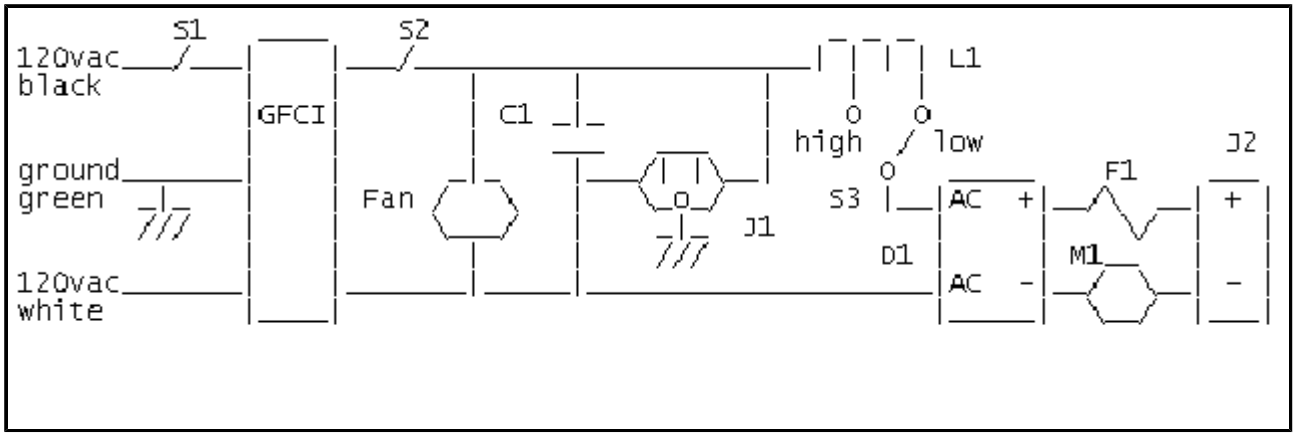
Bonn Electric Vehicle Charger

***By Lee Hart** (Last Update: 15 Mar 2006)*

The Bonn charger (designed by Don Bonn) is a bad-boy charger with a few manners. The key addition is a big series inductor, in series with the input to the bridge rectifier. The inductor filters and limits the peak current, so it won't burn up cords. The inductor also improves the power factor, so you get more charging current out of a given AC outlet. It also has a GFCI for safety, an ammeter so you know what you're doing, and a timer to automatically shut it off.



GFCI = Ground Fault Circuit Interruptor. This is the same gadget you find in your kitchen, bathroom, or outside outlets. It is there to prevent shocks if you touch your batteries while the charger is operating.

S1 = Circuit breaker. I used a 120vac 12amp breaker which looks like an oversized toggle switch. This provides an easy way to turn the charger on/off. I used a 12amp breaker so it will trip *before* the 15amp breaker that protects the circuit, so you don't have to run down to the basement or get someone with a key to reset a tripped breaker.

S2 = Intermatic 240vac 20amp 12-hour timer. This is a mechanical timer with a knob that you can set for 0-12 hours. Set it to the maximum charging time to automatically shut off when done.

S3 = SPDT toggle switch, 120vac 15amp minimum. This switch selects between taps on the inductor, to control the charging rate. If you can find one, a multi-position rotary switch can be used instead to select more than 2 taps.

Fan = 120vac 5-10watt fan, about 3"-4" square. It's needed because D1 and L1 get hot.

C1 = 5-10uf 220vac or more motor run capacitor. This must be a film or paper/oil capacitor, not an electrolytic! It improves the power factor so you can charge at a higher current without

tripping the breaker.

J1 = normal 120vac 15amp receptacle. This is a "convenience" outlet for plugging in a 12v accessory battery charger, heater, or other gadget you might need. As shown it is a switched outlet. If your GFCI includes such a receptacle, you can use it.

J2 = Anderson PowerPole connector, 15/30/45 amp size (all use the same housing). These are DC rated to 600v and the industry standard for battery connectors.

D1 = bridge rectifier, 400v 35amp minimum. If you skimp on the ratings, it will fail sooner or later!

F1 = 250vdc 15amp fuse, Bussman ABC or Littelfuse 3AB 1.25" x 0.25" ceramic-body fuse. Must be DC rated!

M1 = 0-15amp DC ammeter. Inexpensive ones are found in almost any old 12v battery charger.

L1 = inductor. The Bonn inductor is about 3.5" on a side and weighs about 5 lbs. It is a single winding of #12 wire with six connections 1-6. Inductance is as follows:

1-2 = 0.15mH
1-3 = 0.64mH
1-4 = 3mH
1-5 = 7mH
1-6 = 13mH

This provides lots of connection options. Here are the ones I've figured out (with #1 being the input):

96v pack: high=5, low=6
108v pack: high=4, low=5
120v pack: high=3, low=4
132v pack: high=2, low=3

You'll probably have to make this inductor yourself. Find a 60hz transformer of about the right weight, and take it apart. Rewind it with as much #12 wire as will fit, bringing out taps every layer or so. Reassemble it with all the "E" laminations in one stack, and all the "I" in another. Put a thin paper shim between the E and I stacks (this stabilizes the inductance so it won't change so much with current). The thickness of this paper shim will adjust the inductance, too.

You also need a good accurate voltmeter. The charging current alone is meaningless unless you also know the voltage! I use the E-meter already in my EV. You could add a cheap digital multimeter onto the charger, powering it with a "wall wart" so you don't have to keep replacing the battery.