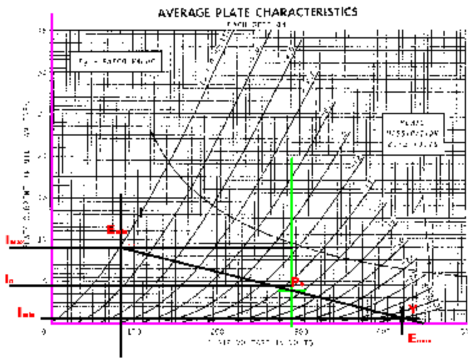
Calculate using first approximation formulas suggested operating parameters for the 12AU7 tube as an output tube. Assumption, class A calculations from RC15 or RC30 are applicable to self split output power tubes

Basis:

Values from GE chart ET-T880A, mu = about 15

From firefly schematic Eb=294v,



(1)So I_0=(-0.68X294)/15=-13.3volts, adjust for ac so bias voltage is -15 volts.

(2)(3)From chart I_0 = 4.5ma, and $2I_0$ or I_{max} = 9ma E_{min}=88v

(4)(5) I_{min}=0.6ma . E_{max}=428v.

Determine resistance:

(428-88)/(0.009-0.0006)= 40500Ω

Determine Power:

(0.009-0.0006)x(428-88)/8=0.36w.

Determine Distortion:

((0.009+0.0006)/2)-0.0045)/(0.009-0.0006)x100=3.6%

This is a guitar amp, so we want more power and can live with more distortion. So, lets look at maximum power in Class A.

Power –Output Calcs

The easiest method is to use is the graphical method, by assuming a resistance load. The proper plate current, grid bias, optimum load resistance, percent second-harmonic distortion can be determined.

(1) locate the zero-signal bias point P by determining the zero-signal bias Ec from the formula: Zero-signal bias (Ec_0)=(-0.68)(Eb)/μ, where Eb is the chosen value in volts of dc plate voltage at which the tube is to be operated, and μ is the amplification factor of the tube. The value is negative to indicate a negative bias will be used.

(2) Locate the value of zero-signal plate current, I_0, corresponding to point P.

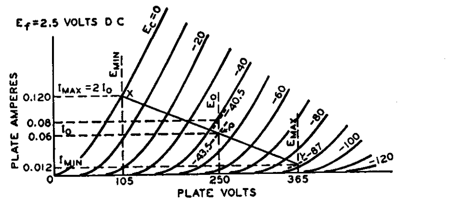
(3) Locate the point $2I_0$, which is twice the value of I_0, and corresponds to the value of the maximum-signal plate current I_{max}.

(4) Locate the point X on the dc bias curve at zero volts E_0= 0, corresponding to the value I_{max}.

(5) Draw a straight line` XY through X and P.

Line XY is known as the load resistance line. Its slope corresponds to the value of the load resistance. The load resistance in ohms is equal to (E_{max}—E_{min}) divided by (I_{max}—I_{min}), where E is in volts and I in amperes.

These calculations are based on having a dc voltage on the filaments. If the filaments are ac, then increase bias by half of the filament voltage of the tube.



41—Graphic calculations for class A amplifier using a power triode.

The value of zero-signal plant current I_0, should be used to determine the plate dissipation, an important factor influencing tube life. In class A amplifiers under zero-signal conditions. The plate dissipation is equal to the power input. i.e., the product of the dc plate voltage and the zero-signal dc plate current I_0. If it is found that the plate dissipation rating of the tube is exceeded with the zero-signal bias Ec, calculated above, it will be necessary to increase the bias by a sufficient amount so that the actual plate dissipation does not exceed the rating before proceeding further with the remaining calculations.

For power-output calculations,. it is assumed that the peak alternating grid voltage is sufficient (1) to swing the grid from the zero-signal bias value Ec_0 to zero bias (Ec=0) on the positive swing and (2) to swing the grid to a value twice the zero-signal bias value on the negative swing. During the negative swing, the plate voltage and plate current reach values of E_{max} and I_{min}; during the positive swing, they reach values of E_{min} and I_{max}. Because power is the product of voltage and current, the power output P_0 as shown by a watt-,meter is given by where E is volts, I is in amperes, and P_0 is in watts.

$$P_0 = \frac{(I_{\max} - I_{\min}) \times (E_{\max} - E_{\min})}{8}$$

In the output of power-amplifier triodes, some distortion is present. This distortion is due predominantly to secondary harmonics in single-tube amplifiers. The percentage of second-harmonics distortion may be calculated by the following formula;

$$\%distortion = \frac{\frac{I_{\max} + I_{\min}}{2} - I_0}{I_{\max} - I_{\min}} \times 100$$

Where I_0 is the zero-signal plate current in amperes. If the distortion excessive, the load resistance should be increased or, occasionally, decreased slightly and the calculations