

Osram WIRELESS GUIDE



Osram Valves

Extra Quality without Extra Cost

Foreword.

The reception of wireless broadcasting is so rapidly becoming less of a scientific achievement and more of a form of pure entertainment that for the majority of listeners detailed knowledge of the technicalities of their receiving set is neither essential nor desired.

In the 1931 edition of the OSRAM WIRELESS GUIDE, therefore, it is the intention to give as useful and complete information as possible concerning the correct choice of valves for any wireless receiver without confusing the reader with too many technical details.

The electrical characteristics of each type are chosen only after months of experimental work as the best for its particular purpose in the set. In addition to the choice of the correct characteristics the quality of each individual OSRAM VALVE is ensured by comprehensive tests on each valve and very complete Life Tests on representative valves taken from manufacture.

By this means the closest check is kept on the reliability of the product.

Every OSRAM VALVE sold carries the guarantee that it is made in the famous OSRAM Works, Hammersmith, and with the backing of the Research Laboratories of The General Electric Company, Ltd., Wembley.

THE THERMIONIC VALVE.

Since the days of the first OSRAM VALVES produced for the Services during the war, many and varied have been the designs evolved but all operate on a common principle—the utilisation and control of the stream of electrons from a chemically prepared electron emitting surface. This is sometimes called the "filament" and sometimes the "cathode."

In addition to this emitting surface the wireless valve must contain a "plate" or "anode" to which can be given a positive charge of electricity, and one or more control electrodes which are called "grids." (In a rectifying valve such as is used on A.C. Mains Sets the control grid is omitted).

Some of the OSRAM VALVES used by the B.B.C. to transmit the wireless energy through space are very large indeed when compared with an ordinary OSRAM receiving valve, as will be seen here.



OSRAM
Cooled-anode
Valve.

OSRAM
L.P.2

THE ESSENTIALS OF A WIRELESS RECEIVER.

Choice of the right valve.

A typical wireless valve receiving set must incorporate a *Detector* valve which may or may not be preceded by magnification of the signals at *High Frequency* exactly as picked up by the aerial, and may or may not be succeeded by one or more stages of *Low Frequency* amplification to magnify the signals as passed on by the *Detector*.

If considerable volume is required without distortion a *Super Power* valve is the best choice for the last stage. In A.C. mains-operated sets a special *Rectifying* valve is required for the H.T. current.

As the choice of the right valve has such a great bearing on the performance of the set, special reference is made in the following pages to the suggested types of OSRAM VALVES which may be chosen for each part of the set. With special circuits and to suit individual needs of the experimenter other types in the OSRAM range may be employed in place of those suggested, but for all ordinary purposes it will be found that the use of the OSRAM VALVES described in pages 4 to 8 will meet the requirements of the great majority of wireless receiving sets.

THE DETECTOR VALVE.

Every valve receiving set must embody that stage which acts, so to speak, as a *separator* enabling us to pick out the signals of speech and music frequencies from the very high frequency wireless carrier wave, for which, having conveyed our entertainment to us over the ether, we have no further use.

This stage is called the "Detector," and the valve used here may be fairly styled the "key" valve to any wireless set. Fortunately in most sets the choice of characteristics for a Detector valve is very elastic, but there are certain valves possibly better suited to this function than others.

For example, in a set with no H.F. amplification and where the input to the Detector may reasonably be considered as small, a valve should be chosen with a moderately high value of "amplification factor," such as an H type. In a set with H.F. amplification, such sensitivity in the Detector is not required, and better quality may result in using an HL or even L type valve with a lower value of grid-leak.

The following types of OSRAM VALVES are specially recommended as Detectors:—

| | |
|--|---------------|
| For 2-volt Battery Sets— | |
| (a) With no H.F. amplification | OSRAM H.2 |
| (b) with one or more stages of H.F. amplification | OSRAM H.L.2 |
| (c) "5 valve" Portables | OSRAM H.L.210 |
| For A.C. Mains-operated Sets | |
| | OSRAM M.H.4 |
| For D.C. Mains-operated Sets | |
| | OSRAM D.H. |
| For 4-volt Battery Sets | OSRAM H.L.410 |
| For 6-volt Battery Sets | OSRAM H.L.610 |

THE HIGH FREQUENCY VALVE.

The objects of High Frequency amplification preceding Detection may be said to be:—

- (1) Increased range to the set.
- (2) Improved Detector Efficiency due to the magnified input to this stage.
- (3) Better selectivity.
- (4) Better quality of reproduction possible as Reaction may be avoided.

Modern sets in which H.F. Amplification is employed in general make use of the Screen Grid type of valve.

The OSRAM Screen Grid Valve has the advantage over the ordinary 3-electrode valve in that it provides much greater and more stable amplification over a wide band of wavelengths. Its use is restricted to sets specifically designed for screen grid amplification.

The following types of OSRAM VALVES are specially recommended for H.F. amplifiers:

| | |
|---|---------------|
| For 2-volt Battery Sets— | |
| (a) with one stage S.G. | OSRAM S.22 |
| (b) with two or more stages S.G. | OSRAM S.21 |
| (c) "5 valve" Portables | OSRAM H.L.210 |
| For A.C. Mains-operated Sets— | |
| (a) with one stage S.G. | OSRAM M.S.4B |
| (b) with two or more stages S.G. | OSRAM M.S.4 |
| For D.C. mains-operated Sets OSRAM D.S. | |
| For 4-volt Battery Sets ... | OSRAM S.410 |
| For 6-volt Battery Sets ... | OSRAM S.610 |

THE LOUDSPEAKER VALVE.

L.F. and small Power Valves.

If it is desired to drive a loudspeaker from a Receiving Set it becomes necessary to add one or more stages of Low Frequency Amplification to follow the Detector stage.

Such valves serve to magnify the weak signals after detection and their choice depends on the volume of undistorted sound the Loudspeaker is required to deliver, and on the nature of the "H.T." supply available.

In general, a wise choice is to use as low an Impedance Power valve in the last stage as the nature of the H.T. supply will allow—a lower Impedance means more H.T. current, but more power output.

If Dry Batteries are used for "H.T." the output valve should be an OSRAM "Small Power" type designed to give the greatest undistorted volume consistent with the maximum economy in High Tension current consumption.

The following types of OSRAM VALVES are specially recommended for L.F. Amplifiers and as Loudspeaker valves:

| | |
|------------------------------|-------------------|
| For 2-volt Battery Sets— | |
| (a) with one stage L.F. | OSRAM L.P. 2 |
| (b) with two stages L.F. | OSRAM L.210* |
| | OSRAM P.2† |
| For A.C. mains-operated sets | OSRAM M.L4 |
| For D.C. mains-operated sets | OSRAM D.L. |
| For 4-volt Battery Sets ... | OSRAM P.410 |
| For 6-volt Battery Sets ... | OSRAM P.610 |

*1st Stage. †2nd Stage.

THE LOUDSPEAKER VALVE.

Super Power and Pentode Valves.

In a Receiving or Amplifying apparatus which is required to deliver a considerable volume of sound free from distortion, it is advisable to employ a "super-power" valve in the last stage.

Such a valve is designed to handle a larger amount of Power than the small power valve and adequate H.T. supply should therefore be available.

This can conveniently be obtained from the D.C. supply mains, or from the A.C. mains by means of a suitable OSRAM Rectifier Valve.

It is also important for the best results that the Impedances of the output valve and Loudspeaker be matched, if necessary, by means of a suitable transformer.

The following types of OSRAM VALVES are specially recommended as Super Power valves.

| | |
|------------------------------|-----------------------|
| For 2-volt Battery Sets ... | OSRAM P.2 or P.240 |
| For A.C. Mains-operated Sets | OSRAM P.X.4 |
| For 4-volt Battery Sets ... | OSRAM P.415 |
| For 6-volt Battery Sets ... | OSRAM P.625 or P.625A |

The use of Pentode valves should be restricted to sets employing one stage only of L.F. amplification where they are often of advantage in providing the greatest magnification of weak signals.

The following are recommended as Pentode Valves:

| | |
|------------------------------|------------------------|
| For 2-volt Battery Sets ... | OSRAM P.T.2 |
| For A.C. Mains-operated Sets | OSRAM P.T.4 or M.P.T.4 |
| For D.C. Mains-operated Sets | OSRAM D.P.T. |
| For 4-volt Battery Sets ... | OSRAM P.T.425 |
| For 6-volt Battery Sets ... | OSRAM P.T.625 |

THE RECTIFYING VALVE.

In all A.C. Mains Sets, and sets operated through a "Battery Eliminator" from A.C. mains, a Rectifying device is necessary to change the Alternating Current mains supply into the Direct Current necessary for the H.T. supply of the Receiving valves.

OSRAM Rectifying Valves are particularly recommended for such a purpose owing to the fact that—

- 1 They provide perfect rectification of the A.C. voltage.
- 2 They are easily replaceable when required.
- 3 They are built to withstand normal fluctuations of mains supply voltage and variation in H.T. current taken by different sets of similar type.

The following types of OSRAM VALVES are specially recommended as Rectifiers—

| | |
|--|------------|
| For small sets and Eliminators taking up to 60 milliamperes | OSRAM U.10 |
| For larger sets taking up to 120 milliamperes ... | OSRAM U.12 |
| For sets using high voltage super-power valves | OSRAM U.14 |
| For electric gramophones and large public entertainment Amplifiers ... | OSRAM GU.1 |

OSRAM VALVES FOR 2-VOLT BATTERY SETS.

| Type | Purpose. | fil'm't Curre'n't amps. | Amplif'ion factor | Impedance ohms. | Mutual Conductance ma/v ¹ |
|--------|---|-------------------------------|----------------------|--------------------|--|
| S.21 | Screen Grid H. F. valve. | 0.1 | 220 | 200,000 | 1.1 |
| S.22 | Screen Grid H.F. valve. | 0.2 | 350 | 200,000 | 1.75 |
| H.2 | High magnification non-microphonic Detector. | 0.1 | 35 | 35,000 | 1.0 |
| H.210 | Detector and R.C. Amplifier. | 0.1 | 35 | 50,000 | 0.7 |
| H.L.2 | Non-microphonic Detector and Amplifier valve. | 0.1 | 27 | 18,000 | 1.5 |
| HL.210 | General purpose valve. | 0.1 | 20 | 23,000 | 0.87 |
| L.210 | 1st stage L.F. amplifier | 0.1 | 11 | 12,000 | 0.92 |
| L.P.2 | L.F. and Loud-speaker Power valve. | 0.2 | 15 | 3,900 | 3.85 |
| P.2 | Loudspeaker Super-power valve | 0.2 | 7.5 | 2,150 | 3.5 |
| P.T.2 | Pentode | 0.2 | — | — | 2.5 |
| P.240 | Super-Power output valve | 0.4 | 4.0 | 2,500 | 1.6 |
| D.G.2 | Double-grid valve (for super-heterodyne sets) | 0.2 | 4.5 | 3,750 | 1.2 |

All the above 2-volt valves are designed specially with a view to the minimum H.T. current consumption for efficient performance in battery-operated sets, such as portables. They are particularly suitable for sets in which the H.T. voltage supply is of the order of 100 to 120 volts.

OSRAM VALVE

TYPE S.21

(For use with 2-volt
Accumulators.)

Screen Grid High
Frequency Amplifying
Valve.

Price, 20/-



The OSRAM S.21 is a 2-volt screen grid H.F. amplifying valve designed with characteristics especially applicable to stable H.F. amplification.

The mutual conductance of 1.1 ma/volt is so chosen as to make the S.21 type particularly suitable for sets with two stages of H.F. under which conditions a valve of higher conductance would be difficult to control. This value of conductance and the straightness of the characteristic enable the selectivity of a receiver to be increased due to reduction of "cross modulation."

The characteristics are also such as to restrict the H.T. current consumption to the lowest possible consistent with the above requirements.

| Anode Volts. | Screen Grid Volts. | Negative Grid Bias Volts. | Average Anode Current milliamps | Approx. Screen Current milliamps |
|--------------|--------------------|---------------------------|---------------------------------|----------------------------------|
| 120-150 | 70 | 0 to 1.5 | 3.5 to 2.0 | 1.5 |
| 100-120 | 50-60 | 0 to 0.9 | 2.8 to 1.8 | 1.0 |

NOMINAL RATING.

| | | | | |
|----------------------|-----|-----|-----|---------------|
| Filament Volts | ... | ... | ... | 2.0 max. |
| Filament Current | ... | ... | ... | 0.1 amp. |
| Anode Volts | ... | ... | ... | 150 max. |
| Screen Grid Volts | ... | ... | ... | 70 max. |
| Amplification Factor | ... | ... | ... | 220 |
| Impedance | ... | ... | ... | 200,000 ohms. |
| Mutual Conductance | ... | ... | ... | 1.1 |

OSRAM VALVE

TYPE S.22

(For use with 2-volt
Accumulators).

Screen Grid High
Frequency Amplifying
Valve.

Price, 20/-



The OSRAM S.22 is a 2-volt screen grid amplifying valve designed with a very high value of mutual conductance or "slope." This, combined with a low value of grid-anode leakage capacity, makes the valve particularly suitable for 2-volt battery sets in which the greatest possible H.F. magnification is required to be obtained from one stage.

The characteristics of the OSRAM S.22 are such as to restrict the H.T. current consumption to the lowest possible value consistent with a high order of efficiency.

The valve is designed to operate without negative grid bias if required, but a small negative grid bias of the value indicated below is recommended to improve the selectivity.

| Anode Volts. | Screen Grid Volts. | Recommended Negative Grid Bias Volts. | Average Anode current m.a. | Approx. Screen current m.a. |
|--------------|--------------------|---------------------------------------|----------------------------|-----------------------------|
| 120-150 | 75 | 0 to -1.5 | 4.0 to 1.5 | 1.6 |
| 100-120 | 50-60 | 0 to -0.9 | 2.5 to 1.2 | 1.0 |

NOMINAL RATING.

| | | | | |
|----------------------|-----|-----|-----|---------------|
| Filament Volts | ... | ... | ... | 2.0 max. |
| Filament Current | ... | ... | ... | 0.2 amp. |
| Anode Volts | ... | ... | ... | 150 max. |
| Screen Grid Volts | ... | ... | ... | 75 max. |
| Amplification Factor | ... | ... | ... | 350 |
| Impedance | ... | ... | ... | 200,000 ohms. |
| Mutual Conductance | ... | ... | ... | 1.75 |

OSRAM VALVE

Type H.2

(For use with 2-volt Accumulators).

Detector and Amplifying Valve.

Price, 8/6



The OSRAM H.2 is designed primarily for use as a high magnification Detector. For this purpose it is eminently suitable owing to the extremely rigid construction of its electrodes, which eliminates microphonic noise and "sound-coupling" interference.

In addition, the high values both of amplification factor and mutual conductance promote the maximum sensitivity both as a Detector or L.F. amplifier, particularly when followed by resistance-capacity coupling.

| Purpose. | Anode Volts. | Recommended Grid Bias Volts. | Average Anode Current m.a. |
|-------------------------------|--------------|---|-------------------------------------|
| Grid Leak Detector | 75-100 | Connect grid leak to positive end of filament | 1.0 to 1.6 |
| Anode Bend Detector. | 75-100 | -1½ to -4½ | Very small. |
| Resistance coupled amplifier. | 125-150 | -1½ | Depends on value of resistance used |
| H.F. Amplifier | 75-150 | Positive, zero or negative according to method of stabilising or damping the circuit. | 1.0 to 3.0 |

NOMINAL RATING.

| | | | | | |
|----------------------|-----|-----|-----|-----|--------------|
| Filament Volts | ... | ... | ... | ... | 2.0 max. |
| Filament Current | ... | ... | ... | ... | 0.1 amp. |
| Anode Volts | ... | ... | ... | ... | 150 max. |
| Amplification Factor | ... | ... | ... | ... | 35 |
| Impedance | ... | ... | ... | ... | 38,000 ohms. |
| Mutual Conductance | ... | ... | ... | ... | 1.0 |

OSRAM VALVE

TYPE H.210

(For use with 2-volt Accumulators).

Resistance-Capacity Amplifying and Detector Valve.

Price, 8/6



The OSRAM H.210 is a dull emitter valve for use with 2-volt accumulators, having a high amplification factor, making it suitable for the following purposes:

1. In resistance-capacity coupled amplifiers except in the last stage.
2. As a Detector valve either with grid leak and condenser or for anode bend rectification.
3. In high frequency amplifiers where a circuit with some form of stabilising or damping is employed.

| Purpose. | Anode Volts | Recommended Grid Bias Volts. | Average Anode Current m.a. |
|------------------------------|-------------|--|--------------------------------------|
| Resistance coupled amplifier | 125-150 | -1½ | Depends on value of resistance used, |
| Grid Leak Detector | 70-110 | Connect grid leak to positive end of filament. | 0.5 to 1.3 |
| Anode Bend Rectifier | 70-150 | -1½ to -3 | Very small |
| High Frequency Amplifier | 70-150 | Positive zero or negative according to method of stabilising or damping the circuit. | 0.5 to 2.4 |

NOMINAL RATING.

| | | | | | |
|----------------------|-----|-----|-----|-----|--------------|
| Filament Volts | ... | ... | ... | ... | 2.0 max. |
| ... Current | ... | ... | ... | ... | 0.1 amp. |
| Anode Volts | ... | ... | ... | ... | 150 max. |
| Amplification Factor | ... | ... | ... | ... | 35 |
| Impedance | ... | ... | ... | ... | 50,000 ohms. |
| Mutual Conductance | ... | ... | ... | ... | 0.7 |

OSRAM VALVE
TYPE H.L.2

(For use with 2-volt
 Accumulators).

**Detector and Amplifying
 Valve.**

Price, 8/6

The OSRAM H.L.2 is a very efficient dull emitter 2-volt valve, having a high value of mutual conductance. The valve is strongly recommended as a Detector in view of its extremely rigid construction which greatly minimises microphonic noise and "sound-coupling" interference.

It may also be employed with success in the first stage of an L.F. amplifier where the relatively low impedance and high amplification factor mean good quality reproduction without loss of magnification.



| Purpose. | Anode Volts. | Recommended Grid Bias Volts. | Average Anode Current m.a. |
|---|--------------|---|----------------------------|
| Grid Leak Detector | 50-100 | Connect grid lead to positive end of filament. | 1.0 to 3.1 |
| Anode Bend Detector. | 50-150 | -1½ to -6 | Very small. |
| In Low Frequency Amplifier (transformer coupled). | 75-150 | -1½ to -3 | 0.5 to 1.8 |
| In High Frequency Amplifier | 50-150 | Positive, zero or negative according to method of stabilising or damping the circuit. | 1.0 to 5.0 |

NOMINAL RATING.

| | | |
|----------------------|-----|--------------|
| Filament Volts | ... | 2.0 |
| Filament Current | ... | 0.1 amp. |
| Anode Volts | ... | 150 |
| Amplification Factor | ... | 27 |
| Impedance | ... | 18,000 ohms. |
| Mutual Conductance | ... | 1.5 |

OSRAM VALVE
TYPE HL.210

(For use with 2-volt
 Accumulators).

General Purpose Valve.

Price, 8/6

The OSRAM H.L.210 is a dull emitter 2-volt valve having a moderate value of mutual conductance which makes it particularly suitable for use in portable receivers of the "five-valve" pattern incorporating aperiodic H.F. amplification. It may also be usefully employed in cases where small bulb dimensions are essential.

The valve may be used in H.F. amplifiers, as a Detector valve, or in the first stage of L.F. amplifiers. For specific purposes a table of recommended operating conditions is given below.



| Purpose. | Anode Volts. | Recommended Grid Bias Volts. | Average Anode Current m.a. |
|------------------------------|--------------|---|----------------------------|
| In High Frequency Amplifier. | 50-150 | Positive, zero or negative according to method of stabilising or damping the circuit. | 0.8 to 4.6 |
| As-Grid Leak Detector. | 50-90 | Connect grid lead to positive end of filament. | 0.8 to 2.2 |
| As Anode Bend Detector. | 50-150 | -1½ to -6 | Very small |
| In Low Frequency Amplifier. | 75-150 | -1½ to -4 | 0.4 to 1.1 |

NOMINAL RATING.

| | | |
|----------------------|-----|--------------|
| Filament Volts | ... | 2.0 |
| Filament Current | ... | 0.1 amp. |
| Anode Volts | ... | 150 max. |
| Amplification Factor | ... | 20 |
| Impedance | ... | 23,000 ohms. |
| Mutual Conductance | ... | 0.87 |

OSRAM VALVE
TYPE L.210

(For use with 2-volt
 Accumulators).

General Purpose and L.F.
 Amplifying Valve.

Price, 8/6

The OSRAM L.210 is a dull emitter 2-volt valve, having characteristics making it suitable for the following purposes:

1. In transformer or choke coupled L.F. amplifiers in all stages except the last.
2. As a Detector valve using grid leak and condenser.
3. In H.F. amplifiers where a circuit with some form of stabilising or damping is employed.



OSRAM VALVE
TYPE L.P.2

(For use with 2-volt
 Accumulators).

Low Frequency and Power
 Amplifying Valve.

Price, 10/6

The OSRAM L.P.2 is the ideal Loudspeaker Power Valve for battery sets, in which the highest amplification is required with the lowest possible H.T. current consumption.

Owing to the high mutual conductance the valve is extremely sensitive to weak signals and is most usefully employed in sets where one stage only of L.F. is used. Excellent quality loudspeaker reproduction is obtained with a negative grid bias of only 3 to 4½ volts.



| Purpose. | Anode Volts. | Recommended Grid Bias Volts. | Average Anode Current m.a. |
|---|--------------|---|----------------------------|
| In Low Frequency Amplifier (transformer coupled). | 70-150 | -3 to -7½ | 1.0 to 2.3 |
| As Grid Leak Detector. | 50-90 | Connect grid leak to positive end of filament. | 2.0 to 5.0 |
| In High Frequency Amplifier. | 50-90 | Positive, zero or negative according to method of stabilising or damping the circuit. | 2.0 to 5.0 |

NOMINAL RATING.

| | | |
|----------------------|--------|--------------|
| Filament Volts | ... .. | 2.0 |
| Filament Current | ... .. | 0.1 amp. |
| Anode Volts | ... .. | 150 max. |
| Amplification Factor | ... .. | 11 |
| Impedance | ... .. | 12,000 ohms. |
| Mutual Conductance | ... .. | 0.92. |

| Anode Volts. | Recommended Negative Grid Bias Volts. | Average Anode Current m.a. |
|--------------|---------------------------------------|----------------------------|
| 150 | 4½* | 1.5 |
| 125 | 4½ | 6.0 |
| 100 | 3. | 5.2 |
| 75 | 1½ | 4.5 |

*Where necessary to effect the greatest economy in H.T. the grid bias may slightly exceed this value with consequent reduction in H.T. current.

NOMINAL RATING.

| | | |
|----------------------|--------|-------------|
| Filament Volts | ... .. | 2.0 max. |
| Filament Current | ... .. | 0.2 amp. |
| Anode Volts | ... .. | 150 max. |
| Amplification Factor | ... .. | 15 |
| Impedance | ... .. | 3,000 ohms. |
| Mutual Conductance | ... .. | 3.85 |

OSRAM VALVE

TYPE P.2

(For use with 2-volt Accumulators).

Last Stage Power Amplifying Valve.

Price, 13/6



The OSRAM P.2 is a Super-Power Valve specially designed to handle the greatest undistorted volume consistent with the lowest possible H.T. and L.T. current. It is recommended for the last stage either in portable sets (particularly with two stages of L.F.) or in any 2-volt battery-operated set.

It is the ideal Loudspeaker valve for four-valve kit sets.

With only 100 to 120 volts H.T. the P.2 will give remarkable volume for low H.T. consumption. To obtain the best results the valve should be used as below:

| Anode Volts. | Recommended Negative Grid Bias Volts. | Average Anode Current m.a. |
|--------------|---------------------------------------|----------------------------|
| 150 | 10½ | 19.0 |
| 125 | 9 to 10½ | 14.0 to 10.0 |
| 100 | 6 to 9 | 12.0 to 6.0 |
| 75 | 4½ | 7.5 |

NOMINAL RATING.

| | | |
|----------------------|-----|-------------|
| Filament Volts | ... | 2.0 max. |
| Filament Current | ... | 0.2 amp. |
| Anode Volts | ... | 150 max. |
| Amplification Factor | ... | 7.5 |
| Impedance | ... | 2,150 ohms. |
| Mutual Conductance | ... | 3.5 |

OSRAM VALVE

TYPE P.240

(For use with 2-volt Accumulators).

Last Stage Power Amplifying Valve.

Price, 13/6



The OSRAM P.240 is a Super Power Valve designed for use in the last stage of sets operated from 2-volt accumulators.

The valve has a large operating grid swing and when used with the correct values of anode voltage and negative grid bias will give an undistorted output sufficient for operating loudspeakers of the larger type. To avoid distortion and to obtain the best results consistent with economy of H.T. current the following operating conditions should be observed:

| Anode Volts. | Grid Bias Volts. | Average Anode Current m.a. |
|--------------|------------------|----------------------------|
| 150 | 24 | 17.0 |
| 130 | 21 | 14.0 |
| 110 | 16½ | 12.5 |
| 90 | 12 | 10.5 |

NOMINAL RATING.

| | | |
|----------------------|-----|-------------|
| Filament Volts | ... | 2.0 max. |
| Filament Current | ... | 0.4 amp. |
| Anode Volts | ... | 150 max. |
| Amplification Factor | ... | 4 |
| Impedance | ... | 2,500 ohms. |
| Mutual Conductance | ... | 1.6 |