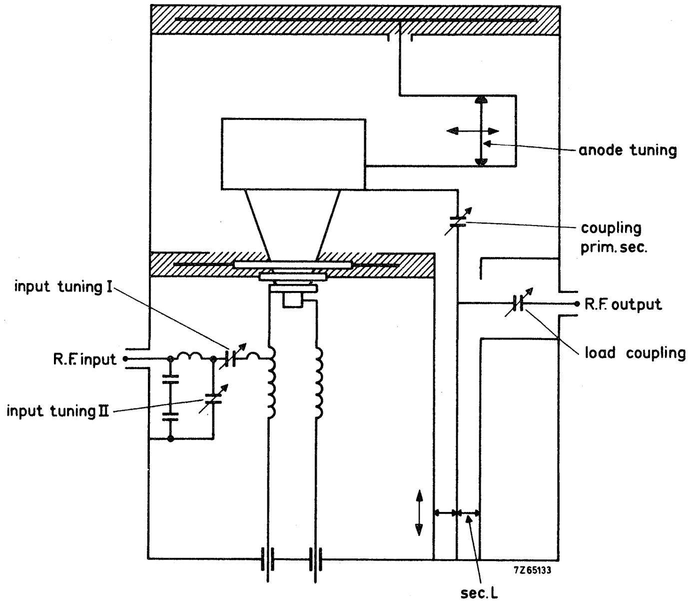


Fig. 2.

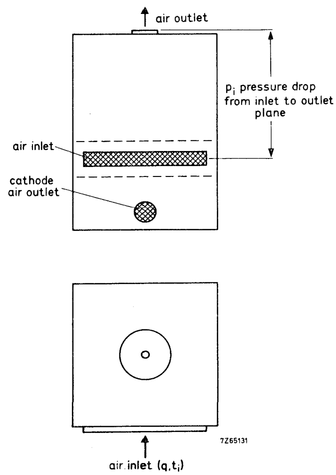


Fig. 3 Cooling air connector diagram.

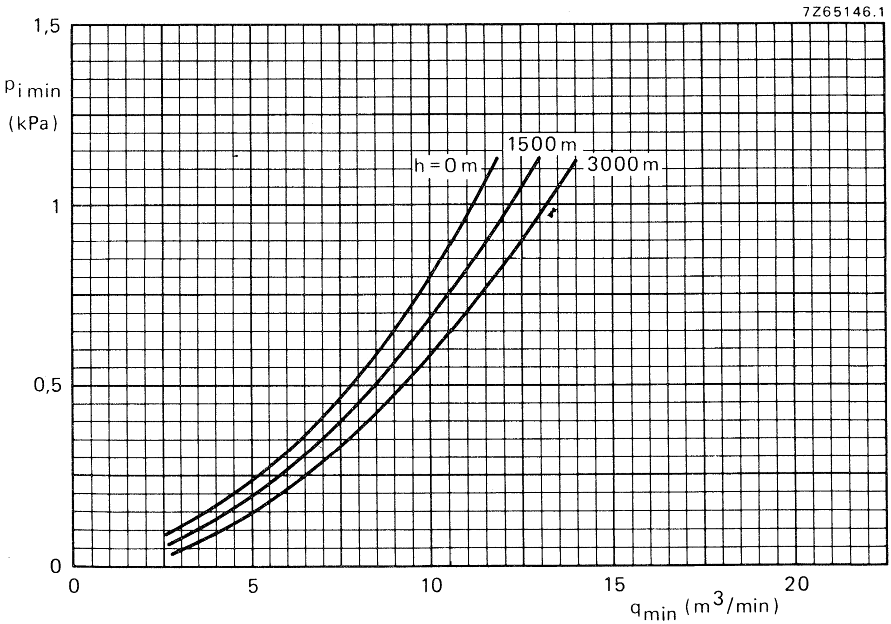


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1420
sound

Channel tuned circuit assembly to be used with YL1420 to form a grounded-grid amplifier of f.m. signals in Band I.

QUICK REFERENCE DATA

Class-B amplifier (sound)			
Frequency	f	up to 88	MHz
Anode voltage	V_a	7	kV
Output power in load	W_ℓ	10,5	kW
Power gain	G	15	dB

FREQUENCY RANGE

Channel tuned — from 53 to 72 MHz and from 82 to 88 MHz

COOLING

See relevant curves on pages 203 to 205. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

  Anode coil for sound carrier frequencies 53 to 72 MHz

- Available on request:

  Anode coil for frequency range 82 to 88 MHz.

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 712 x 530 x 569

Net mass 58 kg

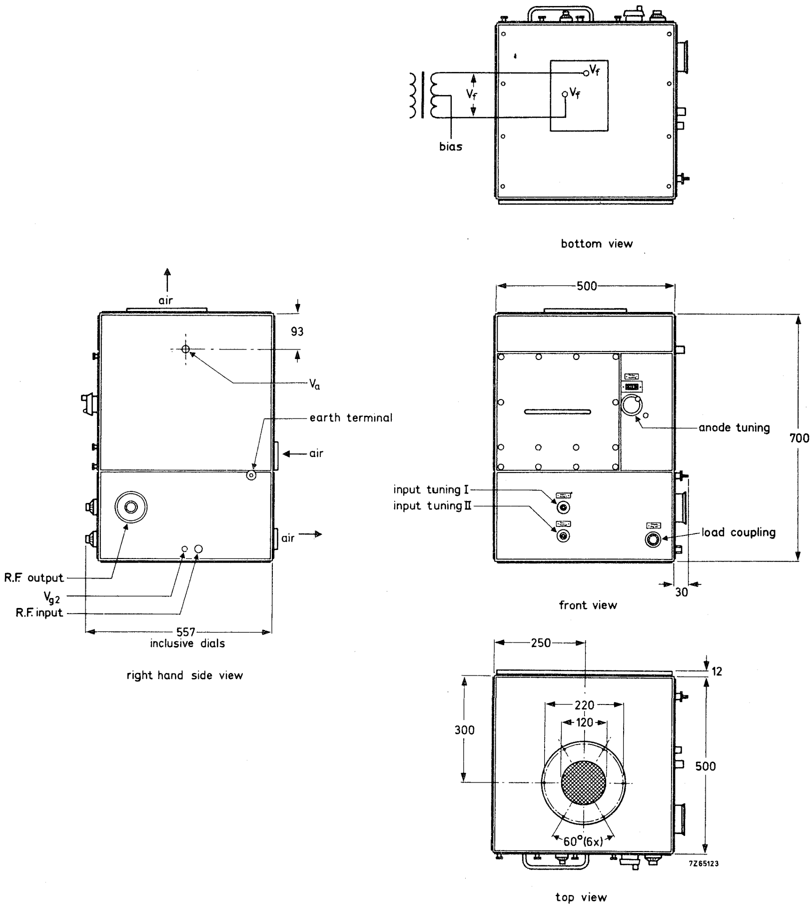


Fig. 1.

CIRCUIT DIAGRAM

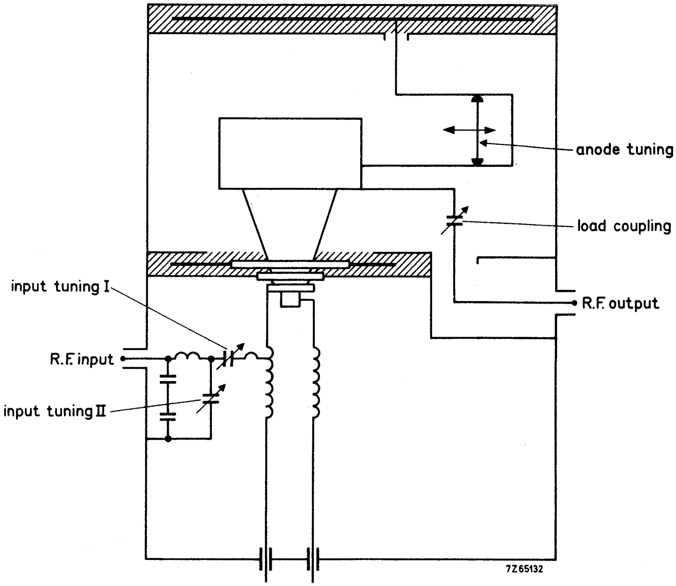


Fig. 2.

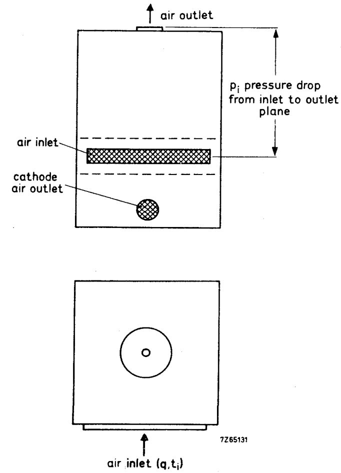


Fig. 3 Cooling air connector diagram.

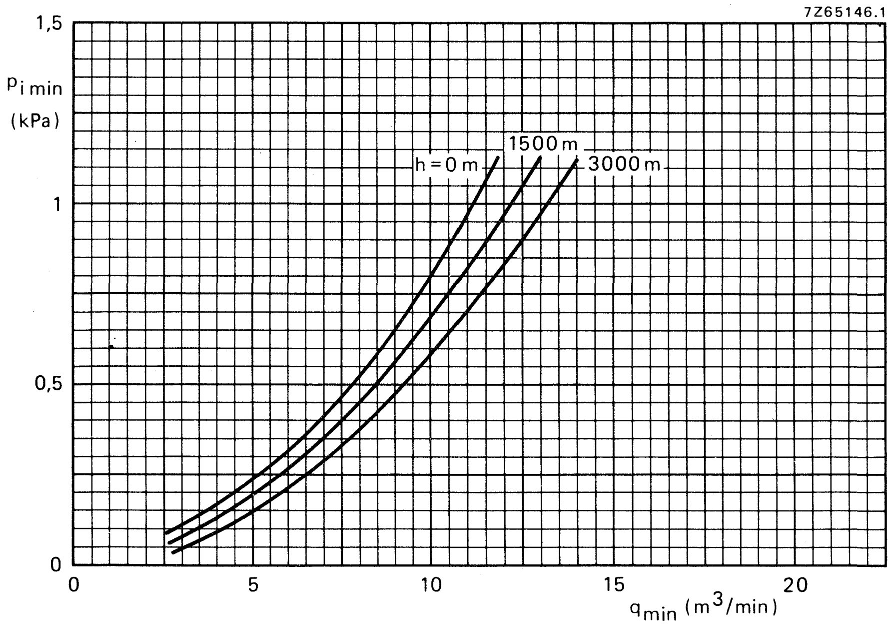


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430 OR YL1520

vision

Channel tuned circuit assembly to be used with YL1430 or YL1520 to form a broad-band grounded-grid linear amplifier of television signals in Band I.

QUICK REFERENCE DATA

Class-AB amplifier (vision)

		YL1430			YL1520		
Frequency	f	83,25	55,25	55,25	83,25	55,25	MHz
Anode voltage	V_a	5,5	5,5	4,0	6,5	6,5	kV
Output power in load, sync	W_ℓ	13,2	13,2	6,4	20	20	kW
Power gain	G	13	12,5	12,5	13,8	13,4	dB

FREQUENCY RANGE

Channel tuned — from 55,25 to 69,25 MHz
and from 77,25 to 83,25 MHz

COOLING

See relevant curves on pages 206 to 211. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510

  Anode coil for frequency range
  55,25 to 67,25 MHz for YL1430 and 55,25 to 61,25 MHz for YL1520.
  Elbow for secondary circuit covering frequency range 55,25 to 67,25 MHz for both types.

- Available on request:

  Anode coil for frequency range
  77,25 to 83,25 MHz for YL1430 and 67,25 to 83,25 MHz for YL1520.
  Elbow for secondary circuit covering frequency range 77,25 to 83,25 MHz for both types.

OUTLINE DRAWING Dimensions in mm

Overall dimensions 712 x 530 x 569 mm

Net mass 70 kg

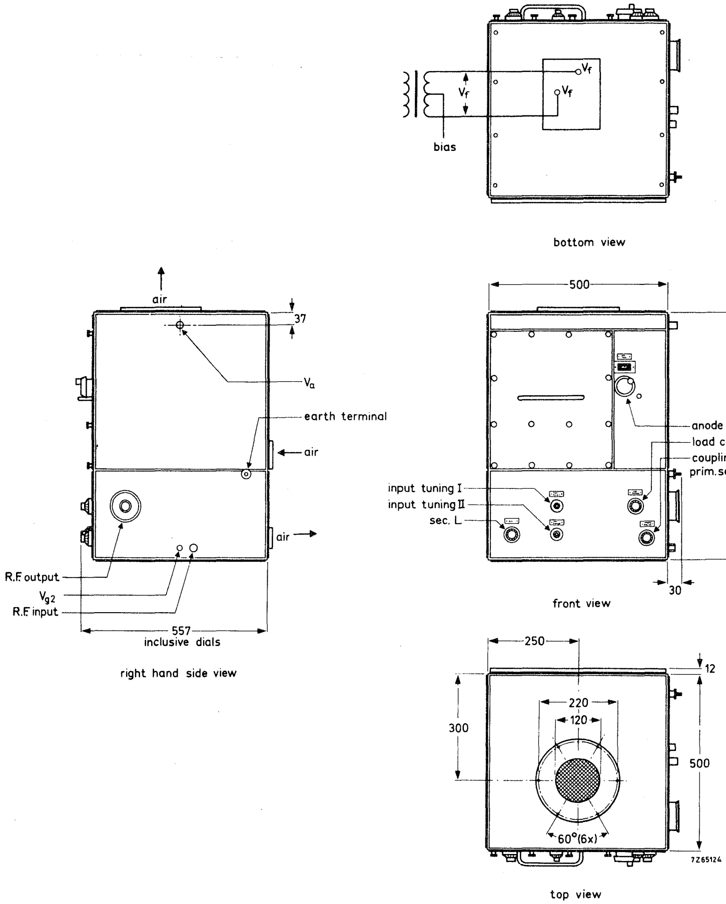


Fig. 1.

CIRCUIT DIAGRAM

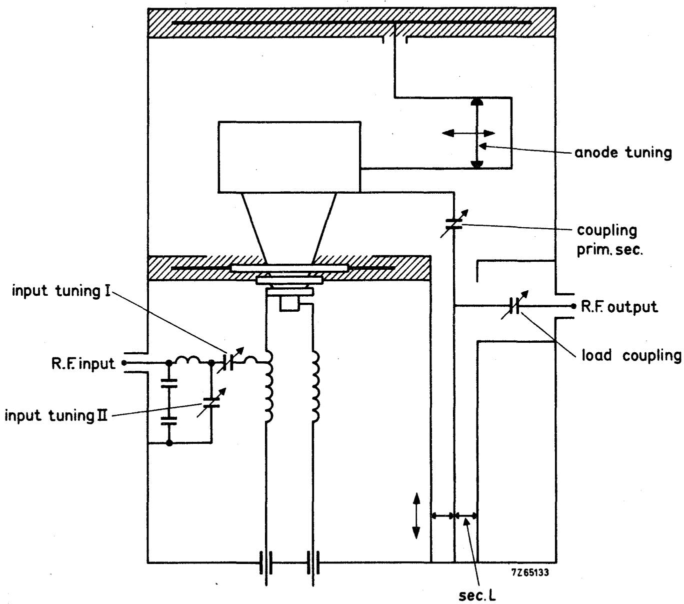


Fig. 2.

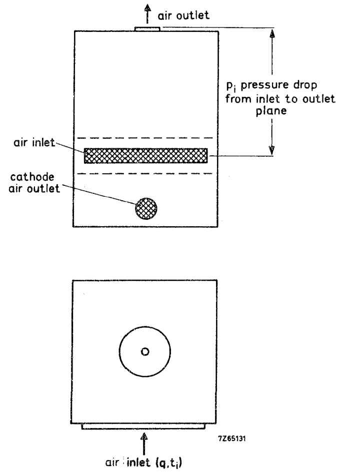


Fig. 3 Cooling air connector diagram.

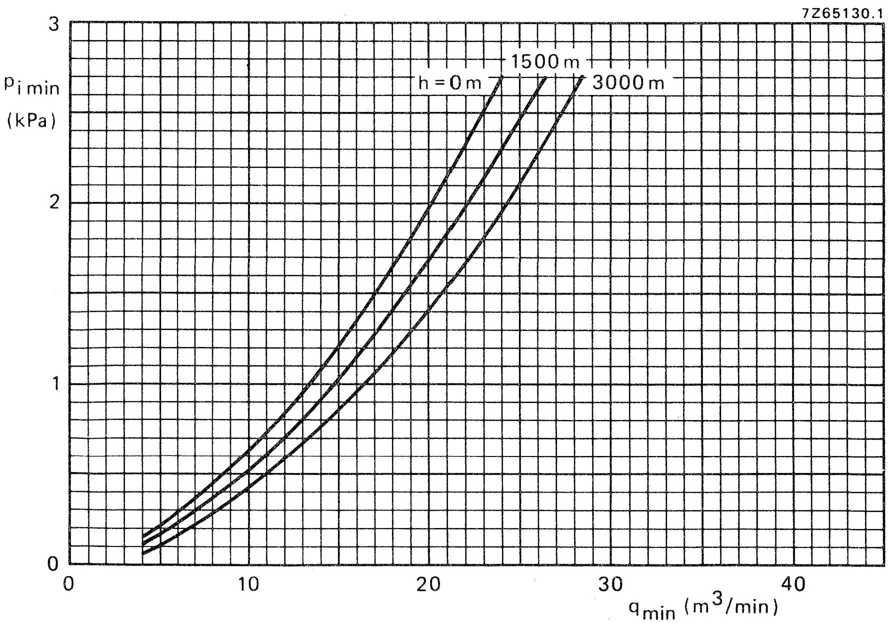


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND I AMPLIFIER CIRCUIT ASSEMBLY FOR YL1430
sound

Channel tuned circuit assembly to be used with YL1430 to form a grounded-grid amplifier of f.m. signals in Band I.

QUICK REFERENCE DATA

Class-AB amplifier (sound)			
Frequency	f	up to	88 MHz
Anode voltage	V_a		7,5 kV
Output power in load	W_ℓ		13 kW
Power gain	G		15,1 dB

FREQUENCY RANGE

Channel tuned: from 53 to 72 MHz and from 82 to 88 MHz

COOLING

See relevant curves on pages 206 to 211. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Anode coils for frequency range 53 to 72 MHz	

- Available on request:

  Anode coil for frequency range 82 to 88 MHz

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 712 x 530 x 569 mm

Net mass 58 kg

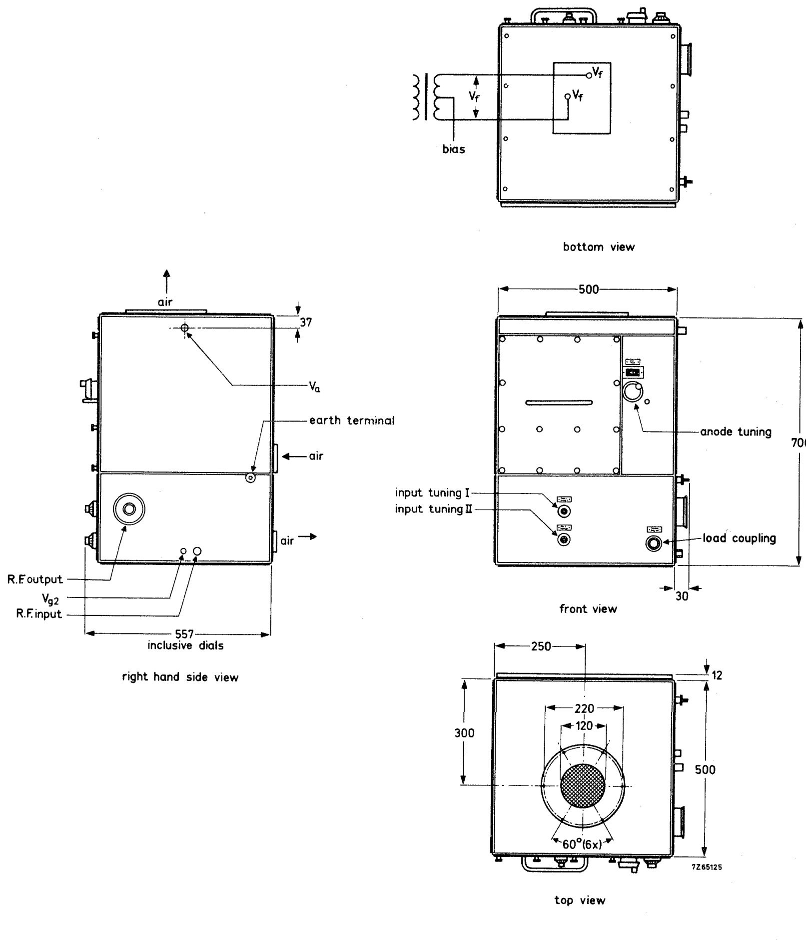


Fig. 1.

CIRCUIT DIAGRAM

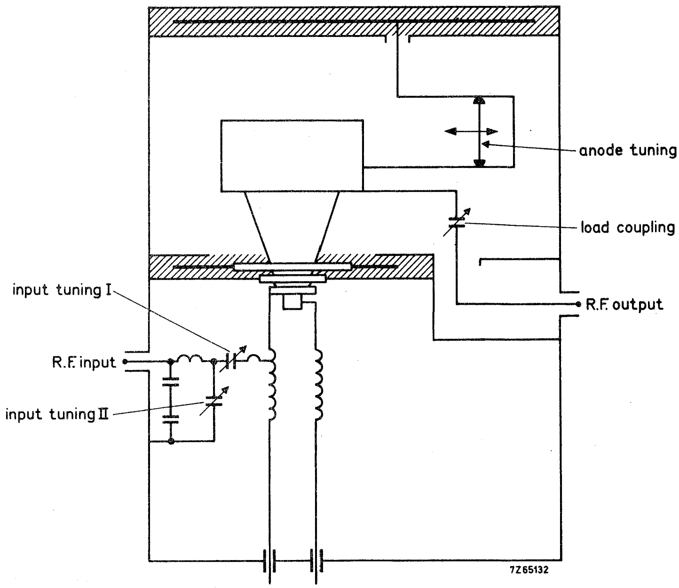


Fig. 2.

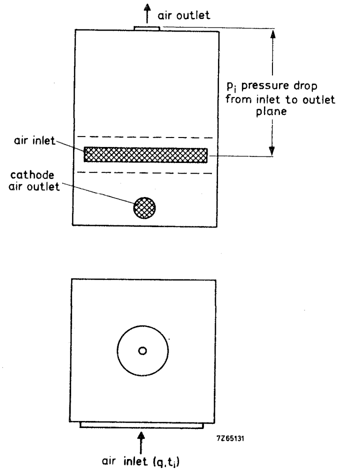


Fig. 3 Cooling air connector diagram.

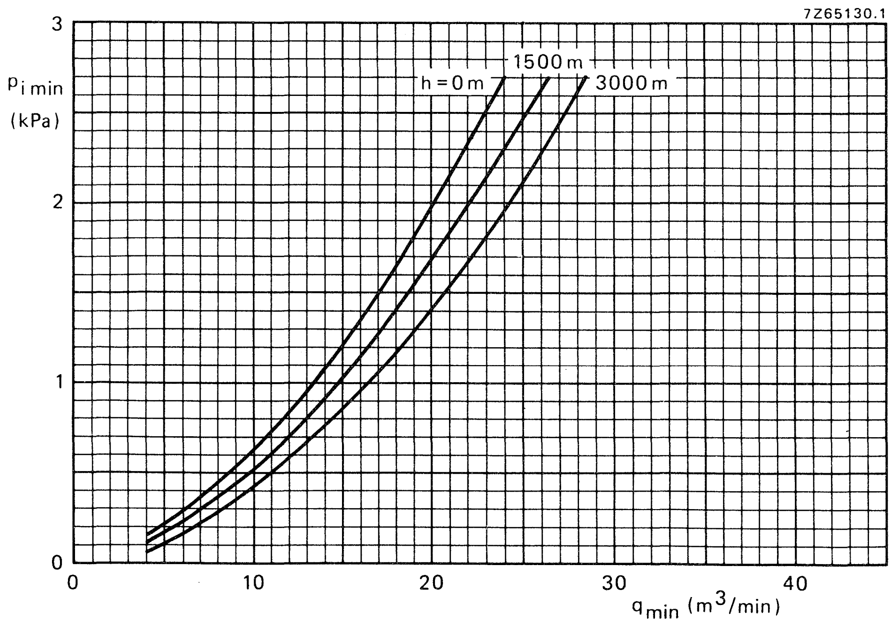


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1520
vision and combined sound/vision

Continuously tunable cavity-type circuit assembly to be used with YL1520 to form a broad-band grounded-grid linear amplifier of television signals in Band III.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)		
Frequency	f	170 to 230 MHz
Anode voltage	V_a	8 kV
Output power in load, sync	W_{ℓ}	27,5 kW
Power gain	G	14,5 dB
Class-AB amplifier for television transposer service		
Frequency	f	175 to 225 MHz
Anode voltage	V_a	8 kV
Output power in load, sync	W_{ℓ}	10,5 kW
Power gain	G	16,2 dB

FREQUENCY RANGE

Continuously tunable from 170 to 230 MHz

Slight modifications make this cavity suitable for YL1430 in the range 205 to 260 MHz.

COOLING

See relevant curves on pages 209 to 211. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type HN.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type HN R7050
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Coupling loop for 175,25 MHz	7322 120 04730

- Recommended circulators:

  Frequency 160 to 178 MHz; type 2722 162 01781
  173 to 204 MHz; type 2722 162 01861
  200 to 230 MHz; type 2722 162 01851

OUTLINE DRAWING

Dimensions in mm

Overall dimensions	697 x 680 x 490 mm
Net mass	85 kg

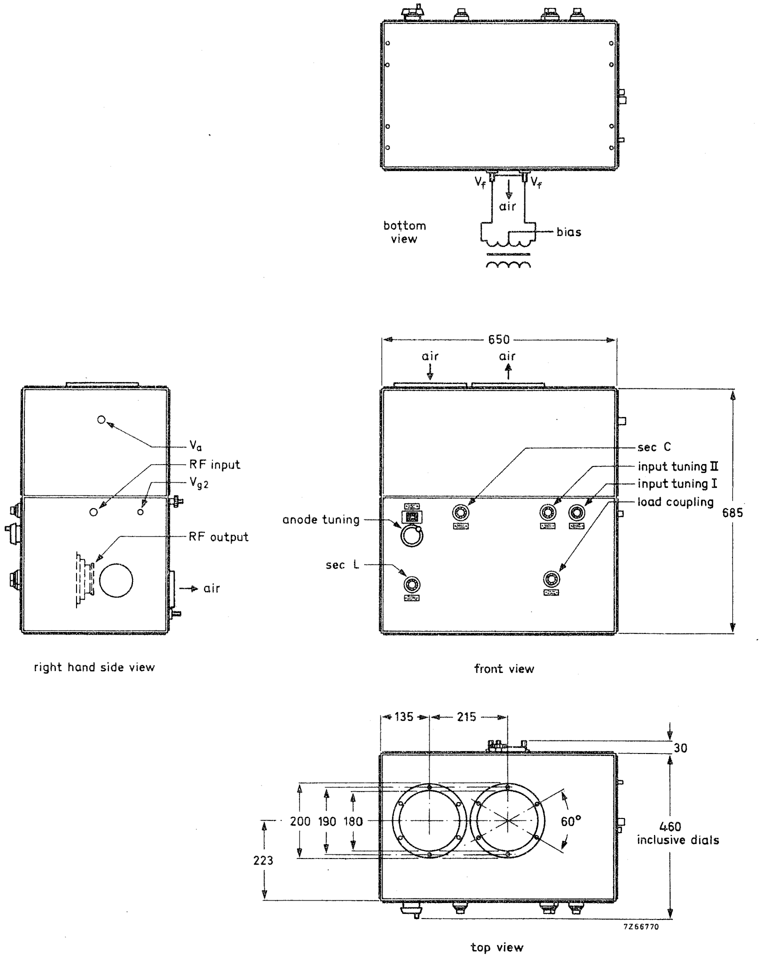


Fig. 1.

CIRCUIT DIAGRAM

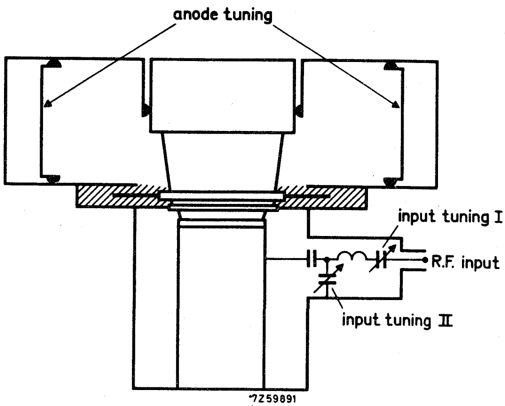


Fig. 2a.

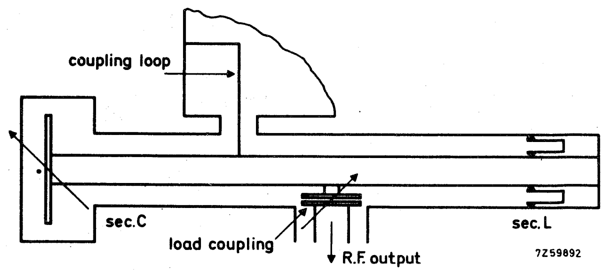


Fig. 2b.

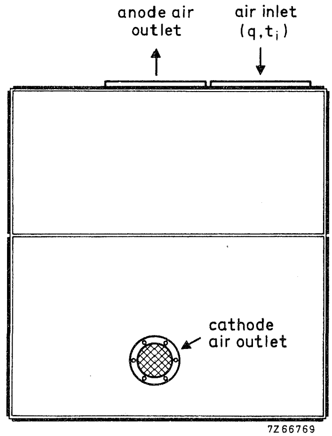


Fig. 3 Cooling air connector diagram.

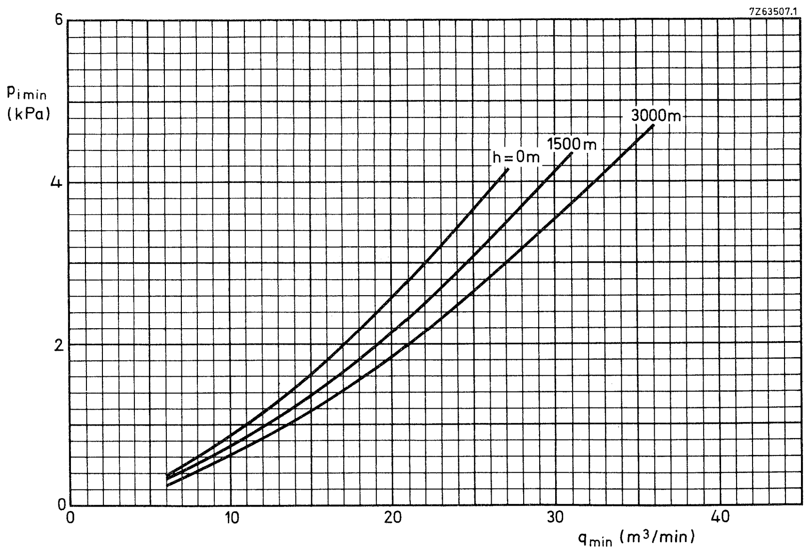


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND II AMPLIFIER CIRCUIT ASSEMBLY FOR YL1470
sound

Continuously tunable cavity-type circuit assembly to be used with YL1470 to form a grounded-grid amplifier of f.m. signals in Band II.

QUICK REFERENCE DATA

Class-B amplifier (sound)

Frequency	f	87,5 to 108	MHz
Anode voltage	V_a	7	kV
Output power in load	W_ℓ	11	kW
Power gain	G	22	dB

FREQUENCY RANGE

Continuously tunable from 87,5 to 108 MHz

COOLING

See relevant curves on pages 212 to 214. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial female connector, type EIA 1 5/8 inch.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 07850
Mating male input connector	Radiall type N
Mating connector for anode voltage	Radiall type R13060

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 393 x 400 x 632 mm

Net mass 54 kg

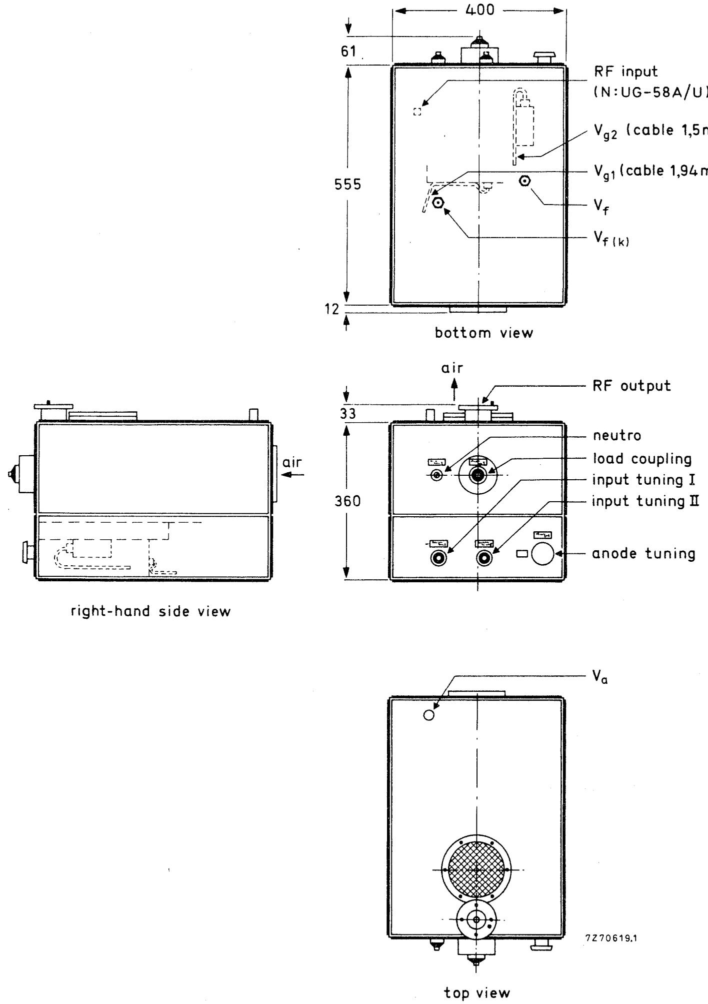


Fig. 1.

CIRCUIT DIAGRAM

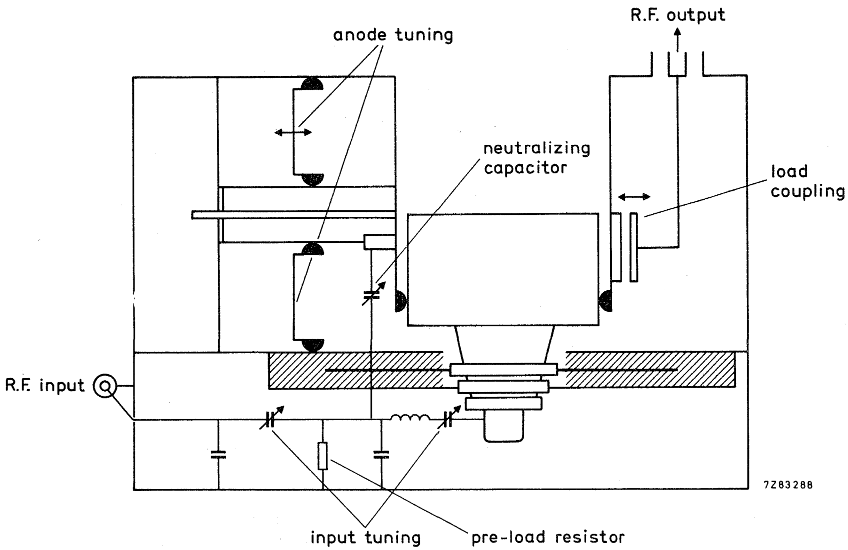


Fig. 2.

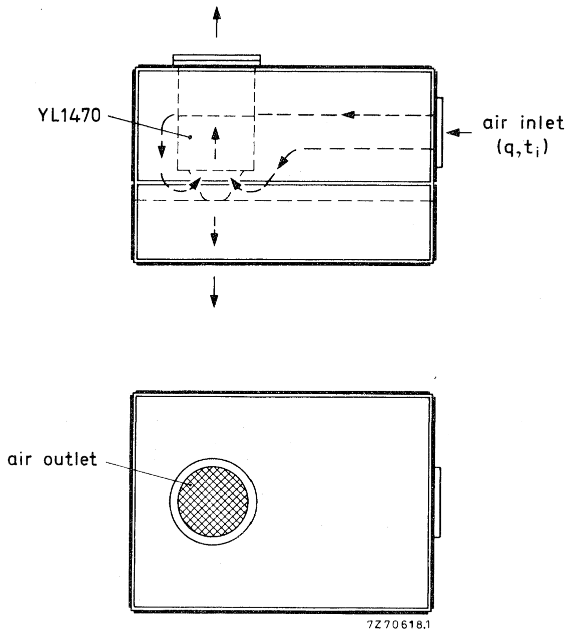


Fig. 3 Cooling air connector diagram.

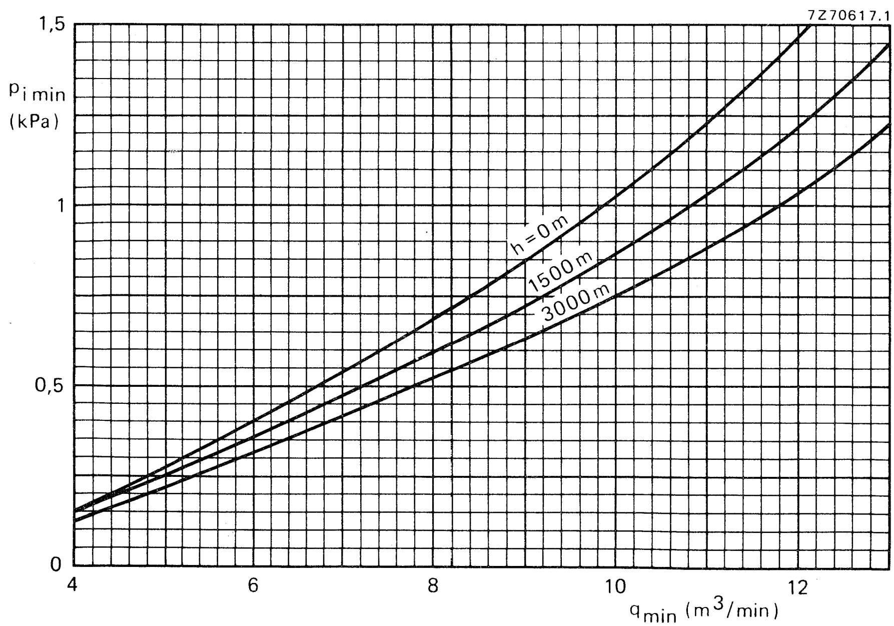


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1540
vision

Continuously tunable cavity-type circuit assembly to be used with YL1540 to form a broad-band grounded-grid linear amplifier of television signals in Band III.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)				
Frequency	f	170 to 230		MHz
Anode voltage	V_a	2,75	3	kV
Output power in load, sync	W_ℓ	0,55	1,1	kW
Power gain	G	20	20	dB

FREQUENCY RANGE

Continuously tunable — from 170 to 236 MHz

COOLING

See relevant curves on pages 215 to 217. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial female connector, type HN.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	7322 120 02143
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Mating connector for bias voltage	Radiall type R24020

- Recommended circulators:

Frequency 160 to 178 MHz; type 2722 162 01781
173 to 204 MHz; type 2722 162 01861
200 to 230 MHz; type 2722 162 01851
225 to 270 MHz; type 2722 162 03171

OUTLINE DRAWING

Dimensions in mm

Overall dimensions	618 x 355 x 412 mm
Net mass	38 kg

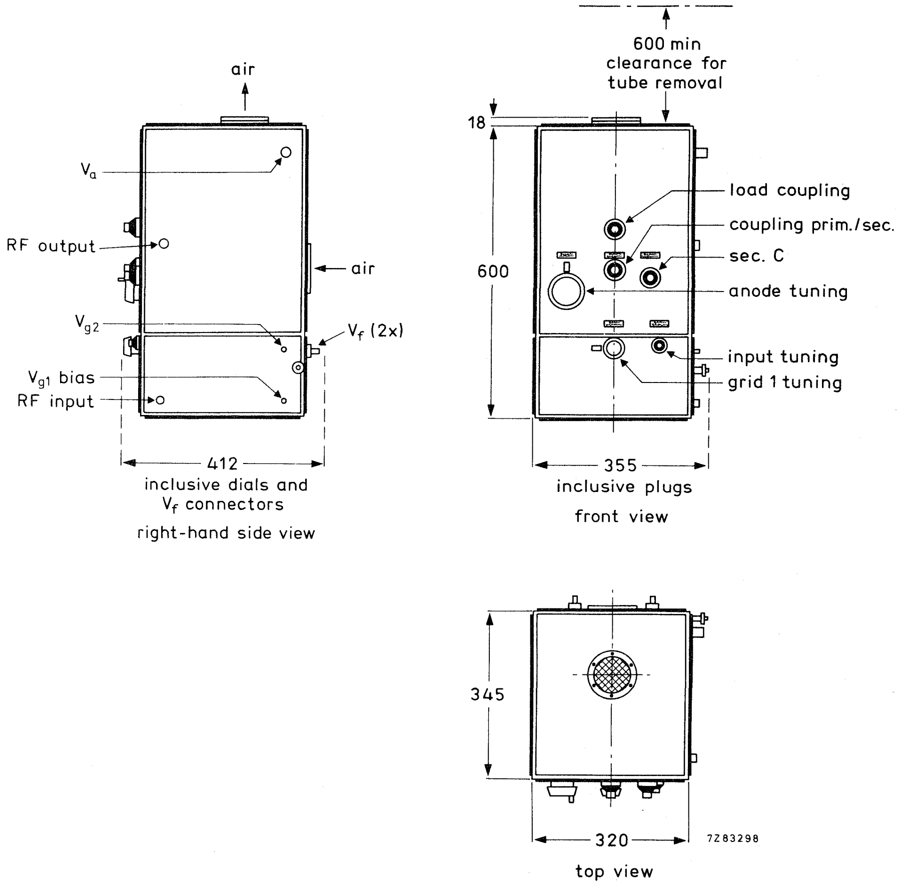


Fig. 1.

CIRCUIT DIAGRAM

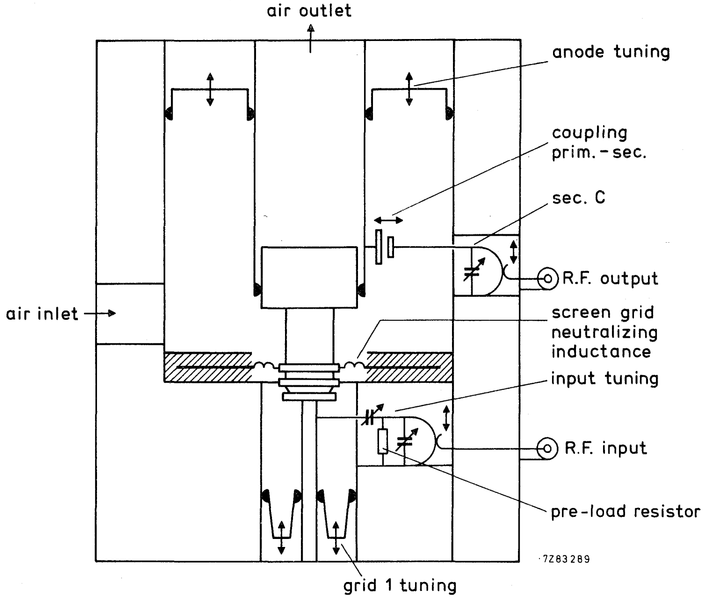


Fig. 2.

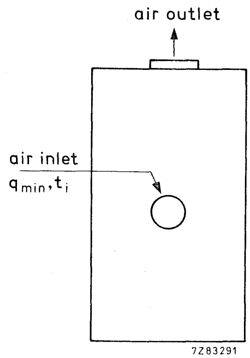


Fig. 3 Cooling air connector diagram.

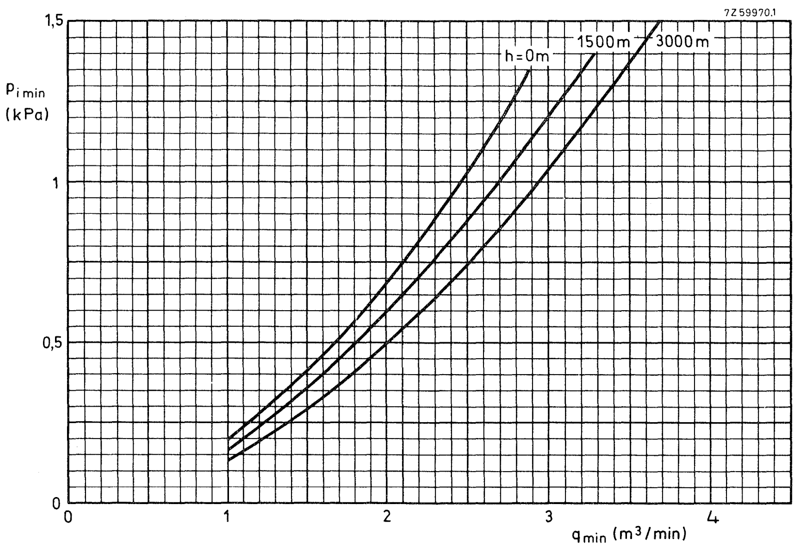


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1540
sound

Continuously tunable cavity-type circuit assembly to be used with YL1540 to form a grounded-grid amplifier of f.m. signals in Band III.

QUICK REFERENCE DATA

Class-B amplifier (sound)		
Frequency	f	170 to 230 MHz
Anode voltage	V_a	4 kV
Output power in load	W_ℓ	2,2 kW
Power gain	G	22,5 dB

FREQUENCY RANGE

Continuously tunable — from 170 to 230 MHz

COOLING

See relevant curves on pages 215 to 217. Direction of air flow see Fig. 3.
Either sucking or blowing via connectors on the top and rear panel.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial female connector, type HN.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor	type 7322 120 02143
Mating male input connector	Radiall type N
Mating male output connector	Radiall type R7050
Mating connector for anode voltage	Radiall type R13060
Mating connector for screen grid voltage	Radiall type R9510
Mating connector for bias voltage	Radiall type R24020

- Recommended circulators:

Frequency 160 to 178 MHz; type 2722 162 01781
173 to 204 MHz; type 2722 162 01861
200 to 230 MHz; type 2722 162 01851
225 to 270 MHz; type 2722 162 03171

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 618 x 355 x 412 mm

Net mass 33 kg

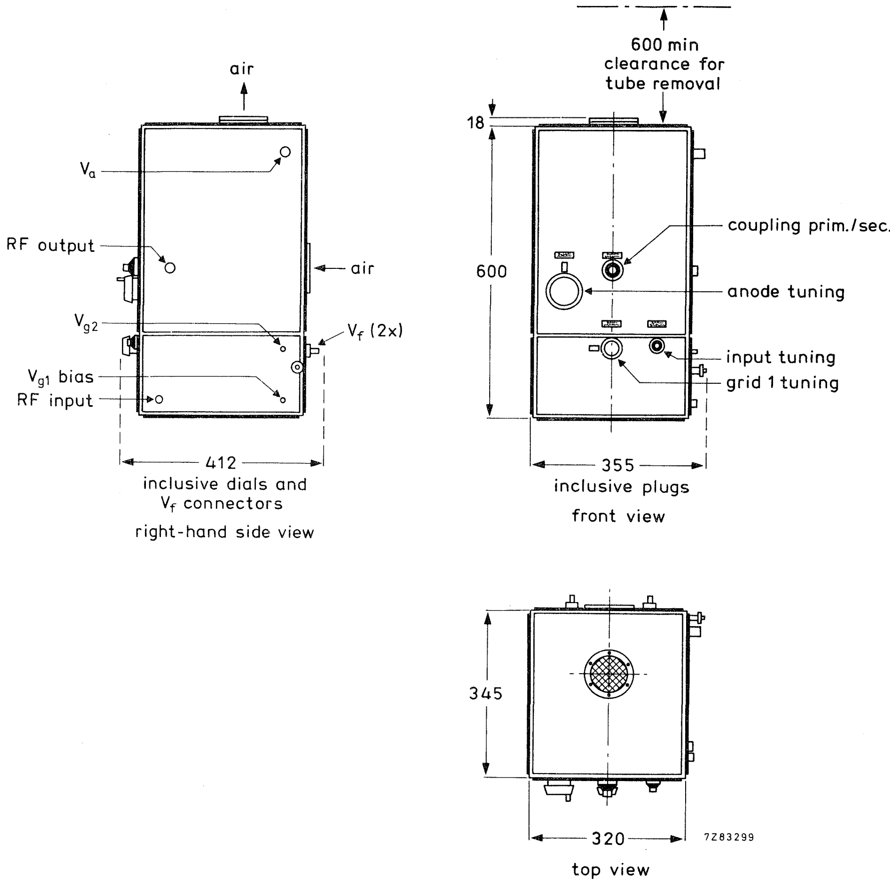


Fig. 1.

CIRCUIT DIAGRAM

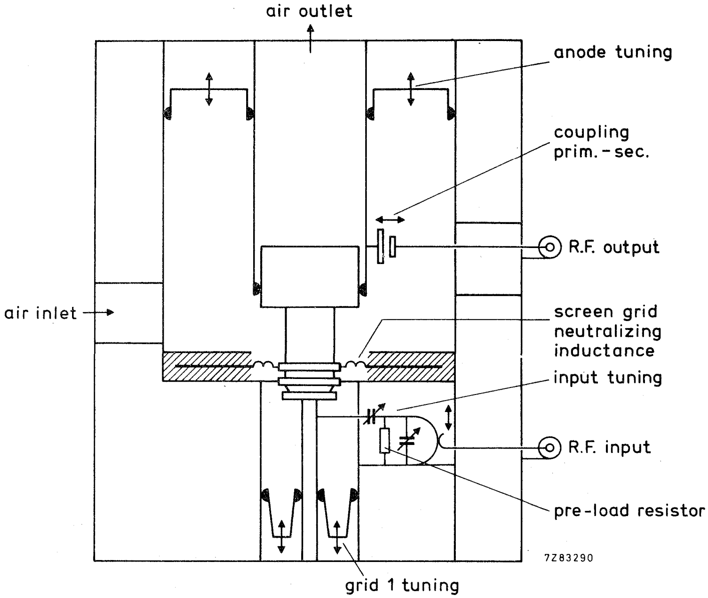


Fig. 2.

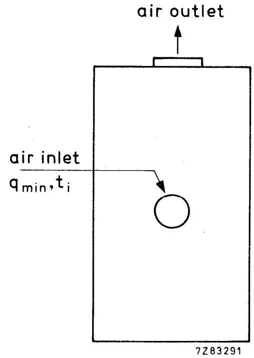


Fig. 3 Cooling air connector diagram.

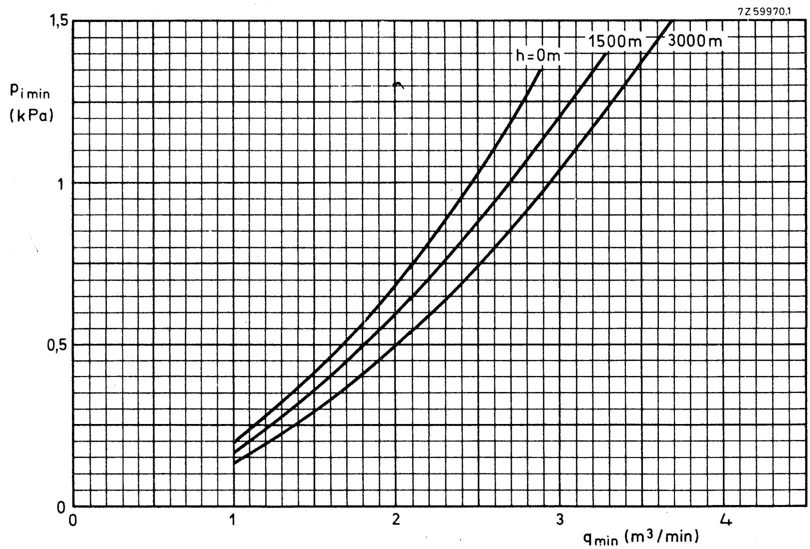


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND IV, V AMPLIFIER CIRCUIT ASSEMBLY FOR YL1560

vision and combined sound/vision

Continuously tunable cavity-type circuit assembly to be used with YL1560 to form a broad-band grounded-grid linear amplifier of television signals in Bands IV and V.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)

Frequency	f	470 to 860	MHz
Anode voltage	V_a	5,5	kV
Output power in load, sync	W_ℓ	5,5	kW
Power gain	G	16,5	dB

Class-AB amplifier for television transposer service

Frequency	f	470 to 860	MHz
Anode voltage	V_a	5,0	kV
Output power in load, sync	W_ℓ	2,2	kW
Power gain	G	16,5	dB

FREQUENCY RANGE

Continuously tunable — from 470 to 860 MHz

Depending on coupling capacitor (number of PTFE sheets), see Fig. 2.

COOLING

See relevant data on YL1560. Direction of air flow see Fig. 3.
Air inlet: blowing.

CONNECTORS

Input: 50 Ω coaxial female connector, type N.
Output: 50 Ω coaxial connector see page 224.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor, type 40754	7322 120 07853
Tube lifter	82222 032 132 51
Mating male input connector	Radiall type N
Mating male output connector	See page H22
Mating connector for anode voltage	Radiall R13070
Air space ring	8222 032 69431

OUTLINE DRAWING

Dimensions in mm

Overall dimensions 745 x 490 x 286 mm

Net mass kg

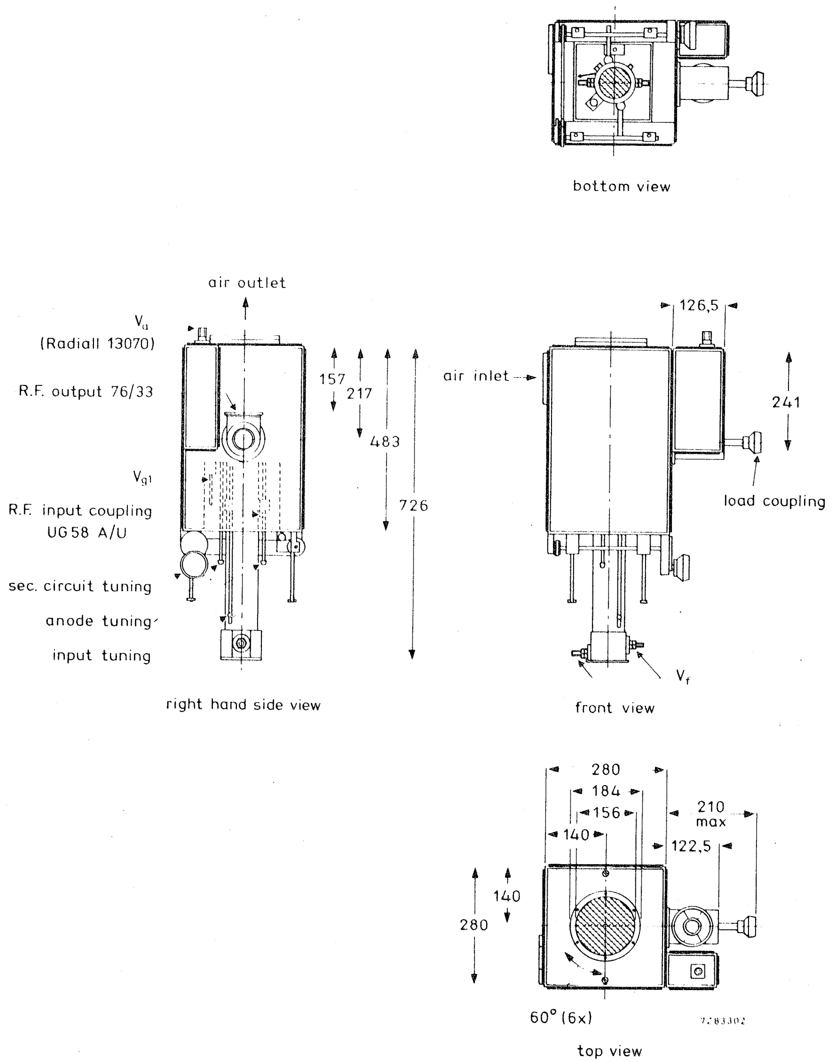


Fig. 1.

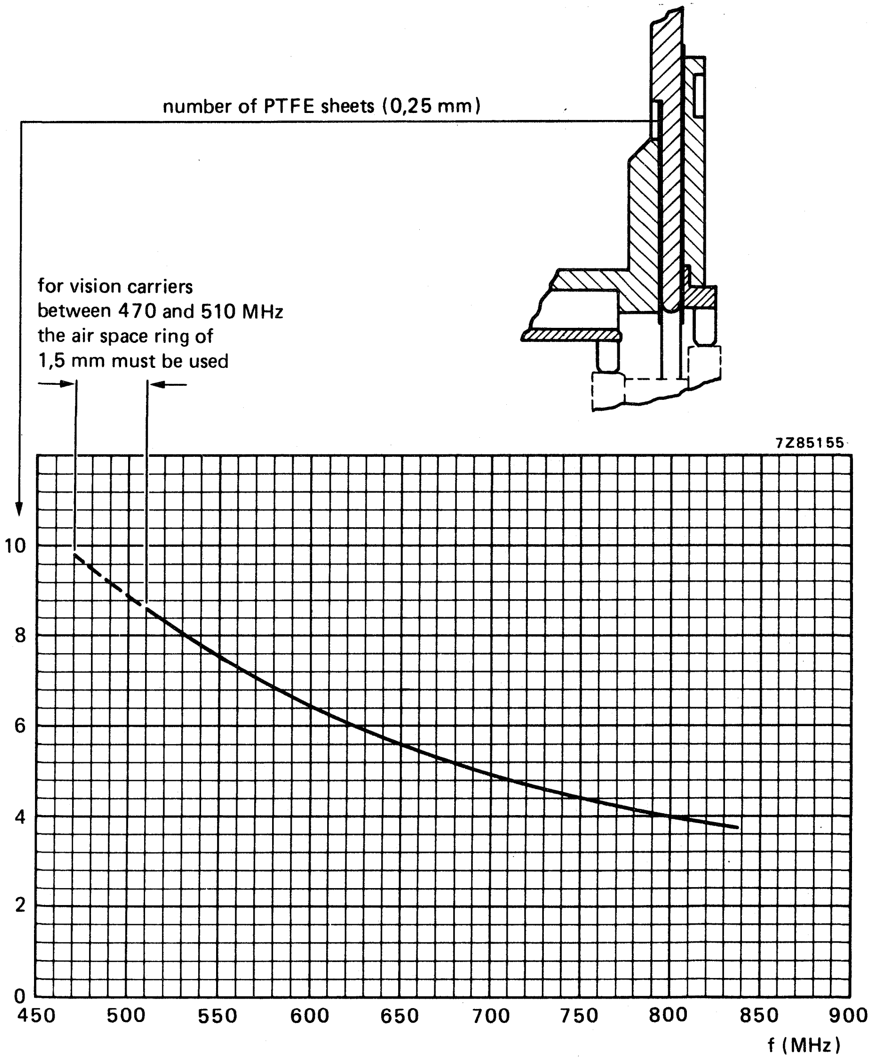


Fig. 2 Coupling capacitor.

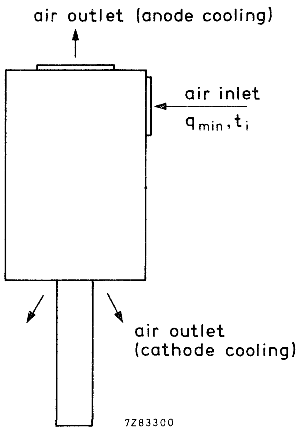


Fig. 3 Cooling air connector diagram.

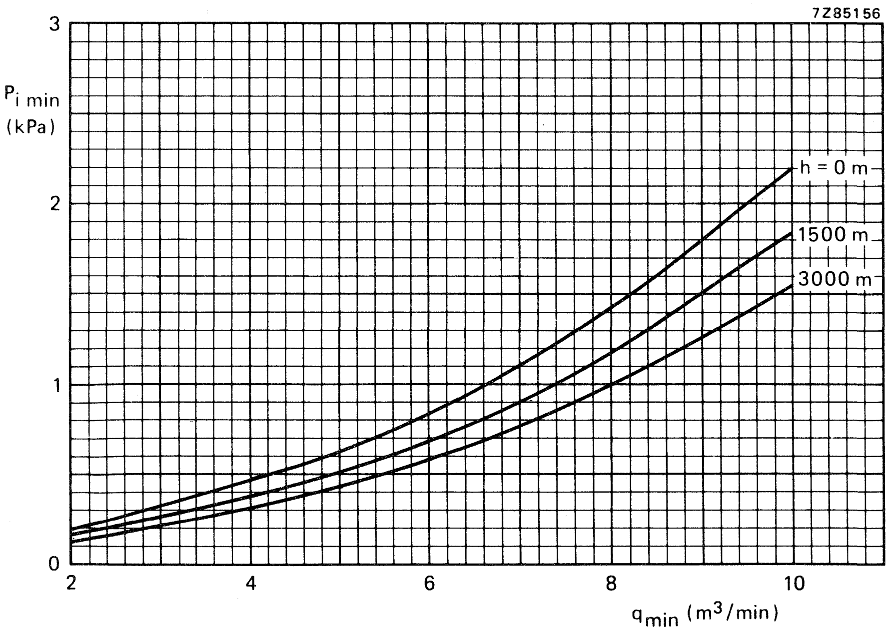


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B′, for blowing $q = q_A$; for sucking $q = q_A + q_B{}'$.

CIRCUIT DIAGRAM

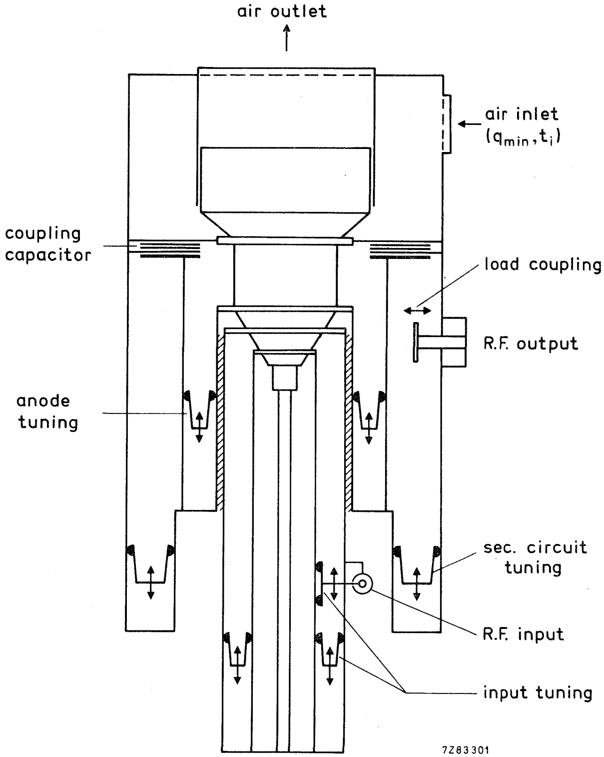


Fig. 5.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1630

vision

Continuously tunable cavity-type circuit assembly with broadband input circuit to be used with YL1630 to form a grounded-screen and control grid linear amplifier of television signals in band III, with screen grid directly connected to earth.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)

Frequency	f	170 to 230	MHz
Anode voltage	V_a	7	kV
Output power in load, sync	W_ℓ	30	kW
Power gain	G	18	dB

FREQUENCY RANGE

Continuously tunable from 170 to 230 MHz

Input circuit of cavity is broadbanded (no input tuning required).

COOLING

See relevant curves on pages 218 to 220. Direction of air flow and pressure, see Figs 3 and 2.

Detailed information: see service manual 40786.

A tube extractor can be supplied separately, type 8222 032 14460.

OUTLINE DRAWING

Overall dimensions

Dimensions in mm

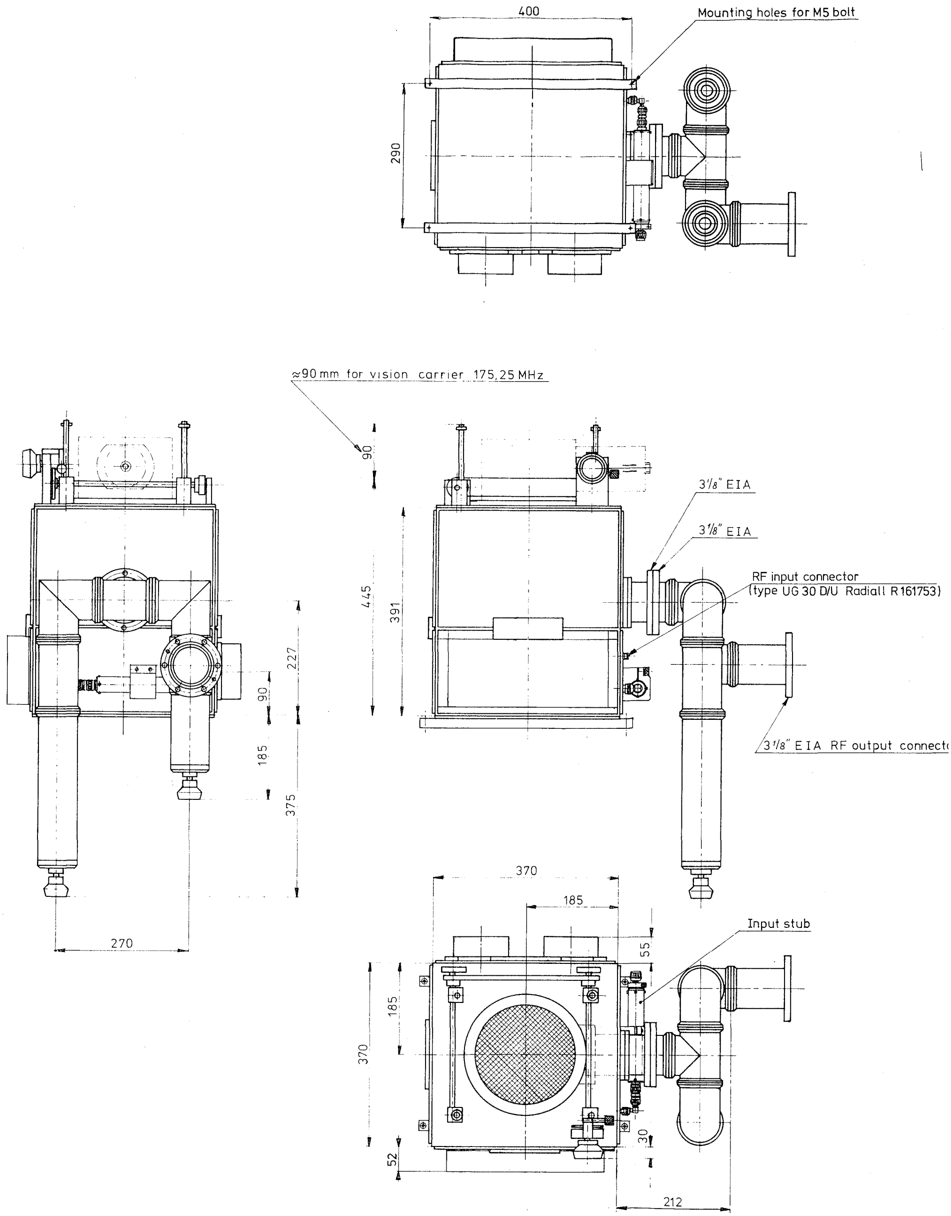


Fig. 1.

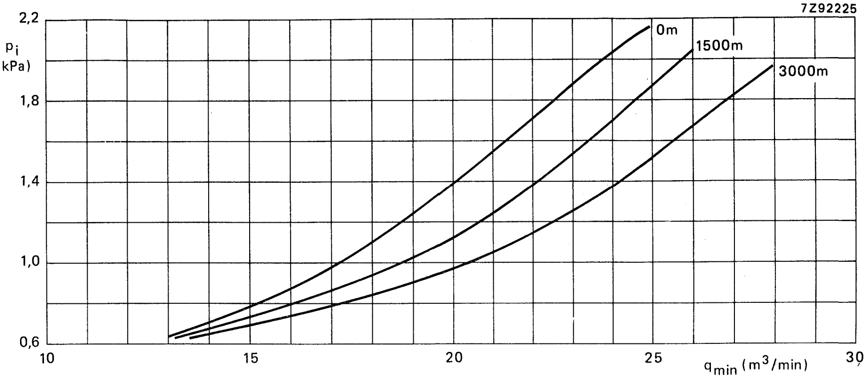


Fig. 2 Ratio of cooling air pressure to cooling air volume at various altitudes.

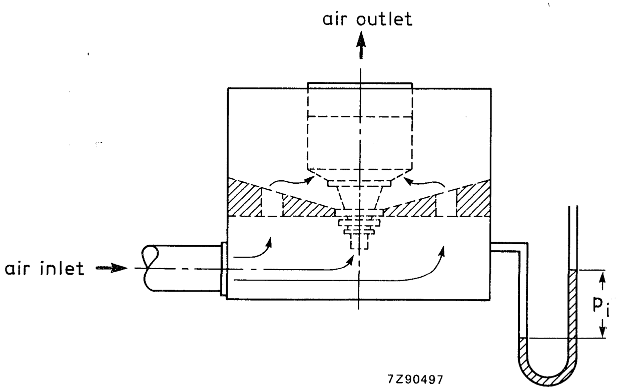


Fig. 3 Direction of air flow.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1610

vision

Continuously tunable cavity-type circuit assembly with broadband input circuit to be used with the YL1610 to form a grounded-screen and control grid linear amplifier of television signals in band III, with the screen grid directly connected to earth.

QUICK REFERENCE DATA

Class-AB linear amplifier (vision)

Frequency	f	170 to 230	MHz
Anode voltage	V_a	5,5	kV
Output power in load, sync	W_ℓ	11	kW
Power gain	G	17	dB

FREQUENCY RANGE

Continuously tunable	from	170 to 230	MHz

Input circuit of cavity is broadbanded (no input tuning required).

COOLING

See relevant curves on pages 221 to 223. Direction of air flow and pressure Figs 3 and 2.

Detailed information: see service manual 40787.

A tube extractor can be supplied separately, type 8222 032 14840.

OUTLINE DRAWING

Dimensions in mm

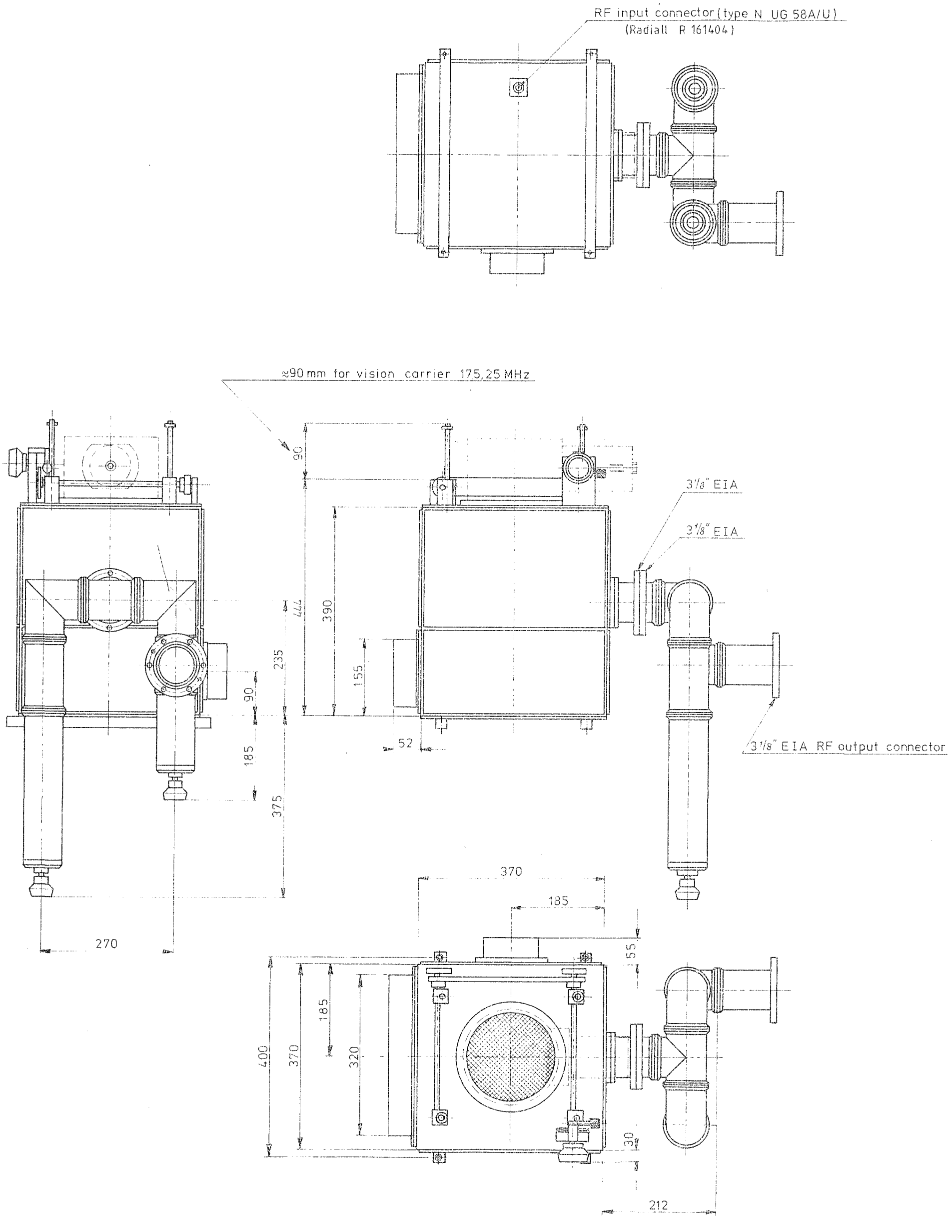


Fig. 1.

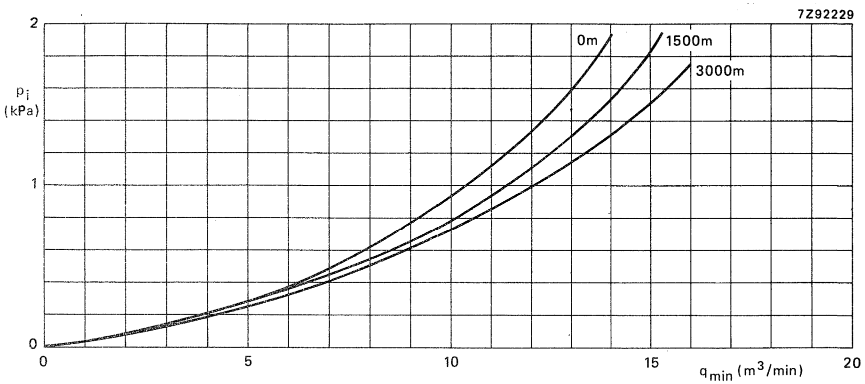


Fig. 2 Ratio of cooling air pressure to cooling air volume at various altitudes.

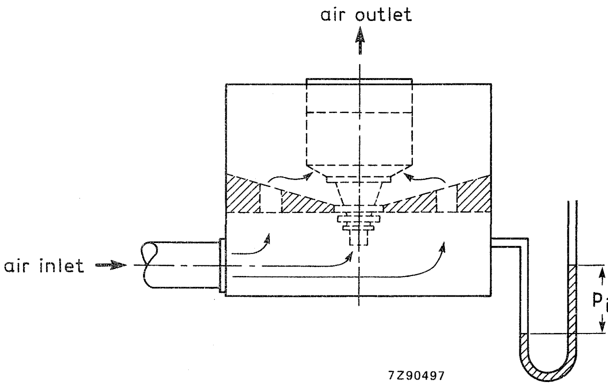


Fig. 3 Direction of air flow.

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