Standard Valves

Standard Telephones and Cables Limited
(VALVE DIVISION)
CONNAUGHT HOUSE, ALDWYCH,
LONDON, W.C.2

Telephone: Holborn 8765
Telegrams "Relay, Telex, London"

PRICE 15/-

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Standard Telephones and Cables Limited

Registered Office:
CONNAUGHT HOUSE,
ALDWYCH, LONDON, W.C.2
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This handbook is intended primarily for equipment designers and gives comprehensive technical information on Standard valves, cathode ray tubes, cold cathode gas tubes, etc. The data sheets forming the bulk of the handbook have been arranged in numerical order of commercial code so that valves of similar type are grouped together.

All constants and curves are to be taken as average values and the power output and other ratings given under “Typical Operating Conditions” are approximate only.

Additional loose sheets will be issued periodically. Applications for these, and all technical enquiries, should be addressed to:

The Chief Valve Engineer,
Standard Telephones and Cables Limited,
Connaught House, Aldwych, London, W.C.2

Valves for broadcast receiving sets are not covered by this publication. For information on such valves enquiries should be addressed to:

Standard Telephones and Cables Limited,
Brimar Valve Division,
Footscray, Kent.

The Company reserves the right to make any modifications to any of the valves listed in this handbook without prior notice.
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MAXIMUM RATINGS

The maximum ratings specified in this catalogue are limiting values. Each maximum rating must be considered in relation to all other maximum ratings, so that under no condition of operation will any maximum rating be exceeded.

As an example a valve may be rated at a maximum D.C. anode voltage of 3 kV and a maximum anode dissipation of 1 kW. The anode dissipation of 1 kW should not be exceeded even if the operating D.C. anode voltage is only 1.5kV.

The filament or heater voltage given in the data sheets is a normal value unless otherwise stated. Variations from this rated value due to line voltage fluctuations or other causes should not exceed ± 5 per cent unless otherwise specified.

In general, the filament of a transmitting valve may be operated with either A.C. or D.C. A.C. is usually employed unless D.C. is necessary for the reduction of hum. With A.C. operation the return from the grid and anode should be connected to the mid-point of the filament transformer secondary. When D.C. is used, the return leads should be connected to the negative filament terminal.

If it is essential to use D.C. filament excitation on any filament type valve for which the data is given for A.C. operation, the grid-bias values specified should be decreased by an amount approximately equal to one-half the rated filament voltage, and be referred to the negative filament terminal instead of the mid-point.

CLASS A AMPLIFIER.—Grid bias and alternating grid voltages such that the anode current flows continuously throughout the electrical cycle.

CLASS AB AMPLIFIER.—Grid bias and alternating grid voltages such that the anode current flows for more than half the electrical cycle but grid current just does not flow.

CLASS B AMPLIFIER.—Grid bias is approximately equal to cut off value so that anode current is approximately zero when no grid drive voltage is applied. Anode current flows for approximately one-half of each cycle when alternating grid voltage is applied.

CLASS C AMPLIFIER.—Grid bias is appreciably greater than the cut off value so that the anode current is zero when no grid drive voltage is applied. A flow angle of 140 degrees has been used in calculations for typical operating conditions in this book.
Cathodes

PURE TUNGSTEN FILAMENTS
Some valves, particularly large transmitting types, employ tungsten filaments. The life of the cathode depends upon the rate of evaporation of the tungsten and failure will occur through decreased emission or burn-out of the filament. Pure tungsten filaments give best life performance when they are operated so as to conserve their emitting capability. In applications where the normal emission at rated voltage is not required the filament may be operated at a reduced voltage. The extent of the reduction depends upon the peak emission requirements of the application. A reduction of 5 per cent in the filament voltage applied to valves with pure tungsten filaments will approximately double their life.

Note.—It is important that when starting up or shutting down heavy duty filaments of tungsten or thoriated-tungsten the current should be applied or cut off, in a number of steps. At no time should the peak current exceed 150 per cent of the normal value.

THORIATED TUNGSTEN FILAMENTS
The use of thoriated-tungsten filaments has recently been extended to the Standard range of Air Blast Cooled Valves, these filaments are operated at such a temperature that diatomic evaporation is negligible. Since the life of the valve is not controlled by the reduction of the filament the life cannot be increased by operating the filament at reduced voltage as in the case of pure tungsten filaments.

The source of emission in a thoriated tungsten filament is a layer of thorium on the surface of the wire. The thorium in this layer is constantly being removed by evaporation and bombardment during operation and is replenished from within the wire. To maintain a balance between the loss and replacement of an active layer of thorium the filament must be operated within a relatively narrow predetermined range of temperature.

Unusually short life may result from the operation of thoriated tungsten filaments much above or below their rated values. Consequently it is essential that the filament voltage be maintained at all times within ± 5 per cent of the rated value unless otherwise stated.

Thoriated tungsten filaments should not in general be operated at or near saturation. In cases where severe overload has temporarily impaired the emission the activity can sometimes be restored by operating the filament, with anode and grid voltages at zero, at 30 per cent above the normal filament voltage for ten minutes and then at normal filament voltage for twenty to thirty minutes.

OXIDE-COATED CATHODES
A coating of alkaline-earth compounds on a metallic base when heated forms a source of electron emission.
Oxide-coated cathodes may be directly heated or indirectly heated. The latter type consists of a small metallic sleeve coated on the outside with the emitting compound; the insulated heater is inserted inside the sleeve.

Care should be taken with cathodes of this type to determine whether the cathode has been designed for operation at a constant current or a constant voltage rating. It is, in general, extremely undesirable to operate valve heaters in series and this may be done only with cathodes having a constant current rating.
Cooling of Valves

RADIATION COOLED VALVES

Valves up to 1 kW anode dissipation in the majority of cases radiate their heat into the surrounding air by radiation. Free circulation of air should be provided for all valves and is essential in the case of large radiation cooled valves. If it is necessary to enclose a valve in a compartment for reasons of screening, due consideration must be given to the dissipation of the heat generated. When this cannot be effected by free convection of air, a fan may be employed so directed as to cool the entire valve as uniformly as possible. Valves with an anode dissipation in excess of 1 kW are usually cooled by water or an air-blast.

WATER COOLING

Water cooled valves should be mounted with the filament vertical and the filament terminals uppermost. Filament leads should not be allowed to come into contact with the glass bulb.

A water circulating system capable of passing a sufficient quantity of water through the jacket and returning it to the source for recooling must be provided.

The water is circulated under pressure through an interconnecting piping system and lengths of rubber hose or ceramic pipes carry the water from an earthed position in the system to and from the water jackets.

It is of extreme importance that the hose or pipe be of sufficient length to reduce the possibility of current leakage to a minimum. Water used for cooling should have a resistance of not less than 4000 ohms per cubic centimetre; distilled water is recommended.

Under normal operating conditions there is the possibility of scale formation on the anode of the valve if the hardness of the circulating water exceeds 10 grams per gallon. Formation of this scale prevents efficient cooling of the valve, and if allowed to persist may result in a breakdown. If it is absolutely necessary to use hard water in an emergency, the anode should be cleaned periodically by dipping into a 10 per cent solution of hydrochloric acid until the scale is dissolved. All traces of acid should be rinsed off before returning the valve to its socket. This procedure should be avoided whenever possible, as frequent removal of the valve from its water jacket increases the danger of accidental damage.

Standard water jackets, available for each type of valve, have been designed to give a thin turbulent stream of water evenly distributed over the surface of the anode. The water flow must be sufficiently fast to prevent steam bubbles from forming on the anode surface—recommended flow is specified for each valve type.
The water flowing through a water jacket should never reach boiling point. Localised boiling may be detected by a singing noise.

The filament and anode supply must be interconnected with the water supply, so that in case of failure of the water supply the filament and anode voltages are cut off from the valve. The heat from the filament alone is sufficient to cause serious damage if operated without cooling water.

It is recommended that water flow around the jacket should be maintained for a sufficient time after the filament and anode supplies are cut off to prevent unequal cooling.

Extreme care must be taken when inserting or removing a valve from its water jacket so that no strains are placed on the copper to glass seals.

When putting a valve into a water jacket the gland should be tightened just sufficiently to prevent any water leak. Screwing the clamping ring right down hard may distort the anode clamping ring.

**AIR BLAST COOLING**

Air blast cooled valves possess the advantage over water cooled types that they are more transportable. This is of a considerable advantage for H.F. heating applications.

A fan capable of delivering the maximum volume of air specified for the valve at the required pressure must be installed. Air flow must be started before the application of any supply voltages, and it is recommended that it should be continued for at least ten minutes after the removal of all supply voltages.

 Provision should be made for automatic removal of all supplies from the valve immediately the air-flow falls below the minimum requirements.
Hot Cathode Mercury Vapour Rectifiers and Thyrotrons

The conditions for correct operation of H.C.M.V. rectifiers and thyrotrons depend very largely on the circuit in which the valves are used and on the local conditions. The following general remarks are intended as a guide to obtain optimum conditions.

An important factor for the correct operation of these valves is the temperature of that part of the bulb on which the mercury condenses. This is normally approximately \( \frac{1}{4} \) in. above the top of the base. The temperature of the condensed mercury must not be too high as it would be liable to cause arc-backs due to the high vapour pressure of the mercury and it must not be too low as this would give a low vapour pressure of the mercury producing an excessive voltage drop inside the valve, which would be liable to cause the deactivation of the oxide coated cathodes. Provided that the temperature of the condensed mercury is kept within allowable limits, the voltage drop inside a mercury vapour rectifier valve is low (8 to 20 volts).

The limits of condensed mercury temperature are given on the information sheet for each valve.

Also listed, for each valve, are the recommended condensed mercury temperature conditions which allow the operation of the valve under natural conditions of ventilation. The extension of the condensed mercury temperature range by using forced air cooling is also shown.

In certain cases, not covered by the information listed, the use of forced air cooling is recommended.

1. For valves used under conditions where the current is appreciably below the maximum peak current and the inverse voltage is very high, it is recommended that air at ambient temperature should be blown on the base of the valve at the point where the mercury condenses. The blowing device should be started when the condensed mercury temperature exceeds 35°C.

2. For valves of high powers, used under conditions such that the current is near the maximum peak current, it is recommended that the voltage drop be kept as low as possible. The pressure of the mercury vapour should therefore be kept as high as possible in relation to the inverse voltage the valve has to stand and a system circulating air at constant temperature should be employed. Such a system would blow air...
through controlled heating resistances on to the base of the valve, the valve itself being surrounded with a screen to prevent circulation of free air.

CATHODE HEATING

It is very important that the cathode of the valve shall be operated under the correct heating conditions when the anode voltage is applied. If the temperature of the cathode is too low, the resultant decrease in emission produces an increase in the voltage drop and a quick deactivation of the oxide coated cathode. For this reason the voltage variation in the main supply feeding the filament transformer should not be more than ± 5% (these limits include the effect of variation of load on the rectifier).

The filament transformer should be connected so that when the mains voltage is at its minimum value the voltage measured at the filament terminals corresponds to the rated value. This adjustment of voltage can be obtained by providing tappings on the primary of filament transformer. It can be seen that in many cases specially designed transformers will have to be used as normal transformers would not be suitable.

Where valves are operated with the filaments connected in parallel, each separate bank of valves should be fitted with a filament voltmeter having an accuracy of ± 2% so that the filament voltage can be controlled at any moment.

When the current is passed through the filament a certain length of time elapses before the filament reaches its normal operating temperature. For this reason a certain delay period between the time of switching on the filament and anode voltages must be incorporated. The necessary time delay for each type of valve is specified on the information sheet and can be obtained by time delay relays operating from the filament supply.

CIRCUIT REQUIREMENTS

In cases where a peak inverse voltage greater than 10,000 volts is used the primary voltage should be applied in steps by means of an induction regulator or similar device, or by short circuiting resistances connected in series with the supply feeding the high tension transformer.

Protection against overloads should be provided by means of overload relays in the supply lines and in the earthed side of the rectified current. These relays should be quick acting and cause the release of the feeding contactors and the oil switches.
The filter circuit used with the rectifier should never begin with a condenser and should be designed so that the resonant frequencies of the filter cells are lower than those of the A.C. supply or of any frequency which may appear during the operation.

INSTALLATION

Mercury vapour valves should always be mounted in a vertical position with the filament terminals at the bottom.

Due to the large currents at low voltage which are required for the heating of the filaments, the filament terminals should make good contact with the contacts in the socket.

OPERATION OF VALVES

After shipment or transit to or from the operating position the valve must be preheated with filament at rated voltage for the full period stated on the data sheet for the valve. By this means the mercury adhering to the electrode structure as a result of jolting, may be distributed correctly.

If peak inverse voltages in excess of 10 kV are to be used, it is very desirable, after transport or handling, that the anode voltage be applied in steps, as explained under "Circuit Requirements".

THYRATRON OPERATION

The grid as employed in the thyratron controls only the starting of the discharge. After starting, under usual operating conditions, it neither modulates, limits, nor extinguishes the arc. This is the fundamental difference between the thyratron as ordinarily used and the high vacuum valve. In order to allow the grid to affect the anode current the anode voltage must be reduced substantially to zero, or made negative for a period long enough for the gas or vapour to become deionized. Once this deionization takes place the grid can resume control.

The critical grid potential is defined as the grid voltage, which is sufficient to prevent conduction at any particular anode voltage. The ratio of the positive anode potential to the critical grid potential is known as the control ratio.

When accurate control of the thyratron output is desired, the grid should be biased beyond the limiting value for the maximum peak anode voltage and to strike the valve should be pulsed positive with a pulse having a leading edge as near vertical as possible. The control of the output of the valve is made by variation in phase of the grid pulse relative to the phase of the applied anode voltage. Variation of the output from zero to maximum is adjusted by this means.

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All British valve bases conform to British Standards specification BS448. Dimensions of American bases are shown on the following pages.
Valve Bases

SMALL 4 PIN

MEDIUM 4 PIN

MEDIUM 4 PIN BAYONET

ON FINISHED TUBE ADD 0.030" TO LENGTH OF PIN FOR SOLDER

May 1947
Valve Bases
SPECIAL 4 PIN BAYONET
SPECIAL 4 PIN WITH OFFSET BAYONET PIN

May 1947
Valve Bases

SUPER JUMBO 4 PIN BAYONET

ON FINISHED TUBE ADD 0.030" TO LENGTH OF PIN FOR SOLDER.

May 1947
Valve Bases

SMALL 5 PIN

MEDIUM 5 PIN

ON FINISHED TUBE ADD 0.030" FOR SOLDER.

May 1947
Valve Bases

GIANT 5 PIN

*ON FINISHED TUBE ADD 0.030 FOR SOLDER.

May 1947
Valve Bases

SMALL 6 PIN

MEDIUM 6 PIN

4 PINS 0.125" ± 0.003"

0.750" P.C.D.

60° ALL PINS

2 PINS 0.156" ± 0.003"

0.843" NOM.

1.165" MAX

1.087" NOM.

0.500" MAX

1.377" MAX

4 PINS 0.125" ± 0.003"

0.750" P.C.D.

60° ALL PINS

2 PINS 0.156" ± 0.003"

* ON FINISHED TUBE ADD 0.030 FOR SOLDER

May 1947
Valve Bases

MEDIUM 7 PIN

1.087" NOM

*0.500"

1.377" MAX

5 PINS 0.125" ± 0.003"

0.855" P.C.D.

51° 3 4 5

52° 2 1 6 7

26° 26°

2 PINS 0.156" ± 0.003"

* ON FINISHED TUBE ADD 0.030 FOR SOLDER

May 1947
Valve Bases

GIANT 7 PIN

* ON FINISHED TUBE ADD 0.030" FOR SOLDER

May 1947
Valve Bases

INTERMEDIATE SHELL OCTAL

* ON FINISHED TUBE ADD 0.030" FOR SOLDER

May 1947
Valve Bases

MEDIUM SHELL OCTAL

---

1.087" NOM.
0.560" MAX.
0.490" NOM.
0.135" MAX.
0.317" MAX.
1.377" MAX

0.035" MAX.
0.355" MIN.
0.437" MAX.
0.095" MAX

---

0.040" RAD
0.055" MAX

ALL PINS

45°

ALL PINS 0.093" ± 0.003"

---

* ON FINISHED TUBE ADD 0.030" FOR SOLDER

May 1947

C
Valve Bases
GIANT EDISON SCREW
MEDIUM SCREW

GIANT EDISON SCREW

MEDIUM SCREW

May 1947
The Commercial Valve Code

The object of the commercial code is to enable classification of valves, cathode ray tubes, thermocouples, etc., to be made according to their electrical sizes and types, and to ensure that the technical information when filed in numerical order will group components of a similar type and rating together.

Where a valve has been marketed under a 4000 code (e.g. 4220C, 4357A, etc.), the valve should be referred to and ordered by that number. It appears at the top centre of each page of data. In these cases a commercial code, for reference purposes only, appears at the top corner of the sheet.

The general valve coding takes the following form: a number indicative of the number of electrodes; a letter which designates the type, followed by a dividing bar; a three figure number, the first two figures of which usually indicate the electrical size, the third figure being a serial number. The type of base is indicated by the letter following and in a few cases a further letter is used to denote physical or test limit variations.

Coding for special types such as cathode ray, cold cathode, velocity modulated tubes, etc., commences with a letter instead of a figure. The subsequent combination of figures and letters indicates electrical size, characteristics, serial number and basing according to the requirements of each type.

Examples of the coding are shown on sheets N—1 and N—2. If a detailed explanation of the code is required a descriptive pamphlet is available on application to the Publicity Department, Connaught House, Aldwych, W.C.2.
EXAMPLES OF CODING

General Valves  ...  2S/300A  2 = diode, S = Low voltage rectifier, 30 = Function of Peak current and P.I.V. 0 = serial number, A = American standard base.

2T/270K  2 = diode, T = High voltage rectifier, 27 = function of Peak current and P.I.V. 0 = serial number, K = miniature button base.

2V/400C  2 = diode, V = Mercury Vapour rectifier, 40 = function of Peak current and P.I.V. 0 = serial number, C = Edison screw base.


3A/107B  3 = triode, A = Anode diss. below 10 watts, 107 = serial number, B = British standard base.

3B/401J  3 = triode, B = Anode diss. between 10 and 100 watts, 40 = Anode diss. 40 watts, 1 = serial number, J = Mounted by disc seal.

3V/320B  3 = triode, V = Mercury vapour, 32 = function of Peak current and P.I.V. 0 = serial number, B = British standard base.

3J/170E  3 = triode, J = Air blast cooled, 17 = function of Peak current and Max. Anode voltage, 0 = serial number, E = Special base.

3Q/213E  3 = triode, Q = Water cooled, 21 = function of Peak current and Max. Anode voltage, 3 = serial number, E = Special base.

33A/100A  33 = double triode, A = Anode diss. below 10 watts, 100 = serial number, A = American standard base.

4C/800E  4 = tetrode, C = Anode diss. between 100 and 1,000 watts, 80 = Anode diss. 800 watts, 0 = serial number, E = Special base.

5A/102D  5 = Pentode, A = Anode diss. below 10 watts, 102 = serial number, D = International Octal base.

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Examples of Coding—continued.

5D/100A  5 = Pentode, D = Anode diss. between 1,000 watts and 10,000 watts, 10 =
Anode diss. 1,000 watts, 0 = serial number, A = American standard base.

Ballast Lamps ... B1C/1G  IC = Indicates the average stabilising current, C denotes the range 1 to 9A
.: current is 1A, /1 = serial number, G = No base leads brought out.

B4B/2C  4B = Indicates the average stabilising current, B denotes the range 0.1 to 9A
.: current is 0.4A, /2 = serial number, C = Edison screw base.

Cathode Ray Tubes ... C16GS/1B  16 = The approximate screen diameter 16/4 which is 4in., G = Gas focused,
S = Electrostatic deflection, /1 = serial number, B = Colour of screen blue.

C22SM/2G  22 = The approximate screen diameter, 22/4 which is 5½in., S = Electrostatic
focus, M = Magnetic deflection, /2 = serial number, G = Colour of screen Green.

Cold Cathode Tubes ... G150/2D  150 = The approximate minimum breakdown voltage of main gap, /2 = serial
number, D = International Octal base.

Vacuum Condenser ... K50/2L  50 = 50 pF capacity, /2 = serial number, L = Mounting by end caps.

Vacuum Thermocouples T4A/40TA  4 = 4 terminals, A = Normal LF type direct contact, /40 = Max. safe heater
current 40 mA, T = Mounted in box with 4 terminals, A = serial letter.
Classification System

Valves are listed according to availability into four categories.

1. Preferred list  Valves for use in new equipment should be chosen from this list.

2. Current list    Valves which are in current production in addition to those in the Preferred list.

3. Maintenance list Valves which will be supplied for replacement purposes in existing designs of equipment only. Not to be used in new designs.

4. Obsolete list   Valves in this list are no longer manufactured and may be supplied subject to being in stock.

Data sheets for valves in the first two categories will be found in this handbook. Data sheets for maintenance types are available on demand from Publicity Dept. No data sheets will be supplied on obsolete types.
# Classified List of Standard Valves—"Preferred" Types

## Vacuum Rectifiers

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$</th>
<th>$I_f$</th>
<th>Max. PIV</th>
<th>Peak $I_a$</th>
<th>Av. $I_a$</th>
<th>D.C. Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2T/270K</td>
<td>IH</td>
<td></td>
<td>4</td>
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<td>12.5</td>
<td>0.04</td>
<td>0.005</td>
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## Mercury Vapour Rectifiers

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<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$</th>
<th>$I_f$</th>
<th>Max. PIV</th>
<th>Peak $I_a$</th>
<th>Av. $I_a$</th>
<th>D.C. Output</th>
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</thead>
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<td>2V/400A</td>
<td>OCF</td>
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<td>2.5</td>
<td>5.0</td>
<td>10</td>
<td>1.0</td>
<td>0.25</td>
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<td>2V/500C</td>
<td>4049D</td>
<td>OCF</td>
<td>4</td>
<td>11</td>
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<td>5</td>
<td>1.25</td>
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<td>2V/530E</td>
<td>4078A</td>
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<td>4080A</td>
<td>OCF</td>
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<td>100</td>
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## Classified List of Standard Valves—“Preferred” Types—continued.

### RADIATION COOLED TRIODES

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<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
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<th>$\mu$</th>
<th>$r_a$</th>
<th>$g_m$</th>
<th>$V_a$</th>
<th>$W_a$</th>
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<td>3B/252B</td>
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(1) Twin Triode—Characteristics given are for one section only, both sections being identical.

*August 1947*
### AIR BLAST COOLED TRIODES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ (V)</th>
<th>$I_f$ (A)</th>
<th>$\mu$</th>
<th>$r$ (k$\Omega$)</th>
<th>Max. Va (kV)</th>
<th>$w_a$ (kW)</th>
<th>MAX. FREQUENCY</th>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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<td>Full Ratings Mc/s</td>
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<td>19</td>
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<td>1</td>
<td>120</td>
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<td>6</td>
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<td>50</td>
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<td>3J/191E</td>
<td>TTF</td>
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<td>26</td>
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<td>3.45</td>
<td>10</td>
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<td>50</td>
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<td>3J/192E</td>
<td>TTF</td>
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<td>3J/221E</td>
<td>TF</td>
<td>22</td>
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<td>17.5</td>
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<td>22</td>
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<tr>
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<td>TF</td>
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August 1947
## Classified List of Standard Valves—"Preferred" Types—continued.

### WATER COOLED TRIODES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ (V)</th>
<th>$I_f$ (A)</th>
<th>$\mu$</th>
<th>$r_a$ (kΩ)</th>
<th>Max. $V_a$ (kV)</th>
<th>$w_a$ (kW)</th>
<th>MAX. FREQUENCY</th>
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<tbody>
<tr>
<td>3Q/150E</td>
<td>4228A</td>
<td>TF</td>
<td>22</td>
<td>41</td>
<td>18</td>
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<td>3</td>
</tr>
<tr>
<td>3Q/191E</td>
<td>TTF</td>
<td>10</td>
<td>33</td>
<td>26</td>
<td></td>
<td>3.45</td>
<td>7.5</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>3Q/221E</td>
<td>TF</td>
<td>22</td>
<td>70</td>
<td>26</td>
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<td>17.5</td>
<td>20</td>
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<td>3Q/292E</td>
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### MERCURY VAPOUR THYRATRONS

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<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ (V)</th>
<th>$I_f$ (A)</th>
<th>Max. PIV (kV)</th>
<th>Max. Peak $I_a$ (A)</th>
<th>Max. Av. $I_a$ (A)</th>
<th>Grid Control ratio approx.</th>
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<tr>
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<td>IH</td>
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<td>1.5</td>
<td>12.5</td>
<td>2.5</td>
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<tr>
<td>3V/500A</td>
<td>4049GD</td>
<td>OCF</td>
<td>4</td>
<td>11</td>
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<td>1.25</td>
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<td>3V/530E</td>
<td>4078GA</td>
<td>OCF</td>
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<td>20</td>
<td>20</td>
<td>10</td>
<td>2.5</td>
<td>1,000</td>
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<td>3V/560E</td>
<td>4079GA</td>
<td>OCF</td>
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<td>20</td>
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<td>1,000</td>
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<td>3V/590E</td>
<td>4080GA</td>
<td>OCF</td>
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<td>100</td>
<td>16</td>
<td>50</td>
<td>20</td>
<td>1,000</td>
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### Radiation Cooled Pentodes

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>Vf V</th>
<th>If A</th>
<th>Screen μ</th>
<th>gm mA/V</th>
<th>Max. Va V</th>
<th>Max. Vg2 V</th>
<th>wa W</th>
<th>Full Ratings Mc/s</th>
<th>Reduced Ratings Mc/s</th>
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</thead>
<tbody>
<tr>
<td>5A/152M</td>
<td>IH</td>
<td>6.3</td>
<td>0.46</td>
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<td>300</td>
<td>200</td>
<td>3</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5B/110M</td>
<td>IH</td>
<td>6.3</td>
<td>0.80</td>
<td>—</td>
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<td>6.5</td>
<td>300</td>
<td>200</td>
<td>11</td>
<td>—</td>
<td>—</td>
</tr>
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<td>5B/250A</td>
<td>IH</td>
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<td>0.9</td>
<td>8</td>
<td>—</td>
<td>6</td>
<td>600</td>
<td>300</td>
<td>25</td>
<td>60</td>
<td>125</td>
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<tr>
<td>5B/251M</td>
<td>IH</td>
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<td>0.9</td>
<td>8</td>
<td>—</td>
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<td>600</td>
<td>300</td>
<td>16</td>
<td>60</td>
<td>125</td>
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<td>5C/100A</td>
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<td>30</td>
<td>60</td>
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<tr>
<td>5C/101A</td>
<td>TTF</td>
<td>10.4</td>
<td>11</td>
<td>5</td>
<td>2,000</td>
<td>400</td>
<td>100</td>
<td>—</td>
<td>20</td>
<td>—</td>
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</tr>
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### Air Blast Cooled Pentode

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<th>Vf V</th>
<th>If A</th>
<th>Screen μ</th>
<th>gm mA/V</th>
<th>Max. Va kV</th>
<th>Max. Vg2 kV</th>
<th>wa kW</th>
<th>Full Ratings Mc/s</th>
<th>Reduced Ratings Mcs</th>
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August 1947
### Classified List of Standard Valves—"Preferred" Types—continued.

#### COLD CATHODE GAS TUBES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Type</th>
<th>Main Gap Striking V</th>
<th>Main Gap Maintaining V</th>
<th>Control Gap Striking V</th>
<th>Control Gap Maintaining V</th>
<th>Cathode Current mA</th>
<th>Regulation Volts</th>
<th>Current mA</th>
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<tbody>
<tr>
<td>G120/1B</td>
<td>Stabiliser</td>
<td>120</td>
<td>55</td>
<td></td>
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<td>20</td>
<td>4</td>
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<tr>
<td>G150/2D</td>
<td>Relay</td>
<td>150</td>
<td>75</td>
<td>75</td>
<td>65</td>
<td></td>
<td>20</td>
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<tr>
<td>G240/2D</td>
<td>Relay</td>
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<td>75</td>
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#### VACUUM CONDENSERS

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<th>Length mm.</th>
<th>Diam. m</th>
<th>Capacity pF</th>
<th>Peak RF kV</th>
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<td>K12/2L</td>
<td>170</td>
<td>70</td>
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<td>12 ± 10%</td>
<td>32</td>
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</tr>
<tr>
<td>K25/2L</td>
<td>170</td>
<td>70</td>
<td></td>
<td>25 ± 10%</td>
<td>32</td>
<td>12</td>
</tr>
<tr>
<td>K50/2L</td>
<td>170</td>
<td>70</td>
<td></td>
<td>50 ± 10%</td>
<td>32</td>
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August 1947
### MISCELLANEOUS TUBES

<table>
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<th>Description</th>
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<tr>
<td>V230A/1K</td>
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<td>V.M. Oscillator. Wave length range 8.9 cm. to 11 cm. and 8 cm. to 16 c.m. Approximate output 0.3W</td>
</tr>
<tr>
<td>V246A/1K</td>
<td></td>
<td>V.M. Oscillator. Wave length range 6 cm. to 7 cm. Approximate output 0.5 W.</td>
</tr>
<tr>
<td>VLS631</td>
<td></td>
<td>Miniature Thermal Delay Switch. $V_h$ 6.3 V. $I_k$ 0.5 A. Delay approximately 50 seconds. Maximum contact current 1 A. Maximum contact o/c Voltage 220 V.</td>
</tr>
<tr>
<td>VLS640</td>
<td></td>
<td>Vacuum Antenna Relay. Equivalent of Bendix 3926E. 4 kV. 1 A.</td>
</tr>
<tr>
<td>X63C/1</td>
<td>4072A</td>
<td>X-Ray Tube. 6.3 kV peak at 10 mA.</td>
</tr>
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August 1947
# Classified List of Standard Valves—"Current" Types

## Radiation Cooled Triodes

<table>
<thead>
<tr>
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<th>Code</th>
<th>Cathode</th>
<th>$V_f$</th>
<th>$I_f$</th>
<th>$\mu$</th>
<th>$r_a$</th>
<th>$g_m$</th>
<th>Max. Va</th>
<th>$w_a$</th>
<th>Max. Frequency</th>
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<tbody>
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<td>OCF</td>
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<td>—</td>
<td>190</td>
<td>—</td>
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</tr>
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<td>3A/108B</td>
<td>OCF</td>
<td>2</td>
<td>0.25</td>
<td>30</td>
<td>50</td>
<td>—</td>
<td>—</td>
<td>190</td>
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<td>—</td>
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<tr>
<td>3A/109B</td>
<td>OCF</td>
<td>4</td>
<td>0.25</td>
<td>6</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>190</td>
<td>—</td>
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<tr>
<td>3A/110B</td>
<td>OCF</td>
<td>4</td>
<td>0.25</td>
<td>12</td>
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<td>—</td>
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<td>190</td>
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<tr>
<td>3A/141A</td>
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<td>190</td>
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<tr>
<td>3B/100B</td>
<td>IH</td>
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<td>—</td>
<td>200</td>
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<td>3B/151A</td>
<td>OCF</td>
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<tr>
<td>3B/505E</td>
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<td>TTF</td>
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<td>12</td>
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<td>1,500</td>
<td>50</td>
<td>100</td>
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<tr>
<td>3C/150A</td>
<td>TTF</td>
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*August 1947*  

*R-1*
### RADIATION COOLED TETRODES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ V</th>
<th>$I_f$ A</th>
<th>$\mu$</th>
<th>$r_a$ kΩ</th>
<th>Max. $V_a$ V</th>
<th>Max. $V_{gs}$ V</th>
<th>$w_a$ W</th>
<th>MAX. FREQUENCY</th>
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<tr>
<td>4A/137B</td>
<td>4045A</td>
<td>OCF</td>
<td>5</td>
<td>1.6</td>
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### RADIATION COOLED PENTODES

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<th>Code</th>
<th>Cathode</th>
<th>$V_f$ V</th>
<th>$I_t$ A</th>
<th>$\mu$</th>
<th>Screen $\mu$</th>
<th>$gm$ ma/V</th>
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<th>Max. $V_{gs}$ V</th>
<th>$w_a$ W</th>
<th>MAX. FREQUENCY</th>
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August 1947
### Classified List of Standard Valves—“Current” Types—continued.

#### CATHODE RAY TUBES

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<th>I&lt;sub&gt;f&lt;/sub&gt; A</th>
<th>Useful Screen Diam., inches</th>
<th>Focus</th>
<th>Deflector</th>
<th>Final Anode Voltage kV</th>
<th>First Anode Voltage V&lt;sub&gt;k&lt;/sub&gt;</th>
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<th>Base</th>
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<tr>
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<td>VLS492AB</td>
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<td>1.8</td>
<td>1½</td>
<td>Electrostatically</td>
<td>Electrostatic</td>
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<td>0.5</td>
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<td>Medium Shell Octal</td>
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<td>Electrostatically</td>
<td>Electrostatic</td>
<td>1</td>
<td>0.5</td>
<td>Green</td>
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<td>C10SS/1B</td>
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<td>1.7</td>
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<td>Electrostatic</td>
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<td>0.25</td>
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<td>0.5</td>
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<td>0.5</td>
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<td>Electrostatic</td>
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<td>0.5</td>
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### COLD CATHODE GAS TUBES

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<th>Control Gap Striking V</th>
<th>Control Gap Maintaining V</th>
<th>Cathode Current mA</th>
<th>Regulation Volts</th>
<th>Regulation mA</th>
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<tr>
<td>G150/1A G180/1G</td>
<td>4313C</td>
<td>Relay Storage Lamp</td>
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### MISCELLANEOUS TUBES

- **P535/1E** ... ... Tetrode Pulse Modulator. Max. Va 15 kV. Peak Ia 15 A
- **P552/1E** ... ... Tetrode Pulse Modulator. Max. Va 20 kV. Peak Ia 15 A
- **VLS612** ... ... Manometer valve. 3A/141A type
- **VLS668A** ... ... Manometer valve. 110 mm., bulb length 76 mm. tubulation
- **VLS668B** ... ... Manometer valve. 200 mm., bulb length 26mm. tubulation

*August 1947*
## CLASSIFIED LIST OF STANDARD VALVES—“MAINTENANCE” TYPES
### VACUUM RECTIFIERS

<table>
<thead>
<tr>
<th>Reference</th>
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<th>$I_f$ A</th>
<th>Max. PIV kV</th>
<th>Peak la A</th>
<th>Av. la A</th>
<th>D.C. OUTPUT ½ wave V</th>
<th>D.C. OUTPUT bi-phase A</th>
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</thead>
<tbody>
<tr>
<td>2T/200E</td>
<td>4065A</td>
<td>TF</td>
<td>4</td>
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<tr>
<td>22S/200A</td>
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### MERCURY VAPOUR RECTIFIERS

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<th>Peak la A</th>
<th>Av. la A</th>
<th>D.C. OUTPUT ½ wave kV</th>
<th>D.C. OUTPUT bi-phase A</th>
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### WATER COOLED RECTIFIERS

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<th>$I_f$ A</th>
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<th>Peak la A</th>
<th>Av. la A</th>
<th>D.C. OUTPUT ½ wave kV</th>
<th>D.C. OUTPUT bi-phase A</th>
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<tr>
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### Classified List of Standard Valves—“Maintenance” Types—continued.

#### RADIATION COOLED TRIODES

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<th>Reduced Ratings Mc/s</th>
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S—2
### Classified List of Standard Valves—“Maintenance” Types—continued.

#### RADIATION COOLED TRIODES

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<th>$R_a$ kΩ</th>
<th>Max. Va V</th>
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### Radiation Cooled Triodes

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<th>$\mu$</th>
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<th>$V_a$</th>
<th>$W_a$</th>
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### Water Cooled Triodes

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<th>$V_a$</th>
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## Classified List of Standard Valves—“Maintenance” Types—continued.

### WATER COOLED TRIODES

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<thead>
<tr>
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<th>Code</th>
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<th>$\mu$</th>
<th>$r_a$ kΩ</th>
<th>Max. $V_a$ kV</th>
<th>$w_a$ kW</th>
<th>MAX. FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>3Q/151G</td>
<td>4013D</td>
<td>TF</td>
<td>20</td>
<td>41</td>
<td>21</td>
<td>4.2</td>
<td>6</td>
<td>5</td>
<td></td>
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<tr>
<td>3Q/180E</td>
<td>4014A</td>
<td>TF</td>
<td>22</td>
<td>41</td>
<td>40</td>
<td>7.5</td>
<td>12</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>3Q/181E</td>
<td>4006A</td>
<td>TF</td>
<td>20</td>
<td>50</td>
<td>40</td>
<td>7.5</td>
<td>13</td>
<td>10</td>
<td>3</td>
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<tr>
<td>3Q/184E</td>
<td>4220C</td>
<td>TF</td>
<td>22</td>
<td>41</td>
<td>40</td>
<td>7.5</td>
<td>13</td>
<td>10</td>
<td>1</td>
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<tr>
<td>3Q/200A</td>
<td>TF</td>
<td>20</td>
<td>59</td>
<td>12.5</td>
<td>3.6</td>
<td>17.5</td>
<td>20</td>
<td>5</td>
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<tr>
<td>3Q/211E</td>
<td>SS.1971</td>
<td>TF</td>
<td>20</td>
<td>64</td>
<td>21.5</td>
<td>3.5</td>
<td>12</td>
<td>15</td>
<td>15</td>
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<tr>
<td>3Q/212E</td>
<td>4081A</td>
<td>TF</td>
<td>20</td>
<td>59</td>
<td>33</td>
<td>6.0</td>
<td>17.5</td>
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<td>5</td>
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<tr>
<td>3Q/213E</td>
<td>TF</td>
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<td>64</td>
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<td>3.5</td>
<td>12</td>
<td>15</td>
<td>15</td>
<td>15</td>
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<tr>
<td>3Q/220E</td>
<td>4009B</td>
<td>TF</td>
<td>20</td>
<td>61</td>
<td>40</td>
<td>6</td>
<td>15</td>
<td>20</td>
<td>3</td>
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<tr>
<td>3Q/290E</td>
<td>4030A</td>
<td>TF</td>
<td>25</td>
<td>250</td>
<td>45</td>
<td>1.8</td>
<td>17.5</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>3Q/330E</td>
<td>4067A</td>
<td>TF</td>
<td>27.5</td>
<td>600</td>
<td>44</td>
<td>750</td>
<td>17.5</td>
<td>160</td>
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S—5
### Classified List of Standard Valves—"Maintenance" Types—continued.

#### MERCURY VAPOUR THYRATRONS

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ V</th>
<th>$I_f$ A</th>
<th>$I_{a}$ A</th>
<th>Max. PIV kV</th>
<th>Peak $I_a$ A</th>
<th>Av. $I_a$ A</th>
<th>Grid Control ratio approx.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3V/280B</td>
<td>4039A</td>
<td>IH</td>
<td>4</td>
<td>1</td>
<td>0.43</td>
<td>1.5</td>
<td>0.45</td>
<td>0.1</td>
<td>40</td>
</tr>
<tr>
<td>3V/281B</td>
<td>VLS.432</td>
<td>IH</td>
<td>10</td>
<td>0.43</td>
<td></td>
<td>1.5</td>
<td>0.45</td>
<td>0.1</td>
<td>40</td>
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</table>

#### RADIATION COOLED TETRODES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ V</th>
<th>$I_f$ A</th>
<th>Screen $\mu$</th>
<th>gm mA/V</th>
<th>Max. $V_a$</th>
<th>Max. $V_{g_a}$</th>
<th>$w_a$ W</th>
<th>MAX. FREQUENCY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4B/700A</td>
<td>4282B</td>
<td>TTF</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>1.4</td>
<td>1.0</td>
<td>250</td>
<td>70</td>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>4C/100A</td>
<td>4260A</td>
<td>TTF</td>
<td>10</td>
<td>3.25</td>
<td>2</td>
<td>1.1</td>
<td>3</td>
<td>500</td>
<td>100</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>4C/800E</td>
<td>4278A</td>
<td>TTF</td>
<td>10</td>
<td>15.6</td>
<td>9</td>
<td>4</td>
<td>3,000</td>
<td>750</td>
<td>800</td>
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#### WATER COOLED TETRODES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ V</th>
<th>$I_f$ A</th>
<th>$\mu$</th>
<th>gm mA/V</th>
<th>Max. $V_a$ kV</th>
<th>Max. $V_{g_a}$ kW</th>
<th>$w_a$ kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>4Q/230A</td>
<td>TF</td>
<td></td>
<td>21</td>
<td>70</td>
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<td>4</td>
<td>11</td>
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### Classified List of Standard Valves—“Maintenance” Types—continued.

#### RADIATION COOLED PENTODES

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Cathode</th>
<th>$V_f$ (V)</th>
<th>$I_f$ (mA)</th>
<th>Screen $\mu$</th>
<th>$g_m$ (mA/V)</th>
<th>Max. $V_a$ (V)</th>
<th>Max. $V_{g_2}$ (V)</th>
<th>$w_s$ (W)</th>
<th>Full Ratings (Mc/s)</th>
<th>Reduced Ratings (Mc/s)</th>
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<tbody>
<tr>
<td>5A/102A</td>
<td>IH</td>
<td>7.5</td>
<td>0.85</td>
<td>—</td>
<td>—</td>
<td>2.5</td>
<td>180</td>
<td>150</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5A/104B</td>
<td>IH</td>
<td>4</td>
<td>2.25</td>
<td>—</td>
<td>—</td>
<td>12</td>
<td>250</td>
<td>250</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5A/116B</td>
<td>4070A</td>
<td>IH</td>
<td>4</td>
<td>2.25</td>
<td>—</td>
<td>12</td>
<td>250</td>
<td>250</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5A/117B</td>
<td>4070C</td>
<td>IH</td>
<td>4</td>
<td>1</td>
<td>—</td>
<td>12</td>
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<td>250</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>5A/136A</td>
<td>4328A</td>
<td>IH</td>
<td>7.5</td>
<td>0.425</td>
<td>—</td>
<td>2</td>
<td>250</td>
<td>180</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5B/100A</td>
<td>4061A</td>
<td>IH</td>
<td>6.3</td>
<td>0.8</td>
<td>6</td>
<td>3</td>
<td>500</td>
<td>250</td>
<td>10</td>
<td>30</td>
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</tr>
<tr>
<td>5B/150B</td>
<td>4071A</td>
<td>IH</td>
<td>4</td>
<td>2.25</td>
<td>—</td>
<td>10</td>
<td>250</td>
<td>250</td>
<td>15</td>
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<td>—</td>
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<tr>
<td>5B/151A</td>
<td>4307A</td>
<td>IH</td>
<td>5.5</td>
<td>1</td>
<td>—</td>
<td>4</td>
<td>500</td>
<td>250</td>
<td>15</td>
<td>—</td>
<td>—</td>
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<tr>
<td>5B/300B</td>
<td>IH</td>
<td>10</td>
<td>0.8</td>
<td>—</td>
<td>—</td>
<td>6</td>
<td>500</td>
<td>300</td>
<td>30</td>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>5B/502A</td>
<td>TTF</td>
<td>12</td>
<td>2</td>
<td>12</td>
<td>3</td>
<td>1,500</td>
<td>300</td>
<td>60</td>
<td>20</td>
<td>60</td>
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<tr>
<td>5B/600A</td>
<td>4052A</td>
<td>TTF</td>
<td>7.5</td>
<td>3</td>
<td>10</td>
<td>3.4</td>
<td>1,500</td>
<td>300</td>
<td>60</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>5D/100A</td>
<td>TTF</td>
<td>10</td>
<td>16</td>
<td>—</td>
<td>—</td>
<td>4.5</td>
<td>3,000</td>
<td>1,000</td>
<td>10</td>
<td>25</td>
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**CATHODE RAY TUBES**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>$V_f$ V</th>
<th>$I_f$ A</th>
<th>Useful Screen Diam. inches</th>
<th>Focus</th>
<th>Deflector</th>
<th>Final Anode Voltage kV</th>
<th>First Anode Voltage kV</th>
<th>Screen Type</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>C10SS/1G</td>
<td>4096AG</td>
<td>2</td>
<td>1.7</td>
<td>2½</td>
<td>Electrostatic</td>
<td>Electrostatic</td>
<td>2</td>
<td>.25</td>
<td>Green</td>
<td>International octal</td>
</tr>
<tr>
<td>C16GS/1B</td>
<td>4018AB</td>
<td>0.75</td>
<td>1.1</td>
<td>4</td>
<td>Gas</td>
<td>Electrostatic</td>
<td>1.5</td>
<td>0.5</td>
<td>Blue</td>
<td>5-pin bayonet</td>
</tr>
<tr>
<td>C16GS/1D</td>
<td>4018AD</td>
<td>1.1</td>
<td>0.75</td>
<td>4</td>
<td>Gas</td>
<td>Electrostatic</td>
<td>1.5</td>
<td>0.5</td>
<td>Long Delay</td>
<td>5-pin bayonet</td>
</tr>
<tr>
<td>C16GS/1G</td>
<td>4018AG</td>
<td>0.75</td>
<td>1.1</td>
<td>4</td>
<td>Gas</td>
<td>Electrostatic</td>
<td>1.5</td>
<td>0.5</td>
<td>Green</td>
<td>5-pin bayonet</td>
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**COLD CATHODE GAS TUBES**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Code</th>
<th>Type</th>
<th>Main Gap Striking V</th>
<th>Main Gap Maintaining V</th>
<th>Control Gap Striking V</th>
<th>Control Gap Maintaining V</th>
<th>Cathode Current mA</th>
<th>Regulation Volts V</th>
<th>Regulation Current mA</th>
<th>Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>G83/1G and GZ</td>
<td>VLS405A and AS</td>
<td>Indicator Lamp</td>
<td>83</td>
<td>65</td>
<td>—</td>
<td>—</td>
<td>0.1</td>
<td>—</td>
<td>—</td>
<td>AS. Specially selected</td>
</tr>
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<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4008B</td>
<td>Half wave water cooled rectifier 45 kV</td>
<td>Replaced by 4222B</td>
</tr>
<tr>
<td>4016A</td>
<td>Triode. Tungsten filament. Radiation cooled 400 W.</td>
<td>Replaced by 4050BB</td>
</tr>
<tr>
<td>4016B</td>
<td>Triode as above but in hard glass</td>
<td>Replaced by 4050BG</td>
</tr>
<tr>
<td>4018BB</td>
<td>Gas focused cathode ray tube</td>
<td>Replaced by 3A/107A</td>
</tr>
<tr>
<td>4018BD</td>
<td>Gas focused cathode ray tube</td>
<td>Replaced by 3A/107AY</td>
</tr>
<tr>
<td>4018BG</td>
<td>Gas focused cathode ray tube</td>
<td>Replaced by 3A/107B</td>
</tr>
<tr>
<td>4019A</td>
<td>1/4 amp. Repeater Triode</td>
<td>Replaced by 3A/107BY</td>
</tr>
<tr>
<td>4019AS</td>
<td>Specially selected 4019A</td>
<td>Replaced by 3A/108A</td>
</tr>
<tr>
<td>4019B</td>
<td>1/4 amp. Repeater Triode</td>
<td>Replaced by 3A/108B</td>
</tr>
<tr>
<td>4019BS</td>
<td>Specially selected 4019B</td>
<td>Replaced by 3A/108AY</td>
</tr>
<tr>
<td>4020A</td>
<td>1/2 amp. Repeater Triode</td>
<td>Replaced by 3A/108BY</td>
</tr>
<tr>
<td>4020B</td>
<td>1/2 amp. Repeater Triode</td>
<td>Replaced by 3A/109A</td>
</tr>
<tr>
<td>4020C</td>
<td>1/2 amp. Repeater Triode</td>
<td>Replaced by 3A/109B</td>
</tr>
<tr>
<td>4020AS</td>
<td>Specially selected 4020A</td>
<td>G₃ to top cap</td>
</tr>
<tr>
<td>4020BS</td>
<td>Specially selected 4020B</td>
<td>Replaced by 3A/109AY</td>
</tr>
<tr>
<td>4021A</td>
<td>1/4 amp. Repeater Triode</td>
<td>Replaced by 3A/109BY</td>
</tr>
<tr>
<td>4021B</td>
<td>1/4 amp. Repeater Triode</td>
<td>Replaced by 3A/110A</td>
</tr>
<tr>
<td>4021C</td>
<td>1/4 amp. Repeater Triode</td>
<td>Replaced by 3A/110B</td>
</tr>
<tr>
<td>4021AS</td>
<td>Specially selected 4021A</td>
<td></td>
</tr>
<tr>
<td>4021AT</td>
<td>1/4 amp. Repeater Triode specially selected 4021A</td>
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</tr>
<tr>
<td>4022A</td>
<td>1/2 amp. Repeater Triode</td>
<td></td>
</tr>
<tr>
<td>4022B</td>
<td>1/2 amp. Repeater Triode</td>
<td></td>
</tr>
<tr>
<td>4024AS</td>
<td>Triode 10W Micromesh construction</td>
<td>Nearest replacement 3B/100B</td>
</tr>
<tr>
<td>4024B</td>
<td>Triode 10W Micromesh construction</td>
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T—1
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Remarks</th>
</tr>
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<tbody>
<tr>
<td>4030B</td>
<td>Double ended water cooled triode 80 kW</td>
<td>Replaced by 4030C</td>
</tr>
<tr>
<td>4033A</td>
<td>Triode</td>
<td>Replaced by 4033L</td>
</tr>
<tr>
<td>4036A</td>
<td>Micro-ray transmitting triode</td>
<td>Barkhausen-Kurtz. 17cm. oscillator</td>
</tr>
<tr>
<td>4036B</td>
<td>Micro-ray receiving triode</td>
<td>Barkhausen-Kurtz. 17cm. oscillator</td>
</tr>
<tr>
<td>4043A</td>
<td>Triode</td>
<td>Replaced by 4043C</td>
</tr>
<tr>
<td>4043B</td>
<td>Triode</td>
<td>Replaced by 4043D</td>
</tr>
<tr>
<td>4047A</td>
<td>Single ended water cooled triode 10 kW</td>
<td>Replaced by 4047B</td>
</tr>
<tr>
<td>4047B</td>
<td>Single ended water cooled triode 10 kW</td>
<td></td>
</tr>
<tr>
<td>4048A</td>
<td>Half wave hot cathode mercury vapour rectifier</td>
<td></td>
</tr>
<tr>
<td>4049GA</td>
<td>Half wave mercury vapour thyatron</td>
<td>Replacement 4049GD</td>
</tr>
<tr>
<td>4053A</td>
<td>Single ended water cooled triode 12 kW</td>
<td>Nearest replacement 4058B</td>
</tr>
<tr>
<td>4056A</td>
<td>Triode 35 W</td>
<td>Nearest replacement 4043C</td>
</tr>
<tr>
<td>4056C</td>
<td>Triode 35 W</td>
<td>Similar to the 4056A with the anode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>connected to the top cap</td>
</tr>
<tr>
<td>4058B</td>
<td>Single ended water cooled triode 12 kW</td>
<td>Nearest replacement 4212E</td>
</tr>
<tr>
<td>4059A</td>
<td>Half wave rectifier, Tungsten filament 25 kW</td>
<td>Replaced by 4064B</td>
</tr>
<tr>
<td>4060A</td>
<td>Tungsten filament. Triode 200 W</td>
<td>Nearest replacement 7A3</td>
</tr>
<tr>
<td>4062A</td>
<td>Radiation cooled triode 75 W</td>
<td>Nearest replacement 2T/270K</td>
</tr>
<tr>
<td>4064A</td>
<td>Hot cathode mercury vapour rectifier</td>
<td>Replacement 4049D</td>
</tr>
<tr>
<td>4066A</td>
<td>High slope output pentode</td>
<td>Nearest replacement 4043C</td>
</tr>
<tr>
<td>4075A</td>
<td>Half wave high vacuum rectifier 15 kW</td>
<td></td>
</tr>
<tr>
<td>4077A</td>
<td>Half wave mercury vapour rectifier P.I.V. 16 kW</td>
<td></td>
</tr>
<tr>
<td>4097A</td>
<td>Triode 35 W</td>
<td></td>
</tr>
<tr>
<td>4251A</td>
<td>Triode 1 kW</td>
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</tr>
<tr>
<td>4251AX</td>
<td>Triode 1 kW</td>
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List of Standard Valves—"Obsolete" Types—continued.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4279A</td>
<td>Transmitting triode 1.2 kW</td>
<td>Replaced by 4282B</td>
</tr>
<tr>
<td>4282BZ</td>
<td>Screen grid tetrode. Air-force base 70 W</td>
<td>Nearest replacement 4282B</td>
</tr>
<tr>
<td>4304CBX</td>
<td>H.F. Triode 50 W British 4-pin ceramic base</td>
<td>Use 4307A</td>
</tr>
<tr>
<td>4305A</td>
<td>Screen grid tube 60 W</td>
<td></td>
</tr>
<tr>
<td>4307AB</td>
<td>15 W transmitting pentode. British 7-pin base</td>
<td>Use 4307A</td>
</tr>
<tr>
<td>3A/101B</td>
<td>Indirectly heated equivalent of 4101D</td>
<td>Replacement under development</td>
</tr>
<tr>
<td>3A/102B</td>
<td>Indirectly heated equivalent of 4102D</td>
<td></td>
</tr>
<tr>
<td>3A/104B</td>
<td>Indirectly heated equivalent of 4104D</td>
<td></td>
</tr>
<tr>
<td>3A/105B</td>
<td>Microphone amplifier quiet tube</td>
<td></td>
</tr>
<tr>
<td>3A/106B</td>
<td>Television output triode. British 7-pin base</td>
<td></td>
</tr>
<tr>
<td>3A/106D</td>
<td>Television output triode on American octal base</td>
<td></td>
</tr>
<tr>
<td>3A/149J</td>
<td>Grounded grid triode oscillator</td>
<td></td>
</tr>
<tr>
<td>33A/100A</td>
<td>Double triode</td>
<td>Replaced by 4033L</td>
</tr>
<tr>
<td>3B/102B</td>
<td>10 W Triode</td>
<td>Nearest replacement 4033L</td>
</tr>
<tr>
<td>3B/200B</td>
<td>20 W Triode</td>
<td>Replacement 4356A</td>
</tr>
<tr>
<td>3B/501A</td>
<td>50 Watt H.F. triode</td>
<td>Nearest replacement 4270A</td>
</tr>
<tr>
<td>3C/250A</td>
<td>250 watt H.F. triode</td>
<td>Air blast cooled version of 3P/270B replaced by 3J/191E</td>
</tr>
<tr>
<td>3J/190E</td>
<td>3½ kW air blast cooled triode Tungsten Fil.</td>
<td></td>
</tr>
<tr>
<td>4C/250A</td>
<td>250 watt tetrode</td>
<td>Replacement Brimar 9A1</td>
</tr>
<tr>
<td>4C/251A</td>
<td>250 watt tetrode</td>
<td>Nearest replacement 5A/104B</td>
</tr>
<tr>
<td>5A/100B</td>
<td>RF screened pentode</td>
<td>Nearest replacement 4071A</td>
</tr>
<tr>
<td>5A/101B</td>
<td>Variable µ copper cathode pentode</td>
<td>Nearest replacement 5B/250A</td>
</tr>
<tr>
<td>5A/103B</td>
<td>Modified 4071 with copper cathode</td>
<td></td>
</tr>
<tr>
<td>5B/111A</td>
<td>11 watt power-amplifier pentode</td>
<td></td>
</tr>
</tbody>
</table>

August 1947
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5B/300BF</td>
<td>30 watt power pentode</td>
<td>Specially tested for Standard Aircraft radio.</td>
</tr>
<tr>
<td>5B/300D</td>
<td>5B/300B on American medium octal base</td>
<td>Replacement 5B/300B</td>
</tr>
<tr>
<td>5B/350A</td>
<td>35 watt R.F. pentode</td>
<td>Nearest replacement 5B/300B</td>
</tr>
<tr>
<td>5B/500B</td>
<td>50 watt R.F. pentode</td>
<td>Nearest replacement 5B/502A</td>
</tr>
<tr>
<td>5B/501B</td>
<td>50 watt R.F. pentode</td>
<td>Nearest replacement 5B/502A</td>
</tr>
<tr>
<td>5B/501BF</td>
<td>50 watt R.F. pentode</td>
<td>Specially tested for Standard Aircraft radio</td>
</tr>
<tr>
<td>5B/503A</td>
<td>60 watt R.F. pentode</td>
<td></td>
</tr>
<tr>
<td>G210/1C</td>
<td>Gas gap relay</td>
<td>Replaced by G240/2D</td>
</tr>
<tr>
<td>G240/2A</td>
<td>Cold cathode relay</td>
<td>Replacement K12/2L</td>
</tr>
<tr>
<td>V230C/1D</td>
<td>Velocity-modulated coaxial-line oscillator with A.F.C.</td>
<td>Replacement K25/2L</td>
</tr>
<tr>
<td>VLS.559/10</td>
<td>10pF vacuum condenser</td>
<td>Replacement K50/2L</td>
</tr>
<tr>
<td>VLS.559/25</td>
<td>25pF vacuum condenser</td>
<td></td>
</tr>
<tr>
<td>VLS.559/50</td>
<td>50 pF vacuum condenser</td>
<td></td>
</tr>
<tr>
<td>VLS.559/100</td>
<td>100 pF vacuum condenser</td>
<td></td>
</tr>
</tbody>
</table>
**CATHODE.**

Indirectly-heated oxide-coated

Voltage 4 V
Nominal current 0.5 A

**DIMENSIONS.**

Maximum seated height 51.5 mm.
Maximum diameter 19.1 mm.
Top cap Miniature skirted
Base Miniature 7 pin button

**MAXIMUM RATINGS.**

Maximum applied RMS voltage 5.5 kV
Maximum applied RMS voltage for simultaneous switching of heater 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 condenser 0.25 μF
Minimum limiting equivalent resistance introduced externally for a RMS voltage of 5.5 kV 62,000 Ω
Minimum delay in switching anode supply after heater voltage at maximum applied voltage 30 sec.

The above ratings apply to operation with a condenser input filter and a supply frequency of 50 c/s.
Miniature Half-Wave High-Voltage Rectifier

2T/270K

Tentative data
January 1946

2T/270K—2
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
(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

<table>
<thead>
<tr>
<th>Natural ventilation...</th>
<th>25°—55°C</th>
<th>20°C—40°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced ventilation...</td>
<td>25°—65°C</td>
<td>20°C—60°C</td>
</tr>
<tr>
<td>Peak Inverse Voltage</td>
<td>up to 5kV</td>
<td>5kV to 10kV</td>
</tr>
</tbody>
</table>

July 1946
TYPICAL OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of valves</th>
<th>Maximum D.C. output voltage</th>
<th>Maximum D.C. output current</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>3.200V</td>
<td>0.5A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>6.500V</td>
<td>0.5A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>4.500V</td>
<td>0.75A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>4.500V</td>
<td>1.5A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>9.500V</td>
<td>0.75A</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="image1" alt="Diagram 1" /></td>
</tr>
<tr>
<td>2</td>
<td><img src="image2" alt="Diagram 2" /></td>
</tr>
<tr>
<td>3</td>
<td><img src="image3" alt="Diagram 3" /></td>
</tr>
<tr>
<td>4</td>
<td><img src="image4" alt="Diagram 4" /></td>
</tr>
<tr>
<td>5</td>
<td><img src="image5" alt="Diagram 5" /></td>
</tr>
<tr>
<td>6</td>
<td><img src="image6" alt="Diagram 6" /></td>
</tr>
</tbody>
</table>
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 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.

<table>
<thead>
<tr>
<th>Natural Ventilation</th>
<th>20°C-55°C.</th>
<th>20°C-40°C.</th>
<th>20°C-55°C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced Ventilation</td>
<td>20°C-65°C.</td>
<td>20°C-55°C.</td>
<td>20°C-55°C.</td>
</tr>
<tr>
<td>Peak inverse voltage</td>
<td>Less than 10 kV</td>
<td>10 kV to 20 kV</td>
<td></td>
</tr>
</tbody>
</table>

Tentative data
June 1946
TYPICAL OPERATION.

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum DC Output Volts</th>
<th>Maximum DC Output Amps.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>6,400 V</td>
<td>2.5 A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>13,000 V</td>
<td>2.5 V</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>9,500 V</td>
<td>3.75 V</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9,500 V</td>
<td>7.5 V</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>18,500 V</td>
<td>3.75 V</td>
</tr>
</tbody>
</table>

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

Circuit No.

1

2

3

4

5

6

Tentative data
June 1946
Hot Cathode Mercury Vapour Rectifier

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.

<table>
<thead>
<tr>
<th>Natural Ventilation</th>
<th>15°C. to 50°C.</th>
<th>15°C. to 40°C.</th>
<th>—</th>
<th>—</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced Ventilation</td>
<td>15°C. to 65°C.</td>
<td>15°C. to 55°C.</td>
<td>15°C. to 45°C.</td>
<td>15°C. to 40°C.</td>
</tr>
<tr>
<td>Peak inverse Voltage</td>
<td>Less than 7,000 V</td>
<td>7,500 to 10,000 V</td>
<td>10,000 to 12,500 V</td>
<td>Greater than 12,500 V</td>
</tr>
</tbody>
</table>

June 1946

2V/530E—1
TYPICAL OPERATION.

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum DC Output Volts</th>
<th>Maximum DC Output Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>6,400 V</td>
<td>5 A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>12,500 V</td>
<td>5 A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>9,500 V</td>
<td>7.5 A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9,500 V</td>
<td>15 A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>18,500 V</td>
<td>7.5 A</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Min. pre-heating period</th>
<th>10°C. to 15°C.</th>
<th>15°C. to 20°C.</th>
<th>20°C. and above</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>30 min.</td>
<td>15 min.</td>
<td>5 min.</td>
</tr>
</tbody>
</table>

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.
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 drawing)
Top cap—Special—(see drawing)

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.

<table>
<thead>
<tr>
<th>Natural Ventilation</th>
<th>15°C. to 45°C.</th>
<th>15°C. to 35°C.</th>
<th>—</th>
<th>—</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forced Ventilation</td>
<td>15°C. to 60°C.</td>
<td>15°C. to 50°C.</td>
<td>15°C. to 40°C.</td>
<td>15°C. to 35°C.</td>
</tr>
<tr>
<td>Peak inverse Voltage</td>
<td>Less than 7,500 V</td>
<td>7,500 to 10,000 V</td>
<td>10,000 to 12,500 V</td>
<td>Greater than 12,500 V</td>
</tr>
</tbody>
</table>

June 1946
TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum DC output volts</th>
<th>Maximum DC output Amps.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>6,400 V</td>
<td>12.5 A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>13,000 V</td>
<td>12.5 A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>9,500 V</td>
<td>16 A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9,500 V</td>
<td>30 A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>18,500 V</td>
<td>16 A</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>10°C. to 15°C.</th>
<th>15°C. to 20°C.</th>
<th>20°C. and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Pre-heating period</td>
<td>30 min.</td>
<td>15 min.</td>
<td>5 min.</td>
</tr>
</tbody>
</table>

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

4079A

36 mm DIA.

ANODE

195 mm MAX. DIA

340 mm MAX.

9.6 mm MAX. DIA

FILAMENT

June 1946
Hot Cathode Mercury Vapour Rectifier

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 range with forced air cooling 15° C. to 60° C. 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 |

August 1945
TYPICAL OPERATING CONDITIONS
(for ideal choke-input filter).

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum D.C. Output Volts</th>
<th>Maximum D.C. Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>5,000 V</td>
<td>31 A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>10,000 V</td>
<td>31 A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>7,500 V</td>
<td>38 A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7,500 V</td>
<td>76 A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>15,000 V</td>
<td>47 A</td>
</tr>
</tbody>
</table>

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

CATHODE HEATING TIME.

<table>
<thead>
<tr>
<th>Ambient Temperature Min. pre-heating period</th>
<th>15° to 20° C.</th>
<th>20° C. and above</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 min.</td>
<td>10 min.</td>
</tr>
</tbody>
</table>

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.
Repeater Triode

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 $\eta \geq 8 \text{ at } V_a = 130 \text{V}$
Impedance $V_{g1}-8 \text{V}, I_f 0.25 \text{A D.C. } \leq 5,500 \text{ ohms}$

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

May 1947

3A/107A-B—1
Repeater Triode

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 \( \beta \) Measured at \( V_a \) 130V \( \beta \) \( \geq \) 30
Impedance \( V_{g1}-1.5V, I_f 0.25A \) D.C. \( \geq 50,000 \) 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

May 1947

3A/108A-B---I
Repeater Triode

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 $\mu$ Measured at $V_a$ 130V 6
Impedance $V_{g1-8}$ V, $I_f$ 0.25A D.C. 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

May 1947

3A/109A-B—1
Repeater Triode

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 \( \frac{V_a}{V_G - 4.5V} \), \( I_f 0.25A \) D.C. 12
Impedance 5,500 ohms

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

May 1947
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 \[ \text{Measured at } V_a \ 130 V \] 6
Impedance \[ V_{g1} - 9 V \] 6,000 \( \Omega \)

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

April 1946
### Typical Operating Conditions

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<thead>
<tr>
<th></th>
<th>100</th>
<th>100</th>
<th>130</th>
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<tbody>
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<td>volts</td>
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<td>Impedance $r_a$</td>
<td>ohms</td>
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For load impedance $R = r_a$

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<td>2nd harmonic</td>
<td>db</td>
<td>33</td>
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<td>32</td>
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<td>29</td>
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For load impedance $R = 2r_a$

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<tbody>
<tr>
<td>Output</td>
<td>mW</td>
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<td>30</td>
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<td>80</td>
<td>90</td>
<td>115</td>
<td>155</td>
<td>210</td>
<td>235</td>
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<td>db</td>
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<td>32</td>
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<td>34</td>
<td>30</td>
<td>25</td>
<td>29</td>
<td>26</td>
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</tbody>
</table>

* Maximum operating conditions.
Repeater Triode
3A/141A
Replaces 4101D
(3A/141AY is the 3A/141A tested to special limits for replacement purposes only.)

April 1946
Repeater Triode
3A/141A
Replaces 4101D
(3A/141AY is the 3A/141A tested to special limits for replacement purposes only.)

46 mm DIA

118 mm MAX.

ANODE
GRID
FILAMENT.
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
Impedance \( \{ \text{Va}130V, \text{Vg} - 1.5V \} \) 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

April 1946
## TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th>Anode voltage</th>
<th>Grid Bias</th>
<th>Anode current</th>
<th>Amplification factor</th>
<th>Anode resistance ohms ra</th>
<th>Load resistance R</th>
<th>Output voltage peak volts</th>
<th>Second harmonic db</th>
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<td>volts</td>
<td>volts</td>
<td>milliamps</td>
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<td>(R=3ra)</td>
<td>38</td>
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<td>(R=5ra)</td>
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* Maximum operating conditions.
Repeater Triode
3A/142A
Replaces 4102D
(3A/142AY is the 3A/142A tested to special limits for replacement purposes only)

April 1946

3A/142A—3
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 \( \frac{V_{a}}{V_{g}} \) Measured at \( V_a = 130V \) \( \frac{2.3}{20V} \) \[\Omega\]
Impedance \( V_{g} = 20V \) \( \frac{20,000}{\Omega} \)

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

April 1946
# Repeater Triode

**3A/144A**

Replaces 4104D

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

## TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th>Anode voltage volts</th>
<th>Grid bias volts</th>
<th>Anode currentmA</th>
<th>Anode resistance chms</th>
<th>Load impedance chms</th>
<th>Output watts</th>
<th>2nd Harmonic db below fundamental</th>
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<td>30.2</td>
</tr>
</tbody>
</table>

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**Dimensions:**

- **Dia.:** 45 mm
- **Max.:** 118 mm

---

**Diagram:**

- Anode
- Grid
- Filament

April 1946

**3A/144A—2**
Repeater Triode
3A/144A
Replaces 4104D
3A/144AY is the 3A/144A tested to special limits for replacement purposes only

ANODE VOLTAGE (V)

ANODE CURRENT (mA)

April 1946
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 \{ Measured at \( V_a250\text{V} \) 100
Mutual conductance \{ Auto-bias resistance 5 mA/V
150 ohms

DIRECT INTER-ELECTRODE CAPACITIES.
Anode to grid \{ Measured with an 1.6 pF
Anode to cathode \{ earthed shield 0.035 pF
Grid to cathode \{ around the bulb 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.

Tentative data
May 1947
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.

Tentative data
May 1947
Grounded Grid Triode
3A/146J (CV53)

50—300 Mc/s AMPLIFIER.

Tentative data
May 1947
Grounded Grid Triode
3A/146J (CV53)

51.3 mm. MAX DIA.

31.5 mm DIA. MAX.

6.43 mm. DIA. MAX.

21.98 mm. MAX.

82.55 mm. MAX.

6.35 mm. MAX.

ANODE.

SPADE ON CATHODE LEAD PAINTED RED.

Tentative data
May 1947
Grounded Grid Oscillator Triode

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
Nominal current

4 V
0.7 A

RATING.

Amplification factor \{ Measured at \( V_{a250V} \) \} 35
Mutual conductance \( V_{g1-3} \) 6 mA/V

DIRECT INTER-ELECTRODE CAPACITIES.

Anode to grid \{ Measured with an earthed shield \} 1.4 pF
Anode to cathode \{ Measured with an 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

Tentative data
November 1945

3A/147J—1
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)

Tentative data
November 1945
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 \( \frac{\text{Measured at } V_{a250V}}{\text{Auto-bias resistance}} \) \( \geq 5 \) mA/V

DIRECT INTER-ELECTRODE CAPACITIES.
- Anode to grid \( \frac{\text{Measured with an earthed shield}}{\text{around the bulb}} \) 1.5 pF
- Anode to cathode \( \frac{\text{earthed shield}}{\text{around the bulb}} \) 0.035 pF
- Grid to cathode \( \frac{\text{around the bulb}}{\text{around the bulb}} \) 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

Tentative data
October 1945
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 0.01µF.

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.
**Twin Triode**

**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 $V_a 250V, V_{g1} = 7V$: 14
- Impedance: 4,700 Ω

### 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

*June 1946*
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 Ω
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—
zero signal 7 mA
Direct anode current per section—
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.

June 1946
Twin Triode

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.

29 mm.

ANODE LEFT

ANODE RIGHT.

46 mm. MAX. DIA.

132 mm. MAX.

GRID LEFT.

CATHODE.

GRID RIGHT.

BLANK.

BLANK

HEATER.

June 1946

33A/138A
CATHODE.
Indirectly-heated oxide-coated

<table>
<thead>
<tr>
<th>Voltage</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>1.1</td>
</tr>
</tbody>
</table>

RATING.
Amplification factor \[ Va \] Measured at \[ Vg_l \] 10
Impedance \[ 200V \] \[ 10V \] \[ 2,000 \] \[ \Omega \]

DIRECT INTER-ELECTRODE CAPACITIES.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid to anode</td>
<td>7.5</td>
</tr>
<tr>
<td>Grid to cathode</td>
<td>10.3</td>
</tr>
<tr>
<td>Anode to cathode</td>
<td>4.8</td>
</tr>
</tbody>
</table>

DIMENSIONS.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>122</td>
</tr>
<tr>
<td>Maximum bulb diameter</td>
<td>46</td>
</tr>
<tr>
<td>Base: British 5 pin</td>
<td></td>
</tr>
<tr>
<td>Net weight</td>
<td>50</td>
</tr>
</tbody>
</table>

MAXIMUM RATINGS.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum direct anode voltage</td>
<td>200</td>
</tr>
<tr>
<td>Maximum direct anode current</td>
<td>50</td>
</tr>
<tr>
<td>Maximum anode dissipation</td>
<td>10</td>
</tr>
</tbody>
</table>
TYPICAL OPERATING CONDITIONS.

AUDIO FREQUENCY.

Class A Amplifier.

<table>
<thead>
<tr>
<th>Anode voltage</th>
<th>Grid bias</th>
<th>Anode current</th>
<th>Load resistance</th>
<th>Power output</th>
<th>Total harmonics</th>
</tr>
</thead>
<tbody>
<tr>
<td>volts</td>
<td>volts</td>
<td>mA</td>
<td>ohms</td>
<td>mW</td>
<td>db</td>
</tr>
<tr>
<td>100</td>
<td>-4</td>
<td>23</td>
<td>8,000</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>100</td>
<td>-4</td>
<td>23</td>
<td>8,000</td>
<td>50</td>
<td>31</td>
</tr>
<tr>
<td>150</td>
<td>-6</td>
<td>40</td>
<td>10,000</td>
<td>50</td>
<td>35</td>
</tr>
<tr>
<td>150</td>
<td>-6</td>
<td>40</td>
<td>10,000</td>
<td>100</td>
<td>32</td>
</tr>
<tr>
<td>200</td>
<td>-10</td>
<td>40</td>
<td>10,000</td>
<td>50</td>
<td>37</td>
</tr>
<tr>
<td>200</td>
<td>-10</td>
<td>40</td>
<td>10,000</td>
<td>250</td>
<td>30</td>
</tr>
</tbody>
</table>

Class B Power Amplifier or Modulator.

(For balanced 2-valve circuit).

Direct anode voltage 200 V
Grid bias -16 V
Direct anode current per valve—minimum signal 8 mA
Direct anode current per valve—maximum signal 50 mA
Load resistance—anode to anode 4,200 Ω
Power output for 2 valves 12.5 W approx.
CATHODE.

Oxide-coated filament
Voltage 4.5 V
Nominal current 1.6 A

RATING.

Amplification factor \(\{\) measured at \(V_a 250V\} 7
Impedance \(V_{g1} - 15V\) 3500Ω

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

Tentative data.
June 1946
## TYPICAL OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Anode voltage (volts)</th>
<th>Grid bias (volts)</th>
<th>Anode current (mA)</th>
<th>Amplification factor</th>
<th>Anode Resistance (ohms)</th>
<th>Load Resistance (ohms)</th>
<th>Power Output (mW)</th>
<th>Second Harmonic (db)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>— 6</td>
<td>22.5</td>
<td>7.4</td>
<td>4,000</td>
<td>4,000</td>
<td>60</td>
<td>35</td>
</tr>
<tr>
<td>250</td>
<td>— 22</td>
<td>9</td>
<td>6.9</td>
<td>6,000</td>
<td>8,000</td>
<td>55</td>
<td>40</td>
</tr>
<tr>
<td>250</td>
<td>— 15</td>
<td>19</td>
<td>7.2</td>
<td>4,350</td>
<td>4,350</td>
<td>500</td>
<td>18</td>
</tr>
<tr>
<td>250</td>
<td>— 10</td>
<td>27.5</td>
<td>7.4</td>
<td>3,800</td>
<td>7,600</td>
<td>450</td>
<td>22</td>
</tr>
<tr>
<td>250</td>
<td>— 5</td>
<td>37.5</td>
<td>7.5</td>
<td>3,500</td>
<td>7,000</td>
<td>380</td>
<td>26</td>
</tr>
<tr>
<td>300</td>
<td>— 30</td>
<td>8</td>
<td>6.7</td>
<td>6,700</td>
<td>6,700</td>
<td>280</td>
<td>30</td>
</tr>
<tr>
<td>300</td>
<td>— 24</td>
<td>15.5</td>
<td>7.1</td>
<td>4,800</td>
<td>4,800</td>
<td>180</td>
<td>33</td>
</tr>
<tr>
<td>300</td>
<td>— 18</td>
<td>25</td>
<td>7.3</td>
<td>4,000</td>
<td>9,600</td>
<td>160</td>
<td>38</td>
</tr>
<tr>
<td>350</td>
<td>— 22.5</td>
<td>29</td>
<td>7.3</td>
<td>3,800</td>
<td>7,600</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>375</td>
<td>— 30</td>
<td>22</td>
<td>7.1</td>
<td>4,300</td>
<td>4,300</td>
<td>45</td>
<td>43</td>
</tr>
<tr>
<td>*300</td>
<td>— 10</td>
<td>41</td>
<td>7.4</td>
<td>3,350</td>
<td>3,350</td>
<td>800</td>
<td>15</td>
</tr>
<tr>
<td>*350</td>
<td>— 20</td>
<td>34</td>
<td>7.3</td>
<td>3,600</td>
<td>7,200</td>
<td>720</td>
<td>20</td>
</tr>
<tr>
<td>*375</td>
<td>— 24</td>
<td>32</td>
<td>7.3</td>
<td>3,650</td>
<td>7,300</td>
<td>675</td>
<td>30</td>
</tr>
<tr>
<td>*400</td>
<td>— 29</td>
<td>30</td>
<td>7.2</td>
<td>3,800</td>
<td>7,600</td>
<td>1,400</td>
<td>23</td>
</tr>
</tbody>
</table>

* Maximum operating conditions.
CATHODE.
Indirectly heated oxide-coated.
Heater voltage 6 V
Nominal current 1.4 A

RATING.

\[
\begin{align*}
\text{Amplification factor} & \quad \text{Measured at } V_a \text{ 400 V} \\
\text{Impedance} & \quad V_g - 20 \text{ V} \\
\end{align*}
\]

15
1,670 ohms

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

Tentative Data
September, 1945

3B/252B—1
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 —zero signal 17 17 mA
Direct anode current per valve —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.

Tentative Data
September, 1945

3B/252B—2
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 \[
\begin{align*}
\text{Measured at} \\
Va & 800V \\
Ia & 40 \text{ mA} \\
\end{align*}
\] 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 mounted in apparatus providing adequate heat radiation 40 W
Maximum direct grid current 15 mA

Tentative data
September, 1945
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.

Tentative data
September, 1945
Double-disc-seal
U.H.F. Triode
3B/401J (CV127)

PISTON "B"

PISTON "A"

MICA

VARIABLE FREQUENCY OSCILLATOR

Tentative data
September, 1945

3B/401J—3
Double-disc-seal
U.H.F. Triode

3B/401J (CV127)

Tentative data
September, 1945
Double-disc-seal
U.H.F. Triode
3B/401J (CV127)

51.3 mm max.

50.8 mm max.

68 mm max.

37 mm dia. max.

6.35 mm

9.525 mm rad.

Tentative data
September, 1945
R. F. Triode
(4356A)
For Operation at full input rating up to 100 Mc/s
4356A

CATHODE.
Thoriated tungsten filament
Voltage 5 V
Nominal current 5 A
Peak emission 2 A

RATING.
Amplification factor \{ Measured at Va 500 V \} 45
Impedance \{ la 100 mA \} 12,000 Ω

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 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.

Tentative data
January 1946
**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).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>1,500 V</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-30 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>50 mA</td>
</tr>
<tr>
<td>Peak R.F. grid voltage peak of modulation cycle</td>
<td>145 V</td>
</tr>
<tr>
<td>Power output</td>
<td>25 W</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>1,250 V max.</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-160 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>100 mA</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>290 V</td>
</tr>
<tr>
<td>Power output</td>
<td>88 W</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>1,500 V</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-72 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>100 mA</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>190 V</td>
</tr>
<tr>
<td><em>Direct grid current</em></td>
<td>22.5 mA (approx.)</td>
</tr>
<tr>
<td>Power output</td>
<td>100 W</td>
</tr>
</tbody>
</table>

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

---

**Tentative data**

*January 1946*
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

Tentative data
January 1946
R. F. Triode
For Operation at full input
rating up to 100 Mc/s
4356A

ANODE

63.5 mm. DIA. MAX.

133 mm. MAX.

CENTRE TAP
FILAMENT

FILAMENT

GRID

Tentative data
January 1946
CATHODE.
Thoriated tungsten filament.
Voltage 10 V
Nominal current 3.25 A
Peak emission 2 A

RATING.
 Amplification factor \( \frac{V_a}{1 \text{kV}, V_g, 55 \text{ V}} \) 12.0
 Impedance \( \frac{1 \text{kV}, V_g, 55 \text{ V}}{3,000 \text{ ohms}} \)

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 30 Mc/s 600 V

NOTE.—This valve should be mounted so that the plane of the filament is vertical.
### TYPICAL OPERATING CONDITIONS.

**AUDIO FREQUENCY.**

**Class B. Amplifier or Modulator.**

For balanced 2-valve circuits.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>1,250</td>
<td>1,000 V</td>
</tr>
<tr>
<td>Anode current per valve zero signal</td>
<td>25</td>
<td>25 mA</td>
</tr>
<tr>
<td>Anode current per valve maximum signal</td>
<td>150</td>
<td>150 mA</td>
</tr>
<tr>
<td>Grid bias</td>
<td>—95</td>
<td>—75 V</td>
</tr>
<tr>
<td>Anode dissipation</td>
<td>64</td>
<td>56 W</td>
</tr>
<tr>
<td>Load resistance</td>
<td>9,600</td>
<td>8,000 ohms</td>
</tr>
<tr>
<td>Peak signal grid to grid</td>
<td>165</td>
<td>140 V</td>
</tr>
<tr>
<td>*Approximate grid driving power</td>
<td>4</td>
<td>2 W</td>
</tr>
<tr>
<td>Maximum output 2 valves</td>
<td>245</td>
<td>185 W</td>
</tr>
</tbody>
</table>

### RADIO FREQUENCY.

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>1,250</td>
<td>1,000 V</td>
</tr>
<tr>
<td>Grid bias</td>
<td>—100</td>
<td>—80 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>100</td>
<td>125 mA</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>2</td>
<td>1.5 mA</td>
</tr>
<tr>
<td></td>
<td>approx.</td>
<td></td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>112</td>
<td>105 V</td>
</tr>
<tr>
<td>Power output</td>
<td>41</td>
<td>40 W</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>—1,000 V max</td>
<td>750 V</td>
</tr>
<tr>
<td>Grid bias</td>
<td>—195</td>
<td>—180 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>150</td>
<td>150 mA</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>295</td>
<td>285 V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>17</td>
<td>17 mA</td>
</tr>
<tr>
<td></td>
<td>approx.</td>
<td></td>
</tr>
<tr>
<td>Power output</td>
<td>110</td>
<td>80 W</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value 1</th>
<th>Value 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>1,250</td>
<td>1,000 V</td>
</tr>
<tr>
<td>Grid bias</td>
<td>—153</td>
<td>—133 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>150</td>
<td>150 mA</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>243</td>
<td>223 V</td>
</tr>
<tr>
<td>*D.C. grid current</td>
<td>11.5</td>
<td>10 mA</td>
</tr>
<tr>
<td></td>
<td>approx.</td>
<td></td>
</tr>
<tr>
<td>Power output</td>
<td>140</td>
<td>108 W</td>
</tr>
</tbody>
</table>

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

August 1945
CATHODE.
Thoriated tungsten filament
Voltage 10 V
Nominal current 3.4 A
Peak emission 2.5 A

RATING.
Amplification factor measured at Va 1kV 18
Impedance 3a 150 mA 3,800 Ω

DIRECT INTER-ELECTRODE CAPACITIES.
Grid to anode 7.3 pF
Grid to filament 8.6 pF
Anode to filament 1.1 pF

DIMENSIONS.
Maximum overall length 246 mm.
Maximum overall width 88 mm.
Base: Large 4-pin bayonet
Net weight 320 g.

MAXIMUM RATINGS.
Maximum direct anode voltage 2.5 kV
Maximum direct anode current 0.2 A
Maximum anode dissipation 150 W
Maximum RF grid current 10 A
Maximum frequency for above ratings 20 Mc/s
Maximum anode voltage for frequency of 60 Mc/s 2 kV

June 1946
TYPICAL OPERATING CONDITIONS.

AUDIO FREQUENCY.

Class B Power Amplifier or Modulator.
(Balanced two valve circuit).

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>2.5</th>
<th>kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid bias</td>
<td>-100</td>
<td>-130</td>
<td>V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.03</td>
<td>0.03</td>
<td>A</td>
</tr>
<tr>
<td>minimum signal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.19</td>
<td>0.18</td>
<td>A</td>
</tr>
<tr>
<td>maximum signal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak AF grid to grid voltage</td>
<td>420</td>
<td>460</td>
<td>V</td>
</tr>
<tr>
<td>Load resistance anode to anode</td>
<td>11,200</td>
<td>16,000</td>
<td>Ω</td>
</tr>
<tr>
<td>Power output</td>
<td>500</td>
<td>600</td>
<td>W</td>
</tr>
<tr>
<td>2 valves</td>
<td></td>
<td></td>
<td>approx.</td>
</tr>
</tbody>
</table>

RADIO FREQUENCY.

Class B Power Amplifier Telephony.
(Carrier conditions per valve for use with 100% modulation).

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>2.5</th>
<th>kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid bias</td>
<td>-110</td>
<td>-140</td>
<td>V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.11</td>
<td>0.09</td>
<td>A</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>125</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>0.5</td>
<td>0 mA</td>
<td>approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>80</td>
<td>80</td>
<td>W</td>
</tr>
</tbody>
</table>

Class C Power Amplifier. Anode subject to modulation.
(Carrier conditions per valve for use with 100% modulation).

<table>
<thead>
<tr>
<th></th>
<th>1.75</th>
<th>2</th>
<th>kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid bias</td>
<td>-300</td>
<td>-350</td>
<td>V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.2</td>
<td>0.16</td>
<td>mA</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>475</td>
<td>500</td>
<td>V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>30</td>
<td>20 mA</td>
<td>approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>270</td>
<td>250</td>
<td>W</td>
</tr>
</tbody>
</table>

Class C Power Amplifier or Oscillator, unmodulated.

<table>
<thead>
<tr>
<th></th>
<th>2</th>
<th>2.5</th>
<th>kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid bias</td>
<td>-250</td>
<td>-300</td>
<td>V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.2</td>
<td>0.2</td>
<td>A</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>410</td>
<td>455</td>
<td>V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>23</td>
<td>18 mA</td>
<td>approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>300</td>
<td>380</td>
<td>W</td>
</tr>
</tbody>
</table>

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

June 1946
CATHODE.
Thoriated tungsten filament
Voltage 14 V
Nominal current 6.2 A
Peak emission 4.5 A

RATING.
Amplification factor: $V_a$ 2,000V, $V_1$ 90V, $V_2$ 1,900 ohms

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
Group 2. $I_a$ 130–148 mA, Measured at $V_a$ 1,500V
Group 3. $I_a$ 149–167 mA, $V_g$ –68V
Group 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.

July 1945
## TYPICAL OPERATING CONDITIONS

### AUDIO FREQUENCY

#### Class A Power Amplifier or Modulator.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>1,500</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-57</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.170</td>
</tr>
<tr>
<td>Load resistance</td>
<td>5,000</td>
</tr>
<tr>
<td>Undistorted output</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>1,250 V</td>
</tr>
<tr>
<td></td>
<td>-40 V</td>
</tr>
<tr>
<td></td>
<td>0.200 A</td>
</tr>
<tr>
<td></td>
<td>3,000 Ω</td>
</tr>
<tr>
<td></td>
<td>40 W</td>
</tr>
<tr>
<td></td>
<td>approx.</td>
</tr>
</tbody>
</table>

#### Class B Power Amplifier or Modulator.

(For balanced 2-valve operation.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2,500</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-145</td>
</tr>
<tr>
<td>Direct anode current per valve—zero signal</td>
<td>50</td>
</tr>
<tr>
<td>Direct anode current per valve max. signal</td>
<td>300</td>
</tr>
<tr>
<td>Peak A.F. grid to grid drive voltage</td>
<td>420</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>13.5</td>
</tr>
<tr>
<td>Load resistance anode to anode</td>
<td>9,100</td>
</tr>
<tr>
<td>*Grid driving power per valve</td>
<td>3</td>
</tr>
<tr>
<td>Recommended grid driving power</td>
<td>50</td>
</tr>
<tr>
<td>Power output</td>
<td>960</td>
</tr>
<tr>
<td></td>
<td>1,500 V</td>
</tr>
<tr>
<td></td>
<td>-80 V</td>
</tr>
<tr>
<td></td>
<td>60 mA</td>
</tr>
<tr>
<td></td>
<td>350 mA</td>
</tr>
<tr>
<td></td>
<td>300 V</td>
</tr>
<tr>
<td></td>
<td>38 mA</td>
</tr>
<tr>
<td></td>
<td>approx.</td>
</tr>
<tr>
<td></td>
<td>4,600 Ω</td>
</tr>
<tr>
<td></td>
<td>6 W</td>
</tr>
<tr>
<td></td>
<td>approx.</td>
</tr>
<tr>
<td></td>
<td>50 W</td>
</tr>
<tr>
<td></td>
<td>660 W</td>
</tr>
</tbody>
</table>

---

July 1945

3C/270A—2
# Triode

## 4212E

### RADIO FREQUENCY

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct anode voltage</th>
<th>Grid bias</th>
<th>Direct anode current</th>
<th>Peak R.F. grid voltage</th>
<th>*Direct grid current</th>
<th>Power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,000 V</td>
<td>—125 V</td>
<td>0.200 A</td>
<td>110 V</td>
<td>34 mA approx.</td>
<td>130 W</td>
<td></td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct anode voltage</th>
<th>Grid bias</th>
<th>Direct anode current</th>
<th>Peak R.F. grid voltage</th>
<th>*Direct grid current</th>
<th>Power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,000 V</td>
<td>—240 V</td>
<td>0.300 A</td>
<td>330 V</td>
<td>22 mA approx.</td>
<td>420 W</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct anode voltage</th>
<th>Grid bias</th>
<th>Direct anode current</th>
<th>Peak R.F. grid voltage</th>
<th>*Direct grid current</th>
<th>*Driving power</th>
<th>Power output</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,000 V</td>
<td>—250 V</td>
<td>0.250 A</td>
<td>345 V</td>
<td>22 mA approx.</td>
<td>6 W</td>
<td>550 W</td>
<td></td>
</tr>
</tbody>
</table>

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

---

*July 1945*
3C/270A
(4212E)

Triode

4212E

93 mm.
DIA.

352 mm.

PLANE OF FILAMENT

A

F

G

July 1945

3C/270A—6
Triode

4270A

CATHODE.
Thoriated tungsten filament.
Voltage 10.0 V
Nominal current 9.75 A
Peak emission 4.0 A

RATING.
Amplification factor Measured at Va 2,500V 16
Impedance la 120 mA 2,800 ohms

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.

July 1945
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.

July 1945
Air-Blast-Cooled
U.H.F. Triode

3J/160E

CATHODE

Thoriated tungsten filament

Voltage 10 V
Nominal current 29 A
Peak emission 10 A

RATING

Amplification factor \( \{ \) Measured at Impedance \( \{ V \) 2.5 kV, \( I_a \) 0.8 A \( \} \) 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
TYPICAL OPERATING CONDITIONS
RADIO FREQUENCY

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-100 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.7 A</td>
</tr>
<tr>
<td>Peak R.F. grid voltage at crest of modulation cycle</td>
<td>320 V</td>
</tr>
<tr>
<td>Power output</td>
<td>0.45 kW</td>
</tr>
</tbody>
</table>

Class C Power Amplifier. Anode subject to modulation.
(Carrier conditions per valve for use with 100% modulation).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-400 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.75 A</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>660 V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>0.225 A approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>1.0 kW</td>
</tr>
</tbody>
</table>

Class C Power Amplifier or Oscillator, unmodulated.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>3 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-325 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>1 A</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>600 V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>0.26 A approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>2.15 kW</td>
</tr>
</tbody>
</table>

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

Tentative data
July 1947
Air-Blast-Cooled
U.H.F. Triode

3J/160E

Tentative data
July 1947

3J/160E—3
Air-Blast-Cooled U.H.F. Triode

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
Air-Blast-Cooled Triode

CATHODE.
Thoriated tungsten filament
Voltage 10 V
Nominal current 22 A
Peak emission 6 A

RATING.
Amplification factor \( \text{measured at } V_a 4 \text{ kV} \) 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 3½ kW
Volume of air at pressure of 1 inch
of water. 300 cu. ft./min.
Maximum radiator core temperature 130° C
Maximum ambient temperature 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 3½ kW
Maximum grid dissipation 150 W
Maximum frequency for above ratings 50 Mc/s.

May 1947
TYPICAL OPERATING CONDITIONS

RADIO FREQUENCY

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>5 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-260 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.9 A</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>960 V</td>
</tr>
<tr>
<td>Power output</td>
<td>1.4 kW</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>4 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-900 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>1.0 A</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>1,500 V</td>
</tr>
<tr>
<td>* Direct grid current</td>
<td>0.230 A</td>
</tr>
<tr>
<td>Power output</td>
<td>2.5 kW</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>6 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-700 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>1.25 A</td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>1,400 V</td>
</tr>
<tr>
<td>* Direct grid current</td>
<td>0.262 A appx.</td>
</tr>
<tr>
<td>Power output</td>
<td>5 kW. appx.</td>
</tr>
</tbody>
</table>

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

*May 1947*
Air-Blast-Cooled Triode

May 1947
CATHODE.
Thoriated tungsten filament
Voltage 10 V
Nominal current 33 A
Peak emission 12 A

RATING.
Amplification factor \[
\begin{align*}
\text{Measured at} & \quad 26 \\
\text{Impedance} & \quad \{ \text{Va5kV} \land I_a 0.8A \} \\
\end{align*}
\]
3,450 Ω

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
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.

May 1947
CATHODE.
Thoriated tungsten filament
Voltage 5 V
Nominal current 66 A
Peak emission 12 A

RATING.
Amplification factor Measured at 17
Impedance \{ V_a 6kV, I_a 0.9A \} 1,500 Ω

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

May 1947
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.

May 1947  3J/192E—2
Air-Blast-Cooled R.F. Triode

GRID
FILAMENT
FILAMENT
RADIAL FINS.

240 mm MAX:
70 mm MAX:
150 mm DIA: MAX:

May 1947
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 $V_a$ 12 kV, 1a 1.5 A 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 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

May 1947
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.

May 1947
Air-Blast-Cooled R.F. Power Amplifier Triode

3J/221E

May 1947

3J/221E—4
CATHODE.

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

RATING.

Amplification factor Measured at 2\,900 Ω
Impedance Va 12kV, Ia 1.5A

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

May 1947
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.
CATHODE.

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

RATING.

Amplification factor measured at $V_a 5 \text{kV} I_a 0.75 \text{A}$ 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

June, 1946
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— zero signal | 0.15 | A     |
| Direct anode current per valve— maximum signal | 0.6  | A     |
| Load resistance—anode to anode       | 8,400 | Ω     |
| 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. |
CATHODE.

Thoriated tungsten filament
Voltage 10 V
Nominal current 33 A
Peak emission 12 A

RATING.

Amplification factor [ Measured at ] 26
Impedance [ Va 5kV, Ia 0.8A ] 3,450 Ω

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 gallons/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
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

5430-O

May 1947
Single-ended Water-cooled
R.F. Power Amplifier Triode

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 \text{Ve} \} 26
Impedance \{ 12\text{kV} \text{ 1A} 1.5\text{A} \} 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

May 1947
### TYPICAL OPERATING CONDITIONS

#### RADIO FREQUENCY

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>15 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-600 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>2.0 A</td>
</tr>
<tr>
<td>Power output</td>
<td>10 kW approx.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>15 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-2,000 V approx.</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>2 A</td>
</tr>
<tr>
<td>Power output</td>
<td>20 kW approx.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>17 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-1,600 V approx.</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>2.5 A</td>
</tr>
<tr>
<td>Power output</td>
<td>30 kW approx.</td>
</tr>
</tbody>
</table>

*May 1947*
Single-ended Water-cooled
R.F. Power Amplifier Triode

FILAMENT
GRID
GRID SCREEN

520 mm. MAX:

115 mm. ± 3 mm.
Double Ended Water Cooled Triode

CATHODE.
Tungsten filament
Nominal voltage (actual voltage marked on bulb) 25 V
Nominal current 248 A
Peak emission 45 A

RATINGS.
Amplification factor \( \text{Measured at} \) Va 17.5kV Ia 5A
Impedance 1800 \( \Omega \)

DIRECT INTER-ELECTRODE CAPACITANCEs
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

August 1945
**TYPICAL OPERATING CONDITIONS**

**AUDIO FREQUENCY**

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>14 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-150 V</td>
</tr>
<tr>
<td>Direct anode current per valve zero signal</td>
<td>1.3 A</td>
</tr>
<tr>
<td>Direct anode current per valve maximum signal</td>
<td>6.5 A</td>
</tr>
<tr>
<td>Anode dissipation</td>
<td>41 kW</td>
</tr>
<tr>
<td>Load resistance anode to anode</td>
<td>1900 Ω</td>
</tr>
<tr>
<td>Maximum output 2 valves</td>
<td>100 kW</td>
</tr>
</tbody>
</table>

**RADIO FREQUENCY**

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>17.5</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-400</td>
</tr>
<tr>
<td>Direct anode current per valve zero signal</td>
<td>4.8 A</td>
</tr>
<tr>
<td>Direct anode current per valve maximum signal</td>
<td>4.8 A</td>
</tr>
<tr>
<td>Power output</td>
<td>25</td>
</tr>
<tr>
<td>Anode dissipation</td>
<td>59</td>
</tr>
<tr>
<td>Frequency</td>
<td>2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>12</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-600</td>
</tr>
<tr>
<td>Direct anode current per valve zero signal</td>
<td>5 A</td>
</tr>
<tr>
<td>Direct anode current per valve maximum signal</td>
<td>5 A</td>
</tr>
<tr>
<td>Power output</td>
<td>40</td>
</tr>
<tr>
<td>Anode dissipation</td>
<td>20</td>
</tr>
<tr>
<td>Frequency</td>
<td>2</td>
</tr>
</tbody>
</table>

Class C Power Amplifier or Oscillator, Unmodulated

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>17.5</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-600</td>
</tr>
<tr>
<td>Direct anode current per valve zero signal</td>
<td>9.6 A</td>
</tr>
<tr>
<td>Direct anode current per valve maximum signal</td>
<td>9.6 A</td>
</tr>
<tr>
<td>Power output</td>
<td>100</td>
</tr>
<tr>
<td>Anode dissipation</td>
<td>68</td>
</tr>
<tr>
<td>Frequency</td>
<td>2</td>
</tr>
</tbody>
</table>
CATHODE.

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

RATING.

Amplification factor \{ \begin{align*} \text{Measured at} & \quad V_a 16 \text{ kV} \\ \text{Vg}_1 & \quad 100 \text{V} \end{align*} \} 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 7 in. 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

Tentative data
May 1947
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 Ω
- 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 V
- Grid bias: -800 V
- Direct anode current: 11 A
- Power output: 95 kW
Single-ended Water-Cooled Triode High Power RF Amplifier and Oscillator

3Q/331E

Tentative data
May 1947
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
25 c/s and above 2 A
Maximum average anode current 0.5 A
Maximum peak grid current 0.1 A
Condensed mercury temperature 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.

<table>
<thead>
<tr>
<th>Natural Ventilation</th>
<th>up to 35°C.</th>
<th>35°C. to 40°C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak inverse voltage</td>
<td>1,500V</td>
<td>1,000V</td>
</tr>
</tbody>
</table>

Tentative data
May 1946
TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th></th>
<th>No. of Valves</th>
<th>Maximum D.C. Output voltage</th>
<th>Maximum D.C. Output current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bi-phase half wave</td>
<td>2</td>
<td>500V</td>
<td>1.0 A</td>
</tr>
<tr>
<td>Full wave</td>
<td>4</td>
<td>1000V</td>
<td>1.0 A</td>
</tr>
</tbody>
</table>

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  Grid voltage (approx.)
200 V          —3
500 V          —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.

Tentative data
May 1946

3V/340B—2
Hot Cathode Mercury Vapour Thyatron

3V/340B

60mm.

168mm.

BLANK

F

G

Tentative data
May 1946
CAThelDE.
Indirectly-heated oxide-coated
Voltage 5 V
Nominal current 5.5 A

DI 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 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.

<table>
<thead>
<tr>
<th>Natural Ventilation</th>
<th>up to 35°C.</th>
<th>35°C. to 40°C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak inverse voltage</td>
<td>1,500V</td>
<td>1,000V</td>
</tr>
</tbody>
</table>

Tentative data
June 1946
TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th></th>
<th>No. of Valves</th>
<th>Maximum D.C. Output voltage</th>
<th>Maximum D.C. Output current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bi-phase half wave</td>
<td>2</td>
<td>500V</td>
<td>5.0 A</td>
</tr>
<tr>
<td>Full wave</td>
<td>4</td>
<td>1000V</td>
<td>5.0 A</td>
</tr>
</tbody>
</table>

THYRATRON OPERATION.

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

<table>
<thead>
<tr>
<th>Anode voltage</th>
<th>Grid voltage (approx.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 V</td>
<td>—10</td>
</tr>
<tr>
<td>500 V</td>
<td>—12</td>
</tr>
</tbody>
</table>

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.

Tentative data
June 1946

3V/420B—2
Hot Cathode Mercury
Vapour Thyatron
4049GD

CATHODE.
Oxide-coated filament, Shielded
Voltage: 4 V
Nominal current: 11 A

DIMENSIONS.
Maximum overall length: 280 mm.
Maximum bulb diameter: 62 mm.
Base, Large American 4 pin.
Net weight.

MAXIMUM RATINGS.
Maximum peak inverse voltage: 20 kV
Maximum peak anode current: 5 A
Maximum average anode current: 1.25 A
Condensed mercury temperature 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°—65° | 20°C—55°C. |
| Peak Inverse Voltage        | Less than 10 kV. | 10 kV. to 20 kV. |
3V/500A
(4049GD) Hot Cathode Mercury Vapour Thyratron
4049GD

TYPICAL OPERATING CONDITIONS
(for ideal choke-input filter)

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum D.C. output Volts</th>
<th>Maximum D.C. output current</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>6,400V</td>
<td>2.5A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>13,000V</td>
<td>2.5A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>9,500V</td>
<td>3.75A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9,500V</td>
<td>7.5A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>18,500V</td>
<td>3.75A</td>
</tr>
</tbody>
</table>

THYRATRON OPERATION.

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

GRID VOLTAGE (approx). ANODE VOLTAGE
—4V 15,000V
—3V 11,000V
—2V 9,000V
—1V 5,000V
—0V 3,000V

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 applied grid pulse relative to that of the anode voltage.

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

CATHODE HEATING TIME.

Ambient temperature 20° to 30° 30° to 65°
Min. pre-heating period 15 mins. 5 mins.

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 under “Natural Ventilation” are only valid for unrestricted natural ventilation, forced air blast cooling 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.

May 1947

3V/500A—2
Hot Cathode Mercury Vapour Thyatron

4049GD

62 mm DIA: MAX:

280 mm MAX:

LARGE 4-PIN BAYONET.

BASING.
1 GRID.
2 FILAMENT.
3 BLANK.
4 FILAMENT.

May 1947
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 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 |

August 1945
TYPICAL OPERATING CONDITIONS

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum D.C. Output volts</th>
<th>Maximum D.C. Output Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>6,400 V</td>
<td>6 A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>13,000 V</td>
<td>6 A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>9,500 V</td>
<td>8 A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9,500 V</td>
<td>15 A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>18,500 V</td>
<td>8 A</td>
</tr>
</tbody>
</table>

THYRATRON OPERATION.

With a condensed mercury temperature of 35° C., the minimum values of grid blocking voltages to prevent ignition are:
- Grid voltage (approximately)
  - 0.5 V
  - 15 V
- Anode voltage
  - 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 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.

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>10° C. to 15° C.</th>
<th>15° C. to 20° C.</th>
<th>20° C. and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum pre-heating period</td>
<td>30 minutes</td>
<td>15 minutes</td>
<td>5 minutes</td>
</tr>
</tbody>
</table>

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.

August 1945
Hot Cathode Mercury 
(4079GA)
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 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 |

August 1945
**TYPICAL OPERATING CONDITIONS**
(for ideal choke-input filter).

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum D.C. Output volts</th>
<th>Maximum D.C. Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>6,400 V</td>
<td>12.5 A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>13,000 V</td>
<td>12.5 A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>9,500 V</td>
<td>16 A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>9,500 V</td>
<td>30 A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>18,500 V</td>
<td>16 A</td>
</tr>
</tbody>
</table>

**THYRATRON OPERATION.**

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

- Grid voltage (approximately) — 1 kV
- — 20 kV

Anode voltage 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.**

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Minimum pre-heating time</th>
</tr>
</thead>
<tbody>
<tr>
<td>10° C. to 15° C.</td>
<td>30 minutes</td>
</tr>
<tr>
<td>15° C. to 20° C.</td>
<td>15 minutes</td>
</tr>
<tr>
<td>20° C. and above</td>
<td>5 minutes</td>
</tr>
</tbody>
</table>

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.

August 1945
Hot Cathode Mercury Vapour Thyatron

4079GA

36 mm
DIA.

13 mm.

196 mm
DIA. MAX.

544 mm MAX

G

36 mm MAX

10 mm MAX

22 mm

August 1945

3V/560E-3
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 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 to 10,000 V | 10,000 to 12,500 V | Greater than 12,500 V |

August 1945
TYPICAL OPERATING CONDITIONS.
(for ideal choke-input filter).

<table>
<thead>
<tr>
<th>Circuit No.</th>
<th>No. of Valves</th>
<th>Maximum D.C. Output volts</th>
<th>Maximum D.C. Output current</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>2</td>
<td>5,000 V</td>
<td>31 A</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>10,000 V</td>
<td>31 A</td>
</tr>
<tr>
<td>4</td>
<td>3</td>
<td>7,500 V</td>
<td>38 A</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>7,500 V</td>
<td>76 A</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>15,000 V</td>
<td>47 A</td>
</tr>
</tbody>
</table>

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 V                                  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.

<table>
<thead>
<tr>
<th>Ambient Temperature</th>
<th>15° to 20° C.</th>
<th>20° C. and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min. Pre-heating period</td>
<td>30 min.</td>
<td>10 min.</td>
</tr>
</tbody>
</table>

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.

August 1945
Hot Cathode Mercury Vapour Thyatron

3V/590E (4080GA)

August 1945
CATHODE.
Oxide-coated filament
Voltage 5 V
Nominal current 1.6 A

RATING.
Amplification factor \( \frac{V_a}{V_{g_2}} \) at 145V \( V_{g_2} \) 70V
\( V_{g_1} \) at 60V
Impedance 3,600 \( \Omega \)

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 screen and control grids 150 V
Maximum control grid potential on 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.

February 1946
TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th>Anode voltage (volts)</th>
<th>130</th>
<th>130</th>
<th>130</th>
<th>130</th>
<th>180</th>
<th>180</th>
<th>*250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control grid voltage (volts)</td>
<td>-40</td>
<td>-60</td>
<td>-40</td>
<td>-60</td>
<td>-40</td>
<td>-50</td>
<td>-65</td>
</tr>
<tr>
<td>Positive grid voltage (volts)</td>
<td>43</td>
<td>63</td>
<td>53</td>
<td>72</td>
<td>59</td>
<td>55</td>
<td>70</td>
</tr>
<tr>
<td>Anode current (mA)</td>
<td>25</td>
<td>25</td>
<td>35</td>
<td>35</td>
<td>45</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Positive grid current (mA)</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
<td>0.7</td>
<td>0.9</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Amplification factor</td>
<td>5.1</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.1</td>
<td>5.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Anode resistance (ohms)</td>
<td>3,700</td>
<td>4,000</td>
<td>3,200</td>
<td>3,400</td>
<td>2,900</td>
<td>3,400</td>
<td>3,600</td>
</tr>
<tr>
<td>Load resistance (ohms)</td>
<td>5,000</td>
<td>3,000</td>
<td>4,000</td>
<td>2,000</td>
<td>2,800</td>
<td>5,000</td>
<td>3,500</td>
</tr>
<tr>
<td>Input peak volts</td>
<td>40</td>
<td>60</td>
<td>40</td>
<td>60</td>
<td>40</td>
<td>50</td>
<td>65</td>
</tr>
<tr>
<td>Fundamental power output (watts)</td>
<td>1.1</td>
<td>2.0</td>
<td>1.2</td>
<td>2.2</td>
<td>1.4</td>
<td>2.1</td>
<td>3.3</td>
</tr>
<tr>
<td>2nd harmonic (db)</td>
<td>29</td>
<td>21</td>
<td>33</td>
<td>21</td>
<td>30</td>
<td>30</td>
<td>26</td>
</tr>
</tbody>
</table>

* Maximum operating condition.
FILAMENT VOLTAGE = 5 VOLTS D.C.
SCREEN VOLTAGE = 70 VOLTS
ANODE CURRENT
SCREEN CURRENT

ANODE CURRENT (mA)

SCREEN CURRENT

CONTROL GRID VOLTAGE (V)

February 1946
Output Pentode

5A/102A and D

(5A/102A is for replacement purposes only)

CATHODE.
Indirectly-heated Oxide-coated
Current 0.85 A
Nominal voltage 7.5 V

RATING.
Mutual conductance
\[
\begin{align*}
&\text{Measured at } V_a 180V \\
&V_g 150V \text{ } V_g 18V
\end{align*}
\]
2.5 ma/V

INTER-ELECTRODE CAPACITIES.
Grid to anode 0.5 pF
Input 6.8 pF
Output 9 pF

DIMENSIONS.

<table>
<thead>
<tr>
<th></th>
<th>5A/102A</th>
<th>5A/102D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>134 mm.</td>
<td>134 mm.</td>
</tr>
<tr>
<td>Maximum bulb diameter</td>
<td>46 mm.</td>
<td>46 mm.</td>
</tr>
<tr>
<td>Net weight</td>
<td>50 g.</td>
<td>55 g.</td>
</tr>
<tr>
<td>Base</td>
<td>Am 6 pin.</td>
<td>Int. Octal</td>
</tr>
</tbody>
</table>

MAXIMUM RATINGS.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum direct anode voltage</td>
<td>180</td>
<td>V</td>
</tr>
<tr>
<td>Maximum direct anode current</td>
<td>50</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum direct screen voltage</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>Maximum direct screen current</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum control grid resistance (using auto-bias)</td>
<td>500</td>
<td>k Ω</td>
</tr>
</tbody>
</table>

April 1946
**TYPICAL OPERATING CONDITIONS.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anode voltage</td>
<td>180 volts</td>
</tr>
<tr>
<td>Control grid voltage</td>
<td>—18 volts</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>150 volts</td>
</tr>
<tr>
<td>Suppressor voltage</td>
<td>0 volts</td>
</tr>
<tr>
<td>Load resistance</td>
<td>4,000 ohms</td>
</tr>
<tr>
<td>Output mW</td>
<td>50 100 250 500 750 1,000</td>
</tr>
<tr>
<td>Total harmonics, db below fundamental</td>
<td>34 31 28 26 25 24</td>
</tr>
</tbody>
</table>
Output Pentode

5A/102A and D

(5A/102A is for replacement purposes only)

ANODE & SCREEN CURRENT (mA)

ANODE VOLTAGE (V)

April 1946

5A/102A-D-3
Output Pentode

5A/102A and D

(5A/102A is for replacement purposes only)

5A/102A BASING
1 HEATER
2 ANODE
3 GRID 2
4 GRID 3
5 CATHODE
6 HEATER

5A/102D BASING
1 BLANK
2 HEATER
3 ANODE
4 GRID 2
5 GRID 3
7 HEATER
8 CATHODE

April 1946
CATHODE.

Indirectly-heated oxide-coated.
Voltage  4  V
Nominal current  1  A

RATING.

Mutual conductance \[ \begin{align*}
&\text{Measured at } V_a 200V \\
&V_{g2} 100V  V_{g1} -2V
\end{align*} \]  3  mA/V

INTER-ELECTRODE CAPACITIES.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid to anode</td>
<td>0.007</td>
<td>pF</td>
</tr>
<tr>
<td>Input</td>
<td>10.7</td>
<td>pF</td>
</tr>
<tr>
<td>Output</td>
<td>8</td>
<td>pF</td>
</tr>
</tbody>
</table>

DIMENSIONS.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>137</td>
<td>mm.</td>
</tr>
<tr>
<td>Maximum bulb diameter</td>
<td>39</td>
<td>mm.</td>
</tr>
<tr>
<td>Base: Standard British 5-pin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net weight</td>
<td>60</td>
<td>g.</td>
</tr>
</tbody>
</table>

MAXIMUM RATINGS.

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum direct anode voltage</td>
<td>250</td>
<td>V</td>
</tr>
<tr>
<td>Maximum direct screen voltage</td>
<td>100</td>
<td>V</td>
</tr>
<tr>
<td>Maximum direct anode current</td>
<td>9</td>
<td>mA</td>
</tr>
</tbody>
</table>

TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th></th>
<th>Anode voltage</th>
<th>Control grid bias</th>
<th>Screen grid voltage</th>
<th>Anode current</th>
<th>Anode resistance</th>
<th>Load</th>
<th>Output</th>
<th>2nd harmonic—%</th>
<th>2nd harmonic—db</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250</td>
<td>—1.5</td>
<td>100</td>
<td>3.9</td>
<td>800,000</td>
<td>50,000</td>
<td>0.315</td>
<td>8.6</td>
<td>21.3</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>—1.5</td>
<td>100</td>
<td>3.8</td>
<td>800,000</td>
<td>46,000</td>
<td>0.258</td>
<td>8.75</td>
<td>20.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>800,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30,000 ohms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>800,000 ohms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.175 watts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

April 1946
CATHODE.
Indirectly heated Oxide-coated.
Current 0.425 A
Nominal voltage 7.5 V

RATING.
\[
\begin{align*}
\text{Mutual conductance } & \left\{ \text{measured at } \begin{array}{c} \text{Va250V Vg4180V} \\
\text{Vg40 Vg1—5.5V} \end{array} \right\} 2 \text{ mA/V} \\
\text{Screen grid } \mu & 19
\end{align*}
\]

INTER-ELECTRODE CAPACITIES.
Grid to Anode 0.03 pF
Input 6 pF
Output 14 pF

DIMENSIONS.
\[
\begin{align*}
\text{Maximum overall length} & 125 \text{ mm.} \\
\text{Maximum bulb diameter} & 40 \text{ mm.} \\
\text{Base} & \text{Small American} 6 \text{ pin} \\
\text{Net weight} & 50 \text{ g.} \\
\end{align*}
\]
\[
\begin{align*}
\text{Maximum overall length} & 125 \text{ mm.} \\
\text{Maximum bulb diameter} & 40 \text{ mm.} \\
\text{Base} & \text{International} \text{ Octal} \\
\text{Net weight} & 45 \text{ g.} \\
\end{align*}
\]

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.
## TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th></th>
<th>5A/136A and D</th>
</tr>
</thead>
</table>
| **Anode voltage**   | 135 135 135 135 135 180 180 225 225 | *
| Screen grid voltage | 135 135 135 135 135 135 135 135 135 | *250 250 250 250 | volts |
| Control grid bias   | -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 | volts |
| **Anode current**   | 5.4 5.4 5.4 5.4 5.4 5.4 5.4 5.5 5.5 5.5 5.5 | mA |
| Load resistance     | 20000 60000 60000 60000 100000 100000 100000 40000 100000 60000 60000 60000 | 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 | peak |
| Output voltage      | — — — 100 75 50 — 175 — 220 — 250 | peak |
| 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 | db |
| Third harmonic      | 30 28 45 39 50 55 28 30 27 31 30 55 29 | db |

* Maximum operating conditions
Carrier Pentode
5A/136A (4328A)
5A/136D (4328D)
4328A, and D

(4328A is for replacement purposes only)

40mm DIA. MAX.

1 HEATER
2 ANODE
3 GRID 2
4 GRID 3
5 CATHODE
6 HEATER

125mm MAX. BASING 4328D

1 BLANK
2 HEATER
3 ANODE
4 GRID 2
5 GRID 3
6 HEATER
7 CATHODE

4328D

8 1
7 2
5 4
3

SMALL SHELL OCTAL

4328A

6 1
5 2
4 3

AMERICAN SMALL SHELL

June 1946
CATHODE.
Indirectly heated oxide-coated
Voltage 10 V
Nominal current 0.32 A

RATING.
Mutual conductance \( \begin{align*}
\text{Measured at} \\
V_a = V_{g_2} = 135 \\
V_{g_3} = 0 \\
V_{g_1} = -3
\end{align*} \) 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

Tentative data
July 1946
## Typical Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Third Harmonic db</td>
<td>30, 28, 26, 24</td>
</tr>
<tr>
<td>Second Harmonic db</td>
<td>39, 37, 35, 33</td>
</tr>
<tr>
<td>Output Power (Watts)</td>
<td>250-480</td>
</tr>
<tr>
<td>Input Voltage Peak (Volts)</td>
<td>2.0-2.5</td>
</tr>
<tr>
<td>Load Resistance (Ohms)</td>
<td>5.4-200k</td>
</tr>
<tr>
<td>Anode Current (Milliampères)</td>
<td>0.5-0.3</td>
</tr>
<tr>
<td>Control Grid Bias (Volts)</td>
<td>-3, 0</td>
</tr>
<tr>
<td>Screen Voltage (Volts)</td>
<td>135, 100, 225</td>
</tr>
<tr>
<td>Grid Voltage (Volts)</td>
<td>135, 100, 225</td>
</tr>
</tbody>
</table>

Tentative data
July 1946

5A/150A—2
CATHODE.

Indirectly heated Oxide coated
Voltage 6.3 V
Nominal current 0.47 A

RATING.

Mutual conductance (at 1a 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 Ω

May 1947
## Typical Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>250</td>
<td>V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>10</td>
<td>mA</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>150</td>
<td>V</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>2</td>
<td>mA</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>0</td>
<td>V</td>
</tr>
<tr>
<td>Load impedance</td>
<td>6,000</td>
<td>Ω</td>
</tr>
<tr>
<td>Power output</td>
<td>50</td>
<td>mW</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt;5</td>
<td>%</td>
</tr>
</tbody>
</table>
Coaxial Repeater
Pentode
5A/152M

\( V_{g2} = 150 \text{ V} \)
\( V_{g3} = 0 \)

\( V_{g1} = 0.5 \)
\( V_{g1} = -1.0 \)
\( V_{g1} = -1.5 \)
\( V_{g1} = -2.0 \)
\( V_{g1} = -2.5 \)
\( V_{g1} = -3.0 \)
\( V_{g1} = -3.5 \)

May 1947
Coaxial Repeater Pentode

5A/152M

B. B. B. BASE

BASING

1 HEATER
2 ANODE
3 GRID 2
4 GRID 3
5 SHIELDS
6 GRID 1
7 CATHODE
8 HEATER

DIM MILIMETRES 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

May 1947
Coaxial Repeater Pentode 5B/110M

CATHODE.
Indirectly-heated oxide-coated
Voltage 6.3 V
Nominal current 0.8 A

RATING.
Mutual conductance \{ Measured at $V_a 250V$ \} 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

May 1947
### TYPICAL OPERATING CONDITIONS.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>250 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>38 mA</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>150 V</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>8 mA</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>0 V</td>
</tr>
<tr>
<td>Load Impedance</td>
<td>5,000 Ω</td>
</tr>
<tr>
<td>Power output</td>
<td>2 W</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt;5 %</td>
</tr>
</tbody>
</table>
Coaxial Repeater
Pentode

V_{g2} = 150V
V_{g3} = 0

May 1947
Coaxial Repeater
Pentode

5B/110M

B.B.B.
BASE.

BASING

1 HEATER
2 ANODE
3 GRID 2
4 GRID 3
5 SHIELDS
6 GRID 1
7 CATHODE
8 HEATER

<table>
<thead>
<tr>
<th>DIM</th>
<th>MILLIMETRES</th>
<th>INCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>80.2 MAX</td>
<td>3 5/32 MAX</td>
</tr>
<tr>
<td>B</td>
<td>66.7 MAX</td>
<td>2 5/8 MAX</td>
</tr>
<tr>
<td>C</td>
<td>30.15 MAX</td>
<td>1 3/16 MAX</td>
</tr>
</tbody>
</table>

NOTE. BASIC FIGURES ARE INCHES.

May 1947
Beam Power Amplifier
5B/250A

CATHODE.
Indirectly heated oxide coated.
Heater voltage 6.3 V
Nominal current 0.9 A

RATING.
Screen Grid $\mu$ \{ Measured \at $V_{a}500$ V \} 9 mA/V
Mutual conductance \{ $V_{g2}250$ V \} 6.0 mA/V
$I_{a}=72$ mA

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

August, 1945
5B/250A—1
## Beam Power Amplifier

### 5B/250A

#### TYPICAL OPERATING CONDITIONS

**AUDIO FREQUENCY**

Class B Power Amplifier or Modulator.

(For balanced 2-valve circuit.)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct anode voltage</th>
<th>Direct screen voltage</th>
<th>Grid bias</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400</td>
<td>600 V</td>
<td>-25</td>
</tr>
<tr>
<td>Anode current per valve—zero signal</td>
<td>50</td>
<td>30 mA</td>
<td></td>
</tr>
<tr>
<td>Anode current per valve—maximum signal</td>
<td>115</td>
<td>100 mA</td>
<td></td>
</tr>
<tr>
<td>Load resistance anode to anode</td>
<td>3,800</td>
<td>6,660 ohms</td>
<td></td>
</tr>
<tr>
<td>Maximum signal direct screen current</td>
<td>10</td>
<td>10 mA</td>
<td></td>
</tr>
<tr>
<td>Maximum signal power output</td>
<td>60</td>
<td>80 W</td>
<td></td>
</tr>
<tr>
<td>Peak A.F. grid-to-grid voltage</td>
<td>80</td>
<td>80 V</td>
<td></td>
</tr>
</tbody>
</table>

#### RADIO FREQUENCY

Class B Telephony Modulated Carrier applied to Grid.

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct anode voltage</th>
<th>Direct screen voltage</th>
<th>Grid bias</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400</td>
<td>600 V</td>
<td>-25</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>75</td>
<td>62.5 mA</td>
<td></td>
</tr>
<tr>
<td>Direct screen current</td>
<td>4</td>
<td>3 mA</td>
<td></td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>0</td>
<td>0 mA</td>
<td></td>
</tr>
<tr>
<td>Peak R.F. grid voltage</td>
<td>30</td>
<td>20 V</td>
<td></td>
</tr>
<tr>
<td>Power output</td>
<td>9</td>
<td>12.5 W</td>
<td></td>
</tr>
</tbody>
</table>

Class C Power Amplifier Anode subject to modulation.

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct anode voltage</th>
<th>Direct screen voltage</th>
<th>Grid bias</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>325</td>
<td>475 V</td>
<td>-45</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>80</td>
<td>83 mA</td>
<td></td>
</tr>
<tr>
<td>Direct screen current</td>
<td>9</td>
<td>9 mA</td>
<td></td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>3</td>
<td>2 mA</td>
<td></td>
</tr>
<tr>
<td>Power output</td>
<td>15</td>
<td>24 W</td>
<td></td>
</tr>
</tbody>
</table>

Class C Power Amplifier or Oscillator unmodulated.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Direct anode voltage</th>
<th>Direct screen voltage</th>
<th>Grid bias</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>400</td>
<td>600 V</td>
<td>-50</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>80</td>
<td>80 V</td>
<td></td>
</tr>
<tr>
<td>Direct screen current</td>
<td>95</td>
<td>100 mA</td>
<td></td>
</tr>
<tr>
<td>Direct screen current</td>
<td>9</td>
<td>9 mA</td>
<td></td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>2.5</td>
<td>3 mA</td>
<td></td>
</tr>
<tr>
<td>Power output</td>
<td>25</td>
<td>37.5 W</td>
<td></td>
</tr>
</tbody>
</table>

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

August, 1945
R.F. Beam Power Amplifier

CATHODE.
Thoriated tungsten filament
Voltage 10 V
Nominal current 5 A
Peak emission 2.25 A

RATING.
Mutual conductance measured at $V_a=2kV$, $V_g=400V$, $I_a=50 mA$

<table>
<thead>
<tr>
<th>Conductance</th>
<th>Measured at $V_a=V_g=400V$, $I_a=50 mA$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutual</td>
<td>3.3 mA/V</td>
</tr>
<tr>
<td>Screen grid $\mu$</td>
<td>10</td>
</tr>
</tbody>
</table>

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

June 1946

5C/100A—1
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.

June 1946

5C/100A—2
### CATHODE.
Thoriated tungsten filament

<table>
<thead>
<tr>
<th>Voltage</th>
<th>10</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal current</td>
<td>5.4</td>
<td>A</td>
</tr>
<tr>
<td>Peak emission</td>
<td>3</td>
<td>A</td>
</tr>
</tbody>
</table>

### RATING.

<table>
<thead>
<tr>
<th>Mutual conductance ( V_{g2} ) 400V, ( V_{g1} ) 20V</th>
<th>5</th>
<th>mA/V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screen grid ( \mu ) ( V_a = V_{g2} = 400V, V_{g1} = 20V )</td>
<td>11</td>
<td></td>
</tr>
</tbody>
</table>

### INTER-ELECTRODE CAPACITIES.

<table>
<thead>
<tr>
<th>Grid to anode</th>
<th>0.1</th>
<th>pF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input capacity</td>
<td>18</td>
<td>pF</td>
</tr>
<tr>
<td>Output capacity</td>
<td>13.0</td>
<td>pF</td>
</tr>
</tbody>
</table>

### DIMENSIONS.

<table>
<thead>
<tr>
<th>Maximum overall length</th>
<th>249</th>
<th>mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum bulb diameter</td>
<td>66</td>
<td>mm.</td>
</tr>
<tr>
<td>Base: Large American 5 pin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net weight</td>
<td>300</td>
<td>g.</td>
</tr>
</tbody>
</table>

### 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 |

*June 1946*
TYPICAL OPERATING CONDITIONS.

RADIO FREQUENCY.

Class C Power Amplifier. Control grid modulated.
(Carrier conditions per valve for use with 100% modulation).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>—140 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>85 mA</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>20 mA</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>0 V</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>170 V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>3 mA approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>70 W approx.</td>
</tr>
</tbody>
</table>

Class C Power Amplifier. Suppressor modulated.
(Carrier conditions per valve for use with 100% modulation).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>—100 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>80 mA</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>85 mA</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>—50 V</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>180 V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>11 mA approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>60 W approx.</td>
</tr>
</tbody>
</table>

Class C Power Amplifier or Oscillator, unmodulated.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>—100 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>120 mA</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>400 V</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>75 mA</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>0 V</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>180 V</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>10 mA approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>160 W approx.</td>
</tr>
</tbody>
</table>

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

June 1946
CATHODE.
Thoriated tungsten filament
Voltage 10 V
Nominal current 12.5 A
Peak emission 7 A

RATING.
Mutual conductance \( \mu \) measured at \( V_a 2.5 \text{ kV} \), \( V_g 0.6 \text{ kV} \), \( V_g 0 \text{ V} \), \( V_g 1-90 \text{ V} \): 4.5 mA/V

INTER-ELECTRODE CAPACITIES.
Grid to anode 0.2 pF
Input 45 pF
Output 27 pF

DIMENSIONS.
Maximum overall length 330 mm.
Maximum bulb diameter 108 mm.
Base—Special, see sketch
Net weight 800 g.

MAXIMUM RATINGS.
Maximum direct anode voltage 3 kV
Maximum direct anode current 0.7 A
Maximum anode dissipation 450 W
Maximum direct screen voltage 850 V
Maximum screen dissipation 100 W
Maximum frequency for above ratings 10 Mc/s.
Maximum anode voltage for frequency for 20 Mc/s. 2.25 kV

NOTE.—It is recommended that the valve be operated in a vertical position. When operated horizontally the plane of the filament should be vertical. Free circulation of air around the bulb is essential. When operated in a confined space circulation of air by means of a fan is recommended.
**TYPICAL OPERATING CONDITIONS**

**RADIO FREQUENCY.**

**Class C Power Amplifier.**  **Suppressor Grid Modulated.**  
*(Carrier conditions per valve for use with 100% modulation)*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2.5 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-165 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.3 A</td>
</tr>
<tr>
<td>Screen voltage</td>
<td>530 V</td>
</tr>
<tr>
<td>Screen resistor</td>
<td>2500 Ω</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>110 mA</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>-90 V</td>
</tr>
<tr>
<td>Direct grid current *</td>
<td>19 mA approx.</td>
</tr>
<tr>
<td>Carrier output</td>
<td>300 W approx.</td>
</tr>
</tbody>
</table>

**Class C Power Amplifier or Oscillator Unmodulated**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>2.5 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-165 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>590 mA</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>600 mA</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>80 mA</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>100 V</td>
</tr>
<tr>
<td>Direct grid current *</td>
<td>19 mA approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>1 kW approx.</td>
</tr>
</tbody>
</table>

*Subject to wide variation depending upon the impedance of the load circuit.*
R.F. Suppressor
Modulated Pentode

$V_{g1} + 100$
$V_{g1} + 75$
$V_{g1} + 50$
$V_{g1} + 25$

$V_{g2} = 600\,\text{V}$
$V_{g3} = 0$

July 1947
Air Blast Cooled Pentode

CATHODE.
Thoriated tungsten filament
Voltage
Nominal current
Peak emission

RATING.
Mutual conductance \( \frac{\text{Measured at}}{\begin{array}{l} V_a 6kV \ V_g, 1.5kV \\ I_a 0.5A \end{array}} \) \( 5 \) mA/V
Screen grid \( \mu \) \( \sqrt{V_a 1.5kV \ V_g, 1.5kV} \) \( 6 \)

INTER-ELECTRODE CAPACITIES.
Grid to anode
Input
Output

AIR BLAST.
For an anode dissipation of 3.5kW
Volume of air
Velocity of air

at a pressure of 1in. SWG.

DIMENSIONS.
Maximum overall length
Maximum diameter over cooler
Net weight

MAXIMUM RATINGS.
Maximum direct anode voltage
Maximum direct anode current
Maximum anode dissipation
Maximum direct screen voltage
Maximum direct screen current
Maximum freq. for above ratings

Tentative data.
June 1946
TYPICAL OPERATING CONDITIONS.

RADIO FREQUENCY.

Class B Power Amplifier. Modulated carrier applied to grid.
(Carrier conditions per valve for use with 100% modulation).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>6 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-250 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>0.8 A</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>1,500 V</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>750 V</td>
</tr>
<tr>
<td>Peak RF grid current</td>
<td>0.33 A</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>25 mA approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>1.4 kW approx.</td>
</tr>
</tbody>
</table>

Class C Power Amplifier. Anode subject to modulation.
(Carrier conditions per valve for use with 100% modulation).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>5 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-1,000 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>1.2 A</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>1.5 kV</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>1.5 kV</td>
</tr>
<tr>
<td>Peak RF grid current</td>
<td>0.36 A</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>46 mA</td>
</tr>
<tr>
<td>Power output</td>
<td>3.8 kW approx.</td>
</tr>
</tbody>
</table>

Class C Power Amplifier or Oscillator unmodulated. For operation up to 25 Mc/s.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct anode voltage</td>
<td>6 kV</td>
</tr>
<tr>
<td>Grid bias</td>
<td>-500 V</td>
</tr>
<tr>
<td>Direct anode current</td>
<td>1.15 A</td>
</tr>
<tr>
<td>Direct screen voltage</td>
<td>1,400 V</td>
</tr>
<tr>
<td>Direct screen current</td>
<td>0.2 A</td>
</tr>
<tr>
<td>Direct suppressor voltage</td>
<td>200 V</td>
</tr>
<tr>
<td>Peak RF grid voltage</td>
<td>1 kV</td>
</tr>
<tr>
<td>*Direct grid current</td>
<td>90 mA approx.</td>
</tr>
<tr>
<td>Power output</td>
<td>5 kW approx.</td>
</tr>
</tbody>
</table>

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

Tentative data.

June 1946 5J/180E—2
Air Blast Cooled Pentode

$V_{G2} = 1500\,V$, $V_{G3} = 0\,V$

Screen

Anode

Grid Current (A)

Anode Voltage (kV)

Anode & Screen Current (Amps)

Tentative data.

June 1946
Air Blast Cooled Pentode

5J/180E

BASING
1 GRID 3
2 FILAMENT
3 GRID 2
4 FILAMENT
5 GRID 3
6 GRID 1

Locating Pin on Radiator

Tentative data.
June 1946
Monitor Cathode Ray Tube

VLS492AB (Blue Screen)  VLS492AG (Green Screen)

CATHODE.
Indirectly-heated oxide-coated
Voltage 2 V
Nominal current 1.8 A

INTER-ELECTRODE CAPACITIES.
\[
\begin{align*}
X_1 \text{ to } X_2 & : 0.8 \text{ pF} \\
Y_1 \text{ to } Y_2 & : 4.3 \text{ pF} \\
X_1 \text{ to all} & : 6.6 \text{ pF} \\
Y \text{ to all} & : 6.0 \text{ pF} \\
\text{Grid to all} & : 8.5 \text{ pF}
\end{align*}
\]

CONSTANTS.
Second anode voltage 250 to 1,000 V
First anode voltage 130 to 500 V
Sensitivity where \( V_{a_2} = 2\text{nd anode voltage} \)
\[
\begin{align*}
\overline{\text{X plates} 110 \text{ mm./V}} \\
\overline{\text{Y plates} 120 \text{ mm./V}} \\
\overline{V_{a_2}}
\end{align*}
\]

DIMENSIONS.
Maximum overall length 181 mm.
Maximum bulb diameter 40 mm.
Base Medium shell Octal
Net weight 100 g.

TYPICAL OPERATION.
Second anode voltage 500 1,000 V
First anode voltage 100 200 V
Grid bias 0 to \(-5\) \(-5\) to \(-10\) V

NOTES ON OPERATION.
1. The life of the tube will be materially increased by keeping the negative grid bias as high as is consistent with the brilliance required.
2. Earthing the second anode increases the stability of the trace.

June 1946
NOTES ON OPERATION—(continued)

3. Provision should be made for a path from the deflector-plates to the anode, e.g. by resistance of 1 to 5 MΩ. The plate Y is strapped to the second anode internally.

4. The tube operates more effectively at the higher anode voltages.

5. Focusing is effected by the variation of the first anode voltage for a fixed value of second anode voltage.

6. The key-way is 45° to the plane of the deflector plates.
CATHODE.
Indirectly-heated oxide-coated
Voltage 2 V
Nominal heater current 1.7 A

DIRECT INTER-ELECTRODE CAPACITIES.
X₁ to X₂ 0.8 pF
Y₁ to Y₂ 4.3 pF
X₁ to all other electrodes 6.6 pF
Y₁ 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 \( \frac{1}{4} \text{th of 2nd anode} \) approx. V
Control electrode bias 0 to —25 V
Cut off voltage at \( V_a₁ \) 2,000V —35 to —45 V
Maximum current to \( V_a₁ \) 300 \( \mu \)A
Sensitivity at \( V_a₂ \) 2,000V \( S_x 0.13 \) mm./V
\( S_y 0.135 \) mm./V
Sensitivity at \( V_a₂ \) 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.

<table>
<thead>
<tr>
<th></th>
<th>2,000</th>
<th>1,000 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second anode voltage</td>
<td>2,000</td>
<td>1,000 V</td>
</tr>
<tr>
<td>First anode voltage</td>
<td>240</td>
<td>120 V</td>
</tr>
<tr>
<td>Grid bias</td>
<td>——15 to —25</td>
<td>0 to —10 V</td>
</tr>
</tbody>
</table>

March 1946
High Vacuum Cathode Ray Tube

79 mm. DIA.

273 mm. MAX.

PY & 2ND. ANODE BOTTOM.

PY. BOTTOM

PX. TOP.

PX. TOP.

I ST. ANODE.

HEATER & CATHODE.

GRID.

HEATER.

March 1946
### 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 ($V = \text{anode voltage}$) | $\sqrt{370}$ | 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.
Gas Focused Cathode Ray Tube

4050AB (Blue Screen)  4050AD (Delay Screen)  4050AG (Green Screen)

118 mm DIA. MAX.

340 mm MAX.

41 mm DIA. MAX.

BASING
1  PY.  6  S.
2  PX.  7  PX.
3  BLANK. 8  PY.
4  F+.  9  ANODE.
5  F–.

June 1946
CATHODE.
Indirectly-heated oxide-coated
Voltage 2 V
Nominal heater current 1.9 A

DIRECT INTER-ELECTRODE CAPACITIES.

<table>
<thead>
<tr>
<th></th>
<th>4063AB</th>
<th>4063YB</th>
</tr>
</thead>
<tbody>
<tr>
<td>$X_1$ plate to $X_2$ plate</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>$X_1$ or $X_2$ plate to earth</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>$Y_1$ plate to $Y_2$ plate</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>$Y_1$ or $Y_2$ plate to earth</td>
<td>10</td>
<td>3.5</td>
</tr>
</tbody>
</table>
| Grid to earth        | 18     | 18     | pF

RATINGS.
Maximum anode voltage 5 kV
Approximate sensitivity where $V = \frac{X}{V}$
$X$ plates 600 mm./V
$Y$ plates 700 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 focus) $0.27 \times V_{a_3}$ approx.
First anode voltage 150 V
Grid bias for maximum brilliancy 0 to $-5$ V
Grid bias for cut off $-30$ V approx.
Grid base for modulation 30 V

June 1946
C22SS/1 & 2B—1
High Vacuum
Cathode Ray Tube

4063AB
(Blue Screen)

4063YB
(Blue Screen)
Y plates terminated
through side of bulb

4063 YB

4063 AB

June 1946

C22SS/1 & 2B-2
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) 580 mm./V
Effective screen diameter 6\(\frac{1}{2}\) 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.
Gas Focused Cathode Ray Tube

4050BB (Blue Screen) 4050BG (Green Screen) 4050BD (Delay Screen)

185 mm DIA

476 mm

46 mm

BLANK F+(s) F-(s) S(s)
PX (g) PX(f) PY (i) ANODE (s) PY (b)
Cold Cathode Stabiliser Valve
G120/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.

![Graph showing voltage drop vs. cathode current](image)

Tentative data
November 1945
Cold Cathode Stabiliser Valve

G120/IB

Tentative data
November 1945
Cold Cathode Gas-Filled Relay 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 μA (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

---

October 1945

G150/1A—1
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, 3 electrode, gas-filled valve for use as a relay. This valve has similar electrical characteristics to the 4313C (G150/1A) but has non-interchangeable trigger and cathode electrodes.

**DIMENSIONS.**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>87 mm</td>
</tr>
<tr>
<td>Maximum bulb diameter</td>
<td>30 mm</td>
</tr>
<tr>
<td>Base</td>
<td>International Octal</td>
</tr>
</tbody>
</table>

**CHARACTERISTICS.**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal control gap breakdown voltage</td>
<td>70 V</td>
</tr>
<tr>
<td>Nominal control gap maintaining voltage</td>
<td>60 V</td>
</tr>
<tr>
<td>Minimum main gap breakdown voltage</td>
<td>150 V</td>
</tr>
<tr>
<td>Nominal main gap maintaining voltage</td>
<td>75 V</td>
</tr>
<tr>
<td>Transfer current at Va 130V</td>
<td>5 μA</td>
</tr>
<tr>
<td>Optimum operating current</td>
<td>20 mA</td>
</tr>
</tbody>
</table>

**MAXIMUM RATINGS.**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum peak cathode current</td>
<td>50 mA</td>
</tr>
<tr>
<td>Maximum direct cathode current</td>
<td>30 mA</td>
</tr>
</tbody>
</table>
Cold Cathode Gas-Filled Relay

G150/2D

BASING
1 BLANK
2 BLANK
3 ANODE
4 BLANK
5 TRIGGER
6 BLANK
7 BLANK
8 CATHODE

DIM  MILLIMETRES  INCHES
A 87 MAX.  3 7/16 MAX.
B 30 MAX.  1 3/16 MAX.
L 73 MAX.  2 7/8 MAX.

NOTE: BASIC FIGURES ARE INCHES

May 1947

G150/2D—2
Cold cathode, 3 electrode, gas filled valve for use as a relay or rectifier in applications where a higher power is needed in the anode circuit than that obtainable with a G150/1A (4313C) valve.

It is characterised by its long life cathode and the non-interchangeability of trigger and cathode electrodes.

**DIMENSIONS.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>102 m.m.</td>
</tr>
<tr>
<td>Maximum bulb diameter</td>
<td>30 m.m.</td>
</tr>
<tr>
<td>Base International Octal</td>
<td></td>
</tr>
<tr>
<td>Net weight</td>
<td>34 g.</td>
</tr>
</tbody>
</table>

**CHARACTERISTICS.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal control gap breakdown voltage</td>
<td>75 V</td>
</tr>
<tr>
<td>Nominal control gap maintaining voltage</td>
<td>65 V</td>
</tr>
<tr>
<td>Minimum main gap breakdown voltage</td>
<td>240 V</td>
</tr>
<tr>
<td>Nominal main gap maintaining voltage</td>
<td>90 V</td>
</tr>
<tr>
<td>Optimum operating current</td>
<td>20 mA</td>
</tr>
<tr>
<td>Transfer current at Va 200V</td>
<td>10 μA</td>
</tr>
</tbody>
</table>

**MAXIMUM RATINGS.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum direct cathode current</td>
<td>30 mA</td>
</tr>
<tr>
<td>Maximum peak cathode current</td>
<td>50 mA</td>
</tr>
</tbody>
</table>
Cold Cathode Gas-Filled Relay

G240/2D

SMALL SHELL OCTAL

30 mm DIA. MAX.

102 mm MAX.

1 BLANK
2 BLANK
3 ANODE
4 BLANK
5 TRIGGER
6 } INTERNALLY
7 } STRAPPED
8 CATHODE

Tentative data
March 1945
Vacuum Condenser

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.

CAPACITY. 12 ± 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
Vacuum Condenser

70mm DIA: MAX:

56mm DIA: MAX:

170mm MAX:

Preliminary data.
October 1946
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.

**CAPACITY.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 ± 10% pF</td>
<td>25</td>
<td>pF</td>
</tr>
</tbody>
</table>

**DIMENSIONS.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>170</td>
<td>mm.</td>
</tr>
<tr>
<td>Maximum bulb diameter</td>
<td>56</td>
<td>mm.</td>
</tr>
<tr>
<td>Maximum overall diameter</td>
<td>70</td>
<td>mm.</td>
</tr>
</tbody>
</table>

**MAXIMUM RATING.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum peak RF voltage</td>
<td>32</td>
<td>kV</td>
</tr>
<tr>
<td>Maximum RF current</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>Maximum frequency of operation</td>
<td>20</td>
<td>Mc/s</td>
</tr>
</tbody>
</table>
Vacuum Condenser

K25/2L

70mm DIA: MAX:

56mm DIA: MAX:

170mm MAX:

Preliminary data.
October 1946
Vacuum Condenser

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.

**CAPACITY.**

<table>
<thead>
<tr>
<th>CAPACITY</th>
<th>50 ± 10%</th>
<th>pF</th>
</tr>
</thead>
</table>

**DIMENSIONS.**

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>170</th>
<th>mm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>56</td>
<td>mm.</td>
</tr>
<tr>
<td>Maximum bulb diameter</td>
<td>70</td>
<td>mm.</td>
</tr>
<tr>
<td>Maximum overall diameter</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MAXIMUM RATING.**

<table>
<thead>
<tr>
<th>RATING</th>
<th>32</th>
<th>kV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum peak RF voltage</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>Maximum RF current</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum frequency of operation</td>
<td>20</td>
<td>Mc/s.</td>
</tr>
</tbody>
</table>

Preliminary data.
October 1946
CATHODE.
Indirectly-heated, oxide-coated
Voltage
Nominal current

INTER-ELECTRODE CAPACITIES.
Grid-anode
Input
Output

DIMENSIONS.
Maximum overall length
Maximum bulb diameter
Base—see sketch
Net weight

MAXIMUM RATINGS.

<table>
<thead>
<tr>
<th></th>
<th>P535/1E</th>
<th>P552/1E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum direct anode voltage</td>
<td>15,000 V</td>
<td>20,000 V</td>
</tr>
<tr>
<td>Maximum direct screen voltage</td>
<td>1,250 V</td>
<td>1,250 V</td>
</tr>
<tr>
<td>Maximum average anode current</td>
<td>30 mA</td>
<td>30 mA</td>
</tr>
<tr>
<td>Maximum peak anode current with duty cycle of 1/1,000 or less</td>
<td>15 A</td>
<td>15 A</td>
</tr>
<tr>
<td>Maximum anode dissipation</td>
<td>60 W</td>
<td>60 W</td>
</tr>
<tr>
<td>Maximum screen dissipation</td>
<td>8 W</td>
<td>8 W</td>
</tr>
<tr>
<td>Maximum peak positive control grid</td>
<td>250 V</td>
<td>250 V</td>
</tr>
<tr>
<td>Maximum grid bias</td>
<td>—1,000 V</td>
<td>—1,000 V</td>
</tr>
</tbody>
</table>

Note.—Product of pulse duration in seconds and pulse recurrence frequency in c/s < 0.001. In any 100 μsec. interval the tube shall not be operated longer than 5 μsec.

Tentative data
June 1946
Tetrode Pulse Modulator

P535/1E & P552/1E

149mm.

65.2mm.

G2

G1

H

H&C

Tentative data
June 1946
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 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

Tentative data
November, 1945
Velocity Modulated Oscillator

V230A/1K (CV234)

OPERATING CONDITIONS.

Oscillator 8.9 to 11 cm. See Fig. 1.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid voltage $V_{g1}$</td>
<td>0 to 200 V negative with respect to cathode</td>
</tr>
<tr>
<td>Resonator voltage $V_{r}$</td>
<td>At 9.1 cm. 250 V ± 5%. For other wavelengths the $V_{r}$ is approximately proportional to the square of the frequency</td>
</tr>
<tr>
<td>Screen voltage $V_{g2}$</td>
<td>0 to $V_{r}$</td>
</tr>
<tr>
<td>Anode voltage $V_{a}$</td>
<td>$V_{r}$ plus 10 to 20 V</td>
</tr>
<tr>
<td>Output power</td>
<td>Not less than 0.3 W at the ends of the band with 15 W input</td>
</tr>
</tbody>
</table>

The output may be controlled by either $V_{g1}$ or $V_{g2}$. It is usually desirable to set $V_{g1}$ to zero voltage and adjust $V_{g2}$ by means of a potentiometer across the resonator supply.

Oscillator over at least an octave, approximately 8-16 cm.

See Fig. 2.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid voltage $V_{g1}$</td>
<td>0 to 200 V negative with respect to cathode</td>
</tr>
<tr>
<td>Resonator voltage $V_{r}$</td>
<td>At 15 cm. 100 V ± 5%. For other wavelengths the $V_{r}$ is approximately proportional to the square of the frequency</td>
</tr>
<tr>
<td>Screen voltage $V_{g2}$</td>
<td>0 to $V_{r}$</td>
</tr>
<tr>
<td>Anode voltage $V_{a}$</td>
<td>$V_{r}$ plus 10 to 20 V</td>
</tr>
<tr>
<td>Output power</td>
<td>Not less than 0.4 W in the middle of the band</td>
</tr>
</tbody>
</table>

The output may be controlled by either $V_{g1}$ or $V_{g2}$ as for 8.9 to 11 cm. operation.

Tentative data
November, 1945
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 rhubatron cavity with micrometer screw for wavelength adjustment. Wavelength 8.9 to 11 cm.

Circuit Fig. 2 is a non-contact octave rhubatron.

Further information may be obtained on application to the Chief Valve Engineer, Standard Telephones and Cables Ltd., Connaught House, Aldwych, London, W.C.2.

Tentative data
November, 1945
Velocity Modulated Oscillator

V230A/1K (CV234)

Tentative data
November, 1945
The V246A/IK is a velocity modulated oscillator of the coaxial line type for pulsed or CW operation over the band 6 to 7 cm.

The low voltage operation is made possible by the use of a magnetic field to focus the electron stream through the resonator system of the valve.

**CATHODE.**
Indirectly-heated oxide-coated.
Voltage 6.3 V
Nominal current (AC frequencies above 60 c/s must not be used) 0.3 A

**DIMENSIONS.**
Maximum overall length 90 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 peak cathode current must not exceed 0.5 A

Tentative data.
August 1947
**OPERATING CONDITIONS.**

**CW BEATING OSCILLATOR 6 to 7 cm.**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid voltage $V_{g1}$</td>
<td>0 to 200 V negative with respect to cathode.</td>
</tr>
</tbody>
</table>
| Resonator voltage $V_r$ | At 6.45 cm. 220 V $\pm 5\%$. For other wavelengths the $V_r$  
                        | is approximately proportional to the square of the  |
|                    | frequency                                          |
| Screen voltage $V_s$  | 0 to $V_r$                                         |
| Anode voltage $V_a$   | $V_r$ plus 10 to 20 V                              |
| Output power $W_o$    | Not less than 0.5 W with 15 W input at 6.45 cm.    |

The output may be controlled by either $V_{g1}$ or $V_{g2}$. It is usually desirable to set $V_{g1}$ to say—15 V and adjust $V_{g2}$ by means of a potentiometer across the resonator supply.

**PULSE OPERATION** with less than 10% duty cycle. Suitable as a transmitter. Subject to a delay time of 1 $\mu$ sec. approximately.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid voltage $V_{g1}$</td>
<td>0 to 200 V negative to the cathode</td>
</tr>
<tr>
<td>Screen voltage $V_s$</td>
<td>0 to $V_r$</td>
</tr>
</tbody>
</table>
| Resonator voltage $V_r$ | At 6.45 cm. 800 V $\pm 5\%$. For other wavelengths the $V_r$  
                        | is approximately proportional to the square of the  |
|                    | frequency                                          |
| Anode voltage $V_a$   | $V_r$ plus 10 to 20 V                              |
| Output power $W_o$    | Up to 20 W                                         |

The output may be controlled by either $V_{g1}$ or $V_{g2}$ as for CW operation.

**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 very accurately aligned in the magnetic field so that as much of the current as possible reaches the anode. Once aligned no further adjustment is necessary when changing valves.
Velocity Modulated Oscillator

V246A/IK (CV.228)

CIRCUITS.

Two circuits suitable for use with this valve are shown below. The position of the output probe is of importance. In circuit A the valve excites a rectangular wave guide which is tunable over the range 6 to 7 cm. by a feathered plunger.

Circuit B is a cavity resonator with a micrometer screw for wavelength adjustment. Wavelength range of this circuit is 6.3 cm. ± 0.2 cm.

The mean wavelength is determined by the diameter of the cavity.

Further information may be obtained on application to the Chief Valve Engineer, Standard Telephones and Cables Ltd., Connaught House, Aldwych, London, W.C.2.
Velocity Modulated Oscillator

V246A/IK (CV.228)
Miniature thermal delay switch suitable for applying the anode voltage to an indirectly heated valve after the cathode has warmed up.

RATINGS.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage</td>
<td>6.3 V</td>
</tr>
<tr>
<td>Nominal heater current</td>
<td>0.5 A</td>
</tr>
<tr>
<td>Nominal delay at 20°C.</td>
<td>50—60 secs.</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>—35°C. to —85°C.</td>
</tr>
<tr>
<td>Time delay is not less than 50 sec. and not more than 90 secs. over the ambient temperature range.</td>
<td></td>
</tr>
<tr>
<td>Max. O/C voltage between contacts</td>
<td>220 V.DC</td>
</tr>
<tr>
<td>Max. contact current on make</td>
<td>1.0 A</td>
</tr>
<tr>
<td>,, surge current on make</td>
<td>5.0 A</td>
</tr>
<tr>
<td>,, current on break</td>
<td>100mA at 50VDC</td>
</tr>
</tbody>
</table>

DIMENSIONS.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum overall length</td>
<td>54 mm.</td>
</tr>
<tr>
<td>Maximum overall diameter</td>
<td>19.1 mm.</td>
</tr>
</tbody>
</table>

Tentative data
June 1946
VLS631

Thermal Delay Switch

VLS 631 (CV.342)

54 mm. MAX.

19.1 mm MAX. DIA.

BLANK

STATIONARY STRIP.

ACTIVE STRIP.

BLANK

Tentative data
June 1946

VLS631—2
X-RAY TUBE

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 ½" of the glass at any point, except in the immediate vicinity of the anode.

FOCUS.

Effective focal spot is 1.5 mm. × 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.

October 1945
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.