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Transmitting tubes for communications, ceramic types

T2b

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Data handbook

Electronic components and materials

Electron tubes

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Transmitting tubes for communications

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T6	**Geiger-Müller tubes**
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T10	**Plumbicon camera tubes and accessories**
T11	**Microwave semiconductors and components**
T12	**Vidicon and Newvicon camera tubes**
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T15	**Dry reed switches**
T16	**Monochrome tubes and deflection units** Black and white TV picture tubes, monochrome data graphic display tubes, deflection units

SEMICONDUCTORS (RED SERIES)

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The purple series of handbooks comprises:

IC01	**Radio, audio and associated systems** Bipolar, MOS	published 1986
IC02a/b	**Video and associated systems** Bipolar, MOS	published 1986
IC03	**Integrated circuits for telephony** Bipolar, MOS	published 1986
IC04	**HE4000B logic family** CMOS	published 1986
IC05N	**HE4000B logic family — uncased ICs** CMOS	published 1984
IC06N	**High-speed CMOS; PC74HC/HCT/HCU** Logic family	published 1986
IC08	**ECL 10K and 100K logic families**	published 1986
IC09N	**TTL logic series**	published 1986
IC10	**Memories** MOS, TTL, ECL	new issue 1987
IC11N	**Linear LSI**	published 1985
Supplement to IC11N	**Linear LSI**	published 1986
IC12	**I^2C-bus compatible ICs**	not yet issued
IC13	**Semi-custom** Programmable Logic Devices (PLD)	new issue 1987
IC14	**Microcontrollers and peripherals** Bipolar, MOS	new issue 1987
IC15	**FAST TTL logic series**	published 1986
IC16	**CMOS integrated circuits for clocks and watches**	published 1986
IC17	**Integrated Services Digital Networks (ISDN)**	not yet issued
IC18	**Microprocessors and peripherals**	new issue 1987

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C2	**Television tuners, coaxial aerial input assemblies**
C3	**Loudspeakers**
C4	**Ferroxcube potcores, square cores and cross cores**
C5	**Ferroxcube for power, audio/video and accelerators**
C6	**Synchronous motors and gearboxes**
C7	**Variable capacitors**
C8	**Variable mains transformers**
C9	**Piezoelectric quartz devices**
C11	**Varistors, thermistors and sensors**
C12	**Potentiometers, encoders and switches**
C13	**Fixed resistors**
C14	**Electrolytic and solid capacitors**
C15	**Ceramic capacitors**
C16	**Permanent magnet materials**
C17	**Stepping motors and associated electronics**
C18	**Direct current motors**
C19	**Piezoelectric ceramics**
C20	**Wire-wound components for TVs and monitors**
C22	**Film capacitors**

TRANSMITTING TUBES FOR COMMUNICATIONS

ceramic types

SELECTION GUIDE
triodes and tetrodes

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
YD1333	C	FA	0,11	6,3	5,3	2	0,25	3,5	0,9	88,5 x 71
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 A	V_a max kV	W_a max kW	h x dia max mm
QBL3.5/2000	C	FA	2,1	3,6	58	4,3	850	0,48	4,5	1,5	
YL1010	C	W	5,5	10	200	10	800	7,4	10	2	306,5 x 140
YL1011	C	FA	5,5	10	200	10	800	7,4	10	2	321,5 x 215
YL1012	C	V	5,5	10	200	10	800	7,4	10	2	315 x 218
YL1420	D	FA	11	6,3	118	5	600	1,45	8,5	6	174 x 125,1
YL1421	D	W	11	6,3	120	7	600	2,3	8,5	6	220 x 86,5
YL1430	D	FA	18	8	120	8	700	3,5	9,5	12	211 x 164,2
YL1440	D	FA	2,4	4,2	53	3	600	0,98	4	1,5	125 x 63
YL1470	D	FA	11	6,3	120	7	600	2,3	8,5	8	174 x 125,1
YL1520	D	FA	25	10,4	120	8,5	700	4,6	9,5	18	225 x 164,2
YL1530	D	FA	35	7,5	180	10	900	2,4	12	30	264 x 215
YL1531	D	W	50	7,5	180	10	900	2,4	14	30	340 x 160,5
YL1540	D	FA	2,2	4,2	53	3	700	0,5	4,2	2	122 x 63
YL1541	D	FA	2,1	4,2	53	4	700	0,5	4,5	2	122 x 63
YL1610	D	FA	11	8	113	5	500	2	7	14	207 x 164
YL1630	D	FA	30	10,4	165	7,5	600	4	10	26	233 x 215
YL1631	D	FA	20	10,4	112	7	900	3	9	17	250 x 164
YL1640	D	W	125	10	280	11	1000	25	15	150	445 x 270
YL1650	D	W	300	18	430	3	1000	2,5	12	300	488 x 260
YL1660	D	W	550	23	500	5	1000	35	15	500	572 x 320
YL1740	D	W	200	15	320	11	1000	25	15	250	505 x 270

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

SELECTION GUIDE

Amplifier Circuit Assemblies

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						
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
40787V	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
40786A	III	20	170 to 230	15,3	YL1631	500 x 400 x 400
Sound						
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	20	80 to 108	17	YL1631	400 x 400 x 500
40789*	II	40	88 to 108	17	YL1630	400 x 400 x 500
Vision and sound						
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
40786A	III	10	175 to 225	17	YL1630	500 x 400 x 400
40786A	III	10	175 to 225	16	YL1631	500 x 400 x 400

* Data available on request.

INDEX OF TYPE NUMBERS

GENERAL SECTION

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.

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
→ Δp	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

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 **device data**. 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 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.

3.3 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.

3.4 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.

3.5 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.

3.6 By-passing the filament

Tubes with directly heated cathodes must have the filament terminals at the same r.f. potential. For this purpose it is usual to connect a capacitor 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.

3.7 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.

3.8 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 3.5 and 3.7 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 minutes 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.

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.	0,8	0,833	1	0,67	0,67	0,67
R.F. class B	1	0,833	1	0,833	1	0,67
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	1,13	0,53	0,53	0,665	1	
Two-phase half-wave without filter	0,9	0,89	0,89	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 ^{o}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.

Tubes for communications	test wire diameter, mm
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
YL1610	0,10
YL1630	0,15
YL1631	0,17
YL1640	0,30
YL1650	0,30
YL1660	0,30
YL1740	0,30

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.

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.

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

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	ΔP P_a
900	25	1,5	310

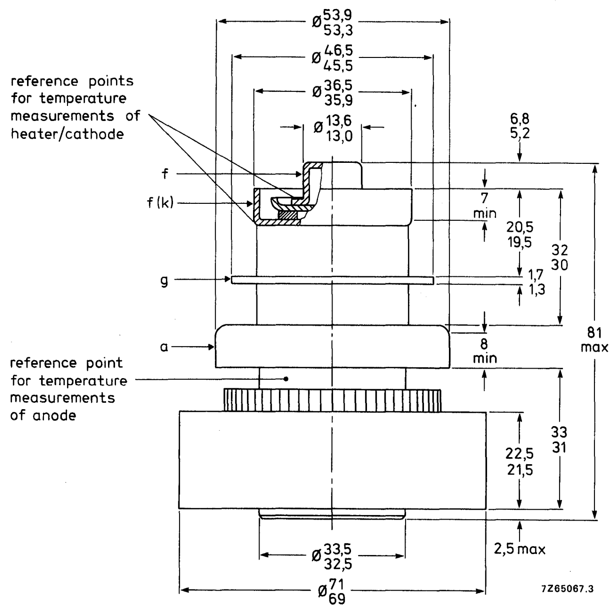
Other terminals: low velocity airflow.

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

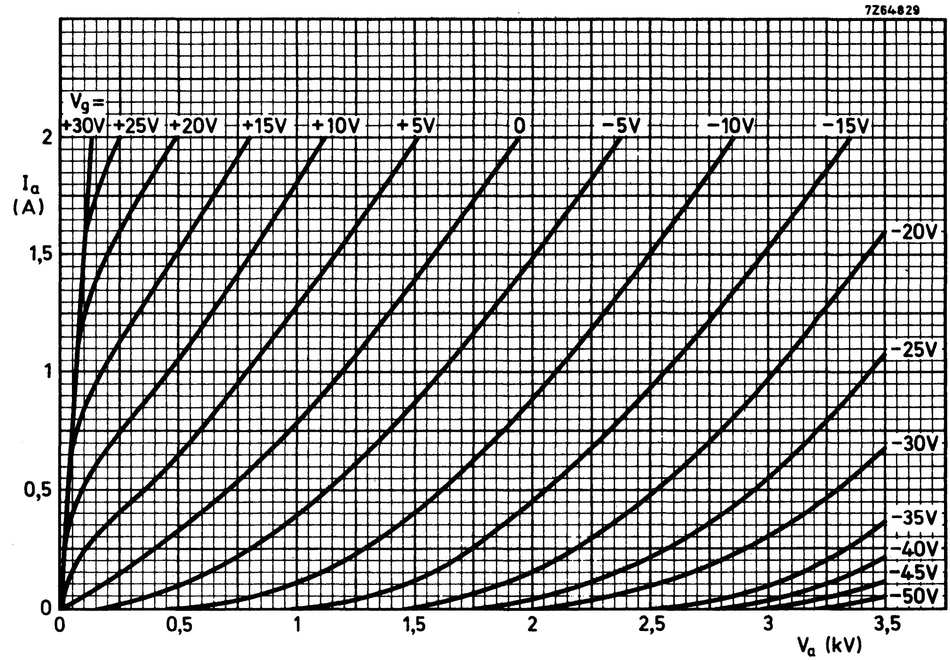
LIMITING VALUES (Absolute maxium rating system)

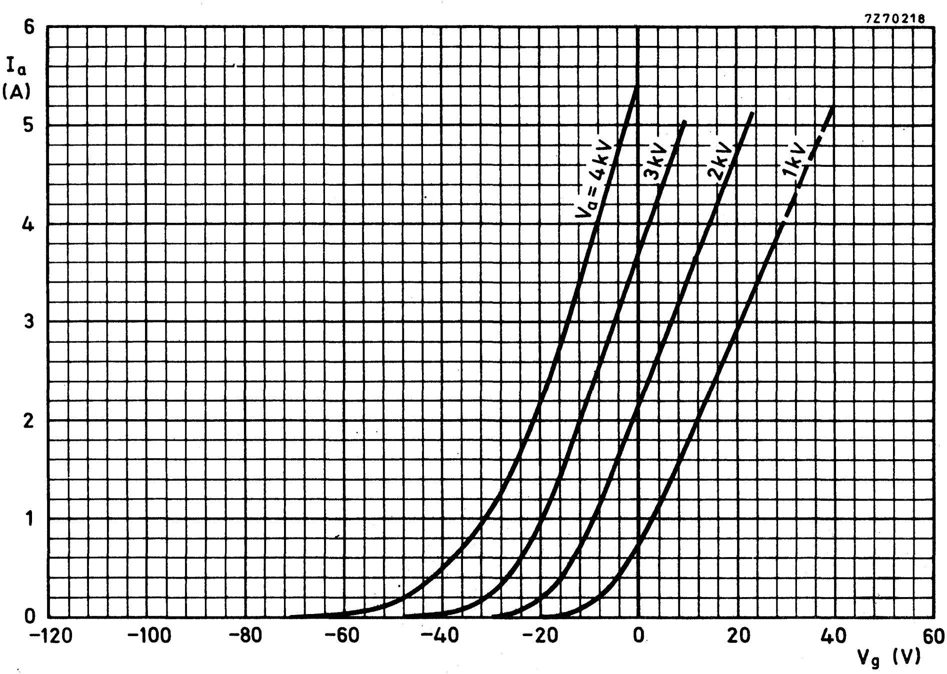
Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3000	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	900	W
Grid current	I_g	max.	5	mA
Cathode current	I_k	max.	550	mA

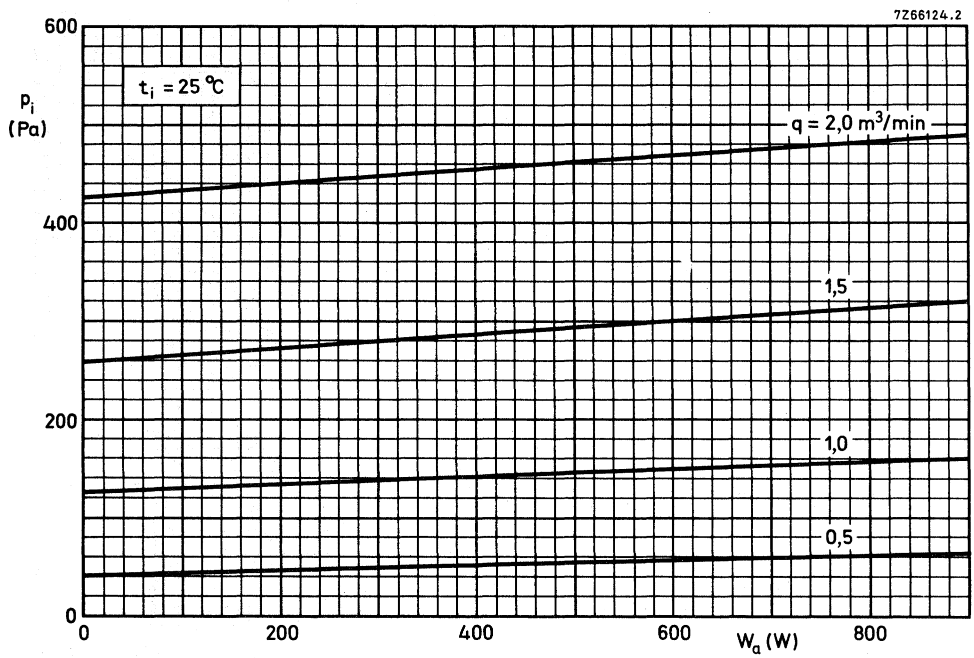
OPERATING CONDITIONS (note 1)

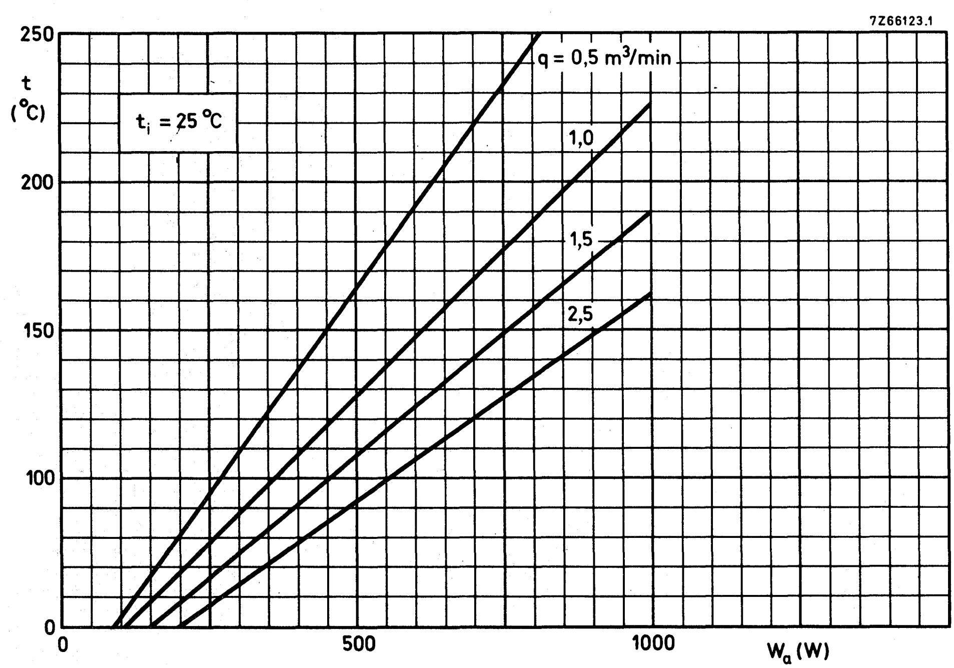
Frequency	f	174 to 860	MHz
Anode voltage	V_a	2700	V
Grid voltage (note 2)	V_g	−28	V
Anode current, no signal	I_a	200	mA
Anode current	I_a	350	mA
Grid current	I_g	0	mA
Driver output power	W_{dr}	8	W
Output power in load	W_ℓ	300	W
Power gain	G	16	dB

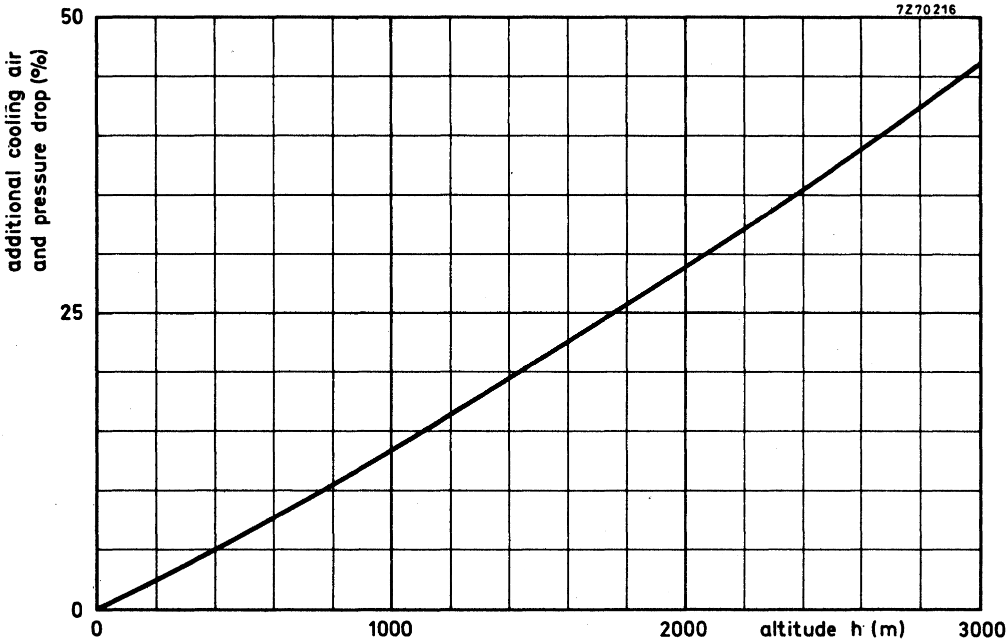
Notes
1. R.F. driving power should be applied after the heater and electrode voltages.
2. To be adjusted for the stated no-signal anode current. Range values for equipment design −15 to −40 V. For "automatic bias" the cathode resistor range is 80 to 180 Ω.

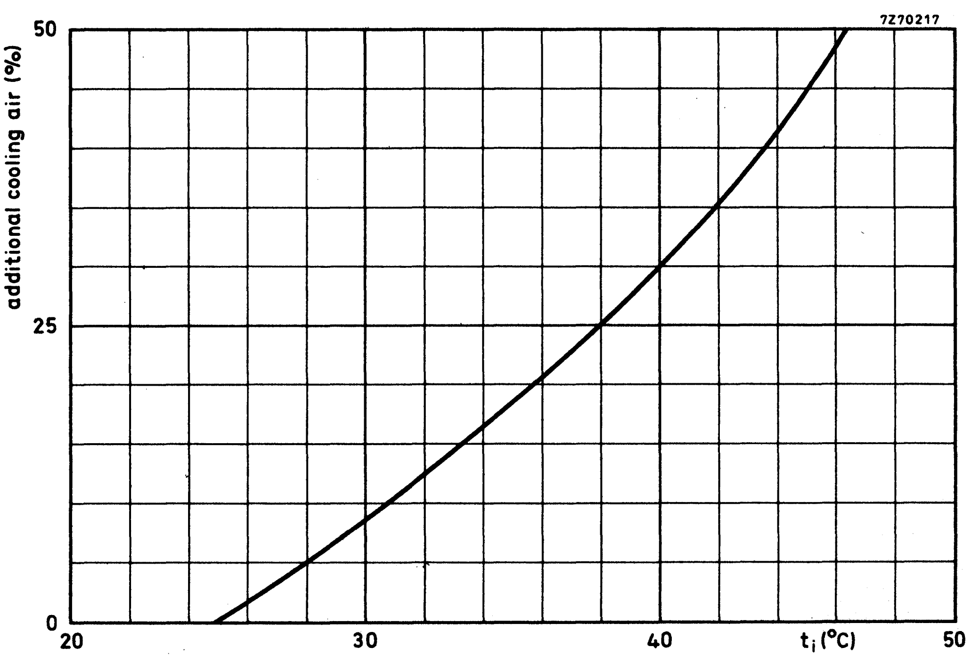

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
0
0,5
1
1,5
2
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


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


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


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

To obtain optimum life this temperature should not exceed 200 °C.

* 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} m^3/min	ΔP P_a
1800	25	2,5	220

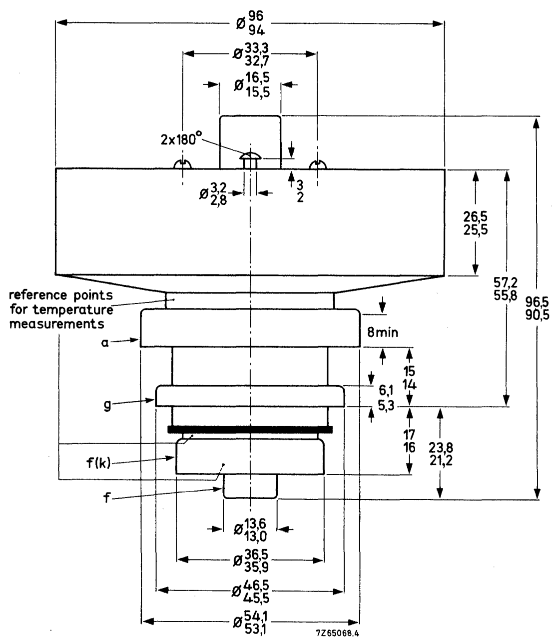
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled. Cooling air and voltages may be switched off simultaneously.

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)

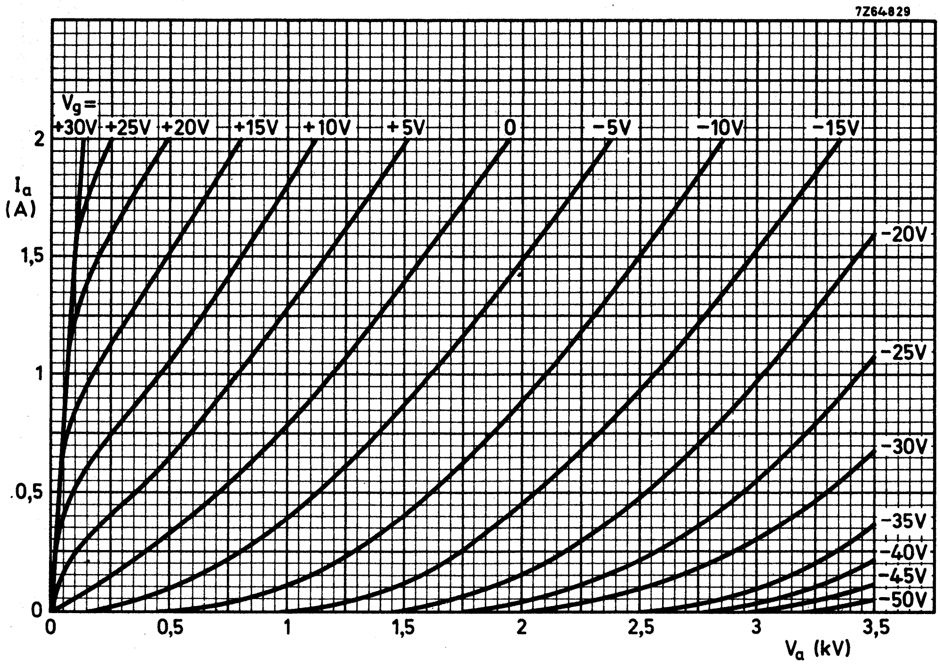
OPERATING CONDITIONS, grounded grid (note 2)

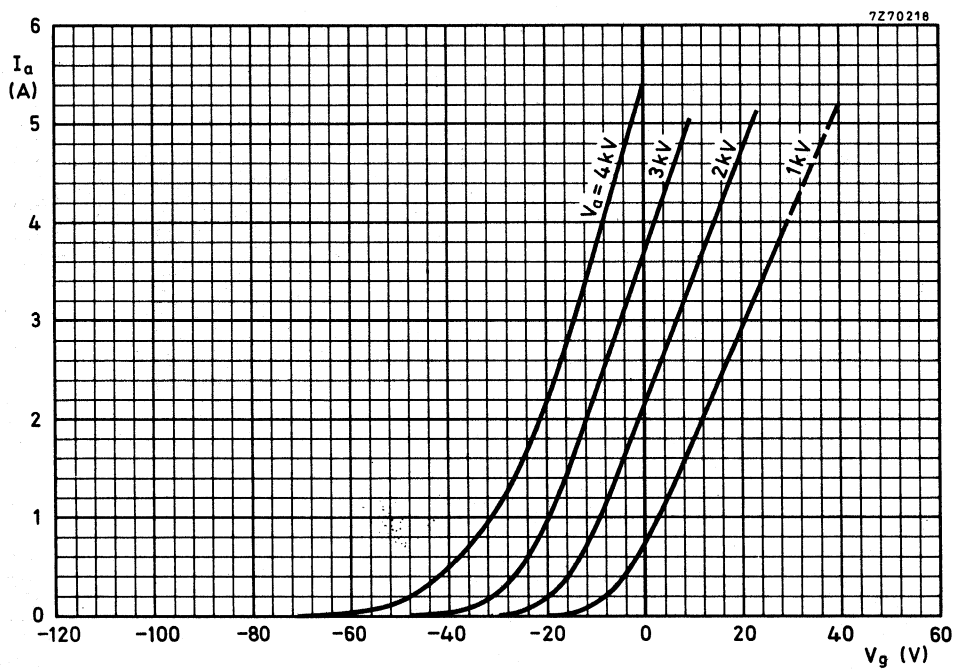
Standard		CCIR-G	CCIR-L	
Frequency	f	470 to 860	470 to 860	MHz
Bandwidth (−1 dB)	B	9	9	MHz
Anode voltage	V_a	3500	3500	V
Grid voltage (note 3)	V_g	−38	−38	V
Anode current, no signal	I_a	250	250	mA
Anode current at average grey level	I_a	≈ 500	≈ 500	mA
Grid current	I_g	≈ 0	≈ 0	mA
Driver output power, 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)

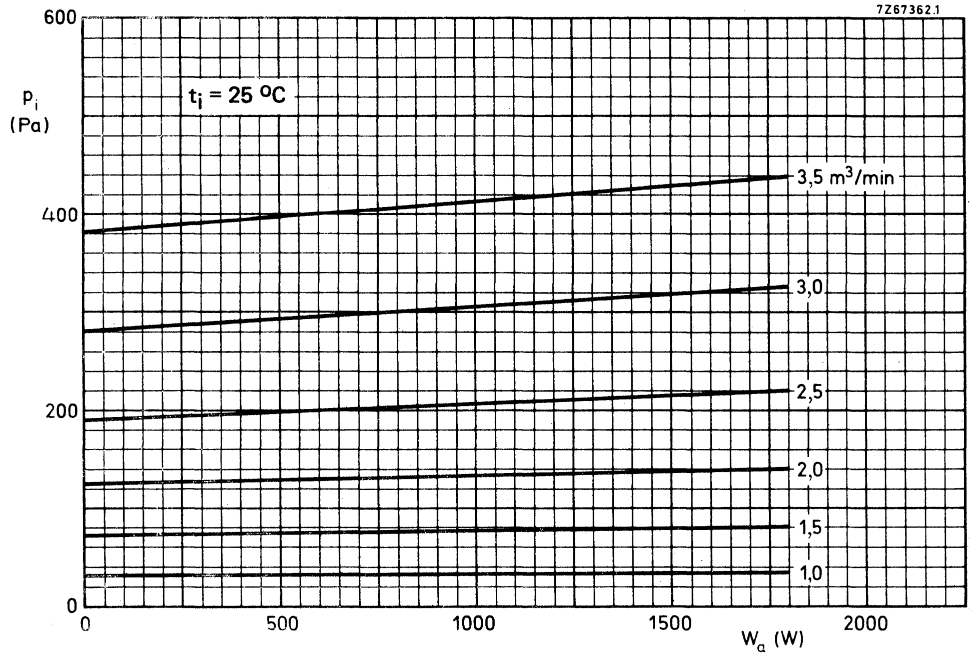
Notes

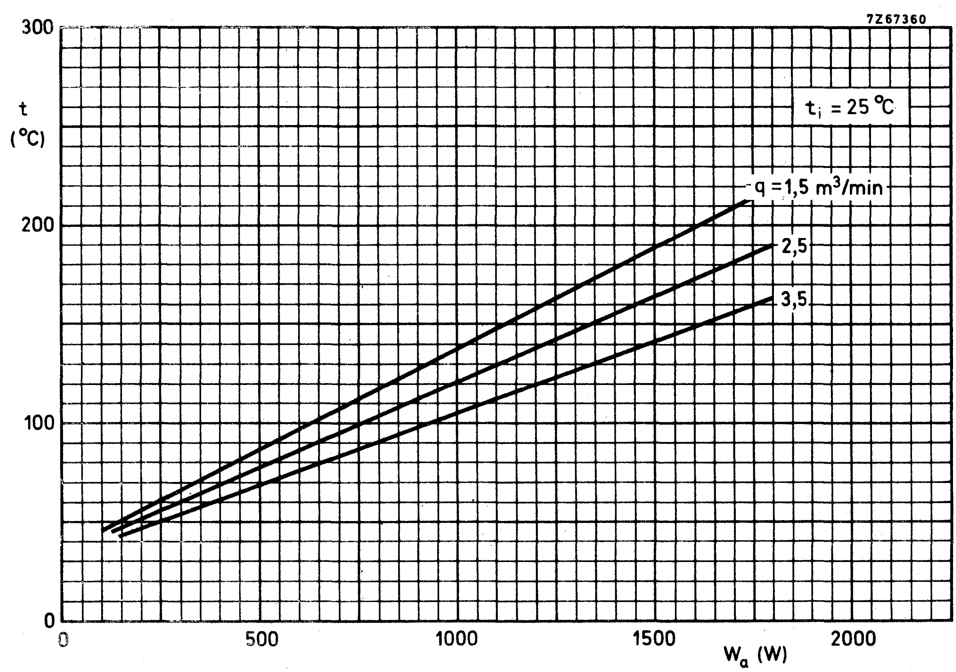
1. During a short period, for adjustment of the transmitter, W_a = max. 2200 W, and I_k = max. 800 mA.
2. R.F. driving power should be applied after the heater and electrode voltages.
3. To be adjusted for the stated no-signal anode current. Range values for equipment design −20 to −50 V.
4. Standard 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.

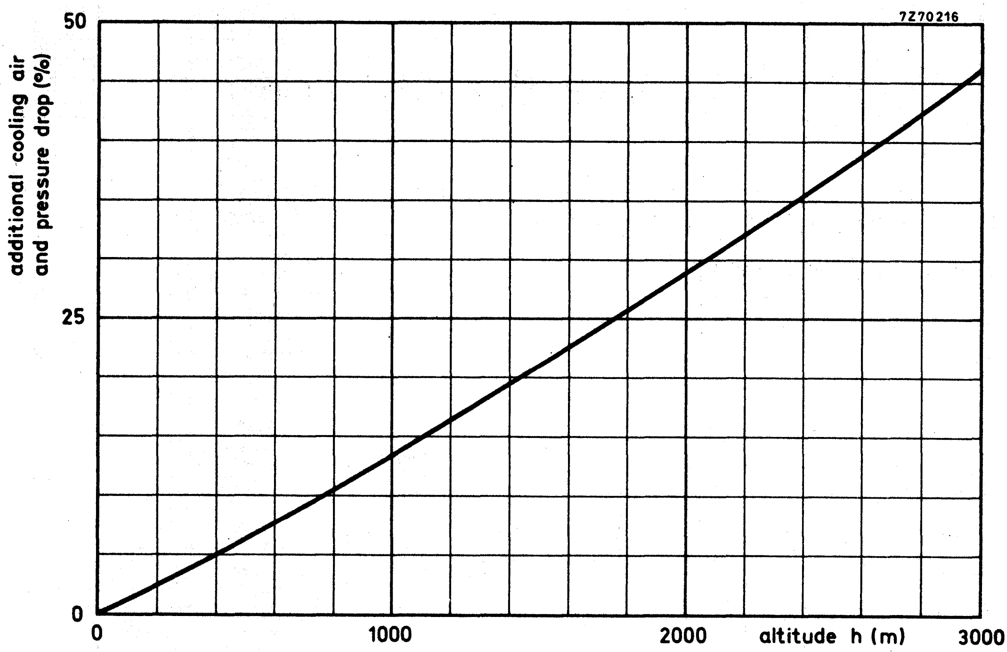
   Standard CCIR-L: Measured on white level with a sawtooth drive of 30% to 100% of peak white amplitude with a superimposed 3 MHz signal with a peak-to-peak value of 30% of the picture white amplitude.

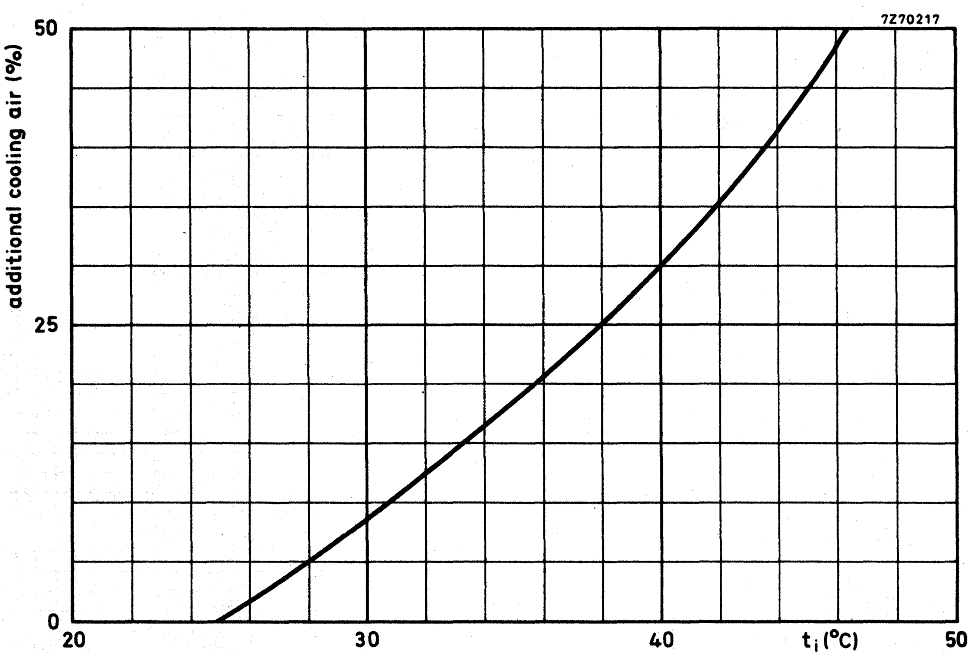

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


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)


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	^{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} m^3/min	ΔP Pa
1800	25	2,5	220

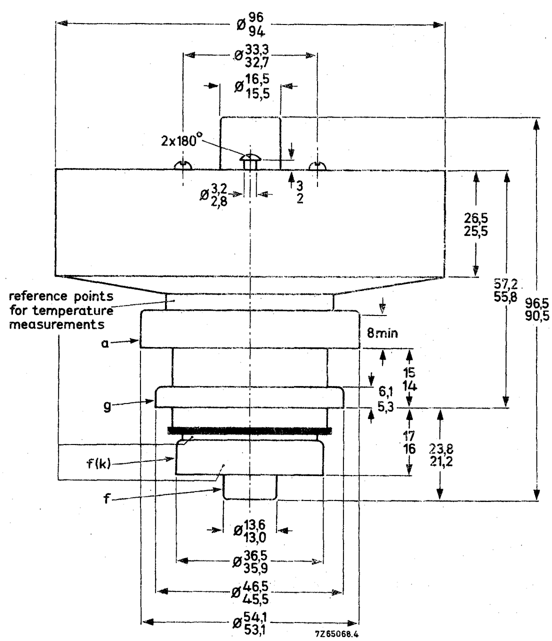
Other terminals: low velocity air flow.
When only the heater voltage is applied, the heater and heater/cathode terminals should also be cooled.
Cooling air and voltages may be switched off simultaneously.

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)

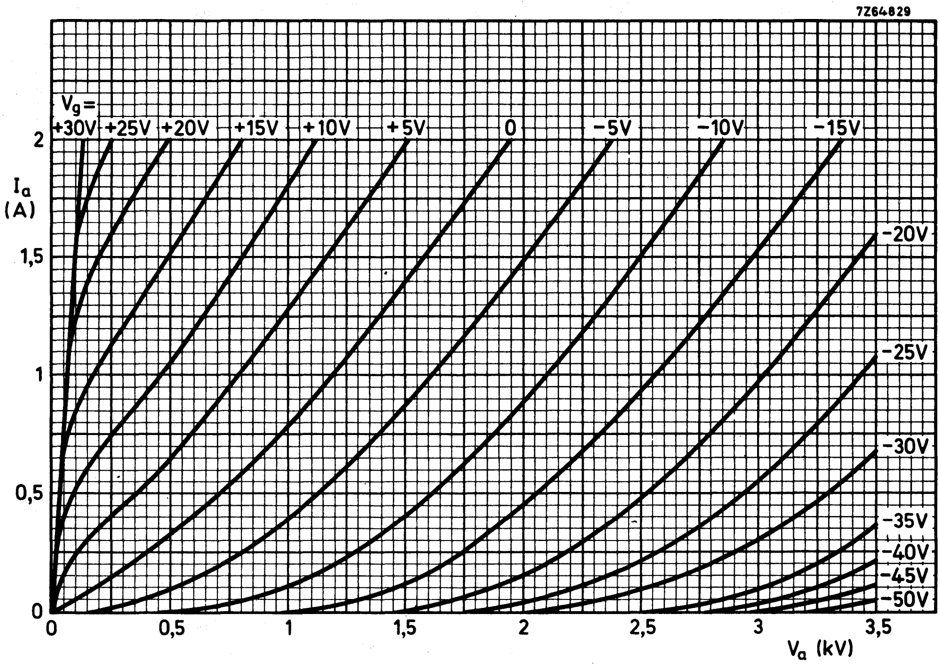
Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	W_a	max.	1800	W
Grid current	I_g	max.	±5	mA
Cathode current	I_k	max.	550	mA (note 1)

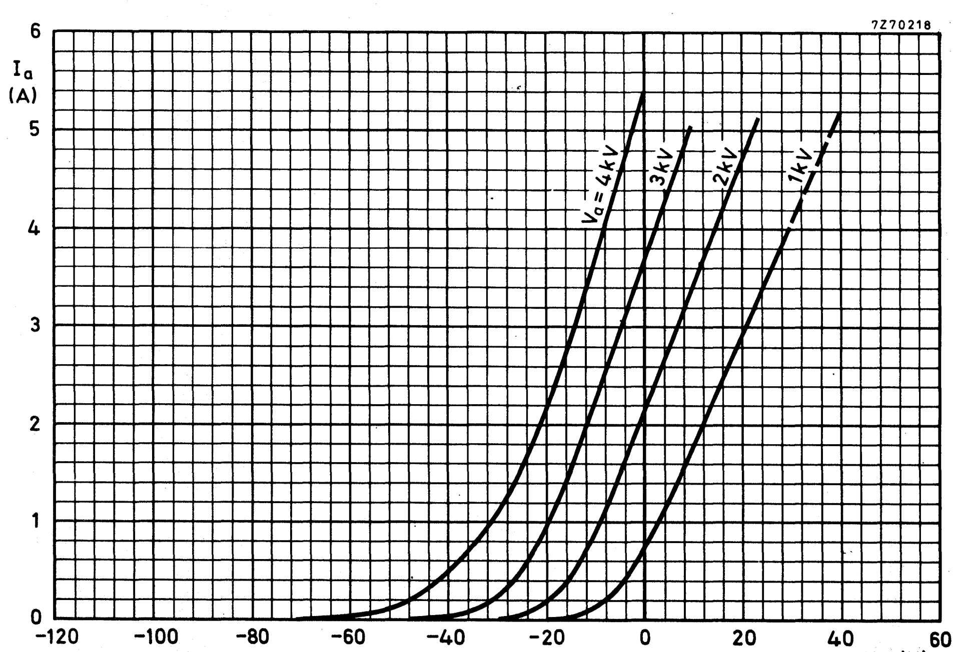
OPERATING CONDITIONS, grounded grid (notes 2,3)

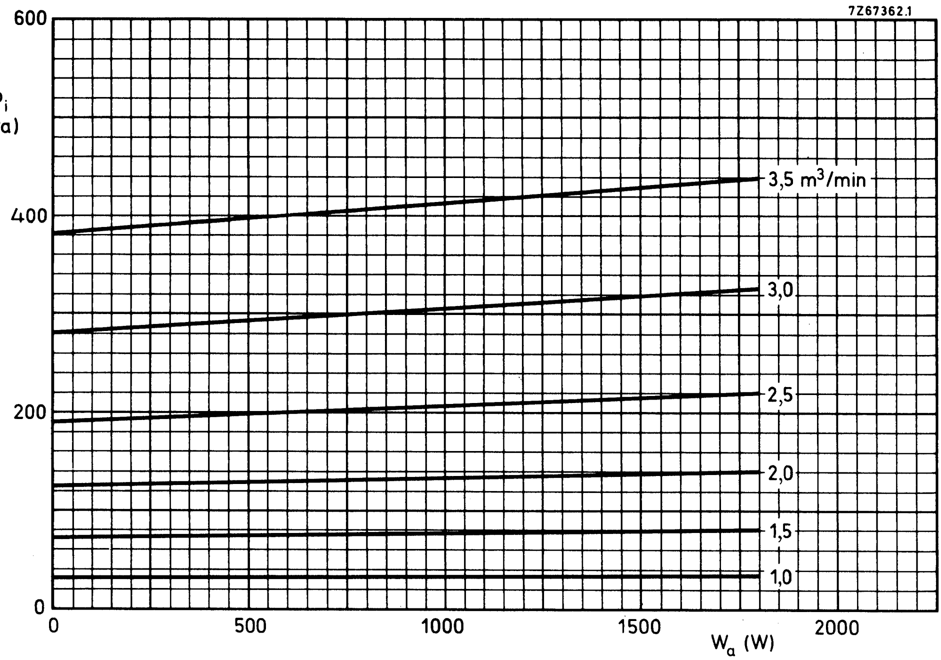
Standard		C.C.I.R-G	C.C.I.R-G	C.C.I.R-I	
Frequency	f	470 to 860	470 to 860	470 to 860	MHz
Bandwidth	B	9	9	9	MHz
Anode voltage	V_a	3000	3000	3000	V
Grid voltage (note 4)	V_g	−30	−30	−30	V
Anode current, no signal	I_a	420	350	420	mA
Anode current at zero dB level	I_a				
(vision carrier)	I_a	650	550	650	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	$\geqslant 390$	$\geqslant 390$	$\geqslant 390$	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	

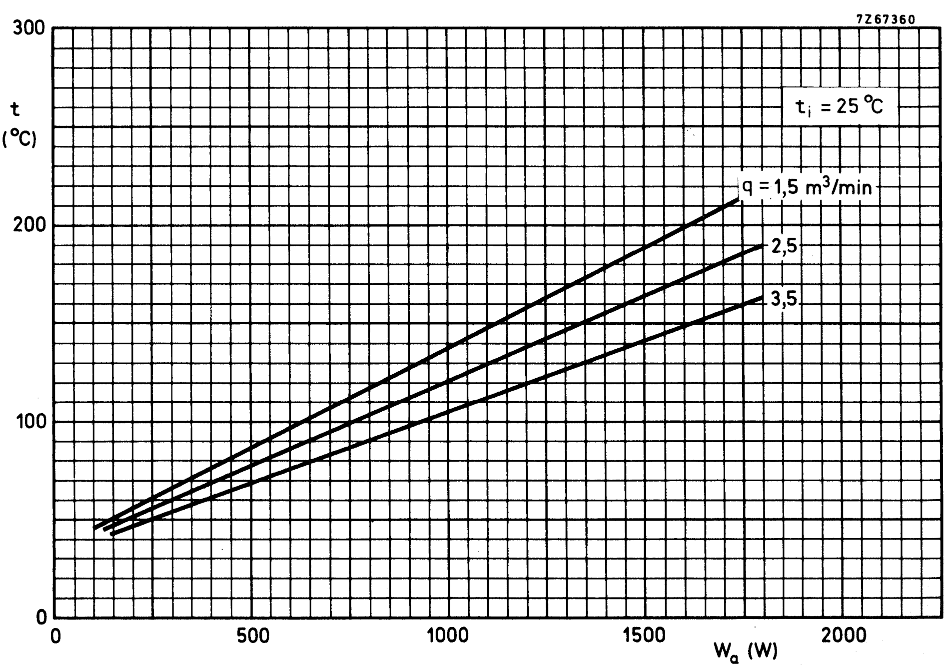
Notes

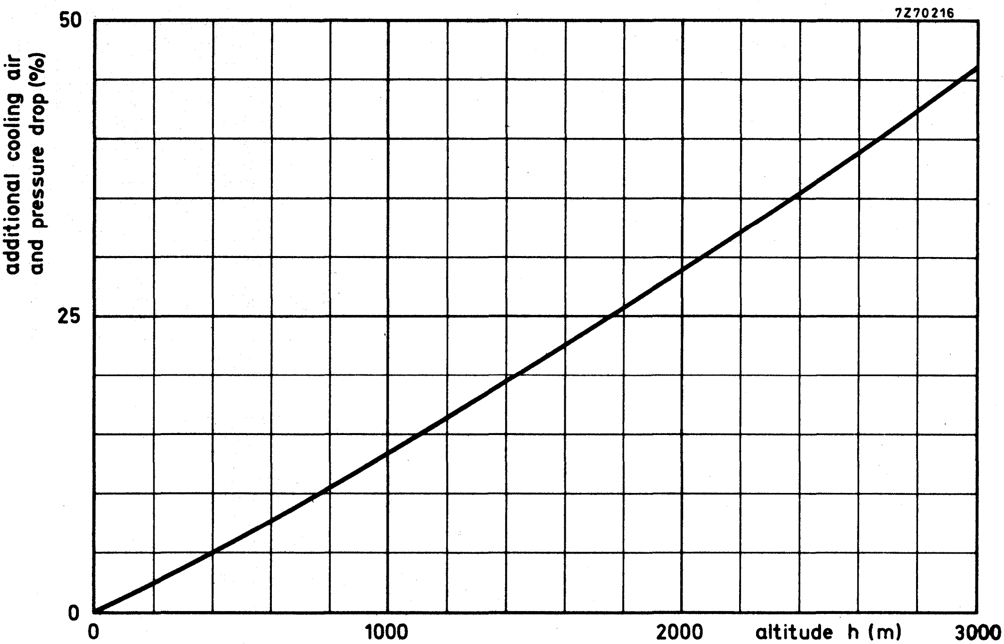
1. During a short period, for adjustment of the transmitter, I_k max. = 700 mA.
2. Negative modulation, positive synchronization, combined sound and vision.
3. R.F. driving power should be applied after the heater and electrode voltages.
4. To be adjusted for the stated no-signal anode current. Range 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).

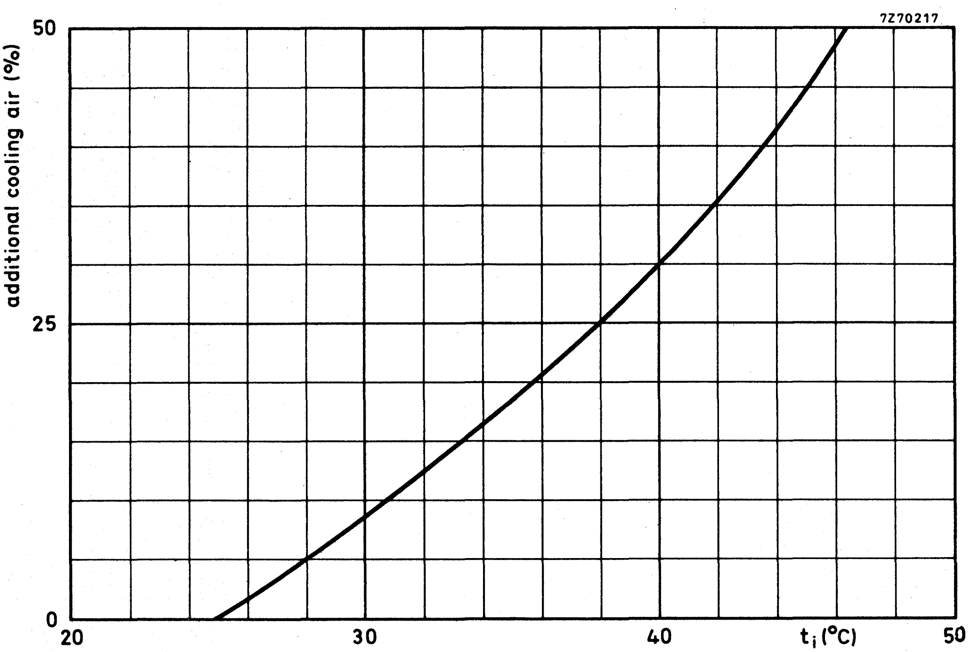

7Z64829
V_g =
+30V
+25V
+20V
+15V
+10V
+5V
0
−5V
−10V
−15V
−20V
−25V
−30V
−35V
−40V
−45V
−50V
I_a (A)
2
1,5
1
0,5
0
0
0,5
1
1,5
2
2,5
3
3,5
V_a (kV)


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


7Z67362.1
600
400
200
0
p_i
(Pa)
3,5 m^3/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 m^3/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, QBL and YL TYPES

COAXIAL U.H.F./POWER TETRODE

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

QUICK REFERENCE DATA

Class-A linear amplifier

Frequency	f	790	MHz
Anode voltage	V_a	2,5	kV
Output power in load	W_φ	210	W
Gain	G	13	

Class-C telegraphy

Frequency	f	800	MHz
Anode voltage	V_a	4,31	kV
Output power in load	W_φ	2,1	kW
Gain	G	12	

HEATING: direct; thoriated tungsten filament

Filament voltage	V_f		$3,6\ ^{+1\%}_{-3\%}$	V
Filament current	I_f		58	A
Filament starting current	I_{fp}	max.	150	A

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

TYPICAL CHARACTERISTICS

Anode voltage	V_a	=	3000 V
Grid 2 voltage	V_{g2}	=	500 V
Anode current	I_a	=	0,48 A
Mutual conductance	S	=	20 mA/V
Amplification factor of grid 2 with respect to grid 1	μ_{g2g1}	=	9

CAPACITANCES

Grounded cathode

Grid 1 to all other elements except anode	C_{g1}	=	46 pF
Anode to all other elements except grid 1	C_a	=	6,0 pF
Anode to grid 1	C_{ag1}	=	0,15 pF

Grounded grids 1 and 2

Anode to grid 2	C_{ag2}	=	7 pF
Grid 1 to filament	C_{g1f}	=	20 pF
Anode to filament	C_{af}	=	0,02 pF

TEMPERATURE LIMITS

Absolute maximum rating system

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

For the measurement of the anode temperature see diagram

COOLING

Cooling data for the anode radiator

W_a W	h m	T_i °C	q m³/min.	ΔP P_a
1500	0	45	3,2	750

Forced-air cooling for the radiator and for the ceramic to metal seals will be required before and during the application of any voltage. After switching off voltages the cooling must be maintained for at least two minutes. The distribution of the cooling air will vary with the cavity configuration around the tube.

The screen grid and anode connections should be preferably be made of contact finger stock. The fingers shall make good contact with the cylindrical planes of the electrode connections. Slots of sufficient width should be provided between the finger contacts to allow for passage of the cooling air.

The control grid and filament connections shall provide for good electrical contacts and sufficient heat conduction.

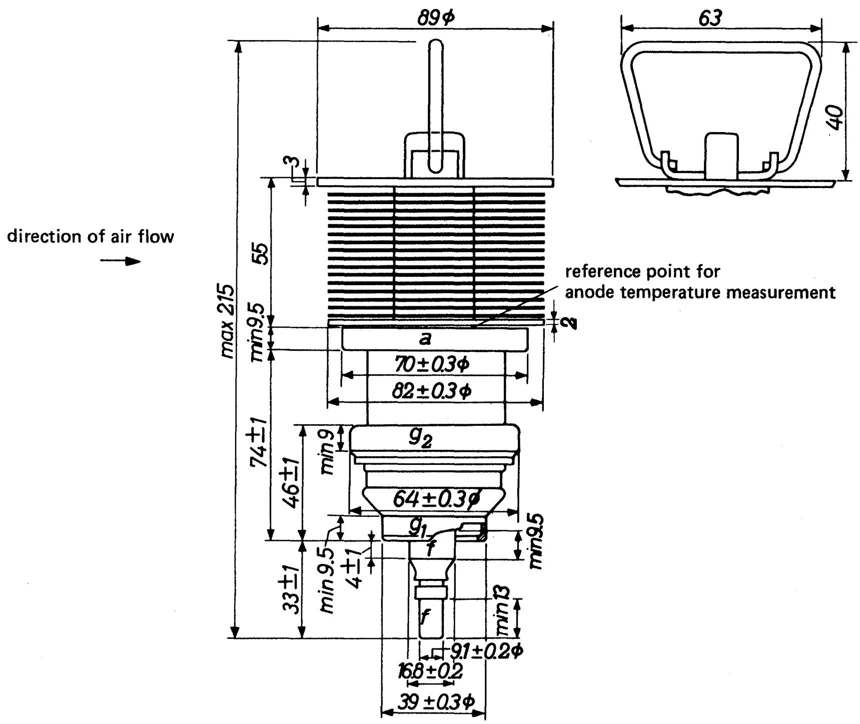
The amount and temperature of the cooling air shall be watched during operation. If the amount of cooling air decreases below the specified value all voltages shall be switched off automatically.

The cooling air shall be filtered to prevent the radiator from being choked.

MECHANICAL DATA

Net mass 1900 g

Mounting position vertical with anode up or down.



U.H.F. POWER AMPLIFIER, CLASS C TELEGRAPHY; cathode driven

A tunable coaxial circuit is built between grids 1 and 2 which introduces a variable capacitive reactance between these grids. The results of this arrangement are better efficiency and negligible regeneration from anode to cathode.

The reference point for the electrode voltages is the terminal of grid 1.

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	1000	MHz
Anode voltage	V_a	max.	4500	V
Anode dissipation	W_a	max.	1500	W
Anode input power	W_{ia}	max.	3800	W
Anode current	I_a	max.	0,9	A
Grid 2 voltage	V_{g2}	max.	700	V
Grid 2 dissipation	W_{g2}	max.	50	W
Grid 2 current	I_{g2}	max.	75	mA
Grid 1 current	I_{g1}	max.	100	mA
Cathode voltage	V_k	max.	300	V

OPERATING CONDITIONS

Frequency	f	800	MHz
Anode voltage	V_a	4310	V
Grid 2 voltage	V_{g2}	600	V
Cathode voltage	V_k	110	V
Anode current	I_a	0,85	A
Grid 2 current	I_{g2}	28	mA
Grid 1 current	I_{g1}	50	mA
Driving power	W_{dr}	180	W
Output power in load	W_{φ}	2100	W *
Power gain	G	12	

* Typical value, measured in a circuit having an efficiency of approx. 85%.

U.H.F. CLASS A LINEAR AMPLIFIER FOR TELEVISION SERVICE, sound and vision, cathode driven.

A tunable coaxial circuit is built between grid 1 and 2 which introduces a variable capacitive reactance between these grids. The results of this arrangement are better efficiency and negligible regeneration from anode to cathode.

The reference point for the electrode voltages is the terminal of grid 1.

LIMITING VALUES (Absolute maximum rating system)					notes
Frequency	f	up to	1000	MHz	
Anode voltage	V_a	max.	3000	V	
Anode dissipation	W_a	max.	1500	W	
Anode input power	W_{ia}	max.	1800	W	
Anode current	I_a	max.	800	mA	
Grid 2 voltage	V_{g2}	max.	700	V	
Grid 2 dissipation	W_{g2}	max.	50	W	
Grid 2 current	I_{g2}	max.	75	mA	
Grid 1 current	I_{g1}	max.	100	mA	
Cathode voltage	V_k	max.	300	V	

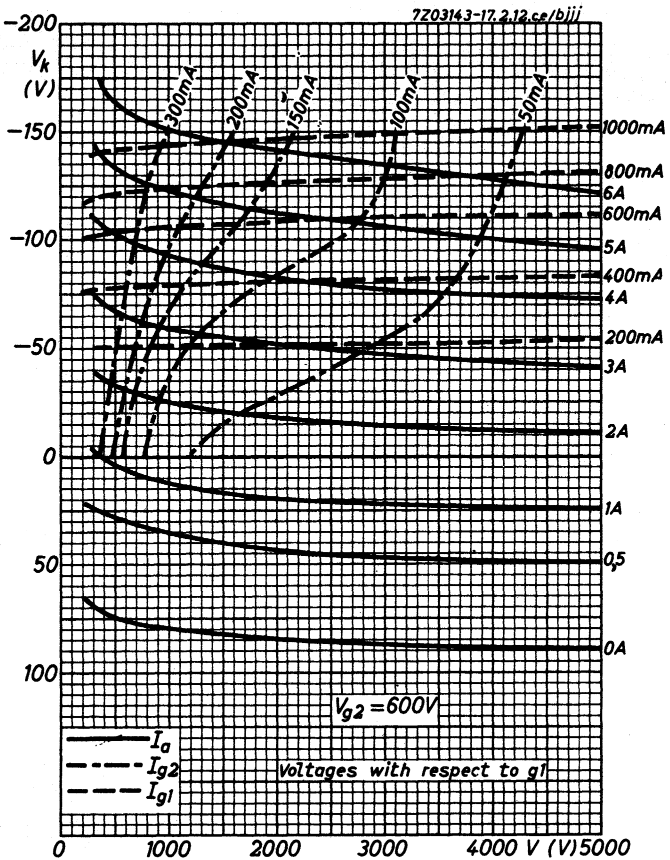
OPERATING CONDITIONS				
Frequency	f	790	MHz	
Bandwidth (−1 dB)	B	6	MHz	
Anode voltage	V_a	2500	V	
Grid 2 voltage	V_{g2}	500	V	
Cathode voltage	V_k	28	V	1
Anode current	I_a	580	mA	
Grid 2 current	I_{g2}	5	mA	
Grid 1 current	I_{g1}	0	mA	
Driving power	W_{dr}(PEP)	16	W	2
Output power in load	W_{φ} (PEP)	210	W	3
Intermodulation products	d	−52	dB	4
Power gain	G	13		

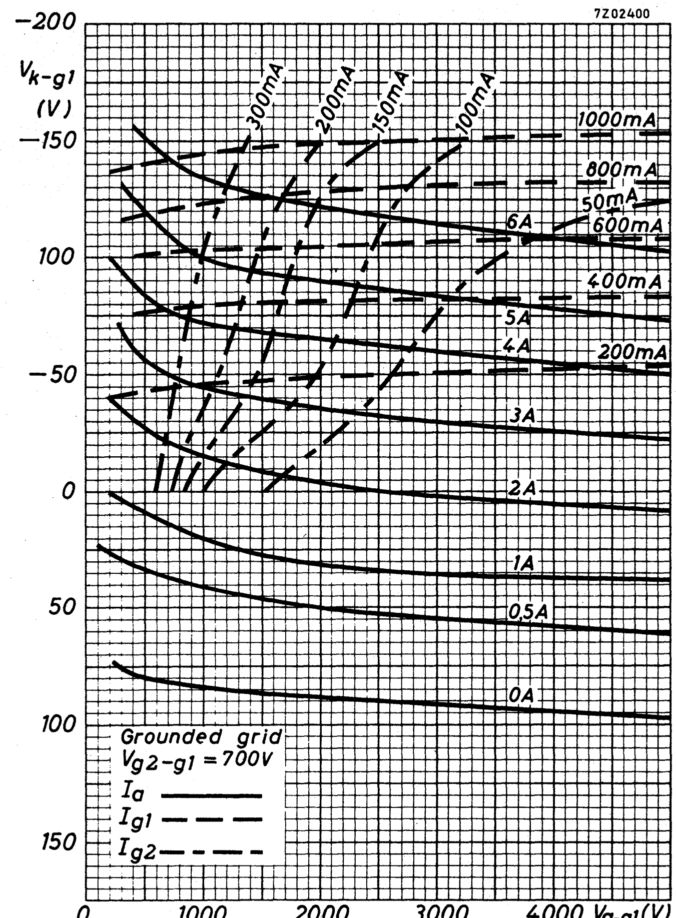
Notes

1. The cathode voltage should be adjusted for a zero signal anode current I_a = 580 mA.
2. Peak envelope power. The driving signal consists of three independent h.f. signal voltages, i.e.

   picture carrier −8 dB
   sideband signal −17 dB
   sound carrier −7 dB
   with respect to the sum signal amplitude of the composite signal

   The frequency bandwidth of the driving signal is more than 6 MHz at −1 dB.
3. Peak envelope power. Typical value, measured in a circuit having an efficiency of about 85%.
4. The intermodulation product in the passband of the output signal is measured with reference to 0 dB.


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


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

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.

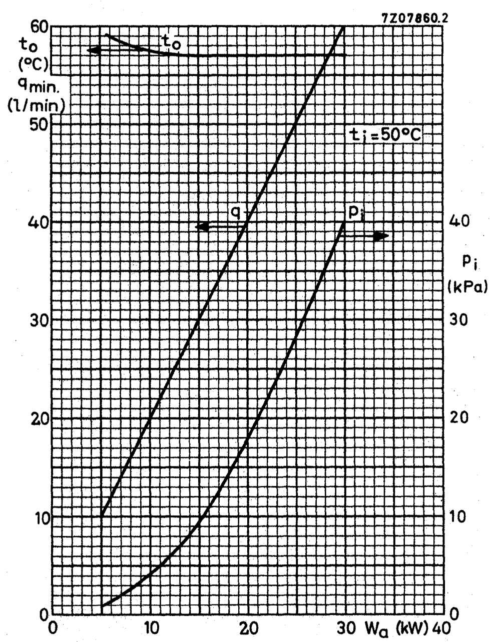


Fig.1.

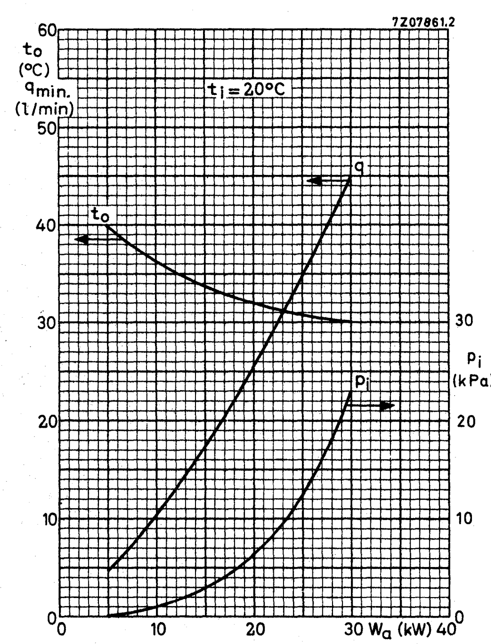


Fig.2.

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			

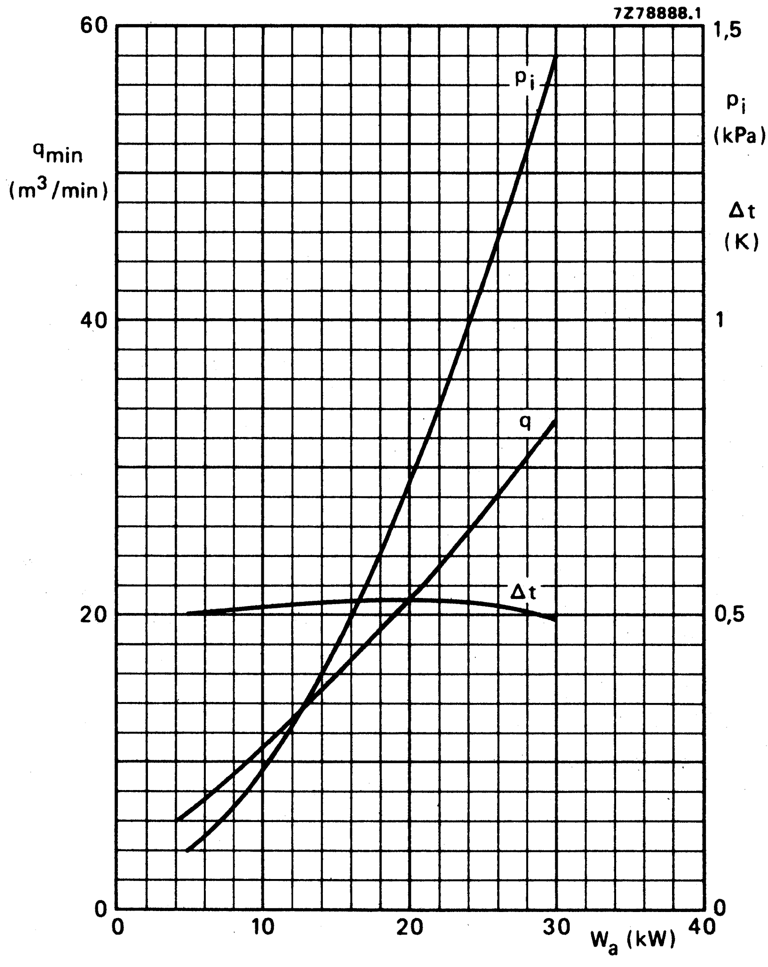


Fig. 3.

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.

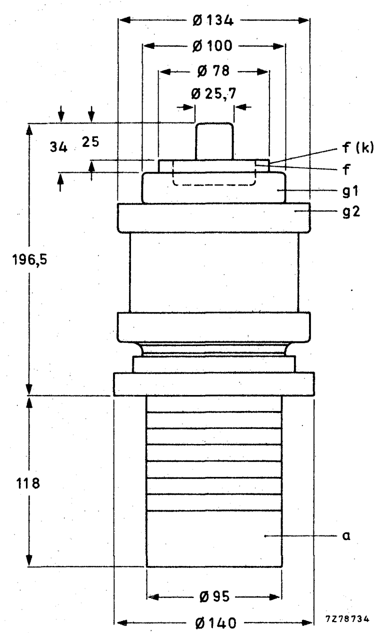


Fig. 4.

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

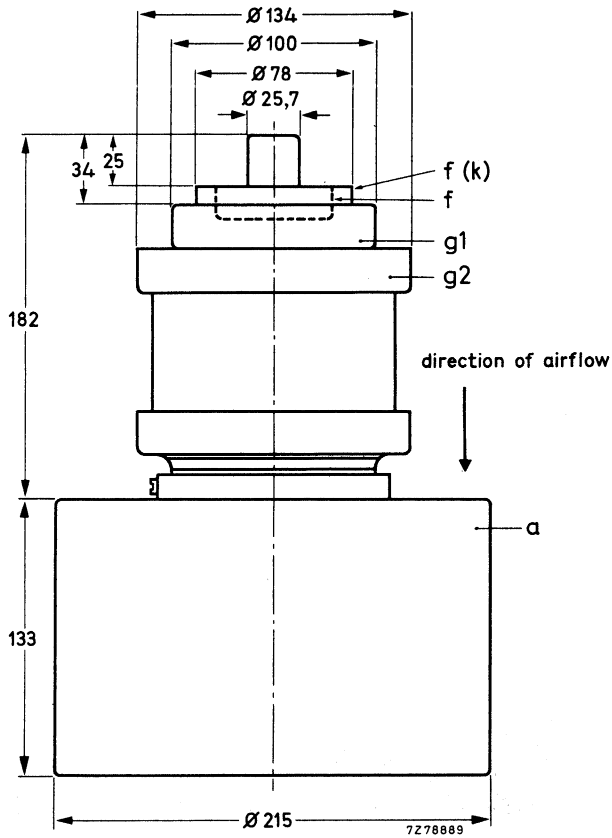


Fig. 5.

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

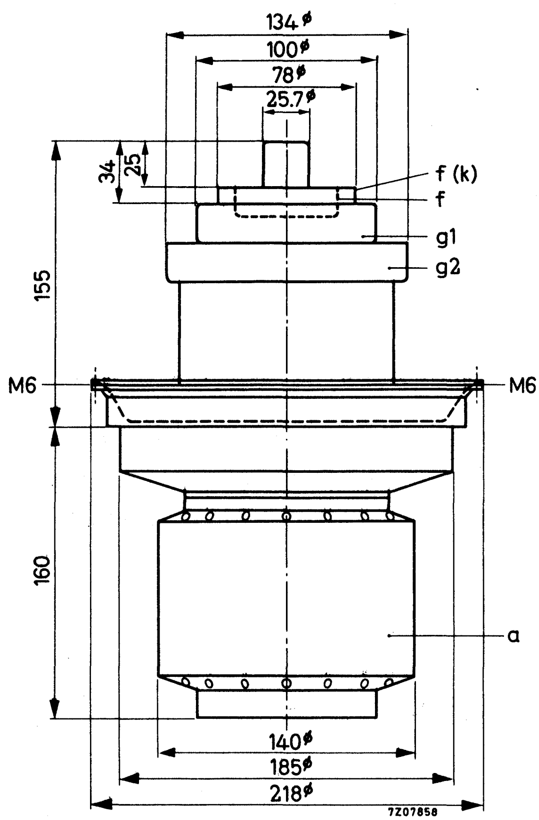


Fig. 6.

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 **

* 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.

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

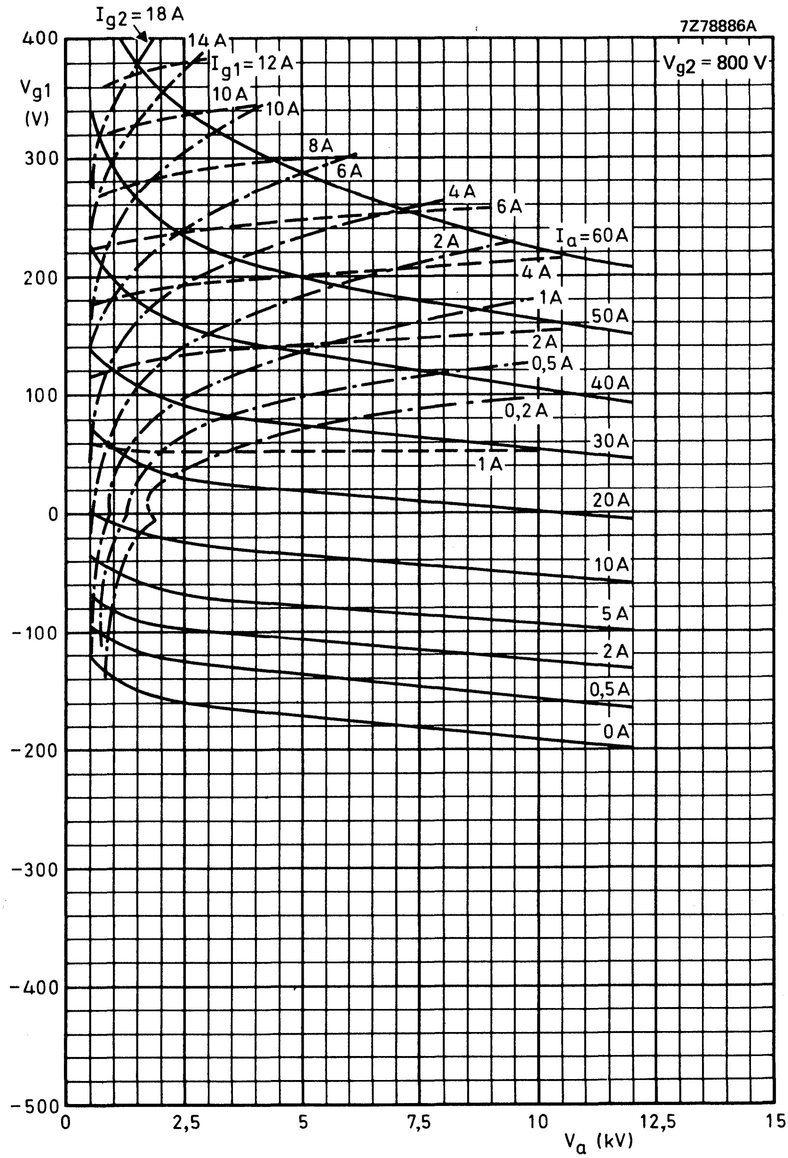

7Z78886A
V_{g2} = 800 V
I_{g2} = 18 A
14 A
I_{g1} = 12 A
10 A
10 A
8 A
6 A
4 A
6 A
2 A
I_a = 60 A
4 A
1 A
50 A
2 A
0,5 A
40 A
0,2 A
30 A
1 A
20 A
10 A
5 A
2 A
0,5 A
0 A
V_{g1} (V)
400
300
200
100
0
-100
-200
-300
-400
-500
0
2,5
5
7,5
10
12,5
15
V_a (kV)

Fig. 7.

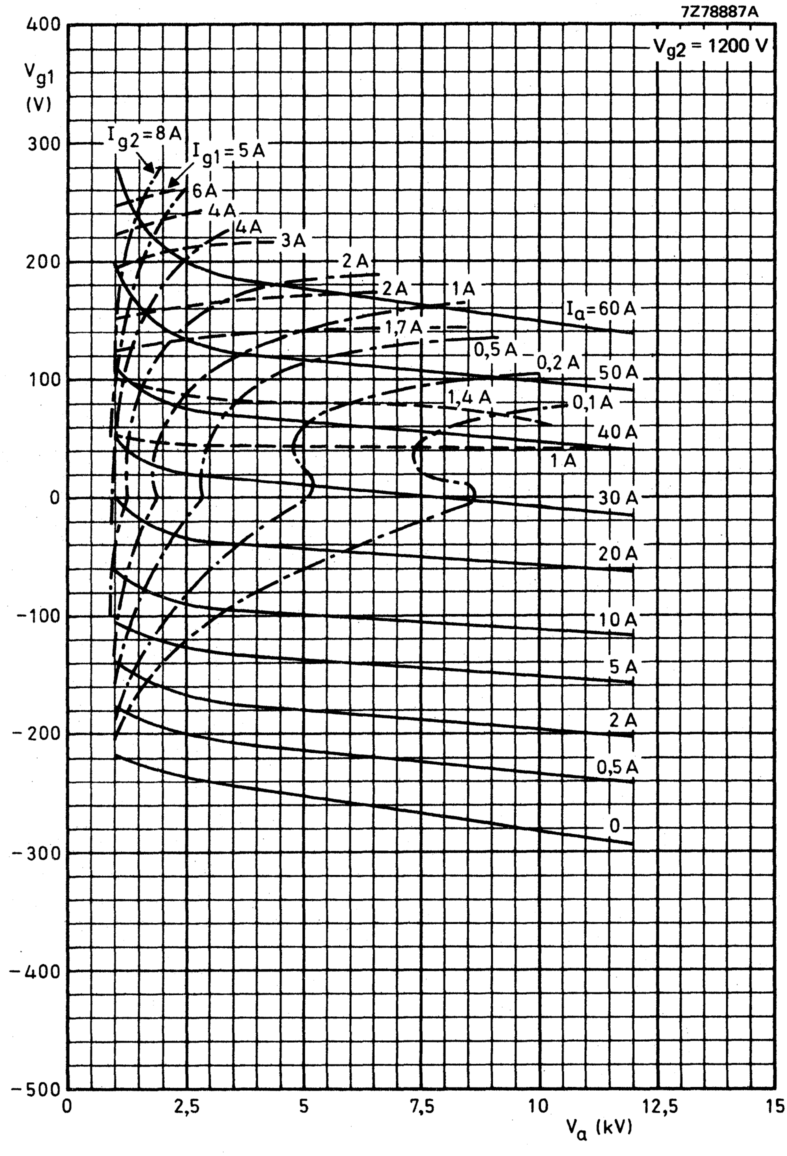

7Z78887A
V_{g2} = 1200 V
V_{g1} (V)
400
300
200
100
0
-100
-200
-300
-400
-500
I_{g2} = 8 A
I_{g1} = 5 A
6 A
4 A
4 A
3 A
2 A
2 A
1 A
1,7 A
0,5 A
0,2 A
1,4 A
0,1 A
1 A
I_a = 60 A
50 A
40 A
30 A
20 A
10 A
5 A
2 A
0,5 A
0
0
2,5
5
7,5
10
12,5
15
V_a (kV)

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	35	mA/V
Amplification factor	μ_{g2g1}	7	

CAPACITANCES

	(grounded cathode)		(grounded grid)		
Input	C_i	90		49	pF
Output	C_o	16		17	pF
Anode to grid 1	C_{ag1}	0,55			pF
Anode to filament			C_{af}	0,15	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 temperature below the limits

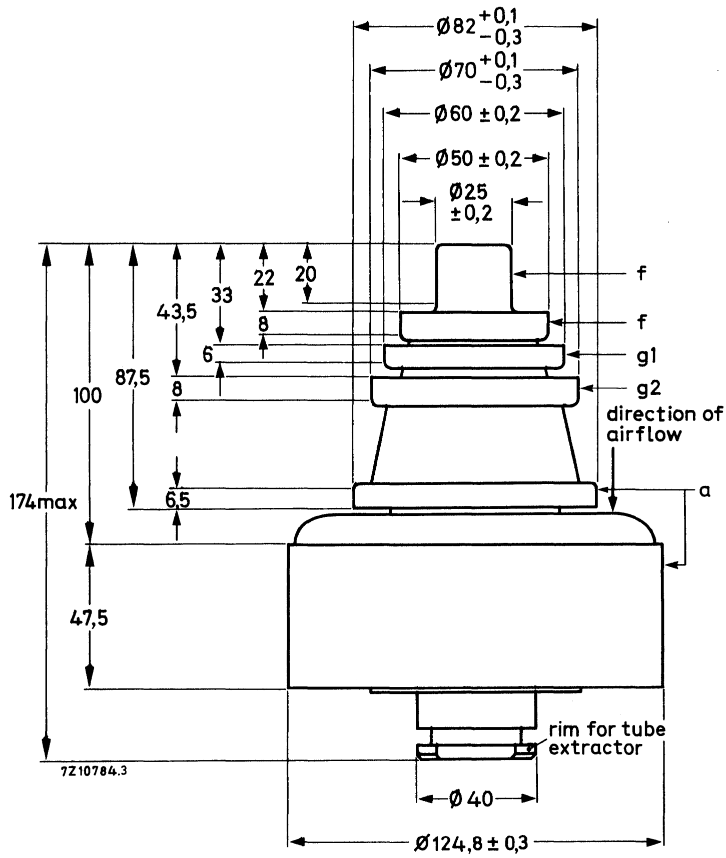
ACCESSORIES

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	
Grid 1 voltage	V_{g1}	max.	−500	V	
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

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}	−80	−70	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	°	5
Differential gain		$\geqslant$ 85	$\geqslant$ 85	%	5
L.F. linearity		$\geqslant$ 85	$\geqslant$ 85	%	5

Notes see page 71.

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}	–70	–70	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	^{o}	5
Differential gain		$\geqslant$ 85	$\geqslant$ 85	%	5
L.F. linearity		$\leqslant$ 85	$\leqslant$ 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}	–70	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	$\leqslant$ –54	dB	7

Notes see page 71.

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

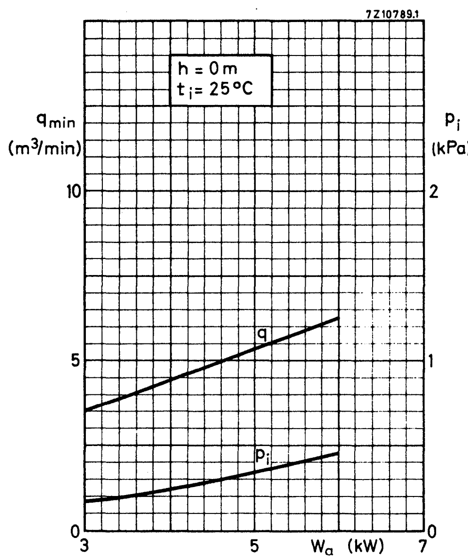
OPERATING CONDITIONS, grounded grid

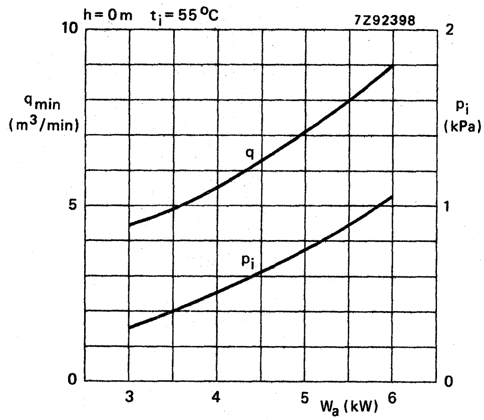
Frequency	f	260	MHz	
Anode voltage	V_a	7	kV	
Grid 2 voltage	V_{g2}	600	V	
Grid 1 voltage	V_{g1}	−120	V	(note 2)
Anode current, no signal condition	I_a	200	mA	
Anode current	I_a	2,3	A	
Grid 2 current	I_{g2}	80	mA	
Grid 1 current	I_{g1}	150	mA	
Anode input power	W_{ia}	16,1	kW	
Anode dissipation	W_a	5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

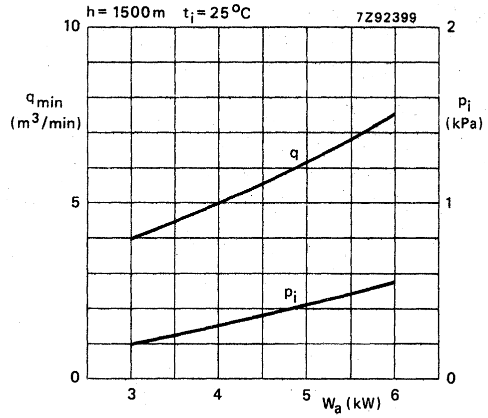
Notes see page 71.

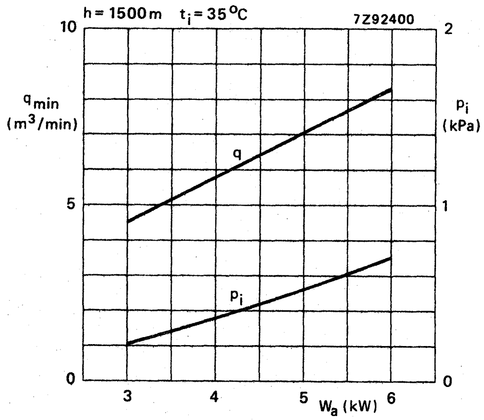
NOTES

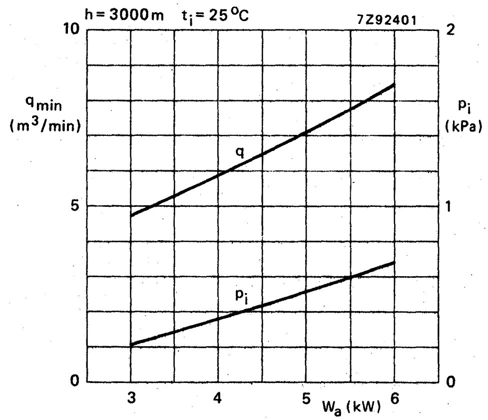
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5. 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).

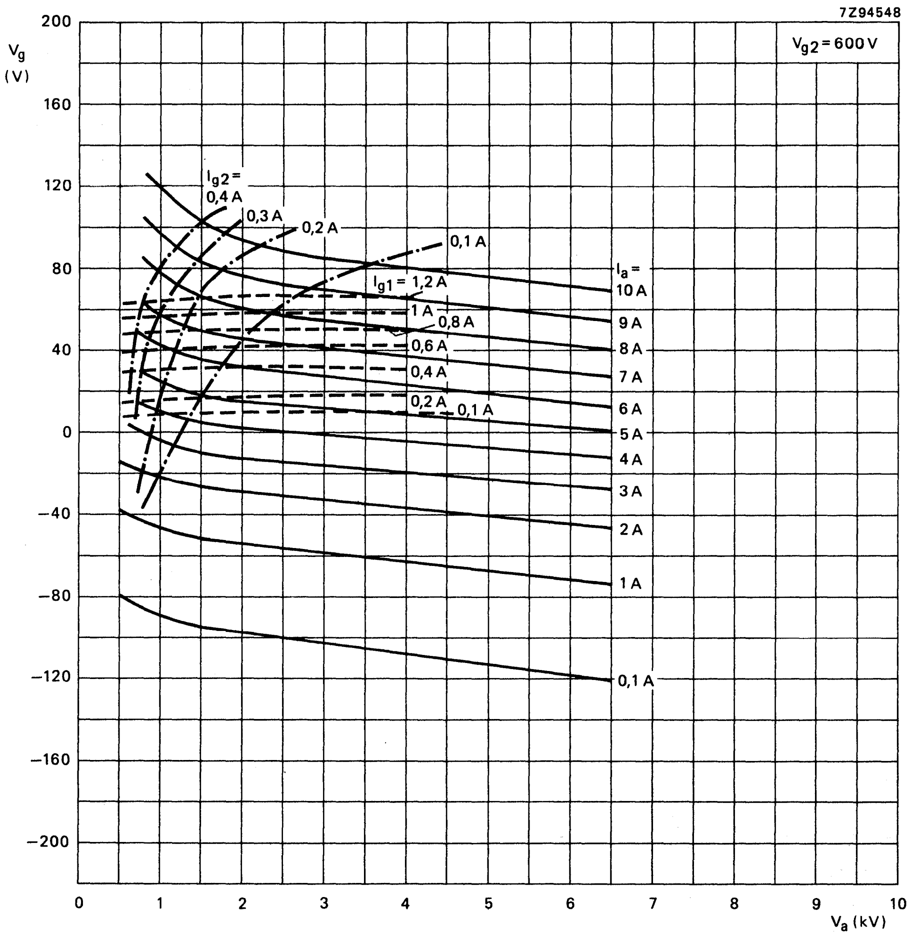


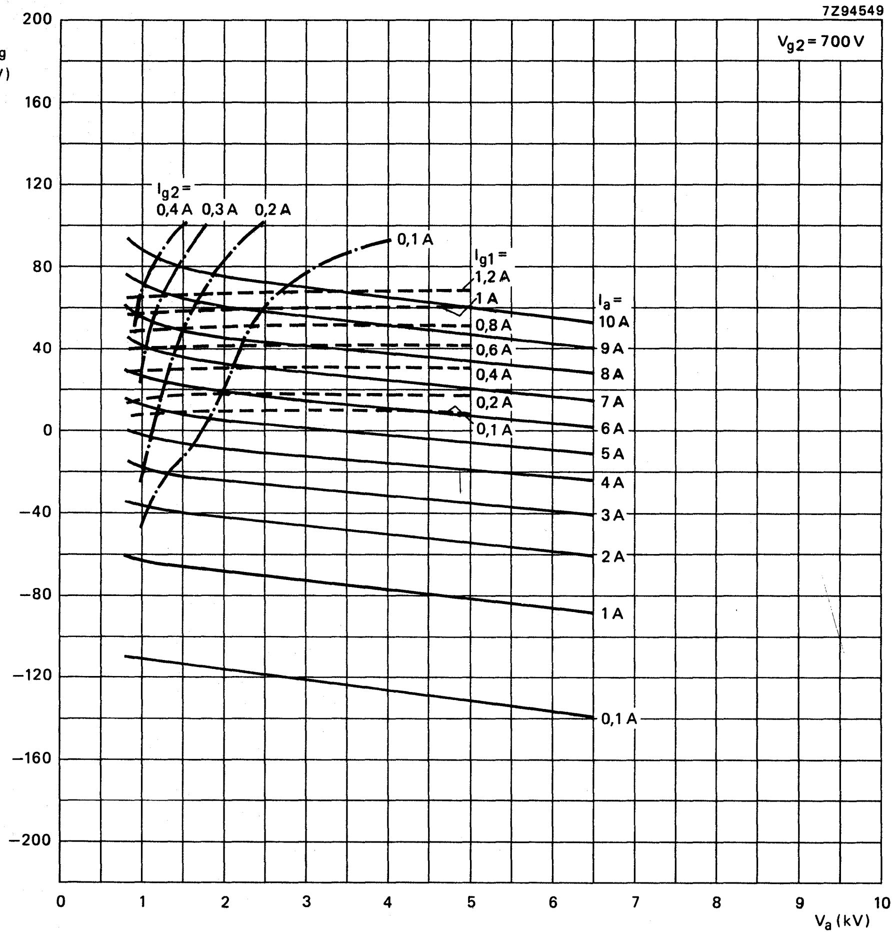

h = 0 m t_i = 55 °C
7Z92398
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
10
5
0
2
1
0
3
4
5
6

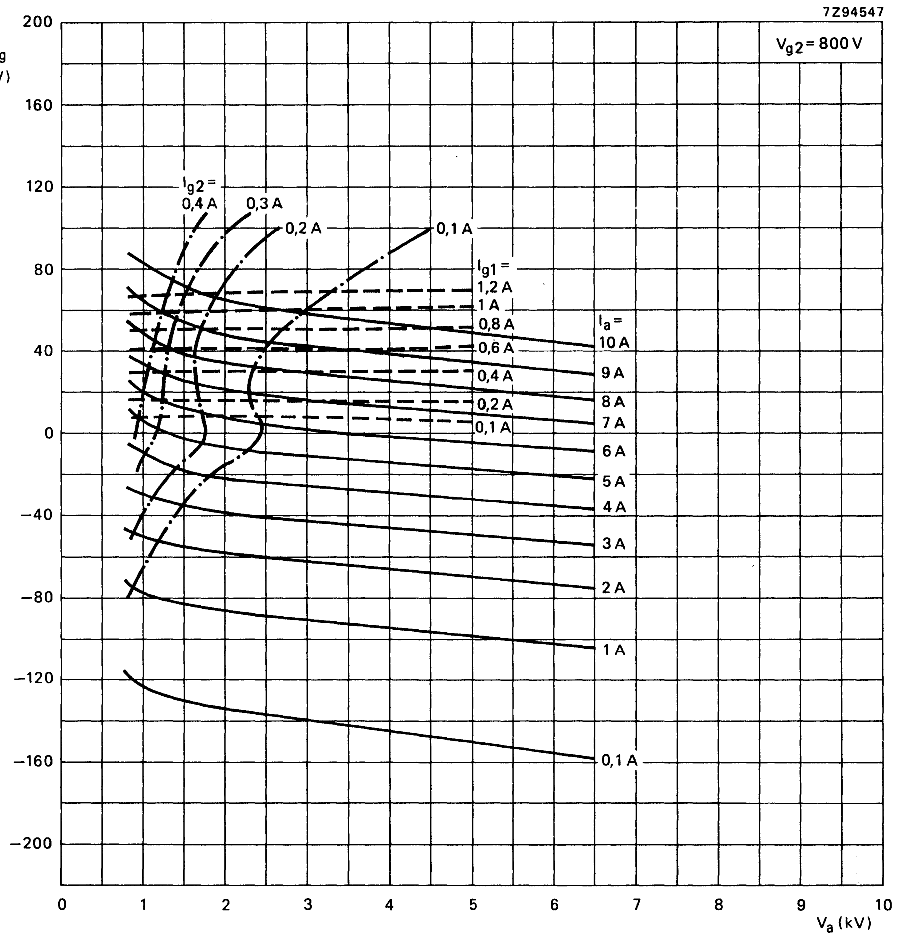

h = 1500 m t_i = 25 °C
7Z92399
q_{min} (m^3/min)
p_i (kPa)
q
p_i
W_a (kW)
10
5
0
2
1
0
3
4
5
6


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


7Z94548
V_{g2} = 600 V
V_g (V)
200
160
120
80
40
0
−40
−80
−120
−160
−200
I_{g2} = 0,4 A
0,3 A
0,2 A
0,1 A
I_{g1} = 1,2 A
1 A
0,8 A
0,6 A
0,4 A
0,2 A
0,1 A
I_a = 10 A
9 A
8 A
7 A
6 A
5 A
4 A
3 A
2 A
1 A
0,1 A
0
1
2
3
4
5
6
7
8
9
10
V_a (kV)


7Z94549
V_{g2} = 700 V
V_g (V)
200
160
120
80
40
0
−40
−80
−120
−160
−200
0
1
2
3
4
5
6
7
8
9
10
V_a (kV)
I_{g2} =
0,4 A 0,3 A 0,2 A
0,1 A
I_{g1} =
1,2 A
1 A
0,8 A
0,6 A
0,4 A
0,2 A
0,1 A
I_a =
10 A
9 A
8 A
7 A
6 A
5 A
4 A
3 A
2 A
1 A
0,1 A


7Z94547
V_{g2} = 800 V
V_g (V)
200
160
120
80
40
0
−40
−80
−120
−160
−200
0
1
2
3
4
5
6
7
8
9
10
V_a (kV)
I_{g2} =
0,4 A
0,3 A
0,2 A
0,1 A
I_{g1} =
1,2 A
1 A
0,8 A
0,6 A
0,4 A
0,2 A
0,1 A
I_a =
10 A
9 A
8 A
7 A
6 A
5 A
4 A
3 A
2 A
1 A
0,1 A

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	ΔP 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

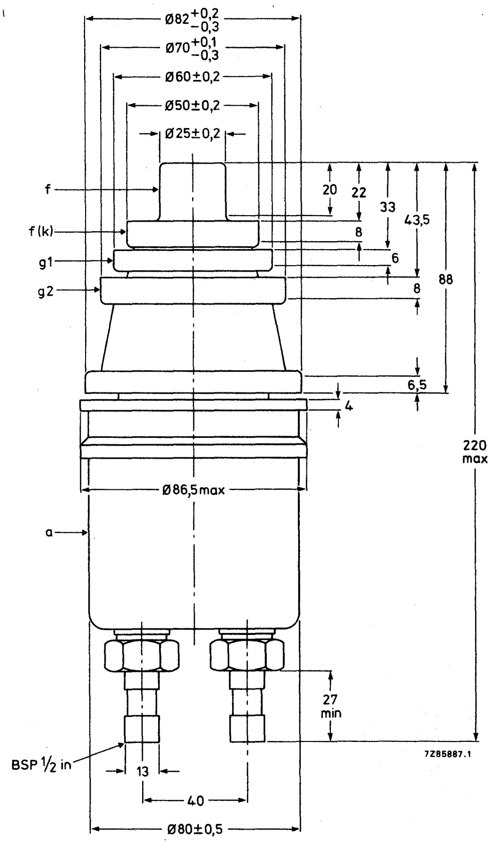
The temperature of the seals and envelope should be kept well below 200 °C.

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	50	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

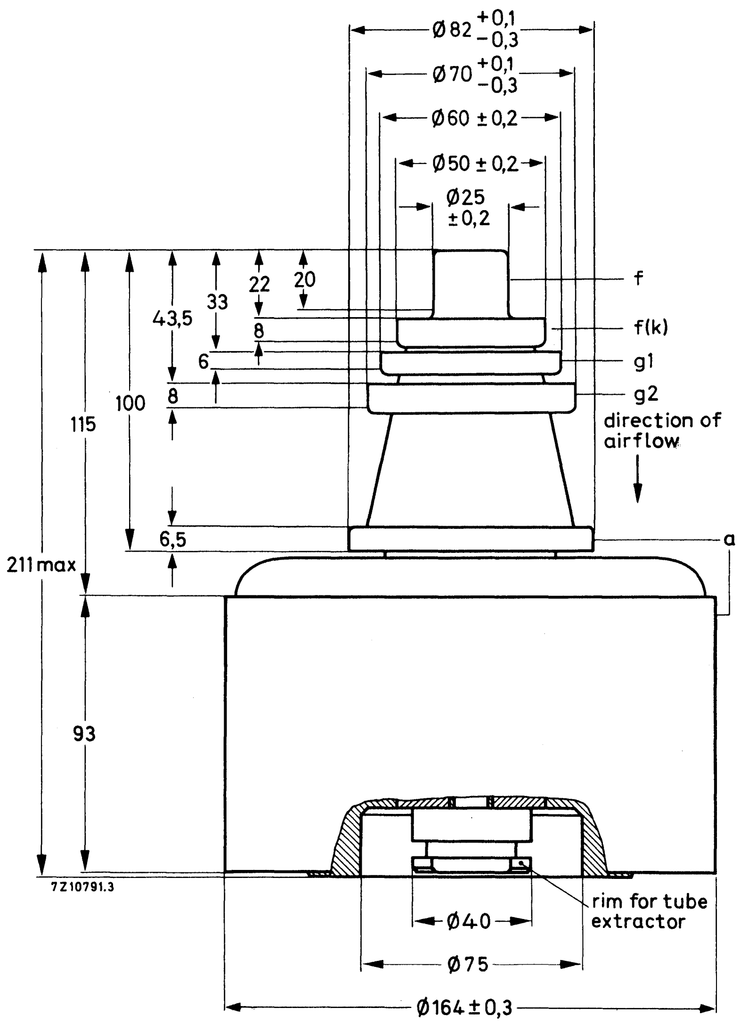
Band I amplifier circuit assembly (vision)	type 40759
Band II amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40747
Band III amplifier circuit assembly (sound)	type 40748

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

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 85.

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 85.

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	^{o}	5
Differential gain			$\geqslant$ 85	%	5
L.F. linearity			$\geqslant$ 85	%	5
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	^{o}	5
Differential gain		$\geqslant$ 85	$\geqslant$ 85	%	5
L.F. linearity		$\geqslant$ 85	$\geqslant$ 85	%	5

Notes see page 85.

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

LIMITING VALUES

See page 80.

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 85.

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	

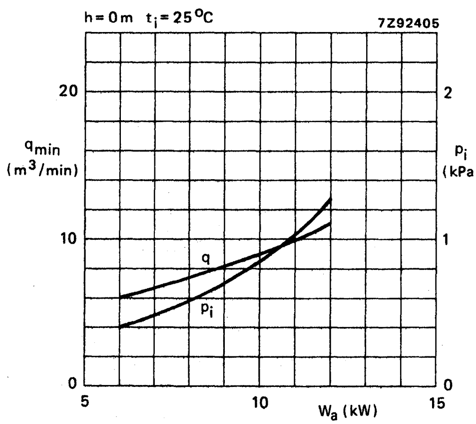
OPERATING CONDITIONS, grounded grid

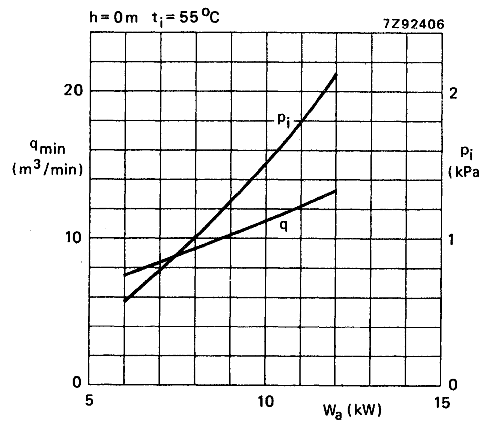
				notes
Frequency	f	260	MHz	
Anode voltage	V_a	8	kV	
Grid 2 voltage	V_{g2}	700	V	
Grid 1 voltage	V_{g1}	−115	V	2
Anode current, no signal condition	I_a	300	mA	
Anode current	I_a	3,5	A	
Grid 2 current	I_{g2}	100	mA	
Grid 1 current	I_{g1}	300	mA	
Anode input power	W_{ia}	28	kW	
Anode dissipation	W_a	10	kW	
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	

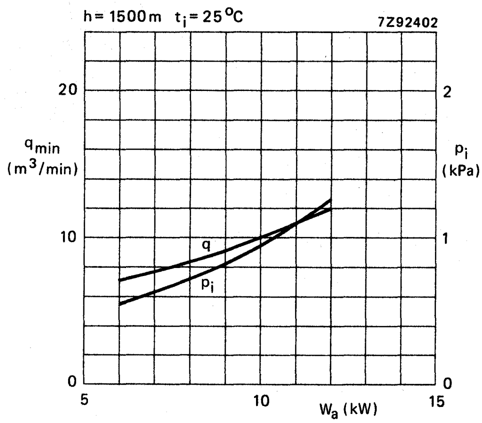
Note see page 85.

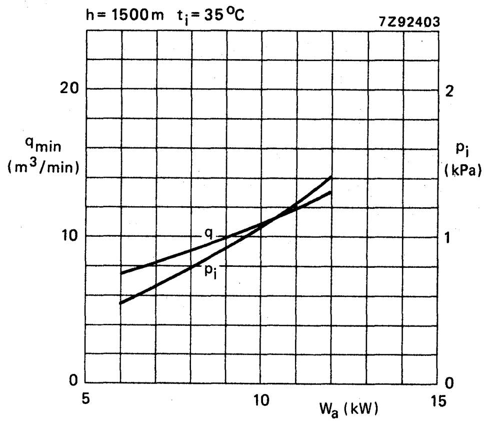
NOTES

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 (m³/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 (m³/min)
p_i (kPa)
q
p_i
W_a (kW)
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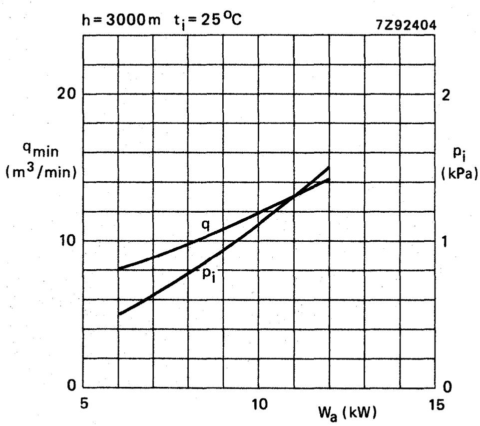
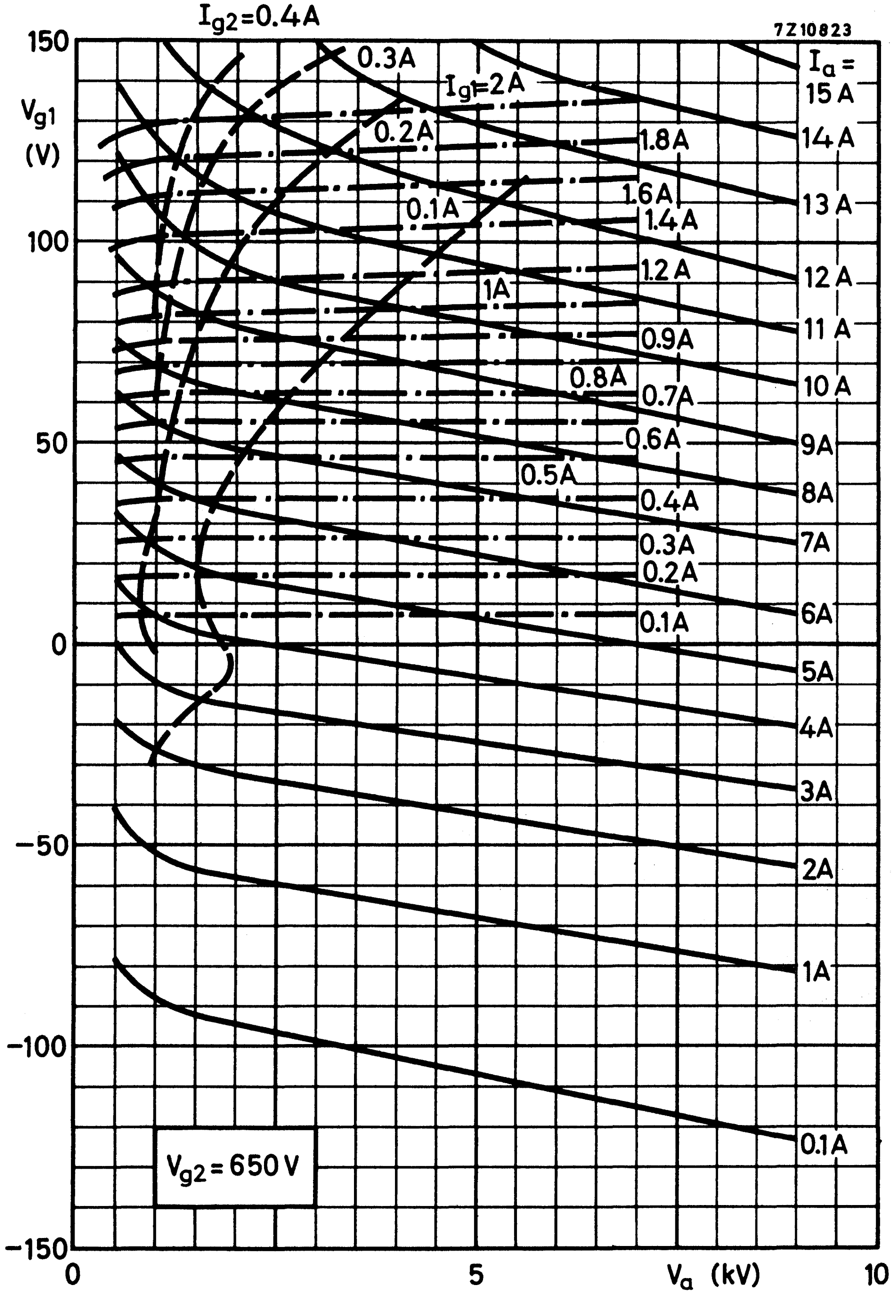
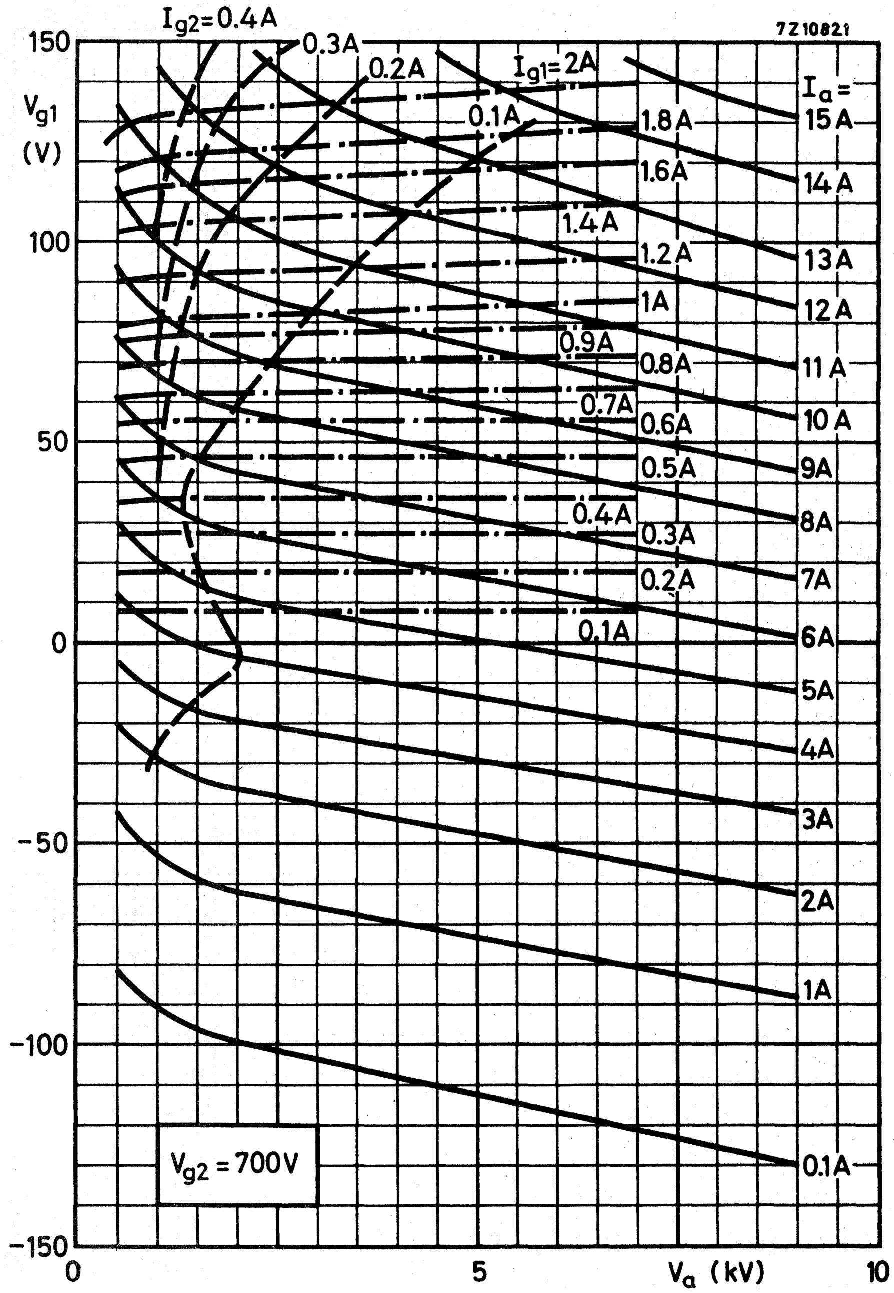
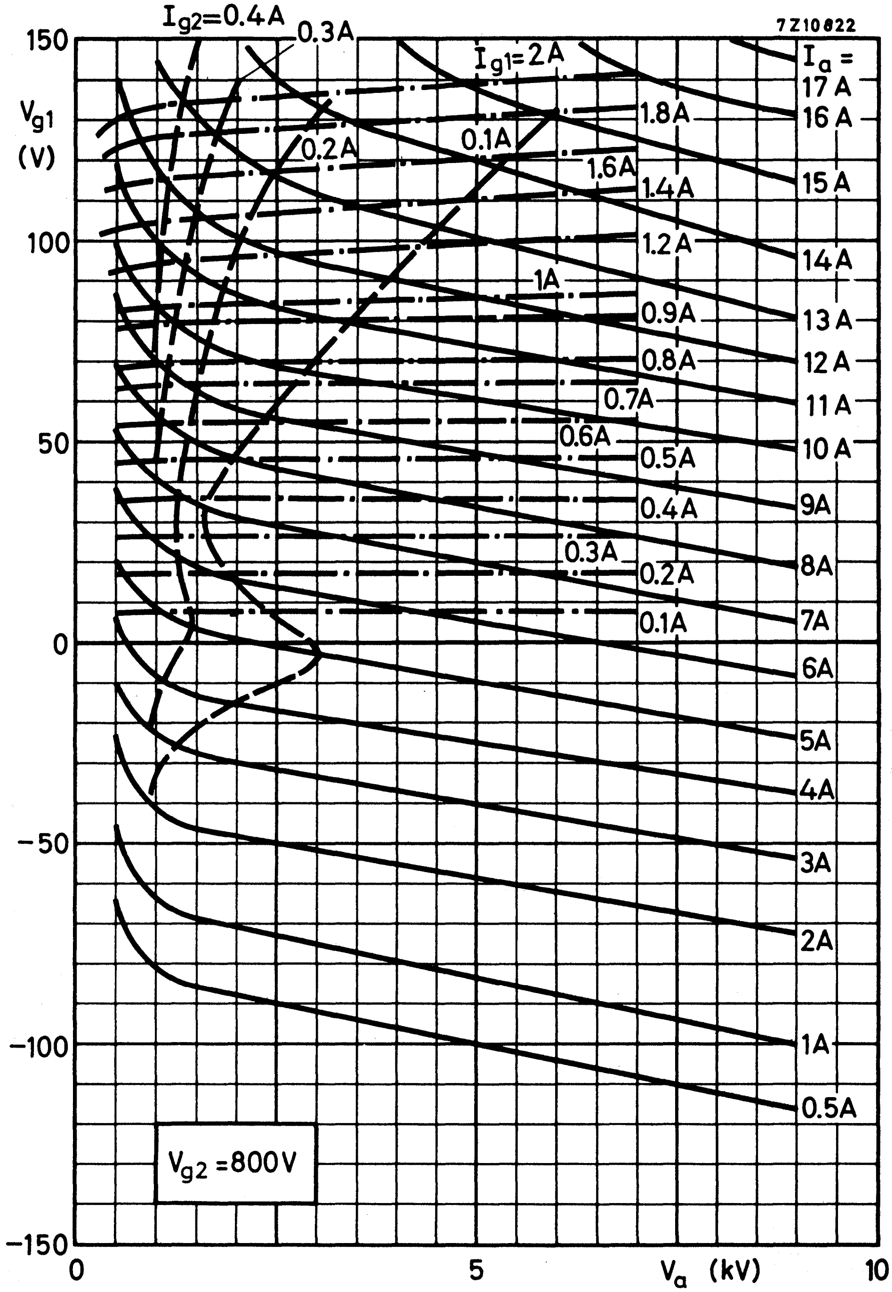
10
20
0
1
2
5
10
15


h = 3000 m t_i = 25 °C
7Z92404
q_min (m³/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
150
100
50
0
-50
-100
-150
V_{g1}
(V)
0
5
10
V_a (kV)
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_{g2} = 700V


7Z10822
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}=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 =
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_{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.

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	1,55	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	^{o}C
Recommended maximum seal temperature	T	max.	200	^{o}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.

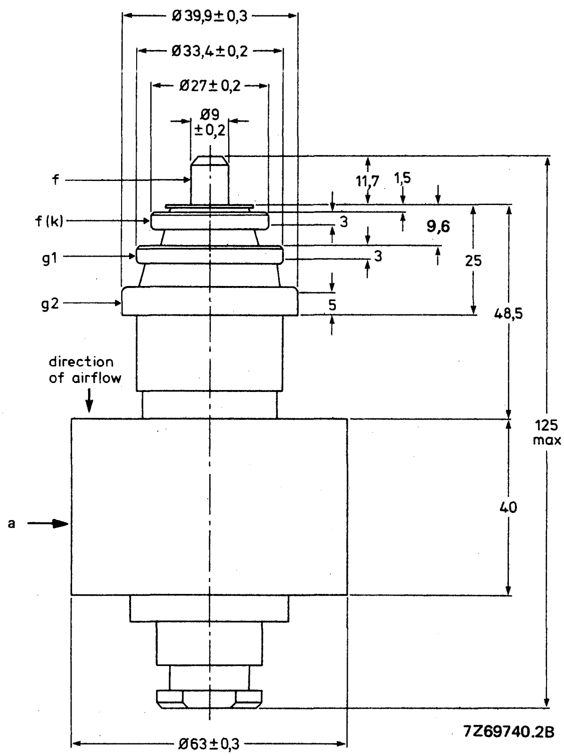
ACCESSORIES

Band I amplifier circuit assembly (vision)	type 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 98.

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 98.

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

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 98.

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

LIMITING VALUES

See page 94.

OPERATING CONDITIONS grounded grid

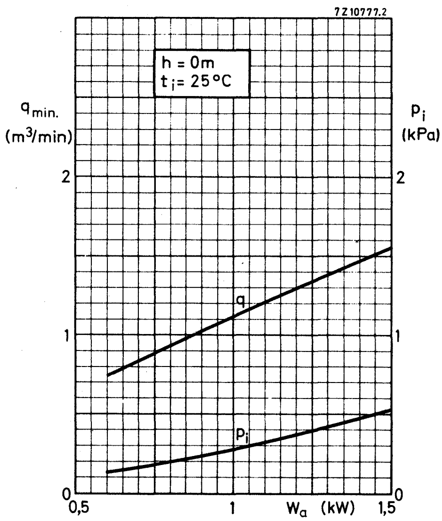
Negative modulation, positive synchronization, combined sound and vision
(CCIR standard G)

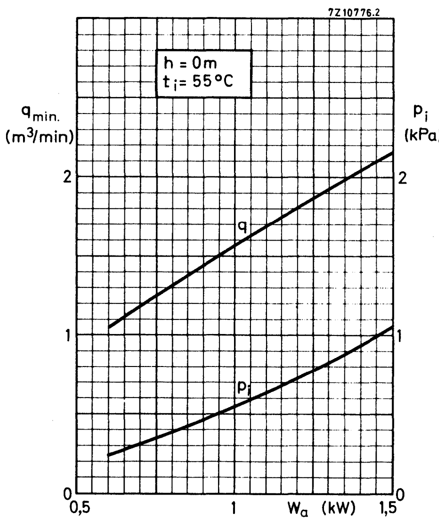
				notes
Frequency	f	175 to 225	MHz	
Bandwidth (−1 dB)	B	8	MHz	1
Anode voltage	V_a	2,5	kV	
Grid 2 voltage	V_{g2}	600	V	
Grid 1 voltage	V_{g1}	−13,5	V	2
Anode current, no signal condition	I_a	550	mA	
Anode current	I_a	730	mA	6
Grid 2 current	I_{g2}	50	mA	6
Grid 1 current	I_{g1}	35	mA	6
Driving power, sync	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

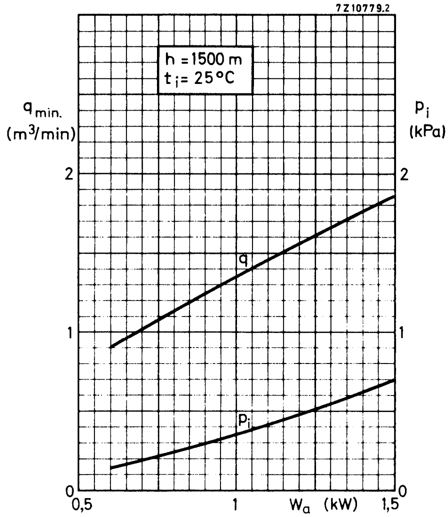
Notes see page 98.

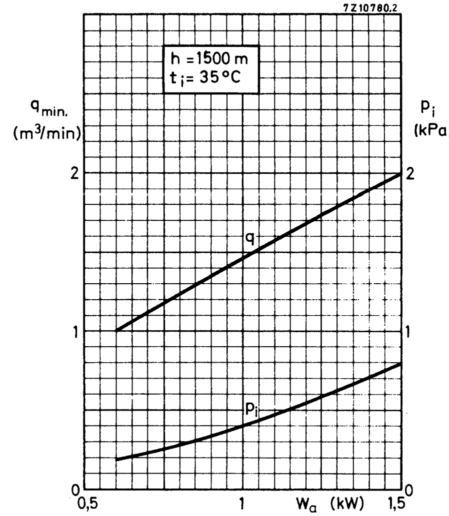
NOTES

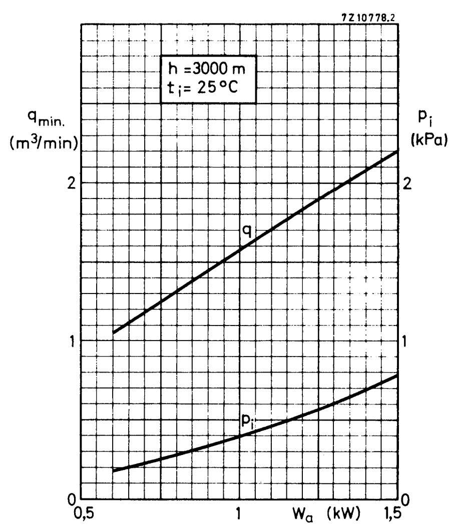
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5. 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).

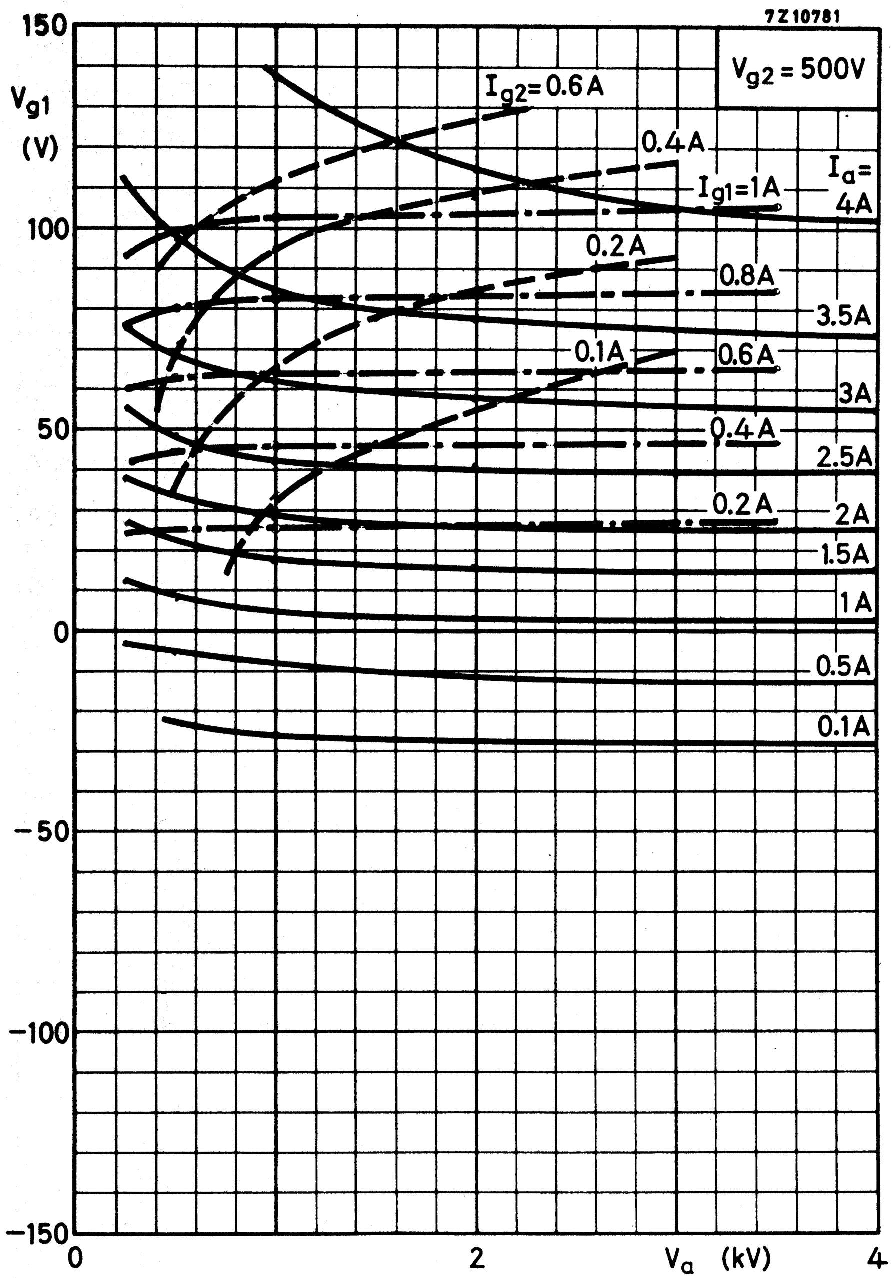


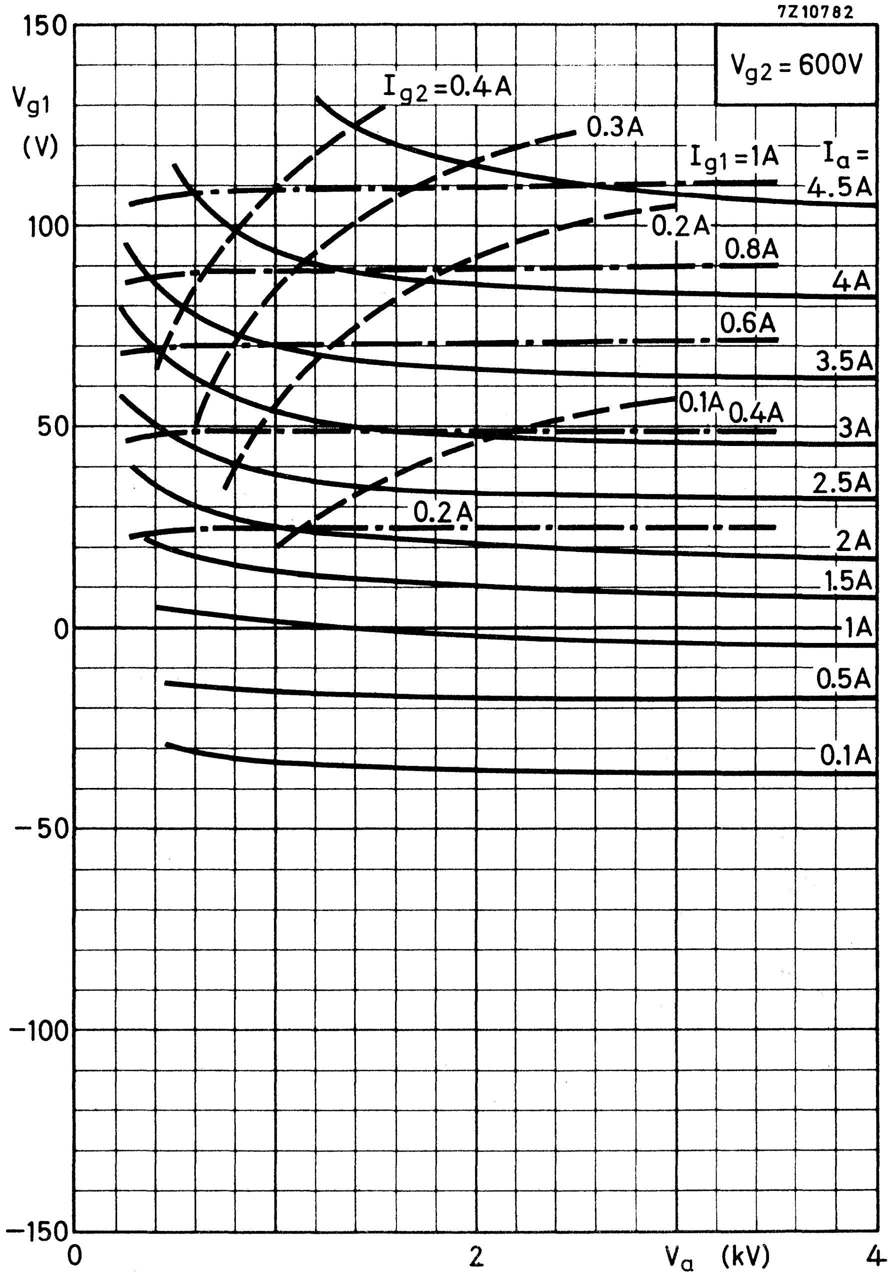


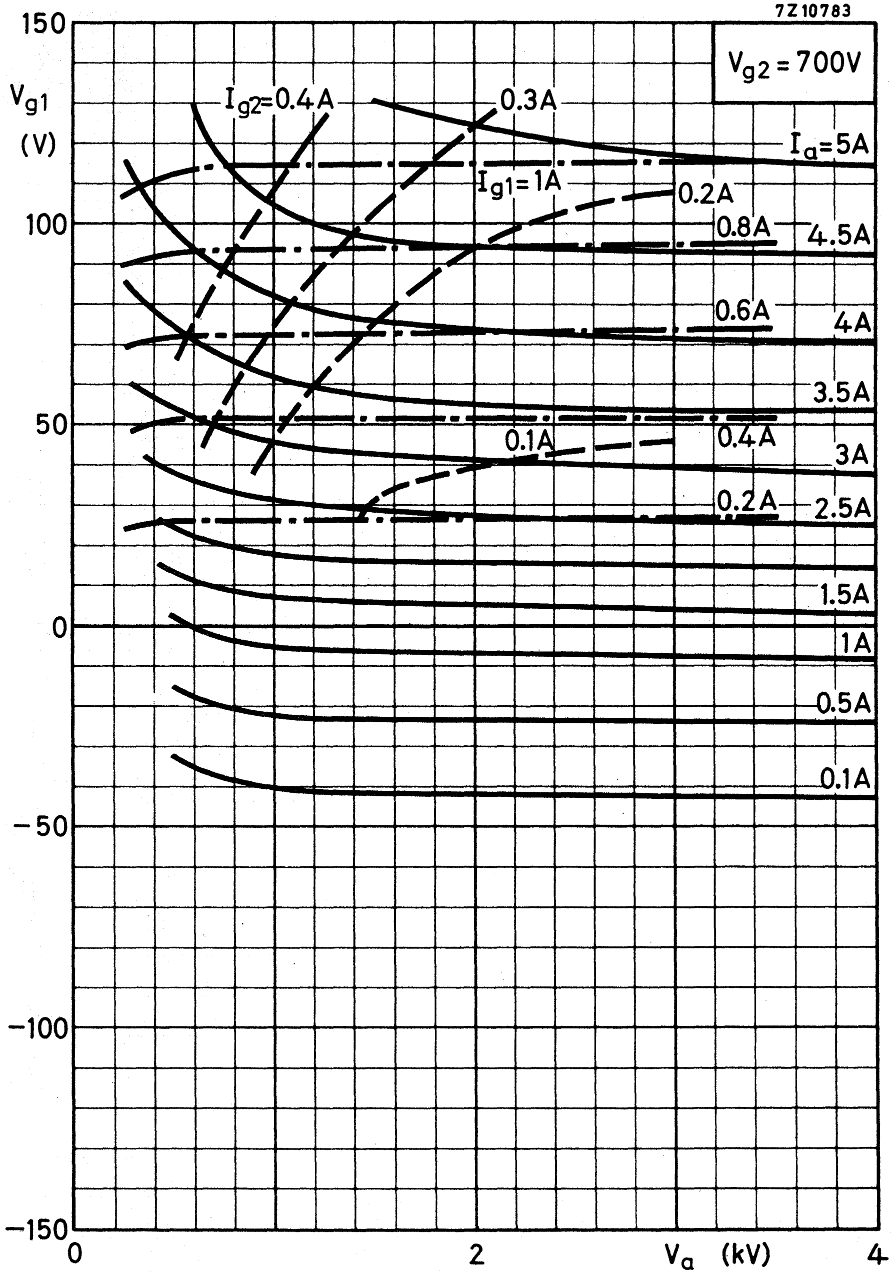

7Z10779.2
h = 1500 m
t_i = 25 °C
$q_{min.}$
(m^3/min)
p_i
(kPa)
q
p_i
0,5
1
W_a (kW)
1,5
0
1
2


7Z10780.2
h = 1500 m
t_i = 35 °C
$q_{min.}$
(m^3/min)
p_i
(kPa)
q
p_i
0,5
1
W_a (kW)
1,5
0
1
2


7Z10778.2
h = 3000 m
t_i = 25 °C
$q_{min.}$
(m^3/min)
p_i
(kPa)
q
p_i
0,5
1
W_a (kW)
1,5
0
1
2


7Z10781
V_{g2} = 500V
V_{g1} (V)
150
100
50
0
−50
−100
−150
I_{g2} = 0.6 A
0.4 A
0.2 A
0.1 A
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
0
2
V_a (kV)
4


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


7Z10783
V_{g2} = 700V
V_{g1} (V)
150
100
50
0
−50
−100
−150
0
2
4
V_a (kV)
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

HIGH GAIN AIR-COOLED V.H.F. POWER TETRODE SPECIAL DESIGN FOR GROUNDED CATHODE OPERATION

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	V_a	W_ℓ	Power gain
MHz	kV	kW	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.

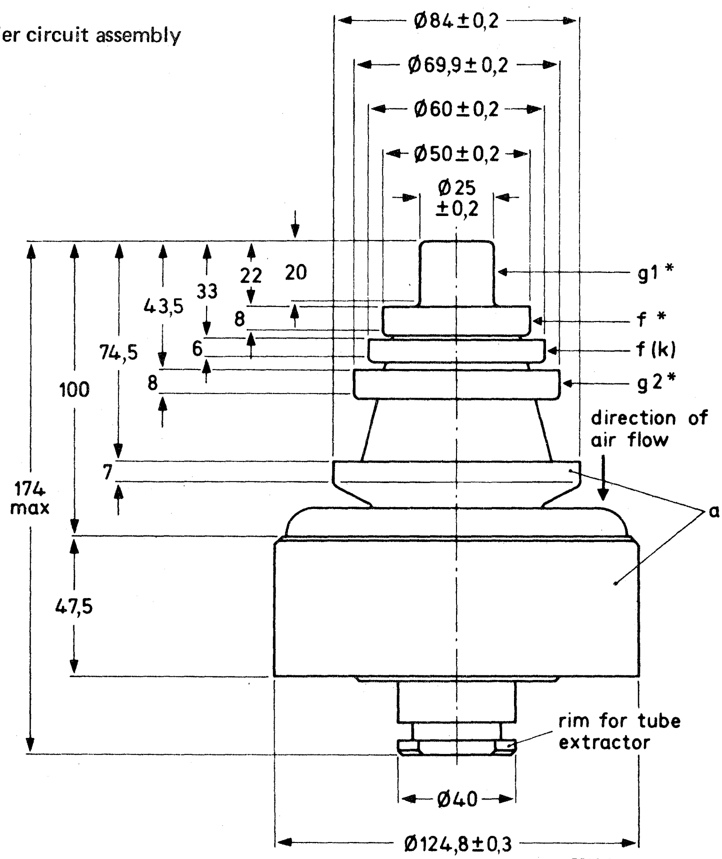
MECHANICAL DATA

Net mass: 3,1 kg

Mounting position: vertical with
anode up or down

ACCESSORY

Band II amplifier circuit assembly
type 40775



* Special design for grounded cathode operation.

R.F. CLASS-B AMPLIFIER

Unless otherwise stated the voltages are specified with respect to cathode

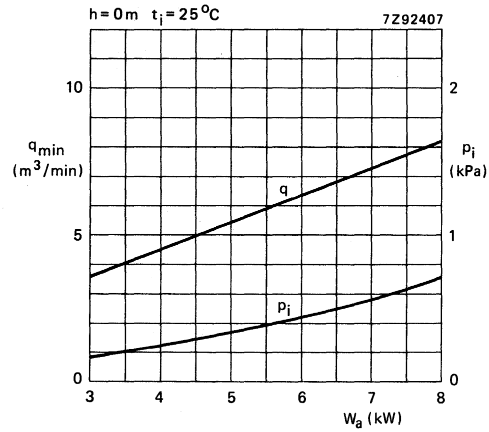
LIMITING VALUES (Absolute maximum rating system)

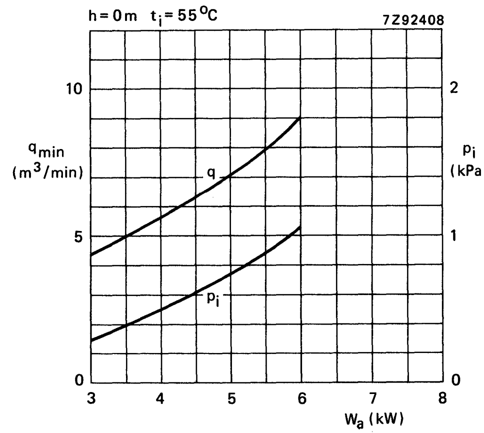
Frequency	f	up to	200	MHz
Anode voltage	V_a	max.	8,5	kV
Grid 2 voltage	V_{g2}	max.	1	kV
Grid 1 voltage	$-V_{g1}$	max.	500	V
Anode current	I_a	max.	4	A
Anode input power	W_{ia}	max.	18,5	kW
Anode dissipation	W_a	max.	8	kW
Grid 2 dissipation	W_{g2}	max.	80	W
Grid 1 dissipation	W_{g1}	max.	40	W
Cathode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

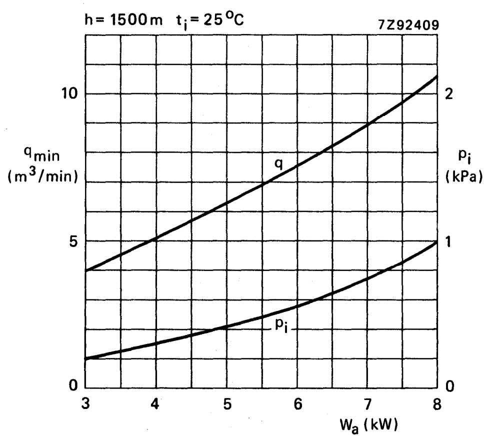
OPERATING CONDITIONS, grounded cathode, measured in amplifier assembly type 40775

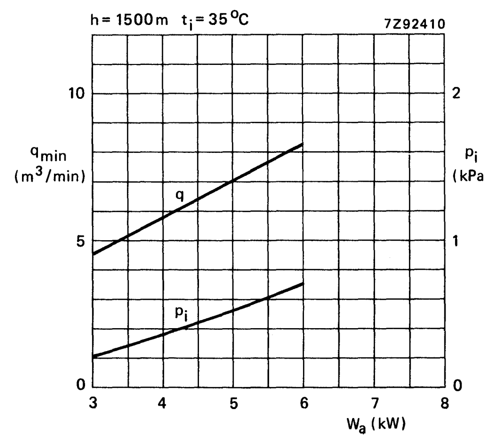
Frequency	f	87 to 100	87 to 110	MHz
Anode voltage	V_a	7	6	kV
Grid 2 voltage	V_{g2}	700	700	V
Grid 1 voltage*	V_{g1}	−105	−100	V
Anode current, no-signal condition	I_a	600	600	mA
Anode current	I_a	2,3	1,6	A
Grid 2 current	I_{g2}	40	70	mA
Grid 1 current	I_{g1}	150	90	mA
Anode input power	W_{ia}	16,1	9,6	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

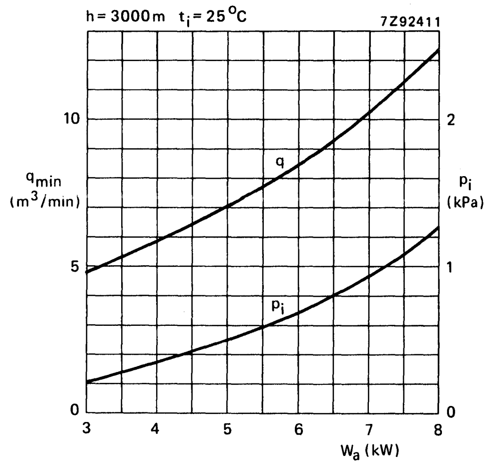
* To be adjusted for the stated no-signal anode current.

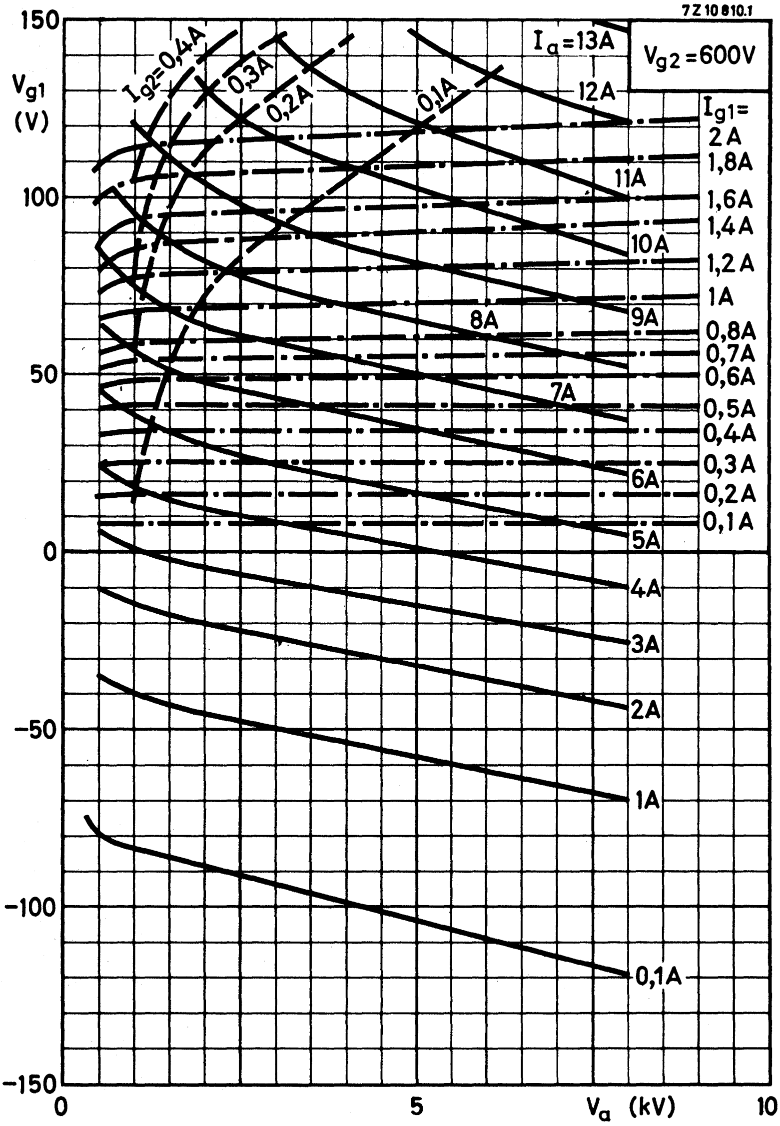

h = 0 m t_i = 25 °C
7Z92407
q_min (m³/min)
p_i (kPa)
q
p_i
W_a (kW)
0
5
10
0
1
2
3
4
5
6
7
8

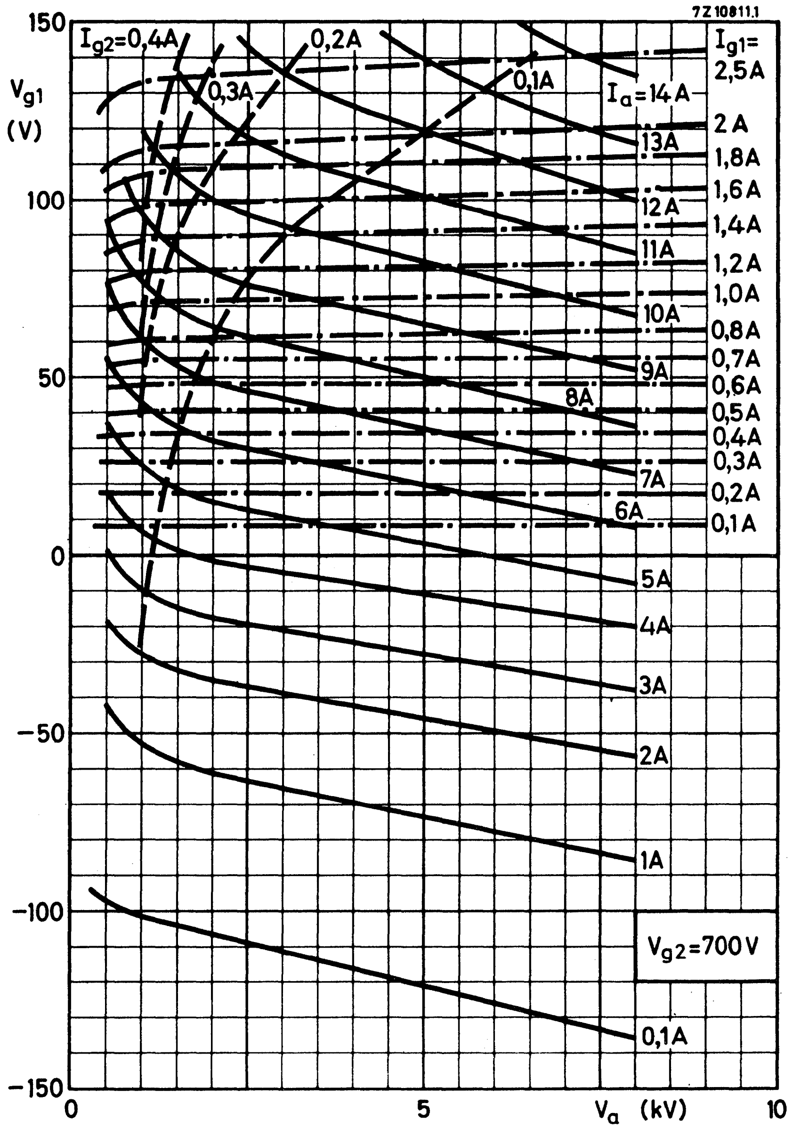

h = 0 m t_i = 55 °C
7Z92408
q_min (m³/min)
p_i (kPa)
q
p_i
W_a (kW)
0
5
10
0
1
2
3
4
5
6
7
8


h = 1500 m t_i = 25 °C
7Z92409
q_min (m³/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 (m³/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
0
5
10
0
1
2
3
4
5
6
7
8
W_a (kW)


7Z10810.1
V_{g2} = 600V
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_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
1,2 A
1A
0,8A
0,7A
0,6A
0,5A
0,4A
0,3 A
0,2 A
0,1 A


7Z10811.1
V_{g1}
(V)
150
100
50
0
−50
−100
−150
0
5
V_a (kV)
10
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

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	°C
Recommended maximum seal temperature	T	max.	200	°C

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

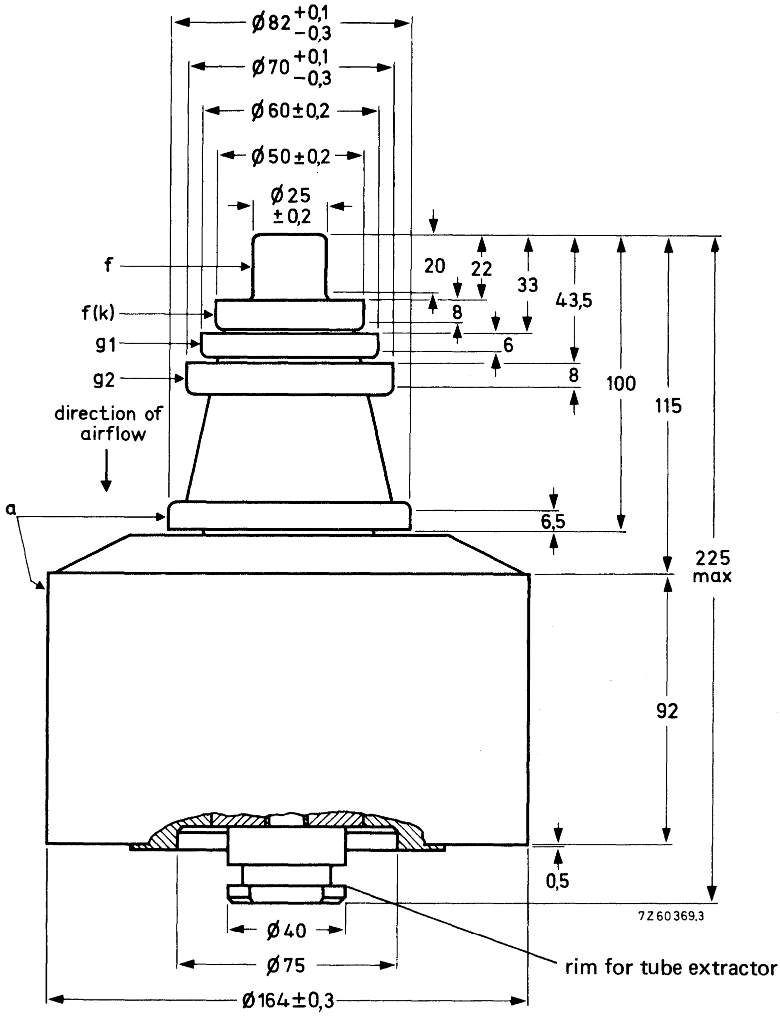
Band I amplifier circuit assembly (vision)	type 40759
Band I amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40768
Band III amplifier circuit assembly (sound)	type 40769

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 115.

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 114.

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 115.

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

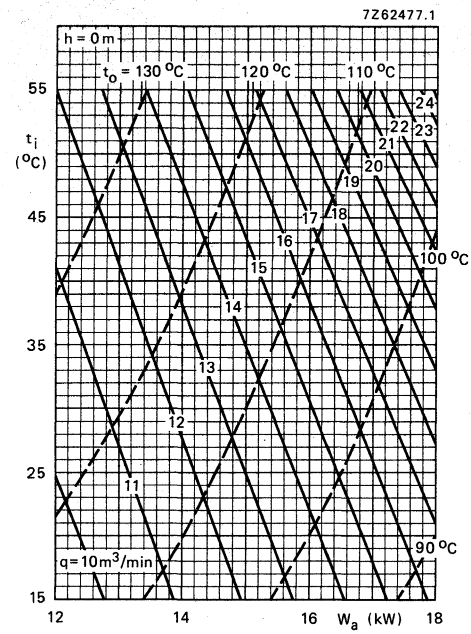
LIMITING VALUES (Absolute maximum rating system)

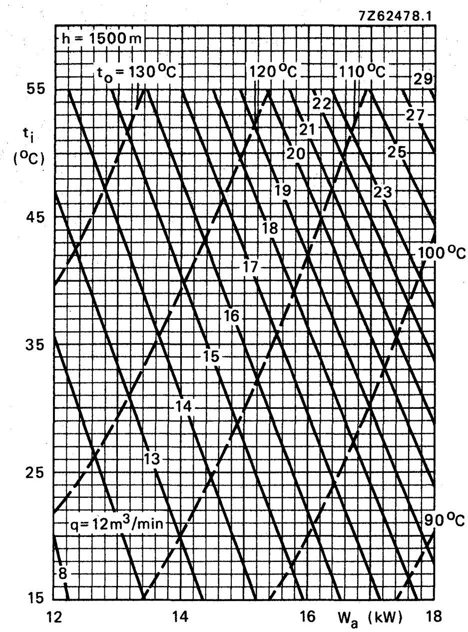
					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	9,5	kV	
Grid 2 voltage	V_{g2}	max.	1	kV	
Grid 1 voltage	$-V_{g1}$	max.	500	V	
Anode current	I_a	max.	7	A	
Anode input power	W_{ia}	max.	42	kW	
Anode dissipation	W_a	max.	18	kW	
Grid 2 dissipation	W_{g2}	max.	100	W	
Grid 1 dissipation	W_{g1}	max.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

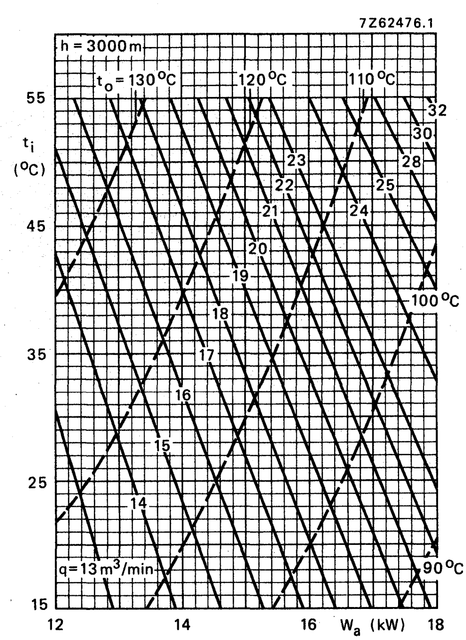
OPERATING CONDITIONS

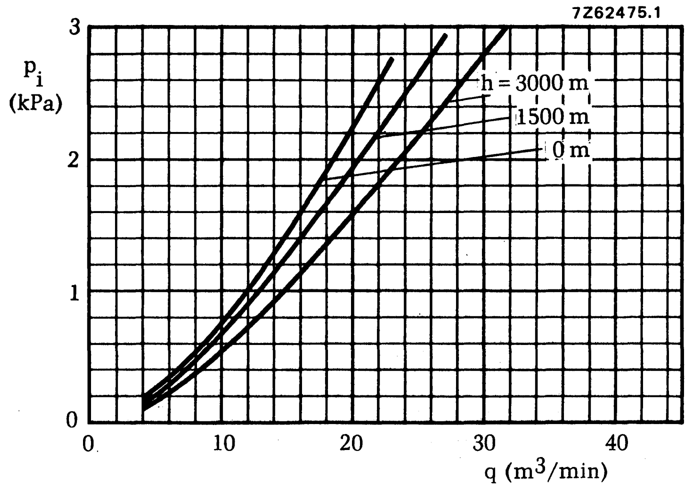
				notes
Frequency	f	260	MHz	
Anode voltage	V_a	8,5	kV	
Grid 2 voltage	V_{g2}	700	V	
Grid 1 voltage	V_{g1}	−106	V	2
Anode current, no signal condition	I_a	300	mA	
Anode current	I_a	4,6	A	
Grid 2 current	I_{g2}	100	mA	
Grid 1 current	I_{g1}	325	mA	
Anode input power	W_{ia}	39,1	kW	
Anode dissipation	W_a	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	

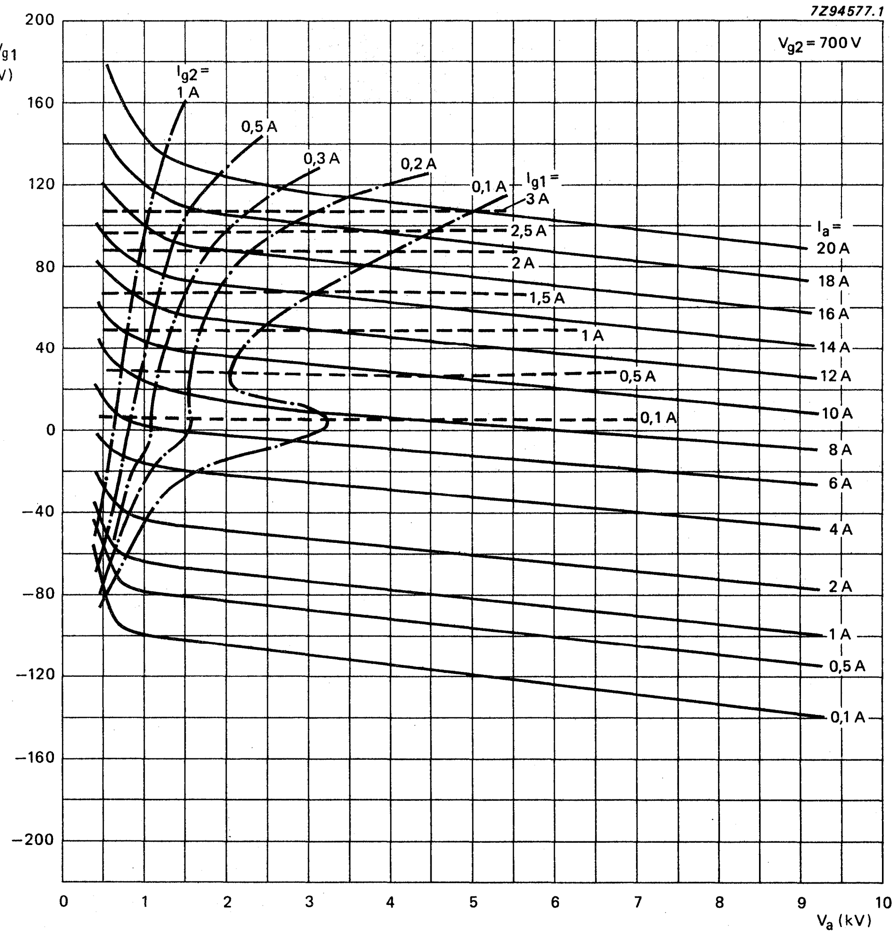
Note see page 115.


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


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


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


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


7Z94577.1
V_{g2} = 700 V
V_{g1} (V)
200
160
120
80
40
0
−40
−80
−120
−160
−200
I_{g2} = 1 A
0,5 A
0,3 A
0,2 A
0,1 A
I_{g1} = 3 A
2,5 A
2 A
1,5 A
1 A
0,5 A
0,1 A
I_a = 20 A
18 A
16 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 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

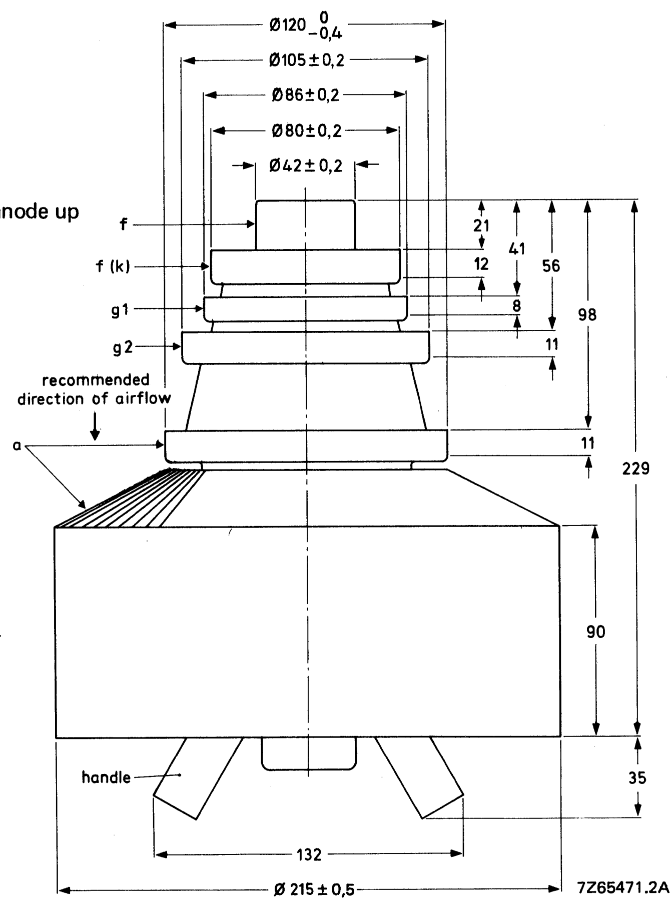
COOLING

$W_a + W_g$ kW	h m	T_i °C	q_{min} m³/min.	ΔP, tube only Pa	ΔP 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.

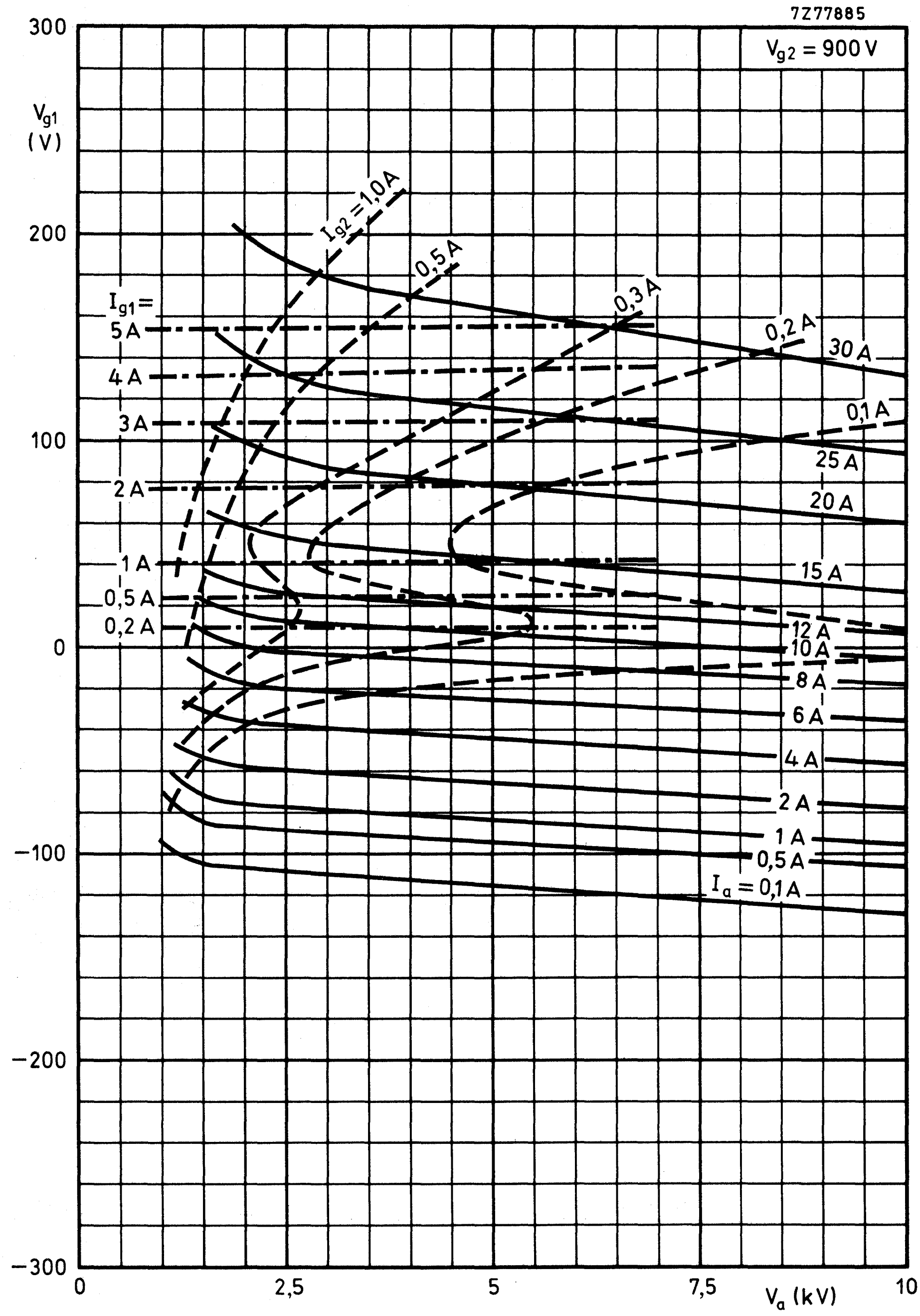
LIMITING VALUES (Absolute maximum rating system)

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 50 kW POWER TETRODE

Water cooled coaxial power tetrode in metal-ceramic construction primarily intended for use in R.F. power amplifier applications up to 100 MHz.

QUICK REFERENCE DATA

Class-B amplifier (C.W.)				
Frequency	f		100	MHz
Anode voltage	V_a		12	kV
Anode output power	W		50	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 ←

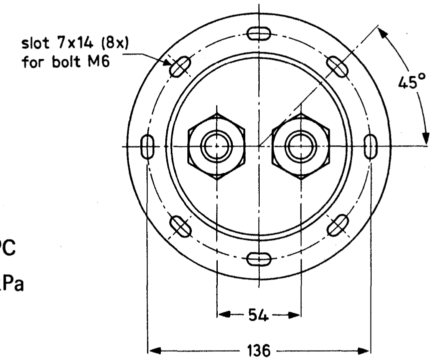
Input	C_i		80	pF
Output	C_o		30	pF
Anode to filament	C_{af}	<	0,1	pF

TEMPERATURE LIMITS

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

COOLING

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



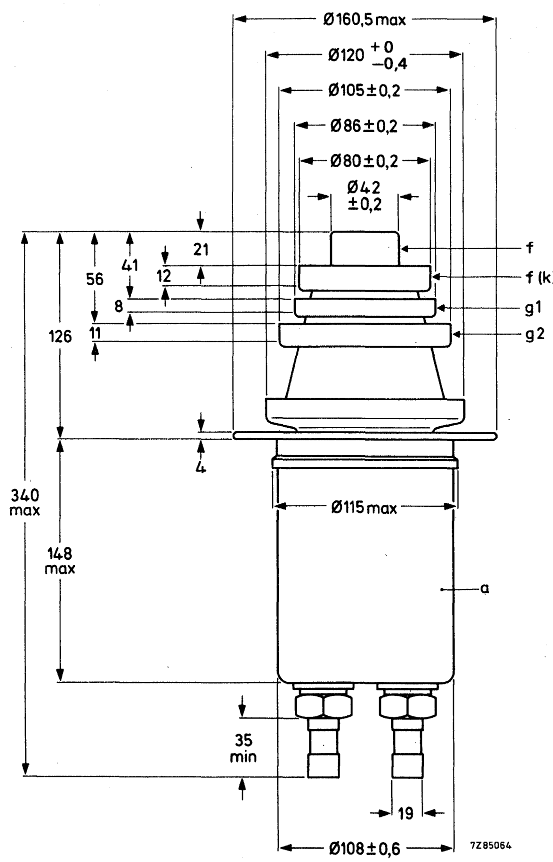
Absolute maximum water inlet temperature T_i 50 °C
Absolute maximum water pressure p 600 kPa

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.



R.F. CLASS-B POWER AMPLIFIER

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

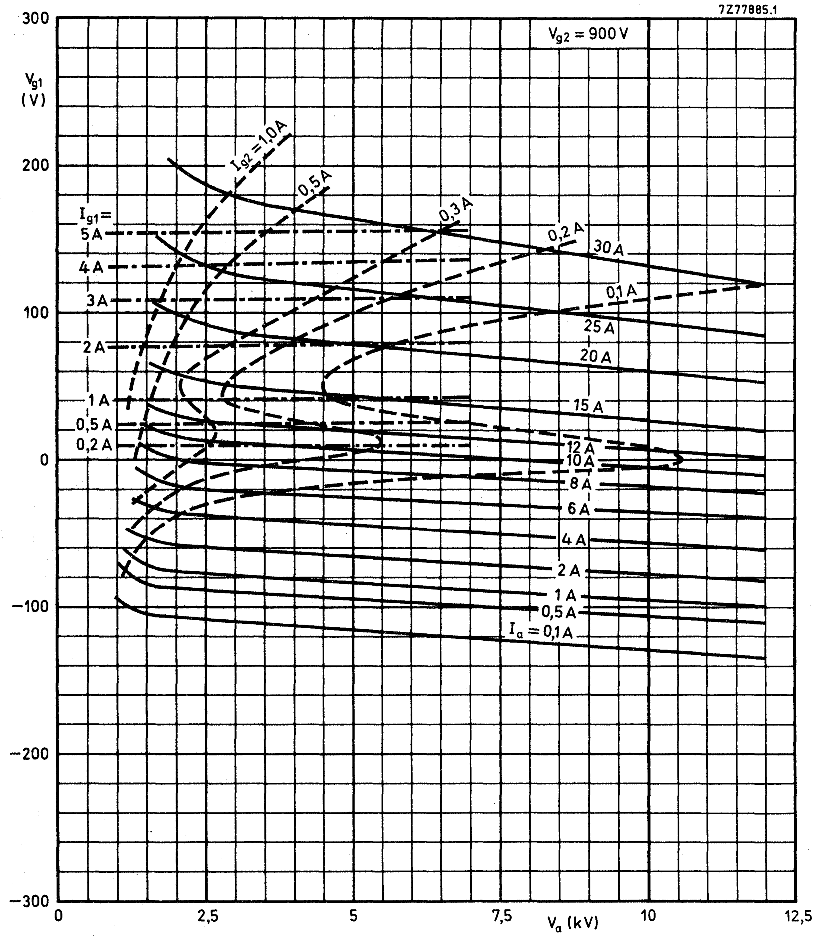
LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	250	MHz*
Anode voltage	V_a	max.	14	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		100	MHz
Anode voltage	V_a		12	kV
Grid 2 voltage	V_{g2}		900	V
Grid 1 voltage	V_{g1}	≈	−110	V **
Anode current, no-signal condition	I_a		0,5	A
Anode current	I_a		6	A
Grid 2 current	I_{g2}		190	mA
Grid 1 current	I_{g1}		800	mA
Anode output power	W		50	kW
Driving power	W_{dr}		1250	W
Gain	G		16	dB

* For operation above 100 MHz the tube manufacturer should be consulted.
** To be adjusted for the stated no-signal anode current.


7Z77885.1
V_{g2} = 900 V
V_{g1} (V)
300
200
100
0
−100
−200
−300
I_{g2} = 1,0 A
0,5 A
0,3 A
0,2 A
0,1 A
I_{g1} =
5 A
4 A
3 A
2 A
1 A
0,5 A
0,2 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
12,5
V_a (kV)

HIGH GAIN AIR-COOLED V.H.F. POWER TETRODE
SPECIAL DESIGN 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} m^3/min	ΔP 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.

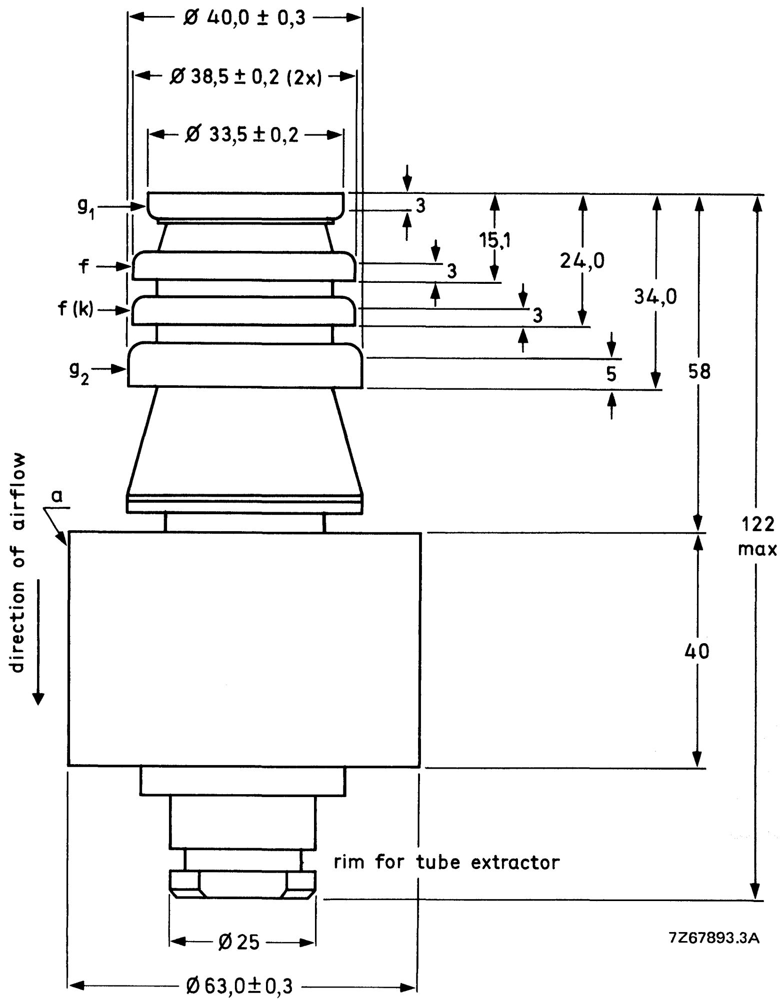
ACCESSORIES

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

Net mass: 0,55 kg

Mounting position: vertical with anode up or down



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)

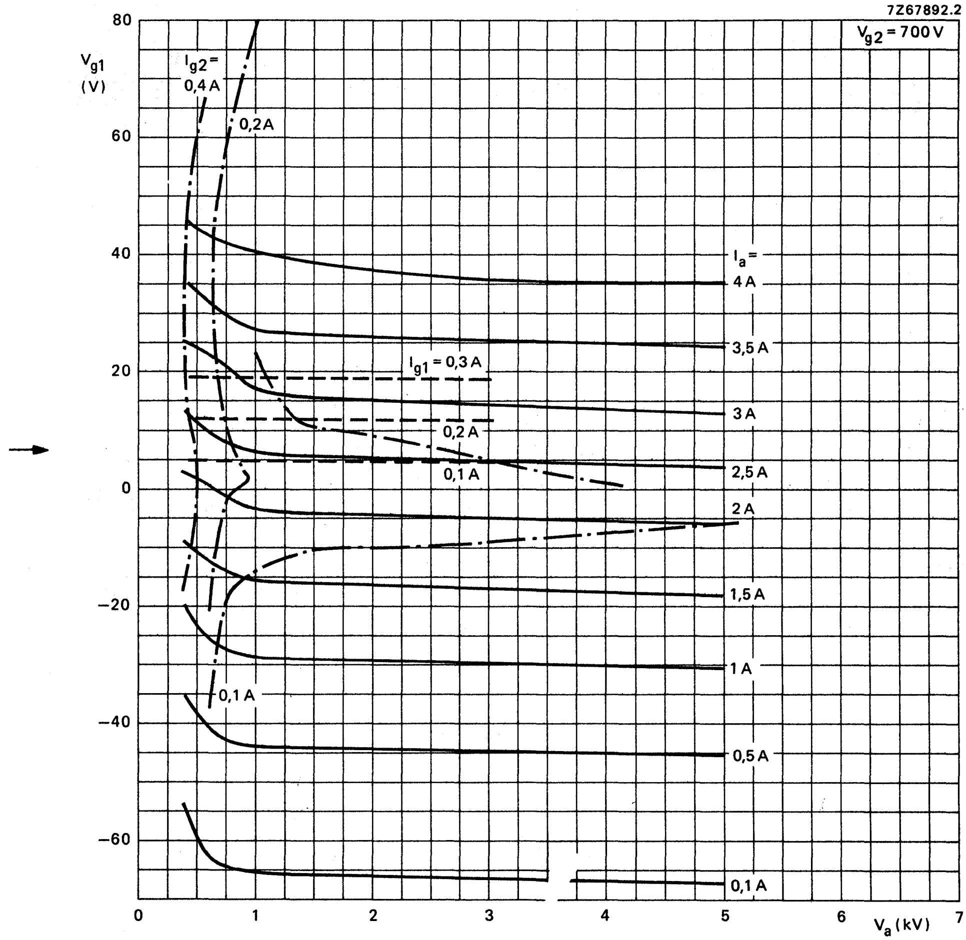
					notes
Frequency	f	up to	260	MHz	
Anode voltage	V_a	max.	4,2	kV	
Grid 2 voltage	V_{g2}	max.	750	V	
Grid 1 voltage	$-V_{g1}$	max.	100	V	
Anode current, black	I_a	max.	1,2	A	
Anode input power, black	W_{ia}	max.	4	kW	
Anode dissipation	W_a	max.	2	kW	
Grid 2 dissipation	W_{g2}	max.	70	W	
Grid 1 dissipation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


7Z67892.2
V_{g2} = 700 V
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)

HIGH GAIN AIR-COOLED R.F. POWER TETRODE SPECIAL DESIGN 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.

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	ΔP 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.

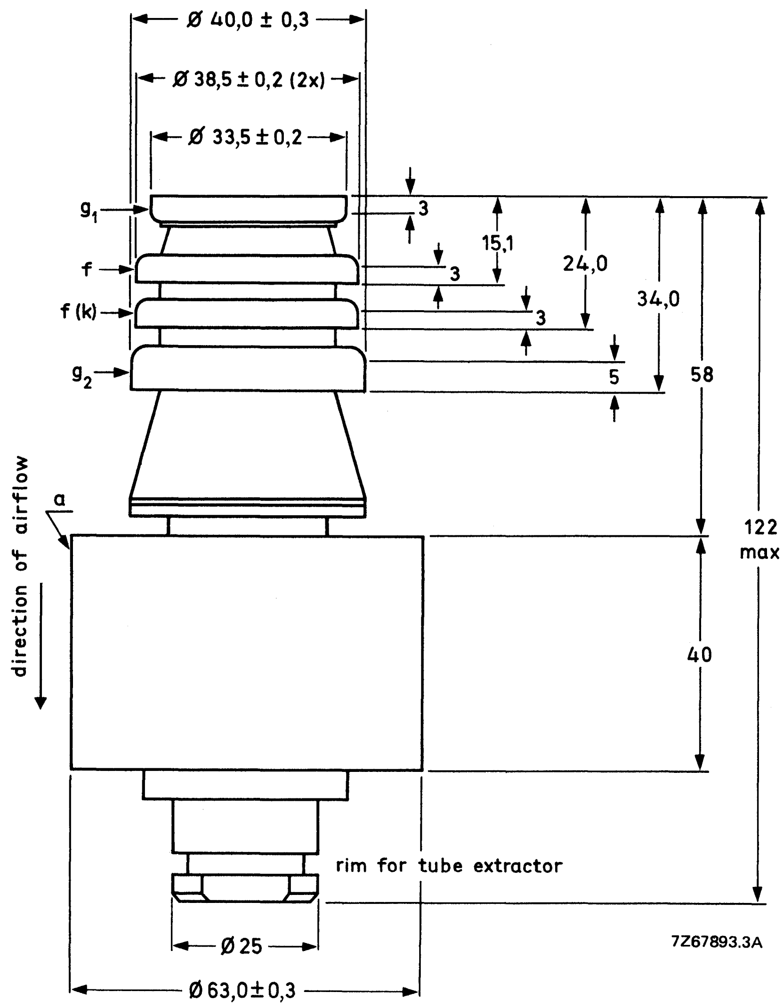
ACCESSORIES

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

MECHANICAL DATA

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	

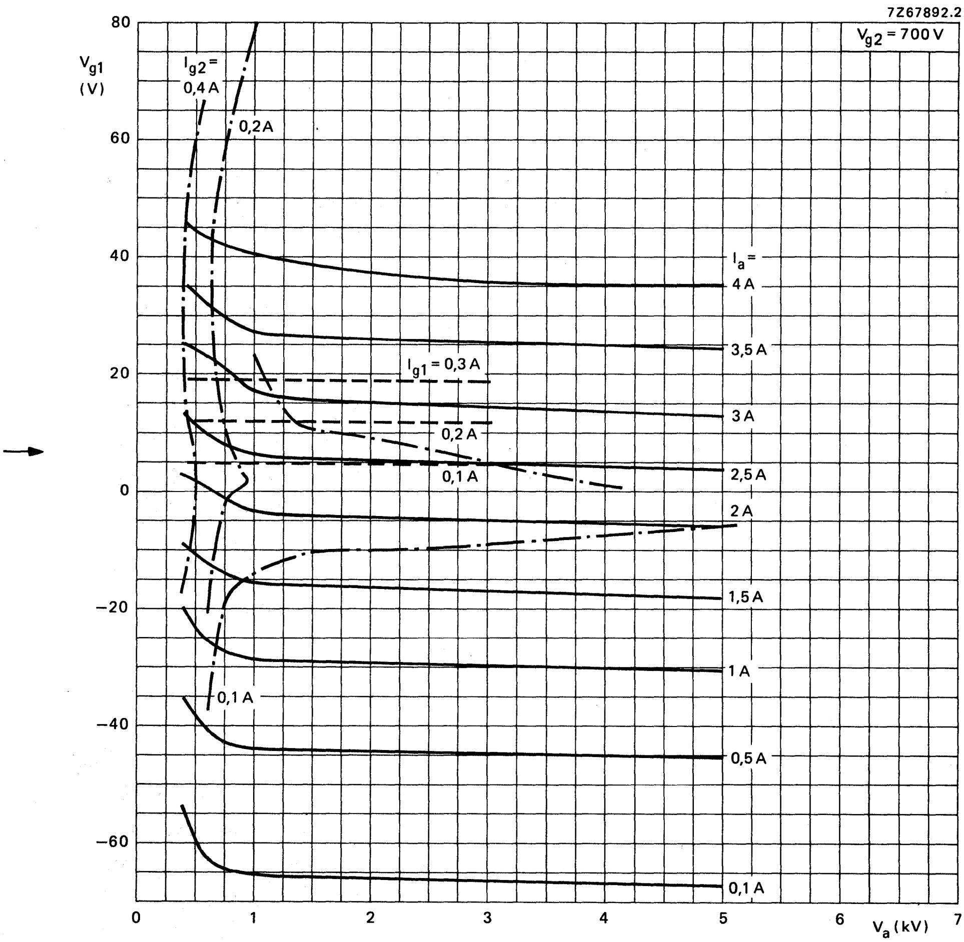
OPERATING CONDITIONS

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.


7Z67892.2
V_{g2} = 700 V
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} m^3/min	ΔP 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.

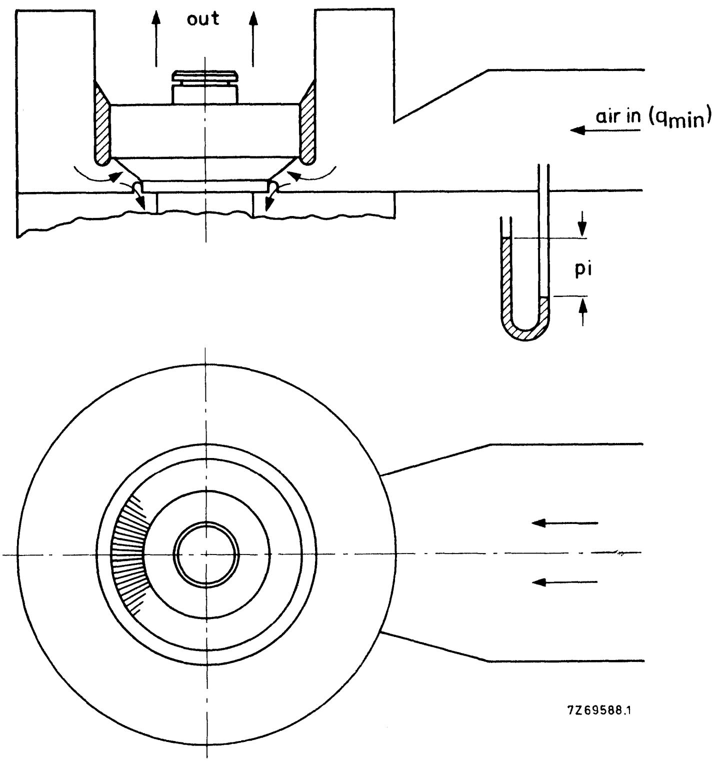


Fig. 1 Schematic of cooling air flow.

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

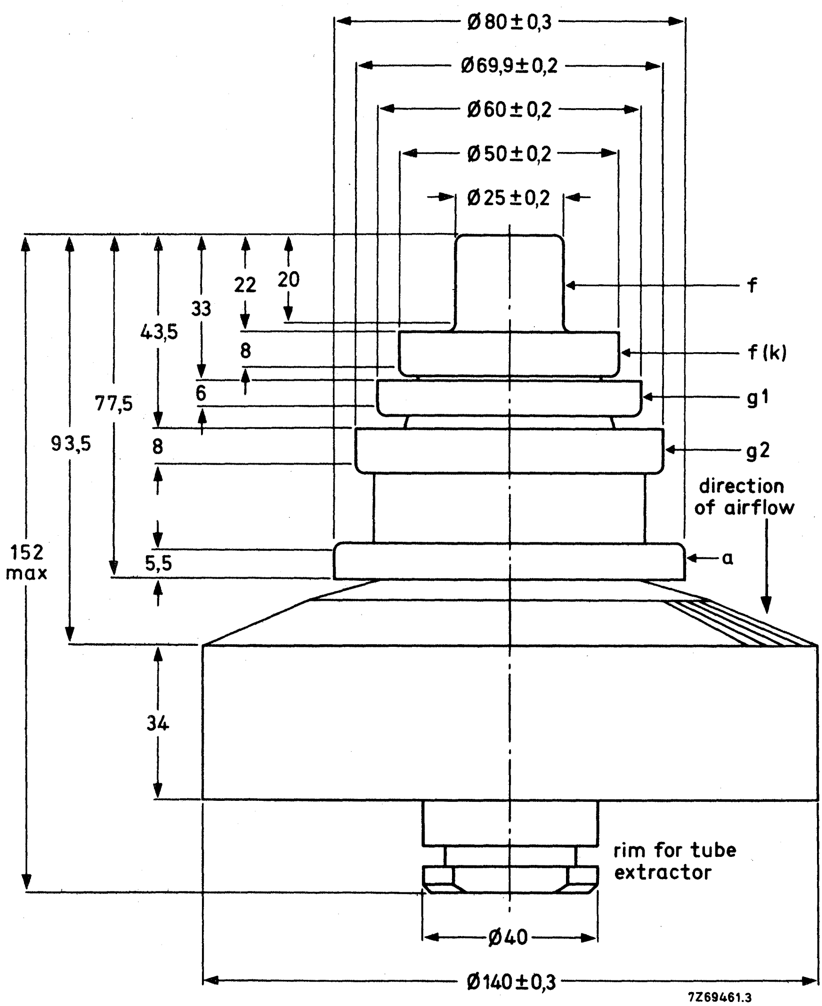


Fig. 2.

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)

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).

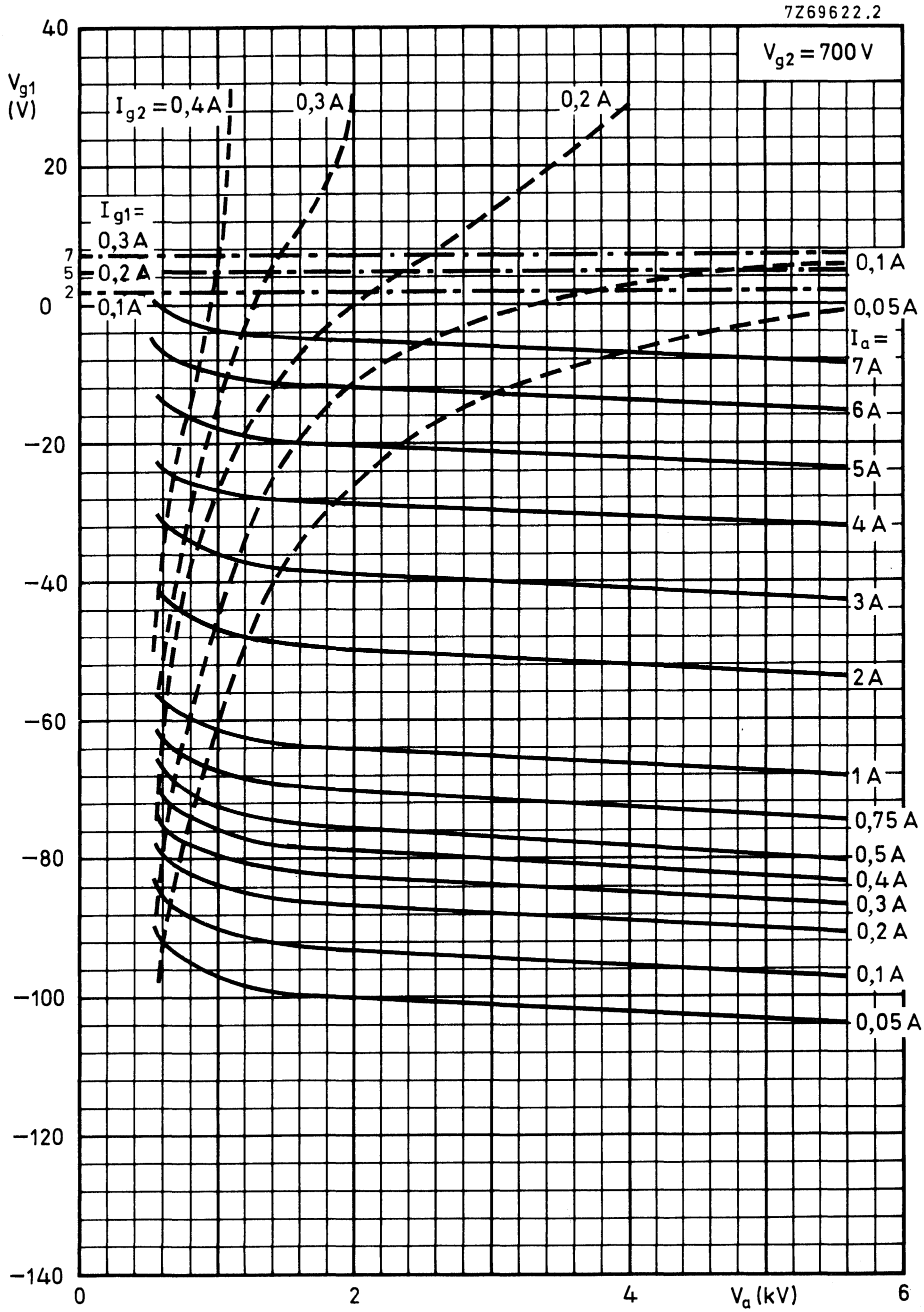

7Z69622.2
$V_{g2} = 700\,V$
V_{g1} (V)
$I_{g2} = 0,4\,A$
0,3 A
0,2 A
$I_{g1} =$
0,3 A
0,2 A
0,1 A
0,1 A
0,05 A
$I_a =$
7 A
6 A
5 A
4 A
3 A
2 A
1 A
0,75 A
0,5 A
0,4 A
0,3 A
0,2 A
0,1 A
0,05 A
40
20
0
−20
−40
−60
−80
−100
−120
−140
7
5
2
0
2
4
6
V_a (kV)

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.

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}		7,4 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	3 A ←
Transconductance	S	115 mA/V
Amplification factor	μ_{g2g1}	8

CAPACITANCES (grounded grid)

Input	C_i	70 pF ←
Output	C_o	18 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	ΔP 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.

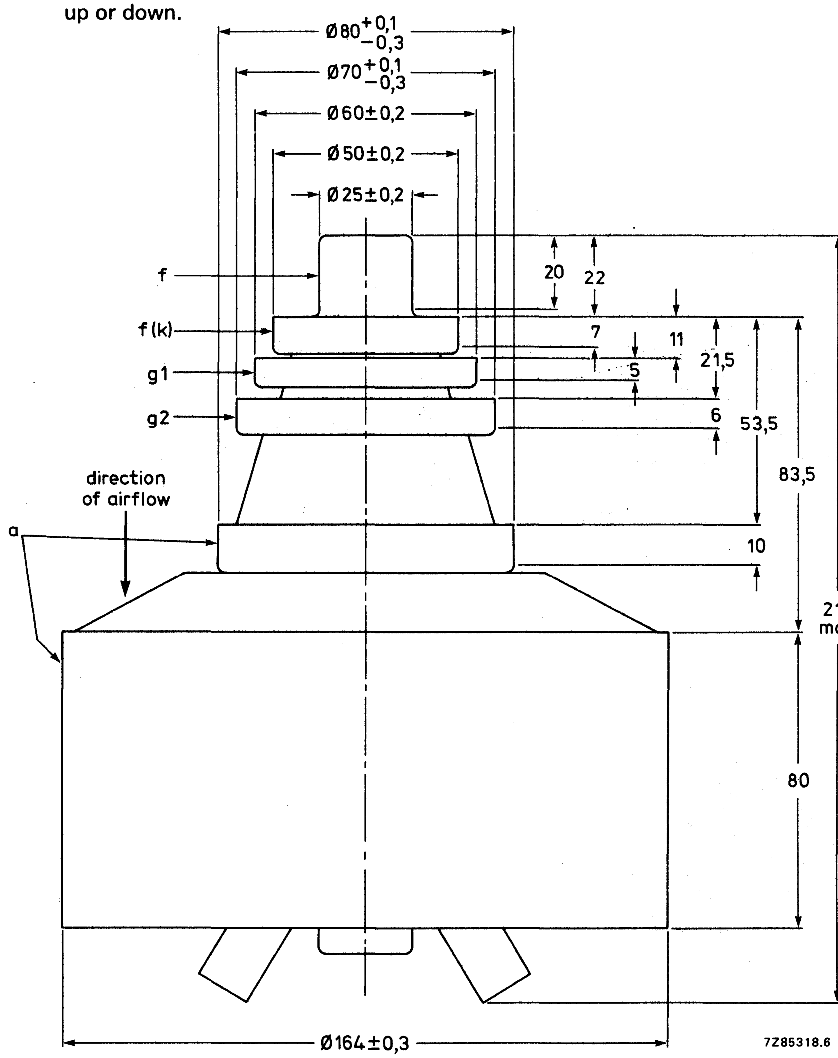
→ LIMITING VALUES (Absolute maximum rating system)

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. 10 kg

Mounting position: vertical with anode up or down.



ACCESSORIES

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 (grounded grid)

The voltages are given with respect to the cathode.

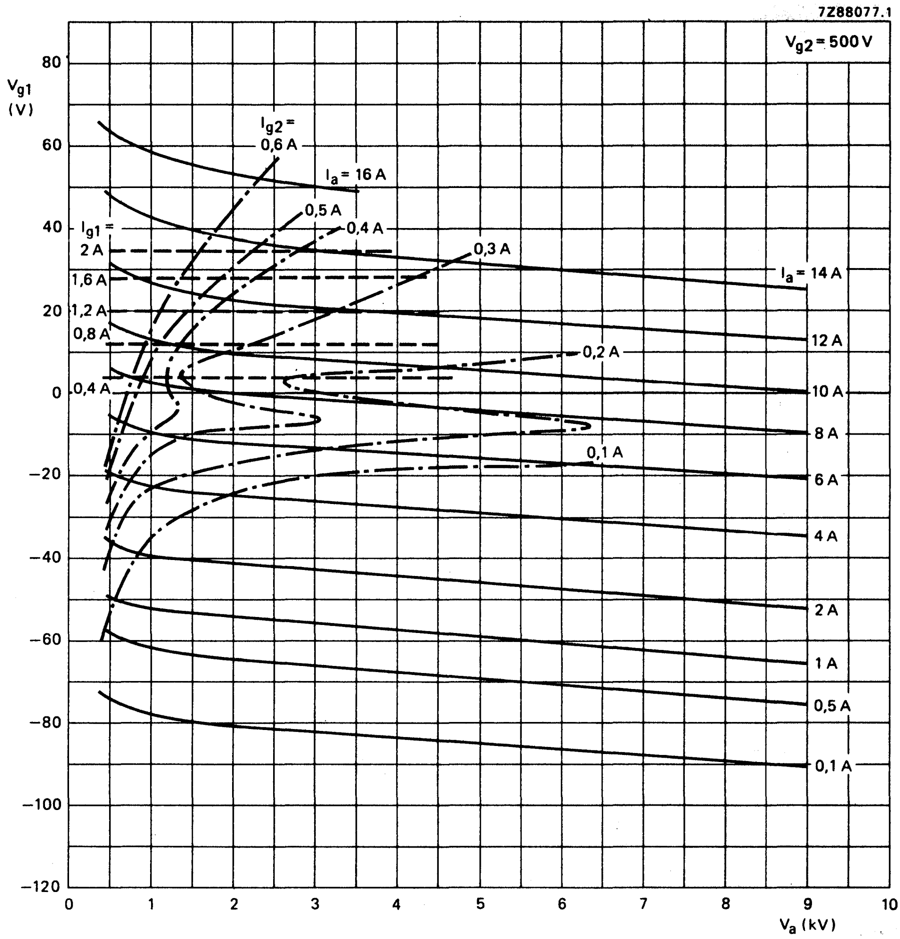
CLASS-AB AMPLIFIER FOR TELEVISION SERVICE

						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	$-V_{g1}$	≈	45	45	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}	≈	75	75	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

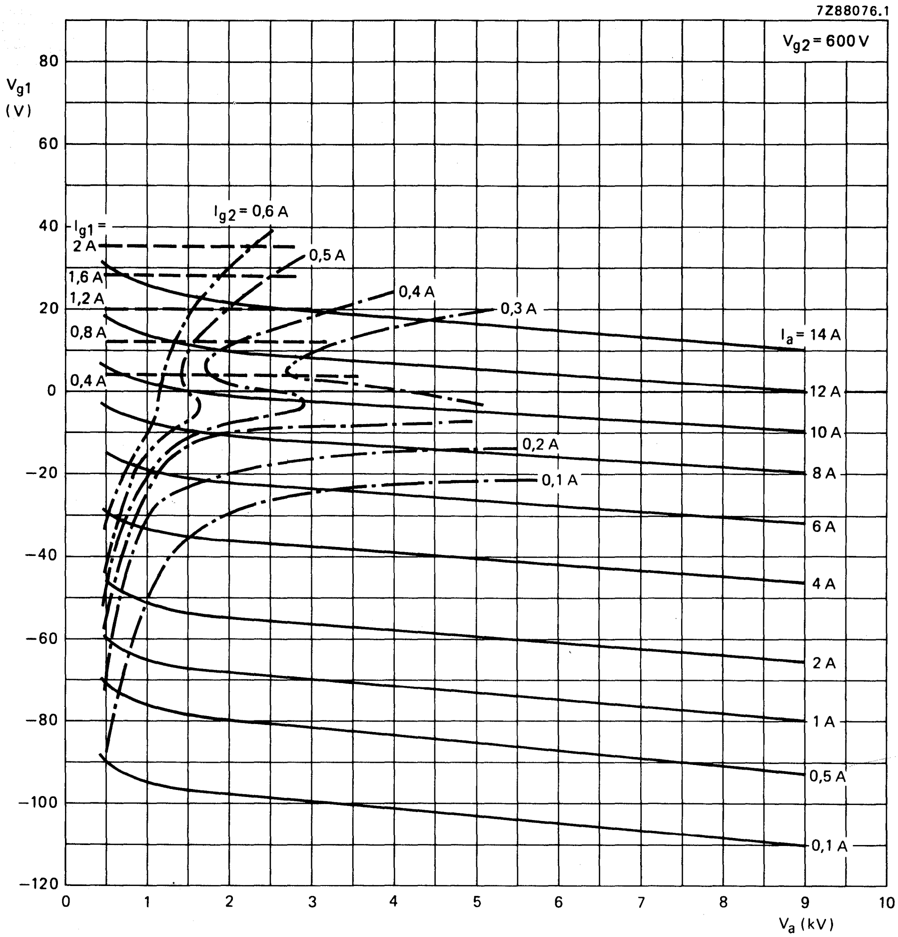
→ Frequency	f		230	230	MHz	
Bandwidth (−3 dB) 230 MHz	B	≈	4	4	MHz	
Anode voltage	V_a		5,5	6,5	kV	
Grid 2 voltage	V_{g2}		500	500	V	
→ Grid 1 voltage	$-V_{g1}$	≈	50	50	V	2
Anode current, no-signal condition	I_a		1	1	A	
Anode current	I_a	≈	2,2	2,7	A	
Grid 2 current	I_{g2}	≈	100	125	mA	
Grid 1 current	I_{g1}	≈	0	20	mA	
Output power in load	W_ℓ		5	10	kW	
→ Driving power	W_{dr}		65	110	W	
→ Power gain	G		19	19	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		230 MHz
Anode voltage	V_a		7,5 kV
Output power in load (sync)	W_ℓ		30 kW
Power gain (sync)	G		17 dB

HEATING: direct; thoriated tungsten filament, mesh type.

Filament voltage	V_f		10,4 V $^{+1}_{-3}$ %
Filament current	I_f		165 A
Filament peak starting current	I_{fp}	max.	700 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 $V_f = 10,4$ V	t_w	5 s

TYPICAL CHARACTERISTICS

Anode voltage	V_a		6	kV
Grid 2 voltage	V_{g2}		600	V
Anode current	I_a		4	A
Transconductance	S	≈	100	mA/V
Amplification factor	μ_{g2g1}	≈	7	

CAPACITANCES, grounded grid

Input	C_i	≈	100	pF
Output	C_o	≈	28	pF

TEMPERATURE LIMITS

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

COOLING

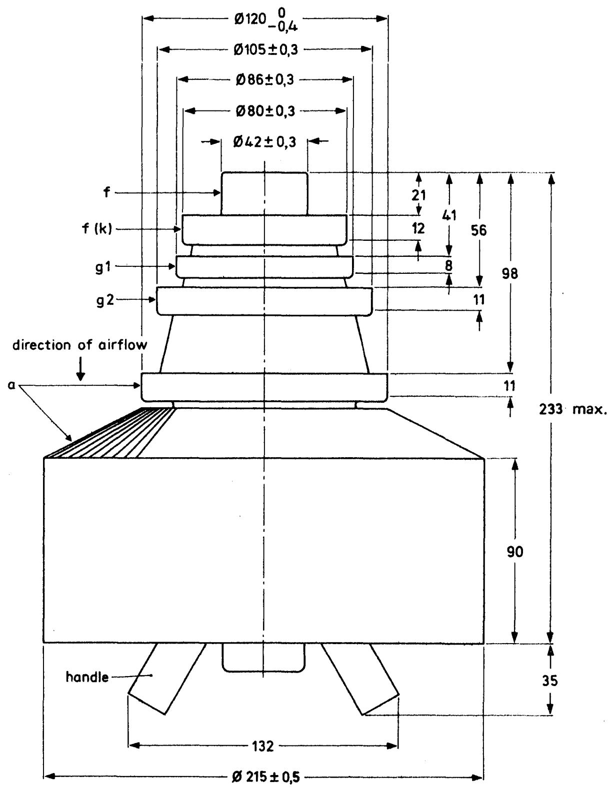
$W_a + W_g$ kW	h m	T_i ^oC	q_{min} m^3/min	Δp Pa tube only	Δp Pa tube + cavity	T_o max ^oC
12	0	25	10	450	570	90
16	0	25	14	550	750	90
20	0	25	18	770	1200	90
24	0	25	22	1150	1700	90
26	0	25	24	1320	2040	90
12	0	55	14	550	750	110
16	0	55	18	770	1200	110
20	0	55	22	1150	1700	110
24	0	55	26	1550	2300	110
26	0	55	28	1660	2700	110
12	1500	25	10	400	570	100
16	1500	25	14	480	700	100
20	1500	25	18	640	1000	100
24	1500	25	22	970	1500	100
26	1500	25	24	1130	1700	100
12	3000	25	14	530	670	100
16	3000	25	18	600	930	100
20	3000	25	22	850	1300	100
24	3000	25	26	1250	1650	100
26	3000	25	28	1350	2000	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



7Z65471.4A

ACCESSORIES

Band III amplifier circuit assembly type 40786

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

DEVELOPMENT DATA

LIMITING VALUES (Absolute maximum rating system)

Frequency	f	up to	250	MHz
Anode voltage	V_a		10	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

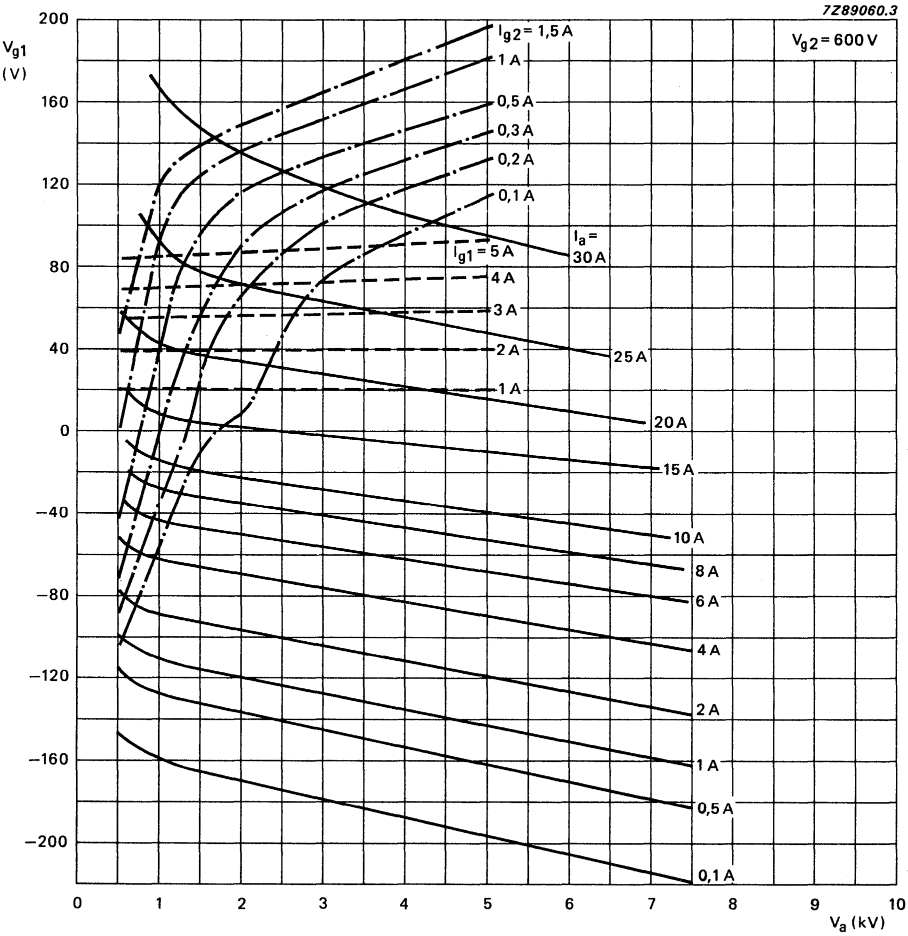
The voltages are given with respect to the cathode.

CLASS-AB AMPLIFIER FOR TELEVISION SERVICE

										notes
System								M		
Frequency of vision carrier	f				175 to 225				MHz	
Bandwidth (−1 dB)	B		7	7	7	7	7	6	MHz	1
Anode voltage	V_a		5,5	6	6,5	7,5	7,5	8,5	kV	
Grid 2 voltage	V_{g2}		600	600	600	600	600	600	V	
Grid 1 voltage	$-V_{g1}$	≈	110	115	120	125	125	135	V	2
Anode current (zero signal)	I_a		2	2	2	2	2	1,8	A	
Anode current (black)	I_a	≈	3,5	4,0	4,5	5	5,4	5,4	A	3
Grid 2 current (black)	I_{g2}	≈	30	50	50	50	70	50	mA	3
Grid 1 current (black)	I_{g1}	≈	0	0	0	0	30	30	mA	3
Output power in load, sync	W_ℓ		11	15	20	25	30	37	kW	
Output power in load, black	W_ℓ		6,6	9	12	15	18	22	kW	
Gain	G		17	17	17	17	17	17,6	dB	
Sync compression	sync in/out	⩽				30/25				4
Differential phase		⩽				3			deg	6
Differential gain		⩾				90			%	6
L.F. linearity		⩾				90			%	5

Notes

1. With double tuned 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 is 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 sinewave heading a 10% peak-to-peak value.



DEVELOPMENT DATA

AIR COOLED V.H.F. POWER TETRODE

Forced air cooled coaxial power tetrode in metal-ceramic construction for use in:
- linear broad band amplifiers for T.V. band III, vision and sound combined
- linear broad band amplifiers for T.V. band III, vision only
- F.M. broadcast applications in band II

QUICK REFERENCE DATA

Class-AB linear amplifier (vision and sound combined)					
Frequency	f		225		MHz
Anode voltage	V_a		5,5	7	kV
Output power in load, sync	W_ℓ		5	10	kW
Power gain	G		16	16	dB
Class-AB linear amplifier (vision)					
Frequency	f		225		MHz
Anode voltage	V_a	4,5	6	7,5	kV
Output power in load, sync	W_ℓ	5,5	11	21	kW
Power gain	G	15,3	15,5	15,3	dB
Class-AB f.m. amplifier					
Frequency	f		110		MHz
Anode voltage	V_a	6	7,5	9	kV
Output power in load	W_ℓ	5,5	10,5	20	kW
Gain	G	17	17	17	dB

HEATING: direct: thoriated tungsten filament, mesh type.

Filament voltage	V_f		10,4	$V^{+1}_{-3}\%$
Filament current	I_f		112	A
Filament peak starting current	I_{fp}	max.	750	A
Cold filament resistance	R_{fo}		10,5	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 = 10,4 V	t_w	5	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

Maximum envelope temperature	T_{env}	240	°C
Maximum seal temperature	T_s	200	°C

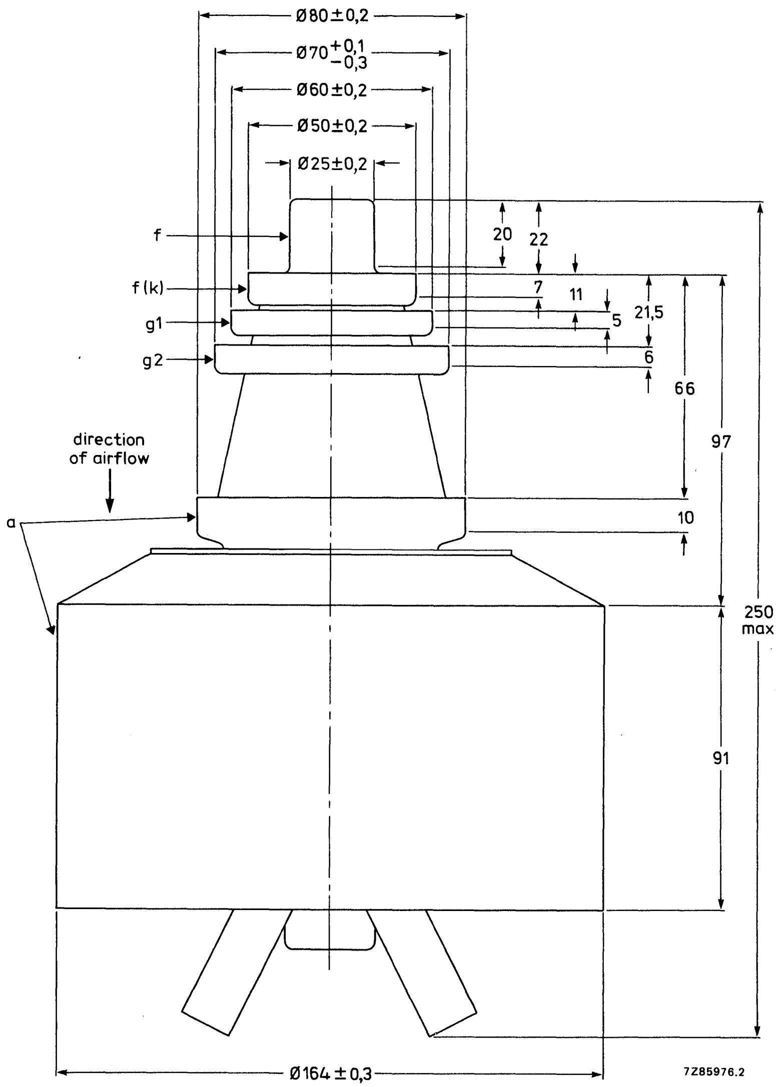
COOLING

$W_a + W_g$ kW	h m	T_i °C	q_{min} m^3/min	Δp P_a tube only	Δp P_a tube + cavity	$T_{o\,max}$ °C
17	0	25	15	1400	1600	100
14	0	25	12	1000	1100	100
10	0	25	8	500	600	100
5	0	25	4	250	300	100
17	0	55	19	2100	2400	110
14	0	55	16	1600	1800	110
10	0	55	12	900	1100	110
5	0	55	7	400	500	110
17	1500	25	17	1550	1700	100
14	1500	25	14	1100	1200	100
10	1500	25	10	600	750	100
5	1500	25	5	260	300	100
17	3000	25	19	1450	1700	100
14	3000	25	16	1150	1300	100
10	3000	25	12	680	800	100
5	3000	25	7	300	350	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. 11 kg
Mounting position	vertical with anode up or down.



ACCESSORIES

Band II amplifier circuit assembly	type 40788
Band III amplifier circuit assembly	type 40786A

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

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

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, black	I_a		7	A
Anode input power, black	W_{ia}		30	kW
Anode dissipation	W_a		17	kW
Grid 2 dissipation	W_{g2}		150	W
Grid 1 dissipation	W_{g1}		50	W

OPERATING CONDITIONS

Vision and sound combined (10 : 1) cathode driven

Frequency	f	175 to 225		MHz
Bandwidth (−1 dB)	B	8	8	MHz
Anode voltage	V_a	5,5	7	kV
Grid 2 voltage	V_{g2}	900	900	V
Grid 1 voltage*	$-V_{g1}$	$\approx$ 95	$\approx$ 100	V
Anode current (zero signal)	I_a	1,8	1,8	A
Anode current, black + line sync pulse	I_a	$\approx$ 2,45	$\approx$ 2,9	A
Grid 2 current, black + line sync pulse	I_{g2}	$\approx$ 30	$\approx$ 50	mA
Grid 1 current, black + line sync pulse	I_{g1}	$\approx$ 0	$\approx$ 0	mA
Output power in load (sync)	W_ℓ	5	10	kW
Driving power (sync)	W_{dr}	$\leq$ 125	$\leq$ 250	W
Power gain	G	$\geq$ 16	$\geq$ 16	dB
Intermodulation products**	d	$\leq$ −54	$\leq$ −54	dB

* To be adjusted for the stated zero signal anode current.

** Measured with:
sync. = 0 dB
black = −2,2 dB
grey = −8 dB
sound = −10 dB
side band = −16 dB
Intermodulation products of driver $\leq$ −70 dB.

OPERATING CONDITIONS

Vision only

									notes
Frequency	f				175 to 225			MHz	
Bandwidth (−1 dB)	B		7		7		7	MHz	1
Anode voltage	V_a		4,5		6		7,5	kV	
Grid 2 voltage	V_{g2}		800		800		800	V	
Grid 1 voltage	$-V_{g1}$	≈	90	≈	95	≈	100	V	2
Anode current (zero signal)	I_a		1,2		1,2		1	A	
Anode current, black	I_a	≈	2,1	≈	2,75	≈	3,6	A	3
Grid 2 current, black	I_{g2}	≈	50		75		75	mA	3
Grid 1 current, black	I_{g1}	≈	0	≈	10	≈	100	mA	3
Output power in load, black	W_ℓ		3,3		6,6		12,6	kW	
Output power in load, sync	W_ℓ		5,5		11		21	kW	
Gain, black	G		15,3		15,5		15,3	dB	
Sync compression		⩽	27/25	⩽	27/25	⩽	27/25		4
Differential phase		⩽	3	⩽	3	⩽	3	deg	6
Differential gain		⩾	90	⩾	90	⩾	90	%	6
L.F. linearity		⩾	90	⩾	90	⩾	90	%	5

Notes

1. With double-tuned 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 is 30/25.
5. Measured with a step staircase, running from 17% to 75% of the peak sync value.
6. As 5 but with a superimposed 4,43 MHz sine-waye having a 10% peak-to-peak value.

CLASS-AB F.M. AMPLIFIER

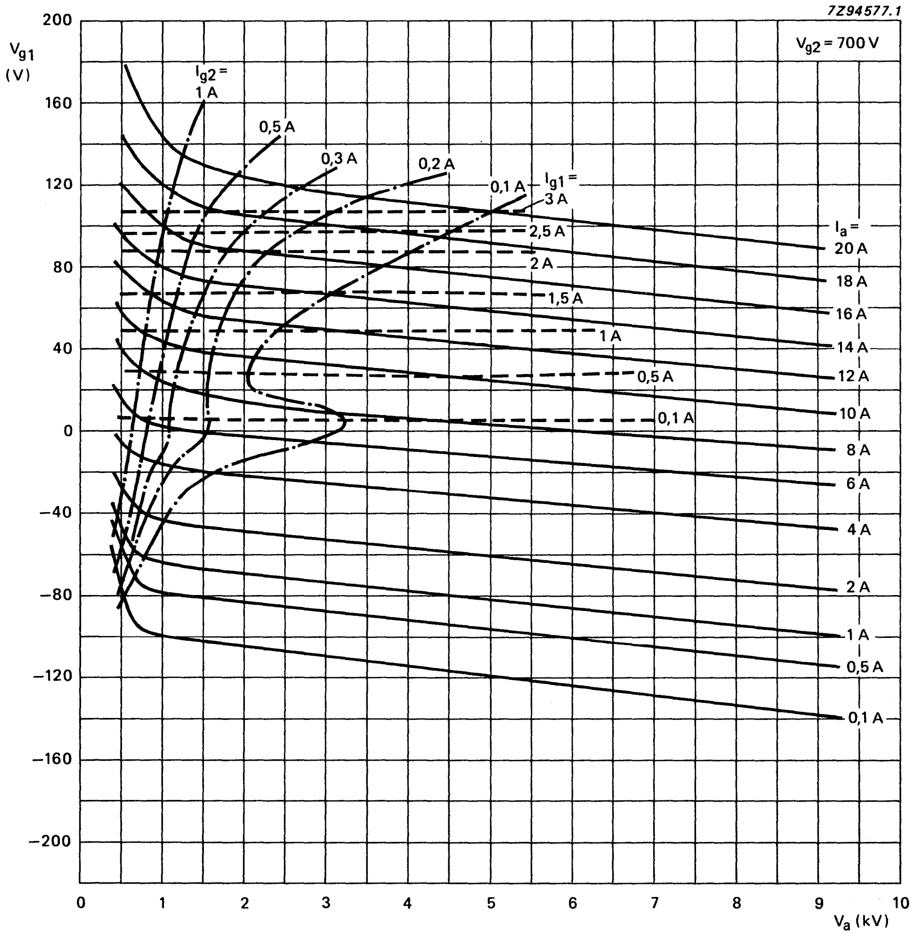
LIMITING VALUES (Absolute maximum rating system)

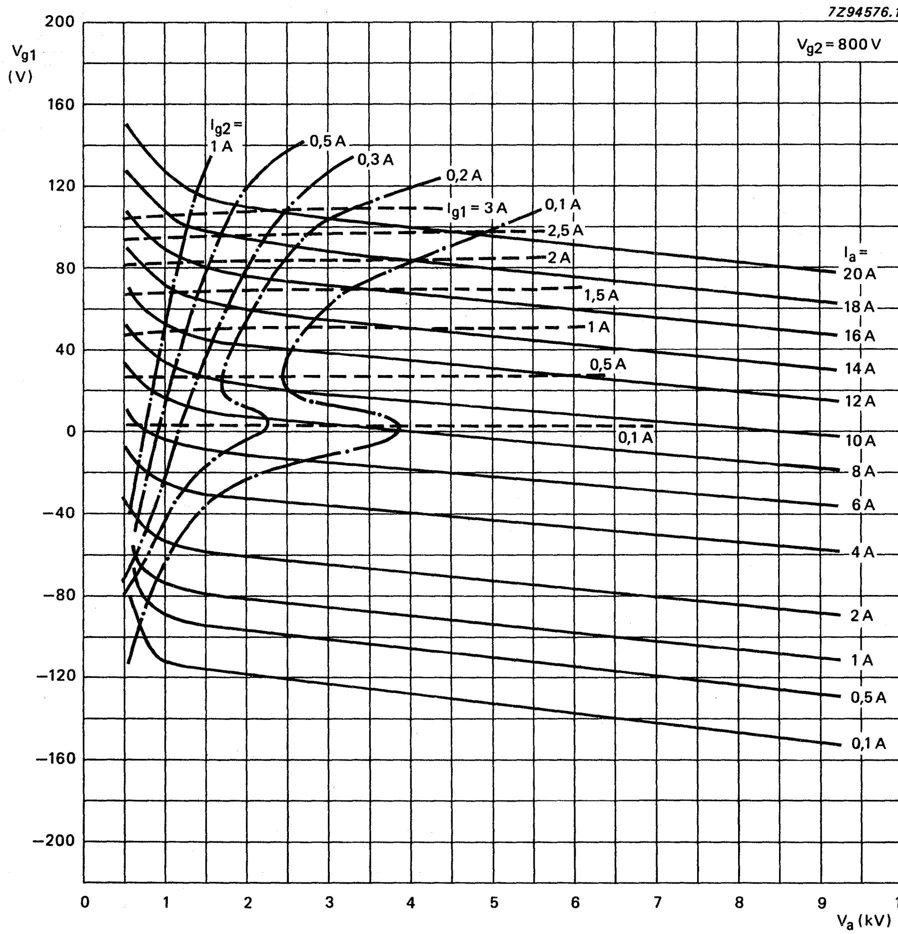
Frequency	f	up to	250	MHz
Anode voltage	V_a		10	kV
Grid 2 voltage	V_{g2}		1	kV
Grid 1 voltage	$-V_{g1}$		500	V
Anode current, black	I_a		7	A
Anode dissipation	W_a		17	kW
Grid 2 dissipation	W_{g2}		150	W
Grid 1 dissipation	W_{g1}		50	W

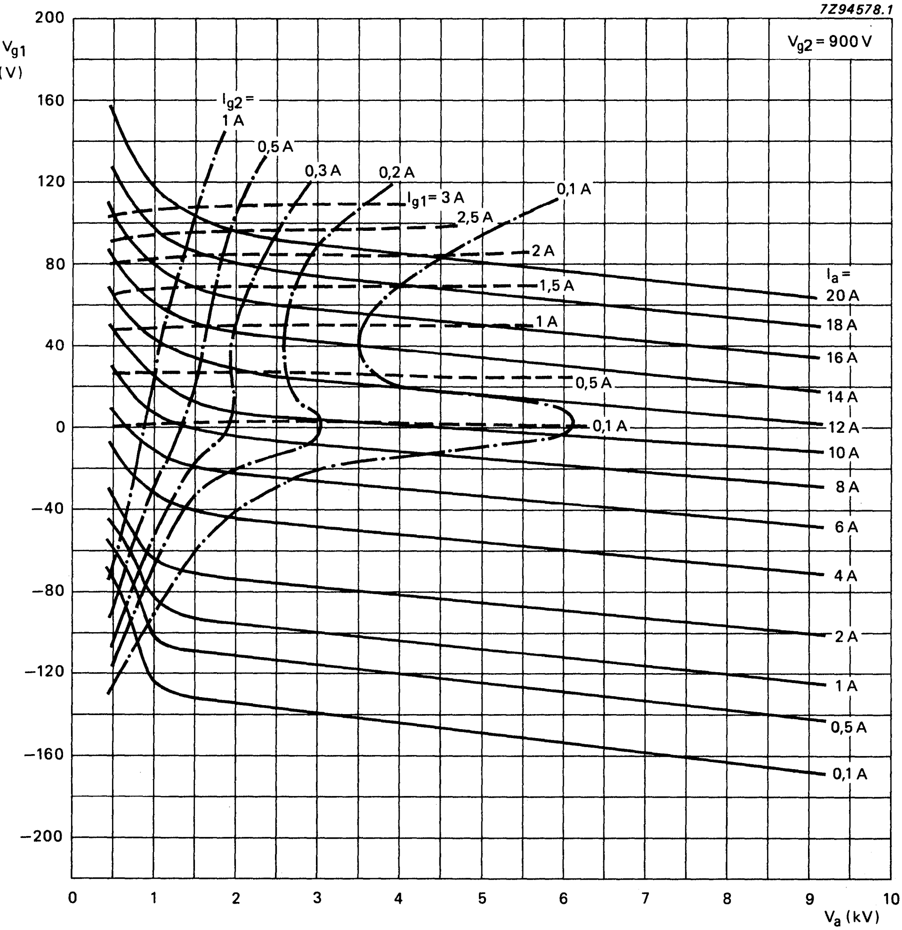
OPERATING CONDITIONS

Frequency	f			88 to 110				MHz
Bandwidth (−3 dB)	B	≈	1,5	≈	1,5	≈	1,5	MHz
Anode voltage	V_a		6		7,5		9	kV
Grid 2 voltage	V_{g2}		700		700		700	V
Grid 1 voltage*	$-V_{g1}$	≈	95	≈	110	≈	90	V
Anode current (zero signal)	I_a		0,5		0,5		1	A
Anode current	I_a	≈	1,5	≈	2,15	≈	3,4	A
Grid 2 current	I_{g2}	≈	80	≈	120	≈	150	mA
Grid 1 current	I_{g1}	≈	0	≈	20	≈	150	mA
Output power in load	W_ℓ		5,5	⩾	10,5	⩾	20	kW
Driving power (sync)	W_{dr}	⩽	100	⩽	200	⩽	400	W
Power gain	G	⩾	17	⩾	17	⩾	17	dB

* To be adjusted for the stated zero signal anode current.


7Z94577.1
V_{g2} = 700 V
V_{g1} (V)
200
160
120
80
40
0
−40
−80
−120
−160
−200
I_{g2} = 1 A
0,5 A
0,3 A
0,2 A
0,1 A
I_{g1} = 3 A
2,5 A
2 A
1,5 A
1 A
0,5 A
0,1 A
I_a =
20 A
18 A
16 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)


7Z94576.1
V_{g2} = 800 V
V_{g1} (V)
200
160
120
80
40
0
−40
−80
−120
−160
−200
0
1
2
3
4
5
6
7
8
9
10
V_a (kV)
I_{g2} = 1 A
0,5 A
0,3 A
0,2 A
0,1 A
I_{g1} = 3 A
2,5 A
2 A
1,5 A
1 A
0,5 A
0,1 A
I_a =
20 A
18 A
16 A
14 A
12 A
10 A
8 A
6 A
4 A
2 A
1 A
0,5 A
0,1 A


7Z94578.1
V_{g2} = 900 V
V_{g1} (V)
200
160
120
80
40
0
−40
−80
−120
−160
−200
I_{g2} = 1 A
0,5 A
0,3 A
0,2 A
0,1 A
I_{g1} = 3 A
2,5 A
2 A
1,5 A
1 A
0,5 A
0,1 A
I_a =
20 A
18 A
16 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)

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, two tubes in push-pull	W_o		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

→ ACCESSORIES

Quick-coupling water connections (2 x), type 3322 138 27000

Water connections with anti-electrolyse bar (2 x), type 3322 138 29600

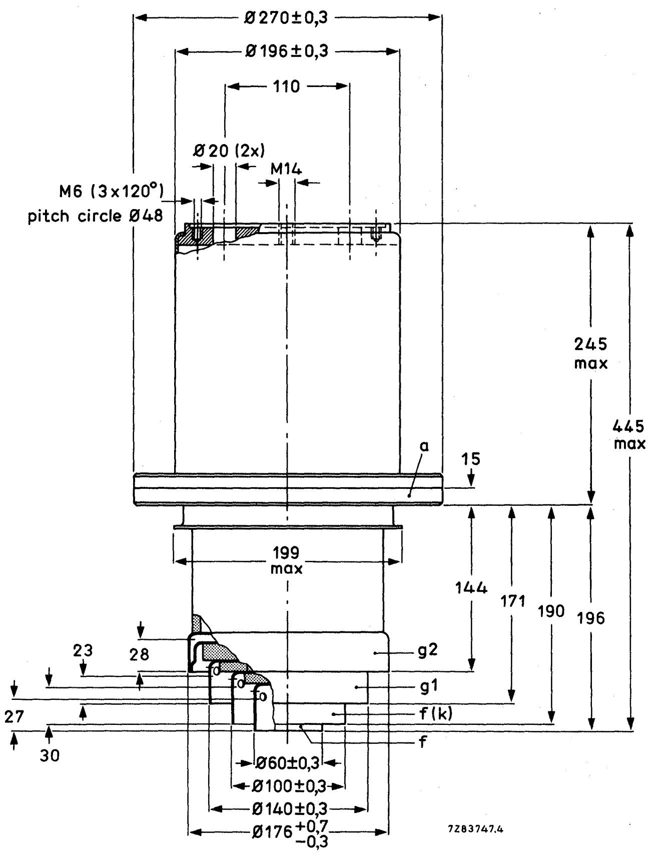


Fig. 1.

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

LIMITING VALUES (Absolute maximum rating system)

Frequency *	f	up to	110	MHz
Anode voltage	V_a		13	kV
Grid 2 voltage	V_{g2}		1200	V
Grid 1 voltage	V_{g1}		−800	V
Cathode current	I_k		17	A
Cathode current (peak)	I_{kp}		160	A
Anode input power	W_{ia}		200	kW
Anode dissipation	W_a		150	kW
Grid 2 dissipation	W_{g2}		2,2	kW
Grid 1 dissipation	W_{g1}		1	kW

OPERATING CONDITIONS

Frequency	f		30	MHz
Anode voltage	V_a		11	kV
Grid 2 voltage	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_o		125	kW
Anode dissipation	W_a		40	kW
Efficiency	η		76	%

* For operation above 30 MHz, please consult the tube manufacturer.

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	I_k		20	A
Cathode current (peak)	I_{kp}		160	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_o		2 x 75	kW
Anode dissipation	W_a		2 x 35	kW
Efficiency	η		68	%

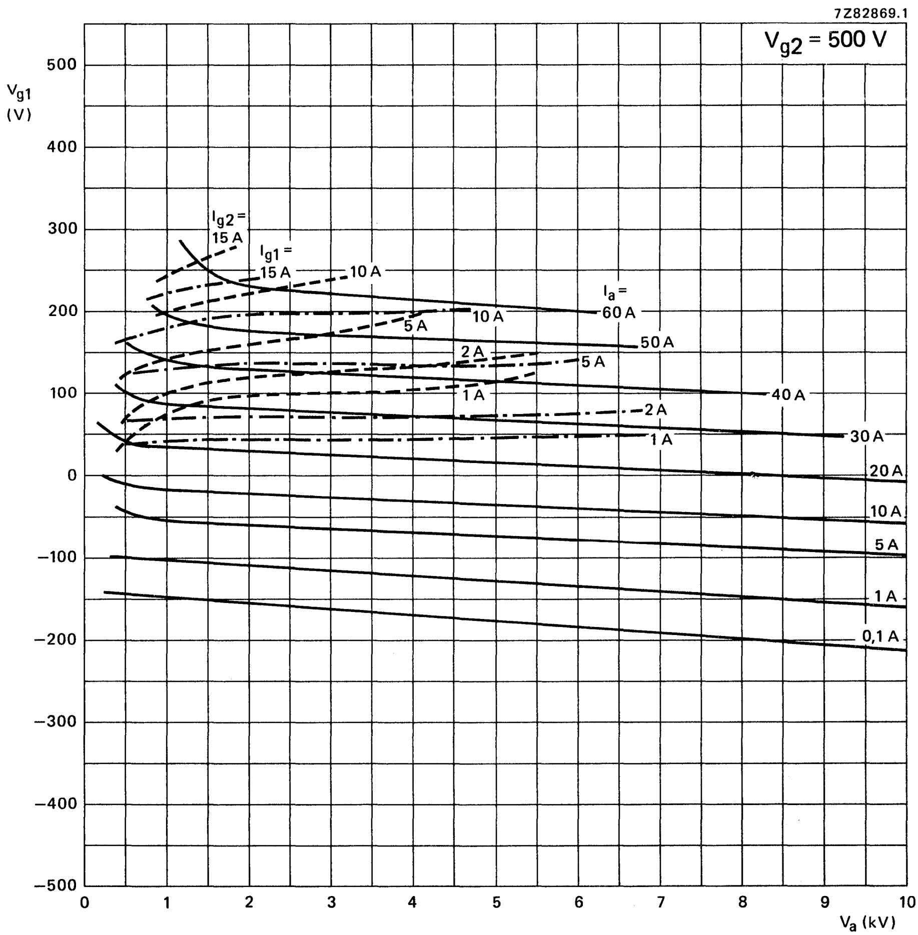

7Z82869.1
V_{g2} = 500 V
V_{g1} (V)
I_{g2} = 15 A
I_{g1} = 15 A
10 A
5 A
2 A
1 A
I_a = 60 A
50 A
40 A
30 A
20 A
10 A
5 A
1 A
0,1 A
10 A
5 A
2 A
1 A
V_a (kV)

Fig. 2.

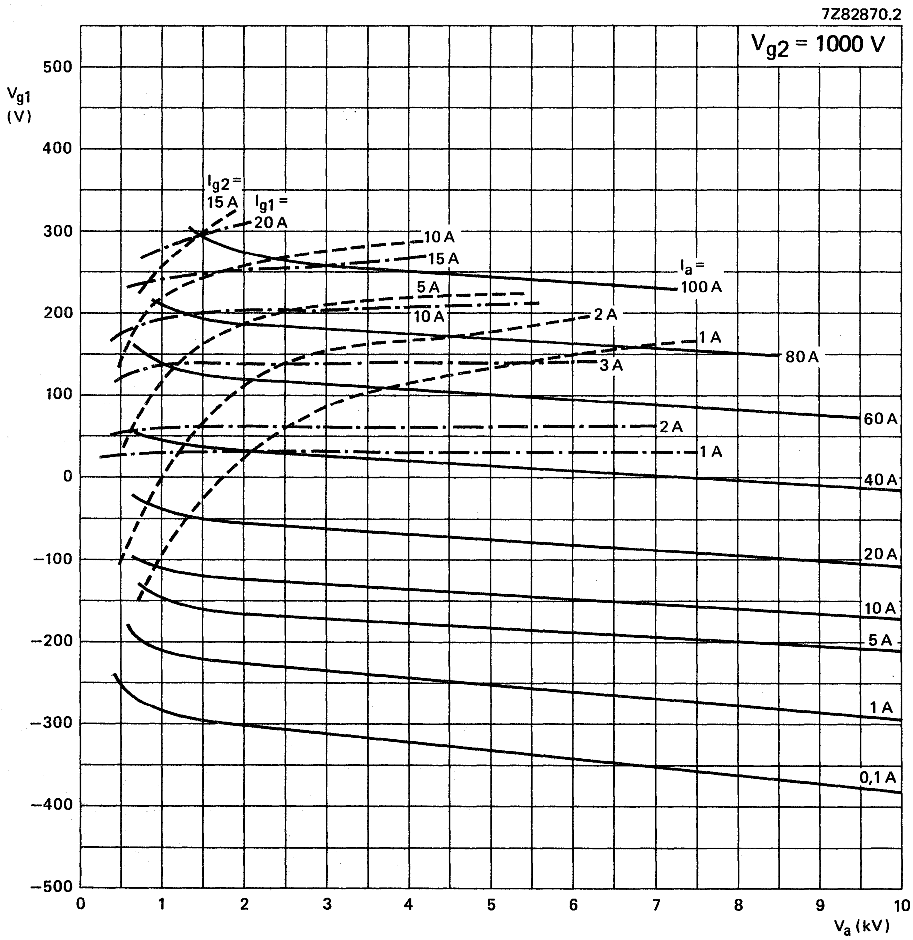

7Z82870.2
V_{g2} = 1000 V
V_{g1} (V)
500
400
300
200
100
0
−100
−200
−300
−400
−500
I_{g2} = 15 A
I_{g1} = 20 A
10 A
15 A
5 A
10 A
2 A
1 A
3 A
2 A
1 A
I_a = 100 A
80 A
60 A
40 A
20 A
10 A
5 A
1 A
0,1 A
0
1
2
3
4
5
6
7
8
9
10
V_a (kV)

Fig. 3.

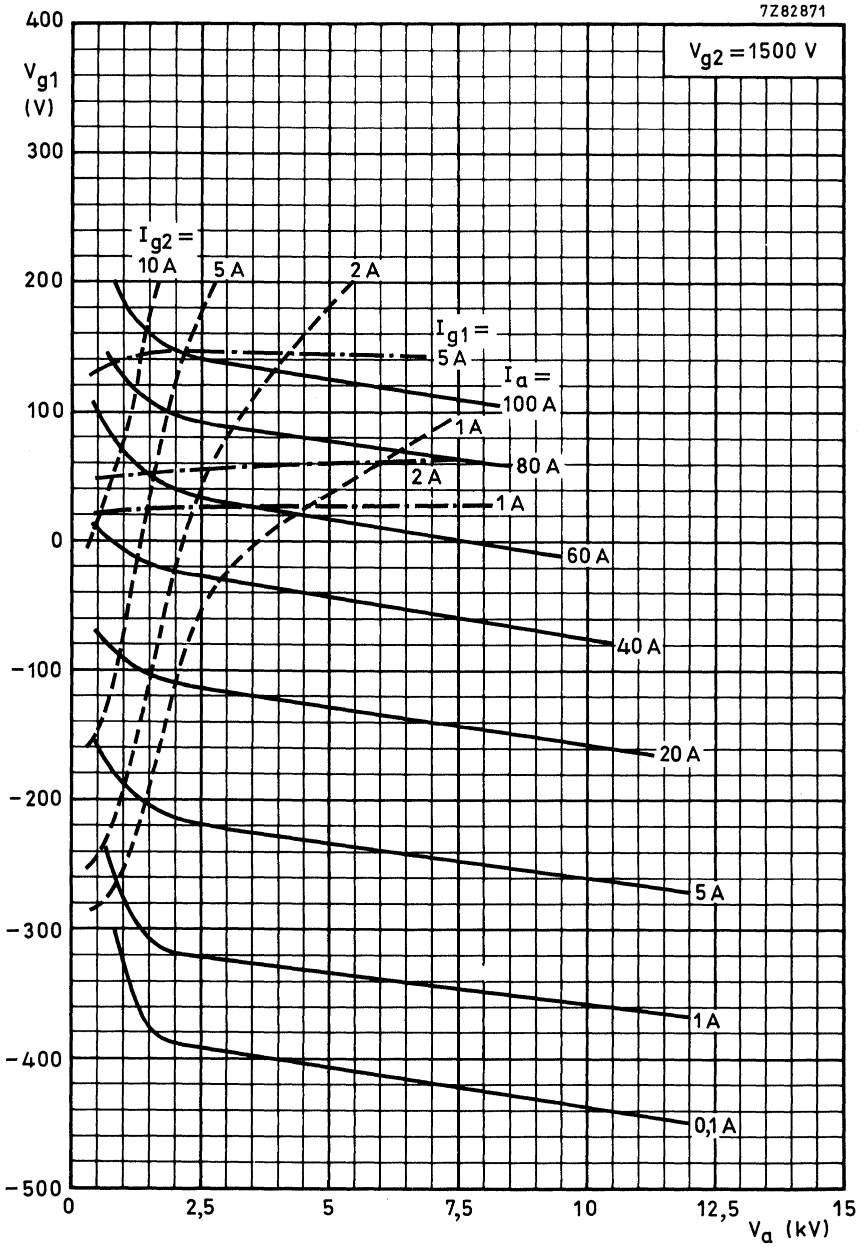

7Z82871
$V_{g2} = 1500$ V
V_{g1} (V)
400
300
200
100
0
−100
−200
−300
−400
−500
0
2,5
5
7,5
10
12,5
15
V_a (kV)
$I_{g2} =$
10 A
5 A
2 A
$I_{g1} =$
5 A
2 A
1 A
$I_a =$
100 A
1 A
80 A
60 A
40 A
20 A
5 A
1 A
0,1 A

Fig. 4.

WATER COOLED 300 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		300	kW
Class-B				
Anode voltage	V_a		11	kV
Output power, two tubes in push-pull	W_o		2 x 200	kW

HEATING: direct, thoriated tungsten filament, mesh type.

Filament voltage, note 1	V_f		18	V $^{+1}_{-3}$ %
Filament current	I_f		430	A
Filament peak starting current	I_{fp}	max.	1300	A
Cold filament resistance	R_{fo}		4	mΩ
Waiting time	t_w	min.	10	s

Recommended switch-on procedore; 8 s at 7 V; 2 s at 18 V, note 2

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3	kV
Grid 2 voltage	V_{g2}	1	kV
Anode current	I_a	25	A
Transconductance	S	400	mA/V
Amplification factor	μ_{g2g1}	4,3	

CAPACITANCES

Cathode to grid 1	C_{kg1}	≈	310	pF
Cathode to grid 2	C_{kg2}	≈	26	pF
Cathode to anode	C_{ka}	≈	0,6	pF
Grid 1 to grid 2	C_{g1g2}	≈	510	pF
Grid 1 to anode	C_{g1a}	≈	4,5	pF
Grid 2 to anode	C_{g2a}	≈	74	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 1,5 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	W_a		300 kW
Water cooling with 200 ℓ/min			
Absolute maximum output temperature	T_o		100 °C
Pressure drop in anode cooler		≈	60 kPa
Absolute maximum water pressure			500 kPa

NOTES

1. The filament voltage must be optimized depending on the operating conditions. Please consult the tube manufacturer for further information.
2. For other switch-on procedures please consult the tube manufacturer.

ACCESSORIES

Quick-coupling water connections (2x)	type 3322 138 27000
Water connections with anti-electrolysis bar (2x)	type 3322 138 29600

MECHANICAL DATA

Net mass	approx. 53 kg
Mounting position	vertical with anode up

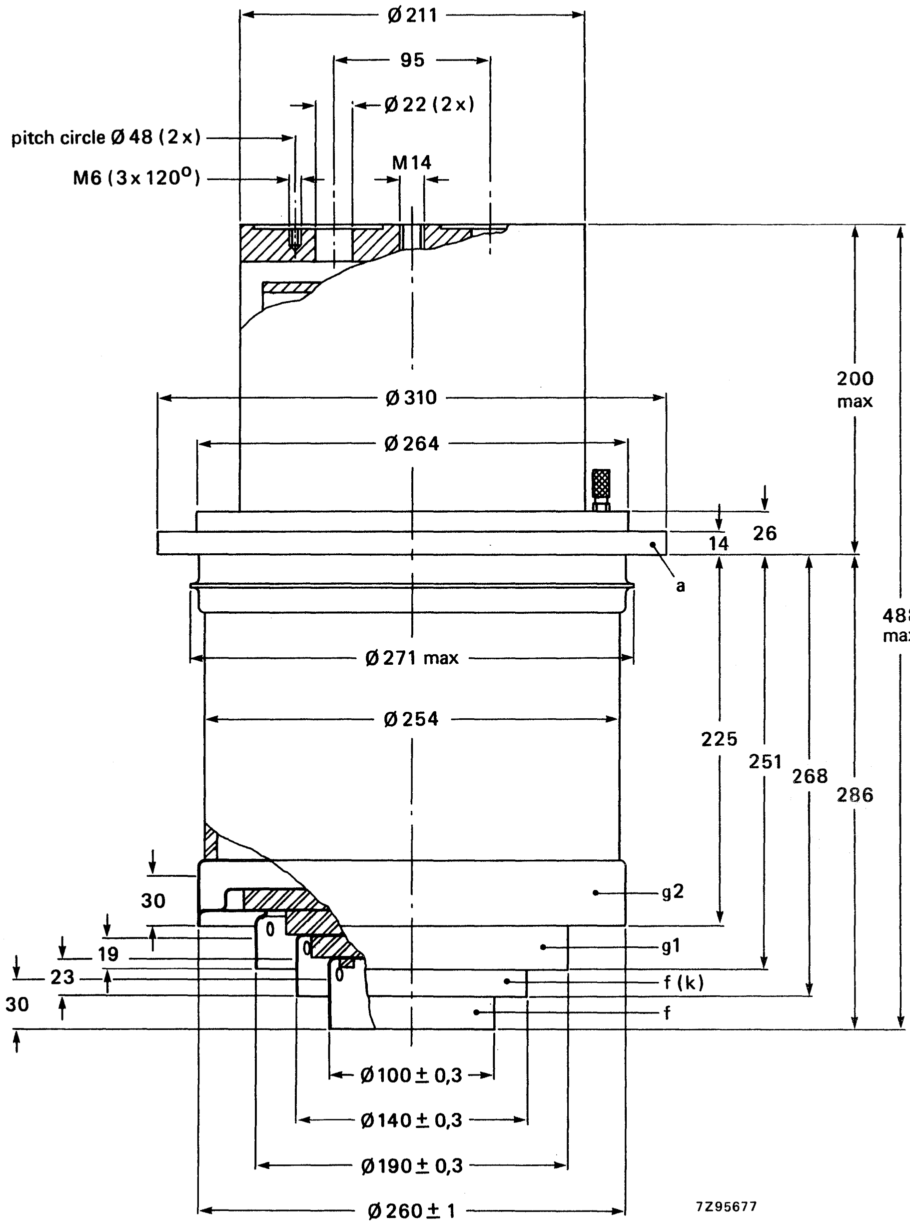


Fig. 1.

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		12	kV
Grid 2 voltage	V_{g2}		1200	V
Grid 1 voltage	V_{g1}		–800	V
Anode input power	W_{ia}		450	kW
Anode dissipation	W_a		300	kW
Cathode current	I_k		43	A
Cathode current (peak)	I_{kp}		400	A
Grid 2 dissipation	W_{g2}		5	kW
Grid 1 dissipation	W_{g1}		2	kW

OPERATING CONDITIONS

Frequency	f		30	MHz
Anode voltage	V_a		11	kV
Grid 2 voltage	V_{g2}		1	kV
Grid 1 voltage	V_{g1}		–550	V
Grid driving voltage peak	V_p	≈	700	V
Anode current	I_a		36	A
Grid 2 current	I_{g2}	≈	1,3	A
Grid 1 current	I_{g1}	≈	2	A
Driving power	W_{dr}		2,4	kW
Grid 2 dissipation	W_{g2}		4	kW
Grid 1 dissipation	W_{g1}		600	W
Anode input power	W_{ia}		396	kW
Anode output power	W_o		305	kW
Anode dissipation	W_a		91	kW

* Operation at higher frequencies is possible, please consult the tube manufacturer.

DEVELOPMENT DATA

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}		1,5	kV
Grid 1 voltage	V_{g1}		−800	V
Anode input power	W_{ia}		400	kW
Anode dissipation	W_a		300	kW
Cathode current	I_k		35	A
Cathode current (peak)	I_{kp}		400	A
Grid 2 dissipation	W_{g2}		5	kW
Grid 1 dissipation	W_{g1}		2	kW

OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a		11	kV
Grid 2 voltage	V_{g2}		1250	V
Grid 1 voltage	V_{g1}	≈	−300	V
Anode current	I_a		2 x 27	A
Grid 2 current	I_{g2}	≈	2 x 0,8	A
Grid 1 current	I_{g1}	≈	0	A
Anode input power	W_{ia}		2 x 297	kW
Anode output power	W_o		2 x 200	kW
Anode dissipation	W_a		2 x 97	kW

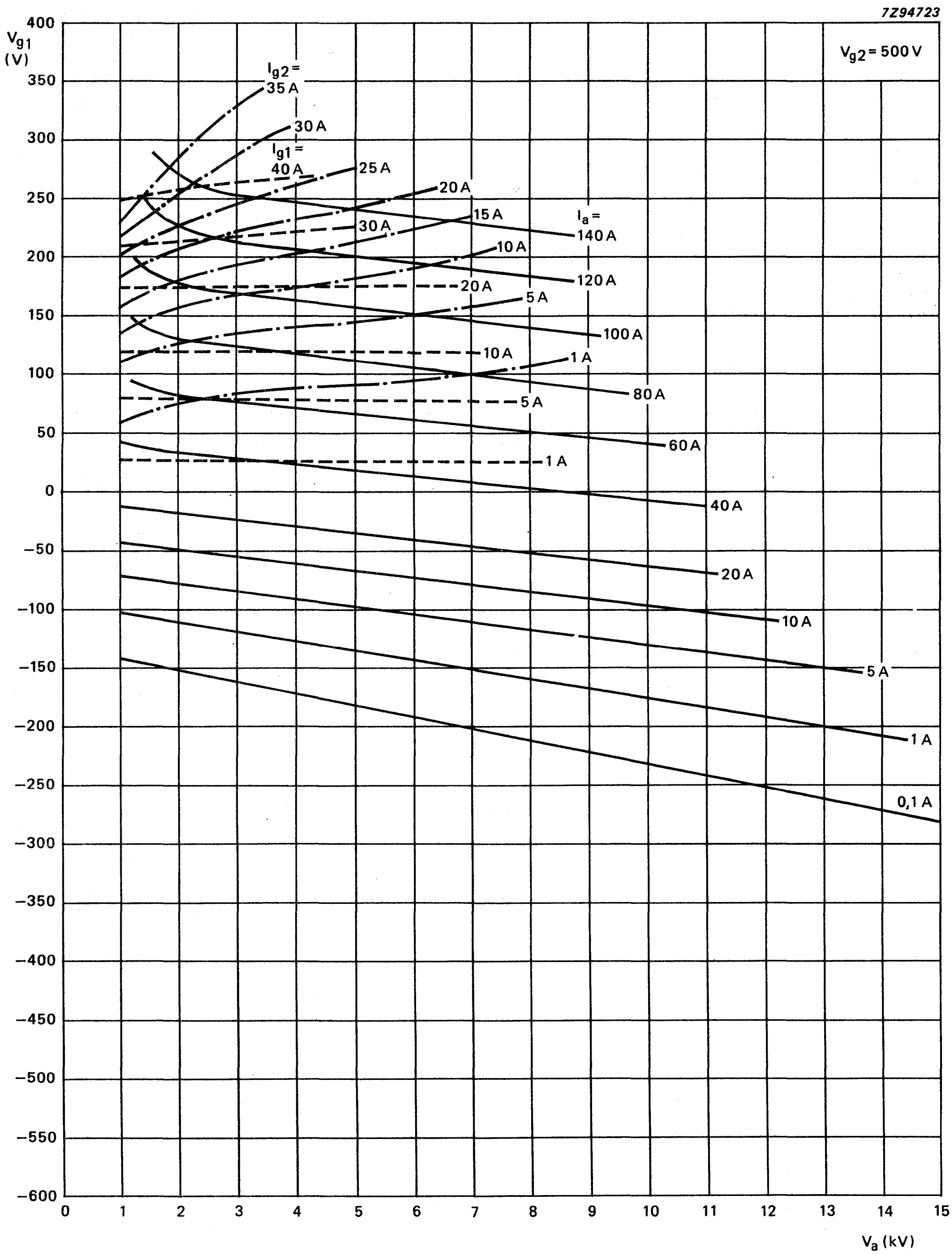

7Z94723
V_{g2} = 500 V
V_{g1} (V)
V_a (kV)
I_{g2} =
35 A
30 A
25 A
20 A
15 A
10 A
5 A
1 A
I_{g1} =
40 A
30 A
20 A
10 A
5 A
1 A
I_a =
140 A
120 A
100 A
80 A
60 A
40 A
20 A
10 A
5 A
1 A
0,1 A

Fig. 2.

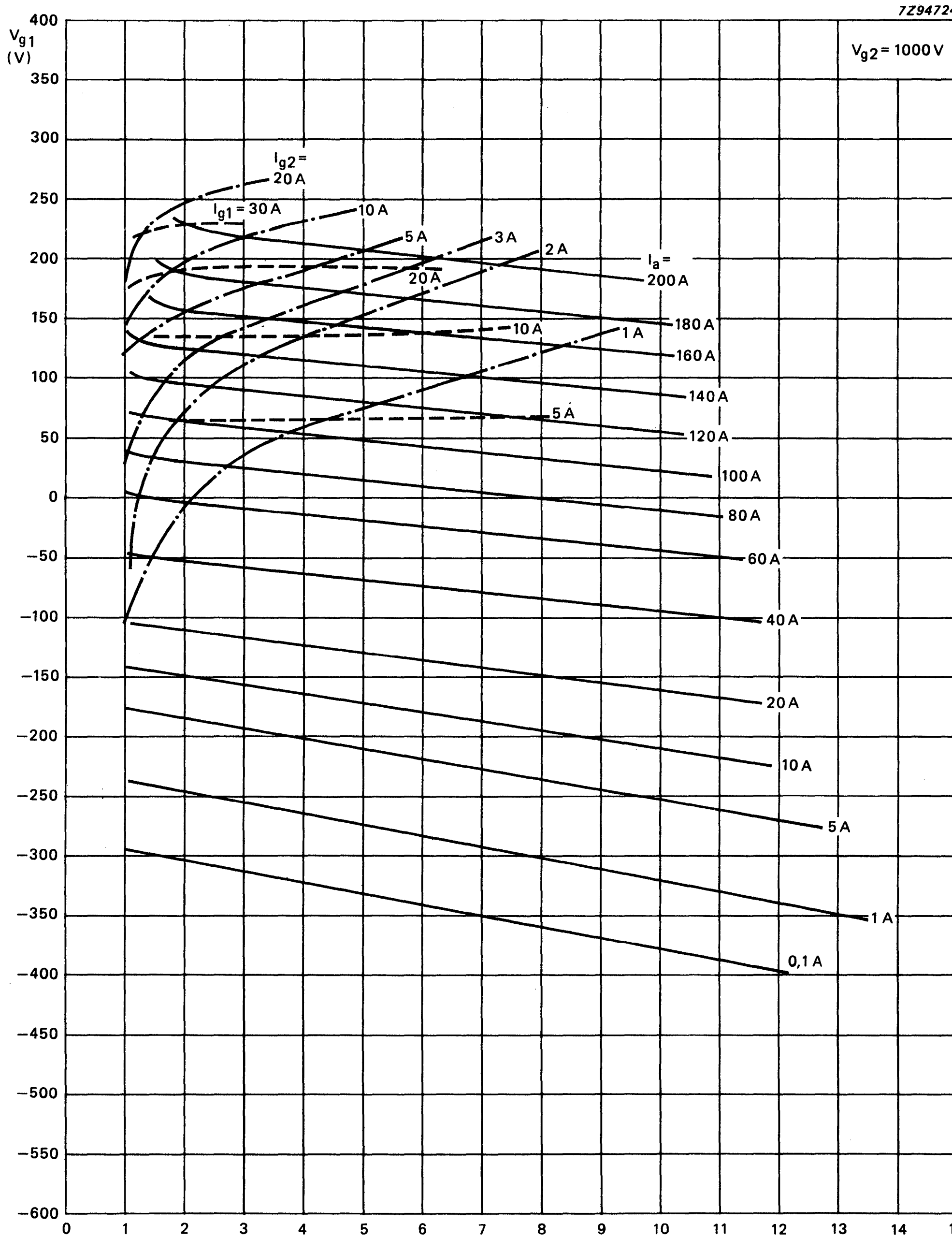


Fig. 3.

DEVELOPMENT DATA

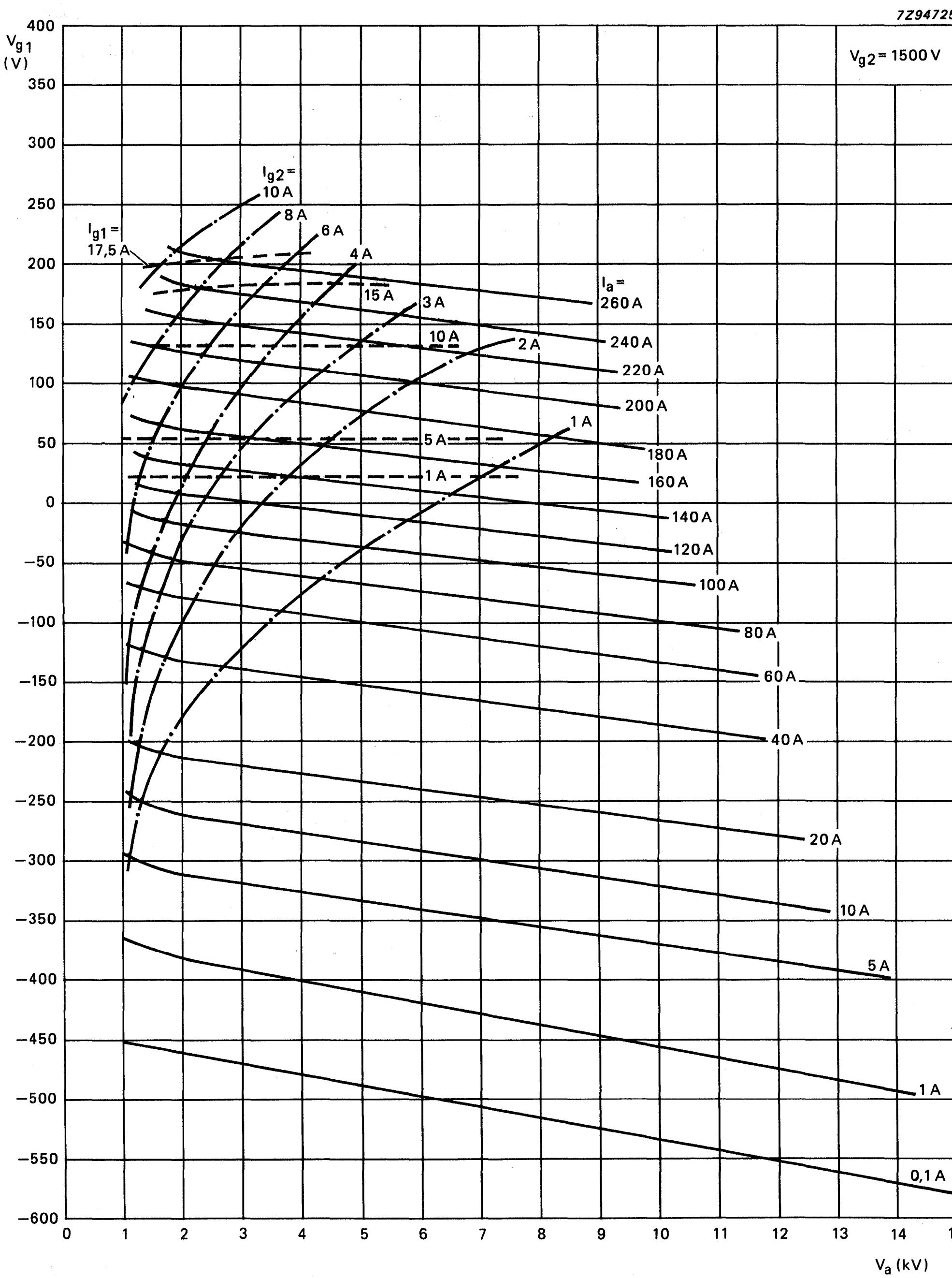

7Z94725
V_{g2} = 1500 V
V_{g1} (V)
400
350
300
250
200
150
100
50
0
−50
−100
−150
−200
−250
−300
−350
−400
−450
−500
−550
−600
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
V_a (kV)
I_{g2} =
10 A
8 A
6 A
4 A
3 A
2 A
1 A
I_{g1} =
17,5 A
15 A
10 A
5 A
1 A
I_a =
260 A
240 A
220 A
200 A
180 A
160 A
140 A
120 A
100 A
80 A
60 A
40 A
20 A
10 A
5 A
1 A
0,1 A

Fig. 4.

WATER COOLED 500 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		12,5	kV
Output power	W_o		550	kW
Class B				
Anode voltage	V_a		12	kV
Output power, two tubes in push-pull	W_o		2 x 330	kW

HEATING: direct, thoriated tungsten filament, mesh type.

Filament voltage, note 1	V_f		23	V^{+1}_{-3} %
Filament current	I_f		500	A
Filament peak starting current	I_{fp}	max.	1500	A
Cold filament resistance	R_{fo}		4,5	Ω
Waiting time	t_w	min.	10	s

Recommended switch-on procedure; 8 s at 8 V; 2 s at 23 V, note 2

TYPICAL CHARACTERISTICS

Anode voltage	V_a	5	kV
Grid 2 voltage	V_{g2}	1	kV
Anode current	I_a	35	A
Transconductance	S	500	mA/V
Amplification factor	μ_{g2g1}	4,4	

CAPACITANCES

Cathode to grid 1	C_{kg1}	≈	425	pF
Catgode to grid 2	C_{kg2}	≈	40	pF
Cathode to anode	C_{ka}	≈	0,6	pF
Grid 1 to grid 2	C_{g1g2}	≈	750	pF
Grid 1 to anode	C_{g1a}	≈	4,2	pF
Grid 2 to anode	C_{g2a}	≈	100	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 1,6 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	W_a	500 kW
Water cooling with 200 ℓ/min		
Absolute maximum output temperature	T_o	100 °C
Pressure drop in anode cooler		50 kPa
Absolute maximum water pressure		500 kPa

NOTES

1. The filament voltage must be optimized depending on the operating conditions. Please consult the tube manufacturer for further information.
2. For other switch-on procedures please consult the tube manufacturer.

MECHANICAL DATA

Net mass approx. 65 kg

Mounting position vertical with anode up

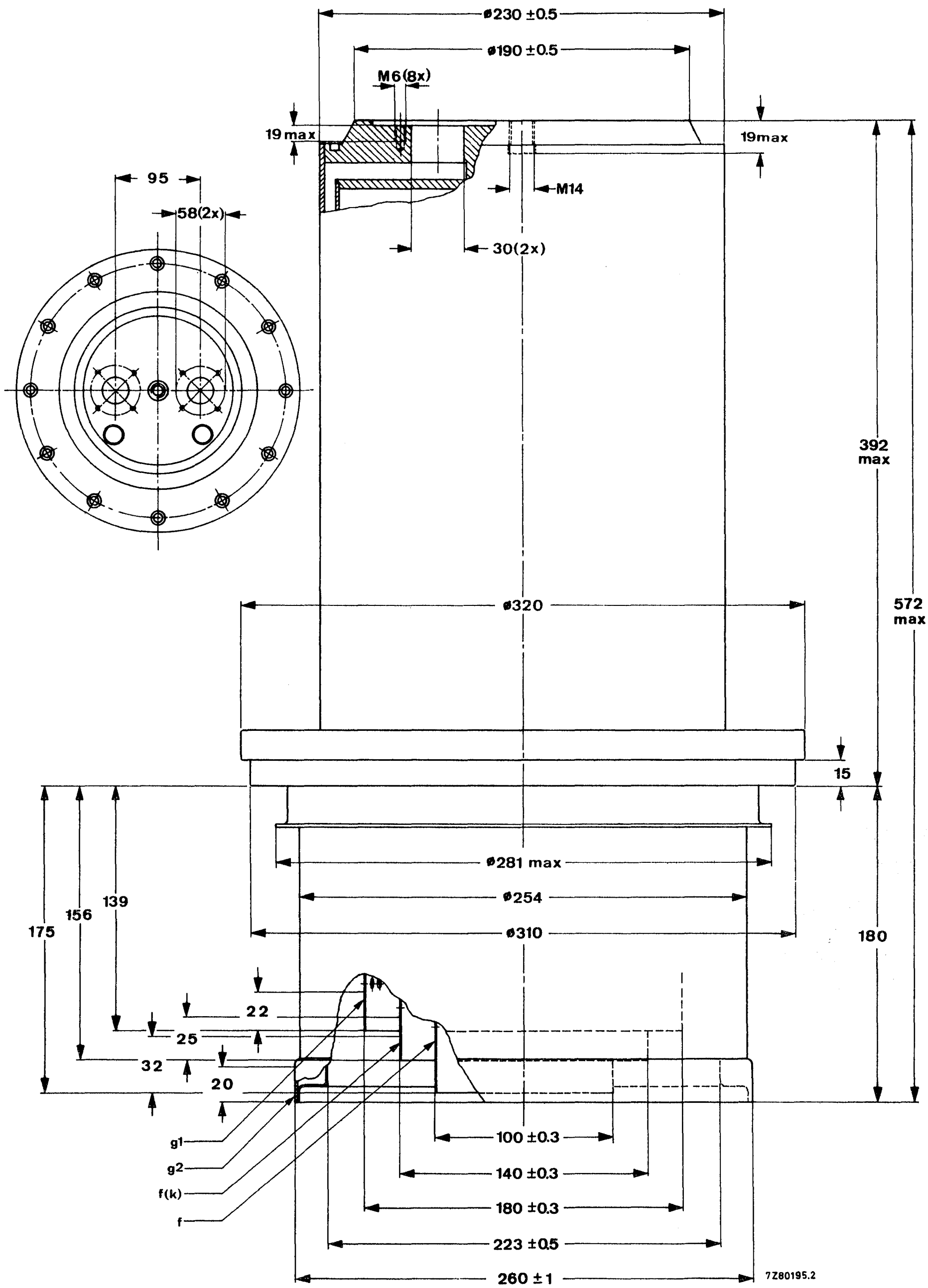


Fig. 1.

DEVELOPMENT DATA

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		13,5	kV
Grid 2 voltage	V_{g2}		1250	V
Grid 1 voltage	V_{g1}		−800	V
Anode input power	W_{ia}		700	kW
Anode dissipation	W_a		500	kW
Cathode current	I_k		65	A
Cathode current (peak)	I_{kp}		600	A
Grid 2 dissipation	W_{g2}		8	kW
Grid 1 dissipation	W_{g1}		4	kW

OPERATING CONDITIONS

Frequency	f		30	MHz
Anode voltage	V_a		12,5	kV
Grid 2 voltage	V_{g2}		1,1	kV
Grid 1 voltage	V_{g1}		−600	V
Grid driving voltage peak	V_p	≈	750	V
Anode current	I_a		54	A
Grid 2 current	I_{g2}	≈	2,5	A
Grid 1 current	I_{g1}	≈	4	A
Driving power	W_{dr}		3	kW
Grid 2 dissipation	W_{g2}		2,75	kW
Grid 1 dissipation	W_{g1}		600	W
Anode input power	W_{ia}		675	kW
Anode output power	W_o		550	kW
Anode dissipation	W_a		125	kW

* Operation at higher frequencies is possible, please consult the tube manufacturer.

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}	1,5	kV
Grid 1 voltage	V_{g1}	–800	V
Anode input power	W_{ia}	600	kW
Anode dissipation	W_a	500	kW
Cathode current	I_k	50	A
Cathode current (peak)	I_{kp}	600	A
Grid 2 dissipation	W_{g2}	8	kW
Grid 1 dissipation	W_{g1}	4	kW

OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a		12	kV
Grid 2 voltage	V_{g2}		1250	V
Grid 1 voltage	V_{g1}	≈	–350	V
Anode current	I_a		2 x 39	A
Grid 2 current	I_{g2}	≈	2 x 2	A
Grid 1 current	I_{g1}	≈	0	A
Anode input power	W_{ia}		2 x 468	kW
Anode output power	W_{oa}		2 x 330	kW
Anode dissipation	W_a		2 x 138	kW

DEVELOPMENT DATA

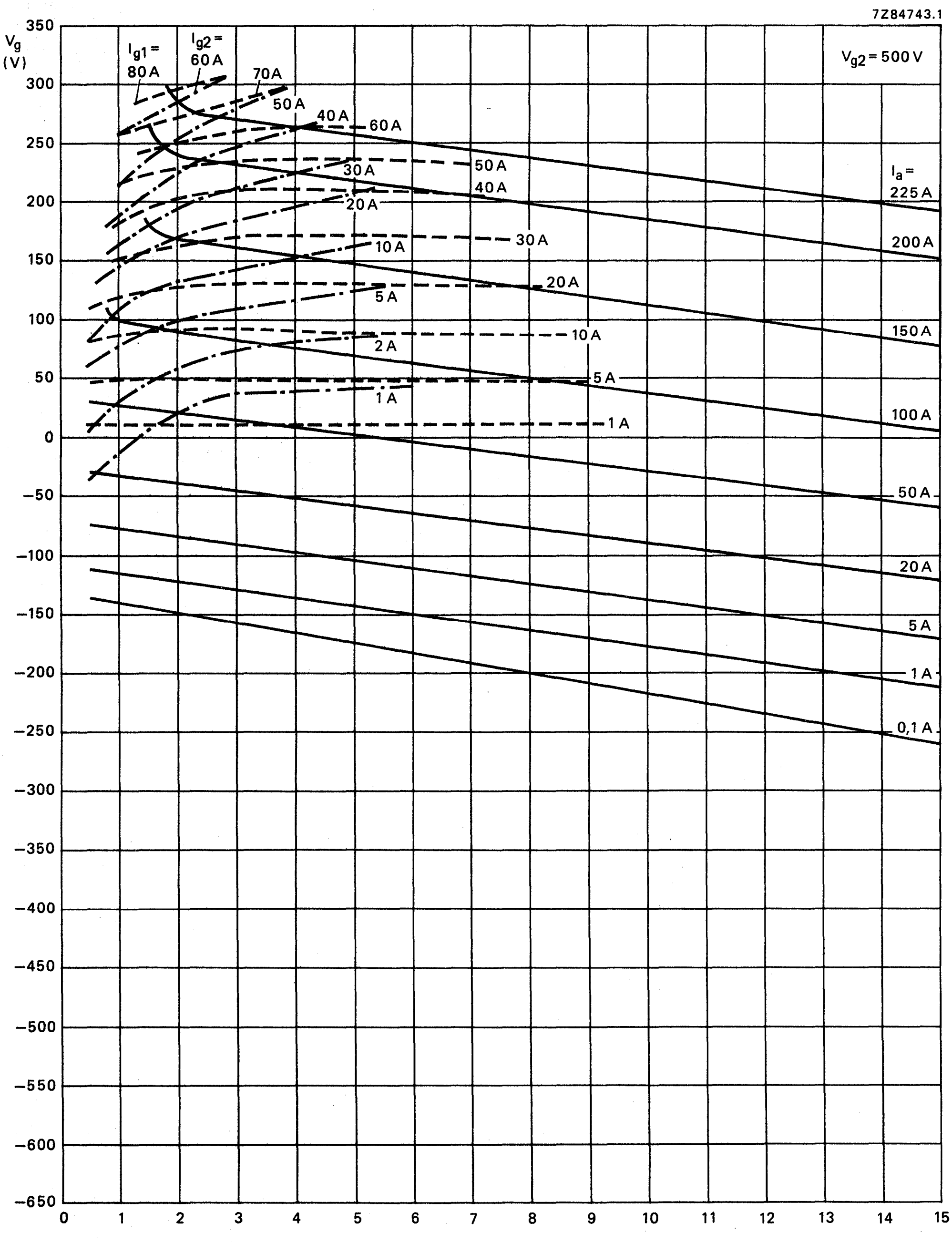
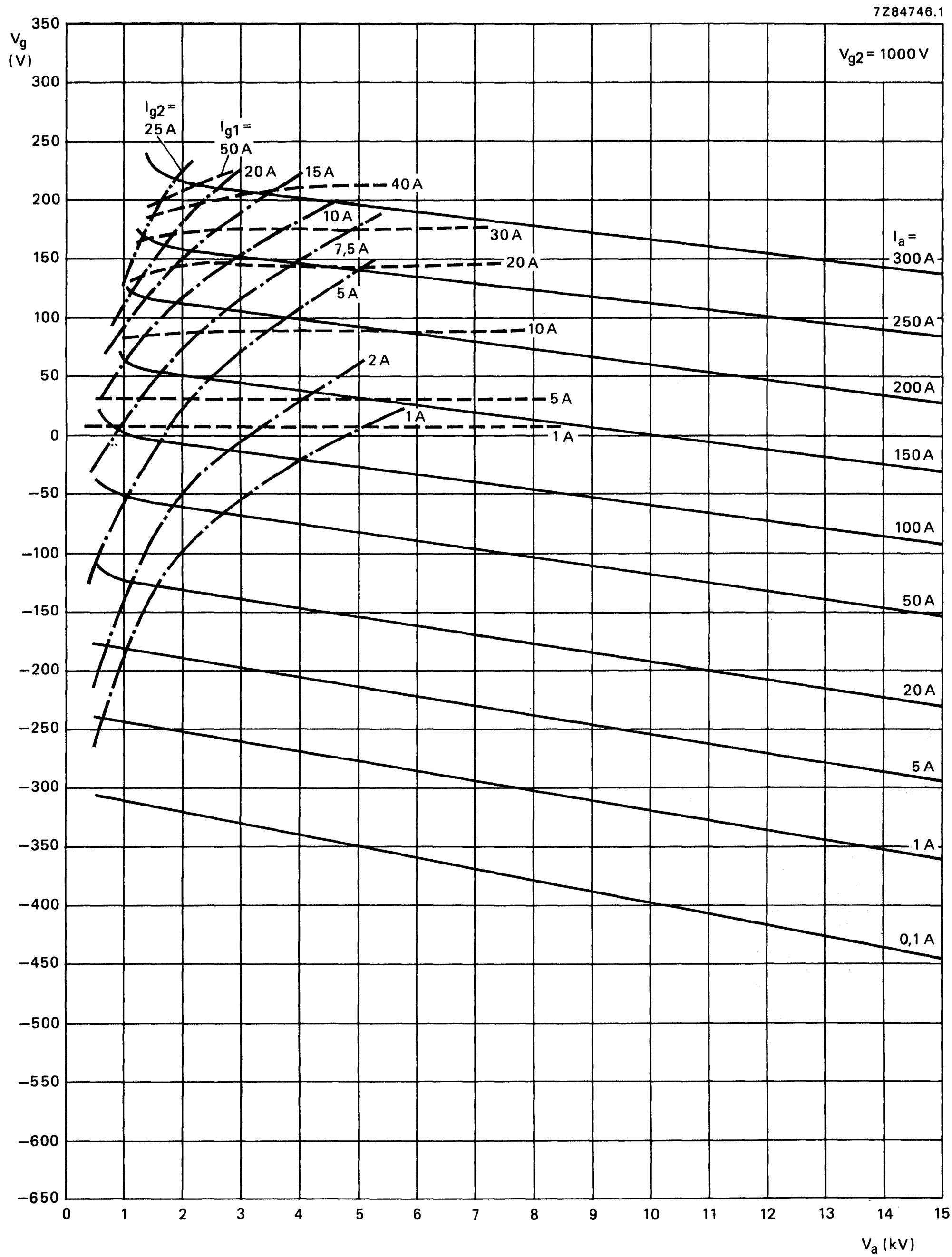

7Z84743.1
V_g (V)
I_{g1} = 80 A
I_{g2} = 60 A
70 A
50 A
40 A
60 A
50 A
30 A
40 A
20 A
30 A
10 A
20 A
5 A
10 A
2 A
5 A
1 A
1 A
V_{g2} = 500 V
I_a = 225 A
200 A
150 A
100 A
50 A
20 A
5 A
1 A
0,1 A
V_a (kV)

Fig. 2.



DEVELOPMENT DATA

Fig. 3.

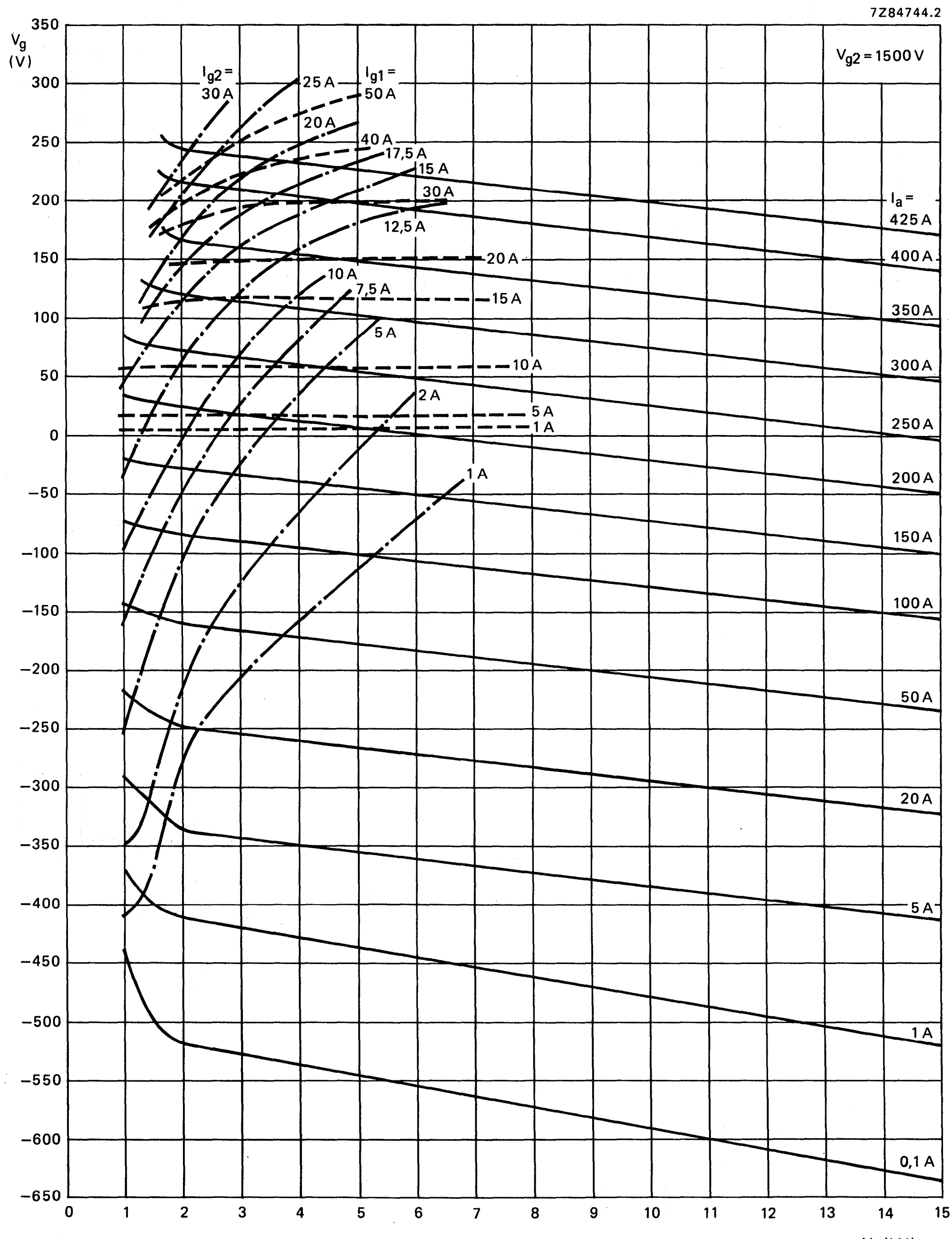

7Z84744.2
V_{g2} = 1500 V
V_g (V)
V_a (kV)
I_{g2} = 30 A
I_{g1} = 50 A
25 A
20 A
40 A
17,5 A
15 A
30 A
12,5 A
20 A
10 A
7,5 A
15 A
5 A
10 A
2 A
5 A
1 A
1 A
I_a = 425 A
400 A
350 A
300 A
250 A
200 A
150 A
100 A
50 A
20 A
5 A
1 A
0,1 A

Fig. 4.

WATER COOLED 200 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		200 kW
Class-B			
Anode voltage	V_a		11 kV
Output power, two tubes in push-pull	W_o		2 x 110 kW

HEATING: direct, thoriated tungsten filament, mesh type.

Filament voltage, note 1	V_f		15 V $^{+1}_{-3}$ %
Filament current	I_f		320 A
Filament peak starting current	I_{fp}	max.	1800 A
Cold filament resistance	R_{fo}		6 mΩ
Waiting time	t_w	min.	10 s

Recommended switch-on procedure; 8 s at 6 V; 2 s at 15 V, note 2

TYPICAL CHARACTERISTICS

Anode voltage	V_a	3 kV
Grid 2 voltage	V_{g2}	1 kV
Anode current	I_a	25 A
Transconductance	S	230 mA/V
Amplification factor	μ_{g2g1}	5

CAPACITANCES

Cathode to grid 1	C_{kg1}	≈	255 pF
Cathode to grid 2	C_{kg2}	≈	23 pF
Cathode to anode	C_{ka}	≈	0,6 pF
Grid 1 to grid 2	C_{g1g2}	≈	470 pF
Grid 1 to anode	C_{g1a}	≈	5 pF
Grid 2 to anode	C_{g2a}	≈	58 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 1,6 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	W_a	250 kW
Water cooling with 200 ℓ/min		
Absolute maximum output temperature	T_o	90 °C
Pressure drop in anode cooler		70 kPa
Absolute maximum water pressure		500 kPa

NOTES

1. The filament voltage must be optimized depending on the operating conditions. Please consult the tube manufacturer for further information.
2. For other switch-on procedures please consult the tube manufacturer.

ACCESSORIES

Quick-coupling water connections (2x)	type 3322 138 27000
Water connections with anti-electrolysis bar (2x)	type 3322 138 29600

MECHANICAL DATA

Net mass	approx. 40 kg
Mounting position	vertical with anode up

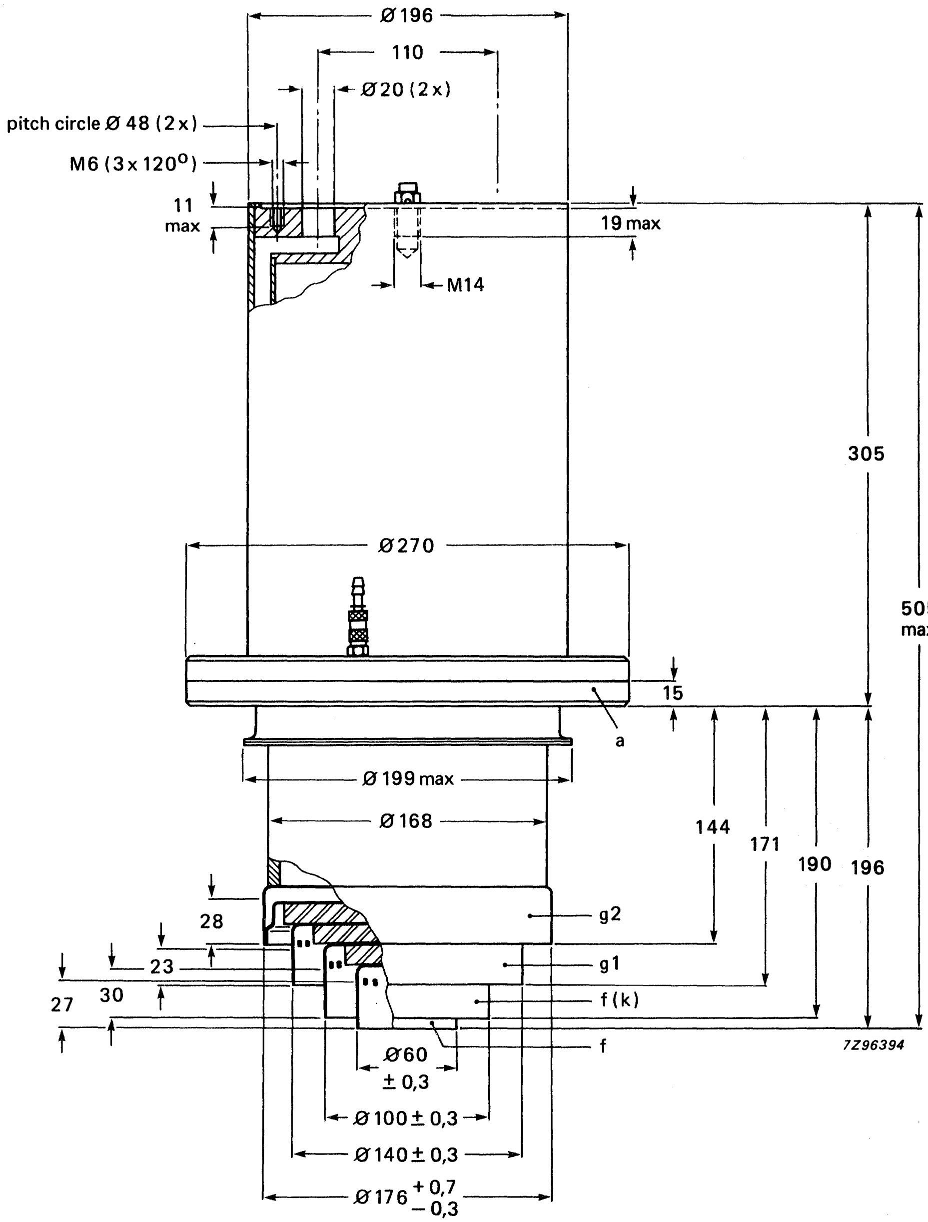


Fig. 1.

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		13	kV
Grid 2 voltage	V_{g2}		1200	V
Grid 1 voltage	V_{g1}		–800	V
Anode input power	W_{ia}		350	kW
Anode dissipation	W_a		250	kW
Cathode current	I_k		30	A
Cathode current (peak)	I_{kp}		300	A
Grid 2 dissipation	W_{g2}		4	kW
Grid 1 dissipation	W_{g1}		1,5	kW

OPERATING CONDITIONS

Frequency	f		30	MHz
Anode voltage	V_a		11	kV
Grid 2 voltage	V_{g2}		1	kV
Grid 1 voltage	V_{g1}		–550	V
Grid driving voltage peak	V_p	≈	750	V
Anode current	I_a		27	A
Grid 2 current	I_{g2}	≈	2,5	A
Grid 1 current	I_{g1}	≈	2,5	A
Driving power	W_{dr}		1,5	kW
Grid 2 dissipation	W_{g2}		2,5	kW
Grid 1 dissipation	W_{g1}		300	W
Anode input power	W_{ia}		297	kW
Anode output power	W_o		220	kW
Anode dissipation	W_a		77	kW

* Operation at higher frequencies is possible, please consult the tube manufacturer.

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}		1,5 kV
Grid 1 voltage	V_{g1}		−800 V
Anode input power	W_{ia}		350 kW
Anode dissipation	W_a		250 kW
Cathode current	I_k		30 A
Cathode current (peak)	I_{kp}		300 A
Grid 2 dissipation	W_{g2}		4 kW
Grid 1 dissipation	W_{g1}		1,5 kW

OPERATING CONDITIONS, two tubes in push-pull

Anode voltage	V_a		11 kV
Grid 2 voltage	V_{g2}		1100 V
Grid 1 voltage	V_{g1}	≈	−350 V
Anode current	I_a		2 x 14 A
Grid 2 current	I_{g2}	≈	2 x 0,2 A
Grid 1 current	I_{g1}	≈	0 A
Anode input power	W_{ia}		2 x 154 kW
Anode output power	W_o		2 x 110 kW
Anode dissipation	W_a		2 x 44 kW

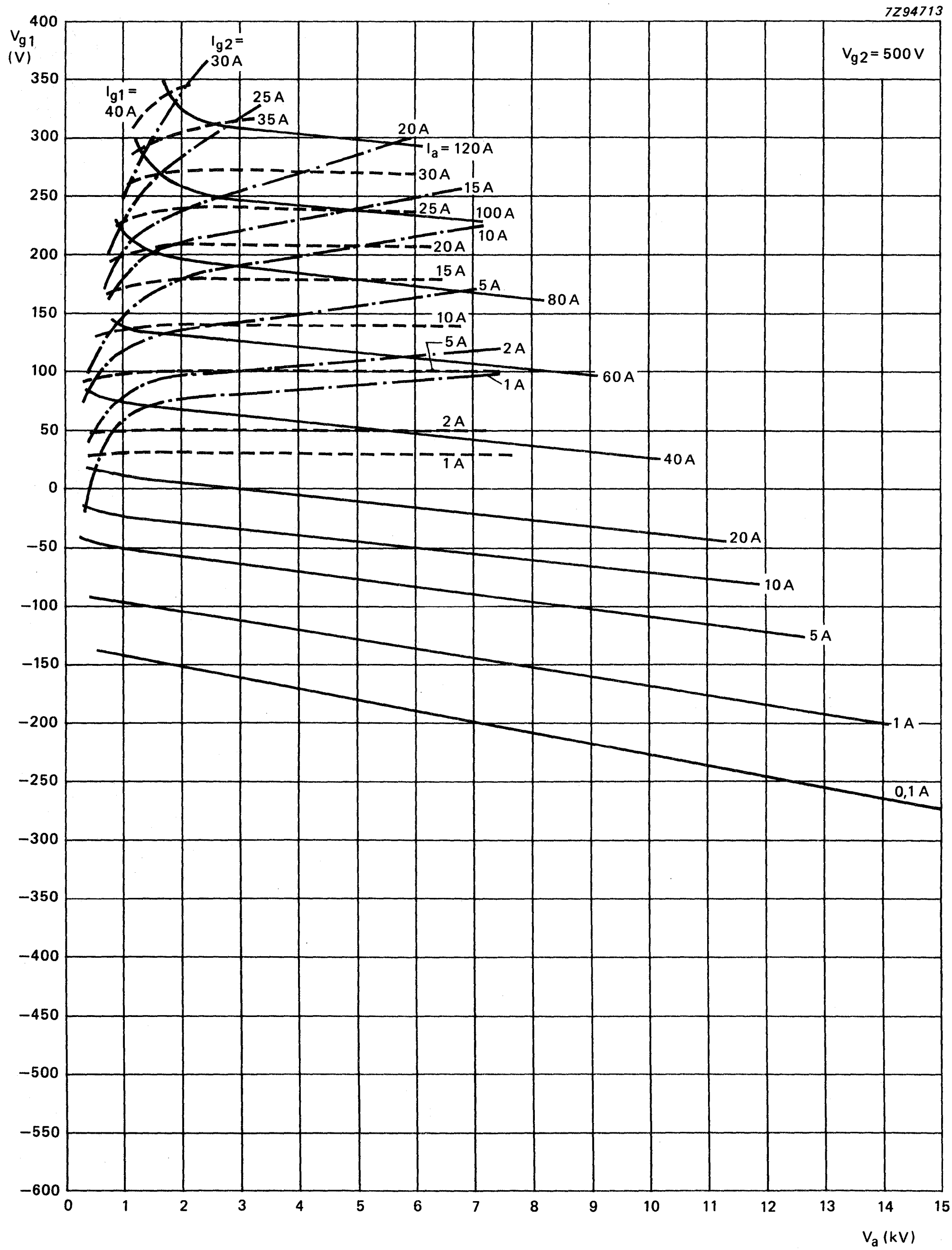

7Z94713
V_{g1} (V)
V_{g2} = 500 V
I_{g2} = 30 A
I_{g1} = 40 A
25 A
35 A
20 A
I_a = 120 A
30 A
15 A
25 A
100 A
10 A
20 A
15 A
5 A
80 A
10 A
5 A
2 A
60 A
1 A
2 A
1 A
40 A
20 A
10 A
5 A
1 A
0,1 A
V_a (kV)

Fig. 2.

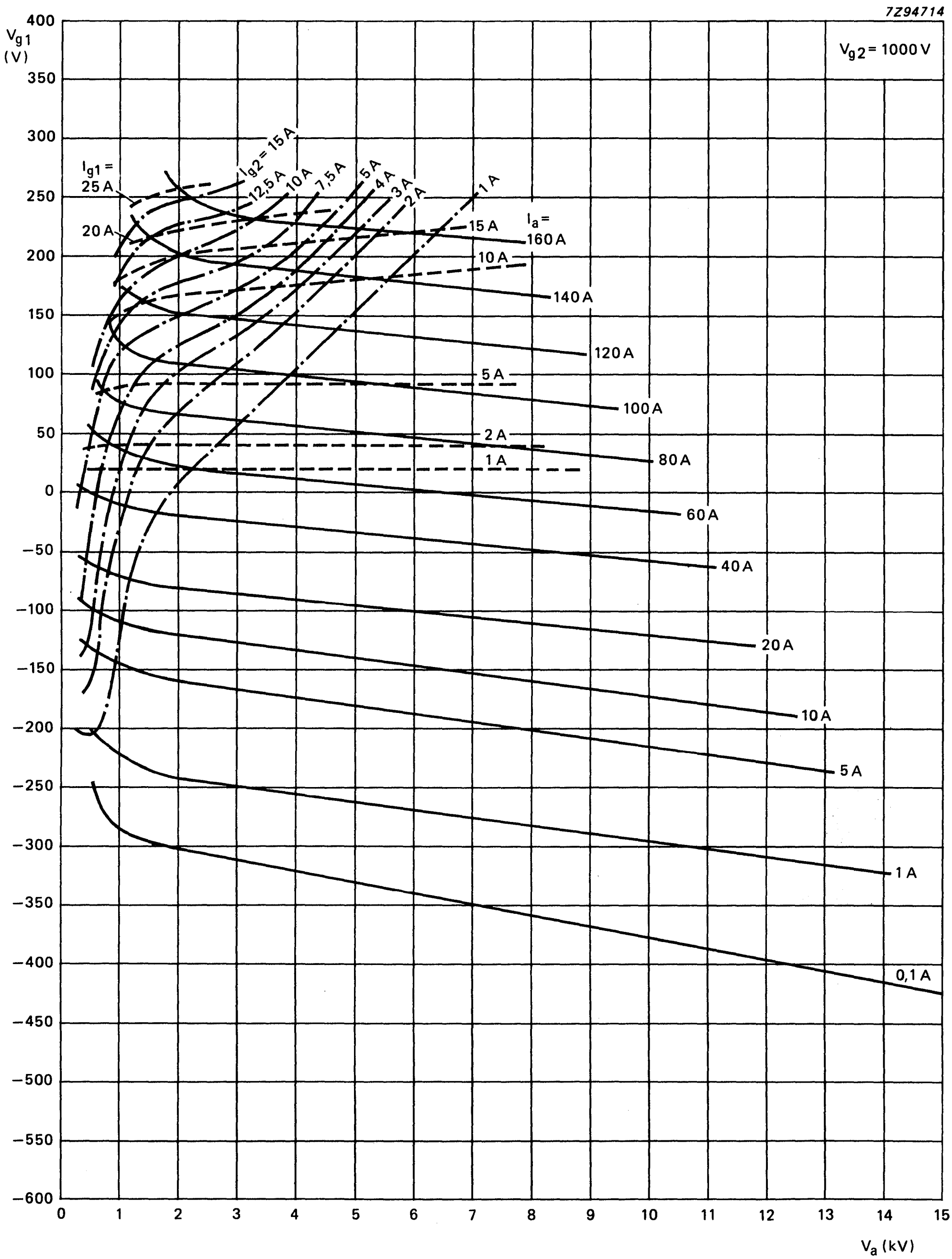

7Z94714
V_{g1} (V)
V_{g2} = 1000 V
I_{g1} = 25 A
20 A
I_{g2} = 15 A
12,5 A
10 A
7,5 A
5 A
4 A
3 A
2 A
1 A
I_a = 160 A
15 A
10 A
140 A
120 A
5 A
100 A
2 A
1 A
80 A
60 A
40 A
20 A
10 A
5 A
1 A
0,1 A
V_a (kV)

Fig. 3.

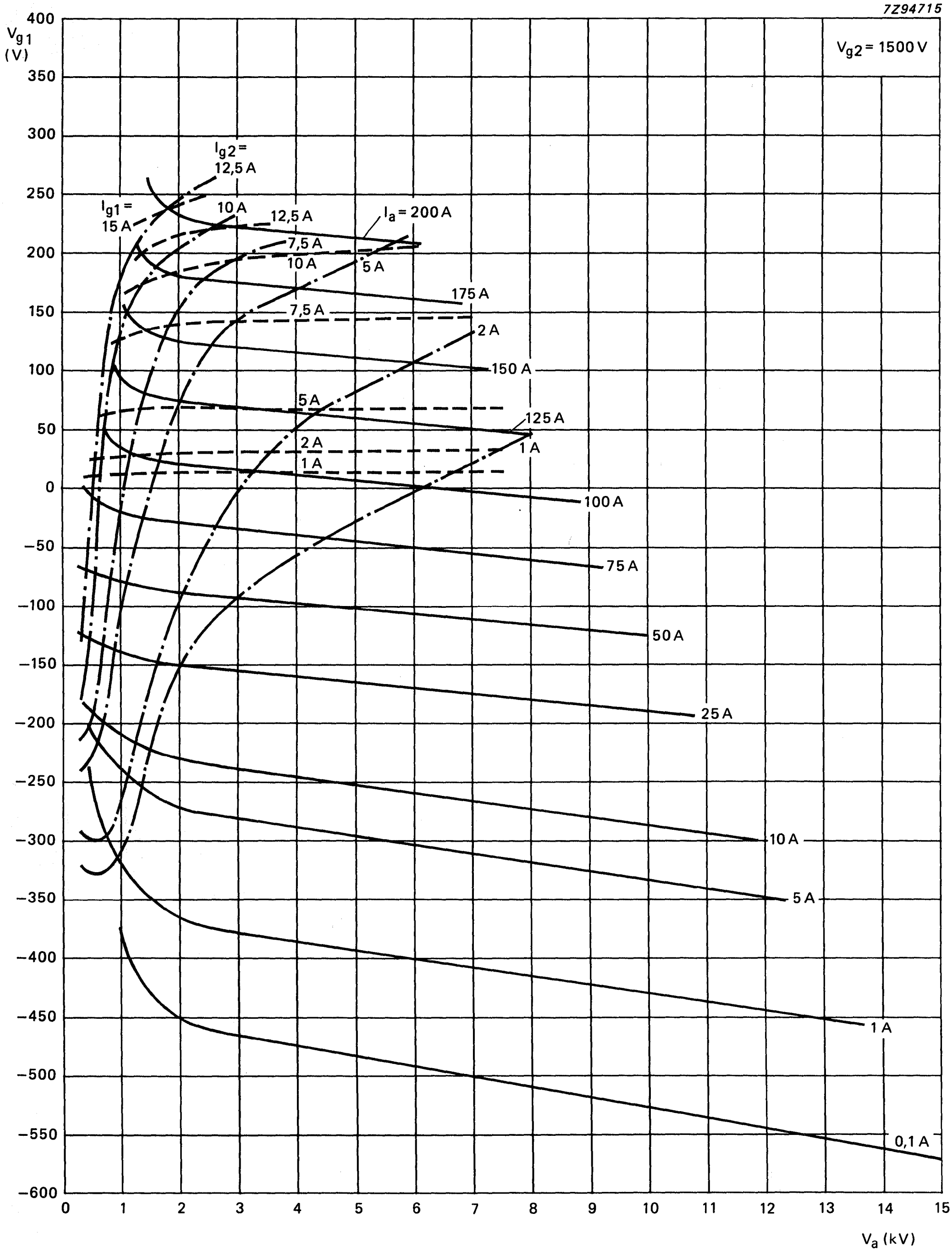

7Z94715
V_{g1} (V)
V_{g2} = 1500 V
400
350
300
250
200
150
100
50
0
−50
−100
−150
−200
−250
−300
−350
−400
−450
−500
−550
−600
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
V_a (kV)
I_{g2} = 12,5 A
I_{g1} = 15 A
10 A
12,5 A
I_a = 200 A
7,5 A
10 A
5 A
175 A
7,5 A
2 A
150 A
5 A
125 A
2 A
1 A
1 A
100 A
75 A
50 A
25 A
10 A
5 A
1 A
0,1 A

Fig. 4.

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 233.

ENVIRONMENTAL CONDITIONS

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

COOLING CURVES

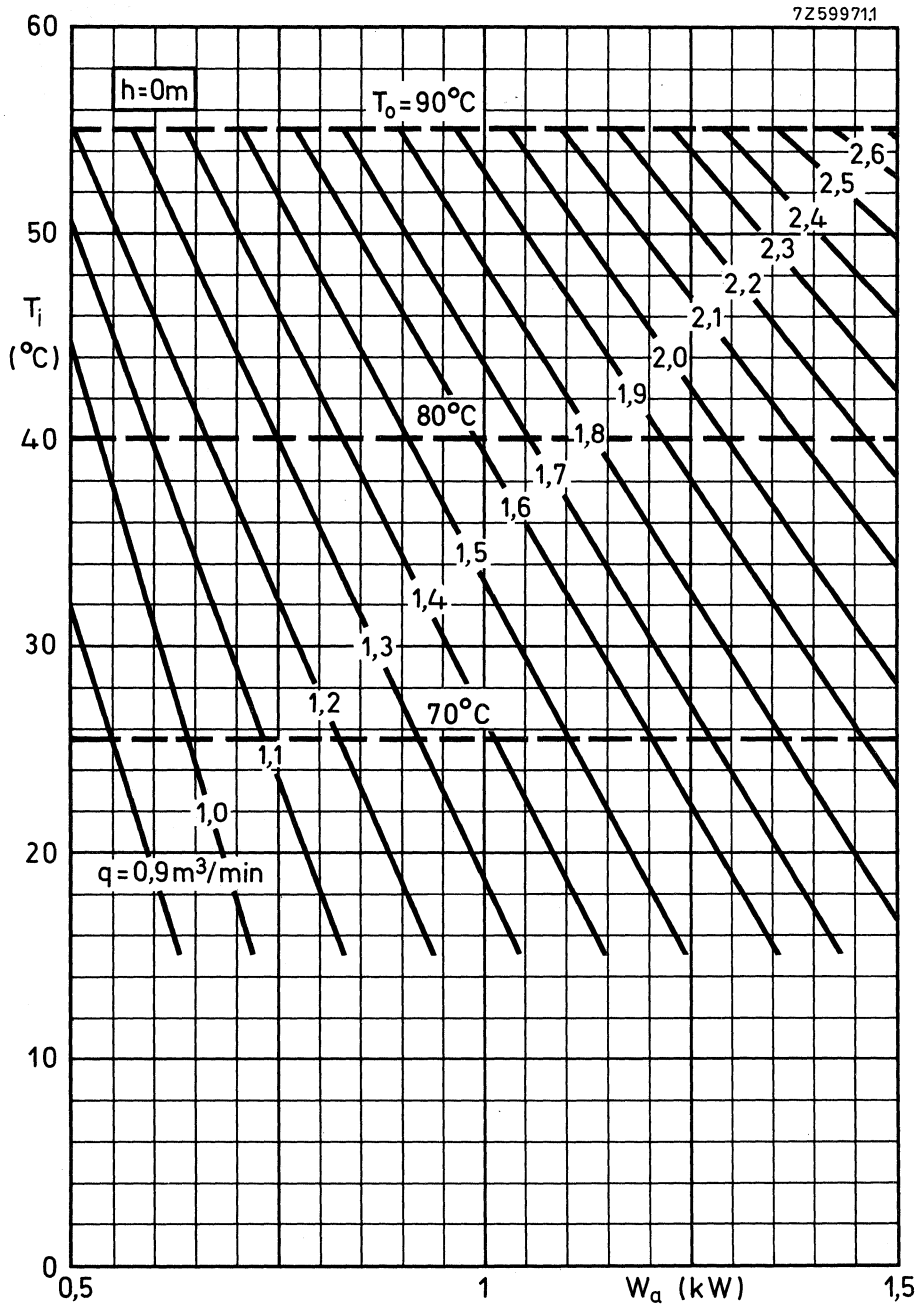
Cooling curves are given at three altitudes: h = sea level, h = 1500 m and h = 3000 m, see the following pages 206 to 232. Amounts of air quantities are minimum values.

APPLICATIONS

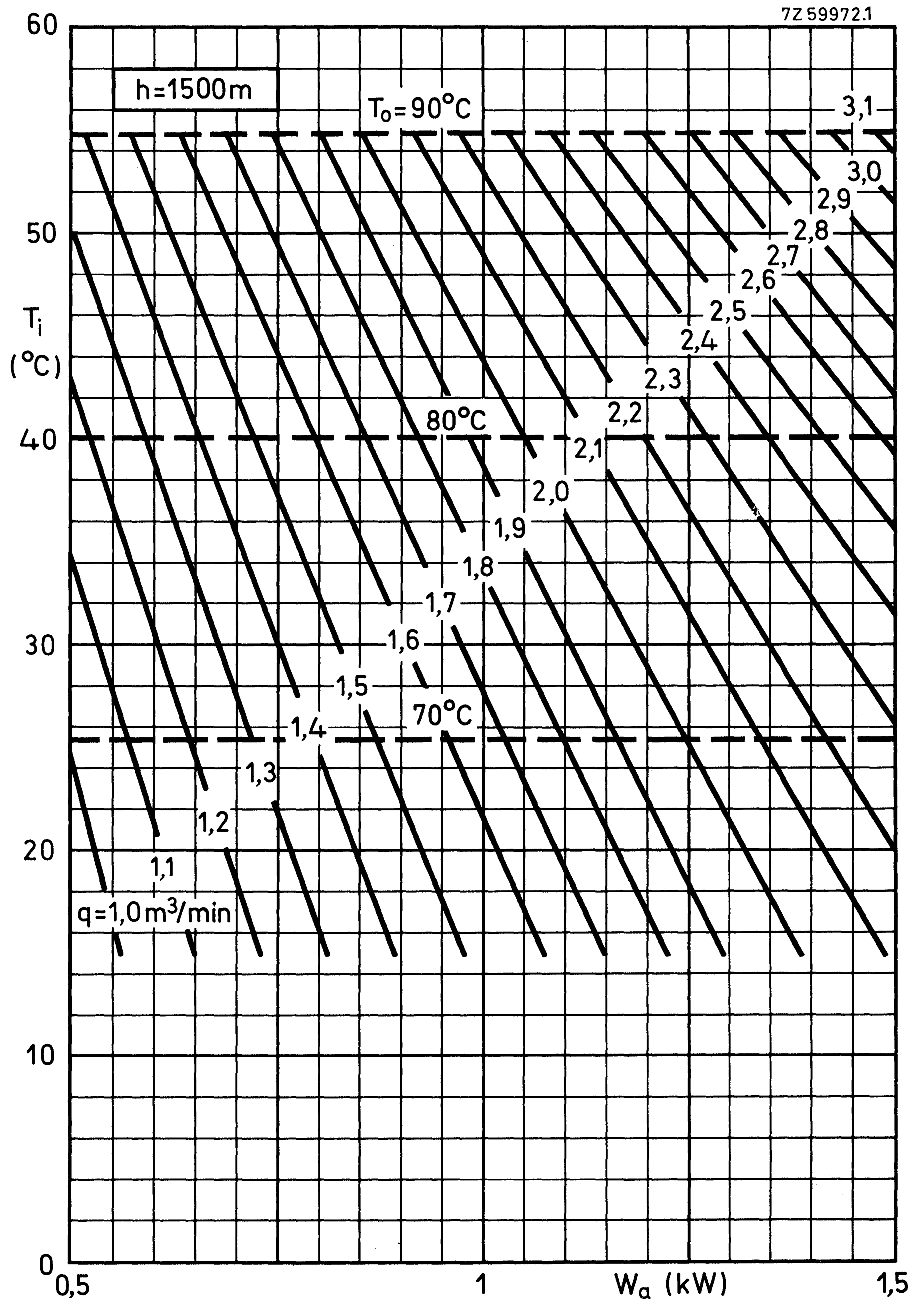
SOUND	VISION + SOUND/VISION
40744	40743
40746	40745
40748	40747
40756	40755
40758	40757
40760	40759
40775	40768
40777	40776
40778*	40783
40769*	40786
40787S*	40786A*
40788	40787
40789	

* Data available on request.

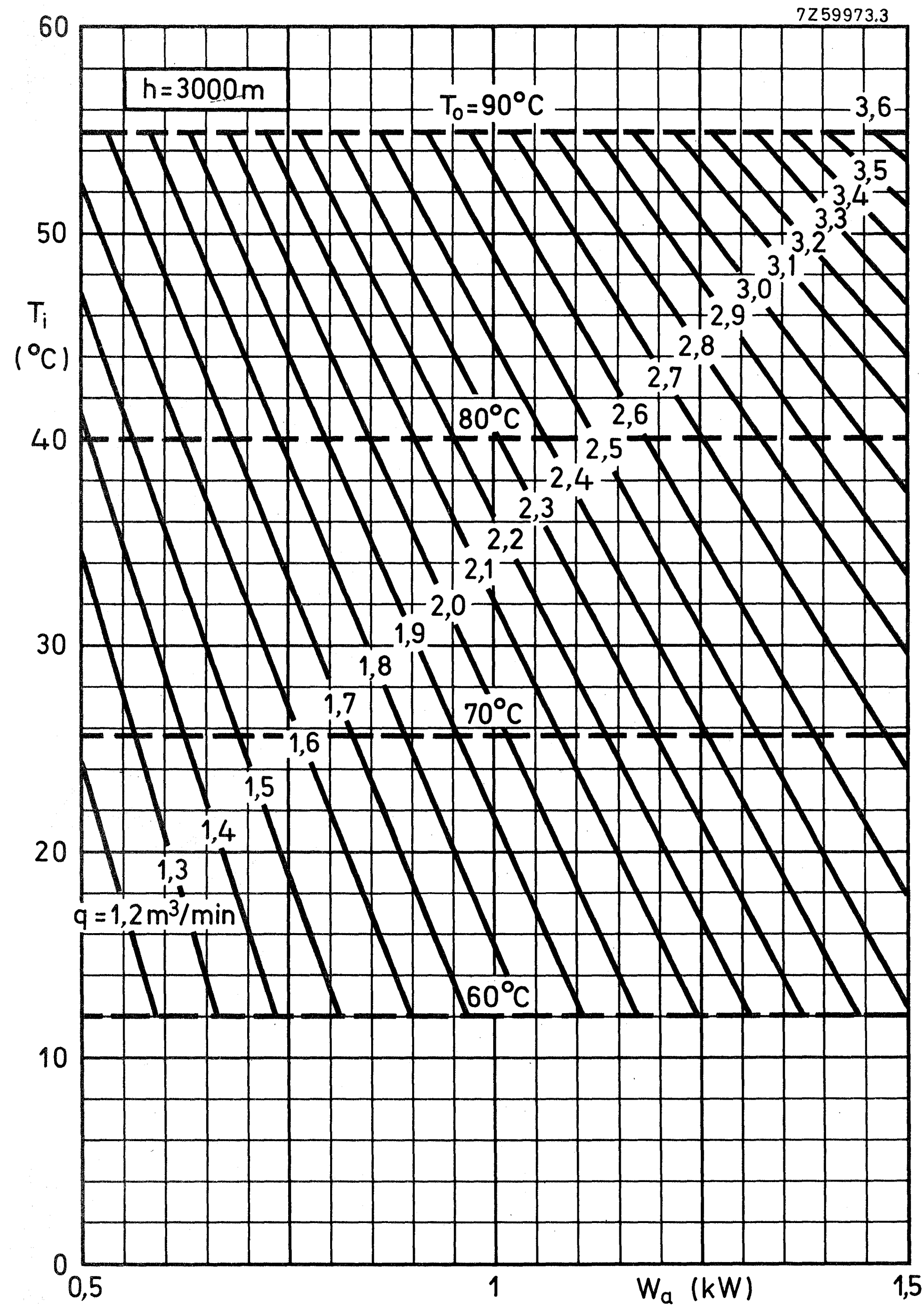
Cooling curves for assemblies 40743, 40744, 40755 and 40756 with tube YL1440.
Altitude: sea level



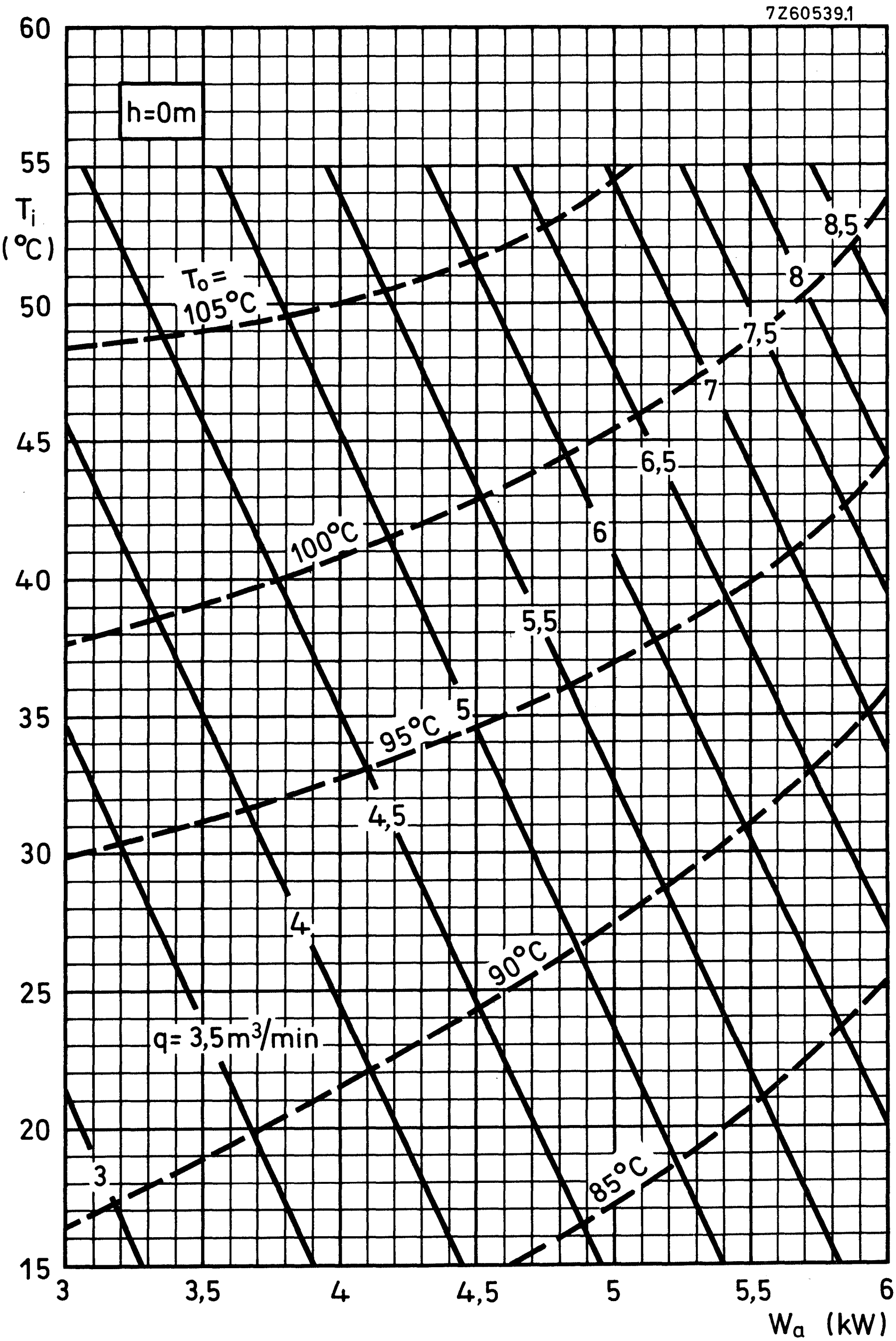
Cooling curves for assemblies 40743, 40744, 40755 and 40756 with tube YL1440.
Altitude: 1500 m



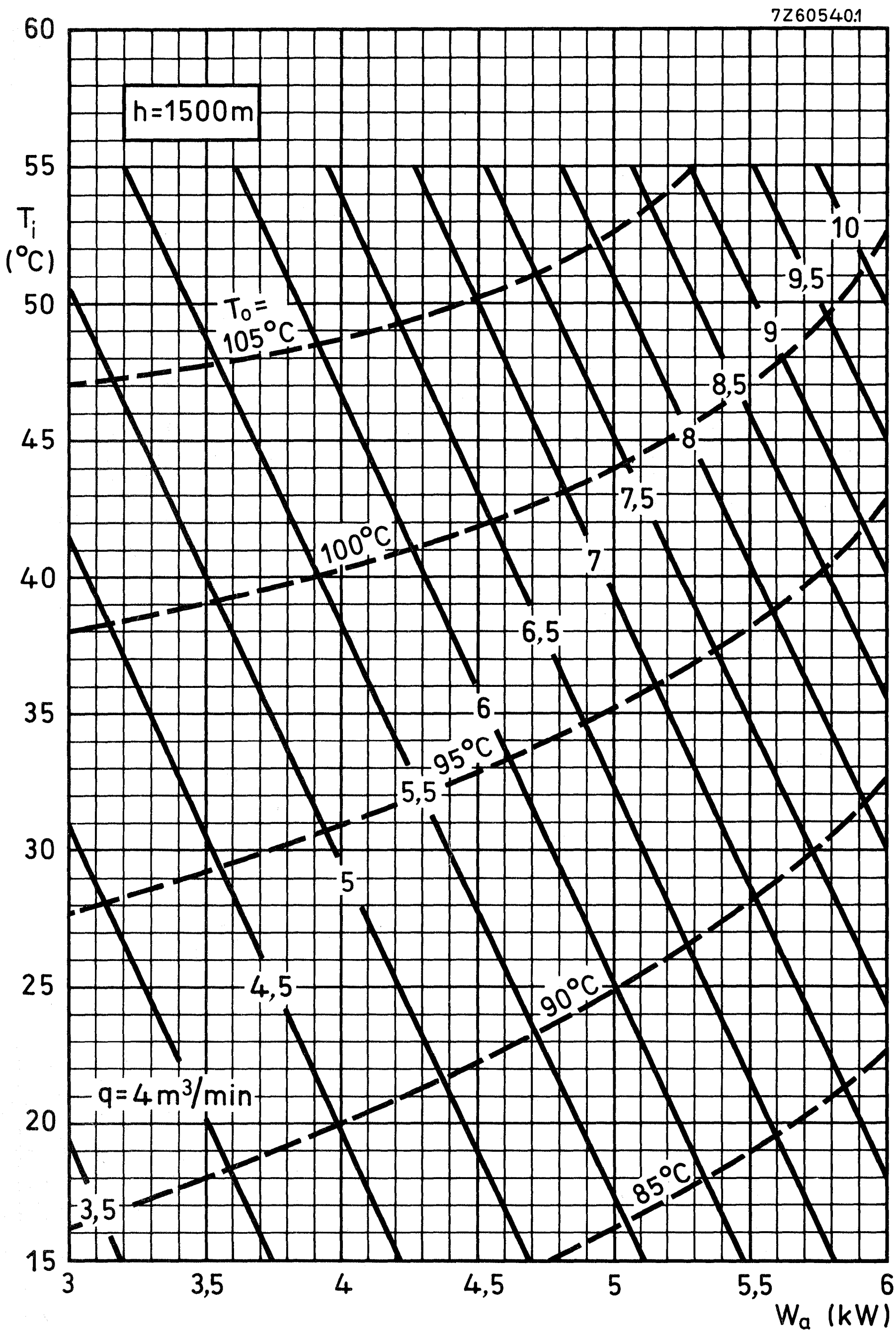
Cooling curves for assemblies 40743, 40744, 40755 and 40756 with tube YL1440.
Altitude: 3000 m



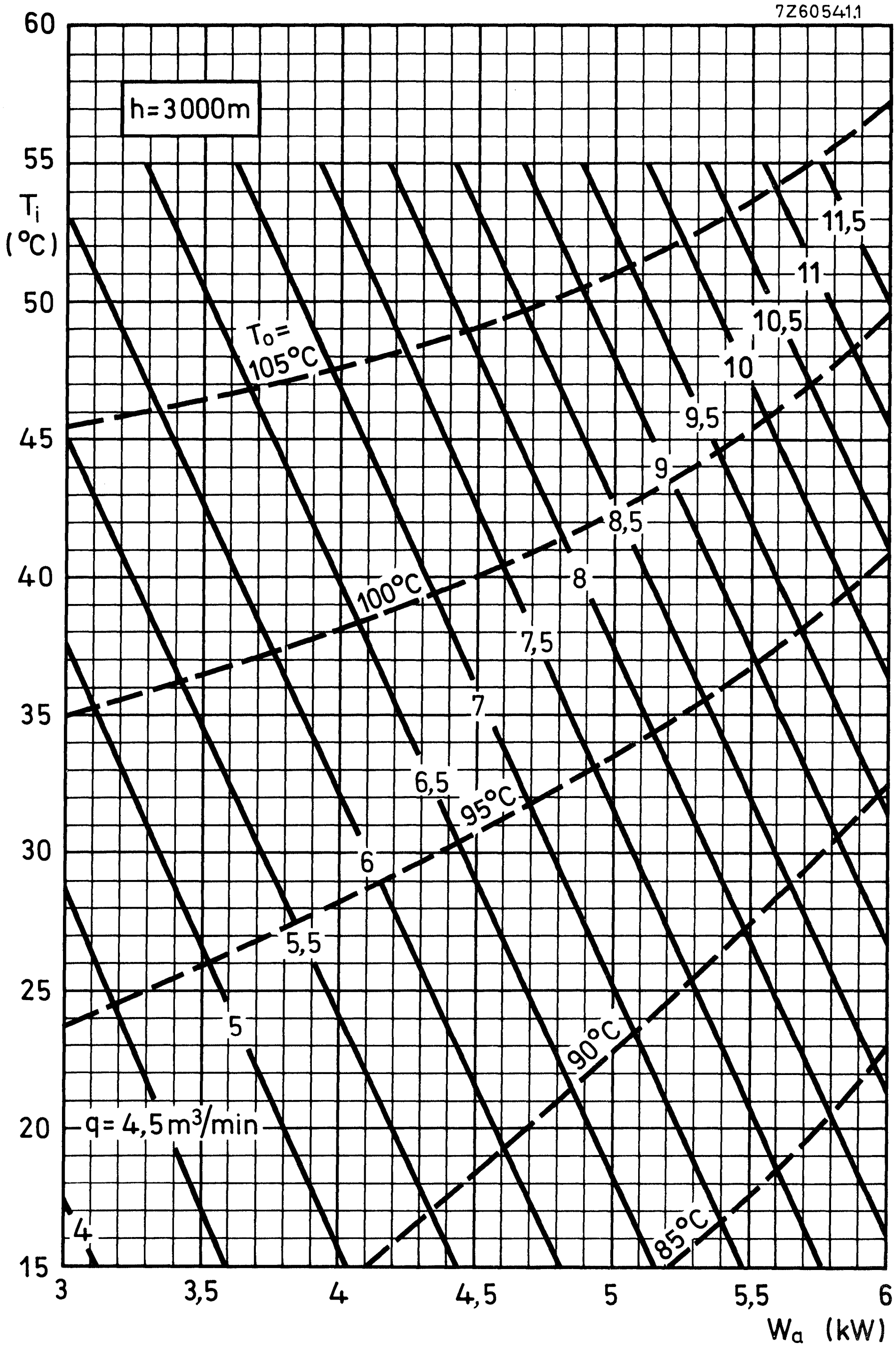
Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.
Altitude: sea level



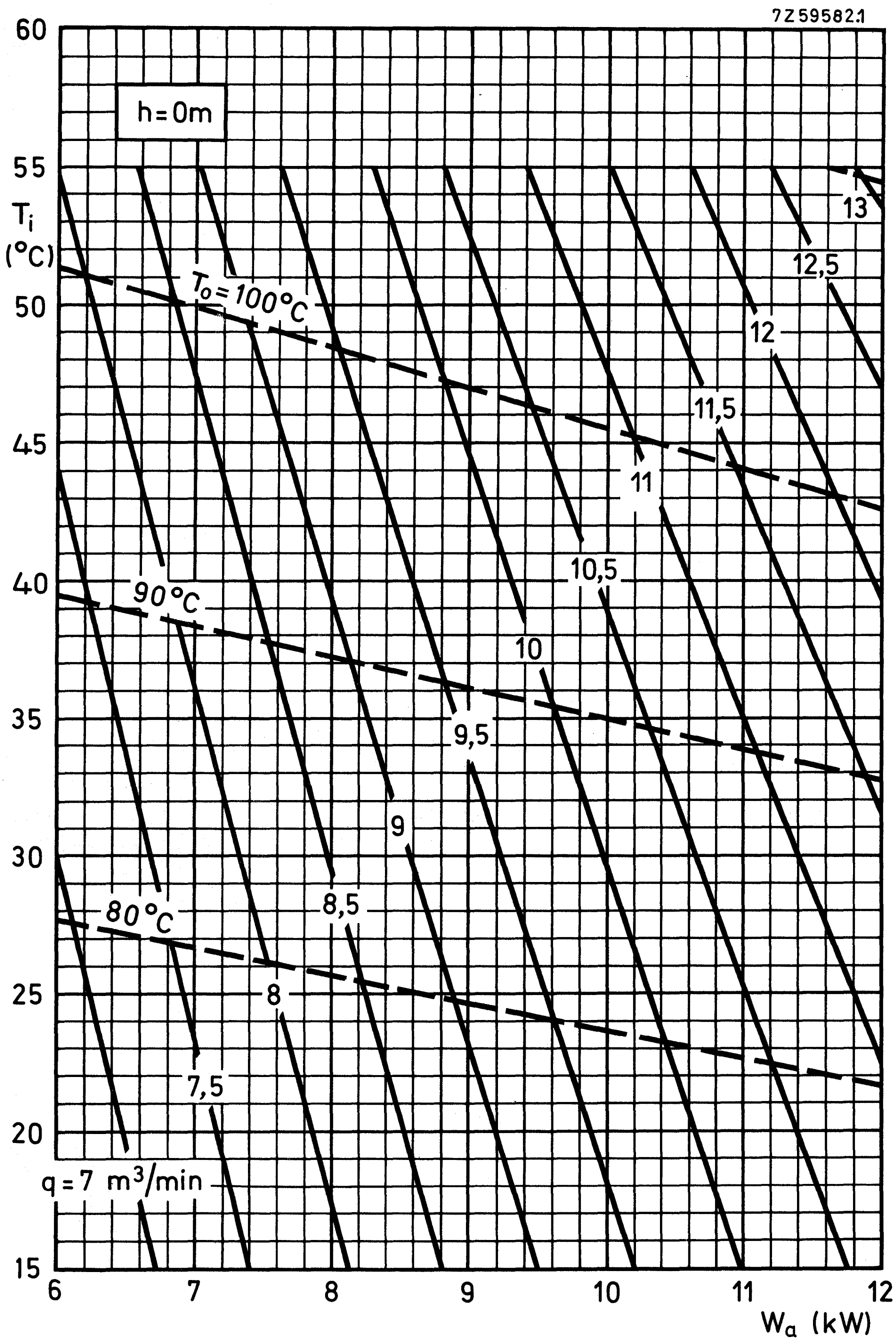
Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.
Altitude: 1500 m



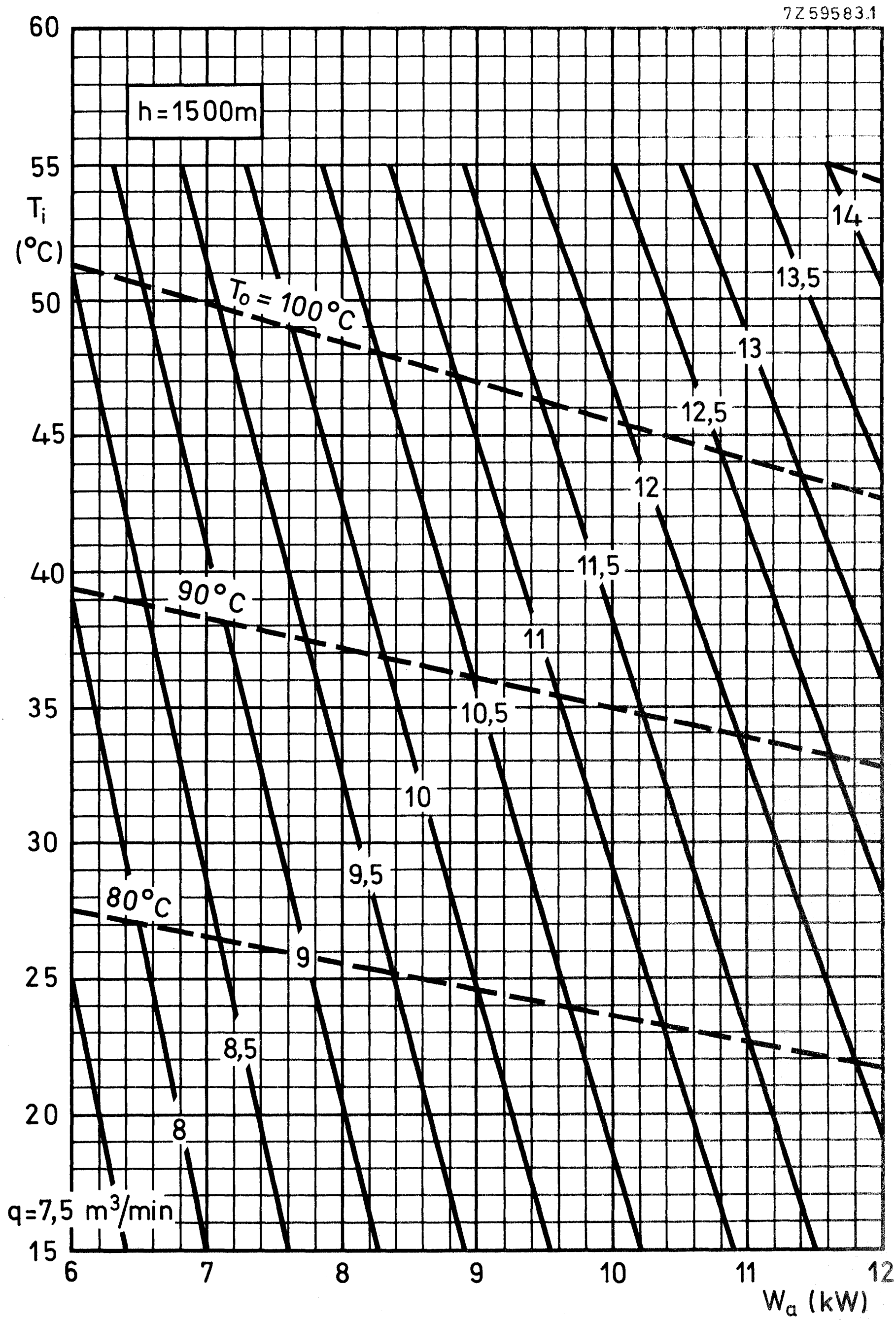
Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.
Altitude: 3000 m



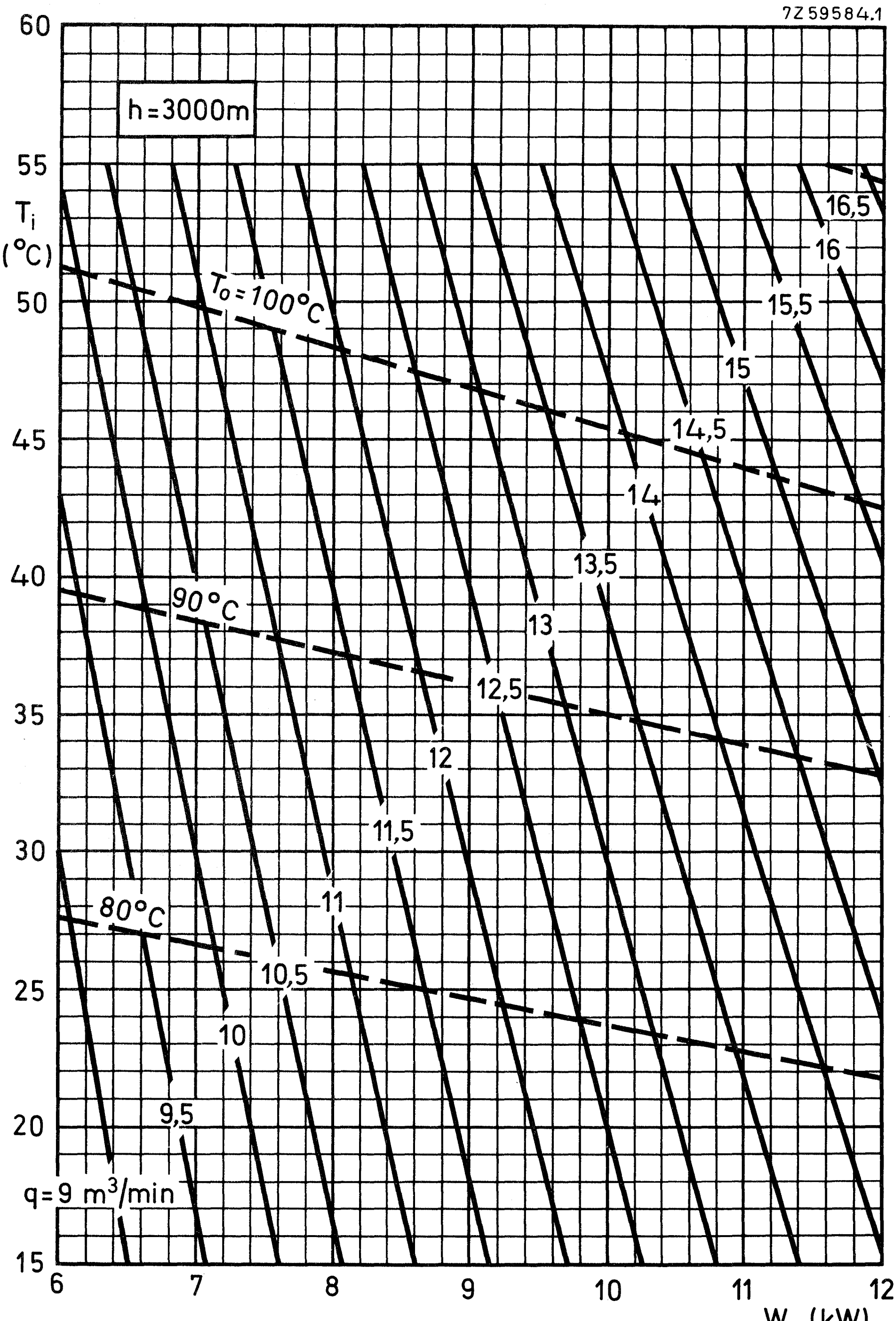
Cooling curves for assemblies 40747, 40748, 40759 and 40760 with tube YL1430.
Altitude: sea level



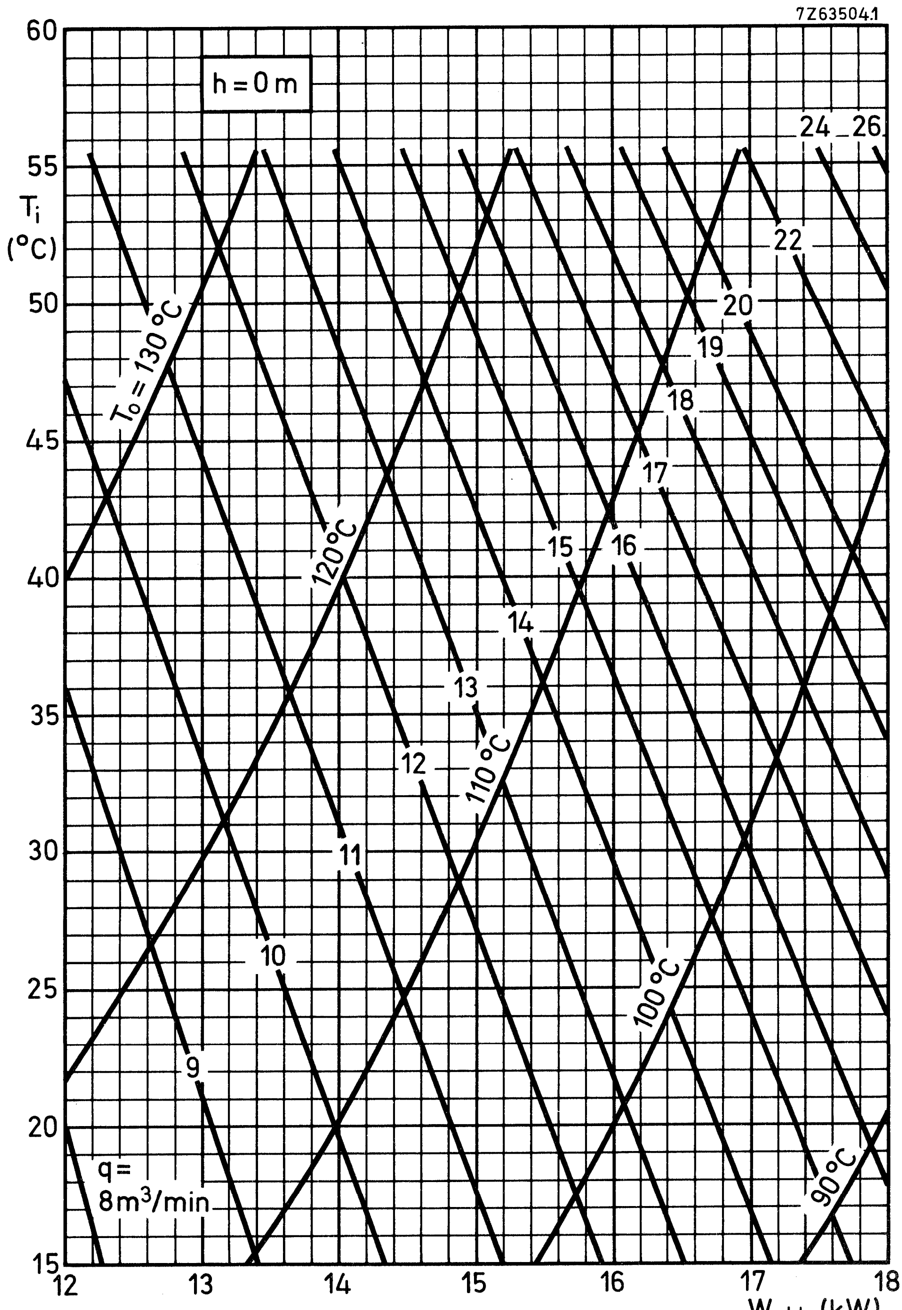
Cooling curves for assemblies 40747, 40748, 40759 and 40760 with tube YL1430.
Altitude: 1500 m



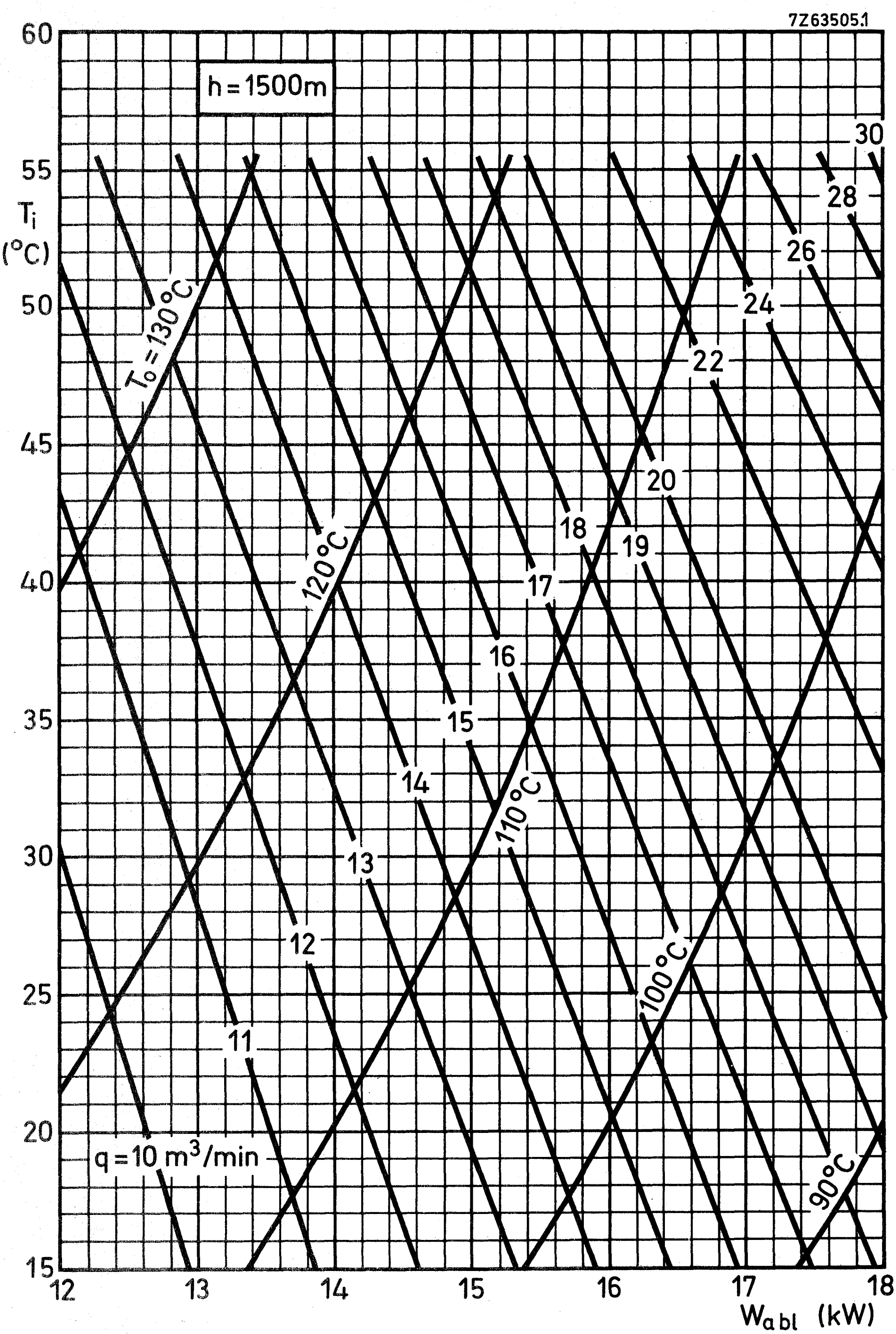
Cooling curves for assemblies 40747, 40748, 40759 and 40760 with tube YL1430.
Altitude: 3000 m



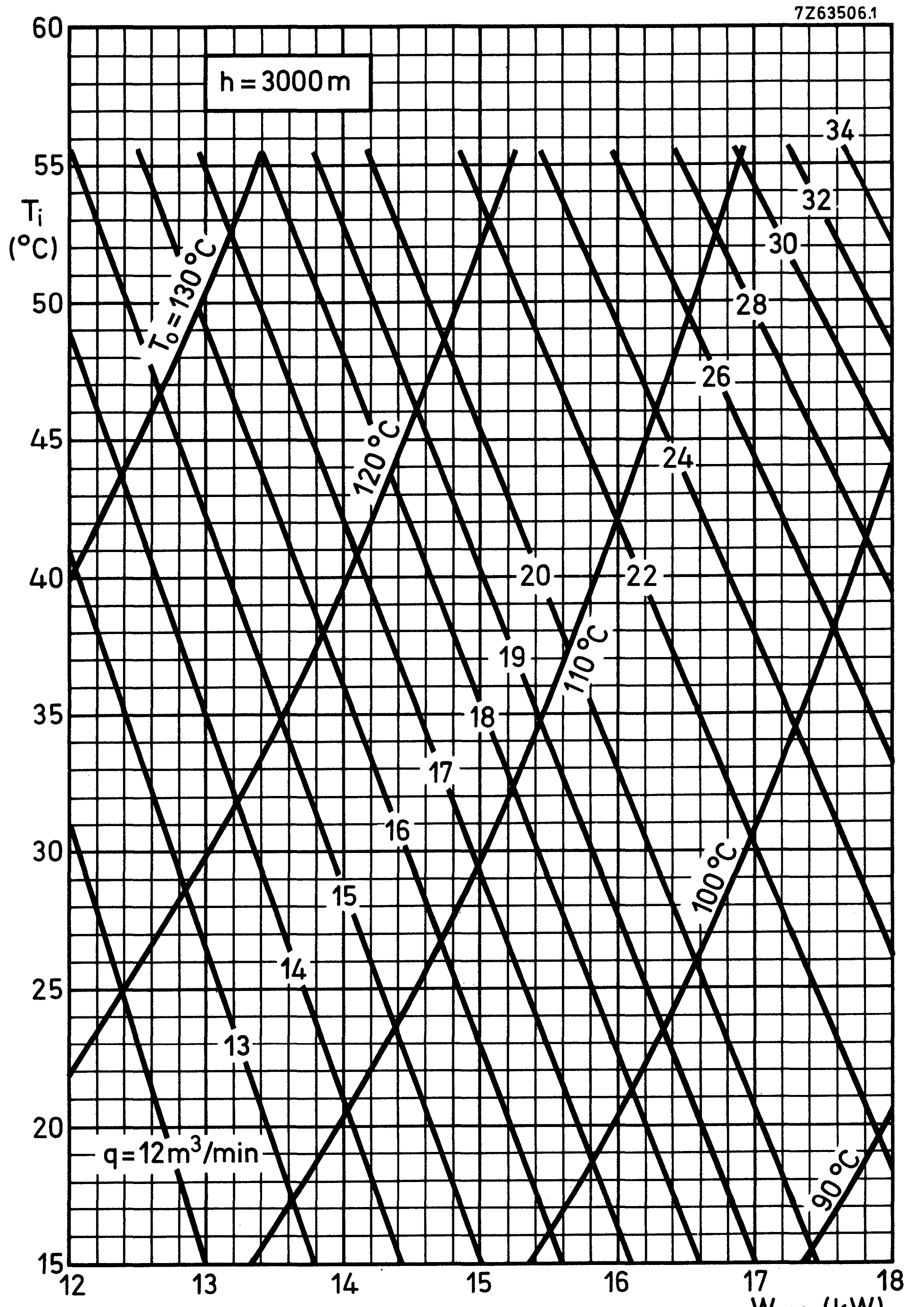
Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.
Altitude: sea level



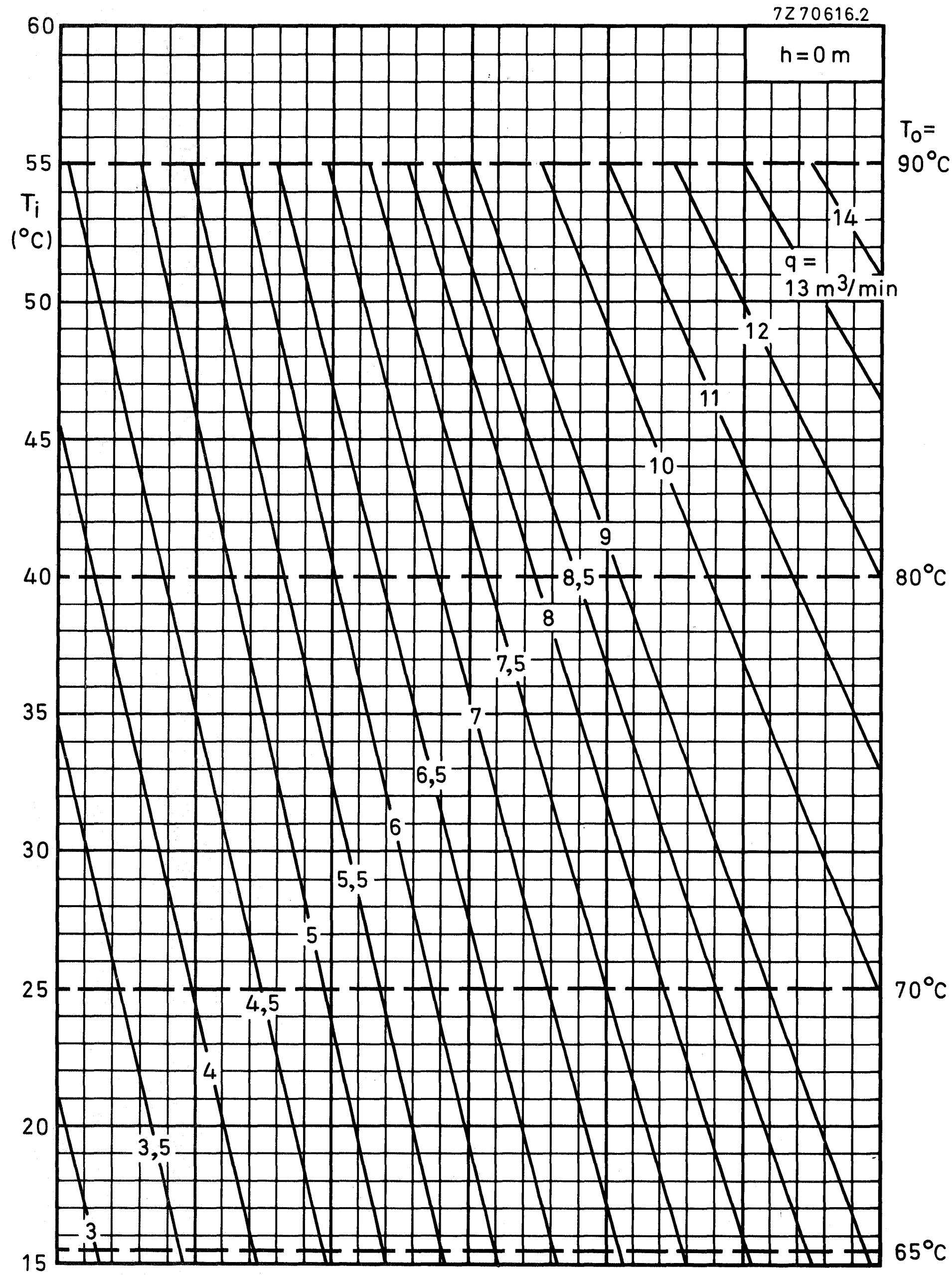
Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.
Altitude: 1500 m



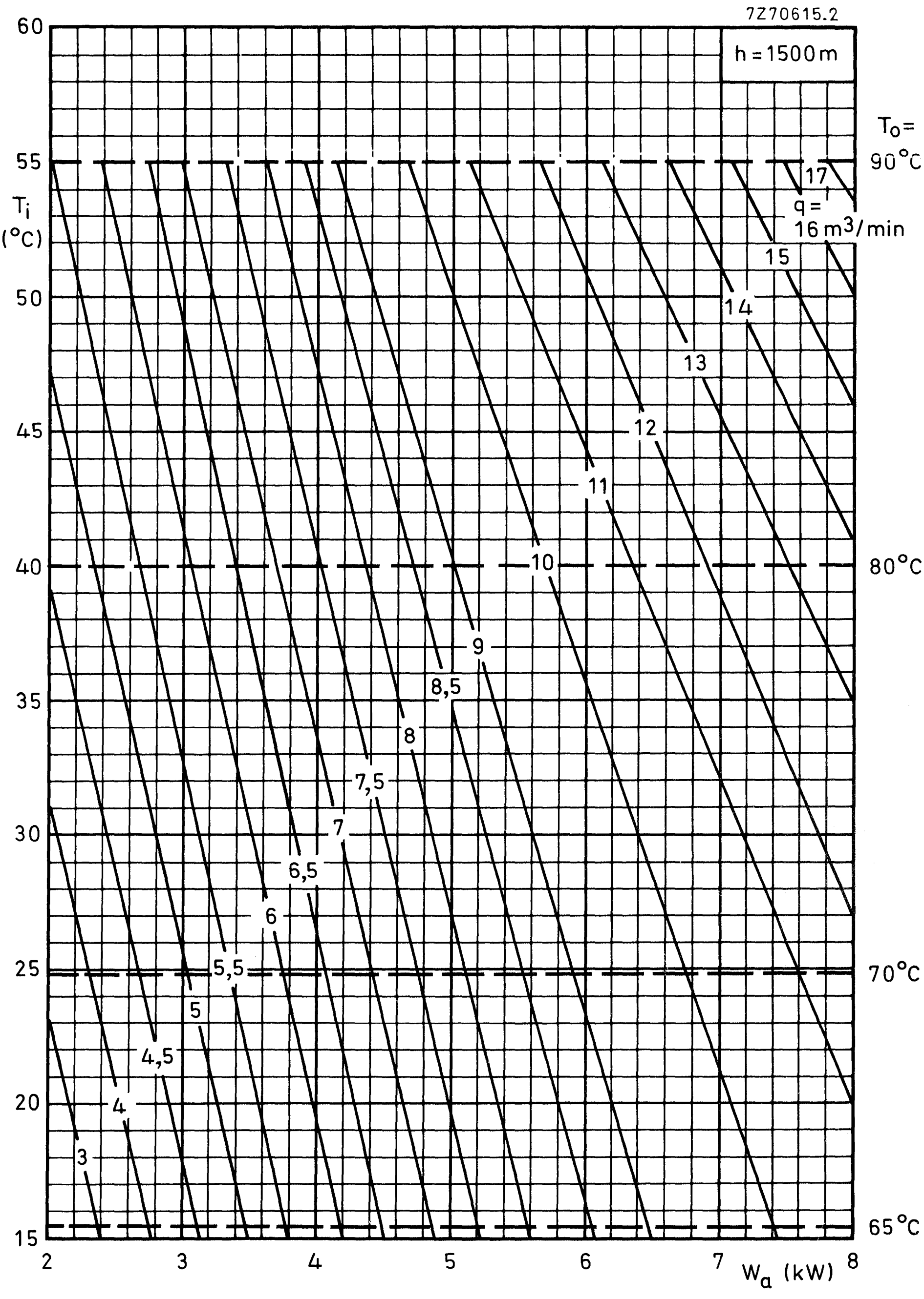
Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.
Altitude: 3000 m



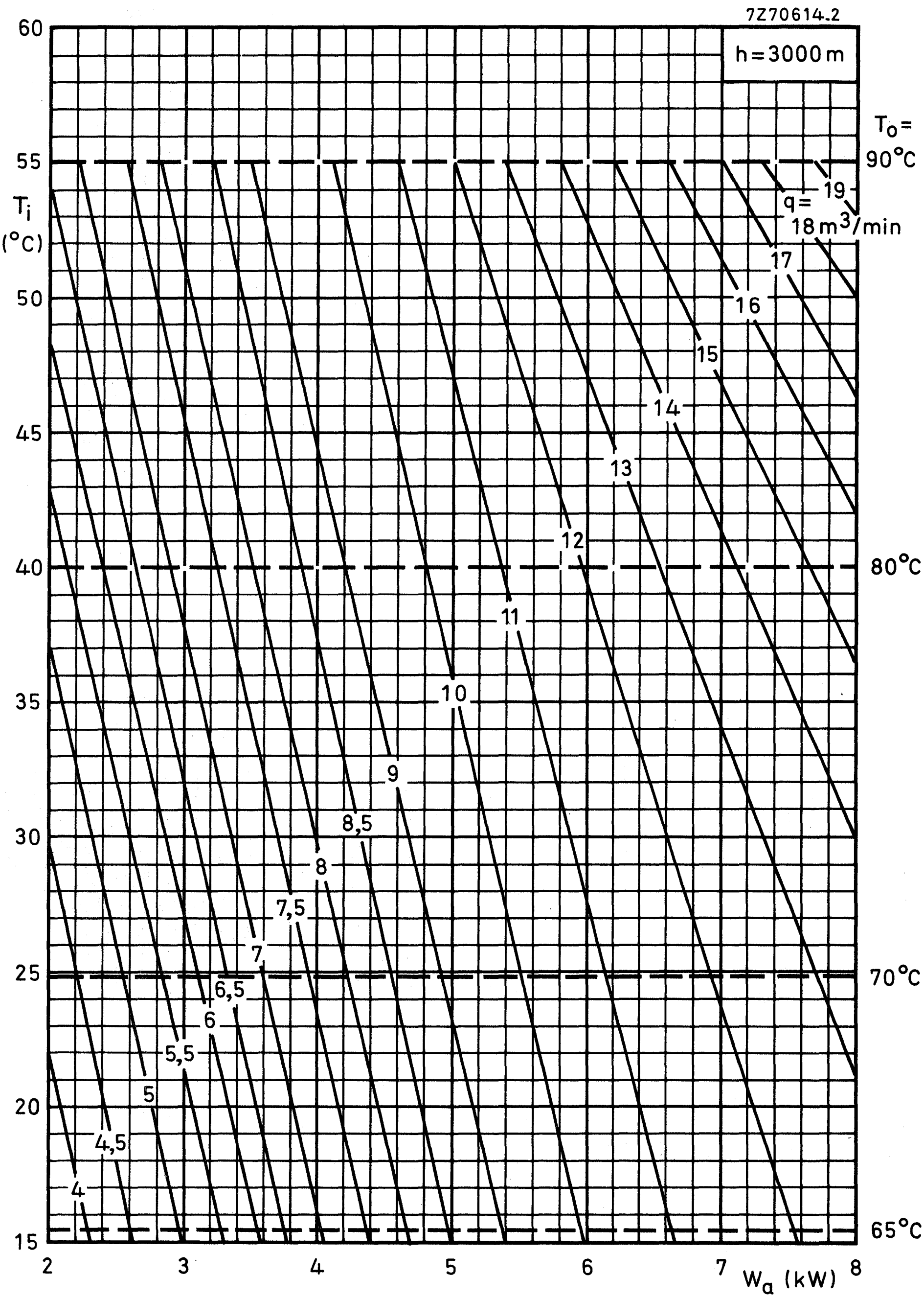
Cooling curves for assembly 40775 with tube YL1470.
Altitude: sea level



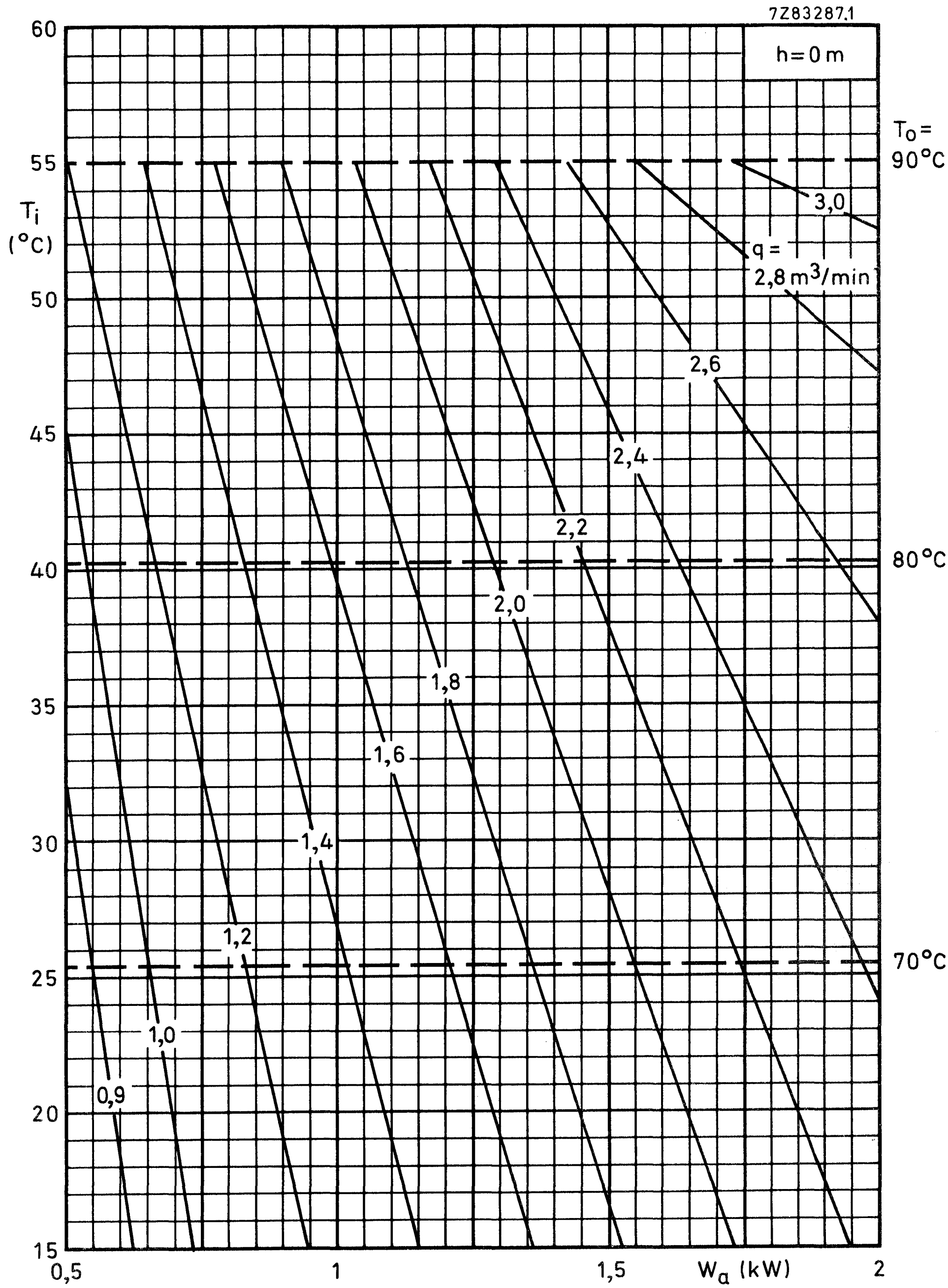
Cooling curves for assembly 40775 with tube YL1470.
Altitude: 1500 m



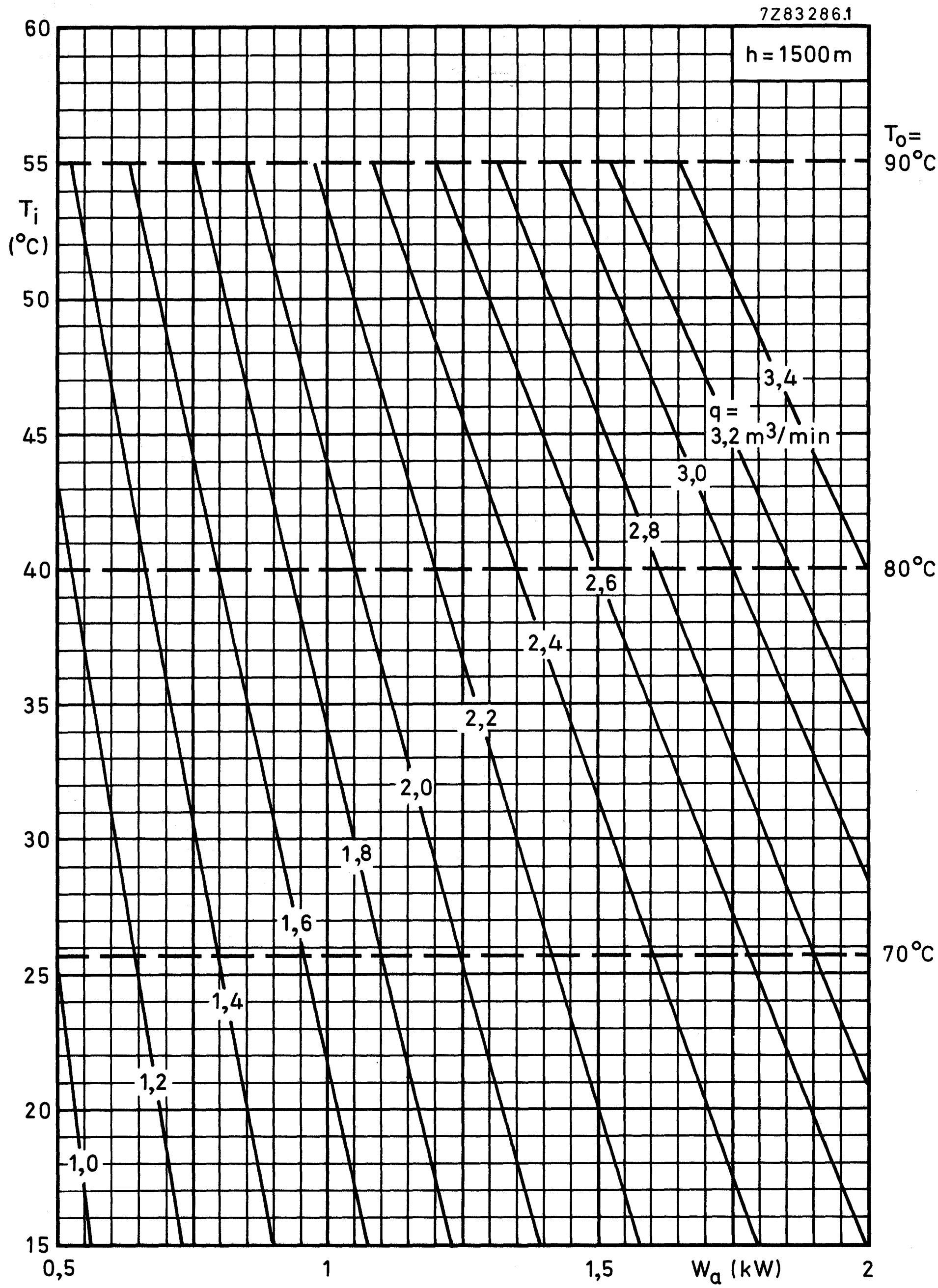
Cooling curves for assembly 40775 with tube YL1470.
Altitude: 3000 m



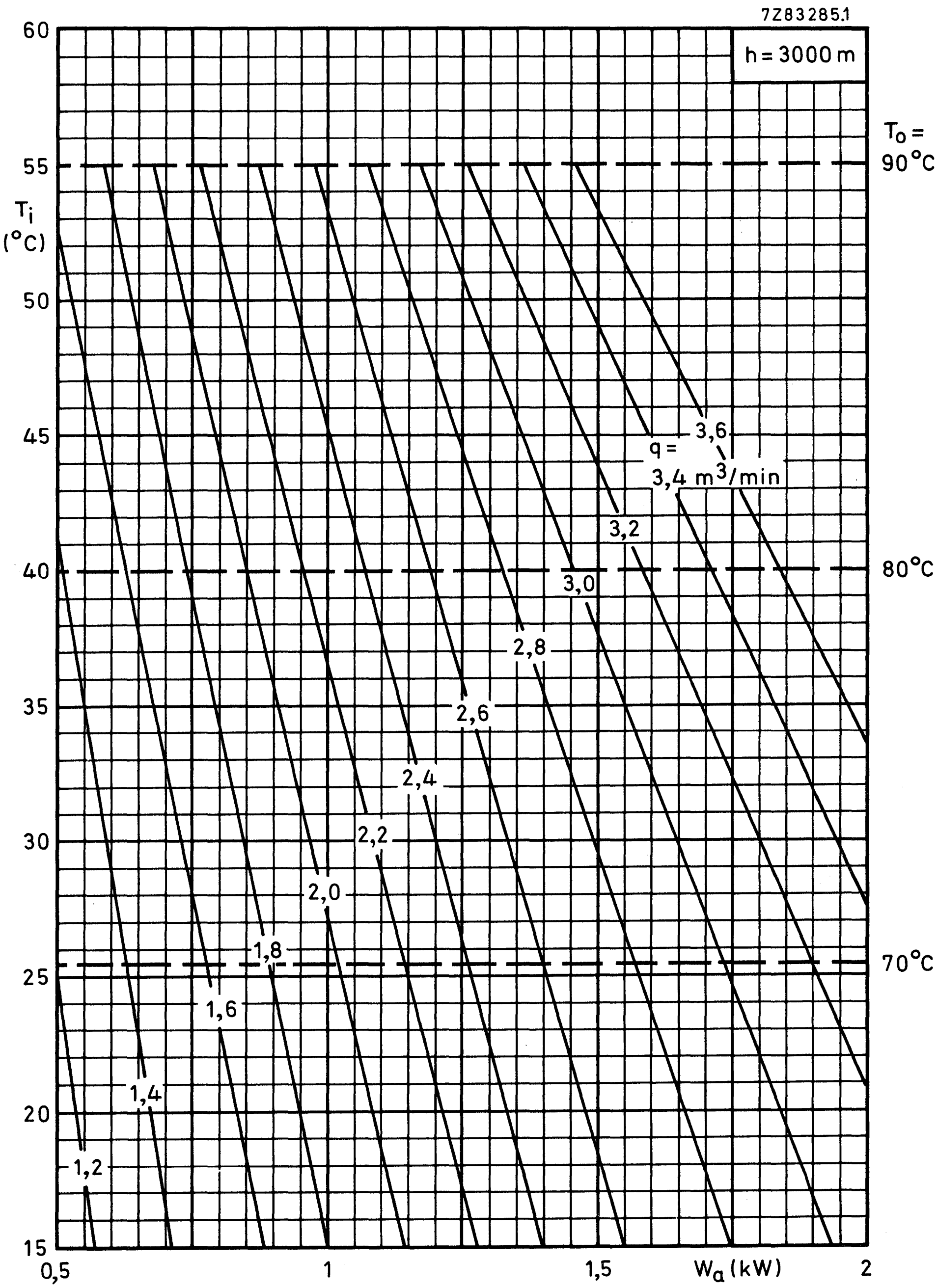
Cooling curves for assemblies 40776 and 40777 with tube YL1540.
Altitude: sea level



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

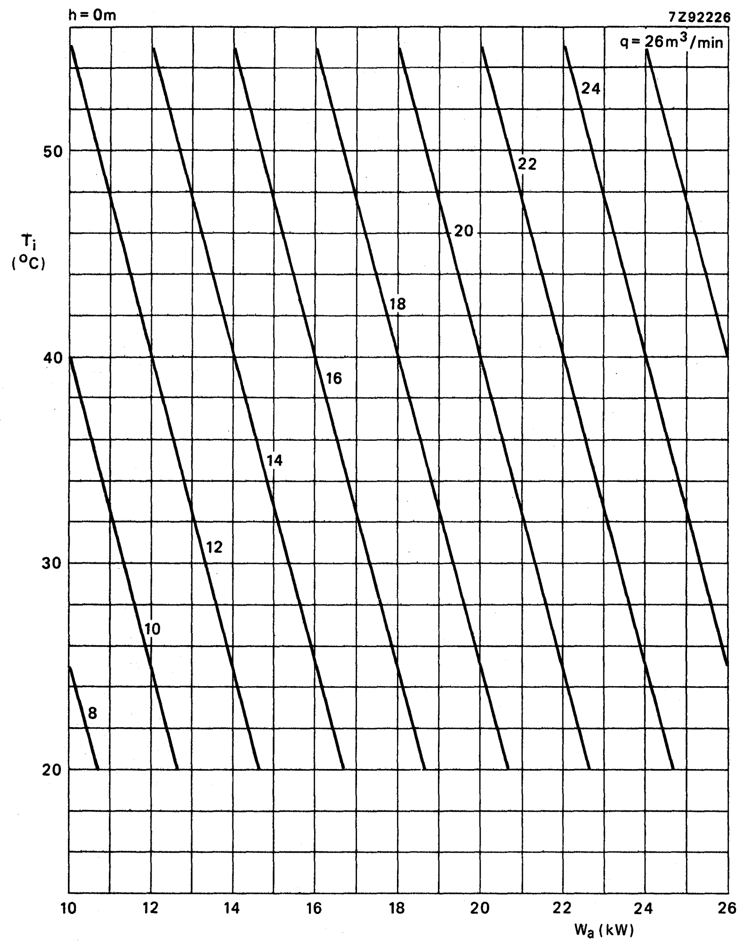


Cooling curves for assemblies 40776 and 40777 with tube YL1540.
Altitude: 3000 m



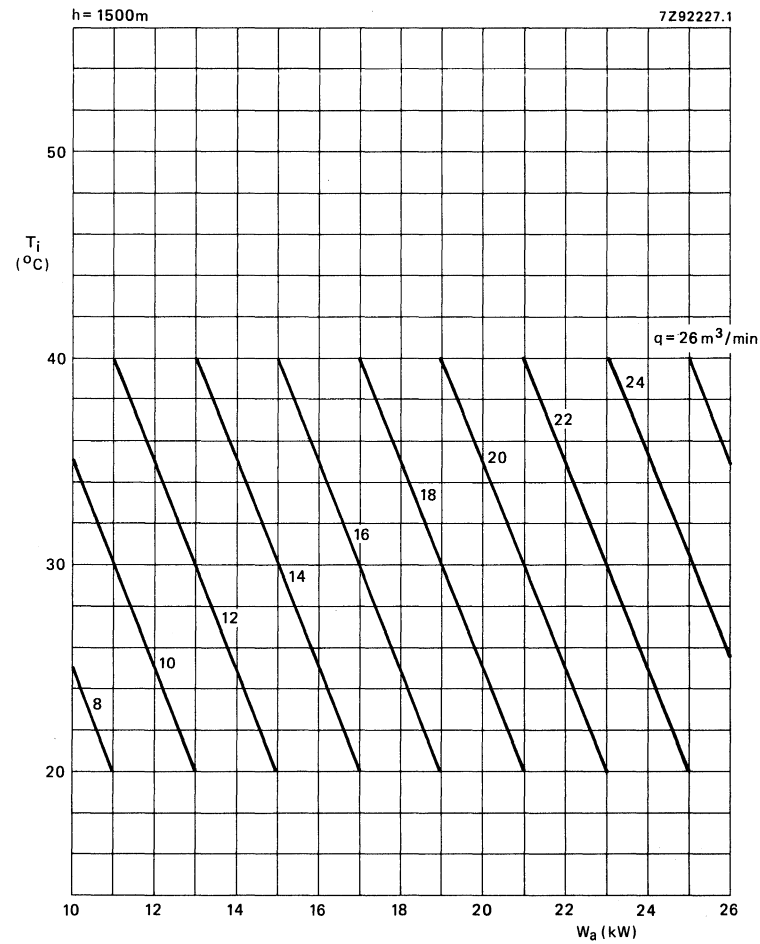
Cooling curves for assembly 40786 with tube YL1630.

Altitude: sea level.



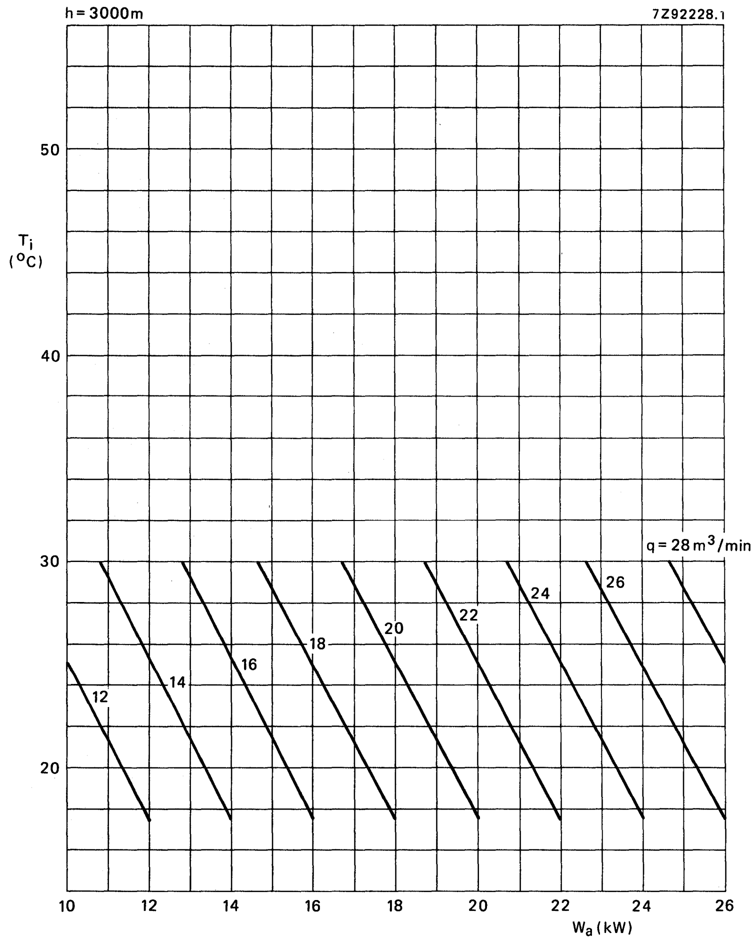
Cooling curves for assembly 40786 with tube YL1630.

Altitude: 1500 m

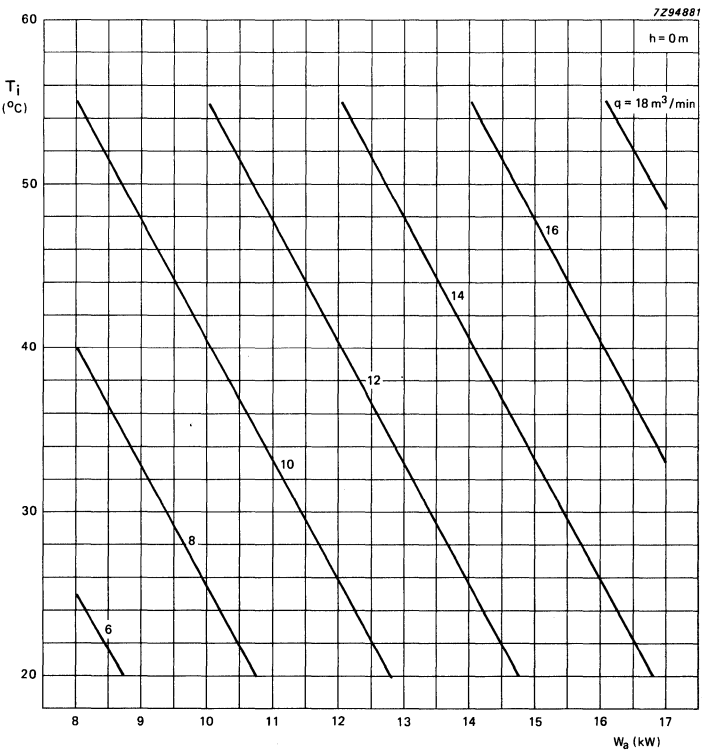


Cooling curves for assembly 40786 with tube YL1630.

Altitude: 3000 m

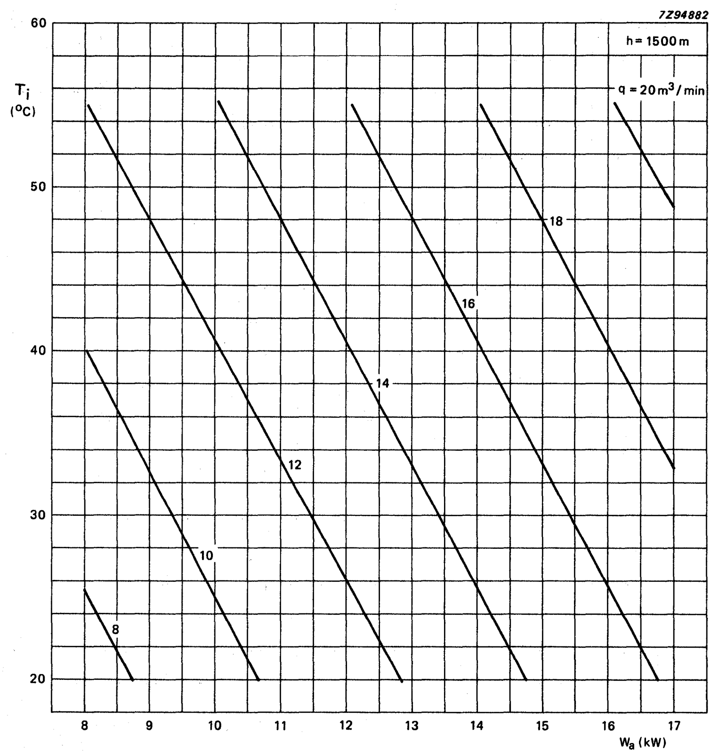


Cooling curves for assembly 40786A with tube YL1631.
Altitude: sea level.

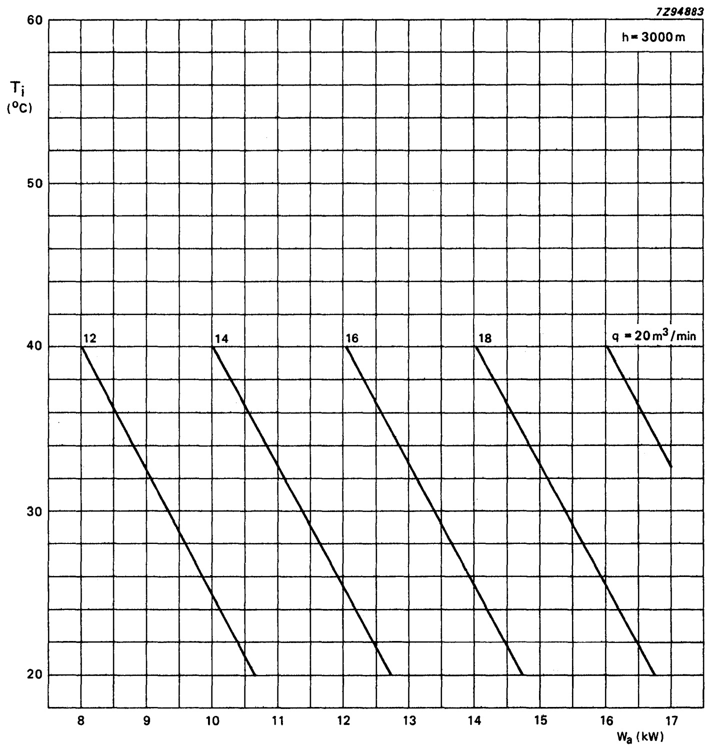


Cooling curves for assembly 40786A with tube YL1631.

Altitude: 1500 m.

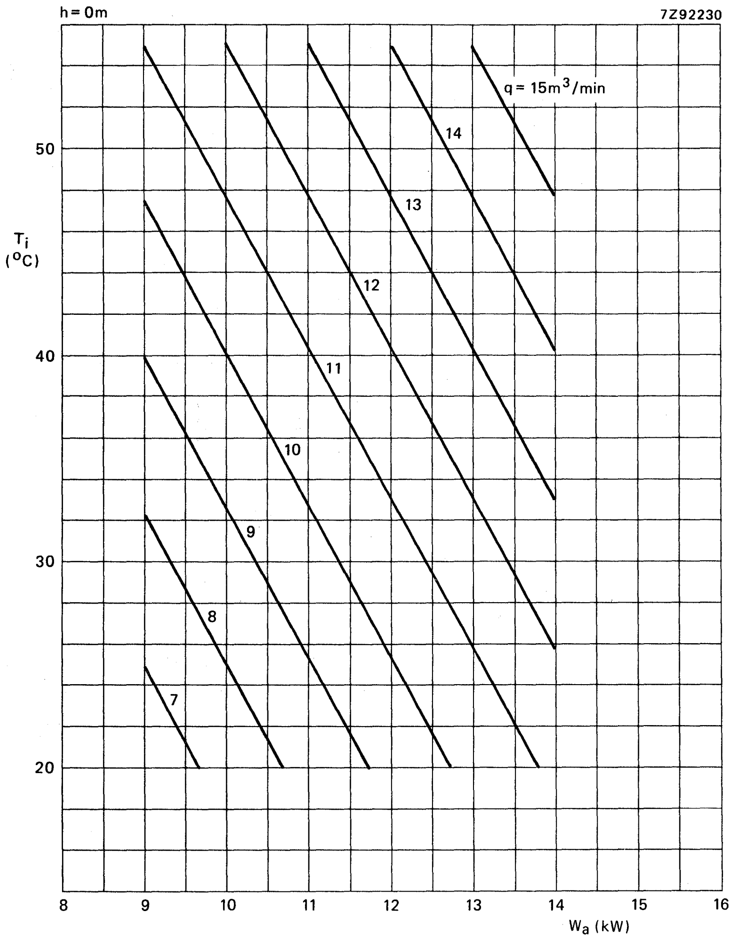


Cooling curves for assembly 40786A with tube YL1631.
Altitude: 3000 m.

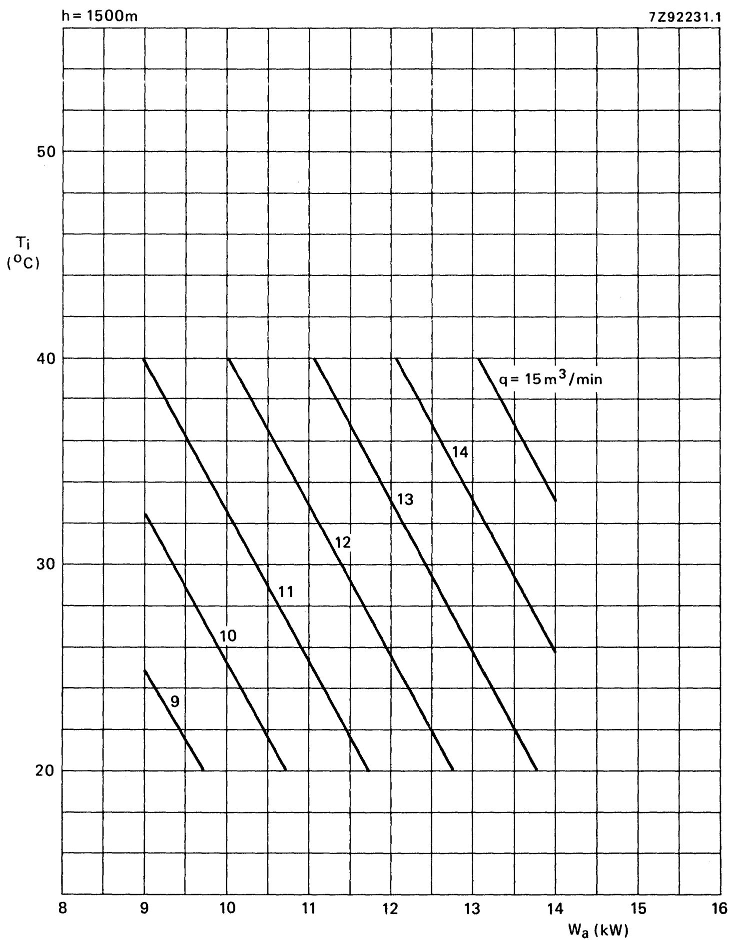


Cooling curves for assembly 40787 with tube YL1610.

Altitude: sea level.

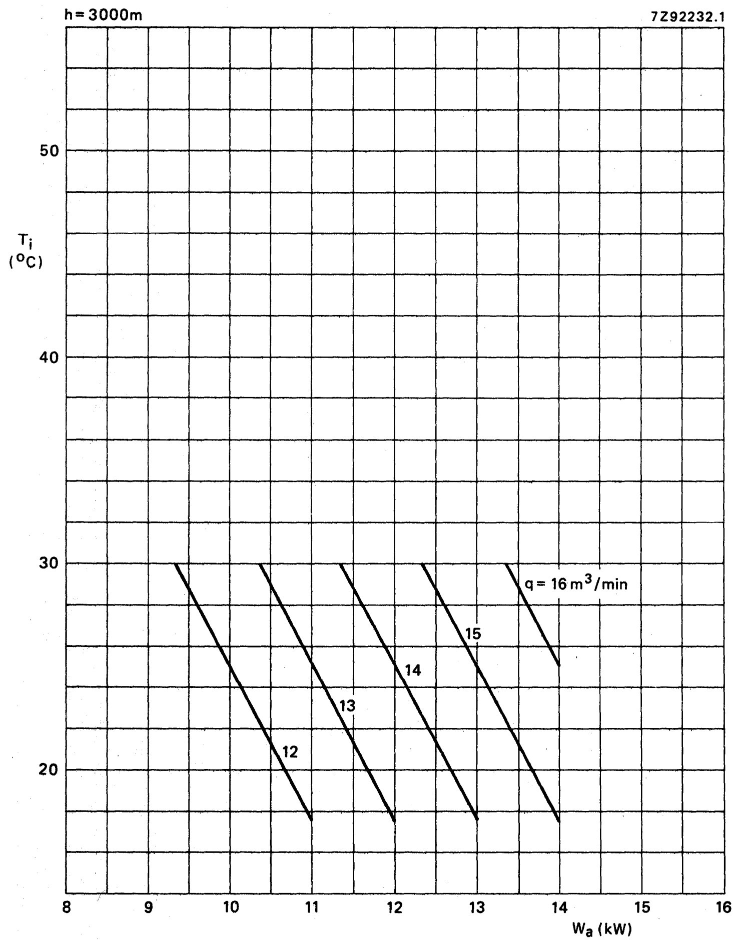


Cooling curves for assembly 40787 with tube UL1610.
Altitude: 1500 m.

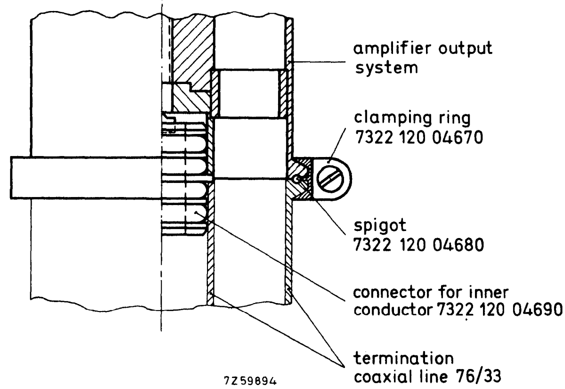


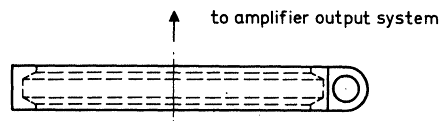
Cooling curves for assembly 40787 with tube YL1610.

Altitude: 3000 m.



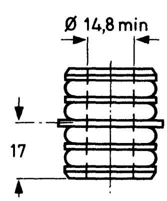
R.F. output connector to be used with assemblies 40745, 40746, 40747, 40748, 40757, 40758, 40759, 40760 and 40768.



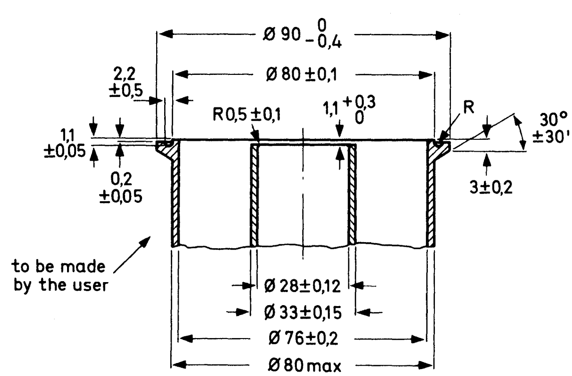


clamping ring 7322 120 04670

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 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 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

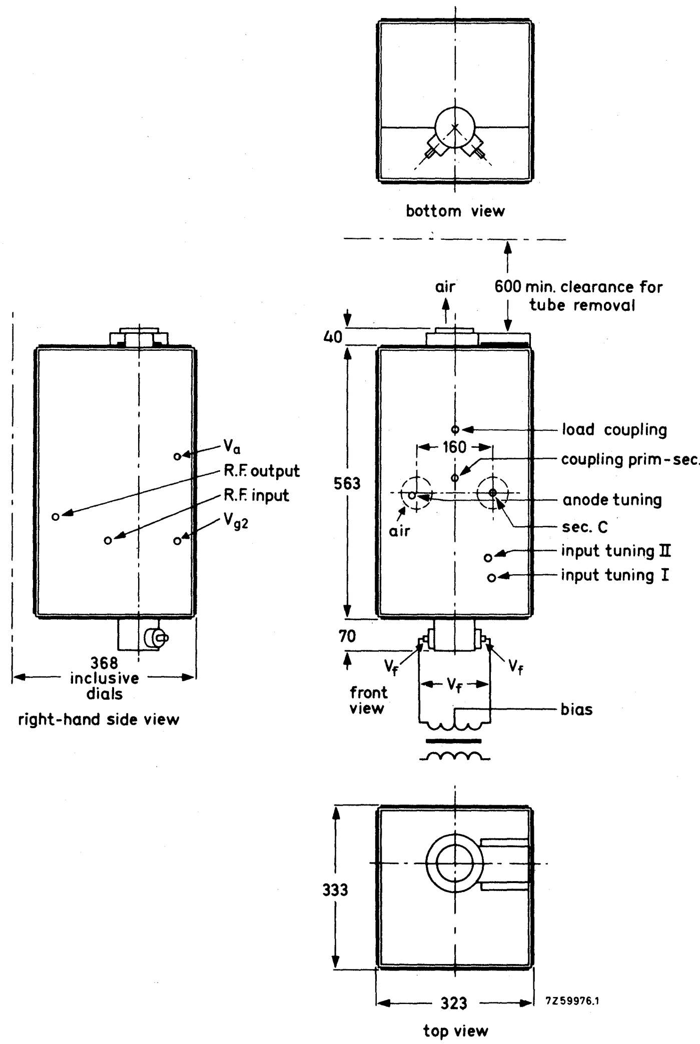


Fig. 1.

CIRCUIT DIAGRAM

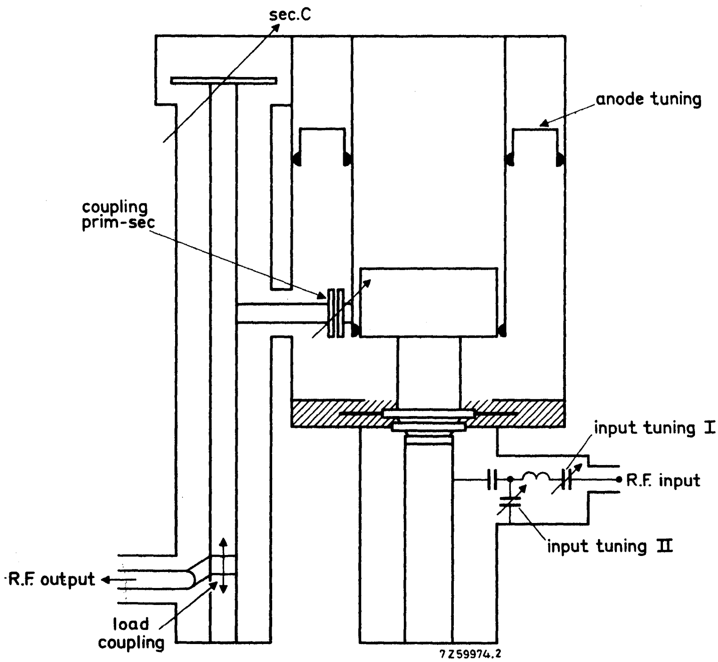


Fig. 2.

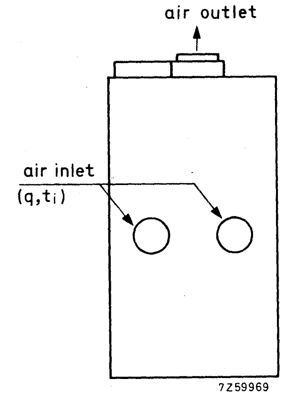


Fig. 3 Cooling air connector diagram.

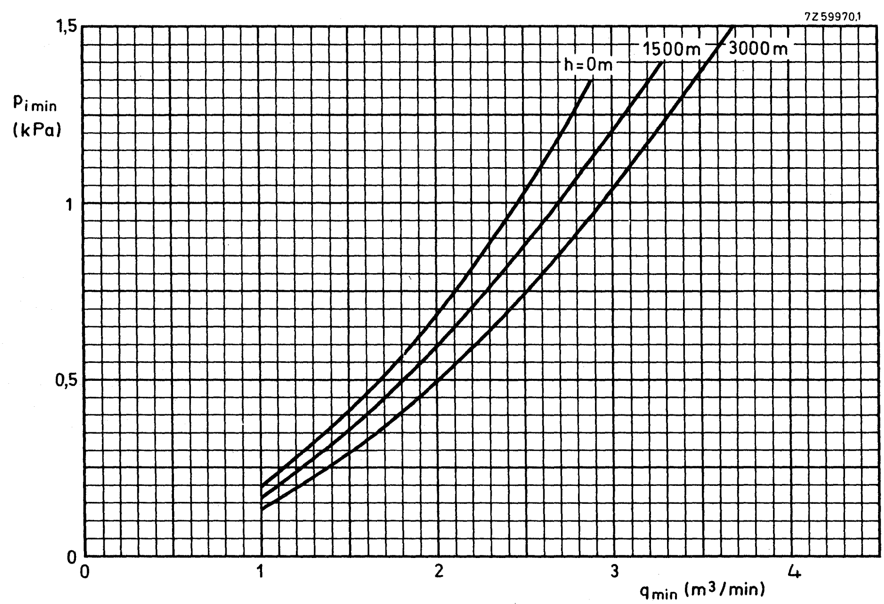


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 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

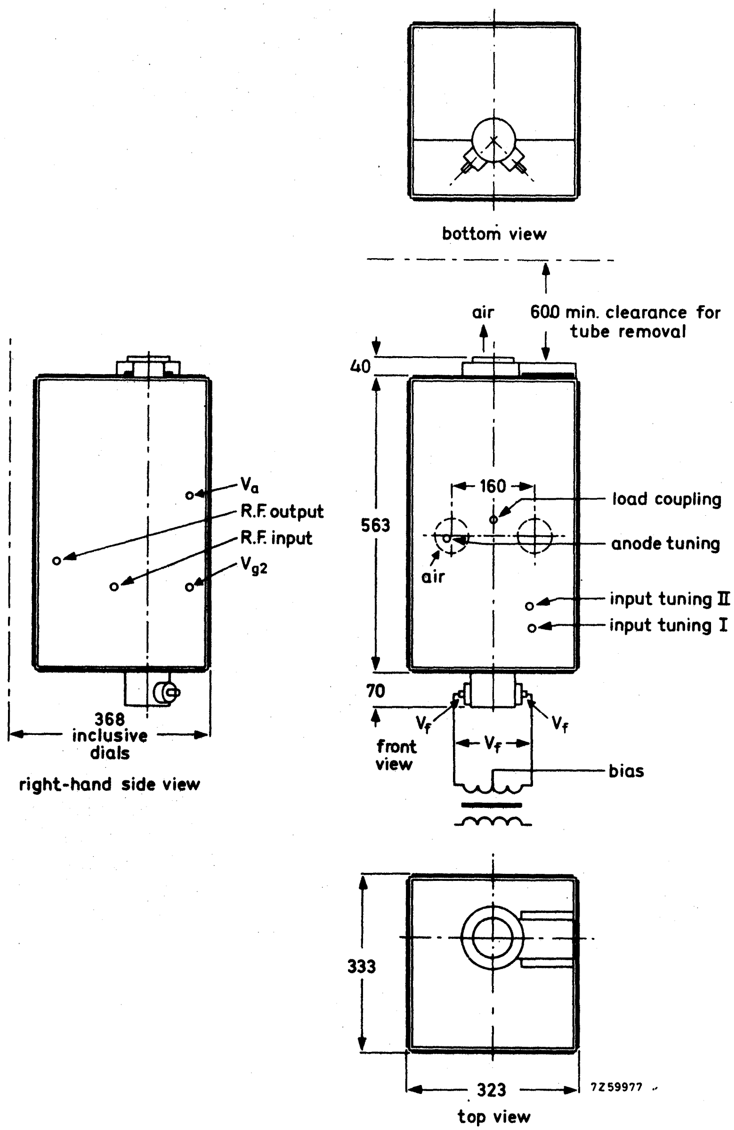


Fig. 1.

CIRCUIT DIAGRAM

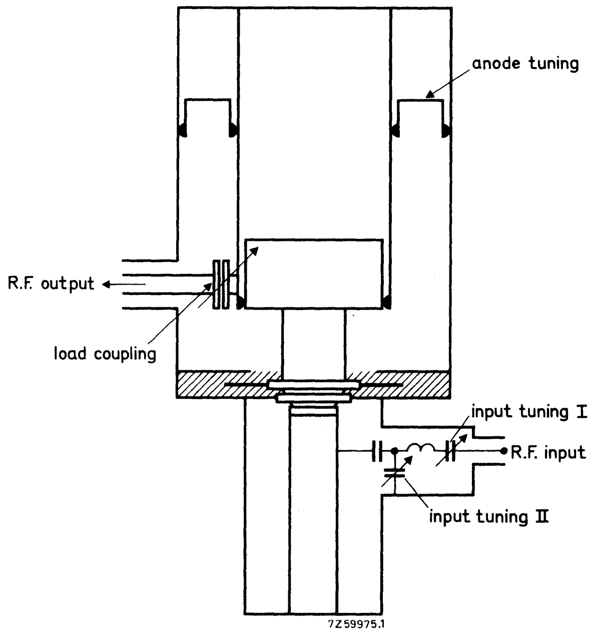


Fig. 2.

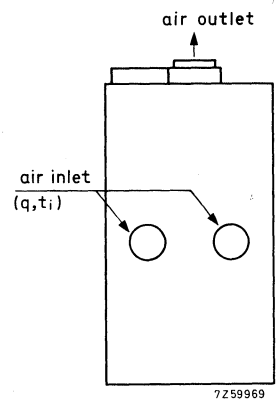


Fig. 3 Cooling air connector diagram.

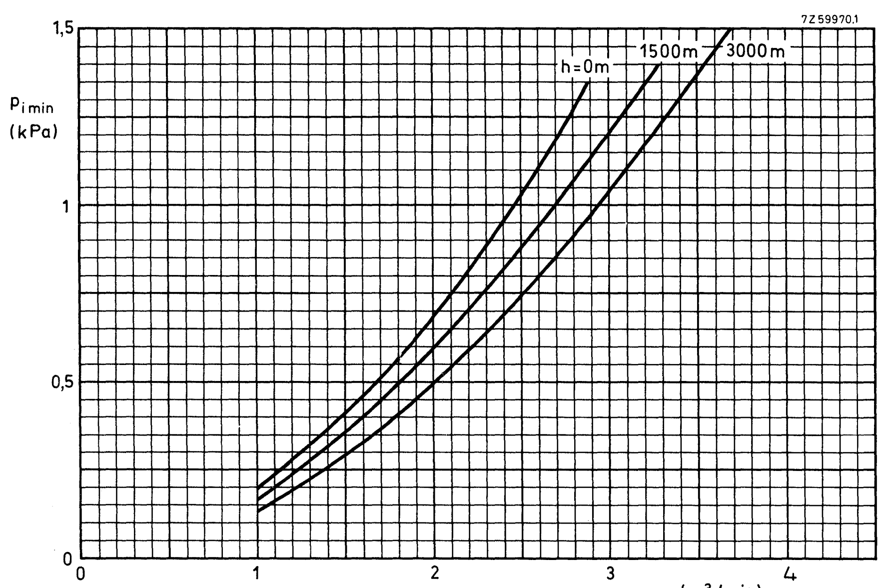


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 N.
Output: 50 Ω coaxial connector see page 233.

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

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

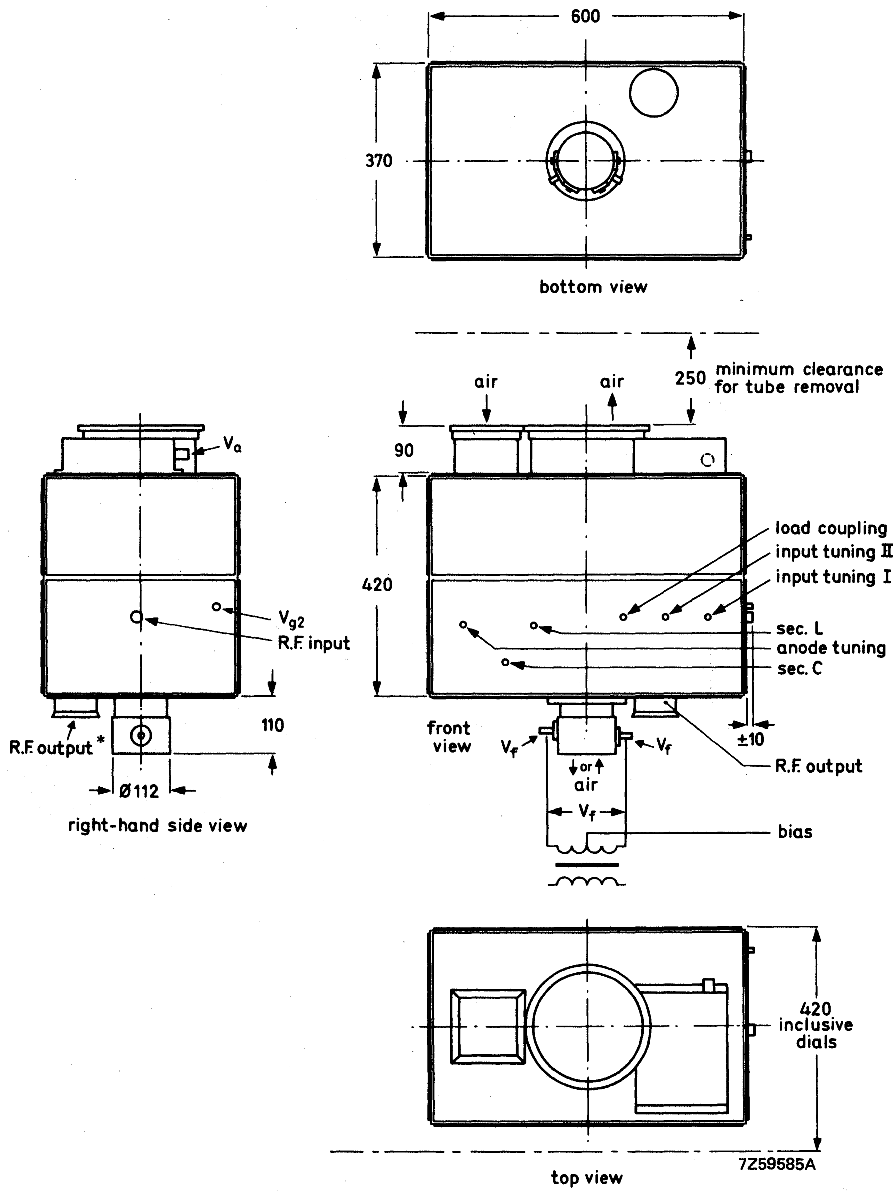
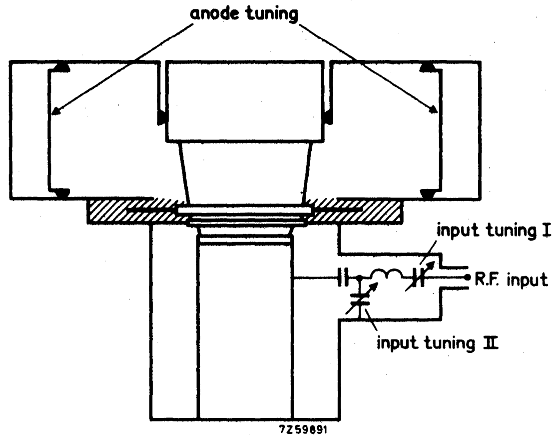


Fig. 1.

*See detail page 233.

CIRCUIT DIAGRAM



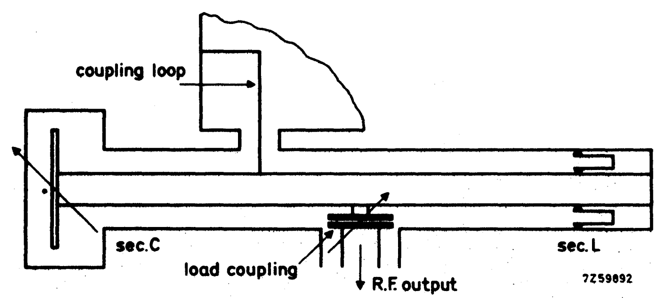


Fig. 2.

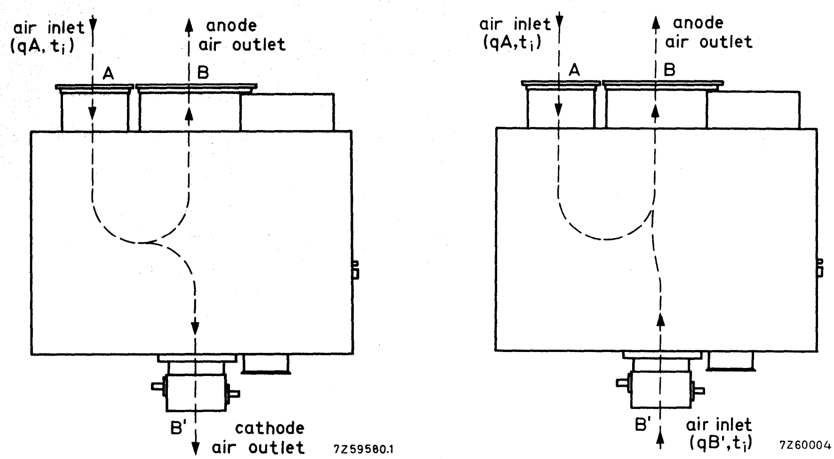


Fig. 3 Cooling air connector diagram.

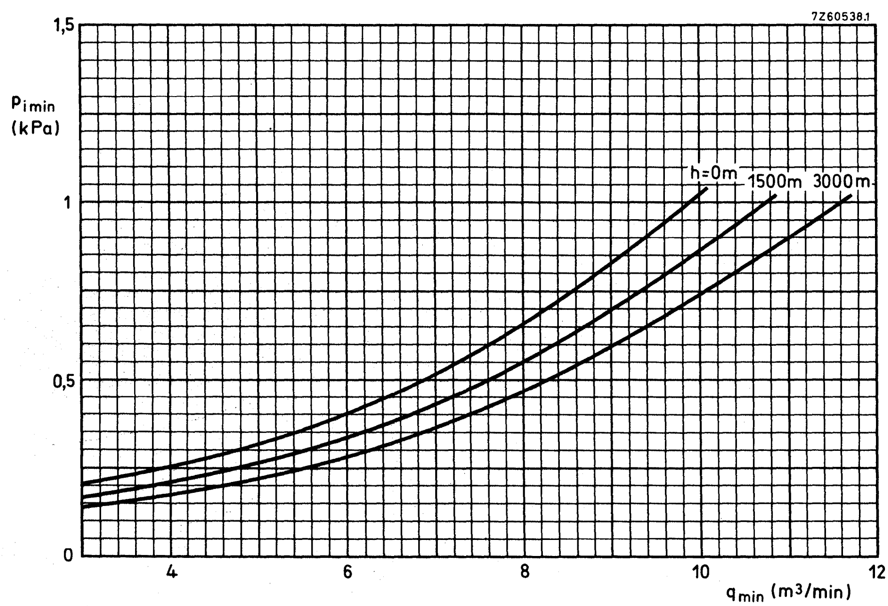


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B'; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

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 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 N.
Output: 50 Ω coaxial connector see page 233.

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

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

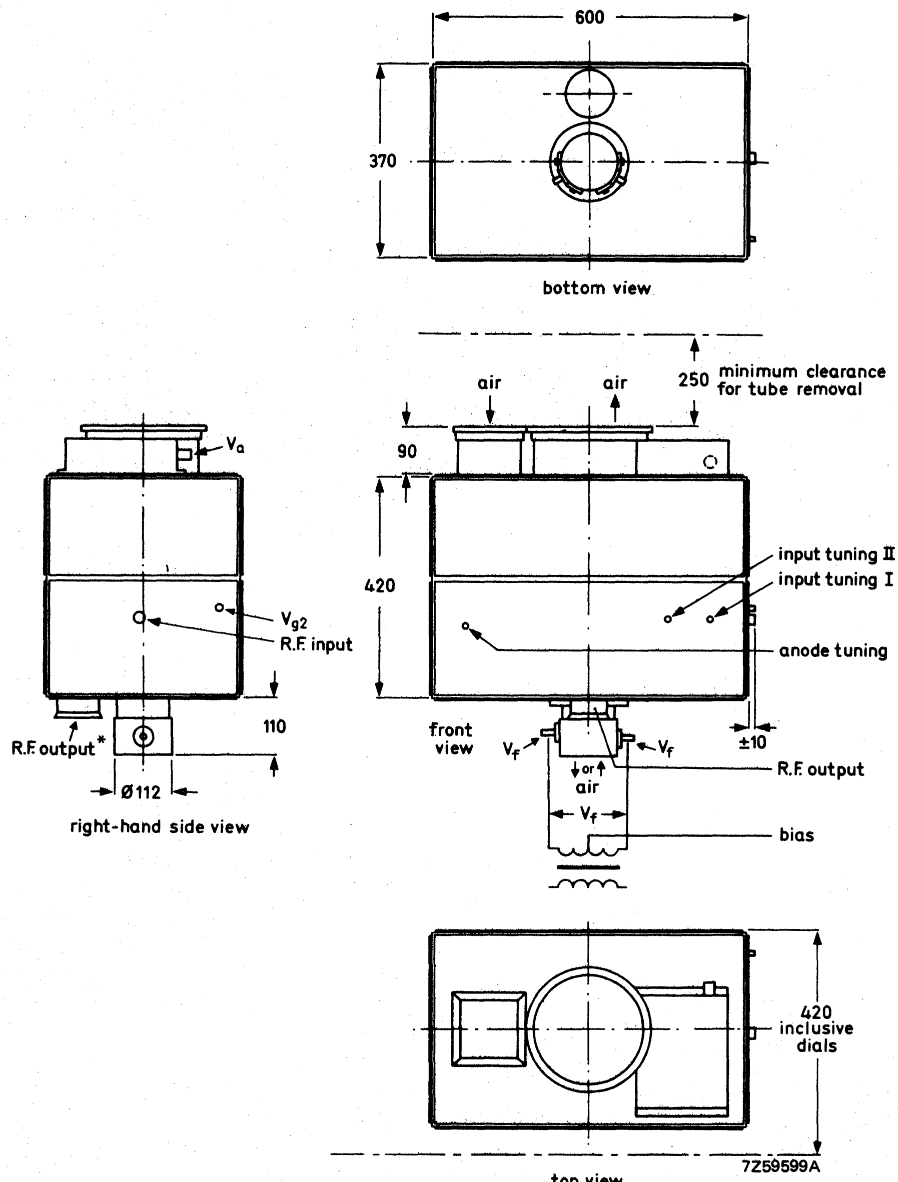
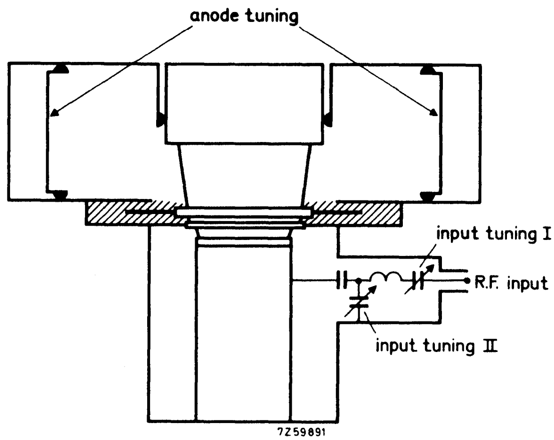


Fig. 1.

*See detail page 233.

CIRCUIT DIAGRAM



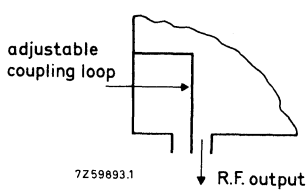


Fig. 2.

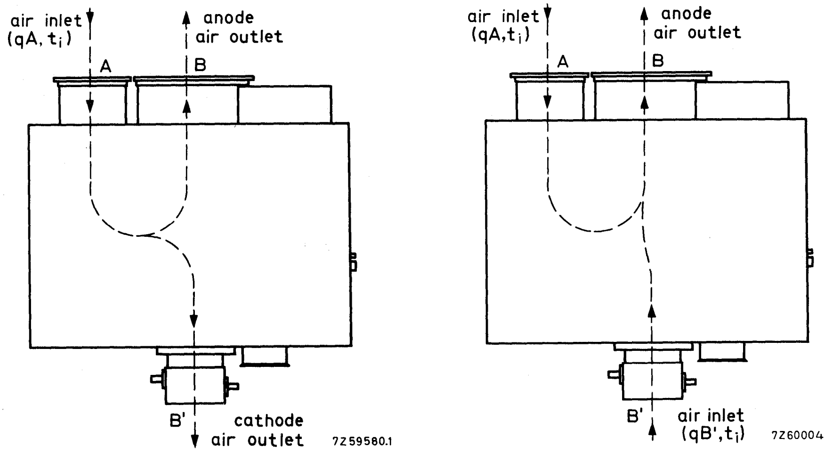


Fig. 3 Cooling air connector diagram.

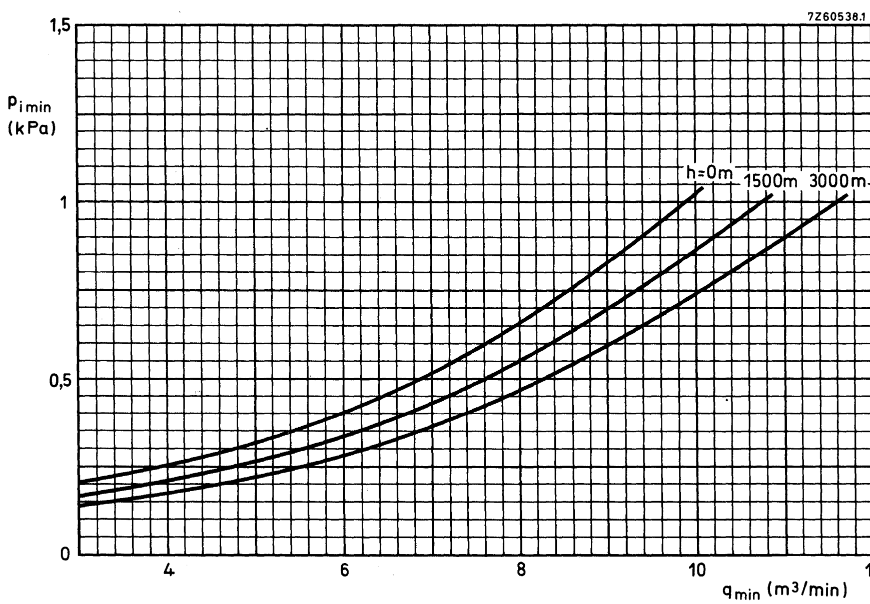


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.
p_i = pressure drop from plane A to plane B or B'; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

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 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 connector see page 233.

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

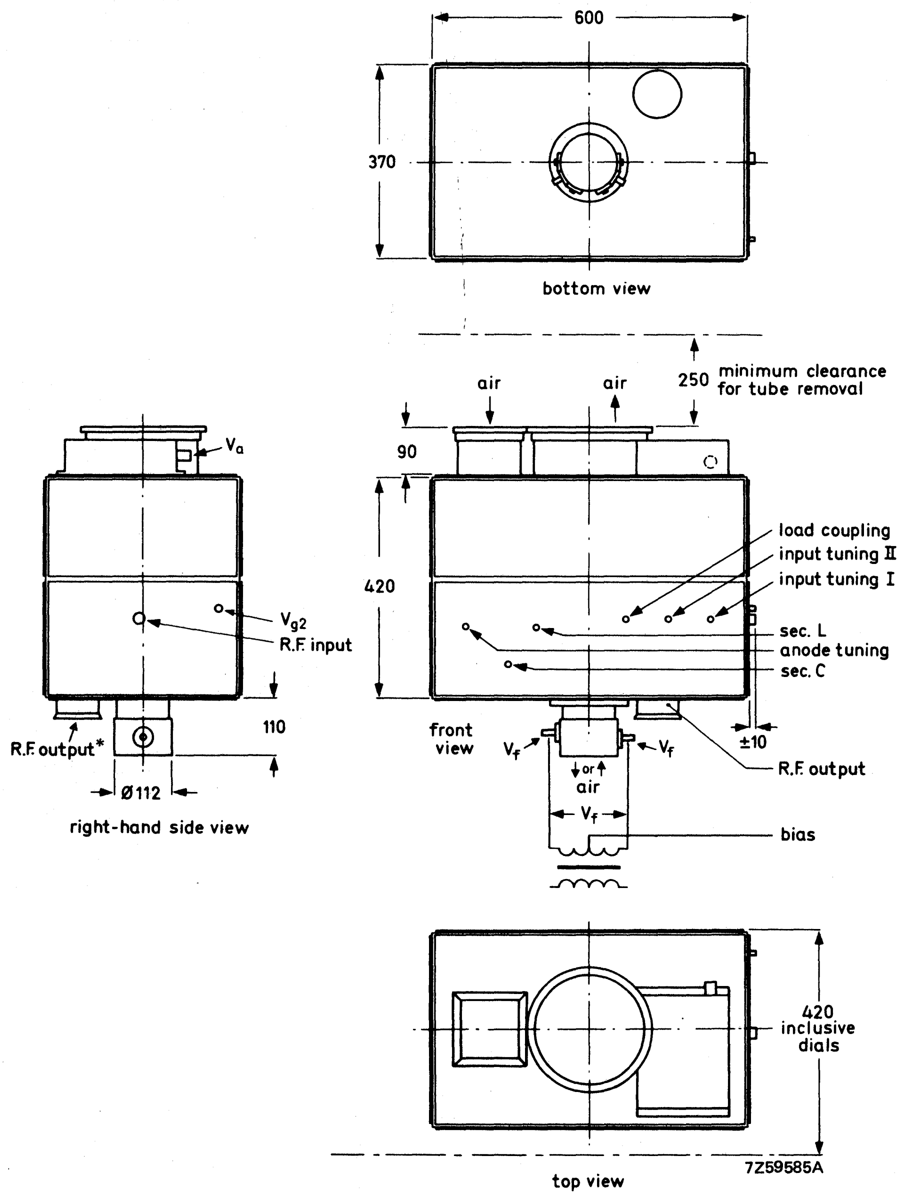
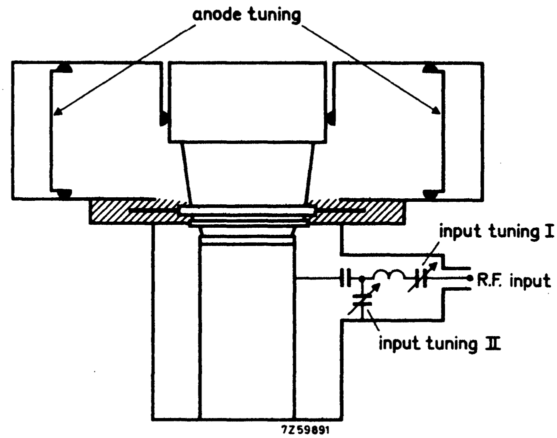


Fig. 1.

*See detail page 233.

CIRCUIT DIAGRAM



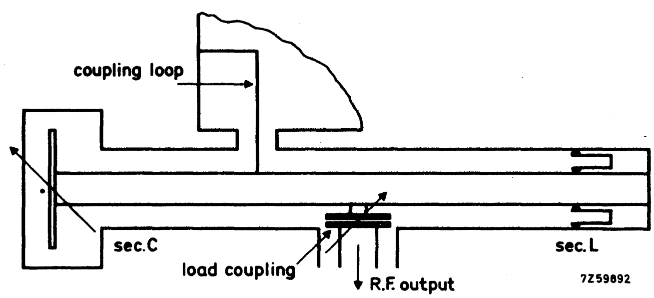


Fig. 2.

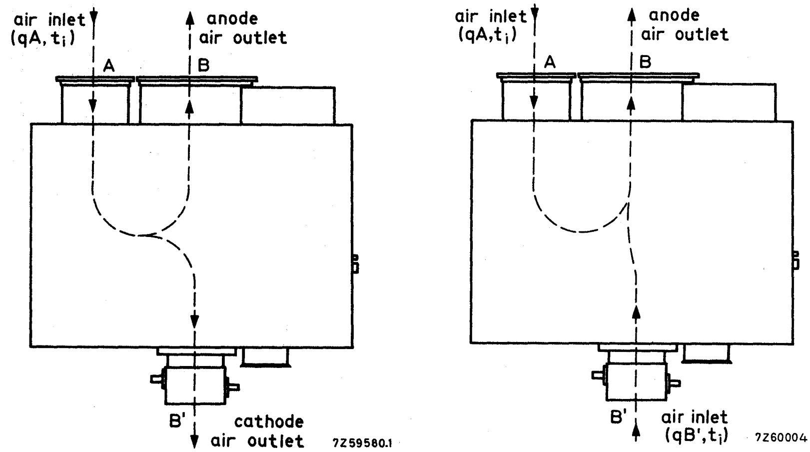


Fig. 3 Cooling air connector diagram.

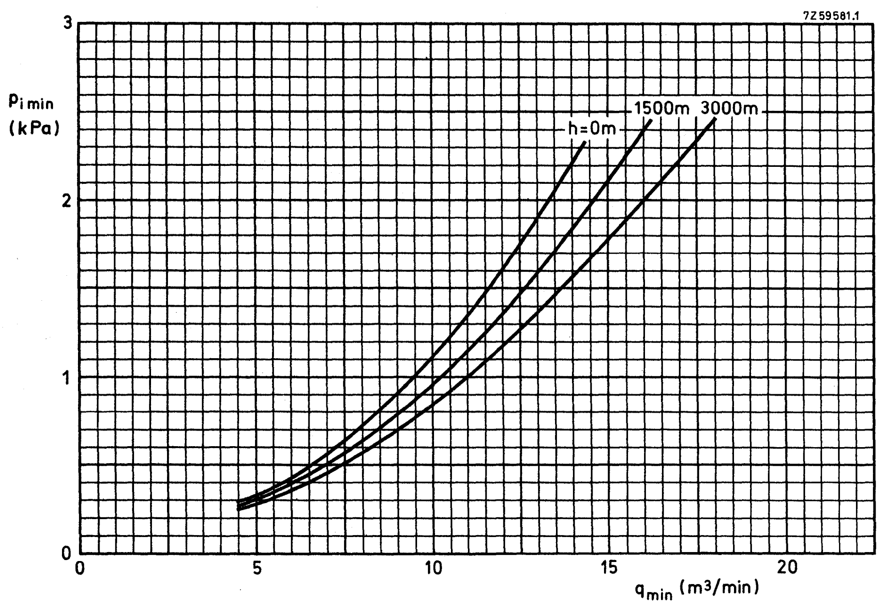


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B'; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

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 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 connector see page 233.

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:

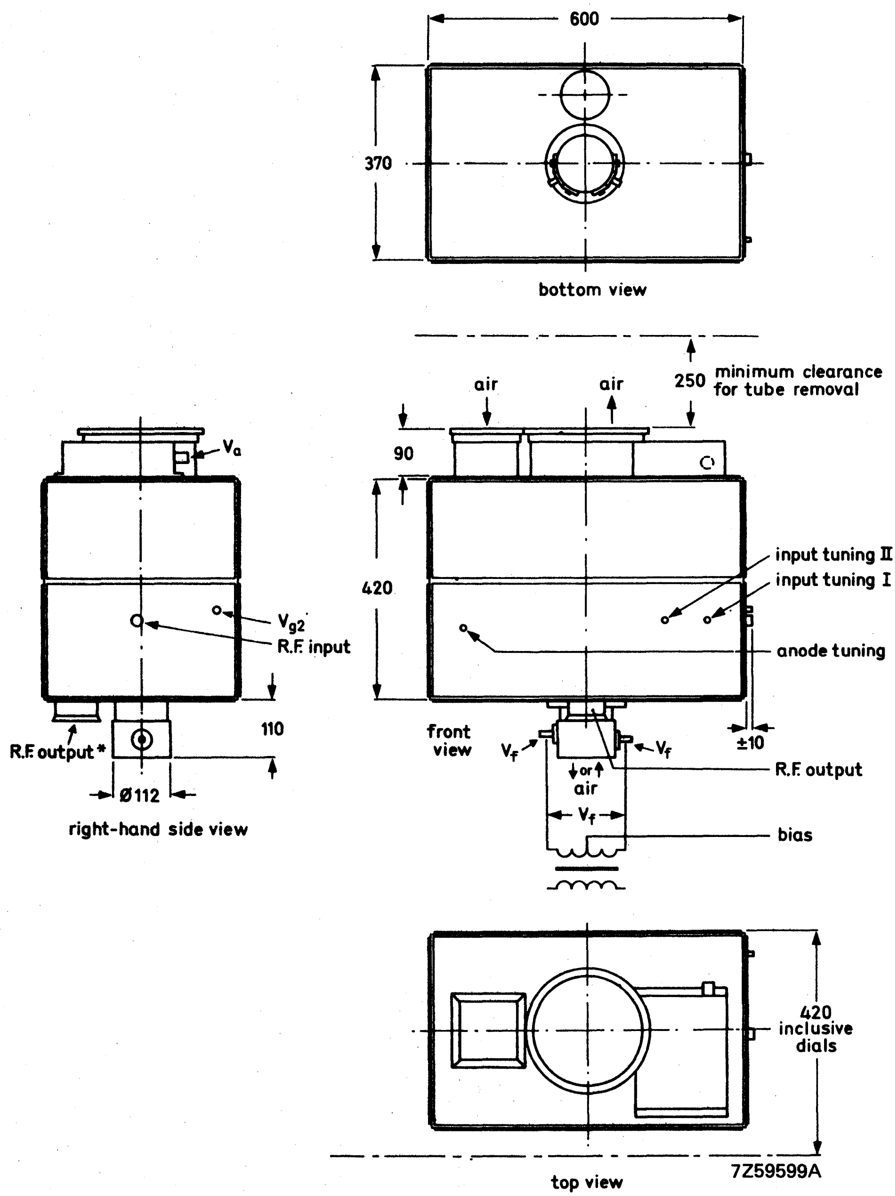
  Frequency 160 to 178 MHz; type 2722 162 01781
  173 to 204 MHz; type 2722 162 01861
  200 to 230 MHz; type 2722 162 01851

- Available on request:
  Tube lifter 8222 032 12062

OUTLINE DRAWING

Overall dimensions 620 x 610 x 420 mm

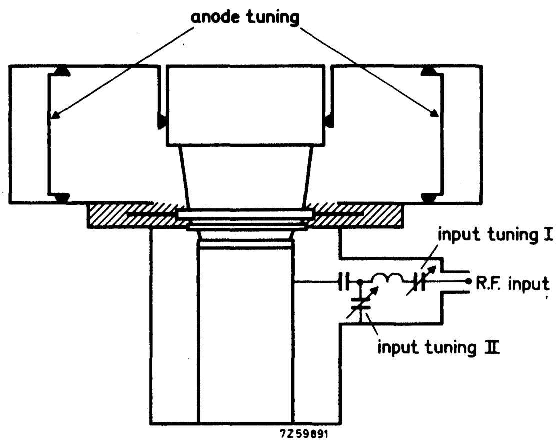
Net mass 54 kg



* See detail page 233.

Fig. 1.

CIRCUIT DIAGRAM



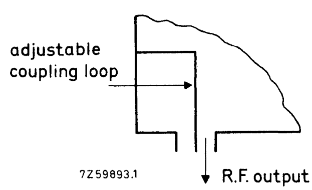


Fig. 2.

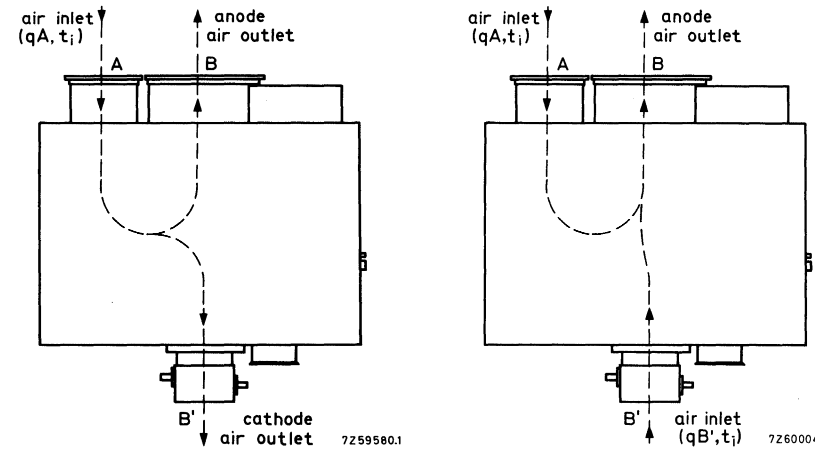


Fig. 3 Cooling air connector diagram.

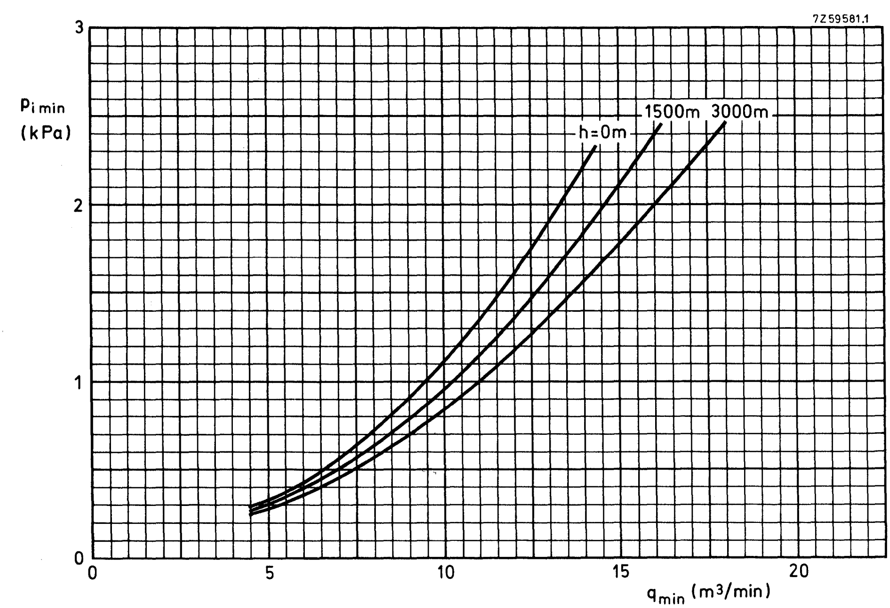


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B′; for blowing $q = q_A$, for sucking $q = q_A + q_{B'}$.

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 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 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

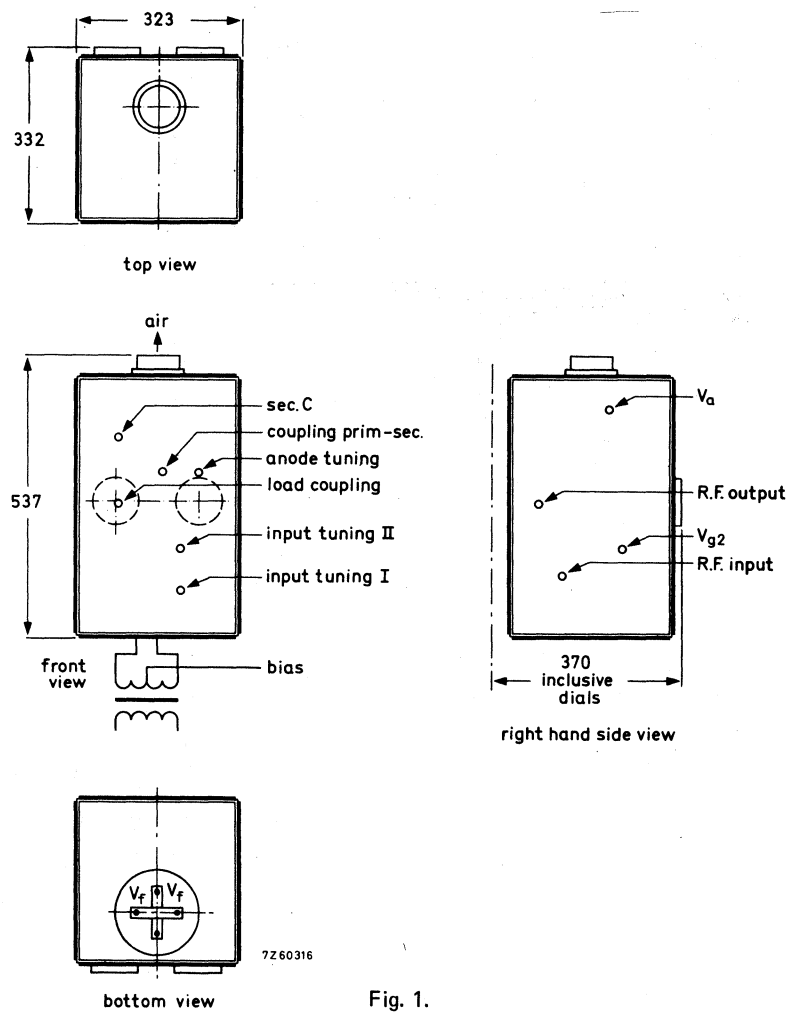


Fig. 1.

CIRCUIT DIAGRAM

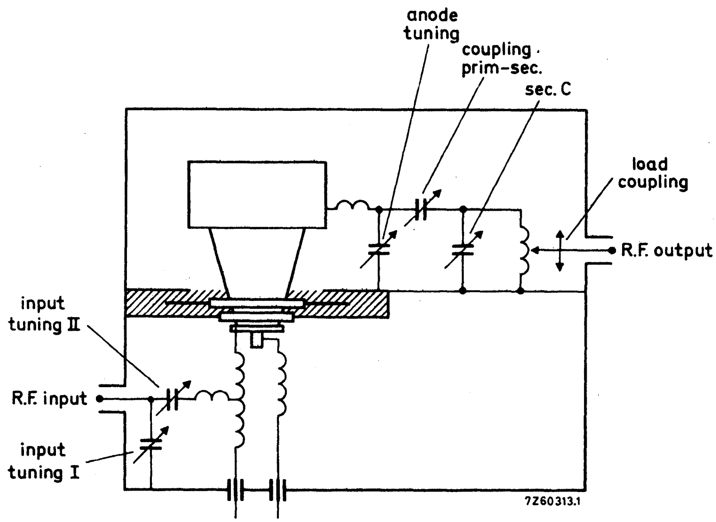


Fig. 2.

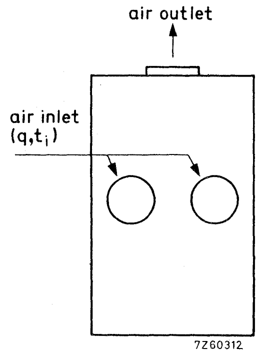


Fig. 3 Cooling air connector diagram.

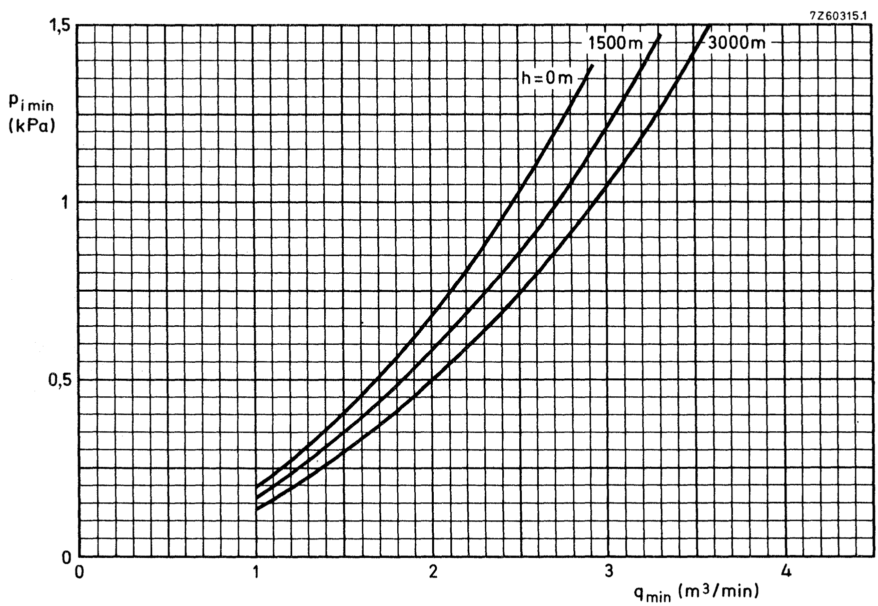


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 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

Overall dimensions 573 x 343 x 370 mm

Net mass 22,5 kg

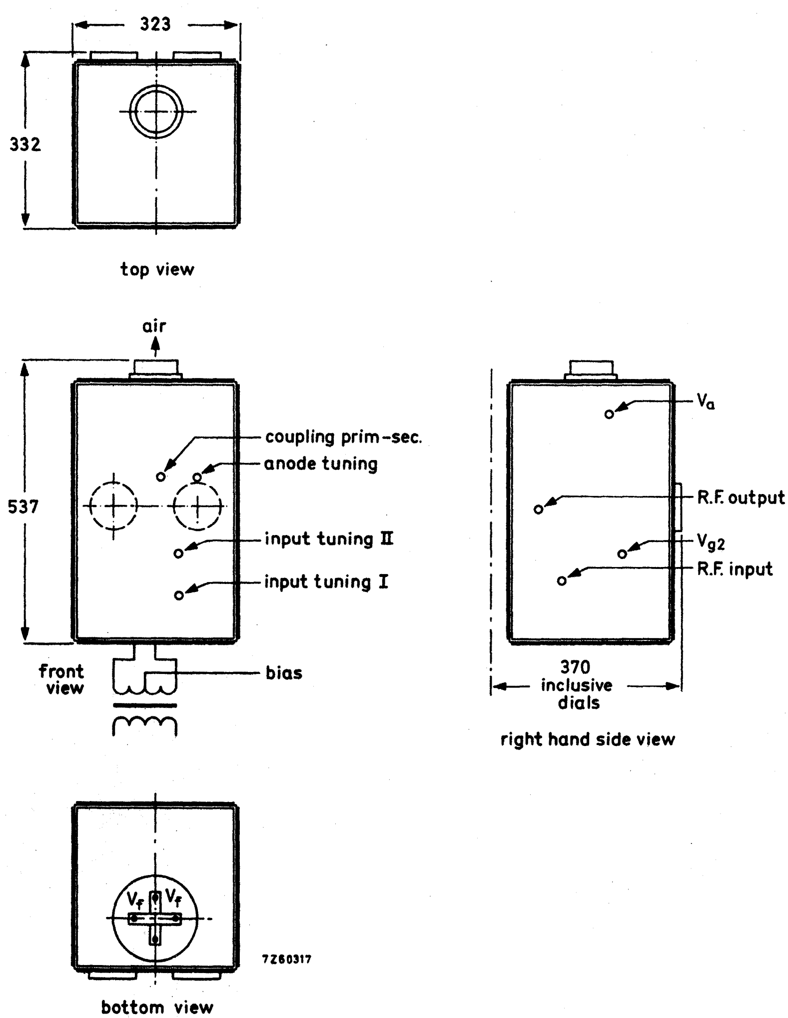


Fig. 1.

CIRCUIT DIAGRAM

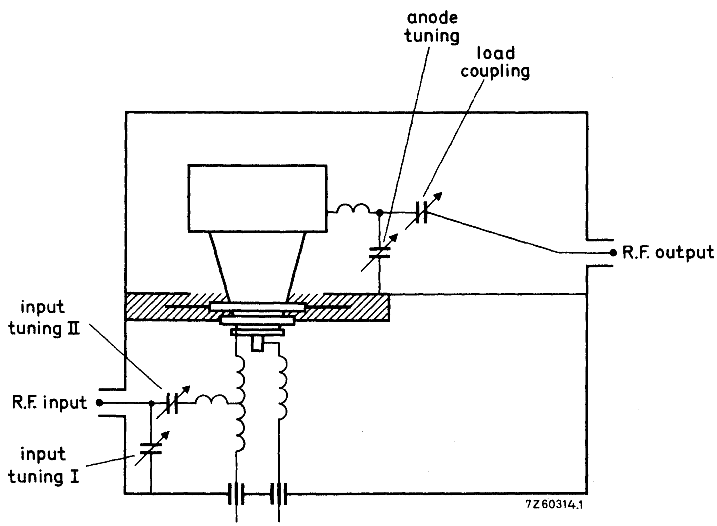


Fig. 2.

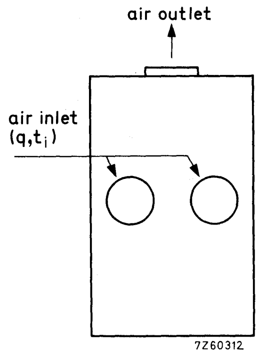


Fig. 3 Cooling air connector diagram.

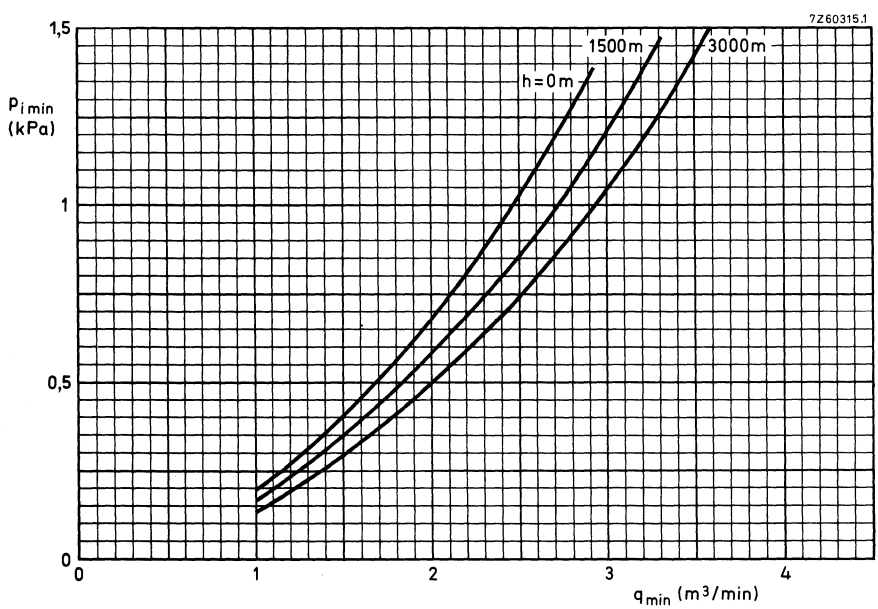


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 N.
Output: 50 Ω coaxial connector see page 233.

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

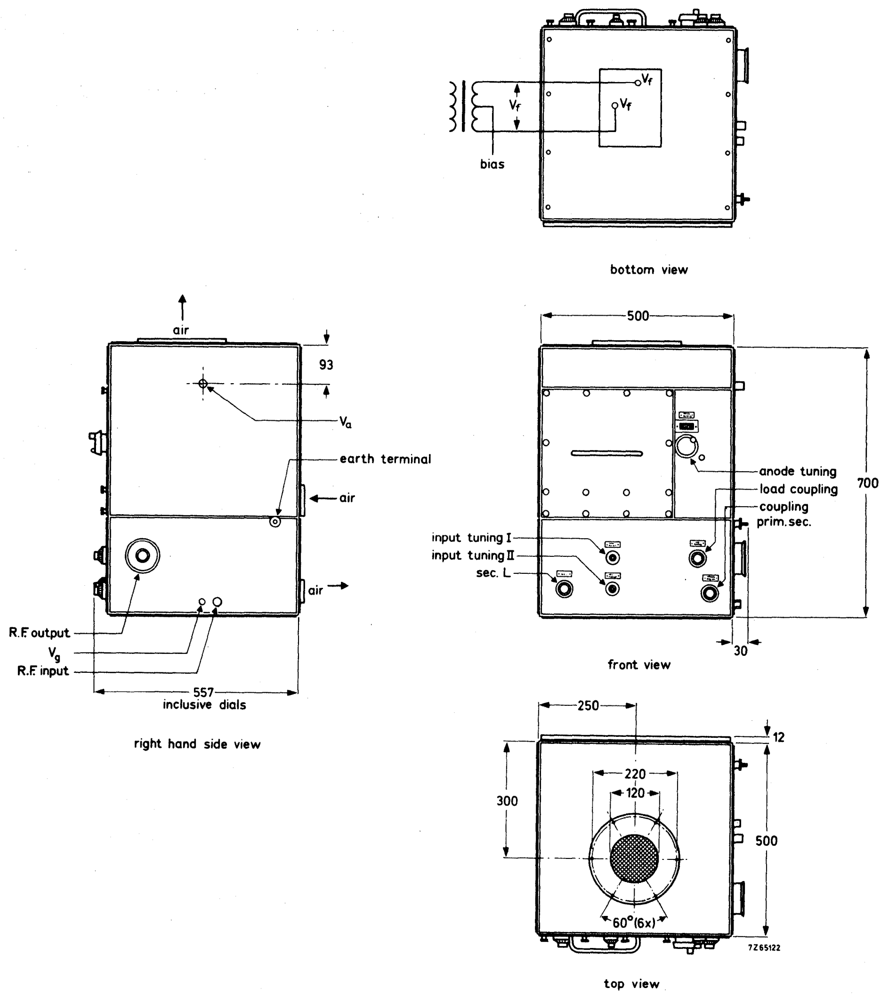


Fig. 1.

CIRCUIT DIAGRAM

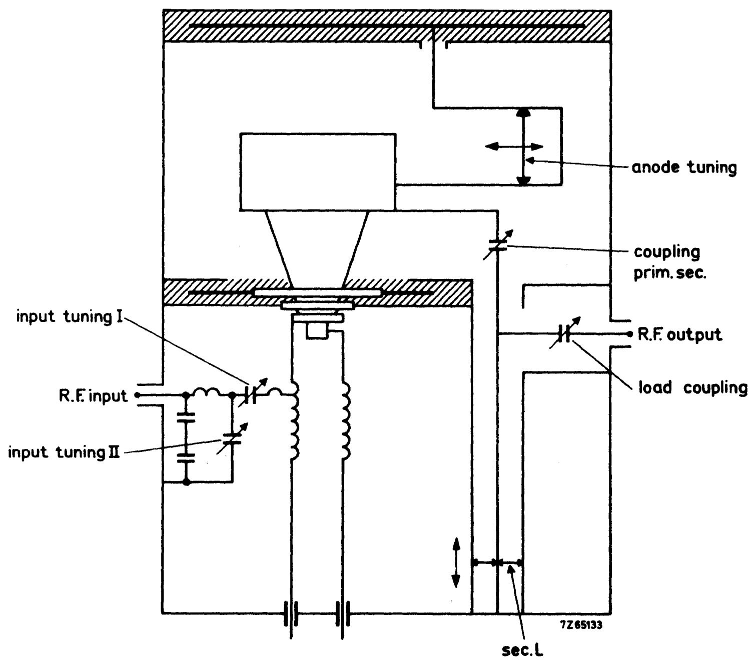


Fig. 2.

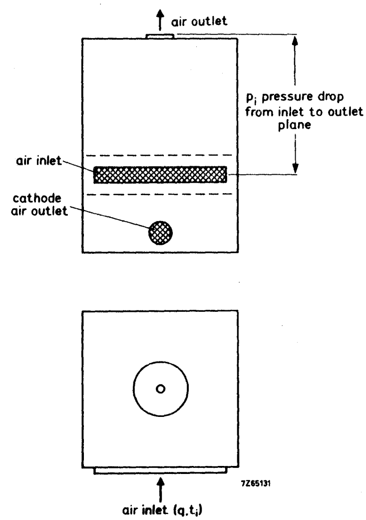


Fig. 3 Cooling air connector diagram.

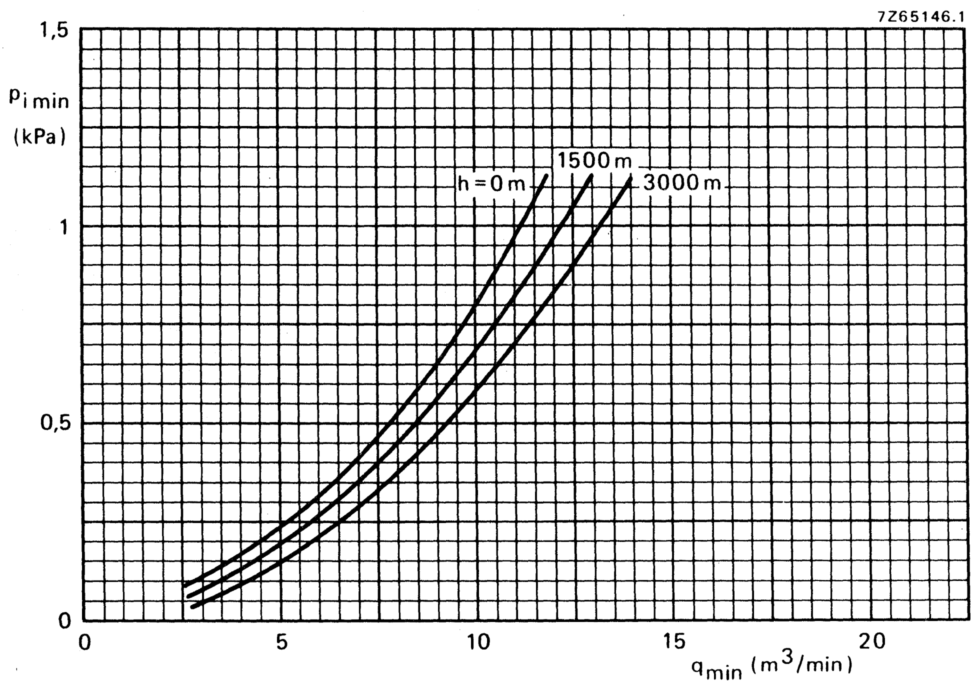


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 N.
Output: 50 Ω coaxial connector see page 233.

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

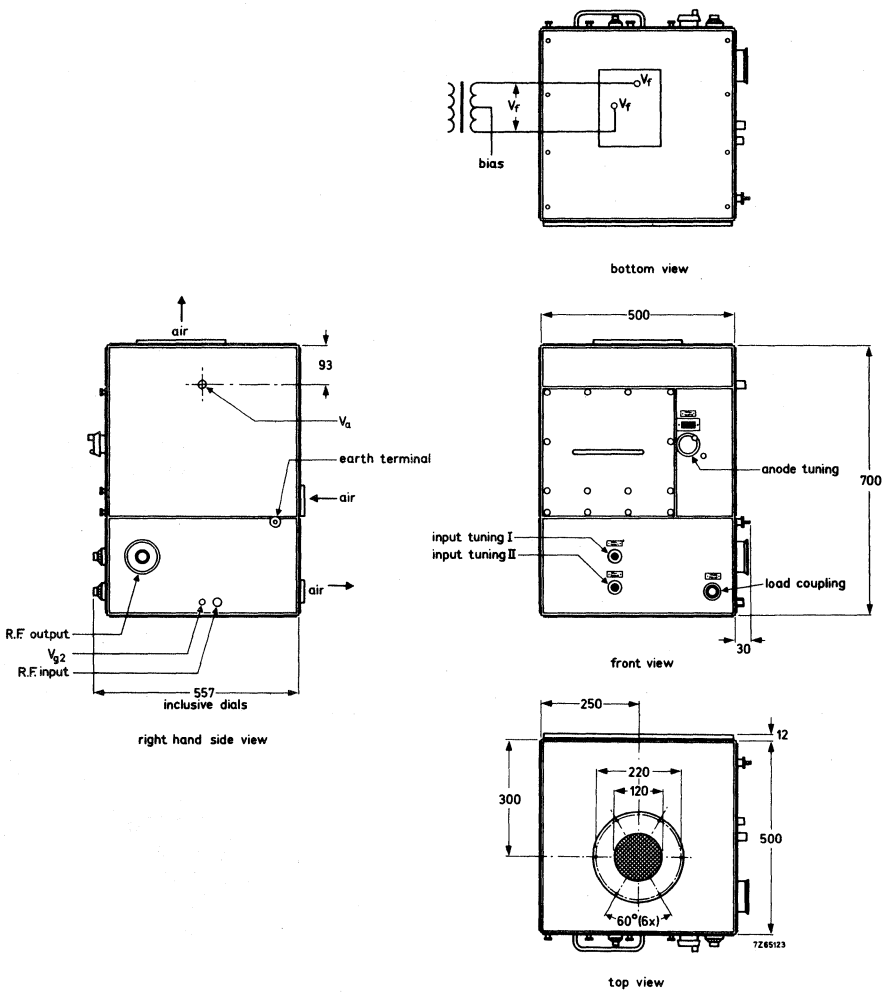


Fig. 1.

CIRCUIT DIAGRAM

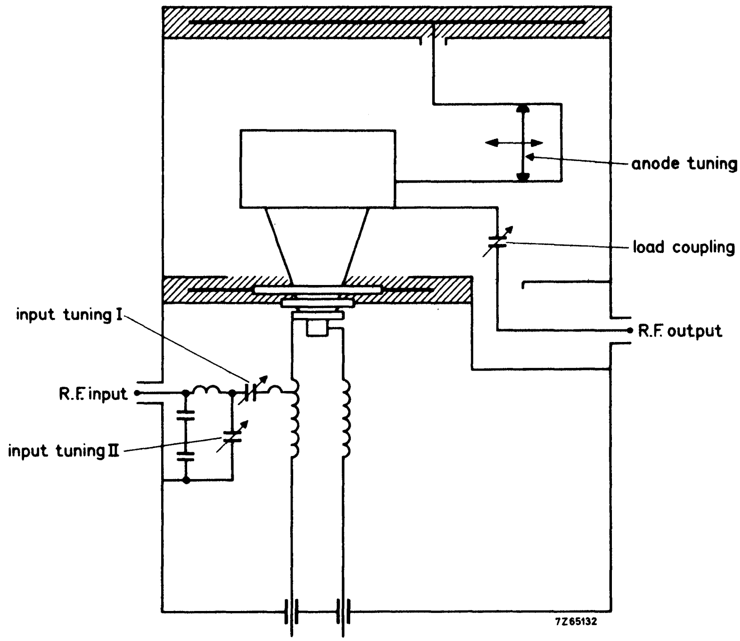


Fig. 2.

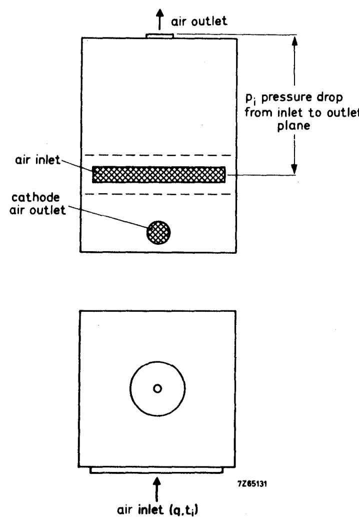


Fig. 3 Cooling air connector diagram.

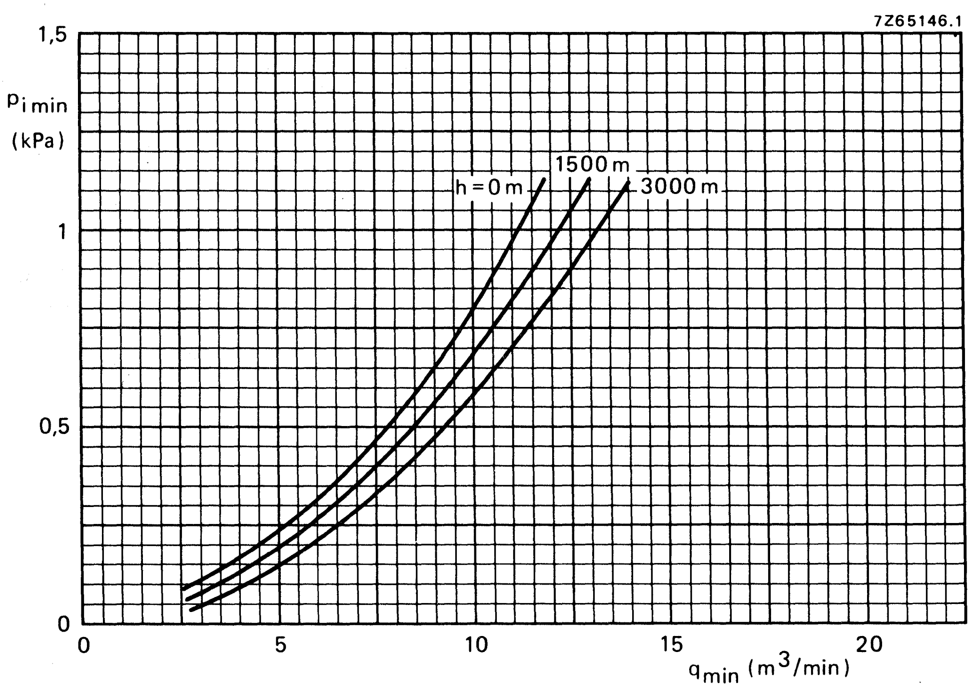


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 connector see page 233.

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

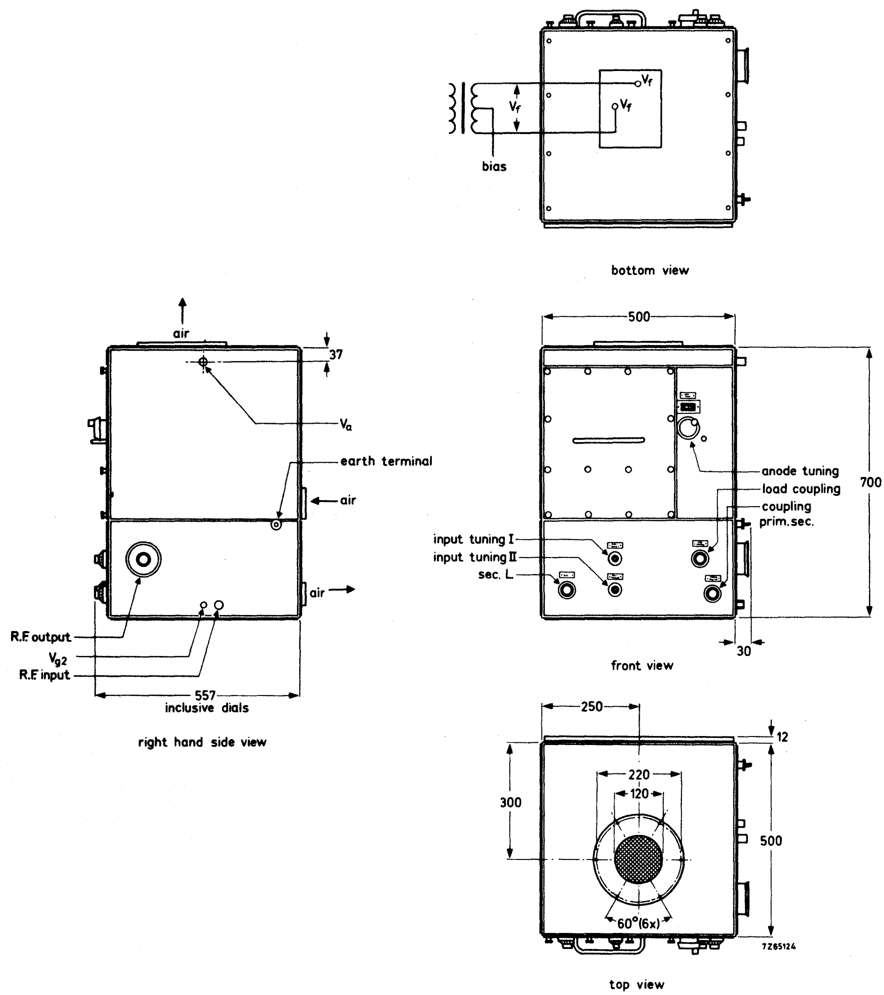


Fig. 1.

CIRCUIT DIAGRAM

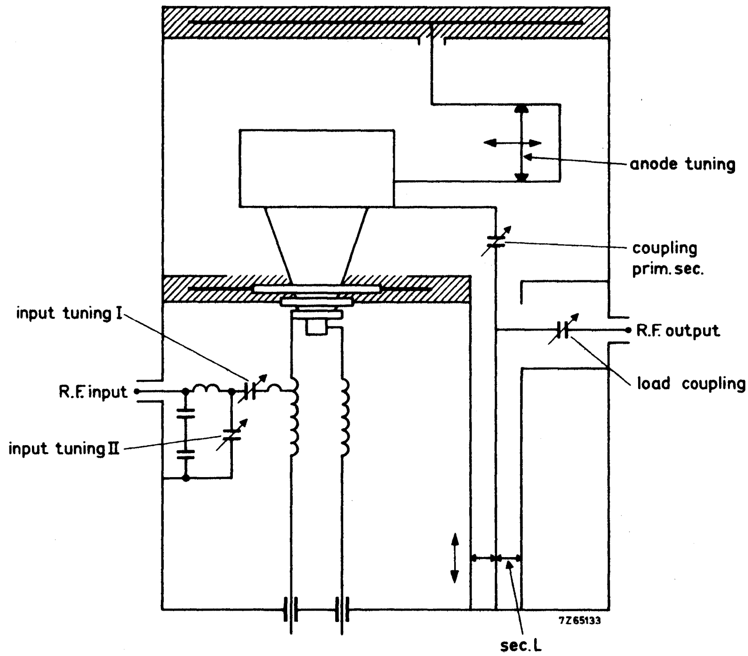


Fig. 2.

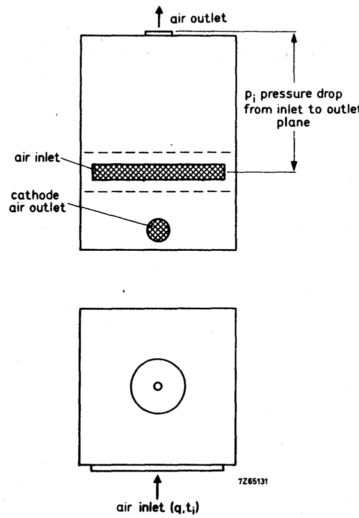


Fig. 3 Cooling air connector diagram.

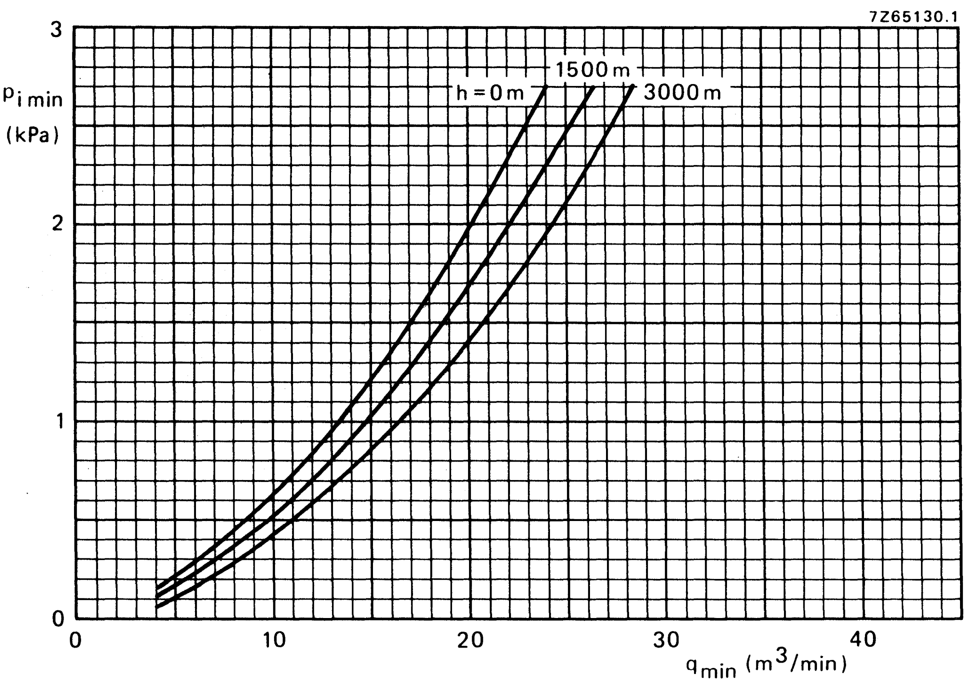


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 connector see page 233.

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

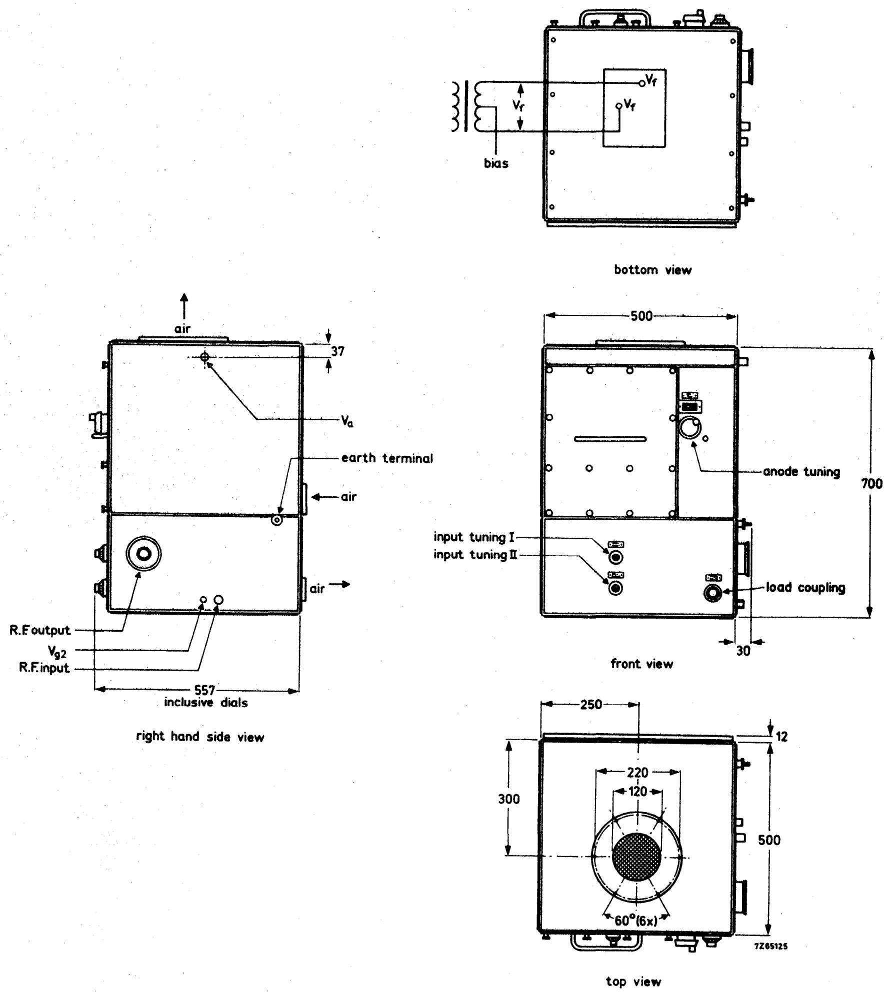


Fig. 1.

CIRCUIT DIAGRAM

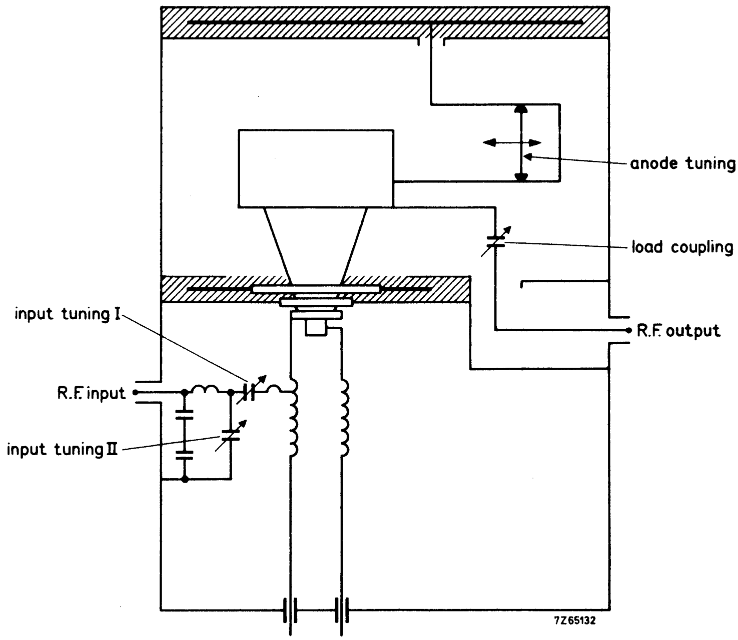


Fig. 2.

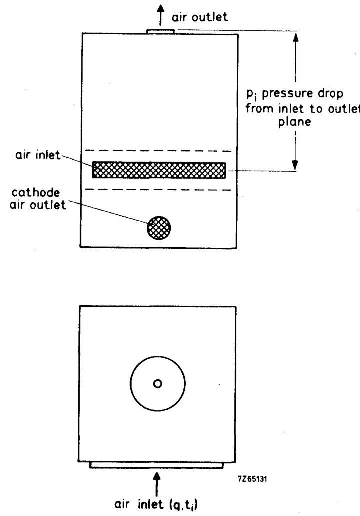


Fig. 3 Cooling air connector diagram.

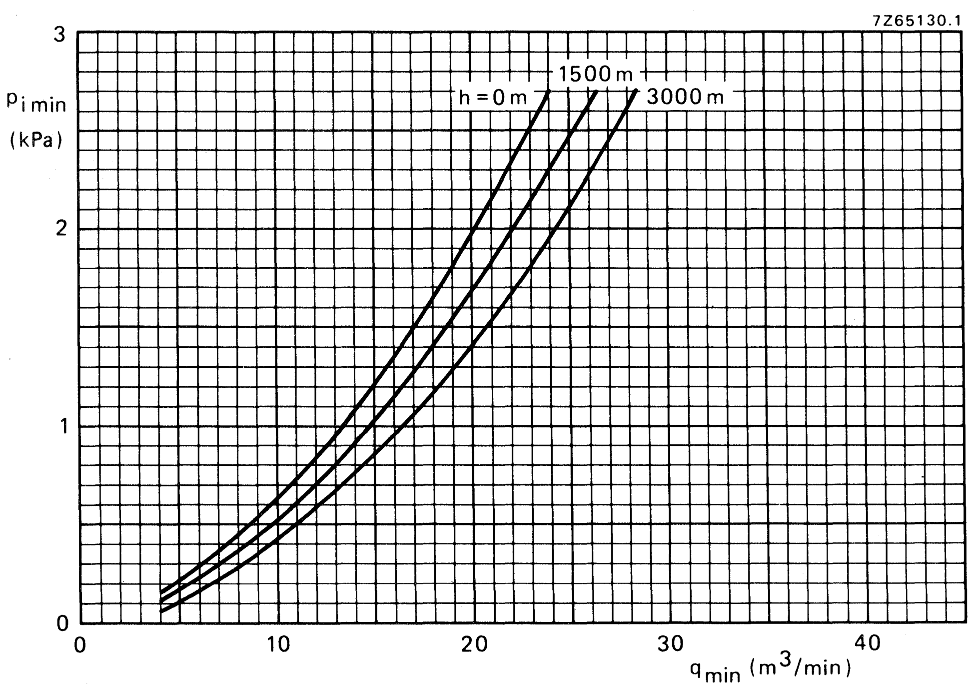


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 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 HN.
Output: 50 Ω coaxial connector see page 233.

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

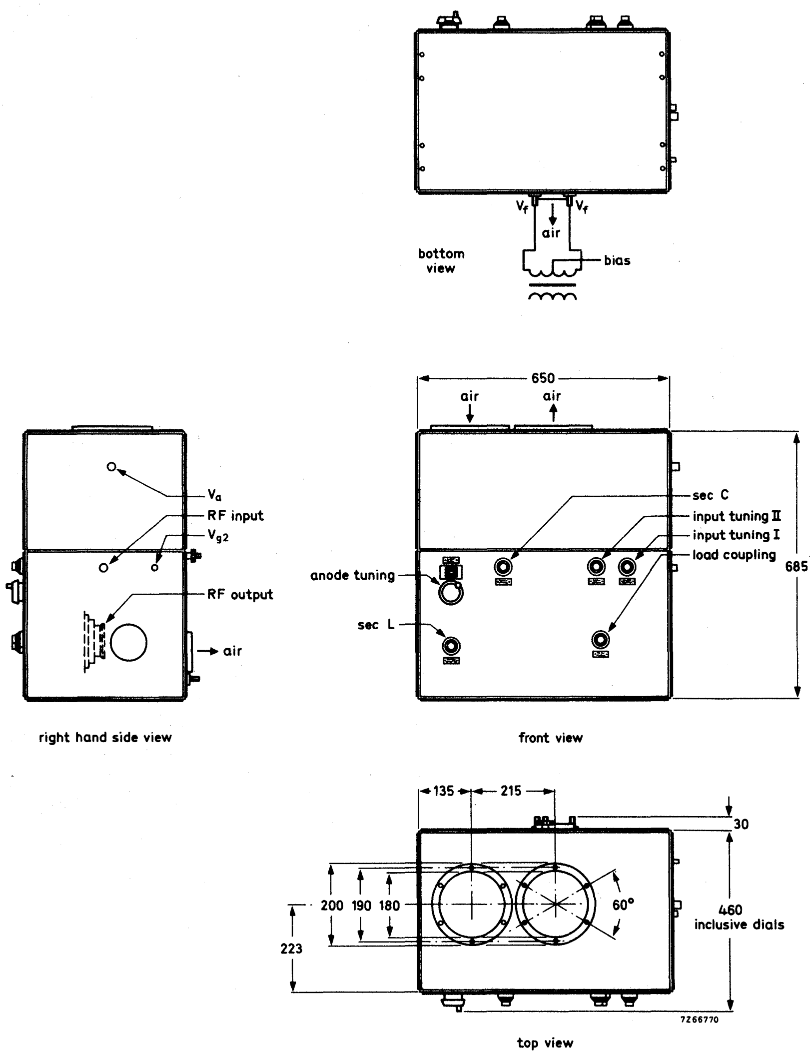


Fig. 1.

CIRCUIT DIAGRAM

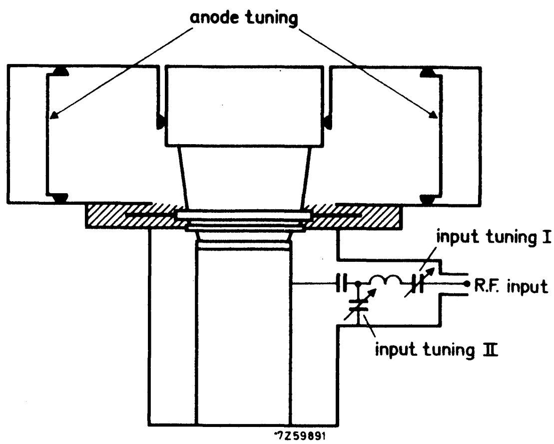


Fig. 2a.

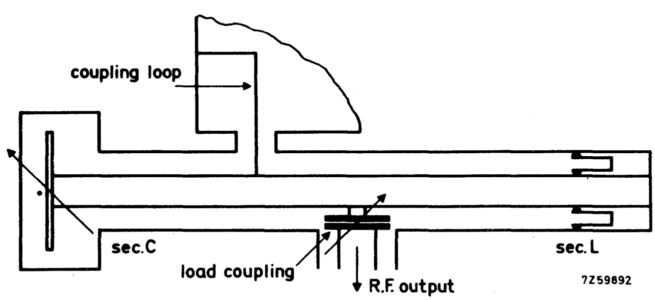


Fig. 2b.

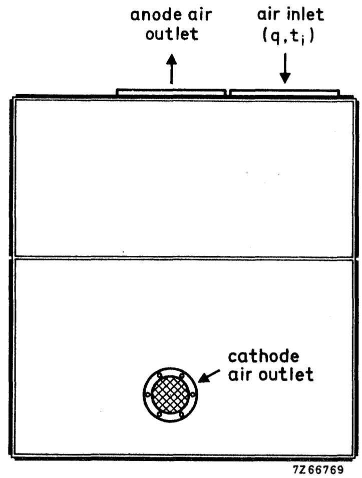


Fig. 3 Cooling air connector diagram.

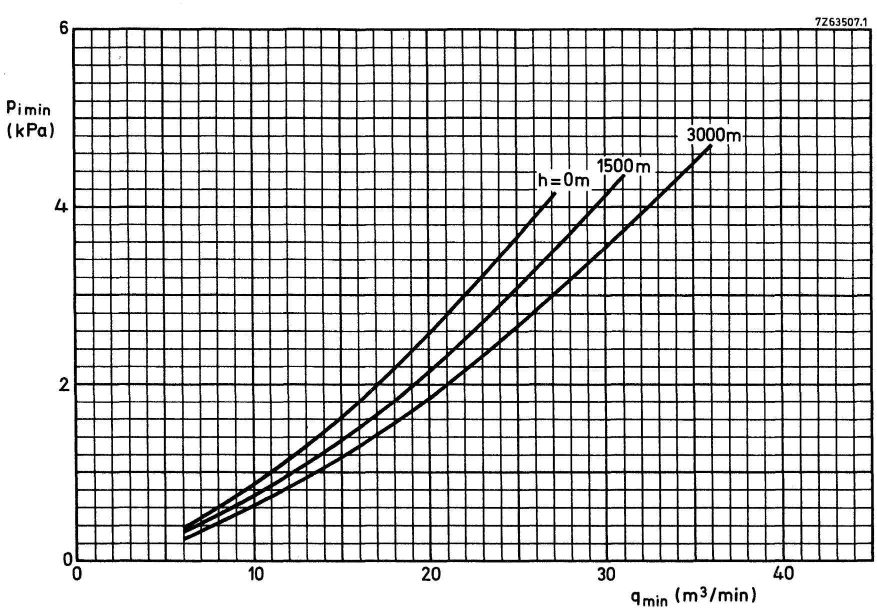


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND II AMPLIFIER CIRCUIT ASSEMBLY FOR YL1470
sound

Continuously tunable cavity-type circuit assembly to be used with YL1470 to form a grounded-cathode 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 218 to 220. 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

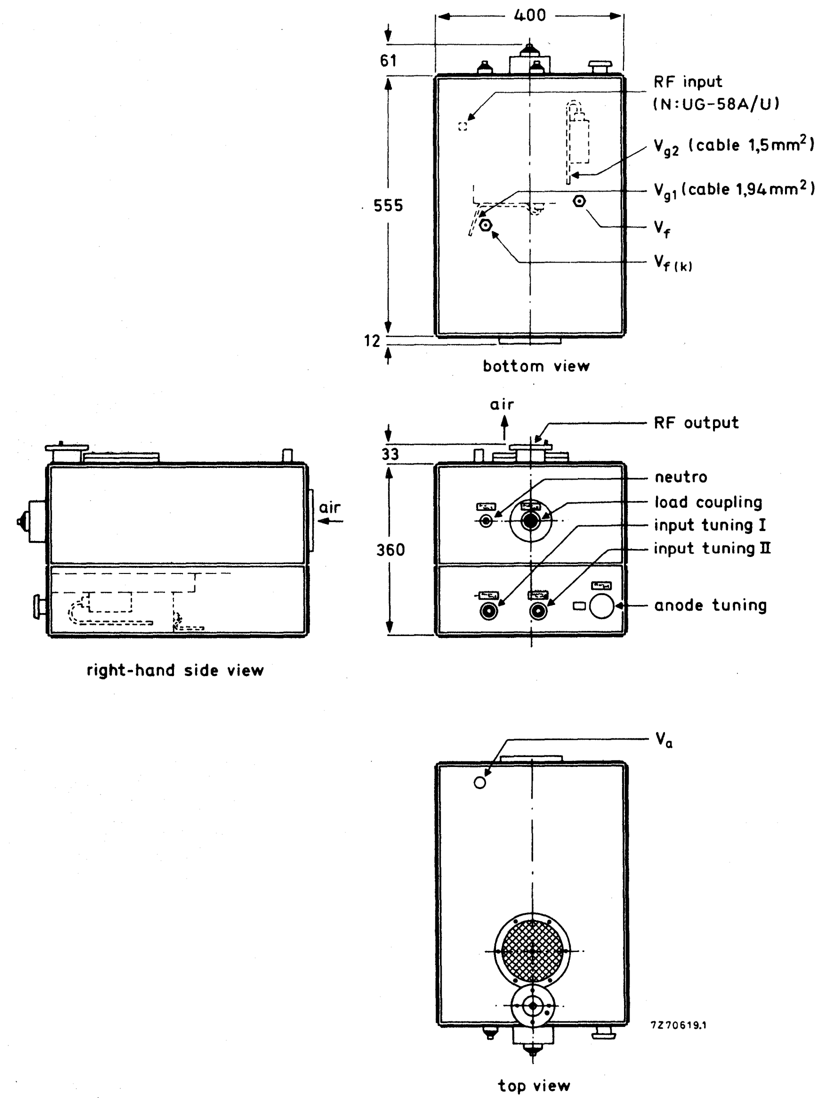


Fig. 1.

CIRCUIT DIAGRAM

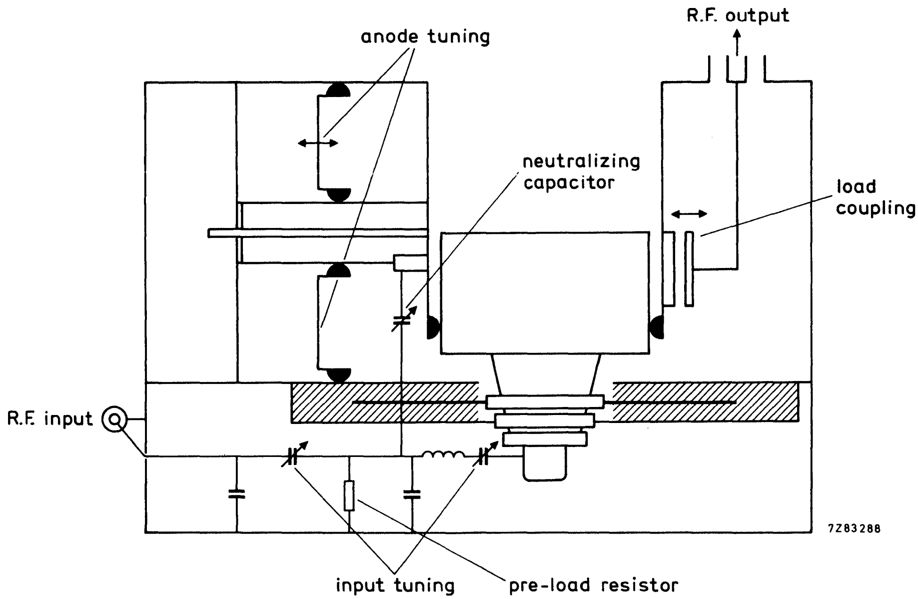


Fig. 2.

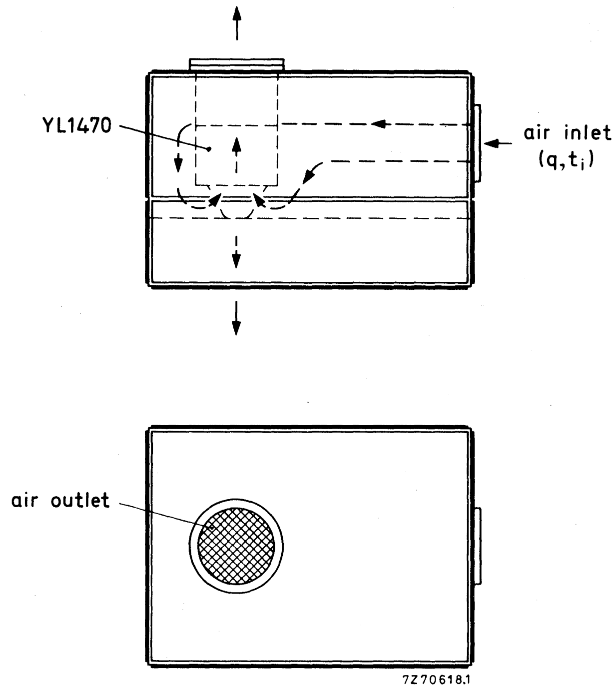


Fig. 3 Cooling air connector diagram.

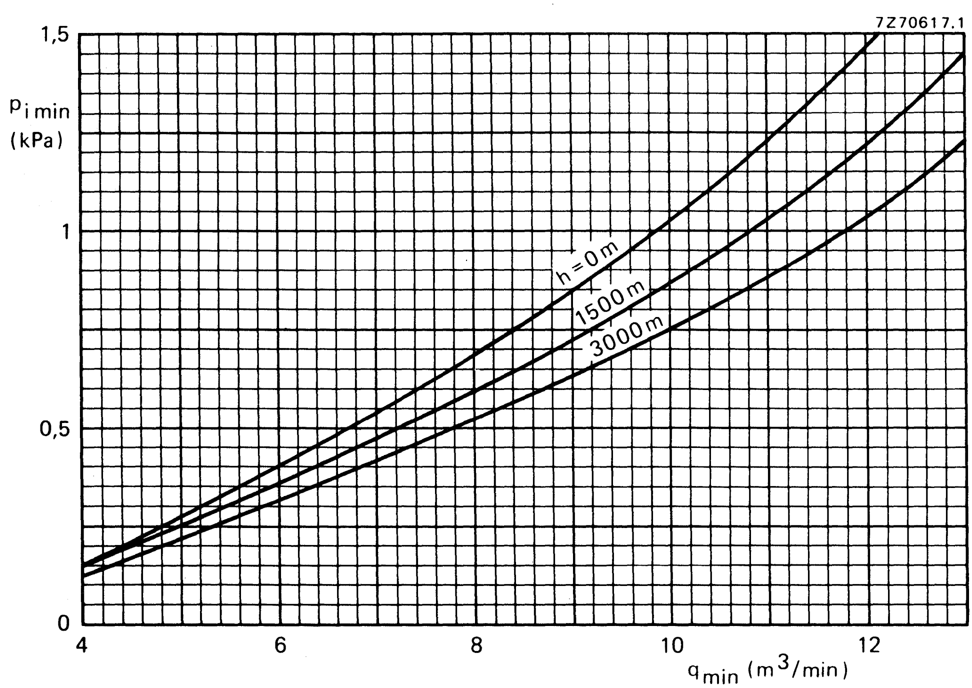


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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-cathode 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 221 to 223. 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

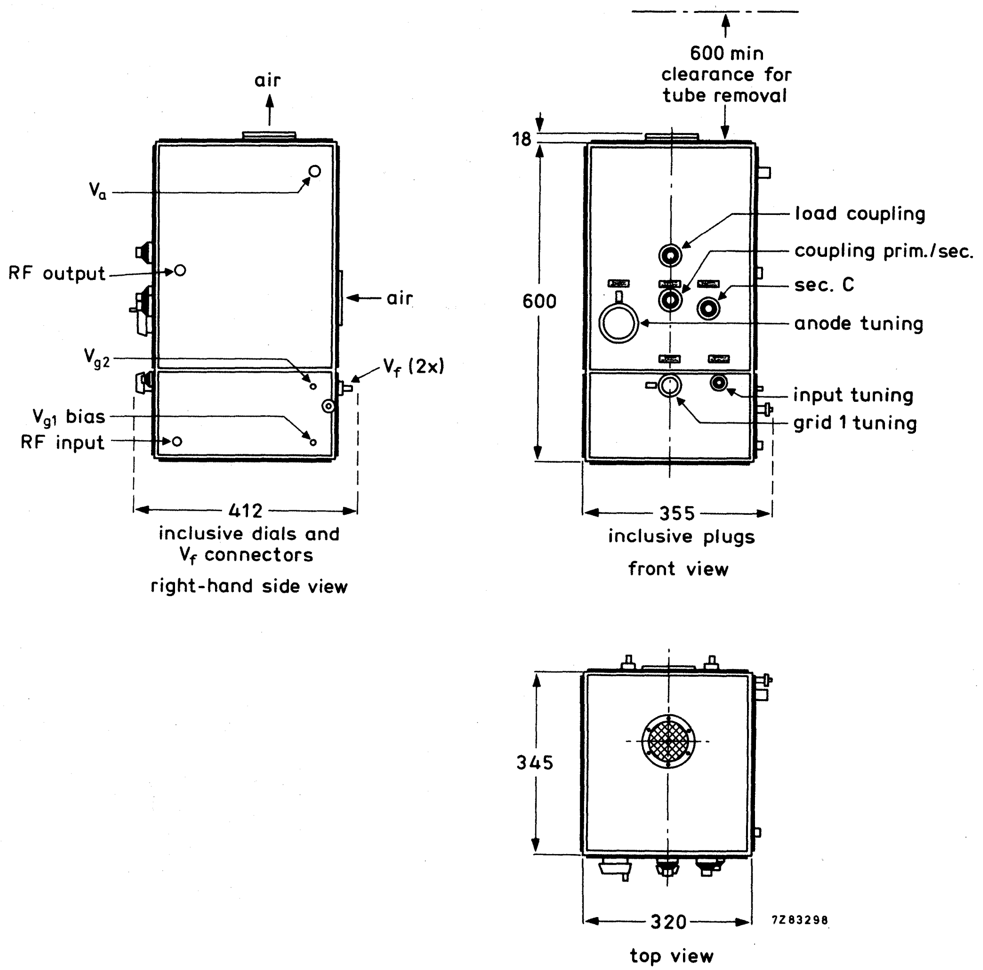


Fig. 1.

CIRCUIT DIAGRAM

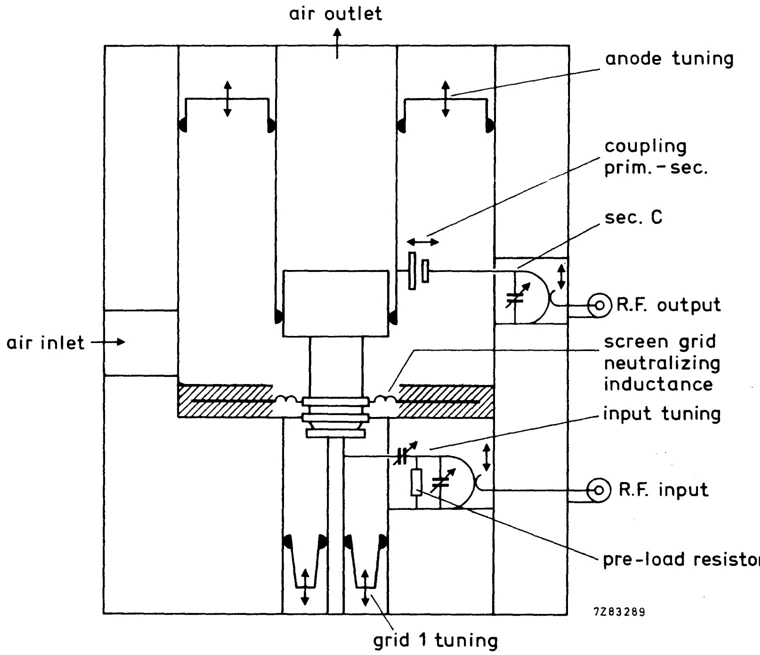


Fig. 2.

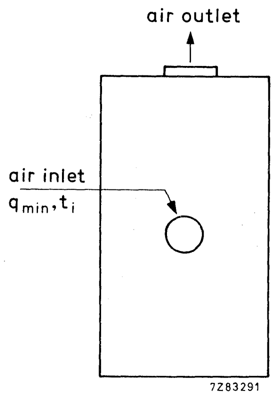


Fig. 3 Cooling air connector diagram.

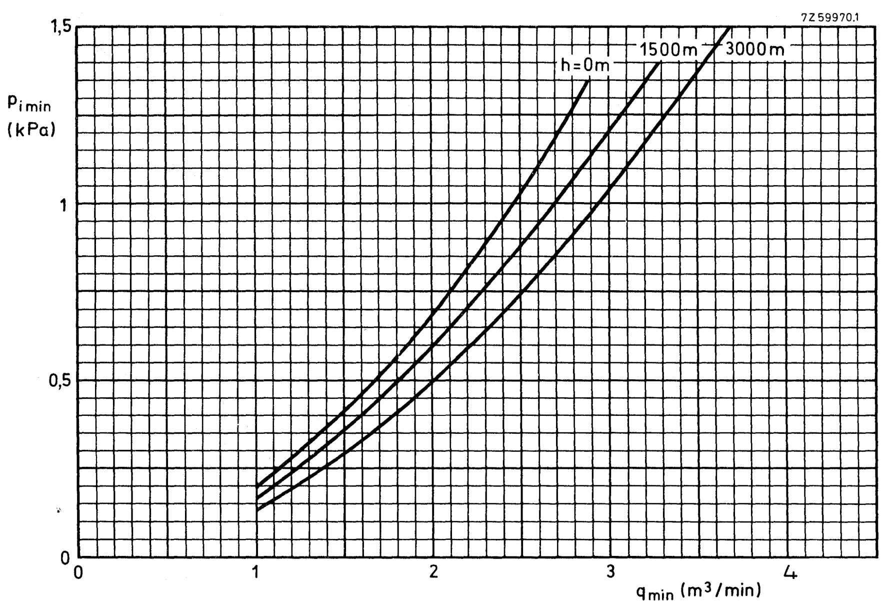


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

BAND III AMPLIFIER CIRCUIT ASSEMBLY FOR YL1540
sound

Continuously tunable cavity-type circuit assembly to be used with YL1540 to form a grounded-cathode 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 221 to 223. 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

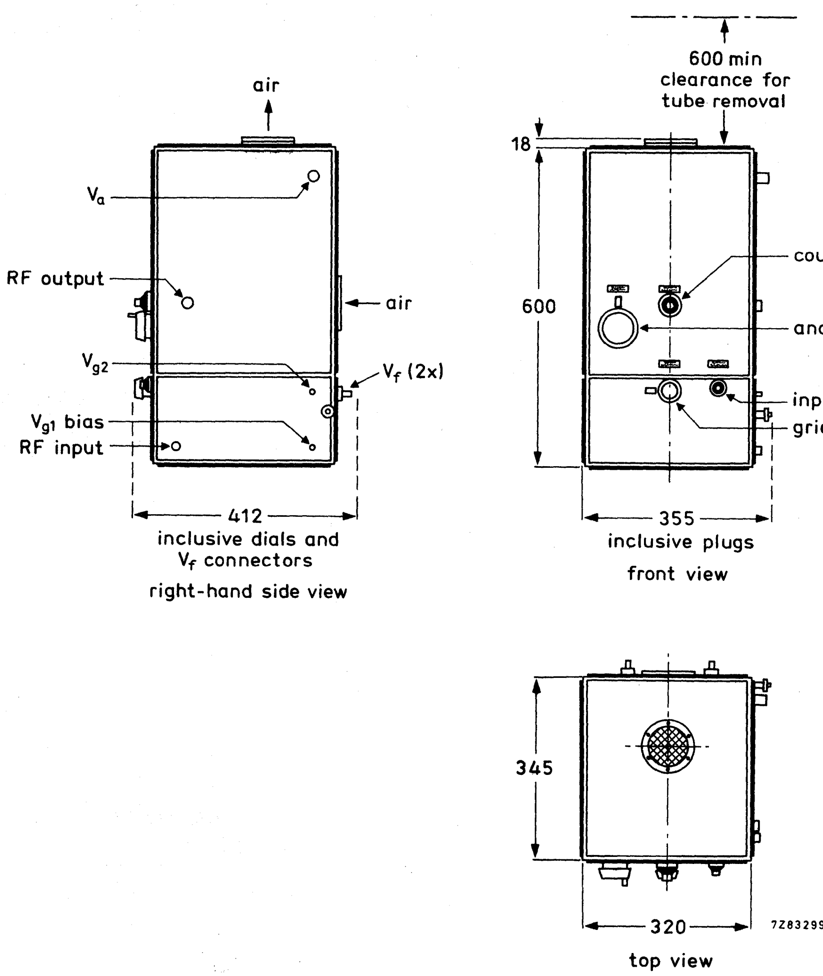


Fig. 1.

CIRCUIT DIAGRAM

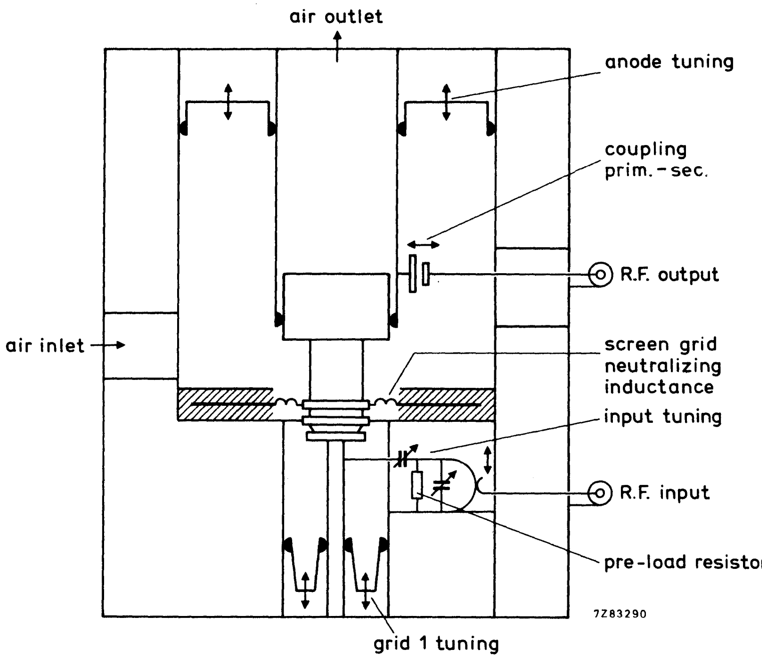


Fig. 2.

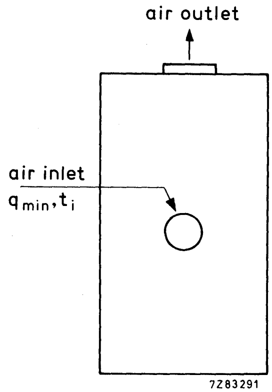


Fig. 3 Cooling air connector diagram.

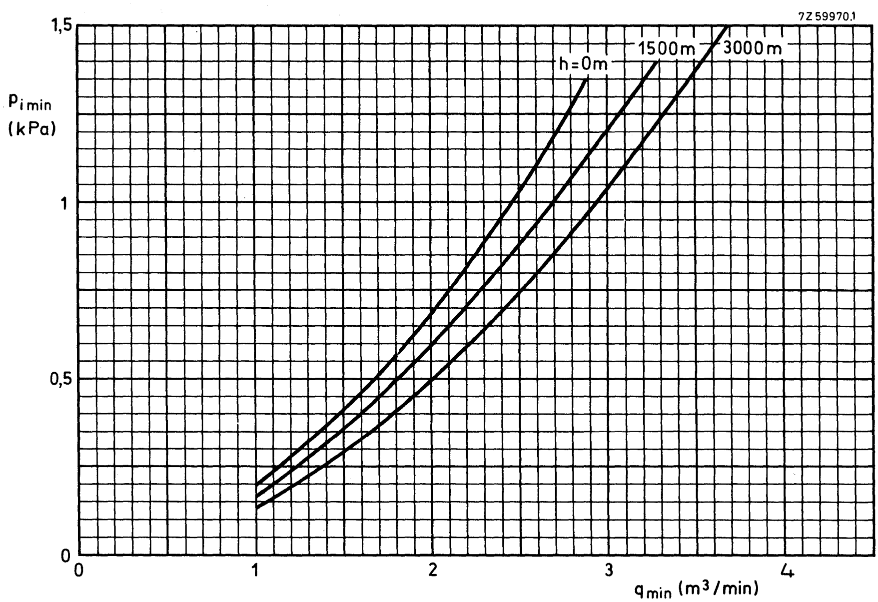


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

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 233.

ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor, type 40754	7322 120 07853
Tube lifter	8222 032 13251
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

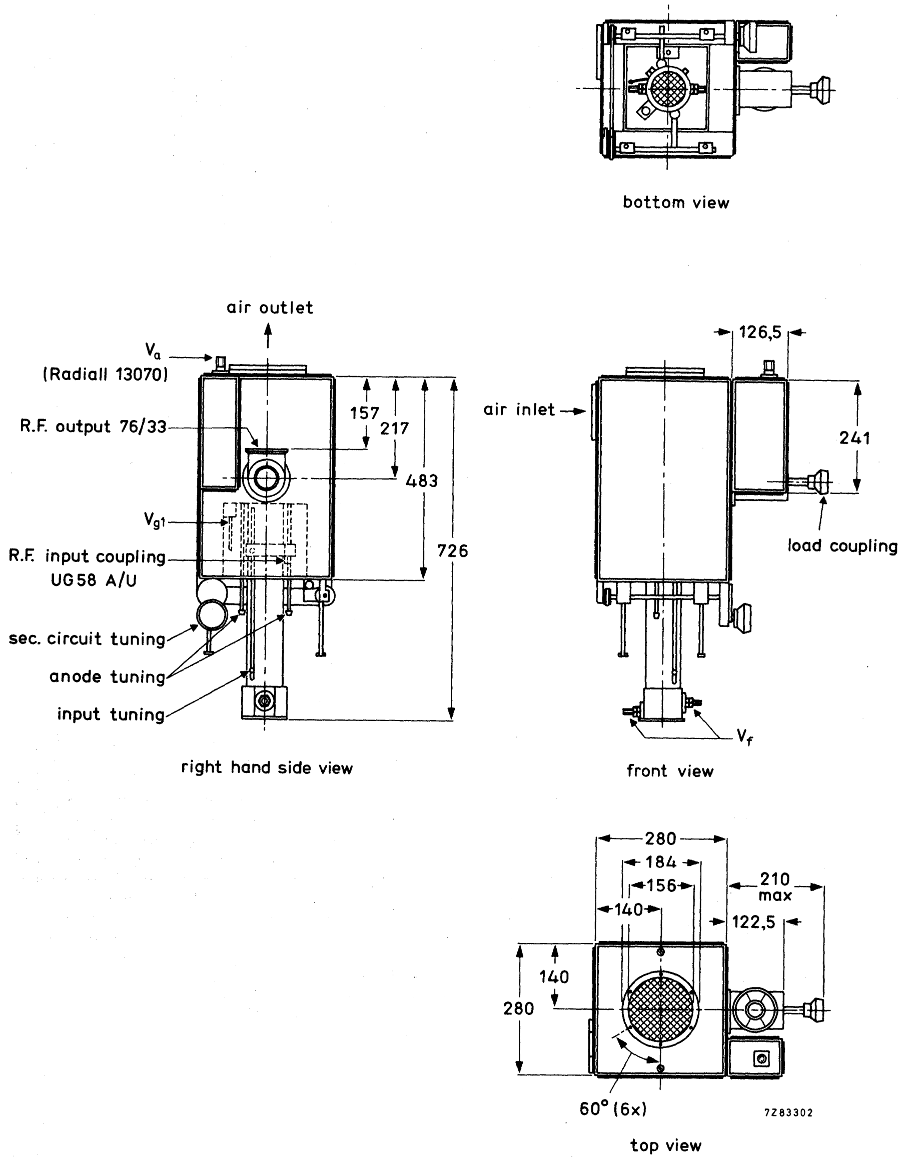


Fig. 1.

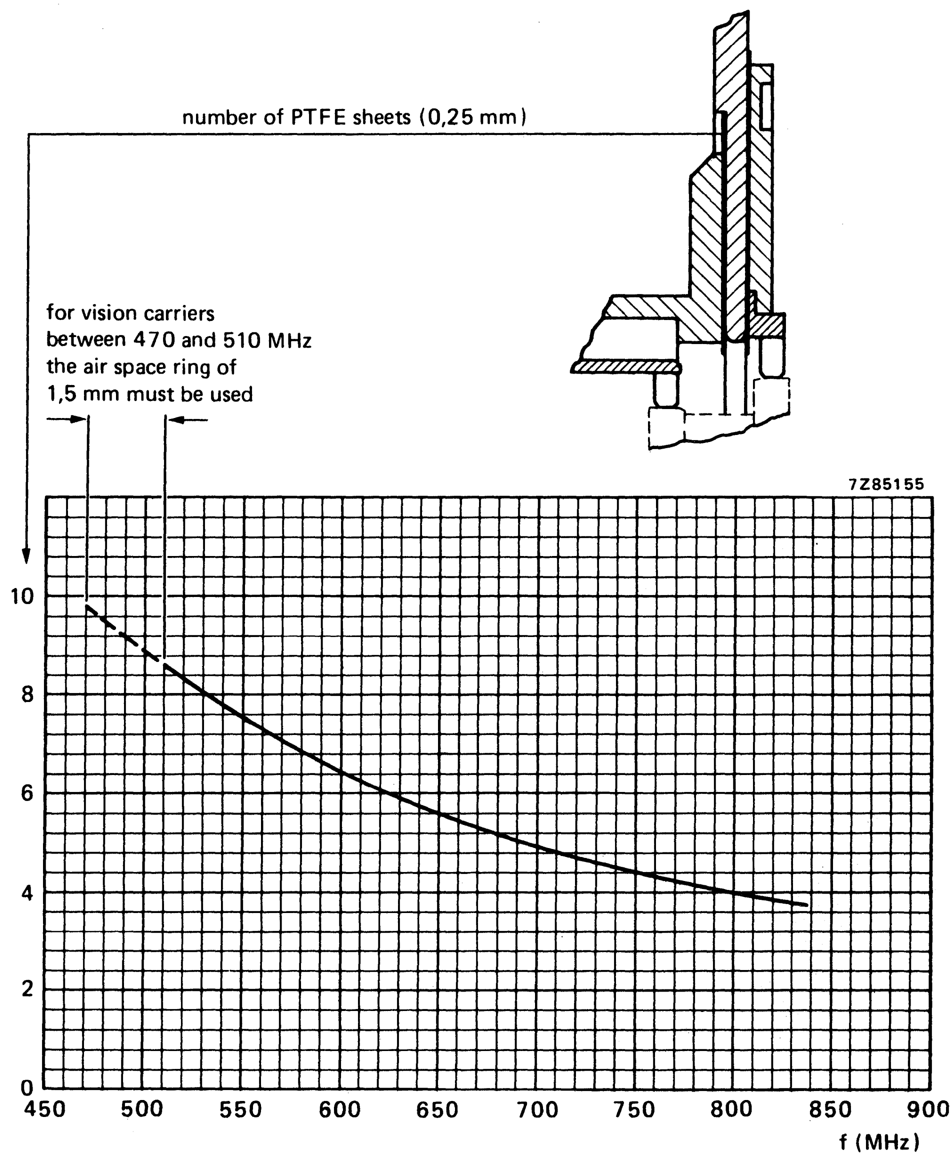


Fig. 2 Coupling capacitor.

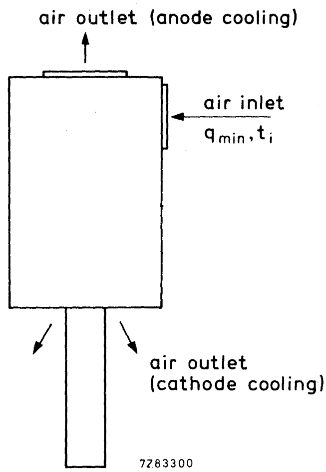


Fig. 3 Cooling air connector diagram.

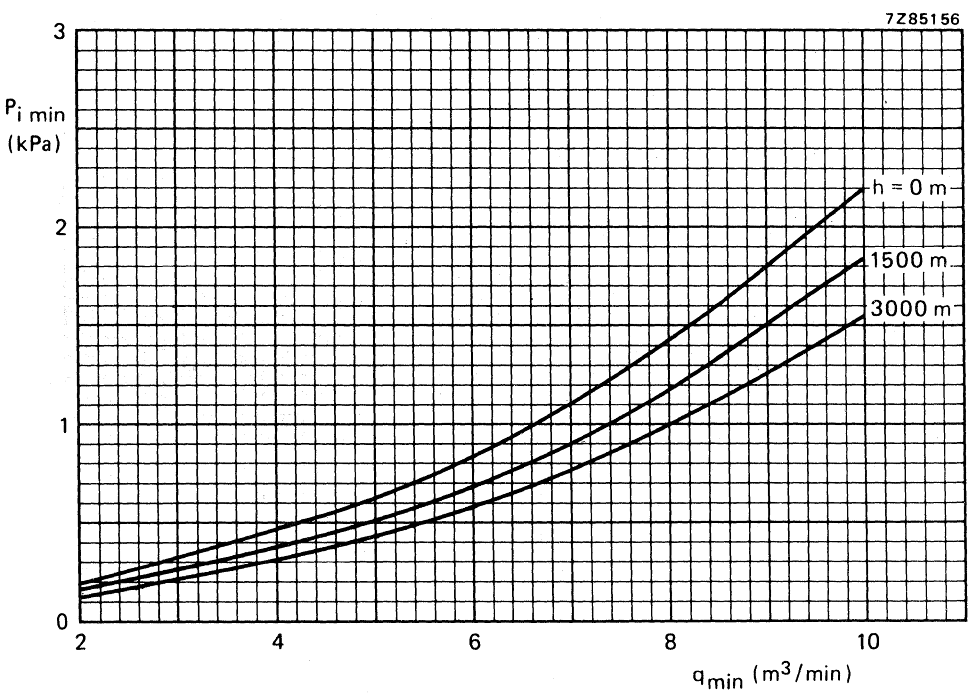


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes. p_i = pressure drop from plane A to plane B or B′, for blowing $q = q_A$; for sucking $q = q_A + q_B'$.

CIRCUIT DIAGRAM

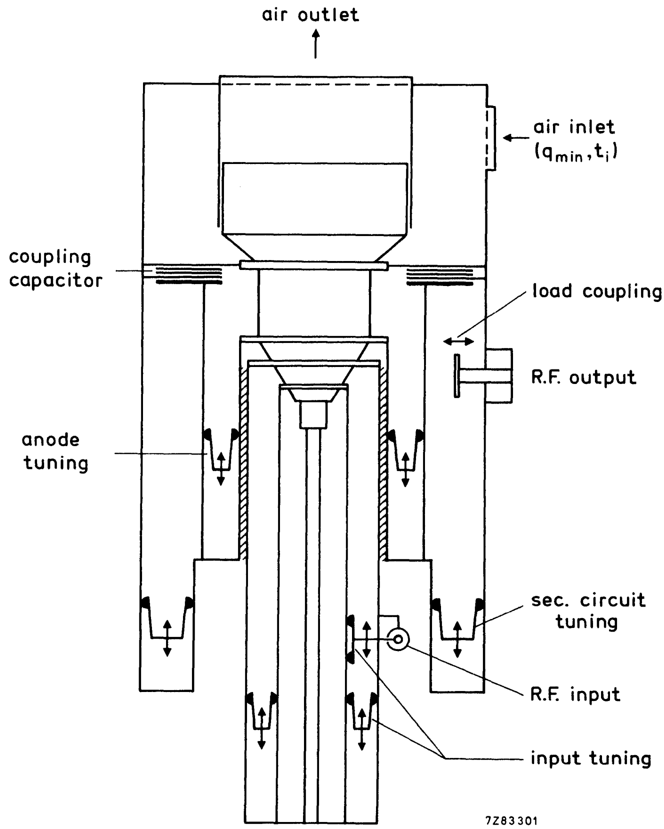


Fig. 5.

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	7,5	kV
Output power in load, sync	W_ℓ	30	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 228 to 230. 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

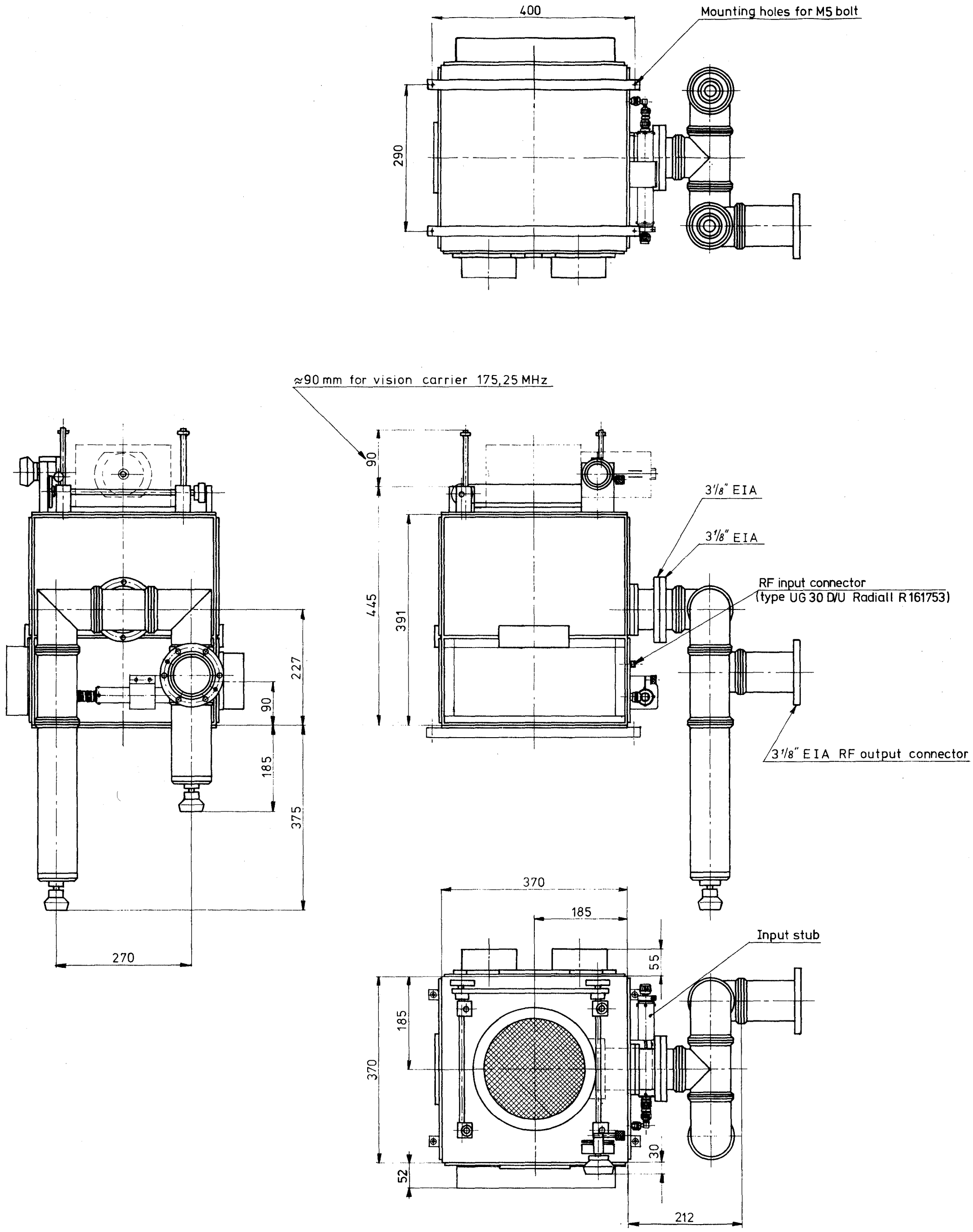


Fig. 1.

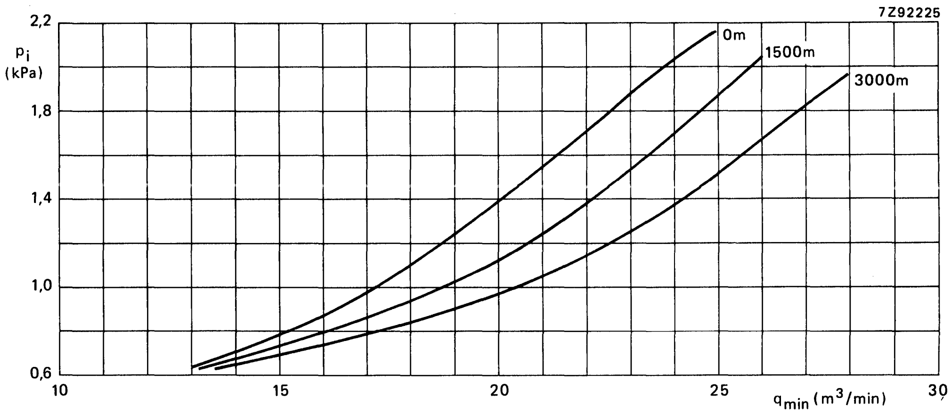


Fig. 2 Ratio of cooling air pressure to cooling air volume at various altitudes.

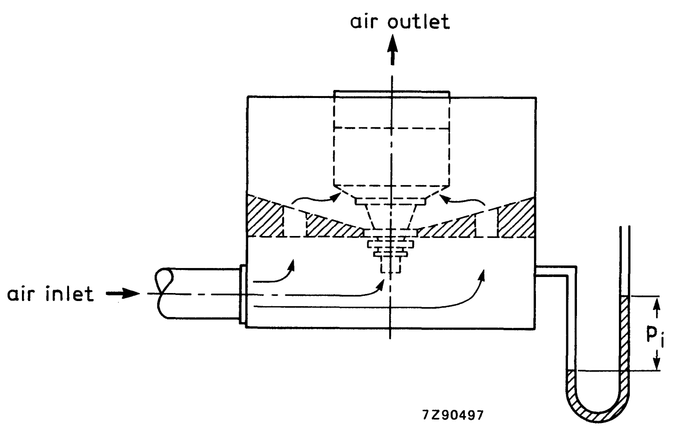


Fig. 3 Direction of air flow.

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 230 to 232. 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

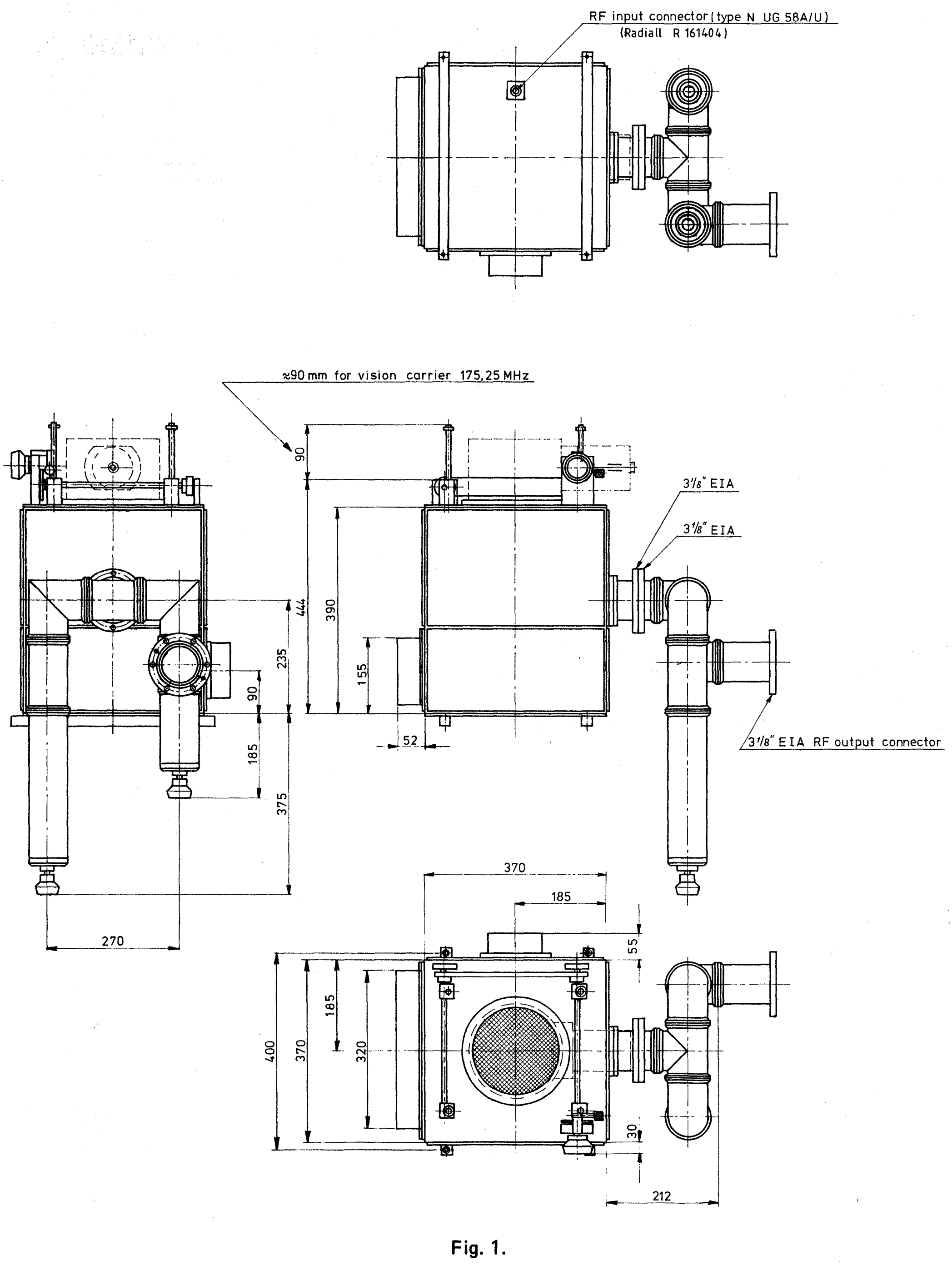


Fig. 1.

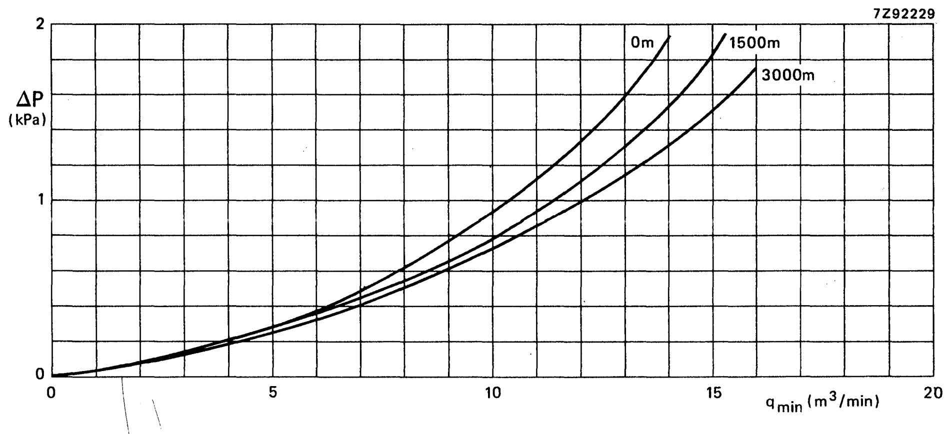


Fig. 2 Ratio of cooling air pressure to cooling air volume at various altitudes.

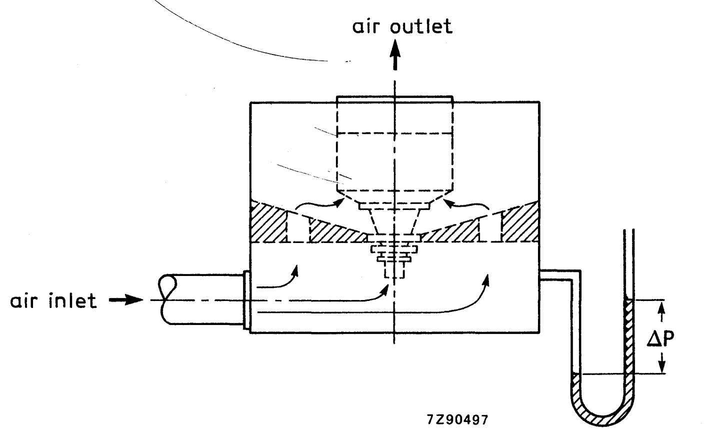


Fig. 3 Direction of air flow.

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