MINISTRY OF SUPPLY (D.C.D.)

VALVE ELECTRONIC

CV2136

Specification MAP/CV.2136
Issue 4 Dated: 3.8.51
To be read in conjunction with K1001

SECURITY	
Specification	Valve
UNCLASSIFIED	UNCLASSIFIED

⟶ Indicates a change

TYPE OF VALVE - Output Beam Tetrode
CATHODE - Indirectly Heated
ENVELOPE - Glass, unmetallised
PROTOTYPE - VX.7062

MARKING

See K1001/4

RATING		Note
Heater Voltage (V)	6.3	
Heater Current (A)	0.45	
Max. Anode Voltage (V)	350	A
Max. Screen Voltage (V)	310	A
Max. Anode Dissipation (W)	13.2	A
Max. Screen Dissipation (W)	2.2	A
Mutual Conductance (mA/V)	4.1	B
Anode Impedance (KΩ)	50	B

CAPACITANCES (pF)

Cag (Nom.)	0.6	C
Cge (Nom.)	8.5	C
Cae (Nom.)	7.5	C

BASE

B9A

CONNECTIONS

Pin	Electrode
1	Control Grid
2	Control Grid
3	Cathode
4	Heater
5	Heater
6	Not Connected
7	Anode
8	Screen Grid
9	Beam Plates

DIMENSIONS

See K.1001/A1/D4

Dimension	Min.	Max.
A mm	-	66.7
B mm	-	22.2
L mm	-	60.3

NOTES

A. Absolute maximum values.

B. Measured at Va = Vg2 = 250V; Vg3 = 0V; Vg1 = -12.5V.

C. Measured without Metal Screen

CV2136

TESTS

To be performed in addition to those applicable in K1001

	Test Conditions					Test	Limits		No. Tested	Note
	Vh	Va	Vg3	Vg2	Vg1		Min.	Max.		
a	6.3	-	-	-	-	Ih (A)	0.41	0.49	100% or S	
b	6.3	250	0	250	-12.5	Ia (mA)	33.0	57.0	100%	1
c	6.3	250	0	250	-12.5	Ig 2 (mA)	-	7.5	100% or S	
d	6.3	250	0	250	-12.5	gm (mA/V)	3.0	5.2	100%	
e	6.3	250	0	250	-12.5	Reverse Igl (μA)	-	2.0	100%	
f	6.3	30	30	30	30	Emission (mA)	100	-	100%	2

NOTES

1. Tested first with pin 1 at voltage Vg1, and pin 2 disconnected and then with pin 2 at voltage Vg1 and pin 1 disconnected.

2. Test to be applied only for sufficient time to obtain a steady reading.

DATA SHEET

Valve Electronic Type CV 2136

TYPICAL OPERATING CONDITIONS

Class A Amplifier (Single Ended) Triode connection (Pins 7 and 8 strapped)

Heater voltage	6.3	6.3	volts
Anode voltage	250	285	volts
Grid voltage	-13.5	-19	volts
Autobias resistor (R_k)	300	470	ohms
Anode impedance (r_a)	2090	2250	ohms
Anode current (no signal)	45	40	mA
Amplification factor (μ)	9.2	9.0	
Mutual conductance	4.4	4.0	mA/V
Anode load resistor (R_a)	4000	4500	ohms
Peak A.F. grid voltage	13.5	19	volts
Total harmonic distortion	3.5	6.0	%
Power output	0.75	1.35	watts

Class A Amplifier Push Pull Triode connection (Pins 7 and 8 strapped)

Heater voltage	6.3	6.3	volts
Anode voltage	250	285	volts
Grid voltage	-13.5	-19	volts
Autobias resistor (R_k)	150	240	ohms
Anode current (no signal)	90	78	mA
Output load (anode-anode) (R_a - a)	4000	4500	ohms
Peak A.F. grid voltage (grid-grid)	27	38	volts
Total harmonic distortion	0.4	0.5	%
Power output	1.7	3.1	watts

Note: Values given are for two valves.

Class A Amplifier (Single ended) Tetrode connection

Heater voltage	6.3	6.3	6.3	6.3	6.3	6.3	volts
Anode voltage	180	180	250	250	315	315	volts
Screen voltage	180	180	250	250	225	225*	volts
Grid voltage	-8.5	-	-12.5	-	-13	-	volts
Autobias Resistor	-	250	-	240	-	330	ohms
Anode current	29	29	45	47	34	34	mA
Screen current	3.0	3.0	4.5	5.0	2.2	2.2	mA
Anode impedance (r_a)	58000	-	52000	-	77000	-	ohms
Mutual conductance	3.7	-	4.1	-	3.75	-	mA/V
Anode load resistor	5500	5500	5000	5000	8500	8500	ohms
Peak A.F. grid voltage	8.5	9.0	12.5	13.5	13	13.5	volts
Total harmonic distortion	7.0	7.5	7.5	8	10	11.5	%
Power output	2.0	1.7	4.5	4.5	5.2	5.0	watts

*The screen voltage, where lower than the anode voltage, should be obtained from a potentiometer across the H.T. line to chassis adequately by-passed to A.F. signals rather than by means of a series resistor to avoid fluctuation of the screen voltage as the current drives up near maximum output.

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Class A Amplifier (Push Pull) Tetrode connection

Heater voltage	6.3	6.3	6.3	volts
Anode voltage	250	250	315	volts
Screen voltage	250	250	250	volts
Grid voltage	-12.5	-	-	volts
Autobias resistor	-	120	125	ohms
Peak A.F. grid-grid voltage	25	26	28	volts
No signal anode current	90	94	98	mA
Max. signal anode current	96	98	102	mA
No signal screen current	9	9.5	8.5	mA
Max. " " "	13.5	13.5	11.5	mA
Anode impedance (r_a)	52000	-	-	ohms
Mutual conductance	4.1	-	-	mA/V
Output load (anode to anode)	10000	10000	10000	ohms
Total harmonic distortion	2	2.5	2.5	%
Power output	9	9	12.5	watts

Note: Values given are for two valves.

Class AB1 Amplifier (Push Pull) Tetrode connection

Heater voltage	6.3	6.3	6.3	6.3	volts
Anode voltage	250	250	285	285	volts
Screen voltage	250	250	285	285	volts
Grid voltage	-15	-	-19	-	volts
Autobias resistor	-	200	-	260	ohms
Peak A.F. grid-grid voltage	30	34	38	45	volts
No signal anode current	70	70	70	70	mA
Max. " " "	80	74	94	78.5	mA
No signal screen "	5	5	4	4	mA
Max. " " "	11.5	11.5	11.5	10	mA
Load resistance (anode-anode)	10000	10000	8000	8000	ohms
Total harmonic distortion	3	3.5	1.8	1	%
Power output	10	10	13	12	watts

Note: Values given are for two valves.

Class AB2 Amplifier (Push Pull) Tetrode connection

Heater voltage	6.3	volts
Anode voltage	315	volts
Screen voltage	285	volts
Grid voltage	-19	volts
Peak A.F. grid-grid voltage	80	volts
No signal anode current	70	mA
Max. " " "	155	mA
No signal screen "	4	mA
Max. " " "	16	mA
Peak grid input power	400	mW
Load resistor (anode-anode)	5000	ohms
Total harmonic distortion	7	%
Power output	30	watts

Note: Values given are for two valves.

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It is essential for Class AB2 operation that the regulation of the anode, screen and grid bias supplies is such that the voltages remain constant within 5% between no signal and maximum signal conditions. The driver stage should be capable of supplying the grids of the two valves with the specified peak voltages with low distortion. The effective resistance per grid circuit represented by the driver valve and/or transformer should not exceed 500 ohms and the effective impedance represented by leakage inductance or equivalent at the highest desired response frequency should not exceed 700 ohms.

General recommendations

(a) Audio Frequencies

Due to the relatively high slope of this valve, trouble may be experienced due to parasitic oscillation, and it is advised that a resistor of 100 ohms is wired in series with the anode, directly connected to the valve holder contact. This resistor should be reduced to 47 ohms in the case of Class AB2 operation.

A series grid resistor may also be employed, if necessary wired directly to the valve holder grid contact, but the value must be carefully chosen bearing the frequency response in mind. Such a resistor should never exceed 100,000 ohms for Class A operation, and should not be employed for Class AB2 operation.

The type of input coupling used should not introduce too much resistance into the grid circuit. It is preferable that such resistance does not exceed 100,000 ohms except in the case of Class A operation under automatic bias conditions where the value may be as high as 500,000 ohms.

(b) Radio Frequencies

Whilst these valves are not primarily intended for operation as an oscillator or as a frequency multiplier they may be used for such purpose up to a maximum frequency of 160 Mc/s.

The D.C. grid current must not at any time exceed 3 mA.

It is preferable that the screen supply voltage should not be obtained via a series dropping resistor, and the D.C. bias should be obtained from a fixed bias or from a combination of grid leak bias and a cathode automatic bias resistor.

The bias required as a Class C frequency multiplier is of the order of -80 volts and the output with normal circuit practice is adequate at 2nd or 3rd harmonic to drive an R.F. amplifier employing valves such as the CV.124 or CV.2129.

When these valves are used as crystal oscillators in a Tri-tet circuit care should be exercised to ensure a safe crystal current if the screen voltage is 180 volts or higher.

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If this valve is used as a Class 'B' or Class 'C' R.F. amplifier neutralisation will normally be necessary at the higher frequencies. Power amplifier operation is not recommended above 100 Mc/s due to the relatively high input drive required. At this and higher frequencies it is more economical to use the valve as a frequency multiplier.

Keying should not be achieved by disconnection of the cathode unless a resistor of not more than 100,000 ohms is permanently connected between cathode and chassis earth.

Under no circumstances should the anode tank circuit of a Class 'B' or 'C' amplifier be tuned through resonance with the aerial or succeeding valve load disconnected. Such procedure causes a violent drop in the anode current and a corresponding increase in screen current which may damage the screen, together with a very high voltage between anode and other electrodes which is liable to break down the insulation of the button base.

Typical operation

R.F. Doubler Continuous ratings as a doubler without modulation			
D.C. anode voltage	250	300	volts
D.C. screen voltage	250	250	volts
D.C. screen series resistor	-	9100	ohms
D.C. grid voltage	-60	-70	volts
D.C. grid resistor	20000	23000	ohms
D.C. cathode resistor	0	0	ohms
Peak R.F. grid voltage	100	100	volts
D.C. anode current	52	46	mA
D.C. screen current	5.0	5.5	mA
D.C. grid current (approx.)	3.0	3.0	mA
Driving power (")	0.3	0.3	watts
Power output	5.0	5.5	watts*

*Measured with typical tank coil doubling from 7 - 14 Mc/s.

R.F. Trebler Continuous ratings as a trebler without modulation		
D.C. anode voltage	300	volts
D.C. screen voltage	250	volts
D.C. screen series resistor	12500	ohms
D.C. grid voltage	-94	volts
D.C. cathode resistor	500	ohms
D.C. grid resistor	23000	ohms
Peak R.F. grid voltage	150	volts
D.C. anode current	46	mA
D.C. screen current	4	mA
D.C. grid current (approx.)	3	mA
Driving power (approx.)	0.45	watts
Power output	2.5	watts*

*Measured with typical tank coil trebling from 7 - 21 Mc/s.

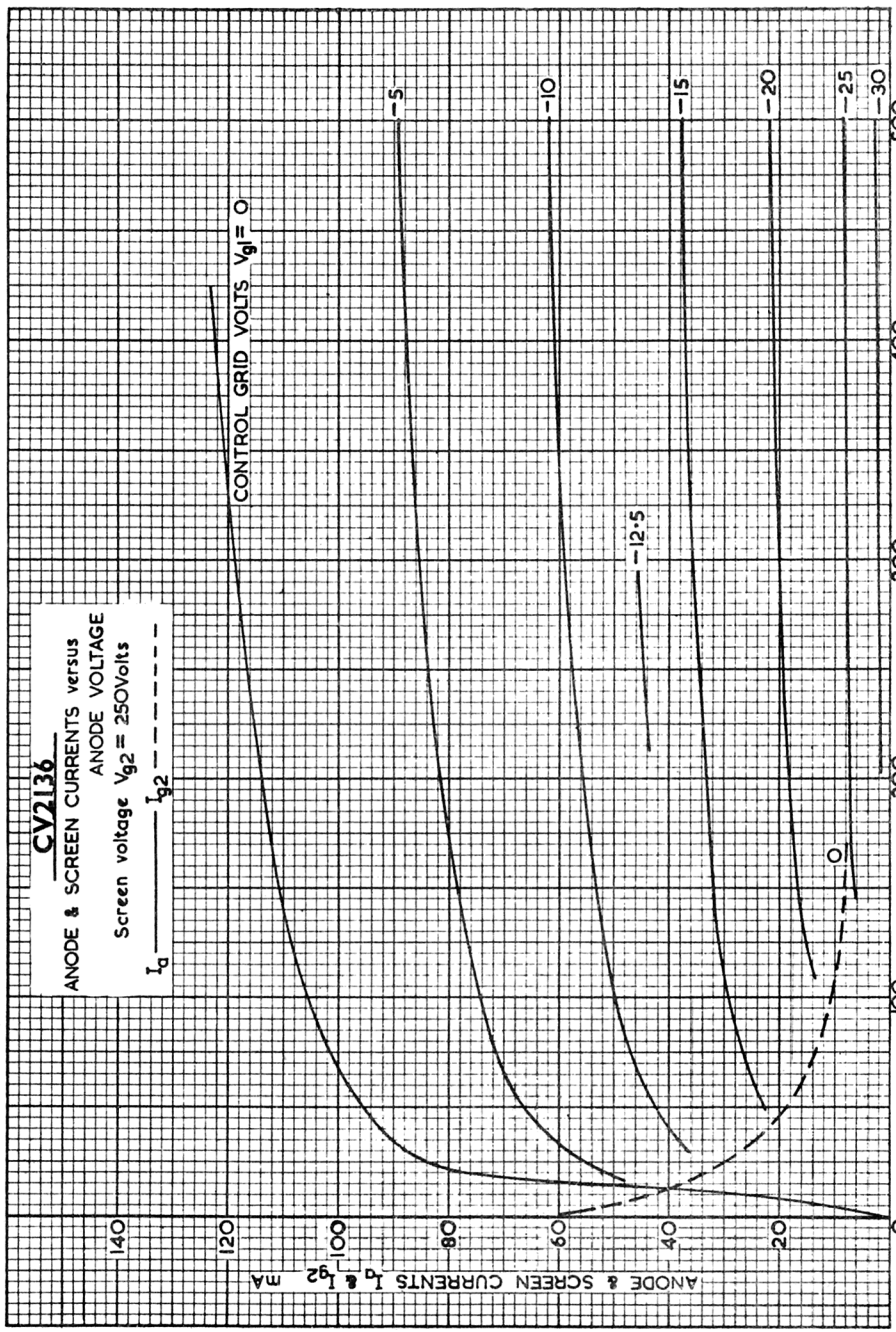
CV 2136

TYPICAL

OPERATING

CURVES.

DATA SHEET


CV2136
ANODE & SCREEN CURRENTS versus ANODE VOLTAGE
Screen voltage V_{g2} = 250Volts
I_a ——— I_{g2} - - - - - -
CONTROL GRID VOLTS V_{g1} = 0
-5
-10
-12·5
-15
-20
-25
-30
0
ANODE & SCREEN CURRENTS I_a & I_{g2} mA
0
20
40
60
80
100
120
140
ANODE VOLTAGE VOLTS
100
200
300
400
500

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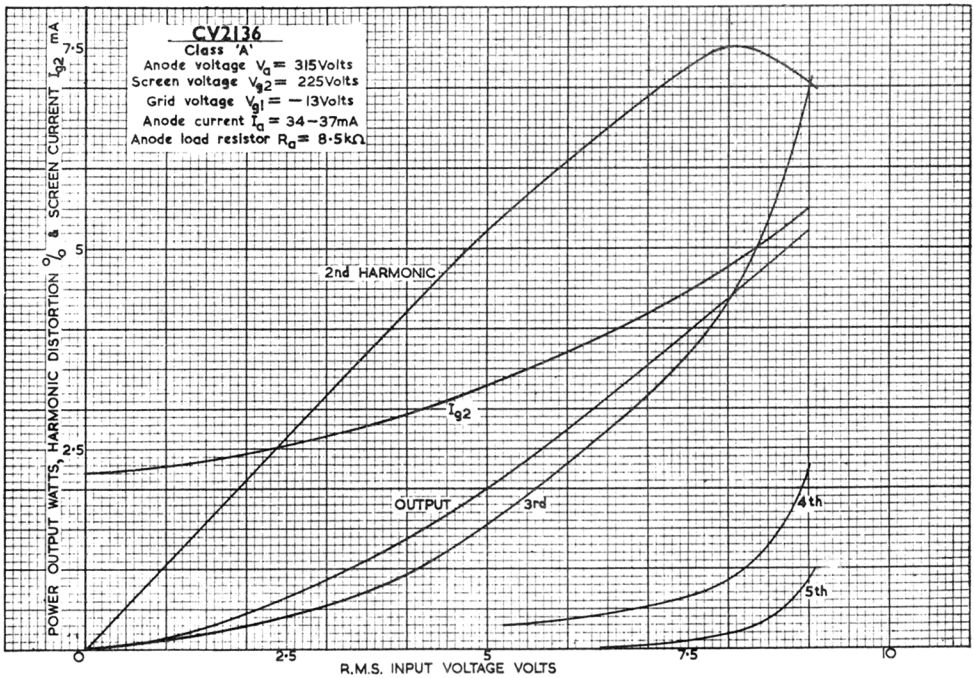
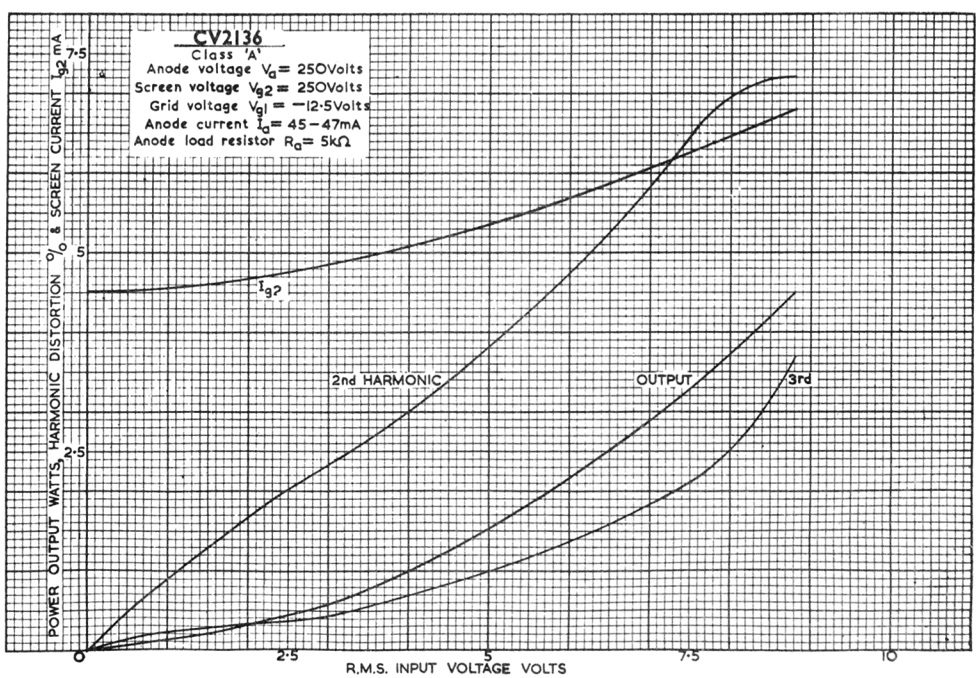
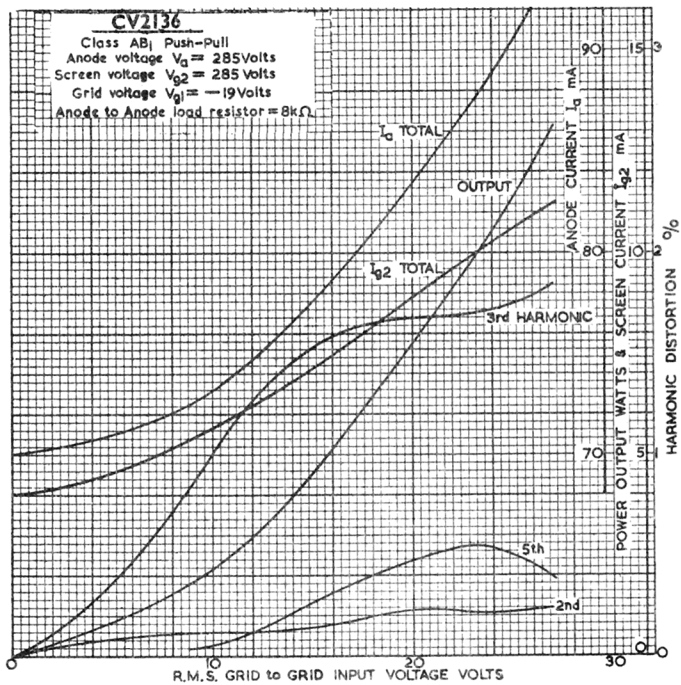
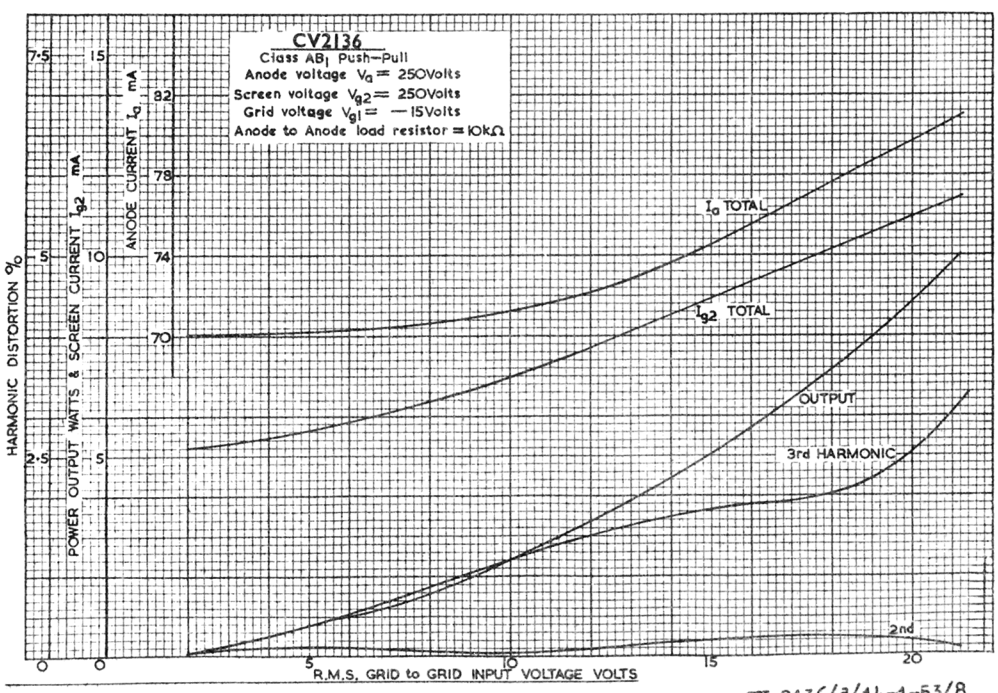
ANODE & SCREEN CURRENTS versus ANODE VOLTAGE
Screen voltage V_{g2} = 225 Volts
I_a ——— I_{g2} — — — —
CONTROL GRID VOLTS V_{g1} = 0
−5
−10
0
13
−15
−20
−26
ANODE CURRENT I_a mA
SCREEN CURRENT I_{g2} mA
ANODE VOLTAGE VOLTS
CV2136
ANODE & GRID CURRENTS versus ANODE VOLTAGE
Triode connected (g2 connected to anode)
I_{a+g2} ——— I_{g1} — — — —
CONTROL GRID VOLTS V_{g1} = +20
+10
0
−10
−20
−30
−40
−50
−60
±20
12·5 WATTS
ANODE & GRID CURRENTS I_{a+g2} & I_{g1} mA
ANODE VOLTAGE VOLTS





CV 2136/d/14-1-53/7





CV 2136/a/14-1-53/8

DATA SHEET

CV2136
Triode connected
(g2 connected to anode)
Class 'A' Push-Pull
Anode voltage V_a = 285Volts
Anode to Anode load resistor=4·5kΩ
Cathode bias resistor R_k=240Ω
I_a TOTAL
OUTPUT
2nd HARMONIC
3rd
HARMONIC DISTORTION %
POWER OUTPUT WATTS
ANODE CURRENT I_a mA
R.M.S. GRID to GRID INPUT VOLTAGE VOLTS

CV2136
Class AB_2 Push-Pull
Anode voltage V_a = 315Volts
Screen voltage V_{g2} = 285Volts
Grid voltage V_{g1} = −19Volts
Anode to Anode load resistor= 5kΩ
I_a TOTAL
I_{g2} TOTAL
OUTPUT
3rd HARMONIC
I_{g1}
5th
2nd
7th
HARMONIC DISTORTION %, GRID CURRENT I_{g1} mA & SCREEN CURRENT I_{g2} mA
POWER OUTPUT WATTS
ANODE CURRENT I_a mA
R.M.S. GRID to GRID INPUT VOLTAGE VOLTS