A guitar amplifier kit aimed towards high school students, providing an interesting and useful introduction to the world of Electrical Engineering. Designed to be low cost with high quality sound, the kit strives to fit the budget of high school students and teach them the basics of electrical engineering with an intuitive assembly guide.

The sudden onset of COVID-19 cases in the US resulted in our inability to meet and test how high school students interact with the difficulties of assembly. We re-evaluated our plans and, despite the additional difficulties, managed to complete the assembly of 8 fully functional units.

**MECHANICAL DESIGN**

The final design was centered around ease of assembly, manufacturability, portability, aesthetics, and price point. The starter kit assembly process caters towards high school students with limited mechanical experience. The design also considers time and ease of manufacturing as well as ease of portability. Finally, aesthetics and total unit cost were important in the final design. The completed amplifier is constructed of 1/8” baltic birch plywood wrapped in Tolex. It measures 12” x 10” x 7” and weighs under 15 lbs.

**ELECTRICAL DESIGN**

The design follows the general composition of a guitar amplifier with the following stages: preamplification, distortion, tone adjust, volume, gain, and power amplification. The circuit is designed to operate on 12V from a DC supply in order to ensure safety during construction. Previous iterations involved assembling an AC to DC converter, which could be dangerous to the students assembling the units.

**KEY DESIGN COMPONENTS**

**POWER AMPLIFIER**

Complementary Darlington transistors in push-pull arrangement for maximum output voltage range and efficiency.

**PASSIVE NOTCH FILTER**

This series RLC segment of the circuit provides a dip in the 600Hz - 1kHz range to create a “brighter” sound.

**TONE CONTROL**

This elegant design allows tone control with the use of just one potentiometer.

**FREQUENCY RESPONSE TESTING**

In order to create the option for a “brighter” sound, we implemented a passive notch filter that provides a dip from 600 - 1kHz. The plot above shows the measured frequency response with (red) and without (blue) the presence switch enabled.