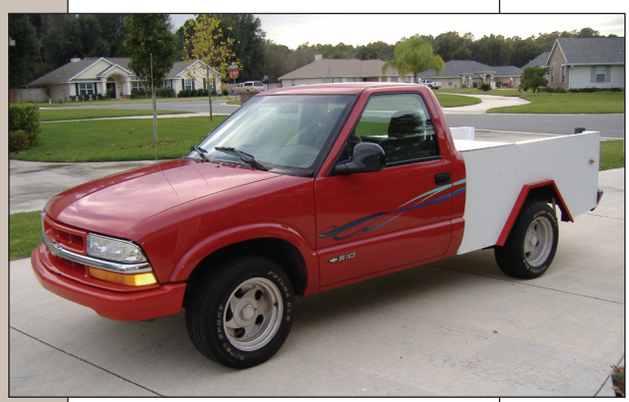
by **Mark E. Hazen**

GOING ALL ELECTRIC – DOING IT YOURSELF

One of the things I have always wanted to build is an all-electric vehicle—it didn't have to be from the ground up—a conversion would be fine. I have always kept that dream in my back pocket until recently when it struck me that the nest was now empty and I had a few bucks to make it happen. So, somewhere around the end of August of last year I began the conversion and was driving my gasless wonder before Christmas.

I decided that a light pickup truck would be a good conversion choice because there is plenty of room for golf-cart batteries and the frame and suspension can handle the extra weight with ease. I purchased a 1998 Chevy S10 that had 188,000 miles on it, but the body and soul were in good shape.

It's interesting that the most difficult part of the entire process was removing the old greasy engine and cleaning the engine compartment. What a mess! Even so, it was fun to pull the fossil-fuel innards out of the beast in preparation for a clean and low-maintenance powertrain.



Hazen's Chevy S10 fully converted and road worthy.

As can be seen in the photo at left, I replaced the bed with a lightweight ABS-sheathed aluminum frame. The stock bed weighed 320 pounds, saving me about half that for battery weight.

If you are like me, you want the facts, the numbers and the stats to view the conversion at a more objective level. The conversion facts table may have what you need—if not, you can get the entire story at http://www.evhelp.com.

I designed the truck for city-street commuting with a top speed of 60 mph being more than adequate. I drive to work, go out to lunch and back, then drive home in the evening—a total distance of 22 to 30 miles, leaving plenty of reserve. It drives and handles great. I can actually start in second gear; then I shift at 30, 40 and 50 mph.

Thus far, I have driven my electric truck about 2,000 miles. The only

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Chevy S10 Conversion Facts

Vehicle	1998 Chevy S10, 2.2 liter, 4 cyl., 5-speed manual transmission
Vehicle cost	$2000
Stock weight	3040 lbs.
Weight without stock bed	2720 lbs.
Final weight	3700 lbs.
Power train	Electric motor, clutch and 5-speed manual transmission
12 V system	Plug-in charger + deep-cycle marine battery (recharges at night when the HV battery bank is charging)
HV battery bank	16 series-connected golf cart batteries, 6 V, 220 AH, Johnson Controls (Energizer branding)
Battery weight	~65 lbs. each
Full-charge voltage	~102 V (bank voltage)
Battery life	Up to 3 years with good care and a good battery charger
Battery bank cost	~$62 each (Sams Club)
Battery bank location	Rack mounted immediately behind cab across truck frame with near perfect front/back weight distribution
Electric motor	Advanced DC, 9.1 inch, series-wound, industrial-grade
Motor controller	Curtis 1231C-8601, pulse-width modulation, 96 to 144 VDC operation, 500 A current limit, paralleled MOSFETs
Tires	Michelin, low rolling resistance
HV charger	Self-designed 3-cycle 120 VAC, 15 A, 15 A starting constant-current cycle
Nightly charge energy	11 to 16 kWhrs (varies with distance driven)
Cost per mile	5 to 6 cents per mile depending on driving care, range and terrain
Stock S10 cost per mile	12.5 cents at $2.50 per gallon.
Range	30+ miles
Top speed	~60 mph (max. with 16 batteries) (~80 mph with 20 batteries)
Cost of conversion	~$10k (including 1998 Chevy S10)

AD INDEX

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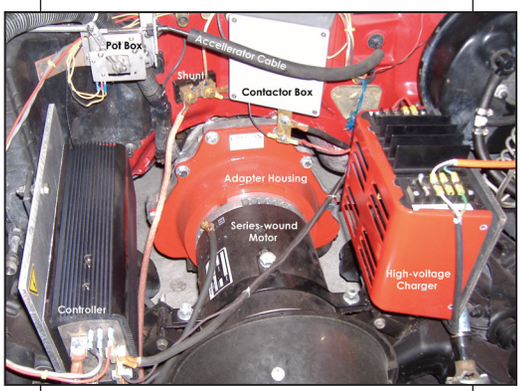
problem I have encountered is the meltdown of three battery terminals caused by the relatively high contact resistance at the battery terminals using the bolt and wing nut method of connecting the cables. This has proven insufficient for current ranging up to a momentary 500 A—ranging between 60 A and 220 A while cruising. Changing to the terminal post clamp method of connection has eliminated this problem.

Everything now appears to be stable and I have high confidence that excessive maintenance will not be an issue. Let's face it, there isn't really that much to maintain compared to the old fossil-fuel beast, so the cost of ownership should be relatively low. The biggest concern is giving the batteries proper care to optimize their life cycle.

Am I glad that I made the conversion to all-electric? You bet I am—especially every time I drive by a gas station or think about the oil changes and timing belts of days gone by. For more details on how you too can turn weekends and a donor vehicle into a reliable commuter, visit my web site—evhelp.com—there you can take a look under the hood. Drop me a line if you have any questions. ■

16 series-connected golf-cart batteries cradled in a center-balanced location.



What's missing here? Answer: hoses, belts, fluids, pumps, plugs and much maintenance.

ABOUT THE AUTHOR

Mark E. Hazen is an electronics engineer and professional technical writer. He has written several college-level engineering textbooks, a paperback on alternative energy and innumerable articles covering analog circuits and communications. He holds a patent on PWM motor control and is the editor for Emerging Wireless Technology, a bimonthly e-newsletter of RF Design/ Penton Media Inc. He can be reached at mail@evhelp.com.