



# Half-Wave Gas-Filled Rectifier

Code: 3B28 (CVI835) ←

The 3B28 is a xenon-filled, half-wave rectifier designed for operation in high voltage circuits where extremes of ambient temperature are encountered.

It is well suited for mobile applications since its construction permits the valve to be mounted in any position and heaters, fans and thermostats are not required for the close control of bulb temperature.

## CATHODE

|                       |     |     |
|-----------------------|-----|-----|
| Oxide-coated filament |     |     |
| Filament voltage      | 2.5 | V   |
| Nominal current       | 5.0 | A   |
| Minimum heating time  | 10  | sec |

## MECHANICAL DATA

|                        |                               |    |
|------------------------|-------------------------------|----|
| Maximum overall length | 162                           | mm |
| Maximum bulb diameter  | 52.6                          | mm |
| Base                   | American medium 4-pin bayonet |    |
| Top cap                | CT3 with insulating collar    |    |
| Mounting position      | Unrestricted←                 |    |
| Net weight             | 120                           | g← |

## MAXIMUM RATINGS

|                                        |               |               |     |
|----------------------------------------|---------------|---------------|-----|
| Maximum peak inverse voltage           | 5             | 10            | kV  |
| Maximum peak anode current             | 2             | 1             | A   |
| Maximum average anode current          | 0.5           | 0.25          | A   |
| Maximum frequency for<br>above ratings | 500           | 150           | c/s |
| Ambient temperature range              | —55 to<br>+75 | —55 to<br>+75 | °C  |
| Maximum voltage drop                   | 14            | 14            | V←  |

# Half-Wave Gas-Filled Rectifier

Code: 3B28 (CVI835) ←



## TYPICAL OPERATING CONDITIONS

| Circuit                                     | No. of Valves | Maximum A.C. Input Voltage (V <sub>r.m.s.</sub> ) | Maximum D.C. Output Voltage (V) | Maximum D.C. Output Current (A) |
|---------------------------------------------|---------------|---------------------------------------------------|---------------------------------|---------------------------------|
| Single Phase Full Wave Circuit No. 1        | 2             | 3535                                              | 3180                            | 0.5                             |
| Single Phase Full Wave Bridge Circuit No. 2 | 4             | 7070                                              | 6360                            | 0.5                             |
| Three Phase Half Wave Circuit No. 3         | 3             | 4080                                              | 4780                            | 0.75                            |
| Three Phase Double Y Parallel Circuit No. 4 | 6             | 4080                                              | 4780                            | 1.5                             |
| Three Phase Full Wave Circuit No. 5         | 6             | 4080                                              | 9570                            | 0.75                            |

The above tables suitable circuits for this rectifier, and shows their safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

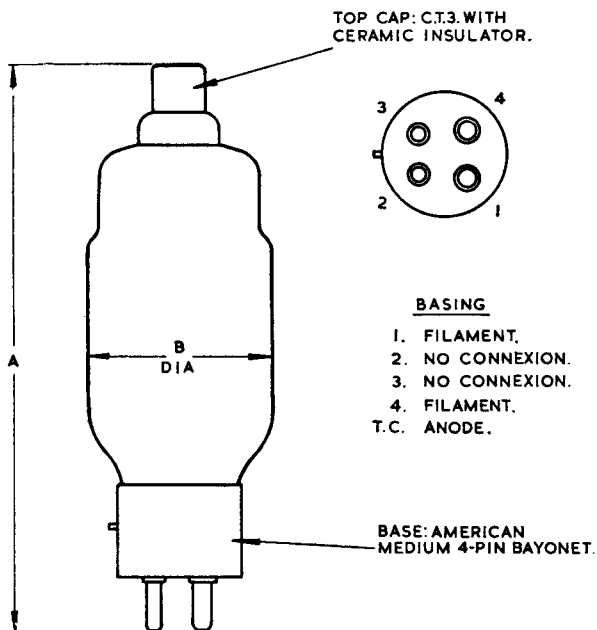
This rectifier being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer secondary winding.

For details of the circuits referred to, see sheet K—8 in the introduction to this handbook.



# Half-Wave Gas-Filled Rectifier

Code: 3B28 (CVI835) ←



| DIM. | MILLIMETRES | INCHES     |
|------|-------------|------------|
| A    | 149·10 MIN. | 5·870 MIN. |
|      | 162·05 MAX. | 6·380 MAX. |
| B    | 52·58 MAX.  | 2·070 MAX. |

NOTE: BASIC FIGURES ARE INCHES.



# Half-Wave Gas-Filled Rectifier

Code: 4B32 (CV2518) ←

The 4B32 is a xenon-filled, half-wave rectifier designed for operation in high voltage circuits where extremes of ambient temperature are encountered.

It is well suited for mobile applications since its construction permits the valve to be mounted in any position and heaters, fans and thermostats are not required for the close control of bulb temperature.

## CATHODE

Oxide-coated filament

|                      |     |     |
|----------------------|-----|-----|
| Filament voltage     | 5.0 | V   |
| Nominal current      | 7.5 | A   |
| Minimum heating time | 30  | sec |

## DIMENSIONS

|                        |                            |    |
|------------------------|----------------------------|----|
| Maximum overall length | 216                        | mm |
| Maximum diameter       | 59                         | mm |
| Base                   | B4F                        |    |
| Top cap                | CT3 with insulating collar |    |
| Mounting position      | Unrestricted               | ←  |

## MAXIMUM RATINGS

|                                         |            |      |
|-----------------------------------------|------------|------|
| Maximum peak inverse voltage            | 10         | kV   |
| Maximum peak anode current              | 5.0        | A    |
| Maximum average anode current           | 1.25       | A    |
| Maximum fault anode current             | 50         | A←   |
| Maximum duration of fault anode current | 0.1        | sec← |
| Maximum voltage drop                    | 16         | V←   |
| Maximum frequency for above ratings     | 150        | c/s  |
| Ambient temperature range               | −55 to +70 | °C   |



# Half-Wave Gas-Filled Rectifier

Code: 4B32 (CV2518)



## TYPICAL OPERATING CONDITIONS.

| Circuit                                     | No. of Valves | Maximum A.C. Input Voltage ( $V_{rms}$ ) | Maximum D.C. Output Voltage (V) | Maximum D.C. Output Current (A) |
|---------------------------------------------|---------------|------------------------------------------|---------------------------------|---------------------------------|
| Single Phase Full Wave Circuit No. 1        | 2             | 3535                                     | 3180                            | 2.5                             |
| Single Phase Full Wave Bridge Circuit No. 2 | 4             | 7070                                     | 6360                            | 2.5                             |
| Three Phase Half Wave Circuit No. 3         | 3             | 4080                                     | 4780                            | 3.75                            |
| Three Phase Double Y Parallel Circuit No. 4 | 6             | 4080                                     | 4780                            | 7.5                             |
| Three Phase Full Wave Circuit No. 5         | 6             | 4080                                     | 9570                            | 3.75                            |

The above tables suitable circuits for this rectifier, and shows their safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

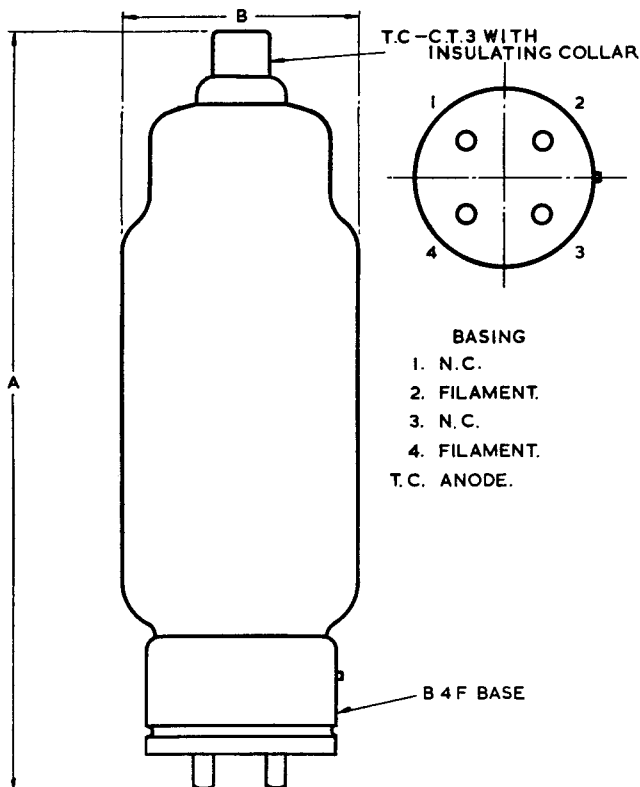
This rectifier being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer secondary winding.

For details of the circuits referred to, see sheet K—8 in the introduction to this handbook.



# Half-Wave Gas-Filled Rectifier

Code: 4B32 (CV2518) ←



| DIM: | MILLIMETRES | INCHES               |
|------|-------------|----------------------|
| A    | 193.7 MIN:  | $7\frac{5}{8}$ MIN:  |
|      | 215.9 MAX:  | $8\frac{1}{2}$ MAX:  |
| B    | 58.9 MAX:   | $2\frac{5}{16}$ MAX: |

NOTE:- BASIC FIGURES ARE INCHES.



## Half-Wave Gas-Filled Rectifier

Code: 2G/473C (CV2399)

The 2G/473C is a xenon-filled, half-wave rectifier designed for operation in high voltage circuits where extremes of ambient temperature are encountered.

It is well suited for mobile applications since its construction permits the valve to be mounted in any position and heaters, fans and thermostats are not required for the close control of bulb temperature.

A mercury-vapour rectifier with similar electrical ratings and dimensions is available under the code 4049D (CV5).

### CATHODE

Oxide-coated filament

|                              |    |     |
|------------------------------|----|-----|
| Filament voltage             | 4  | V   |
| Nominal current              | 11 | A   |
| Minimum cathode heating time | 30 | sec |

### DIMENSIONS

|                        |                      |    |
|------------------------|----------------------|----|
| Maximum overall length | 258                  | mm |
| Maximum bulb diameter  | 60                   | mm |
| Base                   | Goliath Edison Screw |    |
| Top cap                | CT9                  |    |
| Net weight             | 240                  | g  |
| Mounting position      | Unrestricted         |    |

### MAXIMUM RATINGS

|                                         |            |     |
|-----------------------------------------|------------|-----|
| Maximum peak inverse voltage            | 13         | kV  |
| Maximum peak anode current              | 6          | A   |
| Maximum average anode current           | 1.25       | A   |
| Maximum fault anode current             | 25         | A   |
| Maximum duration of fault anode current | 0.1        | sec |
| Maximum voltage drop                    | 13         | V   |
| Maximum frequency                       | 150        | c/s |
| Ambient temperature range               | -55 to +75 | °C  |

# Half-Wave Gas-Filled Rectifier

Code: 2G/473C (CV2399)



## TYPICAL OPERATING CONDITIONS

| Circuit                                     | No. of Valves | Maximum A.C. Input Voltage (Vr.m.s.) | Maximum D.C. Output Voltage (V) | Maximum D.C. Output Current (A) |
|---------------------------------------------|---------------|--------------------------------------|---------------------------------|---------------------------------|
| Single Phase Full Wave Circuit No. 1        | 2             | 4550                                 | 4100                            | 2.5                             |
| Single Phase Full Wave Bridge Circuit No. 2 | 4             | 9100                                 | 8200                            | 2.5                             |
| Three Phase Half Wave Circuit No. 3         | 3             | 5300                                 | 6200                            | 3.75                            |
| Three Phase Double Y Parallel Circuit No. 4 | 6             | 5300                                 | 6200                            | 7.5                             |
| Three Phase Full Wave Circuit No. 5         | 6             | 5300                                 | 12400                           | 3.75                            |

The above tables suitable circuits for this rectifier, and shows their safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

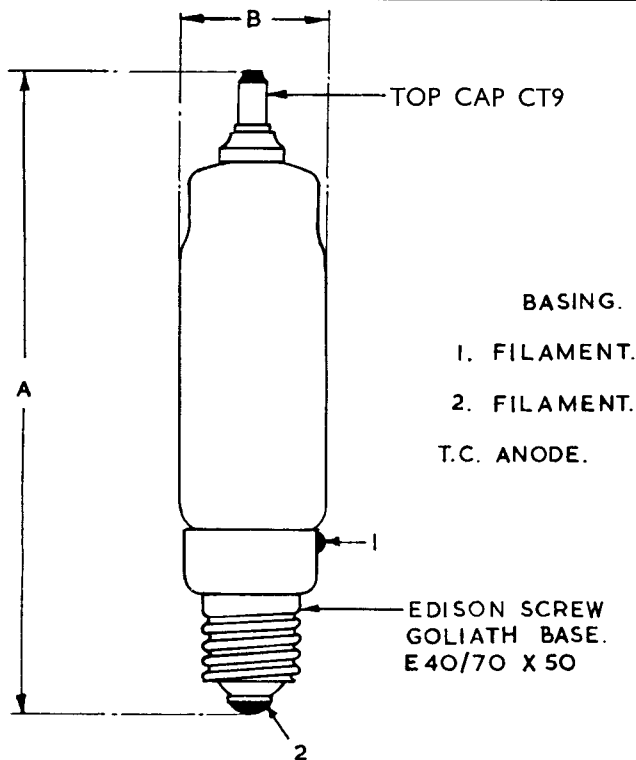
This rectifier being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer secondary winding.

For details of the circuits referred to see sheet K—8 in the introduction to this handbook.



# Half-Wave Gas-Filled Rectifier

Code: 2G/473C (CV2399)



| DIM | INCHES                               | MILLIMETRES |
|-----|--------------------------------------|-------------|
| A   | 10 <sup>5</sup> / <sub>32</sub> MAX: | 258·0 MAX:  |
|     | 9 <sup>1</sup> / <sub>16</sub> MIN:  | 230·0 MIN:  |
| B   | 2 <sup>11</sup> / <sub>32</sub> MAX: | 60·0 MAX:   |
|     | 2 <sup>5</sup> / <sub>32</sub> MIN:  | 55·0 MIN:   |

NOTE: BASIC FIGURES ARE MILLIMETRES.



# Miniature Half-Wave High-Voltage Rectifier

Code: 2T/270K (CV261)

The R.T.M.A. code for this valve is 6305.

←

## CATHODE.

Indirectly-heated, oxide-coated

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 4   | V |
| Nominal current | 0.5 | A |

## DIMENSIONS.

|                        |              |     |
|------------------------|--------------|-----|
| Maximum overall length | 60           | mm← |
| Maximum seated height  | 53           | mm← |
| Maximum diameter       | 19.05        | mm← |
| Top cap                | Skirted CT-1 | ←   |
| Base                   | B7G          |     |

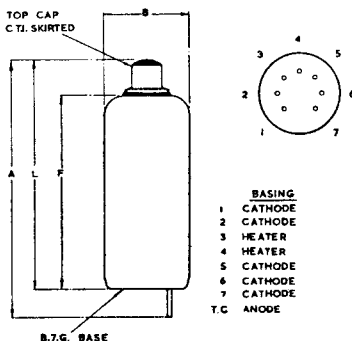
## MAXIMUM RATINGS.

|                                                                                            |      |      |
|--------------------------------------------------------------------------------------------|------|------|
| Maximum applied r.m.s voltage                                                              | 5.5  | kV   |
| Maximum applied r.m.s voltage for simultaneous switching of heater and anode supplies      | 3.5  | kV   |
| Maximum working peak inverse voltage                                                       | 12.5 | kV   |
| Maximum no load peak inverse voltage                                                       | 15.5 | kV   |
| Maximum DC mean rectified current                                                          | 5    | mA   |
| Maximum peak anode current                                                                 | 40   | mA   |
| Recommended reservoir capacitor                                                            | 0.3  | μF←  |
| Minimum limiting equivalent resistor introduced externally for an r.m.s. voltage of 5.5 kV | 50   | kΩ←  |
| Minimum delay in switching anode supply after heater voltage at maximum applied voltage    | 30   | sec. |

The above ratings apply to operation with a capacitor input filter and supply frequency of 50 c/s.

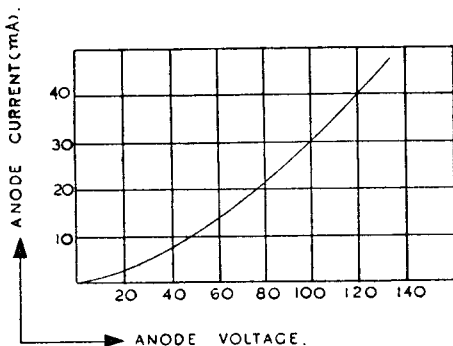
# Miniature Half-Wave High-Voltage Rectifier

Code: 2T/270K (CV261)



| DIM. | MILLIMETRES              | INCHES                                                                       |
|------|--------------------------|------------------------------------------------------------------------------|
| A    | 60.00 MAX.               | 2 <sup>11</sup> / <sub>32</sub> MAX.                                         |
| B    | 19.05 MAX.               | 3 <sup>3</sup> / <sub>4</sub> MAX.                                           |
| F    | 34.04 MIN.<br>42.16 MAX. | 1 <sup>11</sup> / <sub>32</sub> MIN.<br>1 <sup>21</sup> / <sub>32</sub> MAX. |
| L    | 53.00 MAX.               | 2 <sup>1</sup> / <sub>16</sub> MAX.                                          |

NOTE - BASIC FIGURES ARE IN MILLIMETRES.





# Half-Wave High-Vacuum Rectifier

Code: 705A (CV3587) ←

This rectifier is directly equivalent to the U.S.A. 705A type.

## CATHODE

Thoriated tungsten filament with centre tap

Voltage (full filament) 5 V

Nominal current (per half filament) 5 A

## MECHANICAL DATA

Maximum overall length 128.6 mm

Maximum diameter 65.1 mm

Top cap Tungsten lead

Base B4A

Socket Special

Net weight 90 g

## MAXIMUM RATINGS

Maximum peak inverse voltage 30 kV

Maximum peak anode current at 30 kV P.I.V. 0.4 A

Maximum average anode current at 30 kV P.I.V. 0.1 A

Maximum peak anode current at 15 kV P.I.V. 0.6 A

Maximum average anode current at 15 kV P.I.V. 0.15 A

Maximum anode dissipation 60 W

## TYPICAL OPERATION (for ideal choke-input filter)

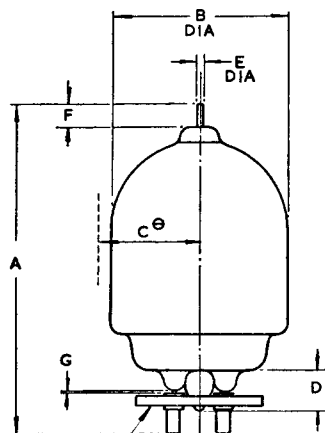
| Circuit            | No. of Valves | Maximum D.C. output voltage | Maximum D.C. output current |
|--------------------|---------------|-----------------------------|-----------------------------|
| Bi-phase half wave | 2             | 9 kV                        | 0.2 A                       |
| Full wave          | 4             | 18 kV                       | 0.2 A                       |



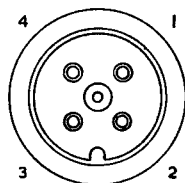
# Half-Wave High-Vacuum Rectifier



Code: 705A (CV3587) ←



B 4 A BASE

**BASING**

1. FILAMENT  
2. FILAMENT C.T.  
3. FILAMENT  
4. NO CONNEXION  
T.L. ANODE

| DIM | MILLIMETRES              | INCHES                             | DIM | MILLIMETRES           | INCHES                 |
|-----|--------------------------|------------------------------------|-----|-----------------------|------------------------|
| A   | 122.25 MIN<br>128.60 MAX | 4.813 MIN<br>5.063 MAX             | E   | 1.40 MIN<br>1.52 MAX  | 0.055 MIN<br>0.060 MAX |
| B   | 65.1 MAX                 | 2 <sup>9</sup> / <sub>16</sub> MAX | F   | 7.75 MIN<br>11.30 MAX | 0.305 MIN<br>0.445 MAX |
| θ C | 35.71 MAX                | 1.406 MAX                          | G   | 0.38 MIN<br>2.39 MAX  | 0.015 MIN<br>0.094 MAX |
| D   | 12.7 MAX                 | 1/2 MAX                            |     |                       |                        |

θ DENOTES :- ECCENTRICITY WITH RESPECT TO  $\phi$  OF BASENOTE:-BASIC DIMENSIONS ARE INCHES



# Hot Cathode Mercury Vapour Rectifier

2V/400A

## CATHODE.

Oxide-coated filament, shielded

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 2.5 | V |
| Nominal current | 5.0 | A |

## DIMENSIONS.

|                            |     |     |
|----------------------------|-----|-----|
| Maximum overall length     | 170 | mm. |
| Maximum bulb diameter      | 66  | mm. |
| Base—American medium 4 pin |     |     |
| Net weight                 | 125 | g.  |

## MAXIMUM RATINGS.

|                                                                           |      |    |
|---------------------------------------------------------------------------|------|----|
| Maximum peak inverse voltage                                              | 10   | kV |
| Maximum peak anode current                                                | 1.0  | A  |
| Maximum average anode current                                             | 0.25 | A  |
| Condensed mercury temperature range 25°-65°C<br>(with forced ventilation) |      |    |

The above ratings apply to operation with a choke input filter  
and a supply frequency of 50 c/s.

## MAXIMUM P.I.V. VOLTAGE RATINGS AND CONDENSED MERCURY TEMPERATURE

|                        |     |           |             |
|------------------------|-----|-----------|-------------|
| Natural ventilation... | ... | 25°—55°C  | 20°C—40°C   |
| Forced ventilation ... | ... | 25°—65°C  | 20°C—60°C   |
| Peak Inverse Voltage   | ... | up to 5kV | 5kV to 10kV |

**2V/400A**

# Hot Cathode Mercury Vapour Rectifier

**2V/400A**

## TYPICAL OPERATING CONDITIONS

| Circuit No. | No. of valves | Maximum D.C. output voltage | Maximum D.C. output current |
|-------------|---------------|-----------------------------|-----------------------------|
| 2           | 2             | 3.200V                      | 0.5A                        |
| 3           | 4             | 6.500V                      | 0.5A                        |
| 4           | 3             | 4.500V                      | 0.75A                       |
| 5           | 6             | 4.500V                      | 1.5A                        |
| 6           | 6             | 9.500V                      | 0.75A                       |

This rectifier being directly heated, it is recommended that the output circuit be returned to the mid-point of the filament transformer secondary.

## CATHODE HEATING TIME.

Minimum pre-heating period 30 seconds. After shipment or transit the pre-heating period must not be less than 5 minutes before any anode voltage is applied, so that the mercury may be correctly distributed.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation forced air blast being required for operation up to the maximum condensed mercury temperature limit.

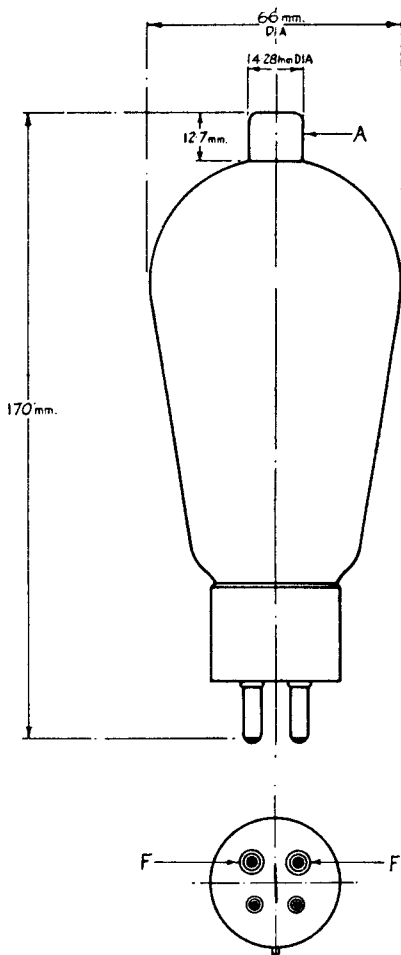
**NOTE.**—Before putting a valve of this type into service it is recommended that reference be made to General Information Sheet K.



# Hot Cathode Mercury Vapour Rectifier

2V/400A

2V/400A



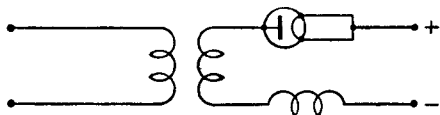
2V/400A

# Hot Cathode Mercury Vapour Rectifier

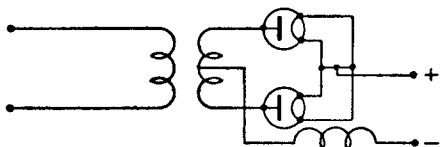


2V/400A

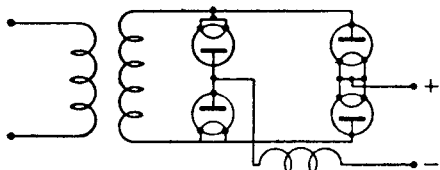
Circuit  
No.  
**1**



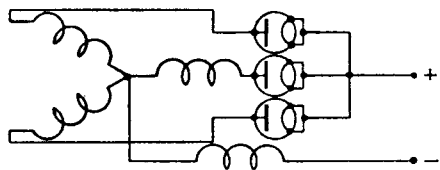
**2**



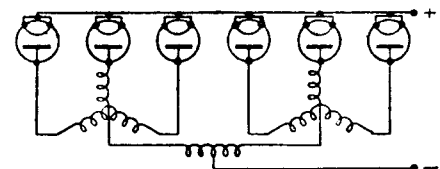
**3**



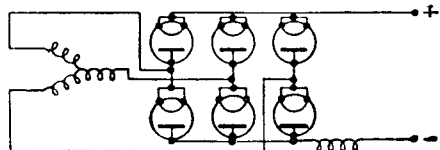
**4**



**5**



**6**





# Half-Wave Mercury- Vapour Rectifier

Code: 872A (CVI449)

This rectifier is equivalent to the U.S.A. 872/872A and F353A← types.

## CATHODE

Oxide-coated filament, shielded

|                              |      |     |
|------------------------------|------|-----|
| Filament voltage             | 5    | V   |
| Nominal current              | 7.25 | A   |
| Minimum cathode heating time | 1    | min |

## MECHANICAL DATA

|                        |                     |    |
|------------------------|---------------------|----|
| Maximum overall length | 216                 | mm |
| Maximum bulb diameter  | 62                  | mm |
| Base                   | Large 4-pin bayonet |    |
| Socket                 | 4009C or 4039A      |    |
| Net weight             | 225                 | g  |
| Mounting position      | Unrestricted←       |    |

## MAXIMUM RATINGS

|                                     |          |    |
|-------------------------------------|----------|----|
| Maximum peak inverse voltage        | 10       | kV |
| Maximum peak anode current          | 5        | A  |
| Maximum average anode current       | 1.25     | A  |
| Maximum volt drop                   | 14       | V  |
| Condensed mercury temperature range |          |    |
| with forced ventilation             | 15 to 70 | °C |

The above ratings apply to operation with a choke-input filter and a supply frequency of 50 c/s.

**Ref. : 2V/471A**

# **Half-Wave Mercury- Vapour Rectifier**

**Code: 872A (CVI449)**



## **CATHODE HEATING TIME**

| Ambient Temperature        | 10 to 20°C | 20°C and above |
|----------------------------|------------|----------------|
| Minimum pre-heating period | 2 minutes  | 1 minute       |

## **MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY TEMPERATURE**

| Natural Ventilation  | 15 to 50° C | 15 to 45° C |
|----------------------|-------------|-------------|
| Forced Ventilation   | 15 to 70° C | 15 to 60° C |
| Peak inverse Voltage | Up to 5 kV  | 5 to 10 kV  |

After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied, so that the mercury may be distributed correctly.

The temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation. Forced air cooling is recommended and is required for operation up to the limit of condensed mercury temperature.

Before putting a valve of this type into service it is recommended that reference be made to the General Information Section K in the introduction to this handbook.



# Half-Wave Mercury-Vapour Rectifier

Code: 872A (CV1449)

## TYPICAL OPERATING CONDITIONS

| Circuit                                     | No. of valves | Maximum A.C. Input Voltage (V <sub>r.m.s.</sub> ) | Maximum D.C. Output Voltage (V) | Maximum D.C. Output Current (A) |
|---------------------------------------------|---------------|---------------------------------------------------|---------------------------------|---------------------------------|
| Single Phase Full-Wave Circuit No. 1        | 2             | 3535                                              | 3200                            | 2.5                             |
| Single Phase Full-Wave Bridge Circuit No. 2 | 4             | 7070                                              | 6400                            | 2.5                             |
| Three Phase Half-Wave Circuit No. 3         | 3             | 4080                                              | 4780                            | 3.75                            |
| Three Phase Double Y Parallel Circuit No. 4 | 6             | 4080                                              | 4780                            | 7.5                             |
| Three Phase Full-Wave Circuit No. 5         | 6             | 4080                                              | 9570                            | 3.75                            |

The above tables suitable circuits for this rectifier, and shows their safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

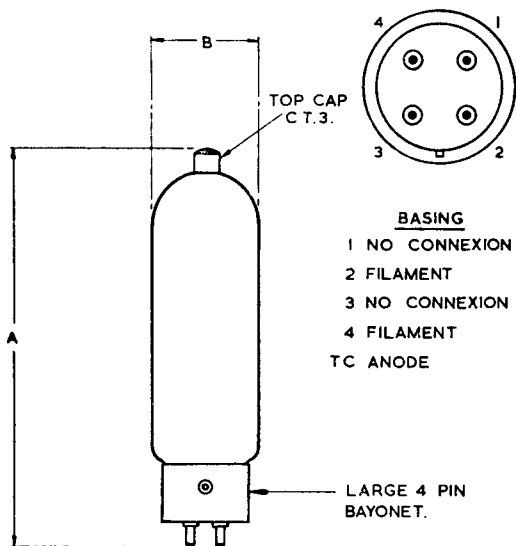
This rectifier being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer secondary winding.

For details of the circuits referred to see sheet K—8 in the introduction to this handbook.



# Half-Wave Mercury- Vapour Rectifier

Code: 872A (CV1449)



| DIM: | MILLIMETRES | INCHES                |
|------|-------------|-----------------------|
| A    | 215.9 MAX:  | 8 $\frac{1}{2}$ MAX:  |
| B    | 61.9 MAX:   | 2 $\frac{7}{16}$ MAX: |

NOTE:-BASIC FIGURES ARE INCHES



# Half Wave Mercury Vapour Rectifier

4049D

2V/500C  
(4049D)

## CATHODE.

Oxide-coated shielded filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 4  | V |
| Nominal current | 11 | A |

## DIMENSIONS.

|                        |                    |     |
|------------------------|--------------------|-----|
| Maximum overall length | 270                | mm. |
| Maximum bulb diameter  | 63                 | mm. |
| Base                   | Giant Edison Screw |     |
| Net weight             | 220                | g.  |

## MAXIMUM RATINGS.

|                                                                |             |    |
|----------------------------------------------------------------|-------------|----|
| Maximum peak inverse voltage                                   | 20          | kV |
| Maximum peak anode current                                     | 5           | A  |
| Maximum average anode current                                  | 1.25        | A  |
| Condensed mercury temperature<br>range with forced ventilation | 20°C.-65°C. |    |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

|                         |                    |                  |
|-------------------------|--------------------|------------------|
| Natural Ventilation     | 20°C.-55°C.        | 20°C.-40°C.      |
| Forced Ventilation      | 20°C.-65°C.        | 20°C.-55°C.      |
| Peak inverse<br>voltage | Less than<br>10 kV | 10kV to<br>20 kV |

**2V/500C  
(4049D)**

# Half Wave Mercury Vapour Rectifier

**4049D**



## TYPICAL OPERATION.

| Circuit No. | No. of Valves | Maximum DC Output Volts | Maximum DC Output Amps. |
|-------------|---------------|-------------------------|-------------------------|
| 2           | 2             | 6,400 V                 | 2.5 A                   |
| 3           | 4             | 13,000 V                | 2.5 V                   |
| 4           | 3             | 9,500 V                 | 3.75 V                  |
| 5           | 6             | 9,500 V                 | 7.5 V                   |
| 6           | 6             | 18,500 V                | 3.75 V                  |

This rectifier being indirectly heated, it is recommended that the output circuit be returned to the mid-point of the filament transformer secondary.

## CATHODE HEATING TIME.

|                         |            |            |           |
|-------------------------|------------|------------|-----------|
| Ambient Temperature     | 10° to 15° | 15° to 30° | above 30° |
| Min. pre-heating period | 30 min.    | 15 min.    | 5 min.    |

After shipment or transit the valve must be pre-heated not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly. Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

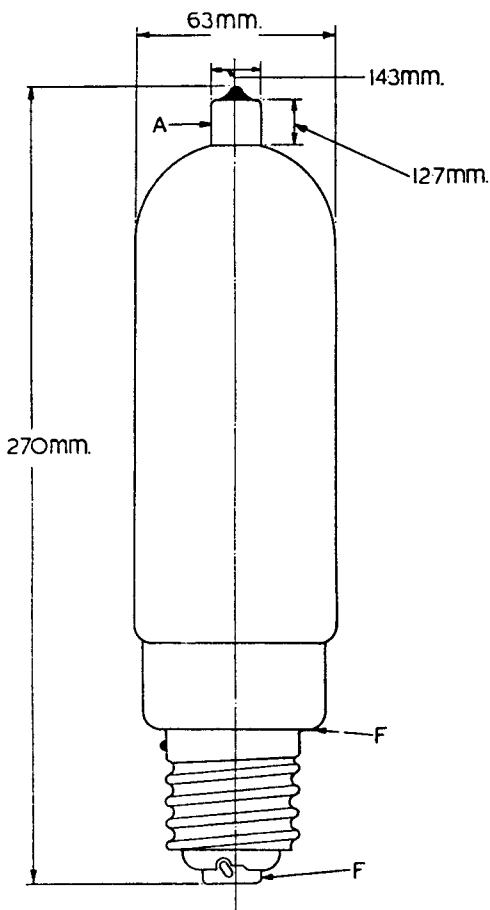
*Note.*—Before putting a valve of this type into service it is recommended that reference be made to the General Information Sheet K.



# Half Wave Mercury Vapour Rectifier

4049D

2V/500C  
(4049D)



2V/500C  
(4049D)

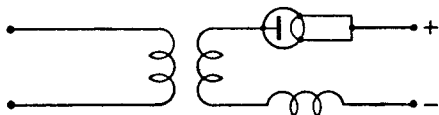
# Half Wave Mercury Vapour Rectifier

4049D

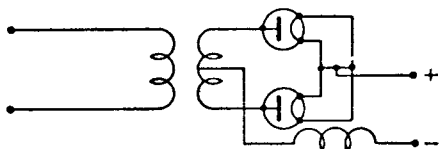


Circuit  
No.

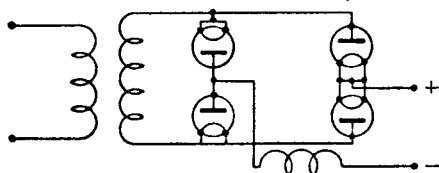
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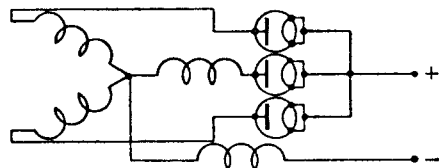
2



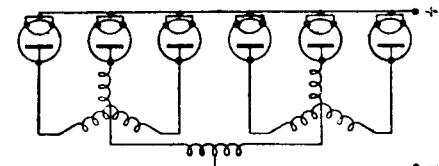
3



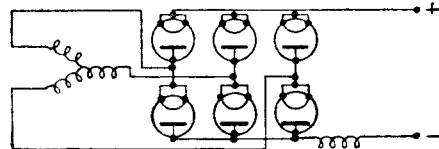
4



5



6



Tentative data  
June 1946

2V/500C—4



# Hot Cathode Mercury Vapour Rectifier

2V/530E  
(4078A)

4078A

## CATHODE.

Oxide-coated shielded filament

Voltage 5 V

Nominal current 20 A

## DIMENSIONS.

Maximum overall length 412 mm.

Maximum bulb diameter 157 mm.

Net weight 900 g.

Base—Special 2-pin—(see *drawing*)

Top cap—Special—(see *drawing*)

## MAXIMUM RATINGS.

Maximum peak inverse voltage 20 kV

Maximum peak anode current 10 A

Maximum average anode current 2.5 A

Condensed mercury temperature  
range with forced ventilation 15°C. to 65°C.  
maximum

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

|                      |                   |                   |                    |                       |
|----------------------|-------------------|-------------------|--------------------|-----------------------|
| Natural Ventilation  | 15°C. to 50°C.    | 15°C. to 40°C.    | —                  | —                     |
| Forced Ventilation   | 15°C. to 65°C.    | 15°C. to 55°C.    | 15°C. to 45°C.     | 15°C. to 40°C.        |
| Peak inverse Voltage | Less than 7,000 V | 7,500 to 10,000 V | 10,000 to 12,500 V | Greater than 12,500 V |

**2V/530E****(4078A)**

# Hot Cathode Mercury Vapour Rectifier

**4078A****TYPICAL OPERATION.**

| Circuit No. | No. of Valves | Maximum DC<br>Output Volts | Maximum DC<br>Output Amps |
|-------------|---------------|----------------------------|---------------------------|
| 2           | 2             | 6,400 V                    | 5 A                       |
| 3           | 4             | 12,500 V                   | 5 A                       |
| 4           | 3             | 9,500 V                    | 7.5 A                     |
| 5           | 6             | 9,500 V                    | 15 A                      |
| 6           | 6             | 18,500 V                   | 7.5 A                     |

This rectifier being directly heated, it is recommended that the output circuit be returned to the mid-point of the filament transformer secondary.

**CATHODE HEATING TIME.**

|                         |                |                |                 |
|-------------------------|----------------|----------------|-----------------|
| Ambient temperature     | 10°C. to 15°C. | 15°C. to 20°C. | 20°C. and above |
| Min. pre-heating period | 30 min.        | 15 min.        | 5 min.          |

After shipment or transit the valve must be pre-heated not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly. Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

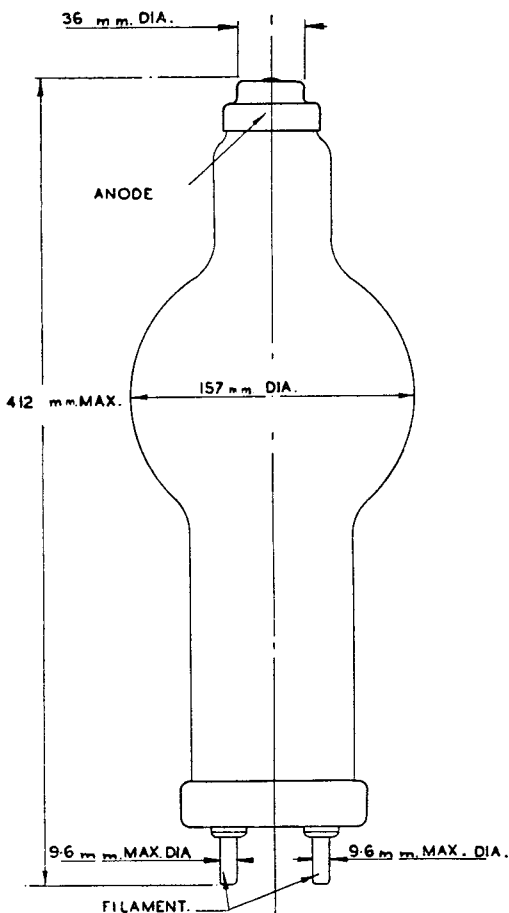
**Note.**—Before putting a valve of this type into service it is recommended that reference be made to the General Information Sheet K.



# Hot Cathode Mercury Vapour Rectifier

2V/530E  
(4078A)

4078A





2V/530E  
(4078A)

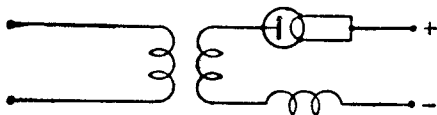
# Hot Cathode Mercury Vapour Rectifier

4078A

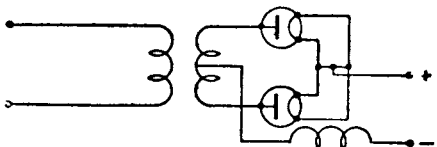


Circuit  
No.

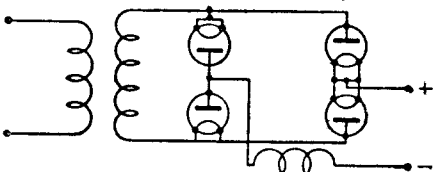
1



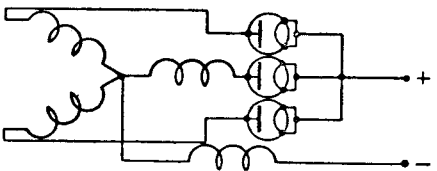
2



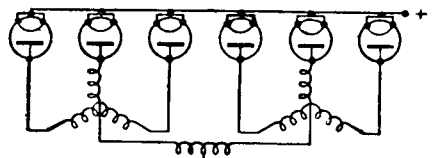
3



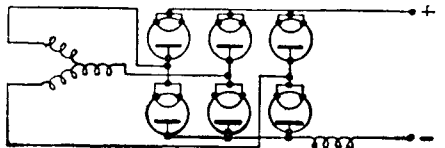
4



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## Half-Wave Mercury-Vapour Rectifier

**Code: 2V/531E (CV1420)**

This rectifier is equivalent to, and replaces, the 4078A type, which is now obsolete.

**CATHODE.**

### Oxide-coated, shielded filament

|                                                      |    |      |
|------------------------------------------------------|----|------|
| Filament voltage                                     | 5  | V    |
| Nominal current                                      | 20 | A    |
| Minimum heating time (ambient temperature<br>≥ 20°C) | 1  | min← |

### MECHANICAL DATA.

|                         |                             |    |
|-------------------------|-----------------------------|----|
| Maximum overall length  | 412.8                       | mm |
| Maximum bulb diameter   | 95.3                        | mm |
| Base                    | Special 2-pin (see drawing) |    |
| Top cap                 | Special (see drawing)       |    |
| Socket type             | 4022A                       |    |
| Net weight              | 900                         | g  |
| Shipping weight approx. | 9                           | kg |
| Shipping dimensions     | 14 × 14 × 29                |    |
|                         |                             | in |

**MAXIMUM RATINGS.**

| MAXIMUM RATINGS.                            | FILAMENT EXCITATION |               |     |
|---------------------------------------------|---------------------|---------------|-----|
|                                             | In phase            | In quadrature |     |
| Maximum peak inverse voltage                | 20                  | 20            | kV  |
| Maximum peak anode current                  | 10                  | 20            | A   |
| Maximum average anode current               | 2.5                 | 5             | A   |
| Maximum fault anode current                 | 50                  | 50            | A   |
| Maximum duration of fault anode current     | 0.1                 | 0.1           | sec |
| Maximum voltage drop                        | 12                  | 12            | V   |
| Maximum condensed mercury temperature range | 15 to 65            | 15 to 65      | °C  |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

# Half-Wave Mercury- Vapour Rectifier



Code: 2V/531E (CV1420)

## CATHODE HEATING TIME.

|                            |            |                |
|----------------------------|------------|----------------|
| Ambient Temperature        | 10 to 20°C | 20°C and above |
| Minimum pre-heating period | 2 minutes  | 1 minute       |

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY-VAPOUR TEMPERATURES.

|                      |                  |                 |                  |                      |
|----------------------|------------------|-----------------|------------------|----------------------|
| Natural Ventilation  | 15 to 50°C       | 15 to 40°C      | —                | —                    |
| Forced Ventilation   | 15 to 65°C       | 15 to 55°C      | 15 to 45°C       | 15 to 40°C           |
| Peak Inverse Voltage | Less than 7000 V | 7500 to 10000 V | 10000 to 12500 V | Greater than 12500 V |

After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied, so that the mercury may be distributed correctly.

The temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation. Forced air cooling is recommended and is required for operation up to the limit of condensed mercury temperature.

Before putting a valve of this type into service it is recommended that reference be made to the General Information section K in the front of the valve handbook.



# Half-Wave Mercury- Vapour Rectifier

Code: 2V/531E (CV1420)←

## TYPICAL OPERATING CONDITIONS.

| Circuit                                     | No. of Valves | Maximum A.C. Input Volts (r.m.s.) | Maximum D.C. Output Volts (Volts) | Maximum D.C. Output Current (Amperes) |
|---------------------------------------------|---------------|-----------------------------------|-----------------------------------|---------------------------------------|
| Single-Phase Full Wave Circuit No. 1        | 2             | 7000                              | 6300                              | 5*                                    |
|                                             |               | 7000                              | 6300                              | 10†                                   |
| Single-Phase Full Wave Bridge Circuit No. 2 | 4             | 14000                             | 12600                             | 5*                                    |
|                                             |               | 14000                             | 12600                             | 10†                                   |
| Three-Phase Half Wave Circuit No. 3         | 3             | 8150                              | 9550                              | 7.5*                                  |
|                                             |               | 8150                              | 9550                              | 15†                                   |
| Three-Phase Double Y Parallel Circuit No. 4 | 6             | 8150                              | 9550                              | 15*                                   |
|                                             |               | 8150                              | 9550                              | 30†                                   |
| Three-Phase Full Wave Circuit No. 5         | 6             | 8150                              | 19100                             | 7.5*                                  |
|                                             |               | 8150                              | 19100                             | 15†                                   |

\* Filament excitation in phase with anode.

† Filament excitation in quadrature with anode.

The above indicates suitable circuits for this rectifier, and shows the safe maximum input and output conditions. The valves are based on sine wave input and the use of a suitable choke input filter.

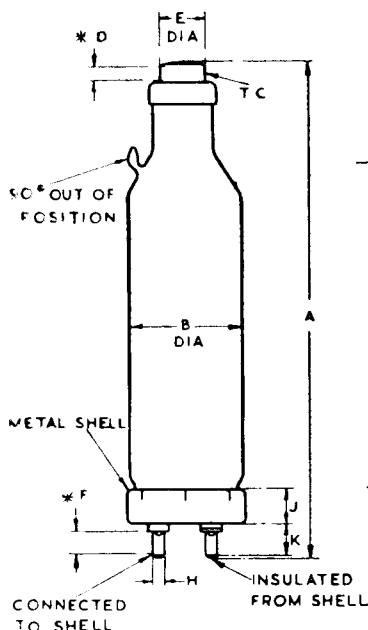
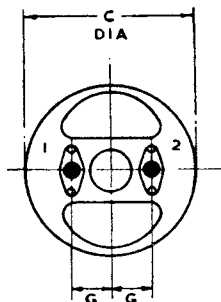
This rectifier being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer.

For details of the circuits referred to see sheet K—8 in the introduction to this handbook.

# Half-Wave Mercury- Vapour Rectifier



Code: 2V/531E (CV1420)←

**BASING**

1 FILAMENT

2 FILAMENT

T.C ANODE

**NOTE:**

ONE FILAMENT PIN  
CONNECTED TO METAL  
SHELL.

| DIM | MILLIMETRES  | INCHES         | DIM | MILLIMETRES  | INCHES        |
|-----|--------------|----------------|-----|--------------|---------------|
| A   | 412.8 MAX    | 16 1/4 MAX     | F   | 23.80 ± 0.51 | 0.937 ± 0.020 |
| B   | 95.3 MAX     | 3 3/4 MAX      | G   | 22.00 ± 0.25 | 0.866 ± 0.010 |
| C   | 96.04 ± 0.4  | 3 25/32 ± 1/64 | H   | 9.53 ± 0.05  | 0.375 ± 0.002 |
| D   | 10.0 MIN     | 0.393 MIN      | J   | 25.4 ± 0.4   | 1 ± 1/64      |
| E   | 36.00 ± 0.25 | 1.418 ± 0.010  | K   | 28.57 ± 0.51 | 1.125 ± 0.020 |

**NOTE:- BASIC FIGURES ARE INCHES****\* DENOTES:- CONTACT LENGTH.**



# Hot Cathode Mercury Vapour Rectifier

2V/560E  
(4079A)

4079A

## CATHODE.

Oxide-coated shielded filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 5  | V |
| Nominal current | 38 | A |

## DIMENSIONS.

|                                          |     |     |
|------------------------------------------|-----|-----|
| Maximum overall length                   | 540 | mm. |
| Maximum bulb diameter                    | 195 | mm. |
| Net weight                               | 1.9 | kg. |
| Base—Special 2-pin—(see <i>drawing</i> ) |     |     |
| Top cap—Special—(see <i>drawing</i> )    |     |     |

## MAXIMUM RATINGS.

|                                                             |                        |    |
|-------------------------------------------------------------|------------------------|----|
| Maximum peak inverse voltage                                | 20                     | kV |
| Maximum peak anode current                                  | 20                     | A  |
| Maximum average anode current                               | 7.5                    | A  |
| Condensed mercury temperature range with forced ventilation | 15°C. to 65°C. maximum |    |

The above ratings apply to operation with a choke-input filter and a supply frequency of 50 c/s.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

|                      |                   |                   |                    |                       |
|----------------------|-------------------|-------------------|--------------------|-----------------------|
| Natural Ventilation  | 15°C. to 45°C.    | 15°C. to 35°C.    | —                  | —                     |
| Forced Ventilation   | 15°C. to 60°C.    | 15°C. to 50°C.    | 15°C. to 40°C.     | 15°C. to 35°C.        |
| Peak inverse Voltage | Less than 7,000 V | 7,500 to 10,000 V | 10,000 to 12,500 V | Greater than 12,500 V |

**2V/560E****(4079A)**

# Hot Cathode Mercury Vapour Rectifier

**4079A**

## TYPICAL OPERATING CONDITIONS.

| Circuit No. | No. of Valves | Maximum DC output volts | Maximum DC output Amps. |
|-------------|---------------|-------------------------|-------------------------|
| 2           | 2             | 6,400 V                 | 12.5 A                  |
| 3           | 4             | 13,000 V                | 12.5 A                  |
| 4           | 3             | 9,500 V                 | 16 A                    |
| 5           | 6             | 9,500 V                 | 30 A                    |
| 6           | 6             | 18,500 V                | 16 A                    |

This rectifier being directly heated it is recommended that the output circuit be returned to the mid-point of the filament transformer secondary.

## CATHODE HEATING TIME.

| Ambient Temperature     | 10°C. to 15°C. | 15°C. to 20°C. | 20°C. and above |
|-------------------------|----------------|----------------|-----------------|
| Min. Pre-heating period | 30 min.        | 15 min.        | 5 min.          |

After shipment or transit the valve must be pre-heated not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly. Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

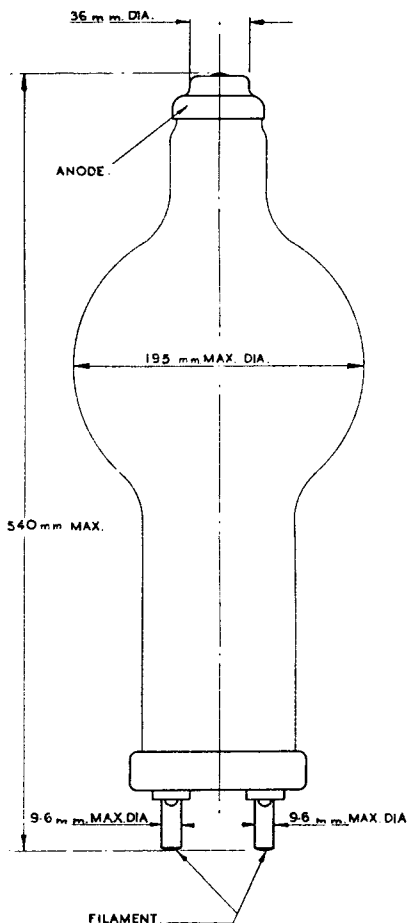
*Note.*—Before putting a valve of this type into service it is recommended that reference be made to the General Information Sheet K.



# Hot Cathode Mercury Vapour Rectifier

2V/560E  
(4079A)

4079A





2V/560E  
(4079A)

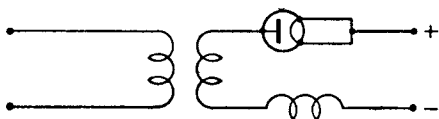
# Hot Cathode Mercury Vapour Rectifier



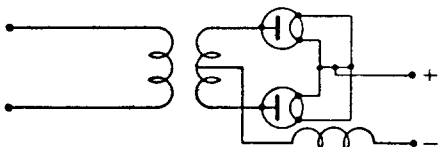
4079A

Circuit  
No.

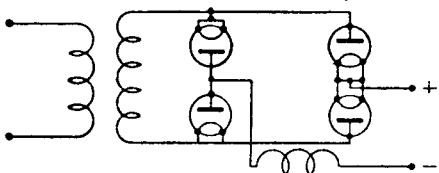
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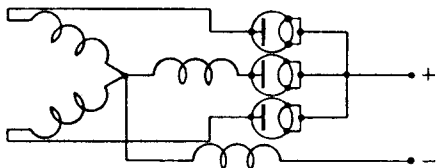
2



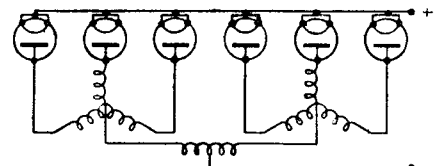
3



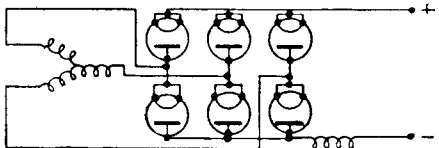
4



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# Half-Wave Mercury- Vapour Rectifier

Code: 2V/561E

This rectifier is equivalent to, and replaces, the 4079A type, which is now obsolete.

## CATHODE.

Oxide-coated, shielded filament

|                                                      |    |     |
|------------------------------------------------------|----|-----|
| Filament voltage                                     | 5  | V   |
| Nominal current                                      | 40 | A   |
| Minimum heating time (ambient temperature<br>> 20°C) | 1  | min |

## MECHANICAL DATA.

|                          |                             |    |
|--------------------------|-----------------------------|----|
| Maximum overall length   | 539.8                       | mm |
| Maximum bulb diameter    | 133.4                       | mm |
| Base                     | Special 2-pin (see drawing) |    |
| Top cap                  | Special (see drawing)       |    |
| Socket type              | 47/4022J                    | ←  |
| Net weight               | 1.9                         | kg |
| Shipping weight, approx. | 13.4                        | kg |
| Shipping dimensions      | 20 × 20 × 36                | in |

## MAXIMUM RATINGS.

### FILAMENT EXCITATION

|                                                | In phase | In quadrature |     |
|------------------------------------------------|----------|---------------|-----|
| Maximum peak inverse voltage                   | 20       | 20            | kV  |
| Maximum peak anode current                     | 20       | 40            | A   |
| Maximum average anode current                  | 7.5      | 15            | A   |
| Maximum fault anode current                    | 125      | 125           | A   |
| Maximum duration of fault anode<br>current     | 0.1      | 0.1           | sec |
| Maximum voltage drop                           | 15       | 15            | V   |
| Maximum condensed mercury<br>temperature range | 15 to 60 | 15 to 60      | °C  |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

# Half-Wave Mercury-Vapour Rectifier



Code: 2V/561E

## CATHODE HEATING TIME.

|                            |            |                |
|----------------------------|------------|----------------|
| Ambient Temperature        | 10 to 20°C | 20°C and above |
| Minimum pre-heating period | 2 minutes  | 1 minute       |

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY-VAPOUR TEMPERATURES.

|                      |                  |                 |                  |                      |
|----------------------|------------------|-----------------|------------------|----------------------|
| Natural Ventilation  | 15 to 45°C       | 15 to 35°C      | —                | —                    |
| Forced Ventilation   | 15 to 60°C       | 15 to 50°C      | 15 to 45°C       | 15 to 40°C←          |
| Peak Inverse Voltage | Less than 7000 V | 7000 to 10000 V | 10000 to 12500 V | Greater than 12500 V |

After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied, so that the mercury may be distributed correctly.

The temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation. Forced air cooling is recommended and is required for operation up to the limit of condensed mercury temperature.

Before putting a valve of this type into service it is recommended that reference be made to the General Information section K in the front of the valve handbook.



# Half-Wave Mercury-Vapour Rectifier

Code: 2V/561E

## TYPICAL OPERATING CONDITIONS.

| Circuit                                     | No. of Valves | Maximum A.C. Input Voltage (r.m.s.) | Maximum D.C. Output Voltage (Volts) | Maximum D.C. Output Current (Amperes) |
|---------------------------------------------|---------------|-------------------------------------|-------------------------------------|---------------------------------------|
| Single-Phase Full Wave Circuit No. 1        | 2             | 7000                                | 6300                                | 12.5* ←                               |
|                                             |               | 7000                                | 6300                                | 25† ←                                 |
| Single-Phase Full Wave Bridge Circuit No. 2 | 4             | 14000                               | 12600                               | 12.5* ←                               |
|                                             |               | 14000                               | 12600                               | 25† ←                                 |
| Three-Phase Half Wave Circuit No. 3         | 3             | 8150                                | 9550                                | 18.75* ←                              |
|                                             |               | 8150                                | 9550                                | 37.5† ←                               |
| Three-Phase Double Y Parallel Circuit No. 4 | 6             | 8150                                | 9550                                | 37.5* ←                               |
|                                             |               | 8150                                | 9550                                | 75† ←                                 |
| Three-Phase Full Wave Circuit No. 5         | 6             | 8150                                | 19100                               | 18.75* ←                              |
|                                             |               | 8150                                | 19100                               | 37.5† ←                               |

\* Filament excitation in phase with anode.

† Filament excitation in quadrature with anode.

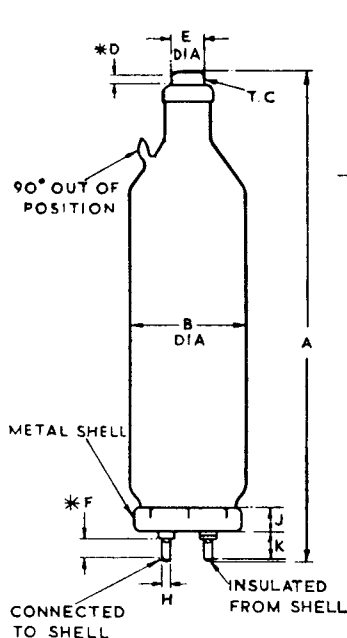
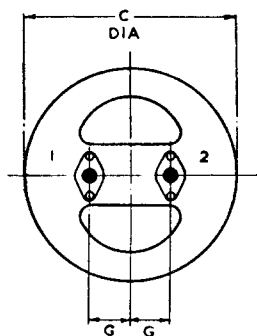
The above, tables suitable circuits for this rectifier, and shows the safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

This rectifier being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer.

For details of the circuits referred to see sheet K—8 in the introduction to this handbook.

# Half-Wave Mercury-Vapour Rectifier

Code: 2V/561E



## BASING

- 1 FILAMENT  
2 FILAMENT  
T.C ANODE

## NOTE:

ONE FILAMENT PIN  
CONNECTED TO METAL  
SHELL.

| DIM | MILLIMETRES  | INCHES                                                       | DIM | MILLIMETRES  | INCHES                           |
|-----|--------------|--------------------------------------------------------------|-----|--------------|----------------------------------|
| A   | 539.8 MAX.   | 21 <sup>1</sup> / <sub>4</sub> MAX.                          | F   | 23.80 ± 0.51 | 0.937 ± 0.020                    |
| B   | 133.4 MAX.   | 5 <sup>1</sup> / <sub>4</sub> MAX.                           | G   | 22.00 ± 0.25 | 0.866 ± 0.010                    |
| C   | 117.5 ± 0.4  | 4 <sup>5</sup> / <sub>8</sub> ± <sup>1</sup> / <sub>64</sub> | H   | 9.53 ± 0.05  | 0.375 ± 0.002                    |
| D   | 10.0 MIN     | 0.393 MIN                                                    | J   | 25.4 ± 0.4   | 1 ± <sup>1</sup> / <sub>64</sub> |
| E   | 36.00 ± 0.25 | 1.418 ± 0.010                                                | K   | 28.57 ± 0.51 | 1.125 ± 0.020                    |

NOTE:- BASIC FIGURES ARE INCHES.

\* DENOTES:- CONTACT LENGTH.



# Hot Cathode Mercury Vapour Rectifier 4080A

2V/590E  
(4080A)

## CATHODE.

Oxide-coated shielded filament

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 5   | V |
| Nominal current | 100 | A |

## DIMENSIONS.

|                        |                |              |
|------------------------|----------------|--------------|
| Maximum overall length | 685            | mm.          |
| Maximum bulb diameter  | 266            | mm.          |
| Net weight             | 4              | kg.          |
| Base.                  | Special 3 pin. | See Drawing. |
| Top Cap.               | Special.       | See Drawing. |

## MAXIMUM RATINGS.

|                                                                |                             |   |
|----------------------------------------------------------------|-----------------------------|---|
| Maximum peak inverse voltage                                   | 16,000                      | V |
| Maximum peak anode current                                     | 50                          | A |
| Maximum average anode current                                  | 20                          | A |
| Condensed mercury temperature<br>range with forced air cooling | 15° C. to 60° C.<br>maximum |   |

The above ratings apply to operation with choke input filter and a supply frequency of 50 c/s.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

|                      |                    |                     |                      |                       |
|----------------------|--------------------|---------------------|----------------------|-----------------------|
| Natural Ventilation  | { 15° C. to 45° C. | 15° C. to 35° C.    | —                    | —                     |
| Forced Ventilation   | { 15° C. to 60° C. | 15° C. to 50° C.    | 15° C. to 40° C.     | 15° C. to 35° C.      |
| Peak inverse voltage | Less than 7,500 V  | 7,500 V to 10,000 V | 10,000 V to 12,500 V | Greater than 12,500 V |

**2V/590E****(4080A)****Hot Cathode Mercury****Vapour Rectifier****4080A**


---

**TYPICAL OPERATING CONDITIONS**  
 (for ideal choke-input filter).

| Circuit No. | No. of Valves | Maximum D.C. Output Volts | Maximum D.C. Output Current |
|-------------|---------------|---------------------------|-----------------------------|
| 2           | 2             | 5,000 V                   | 31 A                        |
| 3           | 4             | 10,000 V                  | 31 A                        |
| 4           | 3             | 7,500 V                   | 38 A                        |
| 5           | 6             | 7,500 V                   | 76 A                        |
| 6           | 6             | 15,000 V                  | 47 A                        |

---

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer secondary.

**CATHODE HEATING TIME.**

| Ambient Temperature     | 15° to 20° C. | 20° C. and above |
|-------------------------|---------------|------------------|
| Min. pre-heating period | 30 min.       | 10 min.          |

---

After shipment or transit the valve must be pre-heated not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly.

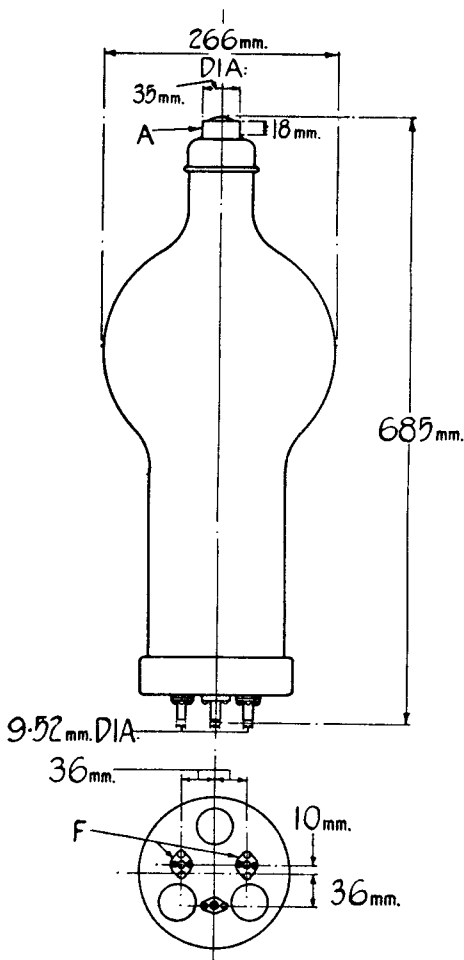
Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

**NOTE.**—Before putting a valve of this type into service it is recommended that reference be made to the General Information Sheet K.



# Hot Cathode Mercury Vapour Rectifier 4080A

2V/590E  
(4080A)





2V/590E  
(4080A)

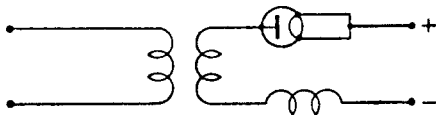
# Hot Cathode Mercury Vapour Rectifier

4080A

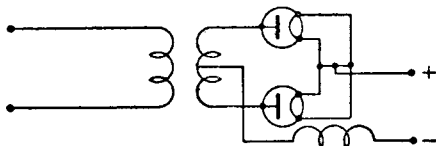


Circuit  
No.

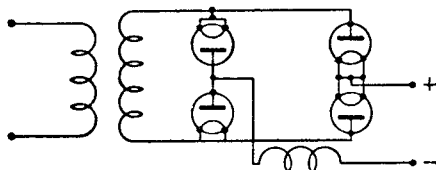
1



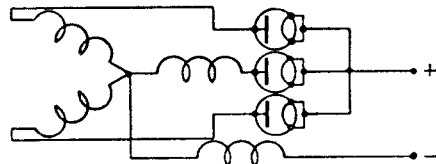
2



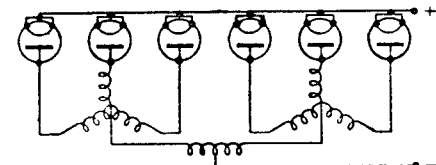
3



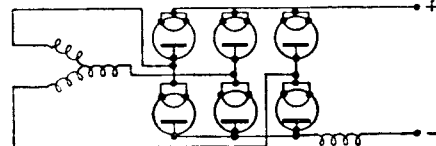
4



5



6



# —Standard Valves—

## VALVE TYPE 3A/101-B

(Previously coded VLS.350 valve).

TRIODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.

Constant current type.

#### Base.

Standard British 5-pin.

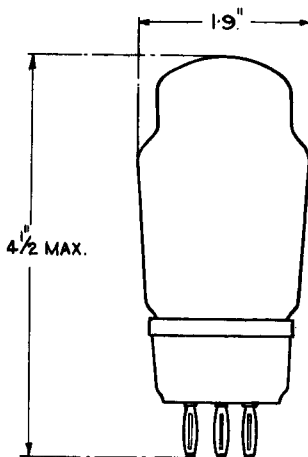
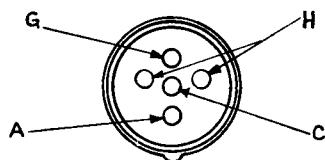
#### Dimensions.

Maximum overall length  $4\frac{1}{2}$ " (11.4 cms.)  
 Bulb diameter 1.9" (4.9 cms.)  
 Net weight 0.11 lb. (50 gms.)

#### Constants.

Heater current 1.0 amps.  
 Nominal heater voltage 4.5 volts  
 \*Impedance 5,700 ohms.  
 \*Amplification factor 5.8  
 \*Mutual conductance 1.0 mA per volt  
 Anode-grid capacity  $4.2 \mu\text{F}$ .  
 Grid-cathode capacity  $4.2 \mu\text{F}$ .  
 Anode-cathode capacity  $4.4 \mu\text{F}$ .

\* at  $V_p = 130$  volts,  $V_g = -9$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 200 volts |
| Maximum anode dissipation    | 5 watts   |

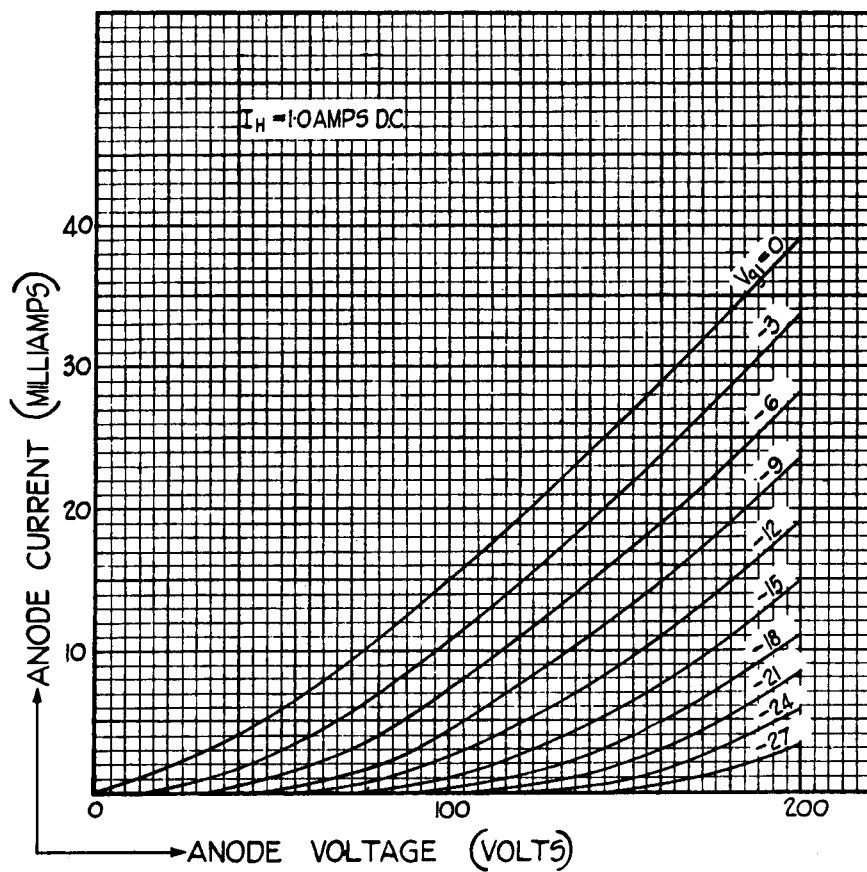
—Standard Valves—

TYPICAL OPERATING CONDITIONS.

|                                                        |                |       |       |       |       |       |       |       |       |       |       |       |
|--------------------------------------------------------|----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Anode voltage                                          | volts          | 100   | 100   | 130   | 130   | 130   | 160   | 160   | 160   | 160   | 190   | 190   |
| Grid bias                                              | volts          | —4    | —6    | —6    | —9    | —12   | —10   | —12   | —16   | —16   | —18   | —20   |
| Anode current                                          | mA.            | 10    | 7.2   | 13    | 9.5   | 6.2   | 14    | 11    | 6.8   | 12    | 9.5   | 8     |
| Anode resistance                                       | Z <sub>o</sub> | 5,000 | 6,400 | 5,000 | 5,700 | 6,500 | 5,000 | 5,500 | 6,500 | 5,000 | 5,300 | 6,000 |
| For load resistance, R <sub>L</sub> = Z <sub>o</sub>   |                |       |       |       |       |       |       |       |       |       |       |       |
| Output                                                 | mW.            | 14    | 26    | 35    | 65    | 90    | 100   | 130   | 175   | 235   | 265   | 285   |
| Total harmonic distortion                              | db             | 38    | 29    | 35    | 29    | 22    | 30    | 22    | 20    | 22    | 20    | 18    |
| For load resistance, R <sub>L</sub> = 2 Z <sub>o</sub> |                |       |       |       |       |       |       |       |       |       |       |       |
| Output                                                 | mW.            | 12    | 24    | 30    | 60    | 80    | 90    | 115   | 155   | 210   | 235   | 250   |
| Total harmonic distortion                              | db.            | 35    | 35    | 37    | 32    | 26    | 33    | 28    | 23    | 27    | 25    | 22    |

# —Standard Valves—

3A/101-B



Tentative data

W.3A/101-B.2  
March, 1939

PRINTED IN  
ENGLAND

# —Standard Valves—

3A/102-B

## VALVE TYPE 3A/102-B

(Previously coded VLS.407 valve).

TRIODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant current type.

#### Base.

Small British 5 pin.  
Anode connected to top cap type B.

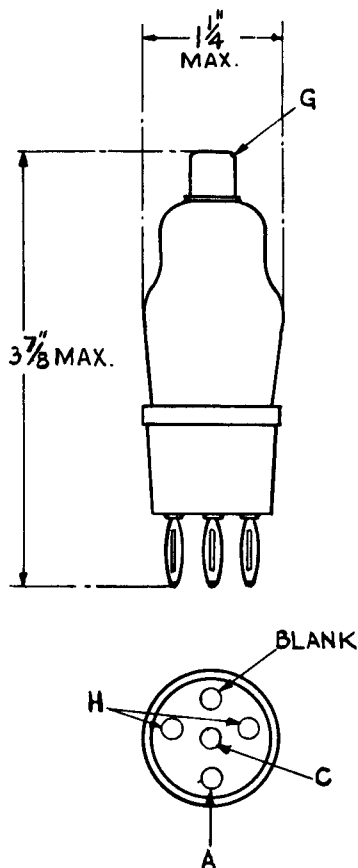
#### Dimensions.

Max. overall length  $3\frac{7}{8}"$  (9.8 cms.)  
Max. bulb diameter  $1\frac{1}{4}"$  (3.2 cms.)

#### Constants.

Heater current 1.0 amp.  
Nominal heater voltage 2.1 volts  
\*Amplification factor 30  
\*Mutual conductance 0.5 mA. per volt  
\*Impedance 60,000 ohms  
Grid-anode capacity  $1.7 \mu\text{F}$ .  
Grid-cathode capacity  $1.5 \mu\text{F}$ .  
Anode-cathode capacity  $3.9 \mu\text{F}$ .

\* at  $V_p = 130$  volts,  $I_p = 0.75$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 190 volts  
Maximum direct anode current 1.5 mA.

Tentative data

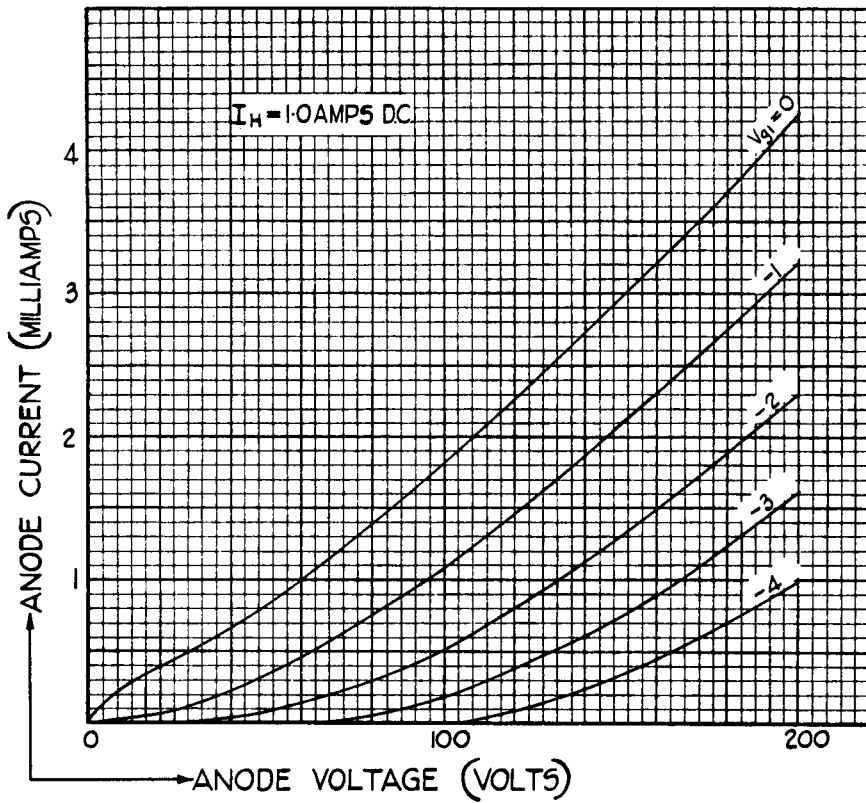
W.3A/102-B.1  
March, 1939

*—Standard Valves—*

**TYPICAL OPERATING CONDITIONS.**

| Anode<br>voltage<br>volts | Grid<br>Bias<br>volts | Anode<br>Current<br>mA. | Load<br>Resistance<br>ohms | Output<br>voltage<br>peak volts | Total harmonic<br>distortion in<br>db below<br>fundamental |
|---------------------------|-----------------------|-------------------------|----------------------------|---------------------------------|------------------------------------------------------------|
| 130                       | —2                    | 1·0                     | 80,000                     | 27                              | 35                                                         |
|                           |                       |                         | 160,000                    | 38                              | 32                                                         |
|                           |                       |                         | 240,000                    | 41                              | 31                                                         |
| 130                       | —1                    | 1·7                     | 50,000                     | 15                              | 34                                                         |
|                           |                       |                         | 100,000                    | 20                              | 31                                                         |
|                           |                       |                         | 150,000                    | 23                              | 32                                                         |
| 160                       | —3                    | 0·9                     | 80,000                     | 40                              | 36                                                         |
|                           |                       |                         | 160,000                    | 57                              | 32                                                         |
|                           |                       |                         | 240,000                    | 62                              | 32                                                         |
| 160                       | —1                    | 2·3                     | 40,000                     | 15                              | 33                                                         |
|                           |                       |                         | 80,000                     | 21                              | 32                                                         |
|                           |                       |                         | 120,000                    | 24                              | 31                                                         |
| 190                       | —3                    | 1·4                     | 50,000                     | 42                              | 36                                                         |
|                           |                       |                         | 100,000                    | 63                              | 32                                                         |
|                           |                       |                         | 150,000                    | 68                              | 31                                                         |
| 190                       | —2                    | 2·1                     | 40,000                     | 30                              | 33                                                         |
|                           |                       |                         | 80,000                     | 43                              | 31                                                         |
|                           |                       |                         | 120,000                    | 48                              | 32                                                         |

# —Standard Valves—



Tentative data

W.3A/102-B.2  
March, 1939



PRINTED IN  
ENGLAND

# —Standard Valves—

## VALVE TYPE 3A/105-B

LOW NOISE TRIODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

British small 4-pin.  
Grid connected to top cap type B.

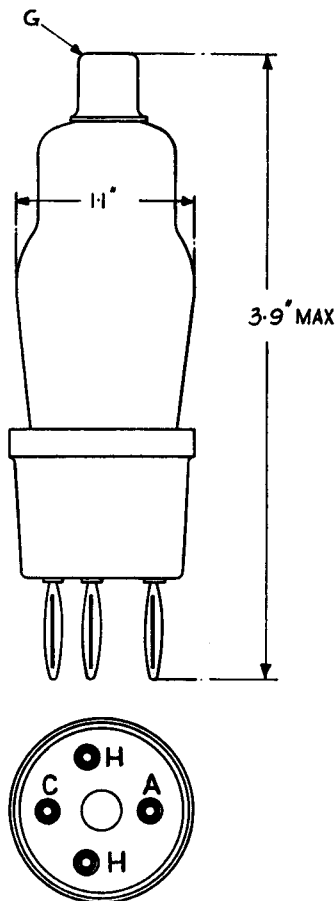
#### Dimensions.

Maximum overall length 3.9" (9.9 cms.)  
Maximum diameter 1.1" (2.8 cms.)

#### Constants.

|                        |                        |
|------------------------|------------------------|
| Heater voltage         | 13 volts               |
| Heater current         | 0.19 amps.             |
| *Amplification factor  | 40                     |
| *Impedance             | 19,000 ohms            |
| *Mutual conductance    | 2.1 mA. per volt       |
| Grid-anode capacity    | 1.5 $\mu\mu\text{F}$ . |
| Grid-cathode capacity  | 2.4 $\mu\mu\text{F}$ . |
| Anode-cathode capacity | 4.5 $\mu\mu\text{F}$ . |

\* at  $V_p = 130$  volts,  $V_{g1} = -1.5$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 250 volts |
| Maximum anode dissipation    | 2.5 watts |
| Maximum direct anode current | 15 mA.    |

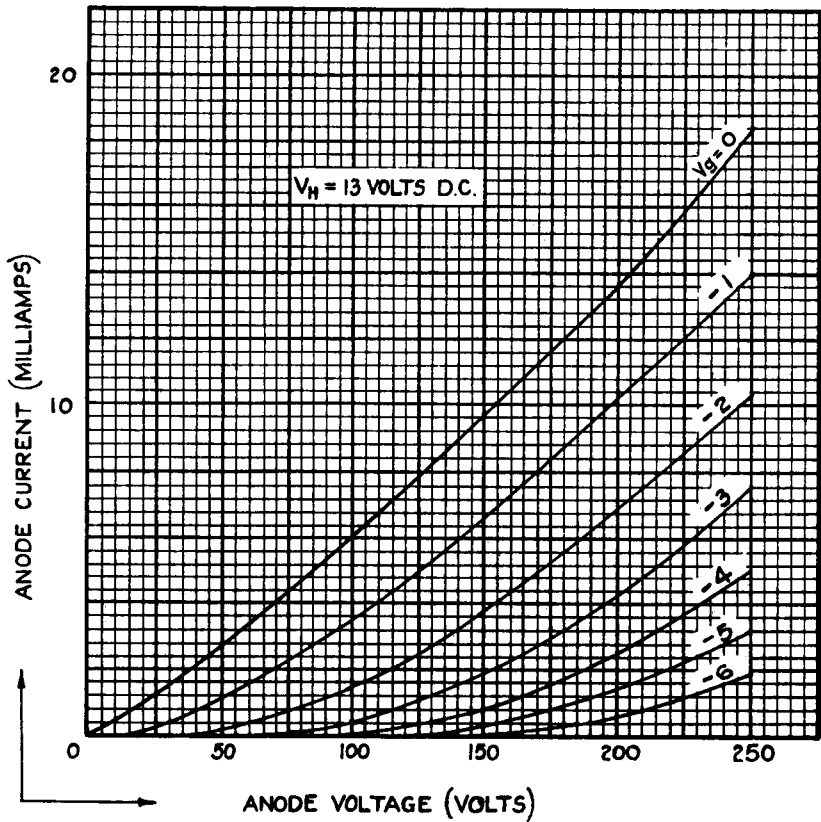
Tentative data

W.3A/105-B.1  
April 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Anode Voltage<br>Volts | Grid Bias<br>Volts | Load Resistance<br>Ohms | Output<br>mW. | Total<br>Harmonics<br>db |
|------------------------|--------------------|-------------------------|---------------|--------------------------|
| 130                    | —1                 | 9,000                   | 3             | 26                       |
| 150                    | —1.5               | 11,000                  | 3             | 29                       |
| 200                    | —2                 | 14,000                  | 5             | 30                       |
| 200                    | —2                 | 14,000                  | 15            | 25                       |
| 250                    | —2.5               | 18,000                  | 5             | 32                       |
| 250                    | —2.5               | 18,000                  | 30            | 27                       |



PM 442

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ENGLAND



# Repeater Triode

3A/107A

3A/107B

3A/107A

3A/107B

(3A/107A is for replacement purposes only)

## CATHODE.

Oxide-coated filament

|         |      |   |
|---------|------|---|
| Current | 0.25 | A |
|---------|------|---|

|                 |   |   |
|-----------------|---|---|
| Nominal voltage | 4 | V |
|-----------------|---|---|

## RATING.

|                      |                                    |       |      |
|----------------------|------------------------------------|-------|------|
| Amplification factor | { Measured at $V_a$ 130V }         | 7     |      |
| Impedance            | { $V_{g1}$ -8V, $I_f$ 0.25A D.C. } | 5,500 | ohms |

## DIRECT INTER-ELECTRODE CAPACITIES.

|               |     |    |
|---------------|-----|----|
| Grid to anode | 4.7 | pF |
|---------------|-----|----|

|                  |     |    |
|------------------|-----|----|
| Grid to filament | 6.2 | pF |
|------------------|-----|----|

|                   |     |    |
|-------------------|-----|----|
| Anode to filament | 2.1 | pF |
|-------------------|-----|----|

## BASE.

3A/107A American 4-pin bayonet

3A/107B Standard 5-pin British

## DIMENSIONS.

Maximum overall length

|         |     |     |
|---------|-----|-----|
| 3A/107A | 116 | mm. |
|---------|-----|-----|

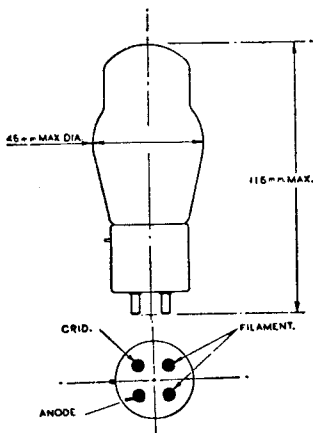
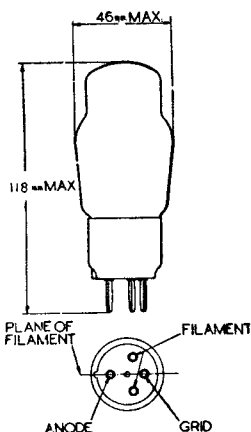
|         |     |     |
|---------|-----|-----|
| 3A/107B | 118 | mm. |
|---------|-----|-----|

|                       |    |     |
|-----------------------|----|-----|
| Maximum bulb diameter | 46 | mm. |
|-----------------------|----|-----|

|            |    |    |
|------------|----|----|
| Net weight | 44 | g. |
|------------|----|----|

## MAXIMUM RATINGS.

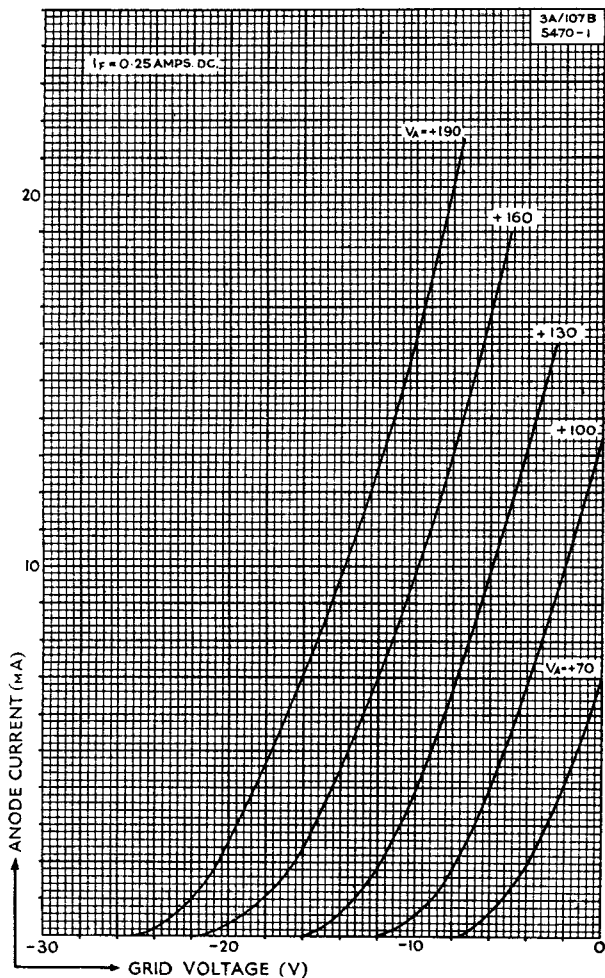
|                              |     |   |
|------------------------------|-----|---|
| Maximum direct anode voltage | 190 | V |
|------------------------------|-----|---|



3A/107A  
3A/107B

# Repeater Triode

3A/107A  
3A/107B





# Repeater Triode

3A/108A

3A/108B

3A/108A

3A/108B

(3A/108A is for replacement purposes only)

## CATHODE.

Oxide-coated filament

Current 0.25 A

Nominal voltage 2 V

## RATING.

Amplification factor } Measured at  $V_a$  130V { 30  
Impedance }  $V_{g1}$  -1.5V,  $I_f$  0.25A D.C. { 50,000 ohms

## DIRECT INTER-ELECTRODE CAPACITIES.

Grid to anode 5.0 pF

Grid to filament 5.0 pF

Anode to filament 2.5 pF

## BASE.

3A/108A American 4-pin bayonet

3A/108B Standard 5-pin British

## DIMENSIONS.

Maximum overall length

3A/108A 116 mm.

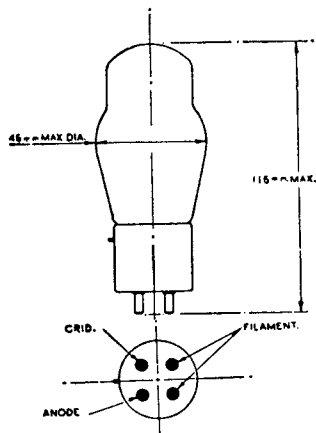
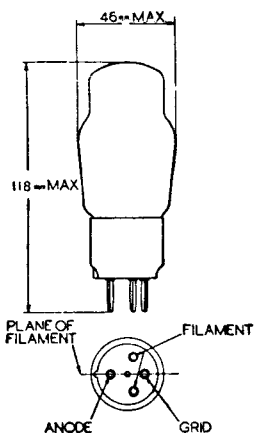
3A/108B 118 mm.

Maximum bulb diameter 46 mm.

Net weight 44 g.

## MAXIMUM RATINGS.

Maximum direct anode voltage 190 V



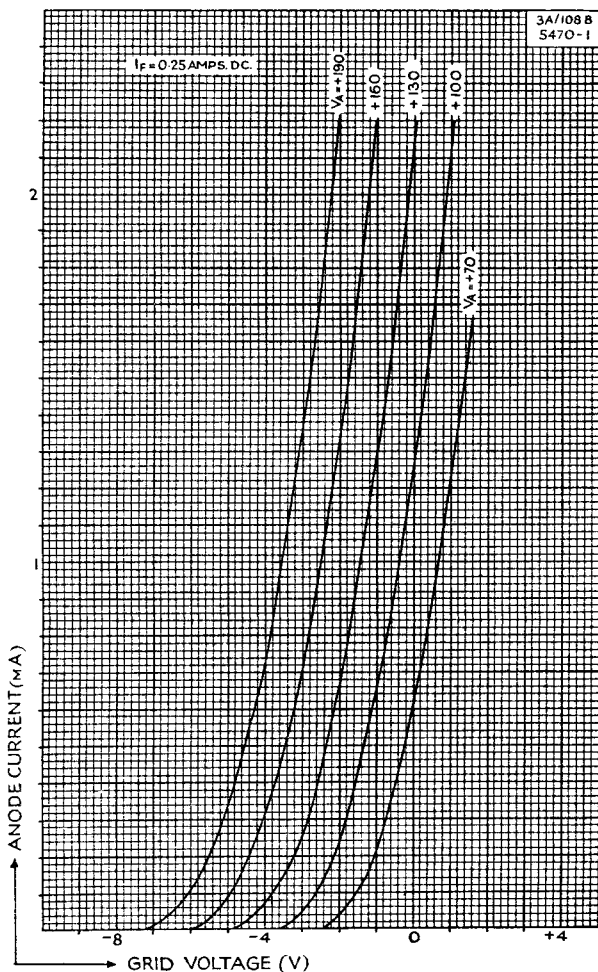
3A/108A

3A/108B

# Repeater Triode

3A/108A

3A/108B





# Repeater Triode

3A/109A

3A/109B

3A/109A

3A/109B

(3A/109A is for replacement purposes only)

## CATHODE.

Oxide-coated filament

Current

0.25

A

Nominal voltage

4

V

## RATING.

Amplification factor } Measured at  $V_a$  130V  
Impedance }  $V_{g1}$ -8 V,  $I_f$  0.25A D.C. { 6  
2,000

ohms

## DIRECT INTER-ELECTRODE CAPACITIES.

Grid to anode

9.0

pF

Grid to filament

6.0

pF

Anode to filament

3.6

pF

## BASE.

3A/109A American 4-pin bayonet

3A/109B Standard 5-pin British

## DIMENSIONS.

Maximum overall length

3A/109A

116

mm.

3A/109B

118

mm.

Maximum bulb diameter

46

mm.

Net weight

44

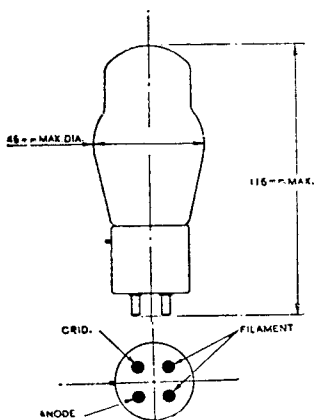
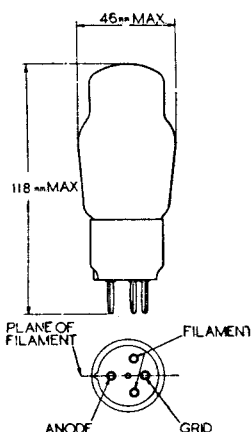
g.

## MAXIMUM RATINGS.

Maximum direct anode voltage

190

V



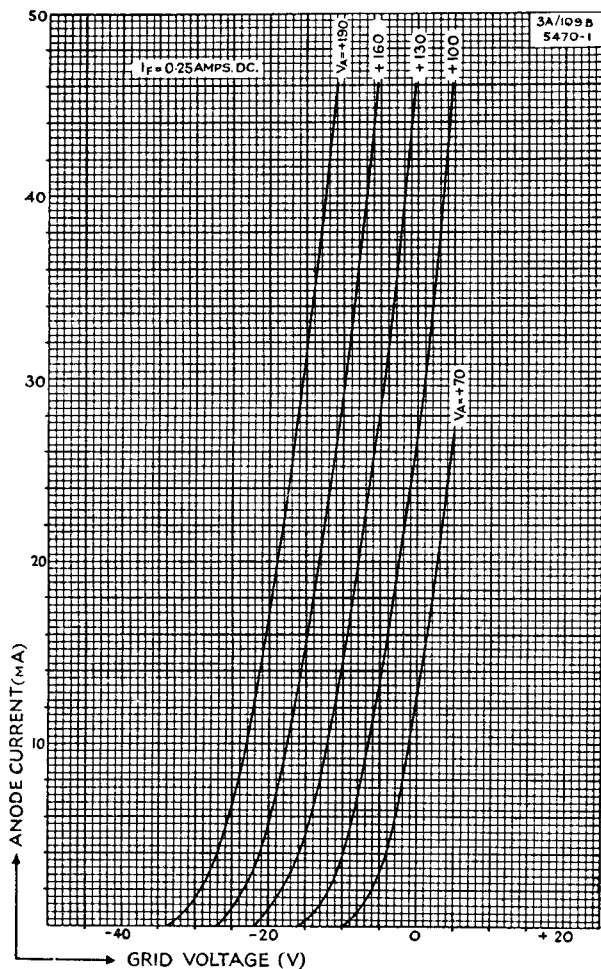


3A/109A  
3A/109B

# Repeater Triode



3A/109A  
3A/109B





# Repeater Triode

3A/110A

3A/110B

3A/110A

3A/110B

(3A/110A is for replacement purposes only)

## CATHODE.

Oxide-coated filament

|         |      |   |
|---------|------|---|
| Current | 0.25 | A |
|---------|------|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal voltage | 4.0 | V |
|-----------------|-----|---|

## RATING.

|                      |                                                                |             |      |
|----------------------|----------------------------------------------------------------|-------------|------|
| Amplification factor | } Measured at $V_a$ 130V<br>$V_{g1}$ -4.5V, $I_f$ 0.25A D.C. } | 12<br>5,500 | ohms |
| Impedance            |                                                                |             |      |

## DIRECT INTER-ELECTRODE CAPACITIES.

|               |     |    |
|---------------|-----|----|
| Grid to anode | 9.7 | pF |
|---------------|-----|----|

|                  |     |    |
|------------------|-----|----|
| Grid to filament | 6.5 | pF |
|------------------|-----|----|

|                   |     |    |
|-------------------|-----|----|
| Anode to filament | 2.5 | pF |
|-------------------|-----|----|

## BASE.

3A/110A American 4-pin bayonet

3A/110B Standard 5-pin British

## DIMENSIONS.

Maximum overall length

|         |     |     |
|---------|-----|-----|
| 3A/110A | 116 | mm. |
|---------|-----|-----|

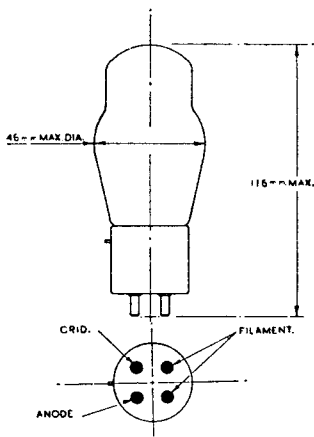
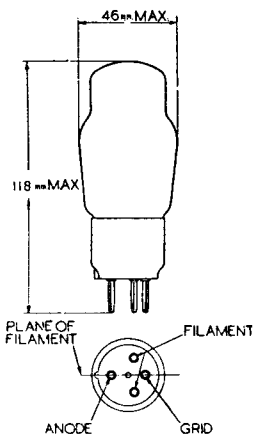
|         |     |     |
|---------|-----|-----|
| 3A/110B | 118 | mm. |
|---------|-----|-----|

|                       |    |     |
|-----------------------|----|-----|
| Maximum bulb diameter | 46 | mm. |
|-----------------------|----|-----|

|            |    |    |
|------------|----|----|
| Net weight | 44 | g. |
|------------|----|----|

## MAXIMUM RATINGS.

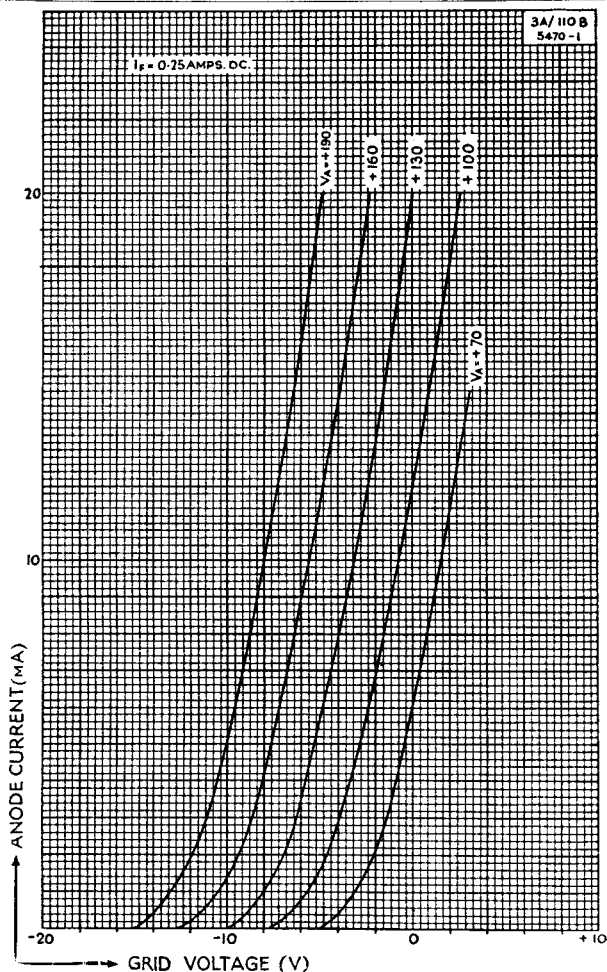
|                              |     |   |
|------------------------------|-----|---|
| Maximum direct anode voltage | 190 | V |
|------------------------------|-----|---|



3A/110A  
3A/110B

# Repeater Triode

3A/110A  
3A/110B





# Repeater Triode

## 3A/141A

### Replaces 4101D

(3A/141AY is the 3A/141A tested to special limits for replacement purposes only.)

#### CATHODE.

Oxide-coated filament

|         |     |   |
|---------|-----|---|
| Current | 1.0 | A |
|---------|-----|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal voltage | 4.5 | V |
|-----------------|-----|---|

#### RATING.

|                      |                                            |            |          |
|----------------------|--------------------------------------------|------------|----------|
| Amplification factor | } Measured at $V_a$ 130V<br>$V_{g1}$ -9V } | 6<br>6,000 | $\Omega$ |
| Impedance            |                                            |            |          |

#### DIRECT INTER-ELECTRODE CAPACITIES.

|               |     |    |
|---------------|-----|----|
| Grid to anode | 8.1 | pF |
|---------------|-----|----|

|                  |     |    |
|------------------|-----|----|
| Grid to filament | 6.4 | pF |
|------------------|-----|----|

|                   |     |    |
|-------------------|-----|----|
| Anode to filament | 5.6 | pF |
|-------------------|-----|----|

#### DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 118 | mm. |
|------------------------|-----|-----|

|                       |    |     |
|-----------------------|----|-----|
| Maximum bulb diameter | 46 | mm. |
|-----------------------|----|-----|

Base : American medium 4-pin  
bayonet

|            |    |    |
|------------|----|----|
| Net weight | 60 | g. |
|------------|----|----|

#### MAXIMUM RATINGS.

|                              |     |   |
|------------------------------|-----|---|
| Maximum direct anode voltage | 190 | V |
|------------------------------|-----|---|

|                              |    |    |
|------------------------------|----|----|
| Maximum direct anode current | 12 | mA |
|------------------------------|----|----|

## Repeater Triode

**3A/141A**

## Replaces 4101D

**(3A/141AY is the 3A/141A tested to special limits for replacement purposes only.)**



### TYPICAL OPERATING CONDITIONS.

|                             |       |       |       |       |       |       |       |       |       |       |
|-----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Anode voltage               | volts | 100   | 100   | 130   | 130   | 160   | 160   | 160   | 190   | 190   |
| Grid bias                   | volts | —4    | —6    | —9    | —12   | —10   | —12   | —16   | —18   | —20   |
| Anode current               | mA    | 7.3   | 5.5   | 11.1  | 7.8   | 5.0   | 12.3  | 6.3   | 9.0   | 7.2   |
| Amplification factor        |       | 6.1   | 6.0   | 6.1   | 6.0   | 5.9   | 6.1   | 5.9   | 6.0   | 5.9   |
| Impedance $r_a$             | ohms  | 5,500 | 6,200 | 4,900 | 5,700 | 7,000 | 4,700 | 5,200 | 5,100 | 6,300 |
| For load impedance $R=r_a$  |       |       |       |       |       |       |       |       |       |       |
| Output                      | mW    | 14    | 26    | 35    | 65    | 90    | 100   | 130   | 235   | 285   |
| 2nd harmonic                | db    | 33    | 27    | 32    | 26    | 21    | 29    | 25    | 24    | 19    |
| For load impedance $R=2r_a$ |       |       |       |       |       |       |       |       |       |       |
| Output                      | mW    | 12    | 24    | 30    | 60    | 80    | 90    | 115   | 210   | 250   |
| 2nd harmonics               | db    | 38    | 32    | 38    | 31    | 26    | 34    | 30    | 29    | 24    |

\* Maximum operating conditions.

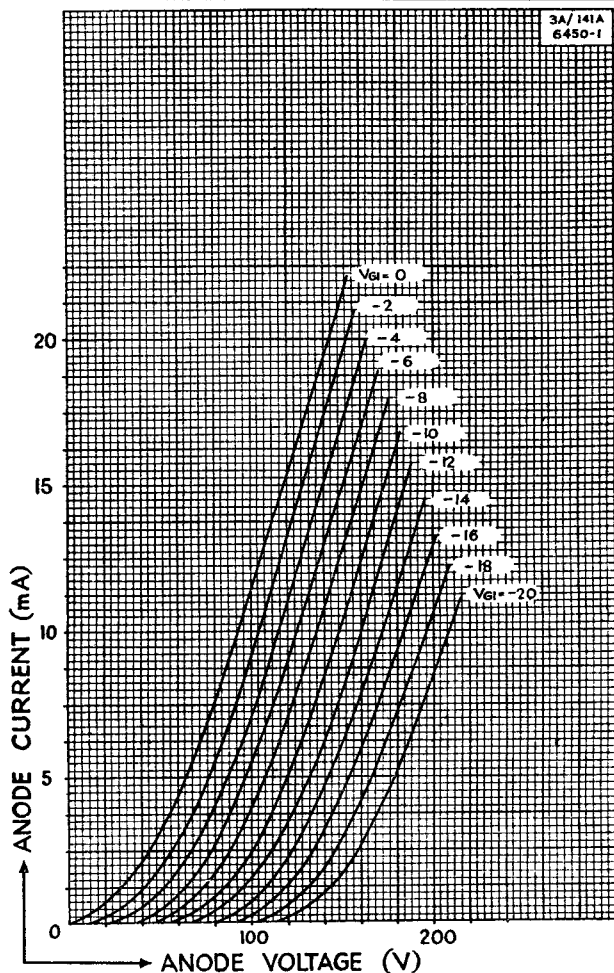


# Repeater Triode

## 3A/141A

### Replaces 4101D

(3A/141AY is the 3A/141A tested to special limits for replacement purposes only.)



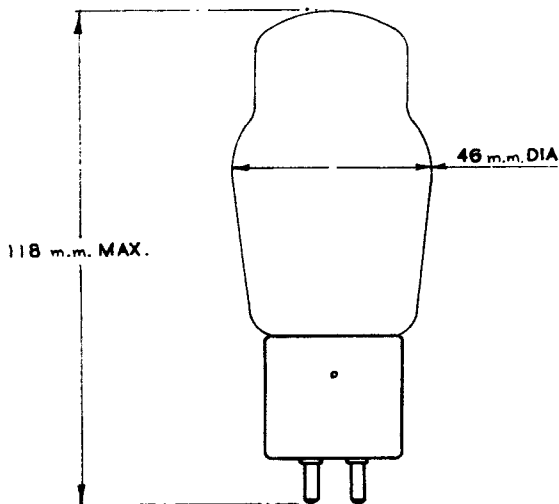
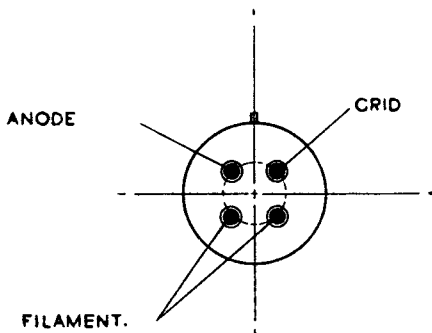
3A/141A

# Repeater Triode

3A/141A

Replaces 4101D

(3A/141AY is the 3A/141A tested to special limits for replacement purposes only.)





# Repeater Triode

## 3A/142A

### Replaces 4102D

(3A/142AY is the 3A/142A tested to special limits for replacement purposes only)

---

#### CATHODE.

Oxide-coated filament

|                 |     |   |
|-----------------|-----|---|
| Current         | 1.0 | A |
| Nominal voltage | 4.5 | V |

#### RATING.

|                      |                         |    |                 |
|----------------------|-------------------------|----|-----------------|
| Amplification factor | } Measured at           | 30 |                 |
| Impedance            |                         |    |                 |
|                      | } $V_a 130V, V_g -1.5V$ |    | 60,000 $\Omega$ |

#### DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 7.6 | pF |
| Grid to filament  | 5.5 | pF |
| Anode to filament | 5.0 | pF |

#### DIMENSIONS.

|                                    |     |     |
|------------------------------------|-----|-----|
| Maximum overall length             | 118 | mm. |
| Maximum bulb diameter              | 46  | mm. |
| Base American medium 4 pin bayonet |     |     |
| Net weight                         | 60  | g.  |

#### MAXIMUM RATINGS.

|                              |     |    |
|------------------------------|-----|----|
| Maximum direct anode voltage | 190 | V  |
| Maximum direct anode current | 1.5 | mA |



## Repeater Triode

3A/142A

Replaces 4102D

(3A/142AY is the 3A/142A tested to special limits for replacement purposes only)



## TYPICAL OPERATING CONDITIONS.

| Anode voltage<br>volts | Grid Bias<br>volts | Anode current<br>milli-amps | Amplification factor | Anode resistance<br>ohms $r_a$ | Load resistance<br>$R$ | Output voltage<br>peak volts | Second harmonic<br>db |
|------------------------|--------------------|-----------------------------|----------------------|--------------------------------|------------------------|------------------------------|-----------------------|
| 130                    | —2.0               | 0.36                        | 29.4                 | 80,000                         | $R=r_a$                | 27                           | 20                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 38                           | 24                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 41                           | 25                    |
| 130                    | —1.5               | 0.58                        | 29.8                 | 63,000                         | $R=r_a$                | 20                           | 26                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 30                           | 31                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 34                           | 33                    |
| 130                    | —1.0               | 0.85                        | 30.1                 | 53,000                         | $R=r_a$                | 15                           | 33                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 20                           | 39                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 23                           | 40                    |
| 160                    | —3.0               | 0.34                        | 29.2                 | 81,000                         | $R=r_a$                | 40                           | 18                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 57                           | 21                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 62                           | 22                    |
| 160                    | —2.0               | 0.80                        | 29.9                 | 54,000                         | $R=r_a$                | 28                           | 27                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 42                           | 33                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 45                           | 34                    |
| 160                    | —1.0               | 1.45                        | 30.3                 | 42,000                         | $R=r_a$                | 15                           | 38                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 21                           | 43                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 24                           | 48                    |
| 190*                   | —3.0               | 0.83                        | 29.8                 | 54,000                         | $R=r_a$                | 42                           | 23                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 63                           | 28                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 68                           | 30                    |
| 190*                   | —2.0               | 1.46                        | 30.2                 | 43,000                         | $R=r_a$                | 30                           | 31                    |
|                        |                    |                             |                      |                                | $R=3r_a$               | 43                           | 38                    |
|                        |                    |                             |                      |                                | $R=5r_a$               | 48                           | 41                    |

\* Maximum operating conditions.

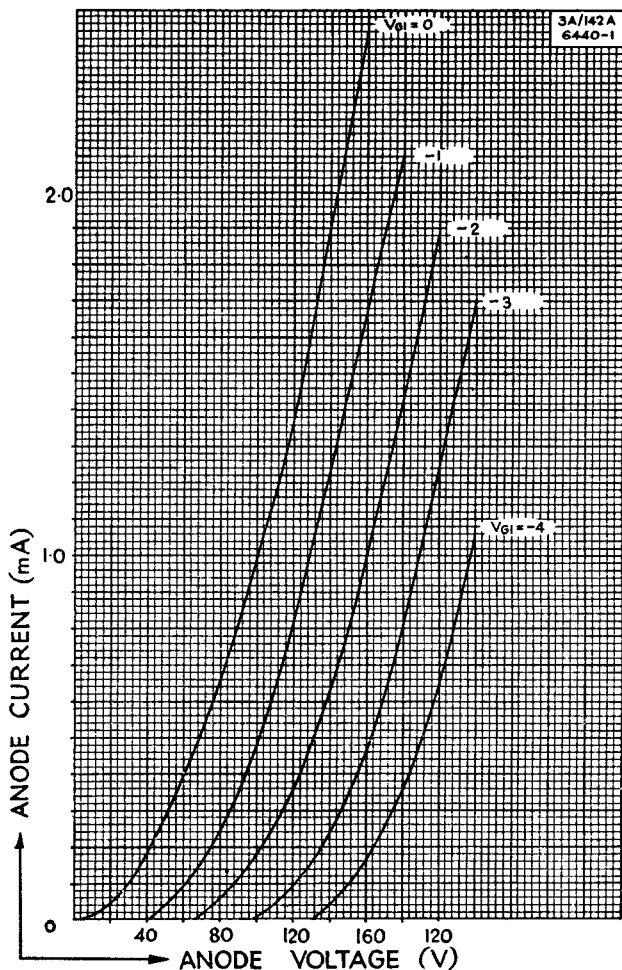


# Repeater Triode

3A/142A

Replaces 4102D

(3A/142AY is the 3A/142A tested to special limits for replacement purposes only)



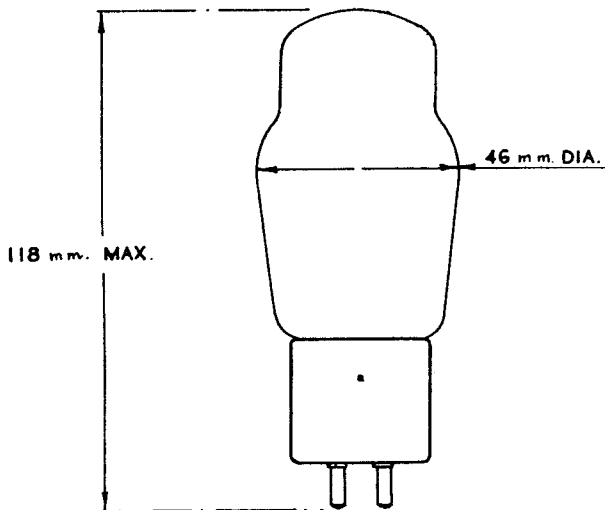
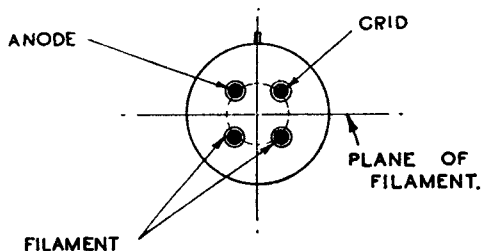
**3A/142A**

# Repeater Triode

**3A/142A**

**Replaces 4102D**

(3A/142AY is the 3A/142A tested to special limits for replacement purposes only)





# Repeater Triode

3A/144A

Replaces 4104D

3A/144AY is the 3A/144A tested to special limits for replacement purposes only

## CATHODE.

Oxide-coated filament

|         |     |   |
|---------|-----|---|
| Current | 1.0 | A |
|---------|-----|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal voltage | 4.5 | V |
|-----------------|-----|---|

## RATING.

|                      |                                             |        |          |
|----------------------|---------------------------------------------|--------|----------|
| Amplification factor | } Measured at $V_a$ 130V<br>$V_{g1}$ -20V } | 2.3    | $\Omega$ |
| Impedance            |                                             | 20,000 |          |

## DIRECT INTER-ELECTRODE CAPACITIES.

|               |     |    |
|---------------|-----|----|
| Grid to anode | 6.8 | pF |
|---------------|-----|----|

|                  |     |    |
|------------------|-----|----|
| Grid to filament | 5.8 | pF |
|------------------|-----|----|

|                   |     |    |
|-------------------|-----|----|
| Anode to filament | 5.5 | pF |
|-------------------|-----|----|

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 118 | mm. |
|------------------------|-----|-----|

|                       |    |     |
|-----------------------|----|-----|
| Maximum bulb diameter | 46 | mm. |
|-----------------------|----|-----|

Base : American medium 4 pin bayonet

|            |    |    |
|------------|----|----|
| Net weight | 60 | g. |
|------------|----|----|

## MAXIMUM RATINGS.

|                              |     |   |
|------------------------------|-----|---|
| Maximum direct anode voltage | 190 | V |
|------------------------------|-----|---|

|                              |    |    |
|------------------------------|----|----|
| Maximum direct anode current | 60 | mA |
|------------------------------|----|----|

|                           |   |   |
|---------------------------|---|---|
| Maximum anode dissipation | 5 | W |
|---------------------------|---|---|

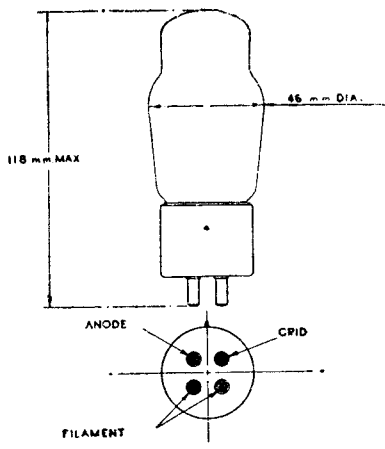
**3A/144A**

# Repeater Triode

**3A/144A****Replaces 4104D****3A/144AY is the 3A/144A tested to special limits for replacement purposes only**

## TYPICAL OPERATING CONDITIONS.

| Anode voltage<br>volts | Grid bias<br>volts | Anode current<br>mA | Anode resistance<br>ohms | Load impedance<br>ohms | Output<br>watts | 2nd Harmonic<br>db below fundamental |
|------------------------|--------------------|---------------------|--------------------------|------------------------|-----------------|--------------------------------------|
| 130                    | —15                | 31.3                | 1,900                    | 1,900                  | .090            | 27.6                                 |
|                        |                    |                     |                          | 3,800                  | .078            | 28.4                                 |
|                        |                    |                     |                          | 5,700                  | .065            | 26.6                                 |
| 130                    | —20                | 25.2                | 2,000                    | 2,000                  | .135            | 25                                   |
|                        |                    |                     |                          | 4,000                  | .126            | 28.2                                 |
|                        |                    |                     |                          | 6,000                  | .103            | 28.4                                 |
| 130                    | —25                | 20.5                | 2,100                    | 2,100                  | .190            | 25.6                                 |
|                        |                    |                     |                          | 4,200                  | .167            | 28.2                                 |
|                        |                    |                     |                          | 6,300                  | .145            | 30                                   |
| 160                    | —25                | 35                  | 1,900                    | 1,900                  | .230            | 27.8                                 |
|                        |                    |                     |                          | 3,800                  | .177            | 31.4                                 |
|                        |                    |                     |                          | 5,700                  | .170            | 33.2                                 |
| 160                    | —30                | 29                  | 1,900                    | 1,900                  | .300            | 26.2                                 |
|                        |                    |                     |                          | 3,800                  | .284            | 27.2                                 |
|                        |                    |                     |                          | 5,700                  | .236            | 30.2                                 |



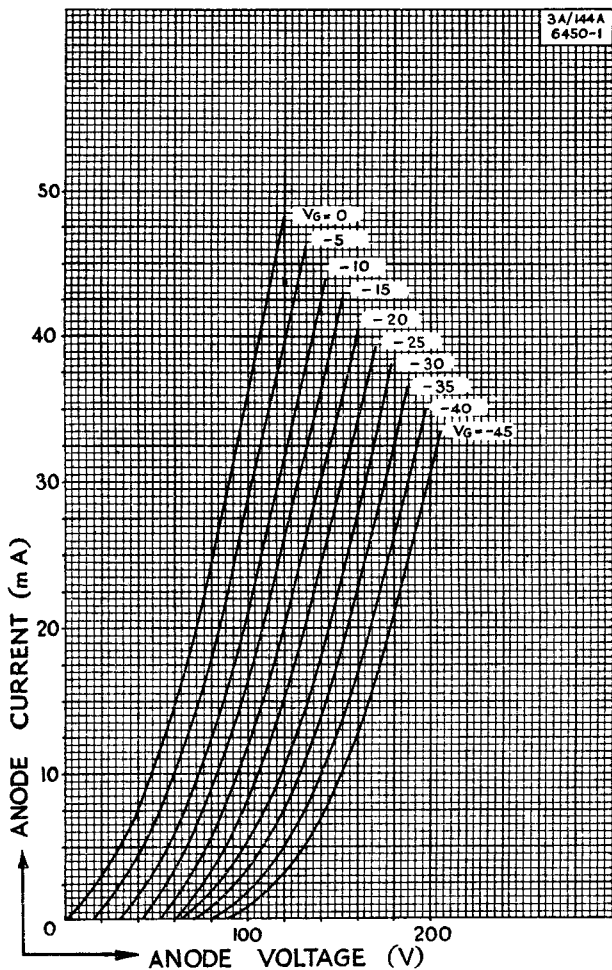


# Repeater Triode

3A/144A

Replaces 4104D

3A/144AY is the 3A/144A tested to special limits for replacement purposes only





# Grounded Grid Triode

3A/146J (CV53)

This is a special triode for UHF operation designed primarily for use as an amplifier at frequencies between 50 and 450 Mc/s. It will operate as an efficient amplifier up to 350 Mc/s with tuning coil and condenser circuits. At higher frequencies, up to 450 Mc/s, coaxial line resonators will be necessary.

## CATHODE.

Indirectly-heated oxide-coated. The cathode is strapped inside the glass bulb to one heater lead.

|                 |      |   |
|-----------------|------|---|
| Voltage         | 4.0  | V |
| Nominal current | 0.65 | A |

## RATING.

|                      |                                                                                                                                 |     |      |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------|-----|------|
| Amplification factor | $\left\{ \begin{array}{l} \text{Measured at } V_a 250V \\ \text{Auto-bias resistance} \\ 150 \text{ ohms} \end{array} \right\}$ | 100 |      |
| Mutual conductance   |                                                                                                                                 | 5   | mA/V |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                  |                                                                                                                            |       |    |
|------------------|----------------------------------------------------------------------------------------------------------------------------|-------|----|
| Anode to grid    | $\left\{ \begin{array}{l} \text{Measured with an} \\ \text{earthed shield} \\ \text{around the bulb} \end{array} \right\}$ | 1.6   | pF |
| Anode to cathode |                                                                                                                            | 0.035 | pF |
| Grid to cathode  |                                                                                                                            | 4.0   | pF |

## DIMENSIONS.

|                          |       |     |
|--------------------------|-------|-----|
| Maximum overall length   | 82.55 | mm. |
| Maximum diameter of disc | 51.3  | mm. |
| Maximum bulb diameter    | 31.5  | mm. |
| Net weight               | 24    | g.  |

## MAXIMUM RATING.

|                              |     |   |
|------------------------------|-----|---|
| Maximum direct anode voltage | 350 | V |
| Maximum anode dissipation    | 2   | W |

## MOUNTING.

The valve may be mounted by means of the grid disc. Spade tags are attached to the heater leads, one of which, that connected to the cathode, is painted red.

# Grounded Grid Triode

3A/146J (CV53)



## TYPICAL OPERATION

### Amplifier for frequencies of 250 to 300 Mc/s

The valve is mounted in a screening box so that the grid disc is integral with the screening system and the input circuit well shielded from the output circuit. The anode resonant circuit must be a high quality coil condenser unit and is mutually coupled to the output by a coupling coil the position of which may be varied to increase or decrease the coupling and hence vary the load transferred to the anode circuit. By increasing the coupling the band width is widened.

The cathode circuit consists of two similar coils—one in the heater lead and one in the heater and cathode lead—tuned by a condenser. The coils are decoupled for H.F. by small condensers at the end remote from the valve. The input is tapped on the coil in the cathode lead to match the input impedance to that of the facing impedance, i.e., aerial or preceding valve.

With care given to the design of the tuned circuit, and stray capacities kept at a minimum, a compact and efficient amplifier may be built for frequencies up to 350 Mc/s with a stage gain of 16 db over a band width of 1.5 Mc/s; or 13 db may be obtained for a band width of 4 Mc/s.



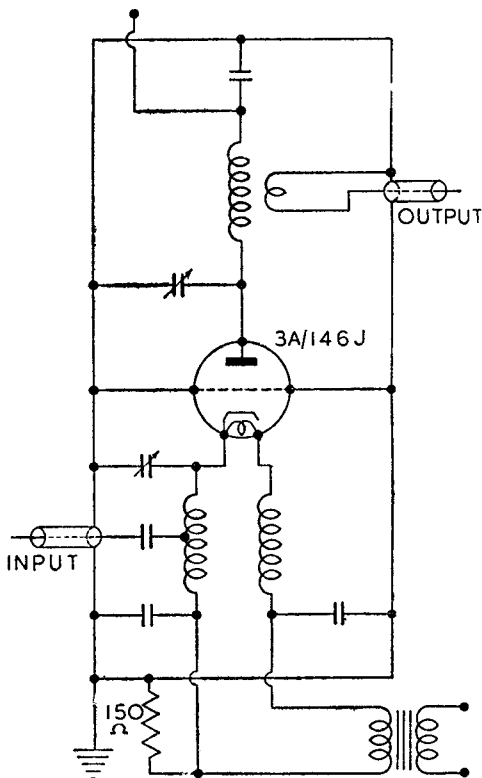


3A/146J

# Grounded Grid Triode

3A/146J (CV53)

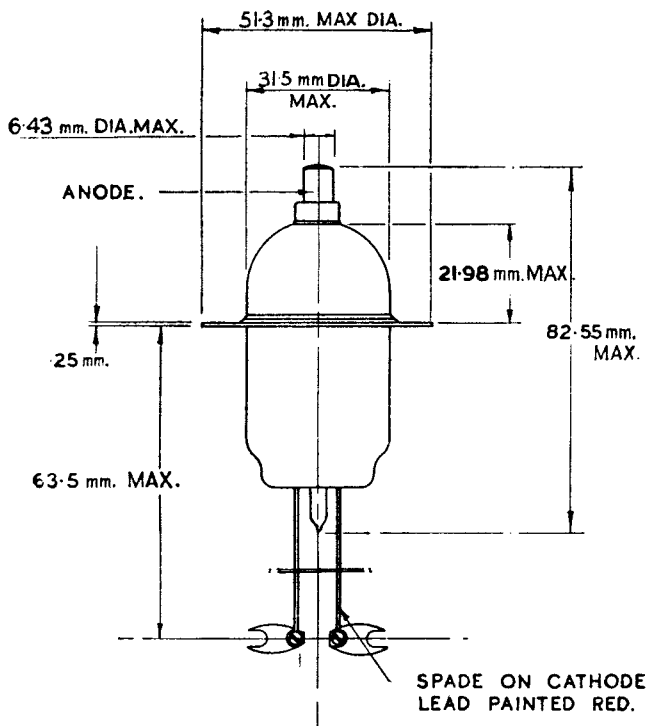
50—300 Mc/s AMPLIFIER.



3A/146J

# Grounded Grid Triode

3A/146J (CV53)





# Grounded Grid Oscillator Triode

3A/147J (CV82)

This valve is intended primarily as an oscillator at frequencies up to 750 Mc/s. In this range outputs between 1 and 2 watts are readily obtainable.

## CATHODE.

Indirectly heated oxide-coated. The cathode is strapped inside the glass bulb to one heater lead.

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 4   | V |
| Nominal current | 0.7 | A |

## RATING.

|                      |                            |    |      |
|----------------------|----------------------------|----|------|
| Amplification factor | { Measured at $V_a 250V$ } | 35 |      |
| Mutual conductance   | { $V_{g_1} - 3$ }          | 6  | mA/V |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                  |                      |     |    |
|------------------|----------------------|-----|----|
| Anode to grid    | { Measured with an } | 1.4 | pF |
| Anode to cathode | { earthed shield }   | 0.4 | pF |
| Grid to cathode  | { around the bulb }  | 4.2 | pF |

## DIMENSIONS.

|                        |       |     |
|------------------------|-------|-----|
| Maximum overall length | 82.55 | mm. |
| Maximum disc diameter  | 51.3  | mm. |
| Maximum bulb diameter  | 31.5  | mm. |
| Maximum disc thickness | 0.25  | mm. |
| Net weight             | 24    | g.  |

## MOUNTING.

The valve is designed to mount by means of the grid disc between coaxial lines. Spade tags are attached to the heater leads one of which, that connected to the cathode, is painted red.

## MAXIMUM RATINGS.

|                              |     |    |
|------------------------------|-----|----|
| Maximum direct anode voltage | 350 | V  |
| Maximum direct anode current | 28  | mA |
| Maximum anode dissipation    | 6   | W  |
| Maximum grid dissipation     | 0.5 | W  |

# Grounded Grid Oscillator Triode



3A/147J (CV82)

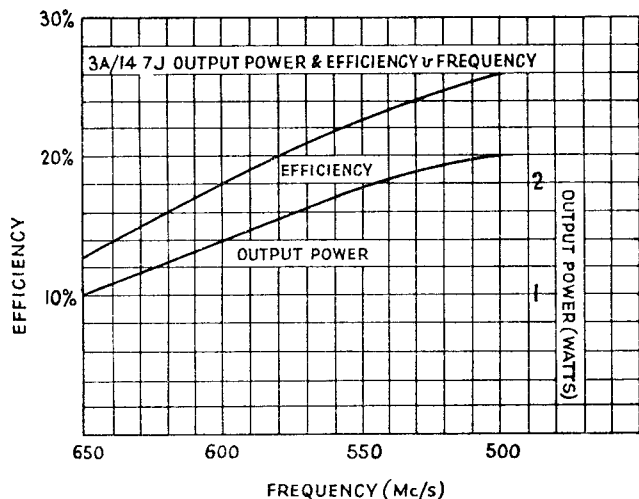
## TYPICAL OPERATION

### Oscillator at 550 to 650 Mc/s.

A convenient oscillator circuit takes the form of that shown in the accompanying sketch, the anode resonator being the only variable and the cathode being choked back by either the inductance of its own leads or small chokes. Using this circuit, an output of from 1 to 2 watts at an efficiency varying between 13 and 26 per cent. has been obtained over the above frequency band. The curve below indicates the variation of efficiency and output with frequency over the range.

650 Mc/s is the highest frequency obtainable with a closed resonator owing to physical limitations, i.e., the length and diameter of the anode lead. Higher frequencies can be obtained with an open line. The highest frequency at which the valve will oscillate is about 850 Mc/s. Appreciable power has been obtained at frequencies as high as 750 Mc/s.

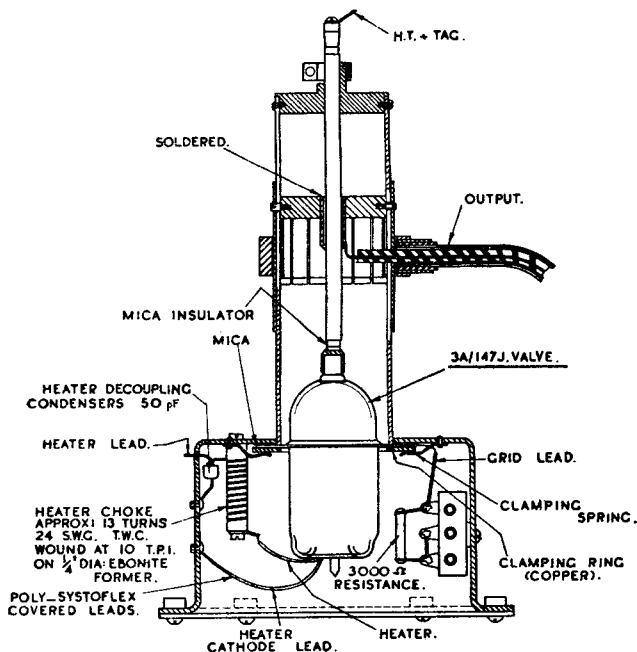
NOTE : The internal diameter of the outer conductor of any coaxial line system employed with this valve should not be less than 1.38 inches if possible damage to the grid disc seal is to be avoided.





# Grounded Grid Oscillator Triode

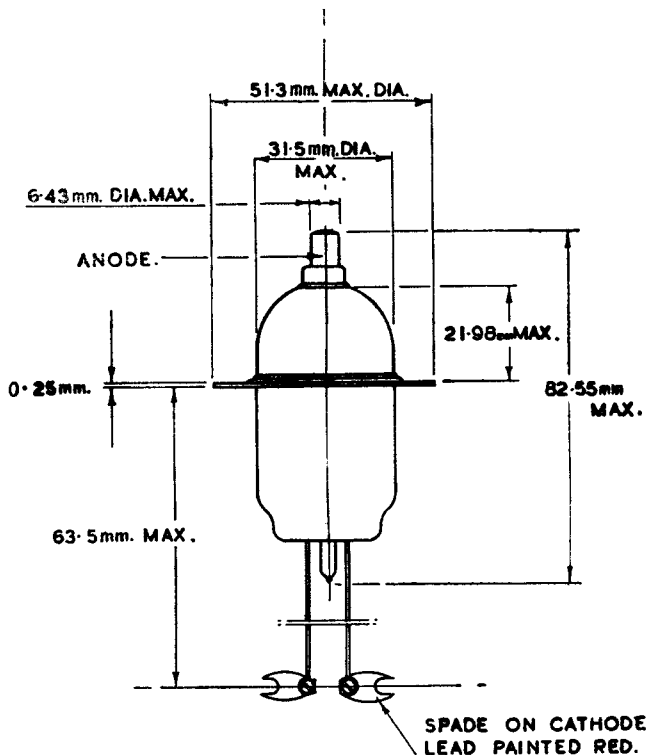
3A/147J (CV82)



3A/147J

# Grounded Grid Oscillator Triode

3A/147J (CV82)





# Grounded Grid Triode

3A/148J (CV88)

This is a special triode for UHF operation designed primarily for use at 600 Mc/s. The grid being operated at ground potential and the feedback capacity low, the input is well shielded from the output. It differs from the 3A/145J in heater voltage, 6.3 V instead of 4 V, and the heater and cathode are brought out to a concentric thimble suitable for direct attachment to a concentric resonator. Used in a pre-amplifier, improvements of the order of 12 to 15 db resulted in the signal to noise ratio performance of UHF receivers, an improvement of 4 to 5 db over the 3A/145J.

## CATHODE.

Indirectly heated oxide-coated. The cathode is strapped internally to one heater lead.

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 6.3 | V |
| Nominal current | 0.4 | A |

## RATING.

|                      |                                                                                                                          |     |      |
|----------------------|--------------------------------------------------------------------------------------------------------------------------|-----|------|
| Amplification factor | $\left\{ \begin{array}{l} \text{Measured at } V_a 250V \\ \text{Auto-bias resistance} \\ 150\Omega \end{array} \right\}$ | 100 |      |
| Mutual conductance   |                                                                                                                          | > 5 | mA/V |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                  |                                                                                                                            |       |    |
|------------------|----------------------------------------------------------------------------------------------------------------------------|-------|----|
| Anode to grid    | $\left\{ \begin{array}{l} \text{Measured with an} \\ \text{earthed shield} \\ \text{around the bulb} \end{array} \right\}$ | 1.5   | pF |
| Anode to cathode |                                                                                                                            | 0.035 | pF |
| Grid to cathode  |                                                                                                                            | 4.0   | pF |

## DIMENSIONS.

|                            |      |     |
|----------------------------|------|-----|
| Maximum overall length     | 80.9 | mm. |
| Maximum diameter over disc | 51.3 | mm. |
| Maximum bulb diameter      | 31.5 | mm. |
| Nominal disc thickness     | 0.25 | mm. |
| Net weight                 | 30   | g.  |

## MOUNTING.

The valve is designed to mount by means of the grid disc between coaxial lines.

## MAXIMUM RATINGS.

|                                                                 |     |   |
|-----------------------------------------------------------------|-----|---|
| Maximum direct anode voltage                                    | 350 | V |
| Maximum anode dissipation                                       | 2   | W |
| With adequate cooling the anode dissipation may be increased to | 3   | W |

# Grounded Grid Triode

3A/148J (CV88)



## TYPICAL OPERATING CONDITIONS

A suitable amplifier for 600 Mc/s operation is shown in the accompanying sketch.

The valve is mounted between two coaxial lines, suitable blocking condensers being inserted to isolate the D.C. potentials.

The inherent negative feedback limits possible gain, but together with the marked reduction of impedances common to both circuits, makes for greater stability. The impedance of the output circuit must be high with the result that the tuning adjustment is critical. The input impedance, however, is normally low, no tuning or coupling adjustment being necessary for fixed frequency working.

The output coupling controls the band width ; 2 to 6 Mc/s has been obtained in practice. The anode load and gain of the valve may be varied by the output coupling ; this has the advantage that it may be pre-set.

The grid is auto-biased through 150 ohms in parallel with the 0.01  $\mu$ F.

In this design of circuit the frame of the amplifier is at ground potential, it is therefore necessary to insert a capacity in series with the centre conductor of the anode resonator since this is at anode potential. The cathode is coupled to the input resonator by the capacity of the cathode and heater leads to the centre conductor.

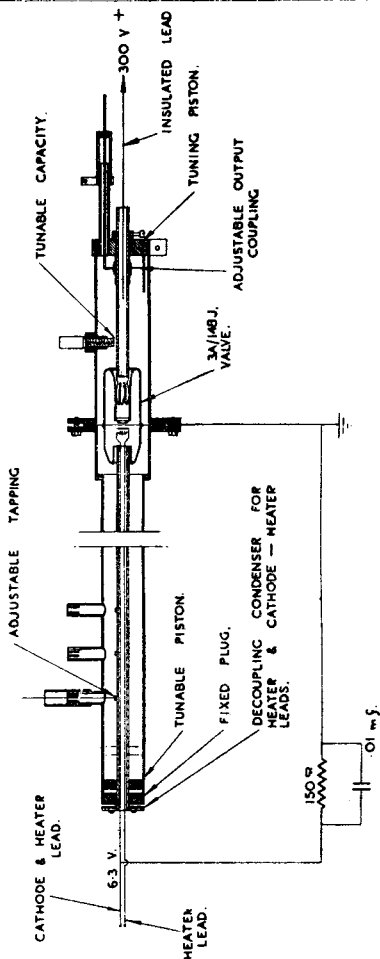
Input is fed to the adjustable tapping on the input resonator. Output power is taken from the slider on the centre line of the anode resonator.





# Grounded Grid Triode

3A/148J (CV88)

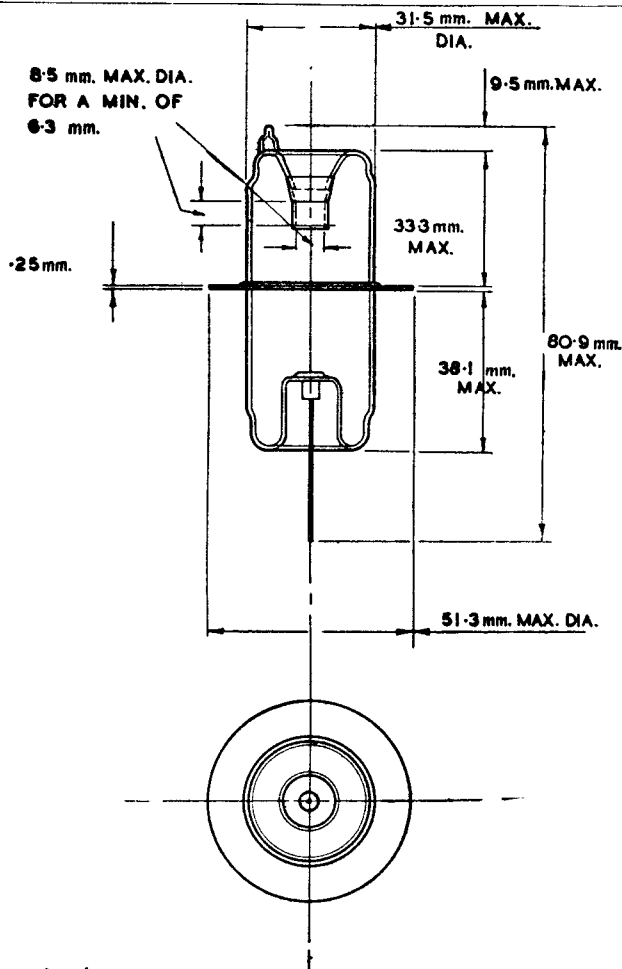


Tentative data  
October, 1945

3A/148J

# Grounded Grid Triode

3A/148J (CV88)



Tentative data  
October 1945

3A/148J—4

# —Standard Valves—

3B/100-B  
Valve

## VALVE TYPE 3B/100-B

TRIODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

Standard British 5-pin.

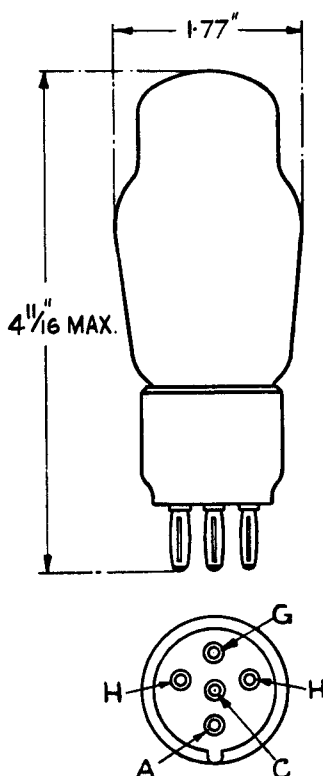
#### Dimensions.

Maximum overall length  $4\frac{11}{16}$ " (11.9 cms.)  
Bulb diameter 1.77" (4.5 cms.)  
Net weight 0.11 lbs. (50 gms.)

#### Constants.

|                        |                         |
|------------------------|-------------------------|
| Heater voltage         | 4 volts                 |
| Heater current         | 1.1 amps.               |
| *Amplification factor  | 13                      |
| *Impedance             | 2,000 ohms.             |
| *Mutual conductance    | 6.5 mA per volt         |
| Grid-anode capacity    | 7.5 $\mu\mu\text{F}$ .  |
| Grid-cathode capacity  | 10.3 $\mu\mu\text{F}$ . |
| Anode-cathode capacity | 4.8 $\mu\mu\text{F}$ .  |

\* at  $V_p = 200$   $V_{g1} = -10$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 200 volts |
| Maximum direct anode current | 50 mA.    |
| Maximum anode dissipation    | 10 watts  |

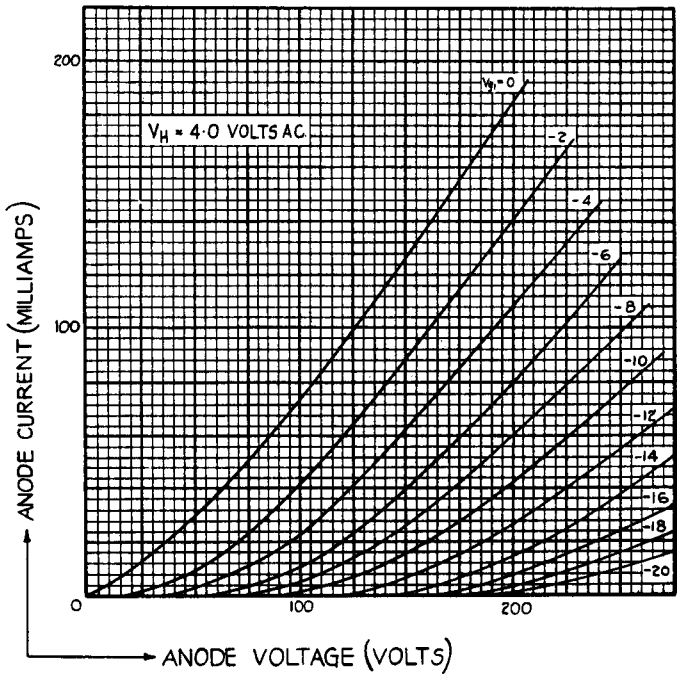
Tentative Data

W.3B/100-B.1  
Feb. 1939

# —Standard Valves—

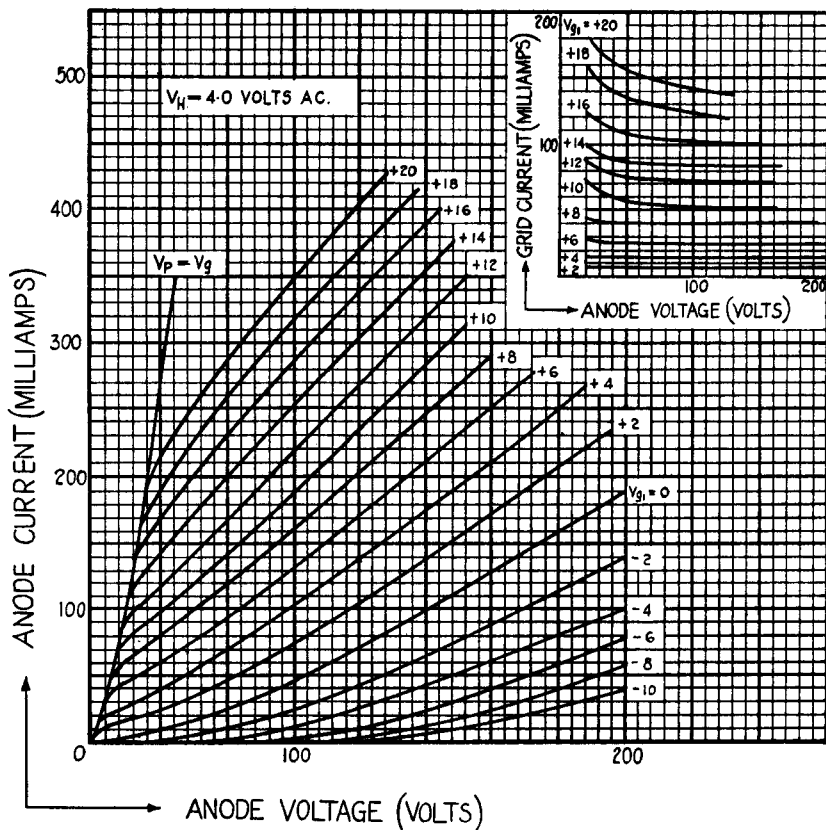
## TYPICAL OPERATING CONDITIONS.

| Class A. AF Amplifier |                 |                   |                      |                  |                     |
|-----------------------|-----------------|-------------------|----------------------|------------------|---------------------|
| Anode Voltage volts   | Grid Bias volts | Anode Current mA. | Load Resistance ohms | Power Output mW. | Total Harmonics db. |
| 100                   | —4              | 23                | 8,000                | 10               | 38                  |
| 100                   | —4              | 23                | 8,000                | 50               | 31                  |
| 150                   | —6              | 40                | 10,000               | 50               | 35                  |
| 150                   | —6              | 40                | 10,000               | 100              | 32                  |
| 200                   | —10             | 40                | 10,000               | 50               | 37                  |
| 200                   | —10             | 40                | 10,000               | 250              | 30                  |



# —Standard Valves—

3B/100-B  
Valve



PRINTED IN  
ENGLAND

# *—Standard Valves—*

3B/101-B

## VALVE TYPE 3B/101-B

TRIODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

Standard British 5-pin.

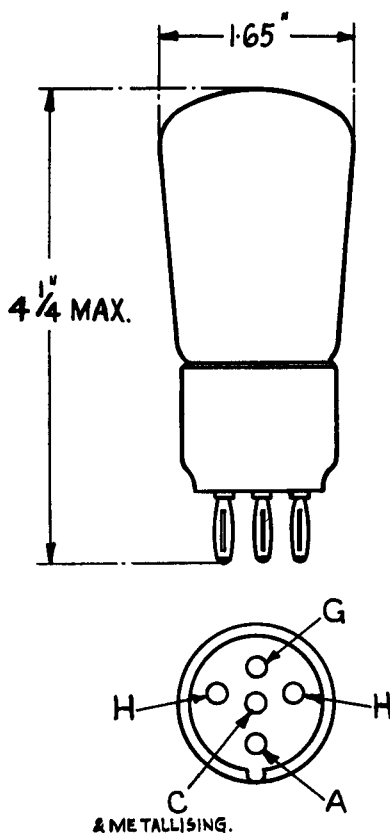
#### Dimensions.

Maximum overall length  $4\frac{1}{4}"$  (10.8 cms.)  
Bulb diameter 1.65" (4.2 cms.)  
Net weight 0.11 lbs. (50 gms.)

#### Constants.

|                        |                         |
|------------------------|-------------------------|
| Heater voltage         | 4 volts                 |
| Nominal heater current | 1.0 amps.               |
| *Amplification factor  | 50                      |
| *Impedance             | 10,000 ohms             |
| *Mutual conductance    | 5.0 mA. per volt        |
| Grid-anode capacity    | 5.3 $\mu\mu\text{F}$ .  |
| Grid-cathode capacity  | 10.5 $\mu\mu\text{F}$ . |
| Anode-cathode capacity | 7.5 $\mu\mu\text{F}$ .  |

\* at  $V_p = 200$ ,  $V_{g1} = -2$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 200 volts |
| Maximum direct anode current | 25 mA.    |

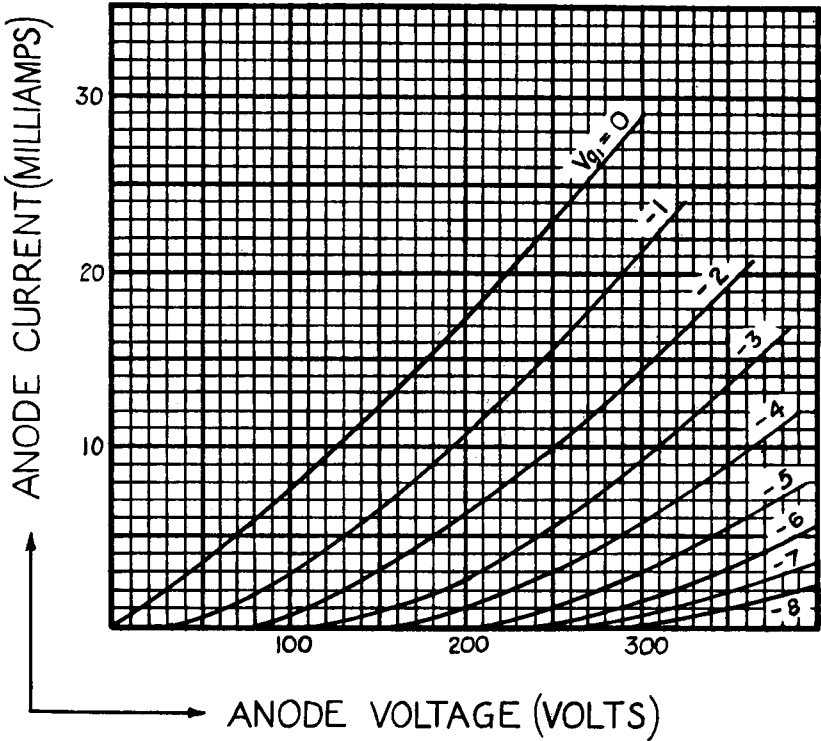
Tentative data

W.3B/101-B.1  
April 1939

# —Standard Valves—

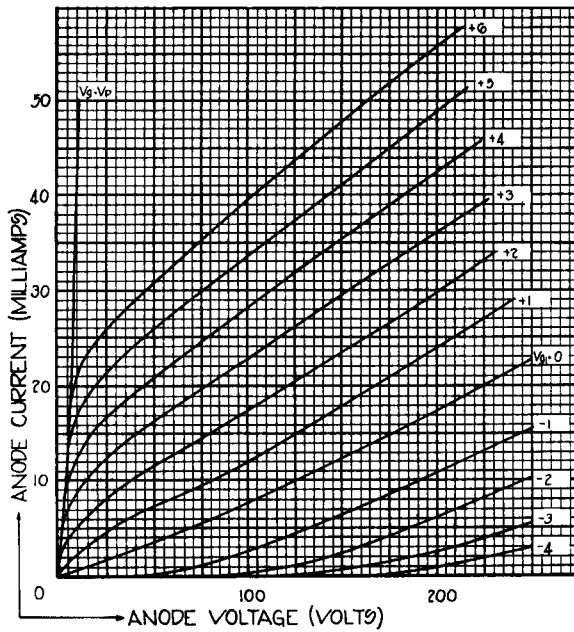
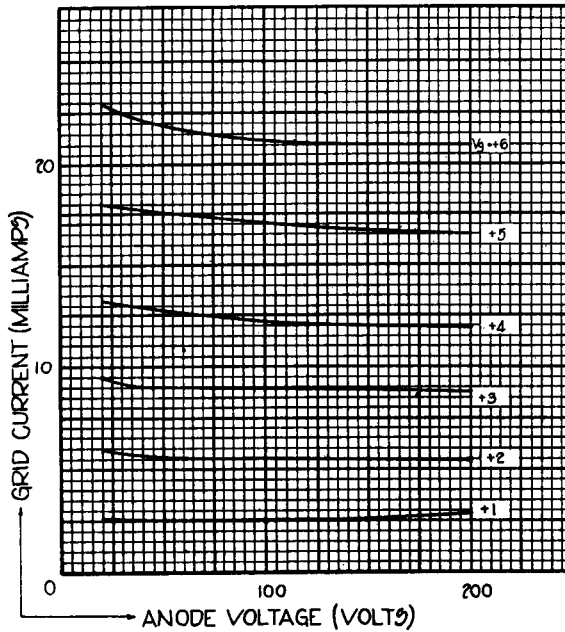
## TYPICAL OPERATING CONDITIONS.

| Anode Voltage Volts | Grid Bias Volts | Anode Current mA. | Load Resistance Ohms | Power Output mW. | Total Harmonics db. |
|---------------------|-----------------|-------------------|----------------------|------------------|---------------------|
| 100                 | —1              | 2.8               | 22,000               | 5                | 31.5                |
| 100                 | —1              | 2.8               | 22,000               | 10               | 31                  |
| 150                 | —1.5            | 4.5               | 28,000               | 5                | 32                  |
| 150                 | —1.5            | 4.5               | 28,000               | 20               | 27                  |
| 200                 | —2              | 6.0               | 34,000               | 5                | 34                  |
| 200                 | —2              | 6.0               | 34,000               | 20               | 29                  |
| 200                 | —2              | 6.0               | 34,000               | 30               | 27                  |





# —Standard Valves—



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ENGLAND



# Triode

## 3B/151A

### CATHODE.

|                       |     |   |
|-----------------------|-----|---|
| Oxide-coated filament |     |   |
| Voltage               | 4.5 | V |
| Nominal current       | 1.6 | A |

### RATING.

|                      |                            |      |          |
|----------------------|----------------------------|------|----------|
| Amplification factor | { measured at $V_a$ 250V } | 7    |          |
| Impedance            | $V_{g_1}$ —15V }           | 3500 | $\Omega$ |

### DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 6.2 | pF |
| Grid to filament  | 5   | pF |
| Anode to filament | 3.2 | pF |

### DIMENSIONS.

|                                                    |     |     |
|----------------------------------------------------|-----|-----|
| Maximum overall length                             | 138 | mm. |
| Maximum bulb diameter                              | 46  | mm. |
| Base—American medium 4 pin bayonet with offset pin |     |     |
| Net weight                                         | 60  | g.  |

### MAXIMUM RATINGS.

|                              |     |    |
|------------------------------|-----|----|
| Maximum direct anode voltage | 400 | V  |
| Maximum direct anode current | 50  | mA |
| Maximum anode dissipation    | 15  | W  |
| Maximum direct grid current  | 10  | mA |

## Triode



3B/151A

## TYPICAL OPERATING CONDITIONS

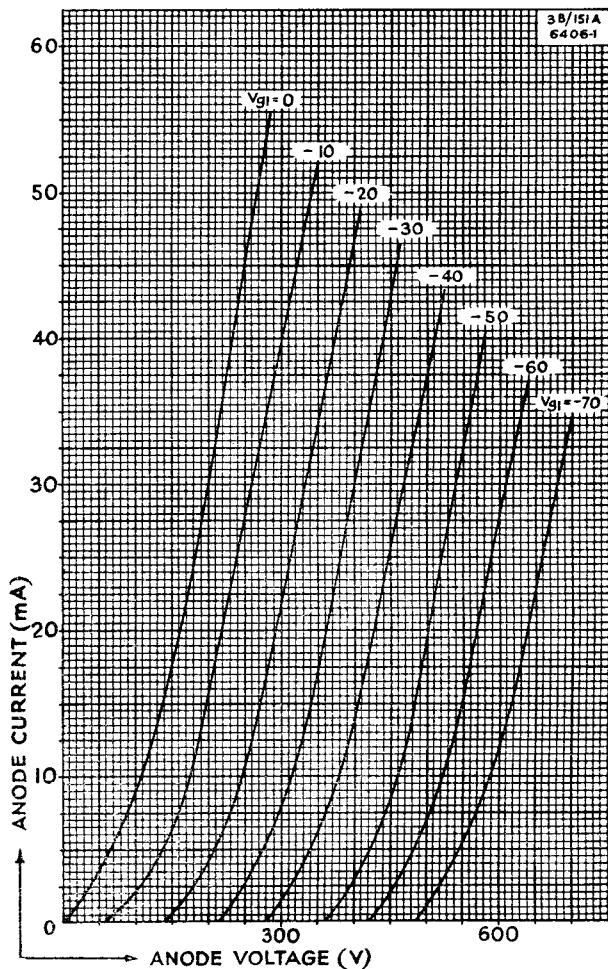
| Anode voltage | Grid bias | Anode current | Amplification factor | Anode Resistance | Load Resistance | Power Output | Second Harmonic |
|---------------|-----------|---------------|----------------------|------------------|-----------------|--------------|-----------------|
| volts         | volts     | mA            |                      | ohms             | ohms            | mW           | db              |
| 200           | — 6       | 22.5          | 7.4                  | 4,000            | 4,000           | 60           | 35              |
|               |           |               |                      |                  | 8,000           | 55           | 40              |
| 250           | —22       | 9             | 6.9                  | 6,000            | 6,000           | 500          | 18              |
|               |           |               |                      |                  | 12,000          | 450          | 22              |
|               |           |               |                      |                  | 18,000          | 380          | 26              |
| 250           | —15       | 19            | 7.2                  | 4,350            | 4,350           | 310          | 26              |
|               |           |               |                      |                  | 8,700           | 280          | 30              |
| 250           | —10       | 27.5          | 7.4                  | 3,800            | 3,800           | 180          | 33              |
|               |           |               |                      |                  | 7,600           | 160          | 38              |
| 250           | — 5       | 37.5          | 7.5                  | 3,500            | 3,500           | 50           | 40              |
|               |           |               |                      |                  | 7,000           | 45           | 43              |
| 300           | —30       | 8             | 6.7                  | 6,700            | 6,700           | 800          | 15              |
|               |           |               |                      |                  | 13,400          | 720          | 20              |
|               |           |               |                      |                  | 19,100          | 600          | 24              |
| 300           | —24       | 15.5          | 7.1                  | 4,800            | 4,800           | 750          | 20              |
|               |           |               |                      |                  | 9,600           | 670          | 25              |
| 300           | —18       | 25            | 7.3                  | 4,000            | 4,000           | 540          | 27              |
|               |           |               |                      |                  | 8,000           | 480          | 31              |
| 350           | —22.5     | 29            | 7.3                  | 3,800            | 3,800           | 875          | 26              |
|               |           |               |                      |                  | 7,600           | 800          | 30              |
| 375           | —30       | 22            | 7.1                  | 4,300            | 4,300           | 1,300        | 20              |
|               |           |               |                      |                  | 8,600           | 1,200        | 26              |
| *300          | —10       | 41            | 7.4                  | 3,350            | 3,350           | 200          | 37              |
|               |           |               |                      |                  | 6,700           | 180          | 41              |
| *350          | —20       | 34            | 7.3                  | 3,600            | 3,600           | 750          | 28              |
|               |           |               |                      |                  | 7,200           | 675          | 32              |
| *375          | —24       | 32            | 7.3                  | 3,650            | 3,650           | 1,000        | 26              |
|               |           |               |                      |                  | 7,300           | 900          | 30              |
| *400          | —29       | 30            | 7.2                  | 3,800            | 3,800           | 1,400        | 23              |
|               |           |               |                      |                  | 7,600           | 1,300        | 28              |

\* Maximum operating conditions.



## Triode

3B/151A

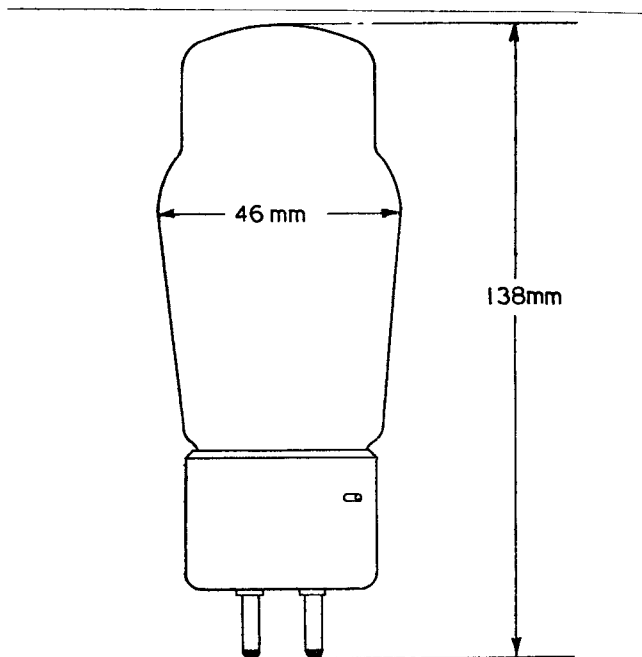
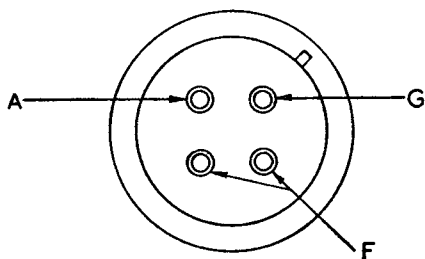


3B/151A

# Triode



3B/151A



June 1946

3B/151A-4

# —Standard Valves—

3B/200-B

## VALVE TYPE 3B/200-B

(Previously coded VLS.417-B valve).

TRIODE.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

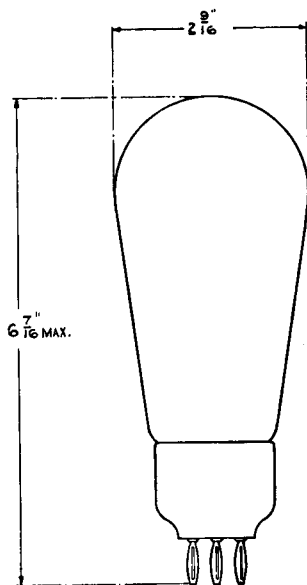
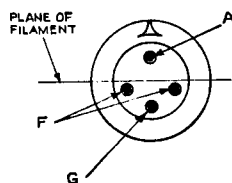
Standard British 4 pin.

#### Dimensions.

Max. Overall length  $6\frac{7}{16}"$  (16.3 cms.)  
Bulb diameter  $2\frac{9}{16}"$  (6.5 cms.)  
Net weight  $\frac{3}{8}$  lb. (170 gms.)

#### Constants.

Filament voltage 6 volts  
Nominal filament current 1.1 amps.  
\*Amplification factor 25  
\*Mutual conductance 5 mA.per volt  
\*Impedance 5,000 ohms.  
Grid-anode capacity  $9.9 \mu\mu\text{F.}$   
Grid-filament capacity  $7.5 \mu\mu\text{F.}$   
Anode-filament capacity  $5.7 \mu\mu\text{F.}$   
\* at  $V_p = 400$  volts,  $I_p = 50$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                      |           |
|------------------------------------------------------|-----------|
| Maximum direct anode voltage                         | 600 volts |
| Maximum anode dissipation                            | 20 watts  |
| Maximum direct anode current                         | 135 mA.   |
| Maximum frequency for above ratings                  | 2 Mc.     |
| Maximum direct anode voltage for frequency of 10 Mc. | 500 volts |

Tentative data

W.3B/200-B.1  
March, 1939

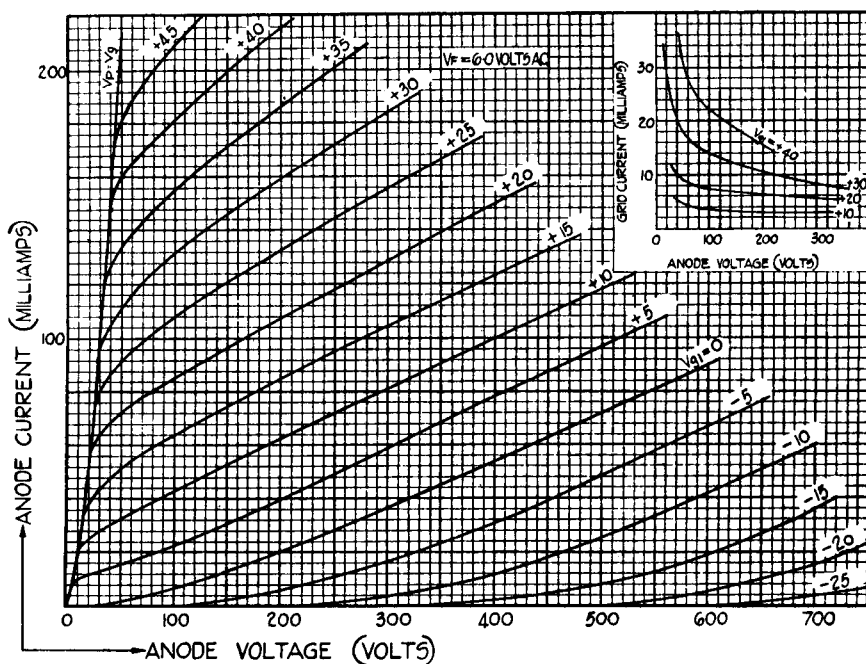
**—Standard Valves—**

### TYPICAL OPERATING CONDITIONS.

|                                            |                                                             |
|--------------------------------------------|-------------------------------------------------------------|
|                                            | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit. |
| Direct anode voltage                       | 600 volts                                                   |
| Direct anode current per valve—zero signal | 12 mA.                                                      |
| maximum signal                             | 64 mA.                                                      |
| Grid bias                                  | —17 volts                                                   |
| Load resistance—anode to anode             | 9,000 ohms                                                  |
| Peak A.F. grid to grid voltage             | 110 volts                                                   |
| Anode dissipation                          | 17 watts                                                    |
| Power output—2 valves                      | 40 watts                                                    |

### RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 600                                     | 450                               | 600 volts             |
| Direct anode current | 50                                      | 67                                | 75 mA.                |
| Control grid bias    | —20                                     | —35                               | —50 to<br>—75 volts   |
| Anode dissipation    | 20                                      | 10                                | 15 watts              |
| Carrier output       | 10                                      | 20                                | 30 watts              |







# Triode

3B/252B  
(4033L)

4033L

## CATHODE.

Indirectly heated oxide-coated.

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 6   | V |
| Nominal current | 1.4 | A |

## RATING.

|                      |                                           |                  |
|----------------------|-------------------------------------------|------------------|
| Amplification factor | Measured<br>at $V_a$ 400 V<br>$V_g$ -20 V | 15<br>1,670 ohms |
| Impedance            |                                           |                  |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                  |    |    |
|------------------|----|----|
| Grid to anode    | 8  | pF |
| Grid to cathode  | 4  | pF |
| Anode to cathode | 10 | pF |

## DIMENSIONS.

|                               |     |     |
|-------------------------------|-----|-----|
| Maximum overall length        | 125 | mm. |
| Maximum bulb diameter         | 56  | mm. |
| Base : Standard 5 pin British |     |     |
| Net weight                    | 60  | g.  |

## MAXIMUM RATINGS.

|                                     |       |      |
|-------------------------------------|-------|------|
| Maximum direct anode voltage        | 600   | V    |
| Maximum direct anode current        | 0.170 | A    |
| Maximum anode dissipation           | 25    | W    |
| Maximum direct grid current         | 0.030 | A    |
| Maximum frequency for above ratings | 45    | Mc/s |

## Triode

4033L



# TYPICAL OPERATION

## AUDIO FREQUENCY

### Class B Power Amplifier and Modulator (For balanced 2-valve circuit).

|                                                   |       |            |
|---------------------------------------------------|-------|------------|
| Direct anode voltage                              | 600   | 600 V      |
| Grid bias                                         | —55   | —55 V      |
| Direct anode current per valve<br>—zero signal    | 17    | 17 mA      |
| Direct anode current per valve<br>—maximum signal | 82    | 71 mA      |
| Load resistance—anode to anode                    | 6,800 | 6,800 ohms |
| Peak A.F. Grid to grid voltage                    | 132   | 112 V      |
| *Direct grid current per valve                    | 7     | 1.5 mA     |
| Output                                            | 48    | 40 W       |
| Distortion                                        | 9%    | 5%         |

## RADIO FREQUENCY

### Class C Power Amplifier or Oscillator unmodulated.

|                        |     |    |
|------------------------|-----|----|
| Direct anode voltage   | 600 | V  |
| Grid bias              | —65 | V  |
| Direct anode current   | 120 | mA |
| Peak R.F. grid voltage | 140 | V  |
| *Direct grid current   | 20  | mA |
| Power output           | 55  | W  |

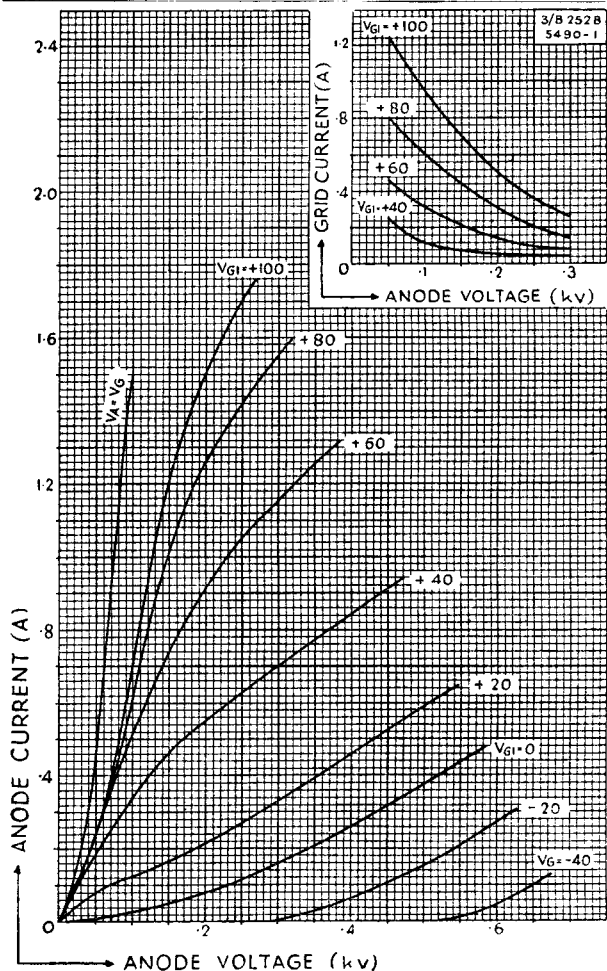
\*Subject to wide variation depending upon the impedance of the load circuit.



# Triode

4033L

3B/252B  
(4033L)



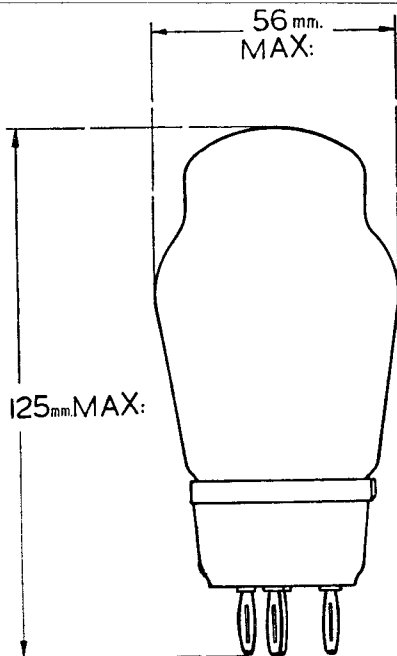
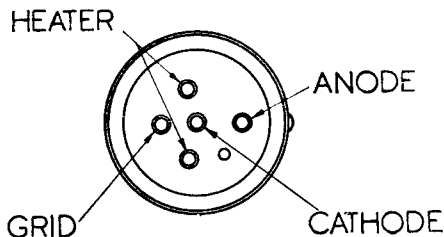
Tentative Data  
September, 1945

3B/252B—3

**3B/252B**  
**(4033L)**

# Triode

**4033L**



Tentative Data  
September, 1945

3B/252B—4



# Double-disc-seal U.H.F. Triode

3B/401J (CV127)

## CATHODE.

Thoriated tungsten filament

|                 |      |   |
|-----------------|------|---|
| Voltage         | 6.3  | V |
| Nominal current | 2.0  | A |
| Peak emission   | 0.75 | A |

## RATING.

|                      |                                          |      |          |
|----------------------|------------------------------------------|------|----------|
| Amplification factor | Measured at<br>$V_a$ 800V<br>$I_a$ 40 mA | 6    |          |
| Impedance            |                                          |      |          |
|                      |                                          | 2000 | $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Anode to grid     | 4   | pF |
| Anode to filament | 0.2 | pF |
| Grid to filament  | 5   | pF |

## DIMENSIONS.

|                  |                     |     |
|------------------|---------------------|-----|
| Overall length   | 130                 | mm. |
| Maximum diameter | 51.3                | mm. |
| Base             | Special, see sketch |     |
| Net weight       | 92                  | g.  |

## MAXIMUM RATINGS.

|                                                                                             |       |    |
|---------------------------------------------------------------------------------------------|-------|----|
| Maximum direct anode voltage                                                                | 1,000 | V  |
| Maximum direct anode current                                                                | 100   | mA |
| Maximum anode dissipation when<br>mounted in apparatus providing<br>adequate heat radiation | 40    | W  |
| Maximum direct grid current                                                                 | 15    | mA |

# Double-disc-seal U.H.F. Triode

3B/401J (CV127)



## TYPICAL OPERATION

### Variable Wavelength Oscillator, 34cm. wavelength upwards.

The anode/grid and filament/grid oscillatory circuits consist of concentric lines ; a common tube forms the inner element of the anode/grid line and the outer element of the grid/filament line. The anode is joined via a condenser to the outer tube of the resonator to hold the D.C. from the grid. Change of wavelength is made by a sliding piston in the anode/grid line (See A in sketch). The filament/grid line must be tuned to match (See B in sketch).

The ends of the filament and the centre tap are all connected through 100 pF capacitors to the centre conductor, and leads are brought from the filament and centre tap through the centre conductor for D.C. connections.

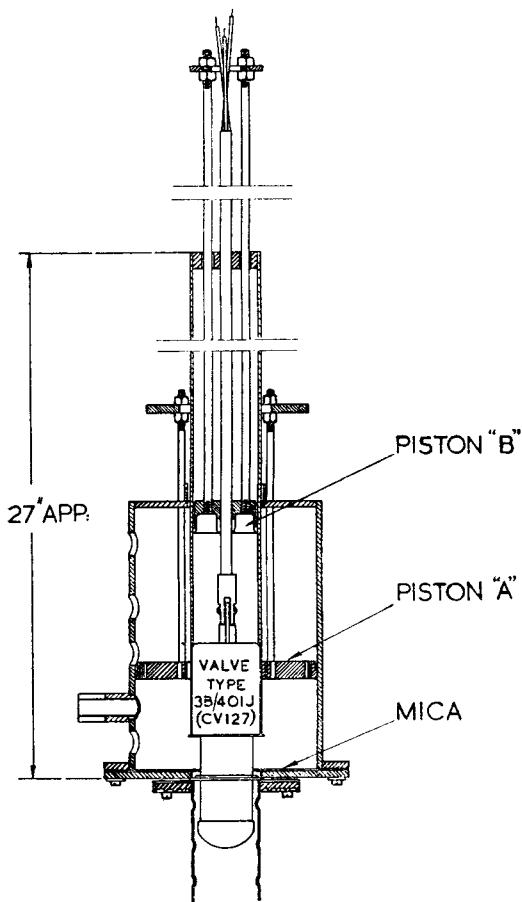
R.F. power may be extracted by a pick-up loop inserted into one of a series of holes in the outer element of the anode/grid line. A suitable tapping point is selected to match the output circuit.

Outputs of approximately 20 watts may be obtained at wavelengths of 50 cm. upward, falling to approximately 6 watts at 34 cm. To obtain the highest frequencies care must be taken to keep the anode/grid piston short.



# Double-disc-seal U.H.F. Triode

3B/401J (CV127)



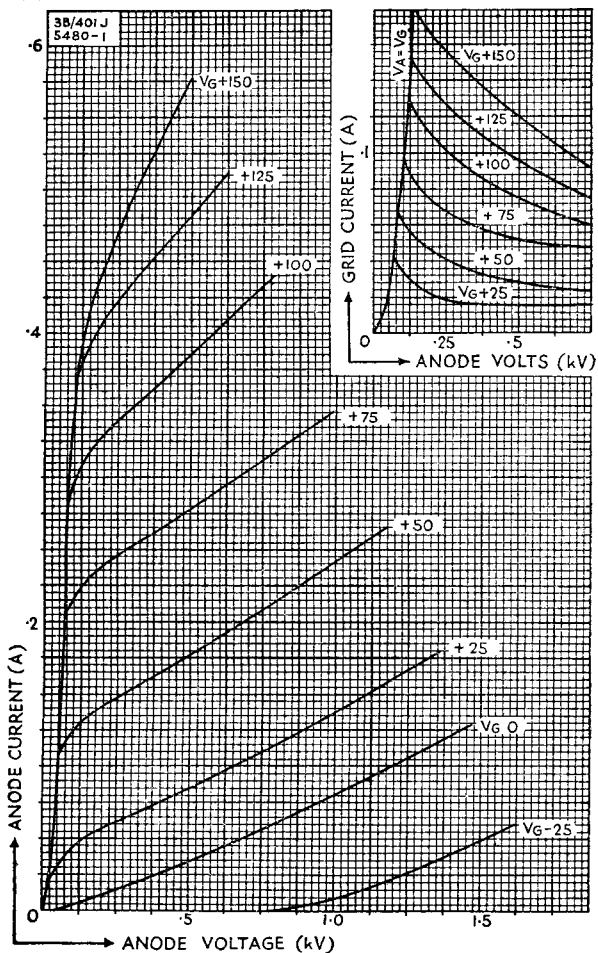
VARIABLE FREQUENCY OSCILLATOR

3B/401J

# Double-disc-seal U.H.F. Triode



3B/401J (CVI27)



Tentative data  
September, 1945

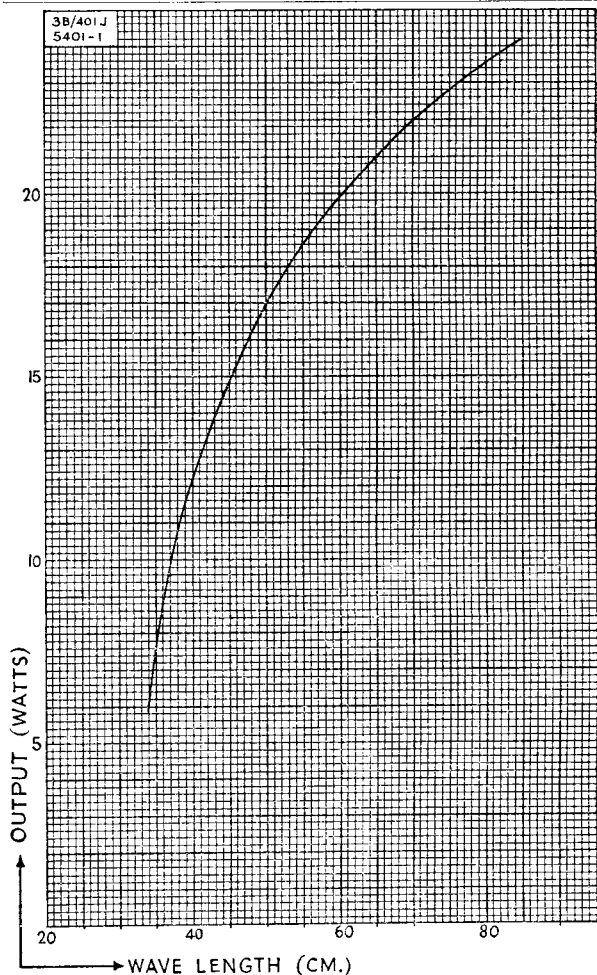
3B/401J—4





# Double-disc-seal U.H.F. Triode

3B/401J (CV127)

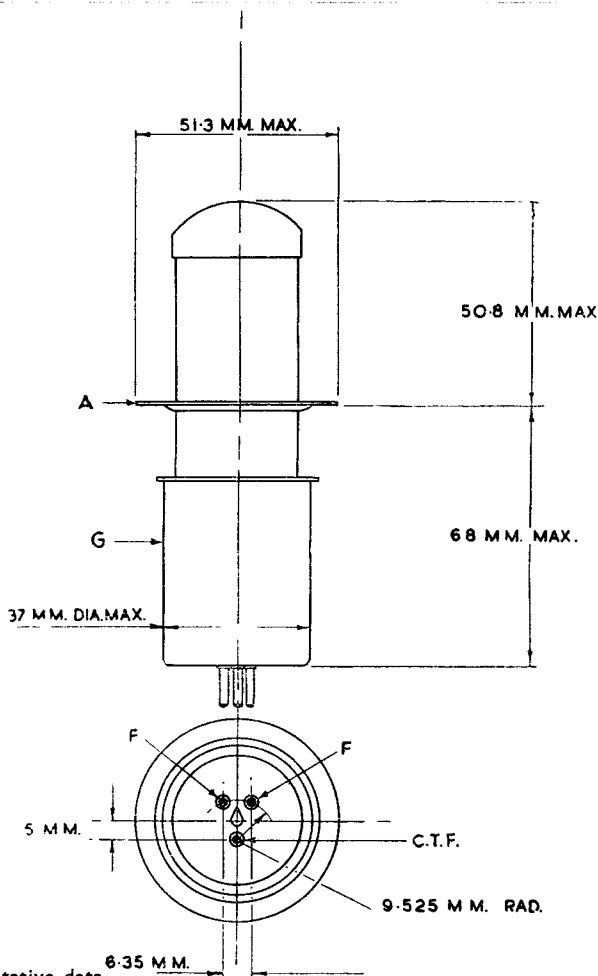


Tentative data  
September, 1945

3B/401J

# Double-disc-seal U.H.F. Triode

3B/401J (CV127)



Tentative data  
September, 1945

3B/401J— 6



# R. F. Triode

For Operation at full input  
rating up to 100 Mc/s

4356A

3B/505E  
(4356A)

## CATHODE.

Thoriated tungsten filament

|                 |   |   |
|-----------------|---|---|
| Voltage         | 5 | V |
| Nominal current | 5 | A |
| Peak emission   | 2 | A |

## RATING.

|                      |                                          |        |          |
|----------------------|------------------------------------------|--------|----------|
| Amplification factor | { Measured at $V_a$ 500 V<br>1a 100 mA } | 45     |          |
| Impedance            |                                          | 12,000 | $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |      |    |
|-------------------|------|----|
| Grid to anode     | 2.25 | pF |
| Grid to filament  | 4.0  | pF |
| Anode to filament | 0.9  | pF |

## DIMENSIONS.

|                        |      |         |
|------------------------|------|---------|
| Maximum overall length | 133  | mm.     |
| Maximum diameter       | 63.5 | mm.     |
| Base                   |      | Special |
| Net weight             | 100  | g.      |

## MAXIMUM CONDITIONS FOR SAFE OPERATION.

|                                                                  |       |      |
|------------------------------------------------------------------|-------|------|
| Maximum direct anode voltage                                     | 1,500 | V    |
| Maximum direct anode current                                     | 120   | mA   |
| Maximum anode dissipation                                        | 50    | W    |
| Maximum direct grid current                                      | 35    | mA   |
| Maximum frequency for above ratings                              | 100   | Mc/s |
| Maximum anode voltage for maximum<br>frequency limit of 250 Mc/s | 1,000 | V    |

The valve should be operated in a vertical position and a free circulation of air must be provided to ensure adequate cooling of the bulb. This is of particular importance when two or more valves are used.

**3B/505E  
(4356A)**

**R. F. Triode**  
**For Operation at full input**  
**rating up to 100 Mc/s**  
**4356A**



**TYPICAL OPERATING CONDITIONS.**

**RADIO FREQUENCY.**

**Class B Telephony. Modulated Carrier applied to Grid.**

(Carrier conditions per valve for use with 100% modulation).

|                                                 |       |    |
|-------------------------------------------------|-------|----|
| Direct anode voltage                            | 1,500 | V  |
| Grid bias                                       | —30   | V  |
| Direct anode current                            | 50    | mA |
| Peak R.F. grid voltage peak of modulation cycle | 145   | V  |
| Power output                                    | 25    | W  |

**Class C Power Amplifier. Anode subjected to modulation**

(Carrier conditions per valve for use with 100% modulation).

|                        |       |        |
|------------------------|-------|--------|
| Direct anode voltage   | 1,250 | V max. |
| Grid bias              | —160  | V      |
| Direct anode current   | 100   | mA     |
| Peak R.F. grid voltage | 290   | V      |
| Power output           | 88    | W      |

**Class C Power Amplifier or Oscillator, unmodulated.**

|                        |       |           |
|------------------------|-------|-----------|
| Direct anode voltage   | 1,500 | V         |
| Grid bias              | —72   | V         |
| Direct anode current   | 100   | mA        |
| Peak R.F. grid voltage | 190   | V         |
| *Direct grid current   | 22.5  | mA        |
|                        |       | (approx.) |
| Power output           | 100   | W         |

\* Subject to wide variation depending upon the impedance of the load circuit.

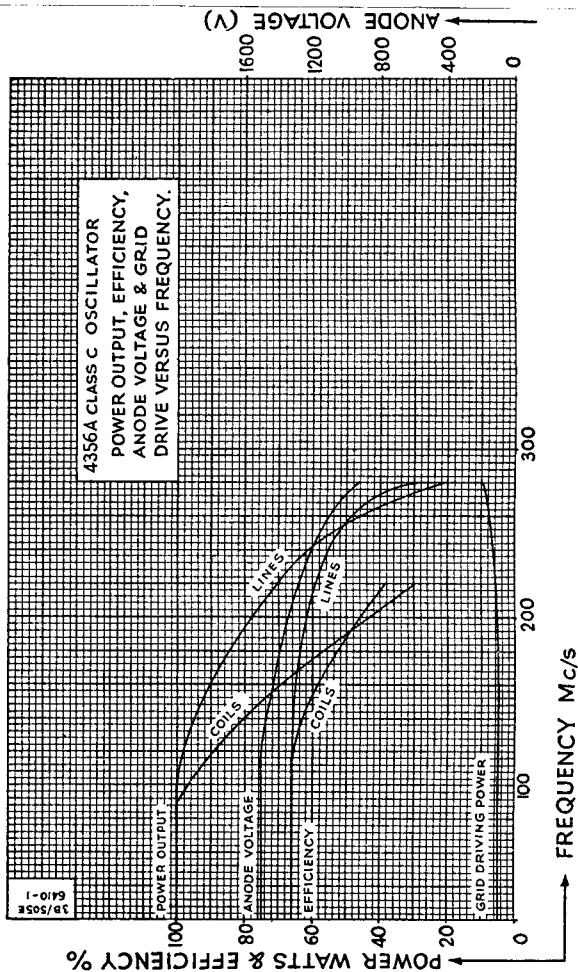


# R. F. Triode

For Operation at full input  
rating up to 100 Mc/s

4356A

3B/505E  
(4356A)

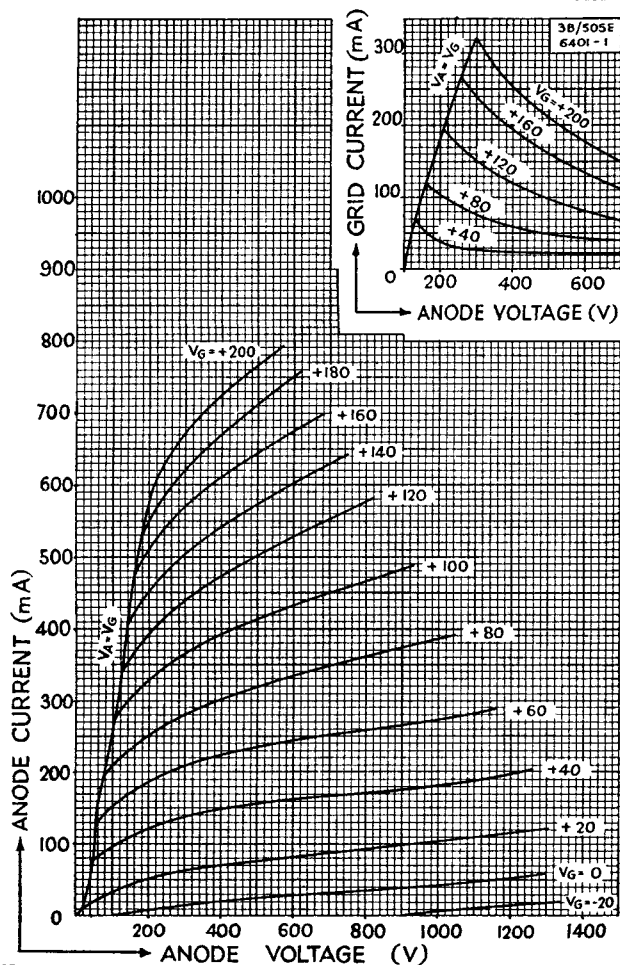


Tentative data  
January 1946

3B/505E-3

3B/505E  
(4356A)

**R. F. Triode**  
For Operation at full input  
rating up to 100 Mc/s  
**4356A**



Tentative data  
January 1946

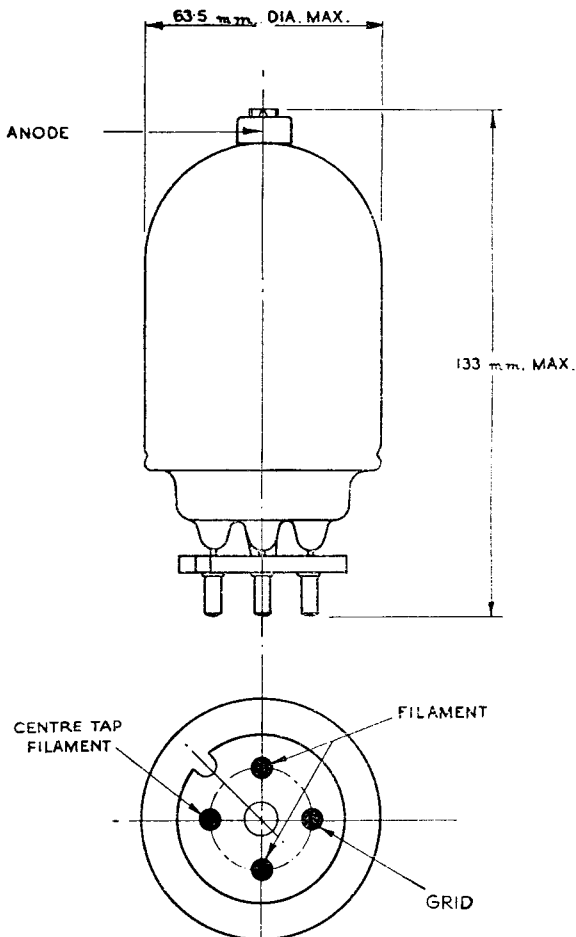


# R. F. Triode

For Operation at full input  
rating up to 100 Mc/s

4356A

3B/505E  
(4356A)



Tentative data  
January 1946

3B/505E—5



# Triode

4242A

3B/850A  
(4242A)

## CATHODE.

Thoriated tungsten filament.

|                 |      |   |
|-----------------|------|---|
| Voltage         | 10   | V |
| Nominal current | 3.25 | A |
| Peak emission   | 2    | A |

## RATING.

|                      |                                                     |       |      |
|----------------------|-----------------------------------------------------|-------|------|
| Amplification factor | } Measured at $V_a$ — }<br>} 1kV, $V_{g_1}$ —55 V } | 12.0  |      |
| Impedance            |                                                     | 3,000 | ohms |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 13  | pF |
| Grid to filament  | 6.5 | pF |
| Anode to filament | 4   | pF |

## DIMENSIONS.

|                  |                     |     |
|------------------|---------------------|-----|
| Overall length   | 204                 | mm. |
| Maximum diameter | 59                  | mm. |
| Base             | Large 4-pin bayonet |     |
| Net weight       | 160                 | g.  |

## MAXIMUM RATINGS.

|                                                   |       |      |
|---------------------------------------------------|-------|------|
| Maximum direct anode voltage                      | 1,250 | V    |
| Maximum direct anode current                      | 150   | mA   |
| Maximum anode dissipation                         | 85    | W    |
| Maximum direct grid current                       | 50    | mA   |
| Maximum frequency for above rating                | 6     | Mc/s |
| Maximum anode voltage for frequency of<br>30 Mc/s | 600   | V    |

**NOTE.**—This valve should be mounted so that the plane of the filament is vertical.



# Triode

**4242A**



## TYPICAL OPERATING CONDITIONS. AUDIO FREQUENCY.

### Class B. Amplifier or Modulator.

For balanced 2-valve circuits.

|                                        |       |            |
|----------------------------------------|-------|------------|
| Direct anode voltage                   | 1,250 | 1,000 V    |
| Anode current per valve zero signal    | 25    | 25 mA      |
| Anode current per valve maximum signal | 150   | 150 mA     |
| Grid bias                              | —95   | —75 V      |
| Anode dissipation                      | 64    | 56 W       |
| Load resistance                        | 9,600 | 8,000 ohms |
| Peak signal grid to grid               | 165   | 140 V      |
| *Approximate grid driving power        | 4     | 2 W        |
| Maximum output 2 valves                | 245   | 185 W      |

## RADIO FREQUENCY.

### Class B. Telephony. Modulated Carrier applied to Grid.

(Carrier conditions per valve for use with 100% modulation.)

|                        |       |         |
|------------------------|-------|---------|
| Direct anode voltage   | 1,250 | 1,000 V |
| Grid bias              | —100  | —80 V   |
| Direct anode current   | 100   | 125 mA  |
| *Direct grid current   | 2     | 1.5 mA  |
|                        |       | approx. |
| Peak R.F. grid voltage | 112   | 105 V   |
| Power output           | 41    | 40 W    |

### Class C. Amplifier. Anode subjected to modulation.

(Carrier conditions per valve for use with 100% modulation.)

|                        |              |         |
|------------------------|--------------|---------|
| Direct anode voltage   | 1,000 V max. | 750 V   |
| Grid bias              | —195         | —180 V  |
| Direct anode current   | 150          | 150 mA  |
| Peak R.F. grid voltage | 295          | 285 V   |
| *Direct grid current   | 17           | 17 mA   |
|                        |              | approx. |
| Power output           | 110          | 80 W    |

### Class C. Amplifier or Oscillator, Unmodulated.

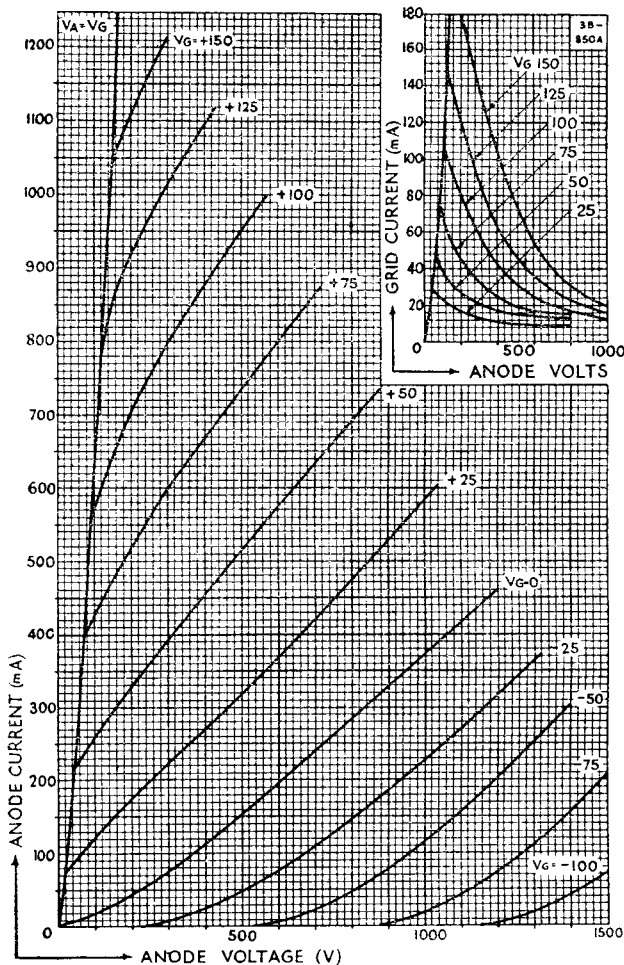
|                        |       |         |
|------------------------|-------|---------|
| Direct anode voltage   | 1,250 | 1,000 V |
| Grid bias              | —153  | —133 V  |
| Direct anode current   | 150   | 150 mA  |
| Peak R.F. grid voltage | 243   | 223 V   |
| *D.C. grid current     | 11.5  | 10 mA   |
|                        |       | approx. |
| Power output           | 140   | 108 W   |

\* Subject to wide variation dependent upon the impedance of the load circuit.



# Triode

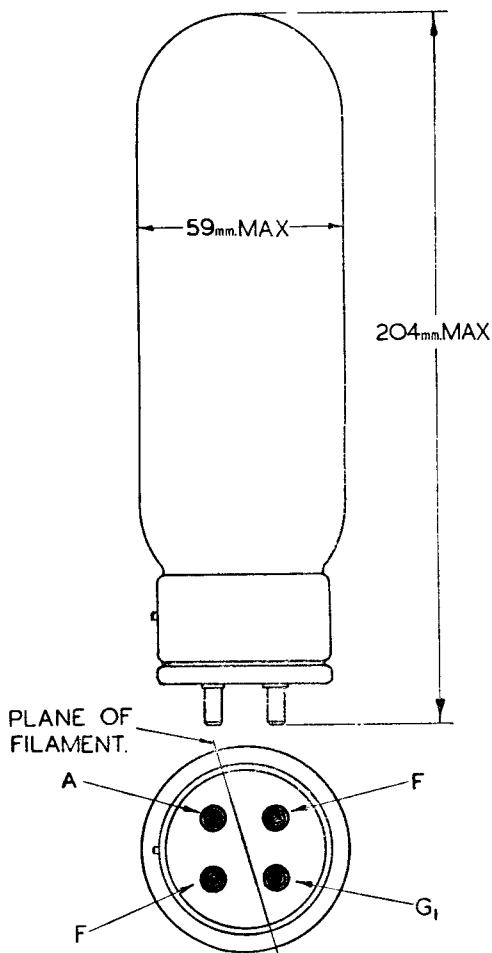
4242A



**3B/850A**  
**(4242A)**

# Triode

**4242A**



# —Standard Valves—

3C/150-A

## VALVE TYPE 3C/150-A

HIGH FREQUENCY TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Dimensions.

Maximum overall length  $9\frac{15}{16}$ " (25.2 cm.)  
Bulb diameter 2.83" (7.2 cm.)  
Net weight 0.7 lbs. (320 gms.)

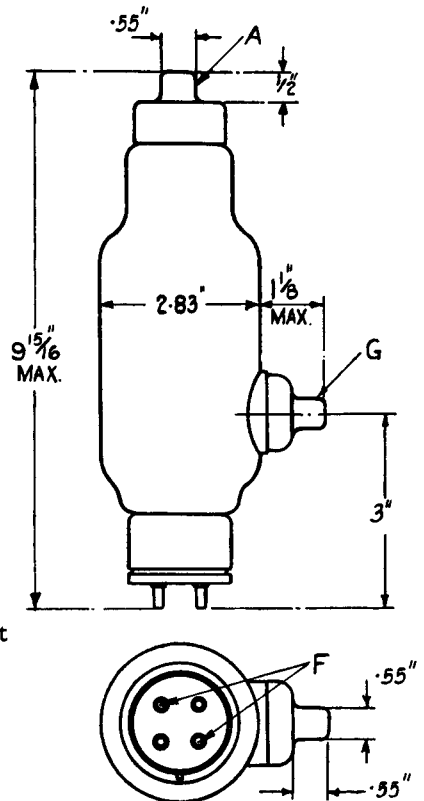
#### Base.

Large 4-pin bayonet.

#### Constants.

|                         |                        |
|-------------------------|------------------------|
| Filament voltage        | 10 volts               |
| Filament current        | 3.4 amps.              |
| *Impedance              | 3,800 ohms.            |
| *Amplification factor   | 18                     |
| *Mutual conductance     | 4.75 mA. per volt      |
| Grid-anode capacity     | 7.3 $\mu\mu\text{F}$ . |
| Grid-filament capacity  | 8.6 $\mu\mu\text{F}$ . |
| Anode-filament capacity | 1.1 $\mu\mu\text{F}$ . |

\* at  $V_p = 1,000$  volts,  $I_p = 150$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 2,500 volts |
| Maximum anode dissipation                     | 150 watts   |
| Maximum direct anode current                  | 200 mA.     |
| Maximum RF grid current                       | 10 amps.    |
| Maximum frequency for above ratings           | 20 Mc.      |
| Maximum anode voltage for frequency of 60 Mc. | 2,000 volts |

Tentative data

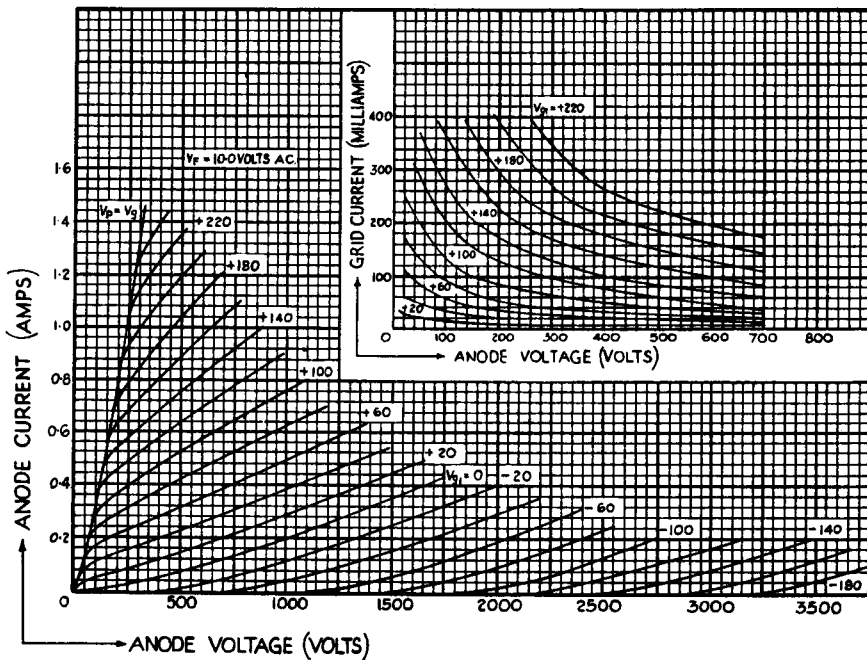
W.3C/150-A.1  
March 1939



# —Standard Valves—

## Class C Telephony—Unmodulated

|                               |       |             |
|-------------------------------|-------|-------------|
| Direct anode voltage          | 2,000 | 2,500 volts |
| Grid bias                     | —250  | —300 volts  |
| Peak RF grid voltage          | 410   | 455 volts   |
| Direct anode current          | 200   | 200 mA.     |
| Direct grid current (approx.) | 23    | 18 mA.      |
| Anode dissipation             | 100   | 120 watts   |
| Driving power (approx.)       | 9     | 8 watts     |
| Output power (approx.)        | 300   | 380 watts   |



PRINTED IN  
ENGLAND



# Triode

3C/270A  
(4212E)

4212E

## CATHODE.

Thoriated tungsten filament

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 14  | V |
| Nominal current | 6.2 | A |
| Peak emission   | 4.5 | A |

## RATING.

|                      |               |       |      |
|----------------------|---------------|-------|------|
| Amplification factor | } Measured at | 16    | ohms |
| Impedance            |               | 1,900 |      |

$V_a$  2,000V  $V_g$  -90V

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |      |    |
|-------------------|------|----|
| Grid to anode     | 19   | pF |
| Grid to filament  | 14.8 | pF |
| Anode to filament | 8.5  | pF |

## DIMENSIONS.

|                |                     |     |
|----------------|---------------------|-----|
| Overall length | 352                 | mm. |
| Max. diameter  | 93                  | mm. |
| Base           | Giant 4-pin bayonet |     |
| Net weight     | 750                 | g.  |

## MAXIMUM RATINGS.

|                                                 |       |      |
|-------------------------------------------------|-------|------|
| Maximum direct anode voltage                    | 3,000 | V    |
| Maximum direct anode current                    | 350   | mA   |
| Maximum direct grid current                     | 75    | mA   |
| Maximum anode dissipation                       | 275   | W    |
| Maximum freq. for above ratings                 | 1.5   | Mc/s |
| Maximum anode voltage for frequency of 4.5 Mc/s | 1,000 | V    |

This valve may be supplied in either one of the four impedance groups :

|                           |                                          |
|---------------------------|------------------------------------------|
| Group 1. $I_a$ 110-129 mA | } Measured at $V_a$ 1,500V<br>$V_g$ -68V |
| 2. $I_a$ 130-148 mA       |                                          |
| 3. $I_a$ 149-167 mA       |                                          |
| 4. $I_a$ 168-185 mA       |                                          |

It is recommended that the valve be operated in a vertical position. When operated horizontally the plane of the filament must be vertical. Free circulation of air must be provided to ensure adequate cooling of the glass during operation.





## TYPICAL OPERATING CONDITIONS

### AUDIO FREQUENCY

#### Class A Power Amplifier or Modulator.

|                      |       |                 |
|----------------------|-------|-----------------|
| Direct anode voltage | 1,500 | 1,250 V         |
| Grid bias            | —57   | —40 V           |
| Direct anode current | 0.170 | 0.200 A         |
| Load resistance      | 5,000 | 3,000 $\Omega$  |
| Undistorted output   | 50    | 40 W<br>approx. |

#### Class B Power Amplifier or Modulator. (For balanced 2-valve operation.)

|                                               |       |                  |
|-----------------------------------------------|-------|------------------|
| Direct anode voltage                          | 2,500 | 1,500 V          |
| Grid bias                                     | —145  | —80 V            |
| Direct anode current per valve—zero<br>signal | 50    | 60 mA            |
| Direct anode current per valve max.<br>signal | 300   | 350 mA           |
| Peak A.F. grid to grid drive voltage          | 420   | 300 V            |
| *Direct grid current                          | 13.5  | 38 mA<br>approx. |
| Load resistance anode to anode                | 9,100 | 4,600 $\Omega$   |
| *Grid driving power per valve                 | 3     | 6 W<br>approx.   |
| Recommended grid driving power                | 50    | 50 W             |
| Power output                                  | 960   | 660 W            |



# Triode

**3C/270A**  
**(4212E)**

**4212E**

## RADIO FREQUENCY

### **Class B Telephony. Modulated carrier applied to grid.**

(Carrier conditions per valve for use with 100% modulation.)

|                        |       |                  |
|------------------------|-------|------------------|
| Direct anode voltage   | 2,000 | 1,500 V          |
| Grid bias              | —125  | —90 V            |
| Direct anode current   | 0.200 | 0.275 A          |
| Peak R.F. grid voltage | 110   | 110 V            |
| *Direct grid current   | 0     | 34 mA<br>approx. |
| Power output           | 130   | 130 W            |

### **Class C Power Amplifier. Anode subject to modulation.**

(Carrier conditions per valve for use with 100% modulation.)

|                        |       |                  |
|------------------------|-------|------------------|
| Direct anode voltage   | 2,000 | 1,500 V          |
| Grid bias              | —240  | —215 V           |
| Direct anode current   | 0.300 | 0.300 A          |
| Peak R.F. grid voltage | 330   | 315 V            |
| *Direct grid current   | 15    | 22 mA<br>approx. |
| Power output           | 420   | 300 W            |

### **Class C Power Amplifier or Oscillator, unmodulated.**

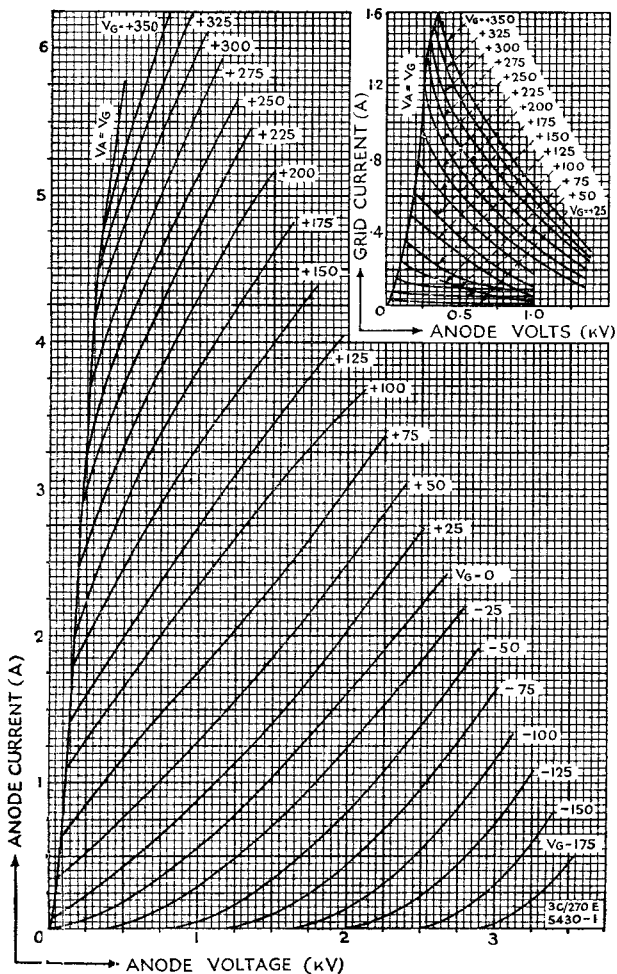
|                        |       |                  |
|------------------------|-------|------------------|
| Direct anode voltage   | 3,000 | 2,000 V          |
| Grid bias              | —250  | —180 V           |
| Direct anode current   | 0.250 | 0.300 A          |
| Peak R.F. grid voltage | 345   | 272 V            |
| *Direct grid current   | 15    | 22 mA<br>approx. |
| *Driving power         | 5     | 6 W<br>approx.   |
| Power output           | 550   | 440 W            |

\* Subject to wide variation, depending upon the impedance of the load circuit.

3C/270A  
(4212E)

# Triode

4212E

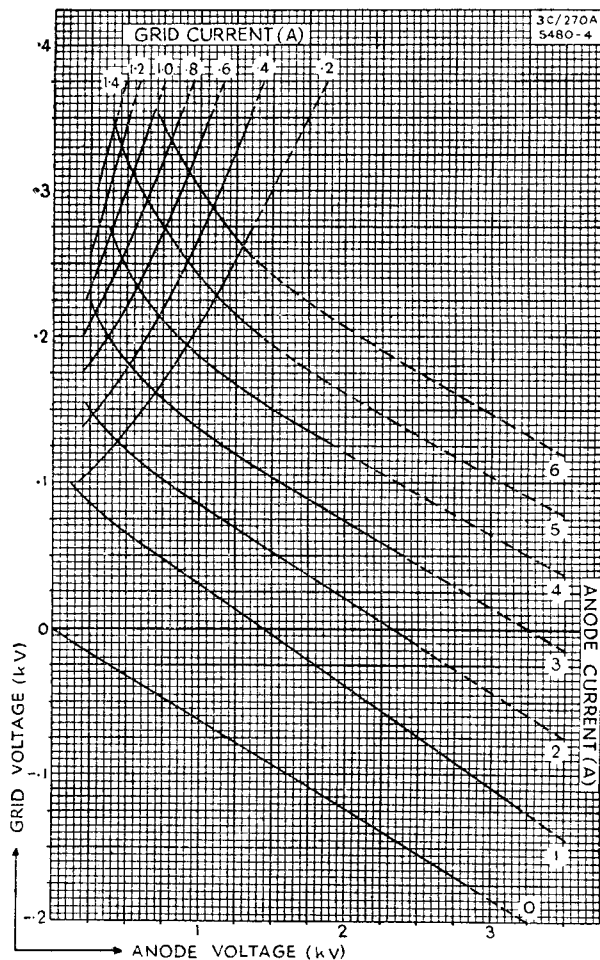




# Triode

3C/270A  
(4212E)

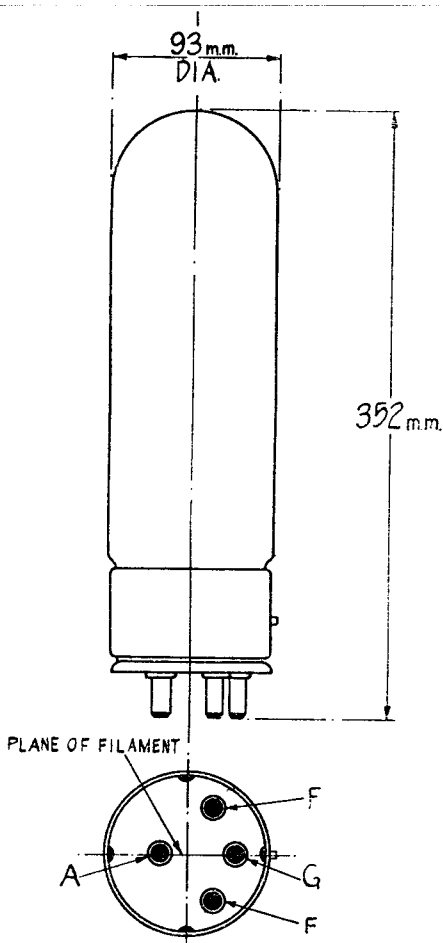
4212E



3C/270A  
(42I2E)

# Triode

42I2E





# Triode

3C/350E  
(4270A)

4270A

## CATHODE.

Thoriated tungsten filament.

|                 |      |   |
|-----------------|------|---|
| Voltage         | 10.0 | V |
| Nominal current | 9.75 | A |
| Peak emission   | 4.0  | A |

## RATING.

|                      |                                                  |                    |
|----------------------|--------------------------------------------------|--------------------|
| Amplification factor | Measured at $V_a 2,500V$<br>$I_a 120 \text{ mA}$ | { 16<br>2,800 ohms |
| Impedance            |                                                  |                    |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |    |    |
|-------------------|----|----|
| Grid to anode     | 21 | pF |
| Grid to filament  | 18 | pF |
| Anode to filament | 2  | pF |

## DIMENSIONS.

|                            |     |     |
|----------------------------|-----|-----|
| Maximum overall length     | 433 | mm. |
| Maximum diameter           | 102 | mm. |
| Base. Special (see sketch) |     |     |
| Net weight                 | 600 | g.  |

## MAXIMUM RATINGS.

|                                                |       |       |
|------------------------------------------------|-------|-------|
| Maximum direct anode voltage                   | 3,000 | V     |
| Maximum direct anode current                   | 0.375 | A     |
| Maximum anode dissipation                      | 350   | W     |
| Maximum direct grid current                    | 0.075 | A     |
| Maximum frequency for above ratings            | 7.5   | Mc/s. |
| Maximum anode voltage for frequency 22.5 Mc/s. | 1,000 | V     |

It is recommended that the valve be operated in a vertical position. When operated horizontally the plane of the filament must be vertical.

# Triode

4270A



## TYPICAL OPERATING CONDITIONS. AUDIO FREQUENCY.

### Class A. Amplifier and Modulator.

|                      |        |             |
|----------------------|--------|-------------|
| Direct anode voltage | 2,500  | 2,000 V     |
| Grid bias            | —130   | —95 V       |
| Direct anode current | 0.120  | 0.150 A     |
| Load impedance       | 15,000 | 10,000 ohms |
| Undistorted output   | 90     | 70 W        |

### Class B. Power Amplifier or Modulator. (For balanced 2-valve operation.)

|                                           |       |               |
|-------------------------------------------|-------|---------------|
| Direct anode voltage                      | 2,500 | 2,000 V       |
| Grid bias                                 | —140  | —100 V        |
| Anode current per valve—zero signal       | 60    | 60 mA         |
| Anode current per valve—maximum signal    | 375   | 357 mA        |
| Peak A.F. grid drive voltage grid to grid | 480   | 400 V         |
| Load resistance—anode to anode            | 7,500 | 5,700 ohms    |
| *Direct grid current per valve            | 9     | 12 mA approx. |
| Power output for 2 valves                 | 1,200 | 940 W approx. |

## RADIO FREQUENCY

### Class B. Power Amplifier Telephony.

|                                                              |       |              |
|--------------------------------------------------------------|-------|--------------|
| (Carrier conditions per valve for use with 100% modulation.) |       |              |
| Direct anode voltage                                         | 3,000 | 2,000 V      |
| Grid bias                                                    | —186  | —155 V       |
| Direct anode current                                         | 0.175 | 0.210 A      |
| *Direct grid current                                         | 0     | 0 mA approx. |
| Power output                                                 | 175   | 180 W        |

### Class C. Power Amplifier. Anode subject to modulation.

|                                                              |       |               |
|--------------------------------------------------------------|-------|---------------|
| (Carrier conditions per valve for use with 100% modulation.) |       |               |
| Direct anode voltage                                         | 2,250 | 1,750 V       |
| Grid bias                                                    | —320  | —260 V        |
| Direct anode current                                         | 0.300 | 0.375 A       |
| Peak RF grid voltage                                         | 420   | 380 V         |
| *Direct grid current                                         | 12    | 17 mA approx. |
| Power output                                                 | 450   | 430 W approx. |

### Class C. Power Amplifier or Oscillator, unmodulated.

|                        |       |               |
|------------------------|-------|---------------|
| Direct anode voltage   | 3,000 | 2,000 V       |
| Grid bias              | —270  | —200 V        |
| Direct anode current   | 0.375 | 0.375 A       |
| Peak R.F. grid voltage | 385   | 335 V         |
| *Direct grid current   | 10    | 31 mA approx. |
| Power output           | 800   | 540 W         |

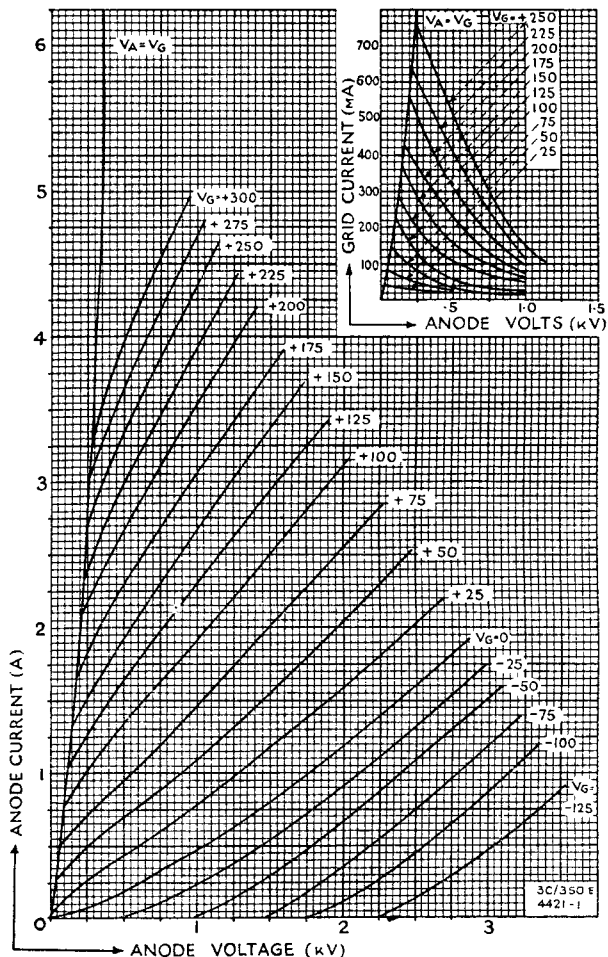
\* Subject to wide variation depending upon the impedance of the load circuit.



# Triode

3C/350E  
(4270A)

4270A

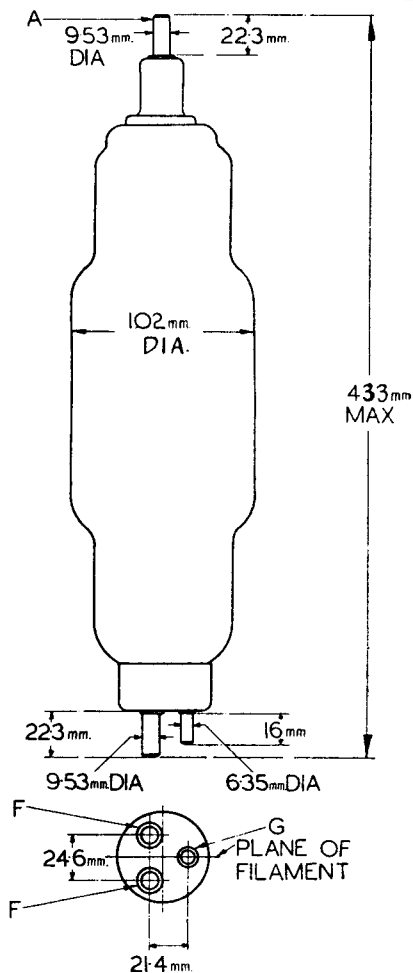




**3C/350E**  
**(4270A)**

# Triode

**4270A**





# Hot-Cathode Gas-Filled Thyratron

Code: 5545 (CV2215) ←

The 5545 is a triode type inert-gas filled thyratron for use in motor speed and welder control circuits. It is directly equivalent to the U.S.A. GL5545.

## CATHODE

|                       |     |     |
|-----------------------|-----|-----|
| Oxide-coated filament |     |     |
| Filament voltage      | 2.5 | V   |
| Nominal current       | 21  | A   |
| Filament heating time | 60  | sec |

## DIRECT INTERELECTRODE CAPACITANCES

|                         |     |    |
|-------------------------|-----|----|
| Anode to control grid   | 0.8 | pF |
| Control grid to cathode | 45  | pF |

## CHARACTERISTICS

|                                |     |           |
|--------------------------------|-----|-----------|
| Deionization time, approximate |     |           |
| At $V_{g1} = 250V$             | 50  | $\mu$ sec |
| At $V_{g1} = 12V$              | 500 | $\mu$ sec |
| Ionization time, approximate   | 10  | $\mu$ sec |
| Voltage drop, typical          | 16  | V         |

## MECHANICAL DATA

|                        |                            |    |
|------------------------|----------------------------|----|
| Maximum overall length | 228.6                      | mm |
| Maximum seated height  | 211.1                      | mm |
| Maximum diameter       | 66.7                       | mm |
| Base                   | B4D                        |    |
| Top cap                | CT3 with insulating collar |    |
| Net weight             | 340                        | g  |
| Mounting position      | Unrestricted               | ←  |

# Hot-Cathode Gas-Filled Thyratron



Code: 5545 (CV2215) ←

## MAXIMUM RATINGS

Maximum peak anode voltage

|         |       |   |
|---------|-------|---|
| Forward | 1 500 | V |
|---------|-------|---|

|          |       |   |
|----------|-------|---|
| Inverse* | 1 500 | V |
|----------|-------|---|

Maximum cathode current

|      |    |   |
|------|----|---|
| Peak | 80 | A |
|------|----|---|

|         |     |   |
|---------|-----|---|
| Average | 6.4 | A |
|---------|-----|---|

|                                  |       |   |
|----------------------------------|-------|---|
| Fault (maximum duration 0.1 sec) | 1 120 | A |
|----------------------------------|-------|---|

|                        |    |     |
|------------------------|----|-----|
| Maximum averaging time | 15 | sec |
|------------------------|----|-----|

Maximum negative control grid voltage

|                   |     |   |
|-------------------|-----|---|
| Before conduction | 250 | V |
|-------------------|-----|---|

|                   |    |   |
|-------------------|----|---|
| During conduction | 10 | V |
|-------------------|----|---|

Maximum positive control grid current

|                |      |   |
|----------------|------|---|
| Anode positive | 0.20 | A |
|----------------|------|---|

|                |      |   |
|----------------|------|---|
| Anode negative | 0.10 | A |
|----------------|------|---|

|                                             |     |    |
|---------------------------------------------|-----|----|
| Maximum recommended grid circuit resistance | 0.1 | MΩ |
|---------------------------------------------|-----|----|

|                   |     |     |
|-------------------|-----|-----|
| Maximum frequency | 150 | c/s |
|-------------------|-----|-----|

|                           |            |    |
|---------------------------|------------|----|
| Ambient temperature range | -55 to +70 | °C |
|---------------------------|------------|----|

\*The product of the rate of current decay in amperes per micro-second just prior to commutation and the rate of inverse voltage rise in volts per micro-second just after commutation must not exceed 130.



# Hot-Cathode Gas-Filled Thyratron

Code: 5545 (CV2215) ←

## TYPICAL OPERATING CONDITIONS

| Circuit                                     | No. of valves | Maximum A.C. Input Voltage (V <sub>r.m.s.</sub> ) | Maximum D.C. Output Voltage (V) | Maximum D.C. Output Current (A) |
|---------------------------------------------|---------------|---------------------------------------------------|---------------------------------|---------------------------------|
| Single Phase Full Wave Circuit No. 1        | 2             | 525                                               | 475                             | 12.8                            |
| Single Phase Full Wave Bridge Circuit No. 2 | 4             | 1 100                                             | 950                             | 12.8                            |
| Three Phase Half Wave Circuit No. 3         | 3             | 610                                               | 715                             | 19.2                            |
| Three Phase Double Y Parallel Circuit No. 4 | 6             | 610                                               | 715                             | 13.4                            |
| Three Phase Full Wave Circuit No. 5         | 6             | 610                                               | 1 430                           | 19.2                            |

The above tables suitable circuits for this thyratron, and shows their safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

This thyratron being directly heated, it is recommended that the output circuit be connected to the midpoint of the filament transformer secondary winding.

For details of circuits referred to see sheet K—8 in the introduction to this handbook.

# Hot-Cathode Gas-Filled Thyratron



Code: 5545 (CV2215) ←

## THYRATRON OPERATION

The minimum values of grid blocking voltage to prevent ignition are :

| Grid Voltage (approx.)<br>(V) | Anode Voltage (peak)<br>(V) |
|-------------------------------|-----------------------------|
| — 11                          | 1 500                       |
| — 9                           | 1 000                       |
| — 5.5                         | 500                         |
| 0                             | 100                         |

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition and a pulse of 20 to 30 volts peak applied.

The pulse used should have a leading edge as near vertical as possible and the pulse circuit should be of high impedance to limit the grid current to the safe maximum value.

Control of the output may be effected by varying the phase of the grid pulse relative to the phase of the applied anode voltage.



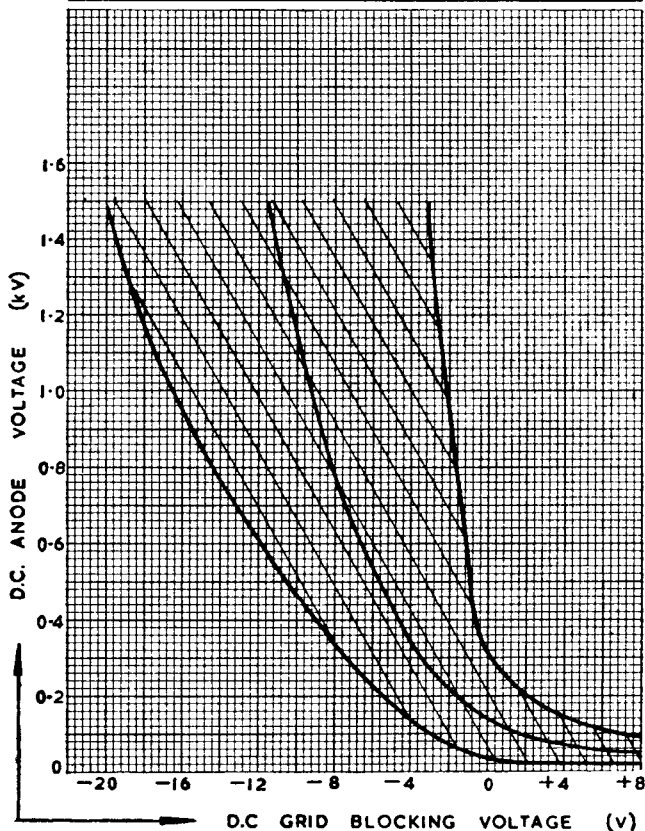
# Hot-Cathode Gas-Filled Thyratron

Code: 5545 (CV2215) ←

5545(3G/501A)

TYPICAL CONTROL  
CHARACTERISTIC. SHADED  
AREA INDICATES THE SPREAD.

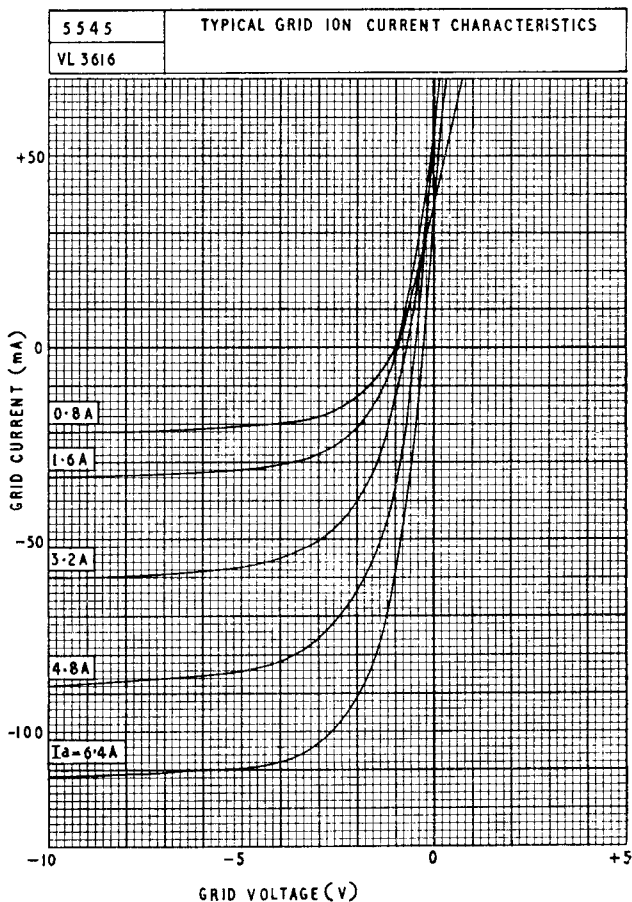
VL 1977



# Hot-Cathode Gas-Filled Thyratron



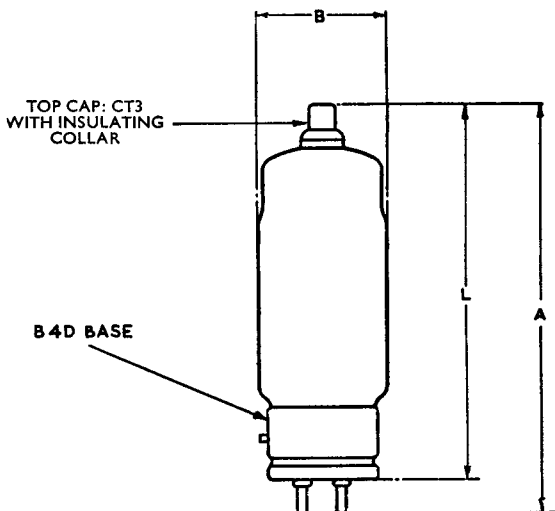
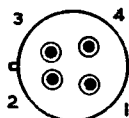
Code: 5545 (CV2215) ←





# Hot-Cathode Gas-Filled Thyratron

Code: 5545 (CV2215) ←



## BASING

- 1 CONTROL GRID
- 2 FILAMENT
- 3 FILAMENT
- 4 NO CONNEXION  
T.C ANODE

| DIM | MILLIMETRES        | INCHES                       |
|-----|--------------------|------------------------------|
| A   | $203.2 \pm 25.4$   | $8 \pm 1$                    |
| B   | $66.7 \text{ MAX}$ | $2 \frac{5}{8} \text{ MAX.}$ |
| L   | $185.7 \pm 25.4$   | $7 \frac{5}{16} \pm 1$       |

NOTE:- BASIC FIGURES ARE INCHES





# Air-Blast-Cooled U.H.F. Triode

3J/160E

3J/160E

## CATHODE

Thoriated tungsten filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 10 | V |
| Nominal current | 29 | A |
| Peak emission   | 10 | A |

## RATING

|                      |                              |       |            |
|----------------------|------------------------------|-------|------------|
| Amplification factor | { Measured at }              | 19    |            |
| Impedance            | { $V_a$ 2.5 kV. $I_a$ 0.8A } | 1,300 | $\Omega$ — |

## DIRECT INTERELECTRODE CAPACITIES

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 8.8 | pF |
| Grid to filament  | 12  | pF |
| Anode to filament | 0.7 | pF |

## AIR COOLING. For 1 kW. anode dissipation

|                                            |      |              |
|--------------------------------------------|------|--------------|
| Volume of air at pressure of 2in. of water | 80   | cu. ft./min. |
| Maximum temperature of radiator core       | 150° | C.           |

## DIMENSIONS

|                              |     |     |
|------------------------------|-----|-----|
| Maximum overall length       | 133 | mm. |
| Maximum diameter over cooler | 65  | mm. |

## MAXIMUM RATINGS

|                                     |     |      |
|-------------------------------------|-----|------|
| Maximum direct anode voltage        | 3   | kV   |
| Maximum anode dissipation           | 1   | kW   |
| Maximum frequency for above ratings | 120 | Mc/s |

# Air-Blast-Cooled U.H.F. Triode

3J/160E



## TYPICAL OPERATING CONDITIONS RADIO FREQUENCY

### Class B Telephony. Modulated carrier applied to grid.

(Carrier conditions per valve for use with 100% modulation)

|                                                     |      |    |
|-----------------------------------------------------|------|----|
| Direct anode voltage                                | 2    | kV |
| Grid bias                                           | —100 | V  |
| Direct anode current                                | 0.7  | A  |
| Peak R.F. grid voltage at crest of modulation cycle | 320  | V  |
| Power output                                        | 0.45 | kW |

### Class C Power Amplifier. Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation).

|                        |       |           |
|------------------------|-------|-----------|
| Direct anode voltage   | 2     | kV        |
| Grid bias              | —400  | V         |
| Direct anode current   | 0.75  | A         |
| Peak R.F. grid voltage | 660   | V         |
| *Direct grid current   | 0.225 | A approx. |
| Power output           | 1.0   | kW        |

### Class C Power Amplifier or Oscillator, unmodulated.

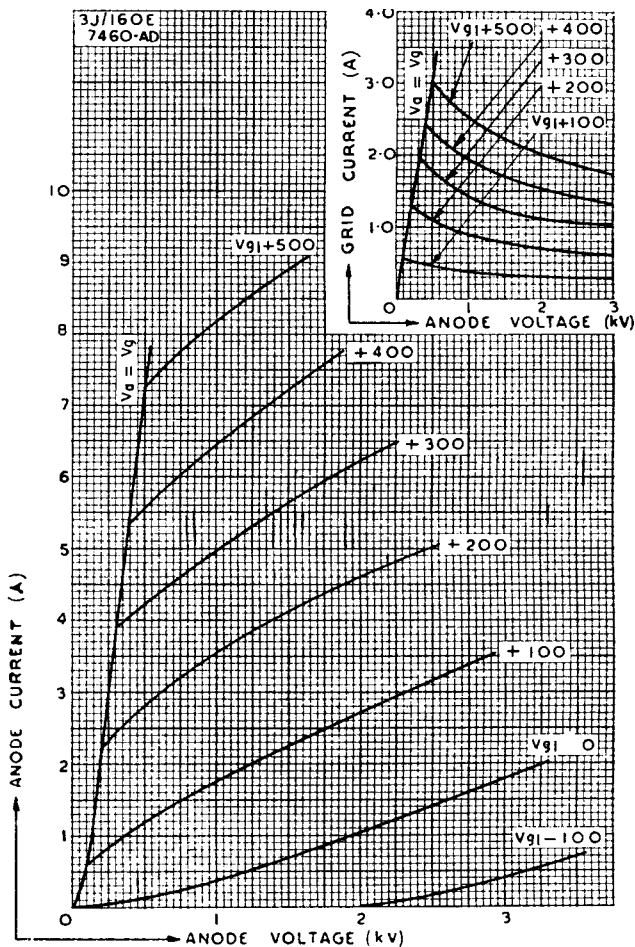
|                        |      |           |
|------------------------|------|-----------|
| Direct anode voltage   | 3    | kV        |
| Grid bias              | —325 | V         |
| Direct anode current   | 1    | A         |
| Peak R.F. grid voltage | 600  | V         |
| *Direct grid current   | 0.26 | A approx. |
| Power output           | 2.15 | kW        |

\* Subject to wide variation depending upon the impedance of the load circuit.



# Air-Blast-Cooled U.H.F. Triode

3J/160E



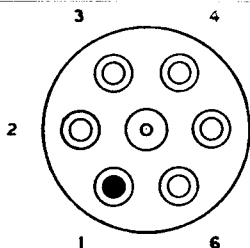
Tentative data  
July 1947

3J/160E

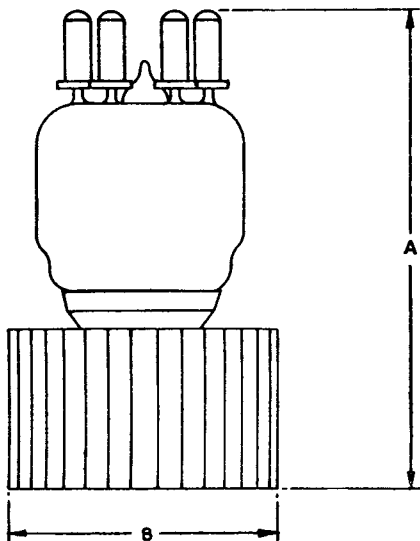
# Air-Blast-Cooled U.H.F. Triode



3J/160E



- BASING**
- 1 FILAMENT C.T.  
(RED TIP)
  - 2 GRID
  - 3 FILAMENT
  - 4 GRID
  - 5 FILAMENT
  - 6 GRID



| DIM | MILLIMETRES | INCHES  |
|-----|-------------|---------|
| A   | 133 MAX     | 5.2 MAX |
| B   | 65 MAX      | 2.6 MAX |

**NOTE** BASIC FIGURES ARE MILLIMETRES

Tentative data  
July 1947

3J/160E—4



# Air-Blast-Cooled Triode

3J/170E

## CATHODE.

Thoriated tungsten filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 10 | V |
| Nominal current | 22 | A |
| Peak emission   | 6  | A |

## RATING.

|                      |                            |  |                |
|----------------------|----------------------------|--|----------------|
| Amplification factor | { measured at $V_a$ 4 kV } |  | 20             |
| Impedance            | { $I_a$ 0.5A }             |  | 3,300 $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 6   | pF |
| Grid to filament  | 9.5 | pF |
| Anode to filament | 1.5 | pF |

## COOLING.

For anode dissipation of  $3\frac{1}{2}$  kWVolume of air at pressure of 1 inch  
of water.

|                                   |      |              |
|-----------------------------------|------|--------------|
| Maximum radiator core temperature | 300  | cu. ft./min. |
| Maximum ambient temperature       | 130° | C            |
|                                   | 45°  | C            |

## DIMENSIONS.

|                                |     |     |
|--------------------------------|-----|-----|
| Maximum overall length         | 225 | mm. |
| Maximum diameter over radiator | 155 | mm. |

## MAXIMUM RATINGS.

|                                     |                |       |
|-------------------------------------|----------------|-------|
| Maximum direct anode voltage        | 6,000          | V     |
| Maximum direct anode current        | 1.25           | A     |
| Maximum anode dissipation           | $3\frac{1}{2}$ | kW    |
| Maximum grid dissipation            | 150            | W     |
| Maximum frequency for above ratings | 50             | Mc/s. |

# Air-Blast-Cooled Triode

3J/170E



## TYPICAL OPERATING CONDITIONS

### RADIO FREQUENCY

#### Class B Telephony. Modulated Carrier applied to grid.

(Carrier conditions per valve for use with 100% modulation).

|                        |      |    |
|------------------------|------|----|
| Direct anode voltage   | 5    | kV |
| Grid bias              | —260 | V  |
| Direct anode current   | 0.9  | A  |
| Peak R.F. grid voltage | 960  | V  |
| Power output           | 1.4  | kW |

#### Class C Power Amplifier. Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation).

|                        |       |    |
|------------------------|-------|----|
| Direct anode voltage   | 4     | kV |
| Grid bias              | —900  | V  |
| Direct anode current   | 1.0   | A  |
| Peak R.F. grid voltage | 1,500 | V  |
| * Direct grid current  | 0.230 | A  |
| Power output           | 2.5   | kW |

#### Class C. Power Amplifier or Oscillator, unmodulated.

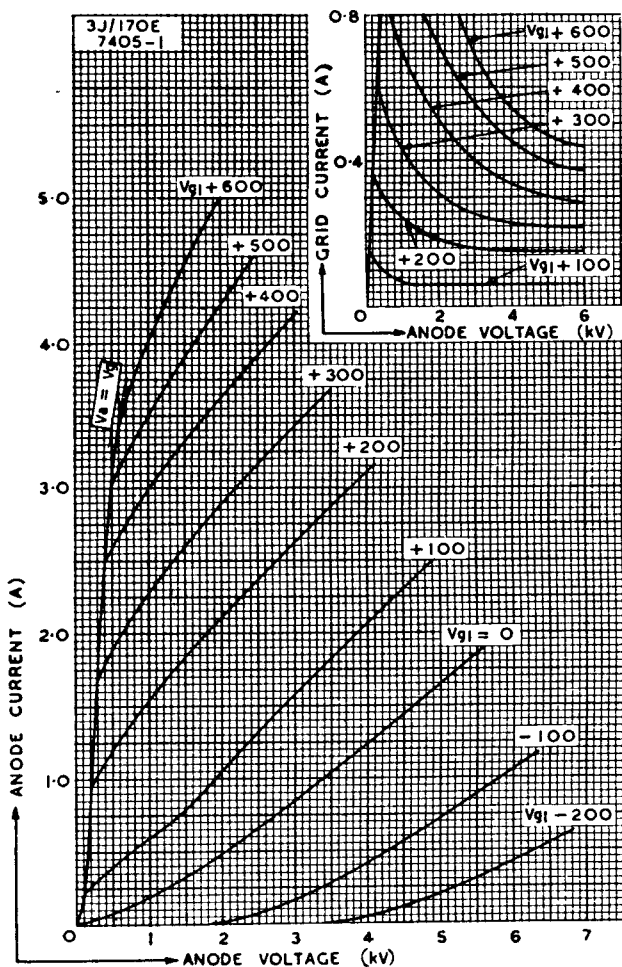
|                        |       |           |
|------------------------|-------|-----------|
| Direct anode voltage   | 6     | kV        |
| Grid bias              | —700  | V         |
| Direct anode current   | 1.25  | A         |
| Peak R.F. grid voltage | 1,400 | V         |
| * Direct grid current  | 0.262 | A appx.   |
| Power output           | 5     | kW. appx. |

\* Subject to wide variation, depending upon the impedance of the load circuit.



# Air-Blast-Cooled Triode

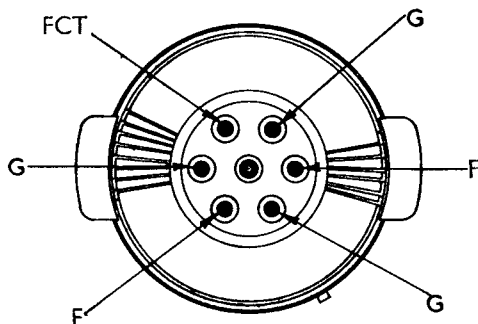
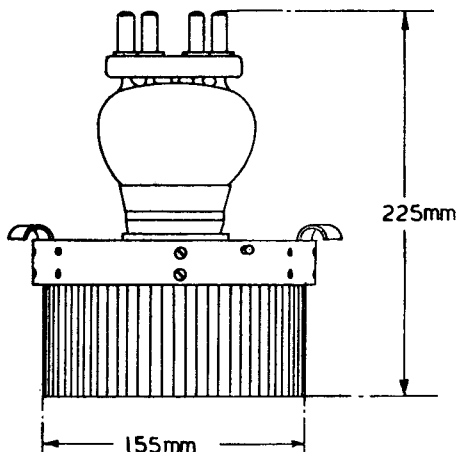
3J/170E



3J/170E

# Air-Blast-Cooled Triode

3J/170E



May 1947

3J/170E—4





# Air-Blast-Cooled R.F. Triode 3J/191E

3J/191E

## CATHODE.

Thoriated tungsten filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 10 | V |
| Nominal current | 33 | A |
| Peak emission   | 12 | A |

## RATING.

|                      |                          |       |          |
|----------------------|--------------------------|-------|----------|
| Amplification factor | { Measured at            | 26    |          |
| Impedance            | { $V_a 5kV$ $I_a 0.8A$ } | 3,450 | $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |      |    |
|-------------------|------|----|
| Anode to grid     | 12.5 | pF |
| Anode to filament | 2    | pF |
| Grid to filament  | 11   | pF |

## DIMENSIONS.

|                              |     |     |
|------------------------------|-----|-----|
| Maximum overall length       | 370 | mm. |
| Maximum diameter over cooler | 155 | mm. |

## AIR COOLING.

For 5.0kW Anode dissipation

|                                                |     |              |
|------------------------------------------------|-----|--------------|
| Volume of air at a pressure of 1.5in. of water | 600 | cu. ft./min. |
| Ambient temperature of air                     | 25° | C            |
| Outlet air temperature above ambient           | 15° | C            |

## MAXIMUM RATINGS.

|                                     |      |      |
|-------------------------------------|------|------|
| Maximum direct anode voltage        | 10   | kV   |
| Maximum direct anode current        | 2    | A    |
| Maximum direct grid current         | 0.25 | A    |
| Maximum anode dissipation           | 5.0  | kW   |
| Maximum frequency for above ratings | 50   | Mc/s |

# Air-Blast-Cooled R.F. Triode 3J/191E



## TYPICAL OPERATING CONDITIONS RADIO FREQUENCY

### **Class B Telephony. Modulated carrier applied to grid.**

(Carrier conditions per valve for use with 100% modulation).

|                        |      |            |
|------------------------|------|------------|
| Direct anode voltage   | 8    | kV         |
| Grid bias              | —480 | V          |
| Direct anode current   | 0.8  | A          |
| Peak R.F. grid voltage | 700  | V          |
| *Direct grid current   | 20   | mA approx. |
| Output                 | 2    | kW approx. |

### **Class C Power Amplifier. Anode subject to modulation.**

(Carrier conditions per valve for use with 100% modulation).

|                        |        |            |
|------------------------|--------|------------|
| Direct anode voltage   | 8      | kV         |
| Grid bias              | —1,000 | V          |
| Direct anode current   | 0.8    | A          |
| Peak R.F. grid voltage | 1,700  | V          |
| *Direct grid current   | 120    | mA approx. |
| Output                 | 4.5    | kW approx. |

### **Class C Power Amplifier or Oscillator—unmodulated.**

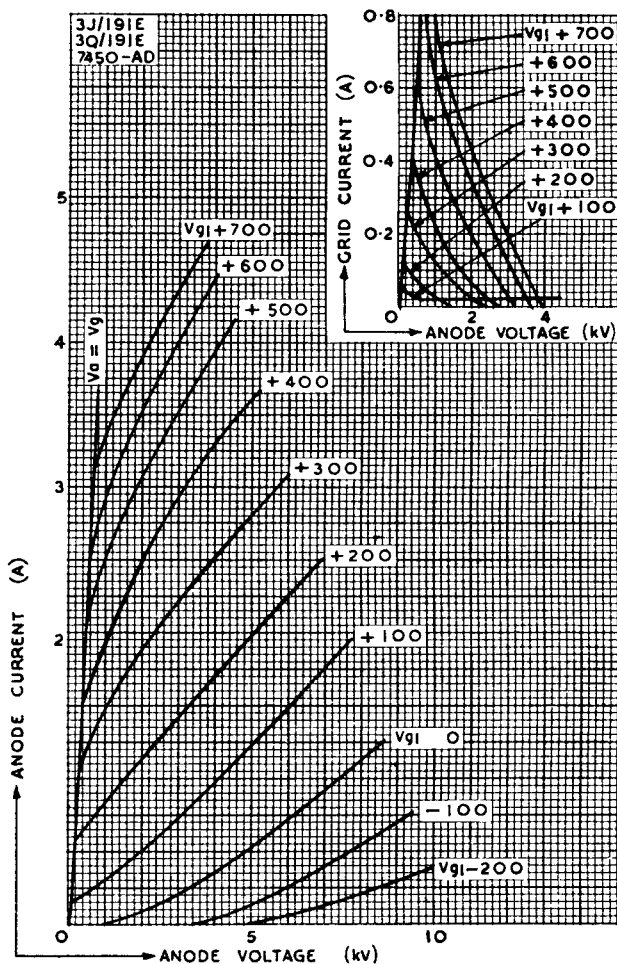
|                        |       |            |
|------------------------|-------|------------|
| Direct anode voltage   | 10    | kV         |
| Grid bias              | —800  | V          |
| Direct anode current   | 1     | A          |
| Peak R.F. grid voltage | 1,500 | V          |
| *Direct grid current   | 120   | mA approx. |
| Output                 | 7.3   | kW approx. |

\* Subject to wide variation depending upon the impedance of the load circuit.



# Air-Blast-Cooled R.F. Triode

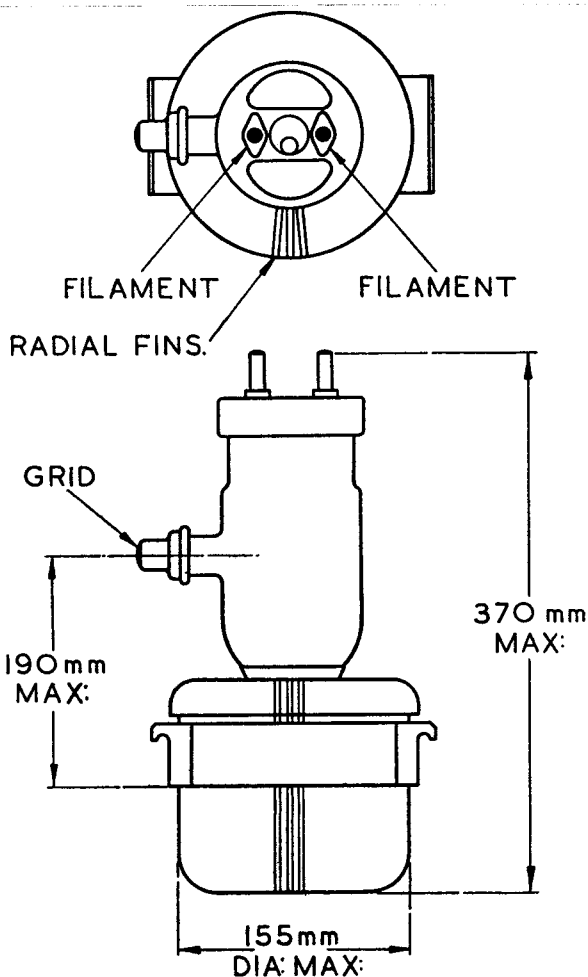
3J/191E



3J/191E

# Air-Blast-Cooled R.F. Triode

3J/191E



May 1947

3J/191E—4



# Air-Blast-Cooled R.F. Triode

3J/192E

## CATHODE.

Thoriated tungsten filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 5  | V |
| Nominal current | 66 | A |
| Peak emission   | 12 | A |

## RATING.

|                      |                                                                        |       |          |
|----------------------|------------------------------------------------------------------------|-------|----------|
| Amplification factor | Measured at                                                            | 17    |          |
| Impedance            | $\left\{ \begin{array}{l} \text{Va 6kV, Ia 0.9A} \end{array} \right\}$ | 1,500 | $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 35  | pF |
| Grid to filament  | 27  | pF |
| Anode to filament | 1.5 | pF |

## COOLING.

Air blast for anode dissipation of 4.5 kW

|                                                    |     |              |
|----------------------------------------------------|-----|--------------|
| Volume of air at a pressure of 1.5 inches of water | 350 | cu. ft./min. |
|----------------------------------------------------|-----|--------------|

|                                   |      |    |
|-----------------------------------|------|----|
| Maximum radiator core temperature | 130° | C. |
|-----------------------------------|------|----|

|                             |     |    |
|-----------------------------|-----|----|
| Maximum ambient temperature | 45° | C. |
|-----------------------------|-----|----|

## DIMENSIONS.

|                              |     |     |
|------------------------------|-----|-----|
| Maximum overall length       | 240 | mm. |
| Maximum diameter over cooler | 150 | mm. |

## MAXIMUM RATINGS.

|                                     |     |      |
|-------------------------------------|-----|------|
| Maximum direct anode voltage        | 7   | kV   |
| Maximum direct anode current        | 2   | A    |
| Maximum anode dissipation           | 4.5 | kW   |
| Maximum grid dissipation            | 350 | W    |
| Maximum frequency for above ratings | 22  | Mc/s |

# Air-Blast-Cooled R.F. Triode



3J/192E

## TYPICAL OPERATING CONDITIONS RADIO FREQUENCY

### Class B Telephony Modulated Carrier applied to Grid.

(Carrier conditions per valve for use with 100% modulation).

|                                                     |      |            |
|-----------------------------------------------------|------|------------|
| Direct anode voltage                                | 5    | kV         |
| Grid bias                                           | —300 | V          |
| Direct anode current                                | 1    | A          |
| Peak R.F. grid voltage at crest of modulation cycle | 750  | V          |
| Power output                                        | 1.6  | kW approx. |

### Class C Power Amplifier. Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation).

|                        |       |            |
|------------------------|-------|------------|
| Direct anode voltage   | 5     | kV         |
| Grid bias              | —750  | V          |
| Direct anode current   | 1.25  | A          |
| Peak R.F. grid voltage | 1,170 | V          |
| Power output           | 4.4   | kW approx. |

### Class C Power Amplifier or Oscillator, unmodulated.

|                        |       |           |
|------------------------|-------|-----------|
| Direct anode voltage   | 7     | kV        |
| Grid bias              | —650  | V         |
| Direct anode current   | 2     | A         |
| Peak R.F. grid voltage | 1,100 | V         |
| *Direct grid current   | 0.35  | A approx. |
| Power output           | 10    | kW        |

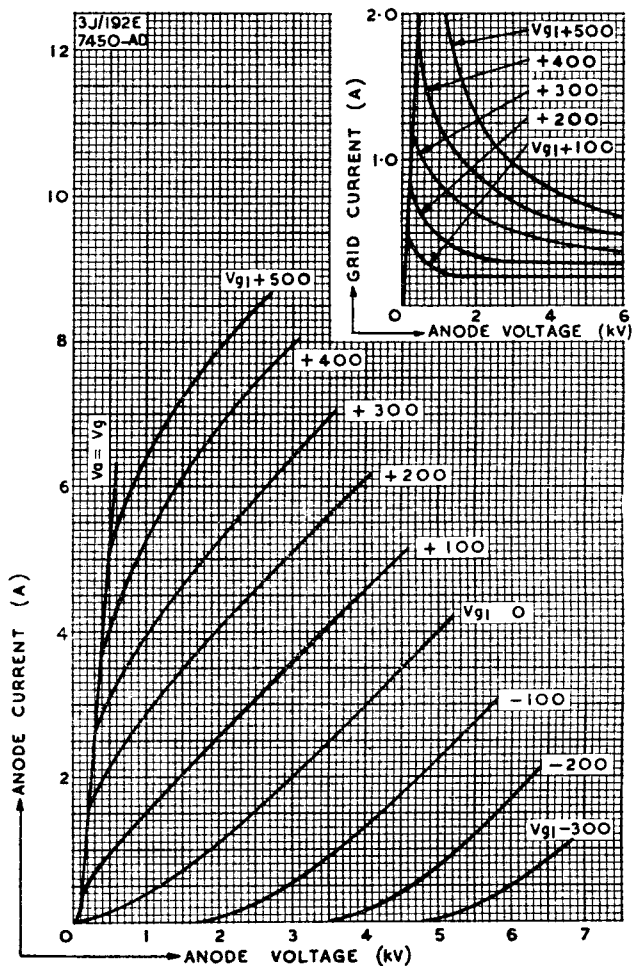
\* Subject to wide variation depending upon the impedance of the load circuit.



# Air-Blast-Cooled R.F. Triode

3J/192E

3J/192E

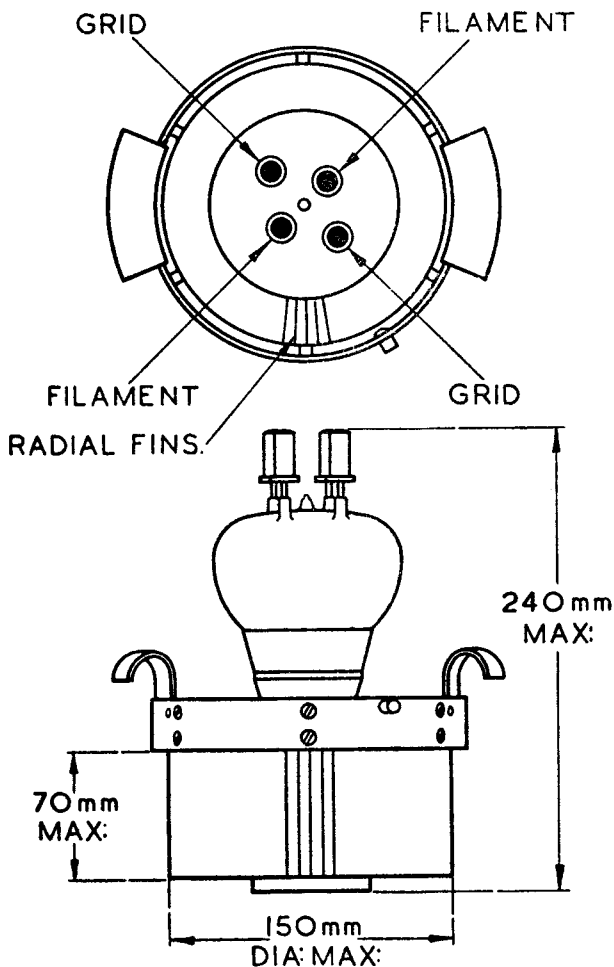


3J/192E

# Air-Blast-Cooled R.F. Triode



3J/192E



May 1947

3J/192E—4





# Air-Blast-Cooled R.F. Power Amplifier Triode 3J/221E

## CATHODE.

|                                         |    |   |
|-----------------------------------------|----|---|
| Tungsten filament                       |    |   |
| Nominal (Actual voltage marked on bulb) | 22 | V |
| Nominal current                         | 70 | A |
| Peak emission                           | 12 | A |

## RATING.

|                      |                        |       |   |
|----------------------|------------------------|-------|---|
| Amplification factor | Measured at            | 26    |   |
| Impedance            | { Va 12 kV, Ia 1.5 A } | 2,900 | Ω |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |      |    |
|-------------------|------|----|
| Grid to anode     | 26   | pF |
| Grid to filament  | 1.3  | pF |
| Anode to filament | 20.0 | pF |

## AIR COOLING.

For anode dissipation of 20 kW.

Volume of air at a pressure of 2in. of water 2,000 cu. ft./min.

Maximum temperature of core of cooler 150° C.

Maximum ambient temperature 45° C.

## DIMENSIONS.

|                              |      |     |
|------------------------------|------|-----|
| Maximum overall length       | 520  | mm. |
| Maximum diameter over cooler | 302  | mm. |
| Net weight                   | 8.15 | kg. |

## MAXIMUM RATINGS.

|                                     |      |      |
|-------------------------------------|------|------|
| Maximum direct anode voltage        | 17.5 | kV.  |
| Maximum direct anode current        | 2.5  | A.   |
| Maximum anode dissipation           | 20   | kW.  |
| Maximum grid dissipation            | 1.2  | kW.  |
| Maximum frequency for above ratings | 22   | Mc/s |

**3J/221E**

**Air-Blast-Cooled R.F.  
Power Amplifier  
Triode  
3J/221E**



**TYPICAL OPERATING CONDITIONS.**

**RADIO FREQUENCY.**

**Class B Telephony.**

Modulated. Carrier applied to grid. (Carrier conditions per valve for use with 100% modulation).

|                      |               |     |
|----------------------|---------------|-----|
| Direct anode voltage | 15            | kV. |
| Grid bias            | —600          | V   |
| Direct anode current | 2.0           | A   |
| Power Output         | 10 kW approx. |     |

**Class C Power Amplifier. Anode subject to modulation.**

(Carrier conditions per valve for use with 100% modulation).

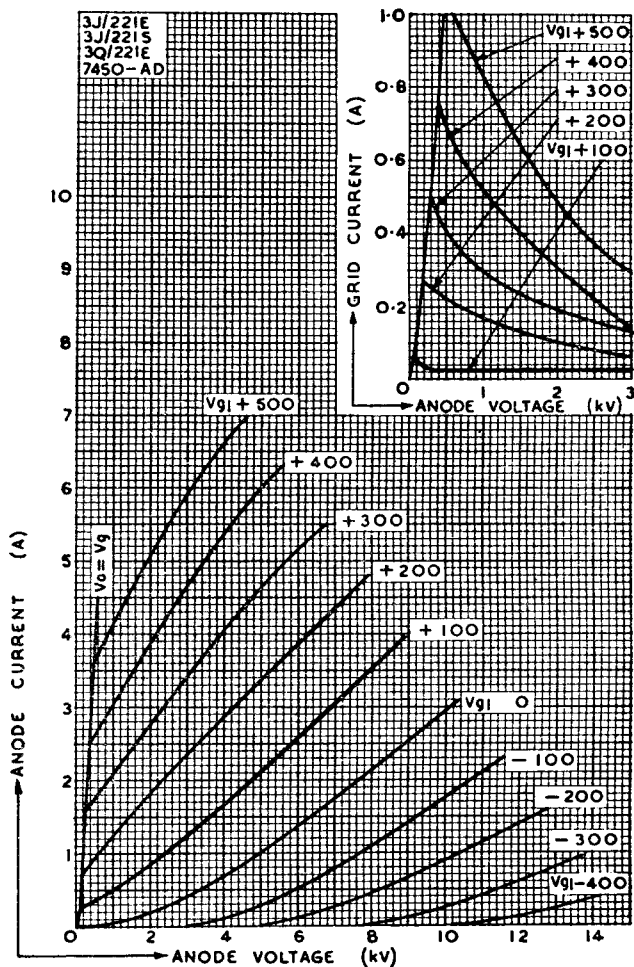
|                      |                |            |
|----------------------|----------------|------------|
| Direct anode voltage | 15             | kV         |
| Grid bias            | —2,000         | V. approx. |
| Direct anode current | 2              | A          |
| Power Output         | 20 kW. approx. |            |

**Class C Power Amplifier or Oscillator, unmodulated.**

|                      |                |            |
|----------------------|----------------|------------|
| Direct anode voltage | 17             | kV.        |
| Grid bias            | —1,600         | V. approx. |
| Direct anode current | 2.5            | A          |
| Power Output         | 30 kW. approx. |            |



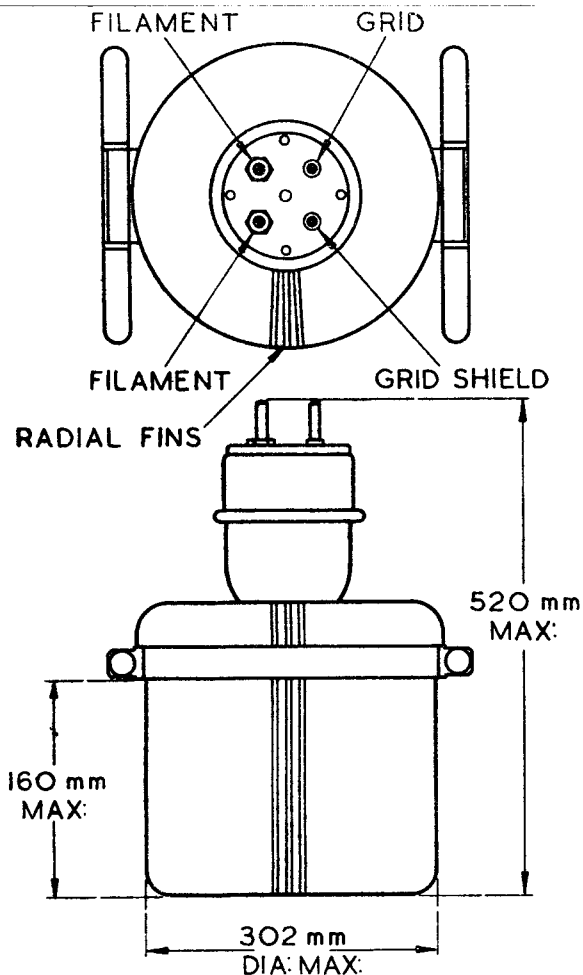
# Air-Blast-Cooled R.F. Power Amplifier Triode 3J/221E



3J/221E

**Air-Blast-Cooled R.F.  
Power Amplifier  
Triode**

3J/221E



May 1947

3J/221E—4



# Air-Blast-Cooled R.F. Power Amplifier Triode 3J/221S

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## CATHODE.

Tungsten filament

|                                         |    |   |
|-----------------------------------------|----|---|
| Nominal (Actual voltage marked on bulb) | 22 | V |
|-----------------------------------------|----|---|

|                 |    |   |
|-----------------|----|---|
| Nominal current | 70 | A |
|-----------------|----|---|

|               |    |   |
|---------------|----|---|
| Peak emission | 12 | A |
|---------------|----|---|

## RATING.

|                      |                            |       |          |
|----------------------|----------------------------|-------|----------|
| Amplification factor | { Measured at }            | 26    |          |
| Impedance            | { $V_a$ 12kV, $I_a$ 1.5A } | 2,900 | $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|               |    |    |
|---------------|----|----|
| Grid to anode | 26 | pF |
|---------------|----|----|

|                  |     |    |
|------------------|-----|----|
| Grid to filament | 1.3 | pF |
|------------------|-----|----|

|                   |      |    |
|-------------------|------|----|
| Anode to filament | 20.0 | pF |
|-------------------|------|----|

## AIR COOLING.

For dissipation of 10 kW

|                                              |     |              |
|----------------------------------------------|-----|--------------|
| Volume of air at a pressure of 3in. of water | 475 | cu. ft./min. |
|----------------------------------------------|-----|--------------|

|                                       |      |   |
|---------------------------------------|------|---|
| Maximum temperature of core of cooler | 150° | C |
|---------------------------------------|------|---|

|                             |     |   |
|-----------------------------|-----|---|
| Maximum ambient temperature | 45° | C |
|-----------------------------|-----|---|

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 506 | mm. |
|------------------------|-----|-----|

|                              |     |     |
|------------------------------|-----|-----|
| Maximum diameter over cooler | 172 | mm. |
|------------------------------|-----|-----|

## MAXIMUM RATINGS.

|                              |      |    |
|------------------------------|------|----|
| Maximum direct anode voltage | 17.5 | kV |
|------------------------------|------|----|

|                              |     |   |
|------------------------------|-----|---|
| Maximum direct anode current | 2.5 | A |
|------------------------------|-----|---|

|                           |    |    |
|---------------------------|----|----|
| Maximum anode dissipation | 10 | kW |
|---------------------------|----|----|

|                          |     |    |
|--------------------------|-----|----|
| Maximum grid dissipation | 1.2 | kW |
|--------------------------|-----|----|

|                                     |    |      |
|-------------------------------------|----|------|
| Maximum frequency for above ratings | 22 | Mc/s |
|-------------------------------------|----|------|

**Air-Blast-Cooled R.F.  
Power Amplifier  
Triode  
3J/221S**



## TYPICAL OPERATING CONDITIONS

### RADIO FREQUENCY

#### **Class B Telephony Modulated Carrier applied to Grid.**

(Carrier conditions per valve for use with 100% modulation).

|                      |      |            |
|----------------------|------|------------|
| Direct anode voltage | 15   | kV         |
| Grid bias            | —600 | V approx.  |
| Direct anode current | 1    | A          |
| Power output         | 5    | kW approx. |

#### **Class C Power Amplifier Anode subject to modulation.**

(Carrier conditions per valve for use with 100% modulation).

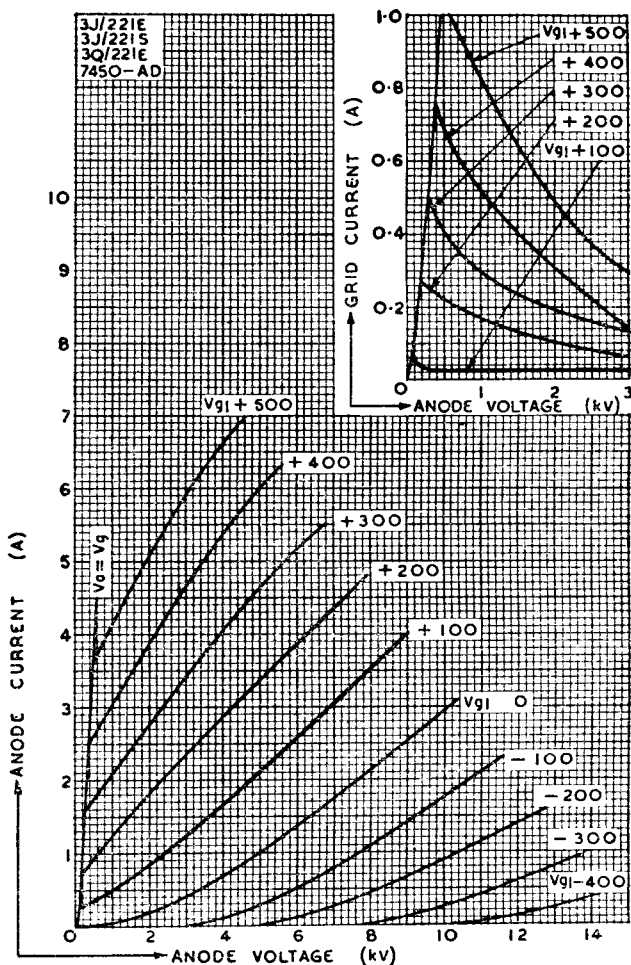
|                      |       |            |
|----------------------|-------|------------|
| Direct anode voltage | 12    | kV         |
| Grid bias            | —2000 | V approx.  |
| Direct anode current | 1.25  | A          |
| Power output         | 12    | kW approx. |

#### **Class C Power Amplifier or Oscillator, unmodulated.**

|                      |        |            |
|----------------------|--------|------------|
| Direct anode voltage | 17.5   | kV         |
| Grid bias            | —1,500 | V approx.  |
| Direct anode current | 2      | A          |
| Power output         | 25     | kW approx. |



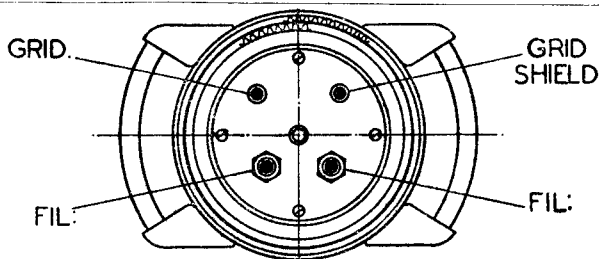
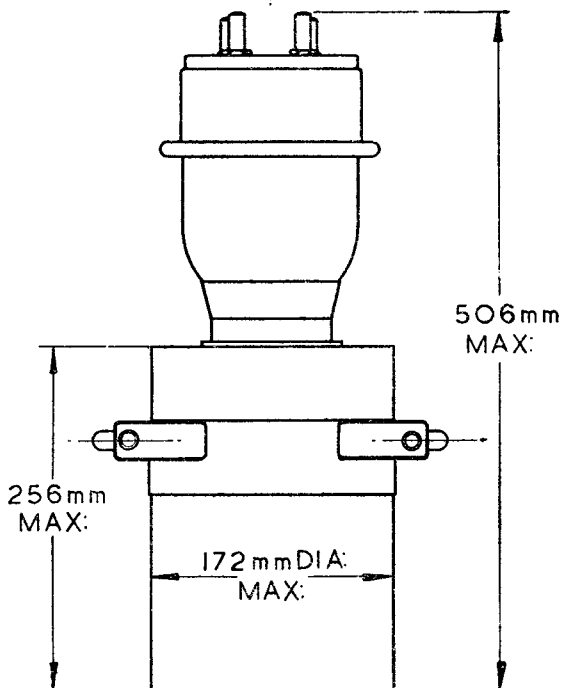
# Air-Blast-Cooled R.F. Power Amplifier Triode 3J/22IS



3J/221S

**Air-Blast-Cooled R.F.  
Power Amplifier  
Triode**

3J/221S







# Water Cooled Triode

4228A

3Q/150E  
(4228A)

## CATHODE.

|                                            |    |   |
|--------------------------------------------|----|---|
| Tungsten filament                          |    |   |
| Voltage (operating voltage marked on bulb) | 22 | V |
| Nominal current                            | 41 | A |
| Peak emission                              | 6  | A |

## RATING.

|                      |                                  |    |          |
|----------------------|----------------------------------|----|----------|
| Amplification factor | Measured at<br>Va 5 kV Ia 0.75 A | 18 |          |
| Impedance            |                                  |    |          |
|                      | 2,200                            |    | $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 24  | pF |
| Grid to filament  | 25  | pF |
| Anode to filament | 3.1 | pF |

## WATER FLOW.

|                    |          |             |
|--------------------|----------|-------------|
| Water jacket type  | 235/LU2A |             |
| Nominal water flow | 5        | galls./min. |

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 475 | mm. |
| Maximum bulb diameter  | 95  | mm. |
| Net weight             | 1.2 | kg. |

## MAXIMUM RATINGS.

|                                                      |     |      |
|------------------------------------------------------|-----|------|
| Maximum direct anode voltage                         | 6   | kV   |
| Maximum direct anode voltage for anode modulation    | 4   | kV   |
| Maximum direct anode current                         | 1.5 | A    |
| Maximum anode dissipation                            | 5   | kW   |
| Maximum grid dissipation                             | 100 | W    |
| Maximum frequency for above ratings                  | 3   | Mc/s |
| Maximum direct anode voltage for frequency of 6 Mc/s | 3   | kV   |

**3Q/150E  
(4228A)**

# Water Cooled Triode

**4228A**



## TYPICAL OPERATING CONDITIONS. AUDIO FREQUENCY.

### Class B Power Amplifier.

(For balanced 2-valve circuit).

|                                                   |       |          |
|---------------------------------------------------|-------|----------|
| Direct anode voltage                              | 5     | kV       |
| Grid bias                                         | —265  | V        |
| Direct anode current per valve—<br>zero signal    | 0.15  | A        |
| Direct anode current per valve—<br>maximum signal | 0.6   | A        |
| Load resistance—anode to anode                    | 8,400 | $\Omega$ |
| Power output 2 valves                             | 3.75  | kW       |

## RADIO FREQUENCY.

### Class B Telephony. Modulated Carrier applied to Grid.

(Carrier conditions per valve for use with 100% modulation).

|                      |                |    |
|----------------------|----------------|----|
| Direct anode voltage | 5              | kV |
| Grid bias            | —325           | V  |
| Direct anode current | 0.65           | A  |
| Carrier output       | 1.1 kW approx. |    |

### Class C Power Amplifier. Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation).

|                      |       |    |
|----------------------|-------|----|
| Direct anode voltage | 4,000 | V  |
| Grid bias            | —500  | V  |
| Direct anode current | 1.25  | A  |
| Carrier output       | 2.5   | kW |

### Class C Power Amplifier or Oscillator, unmodulated.

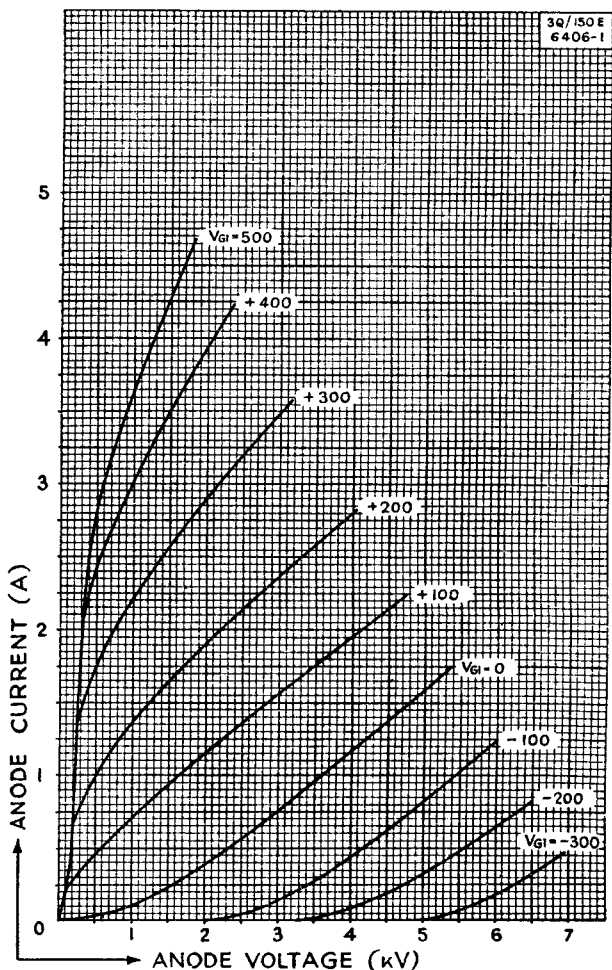
|                      |                |    |
|----------------------|----------------|----|
| Direct anode voltage | 6              | kV |
| Grid bias            | —750           | V  |
| Direct anode current | 1.25           | A  |
| Power output         | 3.4 kW approx. |    |



# Water Cooled Triode

4228A

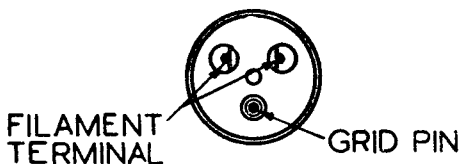
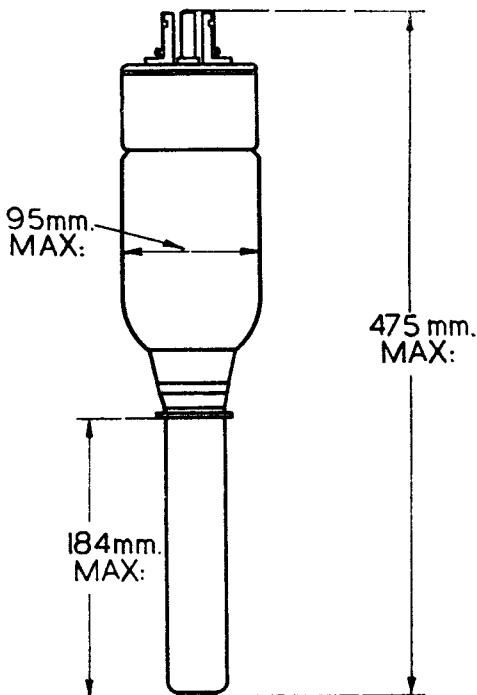
3Q/150E  
(4228A)



**3Q/150E  
(4228A)**

# Water Cooled Triode

**4228A**





# Water-Cooled R.F. Triode

3Q/191E

3Q/191E

## CATHODE.

Thoriated tungsten filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 10 | V |
| Nominal current | 33 | A |
| Peak emission   | 12 | A |

## RATING.

|                      |                           |       |          |
|----------------------|---------------------------|-------|----------|
| Amplification factor | { Measured at }           | 26    |          |
| Impedance            | { $V_a$ 5kV, $I_a$ 0.8A } | 3,450 | $\Omega$ |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |      |    |
|-------------------|------|----|
| Grid to anode     | 12   | pF |
| Grid to filament  | 11.5 | pF |
| Anode to filament | 1.5  | pF |

## WATER COOLING.

Water jacket type 235/LU3

|                   |   |            |
|-------------------|---|------------|
| Normal water flow | 3 | galls/min. |
|-------------------|---|------------|

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 355 | mm. |
| Maximum width          | 149 | mm. |
| Net weight             | 905 | g   |

## MAXIMUM RATINGS.

|                              |      |    |
|------------------------------|------|----|
| Maximum direct anode voltage | 10   | kV |
| Maximum direct anode current | 2    | A  |
| Maximum direct grid current  | 0.25 | A  |
| Maximum anode dissipation    | 5    | kW |

# Water-Cooled R.F. Triode

3Q/191E



## TYPICAL OPERATING CONDITIONS

### RADIO FREQUENCY

#### Class B Telephony. Modulated carrier applied to grid.

(Carrier conditions per valve for use with 100% modulation).

|                        |      |            |
|------------------------|------|------------|
| Direct anode voltage   | 8    | kV         |
| Grid bias              | —480 | V          |
| Direct anode current   | 0.8  | A          |
| Peak R.F. grid voltage | 700  | V          |
| *Direct grid current   | 20   | mA approx. |
| Output                 | 2    | kW approx. |

#### Class C Power Amplifier. Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation).

|                        |        |            |
|------------------------|--------|------------|
| Direct anode voltage   | 8      | kV         |
| Grid bias              | —1,000 | V          |
| Direct anode current   | 0.8    | A          |
| Peak R.F. grid voltage | 1,700  | V          |
| * Direct grid current  | 120    | mA approx. |
| Output                 | 4.5    | kW approx. |

#### Class C Power Amplifier or Oscillator—unmodulated.

|                        |       |            |
|------------------------|-------|------------|
| Direct anode voltage   | 10    | kV         |
| Grid bias              | —800  | V          |
| Direct anode current   | 1     | A          |
| Peak R.F. grid voltage | 1,500 | V          |
| * Direct grid current  | 120   | mA approx. |
| Output                 | 7.3   | kW approx. |

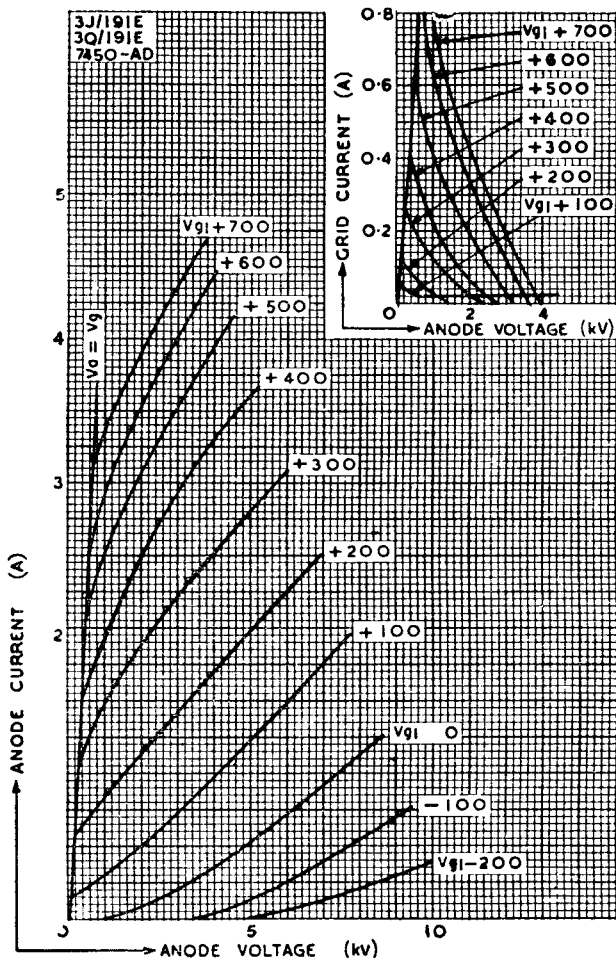
\* Subject to wide variation depending upon the impedance of the load circuit.



# Water-Cooled R.F. Triode

3Q/191E

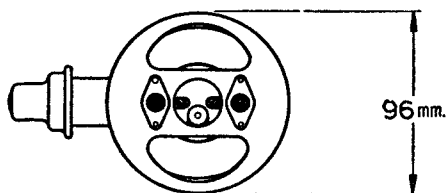
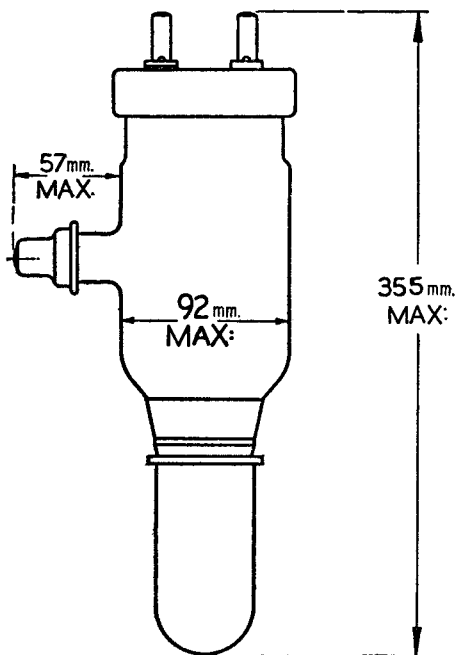
3Q/191E



3Q/191E

# Water-Cooled R.F. Triode

3Q/191E



5430-O





# Single-ended Water-cooled R.F. Power Amplifier Triode

3Q/221E

3Q/221E

## CATHODE.

Tungsten filament

Nominal voltage (Actual voltage marked on  
bulb)

22

V

Nominal current

70

A

Peak emission

12

A

## RATING.

Amplification factor { Measured at  $V_a$  } 26

Impedance { 12kV  $I_a$  1.5A } 2,900  $\Omega$

## DIRECT INTER-ELECTRODE CAPACITIES.

Grid to anode 17 pF

Grid to filament 29 pF

Anode to filament 1 pF

## WATER FLOW

Water Jacket type 3005A

Normal water flow 11 gal. per min.

Pressure drop for normal flow 14 lb. per sq. in.

Maximum water pressure 50 lb. per sq. in.

## DIMENSIONS.

Maximum overall length 520 mm.

Net weight 3.6 kg.

## MAXIMUM RATINGS.

Maximum direct anode voltage 17,500 V

Maximum direct anode current 2.5 A

Maximum anode dissipation 20 kW

Maximum grid dissipation 1.2 kW

**3Q/221E**

**Single-ended Water-cooled  
R.F. Power Amplifier Triode**



**3Q/221E**

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**TYPICAL OPERATING CONDITIONS**

**RADIO FREQUENCY**

**Class B Telephony. Modulated. Carrier applied to grid.**

(Carrier conditions per valve for use with 100% modulation).

|                      |      |            |
|----------------------|------|------------|
| Direct anode voltage | 15   | kV         |
| Grid bias            | —600 | V          |
| Direct anode current | 2.0  | A          |
| Power output         | 10   | kW approx. |

**Class C Power Amplifier. Anode subject to modulation.**

(Carrier conditions per valve for use with 100% modulation).

|                      |        |            |
|----------------------|--------|------------|
| Direct anode voltage | 15     | kV         |
| Grid bias            | —2,000 | V approx.  |
| Direct anode current | 2      | A          |
| Power output         | 20     | kW approx. |

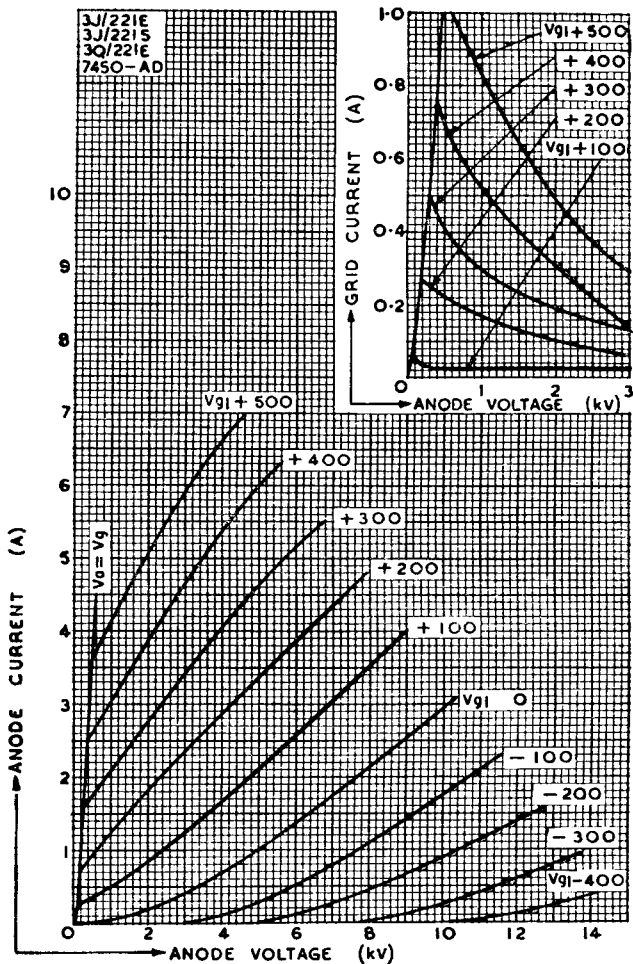
**Class C Power Amplifier or Oscillator, unmodulated.**

|                      |        |            |
|----------------------|--------|------------|
| Direct anode voltage | 17     | kV         |
| Grid bias            | —1,600 | V approx.  |
| Direct anode current | 2.5    | A          |
| Power output         | 30     | kW approx. |



# Single-ended Water-cooled R.F. Power Amplifier Triode

3Q/221E

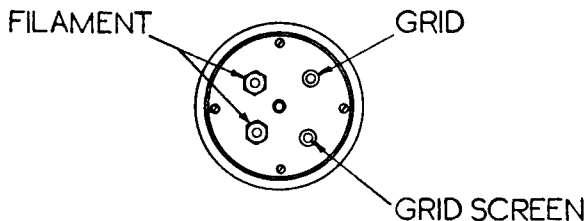
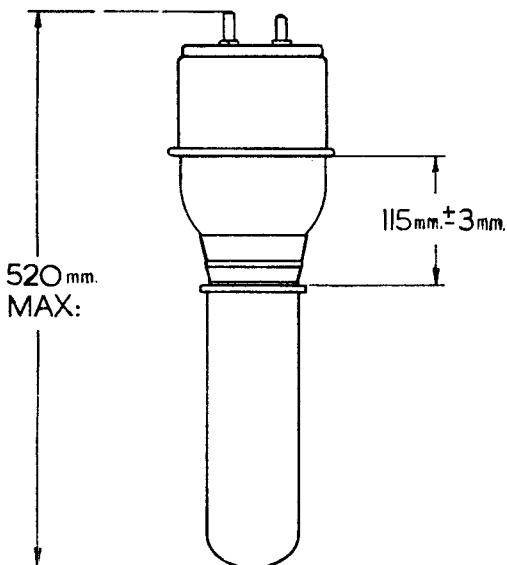


**3Q/221E**

**Single-ended Water-cooled  
R.F. Power Amplifier Triode**



**3Q/221E**





# Single Ended Water Cooled R.F. Triode

3Q/260E

## CATHODE.

Thoriated tungsten filament

|                      |    |   |
|----------------------|----|---|
| Voltage              | 10 | V |
| Nominal current      | 80 | A |
| Peak usable emission | 35 | A |

## RATING.

|                      |                                      |       |          |
|----------------------|--------------------------------------|-------|----------|
| Amplification factor | { Measured at<br>$V_a 2kV, I_a 2A$ } | 35    | $\Omega$ |
| Impedance            |                                      | 1,400 |          |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 30  | pF |
| Grid to filament  | 50  | pF |
| Anode to filament | 2.0 | pF |

## COOLING.

|                   |            |        |
|-------------------|------------|--------|
| Normal water flow | 11         | g.p.m. |
| Water Jacket      | type 3005C |        |

|                                                                                                                                                                          |    |           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------|
| Air cooling required when R.F. grid current exceeds 10 A per lead to be directed at grid seals through a fish-tail nozzle of 3" by $\frac{1}{4}$ " orifice not less than |    |           |
|                                                                                                                                                                          | 10 | cu ft/min |

## DIMENSIONS.

|                        |       |    |
|------------------------|-------|----|
| Maximum overall length | 355   | mm |
| Maximum diameter       | 130   | mm |
| Net weight             | 2,060 | g  |

## MAXIMUM RATINGS.

|                                     |     |      |
|-------------------------------------|-----|------|
| Maximum direct anode voltage        | 11  | kV   |
| Maximum anode dissipation           | 20  | kW   |
| Maximum grid dissipation            | 800 | W    |
| Maximum R.F. grid current per lead  | 30  | A    |
| Maximum frequency for above ratings | 30  | Mc/s |

# Single Ended Water Cooled R.F. Triode



3Q/260E

## TYPICAL OPERATING CONDITIONS

### RADIO FREQUENCY

#### Class B Telephony. Modulated Carrier applied to grid.

(Carrier conditions per valve for use with 100% modulation).

|                        |      |    |
|------------------------|------|----|
| Direct anode voltage   | 10   | kV |
| Grid bias              | —300 | V  |
| Direct anode current   | 3    | A  |
| Peak R.F. grid voltage | 540  | V  |
| Power output           | 10   | kW |

#### Class C Power Amplifier Anode subject to Modulation.

(Carrier conditions per valve for use with 100% modulation).

|                        |       |           |
|------------------------|-------|-----------|
| Direct anode voltage   | 8     | kV        |
| Grid bias              | —950  | V         |
| Direct anode current   | 4     | A         |
| Peak R.F. grid voltage | 1,600 | V         |
| *Direct grid current   | 0.75  | A approx. |
| Power output           | 20    | kW        |

#### Class C Power Amplifier or Oscillator, Unmodulated.

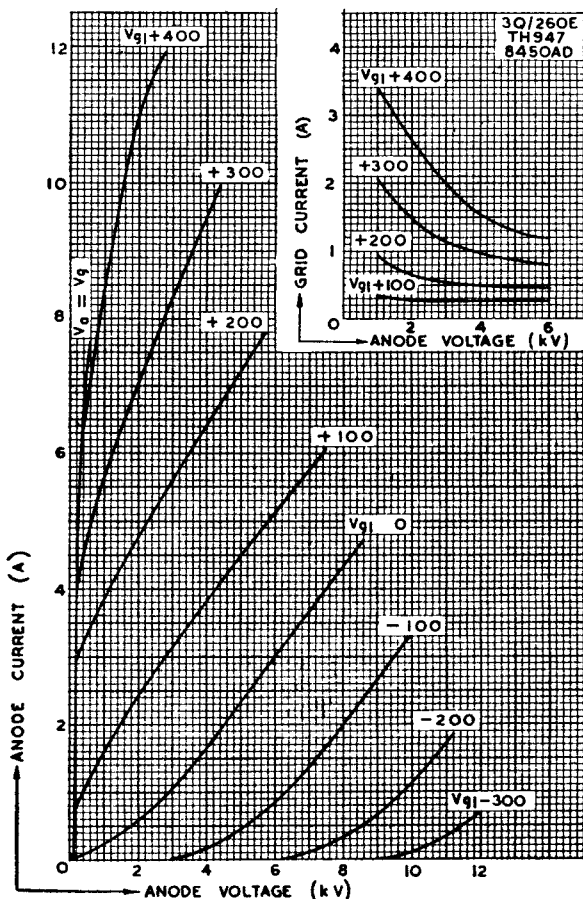
|                        |       |            |
|------------------------|-------|------------|
| Direct anode voltage   | 11    | kV         |
| Grid bias              | —700  | V          |
| Direct anode current   | 5     | A          |
| Peak R.F. grid voltage | 1,400 | V          |
| *Direct grid current   | 0.8   | A approx.  |
| Power output           | 38    | kW approx. |

\*Subject to wide variation, depending upon the impedance of the load circuit.



# Single Ended Water Cooled R.F. Triode

3Q/260E

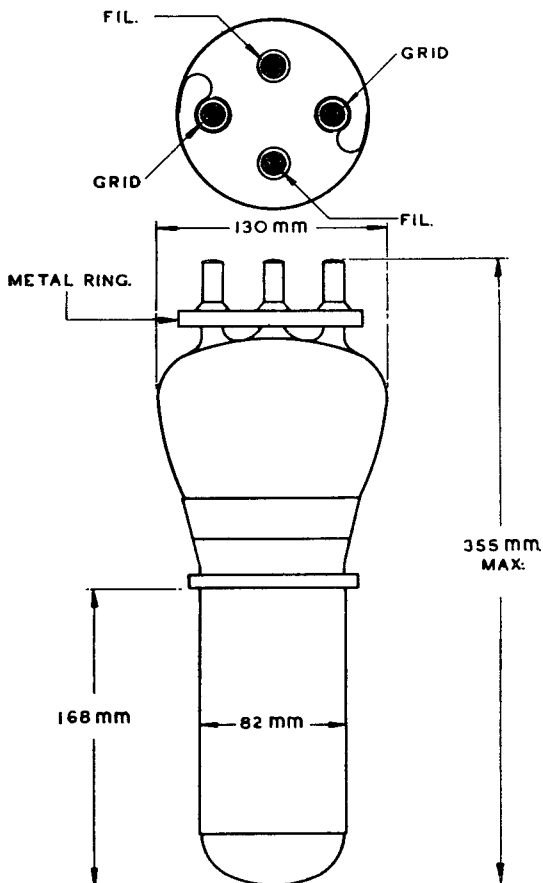


**3Q/260E**

# Single Ended Water Cooled R.F. Triode



**3Q/260E**



Tentative data  
September 1948

**3Q/260E—4**





# Double Ended Water Cooled Triode

3Q/292E  
(4030C)

4030C

## CATHODE.

Tungsten filament

|                                                 |     |   |
|-------------------------------------------------|-----|---|
| Nominal voltage (actual voltage marked on bulb) | 25  | V |
| Nominal current                                 | 248 | A |
| Peak emission                                   | 45  | A |

## RATINGS.

|                      |                                  |      |          |
|----------------------|----------------------------------|------|----------|
| Amplification factor | } Measured at<br>Va 17.5kV Ia 5A | 36   | $\Omega$ |
| Impedance            |                                  | 1800 |          |

## DIRECT INTER-ELECTRODE CAPACITANCIES

|                   |    |    |
|-------------------|----|----|
| Grid to anode     | 61 | pF |
| Grid to filament  | 45 | pF |
| Anode to filament | 15 | pF |

## COOLING

(Water Jacket is integral part of the valve)

|                                  |                    |
|----------------------------------|--------------------|
| Nominal water flow               | 22 gal. per minute |
| Pressure drop at nominal flow    | 9 lb. per sq. in.  |
| Maximum water pressure in jacket | 35 lb. per sq. in. |

## DIMENSIONS.

|                        |      |     |
|------------------------|------|-----|
| Maximum overall length | 1346 | mm. |
| Net weight             | 16   | kg. |

## MAXIMUM RATINGS.

|                                                |      |      |
|------------------------------------------------|------|------|
| Maximum direct anode voltage                   | 17.5 | kV   |
| Maximum direct anode current                   | 11   | A    |
| Maximum anode dissipation                      | 80   | kW   |
| Maximum grid dissipation                       | 1.5  | kW   |
| Maximum frequency for above ratings            | 2    | Mc/s |
| Maximum anode voltage for frequency of 22 Mc/s | 15   | kV   |

# Double Ended Water Cooled Triode



**4030C**

## TYPICAL OPERATING CONDITIONS AUDIO FREQUENCY

**Class B Power Amplifier or Modulator  
(for balanced 2 valve circuit)**

|                                               |      |          |
|-----------------------------------------------|------|----------|
| Direct anode voltage                          | 14   | kV       |
| Grid bias                                     | -150 | V        |
| Direct anode current per valve zero signal    | 1.3  | A        |
| Direct anode current per valve maximum signal | 6.5  | A        |
| Anode dissipation                             | 41   | kW       |
| Load resistance anode to anode                | 1900 | $\Omega$ |
| Maximum output 2 valves                       | 100  | kW       |

## RADIO FREQUENCY

**Class B Telephony, Modulated Carrier applied to Grid  
(Carrier conditions per valve for use with 100% modulation)**

|                      |      |      |      |         |
|----------------------|------|------|------|---------|
| Direct anode voltage | 17.5 | 15   | 12   | 10 kV   |
| Direct anode current | 4.8  | 4.8  | 4.8  | 4.8 A   |
| Grid bias            | -400 | -300 | -250 | -150 V  |
| Power output         | 25   | 22   | 17   | 12 kW   |
| Anode dissipation    | 59   | 50   | 40   | 36 kW   |
| Frequency            | 2    | 12   | 19   | 22 Mc/s |

**Class C Power Amplifier, Anode Subject to Modulation  
(Carrier conditions per valve for use with 100% modulation)**

|                      |      |      |      |         |
|----------------------|------|------|------|---------|
| Direct anode voltage | 12   | 11   | 10   | 9 kV    |
| Direct anode current | 5    | 5    | 5    | 5 A     |
| Grid bias            | -600 | -500 | -450 | -400 V  |
| Power output         | 40   | 35   | 30   | 20 kW   |
| Anode dissipation    | 20   | 20   | 20   | 25 kW   |
| Frequency            | 2    | 12   | 19   | 22 Mc/s |

**Class C Power Amplifier or Oscillator, Unmodulated**

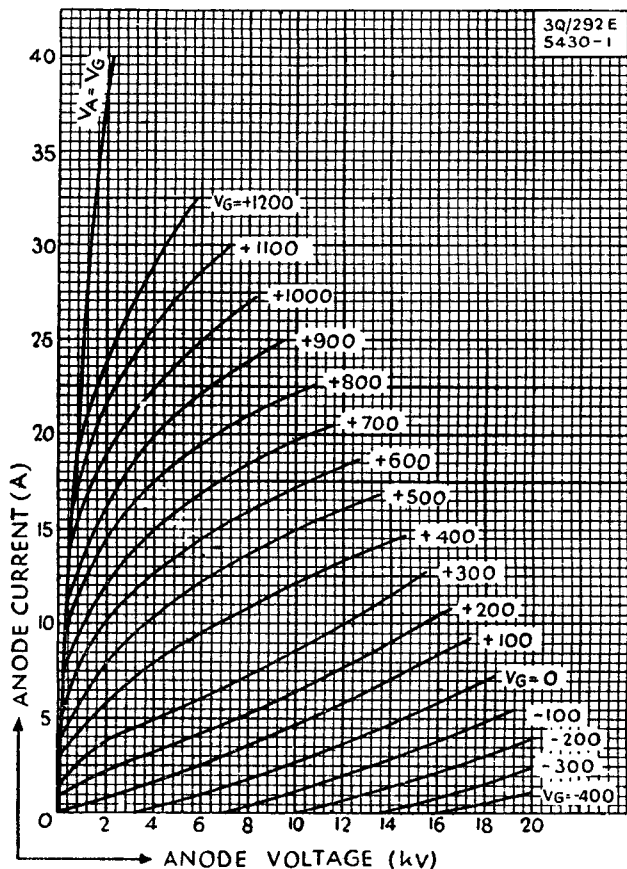
|                      |      |      |      |         |
|----------------------|------|------|------|---------|
| Direct anode voltage | 17.5 | 15   | 12   | 10 kV   |
| Direct anode current | 9.6  | 9.6  | 9.6  | 9.6 A   |
| Grid bias            | -600 | -500 | -450 | -400 V  |
|                      | -700 | -600 | -500 | -400 V  |
| Power output         | 100  | 88   | 68   | 48 kW   |
| Anode dissipation    | 68   | 56   | 47   | 48 kW   |
| Frequency            | 2    | 12   | 19   | 22 Mc/s |



# Double Ended Water Cooled Triode

3Q/292E  
(4030C)

4030C

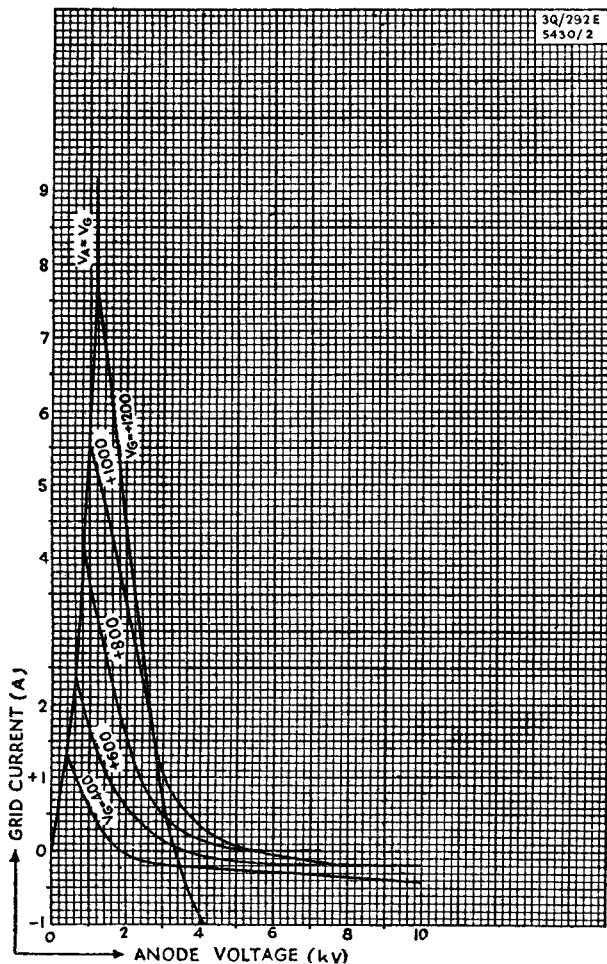


3Q/292E  
(4030C)

# Double Ended Water Cooled Triode



4030C

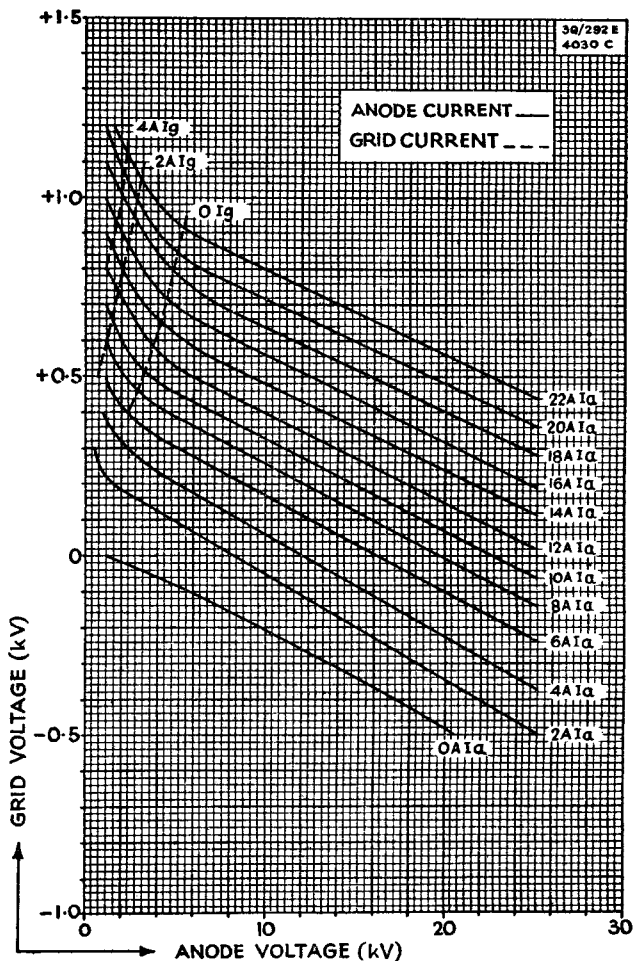




# Double Ended Water Cooled Triode

3Q/292E  
(4030C)

4030C

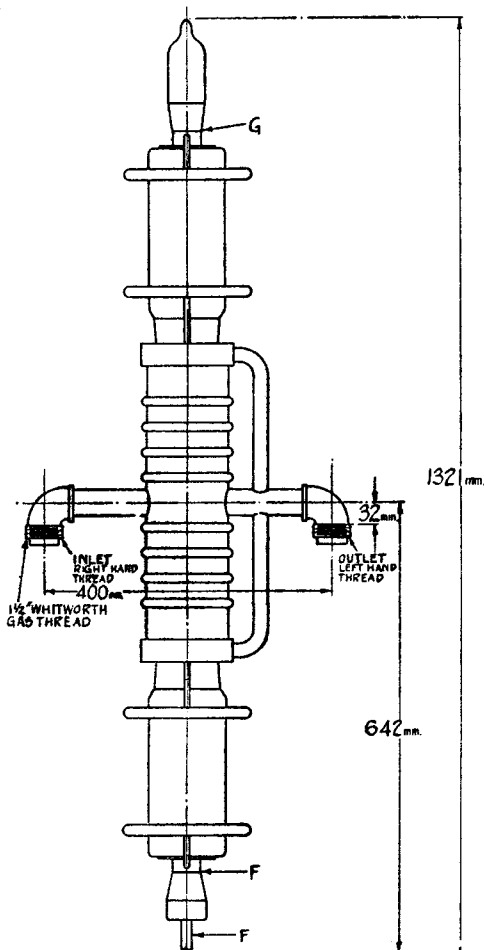


**3Q/292E  
(4030C)**

# Double Ended Water Cooled Triode



**4030C**



August 1945

3Q/292E—6



**Single-ended Water-Cooled  
Triode High Power RF  
Amplifier and Oscillator  
3Q/331E**

**3Q/331E**

**CATHODE.**

|                                            |      |   |
|--------------------------------------------|------|---|
| Tungsten filament                          |      |   |
| Voltage (operating voltage marked on bulb) | 27.5 | V |
| Nominal current                            | 600  | A |
| Peak emission                              | 100  | A |

**RATING.**

|                      |                                                      |     |
|----------------------|------------------------------------------------------|-----|
| Amplification factor | { Measured at<br>Va 16 kV<br>Vg <sub>1</sub> —100V } | 46  |
| Impedance            |                                                      | 750 |

**DIRECT INTER-ELECTRODE CAPACITIES.**

|                   |     |    |
|-------------------|-----|----|
| Grid to anode     | 98  | pF |
| Grid to filament  | 145 | pF |
| Anode to filament | 7   | pF |

**COOLING.**

|                                                                   |                |              |
|-------------------------------------------------------------------|----------------|--------------|
| Water Jacket type                                                 | PL125,549/8459 |              |
| Normal water flow                                                 | 50             | galls/min.   |
| Pressure drop across the jacket at normal flow                    | 15             | lbs/sq. in.  |
| Maximum water pressure                                            | 50             | lbs/sq. in.  |
| Air cooling for filament and grid seals at a pressure of 7in. SWG | 5              | cu. ft./min. |

**DIMENSIONS.**

|                        |     |       |
|------------------------|-----|-------|
| Maximum overall length | 104 | cms.  |
| Net weight             | 35  | kgms. |

**MAXIMUM RATINGS.**

|                                     |      |      |
|-------------------------------------|------|------|
| Maximum direct anode voltage        | 17.5 | kV   |
| Maximum anode dissipation           | 160  | kW   |
| Maximum grid dissipation            | 3    | kW   |
| Maximum direct anode current        | 16   | A    |
| Maximum frequency for above ratings | 22   | Mc/s |

**3Q/33IE**

**Single-ended Water-Cooled  
Triode High Power RF  
Amplifier and Oscillator  
3Q/33IE**



**TYPICAL OPERATING CONDITIONS.**

**Class B Audio Frequency Amplifier or modulator for balanced  
2 valve operation.**

|                      |        |          |
|----------------------|--------|----------|
| Direct anode voltage | 12,500 | V        |
| Grid bias            | —150   | V        |
| Direct anode current | 12.4   | A        |
| Load resistance      | 1,080  | $\Omega$ |
| Power output         | 185    | kW       |

**RADIO FREQUENCY.**

**Class B Telephony. Modulated carrier applied to grid.  
(Carrier conditions for use with 100% modulation.)**

|                      |        |    |
|----------------------|--------|----|
| Direct anode voltage | 17,000 | V  |
| Grid bias            | —325   | V  |
| Direct anode current | 11     | A  |
| Power output         | 65     | kW |

**Class C Power Amplifier. Anode subjected to modulation.  
(Carrier conditions for use with 100% modulation.)**

|                      |        |    |
|----------------------|--------|----|
| Direct anode voltage | 12,000 | V  |
| Grid bias            | —1,300 | V  |
| Direct anode current | 11     | A  |
| Power output         | 90     | kW |

**Class C. Amplifier or Oscillator, unmodulated.**

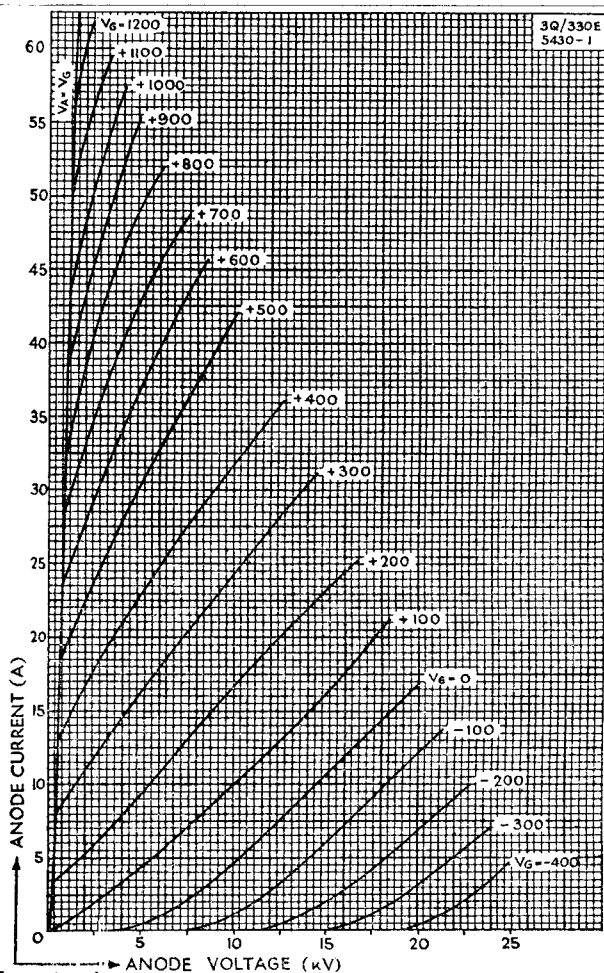
|                      |        |        |    |
|----------------------|--------|--------|----|
| Direct anode voltage | 12,000 | 17,000 | V  |
| Grid bias            | —800   | —1,000 | V  |
| Direct anode current | 11     | 15     | A  |
| Power output         | 95     | 180    | kW |





# Single-ended Water-Cooled Triode High Power RF Amplifier and Oscillator

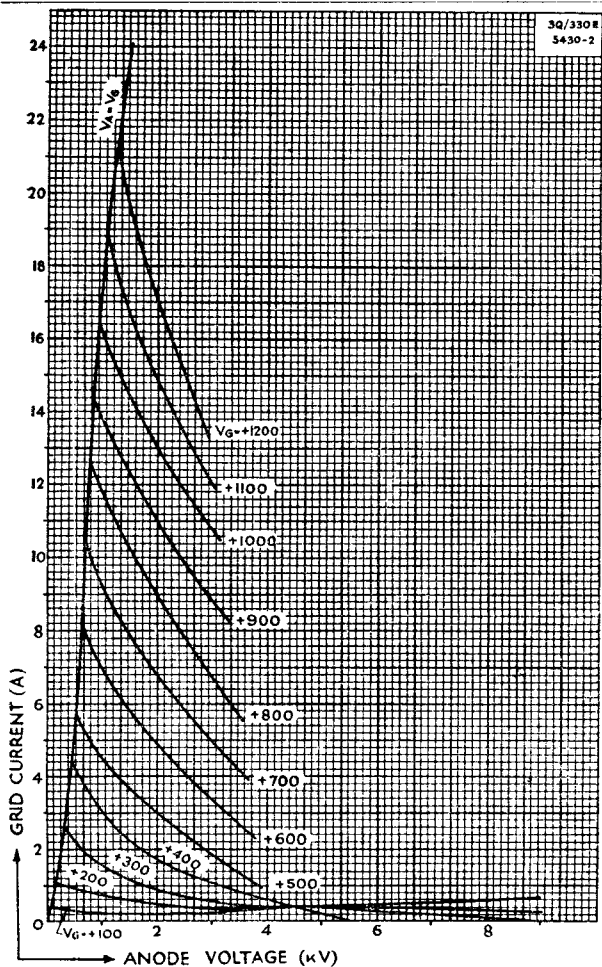
3Q/331E



Tentative data  
May 1947

**3Q/331E**

**Single-ended Water-Cooled  
Triode High Power RF  
Amplifier and Oscillator  
3Q/331E**



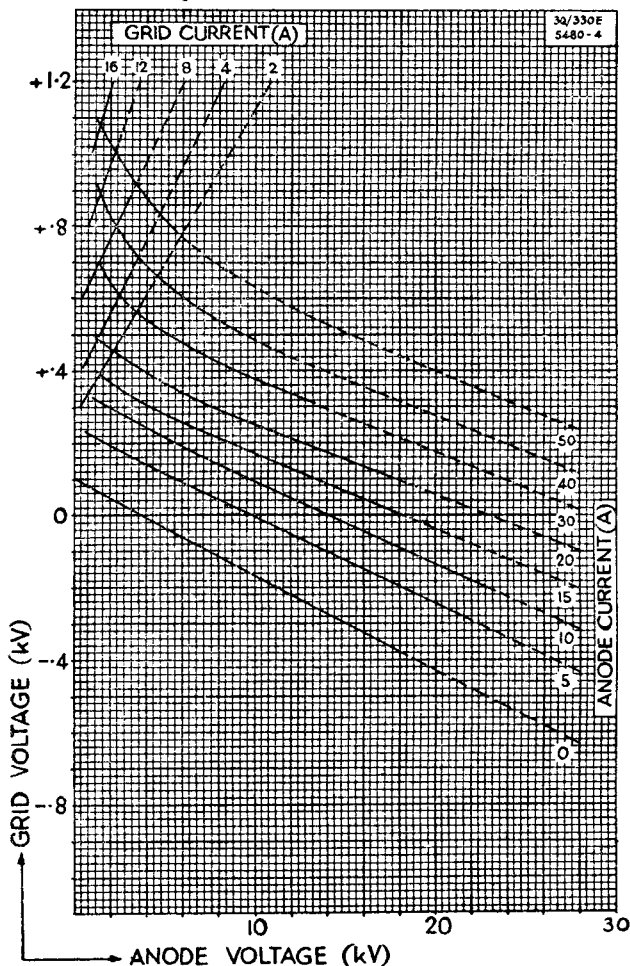
Tentative data  
May 1947

3Q/331E-4



# Single-ended Water-Cooled Triode High Power RF Amplifier and Oscillator

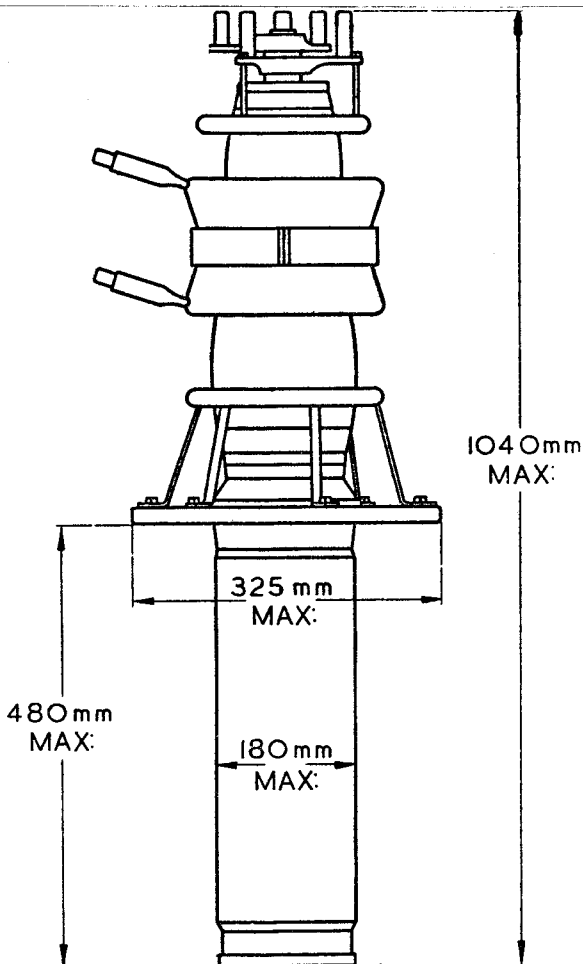
3Q/331E



Tentative data  
May 1947

**3Q/331E**

**Single-ended Water-Cooled  
Triode High Power RF  
Amplifier and Oscillator  
3Q/331E**



Tentative data  
May 1947

3Q/331E—6



# Hot Cathode Mercury Vapour Thyatron

3V/340B

## CATHODE.

Oxide-coated filament

|         |     |   |
|---------|-----|---|
| Voltage | 2.5 | V |
|---------|-----|---|

|                 |   |   |
|-----------------|---|---|
| Nominal current | 5 | A |
|-----------------|---|---|

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 168 | mm. |
|------------------------|-----|-----|

|                       |    |     |
|-----------------------|----|-----|
| Maximum bulb diameter | 60 | mm. |
|-----------------------|----|-----|

|      |                  |       |
|------|------------------|-------|
| Base | Standard British | 4-pin |
|------|------------------|-------|

|            |    |     |
|------------|----|-----|
| Net weight | 90 | gm. |
|------------|----|-----|

## MAXIMUM RATINGS.

|                              |       |   |
|------------------------------|-------|---|
| Maximum peak inverse voltage | 1,500 | V |
|------------------------------|-------|---|

|                                                   |   |   |
|---------------------------------------------------|---|---|
| Maximum peak anode current at<br>25 c/s and above | 2 | A |
|---------------------------------------------------|---|---|

|                               |     |   |
|-------------------------------|-----|---|
| Maximum average anode current | 0.5 | A |
|-------------------------------|-----|---|

|                           |     |   |
|---------------------------|-----|---|
| Maximum peak grid current | 0.1 | A |
|---------------------------|-----|---|

|                                        |                |
|----------------------------------------|----------------|
| Condensed mercury temperature<br>range | 15°C. to 40°C. |
|----------------------------------------|----------------|

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

| Natural Ventilation  | up to 35°C. | 35°C. to 40°C. |
|----------------------|-------------|----------------|
| Peak inverse voltage | 1,500V      | 1,000V         |

**3V/340B**

# Hot Cathode Mercury Vapour Thyatron

**3V/340B**

## TYPICAL OPERATING CONDITIONS.

|                    | No. of<br>Valves | Maximum D.C.<br>Output voltage | Maximum D.C.<br>Output current |
|--------------------|------------------|--------------------------------|--------------------------------|
| Bi-phase half wave | 2                | 500V                           | 1.0 A                          |
| Full wave          | 4                | 1000V                          | 1.0 A                          |

## THYRATRON OPERATION.

With a condensed mercury temperature of 35°C. the minimum value of grid blocking voltage required to prevent ignition will be :

Anode voltage

200 V

500 V

Grid voltage (approx.)

—3

—4

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition and a pulse of 20 to 30 volts positive applied.

The pulse should have a leading edge as near vertical as possible and the pulse circuit should be of high impedance in order to limit the grid current.

The control of the output may be effected by varying the phase of the grid pulse relative to the phase of the applied anode voltage.

This thyatron being directly heated it is recommended that the output circuit be connected to the midpoint of the filament transformer secondary.

## CATHODE HEATING TIME.

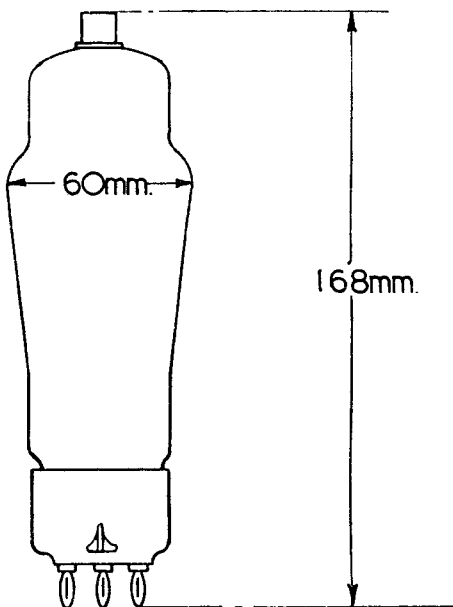
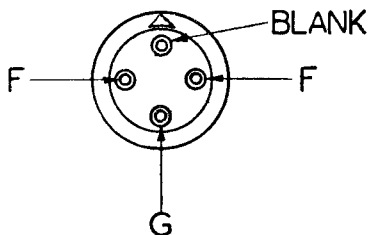
Minimum cathode heating time 30 seconds. After shipment or transit the valve must be pre-heated for not less than 15 minutes before any anode voltage is applied so that the mercury may be distributed correctly.

3V/340B



# Hot Cathode Mercury Vapour Thyatron

3V/340B



Tentative data  
May 1946

3V/340B—3



# Hot-Cathode Mercury-Vapour Thyratrons

Codes: 57 (CV5027) ←  
3V/390B (CV5028) ←

Type 57 is a three-electrode mercury-vapour thyatron developed mainly for use in Industrial Control applications. It is equivalent to the U.S.A. type FG-57. The 3V/390B is an electrically identical thyatron on a British 4-pin base.

## CATHODE

Indirectly-heated, oxide-coated

|                              |     |     |
|------------------------------|-----|-----|
| Heater voltage               | 5   | V   |
| Nominal current              | 4.5 | A   |
| Minimum cathode heating time | 5   | min |

## DIRECT INTERELECTRODE CAPACITANCES

|                 |     |    |
|-----------------|-----|----|
| Anode to grid   | 3.5 | pF |
| Grid to cathode | 8.5 | pF |

## DIMENSIONS

|                        |                       |    |
|------------------------|-----------------------|----|
| Maximum overall length | 190.4                 | mm |
| Maximum seated height  | 168.3                 | mm |
| Maximum bulb diameter  | 82.5                  | mm |
| Base                   | American 4-pin medium |    |
| Net weight             | 150                   | g  |

## MAXIMUM RATINGS

|                                                |          |     |
|------------------------------------------------|----------|-----|
| Maximum peak inverse voltage                   | 1.5      | kV  |
| Maximum peak anode current at 25 c/s and above | 15       | A   |
| Maximum average anode current                  | 3        | A   |
| Maximum fault anode current                    | 200      | A   |
| Maximum duration of fault anode current        | 0.1      | sec |
| Maximum peak grid current                      | 1.0      | A   |
| Maximum average grid current                   | 0.25     | A   |
| Recommended maximum grid circuit resistance    | 0.25     | MΩ  |
| Maximum voltage drop                           | 16       | V   |
| Maximum condensed mercury temperature range    | 35 to 75 | °C  |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.



Ref.:

3V/390A

3V/390B

## Hot-Cathode Mercury- Vapour Thyratrons

Codes: 57 (CV5027) ←  
3V/390B (CV5028) ←



### MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY-VAPOUR TEMPERATURES

|                                        |              |              |
|----------------------------------------|--------------|--------------|
| Condensed mercury<br>temperature range | Up to 60 °C  | 60 to 75 °C  |
| Peak inverse voltage                   | Up to 2000 V | Up to 1500 V |

Before putting a valve of this type into operation it is recommended that reference be made to the General Information Section K in the introduction to this handbook.

### CATHODE HEATING TIME

The minimum cathode heating time is 5 minutes. After shipment or transit the valve must be pre-heated for at least 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly.

### THYRATRON OPERATION

With a condensed mercury temperature of 40°C the minimum values of negative grid voltage required to prevent ignition are :

| Anode Voltage | Grid Voltage |
|---------------|--------------|
| 100 V         | -1.75 V      |
| 1000 V        | -6.5 V       |

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition, and a positive firing pulse of 20 to 30 volts peak applied.

The pulse should have a leading edge as near vertical as possible and the grid pulse circuit should be of high impedance in order to limit the grid current to the safe maximum value.

The control of the output may be affected by varying the phase of the grid pulse relative to the phase of the applied anode voltage.



# Hot-Cathode Mercury- Vapour Thyratrons

Ref.: 3V/390A  
3V/390B

Codes: 57 (CV5027) ←  
3V/390B (CV5028) ←

## TYPICAL OPERATING CONDITIONS

| Circuit                                           | No. of<br>Valves | Maximum<br>A.C.<br>Input<br>Voltage<br>(V <sub>r.m.s.</sub> ) | Maximum<br>D.C.<br>Output<br>Voltage<br>(V) | Maximum<br>D.C.<br>Output<br>Current<br>(A) |
|---------------------------------------------------|------------------|---------------------------------------------------------------|---------------------------------------------|---------------------------------------------|
| Single Phase<br>Full Wave<br>Circuit No. 1        | 2                | 525                                                           | 475                                         | 6                                           |
| Single Phase<br>Full Wave Bridge<br>Circuit No. 2 | 4                | 1050                                                          | 945                                         | 6                                           |
| Three Phase<br>Half Wave<br>Circuit No. 3         | 3                | 610                                                           | 715                                         | 9                                           |
| Three Phase<br>Double Y Parallel<br>Circuit No. 4 | 6                | 610                                                           | 715                                         | 18                                          |
| Three Phase<br>Full Wave<br>Circuit No. 5         | 6                | 610                                                           | 1430                                        | 9                                           |

The above tables suitable circuits for these thyratrons, and shows their safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

For details of the circuits referred to see sheet K—8 in the introduction to this handbook.

Ref.:

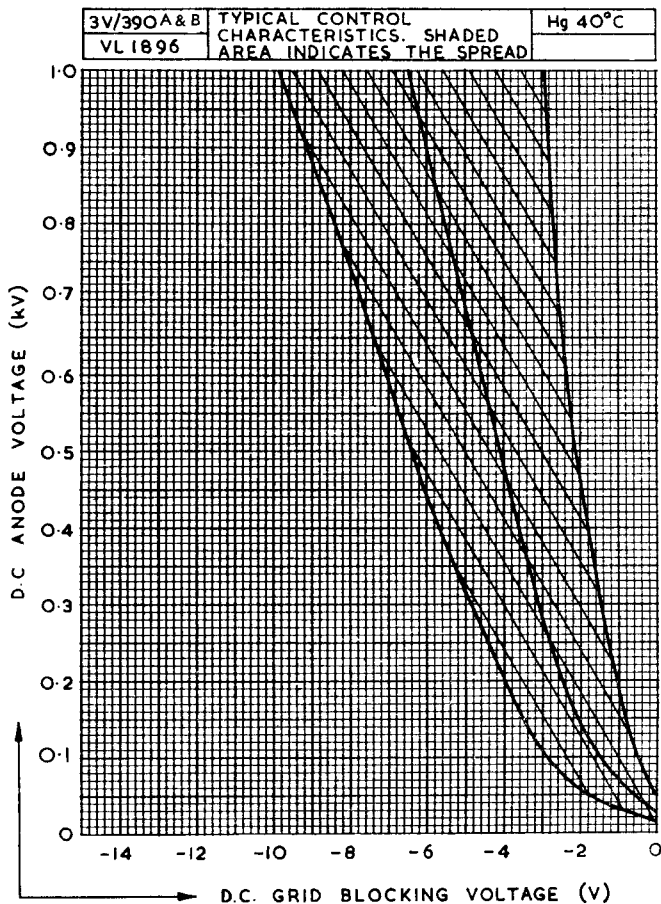
3V/390A

3V/390B

# Hot-Cathode Mercury- Vapour Thyratrons



Codes: 57 (CV5027) ←  
3V/390B (CV5028) ←



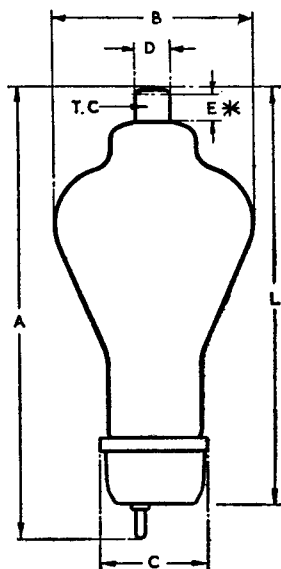


# Hot-Cathode Mercury- Vapour Thyratrons

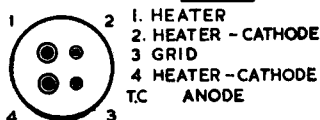
Ref.: 3V/390A

3V/390B

Codes: 57 (CV5027) ←  
3V/390B (CV5028) ←

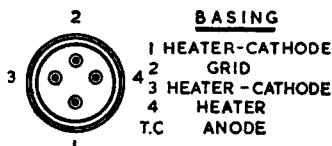


## BASING



## TYPE 57

MEDIUM 4-PIN



## BASING

3V/390B

BRITISH 4-PIN

| DIM | MILLIMETRES      | INCHES                         |
|-----|------------------|--------------------------------|
| A   | $184.1 \pm 6.3$  | $7\frac{1}{4} \pm \frac{1}{4}$ |
| B   | 82.5 MAX         | $3\frac{1}{4}$ MAX             |
| D   | $14.30 \pm 0.25$ | $0.562 \pm 0.010$              |
| E*  | 10.3 MIN         | $\frac{13}{32}$ MIN            |
| L   | 168.3 NOM        | $6\frac{5}{8}$ NOM.            |
| C   | 42.9 MAX         | $1\frac{11}{16}$ MAX           |

NOTE.- BASIC FIGURES ARE INCHES.

\* DENOTES:- CONTACT LENGTH.



# Hot Cathode Mercury Vapour Thyatron

3V/420B

3V/420B

## CATHODE.

Indirectly-heated oxide-coated

|         |   |   |
|---------|---|---|
| Voltage | 5 | V |
|---------|---|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal current | 5.5 | A |
|-----------------|-----|---|

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 225 | mm. |
|------------------------|-----|-----|

|                       |    |     |
|-----------------------|----|-----|
| Maximum bulb diameter | 64 | mm. |
|-----------------------|----|-----|

|      |                        |  |
|------|------------------------|--|
| Base | Standard British 5-pin |  |
|------|------------------------|--|

|            |     |     |
|------------|-----|-----|
| Net weight | 167 | gm. |
|------------|-----|-----|

## MAXIMUM RATINGS.

|                              |       |   |
|------------------------------|-------|---|
| Maximum peak inverse voltage | 1,500 | V |
|------------------------------|-------|---|

|                                                   |      |   |
|---------------------------------------------------|------|---|
| Maximum peak anode current at<br>25 c/s and above | 12.5 | A |
|---------------------------------------------------|------|---|

|                               |     |   |
|-------------------------------|-----|---|
| Maximum average anode current | 2.5 | A |
|-------------------------------|-----|---|

|                           |     |   |
|---------------------------|-----|---|
| Maximum peak grid current | 0.1 | A |
|---------------------------|-----|---|

|                                     |                |  |
|-------------------------------------|----------------|--|
| Condensed mercury temperature range | 25°C. to 50°C. |  |
|-------------------------------------|----------------|--|

The above ratings apply to operation with a choke-input filter and a supply frequency of 50 c/s.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

| Natural Ventilation  | up to 35°C. | 35°C. to 40°C. |
|----------------------|-------------|----------------|
| Peak inverse voltage | 1,500V      | 1,000V         |

**3V/420B**

# Hot Cathode Mercury Vapour Thyatron

**3V/420B**

## TYPICAL OPERATING CONDITIONS.

|                    | No. of<br>Valves | Maximum D.C.<br>Output voltage | Maximum D.C.<br>Output current |
|--------------------|------------------|--------------------------------|--------------------------------|
| Bi-phase half wave | 2                | 500V                           | 5.0 A                          |
| Full wave          | 4                | 1000V                          | 5.0 A                          |

## THYRATRON OPERATION.

With a condensed mercury temperature of 35°C. the minimum value of grid blocking voltage required to prevent ignition will be :

Anode voltage

200 V

500 V

Grid voltage (approx.)

—10

—12

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition and a pulse of 20 to 30 volts positive applied.

The pulse should have a leading edge as near vertical as possible and the pulse-circuit should be of high impedance in order to limit the grid current.

The control of the output may be effected by varying the phase of the grid pulse relative to the phase of the applied anode voltage.

## CATHODE HEATING TIME.

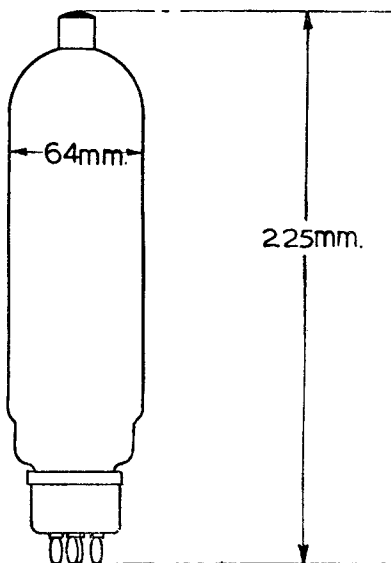
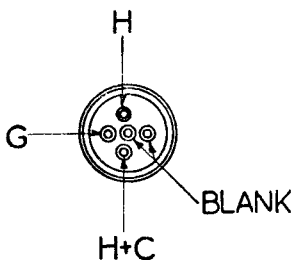
Minimum cathode heating time 5 minutes. After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly.



# Hot Cathode Mercury Vapour Thyatron

3V/420B

3V/420B



Tentative data  
June 1946

3V/420B—3



# Hot-Cathode Mercury-Vapour Thyatron

Code: 3V/490A

The 3V/490A is a mercury-vapour thyatron for use mainly in motor speed and other industrial control applications. It is electrically similar to the U.S.A. FG-105A type.

## CATHODE.

Indirectly-heated, oxide-coated

|                              |      |      |
|------------------------------|------|------|
| Heater voltage               | 5    | V    |
| Nominal current              | 10.5 | A    |
| Minimum cathode heating time | 10   | min← |

## DIRECT INTERELECTRODE CAPACITANCES.

|                 |     |     |
|-----------------|-----|-----|
| Anode to grid   | 0.1 | pF← |
| Grid to cathode | 15  | pF← |

## MECHANICAL DATA.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 285  | mm |
| Maximum seated height  | 270  | mm |
| Maximum bulb diameter  | 66.6 | mm |
| Base                   | B4D  | ←  |
| Net weight             | 350  | g  |

## MAXIMUM RATINGS.

|                                     |      |    |
|-------------------------------------|------|----|
| Maximum peak anode voltage          |      |    |
| Forward                             | 2500 | V  |
| Inverse                             | 2500 | V← |
| Maximum anode current               |      |    |
| Peak (at 25 c/s and above)          | 40   | A  |
| Average                             | 6.4  | A  |
| Fault (maximum duration 0.1 second) | 400  | A  |
| Maximum negative grid voltage       | -1.0 | kV |
| Maximum grid current                |      |    |
| Peak                                | 1.0  | A  |
| Average                             | 0.25 | A  |



# Hot-Cathode Mercury- Vapour Thyatron



Code: 3V/490A

## Recommended grid circuit resistance

|                                     |          |     |
|-------------------------------------|----------|-----|
| Maximum                             | 100      | kΩ← |
| Minimum                             | 1.0      | kΩ  |
| Maximum voltage drop                | 16       | V←  |
| Condensed mercury temperature range | 35 to 80 | °C  |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 cycles per second.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY TEMPERATURES

| Condensed mercury<br>temperature range | Up to 70 °C  | Up to 80 °C  |
|----------------------------------------|--------------|--------------|
| Maximum<br>peak inverse voltage        | Up to 2500 V | Up to 1500 V |

## CATHODE HEATING TIME.

The minimum cathode heating time for this valve is 10 minutes. After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied so that the mercury may be correctly distributed.

## THYRATRON OPERATION.

With a condensed mercury temperature of 35°C the minimum values of negative grid blocking voltages required to prevent ignition are approximately :

| Anode Voltage | Grid Voltage |
|---------------|--------------|
| 100 V         | +1 V         |
| 1000 V        | -9 V         |

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition, and a positive firing pulse of 20 to 30 volts peak applied.



# Hot-Cathode Mercury- Vapour Thyatron

Code: 3V/490A

The pulse should have a leading edge as near vertical as possible and the grid pulse circuit should be of high impedance in order to limit the grid current.

The control of the output may be affected by varying the phase of the grid pulse relative to the phase of the applied anode voltage.

## TYPICAL OPERATING CONDITIONS.

| Circuit                                     | No. of Valves | Maximum A.C. Input Volts (R.M.S.) | Maximum D.C. Output Volts (Volts) | Maximum D.C. Output Current (Amps) |
|---------------------------------------------|---------------|-----------------------------------|-----------------------------------|------------------------------------|
| Single Phase Full Wave Circuit No. 1        | 2             | 883                               | 795                               | 12.8                               |
| Single Phase Full Wave Bridge Circuit No. 2 | 4             | 1766                              | 1590                              | 12.8                               |
| Three Phase Half Wave Circuit No. 3         | 3             | 1020                              | 1195                              | 19.2                               |
| Three Phase Double Y Parallel Circuit No. 4 | 6             | 1020                              | 1195                              | 38.4                               |
| Three Phase Full Wave Circuit No. 5         | 6             | 1020                              | 2390                              | 19.2                               |

The above tables suitable circuits for this thyatron, and shows their safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

For details of the circuits referred to see sheet K—8 in the introduction to this handbook.

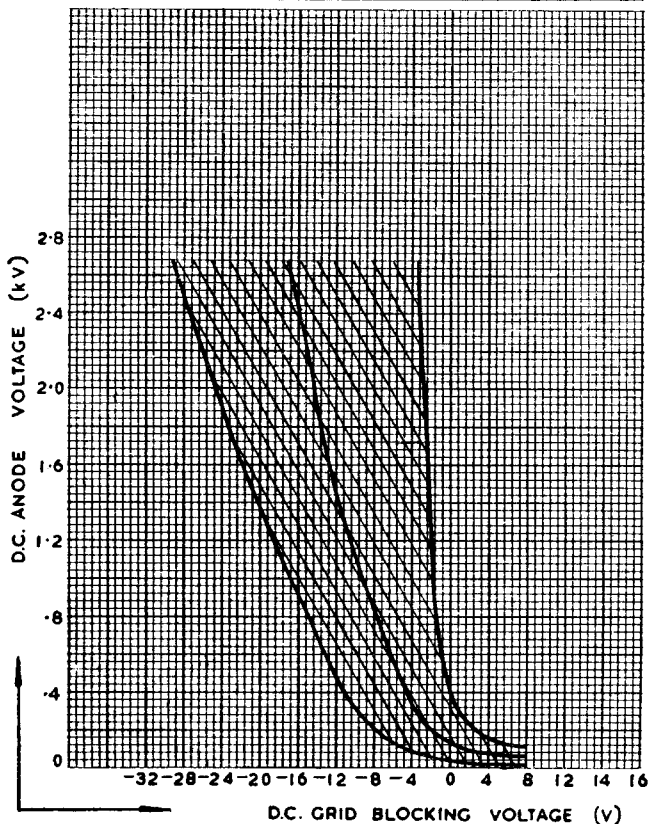
Ref.: 3V/490A

# Hot-Cathode Mercury- Vapour Thyatron



Code: 3V/490A

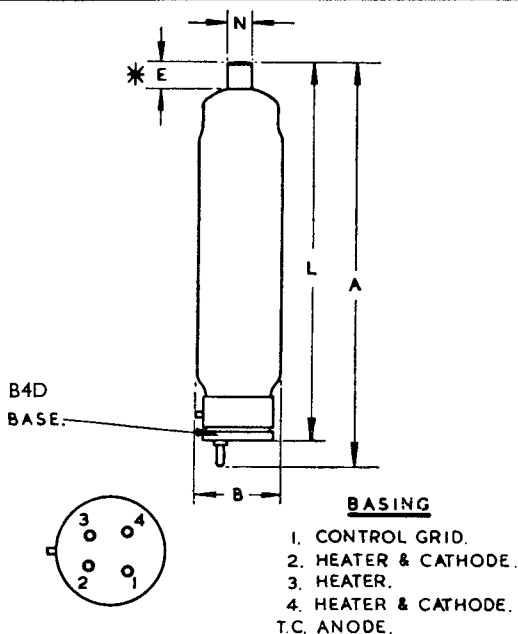
|          |                                                                         |          |
|----------|-------------------------------------------------------------------------|----------|
| 3V/490 A | TYPICAL CONTROL<br>CHARACTERISTICS. SHADED AREA<br>INDICATES THE SPREAD | Hg 35 °C |
| VL 1897  |                                                                         |          |





# Hot-Cathode Mercury- Vapour Thyatron

Code: 3V/490A



| DIM. | MILLIMETRES      | INCHES                  |
|------|------------------|-------------------------|
| A    | 292.1 MAX.       | 11 $\frac{1}{2}$ MAX.   |
| B    | 66.7 MAX.        | 2 $\frac{5}{8}$ MAX.    |
| L    | 274.6 MAX.       | 10 $\frac{13}{16}$ MAX. |
| N    | 20.32 $\pm$ 0.25 | 0.800 $\pm$ 0.010       |
| E    | 17.5 MIN.        | 1 $\frac{1}{16}$ MIN.   |

**NOTE:** BASIC FIGURES ARE INCHES.

**\*DENOTES** CONTACT LENGTH  
OF 'N' DIA



# Hot-Cathode Mercury- Vapour Thyatron

Code: 4049GD

## CATHODE

Oxide-coated, shielded filament

|                              |    |      |
|------------------------------|----|------|
| Filament voltage             | 4  | V    |
| Nominal current              | 11 | A    |
| Minimum cathode heating time | 1  | min← |

## DIRECT INTERELECTRODE CAPACITANCES

|                 |      |    |
|-----------------|------|----|
| Anode to grid   | 2.0  | pF |
| Grid to cathode | 15.0 | pF |

## MECHANICAL DATA

|                        |                      |    |
|------------------------|----------------------|----|
| Maximum overall length | 279.4                | mm |
| Maximum bulb diameter  | 63                   | mm |
| Base                   | Large 4-pin bayonet  |    |
| Socket                 | 4009C or 4039A       |    |
| Net weight             | 250                  | g  |
| Mounting position      | Vertical, base down← |    |

# Hot-Cathode Mercury- Vapour Thyatron



Code: 4049GD

## MAXIMUM RATINGS

|                                                                             |          |     |
|-----------------------------------------------------------------------------|----------|-----|
| Maximum peak inverse voltage                                                | 20       | kV  |
| Maximum peak anode current                                                  | 5        | A   |
| Maximum average anode current                                               | 1.25     | A   |
| Maximum fault anode current                                                 | 25       | A   |
| Maximum duration of fault anode current                                     | 0.1      | sec |
| Maximum peak grid current                                                   | 1.0      | A   |
| Maximum average grid current                                                | 0.25     | A   |
| Recommended maximum grid circuit<br>resistance                              | 50       | kΩ  |
| Maximum volt drop                                                           | 16       | V   |
| Maximum condensed mercury<br>temperature range (with forced<br>ventilation) | 20 to 65 | °C  |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

## CATHODE HEATING TIME

| Ambient Temperature        | 10 to 20°C | 20°C and above |
|----------------------------|------------|----------------|
| Minimum pre-heating period | 2 minutes  | 1 minute       |

After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied, so that the mercury may be distributed correctly.

Before putting a valve of this type into service, it is recommended that reference be made to General Information Section K in the front of this handbook.



# Hot-Cathode Mercury- Vapour Thyatron

Code: 4049GD

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY TEMPERATURE.

|                          |             |             |
|--------------------------|-------------|-------------|
| Natural Ventilation ...  | 20 to 55°C  | 20 to 40°C  |
| Forced Ventilation ...   | 20 to 65°C  | 20 to 55°C  |
| Peak Inverse Voltage ... | Up to 10 kV | Up to 20 kV |

The temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation. Forced air cooling is recommended, and is required for operation up to the limit of condensed mercury temperature.

## THYRATRON OPERATION.

With a condensed mercury temperature of 35°C the minimum values of grid blocking voltage to prevent ignition are :

| Anode Voltage | Grid Voltage |
|---------------|--------------|
| 15000 V       | —4.5 V       |
| 10000 V       | —3.0 V       |
| 5000 V        | —1.5 V       |
| 1000 V        | +1 V         |

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition and a positive firing pulse of 20 to 30 volts peak applied.

The pulse should have a leading edge as near vertical as possible and the grid circuit should be of high enough impedance to limit the grid current to the safe value.

Control of the output may be affected by varying the phase of the grid voltage with respect to the applied anode voltage.

# Hot-Cathode Mercury- Vapour Thyatron



Code: 4049GD

## TYPICAL OPERATING CONDITIONS.

| Circuit                                     | No. of Valves | Maximum A.C. Input Voltage (r.m.s.) | Maximum D.C. Output Voltage (Volts) | Maximum D.C. Output Current (Amperes) |
|---------------------------------------------|---------------|-------------------------------------|-------------------------------------|---------------------------------------|
| Single-Phase Full Wave Circuit No. 1        | 2             | 7000                                | 6300                                | 2.5                                   |
| Single-Phase Full Wave Bridge Circuit No. 2 | 4             | 14000                               | 12600                               | 2.5                                   |
| Three-Phase Half Wave Circuit No. 3         | 3             | 8150                                | 9550                                | 3.75                                  |
| Three-Phase Double Y Parallel Circuit No. 4 | 6             | 8150                                | 9550                                | 7.5                                   |
| Three-Phase Full Wave Circuit No. 5         | 6             | 8150                                | 19100                               | 3.75                                  |

The above tables suitable circuits for this thyatron and shows the safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

This thyatron being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer secondary winding.

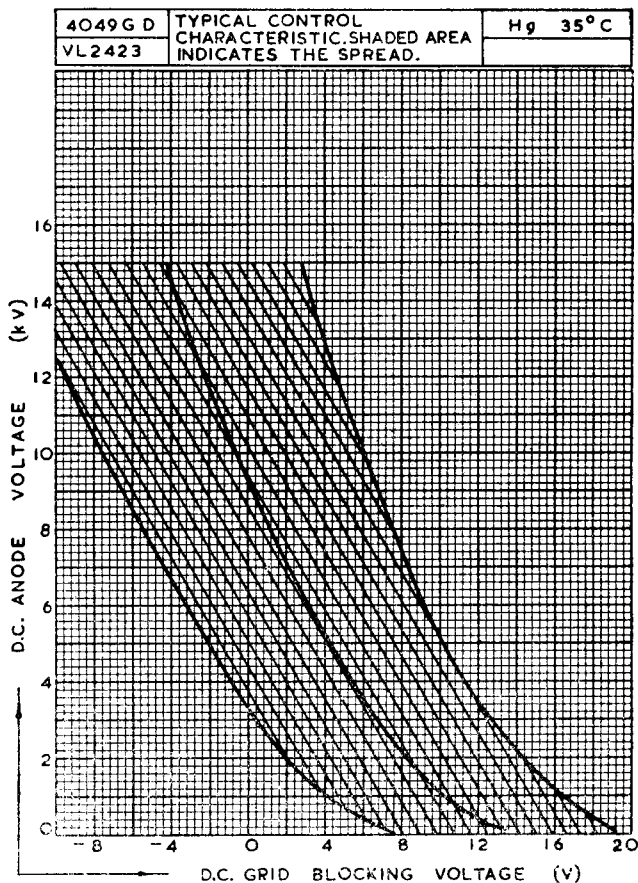
For details of the circuits referred to see sheet K—8 in the introduction to this handbook.





# Hot-Cathode Mercury- Vapour Thyatron

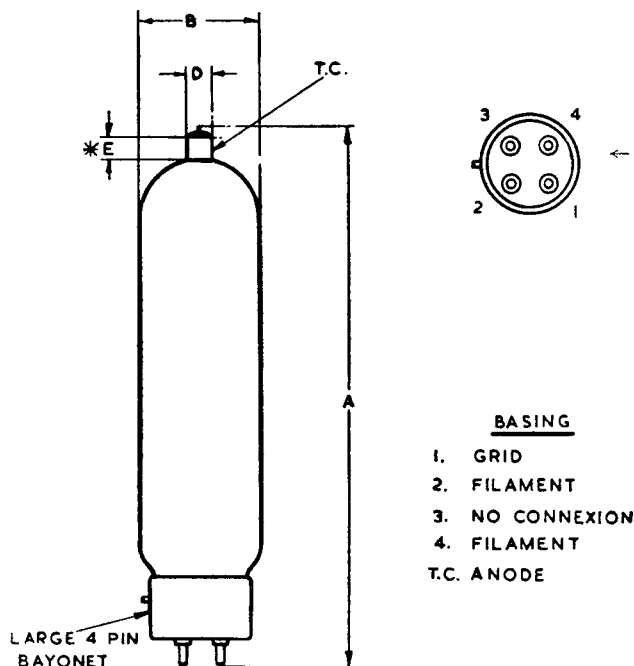
Code: 4049GD



# Hot-Cathode Mercury-Vapour Thyatron



Code: 4049GD



| DIM | MILLIMETRES        | INCHES                                        |
|-----|--------------------|-----------------------------------------------|
| A   | 279.4 MAX          | 11 MAX.                                       |
| B   | 63 MAX.<br>55 MIN. | $2\frac{15}{32}$ MAX.<br>$2\frac{5}{32}$ MIN. |
| E*  | 10.3 MIN           | $\frac{13}{32}$ MIN                           |
| D   | $14.30 \pm 0.25$   | $0.562 \pm 0.010$                             |

NOTE:- BASIC FIGURES ARE INCHES.  
\* DENOTES:- CONTACT LENGTH.



**3V/530E**  
**(4078GA)**

# Hot Cathode Mercury Vapour Thyatron

## 4078GA

---

### CATHODE.

Oxide-coated shielded filament

|                 |    |   |
|-----------------|----|---|
| Voltage         | 5  | V |
| Nominal current | 20 | A |

### DIMENSIONS.

|                        |                |              |
|------------------------|----------------|--------------|
| Maximum overall length | 435            | mm.          |
| Maximum bulb diameter  | 158            | mm.          |
| Net weight             | 925            | g.           |
| Base.                  | Special 3 pin. | See Drawing. |
| Top cap.               | Special.       | See Drawing. |

### MAXIMUM RATINGS.

|                                                                |                             |   |
|----------------------------------------------------------------|-----------------------------|---|
| Maximum peak inverse voltage                                   | 20,000                      | V |
| Maximum peak anode current                                     | 10                          | A |
| Maximum average anode current                                  | 2.5                         | A |
| Condensed mercury temperature<br>range with forced ventilation | 15° C. to 65° C.<br>maximum |   |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

### MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

|                      |                    |                   |                    |                       |
|----------------------|--------------------|-------------------|--------------------|-----------------------|
| Natural Ventilation  | { 15° C. to 50° C. | 15° C. to 40° C.  | —                  | —                     |
| Forced Ventilation   | { 15° C. to 65° C. | 15° C. to 55° C.  | 15° C. to 45° C.   | 15° C. to 40° C.      |
| Peak inverse voltage | Less than 7,000 V  | 7,500 to 10,000 V | 10,000 to 12,500 V | Greater than 12,500 V |

**3V/530E**

# **(4078GA) Hot Cathode Mercury Vapour Thyatron 4078GA**



## **TYPICAL OPERATING CONDITIONS**

| Circuit No. | No. of Valves | Maximum D.C.<br>Output volts | Maximum D.C.<br>Output Amps |
|-------------|---------------|------------------------------|-----------------------------|
| 2           | 2             | 6,400 V                      | 6 A                         |
| 3           | 4             | 13,000 V                     | 6 A                         |
| 4           | 3             | 9,500 V                      | 8 A                         |
| 5           | 6             | 9,500 V                      | 15 A                        |
| 6           | 6             | 18,500 V                     | 8 A                         |

## **THYRATRON OPERATION.**

With a condensed mercury temperature of 35° C. the minimum values of grid blocking voltages to prevent ignition are :

| Grid voltage (approximately) | Anode voltage |
|------------------------------|---------------|
| —0.5 V                       | 2 kV          |
| —15 V                        | 16 kV         |

To strike the valve the grid should be pulsed positive.

The pulse should have a leading edge as near vertical as possible. The control of the output is made by variation in phase of the grid pulse relative to the phase of the applied anode voltage.

This thyatron being directly heated, the output circuit must be connected to the mid-point of the filament transformer secondary.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

## **CATHODE HEATING TIME.**

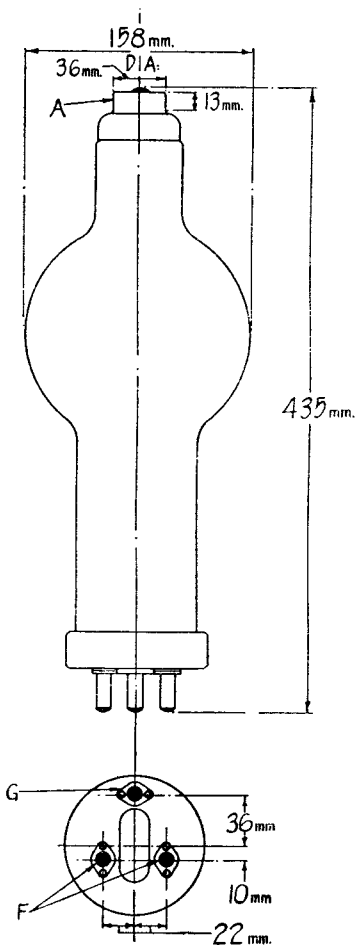
| Ambient Temperature           | 10° C. to<br>15° C. | 15° C. to<br>20° C. | 20° C. and<br>above |
|-------------------------------|---------------------|---------------------|---------------------|
| Minimum pre-heating<br>period | 30 minutes          | 15 minutes          | 5 minutes           |

After shipment or transit the valve must be pre-heated not less than 30 mins. before any voltage is applied so that the mercury may be distributed correctly.

**NOTE.**—Before putting a valve of this type into service it is recommended that reference be made to the General Information sheet K.



**Hot Cathode Mercury** 3V/530E  
**Vapour Thyatron** (4078GA)  
**4078GA**



3V/530E  
(4078GA)

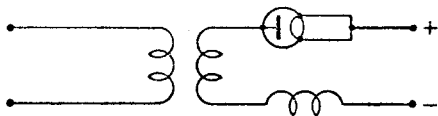
# Hot Cathode Mercury Vapour Thyatron

## 4078GA

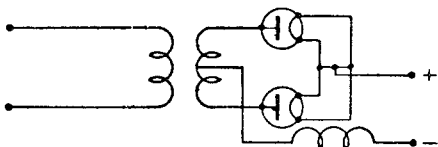


Circuit  
No.

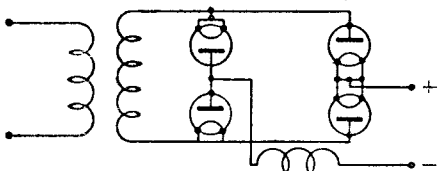
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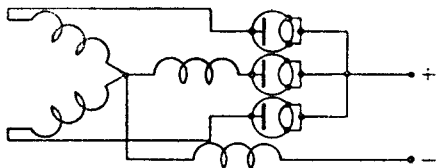
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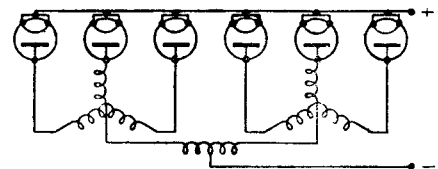
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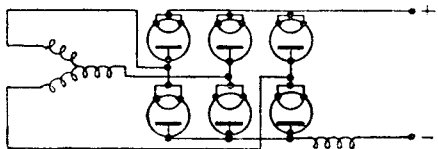
4



5



6





# Hot-Cathode Mercury-Vapour Thyatron

Code: 3V/531E

This thyatron is equivalent to, and replaces, the 4078GA type, which is now obsolete.

## CATHODE.

|                                                                            |    |       |
|----------------------------------------------------------------------------|----|-------|
| Oxide-coated, shielded filament                                            |    |       |
| Filament voltage                                                           | 5  | V     |
| Nominal current                                                            | 20 | A     |
| Minimum cathode heating time (ambient temperature $> 20^{\circ}\text{C}$ ) | 1  | min ← |

## DIRECT INTERELECTRODE CAPACITANCES.

|                  |    |    |
|------------------|----|----|
| Anode to grid    | 20 | pF |
| Grid to filament | 70 | pF |

## MECHANICAL DATA.

|                         |                             |    |
|-------------------------|-----------------------------|----|
| Maximum overall length  | 435                         | mm |
| Maximum bulb diameter   | 95.3                        | mm |
| Base                    | Special 3-pin (see drawing) |    |
| Top cap                 | Special (see drawing)       |    |
| Socket                  | 4022D                       |    |
| Net weight              | 925                         | g  |
| Shipping weight approx. | 9.5                         | kg |
| Shipping dimensions     | 14 × 14 × 29                | in |

## MAXIMUM RATINGS.

### FILAMENT EXCITATION

|  | In phase | In quadrature |  |
|--|----------|---------------|--|
|--|----------|---------------|--|

|                                             |          |     |     |
|---------------------------------------------|----------|-----|-----|
| Maximum peak inverse voltage                | 20       | 20  | kV  |
| Maximum peak anode current                  | 10       | 20  | A   |
| Maximum average anode current               | 2.5      | 5.0 | A   |
| Maximum fault anode current                 | 50       | 50  | A   |
| Maximum duration of fault anode current     | 0.1      | 0.1 | sec |
| Maximum peak grid current                   | 1.0      | 1.0 | A   |
| Maximum average grid current                | 200      | 200 | mA  |
| Recommended maximum grid circuit resistance | 75       | 75  | kΩ  |
| Maximum voltage drop                        | 16       | 16  | V   |
| Maximum condensed mercury temperature range | 15 to 65 |     | °C  |

# **Hot-Cathode Mercury- Vapour Thyatron**

**Code: 3V/531E**

The previous ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

## **CATHODE HEATING TIME.**

|                            |            |                |
|----------------------------|------------|----------------|
| Ambient Temperature        | 10 to 20°C | 20°C and above |
| Minimum pre-heating period | 2 minutes  | 1 minute       |

## **THYRATRON OPERATION.**

With a condensed mercury temperature of 35°C the minimum values of grid blocking voltage to prevent ignition are :

|               |              |
|---------------|--------------|
| Anode Voltage | Grid Voltage |
| 2.0 kV        | -4 V         |
| 16 kV         | -15 V        |

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition, and a positive firing pulse of 20 to 30 volts peak applied.

The pulse should have a leading edge as near vertical as possible and the grid circuit should be of high enough impedance to limit the grid current. The control of the output may be affected by varying the phase of the grid pulse relative to the phase of the applied anode voltage.





# Hot-Cathode Mercury- Vapour Thyatron

Code: 3V/531E

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY VAPOUR TEMPERATURES.

|                            |                        |                       |                        |                            |
|----------------------------|------------------------|-----------------------|------------------------|----------------------------|
| Natural<br>Ventilation     | 15 to 50°C             | 15 to 40°C            | —                      | —                          |
| Forced<br>Ventilation      | 15 to 65°C             | 15 to 55°C            | 15 to 45°C             | 15 to 40°C                 |
| Peak<br>Inverse<br>Voltage | Less<br>than<br>7500 V | 7500<br>to<br>10000 V | 10000<br>to<br>12500 V | Greater<br>than<br>12500 V |

After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly.

The temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation. Forced air cooling is recommended and is required for operation up to the limit of condensed mercury temperature.

Before putting a valve of this type into service it is recommended that reference be made to the General Information Section K in the front of the valve handbook.

# Hot-Cathode Mercury- Vapour Thyatron

Code: 3V/531E



## TYPICAL OPERATING CONDITIONS.

| Circuit                                     | No. of Valves | Maximum A.C. Input Voltage (r.m.s.) | Maximum D.C. Output Voltage (Volts) | Maximum D.C. Output Current (Amperes) |
|---------------------------------------------|---------------|-------------------------------------|-------------------------------------|---------------------------------------|
| Single-Phase Full Wave Circuit No. 1        | 2             | 7000                                | 6300                                | 5*                                    |
|                                             |               | 7000                                | 6300                                | 10†                                   |
| Single-Phase Full Wave Bridge Circuit No. 2 | 4             | 14000                               | 12600                               | 5*                                    |
|                                             |               | 14000                               | 12600                               | 10†                                   |
| Three-Phase Half Wave Circuit No. 3         | 3             | 8150                                | 9550                                | 7.5*                                  |
|                                             |               | 8150                                | 9550                                | 15†                                   |
| Three-Phase Double Y Parallel Circuit No. 4 | 6             | 8150                                | 9550                                | 15*                                   |
|                                             |               | 8150                                | 9550                                | 30†                                   |
| Three-Phase Full Wave Circuit No. 5         | 6             | 8150                                | 19100                               | 7.5*                                  |
|                                             |               | 8150                                | 19100                               | 15†                                   |

\* Filament excitation in phase with anode.

† Filament excitation in quadrature with anode.

The above, tables suitable circuits for this thyatron, and shows the safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

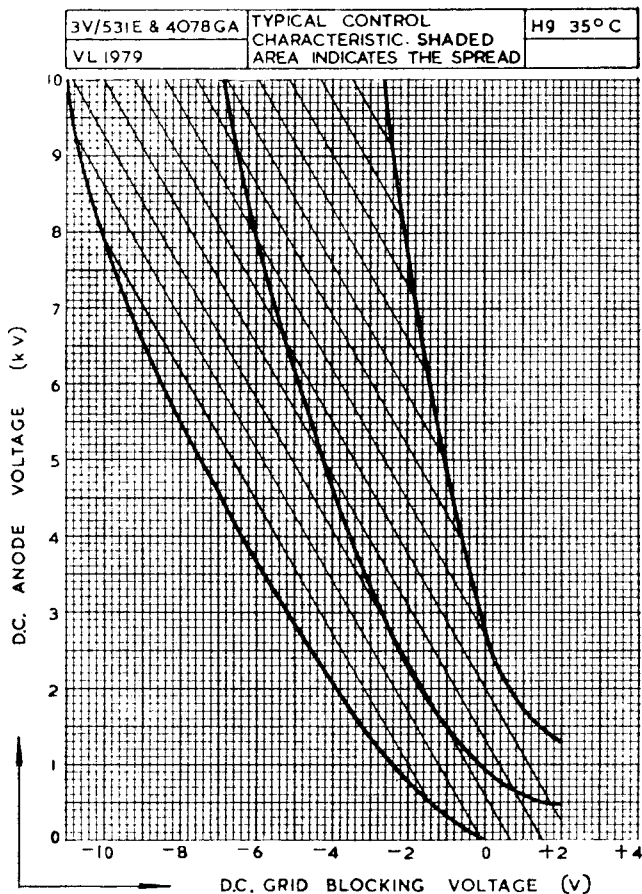
This thyatron being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer secondary winding.

For details of the circuits referred to see sheet K—8 in the introduction to this handbook.



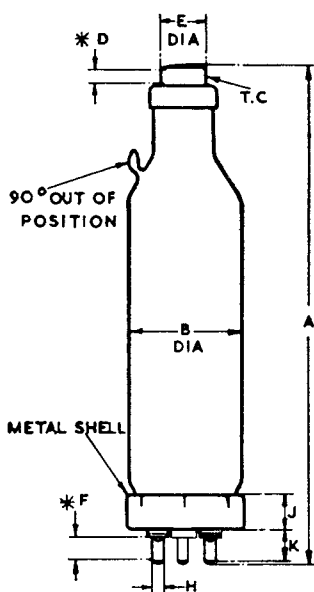
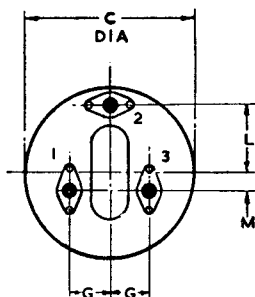
# Hot-Cathode Mercury- Vapour Thyatron

Code: 3V/531E



# Hot-Cathode Mercury-Vapour Thyatron

Code: 3V/531E



## BASING

- 1 FILAMENT  
2 GRID  
3 FILAMENT  
T.C. ANODE

## NOTE:—

GRID PIN  
CONNECTED TO METAL  
SHELL.

| DIM                              | MILLIMETRES      | INCHES                                 | DIM | MILLIMETRES      | INCHES                 |
|----------------------------------|------------------|----------------------------------------|-----|------------------|------------------------|
| A                                | 435 MAX          | 17 $\frac{1}{8}$ MAX                   | F   | 23.80 $\pm$ 0.51 | 0.937 $\pm$ 0.020      |
| B                                | 95.3 MAX         | 3 $\frac{3}{4}$ MAX.                   | G   | 22.00 $\pm$ 0.25 | 0.866 $\pm$ 0.010      |
| C                                | 96.04 $\pm$ 0.4  | 3 $\frac{25}{32}$ $\pm$ $\frac{1}{64}$ | H   | 9.53 $\pm$ 0.05  | 0.375 $\pm$ 0.002      |
| D                                | 10.0 MIN         | 0.393 MIN                              | J   | 25.4 $\pm$ 0.4   | 1 $\pm$ $\frac{1}{64}$ |
| E                                | 36.00 $\pm$ 0.25 | 1.418 $\pm$ 0.010                      | K   | 28.57 $\pm$ 0.51 | 1.125 $\pm$ 0.020      |
| NOTE:— BASIC FIGURES ARE INCHES. |                  |                                        |     |                  |                        |
| * DENOTES:— CONTACT LENGTH       |                  |                                        |     |                  |                        |
| L                                | 36.00 $\pm$ 0.25 | 1.417 $\pm$ 0.010                      | M   | 10.00 $\pm$ 0.25 | 0.393 $\pm$ 0.010      |



**3V/560E**  
**(4079GA)**

# Hot Cathode Mercury Vapour Thyatron

## 4079GA

---

### CATHODE.

Oxide-coated shielded filament.

|                 |    |   |
|-----------------|----|---|
| Voltage         | 5  | V |
| Nominal current | 38 | A |

### DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 544 | mm. |
| Maximum bulb diameter  | 196 | mm. |
| Net weight             | 1.9 | kg. |

|          |                |              |
|----------|----------------|--------------|
| Base.    | Special 3 pin. | See drawing. |
| Top cap. | Special.       | See drawing. |

### MAXIMUM RATINGS.

|                                                                |                             |   |
|----------------------------------------------------------------|-----------------------------|---|
| Maximum peak inverse voltage                                   | 20,000                      | V |
| Maximum peak anode current                                     | 20                          | A |
| Maximum average anode current                                  | 7.5                         | A |
| Condensed mercury temperature<br>range with forced ventilation | 15° C. to 65° C.<br>maximum |   |

The above ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

### MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

|                      |                    |                   |                    |                       |
|----------------------|--------------------|-------------------|--------------------|-----------------------|
| Natural Ventilation  | { 15° C. to 45° C. | 15° C. to 35° C.  | —                  | —                     |
| Forced Ventilation   | { 15° C. to 60° C. | 15° C. to 50° C.  | 15° C. to 40° C.   | 15° C. to 35° C.      |
| Peak inverse voltage | Less than 7,000 V  | 7,500 to 10,000 V | 10,000 to 12,500 V | Greater than 12,500 V |

**3V/560E****(4079GA) Hot Cathode Mercury****Vapour Thyatron****4079GA**

**TYPICAL OPERATING CONDITIONS**  
(for Ideal choke-input filter).

| Circuit No. | No. of Valves | Maximum D.C.<br>Output volts | Maximum D.C.<br>Output Current |
|-------------|---------------|------------------------------|--------------------------------|
| 2           | 2             | 6,400 V                      | 12.5 A                         |
| 3           | 4             | 13,000 V                     | 12.5 A                         |
| 4           | 3             | 9,500 V                      | 16 A                           |
| 5           | 6             | 9,500 V                      | 30 A                           |
| 6           | 6             | 18,500 V                     | 16 A                           |

**THYRATRON OPERATION.**

With a condensed mercury temperature of 35° C. the minimum values of grid blocking voltages to prevent ignition are :

Grid voltage (approximately)

Anode voltage

— 1  
— 20

2 kV  
16 kV

To strike the valve the grid should be pulsed positive.

The pulse should have a leading edge as near vertical as possible. The control of the output is made by variation of the phase of the grid pulse relative to the phase of the applied anode voltage.

This thyatron being directly heated, the output circuit must be connected to the mid-point of the filament transformer secondary.

**CATHODE HEATING TIME.**

|                          |   |                  |                  |                  |
|--------------------------|---|------------------|------------------|------------------|
| Ambient temperature      | { | 10° C. to 15° C. | 15° C. to 20° C. | 20° C. and above |
| Minimum pre-heating time |   | 30 minutes       | 15 minutes       | 5 minutes        |

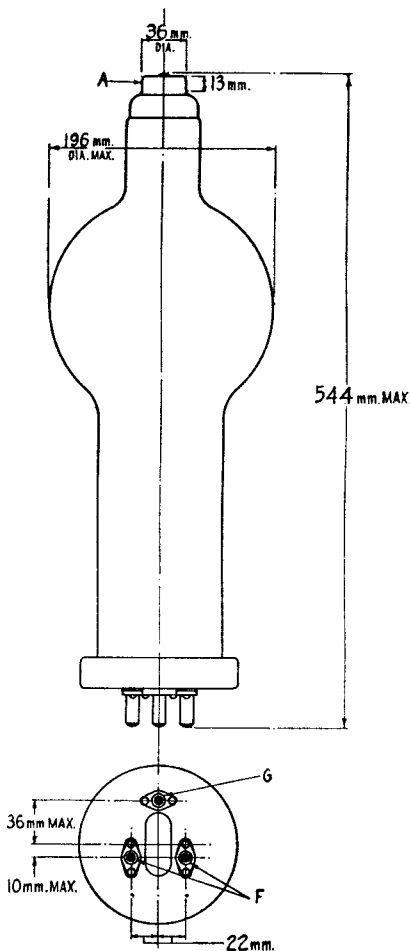
After shipment or transit the valve must be pre-heated not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly.

Temperature limits given under " Natural Ventilation " are only valid for unrestricted natural ventilation, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

**NOTE.**—Before putting a valve of this type into service it is recommended that reference be made to the General Information sheet K.



**Hot Cathode Mercury** **3V/560E**  
**Vapour Thyatron** **(4079GA)**  
**4079GA**



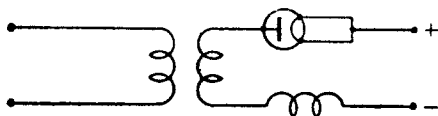
3V/560E  
(4079GA)

# Hot Cathode Mercury Vapour Thyatron

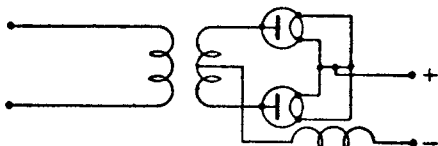
## 4079GA



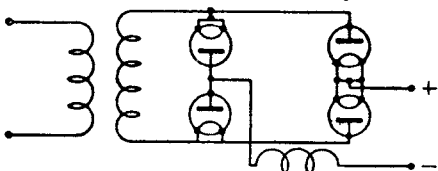
Circuit  
No.  
**1**



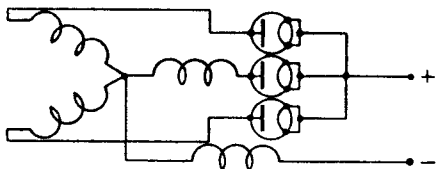
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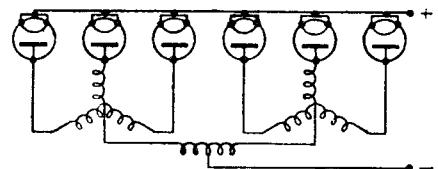
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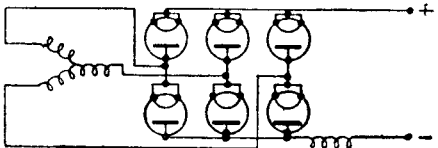
**4**



**5**



**6**







# Hot-Cathode Mercury-Vapour Thyatron

Code: 3V/561E

This thyatron is equivalent to, and replaces, the 4079GA type, which is now obsolete.

## CATHODE.

|                                                           |    |      |
|-----------------------------------------------------------|----|------|
| Oxide-coated, shielded filament                           |    |      |
| Filament voltage                                          | 5  | V    |
| Nominal current                                           | 40 | A    |
| Minimum cathode heating time (ambient temperature > 20°C) | 1  | min← |

## DIRECT INTERELECTRODE CAPACITANCES.

|                  |    |    |
|------------------|----|----|
| Anode to grid    | 9  | pF |
| Grid to filament | 65 | pF |

## MECHANICAL DATA.

|                          |                             |     |
|--------------------------|-----------------------------|-----|
| Maximum overall length   | 539.8                       | mm  |
| Maximum bulb diameter    | 133.4                       | mm  |
| Base                     | Special 3-pin (see drawing) |     |
| Socket                   | 4022D                       |     |
| Top cap                  | Special (see drawing)       |     |
| Net weight               | 2                           | kg  |
| Shipping weight, approx. | 13.5                        | kg← |
| Shipping dimensions      | 20 × 20 × 36                | in← |

## MAXIMUM RATINGS.

|                                             | In phase | In quadrature |     |
|---------------------------------------------|----------|---------------|-----|
| Maximum peak inverse voltage                | 20       | 20            | kV  |
| Maximum peak anode current                  | 20       | 40            | A   |
| Maximum average anode current               | 7.5      | 15            | A   |
| Maximum fault anode current                 | 125      | 125           | A   |
| Maximum duration of fault anode current     | 0.1      | 0.1           | sec |
| Maximum peak grid current                   | 1.5      | 1.5           | A   |
| Maximum average grid current                | 300      | 300           | mA  |
| Recommended maximum grid circuit resistance | 60       | 60            | kΩ  |
| Maximum voltage drop                        | 16       | 16            | V   |
| Maximum condensed mercury temperature range |          | 15 to 65      | °C  |

## FILAMENT EXCITATION

**Ref.: 3V/561E**

# **Hot-Cathode Mercury- Vapour Thyatron**



**Code: 3V/561E**

The previous ratings apply to operation with a choke input filter and a supply frequency of 50 c/s.

## **CATHODE HEATING TIME.**

| Ambient Temperature        | 10 to 20°C | 20°C and above |
|----------------------------|------------|----------------|
| Minimum pre-heating period | 2 minutes  | 1 minute       |

## **THYRATRON OPERATION.**

With a condensed mercury temperature of 35°C the minimum values of grid blocking voltage to prevent ignition are :

| Anode Voltage | Grid Voltage |
|---------------|--------------|
| 2.0 kV        | -3.5 V       |
| 16 kV         | -12 V        |

For positive operation it is recommended that for a given anode voltage the grid should be biased back beyond the value required to prevent ignition, and a positive firing pulse of 20 to 30 volts peak applied.

The pulse should have a leading edge as near vertical as possible and the grid circuit should be of high enough impedance to limit the grid current. The control of the output may be affected by varying the phase of the grid pulse relative to the phase of the applied anode voltage.



# Hot-Cathode Mercury- Vapour Thyatron

Code: 3V/561E

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS AND CONDENSED MERCURY-VAPOUR TEMPERATURES.

|                      |                  |                 |                  |                      |
|----------------------|------------------|-----------------|------------------|----------------------|
| Natural Ventilation  | 15 to 45°C       | 15 to 35°C      | —                | —                    |
| Forced Ventilation   | 15 to 60°C       | 15 to 50°C      | 15 to 45°C       | 15 to 40°C←          |
| Peak Inverse Voltage | Less than 7500 V | 7500 to 10000 V | 10000 to 12500 V | Greater than 12500 V |

After shipment or transit the valve must be pre-heated for not less than 30 minutes before any anode voltage is applied so that the mercury may be distributed correctly.

The temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation. Forced air cooling is recommended and is required for operation up to the limit of condensed mercury temperature.

Before putting a valve of this type into service it is recommended that reference be made to the General Information Section K in the front of the valve handbook.

# Hot-Cathode Mercury- Vapour Thyatron

Code: 3V/561E



## TYPICAL OPERATING CONDITIONS.

| Circuit                                     | No. of Valves | Maximum A.C. Input Voltage (r.m.s.) | Maximum D.C. Output Voltage (Volts) | Maximum D.C. Output Current (Amperes) |
|---------------------------------------------|---------------|-------------------------------------|-------------------------------------|---------------------------------------|
| Single-Phase Full Wave Circuit No. 1        | 2             | 7000                                | 6300                                | 12.5* ←                               |
|                                             |               | 7000                                | 6300                                | 25† ←                                 |
| Single-Phase Full Wave Bridge Circuit No. 2 | 4             | 14000                               | 12600                               | 12.5* ←                               |
|                                             |               | 14000                               | 12600                               | 25† ←                                 |
| Half Wave Three-Phase Circuit No. 3         | 3             | 8150                                | 9550                                | 18.75* ←                              |
|                                             |               | 8150                                | 9550                                | 37.5† ←                               |
| Three-Phase Double Y Parallel Circuit No. 4 | 6             | 8150                                | 9550                                | 37.5* ←                               |
|                                             |               | 8150                                | 9550                                | 75† ←                                 |
| Three-Phase Full Wave Circuit No. 5         | 6             | 8150                                | 19100                               | 18.75* ←                              |
|                                             |               | 8150                                | 19100                               | 37.5† ←                               |

\* Filament excitation in phase with anode.

† Filament excitation in quadrature with anode.

The above tables suitable circuits for this thyatron and shows the safe maximum input and output conditions. The values are based on sine wave input and the use of a suitable choke input filter.

This thyatron being directly heated, it is recommended that the output circuit be taken from the mid-point of the filament supply transformer secondary winding.

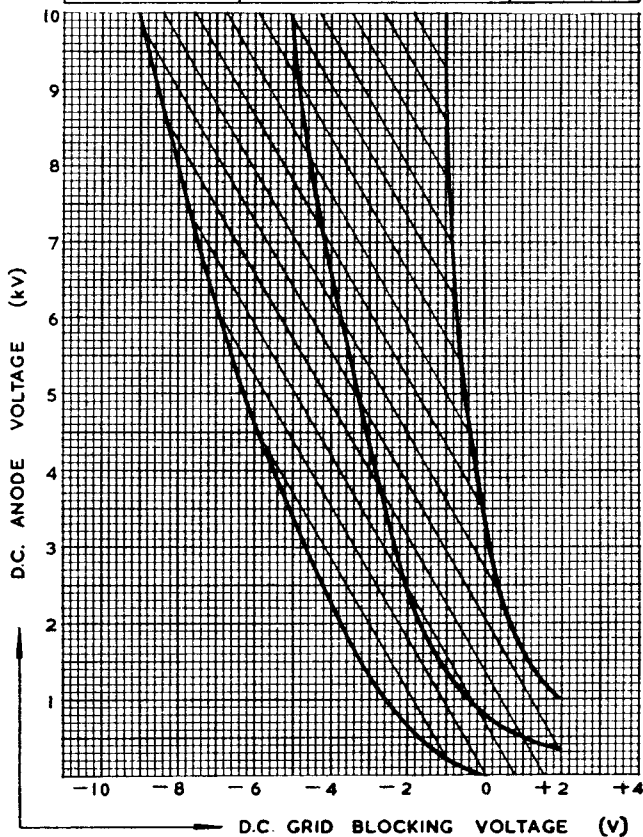
For details of the circuits referred to see sheet K—8 in the introduction to this handbook.



# Hot-Cathode Mercury-Vapour Thyatron

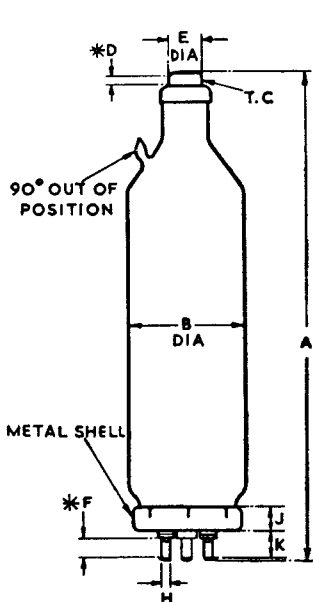
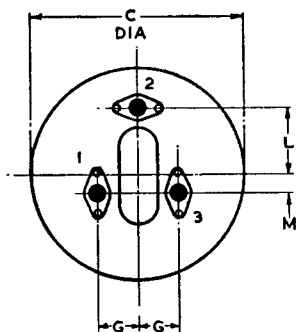
Code: 3V/561E

|                   |                                                                  |         |
|-------------------|------------------------------------------------------------------|---------|
| 3V/561E & 4079 GA | TYPICAL CONTROL CHARACTERISTIC. SHADED AREA INDICATES THE SPREAD | Hg 35°C |
| VL 1980           |                                                                  |         |



# Hot-Cathode Mercury-Vapour Thyatron

Code: 3V/561E

**BASING**

- 1 FILAMENT
- 2 GRID
- 3 FILAMENT
- T.C. ANODE

**NOTE:**

GRID PIN  
CONNECTED TO METAL  
SHELL.

| DIM                            | MILLIMETRES  | INCHES        | DIM | MILLIMETRES  | INCHES        |
|--------------------------------|--------------|---------------|-----|--------------|---------------|
| A                              | 539.8 MAX.   | 21 1/4 MAX.   | F   | 23.80 ± 0.51 | 0.937 ± 0.020 |
| B                              | 133.4 MAX.   | 5 1/4 MAX.    | G   | 22.00 ± 0.25 | 0.866 ± 0.010 |
| C                              | 117.5 ± 0.4  | 4 5/8 ± 1/64  | H   | 9.53 ± 0.05  | 0.375 ± 0.002 |
| D                              | 10.0 MIN     | 0.393 MIN     | J   | 25.4 ± 0.4   | 1 ± 1/64      |
| E                              | 36.00 ± 0.25 | 1.418 ± 0.010 | K   | 28.57 ± 0.51 | 1.125 ± 0.020 |
| NOTE: BASIC FIGURES ARE INCHES |              |               | L   | 36.00 ± 0.25 | 1.417 ± 0.010 |
| * DENOTES:—CONTACT LENGTH      |              |               | M   | 10.00 ± 0.25 | 0.393 ± 0.010 |



**3V/590E**  
**(4080GA)**

# Hot Cathode Mercury Vapour Thyatron

**4080GA**

---

## CATHODE.

Oxide coated shielded filament.

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 5   | V |
| Nominal current | 100 | A |

## DIMENSIONS.

|                        |                |              |
|------------------------|----------------|--------------|
| Maximum overall length | 685            | mm.          |
| Maximum bulb diameter  | 266            | mm.          |
| Net weight             | 4              | kg.          |
| Base.                  | Special 3 pin. | See drawing. |
| Top cap.               | Special.       | See drawing. |

## MAXIMUM RATINGS.

|                               |        |   |
|-------------------------------|--------|---|
| Maximum peak inverse voltage  | 16,000 | V |
| Maximum peak anode current    | 50     | A |
| Maximum average anode current | 20     | A |

Condensed mercury temperature  
range with forced air cooling      15° C. to 60° C.  
maximum

The above ratings apply to operation with a choke  
input filter and a supply frequency of 50 c/s.

## MAXIMUM PEAK INVERSE VOLTAGE RATINGS.

|                         |                      |                      |                       |                          |
|-------------------------|----------------------|----------------------|-----------------------|--------------------------|
| Natural<br>Ventilation  | 15° C. to<br>45° C.  | 15° C. to<br>35° C.  | —                     | —                        |
| Forced<br>Ventilation   | 15° C. to<br>60° C.  | 15° C. to<br>50° C.  | 15° C. to<br>40° C.   | 15° C. to<br>35° C.      |
| Peak inverse<br>voltage | Less than<br>7,500 V | 7,500 to<br>10,000 V | 10,000 to<br>12,500 V | Greater than<br>12,500 V |

**3V/590E  
(4080GA)**

# **Hot Cathode Mercury Vapour Thyatron 4080GA**



## **TYPICAL OPERATING CONDITIONS. (for ideal choke-input filter).**

| Circuit No. | No. of Valves | Maximum D.C.<br>Output volts | Maximum D.C.<br>Output current |
|-------------|---------------|------------------------------|--------------------------------|
| 2           | 2             | 5,000 V                      | 31 A                           |
| 3           | 4             | 10,000 V                     | 31 A                           |
| 4           | 3             | 7,500 V                      | 38 A                           |
| 5           | 6             | 7,500 V                      | 76 A                           |
| 6           | 6             | 15,000 V                     | 47 A                           |

## **THYRATRON OPERATION.**

With a condensed mercury temperature of 35° C. the minimum values of grid blocking voltages to prevent ignition are :

| Grid voltage (approximately) | Anode volts |
|------------------------------|-------------|
| —1                           | 1 kV        |
| —20 V                        | 16 kV       |

To strike the valve the grid should be pulsed positive. The pulse should have a leading edge as near vertical as possible. The control of the output is made by variation of the phase of the grid pulse relative to the phase of the applied grid voltage.

This thyatron being directly heated, the output circuit must be connected to the mid-point of the filament transformer secondary

## **CATHODE HEATING TIME.**

|                         |               |                     |
|-------------------------|---------------|---------------------|
| Ambient Temperature     | 15° to 20° C. | 20° C. and<br>above |
| Min. Pre-heating period | 30 min.       | 10 min.             |

After shipment or transit the valve must be preheated not less than 30 min. before any anode voltage is applied so that the mercury may be distributed correctly.

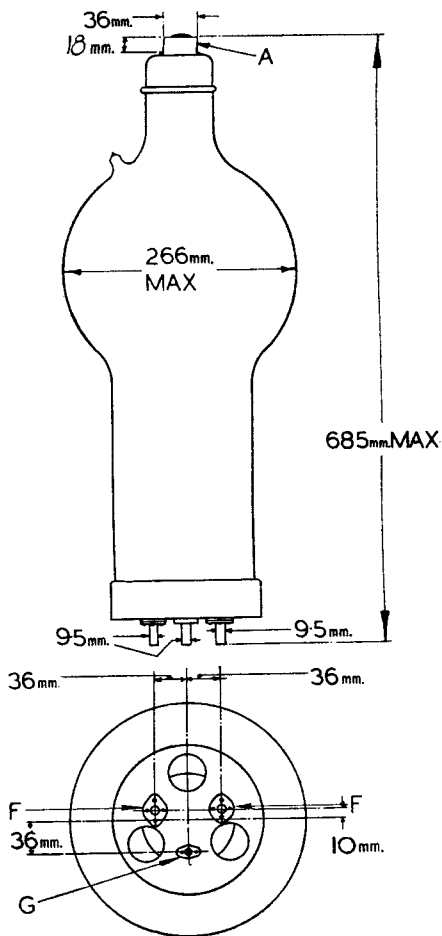
Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

**NOTE.**—Before putting a valve of this type into service it is recommended that reference be made to the General Information Sheet K.





**Hot Cathode Mercury** **3V/590E**  
**Vapour Thyatron** **(4080GA)**  
**4080GA**



3V/590E

(4080 GA)

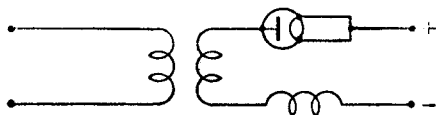
# Hot Cathode Mercury Vapour Thyatron

4080GA

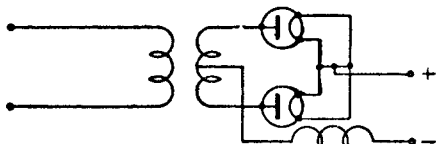


Circuit  
No.

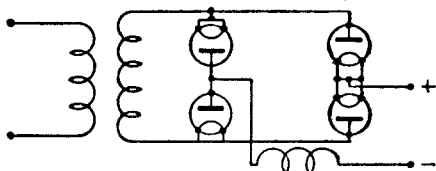
1



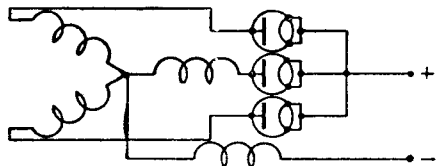
2



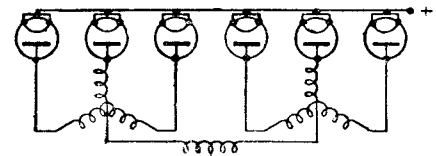
3



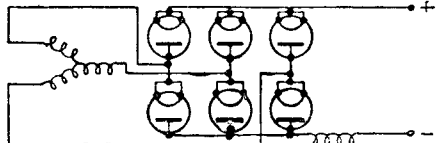
4



5



6





# Coplanar-Grid Tetrode

4045A

4A/137B  
(4045A)

## CATHODE.

Oxide-coated filament

|         |   |   |
|---------|---|---|
| Voltage | 5 | V |
|---------|---|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal current | 1.6 | A |
|-----------------|-----|---|

## RATING.

|                      |                                                                        |     |  |
|----------------------|------------------------------------------------------------------------|-----|--|
| Amplification factor | { Measured at<br>Va 145V Vg <sub>2</sub> 70V<br>Vg <sub>1</sub> -60V } | 5.3 |  |
| Impedance            |                                                                        |     |  |

## INTER-ELECTRODE CAPACITIES.

|               |     |    |
|---------------|-----|----|
| Grid to anode | 3.8 | pF |
|---------------|-----|----|

|       |    |    |
|-------|----|----|
| Input | 18 | pF |
|-------|----|----|

|        |     |    |
|--------|-----|----|
| Output | 9.4 | pF |
|--------|-----|----|

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 165 | mm. |
|------------------------|-----|-----|

|                       |    |     |
|-----------------------|----|-----|
| Maximum bulb diameter | 63 | mm. |
|-----------------------|----|-----|

|      |                        |  |
|------|------------------------|--|
| Base | Standard British 5-pin |  |
|------|------------------------|--|

|            |     |    |
|------------|-----|----|
| Net weight | 100 | g. |
|------------|-----|----|

## MAXIMUM RATINGS.

|                              |     |   |
|------------------------------|-----|---|
| Maximum direct anode voltage | 250 | V |
|------------------------------|-----|---|

|                              |    |    |
|------------------------------|----|----|
| Maximum direct anode current | 45 | mA |
|------------------------------|----|----|

|                                                                  |     |   |
|------------------------------------------------------------------|-----|---|
| Maximum potential difference between<br>screen and control grids | 150 | V |
|------------------------------------------------------------------|-----|---|

|                                                                      |    |   |
|----------------------------------------------------------------------|----|---|
| Maximum control grid potential on<br>positive swing of input voltage | 10 | V |
|----------------------------------------------------------------------|----|---|

It is recommended that the valve be operated in a vertical position. When operated horizontally the plane of the filament must be vertical.

**4A/137B  
(4045A)**

# Coplanar-Grid Tetrode

**4045A**



## TYPICAL OPERATING CONDITIONS.

|                                  |       |       |       |       |       |       |       |       |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Anode voltage (volts)            | 130   | 130   | 130   | 130   | 130   | 180   | 180   | *250  |
| Control grid voltage (volts)     | -40   | -60   | -40   | -60   | -40   | -50   | -65   | -70   |
| Positive grid voltage (volts)    | 43    | 63    | 53    | 72    | 59    | 55    | 70    | 65    |
| Anode current (mA)               | 25    | 25    | 35    | 35    | 45    | 40    | 40    | 45    |
| Positive grid current (mA)       | 0.2   | 0.4   | 0.4   | 0.7   | 0.9   | 0.3   | 0.4   | 0.2   |
| Amplification factor             | 5.1   | 5.0   | 5.0   | 5.0   | 5.1   | 5.2   | 5.2   | 5.2   |
| Anode resistance (ohms)          | 3,700 | 4,000 | 3,200 | 3,400 | 2,900 | 3,400 | 3,600 | 3,600 |
| Load resistance (ohms)           | 5,000 | 3,000 | 4,000 | 2,000 | 2,800 | 5,000 | 3,500 | 5,000 |
| Input peak volts                 | 40    | 60    | 40    | 60    | 40    | 50    | 65    | 70    |
| Fundamental power output (watts) | 1.1   | 2.0   | 1.2   | 2.2   | 1.4   | 2.1   | 3.3   | 4.2   |
| 2nd harmonic (db)                | 29    | 21    | 33    | 21    | 30    | 30    | 26    | 26    |

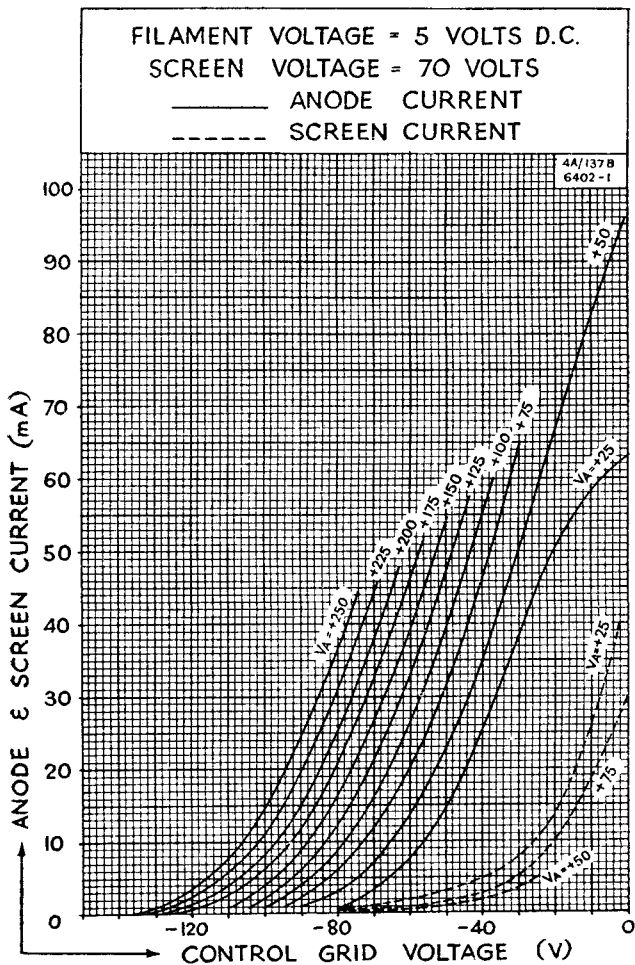
\* Maximum operating condition.



# Coplanar-Grid Tetrode

4045A

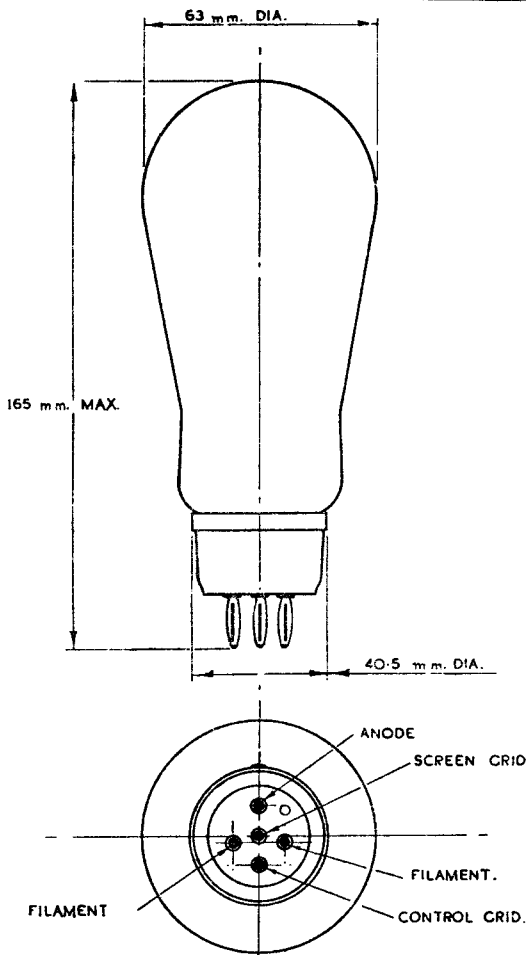
4A/137B  
(4045A)



4A/137B  
(4045A)

# Coplanar-Grid Tetrode

4045A





# Hot-Cathode Gas-Filled Miniature Thyatron

Code: 2D21 (CV797) ←

The 2D21 is a miniature tetrode-type, inert-gas-filled thyatron. It is directly equivalent to the U.S.A. 2D21 type.

## CATHODE

Indirectly-heated, oxide-coated

|                               |     |     |
|-------------------------------|-----|-----|
| Heater voltage                | 6.3 | V   |
| Nominal current               | 0.6 | A   |
| Cathode heating time, minimum | 10  | sec |

## DIRECT INTERELECTRODE CAPACITANCES

|               |       |    |
|---------------|-------|----|
| Grid to anode | 0.026 | pF |
| Input         | 2.4   | pF |
| Output        | 1.6   | pF |

## CHARACTERISTICS

|                                               |                                                                                                                                                            |     |                 |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------|
| Ionization time, approx.                      | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a 100 \text{ V} : V_{g1} + 50 \text{ V} \dagger \\ I_a \text{ pk } 0.5 \text{ A} \end{array} \right\}$   | 0.5 | $\mu\text{sec}$ |
| Deionization time, approx.                    | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a 125 \text{ V} : V_{g1} - 100 \text{ V} \\ R_{g1} 1000 \Omega : I_a 0.1 \text{ A} \end{array} \right\}$ | 35  | $\mu\text{sec}$ |
|                                               | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a 125 \text{ V} : V_{g1} - 10 \text{ V} \\ R_{g1} 1000 \Omega : I_a 0.1 \text{ A} \end{array} \right\}$  | 75  | $\mu\text{sec}$ |
| Critical grid current, max.                   | $\left\{ \begin{array}{l} \text{With } V_a 460 \text{ V r.m.s.} \\ I_a \text{ av } 0.1 \text{ A} \end{array} \right\}$                                     | 0.5 | $\mu\text{A}$   |
| Voltage drop, approx.                         | 8                                                                                                                                                          | V   |                 |
| Control grid                                  |                                                                                                                                                            |     |                 |
| Control Ratio, approx. ( $R_{g1} = 0\Omega$ ) | 250                                                                                                                                                        |     |                 |
| Screen grid                                   |                                                                                                                                                            |     |                 |
| Control Ratio, approx. ( $R_{g2} = 0\Omega$ ) | 1000                                                                                                                                                       |     |                 |

## MECHANICAL DATA

|                        |              |    |
|------------------------|--------------|----|
| Maximum overall length | 54           | mm |
| Maximum seated height  | 47.6         | mm |
| Maximum diameter       | 19.1         | mm |
| Base                   | B7G          |    |
| Net weight             | 8            | g  |
| Mounting position      | Unrestricted |    |

# Hot-Cathode Gas-Filled Miniature Thyatron



Code: 2D2I (CV797) ←

## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

### Maximum Ratings

|                                                          |            |     |
|----------------------------------------------------------|------------|-----|
| Maximum peak forward anode voltage                       | 650        | V   |
| Maximum peak inverse voltage                             | 1 300      | V   |
| Maximum peak screen grid voltage before conduction       | —100       | V   |
| ††Maximum average screen grid voltage during conduction  | —10        | V   |
| Maximum peak control grid voltage before conduction      | —100       | V   |
| ††Maximum average control grid voltage during conduction | —10        | V   |
| Maximum peak cathode current                             | 0.5        | A   |
| ††Maximum average cathode current                        | 0.1        | A   |
| Maximum fault current                                    | 10         | A   |
| Maximum duration of fault current                        | 0.1        | sec |
| ††Maximum average screen current                         | 0.01       | A   |
| ††Maximum average control grid current                   | 0.01       | A   |
| Maximum grid circuit resistance                          | 10         | MΩ  |
| Maximum peak $V_{hk}$ heater negative to cathode         | 100        | V   |
| Maximum peak $V_{hk}$ heater positive to cathode         | 25         | V   |
| Ambient temperature range                                | —75 to +90 | °C  |

### Typical Operating Conditions

#### Relay Service

|                                  |     |     |    |
|----------------------------------|-----|-----|----|
| Anode voltage (r.m.s.)           | 117 | 400 | V  |
| Direct screen grid voltage       | 0   | 0   | V  |
| *Control grid voltage (r.m.s.)   | 5   | —   | V  |
| Direct control grid voltage      | —   | —6  | V  |
| Peak control grid signal voltage | 5   | 6   | V  |
| Control grid circuit resistance  | 1   | 1   | MΩ |
| **Anode circuit resistance       | 1.2 | 2   | kΩ |

† Square pulse voltage.

†† Averaged over any interval of 30 seconds.

\* Approximately 180° out of phase with respect to the anode voltage.

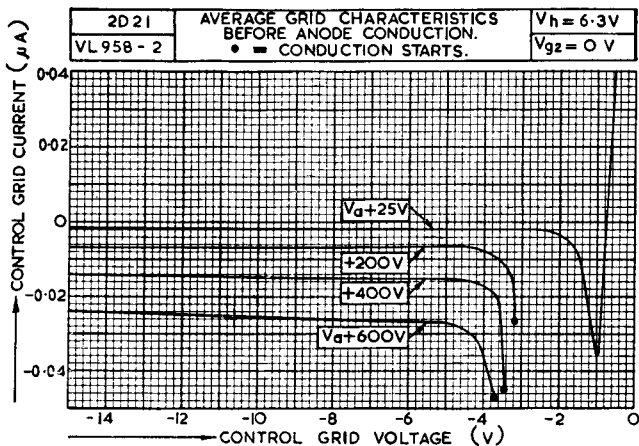
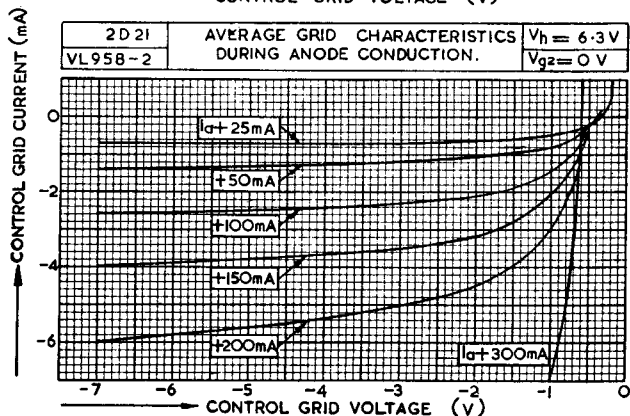
\*\* Sufficient resistance, including the valve load, must be used to prevent the cathode current exceeding the valve ratings.





# Hot-Cathode Gas-Filled Miniature Thyatron

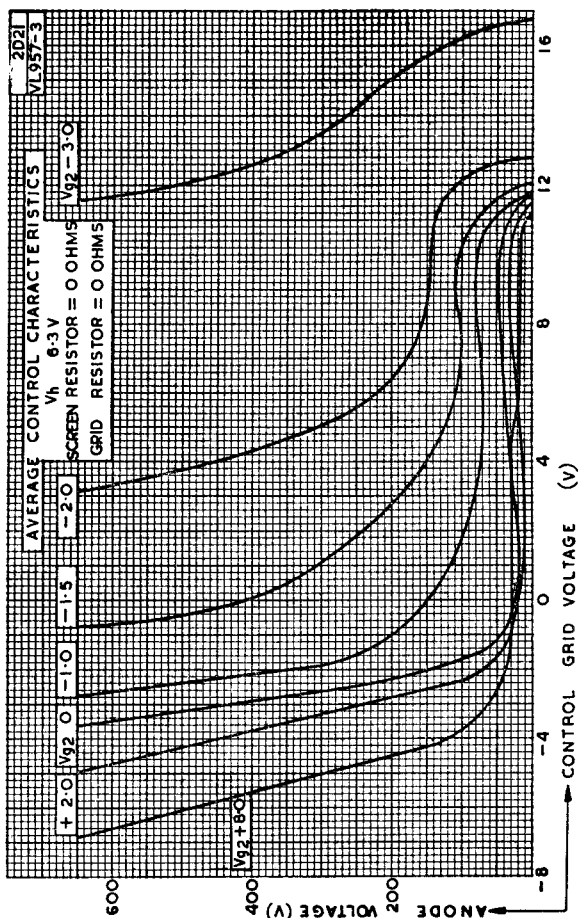
Code: 2D21 (CV797) ←



# Hot-Cathode Gas-Filled Miniature Thyratron



Code: 2D2I (CV797) ←





# Hot-Cathode Gas-Filled Miniature Thyatron

Code: 2D21 (CV797) ←

## OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

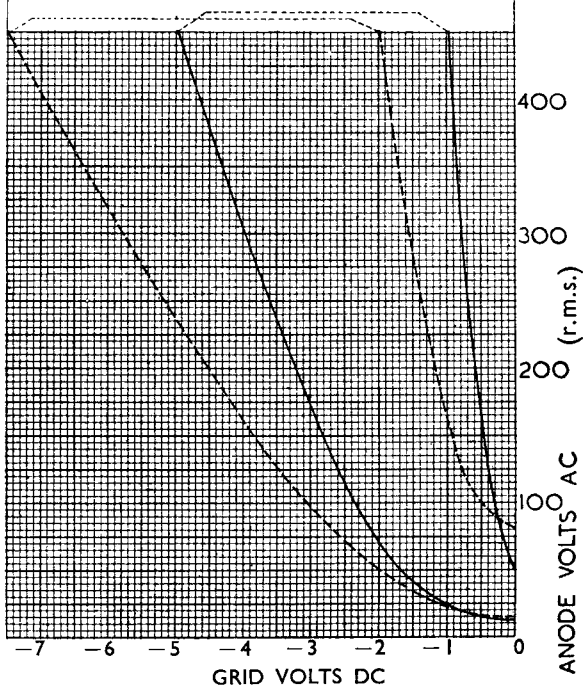
Grid No. 2 Voltage = 0

Ranges shown are for two values of grid resistor, 0.1 and 10.0 Megohms.

Spread takes into consideration differences between valves and subsequent changes during life for heater voltage range of 5.7 to 6.9 Volts.

Range for 10 MΩ

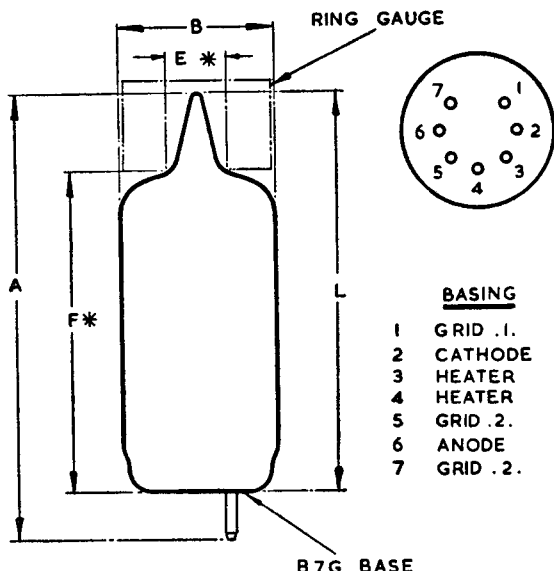
Range for 0.1 MΩ



# Hot-Cathode Gas-Filled Miniature Thyatron



Code: 2D21 (CV797) ←

**BASING**

- 1 GRID .1.
- 2 CATHODE
- 3 HEATER
- 4 HEATER
- 5 GRID .2.
- 6 ANODE
- 7 GRID .2.

B7G BASE

\* DENOTES:- MEASURED FROM BASE SEAT TO BULB TOP LINE, AS DETERMINED BY RING GAUGE OF 'E' INT. DIA.

| DIM | MILLIMETRES | INCHES                                                       |
|-----|-------------|--------------------------------------------------------------|
| A   | 54.0 MAX:   | 2 <sup>1</sup> / <sub>8</sub> MAX:                           |
| B   | 19.1 MAX:   | <sup>3</sup> / <sub>4</sub> MAX:                             |
| * F | 38.1 ± 2.4  | 1 <sup>1</sup> / <sub>2</sub> ± <sup>3</sup> / <sub>32</sub> |
| L   | 47.6 MAX:   | 1 <sup>7</sup> / <sub>8</sub> MAX:                           |
| * E | 11.1        | <sup>7</sup> / <sub>16</sub>                                 |

NOTE:- BASIC FIGURES ARE INCHES



# Hot-Cathode Gas-Filled Thyratron

Code: 3D22 (CV285I) ←

The 3D22 is a tetrode type inert-gas-filled thyratron with a negative control characteristic for use in industrial and other control devices. It is directly equivalent to the U.S.A. 3D22 type.

## CATHODE

Indirectly-heated, oxide-coated

|                               |     |     |
|-------------------------------|-----|-----|
| Heater voltage                | 6.3 | V   |
| Nominal current               | 2.6 | A   |
| Cathode heating time, minimum | 30  | sec |

## DIRECT INTERELECTRODE CAPACITANCES

|               |     |    |
|---------------|-----|----|
| Grid to anode | 0.1 | pF |
| Input         | 7   | pF |
| Output        | 3.6 | pF |

## CHARACTERISTICS

|                                                                        |                                                                                                                                                             |     |                 |
|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------|
| Ionization time, approx.                                               | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a 100 \text{ V} : V_{g1} + 50 \text{ V } \uparrow \\ I_a \text{ pk } 8.0 \text{ A} \end{array} \right\}$  | 0.5 | $\mu\text{sec}$ |
| Deionization time, approx.                                             | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a 125 \text{ V} : V_{g1} - 200 \text{ V} \\ R_{g1} 1000 \Omega : I_a 0.8 \text{ A} \end{array} \right\}$  | 150 | $\mu\text{sec}$ |
|                                                                        | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a 125 \text{ V} : V_{g1} - 14.8 \text{ V} \\ R_{g1} 1000 \Omega : I_a 0.8 \text{ A} \end{array} \right\}$ | 400 | $\mu\text{sec}$ |
| Critical grid current, max.                                            | $\left\{ \begin{array}{l} \text{With } V_a 460 \text{ V r.m.s.} \\ I_a 0.8 \text{ A} \end{array} \right\}$                                                  | 0.8 | $\mu\text{A}$   |
| Voltage drop, approximately                                            |                                                                                                                                                             | 10  | V               |
| Control grid control ratio, approx. ( $R_{g1} = 0.1 \text{ M}\Omega$ ) |                                                                                                                                                             | 150 |                 |
| Screen grid control ratio, approx. ( $R_{g2} = 0.1 \text{ M}\Omega$ )  |                                                                                                                                                             | 650 |                 |

# Hot-Cathode Gas-Filled Thyratron



Code: 3D22 (CV285I) ←

## MECHANICAL DATA

|                        |               |    |
|------------------------|---------------|----|
| Maximum overall length | 117.5         | mm |
| Maximum seated height  | 101.6         | mm |
| Maximum diameter       | 60            | mm |
| Base                   | B7D           |    |
| Net weight             | 165           | g  |
| Mounting position      | Unrestricted← |    |

## MAXIMUM RATINGS

|                                                             |            |     |
|-------------------------------------------------------------|------------|-----|
| Maximum peak forward voltage                                | 650        | V   |
| Maximum peak inverse voltage                                | 1 500      | V   |
| Maximum peak screen voltage before<br>conduction            | —100       | V   |
| ††Maximum average screen grid voltage<br>during conduction  | —10        | V   |
| Maximum peak control grid voltage<br>before conduction      | —200       | V   |
| ††Maximum average control grid voltage<br>during conduction | —10        | V   |
| Maximum peak cathode current                                | 8          | A   |
| ††Maximum average cathode current                           | 0.8        | A   |
| Maximum fault cathode current                               | 30         | A   |
| Maximum duration of fault cathode current                   | 0.1        | sec |
| ††Maximum average screen current                            | 0.1        | A   |
| ††Maximum average control grid current                      | 0.05       | A   |
| Maximum control grid circuit resistance                     | 2          | MΩ  |
| Maximum peak $V_{hk}$ , heater negative to<br>cathode       | 100        | V   |
| Maximum peak $V_{hk}$ , heater positive to<br>cathode       | 25         | V   |
| Ambient temperature range                                   | —75 to +90 | °C  |

Note.—Sufficient resistance, including the valve load, must be used to prevent the cathode current exceeding the valve ratings.

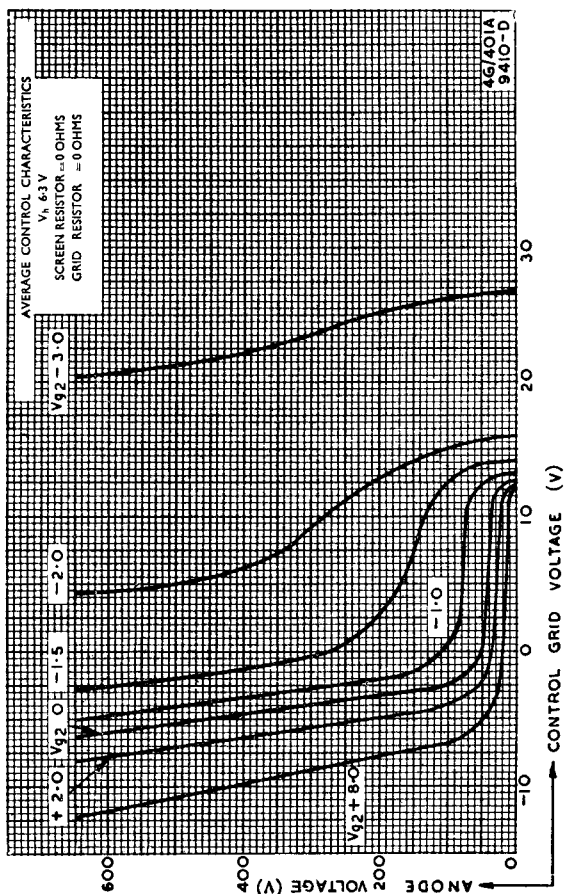
† Square pulse voltage.

†† Averaged over any interval of 30 seconds.



# Hot-Cathode Gas-Filled Thyratron

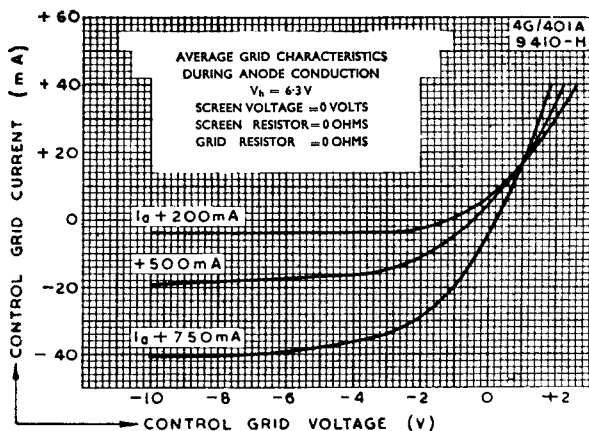
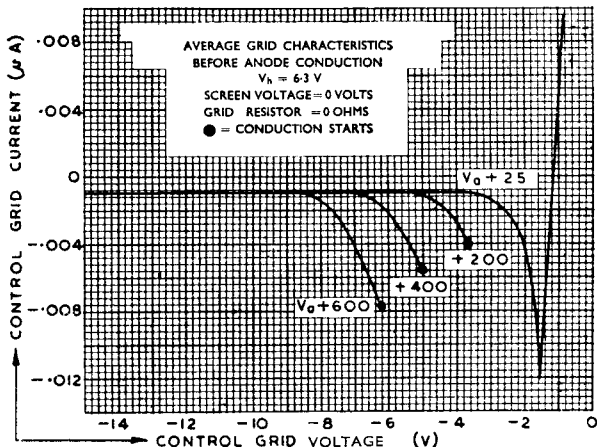
Code: 3D22 (CV285I) ←



# Hot-Cathode Gas-Filled Thyratron



Code: 3D22 (CV2851) ←







# Hot-Cathode Gas-Filled Thyratron

Code: 3D22 (CV285I) ←

## OPERATIONAL RANGE OF CRITICAL GRID VOLTAGE

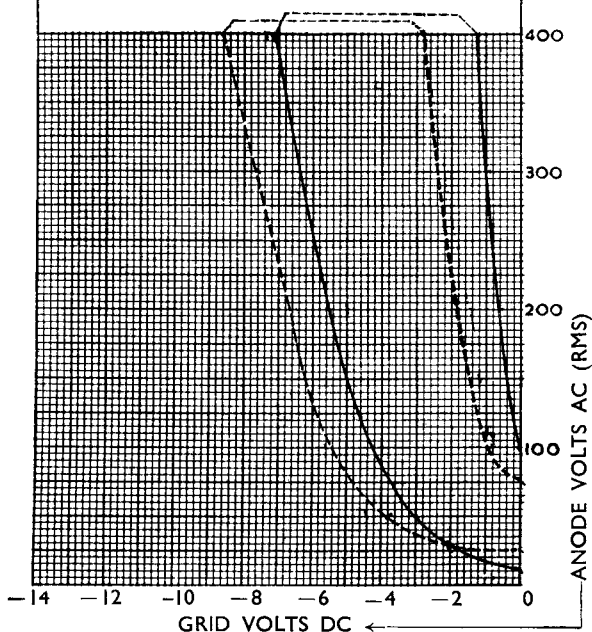
Grid No. 2 Voltage = 0

Ranges shown are for two values of grid resistor, 0.1 and 2.0 megohms.

Spread takes into consideration differences between valves and subsequent changes during life for heater voltage range of 5.7 to 6.9 Volts and ambient temperature range of  $-40$  to  $+90^{\circ}\text{C}$ .

Range for 2 M $\Omega$

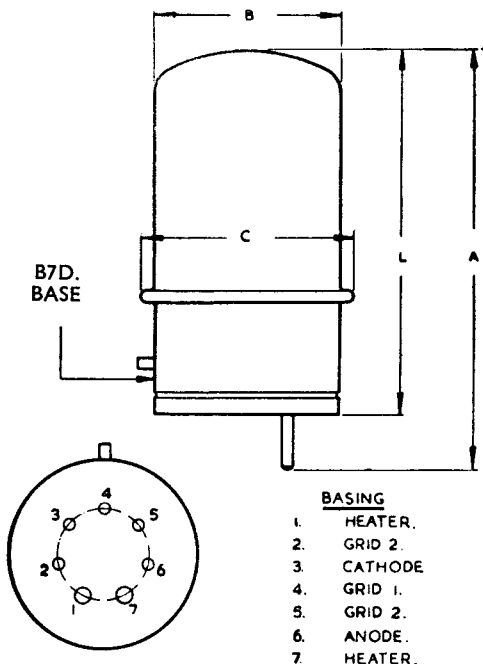
Range for 0.1 M $\Omega$



# Hot-Cathode Gas-Filled Thyratron



Code: 3D22 (CV285I) ←



| DIM. | MILLIMETERS | INCHES                             |
|------|-------------|------------------------------------|
| A    | 117.5 MAX   | 4 <sup>5</sup> / <sub>8</sub> MAX  |
| B    | 52.4 MAX    | 2 <sup>1</sup> / <sub>16</sub> MAX |
| C    | 60 MAX      | 2 <sup>3</sup> / <sub>8</sub> MAX  |
| L    | 101.6 MAX.  | 4 MAX.                             |

NOTE - BASIC FIGURES ARE INCHES.

# —Standard Valves—

5A/102-A

## VALVE TYPE 5A/102-A

(previously coded VLS.452).

OUTPUT PENTODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant current type.

#### Base.

American medium 6-pin—Control grid connected to top cap type B.

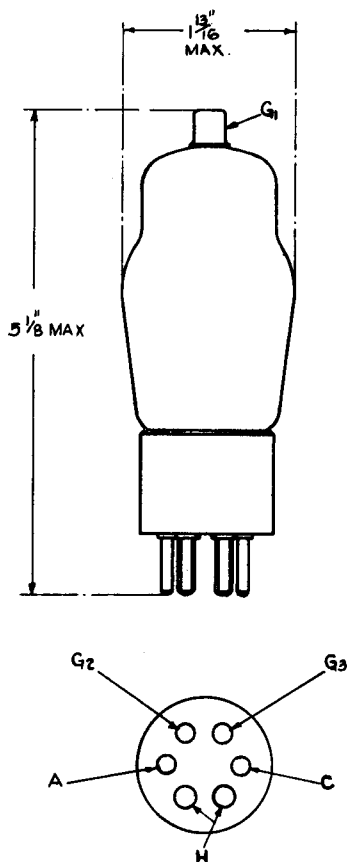
#### Dimensions.

Max. overall length  $5\frac{1}{8}"$  (13 cms.)  
Max. diameter  $1\frac{13}{16}"$  (4.6 cms.)  
Net weight 0.11 lbs. (50 gms.)

#### Constants.

Nominal heater voltage 7.5 volts  
Heater current 0.85 amps.  
\*Amplification factor 110  
\*Impedance 43,000 ohms  
\*Mutual conductance 2.5 mA. per volt  
Grid-anode capacity  $0.5 \mu\mu\text{F.}$   
Input capacity  $6.8 \mu\mu\text{F.}$   
Output capacity  $9 \mu\mu\text{F.}$

\* at  $V_p = 180$   $V_{g_2} = 150$ ,  $V_{g_1} = -18$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                       |              |
|-------------------------------------------------------|--------------|
| Maximum direct anode voltage                          | 180 volts    |
| Maximum direct anode current                          | 50 mA.       |
| Maximum direct screen voltage                         | 150 volts    |
| Maximum direct screen current                         | 10 mA.       |
| Maximum control grid resistance<br>(using auto-bias). | 500,000 ohms |

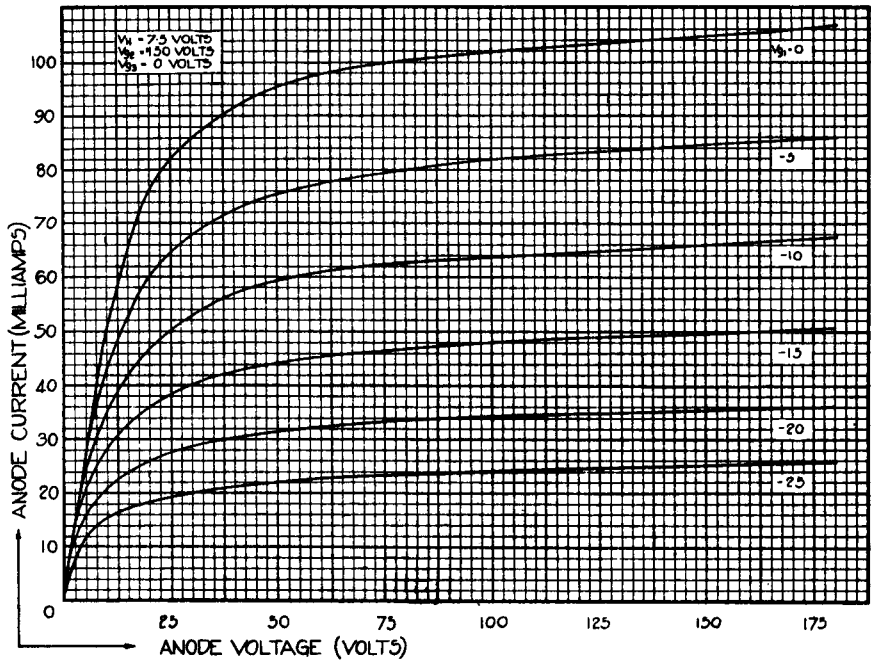
Tentative data

W.5A/102-A.1  
March, 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                       |                          |
|---------------------------------------|--------------------------|
| Anode voltage                         | 180 volts                |
| Control grid voltage                  | —18 volts                |
| Screen voltage                        | 150 volts                |
| Suppressor voltage                    | 0 volts                  |
| Load resistance                       | 4,000 ohms               |
| Output—mW.                            | 50 100 250 500 750 1,000 |
| Total harmonics, db below fundamental | 34 31 28 26 25 24        |





# R.F. Pentode

5A/128B  
(4046A)

4046A

## CATHODE.

Indirectly-heated oxide-coated.

|                 |   |   |
|-----------------|---|---|
| Voltage         | 4 | V |
| Nominal current | 1 | A |

## RATING.

|                    |                                                                                                                                   |   |      |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|---|------|
| Mutual conductance | $\left\{ \begin{array}{l} \text{Measured at } V_a \text{ 200V} \\ V_{g_2} \text{ 100V } V_{g_1} \text{ -2V} \end{array} \right\}$ | 3 | mA/V |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|---|------|

## INTER-ELECTRODE CAPACITIES.

|               |       |    |
|---------------|-------|----|
| Grid to anode | 0.007 | pF |
| Input         | 10.7  | pF |
| Output        | 8     | pF |

## DIMENSIONS.

|                               |     |     |
|-------------------------------|-----|-----|
| Maximum overall length        | 137 | mm. |
| Maximum bulb diameter         | 39  | mm. |
| Base : Standard British 5-pin |     |     |
| Net weight                    | 60  | g.  |

## MAXIMUM RATINGS.

|                               |     |    |
|-------------------------------|-----|----|
| Maximum direct anode voltage  | 250 | V  |
| Maximum direct screen voltage | 100 | V  |
| Maximum direct anode current  | 9   | mA |

## TYPICAL OPERATING CONDITIONS.

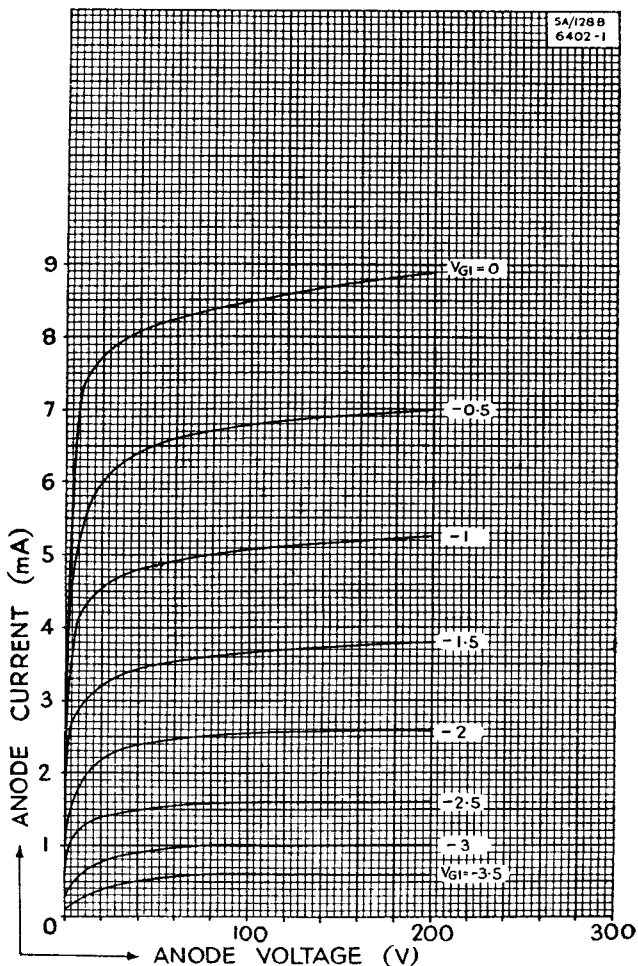
|                        |         |         |              |
|------------------------|---------|---------|--------------|
| Anode voltage ...      | 250     | 200     | 150 volts    |
| Control grid bias ...  | -1.5    | -1.5    | -1.5 volts   |
| Screen grid voltage... | 100     | 100     | 100 volts    |
| Anode current ...      | 3.9     | 3.8     | 3.7 mA       |
| Anode resistance ...   | 800,000 | 800,000 | 800,000 ohms |
| Load ...               | 50,000  | 46,000  | 30,000 ohms  |
| Output ...             | 0.315   | 0.258   | 0.175 watts  |
| 2nd harmonic—% ...     | 8.6     | 8.75    | 11.5         |
| —db                    | 21.3    | 20.7    | 19           |

5A/128B  
(4046A)

# R.F. Pentode



4046A

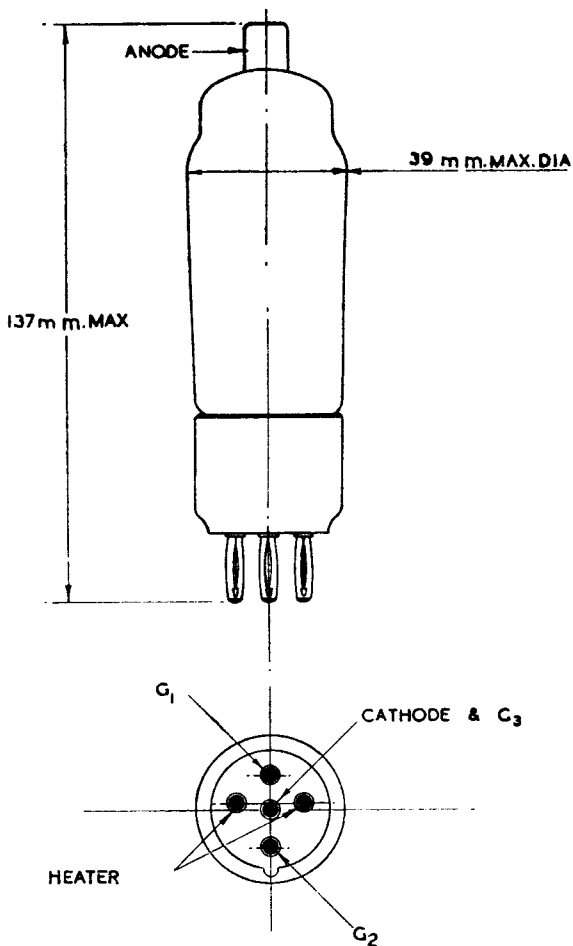




# R.F. Pentode

5A/128B  
(4046A)

4046A





# Carrier Pentode

4328A and D

(4328A is for replacement purposes only)

5A/136A  
(4328A)  
5A/136D  
(4328D)

## CATHODE.

Indirectly heated Oxide-coated.

|                  |       |   |
|------------------|-------|---|
| Current          | 0.425 | A |
| Nominal voltage. | 7.5   | V |

## RATING.

|                    |                                                                                                                                    |    |      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Mutual conductance | $\left\{ \begin{array}{l} \text{measured at} \\ V_a 250V \quad V_{g_2} 180V \\ V_{g_3} 0 \quad V_{g_1} -5.5V \end{array} \right\}$ | 2  | mA/V |
| Screen grid $\mu$  |                                                                                                                                    | 19 |      |

## INTER-ELECTRODE CAPACITIES.

|               |      |    |
|---------------|------|----|
| Grid to Anode | 0.03 | pF |
| Input         | 6    | pF |
| Output        | 14   | pF |

## DIMENSIONS.

|                        | 4328A          | 4328D         |
|------------------------|----------------|---------------|
| Maximum overall length | 125 mm.        | 125 mm.       |
| Maximum bulb diameter  | 40 mm.         | 40 mm.        |
| Base                   | Small American | International |
|                        | 6 pin          | Octal         |
| Net weight             | 50 g.          | 45 g.         |

## MAXIMUM RATINGS.

|                               |     |    |
|-------------------------------|-----|----|
| Maximum direct anode voltage  | 250 | V  |
| Maximum direct anode current  | 7.5 | mA |
| Maximum direct screen voltage | 180 | V  |
| Maximum direct screen current | 2.5 | mA |

**NOTE.**—When this valve is used in series with other valves of a different type, protection should be provided for the heaters at the moment of switching on.



5A/136A  
(4328A)  
5A/136D  
(4328D)

# Carrier Pentode

## 4328A and D



(4328A is for replacement purposes only)

### TYPICAL OPERATING CONDITIONS.

5A/136A and D

|                         | 135   | 135   | 135   | 135   | 135    | 135    | 135    | 135   | 180    | 180   | 225    | 225   | *250  | 250    | 250    | 250    | 250    | volts      |
|-------------------------|-------|-------|-------|-------|--------|--------|--------|-------|--------|-------|--------|-------|-------|--------|--------|--------|--------|------------|
| Anode voltage ...       | 135   | 135   | 135   | 135   | 135    | 135    | 135    | 135   | 135    | 135   | 135    | 135   | 135   | 135    | 135    | 135    | 135    | volts      |
| Screen grid voltage ... | 135   | 135   | 135   | 135   | 135    | 135    | 135    | 135   | 135    | 135   | 135    | 135   | 135   | 135    | 135    | 135    | 135    | volts      |
| Control grid bias ...   | -3    | -3    | -3    | -3    | -3     | -3     | -3     | -3    | -3     | -3    | -3     | -3    | -3    | -3     | -3     | -3     | -3     | volts      |
| Suppressor grid voltage | 0     | 0     | 0     | 0     | 0      | 0      | 0      | 0     | 0      | 0     | 0      | 0     | 0     | 0      | 0      | 0      | 0      | volts      |
| Anode current ...       | 5.4   | 5.4   | 5.4   | 5.4   | 5.4    | 5.4    | 5.4    | 5.4   | 5.4    | 5.4   | 5.5    | 5.5   | 5.5   | 5.5    | 5.5    | 5.5    | 5.5    | mA         |
| Load resistance ...     | 20000 | 60000 | 60000 | 60000 | 100000 | 100000 | 100000 | 40000 | 100000 | 60000 | 100000 | 60000 | 60000 | 100000 | 100000 | 100000 | 100000 | ohms       |
| Input voltage ...       | 3.00  | 1.60  | 0.95  | 1.15  | 0.57   | 0.40   | 2.70   | 1.50  | 2.70   | 1.80  | 2.70   | 1.20  | 2.70  | 2.10   | 1.50   | 1.50   | 1.50   | peak volts |
| Output voltage ...      | —     | —     | —     | 100   | 75     | 50     | —      | —     | 175    | —     | 220    | —     | —     | 250    | 200    | 200    | 200    | peak volts |
| Output power ...        | 250   | 130   | 60    | —     | —      | —      | 340    | —     | 425    | —     | 480    | 110   | —     | —      | —      | —      | —      | mW         |
| Second harmonic ...     | 22    | 26    | 35    | 33    | 35     | 40     | 26     | 26    | 27     | 27    | 26     | 30    | 26    | 26     | 30     | 30     | 30     | db         |
| Third harmonic ...      | 30    | 28    | 45    | 39    | 50     | 55     | 28     | 30    | 27     | 31    | 30     | 55    | 29    | 29     | 43     | 43     | 43     | db         |

\* Maximum operating conditions



# Carrier Pentode

4328A and D

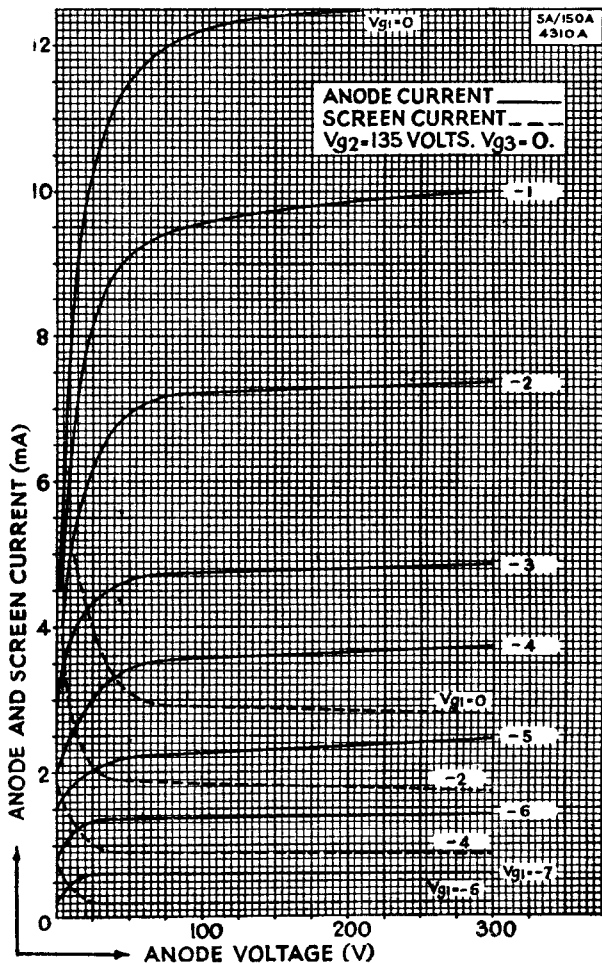
5A/136A

(4328A)

5A/136D

(4328D)

(4328A is for replacement purposes only)



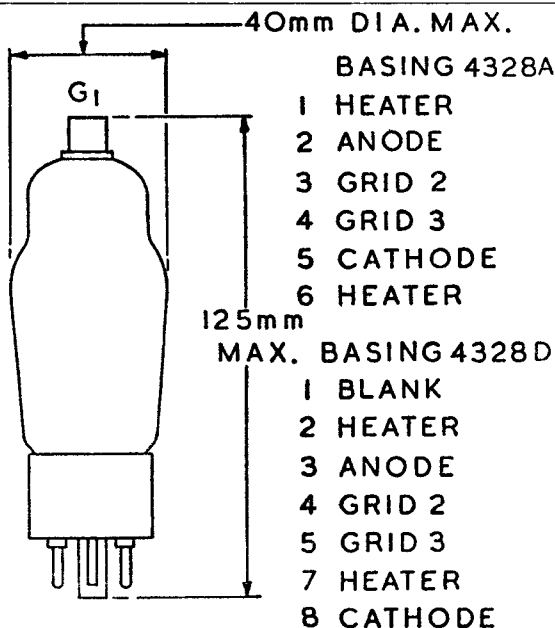
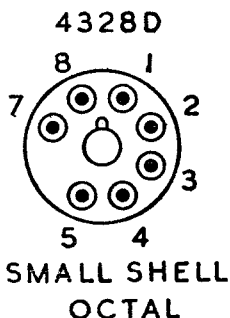
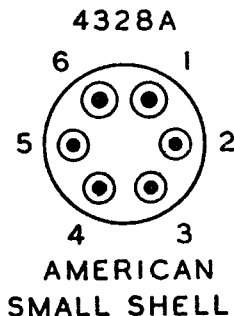
5A/136A  
(4328A)  
5A/136D  
(4328D)

# Carrier Pentode

4328A, and D



(4328A is for replacement purposes only)





# Carrier Pentode

5A/150A  
(4310A)

4310A

## CATHODE.

Indirectly heated oxide-coated

|                 |      |   |
|-----------------|------|---|
| Voltage         | 10   | V |
| Nominal current | 0.32 | A |

## RATING.

|                    |                                                                         |     |      |
|--------------------|-------------------------------------------------------------------------|-----|------|
| Mutual conductance | { Measured at<br>$V_a = V_{g_2} = 135$<br>$V_{g_3} 0$<br>$V_{g_1} -3$ } | 2.0 | mA/V |
| Screen grid $\mu$  |                                                                         | 19  |      |

## INTER-ELECTRODE CAPACITIES.

|               |      |    |
|---------------|------|----|
| Grid to anode | 0.03 | pF |
| Input         | 6    | pF |
| Output        | 14   | pF |

## DIMENSIONS.

|                             |     |     |
|-----------------------------|-----|-----|
| Maximum overall length      | 130 | mm. |
| Maximum bulb diameter       | 40  | mm. |
| Base—Small American six pin |     |     |
| Net weight                  | 50  | g.  |

## MAXIMUM RATINGS.

|                                |     |    |
|--------------------------------|-----|----|
| Maximum direct anode voltage   | 250 | V  |
| Maximum direct screen voltage  | 180 | V  |
| Maximum direct cathode current | 10  | mA |
| Maximum direct screen current  | 2.5 | mA |

5A/150A  
(4310A)

# Carrier Pentode



4310A

## TYPICAL OPERATING CONDITIONS

| Anode Voltage | Screen Gr. Voltage | Control Grid Bias | Suppressor Grid Volt | Anode Current | Load resistance | Input Voltage | Output Voltage | Output Power | Second Harmonic | Third Harmonic |
|---------------|--------------------|-------------------|----------------------|---------------|-----------------|---------------|----------------|--------------|-----------------|----------------|
| Volts         | Volts              | Volts             | Volts                | Milli-amperes | Ohms            | Peak Volts    | Peak Volts     | Milli-watts  | db              | db             |
| 135           | 135                | —3                | 0                    | 5.4           | 20,000          | 3.00          | —              | 250          | 22              | 30             |
|               |                    |                   |                      |               | 60,000          | 1.60          | —              | 130          | 26              | 28             |
|               |                    |                   |                      |               | 60,000          | 0.95          | —              | 60           | 35              | 45             |
|               |                    |                   |                      |               | 60,000          | 1.15          | 100            | —            | 33              | 39             |
|               |                    |                   |                      |               | 100,000         | 0.57          | 75             | —            | 35              | 50             |
|               |                    |                   |                      |               | 100,000         | 0.40          | 50             | —            | 40              | 55             |
| 100           | 135                | —3                | 0                    | 5.4           | 40,000          | 2.70          | —              | 340          | 26              | 28             |
|               |                    |                   |                      |               | 100,000         | 1.50          | 175            | —            | 26              | 30             |
| 225           | 135                | —3                | 0                    | 5.5           | 60,000          | 2.70          | —              | 425          | 27              | 27             |
|               |                    |                   |                      |               | 100,000         | 1.80          | 220            | —            | 27              | 31             |
|               |                    |                   |                      |               | 60,000          | 2.70          | —              | 480          | 26              | 30             |
| 250           | 135                | —3                | 0                    | 5.5           | 60,000          | 1.20          | —              | 110          | 30              | 55             |
|               |                    |                   |                      |               | 100,000         | 2.10          | 250            | —            | 26              | 29             |
|               |                    |                   |                      |               | 100,000         | 1.50          | 200            | —            | 30              | 43             |

Tentative data  
July 1946

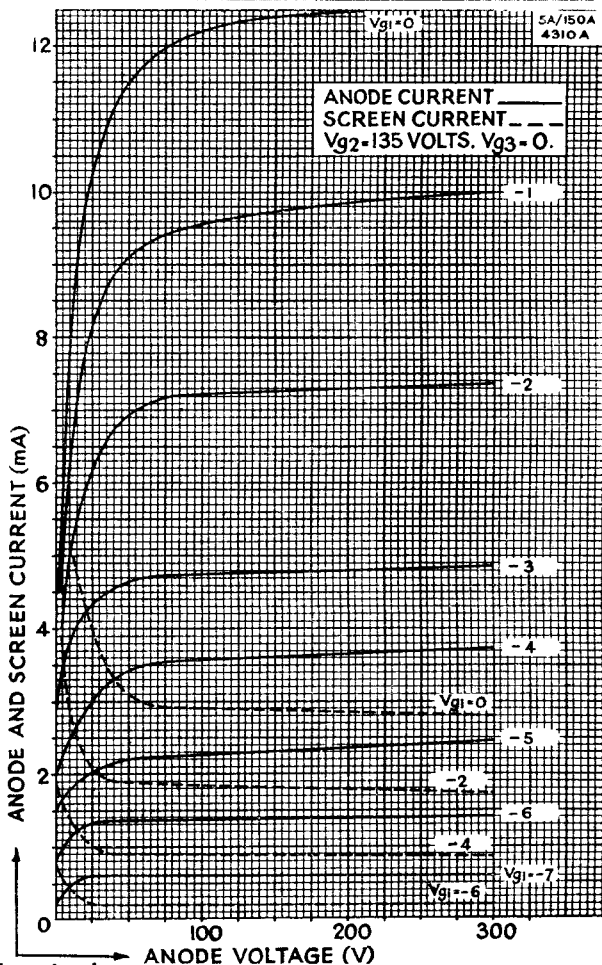
5A/150A—2



# Carrier Pentode

5A/150A  
(4310A)

4310A



Tentative data  
July 1946

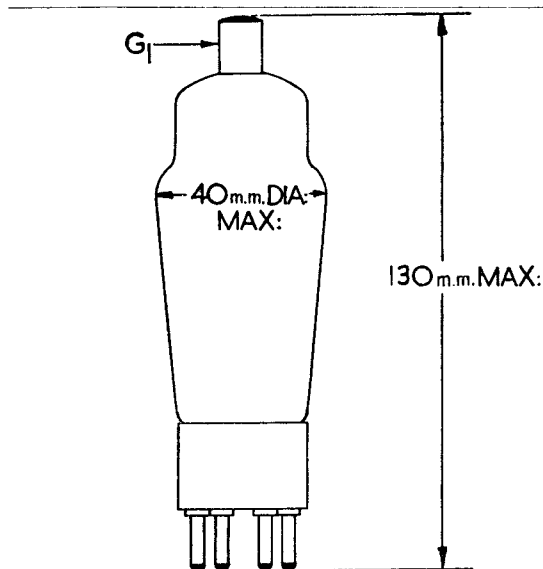
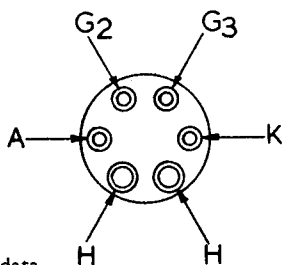
5A/150A—3

5A/150A  
(4310A)

# Carrier Pentode



4310A



Tentative data  
July 1946

5A/150A—4



# Coaxial Repeater Pentode

5A/152M

5A/152M

## CATHODE.

Indirectly heated Oxide coated

|                 |      |   |
|-----------------|------|---|
| Voltage         | 6.3  | V |
| Nominal current | 0.47 | A |

## RATING.

|                                    |     |      |
|------------------------------------|-----|------|
| Mutual conductance (at $I_a$ 10mA) | 7.5 | mA/V |
|------------------------------------|-----|------|

## INTER-ELECTRODE CAPACITIES.

|               |       |    |
|---------------|-------|----|
| Grid to anode | 0.018 | pF |
| Input         | 10    | pF |
| Output        | 5     | pF |

## DIMENSIONS.

|                        |       |       |
|------------------------|-------|-------|
| Maximum overall length | 80.2  | mm.   |
| Maximum seated height  | 66.7  | mm.   |
| Maximum diameter       | 30.15 | mm.   |
| Net weight             | 28.5  | grms. |

## MAXIMUM RATINGS.

|                               |     |          |
|-------------------------------|-----|----------|
| Maximum direct anode voltage  | 250 | V        |
| Maximum direct screen voltage | 150 | V        |
| Maximum direct screen current | 5   | mA       |
| Maximum anode dissipation     | 5   | W        |
| Equivalent noise resistance   | 670 | $\Omega$ |



**5A/152M**

# **Coaxial Repeater Pentode**

**5A/152M**



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## **TYPICAL OPERATING CONDITIONS.**

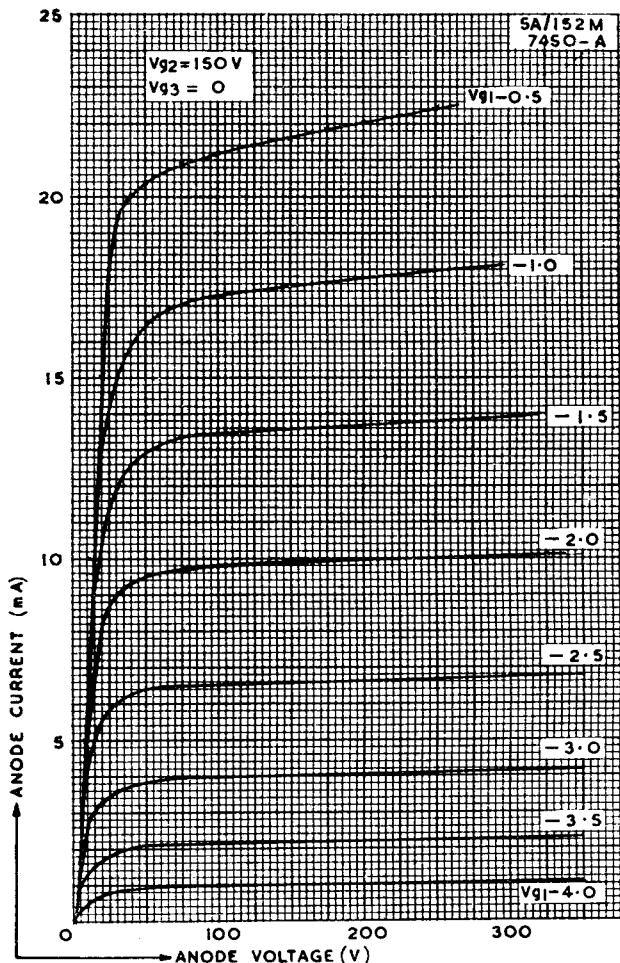
|                           |       |          |
|---------------------------|-------|----------|
| Direct anode voltage      | 250   | V        |
| Direct anode current      | 10    | mA       |
| Direct screen voltage     | 150   | V        |
| Direct screen current     | 2     | mA       |
| Direct suppressor voltage | 0     | V        |
| Load impedance            | 6,000 | $\Omega$ |
| Power output              | 50    | mW       |
| Distortion                | <5    | %        |



# Coaxial Repeater Pentode

5A/152M

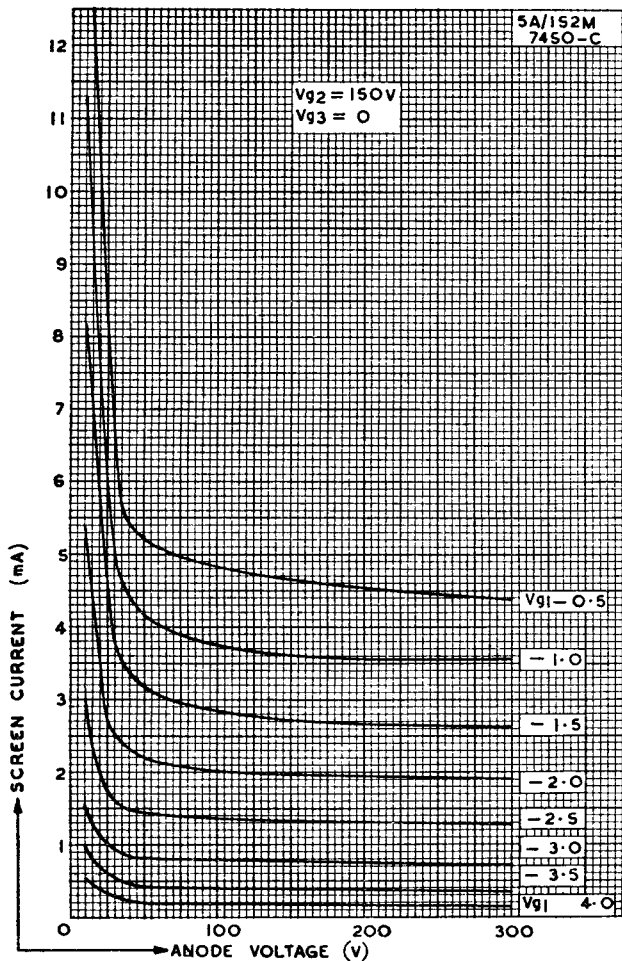
5A/152M



5A/152M

# Coaxial Repeater Pentode

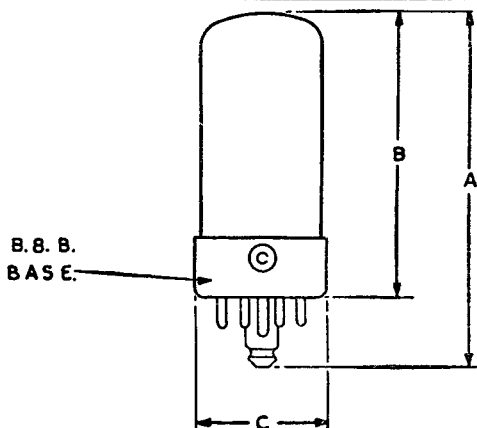
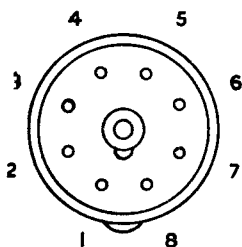
5A/152M





# Coaxial Repeater Pentode

5A/152M



## BASING

- |   |         |
|---|---------|
| 1 | HEATER  |
| 2 | ANODE   |
| 3 | GRID 2  |
| 4 | GRID 3  |
| 5 | SHIELDS |
| 6 | GRID 1  |
| 7 | CATHODE |
| 8 | HEATER  |

| DIM | MILLIMETRES | INCHES     |
|-----|-------------|------------|
| A   | 80.2 MAX    | 3 5/32 MAX |
| B   | 66.7 MAX    | 2 5/8 MAX  |
| C   | 30.15 MAX   | 1 3/16 MAX |

NOTE. BASIC FIGURES ARE INCHES



# Coaxial Repeater Pentode

5B/110M

5B/110M

## CATHODE.

Indirectly-heated oxide-coated

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 6.3 | V |
| Nominal current | 0.8 | A |

## RATING.

|                    |                                                                                        |     |      |
|--------------------|----------------------------------------------------------------------------------------|-----|------|
| Mutual conductance | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a \text{ 250V} \end{array} \right\}$ | 6.5 | ma/V |
|--------------------|----------------------------------------------------------------------------------------|-----|------|

## INTER-ELECTRODE CAPACITIES.

|               |       |    |
|---------------|-------|----|
| Grid to anode | 0.035 | pF |
| Input         | 11    | pF |
| Output        | 6     | pF |

## DIMENSIONS.

|                        |       |       |
|------------------------|-------|-------|
| Maximum overall length | 80.2  | mm.   |
| Maximum seated height  | 66.7  | mm.   |
| Maximum diameter       | 30.15 | mm.   |
| Net weight             | 30    | grms. |

## MAXIMUM RATINGS.

|                                  |     |    |
|----------------------------------|-----|----|
| Maximum direct anode voltage     | 250 | V  |
| Maximum direct screen voltage    | 150 | V  |
| Maximum direct screen current    | 11  | mA |
| Maximum direct anode dissipation | 11  | W  |

**5B/110M**

# **Coaxial Repeater Pentode**

**5B/110M**



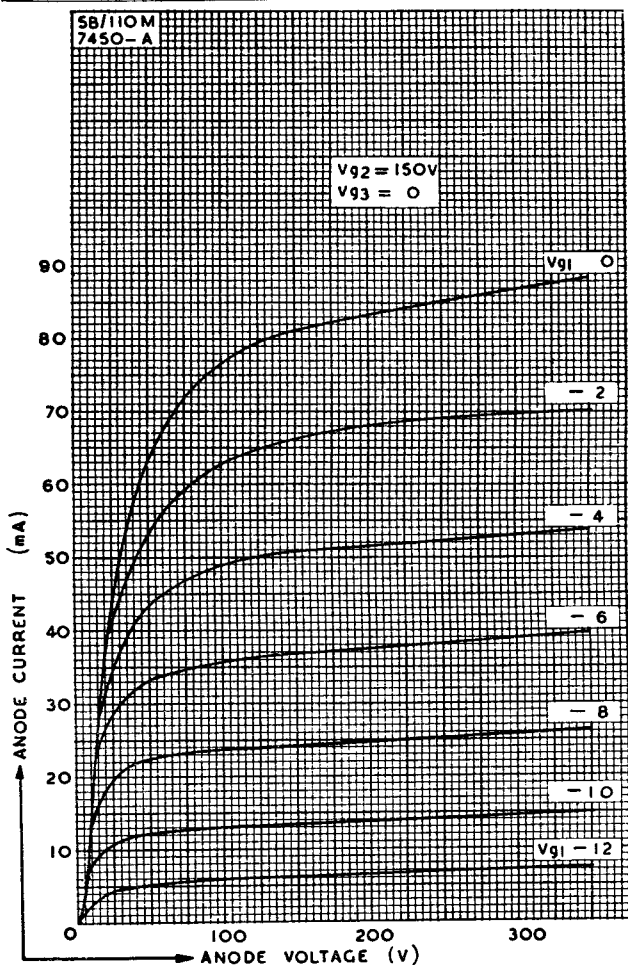
## **TYPICAL OPERATING CONDITIONS.**

|                           |       |          |
|---------------------------|-------|----------|
| Direct anode voltage      | 250   | V        |
| Direct anode current      | 38    | mA       |
| Direct screen voltage     | 150   | V        |
| Direct screen current     | 8     | mA       |
| Direct suppressor voltage | 0     | V        |
| Load Impedance            | 5,000 | $\Omega$ |
| Power output              | 2     | W        |
| Distortion                | <5    | %        |



# Coaxial Repeater Pentode

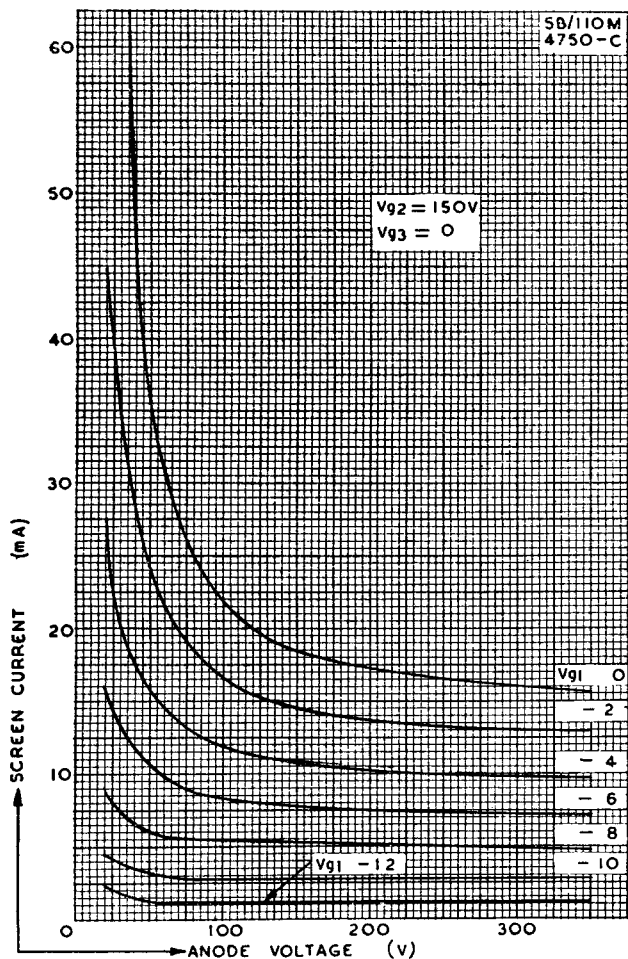
5B/110M



5B/110M

# Coaxial Repeater Pentode

5B/110M

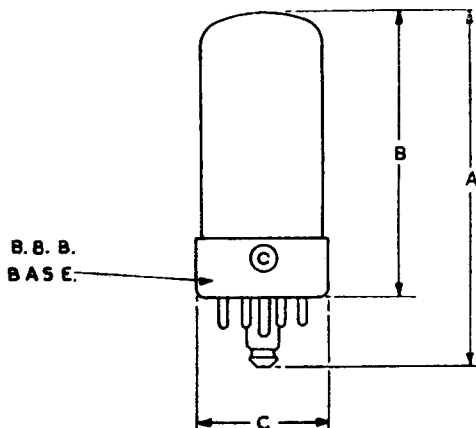
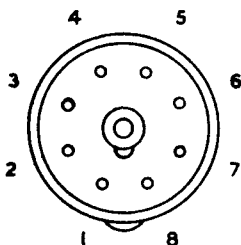






# Coaxial Repeater Pentode

5B/110M



## BASING

- |   |         |
|---|---------|
| 1 | HEATER  |
| 2 | ANODE   |
| 3 | GRID 2  |
| 4 | GRID 3  |
| 5 | SHIELDS |
| 6 | GRID 1  |
| 7 | CATHODE |
| 8 | HEATER  |

| DIM | MILLIMETRES | INCHES                             |
|-----|-------------|------------------------------------|
| A   | 80.2 MAX    | 3 <sup>5</sup> / <sub>32</sub> MAX |
| B   | 66.7 MAX    | 2 <sup>5</sup> / <sub>8</sub> MAX  |
| C   | 30.15 MAX   | 1 <sup>3</sup> / <sub>16</sub> MAX |

NOTE. BASIC FIGURES ARE INCHES.



# Beam Power Amplifier

5B/250A

## CATHODE.

Indirectly heated oxide coated.

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 6.3 | V |
| Nominal current | 0.9 | A |

## RATING.

|                    |                                                                                                                                                |     |      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|
| Screen Grid $\mu$  | $\left\{ \begin{array}{l} \text{Measured} \\ \text{at } V_a 500 \text{ V} \\ V_{g2} 250 \text{ V} \\ I_a = 72 \text{ mA} \end{array} \right\}$ | 9   | mA/V |
| Mutual conductance |                                                                                                                                                | 6.0 |      |

## INTER-ELECTRODE CAPACITIES

|                 |     |    |
|-----------------|-----|----|
| Grid to anode   | 0.2 | pF |
| Input capacity  | 11  | pF |
| Output capacity | 7   | pF |

## DIMENSIONS.

|                                     |     |     |
|-------------------------------------|-----|-----|
| Maximum overall length              | 150 | mm. |
| Maximum diameter                    | 53  | mm. |
| Base—American medium 5-pin ceramic. |     |     |
| Net weight                          | 72  | g.  |

## MAXIMUM RATINGS

|                                                 |     |      |
|-------------------------------------------------|-----|------|
| Maximum direct anode voltage                    | 600 | V    |
| Maximum direct screen voltage                   | 300 | V    |
| Maximum direct anode current                    | 120 | mA   |
| Maximum anode dissipation                       | 25  | W    |
| Maximum screen input                            | 3.5 | W    |
| Maximum frequency for above ratings             | 60  | Mc/s |
| Maximum anode voltage for frequency of 125 Mc/s | 300 | V    |

# Beam Power Amplifier

5B/250A



## TYPICAL OPERATING CONDITIONS AUDIO FREQUENCY

### Class B Power Amplifier or Modulator.

(For balanced 2-valve circuit.)

|                                        |       |            |
|----------------------------------------|-------|------------|
| Direct anode voltage                   | 400   | 600 V      |
| Direct screen voltage                  | 300   | 300 V      |
| Grid bias                              | -25   | -30 V      |
| Anode current per valve—zero signal    | 50    | 30 mA      |
| Anode current per valve—maximum signal | 115   | 100 mA     |
| Load resistance anode to anode         | 3,800 | 6,660 ohms |
| Maximum signal direct screen current   | 10    | 10 mA      |
| Maximum signal power output            | 60    | 80 W       |
| Peak A.F. grid-to-grid voltage         | 80    | 80 V       |

## RADIO FREQUENCY

### Class B Telephony Modulated Carrier applied to Grid.

(Carrier conditions per valve for use with 100% modulation.)

|                        |     |         |
|------------------------|-----|---------|
| Direct anode voltage   | 400 | 600 V   |
| Direct screen voltage  | 250 | 250 V   |
| Grid bias              | -25 | -25 V   |
| Direct anode current   | 75  | 62.5 mA |
| Direct screen current  | 4   | 3 mA    |
| *Direct grid current   | 0   | 0 mA    |
| Peak R.F. grid voltage | 30  | 20 V    |
| Power output           | 9   | 12.5 W  |

### Class C Power Amplifier Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation.)

|                        |     |       |
|------------------------|-----|-------|
| Direct anode voltage   | 325 | 475 V |
| Direct screen voltage  | 225 | 225 V |
| Grid bias              | -45 | -50 V |
| Peak R.F. grid voltage | 70  | 70 V  |
| Direct anode current   | 80  | 83 mA |
| Direct screen current  | 9   | 9 mA  |
| *Direct grid current   | 3   | 2 mA  |
| Power output           | 15  | 24 W  |

### Class C Power Amplifier or Oscillator unmodulated.

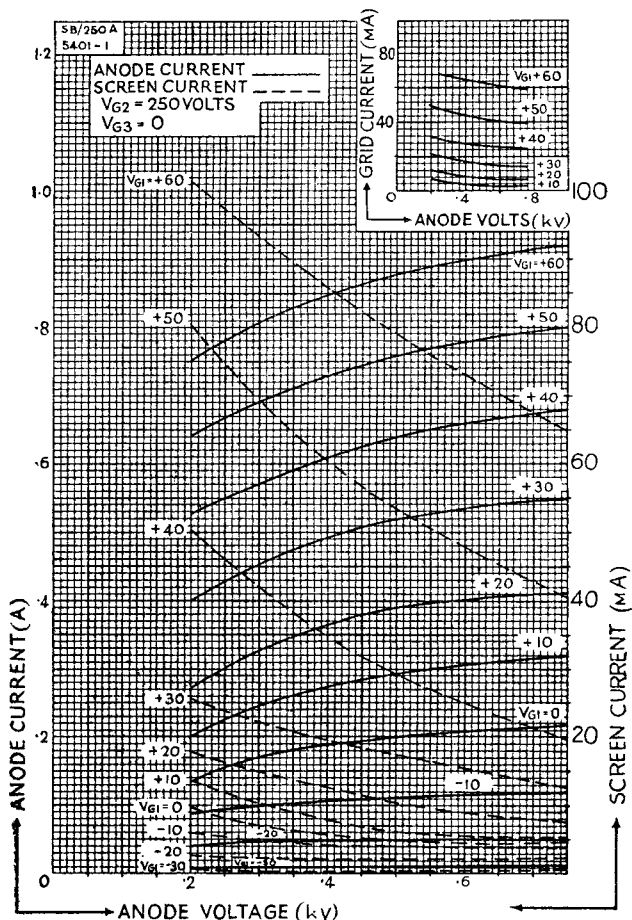
|                        |     |        |
|------------------------|-----|--------|
| Direct anode voltage   | 400 | 600 V  |
| Direct screen voltage  | 250 | 250 V  |
| Grid bias              | -50 | -50 V  |
| Peak R.F. grid voltage | 80  | 80 V   |
| Direct anode current   | 95  | 100 mA |
| Direct screen current  | 9   | 9 mA   |
| *Direct grid current   | 2.5 | 3 mA   |
| Power output           | 25  | 37.5 W |

\*Subject to wide variation depending upon the impedance of the load circuit.



# Beam Power Amplifier

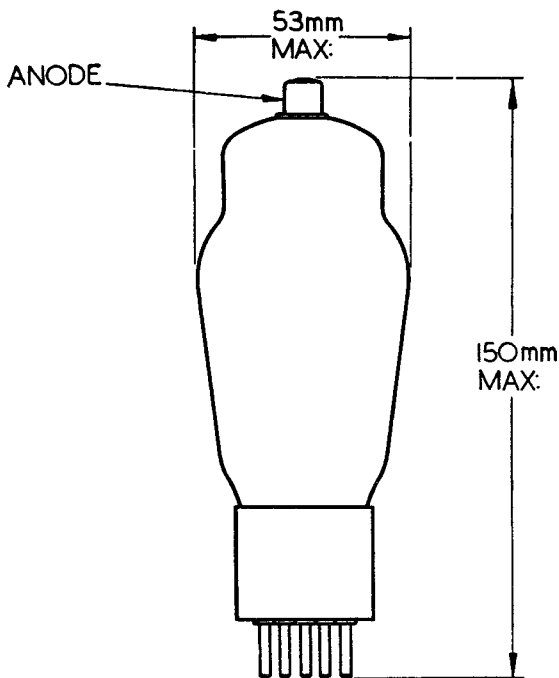
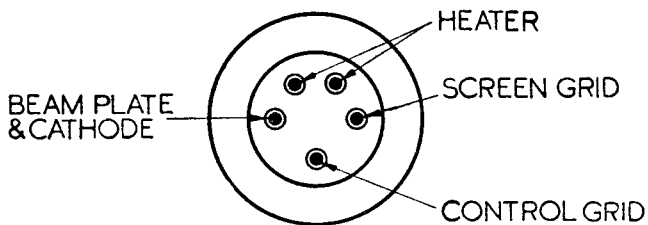
5B/250A



**5B/250A**

# Beam Power Amplifier

**5B/250A**



August, 1945

5B/250A—4



# SPECIAL VALVES

Ref.: 5B/254G  
to  
5B/258M

## Beam-Power Amplifiers

**Codes:** 5B/254G      5B/256M (CV499)  
5B/254M (CV428)    5B/257M (CV2220)  
5B/255M (CV391)    5B/258M (CV2347)

---

These valves are indirectly heated, beam-power tetrodes electrically similar to the 5B/250A (807) type, and of reliable construction. The 5B/254G is identical to the 5B/254M but has flexible leads for wiring directly into the circuit.

For applications where the valve is to be used at either high altitudes or under anode modulated conditions, the use of the double-ended versions (5B/254G, 5B/254M and 5B/258M) is to be preferred because of insulation considerations at the valve base.

### MECHANICAL DATA

#### Mounting Position

There are no restrictions on the mounting position of these valves but, as they may reach high temperatures according to the power dissipated, the equipment should be designed so that adequate ventilation is afforded to ensure safe bulb temperature under all conditions of use. Under no circumstances should the temperature of the hottest point of the bulb be allowed to exceed 250°C.

|            |     |    |
|------------|-----|----|
| Net weight | 40  | g  |
|            | 1.4 | oz |

June 1961

5B/254-8M-1



***Standard Telephones and Cables Limited***

Registered Office: Connaught House, Aldwych, W.C.2

VALVE DIVISION, FOOTSCRAY, KENT

Telephone: Footscray 3333

# SPECIAL VALVES



## Beam-Power Amplifiers

**Codes:** 5B/254G      5B/256M (CV499)  
              5B/254M (CV428)    5B/257M (CV2220)  
              5B/255M (CV391)    5B/258M (CV2347)

### ELECTRICAL DATA

#### CATHODE

Indirectly-heated, oxide-coated

|                          | 5B/254M | 5B/254G | 5B/255M |   |
|--------------------------|---------|---------|---------|---|
| Heater voltage           | 6.3     | 6.3     | 6.3     | V |
| Heater current (nominal) | 0.9     | 0.9     | 0.9     | A |
|                          | 5B/256M | 5B/257M | 5B/258M |   |
| Heater voltage           | 19      | 12      | 19      | V |
| Heater current (nominal) | 0.3     | 0.47    | 0.3     | A |

### DIRECT INTERELECTRODE CAPACITANCES

|                 | 5B/254M | 5B/254G | 5B/255M |    |
|-----------------|---------|---------|---------|----|
| Input           | 13      | 10      | 12      | pF |
| Output          | 7       | 8       | 8.5     | pF |
| Anode to Grid 1 | 0.1     | 0.12    | 0.13    | pF |
|                 | 5B/256M | 5B/257M | 5B/258M |    |
| Input           | 12      | 12      | 13      | pF |
| Output          | 8.5     | 8.5     | 7       | pF |
| Anode to Grid 1 | 0.13    | 0.13    | 0.1     | pF |

### CHARACTERISTICS

|                    |                                                                                                                        |   |      |
|--------------------|------------------------------------------------------------------------------------------------------------------------|---|------|
| Mutual conductance | $\left\{ \begin{array}{l} \text{Measured at} \\ V_a = 300V: V_{g2} = 250V \\ I_a = 72 \text{ mA} \end{array} \right\}$ | 6 | mA/V |
| Screen grid $\mu$  |                                                                                                                        | 9 |      |

### MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

#### AUDIO FREQUENCY

**Class AB<sub>1</sub>. Power Amplifier or Modulator. Triode connected.**  
 (For balanced two-valve operation.)

#### Maximum Ratings (per valve).

|                                                         |     |    |
|---------------------------------------------------------|-----|----|
| Direct anode voltage                                    | 400 | V  |
| Direct average anode current                            | 125 | mA |
| Direct anode plus screen dissipation                    | 25  | W  |
| Peak heater to cathode voltage,<br>positive or negative | 135 | V  |



# SPECIAL VALVES

Ref.: 5B/254G  
to  
5B/258M

## Beam-Power Amplifiers

**Codes:** 5B/254G      5B/256M (CV499)  
5B/254M (CV428)    5B/257M (CV2220)  
5B/255M (CV391)    5B/258M (CV2347)

### Typical Operating Conditions (two valves).

|                                   |       |    |
|-----------------------------------|-------|----|
| Direct anode voltage              | 400   | V  |
| *Direct grid voltage              | —45   | V  |
| Direct anode current, zero signal | 64    | mA |
| Direct anode current, max. signal | 140   | mA |
| Peak a.f. grid to grid voltage    | 90    | V  |
| Load resistor, anode to anode     | 3 000 | Ω  |
| Power output, two valves          | 15    | W  |
| Total harmonic distortion         | 3     | %  |

### Class AB<sub>2</sub> Power Amplifier or Modulator. (For balanced two-valve operation.)

#### Maximum Ratings (per valve).

|                                                      |     |    |
|------------------------------------------------------|-----|----|
| Direct anode voltage                                 | 600 | V  |
| Direct average anode current                         | 120 | mA |
| Direct anode dissipation                             | 25  | W  |
| Direct screen voltage                                | 300 | V  |
| Direct screen dissipation                            | 4.5 | W  |
| Peak heater to cathode voltage, positive or negative | 135 | V  |

#### Typical Operating Conditions (two valves).

|                                    |       |       |    |
|------------------------------------|-------|-------|----|
| Direct anode voltage               | 500   | 600   | V  |
| Direct screen voltage              | 300   | 300   | V  |
| *Direct grid voltage               | —30   | —32   | V  |
| Direct anode current, zero signal  | 60    | 46    | mA |
| Direct anode current, max. signal  | 240   | 200   | mA |
| Direct screen current, zero signal | 0.9   | 0.7   | mA |
| Direct screen current, max. signal | 16    | 12    | mA |
| Peak a.f. grid to grid voltage     | 86    | 90    | V  |
| Load resistor, anode to anode      | 4 600 | 6 900 | Ω  |
| Power output, two valves           | 75    | 80    | W  |

\* The D.C. grid circuit resistance should not exceed 30 000 ohms when a fixed bias source is used. Cathode bias is not recommended.

## RADIO FREQUENCY

### Class B. Telephony. Modulated carrier applied to the grid. (Carrier conditions per valve for use with 100% modulation.)

#### Maximum Ratings.

|                                                      |     |      |
|------------------------------------------------------|-----|------|
| Direct anode voltage                                 | 600 | V    |
| Direct anode current                                 | 80  | mA   |
| Direct anode dissipation                             | 25  | W    |
| Direct screen voltage                                | 300 | V    |
| Direct screen dissipation                            | 4.5 | W    |
| Peak heater to cathode voltage, positive or negative | 135 | V    |
| Maximum frequency for above ratings                  | 60  | Mc/s |
| Maximum anode voltage for 125 Mc/s operation         | 450 | V    |



# SPECIAL VALVES



## Beam-Power Amplifiers

Codes: 5B/254G      5B/256M (CV499)  
5B/254M (CV428)   5B/257M (CV2220)  
5B/255M (CV391)   5B/258M (CV2347)

### Typical Operating Conditions.

|                               |     |      |    |
|-------------------------------|-----|------|----|
| Direct anode voltage          | 500 | 600  | V  |
| Direct screen voltage         | 300 | 300  | V  |
| *Direct grid voltage          | -40 | -40  | V  |
| Direct anode current          | 70  | 62.5 | mA |
| Direct screen current         | 4   | 4    | mA |
| Peak r.f. grid voltage        | 40  | 36   | V  |
| Direct grid current           | 0   | 0    | mA |
| †Grid driving power (approx.) | 0.3 | 0.2  | W  |
| Power output                  | 11  | 12.5 | W  |

\* The total effective grid circuit resistance should not exceed 30 000 ohms.

† At crest of a.f. cycle with 100% modulation.

### Class C. Power Amplifier. Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation.)

#### Maximum Ratings.

|                                                         |      |      |
|---------------------------------------------------------|------|------|
| Direct anode voltage                                    | 475  | V    |
| Direct anode current                                    | 83   | mA   |
| Direct anode dissipation                                | 16.5 | W    |
| Direct screen voltage                                   | 300  | V    |
| Direct screen dissipation                               | 3    | W    |
| Direct grid current                                     | 5    | mA   |
| Peak heater to cathode voltage,<br>positive or negative | 135  | V    |
| Maximum frequency for above ratings                     | 60   | Mc/s |
| Maximum direct anode voltage for 125 Mc/s<br>operation  | 350  | V    |

### Typical Operating Conditions.

|                           |      |      |    |
|---------------------------|------|------|----|
| Direct anode voltage      | 400  | 475  | V  |
| †Direct screen voltage    | 250  | 250  | V  |
| †Screen series resistor   | 25   | 28   | kΩ |
| *Direct grid voltage      | -75  | -85  | V  |
| Grid series resistor      | 21.4 | 21.2 | kΩ |
| Direct anode current      | 80   | 83   | mA |
| Direct screen current     | 6    | 8    | mA |
| Peak r.f. grid voltage    | 95   | 108  | V  |
| §Direct grid current      | 3.5  | 4.0  | mA |
| Grid drive power, approx. | 0.3  | 0.4  | W  |
| Power output              | 22   | 28   | W  |

Codes: 5B/254G

5B/254M (CV428)

5B/255M (CV391)

5B/256M (CV499)

5B/257M (CV2220)

5B/258M (CV2347)

**STC**Ref.: 5B/254G  
to  
5B/258M

CONTINUED

**Class C. Power Amplifier or Oscillator. Unmodulated.****Maximum Ratings.**

|                                                         |     |      |
|---------------------------------------------------------|-----|------|
| Direct anode voltage                                    | 600 | V    |
| Direct anode current                                    | 100 | mA   |
| Direct anode dissipation                                | 25  | W    |
| Direct screen voltage                                   | 300 | V    |
| Direct screen dissipation                               | 4.5 | W    |
| Direct grid current                                     | 5.0 | mA   |
| Peak heater to cathode voltage,<br>positive or negative | 135 | V    |
| Maximum frequency for above ratings                     | 60  | Mc/s |
| Maximum direct anode voltage for 125 Mc/s<br>operation  | 450 | V    |

**Typical Operating Conditions.**

|                           |      |      |    |
|---------------------------|------|------|----|
| Direct anode voltage      | 500  | 600  | V  |
| ⊙ Direct screen voltage   | 250  | 250  | V  |
| ⊙ Screen series resistor  | 31   | 44   | kΩ |
| * Direct grid voltage     | -45  | -45  | V  |
| Grid series resistor      | 11.2 | 11.2 | kΩ |
| Direct anode current      | 100  | 100  | mA |
| Direct screen current     | 8    | 8    | mA |
| Peak r.f. grid voltage    | 65   | 65   | V  |
| § Direct grid current     | 4    | 4    | mA |
| Grid drive power, approx. | 0.3  | 0.3  | W  |
| Power output              | 32   | 40   | W  |

\* Obtained from the resistor of value shown, a cathode resistor, fixed supply or a combination of methods.

When the grid is driven positive and the valve operated at maximum ratings the total D.C. grid resistance should not exceed 30 000 ohms. For operation at less than maximum ratings the value may be increased to 100 000 ohms.

† Obtained from the modulated anode supply via a resistor of the value given, from a fixed supply via an a.f. choke, or, preferably, from a fixed supply via a separate winding on the modulation transformer.

§ Subject to wide variation dependent upon the impedance of the load circuit.

⊙ Obtained from a separate source, from the anode voltage supply via a potential divider or through a series resistor of the value shown. A series screen resistor should be used only in a circuit in which the valve is not keyed.

**STC**

Codes: 5B/254G

5B/256M (CV499)

5B/254M (CV428)

5B/257M (CV2220)

5B/255M (CV391)

5B/258M (CV2347)

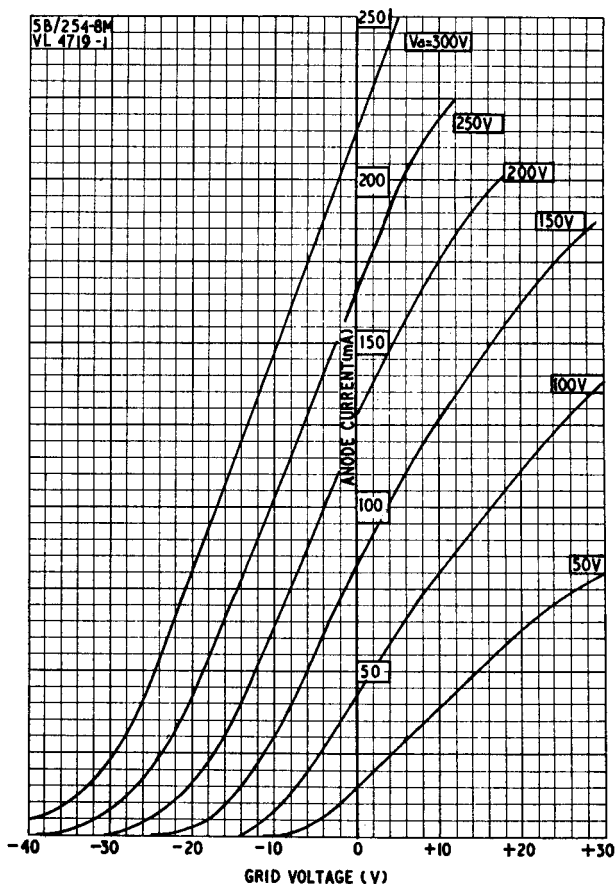
Ref.: 5B/254G

to

5B/258M

CONTINUED

## MUTUAL CHARACTERISTIC—TRIODE CONNECTED



Codes: 5B/254G

5B/254M (CV428)

5B/255M (CV391)

5B/256M (CV499)

5B/257M (CV2220)

5B/258M (CV2347)

**STC**

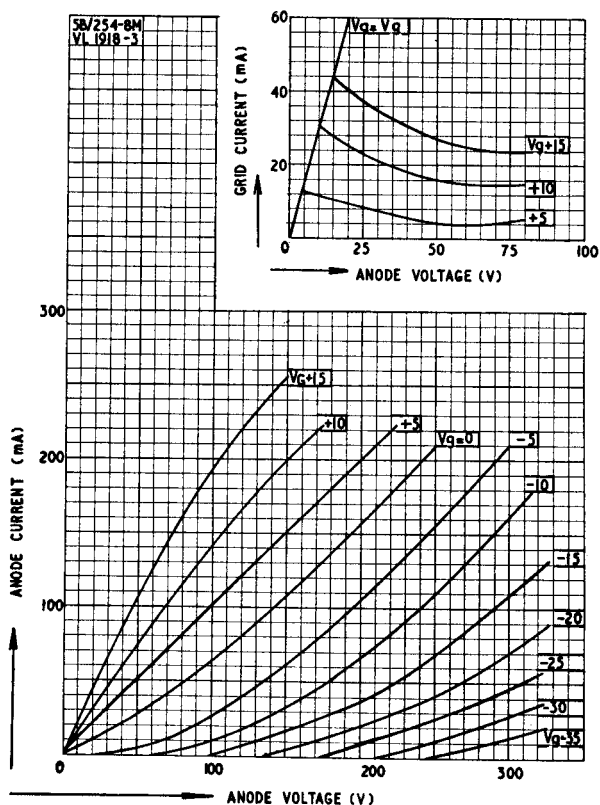
Ref.: 5B/254G

to

5B/258M

CONTINUED

CONSTANT VOLTAGE CHARACTERISTIC—  
TRIODE CONNECTED



**STC**

Codes: 5B/254G

5B/256M (CV499)

5B/254M (CV428)

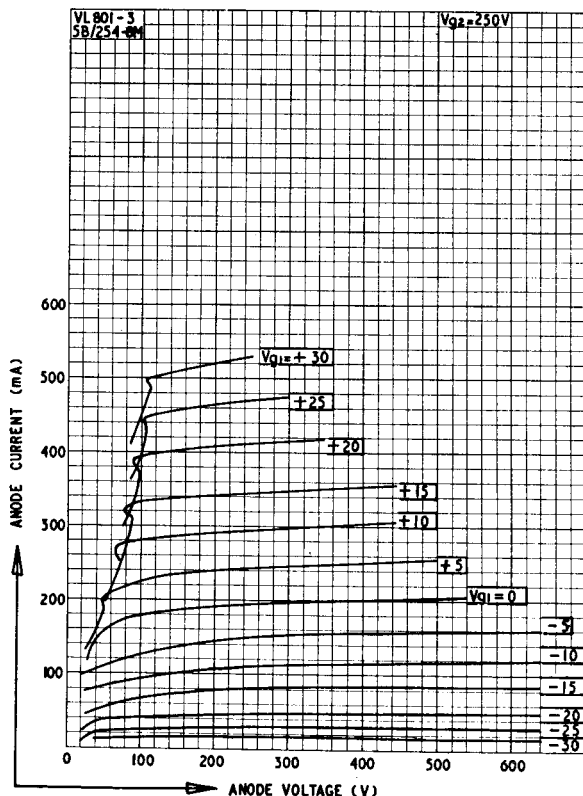
5B/257M (CV2220)

5B/255M (CV391)

5B/258M (CV2347)

Ref.: 5B/254G  
to  
5B/258M

CONTINUED



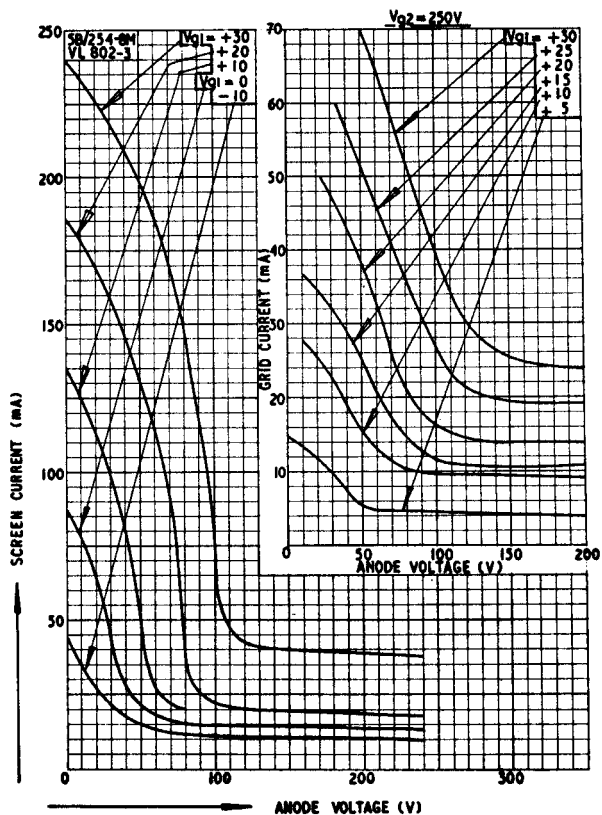


# SPECIAL VALVES

Ref.: 5B/254G  
to  
5B/258M

## Beam-Power Amplifiers

Codes: 5B/254G      5B/256M (CV499)  
5B/254M (CV428)   5B/257M (CV2220)  
5B/255M (CV391)   5B/258M (CV2347)



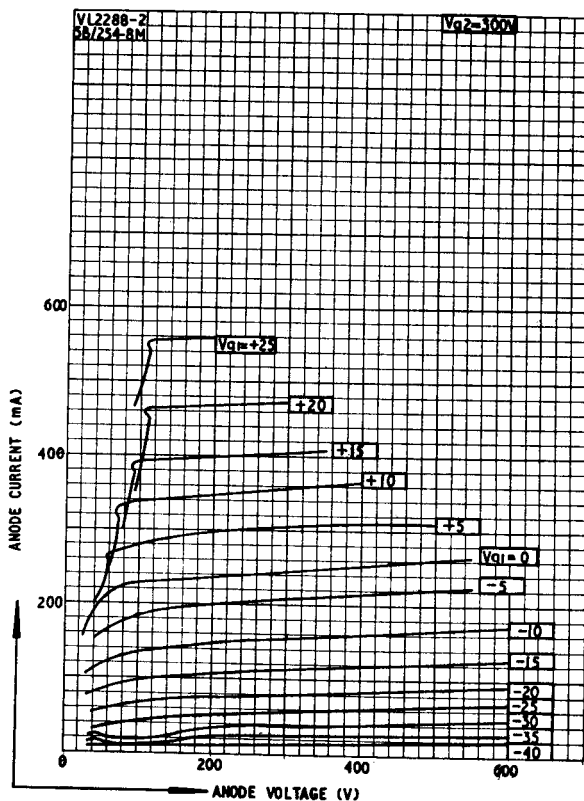
Ref.: 5B/254G  
to  
5B/258M

## SPECIAL VALVES



### Beam-Power Amplifiers

Codes: 5B/254G      5B/256M (CV499)  
5B/254M (CV428)   5B/257M (CV2220)  
5B/255M (CV391)   5B/258M (CV2347)



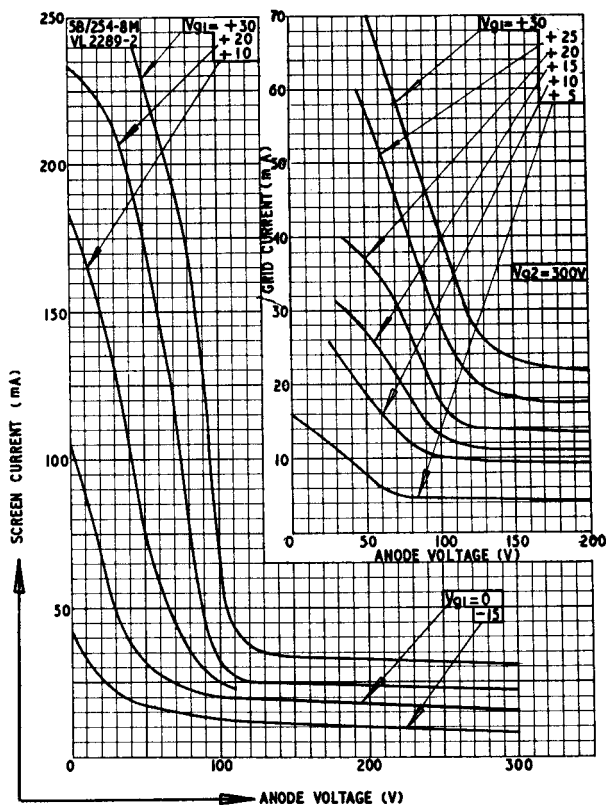


# SPECIAL VALVES

Ref.: 5B/254G  
to  
5B/258M

## Beam-Power Amplifiers

Codes: 5B/254G      5B/256M (CV499)  
5B/254M (CV428) 5B/257M (CV2220)  
5B/255M (CV391) 5B/258M (CV2347)





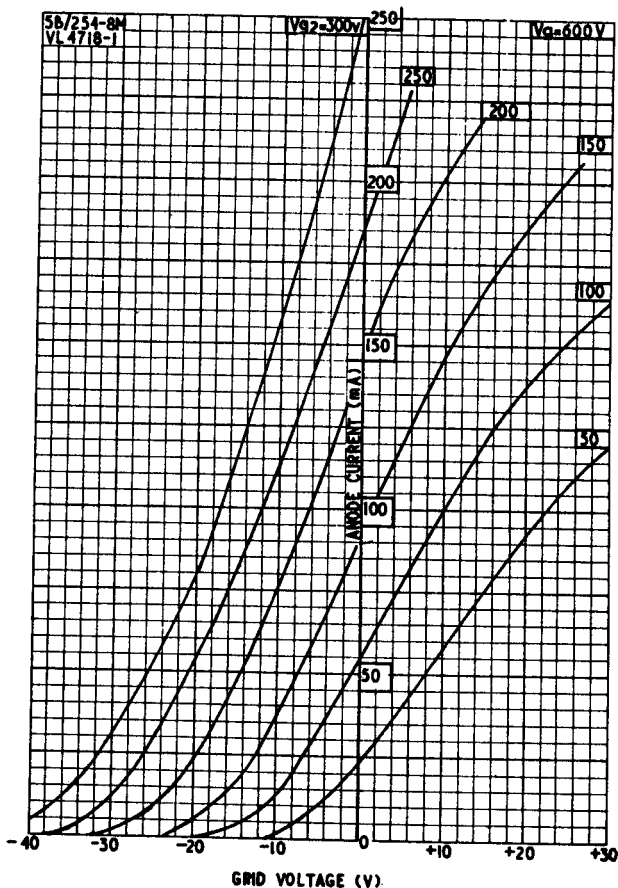
Ref.: 5B/254G  
to  
5B/258M

## SPECIAL VALVES



### Beam-Power Amplifiers

Codes: 5B/254G      5B/256M (CV499)  
5B/254M (CV428) 5B/257M (CV2220)  
5B/255M (CV391) 5B/258M (CV2347)

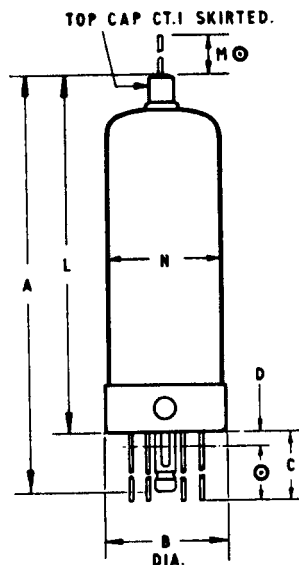
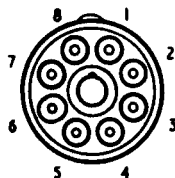




# SPECIAL VALVES

## Beam-Power Amplifiers

Code: 5B/254G



### BASING

1. HEATER.
  2. CATHODE & BEAM PLATES.
  3. GRID No. 2.
  4. CATHODE & BEAM PLATES.
  5. GRID No. 1.
  6. CATHODE & BEAM PLATES.
  7. CATHODE & BEAM PLATES.
  8. HEATER.
- T.C. ANODE.

| DIM. | MILLIMETRES. | INCHES.              |
|------|--------------|----------------------|
| A    | 105,6 MAX.   | 4 $\frac{1}{8}$ MAX. |
| B    | 30,2 MAX.    | 1 $\frac{1}{8}$ MAX. |
| C    | 50,8 MIN.    | 2 MIN.               |
| D    | 3,2 NOM.     | $\frac{1}{8}$ NOM.   |
| L    | 92,1 MAX.    | 3 $\frac{7}{8}$ MAX. |
| M    | 25,4 MIN.    | 1 MIN.               |
| N    | 27,8 MIN.    | 1-095 MIN.           |
|      | 29,2 MAX.    | 1-150 MAX.           |

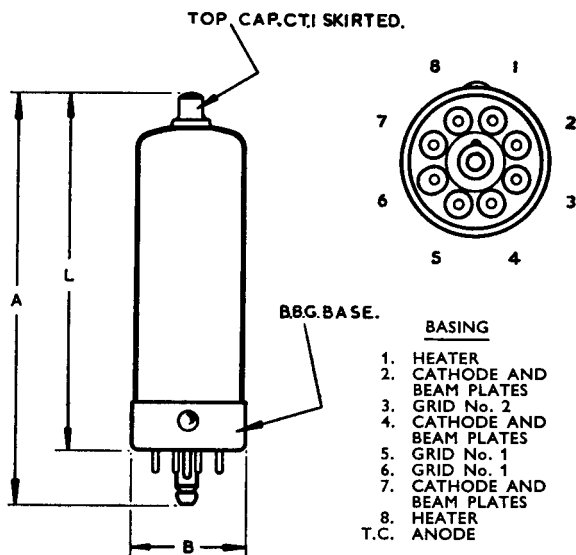
© DENOTES: LEADS TINNED OVER THIS PORTION.  
NOTE:—BASIC FIGURES ARE INCHES.

# SPECIAL VALVES



## Beam-Power Amplifiers

Codes: 5B/254M (CV428)  
5B/258M (CV2347)



| DIM. | MILLIMETRES | INCHES               |
|------|-------------|----------------------|
| A    | 105,6 MAX.  | 4 $\frac{1}{2}$ MAX. |
| B    | 30,15 MAX.  | 1 $\frac{1}{8}$ MAX. |
| L    | 92,1 MAX.   | 3 $\frac{1}{2}$ MAX. |

NOTE.—BASIC DIMENSIONS ARE INCHES

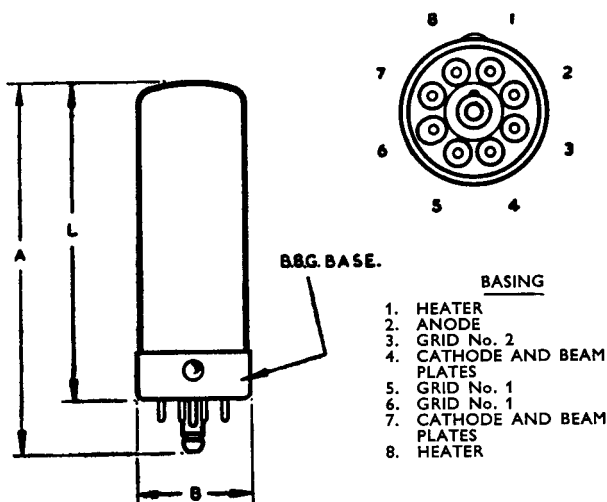


# SPECIAL VALVES

Ref.: 5B/255M  
5B/256M  
5B/257M

## Beam-Power Amplifiers

Codes: 5B/255M (CV391)  
5B/256M (CV499)  
5B/257M (CV2220)



| DIM. | MILLIMETRES            | INCHES                                        |
|------|------------------------|-----------------------------------------------|
| A    | 92,9 MAX.              | 3 $\frac{11}{16}$ MAX.                        |
| B    | 30,15 MAX.             | 1 $\frac{1}{16}$ MAX.                         |
| L    | 69,9 MIN.<br>77,9 MAX. | 2 $\frac{3}{8}$ MIN.<br>3 $\frac{1}{16}$ MAX. |

NOTE.—BASIC DIMENSIONS ARE INCHES

# —Standard Valves—

5B/300-B  
5B/300-BF

## VALVE TYPES 5B/300-B AND 5B/300-BF

RF. PENTODES.

The 5B/300-B and 5B/300-BF Valves are identical and the -F code indicates that the valve has passed special tests for use in Standard Aircraft Radio.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

Standard British 7-pin.  
Anode connected to top cap type B.

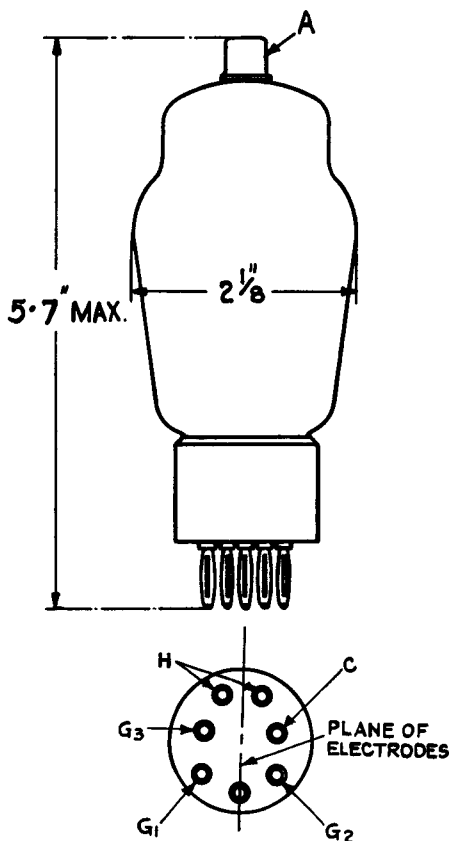
#### Dimensions.

Maximum overall length 5.7" (14.5 cms.)  
Bulb diameter  $2\frac{1}{8}$ " (5.4 cms.)  
Net weight 0.145 lbs. (66 gms.)

#### Constants.

Heater voltage 10 volts  
Nominal heater current 0.80 amps.  
\*Mutual conductance 6 mA. per volt  
Grid-anode capacity  $1.2 \mu\text{F}$ .  
Input capacity  $16 \mu\text{F}$ .  
Output capacity  $8 \mu\text{F}$ .

\* at  $V_p = 500$ ,  $V_{g2} = 250$ ,  $V_{g1} = -8$ ,  
 $V_{g3} = 0$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |           |
|-----------------------------------------------|-----------|
| Maximum direct anode voltage                  | 500 volts |
| Maximum direct screen voltage                 | 300 volts |
| Maximum direct anode current                  | 60 mA.    |
| Maximum direct screen current                 | 25 mA.    |
| Maximum anode dissipation                     | 30 watts  |
| Maximum screen dissipation                    | 6 watts   |
| Maximum frequency for above ratings           | 40 Mc.    |
| Maximum anode voltage for frequency of 70 Mc. | 300 volts |

Tentative data

W.5B/300-B.1  
April 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                                      | Grid Modulated<br>RF Power Amplifier<br>Class B Telephony |
|------------------------------------------------------|-----------------------------------------------------------|
| (Carrier conditions for use with mod. factor of 1.0) |                                                           |
| Direct anode voltage                                 | 500 volts                                                 |
| Direct screen voltage                                | 250 volts                                                 |
| Direct suppressor voltage                            | 0 volts                                                   |
| Direct grid voltage                                  | —20 volts                                                 |
| Peak RF grid voltage                                 | 22 volts                                                  |
| Direct anode current                                 | 35 mA.                                                    |
| Direct screen current                                | 6 mA.                                                     |
| Direct grid current                                  | 1 mA.                                                     |
| Carrier output                                       | 4.8 watts                                                 |
| *Driving power                                       | 0.3 watts                                                 |

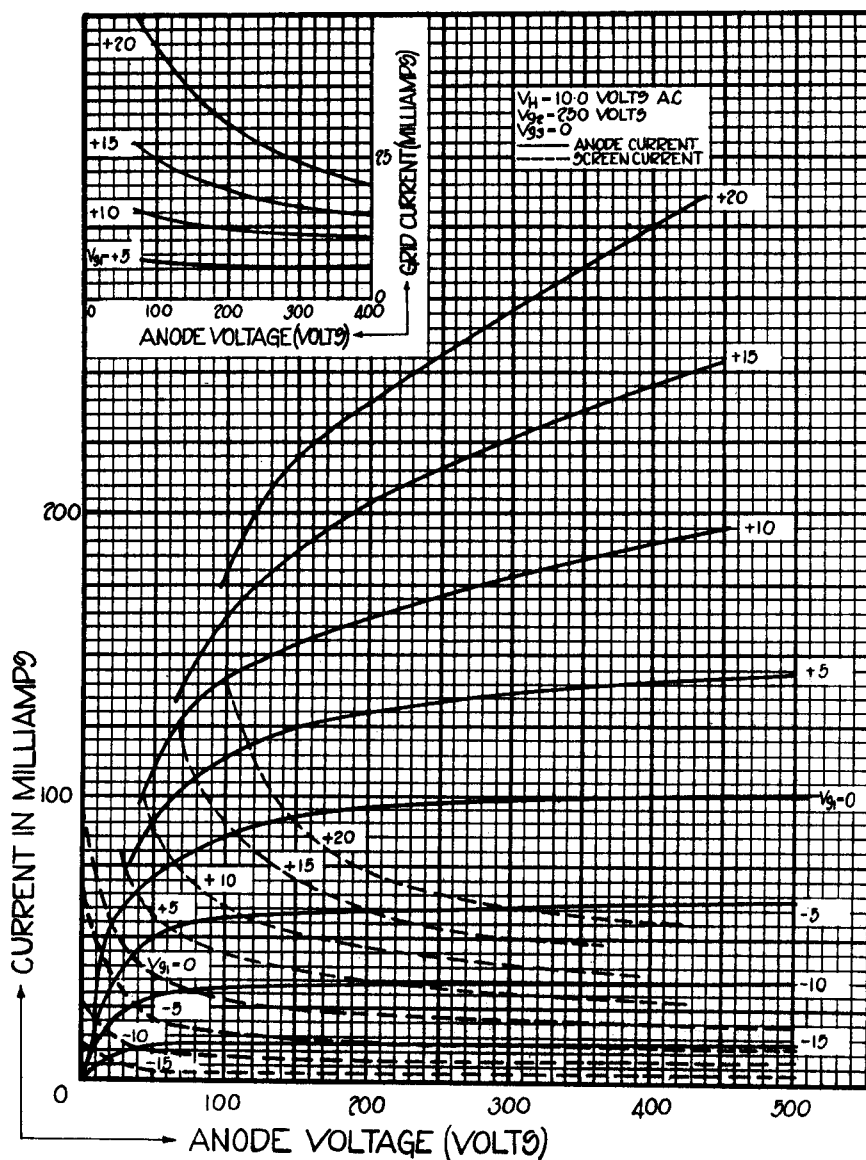
|                                                      | Grid Modulated<br>RF Power Amplifier<br>Class C Telephony |
|------------------------------------------------------|-----------------------------------------------------------|
| (Carrier conditions for use with mod. factor of 1.0) |                                                           |
| Direct anode voltage                                 | 500 volts                                                 |
| Direct screen voltage                                | 250 volts                                                 |
| Direct suppressor voltage                            | 0 volts                                                   |
| Direct grid voltage                                  | —70 volts                                                 |
| Peak RF grid voltage                                 | 77 volts                                                  |
| Peak AF grid voltage                                 | 27 volts                                                  |
| Direct anode current                                 | 35 mA.                                                    |
| Direct screen current                                | 7 mA.                                                     |
| Direct grid current                                  | 1.5 mA.                                                   |
| Carrier output                                       | 5 watts                                                   |
| *Driving power                                       | 0.7 watts                                                 |

\* at crest of AF cycle with modulation factor of 1.0.

|                           | RF Power Amplifier<br>or Oscillator<br>Class C Telegraphy |
|---------------------------|-----------------------------------------------------------|
| Direct anode voltage      | 500 volts                                                 |
| Direct screen voltage     | 250 volts                                                 |
| Direct suppressor voltage | 0 volts                                                   |
| Direct grid voltage       | —50 volts                                                 |
| Peak RF grid voltage      | 75 volts                                                  |
| Direct anode current      | 60 mA.                                                    |
| Direct screen current     | 22 mA.                                                    |
| Direct grid current       | 10 mA.                                                    |
| Power output              | 18 watts                                                  |
| Driving power             | 0.7 watts                                                 |

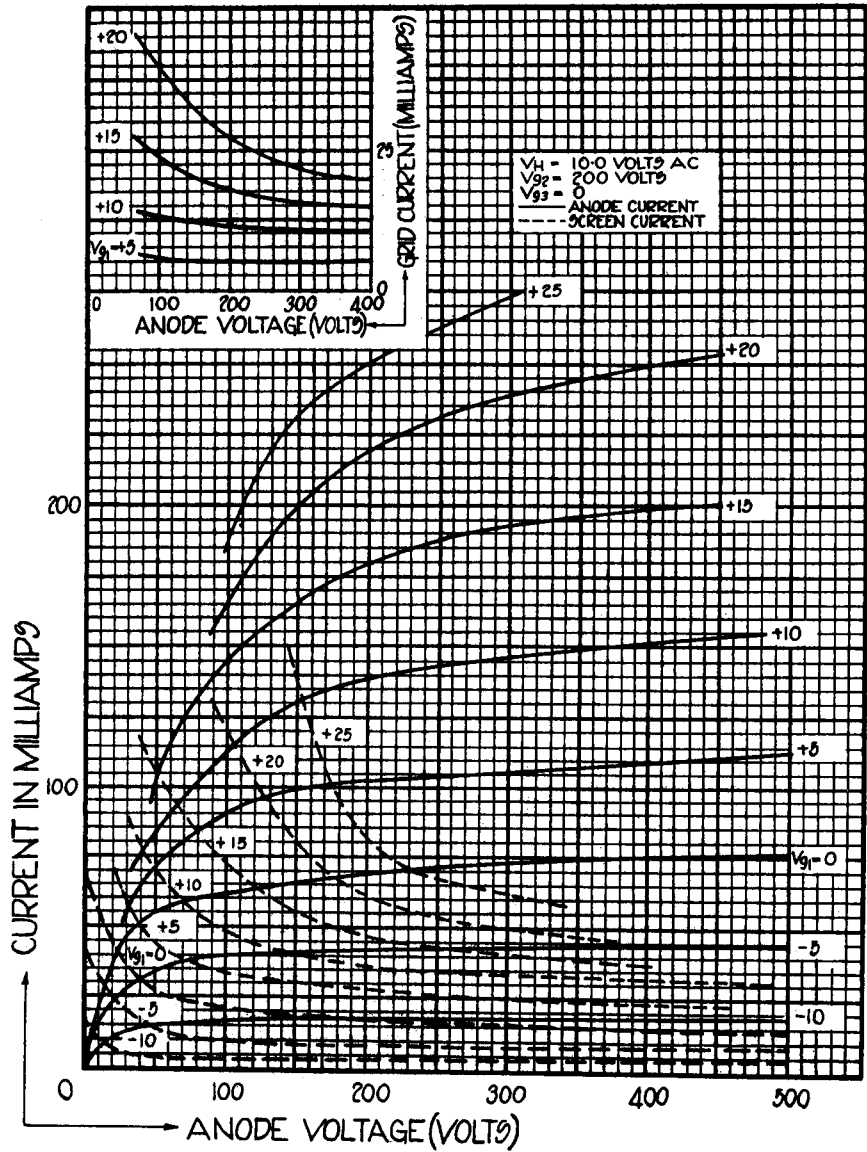
# —Standard Valves—

5B/300-B  
5B/300-BF



5B/300-B  
5B/300-BF

—Standard Valves—



PRINTED IN  
ENGLAND



# —Standard Valves—

## VALVE TYPE 5B/500-B

RF PENTODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

Special British 7-pin.  
Anode connected to top cap type B.

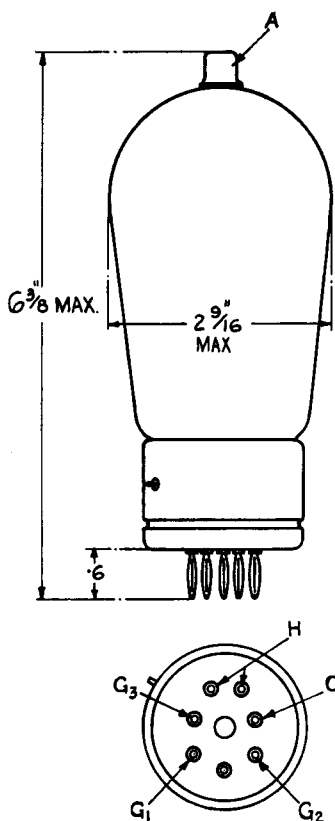
#### Dimensions.

Max. overall length  $6\frac{3}{8}$ " (15.9 cms.)  
Maximum diameter  $2\frac{9}{16}$ " (6.45 cms.)  
Net weight 0.4 lbs. (180 gms.)

#### Constants.

Heater voltage 10 volts  
Nominal heater current 1.3 amps.  
\*Mutual conductance 4.5 mA. per volt  
Grid-anode capacity  $0.15 \mu\mu\text{F.}$   
Input capacity  $20 \mu\mu\text{F.}$   
Output capacity  $7 \mu\mu\text{F.}$

\* at  $V_p = 1,000$ ,  $V_{g1} = -16$ ,  
 $V_{g2} = 200$ ,  $V_{g3} = 0$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |             |
|-------------------------------------|-------------|
| Maximum direct anode voltage        | 1,250 volts |
| Maximum direct screen voltage       | 400 volts   |
| Maximum direct suppressor voltage   | 40 volts    |
| Maximum anode dissipation           | 50 watts    |
| Maximum screen dissipation          | 10 watts    |
| Maximum frequency for above ratings | 20 Mc.      |

Tentative data

W.5B/500-B.1  
March 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                           | Class C Amplifier<br>Unmodulated |
|---------------------------|----------------------------------|
| Direct anode voltage      | 1,200 volts                      |
| Direct screen voltage     | 200 volts                        |
| Direct suppressor voltage | 0 volts                          |
| Control grid bias         | —70 volts                        |
| Anode current             | 77 mA.                           |
| Grid current              | 10 mA.                           |
| Screen current            | 14 mA.                           |
| Peak RF input voltage     | 100 volts                        |
| Peak output power         | 60 watts                         |
| RF input power            | 0.9 watts                        |

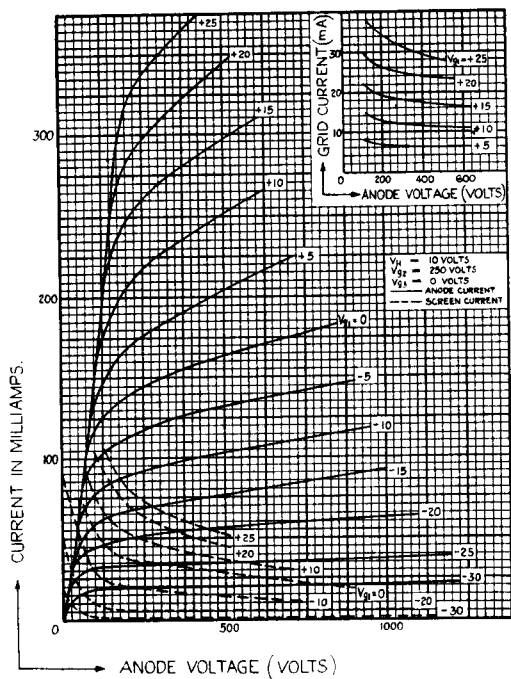
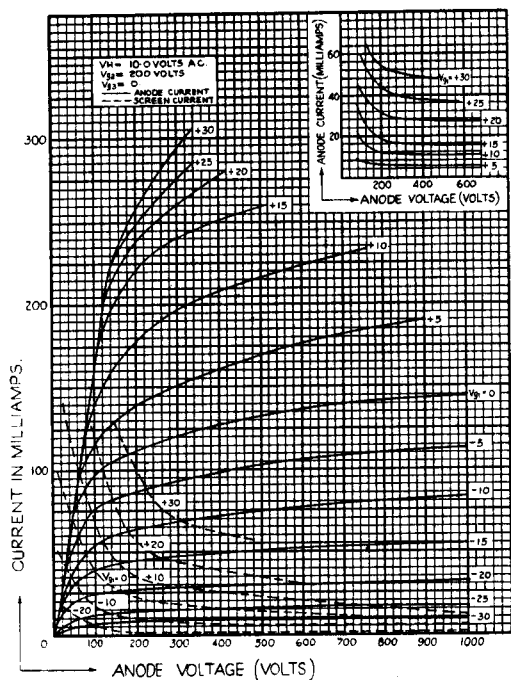
|                           | Class C Amplifier<br>Suppressor grid modulated |
|---------------------------|------------------------------------------------|
| Direct anode voltage      | 1,200 volts                                    |
| Direct screen voltage     | 200 volts                                      |
| Direct suppressor voltage | —60 volts                                      |
| Control grid bias         | —70 volts                                      |
| Anode current             | 38 mA.                                         |
| Grid current              | 10 mA.                                         |
| Screen current            | 14 mA.                                         |
| Peak RF input voltage     | 100 volts                                      |
| Carrier output            | 15 watts                                       |

|                           | Class C Telephony<br>Grid Modulated |
|---------------------------|-------------------------------------|
| Direct anode voltage      | 1,200 volts                         |
| Direct screen voltage     | 200 volts                           |
| Direct suppressor voltage | 0 volts                             |
| Control grid bias         | —145 volts                          |
| Anode current             | 45 mA.                              |
| Screen current            | 4 mA.                               |
| Grid current              | 1.5 mA.                             |
| Peak RF input voltage     | 150 volts                           |
| Peak power output         | 64 watts                            |
| Carrier output            | 16 watts                            |

|                           | Class B Telephony<br>Grid Modulated |
|---------------------------|-------------------------------------|
| Direct anode voltage      | 1,200 volts                         |
| Direct screen voltage     | 200 volts                           |
| Direct suppressor voltage | 0 volts                             |
| Control grid bias         | —30 volts                           |
| Anode current             | 40 mA.                              |
| Screen current            | 3 mA.                               |
| Peak output power         | 56 watts                            |
| Carrier output            | 14 watts                            |

# —Standard Valves—

5B/500-B



PRINTED IN  
ENGLAND

# —Standard Valves—

5B/501-B  
5B/501-BF

## VALVE TYPES 5B/501-B and 5B/501-BF

RF. PENTODES.

The 5B/501-B and 5B/501-BF Valves have identical characteristics and the -F code indicates that the valve has passed special tests for use in Standard Aircraft Radio.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

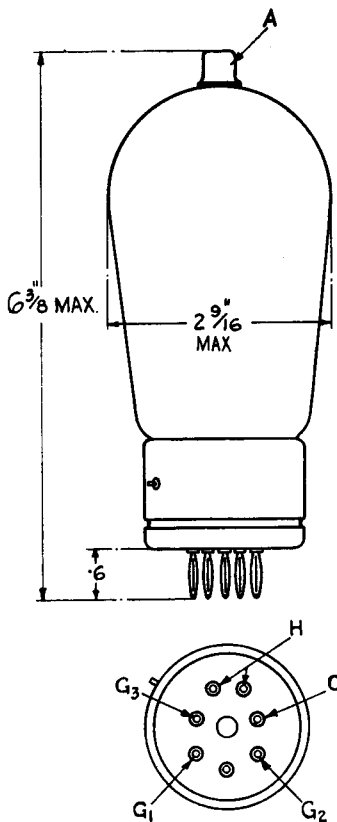
Special British 7-pin.  
Anode connected to top cap type B.

#### Dimensions.

Max. overall length  $6\frac{3}{8}"$  (15.9 cms.)  
Maximum diameter  $2\frac{9}{16}"$  (6.45 cms.)  
Net weight 0.4 lbs. (180 gms.)

#### Constants.

Heater voltage 13 volts  
Nominal heater current 1.0 amps.  
\*Mutual conductance 4.5 mA. per volt  
Grid-anode capacity  $0.15 \mu\mu\text{F.}$   
Input capacity  $20 \mu\mu\text{F.}$   
Output capacity  $7 \mu\mu\text{F.}$   
\* at  $V_p = 1,000$ ,  $V_{g1} = -16$ ,  
 $V_{g2} = 200$ ,  $V_{g3} = 0$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |             |
|-------------------------------------|-------------|
| Maximum direct anode voltage        | 1,250 volts |
| Maximum direct screen voltage       | 400 volts   |
| Maximum direct suppressor voltage   | 40 volts    |
| Maximum anode dissipation           | 50 watts    |
| Maximum screen dissipation          | 10 watts    |
| Maximum frequency for above ratings | 20 Mc.      |

Tentative data

W.5B/501-B.1  
March 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                           | Class C Amplifier<br>Unmodulated |
|---------------------------|----------------------------------|
| Direct anode voltage      | 1,200 volts                      |
| Direct screen voltage     | 200 volts                        |
| Direct suppressor voltage | 0 volts                          |
| Control grid bias         | —70 volts                        |
| Anode current             | 77 mA.                           |
| Grid current              | 10 mA.                           |
| Screen current            | 14 mA.                           |
| Peak RF input voltage     | 100 volts                        |
| Peak output power         | 60 watts                         |
| RF input power            | 0.9 watts                        |

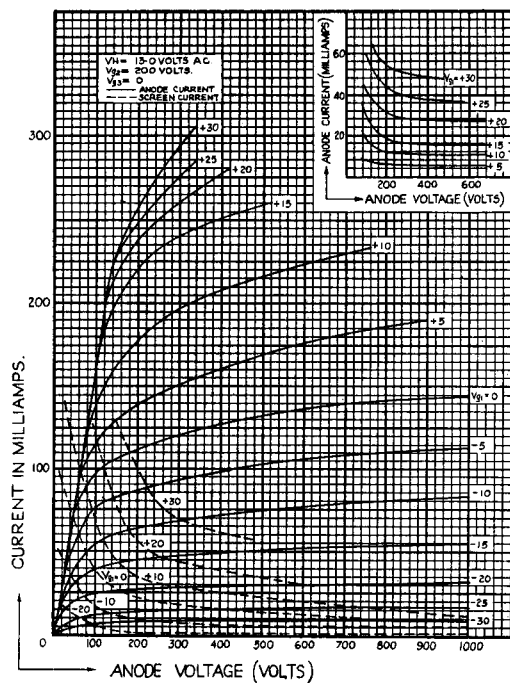
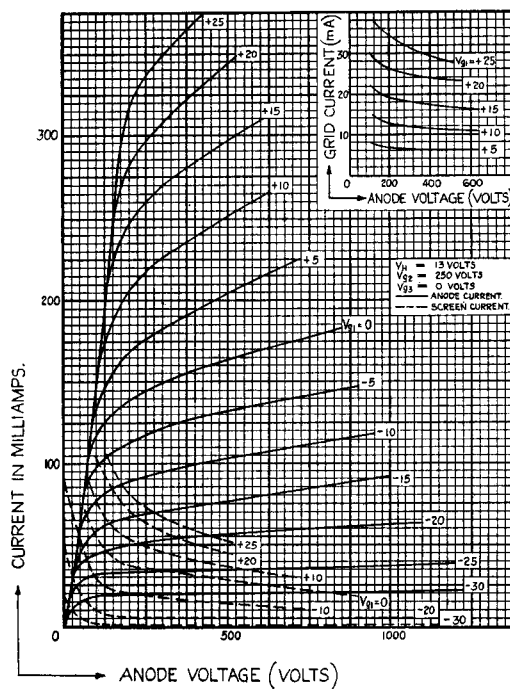
|                           | Class C Amplifier<br>Suppressor grid modulated |
|---------------------------|------------------------------------------------|
| Direct anode voltage      | 1,200 volts                                    |
| Direct screen voltage     | 200 volts                                      |
| Direct suppressor voltage | —60 volts                                      |
| Control grid bias         | —70 volts                                      |
| Anode current             | 38 mA.                                         |
| Grid current              | 10 mA.                                         |
| Screen current            | 14 mA.                                         |
| Peak RF input voltage     | 100 volts                                      |
| Carrier output            | 15 watts                                       |

|                           | Class C Telephony<br>Grid Modulated |
|---------------------------|-------------------------------------|
| Direct anode voltage      | 1,200 volts                         |
| Direct screen voltage     | 200 volts                           |
| Direct suppressor voltage | 0 volts                             |
| Control grid bias         | —145 volts                          |
| Anode current             | 45 mA.                              |
| Screen current            | 4 mA.                               |
| Grid current              | 1.5 mA.                             |
| Peak RF input voltage     | 150 volts                           |
| Peak power output         | 64 watts                            |
| Carrier output            | 16 watts                            |

|                           | Class B Telephony<br>Grid Modulated |
|---------------------------|-------------------------------------|
| Direct anode voltage      | 1,200 volts                         |
| Direct screen voltage     | 200 volts                           |
| Direct suppressor voltage | 0 volts                             |
| Control grid bias         | —30 volts                           |
| Anode current             | 40 mA.                              |
| Screen current            | 3 mA.                               |
| Peak output power         | 56 watts                            |
| Carrier output            | 14 watts                            |

# —Standard Valves—

5B/501-B  
5B/501-BF



PRINTED IN  
ENGLAND





# R.F. Beam Power Amplifier

5C/100A

## CATHODE.

Thoriated tungsten filament

|                 |      |   |
|-----------------|------|---|
| Voltage         | 10   | V |
| Nominal current | 5    | A |
| Peak emission   | 2.25 | A |

## RATING.

|                    |                                                                                                                                                |     |      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|
| Mutual conductance | $\left. \begin{array}{l} \text{Measured at} \\ V_a 2kV, V_g 400V, I_a 50 \text{ mA} \\ V_a = V_g 400V, I_a 50 \text{ mA} \end{array} \right\}$ | 3.3 | mA/V |
| Screen grid $\mu$  |                                                                                                                                                | 10  |      |

## INTER-ELECTRODE CAPACITIES.

|               |      |    |
|---------------|------|----|
| Anode to grid | 0.2  | pF |
| Input         | 17.0 | pF |
| Output        | 14   | pF |

## DIMENSIONS.

|                                     |     |     |
|-------------------------------------|-----|-----|
| Maximum overall length              | 191 | mm. |
| Maximum bulb diameter               | 66  | mm. |
| Base : Large American 7-pin bayonet |     |     |
| Net weight                          | 240 | g.  |

## MAXIMUM RATINGS.

|                                 |     |      |
|---------------------------------|-----|------|
| Maximum direct anode voltage    | 2.0 | kV   |
| Maximum direct anode current    | 200 | mA   |
| Maximum anode dissipation       | 100 | W    |
| Maximum direct screen voltage   | 400 | V    |
| Maximum screen dissipation      | 15  | W    |
| Maximum Freq. for above Ratings | 30  | Mc/s |

# R.F. Beam Power Amplifier

5C/100A



## TYPICAL OPERATING CONDITIONS.

### RADIO FREQUENCY.

#### Class B Power Amplifier Telephony.

(Carrier conditions per valve for use with 100% modulation).

|                       |     |     |           |
|-----------------------|-----|-----|-----------|
| Direct anode voltage  | 1.5 | 2.0 | kV        |
| Grid bias             | —60 | —75 | V         |
| Direct anode current  | 100 | 75  | mA        |
| Direct screen voltage | 400 | 400 | V         |
| Direct screen current | 4   | 3   | mA        |
| Peak RF grid voltage  | 70  | 80  | V         |
| Power output          | 50  | 50  | W approx. |

#### Class C Power Amplifier. Anode subject to modulation.

(Carrier conditions per valve for use with 100% modulation).

|                       |      |      |            |
|-----------------------|------|------|------------|
| Direct anode voltage  | 1.25 | 1.6  | kV         |
| Grid bias             | —120 | —130 | V          |
| Direct anode current  | 150  | 150  | mA         |
| Direct screen voltage | 400  | 400  | V          |
| Direct screen current | 16   | 20   | mA         |
| Peak RF grid voltage  | 195  | 210  | V          |
| *Direct grid current  | 4    | 6    | mA approx. |
| Power output          | 135  | 175  | W approx.  |

#### Class C Power Amplifier or Oscillator, unmodulated.

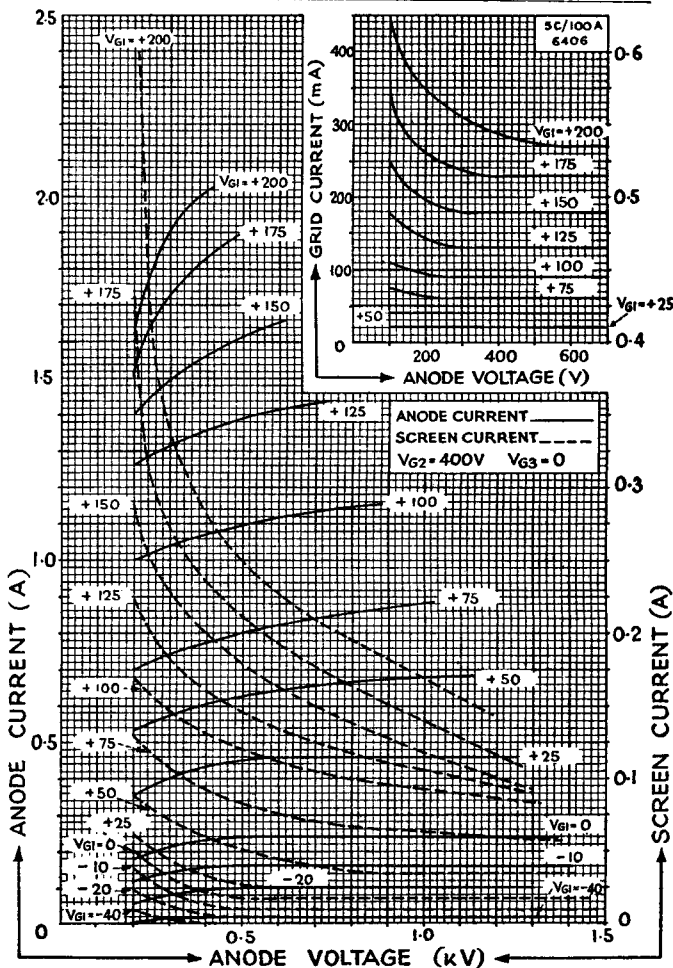
|                       |     |            |
|-----------------------|-----|------------|
| Direct anode voltage  | 2.0 | kV         |
| Grid bias             | —90 | V          |
| Direct anode current  | 180 | mA         |
| Direct screen voltage | 400 | V          |
| Direct screen current | 15  | mA         |
| Peak RF grid voltage  | 160 | V          |
| *Direct grid current  | 3   | mA approx. |
| Power output          | 260 | W approx.  |

\*Subject to wide variation depending upon the impedance of the load circuit.



# R.F. Beam Power Amplifier

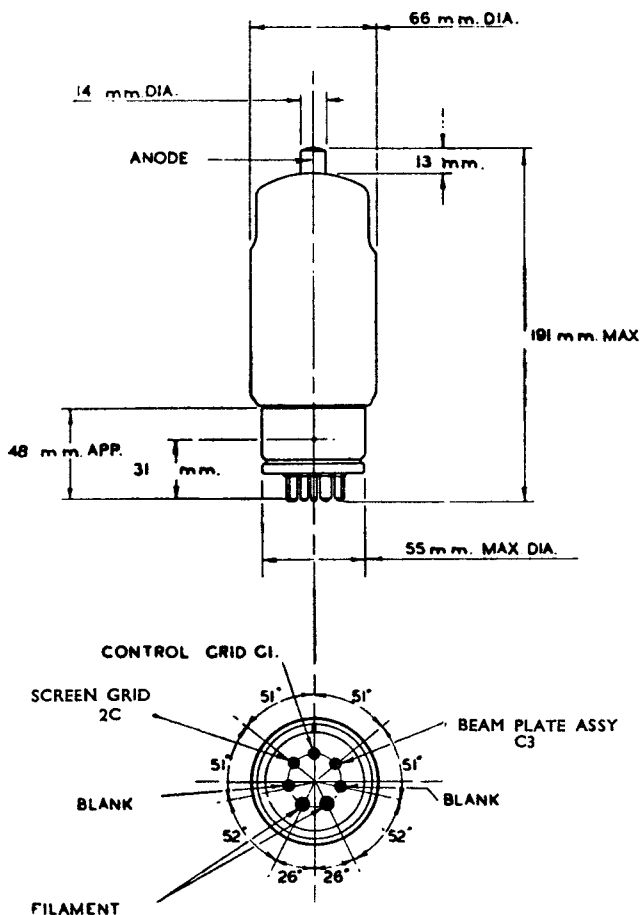
5C/100A



5C/100A

# R.F. Beam Power Amplifier

5C/100A





# Pentode

4069A

5C/101A  
(4069A)

## CATHODE.

Thoriated tungsten filament

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 10  | V |
| Nominal current | 5.4 | A |
| Peak emission   | 3   | A |

## RATING.

|                    |                                                                                                                                    |    |      |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------|----|------|
| Mutual conductance | $\left\{ \begin{array}{l} \text{Measured at } V_a \text{ 2 kV} \\ V_{g_2} \text{ 400V, } V_{g_1} \text{—20V} \end{array} \right\}$ | 5  | mA/V |
| Screen grid $\mu$  | $V_a = V_{g_2} = 400\text{V. } V_{g_1} \text{—20}$                                                                                 | 11 |      |

## INTER-ELECTRODE CAPACITIES.

|                 |      |    |
|-----------------|------|----|
| Grid to anode   | 0.1  | pF |
| Input capacity  | 18   | pF |
| Output capacity | 13.0 | pF |

## DIMENSIONS.

|                             |     |     |
|-----------------------------|-----|-----|
| Maximum overall length      | 249 | mm. |
| Maximum bulb diameter       | 66  | mm. |
| Base : Large American 5 pin |     |     |
| Net weight                  | 300 | g.  |

## MAXIMUM RATINGS.

|                                     |     |      |
|-------------------------------------|-----|------|
| Maximum direct anode voltage        | 2   | kV   |
| Maximum direct screen voltage       | 400 | V    |
| Maximum direct suppressor voltage   | 45  | V    |
| Maximum direct anode dissipation    | 100 | W    |
| Maximum direct screen dissipation   | 35  | W    |
| Maximum direct control grid current | 25  | mA   |
| Maximum RF control grid current     | 8   | A    |
| Maximum frequency at above ratings  | 30  | Mc/s |



**TYPICAL OPERATING CONDITIONS.**

**RADIO FREQUENCY.**

**Class C Power Amplifier. Control grid modulated.**

(Carrier conditions per valve for use with 100% modulation).

|                           |      |            |
|---------------------------|------|------------|
| Direct anode voltage      | 2    | kV         |
| Grid bias                 | —140 | V          |
| Direct anode current      | 85   | mA         |
| Direct screen voltage     | 400  | V          |
| Direct screen current     | 20   | mA         |
| Direct suppressor voltage | 0    | V          |
| Peak RF grid voltage      | 170  | V          |
| *Direct grid current      | 3    | mA approx. |
| Power output              | 70   | W approx.  |

**Class C Power Amplifier. Suppressor modulated.**

(Carrier conditions per valve for use with 100% modulation).

|                           |      |            |
|---------------------------|------|------------|
| Direct anode voltage      | 2    | kV         |
| Grid bias                 | —100 | V          |
| Direct anode current      | 80   | mA         |
| Direct screen voltage     | 400  | V          |
| Direct screen current     | 85   | mA         |
| Direct suppressor voltage | —50  | V          |
| Peak RF grid voltage      | 180  | V          |
| *Direct grid current      | 11   | mA approx. |
| Power output              | 60   | W approx.  |

**Class C Power Amplifier or Oscillator, unmodulated.**

|                           |      |            |
|---------------------------|------|------------|
| Direct anode voltage      | 2    | kV         |
| Grid bias                 | —100 | V          |
| Direct anode current      | 120  | mA         |
| Direct screen voltage     | 400  | V          |
| Direct screen current     | 75   | mA         |
| Direct suppressor voltage | 0    | V          |
| Peak RF grid voltage      | 180  | V          |
| *Direct grid current      | 10   | mA approx. |
| Power output              | 160  | W approx.  |

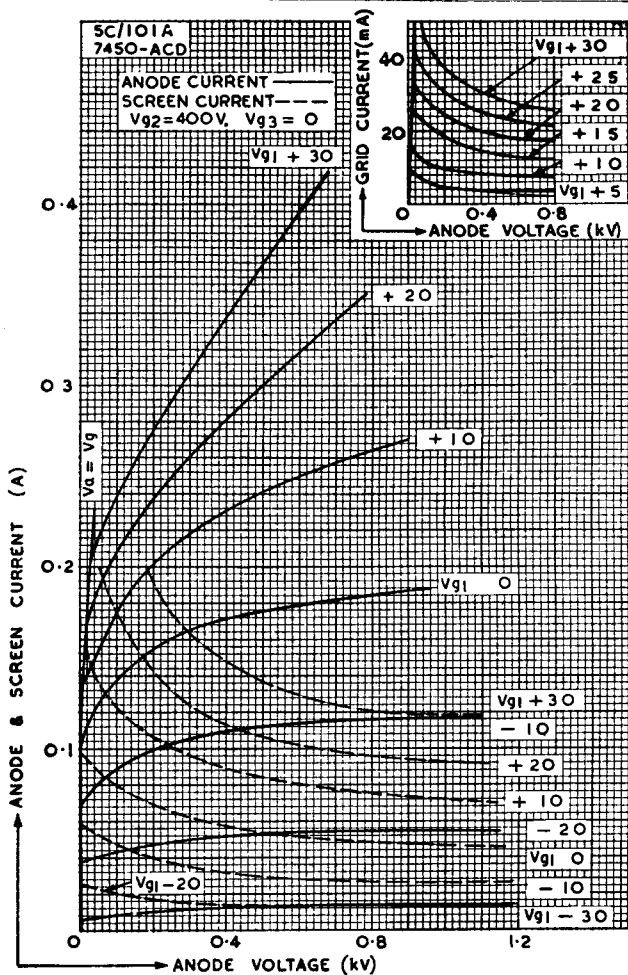
\* Subject to wide variation depending upon the impedance of the load circuit.



# Pentode

4069A

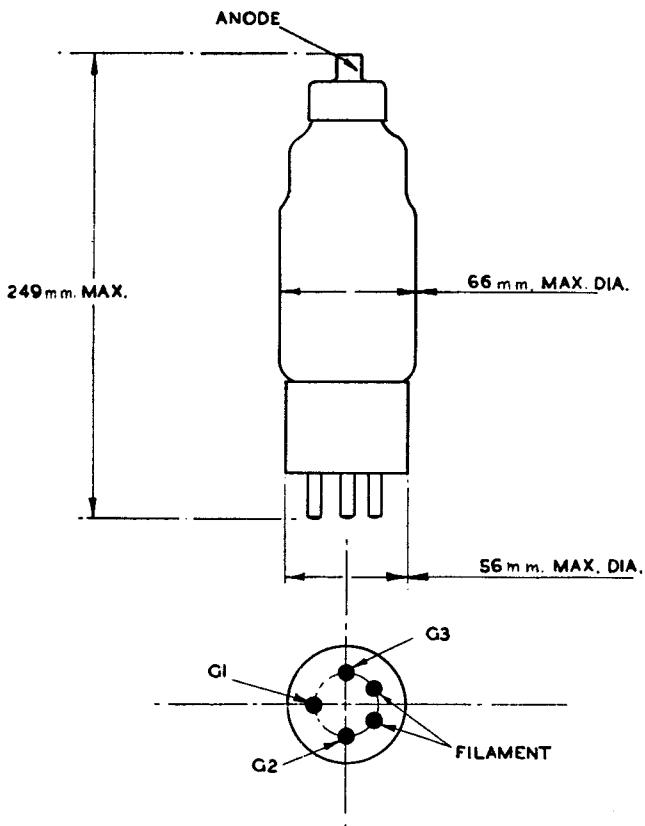
5C/101A  
(4069A)



**5C/101A**  
**(4069A)**

# Pentode

**4069A**





# —Standard Valves—

5C/450-A

## VALVE TYPE 5C/450-A

PENTODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Base.

Diameter of pins and pin spacing identical  
with that of extra large 4 pin bayonet base.

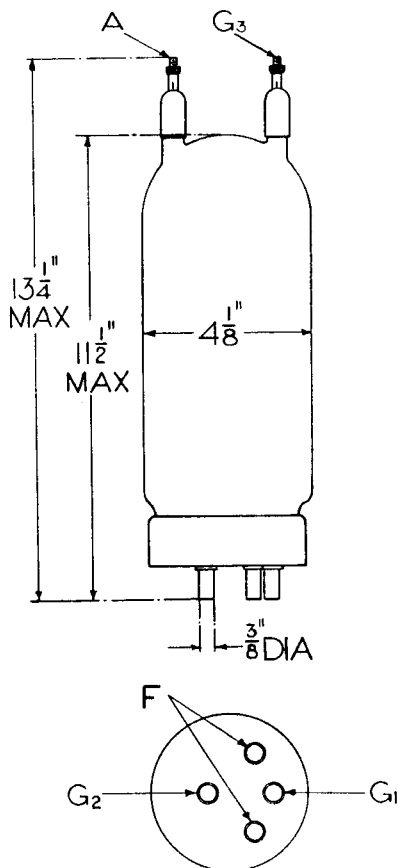
#### Dimensions.

|                     |                               |
|---------------------|-------------------------------|
| Max. overall length | 13 $\frac{1}{4}$ " (33.6 cm.) |
| Max. diameter       | 4 $\frac{1}{8}$ " (10.5 cm.)  |
| Net weight          | 2 lb. (940 gm.)               |

#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 10 volts               |
| Nominal filament current | 12.5 amps.             |
| Total emission           | 5 amps.                |
| *Mutual conductance      | 6.5 mA. per volt       |
| Grid-anode capacity      | 0.2 $\mu\mu\text{F}$ . |
| Input capacity           | 26 $\mu\mu\text{F}$ .  |
| Output capacity          | 39 $\mu\mu\text{F}$ .  |

\* at  $V_p = 3,000$ ,  $V_{g2} = 600$  volts,  
 $I_p = 0.2$  amps.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 3,000 volts |
| Maximum direct screen voltage                 | 650 volts   |
| Maximum anode dissipation                     | 450 watts   |
| Maximum screen dissipation                    | 100 watts   |
| Maximum frequency for above ratings           | 10 Mc.      |
| Maximum anode voltage for frequency of 20 Mc. | 2,250 volts |

For intermediate or higher frequencies the anode voltage should be reduced proportionately.

Tentative data  
(500)

W.5C/450-A.1  
Jan., 1940

# —Standard Valves—

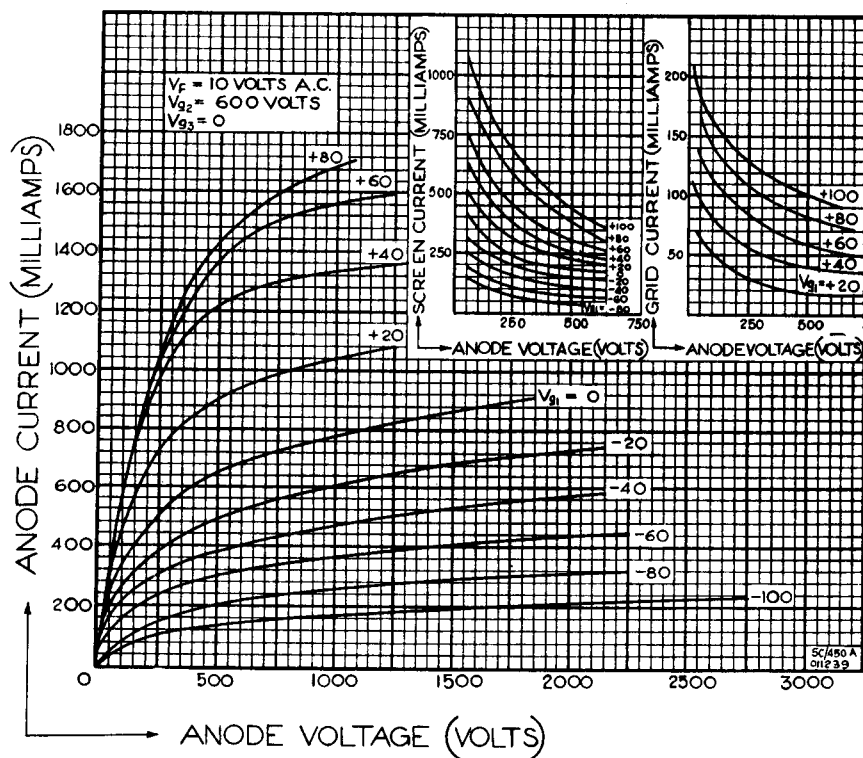
## TYPICAL OPERATING CONDITIONS.

|                         | Unmodulated Amplifier for<br>Frequencies below 12 Mc. |             |
|-------------------------|-------------------------------------------------------|-------------|
| Anode voltage           | 2,000                                                 | 2,500 volts |
| Screen voltage          | 650                                                   | 600 volts   |
| Suppressor voltage      | +90                                                   | +110 volts  |
| Grid bias—Grid resistor | 1,000                                                 | 3,500 ohms  |
| Fixed bias              | —110                                                  | —100 volts  |
| Total                   | —136                                                  | —165 volts  |
| Anode current           | 520                                                   | 590 mA.     |
| Screen current          | 80                                                    | 80 mA.      |
| Grid current            | 16                                                    | 19 mA.      |
| Screen resistor         | —                                                     | 2,500 ohms  |
| Driving power (approx.) | 3                                                     | 4.5 watts   |
| Output power            | 760                                                   | 1,070 watts |
| Efficiency              | 73                                                    | 73 %        |

|                                            | Class C Amplifier—<br>Suppressor Grid Modulation. |
|--------------------------------------------|---------------------------------------------------|
| Anode voltage                              | 2,500 volts                                       |
| Screen voltage                             | 530 volts                                         |
| Suppressor voltage                         | —90 volts                                         |
| Grid bias—Grid resistor                    | 3,500 ohms                                        |
| Fixed bias                                 | —100 volts                                        |
| Total                                      | —165 volts                                        |
| Anode current                              | 300 mA.                                           |
| Screen current                             | 110 mA.                                           |
| Grid current                               | 19 mA.                                            |
| Carrier output                             | 300 watts                                         |
| Screen resistor                            | 2,500 ohms                                        |
| Distortion less than 5% at 80% modulation. |                                                   |

NOTE.—This Valve operates at a high temperature. Free circulation of air is absolutely essential. When the valve is housed in a confined space, such as a cabinet, circulation of air should preferably be provided by means of a fan. The inside of cabinet walls should be matt finished and should, on no account, be polished.

# —Standard Valves—



PRINTED IN  
ENGLAND

# —Standard Valves—

5D/100-A

## VALVE TYPE 5D/100-A

RF POWER PENTODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

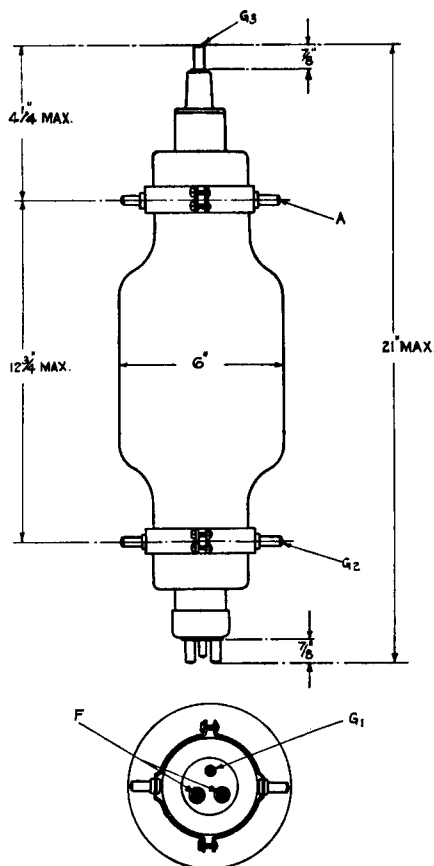
#### Dimensions.

Max. overall length 21" (53.3 cm.)  
Bulb diameter 6" (15.2 cm.)  
Net weight 3.65 lb. (1,650 gms.)

#### Constants.

Filament voltage 10 volts  
Nominal filament current 16 amps.  
Total emission 6 amps.  
\*Mutual conductance 4.5 mA. per volt  
Grid-anode capacity 0.1  $\mu\mu\text{F}$   
Input capacity 42  $\mu\mu\text{F}$   
Output capacity 32.8  $\mu\mu\text{F}$ .

\* at  $V_p = 3,000$ ,  $V_{g_2} = 800$ ,  $V_{g_3} = 0$ .  
 $V_{g_1} = -21$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                      |             |
|------------------------------------------------------|-------------|
| Maximum direct anode voltage                         | 3,000 volts |
| Maximum anode dissipation                            | 1,000 watts |
| Maximum direct screen grid voltage                   | 850 volts   |
| Maximum direct screen grid dissipation               | 250 watts   |
| Maximum frequency for above ratings                  | 10 Mc.      |
| Maximum direct anode voltage for frequency of 20 Mc. | 2,500 volts |

For higher frequencies the anode voltage should be reduced proportionately.

Tentative data

W.5D/100-A.1  
March, 1939

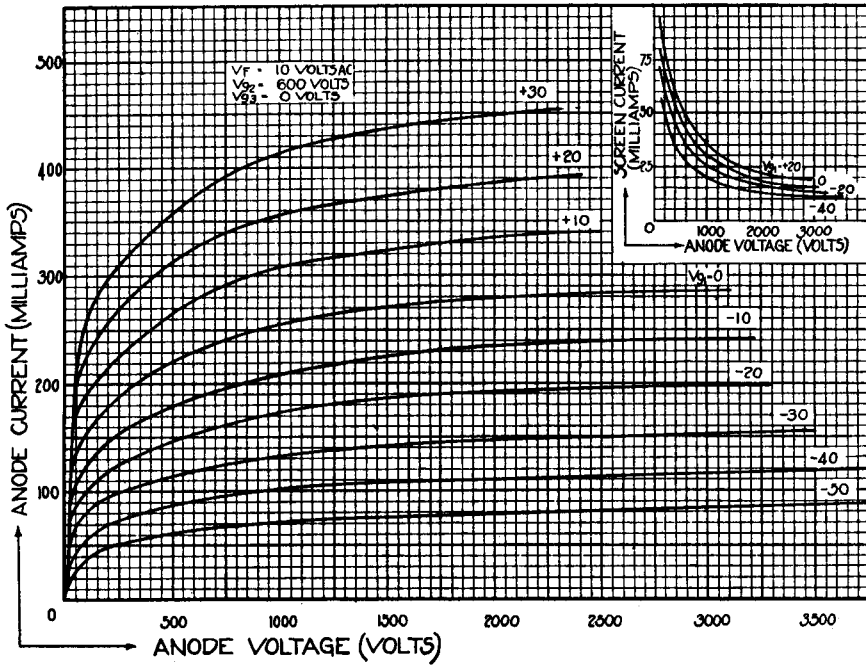
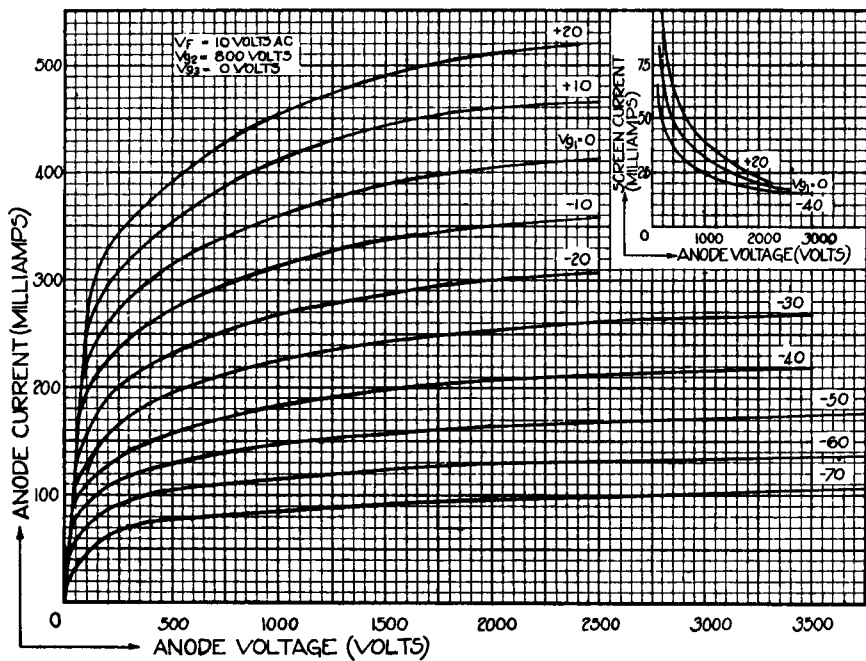
# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                       | Class C Amplifier<br>Unmodulated |              |
|-----------------------|----------------------------------|--------------|
| Anode voltage         | 2,500                            | 3,000 volts  |
| Screen supply voltage | 850                              | 950 volts    |
| Screen resistor       | 2,500                            | 2,500 ohms   |
| Suppressor voltage    | 200                              | 200 volts    |
| Grid voltage :—       |                                  |              |
| Grid leak             | 6,700                            | 3,700 ohms   |
| Fixed bias            | —40                              | —40 volts    |
| Total                 | —540                             | —390 volts   |
| Grid current          | 75                               | 94 mA.       |
| Screen current        | 120                              | 140 mA.      |
| Anode current         | 540                              | 650 mA.      |
| Output power          | 1,000                            | 1,300 watts  |
| Efficiency            | 77                               | 67 per cent. |
| Frequency             | 10                               | 10 Mc.       |

|                       | Class C Amplifier—Suppressor<br>Modulated<br>(Distortion less than 5% at 80% modulation) |
|-----------------------|------------------------------------------------------------------------------------------|
| Anode voltage         | 3,000 volts                                                                              |
| Screen supply voltage | 950 volts                                                                                |
| Screen resistor       | 2,500 ohms                                                                               |
| Grid voltage :—       |                                                                                          |
| Grid leak             | 3,700 ohms                                                                               |
| Fixed bias            | —40 volts                                                                                |
| Total                 | —390 volts                                                                               |
| Suppressor voltage    | —50 volts                                                                                |
| Grid current          | 95 mA.                                                                                   |
| Screen current        | 190 mA.                                                                                  |
| Anode current         | 450 mA.                                                                                  |
| Carrier output        | 400 watts                                                                                |

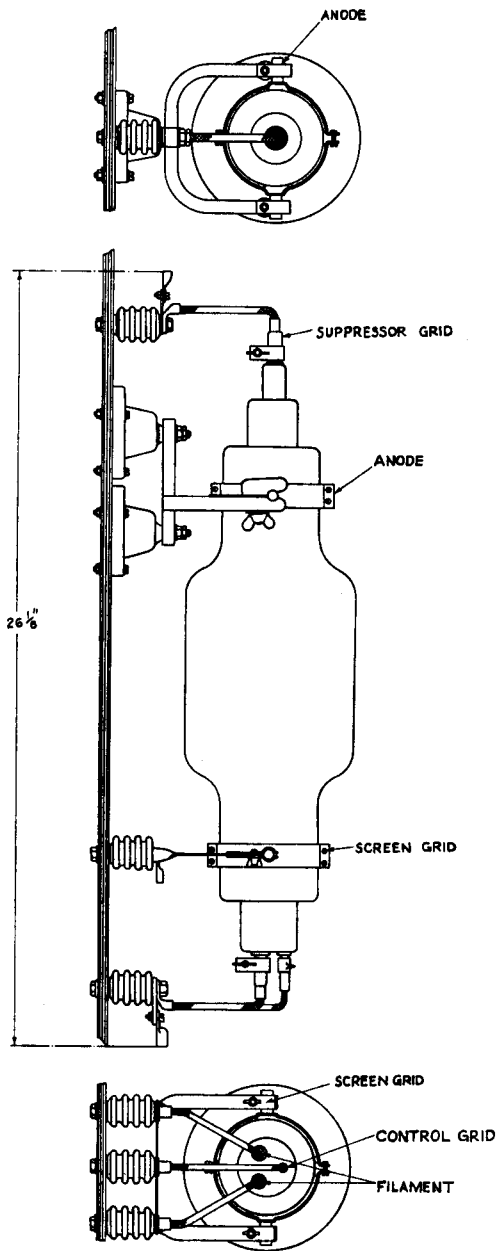
# —Standard Valves—



Tentative data  
HF 13

W.5D/100-A.2  
March, 1939

—Standard Valves—





**SPECIAL VALVES****Forced-Air-Cooled  
R.F. Pentode****Code: 5J/180E (CV445)****CATHODE**

|                              |                                |          |
|------------------------------|--------------------------------|----------|
| Thoriated-tungsten filament  |                                |          |
| Filament voltage             | 9                              | V        |
| Nominal current              | 30                             | A        |
| Filament cold resistance     | 0.04                           | $\Omega$ |
| Maximum usable emission      | 12                             | A        |
| †Pirani test figure, approx. | Measured at<br>4A after 60 min | 0.21 V   |

**CHARACTERISTICS**

|                    |                                          |      |      |
|--------------------|------------------------------------------|------|------|
| Mutual conductance | Measured at<br>$V_a$ 6 kV : $V_g$ 1.5 kV | 5.75 | mA/V |
| Screen grid $\mu$  | $I_a$ 0.5 A                              | 4    |      |

**DIRECT INTERELECTRODE CAPACITANCES**

|               |     |    |
|---------------|-----|----|
| Input         | 35  | pF |
| Output        | 16  | pF |
| Anode to grid | 0.9 | pF |

**AIR COOLING REQUIRED**

|                                          |      |      |     |                     |
|------------------------------------------|------|------|-----|---------------------|
| For an anode dissipation of              | 2.1  | 2.75 | 3.5 | kW                  |
| Volume of air required through radiator  | 325  | 450  | 580 | cu ft/min           |
|                                          | 9    | 12.4 | 16  | m <sup>3</sup> /min |
| At a water pressure of                   | 0.75 | 1.5  | 2.5 | in                  |
|                                          | 1.9  | 3.8  | 6.4 | cm                  |
| Maximum ambient temperature              |      |      | 45  | °C                  |
| Maximum radiator core temperature        |      |      | 130 | °C                  |
| Maximum anode, or lead, seal temperature |      |      | 150 | °C                  |

**MECHANICAL DATA**

|                           |                    |       |     |
|---------------------------|--------------------|-------|-----|
| Nominal overall length    | 8 $\frac{1}{2}$ in | 220   | mm  |
| Maximum radiator diameter | 5 $\frac{7}{8}$ in | 149.2 | mm  |
| Net weight                |                    | 5.2   | kg  |
|                           |                    | 11.5  | lb  |
| Shipping weight, approx.  |                    | 19.8  | kg← |
|                           |                    | 44    | lb← |
| Shipping dimensions       | 24 × 24 × 26       |       | in← |
|                           | 61 × 61 × 66       |       | cm  |

† When Pirani tests are made, the figures quoted on the card received with the valves should be used and not the approximate values given above.

June 1961

5J/180E—1

**Standard Telephones and Cables Limited**

Registered Office: Connaught House, Aldwych, W.C.2

VALVE DIVISION, FOOTSCRAY, KENT

Telephone: Footscray 3333

**SPECIAL VALVES**

**Forced-Air-Cooled  
R.F. Pentode**

**Code: 5J/180E (CV445)**

**MAXIMUM RATINGS AND TYPICAL OPERATING  
CONDITIONS**

**RADIO FREQUENCY**

**Class C Power Amplifier. Anode subject to modulation**  
(Carrier conditions per valve for use with 100% modulation.)

**Maximum Ratings**

|                                     |      |      |
|-------------------------------------|------|------|
| Maximum direct anode voltage        | 4.8  | kV   |
| Maximum direct anode current        | 1.25 | A    |
| Maximum direct anode dissipation    | 2.35 | kW   |
| Maximum direct screen voltage       | 1.5  | kV   |
| Maximum direct screen current       | 165  | mA   |
| Maximum direct screen dissipation   | 100  | W    |
| Maximum direct grid dissipation     | 50   | W    |
| Maximum frequency for above ratings | 30   | Mc/s |

**Typical Operating Conditions**

|                        |       |     |
|------------------------|-------|-----|
| Direct anode voltage   | 4.5   | kV  |
| Direct screen voltage  | 1.5   | kV  |
| Direct grid voltage    | -900  | V   |
| Direct anode current   | 1     | A←  |
| Direct screen current  | 20    | mA← |
| *Direct grid current   | 25    | mA  |
| Peak r.f. grid voltage | 1 050 | V   |
| Power output           | 2.9   | kW  |

**Class C Power Amplifier or Oscillator. Unmodulated**

**Maximum Ratings**

|                                     |     |      |
|-------------------------------------|-----|------|
| Maximum direct anode voltage        | 6   | kV   |
| Maximum direct anode current        | 2.5 | A    |
| Maximum direct anode dissipation    | 3.5 | kW   |
| Maximum direct screen voltage       | 1.5 | kV   |
| Maximum direct screen current       | 250 | mA   |
| Maximum direct screen dissipation   | 150 | W    |
| Maximum direct grid dissipation     | 50  | W    |
| Maximum frequency for above ratings | 30  | Mc/s |

**Typical Operating Conditions**

|                        |      |     |
|------------------------|------|-----|
| Direct anode voltage   | 6    | kV← |
| Direct screen voltage  | 1.5  | kV  |
| Direct grid voltage    | -715 | V←  |
| Direct anode current   | 1.4  | A←  |
| Direct screen current  | 30   | mA← |
| *Direct grid current   | 45   | mA← |
| Peak r.f. grid voltage | 915  | V←  |
| Power output           | 5.75 | kW← |

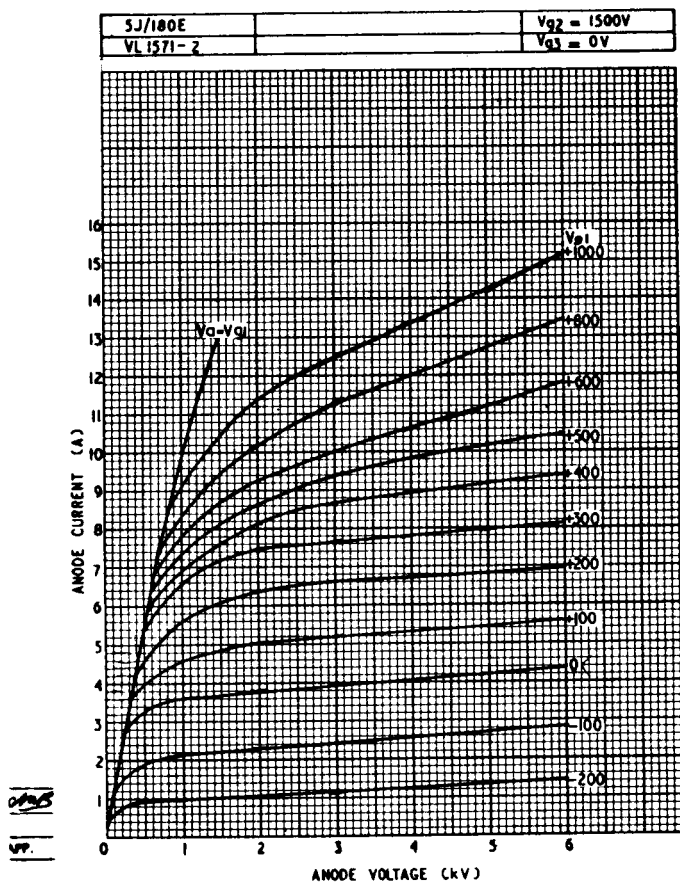
\*Subject to wide variation dependent upon impedance of the load circuit.



# SPECIAL VALVES

## Forced-Air-Cooled R.F. Pentode

Code: 5J/180E (CV445)

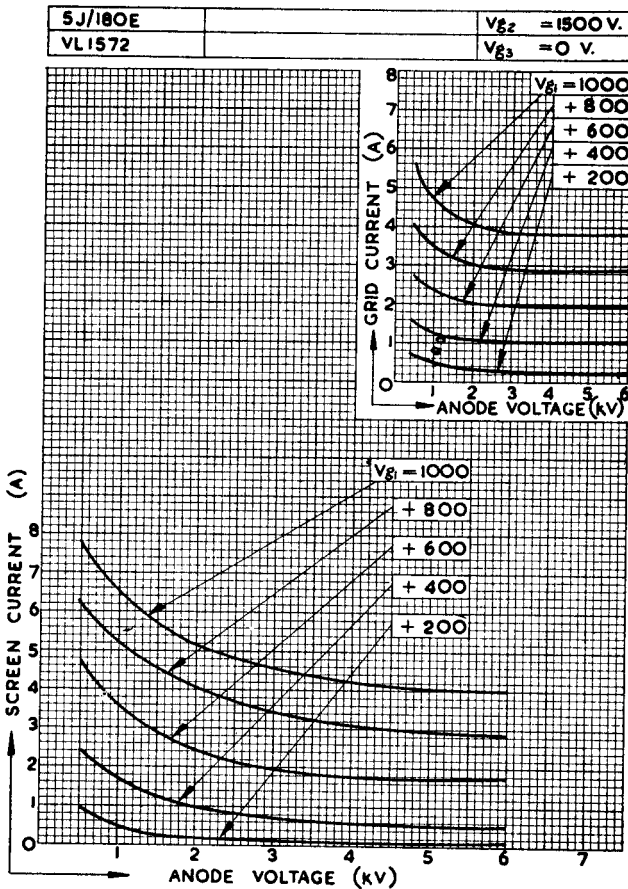


# SPECIAL VALVES



## Forced-Air-Cooled R.F. Pentode

Code: 5J/180E (CV445)

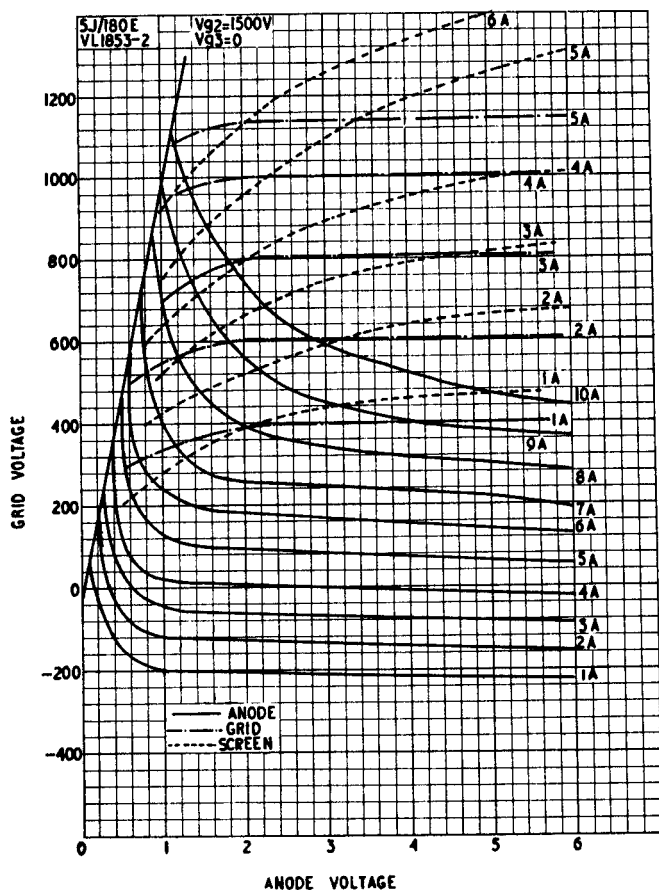




# SPECIAL VALVES

## Forced-Air-Cooled R.F. Pentode

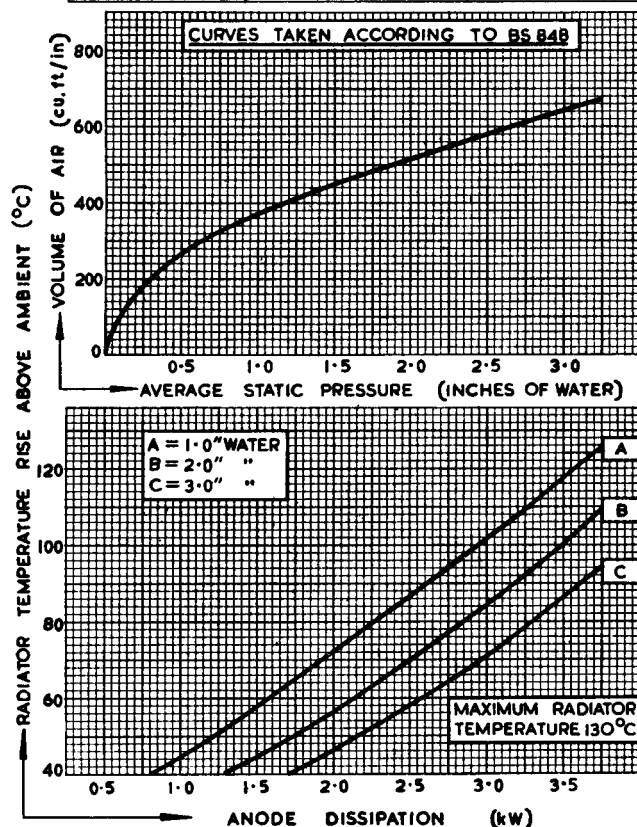
Code: 5J/180E (CV445)



**SPECIAL VALVES**
**Forced-Air-Cooled  
R.F. Pentode**

Code: 5J/180E (CV445)

|                   |                  |                             |
|-------------------|------------------|-----------------------------|
| 3J/170E & 5J/180E | RADIATOR COOLING | $V_f = 9\text{ V}$          |
| VL 1942-2         | REQUIREMENTS     | $p_a = 3.5\text{ kW (MAX)}$ |

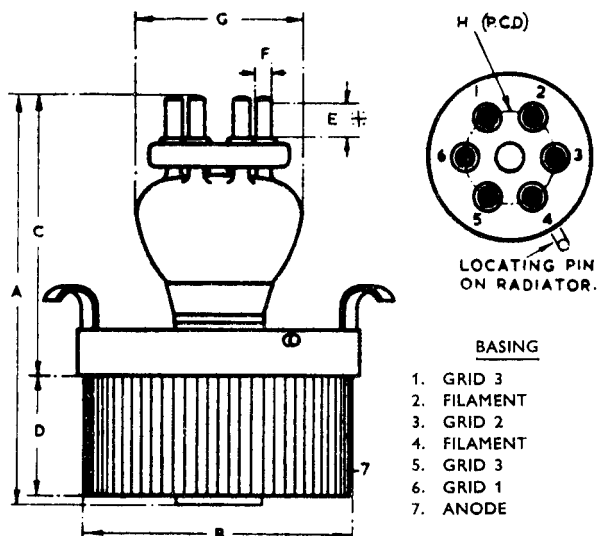




# SPECIAL VALVES

## Forced-Air-Cooled R.F. Pentode

Code: 5J/180E (CV445)



| DIM. | MILLIMETRES     | INCHES                            |
|------|-----------------|-----------------------------------|
| A    | 220 NOM.        | $8\frac{11}{16}$ NOM.             |
| B    | $147.6 \pm 1.6$ | $5\frac{13}{16} \pm \frac{1}{16}$ |
| C    | $154 \pm 3.2$   | $6\frac{1}{16} \pm \frac{1}{8}$   |
| D    | 63.5 NOM.       | $2\frac{1}{2}$ NOM.               |
| E*   | 21 MIN.         | $\frac{13}{16}$ MIN.              |
| F    | $9.53 \pm 0.05$ | $0.375 \pm 0.002$                 |
| G    | 92 MAX.         | $3\frac{3}{8}$ MAX.               |
| H    | $49.2 \pm 0.8$  | $1\frac{13}{16} \pm \frac{1}{32}$ |

BASIC FIGURES ARE INCHES

\* DENOTES: CONTACT LENGTH

# **—Standard Valves—**

22V/310-A

## **VALVE TYPE 22V/310-A**

FULL WAVE MERCURY VAPOUR RECTIFIER.

### **SPECIFICATION.**

#### **Cathode.**

Oxide coated filament.  
Constant voltage type.

#### **Base.**

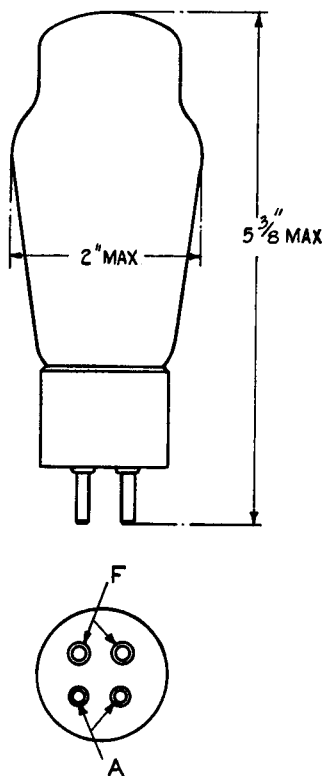
American Medium 4-pin.

#### **Dimensions.**

Maximum overall length  $5\frac{3}{8}"$  (13.6 cms.)  
Maximum diameter 2" (5.1 cms.)  
Net weight 0.13 lbs. (60 gms.)

#### **Constants.**

|                                |             |
|--------------------------------|-------------|
| Filament voltage               | 5 volts     |
| Nominal filament current       | 3 amps.     |
| Maximum peak inverse voltage   | 1,400 volts |
| Maximum peak anode current     | 0.8 amps.   |
| D.C. output current continuous | 250 mA.     |



#### **Operation.**

When this valve is operated with the anodes in parallel, a resistance of not less than 50 ohms should be connected in series with each anode in order that each shall carry its proper share of the load. The resistances should be increased to 100 ohms each if the load is less than 75 per cent. of the maximum current rating of the valve.



PRINTED IN  
ENGLAND



# Twin Triode

33A/138A  
(4074A)

## 4074A

Characteristics are for one section only unless otherwise specified. Both sections are identical.

---

### CATHODE.

Indirectly-heated Oxide-coated

|                 |     |   |
|-----------------|-----|---|
| Voltage         | 6.3 | V |
| Nominal current | 0.8 | A |

### RATING.

|                      |                                                 |       |          |
|----------------------|-------------------------------------------------|-------|----------|
| Amplification factor | } Measured at<br>Va 250V, Vg <sub>1</sub> —7V } | 14    | $\Omega$ |
| Impedance            |                                                 | 4,700 |          |

### DIRECT INTER-ELECTRODE CAPACITIES.

|                  |     |    |
|------------------|-----|----|
| Grid to anode    | 2.7 | pF |
| Grid to cathode  | 6.0 | pF |
| Anode to cathode | 1.3 | pF |

### DIMENSIONS.

|                            |     |     |
|----------------------------|-----|-----|
| Maximum overall length     | 132 | mm. |
| Maximum bulb diameter      | 46  | mm. |
| Base American medium 7 pin |     |     |
| Net weight                 | 75  | g.  |

### MAXIMUM RATINGS.

|                                     |     |      |
|-------------------------------------|-----|------|
| Maximum direct anode voltage        | 300 | V    |
| Maximum direct anode current        | 50  | mA   |
| Maximum anode dissipation           | 5   | W    |
| Maximum frequency for above ratings | 100 | Mc/s |
| Maximum frequency of operation      | 300 | Mc/s |

# Twin Triode

**4074A**



Characteristics are for one section only unless otherwise specified. Both sections are identical.

## TYPICAL OPERATING CONDITIONS.

### AUDIO FREQUENCY.

#### Class A. Amplifier.

(Two sections in parallel).

|                          |       |          |
|--------------------------|-------|----------|
| Direct anode voltage     | 300   | V        |
| Grid bias                | —13   | V        |
| Anode current—2 sections | 30    | mA       |
| Load resistance          | 7,000 | $\Omega$ |
| Power output             | 1.0   | W        |

The output power may be increased to 1.2 W by connecting the two sections in push-pull.

#### Class B. Power Amplifier.

(Two sections in push-pull).

|                                                  |               |    |
|--------------------------------------------------|---------------|----|
| Direct anode voltage                             | 300           | V  |
| Grid bias                                        | —16           | V  |
| Direct anode current per section—<br>zero signal | 7             | mA |
| Direct anode current per section—<br>max. signal | 37            | mA |
| Peak AF grid to grid voltage                     | 120           | V  |
| Power output—2 sections                          | 12 W. approx. |    |

### RADIO FREQUENCY.

#### Class C. Push-pull Power Amplifier or Oscillator Unmodulated.

|                      |              |    |
|----------------------|--------------|----|
| Direct anode voltage | 300          | V  |
| Grid bias            | —36          | V  |
| Direct anode current | 80           | mA |
| Direct grid current  | 18           | mA |
| Power output         | 14 W approx. |    |

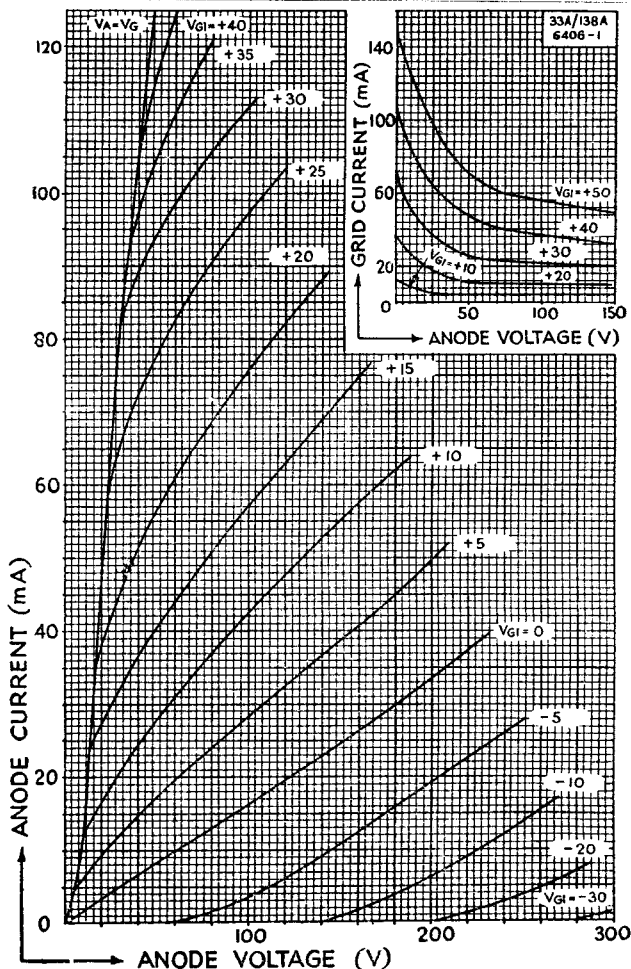


# Twin Triode

33A/138A  
(4074A)

## 4074A

Characteristics are for one section only unless otherwise specified. Both sections are identical.

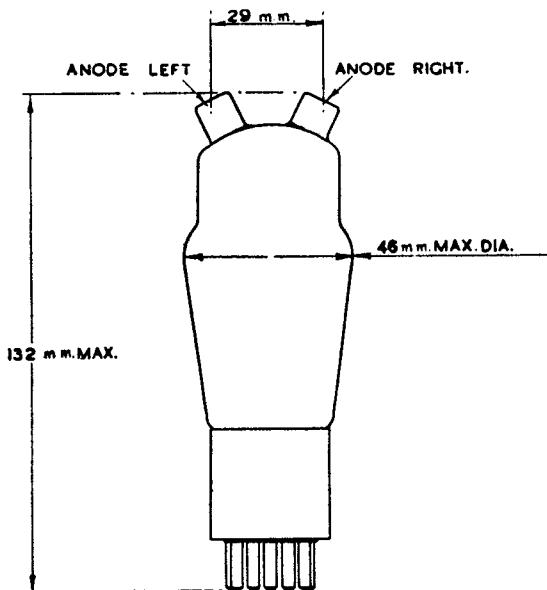
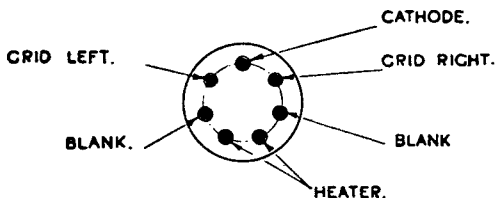


33A/138A  
(4074A)

# Twin Triode

4074A

Characteristics are for one section only  
unless otherwise specified. Both sections  
are identical.



# —Standard Valves—

3067-A  
Valve

## 3067-A VALVE

SINGLE ENDED WATER COOLED TRIODE.  
FOR USE WITH D.C., SINGLE OR TWO PHASE A.C.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type PL.122642/A

#### Water Flow.

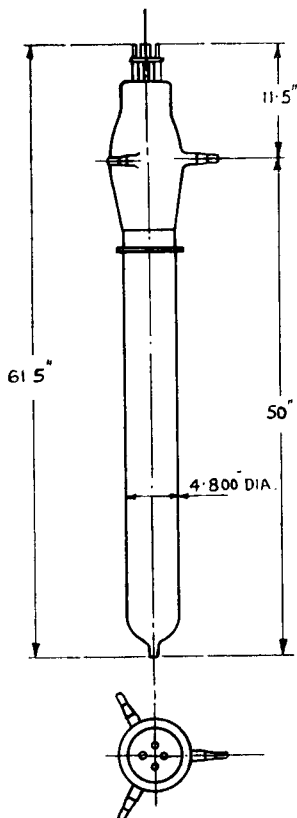
40 gallons per minute.

#### Dimensions.

|                |                               |
|----------------|-------------------------------|
| Overall length | 61 $\frac{1}{2}$ " (156 cms.) |
| Anode diameter | 4.8" (12.2 cms.)              |
| Net Weight     | 40 lbs. (18,000 gms.)         |

#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 35 volts               |
| Nominal filament current | 240 amps.              |
| Total emission           | 100 amps.              |
| Impedance                | 900 ohms.              |
| Amplification factor     | 36                     |
| Grid-anode capacity      | 145 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 38 $\mu\mu\text{F}$ .  |
| Grid-filament capacity   | 110 $\mu\mu\text{F}$ . |



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |              |
|-----------------------------------------------|--------------|
| Maximum direct anode voltage                  | 17,500 volts |
| Maximum direct anode current                  | 25 amps.     |
| Maximum anode dissipation                     | 160 Kw.      |
| Maximum grid dissipation                      | 3,000 watts  |
| Maximum frequency for above ratings           | 2 Mc.        |
| Maximum anode voltage for frequency of 22 Mc. | 15,000 volts |

Note :—All enquiries should be addressed to :—

Les Laboratoires L.M.T.,  
46, Avenue de Breteuil,  
Paris.

Tentative data

V.3067-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |
|-----------------------------------------------|------------------------------------------------------------|
| Direct anode voltage                          | 12.5 Kv.                                                   |
| Grid bias                                     | —250 volts                                                 |
| Direct anode current per valve—zero signal    | 2.6 amps.                                                  |
| Direct anode current per valve—maximum signal | 13 amps.                                                   |
| Anode dissipation                             | 73 Kw.                                                     |
| Load resistance—anode to anode                | 850 ohms.                                                  |
| Maximum output—2 valves                       | 180 Kw.                                                    |

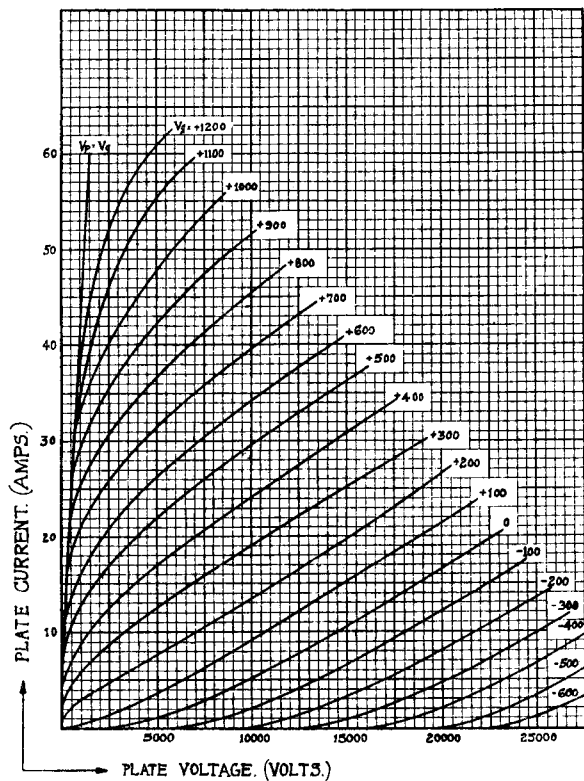
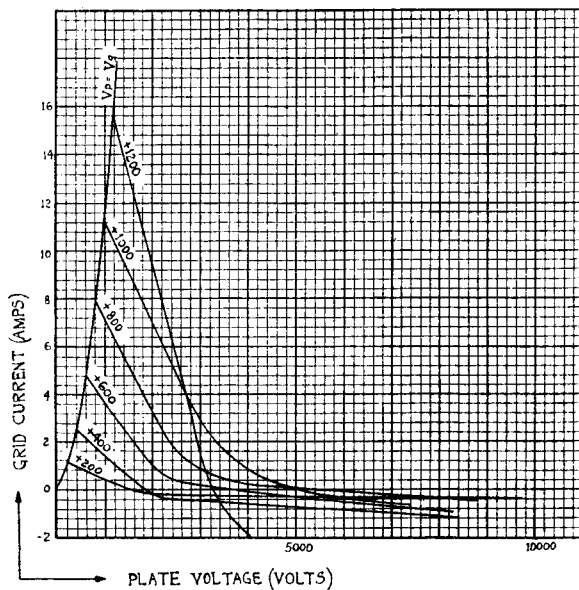
## RADIO FREQUENCY OPERATION.

|                      | Class B Telephony                 |      |      |            |
|----------------------|-----------------------------------|------|------|------------|
|                      | Modulated Carrier applied to grid |      |      |            |
| Direct anode voltage | 17.5                              | 15   | 12   | 10 Kv.     |
| Direct anode current | 9.6                               | 9.6  | 9.6  | 9.6 amps.  |
| Grid bias            | —400                              | —300 | —200 | —150 volts |
| Power output         | 50                                | 43   | 34   | 24 Kw.     |
| Anode dissipation    | 118                               | 101  | 81   | 72 Kw.     |
| FREQUENCY            | 2                                 | 12   | 19   | 22 Mc.     |

|                      | Class C Telephony           |      |      |      | Class C Telegraphy |      |      |            |
|----------------------|-----------------------------|------|------|------|--------------------|------|------|------------|
|                      | Subject to anode modulation |      |      |      | Unmodulated        |      |      |            |
| Direct anode voltage | 12                          | 11   | 10   | 9    | 17.5               | 15   | 12   | 10 Kv.     |
| Direct anode current | 10                          | 10   | 10   | 10   | 19.2               | 19.2 | 19.2 | 19.2 amp.  |
| Grid bias            | —500                        | —450 | —400 | —350 | —500               | —300 | —200 | —150 to    |
| Carrier output       | 80                          | 70   | 60   | 40   | —650               | —450 | —350 | —300 volts |
| Anode dissipation    | 40                          | 40   | 40   | 50   | 200                | 172  | 136  | 96 Kw.     |
|                      |                             |      |      |      | 136                | 112  | 94   | 96 Kw.     |
| FREQUENCY            | 2                           | 12   | 19   | 22   | 2                  | 12   | 19   | 22 Mc.     |

# —Standard Valves—

3067-A  
Valve



Tentative data

V.3067-A.2  
Nov. 1937



PRINTED IN  
ENGLAND

# **—Standard Valves—**

3068-A  
Valve

## **3068-A VALVE**

SINGLE ENDED WATER COOLED TRIODE.  
FOR THREE PHASE OPERATION.

### **SPECIFICATION.**

#### **Cathode.**

Pure Tungsten filament.  
Constant voltage type.

#### **Water Jacket.**

Type PL.122642/A.

#### **Water Flow.**

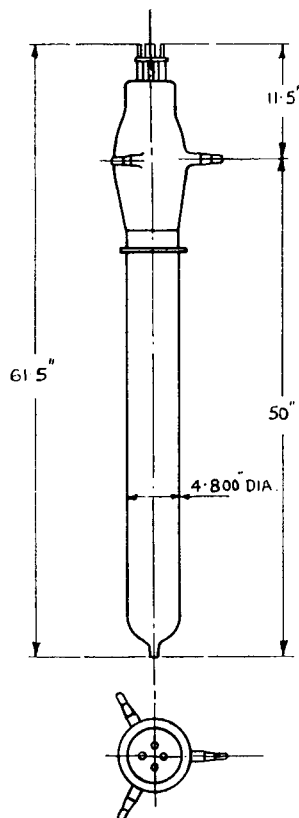
40 gallons per minute.

#### **Dimensions.**

Overall length  $61\frac{1}{2}"$  (156 cms.)  
Anode diameter  $4.8"$  (12.2 cms.)  
Net Weight 40 lbs. (18,000 gms.)

#### **Constants.**

|                          |                       |
|--------------------------|-----------------------|
| Filament voltage         | 30 volts              |
| Nominal filament current | 320 amps.             |
| Total emission           | 100 amps.             |
| Impedance                | 900 ohms              |
| Amplification factor     | 36                    |
| Grid-anode capacity      | 145 $\mu\mu\text{F.}$ |
| Anode-filament capacity  | 38 $\mu\mu\text{F.}$  |
| Grid-filament capacity   | 110 $\mu\mu\text{F.}$ |



### **LIMITING CONDITIONS FOR SAFE OPERATION.**

|                                               |              |
|-----------------------------------------------|--------------|
| Maximum direct voltage                        | 17,500 volts |
| Maximum direct anode current                  | 25 amps.     |
| Maximum anode dissipation                     | 160 Kw.      |
| Maximum grid dissipation                      | 3,000 watts  |
| Maximum frequency for above ratings           | 2 Mc.        |
| Maximum anode voltage for frequency of 22 Mc. | 15,000 volts |

Note :—All enquiries should be addressed to :—

Les Laboratoires L.M.T.,  
46 Avenue de Breteuil,  
Paris.

Tentative data

V.3068-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                     | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |
|-------------------------------------|------------------------------------------------------------|
| Direct anode voltage                | 12.5 Kv.                                                   |
| Grid bias                           | —250 volts                                                 |
| Direct anode current—zero signal    | 2.6 amps.                                                  |
| Direct anode current—maximum signal | 13 amps.                                                   |
| Anode dissipation                   | 73 Kw.                                                     |
| Load resistance—anode to anode      | 850 ohms                                                   |
| Maximum output—2 valves             | 180 Kw.                                                    |

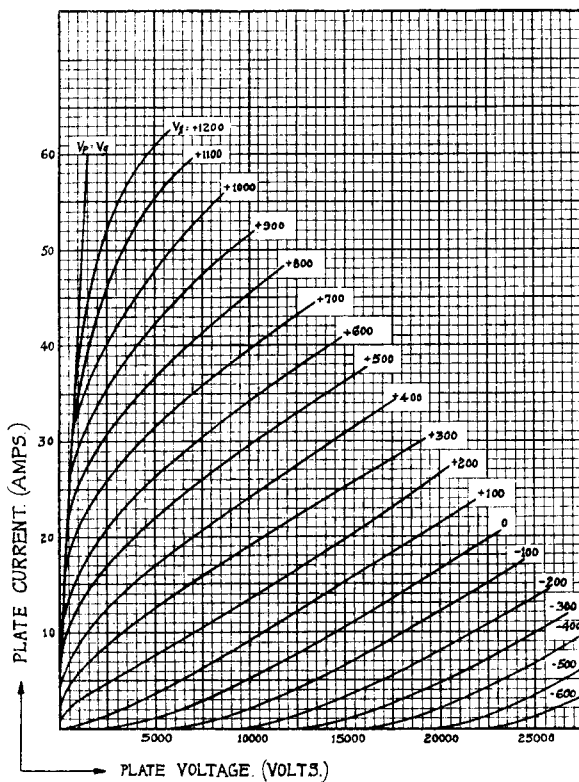
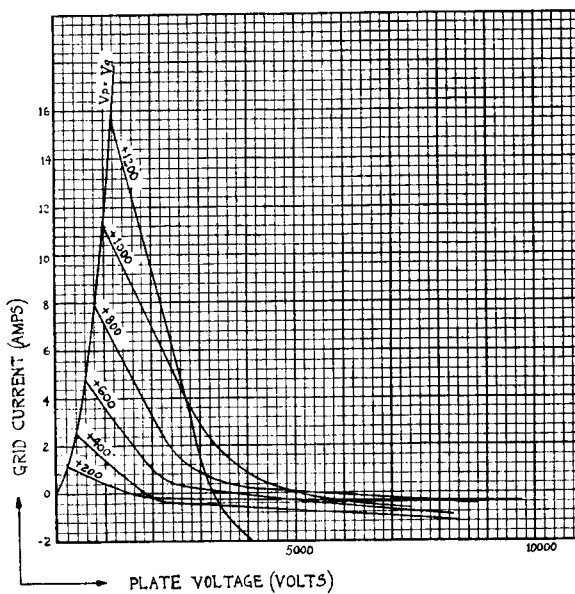
## RADIO FREQUENCY OPERATION.

|                      | Class B Telephony                 |      |      |            |
|----------------------|-----------------------------------|------|------|------------|
|                      | Modulated Carrier applied to grid |      |      |            |
| Direct anode voltage | 17.5                              | 15   | 12   | 10 Kv.     |
| Direct anode current | 9.6                               | 9.6  | 9.6  | 9.6 amps.  |
| Grid bias            | —400                              | —300 | —200 | —150 volts |
| Power output         | 50                                | 43   | 34   | 24 Kw.     |
| Anode dissipation    | 118                               | 101  | 81   | 72 Kw.     |
| FREQUENCY            | 2                                 | 12   | 19   | 22 Mc.     |

|                      | Class C Telephony          |      |      |      | Class C Telegraphy |      |      |            |
|----------------------|----------------------------|------|------|------|--------------------|------|------|------------|
|                      | Subject to anode modulated |      |      |      | Unmodulated        |      |      |            |
| Direct anode voltage | 12                         | 11   | 10   | 9    | 17.5               | 15   | 12   | 10 Kv.     |
| Direct anode current | 10                         | 10   | 10   | 10   | 19.2               | 19.2 | 19.2 | 19.2 amp.  |
| Grid bias            | —500                       | —450 | —400 | —350 | —500               | —300 | —200 | —150 volts |
| Carrier output       | 80                         | 70   | 60   | 40   | 200                | 172  | 136  | 96 Kw.     |
| Anode dissipation    | 40                         | 40   | 40   | 50   | 136                | 112  | 94   | 96 Kw.     |
| FREQUENCY            | 2                          | 12   | 19   | 22   | 2                  | 12   | 19   | 22 Mc.     |

# —Standard Valves—

3068-A  
Valve



Tentative data

V.3068-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

3073-A  
Valve

## 3073-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type PL.121438/A.

#### Water Flow.

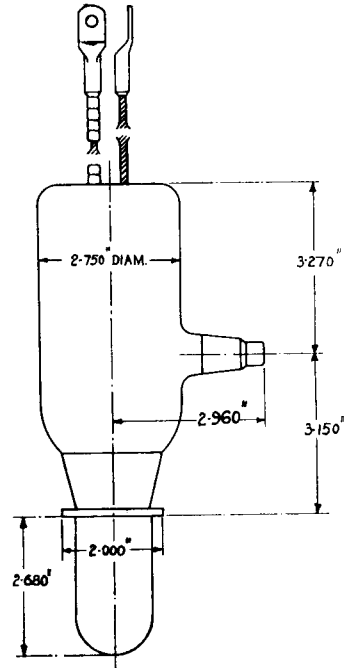
3 gallons per minute.

#### Dimensions.

Overall length  $9\frac{1}{8}"$  (23.2 cms.)  
Bulb diameter  $2\frac{3}{4}"$  (7 cms.)  
Net weight 1.2 lbs. (550 gms.)

#### Constants.

Filament voltage 10 volts  
(exact filament voltage marked  
on bulb)  
Nominal filament current 54 amps.  
Total emission 3.6 amps.  
\*Impedance 17,400 ohms  
\*Amplification factor 40  
Grid-anode capacity  $9 \mu\mu\text{F.}$   
Anode-filament capacity  $1.5 \mu\mu\text{F.}$   
Grid-filament capacity  $7 \mu\mu\text{F.}$



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |             |
|---------------------------------------------------|-------------|
| Maximum direct anode voltage                      | 7,500 volts |
| Maximum direct anode voltage for anode modulation | 6,000 volts |
| Maximum direct anode current                      | 0.9 amps.   |
| Maximum anode dissipation                         | 2.5 Kw.     |
| Maximum grid dissipation                          | 200 watts   |
| Maximum frequency for above ratings               | 50 Mc.      |
| Maximum anode voltage for frequency of 100 Mc.    | 5,000 volts |

Note :—All enquiries should be addressed to :—

Les Laboratoires L.M.T.  
46, Avenue de Breteuil,  
Paris.

Tentative data

V.3073-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

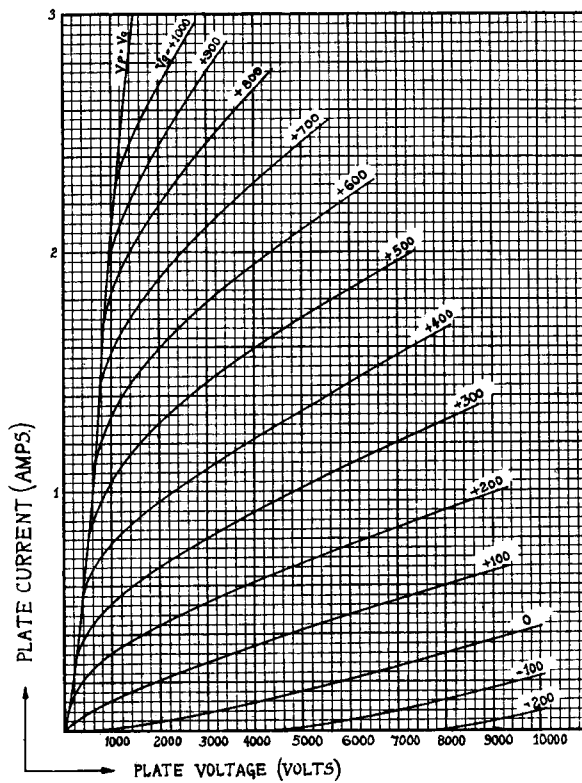
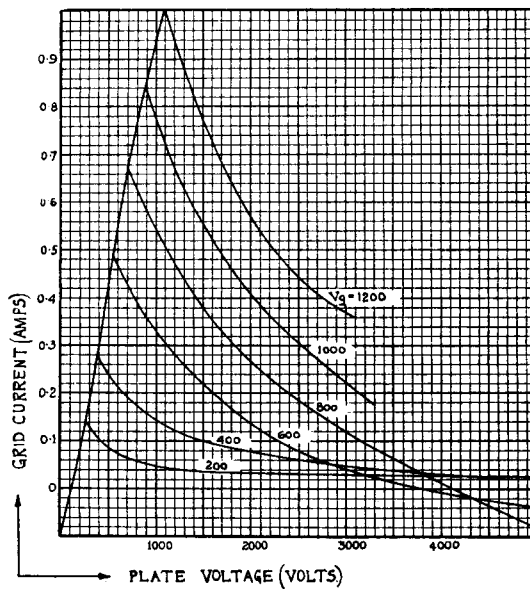
|                                               | Class B A.F. Amp.<br>For balanced 2 valve circuit |
|-----------------------------------------------|---------------------------------------------------|
| Direct anode voltage                          | 7,500 volts                                       |
| Grid bias                                     | —75 to —100 volts                                 |
| Direct anode current per valve—zero signal    | 0.12 amps.                                        |
| Direct anode current per valve—maximum signal | 0.6 amps.                                         |
| Load resistance—anode to anode                | 11,000 ohms                                       |
| Maximum signal output—2 valves                | 4.9 Kw.                                           |
| Anode dissipation                             | 2 Kw.                                             |

## RADIO FREQUENCY OPERATION.

|                      | Class B                                 |       | Class C                           |       | Class C     |             |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-------------|-------------|
|                      | Telephony                               |       | Telephony                         |       | Telegraphy  |             |
|                      | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated |             |
| Direct anode voltage | 7,500                                   | 5,000 | 6,000                             | 4,500 | 7,500       | 5,000 volts |
| Direct anode current | 0.4                                     | 0.3   | 0.4                               | 0.3   | 0.9         | 0.8 amps    |
| Grid Bias            | —150                                    | —80   | —250                              | —200  | —250        | —200 volts  |
|                      |                                         |       |                                   |       | to          | to          |
|                      |                                         |       |                                   |       | —350        | —300        |
| Anode dissipation    | 2.0                                     | 1.0   | 0.8                               | 0.45  | 2.25        | 1.3 Kw.     |
| Carrier output       | 1.0                                     | 0.5   | 1.6                               | 0.9   | 4.5         | 2.7 Kw.     |
| Maximum frequency    | 50                                      | 100   | 50                                | 100   | 50          | 100 Mc.     |

# —Standard Valves—

3073-A  
Valve



Tentative data

V.3073-A.2  
Nov. 1937



PRINTED IN  
ENGLAND

# *—Standard Valves—*

Vacuum  
Thermo-  
couples

## VACUUM THERMOCOUPLES

The Type 4001, 4002 and 4003 Vacuum Thermocouples are all essentially the same, the difference being only in the type of case. They are of the "Contact" type in which the heater wire is in direct metallic contact with a thermo-junction, the whole being mounted in an evacuated glass bulb.

### Dimensions.

|               |                                                                                                               |
|---------------|---------------------------------------------------------------------------------------------------------------|
| 4001 and 4003 | $3\frac{1}{8}"$ long $\times$ $1\frac{3}{8}"$ diameter ( $8 \times 3.5$ cms.). Net weight 0.12 lbs. (55 gms.) |
| 4002          | 4" high $\times$ 3" $\times$ 3" ( $10.2 \times 7.6 \times 7.6$ cms.). Net weight 0.38 lbs. (170 gms.)         |

### Sockets.

The 4001 Type Thermocouple requires to be used in a No. 4004-A Valve Socket.

### *Types available—*

Type 4001 is mounted in a tubular metal case, the connections being brought out to 4 pins at one end, the whole plugging into a 4004-A valve socket.

Type 4002 is mounted in a rectangular mahogany box fitted with four terminals on the top.

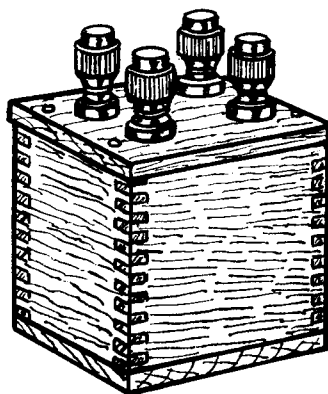
Type 4003 is almost exactly similar to 4001, except that the four pins are replaced by four soldering tags and two small lugs are fitted at the opposite end of the case for base board mounting.

# —Standard Valves—

Each of these three types is available in a number of different ranges denoted by letter suffixes as follows :—

| Suffix letter | Resistance (ohms) $\pm 10\%$ |        | Maximum safe heater current (mA.) | Heater current (mA.) required to produce in couple an open circuit voltage of :— |               |
|---------------|------------------------------|--------|-----------------------------------|----------------------------------------------------------------------------------|---------------|
|               | Heater                       | Couple |                                   | 5 millivolts                                                                     | 15 millivolts |
| A             | 0.3                          | 3      | 1,000                             | 400 — 500                                                                        | 750 — 1,000   |
| B             | 0.6                          | 3      | 500                               | 180 — 205                                                                        | 360 — 500     |
| C             | 5                            | 3      | 75                                | 30 — 37                                                                          | 58 — 75       |
| D             | 35                           | 12     | 16                                | 6 — 8                                                                            | 12 — 16       |
| *E            | 43                           | 30     | 15                                | 5.5 — 7.5                                                                        | 11 — 15       |
| *F            | 46.5                         | 12     | 15                                | 5 — 7.5                                                                          | 10 — 15       |
| G             | 200                          | 12     | 15                                | 3 — 6.5                                                                          | 6.5 — 15      |
| H             | 400                          | 12     | 7                                 | 1.8 — 3.5                                                                        | 4 — 7         |
| J             | 600                          | 12     | 5                                 | 1.5 — 2                                                                          | 3.5 — 5       |
| K             | 750                          | 12     | 5                                 | 1.3 — 1.8                                                                        | 3 — 4.2       |
| L             | 1,000                        | 12     | 4                                 | 1.2 — 1.6                                                                        | 3 — 4         |
| *M            | 1,120                        | 12     | 7                                 | 1.8 — 3.5                                                                        | 4 — 7         |
| N             | 46.5                         | 12     | 15                                | 5 — 7.5                                                                          | 10 — 15       |
| *P            | 600                          | 45     | 5                                 | 1.5 — 2                                                                          | 3.5 — 5       |
| R             | 1.3                          | 12     | 160                               | 67 — 85                                                                          | 130 — 160     |
| S             | 10                           | 12     | 35                                | 13 — 17                                                                          | 26 — 35       |
| *U            | 600                          | 22     | 5                                 | 1.5 — 2                                                                          | 3.5 — 5       |
| AM            | 90                           | 12     | 9                                 | 3 — 4.5                                                                          | 6 — 9         |
| HJ            | 550                          | 12     | 6                                 | 1.6 — 2.5                                                                        | 3.6 — 5.8     |

\* Note.—To meet special requirements it is sometimes necessary to provide adjusting resistance in either the couple or heater circuit. This resistance is non-inductively wound on a tubular former slipped over the glass bulb, thus forming an integral part of the thermocouple. In the case of the 'E,' 'F' and 'P' codes, the resistance of the couple element is increased in this way in order that they shall meet specific current requirements when used with certain types of galvanometer. The resistance of the heater circuit on the 'M' and 'U' codes is also built up in this way to the stated values.



Type 4002

# —Standard Valves—

Vacuum  
Thermo-  
couples

## Accuracy.

Measurements can be made and repeated to  $\pm 1\%$ .

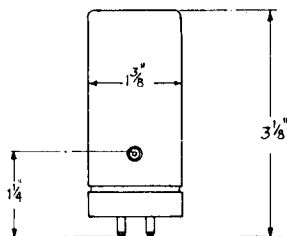
## Reactance.

Inductance of heater approximately  $5 \times 10^{-8} \text{H}$ .

Capacity of heater approximately  $2 \mu\mu\text{F}$ .

## Heating Time.

In the smaller sizes, the heating time is negligible ; the largest size takes approximately 30 seconds to attain maximum value.



Type 4001

PRINTED IN  
ENGLAND

# —Standard Valves—

Ballast  
Lamps

## BALLAST LAMPS

In telephone repeaters it is essential that the filaments of the amplifying valves should be supplied with a constant current. As the battery voltage is liable to variation it is often necessary to use a ballast lamp to supply a constant current for a considerable voltage fluctuation.

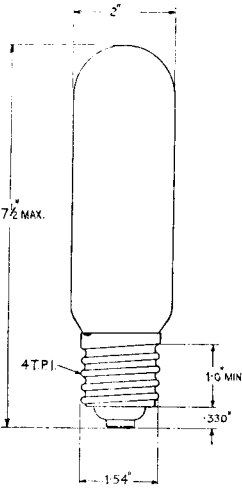
The following types of ballast lamps are available :—

| Type    | Overall length ins. | Diameter ins. | Voltage limits volts | Current limits amps. | Net weight |      |
|---------|---------------------|---------------|----------------------|----------------------|------------|------|
|         |                     |               |                      |                      | lbs.       | gms. |
| 4003-A  | 5                   | 1 1/4         | 3—9.5                | 0.94 — 1.01          | 0.1        | 45   |
| 4004-A  | 4                   | 1 1/4         | 7—14                 | 0.24 — 0.26          | 0.08       | 35   |
| 4004-B  | 4                   | 1 1/4         | 3—9                  | 0.24 — 0.26          | 0.1        | 45   |
| 4004-C  | 4                   | 1 1/4         | 3—9                  | 0.254—0.276          | 0.1        | 45   |
| 4007-A  | 7 1/2               | 2             | 9—14                 | 3.3 — 3.4            | 0.3        | 140  |
| 4008-A  | 5 3/8               | 2             | 5.5—12               | 1.7 — 2.2            | 0.17       | 75   |
| 4120-AA | 4                   | 1 1/4         | 5.5—12               | 0.39 — 0.47          | 0.07       | 30   |
| 4121-AA | 4 1/2               | 1.89"         | 5.5—12               | 0.78 — 0.94          | 0.1        | 45   |

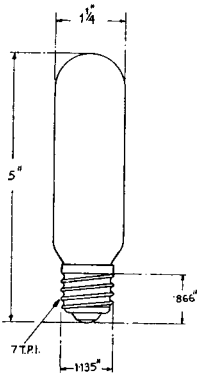
### Base.

|                |                       |
|----------------|-----------------------|
| 4003-A         | Edison medium screw.  |
| 4004-A, -B, -C | Edison medium screw.  |
| 4007-A         | Edison Goliath screw. |
| 4008-A         | Edison medium screw.  |
| 4120-AA        | Edison medium screw.  |
| 4121-AA        | Edison medium screw.  |

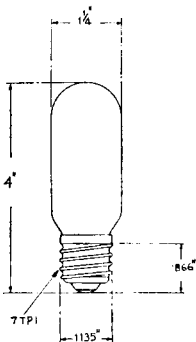
*—Standard Valves—*



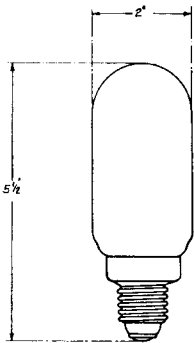
4007-A



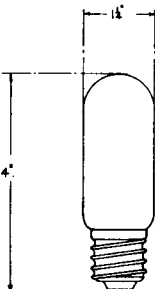
4003-A



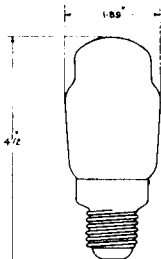
4004-A, -B, -C



4008-A



4120-AA



4121-AA

# —Standard Valves—

4006-A  
Valve

## 4006-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten Filament.  
Constant Voltage Type.

#### Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation  
up to 6 Kw.

Type MS.1362 Grp.20 used for below panel con-  
nection for anode dissipation up to 6 Kw.

Type 223 LU 1A for anode dissipation over  
6 Kw.

#### Water Flow.

5 gallons per minute.

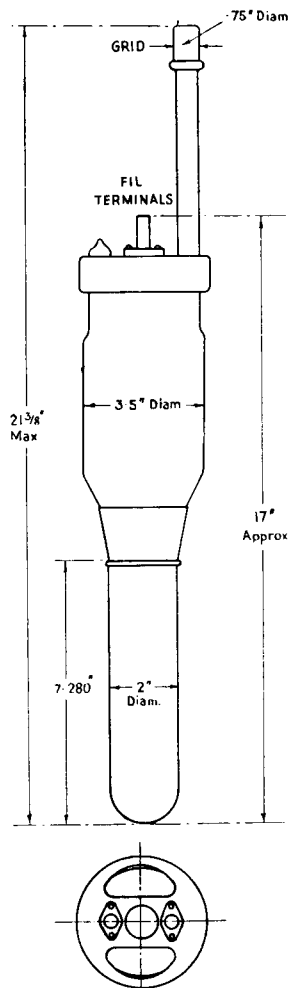
#### Dimensions.

|                |                                  |
|----------------|----------------------------------|
| Overall length | 21 $\frac{3}{8}$ " (54 cms.).    |
| Bulb diameter  | 3 $\frac{1}{2}$ " (8.9 cms.).    |
| Net weight     | 2 $\frac{1}{2}$ lb. (1,150 gms.) |

#### Constants.

|                                            |                         |
|--------------------------------------------|-------------------------|
| Filament voltage                           | 19.5–20.5 volts         |
| (exact filament voltage marked<br>on bulb) |                         |
| Nominal filament current                   | 50 amps.                |
| Total emission                             | 6 amps.                 |
| *Impedance                                 | 7,500 ohms.             |
| *Amplification factor                      | 40                      |
| Grid–anode capacity                        | 20.5 $\mu\mu\text{F}$ . |
| Anode–filament capacity                    | 3 $\mu\mu\text{F}$ .    |
| Grid–filament capacity                     | 20 $\mu\mu\text{F}$ .   |

\* at anode current of 0.75 amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |               |
|---------------------------------------------------|---------------|
| Maximum direct anode voltage                      | 13,000 volts. |
| Maximum direct anode voltage for anode modulation | 9,000 volts.  |
| Maximum direct anode current                      | 1.5 amps.     |
| Maximum anode dissipation                         | 10 Kw.        |
| Maximum grid dissipation                          | 200 watts.    |
| Maximum frequency for above ratings               | 3 Mc.         |
| Maximum anode voltage for frequency of 6 Mc.      | 7,500 volts.  |



# —Standard Valves—

## TYPICAL OPERATING CONDITIONS

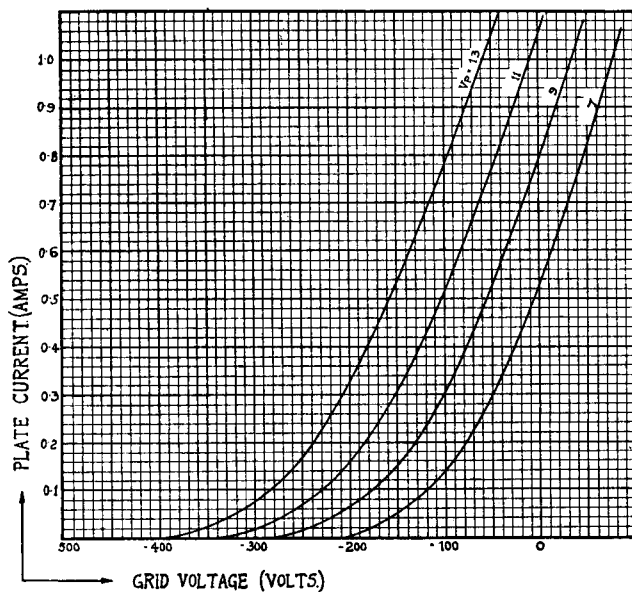
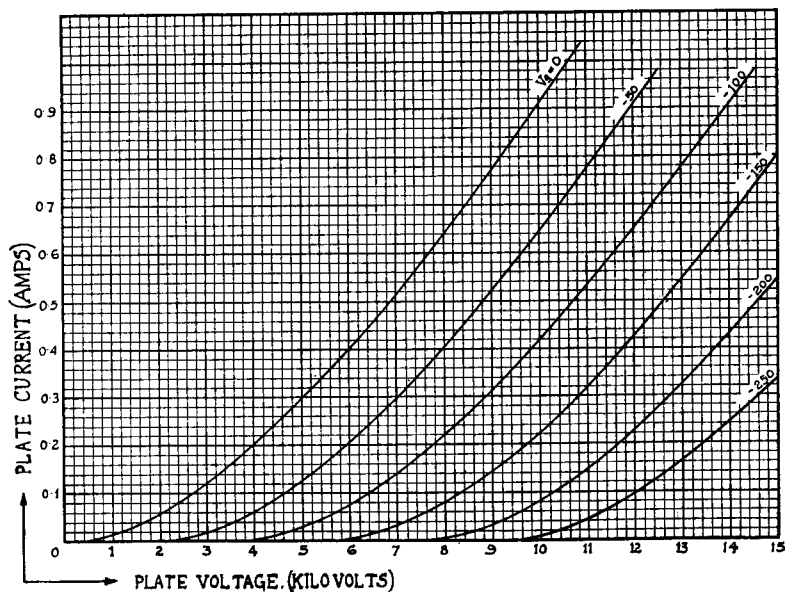
|                                                                                                                                                                                                                           | Class B A.F. Amp.<br>For balanced 2 valve circuit.                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Direct anode voltage<br>Grid Bias<br>Direct anode current per valve zero signal<br>Direct anode current per valve maximum signal<br>Load resistance—anode to anode<br>Maximum signal output—2 valves<br>Anode dissipation | 10,000 volts<br>—120 to —170 volts<br>0.25 amps.<br>1.2 amps.<br>7,450 ohms.<br>13.2 Kw.<br>5.4 Kw. |

## RADIO FREQUENCY OPERATION

|                                                                                                  | Class B<br>Telephony                       | Class C<br>Telephony                 | Class C<br>Telegraphy                                                 |
|--------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------------------------|-----------------------------------------------------------------------|
|                                                                                                  | Modulated<br>Carrier<br>applied to<br>grid | Subject to<br>anode<br>modulation    | Unmodulated                                                           |
| Direct anode voltage<br>Direct anode current<br>Grid bias<br>Anode dissipation<br>Carrier output | 10,000<br>0.75<br>—210<br>5<br>2.5         | 7,000<br>0.75<br>—350<br>1.75<br>3.5 | 10,000 volts<br>1.5 amps.<br>—500 to<br>—700 volts<br>5 Kw.<br>10 Kw. |

# —Standard Valves—

4006-A  
Valve



V.4006-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4007-A  
Valve

## 4007-A VALVE

HALF WAVE WATER COOLED RECTIFIER.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation  
up to 6 Kw.  
Type 223 LU 1A for anode dissipation over  
6 Kw.  
Type MS.1362 Grp. 20 for anode dissipation  
up to 6 Kw. used for below panel  
connection.

#### Water Flow.

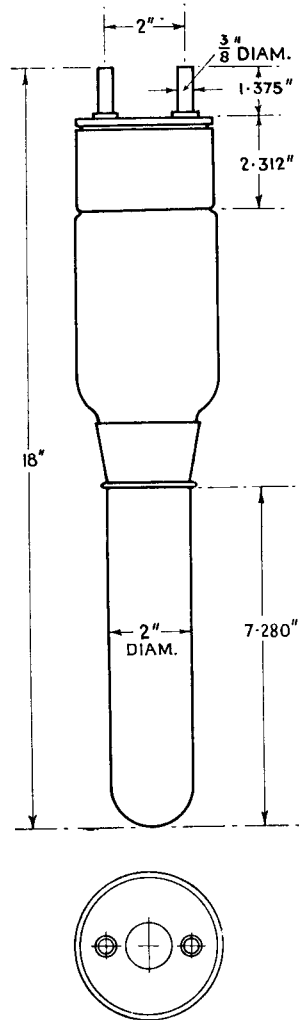
2 gallons per minute.

#### Dimensions.

|                |                                  |
|----------------|----------------------------------|
| Overall length | 18" (46 cms.)                    |
| Bulb diameter  | $3\frac{1}{2}$ " (8.9 cms.)      |
| Net weight     | $2\frac{1}{4}$ lbs. (1,050 gms.) |

#### Constants.

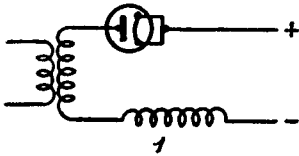
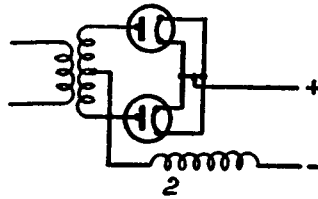
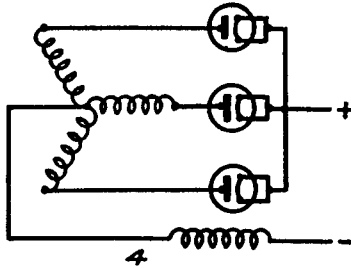
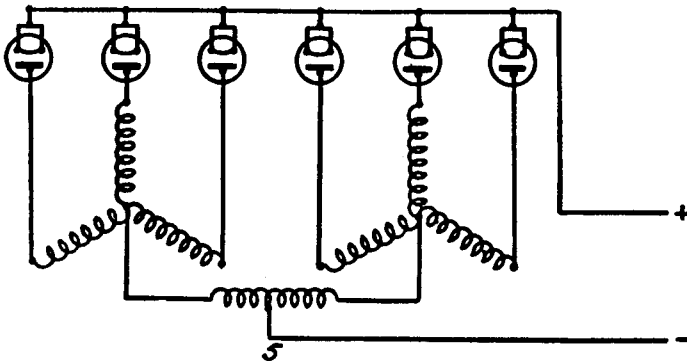
|                                 |                                                                              |
|---------------------------------|------------------------------------------------------------------------------|
| Filament voltage                | 20 – 21 volts<br>(exact filament voltage is marked<br>on bulb of each valve) |
| Nominal filament current        | 50 amps.                                                                     |
| Total emission                  | 6 amps.                                                                      |
| Maximum peak inverse<br>voltage | 45,000 volts                                                                 |
| Maximum anode dissipation       | 10 Kw.                                                                       |



# —Standard Valves—

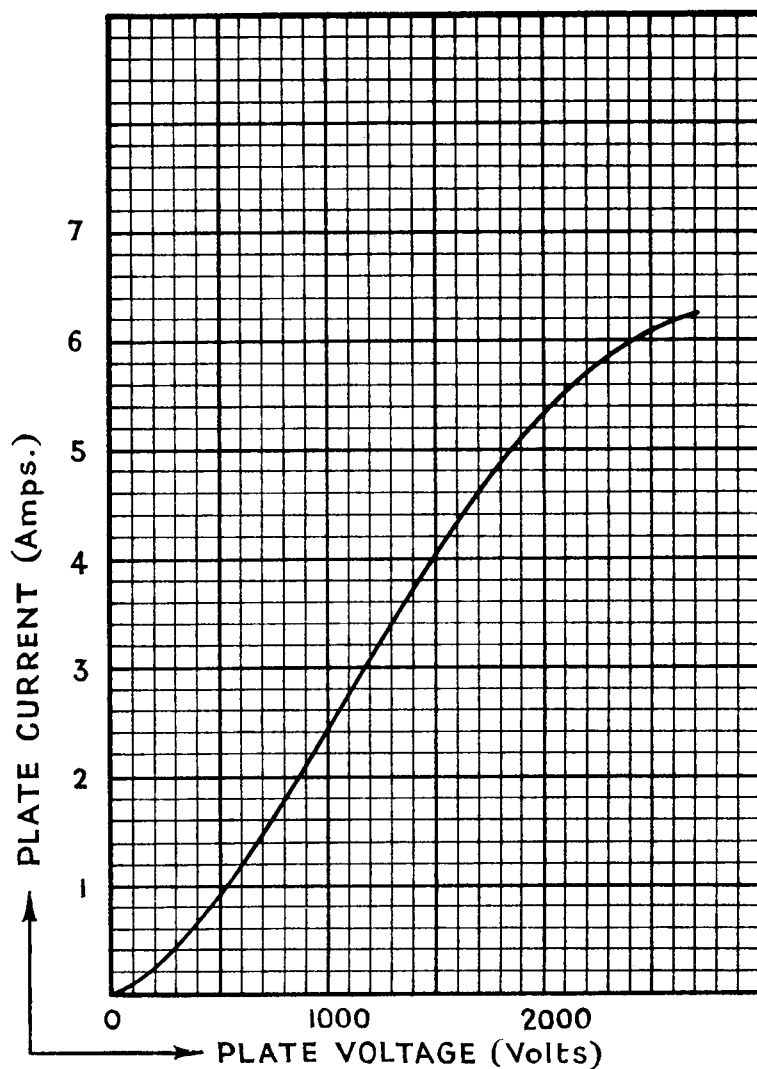
## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of<br>valves | Load potential<br>in volts | Load current<br>in amps. |
|---------|---------------------|----------------------------|--------------------------|
| 1       | 1                   | 7,000                      | 1.5                      |
| 2       | 2                   | 14,000                     | 3.0                      |
| 4       | 3                   | 22,500                     | 4.3                      |
| 5       | 6                   | 22,500                     | 8.5                      |



# *—Standard Valves—*

4007-A  
Valve



V.4007-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4008-B  
Valve

## 4008-B VALVE

HALF WAVE WATER COOLED RECTIFIER.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation  
up to 6 Kw.

Type 223 LU.1A for anode dissipation over  
6 Kw.

Type MS.1362 Grp. 20 used for below panel  
connection up to 6 Kw. anode dissipation.

#### Water Flow.

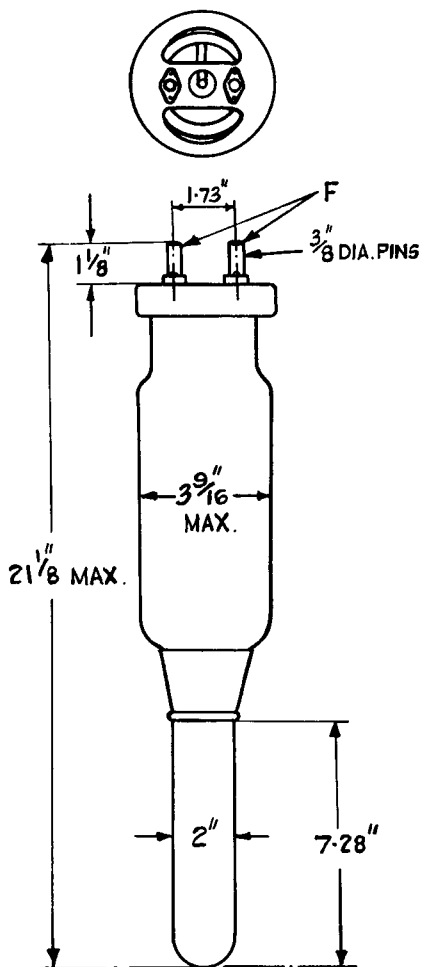
2 gallons per minute.

#### Dimensions.

Max. overall length  $21\frac{1}{8}"$  (53.6 cms.).  
Max. bulb diameter  $3\frac{9}{16}"$  (9 cms.)  
Net weight  $3\frac{1}{2}$  lbs. (1,600 gms.)

#### Constants.

Filament voltage 18.5–19.5 volts  
(exact filament voltage marked  
on bulb of each valve)  
Nominal filament current 59 amps.  
Total emission 6 amps.  
Maximum peak inverse  
voltage 45,000 volts  
Maximum anode dissipation 10 Kw.

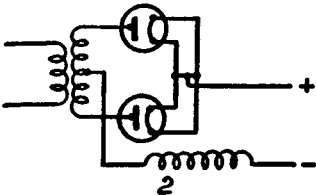
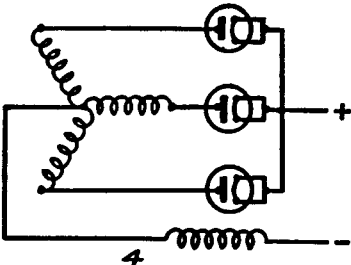
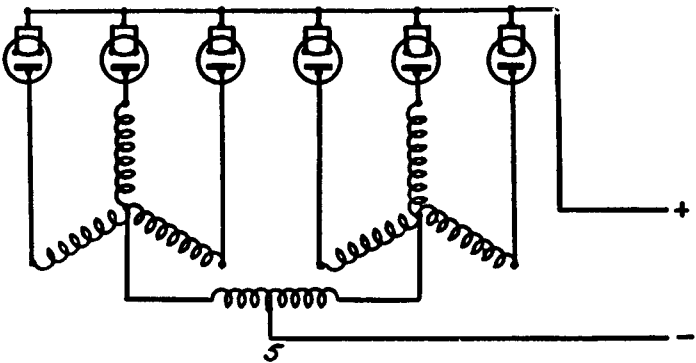




# —Standard Valves—

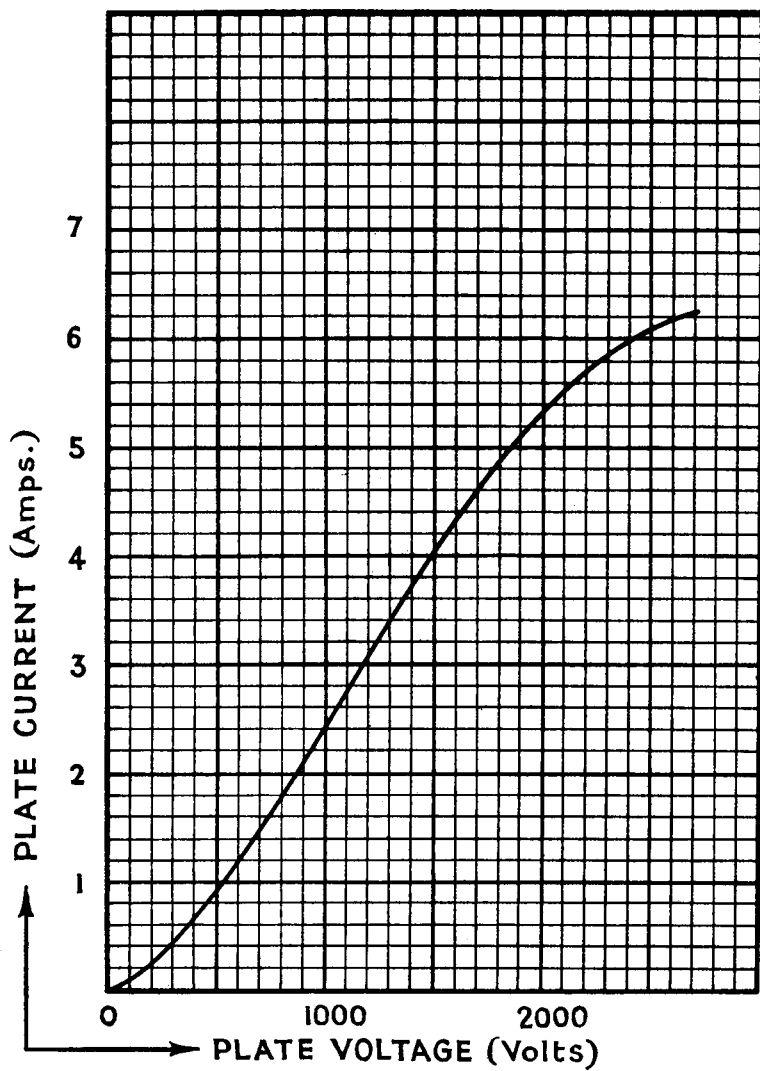
**TYPICAL OPERATING CONDITIONS.**

| Circuit | Number of<br>Valves | Load potential<br>in volts | Load current<br>in amps. |
|---------|---------------------|----------------------------|--------------------------|
| 2       | 2                   | 14,000                     | 3.0                      |
| 4       | 3                   | 22,500                     | 4.3                      |
| 5       | 6                   | 22,500                     | 8.5                      |



# *—Standard Valves—*

4008-B  
Valve



V.4008-B.2  
March, 1939

PRINTED IN  
ENGLAND

# —Standard Valves—

4009-B  
Valve

## 4009-B VALVE

(Replaces the 4009-A Valve which has now been abandoned.)

SINGLE ENDED WATER COOLED TRIODE.

### Cathode. SPECIFICATION.

Pure Tungsten filament.  
Constant voltage type.

### Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation up to 6 Kw.  
Type MS.1362 Grp. 20 used up to 6 Kw. anode dissipation for below panel connection.  
Type 223 LU.1A for anode dissipation from 6–15 Kw.  
Type PL.122.011/A for anode dissipation over 15 Kw.

### Water Flow.

12 gallons per minute.

### Dimensions.

Max. overall length  $21\frac{1}{4}"$  (54 cms.)  
Max. bulb diameter  $3\frac{9}{16}"$  (9.05 cms.)  
Net weight  $3\frac{3}{4}$  lbs. (1,700 gms.)

### Constants.

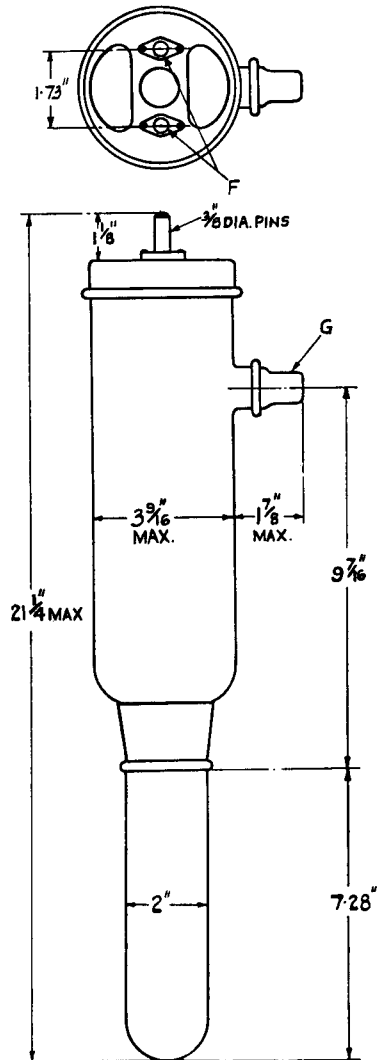
Filament voltage 20 volts  
(exact filament voltage marked on bulb)  
Nominal filament current 61 amps.  
Total emission 10 amps.  
\*Impedance 6,000 ohms  
\*Amplification factor 40  
\*Mutual Conductance 6.7 mA per volt  
Grid-anode capacity  $24 \mu\mu\text{F.}$   
Anode-filament capacity  $1.8 \mu\mu\text{F.}$   
Grid-filament capacity  $17 \mu\mu\text{F.}$

\* at anode current of 1.0 amp.

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |              |
|---------------------------------------------------|--------------|
| Maximum direct anode voltage                      | 17,500 volts |
| Maximum direct anode voltage for anode modulation | 14,000 volts |
| Maximum direct anode current                      | 2.5 amps.    |
| Maximum anode dissipation                         | 20 Kw.       |
| Maximum grid dissipation                          | 300 watts    |
| Maximum frequency for above rating                | 3 Mc.        |
| Maximum anode voltage for frequency of 6 Mc.      | 10,000 volts |

NOTE.—The characteristics of this valve are identical with those of the 4009-A, but the grid lead has been brought out through the side of the bulb. When the 4009-B is used to replace the 4009-A new grid connectors will be required. These connectors type ES.5706-1 should be ordered with the valve.



*—Standard Valves—*

**TYPICAL OPERATING CONDITIONS.**

|                                               | Class B A.F. Amp.<br>For balanced 2 valve circuit. |
|-----------------------------------------------|----------------------------------------------------|
| Direct anode voltage                          | 15,000 volts                                       |
| Grid bias                                     | —200 to —250 volts                                 |
| Direct anode current per valve—zero signal    | 0.4 amps.                                          |
| Direct anode current per valve—maximum signal | 2.0 amps.                                          |
| Load resistance—anode to anode                | 6,700 ohms                                         |
| Maximum signal output—2 valves                | 33 Kw.                                             |
| Anode dissipation                             | 13.5 Kw.                                           |

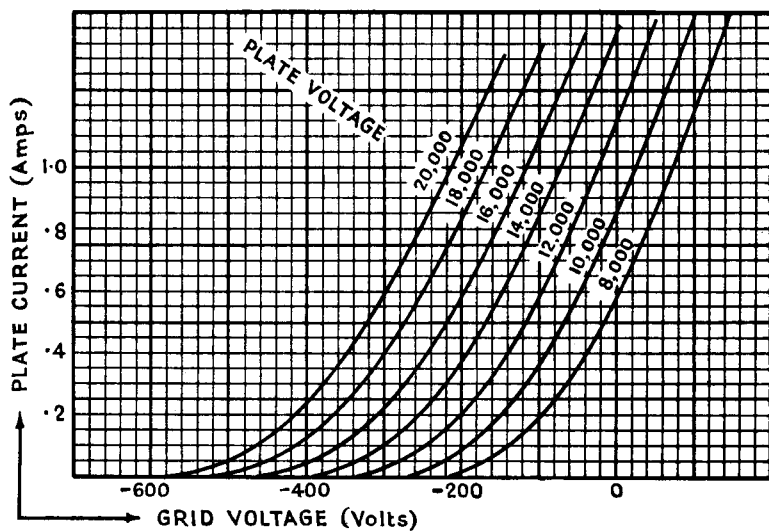
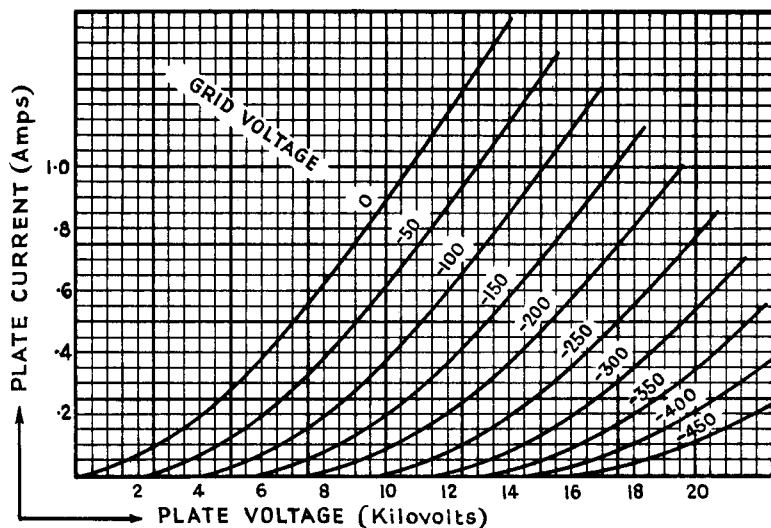
**RADIO FREQUENCY OPERATION.**

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy   |
|----------------------|-----------------------------------------|-----------------------------------|-------------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated             |
| Direct anode voltage | 15,000                                  | 10,000                            | 15,000 volts            |
| Direct anode current | 1.25                                    | 1.25                              | 2.5 amps.               |
| Grid bias            | —300                                    | —500                              | —800 to<br>—1,200 volts |
| Anode dissipation    | 12.5                                    | 4.17                              | 12.5 Kw.                |
| Carrier output       | 6.25                                    | 8.33                              | 25 Kw.                  |

# —Standard Valves—

4009-B  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



PRINTED IN  
ENGLAND

# *—Standard Valves—*

4011-B  
Valve

## 4011-B VALVE

TRIODE.

For replacement purposes only.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.

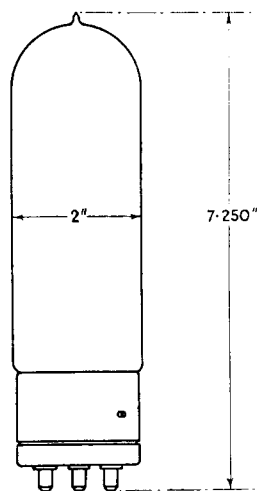
Constant voltage type.

#### Base.

Large 4-pin bayonet thrust.

#### Dimensions.

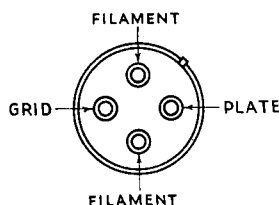
|                  |                             |
|------------------|-----------------------------|
| Overall length   | $7\frac{1}{4}"$ (18.4 cms.) |
| Maximum diameter | 2" (5.1 cms.)               |
| Net weight       | 0.42 lbs. (190 gms.)        |



#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 8 volts                |
| Nominal filament current | 1.6 amps.              |
| * Impedance              | 1,650 ohms.            |
| * Amplification factor   | 4.2                    |
| Grid-anode capacity      | 9.5 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 4 $\mu\mu\text{F}$ .   |
| Grid-filament capacity   | 4.5 $\mu\mu\text{F}$ . |

\* at anode current of 0.060 amps.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |             |
|------------------------------|-------------|
| Maximum direct anode voltage | 350 volts   |
| Maximum direct anode current | 0.150 amps. |
| Maximum anode dissipation    | 30 watts    |

Note :—This valve should be mounted so that the filament is operated in a vertical plane.

V.4011-B.1  
Nov. 1937



# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

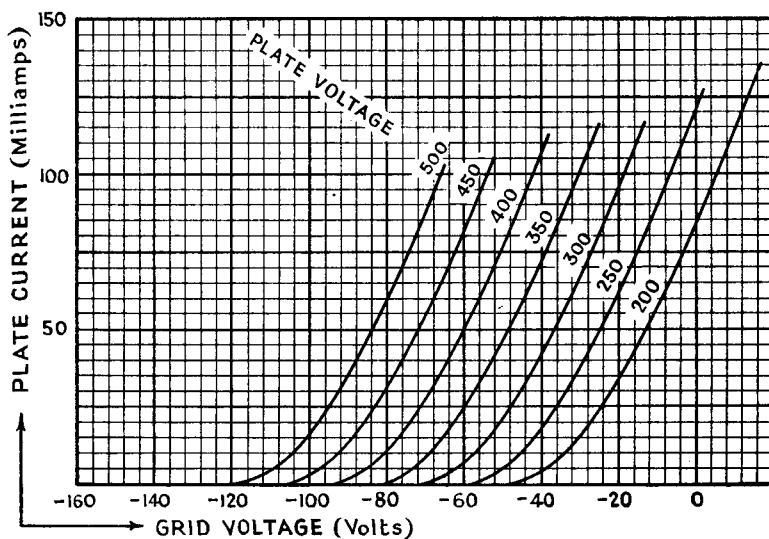
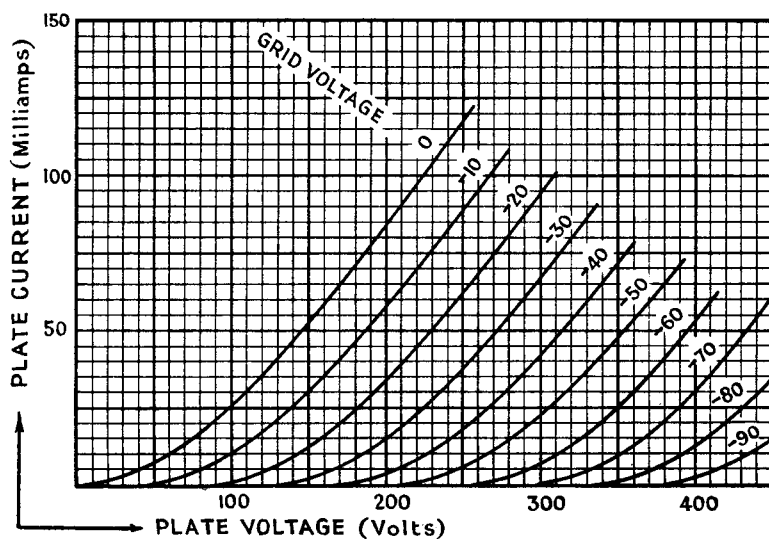
|                                                                                                                        | Class A<br>A.F. Amp.                                                           |
|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Direct anode voltage<br>Grid bias<br>Direct anode current<br>Anode dissipation<br>Load impedance<br>Undistorted output | 350 volts<br>—45 volts<br>0.060 amps.<br>18.9 watts<br>2,000 ohms<br>2.1 watts |

|                                                                                                                                                                                                      | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Direct anode voltage<br>Grid bias<br>Anode current per valve—zero signal<br>Anode current per valve—maximum signal<br>Anode dissipation<br>Load resistance—anode to anode<br>Maximum output—2 valves | 350 volts<br>—55 to —65 volts<br>0.030 amps.<br>0.150 amps.<br>25 watts<br>2,100 ohms<br>60 watts |

# *—Standard Valves—*

4011-B  
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



V.4011-B.2  
Nov. 1937

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# *—Standard Valves—*

4013-A  
Fuse

## 4013-A FUSE

VACUUM MICRO FUSE.

The 4013-A Fuse consists of a nickel wire in an evacuated glass bulb. It is intended to blow on currents ranging from 18 to 25 milliamps.

### Safe Current.

11 milliamps for 1 hour.  
or 5 milliamps for an indefinite period.

### Resistance.

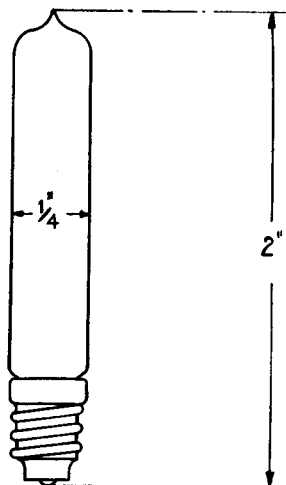
45—55 ohms.

### Dimensions.

|                  |                            |
|------------------|----------------------------|
| Overall length   | 2" (5.1 cms.)              |
| Maximum diameter | $\frac{1}{4}$ " (0.6 cms.) |
| Net weight       | 0.01 lbs. (5 gms.)         |

### Base.

Edison miniature screw base.



**Note :**—Orders for special fuses may be placed. Quotations will be sent on request.

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# —Standard Valves—

4013-C  
Valve

## 4013-C VALVE

SINGLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type MS.1362 Grp. 1.  
Type MS.1362 Grp. 20 used for below panel  
connection.

#### Water Flow.

3 gallons per minute.

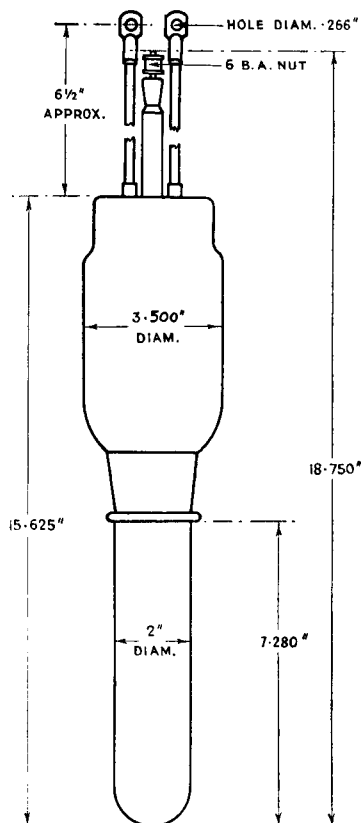
#### Dimensions.

Overall length  $18\frac{3}{4}"$  (47.7 cms.)  
Bulb diameter  $3\frac{1}{2}"$  (8.9 cms.)  
Net weight  $2\frac{1}{2}$  lbs. (1,150 gms.)

#### Constants.

Filament voltage 13.5–14.5 volts  
(exact filament voltage marked  
on bulb)  
Nominal filament current 36 amps.  
Total emission 2.8 amps.  
\*Impedance 5,700 ohms.  
\*Amplification factor 21  
Grid-anode capacity  $18 \mu\mu\text{F.}$   
Anode-filament capacity  $2 \mu\mu\text{F.}$   
Grid-filament capacity  $14 \mu\mu\text{F.}$

\* at anode current of 0.3 amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |             |
|---------------------------------------------------|-------------|
| Maximum direct anode voltage                      | 6,000 volts |
| Maximum direct anode voltage for anode modulation | 4,000 volts |
| Maximum direct anode current                      | 0.7 amps.   |
| Maximum anode dissipation                         | 5 Kw.       |
| Maximum grid dissipation                          | 100 watts   |
| Maximum frequency for above ratings               | 15 Mc.      |
| Anode voltage for frequency of 22 Mc.             | 5,000 volts |

V.4013-C.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B A.F. Amp.<br>For balanced 2 valve circuit |
|-----------------------------------------------|---------------------------------------------------|
| Direct anode voltage                          | 5,000 volts                                       |
| Grid bias                                     | —150 to —175 volts                                |
| Direct anode current per valve—zero signal    | 0.12 amps.                                        |
| Direct anode current per valve—maximum signal | 0.6 amps.                                         |
| Load resistance—anode to anode                | 7,440 ohms                                        |
| Maximum signal output—2 valves                | 3.3 Kw.                                           |
| Anode dissipation                             | 1.35 Kw.                                          |

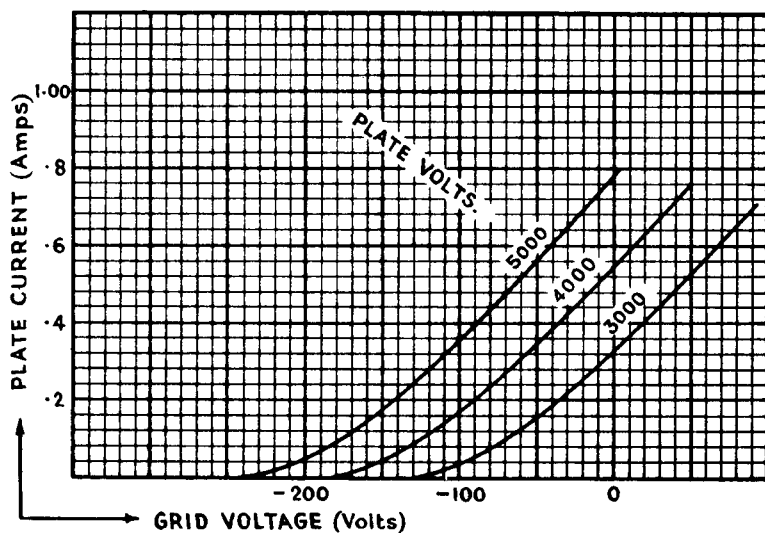
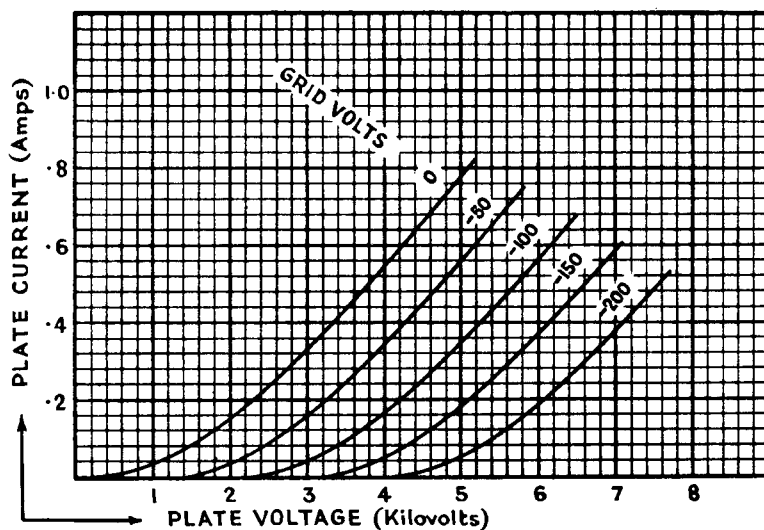
## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 5,000                                   | 3,500                             | 5,000 volts           |
| Direct anode current | 0.35                                    | 0.35                              | 0.7 amps.             |
| Grid bias            | —200                                    | —300                              | —500 to<br>—700 volts |
| Anode dissipation    | 1.17                                    | 0.41                              | 1.17 Kw.              |
| Carrier output       | 0.58                                    | 0.82                              | 2.34 Kw.              |

# —Standard Valves—

4013-C  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.





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# —Standard Valves—

4013-D  
Valve

## 4013-D VALVE

SINGLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type MS.1362 Grp. 1.  
Type MS.1362 Grp. 20. For below panel  
connection.

#### Water Flow.

3 gallons per minute.

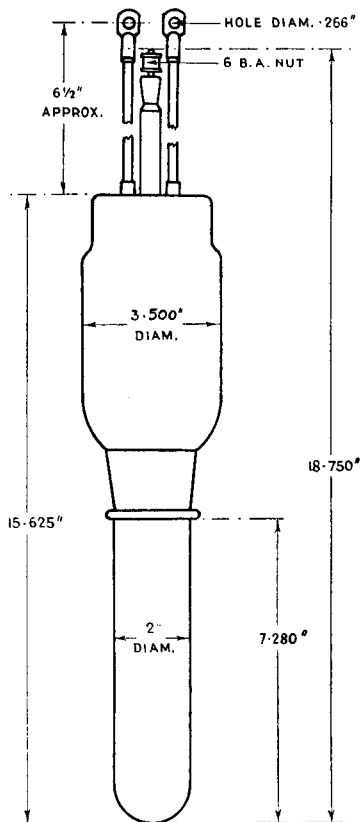
#### Dimensions.

Overall length  $18\frac{3}{4}"$  (47.7 cms.)  
Bulb diameter  $3\frac{1}{2}"$  (8.9 cms.)  
Net weight  $2\frac{1}{2}$  lbs. (1,150 gms.)

#### Constants.

Filament voltage 19–21 volts.  
(exact filament voltage marked  
on bulb)  
Nominal filament current 41 amps.  
Total emission 6 amps.  
\*Impedance 4,200 ohms  
\*Amplification factor 21  
Grid-anode capacity  $21 \mu\mu\text{F.}$   
Anode-filament capacity  $2.5 \mu\mu\text{F.}$   
Grid-filament capacity  $16 \mu\mu\text{F.}$

\* at anode current of 0.75 amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |             |
|---------------------------------------------------|-------------|
| Maximum direct anode voltage                      | 6,000 volts |
| Maximum direct anode voltage for anode modulation | 4,000 volts |
| Maximum direct anode current                      | 1.5 amps.   |
| Maximum anode dissipation                         | 5 Kw.       |
| Maximum grid dissipation                          | 100 watts   |
| Maximum frequency for above ratings               | 15 Mc.      |
| Maximum anode voltage for frequency of 22 Mc.     | 5,000 volts |

V.4013-D.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                                                                                                                                                                                                           | Class B A.F. Amp.<br>For balanced 2 valve circuit                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Direct anode voltage<br>Grid bias<br>Direct anode current per valve—zero signal<br>Direct anode current per valve—maximum signal<br>Load resistance—anode to anode<br>Maximum signal output—2 valves<br>Anode dissipation | 5,000 volts<br>—100 to —150 volts<br>0.25 amps.<br>1.2 amps.<br>3,700 ohms<br>6.6 Kw.<br>2.7 Kw. |

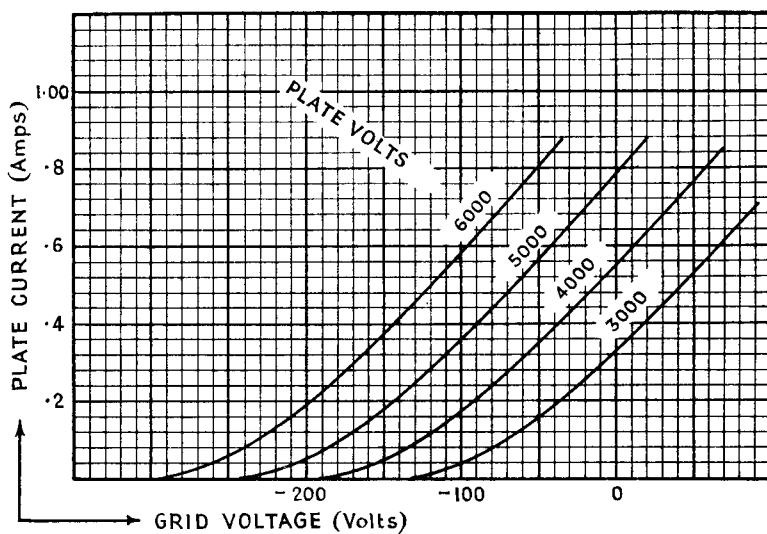
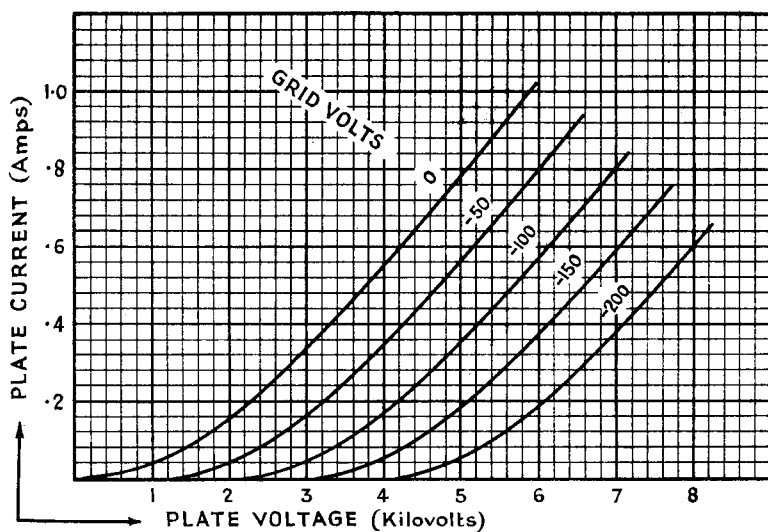
## RADIO FREQUENCY OPERATION.

|                                                                                                  | Class B<br>Telephony                    | Class C<br>Telephony                | Class C<br>Telegraphy                                                 |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------|-----------------------------------------------------------------------|
|                                                                                                  | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation   | Unmodulated                                                           |
| Direct anode voltage<br>Direct anode current<br>Grid bias<br>Anode dissipation<br>Carrier output | 5,000<br>0.75<br>—190<br>2.5<br>1.25    | 3,500<br>0.75<br>—300<br>0.9<br>1.8 | 5,000 volts<br>1.5 amps.<br>—500 to<br>—750 volts<br>2.5 Kw.<br>5 Kw. |

# *—Standard Valves—*

4013-D  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



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# —Standard Valves—

4014-A  
Valve

## 4014-A VALVE

DOUBLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Dimensions.

Overall length  $28\frac{1}{4}"$  (72 cms.)  
Bulb diameter  $3\frac{1}{2}"$  (8.9 cms.)  
Net weight 7 lbs. (3,200 gms.)

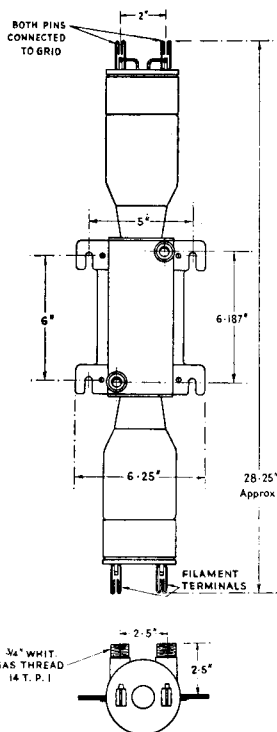
#### Water Flow.

5 gallons per minute.

#### Constants.

Filament voltage 21–22 volts  
(exact filament voltage marked  
on bulb)  
Nominal filament current 41 amps.  
Total emission 6 amps.  
\*Impedance 7,500 ohms  
\*Amplification factor 40  
Grid–anode capacity  $23 \mu\text{F.}$   
Anode–filament capacity  $6.5 \mu\text{F.}$   
Grid–filament capacity  $8 \mu\text{F.}$

\* at anode current of 0.75 amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |              |
|---------------------------------------------------|--------------|
| Maximum direct anode voltage                      | 12,000 volts |
| Maximum direct anode voltage for anode modulation | 9,000 volts  |
| Maximum direct anode current                      | 1.5 amps.    |
| Maximum anode dissipation                         | 12 Kw.       |
| Maximum grid dissipation                          | 200 watts    |
| Maximum frequency for above ratings               | 15 Mc.       |
| Maximum anode voltage for frequency of 22 Mc.     | 10,000 volts |

Note :—No water jacket required as it forms part of the valve.

V.4014-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B A.F. Amp.<br>For balanced 2 valve circuit |
|-----------------------------------------------|---------------------------------------------------|
| Direct anode voltage                          | 10,000 volts                                      |
| Grid bias                                     | —125 to —175 volts                                |
| Direct anode current per valve—zero signal    | 0.25 amps.                                        |
| Direct anode current per valve—maximum signal | 1.2 amps.                                         |
| Load resistance—anode to anode                | 3,700 ohms                                        |
| Maximum signal output—2 valves                | 13.2 Kw.                                          |
| Anode dissipation                             | 5.4 Kw.                                           |

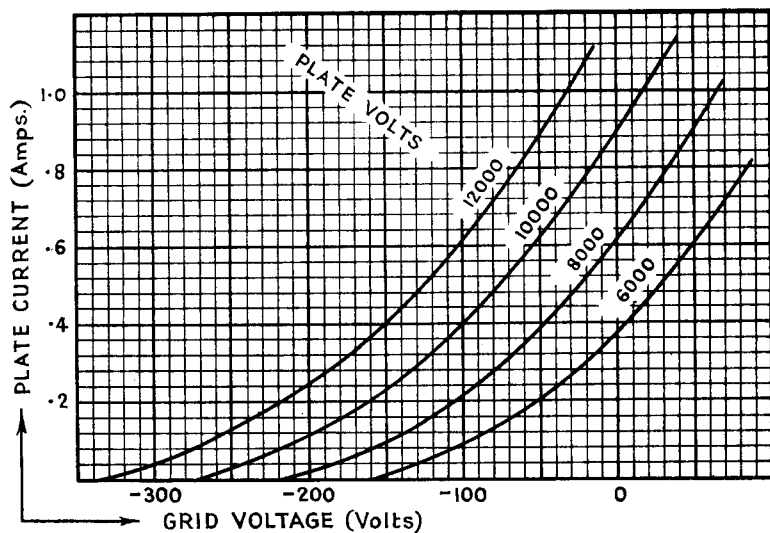
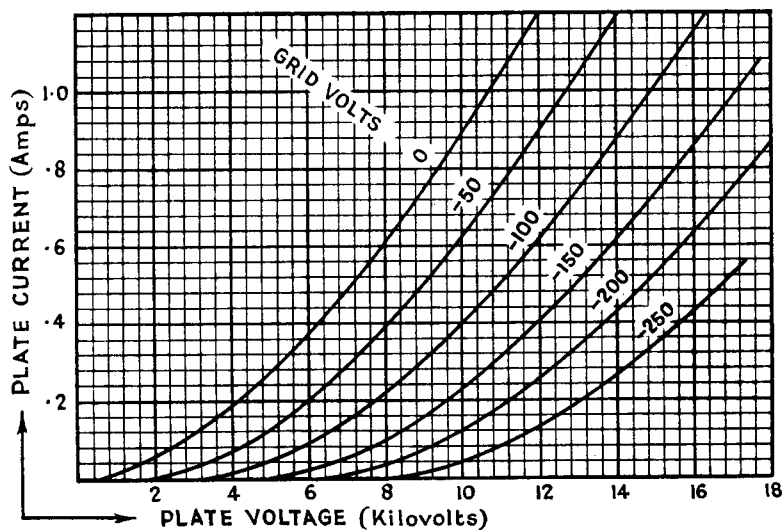
## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy    |
|----------------------|-----------------------------------------|-----------------------------------|--------------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated              |
| Direct anode voltage | 10,000                                  | 7,000                             | 10,000 volts             |
| Direct anode current | 0.75                                    | 0.75                              | 1.5 amps.                |
| Grid bias            | —230                                    | —400                              | — 700 to<br>—1,000 volts |
| Anode dissipation    | 5                                       | 1.75                              | 5 Kw.                    |
| Carrier output       | 2.5                                     | 3.5                               | 10 Kw.                   |

# —Standard Valves—

4014-A  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4014-A.2  
Nov. 1937



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# —Standard Valves—

4015-A  
Valve

## 4015-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Pure tungsten filament.  
Constant voltage type.

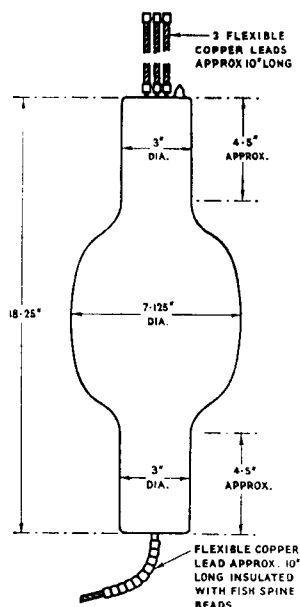
#### Dimensions.

Overall length  $18\frac{1}{2}"$  (46.4 cms.)  
Maximum diameter  $7\frac{1}{8}"$  (18.1 cms.)  
Net weight  $3\frac{1}{4}$  lbs. (1,500 gms.)

#### Constants.

Filament voltage 10.5–11.5 volts  
(exact filament voltage marked  
on bulb)  
Nominal filament current 41 amps.  
Total emission 2.5 amps.  
\*Impedance 8,000 ohms  
\*Amplification factor 20  
\*Mutual conductance 2.5 mA. per volt  
Grid–anode capacity  $10.3 \mu\mu\text{F.}$   
Anode–filament capacity  $0.5 \mu\mu\text{F.}$   
Grid–filament capacity  $15.2 \mu\mu\text{F.}$

\* at  $V_p = 4,000$  volts,  $I_p = 0.3$  amps.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |             |
|------------------------------|-------------|
| Maximum direct anode voltage | 5,000 volts |
| Maximum direct anode current | 0.6 amps.   |
| Maximum anode dissipation    | 1.5 Kw.     |
| Maximum direct grid current  | 0.080 amps. |

V.4015-A.1  
Sept. 1938

*—Standard Valves—*

**TYPICAL OPERATING CONDITIONS.**

|                                        |                                                             |
|----------------------------------------|-------------------------------------------------------------|
|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit. |
| Direct anode voltage                   | 5,000 volts                                                 |
| Grid bias                              | —100 to —150 volts                                          |
| Anode current per valve—zero signal    | 0.12 amps.                                                  |
| Anode current per valve—maximum signal | 0.6 amps.                                                   |
| Anode dissipation                      | 1.4 Kw.                                                     |
| Load resistance—anode to anode         | 7,100 ohms                                                  |
| Maximum output—2 valves                | 3.2 Kw.                                                     |

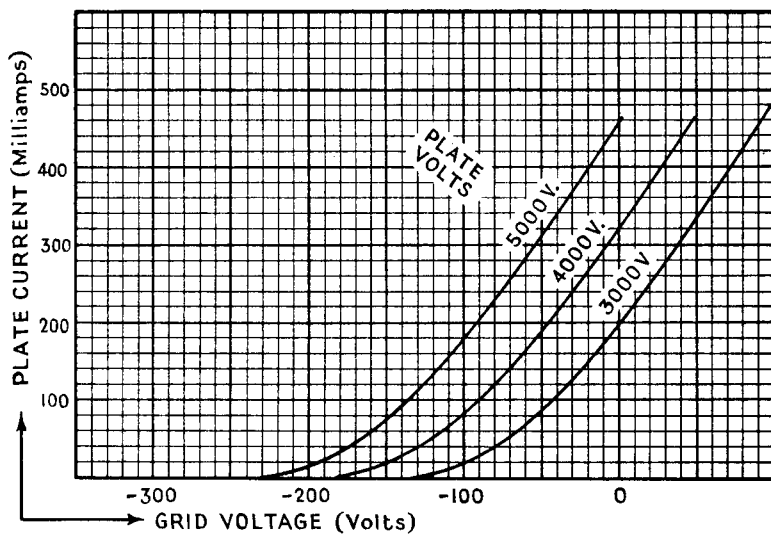
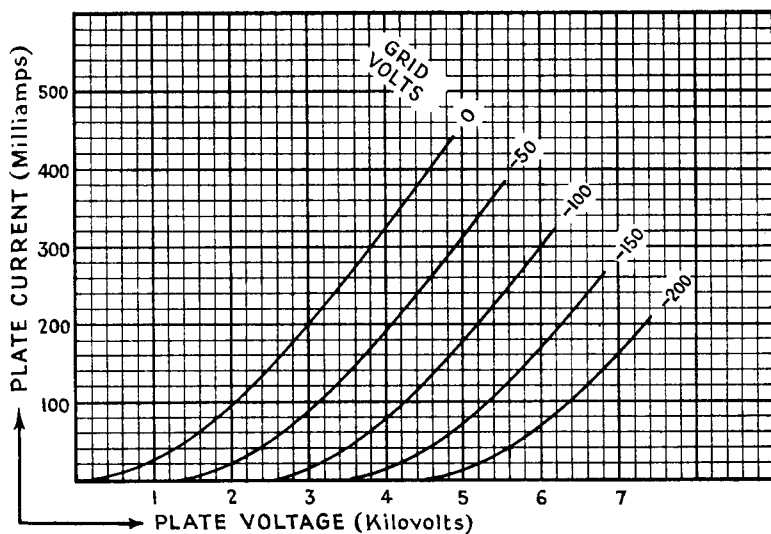
**RADIO FREQUENCY OPERATION.**

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 5,000                                   | 4,000                             | 5,000 volts           |
| Direct anode current | 0.28                                    | 0.3                               | 0.6 amps.             |
| Grid bias            | —190                                    | —350                              | —450 to<br>—600 volts |
| Anode dissipation    | 980                                     | 400                               | 1,000 watts           |
| Carrier output       | 420                                     | 800                               | 2,000 watts           |

# —Standard Valves—

4015-A  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4015-A.2  
Nov. 1937

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# ***—Standard Valves—***

4016-A  
Valve

## **4016-A VALVE**

TRIODE.

### **SPECIFICATION.**

#### **Cathode.**

Pure Tungsten filament.

Constant voltage type.

#### **Dimensions.**

Overall length 15" (38 cms.)

Bulb diameter  $4\frac{1}{8}$ " (10.5 cms.)

Net weight  $2\frac{1}{4}$  lbs. (1,000 gms.)

#### **Constants.**

Filament voltage 14 volts

Nominal filament  
current 18 amps.

Total emission 1.2 amps.

\*Impedance 15,000 ohms

\*Amplification factor 30

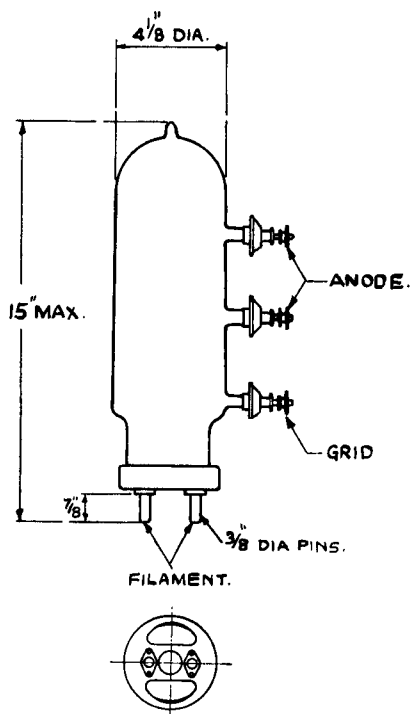
\*Mutual conductance 2 mA per volt

Grid-anode capacity 10  $\mu\mu\text{F}$ .

Anode-filament  
capacity 2.5  $\mu\mu\text{F}$ .

Grid-filament  
capacity 10  $\mu\mu\text{F}$ .

\* at anode current of 0.100 amps,  
 $V_p = 4,000$



### **LIMITING CONDITIONS FOR SAFE OPERATION.**

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 4,000 volts |
| Maximum direct anode current                  | 0.3 amps.   |
| Maximum anode dissipation                     | 400 watts   |
| Maximum grid dissipation                      | 100 watts   |
| Maximum frequency for above ratings           | 33 Mc.      |
| Maximum anode voltage for frequency of 50 Mc. | 3,500 volts |

V.4016-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B A.F. Amp. and Mod.<br>for balanced 2 valve circuit |
|-----------------------------------------------|------------------------------------------------------------|
| Direct anode voltage                          | 4,000 volts                                                |
| Grid bias                                     | —100 volts                                                 |
| Direct anode current per valve—zero signal    | 0.03 amps.                                                 |
| Direct anode current per valve—maximum signal | 0.16 amps.                                                 |
| Anode dissipation                             | 280 watts                                                  |
| Load resistance—anode to anode                | 23,000 ohms                                                |
| Maximum output—2 valves                       | 700 watts                                                  |

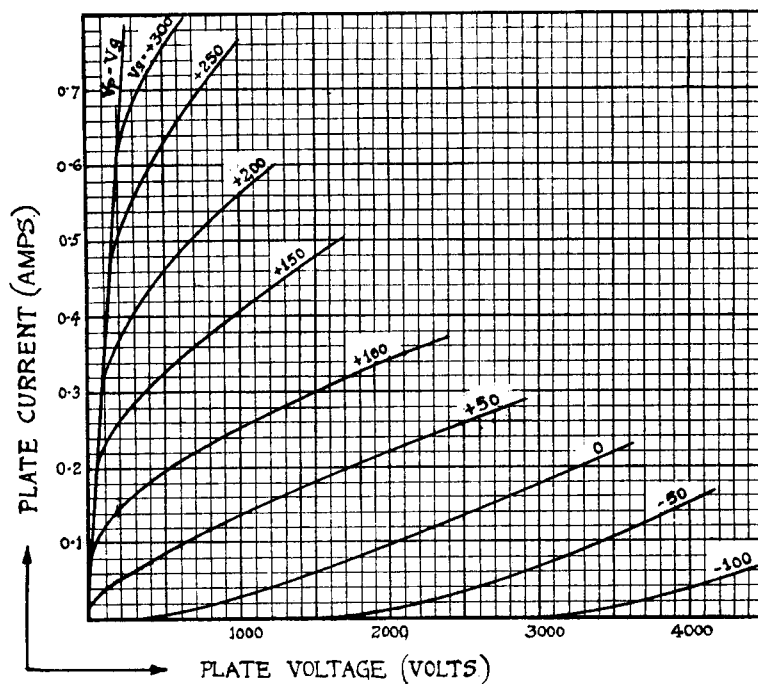
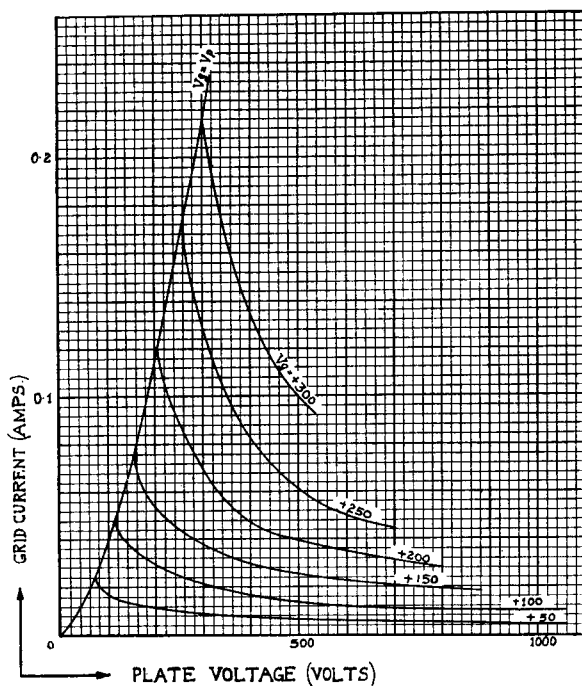
## RADIO FREQUENCY OPERATION.

|                      | Class B Telephony<br>Modulated carrier applied to grid |       |       |             |
|----------------------|--------------------------------------------------------|-------|-------|-------------|
| Direct anode voltage | 4,000                                                  | 4,000 | 4,000 | 3,500 volts |
| Direct anode current | 0.12                                                   | 0.12  | 0.12  | 0.10 amps.  |
| Grid bias            | —130                                                   | —130  | —130  | —100 volts  |
| Power output         | 0.15                                                   | 0.14  | 0.12  | 0.10 Kw.    |
| Anode dissipation    | 0.33                                                   | 0.34  | 0.36  | 0.25 Kw.    |
| FREQUENCY            | 6                                                      | 10    | 33    | 50 Mc.      |

|                      | Class C Telephony              |       |       |       | Class C Telegraphy |       |       |                       |
|----------------------|--------------------------------|-------|-------|-------|--------------------|-------|-------|-----------------------|
|                      | Subject to<br>anode modulation |       |       |       | Unmodulated        |       |       |                       |
| Direct anode voltage | 3,000                          | 3,000 | 3,000 | 2,500 | 4,000              | 4,000 | 4,000 | 3,500 volts           |
| Direct anode current | 0.2                            | 0.2   | 0.2   | 0.16  | 0.2                | 0.2   | 0.2   | 0.16 amps.            |
| Grid bias            | —200                           | —200  | —200  | —150  | —300               | —300  | —300  | —250 to<br>—350 volts |
| Carrier output       | 0.4                            | 0.375 | 0.36  | 0.18  | 0.5                | 0.45  | 0.4   | 0.3 Kw.               |
| Anode dissipation    | 0.2                            | 0.225 | 0.24  | 0.22  | 0.3                | 0.35  | 0.4   | 0.22 Kw.              |
| FREQUENCY            | 6                              | 10    | 33    | 50    | 6                  | 10    | 33    | 50 Mc.                |

# —Standard Valves—

4016-A  
Valve



V.4016-A.2  
Nov. 1937



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# —Standard Valves—

4016-B  
Valve

## 4016-B VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

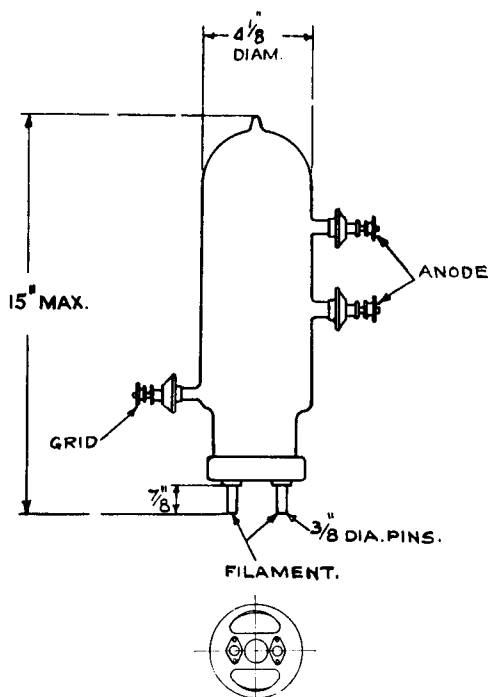
#### Dimensions.

Overall length 15" (38 cms.)  
Bulb diameter  $4\frac{1}{8}"$  (10.5 cms.)  
Net weight  $2\frac{1}{2}$  lbs. (1,000 gms.)

#### Constants.

Filament voltage 14 volts  
Nominal filament current 18 amps.  
Total emission 1.2 amp.  
\*Impedance 7,700 ohms  
\*Amplification factor 17  
\*Mutual conductance 2.2 m.a. per volt  
Grid-anode capacity  $10 \mu\text{F}$ .  
Anode-filament capacity  $2.5 \mu\text{F}$ .  
Grid-filament capacity  $10 \mu\text{F}$ .

\* at anode current of 0.1 amps,  
 $V_p = 4,000$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 4,000 volts |
| Maximum direct anode current                  | 0.3 amps.   |
| Maximum anode dissipation                     | 400 watts   |
| Maximum grid dissipation                      | 100 watts   |
| Maximum frequency for above ratings           | 33 Mc.      |
| Maximum anode voltage for frequency of 50 Mc. | 3,500 volts |

Tentative data.

V.4016-B.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B (A.F. Amp. and Mod.)<br>for balanced 2 valve circuit |
|-----------------------------------------------|--------------------------------------------------------------|
| Direct anode voltage                          | 4,000 volts                                                  |
| Grid bias                                     | —100 volts                                                   |
| Direct anode current per valve—zero signal    | 0.03 amps.                                                   |
| Direct anode current per valve—maximum signal | 0.16 amps.                                                   |
| Anode dissipation                             | 280 watts                                                    |
| Load resistance—anode to anode                | 23,000 ohms                                                  |
| Maximum output—2 valves                       | 700 watts                                                    |

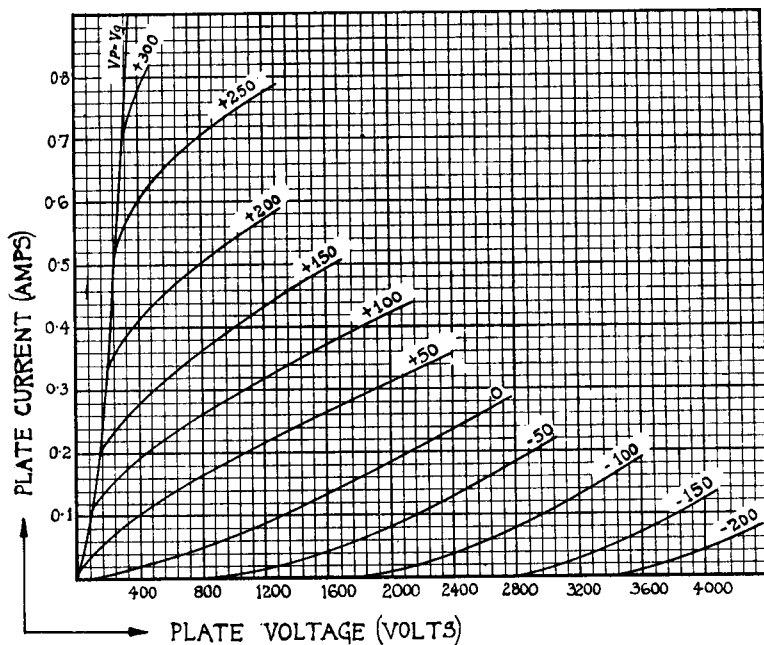
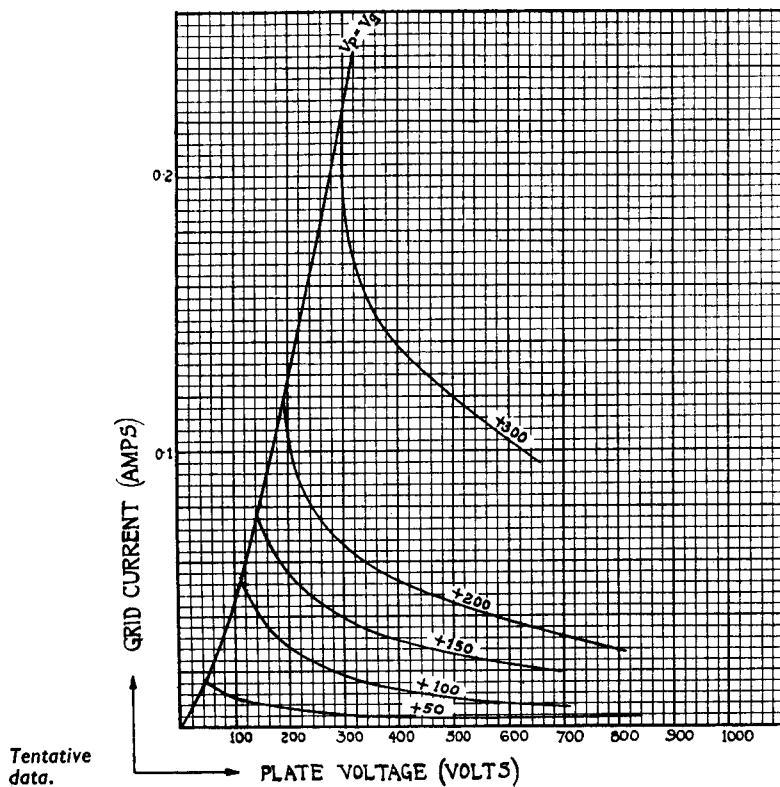
## RADIO FREQUENCY OPERATION.

|                      | Class B Telephony<br>Modulated carrier applied to grid |       |       |             |
|----------------------|--------------------------------------------------------|-------|-------|-------------|
| Direct anode voltage | 4,000                                                  | 4,000 | 4,000 | 3,500 volts |
| Direct anode current | 0.12                                                   | 0.12  | 0.12  | 0.10 amps.  |
| Grid bias            | —130                                                   | —130  | —130  | —100 volts  |
| Power output         | 0.15                                                   | 0.14  | 0.12  | 0.10 Kw.    |
| Anode dissipation    | 0.33                                                   | 0.34  | 0.36  | 0.25 Kw.    |
| FREQUENCY            | 6                                                      | 10    | 33    | 50 Mc.      |

|                      | Class C Telephony              |       |       |       | Class C Telegraphy |       |       |                       |
|----------------------|--------------------------------|-------|-------|-------|--------------------|-------|-------|-----------------------|
|                      | Subject to<br>anode modulation |       |       |       | Unmodulated        |       |       |                       |
| Direct anode voltage | 3,000                          | 3,000 | 3,000 | 2,500 | 4,000              | 4,000 | 4,000 | 3,500 volts           |
| Direct anode current | 0.2                            | 0.2   | 0.2   | 0.16  | 0.2                | 0.2   | 0.2   | 0.16 amps.            |
| Grid bias            | —200                           | —200  | —200  | —150  | —300               | —300  | —300  | —250 to<br>—350 volts |
| Carrier output       | 0.4                            | 0.375 | 0.36  | 0.18  | 0.5                | 0.45  | 0.4   | 0.3 Kw.               |
| Anode dissipation    | 0.2                            | 0.225 | 0.24  | 0.22  | 0.3                | 0.35  | 0.4   | 0.22 Kw.              |
| FREQUENCY            | 6                              | 10    | 33    | 50    | 6                  | 10    | 33    | 50 Mc.                |

# —Standard Valves—

4016-B  
Valve



V.4016-B.2  
Nov. 1937

PRINTED IN  
ENGLAND

# *—Standard Valves—*

4017-B  
Valve

## 4017-B VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR  
RECTIFIER.

### SPECIFICATION.

#### Cathode.

Oxide coated filament (shielded).  
Constant current type.

#### Base.

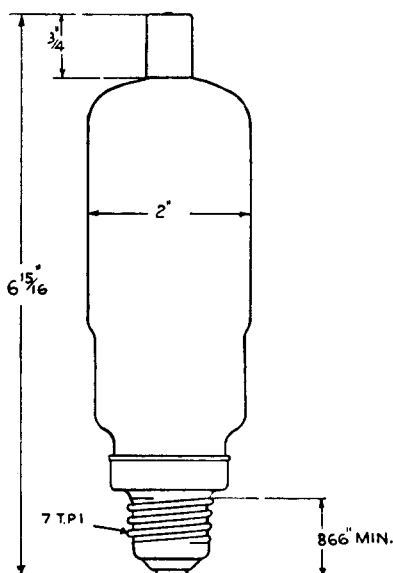
Edison medium screw.  
Anode connected to top cap type A.

#### Dimensions.

Overall length  $6\frac{15}{16}$ " (17.5 cms.)  
Overall diameter 2" (5.1 cms.)  
Net weight 0.22 lbs. (100 gms).

#### Constants.

Filament current 8.25 amps.  
Nominal filament voltage 2.7 volts  
Maximum peak inverse voltage 7,000 volts  
Maximum peak anode current 1.5 amps.  
Time delay 30 seconds  
Heating period after transport 15 mins.  
Recommended ambient temperature range  $10^{\circ}\text{C}.$ — $50^{\circ}\text{C}.$



#### Heating Time.

|                                                         |             |
|---------------------------------------------------------|-------------|
| For ambient temperature $15^{\circ}\text{C}$ and above. | 30 seconds. |
| $10^{\circ}\text{C}.$ — $15^{\circ}\text{C}.$           | 5 minutes.  |

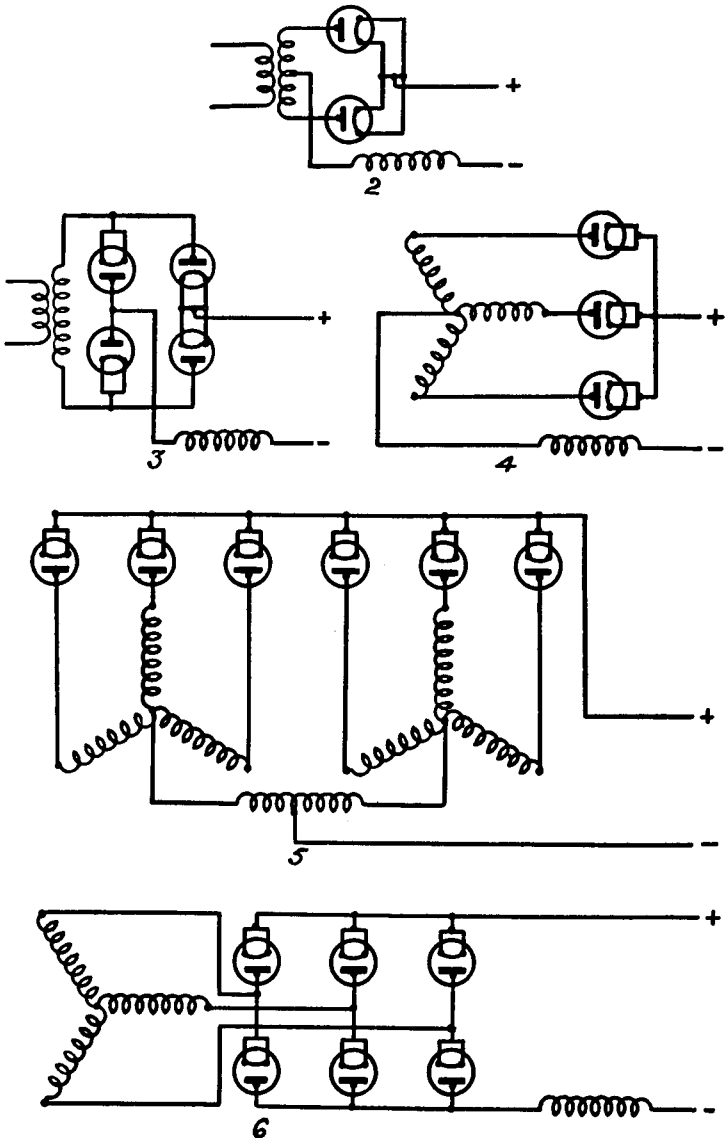
Note :—For further information on H.C.M.V. rectifiers, see sheet G.I.

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of valves | Load potential in volts | Load current in amps. |
|---------|------------------|-------------------------|-----------------------|
| 2       | 2                | 2,500                   | 0.9                   |
| 3       | 4                | 5,000                   | 0.9                   |
| 4       | 3                | 3,000                   | 1.2                   |
| 5       | 6                | 3,000                   | 2.4                   |
| 6       | 6                | 6,000                   | 1.5                   |

**Important.**—This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer.



# —Standard Valves—

4018-AB Valve  
-AD Valve  
-AG Valve

## GAS FILLED CATHODE RAY TUBE TYPE 4018-AB, 4018-AD, 4018-AG

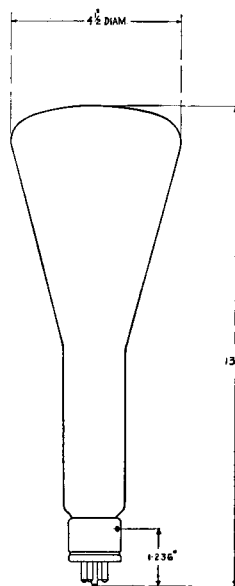
For replacement purposes only (See note at  
bottom of page).

### Characteristics.

|                                                                        |                    |
|------------------------------------------------------------------------|--------------------|
| Filament voltage drop                                                  | 0.75 volts         |
| Filament current                                                       | 0.7 to 1.1 amps.   |
| Anode voltage                                                          | 300 to 2,000 volts |
| Normal anode voltage                                                   | 350 volts          |
| Shield voltage (from a potentiometer)                                  | 0—50 volts         |
| 4018-AB has screen giving blue spot for photographic work.             |                    |
| 4018-AD has screen giving long afterglow of 10—15 seconds in the dark. |                    |
| 4018-AG has screen giving green spot for visual work.                  |                    |
| The × plates are those nearest to the screen.                          |                    |

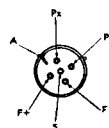
### Dimensions.

|                  |                   |
|------------------|-------------------|
| Length           | 13" (33 cms.)     |
| Maximum diameter | 4½" (11.5 cms.)   |
| Net weight       | ¾ lbs. (340 gms.) |



### Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.



Note :—In the 4018-AB, -AD, -AG valves one plate of each pair of deflecting plates is connected to the anode.

These valves have been replaced by the 4050-AB, -AD, -AG valves which are provided with standard British 9-pin bases, all deflector plates being brought out separately.

MC.4018-A.1  
Nov. 1937



4018-BB Valve  
-BD Valve  
-BG Valve

# —Standard Valves—

## GAS FILLED CATHODE RAY TUBE TYPE 4018-BB, 4018-BD, 4018-BG

For replacement purposes only  
(see note at bottom of page).

### Characteristics.

Filament voltage drop 0.75 volts

Filament current 0.7 to 1.1 amps.

Anode voltage 300 to 2,000 volts

Normal anode voltage 350 volts

Shield voltage (from a potentiometer) 0—50 volts

4018-BB has a screen giving blue spot for photographic work.

4018-BD has screen giving long afterglow of 10—15 seconds in the dark.

4018-BG has screen giving green spot for visual work.

The  $\times$  plates are those nearest to the screen.

### Dimensions.

Length 19" (48 cms.)

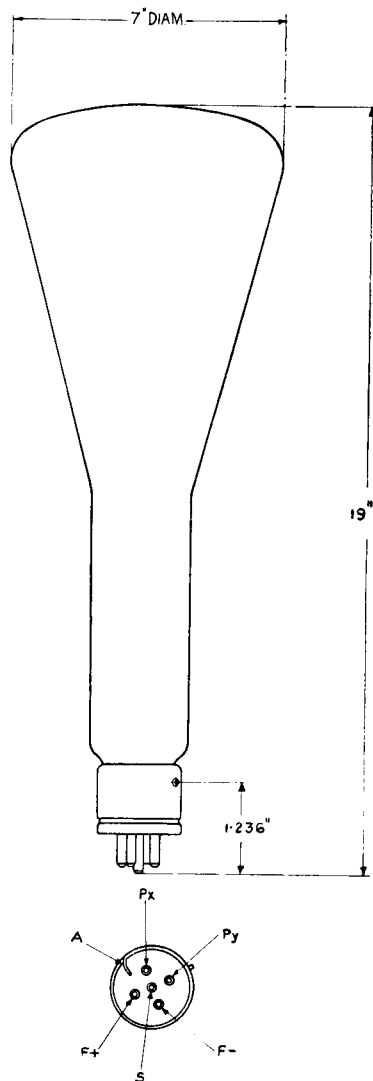
Maximum diameter 7" (18 cms.)

Net weight 2.1 lbs. (940 gms.)

### Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.

**Note:**—In the 4018-BB, -BD, -BG valves one plate of each pair of deflecting plates is connected to the anode.



These valves have been replaced by the 4050-BB, -BD, -BG valves which are provided with standard British 9-pin bases, all deflector plates being brought out separately.

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# —Standard Valves—

4019-A Valve  
-B Valve

## 4019-A AND 4019-B VALVES

TRIODES.

### SPECIFICATION.

#### Cathode.

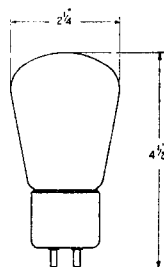
Oxide coated filament.  
Constant current type.

#### Base.

4019-A Medium 4-pin bayonet thrust.  
4019-B Standard British 4-pin.

#### Dimensions.

|                     |      | 4019-A         | 4019-B          |
|---------------------|------|----------------|-----------------|
| Max. overall length | ins. | $4\frac{1}{2}$ | $4\frac{9}{16}$ |
|                     | cms. | 11.4           | 11.6            |
| Bulb diameter—      |      |                |                 |
|                     | ins. | $2\frac{1}{4}$ | $2\frac{1}{4}$  |
|                     | cms. | 5.7            | 5.7             |
| Net weight          | lbs. | 0.14           | 0.14            |
|                     | gms. | 65             | 65              |

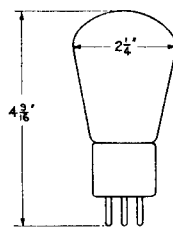


4019-A

#### Constants.

|                              |                       |
|------------------------------|-----------------------|
| Filament current             | 0.25 amps.            |
| Nominal filament voltage     | 4 volts               |
| *Impedance                   | 5,500 ohms            |
| *Amplification factor        | 7                     |
| *Mutual conductance          | 1.27 mA per volt      |
| Maximum direct anode voltage | 190 volts             |
| Grid-anode capacity          | $5.4 \mu\mu\text{F.}$ |
| Anode-filament capacity      | $4.8 \mu\mu\text{F.}$ |
| Grid-filament capacity       | $7.3 \mu\mu\text{F.}$ |

\* at  $V_p = 130$  volts,  $V_{g1} = -8$  volts.



4019-B

# —Standard Valves—

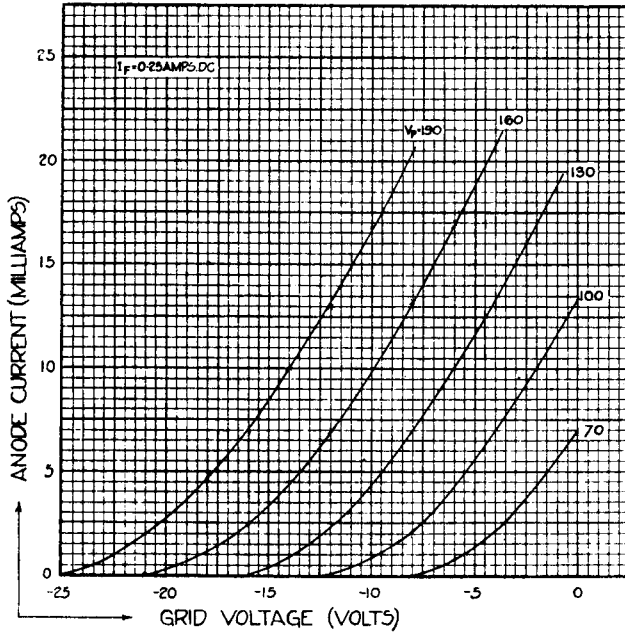
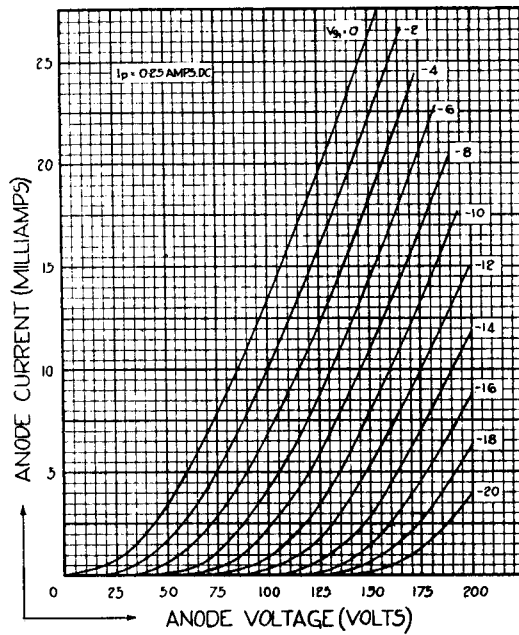
## TYPICAL OPERATING CONDITIONS.

| Anode voltage<br>volts | Grid bias<br>volts | Anode current<br>mA | Anode Resistance<br>ohms | Resistance Load<br>ohms | Output Power<br>mW. | Total Harmonics<br>db below<br>fundamental |
|------------------------|--------------------|---------------------|--------------------------|-------------------------|---------------------|--------------------------------------------|
| 130                    | —6                 | 9.7                 | 4,800                    | 4,600                   | 54                  | 30                                         |
|                        |                    |                     |                          | 9,200                   | 49                  | 34                                         |
|                        |                    |                     |                          | 13,800                  | 36                  | 37                                         |
| 130                    | —8                 | 6.8                 | 5,500                    | 5,500                   | 83                  | 24                                         |
|                        |                    |                     |                          | 11,000                  | 74                  | 30                                         |
|                        |                    |                     |                          | 16,500                  | 61                  | 32                                         |
| 130                    | —10                | 4.3                 | 6,500                    | 5,500                   | 100                 | 16                                         |
|                        |                    |                     |                          | 11,000                  | 85                  | 23                                         |
|                        |                    |                     |                          | 16,500                  | 80                  | 27                                         |
| 160                    | —10                | 9.8                 | 4,700                    | 4,600                   | 150                 | 24                                         |
|                        |                    |                     |                          | 9,200                   | 132                 | 30                                         |
|                        |                    |                     |                          | 13,800                  | 112                 | 37                                         |
| 160                    | —12                | 7.1                 | 5,300                    | 5,500                   | 180                 | 19                                         |
|                        |                    |                     |                          | 11,000                  | 156                 | 23                                         |
|                        |                    |                     |                          | 16,500                  | 130                 | 31                                         |
| 190                    | —14                | 9.7                 | 4,900                    | 5,500                   | 290                 | 23                                         |
|                        |                    |                     |                          | 11,000                  | 240                 | 30                                         |
|                        |                    |                     |                          | 16,500                  | 180                 | 33                                         |

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

# —Standard Valves—

4019-A Valve  
-B Valve



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# —Standard Valves—

4020-A Valve  
-B Valve  
-C Valve

## 4020-A, 4020-B, 4020-C VALVES

TRIODES.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant current type.

#### Base.

4020-A Medium 4-pin bayonet thrust.  
4020-B Standard British 4-pin.  
4020-C Medium 4-pin bayonet thrust, grid connected to top cap.

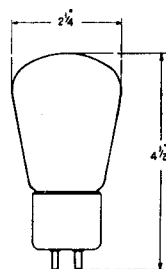
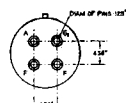
#### Dimensions.

|                   |      | 4020-A | 4020-B                         | 4020-C |
|-------------------|------|--------|--------------------------------|--------|
| Overall length    | ins. | 4½     | 4 <sup>9</sup> / <sub>16</sub> | 5      |
|                   | cms. | 11·4   | 11·6                           | 12·7   |
| Maximum diameter— | ins. | 2¼     | 2¼                             | 2¼     |
|                   | cms. | 5·7    | 5·7                            | 5·7    |
| Net weight        | lbs. | 0·14   | 0·14                           | 0·14   |
|                   | gms. | 65     | 65                             | 65     |

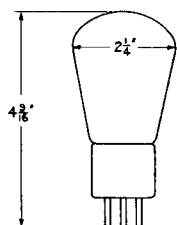
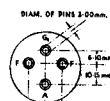
#### Constants.

|                          |        |                  |        |      |
|--------------------------|--------|------------------|--------|------|
| Filament current         |        | 0·25 amps.       |        |      |
| Nominal filament voltage |        | 2 volts          |        |      |
| * Impedance              |        | 50,000 ohms      |        |      |
| * Amplification factor   |        | 30               |        |      |
| * Mutual conductance     |        | 0·6 mA per volt. |        |      |
| Grid-anode capacity      | 4020-A | 4020-B           | 4020-C |      |
|                          | 6·3    | 6·3              | 7·9    | μμF. |
| Anode-filament capacity  | 4·4    | 4·4              | 5·3    | μμF. |
|                          |        |                  |        |      |
| Grid-filament capacity   | 6·2    | 6·2              | 5·8    | μμF. |
|                          |        |                  |        |      |

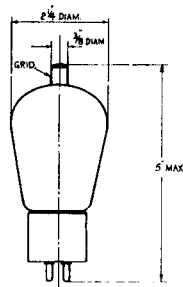
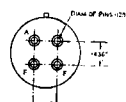
\* at anode current of 0·8 mA.



4020-A



4020-B.



4020-C

V.4020-ABC. I  
Nov. 1937

4020-A Valve  
 -B Valve  
 -C Valve

# *—Standard Valves—*

## TYPICAL OPERATING CONDITIONS.

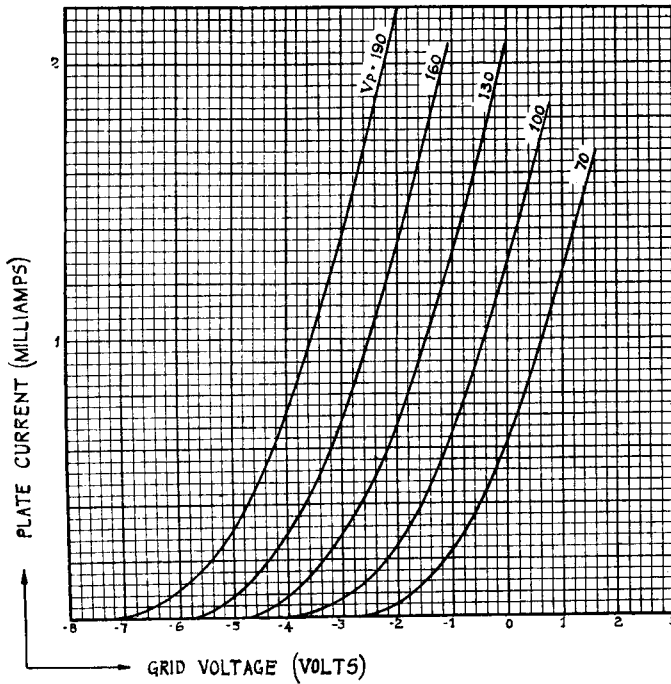
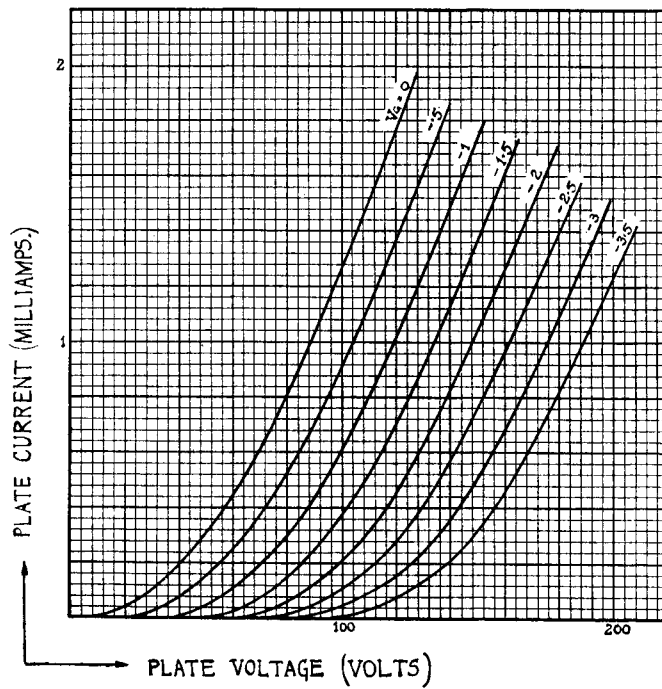
| Anode voltage<br>volts | Grid Bias<br>volts | Anode current<br>mA. | Anode Resistance<br>ohms | Load<br>ohms                 | Output voltage peak<br>volts | Total Harmonic<br>db below<br>fundamental |
|------------------------|--------------------|----------------------|--------------------------|------------------------------|------------------------------|-------------------------------------------|
| 130                    | —1                 | 1.26                 | 43,000                   | 43,000<br>86,000<br>129,000  | 18.5<br>20.3<br>20.6         | 34.5<br>37<br>37                          |
| 130                    | —1.5               | 0.92                 | 46,000                   | 46,000<br>92,000<br>138,000  | 21.4<br>25.4<br>26.2         | 30<br>35.3<br>37                          |
| 130                    | —2                 | 0.64                 | 52,000                   | 52,000<br>104,000<br>156,000 | 12.1<br>14.8<br>17.6         | 21.7<br>28<br>30.5                        |
| 160                    | —1.5               | 1.63                 | 41,000                   | 41,000<br>82,000<br>123,000  | 24<br>30.2<br>35             | 35.2<br>38.2<br>38.5                      |
| 160                    | —2                 | 1.28                 | 44,000                   | 44,000<br>88,000<br>132,000  | 37<br>42<br>45.6             | 29<br>35<br>36                            |

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

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# —Standard Valves—

4020-A Valve  
-B Valve  
-C Valve



V.4020-ABC.2  
Nov. 1937



PRINTED IN  
ENGLAND

# —Standard Valves—

4021-A Valve  
-B Valve  
-C Valve

## 4021-A, 4021-B AND 4021-C VALVES

TRIODES.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant current type.

#### Base.

4021-A Medium 4-pin bayonet thrust.  
4021-B Standard British 4-pin.  
4021-C Medium 4-pin bayonet thrust, grid connected to top cap.

#### Dimensions.

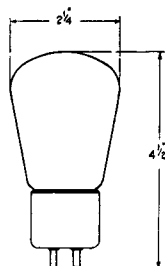
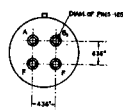
|                  | 4021-A | 4021-B                         | 4021-C |
|------------------|--------|--------------------------------|--------|
| Overall length   |        |                                |        |
| ins.             | 4½     | 4 <sup>9</sup> / <sub>16</sub> | 5      |
| cms.             | 11.4   | 11.6                           | 12.7   |
| Maximum diameter |        |                                |        |
| ins.             | 2¼     | 2¼                             | 2¼     |
| cms.             | 5.7    | 5.7                            | 5.7    |
| Net weight lbs.  | 0.14   | 0.14                           | 0.14   |
| gms.             | 65     | 65                             | 65     |

#### Constants.

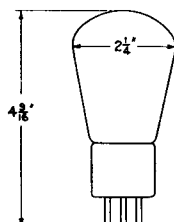
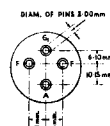
|                          |               |
|--------------------------|---------------|
| Filament current         | 0.25 amps.    |
| Nominal filament voltage | 4 volts       |
| *Impedance               | 2,000 ohms    |
| *Amplification factor    | 6             |
| *Mutual conductance      | 3 mA per volt |

|                         | 4021-A | 4021-B | 4021-C   |
|-------------------------|--------|--------|----------|
| Grid-anode capacity     | 9.1    | 9.1    | 9.7 μμF. |
| Anode-filament capacity | 4.6    | 4.6    | 5.5 μμF. |
| Grid-filament capacity  | 8.0    | 8.0    | 7.3 μμF. |

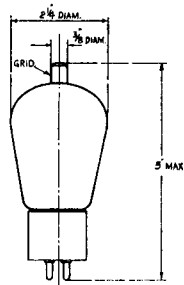
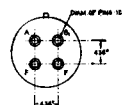
\* at anode current of 23 mA.



4021-A



4021-B



4021-C

V.4021-ABC.1  
Nov. 1937

4021-A Valve  
-B Valve  
-C Valve

# *—Standard Valves—*

## TYPICAL OPERATING CONDITIONS.

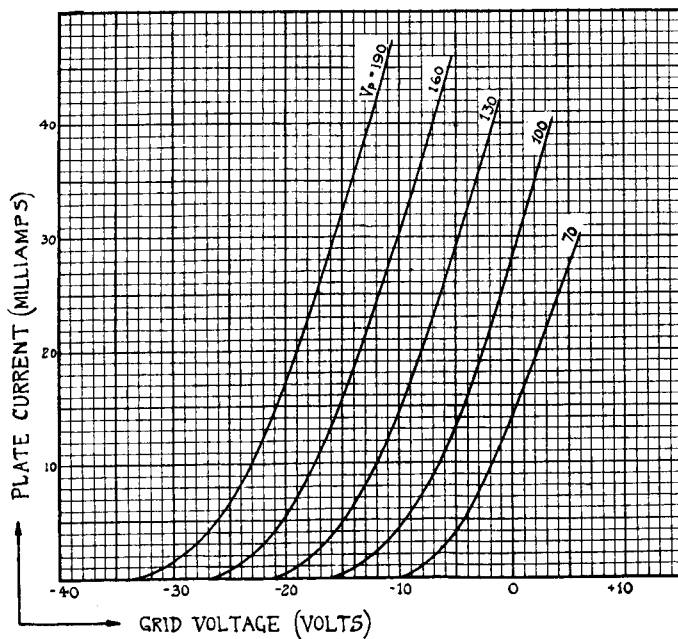
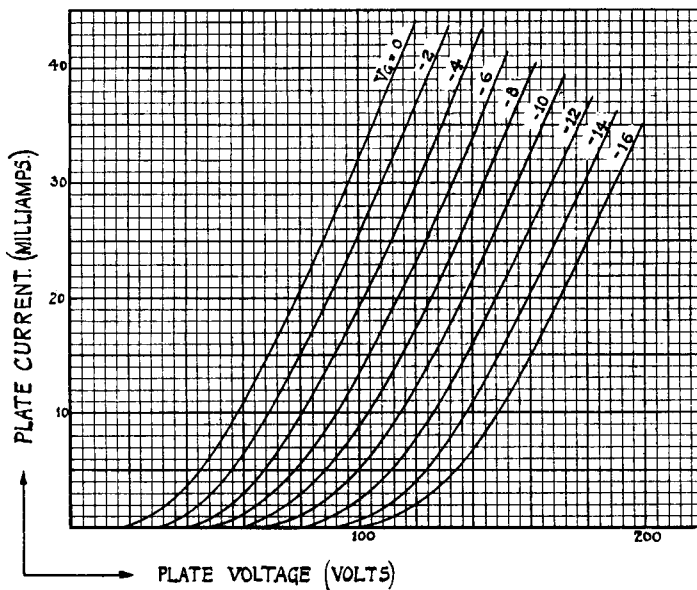
| Anode voltage<br>volts | Grid Bias<br>volts | Anode current<br>mA. | Anode resistance<br>ohms | Load impedance<br>ohms | Output<br>mW. | Total Harmonic<br>db below<br>fundamental |
|------------------------|--------------------|----------------------|--------------------------|------------------------|---------------|-------------------------------------------|
| 130                    | —8                 | 22.5                 | 2,050                    | 2,050                  | 140           | 27                                        |
|                        |                    |                      |                          | 4,100                  | 100           | 31.5                                      |
|                        |                    |                      |                          | 6,150                  | 87            | 35                                        |
| 130                    | —6                 | 28.4                 | 1,750                    | 1,750                  | 65            | 31                                        |
|                        |                    |                      |                          | 2,900                  | 63            | 32.5                                      |
|                        |                    |                      |                          | 5,250                  | 56            | 38                                        |
| 130                    | —10                | 17                   | 2,100                    | 2,100                  | 160           | 24                                        |
|                        |                    |                      |                          | 4,200                  | 125           | 30.4                                      |
|                        |                    |                      |                          | 6,300                  | 107           | 33                                        |
| 160                    | —10                | 32.5                 | 1,800                    | 1,800                  | 250           | 28                                        |
|                        |                    |                      |                          | 3,600                  | 180           | 33.5                                      |
|                        |                    |                      |                          | 5,400                  | 158           | 35.5                                      |

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

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# —Standard Valves—

4021-A Valve  
-B Valve  
-C Valve



V.4021-ABC2.  
Nov. 1937

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# *—Standard Valves—*

4022-AR Valve  
-B Valve

## 4022-AR AND 4022-B VALVES

TRIODES.

All 4022 type valves are made to meet the specification for the 4022-AR valve, the limits of which are closer than those of the 4022-A valve which has now been abandoned.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant current type.

#### Base.

4022-A Medium 4-pin bayonet thrust.  
4022-B Standard British 4-pin.

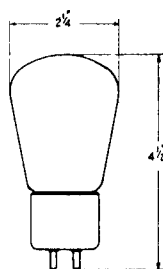
#### Dimensions.

|                       | 4022-AR        | 4022-B          |
|-----------------------|----------------|-----------------|
| Overall length ins.   | $4\frac{1}{2}$ | $4\frac{9}{16}$ |
| cms.                  | 11.4           | 11.6            |
| Maximum diameter ins. | $2\frac{1}{4}$ | $2\frac{1}{4}$  |
| cms.                  | 5.7            | 5.7             |
| Net weight lbs.       | 0.14           | 0.14            |
| gms.                  | 65             | 65              |

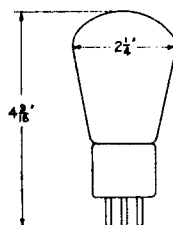
#### Constants.

|                           |                        |
|---------------------------|------------------------|
| Filament current          | 0.25 amps.             |
| Nominal filament voltage  | 4 volts                |
| *Impedance                | 5,500 ohms             |
| *Amplification factor     | 12                     |
| *Mutual conductance       | 2.2 mA per volt        |
| Max. direct anode voltage | 190 volts              |
| Grid-anode capacity       | 9.6 $\mu\mu\text{F}$ . |
| Anode-filament capacity   | 4.3 $\mu\mu\text{F}$ . |
| Grid-filament capacity    | 8.1 $\mu\mu\text{F}$ . |

\* at  $V_p = 130$  volts,  $V_{g1} = -4.5$  volts.



4022-AR



4022-B

# —Standard Valves—

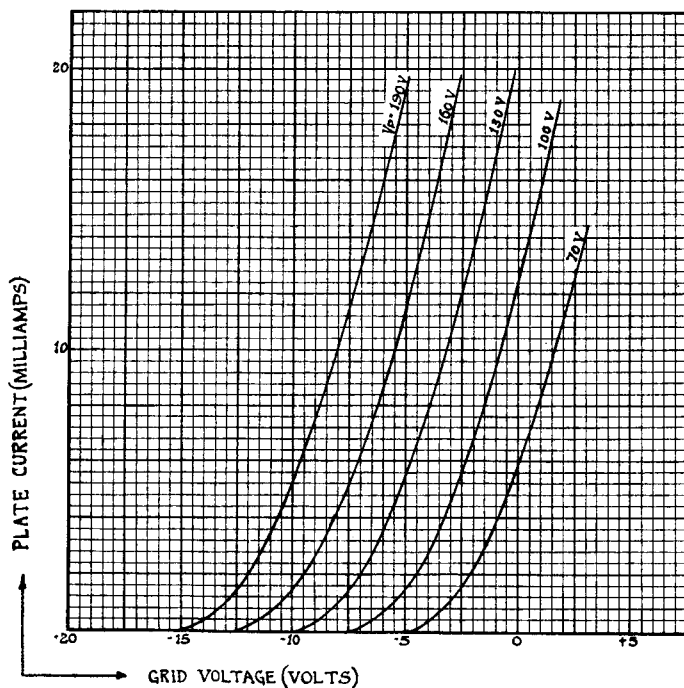
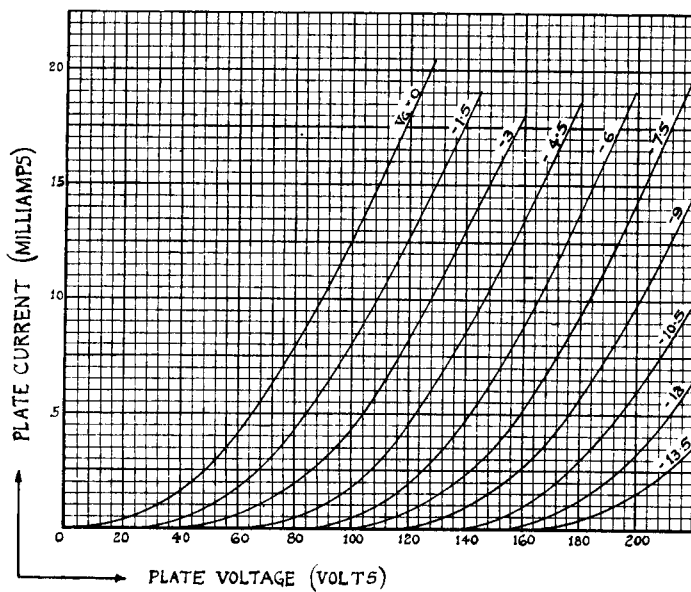
## TYPICAL OPERATING CONDITIONS.

| Anode voltage<br>volts | Grid bias<br>volts | Anode current<br>mA. | Load resistance<br>ohms | Output power<br>mW. | 2nd Harmonic<br>db below<br>fundamental | 3rd Harmonic<br>db below<br>fundamental |
|------------------------|--------------------|----------------------|-------------------------|---------------------|-----------------------------------------|-----------------------------------------|
| 130                    | —6                 | 3.5                  | 6,500                   | 67                  | 27                                      | 47                                      |
|                        |                    |                      | 13,000                  | 65                  | 35                                      | 48                                      |
|                        |                    |                      | 19,500                  | 63                  | 38                                      | —                                       |
| 130                    | —4.5               | 6.5                  | 5,000                   | 120                 | 18                                      | 30                                      |
|                        |                    |                      | 10,000                  | 90                  | 20                                      | 35                                      |
|                        |                    |                      | 15,000                  | 75                  | 33                                      | —                                       |
| 130                    | —3                 | 10.6                 | 4,000                   | 60                  | 16                                      | 35                                      |
|                        |                    |                      | 8,000                   | 50                  | 16                                      | 36                                      |
|                        |                    |                      | 12,000                  | 30                  | 26                                      | 45                                      |
| 160                    | —6                 | 8.8                  | 4,000                   | 110                 | 34                                      | 40                                      |
|                        |                    |                      | 8,000                   | 100                 | 38                                      | 45                                      |
|                        |                    |                      | 12,000                  | 80                  | 41                                      | —                                       |
| 160                    | —4.5               | 13.2                 | 4,000                   | 120                 | 20                                      | 33                                      |
|                        |                    |                      | 8,000                   | 100                 | 20                                      | 37                                      |
|                        |                    |                      | 12,000                  | 85                  | 40                                      | 50                                      |
| 190                    | —6                 | 16.2                 | 4,000                   | 160                 | 34                                      | 41                                      |
|                        |                    |                      | 8,000                   | 125                 | 33                                      | 44                                      |
|                        |                    |                      | 12,000                  | 85                  | 46                                      | —                                       |

Note :—Decreasing the output by N db below the value given in the table improves the harmonic level by N db.

# —Standard Valves—

4022-AR Valve  
-B Valve



V.4022-AB.2  
Nov. 1937



PRINTED IN  
ENGLAND

# —Standard Valves—

4030-A  
Valve

## 4030-A VALVE

DOUBLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Flow.

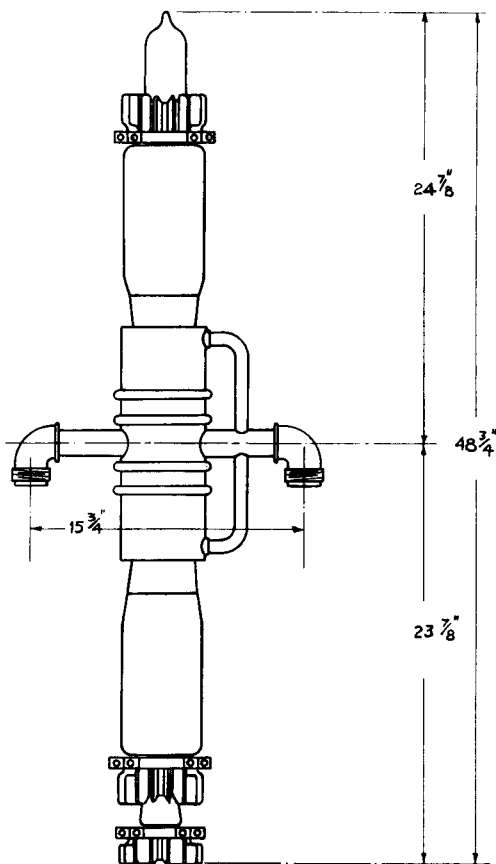
22 gallons per minute.

#### Dimensions.

Overall length  $48\frac{3}{4}"$  (124 cms.)  
Jacket diameter—  
 $5\frac{3}{8}"$  (13.5 cms.)  
Net weight 32 lbs. (14,500 gms.)

#### Constants.

Filament voltage 21 volts  
(exact filament voltage marked  
on bulb)  
Nominal filament  
current 215 amps.  
Total Emission 45 amps.  
Impedance 2,200 ohms  
Amplification factor 36  
Grid-anode capacity  $51 \mu\mu\text{F.}$   
Anode-filament  
capacity  $14 \mu\mu\text{F.}$   
Grid-filament  
capacity  $40 \mu\mu\text{F.}$



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |              |
|-----------------------------------------------|--------------|
| Maximum direct anode voltage                  | 17,500 volts |
| Maximum direct anode current                  | 11 amps.     |
| Maximum anode dissipation                     | 80 Kw.       |
| Maximum grid dissipation                      | 1,500 watts  |
| Maximum frequency for above ratings           | 2 Mc.        |
| Maximum anode voltage for frequency of 22 Mc. | 15,000 volts |

V.4030-A.1  
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

|                                               |                                                            |
|-----------------------------------------------|------------------------------------------------------------|
|                                               | Class B A.F. Amp. and Mod.<br>for balanced 2 valve circuit |
| Direct anode voltage                          | 12,500 volts                                               |
| Grid bias                                     | —150 volts                                                 |
| Direct anode current per valve—zero signal    | 1.3 amps.                                                  |
| Direct anode current per valve—maximum signal | 6.5 amps.                                                  |
| Anode dissipation                             | 36.6 Kw.                                                   |
| Load resistance—anode to anode                | 1,700 ohms                                                 |
| Maximum output—2 valves                       | 90 Kw.                                                     |

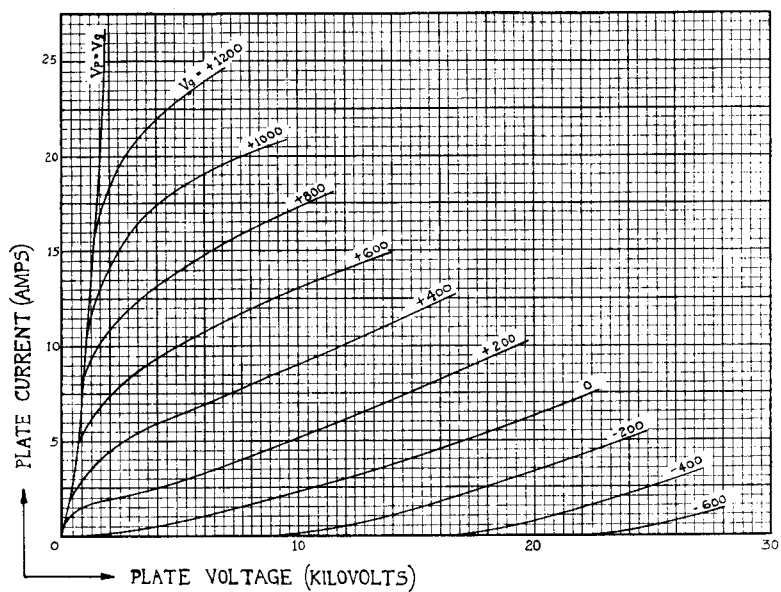
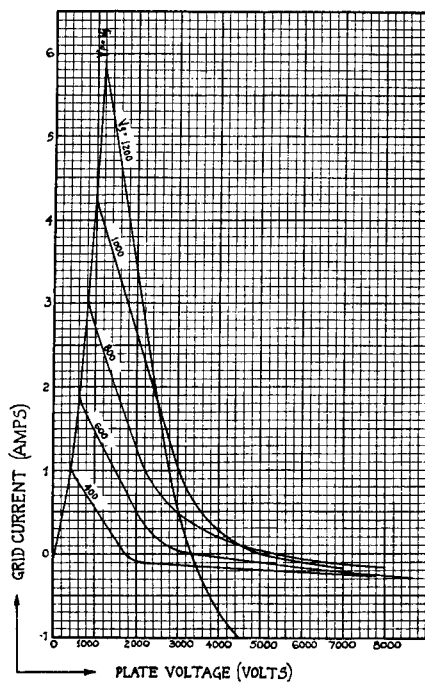
RADIO FREQUENCY OPERATION.

|                      |                                                        |      |      |            |
|----------------------|--------------------------------------------------------|------|------|------------|
|                      | Class B Telephony<br>Modulated carrier applied to grid |      |      |            |
| Direct anode voltage | 17.5                                                   | 15   | 12   | 10 Kv.     |
| Direct anode current | 4.8                                                    | 4.8  | 4.8  | 4.8 amps.  |
| Grid bias            | —400                                                   | —300 | —250 | —150 volts |
| Power output         | 25                                                     | 22   | 17   | 12 Kw.     |
| Anode dissipation    | 59                                                     | 50   | 40   | 36 Kw.     |
| FREQUENCY            | 2                                                      | 12   | 19   | 22 Mc.     |

|                      |                                |      |      |      |                    |      |      |            |
|----------------------|--------------------------------|------|------|------|--------------------|------|------|------------|
|                      | Class C Telephony              |      |      |      | Class C Telegraphy |      |      |            |
|                      | Subject to<br>anode modulation |      |      |      | Unmodulated        |      |      |            |
| Direct anode voltage | 12                             | 11   | 10   | 9    | 17.5               | 15   | 12   | 10 Kv.     |
| Direct anode current | 5                              | 5    | 5    | 5    | 9.6                | 9.6  | 9.6  | 9.6 amps.  |
| Grid bias            | —600                           | —500 | —450 | —400 | —600               | —500 | —450 | —400 to    |
|                      |                                |      |      |      | —800               | —700 | —600 | —550 volts |
| Carrier output       | 40                             | 35   | 30   | 20   | 100                | 88   | 68   | 48 Kw.     |
| Anode dissipation    | 20                             | 20   | 20   | 25   | 68                 | 56   | 47   | 48 Kw.     |
| FREQUENCY            | 2                              | 12   | 19   | 22   | 2                  | 12   | 19   | 22 Mc.     |

# —Standard Valves—

4030-A  
Valve



V.4030-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4030-C  
Valve

## 4030-C VALVE

DOUBLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure tungsten filament.  
Constant voltage type.

#### Water Circulation.

Normal flow—22 gallons per minute.  
Pressure drop in water jacket at normal flow  
9 lbs. per sq. in. (0.63 Kg. per sq. cm.)  
Maximum water pressure in water jacket—  
35 lbs. per sq. in. (2.5 Kg. per sq. cm.)

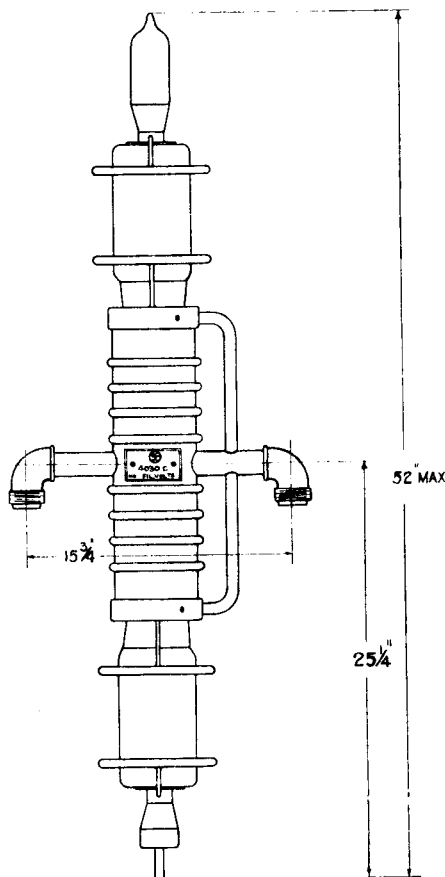
#### Dimensions.

Max. overall length 52" (132 cms.)  
Jacket diameter  $5\frac{3}{8}$ " (13.5 cms.)  
Packing crate See dwg.  
Net weight 35 lbs. (16,000 gms.)

#### Constants.

Filament voltage 25 volts  
(exact filament voltage marked  
on valve)  
Nominal filament current 250 amps.  
Total emission 45 amps.  
\*Impedance 1,800 ohms  
\*Amplification factor 36  
\*Mutual conductance 20 mA per volt  
Grid-anode capacity 61  $\mu\mu\text{F}$ .  
Anode-filament capacity 15  $\mu\mu\text{F}$ .  
Grid-filament capacity 45  $\mu\mu\text{F}$ .

\* at  $V_p = 17 \text{ KV}$ ,  $I_p = 5 \text{ amps}$ .



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |              |
|-----------------------------------------------|--------------|
| Maximum direct anode voltage                  | 17,500 volts |
| Maximum direct anode current                  | 11 amps.     |
| Maximum anode dissipation                     | 80 Kw.       |
| Maximum grid dissipation                      | 1,500 watts  |
| Maximum frequency for above ratings           | 2 Mc.        |
| Maximum anode voltage for frequency of 22 Mc. | 15,000 volts |

**Note.**—The 4030-C Valve is shipped with Corona rings already fitted but is not supplied with grid and filament radiators or connectors. The code numbers of these parts, which must be ordered as a separate item, are as follows :—

Grid and filament radiators type LP.77880  
Filament radiator type LP.77883

Filament connection  
Filament connection

type Det.105  
type Det.105A

V.4030-C.1  
Sept. 1938

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |
|-----------------------------------------------|------------------------------------------------------------|
| Direct anode voltage                          | 14,000 volts                                               |
| Grid bias                                     | —150 volts                                                 |
| Direct anode current per valve—zero signal    | 1.3 amps.                                                  |
| Direct anode current per valve—maximum signal | 6.5 amps.                                                  |
| Anode dissipation                             | 41 kW.                                                     |
| Load resistance—anode to anode                | 1,900 ohms                                                 |
| Maximum output—2 valves                       | 100 kW.                                                    |

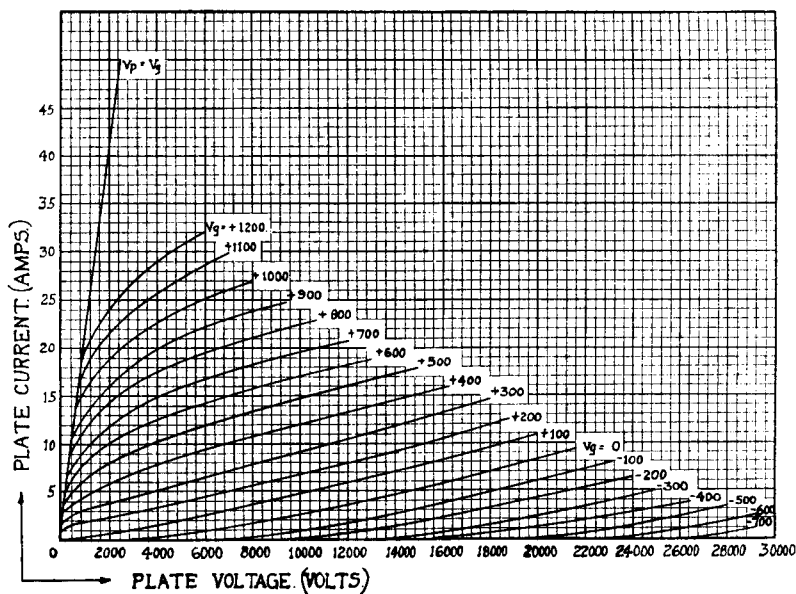
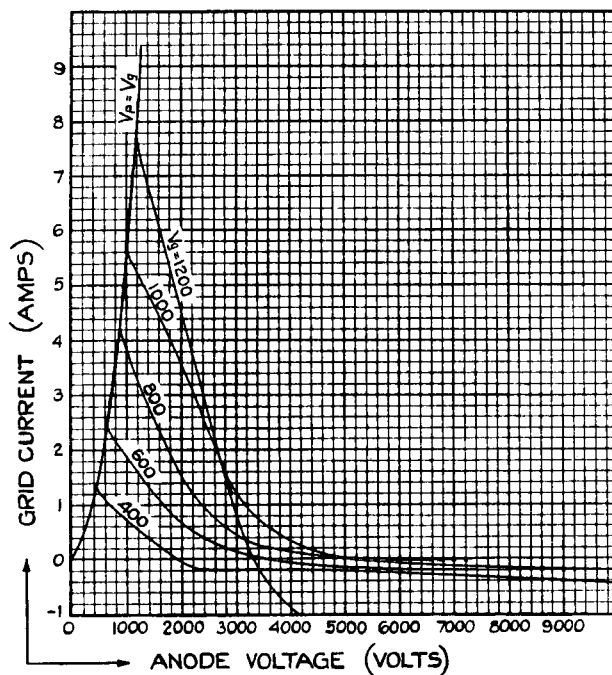
## RADIO FREQUENCY OPERATION.

|                      | Class B Telephony<br>Modulated carrier applied to grid |      |      |            |
|----------------------|--------------------------------------------------------|------|------|------------|
| Direct anode voltage | 17.5                                                   | 15   | 12   | 10 kV.     |
| Direct anode current | 4.8                                                    | 4.8  | 4.8  | 4.8 amps.  |
| Grid bias            | —400                                                   | —300 | —250 | —150 volts |
| Power output         | 25                                                     | 22   | 17   | 12 kW.     |
| Anode dissipation    | 59                                                     | 50   | 40   | 36 kW.     |
| FREQUENCY            | 2                                                      | 12   | 19   | 22 Mc.     |

|                      | Class C Telephony              |      |      |      | Class C Telegraphy |      |      |                       |
|----------------------|--------------------------------|------|------|------|--------------------|------|------|-----------------------|
|                      | Subject to<br>anode modulation |      |      |      | Unmodulated        |      |      |                       |
| Direct anode voltage | 12                             | 11   | 10   | 9    | 17.5               | 15   | 12   | 10 kV.                |
| Direct anode current | 5                              | 5    | 5    | 5    | 9.6                | 9.6  | 9.6  | 9.6 amps.             |
| Grid bias            | —600                           | —500 | —450 | —400 | —600               | —500 | —450 | —400 to<br>—550 volts |
| Carrier output       | 40                             | 35   | 30   | 20   | 100                | 88   | 68   | 48 kW.                |
| Anode dissipation    | 20                             | 20   | 20   | 25   | 68                 | 56   | 47   | 48 kW.                |
| FREQUENCY            | 2                              | 12   | 19   | 22   | 2                  | 12   | 19   | 22 Mc.                |

# —Standard Valves—

4030-C  
Valve



Tentative data

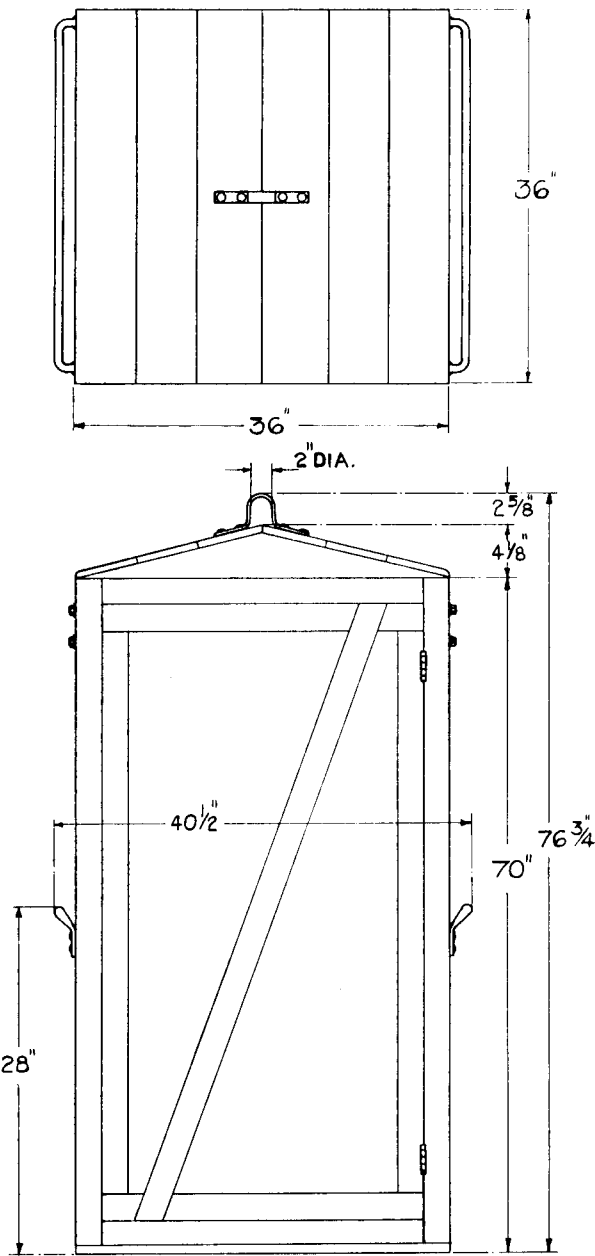
V.4030-C.2  
Sept. 1938



4030-C  
Valve

*—Standard Valves—*

PACKING CRATE.



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ENGLAND

# —Standard Valves—

4033-A Valve  
-AA Valve  
-AF Valve

## 4033-A, -AA AND -AF VALVES

TRIODES.

The 4033-AF valve is identical with the 4033-A valve ; the -F code indicates that the valve has passed special tests for use in Standard Aircraft radio.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

4033-A and -AF Standard British 5-pin.  
4033-AA American Medium 5-pin.

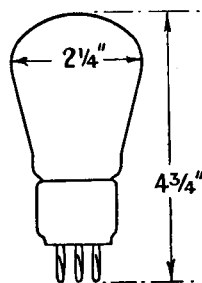
#### Dimensions.

Overall length  $4\frac{3}{4}"$  (12 cms.)  
Maximum diameter  $2\frac{1}{4}"$  (5.8 cms.)  
Net weight 0.14 lbs. (65 gms.)

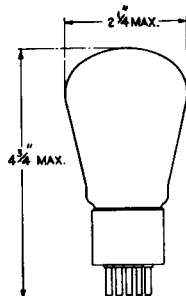
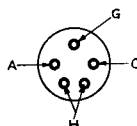
#### Constants.

Heater voltage 6 volts  
Nominal heater current 1.4 amps.  
\*Impedance 1,670 ohms  
\*Amplification factor 15  
\*Mutual conductance 9 mA per volt  
Grid-anode capacity  $8 \mu\mu\text{F.}$   
Anode-filament capacity  $2.7 \mu\mu\text{F.}$   
Grid-filament capacity  $11.9 \mu\mu\text{F.}$

\* at  $V_p = 300$  volts,  $I_p = 50$  mA.



4033-A and -AF



4033-AA

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 600 volts   |
| Maximum direct anode current                  | 0.170 amps. |
| Maximum anode dissipation                     | 25 watts    |
| Maximum direct grid current                   | 0.030 amps. |
| Maximum frequency for above ratings           | 2 Mc.       |
| Maximum anode voltage for frequency of 10 Mc. | 500 volts   |

V.4033-A.1  
Mar. 1939

4033-A Valve  
-AA Valve  
-AF Valve

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class A A.F. Amp.   |
|----------------------|---------------------|
| Direct anode voltage | 400 volts           |
| Grid bias            | (approx.) —20 volts |
| Direct anode current | 0.050 amps.         |
| Anode dissipation    | 16 watts            |
| Load impedance       | 7,000 ohms          |
| Undistorted output   | 4 watts             |

|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit       |
|----------------------------------------|------------------------------------------------------------------|
| Direct anode voltage                   | 600 volts                                                        |
| Grid bias                              | —30 to —40 volts<br>(individual biasing required for each valve) |
| Anode current per valve—zero signal    | 20 mA                                                            |
| Anode current per valve—maximum signal | 80 mA                                                            |
| Anode dissipation                      | 23 watts                                                         |
| Load resistance—anode to anode         | 7,200 ohms                                                       |
| Peak AF grid to grid voltage           | 130 volts                                                        |
| Grid current per valve                 | 8 mA                                                             |
| Maximum output—2 valves                | 50 watts                                                         |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 600                                     | 400                               | 600 volts             |
| Direct anode current | 0.063                                   | 0.094                             | 0.09 amps.            |
| Grid bias            | —45                                     | —70                               | —100 to<br>—150 volts |
| Anode dissipation    | 25                                      | 12.5                              | 18 watts              |
| Carrier output       | 12.5                                    | 25                                | 36 watts              |

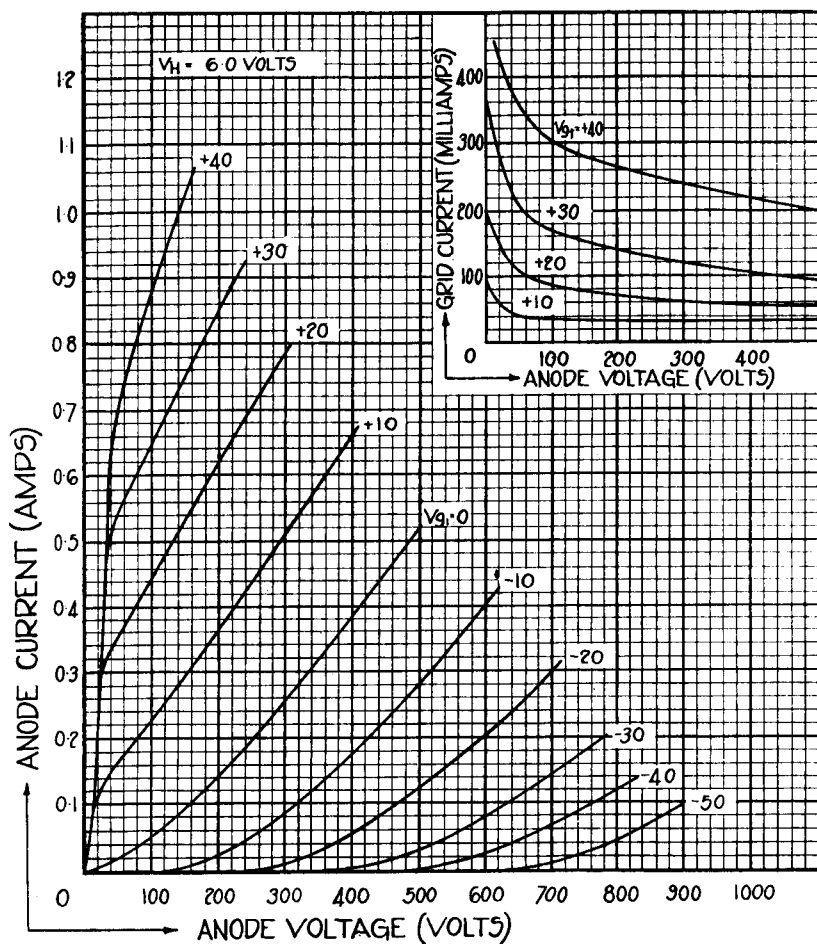
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# *—Standard Valves—*

4033-A Valve

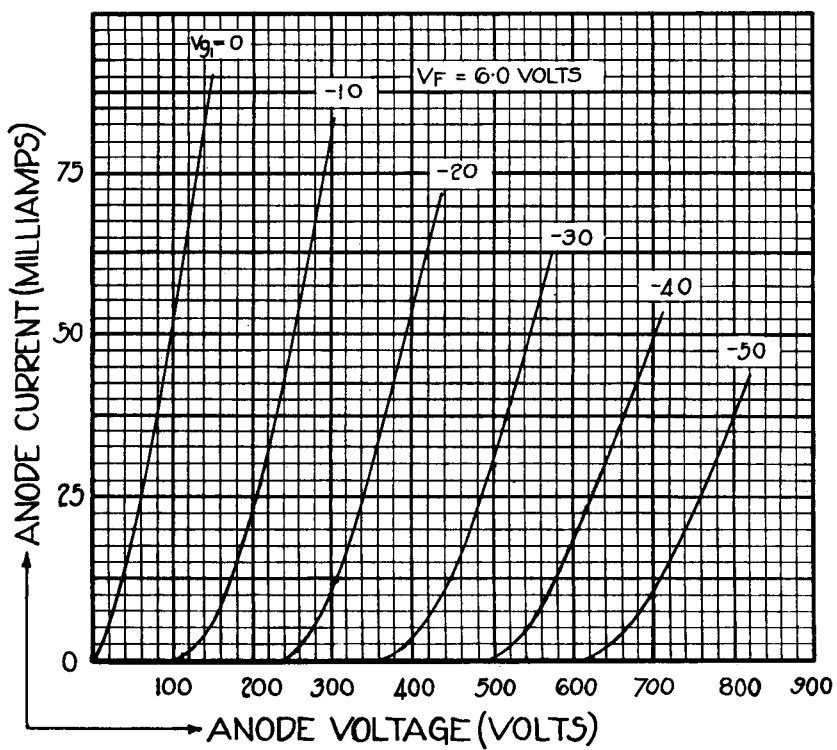
-AA Valve

-AF Valve



4033-A Valve  
-AA Valve  
-AF Valve

# —Standard Valves—



# *—Standard Valves—*

4034-A Valve  
4035-A Valve

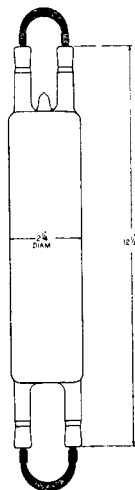
## 4034-A VALVE

VACUUM CONDENSER.

### SPECIFICATION.

#### Dimensions.

|                |                       |
|----------------|-----------------------|
| Overall length | 15½" (40 cms.)        |
| Diameter       | 2¼" (5.7 cms.)        |
| Capacity       | 26 $\mu\mu$ F approx. |
| Test voltage   | 40,000 volts R.M.S.   |
| Net weight     | 0.8 lbs. (360 gms.)   |



## 4035-A VALVE

VACUUM CONDENSER.

### SPECIFICATION.

#### Dimensions.

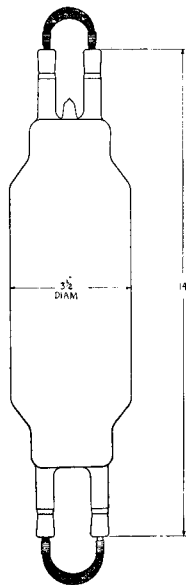
|                |                        |
|----------------|------------------------|
| Overall length | 17" (43 cms.)          |
| Diameter       | 3½" (8.9 cms.)         |
| Capacity       | 40 $\mu\mu$ F. approx. |
| Test voltage   | 40,000 R.M.S.          |
| Net weight     | 1.2 lbs. (540 gms.)    |

Note :—These condensers are intended only for balancing purposes in high power radio transmitters. They must not be used in 50  $\omega$  supply without protective resistors.

#### Ordering.

Please order as :—

“ 4034-A or 4035-A valve  
(vacuum condenser).”



MV.40345-A.1  
Nov. 1937

PRINTED IN  
ENGLAND

# *—Standard Valves—*

4037-A  
Valve

## 4037-A VALVE

HOT CATHODE MERCURY VAPOUR  
RECTIFIER.

### SPECIFICATION.

#### Cathode.

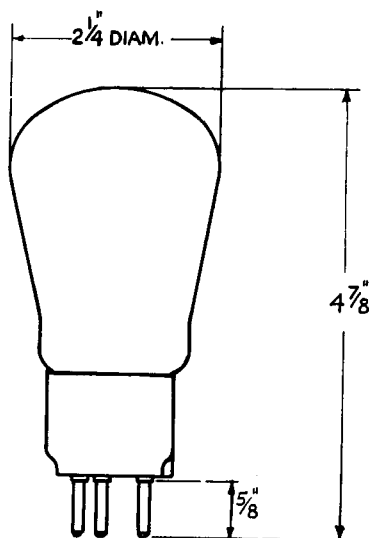
Oxide coated filament.  
Constant voltage type.

#### Base.

Standard British 4 pin.

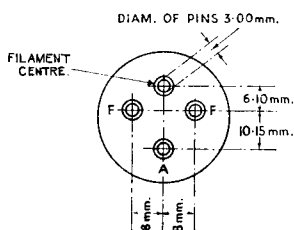
#### Dimensions.

Overall length  $4\frac{7}{8}"$  (12.4 cms.)  
Overall diameter  $2\frac{1}{4}"$  (5.7 cms.)  
Net weight 0.13 lbs. (60 gms.)



#### Constants.

Filament voltage 4 volts  
Nominal filament current 2 amps.  
Maximum peak inverse voltage 1,000 volts  
Maximum peak anode current 0.8 amps.



OUTPUT AS HALF WAVE RECTIFIER.

250 mA. at 300 volts.

V.4037-A.1  
Nov. 1937



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ENGLAND

# —Standard Valves—

4039-A  
Valve

## 4039-A VALVE

### MERCURY VAPOUR RELAY.

In this mercury vapour relay the grid will maintain control with zero anode current as long as it is more negative than a certain critical value. When the grid voltage becomes less negative than this value, anode current starts to flow and the grid loses all further control. The maximum anode current which then flows must be kept within the peak instantaneous anode current limit mentioned below otherwise the valve may be damaged.

The grid can only regain control after interruption of the flow of anode current instantaneously. This can be done by using A.C. on the anode or by special circuit arrangements.

The cathode of this valve must not be operated at less than its rated voltage otherwise the valve may be damaged.

#### SPECIFICATION.

##### Cathode.

Indirectly heated oxide coated.

Constant voltage type.

##### Base.

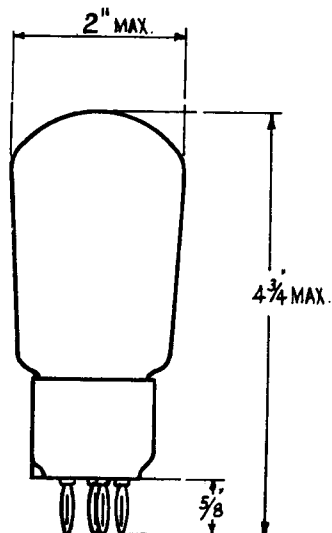
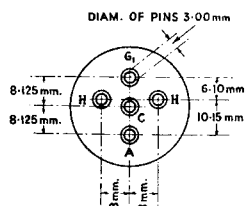
Standard British 5-pin.

##### Dimensions.

|                |                               |
|----------------|-------------------------------|
| Overall height | 4 $\frac{3}{4}$ " (12.1 cms.) |
| Bulb diameter  | 2" (5 cms.)                   |
| Net weight     | 0.12 lbs. (55 gms.)           |

##### Constants.

|                                  |           |
|----------------------------------|-----------|
| Heater voltage                   | 4.0 volts |
| Nominal heater current           | 1.0 amp.  |
| Peak instantaneous anode current | 200 mA.   |
| Continuous anode current         | 100 mA.   |
| Anode peak voltage               | 500 volts |
| Grid control ratio               | 30 to 50  |
| Time delay                       | 30 secs.  |



#### OPERATING INSTRUCTIONS.

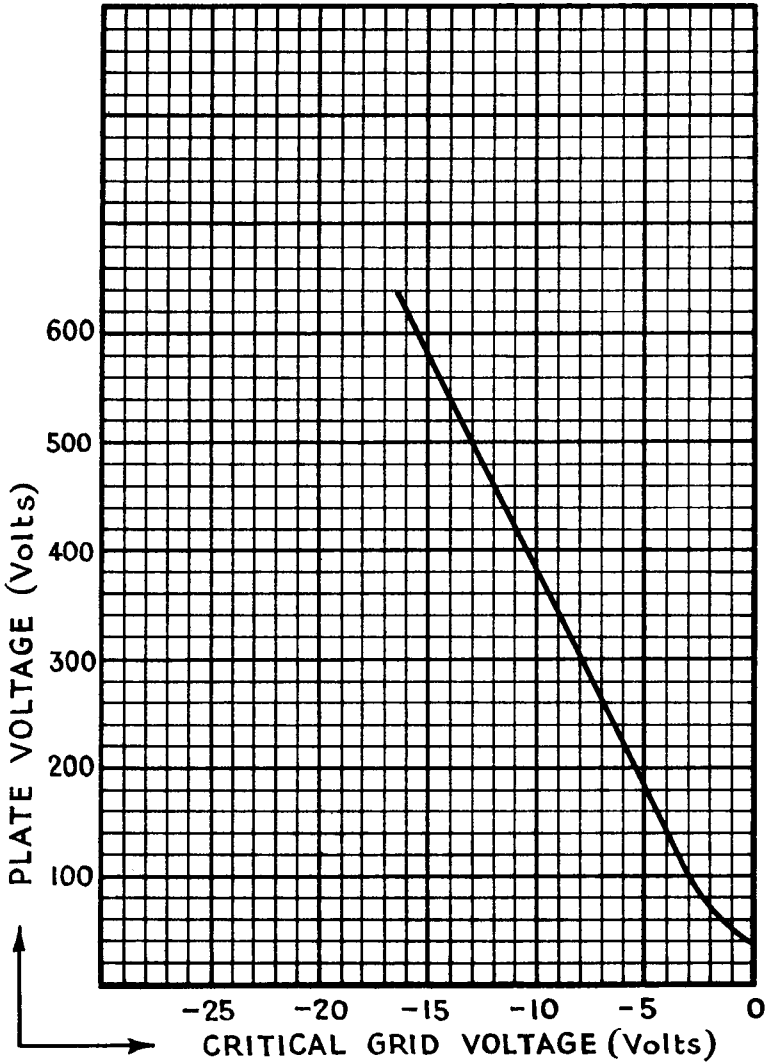
After transit, the valve should be run with full heater voltage for approximately five minutes before applying anode voltage, in order to ensure that liquid mercury splashed on to the anode is evaporated. Each time the circuit is switched on, 30 seconds should be allowed for the cathode to heat up before current is allowed to pass. For this purpose it is not necessary to remove the anode voltage.

MA.4039-A.1  
Nov. 1937

# *—Standard Valves—*

When passing current the potential drop across the valve is 10–15 volts and is nearly independent of the current. The current must be limited to an instantaneous value of 200 mA. by means of an external resistance. For continuous operation the mean value of the current should not exceed 100 mA.

The grid control ratio, which will be found to vary slightly with the temperature of the mercury, is defined as the ratio of the positive anode voltage to the minimum negative grid voltage which is sufficient to prevent anode current flowing. It is very nearly independent of anode voltage for values of the latter over 30 volts. If the grid is liable to be driven positive, it is advisable to connect a high resistance (say 0.5 megohm) in series with it to prevent appreciable current from flowing in the grid circuit.



# —Standard Valves—

4043-A Valve  
-B Valve

## 4043-A AND 4043-B VALVE

TRIODE.

For replacement purposes only.  
Replaced by 4043-C and -D valves.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

4043-A American medium 4-pin.  
4043-B standard British 4-pin.

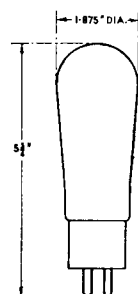
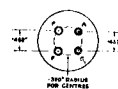
#### Dimensions.

Overall length  $5\frac{3}{4}"$  (14.6 cms.)  
Maximum diameter  $1\frac{7}{8}"$  (4.8 cms.)  
Net weight 0.2 lbs. (90 gms.)

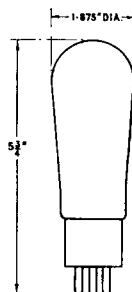
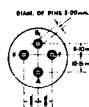
#### Constants.

Filament voltage 7.5 volts  
Nominal filament current 1.2 amps.  
\*Impedance 3,500 ohms  
\*Amplification factor 8  
Grid-anode capacity 13.3  $\mu\mu\text{F}$ .  
Anode-filament capacity 4.8  $\mu\mu\text{F}$ .  
Grid-filament capacity 7.0  $\mu\mu\text{F}$ .

\* at anode current of 0.050 amps.



4043-A



4043-B

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 600 volts   |
| Maximum direct anode current                  | 0.110 amps. |
| Maximum anode dissipation                     | 35 watts    |
| Maximum direct grid current                   | 0.030 amps. |
| Maximum frequency for above ratings           | 2 Mc.       |
| Maximum anode voltage for frequency of 10 Mc. | 500 volts   |

V.4043-AB.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

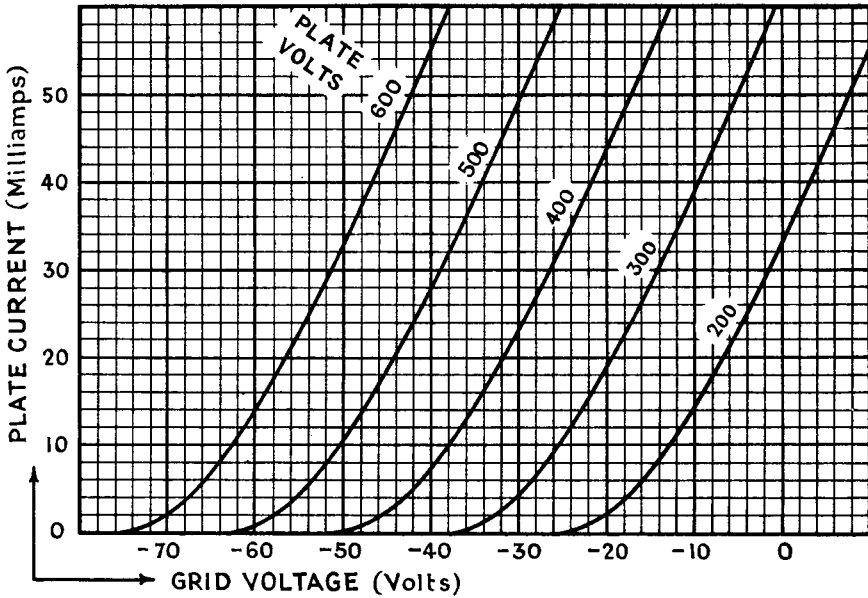
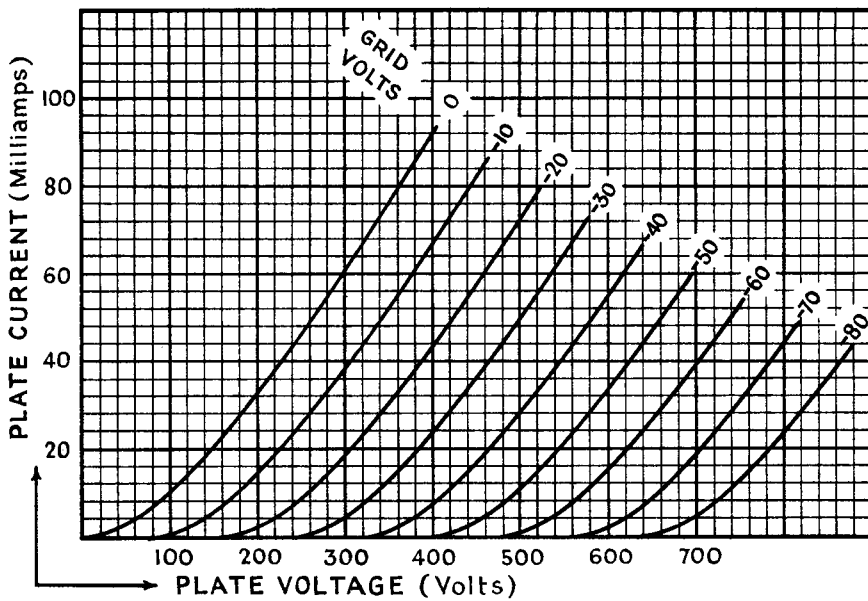
|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |
|----------------------------------------|------------------------------------------------------------|
| Direct anode voltage                   | 600 volts                                                  |
| Grid bias                              | —55 to —65 volts                                           |
| Anode current per valve—zero signal    | 0.012 amps.                                                |
| Anode current per valve—maximum signal | 0.090 amps.                                                |
| Anode dissipation                      | 25 watts                                                   |
| Load resistance—anode to anode         | 6,000 ohms                                                 |
| Maximum output—2 valves                | 60 watts                                                   |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 600                                     | 400                               | 600 volts             |
| Direct anode current | 0.087                                   | 0.131                             | 0.130 amps.           |
| Grid bias            | —65                                     | —100                              | —150 to<br>—200 volts |
| Anode dissipation    | 35                                      | 17.5                              | 26 watts              |
| Carrier output       | 17.5                                    | 35                                | 52 watts              |

# —Standard Valves—

4043-A Valve  
-B Valve



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# —Standard Valves—

4043-C Valve  
-D Valve

## 4043-C AND 4043-D VALVES

TRIODES.

Similar to 4043-A and -B, but have grid designed to reduce grid emission. It is thus possible to drive the grid further positive and to obtain greater undistorted output than for 4043-A and -B Valves.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.

Constant voltage type.

#### Base.

4043-C American medium 4-pin.

4043-D standard British 4-pin.

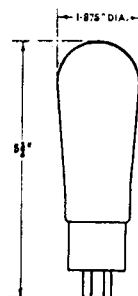
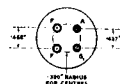
#### Dimensions.

|                  |                               |
|------------------|-------------------------------|
| Overall length   | 5 $\frac{3}{4}$ " (14.6 cms.) |
| Maximum diameter | 1 $\frac{7}{8}$ " (4.8 cms.)  |
| Net weight       | 0.2 lbs. (90 gms.)            |

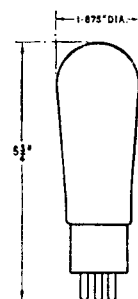
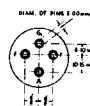
#### Constants.

|                          |               |
|--------------------------|---------------|
| Filament voltage         | 7.5 volts     |
| Nominal filament current | 1.2 amps.     |
| * Impedance              | 3,500 ohms    |
| * Amplification factor   | 8             |
| Grid-anode capacity      | 13.3 $\mu$ F. |
| Anode-filament capacity  | 4.8 $\mu$ F.  |
| Grid-filament capacity   | 7.0 $\mu$ F.  |

\* at anode current of 0.050 amps.



4043-C



4043-D

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 600 volts   |
| Maximum direct anode current                  | 0.110 amps. |
| Maximum anode dissipation                     | 35 watts    |
| Maximum direct grid current                   | 0.030 amps. |
| Maximum frequency for above ratings           | 2 Mc.       |
| Maximum anode voltage for frequency of 10 Mc. | 500 volts   |

V.4043-CD.1  
Nov. 1937



4043-C Valve  
-D Valve

# **—Standard Valves—**

## **TYPICAL OPERATING CONDITIONS.**

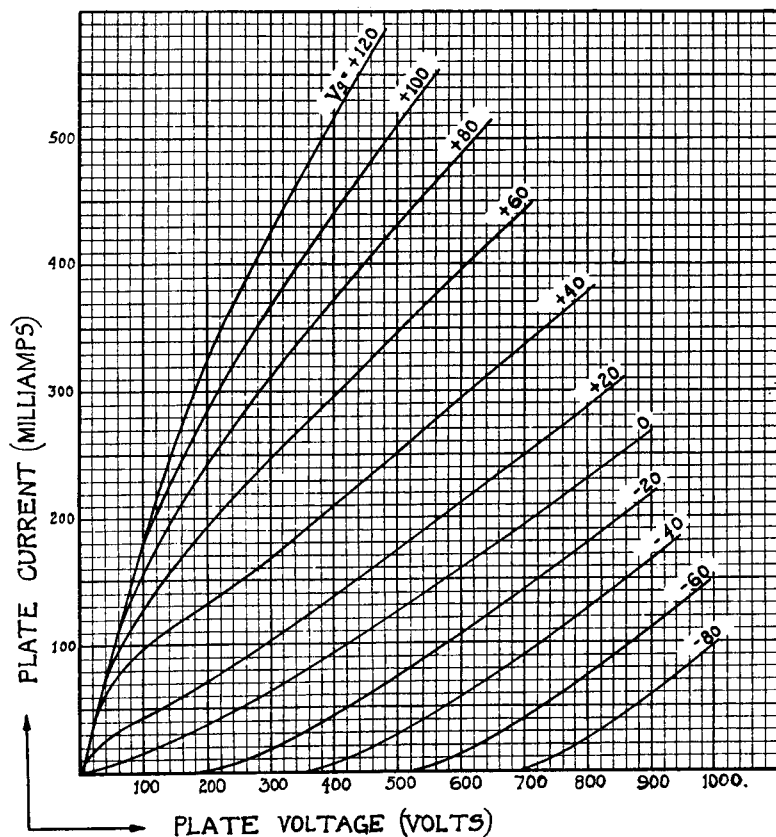
|                                        |                                                            |
|----------------------------------------|------------------------------------------------------------|
|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |
| Direct anode voltage                   | 600 volts                                                  |
| Grid bias                              | —55 to —65 volts                                           |
| Anode current per valve—zero signal    | 0.012 amps.                                                |
| Anode current per valve—maximum signal | 0.11 amps.                                                 |
| Anode dissipation                      | 30 watts                                                   |
| Load resistance—anode to anode         | 6,000 ohms                                                 |
| Maximum output—2 valves                | 73 watts                                                   |

## **RADIO FREQUENCY OPERATION.**

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 600                                     | 400                               | 600 volts             |
| Direct anode current | 0.087                                   | 0.131                             | 0.130 amps.           |
| Grid bias            | —65                                     | —100                              | —150 to<br>—200 volts |
| Anode dissipation    | 35                                      | 17.5                              | 26 watts              |
| Carrier output       | 17.5                                    | 35                                | 52 watts              |

# —Standard Valves—

4043-C Valve  
-D Valve



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# *—Standard Valves—*

4046-A  
Valve

## 4046-A VALVE

PENTODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.

Constant voltage type.

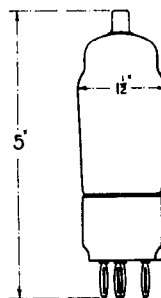
#### Base.

Standard British 5-pin. Anode connected to top cap type B.

Bulb metallised and connected to cathode.

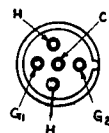
#### Dimensions.

|                     |                             |
|---------------------|-----------------------------|
| Max. overall length | $5\frac{1}{4}"$ (13.3 cms.) |
| Bulb diameter       | $1\frac{1}{2}"$ (3.8 cms.)  |
| Net weight          | 0.13 lbs. (60 gms.)         |



#### Constants.

|                        |                          |
|------------------------|--------------------------|
| Heater voltage         | 4 volts                  |
| Nominal heater current | 0.95 amp.                |
| * Impedance            | 800,000 ohms             |
| * Amplification factor | 2,400                    |
| Grid-anode capacity    | 0.007 $\mu\mu\text{F}$ . |
| Input capacity         | 10.7 $\mu\mu\text{F}$ .  |
| Output capacity        | 8 $\mu\mu\text{F}$ .     |



\* at  $V_p = 200$ ,  $V_{g_2} = 100$ ,  $V_{g_1} = -1.5$  Volts.

### LIMITING CONDITIONS FOR SAFE OPERATION.

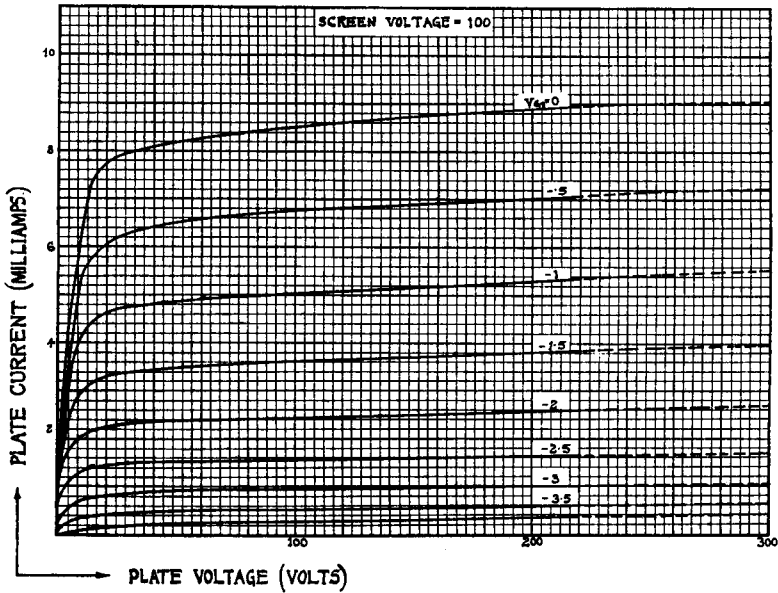
|                               |           |
|-------------------------------|-----------|
| Maximum direct anode voltage  | 250 volts |
| Maximum direct screen voltage | 100 volts |

V.4046-A.1  
Sept. 1938

—Standard Valves—

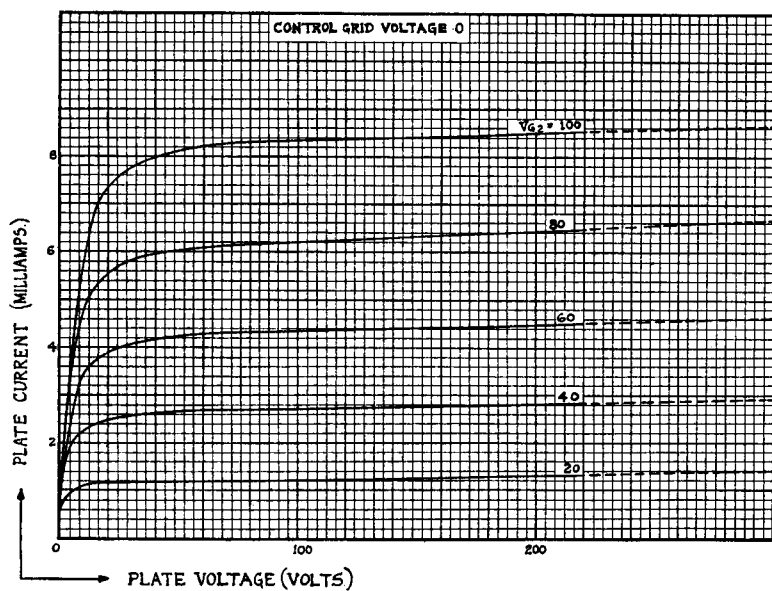
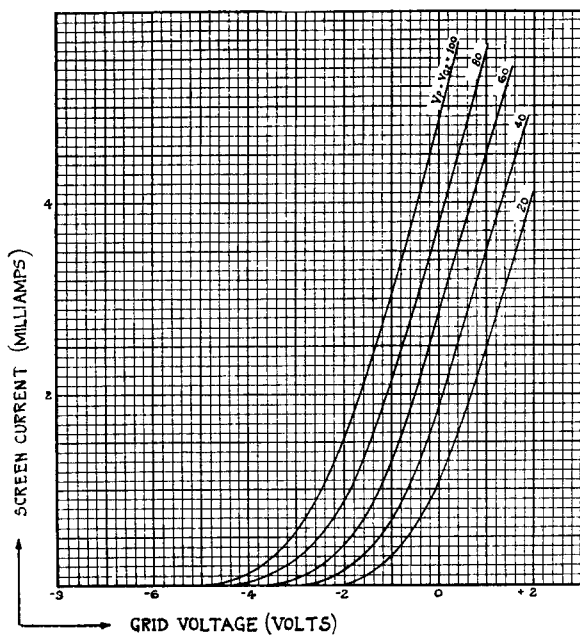
TYPICAL OPERATING CONDITIONS.

|                     |         |         |              |
|---------------------|---------|---------|--------------|
| Anode voltage       | 250     | 200     | 150 volts    |
| Control grid bias   | —1.5    | —1.5    | —1.5 volts   |
| Screen grid voltage | 100     | 100     | 100 volts    |
| Anode current       | 3.9     | 3.8     | 3.7 mA.      |
| Anode resistance    | 800,000 | 800,000 | 800,000 ohms |
| Load                | 50,000  | 46,000  | 30,000 ohms  |
| Output              | 0.315   | 0.258   | 0.175 watts  |
| 2nd harmonic — %    | 8.6     | 8.75    | 11.5         |
| — db                | 21.3    | 20.7    | 19           |



# —Standard Valves—

4046-A  
Valve



V.4046-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4047-B  
Valve

## 4047-B VALVE

(Replaces the 4047-A Valve  
which has now been abandoned)

SINGLE ENDED  
WATER COOLED TRIODE.

### Cathode.

Pure tungsten filament.  
Constant voltage type.

### Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation  
up to 6 Kw.

Type MS.1362 Grp. 20 for anode dissipation  
up to 6 Kw., used for below panel  
connection.

Types 223 LU 1A or PL 122011 (3001-A) for  
anode dissipation over 6 Kw.

### Water Flow.

5 gallons per minute.

### Dimensions.

Max. overall length  $21\frac{1}{4}"$  (54 cms.)  
Max. bulb diameter  $3\frac{9}{16}"$  (9.05 cms.)  
Net weight  $3\frac{3}{4}$  lbs. (1,700 gms.)

### Constants.

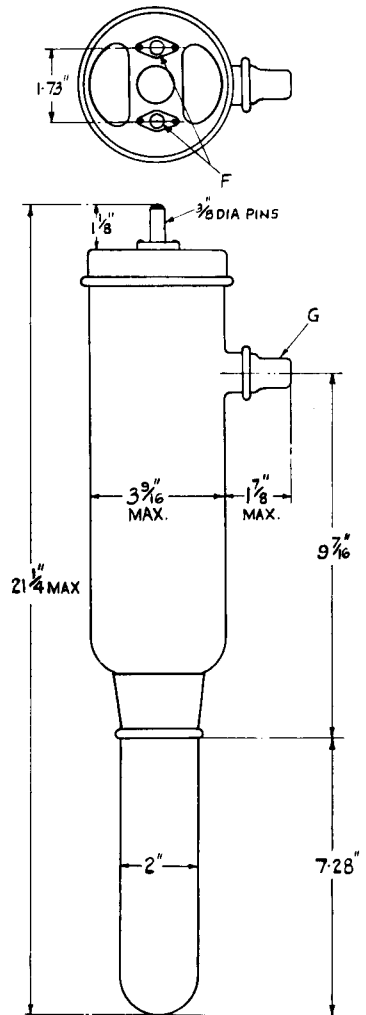
Filament voltage 18—20 volts  
(exact filament voltage  
marked on bulb)  
Nominal filament current 59 amps.  
Total emission 6 amps.  
\*Impedance 7,500 ohms  
\*Amplification factor 40  
\*Mutual conductance 5.3 mA. per volt  
Grid-anode capacity 24  $\mu\mu\text{F}$ .  
Anode-filament capacity 2  $\mu\mu\text{F}$ .  
Grid-filament capacity 17  $\mu\mu\text{F}$ .

\* at anode current of 0.75 amp.

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |              |
|---------------------------------------------------|--------------|
| Maximum direct anode voltage                      | 13,000 volts |
| Maximum direct anode voltage for anode modulation | 10,000 volts |
| Maximum direct anode current                      | 1.5 amp.     |
| Maximum anode dissipation                         | 10 Kw.       |
| Maximum grid dissipation                          | 200 watts    |
| Maximum frequency for above ratings               | 3 Mc.        |
| Maximum anode voltage for frequency of 6 Mc.      | 7,500 volts  |

NOTE.—The characteristics of this valve are identical with those of the 4047-A Valve but the grid lead has been brought out through the side of the bulb. When the 4047-B is used to replace the 4047-A new grid connectors will be required. These connectors type ES.5706-1 should be ordered with the valve.





# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B A.F. Amp. or Mod.<br>For balanced 2 valve circuit |
|-----------------------------------------------|-----------------------------------------------------------|
| Direct anode voltage                          | 10,000 volts                                              |
| Grid bias                                     | —120 to —170 volts                                        |
| Direct anode current per valve—zero signal    | 0.25 amps.                                                |
| Direct anode current per valve—maximum signal | 1.2 amps.                                                 |
| Load resistance—anode to anode                | 7,500 ohms                                                |
| Maximum signal output—2 valves                | 13.2 Kw.                                                  |
| Anode dissipation                             | 5.4 Kw.                                                   |

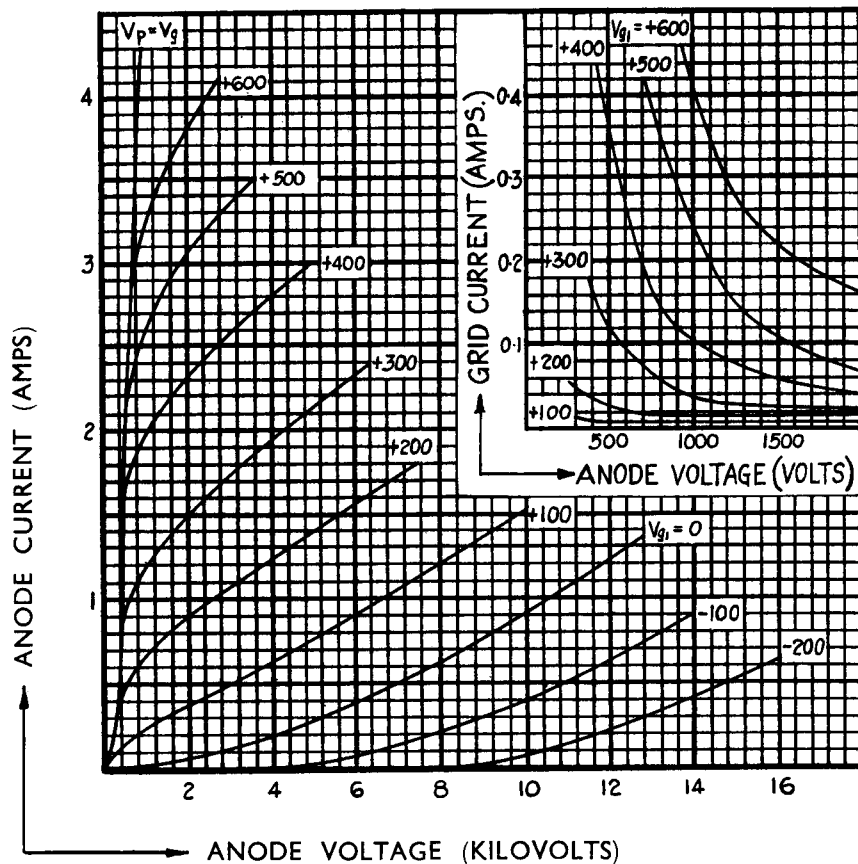
## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 10,000                                  | 7,000                             | 10,000 volts          |
| Direct anode current | 0.75                                    | 0.75                              | 1.5 amps.             |
| Grid bias            | —200                                    | —300                              | —500 to<br>—750 volts |
| Anode dissipation    | 5                                       | 1.75                              | 5 Kw.                 |
| Carrier output       | 2.5                                     | 3.5                               | 10 Kw.                |

# —Standard Valves—

4047-B  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



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# *—Standard Valves—*

4048-A  
Valve

## 4048-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant current type.

#### Base.

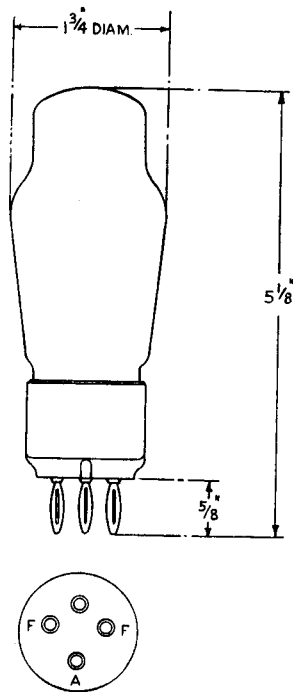
Standard British 4-pin.

#### Dimensions.

|                |                    |
|----------------|--------------------|
| Overall length | 5½" (13 cms.).     |
| Bulb diameter  | 1¾" (4.5 cms.).    |
| Net weight     | 0.1 lbs. (45 gms.) |

#### Constants.

|                                       |             |
|---------------------------------------|-------------|
| Filament current                      | 5 amps.     |
| Nominal filament voltage              | 1.8 volts   |
| Maximum peak inverse voltage          | 1,600 volts |
| Maximum peak anode current            | 0.75 amps.  |
| Time delay                            | 30 secs.    |
| Heating period after transport        | 15 mins.    |
| Recommended ambient temperature range | 10°C.—50°C. |



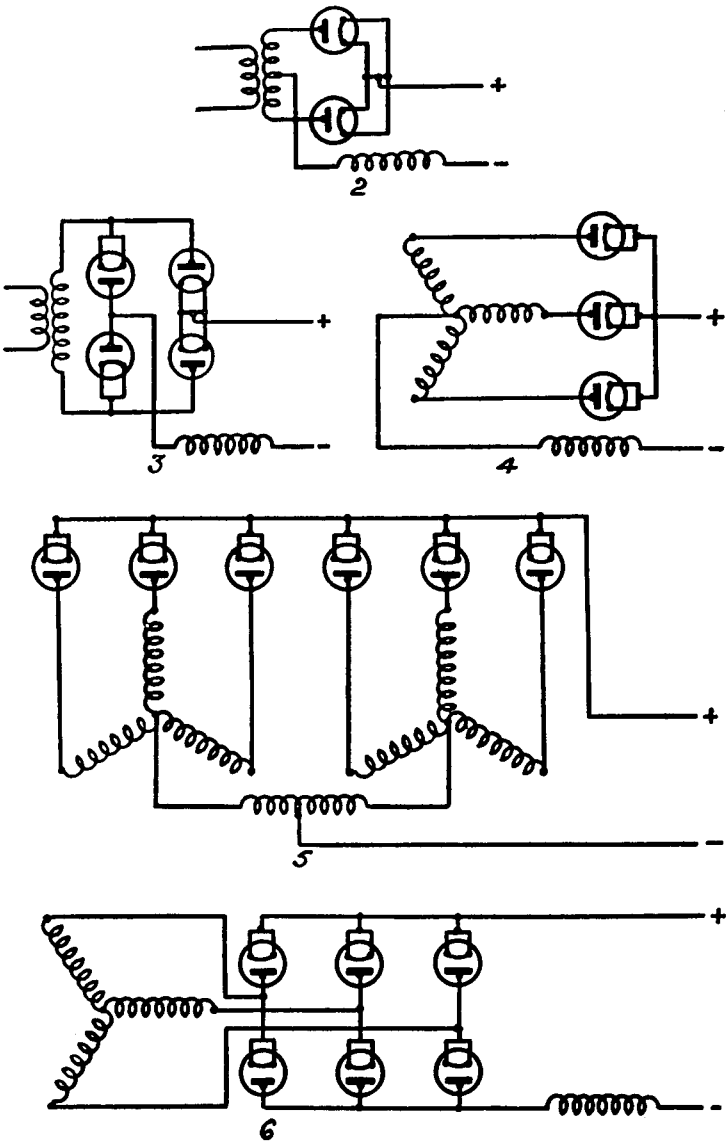
Note :—For further information on H.C.M.V. rectifiers, see sheet G.1.

# —Standard Valves—

**TYPICAL OPERATING CONDITIONS.**

| Circuit | Number of valves | Load potential in volts | Load current in amps. |
|---------|------------------|-------------------------|-----------------------|
| 2       | 2                | 500                     | 0.45                  |
| 3       | 4                | 1,000                   | 0.45                  |
| 4       | 3                | 750                     | 0.55                  |
| 5       | 6                | 750                     | 1.4                   |
| 6       | 6                | 1,500                   | 0.7                   |

**Important.**—This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer.



# —Standard Valves—

4049-C  
Valve

## 4049-C VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

### SPECIFICATION.

#### Cathode.

Oxide coated filament (shielded).  
Constant voltage type.

#### Base.

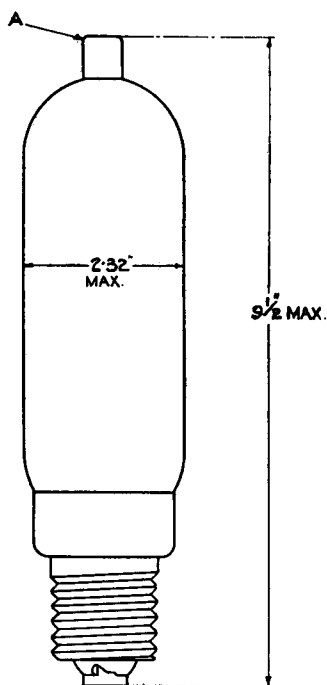
Edison screw Goliath.

#### Dimensions.

Maximum overall length  $9\frac{1}{2}"$  (24.1 cms.)  
Maximum diameter  $2.32"$  (5.9 cms.)  
Anode cap Type D.  
Net weight 0.33 lbs. (150 gms.)

#### Constants.

Filament voltage 4 volts  
Nominal filament current 9.5 amps.  
Maximum peak anode current 5 amps.  
Maximum peak inverse voltage 10,000 volts  
Max. average anode current 1.25 amps.  
Ambient temperature range 5°C. min.  
70°C. max.  
Condensed mercury temperature range 20°C. min.  
70°C. max.



### Recommended Temperature Conditions.

|                     | Peak Inverse Voltage.  |                     |
|---------------------|------------------------|---------------------|
|                     | Less than 5,000 volts. | 5,000—10,000 volts. |
| Natural ventilation | 15°C.—55°C.            | 15°C.—45°C.         |
| Forced ventilation  | 15°C.—70°C.            | 15°C.—60°C.         |

### Cathode Heating Time.

Ambient temperature 5°C.—10°C. 10°C.—15°C. Greater than 15°C.  
Heating period 10 5 1\* mins.

\* This time may be reduced to 30 seconds if absolutely essential.

Note:—After shipment the filament must be run at full voltage for 30 minutes, before any anode voltage is applied, so that the mercury shall be distributed correctly.

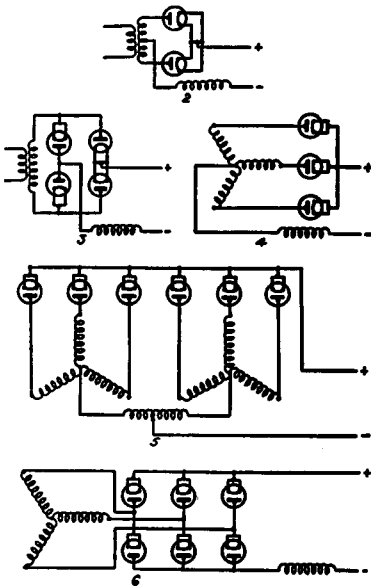
Tentative Data

V.4049-C.1  
Mar. 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of Valves | Approx. D.C. Output Volts | Maximum D.C. Load Current |
|---------|------------------|---------------------------|---------------------------|
| 2       | 2                | 3,200 volts               | 2.5 amps.                 |
| 3       | 4                | 6,400 volts               | 2.5 amps.                 |
| 4       | 3                | 4,550 volts               | 3.75 amps.                |
| 5       | 6                | 4,550 volts               | 7.5 amps.                 |
| 6       | 6                | 9,100 volts               | 3.75 amps.                |



### Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent., if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.I.

# *—Standard Valves—*

4050-AB Valve  
-AD Valve  
-AG Valve

## GAS FILLED CATHODE RAY TUBE TYPE 4050-AB, 4050-AD, 4050-AG

### Characteristics.

Filament voltage 0.75 volts  
Filament current 0.7 to 1.1 amps.  
Anode voltage 300 to 2,000 volts  
Normal anode voltage 350 volts  
Capacity between either pair of deflecting plates including the socket 5.5  $\mu\text{F}$ . (approx.)

Capacity of any single plate to the anode including the socket 7—8  $\mu\text{F}$ .

Conductance of each pair of deflecting plates 1  $\mu\text{mho}$  (approx.)

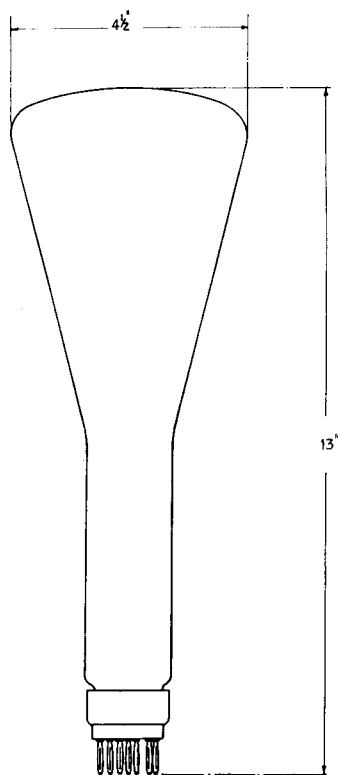
Shield voltage (from a potentiometer) 0—50 volts

Sensitivity (approx.)  $\frac{260 \text{ mm. per}}{\text{V}} \text{ volt}$

4050-AB has screen giving blue spot for photographic work.

4050-AD has screen giving long afterglow of 10—15 seconds in the dark.

4050-AG has screen giving green spot for visual work.



### Dimensions.

Length 13" (33 cms.)  
Maximum diameter  $4\frac{1}{2}$ " (11.5 cms.)  
Net weight 0.75 lbs. (340 gms.)

### Base.

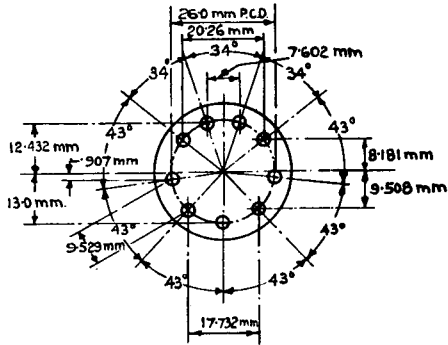
Standard British 9-pin.



# —Standard Valves—

## Connections to Pins.

- Pin 1—deflecting plate PY2.
- Pin 2—deflecting plate PX2.
- Pin 3—not used.
- Pin 4—filament.
- Pin 5—filament.
- Pin 6—shield.
- Pin 7—deflecting plate PX1.
- Pin 8—deflecting plate PY1.
- Pin 9—anode.



The pins are numbered in a clockwise direction looking at the valve from underneath ; the arrow points between pin 4 and pin 5.

The PX plates produce horizontal deflection when the tube is mounted with pins 4 and 5 at the bottom.

## Associated Apparatus.

A large range of apparatus is made for use with the Cathode Ray Tube. The most important units are the 74300 Type Tube Unit, 74300 Type Mains Unit and the 74300 Type Linear Time Base Unit. The 74310 Cathode Ray Oscilloscope Equipment is a complete portable equipment incorporating this tube. For further particulars refer to the Standard Transmission Testing Apparatus Catalogue.

## Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.

# —Standard Valves—

4050-BB Valve  
-BD Valve  
-BG Valve

## GAS FILLED CATHODE RAY TUBE TYPE 4050-BB, 4050-BD, 4050-BG

### Characteristics.

Filament voltage drop 0.75 volts

Filament current 0.7 to 1.1 amps.

Anode voltage 300 to 2,000 volts

Normal anode voltage 350 volts

Capacity between either  
pair of deflecting plates  
including the socket 5.5  $\mu\text{F}$ .  
(approx.)

Capacity of any single  
plate to the anode  
including the socket 7—8  $\mu\text{F}$ .

Conductance of each pair of  
deflecting plates 1  $\mu\text{mho}$   
(approx.)

Shield voltage (from a  
potentiometer) 0—50 volts

Sensitivity (approx.)  $\frac{440 \text{ mm.}}{\text{V}}$  per  
volt

4050-BB has screen giving blue spot for  
photographic work.

4050-BD has screen giving long afterglow of  
10—15 seconds in the dark.

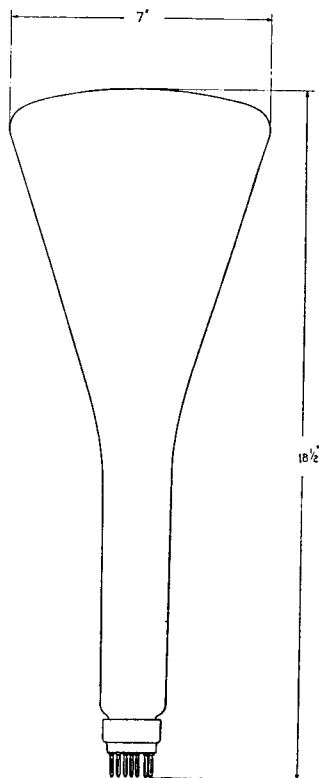
4050-BG has screen giving green spot for  
visual work.

### Dimensions.

Length 18½" (46 cms.)

Maximum diameter 7" (18 cms.)

Net weight 2.1 lbs. (940 gms.)



### Base.

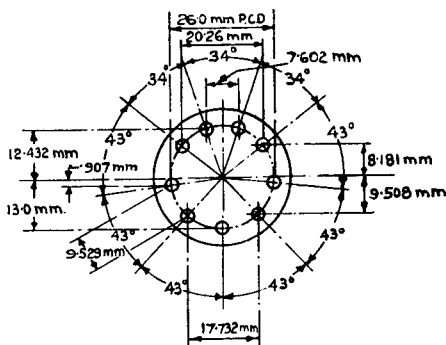
Standard British 9-pin.

4050-BB Valve  
-BD Valve  
-BG Valve

# —Standard Valves—

## Connections to Pins.

- Pin 1—deflecting plate PY2.
- Pin 2—deflecting plate PX2.
- Pin 3—not used.
- Pin 4—filament.
- Pin 5—filament.
- Pin 6—shield.
- Pin 7—deflecting plate PX1.
- Pin 8—deflecting plate PY1.
- Pin 9—anode.



The pins are numbered in a clockwise direction looking at the valve from underneath ; the arrow points between pin 4 and pin 5.

The PX plates produce horizontal deflection when the tube is mounted with pins 4 and 5 at the bottom.

## Associated Apparatus.

A large range of apparatus is made for use with the Cathode Ray Oscillograph. The most important units are the 74300 Type Tube Unit, 74300 Type Mains Unit and the 74300 Type Linear Time Base Unit. The 74310 Cathode Ray Oscillograph Equipment is a complete portable equipment incorporating this tube. For further particulars refer to the Standard Transmission Testing Apparatus Catalogue.

## Operation.

A 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.

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ENGLAND

# —Standard Valves—

4052-A  
Valve

## 4052-A VALVE PENTODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Base.

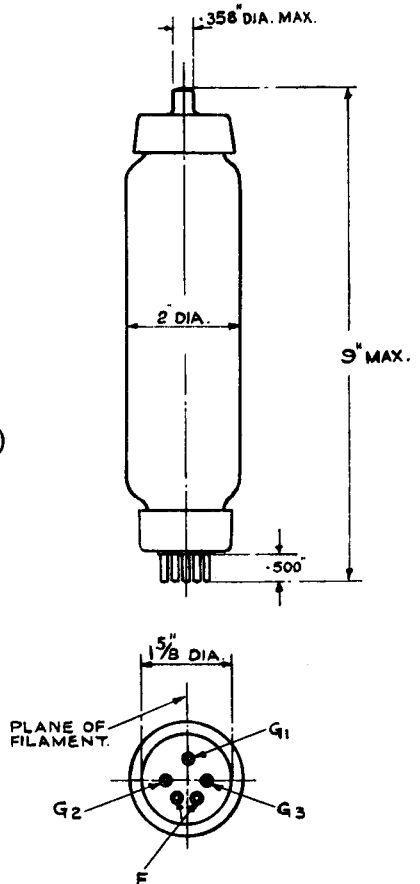
American medium 5-pin.  
Anode connected to top cap.

#### Dimensions.

|                     |                      |
|---------------------|----------------------|
| Max. overall length | 9" (22.9 cms.)       |
| Bulb diameter       | 2" (5.25 cms.)       |
| Net weight          | 0.48 lbs. (220 gms.) |

#### Constants.

|                                                                                     |                          |
|-------------------------------------------------------------------------------------|--------------------------|
| Filament voltage                                                                    | 7.5 volts                |
| Nominal filament current                                                            | 3 amps.                  |
| *Impedance                                                                          | 500,000 ohms             |
| *Amplification factor                                                               | 1,500                    |
| Control grid-anode capacity                                                         | 0.012 $\mu\mu\text{F}$ . |
| Input capacity                                                                      | 11 $\mu\mu\text{F}$ .    |
| Output capacity                                                                     | 10 $\mu\mu\text{F}$ .    |
| * at $V_p = 1,250$ volts $V_{g1} = -13$ volts,<br>$V_{g2} = 300$ volts $V_{g3} = 0$ |                          |



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |             |
|-------------------------------------|-------------|
| Maximum direct anode voltage        | 1,500 volts |
| Maximum direct screen voltage       | 300 volts   |
| Maximum direct suppressor voltage   | 45 volts    |
| Maximum anode dissipation           | 60 watts    |
| Maximum screen dissipation          | 20 watts    |
| Maximum direct control grid current | 10 mA.      |
| Maximum RF control grid current     | 5 amps.     |

Tentative Data.

V.4052-A.1  
Sept. 1938.

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Class B Telephony           |             |
|-----------------------------|-------------|
| Direct anode voltage        | 1,250 volts |
| Direct screen voltage       | 300 volts   |
| Direct control grid voltage | —30 volts   |
| Direct suppressor voltage   | 0 volts     |
| Peak R.F. input             | 70 volts    |
| Anode current               | 43 mA.      |
| Screen current              | 15 mA.      |
| Screen resistor             | 60,000 ohms |
| Driving power               | 0.5 watts   |
| Peak output                 | 64 watts    |
| Carrier output              | 16 watts    |

## RADIO FREQUENCY OPERATION.

| Class C Telephony — Control grid modulated |             |
|--------------------------------------------|-------------|
| Direct anode voltage                       | 1,250 volts |
| Direct screen voltage                      | 300 volts   |
| Direct control grid voltage                | —140 volts  |
| Direct suppressor voltage                  | 0 volts     |
| Anode current                              | 42 mA.      |
| Screen current                             | 10 mA.      |
| Screen resistor                            | 95,000 ohms |
| Control grid current                       | 1.8 mA.     |
| Peak RF input voltage ( $V_{g1}$ )         | 160 volts   |
| Peak AF input volts ( $V_{g1}$ )           | 60 volts    |
| AF power                                   | 0.75 watts  |
| Peak RF input power                        | 2 watts     |
| Peak output                                | 72 watts    |
| Carrier output                             | 18 watts    |

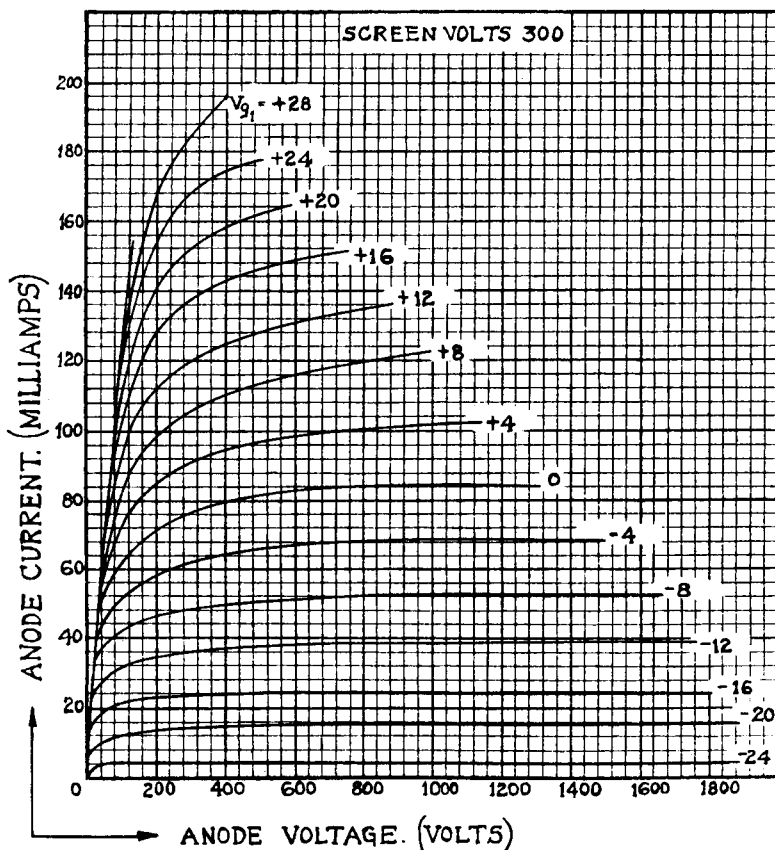
| Class C Telegraphy — Unmodulated |             |
|----------------------------------|-------------|
| Direct anode voltage             | 1,250 volts |
| Direct screen voltage            | 300 volts   |
| Direct control grid voltage      | —100 volts  |
| Direct suppressor voltage        | 0 volts     |
| Anode current                    | 80 mA.      |
| Screen current                   | 37 mA.      |
| Screen resistor                  | 26,000 ohms |
| Control grid current             | 5 mA.       |
| Peak RF input volts              | 175 volts   |
| RF input power                   | 0.9 watts   |
| Output                           | 64 watts    |

# —Standard Valves—

4052-A  
Valve

Class C Telephony, Suppressor and Screen  
Modulated

|                             | Suppressor | Screen      |
|-----------------------------|------------|-------------|
| Direct anode voltage        | 1,250      | 1,250 volts |
| Direct screen voltage       | 300        | 300 volts   |
| Direct control grid voltage | —100       | —100 volts  |
| Direct suppressor voltage   | —45        | —40 volts   |
| Peak AF suppressor voltage  | 75         | 75 volts    |
| Peak AF screen voltage      | 9          | 150 volts   |
| Peak RF input               | 175        | 175 volts   |
| Anode current               | 43         | 47 mA.      |
| Screen current              | 36         | 36 mA.      |
| Screen Resistor             | 25,000     | 25,000 ohms |
| Control grid current        | 5          | 5 mA.       |
| RF input power              | 0.9        | 0.9 watts   |
| AF power                    | 0.3        | 0.8 watts   |
| Peak output                 | 72         | 84 watts    |
| Carrier output              | 18         | 21 watts    |



Tentative data

V.4052-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4053-A  
Valve

## 4053-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type PL.120705/B.

#### Water Flow.

7 gallons per minute.

#### Dimensions.

|                |                      |
|----------------|----------------------|
| Overall length | 29.2" (74 cms.)      |
| Bulb diameter  | 3½" (8.9 cms.)       |
| Net weight     | 4½ lbs. (2,100 gms.) |

#### Constants.

Filament voltage 17.5—19.5 volts  
(exact filament voltages for 3 amps.  
and 7 amps. emission are marked  
on bulb)

Nominal filament  
current 64.5—66.8 amps.

Total emission 3—7 amps.

\*Impedance 830 ohms

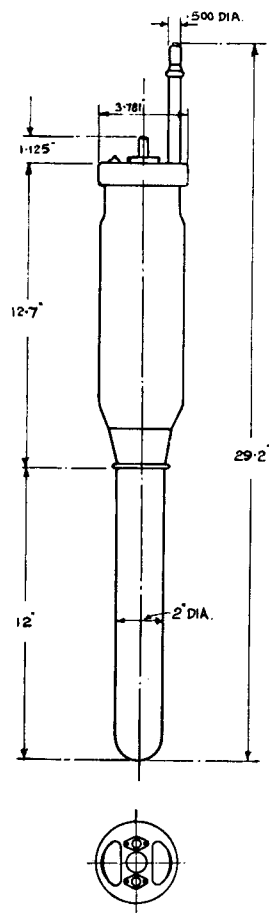
\*Amplification factor 6.5

Grid-anode capacity 40.5  $\mu\mu\text{F}$ .

Anode-filament capacity 3.5  $\mu\mu\text{F}$ .

Grid-filament capacity 36.5  $\mu\mu\text{F}$ .

\* at anode current of 1 amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage

11,000 volts

Maximum anode dissipation

12 Kw.

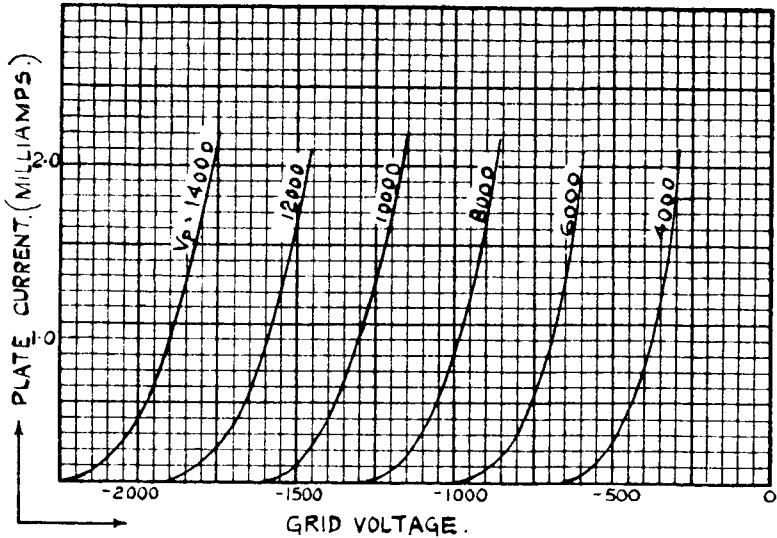
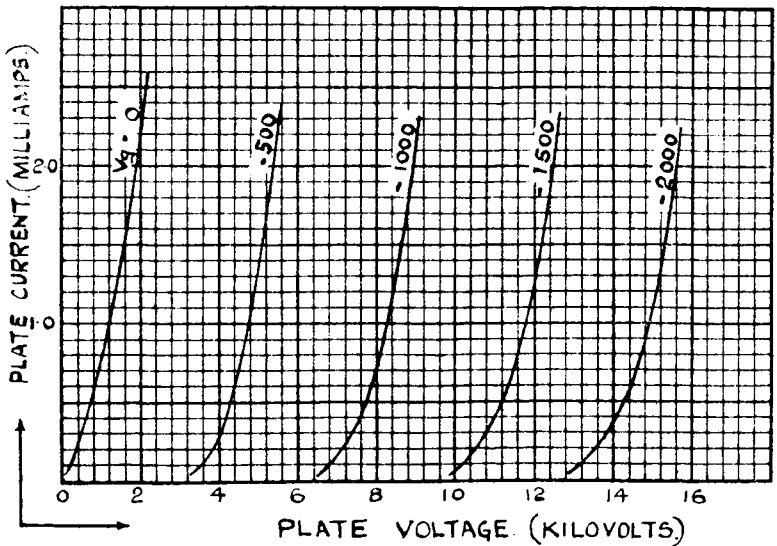
V.4053-A.1  
Nov. 1937



# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Class A — Audio frequency Modulator<br>For Series Modulation |                        |
|--------------------------------------------------------------|------------------------|
| Total H.T. voltage across mod. and mod. amp. in series       | 18,000 volts           |
| Anode voltage                                                | 12,000 volts           |
| Anode current                                                | 0.75 amps.             |
| Grid bias                                                    | —1,600 to —1,800 volts |
| Peak AF grid voltage                                         | 850 volts              |
| Peak AF output voltage                                       | 6,000 volts            |
| AF output power                                              | 4.5 Kw.                |



# —Standard Valves—

4056-A Valve  
-B Valve

## 4056-A AND 4056-B VALVES

TRIODES.

### SPECIFICATION.

#### Cathode.

Thoriated Tungsten filament.  
Constant voltage type.

#### Base.

4056-A Special 4-pin low loss.  
4056-B Large 4-pin bayonet.

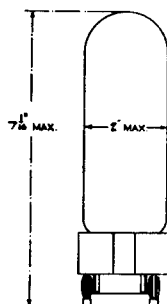
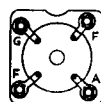
#### Dimensions.

|                     | 4056-A.                     | 4056-B.                      |
|---------------------|-----------------------------|------------------------------|
| Max. overall length | $7\frac{1}{8}"$ (17.9 cms.) | $7\frac{5}{16}"$ (18.5 cms.) |
| Max. diameter       | 2" (5.1 cms.)               | 2" (5.1 cms.)                |
| Net weight          | 0.57lb. (260 gms.)          | 0.46lbs. (210 gms.)          |

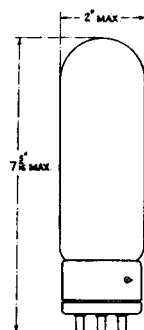
#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 6 volts                |
| Nominal filament current | 1.9 amps.              |
| *Impedance               | 5,500 ohms             |
| *Amplification factor    | 12                     |
| *Mutual conductance      | 2.2 mA per volt        |
| Grid-anode capacity      | 8.4 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 4.8 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 5.0 $\mu\mu\text{F}$ . |

\* at  $V_p = 500$   $V_g = 0$  volts.



4056-A



4056-B

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 1,000 volts |
| Maximum direct anode current                  | 100 mA      |
| Maximum anode dissipation                     | 35 watts    |
| Maximum direct grid current                   | 0.030 amps. |
| Maximum frequency for above ratings           | 15 Mc.      |
| Maximum anode voltage for frequency of 30 Mc. | 800 volts   |

V.4056-AB.1  
Mar. 1939

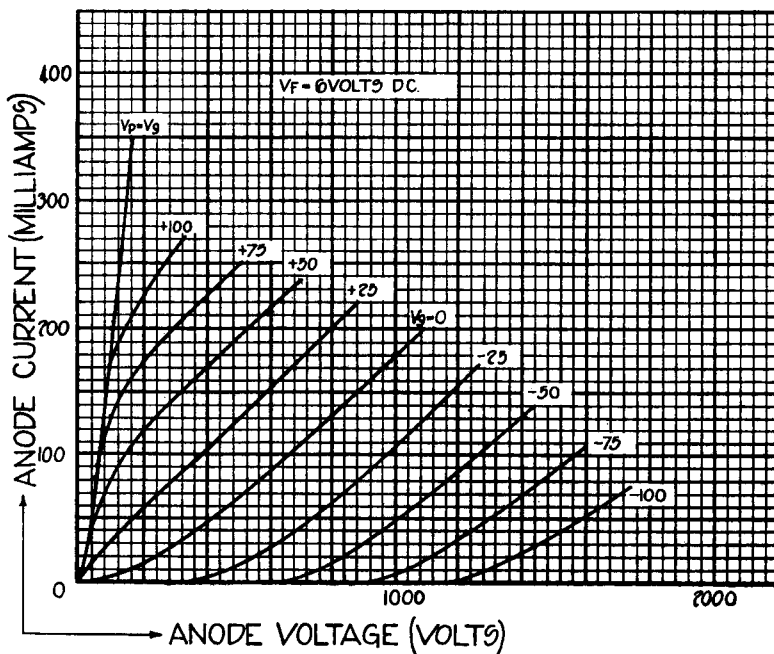
# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuits |
|----------------------------------------|-------------------------------------------------------------|
| Direct anode voltage                   | 1,000 volts                                                 |
| Grid bias                              | —70 volts (approx.)                                         |
| Anode current per valve—zero signal    | 0.013 amps.                                                 |
| Anode current per valve—maximum signal | 0.067 amps.                                                 |
| Anode dissipation                      | 30 watts                                                    |
| Load resistance—anode to anode         | 13,000 ohms                                                 |
| Maximum output—2 valves                | 73 watts                                                    |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 1,000                                   | 750                               | 1,000 volts           |
| Direct anode current | 0.053                                   | 0.070                             | 0.078 amps.           |
| Grid bias            | —80                                     | —130                              | —180 to<br>—250 volts |
| Anode dissipation    | 35                                      | 17.5                              | 26 watts              |
| Carrier output       | 17.5                                    | 35                                | 52 watts              |



# —Standard Valves—

4058-B  
Valve

## 4058-B VALVE

(Replaces the 4058-A valve which has now been abandoned).

SINGLE ENDED  
WATER COOLED TRIODE.

### Cathode.

Pure tungsten filament.  
Constant voltage type.

### Water Jackets.

Type MS.1362 Grp. 1 for anode dissipation up to 6 Kw.

Type MS.1362 Grp. 20 for anode dissipation up to 6 Kw. used for below panel connection.

Types 223 LU.1A or PL.122011 (3001-A) for anode dissipation over 6 Kw.

### Water Flow.

7 gallons per minute.

### Dimensions.

Max. overall length 21 $\frac{1}{4}$ " (54 cms.)  
Max. bulb diameter 3 $\frac{9}{16}$ " (9.05 cms.)  
Net weight 3 $\frac{3}{4}$  lbs. (1,700 gms.)

### Constants.

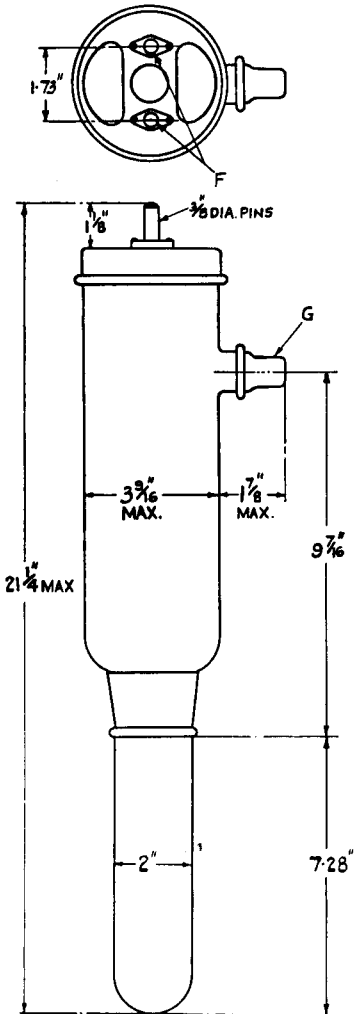
Filament voltage 19—20 volts  
(exact filament voltages for 6 amps. and 10 amps. emission are marked on bulb)  
Nominal filament current 58—61 amps.  
Total emission 6—10 amps.  
\*Impedance 4,800 ohms  
\*Amplification factor 26  
\*Mutual conductance 5.4 mA. per volt  
Grid-anode capacity 34.5  $\mu$ F.  
Anode-filament capacity 0.4  $\mu$ F.  
Grid-filament capacity 27  $\mu$ F.

\* at anode current of 1.0 amp.

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |              |
|---------------------------------------------------|--------------|
| Maximum direct anode voltage                      | 14,000 volts |
| Maximum direct anode voltage for anode modulation | 10,000 volts |
| Maximum direct anode current                      | 2.5 amps.    |
| Maximum anode dissipation                         | 12 Kw.       |
| Maximum grid dissipation                          | 250 watts    |
| Maximum frequency for above ratings               | 3 Mc.        |
| Maximum anode voltage for frequency of 6 Mc.      | 8,000 volts  |

NOTE.—The characteristics of the 4058-B Valve are identical with those of the 4058-A Valve but the grid lead has been brought out through the side of the bulb. Where the 4058-B is used to replace the 4058-A new grid connectors will be required. These connectors, type ES.5706-1, should be ordered with the valve.



# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

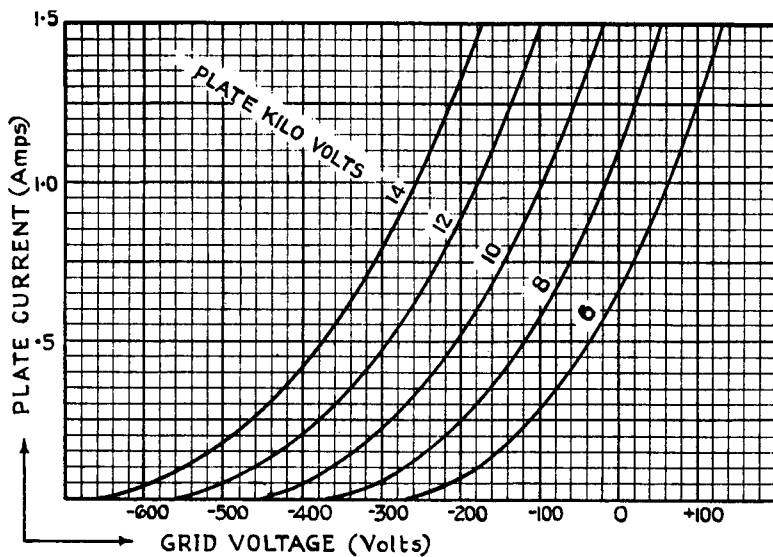
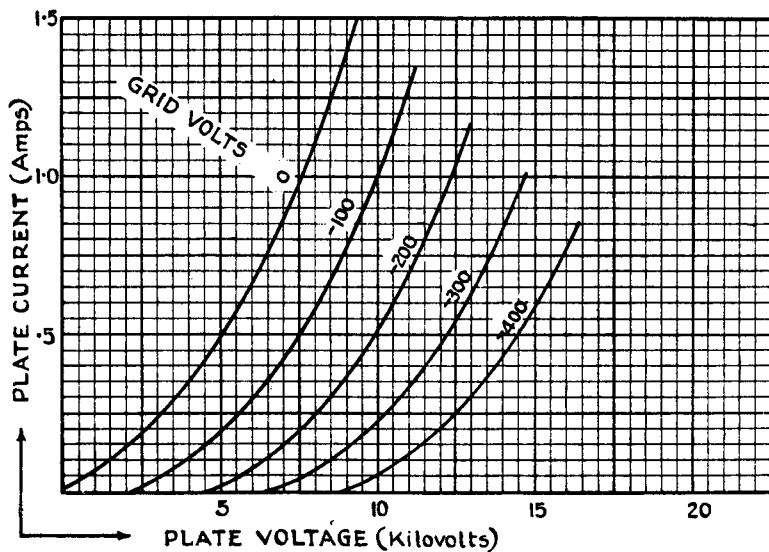
|                                                                                                                                                                                                                           | Class B A.F. Amp.<br>For balanced 2 valve circuit                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Direct anode voltage<br>Grid bias<br>Direct anode current per valve—zero signal<br>Direct anode current per valve—maximum signal<br>Load resistance—anode to anode<br>Maximum signal output—2 valves<br>Anode dissipation | 12,000 volts<br>—300 to —350 volts<br>0.4 amp.<br>2.0 amps.<br>5,400 ohms<br>26.4 Kw.<br>10.8 Kw. |

## RADIO FREQUENCY OPERATION.

|                                                                                                  | Class B<br>Telephony                    | Class C<br>Telephony                | Class C<br>Telegraphy                                                      |
|--------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------------------|----------------------------------------------------------------------------|
|                                                                                                  | Modulated<br>carrier<br>applied to grid | Subject to<br>anode<br>modulation   | Unmodulated                                                                |
| Direct anode voltage<br>Direct anode current<br>Grid bias<br>Anode dissipation<br>Carrier output | 12,000<br>1.25<br>—420<br>10<br>5       | 8,000<br>1.25<br>—700<br>3.3<br>6.7 | 12,000 volts<br>2.5 amps.<br>—1,100 to<br>—1,750 volts<br>10 Kw.<br>20 Kw. |

# —Standard Valves—

4058-B  
Valve



PRINTED IN  
ENGLAND

# —Standard Valves—

4059-A  
Valve

## 4059-A VALVE

HALF WAVE RADIATION COOLED THERMIONIC RECTIFIER.

### SPECIFICATION.

#### Cathode.

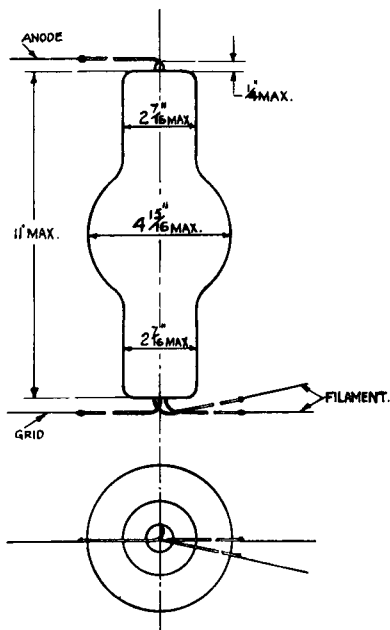
Pure Tungsten filament.  
Constant voltage type.

#### Dimensions.

|                  |                                |
|------------------|--------------------------------|
| Neck diameter    | $2\frac{7}{16}$ " (6.2 cms.)   |
| Overall length   | 11" (28 cms.)                  |
| Overall diameter | $4\frac{15}{16}$ " (12.5 cms.) |
| Net weight       | 0.7 lbs. (320 gms.)            |

#### Constants.

|                                      |              |
|--------------------------------------|--------------|
| Filament voltage                     | 12.5 volts   |
| Nominal filament current             | 6 amps.      |
| Total emission                       | 0.4 amps.    |
| Maximum peak inverse voltage         | 25,000 volts |
| Maximum peak anode current           | 350 mA.      |
| Maximum continuous anode dissipation | 300 watts    |

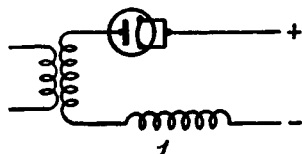
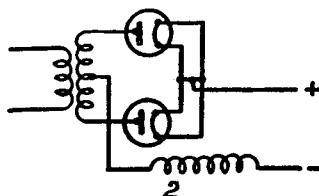
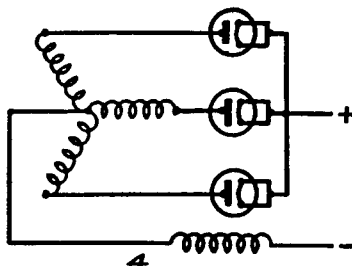
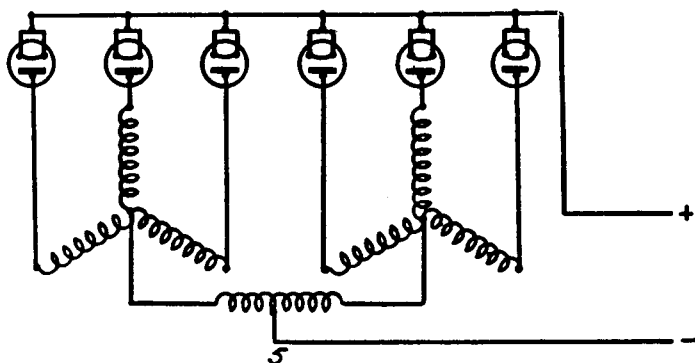




# —Standard Valves—

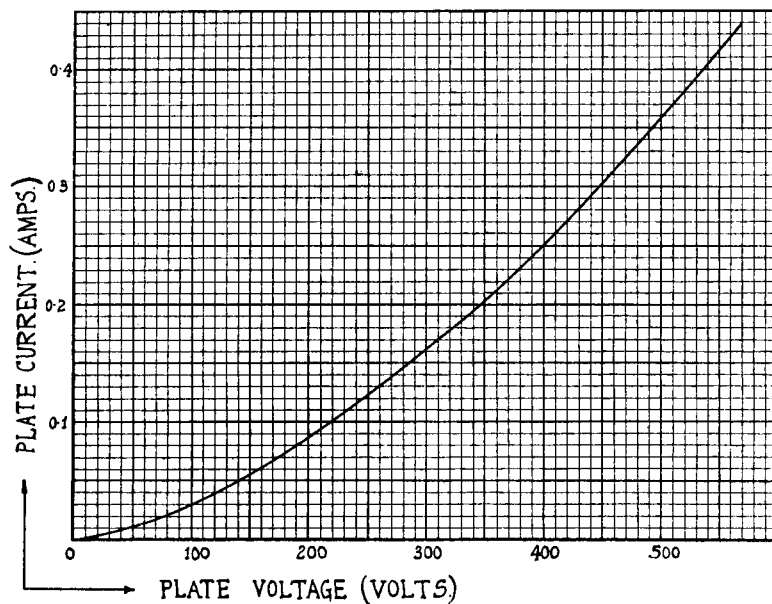
## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of valves | Load potential in volts | Load current in amps. |
|---------|------------------|-------------------------|-----------------------|
| 1       | 1                | 3,750                   | 0.12                  |
| 2       | 2                | 7,500                   | 0.23                  |
| 4       | 3                | 10,000                  | 0.35                  |
| 5       | 6                | 10,000                  | 0.7                   |



# *—Standard Valves—*

4059-A  
Valve



V.4059-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4060-A  
Valve

## 4060-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

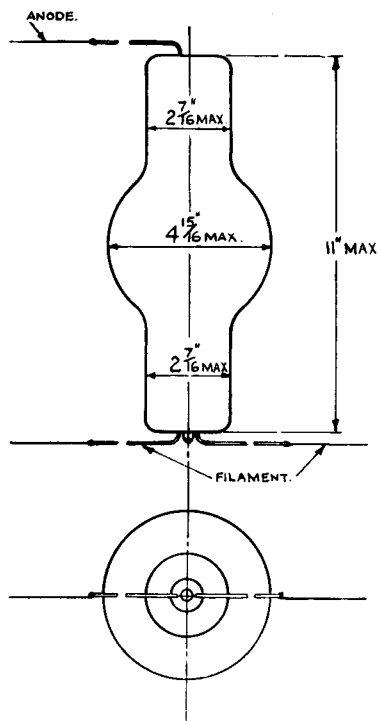
#### Dimensions.

|                  |                                |
|------------------|--------------------------------|
| Neck diameter    | $2\frac{7}{16}$ " (6.2 cms.)   |
| Overall length   | 11" (28 cms.)                  |
| Maximum diameter | $4\frac{15}{16}$ " (12.5 cms.) |
| Net weight       | 0.85 lbs. (390 gms.)           |

#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 12.5 volts             |
| Nominal filament current | 6 amps.                |
| Total emission           | 0.4 amps.              |
| *Impedance               | 17,000 ohms            |
| *Amplification factor    | 20                     |
| Grid-anode capacity      | 6 $\mu\mu\text{F}$ .   |
| Anode-filament capacity  | 0.4 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 7 $\mu\mu\text{F}$ .   |

\* at  $V_p = 2,000$   $V_g = 0$



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |             |
|-------------------------------------|-------------|
| Maximum direct anode voltage        | 4,000 volts |
| Maximum direct anode current        | 0.110 amps. |
| Maximum anode dissipation           | 200 watts   |
| Maximum direct grid current         | 0.030 amps. |
| Maximum frequency for above ratings | 10 Mc.      |

V. 4060-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

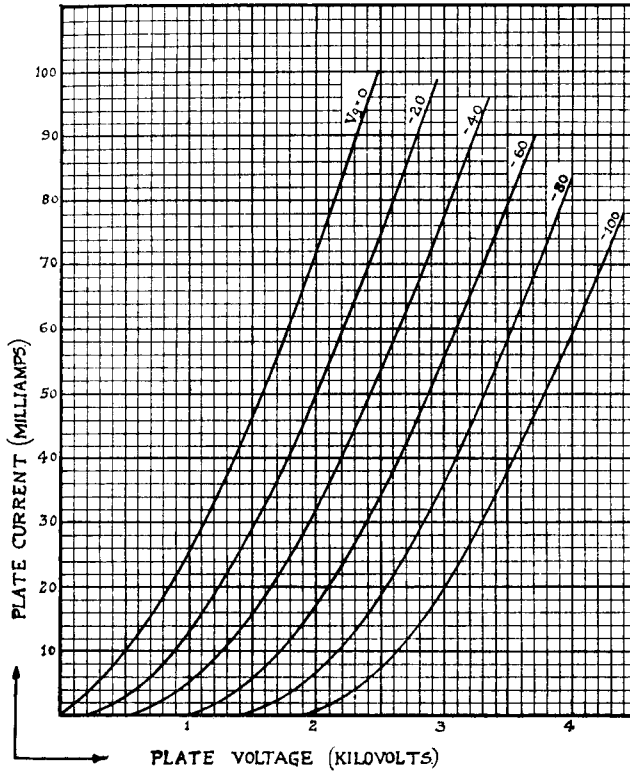
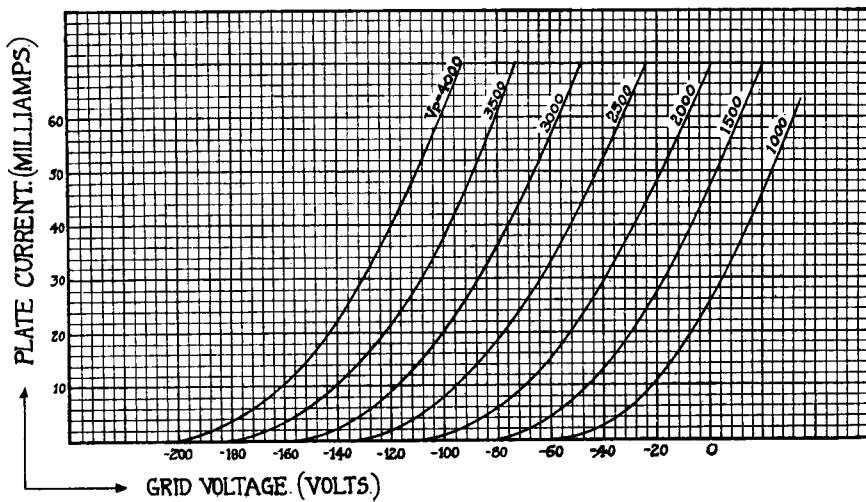
|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |
|----------------------------------------|------------------------------------------------------------|
| Direct anode voltage                   | 4,000 volts                                                |
| Grid bias                              | —120 to —160 volts                                         |
| Anode current per valve—zero signal    | 0.014 amps.                                                |
| Anode current per valve—maximum signal | 0.070 amps.                                                |
| Anode dissipation                      | 125 watts                                                  |
| Load resistance—anode to anode         | 50,000 ohms                                                |
| Maximum output—2 valves                | 300 watts                                                  |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 4,000                                   | 3,000                             | 4,000 volts           |
| Direct anode current | 0.056                                   | 0.075                             | 0.081 amps.           |
| Grid bias            | —180                                    | —300                              | —300 to<br>—500 volts |
| Anode dissipation    | 150                                     | 75                                | 110 watts             |
| Carrier output       | 75                                      | 150                               | 220 watts             |

# —Standard Valves—

4060 A  
Valve



V.4060-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4061-A  
Valve

## 4061-A VALVE

PENTODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

American medium 7-pin.

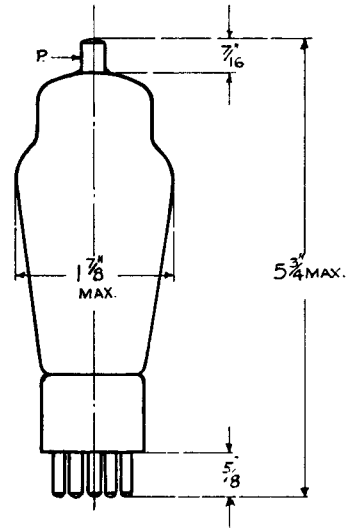
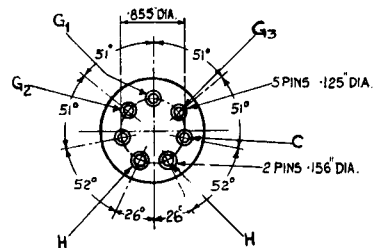
#### Dimensions.

Overall length  $5\frac{3}{4}$ " (14.6 cms.)  
Maximum diameter  $1\frac{7}{8}$ " (4.6 cms.)  
Net weight 0.17 lbs. (77 gms.)

#### Constants.

Heater voltage 6.3 volts  
Nominal heater current 0.8 amps.  
\*Impedance 200,000 ohms  
\*Amplification factor 500  
Grid-anode capacity 0.02  $\mu\mu\text{F}$ .  
Input capacity 10  $\mu\mu\text{F}$ .  
Output capacity 10  $\mu\mu\text{F}$ .

\* at  $V_p = 400$   $V_{g1} = -16.5$   
 $V_{g2} = 200$   $V_{g3} = 0$



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |           |
|-------------------------------------|-----------|
| Maximum direct anode voltage        | 500 volts |
| Maximum direct screen voltage       | 250 volts |
| Maximum direct suppressor voltage   | 45 volts  |
| Maximum anode dissipation           | 10 watts  |
| Maximum screen dissipation          | 8 watts   |
| Maximum direct control grid current | 10 mA.    |
| Maximum RF control grid current     | 4 amps.   |

*Tentative data*

V.4061-A.1  
Nov. 1937



# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Class B Telephony — R.F. Amp. |             |
|-------------------------------|-------------|
| Direct anode voltage          | 500 volts   |
| Direct screen voltage         | 200 volts   |
| Direct control grid voltage   | —38 volts   |
| Direct suppressor voltage     | 0 volts     |
| Peak RF input                 | 80 volts    |
| Anode current                 | 30 mA.      |
| Screen current                | 12 mA.      |
| Screen resistor               | 25,000 ohms |
| Driving power                 | 0.24 watts  |
| Peak output                   | 20 watts    |
| Carrier output                | 5 watts     |

## RADIO FREQUENCY OPERATION.

| Class C Telephony — Control grid Modulated |        |             |
|--------------------------------------------|--------|-------------|
| Direct anode voltage                       | 500    | 500 volts   |
| Direct screen voltage                      | 200    | 200 volts   |
| Direct control grid voltage                | —125   | —125 volts  |
| Direct suppressor voltage                  | 0      | 45 volts    |
| Anode current                              | 32     | 34 mA.      |
| Screen current                             | 20     | 20 mA.      |
| Screen resistor                            | 20,000 | 20,000 ohms |
| Control grid current                       | 1.5    | 1.5 mA.     |
| Peak RF input voltage ( $V_{g1}$ )         | 150    | 150 volts   |
| Peak AF input volts ( $V_{g1}$ )           | 45     | 45 volts    |
| AF power                                   | 0.5    | 0.55 watts  |
| Peak RF input power                        | 1.2    | 1.3 watts   |
| Peak output                                | 22     | 26 watts    |
| Carrier output                             | 5.5    | 6.5 watts   |

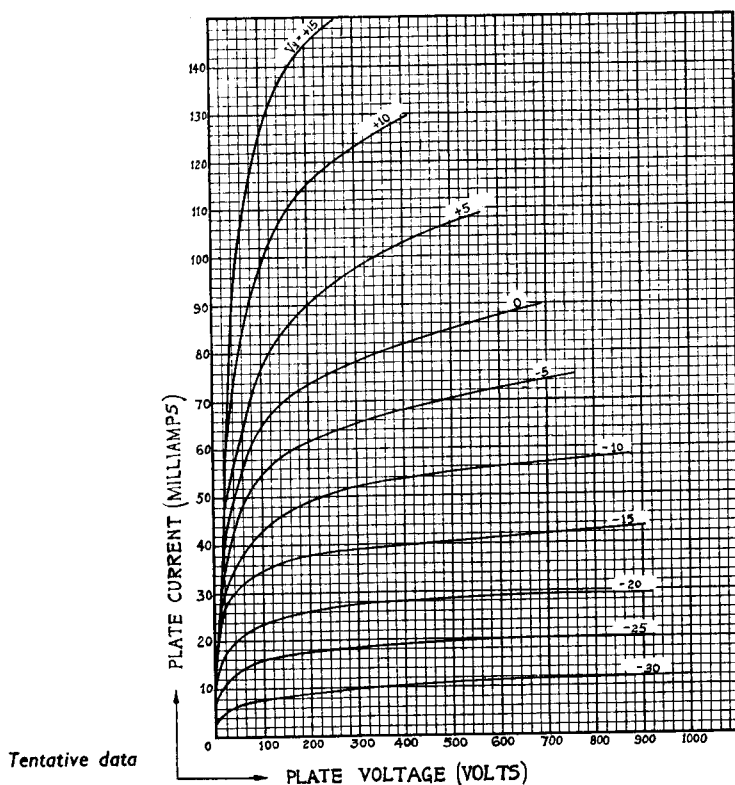
| Class C Telegraphy — Unmodulated.<br>RF Amp. and Osc. |       |            |
|-------------------------------------------------------|-------|------------|
| Direct anode voltage                                  | 500   | 500 volts  |
| Direct screen voltage                                 | 200   | 200 volts  |
| Direct control grid voltage                           | —90   | —90 volts  |
| Direct suppressor voltage                             | 0     | 45 volts   |
| Anode current                                         | 50    | 55 mA.     |
| Screen current                                        | 40    | 35 mA.     |
| Screen resistor                                       | 7,500 | 8,500 ohms |
| Control grid current                                  | 6     | 6 mA.      |
| Peak RF input volts                                   | 135   | 135 volts  |
| RF input power                                        | 0.8   | 0.8 watts  |
| Output                                                | 18    | 24 watts   |

# —Standard Valves—

4061-A  
Valve

| Class C Telephony, Suppressor<br>and Screen modulated |            |            |
|-------------------------------------------------------|------------|------------|
|                                                       | Suppressor | Screen     |
| Direct anode voltage                                  | 500        | 500 volts  |
| Direct screen voltage                                 | 200        | 200 volts  |
| Direct control grid voltage                           | —90        | —90 volts  |
| Direct suppressor voltage                             | —45        | —40 volts  |
| Peak AF suppressor voltage                            | 75         | 75 volts   |
| Peak AF screen voltage                                | 0          | 100 volts  |
| Peak RF input                                         | 135        | 135 volts  |
| Anode current                                         | 32         | 35 mA.     |
| Screen current                                        | 40         | 40 mA.     |
| Screen resistor                                       | 7,500      | 7,500 ohms |
| Control grid current                                  | 6          | 6 mA.      |
| RF input power                                        | 0.82       | 0.82 watts |
| AF power                                              | 0.30       | 0.75 watts |
| Peak output                                           | 22         | 26 watts   |
| Carrier output                                        | 5.5        | 6.5 watts  |

These curves are taken with  $V_H = 6.3$  volts,  $V_{g_2} = 200$  volts,  $V_{g_3} = 0$  volts.



V.4061-A.2  
Sept. 1938.

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# —Standard Valves—

4062-A  
Valve

## 4062-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated Tungsten filament.  
Constant voltage type.

#### Base.

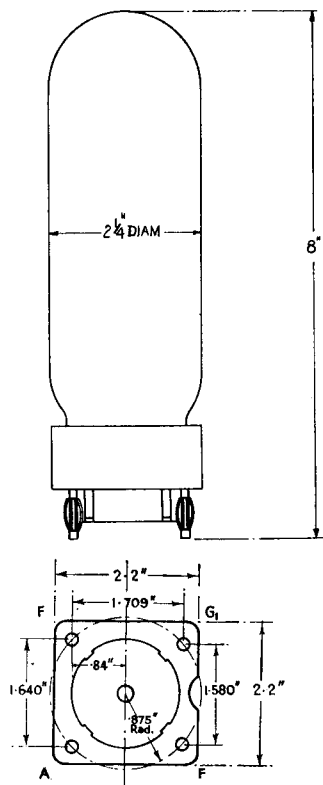
Special 4-pin low loss.

#### Dimensions.

|                |                            |
|----------------|----------------------------|
| Overall length | 8" (20.3 cms.)             |
| Bulb diameter  | $2\frac{1}{4}"$ (5.7 cms.) |
| Net weight     | 0.5 lbs. (230 gms.)        |

#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 12 volts               |
| Nominal filament current | 1.85 amps.             |
| Impedance                | 22,000 ohms            |
| Amplification factor     | 22                     |
| Grid-anode capacity      | 13 $\mu\mu\text{F}$ .  |
| Anode-filament capacity  | 5.3 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 6 $\mu\mu\text{F}$ .   |



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |             |
|-------------------------------------|-------------|
| Maximum direct anode voltage        | 2,000 volts |
| Maximum direct anode current        | 0.123 amps. |
| Maximum anode dissipation           | 75 watts    |
| Maximum direct grid current         | 0.030 amps. |
| Maximum frequency for above ratings | 15 Mc.      |

V.4062-A.1  
Nov. 1937

*—Standard Valves—*

**TYPICAL OPERATING CONDITIONS.**

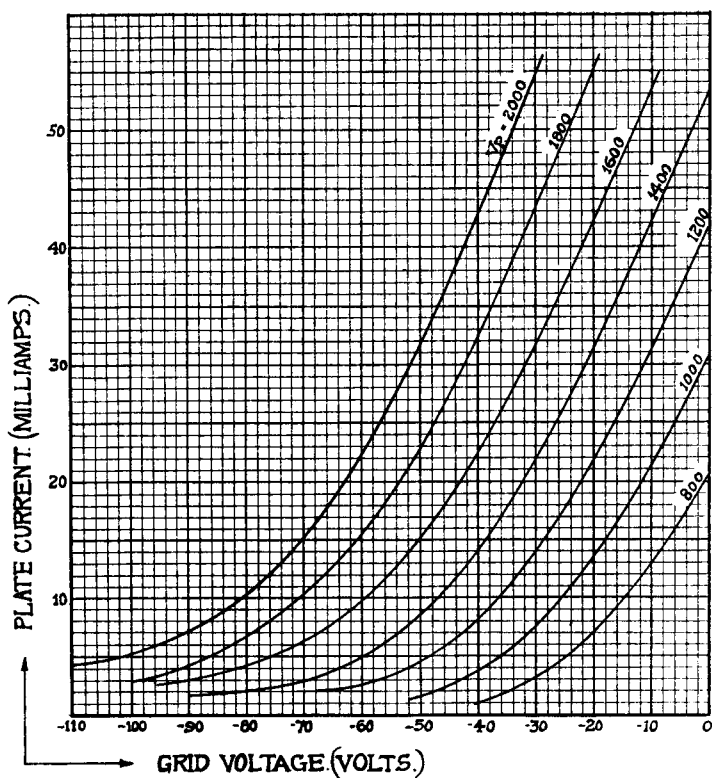
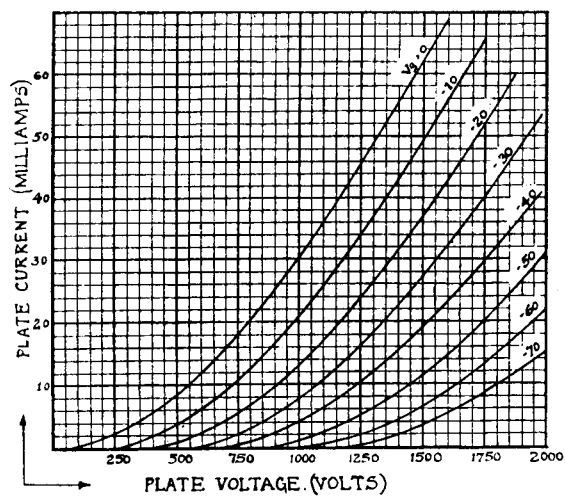
|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |
|----------------------------------------|------------------------------------------------------------|
| Direct anode voltage                   | 2,000 volts                                                |
| Grid bias                              | —50 to —60 volts                                           |
| Anode current per valve—zero signal    | 0.014 amps.                                                |
| Anode current per valve—maximum signal | 0.070 amps.                                                |
| Anode dissipation                      | 65 watts                                                   |
| Load resistance—anode to anode         | 25,000 ohms                                                |
| Maximum output—2 valves                | 150 watts                                                  |

**RADIO FREQUENCY OPERATION.**

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 2,000                                   | 1,500                             | 2,000 volts           |
| Direct anode current | 0.056                                   | 0.075                             | 0.081 amps.           |
| Grid bias            | —95                                     | —200                              | —300 to<br>—500 volts |
| Anode dissipation    | 75                                      | 37.5                              | 55 watts              |
| Carrier output       | 37.5                                    | 75                                | 110 watts             |

# —Standard Valves—

4062-A  
Valve



V.4062-A.2  
Nov. 1937

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# —Standard Valves—

4063 AB Valve  
-YB Valve

## 4063-AB AND 4063-YB VALVES

HIGH VACUUM CATHODE RAY TUBES.

### SPECIFICATION.

| Dimensions.                               | 4063-AB.                                                                                                                                                    | 4063-YB.                                                                                                                  |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Maximum overall length                    | 21" (53.5 cms.)                                                                                                                                             | 21" (53.5 cms.)                                                                                                           |
| Maximum diameter                          | 6 $\frac{1}{4}$ " (15.6 cms.)                                                                                                                               | 6 $\frac{1}{4}$ " (15.6 cms.)                                                                                             |
| Screen diameter                           | 5.5" (14 cms.)                                                                                                                                              | 5.5" (14 cms.)                                                                                                            |
| Net weight                                | 2 $\frac{1}{2}$ lbs. (1,100 gms.)                                                                                                                           | 2.65 lbs. (1,200 gms.)                                                                                                    |
| Base.                                     | Special 12 contact.                                                                                                                                         | Special 12 contact.                                                                                                       |
| Screen Colour.                            | Blue.                                                                                                                                                       | Blue.                                                                                                                     |
| Constants.                                |                                                                                                                                                             |                                                                                                                           |
| Heater voltage                            | 2 volts                                                                                                                                                     | 2 volts                                                                                                                   |
| Nominal heater current                    | 1.8—2 amps.                                                                                                                                                 | 1.8—2 amps.                                                                                                               |
| Maximum final anode voltage               | 5,000 volts                                                                                                                                                 | 5,000 volts                                                                                                               |
| *Sensitivity (approx.)                    | $\left\{ \begin{array}{l} \text{x plates } \frac{600}{V_{a3}} \text{ mm./volt} \\ \text{y plates } \frac{700}{V_{a3}} \text{ mm./volt} \end{array} \right.$ | $\left\{ \begin{array}{l} \frac{600}{V_{a3}} \text{ mm./volt} \\ \frac{700}{V_{a3}} \text{ mm./volt} \end{array} \right.$ |
| Maximum Input power to screen             | 0.01 watts per sq. cm.                                                                                                                                      | 0.01 watts per sq. cm.                                                                                                    |
| Capacities (approx.)                      |                                                                                                                                                             |                                                                                                                           |
| x <sub>1</sub> to x <sub>2</sub>          | 2.0 $\mu\mu\text{F.}$                                                                                                                                       | 2.0 $\mu\mu\text{F.}$                                                                                                     |
| x <sub>1</sub> or x <sub>2</sub> to E     | 16 $\mu\mu\text{F.}$                                                                                                                                        | 16.0 $\mu\mu\text{F.}$                                                                                                    |
| y <sub>1</sub> to y <sub>2</sub>          | 1.1 $\mu\mu\text{F.}$                                                                                                                                       | 1.2 $\mu\mu\text{F.}$                                                                                                     |
| y <sub>1</sub> or y <sub>2</sub> to E     | 10 $\mu\mu\text{F.}$                                                                                                                                        | 3.5 $\mu\mu\text{F.}$                                                                                                     |
| G to E                                    | 18 $\mu\mu\text{F.}$                                                                                                                                        | 18.0 $\mu\mu\text{F.}$                                                                                                    |
| Conductance of any plate pair             | < $\frac{1}{10} \mu\text{Mho.}$                                                                                                                             | < $\frac{1}{10} \mu\text{Mho.}$                                                                                           |
| * V <sub>a3</sub> is third anode voltage. |                                                                                                                                                             |                                                                                                                           |

### OPERATING CONDITIONS.

|                                  |                                                          |
|----------------------------------|----------------------------------------------------------|
| 3rd anode voltage                | 5,000 volts                                              |
| 2nd " "                          | approx. 0.27 $\times$ V <sub>a3</sub> (adjust for focus) |
| 1st " "                          | 150 volts                                                |
| Grid bias for maximum brilliancy | 0 to —5 volts                                            |
| " " cut-off                      | —30 volts (approx.)                                      |
| " " base for modulation          | 30 volts                                                 |

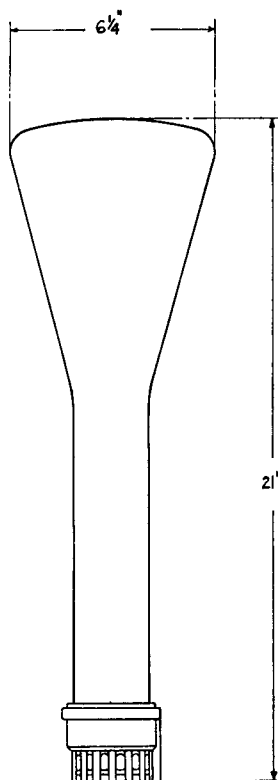
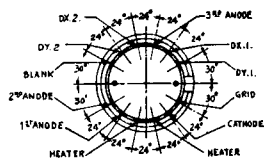
Tentative data

MC.4063-A.1  
March 1939

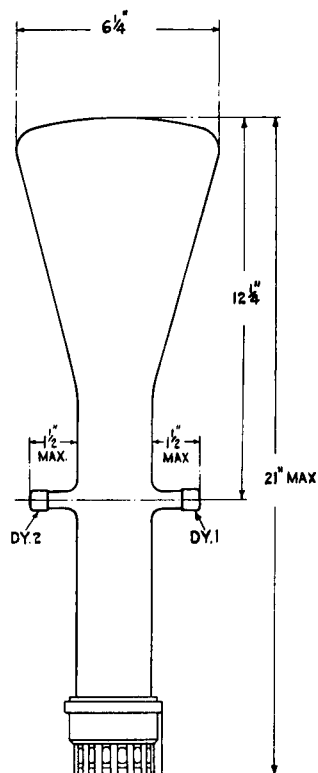
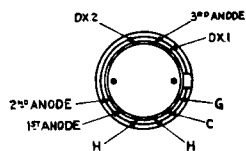


4063 AB Valve  
-YB Valve

# —Standard Valves—



4063-AB.



4063-YB.

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# —Standard Valves—

4064-A Valve  
-B Valve

## 4064-A AND 4064-B VALVES

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

### SPECIFICATION.

#### Cathode.

Oxide coated filament (Shielded).  
Constant voltage type.

#### Base.

4064-A Edison screw Goliath.  
4064-B Large 4-pin bayonet.

#### Dimensions.

|                     | 4064-A                        | 4064-B                        |
|---------------------|-------------------------------|-------------------------------|
| Max. Overall length | 9 $\frac{1}{8}$ " (24.1 cms.) | 8 $\frac{1}{3}$ " (21.6 cms.) |
| Max. diameter       | 2.32" (5.9 cms.)              | 2.32" (5.9 cms.)              |
| Anode cap           | Type D.                       | Type C.                       |

#### Constants.

|                                     |                          |
|-------------------------------------|--------------------------|
| Filament voltage                    | 5 volts                  |
| Nominal filament current            | 6.75 amps.               |
| Maximum peak anode current          | 5 amps.                  |
| Max. peak inverse voltage           | 10,000 volts             |
| Max. Av. anode current              | 1.25 amps.               |
| Ambient temperature range           | 5°C. min.<br>70°C. max.  |
| Condensed mercury temperature range | 20°C. min.<br>70°C. max. |

#### Recommended Temperature Conditions.

|                     | Peak Inverse Voltage.     |                        |
|---------------------|---------------------------|------------------------|
|                     | Less than<br>5,000 volts. | 5,000—10,000<br>volts. |
| Natural ventilation | 15°C.—55°C.               | 15°C.—45°C.            |
| Forced ventilation  | 15°C.—70°C.               | 15°C.—60°C.            |

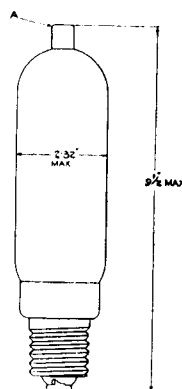
#### Cathode Heating Time.

|                     |            |             |                    |
|---------------------|------------|-------------|--------------------|
| Ambient temperature | 5°C.—10°C. | 10°C.—15°C. | greater than 15°C. |
| Heating period      | 10         | 5           | 1* mins.           |

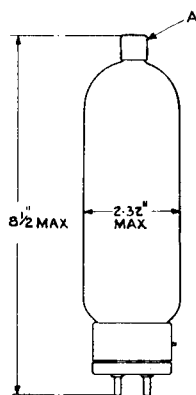
\* This time may be reduced to 30 seconds if absolutely essential.

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

Tentative data



4064-A



4064-B

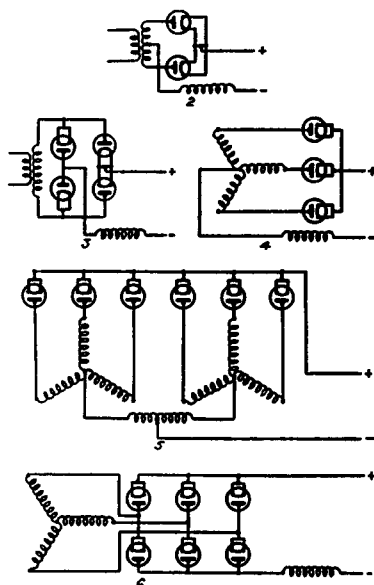


V.4064-A-1  
Sept. 1938

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of Valves | Approx. D.C. Output volts | Max. D.C. Load Current |
|---------|------------------|---------------------------|------------------------|
| 2       | 2                | 3200 volts                | 2.5 amps.              |
| 3       | 4                | 6400 "                    | 2.5 "                  |
| 4       | 3                | 4550 "                    | 3.75 "                 |
| 5       | 6                | 4550 "                    | 7.5 "                  |
| 6       | 6                | 9100 "                    | 3.75 "                 |



### Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.I.

# —Standard Valves—

4065-A  
Valve

## 4065-A VALVE

DIODE.

### SPECIFICATION.

#### Cathode.

Pure tungsten filament.  
Constant voltage type.

#### Base.

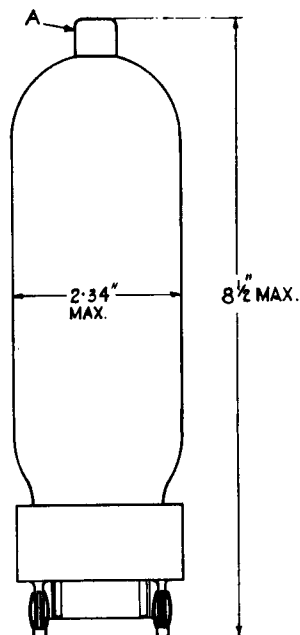
Special 4-pin low loss.  
Anode connected to top cap type C.

#### Dimensions.

Max. overall length  $8\frac{1}{2}"$  (21.6 cms.)  
Max. bulb diameter  $2.34"$  (6.0 cms.)  
Net weight 0.5 lbs. (225 gms.)

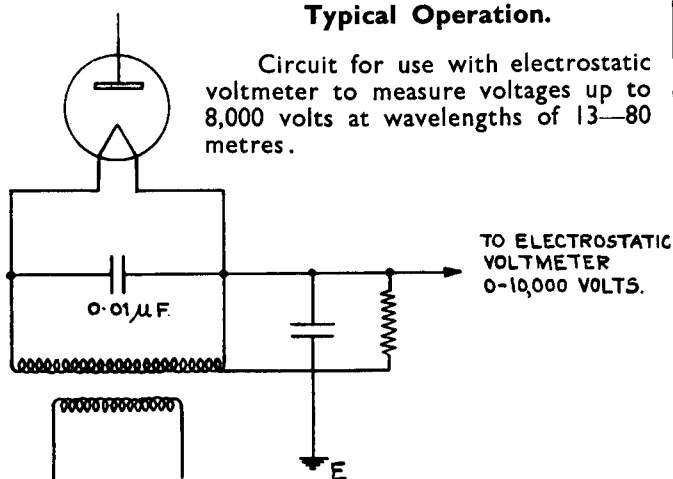
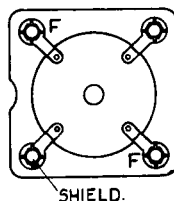
#### Constants.

Filament voltage 2.5 volts  
Nominal filament current 8 amps.  
Maximum direct current 1 mA.  
Maximum inverse peak voltage 20,000 volts



### Typical Operation.

Circuit for use with electrostatic voltmeter to measure voltages up to 8,000 volts at wavelengths of 13—80 metres.



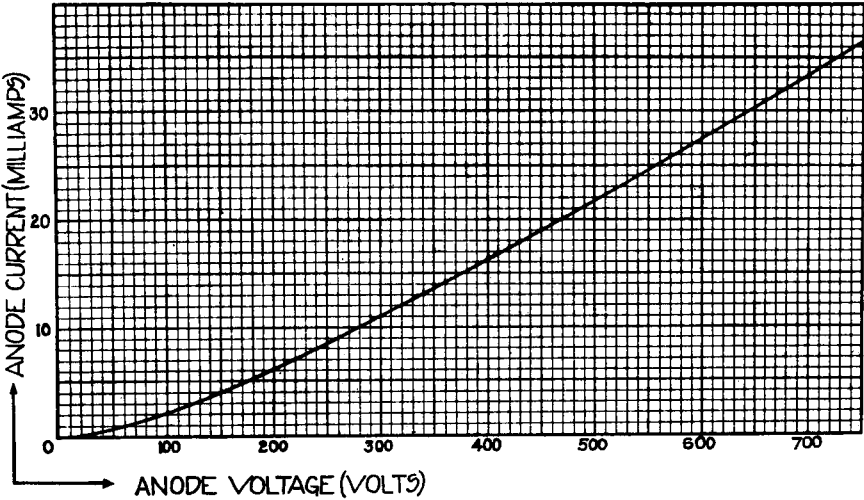
Transformer insulation resistance to earth to be at least 20,000 megohms.  
Suitable transformer for operation from 240 volt mains is the 4600-12 transformer.

Tentative data

V.4065-A.1  
March, 1939

4065-A  
Valve

*—Standard Valves—*



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# *—Standard Valves—*

4066-A  
Valve

## 4066-A VALVE

PENTODE.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

Standard British 7-pin.

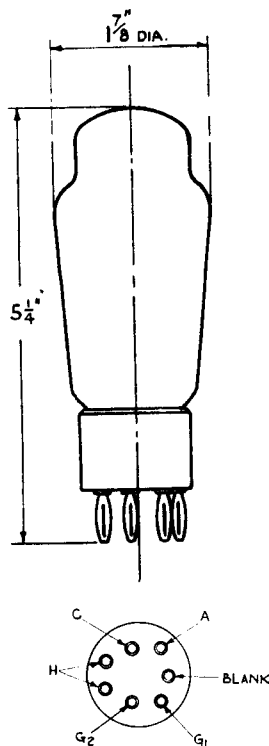
#### Dimensions.

|                  |                             |
|------------------|-----------------------------|
| Overall length   | $5\frac{1}{4}"$ (13.3 cms.) |
| Maximum diameter | $1\frac{7}{8}"$ (4.7 cms.)  |
| Net weight       | 0.13 lbs. (60 gms.)         |

#### Constants.

|                        |                     |
|------------------------|---------------------|
| Heater voltage         | 4 volts             |
| Nominal heater current | 2 amps.             |
| *Impedance             | 60,000 ohms         |
| *Amplification factor  | 600                 |
| Grid-anode capacity    | $1.6 \mu\text{F.}$  |
| Input capacity         | $17.5 \mu\text{F.}$ |
| Output capacity        | $10.3 \mu\text{F.}$ |

\*  $V_p = V_{g_2} = 250$  volts,  $V_{g_1} = -6$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

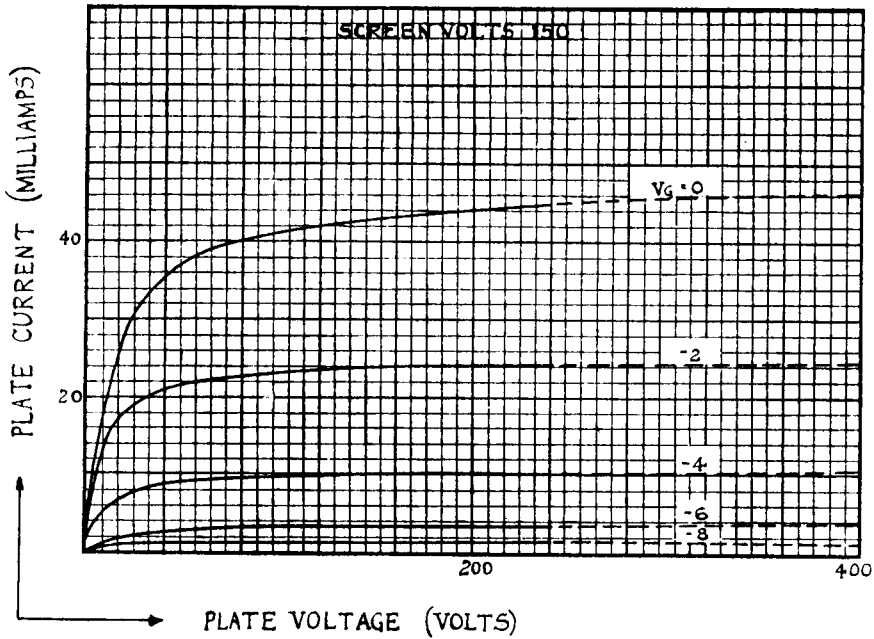
|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 250 volts |
| Maximum direct anode current | 40 mA.    |
| Maximum screen voltage       | 250 volts |

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# —Standard Valves—

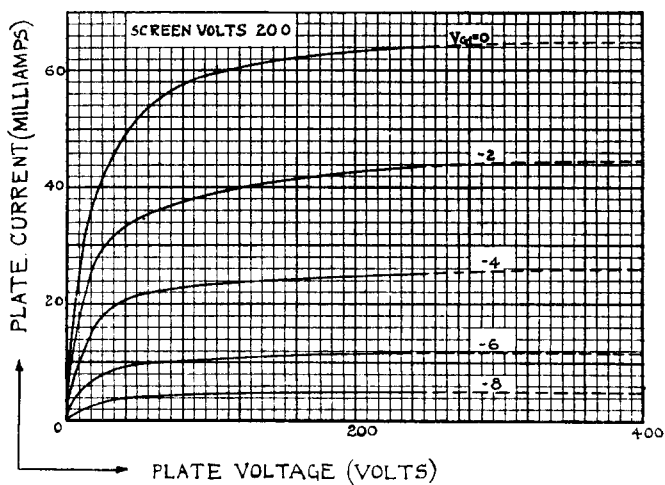
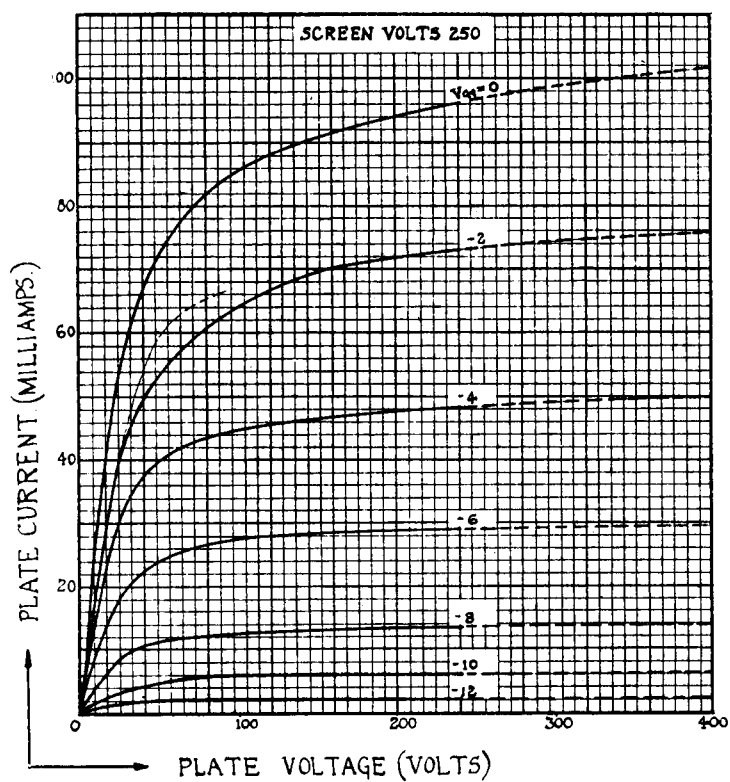
## TYPICAL OPERATING CONDITIONS.

|                     |        |        |              |
|---------------------|--------|--------|--------------|
| Anode voltage       | 250    | 200    | 150 volts    |
| Control grid bias   | —6     | —4     | —2 volts     |
| Screen grid voltage | 250    | 200    | 150 volts    |
| Anode current       | 29     | 24.5   | 23 mA.       |
| Anode resistance    | 60,000 | 80,000 | 100,000 ohms |
| Load                | 3,900  | 5,800  | 9,000 ohms   |
| Output              | 2.75   | 1.45   | 0.75 watts   |
| 2nd harmonic—%      | 10     | 9.3    | 2            |
| —db                 | 20     | 21     | 34           |



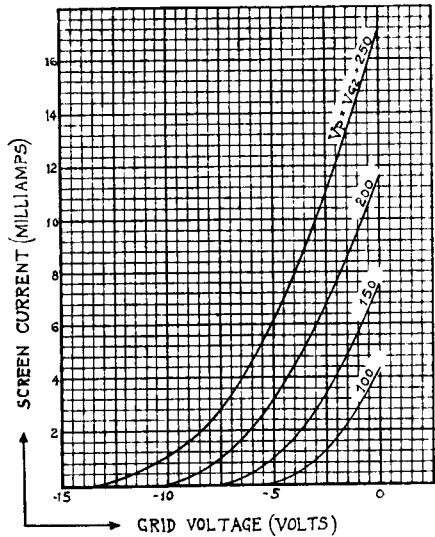
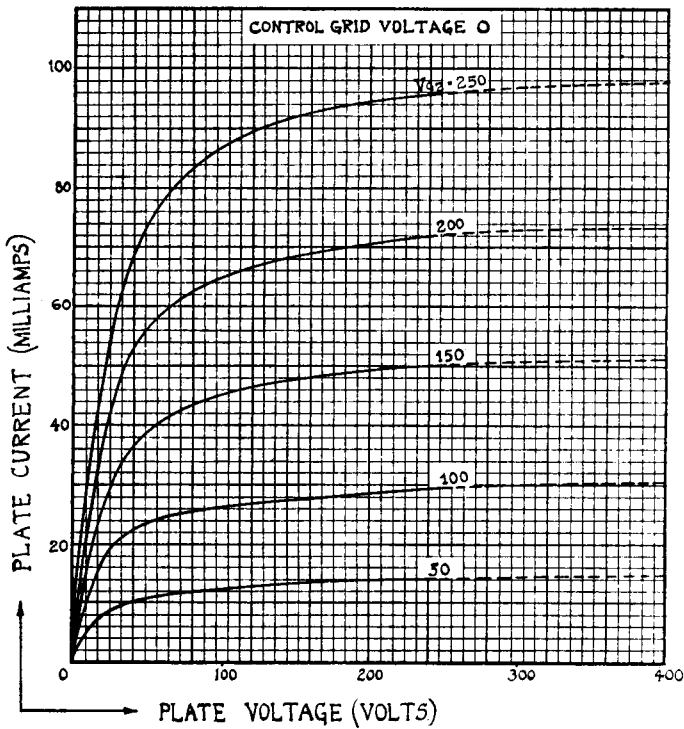
# *—Standard Valves—*

4066-A  
Valve





*—Standard Valves—*



# —Standard Valves—

4069-A  
Valve

## 4069-A VALVE

PENTODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Base.

American Giant 5-pin.

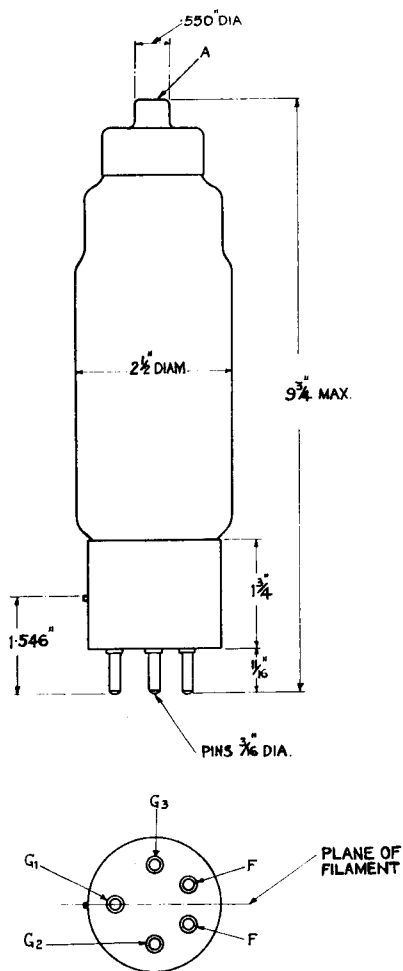
#### Dimensions.

|                     |                               |
|---------------------|-------------------------------|
| Max. overall length | 9 $\frac{3}{4}$ " (24.7 cms.) |
| Bulb diameter       | 2 $\frac{1}{2}$ " (6.4 cms.)  |
| Anode cap diameter  | 0.55" (1.4 cms.)              |
| Net weight          | 0.75 lbs. (340 gms.)          |

#### Constants.

|                          |                  |
|--------------------------|------------------|
| Filament voltage         | 10 volts         |
| Nominal filament current | 5.4 amps.        |
| *Mutual conductance      | 4.5 mA. per volt |
| Grid-anode capacity      | 0.02 $\mu$ F.    |
| Input capacity           | 15.5 $\mu$ F.    |
| Output capacity          | 5.5 $\mu$ F.     |

\* at  $V_p = 2,000$  volts,  $V_{g2} = 400$  volts,  
 $V_{g1} = -20$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |             |
|-------------------------------------|-------------|
| Maximum direct anode voltage        | 2,000 volts |
| Maximum direct screen voltage       | 400 volts   |
| Maximum direct suppressor voltage   | 45 volts    |
| Maximum anode dissipation           | 100 watts   |
| Maximum screen dissipation          | 35 watts    |
| Maximum direct control grid current | 25 mA.      |
| Maximum RF control grid current     | 8 amps.     |

Tentative data

V.4069-A.1  
Sept. 1938

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Class B Telephony           |             |
|-----------------------------|-------------|
| Direct anode voltage        | 2,000 volts |
| Direct screen voltage       | 400 volts   |
| Direct control grid voltage | —38 volts   |
| Direct suppressor voltage   | 0 volts     |
| Peak RF input               | 90 volts    |
| Anode current               | 75 mA.      |
| Screen current              | 30 mA.      |
| Screen resistor             | 55,000 ohms |
| Driving power               | 0.9 watts   |
| Peak output                 | 200 watts   |
| Carrier output              | 50 watts    |

## RADIO FREQUENCY OPERATION.

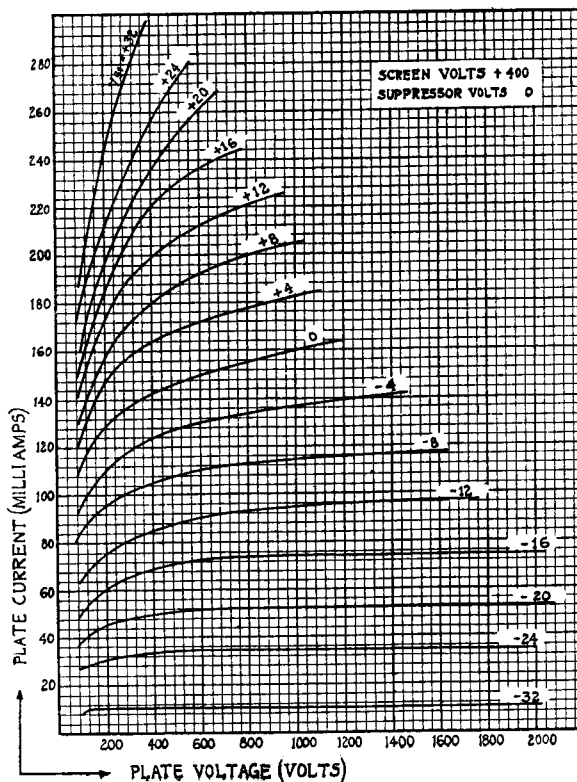
| Class C Telephony — Control grid modulated |             |
|--------------------------------------------|-------------|
| Direct anode voltage                       | 2,000 volts |
| Direct screen voltage                      | 400 volts   |
| Direct control grid voltage                | —140 volts  |
| Direct suppressor voltage                  | 0 volts     |
| Anode current                              | 85 mA.      |
| Screen current                             | 20 mA.      |
| Screen resistor                            | 80,000 ohms |
| Control grid current                       | 2.8 mA.     |
| Peak RF input voltage ( $V_{g1}$ )         | 170 volts   |
| Peak AF input voltage ( $V_{g1}$ )         | 60 volts    |
| AF power                                   | 1.0 watts   |
| Peak RF input power                        | 3.0 watts   |
| Peak output                                | 280 watts   |
| Carrier output                             | 70 watts    |

| Class C Telegraphy          |             |
|-----------------------------|-------------|
| Direct anode voltage        | 2,000 volts |
| Direct screen voltage       | 400 volts   |
| Direct control grid voltage | —100 volts  |
| Direct suppressor voltage   | 0 volts     |
| Anode current               | 120 mA.     |
| Screen current              | 75 mA.      |
| Screen resistor             | 21,000 ohms |
| Control grid current        | 10 mA.      |
| Peak RF input volts         | 180 volts   |
| RF input power              | 1.8 watts   |
| Output                      | 160 watts   |

# —Standard Valves—

4069-A  
Valve

| Class C Telephony — Suppressor and Screen modulated |            |              |
|-----------------------------------------------------|------------|--------------|
|                                                     | Suppressor | Screen       |
| Direct anode voltage                                | 2,000      | 2,000 volts  |
| Direct screen voltage                               | 400        | 400 volts    |
| Direct control grid voltage                         | —100       | —100 volts   |
| Direct suppressor voltage                           | —50        | —45 volts    |
| Peak AF suppressor voltage                          | 90         | 90 volts     |
| Peak AF screen voltage                              | 0          | 200 volts    |
| Peak RF input                                       | 180        | 180 volts    |
| Anode current                                       | 80         | 85 mA.       |
| Screen current                                      | 85         | 85 mA.       |
| Screen resistor                                     | 20,000     | 20,000 ohms. |
| Control grid current                                | 11         | 11 mA.       |
| RF input power                                      | 2.7        | 2.0 watts    |
| AF input                                            | 1.2        | 6.2 watts    |
| Peak output                                         | 240        | 280 watts    |
| Carrier output                                      | 60         | 70 watts     |



Tentative data

V.4069-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4074-A  
Valve

## 4074-A VALVE

DOUBLE TRIODE.

The characteristics given below are for one section only unless otherwise specified. Both sections of this valve are identical.

### SPECIFICATION.

#### Cathode.

Indirectly heated oxide coated.  
Constant voltage type.

#### Base.

American medium 7-pin.  
Anode connected to top cap type B.

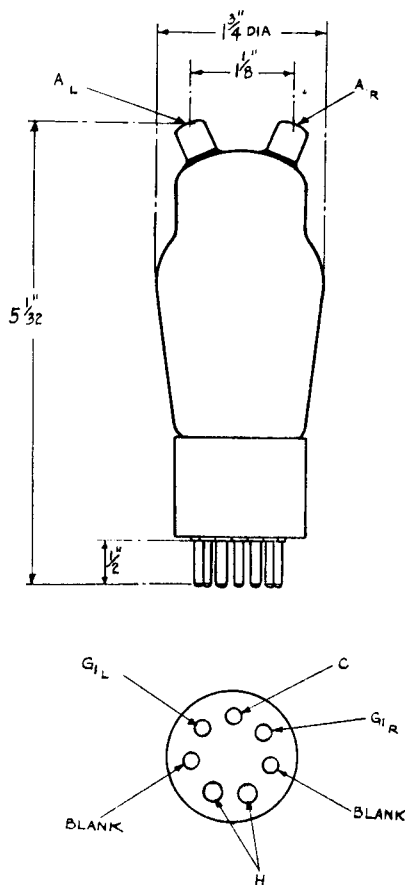
#### Dimensions.

|                     |                               |
|---------------------|-------------------------------|
| Max. overall length | $5\frac{1}{32}$ " (12.8 cms.) |
| Max. diameter       | $1\frac{13}{16}$ " (4.6 cms.) |
| Net weight          | 0.15 lbs. (68 gms.)           |

#### Constants.

|                        |                        |
|------------------------|------------------------|
| Heater voltage         | 6.3 volts              |
| Nominal heater current | 0.8 amps.              |
| *Amplification factor  | 14                     |
| *Impedance             | 4,700 ohms.            |
| *Mutual conductance    | 3.0 mA. per volt       |
| Grid-anode capacity    | 2.7 $\mu\mu\text{F}$ . |
| Grid-cathode capacity  | 6.0 $\mu\mu\text{F}$ . |
| Anode-cathode capacity | 2.1 $\mu\mu\text{F}$ . |

\* For one section measured at  $V_p = 250$  volts,  
 $V_{g1} = -7$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                           |           |
|---------------------------|-----------|
| Maximum anode voltage     | 300 volts |
| Maximum anode dissipation | 5 watts   |
| Maximum anode current     | 50 mA.    |

Tentative data.

V.4074A.1  
Sept., 1938

**—Standard Valves—**

### TYPICAL OPERATING CONDITIONS.

|                                     |                                    |
|-------------------------------------|------------------------------------|
|                                     | Class A. A.F. Amp.<br>(See Note 1) |
| Anode voltage                       | 300 volts                          |
| Grid bias                           | —13 volts                          |
| Total anode current for 2 sections  | 30 mA.                             |
| Load resistance                     | 5,000 ohms                         |
| Nominal power output for 2 sections | 0.8 watt                           |

|                                       | Class B. A.F. Amp.<br>(See Note 3) |            |
|---------------------------------------|------------------------------------|------------|
| Anode voltage                         | 180                                | 300 volts  |
| Grid bias                             | -8                                 | -16 volts  |
| Anode current per section—zero signal | 7                                  | 7 mA.      |
| maximum signal                        | 37                                 | 37 mA.     |
| Load resistance—anode to anode        | 4,000                              | 7,000 ohms |
| Peak AF grid to grid voltage          | 100                                | 120 volts  |
| Anode dissipation per section         | 3                                  | 5 watts    |
| Power output—two sections             | 7                                  | 12 watts   |

|                        |                                   |
|------------------------|-----------------------------------|
|                        | Class C Push Pull Amp.<br>or Osc. |
| Anode voltage          | 300 volts                         |
| Grid bias (See Note 2) | —36 volts                         |
| Average anode current  | 80 mA.                            |
| Grid current           | 18 mA.                            |
| Grid resistor          | 2,000 ohms                        |
| Power output           | 14 watts                          |

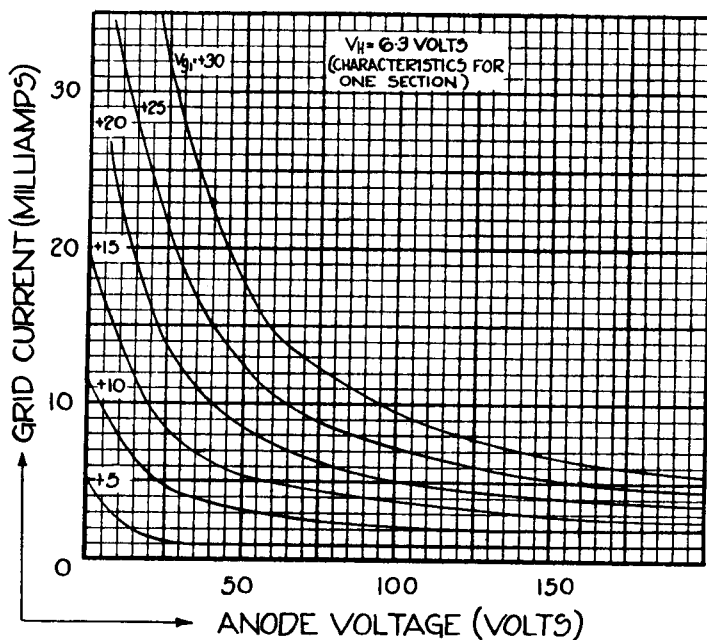
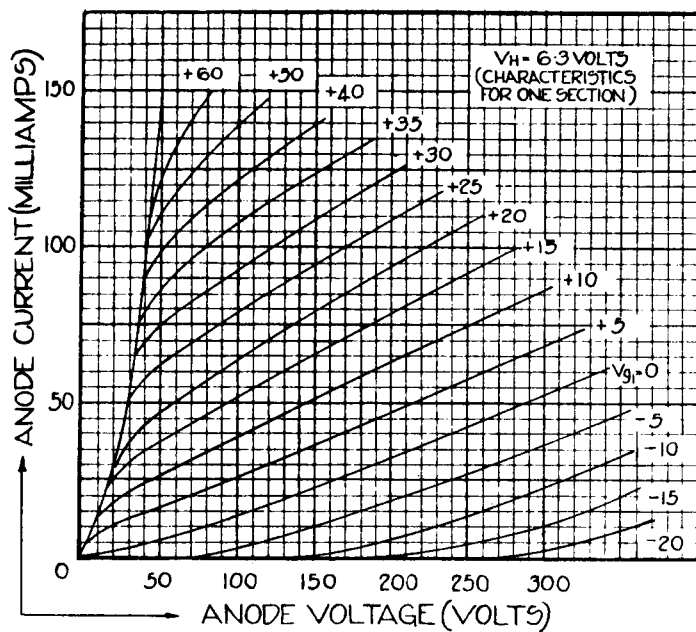
**Note 1.**—Two sections connected in parallel at the socket, anode to anode and grid to grid. The output power may be increased to 1.0 watt by connecting the two halves in push-pull.

**Note 2.**—The fixed bias should be at least 15 volts to protect the valve in case of failure to oscillate.

**Note 3.**—Two sections connected in push pull.

# —Standard Valves—

4074-A  
Valve



Tentative data

V.4074A.2  
Sept., 1938



PRINTED IN  
ENGLAND

# —Standard Valves—

4075-A  
Valve  
(VLS.61)

## 4075-A VALVE

(Previously Coded VLS.61 Valve).

HALF WAVE HIGH VACUUM RECTIFIER.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

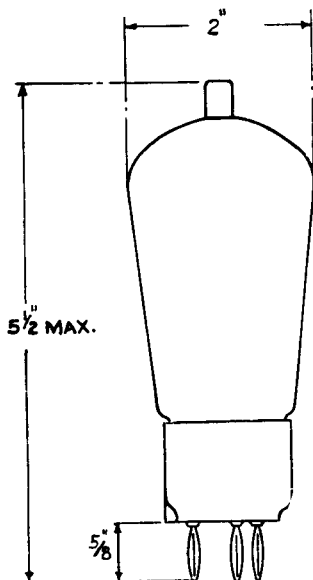
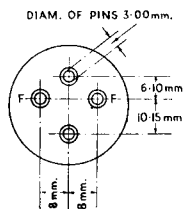
Standard British 4-pin.  
Anode connected to top cap.

#### Dimensions.

Overall length  $5\frac{1}{2}$ " (14 cms.)  
Overall diameter 2" (5.1 cms.)  
Net weight 0.12 lbs. (55 gms.)

#### Constants.

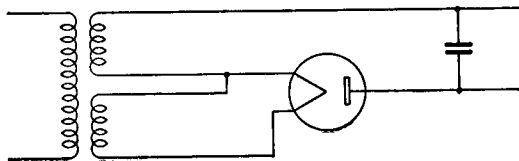
Filament voltage 2 volts  
Nominal filament current 1.2 amps.  
Maximum peak inverse voltage 15,000 volts  
Maximum peak anode current 10 mA.



### OUTPUT AS HALF WAVE RECTIFIER.

3 milliamps at 6,000 volts.

Typical Circuit :—



V.4075-A.1  
Nov. 1937

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ENGLAND

# —Standard Valves—

4077-A  
Valve

## 4077-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

### SPECIFICATION.

#### Cathode.

Shielded, oxide coated filament.  
Constant voltage type.

#### Base.

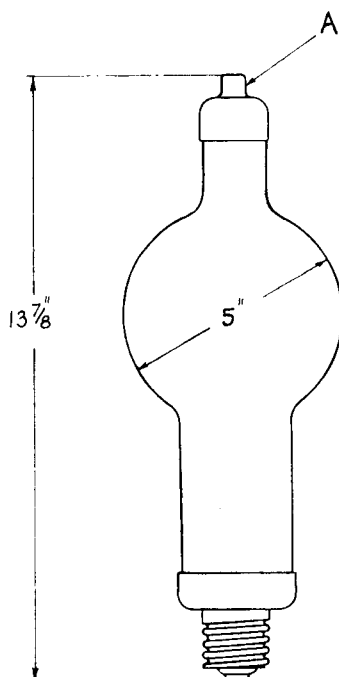
Edison screw Goliath.

#### Dimensions.

Maximum overall length  $14\frac{1}{32}$ " (35.7 cms.)  
Bulb diameter 5" (12.7 cms.)  
Net weight 0.9 lb. (410 gms.)  
Anode cap diameter 0.55" (1.4 cms.)

#### Constants.

Filament voltage 5 volts  
Filament current 10 amps.  
Max. peak anode current 5 amps.  
Max. peak inverse voltage 16,000 volts  
Max. average anode current 1.25 amps.  
Ambient temperature range  
10°C. min.  
65°C. max.  
Condensed mercury temperature range  
25°C. min.  
65°C. max.



### Recommended Ambient Temperature Conditions.

|                     | Peak Inverse Voltage. |                     |                      |                           |
|---------------------|-----------------------|---------------------|----------------------|---------------------------|
|                     | Less than<br>7,500 v. | 7,500—<br>10,000 v. | 10,000—<br>12,500 v. | Greater than<br>12,500 v. |
| Natural ventilation | 15°C.—50°C.           | 15°C.—40°C.         | —                    | —                         |
| Forced ventilation  | 15°C.—65°C.           | 15°C.—55°C.         | 15°C.—45°C.          | 15°C.—40°C.               |

### Cathode Heating Time.

Ambient temperature 10°C.—15°C. 15°C.—20°C. 20°C. and above  
Heating period 30 15 5 \* mins.

\* This time may be reduced to 1 minute if absolutely essential.

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

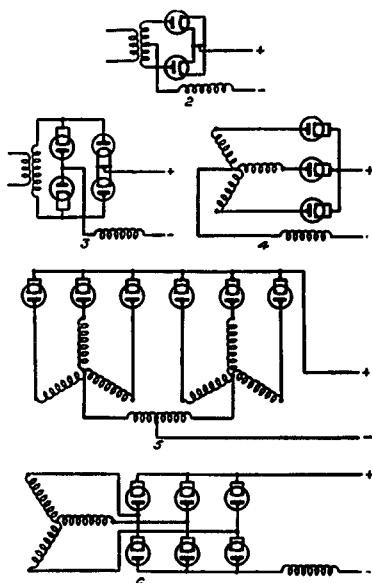
Tentative data

V.4077A-1.  
Sept. 1938

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of Valves | Approx. D.C. Output volts | Max. D.C. Load Current |
|---------|------------------|---------------------------|------------------------|
| 2       | 2                | 5150 volts                | 2.5 amps.              |
| 3       | 4                | 10300 "                   | 2.5 "                  |
| 4       | 3                | 7250 "                    | 3.75 "                 |
| 5       | 6                | 7250 "                    | 7.5 "                  |
| 6       | 6                | 14500 "                   | 3.75 "                 |



### Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see Sheet G.I.

# —Standard Valves—

4078-A  
Valve

## 4078-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

### SPECIFICATION.

#### Cathode.

Shielded, Oxide coated filament.  
Constant voltage type.

#### Base.

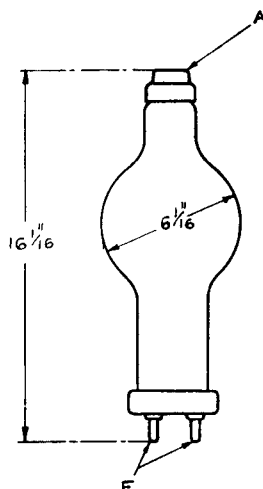
Special 2-pin.

#### Dimensions.

Maximum overall length  $16\frac{1}{16}"$  (40.8 cms.)  
Bulb diameter  $6\frac{1}{16}"$  (15.4 cms.)  
Net weight 1.9 lbs. (860 gms.)  
Anode cap diameter  $1.42"$  (3.6 cms.)

#### Constants.

Filament voltage 5 volts  
Filament current 20 amps.  
Maximum peak anode current 10 amps.  
Maximum peak inverse voltage 20,000 volts  
Maximum average anode current 2.5 amps.  
Ambient temperature range  $10^{\circ}\text{C. min.}$   
 $65^{\circ}\text{C. max.}$   
Condensed mercury temperature range  $25^{\circ}\text{C. min.}$   
 $65^{\circ}\text{C. max.}$



### Recommended Ambient Temperature Conditions.

|                     | Peak Inverse Voltage.                     |                                           |                                           |                                           |
|---------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|-------------------------------------------|
|                     | Less than<br>7,500 v.                     | 7,500—<br>10,000 v.                       | 10,000—<br>12,500 v.                      | Greater than<br>12,500 v.                 |
| Natural ventilation | $15^{\circ}\text{C.}—50^{\circ}\text{C.}$ | $15^{\circ}\text{C.}—40^{\circ}\text{C.}$ | —                                         | —                                         |
| Forced ventilation  | $15^{\circ}\text{C.}—65^{\circ}\text{C.}$ | $15^{\circ}\text{C.}—55^{\circ}\text{C.}$ | $15^{\circ}\text{C.}—45^{\circ}\text{C.}$ | $15^{\circ}\text{C.}—40^{\circ}\text{C.}$ |

#### Cathode Heating Time.

Ambient temperature  $10^{\circ}\text{C.}—15^{\circ}\text{C.}$   $15^{\circ}\text{C.}—20^{\circ}\text{C.}$   $20^{\circ}\text{C.}$  and above  
Heating period 30 15 5\* mins.

\* If absolutely essential, this time may be reduced to 2 minutes.

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

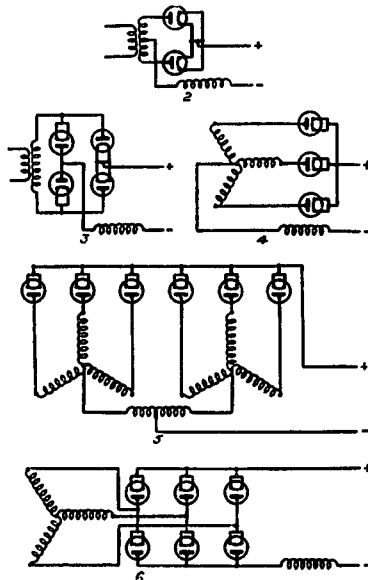
Tentative Data

V.4078-A.1  
Sept. 1938

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of Valves | Approx. D.C. Output Volts | Maximum D.C. Load Current |
|---------|------------------|---------------------------|---------------------------|
| 2       | 2                | 6,400 volts               | 5 amps.                   |
| 3       | 4                | 12,800 volts              | 5 amps.                   |
| 4       | 3                | 9,100 volts               | 7.5 amps.                 |
| 5       | 6                | 9,100 volts               | 15 amps.                  |
| 6       | 6                | 18,200 volts              | 7.5 amps.                 |



### Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.I.

# —Standard Valves—

4079-A  
Valve

## 4079-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

### SPECIFICATION.

#### Cathode.

Shielded, Oxide coated filament.  
Constant voltage type.

#### Base.

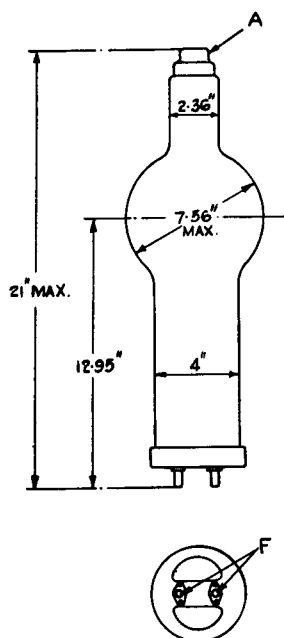
Special 2-pin.

#### Dimensions.

Maximum overall length 21" (53.4 cms.)  
Maximum bulb diameter 7.56" (19.2 cms.)  
Net weight 3 lbs. (1350 gms.)  
Anode cap diameter 1.42" (3.6 cms.)

#### Constants.

|                                     |                          |
|-------------------------------------|--------------------------|
| Filament voltage                    | 5 volts                  |
| Filament current                    | 40 amps.                 |
| Maximum peak anode current          | 20 amps.                 |
| Maximum peak inverse voltage        | 20,000 volts             |
| Maximum average anode current       | 7.5 amps.                |
| Ambient temperature range           | 10°C. min.<br>60°C. max. |
| Condensed mercury temperature range | 25°C. min.<br>60°C. max. |



#### Recommended Ambient Temperature Conditions.

|                     | Peak Inverse Voltage |                 |                  |                        |
|---------------------|----------------------|-----------------|------------------|------------------------|
|                     | Less than 7,500 v.   | 7,500—10,000 v. | 10,000—12,500 v. | Greater than 12,500 v. |
| Natural ventilation | 15°C.—45°C.          | 15°C.—35°C.     | —                | —                      |
| Forced ventilation  | 15°C.—60°C.          | 15°C.—50°C.     | 15°C.—40°C.      | 15°C.—35°C.            |

#### Cathode Heating Time.

|                     |             |             |                 |
|---------------------|-------------|-------------|-----------------|
| Ambient temperature | 10°C.—15°C. | 15°C.—20°C. | 20°C. and above |
| Heating period      | 30          | 15          | 5 mins.         |

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

Tentative Data

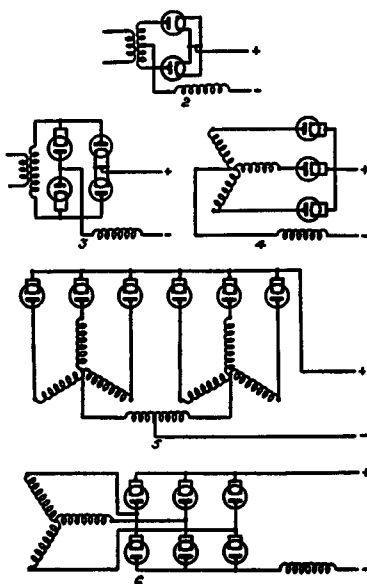
V.4079-A.1  
Mar. 1939



# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of Valves | Approx. D.C. Output Volts | Maximum D.C. Load Current |
|---------|------------------|---------------------------|---------------------------|
| 2       | 2                | 6,400 volts               | 12.5 amps.                |
| 3       | 4                | 12,800 volts              | 12.5 amps.                |
| 4       | 3                | 9,100 volts               | 15.4 amps.                |
| 5       | 6                | 9,100 volts               | 30.8 amps.                |
| 6       | 6                | 18,200 volts              | 18.8 amps.                |



### Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further information on H.C.M.V. rectifiers, see sheet G.I.

# —Standard Valves—

4080-A  
Valve

## 4080-A VALVE

HALF WAVE, HOT CATHODE MERCURY VAPOUR RECTIFIER.

### SPECIFICATION.

#### Cathode.

Shielded, Oxide coated filament.  
Constant voltage type.

#### Base.

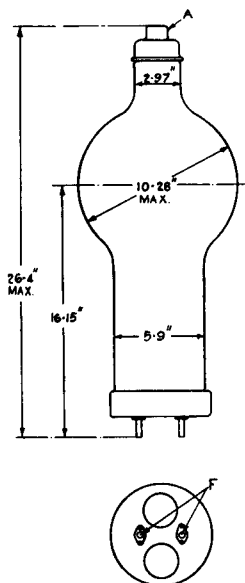
Special 2-pin.

#### Dimensions.

Maximum overall length 26.4" (67.1 cms.)  
Maximum bulb diameter 10.28" (26.1 cms.)  
Net weight 9 lbs. (4050 gms.)  
Anode cap diameter 1.42" (3.6 cms.)

#### Constants.

|                                     |                          |
|-------------------------------------|--------------------------|
| Filament voltage                    | 5 volts                  |
| Filament current                    | 100 amps.                |
| Maximum peak anode current          | 50 amps.                 |
| Maximum peak inverse voltage        | 16,000 volts             |
| Maximum average anode current       | 20 amps.                 |
| Ambient temperature range           | 15°C. min.<br>60°C. max. |
| Condensed mercury temperature range | 30°C. min.<br>60°C. max. |



#### Recommended Ambient Temperature Conditions.

|                     | Peak Inverse Voltage. |                 |                  |                        |
|---------------------|-----------------------|-----------------|------------------|------------------------|
|                     | Less than 7,500 v.    | 7,500—10,000 v. | 10,000—12,500 v. | Greater than 12,500 v. |
| Natural ventilation | 15°C.—45°C.           | 15°C.—35°C.     | —                | —                      |
| Forced ventilation  | 15°C.—60°C.           | 15°C.—50°C.     | 15°C.—40°C.      | 15°C.—35°C.            |

#### Cathode Heating Time.

|                     |             |                 |
|---------------------|-------------|-----------------|
| Ambient temperature | 15°C.—20°C. | 20°C. and above |
| Heating period      | 30          | 10 mins.        |

Note :—After shipment the filament must be run at full voltage for 30 minutes before any anode voltage is applied, so that the mercury shall be distributed correctly.

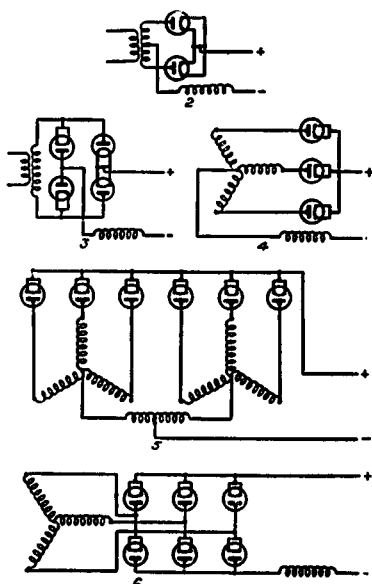
Tentative Data

V.4080-A.1  
Mar. 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Circuit | Number of Valves | Approx. D.C. Output Volts | Maximum D.C. Load Current |
|---------|------------------|---------------------------|---------------------------|
| 2       | 2                | 5,150 volts               | 31 amps.                  |
| 3       | 4                | 10,300 volts              | 31 amps.                  |
| 4       | 3                | 7,250 volts               | 38 amps.                  |
| 5       | 6                | 7,250 volts               | 76 amps.                  |
| 6       | 6                | 14,500 volts              | 47 amps.                  |



### Important.

This rectifier being directly heated, the output circuit must be connected to the mid-point of the filament transformer. The filament transformer should be so connected that the anode and filament voltages are 90° out of phase. The maximum peak anode current and output current should be reduced by 50 per cent. if quadrature operation of the filament and anode voltages is not possible.

Temperature limits given under "Natural Ventilation" are only valid for unrestricted natural ventilation which causes the condensed mercury temperature to be about 15°C.—20°C. above the ambient temperature, forced air blast being required for operation up to the maximum condensed mercury temperature limit.

For further Information on H.C.M.V. rectifiers, see sheet G.1.

# —Standard Valves—

4081-A  
Valve

## 4081-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

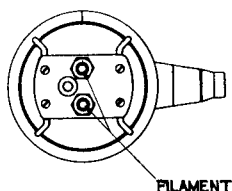
### SPECIFICATION.

#### Cathode.

Pure tungsten filament.  
Constant voltage type.

#### Dimensions.

Max. overall length  $23\frac{3}{4}"$  (60.2 cms.)  
Bulb diameter 5" (12.7 cms.)



#### Water Jacket.

Type PL 122.676.

#### Water Circulation.

Normal water flow—11 gallons per minute  
(50 litres per minute).

Pressure drop for normal flow—14 lbs. per  
sq. in. (1.0 Kg. per sq. cm.)

Maximum water pressure—50 lbs. per sq. in.  
(3.5 Kg. per sq. cm.)

#### Constants.

Filament voltage 20 volts  
(exact filament voltage marked  
on bulb)

Nominal filament current 59 amps.

Total emission 7.5 amps.

\*Amplification factor 33

\*Impedance 6,000 ohms

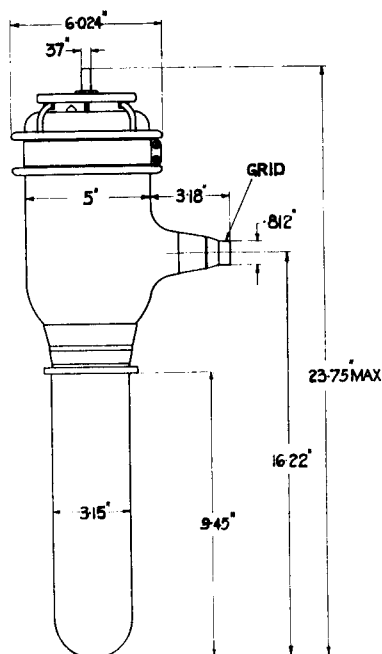
\*Mutual conductance 5.5 mA. per volt

Grid-anode capacity 18.6  $\mu$ F.

Grid-filament capacity 18.4  $\mu$ F.

Anode-filament capacity 3.8  $\mu$ F.

\*  $V_p = 16,000$  volts,  $I_p = 1.0$  amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                     |              |
|-------------------------------------|--------------|
| Maximum direct anode voltage        | 17,500 volts |
| Maximum anode dissipation           | 20 kW.       |
| Maximum grid dissipation            | 1.2 kW.      |
| Maximum frequency for above ratings | 5 Mc.        |

Tentative data.

V.4081-A.1  
Sept., 1938

# *—Standard Valves—*

## TYPICAL OPERATING CONDITIONS.

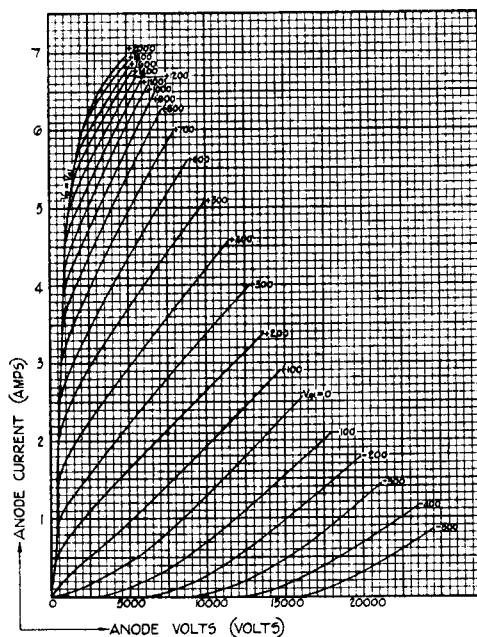
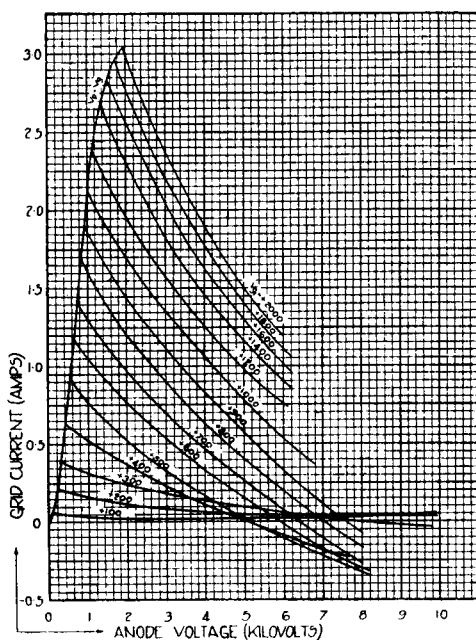
|               | Class B. A.F. Amp or Mod. |
|---------------|---------------------------|
| Anode voltage | 17,500 volts              |
| Anode current | 1.05 amps.                |
| Power output  | 11 kW.                    |

|                | Class B Telephony<br>Modulated carrier applied to grid. |        |              |
|----------------|---------------------------------------------------------|--------|--------------|
| Anode voltage  | 17,500                                                  | 15,000 | 13,000 volts |
| Anode current  | 0.83                                                    | 0.83   | 0.83 amps.   |
| Carrier output | 5                                                       | 3.75   | 2.75 kW.     |
| Frequency      | 5                                                       | 25     | 50 Mc.       |

|                | Class C Telephony<br>Subject to anode modulation. |        |             |
|----------------|---------------------------------------------------|--------|-------------|
| Anode voltage  | 12,500                                            | 10,600 | 9,100 volts |
| Anode current  | 0.83                                              | 0.83   | 0.83 amps.  |
| Carrier output | 6.75                                              | 5.25   | 3.75 kW.    |
| Frequency      | 5                                                 | 25     | 50 Mc.      |

# —Standard Valves—

4081-A  
Valve



Tentative data.

V.4081-A.2  
Sept. 1938

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# —Standard Valves—

4094-A  
Valve

## 4094-A VALVE

TRIODE.

This valve is similar to the 4012-A valve but employs a thoriated tungsten filament, molybdenum anode and hard glass bulb.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Base.

Large 4-pin bayonet.

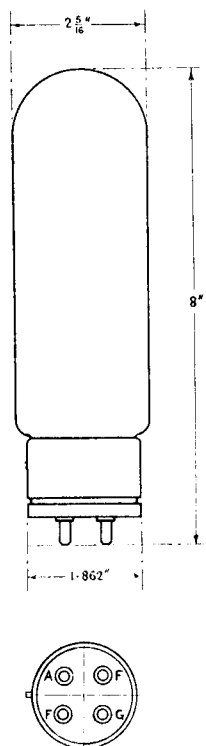
#### Dimensions.

Maximum overall length 8" (20.4 cms.)  
Maximum bulb diameter  $2\frac{5}{16}$ " (5.9 cms.)  
Net weight 0.36 lb. (164 gms.)

#### Constants.

|                          |                       |
|--------------------------|-----------------------|
| Filament voltage         | 10 volts              |
| Nominal filament current | 3.25 amps.            |
| Total emission           | 1.5 amps.             |
| *Impedance               | 9,300 ohms.           |
| *Amplification factor    | 37                    |
| *Mutual conductance      | 4 mA. per volt.       |
| Anode-grid capacity      | 14 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 9 $\mu\mu\text{F}$ .  |
| Anode-filament capacity  | 4 $\mu\mu\text{F}$ .  |

\* at  $V_p = 1,000$  volts,  $I_p = 30$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 1,250 volts |
| Maximum direct anode current                  | 0.150 amps. |
| Maximum anode dissipation                     | 85 watts    |
| Maximum direct grid current                   | 0.050 amps. |
| Maximum frequency for above ratings           | 6 Mc.       |
| Maximum anode voltage for frequency of 30 Mc. | 600 volts   |

Note :—This valve should be mounted so that the plane of the filament is vertical.

Tentative data

V.4094-A.1  
Sept. 1938



*—Standard Valves—*

**TYPICAL OPERATING CONDITIONS.**

|                                     | Class B. A.F. Amp. and Mod.<br>For balanced 2-valve circuits. |             |
|-------------------------------------|---------------------------------------------------------------|-------------|
|                                     |                                                               |             |
| Direct anode voltage                | 1,250                                                         | 1,000 volts |
| Grid bias (approx.)                 | —25                                                           | —17 volts   |
| Anode current per valve—zero signal | 0.030                                                         | 0.030 amps. |
| Maximum signal                      | 0.150                                                         | 0.150 amps. |
| Anode dissipation                   | 80                                                            | 70 watts    |
| Load resistance—anode to anode      | 8,000                                                         | 6,000 ohms  |
| Maximum output—2 valves             | 200                                                           | 160 watts   |

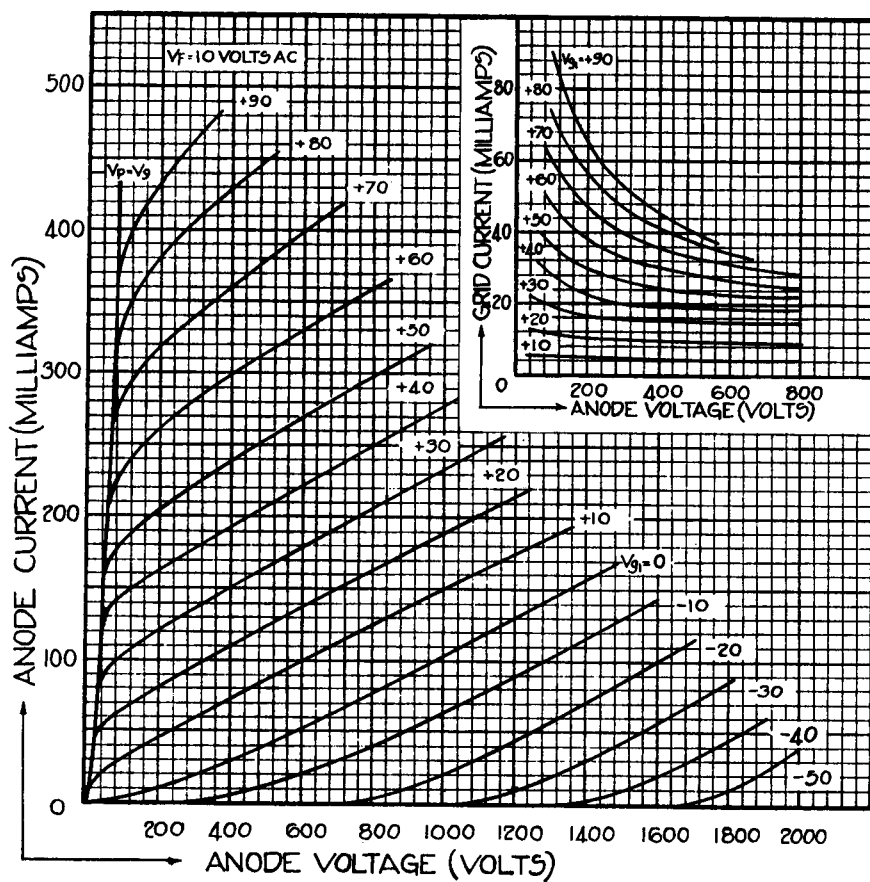
**RADIO FREQUENCY OPERATION.**

|                      | Class B. Telephony                   |             |
|----------------------|--------------------------------------|-------------|
|                      | Modulated carrier<br>applied to grid |             |
| Direct anode voltage | 1,250                                | 1,000 volts |
| Direct anode current | 0.105                                | 0.130 amps. |
| Grid bias            | —30                                  | —20 volts   |
| Carrier output       | 45                                   | 43 watts    |
| Anode dissipation    | 85                                   | 87 watts    |

|                      | Class C.<br>Telephony             |       | Class C.<br>Telegraphy |                      |
|----------------------|-----------------------------------|-------|------------------------|----------------------|
|                      | Subject to<br>anode<br>modulation |       | Unmodulated            |                      |
| Direct anode voltage | 1,000                             | 750   | 1,250                  | 1,000 volts          |
| Direct anode current | 0.150                             | 0.130 | 0.150                  | 0.150 amps.          |
| Grid bias            | —60                               | —40   | —70 to<br>—120         | —60 to<br>—100 volts |
| Carrier output       | 100                               | 65    | 130                    | 100 watts            |
| Anode dissipation    | 50                                | 32    | 57.5                   | 50 watts             |

# —Standard Valves—

4094-A  
Valve



Tentative Data.

V.4094-A.2.  
Sept. 1938.

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# —Standard Valves—

4096-AB  
Valve

## 4096 AB VALVE

HIGH VACUUM CATHODE RAY TUBE.

### SPECIFICATION.

#### Dimensions.

|                     |                              |
|---------------------|------------------------------|
| Max. overall length | 10 $\frac{5}{8}$ " (27 cms.) |
| Maximum diameter    | 3" (7.6 cms.)                |
| Screen diameter     | 2 $\frac{1}{2}$ " (6.4 cms.) |
| Net weight          | 0.22 lbs. (100 gms.)         |

#### Base.

American Small Shell Octal 8-pin.

#### Screen Colour.

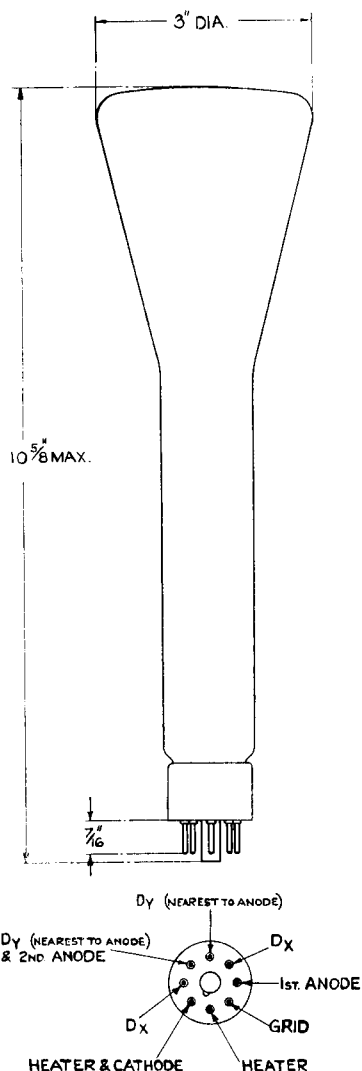
Blue.

#### Constants.

|                                                                        |                    |
|------------------------------------------------------------------------|--------------------|
| Heater voltage                                                         | 2 volts            |
| Nominal heater current                                                 | 1.7 amps.          |
| 1st anode voltage approximately $\frac{1}{8}$ of<br>2nd anode voltage. |                    |
| 2nd anode voltage                                                      | 800—2,000 volts    |
| Control electrode bias                                                 | 0 to —20 volts     |
| Sensitivity at 2,000 volts—                                            |                    |
| X plates                                                               | 0.13 mm per volt   |
| Y plates                                                               | 0.135 mm. per volt |
| Sensitivity at 1,000 volts—                                            |                    |
| X plates                                                               | 0.26 mm. per volt  |
| Y plates                                                               | 0.27 mm. per volt  |
| Cut off voltage at 2,000 volts—                                        |                    |
| —35 to —45 volts                                                       |                    |
| Max. current to 1st anode                                              | 300 $\mu$ A        |

#### Capacities.

|                                             |              |
|---------------------------------------------|--------------|
| X1 to X2                                    | 0.8 $\mu$ F. |
| Y1 to Y2                                    | 4.3 $\mu$ F. |
| X1 to all other electrodes<br>strapped      | 6.6 $\mu$ F. |
| Y1 to all other electrodes<br>strapped      | 6.0 $\mu$ F. |
| Control electrode to all others<br>strapped | 8.5 $\mu$ F. |



### TYPICAL OPERATING CONDITIONS.

|                   |         |                  |
|-------------------|---------|------------------|
| 1st anode voltage | 120     | 240 volts        |
| 2nd anode voltage | 1,000   | 2,000 volts      |
| Grid bias         | 0 to —5 | —10 to —15 volts |

Tentative data

MC.4096-AB.1  
Sept., 1938

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# —Standard Valves—

4097-A  
Valve

## 4097-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

Standard British 4-pin.

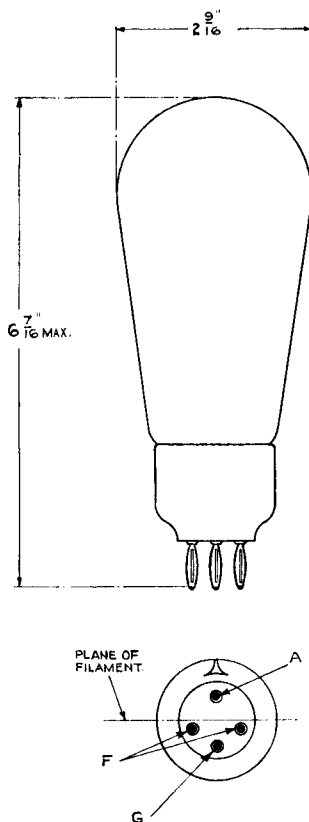
#### Dimensions.

Maximum overall length  $6\frac{7}{16}"$  (16.3 cm.)  
Maximum diameter  $2\frac{9}{16}"$  (6.5 cm.)

#### Constants.

|                          |                      |
|--------------------------|----------------------|
| Filament voltage         | 6 volts              |
| Nominal filament current | 1.1 amps.            |
| *Impedance               | 3,000 ohms           |
| *Amplification factor    | 10                   |
| *Mutual conductance      | 3.3 mA per volt      |
| Grid-anode capacity      | 8.5 $\mu\text{F}$ .  |
| Grid-filament capacity   | 12.5 $\mu\text{F}$ . |
| Anode-filament capacity  | 10.5 $\mu\text{F}$ . |

\* At  $V_p = 500$  volts.  $I_p = 50$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |           |
|-----------------------------------------------|-----------|
| Maximum direct anode voltage                  | 500 volts |
| Maximum anode dissipation                     | 35 watts  |
| Maximum direct anode current                  | 135 mA.   |
| Maximum frequency for above ratings           | 2 Mc.     |
| Maximum anode voltage for frequency of 10 Mc. | 400 volts |

Tentative data

V.4097-A.1  
Sept. 1938

**—Standard Valves—**

### TYPICAL OPERATING CONDITIONS.

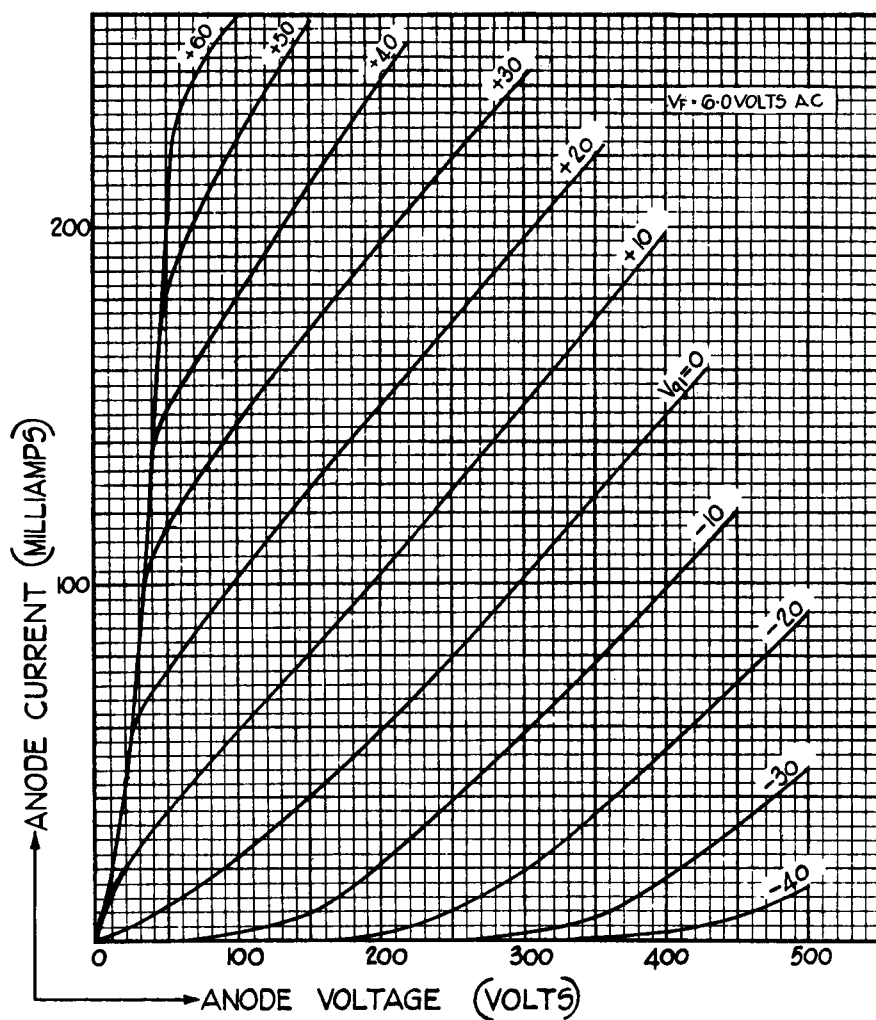
|                                            |                                                             |
|--------------------------------------------|-------------------------------------------------------------|
|                                            | Class B. A.F. Amp. and Mod.<br>For balanced 2-valve circuit |
| Direct anode voltage                       | 500 volts                                                   |
| Grid bias (approx).                        | —38 volts                                                   |
| Direct anode current per valve—zero signal | 25 mA.                                                      |
| maximum signal                             | 135 mA.                                                     |
| Load resistance, anode to anode            | 3,300 ohms                                                  |
| Anode dissipation per valve                | 30 watts                                                    |
| Maximum signal output—2 valves             | 75 watts                                                    |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 500                                     | 350                               | 500 volts             |
| Direct anode current | 100                                     | 130                               | 120 mA.               |
| Control grid bias    | —45                                     | —80                               | —100 to<br>—150 volts |
| Anode dissipation    | 33                                      | 15                                | 20 watts              |
| Power output         | 17                                      | 30                                | 40 watts              |

# —Standard Valves—

4097-A  
Valve



Tentative data

V.4097-A.2  
Sept. 1938



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# *—Standard Valves—*

4101-D Valve  
-E Valve  
-G Valve

## 4101-D, -E AND -G VALVES

TRIODES.

The 4101-D, -E, -G valves have similar characteristics. The 4101-E valve has the filament designed to reduce sputter noise.

The 4101-G is similar to 4101-E but has the anode lead brought out through the stem to increase the grid-anode insulation.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant current type.

#### Base.

Medium 4-pin bayonet thrust.

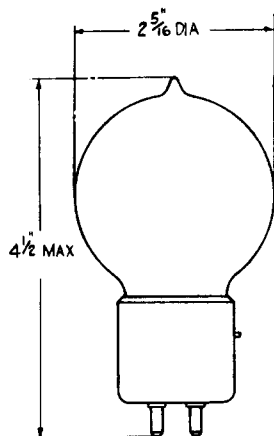
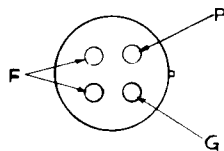
#### Dimensions.

|                     |                             |
|---------------------|-----------------------------|
| Max. overall length | $4\frac{1}{2}"$ (11.2 cms.) |
| Bulb diameter       | $2\frac{5}{16}"$ (5.9 cms.) |
| Net weight          | 0.14 lbs. (65 gms.)         |

#### Constants.

|                          |                       |
|--------------------------|-----------------------|
| Filament current         | 1.0 amps.             |
| Nominal filament voltage | 4.5 volts             |
| *Impedance               | 5,600 ohms            |
| *Amplification factor    | 6                     |
| *Mutual conductance      | 1.07 mA. per volt     |
| Anode-grid capacity      | 6.0 $\mu\mu\text{F.}$ |
| Anode-filament capacity  | 4.5 $\mu\mu\text{F.}$ |
| Grid-filament capacity   | 5.5 $\mu\mu\text{F.}$ |

\* at  $V_p = 130$  volts,  $V_{g1} = -9$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 190 volts |
| Maximum direct anode current | 12 mA.    |

V.4101-DEG.1  
Sept. 1938

- E Valve
- G Valve

## —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

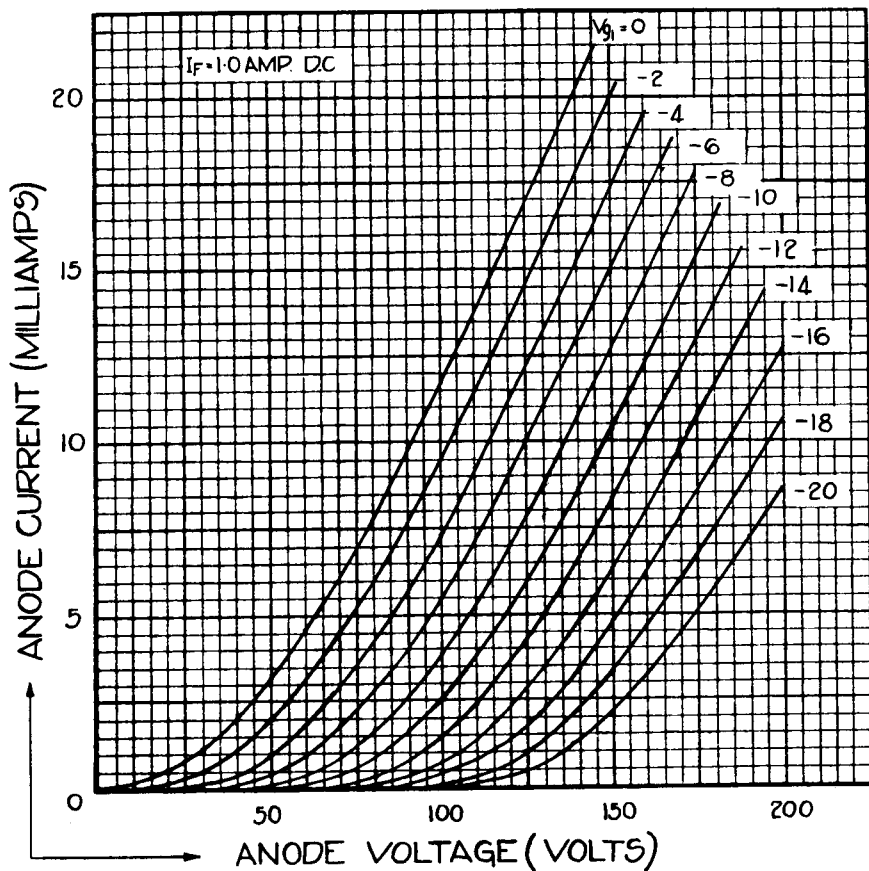
|                                                  |       |       |       |       |       |       |       |       |       |       |
|--------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Anode voltage                                    | volts | 100   | 100   | 130   | 130   | 160   | 160   | 190   | 190   | 190   |
| Grid bias                                        | volts | —4    | —6    | —9    | —12   | —10   | —12   | —16   | —18   | —20   |
| Anode current                                    | mA.   | 7.3   | 5.5   | 11.1  | 7.8   | 12.3  | 10.1  | 6.3   | 11    | 9.0   |
| Amplification factor                             |       | 6.1   | 6.0   | 6.1   | 6.0   | 6.1   | 6.0   | 5.9   | 6.0   | 5.9   |
| Impedance $Z_0$                                  | ohms  | 5,500 | 6,200 | 4,900 | 5,700 | 7,000 | 5,200 | 6,600 | 5,100 | 6,300 |
| <b>For load impedance <math>Z = Z_0</math>.</b>  |       |       |       |       |       |       |       |       |       |       |
| Output                                           | mW.   | 14    | 26    | 35    | 65    | 90    | 130   | 175   | 235   | 285   |
| 2nd harmonic                                     | db    | 33    | 27    | 32    | 26    | 21    | 25    | 19    | 24    | 19    |
| <b>For load impedance <math>Z = 2Z_0</math>.</b> |       |       |       |       |       |       |       |       |       |       |
| Output                                           | mW.   | 12    | 24    | 30    | 60    | 80    | 115   | 155   | 210   | 250   |
| 2nd harmonics                                    | db    | 38    | 32    | 38    | 31    | 26    | 30    | 25    | 29    | 24    |

**\*\* Maximum operating conditions.**

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# —Standard Valves—

4101-D Valve  
-E Valve  
-G Valve



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# *—Standard Valves—*

4102-D Valve  
-E Valve  
-G Valve

## 4102-D, -E AND -G VALVES

TRIODES.

4102-D, -E, -G valves have similar characteristics.

4102-E valve has a filament designed to reduce sputter noise.

4102-G valve is similar to 4102-E valve but has the anode lead brought out through the stem to increase grid-anode insulation.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.

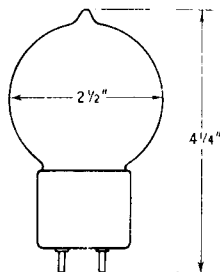
Constant current type.

#### Base.

Medium 4-pin bayonet thrust.

#### Dimensions.

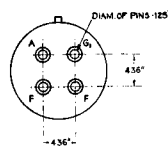
|                |                             |
|----------------|-----------------------------|
| Overall length | $4\frac{1}{4}"$ (10.8 cms.) |
| Bulb diameter  | $2\frac{1}{2}"$ (6.4 cms.)  |
| Net weight     | 0.14 lbs. (65 gms.)         |



#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament current         | 0.97 amps.             |
| Nominal filament voltage | 2 volts                |
| *Impedance               | 60,000 ohms            |
| *Amplification factor    | 30                     |
| *Mutual conductance      | 0.5 mA. per volt       |
| Grid-anode capacity      | 5.6 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 2.3 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 3.8 $\mu\mu\text{F}$ . |

\* at anode current of 0.75 mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 190 volts |
| Maximum direct anode current | 1.5 mA.   |

V.4102-DEG.1  
Nov. 1937

4102-D Valve  
-E Valve  
-G Valve

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Anode voltage | Grid Bias | Anode current | Amplification factor | Anode resistance | Load resistance        | Output voltage | Second harmonic |
|---------------|-----------|---------------|----------------------|------------------|------------------------|----------------|-----------------|
| volts         | volts     | milliamps     |                      | ohms rp          | R                      | peak volts     | db              |
| 130           | —2.0      | 0.36          | 29.4                 | 80,000           | R=rp<br>R=3rp<br>R=5rp | 27<br>38<br>41 | 20<br>24<br>25  |
| 130           | —1.5      | 0.58          | 29.8                 | 63,000           | R=rp<br>R=3rp<br>R=5rp | 20<br>30<br>34 | 26<br>31<br>33  |
| 130           | —1.0      | 0.85          | 30.1                 | 53,000           | R=rp<br>R=3rp<br>R=5rp | 15<br>20<br>23 | 33<br>39<br>40  |
| 160           | —3.0      | 0.34          | 29.2                 | 81,000           | R=rp<br>R=3rp<br>R=5rp | 40<br>57<br>62 | 18<br>21<br>22  |
| 160           | —2.0      | 0.80          | 29.9                 | 54,000           | R=rp<br>R=3rp<br>R=5rp | 28<br>42<br>45 | 27<br>33<br>34  |
| 160           | —1.0      | 1.45          | 30.3                 | 42,000           | R=rp<br>R=3rp<br>R=5rp | 15<br>21<br>24 | 38<br>43<br>48  |
| *190          | —3.0      | 0.83          | 29.8                 | 54,000           | R=rp<br>R=3rp<br>R=5rp | 42<br>63<br>68 | 23<br>28<br>30  |
| *190          | —2.0      | 1.46          | 30.2                 | 43,000           | R=rp<br>R=3rp<br>R=5rp | 30<br>43<br>48 | 31<br>38<br>41  |

\* Maximum operating conditions.

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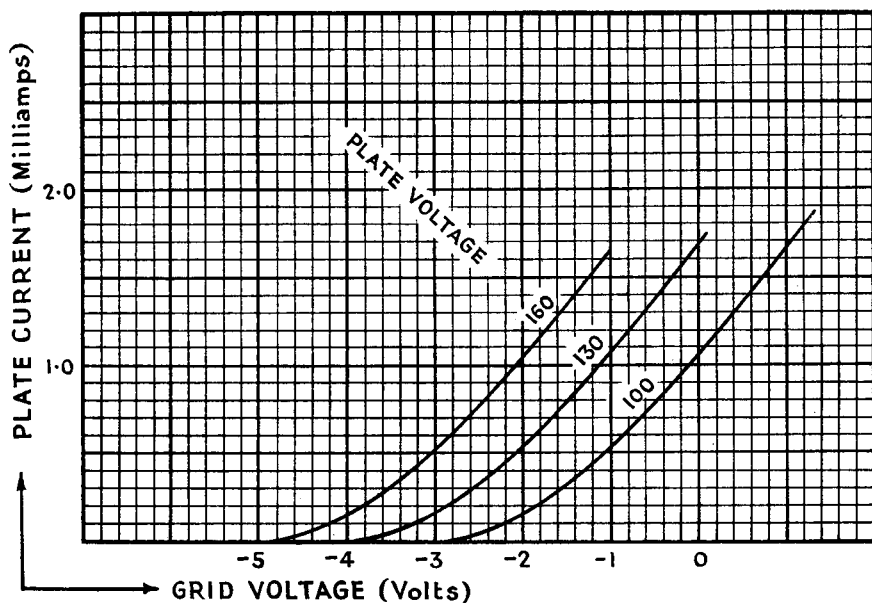
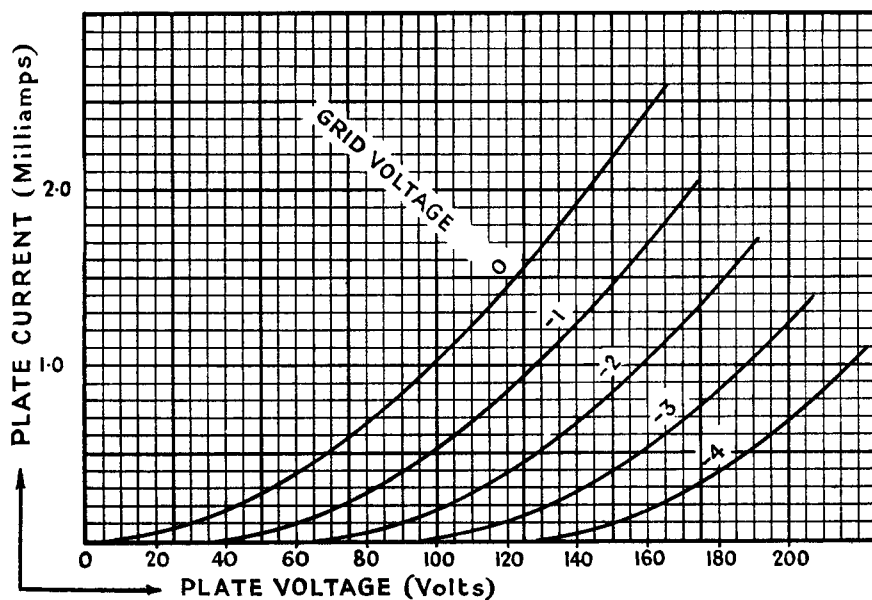
# —Standard Valves—

4102-D Valve

-E Valve

-G Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.





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# —Standard Valves—

4104-D Valve  
-E Valve  
-G Valve

## 4104-D, -E AND -G VALVES

TRIODES.

4104-D, -E, -G valves have similar characteristics.

4104-E valve has a filament designed to reduce sputter noise.

4104-G valve is similar to 4104-E but has anode lead brought out through the stem to increase the grid-anode insulation.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant current type.

#### Base.

Medium 4-pin bayonet thrust.

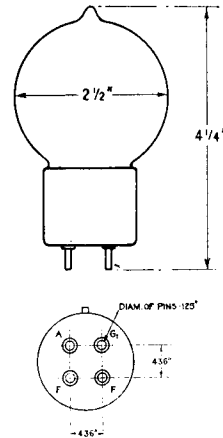
#### Dimensions.

|                |                               |
|----------------|-------------------------------|
| Overall length | 4 $\frac{1}{4}$ " (10.8 cms.) |
| Bulb diameter  | 2 $\frac{1}{2}$ " (6.4 cms.)  |
| Net weight     | 0.14 lbs. (65 gms.)           |

#### Constants.

|                                      |                        |
|--------------------------------------|------------------------|
| Filament current                     | 0.97 amps.             |
| Nominal filament voltage             | 4.4 volts              |
| Maximum steady anode voltage         | 160 volts              |
| Maximum continuous anode dissipation | 5 watts                |
| * Impedance                          | 2,000 ohms             |
| * Amplification factor               | 2.3                    |
| * Mutual conductance                 | 1.15 mA. per volt      |
| Grid-anode capacity                  | 5.9 $\mu\mu\text{F}$ . |
| Anode-filament capacity              | 3.7 $\mu\mu\text{F}$ . |
| Grid-filament capacity               | 5.2 $\mu\mu\text{F}$ . |

\* at anode current of 20 mA.

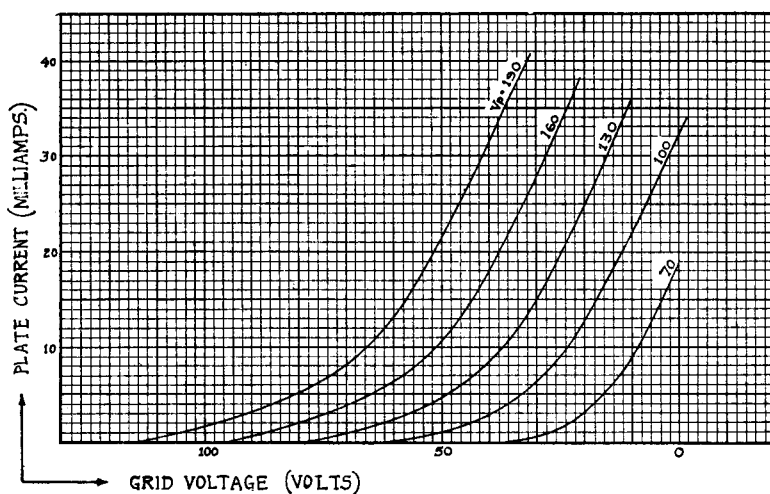


4104-D Valve  
-E Valve  
-G Valve

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Anode voltage<br>volts | Grid bias<br>volts | Anode current<br>mA. | Anode resistance<br>ohms | Load impedance<br>ohms | Output<br>watts | 2nd Harmonic<br>db below<br>fundamental |
|------------------------|--------------------|----------------------|--------------------------|------------------------|-----------------|-----------------------------------------|
| 130                    | —15                | 31.3                 | 1,900                    | 1,900                  | .090            | 27.6                                    |
|                        |                    |                      |                          | 3,800                  | .078            | 28.4                                    |
|                        |                    |                      |                          | 5,700                  | .065            | 26.6                                    |
| 130                    | —20                | 25.2                 | 2,000                    | 2,000                  | .135            | 25                                      |
|                        |                    |                      |                          | 4,000                  | .126            | 28.2                                    |
|                        |                    |                      |                          | 6,000                  | .103            | 28.4                                    |
| 130                    | —25                | 20.5                 | 2,100                    | 2,100                  | .190            | 25.6                                    |
|                        |                    |                      |                          | 4,200                  | .167            | 28.2                                    |
|                        |                    |                      |                          | 6,300                  | .145            | 30                                      |
| 160                    | —25                | 35                   | 1,900                    | 1,900                  | .230            | 27.8                                    |
|                        |                    |                      |                          | 3,800                  | .177            | 31.4                                    |
|                        |                    |                      |                          | 5,700                  | .170            | 33.2                                    |
| 160                    | —30                | 29                   | 1,900                    | 1,900                  | .300            | 26.2                                    |
|                        |                    |                      |                          | 3,800                  | .284            | 27.2                                    |
|                        |                    |                      |                          | 5,700                  | .236            | 30.2                                    |



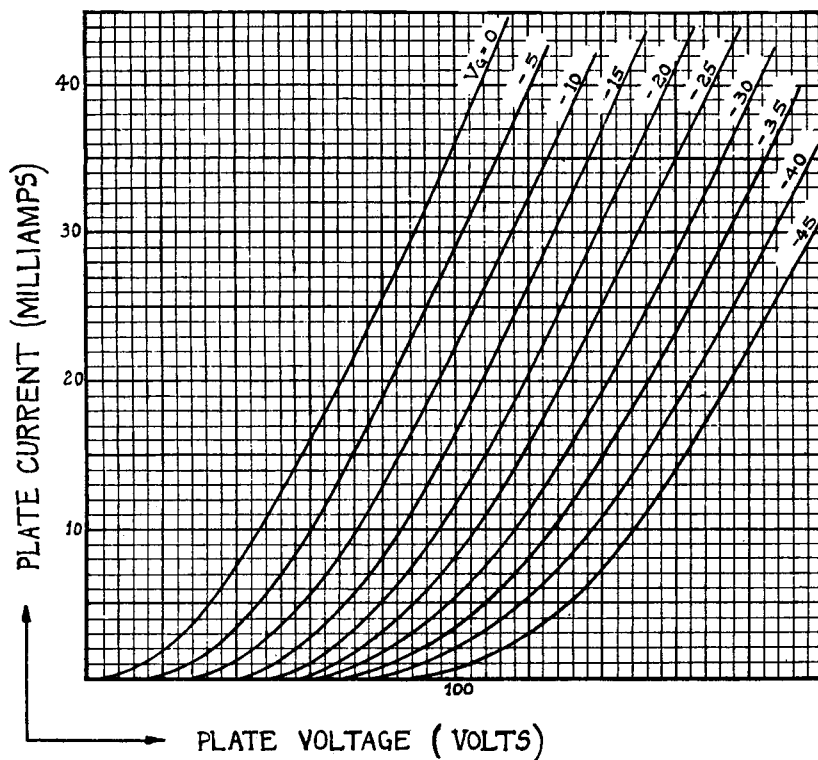
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# *—Standard Valves—*

4104-D Valve

-E Valve

-G Valve



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# **—Standard Valves—**

4205-E Valve  
M.4205-E Valve

## **4205-E AND M.4205-E VALVES**

TRIODE.

M.4205-E valve is similar to 4205-E but has the grid and anode specially treated to reduce secondary emission.

### **SPECIFICATION.**

#### **Cathode.**

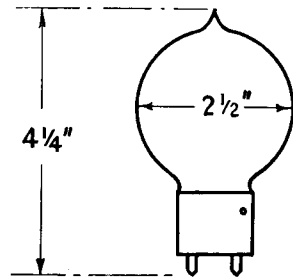
Oxide coated filament.  
Constant current type.

#### **Base.**

Medium 4-pin bayonet thrust, with offset pin.

#### **Dimensions.**

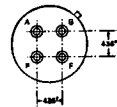
|                |                             |
|----------------|-----------------------------|
| Overall length | $4\frac{1}{4}"$ (10.8 cms.) |
| Bulb diameter  | $2\frac{1}{2}"$ (6.4 cms.)  |
| Net weight     | 0.14 lbs. (65 gms.)         |



#### **Constants.**

|                          |                        |
|--------------------------|------------------------|
| Filament current         | 1.6 amps.              |
| Nominal filament voltage | 4.5 volts              |
| *Impedance               | 3,500 ohms             |
| *Amplification factor    | 7                      |
| *Mutual conductance      | 2 mA. per volt         |
| Anode-grid capacity      | 4.8 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 3.3 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 5.2 $\mu\mu\text{F}$ . |

\* at anode current of 30 mA.



### **LIMITING CONDITIONS FOR SAFE OPERATION.**

|                                               |           |
|-----------------------------------------------|-----------|
| Maximum direct anode voltage                  | 400 volts |
| Maximum direct anode current                  | 50 mA.    |
| Maximum anode dissipation                     | 15 watts  |
| Maximum direct grid current                   | 10 mA.    |
| Maximum frequency for above ratings           | 15 Mc.    |
| Maximum anode voltage for frequency of 30 Mc. | 300 volts |

V.4205-E.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Anode voltage | Grid bias | Anode current | Amplification factor | Anode resistance | Load resistance | Power output | Second Harmonic |
|---------------|-----------|---------------|----------------------|------------------|-----------------|--------------|-----------------|
| volts         | volts     | mA.           |                      | ohms             | ohms            | mW.          | db              |
| 200           | —6        | 22.5          | 7.4                  | 4,000            | 4,000           | 60           | 35              |
|               |           |               |                      |                  | 8,000           | 55           | 40              |
| 250           | —22       | 9             | 6.9                  | 6,000            | 6,000           | 500          | 18              |
|               |           |               |                      |                  | 12,000          | 450          | 22              |
|               |           |               |                      |                  | 18,000          | 380          | 26              |
| 250           | —15       | 19            | 7.2                  | 4,350            | 4,350           | 310          | 26              |
|               |           |               |                      |                  | 8,700           | 280          | 30              |
| 250           | —10       | 27.5          | 7.4                  | 3,800            | 3,800           | 180          | 33              |
|               |           |               |                      |                  | 7,600           | 160          | 38              |
| 250           | —5        | 37.5          | 7.5                  | 3,500            | 3,500           | 50           | 40              |
|               |           |               |                      |                  | 7,000           | 45           | 43              |
| 300           | —30       | 8             | 6.7                  | 6,700            | 6,700           | 800          | 15              |
|               |           |               |                      |                  | 13,400          | 720          | 20              |
|               |           |               |                      |                  | 19,100          | 600          | 24              |
| 300           | —24       | 15.5          | 7.1                  | 4,800            | 4,800           | 750          | 20              |
|               |           |               |                      |                  | 9,600           | 670          | 25              |
| 300           | —18       | 25            | 7.3                  | 4,000            | 4,000           | 540          | 27              |
|               |           |               |                      |                  | 8,000           | 480          | 31              |
| 350           | —22.5     | 29            | 7.3                  | 3,800            | 3,800           | 875          | 26              |
|               |           |               |                      |                  | 7,600           | 800          | 30              |
| 375           | —30       | 22            | 7.1                  | 4,300            | 4,300           | 1,300        | 20              |
|               |           |               |                      |                  | 8,600           | 1,200        | 26              |
| *300          | —10       | 41            | 7.4                  | 3,350            | 3,350           | 200          | 37              |
|               |           |               |                      |                  | 6,700           | 180          | 41              |
| *350          | —20       | 34            | 7.3                  | 3,600            | 3,600           | 750          | 28              |
|               |           |               |                      |                  | 7,200           | 675          | 32              |
| *375          | —24       | 32            | 7.3                  | 3,650            | 3,650           | 1,000        | 26              |
|               |           |               |                      |                  | 7,300           | 900          | 30              |
| *400          | —29       | 30            | 7.2                  | 3,800            | 3,800           | 1,400        | 23              |
|               |           |               |                      |                  | 7,600           | 1,300        | 28              |

\* Maximum operating conditions.

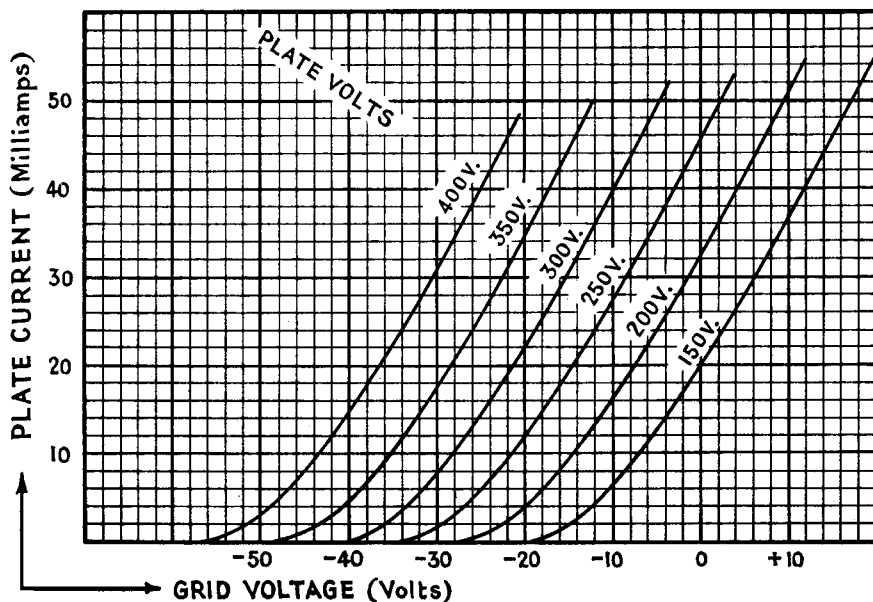
# —Standard Valves—

4205-E Valve  
M.4205-E Valve

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|----------------|
|                      | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                |
| Direct anode voltage | 350                                     | 400   | 300                               | 350   | 350                   | 400 volts      |
| Direct anode current | 28                                      | 28    | 35                                | 35    | 45                    | 45 mA.         |
| Grid bias            | -48                                     | -56   | -120                              | -144  | -96                   | -112 volts     |
| Driving voltage—     |                                         |       |                                   |       |                       |                |
| Carrier              | 69                                      | 73    | —                                 | —     | —                     | — peak volts   |
| A-F peak             | 138                                     | 146   | —                                 | —     | —                     | — volts        |
| Driving voltage      | —                                       | —     | 205                               | 229   | 186                   | 202 peak volts |
| Power output—        |                                         |       |                                   |       |                       |                |
| Carrier              | 2.5                                     | 3.0   | —                                 | —     | —                     | — watts        |
| A-F peak             | 10                                      | 12    | —                                 | —     | —                     | — watts        |
| Power output         | —                                       | —     | 6.0                               | 7.1   | 8.3                   | 10.0 watts     |
| Effective load—      |                                         |       |                                   |       |                       |                |
| Resistance           | 3,100                                   | 3,700 | 4,000                             | 5,000 | 3,750                 | 4,500 ohms     |
| Peak driving—        |                                         |       |                                   |       |                       |                |
| Power-peak           | 1                                       | 1     | —                                 | —     | —                     | — watts        |
| Driving power        | —                                       | —     | 1.3                               | 1.7   | 1.3                   | 1.5 watts      |

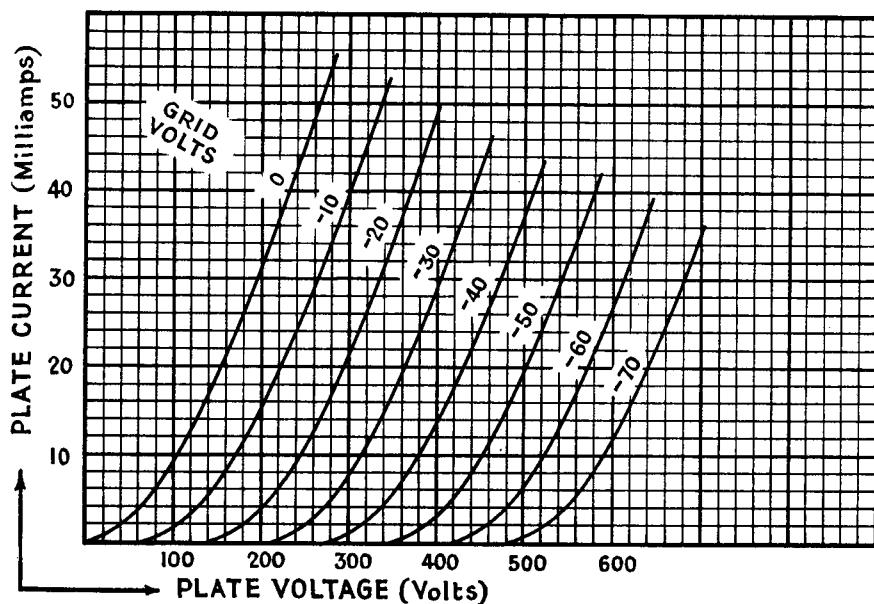
These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.





4205-E Valve  
M.4205-E Valve

# —Standard Valves—



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# —Standard Valves—

4211-D Valve  
-E Valve

## 4211-D AND 4211-E VALVE

TRIODE.

For replacement purposes only.

The 4211-E valve is similar to 4211-D valve but has small chokes (approximately one microhenry) connected in series with the grid and anode leads to prevent spurious oscillations at ultra high frequencies. These valves have been replaced by the 4242-A valve.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

Large 4-pin bayonet.

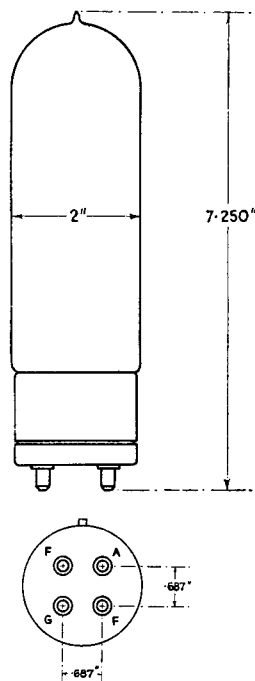
#### Dimensions.

|                |                               |
|----------------|-------------------------------|
| Overall length | 7 $\frac{1}{4}$ " (18.4 cms.) |
| Bulb diameter  | 2" (5.1 cms.)                 |
| Net weight     | 0.4 lbs. (180 gms.)           |

#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 10 volts               |
| Nominal filament current | 3 amps.                |
| *Impedance               | 3,000 ohms             |
| *Amplification factor    | 12                     |
| *Mutual conductance      | 4 mA. per volt         |
| Grid-anode capacity      | 8.9 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 4.5 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 6.9 $\mu\mu\text{F}$ . |

\* at anode current of 65 mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |             |
|------------------------------|-------------|
| Maximum direct anode voltage | 1,000 volts |
| Maximum direct anode current | 0.200 amps. |
| Maximum anode dissipation    | 65 watts    |
| Maximum direct grid current  | 0.045 amps. |

Note :—This valve should be mounted so that the filament is operated in a vertical plane.

V.4211-DE.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class A AF Amp. |
|----------------------|-----------------|
| Direct anode voltage | 900 volts       |
| Grid bias            | —45 volts       |
| Direct anode current | 0.055 amps.     |
| Anode dissipation    | 45 watts        |
| Load impedance       | 10,000 ohms     |
| Undistorted output   | 8.1 watts       |
| % Harmonics          | 4.5             |

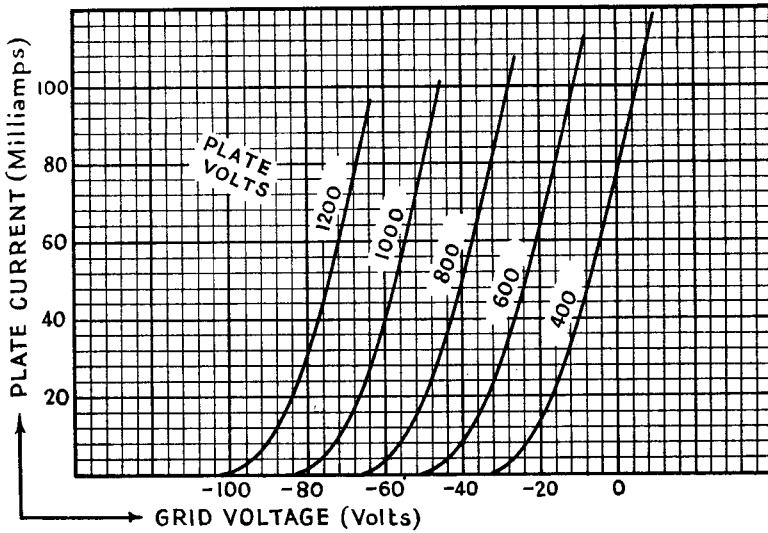
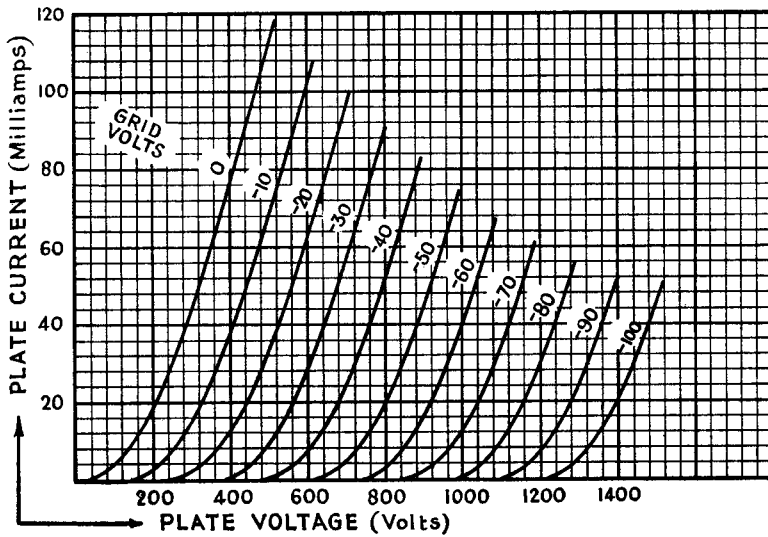
## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------------|-----------------------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 1,000                                   | 750                               | 1,000 volts           |
| Direct anode current | 0.075                                   | 0.100                             | 0.135 amps.           |
| Grid bias            | —75                                     | —120                              | —200 to<br>—250 volts |
| Anode dissipation    | 50                                      | 25                                | 45 watts              |
| Carrier output       | 25                                      | 50                                | 90 watts              |

# —Standard Valves—

4211-D Valve  
-E Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



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# —Standard Valves—

4212-D  
Valve

## 4212-D VALVE

TRIODE.

For replacement purposes only.

The 4212-D valve employs an oxidised nickel anode and has been replaced by the 4212-E valve.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

Extra large 4-pin bayonet.

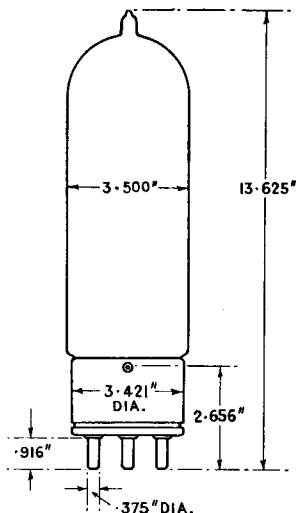
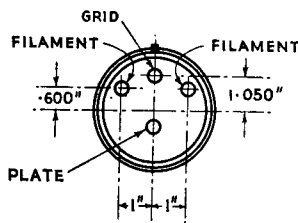
#### Dimensions.

Overall length  $13\frac{5}{8}"$  (34.5 cms.)  
Maximum diameter  $3\frac{1}{2}"$  (8.9 cms.)  
Net weight  $1\frac{5}{8}$  lbs. (750 gms.)

#### Constants.

Filament voltage 14 volts  
Nominal filament current 6 amps.  
\*Impedance 2,000 ohms  
\*Amplification factor 16  
\*Mutual conductance 8 mA. per volt  
Grid-anode capacity  $18.5 \mu\mu\text{F.}$   
Anode-filament capacity  $6 \mu\mu\text{F.}$   
Grid-filament capacity  $18.5 \mu\mu\text{F.}$

\* at anode current of 130 mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 2,000 volts  
Maximum direct anode current 300 mA.  
Maximum anode dissipation 200 watts  
Maximum direct grid current 75 mA.  
Maximum frequency for above ratings 1.5 Mc.  
Maximum anode voltage for frequency of 4.5 Mc. 750 volts

Note :—This valve should be mounted so that the filament is operated in a vertical plane.

V.4212-D.1  
Nov. 1937

*—Standard Valves—*

**TYPICAL OPERATING CONDITIONS.**

|                      | Class A AF Amp. |
|----------------------|-----------------|
| Direct anode voltage | 1,500 volts     |
| Grid bias            | —67 volts       |
| Direct anode current | 130 mA.         |
| Anode dissipation    | 150 watts       |
| Load impedance       | 4,000 ohms      |
| Undistorted output   | 45 watts        |

|                                        | Class B AF Amp. and Mod.<br>For balanced 2 valve circuit |       |       |
|----------------------------------------|----------------------------------------------------------|-------|-------|
| Direct anode voltage                   | 1,600                                                    | 1,600 | volts |
| Grid bias                              | —80                                                      | —70   | to    |
|                                        | —100                                                     | —90   | volts |
| Anode current per valve—zero signal    | 33                                                       | 50    | mA.   |
| Anode current per valve—maximum signal | 167                                                      | 250   | mA.   |
| Anode dissipation                      | 122                                                      | 175   | watts |
| Load resistance—anode to anode         | 8,000                                                    | 6,000 | ohms  |
| Maximum output—2 valves                | 290                                                      | 450   | watts |

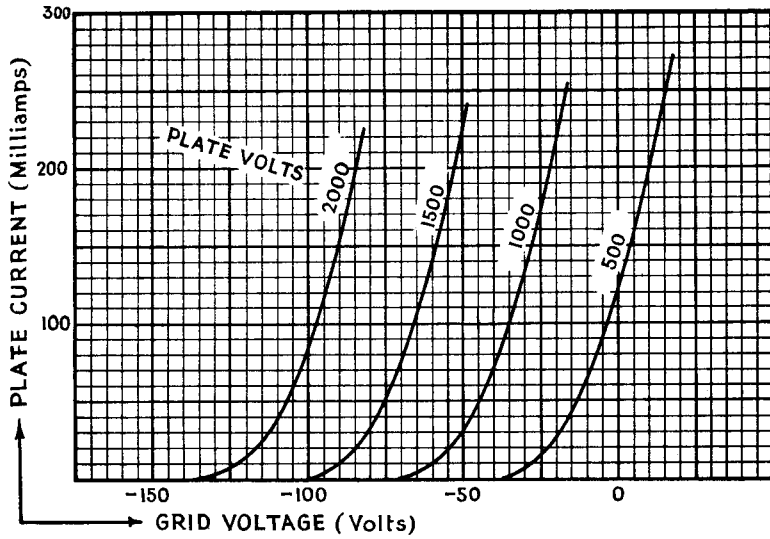
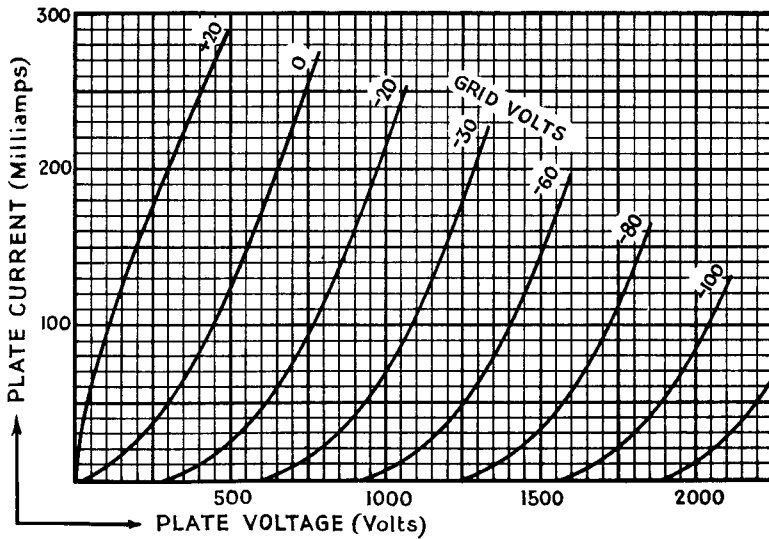
**RADIO FREQUENCY OPERATION.**

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |             |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-------------|
|                      | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |             |
| Direct anode voltage | 1,000                                   | 1,500 | 750                               | 1,000 | 1,000                 | 1,500 volts |
| Direct anode current | 250                                     | 200   | 250                               | 250   | 250                   | 250 mA.     |
| Grid bias            | —50                                     | —80   | —100                              | —140  | —140                  | —200 to     |
|                      |                                         |       |                                   |       | —200                  | —300 volts  |
| Anode dissipation    | 167                                     | 200   | 62                                | 83    | 83                    | 125 watts   |
| Carrier output       | 83                                      | 100   | 125                               | 167   | 167                   | 250 watts   |

# —Standard Valves—

4212-D  
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.





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# —Standard Valves—

4212-E  
Valve

## 4212-E VALVE

TRIODE.

The 4212-E valve employs a molybdenum anode and hard glass bulb.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Base.

Extra large 4-pin bayonet.

#### Dimensions.

Max. overall length  $13\frac{5}{8}"$  (34.6 cms.)  
Bulb diameter  $3\frac{9}{16}"$  (9.1 cms.)  
Net weight 1.6 lbs. (725 gms.)

#### Constants.

Filament voltage 14 volts  
Nominal filament current 6 amps.  
Total emission 4 amps.

\*Impedance 1,900 ohms

\*Amplification factor 16

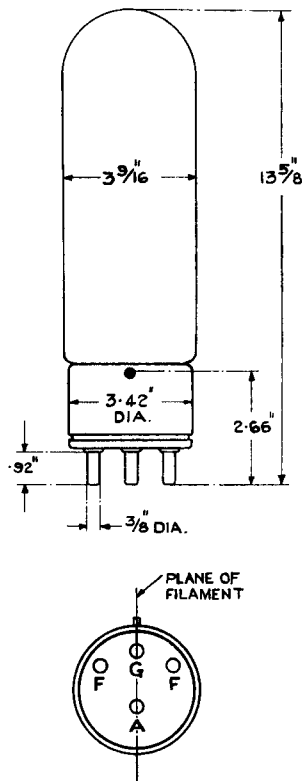
\*Mutual conductance 8.4 mA per volt

Grid-anode capacity 18.8  $\mu\mu\text{F}$ .

Anode-filament capacity 8.6  $\mu\mu\text{F}$ .

Grid-filament capacity 14.9  $\mu\mu\text{F}$ .

\* at  $V_p = 2,000$  volts.  $V_g = -90$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                |             |
|------------------------------------------------|-------------|
| Maximum direct anode voltage                   | 3,000 volts |
| Maximum direct anode current                   | 350 mA.     |
| Maximum anode dissipation                      | 275 watts   |
| Maximum direct grid current                    | 75 mA.      |
| Maximum frequency for above ratings            | 1.5 Mc.     |
| Maximum anode voltage for frequency of 4.5 Mc. | 1,000 volts |

Note :—This valve should be mounted so that the plane of the filament is vertical.

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class A<br>AF Amp. and Mod. |       |           |
|----------------------|-----------------------------|-------|-----------|
| Direct anode voltage | 1,500                       | 1,250 | volts     |
| Grid bias            | —57                         | —40   | volts     |
| Direct anode current | 170                         | 200   | milliamps |
| Load impedance       | 5,000                       | 3,000 | ohms      |
| Undistorted output   | 50                          | 40    | watts     |

|                                        | Class B AF Amp. and Mod.<br>For balanced 2 valve circuit |       |       |
|----------------------------------------|----------------------------------------------------------|-------|-------|
| Direct anode voltage                   | 2,000                                                    | 1,500 | volts |
| Grid bias                              | —105                                                     | —75   | volts |
| Anode current per valve—zero signal    | 40                                                       | 50    | mA.   |
| Anode current per valve—maximum signal | 300                                                      | 300   | mA.   |
| Anode dissipation                      | 250                                                      | 200   | watts |
| Load resistance—anode to anode         | 8,000                                                    | 5,900 | ohms  |
| Maximum output, 2 Valves               | 650                                                      | 500   | watts |

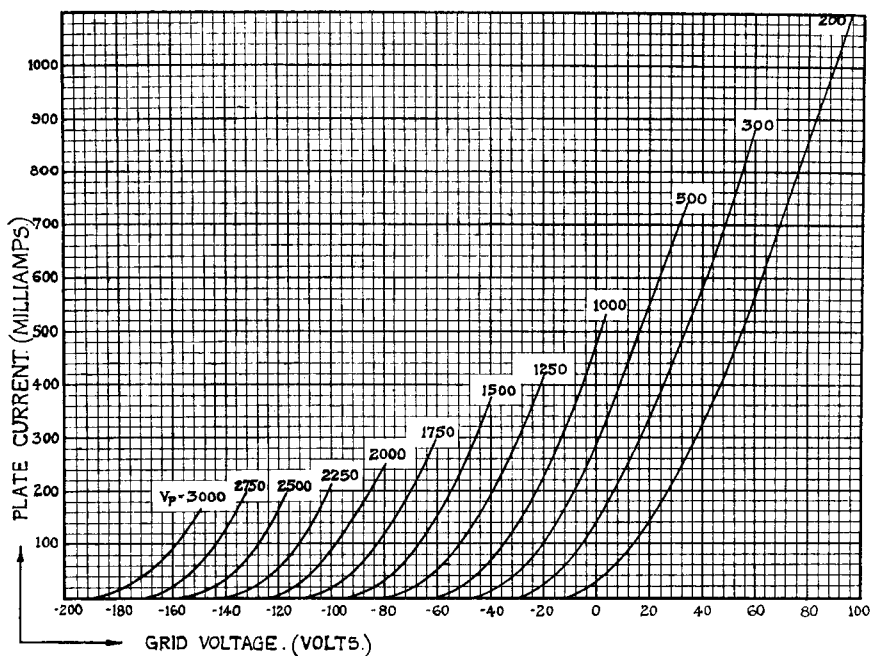
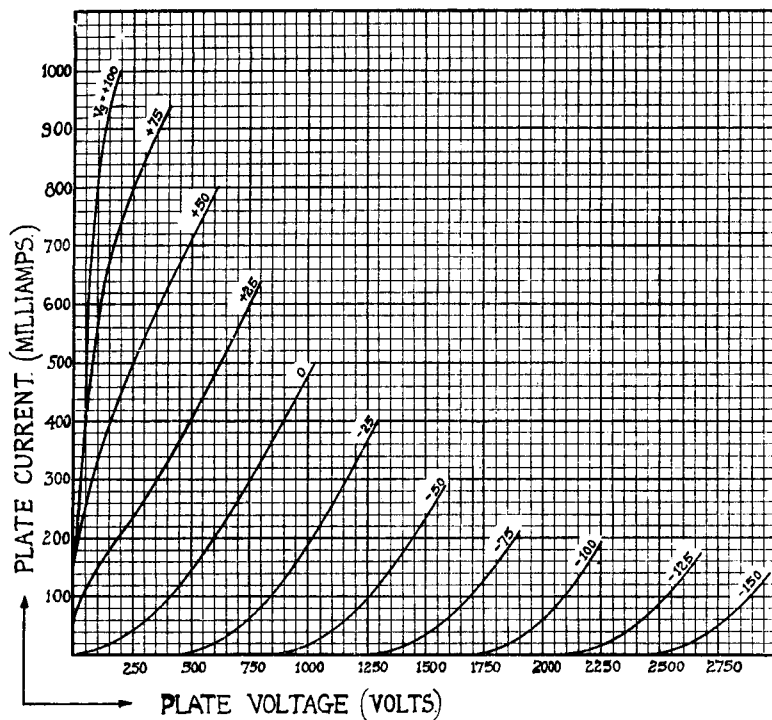
## RADIO FREQUENCY OPERATION

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                       |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                       |
| Direct anode voltage | 2,000                                   | 1,500 | 1,500                             | 1,000 | 2,000                 | 1,500 volts           |
| Direct anode current | 0.206                                   | 0.275 | 0.300                             | 0.300 | 0.300                 | 0.300 amps.           |
| Grid bias            | —120                                    | —90   | —200                              | —125  | —185<br>—250          | —150 to<br>—200 volts |
| Anode dissipation    | 275                                     | 275   | 150                               | 100   | 200                   | 150 watts             |
| Carrier output       | 137                                     | 137   | 300                               | 200   | 400                   | 300 watts             |

The curves shown on sheet V.4212-E.2 are taken with direct filament heating, grid and anode voltages being referred to the negative end of the filament.

# —Standard Valves—

4212-E  
Valve



V.4212-E.2  
Nov. 1937

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# **—Standard Valves—**

4215-A  
Valve

## **4215-A VALVE**

TRIODE.

For replacement purposes only.

### **SPECIFICATION.**

#### **Cathode.**

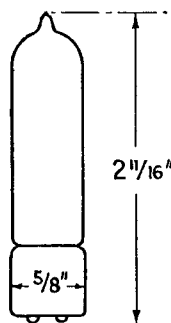
Oxide coated filament.  
Constant current type.

#### **Base.**

Miniature 4-pin bayonet thrust.

#### **Dimensions.**

|                  |                               |
|------------------|-------------------------------|
| Overall length   | $2\frac{11}{16}$ " (6.9 cms.) |
| Maximum diameter | $\frac{5}{8}$ " (1.6 cms.)    |
| Net weight       | 0.02 lbs. (10 gms.)           |



#### **Constants.**

|                          |                        |
|--------------------------|------------------------|
| Filament current         | 0.25 amps.             |
| Nominal filament voltage | 1.1 volts              |
| *Impedance               | 25,000 ohms            |
| *Amplification factor    | 6                      |
| *Mutual conductance      | 0.24 mA. per volt      |
| Grid-anode capacity      | 3.5 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 1.5 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 2.0 $\mu\mu\text{F}$ . |

\* at anode current of 1 mA.



### **LIMITING CONDITIONS FOR SAFE OPERATION.**

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 100 volts |
| Maximum direct anode current | 2.2 mA.   |

V.4215-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

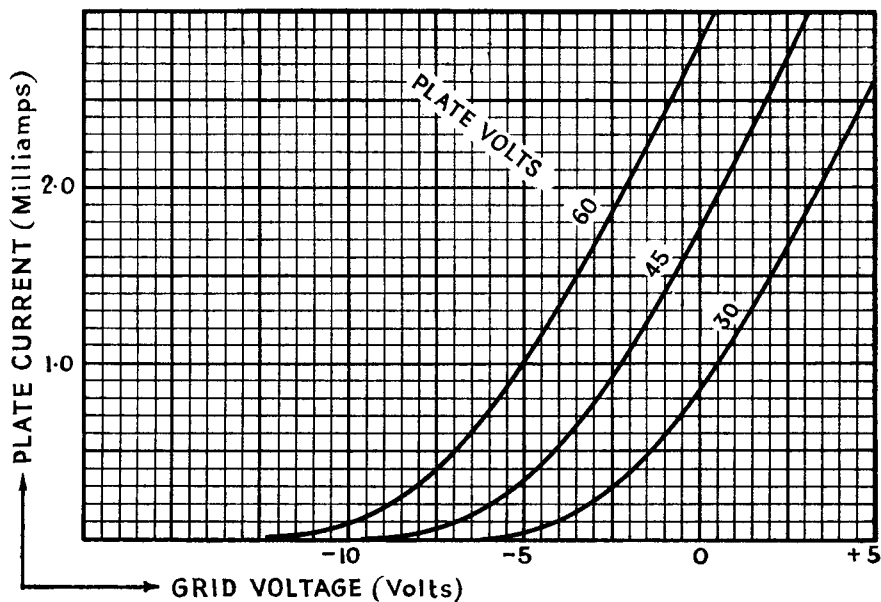
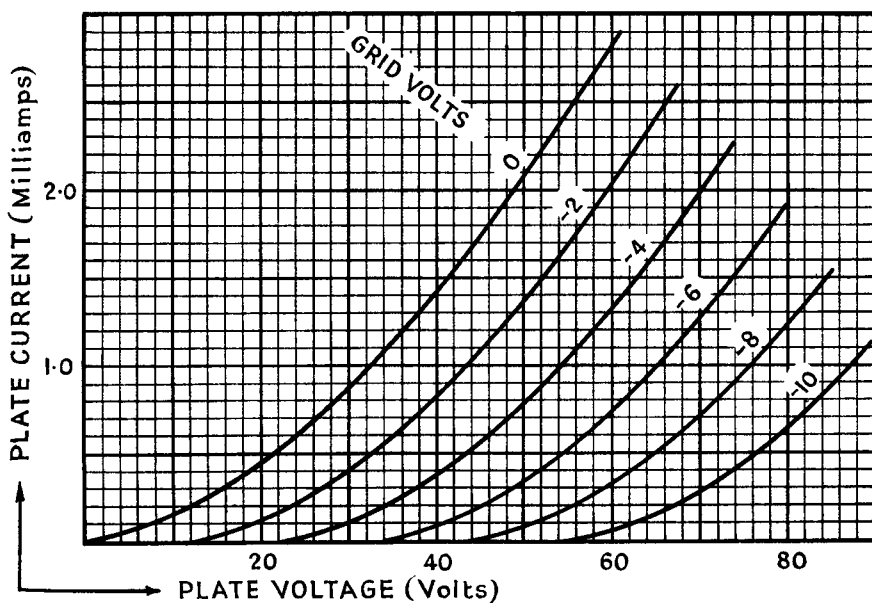
| Anode voltage        | Grid bias             | Anode current        | Amplification factor                                                                                      | Anode resistance | Load resistance                    | Power output | Voltage output | Second harmonic |
|----------------------|-----------------------|----------------------|-----------------------------------------------------------------------------------------------------------|------------------|------------------------------------|--------------|----------------|-----------------|
| volts                | volts                 | mA.                  |                                                                                                           | ohms $r_p$       | R                                  | mW.          | peak volts     | db              |
| 45.0                 | —3.0                  | 1.0                  | 5.7                                                                                                       | 16,500           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 2.2<br>1.9   | 14.0           | 29<br>34<br>39  |
| 45.0                 | —1.5                  | 1.6                  | 5.8                                                                                                       | 14,500           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 0.60<br>0.55 | 7.2            | 40<br>45<br>49  |
| 60.0                 | —3.0                  | 2.0                  | 5.7                                                                                                       | 13,500           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 2.9<br>2.6   | 14.5           | 35<br>40<br>45  |
| 67.5                 | —6.0                  | 1.4                  | 5.6                                                                                                       | 15,500           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 9.4<br>8.3   | 28.5           | 25<br>30<br>35  |
| 67.5                 | —4.5                  | 2.0                  | 5.7                                                                                                       | 14,000           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 6.0<br>5.5   | 22.0           | 31<br>36<br>40  |
| *67.5                | —4.0                  | 2.0                  | 5.7                                                                                                       | 13,500           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 5.0<br>4.5   | 19.5           | 34<br>38<br>43  |
| *90.0                | —8.0                  | 2.2                  | 5.6                                                                                                       | 14,000           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 18<br>16     | 40.0           | 26<br>31<br>37  |
| *100.0               | —10.0                 | 2.1                  | 5.6                                                                                                       | 14,500           | R= $r_p$<br>R=2 $r_p$<br>R=5 $r_p$ | 26<br>23     | 47.0           | 24<br>29<br>36  |
| 22.5<br>45.0<br>67.5 | —4.0<br>—9.0<br>—14.0 | 0.01<br>0.01<br>0.01 | Anode current detection                                                                                   |                  |                                    |              |                |                 |
| 22.5<br>*45.0        | +1.0<br>+1.0          | 1.0<br>2.6           | Grid current detection. Grid bias usually obtained by connecting grid return to positive end of filament. |                  |                                    |              |                |                 |

\* Maximum operating conditions.

# —Standard Valves—

4215-A  
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to negative end of filament.



V.4215-A.2  
Nov. 1937



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# —Standard Valves—

4220-C  
Valve

## 4220-C VALVE

SINGLE ENDED  
WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type MS.1362 Grp. 1 for anode dissipation  
up to 6 Kw.

Type MS.1362 Grp. 20 used for below panel  
connection for anode dissipation up to  
6 Kw.

Type 223 LU 1A for anode dissipation over  
6 Kw.

#### Water Flow.

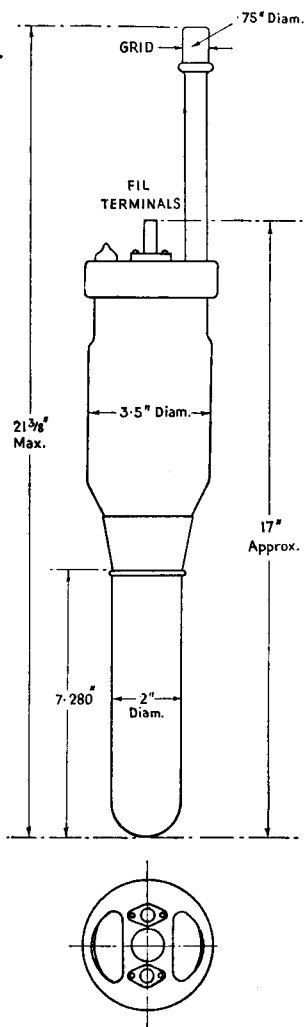
5 gallons per minute.

#### Dimensions.

Overall length  $21\frac{3}{8}"$  (54.6 cms.)  
Bulb diameter  $3\frac{1}{8}"$  (9.1 cms.)  
Net weight  $2\frac{7}{8}$  lbs. (1,300 gms.)

#### Constants.

|                                            |                       |
|--------------------------------------------|-----------------------|
| Filament voltage                           | 22 volts              |
| (exact filament voltage marked<br>on bulb) |                       |
| Nominal filament current                   | 41 amps.              |
| Total emission                             | 6 amps.               |
| *Impedance                                 | 7,500 ohms            |
| *Amplification factor                      | 40                    |
| *Mutual conductance                        | 5.3 mA per volt       |
| Grid-anode capacity                        | 20.5 $\mu\mu\text{F}$ |
| Grid-filament capacity                     | 20 $\mu\mu\text{F}$   |
| Anode-filament capacity                    | 3 $\mu\mu\text{F}$    |
| * at $V_p = 10\text{kV}$ $I_p = 0.8$ amp.  |                       |



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |              |
|---------------------------------------------------|--------------|
| Maximum direct anode voltage                      | 13,000 volts |
| Maximum direct anode voltage for anode modulation | 9,000 volts  |
| Maximum direct anode current                      | 1.5 amps.    |
| Maximum anode dissipation                         | 10 Kw.       |
| Maximum grid dissipation                          | 200 watts    |
| Maximum frequency for above ratings               | 1 Mc.        |
| Maximum anode voltage for frequency of 2 Mc.      | 7,500 volts  |

V.4220-C.1  
March, 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class A AF Amp. and Mod. |        |       |
|----------------------|--------------------------|--------|-------|
| Direct anode voltage | 10,000                   | 12,000 | volts |
| Grid bias            | —150                     | —200   | volts |
| Direct anode current | 0.30                     | 0.38   | amps. |
| Load impedance       | 17,500                   | 10,000 | ohms  |
| Undistorted output   | 325                      | 545    | watts |

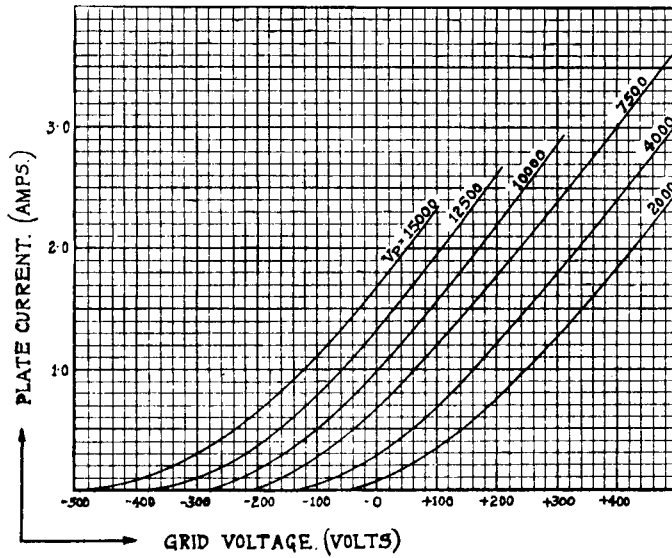
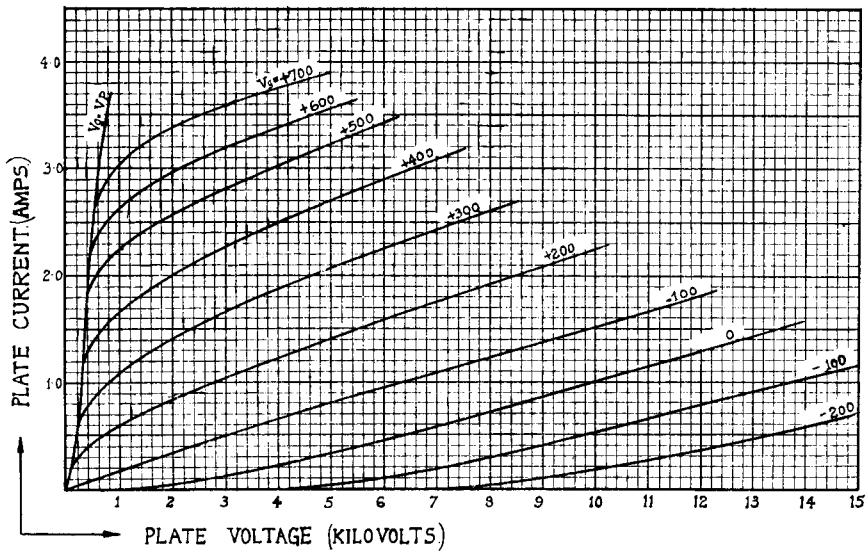
|                                               | Class B AF Amp. and Mod.<br>For balanced 2 valve circuit |       |       |
|-----------------------------------------------|----------------------------------------------------------|-------|-------|
| Direct anode voltage                          | 10,000                                                   | 5,000 | volts |
| Grid bias                                     | —190                                                     | —75   | volts |
| Direct anode current per valve—zero signal    | 0.20                                                     | 0.10  | amps. |
| Direct anode current per valve—maximum signal | 1.3                                                      | 1.3   | amps. |
| Load resistance—anode to anode                | 7,000                                                    | 3,480 | ohms  |
| Maximum output—2 valves                       | 14,500                                                   | 7,200 | watts |
| Recommended power for driving stage           | 2,000                                                    | 2,000 | watts |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |        | Class C<br>Telephony              |       | Class C<br>Telegraphy |                 |
|----------------------|-----------------------------------------|--------|-----------------------------------|-------|-----------------------|-----------------|
|                      | Modulated<br>Carrier<br>applied to grid |        | Subject to<br>anode<br>modulation |       | Unmodulated           |                 |
| Direct anode voltage | 12,000                                  | 10,000 | 7,500                             | 5,000 | 10,000                | 7,500 volts     |
| Direct anode current | 0.6                                     | 0.6    | 0.6                               | 0.6   | 1.1                   | 1.1 amps        |
| Grid bias            | —350                                    | —300   | —600                              | —300  | —470                  | —350 to<br>—550 |
| Anode dissipation    | 4,850                                   | 4,100  | 1,350                             | 1,100 | 3,500                 | 2,650 watts     |
| Carrier output       | 2,350                                   | 1,900  | 3,150                             | 1,900 | 7,500                 | 5,600 watts     |

# —Standard Valves—

4220-C  
Valve



PRINTED IN  
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# *—Standard Valves—*

4222-B  
Valve

## 4222-B VALVE

HALF WAVE WATER COOLED RECTIFIER.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type MS.1362 Grp. I for anode dissipation up to 6 Kw.

Type MS.1362 Grp. 20 for below panel connection for anode dissipation up to 6 Kw.

Type 223 LU 1A for anode dissipation over 6 Kw.

#### Dimensions.

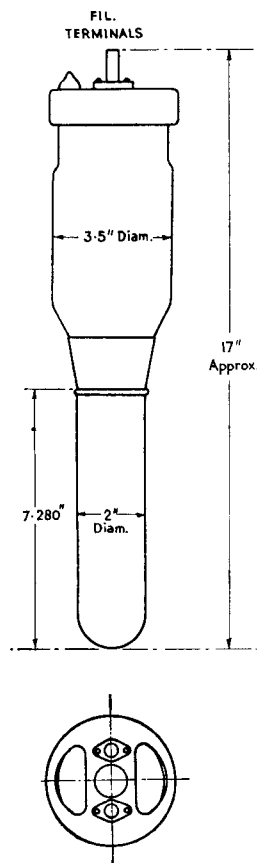
|                  |                      |
|------------------|----------------------|
| Overall length   | 17" (43 cms.)        |
| Overall diameter | 3½" (8.9 cms.)       |
| Net weight       | 2½ lbs. (1,150 gms.) |

#### Water Flow.

2 gallons per minute.

#### Constants.

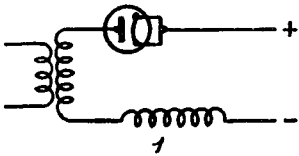
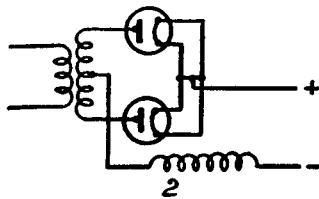
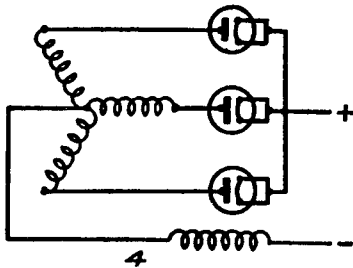
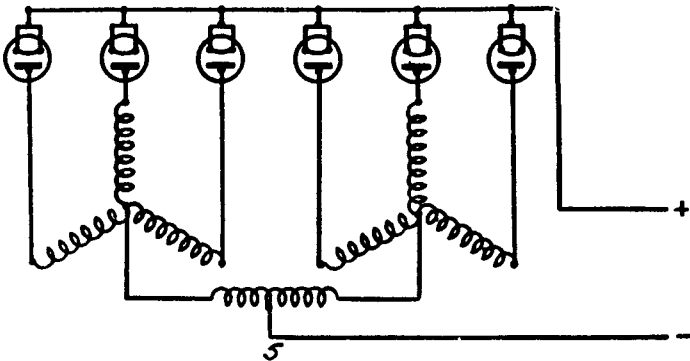
|                                                          |              |
|----------------------------------------------------------|--------------|
| Filament voltage                                         | 22 volts     |
| (exact filament voltage is marked on bulb of each valve) |              |
| Nominal filament current                                 | 41 amps.     |
| Total emission                                           | 6 amps.      |
| Maximum peak inverse voltage                             | 45,000 volts |
| Maximum anode dissipation                                | 10 Kw.       |



# *—Standard Valves—*

## TYPICAL OPERATING CONDITIONS.

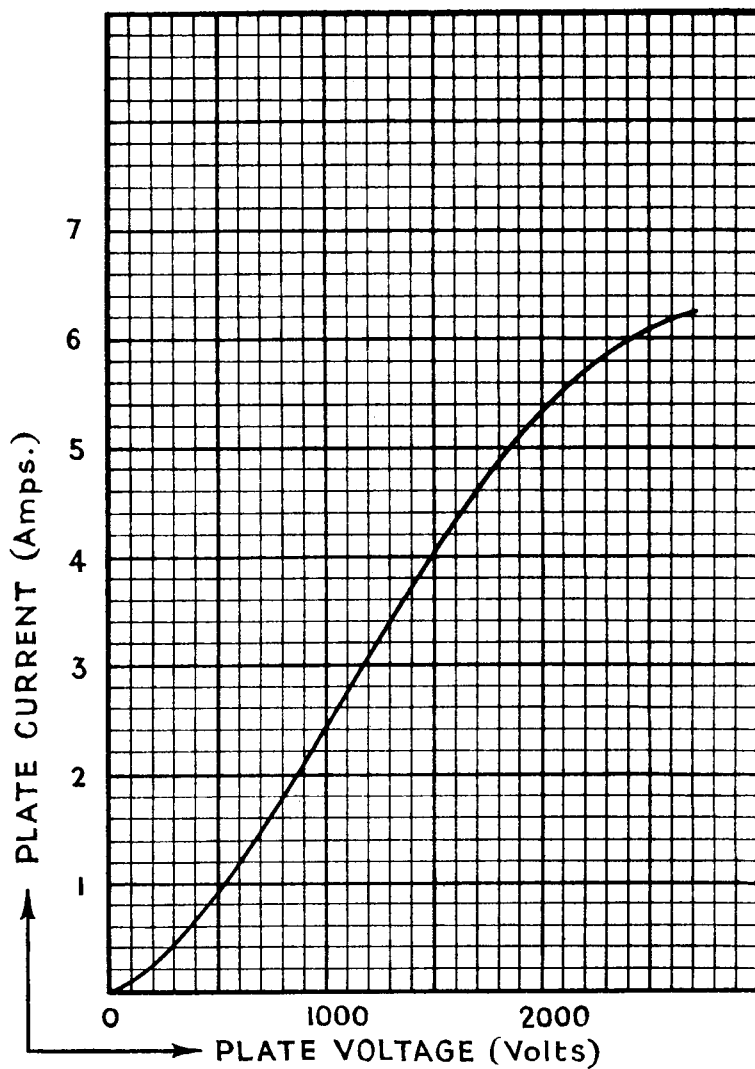
| Circuit | Number of<br>valves | Load potential<br>in volts | Load current<br>in amps. |
|---------|---------------------|----------------------------|--------------------------|
| 1       | 1                   | 7,000                      | 1.5                      |
| 2       | 2                   | 14,000                     | 3.0                      |
| 4       | 3                   | 22,500                     | 4.3                      |
| 5       | 6                   | 22,500                     | 8.5                      |



# *—Standard Valves—*

4222-B  
Valve

This curve is taken with A.C. filament heating, anode voltages being referred to the centre point of the filament.





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# —Standard Valves—

4228-A  
Valve

## 4228-A VALVE

SINGLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Water Jacket.

Type MS.1362 Grp. 1  
Type MS.1362 Grp. 20 for below panel  
connection.

#### Dimensions.

Overall length 18" (45.7 cms.)  
Bulb diameter  $3\frac{1}{2}$ " (8.9 cms.)  
Net weight  $2\frac{1}{2}$  lbs. (1,150 gms.)

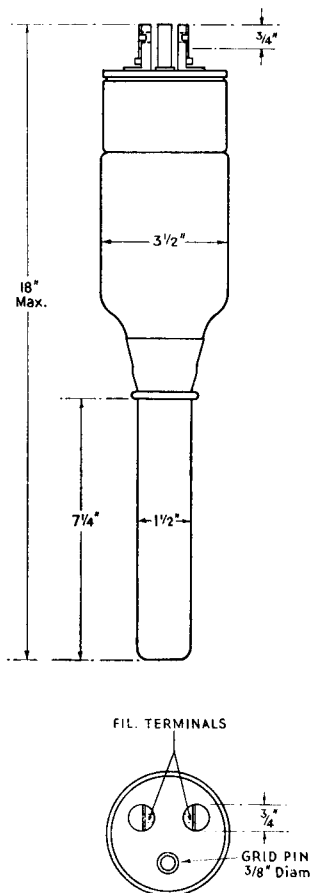
#### Water Flow.

5 gallons per minute.

#### Constants.

|                                            |                        |
|--------------------------------------------|------------------------|
| Filament voltage                           | 22 volts               |
| (exact filament voltage marked<br>on bulb) |                        |
| Nominal filament current                   | 41 amps.               |
| Total emission                             | 6 amps.                |
| * Impedance                                | 2,200 ohms             |
| * Amplification factor                     | 18                     |
| Grid-anode capacity                        | 24 $\mu\mu\text{F}$ .  |
| Anode-filament capacity                    | 3.1 $\mu\mu\text{F}$ . |
| Grid-filament capacity                     | 25 $\mu\mu\text{F}$ .  |

\* at anode current of 0.75 amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |             |
|---------------------------------------------------|-------------|
| Maximum direct anode voltage                      | 6,000 volts |
| Maximum direct anode voltage for anode modulation | 4,000 volts |
| Maximum direct anode current                      | 1.5 amps.   |
| Maximum anode dissipation                         | 5 Kw.       |
| Maximum grid dissipation                          | 100 watts   |
| Maximum frequency for above ratings               | 3 Mc.       |
| Maximum anode voltage for frequency of 6 Mc.      | 3,000 volts |

V.4228-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

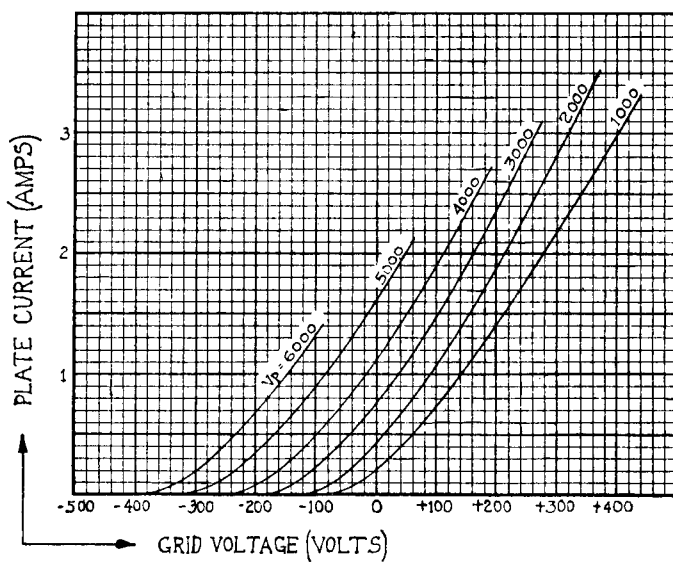
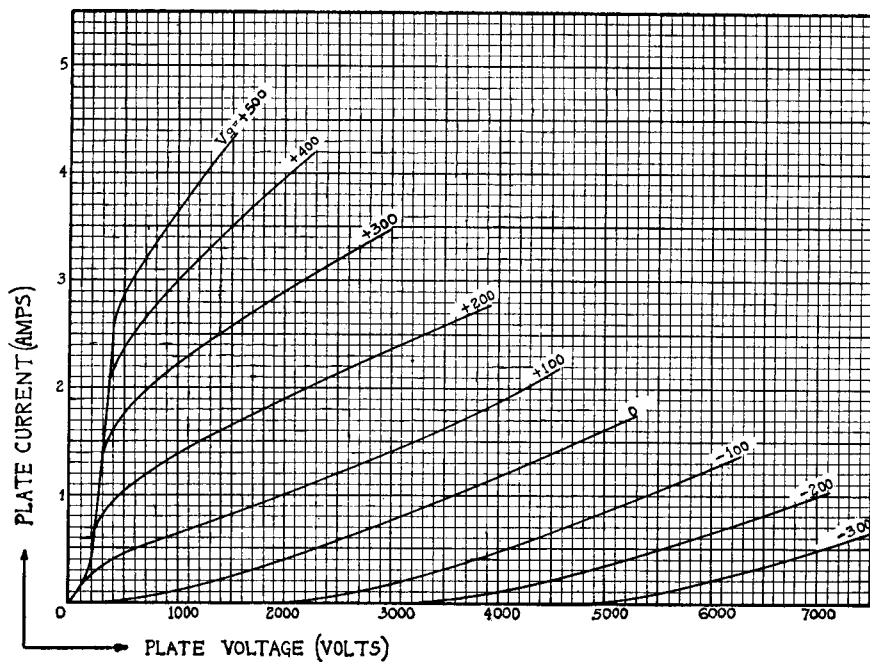
|                                               | Class B AF Amp.<br>For balanced 2 valve circuit |       |       |
|-----------------------------------------------|-------------------------------------------------|-------|-------|
|                                               |                                                 |       |       |
| Direct anode voltage                          | 5,000                                           | 4,000 | volts |
| Grid bias                                     | —265                                            | —200  | volts |
| Direct anode current per valve—zero signal    | 0.15                                            | 0.15  | amps. |
| Direct anode current per valve—maximum signal | 0.6                                             | 0.7   | amps. |
| Load resistance—anode to anode                | 8,400                                           | 5,000 | ohms  |
| Maximum signal output—2 valves                | 3.75                                            | 3.0   | Kw.   |
| Anode dissipation                             | 1.125                                           | 1.3   | Kw.   |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                       |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                       |
| Direct anode voltage | 5,000                                   | 4,000 | 4,000                             | 3,000 | 6,000                 | 4,000 volts           |
| Direct anode current | 0.65                                    | 0.65  | 1.25                              | 1.3   | 1.25                  | 1.25 amps.            |
| Grid bias            | —325                                    | —275  | —500                              | —300  | —600<br>—800          | —450 to<br>—550 volts |
| Anode dissipation    | 2.15                                    | 1.7   | 2.5                               | 1.9   | 2.5                   | 1.7 Kw.               |
| Carrier output       | 1.1                                     | 0.9   | 2.5                               | 2     | 5                     | 3.3 Kw.               |

# —Standard Valves—

4228-A  
Valve



V.4228-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4242-A  
Valve

## 4242-A VALVE

TRIODE.

The 4242-A valve is similar to the 4211-D valve but employs a molybdenum anode and hard glass bulb.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Base.

Large 4-pin bayonet.

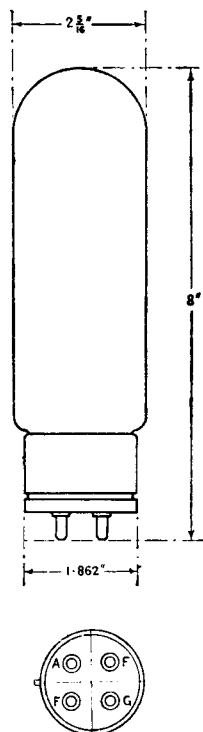
#### Dimensions.

Max. overall length 8" (20.4 cms.)  
Max. bulb diameter  $2\frac{5}{16}$ " (5.9 cms.)  
Net weight 0.36 lbs. (164 gms.)

#### Constants.

Filament voltage 10 volts  
Nominal filament current 3.25 amps.  
Total emission 1.5 amps.  
\*Impedance 3,100 ohms  
\*Amplification factor 13  
\*Mutual conductance 4.2 mA per volt  
Grid-anode capacity 13  $\mu\mu\text{F}$ .  
Anode-filament capacity 4  $\mu\mu\text{F}$ .  
Grid-filament capacity 6.5  $\mu\mu\text{F}$ .

\* at  $V_p = 1,250$  volts,  $V_{g1} = -55$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

Maximum direct anode voltage 1,250 volts  
Maximum direct anode current 0.150 amps.  
Maximum anode dissipation 85 watts  
Maximum direct grid current 0.050 amps.  
Maximum frequency for above ratings 6 Mc.  
Maximum anode voltage for frequency of 30 Mc. 600 volts

Note :—This valve should be mounted so that the plane of the filament is vertical.

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class A AF Amp. and Mod. |       |       |
|----------------------|--------------------------|-------|-------|
| Direct anode voltage | 1,250                    | 1,000 | volts |
| Grid bias            | —70                      | —46   | volts |
| Direct anode current | 0.060                    | 0.075 | amps. |
| Load impedance       | 10,000                   | 7,000 | ohms  |
| Undistorted output   | 18                       | 12    | watts |

|                                        | Class B AF Amp. and Mod.<br>For balanced 2 valve circuits. |       |       |
|----------------------------------------|------------------------------------------------------------|-------|-------|
| Direct anode voltage                   | 1,250                                                      | 1,000 | volts |
| Grid bias                              | —80                                                        | —55   | volts |
| Anode current per valve—zero signal    | 0.030                                                      | 0.030 | amps. |
| Anode current per valve—maximum signal | 0.150                                                      | 0.150 | amps. |
| Anode dissipation                      | 80                                                         | 70    | watts |
| Load resistance—anode to anode         | 8,000                                                      | 6,000 | ohms  |
| Maximum output—2 valves                | 200                                                        | 160   | watts |

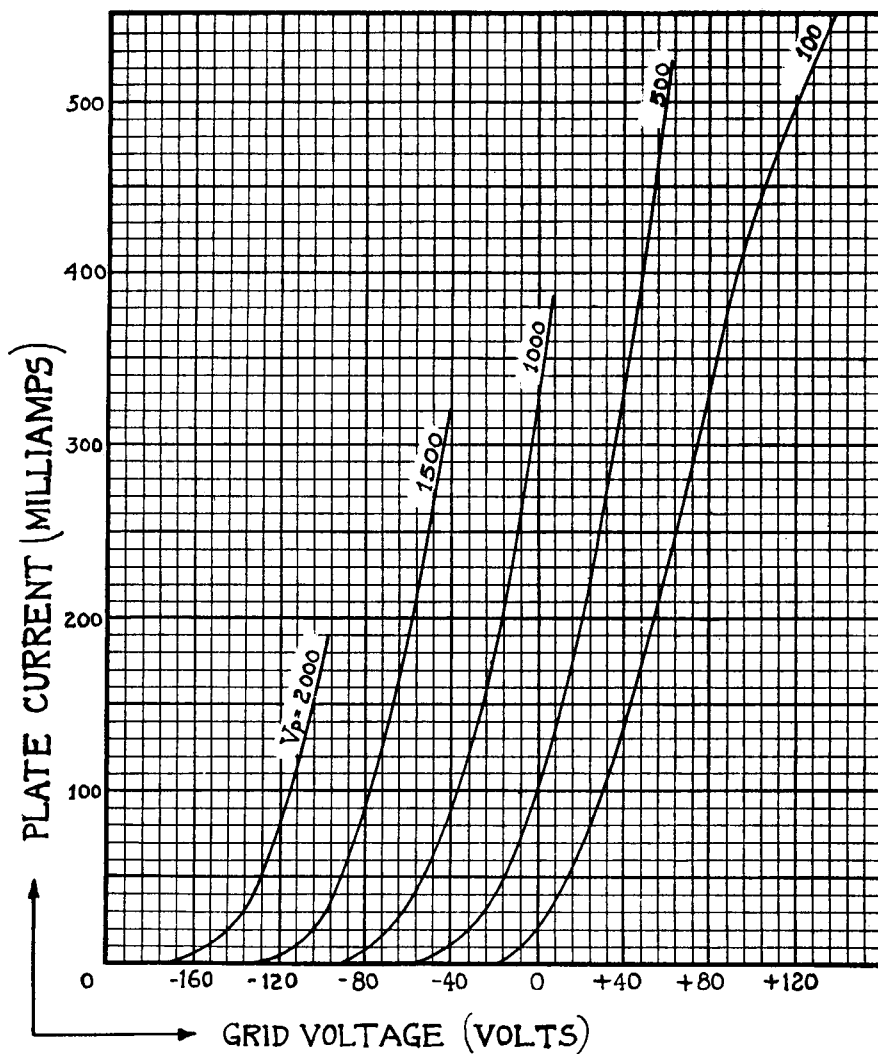
## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                       |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                       |
| Direct anode voltage | 1,250                                   | 1,000 | 1,000                             | 750   | 1,250                 | 1,000 volts           |
| Direct anode current | 0.106                                   | 0.130 | 0.150                             | 0.130 | 0.150                 | 0.150 amps.           |
| Grid bias            | —90                                     | —70   | —160                              | —120  | —150<br>—200          | —120 to<br>—160 volts |
| Carrier output       | 44                                      | 43    | 100                               | 64    | 130                   | 100 watts             |
| Anode dissipation    | 85                                      | 85    | 50                                | 32    | 58                    | 50 watts              |

The curves on sheet V.4242-A.2 are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.

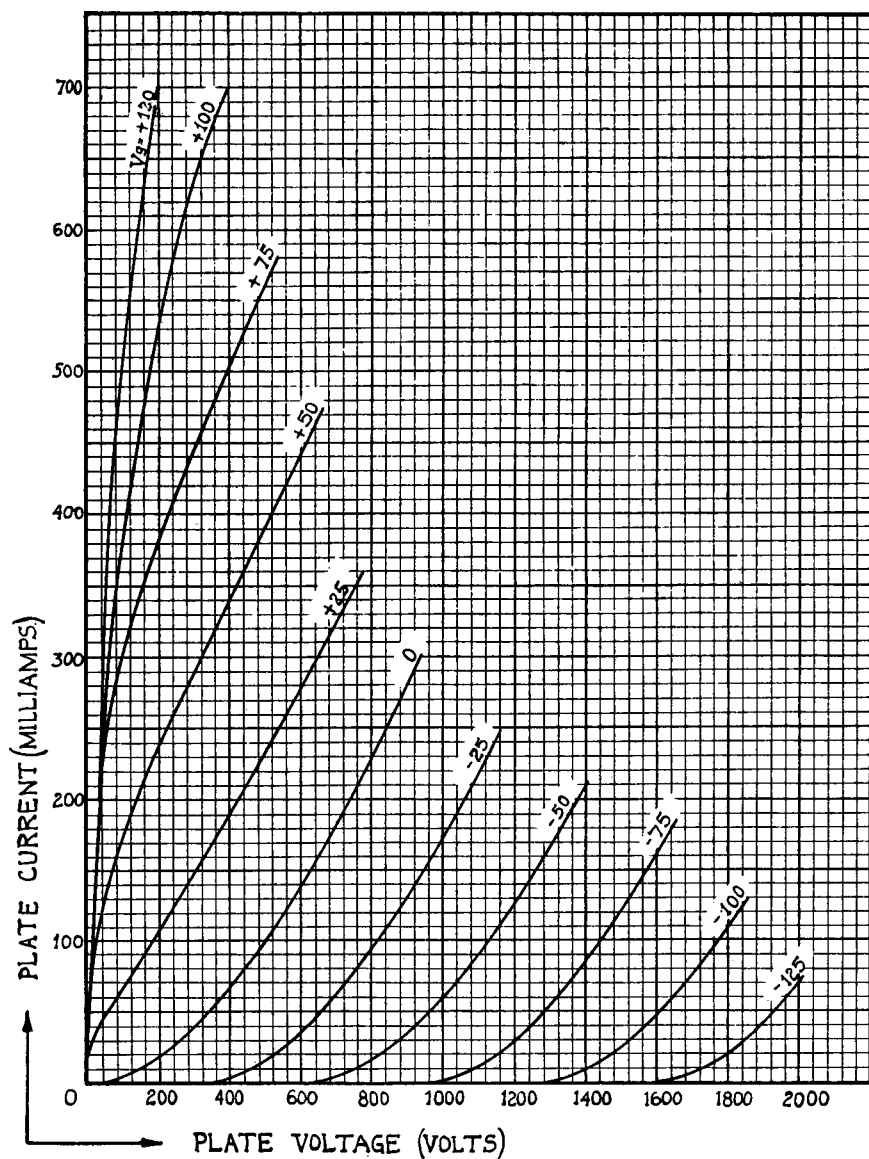
# —Standard Valves—

4242-A  
Valve





# —Standard Valves—



# —Standard Valves—

4251-A  
Valve

## 4251-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

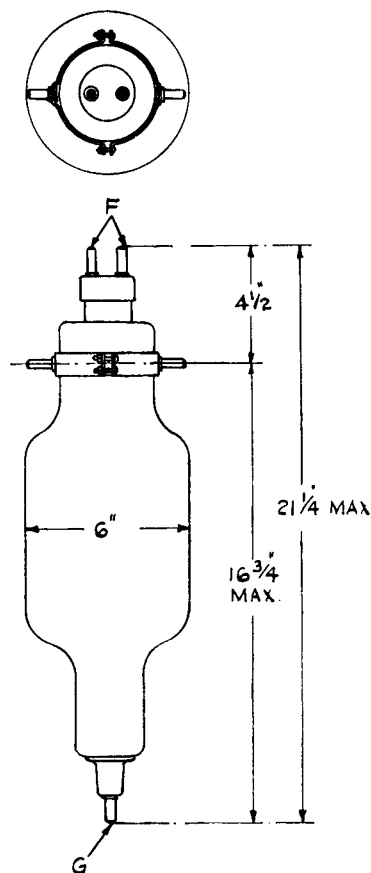
#### Dimensions.

Max. overall length 21½" (54 cms.)  
Bulb diameter 6" (15.2 cms.)  
Net weight 3.3 lbs. (1,500 gms.)

#### Constants.

Filament voltage 10 volts  
Nominal filament current 16 amps.  
Total emission 6 amps.  
\*Impedance 2,750 ohms  
\*Amplification factor 10.5  
\*Mutual conductance 3.8 mA. per volt  
Grid-anode capacity 8 μμF.  
Anode-filament capacity 6 μμF.  
Grid-filament capacity 10 μμF.

\* at  $V_p = 2,500$  volts,  $I_p = 200$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 3,000 volts |
| Maximum direct anode current                  | 0.600 amps. |
| Maximum anode dissipation                     | 1,000 watts |
| Maximum grid dissipation                      | 50 watts    |
| Maximum frequency for above ratings           | 30 Mc.      |
| Maximum anode voltage for frequency of 50 Mc. | 2,000 volts |

V.4251-A.1  
Sept. 1938

*—Standard Valves—*

**TYPICAL OPERATING CONDITIONS.**

|                      | Class A A.F. Amp. and Mod. |             |
|----------------------|----------------------------|-------------|
| Direct anode voltage | 2,500                      | 2,000 volts |
| Grid bias            | —150                       | —90 volts   |
| Direct anode current | 0.240                      | 0.300 amps. |
| Load impedance       | 6,500                      | 4,000 ohms  |
| Undistorted output   | 130                        | 85 watts    |

|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |             |
|----------------------------------------|------------------------------------------------------------|-------------|
| Direct anode voltage                   | 3,000                                                      | 2,500 volts |
| Grid bias                              | —250                                                       | —200 volts  |
| Anode current per valve—zero signal    | 0.075                                                      | 0.075 amps. |
| Anode current per valve—maximum signal | 0.600                                                      | 0.600 amps. |
| Anode dissipation                      | 800                                                        | 675 watts   |
| Load resistance—anode to anode         | 4,500                                                      | 3,700 ohms  |
| Maximum output—2 valves                | 2,000                                                      | 1,650 watts |

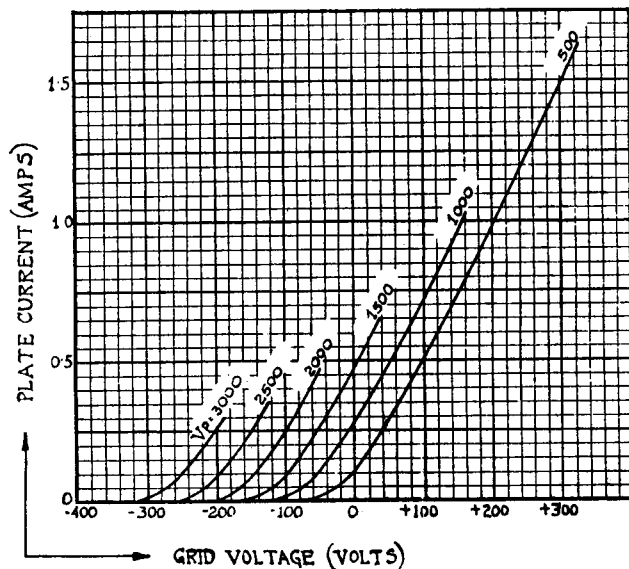
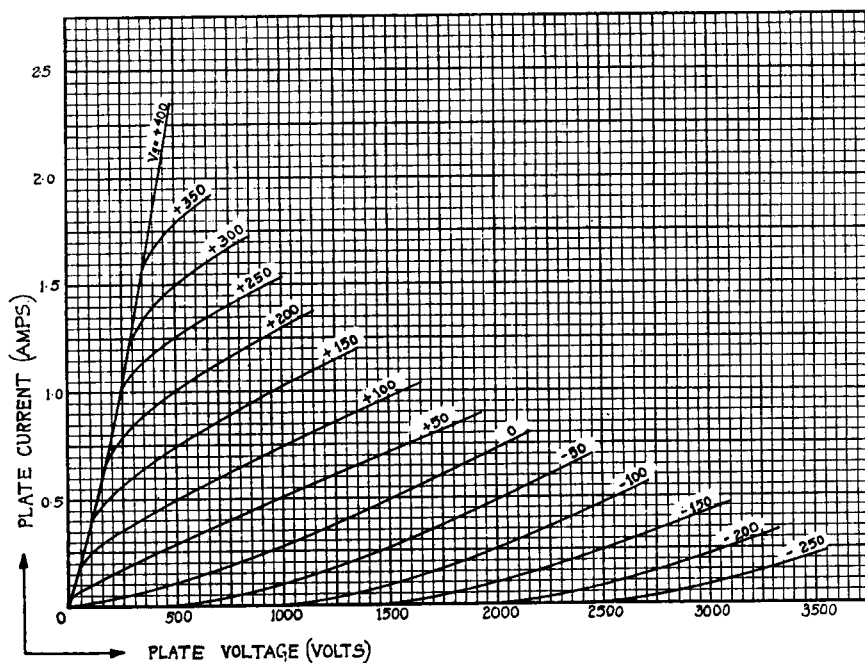
**RADIO FREQUENCY OPERATION.**

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                       |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-----------------------|
|                      | Modulated<br>carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                       |
| Direct anode voltage | 3,000                                   | 2,500 | 2,250                             | 1,750 | 3,000                 | 2,500 volts           |
| Direct anode current | 0.400                                   | 0.500 | 0.400                             | 0.500 | 0.600                 | 0.600 amps.           |
| Grid bias            | —300                                    | —250  | —450                              | —360  | —450<br>—600          | —375 to<br>—500 volts |
| Carrier output       | 400                                     | 420   | 600                               | 585   | 1,200                 | 1,000 watts           |
| Anode dissipation    | 800                                     | 830   | 300                               | 290   | 600                   | 500 watts             |

# —Standard Valves—

4251-A  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4251-A.2  
Sept. 1938

**—Standard Valves—**



# —Standard Valves—

4251-AX  
Valve

## 4251-AX VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

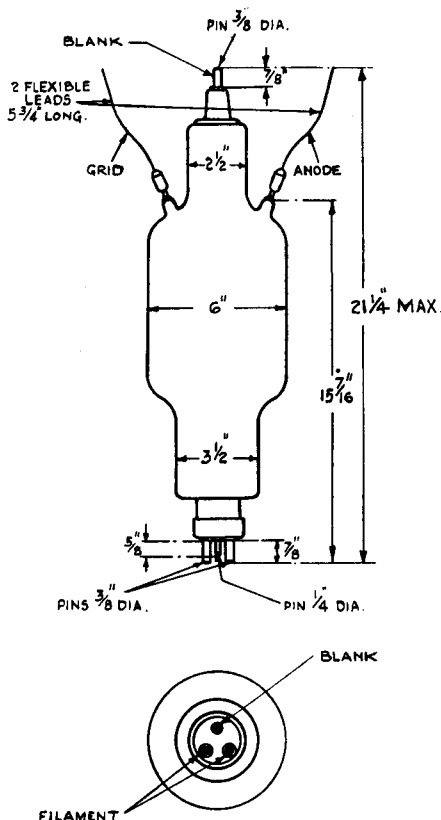
#### Dimensions.

Max. overall length  $21\frac{1}{4}"$  (54 cms.)  
Bulb diameter  $6"$  (15.2 cms.)  
Net weight  $2\frac{3}{4}$  lbs. (1,250 gms.)

#### Constants.

Filament voltage 10 volts  
Nominal filament current 16 amps.  
Total emission 6 amps.  
\*Impedance 2,750 ohms  
\*Amplification factor 10.5  
\*Mutual conductance 3.8 mA. per volt.  
Grid-anode capacity  $8.6 \mu\text{F}$ .  
Anode-filament capacity  $5.2 \mu\text{F}$ .  
Grid-filament capacity  $12 \mu\text{F}$ .

\* at  $V_p = 2,500$  volts,  $I_p = 200$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 3,000 volts |
| Maximum direct anode current                  | 0.600 amps. |
| Maximum anode dissipation                     | 1,000 watts |
| Maximum grid dissipation                      | 50 watts    |
| Maximum frequency for above ratings           | 30 Mc.      |
| Maximum anode voltage for frequency of 50 Mc. | 2,000 volts |

V.4251-AX.1  
March, 1939

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

|                      | Class A A.F. Amp. and Mod. |             |
|----------------------|----------------------------|-------------|
|                      |                            |             |
| Direct anode voltage | 2,500                      | 2,000 volts |
| Grid bias            | —150                       | —90 volts   |
| Direct anode current | 0.240                      | 0.300 amps. |
| Load impedance       | 6,500                      | 4,000 ohms  |
| Undistorted output   | 130                        | 85 watts    |

|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |             |
|----------------------------------------|------------------------------------------------------------|-------------|
|                                        |                                                            |             |
| Direct anode voltage                   | 3,000                                                      | 2,500 volts |
| Grid bias                              | —250                                                       | —200 volts  |
| Anode current per valve—zero signal    | 0.075                                                      | 0.075 amps. |
| Anode current per valve—maximum signal | 0.600                                                      | 0.600 amps. |
| Anode dissipation                      | 800                                                        | 675 watts   |
| Load resistance—anode to anode         | 4,500                                                      | 3,700 ohms  |
| Maximum output—2 valves                | 2,000                                                      | 1,650 watts |

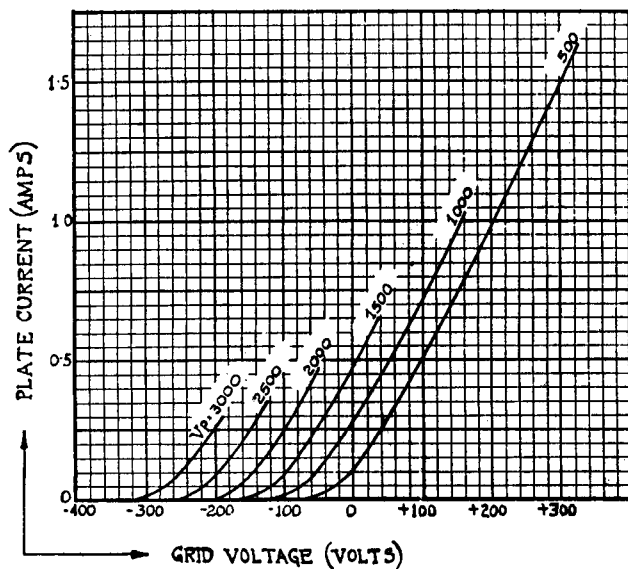
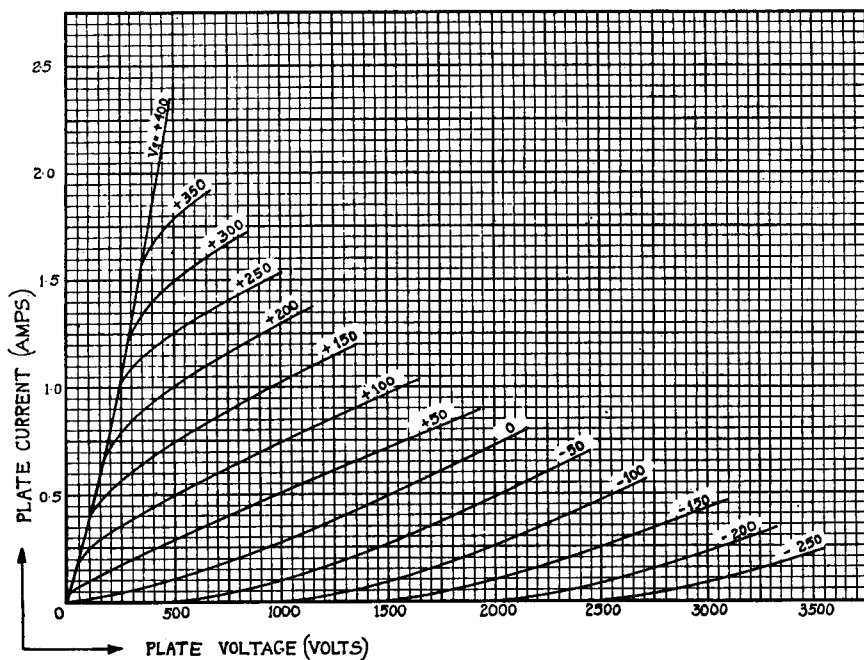
RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |             |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-------------|
|                      | Modulated<br>carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |             |
| Direct anode voltage | 3,000                                   | 2,500 | 2,250                             | 1,750 | 3,000                 | 2,500 volts |
| Direct anode current | 0.400                                   | 0.500 | 0.400                             | 0.500 | 0.600                 | 0.600 amps. |
| Grid bias            | —300                                    | —250  | —450                              | —360  | —450                  | —375 to     |
|                      |                                         |       |                                   |       | —600                  | —500 volts  |
| Carrier output       | 400                                     | 420   | 600                               | 585   | 1,200                 | 1,000 watts |
| Anode dissipation    | 800                                     | 830   | 300                               | 290   | 600                   | 500 watts   |

# —Standard Valves—

4251-AX  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4251-AX.2  
March, 1939



PRINTED IN  
ENGLAND

# —Standard Valves—

4260-A  
Valve

## 4260-A VALVE

TETRODE.

### SPECIFICATION.

#### Cathode.

Thoriated Tungsten filament.  
Constant voltage type.

#### Base.

American medium 4-pin bayonet.

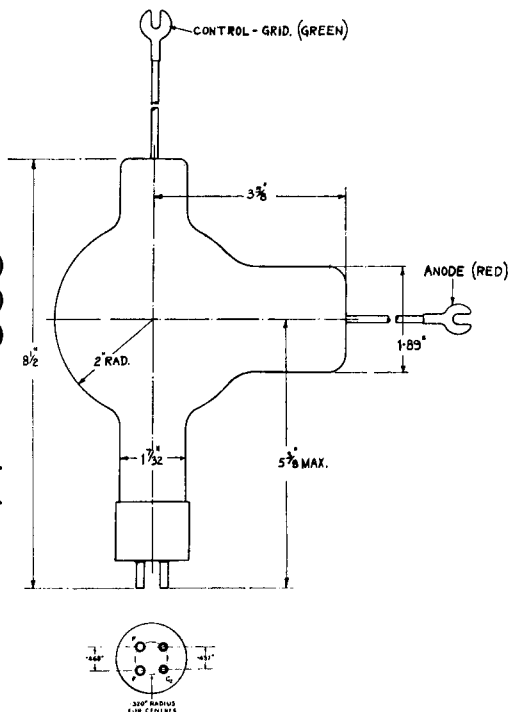
#### Dimensions.

Overall length  $8\frac{1}{2}"$  (21.6 cms.)  
Maximum width  $5\frac{5}{8}"$  (14.3 cms.)  
Net weight 0.5 lbs. (225 gms.)

#### Constants.

Filament voltage 10 volts  
Nominal filament current 3.25 amps.  
Total emission 1.5 amps.  
\*Impedance 175,000 ohms  
\*Amplification factor 200  
Grid-anode capacity 0.09  $\mu\text{F}$ .  
Input capacity 7.8  $\mu\text{F}$ .  
Output capacity 6.75  $\mu\text{F}$ .

\* at anode current of 0.033 amps.



### LIMITING CONDITIONS FOR SAFE OPERATION.

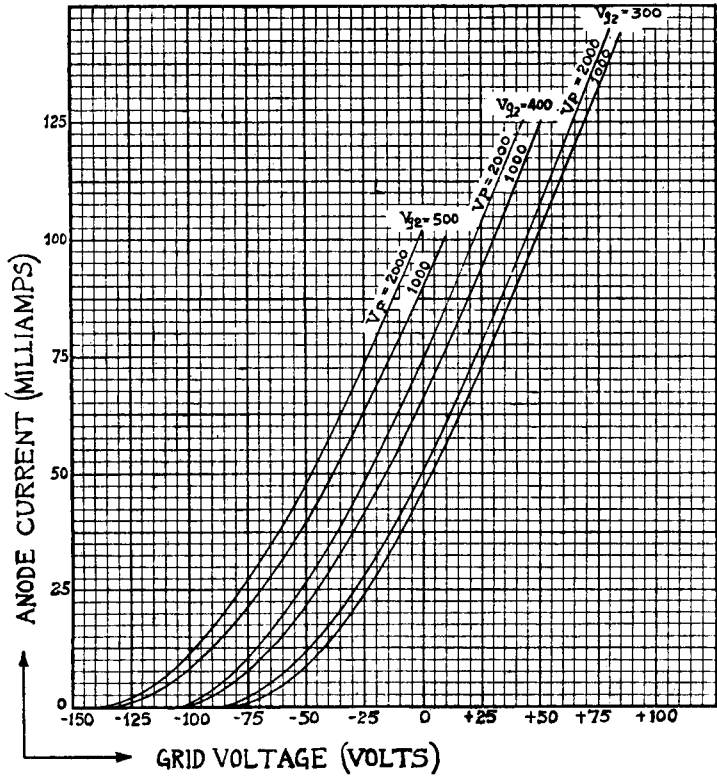
|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 3,000 volts |
| Maximum direct anode current                  | 0.100 amps. |
| Maximum anode dissipation                     | 100 watts   |
| Maximum screen grid dissipation               | 15 watts    |
| Maximum R.F. grid current                     | 10 amps.    |
| Maximum direct grid current                   | 40 mA.      |
| Maximum frequency for above ratings           | 30 Mc.      |
| Maximum anode voltage for frequency of 40 Mc. | 2,500 volts |

V.4260-A.1  
Nov. 1937

—Standard Valves—

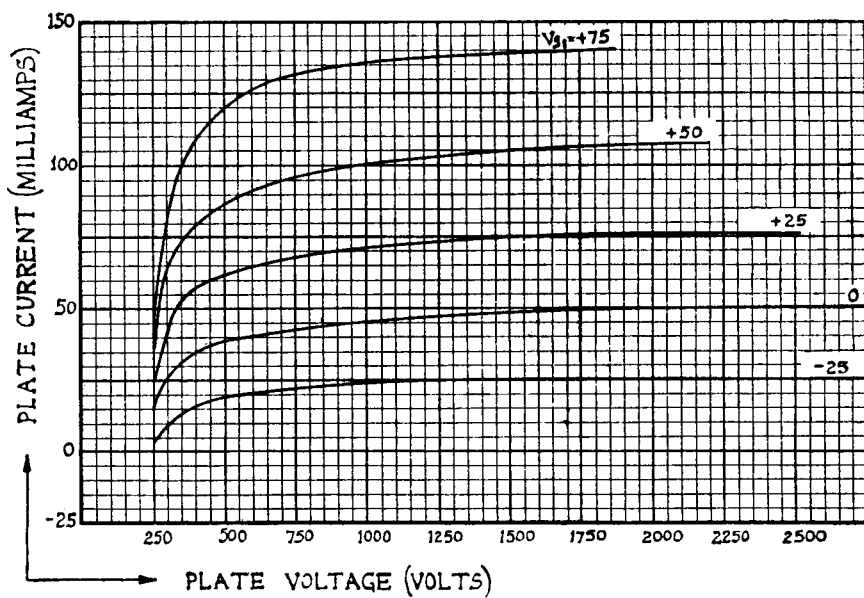
TYPICAL OPERATING CONDITIONS.  
RADIO FREQUENCY OPERATION.

|                            | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                       |
|----------------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-----------------------|
|                            | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                       |
| Direct anode voltage       | 3,000                                   | 2,000 | 2,000                             | 1,500 | 3,000                 | 2,000 volts           |
| Control-grid bias          | —100                                    | —100  | —200                              | —200  | —150                  | —150 to<br>—200 volts |
| Direct screen-grid voltage | 300                                     | 300   | 300                               | 300   | 300                   | 300 volts             |
| Direct anode current       | 0.050                                   | 0.075 | 0.100                             | 0.100 | 0.100                 | 0.100 amps.           |
| Anode dissipation          | 100                                     | 100   | 65                                | 50    | 100                   | 65 watts              |
| Carrier output             | 50                                      | 50    | 135                               | 100   | 200                   | 135 watts             |



# *—Standard Valves—*

4260-A  
Valve



PRINTED IN  
ENGLAND

# —Standard Valves—

4264-A  
Valve

## 4264-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.

Constant current type.

#### Base.

American tapered small 4-pin.

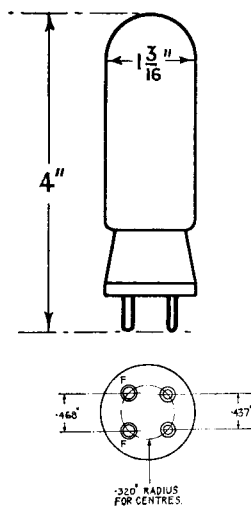
#### Dimensions.

|                |                              |
|----------------|------------------------------|
| Overall length | 4" (10.2 cms.)               |
| Bulb diameter  | $1\frac{3}{16}$ " (3.0 cms.) |
| Net weight     | 0.07 lbs. (30 gms.)          |

#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament current         | 0.3 amp.               |
| Nominal filament voltage | 1.5 volts              |
| *Impedance               | 12,900 ohms            |
| *Amplification factor    | 7.0                    |
| *Mutual conductance      | 0.54 mA. per volt      |
| Grid-anode capacity      | 5.3 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 2.2 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 3.5 $\mu\mu\text{F}$ . |

\* at anode current of 2.0 mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |           |
|------------------------------|-----------|
| Maximum direct anode voltage | 100 volts |
| Maximum direct anode current | 2.8 mA.   |

# —Standard Valves—

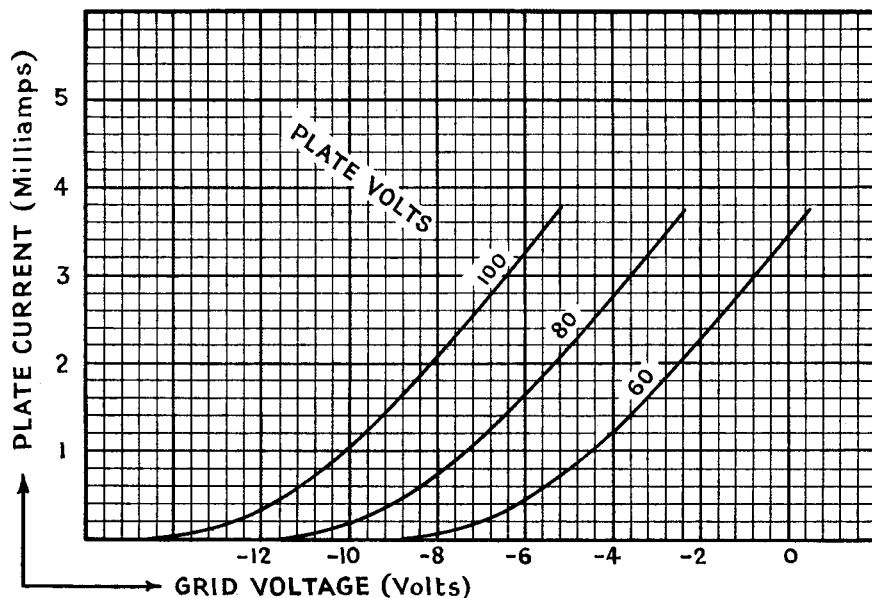
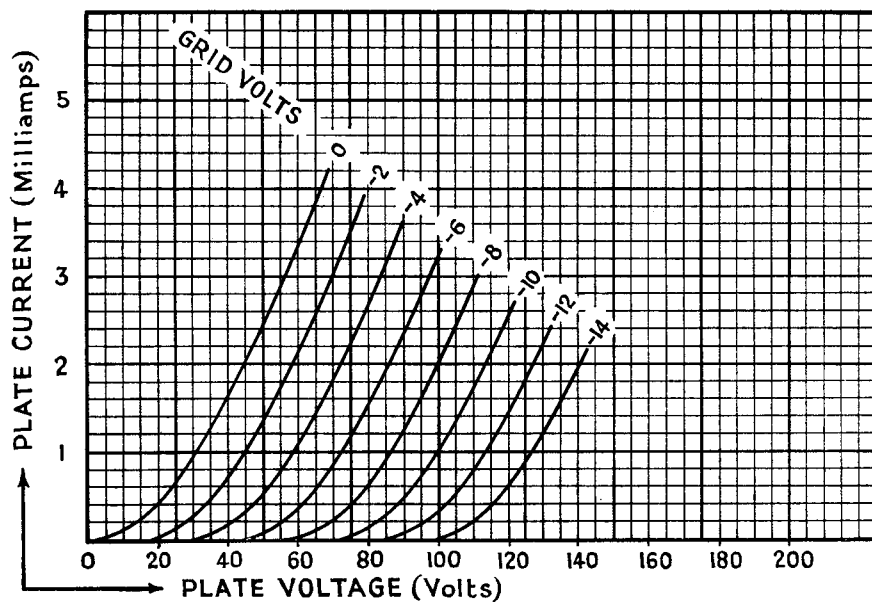
## TYPICAL OPERATING CONDITIONS.

| Anode voltage | Grid bias | Anode current | Amplification factor | Anode resistance | Load resistance | Power output | Voltage output | Second harmonic |
|---------------|-----------|---------------|----------------------|------------------|-----------------|--------------|----------------|-----------------|
| volts         | volts     | mA.           |                      | ohms             | R               | mW.          | peak volts     | db              |
| 60            | —2.0      | 2.35          | 7.3                  | 11,700           | R=rp            | 2.4          | —              | 38              |
|               |           |               |                      |                  | R=2rp           | 2.1          | —              | 44              |
|               |           |               |                      |                  | R=5rp           | —            | 12             | 51              |
| 90            | —7.0      | 1.90          | 7.2                  | 12,800           | R=rp            | 25           | —              | 24              |
|               |           |               |                      |                  | R=2rp           | 23           | —              | 31              |
|               |           |               |                      |                  | R=5rp           | —            | 41             | 39              |
| 100           | —8.0      | 2.10          | 7.2                  | 12,400           | R=rp            | 33           | —              | 24              |
|               |           |               |                      |                  | R=2rp           | 30           | —              | 31              |
|               |           |               |                      |                  | R=5rp           | —            | 48             | 39              |
| 90            | —5.5      | 2.80          | 7.2                  | 11,300           | R=rp            | 18           | —              | 30              |
|               |           |               |                      |                  | R=2rp           | 16           | —              | 36              |
|               |           |               |                      |                  | R=5rp           | —            | 33             | 44              |
| 100           | —7.0      | 2.70          | 7.2                  | 11,400           | R=rp            | 28           | —              | 28              |
|               |           |               |                      |                  | R=2rp           | 25           | —              | 34              |
|               |           |               |                      |                  | R=5rp           | —            | 42             | 42              |

# —Standard Valves—

4264-A  
Valve

These curves are taken with direct filament heating, grid and anode voltages being referred to the negative end of the filament.



V.4264-A.2  
Nov. 1937



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# —Standard Valves—

4270-A  
Valve

## 4270-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated Tungsten filament.  
Constant voltage type.

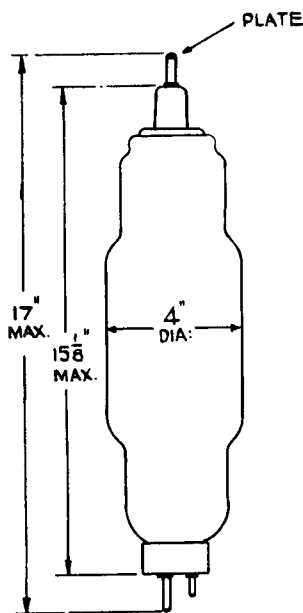
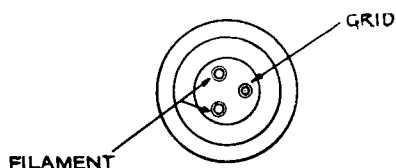
#### Dimensions.

|                  |                    |
|------------------|--------------------|
| Overall length   | 17" (43 cms.)      |
| Maximum diameter | 4" (10.2 cms.)     |
| Net weight       | 1½ lbs. (600 gms.) |

#### Constants.

|                          |                       |
|--------------------------|-----------------------|
| Filament voltage         | 10 volts              |
| Nominal filament current | 9.75 amps.            |
| Total emission           | 4.0 amps.             |
| *Impedance               | 2,800 ohms            |
| *Amplification factor    | 16                    |
| Grid-anode capacity      | 21 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 2 $\mu\mu\text{F}$ .  |
| Grid-filament capacity   | 18 $\mu\mu\text{F}$ . |

\* at anode current of 0.12 amps.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                 |             |
|-------------------------------------------------|-------------|
| Maximum direct anode voltage                    | 3,000 volts |
| Maximum direct anode current                    | 0.375 amps. |
| Maximum anode dissipation                       | 350 watts   |
| Maximum direct grid current                     | 0.075 amps. |
| Maximum frequency for above ratings             | 7.5 Mc.     |
| Maximum anode voltage for frequency of 22.5 Mc. | 1,000 volts |

V.4270-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class A A.F. Amp. or Mod. |        |       |
|----------------------|---------------------------|--------|-------|
| Direct anode voltage | 2,500                     | 2,000  | volts |
| Grid bias            | —130                      | —95    | volts |
| Direct anode current | 0.120                     | 0.150  | amps. |
| Anode dissipation    | 300                       | 300    | watts |
| Load impedance       | 15,000                    | 10,000 | ohms  |
| Undistorted output   | 90                        | 70     | watts |

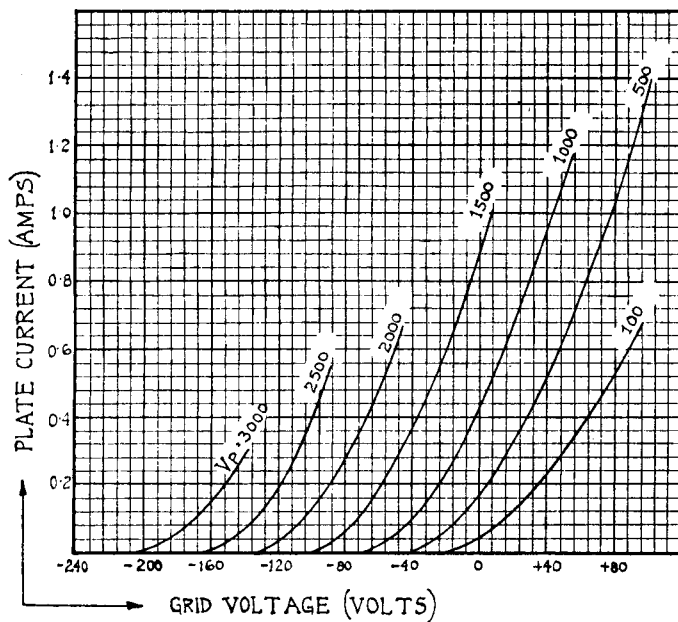
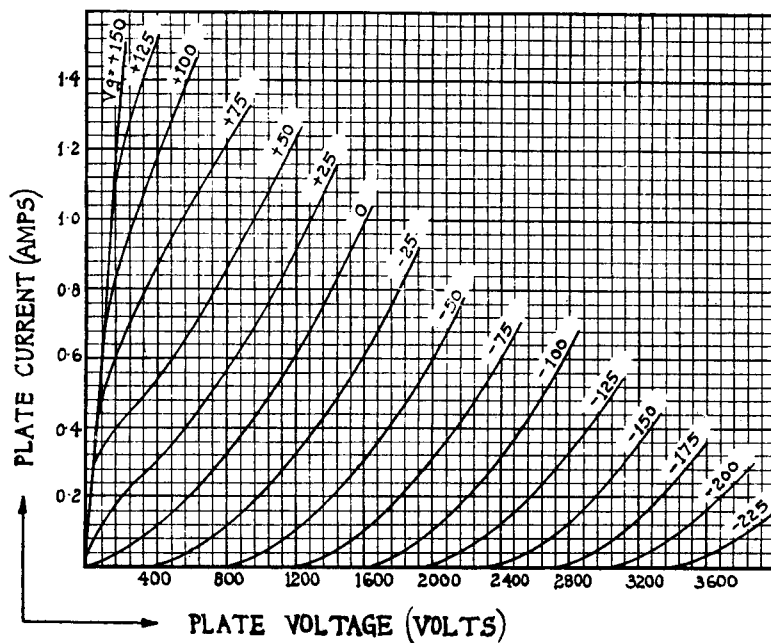
|                                        | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |       |       |
|----------------------------------------|------------------------------------------------------------|-------|-------|
| Direct anode voltage                   | 2,500                                                      | 2,000 | volts |
| Grid bias                              | —140                                                       | —105  | volts |
| Anode current per valve—zero signal    | 0.060                                                      | 0.060 | amps. |
| Anode current per valve—maximum signal | 0.375                                                      | 0.375 | amps. |
| Load resistance—anode to anode         | 8,000                                                      | 6,000 | ohms  |
| Anode dissipation                      | 350                                                        | 350   | watts |
| Maximum output—2 valves                | 1,000                                                      | 850   | watts |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |       |       |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-------|-------|
|                      | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |       |       |
| Direct anode voltage | 3,000                                   | 2,500 | 2,250                             | 1,750 | 3,000                 | 1,750 | volts |
| Direct anode current | 0.175                                   | 0.210 | 0.300                             | 0.350 | 0.350                 | 0.350 | amps. |
| Grid bias            | —180                                    | —140  | —300                              | —240  | —315                  | —225  | to    |
| Carrier output       | 175                                     | 175   | 450                               | 410   | —420                  | —340  | volts |
| Anode dissipation    | 350                                     | 350   | 225                               | 200   | 700                   | 585   | watts |
|                      |                                         |       |                                   |       | 350                   | 290   | watts |

# —Standard Valves—

4270-A  
Valve



V.4270-A.2  
Nov. 1937

PRINTED IN  
ENGLAND

# —Standard Valves—

4274-A  
Valve

## 4274-A VALVE

FULL WAVE THERMIONIC HIGH VACUUM RECTIFIER.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

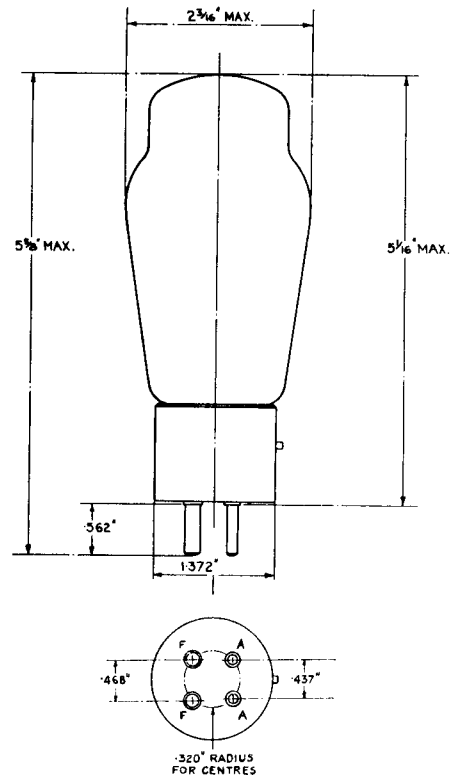
American medium 4-pin bayonet.

#### Dimensions.

Overall length  $5\frac{5}{8}"$  (14.3 cms.)  
Overall diameter  $2\frac{3}{16}"$  (5.5 cms.)  
Net weight 0.12 lbs. (55 gms.)

#### Constants.

Filament voltage 5 volts  
Nominal filament current 2 amps.



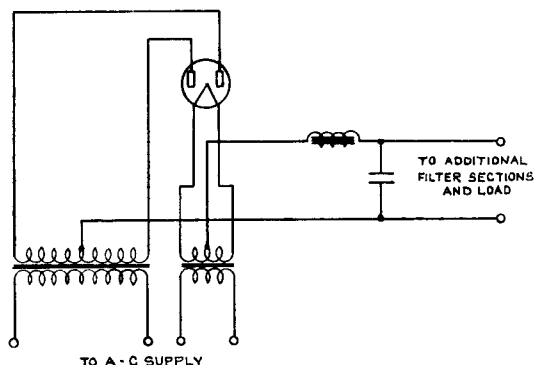
# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

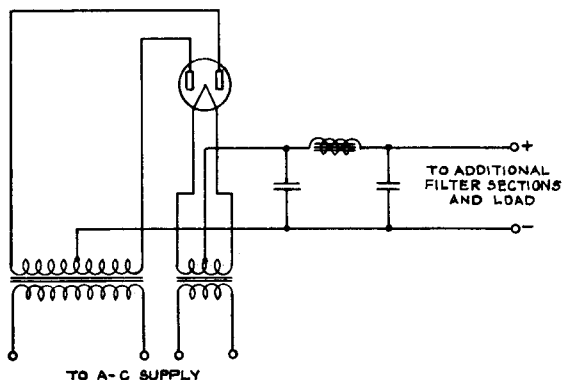
| Input Filter        | R.M.S. A.C. voltage<br>per anode | Total rectified<br>current—mA. |
|---------------------|----------------------------------|--------------------------------|
| Choke—circuit A     | 550                              | 160                            |
|                     | *550                             | 200                            |
|                     | *660                             | 160                            |
| Condenser—Circuit B | 450                              | 140                            |
|                     | *450                             | †150                           |

\* Maximum operating conditions.

† 4 u/F. max. input filter capacity.



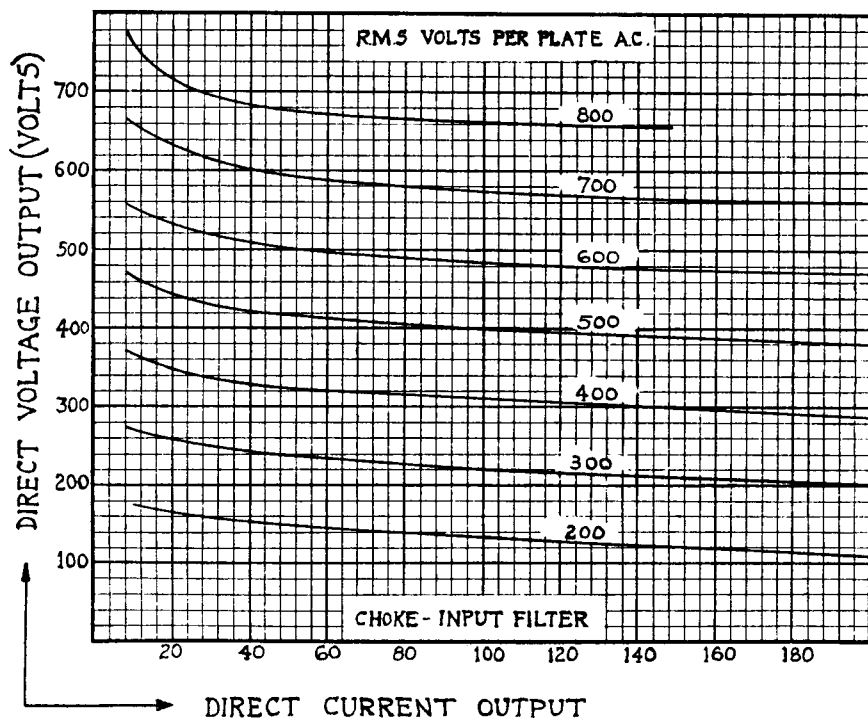
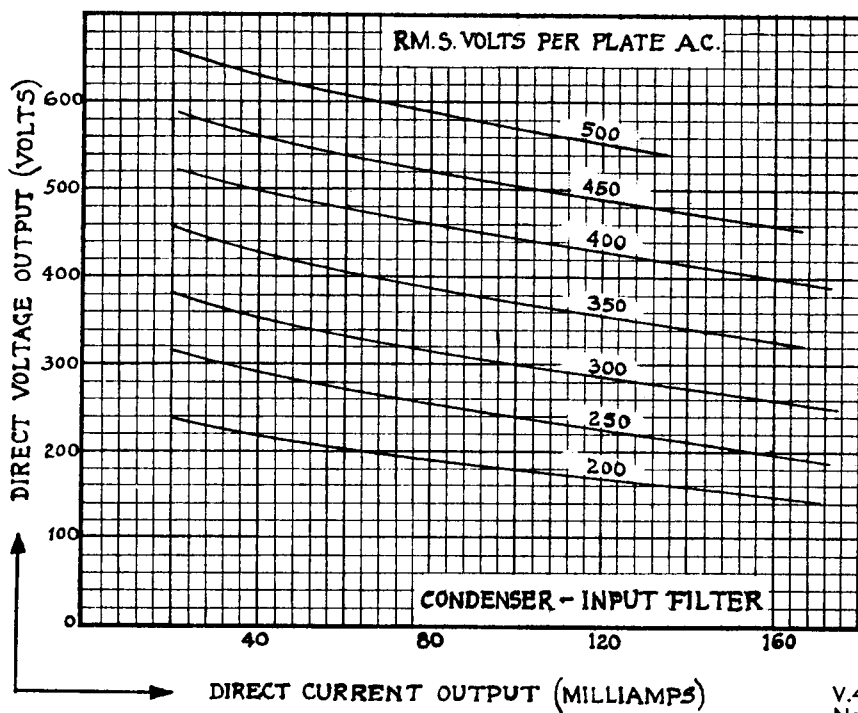
CHOKE INPUT FILTER  
CIRCUIT A



CONDENSER INPUT FILTER  
CIRCUIT B

# —Standard Valves—

4274-A  
Valve



V.4274-A.2  
Nov. 1937



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ENGLAND

# —Standard Valves—

4275-A  
Valve

## 4275-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

American medium 4-pin bayonet.

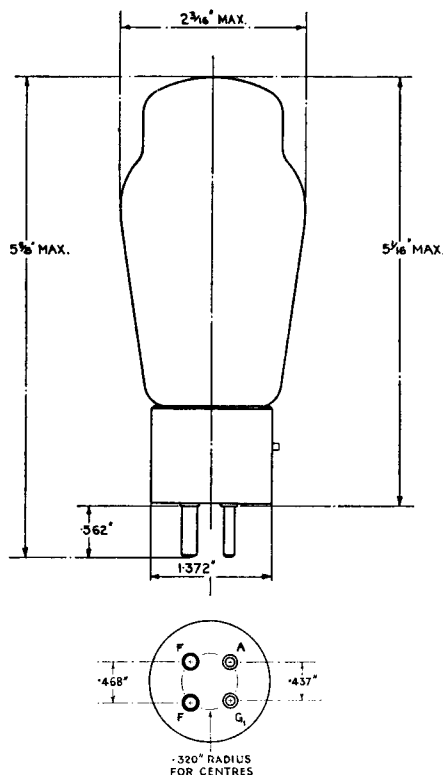
#### Dimensions.

Overall length  $5\frac{5}{8}"$  (14.3 cms.)  
Diameter  $2\frac{3}{16}"$  (5.5 cms.)  
Net weight 0.12 lbs. (55 gms.)

#### Constants.

Filament voltage 5 volts  
Nominal filament current 1.2 amps.  
\*Amplification factor 2.8  
\*Impedance 1,000 ohms  
Grid-anode capacity 12  $\mu\mu\text{F.}$   
Anode-filament capacity 3.2  $\mu\mu\text{F.}$   
Grid-filament capacity 6.8  $\mu\mu\text{F.}$

\* at anode current of 53 mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                                               |           |
|-------------------------------------------------------------------------------|-----------|
| Maximum anode voltage                                                         | 300 volts |
| Maximum anode dissipation                                                     | 17 watts  |
| Maximum anode current of average valve for fixed grid bias                    | 70 mA.    |
| Maximum anode current for manually adjusted grid bias or self-biasing circuit | 80 mA.    |

V.4275-A.1  
Nov. 1937

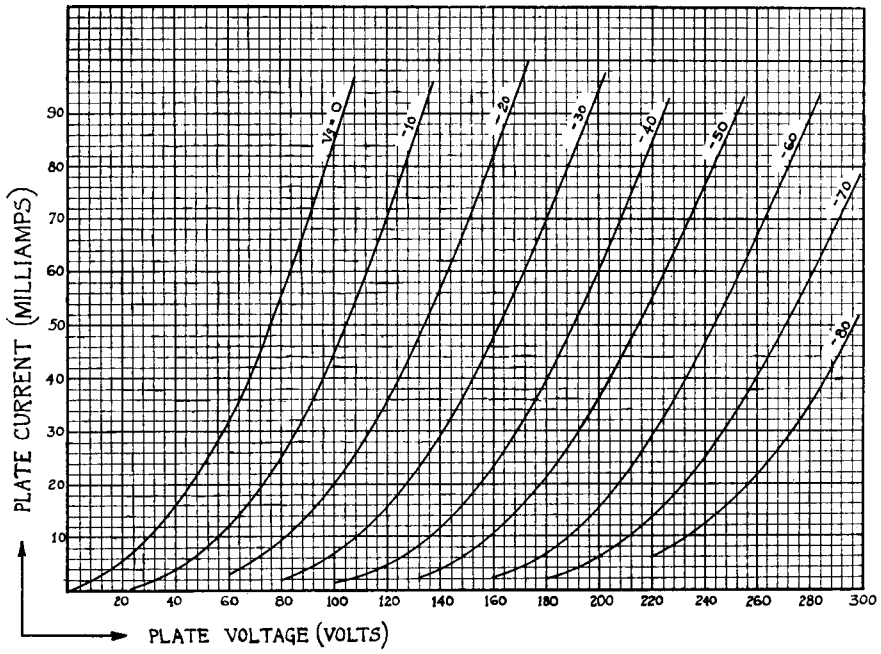
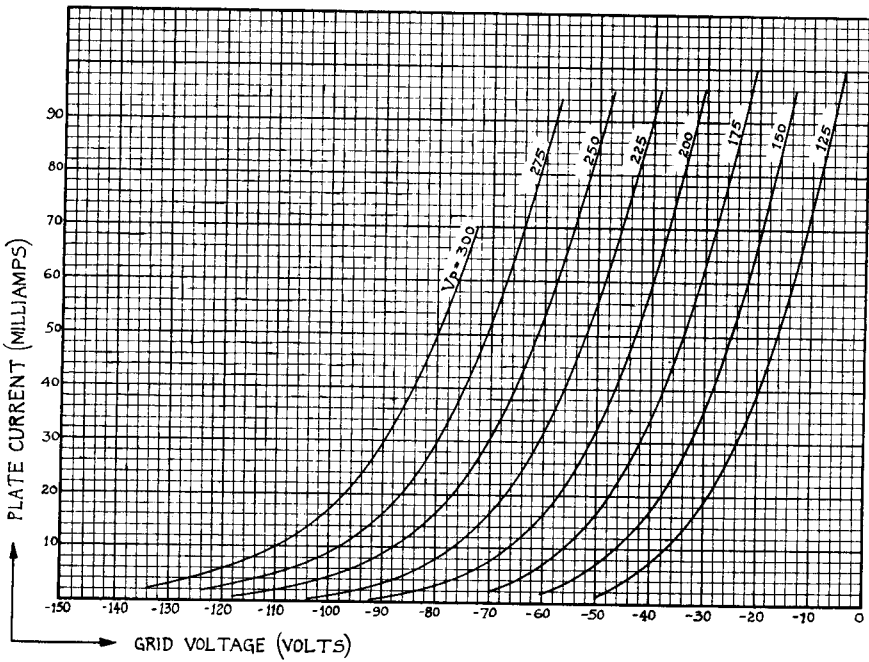
## —Standard Valves—

| Anode voltage | Grid bias | Anode current | Amplification factor | Anode resistance | Mutual conductance | Load resistance                                     | Power output                           | Second harmonic                  |
|---------------|-----------|---------------|----------------------|------------------|--------------------|-----------------------------------------------------|----------------------------------------|----------------------------------|
| volts         | volts     | mA.           |                      | ohms             | mA. per v          | ohms                                                | watts                                  | db                               |
| 150           | —40       | 17            | 2.6                  | 1,630            | 1.600              | 3,260<br>6,520                                      | 0.81<br>0.58                           | 19<br>23                         |
| 150           | —30       | 38            | 2.8                  | 1,065            | 2.700              | 1,065<br>2,130<br>4,260                             | 0.86<br>0.77<br>0.56                   | 19<br>24<br>29                   |
| 150           | —20       | 70            | 3.0                  | 810              | 3.700              | 810<br>1,620<br>3,240                               | 0.55<br>0.49<br>0.36                   | 26<br>30<br>34                   |
| 200           | —55       | 24            | 2.6                  | 1,530            | 1.750              | 1,530<br>3,060<br>6,120                             | 2.0<br>1.6<br>1.2                      | 15<br>19<br>23                   |
| 200           | —50       | 34            | 2.7                  | 1,230            | 2.250              | 1,230<br>2,460<br>4,920                             | 2.0<br>1.8<br>1.3                      | 16<br>20<br>25                   |
| 200           | —45       | 47            | 2.8                  | 1,030            | 2.770              | 1,030<br>2,060<br>4,120                             | 1.9<br>1.7<br>1.3                      | 18<br>22<br>27                   |
| 200           | —40       | 61            | 2.9                  | 885              | 3.270              | 885<br>1,770<br>3,540                               | 1.8<br>1.6<br>1.2                      | 20<br>25<br>29                   |
| 250           | —70       | 30            | 2.6                  | 1,400            | 1.880              | 3,000<br>6,000<br>10,000                            | 2.8<br>2.0<br>1.4                      | 18<br>23<br>26                   |
| 250           | —65       | 41            | 2.7                  | 1,170            | 2.330              | 2,000<br>4,000<br>8,000                             | 3.2<br>2.5<br>1.5                      | 19<br>23<br>28                   |
| 250           | —60       | 53            | 2.8                  | 1,000            | 2.780              | 2,000<br>3,000<br>4,000<br>6,000<br>8,000<br>10,000 | 3.1<br>2.6<br>2.3<br>1.7<br>1.4<br>1.2 | 21<br>23<br>25<br>28<br>29<br>30 |
| *200          | —35       | 78            | 2.9                  | 780              | 3.750              | 1,560<br>3,120                                      | 1.5<br>1.1                             | 27<br>31                         |
| *250          | —55       | 68            | 2.8                  | 870              | 3.220              | 1,000<br>3,000<br>6,000<br>8,000                    | 3.3<br>2.4<br>1.6<br>1.2               | 19<br>26<br>30<br>31             |
| *300          | —100      | 18            | 2.4                  | 2,420            | 1.000              | 9,680                                               | 2.3                                    | 20                               |
| *300          | —95       | 23            | 2.5                  | 1,910            | 1.280              | 7,640                                               | 2.6                                    | 21                               |
| *300          | —90       | 30            | 2.6                  | 1,560            | 1.630              | 6,240                                               | 3.0                                    | 22                               |
| *300          | —85       | 41            | 2.6                  | 1,300            | 2.030              | 2,600<br>5,200                                      | 4.7<br>3.3                             | 18<br>23                         |
| *300          | —80       | 51            | 2.7                  | 1,100            | 2.450              | 2,200<br>4,400                                      | 4.9<br>5.5                             | 19<br>24                         |

\* Maximum operating conditions.

# —Standard Valves—

4275-A  
Valve



V.4275-A.2  
Nov. 1937

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# —Standard Valves—

4278-A  
Valve

## 4278-A VALVE

TETRODE.

### SPECIFICATION.

#### Cathode.

Thoriated Tungsten filament.  
Constant voltage type.

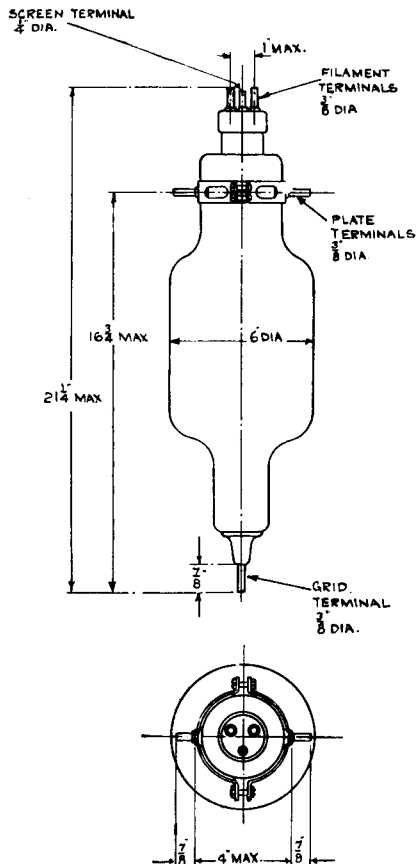
#### Dimensions.

Overall length  $21\frac{1}{4}"$  (54 cms.)  
Maximum diameter 6" (15.2 cms.)  
Net weight  $3\frac{1}{8}$  lbs. (1,500 gms.)

#### Constants.

Filament voltage 10 volts  
Nominal filament current 15.6 amps.  
Total emission 6 amps.  
\*Impedance 105,000 ohms  
\*Amplification factor 400  
Control grid-anode capacity 0.60  $\mu\mu\text{F}$ .  
Input capacity 31  $\mu\mu\text{F}$ .  
Output capacity 29.4  $\mu\mu\text{F}$ .

\* at  $V_p = 3,000$  volts,  $V_{g1} = 75$  volts.  
 $V_{g2} = 750$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

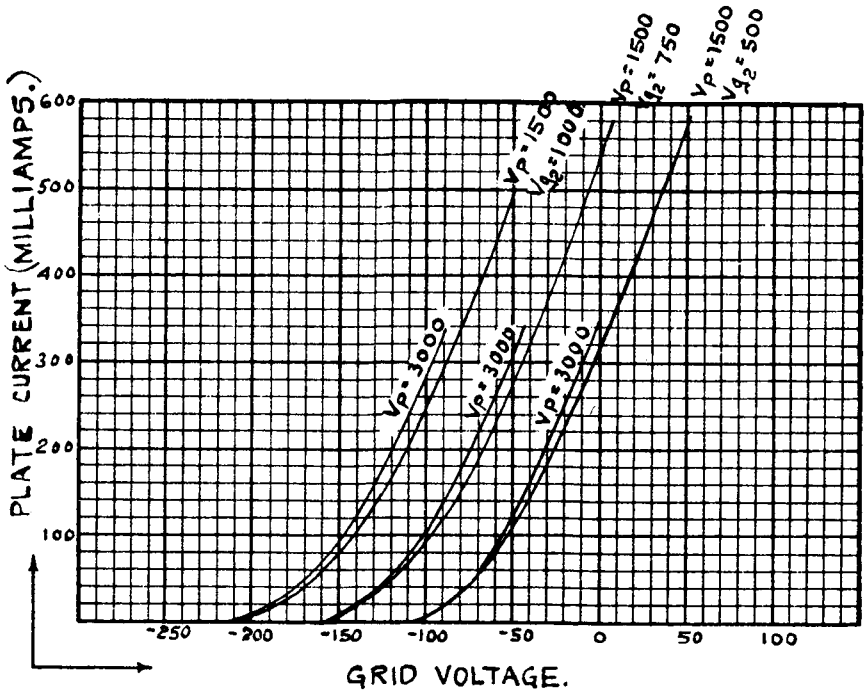
|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 3,000 volts |
| Maximum screen-grid voltage                   | 750 volts   |
| Maximum direct anode current                  | 0.600 amps. |
| Maximum anode dissipation                     | 800 watts   |
| Maximum screen-grid dissipation               | 75 watts    |
| Maximum control-grid dissipation              | 50 watts    |
| Maximum frequency for above ratings           | 30 Mc.      |
| Maximum anode voltage for frequency of 50 Mc. | 2,000 volts |

V.4278-A.1  
Nov. 1937

—Standard Valves—

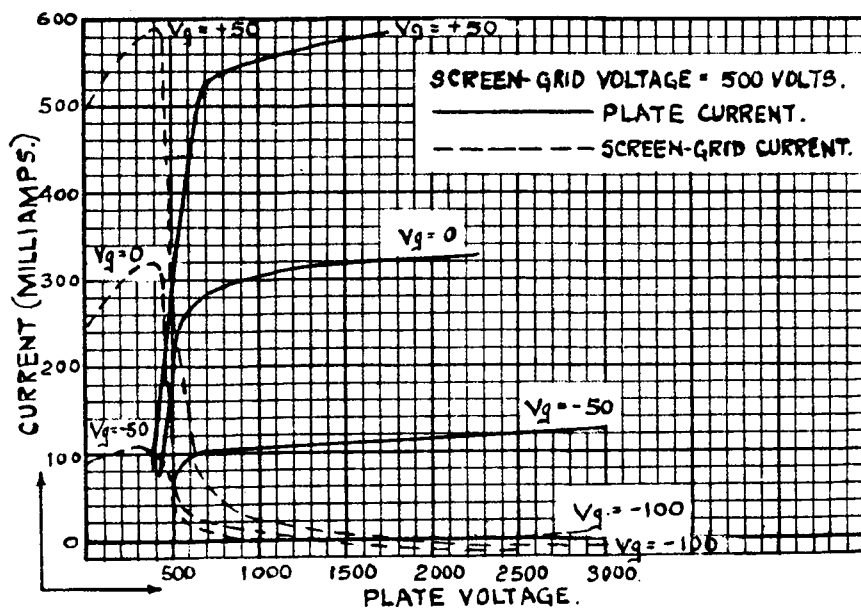
TYPICAL OPERATING CONDITIONS.  
RADIO FREQUENCY OPERATION.

|                            | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |             |
|----------------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-------------|
|                            | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |             |
| Direct anode voltage       | 3,000                                   | 2,500 | 2,250                             | 1,750 | 3,000                 | 2,500 volts |
| Direct anode current       | 0.400                                   | 0.480 | 0.400                             | 0.500 | 0.500                 | 0.500 amps. |
| Direct screen-grid voltage | 500                                     | 500   | 500                               | 500   | 500                   | 500 volts   |
| Control grid bias          | —110                                    | —110  | —165                              | —165  | —165                  | —165 to     |
|                            |                                         |       |                                   |       | —220                  | —220 volts  |
| Carrier output             | 400                                     | 400   | 600                               | 580   | 1,000                 | 850 watts   |
| Anode dissipation          | 800                                     | 800   | 300                               | 295   | 500                   | 400 watts   |



# —Standard Valves—

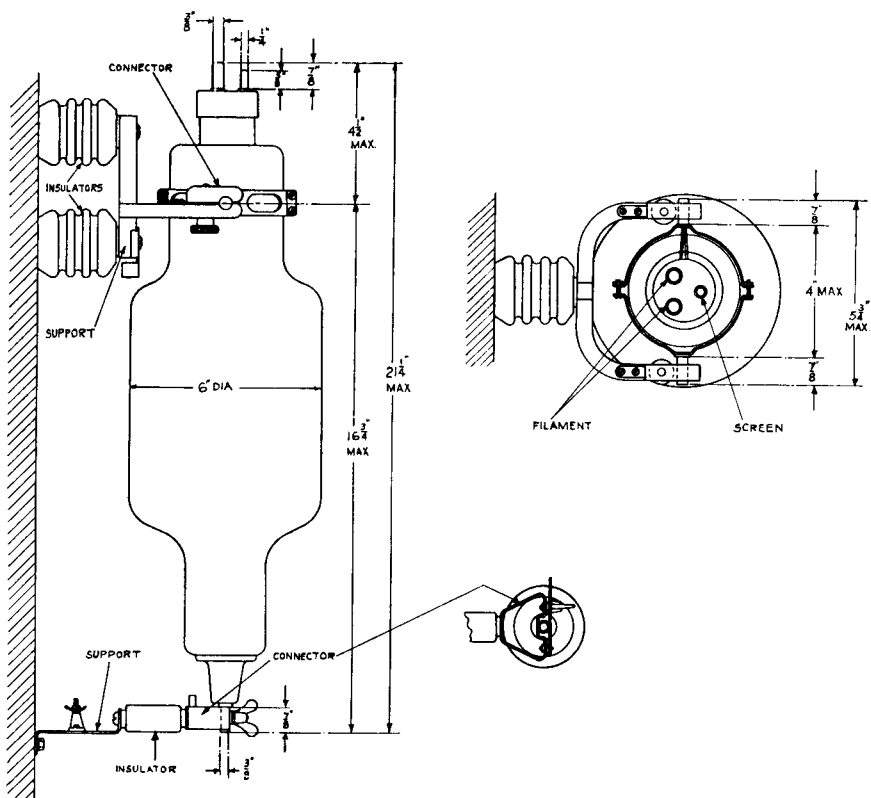
4278-A  
Valve





4278-A  
Valve

—Standard Valves—



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# —Standard Valves—

4279-A  
Valve

## 4279-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated Tungsten filament.  
Constant voltage type.

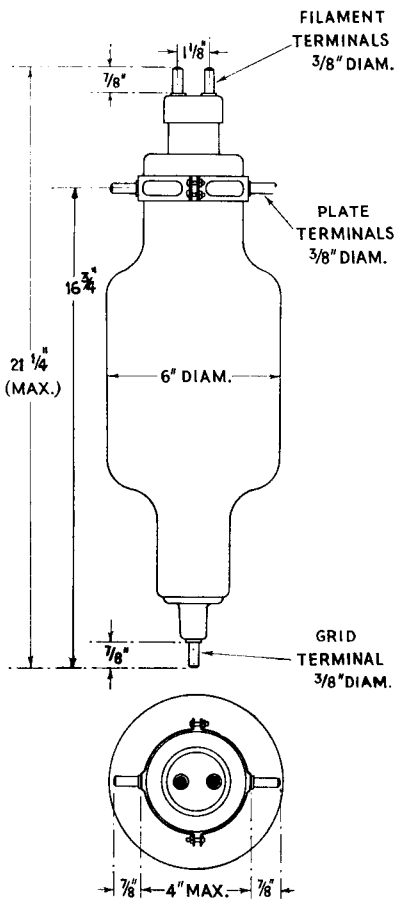
#### Dimensions.

Overall length  $21\frac{1}{4}"$  (54 cms.)  
Maximum diameter 6" (15.2 cms.)  
Net weight  $3\frac{1}{2}$  lbs. (1,500 gms.)

#### Constants.

Filament voltage 10 volts  
Nominal filament current 21 amps.  
Total emission 8 amps.  
\*Impedance 2,000 ohms  
\*Amplification factor 10  
Grid-anode capacity  $18 \mu\mu\text{F.}$   
Anode-filament capacity  $7 \mu\mu\text{F.}$   
Grid-filament capacity  $15 \mu\mu\text{F.}$

\* at anode current of 300 mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 3,000 volts |
| Maximum direct anode current                  | 0.800 amps. |
| Maximum anode dissipation                     | 1,200 watts |
| Maximum direct grid current                   | 100 mA.     |
| Maximum frequency for above ratings           | 20 Mc.      |
| Maximum anode voltage for frequency of 40 Mc. | 1,500 volts |

V.4279-A.1  
Nov. 1937

—Standard Valves—

TYPICAL OPERATING CONDITIONS.

|                      | Class A A.F. Amp. and Mod. |       |       |
|----------------------|----------------------------|-------|-------|
| Direct anode voltage | 2,500                      | 2,000 | volts |
| Grid bias            | —170                       | —110  | volts |
| Direct anode current | 0.300                      | 0.375 | amps. |
| Anode dissipation    | 750                        | 750   | watts |
| Load impedance       | 4,500                      | 2,000 | ohms  |
| Undistorted output   | 155                        | 85    | watts |

|                                            | Class B A.F. Amp. and Mod.<br>For balanced 2 valve circuit |       |       |
|--------------------------------------------|------------------------------------------------------------|-------|-------|
| Direct anode voltage                       | 2,500                                                      | 2,000 | volts |
| Grid bias                                  | —200                                                       | —150  | volts |
| Direct anode current per valve—zero signal | 0.150                                                      | 0.110 | amps. |
| Anode current per valve—maximum signal     | 0.800                                                      | 0.800 | amps. |
| Anode dissipation                          | 900                                                        | 720   | watts |
| Load resistance—anode to anode             | 2,800                                                      | 2,240 | ohms  |
| Maximum output—2 valves                    | 2,200                                                      | 1,760 | watts |

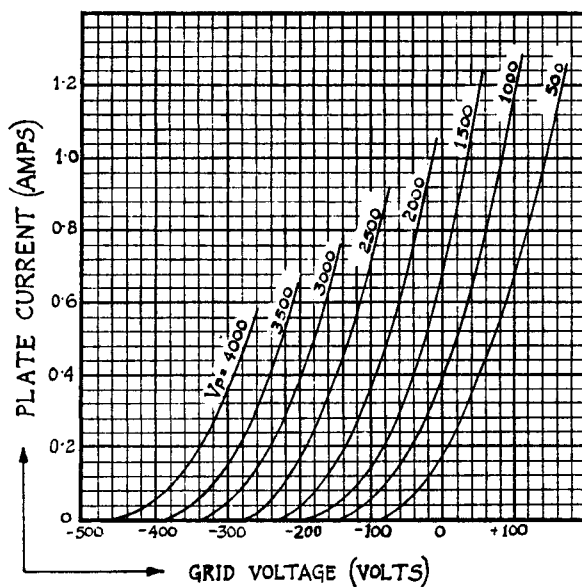
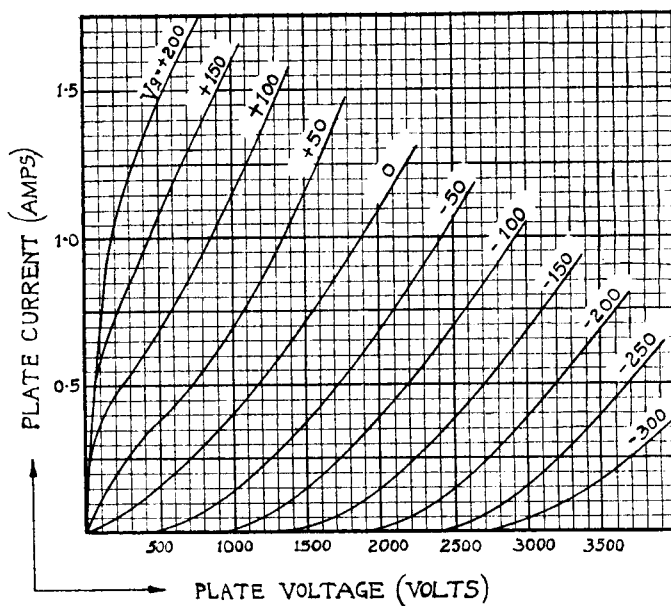
RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                       |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-----------------------|
|                      | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                       |
| Direct anode voltage | 3,000                                   | 2,500 | 2,250                             | 1,750 | 3,000                 | 2,500 volts           |
| Direct anode current | 0.600                                   | 0.720 | 0.600                             | 0.700 | 0.800                 | 0.800 amps.           |
| Grid bias            | —325                                    | —275  | —450                              | —360  | —500                  | —400 to<br>—540 volts |
| Carrier output       | 600                                     | 600   | 900                               | 830   | 1,600                 | 1,300 watts           |
| Anode dissipation    | 1,200                                   | 1,200 | 450                               | 395   | 800                   | 700 watts             |

# —Standard Valves—

4279-A  
Valve

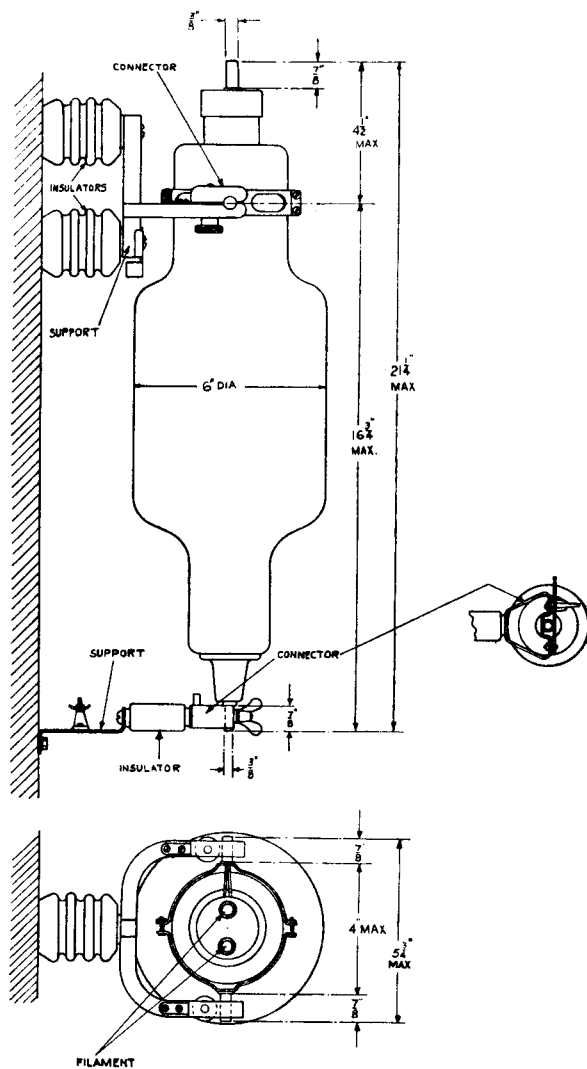
These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.4279-A.2  
Sept. 1938

4279-A  
Valve

# —Standard Valves—



PRINTED IN  
ENGLAND

# —Standard Valves—

4282-B Valve  
-BZ Valve

## 4282-B, 4282-BZ VALVES

TETRODES.

SPECIFICATION.

### Cathode.

Thoriated Tungsten filament.

Constant voltage type.

### Base.

4282-B American medium 4-pin. Anode connected to top cap.

4282-BZ—Special 4-pin low loss. Anode connected to top cap.

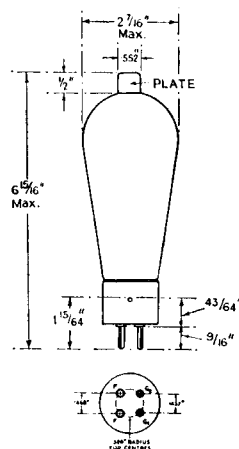
### Dimensions.

|                    | 4282-B                          | 4282-BZ                       |
|--------------------|---------------------------------|-------------------------------|
| Overall length     | 6 $\frac{15}{16}$ " (17.7 cms.) | 6" (15.2 cms.)                |
| Maximum diameter } | 2 $\frac{7}{16}$ " (6.2 cms.)   | 2 $\frac{7}{16}$ " (6.2 cms.) |
| Net weight         | 0.2 lbs. (90 gms.)              | 0.3 lbs. (140 gms.)           |

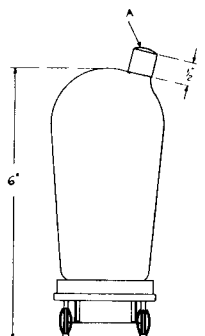
### Constants.

|                             |               |
|-----------------------------|---------------|
| Filament voltage            | 10 volts      |
| Nominal filament current    | 3 amps.       |
| Total emission              | 1.25 amps.    |
| *Impedance                  | 70,000 ohms   |
| *Amplification factor       | 100           |
| Control grid-anode capacity | 0.2 $\mu$ F.  |
| Input capacity              | 12.2 $\mu$ F. |
| Output capacity             | 6.8 $\mu$ F.  |

\* at  $V_p = 1,000$  volts,  $V_{g_2} = 150$  volts,  
 $I_p = 70$  mA.



4282-B



4282-BZ

## LIMITING CONDITIONS FOR SAFE OPERATION.

|                                               |             |
|-----------------------------------------------|-------------|
| Maximum direct anode voltage                  | 1,000 volts |
| Maximum direct anode current                  | 0.100 amps. |
| Maximum anode dissipation                     | 70 watts    |
| Maximum direct grid current                   | 0.050 amps. |
| Maximum screen-grid voltage                   | 250 volts   |
| Maximum screen-grid dissipation               | 5 watts     |
| Maximum frequency for above ratings           | 30 Mc.      |
| Maximum anode voltage for frequency of 60 Mc. | 500 volts   |

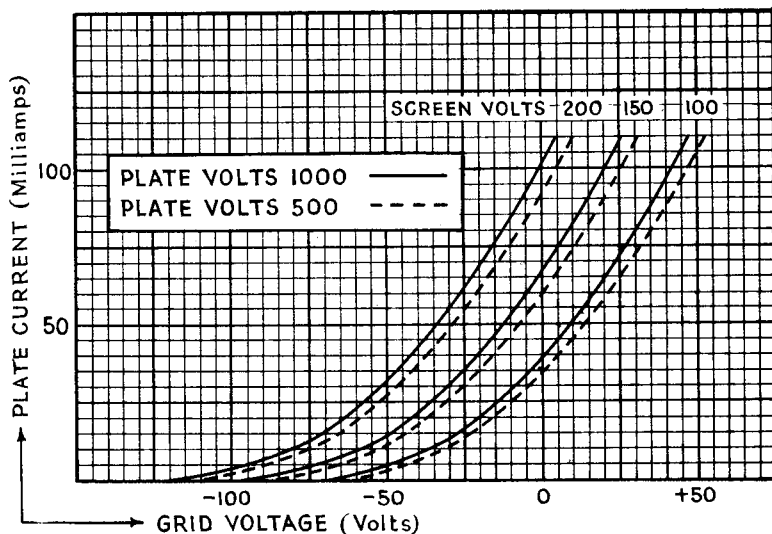
V.4282-BBZ.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

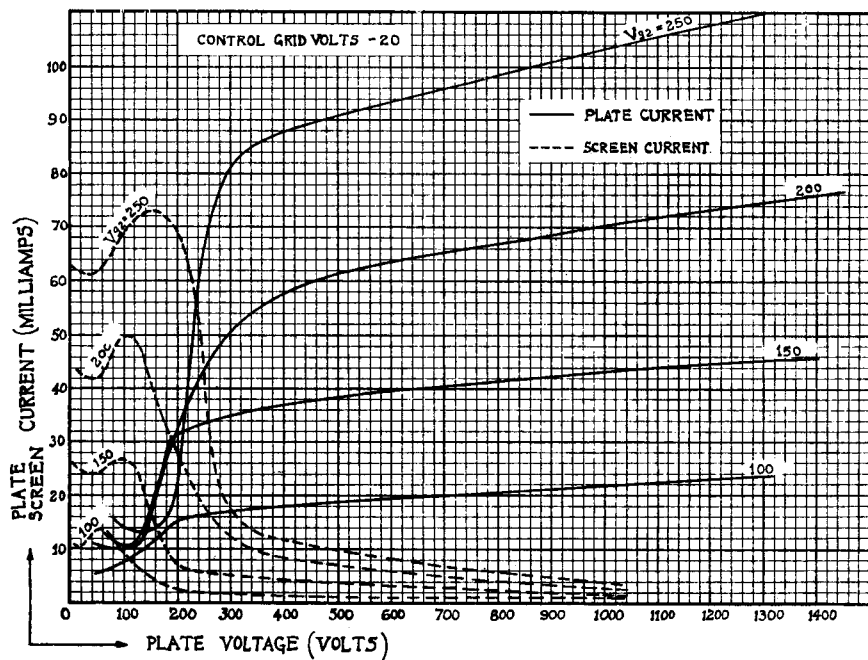
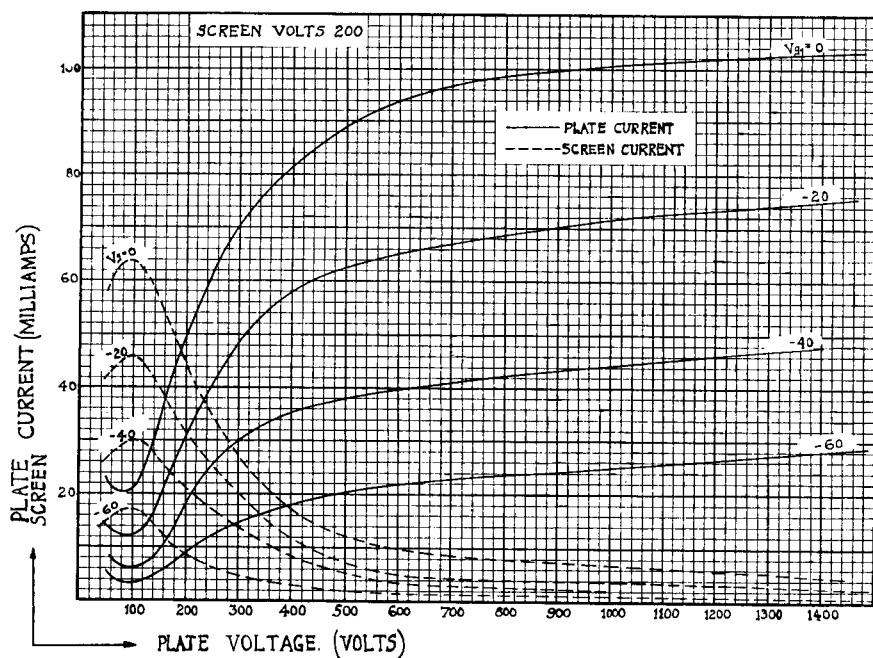
### RADIO FREQUENCY OPERATION.

|                            | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |                       |
|----------------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-----------------------|
|                            | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |                       |
| Direct anode voltage       | 1,000                                   | 750   | 750                               | 500   | 1,000                 | 750 volts             |
| Direct anode current       | 0.100                                   | 0.100 | 0.100                             | 0.100 | 0.100                 | 0.100 amps.           |
| Control grid bias          | —90                                     | —90   | —180                              | —180  | —135                  | —135 to<br>—180 volts |
| Direct screen-grid voltage | 150                                     | 150   | 150                               | 150   | 150                   | 150 volts             |
| Carrier output             | 33                                      | 25    | 50                                | 33    | 67                    | 50 watts              |
| Anode dissipation          | 67                                      | 50    | 27                                | 17    | 33                    | 25 watts              |



# —Standard Valves—

4282-B Valve  
-BZ Valve



V.4282-BBZ.2  
Nov. 1937



PRINTED IN  
ENGLAND

# —Standard Valves—

4300-A  
Valve

## 4300-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

American medium 4-pin bayonet.

#### Dimensions.

Maximum overall length  $6\frac{1}{2}"$  (16.5 cms.)

Maximum diameter  $2\frac{7}{16}"$  (5.9 cms.)

Net weight 0.15 lbs (70 gms.)

#### Constants.

Filament voltage 5.0 volts

Nominal filament current 1.2 amps.

\*Amplification factor 3.9

\*Impedance 720 ohms

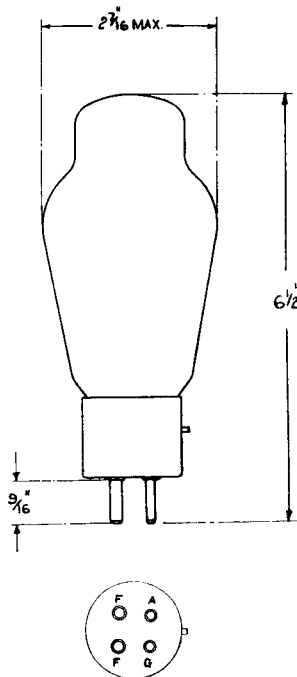
\*Mutual conductance 5.4 mA. per volt

Grid-anode capacity 15  $\mu\mu\text{F}$ .

Grid-filament capacity 9  $\mu\mu\text{F}$ .

Anode-filament capacity 4.3  $\mu\mu\text{F}$ .

\* at  $V_p = 300$  volts,  $V_{g1} = -61.5$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                                               |           |
|-------------------------------------------------------------------------------|-----------|
| Maximum anode voltage                                                         | 450 volts |
| Maximum anode dissipation                                                     | 40 watts  |
| Maximum anode current of average valve for fixed grid bias                    | 70 mA.    |
| Maximum anode current for manually adjusted grid bias or self-biasing circuit | 100 mA.   |

# —Standard Valves—

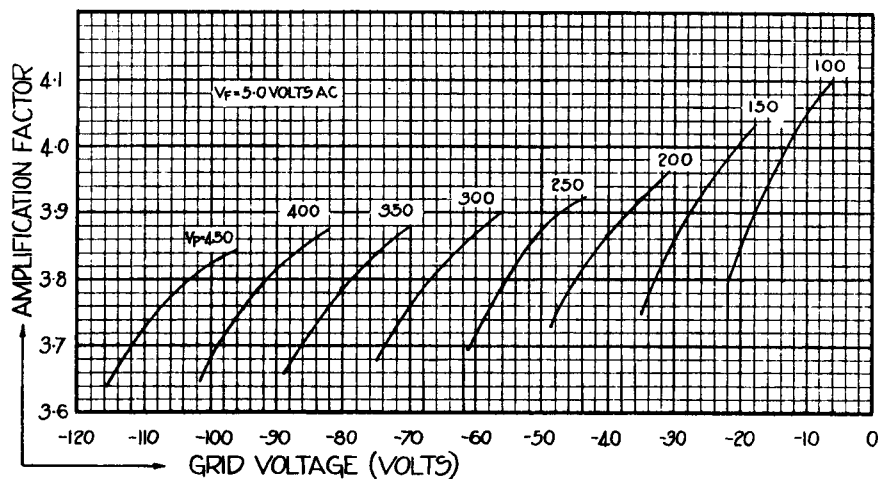
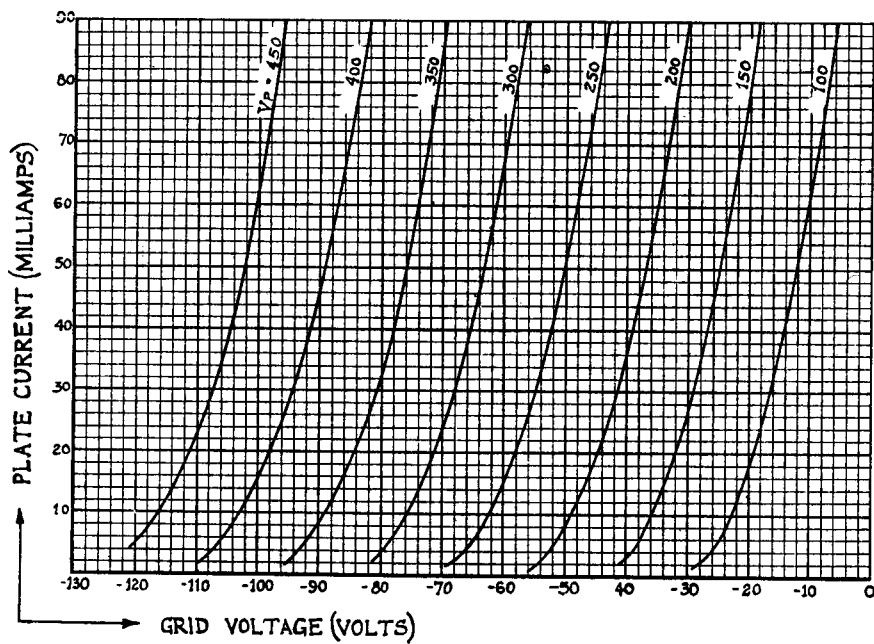
## TYPICAL OPERATING CONDITIONS.

| Anode voltage | Grid bias | Anode current | Load resistance | Power output | Second harmonic |
|---------------|-----------|---------------|-----------------|--------------|-----------------|
| volts         | volts     | milliamperes  | ohms            | watts        | db              |
| 200           | —42       | 30            | 2,000           | 3.0          | 20              |
| 200           | —39       | 40            | 2,500           | 2.6          | 26              |
| 200           | —37       | 50            | 2,500           | 2.5          | 30              |
| 250           | —55       | 30            | 2,000           | 4.9          | 18              |
| 250           | —55       | 30            | 4,500           | 3.2          | 27              |
| 250           | —52       | 40            | 3,000           | 4.0          | 26              |
| 250           | —50       | 50            | 2,500           | 4.4          | 26              |
| 250           | —48       | 60            | 2,000           | 4.7          | 26              |
| 250           | —48       | 60            | 2,700           | 4.1          | 30              |
| 250           | —45       | 80            | 1,500           | 5.0          | 26              |
| 300           | —65       | 40            | 2,500           | 6.7          | 20              |
| 300           | —63       | 50            | 2,000           | 7.2          | 21              |
| 300           | —63       | 50            | 3,000           | 6.1          | 26              |
| 300           | —61       | 60            | 2,400           | 6.6          | 26              |
| 300           | —61       | 60            | 3,400           | 5.6          | 30              |
| 300           | —58       | 80            | 1,700           | 7.5          | 26              |
| 350           | —76       | 50            | 3,600           | 7.8          | 26              |
| 350           | —76       | 50            | 5,000           | 6.2          | 30              |
| 350           | —74       | 60            | 2,000           | 10.2         | 21              |
| 350           | —74       | 60            | 3,000           | 8.3          | 26              |
| 350           | —74       | 60            | 4,000           | 7.0          | 30              |
| 350           | —71       | 80            | 2,200           | 9.6          | 26              |
| 400           | —91       | 40            | 5,000           | 8.4          | 26              |
| 400           | —89       | 50            | 3,000           | 11.5         | 21              |
| 400           | —89       | 50            | 4,000           | 9.4          | 25              |
| 400           | —87       | 60            | 3,500           | 10.5         | 26              |
| 400           | —87       | 60            | 5,000           | 8.3          | 30              |
| 400           | —84       | 80            | 2,500           | 12.5         | 25              |
| *450          | —104      | 40            | 6,000           | 9.5          | 26              |
| *450          | —102      | 50            | 5,000           | 10.7         | 27              |
| *450          | —102      | 50            | 6,500           | 9.0          | 30              |
| *450          | —100      | 60            | 4,000           | 12.5         | 26              |
| *450          | —100      | 60            | 5,500           | 10.1         | 30              |
| *450          | —97       | 80            | 2,000           | 17.8         | 21              |
| *450          | —97       | 80            | 3,000           | 14.6         | 26              |
| *450          | —97       | 80            | 4,500           | 11.5         | 31              |

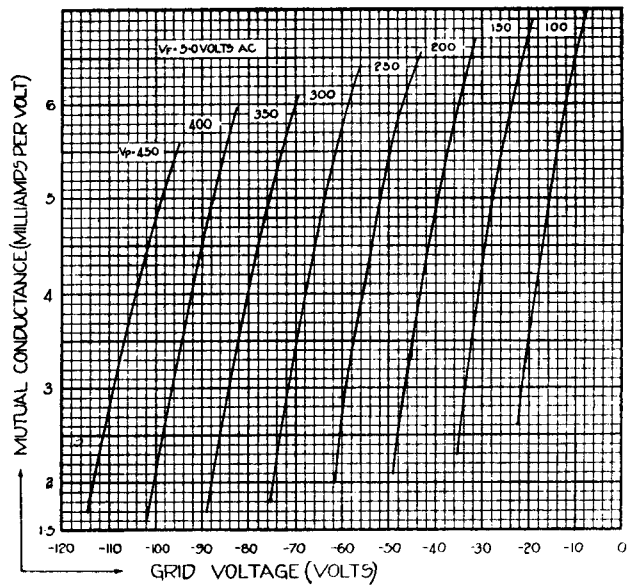
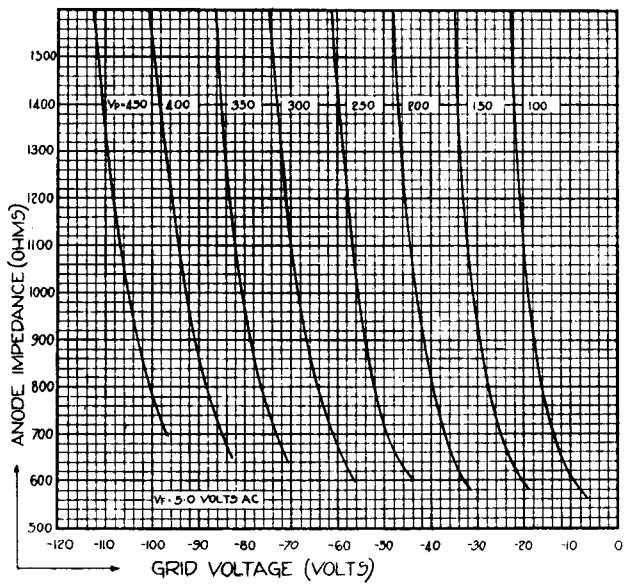
\* Maximum operating conditions.

# —Standard Valves—

4300-A  
Valve



# —Standard Valves—



# —Standard Valves—

4304-B Valve  
-BB Valve

## 4304-B AND 4304-BB VALVES

TRIODES.

### SPECIFICATION.

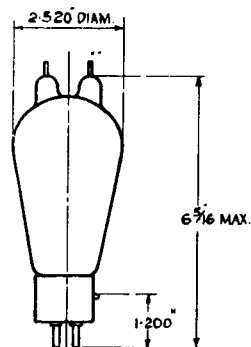
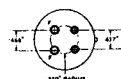
#### Cathode.

Thoriated Tungsten filament.  
Constant voltage type.

#### Base.

4304-B—American medium 4-pin bayonet  
4304-BB—Standard British 4-pin.

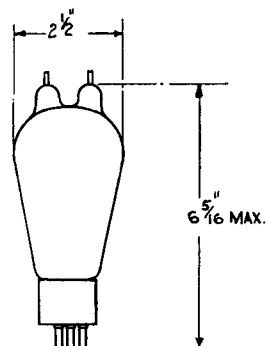
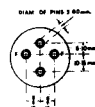
Control grid and anode brought out separately at top of bulb.



4304-B

#### Dimensions.

|                | 4304-B                                      | 4304-BB                                     |
|----------------|---------------------------------------------|---------------------------------------------|
| Overall length | 6 <sup>7</sup> / <sub>8</sub> " (17.5 cms.) | 6 <sup>7</sup> / <sub>8</sub> " (17.5 cms.) |
| Diameter       | 2 <sup>7</sup> / <sub>16</sub> " (6.2 cms.) | 2 <sup>1</sup> / <sub>2</sub> " (6.4 cms.)  |
| Net weight     | 0.15 lbs. (70 gms.)                         | 0.15 lbs. (70 gms.)                         |



4304-BB

#### Constants.

|                          |              |
|--------------------------|--------------|
| Filament voltage         | 7.5 volts    |
| Nominal filament current | 3.25 amps.   |
| Total emission           | 1 amp.       |
| Amplification factor     | 11           |
| Impedance                | 5,500 ohms   |
| Grid-anode capacity      | 2.5 $\mu$ F. |
| Anode-filament capacity  | 0.7 $\mu$ F. |
| Grid-filament capacity   | 2.0 $\mu$ F. |

### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                |             |
|------------------------------------------------|-------------|
| Maximum direct anode voltage                   | 1,250 volts |
| Maximum direct anode current                   | 0.100 amps. |
| Maximum anode dissipation                      | 50 watts    |
| Maximum direct grid current                    | 0.025 amps. |
| Maximum frequency for above ratings            | 100 Mc.     |
| Maximum anode voltage for frequency of 300 Mc. | 750 volts   |

V.4304-B.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

### RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony              |       | Class C<br>Telegraphy |       |       |
|----------------------|-----------------------------------------|-------|-----------------------------------|-------|-----------------------|-------|-------|
|                      | Modulated<br>Carrier<br>applied to grid |       | Subject to<br>anode<br>modulation |       | Unmodulated           |       |       |
| Direct anode voltage | 1,250                                   | 1,000 | 1,000                             | 750   | 1,250                 | 1,000 | volts |
| Grid bias            | —110                                    | —85   | —180                              | —135  | —180                  | —135  | to    |
|                      |                                         |       |                                   |       | —225                  | —180  | volts |
| Direct anode current | 0.060                                   | 0.060 | 0.100                             | 0.100 | 0.100                 | 0.100 | amps. |
| Carrier output       | 25                                      | 20    | 65                                | 50    | 85                    | 65    | watts |
| Anode dissipation    | 50                                      | 40    | 35                                | 25    | 40                    | 35    | watts |

### Ultra High Frequency Operation.

For frequencies above 100 megacycles, the maximum plate voltage must be reduced as follows :—

Frequency                      100      150      200      250      300    megacycles.

#### Anode Voltage :—

Class B Amplifier              1,250    1,125    1,000      875      750    volts

Class C Oscillator or  
Amplifier—unmodulated    1,250    1,125    1,000      875      750    volts

Class C Oscillator or  
Amplifier—anode  
modulated                      1,000      900      800      700      600    volts

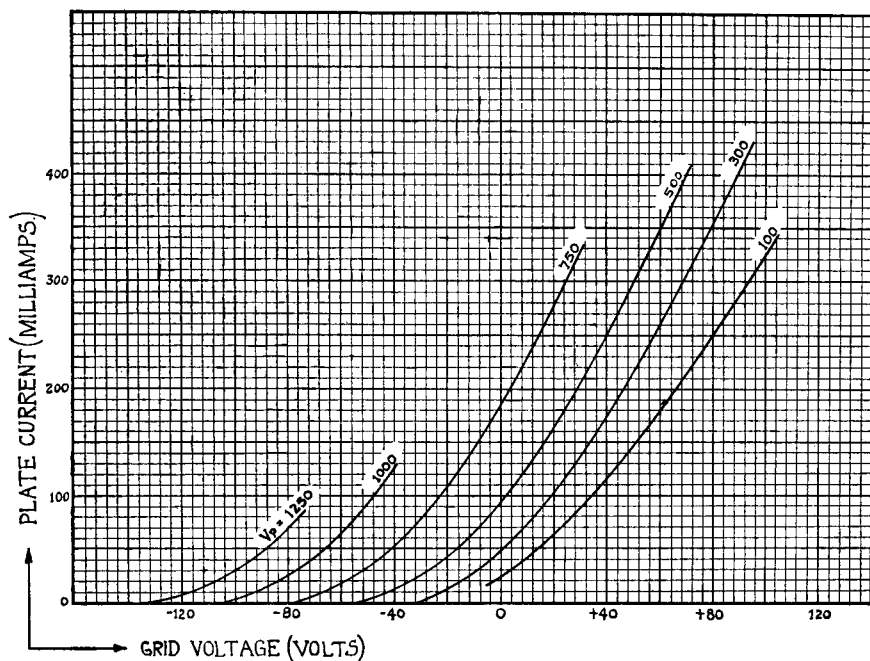
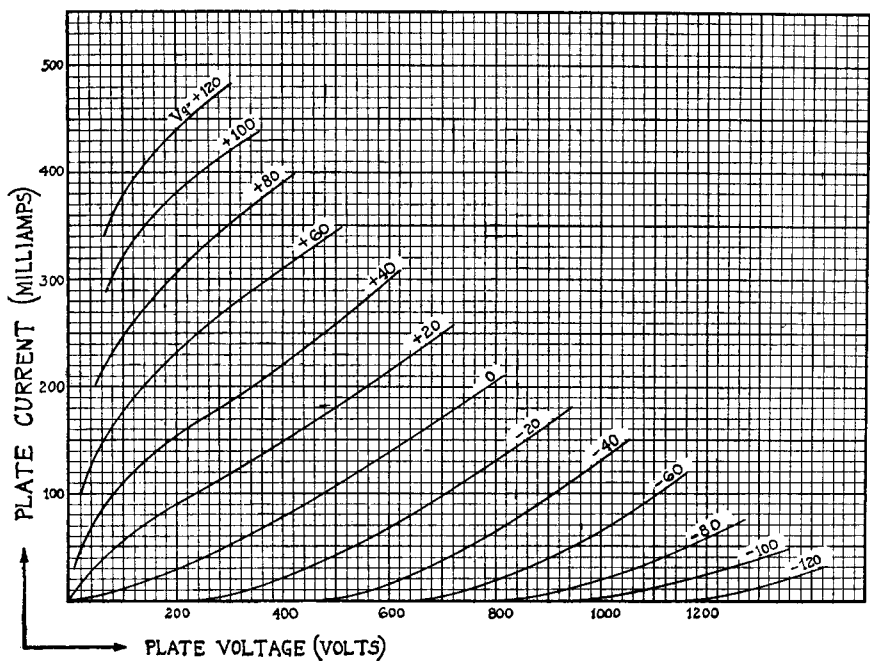
Nominal power obtainable in a load for Class C unmodulated operation is approximately as follows :—

Frequency                      100                      200                      300    megacycles  
Anode voltage                  1,250                      1,000                      750    volts  
Power output                      60                      35                      13    watts  
Efficiency                          48                      35                      17    per cent.

Limit of oscillation, approximately 400 Mc.

# —Standard Valves—

4304-B Valve  
-BB Valve



V.4304-B.2  
Nov. 1937



PRINTED IN  
ENGLAND

# —Standard Valves—

4305-A  
Valve

## 4305-A VALVE

TETRODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.

Constant voltage type.

#### Base.

American medium 4-pin. Screen, anode and filament centre connections made to tungsten rods brought out separately through top of bulb.

#### Dimensions.

Max. overall length  $7\frac{5}{16}$ " (19.3 cms.)

Max. Diameter  $2\frac{13}{32}$ " (6.1 cms.)

Net weight 0.2 lbs. (90 gms.)

#### Constants.

Filament voltage 10 volts

Nominal filament current 3.1 amps.

\*Amplification factor 56

\*Impedance 40,000 ohms

\*Mutual conductance 1.4 mA. per volt

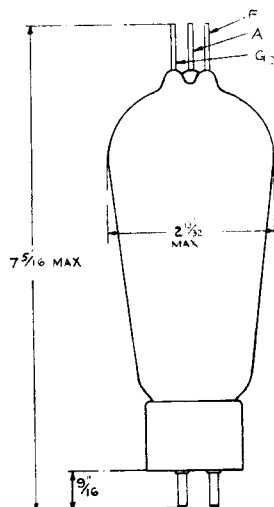
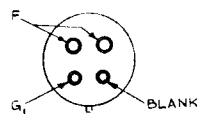
Total emission 1 amp.

Grid-anode capacity  $0.14 \mu\text{F}$ .

Input capacity  $10.5 \mu\text{F}$ .

Output capacity  $5.4 \mu\text{F}$ .

\* at  $V_p = 1,000$  volts,  $I_p = 60$  mA.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                |             |
|------------------------------------------------|-------------|
| Maximum direct anode voltage                   | 1,000 volts |
| Maximum direct anode current                   | 0.125 amps. |
| Maximum anode dissipation                      | 60 watts    |
| Maximum screen-grid voltage                    | 200 volts   |
| Maximum screen-grid dissipation                | 6 watts     |
| Maximum direct grid current                    | 0.040 amps. |
| Maximum frequency for above ratings            | 50 Mc.      |
| Maximum anode voltage for frequency of 100 Mc. | 500 volts   |

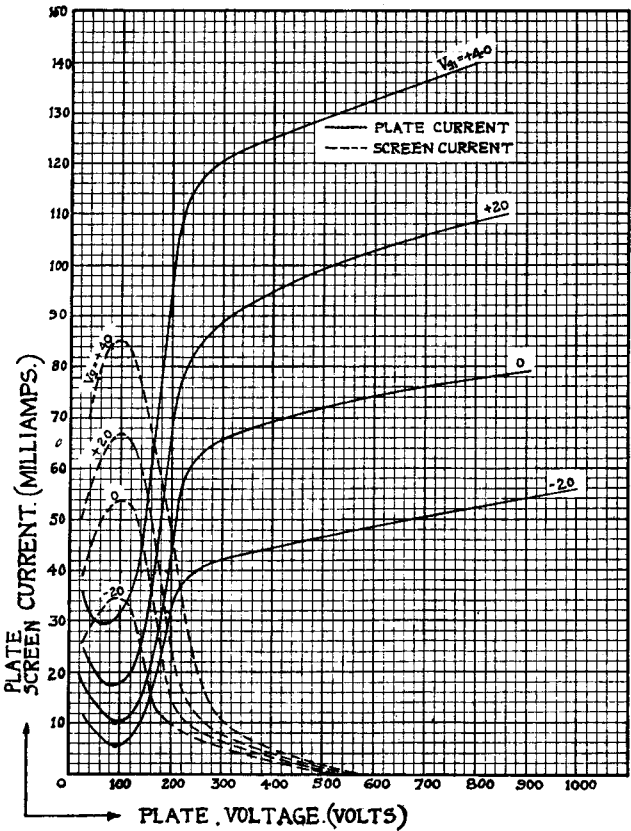
V.4305-A.1  
Sept. 1938

—Standard Valves—

TYPICAL OPERATING CONDITIONS.  
RADIO FREQUENCY OPERATION.

|                            | Class B<br>Telephony                    |      | Class C<br>Telephony              |      | Class C<br>Telegraphy |                       |
|----------------------------|-----------------------------------------|------|-----------------------------------|------|-----------------------|-----------------------|
|                            | Modulated<br>Carrier<br>applied to grid |      | Subject to<br>anode<br>modulation |      | Unmodulated           |                       |
| Direct anode voltage       | 1,000                                   | 750  | 800                               | 500  | 1,000                 | 750 volts             |
| Control grid bias          | —135                                    | —100 | —270                              | —200 | —200                  | —150 to<br>—200 volts |
| Direct screen-grid voltage | 200                                     | 150  | 200                               | 200  | 200                   | 200 volts             |
| Direct anode current       | 90                                      | 120  | 125                               | 125  | 125                   | 125 mA.               |
| Anode dissipation          | 60                                      | 60   | 30                                | 30   | 40                    | 29 watts              |
| Carrier output             | 30                                      | 30   | 70                                | 42   | 85                    | 65 watts              |

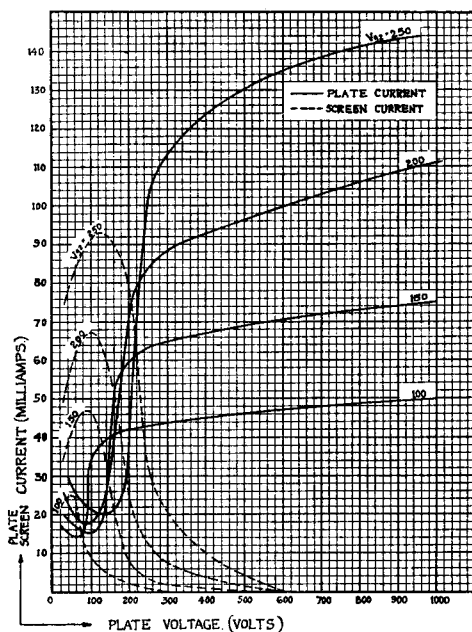
These curves are taken at :— $V_F = 10.0$  volts D.C.       $V_{g_2} = 200$  volts.



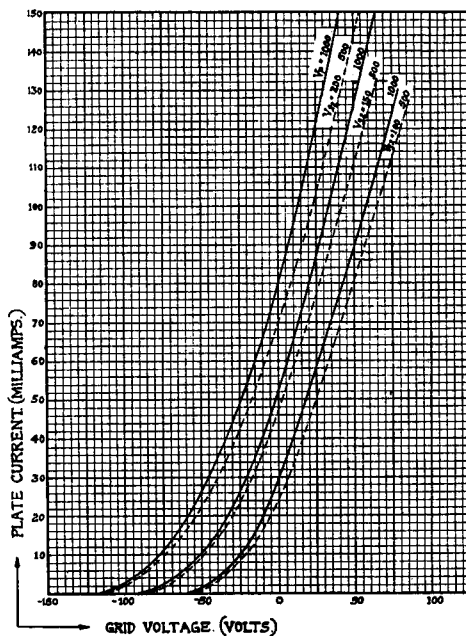
# —Standard Valves—

4305-A  
Valve

These curves are taken at :— $V_F = 10.0$  volts D.C.     $V_{G1} = +20$  volts.



These curves are taken at :— $V_F = 10.0$  volts D.C.



V.4305-A.2  
Sept. 1938.

PRINTED IN  
ENGLAND

# —Standard Valves—

4307-A Valve.  
-AF Valve.

## 4307-A AND -AF VALVES

### PENTODES.

The 4307-AF Valve is identical to the 4307-A Valve and the -F code indicates that the valve has passed special tests for use in Standard Aircraft Radio.

### SPECIFICATION.

#### Cathode.

Oxide coated filament.  
Constant voltage type.

#### Base.

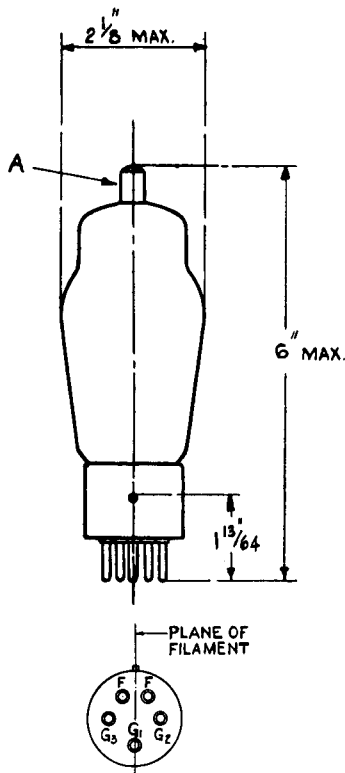
American medium 5-pin.  
Anode connected to top cap type B.

#### Dimensions.

Max. overall length 6" (15.3 cms.)  
Max. Diameter  $2\frac{1}{8}$ " (5.4 cms.)  
Net weight 0.16 lbs. (75 gms.)

#### Constants.

Filament voltage 5.5 volts  
Nominal filament current 1.0 amps.  
Grid-anode capacity 0.55  $\mu\text{F}$ .  
Input capacity 15  $\mu\text{F}$ .  
Output capacity 12  $\mu\text{F}$ .



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                                          | Class A<br>Amplifier | Class C<br>Amplifier<br>or<br>Oscillator | Class B or<br>Suppressor Mod-<br>ulated Class C<br>Amplifier |
|--------------------------------------------------------------------------|----------------------|------------------------------------------|--------------------------------------------------------------|
| Maximum direct anode voltage                                             | 500                  | 500                                      | 500 volts                                                    |
| Maximum direct screen-grid voltage                                       | 300                  | 250                                      | 250 volts                                                    |
| Maximum direct anode current                                             | 60                   | 60                                       | 45 mA.                                                       |
| Maximum direct screen-grid current                                       | 25                   | 25                                       | 25 mA.                                                       |
| Maximum direct control-grid current                                      | —                    | 7                                        | 7 mA.                                                        |
| Maximum anode dissipation                                                | 15                   | 15                                       | 15 watts                                                     |
| Maximum screen-grid dissipation                                          | 6                    | 6                                        | 6 watts                                                      |
| Maximum instantaneous control-grid<br>voltage on positive swing of input | —                    | +30                                      | +30 volts                                                    |

V.4307-A.1  
March, 1939

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

| Anode voltage | Screen Grid voltage | Sup-pressor voltage | Control grid bias | Anode current | Screen grid current | Load resistance | Maximum power output | Maximum second harmonic |
|---------------|---------------------|---------------------|-------------------|---------------|---------------------|-----------------|----------------------|-------------------------|
| volts         | volts               | volts               | volts             | mA.           | mA.                 | ohms            | watts                | db                      |
| 200           | 200                 | 0                   | —15               | 36.5          | 3.4                 | 4,000           | 2.9                  | 23.5                    |
| 250           | 250                 | 0                   | —20               | 50            | 4.0                 | 4,000           | 5.7                  | 24                      |
| 300           | *300                | 0                   | —30               | 43            | 2.6                 | 4,500           | 9.1                  | 21                      |

\* Maximum operating condition.

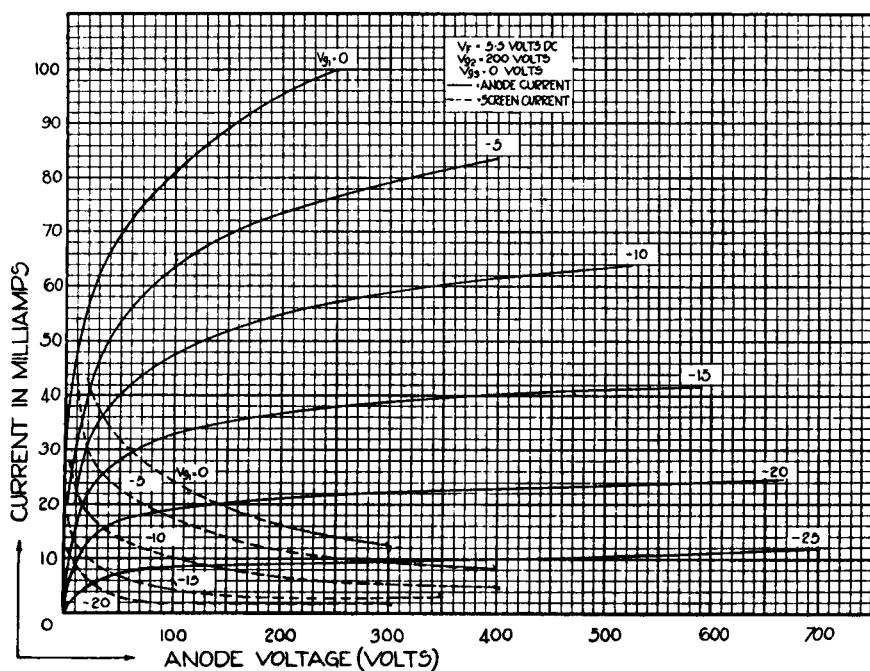
| Class C Telephony.<br>Suppressor modulated R.F. Amp. |                  |
|------------------------------------------------------|------------------|
| Direct anode voltage                                 | 500 volts        |
| Direct screen-grid voltage (approx.)                 | 200 volts        |
| Screen-grid circuit resistance                       | 14,000 ohms      |
| Total control-grid bias (approx.)                    | —35 volts        |
| Control-grid circuit resistance                      | 10,000 ohms      |
| Fixed control-grid bias                              | —20 volts        |
| Suppressor-grid bias                                 | —50 volts        |
| R-F control-grid voltage                             | 50 peak volts    |
| Direct anode current                                 | 40 milliamperes  |
| Direct screen-grid current                           | 20 milliamperes  |
| Direct control-grid current                          | 1.5 milliamperes |
| A-F suppressor-grid voltage                          | 50 peak volts    |
| Effective load resistance                            | 4,000 ohms       |
| Carrier power output                                 | 6 watts          |
| Power output on A-F peaks                            | 24 watts         |

| Class C Telegraphy<br>Osc. or RF amp. unmodulated. |        |               |
|----------------------------------------------------|--------|---------------|
| Direct anode voltage                               | 500    | 500 volts     |
| Direct screen-grid voltage (approx.)               | 250    | 250 volts     |
| Screen-grid circuit resistance                     | 20,000 | 20,000 ohms   |
| Total control-grid bias (approx.)                  | —35    | —35 volts     |
| Control-grid circuit resistance                    | 10,000 | 10,000 ohms   |
| Fixed control-grid bias                            | —20    | —20 volts     |
| Suppressor-grid bias                               | 0      | 0 volts       |
| R-F control-grid voltage                           | 50     | 50 peak volts |
| Direct anode-current                               | 45     | 60 mA.        |
| Direct screen-grid current                         | 12     | 13 mA.        |
| Direct control-grid current                        | 1.3    | 1.4 mA.       |
| A-F suppressor-grid voltage                        | 0      | 0 peak volts  |
| Effective load resistance                          | 6,500  | 5,000 ohms    |
| Carrier power output                               | 15     | 20 watts      |

# —Standard Valves—

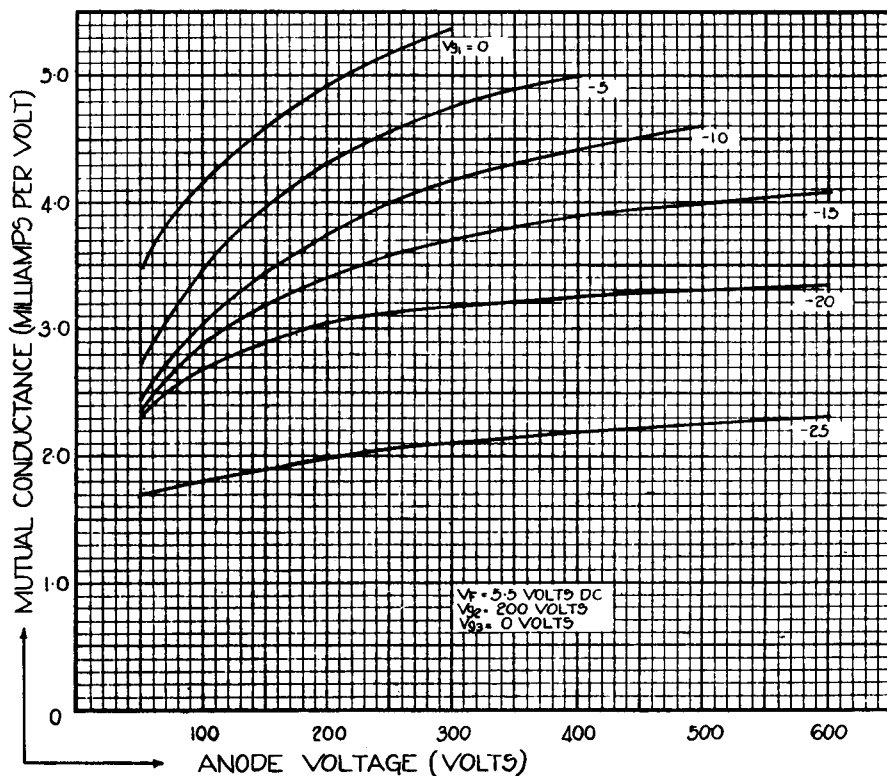
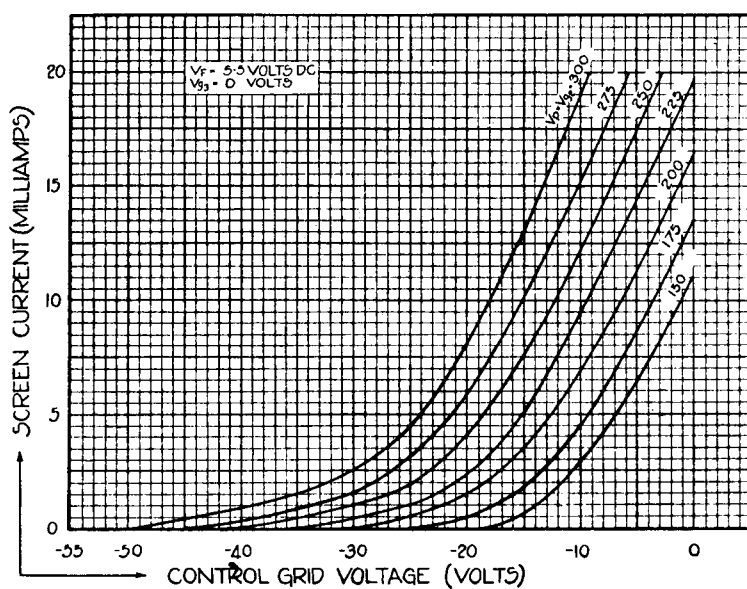
4307-A Valve  
-AF Valve

| High Frequency Ratings                                                                                     |               |                  |
|------------------------------------------------------------------------------------------------------------|---------------|------------------|
|                                                                                                            | 40 megacycles | 70 megacycles    |
| Maximum direct anode voltage                                                                               | 500           | 300 volts        |
| Maximum direct anode current—<br>For class C telegraphy (intermittent)<br>For all other classes of service | 60<br>45      | 45 mA.<br>45 mA. |





# —Standard Valves—



# —Standard Valves—

4308-B  
Valve

## 4308-B VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated tungsten filament.  
Constant voltage type.

#### Base.

Extra large 4-pin bayonet.

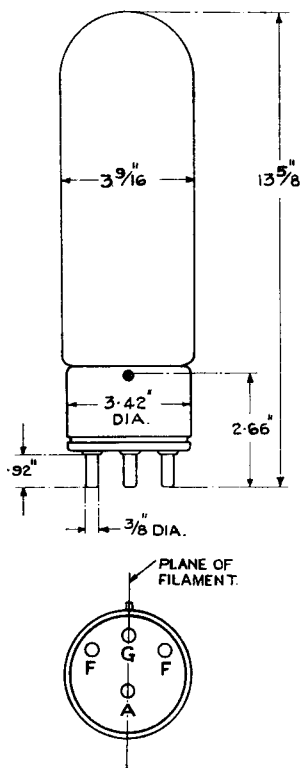
#### Dimensions.

Overall length  $13\frac{5}{8}"$  (34.7 cms.)  
Maximum diameter  $3\frac{5}{8}"$  (9.2 cms.)  
Net weight 1.6 lbs. (725 gms.)

#### Constants.

Filament voltage 14 volts  
Nominal filament current 6 amps.  
Total emission 4 amps.  
\*Amplification factor 8  
\*Impedance 1,070 ohms.  
\*Mutual conductance 7.5 mA. per volt  
Grid-anode capacity  $17.4 \mu\mu\text{F.}$   
Grid-filament capacity  $13.6 \mu\mu\text{F.}$   
Anode-filament capacity  $9.3 \mu\mu\text{F.}$

\* at  $V_p = 1,500$  volts,  $V_g = -150$  volts.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                |             |
|------------------------------------------------|-------------|
| Maximum direct anode voltage                   | 2,250 volts |
| Maximum direct anode current                   | 325 mA.     |
| Maximum direct grid current                    | 75 mA.      |
| Maximum anode dissipation                      | 250 watts   |
| Maximum frequency for above ratings            | 1.5 Mc.     |
| Maximum anode voltage for frequency of 4.5 Mc. | 750 volts   |

Tentative data

V.4308-B.1  
Sept. 1938

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class A<br>A.F. Amp or Mod. |             |
|----------------------|-----------------------------|-------------|
| Direct anode voltage | 1,500                       | 1,000 volts |
| Grid bias            | —155                        | —80 volts   |
| Direct anode current | 135                         | 210 mA.     |
| Load impedance       | 13,000                      | 3,000 ohms  |
| Undistorted output   | 50                          | 35 watts    |

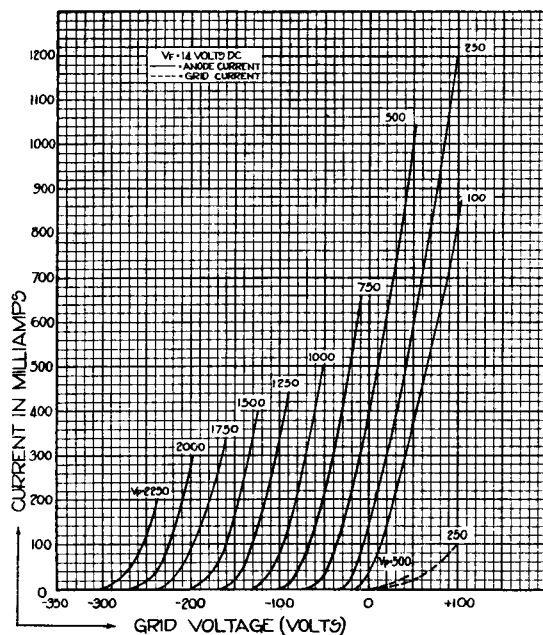
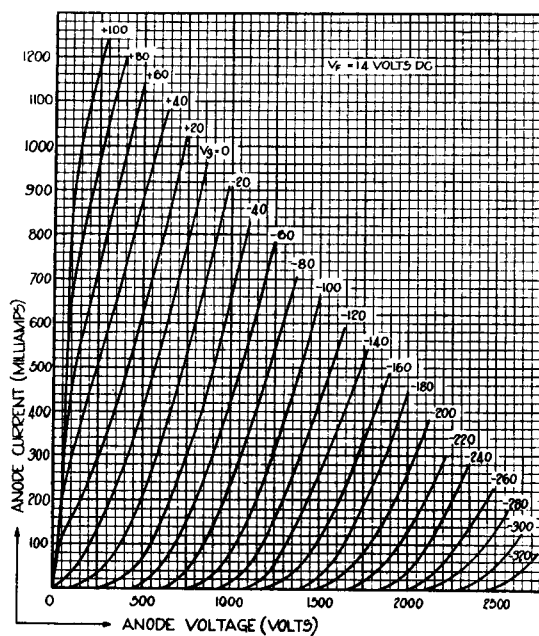
|                                            | Class B. A.F. Amp or Mod.<br>For balanced 2 valve circuit. |             |
|--------------------------------------------|------------------------------------------------------------|-------------|
| Direct anode voltage                       | 1,750                                                      | 1,500 volts |
| Grid bias                                  | —215                                                       | —180 volts  |
| Direct anode current per valve—Zero signal | 30                                                         | 25 mA.      |
| Maximum signal                             | 300                                                        | 300 mA.     |
| Anode dissipation                          | 240                                                        | 210 watts   |
| Load resistance—anode to anode             | 5,200                                                      | 4,280 watts |
| Power output—2 valves                      | 575                                                        | 475 watts   |
| Recommended power for driving stage        | 35                                                         | 35 watts    |

## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    |       | Class C<br>Telephony             |       | Class C<br>Telegraphy |                 |
|----------------------|-----------------------------------------|-------|----------------------------------|-------|-----------------------|-----------------|
|                      | Modulated<br>carrier<br>applied to grid |       | Subject to<br>anode<br>modulated |       | Unmodulated           |                 |
| Direct anode voltage | 1,750                                   | 1,500 | 1,250                            | 1,000 | 1,750                 | 1500 volts      |
| Direct anode current | 215                                     | 250   | 300                              | 300   | 300                   | 300 mA.         |
| Grid bias            | —230                                    | —200  | —320                             | —260  | —345                  | —300 to<br>—460 |
| Anode dissipation    | 250                                     | 250   | 125                              | 100   | 175                   | 150 watts       |
| Carrier output       | 125                                     | 125   | 250                              | 200   | 350                   | 300 watts       |

# —Standard Valves—

4308-B  
Valve



Tentative Data

V.4308-B.2.  
Sept. 1938.

PRINTED IN  
ENGLAND

# —Standard Valves—

4316-A  
Valve

## 4316-A VALVE

TRIODE.

### SPECIFICATION.

#### Cathode.

Thoriated Tungsten filament.

Constant voltage type.

#### Mounting.

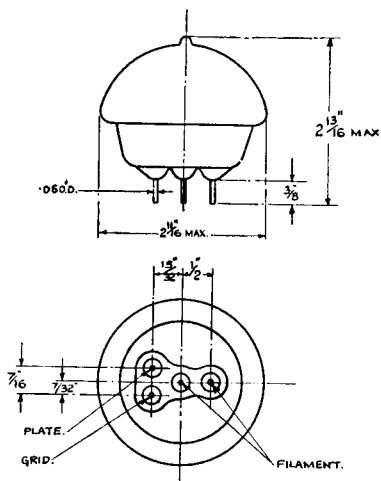
The grid, anode and filament leads are tungsten rods projecting from a flat face of the bulb. The valve may be supported by these leads providing flexibility is maintained so that no glass strains are produced. It is recommended that small brass or copper sleeves equipped with set screws be used for connectors. Soldering direct to the rods should not be attempted.

#### Dimensions.

|                |                               |
|----------------|-------------------------------|
| Overall length | $2\frac{13}{16}$ " (7.1 cms.) |
| Diameter       | $2\frac{11}{16}$ " (6.8 cms.) |
| Net weight     | 0.12 lbs. (55 gms.)           |

#### Constants.

|                          |                        |
|--------------------------|------------------------|
| Filament voltage         | 2 volts                |
| Nominal filament current | 3.65 amps.             |
| Amplification factor     | 6.5                    |
| Impedance                | 2,700 ohms             |
| Mutual conductance       | 2.4 mA. per volt       |
| Grid-anode capacity      | 1.6 $\mu\mu\text{F}$ . |
| Anode-filament capacity  | 0.8 $\mu\mu\text{F}$ . |
| Grid-filament capacity   | 1.2 $\mu\mu\text{F}$ . |



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                              |             |
|------------------------------|-------------|
| Maximum direct anode voltage | 450 volts   |
| Maximum direct anode current | 0.080 amps. |
| Maximum direct grid current  | 0.012 amps. |
| Maximum anode dissipation    | 30 watts    |

V.4316-A.1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                      | Class C<br>Telephony              | Class C<br>Telegraphy |
|----------------------|-----------------------------------|-----------------------|
|                      | Subject to<br>anode<br>modulation | Unmodulated           |
| Direct anode voltage | 400                               | 450 volts             |
| Direct anode current | 80                                | 80 mA.                |
| Direct grid current  | 12                                | 12 mA.                |
| Carrier output       | 6.5                               | 7.5 watts             |

### Ultra High Frequency Operation.

When the 4316-A valve is used at frequencies above 300 megacycles, several precautions must be observed in the circuit design in order to obtain good efficiency. It is necessary to provide tuning in the filament to ground circuit. The use of adjustable concentric lines of approximately  $\frac{3}{8}$  wavelength for each filament lead is probably the most satisfactory method. It is also desirable to avoid the use of dielectric material as much as possible and to confine that which is necessary for mounting circuit elements to points of low r.f. voltage. The grid and anode supply leads should be connected at nodal points if possible. A schematic of an oscillator circuit which will function at frequencies as high as 600 megacycles is shown. For operation at 500 megacycles, the area enclosed by the circuit A should be about  $1\frac{1}{2}$  square inches outside of the valve envelope and the capacity about 1.75 mmF. It is important that a reference ground such as a sheet of copper underneath the circuit, or a copper box enclosing the circuit be used and that by-passes be made directly to this ground with as short leads as possible.

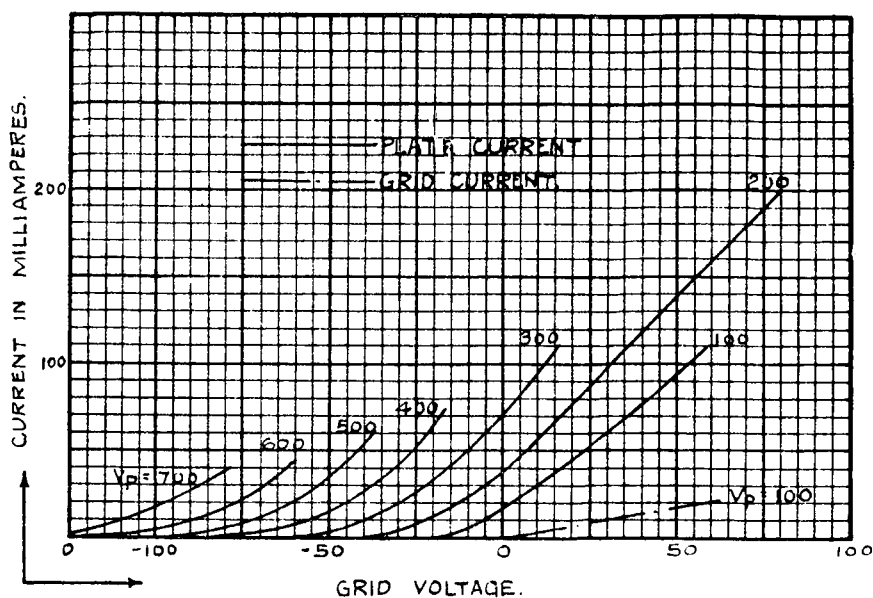
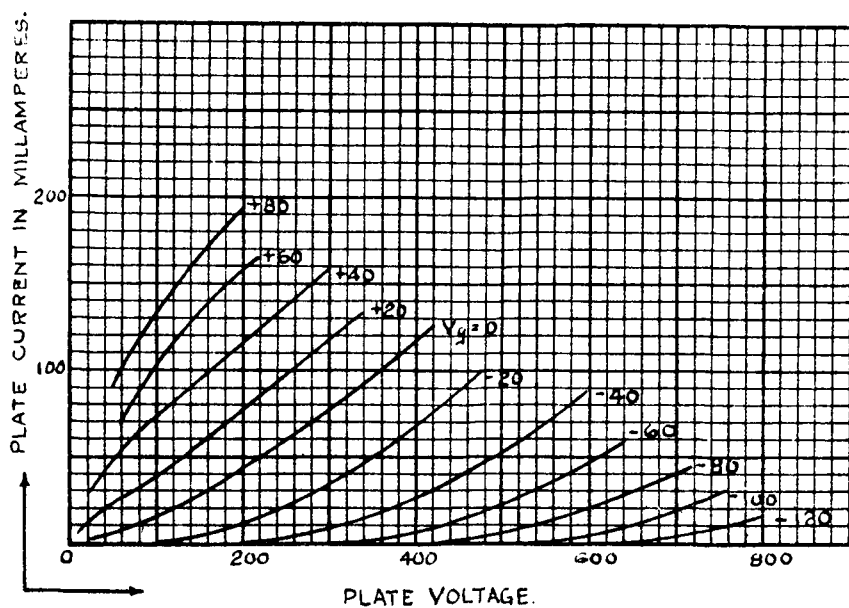
When the circuit is operated initially, the following procedure should be observed.

Place a 1,000 ohm resistor in series with the anode supply source. Apply 2.0 volts to the filament and with the grid leak set at 15,000 ohms apply anode voltage and adjust the filament tuning for greatest amplitude of oscillation as evidenced by the highest grid current. However, the grid current should not





# —Standard Valves—



# —Standard Valves—

4328-A  
Valve

## 4328-A VALVE

PENTODE.

SPECIFICATION.

### Cathode.

Indirectly heated oxide coated.  
Constant current type.

### Base.

American small 6-pin.

Control grid connected to top cap type B.

The cathode should preferably be connected to the heater. If voltage must be applied between cathode and heater it should not exceed 150 volts.

### Dimensions.

Maximum overall length 4.9" (12.5 cms.)  
Maximum diameter 1.52" (3.8 cms.)  
Net weight 0.11 lb (50 gms.)

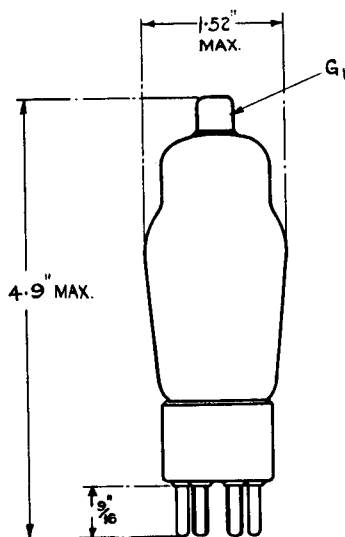
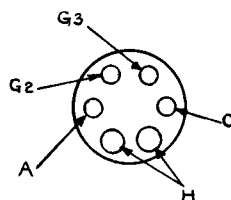
### Constants.

Nominal heater voltage 7.5 volts  
Heater current 0.425 amps.  
\*Mutual conductance 1.9 mA. per volt

### Inter-electrode Capacities.

Control grid to anode 0.025  $\mu\text{F}$ .  
Suppressor grid to anode 12.5  $\mu\text{F}$ .  
Anode to heater, cathode and screen grid 2.2  $\mu\text{F}$ .  
Control grid to suppressor grid 1.8  $\mu\text{F}$ .  
Control grid to heater, cathode and screen grid 4.0  $\mu\text{F}$ .  
Suppressor grid to heater, cathode and screen grid 7.5  $\mu\text{F}$ .

\*  $V_p = 250\text{v}$ .  $V_{g_2} = 180\text{v}$ .  $V_{g_3} = 0$ ,  
 $V_{g_1} = -5.5\text{v}$ .



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                   |           |
|-----------------------------------|-----------|
| Maximum direct anode voltage      | 250 volts |
| Maximum direct screen voltage     | 180 volts |
| Maximum cathode current           | 10 mA.    |
| (screen current + anode current). |           |
| Maximum screen current            | 2.5 mA.   |

Note :— When this valve is used in series with other valves of a different type, protection should be provided for the heaters at the moment of switching on. For this purpose the 4120-AA and 4121-AA Ballast Lamps are available.

Tentative data.

V.4328-A.1  
Sept. 1933

—Standard Valves—

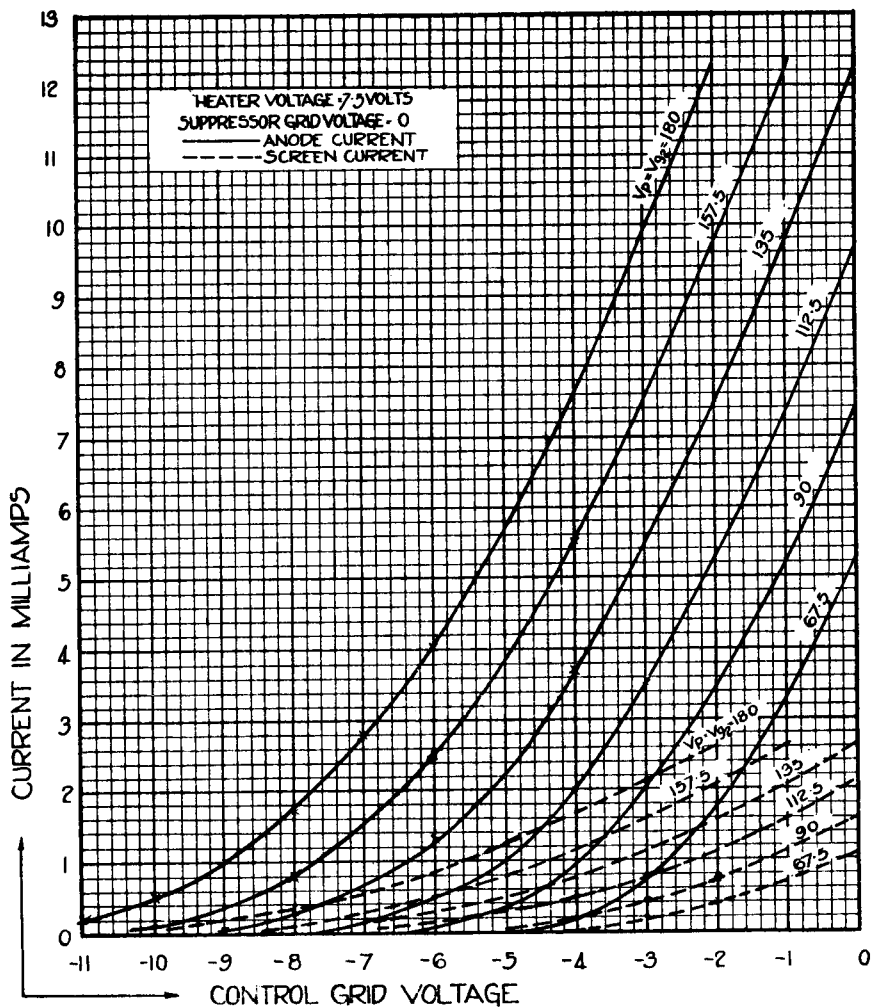
TYPICAL OPERATING CONDITIONS.

|                         |       |       |       |        |        |       |        |       |       |        |       |       |        |        |        |            |
|-------------------------|-------|-------|-------|--------|--------|-------|--------|-------|-------|--------|-------|-------|--------|--------|--------|------------|
| Anode voltage           | 135   | 135   | 135   | 135    | 135    | 135   | 180    | 180   | 225   | 225    | *     | 250   | 250    | 250    | 250    | volts      |
| Screen grid voltage     | 135   | 135   | 135   | 135    | 135    | 135   | 135    | 135   | 135   | 135    | 135   | 135   | 135    | 135    | 135    | volts      |
| Control grid bias       | —3    | —3    | —3    | —3     | —3     | —3    | —3     | —3    | —3    | —3     | —3    | —3    | —3     | —3     | —3     | volts      |
| Suppressor grid voltage | 0     | 0     | 0     | 0      | 0      | 0     | 0      | 0     | 0     | 0      | 0     | 0     | 0      | 0      | 0      | volts      |
| Anode current           | 5.4   | 5.4   | 5.4   | 5.4    | 5.4    | 5.4   | 5.4    | 5.4   | 5.5   | 5.5    | 5.5   | 5.5   | 5.5    | 5.5    | 5.5    | mA.        |
| Load resistance         | 20000 | 60000 | 60000 | 100000 | 100000 | 40000 | 100000 | 60000 | 60000 | 100000 | 60000 | 60000 | 100000 | 100000 | 100000 | ohms       |
| Input voltage           | 3.00  | 1.60  | 0.95  | 1.15   | 0.57   | 0.40  | 2.70   | 1.50  | 2.70  | 1.80   | 2.70  | 1.20  | 2.10   | 1.50   | 1.50   | peak volts |
| Output voltage          | —     | —     | —     | 100    | 75     | 50    | —      | 175   | —     | 220    | —     | —     | 250    | 200    | 200    | peak volts |
| Output power            | 250   | 130   | 60    | —      | —      | —     | 340    | —     | 425   | —      | 480   | 110   | —      | —      | —      | mW         |
| Second harmonic         | 22    | 26    | 35    | 33     | 35     | 40    | 26     | 26    | 27    | 27     | 26    | 30    | 26     | 30     | 30     | db         |
| Third harmonic          | 30    | 28    | 45    | 39     | 50     | 55    | 28     | 30    | 27    | 31     | 30    | 55    | 29     | 43     | 43     | db         |

\* Maximum operating conditions.

# —Standard Valves—

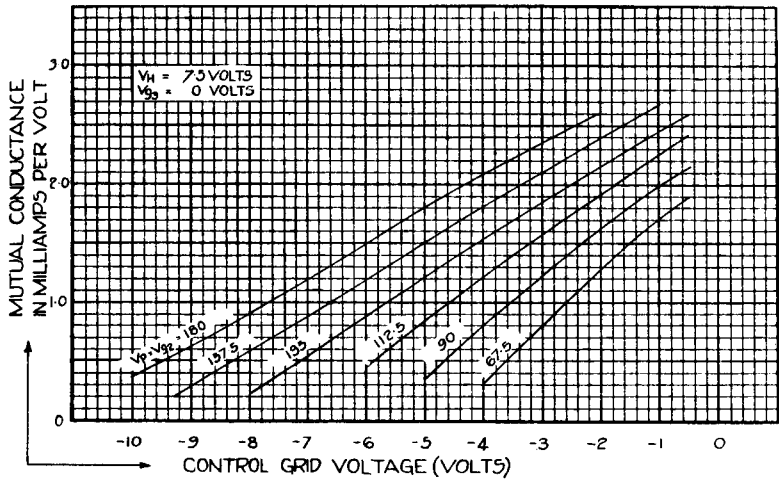
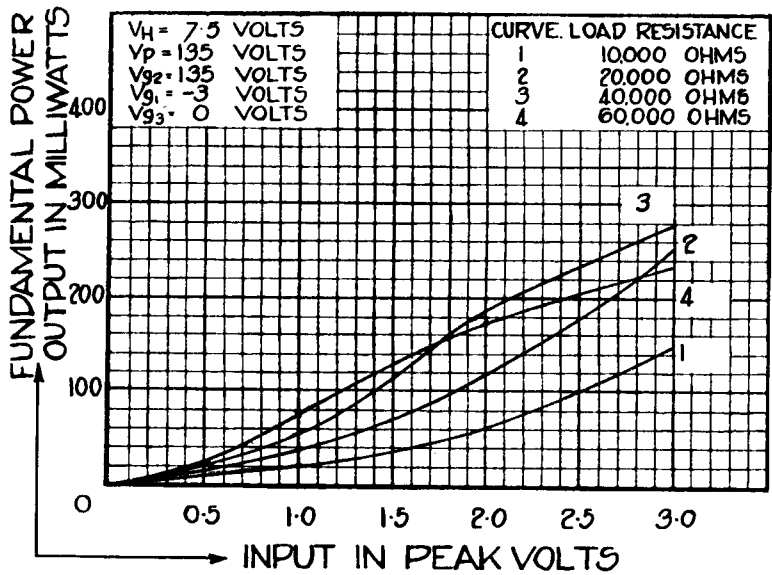
4328-A  
Valve



Tentative data

V.4328-A.2  
Sept. 1938

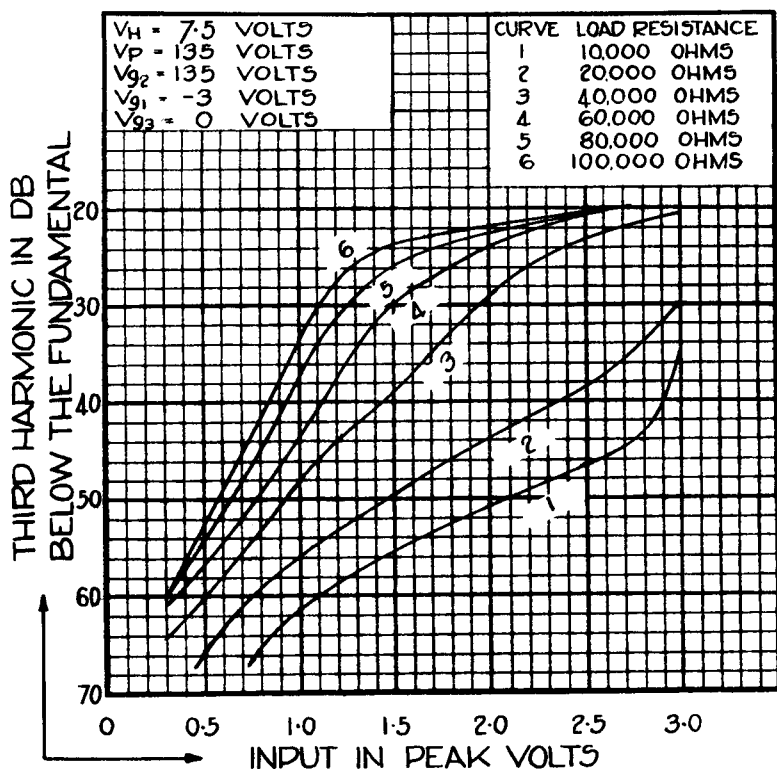
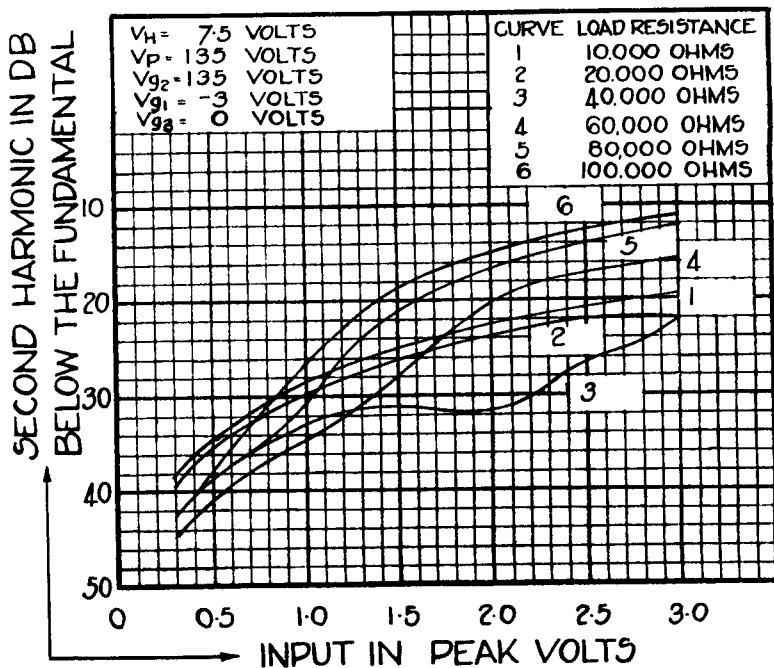
—Standard Valves—



# —Standard Valves—

4328-A  
Valve

## 4328.A VALVE



Tentative data

V.4328-A.3  
Sept. 1938

PRINTED IN  
ENGLAND

# S.T.C. Valves

## TECHNICAL DATA

Ref. : Y330/1E

### BACKWARD-WAVE OSCILLATOR

Type: 7747

The 7747 is a packaged backward wave oscillator with integral focusing solenoid and is designed for voltage tunable oscillator service over the frequency range 26.5 to 40 Gc/s with a minimum power output of 10 mW.

### ELECTRICAL DATA

#### Cathode

Indirectly heated, oxide coated

Heater voltage 6.3 V

Heater current (nominal) 0.3 A

Heater warm up time 120 sec

#### Characteristics

Frequency, electronically tunable over the range 26.5 to 40 Gc/s

Line voltage for tuning over the frequency band 700 to 3000 V

Minimum power output over the frequency band 10 mW

#### Maximum Ratings (absolute values)

Maximum anode voltage 700 V

Maximum anode current 2 mA

Maximum line voltage 3200 V

Maximum line current 13 mA

Maximum line dissipation 42 W

Maximum cathode current 13 mA

#### Typical Operating Conditions

| Frequency         | 26.5 | 30   | 35   | 40   | kMc/s |
|-------------------|------|------|------|------|-------|
| 1st anode voltage | 350  | 350  | 350  | 350  | V     |
| 1st anode current | 0.25 | 0.25 | 0.25 | 0.25 | mA    |
| * Line voltage    | 800  | 1000 | 1600 | 2700 | V     |
| Cathode current   | 10   | 10   | 10   | 10.5 | mA    |
| + Power output    | 15   | 25   | 40   | 50   | mW    |

\* This tube is normally operated with the line earthed and the cathode at a negative potential.

+ The actual power output will vary above or below the values shown but will not be less than 10 mW and there will be no "dead-spots".

October, 1960

Y330/1E-1



**Standard Telephones and Cables Limited**

(Registered Office: Connaught House, 63 Aldwych, London, W.C.2)

**BRIXHAM ROAD, PAIGNTON, DEVON**

Telephone: PAIGNTON 58685

Telegrams: STECO, PAIGNTON



## Focusing

|                                 |     |          |
|---------------------------------|-----|----------|
| Solenoid current                | 9   | A        |
| Solenoid voltage (d.c. nominal) | 24  | V        |
| Field strength (nominal)        | 850 | oersteds |

## MECHANICAL DATA

|                                                       |                                   |
|-------------------------------------------------------|-----------------------------------|
| Power input connections                               | Flying Leads                      |
| R.F. output connector                                 | Waveguide 22                      |
|                                                       | Flange type Z830018               |
| Solenoid plug connector. Inter Services Catalogue No. | Z560050                           |
| Envelope                                              | Metal                             |
| Maximum overall length                                | 12 inches                         |
| Maximum overall diameter                              | 6 inches                          |
| Weight                                                | 10 lb                             |
| Mounting position                                     | Any                               |
| Cooling                                               | Forced Air Cooled                 |
|                                                       | 20 cu.ft./min at a Standard Water |
|                                                       | Gauge pressure of 0.5 inch.       |

## OPERATING NOTES

With a line voltage of 700V, a cathode current of 10 mA is obtained by adjustment of the first anode voltage, the latter then being kept constant as the valve is tuned by variation of the line voltage. Under these conditions, the cathode current will rise to about 11.5 mA with the line voltage increased to 3000V.

The V.S.W.R. of the load connected to the valve should not exceed 2 : 1 if large power variations due to excessive standing wave ratios are to be avoided.

The resistance of the solenoid will increase by about 25% between ambient and normal operating temperature and this should be allowed for in designing the power supply. If the solenoid voltage remains constant, then the valve will operate satisfactorily over the range of solenoid current created by the change in solenoid temperature.

In the event of solenoid power supply failure, the first anode voltage of the valve must be reduced to zero immediately.

Should the cooling air supply fail then the first anode voltage must be reduced to zero and the solenoid supply switched off.

If these precautions are not taken, damage to the valve and/or the solenoid will result.





# Ballast Lamps

In telephone and other equipment it is often essential that the current in a circuit should remain substantially constant notwithstanding voltage fluctuations. A Ballast Lamp may be used to supply this constant current.

The types listed below are mainly for use in the filament circuit of telephone repeater valves.

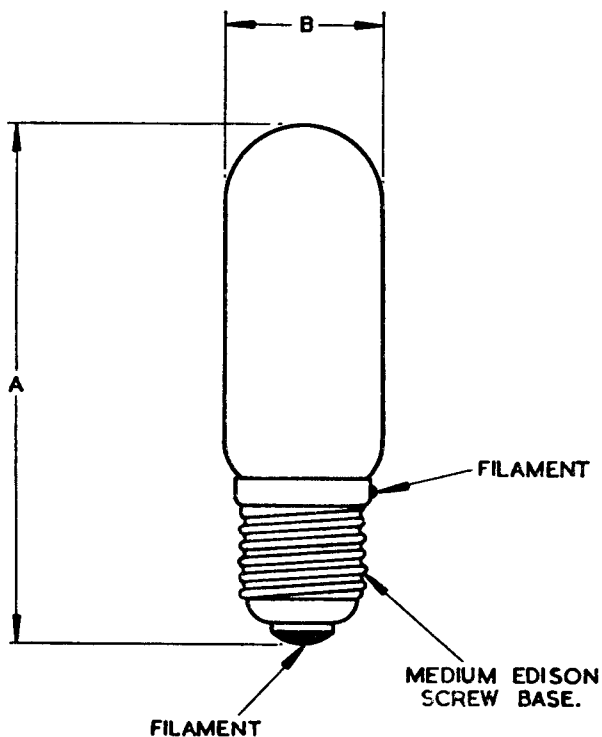
The B1C/1E is a special version of the 4003A type mounted between clips for use in mobile equipment.

The 4006 series are equivalent to the G.P.O.1 and 1S Resistance Barretters.

| Reference | Code           | Current (A)                                                                               | Voltage (V) |
|-----------|----------------|-------------------------------------------------------------------------------------------|-------------|
| B1B/1E    | 4006A          | } 0.080<br>0.095 to 0.105<br>0.88 to 1.07<br>0.23 to 0.27<br>0.37 to 0.49<br>0.76 to 0.96 | 11 max.     |
| B1B/2E    | 4006B          |                                                                                           | 40          |
| B1C/1E    | B1C/1E (CV433) |                                                                                           | 3 to 9.5    |
| *B2B/2C   | 4004B (CV2329) |                                                                                           | 3 to 9 ←    |
| *B4B/1C   | 4120AA (CV536) |                                                                                           | 5.5 to 12   |
| *B8B/1C   | 4121AB         |                                                                                           | 5.5 to 12   |

\*The socket code is 4012B for these types.

# Ballast Lamps

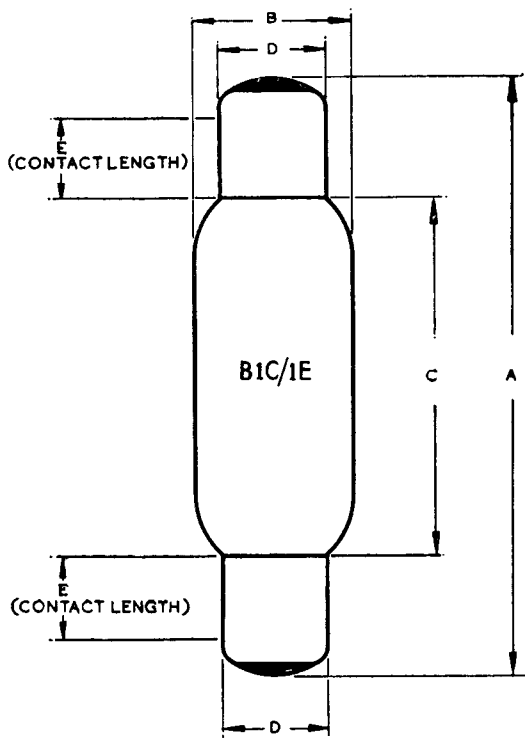


| TYPE                      | DIM. | MILLIMETRES | INCHES              |
|---------------------------|------|-------------|---------------------|
| 4004B<br>4120AA<br>4121AB | A    | 104.8 MAX.  | $4\frac{1}{8}$ MAX. |
|                           | B    | 31.8 MAX.   | $1\frac{1}{4}$ MAX. |

NOTE: BASIC FIGURES ARE INCHES



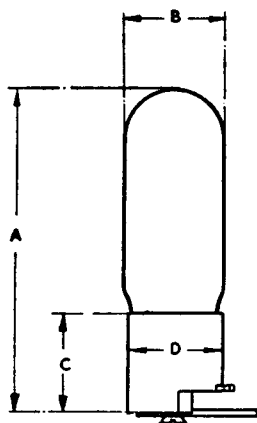
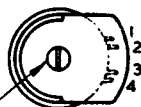
# Ballast Lamps



| DIM | MILLIMETERS | INCHES      |
|-----|-------------|-------------|
| A   | 78.6 MAX.   | 3 3/32 MAX. |
| B   | 22.2 MAX.   | 7/8 MAX.    |
| C   | 49.5 MAX.   | 1.95 MAX.   |
|     | 44.5 MIN.   | 1.75 MIN.   |
| D   | 14.8 MAX.   | 0.58 MAX.   |
|     | 13.8 MIN.   | 0.54 MIN.   |
| E   | 10.7 MIN.   | 27/64 MIN.  |

NOTE:- BASIC FIGURES ARE INCHES.

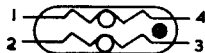
# Ballast Lamps



| TYPE       | SCREW (No. 4 BA x 1/4 ZINC PLATED) |
|------------|------------------------------------|
| 4006A & AS | COUNTER SUNK HEAD                  |
| 4006B      | CHEESE HEAD                        |

## BASING ARRANGEMENT.

| TAG No | ELECTRODE |
|--------|-----------|
| 1 & 4  | FILAMENT  |
| 2 & 3  | FILAMENT  |



| DIM | MILLIMETRES | INCHES    |
|-----|-------------|-----------|
| A   | 85.5 MAX    | 3.37 MAX  |
| B   | 26.1 MAX    | 1.03 MAX  |
| C   | 26.0 NOM    | 1.025 NOM |
| D   | 23.5 NOM    | 0.926 NOM |

NOTE:- BASIC FIGURES ARE INCHES.



# Monitor Cathode Ray Tubes

Codes: VLS492AB  
VLS492AG

## CATHODE.

Indirectly-heated, oxide-coated

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 2   | V |
| Nominal current | 1.8 | A |

## DIRECT INTERELECTRODE CAPACITANCES.

|                                      |     |    |
|--------------------------------------|-----|----|
| $X_1$ plate to $X_2$ plate           | 0.8 | pF |
| $Y_1$ plate to $Y_2$ plate           | 4.3 | pF |
| $X_1$ plate to all other electrodes  | 6.6 | pF |
| $Y_1$ plate to all other electrodes  | 6.0 | pF |
| Control grid to all other electrodes | 8.5 | pF |

## CHARACTERISTICS.

|                                                      |                                                      |                                  |
|------------------------------------------------------|------------------------------------------------------|----------------------------------|
| Screen colour                                        | <div> <div>VLS492AB</div> <div>VLS492AG</div> </div> | <div>Blue</div> <div>Green</div> |
| Focussing method                                     | Electrostatic                                        |                                  |
| Deflection method                                    | Electrostatic                                        |                                  |
| Sensitivity, (where $V_{a2}$ = Second anode voltage) |                                                      |                                  |
| X plates                                             | 110                                                  | mm/V                             |
|                                                      | $\overline{V_{a2}}$                                  |                                  |
| Y plates                                             | 120                                                  | mm/V                             |
|                                                      | $\overline{V_{a2}}$                                  |                                  |

## DIMENSIONS.

|                                 |                    |     |
|---------------------------------|--------------------|-----|
| Maximum overall length          | 171.5              | mm  |
| Maximum seated height           | 157.2              | mm← |
| Maximum bulb diameter           | 41.3               | mm  |
| Useful screen diameter, approx. | 32                 | mm  |
| Base                            | Medium shell octal |     |
| Net weight                      | 100                | g   |

## TYPICAL OPERATING CONDITIONS.

|                      |         |           |   |
|----------------------|---------|-----------|---|
| Second anode voltage | 500     | 1 000     | V |
| First anode voltage  | 100     | 200       | V |
| Grid voltage         | 0 to -5 | -5 to -10 | V |

NOTE.—The key way in the base is at 45° to the plane of the deflector plates.

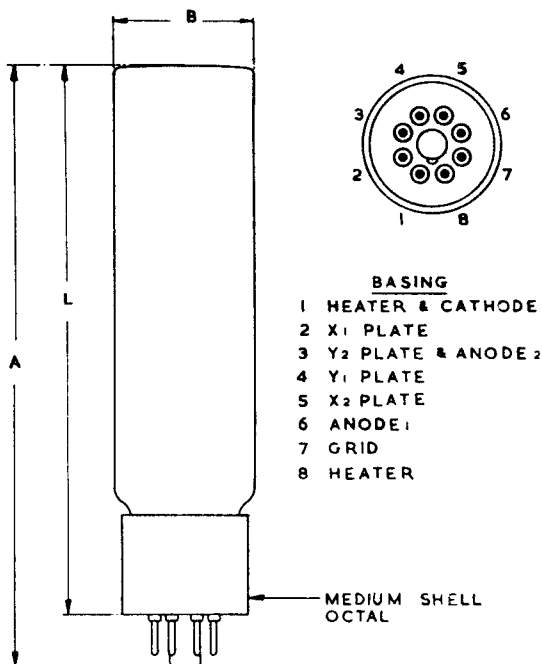
Ref.:

C6SS/1B

C6SS/1G

# Monitor Cathode Ray Tubes

Codes: VLS492AB  
VLS492AG



| DIM | MILLIMETRES | INCHES                              |
|-----|-------------|-------------------------------------|
| A   | 171.5 MAX:  | 6 <sup>3</sup> / <sub>4</sub> MAX:  |
| B   | 41.3 MAX:   | 1 <sup>5</sup> / <sub>8</sub> MAX:  |
| L   | 157.2 MAX:  | 6 <sup>3</sup> / <sub>16</sub> MAX: |

NOTE:- BASIC DIMENSIONS ARE INCHES





# High Vacuum Cathode Ray Tube

4096AB  
(C10SS/IB)  
Blue Trace

4096AG  
(C10SS/IG)  
Green Trace

C10SS/IB  
(4096AB)

C10SS/IG  
(4096AG)

## CATHODE.

Indirectly-heated oxide-coated

|                        |     |   |
|------------------------|-----|---|
| Voltage                | 2   | V |
| Nominal heater current | 1.7 | A |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                                 |     |    |
|---------------------------------|-----|----|
| $X_1$ to $X_2$                  | 0.8 | pF |
| $Y_1$ to $Y_2$                  | 4.3 | pF |
| $X_1$ to all other electrodes   | 6.6 | pF |
| $Y_1$ to all other electrodes   | 6.0 | pF |
| Control electrode to all others | 8.5 | pF |

## CONSTANTS.

|                                     |                               |              |
|-------------------------------------|-------------------------------|--------------|
| Second anode voltage                | 800—2,000                     | V            |
| First anode voltage                 | $\frac{1}{3}$ th of 2nd anode | V<br>approx. |
| Control electrode bias              | 0 to —25                      | V            |
| Cut off voltage at $V_{a_2}$ 2,000V | —35 to —45                    | V            |
| Maximum current to $V_{a_1}$        | 300                           | $\mu$ A      |
| Sensitivity at $V_{a_2}$ 2,000V     | $S_x$ 0.13                    | mm./V        |
|                                     | $S_y$ 0.135                   | mm./V        |
| Sensitivity at $V_{a_2}$ 1,000V     | $S_x$ 0.26                    | mm./V        |
|                                     | $S_y$ 0.27                    | mm./V        |
| Screen diameter                     | 2.5                           | in.          |

## DIMENSIONS.

|                        |                     |     |
|------------------------|---------------------|-----|
| Maximum overall length | 273                 | mm. |
| Maximum diameter       | 79                  | mm. |
| Base                   | International octal |     |
| Net weight             | 215                 | g.  |

## TYPICAL OPERATION.

|                      |            |            |
|----------------------|------------|------------|
| Second anode voltage | 2,000      | 1,000 V    |
| First anode voltage  | 240        | 120 V      |
| Grid bias            | —15 to —25 | 0 to —10 V |

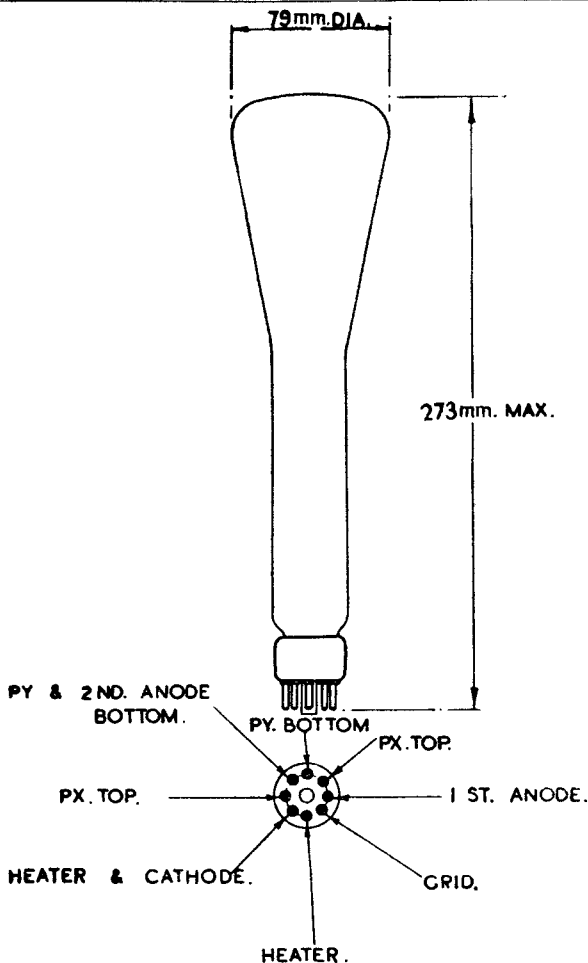
C10SS/IB  
4096 AB)

C10SS/IG  
(4096AG)

# High Vacuum Cathode Ray Tube

4096AB  
(C10SS/IB)  
Blue Trace

4096AG  
(C10SS/IG)  
Green Trace





# Cathode Ray Tube

Code: C10SS/2G (CV2794)

The C10SS/2G is an improved "wire in" version of the 4096AG Cathode Ray Tube which is now obsolete.

## CATHODE.

|                                 |     |   |
|---------------------------------|-----|---|
| Indirectly-heated, oxide-coated |     |   |
| Heater voltage                  | 2   | V |
| Nominal current                 | 1.7 | A |

## DIRECT INTERELECTRODE CAPACITANCES.

|                                      |     |    |
|--------------------------------------|-----|----|
| $X_1$ plate to $X_2$ plate           | 7.5 | pF |
| $Y_1$ plate to $Y_2$ plate           | 0.7 | pF |
| $X_1$ plate to all other electrodes  | 3.6 | pF |
| $Y_1$ plate to all other electrodes  | 3.7 | pF |
| Control grid to all other electrodes | 3.8 | pF |

## CHARACTERISTICS.

|                                     |                  |         |
|-------------------------------------|------------------|---------|
| Screen colour                       | Green            |         |
| Screen persistence                  | Medium           |         |
| Focussing method                    | Electrostatic    |         |
| Deflection method                   | Electrostatic    |         |
| Sensitivity, approx.                | 140              | mm/V    |
|                                     | $\sqrt{V_{a_2}}$ |         |
| Cut off voltage (at $V_{a_2}$ 1 kV) | -30              | V       |
| Maximum first anode current         | 300              | $\mu$ A |

## DIMENSIONS.

|                                 |        |    |
|---------------------------------|--------|----|
| Maximum overall length          | 180    | mm |
| Maximum overall diameter        | 70     | mm |
| Maximum neck diameter           | 40     | mm |
| Useful screen diameter, approx. | 60     | mm |
| Base                            | B10A/A |    |
| Net weight                      | 97     | g  |

## TYPICAL OPERATING CONDITIONS.

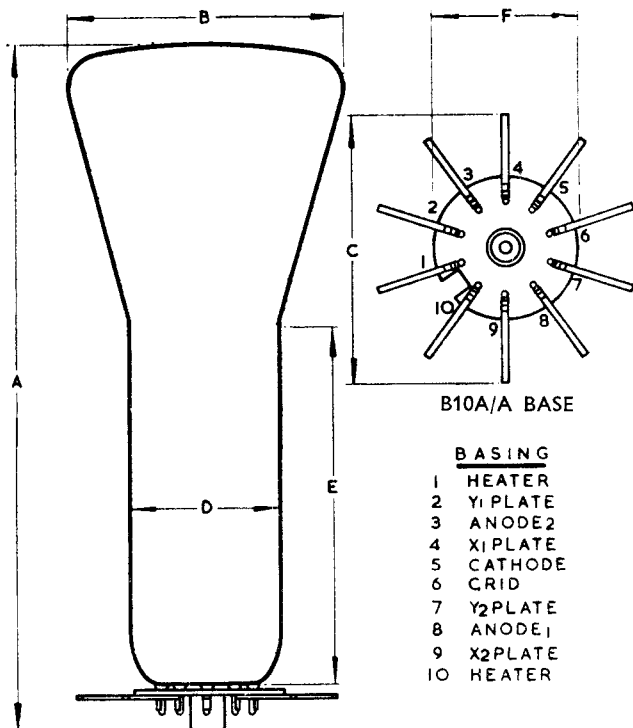
|                      |                                    |    |
|----------------------|------------------------------------|----|
| Second anode voltage | 0.8 to 2.0                         | kV |
| First anode voltage  | $\frac{1}{8}$ of $V_{a_2}$ voltage |    |
| Control grid bias    | 0 to -30                           | V  |

NOTE.—The locating notch on the base is in line with the plane of the plates.

## Cathode Ray Tube



Code: C10SS/2G (CV2794)



| DIM. | MILLIMETRES | INCHES                                  |
|------|-------------|-----------------------------------------|
| A    | 180 MAX.    | 7.1 MAX.                                |
| B    | 70.0 MAX.   | 2.76 MAX.                               |
| C    | 71.4 MAX.   | 2 <sup>13</sup> / <sub>16</sub> MAX.    |
| D    | 40.0 MAX.   | 1.58 MAX.                               |
| E    | 110 APPROX. | 4 <sup>11</sup> / <sub>32</sub> APPROX. |
| F    | 36.5 NOM.   | 1 <sup>7</sup> / <sub>16</sub> NOM.     |

NOTE:- BASIC FIGURES ARE INCHES



# Gas Focused Cathode Ray Tube

CI6GS/2B  
(4050AB)  
CI6GS/2D  
(4050AD)  
CI6GS/2G  
(4050AG)

4050AB  
(Blue Screen)

4050AD  
(Delay Screen)

4050AG  
(Green Screen)

## CATHODE.

Oxide-coated filament

|                 |            |   |
|-----------------|------------|---|
| *Current        | 0.7 to 1.1 | A |
| Nominal voltage | 0.75       | V |

## INTER-ELECTRODE CAPACITIES.

|                                          |     |    |
|------------------------------------------|-----|----|
| Between either pair of deflecting plates | 7.0 | pF |
| Anode to X plates                        | 1.2 | pF |
| Anode to Y plates                        | 2.3 | pF |

## RATING.

|                                 |                 |       |
|---------------------------------|-----------------|-------|
| Anode voltage                   | 350 to 1,500    | V     |
| Normal anode voltage            | 500             | V     |
| Shield voltage                  | 0 to +50        | V     |
| Sensitivity (V = anode voltage) | $\frac{370}{V}$ | mm./V |
| Effective screen diameter       | 4               | in.   |

## DIMENSIONS.

|                        |                        |     |
|------------------------|------------------------|-----|
| Maximum overall length | 340                    | mm. |
| Maximum bulb diameter  | 118                    | mm. |
| Base                   | Standard British 9-pin |     |
| Net weight             | 285                    | g.  |

\* For maximum life the tube should be operated with just sufficient filament current to produce a satisfactory trace. Filament current will rise with life.

The P.x. plates produce horizontal deflection when the tube is mounted with filament pins at the bottom.

It is recommended that a 2,000 ohm protective resistance should be included in the shield circuit as well as in the anode circuit.

CI6GS/2B  
(4050AB)  
CI6GS/2D  
(4050AD)  
CI6GS/2G  
(4050AG)

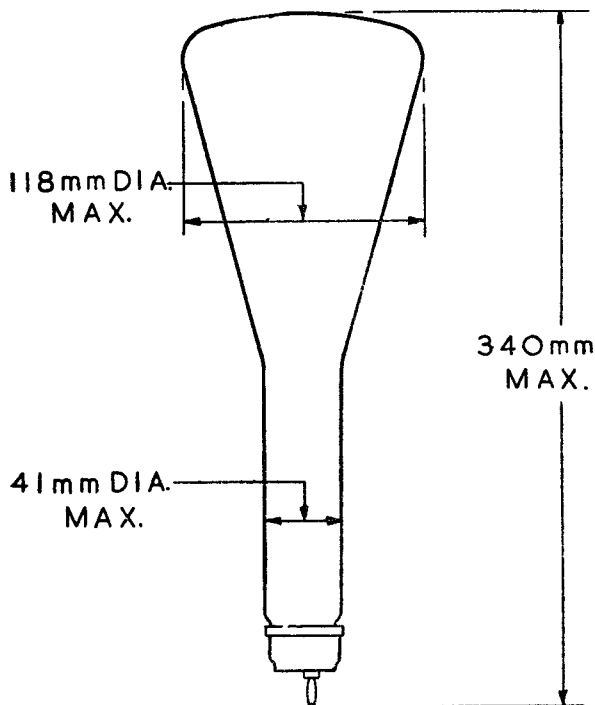
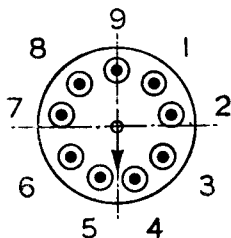
# Gas Focused Cathode Ray Tube



4050AB  
(Blue Screen)

4050AD  
(Delay Screen)

4050AG  
(Green Screen)



## BASING

|   |        |   |        |
|---|--------|---|--------|
| 1 | PY.    | 6 | S.     |
| 2 | PX.    | 7 | PX.    |
| 3 | BLANK. | 8 | PY.    |
| 4 | F +.   | 9 | ANODE. |
| 5 | F -.   |   |        |



# High Vacuum Cathode Ray Tube

4063AB  
(Blue Screen)

4063YB  
(Blue Screen  
Y plates terminated  
through side of bulb)

C22SS/1B  
(4063AB)  
C22SS/2B  
(4063YB)

## CATHODE.

Indirectly-heated oxide-coated

|                        |     |   |
|------------------------|-----|---|
| Voltage                | 2   | V |
| Nominal heater current | 1.9 | A |

## DIRECT INTER-ELECTRODE CAPACITIES.

|                               | 4063AB | 4063YB |    |
|-------------------------------|--------|--------|----|
| $X_1$ plate to $X_2$ plate    | 2      | 2      | pF |
| $X_1$ or $X_2$ plate to earth | 16     | 16     | pF |
| $Y_1$ plate to $Y_2$ plate    | 1.1    | 1.2    | pF |
| $Y_1$ or $Y_2$ plate to earth | 10     | 3.5    | pF |
| Grid to earth                 | 18     | 18     | pF |

## RATINGS.

|                                                            |                 |            |
|------------------------------------------------------------|-----------------|------------|
| Maximum anode voltage                                      | 5               | kV         |
| Approximate sensitivity where $V =$<br>final anode voltage |                 |            |
| X plates                                                   | $\frac{600}{V}$ | mm./V      |
| Y plates                                                   | $\frac{700}{V}$ | mm./V      |
| Conductance of any plate pair                              | less than 0.1   | $\mu$ Mho. |
| Maximum input power to screen                              | 0.01            | W/sq. cm.  |

## OPERATING CONDITIONS.

|                                            |                       |              |
|--------------------------------------------|-----------------------|--------------|
| Third anode voltage                        | 5                     | kV           |
| Second anode voltage (adjust for<br>focus) | $0.27 \times V_{a_3}$ | V<br>approx. |
| First anode voltage                        | 150                   | V            |
| Grid bias for maximum brilliancy           | 0 to —5               | V            |
| Grid bias for cut off                      | —30                   | V            |
| Grid base for modulation                   | 30                    | V<br>approx. |

**C22SS/1B  
(4063AB)  
C22SS/2B  
(4063YB)**

# High Vacuum Cathode Ray Tube

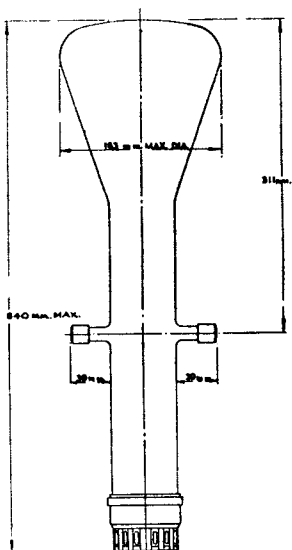
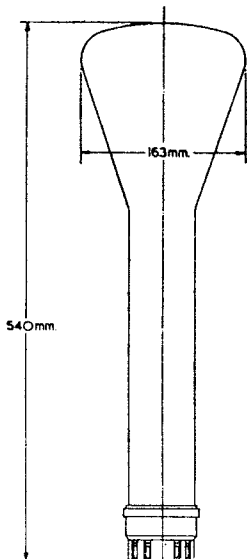
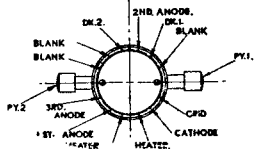
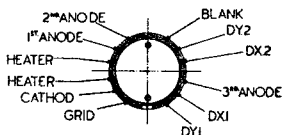
**4063AB  
(Blue Screen)**

**4063YB  
(Blue Screen  
Y plates terminated  
through side of bulb)**



**4063 YB**

**4063 AB**







# Gas Focused Cathode Ray Tube

C28GS/IB  
(4050BB)  
C28GS/IG  
(4050BG)  
C28GS/ID  
(4050BD)

4050BB  
(Blue Screen)

4050BG  
(Green Screen)

4050BD  
(Delay Screen)

## CATHODE.

Oxide-coated filament

|                 |            |   |
|-----------------|------------|---|
| *Current        | 0.7 to 1.1 | A |
| Nominal voltage | 0.75       | V |

## INTER-ELECTRODE CAPACITIES.

|                                          |     |    |
|------------------------------------------|-----|----|
| Between either pair of deflecting plates | 7.0 | pF |
| Anode to X plates                        | 1.2 | pF |
| Anode to Y plates                        | 2.3 | pF |

## RATINGS.

|                                 |                 |       |
|---------------------------------|-----------------|-------|
| Anode voltage                   | 350 to 1,500    | V     |
| Normal anode voltage            | 500             | V     |
| Shield voltage                  | 0 to +50        | V     |
| Sensitivity (V = anode voltage) | $\frac{580}{V}$ | mm./V |
| Effective screen diameter       | 6½              | in.   |

## DIMENSIONS.

|                        |                        |     |
|------------------------|------------------------|-----|
| Maximum overall length | 476                    | mm. |
| Maximum bulb diameter  | 185                    | mm. |
| Base                   | Standard British 9-pin |     |
| Net weight             | 790                    | g.  |

\*For maximum life the tube should be operated with just sufficient filament current to produce a satisfactory trace. Filament current will rise with life. The Px plates produce horizontal deflection when the tube is mounted with pins 4 and 5 at the bottom.

It is recommended that a 2,000 ohms protective resistance should be included in the shield circuit as well as in the anode circuit.

C28GS/IB  
(4050BB)  
C28GS/IG  
(4050BG)  
C28GS/ID  
(4050BD)

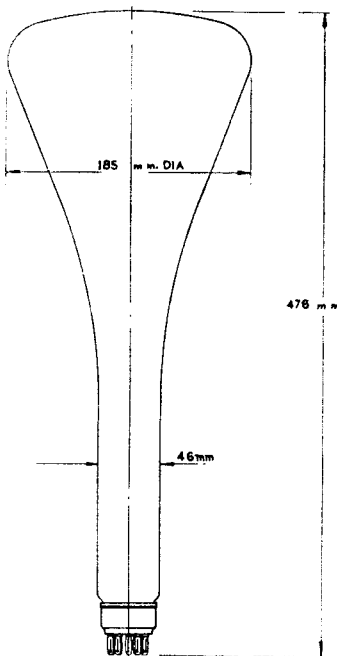
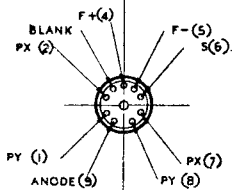
# Gas Focused Cathode Ray Tube



4050BB  
(Blue Screen)

4050BG  
(Green Screen)

4050BD  
(Delay Screen)





# Miniature Cold-Cathode Voltage-Stabiliser

Code: G55/1K

The G55/1K is a miniature cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. The noteworthy feature of this valve is the relatively low maintaining voltage of 55 volts.

## MECHANICAL DATA

|                        |              |    |
|------------------------|--------------|----|
| Maximum overall length | 66.7         | mm |
| Maximum seated height  | 60.3         | mm |
| Maximum diameter       | 19.1         | mm |
| Base                   | B7G          |    |
| Net weight             | 8.5          | g  |
| Mounting position      | Unrestricted | ←  |

## CHARACTERISTICS

|                                                             |              |        |
|-------------------------------------------------------------|--------------|--------|
| Maximum striking voltage                                    | 90           | V←     |
| Maximum stabilising voltage at 30 mA                        | 60           | V←     |
| Minimum stabilising voltage at 2 mA                         | 50           | V←     |
| Nominal stabilising voltage                                 | 55           | V←     |
| D.C. operating current                                      | 2 to 30      | mA     |
| Maximum peak current (10 seconds max.)                      | 75           | mA     |
| Nominal regulation, 2 to 30 mA                              | 3            | V      |
| Maximum regulation, 2 to 30 mA                              | 5            | V      |
| Nominal drift in stabilising voltage<br>(100 to 1000 hours) | +1.25        | V←     |
| Temperature coefficient, — 20 to + 90°C                     | 12           | mV/°C← |
| Ambient temperature range                                   | — 55 to + 90 | °C     |

## Miniature Cold-Cathode Voltage-Stabiliser

Code: G55/1K



### OPERATING NOTES

This valve is designed and manufactured for use as a stabiliser, to provide a constant voltage source independent of supply and load current variations. As such it has a wide current range and low impedance. In cases where the requirements are not too severe, it may also be used to provide a voltage reference source, particularly if steps are taken to maintain constant the current and operating conditions and to age-in the valve under operational conditions.

Sufficient resistance should always be used in series with the stabiliser to limit the current through it to the specified operating range, taking into account fluctuations due to component tolerances, extremes of supply voltage and load current. The minimum supply voltage should always exceed the rated maximum striking voltage to ensure striking initially and during life.

A peak starting current in excess of the maximum D.C. operating current, as indicated by the valve ratings, is permissible, after which several minutes operation at normal current may be required before the stabilising voltage again reaches its normal value. In view of this general characteristic of voltage stabilisers current variations should be limited to a low value in circuits where a high degree of stability is required, as in the case, for example, where the valve is used as a voltage reference source.

If the valve has been operated consistently at a given D.C. current, a change in this current value may bring about some initial drift in the stabiliser characteristics. A similar drift may be experienced with a new valve, since the particular operating conditions will probably differ from those applied during manufacture. For those applications in which such a drift is particularly objectionable, it may be desirable to operate the stabiliser at the proposed current level for up to 100 hours before using it in circuit.

To stabilise high voltage supplies, two or more stabilisers may be operated in series across the supply, all but one valve being shunted by a high resistance to aid striking.

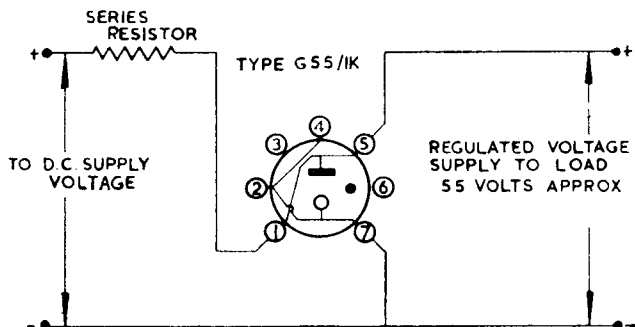
If the associated circuit has a capacitor in shunt with the stabiliser, it should be limited to 0.1 $\mu$ F, as a larger value may cause oscillation and thus give unstable regulation.

Operation with reversed polarity will damage this valve.



# Miniature Cold-Cathode Voltage-Stabiliser

Code: G55/1K

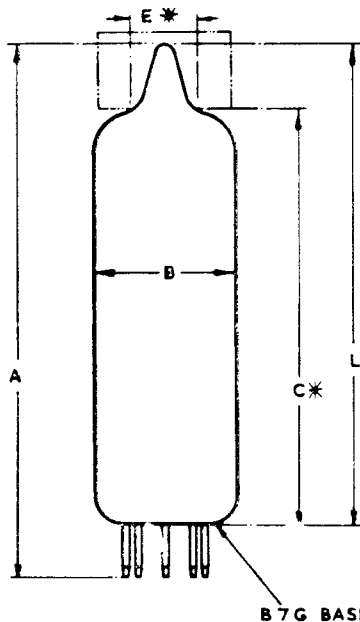
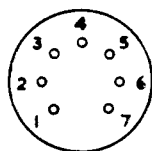


TYPICAL CIRCUIT TO PROVIDE A REGULATED  
SUPPLY VOLTAGE REMOVAL OF THE VALVE  
FROM THE SOCKET DISCONNECTS THE VOLTAGE  
FROM THE LOAD

# Miniature Cold-Cathode Voltage-Stabiliser



Code: G55/1K

BASING

- 1 ANODE
- 2 CATHODE
- 3 INTERNALLY CONNECTED
- 4 CATHODE
- 5 ANODE
- 6 INTERNALLY CONNECTED
- 7 CATHODE

\*DENOTES:—MEASURED FROM BASE SEAT TO BULB TOP LINE, AS DETERMINED BY RING GAUGE OF 'E' INT. DIA.

| DIM | MILLIMETRES    | INCHES                         |
|-----|----------------|--------------------------------|
| A   | $63.5 \pm 3.2$ | $2\frac{1}{2} \pm \frac{1}{8}$ |
| B   | 19.1 MAX.      | $\frac{3}{4}$ MAX.             |
| * C | $50.8 \pm 2.4$ | $2 \pm \frac{3}{32}$           |
| L   | 60.3 MAX.      | $2\frac{3}{8}$ MAX.            |
| * E | 11.1 DIA.      | $\frac{7}{16}$ DIA.            |

NOTE:—BASIC FIGURES ARE IN INCHES.



# Cold-Cathode Voltage-Stabiliser

Code: VR75/30 (CV3798)←

The VR75/30 is a cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OA3 type.

## MECHANICAL DATA

|                        |                   |    |
|------------------------|-------------------|----|
| Maximum overall length | 104.8             | mm |
| Maximum seated height  | 90.5              | mm |
| Maximum diameter       | 39.7              | mm |
| Base                   | Small shell octal |    |
| Net weight             | 40                | g  |
| Mounting position      | Unrestricted      | ←  |

## CHARACTERISTICS

|                                                             |            |        |
|-------------------------------------------------------------|------------|--------|
| Maximum striking voltage                                    | 105        | V      |
| Maximum stabilising voltage at 40 mA                        | 81         | V←     |
| Minimum stabilising voltage at 5 mA                         | 70         | V←     |
| Nominal stabilising voltage                                 | 75         | V      |
| D.C. operating current                                      | 5 to 40    | mA     |
| Maximum peak current<br>(10 seconds max.)                   | 100        | mA     |
| Nominal regulation 5 to 30 mA                               | 3          | V←     |
| Maximum regulation 5 to 30 mA                               | 4.5        | V←     |
| Nominal regulation 5 to 40 mA                               | 4.5        | V←     |
| Maximum regulation 5 to 40 mA                               | 6.5        | V←     |
| Nominal drift in stabilising voltage<br>(100 to 1000 hours) | +1.1       | V←     |
| Temperature coefficient -20 to +70°C                        | ±7         | mV/°C← |
| Ambient temperature range                                   | -55 to +70 | °C     |

## NOTE

With suitable socket connections the internal connection between pins 3 and 7 acts as a switch to open the supply or load circuit when the valve is removed.

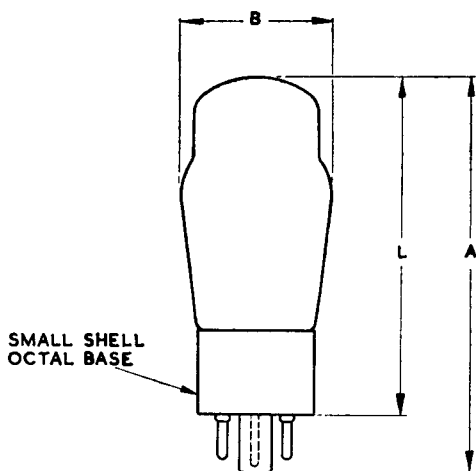
Not less than the maximum striking voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current through the valve to 40 mA under steady state conditions. As stated above during the initial warming up period a maximum current of 100 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

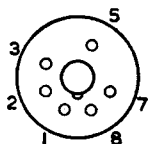
Operation with reversed polarity will damage this valve.

# Cold-Cathode Voltage-Stabiliser

Code: VR75/30 (CV3798)←



## BASING



- 1 NO CONNECTION
- 2 CATHODE
- 3 CONNECTED TO PIN 7
- 4 NO PIN
- 5 ANODE
- 6 NO PIN
- 7 CONNECTED TO PIN 3
- 8 NO CONNECTION

| DIM | MILLIMETRES | INCHES       |
|-----|-------------|--------------|
| A   | 104.8 MAX   | 4 1/8 MAX    |
| B   | 39.7 MAX    | 1 9/16 MAX   |
| L   | 85.7 ± 4.8  | 3 3/8 ± 3/16 |

NOTE:- BASIC FIGURES ARE INCHES.





# Cold-Cathode Voltage-Stabiliser

Code: G75/3G (CV4030)

The G75/3G is a gas-filled voltage-stabiliser which has been developed for applications where conditions of vibration and mechanical shock are encountered. The valve has two anodes which may be used strapped together or with one as a priming anode.

## MECHANICAL DATA

|                                     |                   |    |
|-------------------------------------|-------------------|----|
| Maximum overall length (less leads) | 80.2              | mm |
| Maximum seated height               | 66.7              | mm |
| Maximum diameter                    | 30.2              | mm |
| Minimum lead length                 | 50.8              | mm |
| Base                                | Flying lead octal |    |
| Net weight                          | 32                | g  |
| Mounting position                   | Unrestricted      |    |

## CHARACTERISTICS

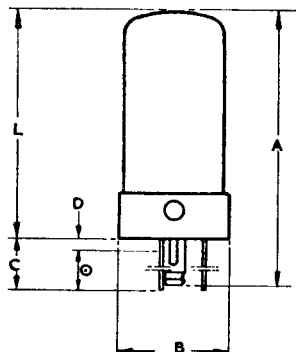
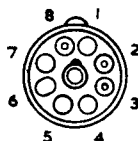
|                                                           |                                                                                                                                                    |                          |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Maximum priming anode striking voltage                    | 115                                                                                                                                                | V                        |
| Maximum transfer voltage                                  | $\left\{ \begin{array}{l} \text{priming anode supply} \\ \text{voltage 115 V through} \\ \text{100 k}\Omega \text{ resistor} \end{array} \right\}$ | V                        |
| Stabilising voltage at 30 mA                              |                                                                                                                                                    | V←                       |
| D.C. operating current                                    | 5 to 60                                                                                                                                            | mA                       |
| Nominal regulation, 5 to 30 mA                            | 2.5                                                                                                                                                | V←                       |
| Maximum regulation, 5 to 30 mA                            | 3.5                                                                                                                                                | V←                       |
| Nominal regulation, 5 to 60 mA                            | 5.25                                                                                                                                               | V←                       |
| Maximum regulation, 5 to 60 mA                            | 6.5                                                                                                                                                | V←                       |
| Nominal drift in stabilising voltage<br>(0 to 1000 hours) | 1                                                                                                                                                  | V←                       |
| Temperature coefficient, $-20$ to $+90^{\circ}\text{C}$   | +5                                                                                                                                                 | mV/ $^{\circ}\text{C}$ ← |
| Ambient temperature range                                 | $-55$ to $+90$                                                                                                                                     | $^{\circ}\text{C}$ ←     |

NOTE.—Sufficient resistance must always be used in series with this type to limit the current through the valve to 60 mA. Not less than the maximum striking voltage should be provided to ensure starting during life.

Operation with reversed polarity will damage this valve.

# Cold-Cathode Voltage-Stabiliser

Code: G75/3G (CV4030)



## BASING.

1. NO LEAD
2. ANODE
3. PRIMING ANODE
4. NO LEAD
5. NO LEAD
6. NO LEAD
7. NO LEAD
8. CATHODE

| DIM. | MILLIMETRES |      | INCHES         |      |
|------|-------------|------|----------------|------|
| A    | 80.2        | MAX. | $3\frac{5}{8}$ | MAX. |
| B    | 30.2        | MAX. | $1\frac{1}{8}$ | MAX. |
| C    | 50.8        | MIN. | 2              | MIN. |
| D    | 3.2         | NOM. | $\frac{1}{8}$  | NOM. |
| L    | 66.7        | MAX. | $2\frac{3}{4}$ | MAX. |

NOTE: BASIC FIGURES ARE INCHES

⊙ DENOTES: LEADS TINNED OVER THIS PORTION



# Cold-Cathode Voltage-Stabiliser

Code: VR105/30 (CV686)←

The VR105/30 is a cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OC3 type.

## MECHANICAL DATA

|                        |                   |               |
|------------------------|-------------------|---------------|
| Maximum overall length | 104.8             | mm            |
| Maximum seated height  | 90.5              | mm            |
| Maximum diameter       | 39.7              | mm            |
| Base                   | Small shell octal |               |
| Net weight             | 40                | g             |
| Mounting position      |                   | Unrestricted← |

## CHARACTERISTICS

|                                                             |            |        |
|-------------------------------------------------------------|------------|--------|
| Maximum striking voltage                                    | 127        | V←     |
| Minimum applied supply voltage                              | 133        | V←     |
| Maximum stabilising voltage at 40 mA                        | 112        | V←     |
| Minimum stabilising voltage at 5 mA                         | 105        | V←     |
| Nominal stabilising voltage                                 | 108        | V←     |
| D.C. operating current                                      | 5 to 40    | mA     |
| Maximum peak current (10 seconds max.)                      | 100        | mA     |
| Nominal regulation, 5 to 30 mA                              | 1          | V←     |
| Maximum regulation, 5 to 30 mA                              | 2          | V←     |
| Nominal regulation, 5 to 40 mA                              | 1.3        | V←     |
| Maximum regulation, 5 to 40 mA                              | 4          | V←     |
| Nominal drift in stabilising voltage<br>(100 to 1000 hours) | 0.75       | V←     |
| Temperature coefficient, -20 to +70°C                       | ±5         | mV/°C← |
| Ambient temperature range                                   | -55 to +70 | °C     |

## NOTE

With suitable socket connections the internal connection between pins 3 and 7 acts as a switch to open the supply or load circuit when the valve is removed.

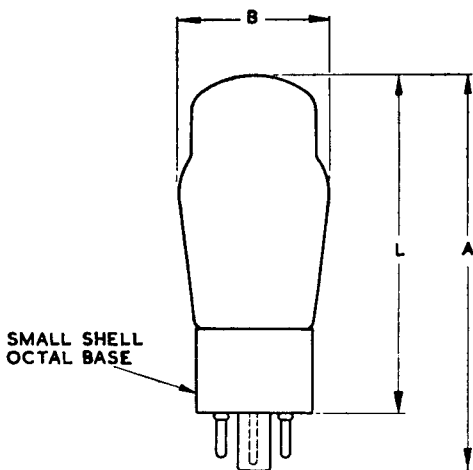
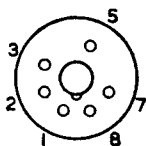
Not less than the quoted minimum supply voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current through the valve to 40 mA under steady state conditions. As stated above during the initial warming up period a maximum current of 100 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

Operation with reversed polarity will damage this valve.

# Cold-Cathode Voltage-Stabiliser

Code: VRI05/30 (CV686)←

**BASING**

- 1 NO CONNECTION
- 2 CATHODE
- 3 CONNECTED TO PIN 7
- 4 NO PIN
- 5 ANODE
- 6 NO PIN
- 7 CONNECTED TO PIN 3
- 8 NO CONNECTION

| DIM | MILLIMETRES | INCHES       |
|-----|-------------|--------------|
| A   | 104.8 MAX   | 4 1/8 MAX    |
| B   | 39.7 MAX    | 1 9/16 MAX   |
| L   | 85.7 ± 4.8  | 3 3/8 ± 3/16 |

**NOTE:-** BASIC FIGURES ARE INCHES.



# Miniature Cold-Cathode Voltage-Stabiliser

Code: OB2 (CVI833) ←

This valve is a miniature cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OB2 type.

## MECHANICAL DATA

|                        |              |    |
|------------------------|--------------|----|
| Maximum overall length | 66.7         | mm |
| Maximum seated height  | 60.3         | mm |
| Maximum diameter       | 19.1         | mm |
| Base                   | B7G          |    |
| Net weight             | 8.5          | g  |
| Mounting position      | Unrestricted |    |

## CHARACTERISTICS

|                                                             |            |    |
|-------------------------------------------------------------|------------|----|
| Maximum striking voltage                                    | 127        | V← |
| Minimum applied supply voltage                              | 133        | V← |
| Maximum stabilising voltage at 30 mA                        | 112        | V← |
| Minimum stabilising voltage at 5 mA                         | 105        | V← |
| Nominal stabilising voltage                                 | 108        | V← |
| D.C. operating current                                      | 5 to 30    | mA |
| Maximum peak current (10 seconds max.)                      | 75         | mA |
| Nominal regulation, 5 to 30 mA                              | 1.5        | V← |
| Maximum regulation, 5 to 30 mA                              | 3.5        | V  |
| Nominal drift in stabilising voltage<br>(100 to 1000 hours) | 1.4        | V← |
| Temperature coefficient, -20 to +90°C                       | ±5         | V← |
| Ambient temperature range                                   | -55 to +90 | °C |

NOTE.—With suitable socket connections the internal connection between pins 1 and 5 acts as a switch to open the load circuit when the valve is removed. (See Fig. 1.)

## **Miniature Cold-Cathode Voltage-Stabiliser**



**Code: OB2 (CVI833) ←**

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Not less than the quoted minimum supply voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current to 30 mA under steady state conditions. As stated, during the initial warming up period a maximum current of 75 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

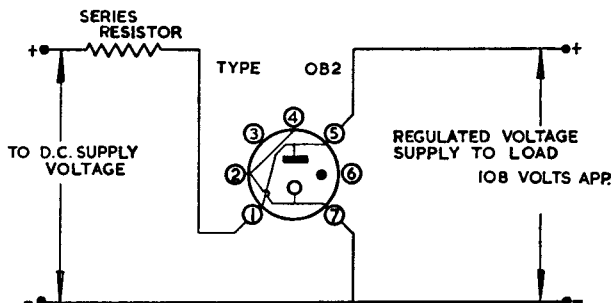
If the associated circuit has a capacitor in shunt with this valve it should be limited to 0.1  $\mu$ F. A larger value may cause oscillation and thus give unstable regulation.

Operation with reversed polarity will damage this valve.



# Miniature Cold-Cathode Voltage-Stabiliser

Code: OB2 (CVI833) ←

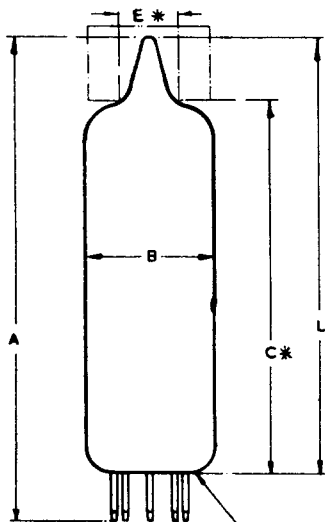
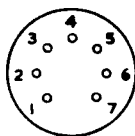


TYPICAL CIRCUIT TO PROVIDE A REGULATED  
SUPPLY VOLTAGE. REMOVAL OF THE VALVE  
FROM THE SOCKET DISCONNECTS THE VOLTAGE  
FROM THE LOAD

# Miniature Cold-Cathode Voltage-Stabiliser



Code: OB2 (CV1833) ←

**BASING**

- 1 ANODE
- 2 CATHODE
- 3 INTERNALLY CONNECTED
- 4 CATHODE
- 5 ANODE
- 6 INTERNALLY CONNECTED
- 7 CATHODE

B 7 G BASE

\*DENOTES:- MEASURED FROM BASE SEAT TO BULB TOP LINE,  
AS DETERMINED BY RING GAUGE OF 'E' INT. DIA

| DIM | MILLIMETRES    | INCHES                         |
|-----|----------------|--------------------------------|
| A   | $63.5 \pm 3.2$ | $2\frac{1}{2} \pm \frac{1}{8}$ |
| B   | 19.1 MAX       | $\frac{3}{4}$ MAX              |
| * C | $50.8 \pm 2.4$ | $2 \pm \frac{3}{32}$           |
| L   | 60.3 MAX       | $2\frac{3}{8}$ MAX             |
| * E | 11.1 DIA       | $\frac{7}{16}$ DIA             |

NOTE :- BASIC FIGURES ARE INCHES.





# Cold Cathode Stabiliser Valve

GI20/IB

This valve is a two-electrode gas-filled stabiliser especially developed for application where a high degree of stability and performance is essential. Its outstanding characteristics are its low voltage drop (55 volts) and close regulation over a wide current range.

## DIMENSIONS.

|                             |     |     |
|-----------------------------|-----|-----|
| Maximum overall length      | 102 | mm. |
| Maximum bulb diameter       | 34  | mm. |
| Standard 4 pin British Base |     |     |
| Net weight                  | 30  | g.  |

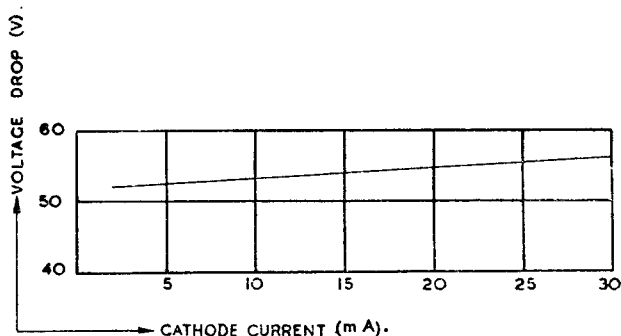
## CHARACTERISTICS.

|                                   |         |    |
|-----------------------------------|---------|----|
| Nominal breakdown voltage         | 100     | V  |
| Nominal maintaining voltage       | 55      | V  |
| D.C. operating current continuous | 2 to 30 | mA |
| Regulation 2 mA to 30 mA          | 3       | V  |

## MAXIMUM RATINGS.

|                                                     |    |    |
|-----------------------------------------------------|----|----|
| Maximum peak cathode current (averaged over 1 sec.) | 50 | mA |
| Maximum direct cathode current                      | 30 | mA |

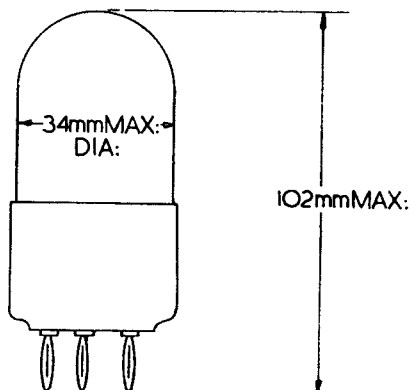
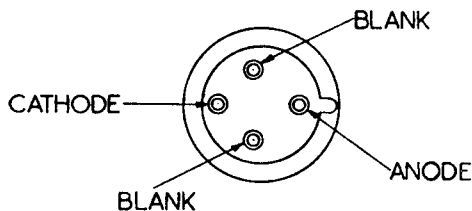
The valve will normally regulate satisfactorily at 1 mA but operation below 2 mA is not recommended as the valve tends to be erratic. The maximum average anode current must not be exceeded or the life will be shortened.



**G120/1B**

# **Cold Cathode Stabiliser Valve**

**G120/1B**





# Sub-Miniature Cold Cathode Gas-Filled Triode

Code: G1/236G (CV3524)

The G1/236G is a three electrode, gas-filled cold cathode triode. It has been designed primarily for "storage" purposes in telephone circuits but has applications in the field of electronic counting.

## DIMENSIONS.

|                       |                                                            |    |
|-----------------------|------------------------------------------------------------|----|
| Maximum bulb length   | 40                                                         | mm |
| Maximum bulb diameter | 8.7                                                        | mm |
| Maximum overall width | 12.7                                                       | mm |
| Base                  | None. Tinned leads for soldering directly into the circuit |    |
| Net weight            | 2.5                                                        | g  |

## D.C. CHARACTERISTICS.

|                                         |     |    |
|-----------------------------------------|-----|----|
| Minimum main gap breakdown voltage      | 235 | V  |
| Nominal main gap maintaining voltage    | 70  | V  |
| Maximum control gap breakdown voltage   | 85  | V  |
| Nominal control gap maintaining voltage | 57  | V  |
| Maximum cathode current                 | 1.5 | mA |
| Minimum cathode current                 | 0.5 | mA |
| Recommended anode voltage               | 180 | V  |
| Maximum trigger resistance              | 1.0 | MΩ |

## DYNAMIC CHARACTERISTICS.

### Transfer

A typical measure of transfer sensitivity is the following :—

Maximum trigger voltage required for main gap breakdown, in the form of a 100 micro-second pulse at  $V_a$  150 volts and  $R_t$  1 megohm\*

95 V

\*The megohm referred to takes a spread of  $\pm 10\%$  into account. This makes 1.1 megohm an absolute maximum.

**Sub-Miniature Cold  
Cathode Gas-Filled  
Triode**  
**Code: G1/236G (CV3524)**



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**Deionisation.**

A typical measure of deionisation is the following :—

After extinguishing, from a conducting condition limited by 100 k $\Omega$ , by pulsing the anode to cathode potential with a square pulse of one milli-second duration, the maximum value of reapplied anode voltage that will not cause the valve to restrike is 200 V.

**General Notes.**

Anode voltages between 150 and 200 volts and a minimum trigger pulse voltage of 95 volts are required to give satisfactory dynamic operation.

If a circuit is used which takes the trigger negative with respect to the cathode at any time, then the ratio of mean cathode current to mean trigger current, when negative, must not be less than 6 to 1. This ratio is a limitation to the value of trigger resistance which should be determined for each such application.

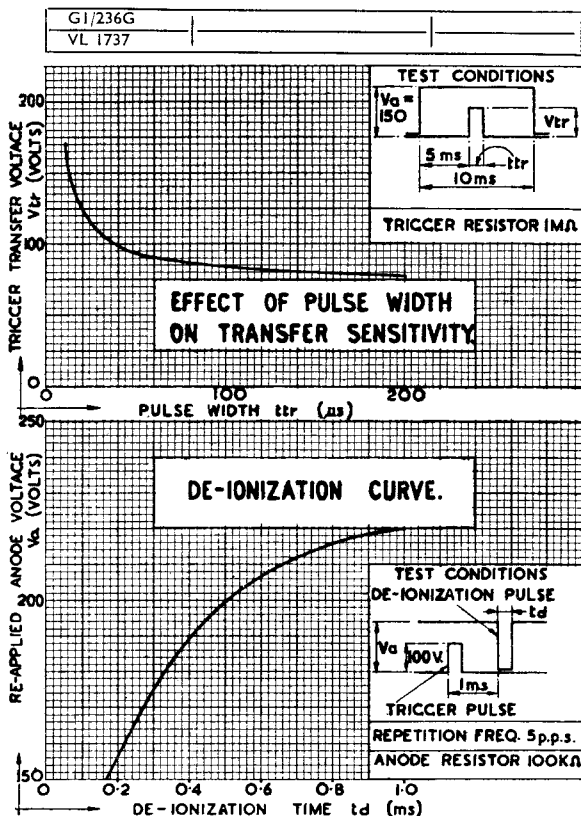
If a metal clip is used for anchoring the valve, it should be electrically connected to the trigger.

These valves are light sensitive during operation and should not be exposed to direct sunlight. On the other hand a small measure of light is necessary to ensure satisfactory dynamic operation. If it is desired to use them in a totally enclosed space a small light source should be provided.



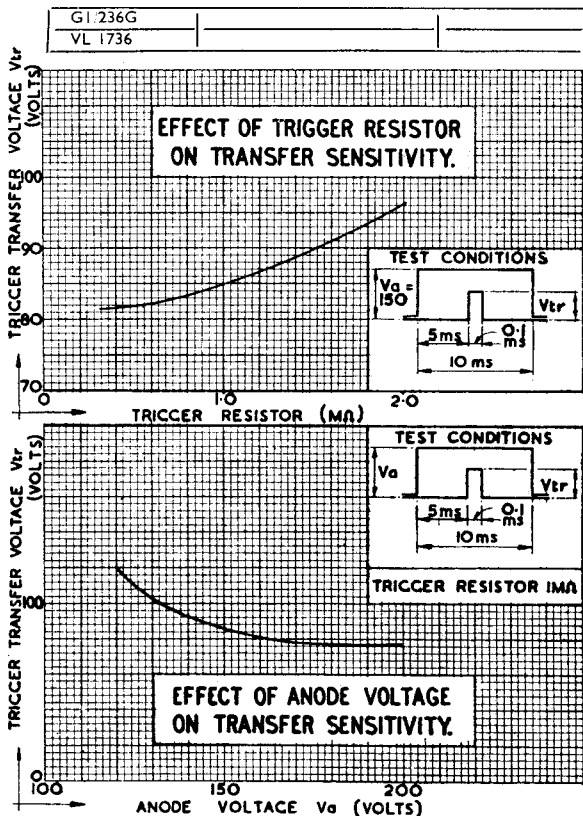
# Sub-Miniature Cold Cathode Gas-Filled Triode

Code: G1/236G (CV3524)



# Sub-Miniature Cold Cathode Gas-Filled Triode

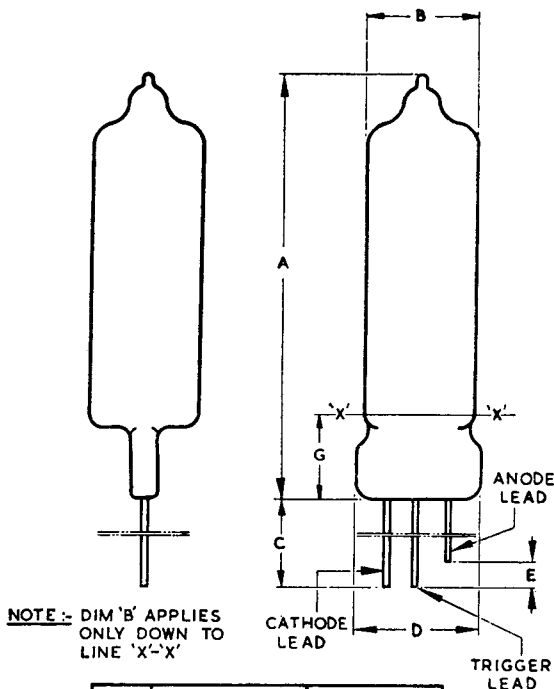
Code: G1/236G (CV3524)





# Sub-Miniature Cold Cathode Gas-Filled Triode

Code: G1/236G (CV3524)



| DIM | MILLIMETERS | INCHES     |
|-----|-------------|------------|
| A   | 40 MAX      | 1 9/16 MAX |
| B   | 8.7 MAX     | 0.343 MAX  |
| C   | 51 MIN      | 2 MIN      |
| D   | 12.7 MAX    | 1/2 MAX    |
| E   | 12.7 NOM    | 1/2 NOM    |
| G   | 8 MAX.      | 5/16 MAX.  |

NOTE:- BASIC FIGURES ARE INCHES



# High-Speed Primed- Trigger Cold-Cathode Tube

Code: G1/371K (CVX2224)

The G1/371K is a high-speed primed-trigger tube developed for use with the G10/241E Unidirectional Cold-Cathode Gas Filled Decade Counter for which a single cathode trigger tube is required as a coupling element between tubes. Its speed and general characteristics, however, make it a useful general component. It also has features which make it specially suitable for use in circuits where a high input impedance is required.

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 54   | mm |
| Maximum seated height  | 47.6 | mm |
| Maximum bulb diameter  | 19.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 10   | g  |

## MAIN ELECTRODE CHARACTERISTICS.

|                                                                                                       |            |       |
|-------------------------------------------------------------------------------------------------------|------------|-------|
| Maximum pulse current output                                                                          | 15         | mA    |
| Maximum D.C. current output                                                                           | 10         | mA    |
| Minimum D.C. current output                                                                           | 2          | mA    |
| Anode supply voltage range                                                                            | 270 to 360 | V←    |
| Main gap maintaining voltage                                                                          | 175 to 185 | V←    |
| Maximum cathode voltage output                                                                        | 140        | V     |
| Shield voltage applied through 50 kΩ                                                                  | 150        | V     |
| Trigger Bias (for $V_a$ up to 325 V)                                                                  | 0 to 165   | V     |
| Trigger Bias (for $V_a$ up to 360 V)                                                                  | 60 to 165  | V     |
| †† Trigger breakdown potential on application of a 25 micro-second square pulse based on maximum bias |            |       |
|                                                                                                       | 12 to 26   | V     |
| *De-ionisation Time (max.)                                                                            | 30         | μ sec |
| † Transfer Time (nom.)                                                                                | 0.5        | μ sec |

Tentative data.  
November 1955

G1/371K—1



# High-Speed Primed- Trigger Cold-Cathode Tube

Code: G1/371K (CVX2224)



## DIRECT INTERELECTRODE CAPACITANCES.

|                                 |     |    |
|---------------------------------|-----|----|
| Trigger to cathode              | 3.0 | pF |
| Trigger to all other electrodes | 5.0 | pF |

## PRIMING GAP CHARACTERISTICS.

|                                                              |            |            |
|--------------------------------------------------------------|------------|------------|
| Priming gap current                                          | 0.2 to 0.5 | mA         |
| Anode feed resistance                                        | 390        | k $\Omega$ |
| Cathode resistance to earth or main gap<br>cathode potential | 56         | k $\Omega$ |

The priming gap cathode must not be more than 140 volts negative to the main cathode at any time.

\*De-ionisation time to be short enough to permit a re-application of the nominal working voltage (90 per cent of maximum, i.e. 325 volts) 30 micro-seconds after the extinguishing of a D.C. discharge of maximum rated current by means of a rectangular pulse applied to the anode. The base of the extinguishing pulse shall be 20 volts below the  $V_m$  of the main gap, all other electrodes may be at potentials within their working range.

†This is the time interval between current flowing in the trigger cathode circuit as the result of applying a trigger pulse, and conduction starting in the main anode-cathode gap.

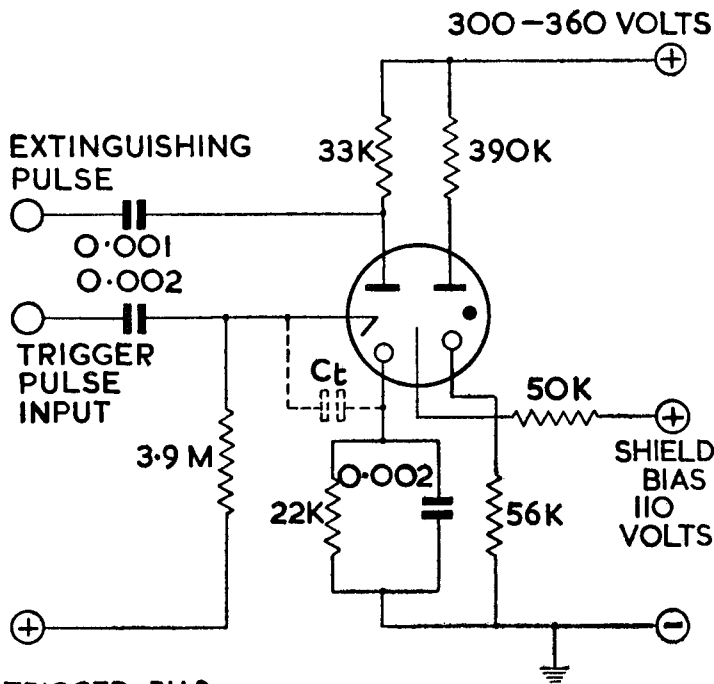
††For pulse widths of less than 25  $\mu$  sec, the triggering pulse-amplitude is an inverse function of the pulse width.



# High-Speed Primed- Trigger Cold-Cathode Tube

Code: G1/371K (CVX2224)

## CIRCUIT SHOWING THE G1/371K USED AS A TRIGGER TUBE WITH HIGH INPUT LEAK RESISTANCE



TRIGGER BIAS.

THE VALUE OF SHIELD POTENTIAL  
110 VOLTS IS IMPORTANT. THE EFFECTIVE  
TRIGGER-CATHODE CAPACITANCE,  $C_t$ ,  
SHOULD BE MADE UP TO 50 pF MINIMUM.

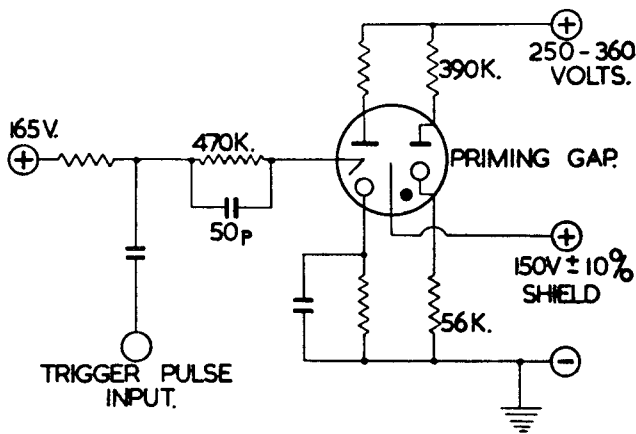
Ref.: G1/371K

# High-Speed Primed- Trigger Cold-Cathode Tube



Code: G1/371K (CVX2224)

## CIRCUIT SHOWING THE G1/371 K USED AS A TRIGGER TUBE.

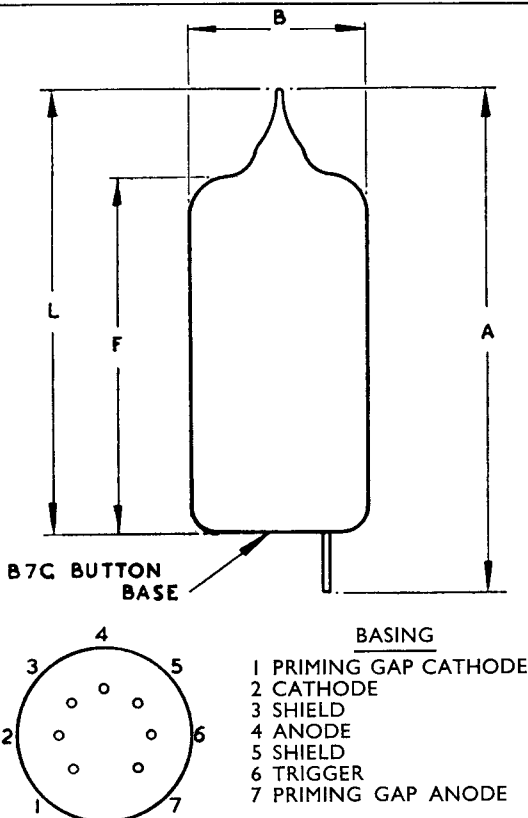


CERTAIN BASIC VALUES ARE GIVEN, OTHER  
VALUES ARE DETERMINED BY THE  
REQUIREMENTS OF THE APPLICATION.



# High-Speed Primed- Trigger Cold-Cathode Tube

Code: G1/371K (CVX2224)



| DIM | MILLIMETRES    | INCHES                               |
|-----|----------------|--------------------------------------|
| A   | 54.0 MAX       | 2 $\frac{1}{8}$ MAX                  |
| B   | 19.1 MAX       | $\frac{3}{4}$ MAX                    |
| F   | 38.1 $\pm$ 2.4 | 1 $\frac{1}{2}$ $\pm$ $\frac{3}{32}$ |
| L   | 47.6 MAX       | 1 $\frac{7}{8}$ MAX                  |

NOTE: BASIC FIGURES ARE INCHES

Tentative data.  
May 1957



# Cold Cathode Gas-Filled Relay

## 4313C

**G150/1A  
(4313C)**

Double gap cold cathode gas-filled valve for use as a relay or voltage regulator in special circuits.

### DIMENSIONS.

|                          |    |     |
|--------------------------|----|-----|
| Maximum overall length   | 88 | mm. |
| Maximum overall diameter | 30 | mm. |
| Net weight               | 30 | g.  |

### CHARACTERISTICS.

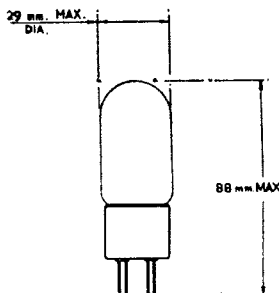
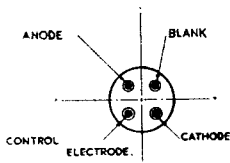
|                                         |     |                   |
|-----------------------------------------|-----|-------------------|
| Nominal control gap breakdown voltage   | 70  | V                 |
| Nominal control gap maintaining voltage | 60  | V                 |
| Minimum main gap breakdown voltage      | 150 | V                 |
| Nominal main gap maintaining voltage    | 75  | V                 |
| Transfer current                        | 5   | $\mu$ A<br>(max.) |

### NOMINAL DEIONIZATION TIME.

|             |                 |
|-------------|-----------------|
| Main gap    | 10 milliseconds |
| Control gap | 3 milliseconds  |

### MAXIMUM RATINGS.

|                                                                    |    |    |
|--------------------------------------------------------------------|----|----|
| Maximum peak control electrode current                             | 30 | mA |
| Maximum average control electrode current (averaged over 1 second) | 10 | mA |
| Maximum peak reverse current in main gap                           | 5  | mA |



**G150/1A  
(4313C)**

# **Cold Cathode Gas-Filled Relay**

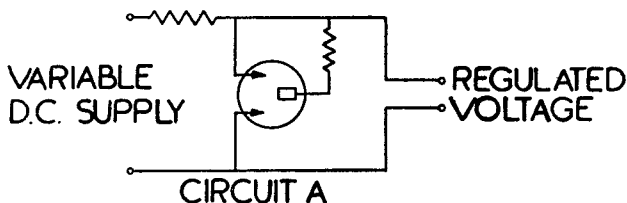
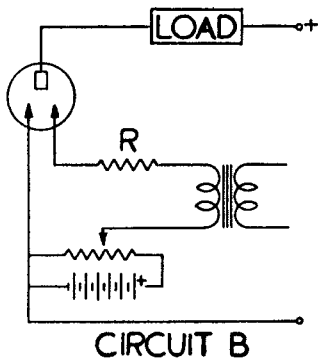
**4313C**



## **TYPICAL OPERATION.**

Circuit A shows a circuit using the control gap of the valve as a voltage regulator.

Circuit B shows a circuit using the valve as a relay. The anode voltage should be intermediate between the main gap breakdown and maintaining voltage. The resistance  $R$  in the control circuit should be of the order of 100,000 ohms. This circuit possesses a "lock-in" feature, since the anode potential must be removed momentarily to restore the valve to a non-conducting condition. When supplied from an A.C. source this feature only occurs if the frequency of the supply voltage is such that the deionization time is not exceeded.





# Cold-Cathode Gas-Filled Triode

Code: G150/2D (CV413)

The G150/2D cold cathode, gas-filled triode has an activated cathode giving a low maintaining voltage, together with a good life performance.

## MECHANICAL DATA

|                        |                                    |    |
|------------------------|------------------------------------|----|
| Maximum overall length | 81                                 | mm |
| Maximum seated height  | 66.7                               | mm |
| Maximum diameter       | 33.3                               | mm |
| Base                   | Small octal wafer with metal shell |    |
| Net weight             | 32                                 | g  |

## CHARACTERISTICS

|                                                                 |     |    |
|-----------------------------------------------------------------|-----|----|
| Minimum control gap breakdown voltage                           | 60  | V  |
| Maximum control gap breakdown voltage                           | 80  | V  |
| Nominal control gap maintaining voltage                         | 60  | V  |
| Maximum control gap maintaining voltage                         | 70  | V  |
| Minimum main gap breakdown voltage                              | 150 | V  |
| Minimum main gap maintaining voltage                            | 60  | V  |
| Maximum main gap maintaining voltage                            | 77  | V  |
| Recommended value of operating current for relay operation      | 20  | mA |
| Recommended value of operating current for counter applications | 2   | mA |

## MAXIMUM RATINGS

|                                 |    |    |
|---------------------------------|----|----|
| Maximum peak cathode current    | 50 | mA |
| Maximum average cathode current | 30 | mA |

## DYNAMIC CHARACTERISTICS

### Transfer

For general dynamic behaviour see curves at the end of this data.

### Deionisation

It should be noted that the curves shown refer to most unfavourable conditions. If the negative going pulse went to approximately 45 volts, instead of to zero, the deionisation time would be improved by as much as a factor of three.

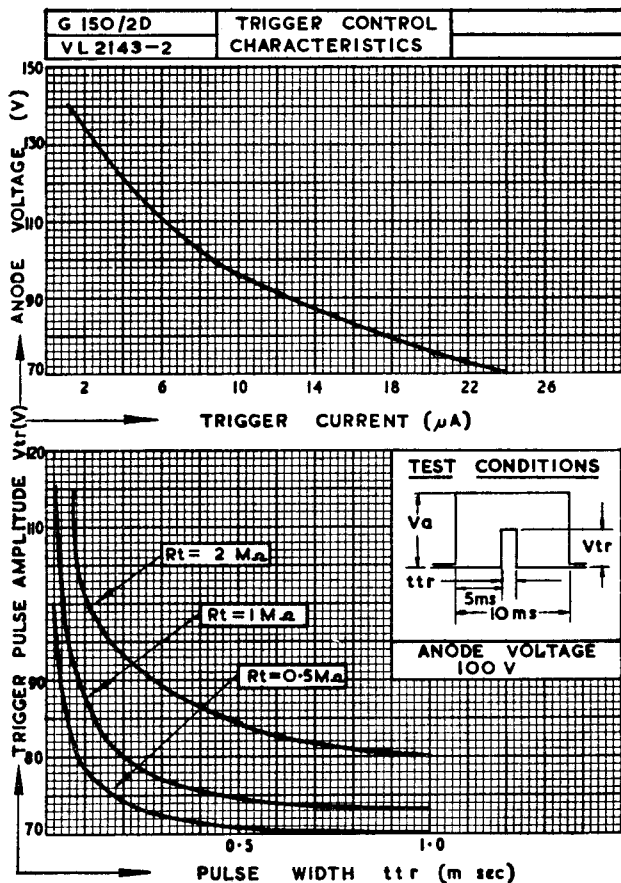
## APPLICATION NOTE

The life expectancy of these valves is a function of cathode current. Curves showing typical figures of life versus D.C. cathode current are included in this data.

# Cold-Cathode Gas-Filled Triode



Code: G150/2D (CV413)

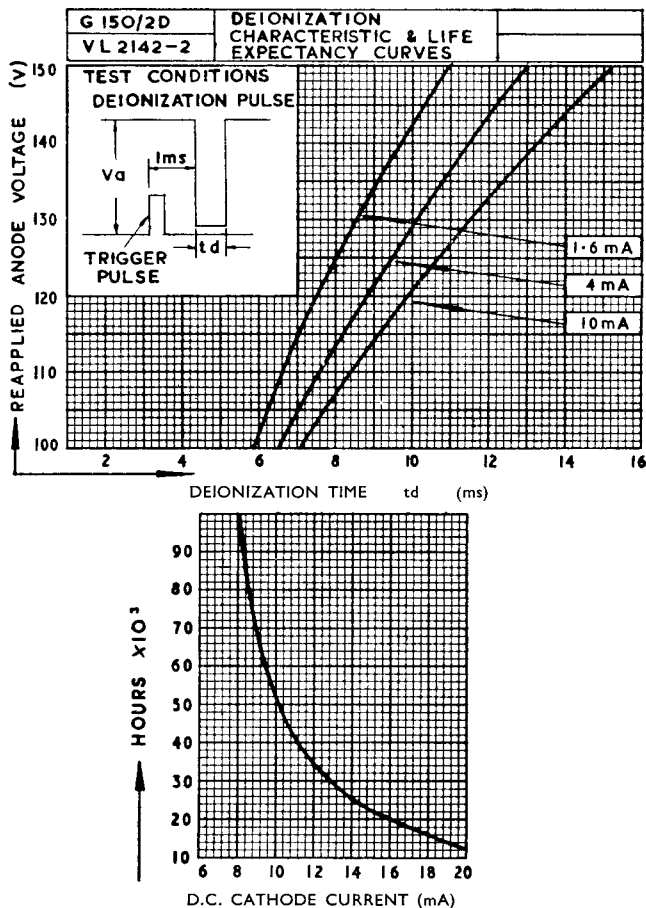






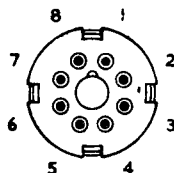
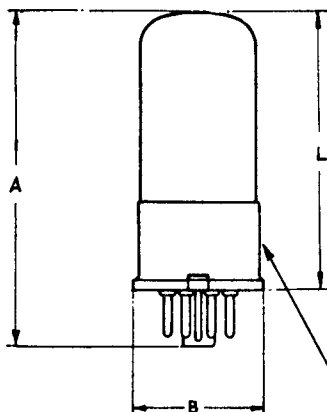
# Cold Cathode Gas-Filled Triode

Code: G150/2D (CV413)



# Cold-Cathode Gas-Filled Triode

Code: G150/2D (CV413)

BASING

- 1 METAL BASE SHELL
- 2 BLANK
- 3 ANODE
- 4 BLANK
- 5 TRIGGER
- 6 } INTERNALLY
- 7 } STRAPPED
- 8 CATHODE

SMALL WAFER OCTAL  
WITH METAL SHELL

| DIM | MILLIMETRES | INCHES                             |
|-----|-------------|------------------------------------|
| A   | 81.0 MAX    | 3 <sup>3</sup> / <sub>16</sub> MAX |
| B   | 33.3 MAX    | 1 <sup>5</sup> / <sub>16</sub> MAX |
| L   | 66.7 MAX    | 2 <sup>5</sup> / <sub>8</sub> MAX  |

NOTE:- BASIC FIGURES ARE INCHES.



# Cold-Cathode Voltage-Stabiliser

Code: VR150/30 (CV216)←

The VR150/30 is a cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OD3 type.

## MECHANICAL DATA

|                        |                   |               |
|------------------------|-------------------|---------------|
| Maximum overall length | 104.8             | mm            |
| Maximum seated height  | 90.5              | mm            |
| Maximum diameter       | 39.7              | mm            |
| Base                   | Small shell octal |               |
| Net weight             | 40                | g             |
| Mounting position      |                   | Unrestricted← |

## CHARACTERISTICS

|                                                             |            |        |
|-------------------------------------------------------------|------------|--------|
| Maximum striking voltage                                    | 180        | V←     |
| Minimum applied supply voltage                              | 185        | V←     |
| Maximum stabilising voltage at 40 mA                        | 162        | V←     |
| Minimum stabilising voltage at 5 mA                         | 145        | V←     |
| Nominal stabilising voltage                                 | 150        | V←     |
| D.C. operating current                                      | 5 to 40    | mA     |
| Maximum peak current (10 seconds max.)                      | 100        | mA     |
| Nominal regulation, 5 to 30 mA                              | 1.5        | V←     |
| Maximum regulation, 5 to 30 mA                              | 4          | V←     |
| Maximum regulation, 5 to 40 mA                              | 5.5        | V←     |
| Nominal drift in stabilising voltage<br>(100 to 1000 hours) | 2.25       | V←     |
| Temperature coefficient, -20 to +70°C                       | -25        | mV/°C← |
| Ambient temperature range                                   | -55 to +70 | °C←    |

## NOTE

With suitable socket connections the internal connection between pins 3 and 7 acts as a switch to open the supply or load circuit when the valve is removed.

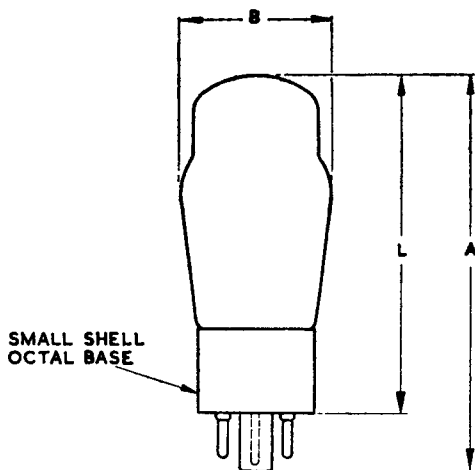
Not less than the quoted minimum supply voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current through the valve to 40 mA under steady state conditions. As stated above during the initial warming up period a maximum current of 100 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

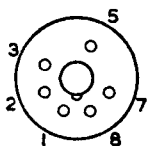
Operation with reversed polarity will damage this valve.

# Cold-Cathode Voltage-Stabiliser

Code: VR150/30 (CV216)←



## BASING



- 1 NO CONNECTION
- 2 CATHODE
- 3 CONNECTED TO PIN 7
- 4 NO PIN
- 5 ANODE
- 6 NO PIN
- 7 CONNECTED TO PIN 3
- 8 NO CONNECTION

| DIM | MILLIMETRES | INCHES                                                         |
|-----|-------------|----------------------------------------------------------------|
| A   | 104.8 MAX   | 4 <sup>1</sup> / <sub>8</sub> MAX                              |
| B   | 39.7 MAX    | 1 <sup>9</sup> / <sub>16</sub> MAX                             |
| L   | 85.7 ± 4.8  | 3 <sup>3</sup> / <sub>8</sub> ± 3 <sup>1</sup> / <sub>16</sub> |

NOTE:- BASIC FIGURES ARE INCHES.



# Miniature Cold-Cathode Voltage-Stabiliser

Code: OA2 (CV1832) ←

This valve is a miniature cold-cathode, gas-filled, voltage-stabiliser for use in industrial and radio equipment where a stable source of voltage is required. It is equivalent to the U.S.A. OA2 type.

## MECHANICAL DATA

|                        |              |    |
|------------------------|--------------|----|
| Maximum overall length | 66.7         | mm |
| Maximum seated height  | 60.3         | mm |
| Maximum diameter       | 19.1         | mm |
| Base                   | B7G          |    |
| Net weight             | 8.5          | g  |
| Mounting position      | Unrestricted |    |

## CHARACTERISTICS

|                                                              |            |        |
|--------------------------------------------------------------|------------|--------|
| Maximum striking voltage                                     | 180        | V←     |
| Minimum applied supply voltage                               | 185        | V←     |
| Maximum stabilising voltage at 30 mA                         | 165        | V←     |
| Minimum stabilising voltage at 5 mA                          | 142        | V←     |
| Nominal stabilising voltage                                  | 150        | V←     |
| D.C. operating current                                       | 5 to 30    | mA     |
| Maximum peak current (10 seconds max.)                       | 75         | mA     |
| Nominal regulation, 5 to 30 mA                               | 1          | V←     |
| Maximum regulation, 5 to 30 mA                               | 6          | V←     |
| Nominal drift in stabilising voltage<br>(100 to 1 000 hours) | 2.9        | V←     |
| Temperature coefficient, -20 to +90°C                        | ±10        | mV/°C← |
| Ambient temperature range                                    | -55 to +90 | °C     |

NOTE.—With suitable socket connections the internal connection between pins 1 and 5 acts as a switch to open the load circuit when the valve is removed. (See Fig. 1.)

**Ref.: G150/4K**

## **Miniature Cold-Cathode Voltage-Stabiliser**



**Code: OA2 (CV1832) ←**

---

Not less than the quoted minimum supply voltage should be provided to ensure starting during life.

Sufficient resistance must always be kept in series with this type to limit the current to 30 mA under steady state conditions. As stated, during the initial warming up period a maximum current of 75 mA is permissible providing that a period of several minutes duration of operation at normal current follows.

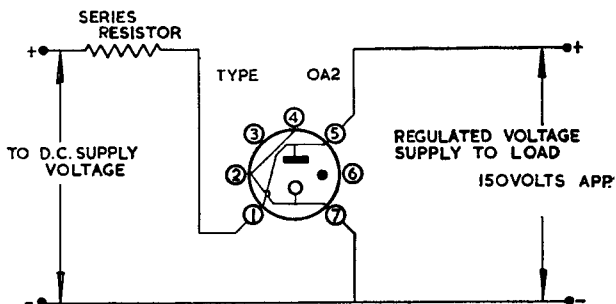
If the associated circuit has a capacitor in shunt with this valve it should be limited to 0.1  $\mu$ F. A larger value may cause oscillation and thus give unstable regulation.

Operation with reversed polarity will damage this valve.



# Miniature Cold-Cathode Voltage-Stabiliser

Code: OA2 (CV1832) ←

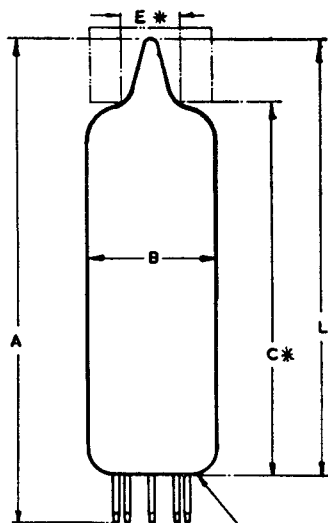
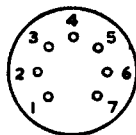


TYPICAL CIRCUIT TO PROVIDE A REGULATED  
SUPPLY VOLTAGE. REMOVAL OF THE VALVE  
FROM THE SOCKET DISCONNECTS THE VOLTAGE  
FROM THE LOAD

# Miniature Cold-Cathode Voltage-Stabiliser



Code: OA2 (CV1832) ←

**BASING**

- 1 ANODE
- 2 CATHODE
- 3 INTERNALLY CONNECTED
- 4 CATHODE
- 5 ANODE
- 6 INTERNALLY CONNECTED
- 7 CATHODE

B 7 G BASE

\*DENOTES:- MEASURED FROM BASE SEAT TO BULB TOP LINE,  
AS DETERMINED BY RING GAUGE OF 'E' INT. DIA.

| DIM | MILLIMETRES    | INCHES                         |
|-----|----------------|--------------------------------|
| A   | $63.5 \pm 3.2$ | $2\frac{1}{2} \pm \frac{1}{8}$ |
| B   | 19.1 MAX.      | $\frac{3}{4}$ MAX.             |
| * C | $50.8 \pm 2.4$ | $2 \pm \frac{3}{32}$           |
| L   | 60.3 MAX.      | $2\frac{3}{8}$ MAX.            |
| * E | 11.1 DIA.      | $\frac{7}{16}$ DIA.            |

NOTE :- BASIC FIGURES ARE INCHES.





# Cold-Cathode Voltage Stabilisers

Codes: G180/2G  
G180/2M (CV395)

Ref.: G180/2G  
G180/2M

The G180/2G is identical to the G180/2M but is fitted with a B8G/F base for wiring directly into the circuit.

Both valves have two symmetrical anodes which may be used singly, strapped or with one as an auxiliary electrode.

## MECHANICAL DATA

|                        |                |    |
|------------------------|----------------|----|
| Maximum overall length | 80.2           | mm |
| Maximum seated height  | 66.7           | mm |
| Maximum diameter       | 30.15          | mm |
| Base                   | B8G            |    |
| Net weight             | 32             | g  |
| Mounting position      | Unrestricted ← |    |

## CHARACTERISTICS

|                                                                                          |            |         |
|------------------------------------------------------------------------------------------|------------|---------|
| *Maximum striking voltage                                                                | 180        | V       |
| *Stabilising voltage at 25 mA                                                            | 150 ± 5    | V ←     |
| *D.C. operating current                                                                  | 5 to 45    | mA      |
| *Nominal regulation, 5 to 25 mA                                                          | 0.5        | V ←     |
| *Maximum regulation, 5 to 25 mA                                                          | 2          | V ←     |
| *Nominal regulation, 5 to 45 mA                                                          | 1          | V ←     |
| *Maximum regulation, 5 to 45 mA                                                          | 5          | V ←     |
| Maximum auxiliary anode striking voltage                                                 | 200        | V ←     |
| Maximum transfer voltage { auxiliary anode supply voltage 200 V through 100kΩ resistor } | 170        | V ←     |
| Recommended value of auxiliary discharge current for starting                            | 1          | mA      |
| Nominal drift in stabilising voltage (100 to 1 000 hours)                                | 2          | V ←     |
| Temperature coefficient, -20 to +70°C                                                    | ±15        | mV/°C ← |
| Ambient temperature range                                                                | -55 to +70 | °C ←    |

\* Measured with auxiliary anode and main anode strapped together.

**NOTE.**—Sufficient resistance must always be used in series with these valves to keep the current within the rated limits under extremes of operating conditions.

To provide sufficient voltage for starting, the anode supply in the unstruck condition should not be less than 180 volts. Operation with reversed polarity will damage the valves.

Ref.:

G180/2G

G180/2M

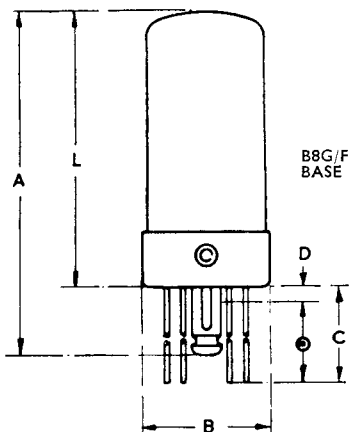
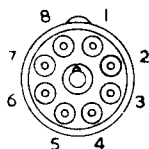
# Cold-Cathode Voltage Stabilisers

Codes: G180/2G

G180/2M (CV395)



G180/2G



## BASING

1. ANODE
2. ANODE
3. AUXILIARY ANODE
4. CATHODE
5. CATHODE
6. CATHODE
7. CATHODE
8. CATHODE

| DIM | MILLIMETRES | INCHES                              |
|-----|-------------|-------------------------------------|
| A   | 80.2 MAX:   | 3 <sup>5</sup> / <sub>32</sub> MAX: |
| B   | 30.2 MAX:   | 1 <sup>3</sup> / <sub>16</sub> MAX: |
| C   | 50.8 MIN    | 2 MIN:                              |
| D   | 3.2 NOM:    | <sup>1</sup> / <sub>8</sub> NOM:    |
| L   | 66.7 MAX:   | 2 <sup>5</sup> / <sub>8</sub> MAX:  |

NOTE - BASIC FIGURES ARE INCHES.

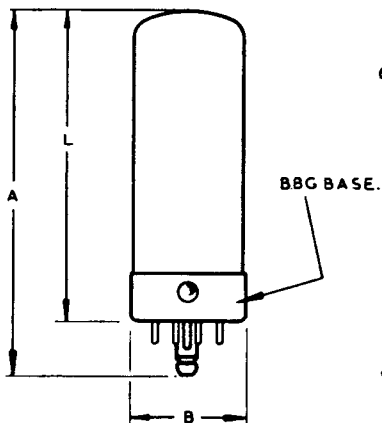
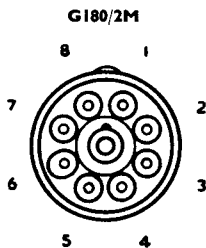
© DENOTES: LEADS TINNED OVER THIS PORTION.



# Cold-Cathode Voltage Stabilisers

Codes : G180/2G  
G180/2M (CV395)

Ref.: G180/2G  
G180/2M



## BASING

- |    |                 |  |
|----|-----------------|--|
| 1. | ANODE           |  |
| 2. | ANODE           |  |
| 3. | AUXILIARY ANODE |  |
| 4. | CATHODE         |  |
| 5. | CATHODE         |  |
| 6. | CATHODE         |  |
| 7. | CATHODE         |  |
| 8. | CATHODE         |  |

| DIM. | MILLIMETRES | INCHES      |
|------|-------------|-------------|
| A    | 80.2 MAX.   | 3 5/32 MAX. |
| B    | 30.15 MAX.  | 1 3/16 MAX. |
| L    | 66.7 MAX.   | 2 5/8 MAX.  |

NOTE:- BASIC DIMENSIONS ARE INCHES.



## Cold-Cathode Gas-Filled Triode

Code: G240/2D (CV2174)

The G240/2D is a cold-cathode, three electrode, gas-filled triode. It has been developed for use in applications where a higher power is needed in the anode circuit than is obtainable with the G150/2D type.

It is characterised by its long life cathode and non-interchangeability of trigger and cathode electrodes.

### DIMENSIONS.

|                        |                                    |     |
|------------------------|------------------------------------|-----|
| Maximum overall length | 92.1                               | mm← |
| Maximum seated height  | 77.8                               | mm← |
| Maximum diameter       | 33.3                               | mm  |
| Base                   | Small wafer octal with metal shell |     |

### CHARACTERISTICS.

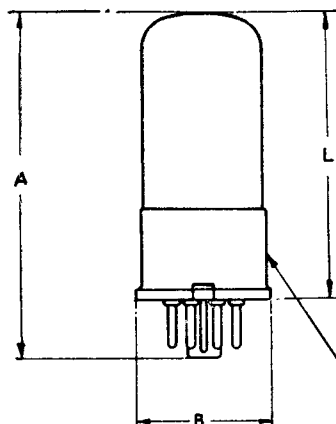
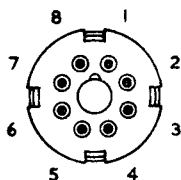
|                                                                 |                                  |         |   |
|-----------------------------------------------------------------|----------------------------------|---------|---|
| Nominal control gap breakdown voltage                           | 75                               | V       |   |
| Maximum control gap breakdown voltage                           | 90                               | V       |   |
| Nominal control gap maintaining voltage                         | } At 20 mA<br>Cathode<br>Current | 65      | V |
| Maximum control gap maintaining voltage                         |                                  |         |   |
|                                                                 |                                  |         |   |
|                                                                 | 75                               | V       |   |
| Minimum main gap breakdown voltage                              | 230                              | V       |   |
| Nominal main gap maintaining voltage                            | } At 20 mA<br>Cathode<br>Current | 90      | V |
| Maximum main gap maintaining voltage                            |                                  |         |   |
|                                                                 |                                  |         |   |
|                                                                 | 110                              | V       |   |
| Maximum transfer current at $R_t$ 10 M $\Omega$ and $V_a$ 200 V | 15                               | $\mu$ A |   |
| Optimum operating current                                       | 20                               | mA      |   |
| Nominal main gap deionization time                              | 8                                | msec    |   |

### MAXIMUM RATINGS.

|                                |    |    |
|--------------------------------|----|----|
| Maximum peak cathode current   | 50 | mA |
| Maximum direct cathode current | 30 | mA |

# Cold-Cathode Gas-Filled Triode

Code: G240/2D (CV2174)



## BASING

- 1 METAL BASE SHELL
- 2 BLANK
- 3 ANODE
- 4 BLANK
- 5 TRIGGER
- 6 } INTERNALLY
- 7 } STRAPPED
- 8 CATHODE

SMALL WAFER OCTAL  
WITH METAL SHELL

| DIM | MILLIMETRES | INCHES                             |
|-----|-------------|------------------------------------|
| A   | 92.1 MAX    | 3 <sup>5</sup> / <sub>8</sub> MAX  |
| B   | 33.3 MAX    | 1 <sup>5</sup> / <sub>16</sub> MAX |
| L   | 77.8 MAX    | 3 <sup>1</sup> / <sub>16</sub> MAX |

NOTE:- BASIC FIGURES ARE INCHES.



# High-Voltage Cold-Cathode Voltage Stabiliser

Code: G400/1K (CV2194)

The G400/1K is a miniature low current, high voltage gas-filled stabiliser specially developed for use where a high degree of stability is required.

## MECHANICAL DATA

|                        |              |    |
|------------------------|--------------|----|
| Maximum overall length | 54           | mm |
| Maximum seated height  | 47.6         | mm |
| Maximum bulb diameter  | 19.1         | mm |
| Base                   | B7G          |    |
| Net weight             | 8.5          | g  |
| Mounting position      | Unrestricted |    |

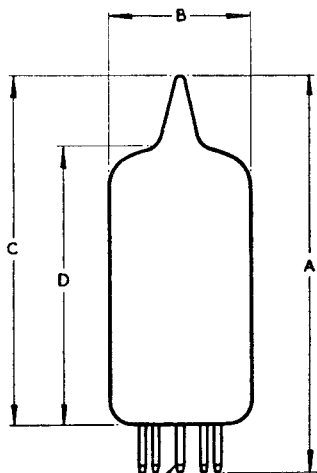
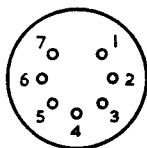
## CHARACTERISTICS

|                                                            |              |        |
|------------------------------------------------------------|--------------|--------|
| Maximum striking voltage                                   | 400          | V      |
| Nominal striking voltage                                   | 375          | V      |
| Maximum stabilising voltage at 3 mA                        | 314          | V←     |
| Minimum stabilising voltage at 3 mA                        | 302          | V←     |
| Nominal stabilising voltage at 3 mA                        | 306          | V←     |
| D.C. operating current                                     | 2 to 4       | mA     |
| Nominal regulation, 2 to 4 mA                              | —1           | V←     |
| Maximum regulation, 2 to 4 mA                              | +0.5<br>—2.5 | V←     |
| Nominal drift in stabilising voltage<br>(0 to 1 000 hours) | 2            | V←     |
| Temperature coefficient, —20 to +70°C                      | ±30          | mV/°C← |
| Ambient temperature range                                  | —55 to +90   | °C←    |

NOTE.—In use, pins numbers 4 and 6 must be directly connected together in the external circuit.

# High-Voltage Cold-Cathode Voltage Stabiliser

Code: G400/1K (CV2194)



## BASING

1. I.C.
2. CATHODE
3. I.C.
4. ANODE
5. I.C.
6. PRIMING ANODE
7. I.C.



B7G BASE

| DIM. | MILLIMETRES | INCHES                                                       |
|------|-------------|--------------------------------------------------------------|
| A    | 54.0 MAX.   | 2 <sup>1</sup> / <sub>8</sub> MAX.                           |
| B    | 19.1 MAX.   | 3 <sup>3</sup> / <sub>4</sub> MAX.                           |
| C    | 47.6 MAX.   | 1 <sup>7</sup> / <sub>8</sub> MAX.                           |
| D    | 38.1 ± 2.4  | 1 <sup>1</sup> / <sub>2</sub> ± <sup>3</sup> / <sub>32</sub> |

NOTE - BASIC FIGURES ARE INCHES.



# High-Voltage Cold-Cathode Voltage Stabiliser

Code: G400/2G (CV4047)

The G400/2G is a reliable, miniature high-voltage gas-filled stabiliser fitted with a flying lead base for wiring directly into the circuit. It has been developed for use where a high degree of stability is required.

## MECHANICAL DATA

|                                     |              |    |
|-------------------------------------|--------------|----|
| Maximum overall length (less leads) | 47.6         | mm |
| Maximum bulb diameter               | 19.1         | mm |
| Minimum lead length                 | 38.1         | mm |
| Base                                | B7G/F        |    |
| Net weight                          | 8.5          | g  |
| Mounting position                   | Unrestricted |    |

## CHARACTERISTICS

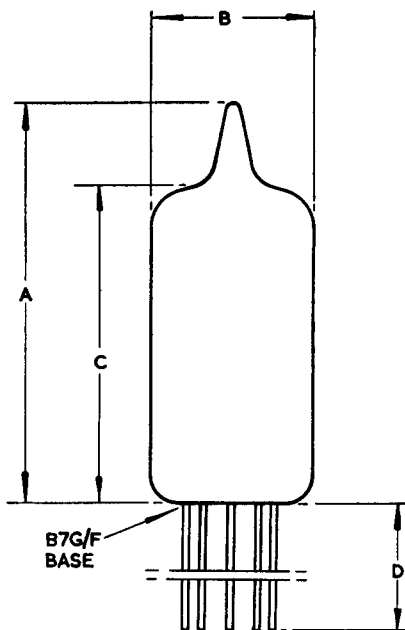
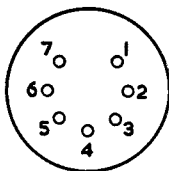
|                                                            |              |        |
|------------------------------------------------------------|--------------|--------|
| Maximum striking voltage                                   | 400          | V      |
| Nominal striking voltage                                   | 375          | V      |
| Maximum stabilising voltage at 3 mA                        | 314          | V←     |
| Minimum stabilising voltage at 3 mA                        | 302          | V←     |
| Nominal stabilising voltage at 3 mA                        | 306          | V←     |
| D.C. operating current                                     | 2 to 4       | mA     |
| Nominal regulation, 2 to 4 mA                              | —1           | V←     |
| Maximum regulation, 2 to 4 mA                              | +0.5<br>—2.5 | V←     |
| Nominal drift in stabilising voltage<br>(0 to 1 000 hours) | 2            | V←     |
| Temperature coefficient, —20 to +90°C                      | 30           | mV/°C← |
| Ambient temperature range                                  | —55 to +90   | °C←    |

NOTE.—In use, leads numbers 4 and 6 must be directly connected together in the external circuit.



# High-Voltage Cold-Cathode Voltage Stabiliser

Code: G400/2G (CV4047)



## BASING

1. I.C.
2. CATHODE.
3. I.C.
4. ANODE.
5. I.C.
6. PRIMING ANODE.
7. I.C.

| DIM. | MILLIMETRES | INCHES                                                       |
|------|-------------|--------------------------------------------------------------|
| A    | 47.6 MAX.   | 1 <sup>7</sup> / <sub>8</sub> MAX.                           |
| B    | 19.1 MAX.   | <sup>3</sup> / <sub>4</sub> MAX.                             |
| C    | 38.1 ± 2.4  | 1 <sup>1</sup> / <sub>2</sub> ± <sup>3</sup> / <sub>32</sub> |
| D    | 38.1 MIN.   | 1 <sup>1</sup> / <sub>2</sub> MIN.                           |

NOTE:- BASIC FIGURES ARE INCHES.



# Unidirectional Cold-Cathode Gas-Filled Decade Counter

Code: G10/241E (CVX2223)

The G10/241E is a single-ended cold-cathode unidirectional gas-filled counter and distributor tube. It has ten cathodes which are used to indicate the number of the count, either visually at low speeds or by means of the voltage developed across the cathode load at high speeds. It is capable of counting pulses at repetition speeds from approximately 0 up to 20 kc/s.

Each cathode provides a voltage output that is sufficient either to operate a coupling tube to the next counter stage or a registering circuit. The tube has been designed so that it is possible to view the discharge directly at low speeds, and so obtain a direct indication of the count. To this end the holes in the anode through which the glow is visible have been numbered.

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 77.8 | mm |
| Maximum seated height  | 50.8 | mm |
| Maximum bulb diameter  | 41   | mm |
| Base                   | B12E |    |
| Net weight             | 66   | g  |

## D.C. CHARACTERISTICS (Nominal).

|                                             |     |    |
|---------------------------------------------|-----|----|
| Anode-cathode breakdown voltage             | 280 | V  |
| Anode-transfer electrode breakdown voltage  | 280 | V  |
| Anode-cathode maintaining voltage (approx.) | 180 | V  |
| Cathode current                             | 3.7 | mA |

## MECHANICAL DATA.

Reasonable care must be taken to prevent serious mechanical shocks.

A special socket has been designed for use with this valve (McMurdo type X12E).

# Unidirectional Cold-Cathode Gas-Filled Decade Counter

Code: G10/241E (CVX2223)



## TYPICAL OPERATING CONDITIONS.

(For pulse repetition frequencies up to 5 kc/s.)

|                                                                                            |                  |            |
|--------------------------------------------------------------------------------------------|------------------|------------|
| H.T. supply voltage (stabilised)                                                           | 315 to 345       | V          |
| Transfer electrode bias (nominal)                                                          | 75               | V          |
| Shield bias (nominal)                                                                      | 90               | V          |
| Anode load (see circuit diagram)                                                           | $24 \pm 2\%$     | k $\Omega$ |
| Cathode load                                                                               | $15 \pm 5\%$     | k $\Omega$ |
| Cathode load capacitor                                                                     | $0.005 \pm 20\%$ | $\mu$ F    |
| Transfer pulse amplitude<br>(Measured at the input capacitor with<br>G10/241E in circuit.) | $120 \pm 15$     | V          |
| Transfer pulse width                                                                       | $16 \pm 4$       | $\mu$ s    |
| Cathode pulse output (min.)                                                                | 40               | V          |

## CIRCUIT.

A basic operating circuit for 330 volts stabilised H.T. is shown in Fig. 1. The transfer electrode and shield bias are obtained from potentiometers across the power supply.

SenTerCel Unistor type Q3/5 provides D.C. restoration of applied pulses. SenTerCel Unistor type Q6/4 isolates the input circuit from the transfer electrode during quiescent conditions and permits a condition of bias equilibrium across the transfer leak resistor. For the pulse duration the Q6/4 Unistor is in its forward conducting state.

## TIME CONSTANTS OF CATHODE CIRCUITS.

The value of cathode capacitor used should be the maximum permitted for the particular application. When the tube is used as a distributor, this value is set by the circuit requirements for the charge on the cathode capacitor to decay to less than 5 volts during the interval between pulse arrivals. The rise of voltage across the cathode resistor is determined by the time constant of the cathode capacitor and the effective resistance of the anode and cathode resistors in parallel.

In straight counting it is unnecessary to have more than three RC cathode circuits. Under these conditions K1, 3, 5, 7 and 9 and K2, 4, 6 and 8 respectively are joined together; K10 has its own circuit as it is from this cathode that the voltage is taken for operating further circuitry.



# Unidirectional Cold-Cathode Gas-Filled Decade Counter

Code: G10/241E (CVX2223)

## TRANSFER PULSE AMPLITUDE AND WIDTH.

The broad requirement of the transfer pulse is that it should be of sufficient amplitude to reduce the anode-earth potential to less than 160 volts, and that its width should be such as to ensure that the glow spreads across the transfer electrode surface during that time. It will be seen that the pulse width should be as wide as possible, but it must be directly related to the cathode circuit time constant, since it is necessary to ensure that there is a bias voltage on the previously conducting cathode of at least 33 volts at the end of the pulse.

The lower limit of pulse width is set by the rate of spread of glow over the electrode surface and may be reduced to approximately 4 micro-seconds provided the transfer electrode input impedance is kept small.

The effective length of the pulse is from the time the anode volts start to fall to the time at which the anode-earth voltage reaches 180 volts. At this point the adjacent forward cathode will break down. Any variation in pulse shape should be considered in the light of these requirements.

## SWITCHING-ON AND RE-SETTING.

Breakdown will probably occur at a cathode other than the desired one and occasionally breakdown may occur at two cathodes simultaneously, which prevents glow stepping, when the tube is switched on initially.

A method of obtaining breakdown at a single specific cathode is to switch on the 330 volt H.T. supply with the common transfer leak resistor and all cathodes, except that required for initial discharge, disconnected. After a glow has been initiated at this cathode, the common transfer leak resistor and all other cathodes may be reconnected into the circuit. Re-setting may also be accomplished in this manner.

## GENERAL REMARKS.

The anode resistor should be mounted as near the anode as possible, and stray capacitances kept to a minimum. Stray capacitances affect the rate of rise of anode voltage with the trailing edge of the pulse, and it is desirable that this should be as rapid as possible.

The input impedance which this circuit with the G10/241E inserted offers to the pulse source is approximately 13 kilohms. The pulse source should be matched to this load value.

There are no photoelectric effects and consequently the valve may be used in bright sunlight, darkness, artificial lighting, etc., without any change in characteristics.

## Unidirectional Cold-Cathode Gas-Filled Decade Counter

**Code: G10/241E (CVX2223)**

### RECOMMENDED CIRCUIT VALUES FOR OPERATING GIO/241E AT SPEEDS UP TO 5 Kc/s

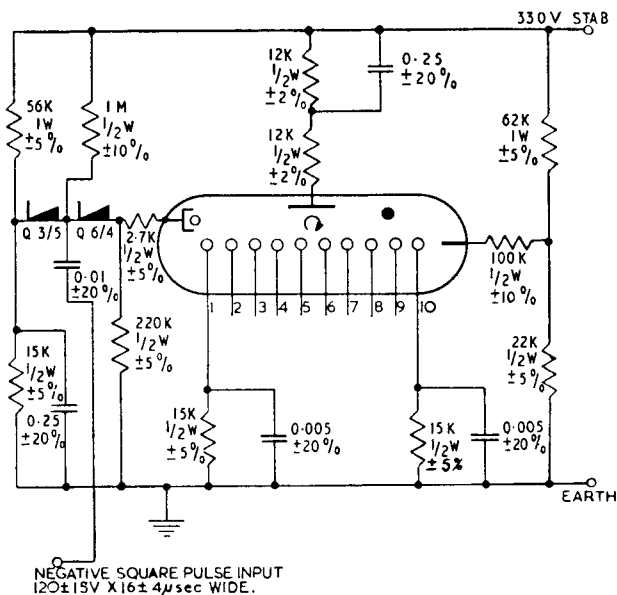
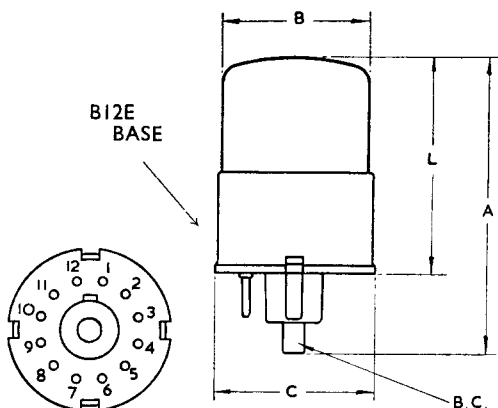


FIG. 1



# Unidirectional Cold-Cathode Gas-Filled Decade Counter

Code: G10/241E (CVX2223)



| BASING ARRANGEMENT |           |         |           |
|--------------------|-----------|---------|-----------|
| PIN No.            | ELECTRODE | PIN No. | ELECTRODE |
| 1                  | SHIELD    | 7       | CATHODE 5 |
| 2                  | CATHODE 0 | 8       | " 4       |
| 3                  | " 9       | 9       | " 3       |
| 4                  | " 8       | 10      | " 2       |
| 5                  | " 7       | 11      | " 1       |
| 6                  | " 6       | 12      | TRANSFER. |
| B.C. ANODE.        |           |         |           |

| DIM. | MILLIMETRES | INCHES                               |
|------|-------------|--------------------------------------|
| A    | 77.8 MAX.   | 3 <sup>1</sup> / <sub>16</sub> MAX.  |
| B    | 41.0 MAX.   | 1.61 MAX.                            |
| C    | 43.7 MAX.   | 1 <sup>23</sup> / <sub>32</sub> MAX. |
| L    | 50.8 MAX.   | 2 MAX.                               |

NOTE: BASIC FIGURES ARE INCHES.



# Vacuum Condenser

K12/2L

This condenser is suitable for wiring direct on to the tank circuit of Radio transmitters.

The physical size of each unit is small and four separate tank circuits need not occupy more space than a single open plate condenser.

|                  |               |    |
|------------------|---------------|----|
| <b>CAPACITY.</b> | $12 \pm 10\%$ | pF |
|------------------|---------------|----|

## DIMENSIONS.

|                          |     |     |
|--------------------------|-----|-----|
| Maximum overall length   | 170 | mm. |
| Maximum bulb diameter    | 56  | mm. |
| Maximum overall diameter | 70  | mm. |

## MAXIMUM RATING.

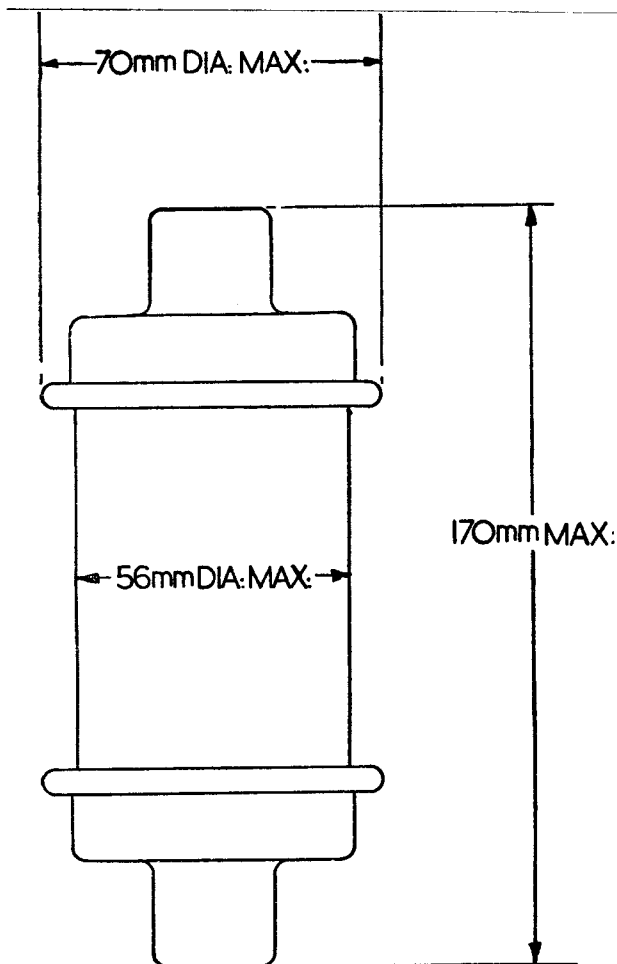
|                                |    |      |
|--------------------------------|----|------|
| Maximum peak RF voltage        | 32 | kV   |
| Maximum RF current             | 12 | A    |
| Maximum frequency of operation | 20 | Mc/s |

K12/2L

# Vacuum Condenser



K12/2L



Preliminary data.  
October 1946

K12/2L—2





# Vacuum Condenser

K25/2L

This condenser is suitable for wiring direct on to the tank circuit of Radio transmitters.

The physical size of each unit is small and four separate tank circuits need not occupy more space than a single open plate condenser.

|                  |              |    |
|------------------|--------------|----|
| <b>CAPACITY.</b> | 25 $\pm$ 10% | pF |
|------------------|--------------|----|

## DIMENSIONS.

|                          |     |     |
|--------------------------|-----|-----|
| Maximum overall length   | 170 | mm. |
| Maximum bulb diameter    | 56  | mm. |
| Maximum overall diameter | 70  | mm. |

## MAXIMUM RATING.

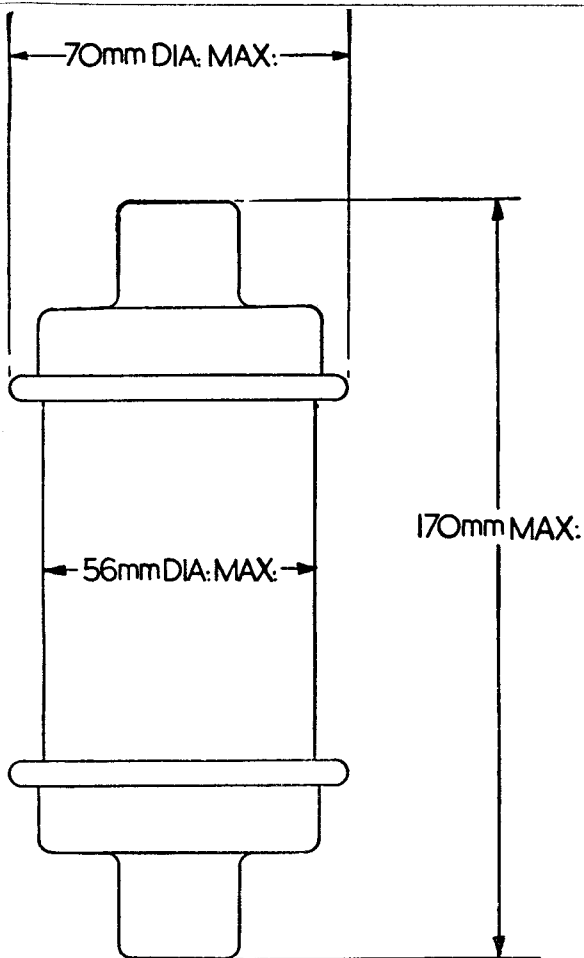
|                                |    |       |
|--------------------------------|----|-------|
| Maximum peak RF voltage        | 32 | kV    |
| Maximum RF current             | 12 | A     |
| Maximum frequency of operation | 20 | Mc/s. |

K25/2L

# Vacuum Condenser



K25/2L



Preliminary data.  
October 1946

K25/2L—2



# Vacuum Capacitors

Codes: K50/2L  
K100/2L

These capacitors are small vacuum dielectric units, intended principally for use as part of the tank circuit capacitance in radio frequency amplifiers or oscillators.

The use of vacuum as the dielectric enables the capacitors to be of small dimensions for a high voltage rating and capacitance.

|                               | K50/2L | K100/2L |    |
|-------------------------------|--------|---------|----|
| <b>CAPACITANCE</b> $\pm 10\%$ | 50     | 100     | pF |

## DIMENSIONS.

|                          |      |      |    |
|--------------------------|------|------|----|
| Maximum overall length   | 170  | 170  | mm |
| Maximum bulb diameter    | 58.7 | 58.7 | mm |
| Maximum overall diameter | 65   | 65   | mm |
| Net weight               | 230  | 260  | g  |

## MAXIMUM RATINGS.

|                                        |    |    |      |
|----------------------------------------|----|----|------|
| Maximum peak voltage                   | 32 | 28 | kV   |
| Maximum r.m.s. current                 | 28 | 28 | A    |
| Maximum frequency for<br>above ratings | 20 | 20 | Mc/s |

These capacitors may be operated at the full maximum voltage at any frequency below that at which the r.m.s. current through the capacitor is 28 amperes. Above this frequency the r.f. voltage across the capacitor must be reduced to prevent the current exceeding the maximum rating. Curves are included in this data which show the relationship between maximum ratings and frequency.

Where both r.f. and d.c. voltages are applied to the capacitor the sum of the peak r.f. and d.c. voltages must not exceed the peak voltage rating of the capacitor.

The clips or other devices used to make connection to the end caps of these capacitors must be kept clean and must at all times make good contact with the capacitor end caps. Failure to maintain a low resistance contact may result in excessive heating and permanent damage to the capacitor.

Ref.:

K50/2L

K100/2L

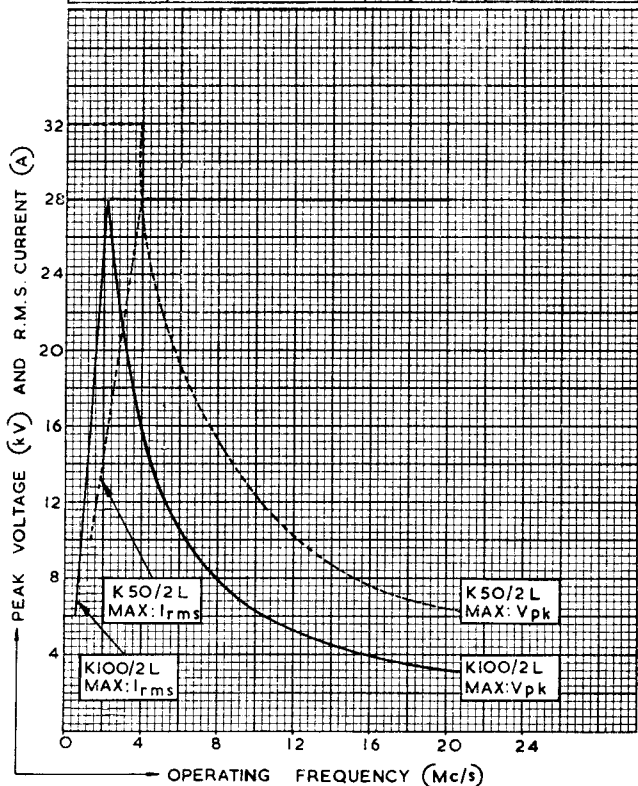
# Vacuum Capacitors

Codes: K50/2L

K100/2L



| MAXIMUM PEAK VOLTAGE AND R.M.S. CURRENT VERSUS FREQUENCY |  |                          |  |
|----------------------------------------------------------|--|--------------------------|--|
| K50/2L                                                   |  | FREQ. 20 Mc/s MAX:       |  |
| K100/2L                                                  |  | $I_{rms}$ 28 A. MAX:     |  |
| VL2702-1                                                 |  | K50/2L $V_{pk}$ 32 MAX:  |  |
|                                                          |  | K100/2L $V_{pk}$ 28 MAX: |  |

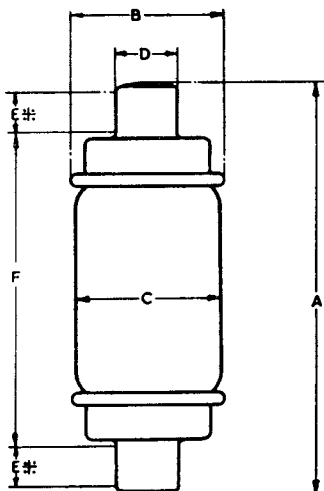




Ref.: K50/2L  
K100/2L

## Vacuum Capacitors

Codes: K50/2L  
K100/2L



| DIM | MILLIMETRES      | INCHES                 |
|-----|------------------|------------------------|
| A   | 170 MAX.         | $6 \frac{11}{16}$ MAX. |
|     | 164 MIN.         | $6 \frac{7}{16}$ MIN.  |
| B   | 65               | $2 \frac{9}{16}$       |
| C   | 58.7 MAX.        | $2 \frac{5}{16}$ MAX.  |
| D   | $25.40 \pm 0.25$ | $1.000 \pm 0.010$      |
| E   | 16 MIN.          | $\frac{5}{8}$ MIN.     |
| F   | 135 MAX.         | $5 \frac{5}{16}$ MAX.  |

\* DENOTES:— CONTACT LENGTH.

NOTE— BASIC FIGURES ARE INCHES.



## Tetrode Pulse Modulators

Ref.: P535/1E  
P552/1E

Code: P535/1E (CV398)  
P552/1E (CV427)

These valves are special purpose tetrodes for pulse use. They are equivalent to American types. The P535/1E to the 715B and the P552/1E to the 5D21.

### CATHODE.

|                                 |    |     |
|---------------------------------|----|-----|
| Indirectly-heated, oxide-coated |    |     |
| Heater voltage                  | 26 | V   |
| Nominal current                 | 2  | A ← |
| *Minimum cathode heating time   | 1  | min |

### DIRECT INTERELECTRODE CAPACITANCES.

|               |      |    |
|---------------|------|----|
| Input         | 37.5 | pF |
| Output        | 7.5  | pF |
| Anode to grid | 2.0  | pF |

### MECHANICAL DATA.

|                        |                        |    |
|------------------------|------------------------|----|
| Maximum overall length | 149.23                 | mm |
| Maximum bulb diameter  | 65.09                  | mm |
| Base                   | B4A                    |    |
| Top cap                | CT3 with cupped flange |    |
| Net weight             | 195                    | g  |

### \*CATHODE PRE-HEATING TIME.

The pre-heating time is dependent upon the peak anode current to be taken. The table below gives the minimum pre-heating time for different conditions. These figures represent minimum times. Whenever practicable, it is recommended that the pre-heating time be increased to about 15 or 20 minutes.

| Peak<br>anode current | Minimum<br>pre-heating time |
|-----------------------|-----------------------------|
| Up to 5 Amperes       | 1 minute                    |
| Up to 10 Amperes      | 2 minutes                   |
| Up to 15 Amperes      | 3 minutes                   |

Ref.:

P535/1E

P552/1E

## Tetrode Pulse Modulators

Code: P535/1E (CV398)  
P552/1E (CV427)



### MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS.

Pulse Modulator. Rectangular wave.

#### MAXIMUM RATINGS.

|                                       | P535/1E | P552/1E |    |
|---------------------------------------|---------|---------|----|
| Maximum direct anode voltage          | 15      | 20      | kV |
| †Maximum peak anode current           | 15      | 15      | A  |
| Maximum direct anode dissipation      | 60      | 60      | W  |
| Maximum direct screen voltage         | 1.25    | 1.25    | kV |
| Maximum peak screen current           | 5       | 5       | A  |
| Maximum direct screen dissipation     | 8       | 8       | W  |
| Maximum negative grid voltage         | 1.0     | 1.0     | kV |
| Maximum peak positive grid<br>voltage | 300     | 300     | V  |
| Maximum peak grid current             | 2       | 2       | A  |
| Maximum direct grid dissipation       | 1.0     | 1.0     | W  |

† The product of pulse duration in seconds and the pulse repetition frequency in cycles per second should not exceed 0.001. For peak currents in excess of 5 amperes the product of peak current in amperes and the pulse duration in microseconds should not exceed 30. The valves should not be operated for more than 5 microseconds in any 100 microsecond interval. For peak currents of less than 5 amperes the duty cycle is determined by the anode dissipation.

#### TYPICAL OPERATING CONDITIONS (Duty cycle 0.001)

|                                 | P535/1E | P552/1E |    |
|---------------------------------|---------|---------|----|
| ‡‡Direct anode voltage          | 15      | 20      | kV |
| ‡‡Direct screen voltage         | 1.25    | 1.25    | kV |
| Direct grid voltage             | -800    | -800    | V  |
| Peak pulse grid voltage         | 1025    | 1025    | V  |
| Direct anode current            | 15      | 15      | mA |
| Peak anode current              | 15      | 15      | A  |
| Direct screen current (approx.) | 1.5     | 1.5     | mA |
| Direct grid current (approx.)   | 10      | 10      | mA |
| Load resistor                   | 800     | 1100    | Ω  |



## Tetrode Pulse Modulators

Code: P535/1E (CV398)  
P552/1E (CV427)

---

Ref.: P535/1E  
P552/1E

### ‡ VALVE PROTECTION.

During the course of the operational life of these valves internal discharges are likely to occur occasionally. In the interest of valve protection and long life, certain protective measures designed to limit the power in such discharges are desirable. The recommended precautions are :

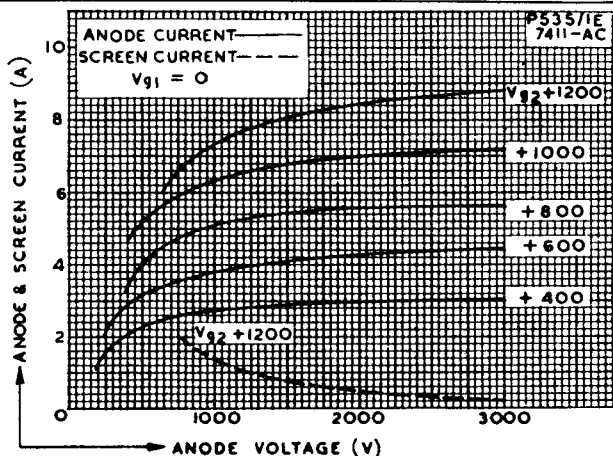
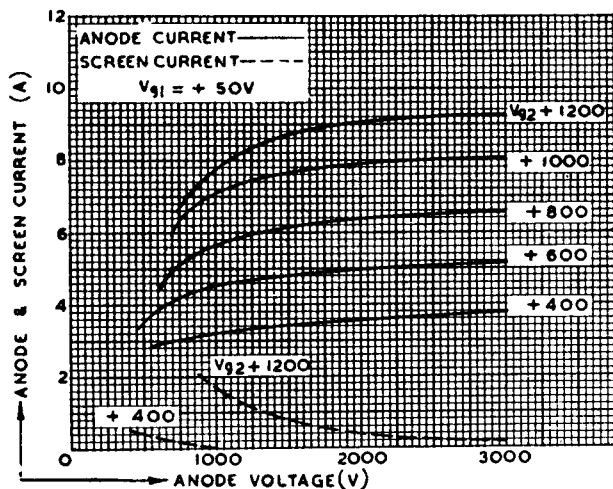
1. The inclusion of sufficient d.c. resistance in series with the anode and screen power supplies to limit the short circuit current to about 500 mA in either circuit.
2. The location of a resistance of approximately 100 ohms in series with the screen as close to the pin of the valve as possible.
3. The use of a by-pass capacitor to earth, about  $0.05 \mu\text{F}$  is a suitable value, connected to the supply side of the 100 ohms resistor as mentioned above.



Ref.:  
P535/1E  
P552/1E

# Tetrode Pulse Modulators

Code: P535/1E (CV398)  
P552/1E (CV427)

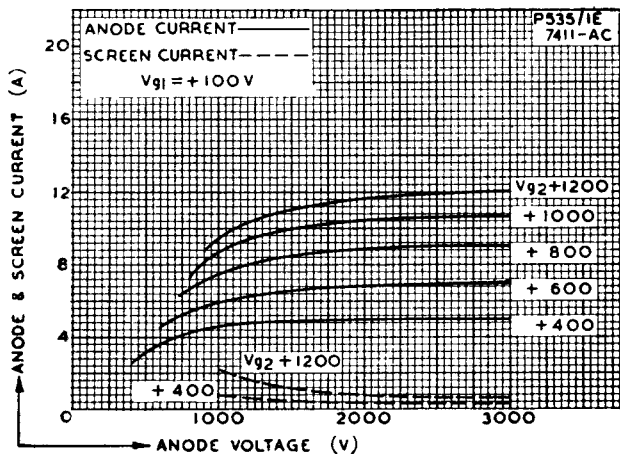
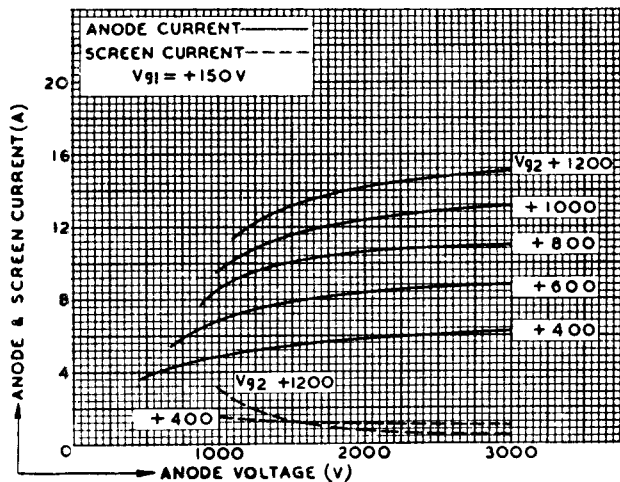




# Tetrode Pulse Modulators

Code: P535/1E (CV398)  
P552/1E (CV427)

Ref.: P535/1E  
P552/1E



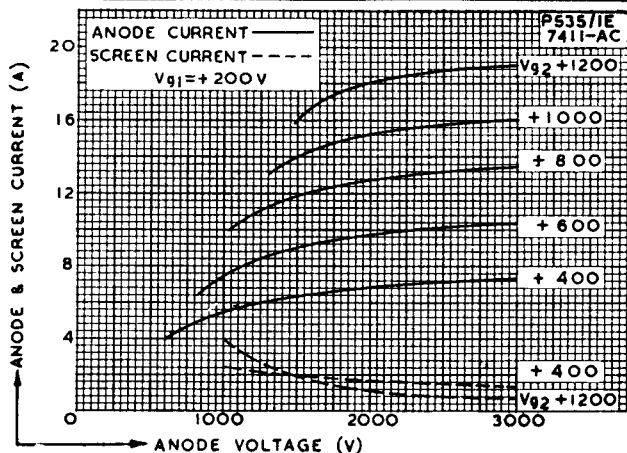
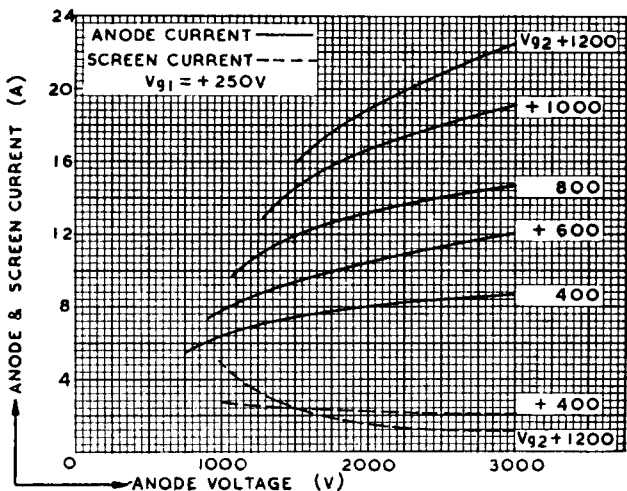
Ref.:

P535/1E

P552/1E

# Tetrode Pulse Modulators

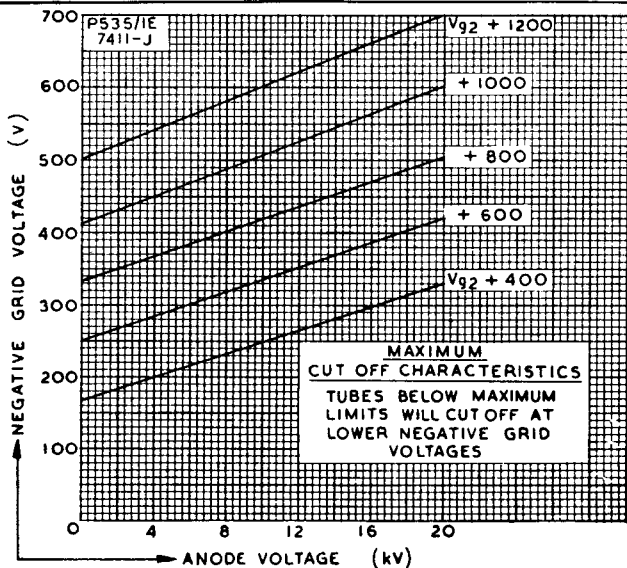
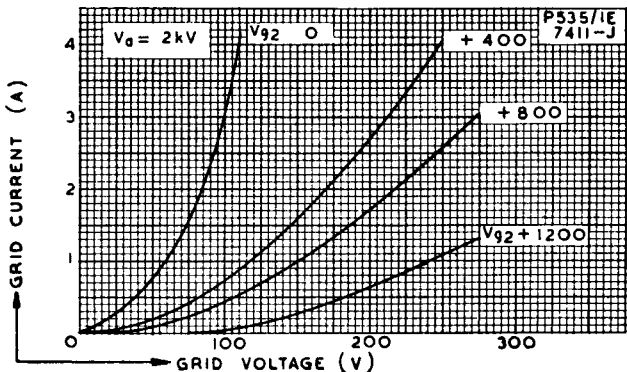
Code: P535/1E (CV398)  
P552/1E (CV427)





# Tetrode Pulse Modulators

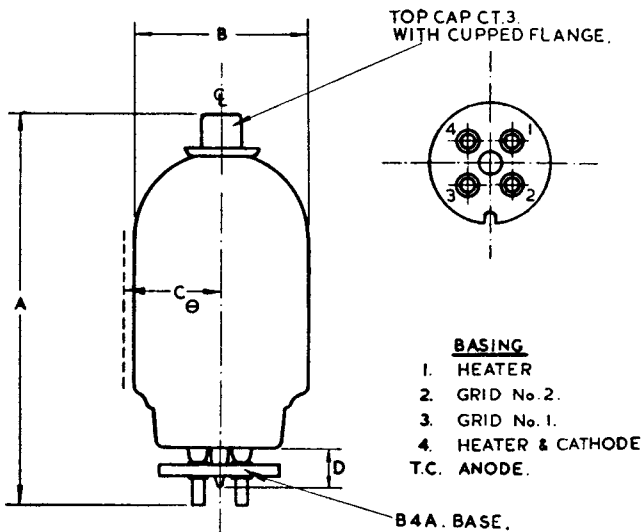
Code: P535/1E (CV398)  
P552/1E (CV427)



Ref.:  
P535/1E  
P552/1E

# Tetrode Pulse Modulators

Code: P535/1E (CV398)  
P552/1E (CV427)



| DIM. | MILLIMETRES | INCHES     |
|------|-------------|------------|
| A    | 142.88 MIN. | 5.625 MIN. |
|      | 149.23 MAX. | 5.875 MAX. |
| B    | 65.09 MAX.  | 2.563 MAX. |
| Θ C  | 35.71 MAX.  | 1.406 MAX. |
| D    | 12.7 MAX.   | 1/2 MAX.   |

Θ DENOTES ECCENTRICITY WITH RESPECT TO C. OF BASE.

NOTE: BASIC FIGURES ARE INCHES.



# Thermal Delay Switches

Codes: S102/1G  
VLS631

These miniature thermal delay switches have been designed to provide delay between the application of heater voltage and anode voltage in indirectly heated valves and mercury vapour rectifiers. The S102/1G is identical to the VLS631 but has a B7G/F base for wiring directly into the circuit.

## HEATER

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 6.3 | V |
| Nominal current | 0.5 | A |

## DELAY TIME AT 20°C

|               |    |     |
|---------------|----|-----|
| Minimum delay | 44 | sec |
| Maximum delay | 66 | sec |

## DIMENSIONS

|                          | S102/1G             | VLS631 |      |
|--------------------------|---------------------|--------|------|
| Maximum overall length   |                     | 54.0   | mm   |
| Maximum seated height    | 47.6                | 47.6   | mm   |
| Maximum overall diameter | 19.1                | 19.1   | mm   |
| Minimum lead length      | 38                  |        | mm ← |
| Base                     | B7G/F               | B7G    |      |
| Net weight               | 9                   | 9      | g    |
| Mounting position        | Vertical, base down |        | ←    |

## MAXIMUM RATINGS

|                                                    |     |    |
|----------------------------------------------------|-----|----|
| Maximum open circuit D.C. voltage between contacts | 220 | V  |
| Maximum contact current on make                    | 1.0 | A  |
| Maximum surge current on make                      | 5.0 | A  |
| Maximum current on break at 50 V D.C.              | 100 | mA |

NOTE.—A recommended method of operation is to arrange for the delay switch to operate a mechanical relay fitted with a "hold-on" coil. By this means large powers can be handled and it can be so arranged that as the contacts close the heater supply of the switch is removed. This will ensure the full delay time in the event of a shut down.

Delay switches may be connected in series to obtain multiples of the quoted delay time.

Ref.:

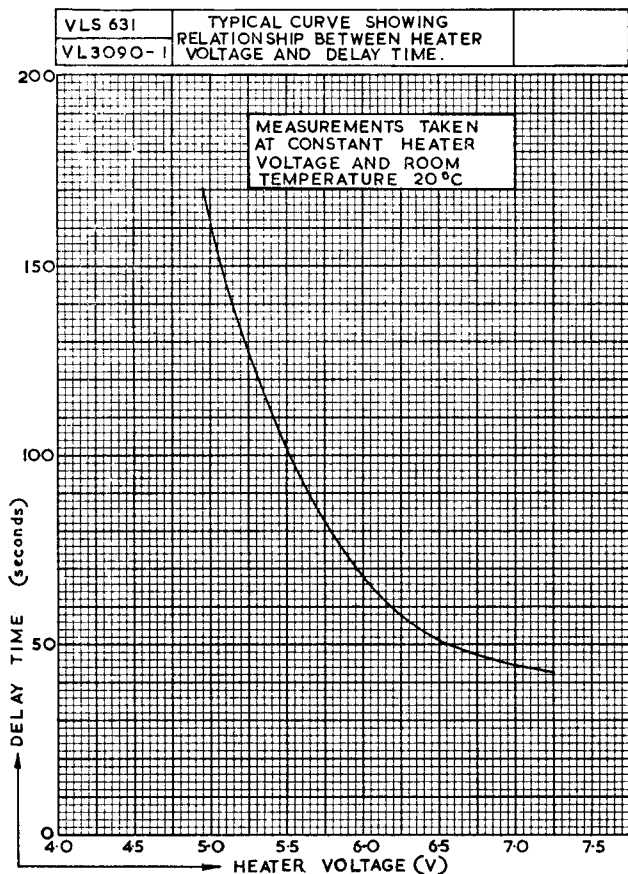
S102/1G

S102/1K

# Thermal Delay Switches



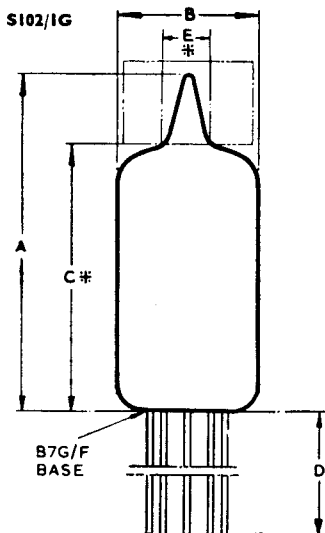
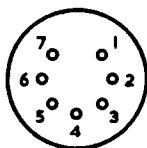
Codes: S102/1G  
VLS631



## Thermal Delay Switches

Codes: S102/1G  
VLS631

\* DENOTES:- MEASURED FROM BASE SEAT TO BULB TOP LINE AS  
DETERMINED BY RING GAUGE OF 'E' INT: DIA:

**BASING**

- 1 HEATER
- 2 I.C.
- 3 ACTIVE STRIP
- 4 STATIONARY STRIP
- 5 N.C.
- 6 I.C.
- 7 HEATER

| DIM | MILLIMETRES | INCHES                                                       |
|-----|-------------|--------------------------------------------------------------|
| A   | 47.6 MAX:   | 1 <sup>7</sup> / <sub>8</sub> MAX:                           |
| B   | 19.1 MAX:   | <sup>3</sup> / <sub>4</sub> MAX:                             |
| C*  | 38.1 ± 2.4  | 1 <sup>1</sup> / <sub>2</sub> ± <sup>5</sup> / <sub>32</sub> |
| D   | 38.0 MIN:   | 1 <sup>1</sup> / <sub>2</sub> MIN: ←                         |
| E*  | 11.1        | <sup>7</sup> / <sub>16</sub>                                 |

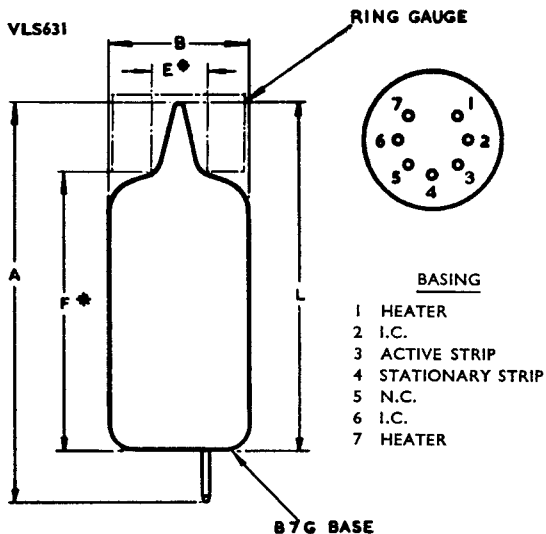
NOTE: BASIC FIGURES ARE INCHES.



Ref.:  
S102/1G  
S102/1K

# Thermal Delay Switches

Codes: S102/1G  
VLS631



\* DENOTES:- MEASURED FROM BASE SEAT TO BULB TOP LINE, AS DETERMINED BY RING GAUGE OF 'E' INT. DIA.

| DIM | MILLIMETRES | INCHES                                                         |
|-----|-------------|----------------------------------------------------------------|
| A   | 54.0 MAX.   | 2 <sup>1</sup> / <sub>8</sub> MAX.                             |
| B   | 19.1 MAX    | 3 <sup>3</sup> / <sub>4</sub> MAX.                             |
| * F | 38.1 ± 4.0  | 1 <sup>1</sup> / <sub>2</sub> ± 5 <sup>5</sup> / <sub>32</sub> |
| * L | 47.6 MAX    | 1 <sup>7</sup> / <sub>8</sub> MAX.                             |
| * E | 11.1        | 7 <sup>7</sup> / <sub>16</sub>                                 |

NOTE:- BASIC FIGURES ARE INCHES.



# Thermal Delay Switches

Codes: S103/1K  
S104/1K

These miniature thermal delay switches have been designed to provide delay between the application of heater voltage and anode voltage in indirectly heated valves and mercury vapour rectifiers.

| HEATER          | S103/1K | S104/1K |   |
|-----------------|---------|---------|---|
| Voltage         | 27      | 6.3     | V |
| Nominal current | 0.115   | 0.5     | A |

## DELAY TIME AT 20°C

|               |    |    |     |
|---------------|----|----|-----|
| Minimum delay | 36 | 25 | sec |
| Maximum delay | 54 | 35 | sec |

## MECHANICAL DATA

|                          |                       |    |
|--------------------------|-----------------------|----|
| Maximum overall length   | 54                    | mm |
| Maximum seated height    | 47.6                  | mm |
| Maximum overall diameter | 19.1                  | mm |
| Base                     | B7G                   |    |
| Net weight               | 9                     | g  |
| Mounting position        | Vertical, base down ← |    |

## MAXIMUM RATINGS

|                                                    |     |    |
|----------------------------------------------------|-----|----|
| Maximum open circuit D.C. voltage between contacts | 220 | V  |
| Maximum contact current on make                    | 1   | A  |
| Maximum surge current on make                      | 5   | A  |
| Maximum current on break at 50 V D.C.              | 100 | mA |

NOTE.—A recommended method of operation is to arrange for the delay switch to operate a mechanical relay fitted with a "hold-on" coil. By this means large powers can be handled and it can be so arranged that as the contacts close the heater supply of the switch is removed. This will ensure the full delay time in the event of a shut down.

These delay switches may be connected in series to obtain multiples of the quoted delay time.

Ref.:

S103/1K

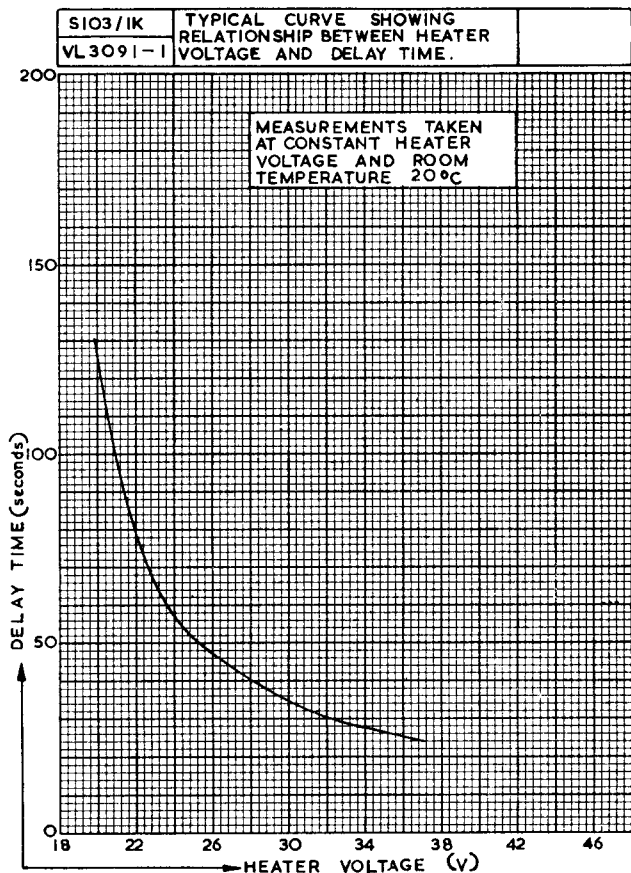
S104/1K

## Thermal Delay Switches



Codes: S103/1K

S104/1K





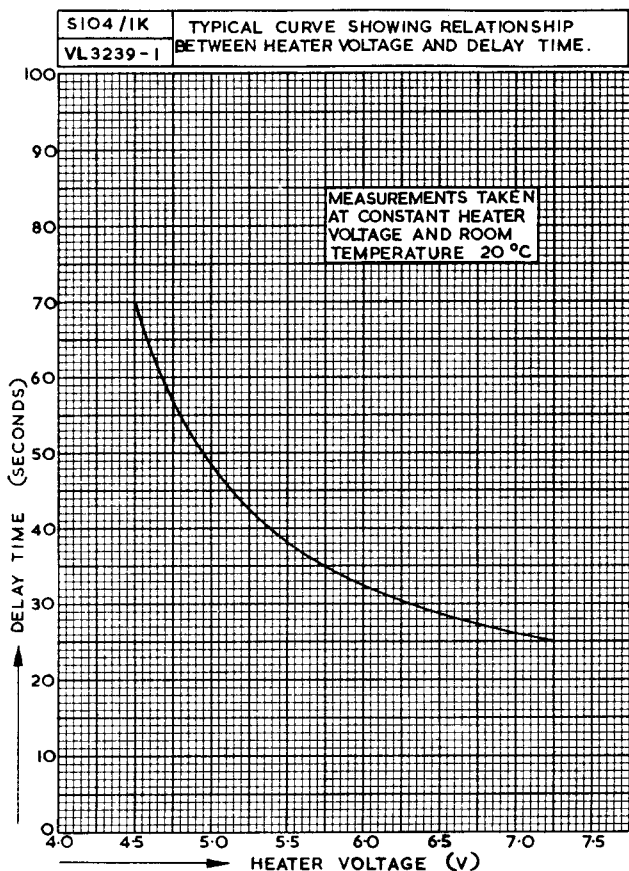
# Thermal Delay Switches

Ref.: S103/1K

S104/1K

Codes: S103/1K

S104/1K



Ref.:

S103/1K

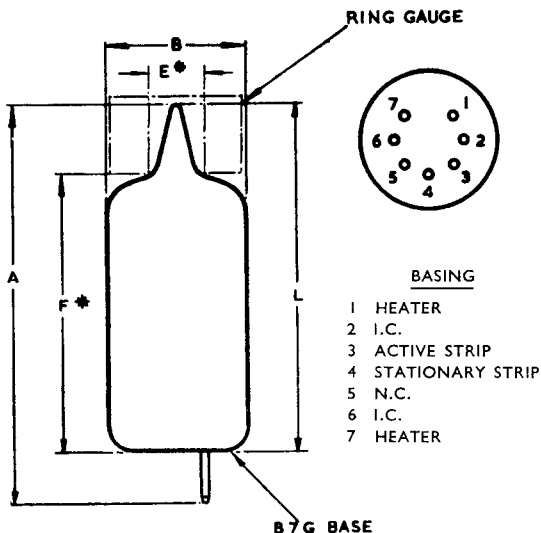
S104/1K

# Thermal Delay Switches



Codes: S103/1K

S104/1K



\* DENOTES:- MEASURED FROM BASE SEAT TO BULB TOP LINE, AS DETERMINED BY RING GAUGE OF 'E' INT. DIA.

| DIM | MILLIMETRES | INCHES       |
|-----|-------------|--------------|
| A   | 54.0 MAX.   | 2 1/8 MAX.   |
| B   | 19.1 MAX    | 3/4 MAX.     |
| * F | 38.1 ± 4.0  | 1 1/2 ± 5/32 |
| L   | 47.6 MAX    | 1 7/8 MAX.   |
| * E | 11.1        | 7/16         |

NOTE:- BASIC FIGURES ARE INCHES.

# —Standard Valves—

SS 1971  
Valve

## SS 1971 VALVE

DOUBLE ENDED WATER COOLED TRIODE.

### SPECIFICATION.

#### Cathode.

Pure Tungsten filament.  
Constant voltage type.

#### Dimensions.

Net weight 7 lbs. (3,200 gms.)  
Overall length  $26\frac{1}{2}"$  (67.5 cms.)  
Bulb diameter  $3\frac{1}{2}"$  (8.9 cms.)

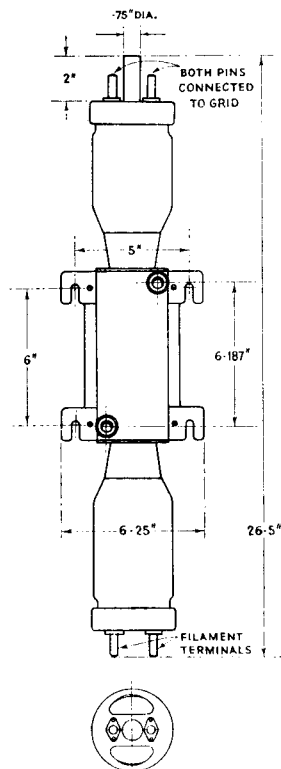
#### Water Flow.

5 gallons per minute.

#### Constants.

|                                          |                        |
|------------------------------------------|------------------------|
| Filament voltage                         | 19-21 volts            |
| (exact filament voltage marked on bulb). |                        |
| Nominal filament current                 | 64 amps.               |
| Total emission                           | 11 amps.               |
| * Impedance                              | 3,500 ohms             |
| * Amplification factor                   | 21                     |
| Grid-anode capacity                      | 20 $\mu\mu\text{F}$ .  |
| Anode-filament capacity                  | 5.5 $\mu\mu\text{F}$ . |
| Grid-filament capacity                   | 8 $\mu\mu\text{F}$ .   |

\* at anode current of 1.0 amp.



### LIMITING CONDITIONS FOR SAFE OPERATION.

|                                                   |              |
|---------------------------------------------------|--------------|
| Maximum direct anode voltage                      | 12,000 volts |
| Maximum direct anode voltage for anode modulation | 9,000 volts  |
| Maximum direct anode current                      | 2.75 amps.   |
| Maximum anode dissipation                         | 15 Kw.       |
| Maximum grid dissipation                          | 250 watts    |
| Maximum frequency for above ratings               | 15 Mc.       |
| Anode voltage for frequency of 22 Mc.             | 10,000 volts |

Note :—No water jacket required as it forms part of the valve.

V.1971-1  
Nov. 1937

# —Standard Valves—

## TYPICAL OPERATING CONDITIONS.

|                                               | Class B. A.F. Amp.<br>For balanced 2 valve circuit. |
|-----------------------------------------------|-----------------------------------------------------|
| Direct anode voltage                          | 10,000 volts                                        |
| Grid bias                                     | —250 to —350 volts                                  |
| Direct anode current per valve—zero signal    | 0.45 amps.                                          |
| Direct anode current per valve—maximum signal | 2.2 amps.                                           |
| Load resistance—anode to anode                | 4,000 ohms.                                         |
| Maximum signal output—2 valves                | 24 Kw.                                              |
| Anode dissipation                             | 10 Kw.                                              |

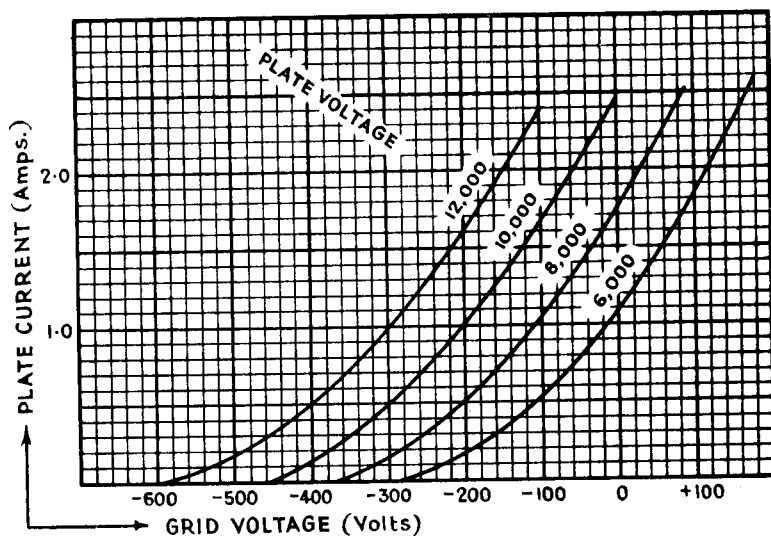
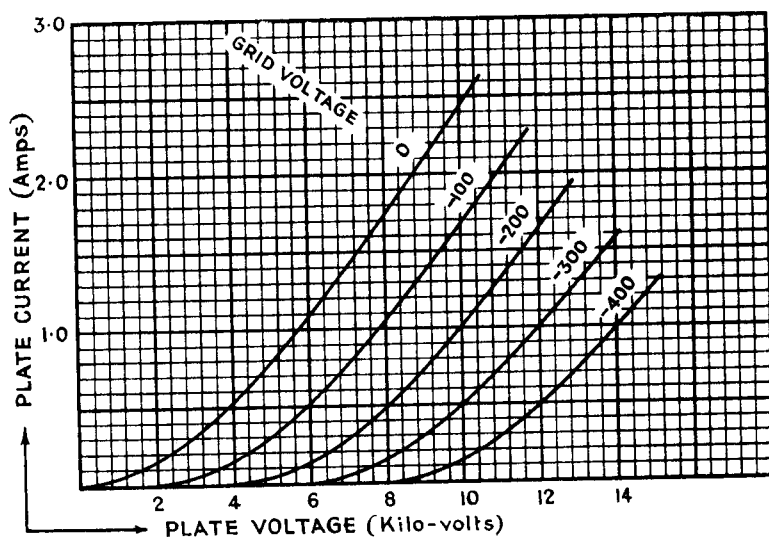
## RADIO FREQUENCY OPERATION.

|                      | Class B<br>Telephony                    | Class C<br>Telephony              | Class C<br>Telegraphy   |
|----------------------|-----------------------------------------|-----------------------------------|-------------------------|
|                      | Modulated<br>Carrier<br>applied to grid | Subject to<br>anode<br>modulation | Unmodulated             |
| Direct anode voltage | 10,000                                  | 7,000                             | 10,000 volts            |
| Direct anode current | 1.5                                     | 1.5                               | 3 amps.                 |
| Grid bias            | —400                                    | —650                              | —900 to<br>—1,300 volts |
| Anode dissipation    | 10                                      | 3.5                               | 10 Kw.                  |
| Carrier output       | 5                                       | 7                                 | 20 Kw.                  |

# —Standard Valves—

SS 1971  
Valve

These curves are taken with A.C. filament heating, grid and anode voltages being referred to the centre point of the filament.



V.1971.2  
Nov. 1937



PRINTED IN  
ENGLAND



## U.H.F. Thermocouples

Code: T2H/60JA & B

These thermocouples are suitable for monitoring within the frequency range 300 Mc/s to 6000 Mc/s and are designed for building into the walls of resonators, wave-guides, and coaxial-lines, without leakage or appreciable loss.

They are small disc-seal tubes with an end cap. On one side of the disc is the R.F. pick-up loop of which the thermo-junction of manganin and constantan form a part.

The loop is incomplete for D.C. but the H.F. circuit is completed to the disc through a decoupling capacitor of approximately 35 pF. At the lower frequency end of the range an additional decoupling capacitance may be required.

The JA types are so connected that the output is positive at the end cap. The JB types have the end cap negative to the disc. The disc is notched on its periphery to provide location of the plane of the loop with respect to the mounting.

### DIMENSIONS

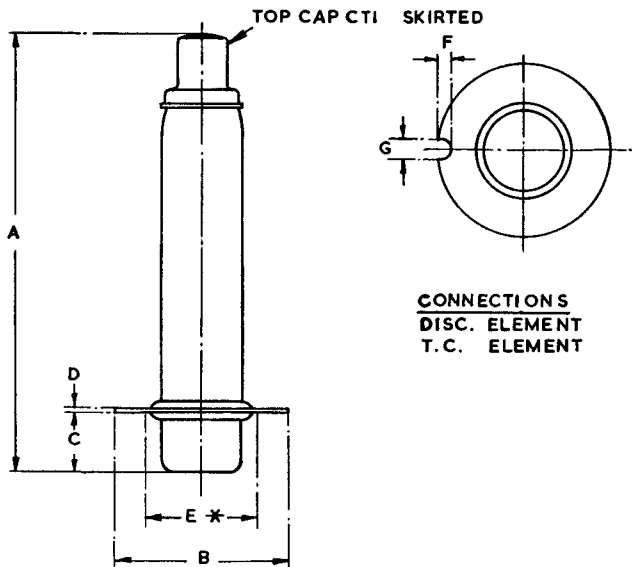
|                        |       |    |
|------------------------|-------|----|
| Maximum overall length | 54    | mm |
| Maximum disc diameter  | 22.65 | mm |
| Maximum bulb diameter  | 10.3  | mm |

### CHARACTERISTICS

| Type         | Nominal Resistance of couple | Maximum safe heater current | Heater current required to produce in couple an open circuit e.m.f. of 15 mV |
|--------------|------------------------------|-----------------------------|------------------------------------------------------------------------------|
| T2H/60JA & B | 6 $\Omega$                   | 60 mA                       | 38 mA                                                                        |

## U.H.F. Thermocouples

Code: T2H/60JA &amp; B



| DIM. | MILLIMETRES                                                 | INCHES                                                         |
|------|-------------------------------------------------------------|----------------------------------------------------------------|
| A    | 49.2 $\pm$ 4.8                                              | 1 $\frac{5}{16}$ $\pm$ $\frac{3}{16}$                          |
| B    | 22.23 $\pm$ 0.20                                            | 0.875 $\pm$ 0.008                                              |
| C    | 6.0 MIN.                                                    | 0.24 MIN.                                                      |
|      | 8.5 MAX.                                                    | 0.33 MAX.                                                      |
| D    | 0.30 MAX.                                                   | 0.012 MAX.                                                     |
| * E  | 15.87 MIN.                                                  | 0.625 MIN.                                                     |
| F    | 1.57 $\begin{smallmatrix} +0.13 \\ -0.00 \end{smallmatrix}$ | 0.062 $\begin{smallmatrix} +0.005 \\ -0.000 \end{smallmatrix}$ |
| G    | 2.36 $\begin{smallmatrix} +0.13 \\ -0.00 \end{smallmatrix}$ | 0.093 $\begin{smallmatrix} +0.005 \\ -0.000 \end{smallmatrix}$ |

NOTE:- BASIC FIGURES ARE INCHES.

\* DENOTES:- MIN CLAMPING DIAMETER



# Velocity-Modulated Oscillator

Code: V190C/1M

The V190C/1M is a coaxial-line velocity-modulated oscillator for C.W. operation in the frequency range 800 to 1 000 Mc/s.

## CATHODE.

Indirectly heated, oxide coated

|                |     |   |
|----------------|-----|---|
| Heater voltage | 6.3 | V |
|----------------|-----|---|

|                 |   |   |
|-----------------|---|---|
| Nominal current | 1 | A |
|-----------------|---|---|

(A.C. frequencies above 60 c/s must not be used)

## DIMENSIONS.

|                        |       |    |
|------------------------|-------|----|
| Maximum overall length | 114.3 | mm |
|------------------------|-------|----|

|                       |      |    |
|-----------------------|------|----|
| Maximum bulb diameter | 31.8 | mm |
|-----------------------|------|----|

|      |     |  |
|------|-----|--|
| Base | B8G |  |
|------|-----|--|

|            |    |   |
|------------|----|---|
| Net weight | 75 | g |
|------------|----|---|

## MOUNTING.

This valve is designed to mount by means of the resonator disc in a suitable tuning circuit.

## MAXIMUM RATINGS.

|                                                                  |    |   |
|------------------------------------------------------------------|----|---|
| Maximum mean input power to all electrodes other than the heater | 25 | W |
|------------------------------------------------------------------|----|---|

|                                |     |    |
|--------------------------------|-----|----|
| Maximum direct cathode current | 100 | mA |
|--------------------------------|-----|----|

|                               |     |   |
|-------------------------------|-----|---|
| Maximum direct screen voltage | 400 | V |
|-------------------------------|-----|---|

|                                   |   |   |
|-----------------------------------|---|---|
| Maximum direct screen dissipation | 2 | W |
|-----------------------------------|---|---|

|                          |     |    |
|--------------------------|-----|----|
| Maximum bulb temperature | 250 | °C |
|--------------------------|-----|----|

# Velocity-Modulated Oscillator



Code: V190C/1M

---

## TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 800–1 000 Mc/s.

### Grid Voltage ( $V_{g1}$ ).

20 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes through the resonator and reaches the anode. See Figure 7 for a sketch of the electrode assembly.

### Resonator Voltage.

A typical curve of resonator voltage versus frequency is shown in Figure 1.

### Cathode Current.

This is dependent on the output power required from the valve and should be kept as low as possible to obtain the maximum life from the valve. A typical value is 80 mA, for which greater than 70 mA anode current should be obtained and an output power of greater than 2 watts over the band.

### Screen Voltage ( $V_{g2}$ ).

Zero to  $V_{res} + 50$  volts. Adjusted to give the desired operating cathode current. A typical value for a cathode current of 80 mA at a frequency of 900 Mc/s is 110 volts. Where the valve is intended for use in unattended equipment, the screen voltage should be adjusted automatically so as to keep the cathode current approximately constant.

### Screen Current ( $I_{g2}$ ).

Not greater than 5 mA.

### Anode Voltage ( $V_a$ ).

This may be maintained at the same voltage as the resonator.

### Output Power ( $P_o$ ).

Not less than 2 watts over the frequency range 800–1 000 Mc/s with a cathode current of 80 mA and the load adjusted for maximum output. A typical curve of output power versus frequency is shown in Figure 2. The variation of output power with anode current at a frequency of 900 Mc/s is shown in Figure 3.



## Velocity-Modulated Oscillator

Code: V190C/1M

### MODULATION.

Frequency modulation may be obtained by variation of the drift tube voltage (the drift tube is connected to the centre conductor of the tuning circuit), and is greater than  $\pm 2$  Mc/s between half-power points for a cathode current of 80 mA when the load has been adjusted to give maximum output power.

A capacitor must be built into the centre conductor of the tuning circuit to allow modulation of the drift tube voltage, as shown in Figure 8.

The drift tube current will be a maximum of 10 mA if the valve is correctly aligned in the magnet and the modulation-sensitivity is about 50 kc/s per volt. The d.c. drift tube voltage must, of course, be maintained equal to the resonator voltage.

Amplitude modulation can be obtained by variation of either control grid ( $g_1$ ) or screen grid ( $g_2$ ) voltages.

### CIRCUIT.

A sketch of a suitable circuit is shown in Figure 8. The frequency of oscillation is a function of circuit length  $L_c$ . A typical curve of circuit length versus frequency is shown in Figure 4. Care must be taken to see that the centre-conductor is maintained concentric with the outer conductor at all tuning piston positions to avoid damage to the valve.

### OUTPUT COUPLING.

The specified output power is obtained over the range 800–1 000 Mc/s by means of the coupling loop, as shown in Figure 8. Satisfactory loading of the valve into 70 ohm cable is obtained but adjustment is required to loop penetration or rotation as the valve is tuned over the frequency band.

### UNLOADED STARTING CURRENT.

The anode current at which oscillation just starts, when the valve is loaded only by the circuit, is referred to as the "unloaded starting current", and serves as a useful measure of the quality of the tuning circuit. A typical curve of unloaded starting current versus frequency for the circuit of Figure 8 is shown in Figure 5. The importance of good quality circuit construction is illustrated in Figure 6, which shows the output power obtained at 900 Mc/s, with a cathode current of 70 mA, as the unloaded starting current is varied.

## Velocity-Modulated Oscillator

Code: V190C/1M

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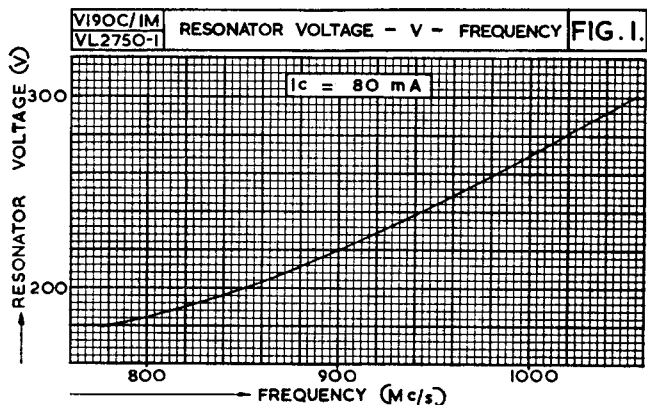
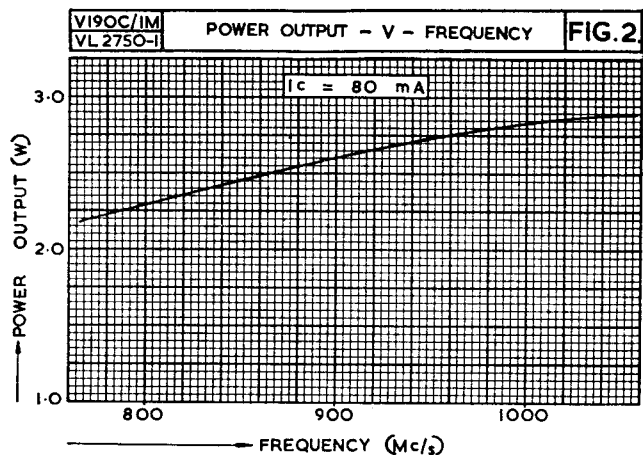
### MAGNET AND MAGNET ALIGNMENT.

A permanent magnet is used to focus the electron beam. A suitable magnet is made by Jessops to their sketch No. SK625, but any magnet giving a uniform field of approximately 1 200 oersteds over a 32 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 7). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.



# Velocity-Modulated Oscillator

Code: V190C/1M

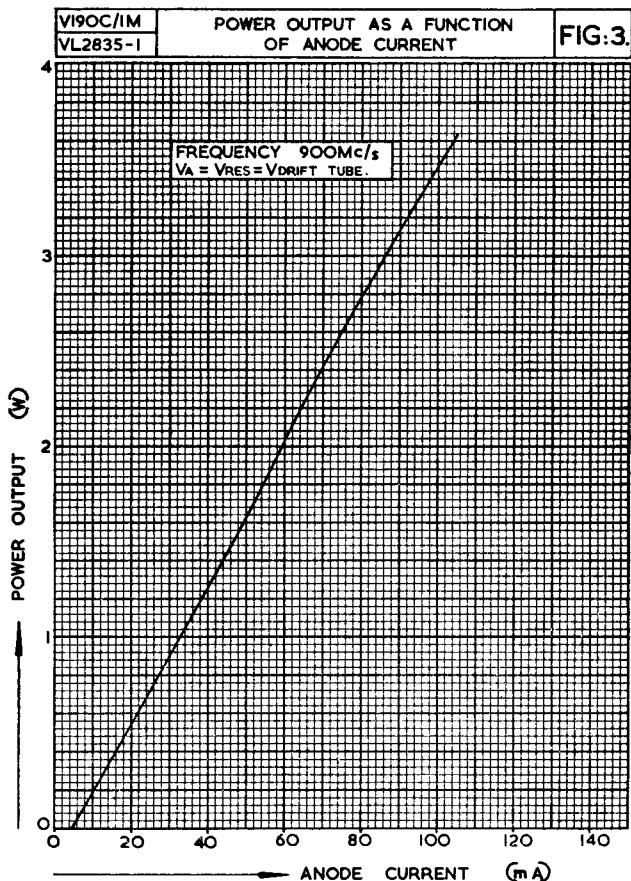




# Velocity-Modulated Oscillator



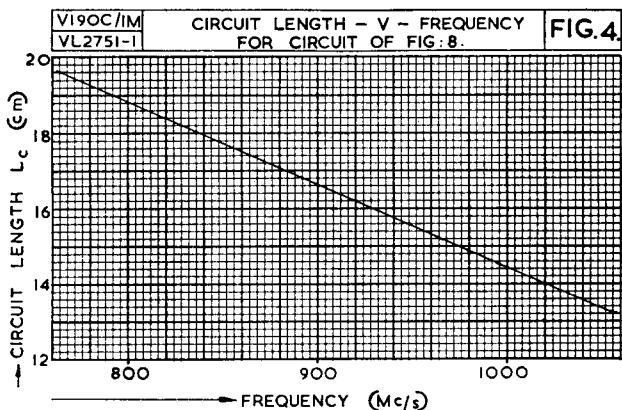
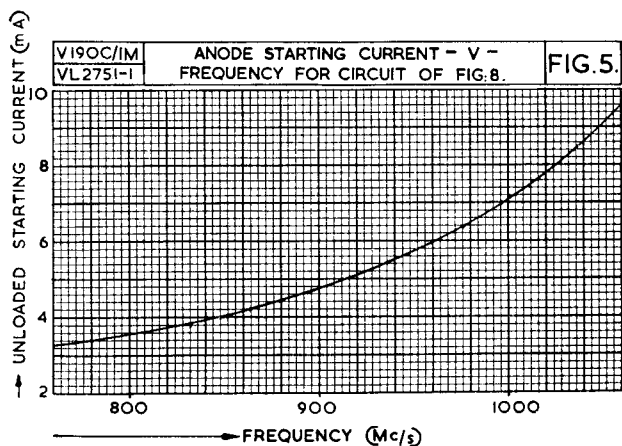
Code: V190C/1M





# Velocity-Modulated Oscillator

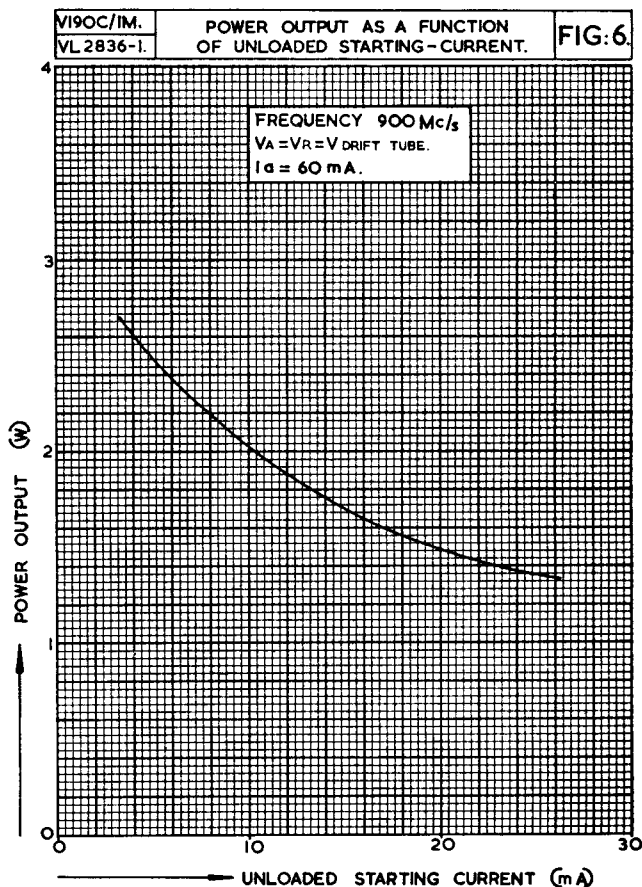
Code: V190C/1M



# Velocity-Modulated Oscillator



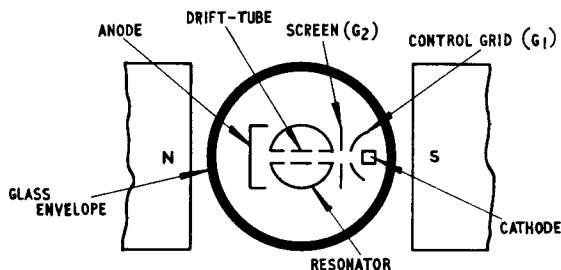
Code: V190C/1M





# Velocity-Modulated Oscillator

Code: V190C/1M



CROSS SECTION OF VALVE ASSEMBLY

FIG. 7

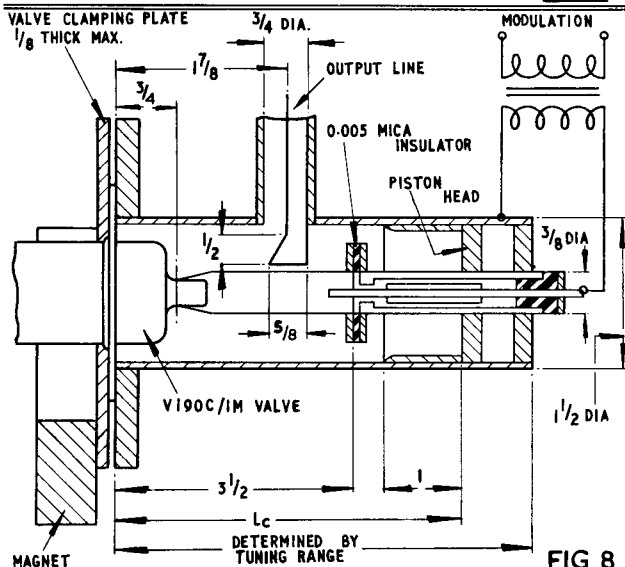
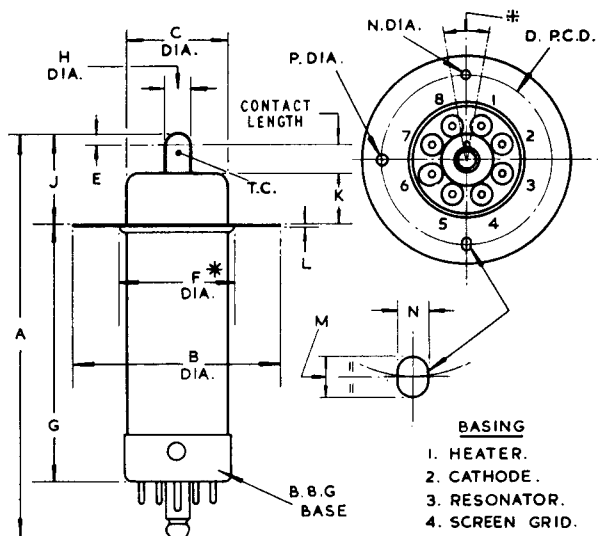


FIG. 8

# Velocity-Modulated Oscillator

Code: V190C/1M



## BASING

1. HEATER.
  2. CATHODE.
  3. RESONATOR.
  4. SCREEN GRID.
  5. NO CONNEXION.
  6. ANODE
  7. GRID.
  8. HEATER.
- T.C. DRIFT TUBE.

\* DENOTES:- KEY ON BASE SPIGOT MAY BE  $\pm 10^\circ$  FROM  $\phi$  OF LOCATING HOLES IN DISC.

\* DENOTES:- ALSO MIN. CLAMPING DIA.

| DIM | MILLIMETRES     | INCHES            | DIM | MILLIMETRES     | INCHES            |
|-----|-----------------|-------------------|-----|-----------------|-------------------|
| A   | 114.3 MAX.      | 4 1/2 MAX.        | K   | 12.7 $\pm 0.2$  | 1/2 $\pm 0.008$   |
| B   | 58.42 MAX.      | 2.3 MAX.          | L   | 0.30 MAX.       | 0.012 MAX.        |
| C   | 31.8 MAX.       | 1 1/4 MAX.        | M   | 3.2 $\pm 0.13$  | 0.125 $\pm 0.005$ |
| D   | 46.0 $\pm 0.06$ | 1.812 $\pm 0.002$ | N   | 2.36 $\pm 0.06$ | 0.093 $\pm 0.002$ |
| E   | 3.2 MAX.        | 1/8 MAX.          | P   | 2.79 $\pm 0.13$ | 0.110 $\pm 0.005$ |
| F   | 38.1 MAX.       | 1 1/2 MAX.        |     |                 |                   |
| G   | 73.0 MAX.       | 2 7/8 MAX.        |     |                 |                   |
| H   | 6.81 $\pm 0.13$ | 0.268 $\pm 0.005$ |     |                 |                   |
| J   | 25.4 $\pm 0.8$  | 1" $\pm 1/32$     |     |                 |                   |

NOTE:- BASIC FIGURES ARE INCHES



# Velocity Modulated Oscillator

V230A/IK (CV234)

This is a velocity modulated oscillator of the coaxial line type for CW operation within the wave range 8.9 cm. to 11 cm. and 8 cm. to 16 cm.

## CATHODE.

Indirectly-heated oxide-coated.

|         |     |   |
|---------|-----|---|
| Voltage | 6.3 | V |
|---------|-----|---|

|                                                                   |     |   |
|-------------------------------------------------------------------|-----|---|
| Nominal current (AC frequencies<br>above 60 c/s must not be used) | 0.3 | A |
|-------------------------------------------------------------------|-----|---|

## DIMENSIONS.

|                        |    |     |
|------------------------|----|-----|
| Maximum overall length | 81 | mm. |
|------------------------|----|-----|

|                       |      |     |
|-----------------------|------|-----|
| Maximum bulb diameter | 20.1 | mm. |
|-----------------------|------|-----|

|      |                        |  |
|------|------------------------|--|
| Base | Miniature 7 pin button |  |
|------|------------------------|--|

|            |     |    |
|------------|-----|----|
| Net weight | 22½ | g. |
|------------|-----|----|

## MAXIMUM RATINGS.

|                                                                              |    |   |
|------------------------------------------------------------------------------|----|---|
| The mean input power to all electrodes other than the heater must not exceed | 15 | W |
|------------------------------------------------------------------------------|----|---|

|                                    |    |    |
|------------------------------------|----|----|
| The maximum direct cathode current | 65 | mA |
|------------------------------------|----|----|

|                               |     |   |
|-------------------------------|-----|---|
| Maximum direct screen voltage | 200 | V |
|-------------------------------|-----|---|

# Velocity Modulated Oscillator

**V230A/1K (CV234)**

## OPERATING CONDITIONS.

**Oscillator 8.9 to 11 cm. See Fig. 1.**

|                          |                                                             |
|--------------------------|-------------------------------------------------------------|
| Grid voltage $V_{g_1}$   | 0 to 200 V negative with respect to cathode                 |
| Resonator voltage $V_r$  |                                                             |
| Screen voltage $V_{g_2}$ | 0 to $V_r$                                                  |
| Anode voltage $V_a$      |                                                             |
| Output power             | Not less than 0.3 W at the ends of the band with 15 W input |

The output may be controlled by either  $V_{g_1}$  or  $V_{g_2}$ . It is usually desirable to set  $V_{g_1}$  to zero voltage and adjust  $V_{g_2}$  by means of a potentiometer across the resonator supply.

**Oscillator over at least an octave, approximately 8-16 cm.**

**See Fig. 2.**

|                          |                                               |
|--------------------------|-----------------------------------------------|
| Grid voltage $V_{g_1}$   | 0 to 200 V negative with respect to cathode   |
| Resonator voltage $V_r$  |                                               |
| Screen voltage $V_{g_2}$ | 0 to $V_r$                                    |
| Anode voltage $V_a$      |                                               |
| Output power             | Not less than 0.4 W in the middle of the band |

The output may be controlled by either  $V_{g_1}$  or  $V_{g_2}$  as for 8.9 to 11 cm. operation.



# Velocity Modulated Oscillator

V230A/1K (CV234)

## PULSE OPERATION.

The valve may be operated with 10% duty cycle giving peak power output of the same values as for CW operation. The delay time for optimum voltage will be approximately 1 microsecond.

## MAGNET AND MAGNET ALIGNMENT.

The magnet recommended is Jessops type 10512 but any magnet giving a uniform field of about 1200 oersteds over a 22 mm. gap may be used. The valve must be accurately aligned in the magnetic field so that as much of the current as possible reaches the anode. Once aligned no further adjustment will be necessary when replacing valves.

## CIRCUITS.

Two circuits suitable for use with this valve are shown in Fig. 1 and 2. The position of the output probe is of importance.

Circuit Fig. 1 is a rhumbatron cavity with micrometer screw for wavelength adjustment. Wavelength 8.9 to 11 cm.

Circuit Fig. 2 is a non-contact octave rhumbatron.

Further information may be obtained on application to the Chief Valve Engineer, Standard Telephones and Cables Ltd., Connaught House, Aldwych, London, W.C.2.

FIG. 1.

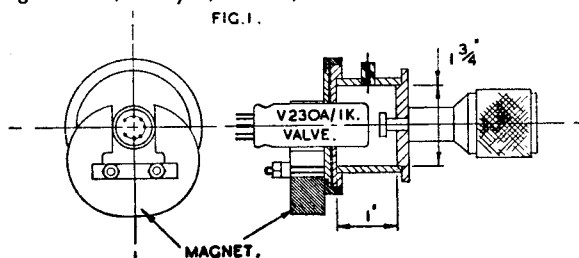
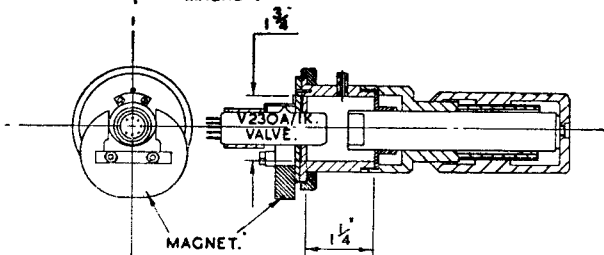


FIG. 2.

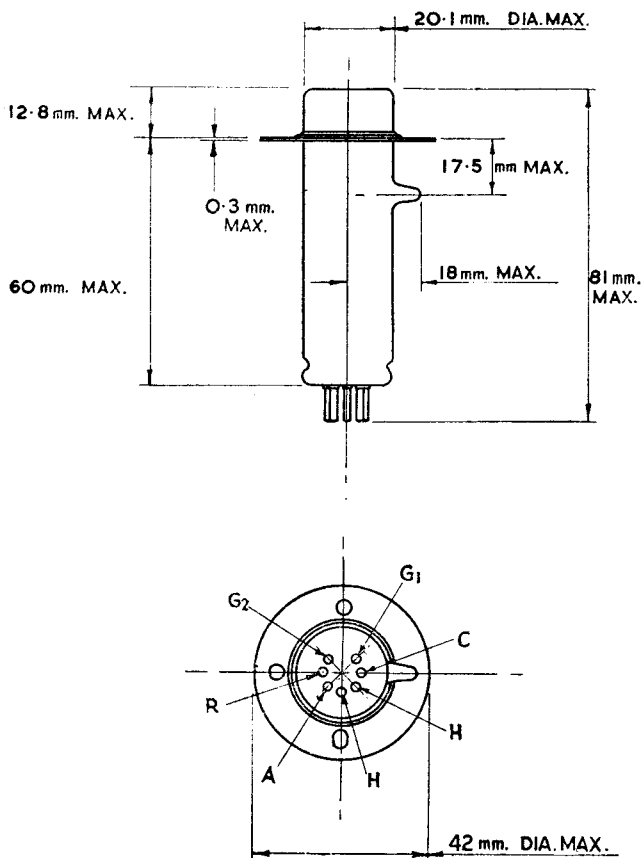


V230A/IK

# Velocity Modulated Oscillator



V230A/IK (CV234)



Tentative data  
November, 1945

V230A/IK- 4



## Velocity Modulated Oscillator

Code: V233A/1K (CV2190)

---

This is a velocity-modulated oscillator of the coaxial-line type for CW operation in the frequency range 2700 to 4200 Mc/s.

### CATHODE.

Indirectly-heated, oxide-coated

|                |     |   |
|----------------|-----|---|
| Heater voltage | 6.3 | V |
|----------------|-----|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal current | 0.3 | A |
|-----------------|-----|---|

(A.C. frequencies above 1.5 kc/s must not be used)

### DIMENSIONS.

|                        |    |    |
|------------------------|----|----|
| Maximum overall length | 73 | mm |
|------------------------|----|----|

|                       |      |    |
|-----------------------|------|----|
| Maximum bulb diameter | 20.1 | mm |
|-----------------------|------|----|

|      |     |  |
|------|-----|--|
| Base | B7G |  |
|------|-----|--|

|            |    |   |
|------------|----|---|
| Net weight | 21 | g |
|------------|----|---|

### MOUNTING.

The valve is designed to mount by means of the resonator disc so that the antenna couples into a suitable tuning circuit.

### MAXIMUM RATINGS.

The mean input power to all electrodes,  
other than the heater

|  |    |   |
|--|----|---|
|  | 18 | W |
|--|----|---|

|                                |    |    |
|--------------------------------|----|----|
| Maximum direct cathode current | 65 | mA |
|--------------------------------|----|----|

|                               |     |   |
|-------------------------------|-----|---|
| Maximum direct screen voltage | 400 | V |
|-------------------------------|-----|---|

|                            |     |   |
|----------------------------|-----|---|
| Maximum screen dissipation | 1.5 | W |
|----------------------------|-----|---|

## Velocity Modulated Oscillator



Code: V233A/1K (CV2190)

---

### TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 2700 to 4200 Mc/s.

#### **Grid voltage ( $V_{g1}$ )**

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes through the resonator and reaches the anode. See Figure 6 for a sketch of the electrode assembly.

#### **Resonator voltage ( $V_{res}$ )**

At 3300 Mc/s, 250 V  $\pm$  5%. For other frequencies the resonator voltage is approximately proportional to the square of the frequency. See Figure 1.

#### **Screen voltage ( $V_{g2}$ )**

Zero to  $V_{res} + 50$  volts. Adjusted to give an anode dissipation of 10 watts, provided that the cathode current does not exceed 65 mA.

#### **Screen current ( $I_{g2}$ )**

Not greater than 5 mA.

#### **Anode voltage ( $V_a$ )**

10 to 20 volts positive with respect to resonator.

#### **Output power ( $P_o$ )**

Not less than 300 mW over the frequency range 2700 to 4200 Mc/s when operated in the tuning circuit of Figure 7, and when the load is adjusted for maximum power output. In Figure 3 power output is plotted as a function of frequency for several values of anode dissipation.



# Velocity Modulated Oscillator

Code: V233A/1K (CV2190)

## CIRCUIT.

Figure 7 shows a sketch of a suitable tuning circuit. The frequency of oscillation is a function of circuit length  $L$ , i.e. piston position, and the frequency range is determined by the stroke of the piston. Curves of circuit length as a function of frequency are plotted in Figure 2. The valve will operate satisfactorily in other types of circuit, with certain differences in performance. Further information may be obtained on application to the Chief Valve Engineer, Standard Telephones and Cables Limited, Dowlish Ford Mills, Ilminster, Somerset.

## OUTPUT COUPLING.

The specified output power is obtainable over the entire range 2700 to 4200 Mc/s by means of a coupling loop placed either at the piston face (position A of Figure 7), or at the valve end of the circuit (position B).

Using Position A, satisfactory loading of the valve into 70 ohm coaxial cable is obtainable for a fixed loop position (pre-set at midband) over a limited range, e.g. 3600 to 4200 Mc/s. In Position B, however, it is usually necessary to make an adjustment of the loop orientation when tuning the oscillator over the frequency range. For applications where such adjustments of the loops are inadmissible the impedance at the loop must be transformed to that of the load by means of an appropriate impedance matching technique.

## UNLOADED STARTING CURRENT.

The anode current at which oscillations just start, when the valve is loaded only by the circuit, is referred to as the "unloaded starting current", and serves as a useful measure of the efficiency of the tuning circuit. In Figure 4 the unloaded starting current for a typical valve is plotted as a function of frequency using the recommended circuit.

To illustrate the importance of good tuning circuit construction a curve of power output versus the unloaded starting current of the valve circuit combination is given in Figure 5.

## Velocity Modulated Oscillator



Code: V233A/1K (CV2190)

---

### OUTPUT MODULATION.

#### (a) Amplitude modulation.

The voltage required is dependent both upon the particular operating conditions, and the loading of the valve. For 100 per cent modulation it is only necessary to reduce the anode current to a value below the starting current of oscillation.

Modulation of either the grid ( $g_1$ ) or the screen ( $g_2$ ) is permissible. Modulating voltages of between  $-50$  and  $-200$  applied to the grid will be found to be adequate. For the screen, however, positive modulating voltages of the same order are necessary, and, since the screen takes current, adequate modulation power should be provided.

#### (b) Frequency modulation.

Although the valve is not specifically designed for frequency modulation about  $\pm 1$  Mc/s is available by variation of the resonator voltage.

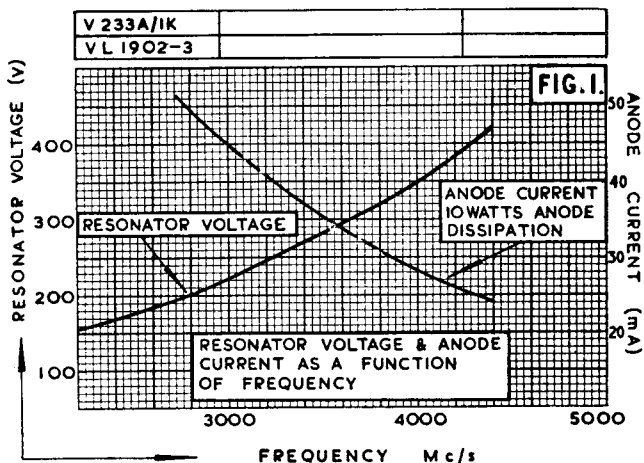
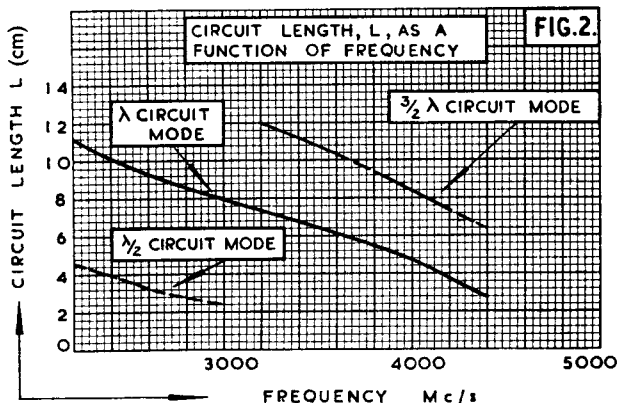
### MAGNET AND MAGNET ALIGNMENT.

The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 6). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.



# Velocity Modulated Oscillator

Code: V233A/1K (CV2190)

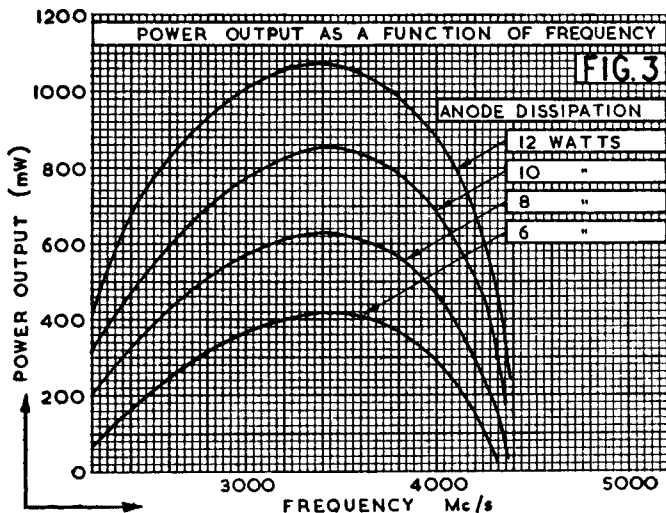
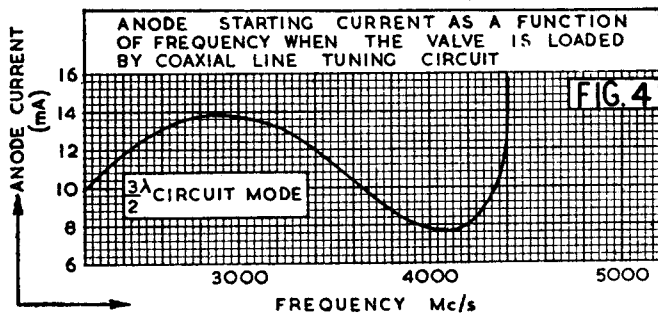


# Velocity Modulated Oscillator



Code: V233A/1K (CV2190)

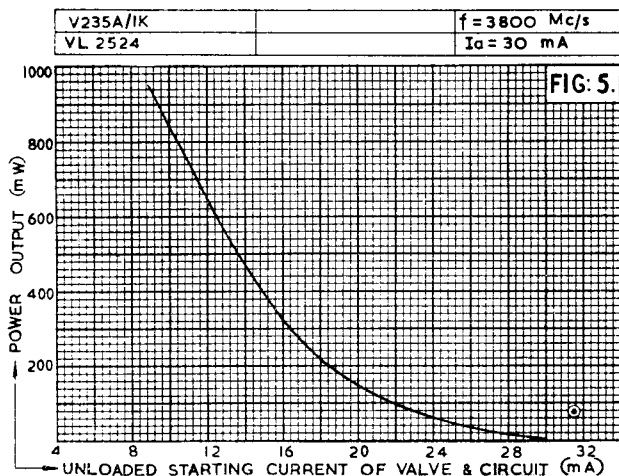
|           |  |  |
|-----------|--|--|
| V 233A/1K |  |  |
| VL 1903   |  |  |





# Velocity Modulated Oscillator

Code: V233A/1K (CV2190)

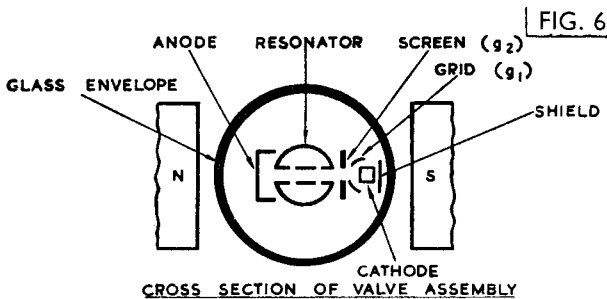
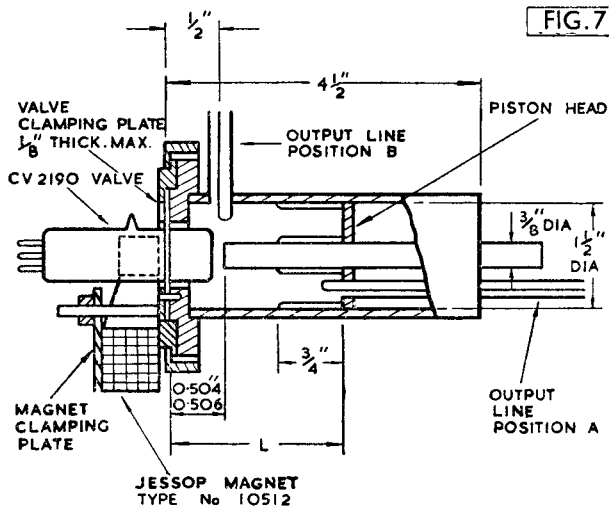




# Velocity Modulated Oscillator



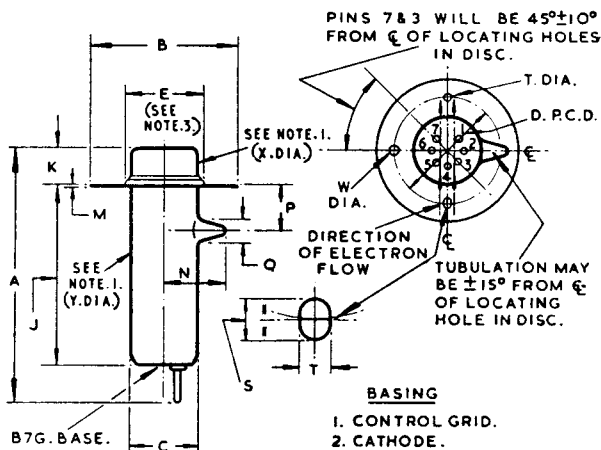
Code: V233A/1K (CV2190)





# Velocity Modulated Oscillator

Code: V233A/1K (CV2190)



NOTE. 1. THIS PORTION OF BULB WILL NOT FOUL A CYLINDER OF INT. DIA. SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN THE DISC.

## BASING

1. CONTROL GRID.
2. CATHODE.
3. HEATER.
4. HEATER.
5. ANODE.
6. RESONATOR.
7. SCREEN GRID.

| DIM | MILLIMETRES            | INCHES                           | DIM | MILLIMETRES               | INCHES                       |
|-----|------------------------|----------------------------------|-----|---------------------------|------------------------------|
| A   | 73 MAX.                | $2\frac{7}{8}$ MAX.              | P   | $13.5 \pm 4.0$            | $0.53 \pm 0.16$              |
| B   | 42 MAX.                | 1.65 MAX.                        | Q   | 8.5 MAX.                  | 0.33 MAX.                    |
| C   | 20.1 MAX.              | 0.79 MAX.                        | S   | $3.2 + 0.13$<br>$- 0.00$  | $0.125 + 0.005$<br>$- 0.000$ |
| D   | $30.96 \pm 0.06$       | $1.218 \pm 0.002$                | T   | $2.36 + 0.06$<br>$- 0.00$ | $0.093 + 0.002$<br>$- 0.000$ |
| E   | 24 MAX.                | 0.94 MAX.                        | W   | $2.79 + 0.13$<br>$- 0.00$ | $0.110 + 0.005$<br>$- 0.000$ |
| J   | $46.0 \pm 6.4$         | $1\frac{13}{16} \pm \frac{1}{4}$ | N   | 18 MAX.                   | 0.710 MAX.                   |
| K   | 11.1 MIN.<br>12.5 MAX. | 0.437 MIN.<br>0.504 MAX.         | X   | 21.59 MIN.                | 0.850 MIN.                   |
| M   | 0.3 MAX.               | 0.012 MAX.                       | Y   | 20.32 MIN.                | 0.800 MIN.                   |

NOTE.2-BASIC FIGURES ARE INCHES.

NOTE.3-ALSO MIN. CLAMPING DIA.



# Velocity Modulated Oscillator

Code: V235A/1K (CV2221)

This is a velocity-modulated oscillator of the coaxial line type for CW operation in the frequency range 2700 to 4000 Mc/s.

## CATHODE.

Indirectly-heated, oxide-coated

|                |     |   |
|----------------|-----|---|
| Heater voltage | 6.3 | V |
|----------------|-----|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal current | 0.3 | A |
|-----------------|-----|---|

(AC frequencies above 1.5 kc/s must not be used)

## DIMENSIONS.

|                        |    |    |
|------------------------|----|----|
| Maximum overall length | 73 | mm |
|------------------------|----|----|

|                       |      |    |
|-----------------------|------|----|
| Maximum bulb diameter | 20.1 | mm |
|-----------------------|------|----|

|      |     |  |
|------|-----|--|
| Base | B7G |  |
|------|-----|--|

|            |    |   |
|------------|----|---|
| Net weight | 21 | g |
|------------|----|---|

## MOUNTING.

The valve is designed to mount by means of the resonator disc so that the antenna couples into a suitable tuning circuit.

## MAXIMUM RATINGS.

|                                                                   |    |   |
|-------------------------------------------------------------------|----|---|
| Maximum mean input power to all electrodes, other than the heater | 15 | W |
|-------------------------------------------------------------------|----|---|

|                                |    |    |
|--------------------------------|----|----|
| Maximum direct cathode current | 65 | mA |
|--------------------------------|----|----|

|                               |     |   |
|-------------------------------|-----|---|
| Maximum direct screen voltage | 400 | V |
|-------------------------------|-----|---|

|                            |     |   |
|----------------------------|-----|---|
| Maximum screen dissipation | 1.5 | W |
|----------------------------|-----|---|

Ref.: V235A/1K

## Velocity Modulated Oscillator



Code: V235A/1K (CV2221)

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### TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 2700 to 4000 Mc/s.

#### **Grid Voltage ( $V_{g1}$ )**

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes through the resonator and reaches the anode. See Figure 6 for a sketch of the electrode assembly.

#### **Resonator voltage ( $V_{res}$ )**

At 3300 Mc/s, 250 V  $\pm$  5 per cent. For other frequencies the resonator voltage is approximately proportional to the square of the frequency. See Figure 1.

#### **Screen voltage ( $V_{g2}$ )**

Zero to  $V_{res} + 50$  volts. Adjusted to obtain the appropriate value of cathode current.

#### **Screen current ( $I_{g2}$ )**

Not greater than 5 mA.

#### **Anode voltage ( $V_a$ )**

10 to 20 volts positive with respect to resonator.

#### **Output power ( $P_o$ )**

Not less than 500 mW over the frequency range 2700 to 3800 Mc/s and not less than 350 mW over the frequency range 3800 to 4000 Mc/s when operated in the tuning circuit of Figure 7, and when the load is adjusted for maximum power output. In Figure 3 power output of a typical valve is plotted as a function of frequency for a cathode input of 15 watts.



## Velocity Modulated Oscillator

Code: V235A/1K (CV2221)

### CIRCUIT.

Figure 7 shows a sketch of a suitable tuning circuit. The frequency of oscillation is a function of tuner position. Curves of tuner position as a function of frequency are plotted in Figure 2. The valve will operate satisfactorily in other types of circuit, with certain differences in performance. Further information may be obtained on application to the Chief Valve Engineer, Standard Telephones and Cables, Limited, Dowlish Ford Mills, Ilminster, Somerset.

### OUTPUT COUPLING.

The specified output power is obtainable over the entire range 2700 to 4000 Mc/s by means of a coupling loop inserted through the cylindrical wall of the circuit.

Satisfactory loading of the valve into 70 ohm coaxial cable is obtainable and it is usually necessary to make an adjustment of the loop orientation when tuning the oscillator over the frequency range. For applications where such adjustment of the loop is inadmissible, the impedance of the load must be transformed by means of an appropriate impedance matching technique.

### UNLOADED STARTING CURRENT.

The anode current at which oscillations just start, when the valve is loaded only by the circuit, is referred to as the "unloaded starting current", and serves as a useful measure of the efficiency of the tuning circuit. In Figure 4 the unloaded starting current for a typical valve is plotted as a function of frequency using the recommended circuit.

To illustrate the importance of good circuit construction a curve of power output versus the unloaded starting current of the valve circuit combination is given in Figure 5.

### MAGNET AND MAGNET ALIGNMENT.

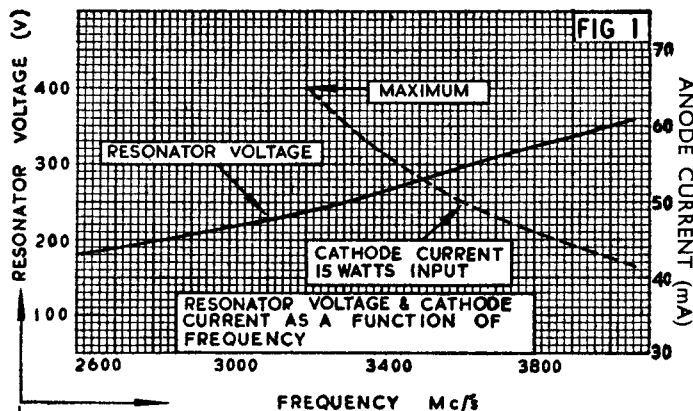
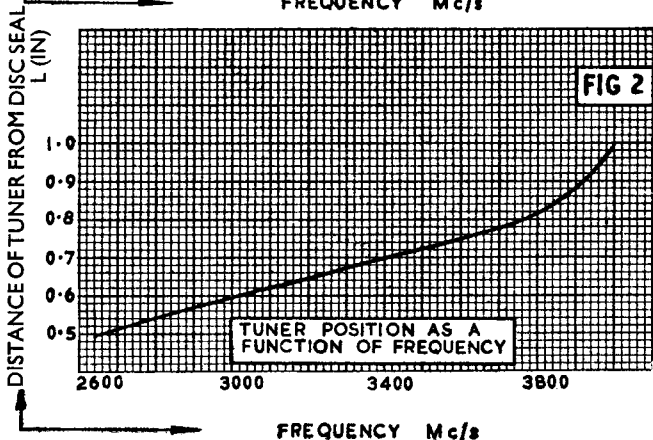
A permanent magnet is used to focus the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained. (See Figure 6.) Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.

# Velocity Modulated Oscillator



Code: V235A/1K (CV2221)

|          |  |  |
|----------|--|--|
| V235A/1K |  |  |
| VL2006-2 |  |  |

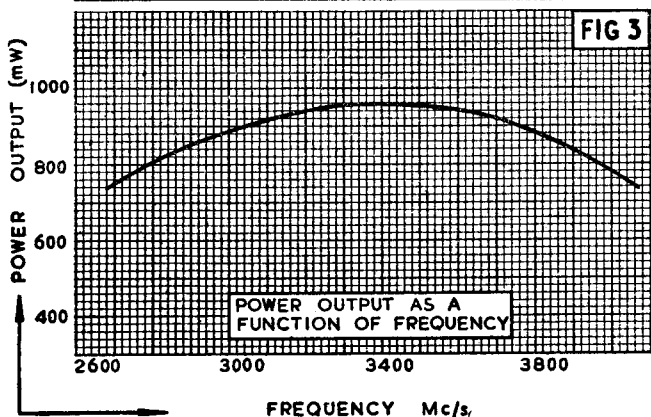
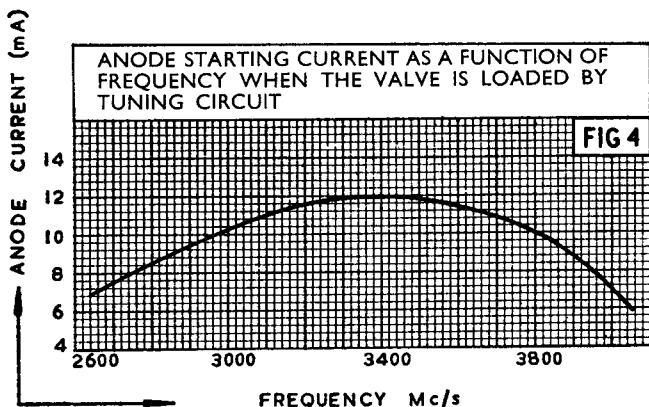




# Velocity Modulated Oscillator

Code: V235A/1K (CV2221)

|            |  |  |
|------------|--|--|
| V 235 A/1K |  |  |
| VL 2007    |  |  |

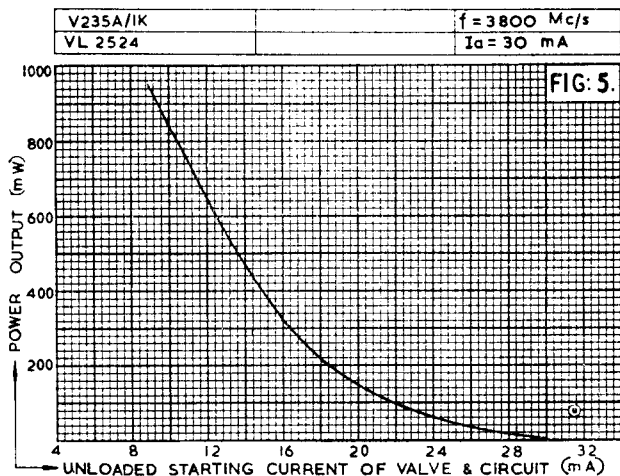


Ref.: V235A/1K

# Velocity Modulated Oscillator



Code: V235A/1K (CV2221)

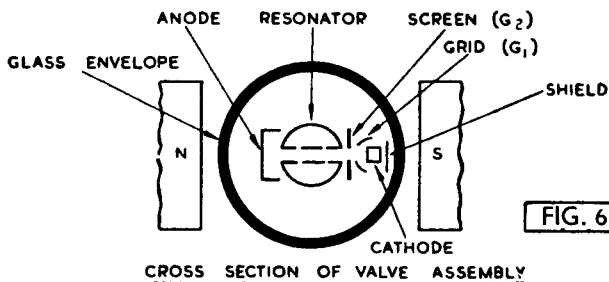
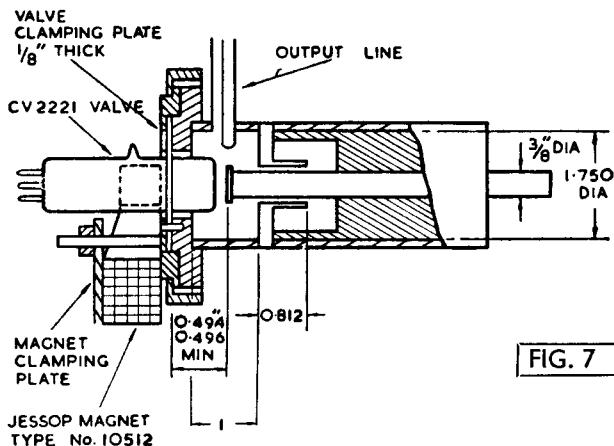






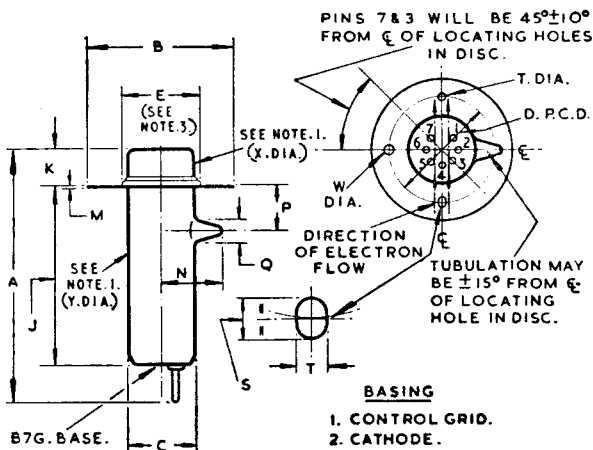
# Velocity Modulated Oscillator

Code: V235A/1K (CV2221)



# Velocity Modulated Oscillator

Code: V235A/1K (CV2221)



NOTE 1. THIS PORTION OF BULB  
WILL NOT FOUL A  
CYLINDER OF INT. DIA. SPECIFIED  
WHICH IS CONCENTRIC WITH THE PITCH  
CIRCLE OF THE LOCATING HOLES IN  
THE DISC.

## BASING

1. CONTROL GRID.
2. CATHODE.
3. HEATER.
4. HEATER.
5. ANODE.
6. RESONATOR.
7. SCREEN GRID.

| DIM | MILLIMETRES            | INCHES                   | DIM | MILLIMETRES         | INCHES                 |
|-----|------------------------|--------------------------|-----|---------------------|------------------------|
| A   | 73 MAX.                | 2 7/8 MAX.               | P   | 13.5 ± 4.0          | 0.53 ± 0.16            |
| B   | 42 MAX.                | 1.65 MAX.                | Q   | 8.5 MAX.            | 0.33 MAX.              |
| C   | 20.1 MAX.              | 0.79 MAX.                | S   | 3.2 +0.13<br>-0.00  | 0.125 +0.005<br>-0.000 |
| D   | 30.96 ± 0.06           | 1.218 ± 0.002            | T   | 2.36 +0.06<br>-0.00 | 0.093 +0.002<br>-0.000 |
| E   | 24 MAX.                | 0.94 MAX.                | W   | 2.79 +0.13<br>-0.00 | 0.110 +0.005<br>-0.000 |
| J   | 46.0 ± 6.4             | 1 13/16 ± 1/4            | N   | 18 MAX.             | 0.710 MAX.             |
| K   | 11.1 MIN.<br>12.5 MAX. | 0.437 MIN.<br>0.504 MAX. | X   | 21.59 MIN.          | 0.850 MIN.             |
| M   | 0.3 MAX.               | 0.012 MAX.               | Y   | 20.32 MIN.          | 0.800 MIN.             |

NOTE 2-BASIC FIGURES ARE INCHES.

NOTE 3-ALSO MIN. CLAMPING DIA.



# Velocity-Modulated Oscillator

Code : V237C/1K

The V237C/1K is a low voltage coaxial-line V.M. oscillator capable of being frequency modulated for operation in the frequency range 3 560–3 820 Mc/s. It is one of a series of three (V239C/1K and V241C/1K) to provide complete coverage of the 3 600–4 200 Mc/s communication band.

## CATHODE.

Indirectly-heated, oxide-coated

|                 |      |   |
|-----------------|------|---|
| Heater voltage  | 6.3  | V |
| Nominal current | 0.26 | A |

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 80   | mm |
| Maximum bulb diameter  | 20.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 22   | g  |

## MOUNTING.

This valve is designed to mount by means of the resonator disc so that the antenna couples with a suitable tuned circuit.

## MAXIMUM RATINGS.

|                                                                  |     |    |
|------------------------------------------------------------------|-----|----|
| Maximum mean input power to all electrodes other than the heater | 15  | W  |
| Maximum direct cathode current                                   | 65  | mA |
| Maximum direct screen voltage                                    | 400 | V  |
| Maximum direct screen dissipation                                | 1.5 | W  |

# Velocity-Modulated Oscillator



Code : V237C/1K

## TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 3 560 to 3 820 Mc/s.

### Grid Voltage ( $V_{g1}$ )

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes the resonator and reaches the anode. See Figure 3 for a sketch of the electrode assembly.

### Screen Voltage ( $V_{g2}$ )

Adjusted to give an anode current of 35 mA and should be varied during the valve life so as to maintain the anode current at a constant value. Where the valve is to be used in unattended equipment it is recommended that this variation be made automatically.

A typical value of screen voltage is 120 volts.

### Screen Current ( $I_{g2}$ )

This will not be greater than 5 mA provided that the screen voltage does not exceed the resonator voltage.

### Resonator Voltage ( $V_{res}$ )

This should be adjusted to give maximum power output and varies between 225 and 285 volts over the mechanical tuning band.

### Anode Voltage ( $V_a$ )

This is kept constant throughout the tuning band at 300 volts.

## PERFORMANCE.

|                                                                                                  |                    |      |
|--------------------------------------------------------------------------------------------------|--------------------|------|
| Power output, minimum                                                                            | 350                | mW   |
| Variation of output with frequency over the specified tuning range                               | less than 3        | db   |
| Electronic tuning range, between half power points                                               | $\pm 4$ to $\pm 7$ | Mc/s |
| Mechanical tuning by variation of length $L_c$                                                   | 3 560 to 3 820     | Mc/s |
| Typical curves of power output and circuit length versus frequency are shown on Figures 1 and 2. |                    |      |



## Velocity-Modulated Oscillator

Code : V237C/1K

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### MODULATION.

Frequency modulation is obtained by variation of the resonator voltage. The figures for electronic tuning range are those for the valve loaded so as to give maximum output power and the modulation sensitivity under these conditions is between 0.2 and 0.4 Mc/s per volt. If the loading on the valve is reduced the electronic tuning range will be increased somewhat but the sensitivity will be reduced. The change in slope of the characteristic will be about 10 per cent for a deviation of about 60 to 70 per cent of the half power value.

The input capacitance when using the circuit shown in Figure 4 is between 20 and 30 pF.

### THERMAL DRIFT AND STABILITY.

The total thermal drift from cold to the final operating frequency is between 7 and 10 Mc/s and is completed in about 5 minutes.

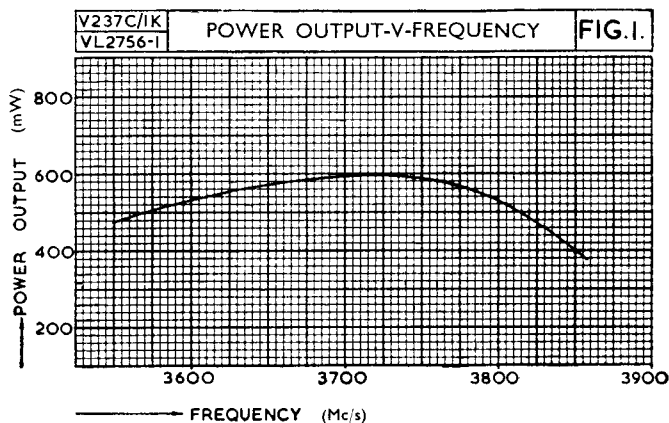
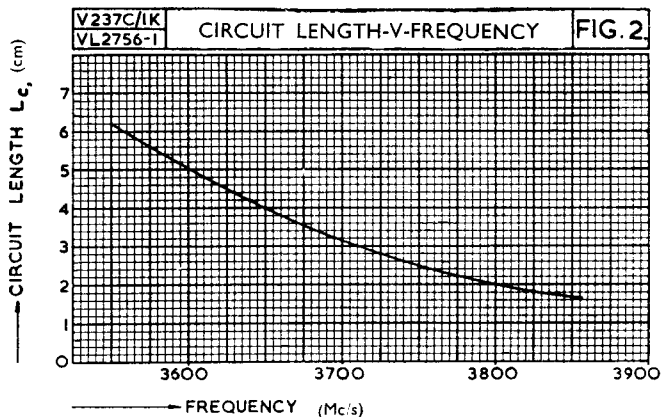
The frequency change with ambient temperature is about 50 kc/s per degree centigrade.

### MAGNET AND MAGNET ALIGNMENT.

A permanent magnet is used to form the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1 200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 3). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.

# Velocity-Modulated Oscillator

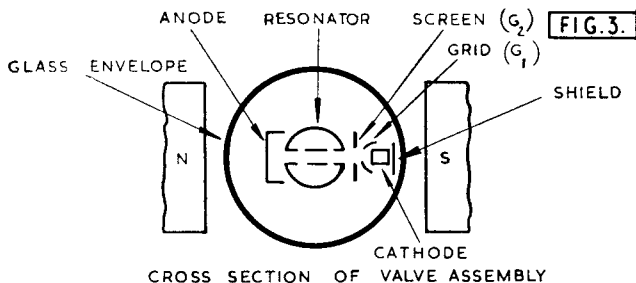
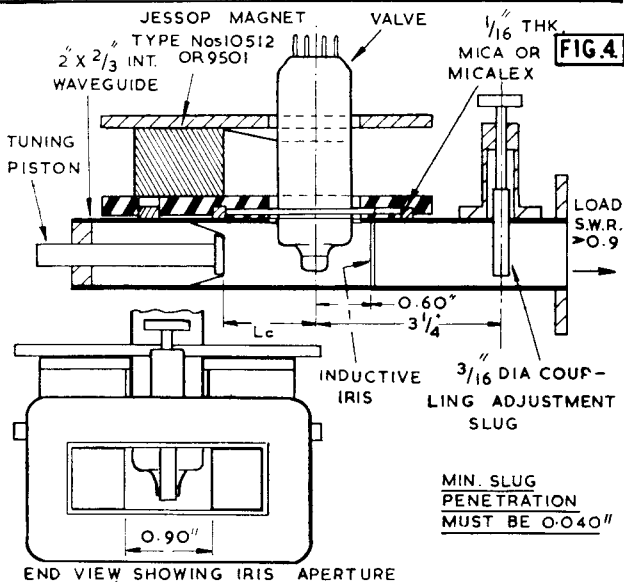
Code : V237C/1K





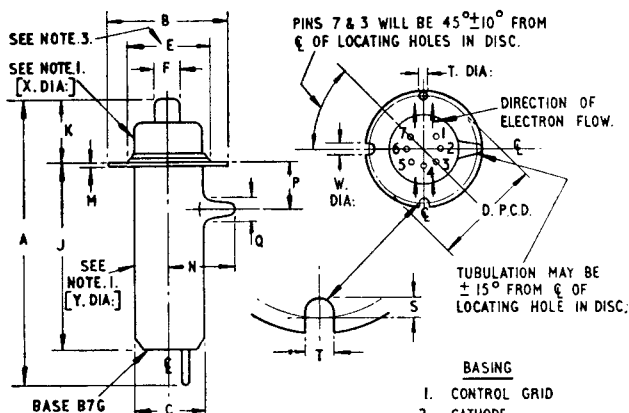
# Velocity-Modulated Oscillator

Code : V237C/1K



# Velocity-Modulated Oscillator

Code : V237C/1K



NOTE. 1. THIS PORTION OF BULB WILL NOT FOUL A CYLINDER OF INT. DIA: SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN DISC.

NOTE. 2. BASIC FIGURES ARE INCHES.

NOTE. 3. ALSO MIN; CLAMPING DIA:

| DIM: | MILLIMETRES      | INCHES            | DIM: | MILLIMETRES                                                   | INCHES                                                           |
|------|------------------|-------------------|------|---------------------------------------------------------------|------------------------------------------------------------------|
| A    | 80 MAX:          | 3.15 MAX:         | P    | 13.5 $\pm$ 4.0                                                | 0.53 $\pm$ 0.16                                                  |
| B    | 31.75 MAX:       | 1 1/4 MAX:        | Q    | 8.5 MAX:                                                      | 0.33 MAX:                                                        |
| C    | 20.1 MAX:        | 0.79 MAX:         | S    | 1.6 $\begin{smallmatrix} + 0.13 \\ - 0.00 \end{smallmatrix}$  | 0.062 $\begin{smallmatrix} + 0.005 \\ - 0.000 \end{smallmatrix}$ |
| D    | 30.96 $\pm$ 0.06 | 1.218 $\pm$ 0.002 | T    | 2.36 $\begin{smallmatrix} + 0.06 \\ - 0.00 \end{smallmatrix}$ | 0.093 $\begin{smallmatrix} + 0.002 \\ - 0.000 \end{smallmatrix}$ |
| E    | 24 MAX:          | 0.94 MAX:         | W    | 2.79 $\begin{smallmatrix} + 0.13 \\ - 0.00 \end{smallmatrix}$ | 0.110 $\begin{smallmatrix} + 0.005 \\ - 0.000 \end{smallmatrix}$ |
| F    | 8.12 MAX:        | 0.320 MAX:        | X    | 21.59 MIN:                                                    | 0.850 MIN:                                                       |
| J    | 56 MAX:          | 2.2 MAX:          | Y    | 20.32 MIN:                                                    | 0.800 MIN:                                                       |
| K    | 16.5 MAX:        | 0.65 MAX:         |      |                                                               |                                                                  |
| M    | 0.3 MAX:         | 0.012 MAX:        |      |                                                               |                                                                  |
| N    | 18 MAX:          | 0.710 MAX:        |      |                                                               |                                                                  |





# Velocity-Modulated Oscillator

Code : V239C/1K

The V239C/1K is a low voltage coaxial-line V.M. oscillator capable of being frequency modulated for operation in the frequency range 3 780–4 040 Mc/s. It is one of a series of three (V237C/1K and V241C/1K) to provide complete coverage of the 3 600–4 200 Mc/s communication band.

## CATHODE.

Indirectly-heated, oxide-coated

|                 |      |   |
|-----------------|------|---|
| Heater voltage  | 6.3  | V |
| Nominal current | 0.26 | A |

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 80   | mm |
| Maximum bulb diameter  | 20.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 22   | g  |

## MOUNTING.

This valve is designed to mount by means of the resonator disc so that the antenna couples with a suitable tuned circuit.

## MAXIMUM RATINGS.

|                                                                  |     |    |
|------------------------------------------------------------------|-----|----|
| Maximum mean input power to all electrodes other than the heater | 15  | W  |
| Maximum direct cathode current                                   | 65  | mA |
| Maximum direct screen voltage                                    | 400 | V  |
| Maximum direct screen dissipation                                | 1.5 | W  |

# Velocity-Modulated Oscillator



Code : V239C/1K

## TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 3 780 to 4 040 Mc/s.

### Grid Voltage ( $V_{g1}$ )

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes the resonator and reaches the anode. See Figure 3 for a sketch of the electrode assembly.

### Screen Voltage ( $V_{g2}$ )

Adjusted to give an anode current of 35 mA and should be varied during the valve life so as to maintain the anode current at a constant value. Where the valve is to be used in unattended equipment it is recommended that this variation be made automatically.

A typical value of screen voltage is 120 volts.

### Screen Current ( $I_{g2}$ )

This will not be greater than 5 mA provided that the screen voltage does not exceed the resonator voltage.

### Resonator Voltage ( $V_{res}$ )

This should be adjusted to give maximum power output and varies between 230 and 280 volts over the mechanical tuning band.

### Anode Voltage ( $V_a$ )

This is kept constant throughout the tuning band at 300 volts.

## PERFORMANCE.

|                                                                    |                    |      |
|--------------------------------------------------------------------|--------------------|------|
| Power output, minimum                                              | 350                | mW   |
| Variation of output with frequency over the specified tuning range | less than 3        | db   |
| Electronic tuning range, between half power points                 | $\pm 4$ to $\pm 7$ | Mc/s |
| Mechanical tuning by variation of length $L_c$                     | 3 780 to 4 040     | Mc/s |

Typical curves of power output and circuit length versus frequency are shown on Figures 1 and 2.



## Velocity-Modulated Oscillator

Code : V239C/1K

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### MODULATION.

Frequency modulation is obtained by variation of the resonator voltage. The figures for electronic tuning range are those for the valve loaded so as to give maximum output power and the modulation sensitivity under these conditions is between 0.2 and 0.4 Mc/s per volt. If the loading on the valve is reduced the electronic tuning range will be increased somewhat but the sensitivity will be reduced. The change in slope of the characteristic will be about 10 per cent for a deviation of about 60 to 70 per cent of the half power value.

The input capacitance when using the circuit shown in Figure 4 is between 20 and 30 pF.

### THERMAL DRIFT AND STABILITY.

The total thermal drift from cold to the final operating frequency is between 7 and 10 Mc/s and is completed in about 5 minutes.

The frequency change with ambient temperature is about 50 kc/s per degree centigrade.

### MAGNET AND MAGNET ALIGNMENT.

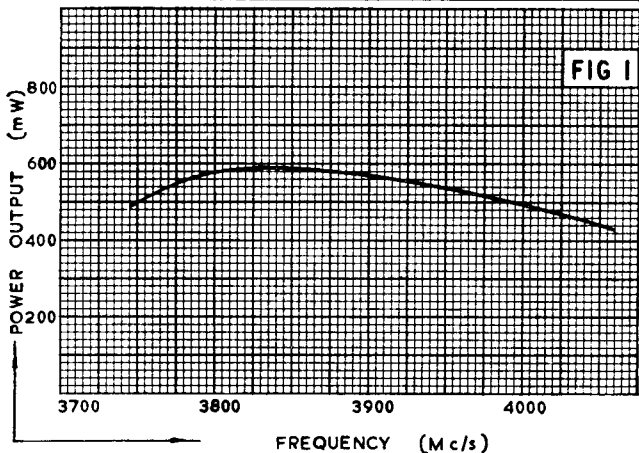
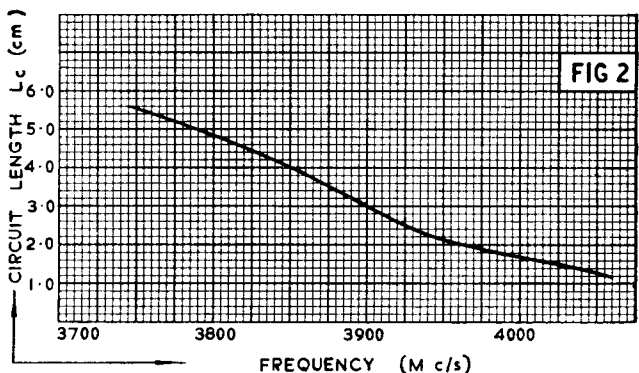
A permanent magnet is used to form the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1 200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 3). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.

# Velocity-Modulated Oscillator

Code : V239C/1K



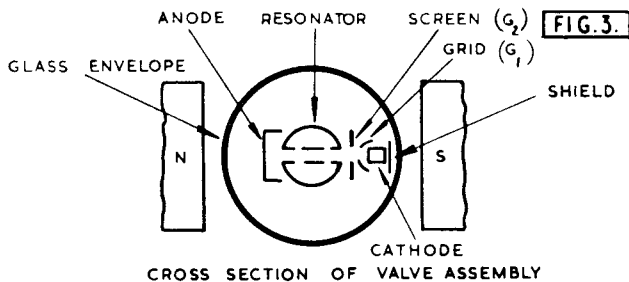
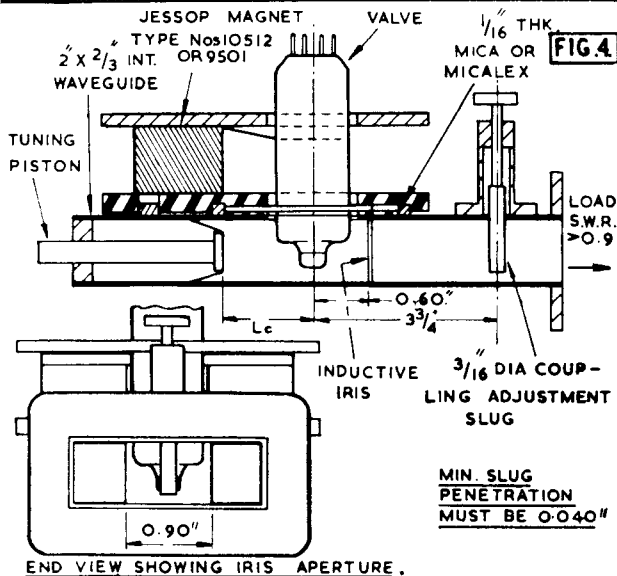
|          |  |  |
|----------|--|--|
| V239C/1K |  |  |
| VL2515   |  |  |





# Velocity-Modulated Oscillator

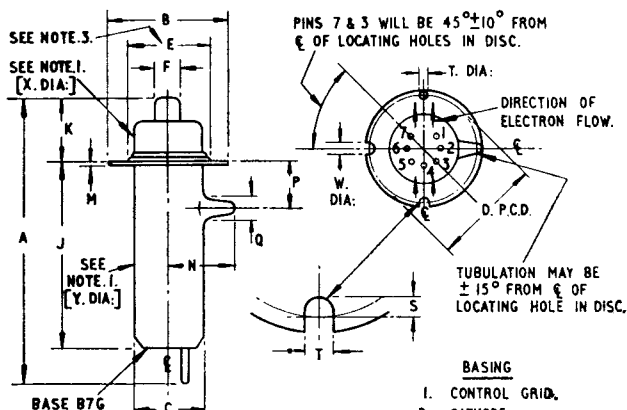
Code : V239C/1K



## Velocity-Modulated Oscillator



**Code : V239C/1K**



NOTE. 1. THIS PORTION OF BULB WILL NOT FOUL A CYLINDER OF INT: DIA: SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN DISC.

NOTE. 2. BASIC FIGURES ARE INCHES.

NOTE 3. ALSO MIN: CLAMPING DIA.

## BASING

1. CONTROL GRID.
2. CATHODE.
3. HEATER.
4. HEATER.
5. ANODE.
6. RESONATOR.
7. SCREEN GRID.

| DIM. | MILLIMETRES  | INCHES        | DIM. | MILLIMETRES           | INCHES                   |
|------|--------------|---------------|------|-----------------------|--------------------------|
| A    | 80 MAX:      | 3.15 MAX:     | P    | 13.5 ± 4.0            | 0.53 ± 0.16              |
| B    | 31.75 MAX:   | 1 1/4 MAX:    | Q    | 8.5 MAX:              | 0.33 MAX:                |
| C    | 20.1 MAX:    | 0.79 MAX:     | S    | 1.6 + 0.13<br>- 0.00  | 0.062 + 0.005<br>- 0.000 |
| D    | 30.96 ± 0.06 | 1.218 ± 0.002 |      |                       |                          |
| E    | 24 MAX:      | 0.94 MAX:     | T    | 2.36 + 0.06<br>- 0.00 | 0.093 + 0.002<br>- 0.000 |
| F    | 8.12 MAX:    | 0.320 MAX:    |      |                       |                          |
| J    | 56 MAX:      | 2.2 MAX:      | W    | 2.79 + 0.13<br>- 0.00 | 0.110 + 0.005<br>- 0.000 |
| K    | 16.5 MAX:    | 0.65 MAX:     |      |                       |                          |
| M    | 0.3 MAX:     | 0.012 MAX:    | X    | 21.59 MIN:            | 0.850 MIN:               |
| N    | 18 MAX:      | 0.710 MAX:    | Y    | 20.32 MIN:            | 0.800 MIN:               |



# Velocity Modulated Oscillators

Ref.: V240C/1K  
V240C/2K

Code: V240C/1K  
V240C/2K (CV2189)

These valves are low voltage coaxial type V.M. Oscillators capable of being frequency modulated. They have sufficient mechanical tuning to cover the necessary carrier frequency variations between sections in a radio link with a mid-band frequency of 4050 and 4000 Mc/s respectively.

## CATHODE.

Indirectly-heated, oxide-coated

|                 |      |   |
|-----------------|------|---|
| Heater voltage  | 6.3  | V |
| Nominal current | 0.26 | A |

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 80   | mm |
| Maximum bulb diameter  | 20.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 22   | g  |

## MOUNTING.

These valves are designed to mount by means of the resonator disc so that the antenna couples with a suitable tuned circuit.

## MAXIMUM RATINGS.

|                                                                     |     |    |
|---------------------------------------------------------------------|-----|----|
| Maximum mean input power to all electrodes<br>other than the heater | 18  | W  |
| Maximum direct cathode current                                      | 65  | mA |
| Maximum direct screen voltage                                       | 400 | V  |
| Maximum direct screen dissipation                                   | 1.5 | W  |

Ref.: V240C/1K  
V240C/2K

## Velocity Modulated Oscillators

Code: V240C/1K  
V240C/2K (CV2189)



### TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 4000 to 4100 Mc/s (V240C/1K)  
3950 to 4050 Mc/s (V240C/2K)

#### Grid voltage ( $V_{g1}$ )

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes the resonator and reaches the anode. See Figure 3 for a sketch of the electrode assembly.

#### Screen voltage ( $V_{g2}$ )

Adjusted to give an anode current of 35 mA and should be varied during the valve life so as to maintain the anode current at a constant value. Where the valve is to be used in unattended equipment it is recommended that this variation be made automatically.

A typical value of screen voltage is 120 volts.

#### Screen current ( $I_{g2}$ )

This will not be greater than 5 mA provided that the screen voltage does not exceed the resonator voltage.

#### Resonator voltage ( $V_{res}$ )

This should be adjusted to give maximum power output and varies between 250 and 280 volts for the V240C/1K, and between 240 and 270 for the V240C/2K over the mechanical tuning band.

#### Anode voltage ( $V_a$ )

This is kept constant throughout the tuning band at 300 volts.





# Velocity Modulated Oscillators

Ref.: V240C/1K  
V240C/2K

Code: V240C/1K  
V240C/2K (CV2189)

## PERFORMANCE.

These valves should be operated in a tuning circuit as shown in Figure 4 with the coupling slug and the resonator voltage adjusted for maximum power output. With the operating conditions as specified the following performance should be obtained.

|                       |     |    |
|-----------------------|-----|----|
| Power output, minimum | 350 | mW |
|-----------------------|-----|----|

|                                                                    |             |    |
|--------------------------------------------------------------------|-------------|----|
| Variation of output with frequency over the specified tuning range | less than 3 | db |
|--------------------------------------------------------------------|-------------|----|

|                                                    |                     |      |
|----------------------------------------------------|---------------------|------|
| Electronic tuning range, between half power points | $\pm 7$ to $\pm 10$ | Mc/s |
|----------------------------------------------------|---------------------|------|

|                                                |                  |      |
|------------------------------------------------|------------------|------|
| Mechanical tuning by variation of length $L_c$ | $\pm 50$ minimum | Mc/s |
|------------------------------------------------|------------------|------|

|                                                                                      |         |      |
|--------------------------------------------------------------------------------------|---------|------|
| Rate of change of frequency with mechanical tuning, per mm change of piston position | 3 to 12 | Mc/s |
|--------------------------------------------------------------------------------------|---------|------|

Typical curves of power output and electronic tuning range versus frequency are shown on Figures 1 and 2 (Sheet 5).

## MODULATION.

Frequency modulation is obtained by variation of the resonator voltage. The figures for electronic tuning range are those for the valve loaded so as to give maximum output power and the modulation sensitivity under these conditions is between 0.2 and 0.4 Mc/s per volt. If the loading on the valve is reduced the electronic tuning range will be increased somewhat but the sensitivity will be reduced. The change in slope of the characteristic will be about 10 per cent for a deviation of about 60 to 70 per cent of the half power value.

Distortion components for small deviations ( $< \pm 2$  Mc/s) at the correct resonator voltage will be about 50 db down on the fundamental.

The input capacitance when using the circuit shown in Figure 4 is between 20 and 30 pF.

Ref.: V240C/1K  
V240C/2K

## Velocity Modulated Oscillators

Code: V240C/1K  
V240C/2K (CV2189)



### THERMAL DRIFT AND STABILITY.

The total thermal drift from cold to the final operating frequency is between 7 and 10 Mc/s and is completed in about 5 minutes.

The frequency change with ambient temperature is about 50 kc/s per degree centigrade.

### MAGNET AND MAGNET ALIGNMENT.

A permanent magnet is used to form the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 3). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.

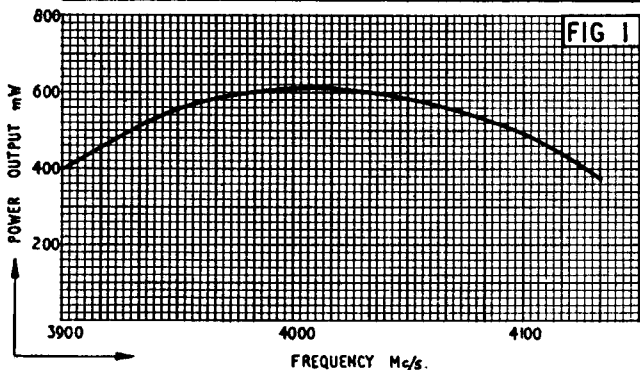
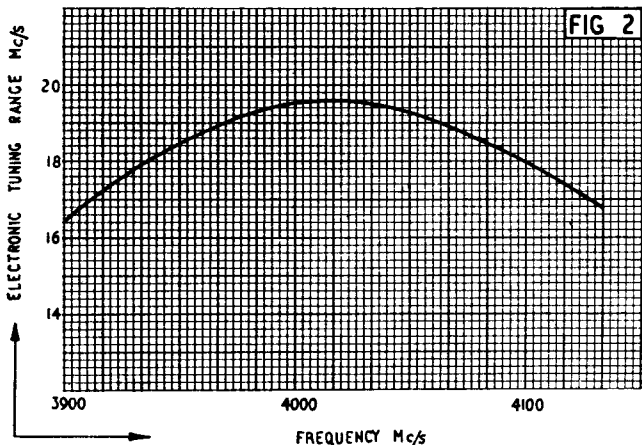


# Velocity Modulated Oscillators

Ref.: V240C/1K  
V240C/2K

Code: V240C/1K  
V240C/2K (CV2189)

|                     |  |  |
|---------------------|--|--|
| V240C/1K & V240C/2K |  |  |
| VL 2019             |  |  |



Tentative data.  
February 1955

V240C/1K }  
V240C/2K } —5

Ref.: V240C/1K  
V240C/2K

# Velocity Modulated Oscillators

Code : V240C/1K  
V240C/2K (CV2189)

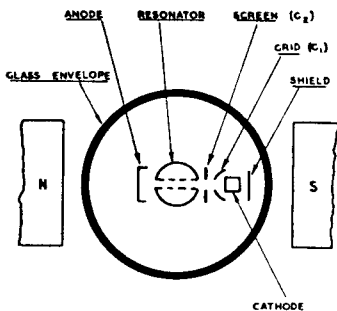


FIG 3

CROSS SECTION OF VALVE ASSEMBLY

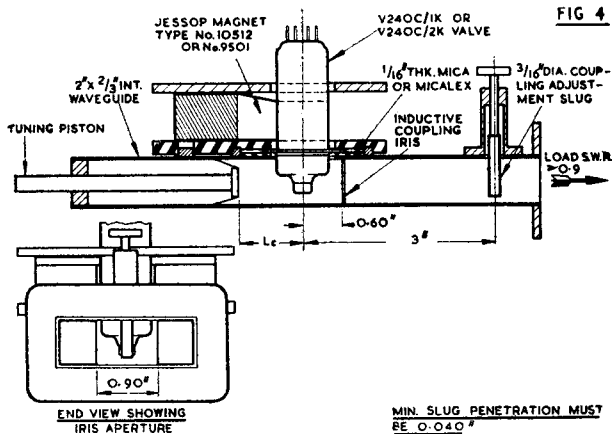


FIG 4

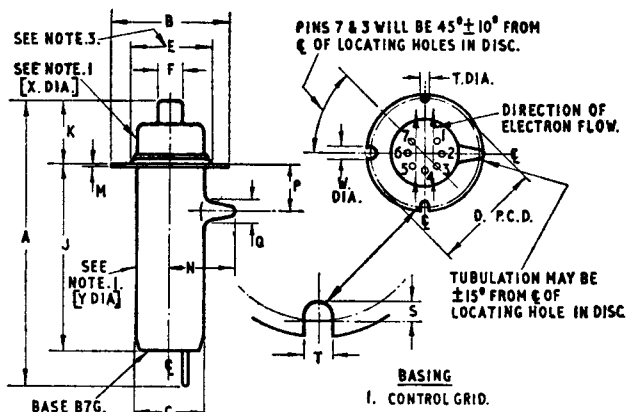
MIN. SLUG PENETRATION MUST  
BE 0.040"



# Velocity Modulated Oscillators

Ref. : V240C/1K  
V240C/2K

Code : V240C/1K  
V240C/2K (CV2189)



NOTE 1. THIS PORTION OF BULB WILL NOT FOUL A CYLINDER OF INT. DIA. SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN DISC.

NOTE 2. BASIC FIGURES ARE INCHES.

NOTE 3. ALSO MIN. CLAMPING DIA.

| DIM. | MILLIMETRES      | INCHES            | DIM. | MILLIMETRES               | INCHES                       |
|------|------------------|-------------------|------|---------------------------|------------------------------|
| A    | 80 MAX.          | 3.15 MAX.         | P    | $13.5 \pm 4.0$            | $0.53 \pm 0.16$              |
| B    | 31.75 MAX.       | 1 1/4 MAX.        | Q    | 8.5 MAX.                  | 0.33 MAX.                    |
| C    | 20.1 MAX.        | 0.79 MAX.         | S    | $1.6 + 0.13$<br>$- 0.00$  | $0.062 + 0.005$<br>$- 0.000$ |
| D    | $30.96 \pm 0.06$ | $1.218 \pm 0.002$ | T    | $2.36 + 0.06$<br>$- 0.00$ | $0.093 + 0.002$<br>$- 0.000$ |
| E    | 24 MAX.          | 0.94 MAX.         | W    | $2.79 + 0.13$<br>$- 0.00$ | $0.110 + 0.005$<br>$- 0.000$ |
| F    | 8.12 MAX.        | 0.320 MAX.        | X    | 21.59 MIN.                | 0.850 MIN.                   |
| J    | 56 MAX.          | 2.2 MAX.          | Y    | 20.32 MIN.                | 0.800 MIN.                   |
| K    | 16.5 MAX.        | 0.65 MAX.         |      |                           |                              |
| M    | 0.3 MAX.         | 0.012 MAX.        |      |                           |                              |
| N    | 18 MAX.          | 0.710 MAX.        |      |                           |                              |



# Velocity-Modulated Oscillator

Code : V241C/1K

The V241C/1K is a low voltage coaxial-line V.M. oscillator capable of being frequency modulated for operation in the frequency range 4 000–4 240 Mc/s. It is one of a series of three (V237C/1K and V239C/1K) to provide complete coverage of the 3 600–4 200 Mc/s communication band.

## CATHODE.

Indirectly-heated, oxide-coated

|                 |      |   |
|-----------------|------|---|
| Heater voltage  | 6.3  | V |
| Nominal current | 0.26 | A |

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 80   | mm |
| Maximum bulb diameter  | 20.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 22   | g  |

## MOUNTING.

This valve is designed to mount by means of the resonator disc so that the antenna couples with a suitable tuned circuit.

## MAXIMUM RATINGS.

|                                                                  |     |    |
|------------------------------------------------------------------|-----|----|
| Maximum mean input power to all electrodes other than the heater | 15  | W  |
| Maximum direct cathode current                                   | 65  | mA |
| Maximum direct screen voltage                                    | 400 | V  |
| Maximum direct screen dissipation                                | 1.5 | W  |

# Velocity-Modulated Oscillator



Code : V241C/1K

## TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 4 000 to 4 240 Mc/s.

### Grid Voltage ( $V_{g1}$ )

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes the resonator and reaches the anode. See Figure 3 for a sketch of the electrode assembly.

### Screen Voltage ( $V_{g2}$ )

Adjusted to give an anode current of 35 mA and should be varied during the valve life so as to maintain the anode current at a constant value. Where the valve is to be used in unattended equipment it is recommended that this variation be made automatically.

A typical value of screen voltage is 120 volts.

### Screen Current ( $I_{g2}$ )

This will not be greater than 5 mA provided that the screen voltage does not exceed the resonator voltage.

### Resonator Voltage ( $V_{res}$ )

This should be adjusted to give maximum power output and varies between 230 and 285 volts over the mechanical tuning band.

### Anode Voltage ( $V_a$ )

This is kept constant throughout the tuning band at 300 volts.

## PERFORMANCE.

|                                                                    |                    |      |
|--------------------------------------------------------------------|--------------------|------|
| Power output, minimum                                              | 350                | mW   |
| Variation of output with frequency over the specified tuning range | less than 3        | db   |
| Electronic tuning range, between half power points                 | $\pm 4$ to $\pm 7$ | Mc/s |
| Mechanical tuning by variation of length $L_c$                     | 4 000 to 4 240     | Mc/s |

Typical curves of power output and circuit length versus frequency are shown on Figures 1 and 2.



## Velocity-Modulated Oscillator

Code : V241C/1K

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### MODULATION.

Frequency modulation is obtained by variation of the resonator voltage. The figures for electronic tuning range are those for the valve loaded so as to give maximum output power and the modulation sensitivity under these conditions is between 0.2 and 0.4 Mc/s per volt. If the loading on the valve is reduced the electronic tuning range will be increased somewhat but the sensitivity will be reduced. The change in slope of the characteristic will be about 10 per cent for a deviation of about 60 to 70 per cent of the half power value.

The input capacitance when using the circuit shown in Figure 4 is between 20 and 30 pF.

### THERMAL DRIFT AND STABILITY.

The total thermal drift from cold to the final operating frequency is between 7 and 10 Mc/s and is completed in about 5 minutes.

The frequency change with ambient temperature is about 50 kc/s per degree centigrade.

### MAGNET AND MAGNET ALIGNMENT.

A permanent magnet is used to form the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1 200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 3). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.

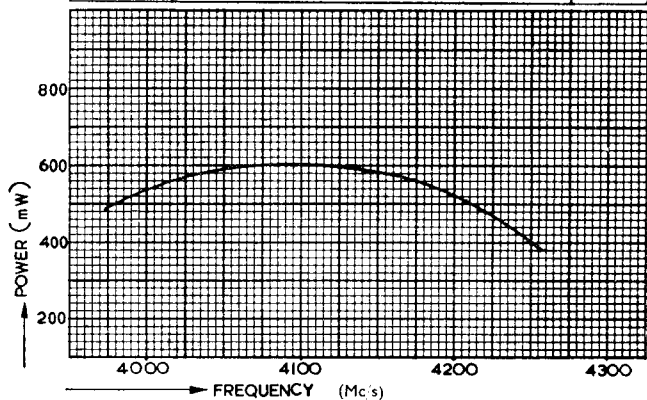


# Velocity-Modulated Oscillator

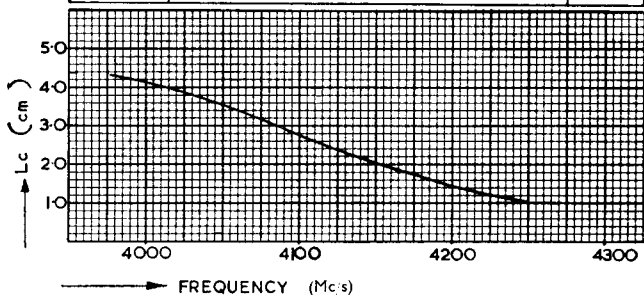


Code : V241C/1K

|          |                          |         |
|----------|--------------------------|---------|
| V241C/1K | POWER OUTPUT-V-FREQUENCY | FIG: 1. |
| VL2716-1 |                          |         |



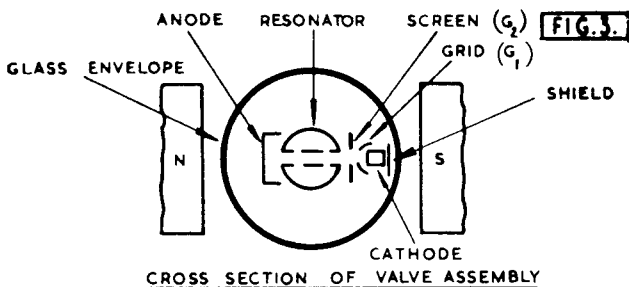
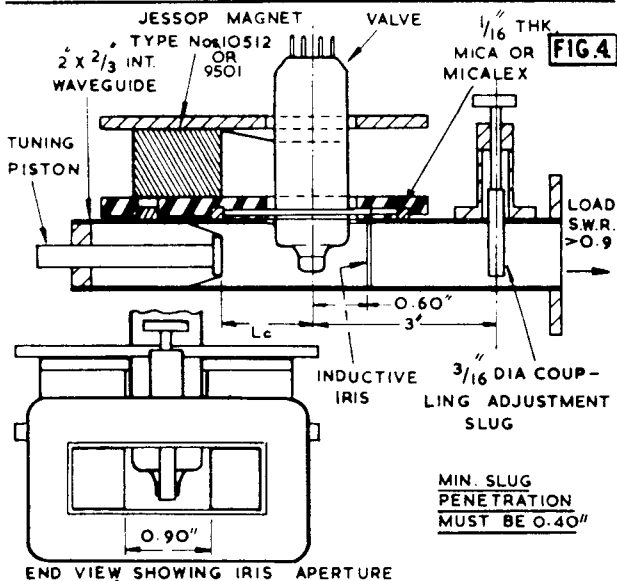
|          |                            |         |
|----------|----------------------------|---------|
| V241C/1K | CIRCUIT LENGTH-V-FREQUENCY | FIG: 2. |
| VL2716-1 |                            |         |





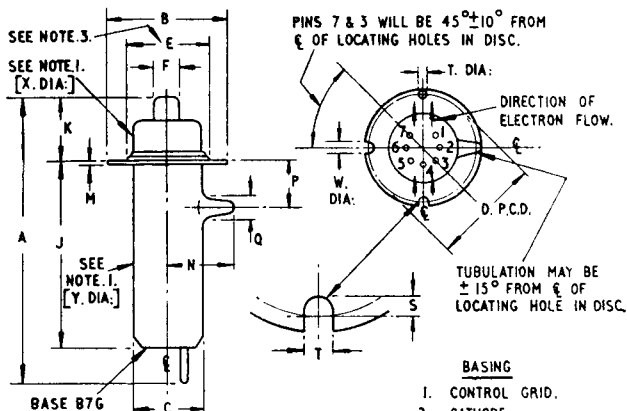
# Velocity-Modulated Oscillator

Code : V241C/1K



# Velocity-Modulated Oscillator

Code : V241C/1K



NOTE 1. THIS PORTION OF BULB WILL NOT FOUL A CYLINDER OF INT. DIA. SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN DISC.

NOTE 2. BASIC FIGURES ARE INCHES.

NOTE 3. ALSO MIN. CLAMPING DIA.

| DIM. | MILLIMETRES      | INCHES            | DIM. | MILLIMETRES               | INCHES                       |
|------|------------------|-------------------|------|---------------------------|------------------------------|
| A    | 80 MAX.          | 3.15 MAX.         | P    | $13.5 \pm 4.0$            | $0.53 \pm 0.16$              |
| B    | 31.75 MAX.       | 1 1/4 MAX.        | Q    | 8.5 MAX.                  | 0.33 MAX.                    |
| C    | 20.1 MAX.        | 0.79 MAX.         | S    | $1.6 + 0.13$<br>$- 0.00$  | $0.062 + 0.005$<br>$- 0.000$ |
| D    | $30.96 \pm 0.06$ | $1.218 \pm 0.002$ | T    | $2.36 + 0.06$<br>$- 0.00$ | $0.093 + 0.002$<br>$- 0.000$ |
| E    | 24 MAX.          | 0.94 MAX.         | W    | $2.79 + 0.13$<br>$- 0.00$ | $0.110 + 0.005$<br>$- 0.000$ |
| F    | 8.12 MAX.        | 0.320 MAX.        | X    | 21.59 MIN.                | 0.850 MIN.                   |
| J    | 56 MAX.          | 2.2 MAX.          | Y    | 20.32 MIN.                | 0.800 MIN.                   |
| K    | 16.5 MAX.        | 0.65 MAX.         |      |                           |                              |
| M    | 0.3 MAX.         | 0.012 MAX.        |      |                           |                              |
| N    | 18 MAX.          | 0.710 MAX.        |      |                           |                              |



# Velocity Modulated Oscillator

Code: V245C/1K

This valve is a low-voltage coaxial-type V.M. oscillator for the frequency range 4 400 to 4 630 Mc/s capable of being frequency modulated.

## CATHODE.

Indirectly-heated, oxide-coated

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 6.3 | V |
| Nominal current | 0.3 | A |

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 80   | mm |
| Maximum bulb diameter  | 20.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 22   | g  |

## MOUNTING.

This valve is designed to mount by means of the resonator disc so that the antenna couples with a suitable tuned circuit.

## MAXIMUM RATINGS.

|                                                                     |     |    |
|---------------------------------------------------------------------|-----|----|
| Maximum mean input power to all<br>electrodes other than the heater | 15  | W  |
| Maximum direct cathode current                                      | 65  | mA |
| Maximum direct screen voltage                                       | 400 | V  |
| Maximum direct screen dissipation                                   | 1.5 | W  |

# Velocity Modulated Oscillator

Code: V245C/1K



## TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 4 400 to 4 630 Mc/s.

### Grid Voltage ( $V_{g1}$ )

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes the resonator and reaches the anode. See Figure 4 for a sketch of the electrode assembly.

### Screen Voltage ( $V_{g2}$ )

Adjusted to give a cathode current of 50 mA and should be varied during the valve life so as to maintain the cathode current at a constant value. Where the valve is to be used in unattended equipment, it is recommended that this variation be made automatically. The anode current should be between 33 and 40 mA.

A typical value of screen voltage is 120 volts.

### Screen Current ( $I_{g2}$ )

This will not be greater than 5 mA provided that the screen voltage does not exceed the resonator voltage.

### Resonator Voltage ( $V_{res}$ )

This should be adjusted to give maximum power output and varies between 220 and 260 volts over the mechanical tuning band.

### Anode Voltage ( $V_a$ )

This is kept constant throughout the tuning band at 300 volts.



# Velocity Modulated Oscillator

Code: V245C/1K

## PERFORMANCE.

This valve should be operated in a tuning circuit as shown in Figure 5 with the coupling slug and the resonator voltage adjusted for maximum power output. With the operating conditions as specified, the following performance should be obtained.

|                                                                                                                              |           |      |
|------------------------------------------------------------------------------------------------------------------------------|-----------|------|
| Power output, minimum                                                                                                        | 200       | mW   |
| Variation of output with frequency over the specified tuning range less than                                                 | 3         | db   |
| Electronic tuning range, between half power points, minimum                                                                  | $\pm 8.5$ | Mc/s |
| Typical curves of power output, electronic tuning range and circuit length versus frequency are shown on Figures 1, 2 and 3. |           |      |

## MODULATION.

Frequency modulation is obtained by variation of the resonator voltage. The figures for electronic tuning range are those for the valve loaded so as to give maximum output power and the modulation sensitivity under these conditions is between 0.4 and 0.6 Mc/s per volt. If the loading on the valve is reduced, the electronic tuning range will be increased somewhat but the sensitivity will be reduced. The change in slope of the characteristic will be about 10 per cent for a deviation of about 60 to 70 per cent of the half power value.

Distortion components for small deviations (less than  $\pm 2$  Mc/s) at the correct resonator voltage will be about 50 db down on the fundamental.

The input capacitance when using the circuit shown in Figure 5 is between 20 and 30 pF.

# Velocity Modulated Oscillator

Code: V245C/1K



## THERMAL DRIFT AND STABILITY.

The total thermal drift from cold to the final operating frequency is between 7 and 10 Mc/s and is completed in about five minutes.

The frequency change with ambient temperature is about 50 Kc/s per degree Centigrade.

## MAGNET AND MAGNET ALIGNMENT

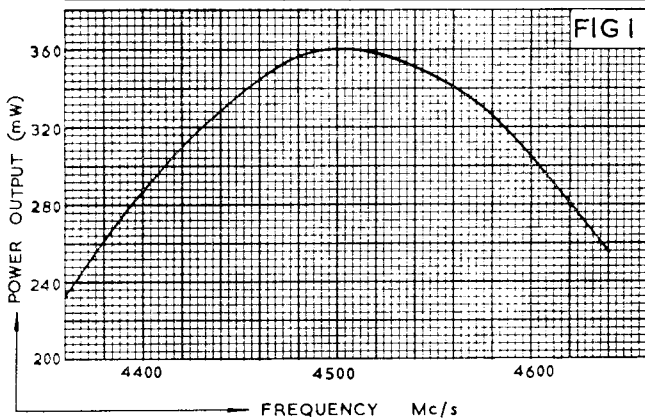
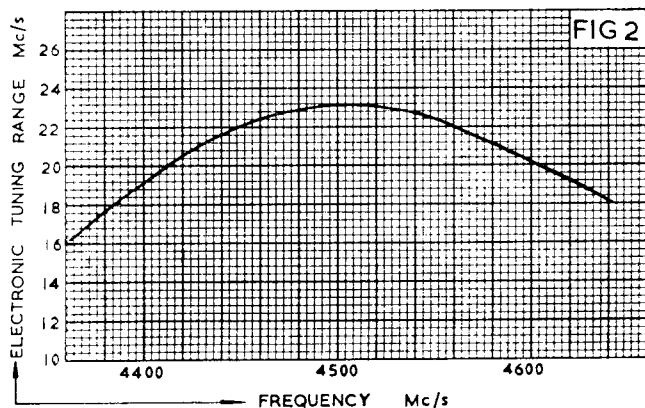
A permanent magnet is used to form the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1 200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 4). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.



# Velocity Modulated Oscillator

Code: V245C/1K

|          |  |  |
|----------|--|--|
| V245C/1K |  |  |
| VL 2529  |  |  |

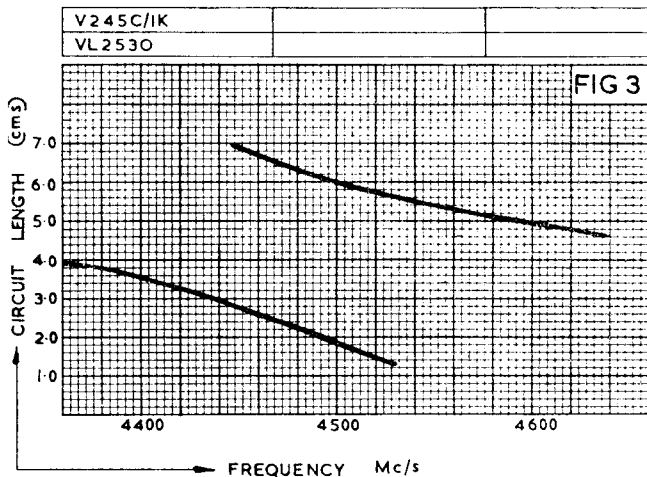
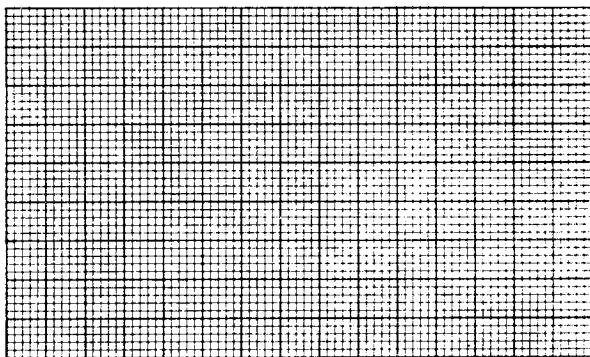




# Velocity Modulated Oscillator



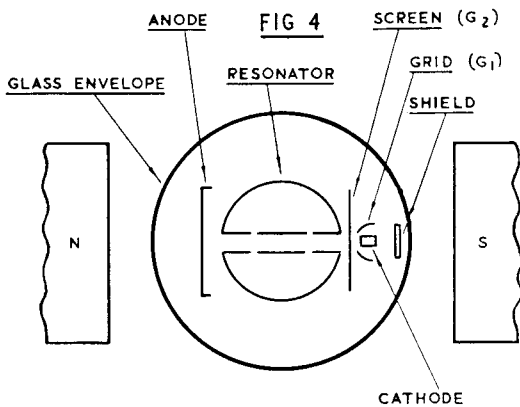
Code: V245C/1K



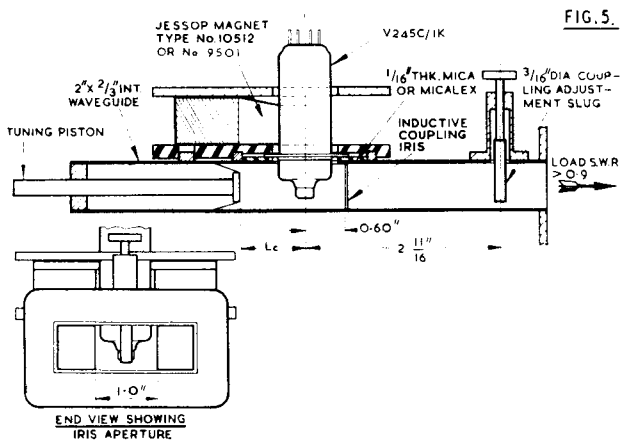


# Velocity Modulated Oscillator

Code: V245C/1K

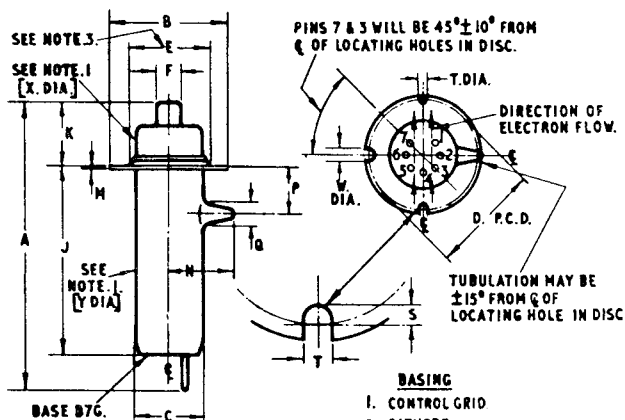


CROSS-SECTION OF VALVE ASSEMBLY



# Velocity Modulated Oscillator

Code: V245C/1K



**NOTE 1.** THIS PORTION OF BULB WILL NOT FOUL A CYLINDER OF INT. DIA. SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN DISC.

**NOTE 2.** BASIC FIGURES ARE INCHES.

**NOTE 3.** ALSO MIN. CLAMPING DIA.

| DIM. | MILLIMETRES      | INCHES            | DIM. | MILLIMETRES               | INCHES                       |
|------|------------------|-------------------|------|---------------------------|------------------------------|
| A    | 80 MAX.          | 3.15 MAX.         | P    | $13.5 \pm 4.0$            | $0.53 \pm 0.16$              |
| B    | 31.75 MAX.       | 1 1/4 MAX.        | Q    | 8.5 MAX.                  | 0.33 MAX.                    |
| C    | 20.1 MAX.        | 0.79 MAX.         | S    | $1.6 + 0.13$<br>$- 0.00$  | $0.062 + 0.005$<br>$- 0.000$ |
| D    | $30.96 \pm 0.06$ | $1.218 \pm 0.002$ | T    | $2.36 + 0.06$<br>$- 0.00$ | $0.093 + 0.002$<br>$- 0.000$ |
| E    | 24 MAX.          | 0.94 MAX.         | W    | $2.79 + 0.13$<br>$- 0.00$ | $0.110 + 0.005$<br>$- 0.000$ |
| F    | 8.12 MAX.        | 0.320 MAX.        | X    | 21.59 MIN.                | 0.850 MIN.                   |
| J    | 56 MAX.          | 2.2 MAX.          | Y    | 20.32 MIN.                | 0.800 MIN.                   |
| K    | 16.5 MAX.        | 0.65 MAX.         |      |                           |                              |
| M    | 0.3 MAX.         | 0.012 MAX.        |      |                           |                              |
| N    | 18 MAX.          | 0.710 MAX.        |      |                           |                              |



# Velocity Modulated Oscillator

Code: V246A/1K (CV228)

The V246A/1K is a velocity-modulated oscillator of the coaxial line type for operation in the frequency band 4400 to 4850 Mc/s.

## CATHODE

Indirectly-heated, oxide-coated

|                |     |   |
|----------------|-----|---|
| Heater voltage | 6.3 | V |
|----------------|-----|---|

|                 |     |   |
|-----------------|-----|---|
| Nominal current | 0.3 | A |
|-----------------|-----|---|

(A.C. frequencies above 60 c/s must not be used)

## DIMENSIONS

|                        |      |      |
|------------------------|------|------|
| Maximum overall length | 89   | mm   |
| Maximum bulb diameter  | 19.8 | mm ← |
| Base                   | B7G  |      |
| Net weight             | 22.5 | g    |

## MOUNTING

The valve is designed to mount by means of the resonator disc so that the antenna couples into a suitable tuning circuit.

## MAXIMUM RATINGS

|                                                                      |     |    |
|----------------------------------------------------------------------|-----|----|
| Maximum mean input power to all electrodes,<br>other than the heater | 18  | W  |
| Maximum direct cathode current                                       | 65  | mA |
| Maximum peak cathode current                                         | 0.5 | A  |
| Maximum direct screen voltage                                        | 400 | V  |
| Maximum screen dissipation                                           | 1.5 | W  |

# Velocity Modulated Oscillator



Code: V246A/1K (CV228)

---

## TYPICAL OPERATING CONDITIONS

Oscillator in the frequency range 4400 to 4850 Mc/s

### Grid voltage ( $V_{g1}$ )

20 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes through the resonator and reaches the anode. See Figure 6 for a sketch of the electrode assembly.

### Resonator voltage ( $V_{res}$ )

$225 \pm 5$  per cent at 4650 Mc/s. For other frequencies the resonator voltage is approximately proportional to the square of the frequency. See Figure 1.

### Screen voltage ( $V_{g2}$ )

Zero to  $V_{res} + 50$  volts. Adjusted to obtain the appropriate value of cathode current (65 mA).

### Screen current ( $I_{g2}$ )

Not greater than 5 mA.

### Anode voltage ( $V_a$ )

10 to 20 volts positive with respect to resonator.

## PERFORMANCE

This valve should be operated in a tuning circuit as shown in Figure 7, and the resonator voltage and load coupling adjusted for maximum output. With a cathode current of 65 mA, a minimum output of 450 mW at 4650 Mc/s should be obtained. A typical curve of power output versus frequency is shown in Figure 2.

It is possible to operate the valve in a high voltage mode under pulse conditions. The resonator voltage will be 800 volts at 4650 Mc/s, and the starting time will be about 1 microsecond. The maximum mean input power is 18 watts and the peak input power is limited by the maximum peak cathode current of 0.5 ampere.

Under these conditions the peak output power will be in the region of 20 to 30 watts.

## CIRCUIT

A sketch of a suitable tuning circuit is given in Figure 7 ; a typical curve of circuit length  $L_e$  versus frequency is given in Figure 3.

## UNLOADED STARTING CURRENT

The anode current at which oscillations just start, when the valve is loaded only by the circuit, is referred to as the " unloaded starting current", and serves as a useful measure of the efficiency of the



# Velocity Modulated Oscillator

Code: V246A/1K (CV228)

tuning circuit. In Figure 4 the unloaded starting current for a typical valve is plotted as a function of frequency using the recommended circuit.

To illustrate the importance of good circuit construction a curve of power output versus the unloaded starting current of the valve circuit combination is given in Figure 5.

## OUTPUT COUPLING.

The output power can be obtained from two coupling positions. The use of a probe in the end wall of the circuit, as shown at A in Figure 7, or the use of a loop in the side wall of the circuit, as shown at B, have been found satisfactory. Adjustment of probe penetration or loop rotation will usually be necessary when tuning over the frequency band.

## OUTPUT MODULATION.

### (a) Amplitude modulation.

The voltage required is dependent both upon the particular operating conditions, and the loading of the valve. For 100 per cent modulation it is only necessary to reduce the anode current to a value below the starting current of oscillation.

Modulation of either the grid ( $g_1$ ) or the screen ( $g_2$ ) is permissible. For the screen, however, positive modulating voltages are necessary, and, since the screen takes current, adequate modulation power should be provided.

### (b) Frequency modulation.

The amount of frequency modulation obtainable by variation of the resonator voltage is about  $\pm 8$  Mc/s between half power points at 4650 Mc/s.

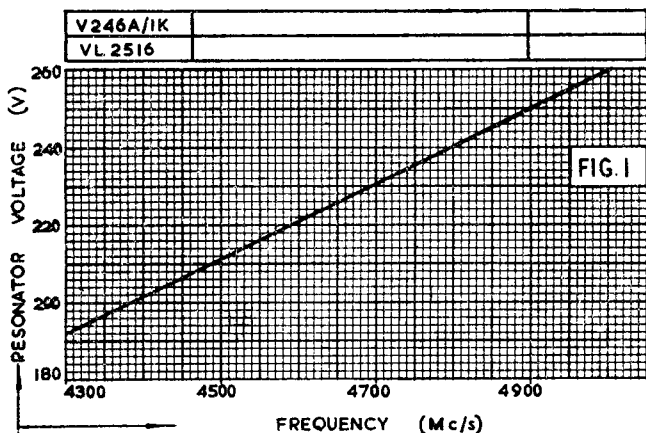
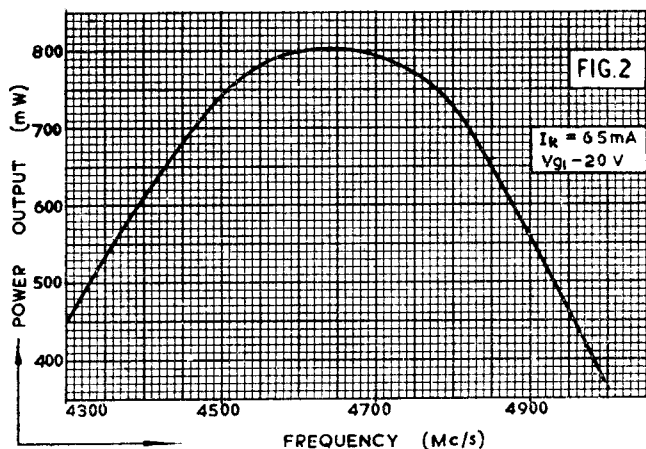
## MAGNET AND MAGNET ALIGNMENT.

A permanent magnet is used to focus the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained. (See Figure 6.) Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.

# Velocity Modulated Oscillator



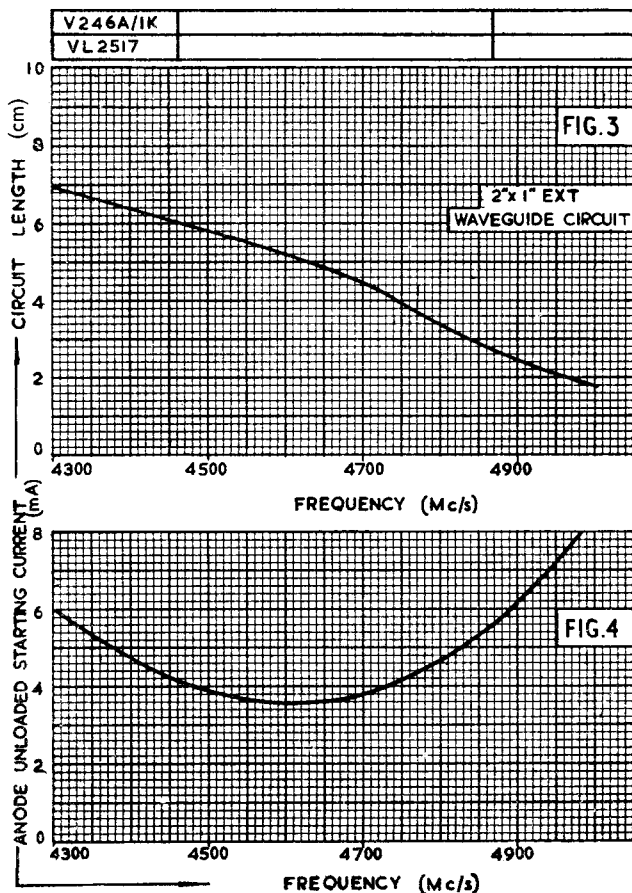
Code: V246A/1K (CV228)





# Velocity Modulated Oscillator

Code: V246A/1K (CV228)

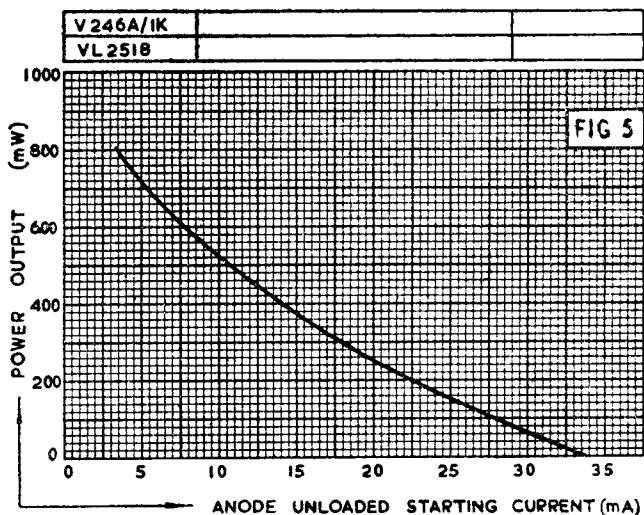




Ref.: V246A/1K

# Velocity Modulated Oscillator

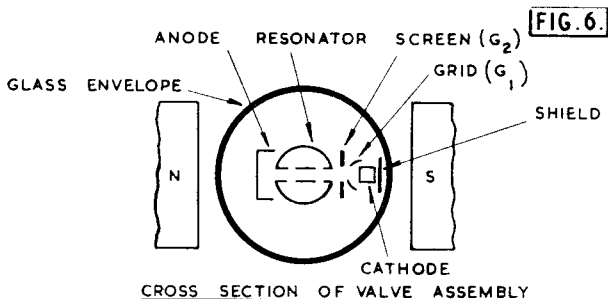
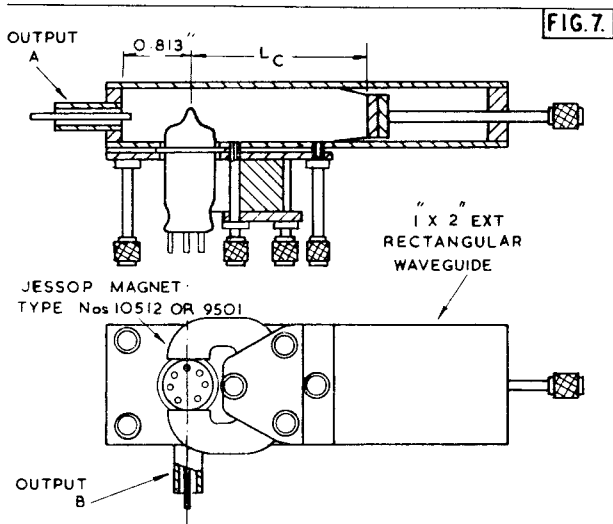
Code: V246A/1K (CV228)





# Velocity Modulated Oscillator

Code: V246A/1K (CV228)

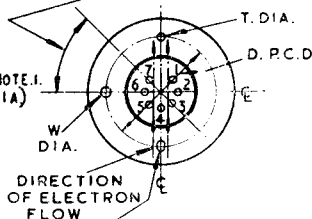


# Velocity Modulated Oscillator

Code: V246A/1K (CV228)

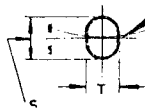


PINS 7 & 3 WILL BE  $45^{\circ} \pm 10^{\circ}$   
FROM  $\phi$  OF LOCATING HOLES  
IN DISC.



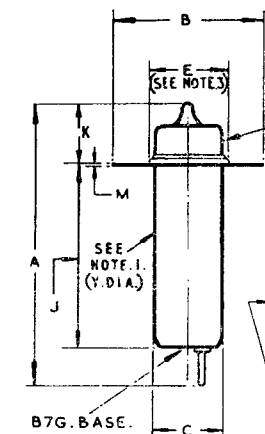
SEE NOTE 1.  
(X.DIA.)

DIRECTION  
OF ELECTRON  
FLOW



## BASING

1. CONTROL GRID
2. CATHODE
3. HEATER
4. HEATER
5. ANODE
6. RESONATOR
7. SCREEN GRID



NOTE 1. THIS PORTION OF BULB  
WILL NOT FOUL A CYLINDER OF  
INT. DIA. SPECIFIED WHICH IS  
CONCENTRIC WITH THE PITCH  
CIRCLE OF THE LOCATING HOLES  
IN THE DISC.

| DIM | MILLIMETRES      | INCHES                            | DIM | MILLIMETRES               | INCHES                       |
|-----|------------------|-----------------------------------|-----|---------------------------|------------------------------|
| A   | 89 MAX.          | 3 $\frac{1}{2}$ MAX.              |     |                           |                              |
| B   | 42 MAX.          | 1.65 MAX.                         |     |                           |                              |
| C   | 19.81 MAX.       | 0.78 MAX.                         |     |                           |                              |
| D   | $30.96 \pm 0.06$ | $1.218 \pm 0.002$                 | S   | 3.2 $\pm 0.13$<br>— 0.00  | 0.125 $\pm 0.005$<br>— 0.000 |
| E   | 24 MAX.          | 0.94 MAX.                         |     |                           |                              |
| J   | $55.6 \pm 4$     | $2 \frac{3}{16} \pm \frac{5}{32}$ | T   | 2.36 $\pm 0.06$<br>— 0.00 | 0.093 $\pm 0.002$<br>— 0.000 |
|     |                  |                                   |     |                           |                              |
| K   | 23 MAX.          | $\frac{21}{32}$ MAX.              | W   | 2.79 $\pm 0.13$<br>— 0.00 | 0.110 $\pm 0.005$<br>— 0.000 |
| M   | 0.3 MAX.         | 0.012 MAX.                        |     |                           |                              |
|     |                  |                                   | X   | 21.59 MIN.                | 0.850 MIN.                   |
|     |                  |                                   | Y   | 20.07 MIN.                | 0.790 MIN.                   |

NOTE 2:—BASIC FIGURES ARE IN.

NOTE 3:—ALSO MIN. CLAMPING  
DIA.

Tentative data  
February 1957



# Velocity Modulated Oscillator

Code: V247C/1K

This valve is a low-voltage coaxial-type V.M. oscillator for the frequency range 4 570 to 4 750 Mc/s capable of being frequency modulated.

## CATHODE.

Indirectly-heated, oxide-coated

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 6.3 | V |
| Nominal current | 0.3 | A |

## DIMENSIONS.

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 80   | mm |
| Maximum bulb diameter  | 20.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 22   | g  |

## MOUNTING.

This valve is designed to mount by means of the resonator disc so that the antenna couples with a suitable tuned circuit.

## MAXIMUM RATINGS.

|                                                                     |     |    |
|---------------------------------------------------------------------|-----|----|
| Maximum mean input power to all<br>electrodes other than the heater | 15  | W  |
| Maximum direct cathode current                                      | 65  | mA |
| Maximum direct screen voltage                                       | 400 | V  |
| Maximum direct screen dissipation                                   | 1.5 | W  |

# Velocity Modulated Oscillator

Code: V247C/1K



## TYPICAL OPERATING CONDITIONS.

Oscillator in the frequency range 4 570 to 4 750 Mc/s.

### Grid Voltage ( $V_{g1}$ )

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes the resonator and reaches the anode. See Figure 4 for a sketch of the electrode assembly.

### Screen Voltage ( $V_{g2}$ )

Adjusted to give a cathode current of 50 mA and should be varied during the valve life so as to maintain the cathode current at a constant value. Where the valve is to be used in unattended equipment, it is recommended that this variation be made automatically. The anode current should be between 33 and 40 mA.

A typical value of screen voltage is 120 volts.

### Screen Current ( $I_{g2}$ )

This will not be greater than 5 mA provided that the screen voltage does not exceed the resonator voltage.

### Resonator Voltage ( $V_{res}$ )

This should be adjusted to give maximum power output and varies between 225 and 260 volts over the mechanical tuning band.

### Anode Voltage ( $V_a$ )

This is kept constant throughout the tuning band at 300 volts.



## Velocity Modulated Oscillator

Code: V247C/1K

### PERFORMANCE.

This valve should be operated in a tuning circuit as shown in Figure 5 with the coupling slug and the resonator voltage adjusted for maximum power output. With the operating conditions as specified, the following performance should be obtained.

|                                                                               |           |      |
|-------------------------------------------------------------------------------|-----------|------|
| Power output, minimum                                                         | 200       | mW   |
| Variation of output with frequency over the specified tuning range, less than | 3         | db   |
| Electronic tuning range, between half power points, minimum                   | $\pm 8.5$ | Mc/s |

Typical curves of power output, electronic tuning range and circuit length versus frequency are shown on Figures 1, 2 and 3.

### MODULATION.

Frequency modulation is obtained by variation of the resonator voltage. The figures for electronic tuning range are those for the valve loaded so as to give maximum output power and the modulation sensitivity under these conditions is between 0.4 and 0.6 Mc/s per volt. If the loading on the valve is reduced, the electronic tuning range will be increased somewhat but the sensitivity will be reduced. The change in slope of the characteristic will be about 10 per cent for a deviation of about 60 to 70 per cent of the half power value.

Distortion components for small deviations (less than  $\pm 2$  Mc/s) at the correct resonator voltage will be about 50 db down on the fundamental.

The input capacitance when using the circuit shown in Figure 5 is between 20 and 30 pF.

# Velocity Modulated Oscillator

Code: V247C/1K

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## THERMAL DRIFT AND STABILITY.

The total thermal drift from cold to the final operating frequency is between 7 and 10 Mc/s and is completed in about five minutes.

The frequency change with ambient temperature is about 50 kc/s per degree Centigrade.

## MAGNET AND MAGNET ALIGNMENT.

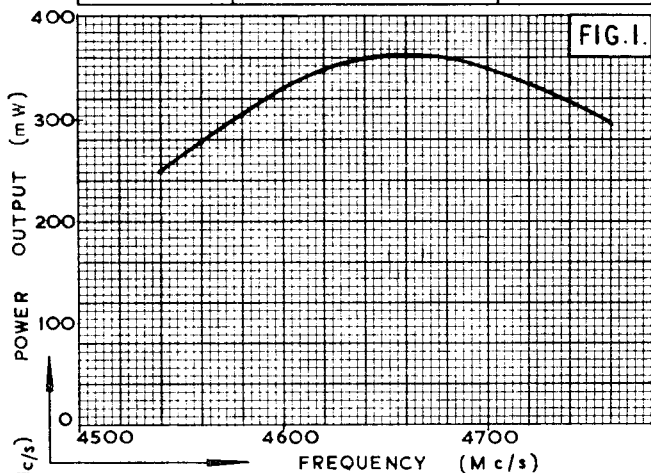
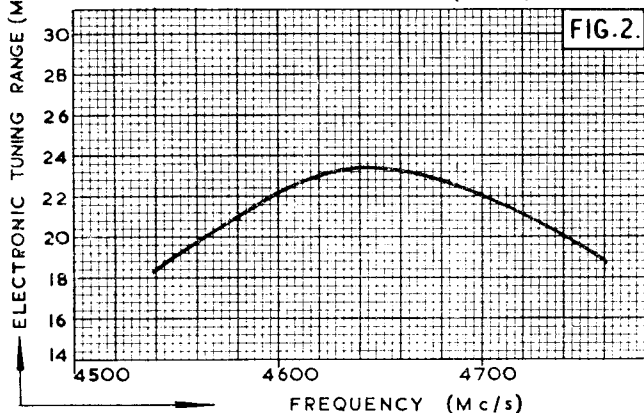
A permanent magnet is used to form the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1 200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 4). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.



# Velocity Modulated Oscillator

Code: V247C/1K

|           |  |  |
|-----------|--|--|
| V 247C/1K |  |  |
| VL 2291-2 |  |  |



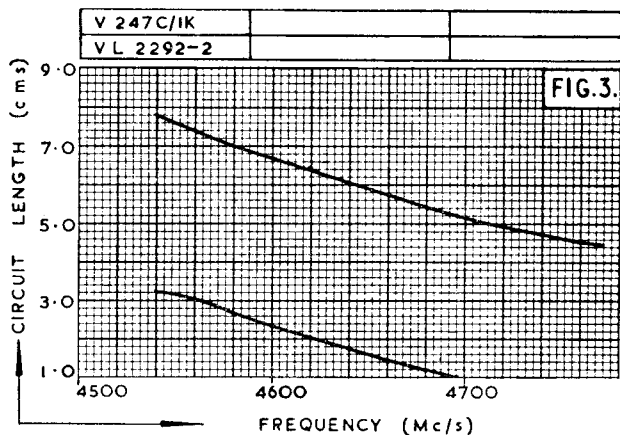
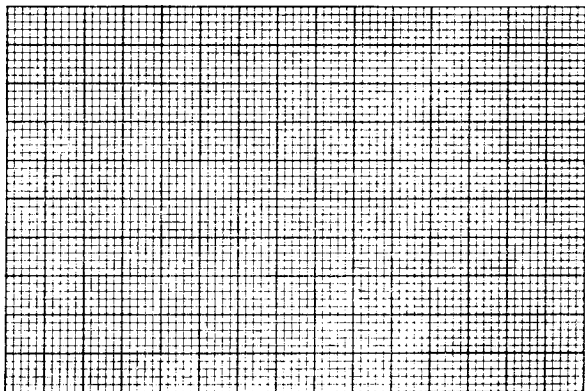
Tentative data  
November 1955

V247C/1K—5



# Velocity Modulated Oscillator

Code: V247C/1K





# Velocity Modulated Oscillator

Code: V247C/1K

Fig. 4

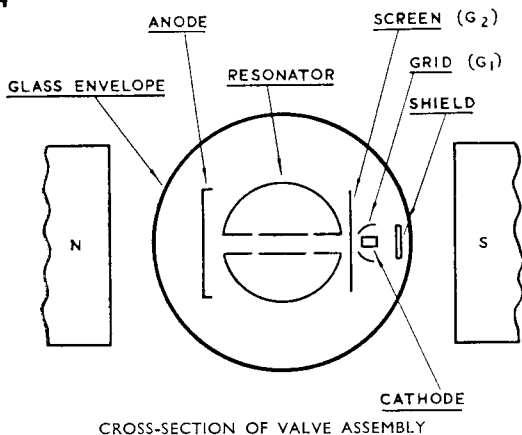
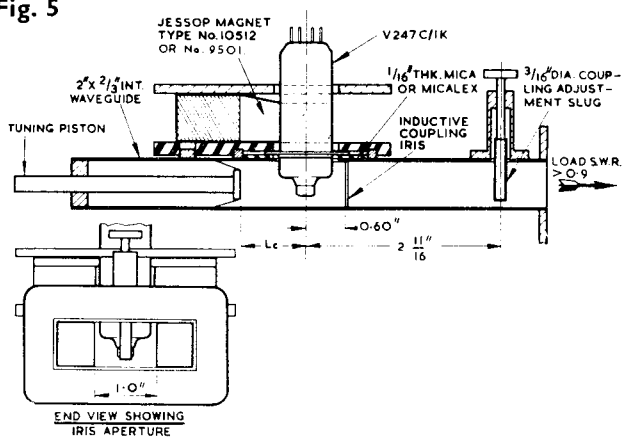
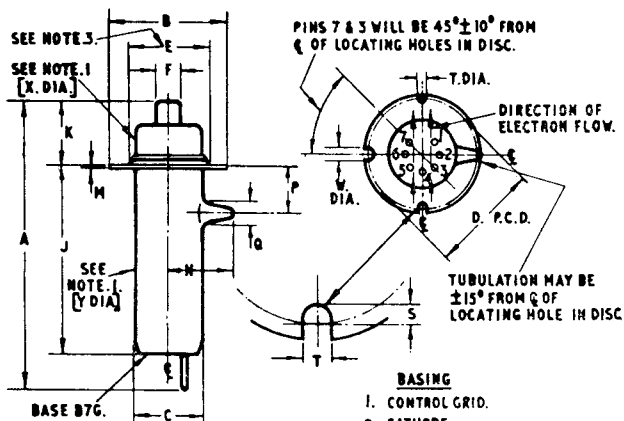


Fig. 5



# Velocity Modulated Oscillator

Code: V247C/1K



**NOTE 1.** THIS PORTION OF BULB WILL NOT FULFILL A CYLINDER OF INT. DIA. SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN DISC.

**NOTE 2.** BASIC FIGURES ARE INCHES.

**NOTE 3.** ALSO MIN. CLAMPING DIA.

| DIM. | MILLIMETRES      | INCHES            | DIM. | MILLIMETRES               | INCHES                       |
|------|------------------|-------------------|------|---------------------------|------------------------------|
| A    | 80 MAX.          | 3.15 MAX.         | P    | $13.5 \pm 4.0$            | $0.53 \pm 0.16$              |
| B    | 31.75 MAX.       | 1 1/4 MAX.        | Q    | 8.5 MAX.                  | 0.33 MAX.                    |
| C    | 20.1 MAX.        | 0.79 MAX.         | S    | $1.6 + 0.13$<br>$- 0.00$  | $0.062 + 0.005$<br>$- 0.000$ |
| D    | $30.96 \pm 0.06$ | $1.218 \pm 0.002$ | T    | $2.36 + 0.06$<br>$- 0.00$ | $0.093 + 0.002$<br>$- 0.000$ |
| E    | 24 MAX.          | 0.94 MAX.         | W    | $2.79 + 0.13$<br>$- 0.00$ | $0.110 + 0.005$<br>$- 0.000$ |
| F    | 8.12 MAX.        | 0.320 MAX.        | X    | 21.59 MIN.                | 0.850 MIN.                   |
| J    | 56 MAX.          | 2.2 MAX.          | Y    | 20.32 MIN.                | 0.800 MIN.                   |
| K    | 16.5 MAX.        | 0.65 MAX.         |      |                           |                              |
| M    | 0.3 MAX.         | 0.012 MAX.        |      |                           |                              |
| N    | 18 MAX.          | 0.710 MAX.        |      |                           |                              |



# Velocity-Modulated Oscillator

Code: V249C/1K

The V249C/1K is a low voltage coaxial type velocity-modulated oscillator for the frequency range 4 760 to 5 000 Mc/s, capable of being frequency modulated.

## CATHODE

Indirectly-heated, oxide-coated

|                 |     |   |
|-----------------|-----|---|
| Heater voltage  | 6.3 | V |
| Nominal current | 0.3 | A |

## DIMENSIONS

|                        |      |    |
|------------------------|------|----|
| Maximum overall length | 80   | mm |
| Maximum bulb diameter  | 20.1 | mm |
| Base                   | B7G  |    |
| Net weight             | 22   | g  |

## MOUNTING

This valve is designed to mount by means of the resonator disc so that the antenna couples with a suitable tuned circuit.

## MAXIMUM RATINGS

|                                                                  |     |    |
|------------------------------------------------------------------|-----|----|
| Maximum mean input power to all electrodes other than the heater | 18  | W  |
| Maximum direct cathode current                                   | 65  | mA |
| Maximum direct screen voltage                                    | 400 | V  |
| Maximum direct screen dissipation                                | 1.5 | W  |

# Velocity-Modulated Oscillator

Code: V249C/1K



## TYPICAL OPERATING CONDITIONS

Oscillator in the frequency range 4 760 to 5 000 Mc/s

### Grid Voltage ( $V_{g1}$ )

40 volts negative with respect to cathode. The use of bias improves the proportion of cathode current which passes the resonator and reaches the anode. See Figure 4 for a sketch of the electrode assembly.

### Screen Voltage ( $V_{g2}$ )

Adjusted to give a cathode current of 50 mA and should be varied during the valve life so as to maintain the cathode current at a constant value. Where the valve is to be used in unattended equipment, it is recommended that this variation be made automatically. The anode current should be between 33 and 40 mA.

A typical value of screen voltage is 120 volts.

### Screen Current ( $I_{g2}$ )

This will not be greater than 5 mA provided that the screen voltage does not exceed the resonator voltage.

### Resonator Voltage ( $V_{res}$ )

This should be adjusted to give maximum power output and varies between 240 and 290 volts over the mechanical tuning band.

### Anode Voltage ( $V_a$ )

This is kept constant throughout the tuning band at 310 volts.

## PERFORMANCE

This valve should be operated in a tuning circuit as shown in Figure 5 with the coupling slug and the resonator voltage adjusted for maximum power output. With the operating conditions as specified, the following performance should be obtained.

|                                                                               |           |      |
|-------------------------------------------------------------------------------|-----------|------|
| Power output, minimum                                                         | 200       | mW   |
| Variation of output with frequency over the specified tuning range, less than | 3         | db   |
| Electronic tuning range, between half power points, minimum                   | $\pm 8.0$ | Mc/s |

Typical curves of power output, electronic tuning range and circuit length versus frequency are shown on Figures 1, 2 and 3.



# Velocity-Modulated Oscillator

Code: V249C/1K

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## MODULATION

Frequency modulation is obtained by variation of the resonator voltage. The figures for electronic tuning range are those for the valve loaded so as to give maximum output power and the modulation sensitivity under these conditions is between 0.4 and 0.6 Mc/s per volt. If the loading on the valve is reduced, the electronic tuning range will be increased somewhat but the sensitivity will be reduced. The change in slope of the characteristic will be about 10 per cent for a deviation of about 60 to 70 per cent of the half power value.

Distortion components for small deviations (less than  $\pm 2$  Mc/s) at the correct resonator voltage will be about 50 db down on the fundamental.

The input capacitance when using the circuit shown in Figure 5 is between 20 and 30 pF.

## THERMAL DRIFT AND STABILITY

The total thermal drift from cold to the final operating frequency is between 7 and 10 Mc/s and is completed in about 5 minutes.

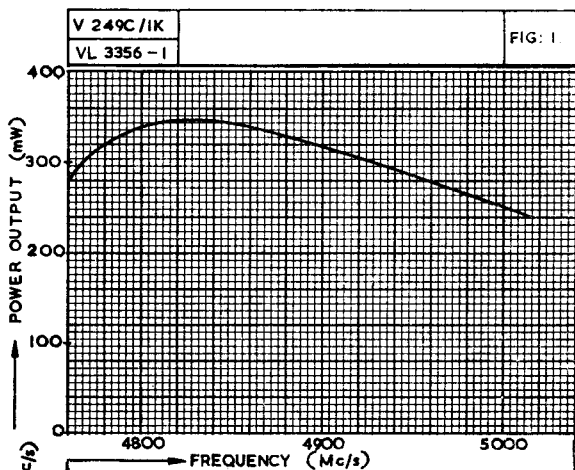
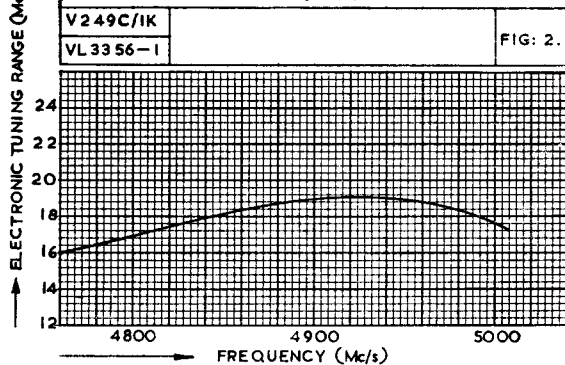
The frequency change with ambient temperature is about 50 kc/s per degree centigrade.

## MAGNET AND MAGNET ALIGNMENT

A permanent magnet is used to form the electron beam. The recommended magnet is Jessop Type No. 10512, but any magnet giving a uniform field of approximately 1 200 oersteds over a 22 mm gap can be used. The magnet must be aligned so that the best ratio of anode current to cathode current is obtained (see Figure 4). Three holes are punched in the valve disc and locate on pins fixed to the valve clamping plate. Once the magnet has been aligned, and has been securely clamped with respect to the locating pins, no further adjustment will be necessary when replacing valves. It is recommended that at least three, and preferably six, valves are used to establish the initial alignment of the magnet.

# Velocity-Modulated Oscillator

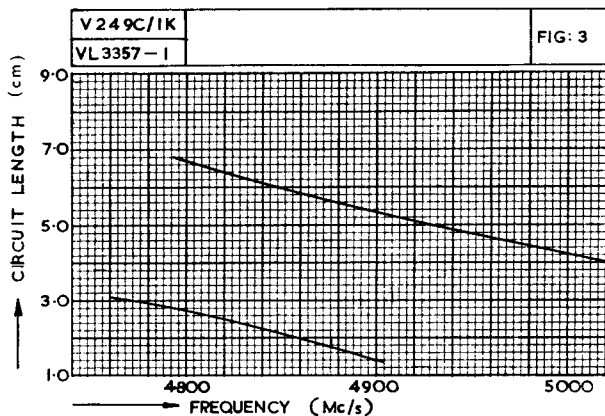
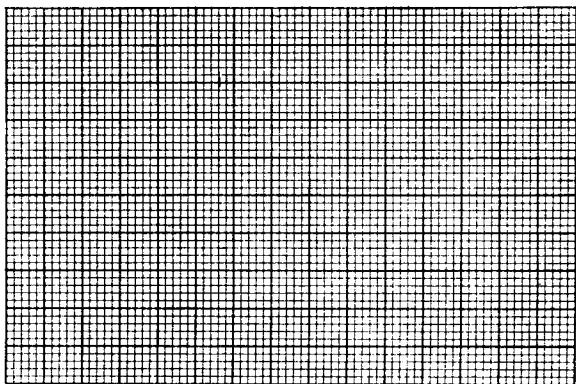
Code: V249C/1K





# Velocity-Modulated Oscillator

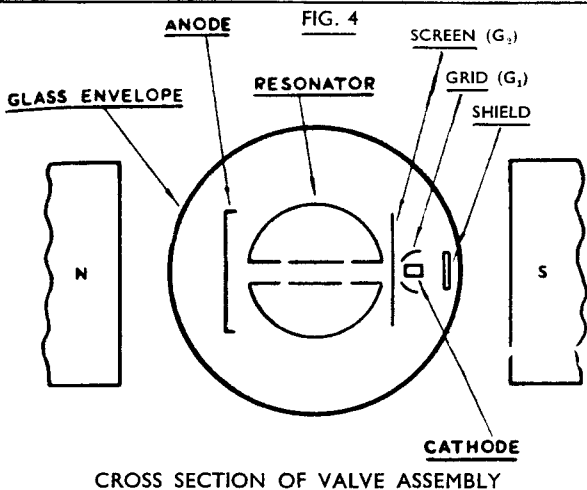
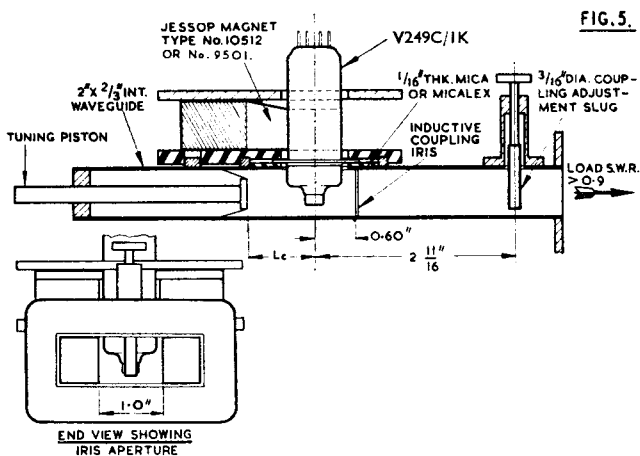
Code: V249C/1K





# Velocity-Modulated Oscillator

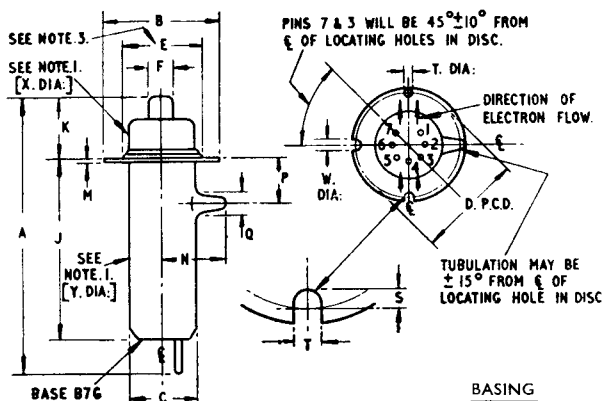
Code: V249C/1K





# Velocity-Modulated Oscillator

Code: V249C/1K



NOTE 1. THIS PORTION OF BULB WILL NOT FOUL A CYLINDER OF INT. DIA. SPECIFIED WHICH IS CONCENTRIC WITH THE PITCH CIRCLE OF THE LOCATING HOLES IN DISC.

NOTE 2. BASIC FIGURES ARE INCHES.

NOTE 3. ALSO MIN. CLAMPING DIA.

1. CONTROL GRID
2. CATHODE
3. HEATER
4. HEATER
5. ANODE
6. RESONATOR
7. SCREEN GRID

| DIM | MILLIMETRES      | INCHES            | DIM | MILLIMETRES              | INCHES                      |
|-----|------------------|-------------------|-----|--------------------------|-----------------------------|
| A   | 80 MAX.          | 3.15 MAX.         | P   | 13.5 $\pm$ 4.0           | 0.53 $\pm$ 0.16             |
| B   | 31.75 MAX.       | 1.25 MAX.         | Q   | 8.5 MAX.                 | 0.33 MAX.                   |
| C   | 20.1 MAX.        | 0.79 MAX.         | S   | 1.6 $\pm$ 0.13<br>-0.00  | 0.062 $\pm$ 0.005<br>-0.000 |
| D   | 30.96 $\pm$ 0.06 | 1.218 $\pm$ 0.002 | T   | 2.36 $\pm$ 0.06<br>-0.00 | 0.093 $\pm$ 0.002<br>-0.000 |
| E   | 24 MAX.          | 0.94 MAX.         | V   | 2.79 $\pm$ 0.13<br>-0.00 | 0.110 $\pm$ 0.005<br>-0.000 |
| F   | 8.12 MAX.        | 0.320 MAX.        | X   | 21.59 MIN.               | 0.850 MIN.                  |
| J   | 56 MAX.          | 2.2 MAX.          | Y   | 20.32 MIN.               | 0.800 MIN.                  |
| K   | 16.5 MAX.        | 0.65 MAX.         |     |                          |                             |
| M   | 0.3 MAX.         | 0.012 MAX.        |     |                          |                             |
| N   | 18 MAX.          | 0.710 MAX.        |     |                          |                             |



# SPECIAL VALVES

## Velocity-Modulated Oscillator

Code: V271C/3M

The V271C/3M is a single-transit velocity-modulated oscillator of a new type for operation in the frequency range 6 850–7 350 Mc/s.

It is intended for use as a frequency modulated transmitting valve in radio links. No forced air cooling is required for operation up to the conditions specified as maximum ratings.

### CATHODE

Indirectly-heated, oxide-coated

|                |     |   |
|----------------|-----|---|
| Heater voltage | 6.3 | V |
|----------------|-----|---|

|                 |      |   |
|-----------------|------|---|
| Nominal current | 0.25 | A |
|-----------------|------|---|

### DIMENSIONS

|                        |         |     |    |
|------------------------|---------|-----|----|
| Nominal overall length | 5¼ in., | 134 | mm |
|------------------------|---------|-----|----|

|                       |         |     |    |
|-----------------------|---------|-----|----|
| Nominal overall width | 4¼ in., | 108 | mm |
|-----------------------|---------|-----|----|

|                       |          |    |    |
|-----------------------|----------|----|----|
| Nominal overall depth | 1.9 in., | 69 | mm |
|-----------------------|----------|----|----|

|      |     |  |  |
|------|-----|--|--|
| Base | B8G |  |  |
|------|-----|--|--|

|                                                                                        |      |    |
|----------------------------------------------------------------------------------------|------|----|
| Weight of packaged assembly, including magnet but excluding tuning and output circuits | 900  | g  |
|                                                                                        | 31.8 | oz |

### MOUNTING

The valve has fitted on each side a flange plate with three OBA tapped holes into which are screwed special studs shown on the outline drawing.

The circuits have special flanges with quick release attachments which engage under the heads of the studs, as shown in Fig. 1.

Alternatively the tuning and output circuits may have plain flanges which are attached to the plates by OBA knurled screws. In this case the special studs are removed by unscrewing them.

February 1961

V271C/3M—1

**Standard Telephones and Cables Limited**

Registered Office: Connaught House, Aldwych, W.C.2

VALVE DIVISION, FOOTSCRAY, KENT

Telephone: Footscray 3333

**SPECIAL VALVES****Velocity-Modulated Oscillator****Code: V271C/3M****MAXIMUM RATINGS**

Voltages are given with respect to cathode unless otherwise stated.

|                                                              |     |    |
|--------------------------------------------------------------|-----|----|
| Maximum direct anode voltage                                 | 600 | V  |
| Maximum direct resonator voltage                             | 600 | V  |
| Maximum direct drift tube voltage, with respect to resonator | 200 | V  |
| Maximum direct screen voltage                                | 400 | V  |
| Maximum direct anode dissipation                             | 27  | W  |
| Maximum direct resonator dissipation                         | 18  | W  |
| Maximum direct drift tube dissipation                        | 3   | W  |
| Maximum direct screen dissipation                            | 2   | W  |
| Maximum total dissipation for all electrodes except heater   | 40  | W  |
| Maximum direct cathode current                               | 65  | mA |
| Maximum temperature of mica window seal                      | 130 | °C |
| Maximum temperature of any other part of valve envelope      | 300 | °C |

**TYPICAL OPERATING CONDITIONS**

Conditions are given for operation in Mode 15 ( $3\frac{3}{4}$  cycles) and Mode 19 ( $4\frac{3}{4}$  cycles). The Mode numbers are the number of quarter periods of oscillation occupied by electrons in transit through the drift space.

**Mode 15**

Frequency-modulated oscillator in the frequency range 6 850–7 350 Mc/s.

|                                       |            |   |
|---------------------------------------|------------|---|
| Direct anode voltage                  | 550        | V |
| Direct resonator voltage              | 530        | V |
| Direct grid voltage                   | —50        | V |
| *Direct drift tube voltage            | 395 to 505 | V |
| †Direct screen voltage, approximately | 180        | V |

\*This is adjusted to give maximum power output at the operating frequency set by the tuning piston. Graphs of frequency as a function of piston position and drift tube voltage are shown in Figs. 3 and 4. The frequency-modulating voltage is applied to the drift tube only.

†This is adjusted to give a cathode current of 60 mA with a corresponding anode current of 30 to 40 mA.



# SPECIAL VALVES

## Velocity-Modulated Oscillator

Code: V271C/3M

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### Mode 19

Oscillator in the frequency range 6 850–7 350 Mc/s.

|                          |     |   |
|--------------------------|-----|---|
| Direct anode voltage     | 370 | V |
| Direct resonator voltage | 350 | V |
| Direct grid voltage      | —50 | V |

\*Direct drift tube voltage 240 to 310 V

†Direct screen voltage, approximately 120 V

\*This is adjusted to give maximum power output at the operating frequency. The graph of piston position versus operating frequency is the same as for Mode 15.

†This is adjusted to give a cathode current of 45 mA with a corresponding anode current of 22 to 30 mA.

### PERFORMANCE

The valve should be used with the tuning and output circuits shown in Fig. 1. With the operating conditions as previously specified and the coupling slug adjusted to give maximum power output into a waveguide load whose V.S.V.V.R. is less than 1.2 the following performance should be obtained.

### Mode 15

|                                                                          |                |            |
|--------------------------------------------------------------------------|----------------|------------|
| Power output, minimum                                                    | 800            | mW         |
| Electronic tuning between half-power points, minimum                     | $\pm 8.5$      | Mc/s       |
| Modulation sensitivity when loaded for maximum power                     | 250 to 450     | kc/s per V |
| Minimum mechanical tuning range obtained by variation of piston position | 6 850 to 7 350 | Mc/s       |

### Typical Characteristic Curves

Tuning piston position versus frequency Figure 3

Power output versus frequency Figure 5

Electronic tuning versus frequency Figure 6

### Mode 19

|                                                      |            |            |
|------------------------------------------------------|------------|------------|
| Power output, minimum                                | 200        | mW         |
| Electronic tuning between half-power points, minimum | $\pm 6$    | Mc/s       |
| Modulation sensitivity when loaded for maximum power | 450 to 650 | kc/s per V |

# SPECIAL VALVES



## Velocity-Modulated Oscillator

Code: V271C/3M

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### CIRCUITS

A diagram of the tuning and output circuits with a valve assembled is shown in Fig. 1. A separate diagram of the tuning circuit showing the reference plane for measurement of piston position is shown in Fig. 2.

The valve is designed to operate into Waveguide No. 14, correct loading being obtained by adjustment of the coupling slug. Some adjustment may be necessary to obtain maximum power when tuning over the available frequency range.

The tuning circuit is of 1 in.  $\times$   $\frac{1}{2}$  in. internal section waveguide incorporating a non-contact tuning piston moved directly by a micrometer.

### MODULATION

Frequency modulation is obtained by variation of the drift tube voltage with respect to resonator.

The direct drift tube current does not exceed 5 mA; the input capacitance is 20 to 30 pF and the slope resistance is of the order of 25 kilohm.

### THERMAL DRIFT AND STABILITY

The initial thermal drift from cold to the final operating frequency is between 9 Mc/s and 13 Mc/s and is completed in less than 5 minutes.

The variation of frequency with ambient temperature is between 50 and 100 kc/s per °C over the range covered by movement of the tuning piston.

### MAGNET

The magnet is adjusted and locked in position during the testing of the valve and *should not be re-adjusted* during the life of the valve.

## Code: V271C/3M

CONTINUED

Type 495-LVA-352

Type 495-LVA-351

OUTPUT CIRCUIT.  
GUIDE SIZE 14.

TUNING CIRCUIT.

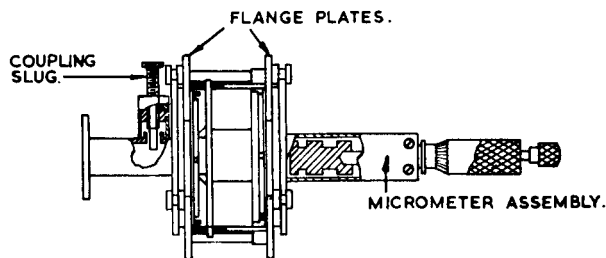


FIG. 1

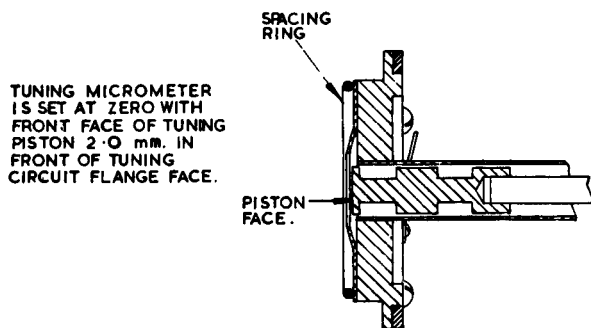


FIG. 2

Code: V271C/3M

CONTINUED

Fig. 3.—Typical Mechanical Tuning Characteristic.

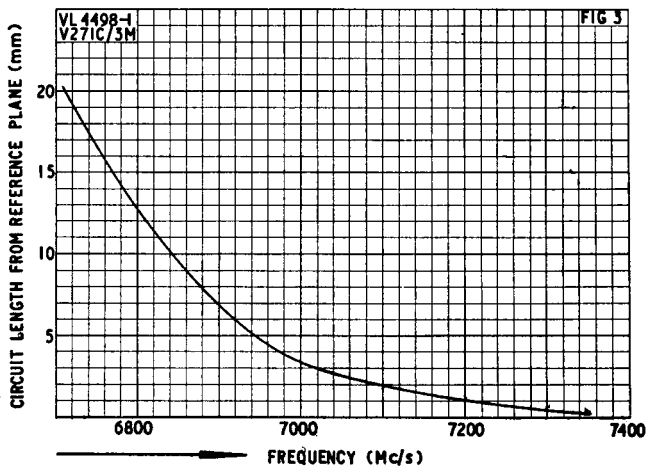
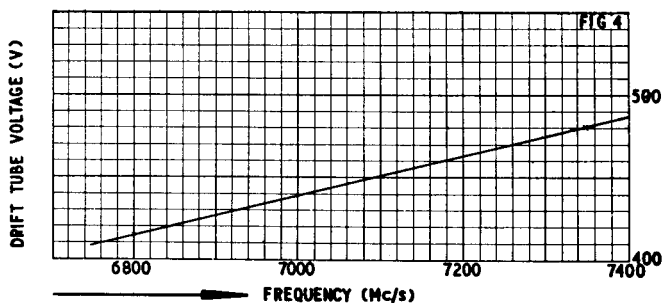


Fig. 4.—Typical Optimum Drift Tube Voltage Characteristic.







# SPECIAL VALVES

## Velocity-Modulated Oscillator

Code: V271C/3M

Fig. 5.—Typical Power Output Characteristic.

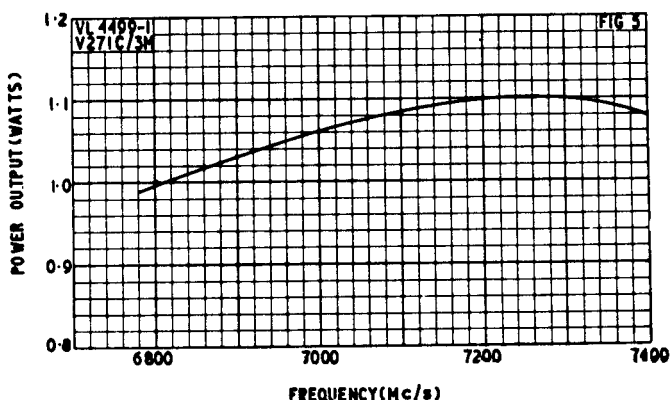
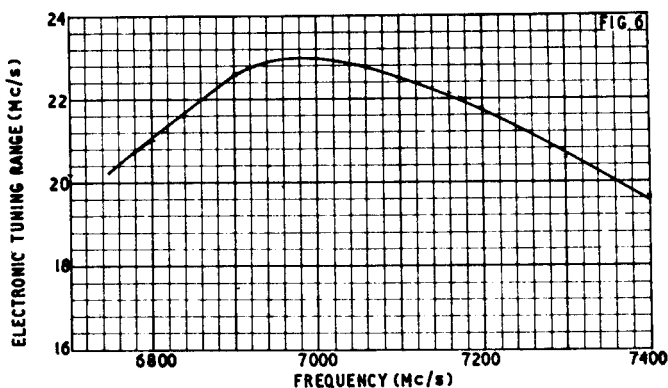


Fig. 6.—Typical Variation of Electronic Tuning Range with Operating Frequency.

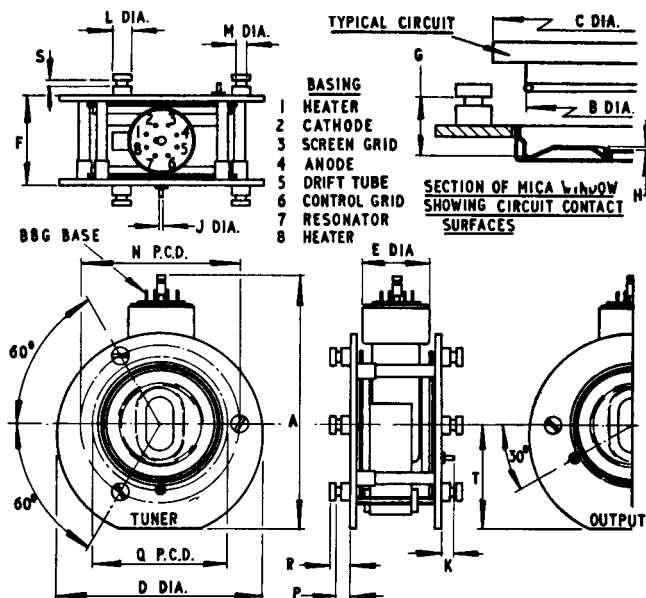


## SPECIAL VALVES



## Velocity-Modulated Oscillator

Code: V271C/3M



| DIM. | MILLIMETRES      | INCHES                          | DIM. | MILLIMETRES        | INCHES                          |
|------|------------------|---------------------------------|------|--------------------|---------------------------------|
| A    | 138,1 MAX.       | $5\frac{7}{8}$ MAX.             | K    | $6,4 \pm 0,4$      | $\frac{1}{4} \pm \frac{1}{16}$  |
| B    | 57,63 MAX.       | 2.269 MAX.                      | L    | $9,53 +0,00 -0,25$ | $0.375 +0.000 -0.010$           |
| C    | 74,40 MAX.       | 2.929 MAX.                      | M    | $4,75 \pm 0,13$    | $0.187 \pm 0.005$               |
| D    | $108,0 \pm 1,6$  | $4\frac{1}{4} \pm \frac{1}{16}$ | N    | 84,33 NOM.         | 3.320 NOM.                      |
| E    | 38,1 MAX.        | $1\frac{1}{2}$ MAX.             | P    | $7,54 \pm 0,18$    | $0.297 \pm 0.007$               |
| F    | 51,6 MAX.        | $2\frac{1}{2}$ MAX.             | Q    | 71,42 NOM.         | 2.812 NOM.                      |
| G    | $16,69 \pm 0,51$ | $0.657 \pm 0.020$               | R    | $10,72 \pm 0,79$   | $0.422 \pm 0.031$               |
| H    | 1,78 MIN.        | 0.070 MIN.                      | S    | $2,36 \pm 0,18$    | $0.093 \pm 0.007$               |
| J    | $3,18 \pm 0,25$  | $0.125 \pm 0.010$               | T    | $55,6 \pm 0,8$     | $2\frac{1}{8} \pm \frac{1}{16}$ |

NOTE.—Basic figures are inches.

# **—Standard Valves—**

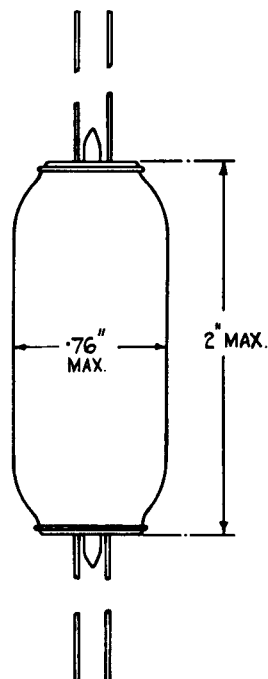
VLS.405-A  
Valve  
VLS.405-AS  
Valve.

## **VLS. 405-A AND -AS VALVES**

NEON INDICATOR LAMPS.

### **SPECIFICATION.**

This indicator lamp is not supplied with a base but in special applications a cap has been fitted. No resistances are supplied inside this cap but it is recommended that the current under normal working conditions be kept as small as possible. A suitable series resistance is 100,000 ohms.



The characteristics of this lamp are as follows :—

|                   | VLS.405-A    | VLS.405-AS                         |
|-------------------|--------------|------------------------------------|
| Striking voltage  | 87.5 $\pm$ 5 | 90 $\pm$ 5 volts in each direction |
| Maximum current   | 500          | 500 microamps.                     |
| Operating current | 0.1          | 0.1 milliamps.                     |
| Capacity          | 2            | 2 $\mu$ F                          |

Photo electrical effect.—Approximately 1 volt difference between striking voltage measured in daylight and in darkness.

If the current is kept low (less than 70 microamps) the maintaining voltage under these conditions is not less than 75% of the striking voltage (approximately 65 volts.)

### **Dimensions.**

|                  |                        |
|------------------|------------------------|
| Overall length   | 2" max. (5.08 cms.)    |
| Maximum diameter | 0.76" max. (1.93 cms.) |
| Net weight       | 0.02 lb. (10 gm.)      |

*Tentative data*

MN.VLS.405-A.1,  
March 1939

PRINTED IN  
ENGLAND



# Thermal Delay Switch

VLS 631 (CV342)

Miniature thermal delay switch suitable for applying the anode voltage to an indirectly heated valve after the cathode has warmed up.

## RATINGS.

|                                                                                                    |                  |       |
|----------------------------------------------------------------------------------------------------|------------------|-------|
| Heater voltage                                                                                     | 6.3              | V     |
| Nominal heater current                                                                             | 0.5              | A     |
| Nominal delay at 20°C.                                                                             | 50—60            | secs. |
| Ambient temperature range                                                                          | —35°C. to —85°C. |       |
| Time delay is not less than 50 sec. and not more than 90 secs. over the ambient temperature range. |                  |       |
| Max. O/C voltage between contacts                                                                  | 220              | V.DC  |
| Max. contact current on make                                                                       | 1.0              | A     |
| „ surge current on make                                                                            | 5.0              | A     |
| „ current on break                                                                                 | 100mA at 50VDC   |       |

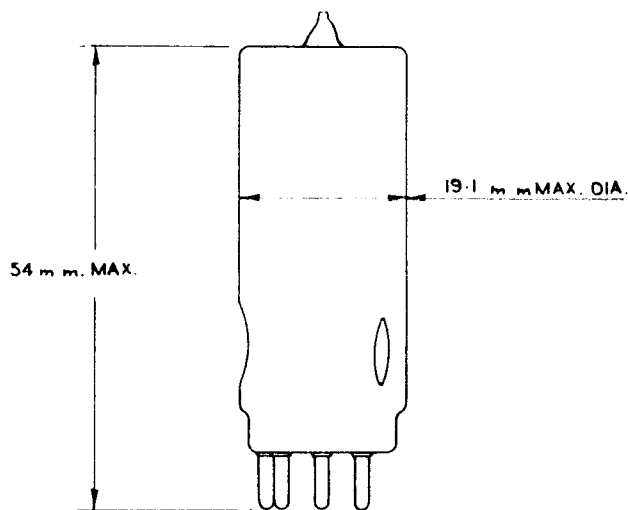
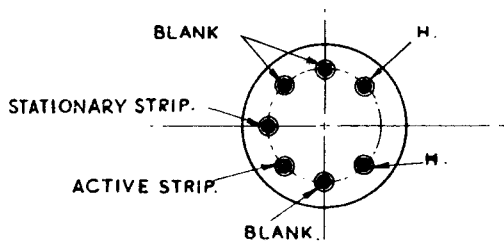
## DIMENSIONS.

|                          |      |     |
|--------------------------|------|-----|
| Maximum overall length   | 54   | mm. |
| Maximum overall diameter | 19.1 | mm. |

VLS631

# Thermal Delay Switch

VLS 631 (CV.342)





# Travelling-Wave Amplifier

Code: W7/1D (CV2358)

The W7/1D is a travelling-wave amplifier for use in the frequency range 3 530 to 4 620 Mc/s. It has a bandwidth of the order of 1 000 Mc/s which makes possible the amplification of signals of large bandwidth and operation over a wide frequency range without retuning.

## ELECTRICAL DATA

### Cathode

Indirectly-heated, oxide-coated

|                |     |   |
|----------------|-----|---|
| Heater voltage | 6.3 | V |
|----------------|-----|---|

|                 |      |   |
|-----------------|------|---|
| Nominal current | 0.85 | A |
|-----------------|------|---|

|                          |     |     |
|--------------------------|-----|-----|
| Minimum pre-heating time | 120 | sec |
|--------------------------|-----|-----|

### Characteristics

|                                                                            |    |    |
|----------------------------------------------------------------------------|----|----|
| *Amplification { at Collector current 4 mA<br>and Helix voltage† 1.45 kV } | 24 | db |
|----------------------------------------------------------------------------|----|----|

|                                               |     |    |
|-----------------------------------------------|-----|----|
| Maximum output<br>(at collector current 4 mA) | 120 | mW |
|-----------------------------------------------|-----|----|

|                                                       |       |      |
|-------------------------------------------------------|-------|------|
| Bandwidth, between 3 db power points,<br>greater than | 1 000 | Mc/s |
|-------------------------------------------------------|-------|------|

|                           |             |      |
|---------------------------|-------------|------|
| Operating frequency range | 3 530–4 620 | Mc/s |
|---------------------------|-------------|------|

## PHYSICAL DATA

|                        |       |    |
|------------------------|-------|----|
| Maximum overall length | 350.8 | mm |
|------------------------|-------|----|

|                                    |       |    |
|------------------------------------|-------|----|
| Maximum diameter of alignment ring | 66.57 | mm |
|------------------------------------|-------|----|

|      |               |
|------|---------------|
| Base | Special Octal |
|------|---------------|

|            |     |   |
|------------|-----|---|
| Net weight | 105 | g |
|------------|-----|---|

|                   |              |
|-------------------|--------------|
| Mounting position | Unrestricted |
|-------------------|--------------|

\* The figure quoted for amplification is that obtained at small signal levels. At maximum output it is approximately 3 db lower.

† The helix voltage should be set within  $\pm 10$  volts of the optimum value for the valve.

# Travelling-Wave Amplifier

Code: W7/1D (CV2358)



## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

S.H.F. Amplifier at 3 900 Mc/s

### Maximum Ratings

|                                               |      |     |
|-----------------------------------------------|------|-----|
| Maximum direct second anode and helix voltage | 1.6  | kV  |
| Maximum direct second anode and helix current | 2    | mA  |
| Maximum direct cathode current                | 6    | mA  |
| Maximum direct first anode voltage            | 1.6  | kV← |
| Maximum direct first anode current            | 250  | μA  |
| Maximum direct collector voltage              | 1.65 | kV← |

### \*Typical Operating Conditions

|                                                                           |        |     |
|---------------------------------------------------------------------------|--------|-----|
| † Direct second anode and helix voltage, nominal                          | 1.45   | kV  |
| ‡ Direct collector voltage, nominal                                       | 1.5    | kV← |
| § Direct collector current, adjusted by $V_{a1}$                          | 4      | mA  |
| Direct first anode voltage, $V_{a1}$                                      | 0.85   | kV  |
| Amplification                                                             | 24     | db  |
| Power output, approx.                                                     | 150    | mW  |
| Input and output voltage standing wave ratio, 3 530–4 620 Mc/s, less than | 2 to 1 |     |

\* This valve is designed to operate in a recommended circuit, the required focus coil current for which is 250 mA.

These operating conditions are obtained when using the recommended circuit.

† Adjusted to give optimum gain. The appropriate helix voltage for individual valves lies between 1.3 and 1.5 kV.

‡ The collector is operated at 50 volts positive with respect to the helix.

§ Recommended value. The first anode voltage necessary to give a collector current of 4 mA lies between 500 and 1 200 volts. The first anode draws negligible current and may be supplied from a potentiometer connected between the helix supply and cathode. During life, however, the optimum first anode voltage may rise to as much as 1 400 volts. It is recommended that to obtain best life the first anode voltage should be obtained from a circuit arranged to keep the collector current constant by variation of the first anode voltage supply.





# Travelling-Wave Amplifier

Code: W7/1D (CV2358)

---

## OPERATIONAL DATA

### Amplification

As previously stated, an average valve will give a gain of 24 db at a collector current of 4 mA.

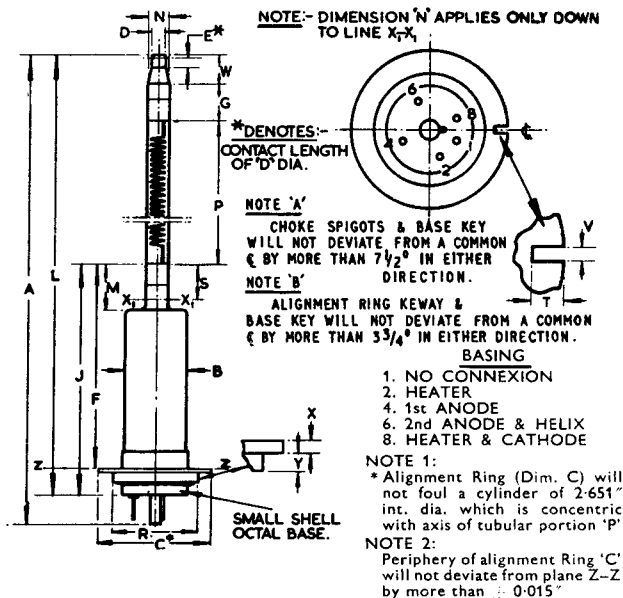
While variation of helix voltage will affect the gain, it will be maintained within 2 db of the maximum if the helix voltage is held within 50 volts of the optimum value.

## CIRCUIT

Further information concerning the circuit and focus coil assembly may be obtained on application to Special Valve Sales Department, Standard Telephones and Cables Limited, Connaught House, 63, Aldwych, London, W.C.2.

# Travelling-Wave Amplifier

Code: W7/1D (CV2358)



| DIM | MILLIMETRES      | INCHES                            | DIM | MILLIMETRES                | INCHES                               |
|-----|------------------|-----------------------------------|-----|----------------------------|--------------------------------------|
| A   | 350.8 MAX.       | 13 $\frac{13}{16}$ MAX.           | N   | 9.83 MAX.                  | 0.387 MAX.                           |
| B   | 30.2 MAX.        | 1 $\frac{3}{16}$ MAX.             | P   | 190.50 $\pm 0.51$          | 7.500 $\pm 0.020$                    |
| C   | 66.52 $\pm 0.05$ | 2.619 $\pm 0.002$                 | R   | 46 $\pm 0.8$               | 1 $\frac{13}{16}$ $\pm \frac{1}{32}$ |
| D   | 7.92 $\pm 0.05$  | 0.312 $\pm 0.002$                 | S   | 9.5 MIN.                   | $\frac{3}{8}$ MIN.                   |
| E   | 5.5 $\pm 1.6$    | $\frac{7}{32}$ $\pm \frac{1}{16}$ | T   | 3.18 $\pm 0.25$            | 0.125 $\pm 0.010$                    |
| F   | 87.31 $\pm 0.38$ | 3.437 $\pm 0.015$                 | V   | 1.65 $\pm 0.25$<br>$-0.00$ | 0.065 $\pm 0.010$<br>$-0.000$        |
| G   | 19.1 $\pm 2.4$   | $\frac{3}{4}$ $\pm \frac{1}{32}$  | W   | 14.3 $\pm 1.6$             | $\frac{9}{16}$ $\pm \frac{1}{16}$    |
| J   | 104.8 $\pm 3.2$  | 4 $\frac{1}{8}$ $\pm \frac{1}{8}$ | X   | 4.75 $\pm 0.12$            | 0.187 $\pm 0.005$                    |
| L   | 336.6 MAX.       | 13 $\frac{1}{2}$ MAX.             | Y   | 7.92 $\pm 0.25$            | 0.312 $\pm 0.010$                    |
| M   | 20.6 $\pm 3.2$   | $\frac{13}{16}$ $\pm \frac{1}{8}$ |     |                            |                                      |

NOTE: BASIC FIGURES ARE INCHES.



# Travelling-Wave Amplifier

Code: W7/2D (CV2188)

The W7/2D is a travelling-wave amplifier for use in the frequency range 3 600 to 4 200 Mc/s. It has a bandwidth of the order of 1 000 Mc/s which makes possible the amplification of signals of large bandwidth and operation over a wide frequency range without retuning.

## ELECTRICAL DATA

### Cathode

Indirectly-heated, oxide-coated

|                          |     |     |
|--------------------------|-----|-----|
| Heater voltage           | 6.3 | V   |
| Nominal current          | 1.0 | A   |
| Minimum pre-heating time | 120 | sec |

### Characteristics

|                                                     |                                                           |             |      |
|-----------------------------------------------------|-----------------------------------------------------------|-------------|------|
| *Amplification                                      | { at Collector current 14 mA<br>and Helix voltage† 3 kV } | 20          | db   |
| Amplification, at one watt output                   |                                                           | 18          | db   |
| Maximum output<br>(at Collector current 14 mA)      |                                                           | 2.5         | W    |
| Bandwidth between 3 db gain points,<br>greater than |                                                           | 1 000       | Mc/s |
| Operating frequency range                           |                                                           | 3 600–4 200 | Mc/s |
| Cold transmission loss                              |                                                           | 40          | db   |

\* The figure quoted for amplification is that obtained at small signal levels. At maximum output it is approximately 4 db lower. See Figure 2.

† The helix voltage should be set within  $\pm 20$  volts of the optimum value for the valve. See Figure 5.





# Travelling-Wave Amplifier

Code: W7/2D (CV2188)

## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

S.H.F. Amplifier at 3 900 Mc/s

### Maximum Ratings

|                                               |     |         |
|-----------------------------------------------|-----|---------|
| Maximum direct second anode and helix voltage | 3.2 | kV      |
| Maximum direct second anode and helix current | 4.0 | mA      |
| Maximum direct first anode voltage            | 2.0 | kV      |
| Maximum direct first anode current            | 500 | $\mu$ A |
| Maximum direct collector voltage              | 3.5 | kV      |
| Maximum direct cathode current                | 18  | mA      |

### \*Typical Operating Conditions

|                                                                              |          |         |
|------------------------------------------------------------------------------|----------|---------|
| † Direct second anode and helix voltage, nominal                             | 3.0      | kV      |
| ‡ Direct collector voltage, nominal                                          | 3.05     | kV      |
| § Direct collector current, adjusted by $V_{a1}$                             | 14       | mA      |
| Direct first anode voltage, $V_{a1}$                                         | 1.3      | kV      |
| Direct first anode current                                                   | 20       | $\mu$ A |
| Direct cathode current                                                       | 15       | mA      |
| Amplification (low level)                                                    | 20       | db      |
| Maximum power output (approx.)                                               | 2.5      | W       |
| Input and output voltage standing wave ratio, 3 600 to 4 200 Mc/s, less than | 2.5 to 1 |         |

\* These figures are obtained when using the recommended circuit.

† Adjusted to give optimum gain. The appropriate helix voltage for individual valves lies between 2.8 and 3.2 kV. See Figure 5.

‡ The collector is operated at 50 volts positive with respect to the helix.

§ Recommended value. The required first anode voltage will be between 800 and 1 600 volts initially, rising to 2 000 volts towards the end of tube life.

# Travelling-Wave Amplifier

Code: W7/2D (CV2188)



## OPERATIONAL DATA

### General

The tube fits into the approved circuit and is held rigidly by an alignment ring around the base and by the radiator mounting. Optimum adjustment of focussing, to allow for variations from tube to tube and in circuit manufacture, is achieved by the use of deflector coils around the gun, each requiring about 20 mA current. See Figure 6 for a sketch of the circuit, showing the deflector coils.

The electron beam, which is directed through the helix to the collector electrode, has available sufficient power to cause damage to the helix and other internal parts if the beam should be out of alignment. It is desirable to make the initial alignment, by means of the deflector coil currents, with a beam current of a few milliamperes, using a low first anode voltage and preferably a reduced helix voltage of about 2 000 volts, the collector electrode being maintained at 50 volts positive with respect to the helix. The alignment will require some readjustment when the helix voltage and beam current are raised to their full values. At no time must the second anode and helix current exceed 3.5 mA.

It is recommended that the tube be operated with the helix or collector earthed and the cathode at a negative potential with respect to earth.

To obtain optimum performance, the tube should be operated at the rated collector current of 14 mA. The helix current will be between 0.5 and 2.0 mA and the first anode voltage between 800 and 1 600 volts initially, rising to 2 000 volts towards the end of the life of the tube. Since the first anode current is less than 500  $\mu$ A, the anode voltage may be obtained from a potentiometer across the helix supply or alternatively the circuit shown in Figure 7, which stabilises the cathode current by automatically adjusting the anode voltage, may be used.

Under no conditions should the collector electrode be operated at a lower potential than the helix as this may give rise to spurious oscillation and excessive interception current.



# Travelling-Wave Amplifier

Code: W7/2D (CV2188)

## Amplification

The helix voltage must be adjusted to give maximum gain. At the optimum helix voltage, and with a collector current of 14 mA, the average low level gain is 20 db.

Figure 2 shows the variation of low level gain which may be expected over the frequency range when operated in the approved circuit with no adjustments.

Figure 5 is a graph of the low level gain as a function of helix voltage. From this it will be seen that in order to maintain the gain within 1 db of maximum, the helix voltage must be within  $\pm 50$  volts of the optimum value.

## Power Output

The input power required for maximum power output is 75 mW. The variation of power output with signal power input is shown in Figure 3.

Although increased power output may be obtained by operating the helix above the optimum voltage, this is not recommended because of the lower gain. Graphs showing power output as a function of frequency and helix voltage are given in Figures 1 and 4 respectively.

## Matching

The backing piston in the waveguide may be tuned to give a voltage standing-wave ratio of less than 2.5 : 1 over a 1 000 Mc/s band in wide band amplifier applications.

Where a better match over a narrow band at a particular frequency is required, the piston position should be fixed and a tuning device used, details of which are available.

## Circuit

A sketch of the recommended circuit, showing the principal external dimensions, is given in Figure 6.

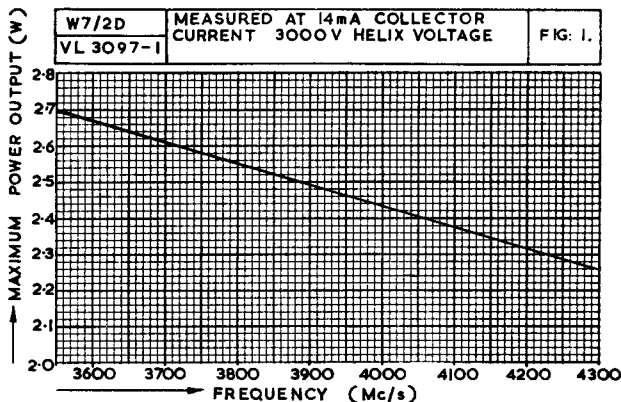
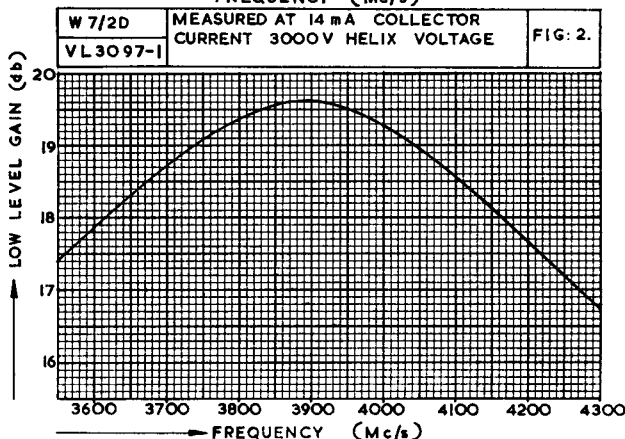
The focus coils require an energising current of 250 mA and, when temperature equilibrium has been reached, the circuit power input is 50 watts. This does not take into account the power needed to energise the deflector coils. These have a resistance of 45 ohms each pair and provision should be made for passing 40 mA through each pair in either direction.

The waveguide size used with the recommended circuit is 2 in by 0.667 in internal, giving a ratio of major-to-minor dimension of 3 to 1.

Detailed information concerning the circuit and focus coil assembly is available on request.

# Travelling-Wave Amplifier

Code: W7/2D (CV2188)



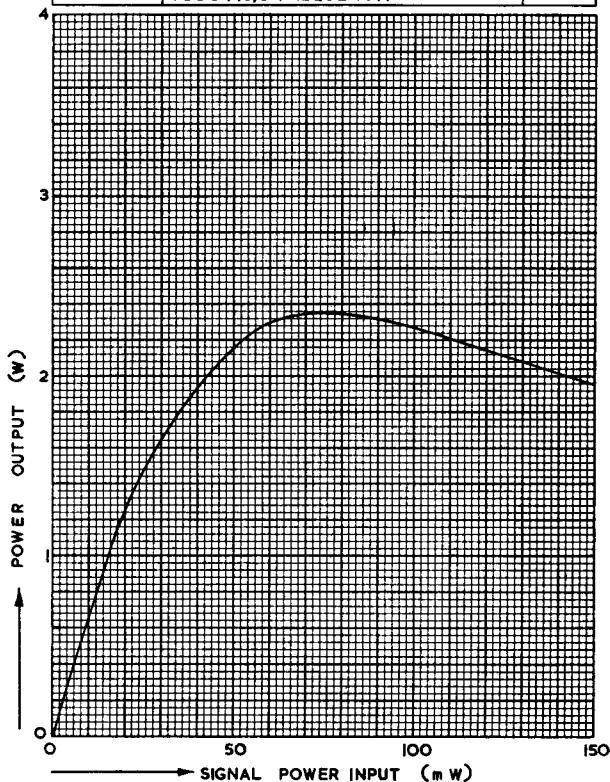




# Travelling-Wave Amplifier

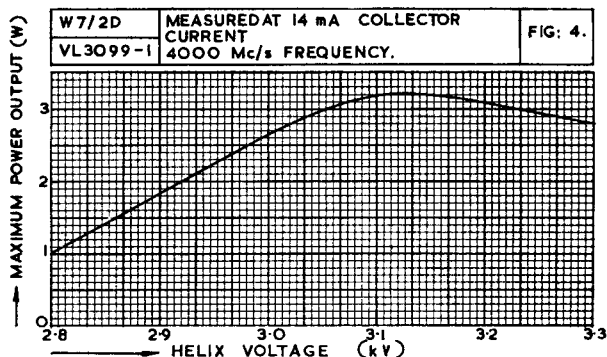
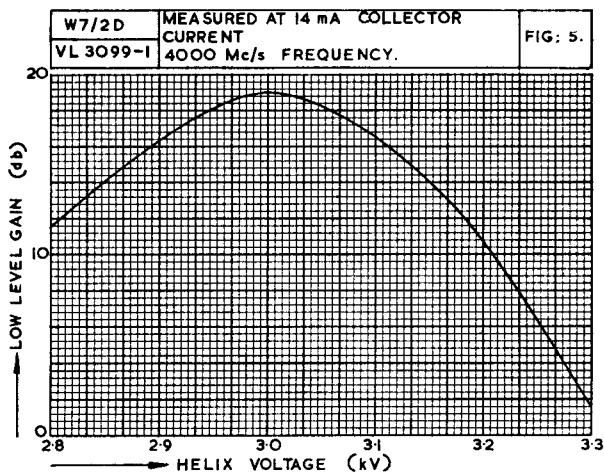
Code: W7/2D (CV2188)

|          |                                                             |         |
|----------|-------------------------------------------------------------|---------|
| W7/2D    | MEASURED AT 14 mA COLLECTOR<br>CURRENT 3000 V HELIX VOLTAGE | FIG: 3. |
| VL3098-1 | 4000 Mc/s FREQUENCY.                                        |         |



# Travelling-Wave Amplifier

Code: W7/2D (CV2188)

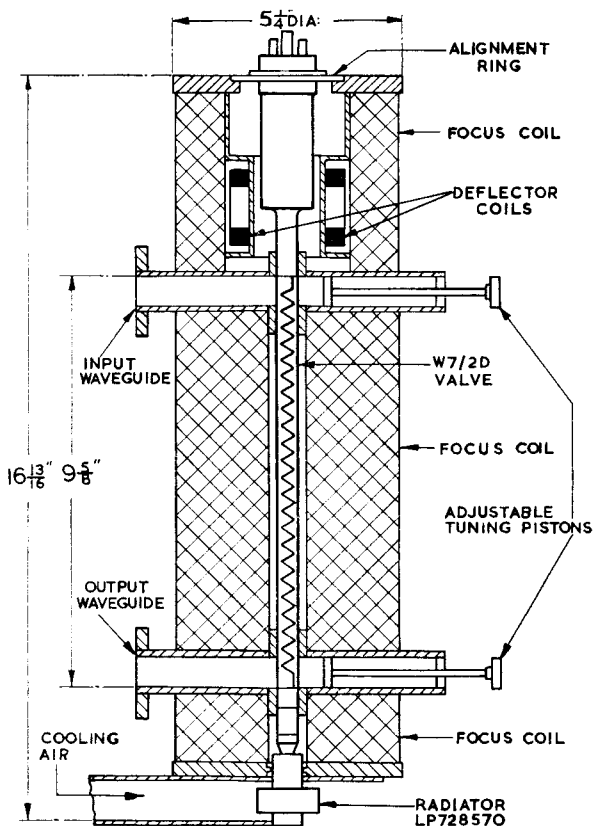




# Travelling-Wave Amplifier

Code: W7/2D (CV2188)

FIG. 6



# Travelling-Wave Amplifier

Code: W7/2D (CV2188)

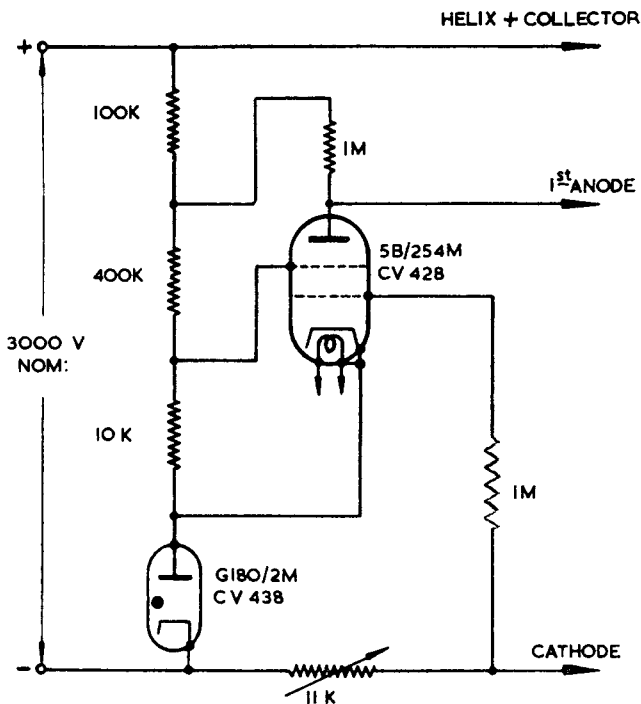
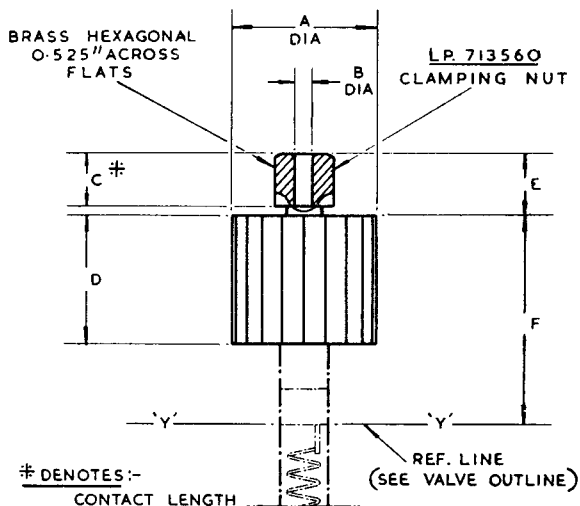


FIG. 7 CIRCUI T FOR STABILISING CATHODE CURRENT



# Travelling-Wave Amplifier

Code: W7/2D (CV2188)



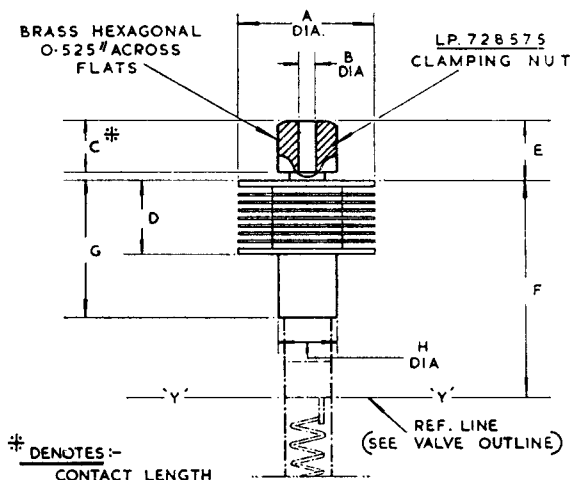
RADIATOR LP.713557

| DIM | MILLIMETRES     | INCHES                           |
|-----|-----------------|----------------------------------|
| A   | $38.0 \pm 1.0$  | $1.500 \pm 0.040$                |
| B   | $4.75 \pm 0.05$ | $0.187 \pm 0.002$                |
| C   | $12.7 \pm 1.2$  | $\frac{1}{2} \pm \frac{3}{64}$   |
| D   | $35.0 \pm 1.6$  | $1 \frac{3}{8} \pm \frac{1}{16}$ |
| E   | $15.1 \pm 1.2$  | $\frac{19}{32} \pm \frac{3}{64}$ |
| F   | $57.2 \pm 4.0$  | $2 \frac{1}{4} \pm \frac{5}{32}$ |

NOTE:- BASIC FIGURES ARE INCHES.

# Travelling-Wave Amplifier

Code: W7/2D (CV2188)



RADIATOR LP.728570

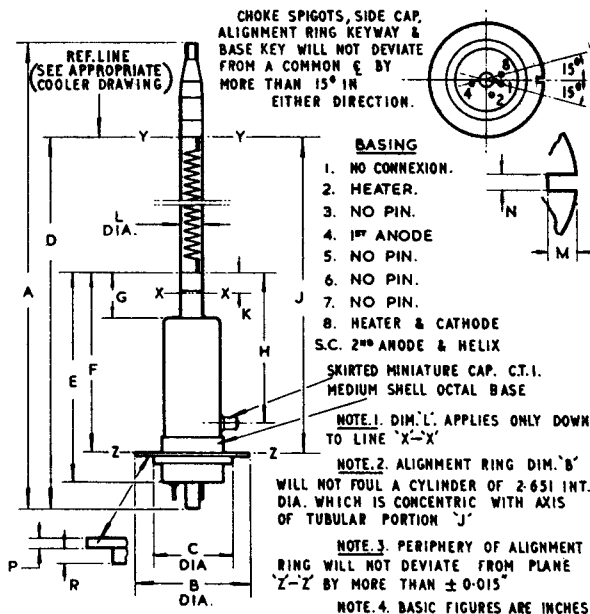
| DIM | MILLIMETRES      | INCHES                               |
|-----|------------------|--------------------------------------|
| A   | 38.0 $\pm$ 0.25  | 1.500 $\pm$ 0.010                    |
| B   | 4.75 $\pm$ 0.05  | 0.187 $\pm$ 0.002                    |
| C   | 12.7 $\pm$ 1.2   | $\frac{1}{2}$ $\pm$ $\frac{3}{64}$   |
| D   | 19.1 $\pm$ 1.6   | $\frac{3}{4}$ $\pm$ $\frac{1}{16}$   |
| E   | 15.1 $\pm$ 1.2   | $\frac{19}{32}$ $\pm$ $\frac{3}{64}$ |
| F   | 69.8 $\pm$ 4.0   | 2 $\frac{3}{4}$ $\pm$ $\frac{5}{32}$ |
| G   | 38.1 $\pm$ 1.6   | 1 $\frac{1}{2}$ $\pm$ $\frac{1}{16}$ |
| H   | 15.88 $\pm$ 0.02 | 0.625 $\pm$ 0.001                    |

NOTE:- BASIC FIGURES ARE INCHES.



# Travelling-Wave Amplifier

Code: W7/2D (CV2188)



| DIM | MILLIMETRES       | INCHES                            | DIM | MILLIMETRES                                                   | INCHES                                                           |
|-----|-------------------|-----------------------------------|-----|---------------------------------------------------------------|------------------------------------------------------------------|
| A   | 444.5 MAX.        | $17\frac{1}{2}$ MAX.              | J   | $347.26 \pm 0.89$                                             | $13.672 \pm 0.035$                                               |
| B   | $66.52 \pm 0.05$  | $2.619 \pm 0.002$                 | K   | 11.1 MIN.                                                     | $\frac{7}{16}$ MIN.                                              |
| C   | $46 \pm 0.8$      | $1\frac{13}{16} \pm \frac{1}{16}$ | L   | 13.08 MAX.                                                    | 0.515 MAX.                                                       |
| D   | 387.3 MAX.        | $15\frac{1}{4}$ MAX.              | M   | $3.18 \pm 0.25$                                               | $0.125 \pm 0.010$                                                |
| E   | $120.65 \pm 6.35$ | $4\frac{3}{4} \pm \frac{1}{4}$    | N   | $1.65 \pm \begin{smallmatrix} 0.25 \\ 0.00 \end{smallmatrix}$ | $0.065 \pm \begin{smallmatrix} 0.010 \\ 0.000 \end{smallmatrix}$ |
| F   | $102.79 \pm 0.38$ | $4.047 \pm 0.015$                 | P   | $4.75 \pm 0.12$                                               | $0.187 \pm 0.005$                                                |
| G   | $25.4 \pm 4.0$    | $1 \pm \frac{5}{16}$              | R   | $7.92 \pm 0.25$                                               | $0.312 \pm 0.010$                                                |
| H   | $85.7 \pm 3.2$    | $3\frac{3}{8} \pm \frac{1}{8}$    |     |                                                               |                                                                  |



# X-RAY TUBE

**X63C/I**  
**(4072A)**

**4072A**

## CATHODE.

**(a) For operation on 10 mA only.**

Filament voltage 3.4 volts maximum, 2.6 volts minimum.  
Filament current 2.4 amps. maximum, 1.7 amps minimum.

**(b) For operation on any emission between 2 mA and 10 mA.**

Filament voltage 3.4 volts maximum, 2.0 volts minimum.  
Filament current 2.4 amps maximum, 1.5 amps minimum.

## DIMENSIONS.

|                        |     |     |
|------------------------|-----|-----|
| Maximum overall length | 121 | mm. |
| Maximum diameter       | 38  | mm. |
| Net weight             | 110 | g.  |

## MOUNTING.

The tube is intended for mounting by means of a 2 B.A. screw fitting the tapped hole in the anode and a locating slot as shown on the drawing. No metal parts should approach within  $\frac{1}{2}$ " of the glass at any point, except in the immediate vicinity of the anode.

## FOCUS.

Effective focal spot is 1.5 mm.  $\times$  1.5 mm.

## COVERING POWER.

The diameter of the cone of X-rays emerging from the tube is 16" (min.) at 30 inches target distance and the intensity is effectively constant over this area.

## OPERATION.

The tube is only to be operated when wholly immersed in Grade A transformer oil. It is most important that the electrical connections to the tube shall be thoroughly sound.

The tube is self-rectifying and is intended to be run directly across the poles of a high tension transformer which delivers 10 mA mean rectified current at a peak voltage, during the active half cycle, of 63 kilovolts. The regulation of the transformer secondary circuit should be such that the peak voltage does not rise above 75 kV when the tube is removed and yet such that the maximum current which the transformer will deliver on short circuit is less than 120 mA. The high tension should be applied by means of a switch in the primary circuit which momentarily inserts a resistance of at least 0.06 ohm per volt of mains voltage.



**X63C/I**  
**(4072A)**

# X-RAY TUBE

**4072A**



## PROTECTION.

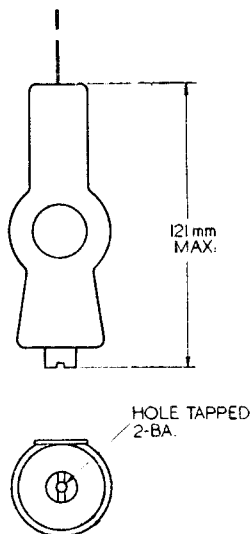
This tube is not self-protected and therefore external X-ray protection equivalent to 1 mm. of lead should be provided.

## MAXIMUM RATING.

The tube may be run continuously at 63 kV peak 10 mA for a period depending upon the design of the tube container. Provision must be made for perfectly free circulation of oil round the tube, especially the anode, in order to prevent excessive local rise in temperature. The temperature of the body of the oil must not be permitted to rise above 60°C.

## MAINS FLUCTUATION.

While the tube is intended to be run at 10 mA, small changes in tube current due to voltage variations of the mains will not damage the tube, but it is important to ensure that the tube current never exceeds 12 mA. It is therefore advisable when starting to reduce the filament current slightly, in case the mains voltage has risen considerably since the tube was last used.





# Reflex Klystron

**Code : Z239/1G (CV2187)**

The Z239/1G is a Reflex Klystron developed for use as a frequency modulated transmitter and capable of delivering an output of approximately one watt.

## ELECTRICAL DATA.

### Cathode

Indirectly-heated, oxide-coated

|                      |     |      |
|----------------------|-----|------|
| Heater voltage       | 6.3 | V    |
| Nominal current      | 1.0 | A    |
| Cathode heating time | 60  | secs |

### Characteristics

|                         |              |      |
|-------------------------|--------------|------|
| Frequency range         | 3600 to 4200 | Mc/s |
| Minimum output power    | 1.0          | W    |
| Bandwidth to half power | 40           | Mc/s |

## MECHANICAL DATA.

Mounting position :—Vertical, base up or down

Maximum overall length, less leads 141.81 mm

Maximum diameter over seals 35.027 mm

Base : None, connections made to flexible leads

Net weight 42 g

Top cap Skirted CT.1

Resonant cavity :

Not an integral part of valve ; various sizes may be fitted to the valve. (Minimum contact diameter of resonator 1.15 in.)

Air flow required with recommended cooler :

When operated with gun end uppermost  
(approx.) 7 cu ft/min

When operated with gun end down  
(approx.) 5 cu ft/min

Maximum seal temperature 90 °C

The cooling air should be directed towards the gun end of the valve.

Tentative data

May 1952

**Z239/1G—1**

## Reflex Klystron



Code: Z239/1G (CV2187)

**MAXIMUM RATINGS.**

|                                  |      |    |
|----------------------------------|------|----|
| Maximum direct resonator voltage | 1100 | V  |
| Maximum direct reflector voltage | -700 | V  |
| Maximum direct resonator current | 70   | mA |

**TYPICAL OPERATING CONDITIONS.****Mode 7 at 7.6 cm**

|                                                   |              |        |
|---------------------------------------------------|--------------|--------|
| Direct resonator voltage                          | 950 to 1100  | V      |
| Direct reflector voltage<br>(Relative to cathode) | -150 to -250 | V      |
| Direct resonator current                          | 60           | mA     |
| Bandwidth to half power                           | 45 to 70     | Mc/s   |
| Modulation sensitivity, approx.                   | 0.5          | Mc/s/V |
| Modulation capacity, approx.                      | 3            | pF     |
| Power output                                      | 1.2          | W      |

**OPERATING DETAILS.**

All tabulated data shown for the Z239/1G were taken with the recommended cavity and waveguide. The dynamic figures shown relate to operation into a resistive load with a standing wave ratio of at least 0.94 and are measured at the highest frequency and at mid-band.

When switching on care should be taken to ensure that the reflector is never allowed to receive a positive bias.

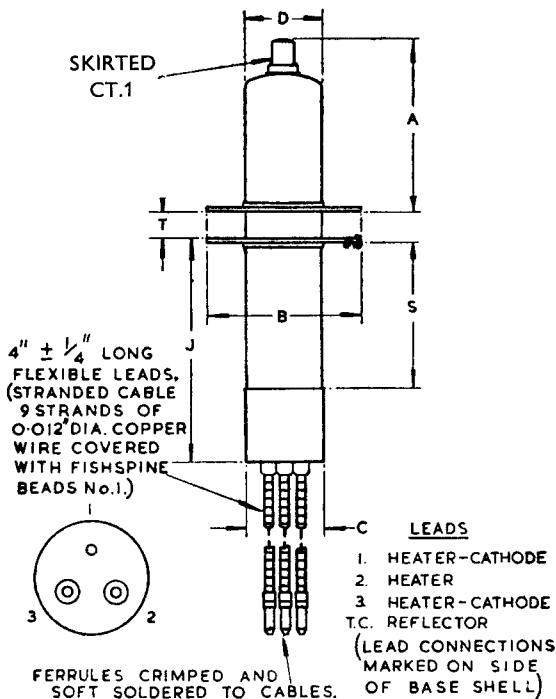
The valve should normally be operated with the resonator earthed and the cathode negative.

Two heater-cathode leads are brought out from the valve so that one can be used as a separate d.c. return path to avoid hum.



# Reflex Klystron

Code: Z239/1G (CV2187)



| DIM. | MILLIMETRES      | INCHES                                    |
|------|------------------|-------------------------------------------|
| A    | 55.56 $\pm$ 4.75 | 2 <sup>3</sup> / <sub>16</sub> $\pm$ 3/16 |
| B    | 34.9 $\pm$ 0.127 | 1.375 $\pm$ 0.005                         |
| C    | 22.23 MAX.       | 0.875 MAX.                                |
| D    | 22.2 MAX.        | 7/8 MAX.                                  |
| J    | 73.03 MAX.       | 2 <sup>7</sup> / <sub>8</sub> MAX.        |
| S    | 50.80 $\pm$ 3.18 | 2 $\pm$ 1/8                               |
| T    | 7.97 $\pm$ 0.5   | 0.314 $\pm$ 0.020                         |

NOTE: BASIC FIGURES ARE INCHES