

# OUTPUT PENTODE

# EL34

Output pentode rated for 25W anode dissipation,  
intended for use in a.c. mains operated equipment.

## HEATER

|       |     |   |
|-------|-----|---|
| $V_h$ | 6.3 | V |
| $I_h$ | 1.5 | A |

## CAPACITANCES

|            |      |    |
|------------|------|----|
| $C_{out}$  | 8.4  | pF |
| $C_{In}$   | 15.2 | pF |
| $C_{a-g1}$ | <1.0 | pF |
| $C_{g1-h}$ | <1.0 | pF |
| $C_{h-k}$  | 11   | pF |

## CHARACTERISTICS

### Pentode connection

|                                                   |       |            |
|---------------------------------------------------|-------|------------|
| $V_a$                                             | 250   | V          |
| $V_{g2}$                                          | 250   | V          |
| $V_{g3}$                                          | 0     | V          |
| $I_a$                                             | 100   | mA         |
| $I_{g2}$                                          | 15    | mA         |
| $V_{g1}$                                          | -12.2 | V          |
| $g_m$                                             | 11    | mA/V       |
| $r_a$                                             | 15    | k $\Omega$ |
| $\mu_{g1-g2}$                                     | 11    |            |
| $V_{g1 \text{ max.}}$<br>( $I_{g1} = +0.3\mu A$ ) | -1.3  | V          |

### Triode connection ( $g_2$ connected to a)

|          |       |          |
|----------|-------|----------|
| $V_a$    | 250   | V        |
| $I_a$    | 70    | mA       |
| $V_{g1}$ | -15.5 | V        |
| $g_m$    | 11.5  | mA/V     |
| $r_a$    | 910   | $\Omega$ |
| $\mu$    | 10.5  |          |

## OPERATING CONDITIONS AS SINGLE VALVE CLASS "A" AMPLIFIER

### Pentode connection

|                                       |     |     |            |
|---------------------------------------|-----|-----|------------|
| $V_a$                                 | 250 | 300 | V          |
| $V_{g2}$                              | 250 | 300 | V          |
| $V_{g3}$                              | 0   | 0   | V          |
| $R_k$                                 | 106 | 190 | $\Omega$   |
| $R_a$                                 | 2.0 | 3.5 | k $\Omega$ |
| $I_a$                                 | 100 | 83  | mA         |
| $I_{g2}$                              | 15  | 13  | mA         |
| $V_{in(r.m.s.)}$ ( $P_{out} = 50mW$ ) | 500 | 450 | mV         |
| $V_{in(r.m.s.)}$                      | 8.0 | 8.2 | V          |
| * $P_{out}$                           | 11  | 11  | W          |
| * $D_{tot}$                           | 10  | 10  | %          |

\* $P_{out}$  and  $D_{tot}$  are measured at fixed bias and therefore represent the power output available during the reproduction of speech and music. When a sustained sine wave is applied to the control-grid the bias across the cathode resistor will readjust itself as a result of the increased anode and screen-grid currents. This will result in a reduction in power output of approximately 10%.

### OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL

Distributed load conditions for maximum output (screen-grid tapping at 20% of primary turns)

|                       |  |                |            |
|-----------------------|--|----------------|------------|
| $V_b$                 |  | 450            | V          |
| $R_{g2}$ (per valve)  |  | 1.0            | k $\Omega$ |
| $R_k$ (per valve)     |  | 500            | $\Omega$   |
| $R_{a-a}$             |  | 7.0            | k $\Omega$ |
| $I_{a(o)}$            |  | $2 \times 55$  | mA ←       |
| $I_{g2(o)}$           |  | $2 \times 9.0$ | mA ←       |
| $V_{in(g1-g1)r.m.s.}$ |  | 55.2           | V          |
| $P_{out}$             |  | 40             | W          |
| $D_{tot}$             |  | 4.5            | %          |
| $I_a$ (max. sig.)     |  | $2 \times 74$  | mA         |
| $I_{g2}$ (max. sig.)  |  | $2 \times 9.0$ | mA         |

Distributed load conditions for minimum distortion (with screen-grid tapping at 43% of primary turns)

|                       |                 |                 |            |
|-----------------------|-----------------|-----------------|------------|
| $V_b$                 | 430             | 430             | V          |
| $R_{g2}$ (per valve)  | 1.0             | 1.0             | k $\Omega$ |
| $R_k$ (per valve)     | 470             | 470             | $\Omega$   |
| $R_{a-a}$             | 6.0             | 6.0             | k $\Omega$ |
| $I_{a(o)}$            | $2 \times 62.5$ | $2 \times 62.5$ | mA         |
| $I_{g2(o)}$           | $2 \times 10$   | $2 \times 10$   | mA         |
| $V_{in(g1-g1)r.m.s.}$ | 35              | 50              | V          |
| $P_{out}$             | 20              | 34              | W          |
| $D_{tot}$             | 0.35            | 2.5             | %          |
| $I_a$ (max. sig.)     | $2 \times 65$   | $2 \times 70$   | mA         |
| $I_{g2}$ (max. sig.)  | $2 \times 10.2$ | $2 \times 14$   | mA         |

### OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL

#### Fixed bias

|                       |                  |                  |            |
|-----------------------|------------------|------------------|------------|
| $V_b$                 | 375              | 400              | V          |
| $V_{g3}$              | 0                | 0                | V          |
| * $R_{g2}$            | 600              | 800              | $\Omega$   |
| $V_{g1}$              | -33              | -36              | V          |
| $R_{a-a}$             | 3.5              | 3.5              | k $\Omega$ |
| $I_{a(o)}$            | $2 \times 30$    | $2 \times 30$    | mA         |
| $I_{g2(o)}$           | $2 \times 4.7$   | $2 \times 4.5$   | mA         |
| $V_{in(g1-g1)r.m.s.}$ | 46.7             | 50               | V          |
| $P_{out}$             | 48               | 54               | W          |
| $D_{tot}$             | 2.8              | 1.6              | %          |
| $I_a$ (max. sig.)     | $2 \times 107.5$ | $2 \times 110.5$ | mA         |
| $I_{g2}$ (max. sig.)  | $2 \times 23.5$  | $2 \times 23$    | mA         |

\*Screen-grid resistor common to both valves.

## Cathode bias

|                       |                 |                 |            |
|-----------------------|-----------------|-----------------|------------|
| $V_b$                 | 375             | 450             | V          |
| $V_{g3}$              | 0               | 0               | V          |
| $*R_{g2}$             | 0.47            | 1.0             | k $\Omega$ |
| $R_k$ (per valve)     | 260             | 465             | $\Omega$   |
| $R_{a-a}$             | 3.5             | 6.5             | k $\Omega$ |
| $I_{a(o)}$            | $2 \times 75$   | $2 \times 60$   | mA         |
| $I_{g2(o)}$           | $2 \times 12.5$ | $2 \times 10$   | mA         |
| $V_{in(g1-g1)r.m.s.}$ | 40              | 54              | V          |
| $P_{out}$             | 35              | 40              | W          |
| $D_{tot}$             | 1.7             | 5.1             | %          |
| $I_a(max. sig.)$      | $2 \times 94$   | $2 \times 71.5$ | mA         |
| $I_{g2(max. sig.)}$   | $2 \times 19.5$ | $2 \times 22$   | mA         |

\*Screen-grid resistor common to both valves.

## OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL

**Triode connection** ( $g_2$  connected to a,  $g_3$  to k) with separate cathode bias resistors.

### With $R_k$ bypassed

|                       |               |            |
|-----------------------|---------------|------------|
| $V_b$                 | 430           | V          |
| $V_a$                 | 400           | V          |
| $V_{g3}$              | 0             | V          |
| $R_k$ (per valve)     | 440           | $\Omega$   |
| $R_{a-a}$             | 5.0           | k $\Omega$ |
| $I_{a(o)}$            | $2 \times 70$ | mA         |
| $V_{in(g1-g1)r.m.s.}$ | 48            | V          |
| $P_{out}$             | 19            | W          |
| $D_{tot}$             | 1.8           | %          |
| $I_a(max. sig.)$      | $2 \times 75$ | mA         |

### With $R_k$ unbypassed

|                       |               |            |
|-----------------------|---------------|------------|
| $V_b$                 | 430           | V          |
| $V_a$                 | 400           | V          |
| $V_{g3}$              | 0             | V          |
| $R_k$ (per valve)     | 440           | $\Omega$   |
| $R_{a-a}$             | 10            | k $\Omega$ |
| $I_{a(o)}$            | $2 \times 70$ | mA         |
| $V_{in(g1-g1)r.m.s.}$ | 48            | V          |
| $P_{out}$             | 14            | W          |
| $D_{tot}$             | 0.4           | %          |
| $I_a(max. sig.)$      | $2 \times 73$ | mA         |

### OPERATING CONDITIONS FOR TWO VALVES IN PUSH-PULL WITH CONTINUOUS SINE WAVE DRIVE

#### Fixed bias

|                       |                |                |           |
|-----------------------|----------------|----------------|-----------|
| $V_b$                 | 375            | 400            | V         |
| $V_{g3}$              | 0              | 0              | V         |
| $R_{g2}$              | 1.0            | 1.5            | $k\Omega$ |
| $V_{g1}$              | -32            | -35.5          | V         |
| $R_{a-a}$             | 3.5            | 3.5            | $k\Omega$ |
| $I_{a(o)}$            | $2 \times 30$  | $2 \times 30$  | mA        |
| $I_{g2(o)}$           | $2 \times 4.4$ | $2 \times 4.4$ | mA        |
| $V_{in(g1-g1)r.m.s.}$ | 45             | 50             | V         |
| $P_{out}$             | 42             | 51             | W         |
| $D_{tot}$             | 3.0            | 1.8            | %         |
| $I_a(max, sig.)$      | $2 \times 98$  | $2 \times 106$ | mA        |
| $I_{g2(max, sig.)}$   | $2 \times 19$  | $2 \times 21$  | mA        |

#### Cathode bias

Any of the cathode bias conditions published in this data sheet are suitable for continuous sine wave drive.

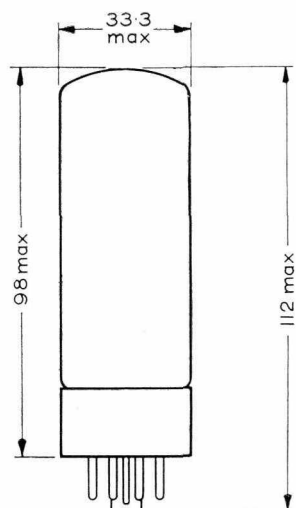
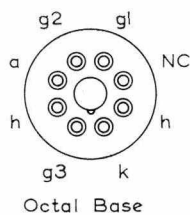
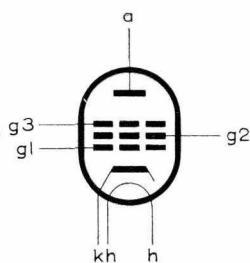
### DESIGN CENTRE RATINGS

|                  |     |           |
|------------------|-----|-----------|
| $V_{a(b)} max.$  | 2.0 | kV        |
| $V_a max.$       | 800 | V         |
| $p_a max.$       | 25  | W         |
| $V_{g2(b)} max.$ | 800 | V         |
| $V_{g2} max.$    | 500 | V         |
| $p_{g2} max.$    | 8.0 | W         |
| $I_k max.$       | 150 | mA        |
| $R_{g1-k} max.$  | 500 | $k\Omega$ |
| $V_{h-k} max.$   | 100 | V         |
| $R_{h-k} max.$   | 20  | $k\Omega$ |

#### Triode connected

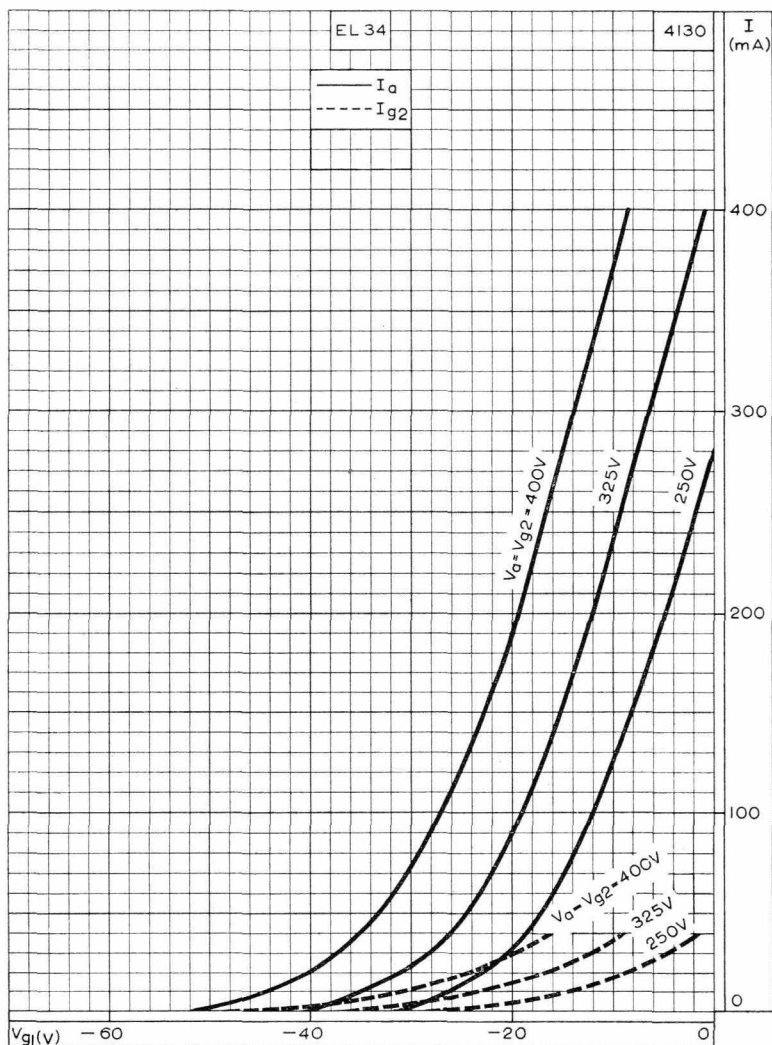
|                              |     |   |
|------------------------------|-----|---|
| $V_a max.$                   | 600 | V |
| $p_{a+g2} max. (V_a = 500V)$ | 30  | W |
| $p_{a+g2} max. (V_a = 600V)$ | 15  | W |

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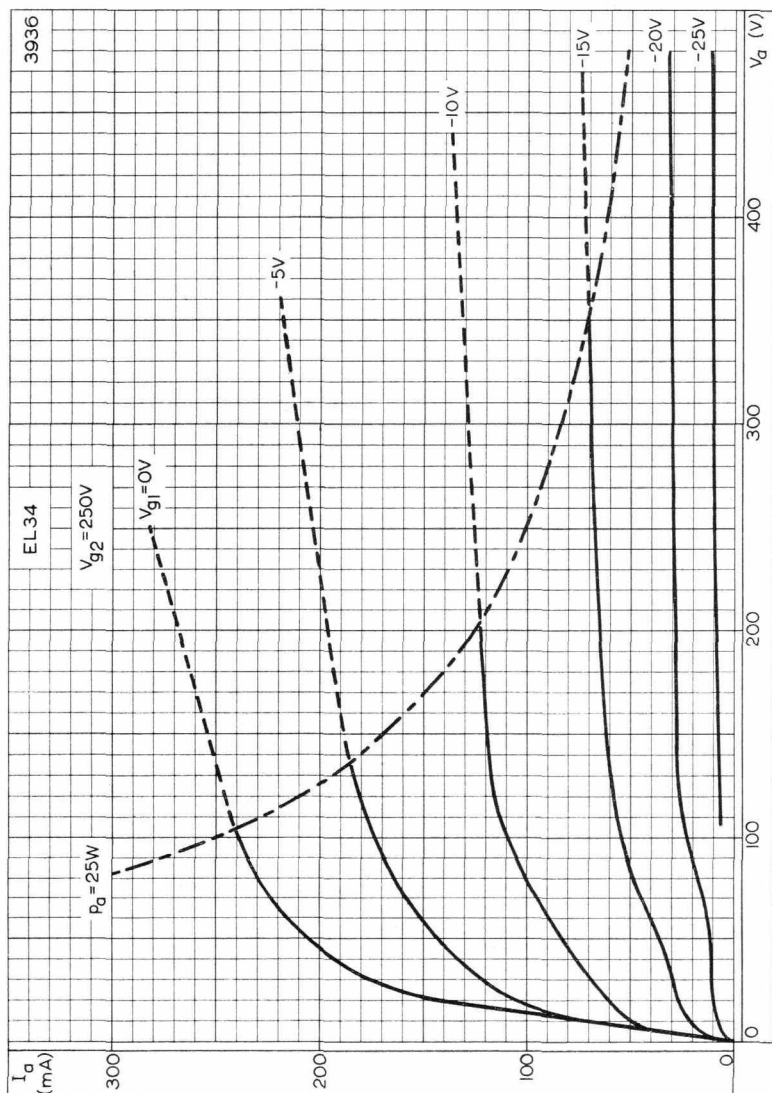


All dimensions in mm

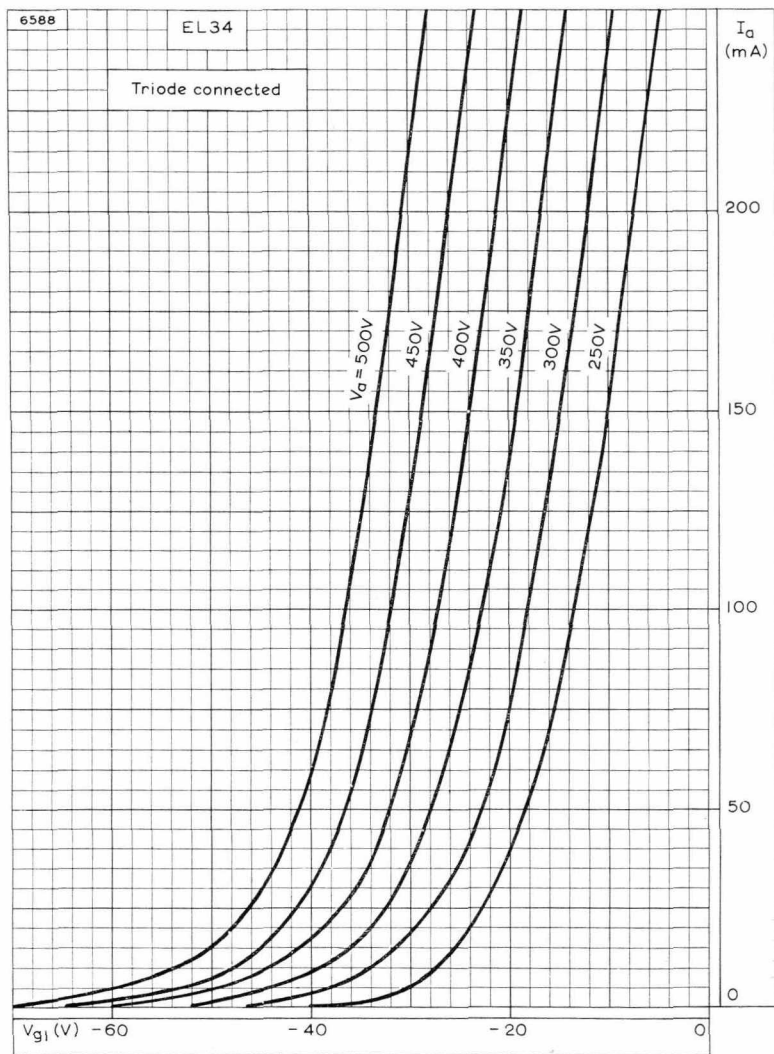




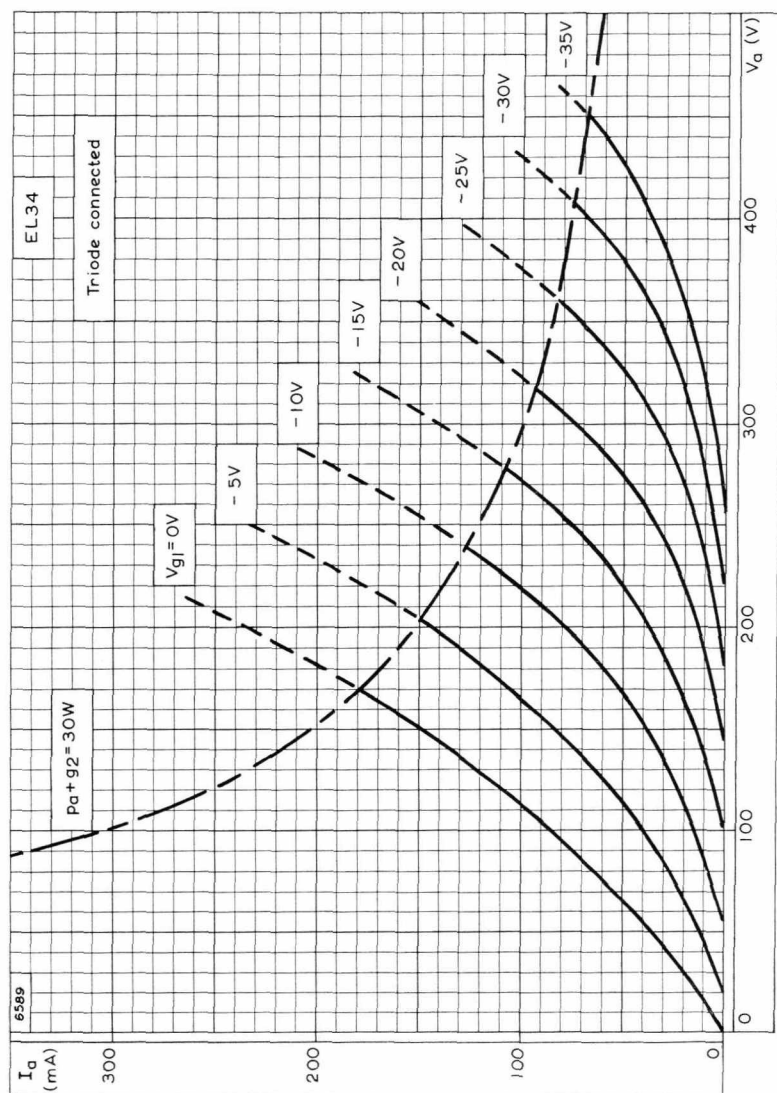
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE AND SCREEN-GRID VOLTAGES AS PARAMETERS



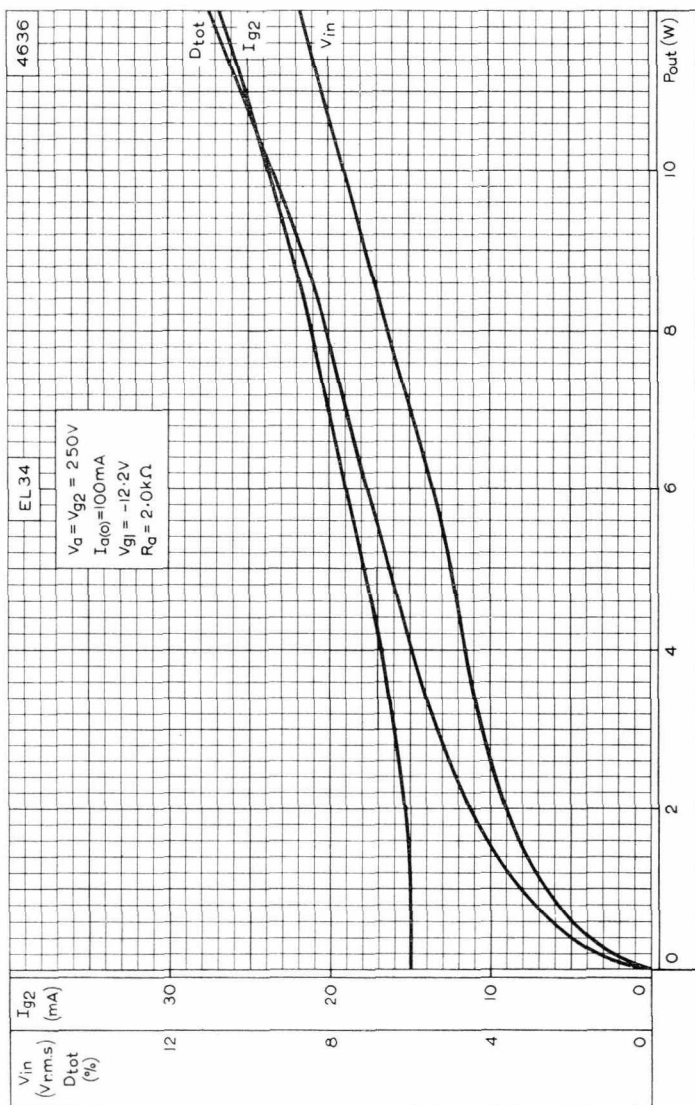
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER



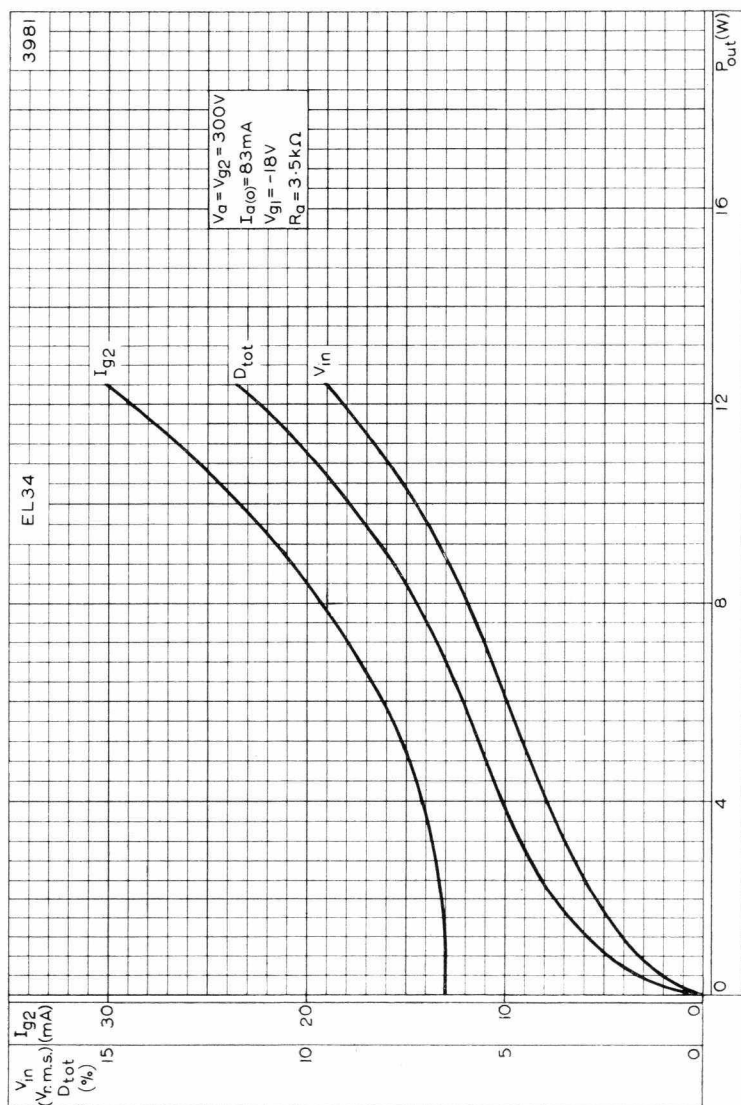
ANODE CURRENT PLOTTED AGAINST CONTROL-GRID VOLTAGE WITH ANODE VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED



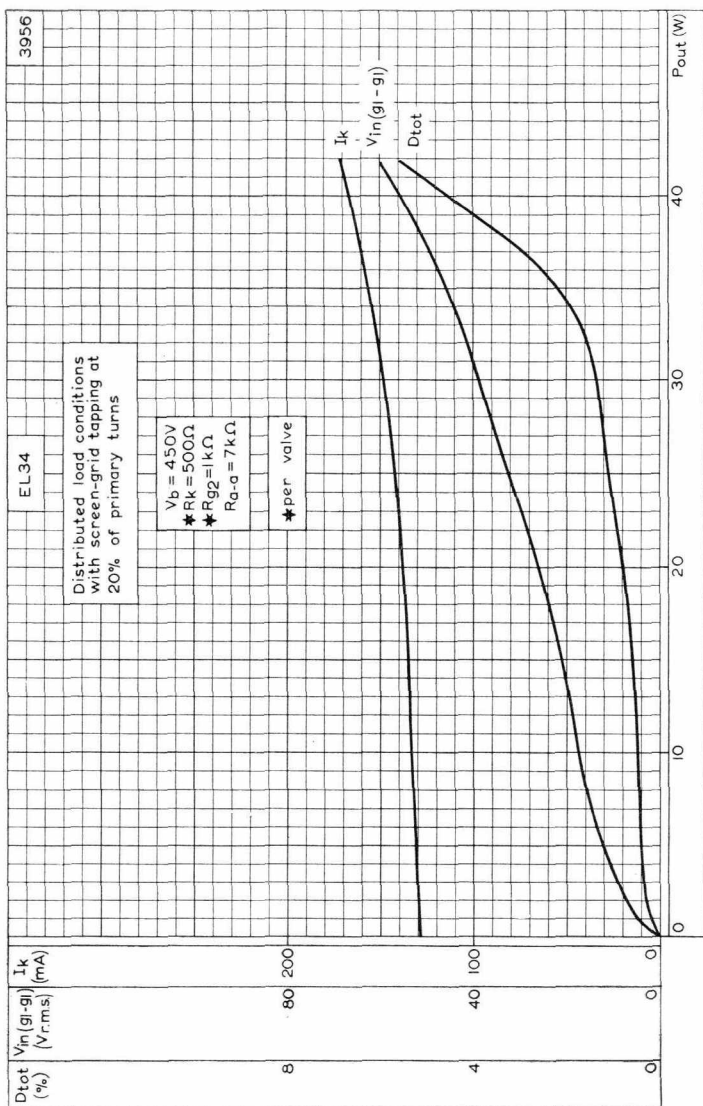
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER WHEN TRIODE CONNECTED



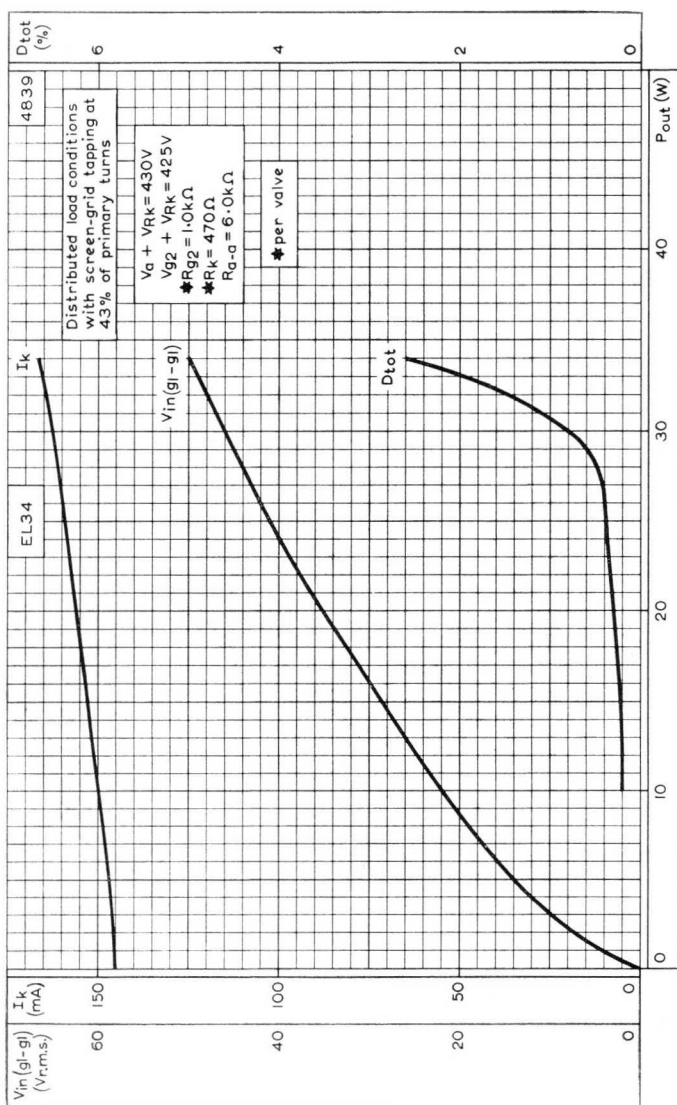
PERFORMANCE OF EL34 WHEN USED AS A SINGLE VALVE CLASS 'A' AMPLIFIER.  $V_{a1} = 250V$



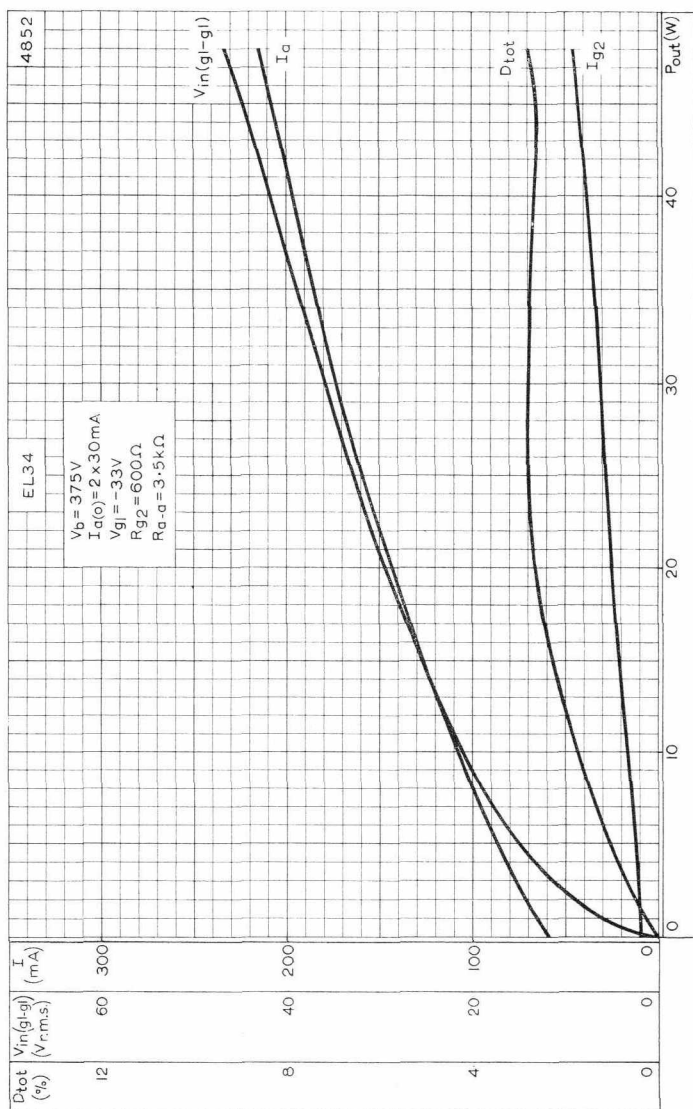
PERFORMANCE OF EL34 WHEN USED AS A SINGLE VALVE CLASS 'A' AMPLIFIER.  $V_{gt} = 300V$



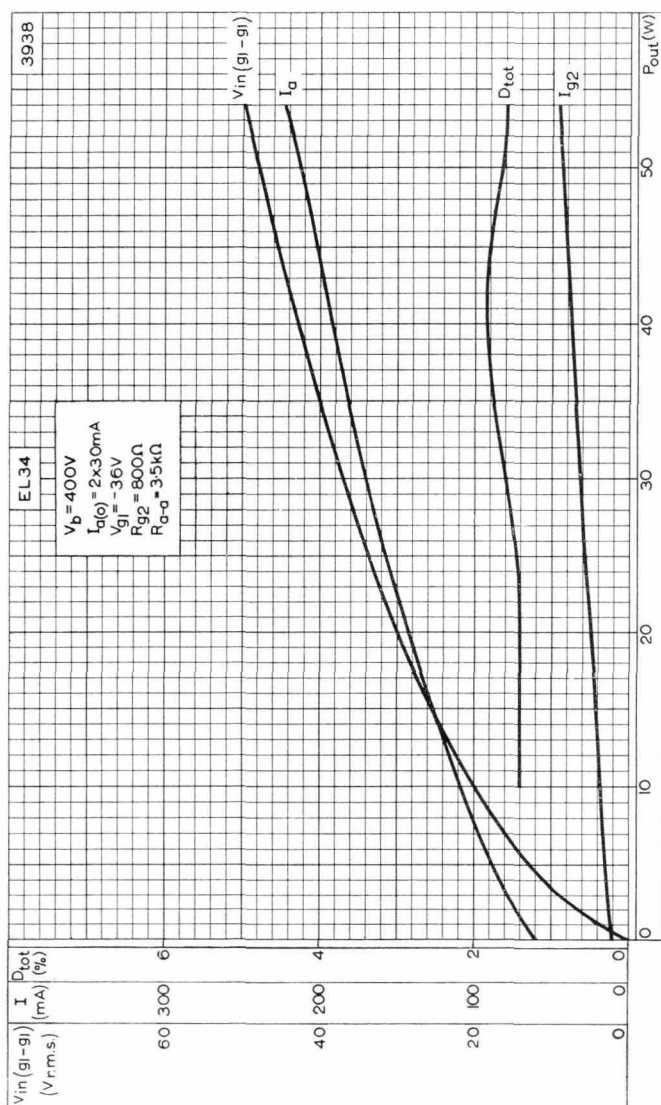
PERFORMANCE OF TWO EL34 IN PUSH-PULL WITH DISTRIBUTED LOAD CONDITIONS. SCREEN-GRID TAPPING AT 20% OF PRIMARY TURNS



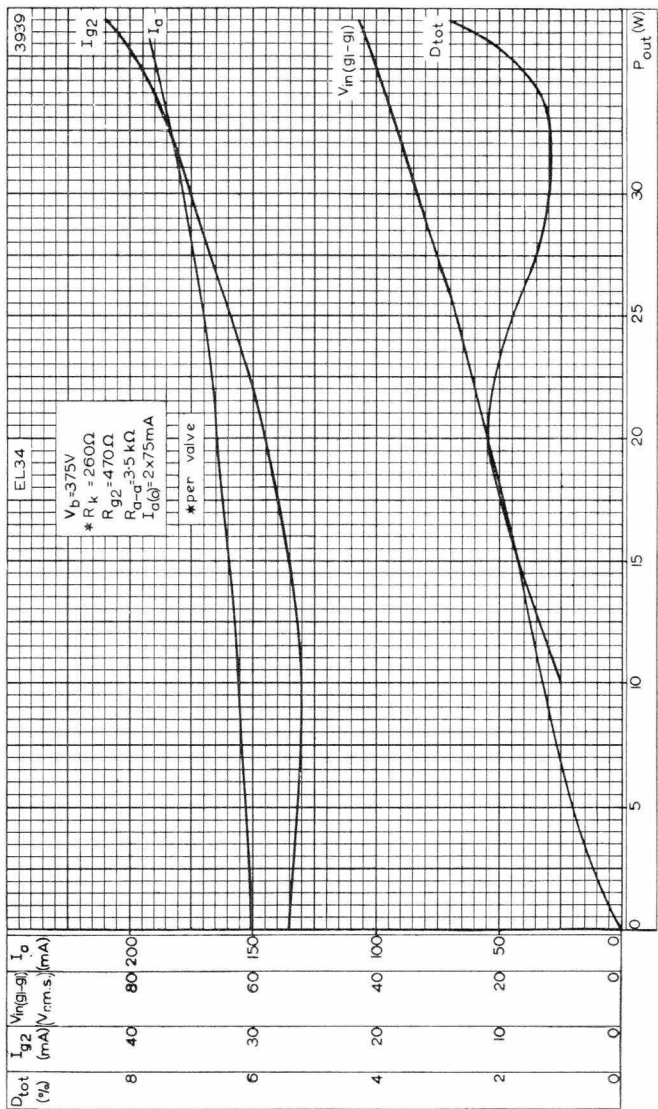
PERFORMANCE OF TWO EL34 IN PUSH-PULL WITH DISTRIBUTED LOAD CONDITIONS. SCREEN-GRID TAPPING AT 43% OF PRIMARY TURNS



PERFORMANCE OF TWO EL34 IN PUSH-PULL WITH FIXED BIAS  
 $V_b = 375V$

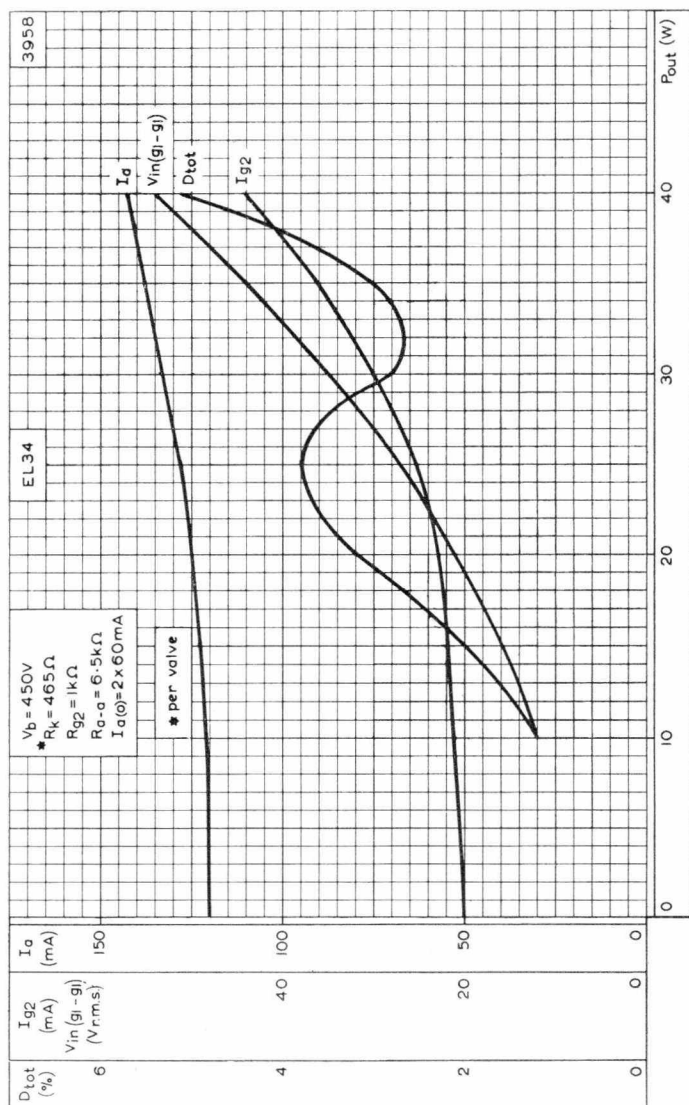


PERFORMANCE OF TWO EL34 IN PUSH-PULL WITH FIXED BIAS  
 $V_b = 400V$

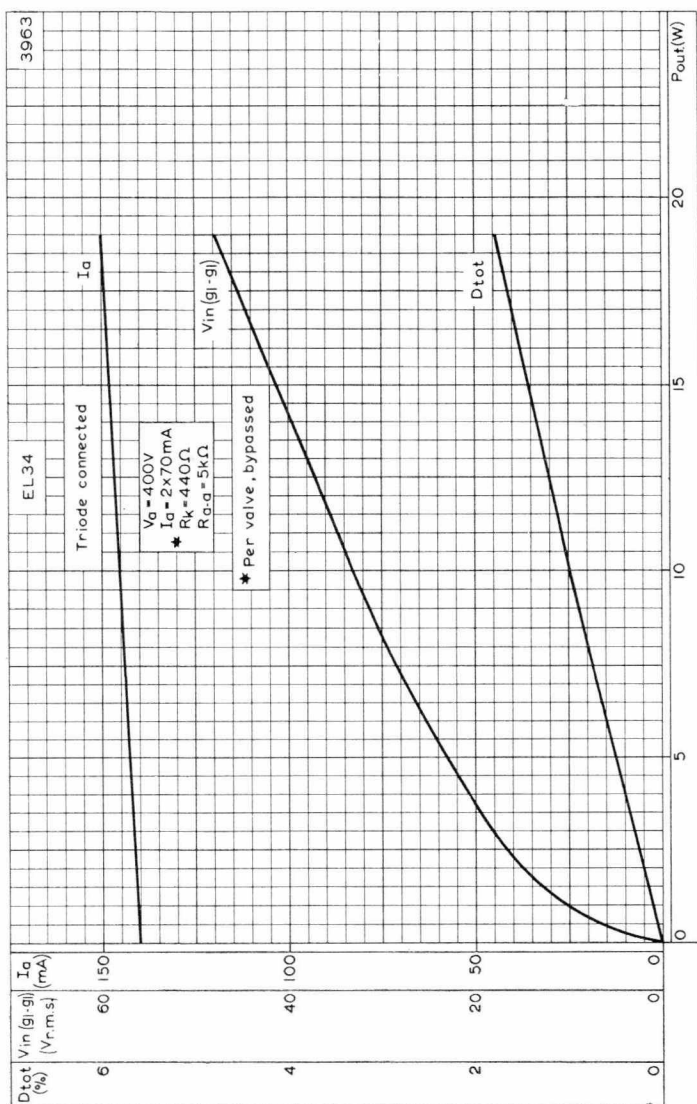


PERFORMANCE OF TWO EL34 IN PUSH-PULL WITH CATHODE BIAS  
 $V_b = 375V$

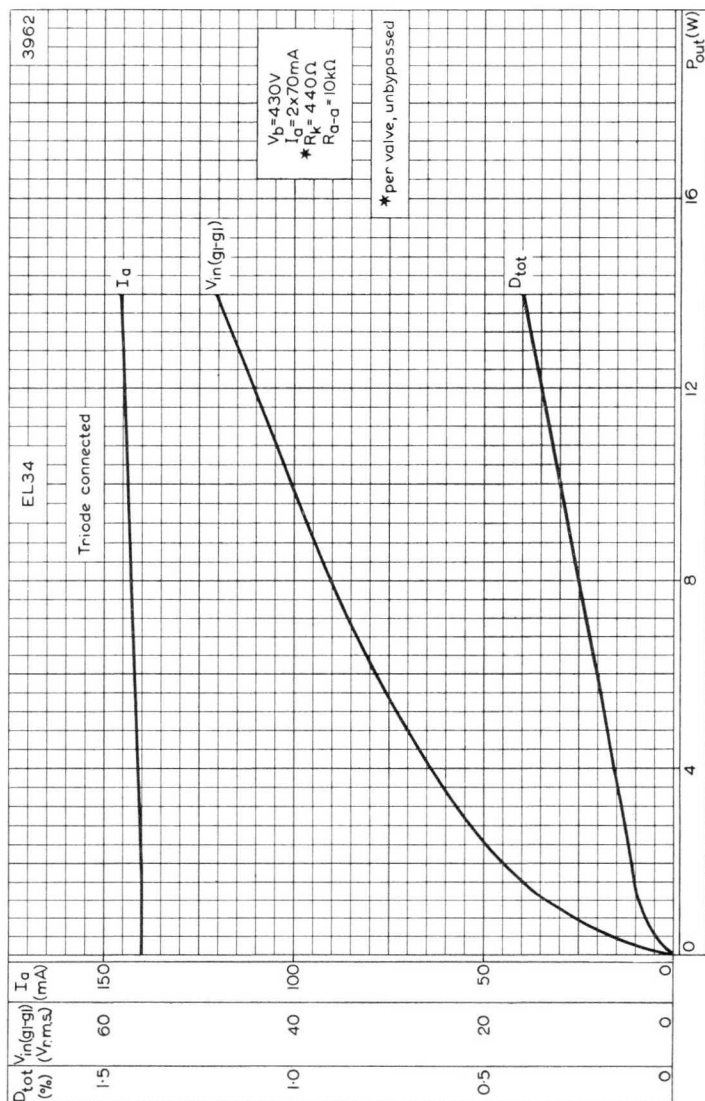




PERFORMANCE OF TWO EL34 IN PUSH-PULL WITH CATHODE BIAS  
 $V_b = 450V$



PERFORMANCE OF TWO EL34 IN PUSH-PULL WHEN TRIODE CONNECTED AND THE CATHODE BYPASSED



PERFORMANCE OF TWO EL34 IN PUSH-PULL WHEN TRIODE CONNECTED AND THE CATHODE UNBYPASSED