Suppose, for simplicity, the output stage is running in "ideal class B," and the audio signal is a sine wave with angular frequency ω. The upper tube is then passing current $I(t) = I_0 \sin\omega t$ for the positive half-cycle, $0 \le t \le \pi/\omega$, where I_0 is the peak current, and it passes zero current for the negative half-cycle $\pi/\omega \le t \le 2\pi/\omega$. If the B_+ voltage is V_0 and the speaker impedance is R, then the anode-cathode voltage across the upper tube is $V(t) = V_0 - I_0\, R \sin\omega t$ during the positive half-cycle when the tube is passing current $I(t) = I_0 \sin\omega t$. The instantaneous power dissipation in the upper tube is then

$$P(t) = V_0\, I_0\, \sin\omega t - I_0^2\, R\, \sin^2\omega t$$

during the positive half-cycle, and zero during the negative half-cycle. The average power dissipation in the upper tube is then given by

$$P_{\text{av.}} = \frac{\omega}{2\pi}\int_0^{\pi/\omega} P(t)\, dt = \frac{V_0\, I_0}{\pi} - \frac{1}{4} I_0^2\, R\,.$$

If we assume the B_+ voltage is $V_0 = 150$ volts, that the speaker impedance is 8 ohms, and that the amplifier is outputting 25 watts (so $I_0 = 2.5$ amps), this gives $P_{av.} \approx 107$ watts dissipation in the upper tube.

This is significantly more than the nominal 60 watt maximum for the 6C33C tube, but two things help to save the day; firstly, tube ratings are not absolute, and they can be exceeded for brief periods of time. Secondly, we do not in practice listen continuously to 25 watt sinewaves; music has loud peaks, but most of the time the required output power is much lower than the peak power at the crescendos.

Of course the calculation for the dissipation in the lower tube will be exactly analogous, leading to the same result of about 107 watts for it also.

The assumption of ideal class B was an approximation. The average power dissipation in the tube will be somewhat higher once the more realistic class AB operation is taken into account.