12AT7 Voltage Divider for filaments:

Vf/k = MAX Voltage between cathode and heater: 90 **V**
Rf/k = MAX Resistence between cathode and heater: 20**k**

R2 = 20k

Vf/k = 60V

VA = 400V

R1 = 20k * (400 – 60) : 60 = 112k

Voltage Divider Current = 400V : (R1 + R2) = 3mA

R1 Watt = (3mA * 3mA) * 112k = 1W

R2 Watt = (3mA * 3mA) * 20k = 0,18W

Heater-Cathode Insulation

J B Dance MSc, *The Radio Constructor*, March, 1962.

Valve manufacturers normally quote a value for the maximum permissible voltage which can be applied between the cathode and heater of a valve. This is usually expressed as a DC value and varies from about 50 to 750 Volts or more according to the type of valve.

The value of the maximum heater-cathode voltage rating when the cathode is positive may be different from that when the cathode is negative. For example, the EF86 has a maximum rating of 100 Volts when the cathode is positive and 50 Volts when it is negative with respect to the heater. There may also be a maximum value quoted for the resistance to be placed between the heater and cathode. In the case of the EL37, this is as low as 5kΩ. The ECC82 and ECC83 (equivalent to the 12AU7 and 12AX7 respectively) have a maximum permissible heater-cathode resistance of 20kΩ, although this may be increased to 150kΩ when one of these valves is used as a phase inverter immediately preceding the output stage. The large maximum heater-cathode voltage rating of these two valves (180 Volts) is especially useful when they are to be used as phase splitters with equal resistors in their anode and cathode circuits, as voltages (DC plus signal peak) exceeding 100 may easily be developed across the cathode resistor in this type of circuit.

Valves should not be rendered inoperative by disconnecting the cathode unless there is a resistor between the heater and cathode not exceeding the maximum specified value.

Rectifiers frequently have a high maximum heater-cathode voltage rating; this is often approximately equal to the maximum DC voltage output which can be obtained when the input to the anode(s) is equal to the maximum permissible RMS value.

The insulation resistance between the heater and cathode in the valve should not be included as part of any RF oscillator circuit or frequency instability due to changes in the heater-cathode capacitance may occur. In addition modulation hum is likely to appear. Similarly the insulation resistance between the cathode and heater should not be included as part of an AF circuit if the signal level is low in the valve concerned, or the amount of hum introduced may be comparable with the signal voltage.

A valve may be tested for heater-cathode leakage in the following way. A steady voltage of the maximum rated value should be applied between the heater and cathode using a 0-500 microammeter and a 100kΩ resistor in series in the circuit. The current passing should be less than 20µA for a heater rated at 6.3 Volts, 0.3A. If a fairly large power valve is being tested with a potential of about 100 Volts between the heater and cathode, a current of up to about 100µA can be considered as being reasonably satisfactory. The 100kΩ resistor protects the meter from damage if a heater-cathode short circuit has developed in the valve.

12AX7 Voltage Divider for filaments:

Vf/k = MAX Voltage between cathode and heater: **180 V**
Rf/k = MAX Resistence between cathode and heater: **150k**

R2 = 120k

Vf/k = 60V

VA = 400V

R1 = 120k * (400 – 60) : 60 = 680k

Voltage Divider Current = 400V : (R1 + R2) = 0,5mA

R1 Watt = (0,5mA * 0,5mA) * 680k = 0,17W

R2 Watt = (0,5mA * 0,5mA) *120k = 0,03W