

**PHILIPS**

Data handbook



Electronic  
components  
and materials

Electron tubes

Book T2b

1987

Transmitting tubes for communications

Ceramic types



# TRANSMITTING TUBES FOR COMMUNICATIONS

ceramic types

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SELECTION GUIDE  
triodes and tetrodes

Triodes – YD types

type	status	cooling	W <sub>o</sub> kW	V <sub>f</sub> V	I <sub>f</sub> A	V <sub>a</sub> kV	I <sub>a</sub> A	V <sub>a</sub> max kV	W <sub>a</sub> 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 <sub>o</sub> kW	V <sub>f</sub> V	I <sub>f</sub> A	V <sub>a</sub> kV	V <sub>g2</sub> V	I <sub>a</sub> A	V <sub>a</sub> max kV	W <sub>a</sub> 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
<b>Vision</b>						
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
<b>Sound</b>						
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
<b>Vision and sound</b>						
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.

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**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
→ $\Delta p$	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

# GENERAL

$R_k$	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
$W_\ell$	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
$\delta$	Duty factor
$\eta$	Efficiency
$\eta_a$	Anode efficiency
$\eta_{osc}$	Oscillator efficiency
$\lambda$	Wavelength
$\mu$	Amplification factor
$\mu_{g2g1}$	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 $\mu$ 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  $\pm 10\%$ . 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  $0.95 \times$  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, i.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:

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

where  $Q$  = air flow in  $\text{m}^3/\text{min}$

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

$\Delta T$  = temperature rise in K

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

**7 COOLING (continued)****7.3.2 Minimum cooling water flow**

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

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

where  $Q$  = water flow in litres/min

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

$\Delta T$  = 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.



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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)	$W_\ell$	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	$\mu$	80

### TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250 °C
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To obtain optimum life, this temperature should not exceed 200 °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  $\pm 2\%$  for transposer service, or  $\pm 5\%$  for other applications.

**COOLING**

Anode: forced air

$W_a$ W	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min	$\Delta P$ Pa
900	25	1,5	310

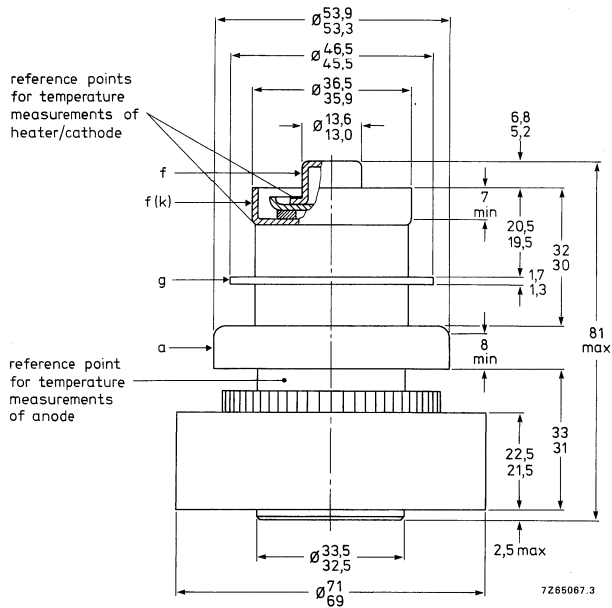
Other terminals: low velocity airflow.

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

Cooling air and voltages may be switched off simultaneously.

**MECHANICAL DATA**

Net mass ≈ 1000 g



**ACCESSORY:**

Band IV and V amplifier circuit assembly type 40771.

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

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

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

grounded grid

**LIMITING VALUES (Absolute maximum rating system)**

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

**OPERATING CONDITIONS, grounded grid**

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

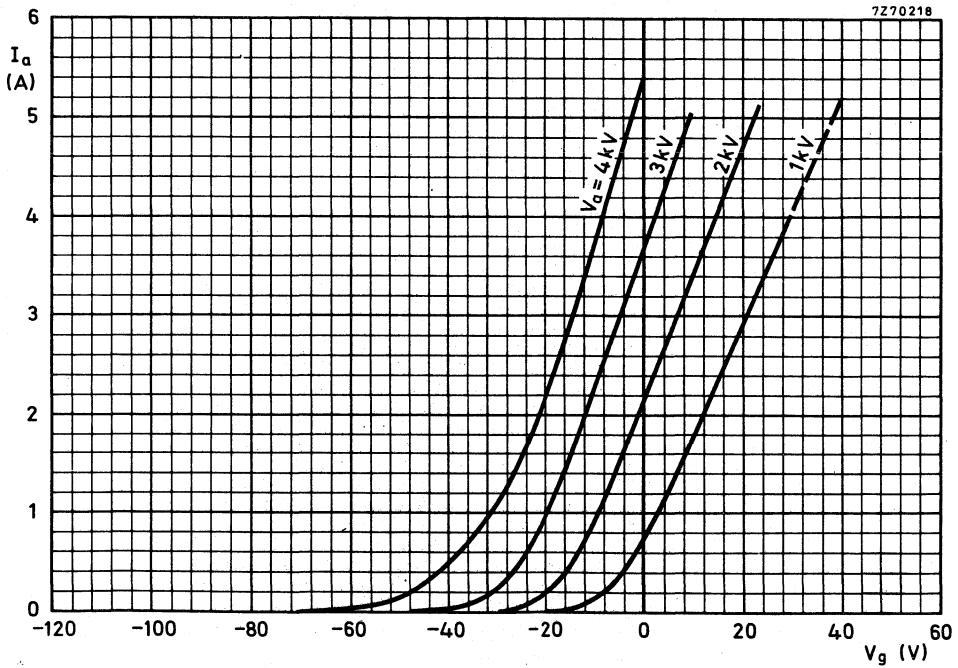
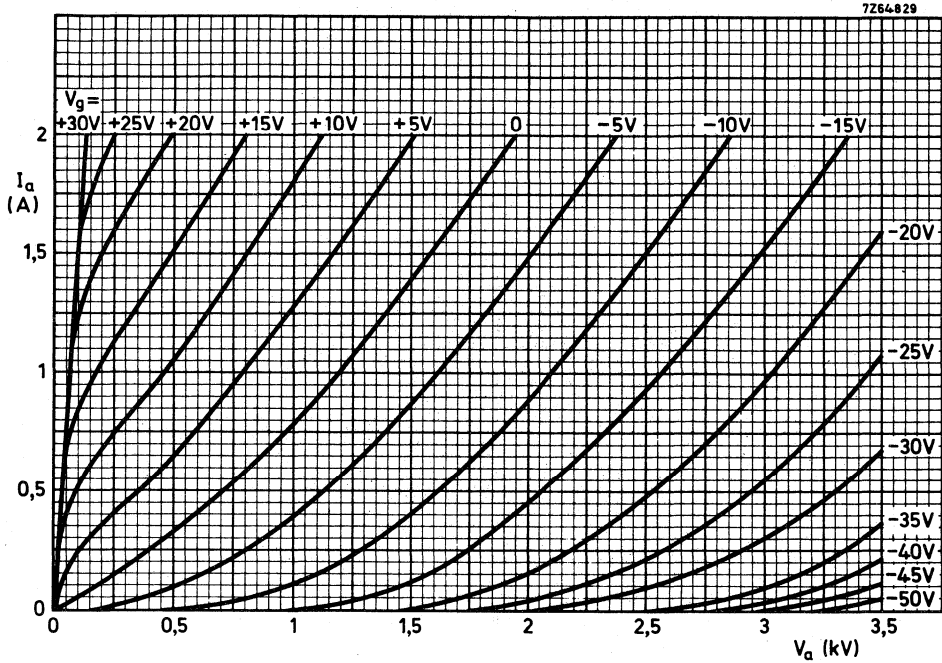
Frequency	f	up to	1000 MHz
Anode voltage	$V_a$	max.	3000 V
Grid voltage	$-V_g$	max.	200 V
Anode dissipation	$W_a$	max.	900 W
Grid current	$I_g$	max.	5 mA
Cathode current	$I_k$	max.	550 mA

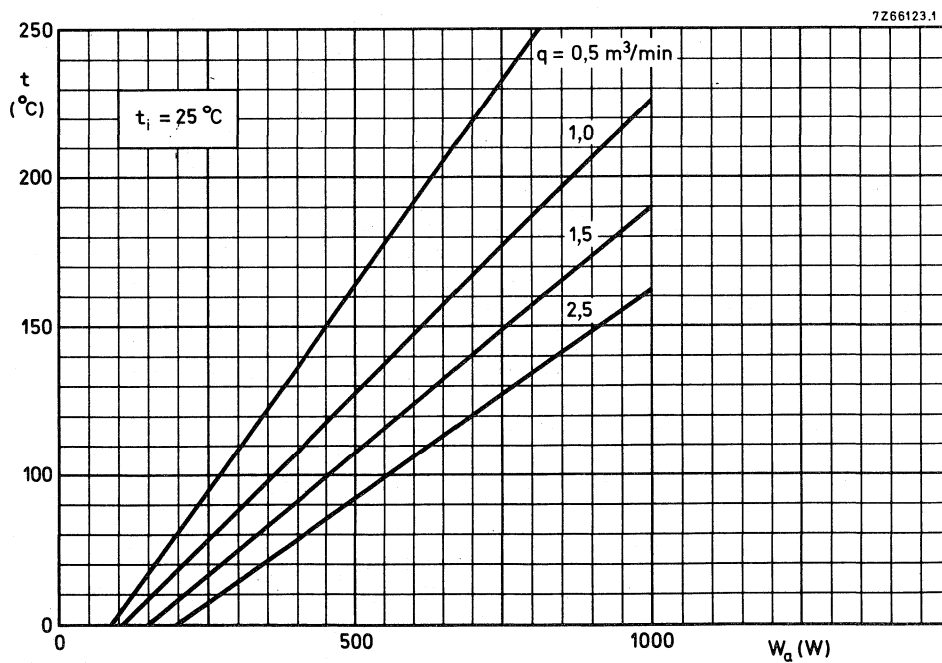
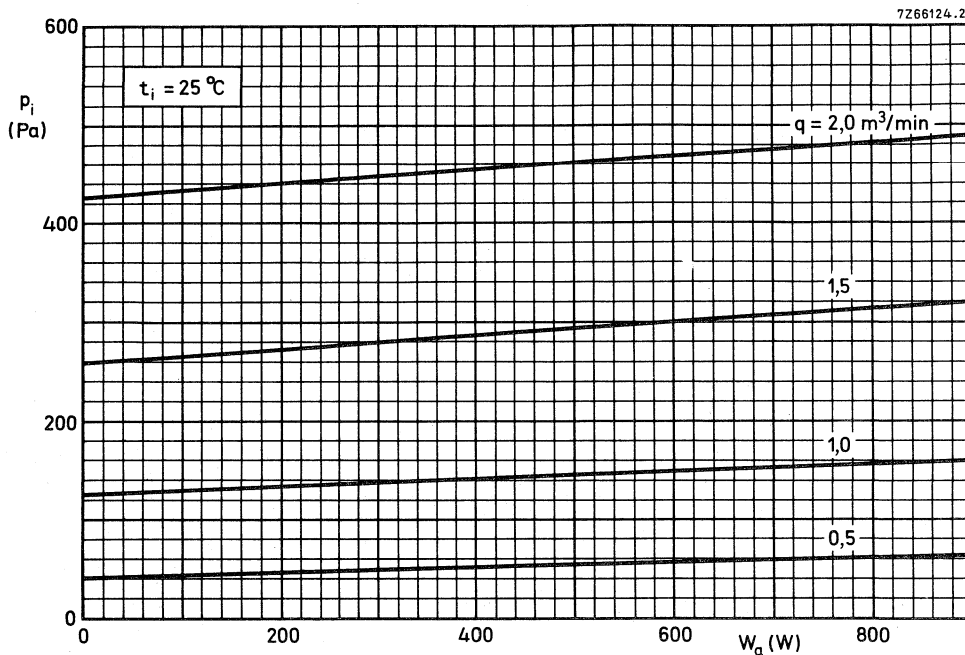
**OPERATING CONDITIONS (note 1)**

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	$W_\ell$	300 W
Power gain	G	16 dB

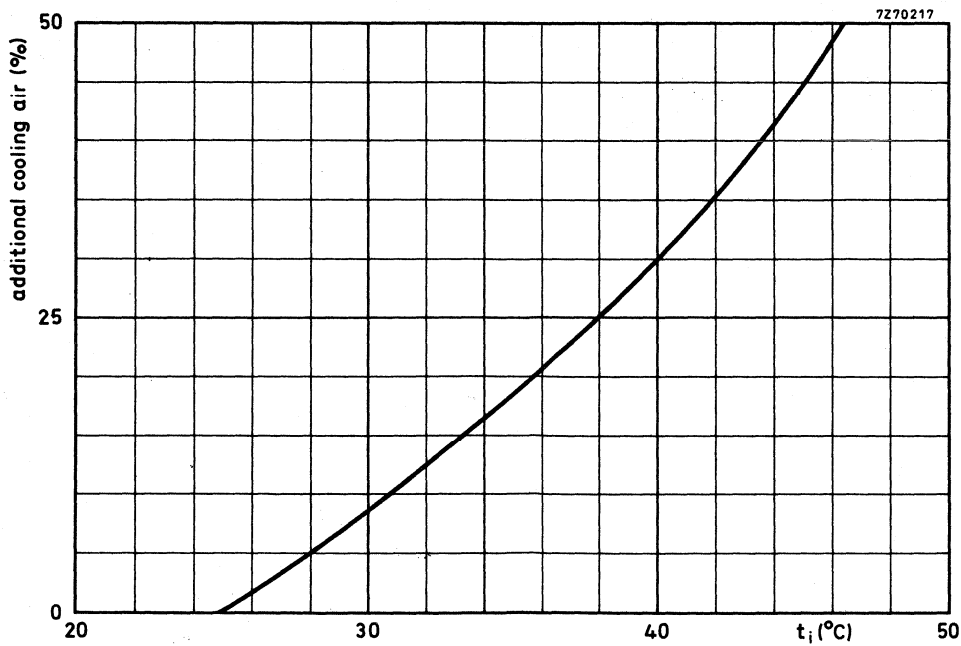
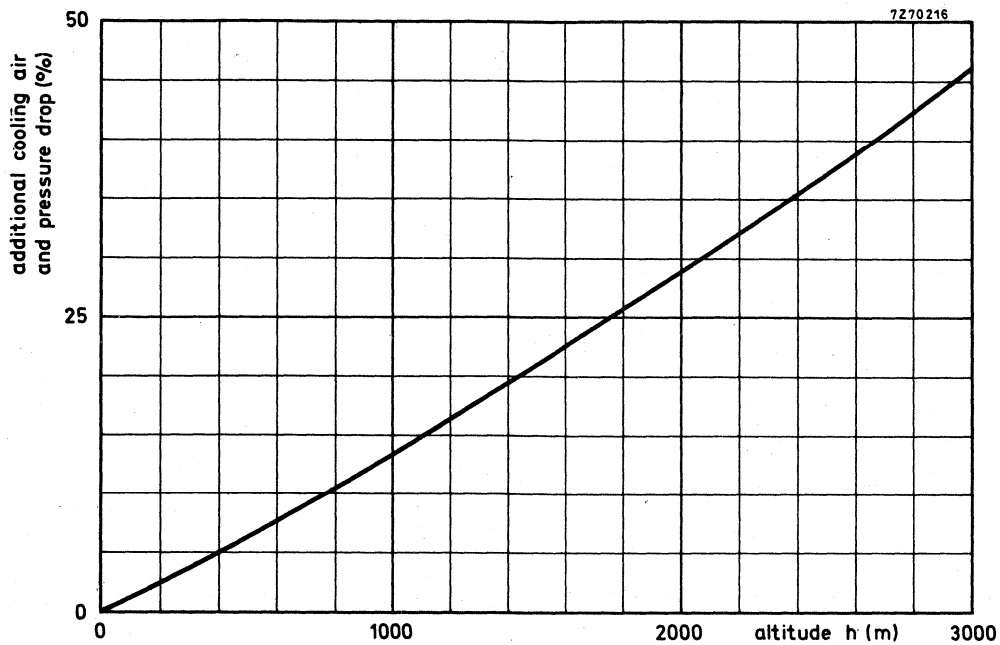
**Notes**

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  $\Omega$ .











## 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)	$W_Q$	550 W
(peak white – CCIR-L)	$W_Q$	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	$\mu$	90

### TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250 °C
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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  $\pm 2\%$ .

Data based on pre-production tubes.

**COOLING**

Anode: forced air

$W_a$ W	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min	$\Delta P$ 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.

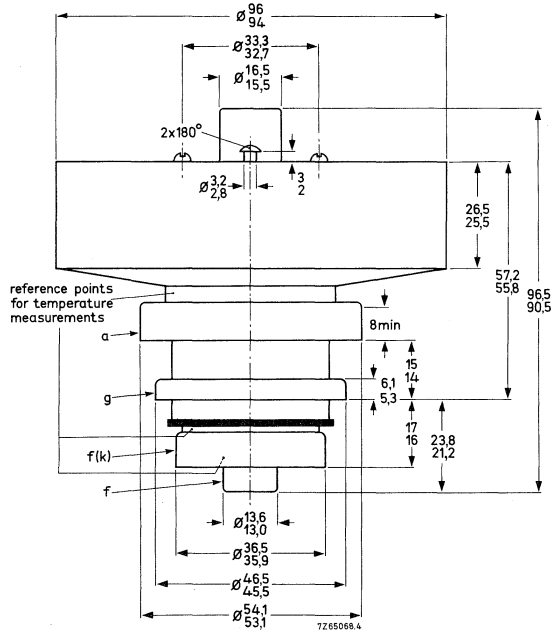
**MECHANICAL DATA**

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 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.	$\pm 5$ mA
Cathode current	$I_k$	max.	700 mA (note 1)

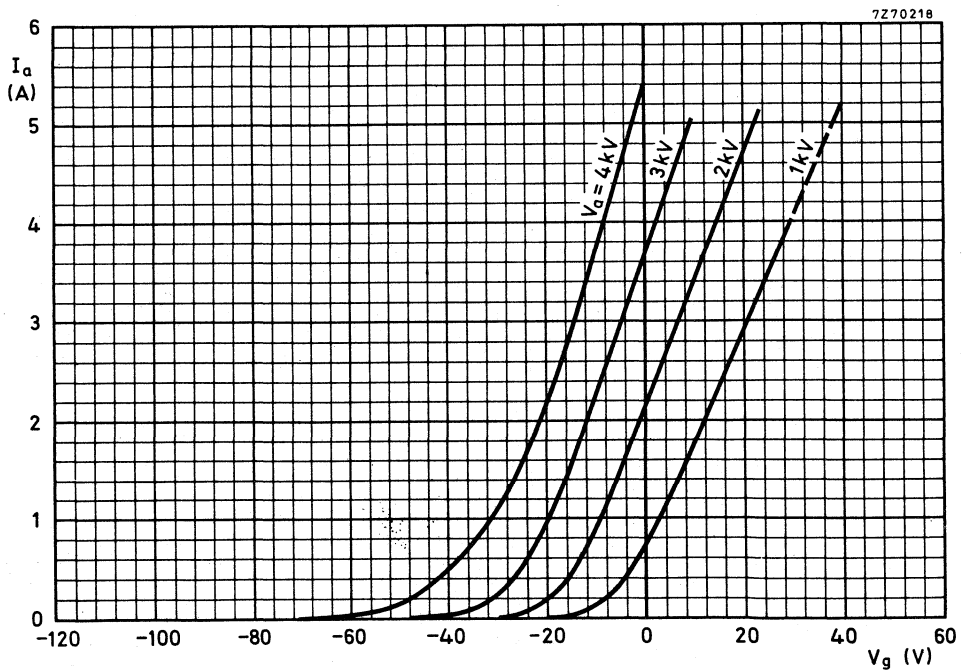
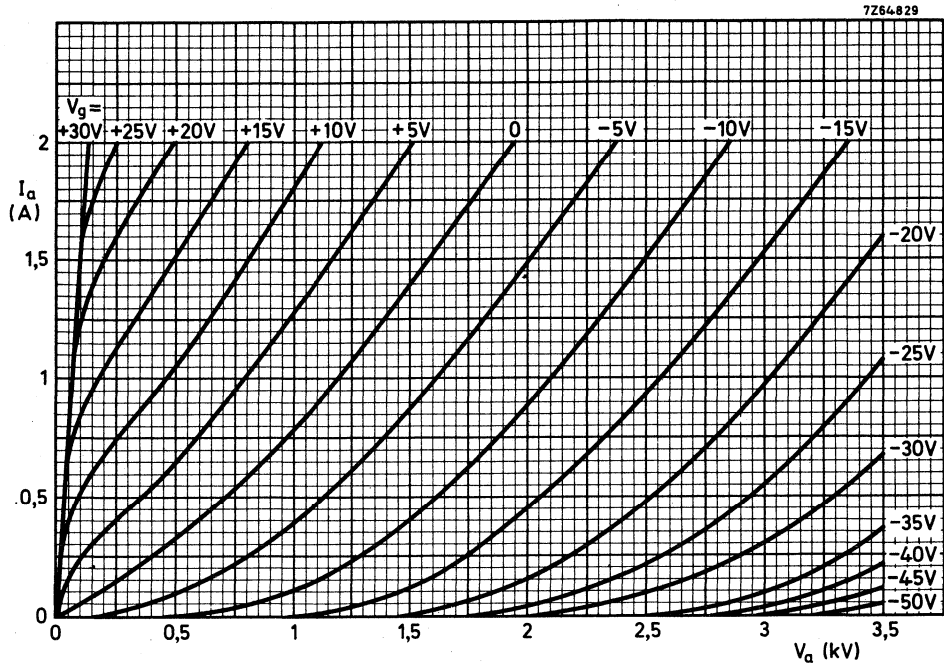
**OPERATING CONDITIONS**, grounded grid (note 2)

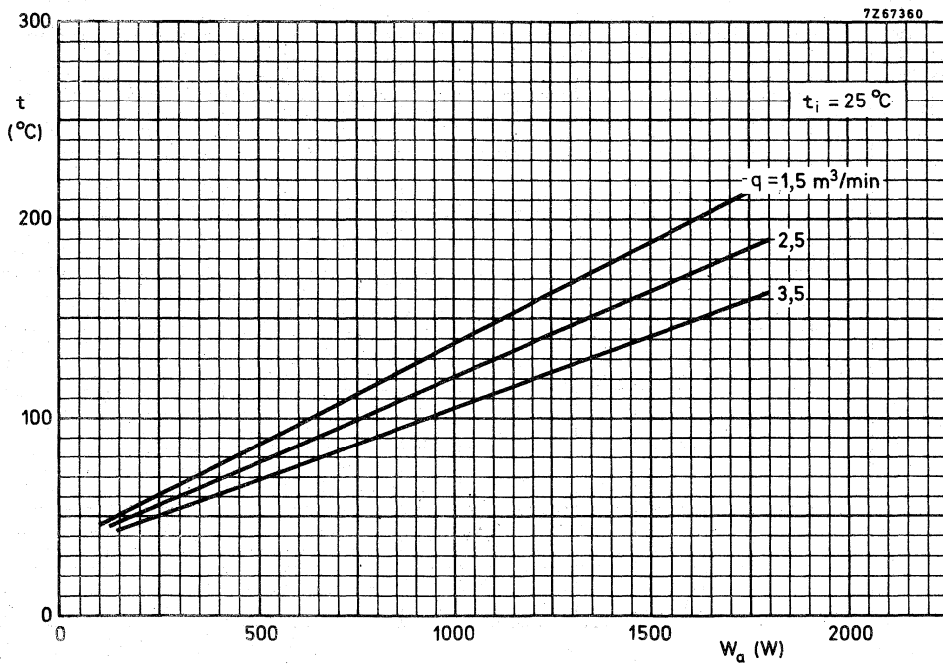
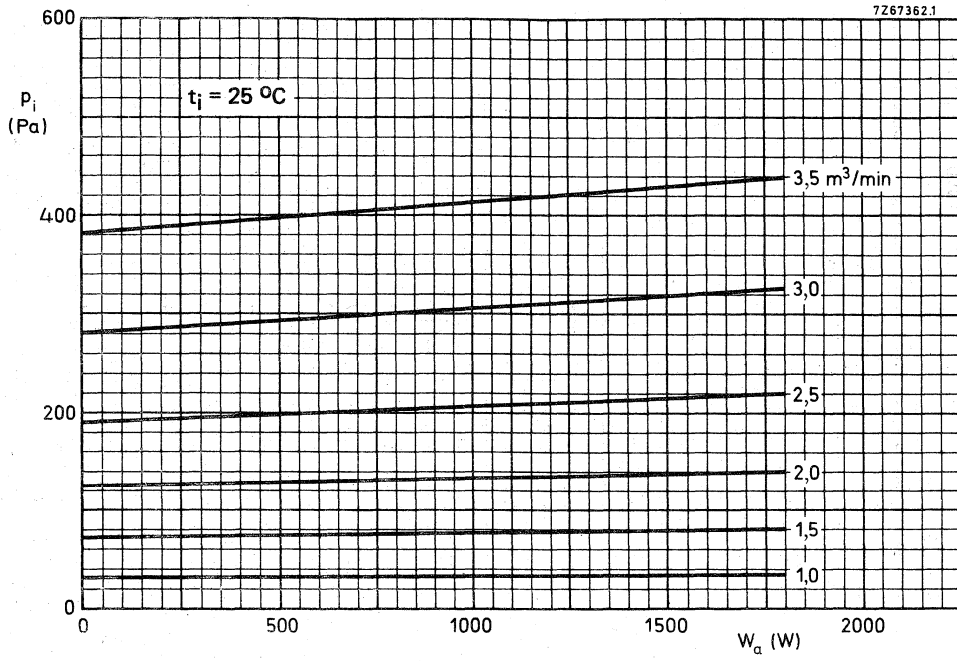
Standard		<u>CCIR-G</u>	<u>CCIR-L</u>
Frequency	f	470 to 860	470 to 860 MHz
Bandwidth (-1 dB)	B	9	9 MHz
Anode voltage	$V_a$	3500	3500 V
Grid voltage (note 3)	$V_g$	-38	-38 V
Anode current, no signal	$I_a$	250	250 mA
Anode current at average grey level	$I_a$	$\approx 500$	$\approx 500$ mA
Grid current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

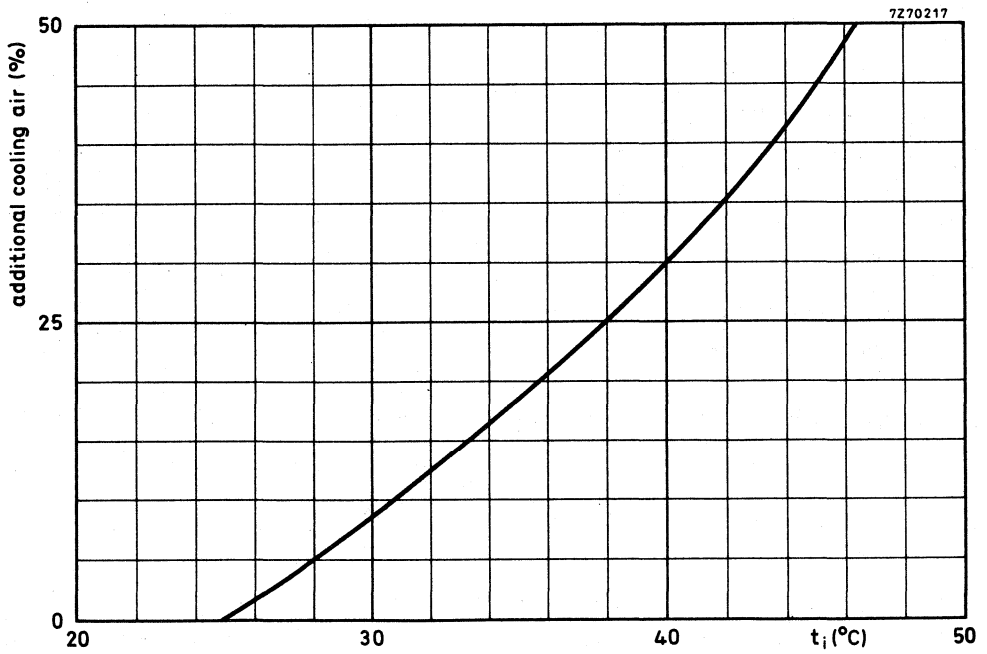
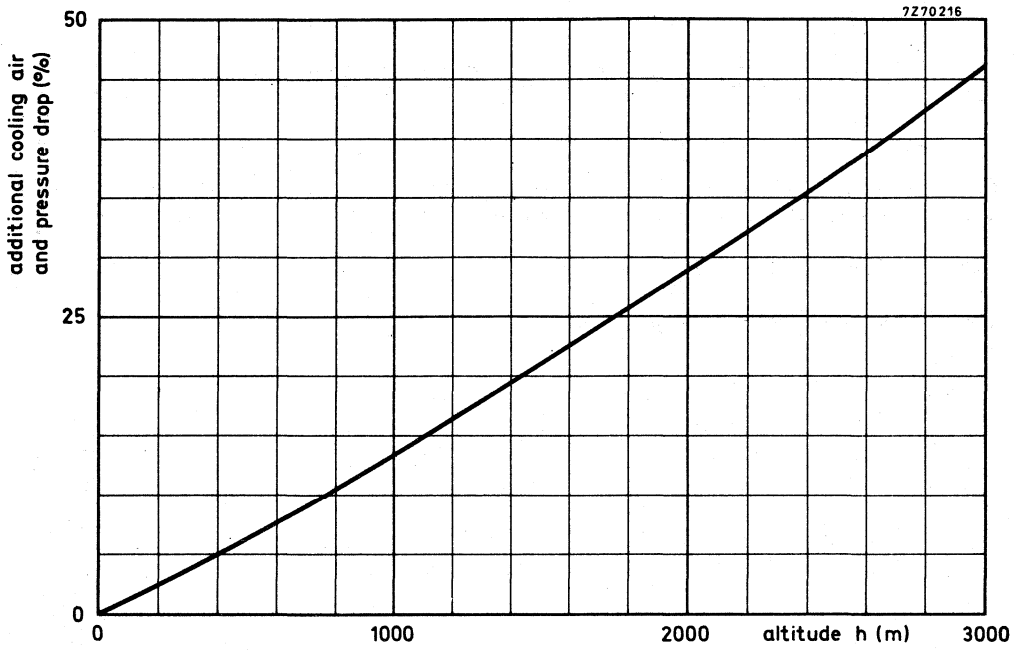
## Notes

1. During a short period, for adjustment of the transmitter,  $W_a = \text{max. } 2200 \text{ W}$ , and  $I_k = \text{max. } 800 \text{ mA}$ .
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.









## 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)	$W_\Omega$	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	$\mu$	90

### TEMPERATURE LIMITS

Absolute max. temperature measured at reference points	T	max. 250 °C
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To obtain optimum life, this temperature should not exceed 200 °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  $\pm 2\%$  for transposer service, or  $\pm 5\%$  for other applications.

**COOLING**

Anode: forced air

$W_a$ W	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min	$\Delta P$ 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.

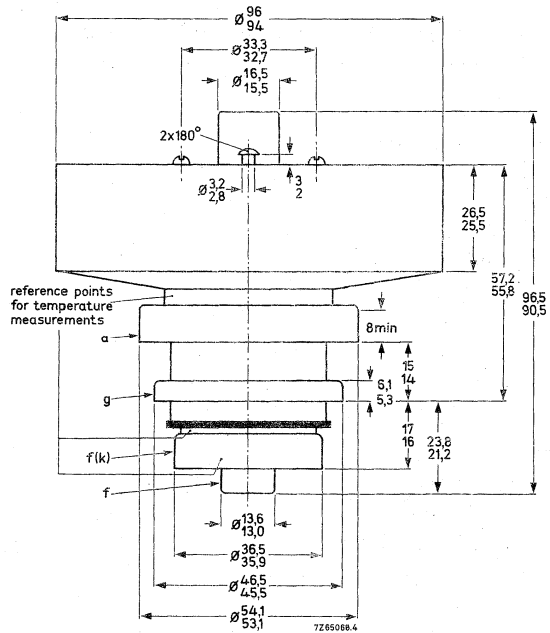
**MECHANICAL DATA**

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)**

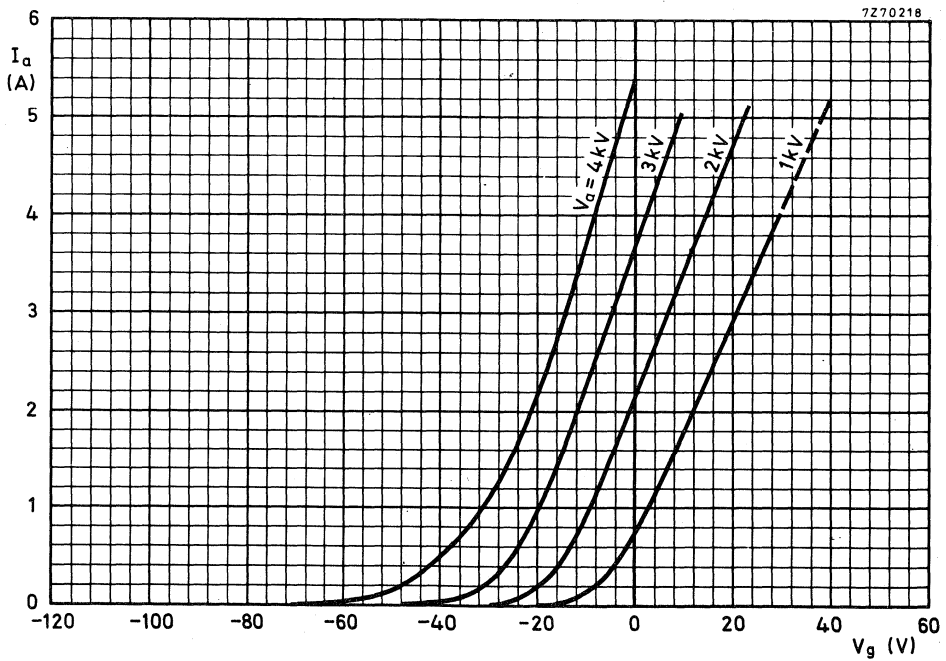
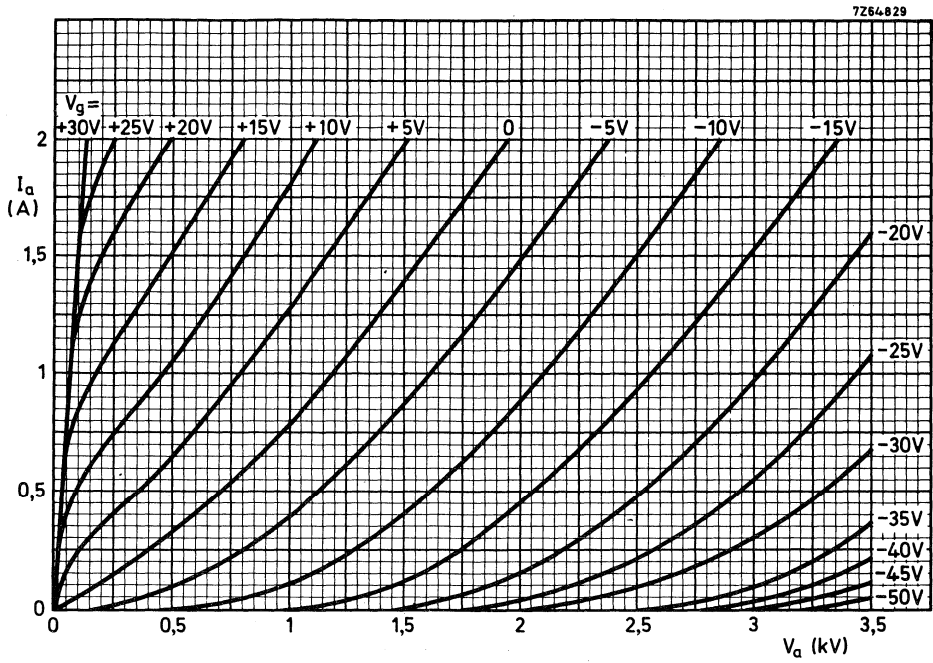
Frequency	f	up to	1000	MHz
Anode voltage	$V_a$	max.	3500	V
Grid voltage	$-V_g$	max.	200	V
Anode dissipation	$W_a$	max.	1800	W
Grid current	$I_g$	max.	$\pm 5$	mA
Cathode current	$I_k$	max.	550	mA (note 1)

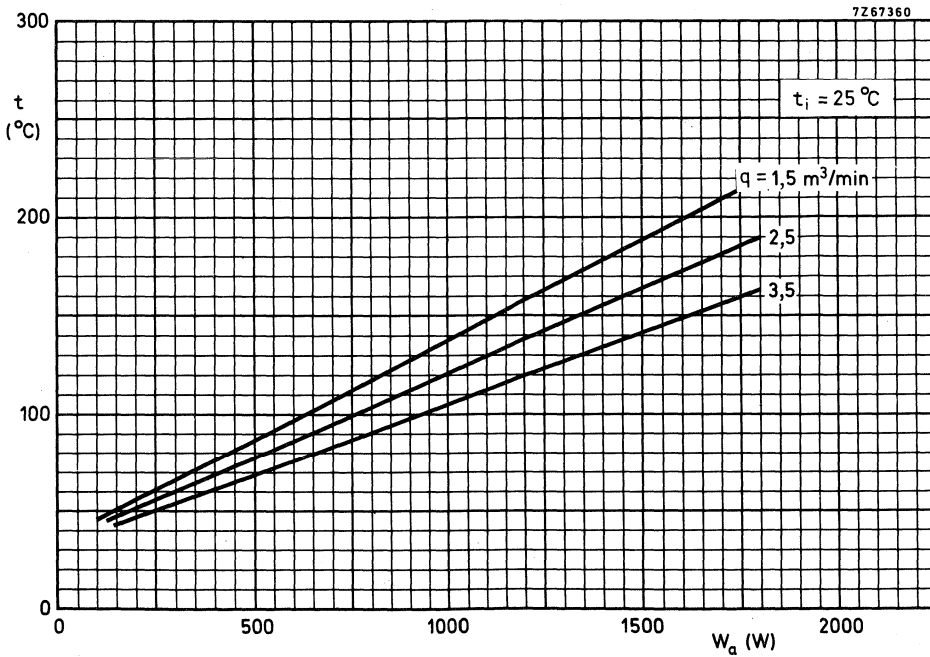
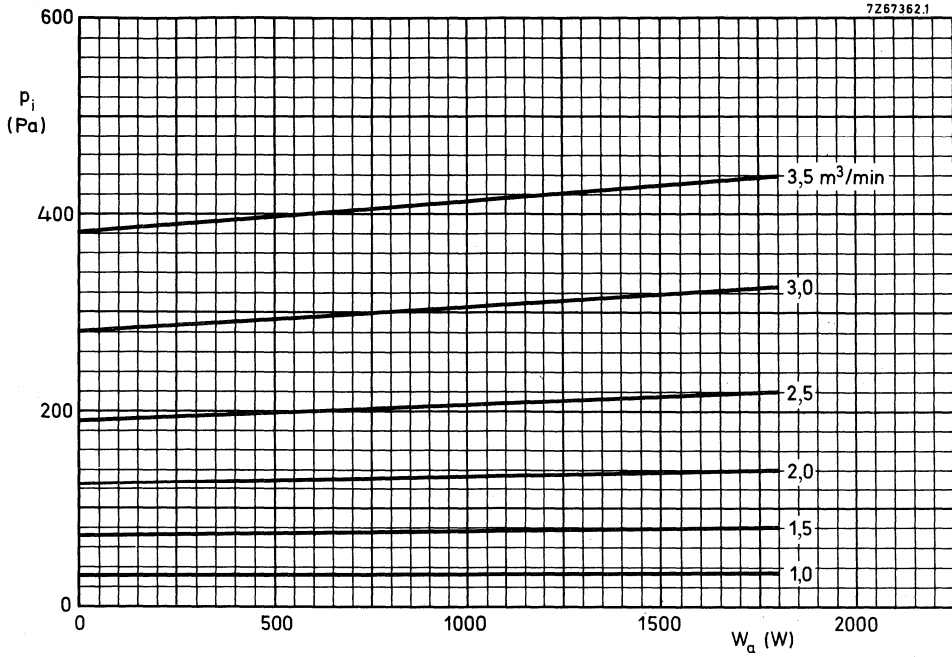
**OPERATING CONDITIONS, grounded grid (notes 2,3)**

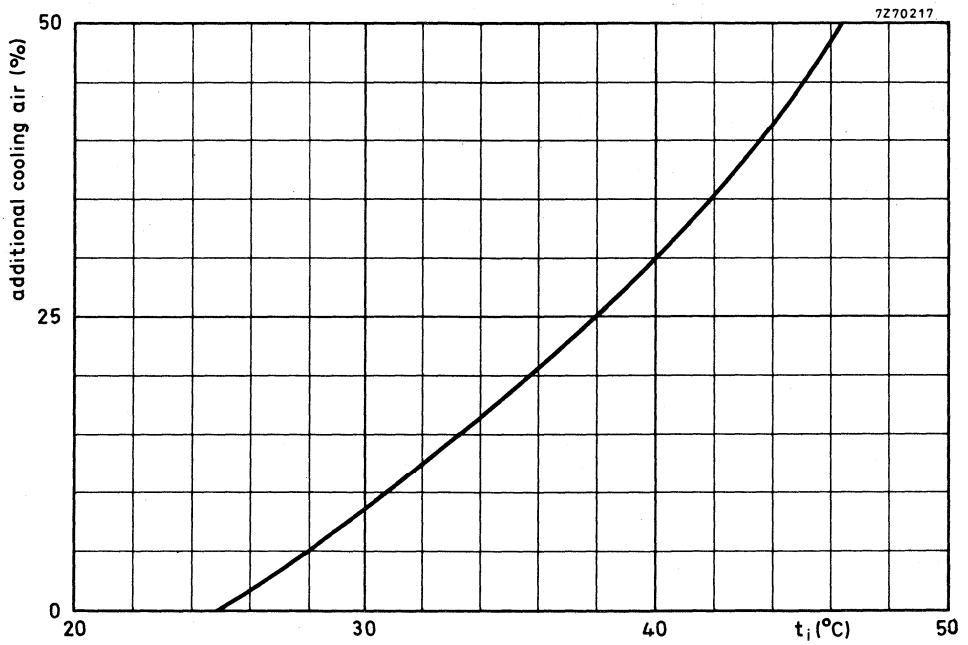
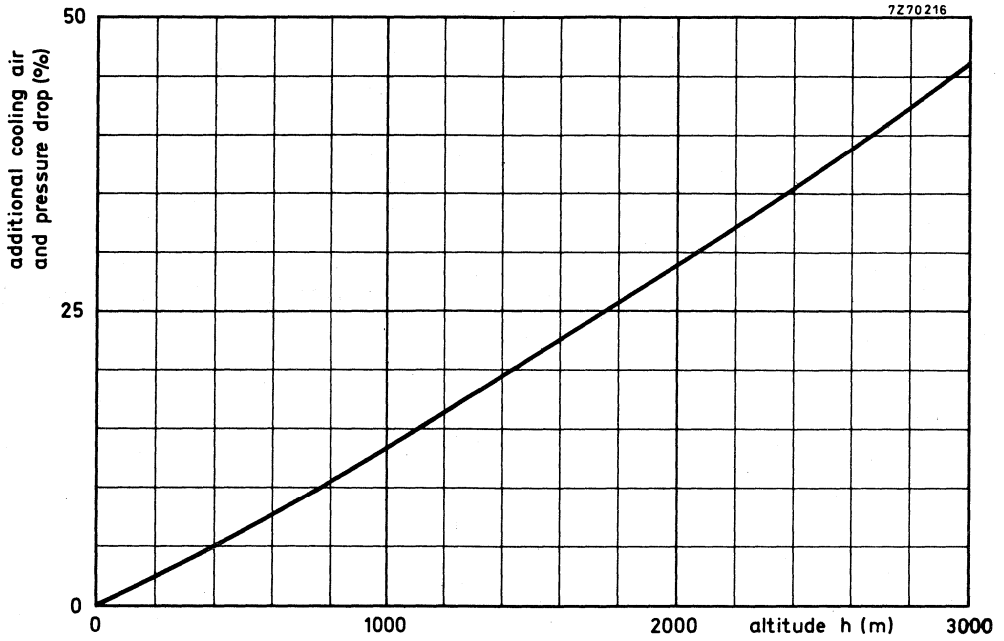
Standard		C.C.I.R-G	C.C.I.R-G	C.C.I.R-I	
Frequency	f	470 to 860	470 to 860	470 to 860	MHz
Bandwidth	B	9	9	9	MHz
Anode voltage	$V_a$	3000	3000	3000	V
Grid voltage (note 4)	$V_g$	-30	-30	-30	V
Anode current, no signal	$I_a$	420	350	420	mA
Anode current at zero dB level (vision carrier)	$I_a$	650	550	650	mA
Grid current	$I_g$	$\approx 0$	$\approx 0$	$\approx 0$	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 $I_g = 0$	$W_o$	$\geq 390$	$\geq 390$	$\geq 390$	W
Power gain	G	16,5	16,0	16,5	dB
Intermodulation products	d	-57 (note 5) < -55	-56 (note 5) < -54	-55 (note 6) dB < -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).







**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	$W_\varphi$	210	W
Gain	G	13	

#### Class-C telegraphy

Frequency	f	800	MHz
Anode voltage	$V_a$	4,31	kV
Output power in load	$W_\varphi$	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	$\mu_{g2g1}$	=	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

$\frac{W_a}{W}$	h m	$T_i$ °C	q m <sup>3</sup> /min.	$\frac{\Delta P}{P_a}$
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.

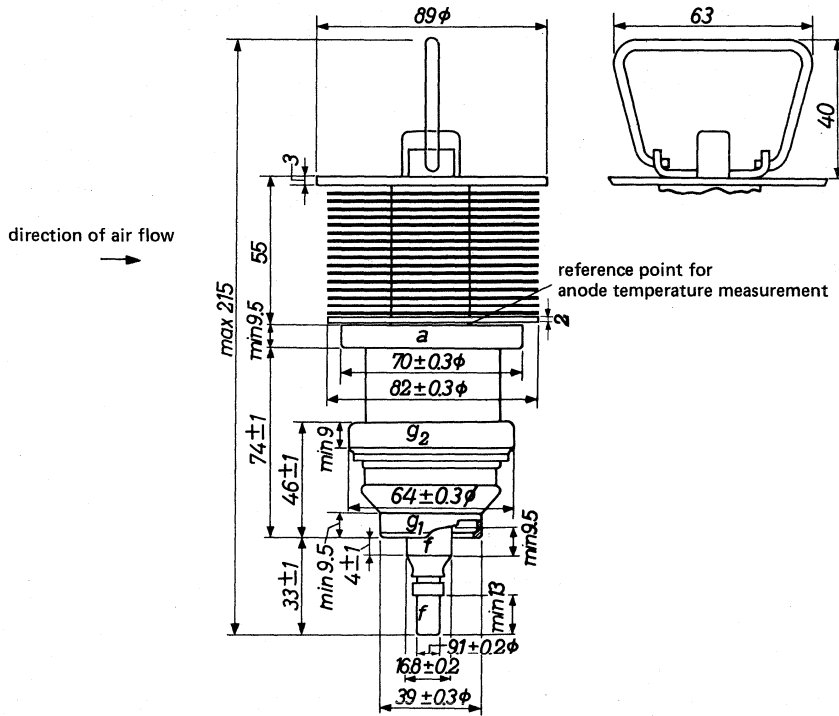
The amount and temperature of the cooling air shall be watched during operation. If the amount of cooling air decreases below the specified value all voltages shall be switched off automatically.

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	$W_{\varphi}$	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	$W_{\varphi}(PEP)$	210 W	3
Intermodulation products	d	−52 dB	4
Power gain	G	13	

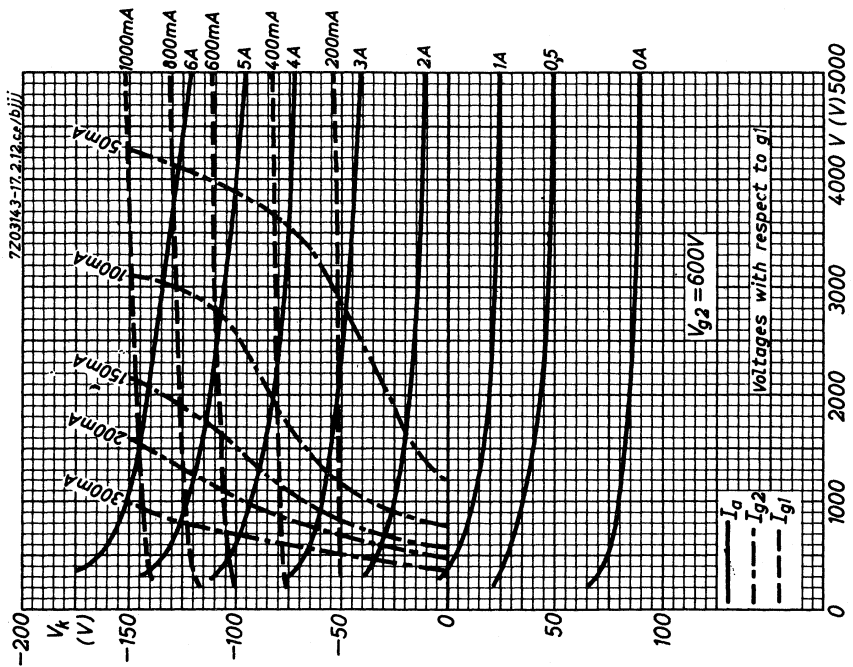
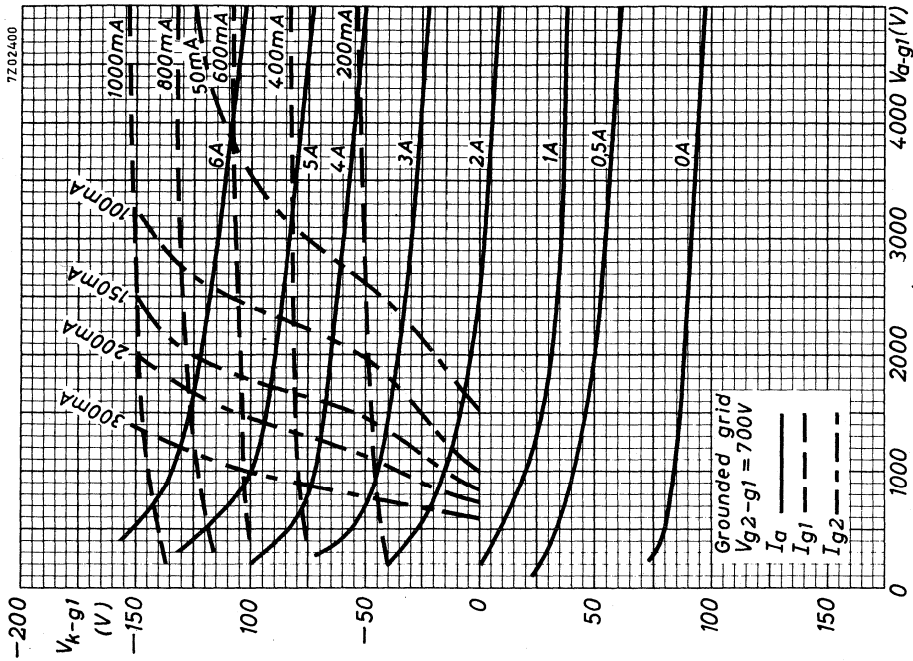
**Notes**

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

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

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

- Peak envelope power. Typical value, measured in a circuit having an efficiency of about 85%.
- The intermodulation product in the passband of the output signal is measured with reference to 0 dB.



## 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	$\mu_{g2g1}$		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.

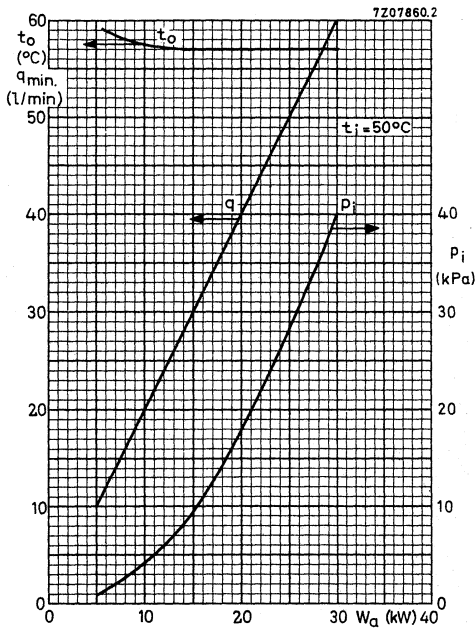


Fig.1.

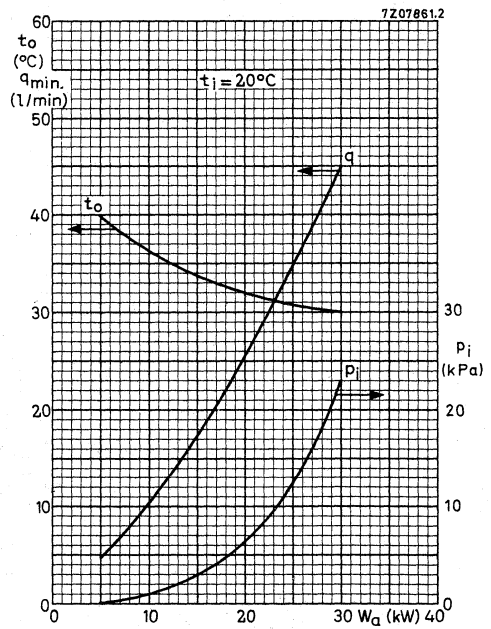


Fig.2.



**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

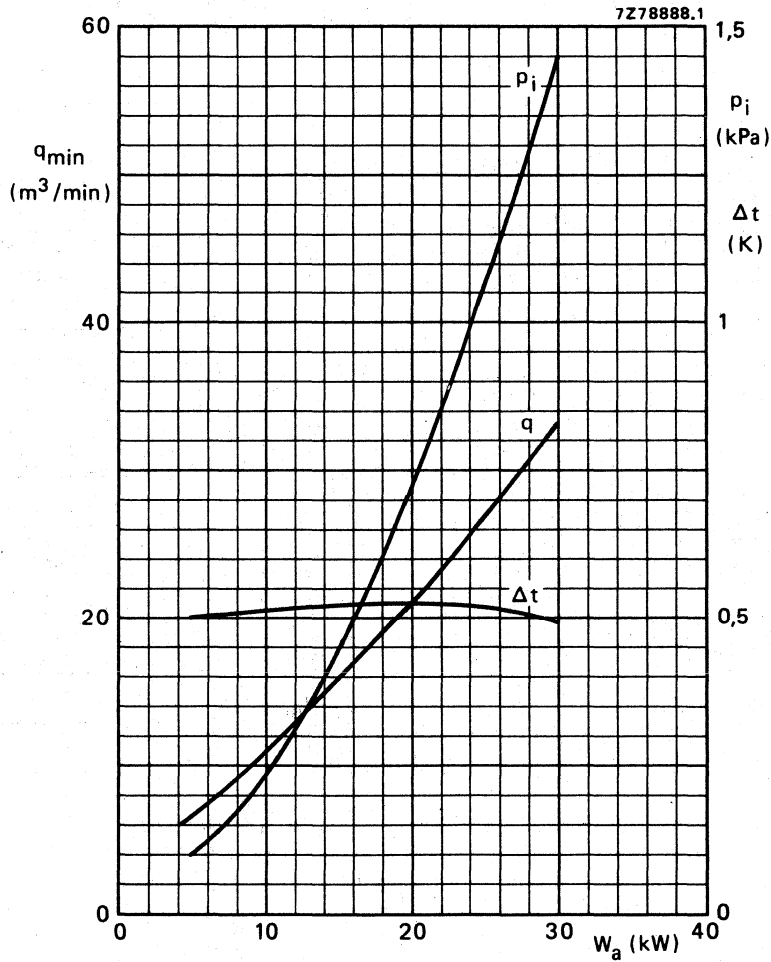


Fig. 3.

**YL1012**

Absolute maximum envelope and seal temperature

$T_{env}$  max. 220 °C

YL1010  
YL1011  
YL1012

MECHANICAL DATA

Dimensions in mm

YL1010

Net mass:  $\approx 7$  kg

Mounting position: Vertical with anode down.

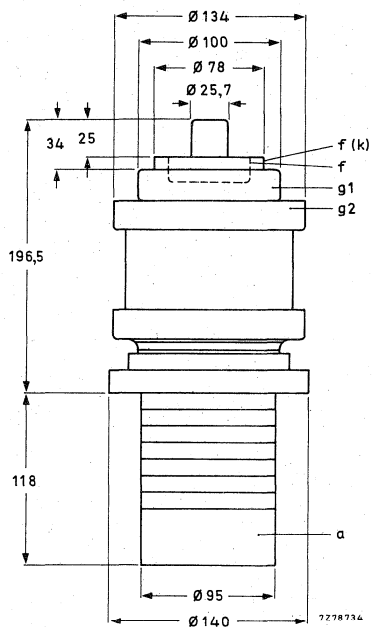


Fig. 4.

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:  $\approx 13,5$  kg

Mounting position: Vertical with anode down

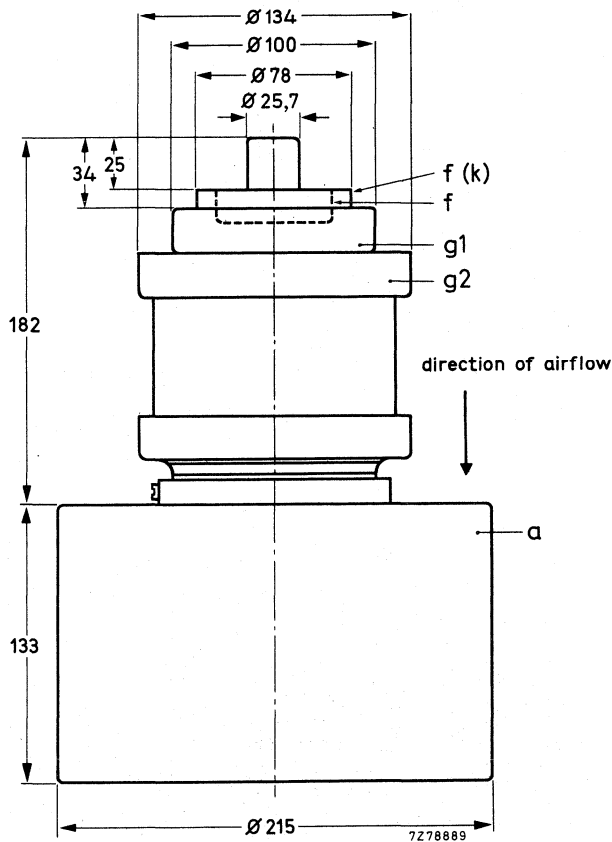


Fig. 5.

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:  $\approx 14,7$  kg

Mounting position: Vertical with anode down

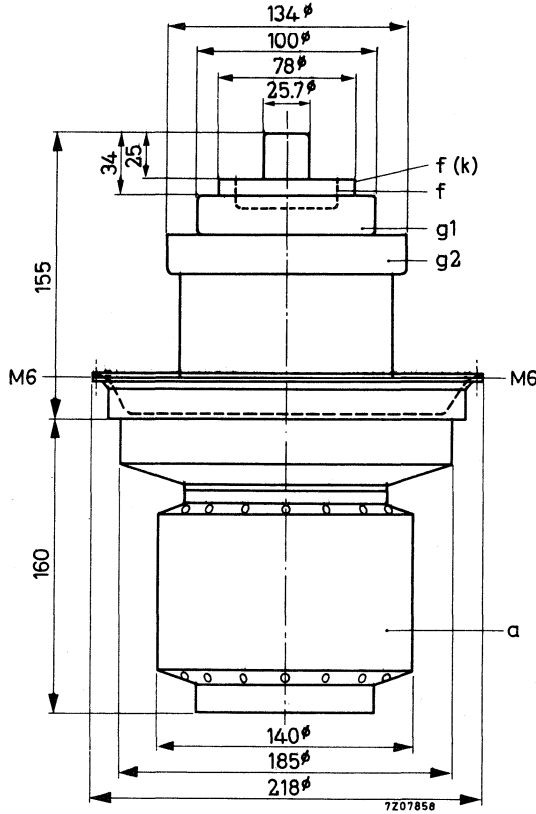


Fig. 6.

**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	$\eta$		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	$\eta$		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	$W_{\ell}$	25 kW *
Efficiency	$\eta$	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 $\Omega$
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	$\eta$	80 %
Modulation depth	m	100 %
Modulation power	$W_{mod}$	35 kW
Grid 2 voltage, peak	$V_{g2p}$	700 V



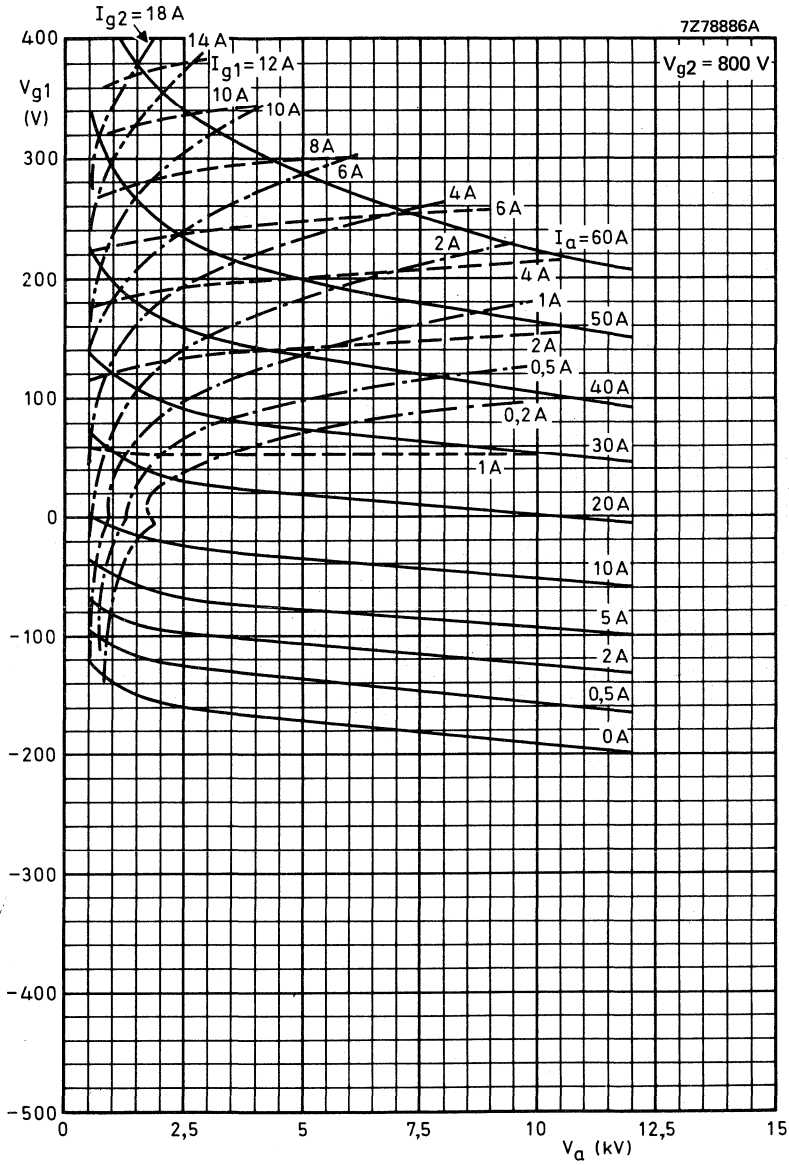


Fig. 7.

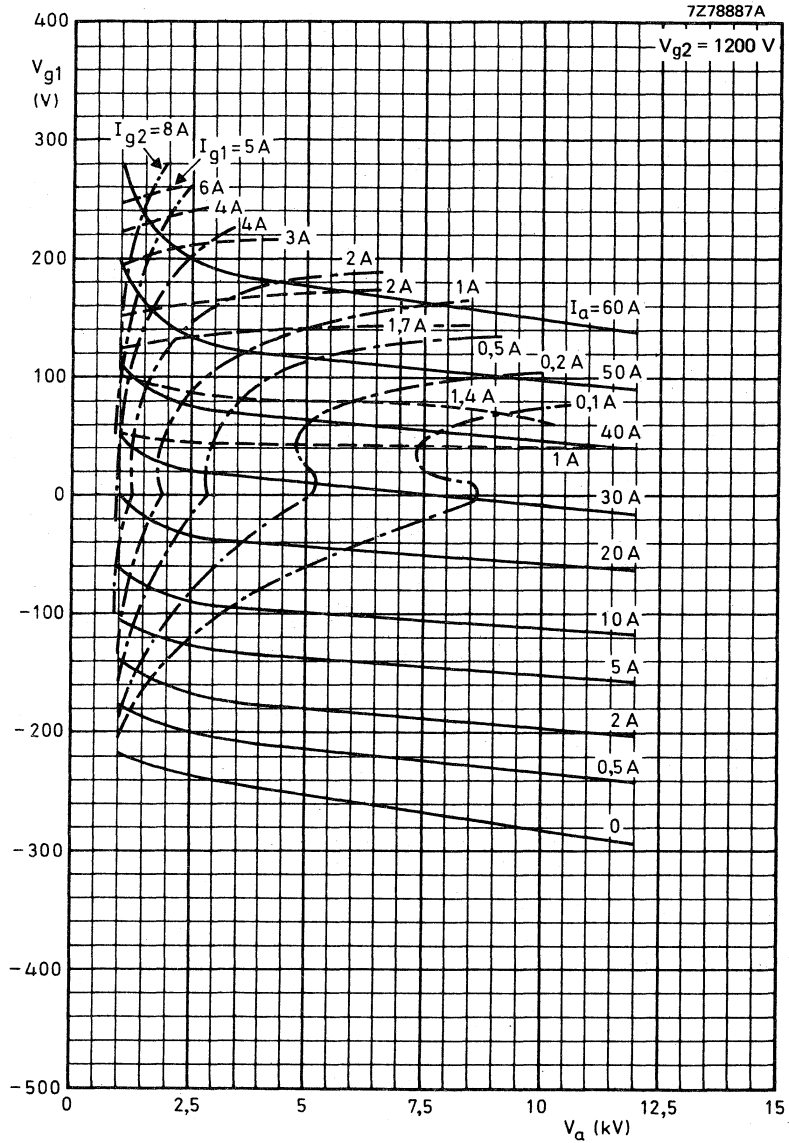


Fig. 8.

## 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)	$W_{\varrho}$	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	$W_{\varrho}$	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	$W_{\varrho}$	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%
Filament current	$I_f$	118 A	-3%
Filament peak starting current	$I_{fp}$	max. 750 A	
Cold filament resistance	$R_{fo}$	6 m $\Omega$	
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	$\mu_{g2g1}$	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

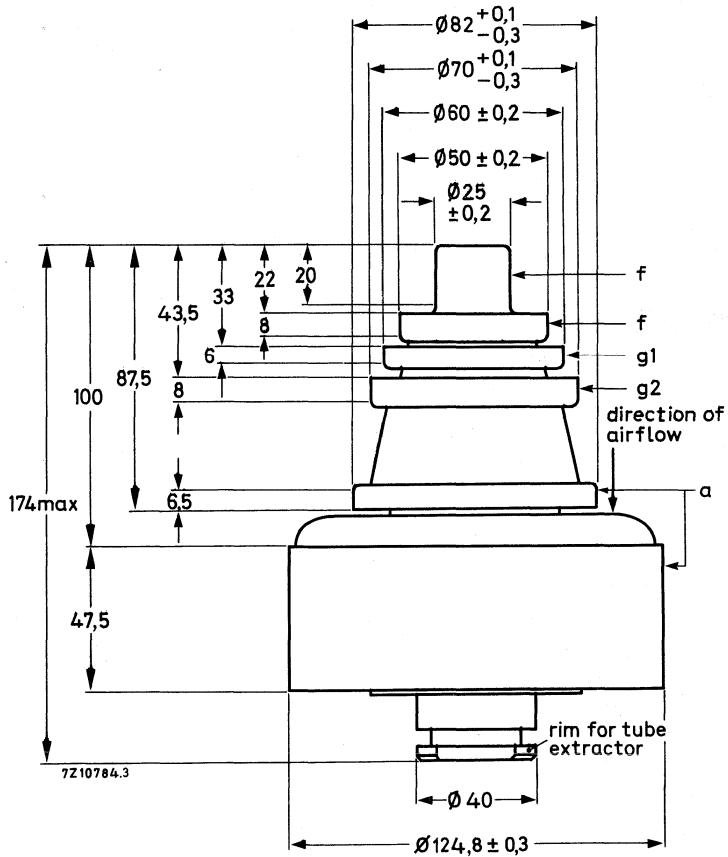
**ACCESSORIES**

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		≥ 85	≥ 85 %	5
L.F. linearity		≥ 85	≥ 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 <sub>a</sub>	4	4 kV	
Grid 2 voltage	V <sub>g2</sub>	600	600 V	
Grid 1 voltage	V <sub>g1</sub>	-70	-70 V	2
Anode current, no signal condition	I <sub>a</sub>	750	750 mA	
Anode current, black	I <sub>a</sub> black	2,1	2,3 A	3
Grid 2 current, black	I <sub>g2</sub> black	45	45 mA	3
Grid 1 current, black	I <sub>g1</sub> black	75	85 mA	3
Output power in load, sync	W <sub>ℓ</sub> sync	6,25	6,25 kW	
Output power in load, black	W <sub>ℓ</sub> black	3,75	3,75 kW	
Driving power, sync	W <sub>dr</sub> sync	340	385 W	
Driving power, black	W <sub>dr</sub> black	180	210 W	
Gain, sync	G <sub>sync</sub>	12,7	12,1 dB	
Gain, black	G <sub>black</sub>	13,3	12,5 dB	
Sync compression	sync in/out	30/25	29/25	4
Differential phase		< 3	< 3 °	5
Differential gain		≥ 85	≥ 85 %	5
L.F. linearity		≤ 85	≤ 85 %	5

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

## LIMITING VALUES

see previous page.

## OPERATING CONDITIONS, grounded grid

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

Frequency	f	175 to 225 MHz	
Bandwidth (-1 dB)	B	8 MHz	1
Anode voltage	V <sub>a</sub>	4 kV	
Grid 2 voltage	V <sub>g2</sub>	700 V	
Grid 1 voltage	V <sub>g1</sub>	-70 V	2
Anode current, no signal condition	I <sub>a</sub>	1 A	
Anode current	I <sub>a</sub>	1,65 A	6
Grid 2 current	I <sub>g2</sub>	25 mA	6
Grid 1 current	I <sub>g1</sub>	10 mA	6
Driving power, sync	W <sub>dr</sub>	85 W	
Output power in load, sync	W <sub>ℓ</sub>	2,5 kW	
Power gain	G	14,8 dB	
Intermodulation products	d	≤ -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

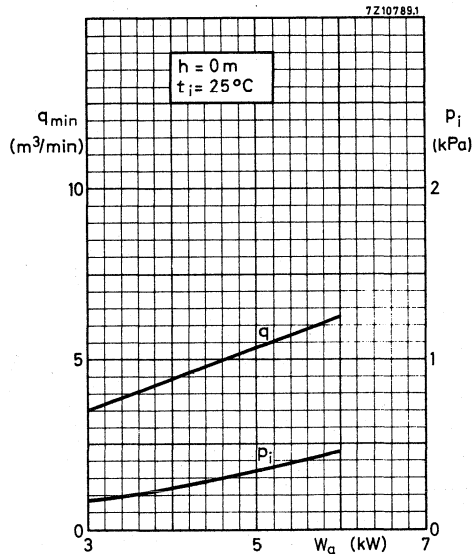
Frequency	f	260 MHz
Anode voltage	$V_a$	7 kV
Grid 2 voltage	$V_{g2}$	600 V
Grid 1 voltage	$V_{g1}$	-120 V (note 2)
Anode current, no signal condition	$I_a$	200 mA
Anode current	$I_a$	2,3 A
Grid 2 current	$I_{g2}$	80 mA
Grid 1 current	$I_{g1}$	150 mA
Anode input power	$W_{ia}$	16,1 kW
Anode dissipation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

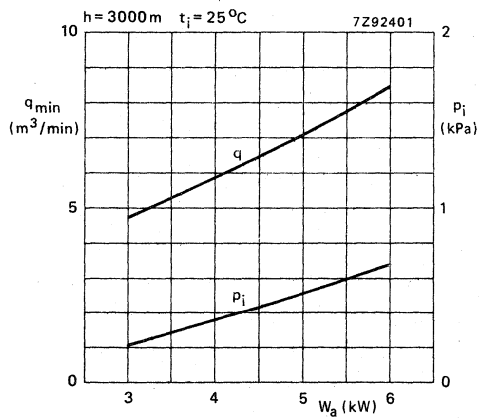
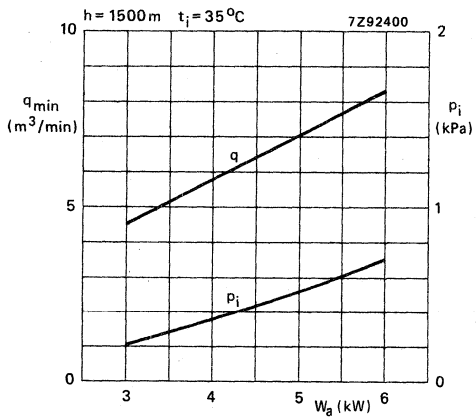
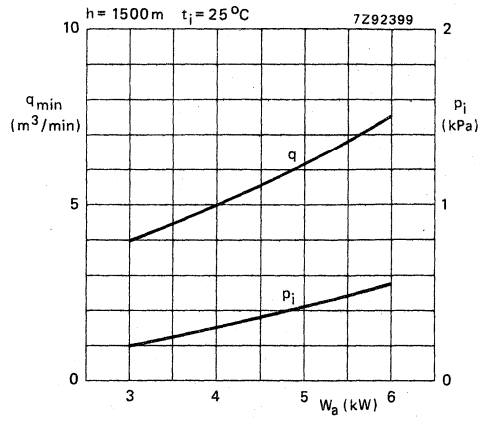
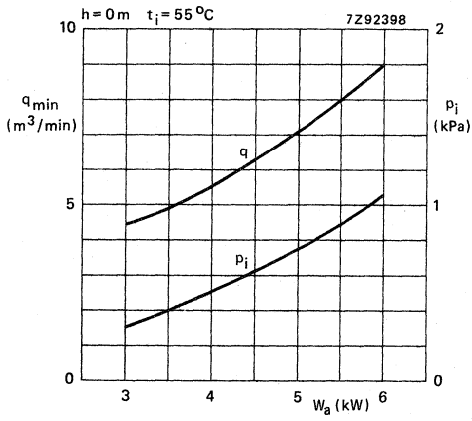
Notes see page 71.

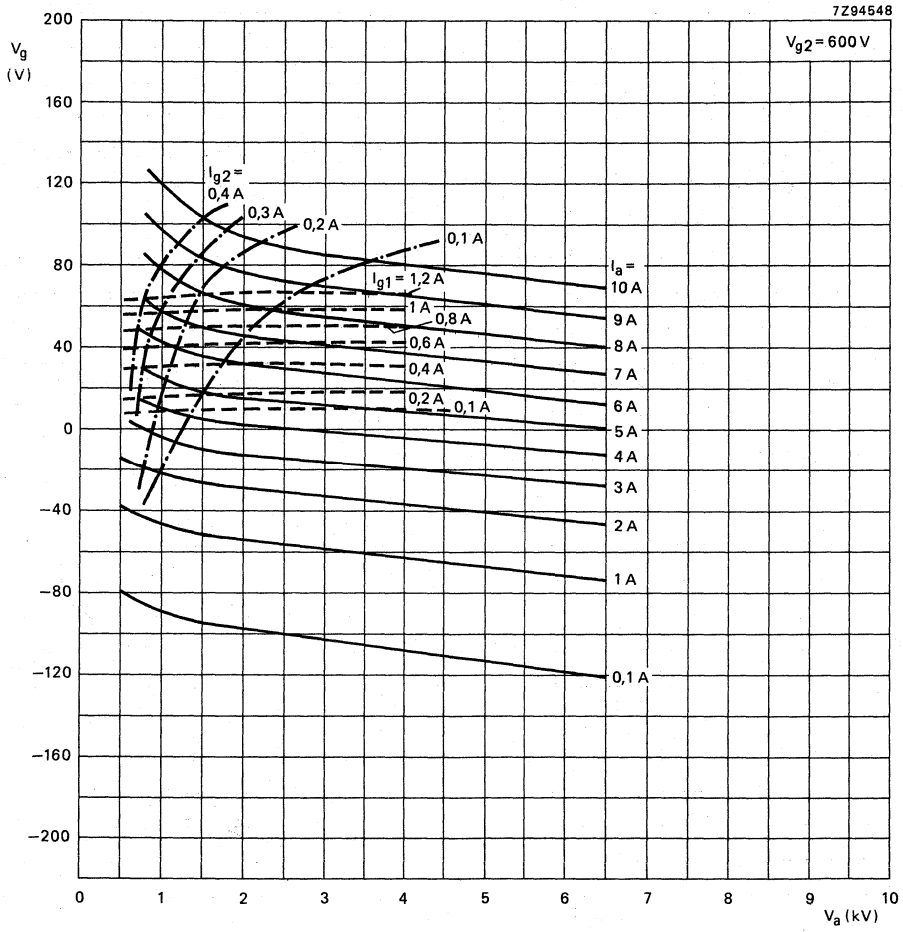


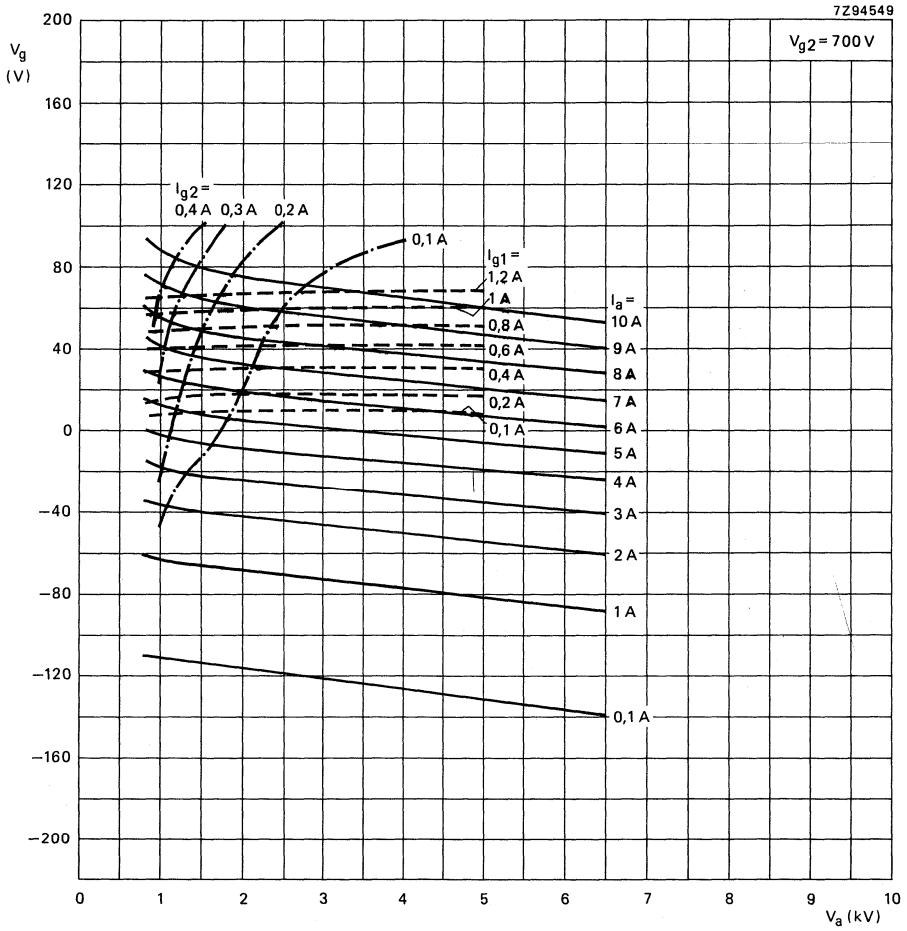
## NOTES

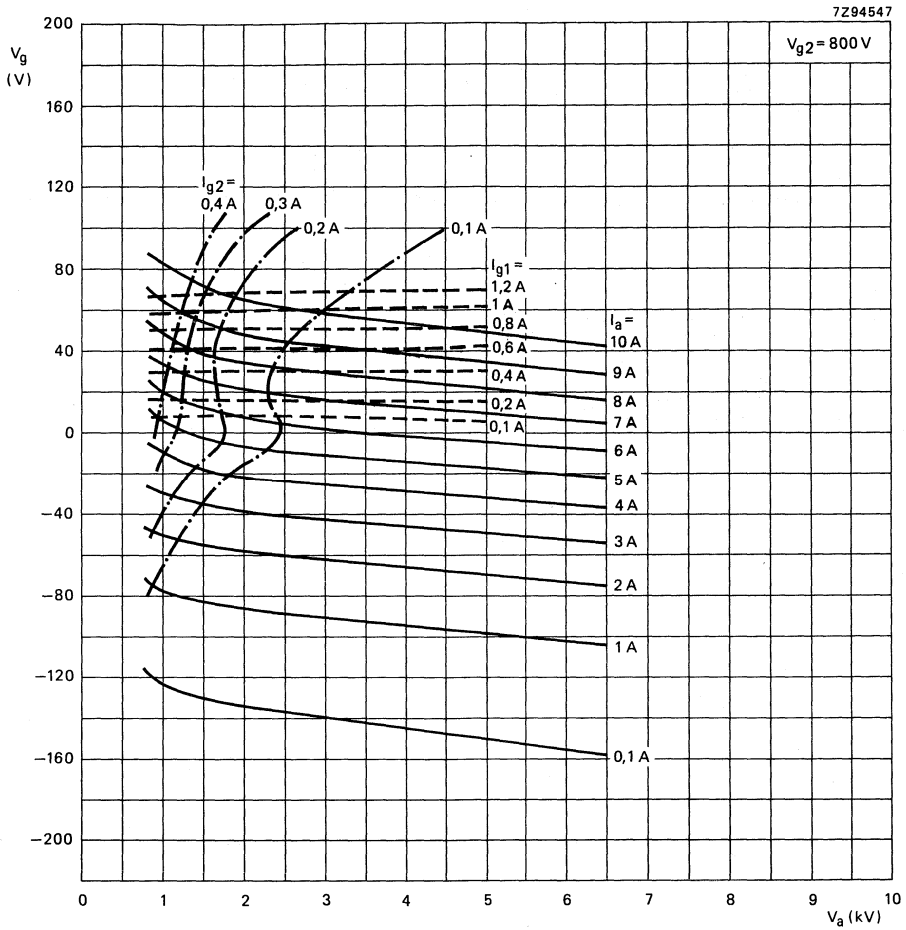
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5.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











## 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	$\Delta P$ kPa	$T_o$ °C
8	20	5	7,3	45
	50	7,5	14,5	67
5	20	3	3	48
	50	4,5	6	69

Absolute maximum water inlet temperature

$T_i$  50 °C

Absolute maximum water pressure

$p$  600 kPa

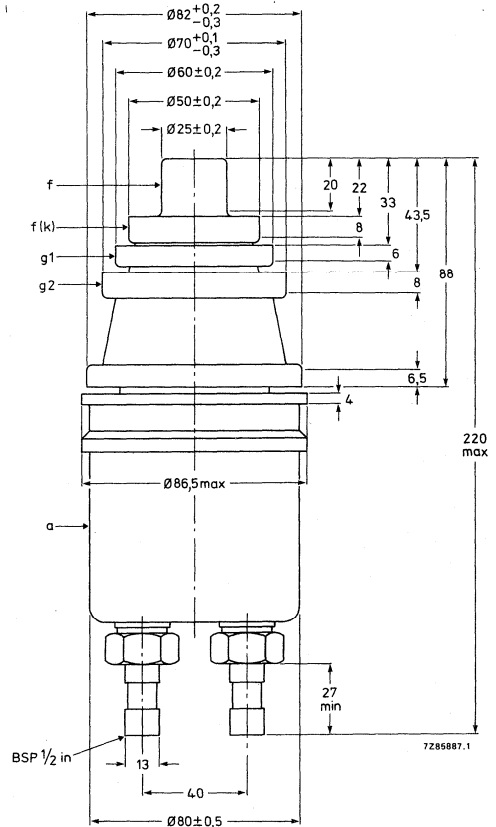
The temperature of the seals and envelope should be kept well below 200 °C.

An air flow of about 0,5 m<sup>3</sup>/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	$W_{\ell}$	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	$W_{\ell}$	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	$W_{\ell}$	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	$W_{\ell}$	7 kW
Power gain, sync	G	15 dB

**HEATING:** direct; thoriated tungsten filament, mesh type.

Filament voltage	$V_f$	8 V	+1%
Filament current	$I_f$	116 A	-3%
Filament peak starting current	$I_{fp}$	max. 750 A	
Cold filament starting current	$R_{fo}$	7,5 m $\Omega$	
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	$\mu_{g2g1}$	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

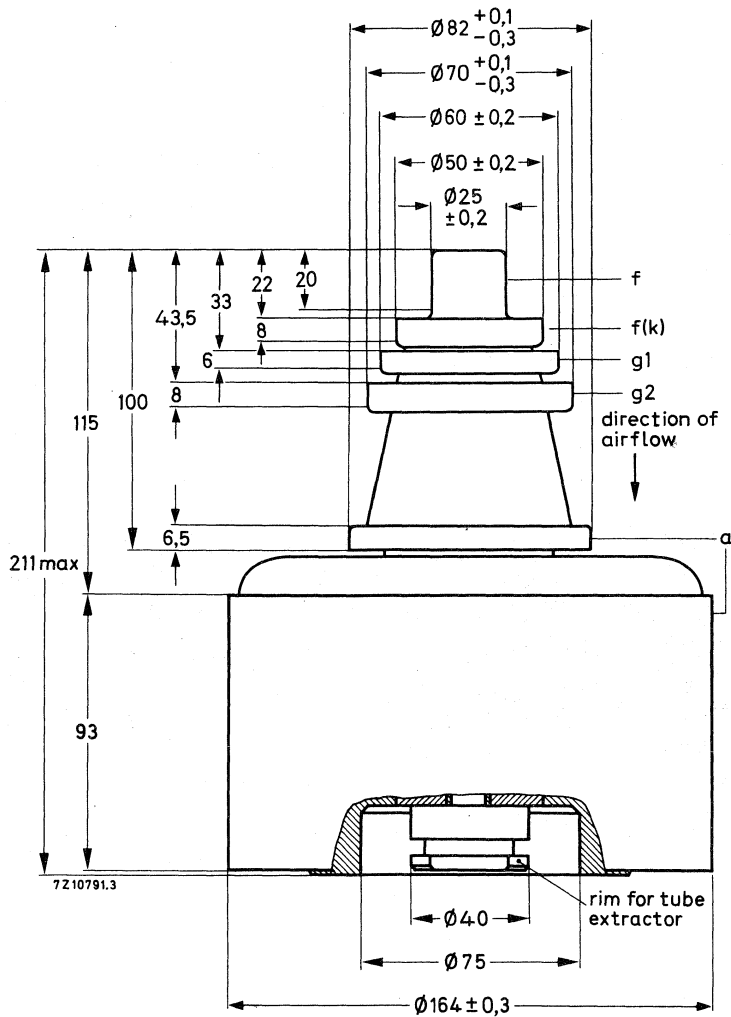


## MECHANICAL DATA

Net mass: 10,5 kg

Mounting position: vertical with anode up or down

Dimensions in mm



**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	$W_{\ell}$	13 kW	
Efficiency, total	$\eta$	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

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		≥ 85	≥ 85 %	5
L.F. linearity		≥ 85	≥ 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 <sub>a</sub>	5,5	kV	
Grid 2 voltage	V <sub>g2</sub>	700	V	
Grid 1 voltage	V <sub>g1</sub>	−72	V	2
Anode current, no signal condition	I <sub>a</sub>	900	mA	
Anode current, black	I <sub>a</sub> black	3,2	A	3
Grid 2 current, black	I <sub>g2</sub> black	55	mA	3
Grid 1 current, black	I <sub>g1</sub> black	165	mA	3
Output power in load, sync	W <sub>ℓ</sub> sync	13,2	kW	
Output power in load, black	W <sub>ℓ</sub> black	7,9	kW	3
Driving power, sync	W <sub>dr</sub> sync	660	W	
Driving power, black	W <sub>dr</sub> black	350	W	
Gain, sync	G <sub>sync</sub>	13	dB	
Gain, black	G <sub>black</sub>	13,4	dB	
Sync compression	sync in/out	30/25		4
Differential phase		< 3	°	5
Differential gain		≥ 85	%	5
L.F. linearity		≥ 85	%	5
Frequency of vision carrier	f	55,25	MHz	
Bandwidth (−1 dB)	B	7	MHz	1
Anode voltage	V <sub>a</sub>	4	5,5 kV	
Grid 2 voltage	V <sub>g2</sub>	700	700 V	
Grid 1 voltage	V <sub>g1</sub>	−70	−72 V	2
Anode current, no signal condition	I <sub>a</sub>	800	900 mA	
Anode current, black	I <sub>a</sub> black	2,4	3,4 A	3
Grid 2 current, black	I <sub>g2</sub> black	55	45 mA	3
Grid 1 current, black	I <sub>g1</sub> black	60	175 mA	3
Output power in load, sync	W <sub>ℓ</sub> sync	6,4	13,2 kW	
Output power in load, black	W <sub>ℓ</sub> black	3,8	7,9 kW	3
Driving power, sync	W <sub>dr</sub> sync	352	733 W	
Driving power, black	W <sub>dr</sub> black	190	390 W	
Gain, sync	G <sub>sync</sub>	12,5	12,5 dB	
Gain, black	G <sub>black</sub>	13	13 dB	
Sync compression	sync in/out	28/25	30/25	4
Differential phase		< 3	< 3 °	5
Differential gain		≥ 85	≥ 85 %	5
L.F. linearity		≥ 85	≥ 85 %	5

Notes see page 85.

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

See page 80.

**OPERATING CONDITIONS**, grounded gridNegative 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	$\leq -54$ 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	

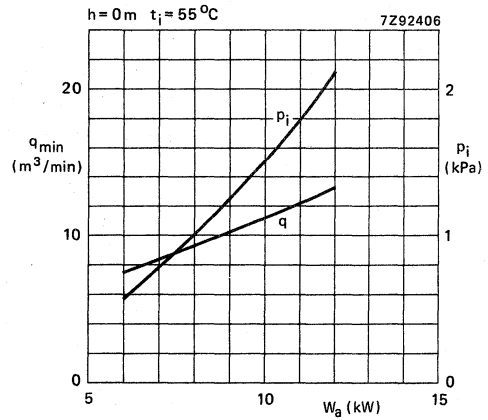
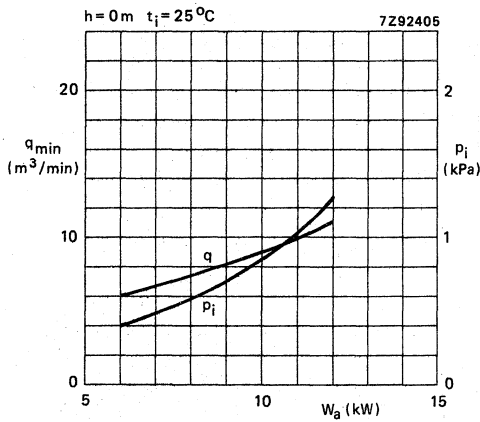
**OPERATING CONDITIONS**, grounded grid

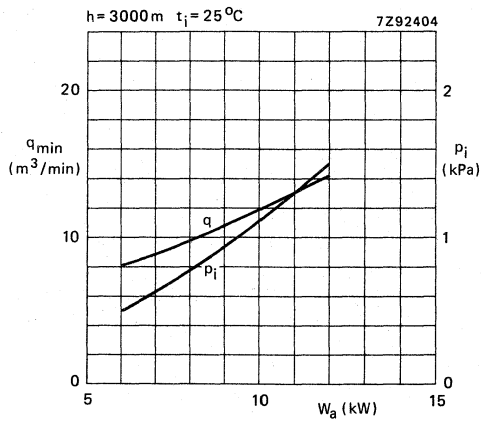
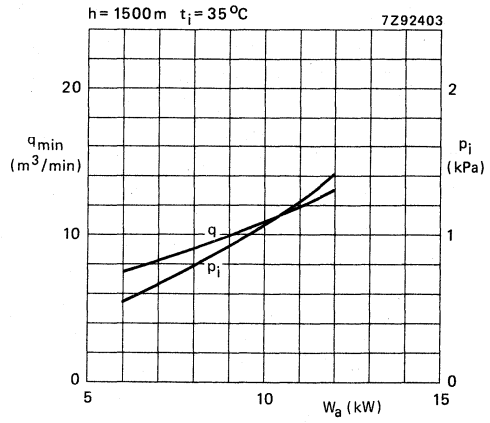
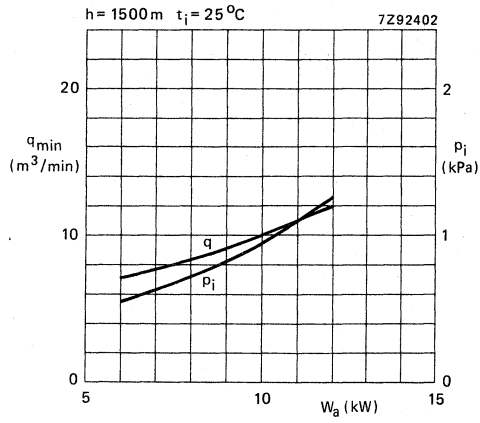
Frequency	f	260 MHz	
Anode voltage	$V_a$	8 kV	
Grid 2 voltage	$V_{g2}$	700 V	
Grid 1 voltage	$V_{g1}$	-115 V	2
Anode current, no signal condition	$I_a$	300 mA	
Anode current	$I_a$	3,5 A	
Grid 2 current	$I_{g2}$	100 mA	
Grid 1 current	$I_{g1}$	300 mA	
Anode input power	$W_{ia}$	28 kW	
Anode dissipation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

Note see page 85.

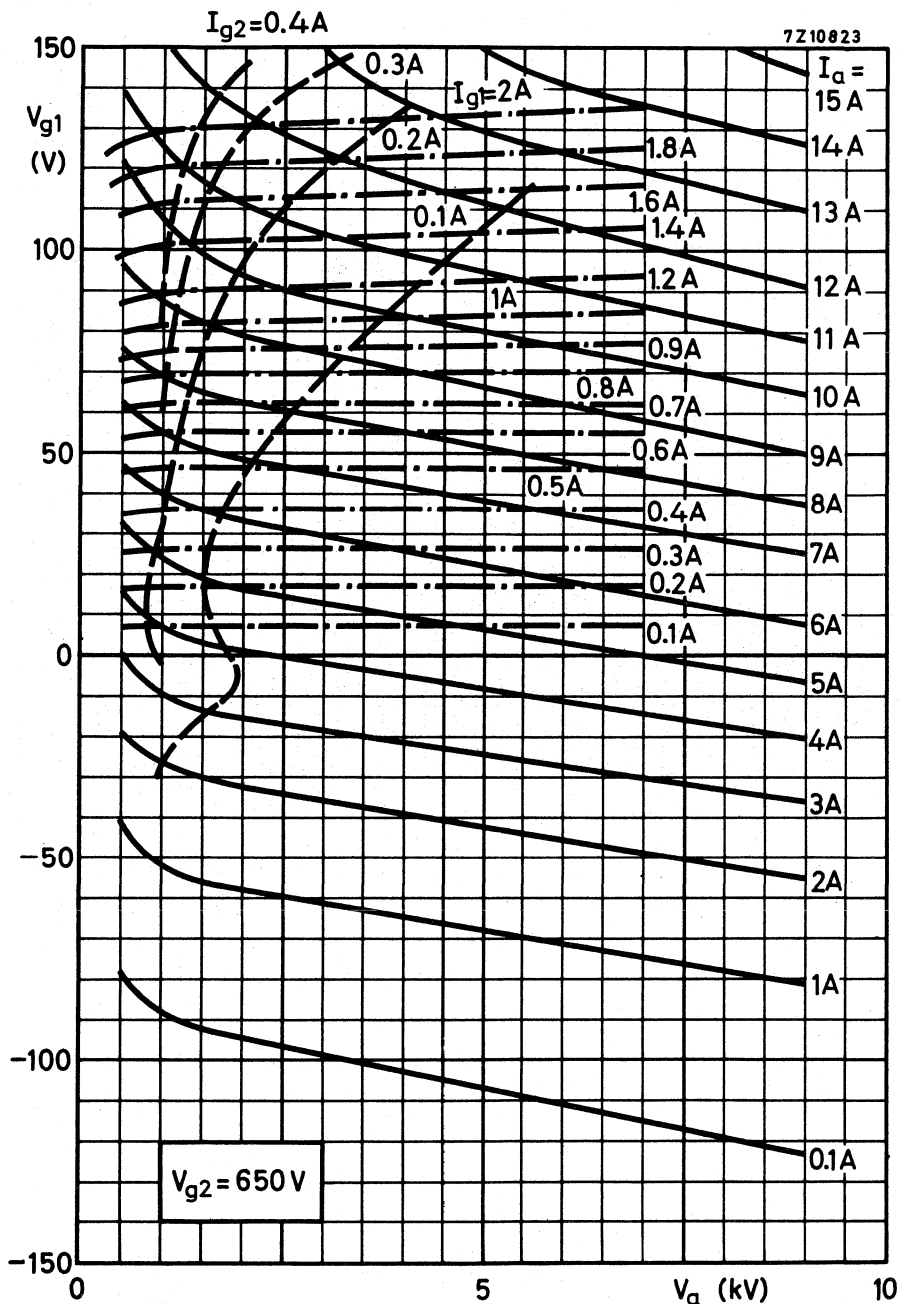
## NOTES

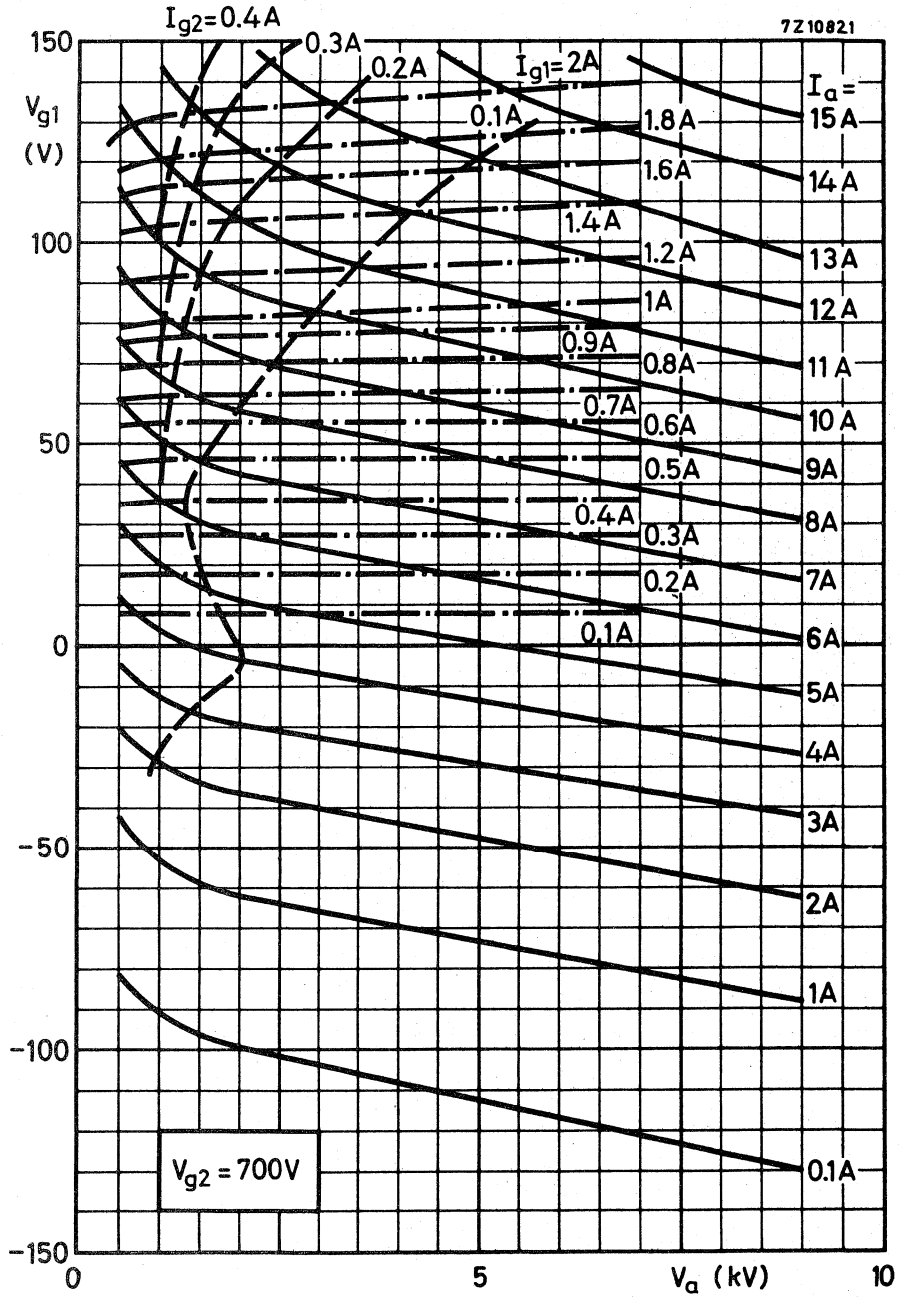
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 72/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5. 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).

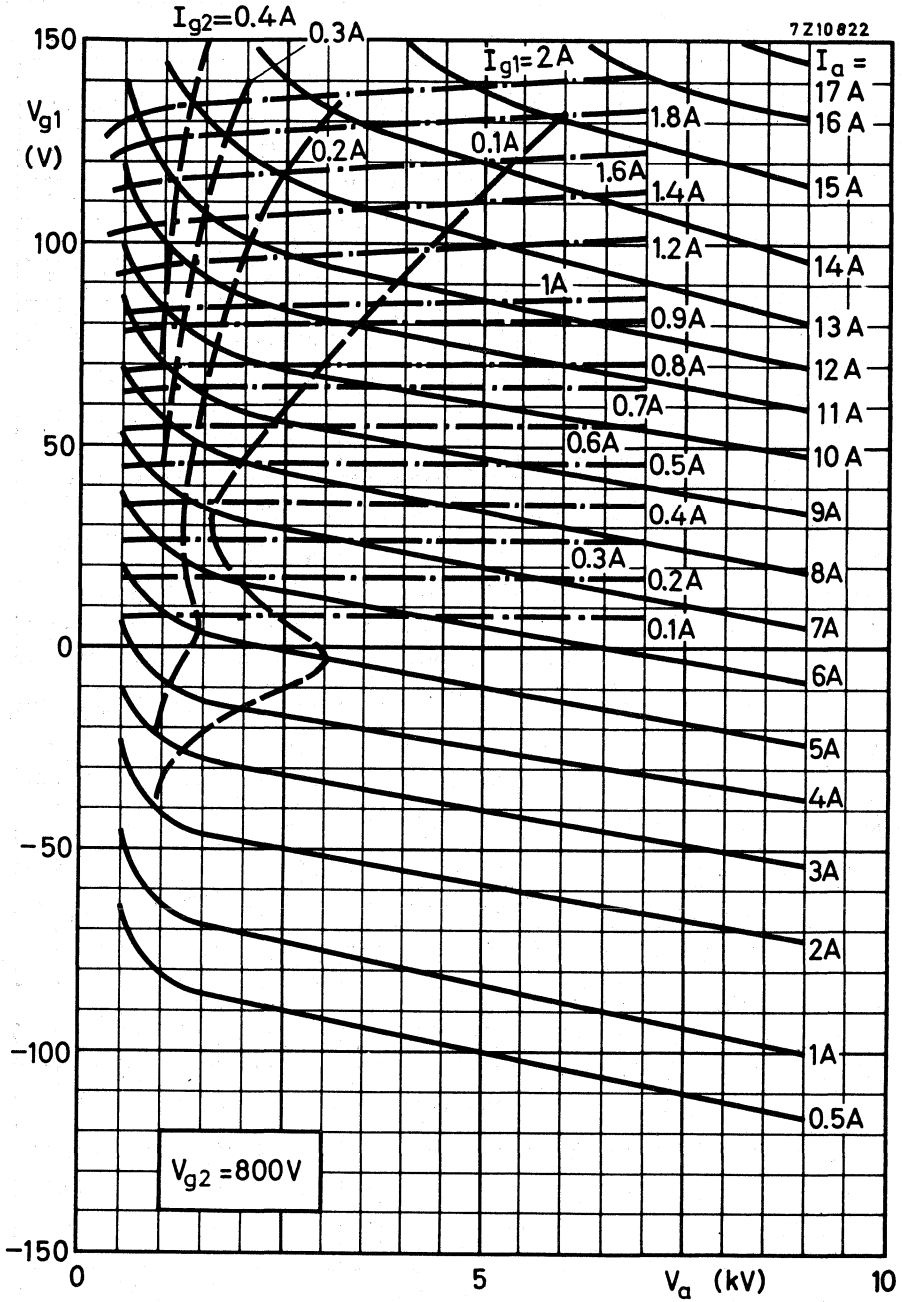














## AIR COOLED V.H.F. POWER TETRODE

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	$W_\ell$	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	$W_\ell$	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	$W_\ell$	0,55 kW
Power gain	G	14,8 dB

**HEATING:** direct; thoriated tungsten filament, mesh type.

Filament voltage	$V_f$	4,2 V	+1%
Filament current	$I_f$	53 A	-3%
Filament peak starting current	$I_{fp}$	max. 300 A	
Cold filament resistance	$R_{fo}$	8,5 m $\Omega$	
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	$\mu_{g2g1}$	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 °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.

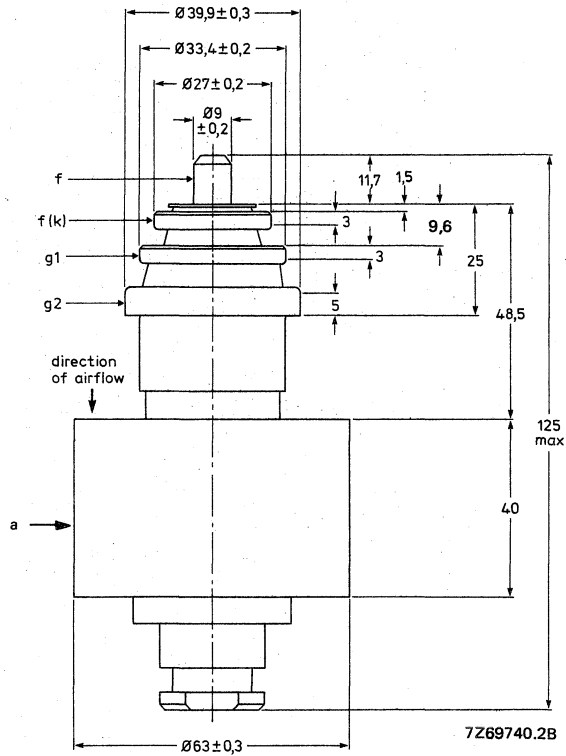
**ACCESSORIES**

Band I amplifier circuit assembly (vision)	type 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	$W_\ell$		2,4 kW	
Efficiency, total	$\eta$		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 °	5
Differential gain		≥ 85	≥ 85 %	5
L.F. linearity		≥ 85	≥ 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 <sub>a</sub>	2,5	2	2,5 kV	
Grid 2 voltage	V <sub>g2</sub>	600	600	600 V	
Grid 1 voltage	V <sub>g1</sub>	-21	-20	-21 V	2
Anode current, no signal condition	I <sub>a</sub>	200	200	200 mA	
Anode current, black	I <sub>a</sub> black	820	650	900 mA	3
Grid 2 current, black	I <sub>g2</sub> black	45	40	50 mA	3
Grid 1 current, black	I <sub>g1</sub> black	80	50	90 mA	3
Output power in load, sync	W <sub>ℓ</sub> sync	1170	670	1500 W	
Output power in load, black	W <sub>ℓ</sub> black	700	400	900 W	3
Driving power, sync	W <sub>dr</sub> sync	83	42	94 W	
Driving power, black	W <sub>dr</sub> black	46	24	50 W	
Gain, sync	G <sub>sync</sub>	11,5	12	12 dB	
Gain, black	G <sub>black</sub>	11,8	12,2	12,6 dB	
Sync compression	sync in/out	28/25	27/25	30/25	4
Differential phase		< 3	< 3	< 3 °	5
Differential gain		≥ 85	≥ 85	≥ 85 %	5
L.F. linearity		≥ 85	≥ 85	≥ 85 %	5
Frequency of vision carrier	f		83, 25	MHz	
Bandwidth (-1 dB)	B	7		7 MHz	1
Anode voltage	V <sub>a</sub>	2,5		2 kV	
Grid 2 voltage	V <sub>g2</sub>	600		600 V	
Grid 1 voltage	V <sub>g1</sub>	-21		-20 V	2
Anode current, no signal condition	I <sub>a</sub>	200		200 mA	
Anode current, black	I <sub>a</sub> black	900		610 mA	3
Grid 2 current, black	I <sub>g2</sub> black	50		45 mA	3
Grid 1 current, black	I <sub>g1</sub> black	90		45 mA	3
Output power in load, sync	W <sub>ℓ</sub> sync	1500		670 W	
Output power in load, black	W <sub>ℓ</sub> black	900		400 W	3
Driving power, sync	W <sub>dr</sub> sync	94		39 W	
Driving power, black	W <sub>dr</sub> black	50		22 W	
Gain, sync	G <sub>sync</sub>	12		12,3 dB	
Gain, black	G <sub>black</sub>	12,6		12,6 dB	
Sync compression	sync in/out	30/25		28/25	4
Differential phase		< 3		< 3 °	5
Differential gain		≥ 85		≥ 85 %	5
L.F. linearity		≥ 85		≥ 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

notes

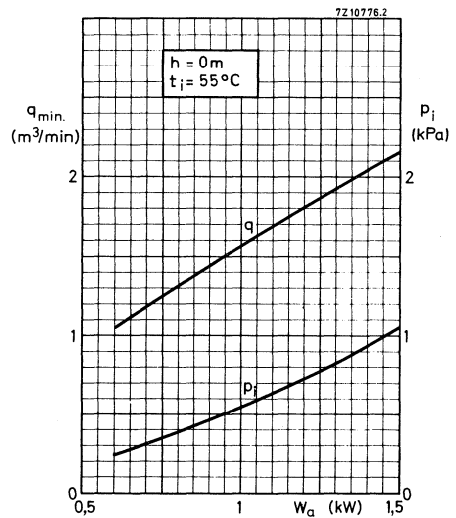
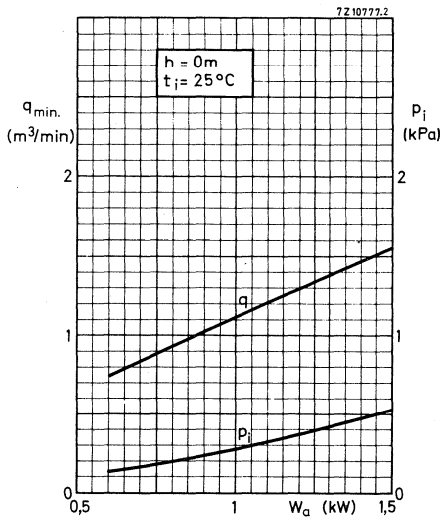
Negative modulation, positive synchronization, combined sound and vision  
(CCIR standard G)

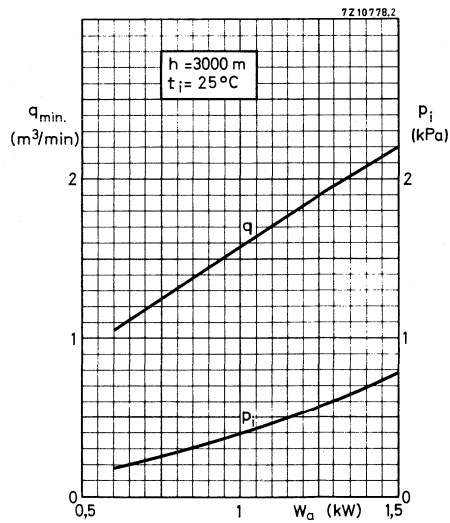
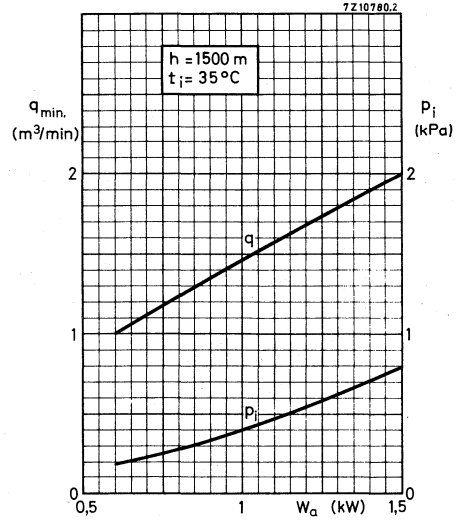
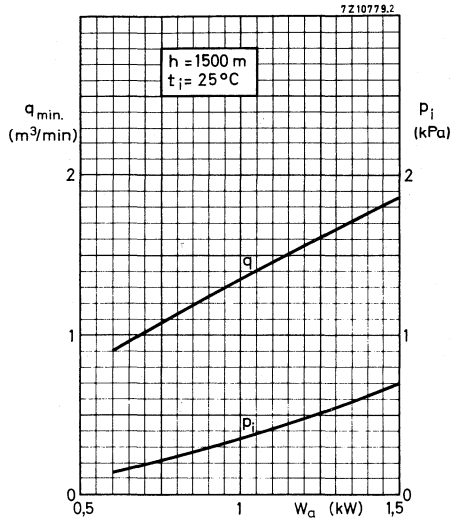
Frequency	f	175 to 225 MHz	
Bandwidth (-1 dB)	B	8 MHz	1
Anode voltage	$V_a$	2,5 kV	
Grid 2 voltage	$V_{g2}$	600 V	
Grid 1 voltage	$V_{g1}$	-13,5 V	2
Anode current, no signal condition	$I_a$	550 mA	
Anode current	$I_a$	730 mA	6
Grid 2 current	$I_{g2}$	50 mA	6
Grid 1 current	$I_{g1}$	35 mA	6
Driving power,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

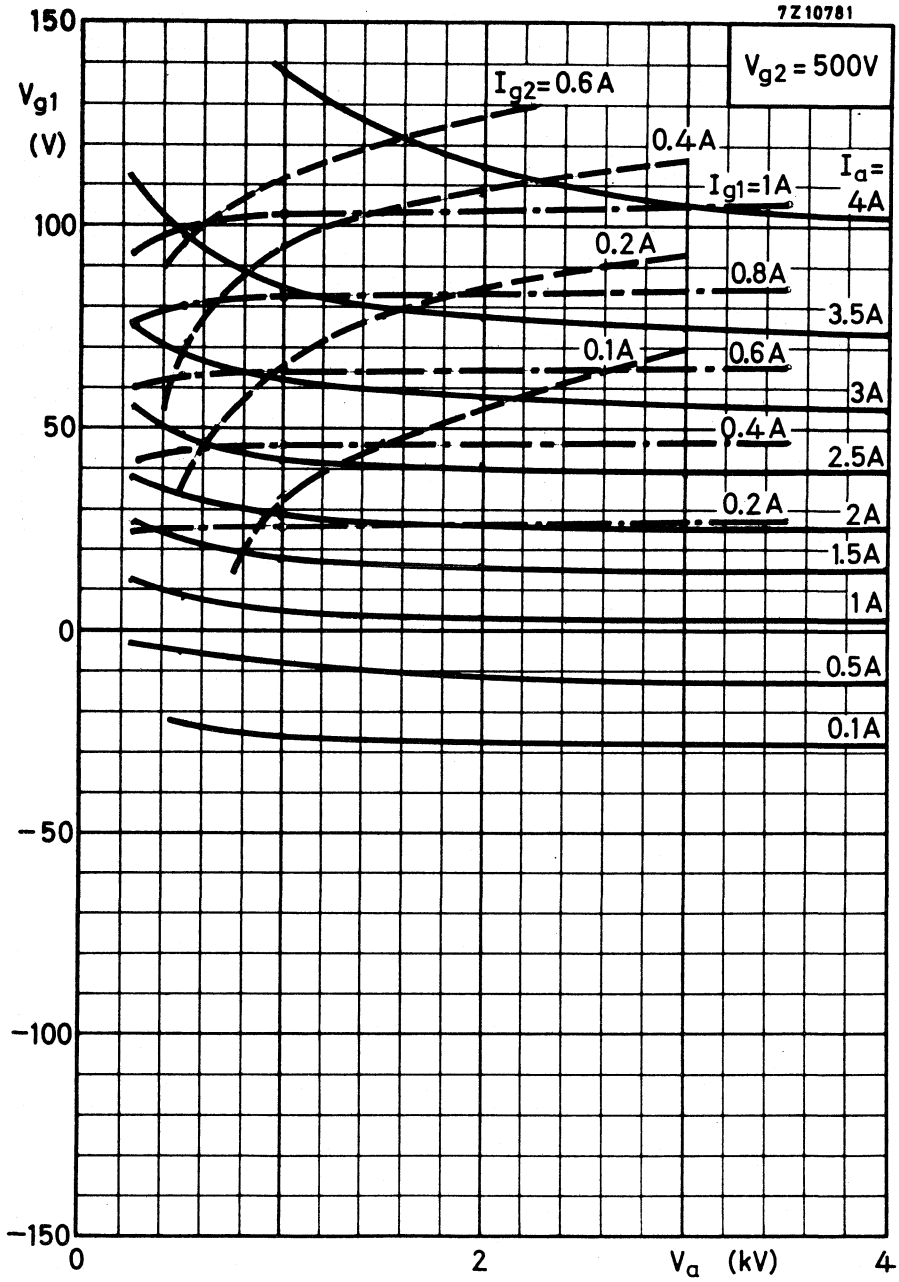
Notes see page 98.

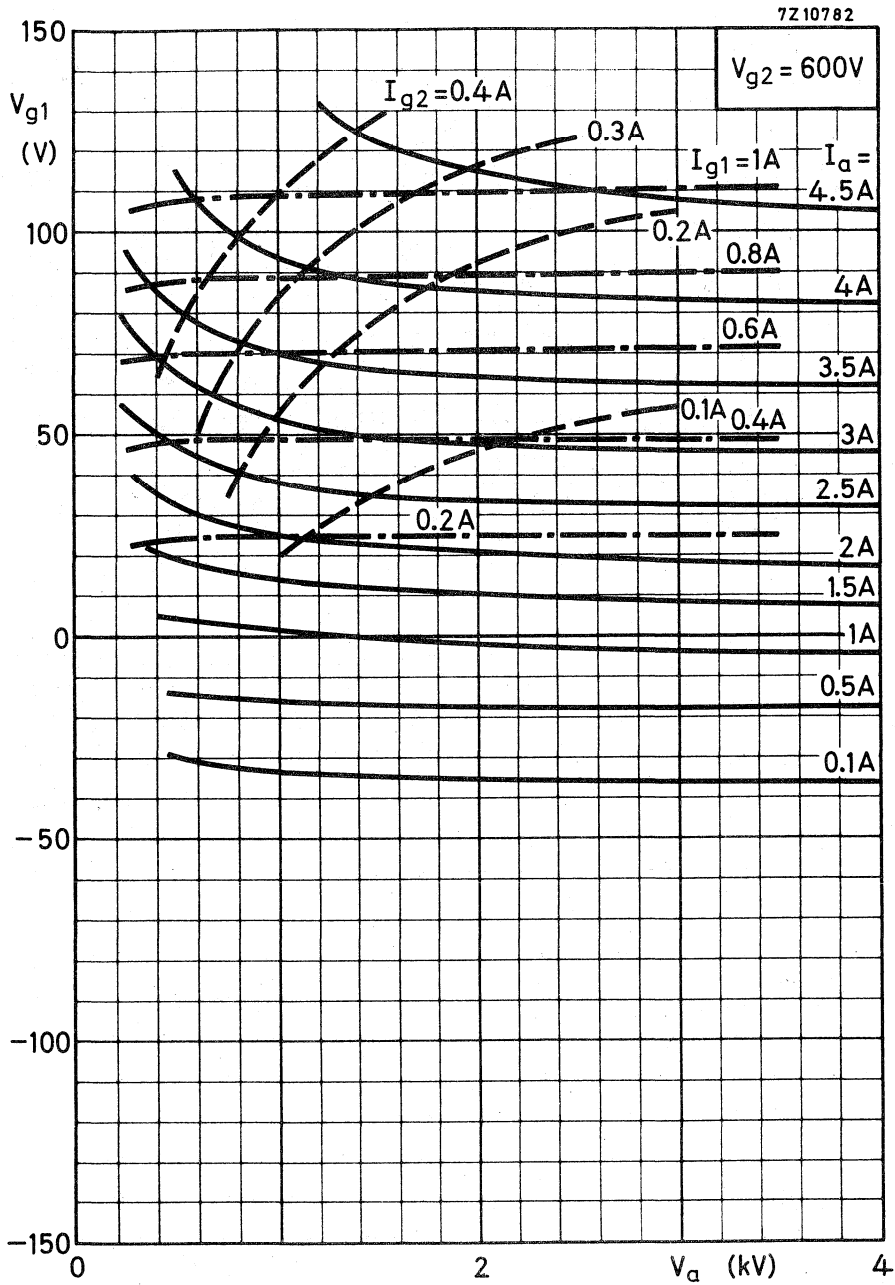
NOTES

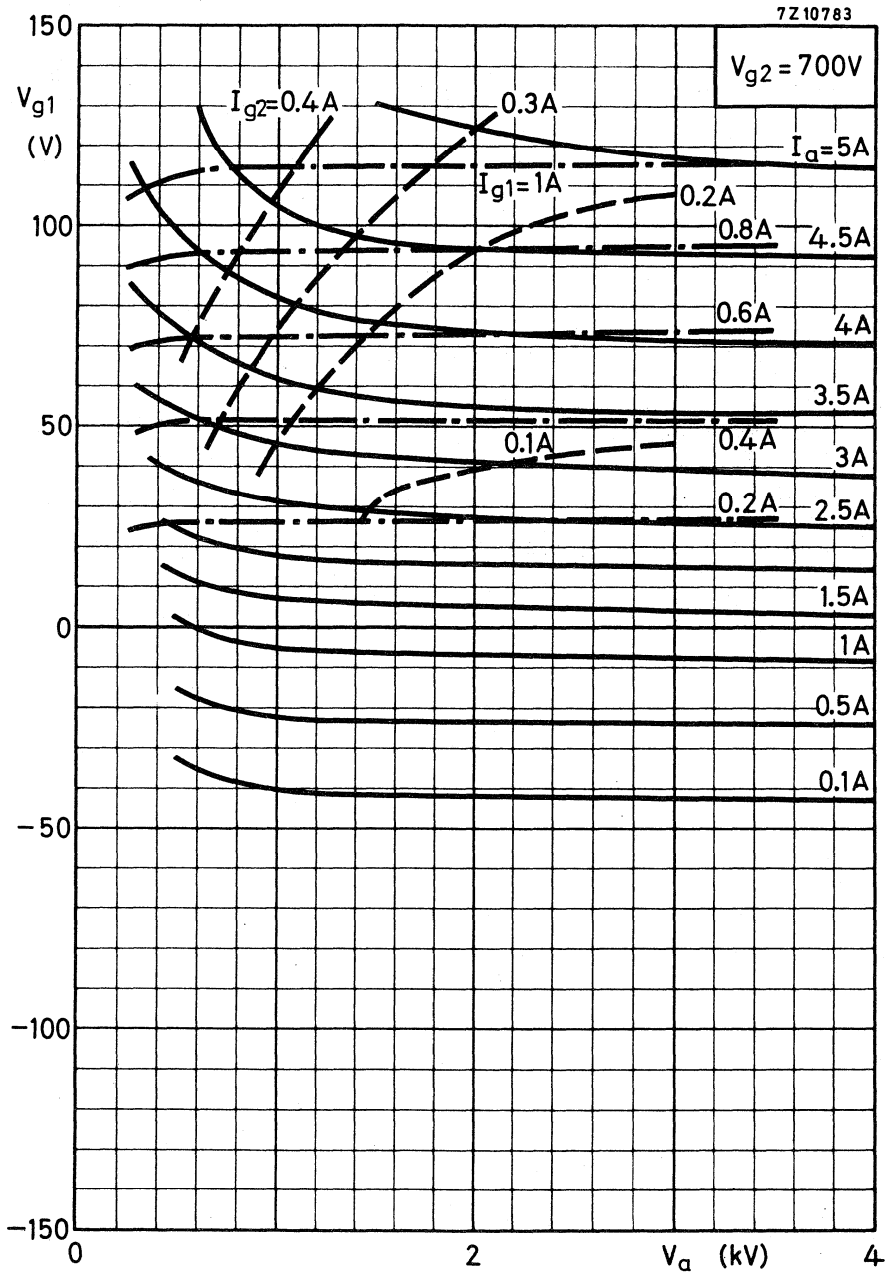
1. With double tuned circuit.
2. To be adjusted for the stated no signal anode current.
3. Black signal including line sync pulses.
4. A picture/sync ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal in which case the sync compression sync in/out = 30/25.
5.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













## 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	$V_a$	$W_{\ell}$	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 $\begin{matrix} +1\% \\ -3\% \end{matrix}$
Filament current	$I_f$	118 A
Filament peak starting current	$I_{fp}$	max. 750 A
Cold filament resistance	$R_{fo}$	6 m $\Omega$
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	$\mu_{g2g1}$	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.

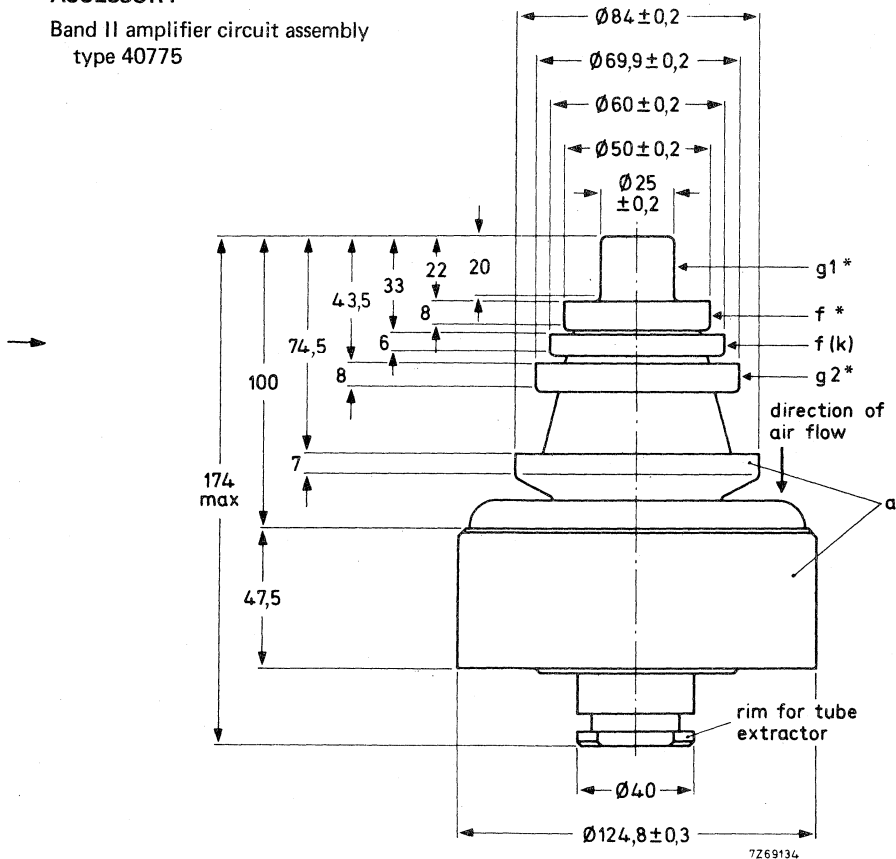
**MECHANICAL DATA**

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

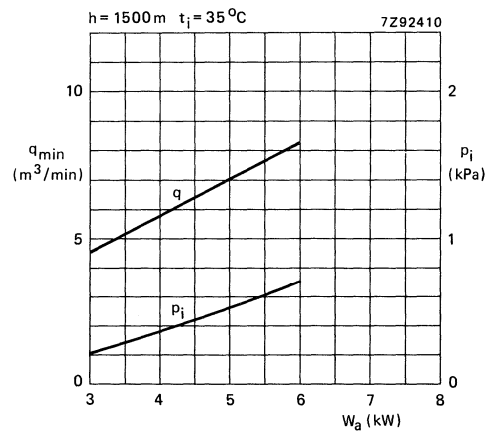
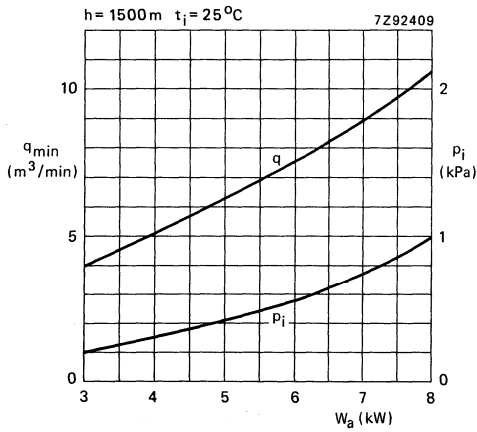
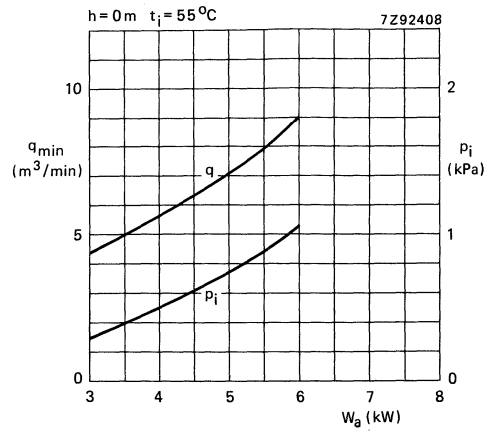
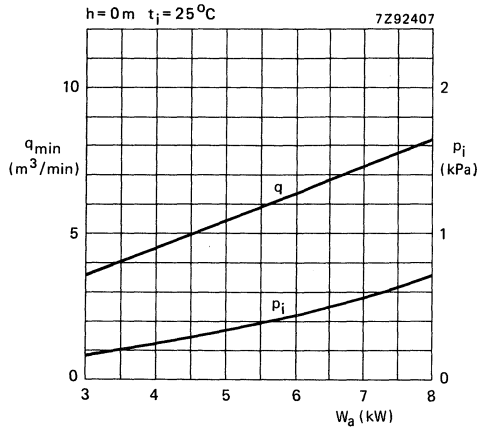
**LIMITING VALUES** (Absolute maximum rating system)

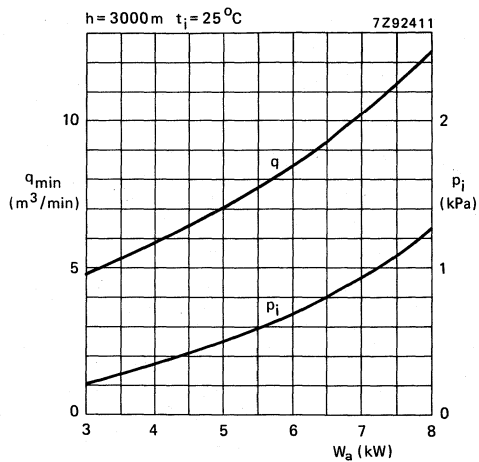
Frequency	f	up to	200 MHz
Anode voltage	$V_a$	max.	8,5 kV
Grid 2 voltage	$V_{g2}$	max.	1 kV
Grid 1 voltage	$-V_{g1}$	max.	500 V
Anode current	$I_a$	max.	4 A
Anode input power	$W_{ia}$	max.	18,5 kW
Anode dissipation	$W_a$	max.	8 kW
Grid 2 dissipation	$W_{g2}$	max.	80 W
Grid 1 dissipation	$W_{g1}$	max.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

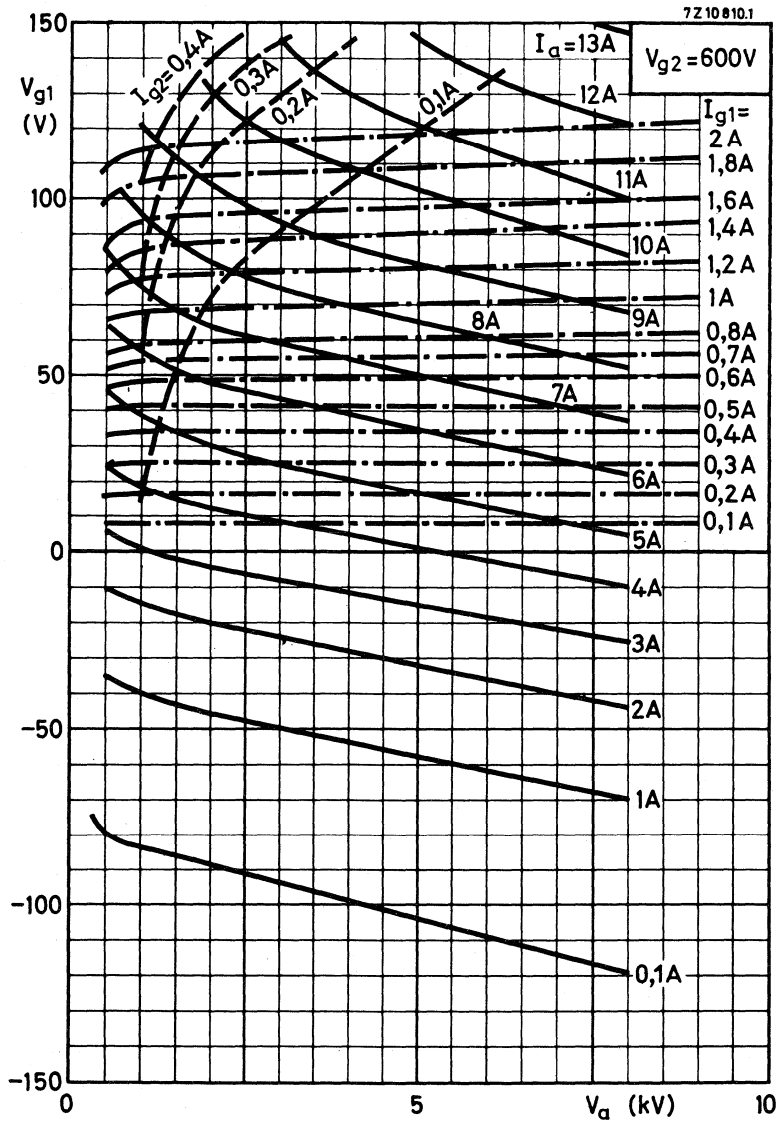
**OPERATING CONDITIONS**, grounded cathode, measured in amplifier assembly type 40775

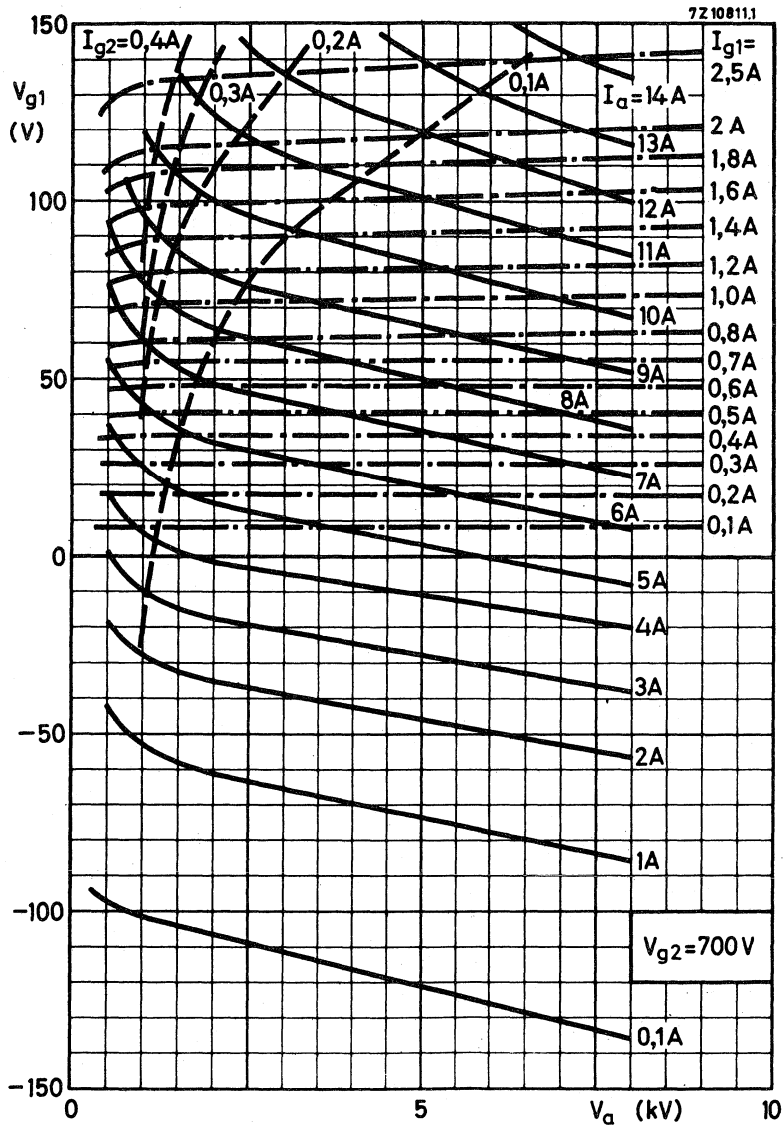
Frequency	f	87 to 100	87 to 110 MHz
Anode voltage	$V_a$	7	6 kV
Grid 2 voltage	$V_{g2}$	700	700 V
Grid 1 voltage*	$V_{g1}$	-105	-100 V
Anode current, no-signal condition	$I_a$	600	600 mA
Anode current	$I_a$	2,3	1,6 A
Grid 2 current	$I_{g2}$	40	70 mA
Grid 1 current	$I_{g1}$	150	90 mA
Anode input power	$W_{ia}$	16,1	9,6 kW
Anode dissipation	$W_a$	4,6	3,5 kW
Output power in load	$W_\ell$	11	6 kW
Efficiency, total	$\eta$	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.













## 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	$W_{\rho}$	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	$W_{\rho}$	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	$W_{\rho}$	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 m $\Omega$		
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	$\mu_{g2g1}$	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**

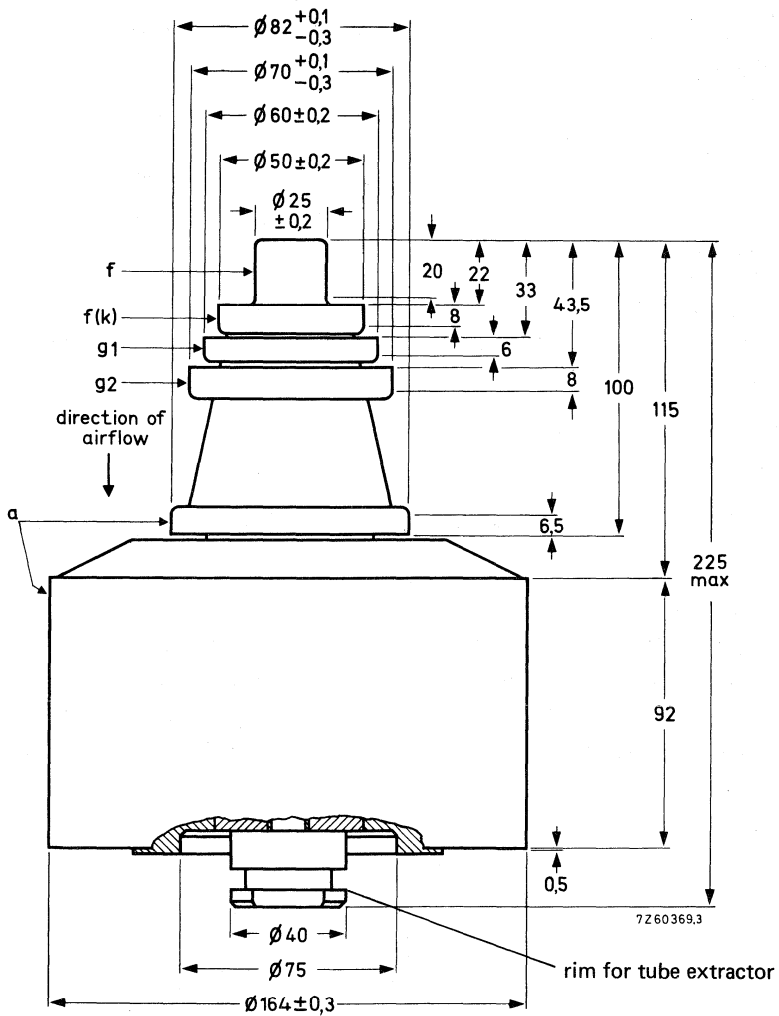
Band I amplifier circuit assembly (vision)	type 40759
Band I amplifier circuit assembly (sound)	type 40760
Band III amplifier circuit assembly (vision)	type 40768
Band III amplifier circuit assembly (sound)	type 40769

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

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	$W_l$ sync	27,5 kW	
Output power in load, black	$W_l$ 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		≥ 85 %	5
L.F. linearity		≥ 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 <sub>a</sub>	6,5	6,5 kV	
Grid 2 voltage	V <sub>g2</sub>	700	700 V	
Grid 1 voltage	V <sub>g1</sub>	−88	−88 V	2
Anode current, no signal condition	I <sub>a</sub>	900	900 mA	
Anode current, black	I <sub>a</sub> black	4,1	4,5 A	3
Grid 2 current, black	I <sub>g2</sub> black	55	45 mA	3
Grid 1 current, black	I <sub>g1</sub> black	160	175 mA	3
Output power in load, sync	W <sub>ℓ</sub> sync	20	20 kW	
Output power in load, black	W <sub>ℓ</sub> black	12	12 kW	3
Anode dissipation, black	W <sub>a</sub> black	14,6	17,2 kW	
Driving power, sync	W <sub>dr</sub> sync	835	910 W	
Driving power, black	W <sub>dr</sub> black	444	520 W	
Gain, sync	G <sub>sync</sub>	13,8	13,4 dB	
Gain, black	G <sub>black</sub>	14,3	13,6 dB	
Sync compression	sync in/out	30/25	27/25	4
Differential phase		< 3	< 3 deg	5
Differential gain		≥ 85	≥ 85 %	5
L.F. linearity		≥ 85	≥ 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 gridNegative 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 voltage	$V_{g1}$	-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	$W_{\ell}$	10,5 kW	
Power gain	G	16,2 dB	
Intermodulation products	d	-56 dB	7

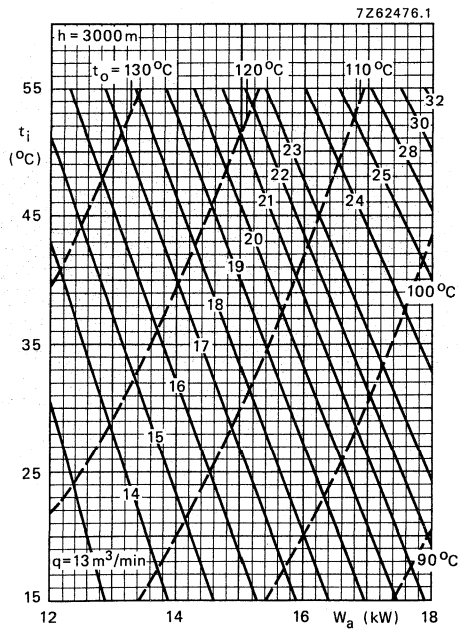
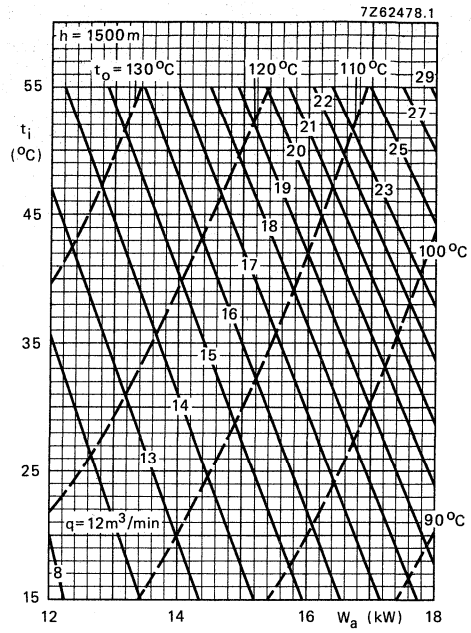
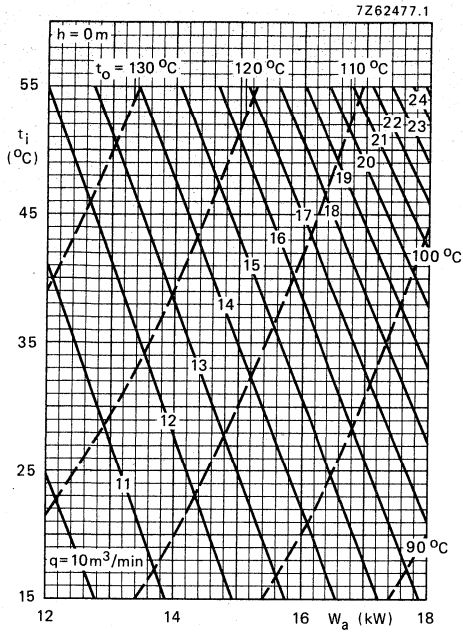
Notes see page 115.

**R.F. CLASS-B F.M. TELEPHONY****LIMITING VALUES (Absolute maximum rating system)**

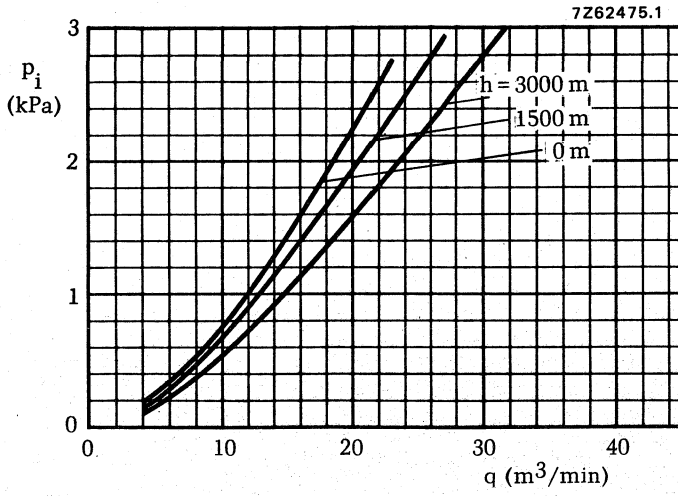
			notes
Frequency	f	up to 260 MHz	
Anode voltage	$V_a$	max. 9,5 kV	
Grid 2 voltage	$V_{g2}$	max. 1 kV	
Grid 1 voltage	$-V_{g1}$	max. 500 V	
Anode current	$I_a$	max. 7 A	
Anode input power	$W_{ia}$	max. 42 kW	
Anode dissipation	$W_a$	max. 18 kW	
Grid 2 dissipation	$W_{g2}$	max. 100 W	
Grid 1 dissipation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

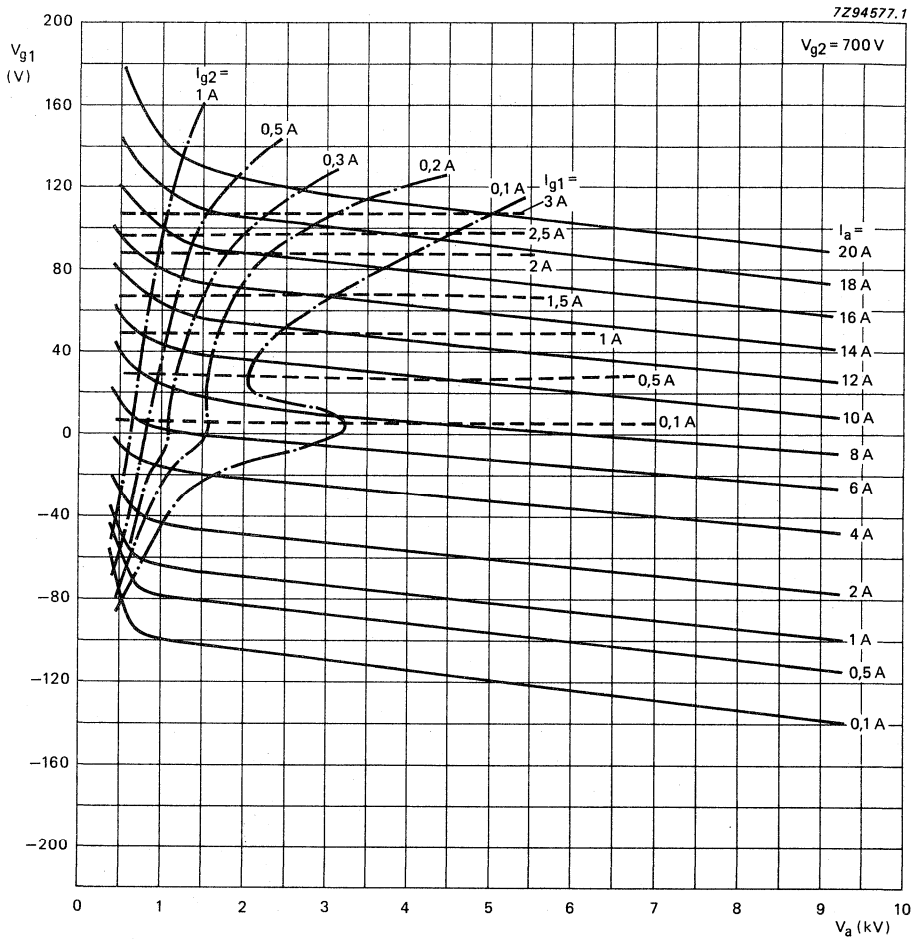
**OPERATING CONDITIONS**

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	$W_\ell$	25 kW	
Efficiency, total		64 %	
Driving power	$W_{dr}$	800 W	
Power gain	G	14,9 dB	









## 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	$W_{\ell}$	35 kW
Power gain	G	16 dB

**HEATING:** direct; thoriated tungsten filament, mesh type.

Filament voltage	$V_f$	7,5 V $\begin{matrix} +1\% \\ -3\% \end{matrix}$
Filament current	$I_f$	180 A
Filament peak starting current	$I_{fp}$	max. 1000 A
Cold filament resistance	$R_{fo}$	4,2 m $\Omega$
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	$\approx$ 70 mA/V
Amplification factor	$\mu_{g2g1}$	10

**CAPACITANCES**, 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

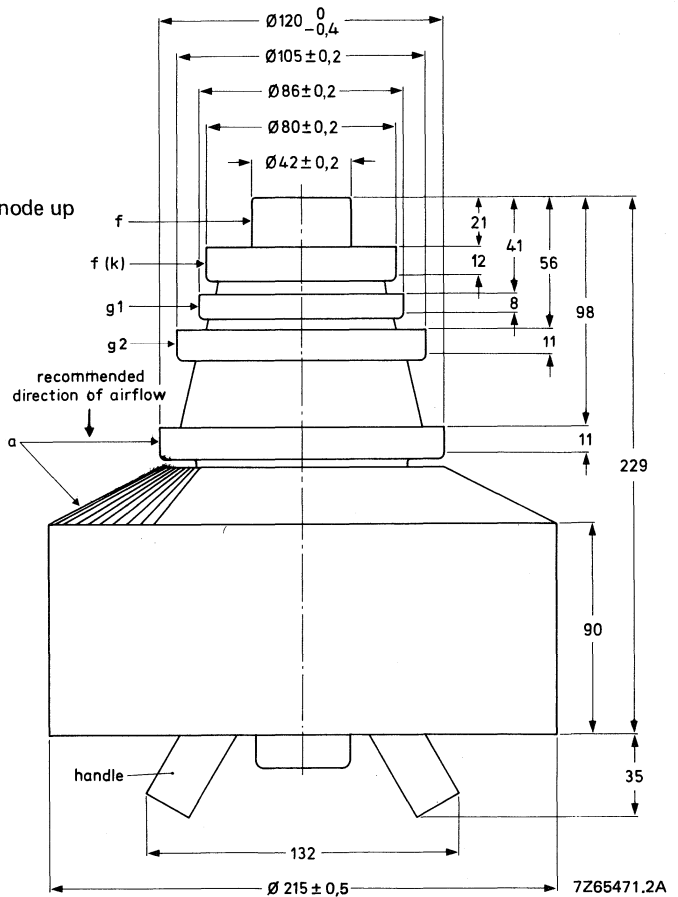
**COOLING**

$W_a + W_g$ kW	$h$ m	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min.	$\Delta P$ , tube only Pa	$\Delta P$ 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.

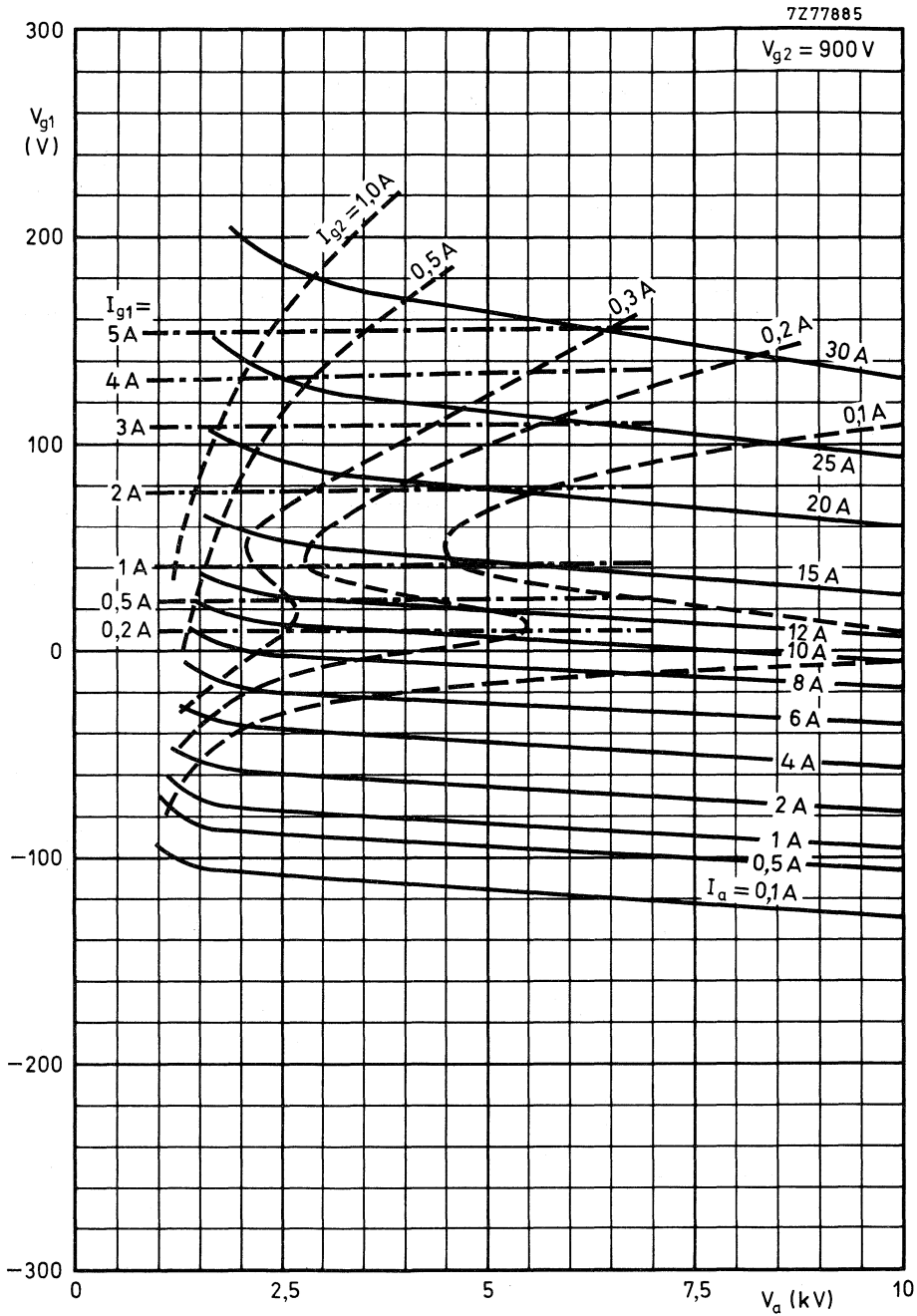
**LIMITING VALUES** (Absolute maximum rating system)

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	$W_\ell$	≥	35 kW
Driving power	$W_{dr}$		850 W
Gain	G		16 dB

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



## 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 $\begin{matrix} +1\% \\ -3\% \end{matrix}$
Filament current	$I_f$	180 A
Filament peak starting current	$I_{fp}$	max. 1000 A
Cold filament resistance	$R_{fo}$	4,2 m $\Omega$
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	$\approx$ 70 mA/V
Amplification factor	$\mu_{g2g1}$	10

**CAPACITANCES,** grounded grid

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

#### TEMPERATURE LIMITS

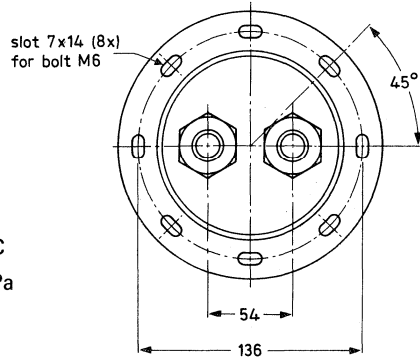
Absolute maximum envelope temperature	$T_{env}$	max. 240 °C
Recommended maximum seal temperature	T	max. 200 °C

COOLING

$W_a$ kW	$T_i$ °C	$q$ l/min	$\Delta P$ 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

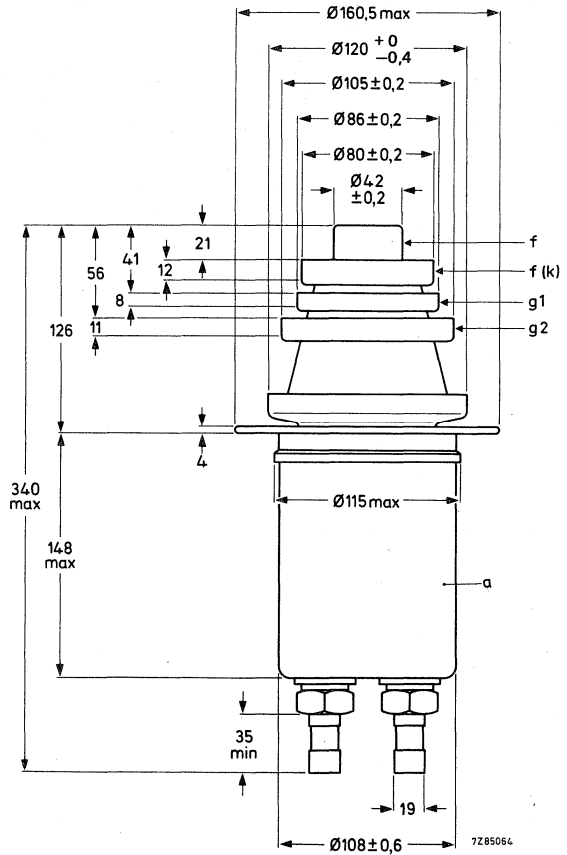
The temperature of the seals and envelope should be kept well below 200 °C.



An air flow of about 1 m<sup>3</sup>/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)**

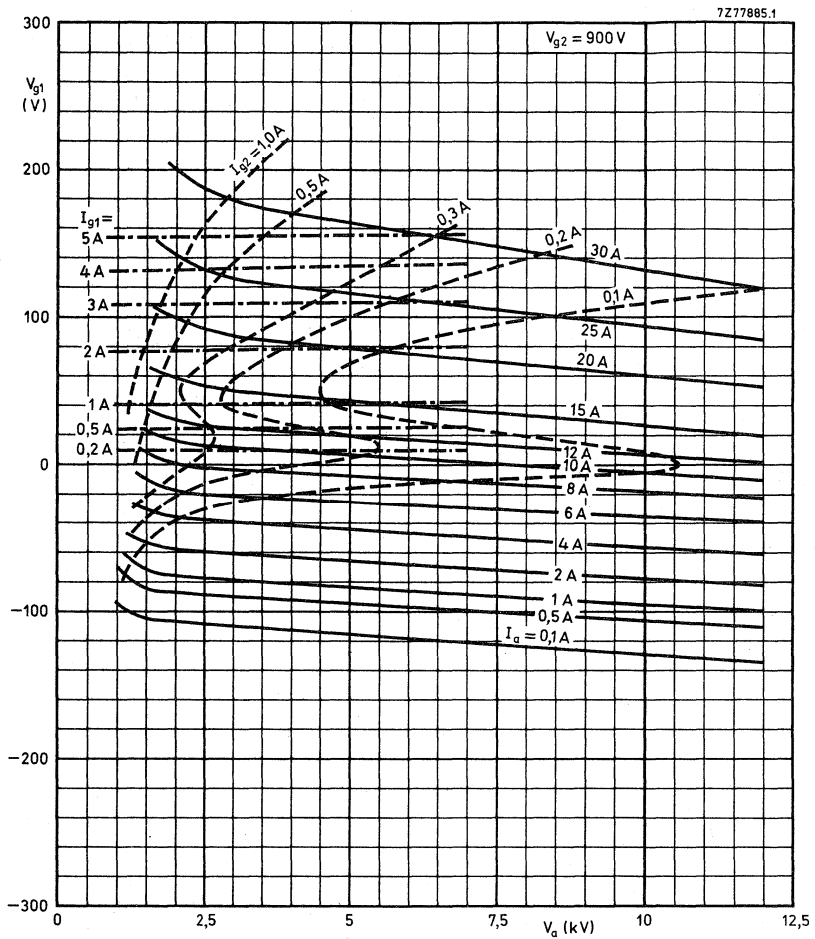
Frequency	f	up to 250 MHz*
Anode voltage	$V_a$	max. 14 kV
Grid 2 voltage	$V_{g2}$	max. 1200 V
Grid 1 voltage	$-V_{g1}$	max. 500 V
Anode current	$I_a$	max. 8 A
Anode dissipation	$W_a$	max. 30 kW
Grid 2 dissipation	$W_{g2}$	max. 400 W
Grid 1 dissipation	$W_{g1}$	max. 300 W
Cathode current	$I_k$	max. 9 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.



## 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)	$W_\ell$	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	$W_\ell$		2,2 kW
Power gain	G		22 dB

**HEATING:** direct; thoriated tungsten filament, mesh type

Filament voltage	$V_f$		4,2 V $\begin{matrix} +1\% \\ -3\% \end{matrix}$ ←
Filament current	$I_f$		53 A
Filament peak starting current	$I_{fp}$	max.	300 A
Cold filament resistance	$R_{fo}$		8,5 m $\Omega$
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	$\mu_{g^2g1}$	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

$\frac{W_a + W_g}{W}$	h m	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min	$\Delta P$ 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.

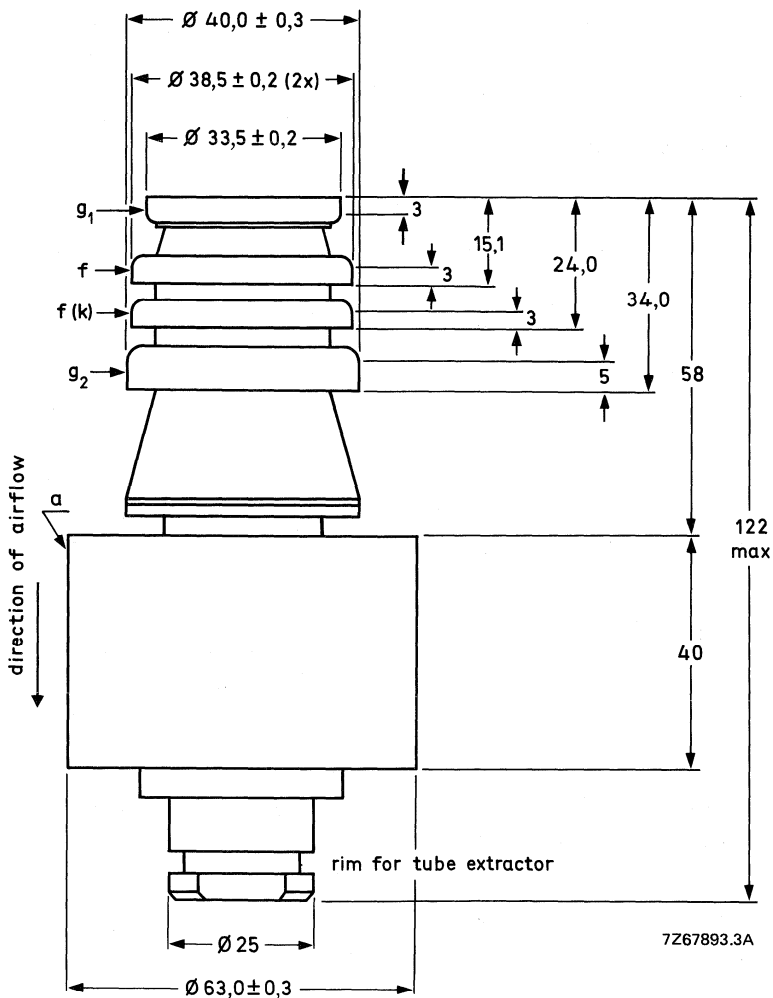
**ACCESSORIES**

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 k $\Omega$	

**OPERATING CONDITIONS** grid driven

Frequency of vision carrier	f	175,25 MHz	4
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	$\approx$ 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		$\geq$ 90 %	7
L.F. linearity		$\geq$ 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 k $\Omega$

**OPERATING CONDITIONS** grid driven

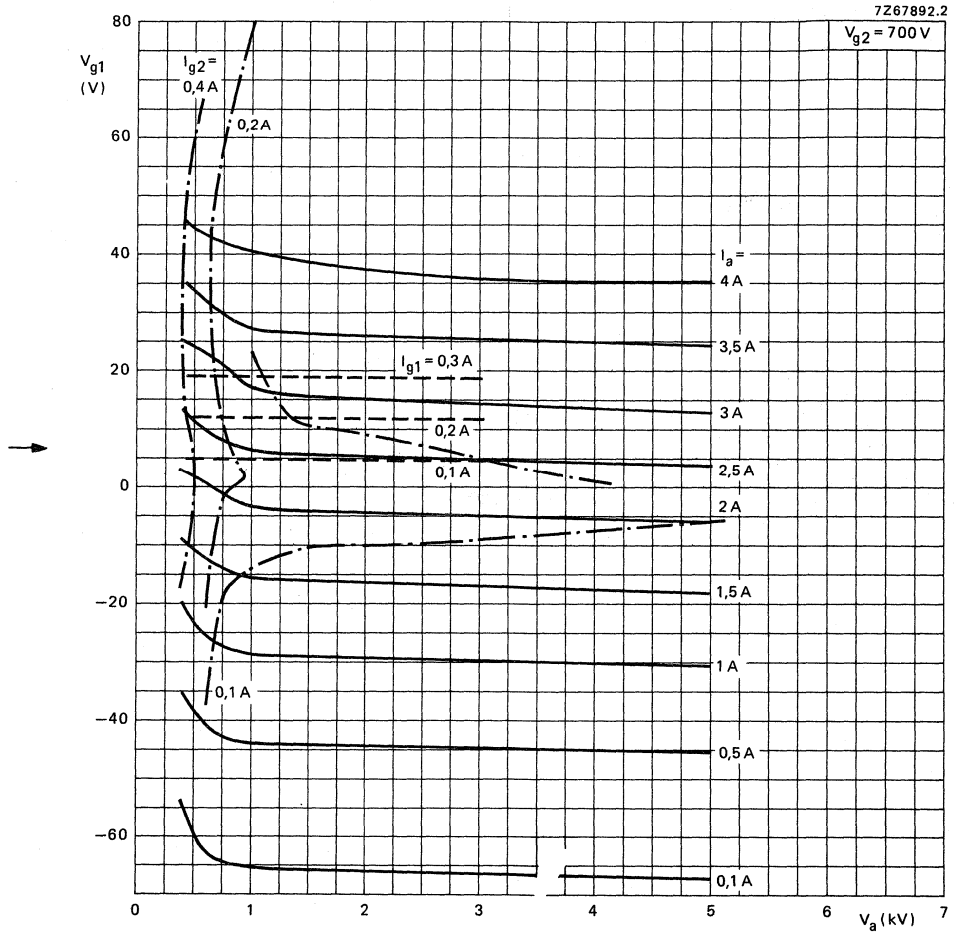
5

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
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	$W_{\rho}$	1,1	2,2 kW
Power gain	G	22,5	22,5 dB
Driving power	$W_{dr}$	6	12 W

2

**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.





## 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 <sub>a</sub>	4 kV
Output power in load	W <sub>l</sub>	2100 W
Power gain	G	23 dB

**HEATING:** direct; thoriated tungsten filament, mesh type

Filament voltage	V <sub>f</sub>	4,2 V <sup>+1%</sup> <sub>-3%</sub>
Filament current	I <sub>f</sub>	53 A
Filament peak starting current	I <sub>fp max</sub>	300 A
Cold filament resistance	R <sub>fo</sub>	8,5 mΩ
Waiting time	t <sub>w min</sub>	1 s

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	3 kV
Grid 2 voltage	V <sub>g2</sub>	700 V
Anode current	I <sub>a</sub>	500 mA
Transconductance	S	25 mA/V
Amplification factor	μ <sub>g2g1</sub>	10

### CAPACITANCES

Input	C <sub>i</sub>	54 pF
Output	C <sub>o</sub>	8 pF
Anode to grid 1	C <sub>ag1</sub>	0,1 pF

**TEMPERATURE LIMITS**

Absolute maximum envelope temperature  
 Recommended maximum seal temperature

$T_{env}$  max. 240 °C  
 T max. 200 °C

**COOLING**

Direction of air flow: see drawing.

$W_a + W_g$ W	h m	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min	$\Delta P$ 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.

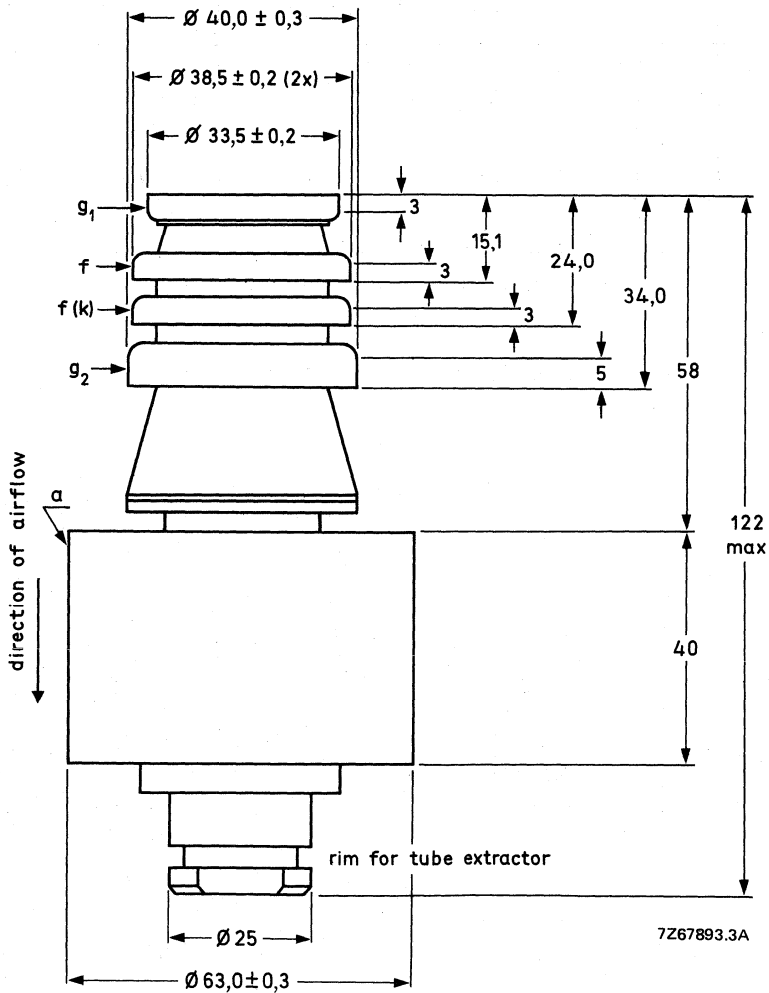
**ACCESSORIES**

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 k $\Omega$	

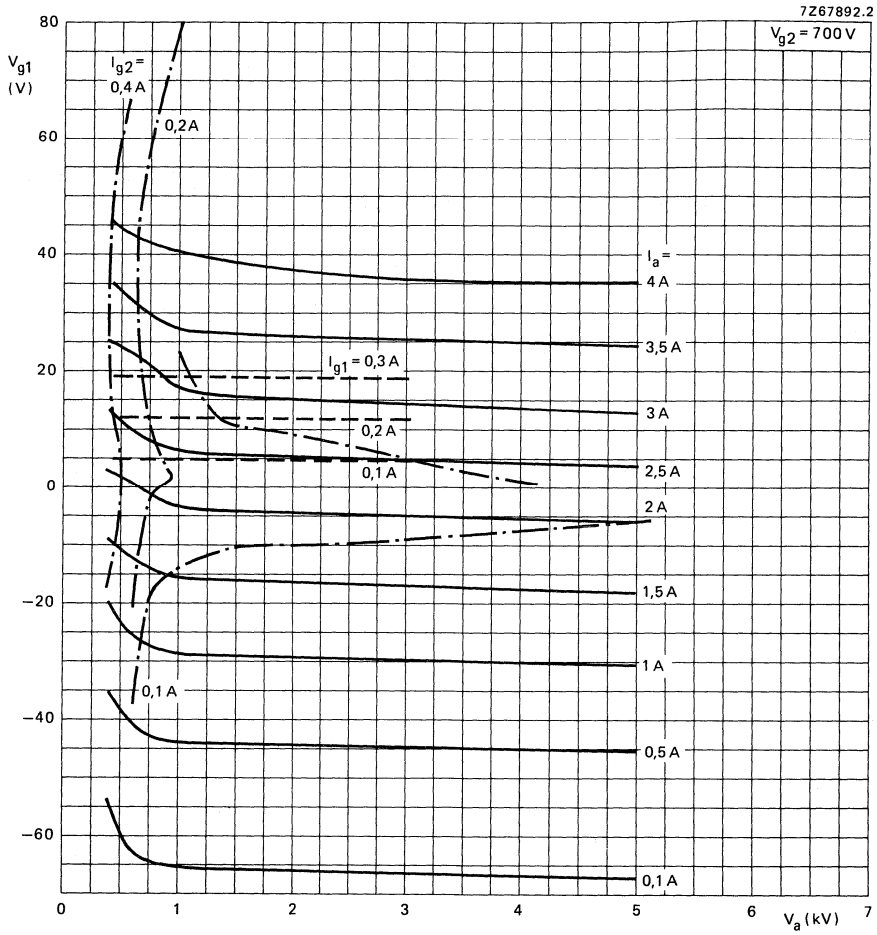
**OPERATING CONDITIONS**

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		k $\Omega$	
Load resistance	$R_a$	2500		$\Omega$	
		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	$\eta$	-	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 <sub>a</sub>		3		kV
Grid 2 voltage	V <sub>g2</sub>		700		V
Grid 1 voltage	V <sub>g1</sub>		≈ -66		V 1
Grid 1 circuit resistance (load)	R <sub>g1</sub>		1		kΩ
Load resistance	R <sub>a~</sub>		1500		Ω
		zero signal	single tone signal	double tone signal	
Grid 1 driving voltage	V <sub>g1 p</sub>	0	75	75	V
Anode current	I <sub>a</sub>	200	800	500	mA
Grid 2 current	I <sub>g2</sub>	0	90	40	mA
Grid 1 current	I <sub>g1</sub>	0	10	1	mA
Driving power (PEP)	W <sub>dr</sub>	0	10	10	W 2
Anode input power	W <sub>ia</sub>	600	2400	1500	W
Anode dissipation	W <sub>a</sub>	600	800	700	W
Power gain	G	—	—	22	dB
Output power in load	W <sub>l</sub>	—	1600	—	W
Output power in load (PEP)	W <sub>l</sub>	—	—	1600	W
Total efficiency	η	—	66	53	%
Intermodulation distortion					
3rd order	d <sub>3</sub>	—	—	-30	dB 3
5th order	d <sub>5</sub>	—	—	-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.



## 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	$W_{\Omega(\text{sync})}$	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	$W_{\Omega(\text{sync})}$	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 m $\Omega$		
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	$\mu_{g2g1}$	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 <sup>3</sup> /min	$\Delta P$ Pa		$T_o$ max. °C
				tube only	tube + cavity	
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.



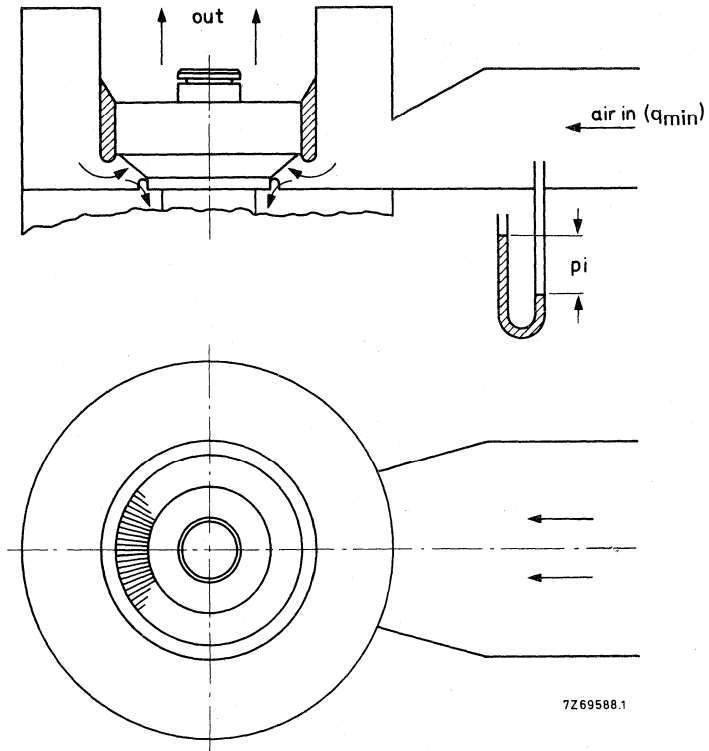


Fig. 1 Schematic of cooling air flow.

**ACCESSORIES**

Band IV/V amplifier circuit assembly type 40783.

MECHANICAL DATA

Net mass:  $\approx 3,5$  kg

Mounting position: vertical with anode up or down

Dimensions in mm

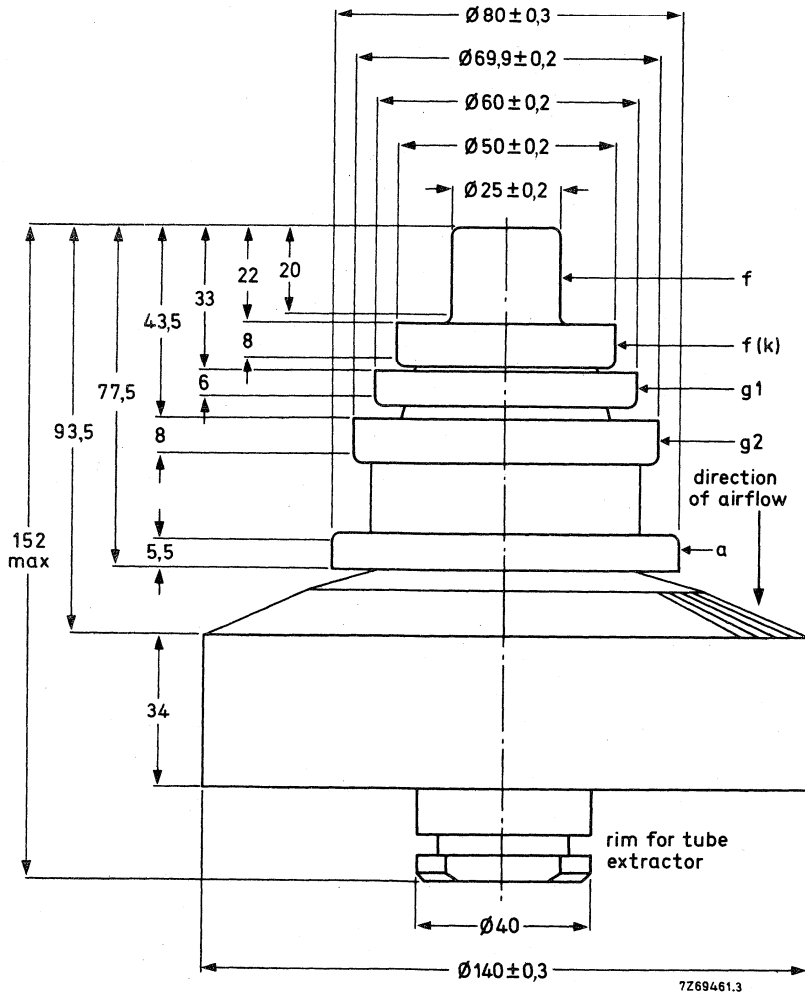


Fig. 2.

**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

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	$W_{\ell \text{ sync}}$		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).

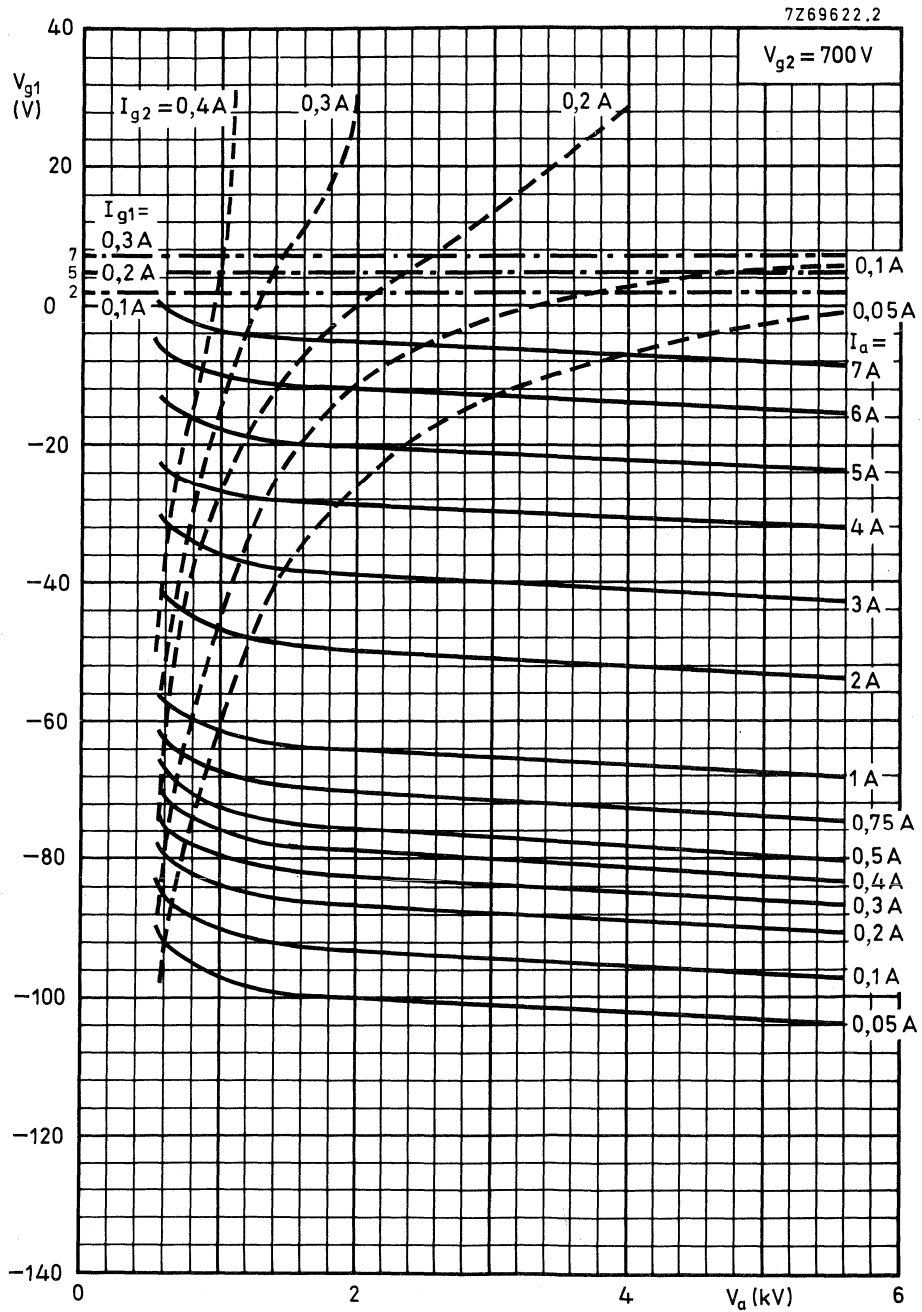


Fig. 3.



## 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	$W_\ell$	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	$W_\ell$	5   10 kW
Gain	G	19   19 dB

**HEATING:** direct; thoriated tungsten filament, mesh type.

Filament voltage	$V_f$	8 V $\begin{matrix} +1 \\ -3 \end{matrix}$ %
Filament current	$I_f$	113 A
Filament peak starting current	$I_{fp}$	max. 560 A
Cold filament resistance	$R_{fo}$	7,4 m $\Omega$ ←
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	$\mu_{g2g1}$	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	$q_{min}$ m <sup>3</sup> /min	$\Delta P$ Pa		$T_o$ max. °C
				tube only	tube + cavity	
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





**OPERATING CONDITIONS** (grounded grid)

The voltages are given with respect to the cathode.

notes

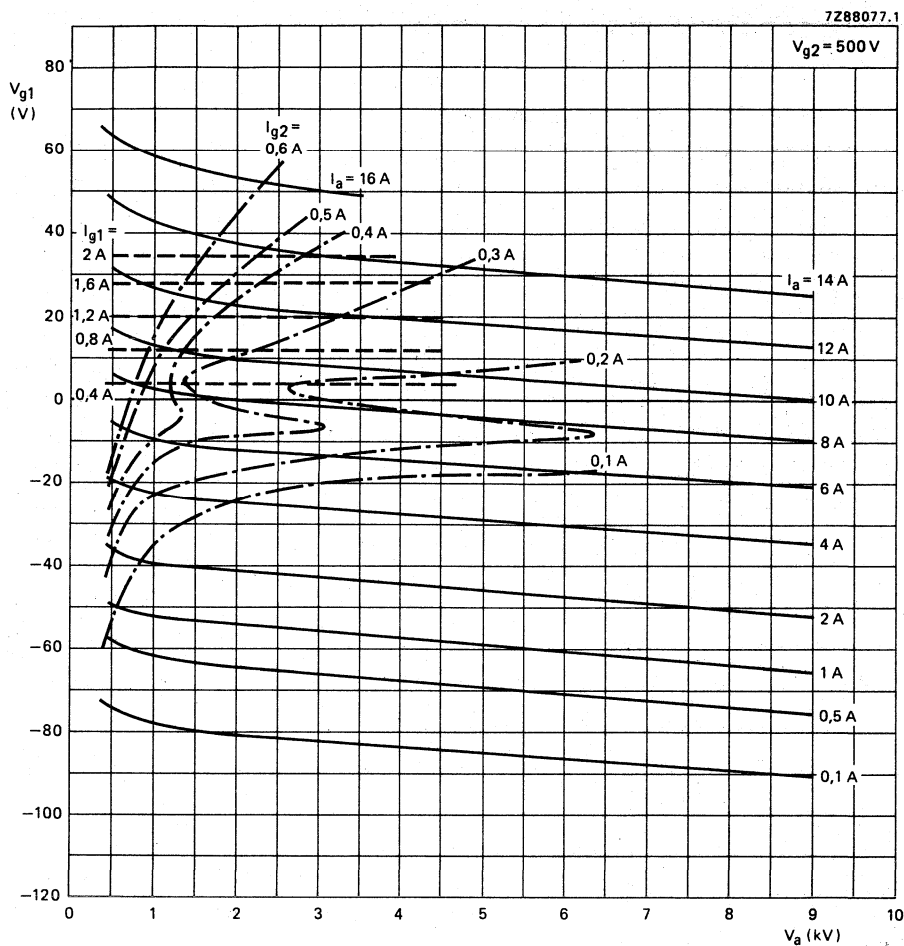
**CLASS-AB AMPLIFIER FOR TELEVISION SERVICE**

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	$W_{\ell}$	5,5	11 kW	
Output power in load, black	$W_{\ell}$	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

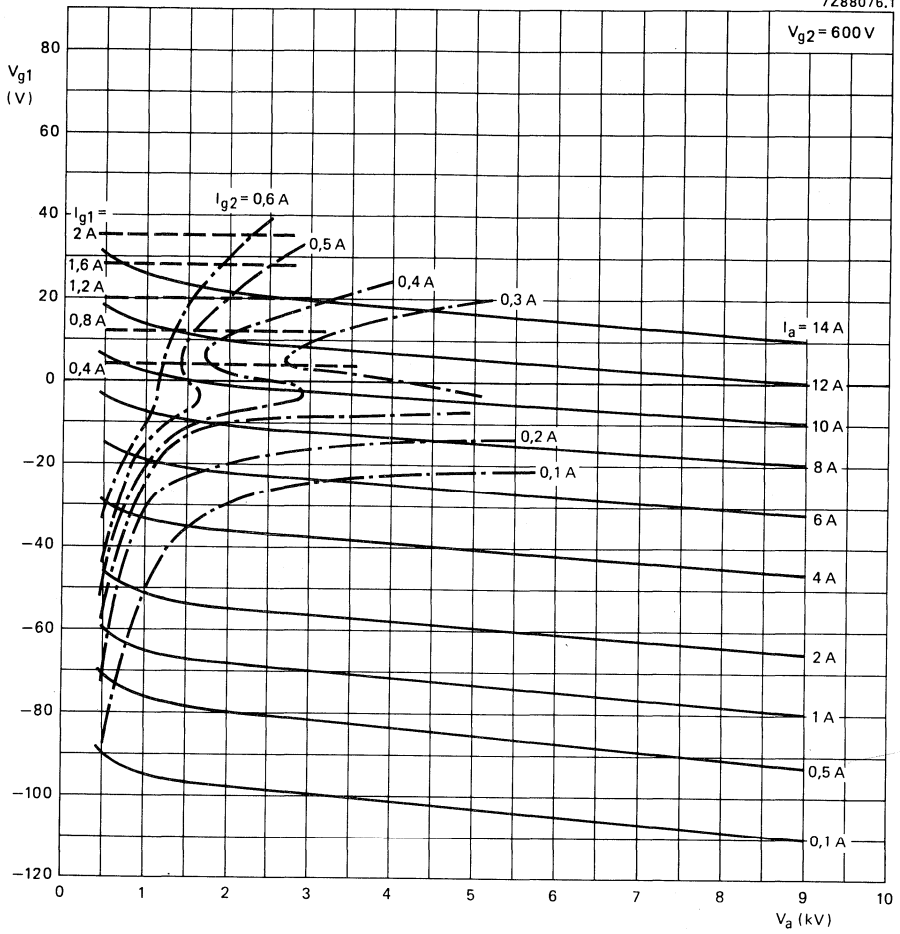
**CLASS-AB F.M. AMPLIFIER**

→ 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	$W_{\ell}$	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 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 sine-wave having a 10% peak-to-peak value.



# DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

YL1630

## 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)	$W_\ell$	30 kW
Power gain (sync)	G	17 dB

**HEATING:** direct; thoriated tungsten filament, mesh type.

Filament voltage	$V_f$	10,4 V $\begin{matrix} +1 \\ -3 \end{matrix}$ %
Filament current	$I_f$	165 A
Filament peak starting current	$I_{fp}$	max. 700 A
Cold filament resistance	$R_{fo}$	4,2 m $\Omega$

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	$\mu_{g2g1}$	≈	7

**CAPACITANCES, grounded grid**

Input	$C_i$	≈	100 pF
Output	$C_o$	≈	28 pF

**TEMPERATURE LIMITS**

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

**COOLING**

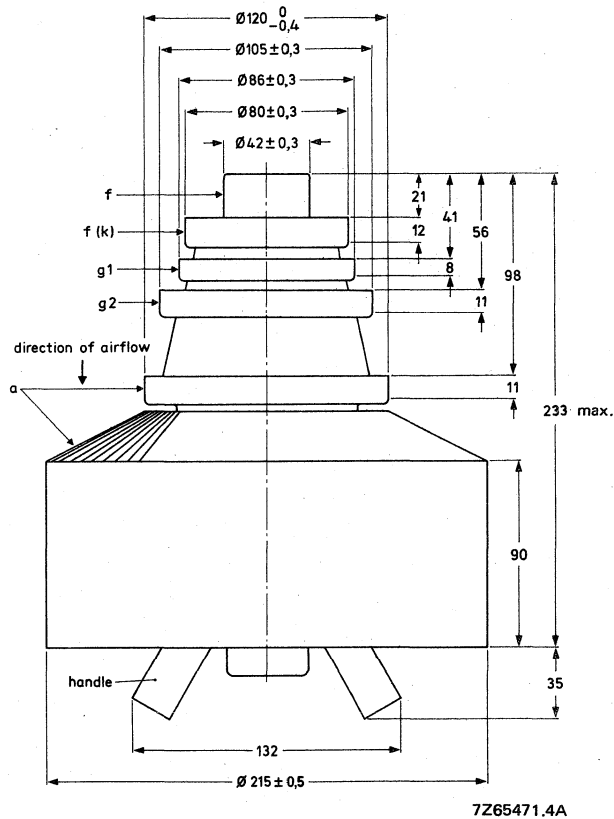
$W_a + W_g$ kW	h m	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min	$\Delta p$ Pa		$T_{o max}$ °C
				tube only	tube + cavity	
12	0	25	10	450	570	90
16	0	25	14	550	750	90
20	0	25	18	770	1200	90
24	0	25	22	1150	1700	90
26	0	25	24	1320	2040	90
12	0	55	14	550	750	110
16	0	55	18	770	1200	110
20	0	55	22	1150	1700	110
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

DEVELOPMENT DATA



**ACCESSORIES**

Band III amplifier circuit assembly type 40786  
 Input circuit of cavity is broadbanded (no input tuning required)

**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		175 to 225					M		
Frequency of vision carrier	f						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	$W_{\ell}$	11	15	20	25	30	37 kW		
Output power in load, black	$W_{\ell}$	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**

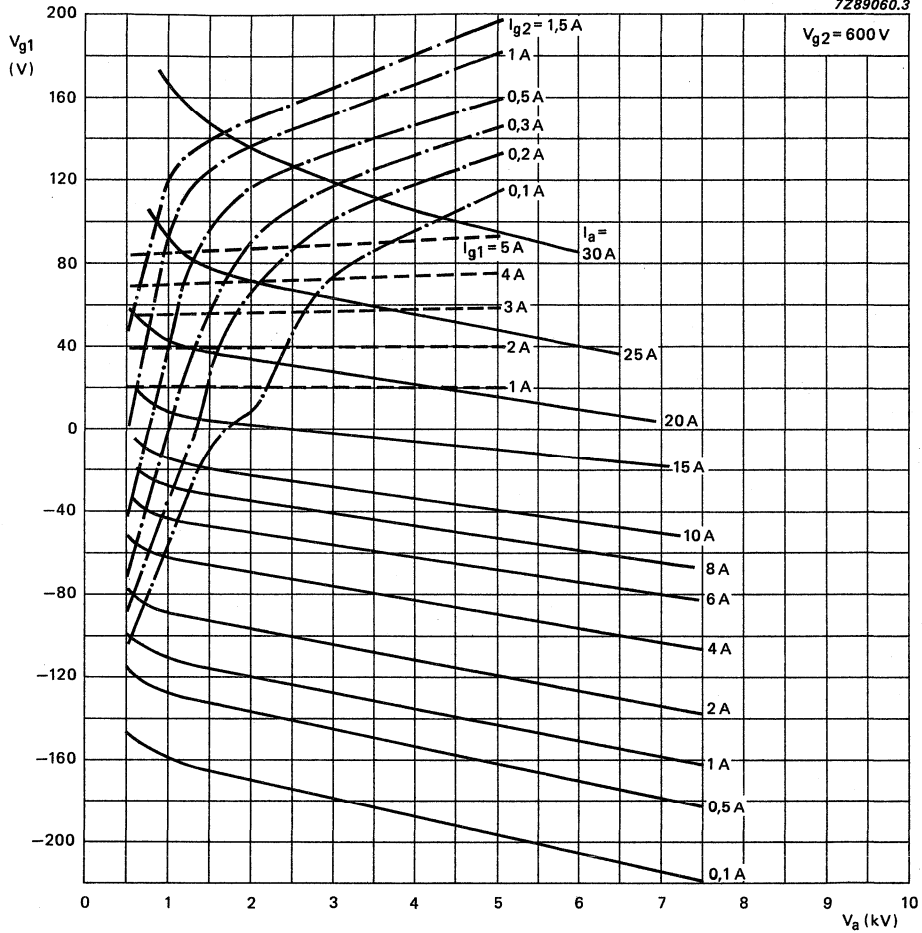
1. With double tuned circuit.
2. To be adjusted for the stated zero signal anode current.
3. Black signal, including line sync, pulses.
4. A picture/sync. ratio of 75/25 for the outgoing signal requires a ratio of max. 70/30 for the incoming signal, in which case the sync. compression is 30/25.
5. Measured 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.



7Z89060.3

$V_{g2} = 600 \text{ V}$

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 <sub>a</sub>	5,5	7 kV	
Output power in load, sync	W <sub>ℓ</sub>	5	10 kW	
Power gain	G	16	16 dB	

#### Class-AB linear amplifier (vision)

Frequency	f	225		MHz
Anode voltage	V <sub>a</sub>	4,5	6	7,5 kV
Output power in load, sync	W <sub>ℓ</sub>	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 <sub>a</sub>	6	7,5	9 kV
Output power in load	W <sub>ℓ</sub>	5,5	10,5	20 kW
Gain	G	17	17	17 dB

**HEATING:** direct: thoriated tungsten filament, mesh type.

Filament voltage	V <sub>f</sub>	10,4 V <sub>-3</sub> <sup>+1%</sup>	
Filament current	I <sub>f</sub>	112 A	
Filament peak starting current	I <sub>fp</sub>	max.	750 A
Cold filament resistance	R <sub>fo</sub>	10,5 mΩ	
Waiting time: procedure prior to switching subsequently -V <sub>g1</sub> , V <sub>a</sub> and V <sub>g2</sub> :			
V <sub>f</sub> = 2 V	t <sub>w</sub>	30 s	
then V <sub>f</sub> = 10,4 V	t <sub>w</sub>	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	$\mu_{g2g1}$	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

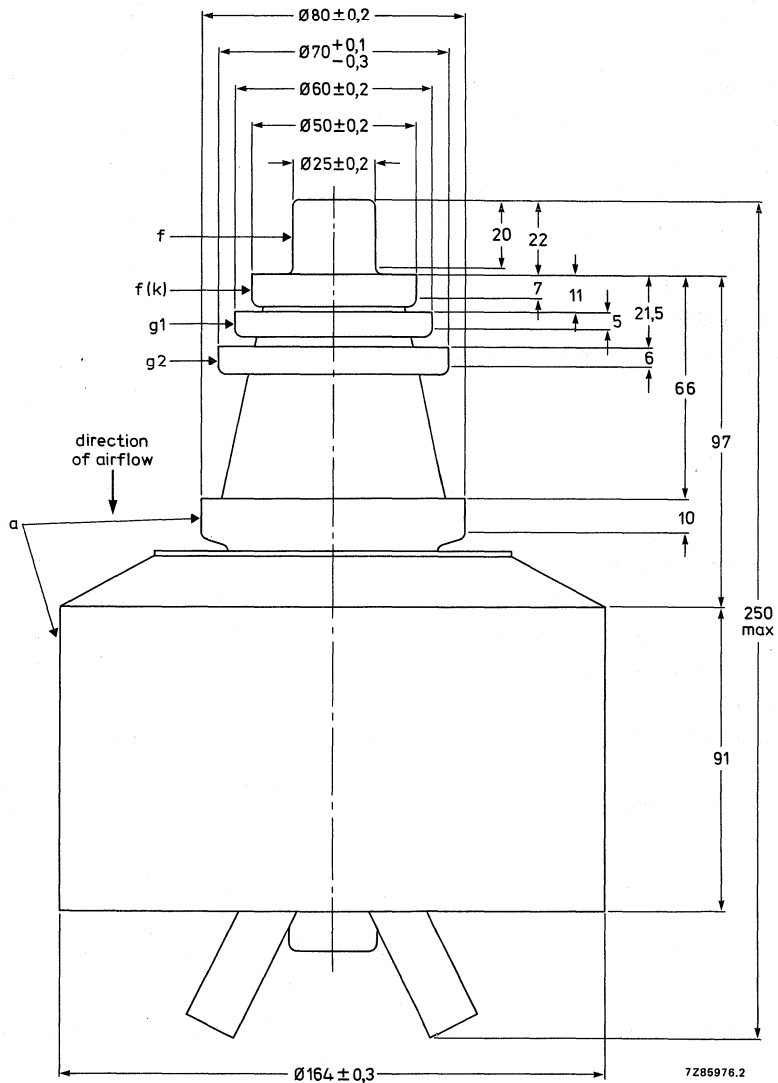
**COOLING**

$W_a + W_g$ kW	h m	$T_i$ °C	$q_{min}$ m <sup>3</sup> /min	$\Delta p$ Pa		$T_o$ max °C
				tube only	tube + cavity	
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*	$-V_{g1}$	≈ 95	≈ 100 V
Anode current (zero signal)	$I_a$	1,8	1,8 A
Anode current, black + line sync pulse	$I_a$	≈ 2,45	≈ 2,9 A
Grid 2 current, black + line sync pulse	$I_{g2}$	≈ 30	≈ 50 mA
Grid 1 current, black + line sync pulse	$I_{g1}$	≈ 0	≈ 0 mA
Output power in load (sync)	$W_{\ell}$	5	10 kW
Driving power (sync)	$W_{dr}$	≤ 125	≤ 250 W
Power gain	G	≥ 16	≥ 16 dB
Intermodulation products**	d	≤ -54	≤ -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 ≤ -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	$W_{\ell}$	3,3	6,6	12,6 kW	
Output power in load, sync	$W_{\ell}$	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-wave having a 10% peak-to-peak value.

## CLASS-AB F.M. AMPLIFIER

## LIMITING VALUES (Absolute maximum rating system)

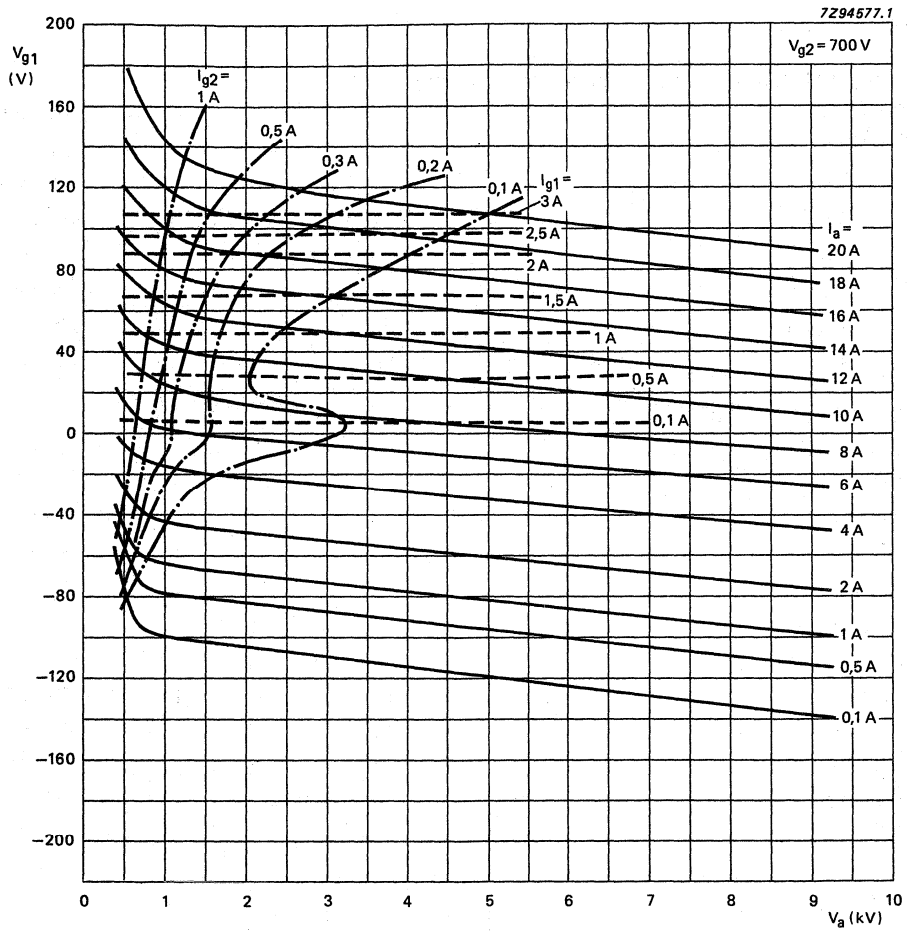
Frequency	f	up to	250 MHz
Anode voltage	$V_a$		10 kV
Grid 2 voltage	$V_{g2}$		1 kV
Grid 1 voltage	$-V_{g1}$		500 V
Anode current, black	$I_a$		7 A
Anode dissipation	$W_a$		17 kW
Grid 2 dissipation	$W_{g2}$		150 W
Grid 1 dissipation	$W_{g1}$		50 W

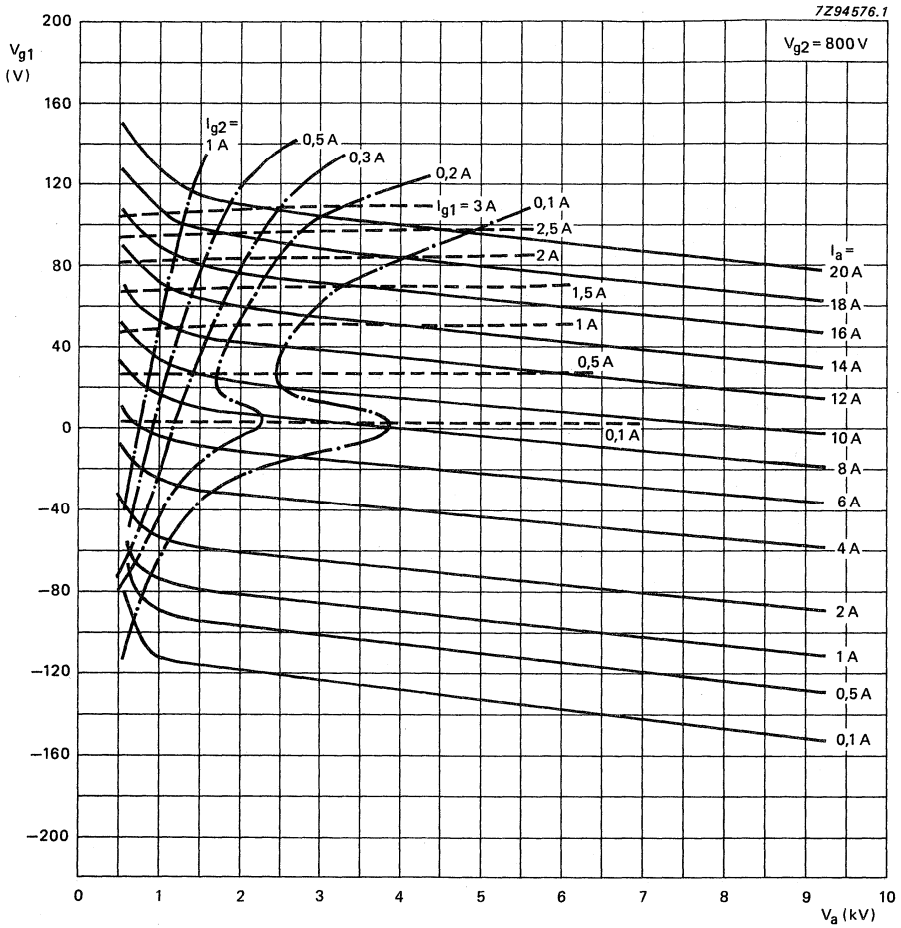
## OPERATING CONDITIONS

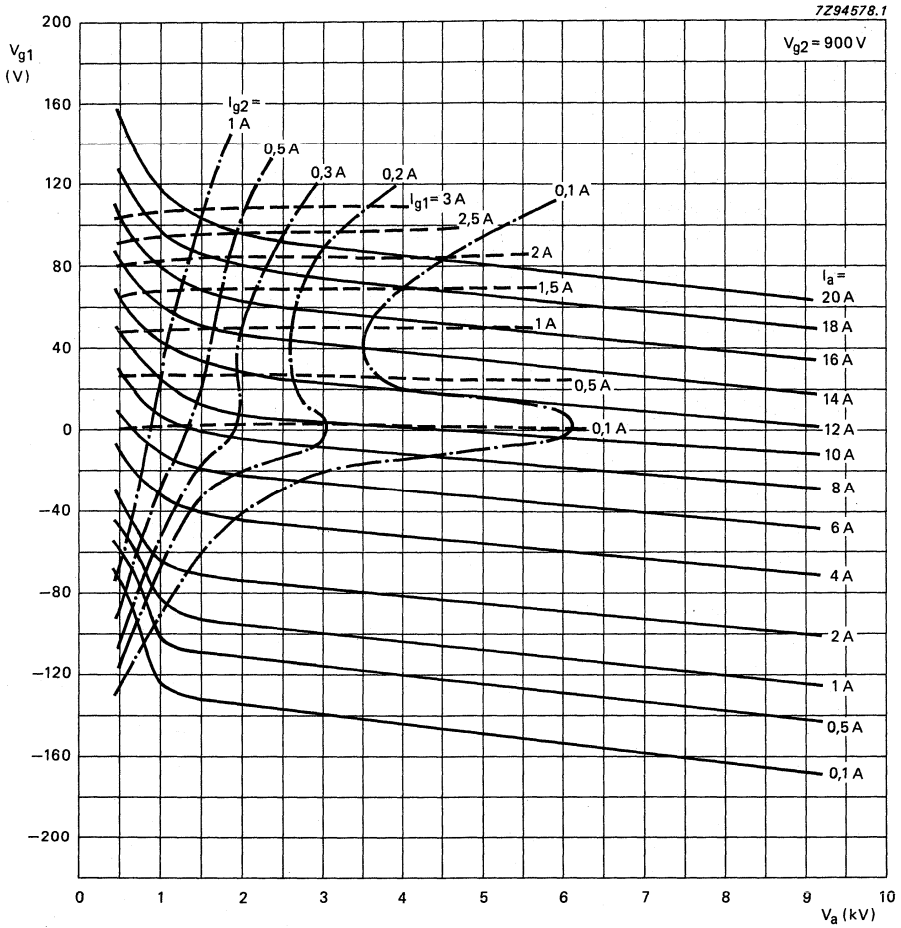
Frequency	f	88 to 110 MHz		
Bandwidth (-3 dB)	B	≈ 1,5	≈ 1,5	≈ 1,5 MHz
Anode voltage	$V_a$	6	7,5	9 kV
Grid 2 voltage	$V_{g2}$	700	700	700 V
Grid 1 voltage*	$-V_{g1}$	≈ 95	≈ 110	≈ 90 V
Anode current (zero signal)	$I_a$	0,5	0,5	1 A
Anode current	$I_a$	≈ 1,5	≈ 2,15	≈ 3,4 A
Grid 2 current	$I_{g2}$	≈ 80	≈ 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.











## 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 $\begin{matrix} +1\% \\ -3\% \end{matrix}$
Filament current	$I_f$	280 A
Filament peak starting current	$I_{fp}$	max. 1600 A
Cold filament resistance	$R_{fo}$	4,0 m $\Omega$
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	$\mu_{g2g1}$	5

### CAPACITANCES

Cathode to grid 1	$C_{kg1}$	$\approx$	180 pF
Cathode to grid 2	$C_{kg2}$	$\approx$	13 pF
Cathode to anode	$C_{ka}$	$\approx$	0,3 pF
Grid 1 to grid 2	$C_{g1g2}$	$\approx$	300 pF
Grid 1 to anode	$C_{g1a}$	$\approx$	2,3 pF
Grid 2 to anode	$C_{g2a}$	$\approx$	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<sup>3</sup>/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

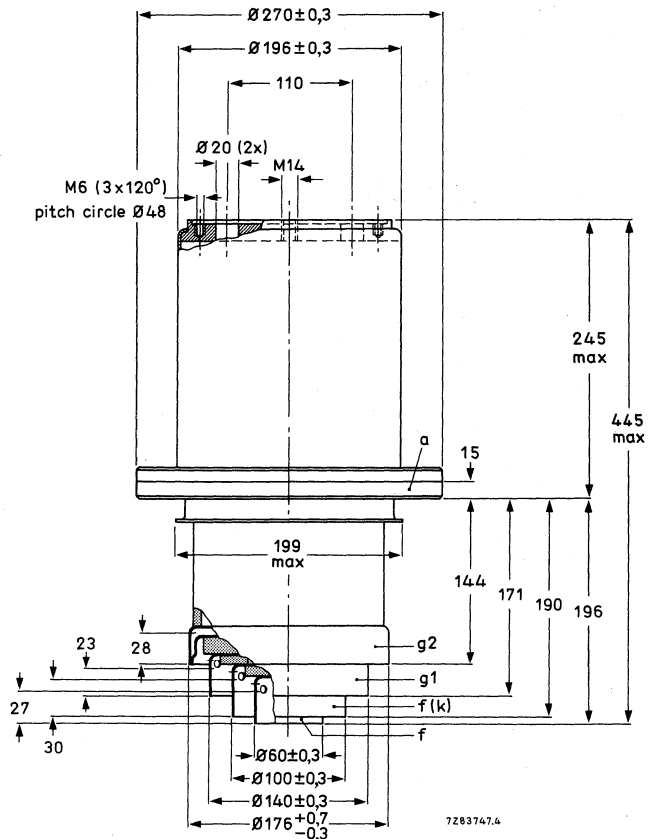


Fig. 1.

**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	$\eta$		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, $I_{a0} = 1$ A	$V_{g1}$	$\approx$ -350 V
Anode current	$I_a$	$2 \times 10$ A
Grid 2 current	$I_{g2}$	$\approx$ $2 \times 0,3$ A
Grid 1 current	$I_{g1}$	$\approx$ 0 A
Anode input power	$W_{ia}$	$2 \times 110$ kW
Anode output power	$W_o$	$2 \times 75$ kW
Anode dissipation	$W_a$	$2 \times 35$ kW
Efficiency	$\eta$	68 %



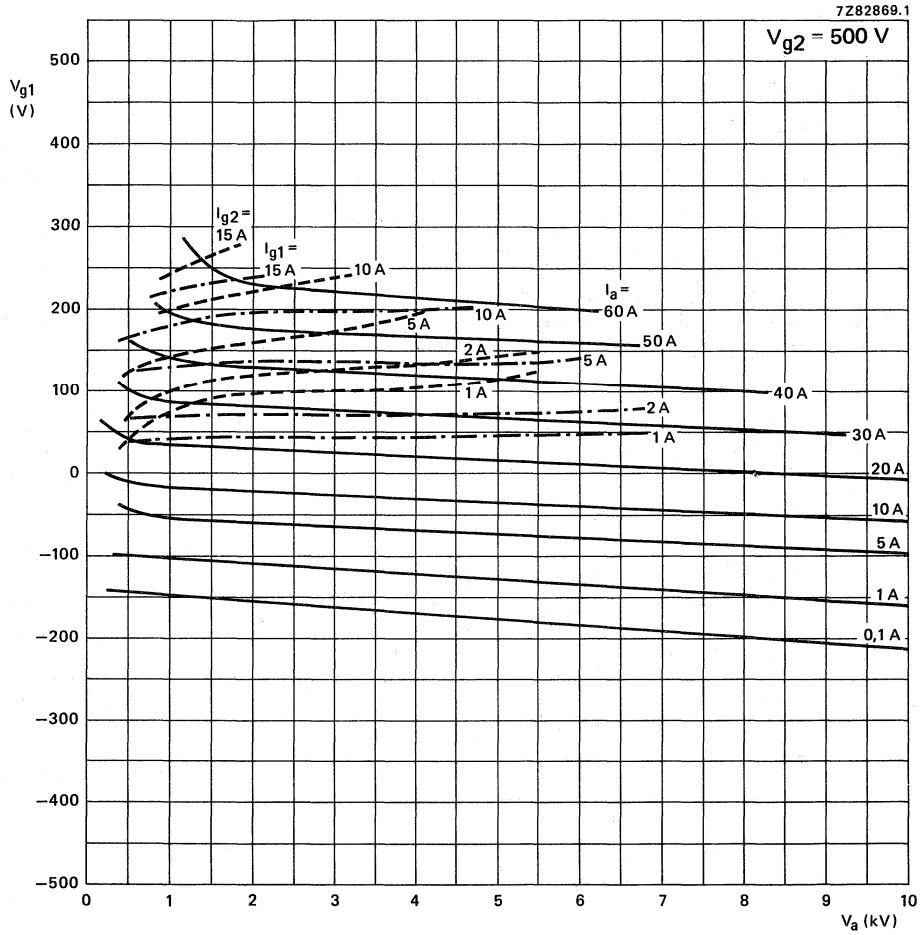


Fig. 2.

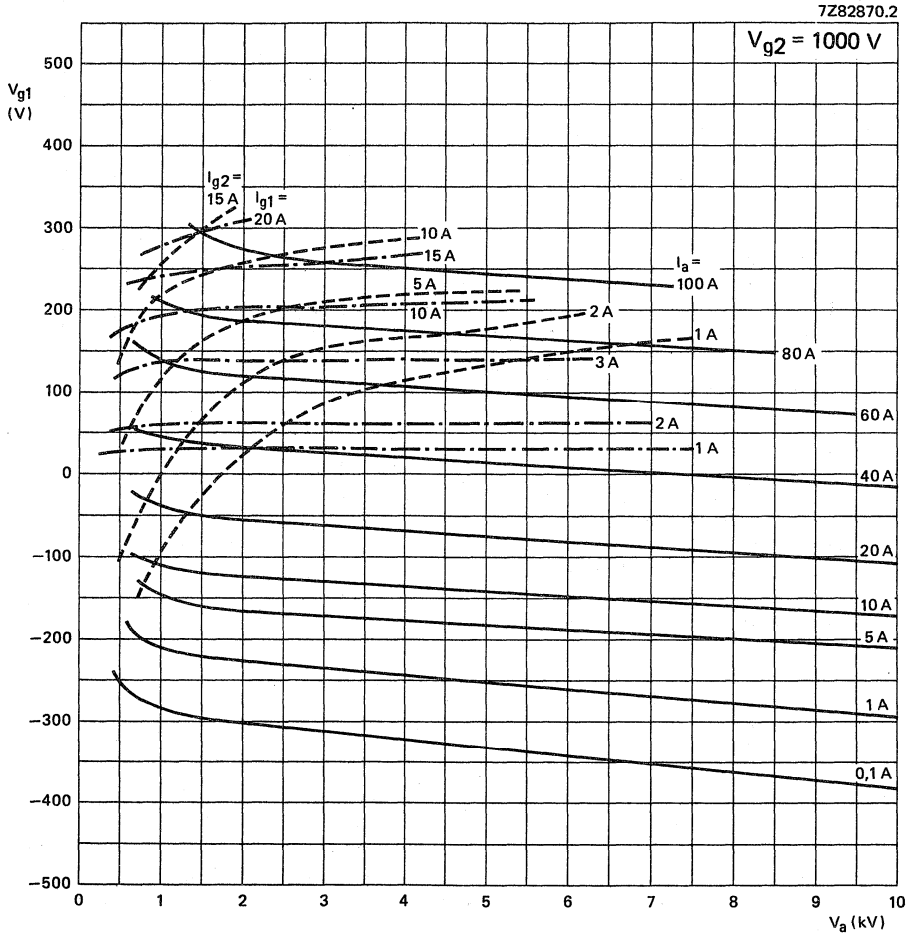


Fig. 3.

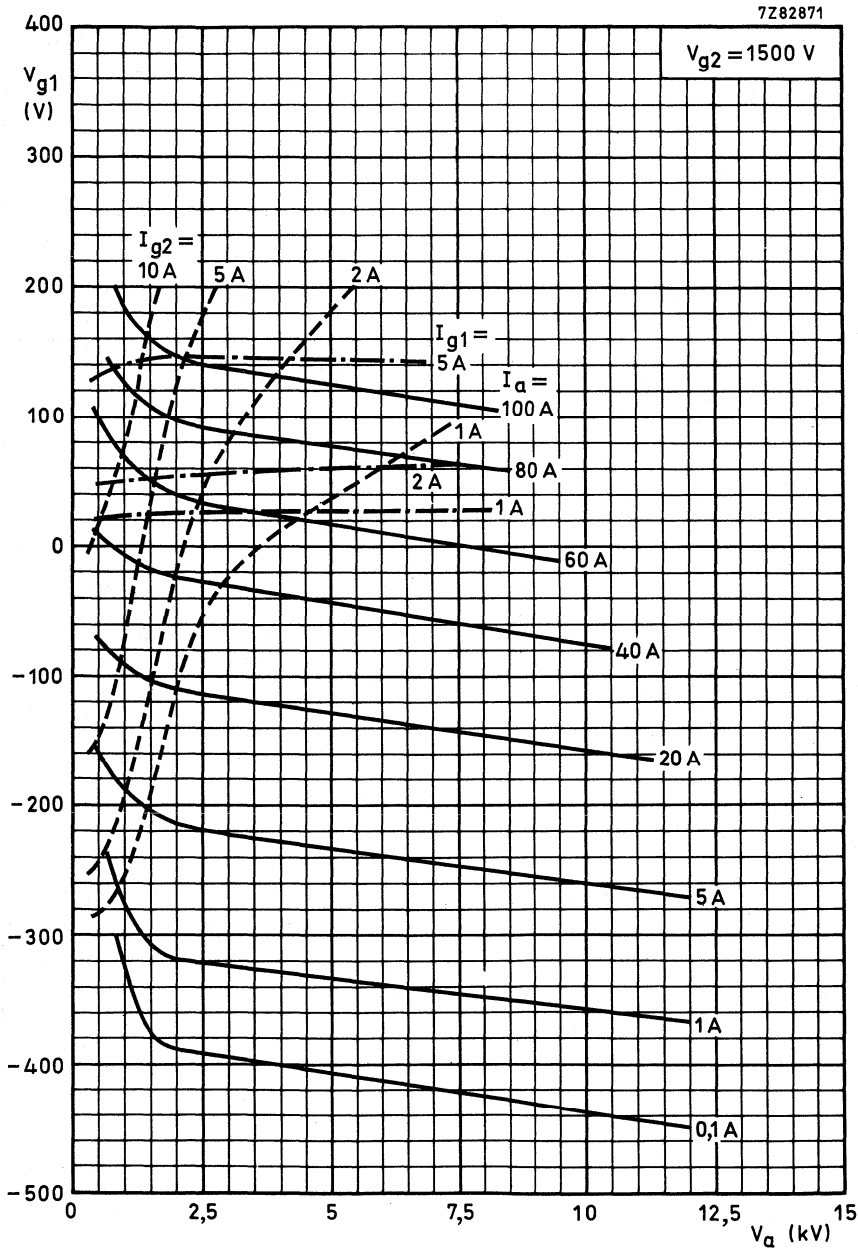


Fig. 4.



# DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

YL1650

## 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 <sub>a</sub>	11 kV
Output power	W <sub>o</sub>	300 kW

#### Class-B

Anode voltage	V <sub>a</sub>	11 kV
Output power, two tubes in push-pull	W <sub>o</sub>	2 x 200 kW

**HEATING:** direct, thoriated tungsten filament, mesh type.

Filament voltage, note 1	V <sub>f</sub>	18 V <sup>+1</sup> <sub>-3</sub> %
Filament current	I <sub>f</sub>	430 A
Filament peak starting current	I <sub>fp</sub>	max. 1300 A
Cold filament resistance	R <sub>fo</sub>	4 mΩ
Waiting time	t <sub>w</sub>	min. 10 s
Recommended switch-on procedure; 8 s at 7 V; 2 s at 18 V, note 2		

### TYPICAL CHARACTERISTICS

Anode voltage	V <sub>a</sub>	3 kV
Grid 2 voltage	V <sub>g2</sub>	1 kV
Anode current	I <sub>a</sub>	25 A
Transconductance	S	400 mA/V
Amplification factor	μ <sub>g2g1</sub>	4,3

### CAPACITANCES

Cathode to grid 1	C <sub>kg1</sub>	≈	310 pF
Cathode to grid 2	C <sub>kg2</sub>	≈	26 pF
Cathode to anode	C <sub>ka</sub>	≈	0,6 pF
Grid 1 to grid 2	C <sub>g1g2</sub>	≈	510 pF
Grid 1 to anode	C <sub>g1a</sub>	≈	4,5 pF
Grid 2 to anode	C <sub>g2a</sub>	≈	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<sup>3</sup>/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  $\approx$  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

DEVELOPMENT DATA

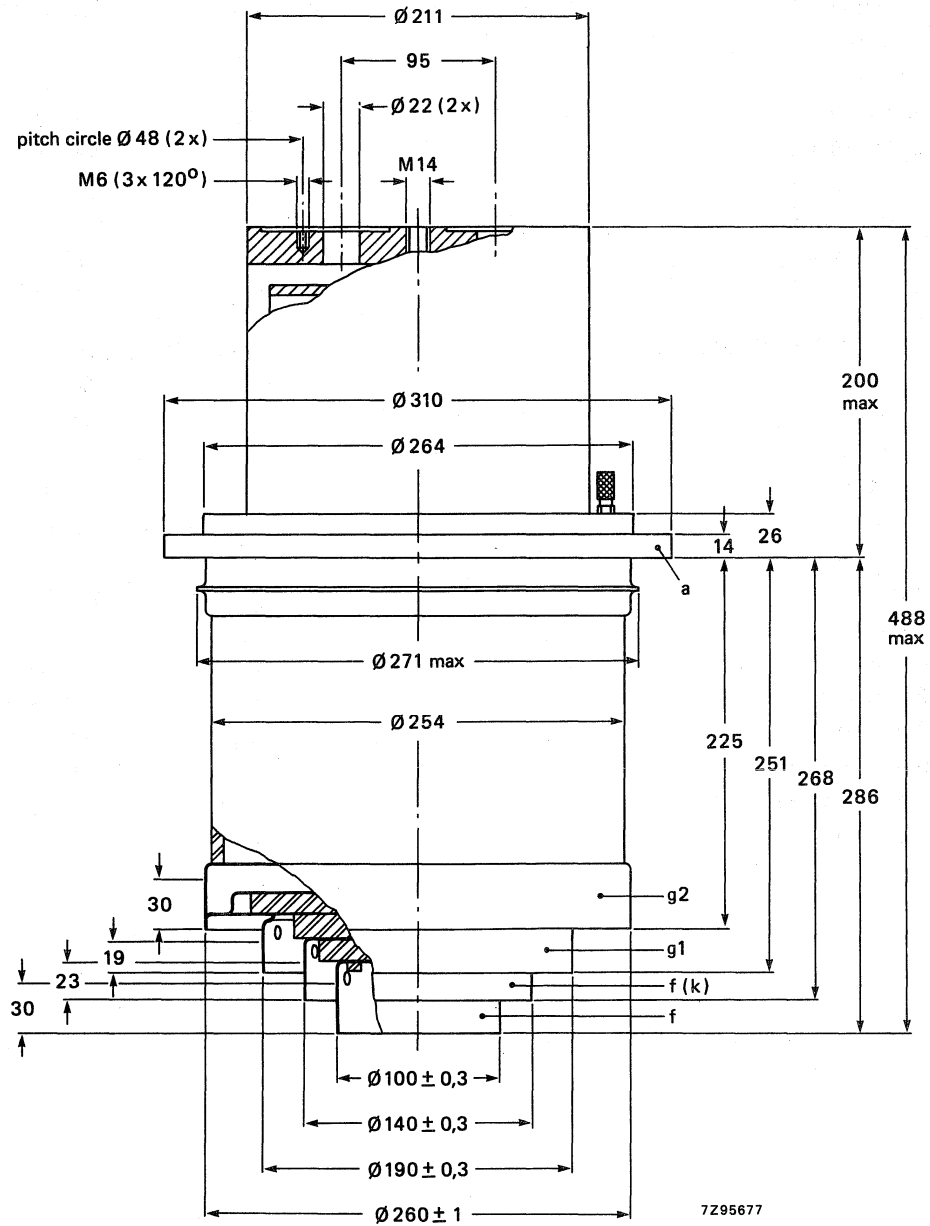


Fig. 1.

## 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.



**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

DEVELOPMENT DATA

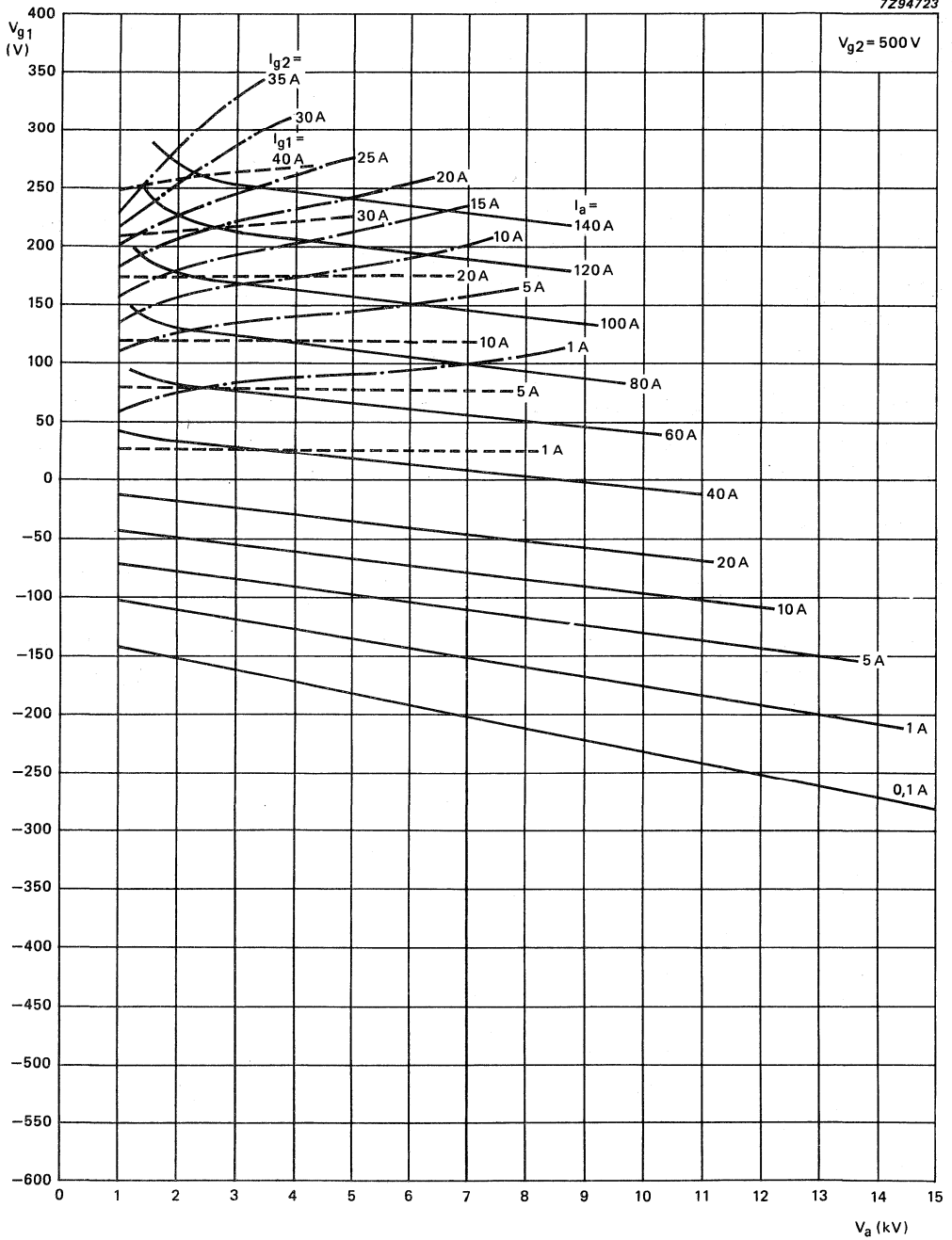


Fig. 2.

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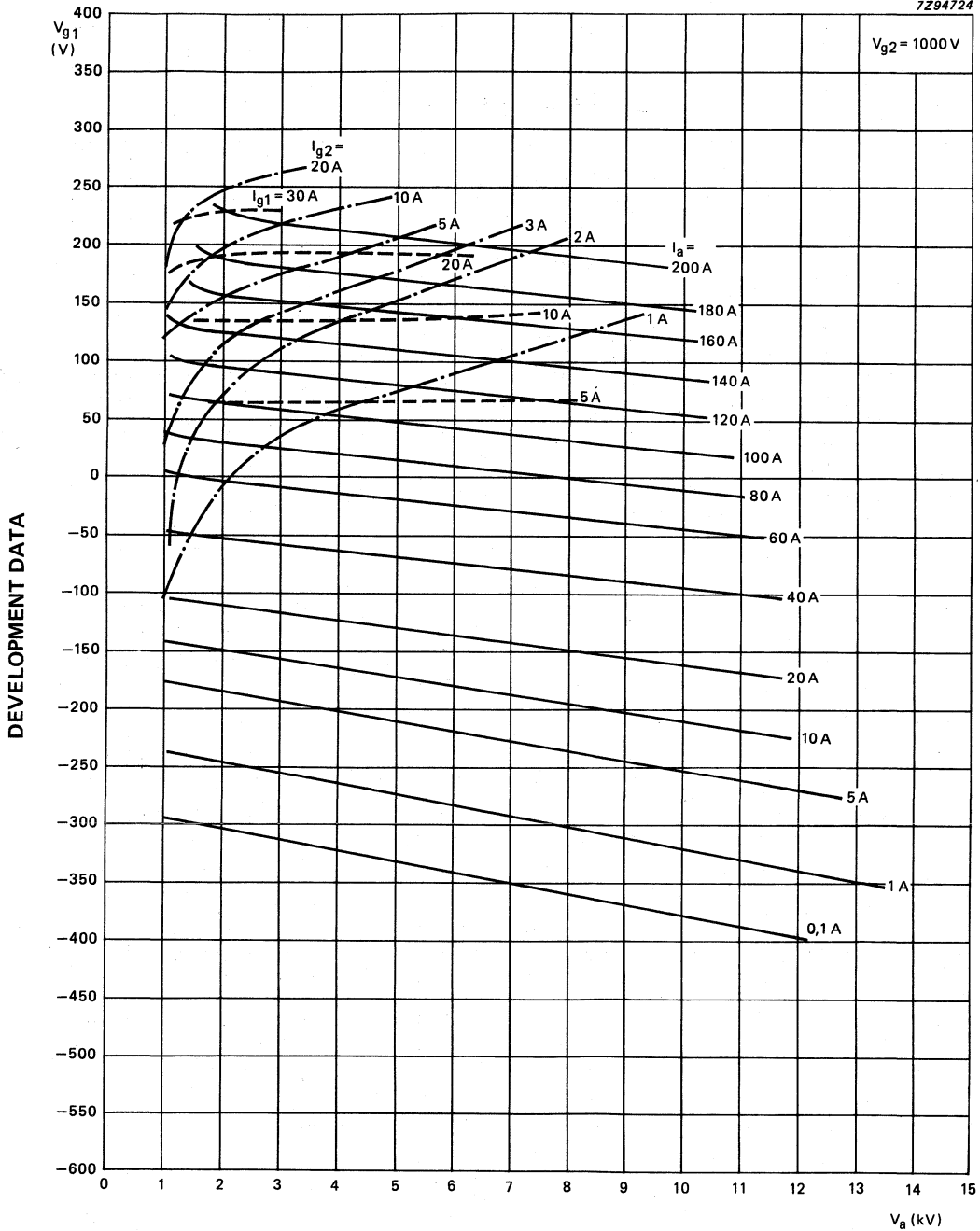


Fig. 3.

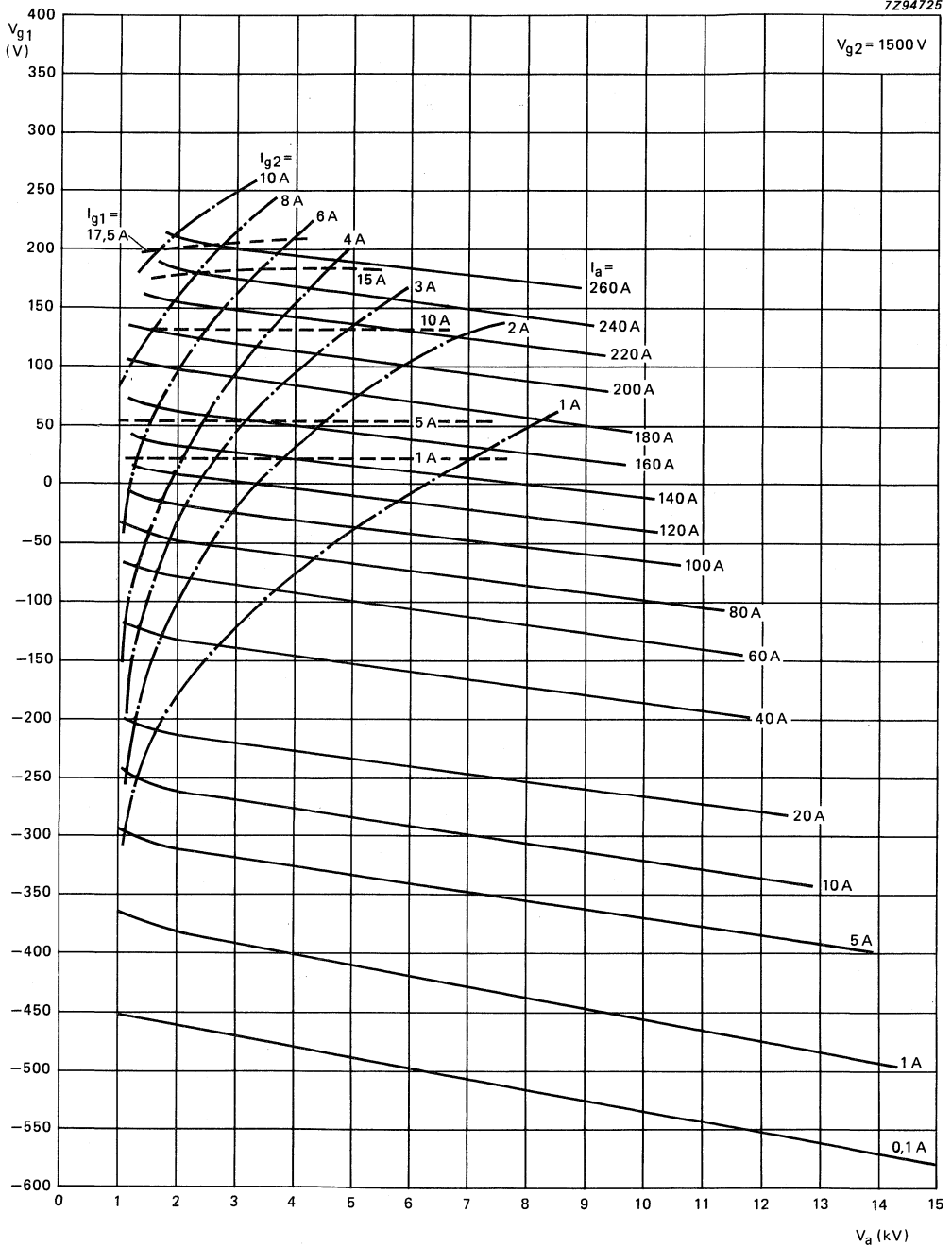


Fig. 4.

# DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

YL1660

## 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	$V_f$	$23 V_{-3}^{+1} \%$
Filament current	$I_f$	500 A
Filament peak starting current	$I_{fp}$	max. 1500 A
Cold filament resistance	$R_{fo}$	4,5 $\Omega$
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	$\mu_{g2g1}$	4,4

### CAPACITANCES

Cathode to grid 1	$C_{kg1}$	$\approx$	425 pF
Cathode to grid 2	$C_{kg2}$	$\approx$	40 pF
Cathode to anode	$C_{ka}$	$\approx$	0,6 pF
Grid 1 to grid 2	$C_{g1g2}$	$\approx$	750 pF
Grid 1 to anode	$C_{g1a}$	$\approx$	4,2 pF
Grid 2 to anode	$C_{g2a}$	$\approx$	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<sup>3</sup>/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

DEVELOPMENT DATA

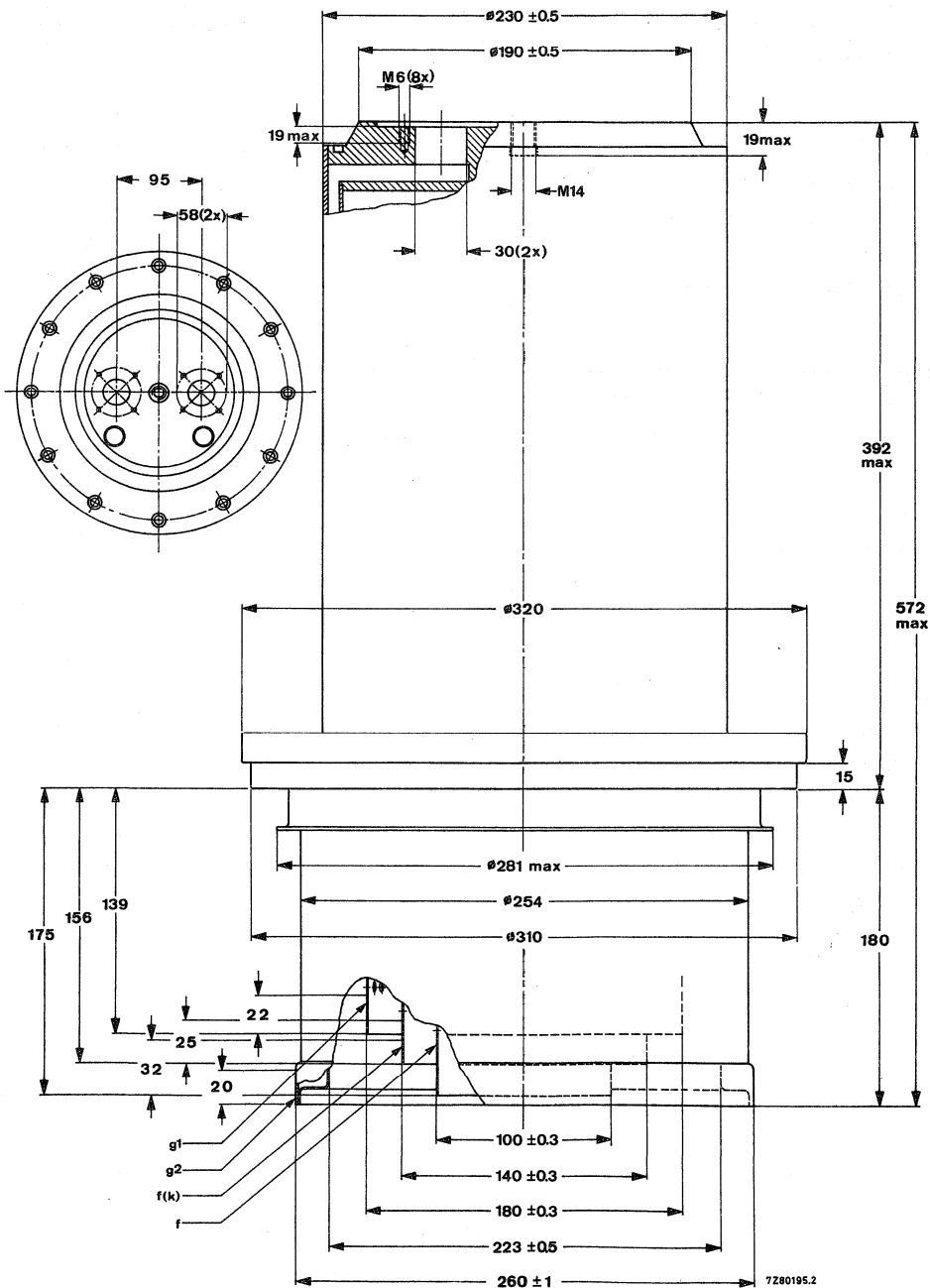


Fig. 1.

## 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	$V_a$		13,5 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

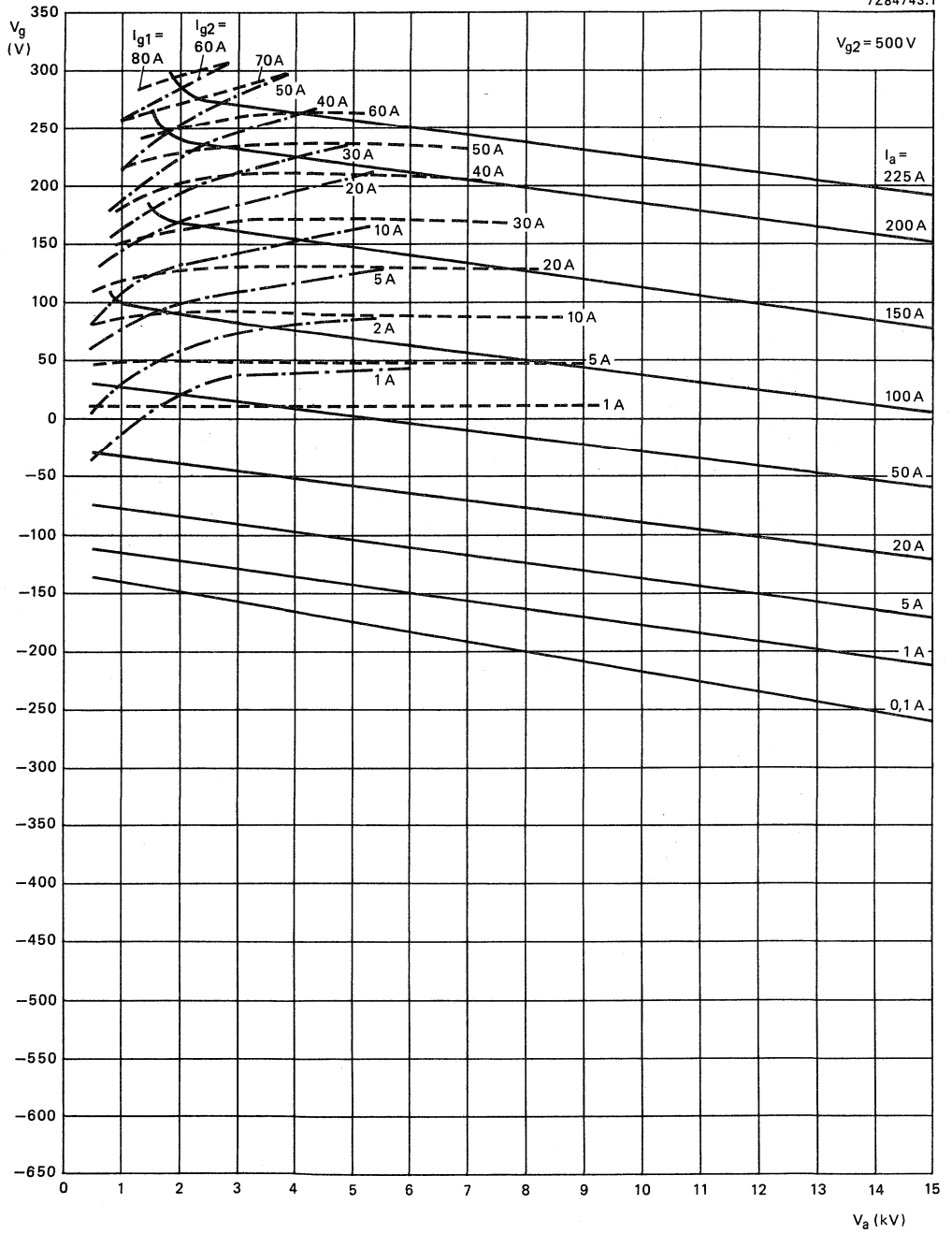


Fig. 2.

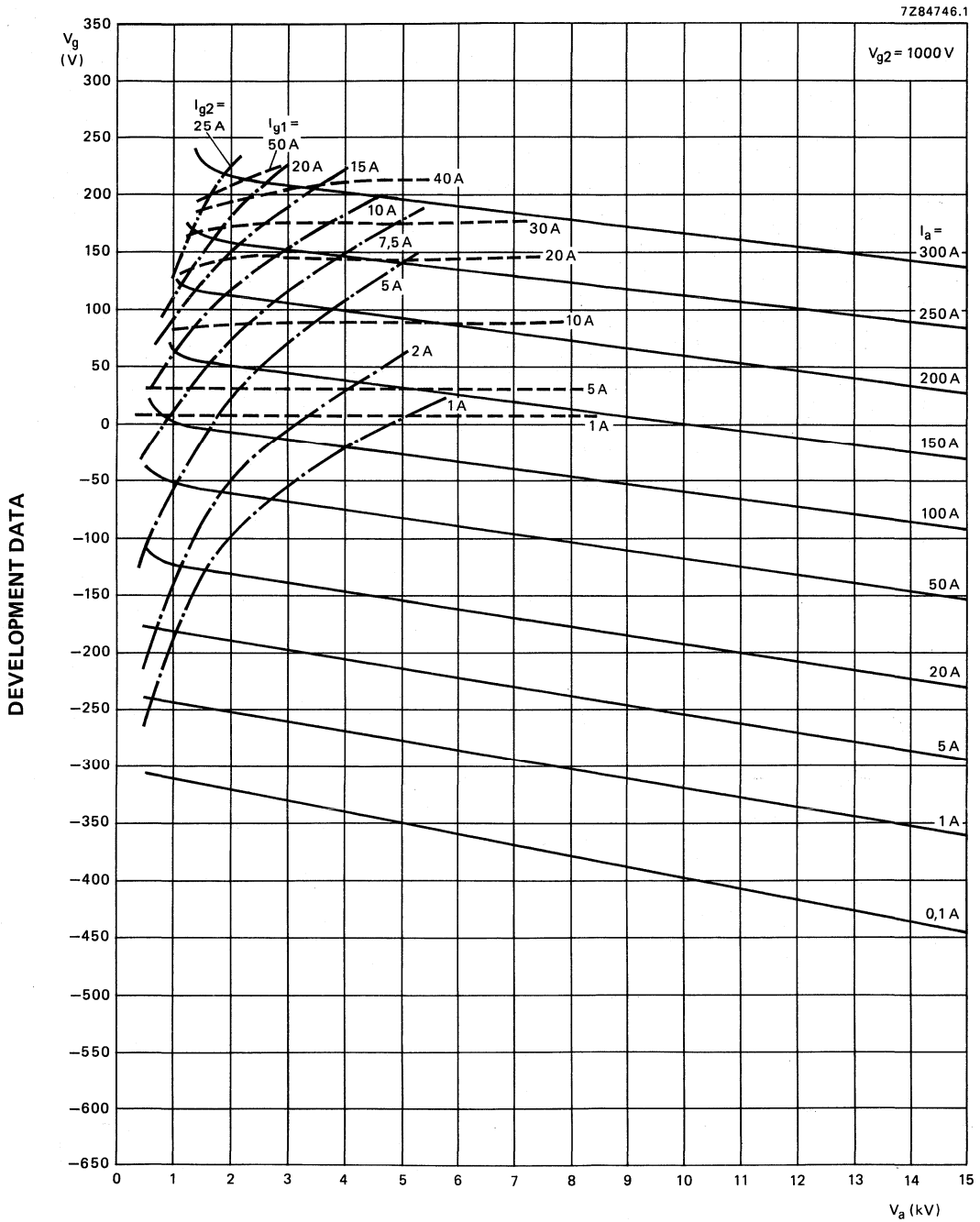


Fig. 3.

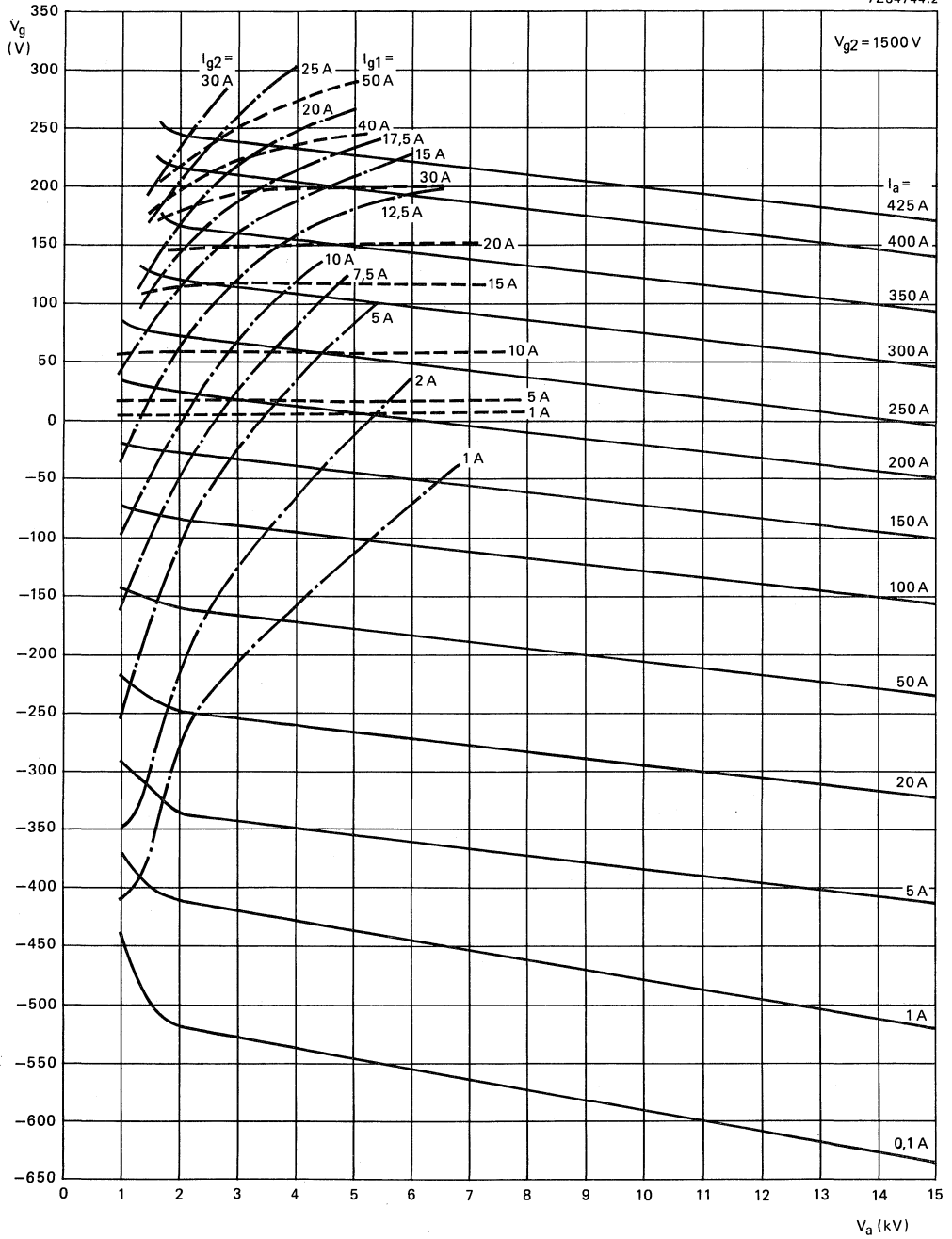


Fig. 4.

## 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 <sub>-3</sub> <sup>+1</sup> %
Filament current	$I_f$	320 A
Filament peak starting current	$I_{fp}$	max. 1800 A
Cold filament resistance	$R_{fo}$	6 m $\Omega$
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	$\mu_{g2g1}$	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<sup>3</sup>/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

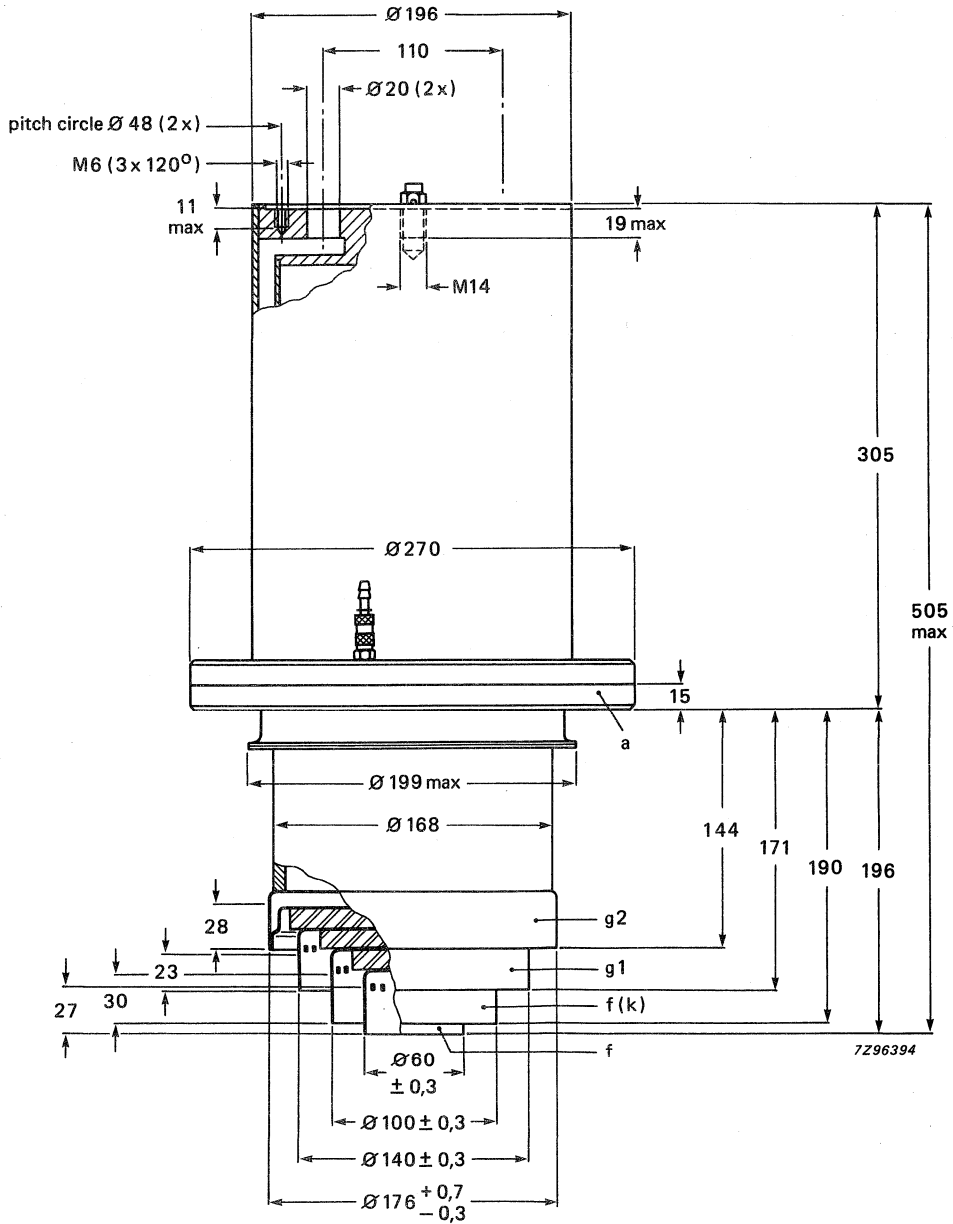


Fig. 1.

**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

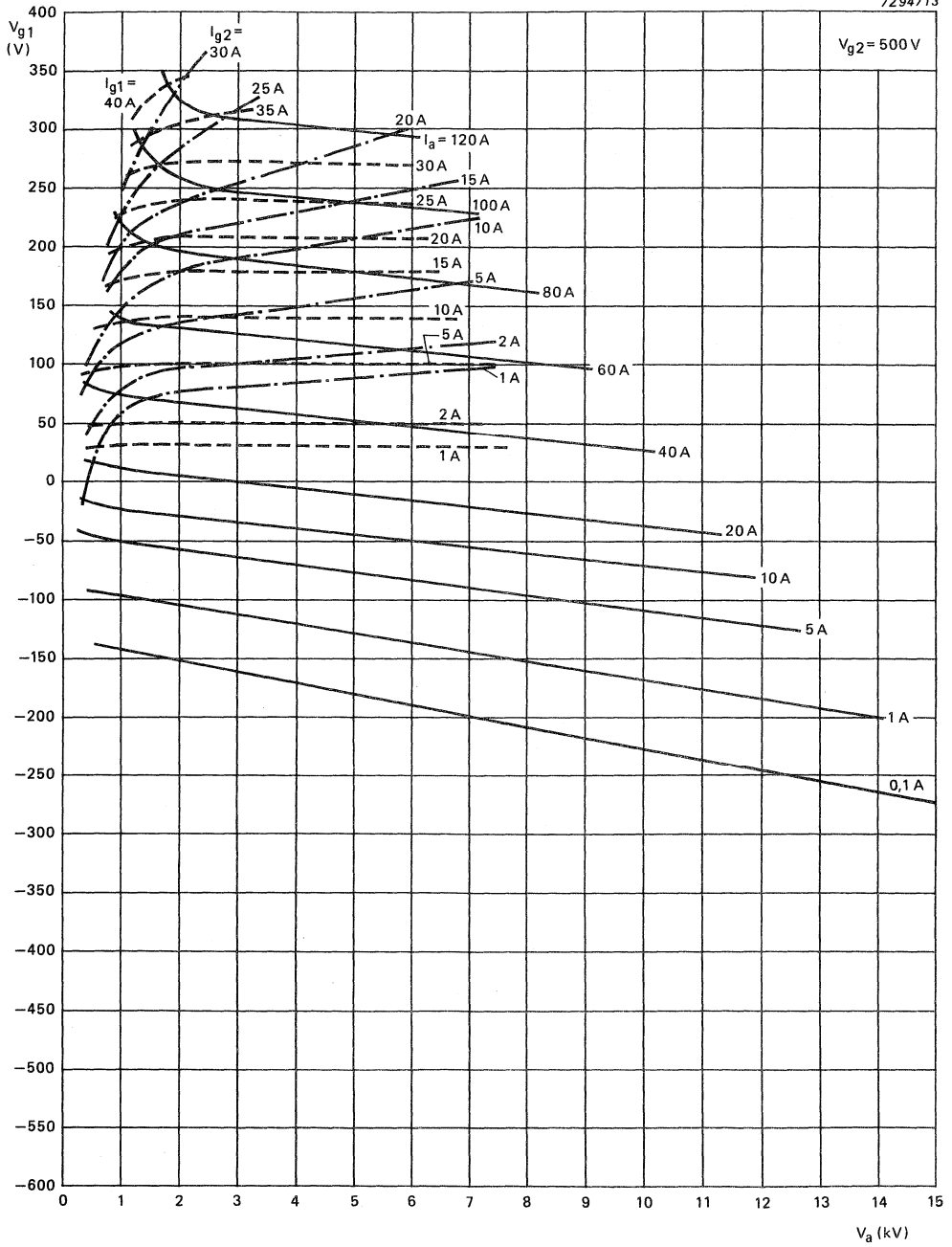


Fig. 2.

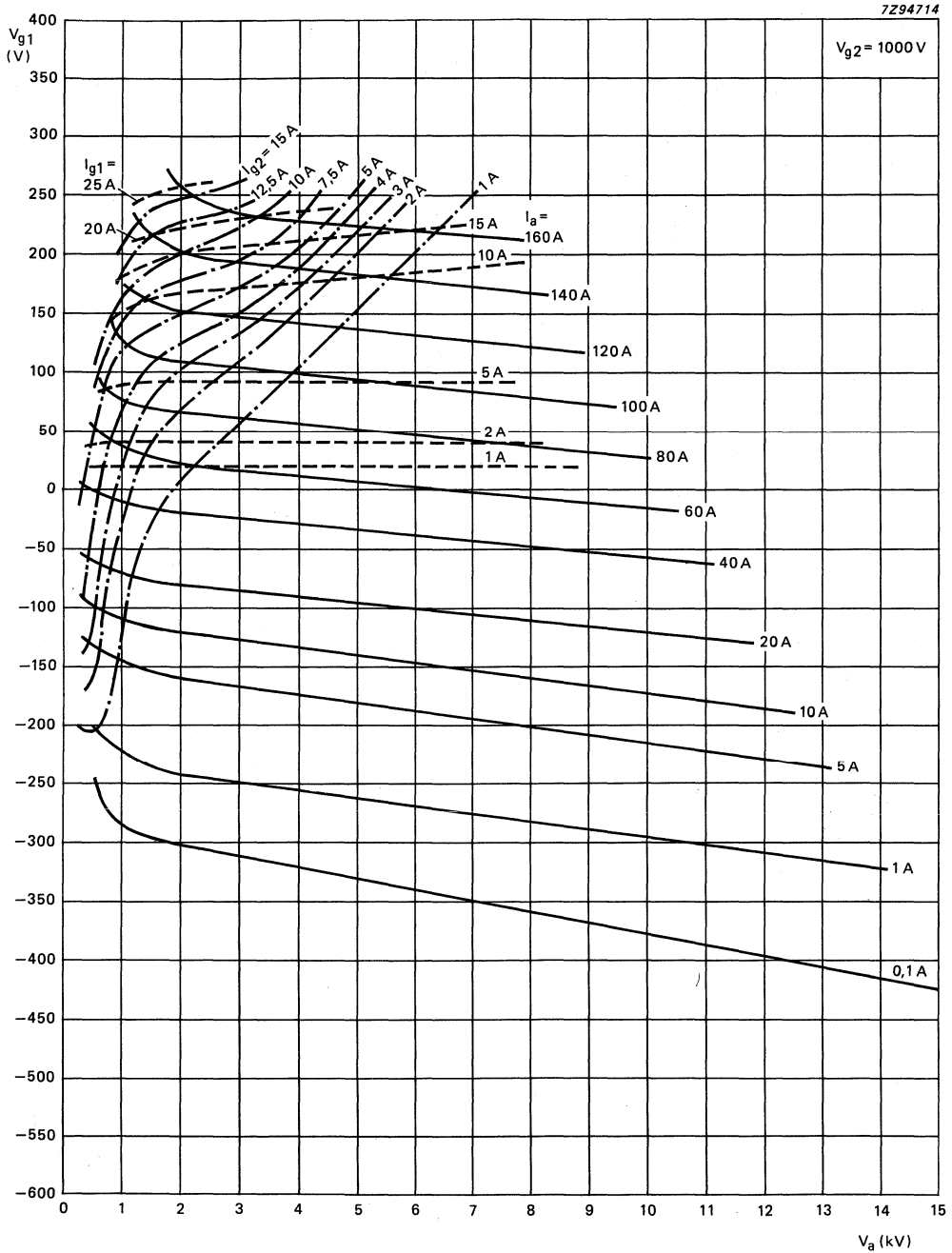


Fig. 3.

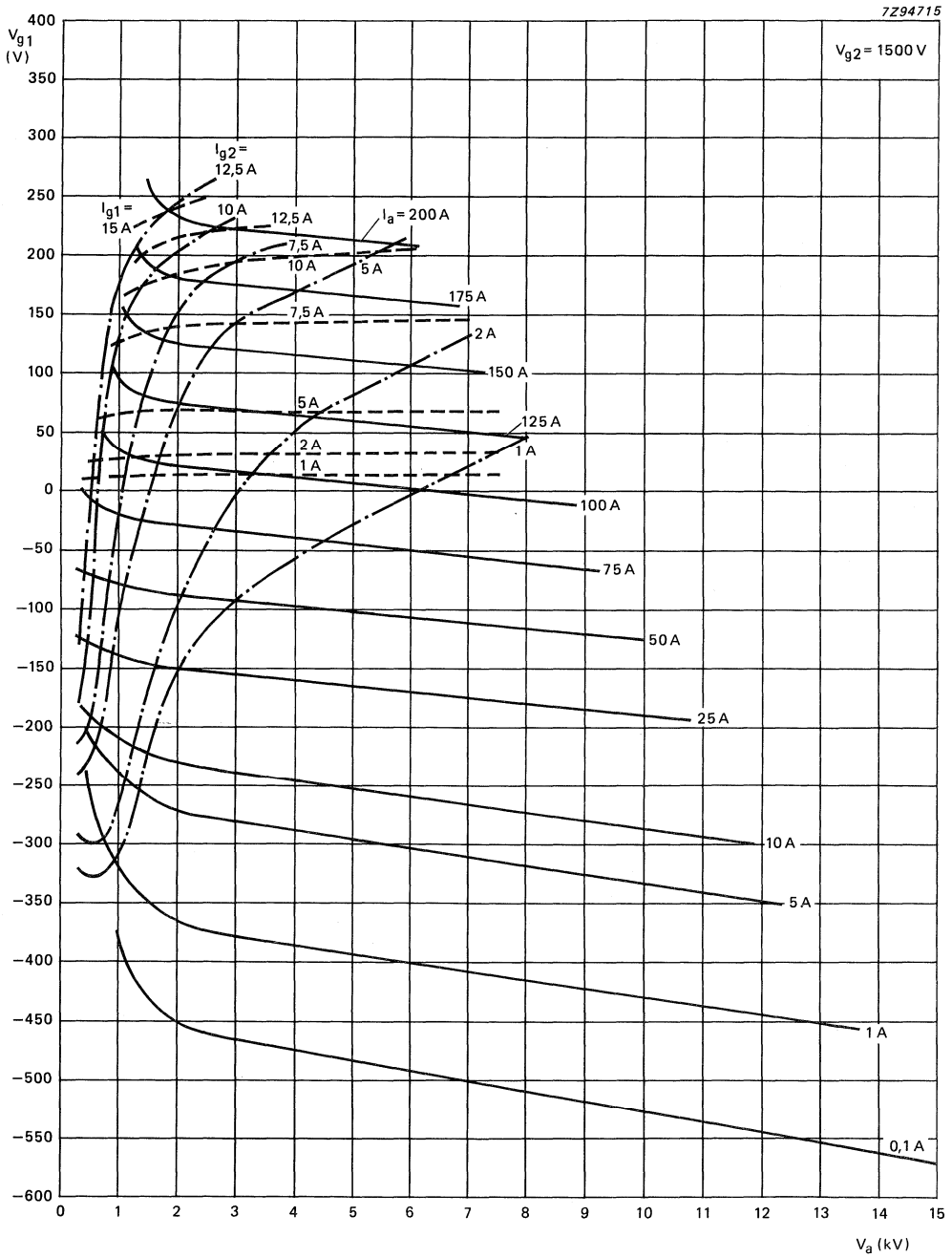


Fig. 4.

## 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  $50 \Omega$

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

40744  
40746  
40748  
40756  
40758  
40760  
40775  
40777  
40778\*  
40769\*  
40787S\*  
40788  
40789

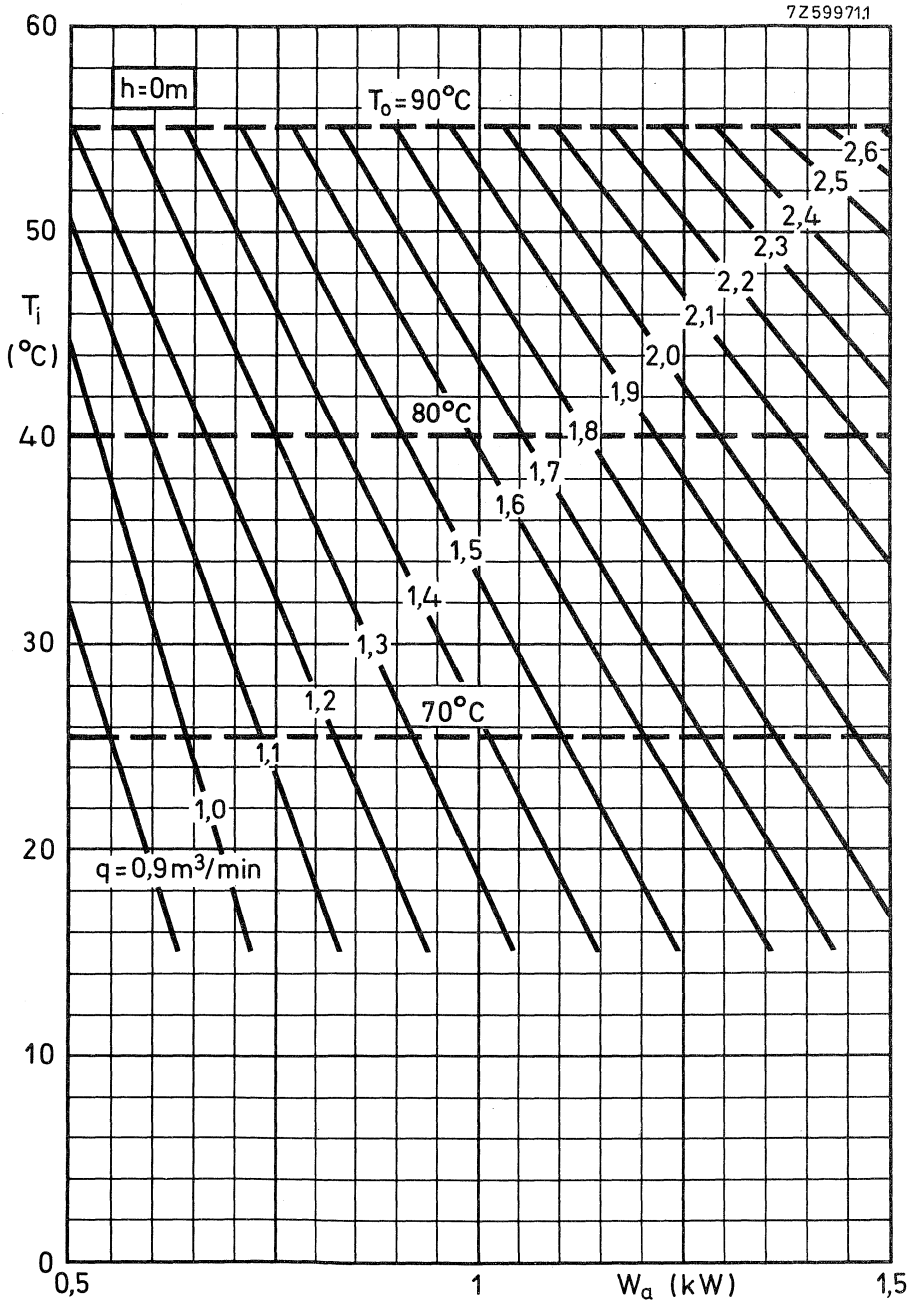
## VISION + SOUND/VISION

40743  
40745  
40747  
40755  
40757  
40759  
40768  
40776  
40783  
40786  
40786A\*  
40787

\* Data available on request.

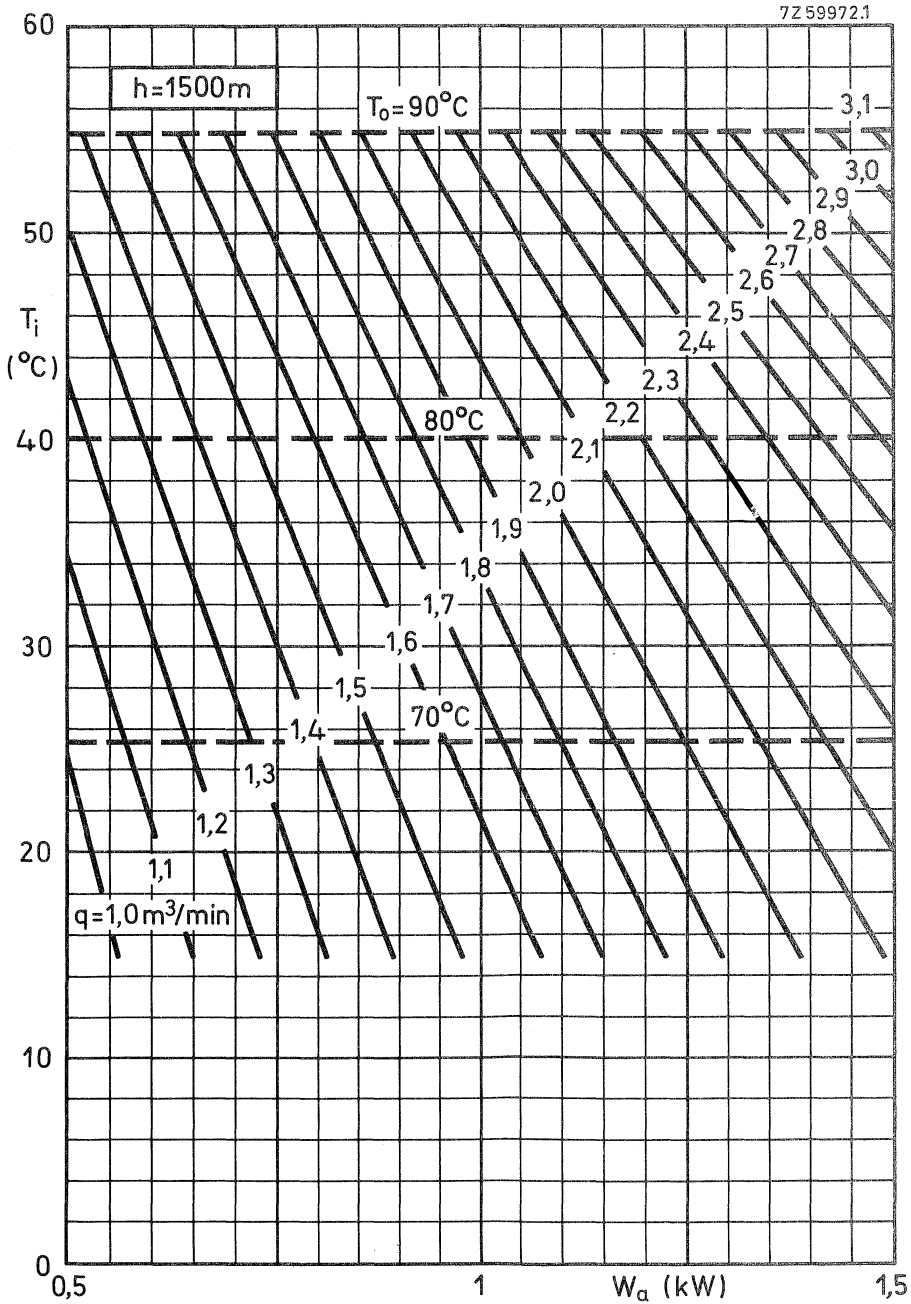
# COOLING CURVES

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



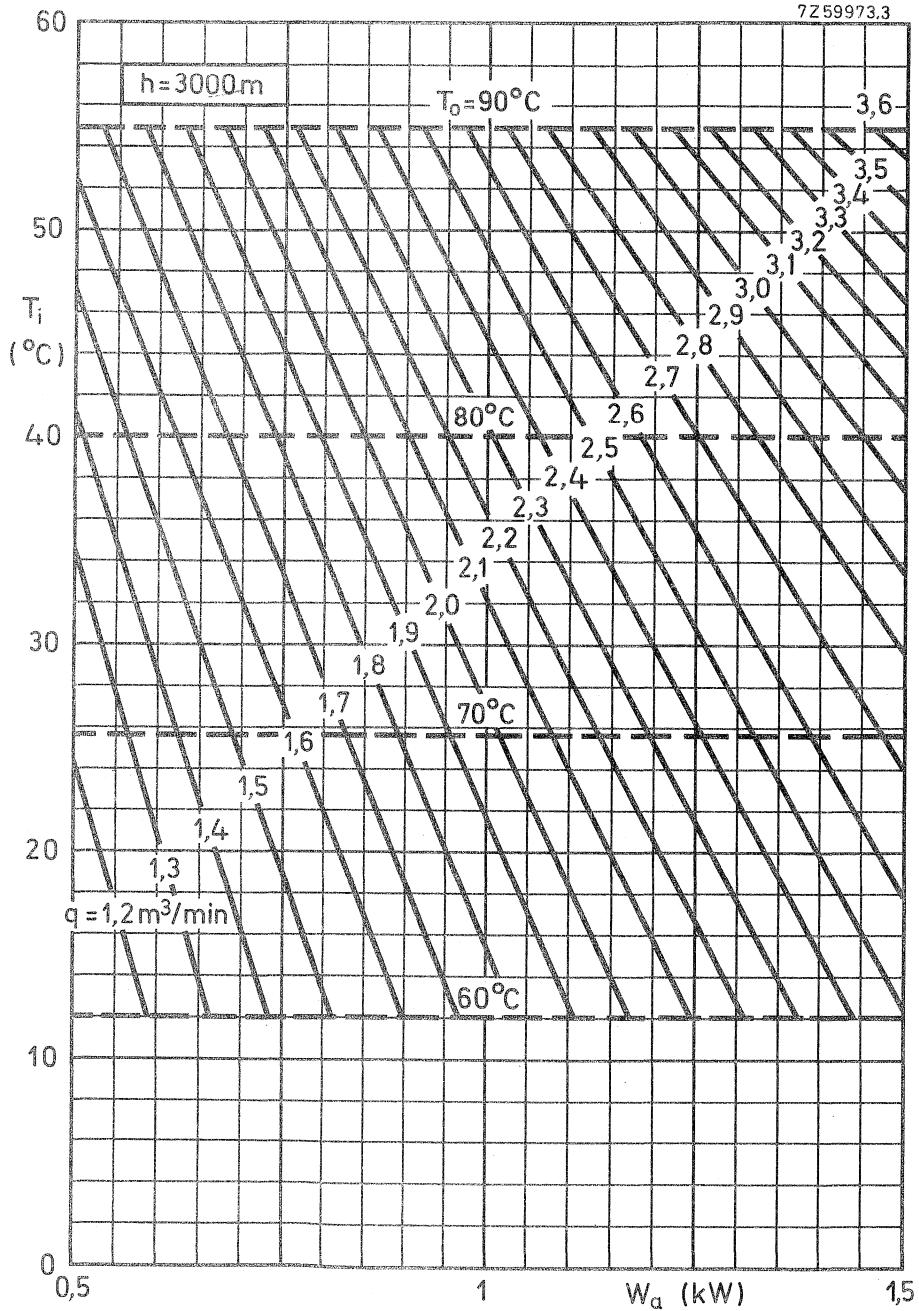


Cooling curves for assemblies 40743, 40744, 40755 and 40756 with tube YL1440.  
 Altitude: 1500 m

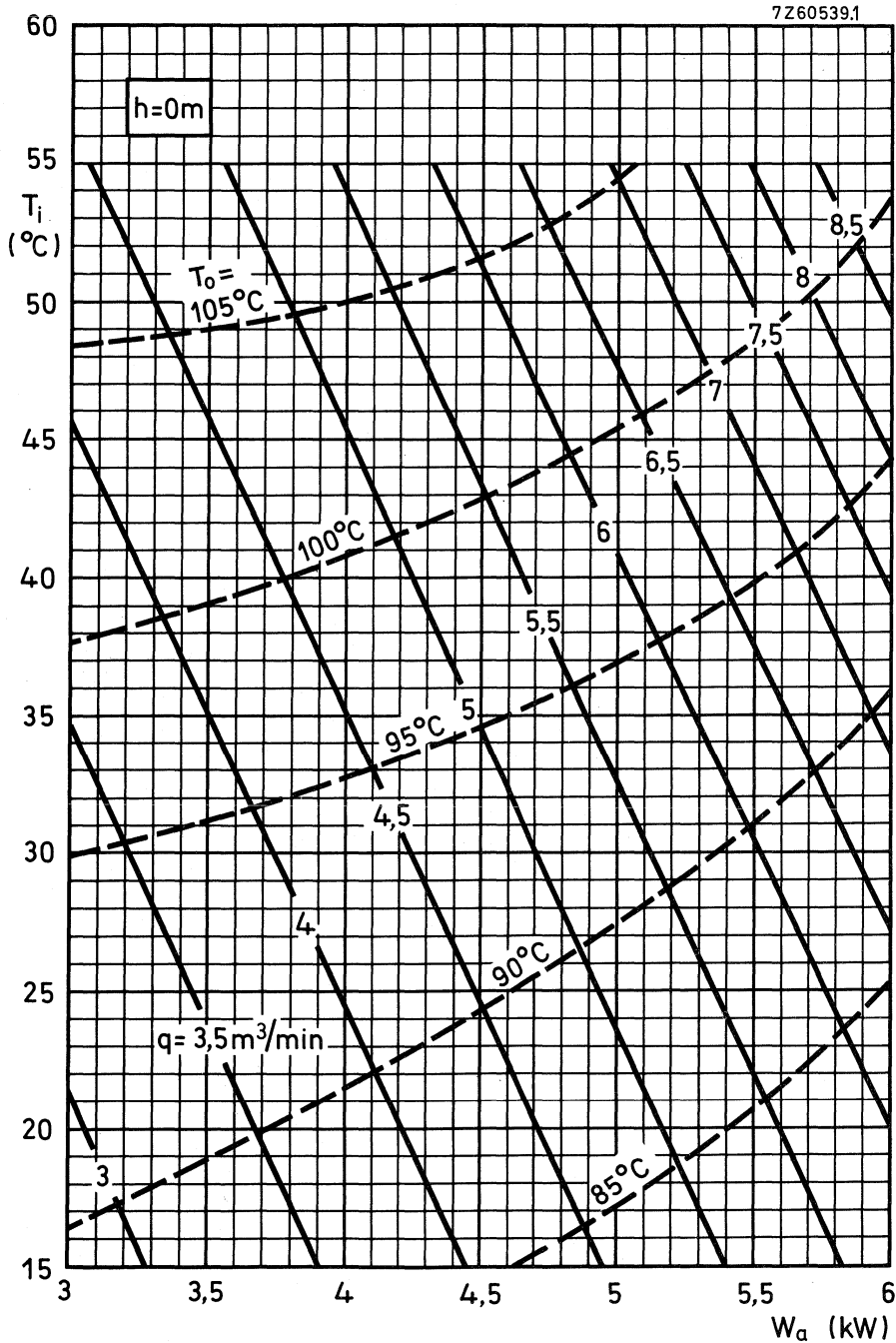


# COOLING CURVES

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

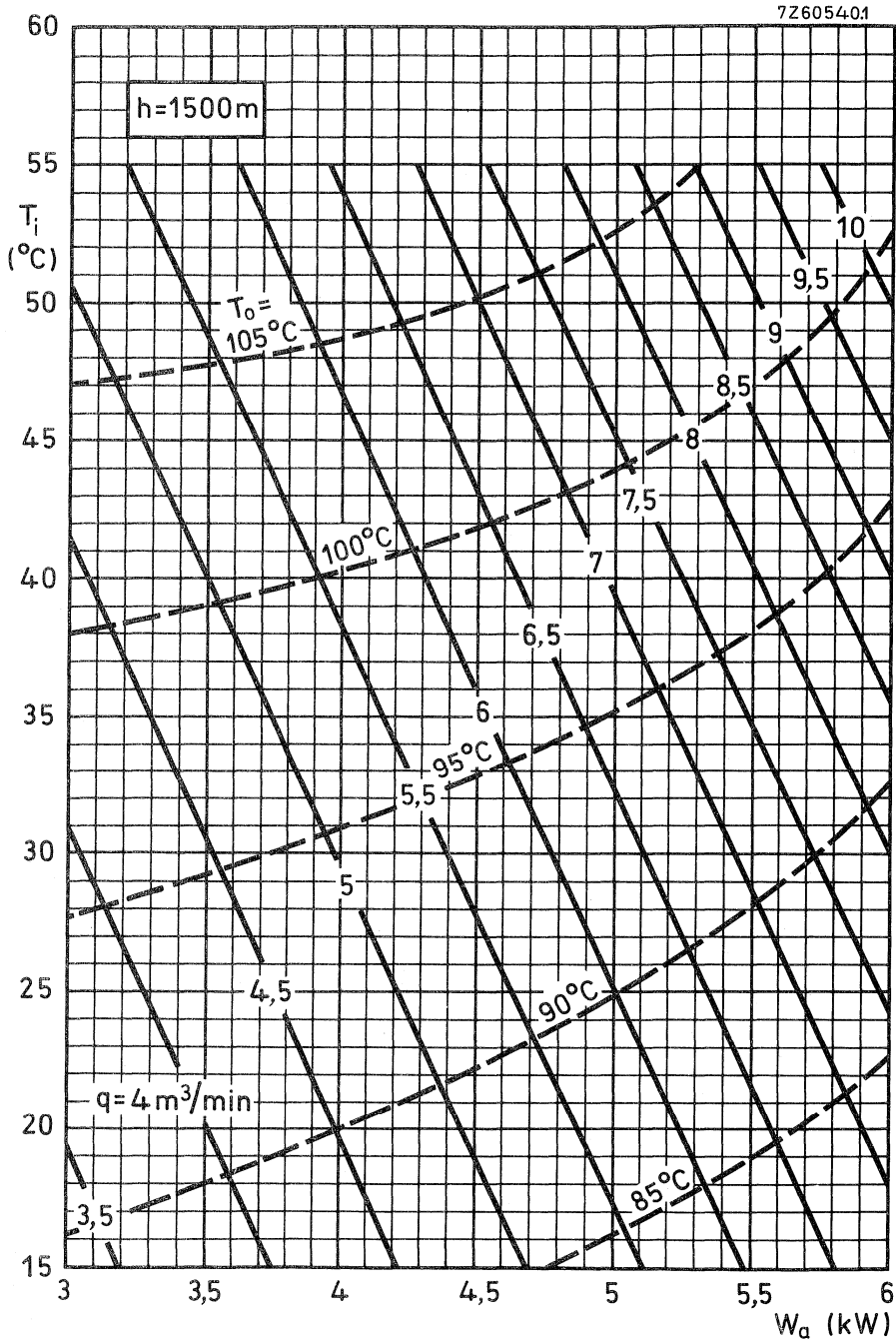


Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.  
 Altitude: sea level

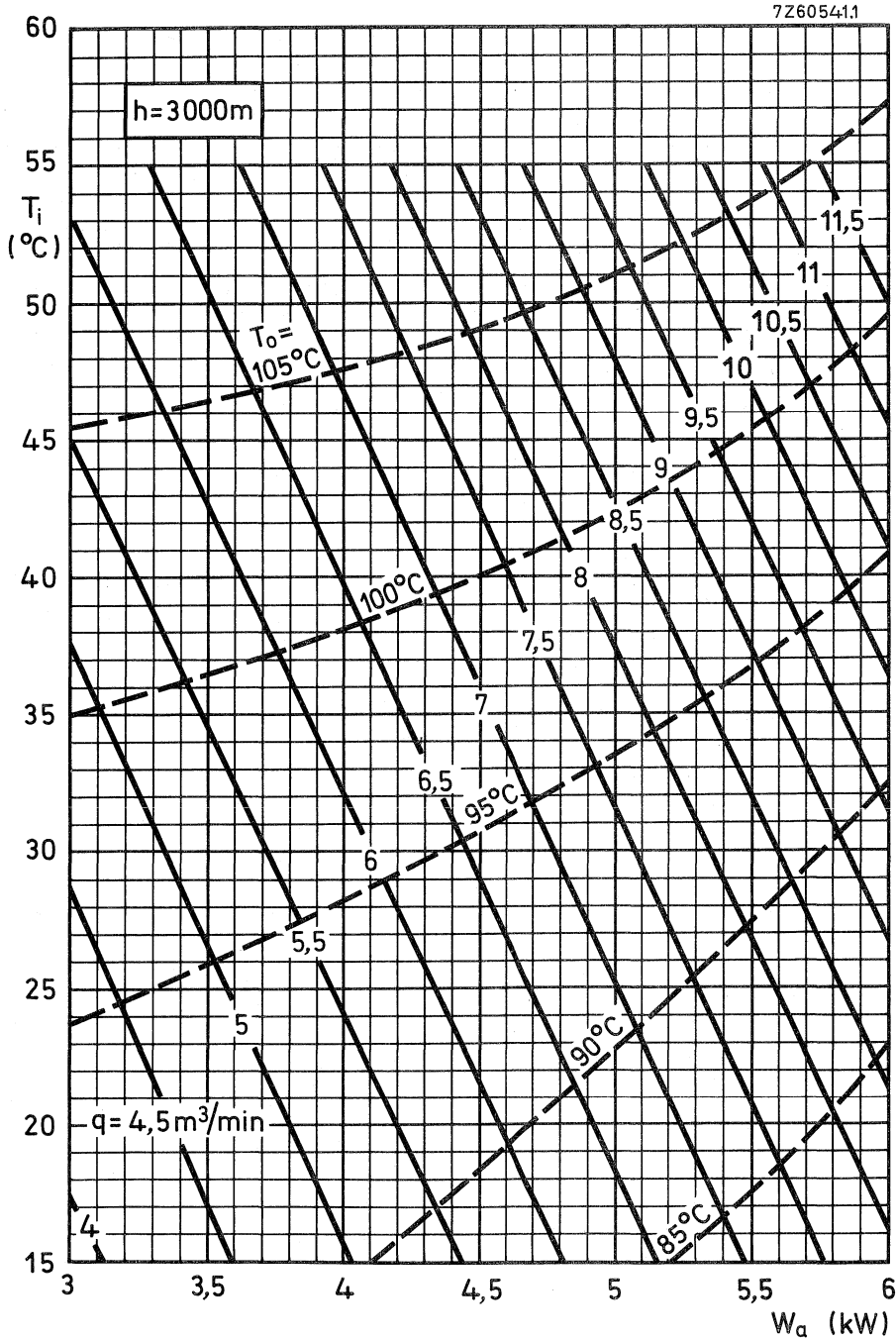


# COOLING CURVES

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

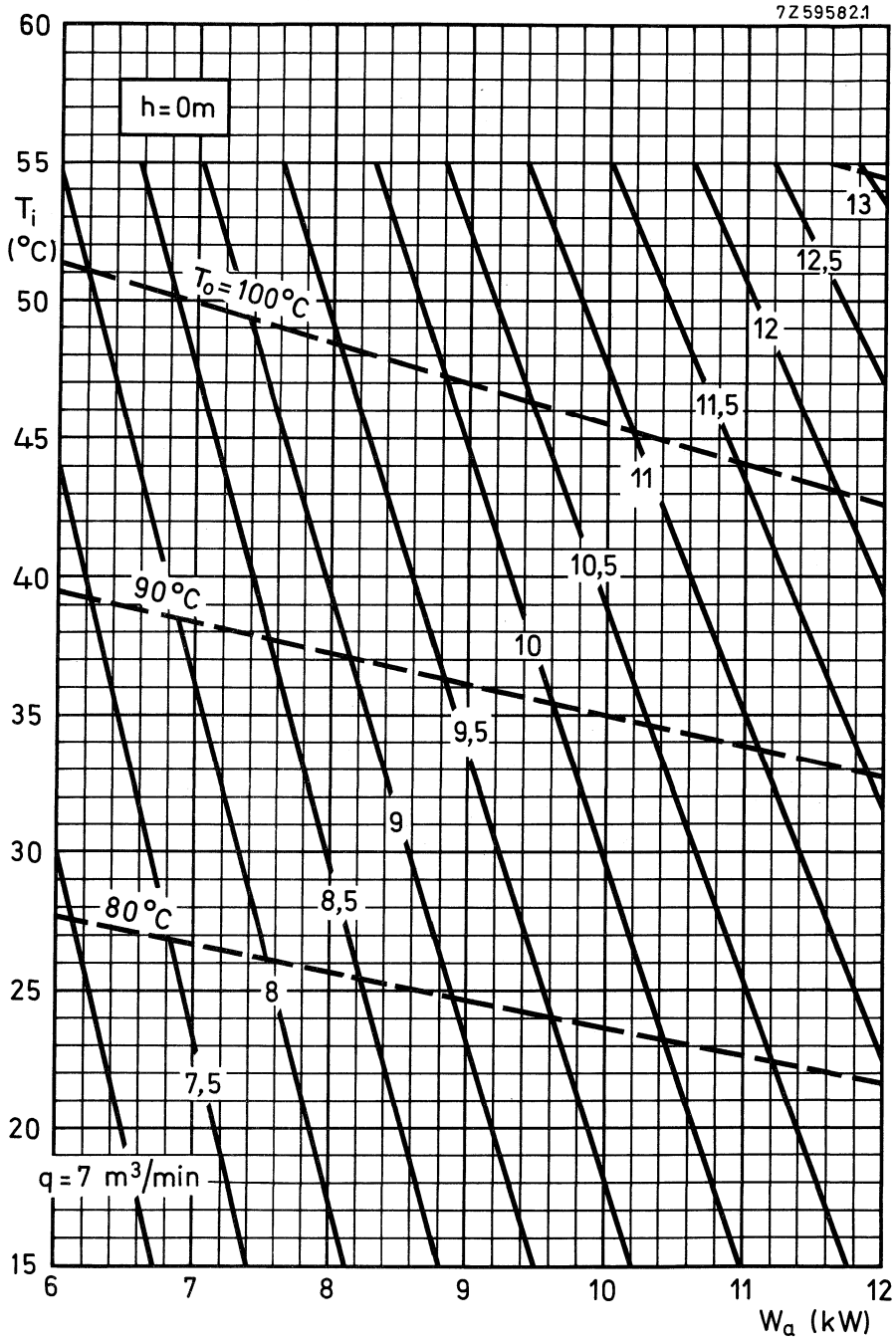


Cooling curves for assemblies 40745, 40746, 40757 and 40758 with tube YL1420.  
 Altitude: 3000 m

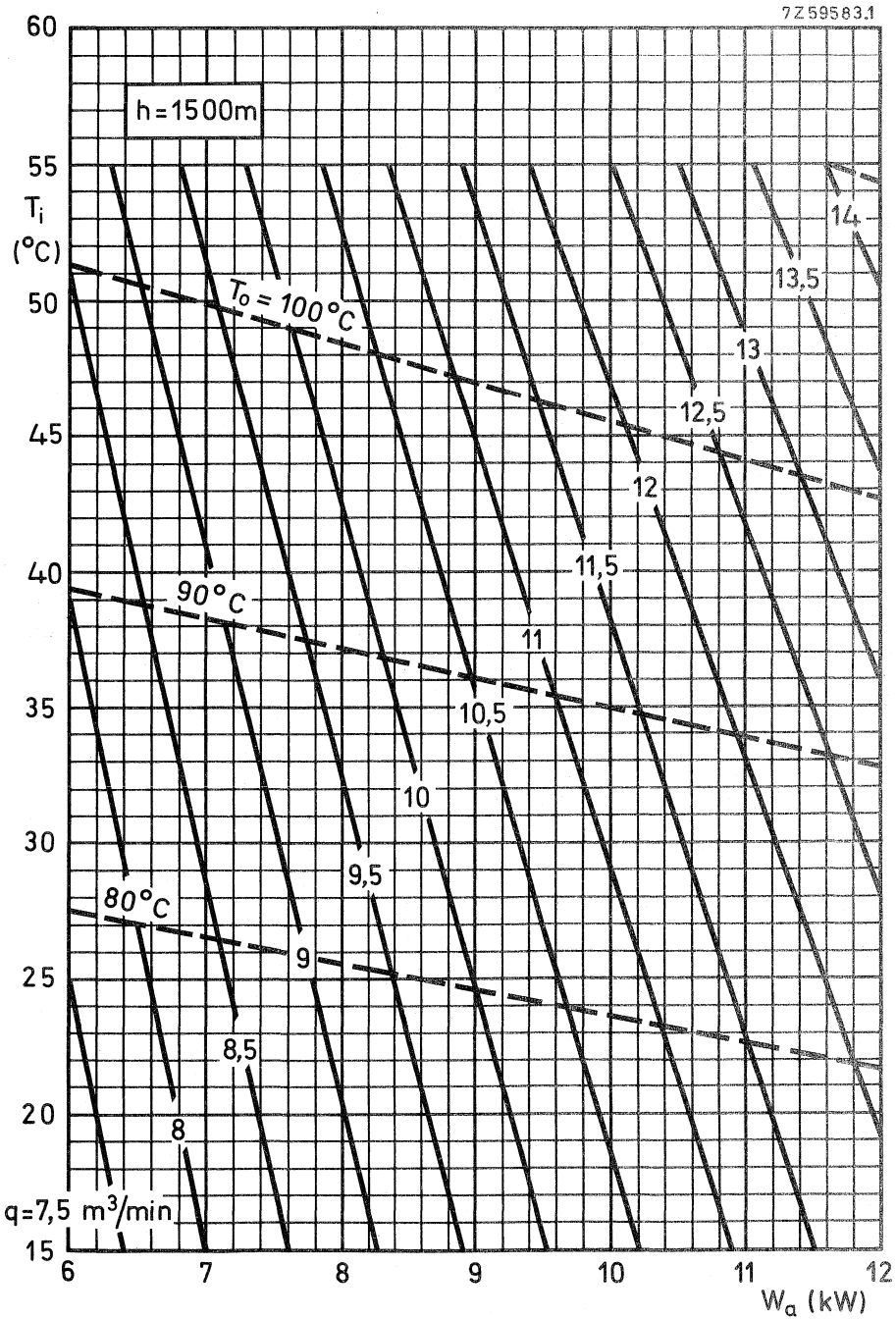


# COOLING CURVES

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

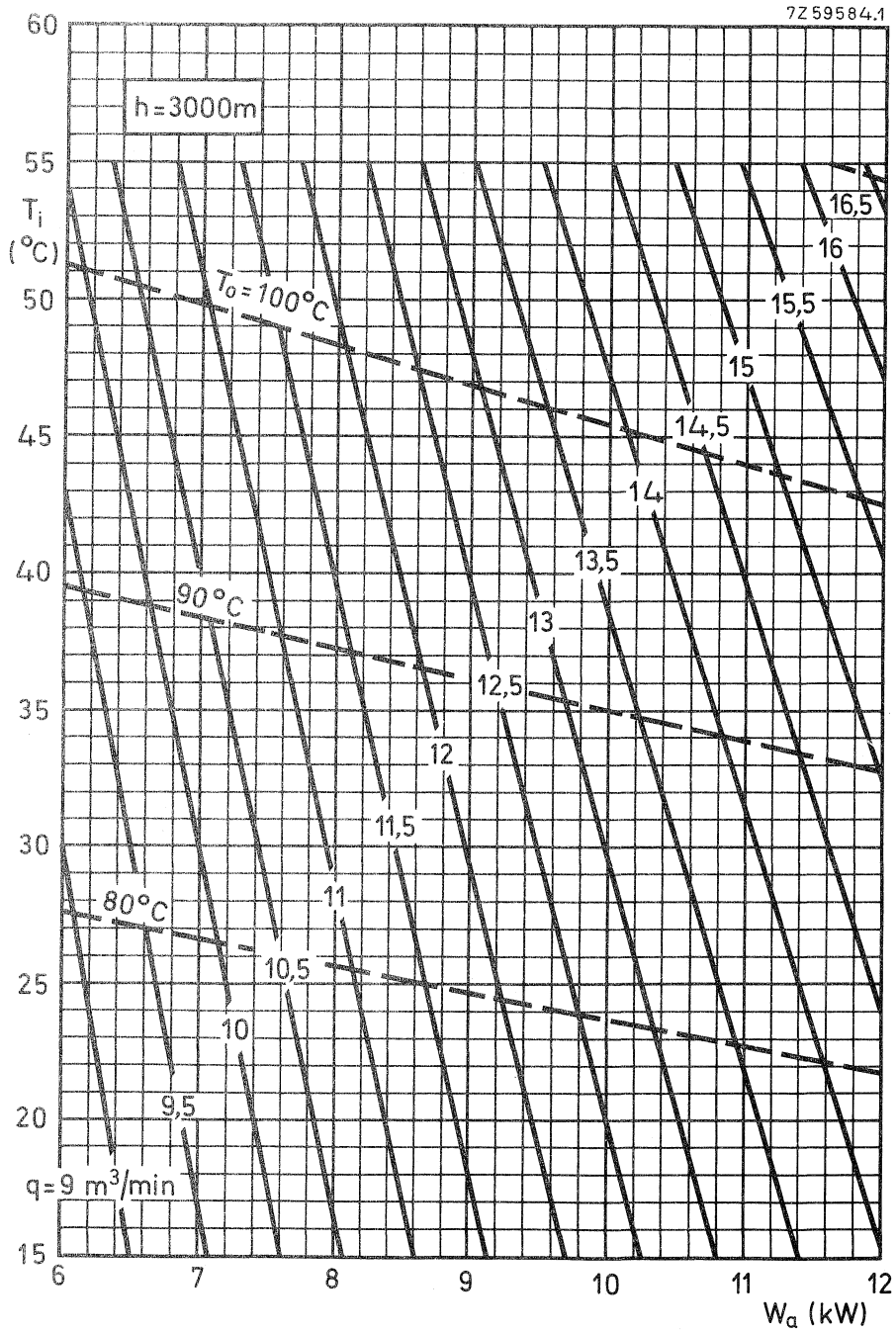


Cooling curves for assemblies 40747, 40748, 40759 and 40760 with tube YL1430.  
 Altitude: 1500 m



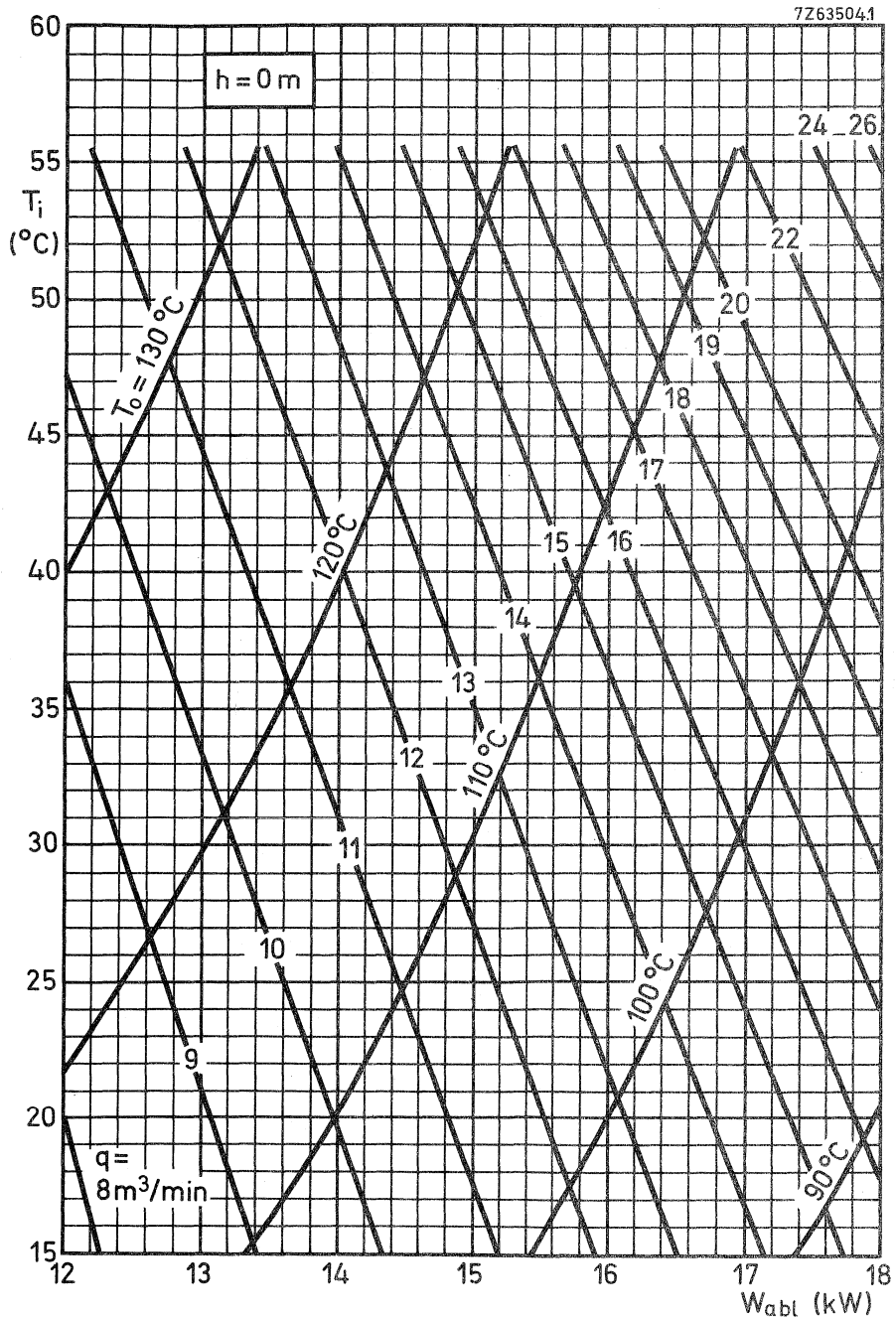
# COOLING CURVES

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



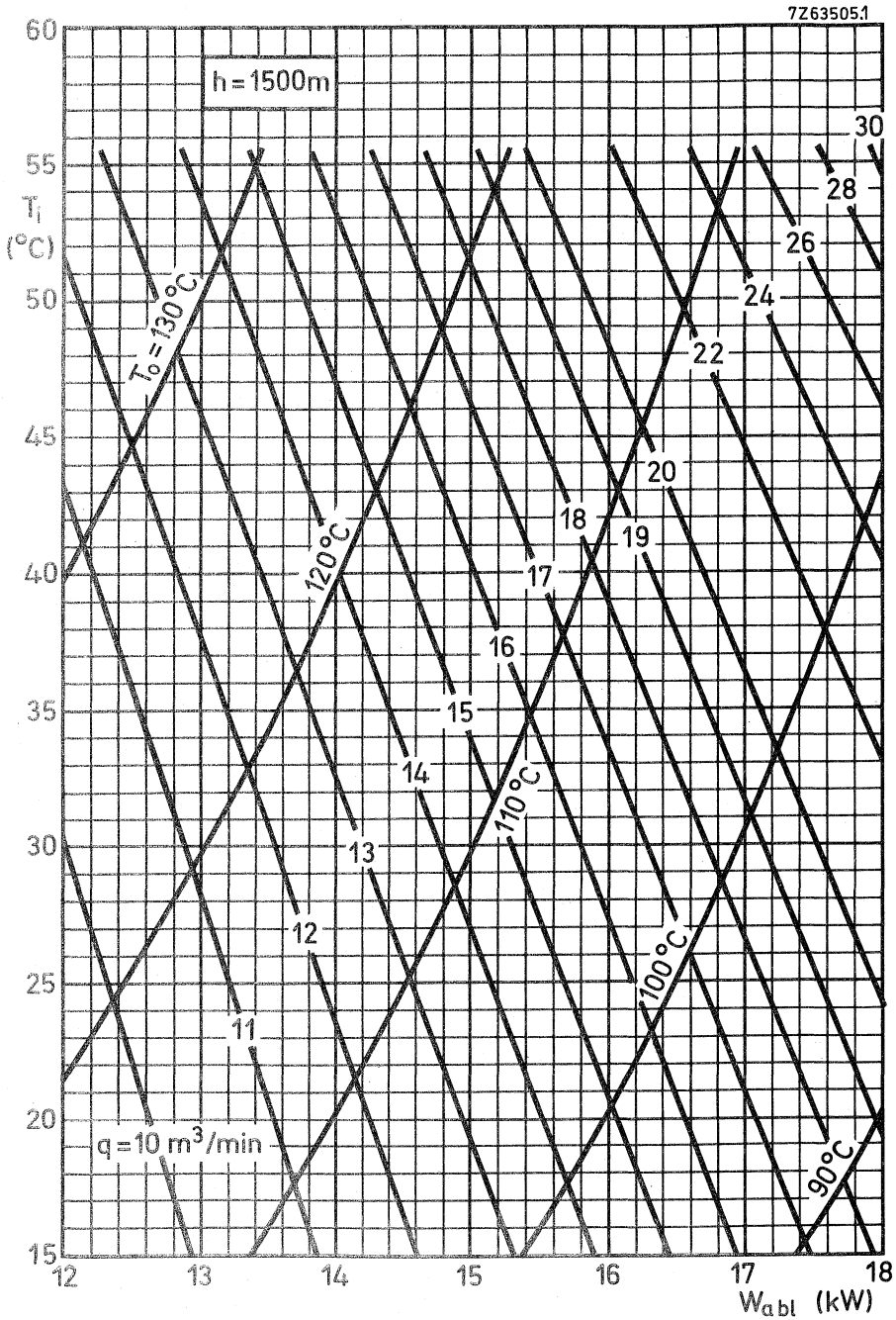


Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.  
 Altitude: sea level

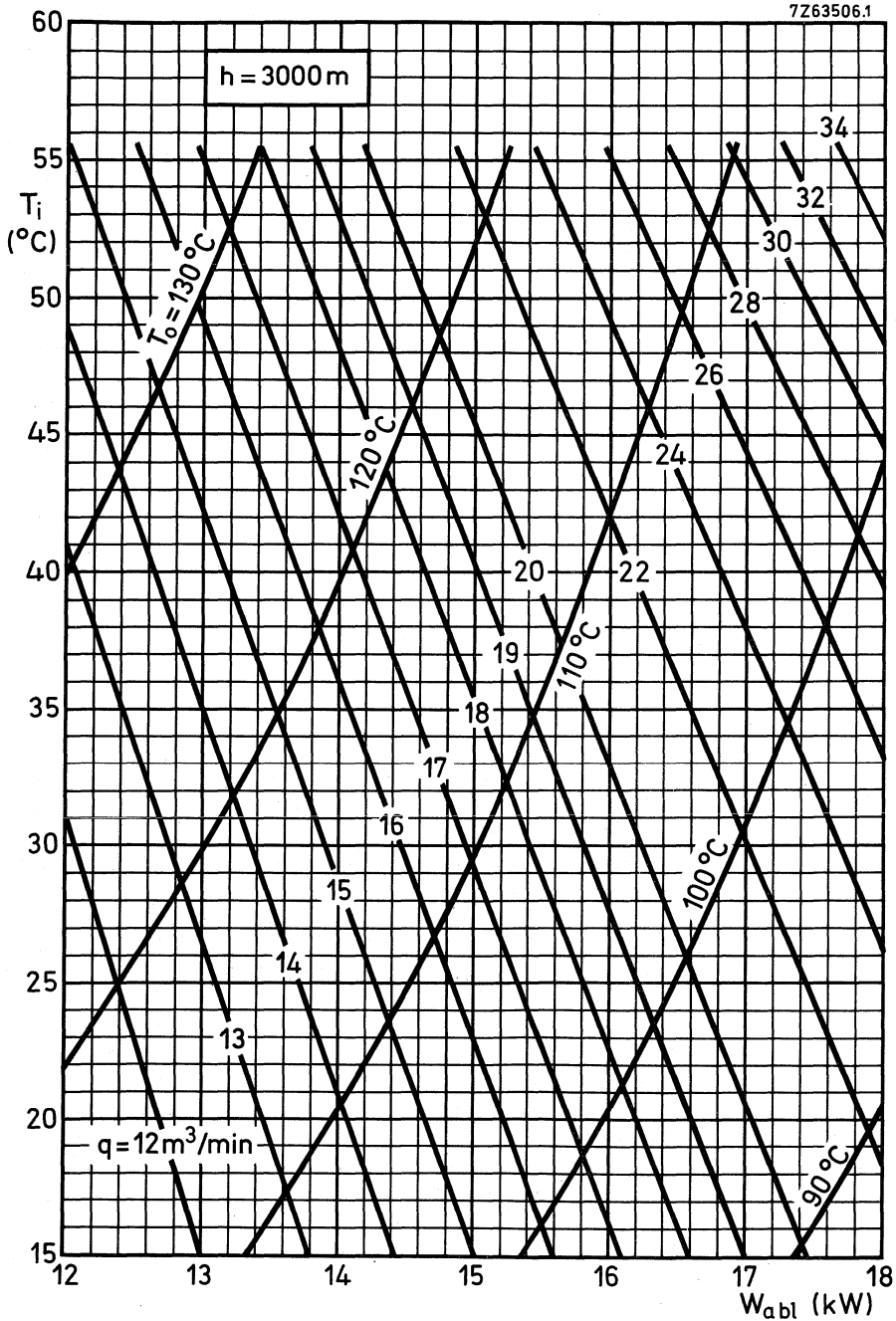


# COOLING CURVES

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

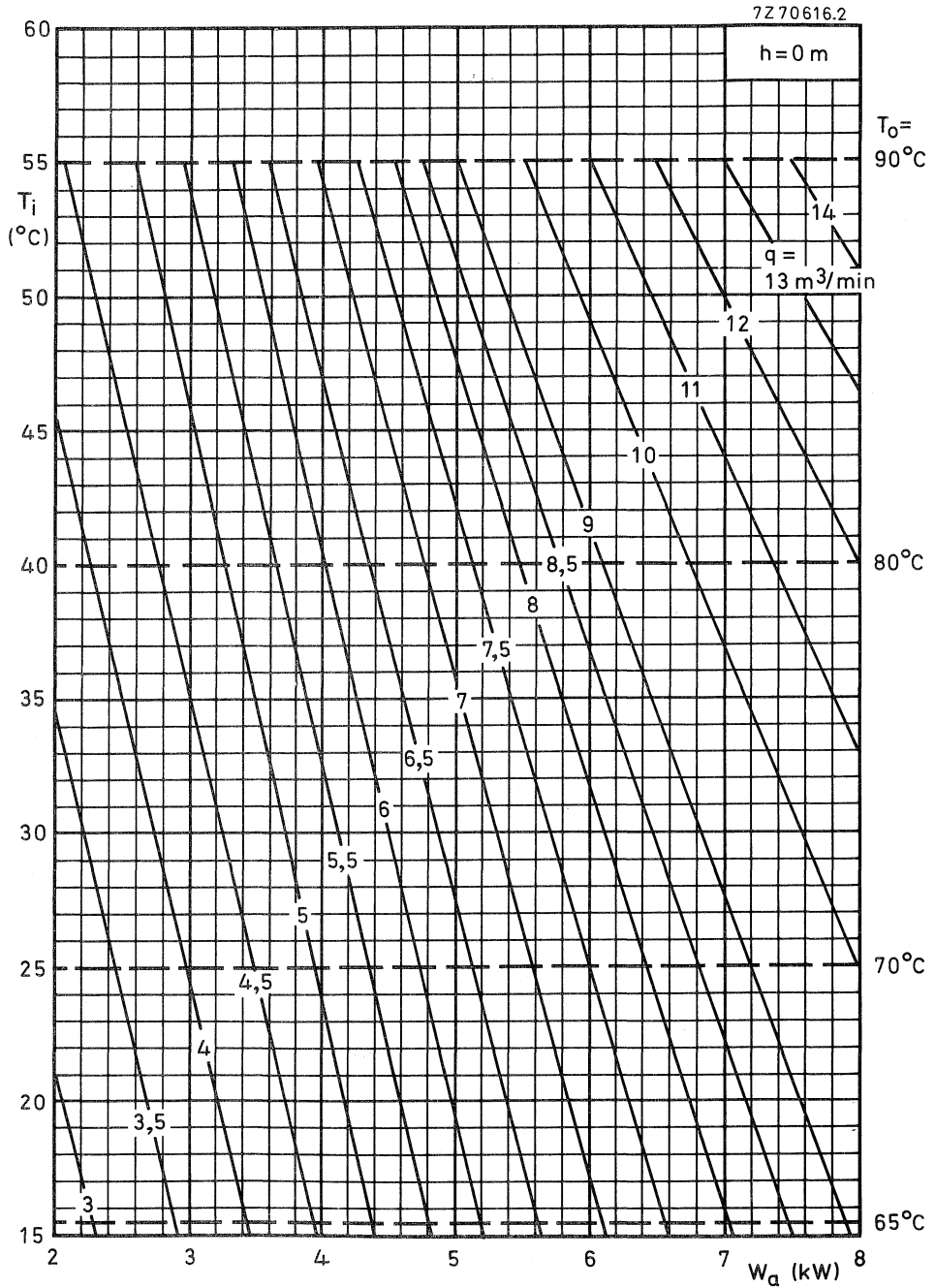


Cooling curves for assemblies 40759, 40760 and 40768 with tube YL1520.  
 Altitude: 3000 m

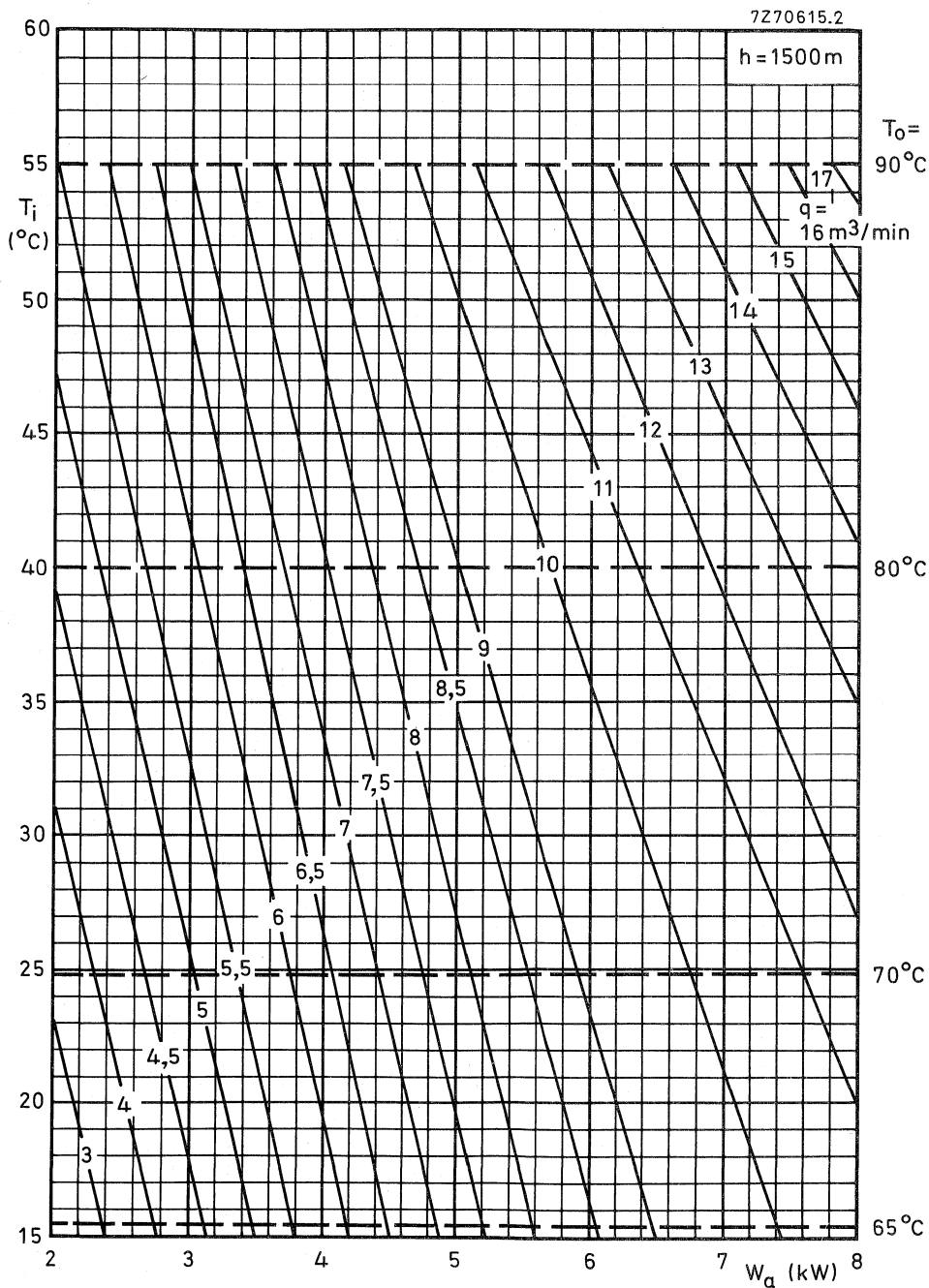


# COOLING CURVES

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

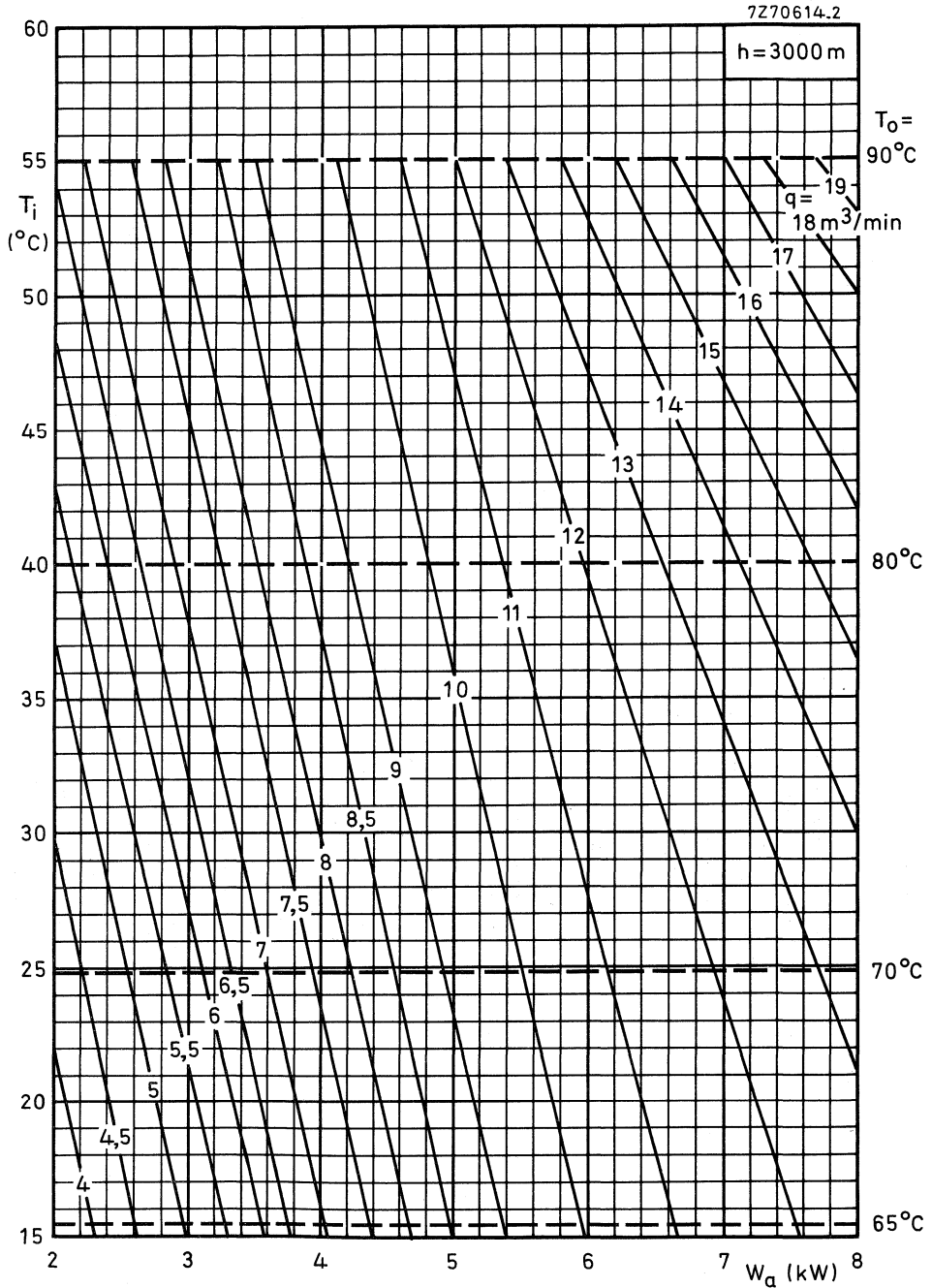


Cooling curves for assembly 40775 with tube YL1470.  
 Altitude: 1500 m

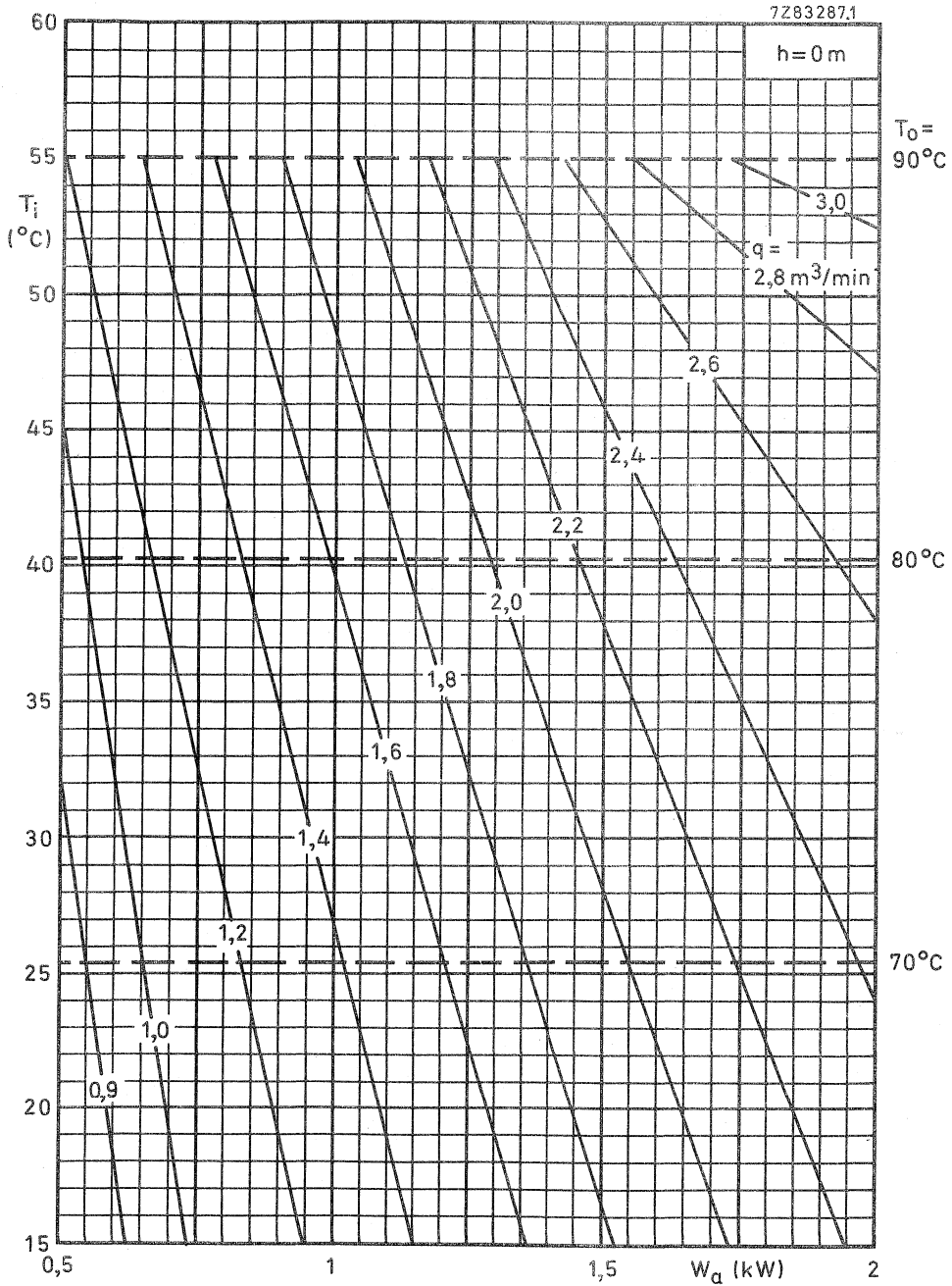


# COOLING CURVES

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

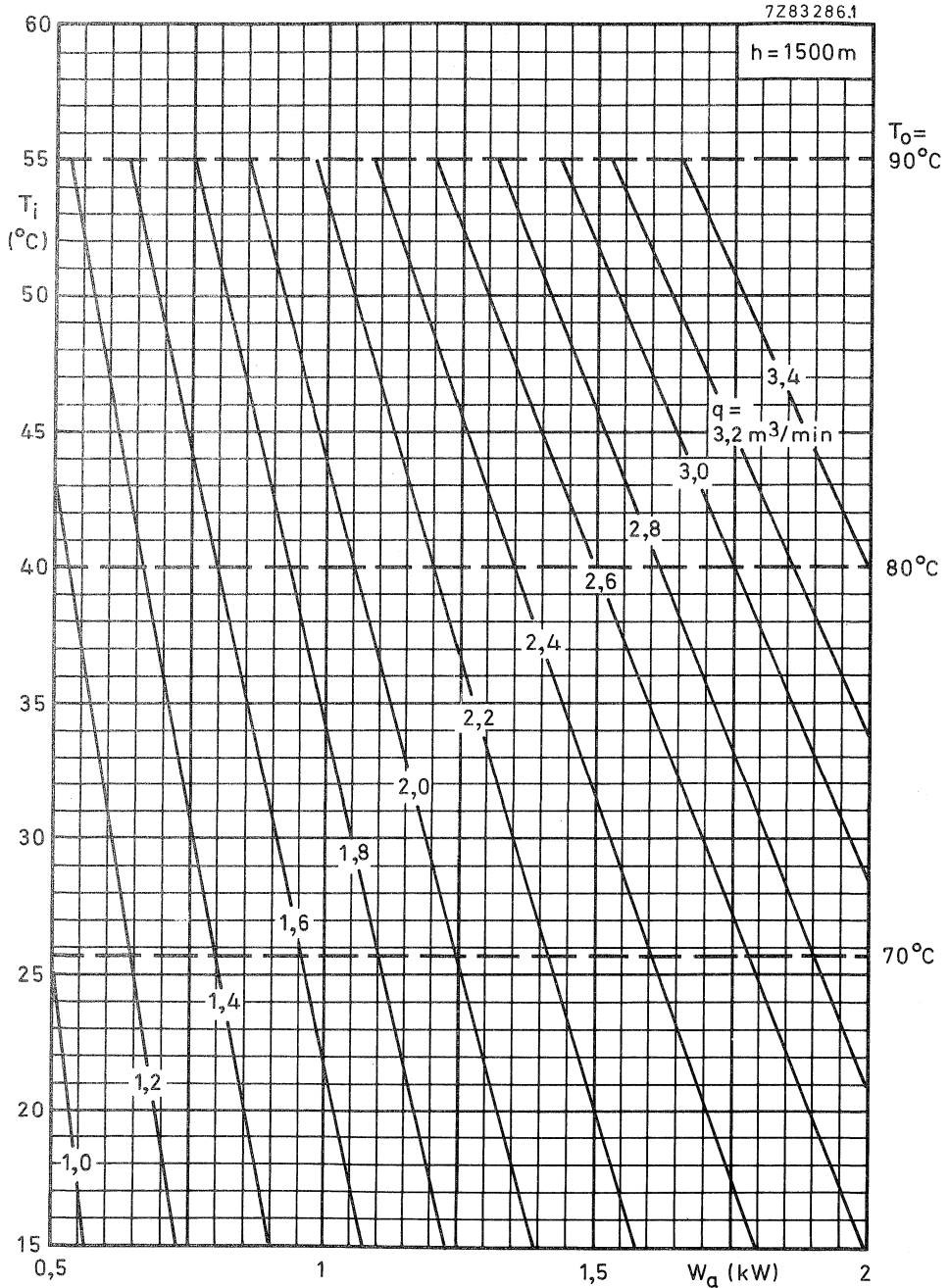


Cooling curves for assemblies 40776 and 40777 with tube YL1540.  
 Altitude: sea level



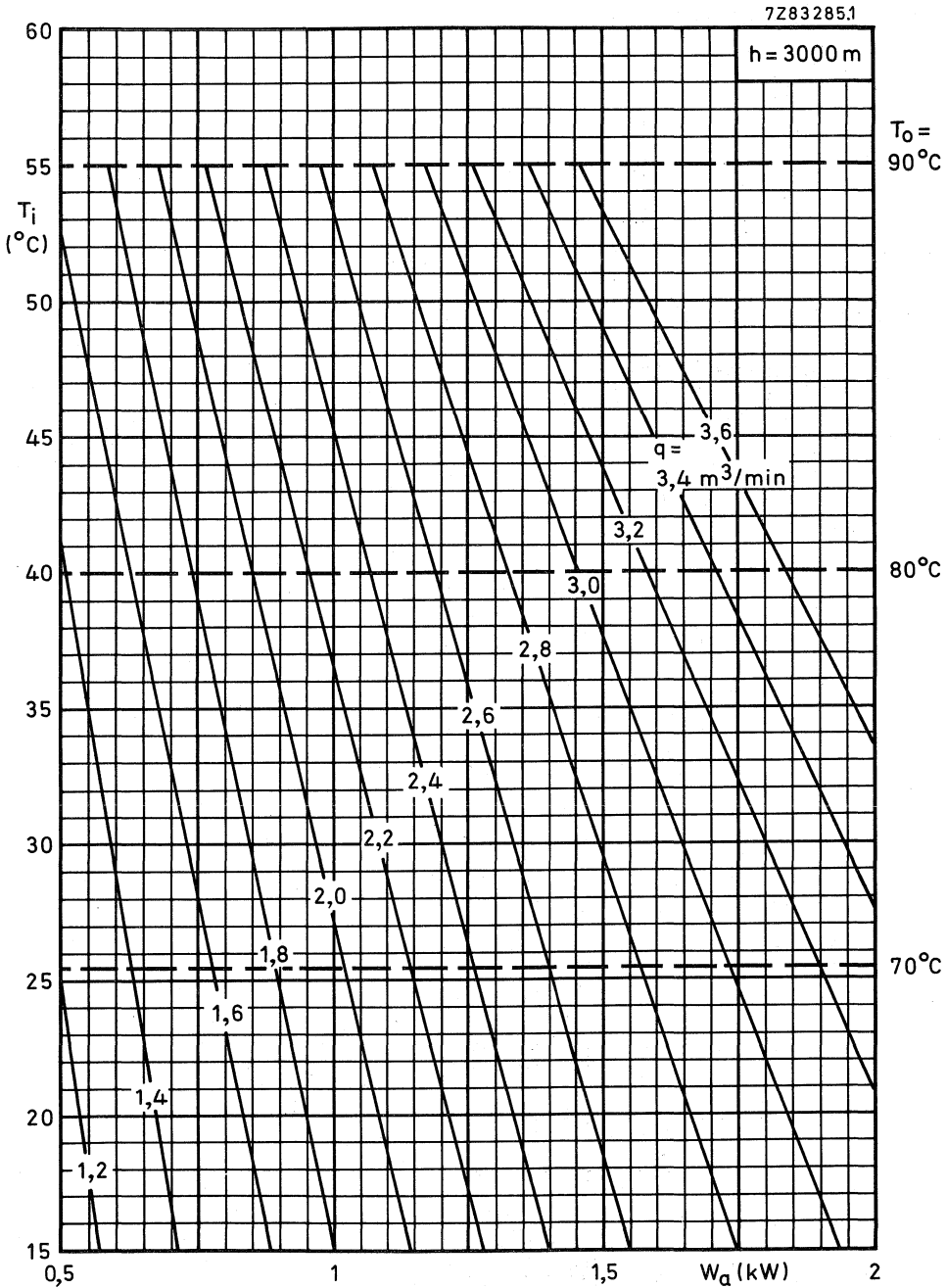
# COOLING CURVES

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





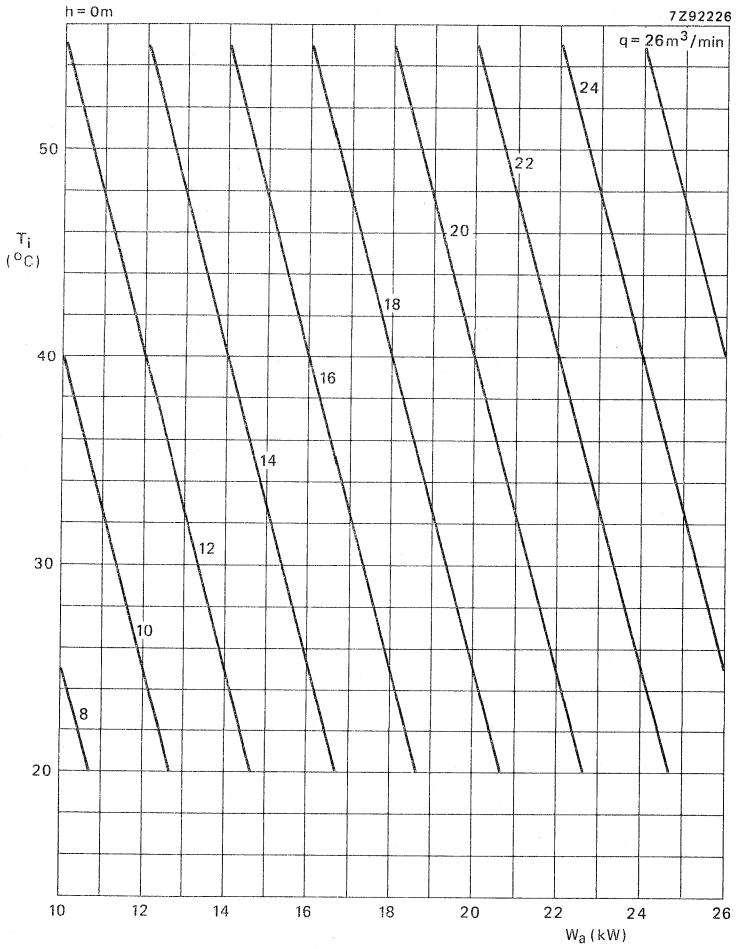
Cooling curves for assemblies 40776 and 40777 with tube YL1540.  
 Altitude: 3000 m



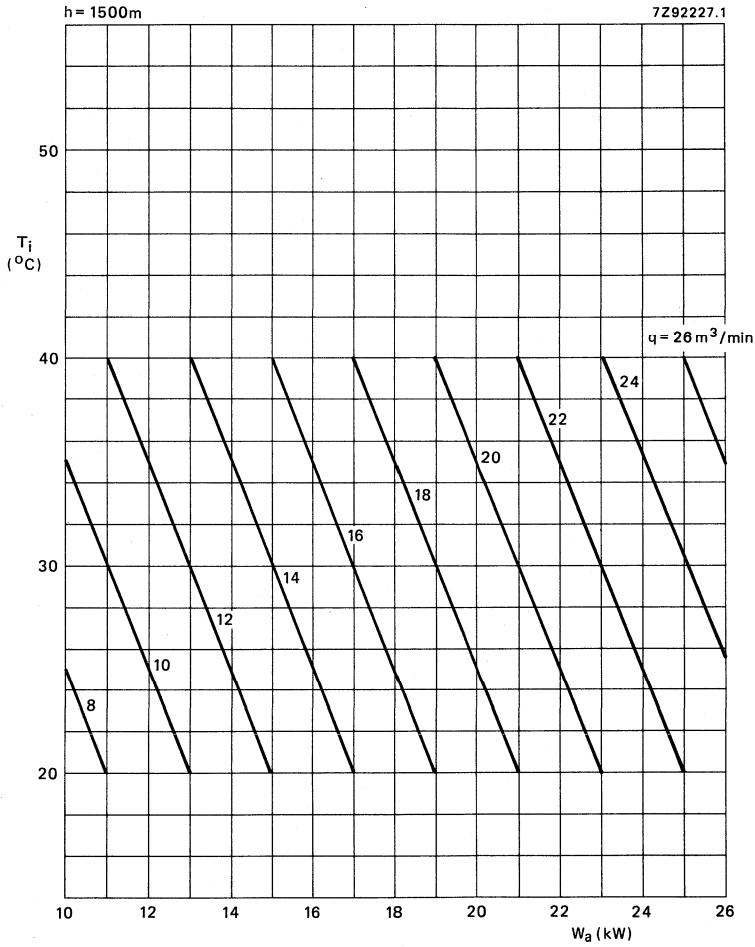
# COOLING CURVES

Cooling curves for assembly 40786 with tube YL1630.

Altitude: sea level.



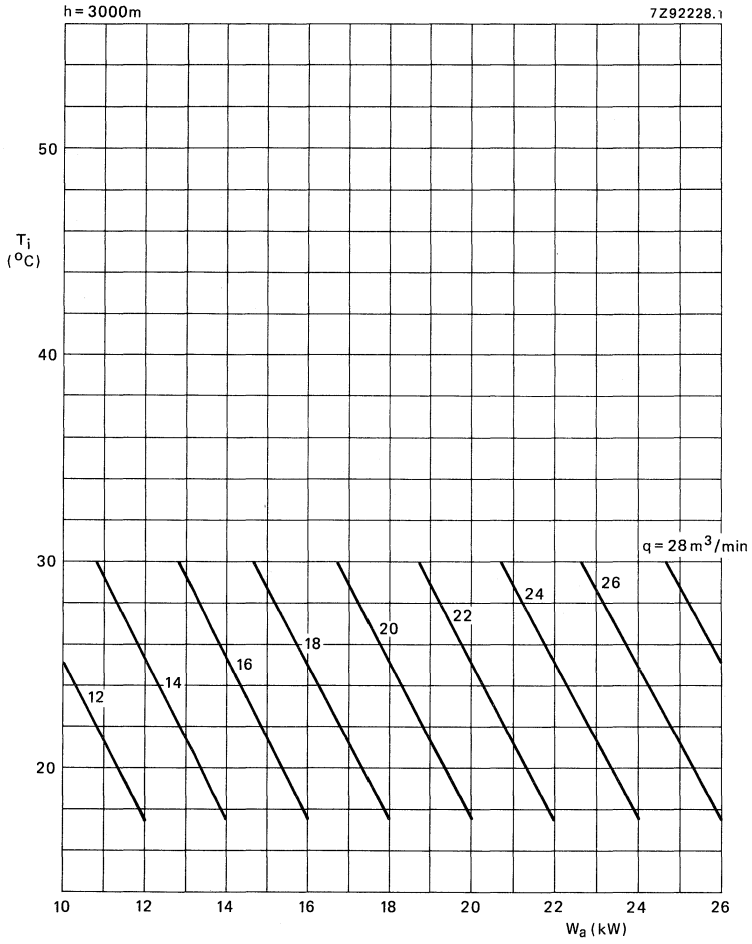
Cooling curves for assembly 40786 with tube YL1630.  
Altitude: 1500 m



# COOLING CURVES

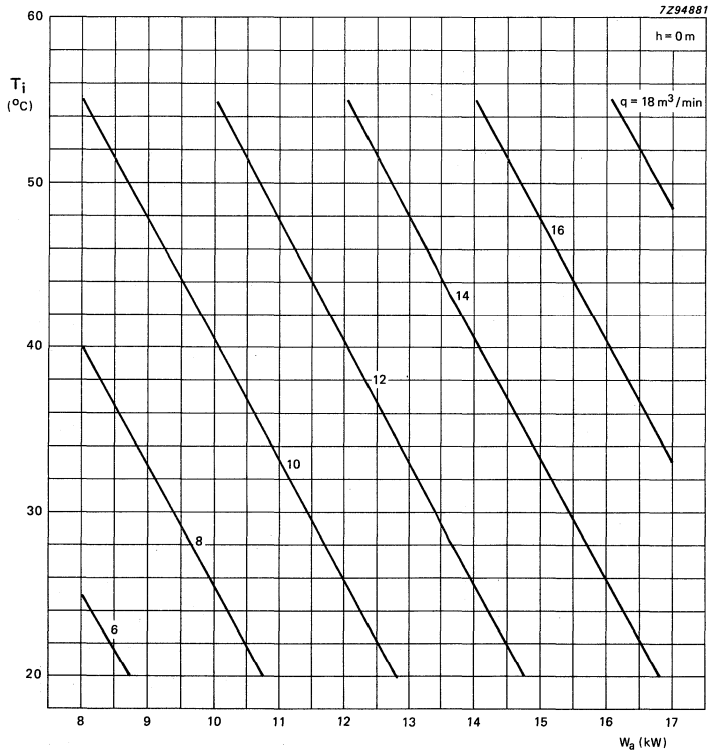
Cooling curves for assembly 40786 with tube YL1630.

Altitude: 3000 m



Cooling curves for assembly 40786A with tube YL1631.

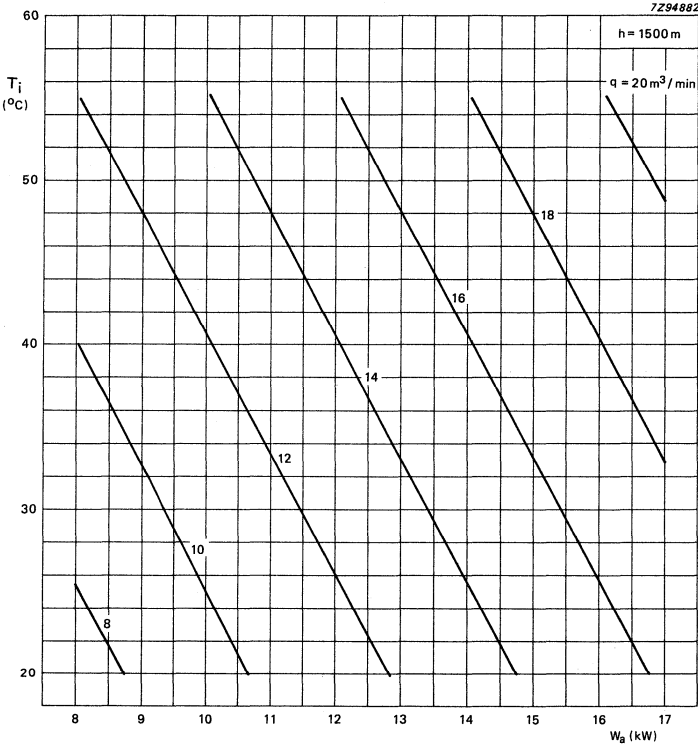
Altitude: sea level.



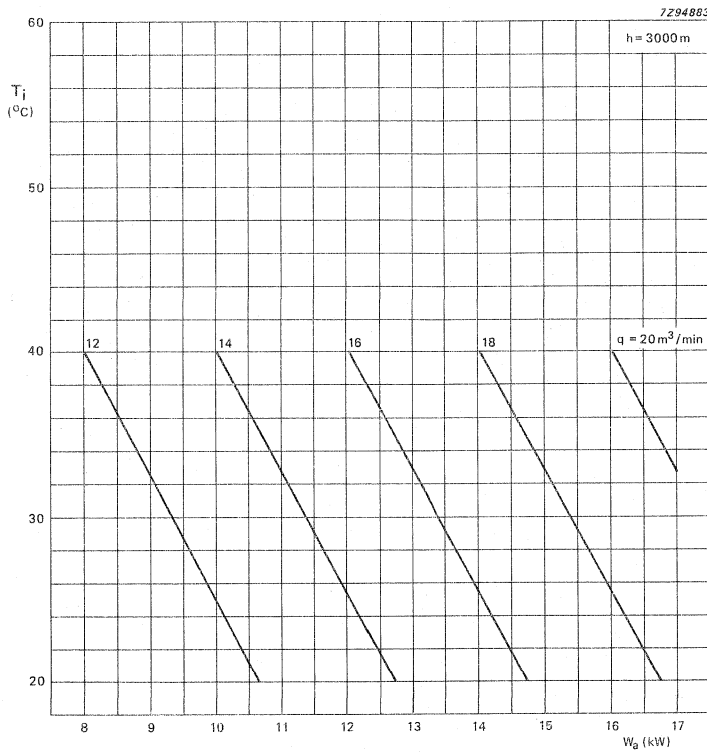
# COOLING CURVES

Cooling curves for assembly 40786A with tube YL1631.

Altitude: 1500 m.



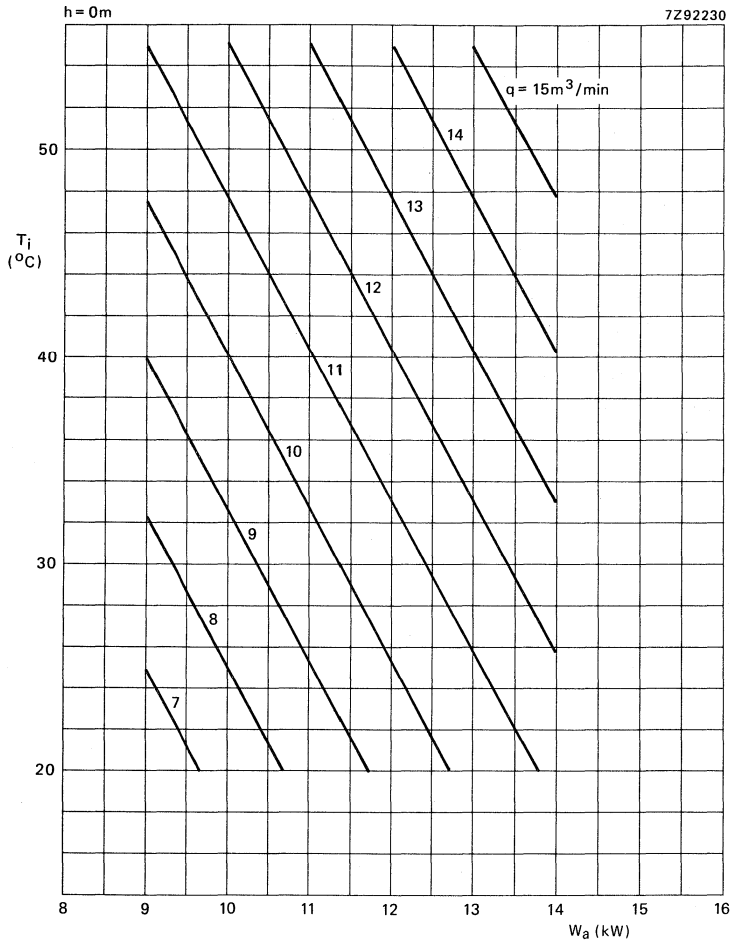
Cooling curves for assembly 40786A with tube YL1631.  
Altitude: 3000 m.



# COOLING CURVES

Cooling curves for assembly 40787 with tube YL1610.

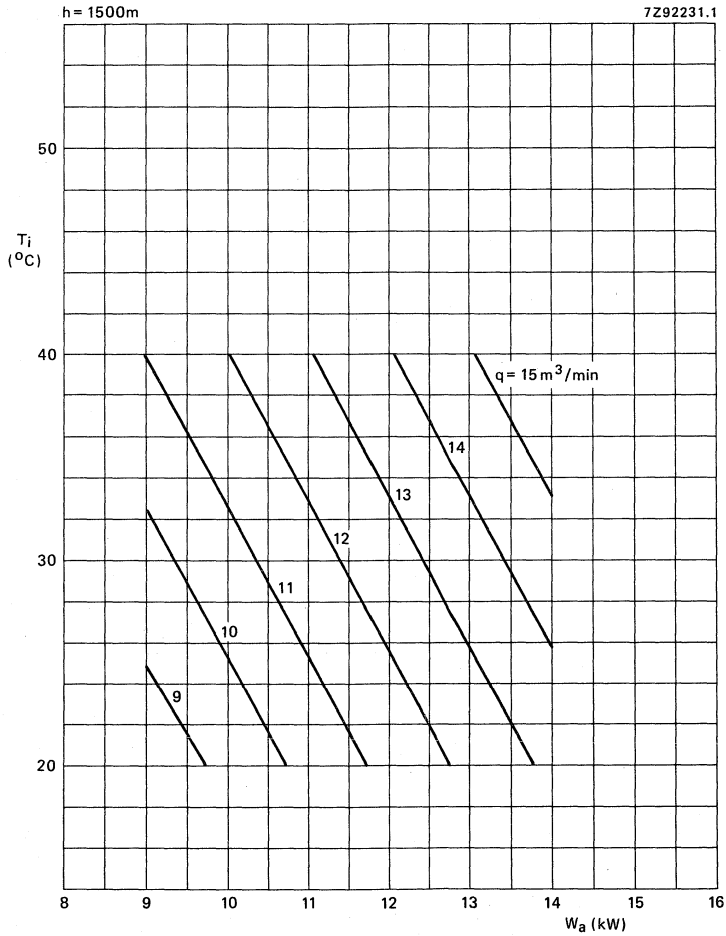
Altitude: sea level.





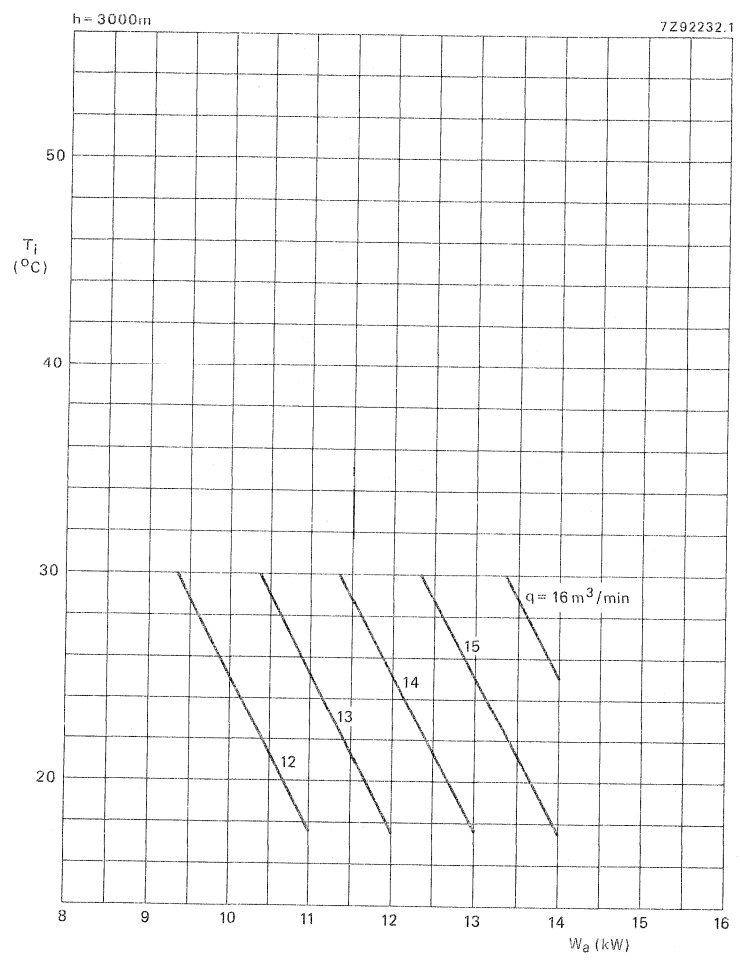
Cooling curves for assembly 40787 with tube UL1610.

Altitude: 1500 m.



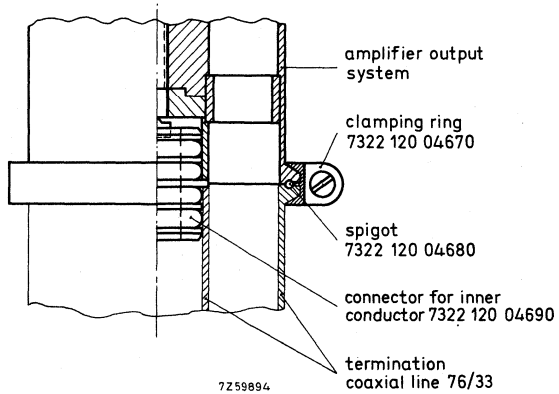
# COOLING CURVES

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

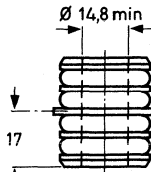
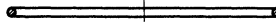
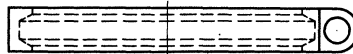


# R.F. OUTPUT CONNECTOR

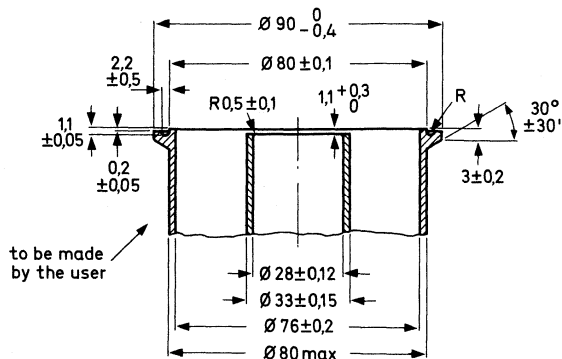
R.F. output connector to be used with assemblies 40745, 40746, 40747, 40748, 40757, 40758, 40759, 40760 and 40768.



↑ to amplifier output system



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	$W_\ell$	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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.  
Output: 50  $\Omega$  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

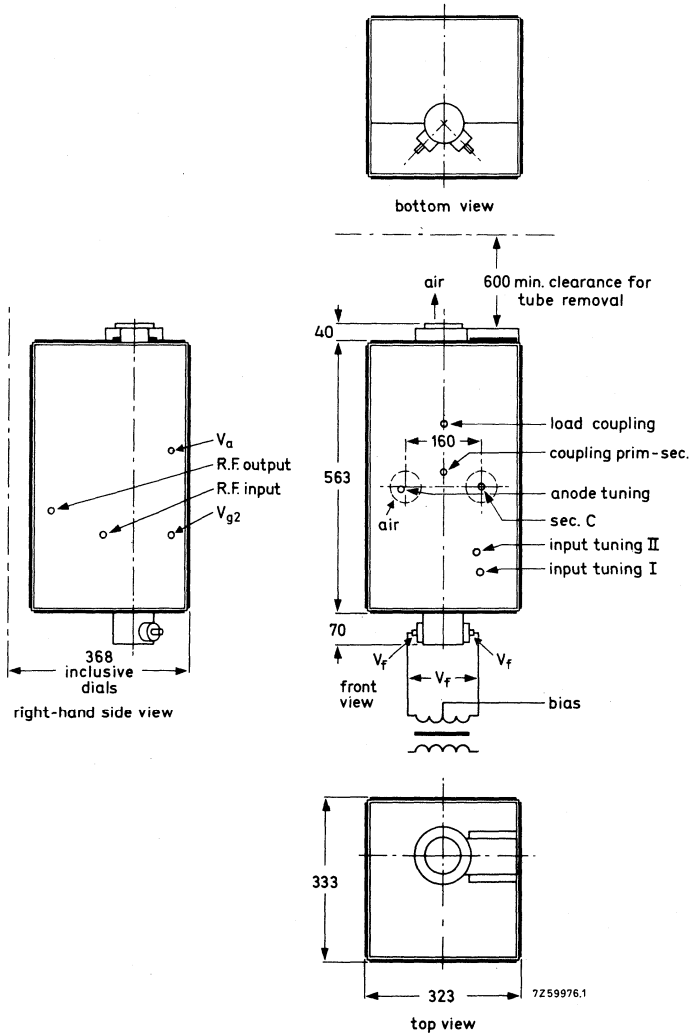


Fig. 1.

CIRCUIT DIAGRAM

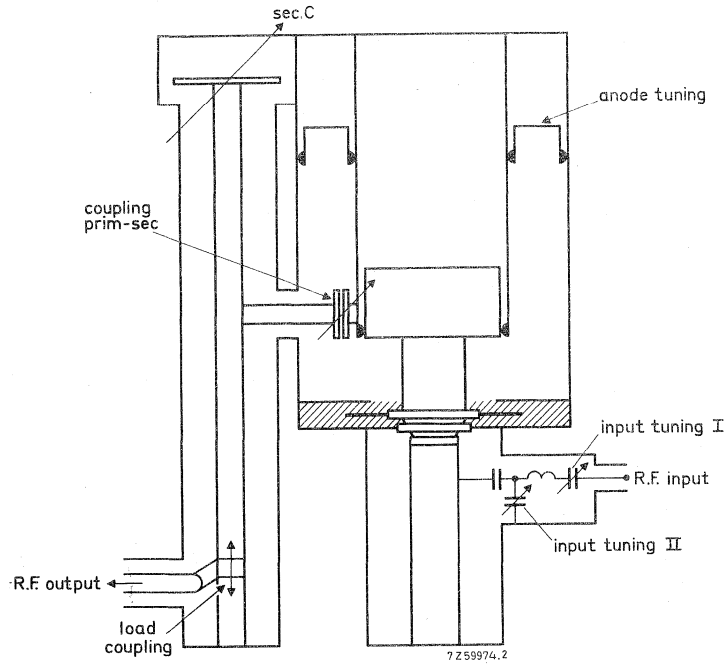


Fig. 2.

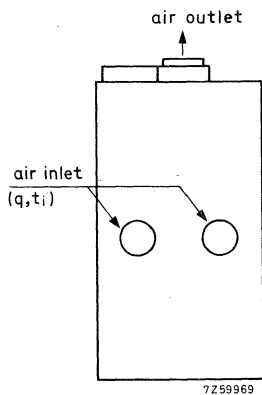


Fig. 3 Cooling air connector diagram.

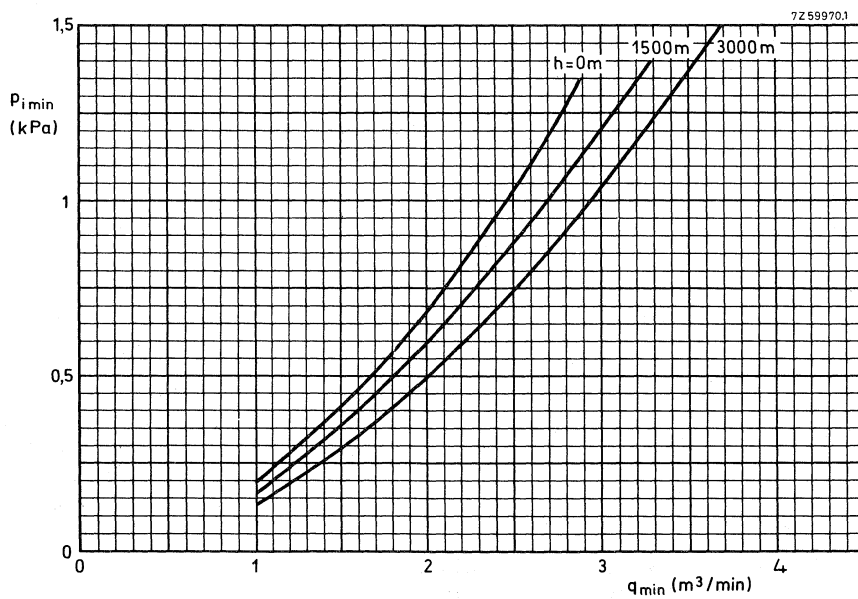


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.



## 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	$W_\ell$	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  $\Omega$  coaxial female connector, type N

Output: 50  $\Omega$  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

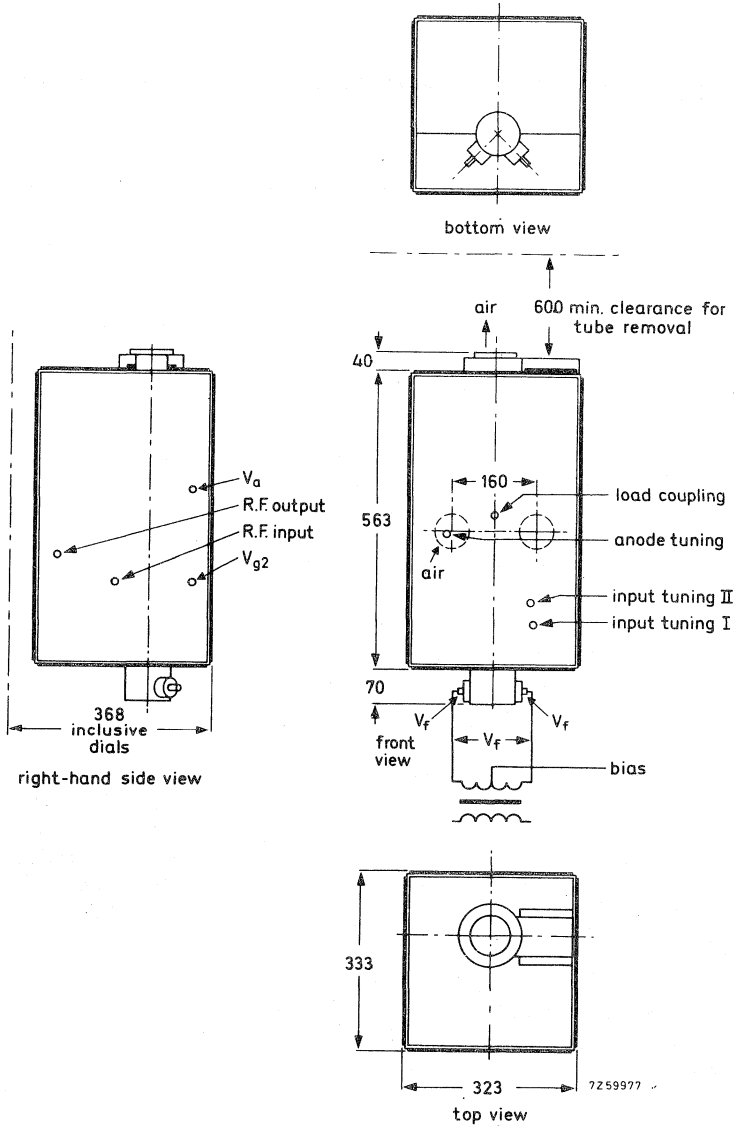


Fig. 1.

CIRCUIT DIAGRAM

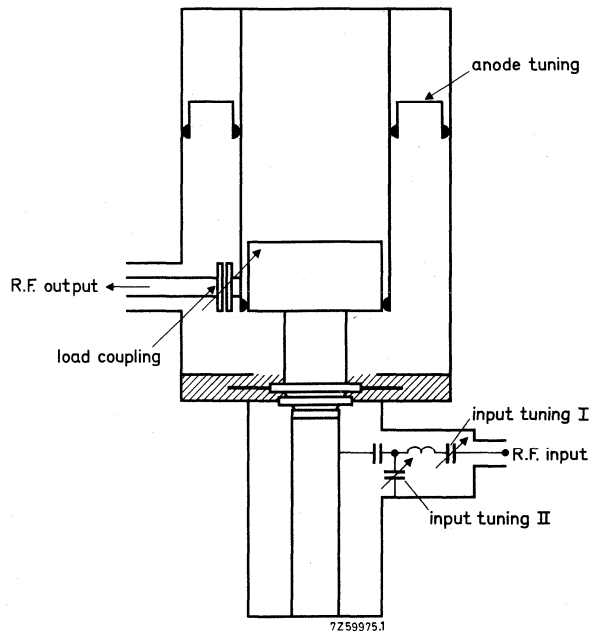


Fig. 2.

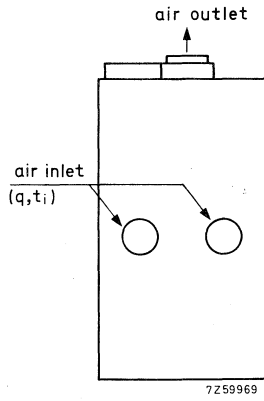


Fig. 3 Cooling air connector diagram.

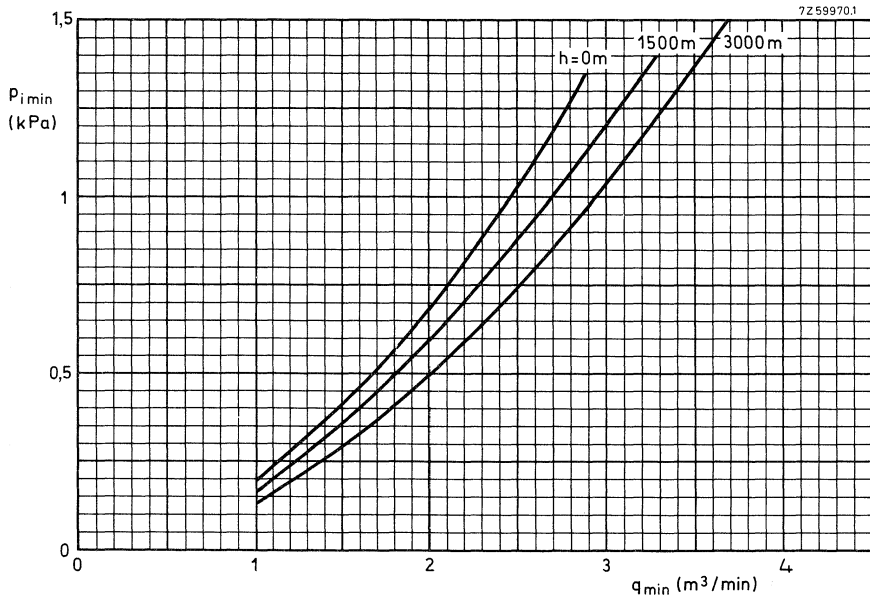


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

## 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	$W_\ell$	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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.  
Output: 50  $\Omega$  coaxial connector see page 233.

### ADDITIONAL COMPONENTS

- Delivered with the assembly:

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

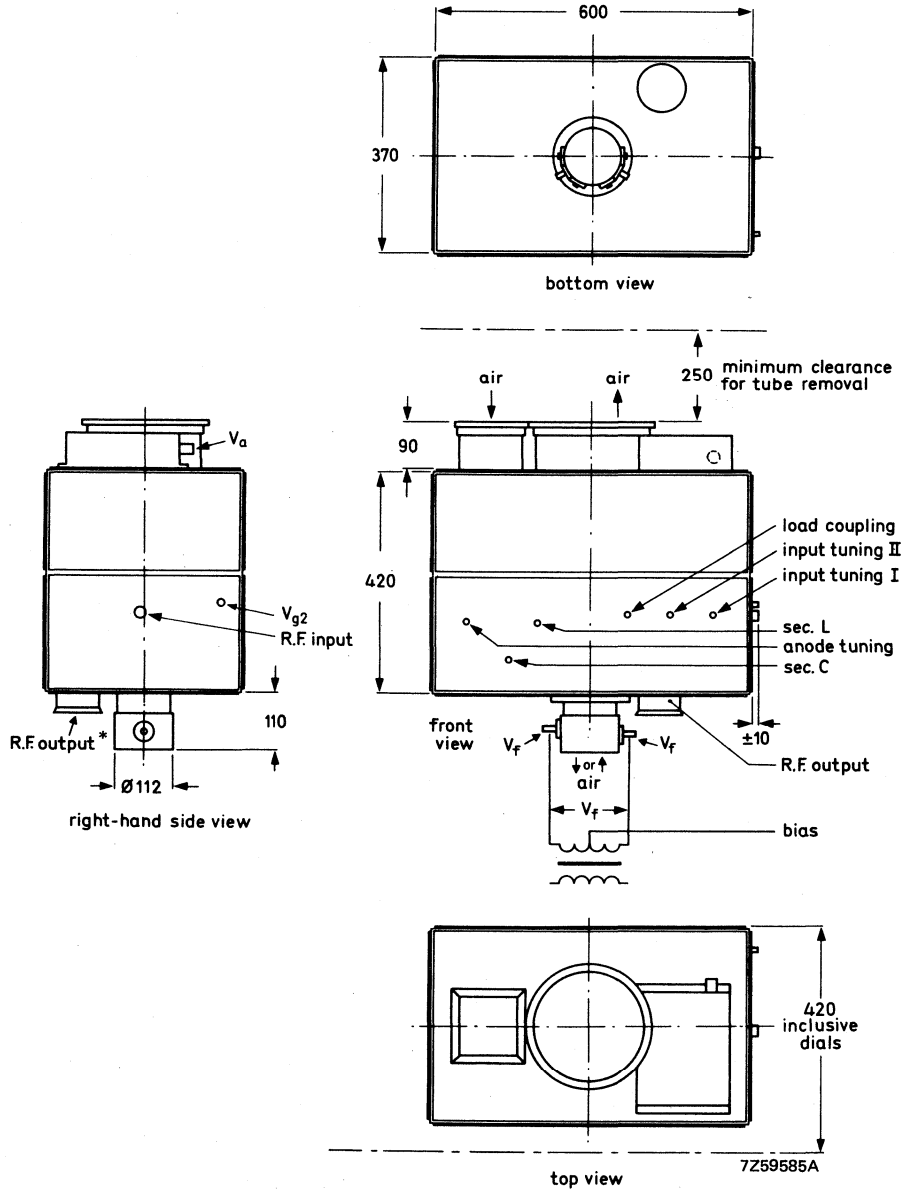


Fig. 1.

\*See detail page 233.

CIRCUIT DIAGRAM

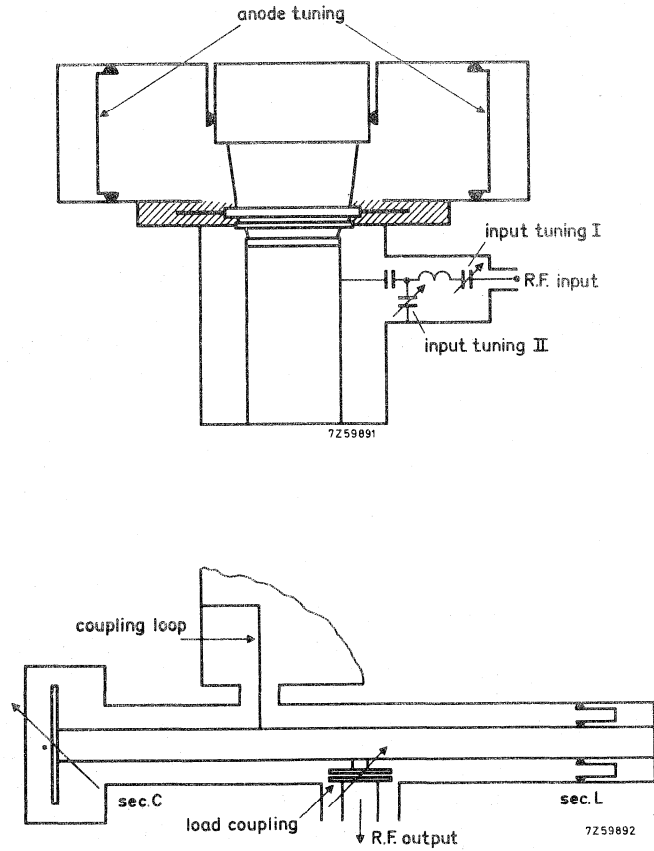


Fig. 2.

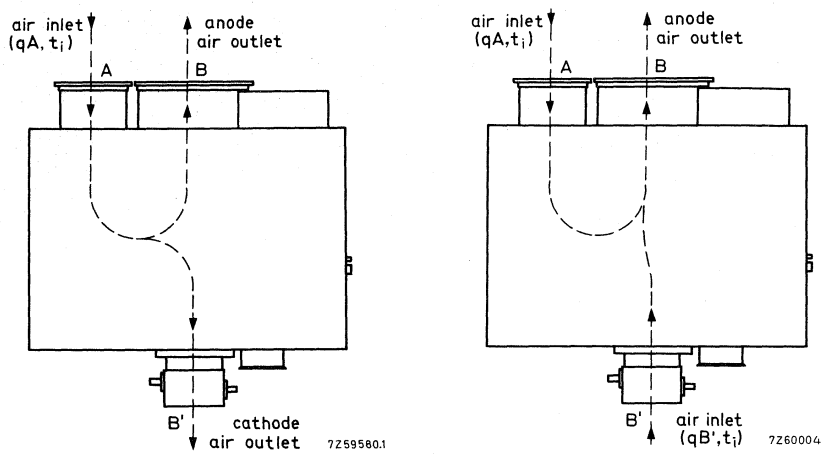


Fig. 3 Cooling air connector diagram.

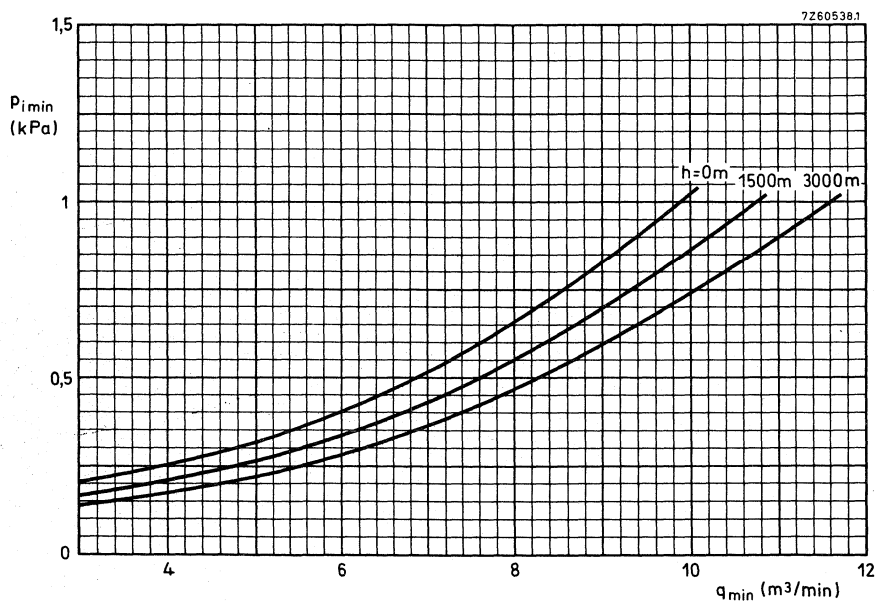


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.  
 $p_i$  = pressure drop from plane A to plane B or B'; for blowing  $q = q_A$ , for sucking  $q = q_A + q_{B'}$ .



## 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	$W_o$	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  $\Omega$  coaxial female connector, type N.  
Output: 50  $\Omega$  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

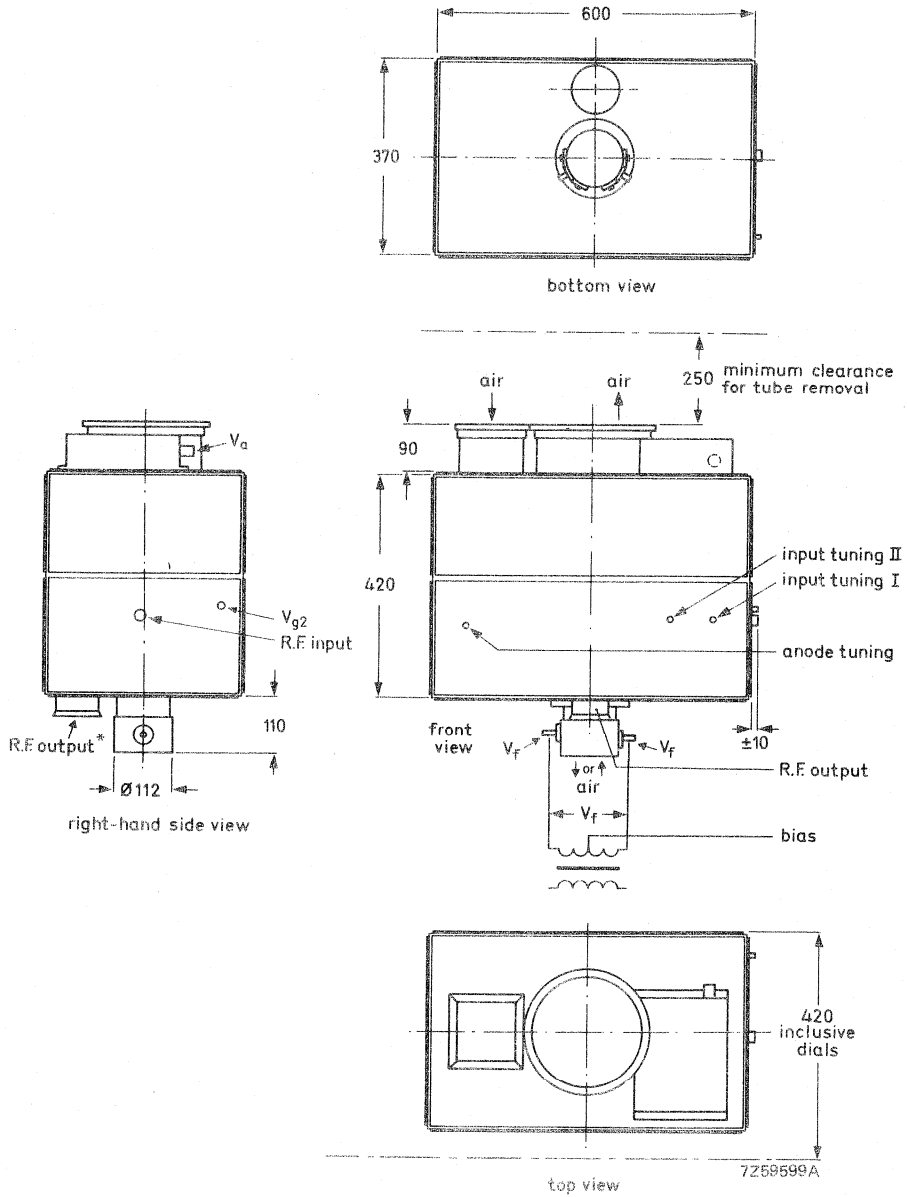


Fig. 1.

\*See detail page 233.

CIRCUIT DIAGRAM

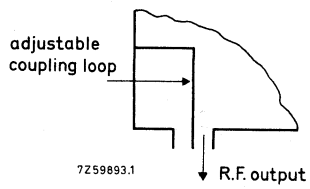
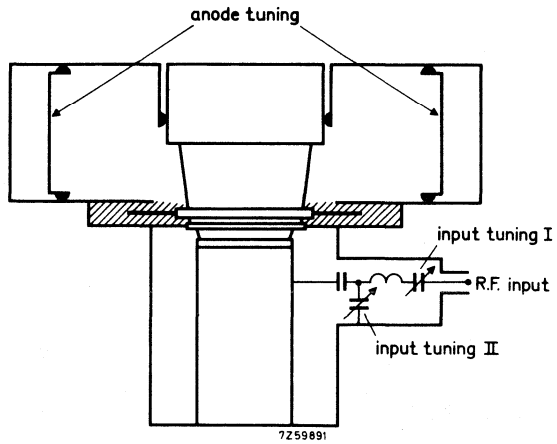


Fig. 2.

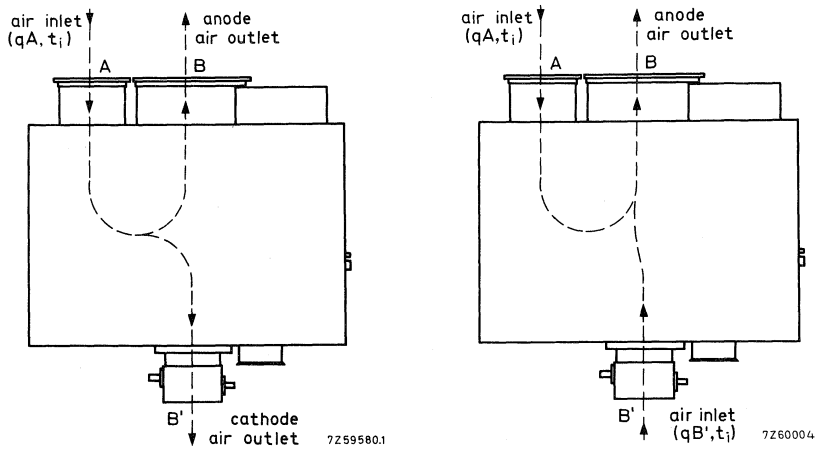


Fig. 3 Cooling air connector diagram.

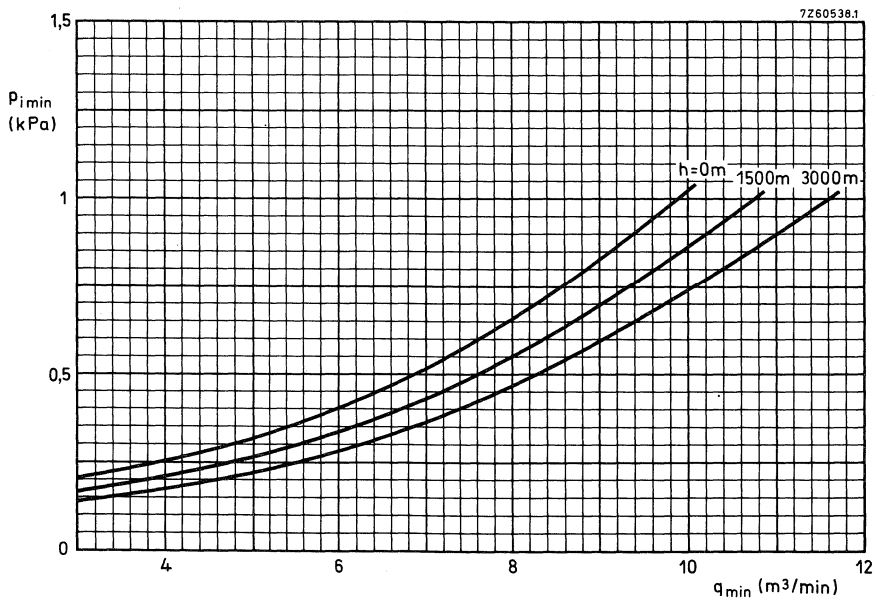


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.  $p_i$  = pressure drop from plane A to plane B or B'; for blowing  $q = q_A$ , for sucking  $q = q_A + q_{B'}$ .

## 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	$W_\ell$	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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.

Output: 50  $\Omega$  coaxial connector see page 233.

### ADDITIONAL COMPONENTS

- Delivered with the assembly:
 

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

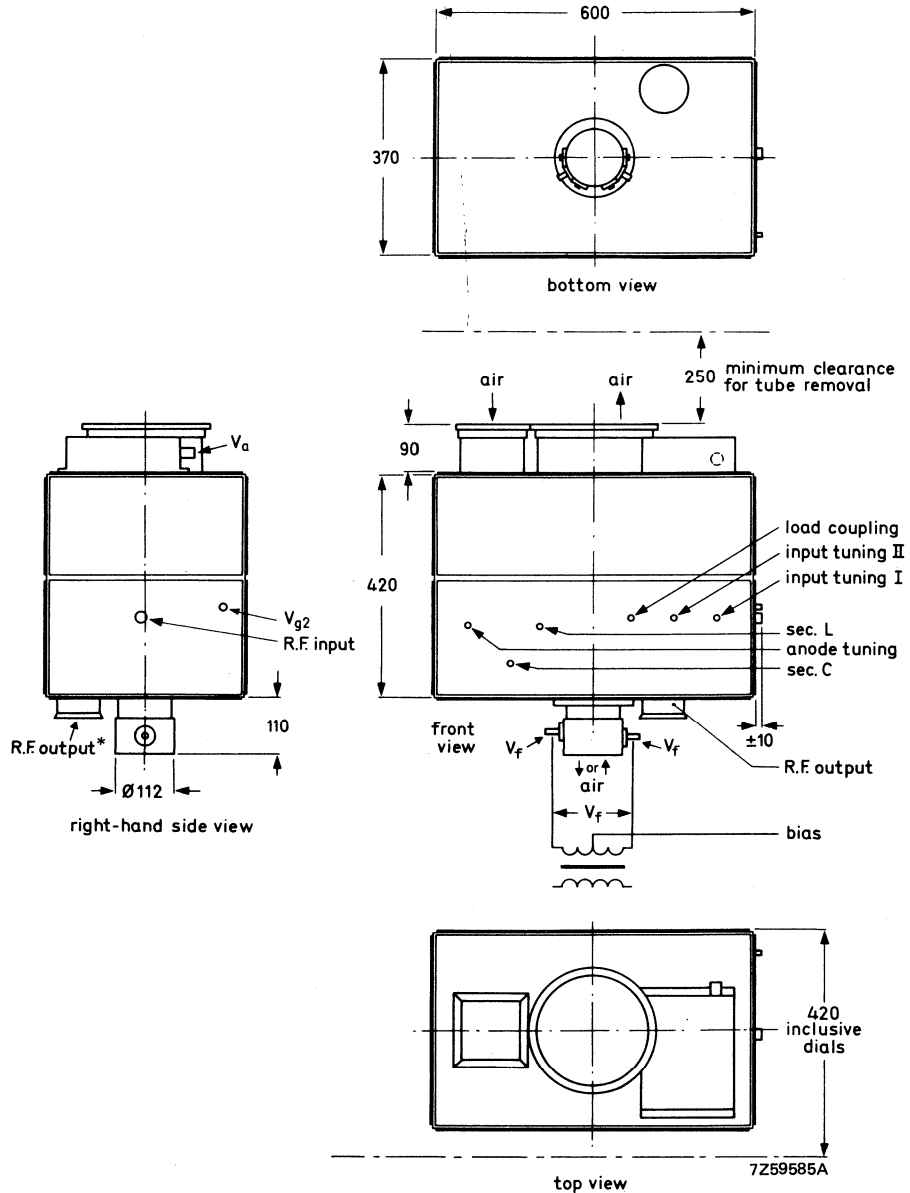


Fig. 1.

\*See detail page 233.

CIRCUIT DIAGRAM

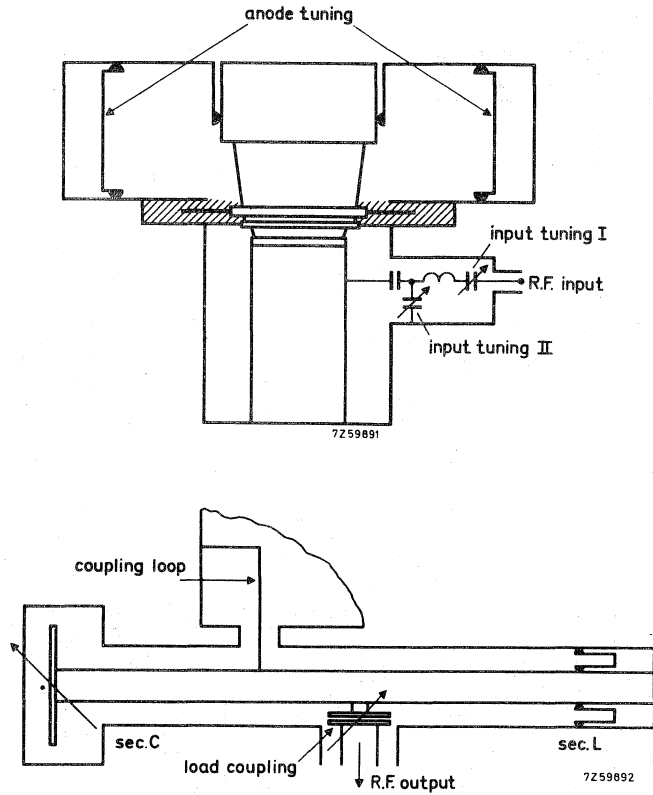


Fig. 2.

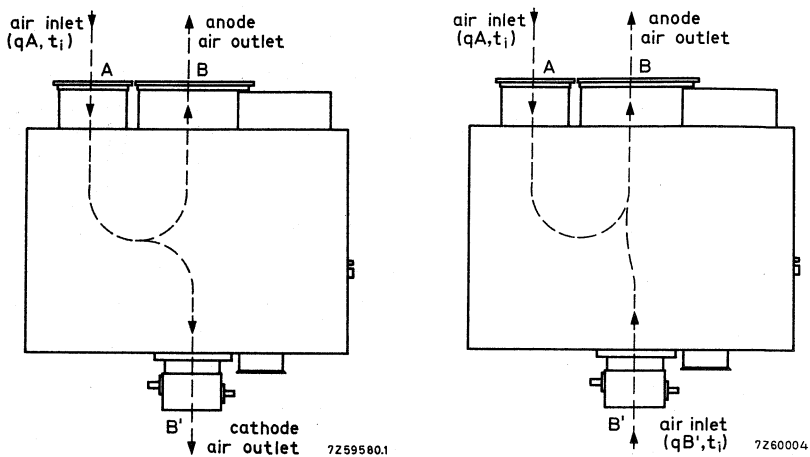


Fig. 3 Cooling air connector diagram.

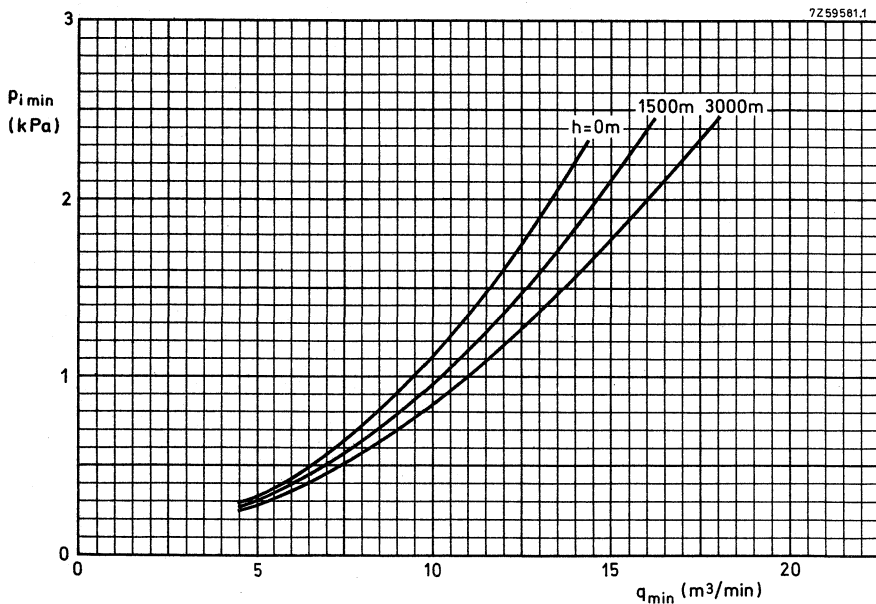


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.  $p_i$  = pressure drop from plane A to plane B or B'; for blowing  $q = q_A$ , for sucking  $q = q_A + q_{B'}$ .



## 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	$W_{\varrho}$	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  $\Omega$  coaxial female connector, type N.

Output: 50  $\Omega$  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

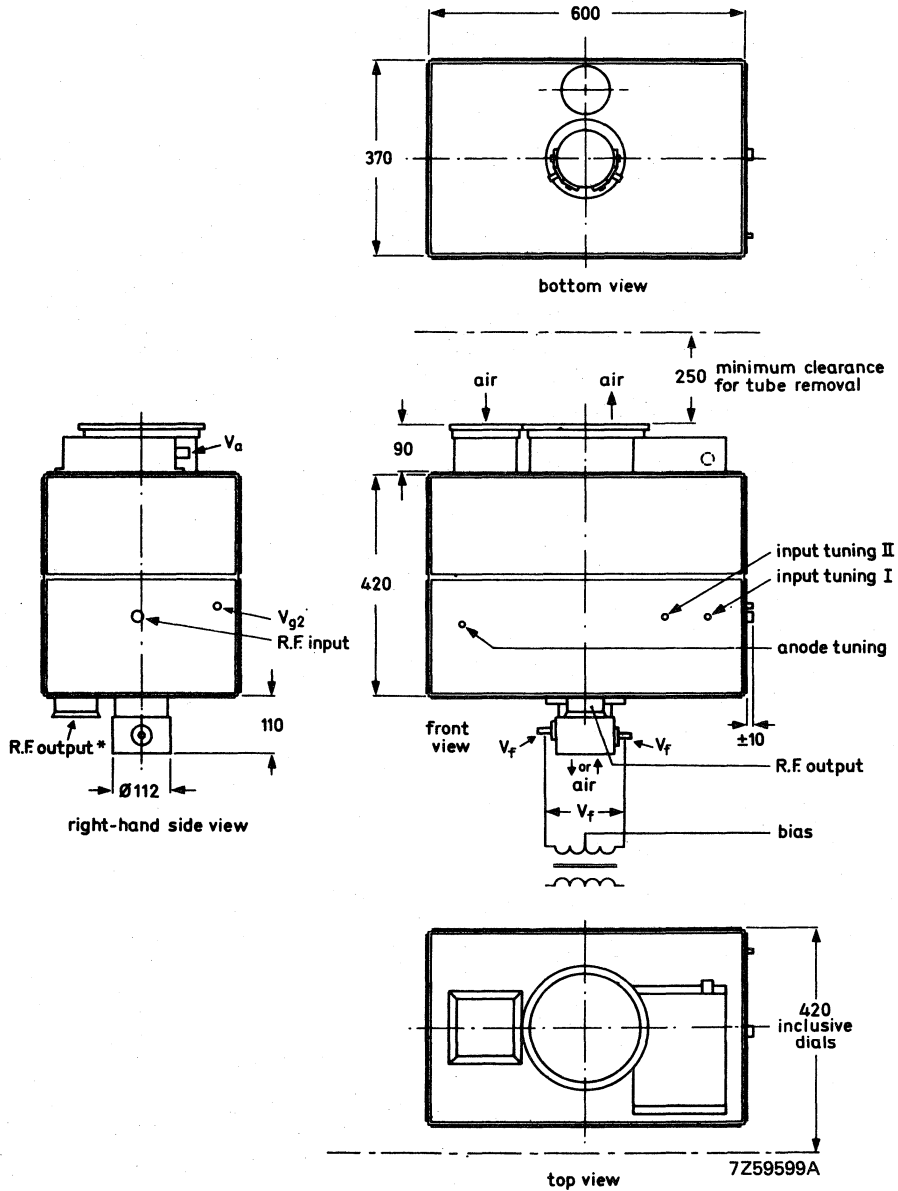


Fig. 1.

\* See detail page 233.

CIRCUIT DIAGRAM

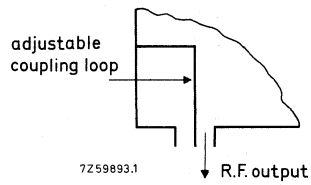
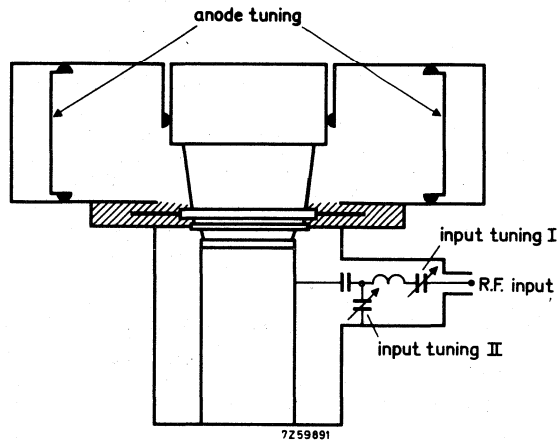


Fig. 2.

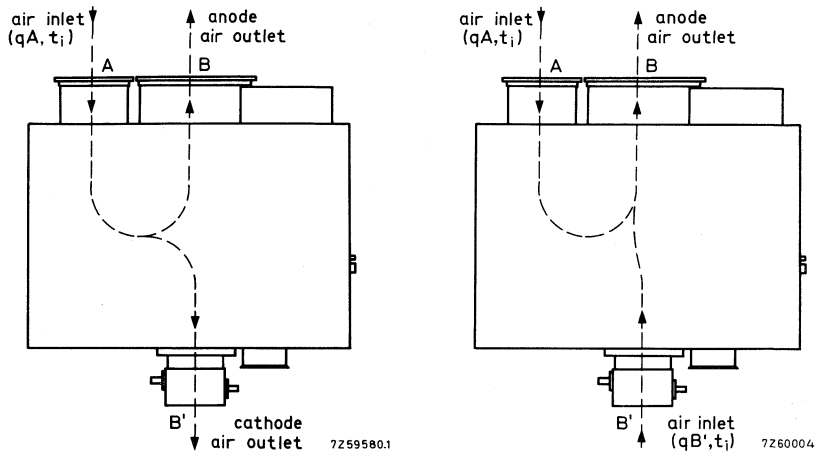


Fig. 3 Cooling air connector diagram.

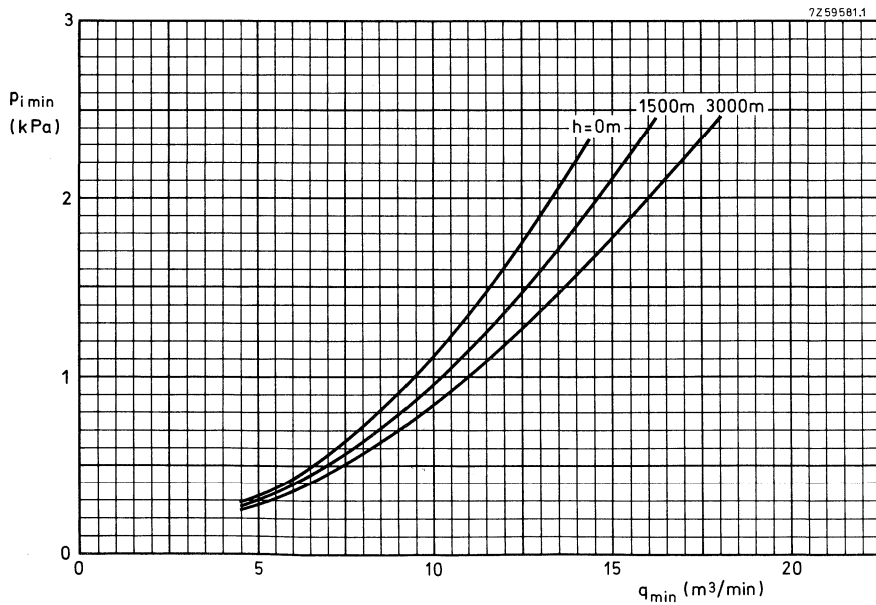


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.  $p_i$  = pressure drop from plane A to plane B or B'; for blowing  $q = q_A$ , for sucking  $q = q_A + q_{B'}$ .

## BAND 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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.  
Output: 50  $\Omega$  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

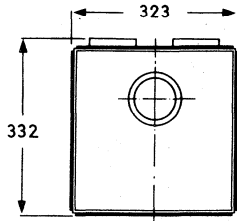
Spanner for fitting the coils

OUTLINE DRAWING

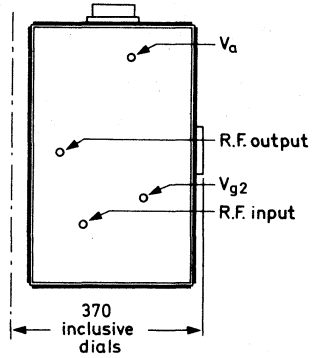
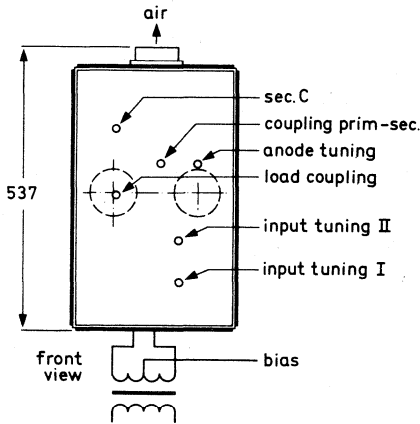
Dimensions in mm

Overall dimensions 537 x 343 x 370 mm

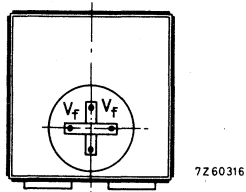
Net mass 23 kg



top view



right hand side view



bottom view

Fig. 1.

CIRCUIT DIAGRAM

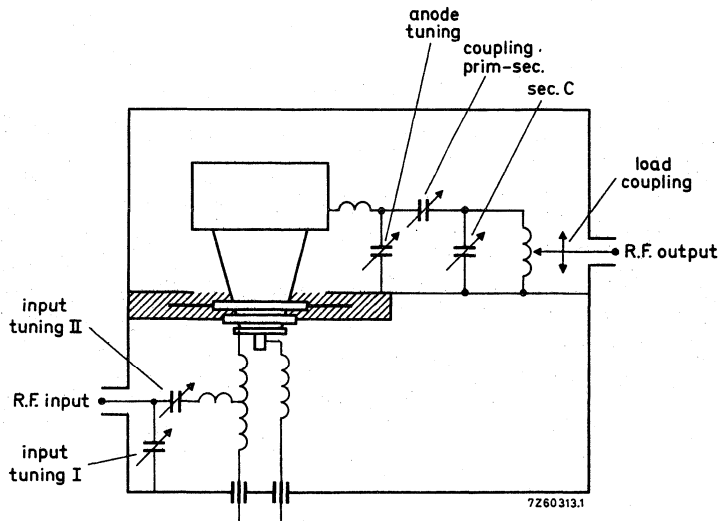


Fig. 2.

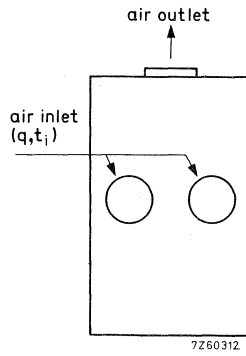


Fig. 3 Cooling air connector diagram.

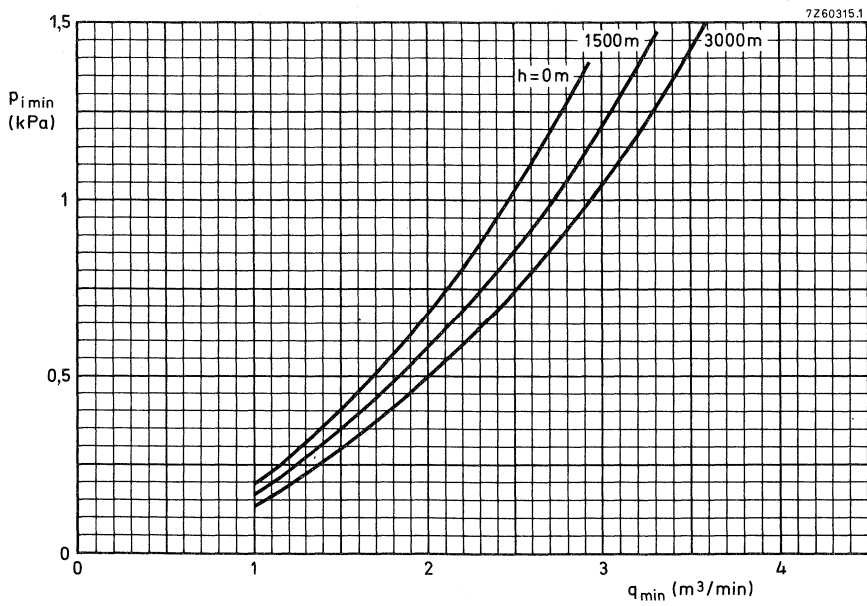


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.



## 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	$W_\ell$		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  $\Omega$  coaxial female connector, type N.  
Output: 50  $\Omega$  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

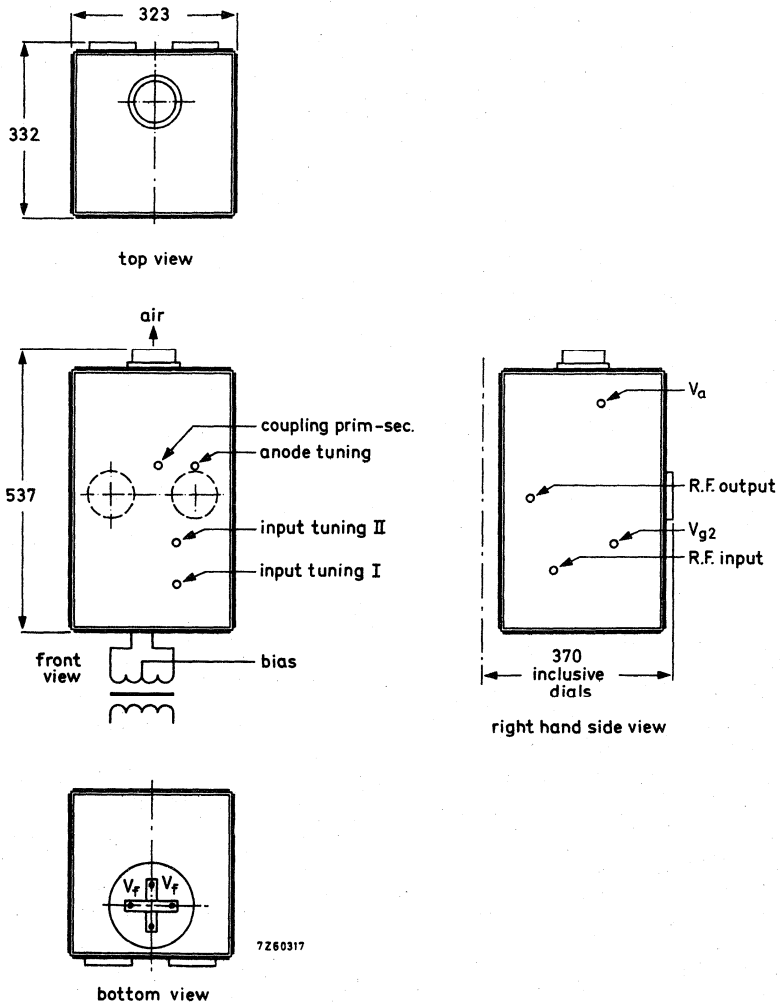


Fig. 1.

CIRCUIT DIAGRAM

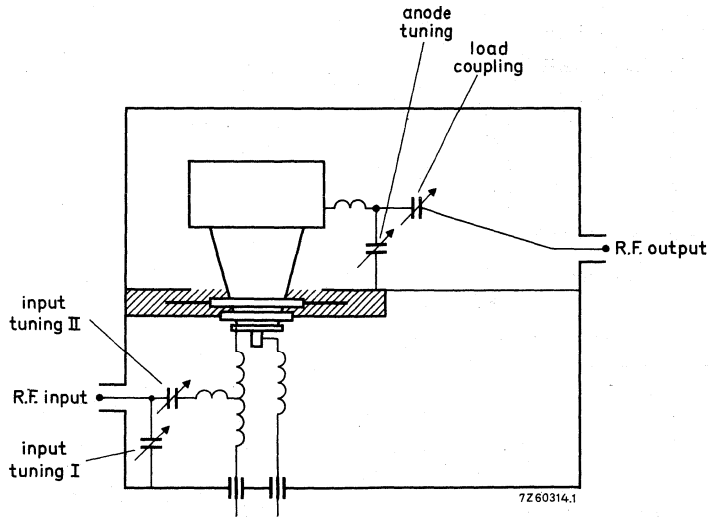


Fig. 2.

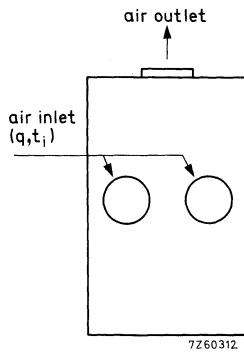


Fig. 3 Cooling air connector diagram.

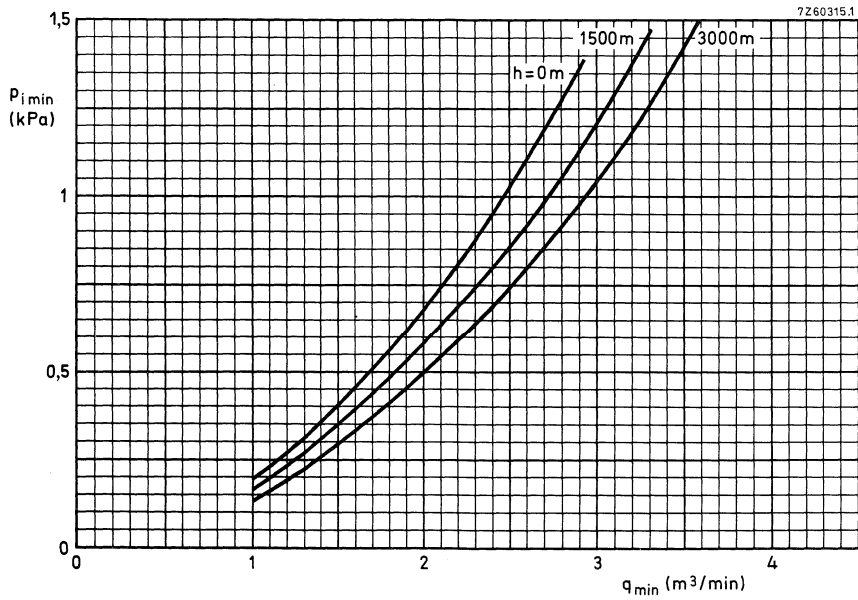


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

## 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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.

Output: 50  $\Omega$  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.

40757

OUTLINE DRAWING

Overall dimensions 712 x 530 x 569 mm

Net mass 70 kg

Dimensions in mm

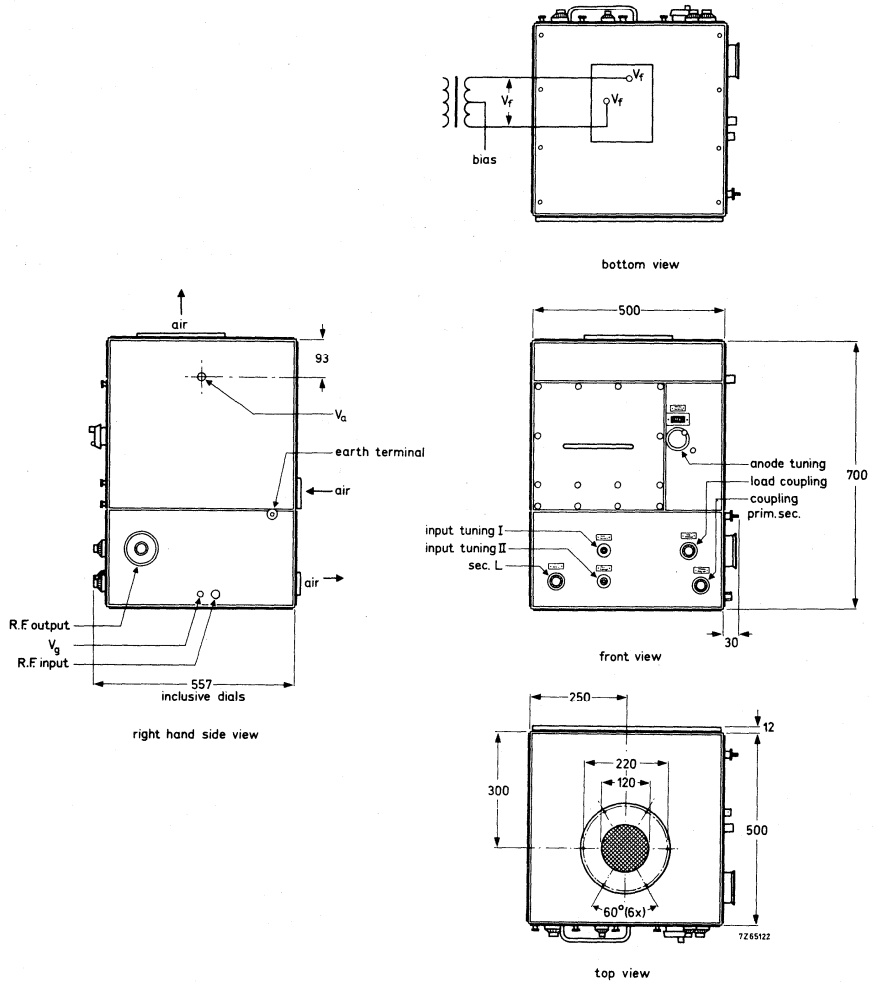


Fig. 1.

CIRCUIT DIAGRAM

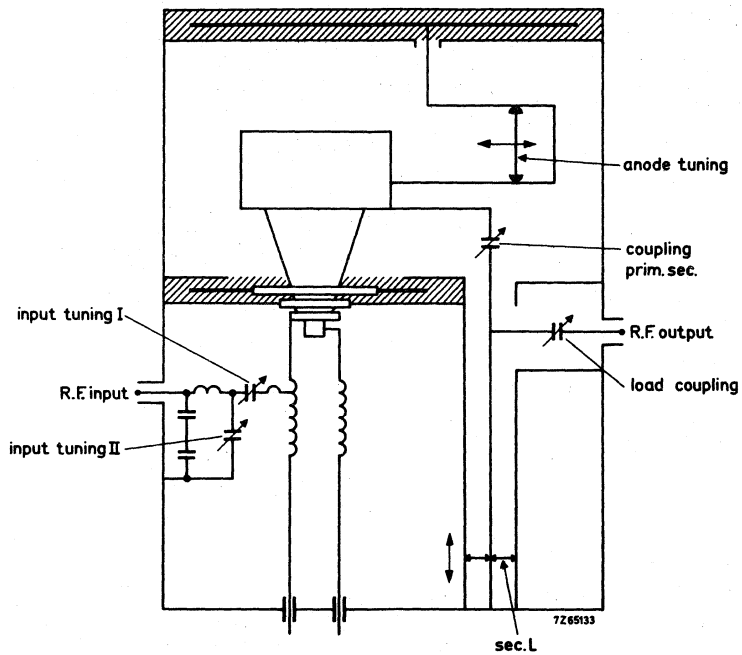


Fig. 2.

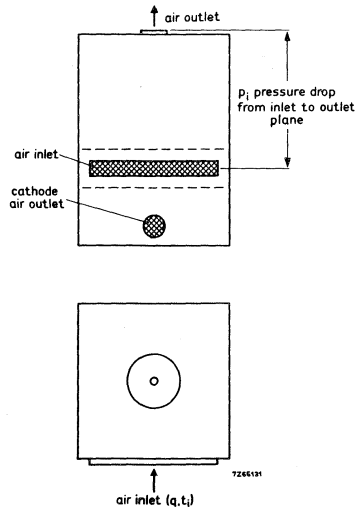


Fig. 3 Cooling air connector diagram.

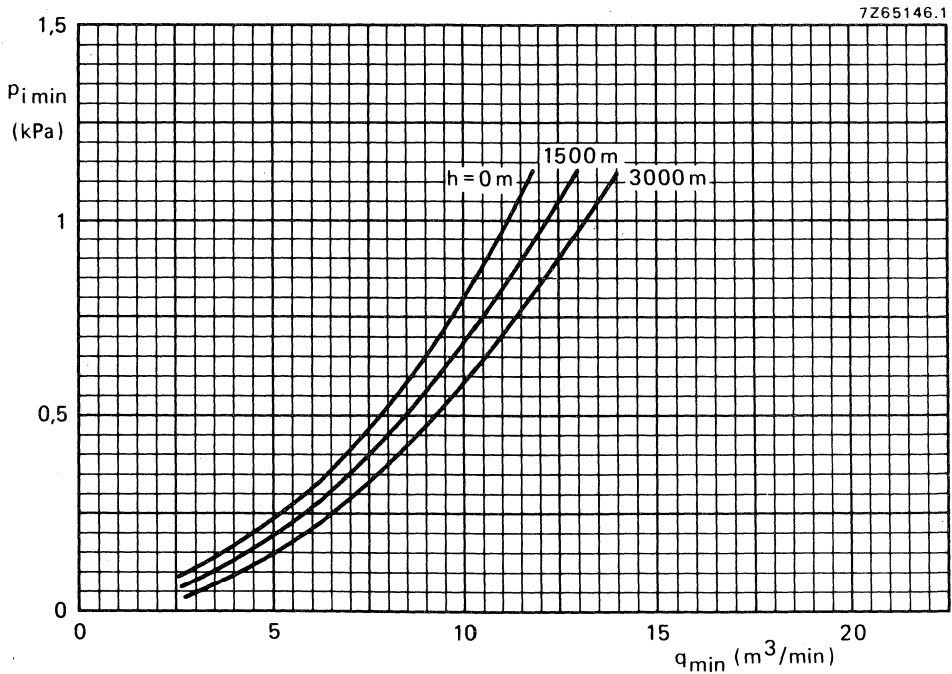


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.



## 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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.

Output: 50  $\Omega$  coaxial connector see page 233.

### ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor

Mating male input connector

Mating male output connector

Mating connector for anode voltage

Mating connector for screen grid voltage

Anode coil for sound carrier frequencies 53 to 72 MHz

7322 120 07850

Radial type N

See page H22

Radial type R13060

Radial type R9510

- Available on request:

Anode coil for frequency range 82 to 88 MHz.

OUTLINE DRAWING

Overall dimensions 712 x 530 x 569

Net mass 58 kg

Dimensions in mm

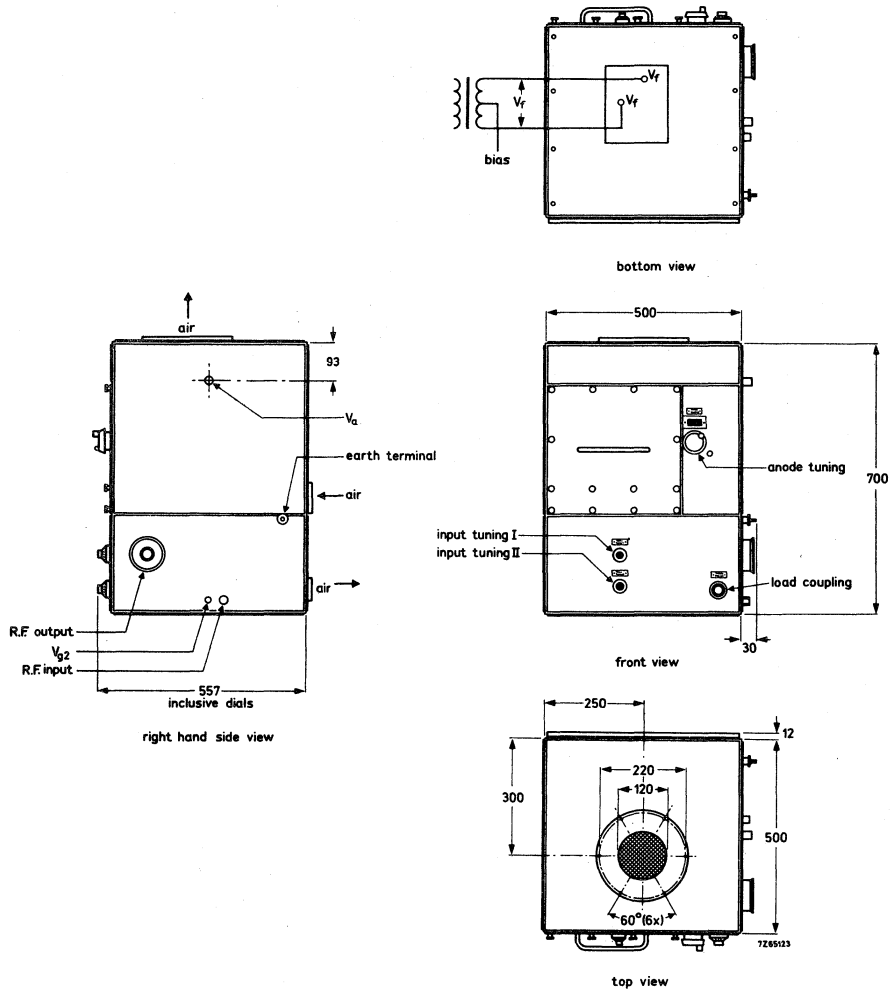


Fig. 1.

CIRCUIT DIAGRAM

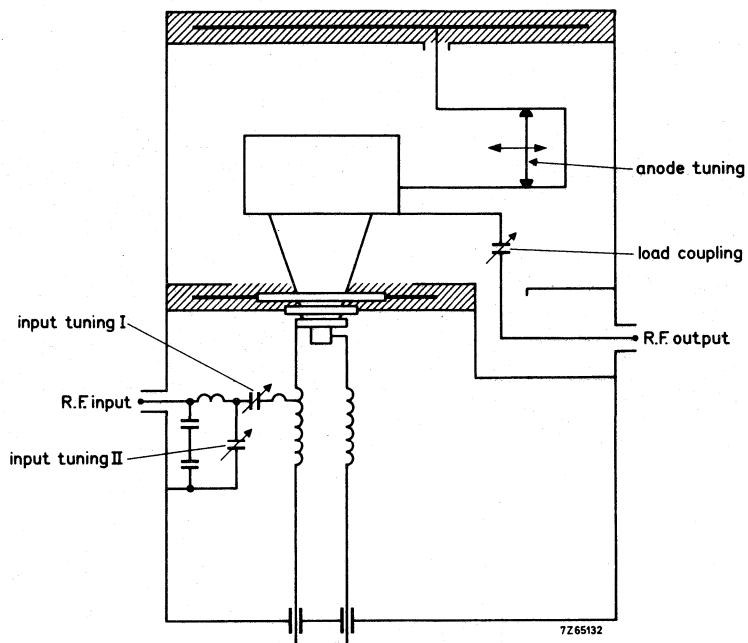


Fig. 2.

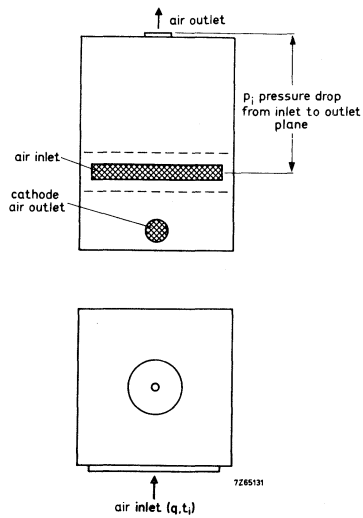


Fig. 3 Cooling air connector diagram.

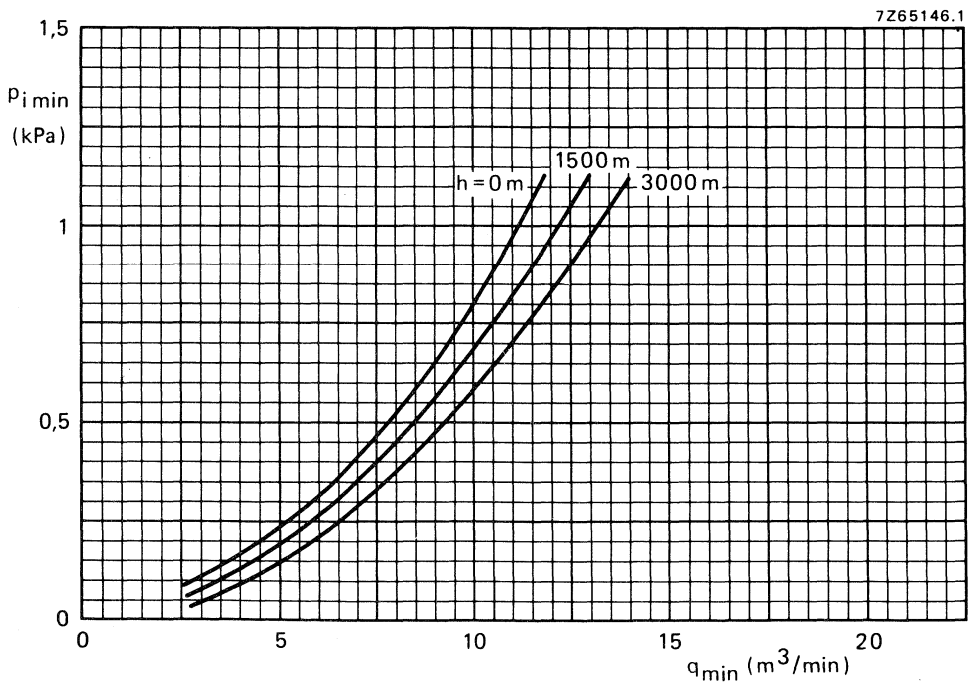


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

## 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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.

Output: 50  $\Omega$  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.

40759

OUTLINE DRAWING

Overall dimensions 712 x 530 x 569 mm

Net mass 70 kg

Dimensions in mm

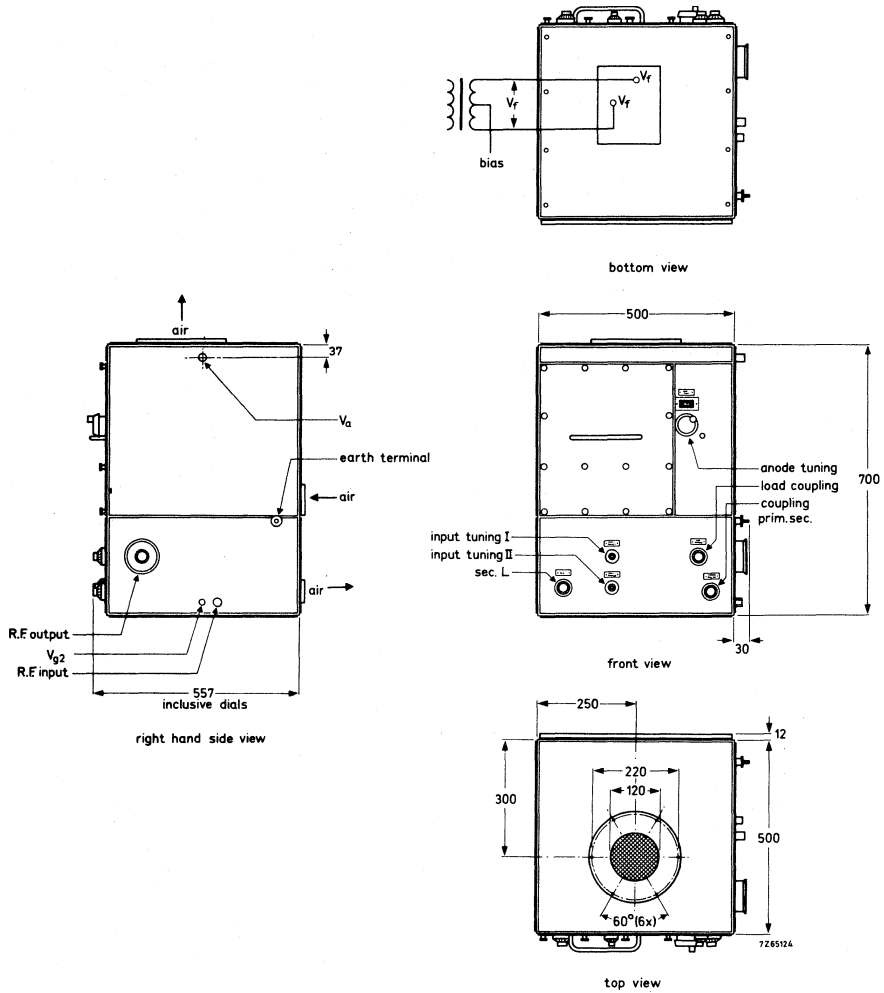


Fig. 1.

CIRCUIT DIAGRAM

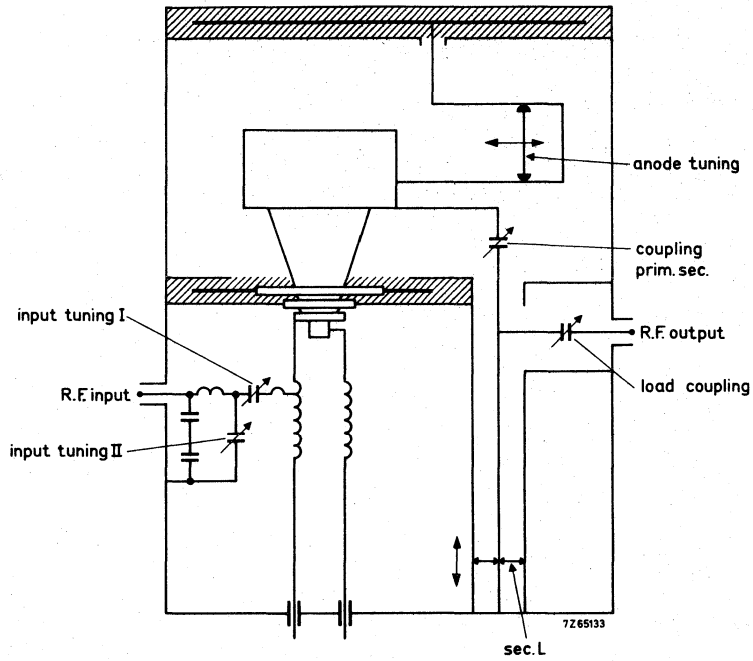


Fig. 2.

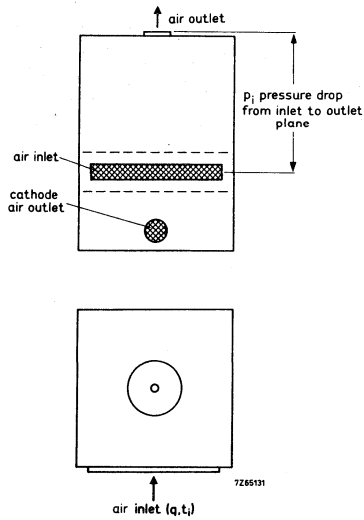


Fig. 3 Cooling air connector diagram.

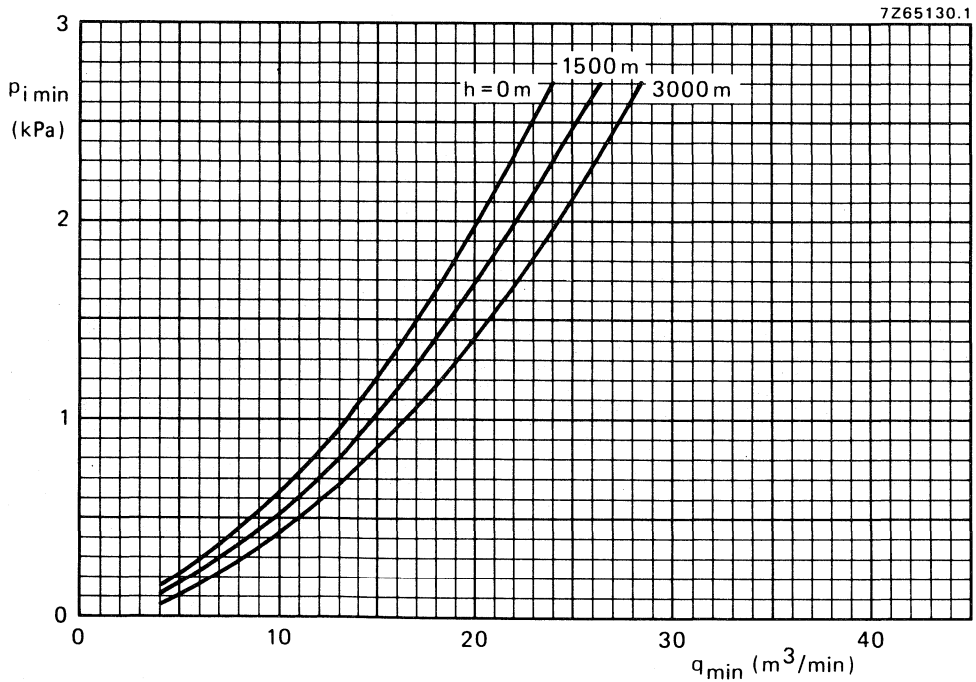


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.



## 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	$W_\rho$		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  $\Omega$  coaxial female connector, type N.

Output: 50  $\Omega$  coaxial connector see page 233.

### ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor

Mating male input connector

Mating male output connector

Mating connector for anode voltage

Mating connector for screen grid voltage

Anode coils for frequency range

53 to 72 MHz

- Available on request:

Anode coil for frequency range

82 to 88 MHz

7322 120 07850

Radial type N

See page H22

Radial type R13060

Radial type R9510

OUTLINE DRAWING

Overall dimensions 712 x 530 x 569 mm

Net mass 58 kg

Dimensions in mm

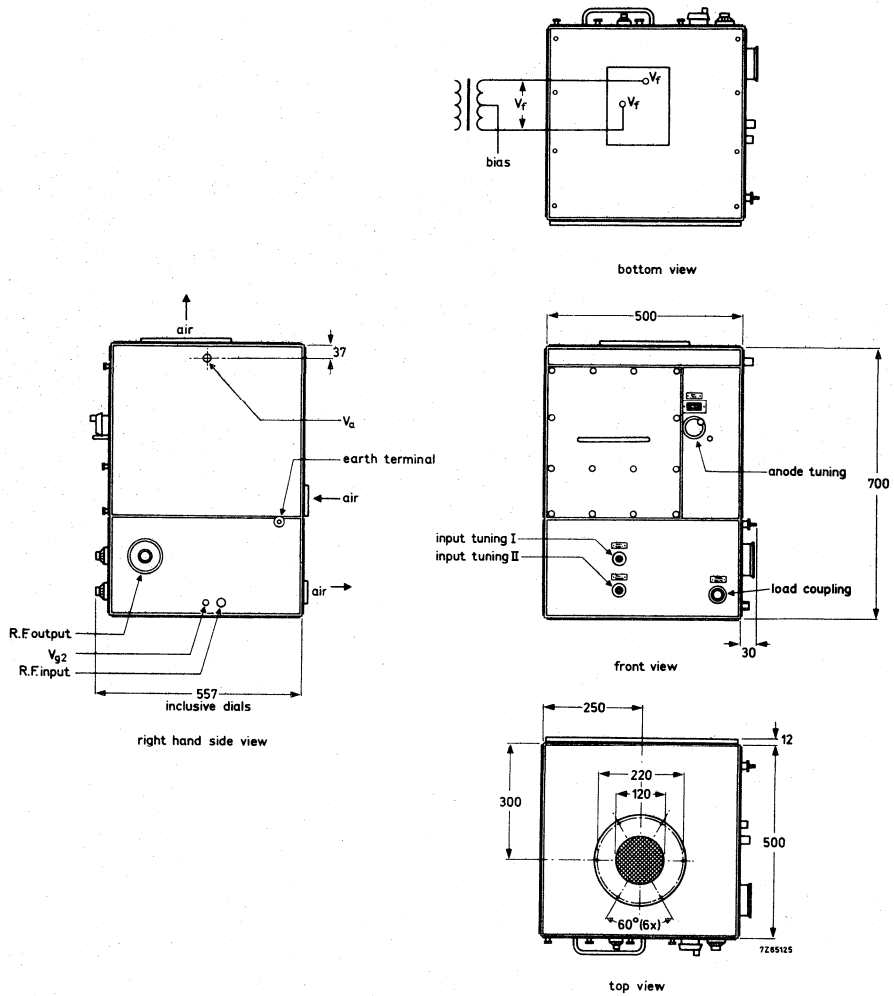


Fig. 1.

CIRCUIT DIAGRAM

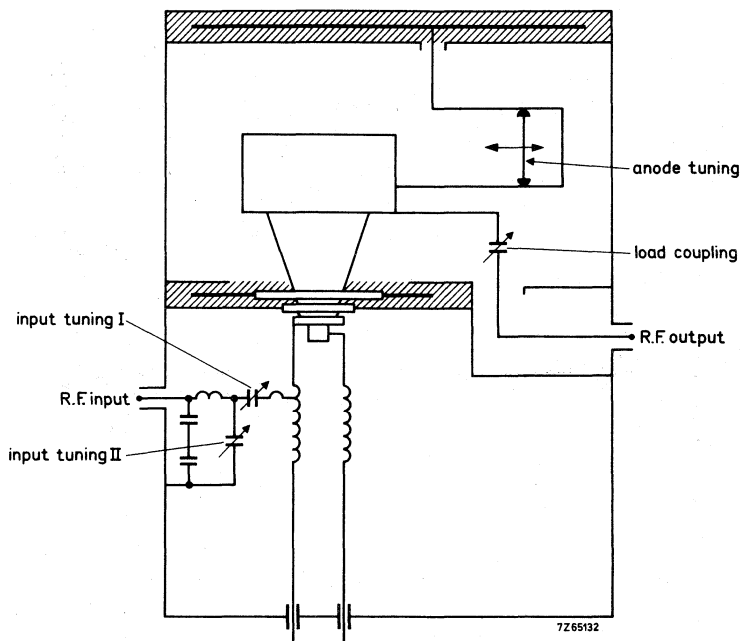


Fig. 2.

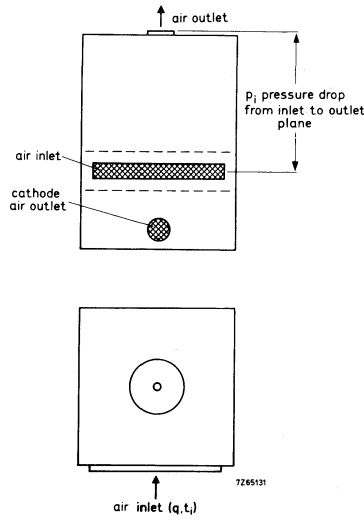


Fig. 3 Cooling air connector diagram.

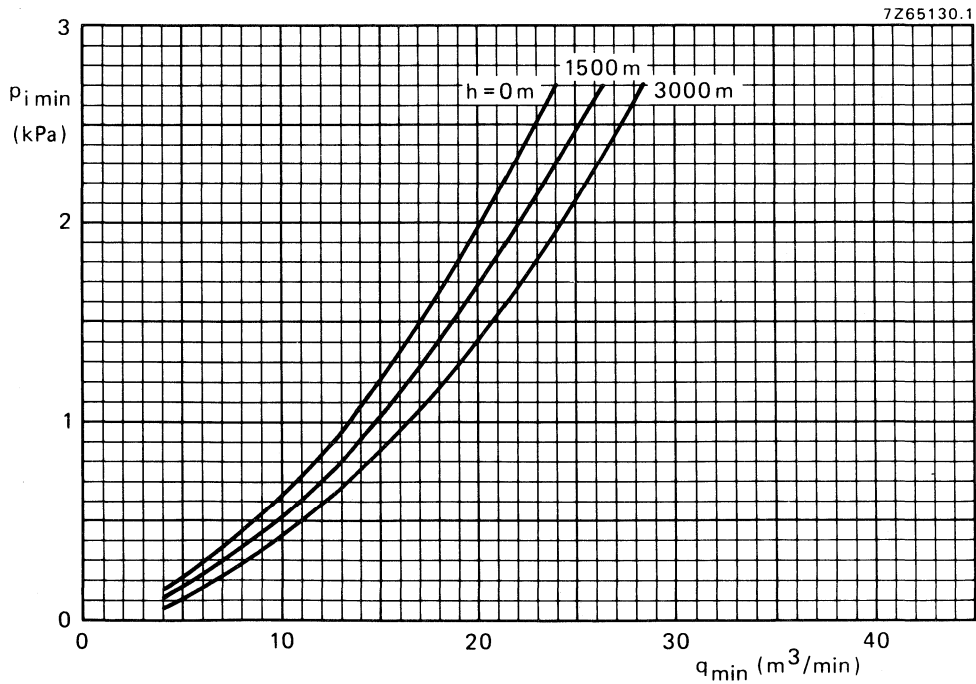


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

## 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	$W_\ell$	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	$W_\ell$	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  $\Omega$  coaxial female connector, type HN.  
Output: 50  $\Omega$  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

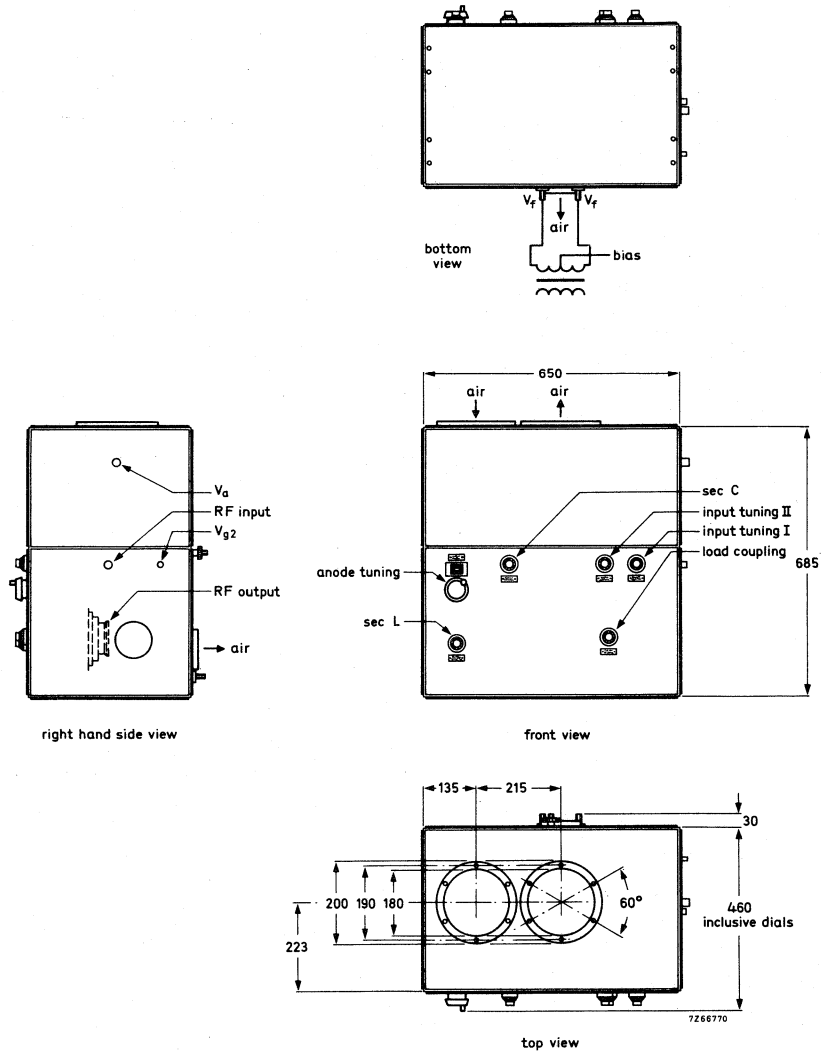


Fig. 1.

CIRCUIT DIAGRAM

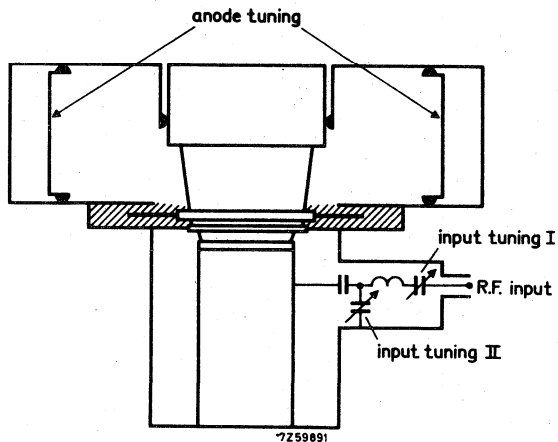


Fig. 2a.

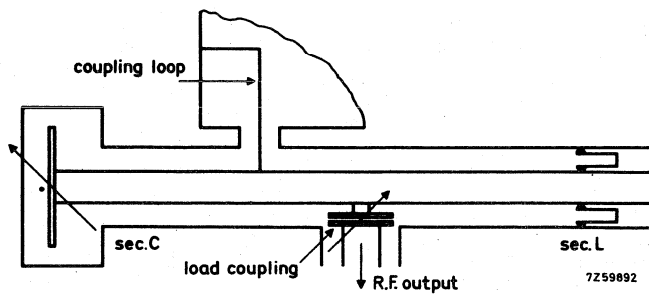


Fig. 2b.

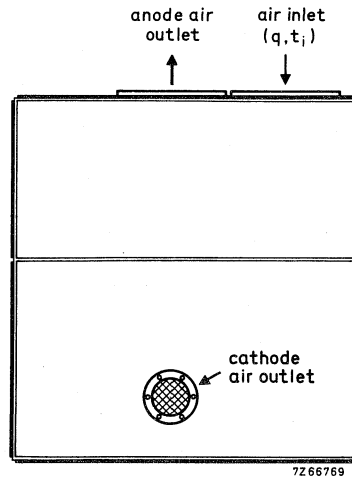


Fig. 3 Cooling air connector diagram.

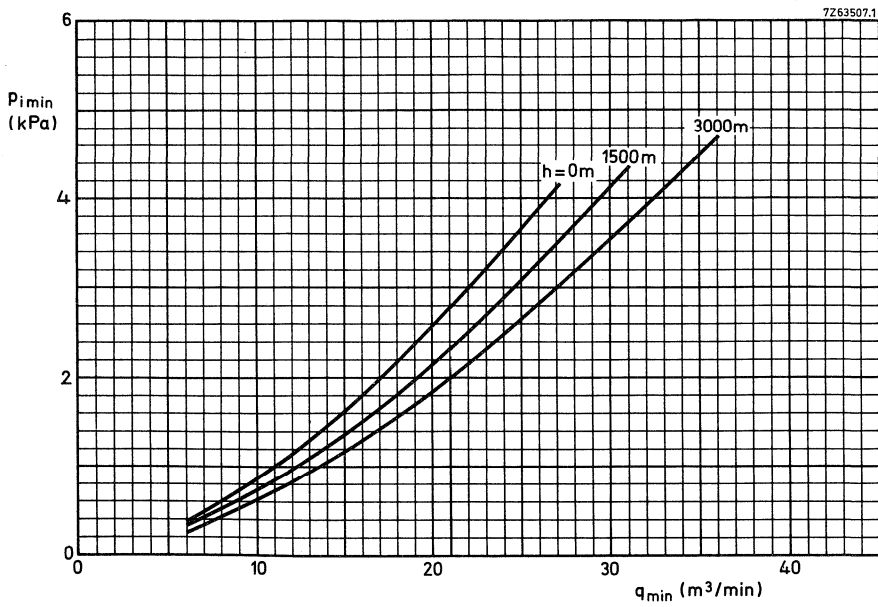


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.



## 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	$W_\varrho$	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  $\Omega$  coaxial female connector, type N.

Output: 50  $\Omega$  coaxial female connector, type EIA 1 5/8 inch.

### ADDITIONAL COMPONENTS

- Delivered with the assembly:

Tube extractor

Mating male input connector

Mating connector for anode voltage

7322 120 07850

Radial type N

Radial type R13060

OUTLINE DRAWING

Overall dimensions 393 x 400 x 632 mm

Net mass 54 kg

Dimensions in mm

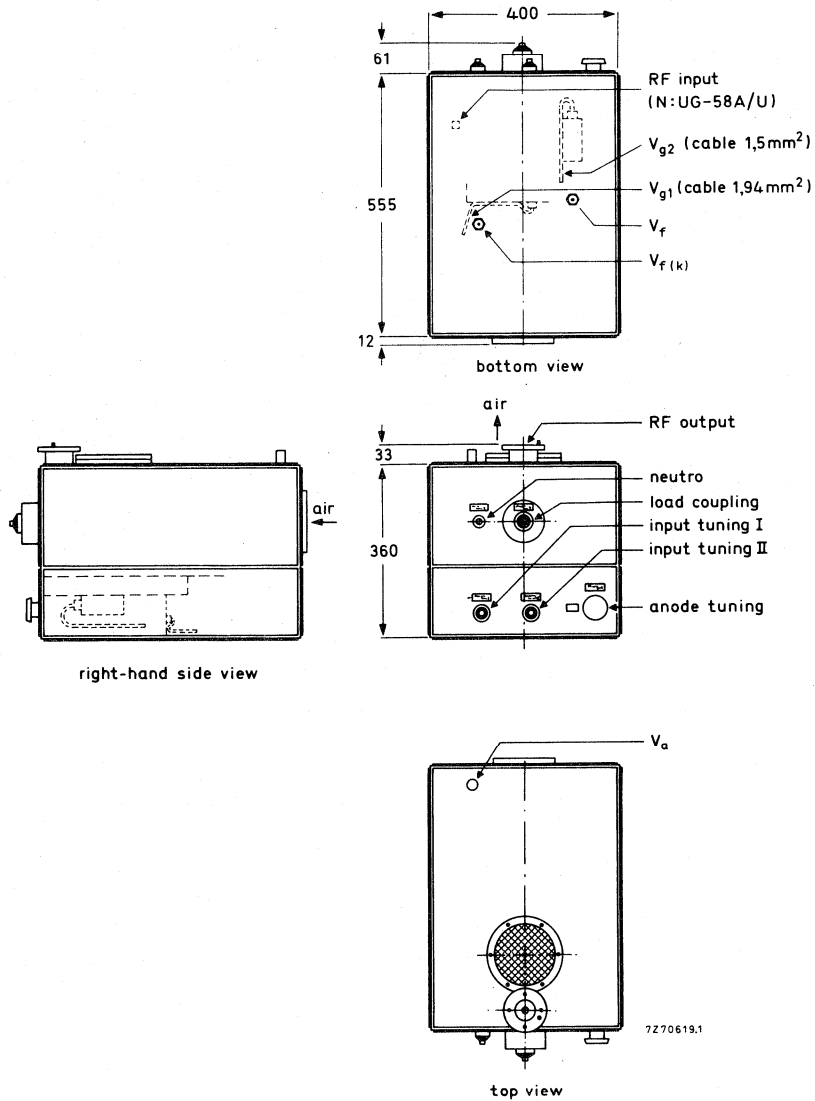


Fig. 1.

CIRCUIT DIAGRAM

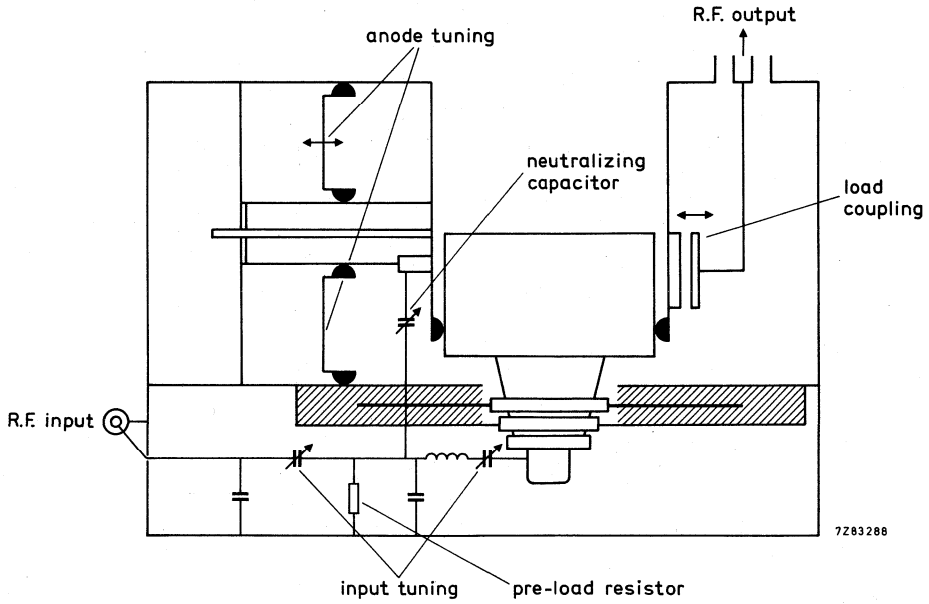


Fig. 2.

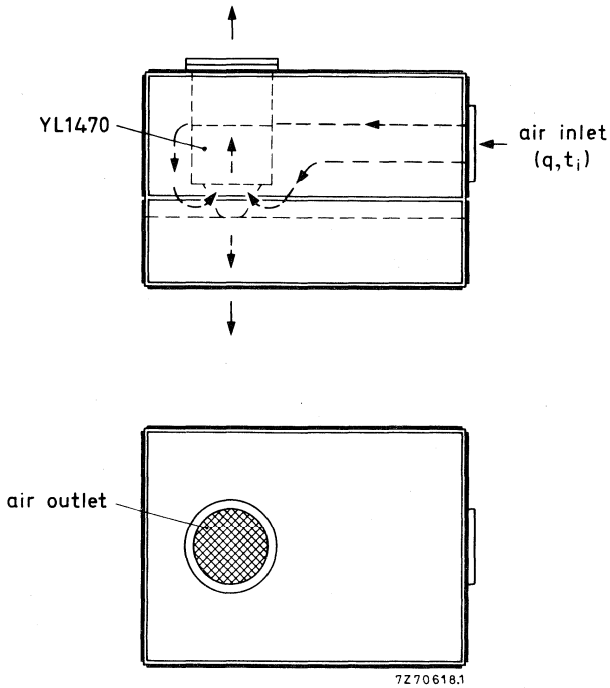


Fig. 3 Cooling air connector diagram.

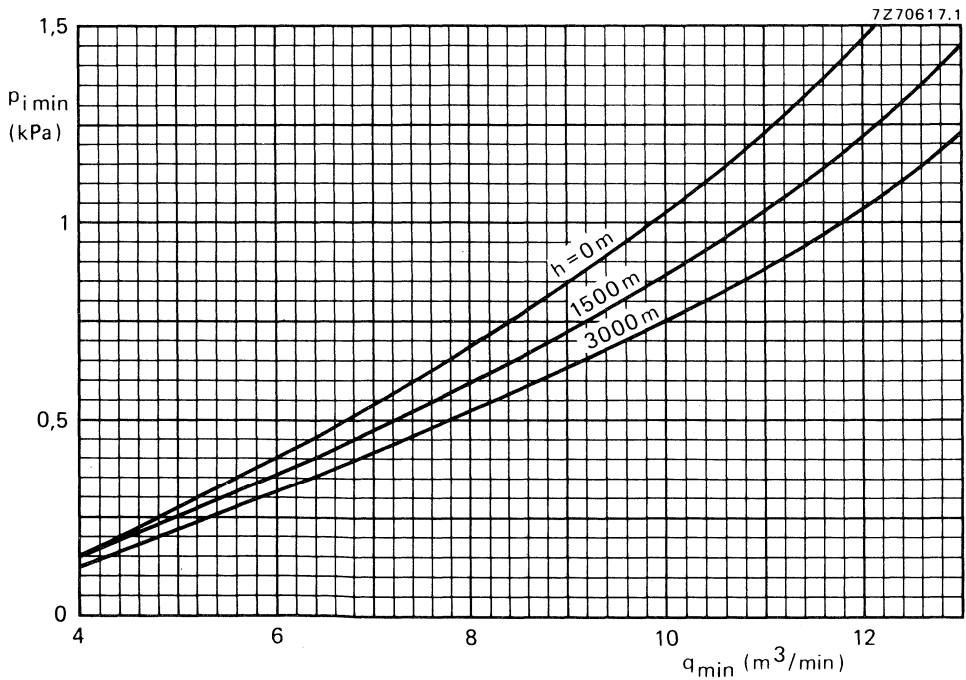


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

## 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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.  
Output: 50  $\Omega$  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

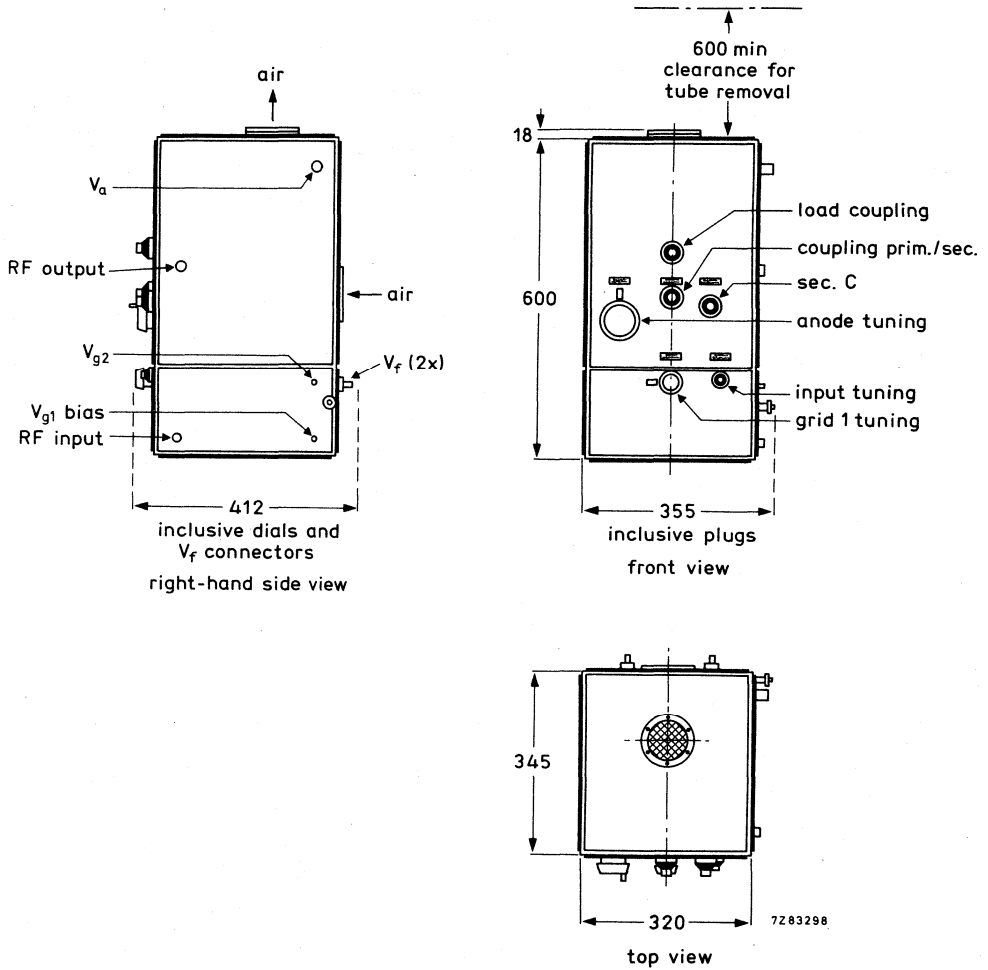


Fig. 1.

CIRCUIT DIAGRAM

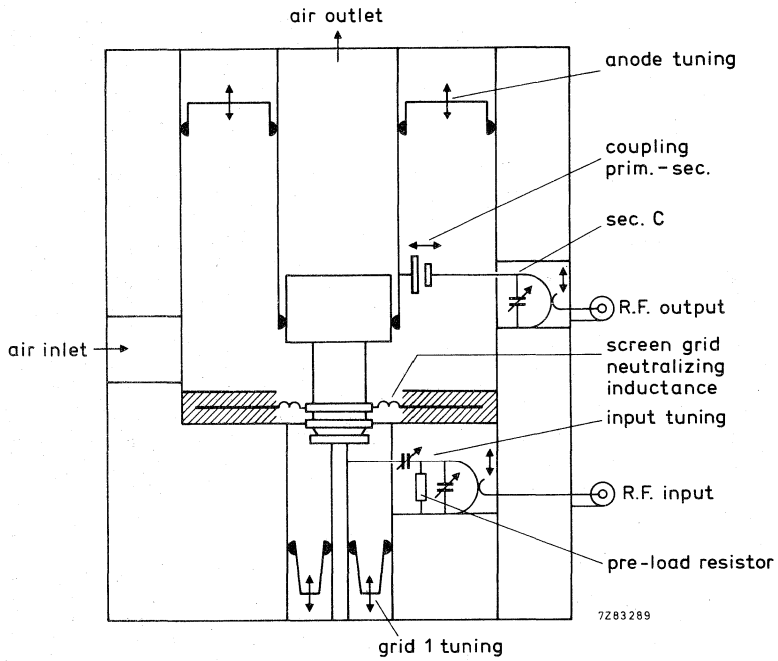


Fig. 2.

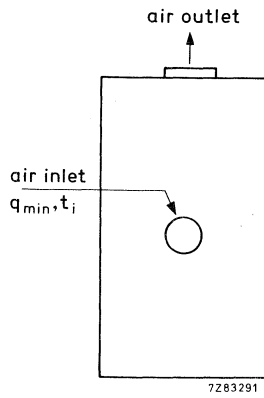


Fig. 3 Cooling air connector diagram.

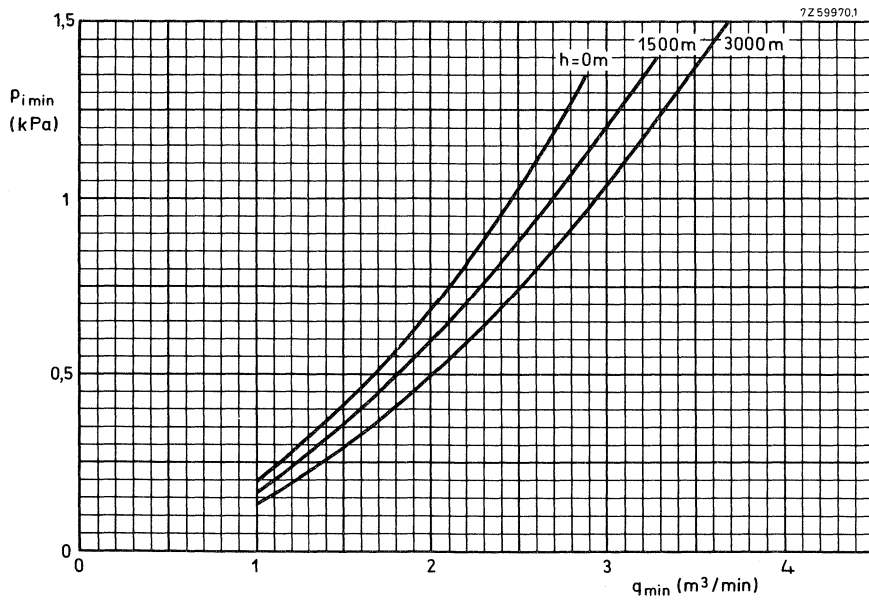


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.



## 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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.  
Output: 50  $\Omega$  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

Overall dimensions 618 x 355 x 412 mm  
 Net mass 33 kg

Dimensions in mm

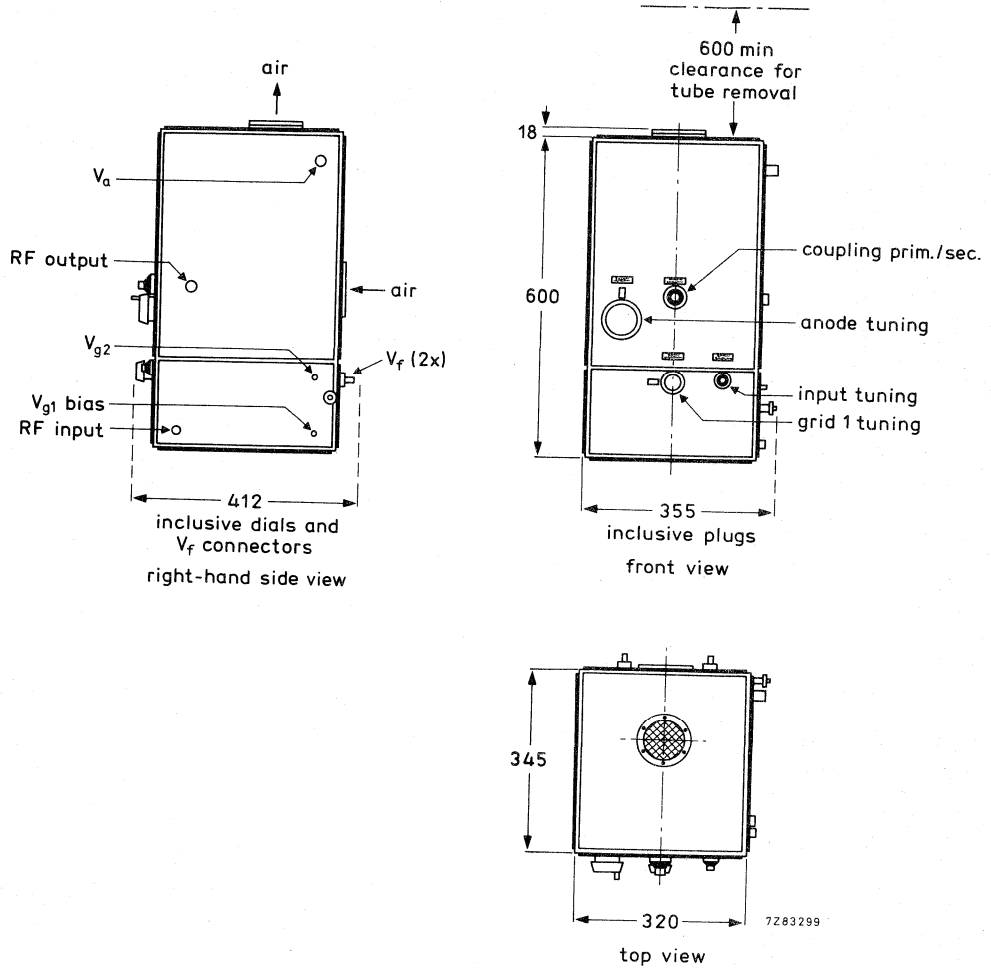


Fig. 1.

CIRCUIT DIAGRAM

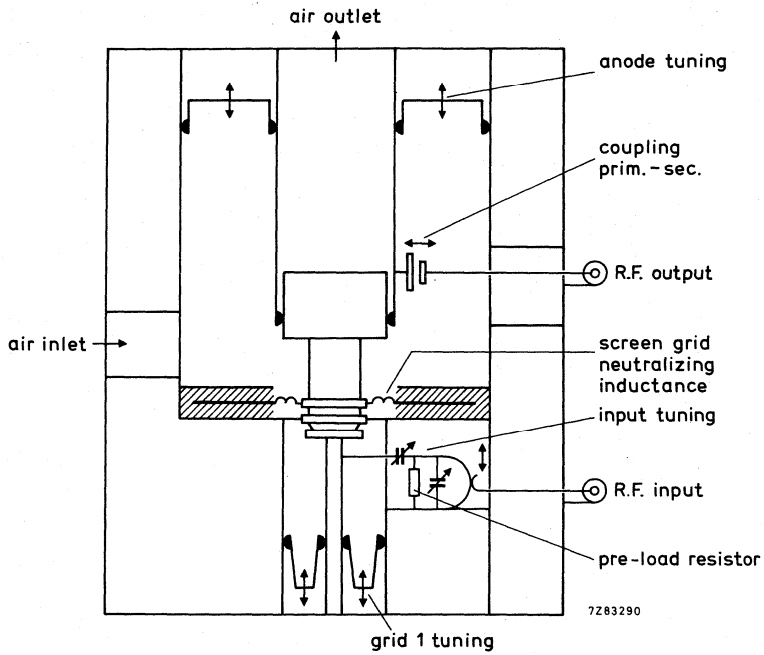


Fig. 2.

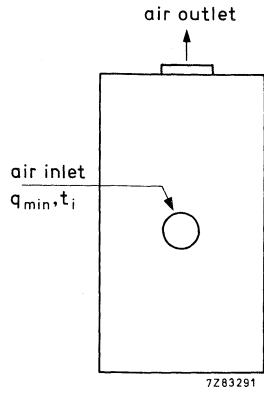


Fig. 3 Cooling air connector diagram.

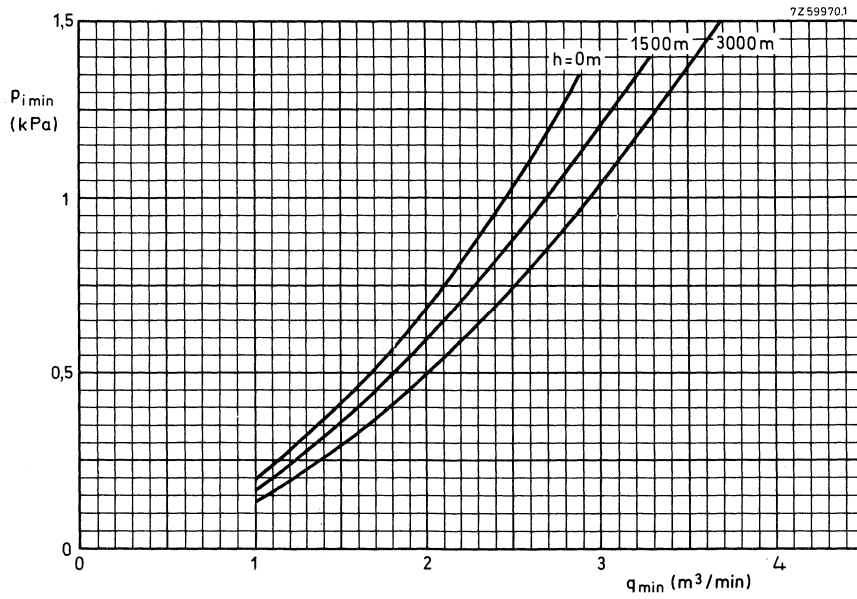


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.

## 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	$W_\ell$	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	$W_\ell$	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  $\Omega$  coaxial female connector, type N.  
 Output: 50  $\Omega$  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 R 13070
Air space ring	8222 032 69431

OUTLINE DRAWING

Overall dimensions 745 x 490 x 286 mm

Net mass kg

Dimensions in mm

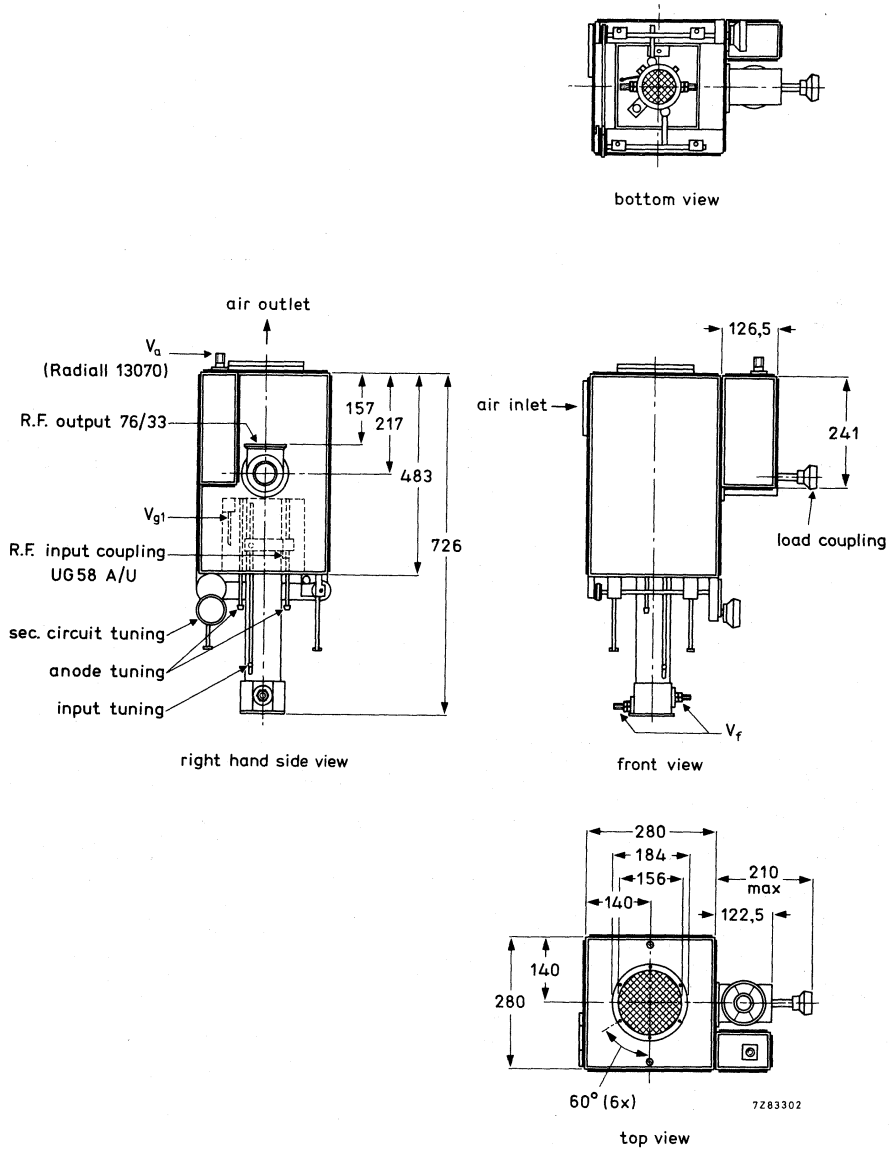


Fig. 1.

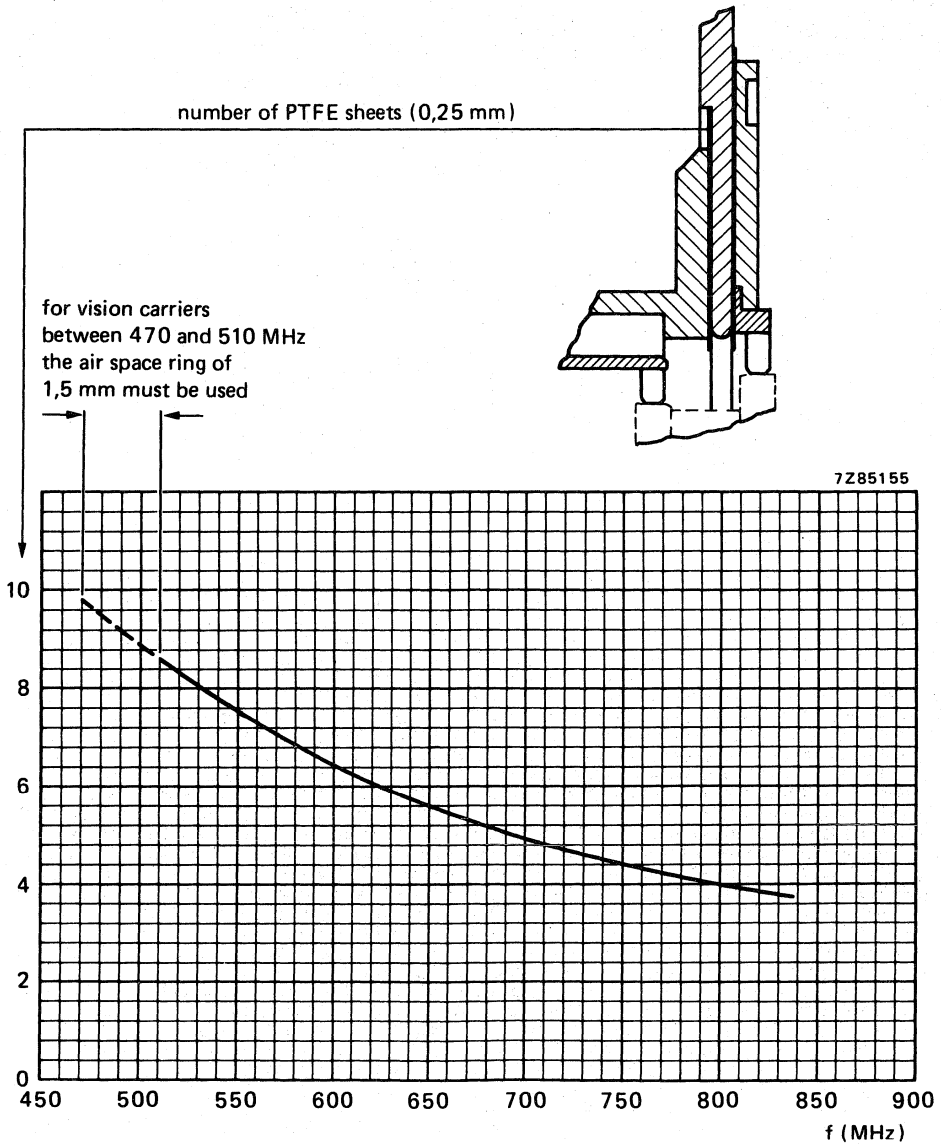


Fig. 2 Coupling capacitor.

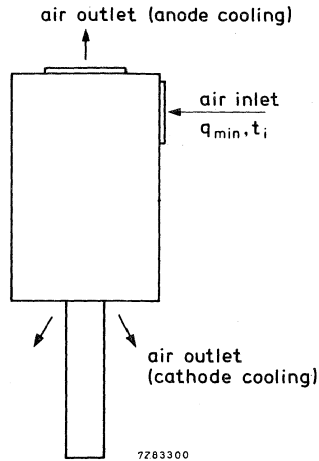


Fig. 3 Cooling air connector diagram.

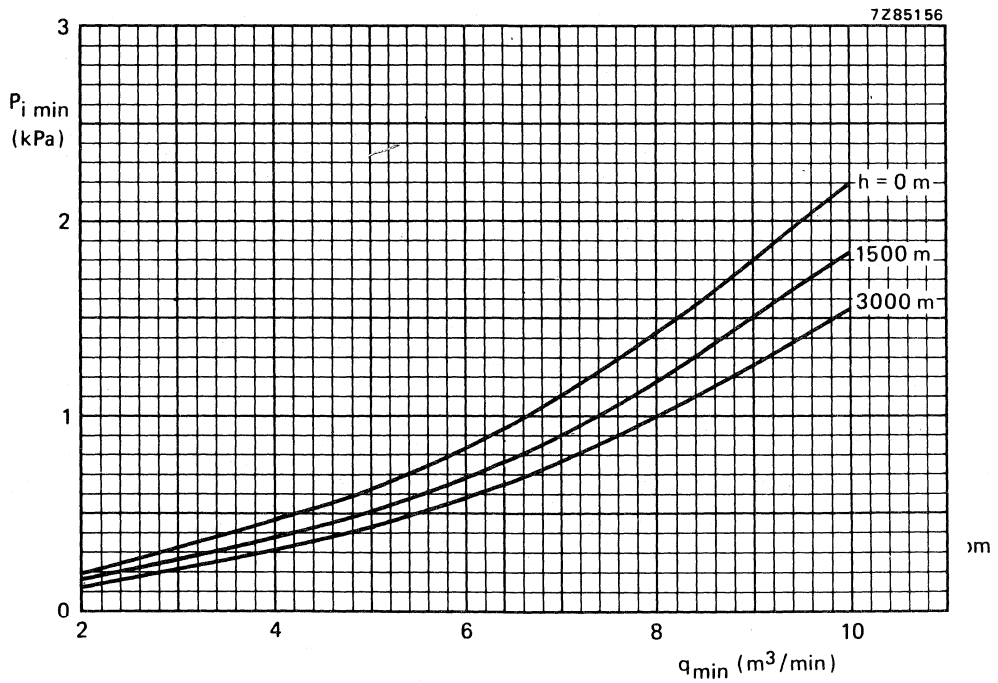


Fig. 4 Ratio of cooling air pressure to cooling air volume at various altitudes.  $p_i$  = pressure drop from plane A to plane B or B', for blowing  $q = q_A$ ; for sucking  $q = q_A + q_{B'}$ .



CIRCUIT DIAGRAM

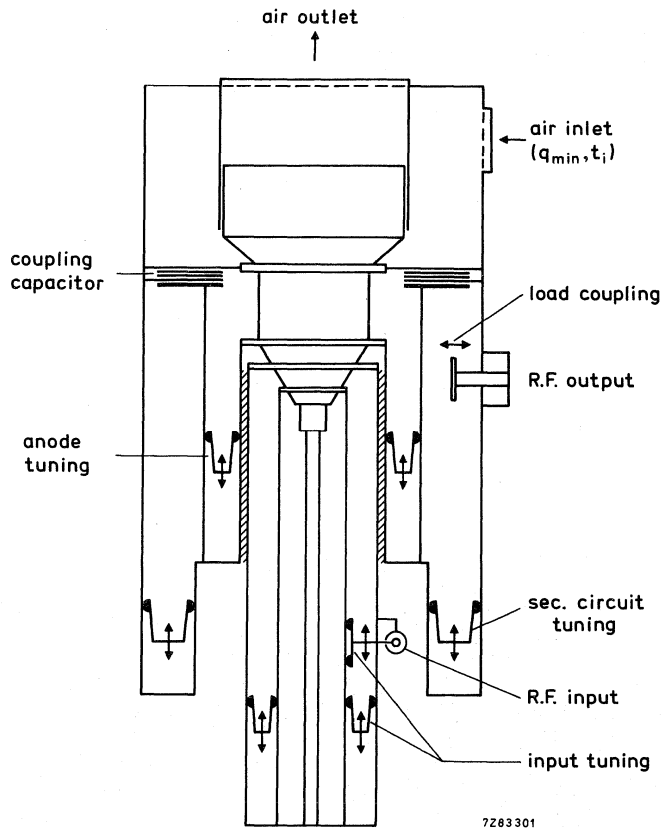


Fig. 5.



## 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	$W_\ell$	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.



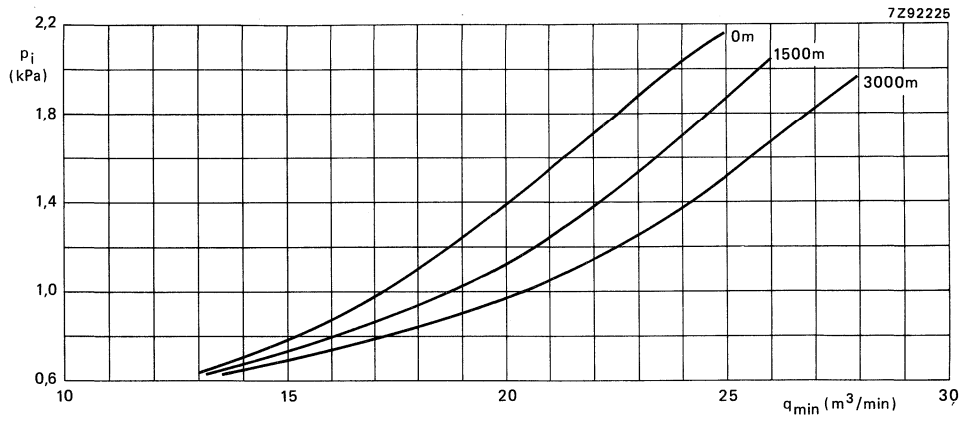


Fig. 2 Ratio of cooling air pressure to cooling air volume at various altitudes.

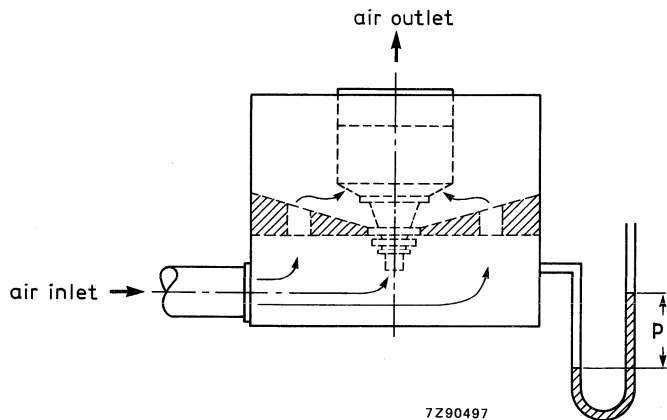


Fig. 3 Direction of air flow.



**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	$W_\ell$	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.

40787V

OUTLINE DRAWING

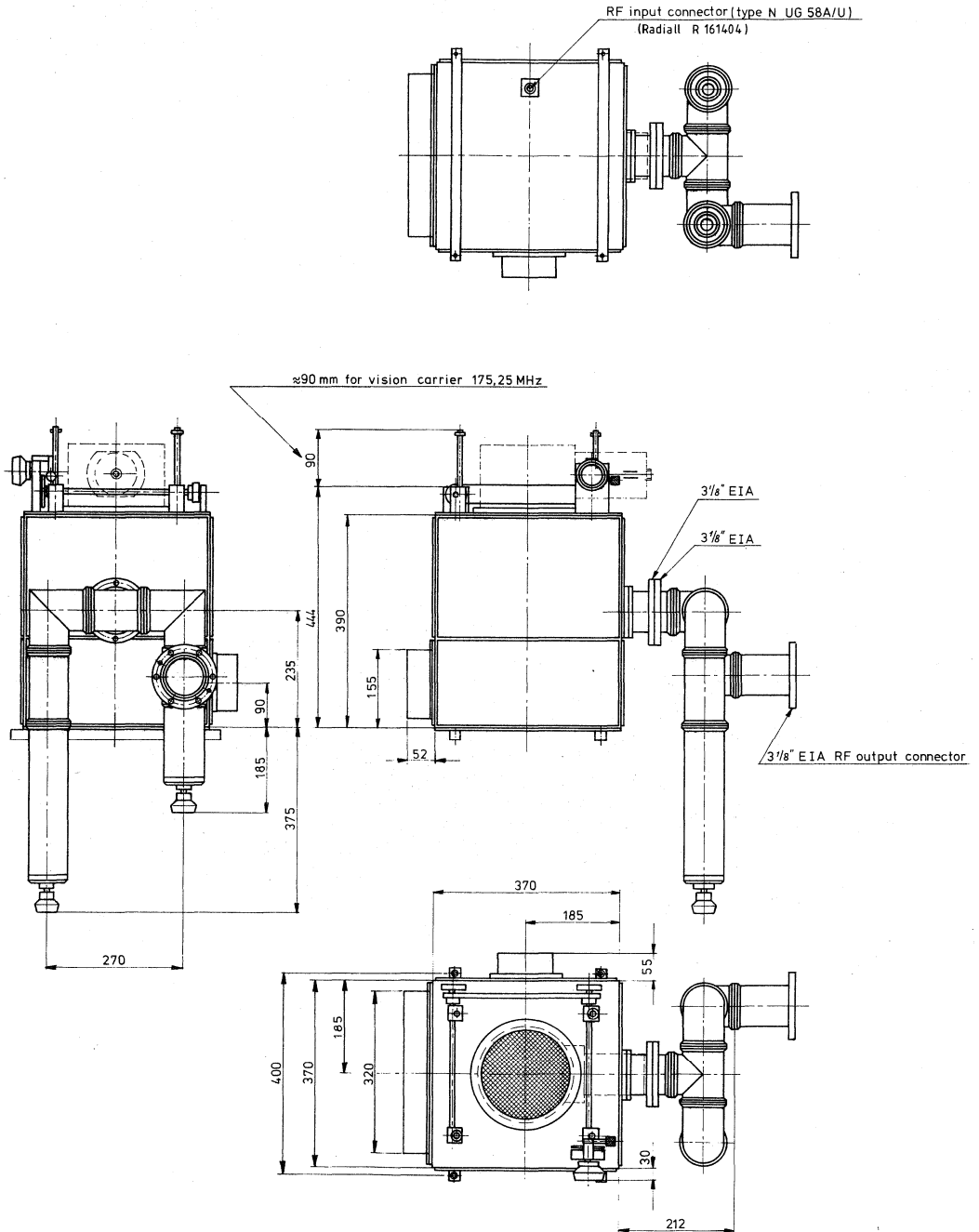


Fig. 1.



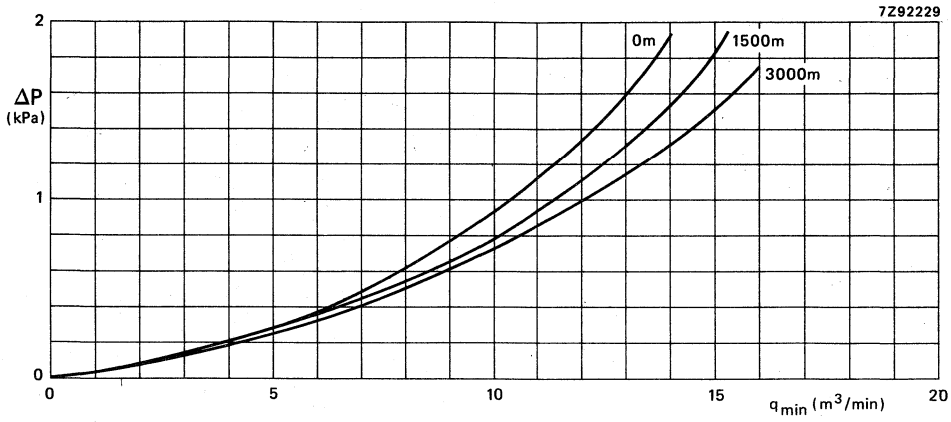


Fig. 2 Ratio of cooling air pressure to cooling air volume at various altitudes.

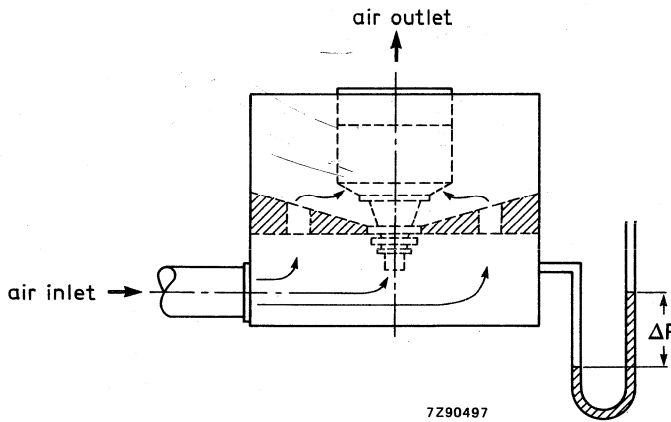


Fig. 3 Direction of air flow.



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

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