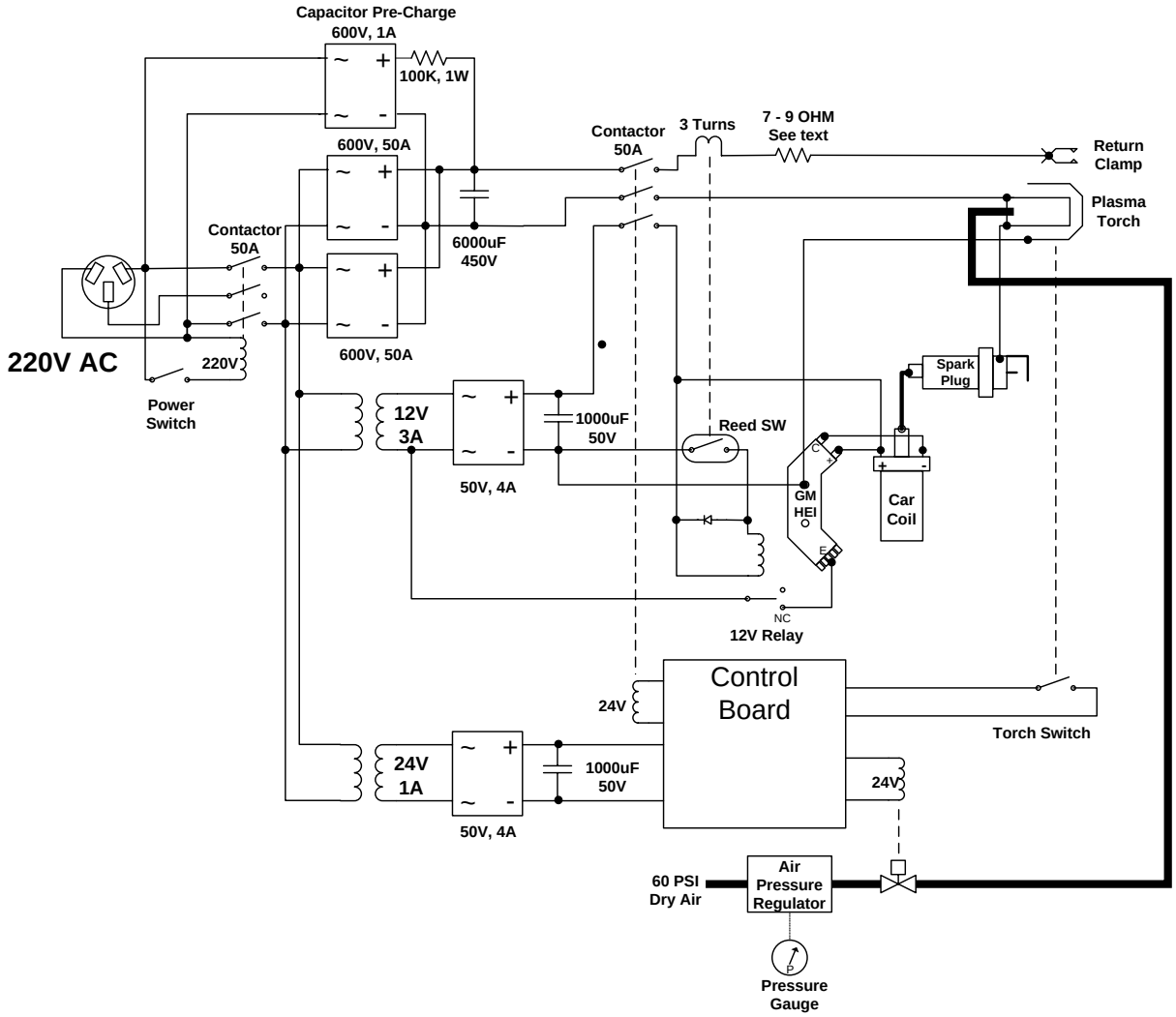
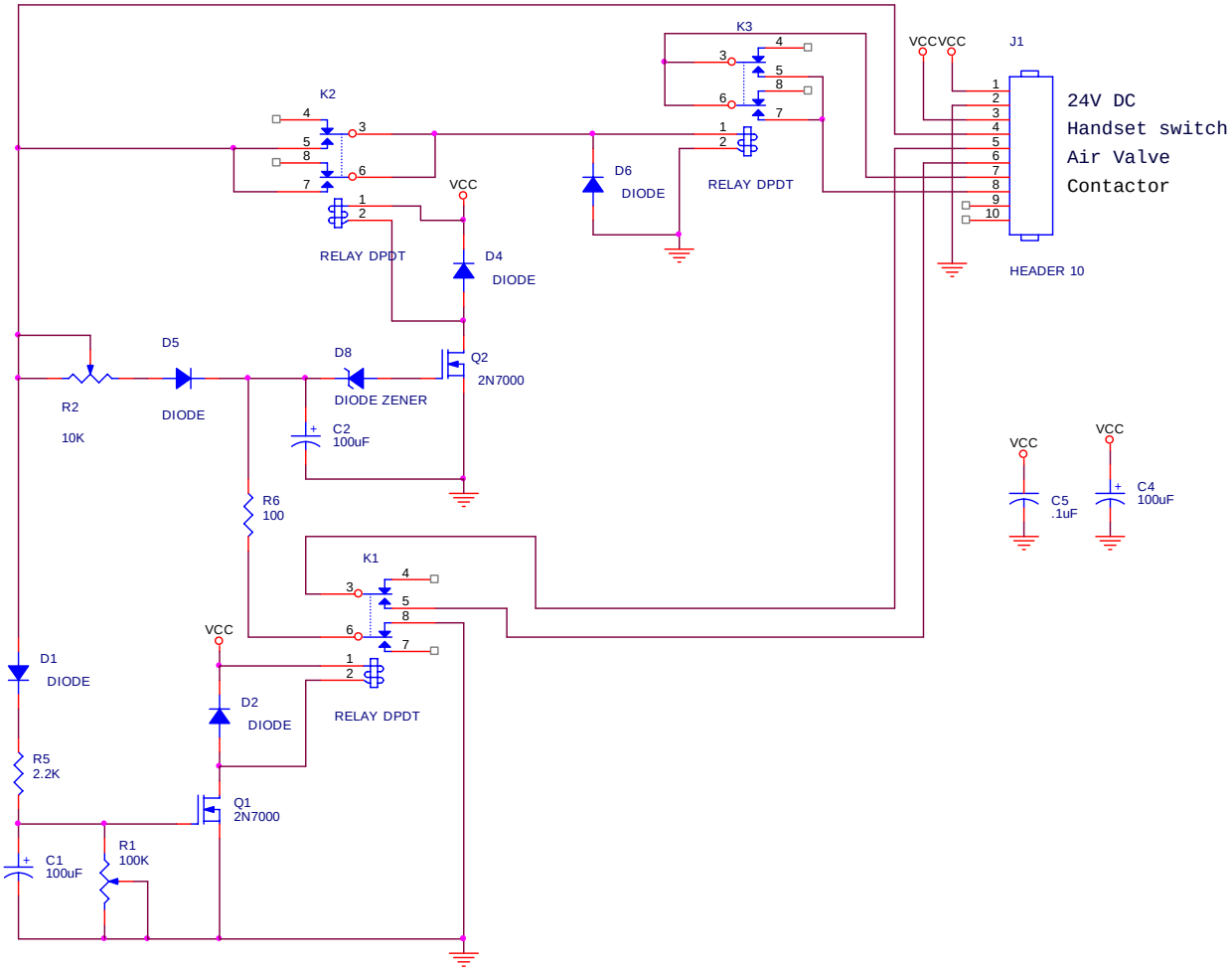
Electro-Mechanical assembly



Notes:

1. The reed switch used to turn on/off the high voltage start should have the main lead wrapped around it about three times. When the main plasma current starts, it will turn off the high frequency start. If this option is not needed, just remove the relay, and the reed switch, and wire directly from the transformer to the GM HEI module.
2. The capacitor pre-charge circuit protects the contactor from large surge currents as the capacitors are charged. If a suitable sized contactor is used, this may not be necessary.
3. The capacitor (6000 uF) can be made larger to improve cut.
4. Spark plug type is not important. Spark plug's spark end should be enclosed if possible.
5. Car coil type is not important. Voltage should be 12V.
6. Ignition module shown is GM 7 pin, with trigger connected to E pin. Other ignition modules should also work.

Control board schematic



Plasma cutter construction.

Figure 1: Inside plasma cutter box

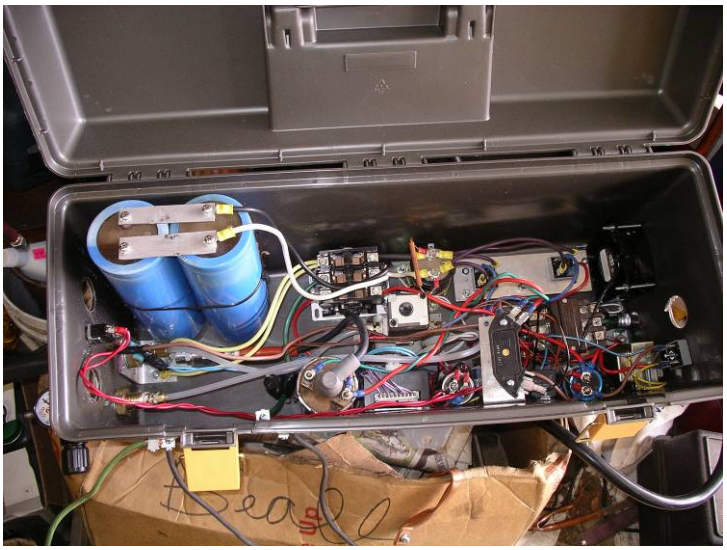


Figure 2: Fan end of plasma cutter box

Figure 3: Front end of plasma cutter box

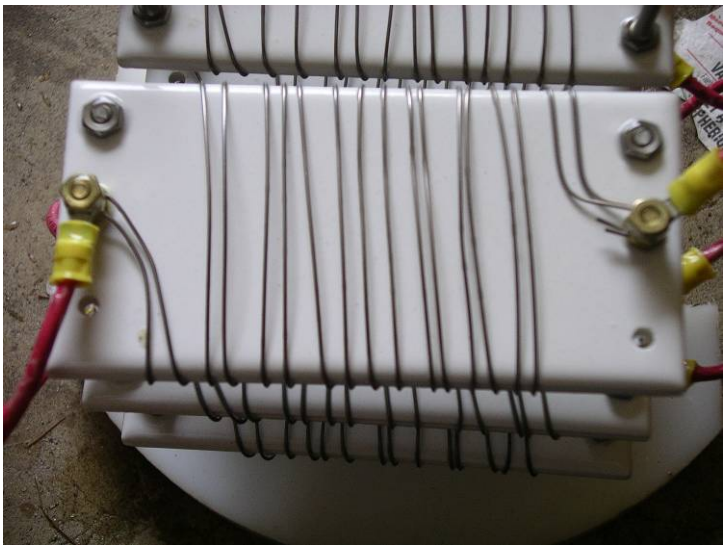
Resistor Construction

Start with 3” X 6” ceramic tile pieces as shown in Figure 4. Drill holes as necessary for mounting. Drill bits are available at home improvement stores that will readily drill through ceramic tile.

Figure 4: Ceramic tiles used for making resistors

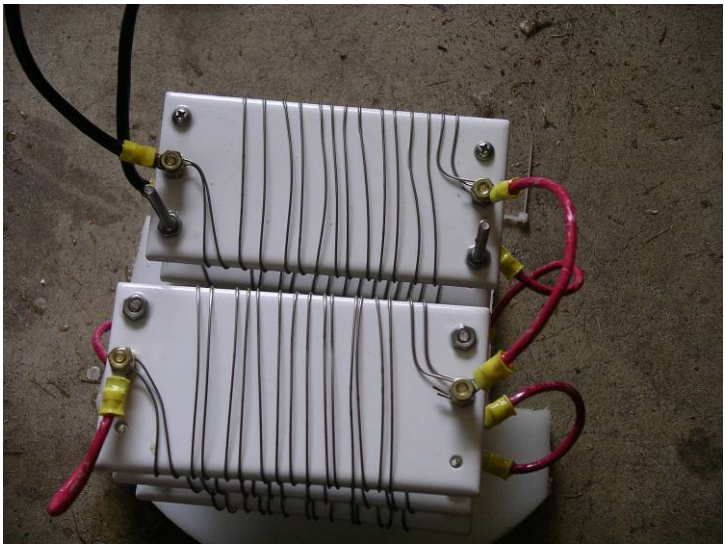
Drill holes for brass screws for making contact with the nichrome wire. Wind the nichrome wire on the ceramic tile as shown in Figure 5**, being careful to keep wires from touching. Note that in this example, the nichrome wire is wound as two strands in order to handle the high current. You will need to choose nichrome wire that will handle the current. I used 18 ga. (.4 ohms/foot), and it is holding up well.**

Figure 5: Nichrome wire mounted to ceramic



Once you have constructed enough resistors to create the needed resistance, mount them together in some fashion, such as that shown in Figure 6**, and use 10 gauge wire to wire them all in series. Connect one of the plasma cutter resistor leads to the beginning of the resistor string, and the other to the end.**

Figure 6: Resistors tied together



The resistors must be kept cool during operation. This can be done by immersing the resistor assembly in water as shown in Figure 7**.**

Figure 7: Resistors immersed in water.

Here is an alternative way to mount the resistors in water. It is much more portable, but will require a running water source for extended cutting. Figure 8 shows a resistor assembly using 4" ABS pipe. ABS is used due to its low cost. PVC could also be used. This ABS container holds about 1.25 gallons of water. After several inches of cutting (maybe 20-30 inches of 17 ga.), the temperature had elevated to about 160 degF. Therefore, for extended cutting, it will be necessary to have a continuous flow of water.

Figure 8: ABS Resistor

Figure 9 **shows the entire resistor assembly. Brass is used to tie the individual resistors together, and to attach the resistors to the end cap. Brass conducts nicely, keeps the resistor rigid, and doesn't corrode as easily. Also note the thermometer protruding from the left end. This is used to ensure that the temperature doesn't get too high.**

Figure 9: ABS Resistor Assembly

Figure 10 **shows how the resistor is wired. This resistor has three taps, one at 7 ohms, on at 8 ohms, and the end one at 9 ohms. Also note the plastic screws and standoffs that keep the resistors apart, and center them within the 4" ABS pipe. The plastic screws and standoffs are 10-32 threads and came from Ace Hardware.** Figure 11 **shows the attachment of the wires and the brass attachments to the end cap.**

Figure 10: Resistor wiring

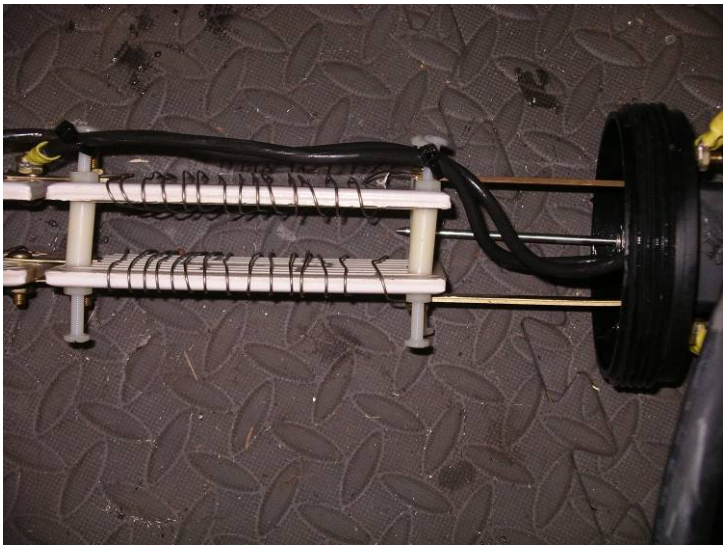


Figure 11: Resistor wiring attach to cap

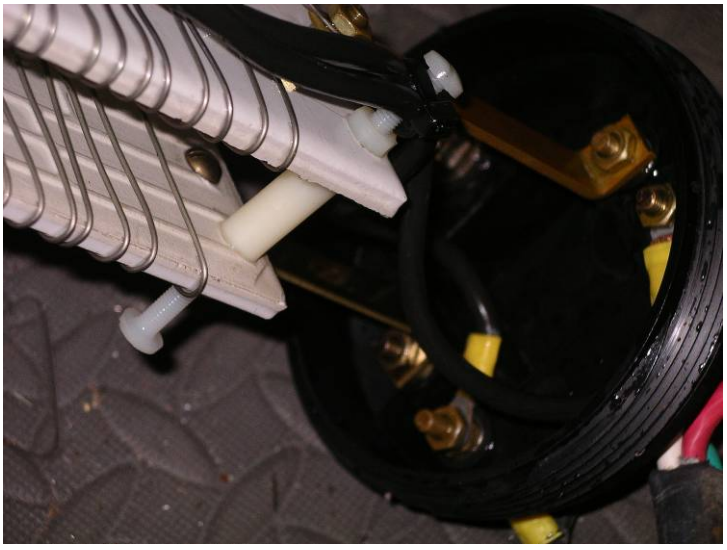


Figure 12 **shows the wiring and the thermometer for the end cap. The thermometer is held in place by a 5/16 bolt that has been drilled out. The thermometer is held in the bolt with epoxy. All through screws have rubber washers on both sides to prevent leaks.**

Figure 12: End Cap External Wiring

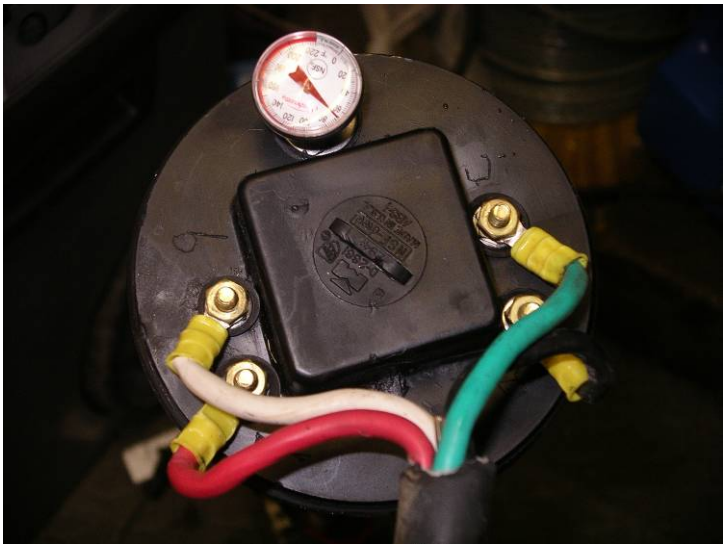


Figure 13 **shows the water connections for bringing water into and out of the resistor. This figure shows regular garden hose connections which will allow it to be used anywhere you have a garden hose, but other types of water connection could be used. When the end cap is screwed into the open end, it must be sealed with a non-hardening gasket sealer (permatex #2 works well) to prevent leaks.**

Figure 13: Plumbing

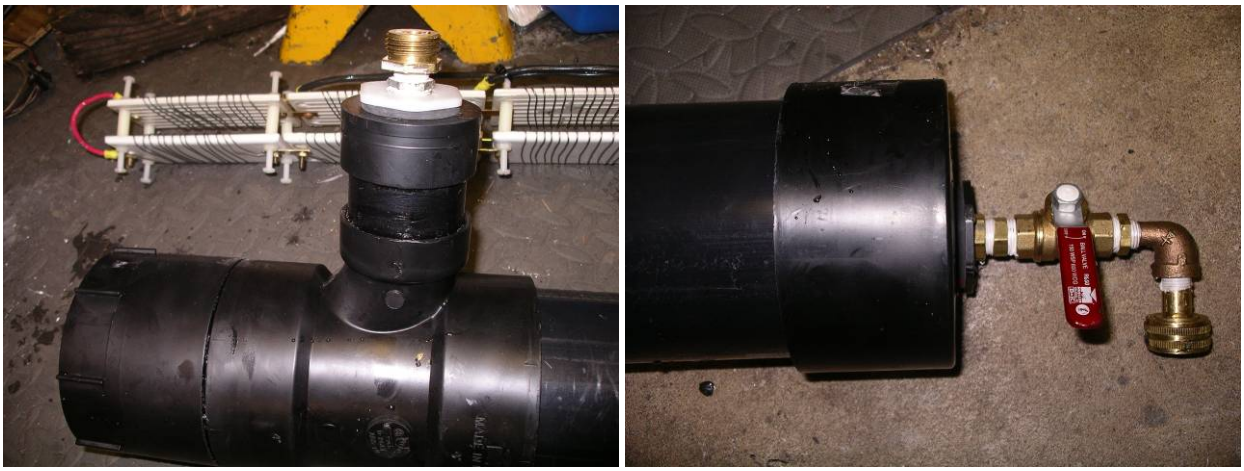


Figure 14 **shows the final resistor assembly, plumbed to my garage sink using ¼" plastic tubing. The wiring inside the cutter box includes a switch to change resistance settings. A 4 prong dryer plug and receptacle were used for connecting the resistor to the plasma cutter box.**

Figure 14: Final resistor assembly