

V.H.F. POWER PENTODE

YL1000

Directly heated v.h.f. power pentode for use as a power amplifier or frequency multiplier in portable and mobile equipment.

PRELIMINARY DATA

FILAMENT (parallel operation only)

| | | |
|---|--------------------|----|
| V_f | 1.1 ($\pm 15\%$) | V |
| I_f | 880 | mA |
| t_h max. ($P_{out} = 70\%$ of final value) | 0.5 | s |

CAPACITANCES (unshielded)

| | | |
|------------|-------|-----|
| C_{a-g1} | < 150 | mpF |
| C_{in} | 6.5 | pF |
| C_{out} | 3.8 | pF |
| C_{g1-f} | 1.5 | pF |

CHARACTERISTICS

| | | |
|---------------|------|------|
| V_a | 120 | V |
| V_{g2} | 120 | V |
| V_{g1} | -6.5 | V |
| I_a | 30 | mA |
| I_{g2} | 2.3 | mA |
| g_m | 4.3 | mA/V |
| μ_{g1-g2} | 7.0 | |

DESIGN CENTRE RATINGS

| | | |
|-----------------------|------|--------------|
| $V_{a(b)}$ max. | 500 | V |
| V_a max. | 300 | V |
| P_a max. | 5.0 | W |
| $V_{g2(b)}$ max. | 500 | V |
| V_{g2} max. | 300 | V |
| P_{g2} max. | 1.0 | W |
| V_{g1} max. | -100 | V |
| $+V_{g1(pk)}$ max. | 25 | V |
| I_k max. | 50 | mA |
| R_{g1-f} max. | 2.0 | M Ω |
| T_{bulb} max. | 200 | $^{\circ}$ C |
| V_f max. (absolute) | 1.27 | V |
| V_f min. (absolute) | 0.93 | V |

CLASS 'C' OPERATION F.M. TELEPHONY

Maximum recommended operating conditions

These conditions are based on reaching either the maximum electrode ratings or the point where load efficiency (η_{load}) begins to fall rapidly. The conditions for 175Mc/s were measured in a circuit with a parallel tuned output circuit. If a series tuned output circuit is used at this frequency with the same operating conditions, approx. 10% higher P_{load} figures are obtained.

CLASS 'C' OPERATION F.M. TELEPHONY AT $f = 50\text{Mc/s}$

| Power amplifier | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-----------------|--------------|-----------------|-----------------|--------------------|
| | 300 | 150 | -35 | 40 |
| | 250 | 150 | -35 | 40 |
| | 200 | 150 | -35 | 40 |
| | 150 | 150 | -35 | 32 |
| | 100 | 100 | -23 | 22 |

| Frequency doubler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-------------------|--------------|-----------------|-----------------|--------------------|
| | 300 | 150 | -90 | 40 |
| | 250 | 150 | -90 | 40 |
| | 200 | 150 | -90 | 38 |
| | 150 | 150 | -90 | 32 |
| | 100 | 100 | -60 | 20 |

| Frequency trebler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-------------------|--------------|-----------------|-----------------|--------------------|
| | 300 | 150 | -100 | 29 |
| | 250 | 150 | -100 | 35 |
| | 200 | 150 | -100 | 32 |
| | 150 | 150 | -100 | 28 |
| | 100 | 100 | -100 | 20 |

CLASS 'C' OPERATION F.M. TELEPHONY AT $f = 175\text{Mc/s}$

| Power amplifier | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-----------------|--------------|-----------------|-----------------|--------------------|
| | 300 | 150 | -35 | 30 |
| | 250 | 150 | -35 | 37 |
| | 200 | 150 | -35 | 40 |
| | 150 | 150 | -35 | 40 |
| | 100 | 100 | -23 | 28 |

| Frequency doubler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-------------------|--------------|-----------------|-----------------|--------------------|
| | 300 | 150 | -90 | 26 |
| | 250 | 150 | -90 | 32 |
| | 200 | 150 | -90 | 38 |
| | 150 | 150 | -90 | 32 |
| | 100 | 100 | -90 | 20 |

| Frequency trebler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-------------------|--------------|-----------------|-----------------|--------------------|
| | 250 | 150 | -100 | 27 |
| | 200 | 150 | -100 | 32 |
| | 150 | 150 | -100 | 28 |
| | 100 | 100 | -100 | 20 |

TYPICAL OPERATION CLASS 'C' OPERATION F.M. TELEPHONY

Amplifier at $f = 50\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | $+V_{g1(pk)}$ (V) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|----------------------|-------------------|----------------------|
| 300 | 150 | -35 | 10 | 1.45 | 0.006 | -4.5 | 1.68 | 56 |
| | | | 20 | 2.6 | 0.045 | 2.5 | 3.8 | 63.3 |
| | | | 30 | 3.0 | 0.45 | 9.0 | 6.1 | 67.8 |
| | | | 40 | 3.5 | 0.85 | 14.5 | 8.0 | 66.6 |
| 250 | 150 | -35 | 10 | 1.62 | 0.008 | -2.0 | 1.5 | 60 |
| | | | 20 | 3.1 | 0.08 | 3.5 | 3.3 | 65 |
| | | | 30 | 4.0 | 0.55 | 10 | 5.1 | 68 |
| | | | 40 | 5.0 | 0.95 | 17 | 6.7 | 67 |
| 200 | 150 | -35 | 10 | 1.95 | 0.025 | -1.5 | 1.3 | 65 |
| | | | 20 | 3.8 | 0.20 | 5.5 | 2.75 | 69 |
| | | | 30 | 5.0 | 0.75 | 12 | 4.1 | 68 |
| | | | 40 | 6.0 | 1.05 | 18 | 5.2 | 65 |
| 150 | 150 | -35 | 10 | 2.6 | 0.038 | -1.0 | 1.0 | 67 |
| | | | 20 | 4.3 | 0.24 | 6.0 | 2.05 | 68 |
| | | | 30 | 6.0 | 0.85 | 13.5 | 2.95 | 65.5 |
| 100 | 100 | -23 | 10 | 2.1 | 0.09 | 1.5 | 0.6 | 60 |
| | | | 20 | 3.4 | 0.7 | 9.0 | 1.22 | 61 |
| | | | 25 | 4.5 | 1.2 | 13 | 1.45 | 57.6 |

Frequency doubler at $f_{out} = 50\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | $+V_{g1(pk)}$ (V) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|----------------------|-------------------|----------------------|
| 300 | 150 | -90 | 10 | 1.38 | 0.015 | 0.5 | 1.58 | 52.7 |
| | | | 20 | 2.15 | 0.28 | 8.5 | 3.42 | 57 |
| | | | 30 | 2.6 | 0.73 | 15 | 5.15 | 57.2 |
| | | | 40 | 3.4 | 0.95 | 21 | 6.62 | 55.1 |
| 250 | 150 | -90 | 10 | 1.6 | 0.024 | 1.2 | 1.36 | 54.4 |
| | | | 20 | 2.4 | 0.38 | 9.5 | 3.0 | 60 |
| | | | 30 | 3.2 | 0.80 | 15.5 | 4.45 | 59.3 |
| | | | 40 | 4.2 | 1.02 | 22 | 5.6 | 56 |
| 200 | 150 | -90 | 10 | 2.05 | 0.04 | 2.0 | 1.16 | 58 |
| | | | 20 | 2.9 | 0.45 | 10 | 2.5 | 62.5 |
| | | | 30 | 3.6 | 0.85 | 16.5 | 3.5 | 58.3 |
| 150 | 150 | -90 | 10 | 2.4 | 0.05 | 2.5 | 0.86 | 57.3 |
| | | | 20 | 3.8 | 0.56 | 11 | 1.8 | 60 |
| | | | 30 | 4.5 | 0.95 | 18 | 2.48 | 55.2 |
| 100 | 100 | -60 | 10 | 1.95 | 0.26 | 6.0 | 0.53 | 53 |
| | | | 20 | 3.1 | 0.92 | 13 | 0.94 | 47 |

Frequency trebler at $f_{out} = 50\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | $+V_{g1(pk)}$ (V) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|----------------------|-------------------|----------------------|
| 300 | 150 | -100 | 10 | 1.0 | 0.01 | 0.8 | 1.2 | 40 |
| | | | 20 | 1.75 | 0.26 | 9.5 | 2.6 | 43.3 |
| 250 | 150 | -100 | 10 | 1.16 | 0.012 | 1.0 | 1.05 | 42 |
| | | | 20 | 1.9 | 0.3 | 10 | 2.24 | 44.8 |
| | | | 30 | 2.3 | 0.7 | 17 | 3.2 | 42.7 |
| 200 | 150 | -100 | 10 | 1.4 | 0.015 | 1.3 | 0.9 | 45 |
| | | | 20 | 2.05 | 0.35 | 10.5 | 1.88 | 47 |
| | | | 30 | 2.45 | 0.72 | 17.5 | 2.7 | 45 |
| 150 | 150 | -100 | 10 | 1.7 | 0.027 | 1.9 | 0.67 | 44.7 |
| | | | 20 | 2.35 | 0.39 | 11 | 1.44 | 48 |
| 100 | 100 | -100 | 10 | 1.1 | 0.29 | 7.5 | 0.47 | 47 |
| | | | 20 | 2.2 | 1.02 | 17 | 0.8 | 40 |

Amplifier at $f = 175\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|-------------------|----------------------|
| 300 | 150 | -35 | 15 | 0.9 | 0 | 0.98 | 21.7 |
| | | | 20 | 1.34 | 0 | 1.66 | 27.7 |
| | | | 25 | 1.56 | 0.01 | 2.48 | 33.1 |
| | | | 30 | 2.08 | 0.07 | 3.3 | 36.7 |
| 250 | 150 | -35 | 15 | 1.0 | 0 | 0.91 | 24.3 |
| | | | 20 | 1.42 | 0 | 1.48 | 29.4 |
| | | | 25 | 1.96 | 0.01 | 2.17 | 34.7 |
| | | | 30 | 2.25 | 0.1 | 2.88 | 38.5 |
| | | | 35 | 2.42 | 0.2 | 3.6 | 41.1 |
| 200 | 150 | -35 | 15 | 1.3 | 0 | 0.81 | 27 |
| | | | 20 | 1.96 | 0 | 1.37 | 32.5 |
| | | | 25 | 2.12 | 0.02 | 1.9 | 38 |
| | | | 30 | 2.4 | 0.11 | 2.5 | 41.7 |
| | | | 35 | 2.64 | 0.28 | 3.08 | 44 |
| | | | 40 | 3.0 | 0.5 | 3.69 | 46.1 |
| 150 | 150 | -35 | 15 | 1.74 | 0 | 0.7 | 31.1 |
| | | | 20 | 2.14 | 0.01 | 1.14 | 38 |
| | | | 25 | 2.5 | 0.03 | 1.56 | 41.7 |
| | | | 30 | 2.9 | 0.12 | 2.0 | 44.5 |
| | | | 35 | 3.2 | 0.3 | 2.42 | 46.1 |
| | | | 40 | 3.5 | 0.55 | 2.82 | 47 |
| 100 | 100 | -23 | 15 | 1.28 | 0.04 | 0.56 | 37.3 |
| | | | 20 | 1.5 | 0.22 | 0.89 | 44.5 |
| | | | 25 | 1.82 | 0.54 | 1.18 | 47.2 |

Frequency doubler at $f_{out} = 175\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|-------------------|----------------------|
| 300 | 150 | -90 | 15 | 0.84 | 0 | 0.82 | 18.2 |
| | | | 20 | 1.1 | 0.12 | 1.46 | 24.3 |
| | | | 25 | 1.22 | 0.34 | 2.1 | 28 |
| 250 | 150 | -90 | 15 | 0.98 | 0.02 | 0.8 | 21.3 |
| | | | 20 | 1.26 | 0.15 | 1.35 | 27 |
| | | | 25 | 1.4 | 0.4 | 1.88 | 30 |
| | | | 30 | 1.62 | 0.6 | 2.4 | 32 |
| 200 | 150 | -90 | 15 | 1.2 | 0.04 | 0.73 | 24.3 |
| | | | 20 | 1.4 | 0.22 | 1.2 | 30 |
| | | | 25 | 1.6 | 0.42 | 1.7 | 34 |
| | | | 30 | 1.85 | 0.66 | 2.15 | 35.9 |
| | | | 35 | 2.0 | 0.8 | 2.55 | 36.5 |
| 150 | 150 | -90 | 15 | 1.58 | 0.06 | 0.66 | 29.4 |
| | | | 20 | 1.76 | 0.26 | 1.04 | 34.7 |
| | | | 25 | 2.07 | 0.46 | 1.42 | 37.9 |
| | | | 30 | 2.25 | 0.72 | 1.78 | 39.5 |
| | | | 35 | 2.36 | 0.88 | 2.1 | 40 |
| 100 | 100 | -60 | 15 | 1.0 | 0.38 | 0.54 | 36 |
| | | | 20 | 1.36 | 0.7 | 0.74 | 37 |

Frequency trebler $f_{out} = 175\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|-------------------|----------------------|
| 250 | 150 | -100 | 15 | 0.88 | 0.04 | 0.6 | 16 |
| | | | 20 | 1.12 | 0.18 | 0.95 | 19 |
| | | | 25 | 1.26 | 0.4 | 1.29 | 20.7 |
| 200 | 150 | -100 | 15 | 1.02 | 0.05 | 0.55 | 18.3 |
| | | | 20 | 1.24 | 0.22 | 0.86 | 21.5 |
| | | | 25 | 1.42 | 0.42 | 1.15 | 23 |
| | | | 30 | 1.66 | 0.6 | 1.42 | 23.7 |
| 150 | 150 | -100 | 15 | 1.26 | 0.07 | 0.49 | 21.8 |
| | | | 20 | 1.42 | 0.30 | 0.76 | 25.3 |
| | | | 25 | 1.64 | 0.44 | 0.99 | 26.4 |
| 100 | 100 | -100 | 15 | 0.94 | 0.52 | 0.4 | 26.7 |
| | | | 20 | 1.5 | 0.84 | 0.5 | 25 |

CLASS 'C' A.M. TELEPHONY

Maximum carrier conditions for 100% modulation

Output tuned circuit

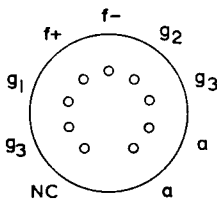
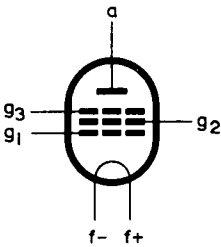
| | Single valve operation | | | Push-pull operation | | Mc/s |
|---------------------|------------------------|----------|--------|---------------------|----------|------|
| | Parallel | Parallel | Series | | | |
| f | 50 | 175 | 175 | 50 | 175 | |
| V _a | 250 | 200 | 200 | 250 | 200 | V |
| V _{g2} | 150 | 150 | 150 | 150 | 150 | V |
| V _{g1} | -35 | -35 | -35 | -35 | -35 | V |
| I _a | 32 | 31 | 32 | 2 × 32 | 2 × 32 | mA |
| I _{g2} | 4.2 | 2.45 | 2.5 | 2 × 4.2 | 2 × 2.5 | mA |
| I _{g1} | 0.62 | 0.14 | 0.18 | 2 × 0.62 | 2 × 0.18 | mA |
| P _{load} | 5.4 | 2.65 | 3.05 | 12 | 6.2 | W |
| η | 67.5 | 42 | 47 | 75 | 48.5 | % |
| For 100% modulation | | | | | | |
| P _{mod} | 4.2 | 3.2 | 3.3 | 8.4 | 6.4 | W |
| v _{g2(pk)} | 135 | 120 | 120 | 135 | 120 | V |

Maximum carrier conditions for anode and screen-grid modulation for various modulation depths. f = 175Mc/s

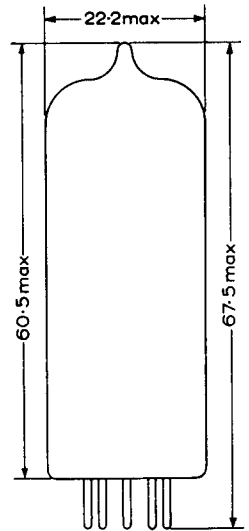
| m (%) | V _a (V) | I _a (mA) | p _a (max.) (W) | p _{g2} (max.) (W) | P _{load} * (W) | Output tuned circuit |
|-------|--------------------|---------------------|---------------------------|----------------------------|-------------------------|----------------------|
| 100 | 200 | 31 | 3.3 | 0.67 | 2.65 | Parallel |
| | 200 | 32 | 3.3 | 0.67 | 3.05 | Series |
| | 200 | 64 | 2 × 3.3 | 2 × 0.67 | 6.2 | Push-Pull |
| 75 | 220 | 34 | 3.9 | 0.78 | 3.2 | Parallel |
| | 220 | 35 | 3.9 | 0.78 | 3.65 | Series |
| | 220 | 70 | 2 × 3.9 | 2 × 0.78 | 7.4 | Push-Pull |
| 50 | 235 | 35 | 4.45 | 0.89 | 3.47 | Parallel |
| | 235 | 36 | 4.45 | 0.89 | 3.96 | Series |
| | 235 | 72 | 2 × 4.45 | 2 × 0.89 | 8.0 | Push-Pull |
| 25 | 245 | 37 | 4.85 | 0.97 | 3.82 | Parallel |
| | 245 | 38 | 4.85 | 0.97 | 4.37 | Series |
| | 245 | 76 | 2 × 4.85 | 0.97 | 8.8 | Push-Pull |
| 0 | 250 | 38 | 5.0 | 1.0 | 4.02 | Parallel |
| | 250 | 39 | 5.0 | 1.0 | 4.55 | Series |
| | 250 | 80 | 2 × 5.0 | 2 × 1.0 | 9.6 | Push-Pull |

*Estimated value

These conditions may be varied for operation at lower frequencies. Operation at 100% modulation with V_a > 250V, I_a > 32mA is not permitted and the p_a max. and p_{g2} max. limits shown above must never be exceeded.

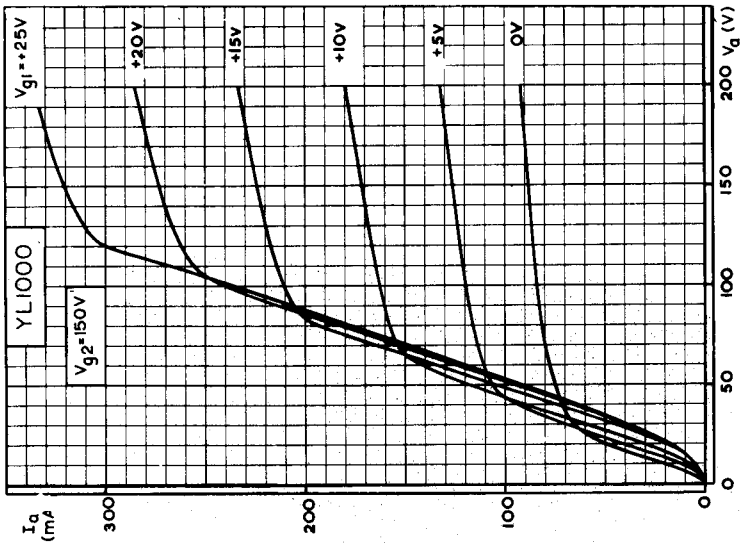
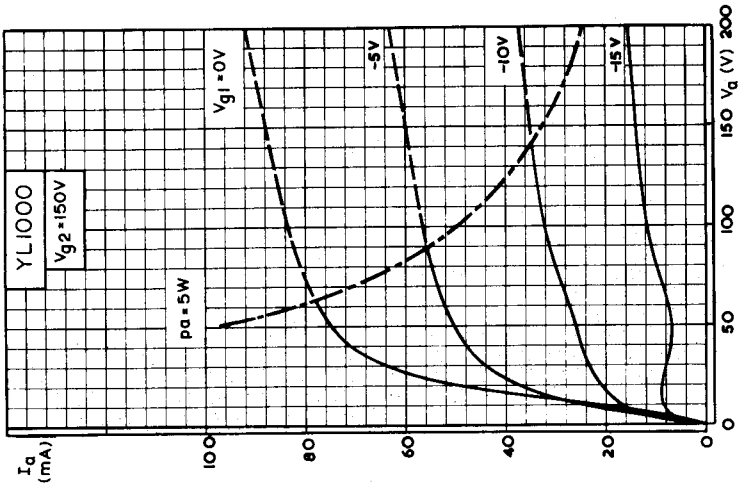


B9A Base

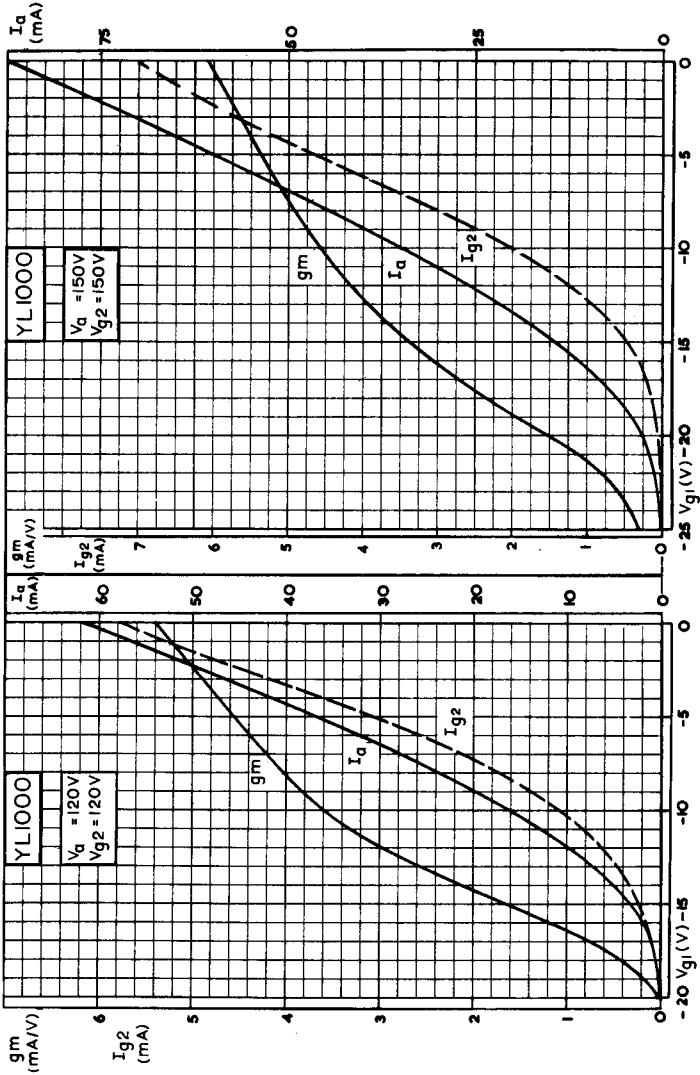


All dimensions in mm

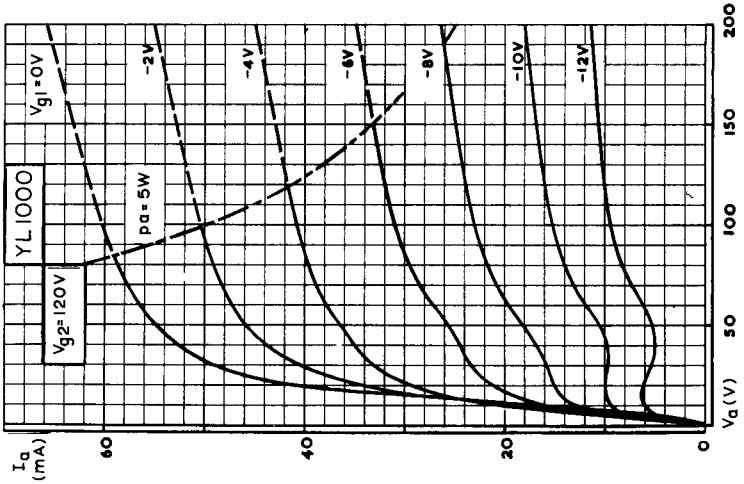
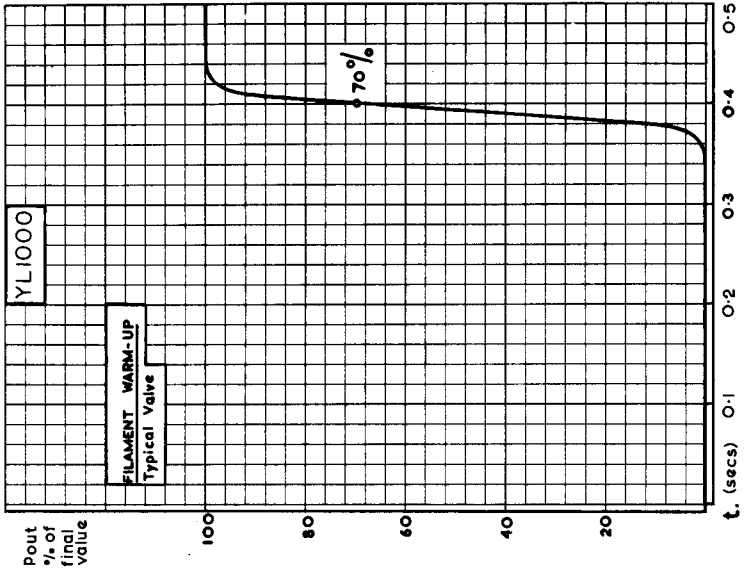
9283



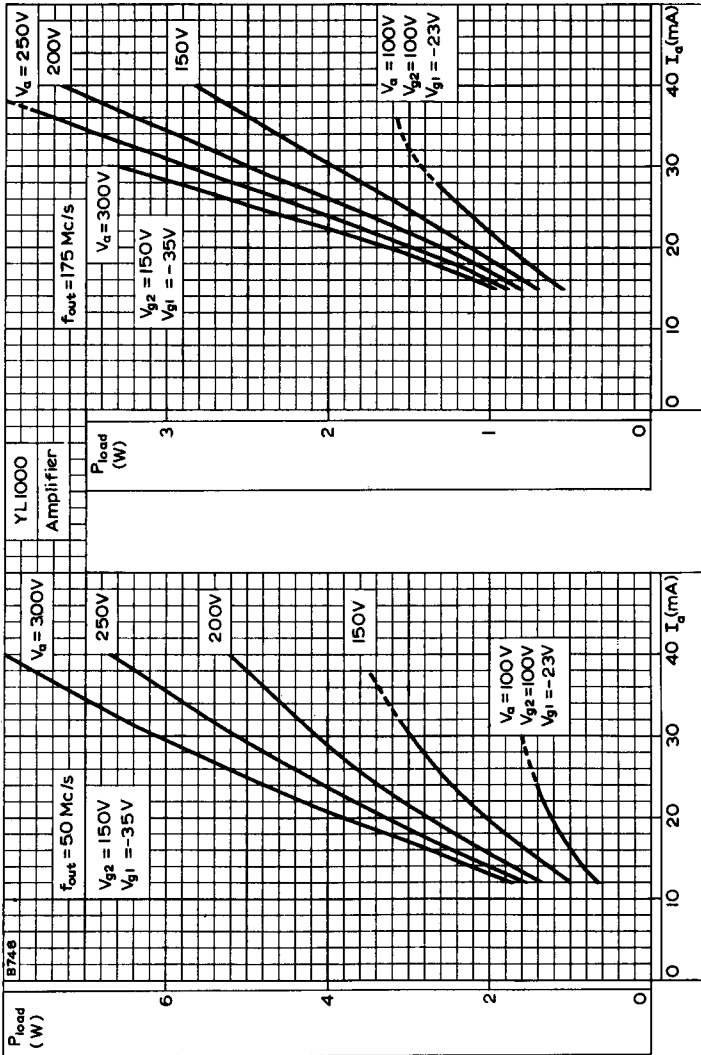
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 150V$



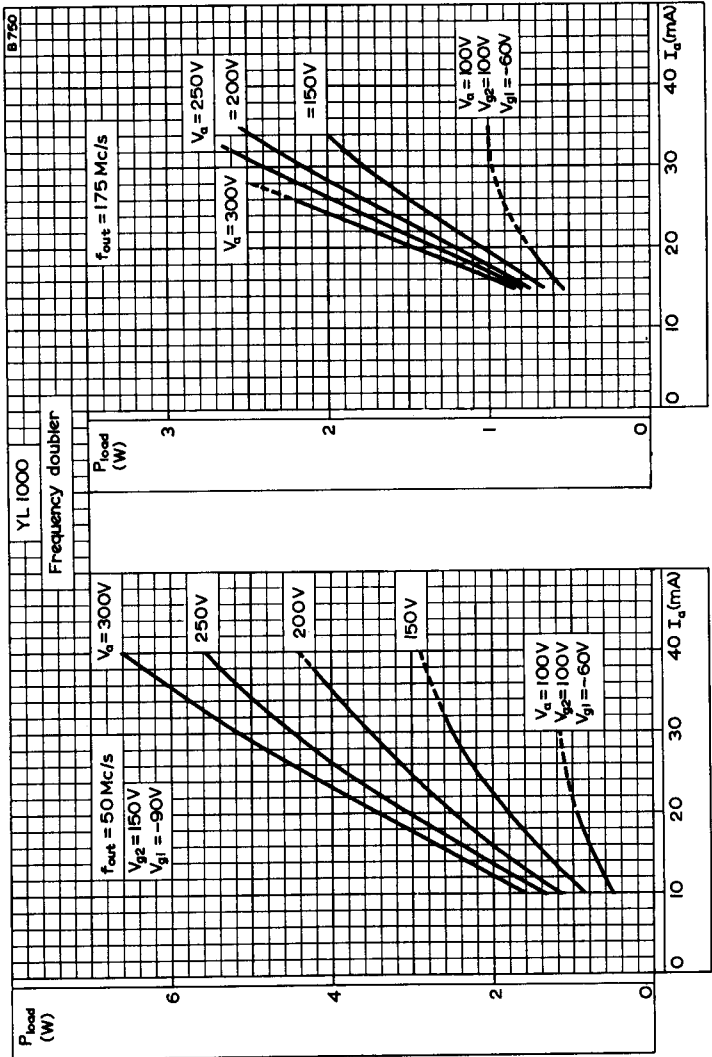
ANODE CURRENT, SCREEN-GRID CURRENT, AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE



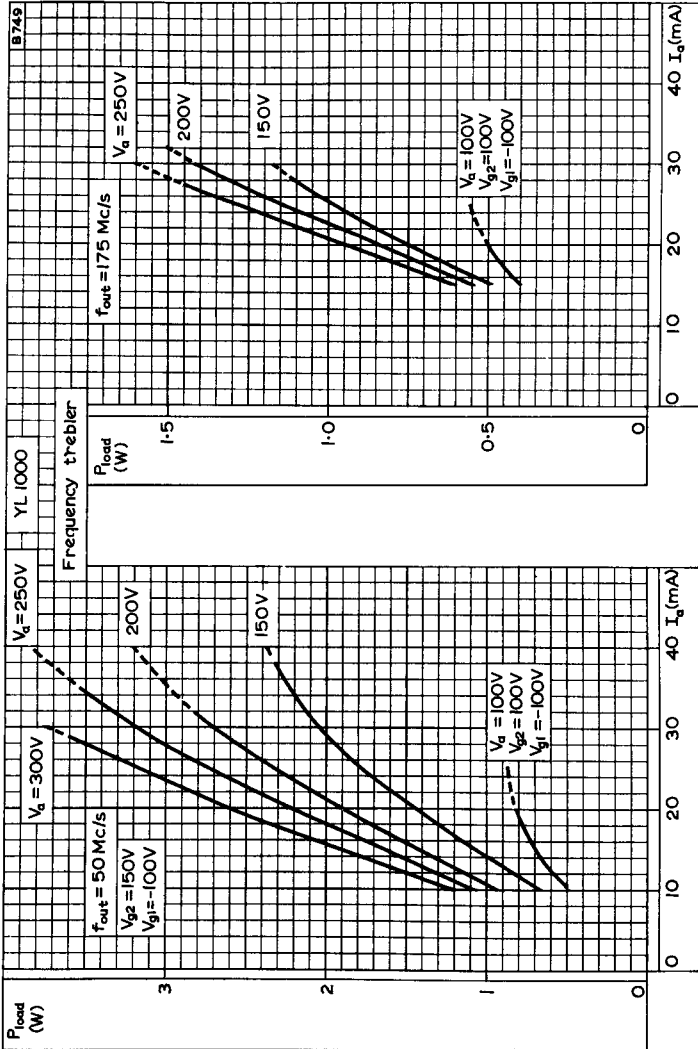
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 120V$
FILAMENT WARM-UP TIME



LOAD POWER AS AN AMPLIFIER PLOTTED AGAINST ANODE CURRENT FOR VARIOUS ANODE VOLTAGES



LOAD POWER AS A FREQUENCY DOUBLER PLOTTED AGAINST ANODE CURRENT FOR VARIOUS ANODE VOLTAGES



LOAD POWER AS A FREQUENCY TREBLER PLOTTED AGAINST ANODE CURRENT FOR VARIOUS ANODE VOLTAGES

Directly heated v.h.f. power pentode for use as a power amplifier or frequency multiplier in portable and mobile equipment.

FILAMENT (parallel operation only)

| | | |
|---|--------------------|----|
| V_f | 1.1 ($\pm 15\%$) | V |
| I_f | 880 | mA |
| t_n max. ($P_{out} = 70\%$ of final value) | 0.5 | s |

CAPACITANCES (unshielded)

| | | |
|------------|-------|------|
| C_{a-g1} | < 150 | mpF |
| C_{in} | 6.0 | pF ← |
| C_{out} | 3.5 | pF ← |
| C_{g1-f} | 1.5 | pF |

CHARACTERISTICS

| | | |
|---------------|------|------|
| V_a | 120 | V |
| V_{g2} | 120 | V |
| V_{g1} | -6.5 | V |
| I_a | 30 | mA |
| I_{g2} | 2.3 | mA |
| g_m | 4.3 | mA/V |
| μ_{g1-g2} | 7.0 | |

RATINGS (DESIGN CENTRE SYSTEM)

| | | |
|-----------------------|------|----|
| $V_{a(b)}$ max. | 500 | V |
| V_a max. | 300 | V |
| P_a max. | 5.0 | W |
| $V_{g2(b)}$ max. | 500 | V |
| V_{g2} max. | 300 | V |
| P_{g2} max. | 1.0 | W |
| V_{g1} max. | -100 | V |
| + $V_{g1(pk)}$ max. | 25 | V |
| I_k max. | 50 | mA |
| R_{g1-f} max. | 2.0 | MΩ |
| T_{bulb} max. | 200 | °C |
| V_f max. (absolute) | 1.27 | V |
| V_f min. (absolute) | 0.93 | V |

CLASS 'C' OPERATION F.M. TELEPHONY

Maximum recommended operating conditions

These conditions are based on reaching either the maximum electrode ratings or the point where load efficiency (η_{load}) begins to fall rapidly. The conditions for 175Mc/s were measured in a circuit with a parallel tuned output circuit. If a series tuned output circuit is used at this frequency with the same operating conditions, approx. 10% higher P_{load} figures are obtained.

CLASS 'C' OPERATION F.M. TELEPHONY AT $f = 50\text{Mc/s}$

| | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-------------------|--------------|-----------------|-----------------|--------------------|
| Power amplifier | 300 | 150 | -35 | 40 |
| | 250 | 150 | -35 | 40 |
| | 200 | 150 | -35 | 40 |
| | 150 | 150 | -35 | 32 |
| | 100 | 100 | -23 | 22 |
| Frequency doubler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
| | 300 | 150 | -90 | 40 |
| | 250 | 150 | -90 | 40 |
| | 200 | 150 | -90 | 38 |
| | 150 | 150 | -90 | 32 |
| 100 | 100 | -60 | 20 | |
| Frequency trebler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
| | 300 | 150 | -100 | 29 |
| | 250 | 150 | -100 | 35 |
| | 200 | 150 | -100 | 32 |
| | 150 | 150 | -100 | 28 |
| 100 | 100 | -100 | 20 | |

CLASS 'C' OPERATION F.M. TELEPHONY AT $f = 175\text{Mc/s}$

| | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
|-------------------|--------------|-----------------|-----------------|--------------------|
| Power amplifier | 300 | 150 | -35 | 30 |
| | 250 | 150 | -35 | 37 |
| | 200 | 150 | -35 | 40 |
| | 150 | 150 | -35 | 40 |
| | 100 | 100 | -23 | 28 |
| Frequency doubler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
| | 300 | 150 | -90 | 26 |
| | 250 | 150 | -90 | 32 |
| | 200 | 150 | -90 | 38 |
| | 150 | 150 | -90 | 32 |
| 100 | 100 | -90 | 20 | |
| Frequency trebler | V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a max. (mA) |
| | 250 | 150 | -100 | 27 |
| | 200 | 150 | -100 | 32 |
| | 150 | 150 | -100 | 28 |
| | 100 | 100 | -100 | 20 |

TYPICAL OPERATION CLASS 'C' OPERATION F.M. TELEPHONY

Amplifier at $f = 50\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | $+V_{g1(pk)}$ (V) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|----------------------|-------------------|----------------------|
| 300 | 150 | -35 | 10 | 1.45 | 0.006 | -4.5 | 1.68 | 56 |
| | | | 20 | 2.6 | 0.045 | 2.5 | 3.8 | 63.3 |
| | | | 30 | 3.0 | 0.45 | 9.0 | 6.1 | 67.8 |
| | | | 40 | 3.5 | 0.85 | 14.5 | 8.0 | 66.6 |
| 250 | 150 | -35 | 10 | 1.62 | 0.008 | -2.0 | 1.5 | 60 |
| | | | 20 | 3.1 | 0.08 | 3.5 | 3.3 | 65 |
| | | | 30 | 4.0 | 0.55 | 10 | 5.1 | 68 |
| | | | 40 | 5.0 | 0.95 | 17 | 6.7 | 67 |
| 200 | 150 | -35 | 10 | 1.95 | 0.025 | -1.5 | 1.3 | 65 |
| | | | 20 | 3.8 | 0.20 | 5.5 | 2.75 | 69 |
| | | | 30 | 5.0 | 0.75 | 12 | 4.1 | 68 |
| | | | 40 | 6.0 | 1.05 | 18 | 5.2 | 65 |
| 150 | 150 | -35 | 10 | 2.6 | 0.038 | -1.0 | 1.0 | 67 |
| | | | 20 | 4.3 | 0.24 | 6.0 | 2.05 | 68 |
| | | | 30 | 6.0 | 0.85 | 13.5 | 2.95 | 65.5 |
| 100 | 100 | -23 | 10 | 2.1 | 0.09 | 1.5 | 0.6 | 60 |
| | | | 20 | 3.4 | 0.7 | 9.0 | 1.22 | 61 |
| | | | 25 | 4.5 | 1.2 | 13 | 1.45 | 57.6 |

Frequency doubler at $f_{out} = 50\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | $+V_{g1(pk)}$ (V) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|----------------------|-------------------|----------------------|
| 300 | 150 | -90 | 10 | 1.38 | 0.015 | 0.5 | 1.58 | 52.7 |
| | | | 20 | 2.15 | 0.28 | 8.5 | 3.42 | 57 |
| | | | 30 | 2.6 | 0.73 | 15 | 5.15 | 57.2 |
| | | | 40 | 3.4 | 0.95 | 21 | 6.62 | 55.1 |
| 250 | 150 | -90 | 10 | 1.6 | 0.024 | 1.2 | 1.36 | 54.4 |
| | | | 20 | 2.4 | 0.38 | 9.5 | 3.0 | 60 |
| | | | 30 | 3.2 | 0.80 | 15.5 | 4.45 | 59.3 |
| | | | 40 | 4.2 | 1.02 | 22 | 5.6 | 56 |
| 200 | 150 | -90 | 10 | 2.05 | 0.04 | 2.0 | 1.16 | 58 |
| | | | 20 | 2.9 | 0.45 | 10 | 2.5 | 62.5 |
| | | | 30 | 3.6 | 0.85 | 16.5 | 3.5 | 58.3 |
| 150 | 150 | -90 | 10 | 2.4 | 0.05 | 2.5 | 0.86 | 57.3 |
| | | | 20 | 3.8 | 0.56 | 11 | 1.8 | 60 |
| | | | 30 | 4.5 | 0.95 | 18 | 2.48 | 55.2 |
| 100 | 100 | -60 | 10 | 1.95 | 0.26 | 6.0 | 0.53 | 53 |
| | | | 20 | 3.1 | 0.92 | 13 | 0.94 | 47 |



Frequency trebler at $f_{out} = 50\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | $+V_{g1(pk)}$ (V) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|----------------------|-------------------|----------------------|
| 300 | 150 | -100 | 10 | 1.0 | 0.01 | 0.8 | 1.2 | 40 |
| | | | 20 | 1.75 | 0.26 | 9.5 | 2.6 | 43.3 |
| 250 | 150 | -100 | 10 | 1.16 | 0.012 | 1.0 | 1.05 | 42 |
| | | | 20 | 1.9 | 0.3 | 10 | 2.24 | 44.8 |
| | | | 30 | 2.3 | 0.7 | 17 | 3.2 | 42.7 |
| 200 | 150 | -100 | 10 | 1.4 | 0.015 | 1.3 | 0.9 | 45 |
| | | | 20 | 2.05 | 0.35 | 10.5 | 1.88 | 47 |
| | | | 30 | 2.45 | 0.72 | 17.5 | 2.7 | 45 |
| 150 | 150 | -100 | 10 | 1.7 | 0.027 | 1.9 | 0.67 | 44.7 |
| | | | 20 | 2.35 | 0.39 | 11 | 1.44 | 48 |
| 100 | 100 | -100 | 10 | 1.1 | 0.29 | 7.5 | 0.47 | 47 |
| | | | 20 | 2.2 | 1.02 | 17 | 0.8 | 40 |

Amplifier at $f = 175\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|-------------------|----------------------|
| 300 | 150 | -35 | 15 | 0.9 | 0 | 0.98 | 21.7 |
| | | | 20 | 1.34 | 0 | 1.66 | 27.7 |
| | | | 25 | 1.56 | 0.01 | 2.48 | 33.1 |
| | | | 30 | 2.08 | 0.07 | 3.3 | 36.7 |
| 250 | 150 | -35 | 15 | 1.0 | 0 | 0.91 | 24.3 |
| | | | 20 | 1.42 | 0 | 1.48 | 29.4 |
| | | | 25 | 1.96 | 0.01 | 2.17 | 34.7 |
| | | | 30 | 2.25 | 0.1 | 2.88 | 38.5 |
| | | | 35 | 2.42 | 0.2 | 3.6 | 41.1 |
| 200 | 150 | -35 | 15 | 1.3 | 0 | 0.81 | 27 |
| | | | 20 | 1.96 | 0 | 1.37 | 32.5 |
| | | | 25 | 2.12 | 0.02 | 1.9 | 38 |
| | | | 30 | 2.4 | 0.11 | 2.5 | 41.7 |
| | | | 35 | 2.64 | 0.28 | 3.08 | 44 |
| | | | 40 | 3.0 | 0.5 | 3.69 | 46.1 |
| 150 | 150 | -35 | 15 | 1.74 | 0 | 0.7 | 31.1 |
| | | | 20 | 2.14 | 0.01 | 1.14 | 38 |
| | | | 25 | 2.5 | 0.03 | 1.56 | 41.7 |
| | | | 30 | 2.9 | 0.12 | 2.0 | 44.5 |
| | | | 35 | 3.2 | 0.3 | 2.42 | 46.1 |
| | | | 40 | 3.5 | 0.55 | 2.82 | 47 |
| 100 | 100 | -23 | 15 | 1.28 | 0.04 | 0.56 | 37.3 |
| | | | 20 | 1.5 | 0.22 | 0.89 | 44.5 |
| | | | 25 | 1.82 | 0.54 | 1.18 | 47.2 |



Frequency doubler at $f_{out} = 175\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|-------------------|----------------------|
| 300 | 150 | -90 | 15 | 0.84 | 0 | 0.82 | 18.2 |
| | | | 20 | 1.1 | 0.12 | 1.46 | 24.3 |
| | | | 25 | 1.22 | 0.34 | 2.1 | 28 |
| 250 | 150 | -90 | 15 | 0.98 | 0.02 | 0.8 | 21.3 |
| | | | 20 | 1.26 | 0.15 | 1.35 | 27 |
| | | | 25 | 1.4 | 0.4 | 1.88 | 30 |
| | | | 30 | 1.62 | 0.6 | 2.4 | 32 |
| 200 | 150 | -90 | 15 | 1.2 | 0.04 | 0.73 | 24.3 |
| | | | 20 | 1.4 | 0.22 | 1.2 | 30 |
| | | | 25 | 1.6 | 0.42 | 1.7 | 34 |
| | | | 30 | 1.85 | 0.66 | 2.15 | 35.9 |
| | | | 35 | 2.0 | 0.8 | 2.55 | 36.5 |
| 150 | 150 | -90 | 15 | 1.58 | 0.06 | 0.66 | 29.4 |
| | | | 20 | 1.76 | 0.26 | 1.04 | 34.7 |
| | | | 25 | 2.07 | 0.46 | 1.42 | 37.9 |
| | | | 30 | 2.25 | 0.72 | 1.78 | 39.5 |
| | | | 35 | 2.36 | 0.88 | 2.1 | 40 |
| 100 | 100 | -60 | 15 | 1.0 | 0.38 | 0.54 | 36 |
| | | | 20 | 1.36 | 0.7 | 0.74 | 37 |

Frequency tripler $f_{out} = 175\text{Mc/s}$

| V_a (V) | V_{g2} (V) | V_{g1} (V) | I_a (mA) | I_{g2} (mA) | I_{g1} (mA) | P_{load} (W) | η_{load} (%) |
|--------------|-----------------|-----------------|---------------|------------------|------------------|-------------------|----------------------|
| 250 | 150 | -100 | 15 | 0.88 | 0.04 | 0.6 | 16 |
| | | | 20 | 1.12 | 0.18 | 0.95 | 19 |
| | | | 25 | 1.26 | 0.4 | 1.29 | 20.7 |
| 200 | 150 | -100 | 15 | 1.02 | 0.05 | 0.55 | 18.3 |
| | | | 20 | 1.24 | 0.22 | 0.86 | 21.5 |
| | | | 25 | 1.42 | 0.42 | 1.15 | 23 |
| | | | 30 | 1.66 | 0.6 | 1.42 | 23.7 |
| 150 | 150 | -100 | 15 | 1.26 | 0.07 | 0.49 | 21.8 |
| | | | 20 | 1.42 | 0.30 | 0.76 | 25.3 |
| | | | 25 | 1.64 | 0.44 | 0.99 | 26.4 |
| 100 | 100 | -100 | 15 | 0.94 | 0.52 | 0.4 | 26.7 |
| | | | 20 | 1.5 | 0.84 | 0.5 | 25 |

CLASS 'C' A.M. TELEPHONY

Maximum carrier conditions for 100% modulation

Output tuned circuit

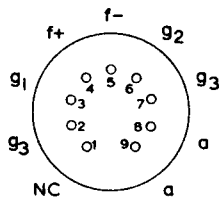
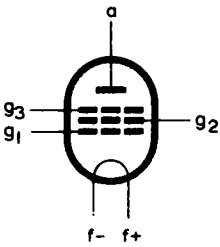
| | Single valve operation | | | Push-pull operation | | |
|---------------------|------------------------|----------|--------|---------------------|-----------------|------|
| | Parallel | Parallel | Series | | | |
| f | 50 | 175 | 175 | 50 | 175 | Mc/s |
| V_a | 250 | 200 | 200 | 250 | 200 | V |
| V_{g2} | 150 | 150 | 150 | 150 | 150 | V |
| V_{g1} | -35 | -35 | -35 | -35 | -35 | V |
| I_a | 32 | 31 | 32 | 2×32 | 2×32 | mA |
| I_{g2} | 4.2 | 2.45 | 2.5 | 2×4.2 | 2×2.5 | mA |
| I_{g1} | 0.62 | 0.14 | 0.18 | 2×0.62 | 2×0.18 | mA |
| P_{load} | 5.4 | 2.65 | 3.05 | 12 | 6.2 | W |
| η | 67.5 | 42 | 47 | 75 | 48.5 | % |
| For 100% modulation | | | | | | |
| P_{mod} | 4.2 | 3.2 | 3.3 | 8.4 | 6.4 | W |
| $V_{g2}(pk)$ | 135 | 120 | 120 | 135 | 120 | V |

Maximum carrier conditions for anode and screen-grid modulation for various modulation depths. $f = 175\text{Mc/s}$

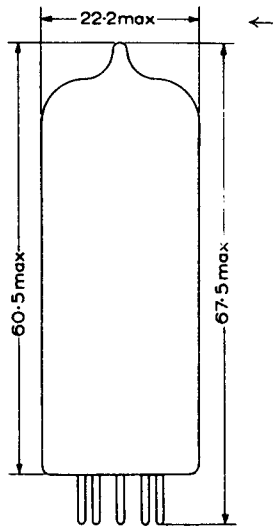
| m (%) | V_a (V) | I_a (mA) | P_a (max.) (W) | P_{g2} (max.) (W) | P_{load}^* (W) | Output tuned circuit |
|------------|--------------|---------------|---------------------|------------------------|---------------------|-------------------------|
| 100 | 200 | 31 | 3.3 | 0.67 | 2.65 | Parallel |
| | 200 | 32 | 3.3 | 0.67 | 3.05 | Series |
| | 200 | 64 | 2×3.3 | 2×0.67 | 6.2 | Push-Pull |
| 75 | 220 | 34 | 3.9 | 0.78 | 3.2 | Parallel |
| | 220 | 35 | 3.9 | 0.78 | 3.65 | Series |
| | 220 | 70 | 2×3.9 | 2×0.78 | 7.4 | Push-Pull |
| 50 | 235 | 35 | 4.45 | 0.89 | 3.47 | Parallel |
| | 235 | 36 | 4.45 | 0.89 | 3.96 | Series |
| | 235 | 72 | 2×4.45 | 2×0.89 | 8.0 | Push-Pull |
| 25 | 245 | 37 | 4.85 | 0.97 | 3.82 | Parallel |
| | 245 | 38 | 4.85 | 0.97 | 4.37 | Series |
| | 245 | 76 | 2×4.85 | 0.97 | 8.8 | Push-Pull |
| 0 | 250 | 38 | 5.0 | 1.0 | 4.02 | Parallel |
| | 250 | 39 | 5.0 | 1.0 | 4.55 | Series |
| | 250 | 80 | 2×5.0 | 2×1.0 | 9.6 | Push-Pull |

*Estimated value

These conditions may be varied for operation at lower frequencies. Operation at 100% modulation with $V_a > 250\text{V}$, $I_a > 32\text{mA}$ is not permitted and the P_a max. and P_{g2} max. limits shown above must never be exceeded.

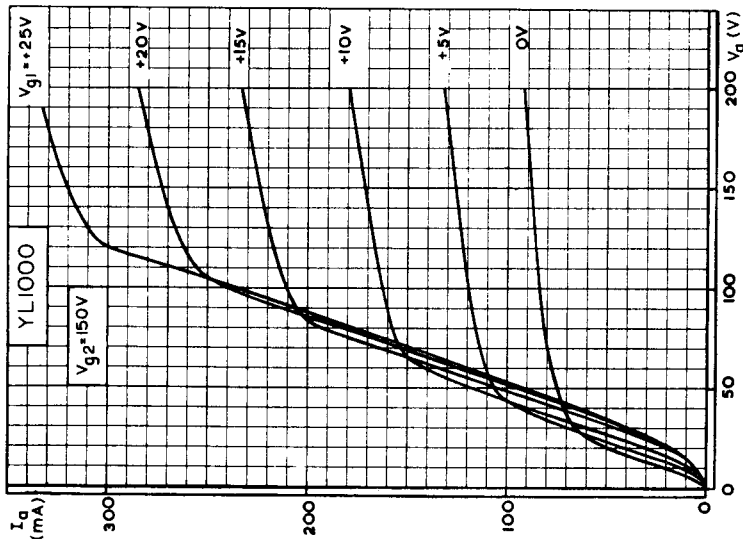
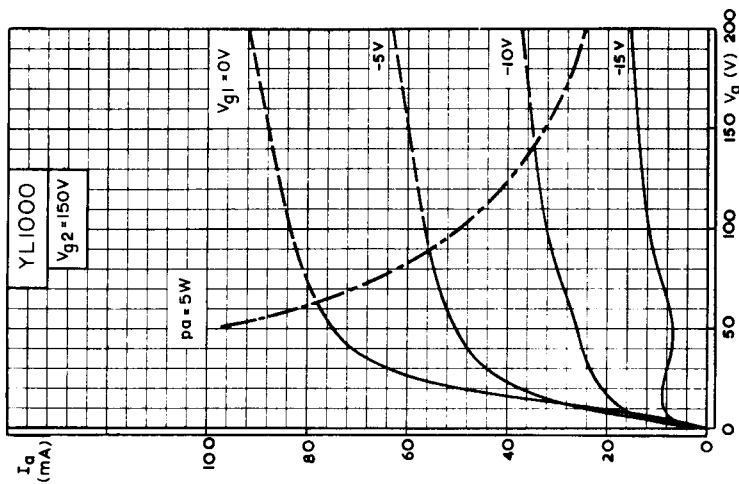


B9A Base

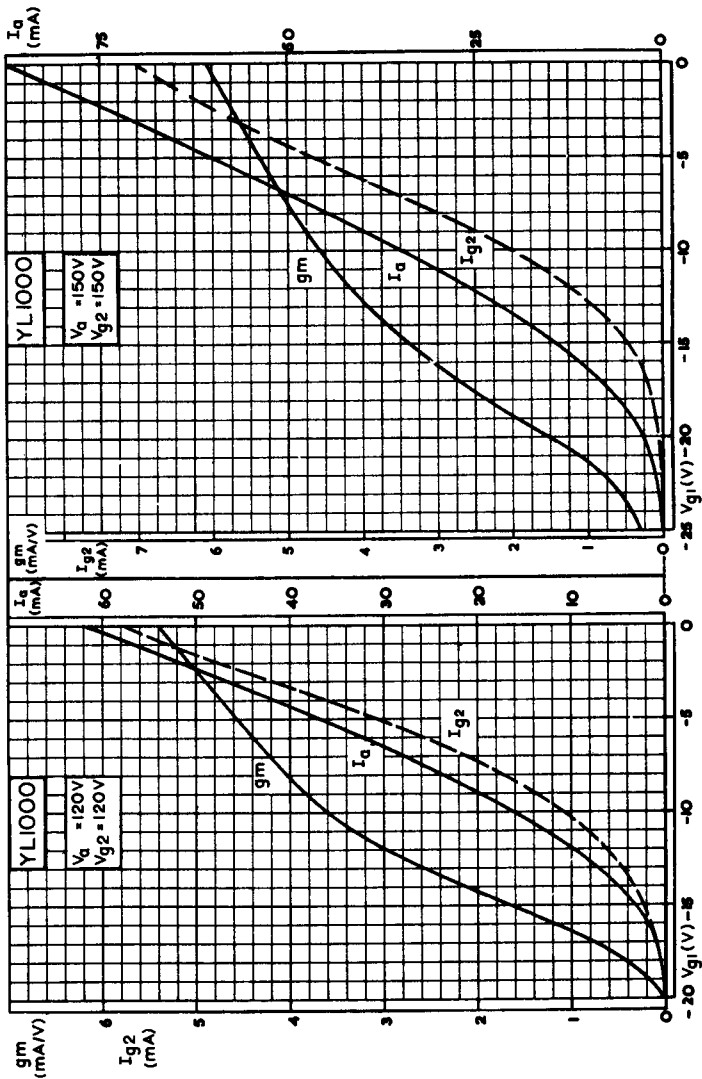


All dimensions in mm

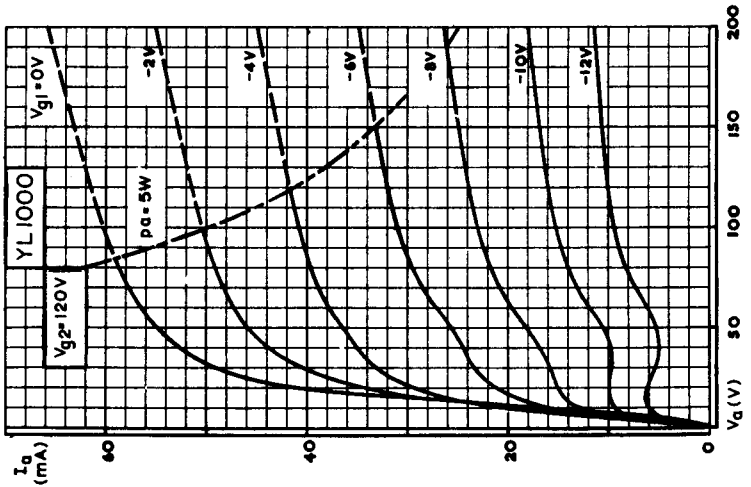
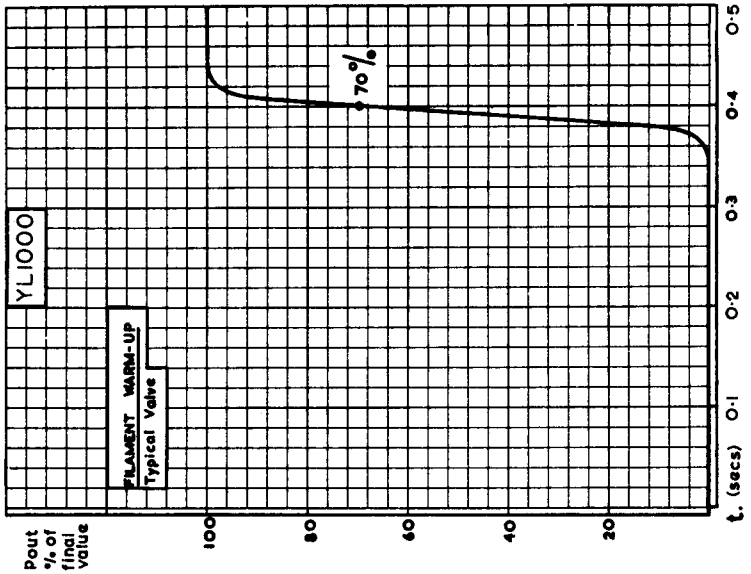
B4662



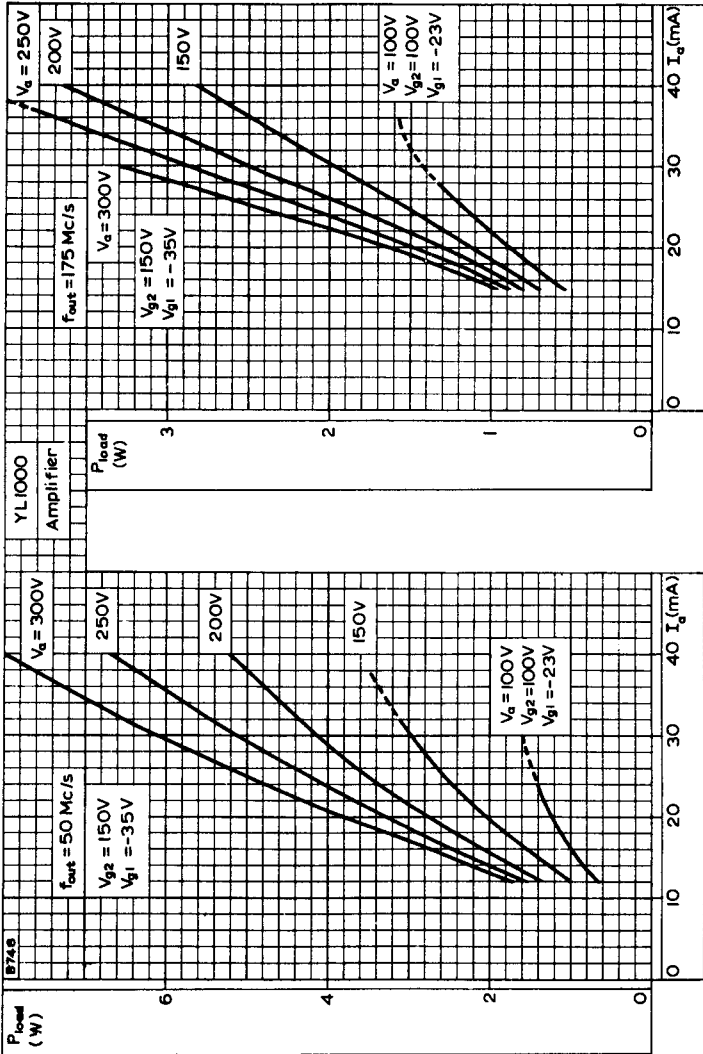
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2} = 150V$



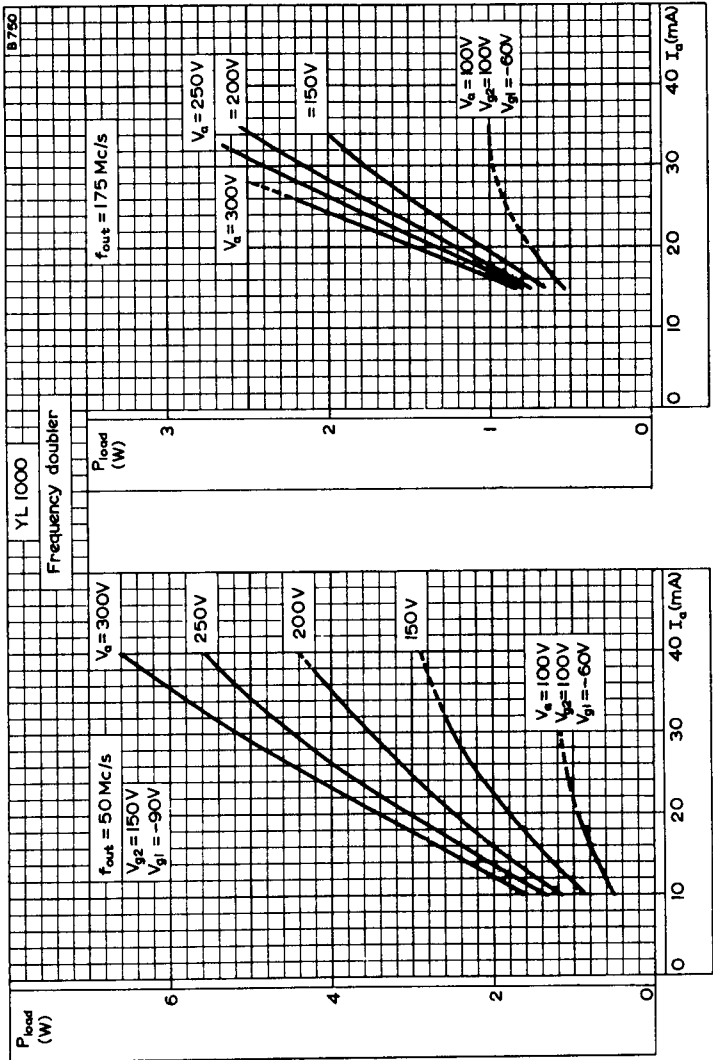
ANODE CURRENT, SCREEN-GRID CURRENT, AND MUTUAL CONDUCTANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE



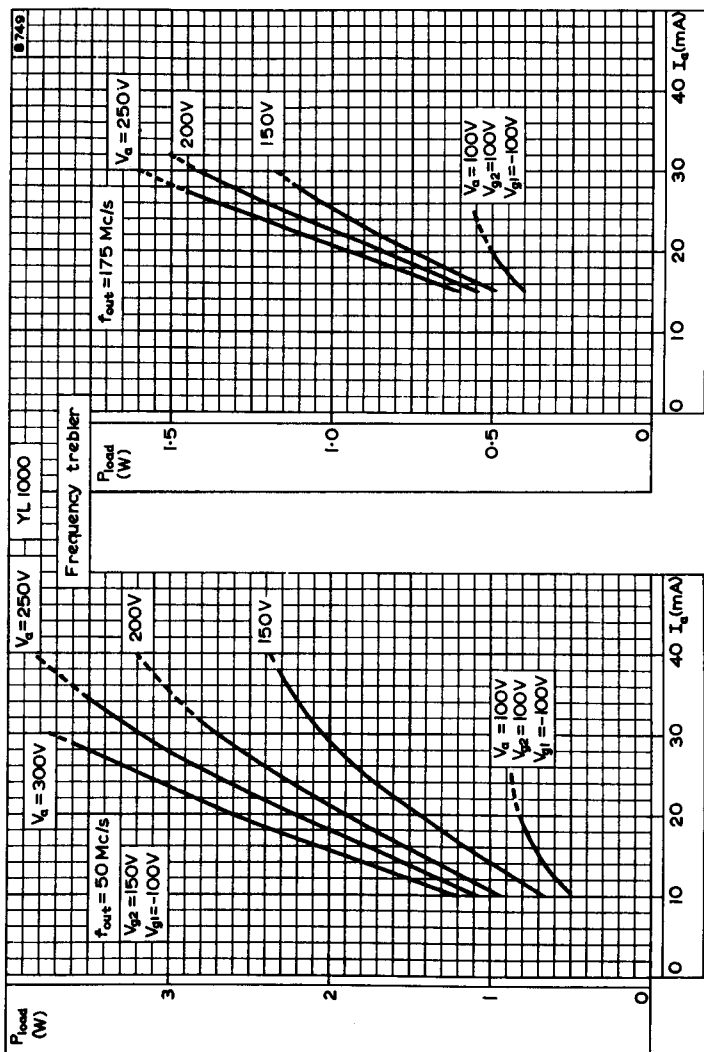
ANODE CURRENT PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER $V_{g2}=120V$
FILAMENT WARM-UP TIME



LOAD POWER AS AN AMPLIFIER PLOTTED AGAINST ANODE CURRENT FOR VARIOUS ANODE VOLTAGES



LOAD POWER AS A FREQUENCY DOUBLER PLOTTED AGAINST ANODE CURRENT FOR VARIOUS ANODE VOLTAGES



LOAD POWER AS A FREQUENCY TREBLER PLOTTED AGAINST ANODE CURRENT FOR VARIOUS ANODE VOLTAGES

