THE M-O VALVE
COMPANY LIMITED

CCS1

Y799

CONDUCTION COOLED
BEAM TETRODE

BRIEF DATA

A compact conduction cooled beam tetrode electrically similar to the 4CX250B (CV6137). The anode is fitted with a square copper block intended to be bolted to a metal heat sink or to a beryllia heat conducting block HC1 which gives electrical isolation.

D.C. anode voltage (max)	2	kV
Anode dissipation (max)	250	W
Frequency (max)	500	MHz
Load power (Class C, up to 175MHz)	350	W
Load power (Class C, at 500MHz)	220	W
Load power (Class AB1, up to 175MHz)	270	W

HEATER

*Heater voltage	6.0	V
Heater current (approx)	2.6	A

*At high operating frequencies, back-heating of the cathode occurs. The target heater voltage should be adjusted or selected according to the operating frequency as follows:-

0–300MHz	6.0	V
400MHz	5.75	V
500MHz	5.5	V

During operation, the heater voltage should be maintained within ±5% of the target value.

CHARACTERISTICS (Typical)

Anode voltage	500	V
Screen voltage	250	V
Anode current	200	mA
Mutual conductance	12	mA/V
Grid-screen amplification factor	5	

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RATINGS (Absolute, maximum unless otherwise stated)

These ratings apply for operation at frequencies up to 500MHz.

D.C. anode voltage	2	kV
Screen voltage	400	V
Negative d.c. grid voltage	250	V
Peak heater–cathode voltage	±150	V
Mean (d.c.) anode current	250	mA
Mean (d.c.) cathode current	300	mA
Peak cathode current	1.5	A
†Anode dissipation	250	W
Screen dissipation	12	W
Grid dissipation	2	W
Grid–cathode circuit resistance	100	kΩ
*Switching delay time (minimum)	30	s
Seal temperature	250	°C

†Using heat conducting block HC1, with heat sink at 25°C (see page 8).
*Minimum time between applying heater voltage and drawing cathode current.

CAPACITANCES (Typical, measured on a cold unscreened tube)

Anode to grid (max)	0.06	pF
Grid to other electrodes less anode	17.5	pF
Anode to other electrodes less grid	6	pF

The capacitance of the beryllia heat conducting block HC1 is 3pF approx.

OPERATING DATA

Screen Current Reversal

As the screen current may reverse under some conditions, the circuit design must allow for at least 15mA of reverse current. If the screen voltage is to be derived from the anode supply, a shunt regulator circuit should be used. The series resistor current should not be less than the largest expected screen current; whilst the shunt regulator device(s) should be capable of carrying at least 15mA more than the resistor current.

CLASS AB1 AF POWER AMPLIFIER OR MODULATOR

Maximum Permissible Conditions

D.C. anode voltage	2	kV
Screen voltage	400	V
D.C. anode current	250	mA
Anode dissipation	250	W
Screen dissipation	12	W
Grid dissipation	2	W

Typical Operation
Sinusoidal wave, two tubes unless otherwise indicated.

D.C. anode voltage	1	1.5	2	kV
D.C. screen voltage	350	350	350	V
*D.C. grid voltage	−55	−55	−55	V
D.C. anode current (no sig).	2 x 100	2 x 100	2 x 100	mA
D.C. anode current (max sig)	2 x 250	2 x 250	2 x 250	mA
D.C. screen current (max sig)	2 x 10	2 x 8	2 x 5	mA
Anode to anode load impedance	3.5	6.2	9.5	kΩ
A.C. grid voltage (per tube)(crest)	50	50	50	V
Total output power	240	430	600	W

*D.C. grid voltage adjusted for specified zero signal anode current

RF POWER AMPLIFIER
ANODE MODULATED CLASS C TELEPHONY (CARRIER CONDITIONS)

Maximum Permissible Conditions

D.C. anode voltage	1.5	kV
Screen voltage	300	V
Negative grid voltage	250	V
D.C. anode current	200	mA
Anode dissipation	165	W
Screen dissipation	12	W
Grid dissipation	2	W

Typical Operation (Up to 175MHz)

D.C. anode voltage	500	1000	1500	V
D.C. screen voltage	250	250	250	V
D.C. grid voltage	−100	−100	−100	V
D.C. anode current	200	200	200	mA
D.C. screen current	31	22	20	mA
D.C. grid current	15	14	14	mA
A.C. grid voltage (crest)	118	117	117	V
Drive power	1.8	1.7	1.7	W
Input power	100	200	300	W
Total output power	60	145	235	W

RF LINEAR AMPLIFIER CLASS AB1
SINGLE-SIDEBAND SUPPRESSED-CARRIER OPERATION

Maximum Permissible Conditions

D.C. anode voltage	2	kV
Screen voltage	400	V
D.C. anode current	250	mA
Anode dissipation	250	W
Screen dissipation	12	W
Grid dissipation	2	W

Typical Operation (Up to 175MHz)

Single Tone

D.C. anode voltage	1	1.5	2	kV
D.C. screen voltage	350	350	350	V
*D.C. grid voltage	−55	−55	−55	V
D.C. anode current (no sig)	100	100	100	mA
A.C. grid voltage (crest)	50	50	50	V
D.C. anode current (max sig)	250	250	250	mA
D.C. screen current (max sig)	10	8	5	mA
Total output power	120	215	300	W

Two Tone

D.C. anode current (max sig)	190	190	190	mA
D.C. screen current (max sig)	2	−1	−2	mA
Peak envelope output power	120	215	300	W
Mean output power	60	107.5	150	W

*D.C. grid voltage adjusted for specified zero signal anode current.

RF POWER AMPLIFIER OR OSCILLATOR
CLASS C TELEGRAPHY OR FM TELEPHONY (KEY-DOWN CONDITIONS)

Maximum Permissible Conditions

D.C. anode voltage	2	kV
Screen voltage	300	V
Negative d.c. grid voltage	250	V
D.C. anode current	250	mA
Anode dissipation	250	W
Screen dissipation	12	W
Grid dissipation	2	W

Typical Operation (Up to 175MHz)

D.C. anode voltage . .	500	1000	1500	2000	V
D.C. screen voltage . .	250	250	250	250	V
D.C. grid voltage . . .	−90	−90	−90	−90	V
D.C. anode current . .	250	250	250	250	mA
D.C. screen current . .	.45	38	21	19	mA
D.C. grid current . . .	.35	31	28	26	mA
A.C. grid voltage (crest).	114	114	112	112	V
Drive power.	4	3.5	3.2	2.9	W
Input power	125	250	375	500	W
Total output power . .	.70	190	280	390	W

OPERATION AT HIGHER FREQUENCIES

At operating frequencies greater than 175MHz, the output power falls owing to transit time effects. In a Class C amplifier at 500MHz, with input power = 500W, a typical value for load power would be 220W.

COOLING

Adequate heat transfer must be provided from all thermal contact areas so as to ensure that no metal/ceramic seal exceeds the maximum temperature rating of 250°C under any condition of use.

The anode block should be bolted to a suitable heat conducting surface. As, commonly, electrical insulation is required between anode and heat sink, an approved heat conducting block incorporating beryllia is available under the reference HC1 (see page 8).

A heat conducting path should be provided from the screen grid ring of the tube to the equipment chassis. A base socket incorporating a screen by-pass capacitor and with eight fingers contacting the screen grid ring is normally recommended. At frequencies below 30MHz, it is possible to use a lower cost base socket not incorporating screen fingers or by-pass capacitor. The r.f. connection to the screen must still be made to the screen grid ring and should provide an adequate thermal path.

It is important to provide a good thermal connection to the tube grid spigot. A hole in the spigot is provided to accept a bifurcated pin to which a small metal plate should be attached.

The use of a heat sink compound at all thermal joints is recommended.

A convenient method of measuring temperature under operating conditions is to use temperature sensitive paints or crayons. Various forms are available from J.M. Steel and Co. Ltd., Kingsway House, Paradise Road, Richmond, Surrey (Telephone No. 01-940 6077).

MOUNTING POSITION

The tube may be mounted in any position.

WEIGHT

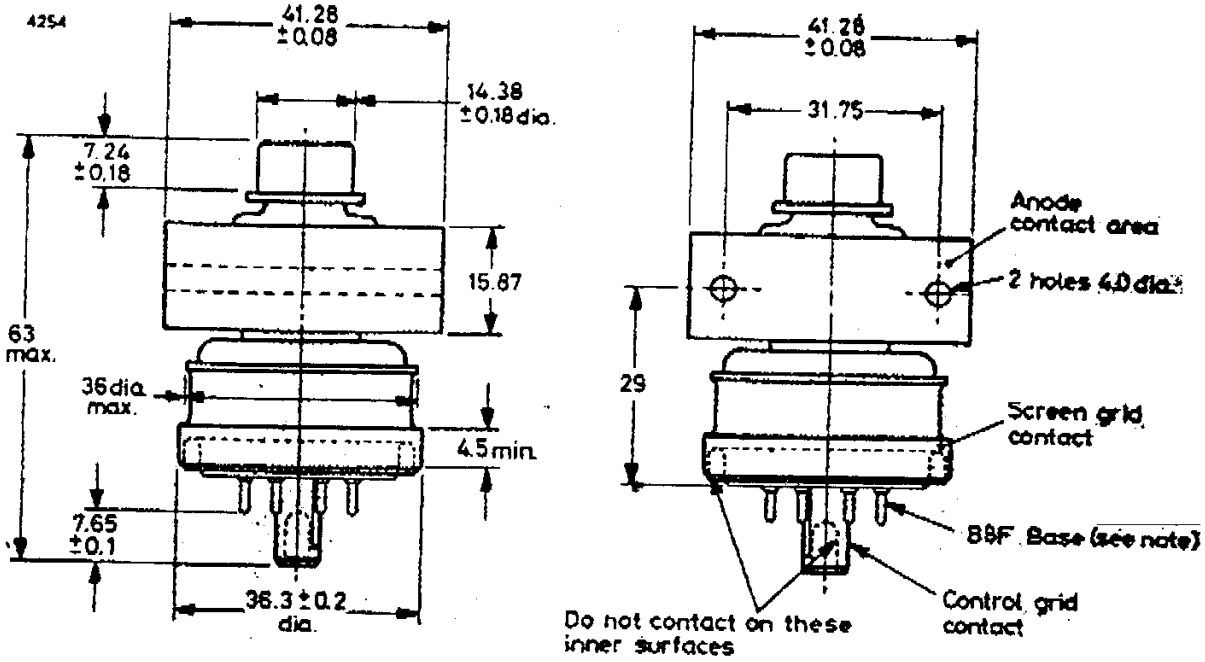
The approximate weight of the tube is 255gms.

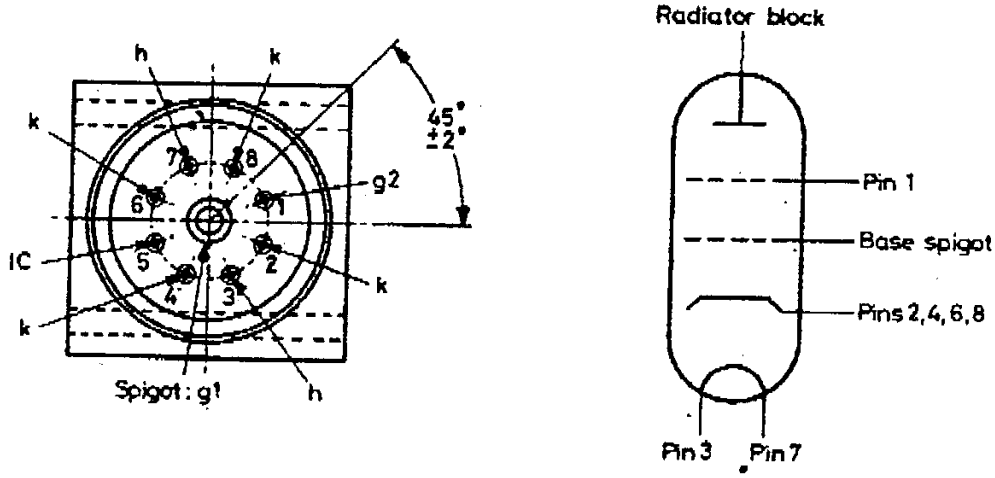
WARNING

The type HC1 heat conducting block incorporates Beryllium Oxide, the dust of which is toxic. The device is safe provided it is not dismantled or its component parts or finish tampered with. Care should be taken to ensure that all those who may handle, use or dispose of this device are aware of its nature and of the necessary safety precautions. In particular, it should never be thrown out with general industrial or domestic waste. Advice on disposal can be obtained from The Applications Laboratory of The M-O Valve Co. Ltd. (Telephone No. 01-603 3431, Ext. 22).

No special precautions are necessary for the tube itself.

OUTLINE

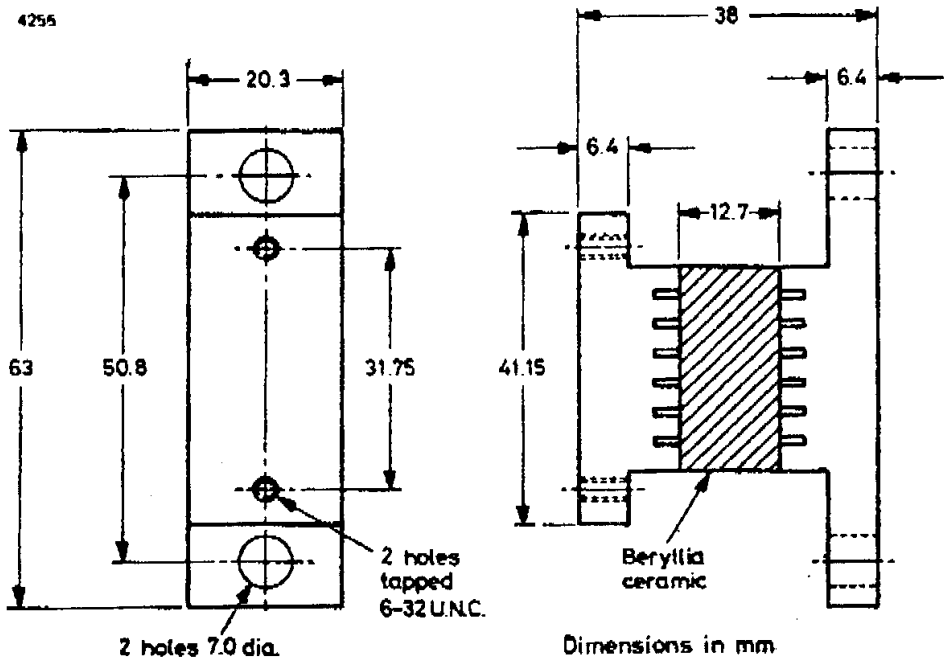


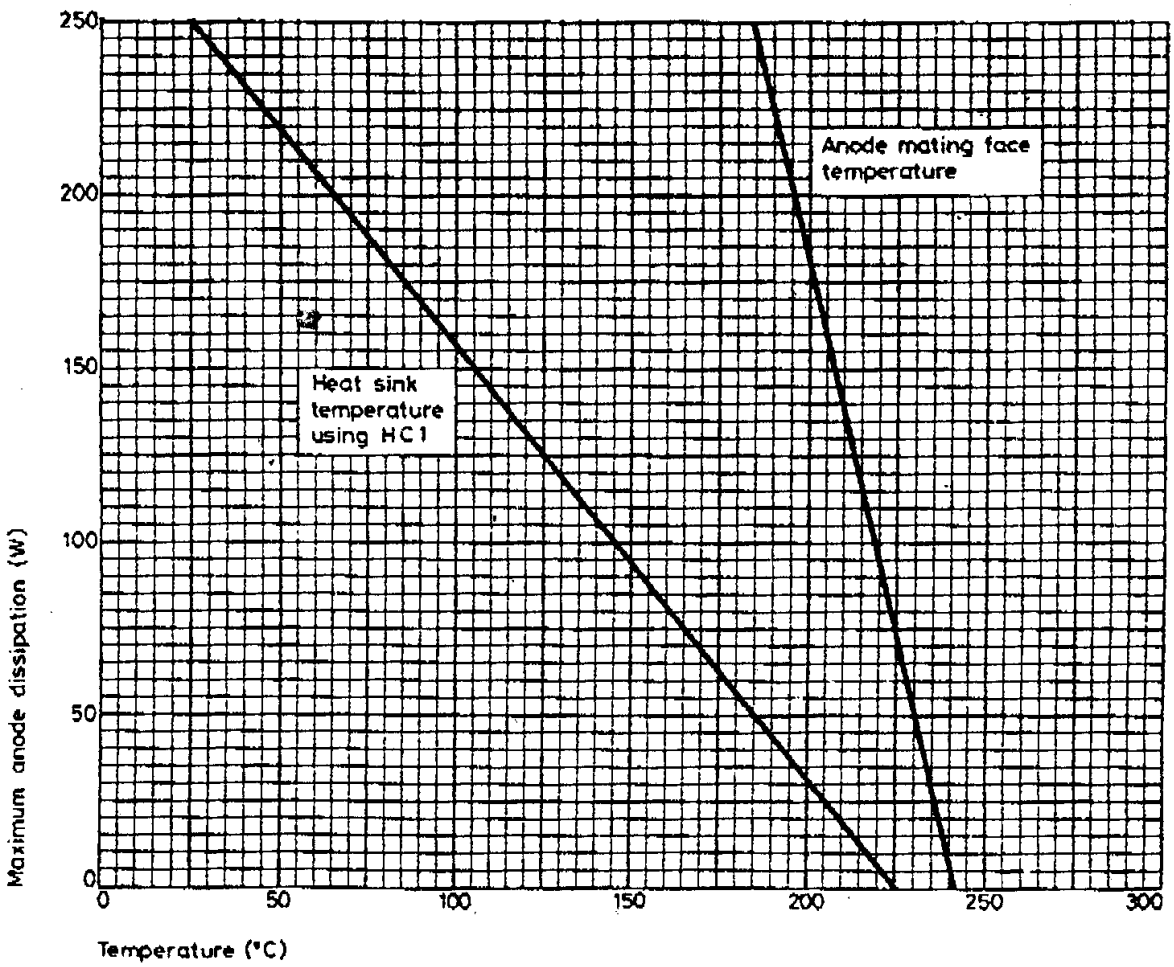


NOTE:
B8F Base to B.S.448 with the exception of 4mm diameter hole in the spigot.

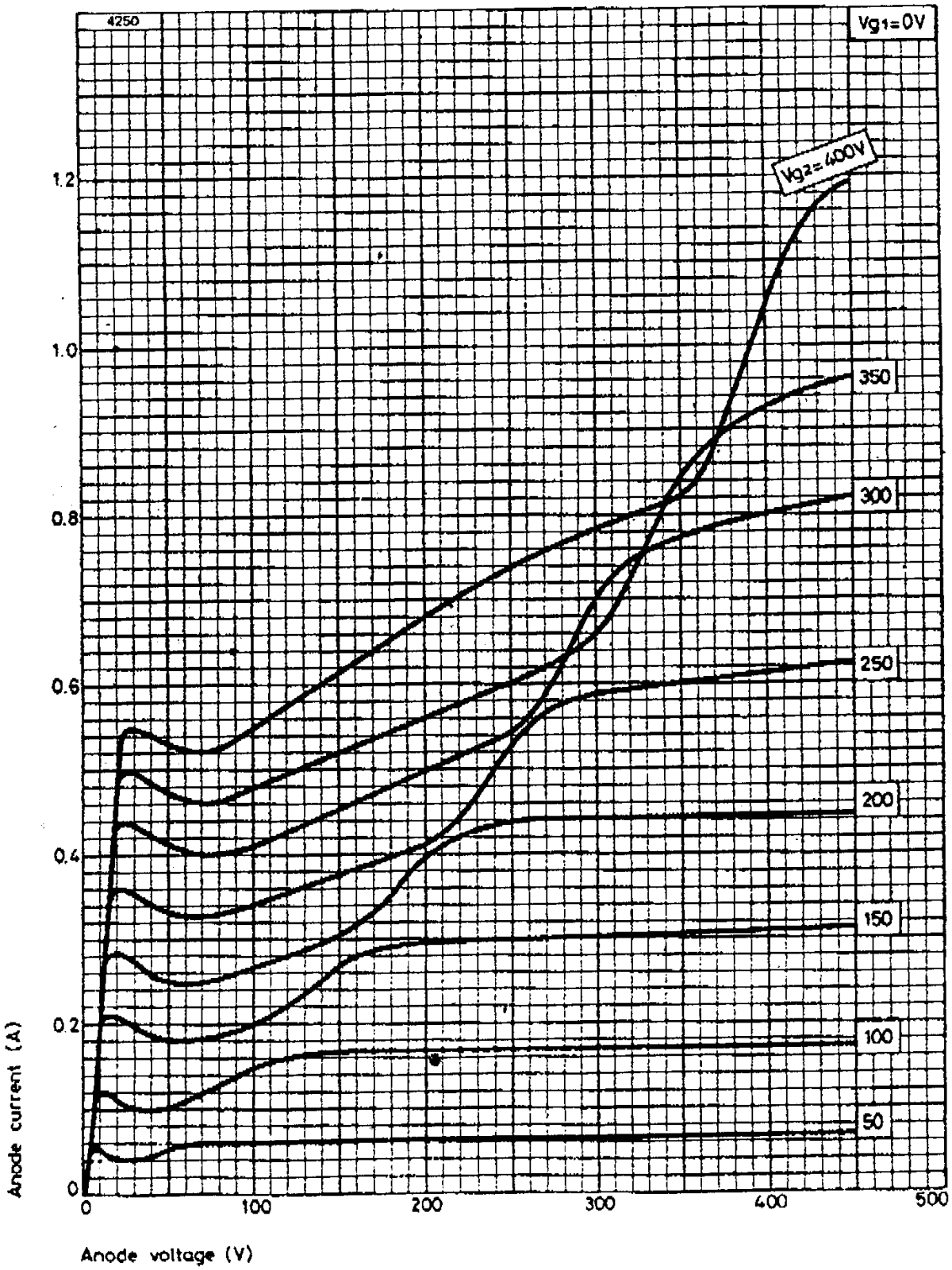
Dimensions in mm

HEAT CONDUCTING BLOCK HC1 AND ANODE DISSIPATION RATING

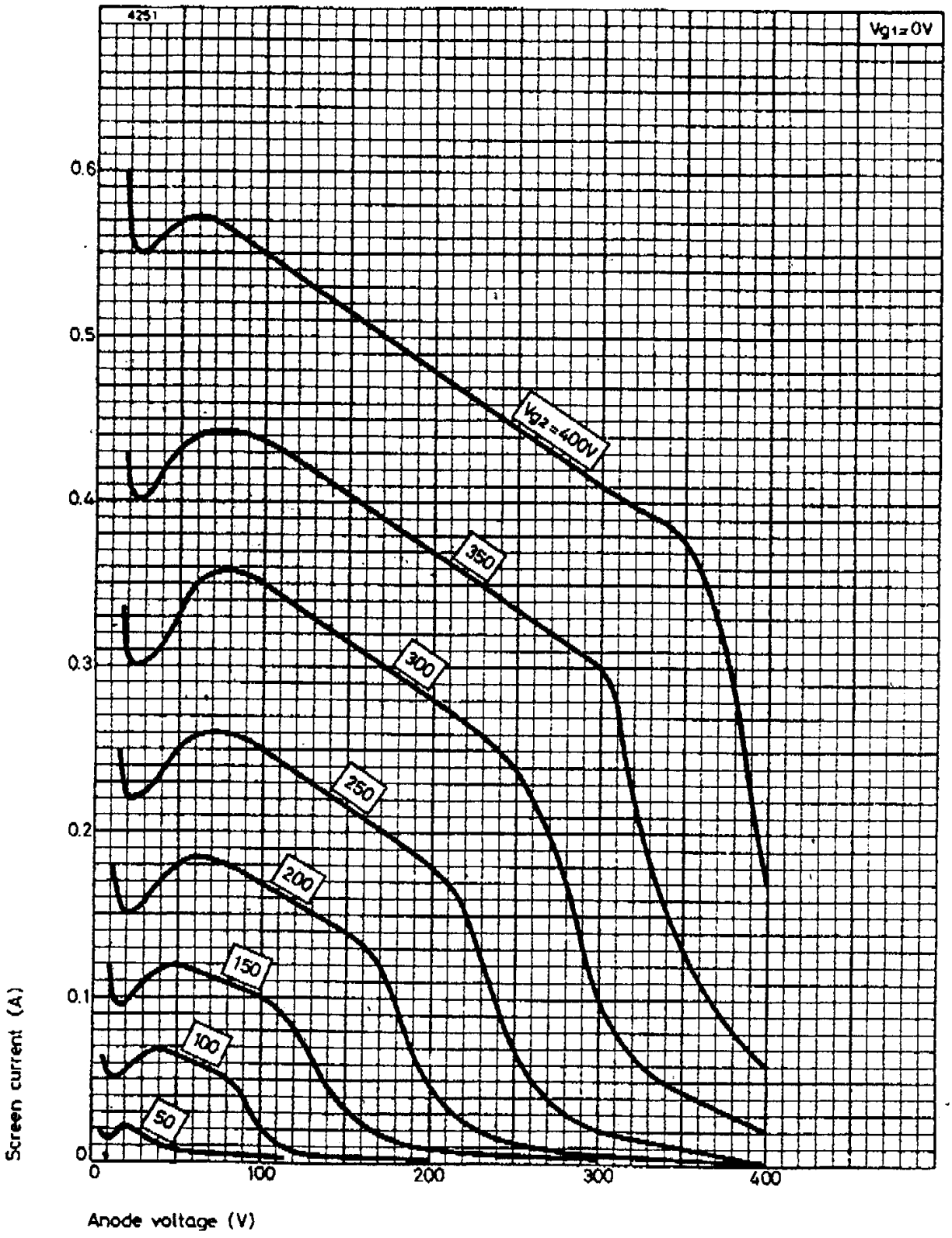




ANODE CURRENT–ANODE VOLTAGE AT V_{g1} = 0V WITH V_{g2} AS PARAMETER

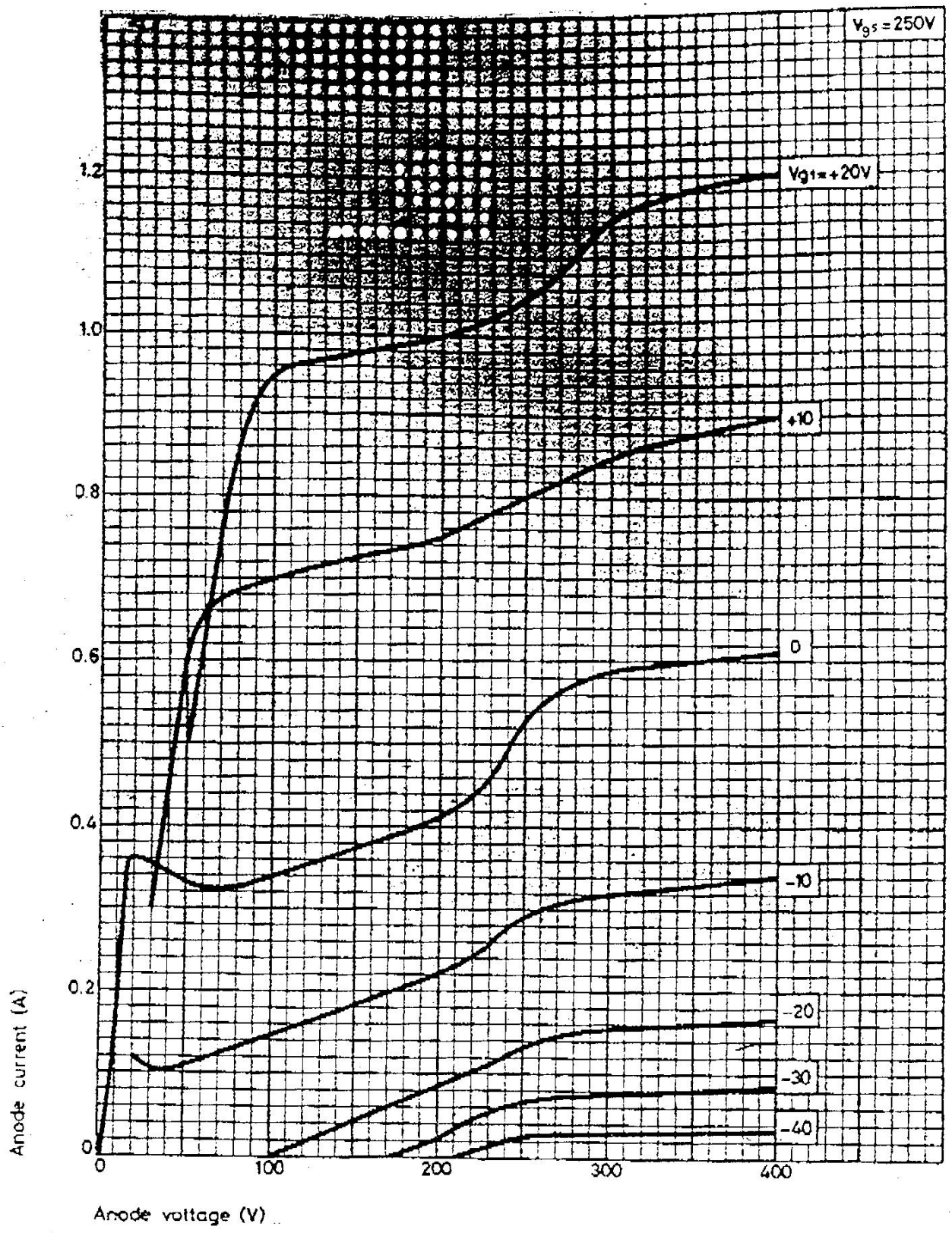


SCREEN CURRENT–ANODE VOLTAGE AT V_{g1} = 0V WITH V_{g2} AS PARAMETER



ANODE CURRENT - ANODE VOLTAGE AT Vg2 = 250 V WITH Vg1

AS PARAMETER



CONTROL GRID AND SCREEN CURRENTS–ANODE VOLTAGE AT V_{g2} = 250V WITH V_{g1} AS PARAMETER