**TRIODE**

# TY12-20A

*Application:* *R.F. industrial heating.*
*Power output:* *39kW continuous rating.*
*Frequency:* *30Mc/s at full rating.*
*Construction:* *External anode, forced air-cooled.*

## PRELIMINARY DATA

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS – TRANSMITTING VALVES included in this volume of the handbook.

## FILAMENT Thoriated tungsten

| | | |
|---|---|---|
| $V_f$ | 8.0 | V |
| $I_f$ | 130 | A |

The filament current must never exceed a surge value of 280A at any time during the warming up period. The filament has been designed to accept temporary voltage fluctuations of $^{+5}_{-10}$%

## MOUNTING POSITION

Vertical, anode down

## CAPACITANCES

| | | |
|---|---|---|
| $C_{a-g}$ | 23.5 | pF |
| $C_{g-f}$ | 42.5 | pF |
| $C_{a-f}$ | 0.9 | pF |

## CHARACTERISTICS (measured at $V_a$ = 12kV, $I_a$ = 2A)

| | | |
|---|---|---|
| $g_m$ | 25 | mA/V |
| $g_m$ (at $V_a$ = 1kV, $I_a$ = 20A) | 30 | mA/V |
| $\mu$ | 21 | |

## COOLING

Forced air-cooling

| | | |
|---|---|---|
| Max. temperature of seals | 220 | °C |

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals. The amount of forced air-cooling required for this valve depends upon the anode dissipation and the height above sea-level. Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet housing are given overleaf.

# TY12-20A

**TRIODE**

| Anode dissipation $p_a$ | Height above sea-level h | | Inlet temperature $T_{in}$ | Min. rate of flow of air per minute | | Pressure difference between inlet and outlet |
|---|---|---|---|---|---|---|
| (kW) | (km) | (ft) | (°C) | ($m^3$) | ($ft^3$) | (mm of $H_2O$) |
| 7.0 | 0 | 0 | 35 | 6.6 | 235 | 10 |
| 7.0 | 0 | 0 | 45 | 7.7 | 270 | 13 |
| 7.0 | 1.5 | 4920 | 35 | 7.9 | 280 | 12 |
| 7.0 | 3.0 | 9840 | 25 | 8.3 | 295 | 12 |
| 10 | 0 | 0 | 35 | 10.5 | 370 | 23 |
| 10 | 0 | 0 | 45 | 12.3 | 435 | 31 |
| 10 | 1.5 | 4920 | 35 | 12.6 | 445 | 28 |
| 10 | 3.0 | 9840 | 25 | 13.2 | 465 | 27 |
| 15 | 0 | 0 | 35 | 18.1 | 640 | 60 |
| 15 | 0 | 0 | 45 | 21.2 | 750 | 79 |
| 15 | 1.5 | 4920 | 35 | 21.7 | 765 | 73 |
| 15 | 3.0 | 9840 | 25 | 22.8 | 805 | 70 |

## CLASS 'C' OSCILLATOR

***Anode supply from three-phase full-wave rectifier without smoothing filter***

**Limiting values** (absolute ratings)

| | | |
|---|---|---|
| f max. | 30 | Mc/s |
| $V_a$ max. | 13 | kV |
| $I_a$ max. | 4.8 | A |
| $V_g$ max. | −2.0 | kV |
| $I_g$ max. | 1.5 | A |
| $p_a$ max. | 15 | kW |
| $R_{g-f}$ max. | 10 | kΩ |
| $p_g$ max. | 1.1 | kW |

**Operating conditions**

| | | | | |
|---|---|---|---|---|
| f | 30 | 30 | 30 | Mc/s |
| $V_{tr(r.m.s.)}$ | 8.9 | 7.4 | 6.0 | kV |
| $V_a$ | 12 | 10 | 8.0 | kV |
| $I_a$ | 4.5 | 4.5 | 4.5 | A |
| $I_g$ | 0.9 | 0.9 | 0.9 | A |
| $p_a$ | 15 | 13.7 | 12.8 | kW |
| $\eta_a$ | 72.5 | 70 | 64.5 | % |
| $R_{g-f}$ | 1.1 | 1.0 | 0.9 | kΩ |
| $R_a$ | 1500 | 1200 | 700 | Ω |
| Feedback ratio | 0.16 | 0.18 | 0.22 | |
| $P_{out}$ | 39 | 31.3 | 23.2 | kW |
| *$P_{load}$ | 33 | 26.6 | 19.7 | kW |

*0.85 ($P_{out}$–$P_{drive}$)

# TY12-20A

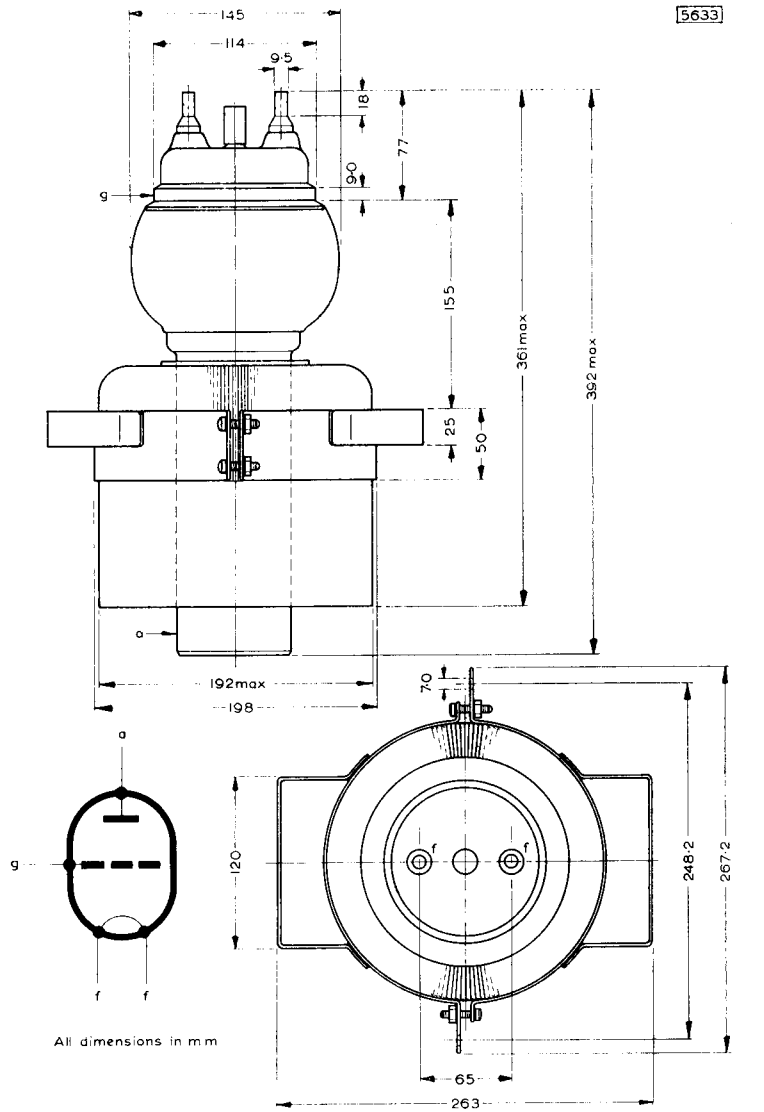
## WEIGHT

| | | |
|---|---|---|
| Valve only | 36 | lbs |
| | 16.5 | kg |
| Insulating pedestal | 20 | lbs |
| | 9.0 | kg |
| Shipping weight | 186 | lbs |
| | 84.5 | kg |

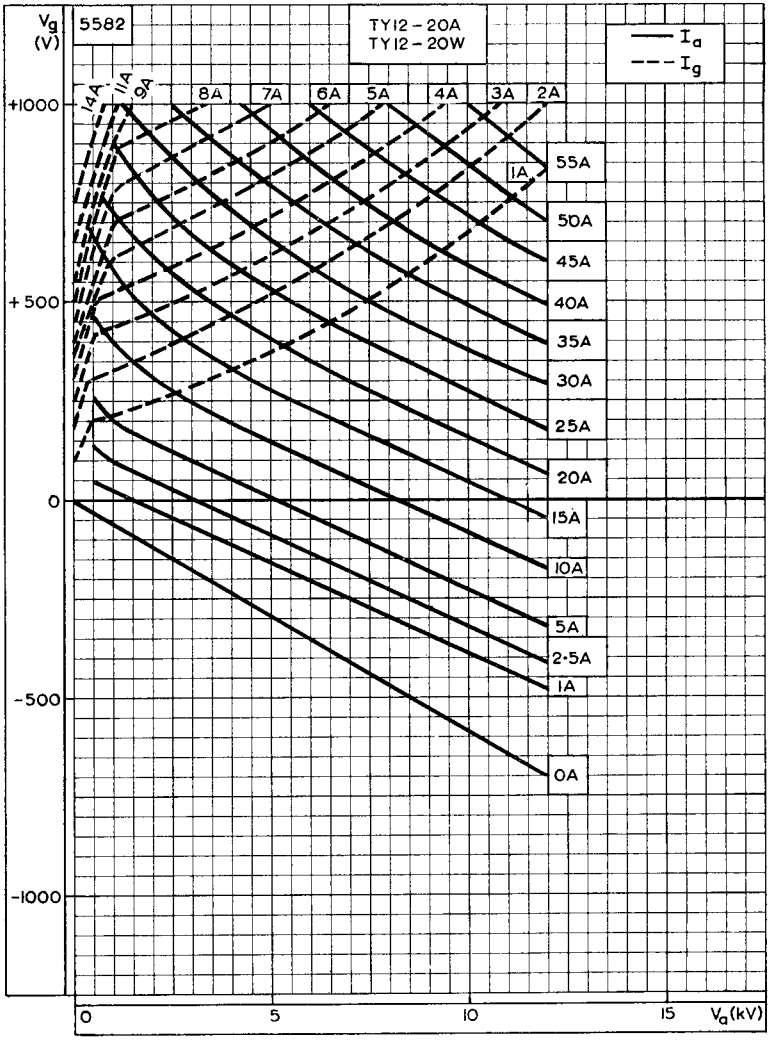
## ACCESSORIES

| | |
|---|---|
| Insulating pedestal | 40648 |
| Grid connector | 40663 |
| Filament clips with lead | 40662 |

# TY12-20A




All dimensions in mm




CONSTANT CURRENT CURVES

## TRIODE

# TY12-20A

*Application:* *R.F. industrial heating.*
*Power output:* *39kW continuous rating.*
*Frequency:* *30Mc/s at full rating.*
*Construction:* *External anode, forced-air cooled.*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES which precede this section of the handbook.

### FILAMENT Thoriated tungsten

| | | |
|---|---|---|
| $V_f$ | 8.0 | V |
| $I_f$ | 130 | A |

The filament current must never exceed a surge value of 280A at any time during the warming up period. The filament has been designed to accept temporary voltage fluctuations of $^{+5\%}_{-10}$

### MOUNTING POSITION

Vertical, anode down

### CAPACITANCES

| | | |
|---|---|---|
| $c_{a-g}$ | 23.5 | pF |
| $c_{g-f}$ | 45 | pF |
| $c_{a-f}$ | 900 | mpF |

### CHARACTERISTICS (measured at $V_a = 12kV$, $I_a = 2A$)

| | | |
|---|---|---|
| $g_m$ | 25 | mA/V |
| $g_m$ (at $V_a = 1kV$, $I_a = 20A$) | 30 | mA/V |
| $\mu$ | 21 | |

### COOLING

Forced-air cooling

| | | |
|---|---|---|
| Max. temperature of seals | 220 | °C |

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals. The amount of forced-air cooling required for this valve depends upon the anode dissipation and the height above sea-level. Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet housing are given overleaf.

| Anode dissipation $p_a$ | Height above sea-level h | | Inlet temperature $T_{in}$ | Min. rate of flow of air per minute | | Pressure difference between inlet and outlet |
|---|---|---|---|---|---|---|
| (kW) | (km) | (ft) | (°C) | ($m^3$) | ($ft^3$) | (mm of $H_2O$) |
| 7.0 | 0 | 0 | 35 | 6.6 | 235 | 10 |
| 7.0 | 0 | 0 | 45 | 7.7 | 270 | 13 |
| 7.0 | 1.5 | 4920 | 35 | 7.9 | 280 | 12 |
| 7.0 | 3.0 | 9840 | 25 | 8.3 | 295 | 12 |
| 10 | 0 | 0 | 35 | 10.5 | 370 | 23 |
| 10 | 0 | 0 | 45 | 12.3 | 435 | 31 |
| 10 | 1.5 | 4920 | 35 | 12.6 | 445 | 28 |
| 10 | 3.0 | 9840 | 25 | 13.2 | 465 | 27 |
| 15 | 0 | 0 | 35 | 18.1 | 640 | 60 |
| 15 | 0 | 0 | 45 | 21.2 | 750 | 79 |
| 15 | 1.5 | 4920 | 35 | 21.7 | 765 | 73 |
| 15 | 3.0 | 9840 | 25 | 22.8 | 805 | 70 |

## CLASS 'C' OSCILLATOR

***Anode supply from three-phase full-wave rectifier without smoothing filter***

### Absolute maximum ratings

| | | |
|---|---|---|
| f max. | 30 | Mc/s |
| $V_a$ max. | 13 | kV |
| $I_a$ max. | 5.0 | A |
| $V_g$ max. | −2.0 | kV |
| $I_g$ max. | 1.5 | A |
| $p_a$ max. | 20 | kW |
| $R_{g-f}$ max. | 10 | kΩ |
| $p_g$ max. | 1.1 | kW |

### Operating conditions

| | | | | |
|---|---|---|---|---|
| f | 30 | 30 | 30 | Mc/s |
| $V_{tr(r.m.s.)}$ | 8.9 | 7.4 | 6.0 | kV |
| $V_a$ | 12 | 10 | 8.0 | kV |
| $I_a$ | 4.5 | 4.5 | 4.5 | A |
| $I_g$ | 0.9 | 0.9 | 0.9 | A |
| $p_a$ | 15 | 13.7 | 12.8 | kW |
| $\eta_a$ | 72.5 | 70 | 64.5 | % |
| $R_{g-f}$ | 1.1 | 1.0 | 0.9 | kΩ |
| $R_a$ | 1450 | 1100 | 800 | Ω |
| Feedback ratio | 0.16 | 0.19 | 0.24 | |
| $P_{out}$ | 39 | 31.2 | 23.2 | kW |
| $P_{load}$ | 33 | 26.6 | 19.7 | kW |

# TY12-20A

## CLASS 'B' A.F.

### Absolute maximum ratings

| | | |
|---|---|---|
| $V_a$ max. | 13 | kV |
| $I_a$ max. | 4.8 | A |
| $p_a$ max. | 20 | kW |
| $R_{g-f}$ max. | 10 | kΩ |

### Operating conditions

| | | | | |
|---|---|---|---|---|
| $V_a$ | 8.0 | 10 | 12 | kV |
| $I_{a(o)}$ | 2 × 350 | 2 × 400 | 2 × 450 | mA |
| $I_a$ (max. sig.) | 2 × 4.2 | 2 × 4.2 | 2 × 3.8 | A |
| $V_g$ | −420 | −500 | −550 | V |
| $V_{in(g-g)}$ (r.m.s.) | 1.24 | 1.32 | 1.35 | kV |
| $I_g$ | 2 × 825 | 2 × 700 | 2 × 630 | mA |
| $P_{load\ (driver)}$ | 2 × 680 | 2 × 640 | 2 × 610 | W |
| $p_a$ | 12.6 | 14.8 | 14.9 | kW |
| $\eta_a$ | 62 | 65 | 67 | % |
| $R_{a-a}$ | 2.07 | 2.6 | 3.73 | kΩ |
| $P_{out}$ | 42 | 54.5 | 61.5 | kW |

## WEIGHT

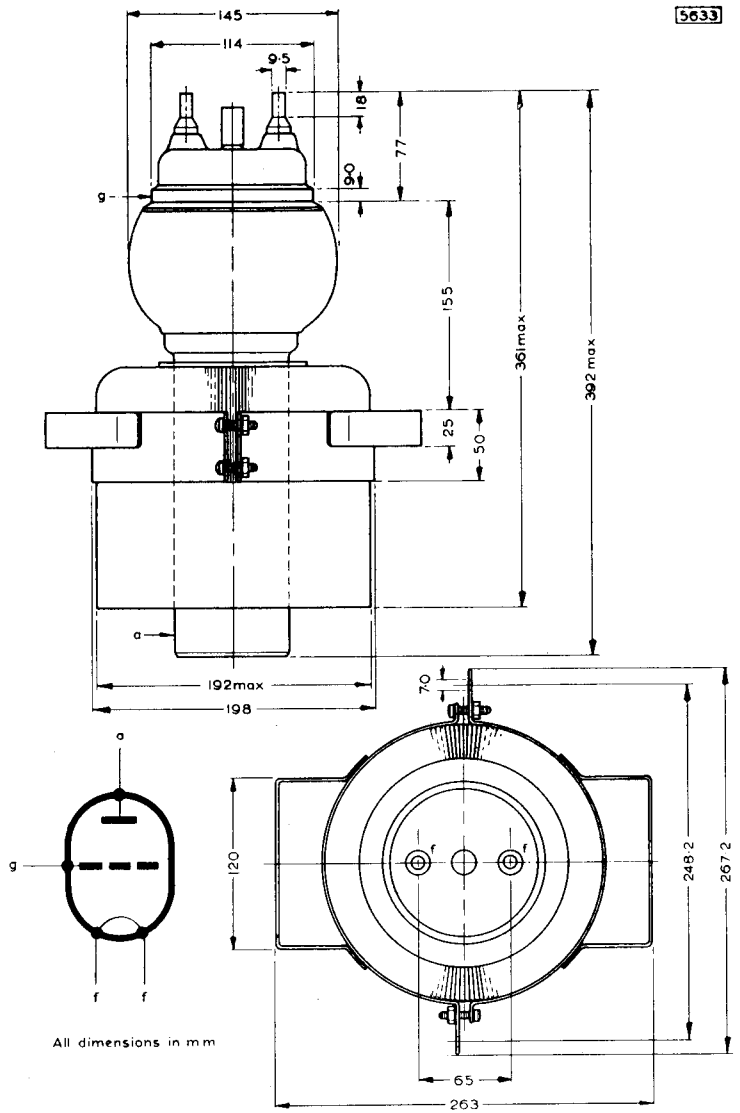
| | | |
|---|---|---|
| Weight of valve | 35.5 | lb |
| | 16.1 | kg |
| Weight of valve plus carton | 121.5 | lb |
| | 55.1 | kg |
| Weight of insulating pedestal | 15.8 | lb |
| | 7.15 | kg |
| Weight of insulating pedestal plus carton | 21.2 | lb |
| | 9.6 | kg |

## ACCESSORIES

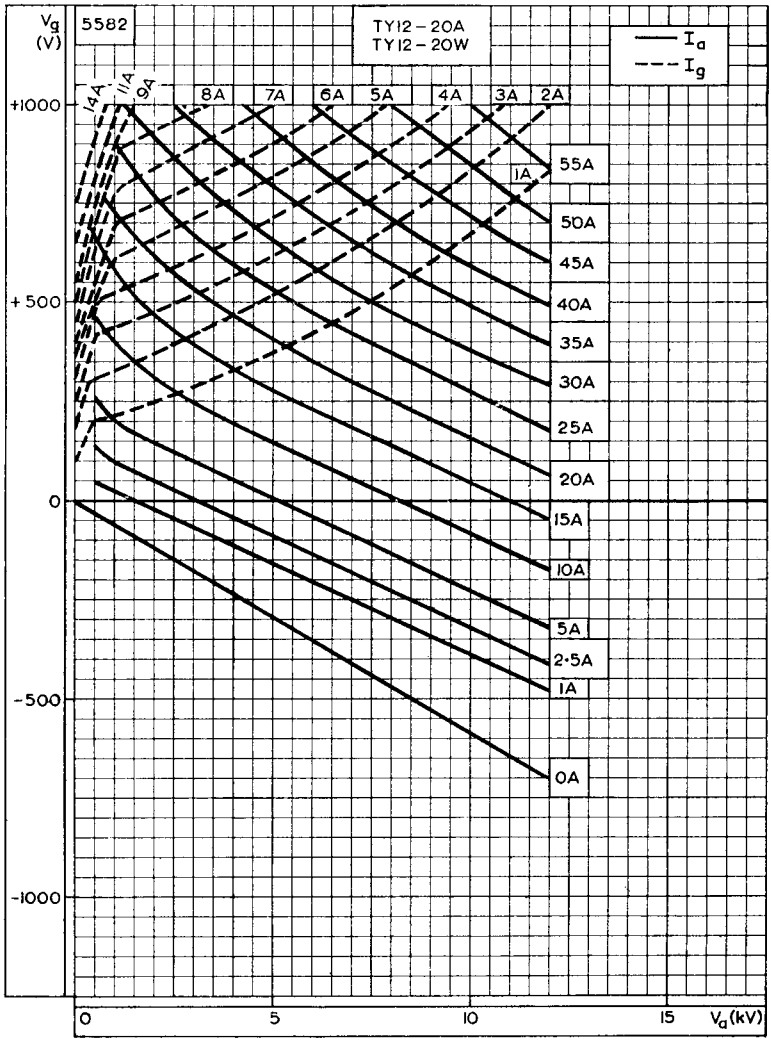
| | |
|---|---|
| Insulating pedestal | 40648 |
| Grid connector | 40663 |
| Filament clips with lead | 40662 |

# TY12-20A

**TRIODE**



# TY12-20A




CONSTANT CURRENT CURVES

**TRIODE**

# TYI2-20W

*Application:* *R.F. industrial heating.*
*Power Output:* *39kW continuous rating.*
*Frequency:* *30Mc/s at full rating.*
*Construction:* *External anode, water-cooled.*

## PRELIMINARY DATA

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES included in this volume of the handbook.

## FILAMENT Thoriated tungsten

| | | |
|---|---|---|
| $V_f$ | 8.0 | V |
| $I_f$ | 130 | A |

The filament current must never exceed a surge value of 280A at any time during the warming up period. The filament has been designed to accept temporary voltage fluctuations of $^{+5}_{-10}\%$

## MOUNTING POSITION

Vertical, anode down

## CAPACITANCES

| | | |
|---|---|---|
| $C_{a-g}$ | 23.5 | pF |
| $C_{g-f}$ | 42.5 | pF |
| $C_{a-f}$ | 0.9 | pF |

## CHARACTERISTICS (measured at $V_a = 12kV$, $I_a = 2A$)

| | | |
|---|---|---|
| $g_m$ | 25 | mA/V |
| $g_m$ (at $V_a = 1.0kV$, $I_a = 20A$) | 30 | mA/V |
| $\mu$ | 21 | |

## COOLING

Water cooling

| | | |
|---|---|---|
| Max. temperature of seals | 220 | °C |
| Max. inlet temperature of water | 50 | °C |

Typical values of inlet temperature, rate of flow of water, and pressure difference between the inlet and outlet housing at various anode dissipations are given overleaf.

| Anode dissipation $p_a$ | Inlet temperature $T_{in}$ | Rate of flow of water per minute | | Pressure difference between inlet and outlet |
|---|---|---|---|---|
| (kW) | (°C) | (litres) | (gal) | (atm) |
| 5.0 | 20 | 6.0 | 1.5 | 0.02 |
| 5.0 | 50 | 15 | 3.5 | 0.22 |
| 10 | 20 | 11 | 2.5 | 0.1 |
| 10 | 50 | 25 | 5.5 | 0.7 |
| 15 | 20 | 16 | 3.5 | 0.25 |
| 15 | 50 | 37 | 8.0 | 1.3 |
| 20 | 20 | 22 | 5.0 | 0.5 |
| 20 | 50 | 49 | 10.5 | 2.3 |

At inlet temperatures between 20 and 50°C the required quantity of water can be found by linear interpolation. In order to keep within the temperature limits it is necessary to direct a flow of air on to the seals. The air flow should be started at the application of filament voltage.

## WEIGHT

| | | |
|---|---|---|
| Valve only | 7.0 | lbs |
| | 3.0 | kg |
| Shipping weight | 83 | lbs |
| | 37.7 | kg |
| Water jacket | 4.5 | lbs |
| | 2.1 | kg |

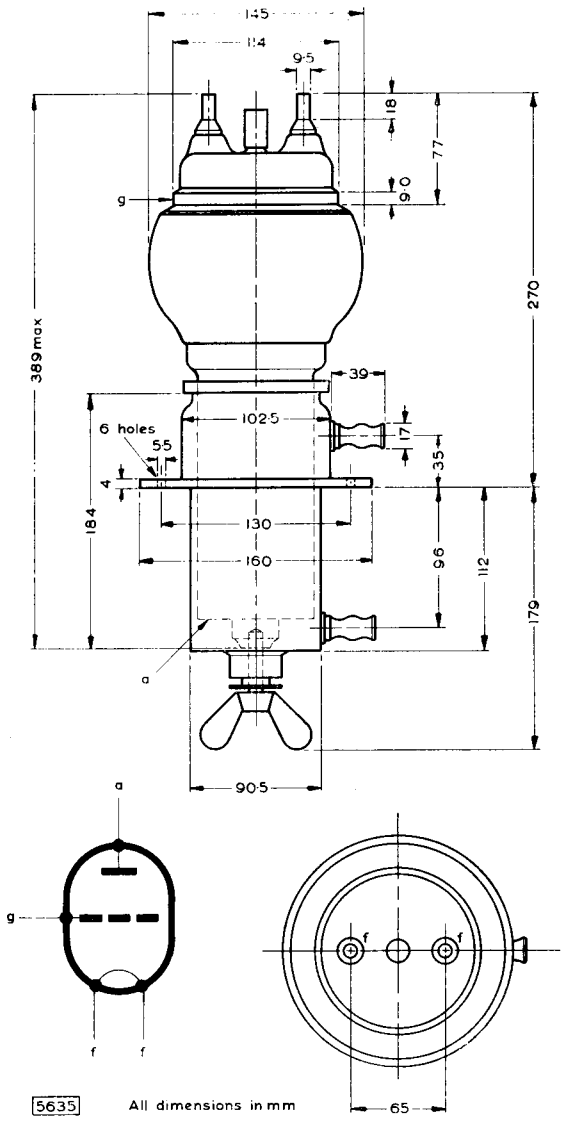
## ACCESSORIES

| | |
|---|---|
| Water jacket | K717 |
| Grid connector | 40663 |
| Filament clips with lead | 40662 |

***The characteristics, operating conditions, limiting values and curves are identical with those given for the TY12-20A but for the following difference:***

| | | |
|---|---|---|
| ***$p_a$ max.*** | ***20*** | ***kW*** |

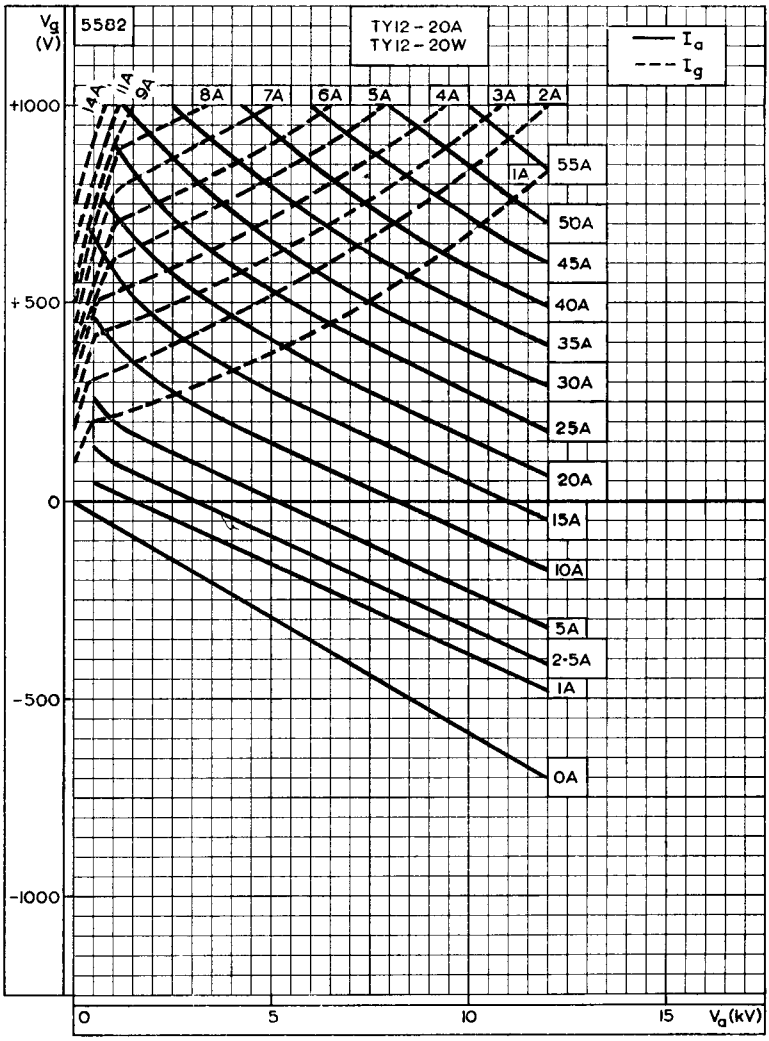
# TYI2-20W




5635 All dimensions in mm

# TY12-20W

**TRIODE**




CONSTANT CURRENT CURVES

R.F. POWER TRIODE

# TY12-20A
# TY12-20W

## QUICK REFERENCE DATA

*External anode triodes intended for use as r.f. oscillators or a.f. power amplifiers.*

The TY12-20A is forced-air cooled, and the TY12-20W is water cooled.

| | Class 'C' industrial oscillator | Class 'B' A.F. | |
|---|---|---|---|
| f max. | 30 | — | Mc/s |
| $V_a$ max. | 13 | 13 | kV |
| $p_a$ max. | 20 | 20 | kW |
| Performance | | | |
| f | 30 | — | Mc/s |
| $P_{out}$ | 39 | 61.5 | kW |

*Unless otherwise shown, data is applicable to both types*

This data should be read in conjunction with GENERAL OPERATIONAL RECOMMENDATIONS—TRANSMITTING VALVES which precede this section of the handbook.

## INDUSTRIAL OPERATION AS CLASS 'C' OSCILLATOR

### Absolute maximum ratings

| | | |
|---|---|---|
| f max. | 30 | Mc/s |
| $V_a$ max. | 13 | kV |
| $I_a$ max. | 5.0 | A |
| $-V_g$ max. | 2.0 | kV |
| $I_g$ max. | 1.5 | A |
| $p_a$ max. | 20 | kW |
| $R_{g\ f}$ max. | 10 | kΩ |
| $p_g$ max. | 1.1 | kW |

### Typical operating conditions

| | | | | |
|---|---|---|---|---|
| f | 30 | 30 | 30 | Mc/s |
| $V_a$ | 12 | 10 | 8.0 | kV |
| $V_{tr(r.m.s.)}$ | 8.9 | 7.4 | 6.0 | kV |
| $I_a$ | 4.5 | 4.5 | 4.5 | A |
| $I_g$ | 0.9 | 0.9 | 0.9 | A |
| $p_a$ | 15 | 13.7 | 12.8 | kW |
| $\eta_a$ | 72.5 | 70 | 64.5 | % |
| $R_{g-f}$ | 1.1 | 1.0 | 0.9 | kΩ |
| $R_a$ | 1450 | 1100 | 800 | Ω |
| Feedback ratio $\frac{V_{in(pk)}}{V_{a(pk)}}$ | 0.16 | 0.19 | 0.24 | |
| $P_{out}$ | 39 | 31.3 | 23.2 | kW |
| $P_{load}$ | 33 | 26.6 | 19.7 | kW |

# TY12-20A
# TY12-20W

**R.F. POWER TRIODE**

## CLASS 'B' A.F.

### Absolute maximum ratings

| | | |
|---|---|---|
| $V_a$ max. | 13 | kV |
| $I_a$ max. | 4.8 | A |
| $p_a$ max. | 20 | kW |
| $R_{g-f}$ max. | 10 | kΩ |

### Typical operating conditions

| | | | | |
|---|---|---|---|---|
| $V_a$ | 8.0 | 10 | 12 | kV |
| $I_{a(o)}$ | 2×350 | 2×400 | 2×450 | mA |
| $I_a$ (max. signal) | 2×4.2 | 2×4.2 | 2×3.8 | A |
| $-V_g$ | 420 | 500 | 550 | V |
| $V_{in(g-g)r.m.s.}$ | 1.24 | 1.32 | 1.35 | kV |
| $I_g$ | 2×825 | 2×700 | 2×630 | mA |
| $P_{load(driver)}$ | 2×680 | 2×640 | 2×610 | W |
| $p_a$ | 12.6 | 14.8 | 14.9 | kW |
| $\eta_a$ | 62 | 65 | 67 | % |
| $R_{a-a}$ | 2.07 | 2.6 | 3.73 | kΩ |
| $P_{out}$ | 42 | 54.5 | 61.5 | kW |

## CATHODE

Thoriated tungsten

| | | |
|---|---|---|
| **$V_f$ | 8.0 | V |
| *$I_f$ | 130 | A |

*The filament current must never exceed a surge value of 280A at any time during the warming-up period.

**The filament has been designed to accept temporary variations in supply voltage of +5% and −10%.

## MOUNTING POSITION

Vertical, anode down

## CAPACITANCES

| | | |
|---|---|---|
| $C_{a-g}$ | 23.5 | pF |
| $C_{g-f}$ | 42.5 | pF |
| $C_{a-f}$ | 0.9 | pF |

## CHARACTERISTICS (Measured at $V_a$ = 12kV, $I_a$ = 2A)

| | | |
|---|---|---|
| $g_m$ | 25 | mA/V |
| $\mu$ | 21 | |
| $g_m$ (Measured at $V_a$ = 1kV, $I_a$ = 20A) | 30 | mA/V |

## COOLING

### TY12-20A

Forced-air cooling

$T_{seals}$ max. 220 °C

In order to keep within the temperature limits it may be necessary to direct a flow of air on to the seals. The amount of forced-air cooling required for this valve depends upon the anode dissipation and the height above sea-level. Typical values of inlet temperature, rate of flow of air and pressure difference between the inlet and outlet housing are given below.

| Anode dissipation $P_a$ | Height above sea-level h | | Inlet temperature $T_{in}$ | Min. rate of flow of air per minute | | Pressure difference between inlet and outlet |
|---|---|---|---|---|---|---|
| (kW) | (km) | (ft) | (°C) | ($m^3$) | ($ft^3$) | (mm of $H_2O$) |
| 7.0 | 0 | 0 | 35 | 6.6 | 235 | 10 |
| 7.0 | 0 | 0 | 45 | 7.7 | 270 | 13 |
| 7.0 | 1.5 | 4920 | 35 | 7.9 | 280 | 12 |
| 7.0 | 3.0 | 9840 | 25 | 8.3 | 295 | 12 |
| 10 | 0 | 0 | 35 | 10.5 | 370 | 23 |
| 10 | 0 | 0 | 45 | 12.3 | 435 | 31 |
| 10 | 1.5 | 4920 | 35 | 12.6 | 445 | 28 |
| 10 | 3.0 | 9840 | 25 | 13.2 | 465 | 27 |
| 15 | 0 | 0 | 35 | 18.1 | 640 | 60 |
| 15 | 0 | 0 | 45 | 21.2 | 750 | 79 |
| 15 | 1.5 | 4920 | 35 | 21.7 | 765 | 73 |
| 15 | 3.0 | 9840 | 25 | 22.8 | 805 | 70 |

**TY12-20W**

Water cooling

| | | |
|---|---|---|
| $T_{seals}$ max. | 220 | °C |
| $T_{inlet}$ max. | 50 | °C |

Typical values of inlet temperature, rate of flow of water, and pressure difference between the inlet and outlet housing at various anode dissipations are given below.

| Anode dissipation $P_a$ | Inlet temperature $T_{in}$ | Rate of flow of water per minute | | Pressure difference between inlet and outlet |
|---|---|---|---|---|
| (kW) | (°C) | (litres) | (gal) | (atm) |
| 5.0 | 20 | 6.0 | 1.5 | 0.02 |
| 5.0 | 50 | 15 | 3.5 | 0.22 |
| 10 | 20 | 11 | 2.5 | 0.1 |
| 10 | 50 | 25 | 5.5 | 0.7 |
| 15 | 20 | 16 | 3.5 | 0.25 |
| 15 | 50 | 37 | 8.0 | 1.3 |
| 20 | 20 | 22 | 5.0 | 0.5 |
| 20 | 50 | 49 | 10.5 | 2.3 |

At inlet temperatures between 20 and 50°C the required quantity of water can be found by linear interpolation. In order to keep within the temperature limits it is necessary to direct a flow of air on to the seals. The air flow should be started at the application of filament voltage.

## PHYSICAL DATA

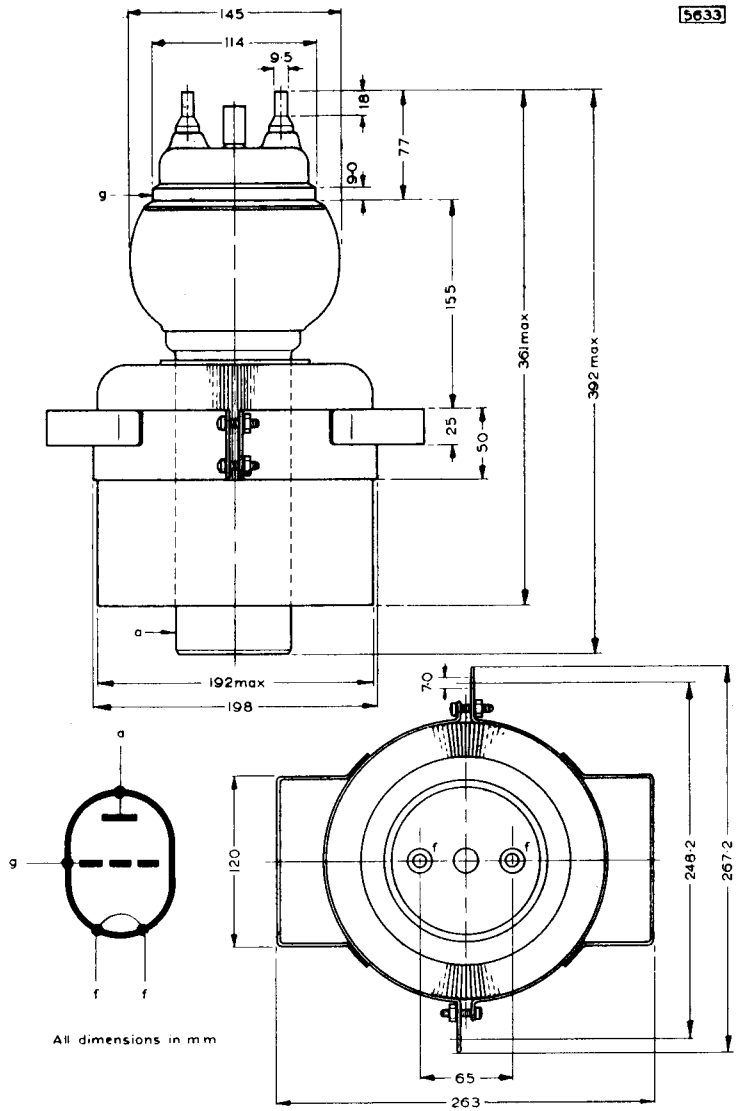
| | TY12-20A | TY12-20W | |
|---|---|---|---|
| Weight of valve | 35.5 | 7.0 | lb |
| | 16.1 | 3.0 | kg |
| Weight of valve plus carton | 121.5 | 83 | lb |
| | 55.1 | 37.7 | kg |
| Weight of insulating pedestal (TY12-20A) | | 15.8 | lb |
| | | 7.15 | kg |
| Weight of water jacket (TY12-20W) | | 4.5 | lb |
| | | 2.1 | kg |

## ACCESSORIES

| | |
|---|---|
| Insulating pedestal (TY12-20A) | 40648 |
| Water jacket (TY12-20W) | K722 |
| Grid connector | 40663 |
| Filament clips with lead | 40662 |
| Rubber gasket | 89 039 48 |

# TY12-20A
# TY12-20W

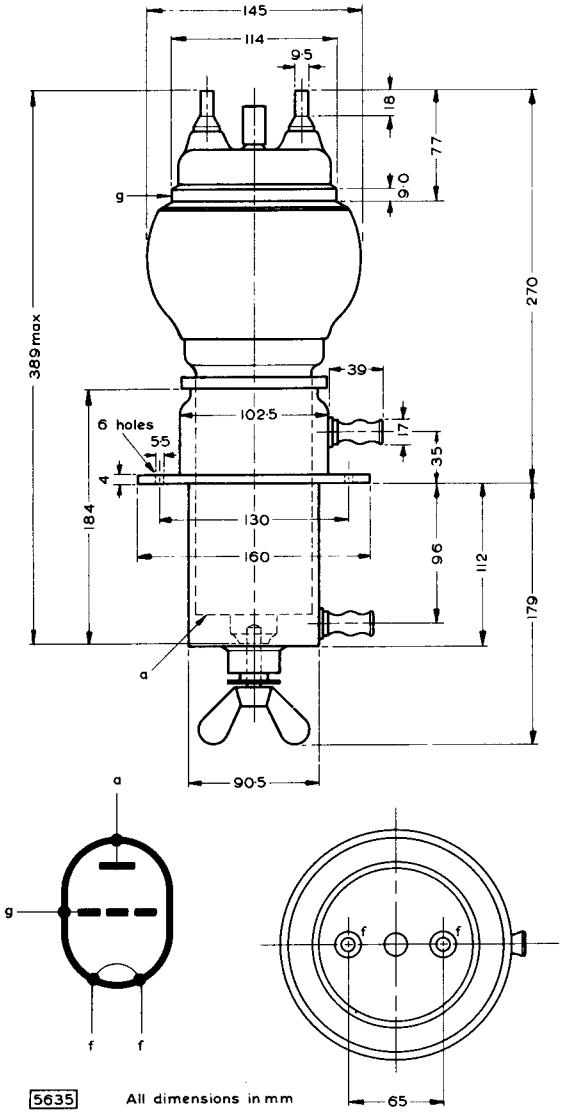
## TY12-20A



# TY12-20A
# TY12-20W

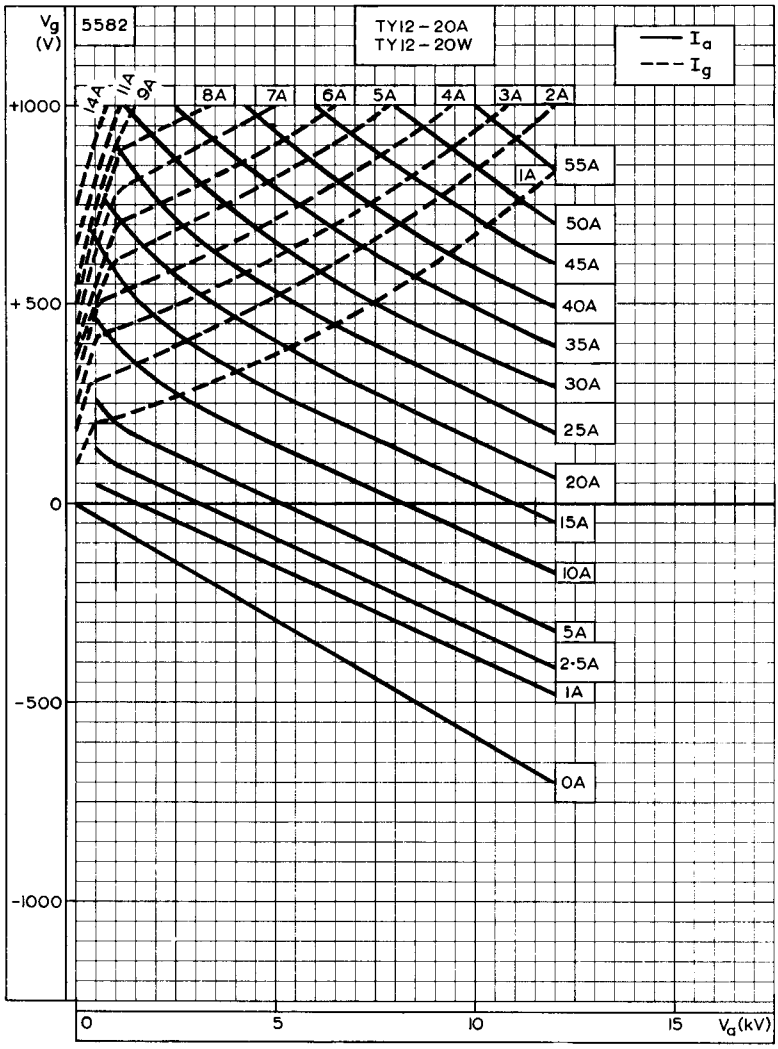
## R.F. POWER TRIODE

**TY12-20W**




5635 All dimensions in mm

# TY12-20A
# TY12-20W




CONSTANT CURRENT CURVES