TH 393

Tetrode with Pyrobloc® grids

- Output power :
  – 4.4 kW peak of sync in vision carrier amplification
  – 2.2 kW peak of sync in common amplification of the vision and sound carriers
  – 2.5 kW in sound carrier amplification
- Excellent linearity
- High stability, due to the Pyrobloc® grids
- Anode dissipation up to 7.5 kW
- Forced air cooling

The TH 393 is a ceramic-metal, air-cooled tetrode of coaxial structure, designed for use in RF amplifiers of frequencies up to 1000 MHz. These amplifiers are used in UHF-TV transmitters and transposers.

Supersedes TEG 2442.

GENERAL CHARACTERISTICS

Electrical (1)

Type of cathode	Thoriated tungsten	
Type of heating	Direct, DC or single-phase AC	
Heater voltage	See page 5	
Heating surge current	See page 5	
Interelectrode capacitances (with cathode grounded) :		
cathode - control grid	45	pF
cathode - anode	0.03	pF
control grid - screen grid	72	pF
control grid - anode	0.3	pF
screen grid - anode	9	pF
Amplification factor g1-g2 average	8	
Transconductance (I_a = 1.5 A ; V_{g2} = 400 V)	80	mA/V

Mechanical

Operating position	Vertical	
Anode cooling	Forced air	
Minimum air flow (2)	8	m^3/min
Corresponding pressure drop	9	mbar
Maximum inlet-air temperature	45	°C
Maximum outlet-air temperature	100	°C
Maximum temperature at any point on insulator ceramics or ceramic-metal seals (3)	300	°C
Net weight, approx.	3.6	kg
Dimensions	See outline drawing	

Cavity

Cavity for TV transmitter, bands IV and V	TH 18665

OPERATING CONDITIONS

Maximum Ratings (4) (All potentials referenced to cathode)

Frequency	1000	MHz
Anode dc voltage	6	kV
Control-grid dc bias voltage	-200	V
Screen-grid dc voltage	800	V
Maximum heating surge current	175	A
Peak cathode current	15	A
Anode direct current	3	A
Anode dissipation	7.5	kW
Control-grid dissipation	25	W
Screen-grid dissipation	75	W

(1) To apply the different voltages, see instructions on page 5.

(2) For an inlet-air temperature of 25 °C, an anode dissipation of 7.5 kW, and at sea level

(3) This temperature is the absolute limiting value ; it must not be exceeded whatever the operating conditions (frequency, ambient air temperature, altitude). See paragraph "Particular Operating Instructions", page 4.

(4) Absolute limiting values. No one value to be exceeded, even under transient conditions. Operating at more than one limiting value at the same time may cause tube damage.

AMPLIFIER FOR TV TRANSMITTERS

values given for vision only operation

Typical operation in the cavity TH 18665 (CCIR G standard at black level)

Frequency	800	MHz
–1 dB bandwidth	11.5	MHz
Operating heater voltage	5.8	V
Anode voltage	5	kV
Screen-grid voltage	700	V
Anode current at zero signal	0.9	A
Anode current	1.9	A
Control-grid current	1	mA
Screen-grid current	15	mA
Gain	16	dB
Peak-of-sync output power (5)	4.4	kW
Average output power at black level(5)	2.5	kW

LINEAR AMPLIFIER FOR TV TRANSMITTERS AND TRANSPOSERS

common amplification of vision and sound carriers

Typical operation in the cavity TH 18665 (CCIR G standard at black level).

Frequency	800	MHz
–1 dB bandwidth	11.5	MHz
Operating heater voltage	5.8	V
Anode voltage	5.5	kV
Screen -grid voltage	600	V
Anode current at zero signal	0.9	A
Anode current	1.6	A
Control-grid current	0	mA
Screen-grid current	10	mA
Gain	16	dB
Peak-of sync output power (5)	2.2	kW
Sound output power (5)	220	W
Average output power at black level + sound (5)	1.5	kW
Intermodulation ratio (6)	–52	dB

(5) At the cavity output.

(6) Third-order IMD ratio measured using a three-tone test, with :
a - a reference level at peak power
b - a vision carrier 8 dB below the reference level,
c - a sound carrier 10 dB below the reference level,
d - a third signal 16 dB below the reference level,
e - 5.5 MHz difference between the vision and sound-carrier frequencies,
f - the frequency of the third signal varied over the full range between the vision and the sound carriers.
g - and a third-order IMD ratio at the input, measured under the same conditions, equal to or greater than 70 dB.

LINEAR AMPLIFIER FOR TV TRANSMITTERS AND TRANSPOSERS

Amplification of sound carrier

Typical operation in the cavity TH 18665 (CCIR G standard).

	Ex. 1	Ex. 2	Units
Frequency	800	800	MHz
–1 dB bandwidth	12	12	MHz
Operating heater voltage	5.8	5.8	V
Anode voltage	4	5	kV
Screen -grid voltage	500	500	V
Anode current at zero signal	0.85	0.85	A
Anode current	2	1.5	A
Control-grid current	5	3	mA
Screen-grid current	30	15	mA
Gain	16	16	dB
Output power (5)	2.5		kW
Output power carrier 1 (5)		1.25	kW
Output power carrier 2 (5)		0.25	kW

(5) At the cavity output.

PARTICULAR OPERATING INSTRUCTIONS

Handling and Mounting

Since shocks and vibrations can damage the tube, any unnecessary handling should be avoided. The tube must be stored where it is protected from shocks, dust and humidity, e.g. inside its packing.

Electrode Terminal Cooling

The cooling of the tube electrode terminals requires a maximum air inlet temperature of 45 °C.
The temperature of both the ceramic insulators and the ceramic metal seals should be kept below the maximum value of 300 °C, since this is the controlling and final limiting factor for the tube. This temperature can be checked using temperature-sensitive paint, before the equipment design and air-cooling arrangements are finalized.

IMPORTANT
ALL COOLING MUST BE APPLIED BEFORE OR SIMULTANEOUSLY WITH THE APPLICATION OF ELECTRODE VOLTAGES AND MUST BE MAINTAINED AT LEAST 3 MINUTES AFTER ALL VOLTAGES ARE REMOVED, TO ALLOW FOR TUBE COOL-DOWN.

Verification Before Installation

Before putting a tube into service, check with an ohmmeter that the cathode heater is undamaged and that there are no contacts between the electrodes.

Heater Voltage

- *Heater voltage measurement*

The heater voltage must be measured directly at the entrance of the cavity using a class 1 ferromagnetic or thermal voltmeter or a digital voltmeter indicating true RMS.

- *Permanent blackheating voltage*

For maximum tube life, heater voltage must imperatively be applied continuously, even during transmitter off-time. During these intervals, the heater voltage may be reduced to 1.6 V ± 5 % and the anode, screen-grid, and electrode terminal cooling cut off, provided that air can circulate freely around the tube base to supply convection cooling.

- *Operating heater voltage*

The operating heater voltage depends on the specific tube operating conditions ; these conditions should be conveyed to Thomson Tubes Electroniques which will define the voltage value to be used. This value must be observed within a ± 2 % margin.
For power supply design the heating current is approximately 65 A for a 6 V heater voltage. The heating surge current must not be allowed to exceed 175 A peak on the first cycle.

Application of Electrode Voltages

In general, the tube being under permanent blackheating voltage, apply successively :

1 - Ventilation
2 - Heater voltage; wait 10 sec, then :
3 - Control-grid bias voltage
4 - Anode voltage
5 - Screen-grid voltage
6 - RF driving voltage.

For a new tube, apply the permanent blackheating voltage for at least 10 minutes before applying the other voltages as indicated above.
When the transmitter is switched off, the various voltages are cut off by proceeding in the reverse order of the "application of electrode voltages" above.

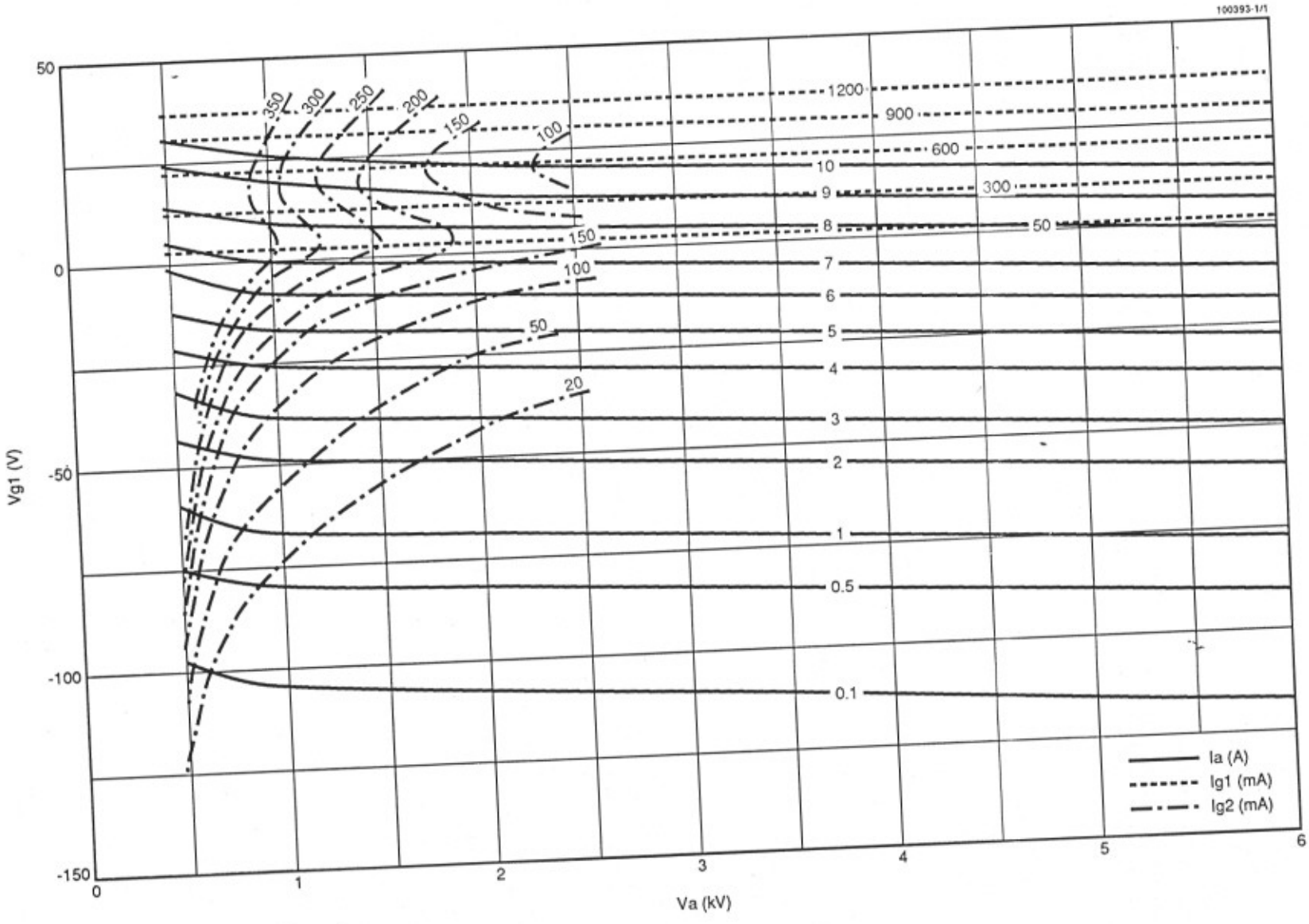
Protection Against Overcurrents

The tube should be protected against overcurrents by means of three relays, inserted in series in the control-grid, screen-grid, and anode circuits, respectively. These relays are adjusted to operate when a current equal to 1.5 $I_{max.}$ is reached, $I_{max.}$ being the maximum current drawn under normal operating conditions. When one of these relays operates, the RF driving voltage and the screen-grid and anode voltages must be cut off simultaneaously.

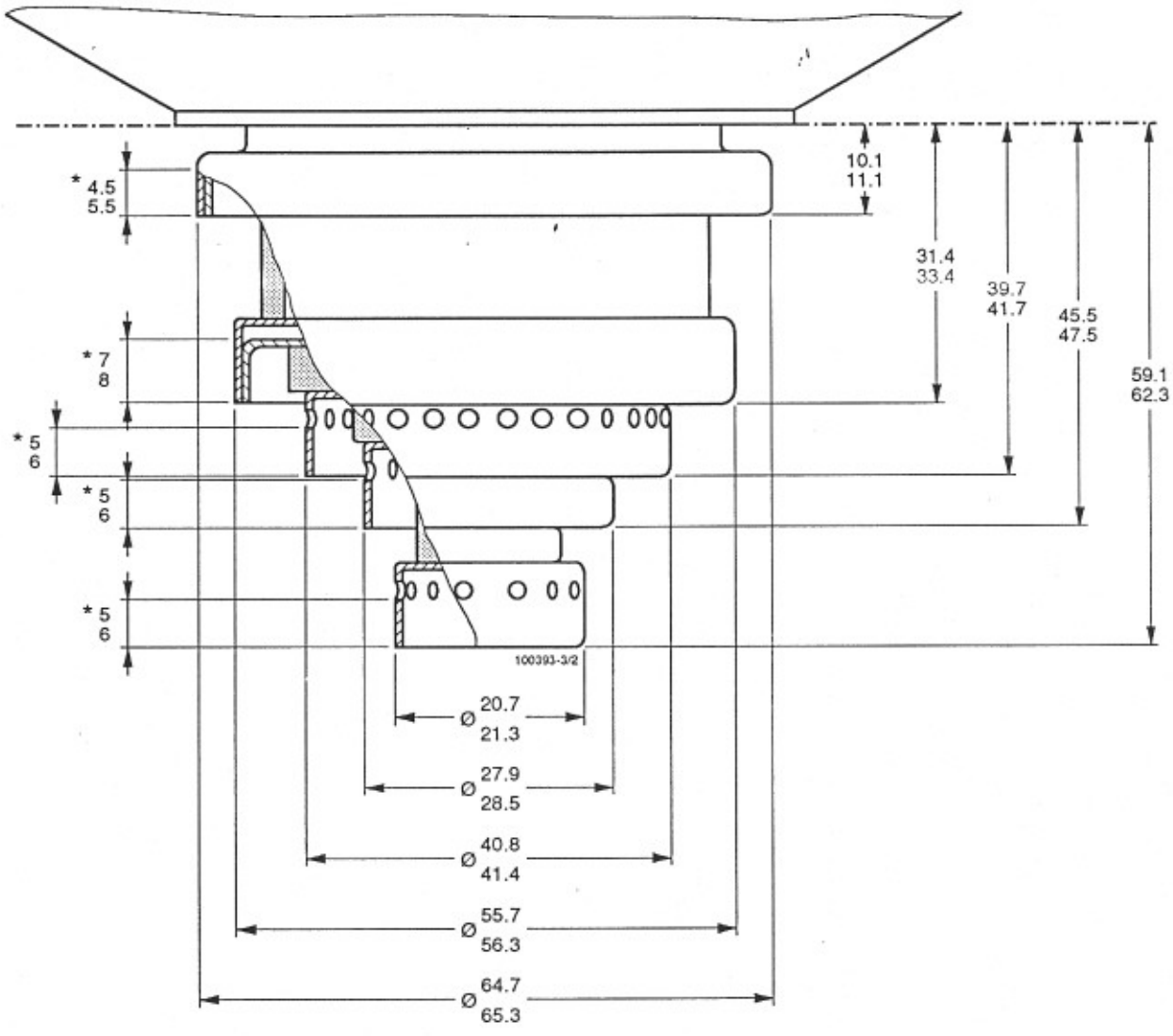
Monitoring Device for Overtemperature of Outlet Cooling Air

The temperature of the outlet air coming from the anode cavity must not exceed 100 °C. This temperature rises when the cavity is not properly adjusted. A monitoring device must be provided to warn the user of improper adjustment. On the other hand, this device allows the user to check that the air evacuation system (generally made by the user) is well adapted to the equipment.

CONSTANT-CURRENT CHARACTERISTICS
Vg2 = 600 V



DETAIL OF ELECTRICAL CONNECTIONS



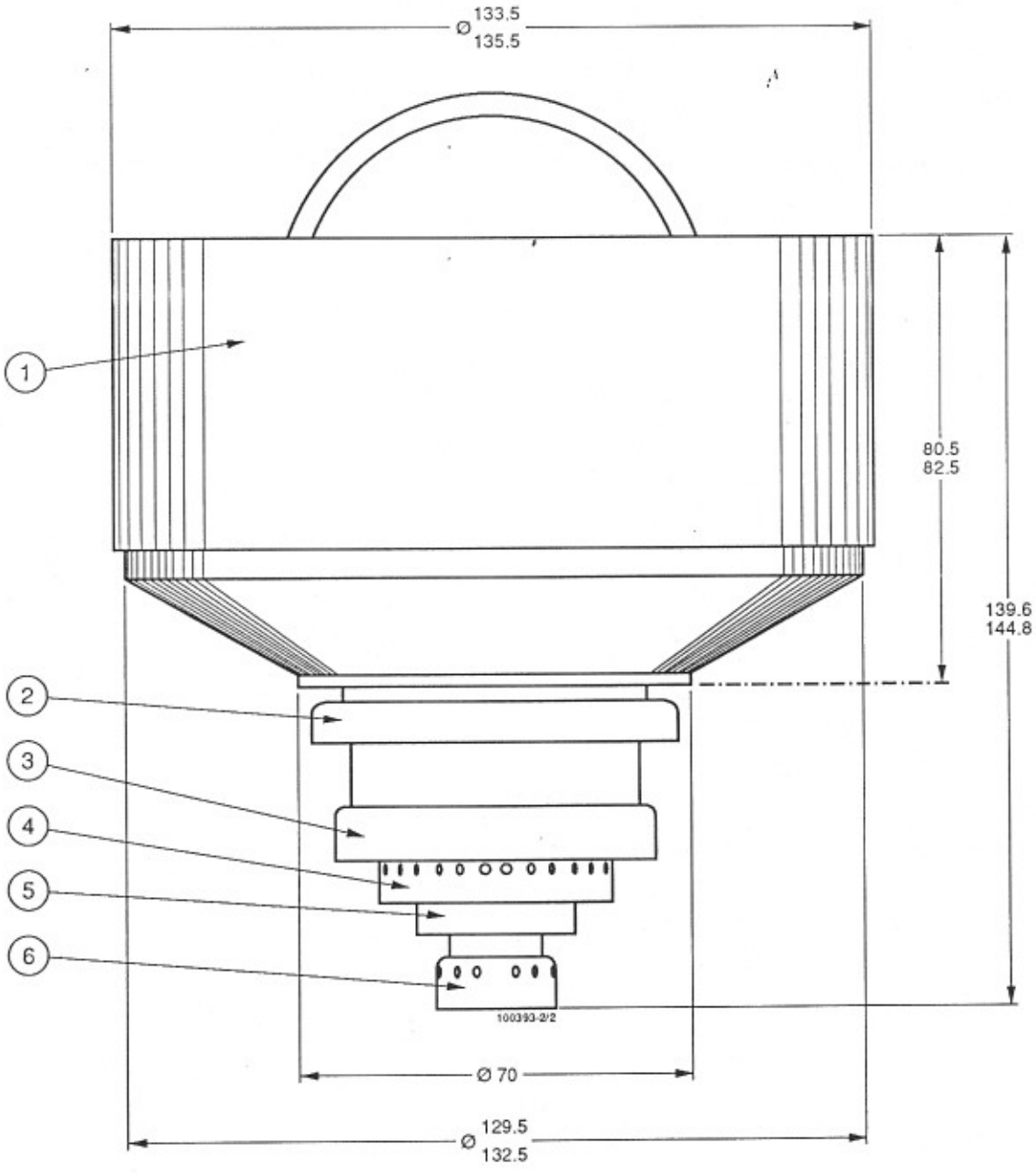
* Contact zones
Maximum excentricity : 0.3

—·—·— Reference plane

IMPORTANT NOTES
1. Respect the contact zones
2. Do not obstruct in any way the free flow of air through the holes in the terminal for example with the contacts or their support
3. Nothing must touch the ceramics

Dimensions in mm

OUTLINE DRAWING



(1) Radiator
(2) Anode
(3) Screen-grid (g2)
(4) Control-grid (g1)
(5) Filament-cathode
(6) Filament
—·— Reference plane

Dimensions in mm