

# STARVED TUBE CIRCUIT OPERATION

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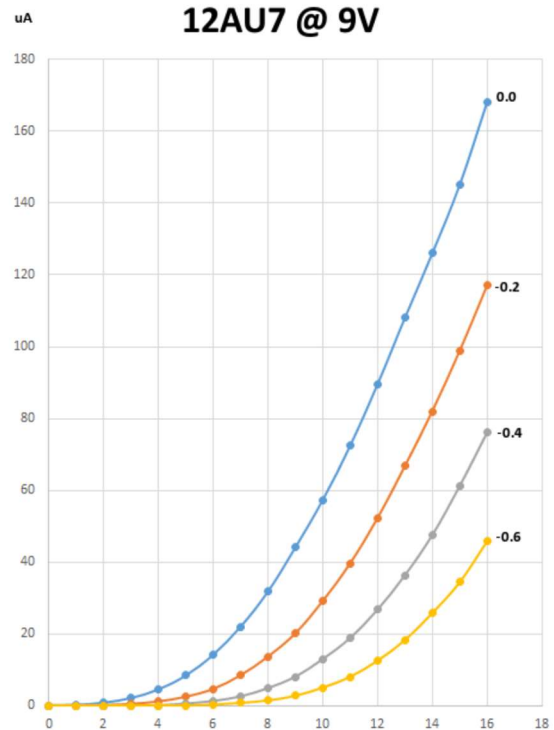
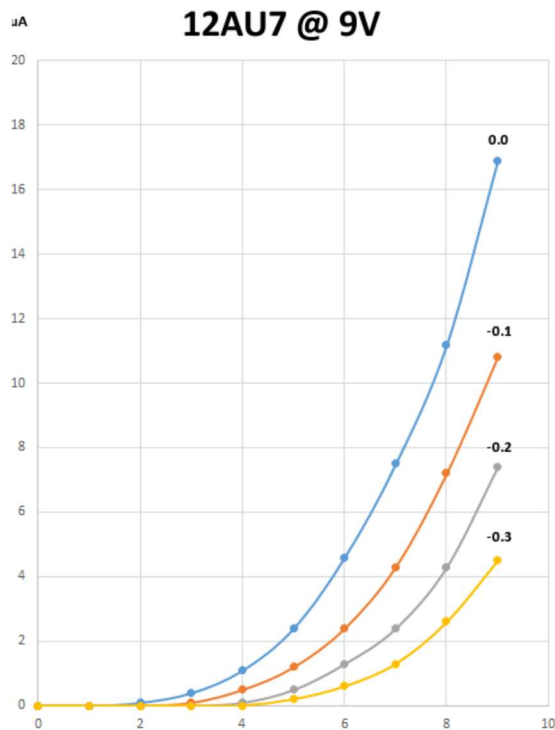
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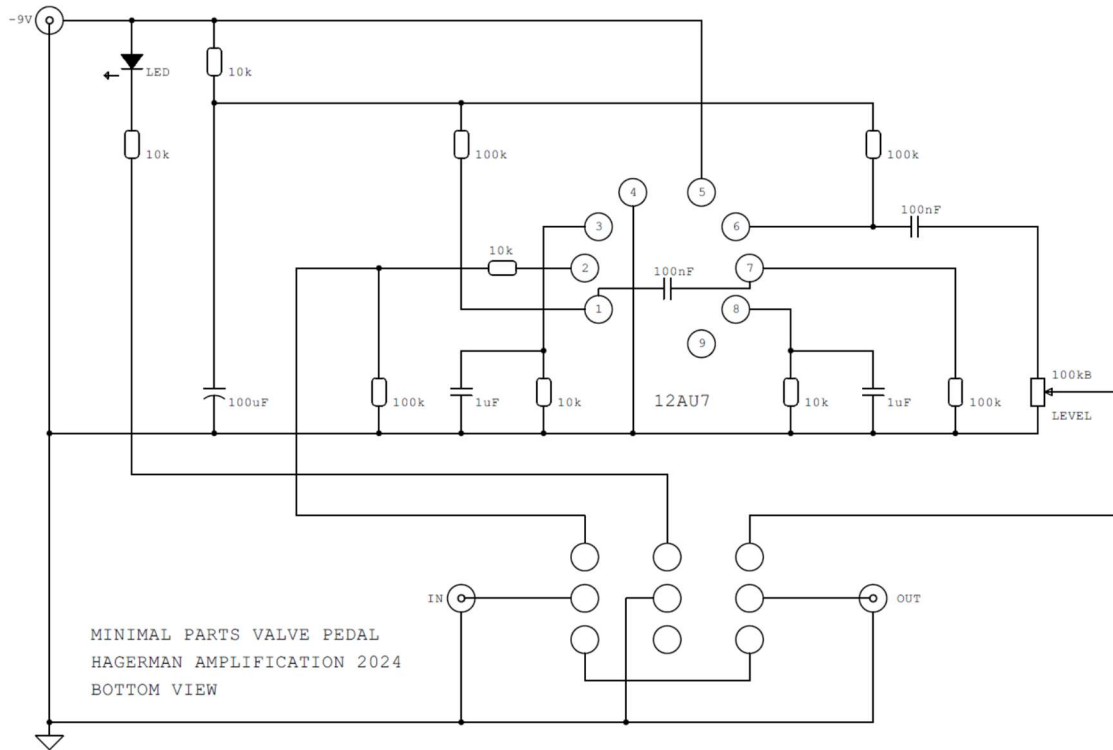
This mode of operation only works with low-mu type tubes and this article will focus on 12AU7 type only. The main goal with starved operation is to lower the power required to achieve a tube amplifier circuit. A secondary benefit is greatly reduced heat dissipation.

A particularly useful example of a starved-tube circuit would be a guitar pedal. Normal pedal power is 9V, often current limited to 250mA or so. Well, the heater in a 12AU7 at 6.3V is 300mA, so that alone pushes it above most pedal power supplies. Starved operation solves this! We don't need full output capability from the tube (100V swing at 20mA), so starving the heater is a great first step. Powering both heaters in series at 9V results in about 130mA draw. This is 62% of normal power, so cathode emission will drop significantly. That's fine, as we will need only 0.1% of maximum cathode current.

For B+, we can use 9V direct or apply a charge-pump doubler to get 16V or so (after losses and low pass filtering). How well does a tube operate at such low plate voltages? Left chart is a typical sample, right is a high gain sample (selected):



A minimal component guitar pedal circuit was designed to employ fully starved tube operation running at 9V. Total current consumption is about 130mA and a signal gain of 20dB can be achieved via selection of tube.



The following oscilloscope photo shows the result of a high-gain sample 12AU7 with 100mV input signal. Distortion is mainly second harmonic, resulting in a warm, euphonic tone.

