Your task is to design a battery charger for an electric vehicle. The design will materialize in a report. The report will detail the method and reasons for selecting each component. Using proper modeling and computations you will demonstrate that the components do not overheat and the charger performs as expected. Use of microprocessors and concepts of microelectronics are highly encouraged.

- Available voltages:
  - 120 / 240 V, 60 Hz, single-phase, or
  - 440 V, 60 Hz, three-phase

- The battery is Lead-Acid with $200 \times \xi$ Ah (If you wish to use other battery type you should do so.) Battery rated voltage is 24 V for $\xi < 11$, 48 V for $11 < \xi < 21$ and 96 V for $\xi > 20$.

- The battery charger has to have efficiency better than 85%, a power factor better than 95%, a total distortion factor of the current better than 10%.

- The $\pm$ terminals that are connected with the battery terminals must be floating.

- The charging should be performed with a constant current with a ripple less than 10%. Once the full charge is reached the battery is disconnected or a trickle current is continuously supplied.

- The charger should operate silently. Lights should indicate the stage of operation and the approximate amount of charge stored.

- The system should fail safe, (no fire, no arc escalation).

- The system should be immune to voltage surges of 2000 V peak, lasting 2 $\mu$s.

- The charger will operate in a room with a temperature in the range $-20^\circ C$ to $40^\circ C$ and very dusty air.

- You should determine what quality insurance tests the charger should pass.

- You should determine the cost of the charger (materials, labor, overhead.)

- $\xi$ is your student number. ($\xi \in \mathbb{N}$). 

I hope you will learn a lot and enjoy this project. Good luck!  

A.E. Emanuel