



BULLETIN

CX-330, CX-331 and CX-332

TWO VOLT FILAMENT TUBES

This group of new and improved battery operated tubes includes a general purpose tube (CX-330), a power output tube (CX-331) and a screen grid tube (CX-332). All three are of the high vacuum type and employ a strong coated type filament. The filament in each type has been carefully designed to take as little power as possible, consistent with satisfactory operating performance. These tubes are particularly suited for use in radio receivers operating either from dry cells or from a storage battery where economy of filament current drain is important.

FILAMENT OPERATING DATA

In order to keep the filament voltage of these tubes within their safe operating range (1.8 to 2.2 volts), two methods are herewith described. The first and preferred method is by use of a rheostat and filament voltmeter connected permanently in the circuit. As these tubes will usually be operated with their filaments in parallel, the size of the rheostat required with various tube combinations and batteries is shown in Table 1. The other method is to make use of a fixed resistance of correct value to limit the voltage to a maximum safe value of 2.2 volts at the peak battery voltage. As the battery is being used the tubes will be operated through their operating range of 2.2 to 1.8 volts. Care must be taken, however, to check the socket voltage with a good quality voltmeter while making the initial installation. Table 2 shows the size of fixed resistor to be used with various tube combinations.

Each of these tubes is discussed in detail as follows:

CX-330

GENERAL PURPOSE TUBE

The CX-330 is a new general purpose tube designed to operate in battery receivers where economy of filament consumption is important. It may be used as a detector or amplifier and has an appearance similar to the CX-299, but has electrical characteristics which are considerably better. By using the CX-330 with the CX-331 (power tube) and CX-332 (screen grid tube) it is possible to construct a modern radio receiver having screen grid R.F. amplification and a power output stage.



FILAMENT

The CX-330 has a coated type filament which operates at a normal voltage of 2 volts and a current of 60 milliamperes. This filament power can conveniently be supplied from dry or storage batteries. Although the normal filament voltage is two volts, this tube has been so designed that it will give excellent operation at voltages slightly above and below the specified two volts. However, it is absolutely essential that the voltage is never above 2.2 volts or its life will be seriously shortened. Operation below 1.8 volts is not recommended.

PLATE AND GRID

The plate of this new general purpose tube is of the oval construction resulting in good mutual conductance with the extremely small filament consumption. The grid is also of oval construction and has been so designed to give the greatest possible operating characteristics.

The maximum recommended plate voltage for the CX-330 is 90 volts. At this voltage with the proper grid bias of -4.5 volts, the average plate current is 1.8 milliamperes. This value should be regarded as an average and tubes will be found to vary somewhat above and below this value.

Circuit Recommendations

AS AN R.F. AMPLIFIER

The CX-330 may be used in circuits of conventional design, as a radio frequency amplifier in which case the grid and plate circuit return should be completed through correct batteries to the negative filament terminal of the tube. It is also possible to reduce the plate voltage to 67.5 volts and the grid bias to -3.0 volts and still secure proper amplification.

It is not recommended that a rheostat be used as a volume control unless provision is made, that the highest voltage applied to the filament is never above 2.2 volts.

AS A DETECTOR

When used as a detector with grid leak and condenser, the plate voltage should not be higher than 45 volts and the grid return

should be connected to the positive side of the filament. The grid condenser should have a capacitance of .00025 mfd. and the grid-leak a resistance of from $\frac{1}{4}$ to 5 megohms. The higher the value of grid-leak, the greater will be the sensitivity on very weak signals, but the fidelity will be somewhat inferior to that obtained with the lower value.

The grid bias method of detection is recommended where better quality and selectivity is desired at the expense of sensitivity. The following table gives the approximate grid voltages to be used for a number of different plate voltages. Plate voltages above 90 volts should only be used when operating as a bias detector at the grid bias recommended below. The values of E_p are actual plate-filament voltages. The "B" battery voltage is higher by the drop in the plate resistance if resistance coupling is used.

E_p	E_g
90	-10.5
135	-15.0
165	-18.0

AS AN A.F. AMPLIFIER

As in R.F. amplification the grid return should be connected to the negative filament terminal, when the CX-330 is used as an A.F. amplifier. With resistance coupling the grid resistance should not be greater than 2 megohms.

SUBSTITUTION FOR OTHER CUNNINGHAM TUBES

The CX-330 may be substituted for the CX-299 in sets using the latter, providing suitable precautions are taken to limit the filament voltage to 2.0 volts. In tuned radio frequency receivers, it may be necessary to readjust the neutralizing condenser or grid resistor before stable operation is obtained.

OPERATING CONDITIONS

Filament Voltage	2.0 volts
Filament Current	0.06 amperes
Plate Voltage (maximum)	90 volts
Grid Bias Voltage	-4.5 volts

AVERAGE CHARACTERISTICS

Amplification Factor	9.3
Mutual Conductance	700 micromhos
Plate Resistance	13000 ohms
Plate Current	1.8 milliamperes
Maximum Undistorted Power Output . .	16 milliwatts
Grid-Plate Capacitance	6.0 mmf.
Grid-Filament Capacitance	3.5 mmf.
Plate-Filament Capacitance	2.0 mmf.

DIMENSIONS

Maximum Overall Length	4 $\frac{1}{4}$ "
Maximum Overall Diameter	1 $\frac{3}{16}$ "

BASE

The new small CX type base is employed on this tube. This base has the same maximum diameter as the base used on the CX-299 and CX-220 tubes but instead of the tapered shell a straight side shell is used. This new style base was developed for the slightly larger bulb size employed in the CX-330. The standard CX pin dimensions and connections are employed.

AVERAGE CHARACTERISTIC CURVES

(Pages 61 and 62)

Filament Characteristic—Fig. 1 shows the change of filament current with various filament voltages.

Grid Characteristic—Fig. 2 shows the relation between grid current and voltage.

Plate Characteristics—Fig. 3 shows a family of plate voltage-plate current curves at various grid bias voltages.

Mutual Characteristics—Fig. 5 shows a family of grid voltage-plate current curves for various plate voltages.

Dynamic Characteristics—Fig. 4 shows the effect of plate current upon the amplification factor, mutual conductance and plate resistance.

Detector Characteristics—Fig. 6 shows the relation between the radio frequency input and the audio frequency output, for several percentages of modulation.

CX-330 AVERAGE CHARACTERISTICS

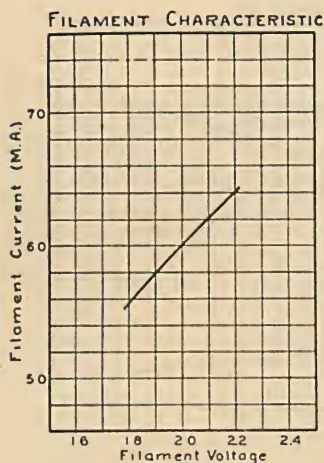


Fig. 1

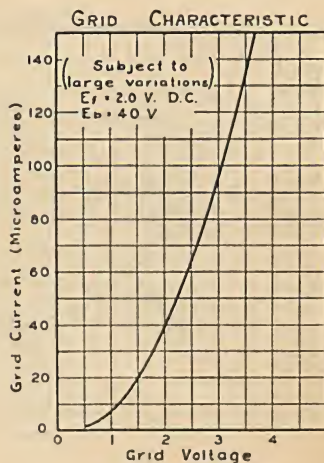


Fig. 2

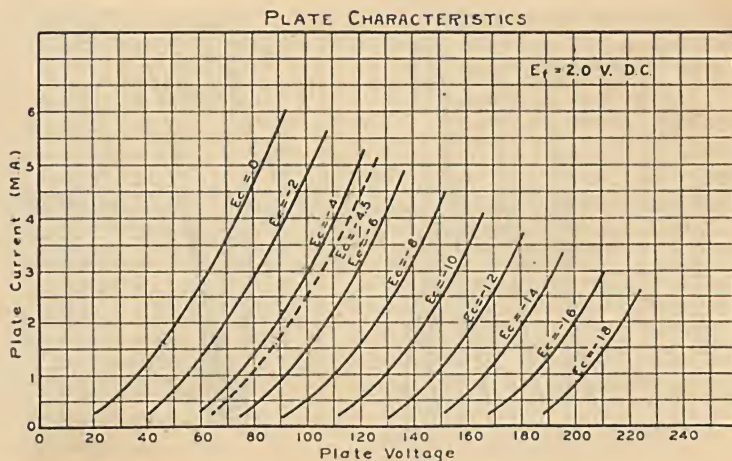


Fig. 3

CX-330 AVERAGE CHARACTERISTICS

DYNAMIC CHARACTERISTICS

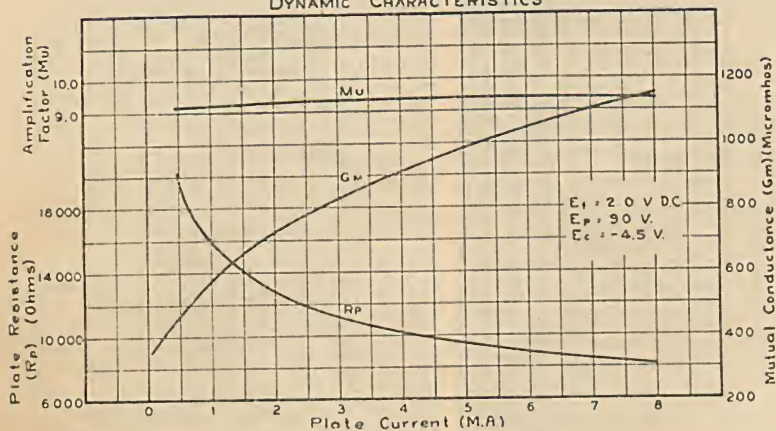


Fig. 4

MUTUAL CHARACTERISTICS

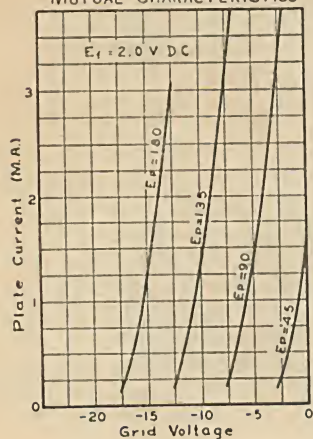


Fig. 5

DETECTOR CHARACTERISTICS

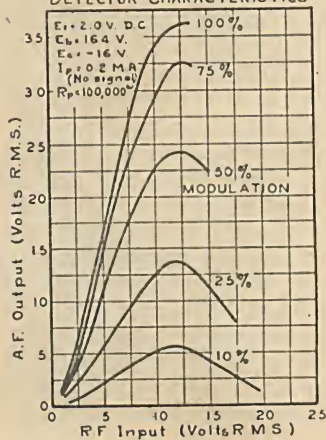


Fig. 6