

CURRENT EVENTS



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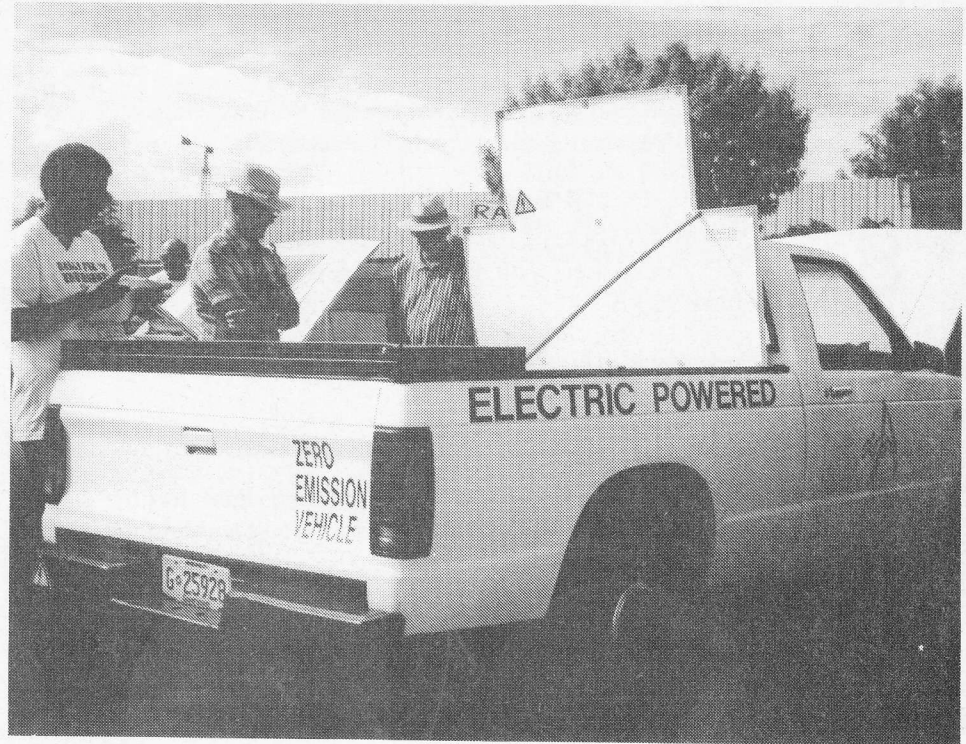
Making a Zapi Happy

by Clare Bell

So you've taken the first step away from the plain vanilla PWM controller to a more advanced unit that features regenerative braking. At this stage of the game, unless you have the smarts to brew up your own, have resident genius controller-builder or can throw 4-5K at a custom-built regen controller, this probably means a Zapi, the Italian/British-built regenerative controller. Originally designed for forklift applications, various models of the Zapi controllers are showing up in EVs around the country. Anyone who follows the Internet EV Discussion List will have noticed the Zapi postings. This article is for those EAA members and others who don't have access to the EV List, but have heard various rumors about Zapis and would like to know more.

Cherry

I had the opportunity to bring up a Zapi HFM 400 in an electric S-10 truck. Since I tend to name EVs, I dubbed the deep red 1985 S-10 "Cherry". Cherry-truck was an incomplete conversion done with a kit from Solar Car (Doug Cobb) who is unfortunately now out of business. She had not yet run; in fact her Optima yellow-tops had not even been cabled up. The project had a sad dragged-out history, since the owner knew next to nothing about EVs and had hired mechanics who also knew next to nothing. Sufficient to say that even in this shape, Cherry was much nicer than her owner, which is all I will say about him.



Cherry was a standard Solar Car S-10 conversion, modified to use Optima yellow-tops instead of fluid-filled 6V traction cells and the Zapi instead of the Curtis. I arranged the Optimas in two 144V strings, each individually fused at 250 A and overall at 400. Cherry's Zapi was installed vertically in the Solar Car support frame, but not cabled up. The first thing was to pull the HFM 400 out of the frame in order to get access to its terminals. Also to get acquainted, since the thing looked pretty formidable with all the contactors hanging off it. I was lucky in that this unit had come with all contactors and external resistors in place and already wired internally for regen.

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The city of Albuquerque's first city-owned EV.

Photo credit: Clare Bell

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Contact Clare Bell, Managing Editor for further information. If you would like to submit an article for CE, the preferred format is on a floppy disk, along with a printed copy of the article. Include camera-ready photos or graphics in TIFF or EPS. Please specify PC or MAC and identify software and version number.

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Passing the Flag and Passing the Bucks

Now that oil and auto interests have ripped the ZEV flag from California's hands, Massachusetts and New York have taken it up and is waving it defiantly. Auto and oil say that the two states must follow the wretched route that California has taken, but Massachusetts Governor William Weld is holding fast, despite the money that has already been spent in Massachusetts to undermine his courageous stance (see below).

When I went up to testify at the CARB ZEV workshops/hearings, I met a representative from the Massachusetts state government (it might have been Trudy Coxe herself). She thanked me for coming and said she was glad I and other ZEV supporters were attending. By coming all the way to the West Coast for those hearings, I imagine she got a good taste of auto industry foot-dragging and

oil industry conniving. (CE's readers have had a good taste of it already in articles such as the CARB workshop report and various editorials).

To Governor Weld and Massachusetts, CE's praise for not bowing to pressure from established interests.

And to help you in your fight, here's some information about what the anti-ZEV forces have been doing in your state. This comes from the California Public Interest Research Group (CALPIRG) "Money Talks" report (which provided the information published in CE, March '96 about the anti-ZEV spending campaign in California).

The same culprits are at work again, too. Here's the spending breakdown:

* The American Automobile Manufacturers Association (AAMA) spent \$280,000 for advertisements in the

Boston Globe, Boston Herald, NY Times and Wall Street Journal.

* For radio advertising, AAMA spent a total of \$450,000 for ads on stations including those in the Boston area and Albany, NY.

* In MA, oil interests spent \$372,000 in MA in 1994, \$326,000 in 1994-95.

Auto interests spent \$67,000 in MA in 1994-95. — CB

MASSPIRG, a Massachusetts version of CALPIRG, contributed to this report, as did Environmental Advocates of New York. Copies are available from CALPIRG, 1129 State St., Santa Barbara, CA 93101. The CALPIRG legislative office is (916) 448-4516, fax (916) 448-4560. This report really has the lowdown on the undermining of California's ZEV program.

A Shark on Astroturf

I noticed that Anita Mangles, known in EV circles as "The Mangler" or "The Shark Lady", is showing up in news discussions about the Massachusetts ZEV program. Her organization, Californians Against Hidden Taxes or CAHT, is an "astroturf" front for the Western States Petroleum Association. (WSPA). She is not a grassroots advocate but a paid "mouth". Her method is to berate her opponent into silence by the volume and quantity of her speech. I have witnessed her performance at the CARB hearings. If a "MAHT" turns up and Ms. Mangles is the spokesperson, she needs to be exposed and discredited. She did a lot of damage in California, for which she was well-paid by WSPA. She doesn't do it for belief but for money, plain and simple. I have also heard that she is a pro-choice advocate and a member of NOW, both of

which I support, by the way. How she can reconcile her progressive stance in those areas with her regressive way of making a living, I do not know. Perhaps she has to make an effort to suppress her conscience. I would. I'm not sure I'd be able to, quite frankly.

The CA PR firm, Woodward and McDowell is another one to beware of. They got \$1M from WSPA for various anti-ZEV activities including anti-ZEV letters purported to be written by concerned individuals. Look out as well for Ralph Craven and his National Institute of Emergency Vehicle Safety. He attacks EVs on the grounds of safety and is another petro-dollar beneficiary. His organization is based in Nevada and its name misleadingly resembles that of various national and emergency safety and response groups. — CB



Zapi

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My mission (should I accept it — yes sir Mr Phelps!) was to hook up the Zapi to the rest of the car and make it run.

Not for Real Greenhorns

Solar Car's documentation was actually pretty good, although it is written more for experienced EV converters than for real greenhorns. It required some common sense and interpolating between the lines. It was also written with the assumption that the vehicle would use the Curtis 1221. The Zapi was covered by its own manual, but there was only a minimal attempt to integrate it into the overall kit instructions. This was done by a few markups and comments by Solar Car in the Zapi manual. I was aided in that task by a copy of the Zapi manual with additional markups by Gary Flo of InEVations. Gary also fielded my telephone queries and provided encouragement. Even so, it still took a bit of sittin' and figurin' before I started in. But I got that thing running and here's how you can too.

Here's what to do when faced by a Zapi HFM 400

Wiring

1. The first task is to get access to everything. You need to, since there is a LOT of everything. Working under cramped conditions will make things unnecessarily difficult and hazardous. Yank (gently) that Italian stallion from its mounts and lay it somewhere safe and stable on its heatsink. If you have to disconnect a couple of cable lugs to do it, don't be shy, though label the connections first and check voltages before you apply a wrench (ALWAYS check with a meter first — NEVER assume that a terminal is de-energized or too low-voltage to bother with).

2. Orient the monster with the "Z" logo plus "Chopper HFM 400" right side up. Refer to p. 17 in the photocopied manual, a drawing called "Cabling Plan Controller HFM 400 for Electric Cars."

Familiarize yourself with the physical location of the terminals, i.e. BATT+, VMN and -BATT to the left, INPUT and OUTPUT. I also needed to look at the next page, which was "Cabling Plan for Control Type HFM for Electric Car with Speed Sensor", since Cherry's Zapi was rigged with 4 contactors and p. 17 only showed three (TIND was the one missing).

3. Using p. 17 and p. 16 ("Functional Plan and Controller Connectors for HFM 400..." trace out the factory wiring to ensure it is as advertised. If not, stop right there and call the dealer or the factory rep to get that straightened out first. This checkout is tricky, since the actual physical hardware is a bit different from the schematic. Specifically, T1 and TA, shown as separate entities, are combined into a single reversing contactor.

In Cherry's case, someone (Gary Flo, I think) had translated the Italian wire color-codes to English, which was a god-send, since I would have never known that "G" stands for yellow, "M" for brown and "W" for violet.

4. At the minus terminal, a fast-acting semiconductor fuse is installed to protect the controller. The one on Cherry's Zapi was an International Rectifier L-350-180 X. Check continuity on that fuse — if blown, the controller won't run, and you'll spend ages figuring out why. Cherry's WAS blown as a result of a goof while cabling up the pack. Though I couldn't find an exact replacement, I made do with a similar (electrically — the physical mounting was different and I had to adapt it)

5. The low voltage hookups are done with keyed Molex connectors, which hang off the controller at various intervals between the high-voltage terminals. You should have matching Molexes and pins. Before doing the wiring, be sure that there are no live connections on either the Zapi or the input/output signals. Use p. 16 as a guide for hookup. The

alphanumerics above the circles indicate connector pins — "A1" meaning connector A, pin 1, etc. Connector designations, "A", "B", etc., are shown on p. 17. To give a brief summary of connector functions, "A" handles inputs from the potbox, "B" conducts command signals and the brake regen microswitch, and "C" is used for speed control and thermal (overheating) input from the motor. "D" handles enable signals, such as the relay-switched traction voltage input and the 12V auxiliary battery input. It also has a optional motor current analog output from 0-10 V full-scale and signals to activate LED alarm lights. "E" takes care of activating the contactors and should already be connected up by the factory.

6. Mount the Zapi's status and control LED display (the black gauge-like thing at the end of a lime-green cable). Feed the cable through to the controller and plug in the 9-pin D-connector. Tighten the jackscrews.

7. IMPORTANT Unlike the Curtis 1221, where the traction voltage enable can run directly from the pack, the Zapi HFM 400 requires that it be on an ignition-switched relay. I used a 30-amp automotive style SPST whose coil was activated from the keyswitched 12V bus. Run the output from the relay's contact to Molex connector D, pin 5, "+KEY EV BATT TRACTION". Similarly the keyswitched 12 V auxiliary battery signal goes to D1.

8. When wiring a microswitch to the brake pedal for regen (or using the original OEM brake light indicator switch), be sure that the switch is normally open and closes when the brake pedal is pressed. This may seem so simple as to be stupid, but OEM vehicle microswitches for brake lights work the reverse way, i.e. they are normally closed, and open when the brake is applied. Luckily Cherry-truck had a switch with both normally open and normally closed outputs. I still

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managed to get it backwards the first time and got the Zapi into the "accelerator and brake on at same time" mode, in which the controller drops the motor power to a low torque as a safety measure, figuring that either the operator or the control interface is confused.

9. P. 17 in the Zapi Manual shows a direction selector. In Cherry, it was implemented with a three-position (FWD/OFF/REV) toggle switch on the dash. The "ECONOMIC DRIVE" request signal wasn't used.

10. Debug the low-voltage stuff by continuity checks or by seeing if the externally supplied voltages (i.e. enables, interlocks, etc.) are where they are supposed to be. Don't try to turn on the controller yet.

11. Now the fun stuff - the high voltage wiring. Make sure the battery pack is "broken", i.e. has a link taken out of it so that you can't complete the circuit accidentally. In the case of a double string pack, either break both sides or disable it downstream of the "T" connection where both strings parallel in. (I broke both of Cherry's strings separately).

In some conversions, such as the Solar Car S-10, the battery pack to controller connection is via a big Anderson that can be pulled apart as an emergency disconnect. However you do it, make sure everything is de-energized before doing the high-voltage hookups. You don't want to zap the Zapi, or yourself either. I found that Cherry's 144V double pack could give one hell of a buzz.

Cable up the motor using p. 17 ("Cabling Plan Controller..." as a guide. If you are using an Advanced DC Series motor, remove the factory-installed strapping connection, since you need separate access to both field and rotor terminals. The diagram of the motor's connection locations as shown on P.17 is correct. Run the field connections to OUTPUT and VMN as shown. I used a paint marker to mark the destination of

each cable-end to avoid confusion (and still had some even so). Connect the rotor to the big reversing contactor which implements functions TA and T1. (The connection from INPUT to T1 and TA should have been installed at the factory.) Recheck what you've done against p. 17. It is right and if you follow it, things won't smoke. If you don't, they probably will.

Now cable up the battery pack (de-energized, remember?). Again, p. 17 is your bible. Install a high amp fuse or fusible link in the +BATT line. Cherry used a 400 amper. The connection from +BATT to contactor TFR should have been installed at the factory. Now run your -BATT line. Again, the factory should have installed the -BATT to TFR connection.

Make sure that all connections have lockwashers and/or are TIGHT! Also be sure that there are no shorts to the vehicle's body or between connections that should be isolated from each other.

In Cherry-truck, for instance, the Zapi was mounted so close to the brake master cylinder that the front of the master cylinder was nearly sticking right into the contacts of the TA/T1 reverser. A few sheets of neoprene rubber solved that problem. I used shrink-tube or electrical tape to cover any exposed buss-bars, fuse connections or other potential exposures.

Bring-up and Debug

1. Recheck all wiring against pp. 16 and 17. Do it in the morning when you are fresh. It may be boring, but it's better to nip any stupid mistakes before they get their fangs into you. And leave the controller unmounted. You need access for debug.

2. Check your motor to be sure it has been set up to regen without arcing. The advance on the brushes needs to be reset from 10 degrees to zero. If you bought the motor as part of a kit, the kit supplier will probably have prepared the motor.

To check, remove the snap-on guard at the brush end of the motor.

2. Put the vehicle's drive wheels up so that if things go squirrely, it can't escape you. Use jackstands; don't leave it on a jack. Put those wheels in the air; don't assume that having the shift in neutral will be enough!

3. First check out the Zapi's normal function without regen. This means disabling the brake microswitch (leaving the connection open) and turning down the release braking and pedal braking regen trimpots on the logic board.

To get at these, you remove the cover. Page 15 in the Zapi HFM 400 manual shows the location and adjustment of the logic board trimmers. You want P2 and P3 all the way counter clockwise to start with (you'll turn them back up later).

4. If you haven't already, check to see that relay-keyswitched traction pack voltage and 12V auxiliary battery voltage will appear on pins D5 and D1 when the ignition key is turned.

Also check the potbox microswitch and variable resistor functions that come in on connector A. The microswitch should be normally open and the input resistance should vary from 0-5 Kohms as the potbox throttle lever is pushed. Check that the linkage from the throttle pedal is operating the potbox as it should.

5. With the battery pack still disconnected from the controller and the ignition switch OFF, reinstall the links used to break the pack so that it is complete and live. Now reconnect the pack to the controller. In Cherry's case, this involved plugging the two halves of the big Anderson emergency disconnect. Since this tended to give a sharp snap at connection, I would have preferred the use of a regular battery disconnect or circuit breaker (which is what I tend to use on my cars), but the kit didn't include one.

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Yellow Tops Coming!

by John Wayland, E-Car

Tues, 6/18/96 18:41:39 — Optima's Yellow-top (12V true deep-cycle) batteries are now being produced and will continue to be part of the regular production schedule! They will be sold through Optima's regular battery distributors, just like the Red-tops. Because the Yellow-tops have to be pre-cycled at the factory, they are more expensive, and take more time to build. Optima's Glen Johnson wasn't sure what the retail price would be, but it might be close to \$175 per battery. He added that the price would be the suggested 'list', and that EVers should be able to get better pricing through their respective local distributors.

Even though Optima is presently building these batteries, it will be a while before the distributors have them in stock. Due to manufacturing and pre-cycling time, the Yellow-tops are still be a 'limited availability item'.

According to Glen Johnson, a few selected small companies and individuals can get the Yellow-tops right now. It is also all right to resell them, if we are so inclined.

For the fans of E-Car's APS Phoenix drag race Datsun 1200 burnout, rejoice, Optima may include footage of the event in a new Optima video.—JW

(For a description of the burnout, see *Current Events*, April 1996 —CB)

For more info, contact John at <Datsun1200@AOL.COM>

With permission from Optima's Glenn Johnson. Thanks to Mike Thompson <madkatz@NETCOM.COM> who re-posted John's original message.

EVs Draws Crowds

by Michael H. Bianchi

Keith Smith, of MascoTech Special Vehicles of Detroit, has been at each display site with 3 Chrysler vehicles that draw considerable interest. The first is a new Dodge Intrepid ESX concept vehicle. It's a series hybrid EV with a diesel engine/generator set for charging the batteries. It has 100 hp electric motors at each rear wheel. It has an all aluminum body and chassis and is slated for production by the year 2000. The model is strictly a show car.

The second car here is the first prototype of the Plymouth Prowler, built in 1993, again with an all aluminum body and chassis, which will be for sale in January 1997. The third is an Epic electric minivan.

Bertoni EV Landspeeder

Here's some quick info on the Italian electric that took the EV landspeed record from the GM SunnySide Up Impact EV1.

Bertone's ZER (Zero Emission Record) electric car has achieved a speed of 309.977 km/h (188.888 mph) at the Nardo track in southern Italy. The car, which was exhibited in the Turin motor show of 1994, is 165.4 in. long, but only 39.0 in. wide, and has an amazingly low drag coefficient of 0.115.—Paul Frere

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6. Now you should have pack voltage on +BATT and -BATT. Check it with a meter. Next, turn on the ignition switch to activate the keyswitched 12V and keyswitched pack voltage to the controller's +KEY (VBATT TRACTION) on pin D5 and AUXILIARIES BATTERY PLUS on D1.

The click of both relays should be accompanied by a quiet keening, which indicates that the Zapi is on in the standby mode and is ready to accept direction commands. The display should also flash "8" briefly, then go off. Now set the direction request toggle switch to FWD and gently press the throttle linkage. You should hear the TFR contactor click and the motor should start running.

If it does, congratulations. You've hooked up a Zapi and made it run.

7. If it doesn't, don't feel bad. I didn't get it the first time either.

The display will probably show an error code. Look up the number on pp. 13-14 and try to figure out if any of the possibilities apply. Try the simpler ones first.

The first time I got a flashing 7, which turned out to be caused by the blown semiconductor fuse at -BATT. The second time I got a flashing 6, which was due to a problem with the potbox. When those got licked, the HFM 400 flashed me an "8", then happily ran the motor. The wheels even turned the right direction!

Hopefully there won't be any problems more serious than those.

You may want to drive the vehicle without regen for a while, just to get a feel for the controller's normal behavior. Since some of the Zapis (the H3's) have had a reputation for being smoke releasers, you may not want to use regen immediately. — CB

BAT Hits with Crash Video

In a move to counter another oil and auto generated attack on EV safety by means of an outdated film of an EV crash, , Battery Automated Technology (BAT) has put up its own crash-test video on the Web.

After some California news stations aired the classic 1970's era flying-batteries (they weren't tied down, so what do you expect!) film, feisty little BAT retaliated with a video of its 1996 Geo Metro conversion passing the 30 mph barrier crash test with flying colors.

BAT reported that the vehicle's crush zone successfully absorbed the impact and that "A majority of the critical data was less than 50% of the allowable [forces on the occupants] with some of the readings being as low as 15%.

The B.A.T. video illustrates textbook-safe crash test results at 30 mph into a fixed barrier. The crumple zone designed

into the vehicle absorbed the energy quite successfully. All of the crash test data was well below the allowable limits. In fact, a majority of the critical data was less than 50% of the allowable, with some of the readings being as low as 15% of the allowable forces. The test did not alter the vehicle's roofline, allowing BAT to use it for a roof crush test.

BAT also gave their EV the not-yet-required rollover test, in which a car is run through a frontal crash then turned first 90 degrees, then 180 and then 270. The idea is to measure how much electrolyte drips from the EV after this treatment — BAT's Geo didn't drip any.

As BAT's press release states, "These three tests demonstrate the excellent engineering that goes into today's electric vehicles."

The B.A.T. video clip is presented in a revolutionary new video format called

view.topia. It is the first full-screen self-executing video format. Once downloaded it plays itself and does not require any additional hardware or software on your computer. This technology represents a major step forward in the digital delivery of video because its full-screen playback provides a picture size which is more than ten times that of existing standards.

You can view this video clip by visiting BAT's Internet site at www.besiweb.com/bat

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North Bay EAA Suspension Analysis, Part 2

(Continuing from CE June 1996)

Brakes

This is an important concern in safe conversions. If the percentage increase of either the GVW, the GRAW, or the GFAW is greater than 110%, stopping distances will increase. Since all three affect braking capacity and distance, it is hard to say at what point it becomes serious. You should, at the very least, change your driving habits to allow an extra one-half to one second of space between you and the car ahead. For percentages above 125, consider consulting a brake specialist about increasing brake capacity.

If your vehicle has become nose-heavy due to an increase in % GFAW, it loses additional braking capacity. During braking, weight is shifted forward, making the front brakes work even harder.

Steering

As % GFAW increases, so does the EV's tendency to understeer. It wants to keep on plowing ahead, even when the wheel is turned. Although a little understeer is beneficial, too much can destabilize steering. The reverse is true, e.g. as % GFAW decreases, so does the vehicle's tendency to oversteer. It wants to turn in and sometimes the rear end tries to swap places with the front. Oversteer is rarely beneficial and leads to unstable situations, such as spinning out. Another result of a decrease in % GFAW is a possible loss of steering control, especially during cornering and maneuvering. This is due to a lighter load on the steering wheels. If you have design-related steering problems, seek professional help or redesign your EV to bring the % GFAW to its original value.

Tires

Every tire sold in the US in the last 8-10 years has its maximum rated load capacity printed on the sidewall. This value represents the maximum weight that the tire can safely take. Tire manufacturers also quote load capacities at

much lower recommended inflation pressures, for example, 26 psi. Table 2 in the previous CE, contains information from Goodyear about the most common tire sizes on domestic/imported compacts and subcompacts, over 87% of the tire needs for this class. Note that the load rating is quoted at 26 psi, whereas the maximum pressure varies from 32-35 psi. Maximum load capacities were not available in all instances.

To check the load capacity of your EV's tires, use the following equations. Alc is axle load capacity, Tlc is tire load capacity, Arcf is reserve axle capacity, front; Arcr is reserve axle capacity, rear.

$$\text{Alc} = \text{Tlc} \times 2 \quad (21)$$

$$\text{Arcf} = \text{Alc} - \text{GFAW}(\text{new}) \quad (22)$$

$$\text{Arcr} = \text{Alc} - \text{GRAW}(\text{new}) \quad (23)$$

Inflation and size

If your EV's new GVW exceeds the axle load capacity given at 26 psi, you can compensate by increasing the inflation pressure in the tires on that axle. However there is a limit to how much this will help. Before trying, check the maximum inflation pressure and maximum load capacity for your tires. If you exceed this, look into a different tire size or profile that has a higher capacity. Keep in mind that changing tire sizes from those recommended by the vehicle's manufacturer may require surgery on your fenders, if not changes to the steering geometry and the front axle.

Temperature

A tire that is subjected to continuous heavy loading will heat up as it flexes under the stress. This leads to excess tire wear and blowouts. To prevent the problem, you can upgrade to a better grade of tire. In the US, tires are rated A, B, and C where A is the best. European tires are rated S, H, and V, where V is best.

European tire grades actually refer to the tire's performance at high speed; S is limited to 112 mph limit, H is safe at a sustained 130 mph, V can be taken

beyond 130. These ratings, however are directly related to temperature tolerance.

Suspension

A percentage increase in GVW, GRAW and/or GFAW indicates that associated suspension components for that axle should be changed. For a rear axle coil spring suspension, this might be as easy as going to Sears and getting an overload spring for your vehicle. However, overload springs are not always available for all makes and models. You may have to go to a custom spring shop (check your Yellow Pages under Springs - Automotive. If you do, you will need to tell the specialist the expected Gross Rear/Front Axle Weight (GRAW(new)).

For rear axle leaf springs, you can add one or two new leaves to the spring bundle if the increase is less than 125%. For increases that exceed that, you may have to add separate helper springs. If your rear suspension uses torsion bars (VWs and others), you may need professional help in designing a stiffer suspension. In all cases, you will need at least heavy-duty shocks. Consider gas of air shocks for the heavier loads. Please note that it is not a case of using either heavier shocks or stiffer springs, but a case of using both.

If the front suspension is a coil-and-shock type ("coil-over-shock"), you may be able to upgrade it yourself. For McPherson struts, you will need professional assistance.

Limits

"Beefing up" the suspension is only good up to a certain point. Beyond that you are at risk of causing premature failure in other components from overloading. Don't attempt to correct an overage of more than 125-140% without first considering a redesign.—NBEEA

WHY SHOULD YOU BUY FROM ELECTRO AUTOMOTIVE? IN ONE WORD, EXPERTISE.



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conversion
by EVA**

EAA Silicon Valley Rally Rules

ENTRY FEE

\$15 (Mail In) or \$20 (at Rally)

ELIGIBILITY

Anyone with a valid driver's license may apply to run an electric car in this rally. The vehicle must be "street legal" and pass an inspection by one of the officials. Registration forms, fees, liability form and your auto insurance company name are needed. Registration and inspection will begin at 8:30 am. Inspection is not required for vehicles on display only

REGISTRATION

Registration is required, with a \$15 fee in advance or a \$20 fee at the event. This fee helps to recover the costs of the rally. Please pre-register at the reduced rate.

INSPECTION

An inspection card will be issued at registration. Present this card to an inspector who will inspect your electric car.

ONE PASSENGER RULE

Every vehicle capable of carrying 2 or more people (including driver) must carry a passenger. Passengers will be lined up near the starting point, so the driver can exchange passengers after each lap. There may be an award for passenger miles.

Awards * (Distance completed and appearance). This year we will offer awards to cars on display as well as those that participate in the Rally. Passenger miles may also be a category. Appearance will include best: Looking, Engineered, Classic and Coolest Overall.

*NOTES (DURING RUN)

1. No battery replacement is allowed.
2. The only exception will be power from photovoltaic cells mounted permanently on the vehicle.
3. Each lap must be completed in 5 minutes or less. Drive at the speed limit whenever possible, don't save the watts! Route is 1.5 miles.
4. All traffic lights and signs must be obeyed.

No skimming through stop signs!

5. The all-electric vehicle that completes the most laps by 4 pm will be declared the endurance winner.
6. In the event that two or more vehicles have run the same number of laps by 4pm, those vehicles may run a times laps to determine the winner. Observing the speed limits, the shortest lap time wins. If there are many cars with a range greater than 100, we may add a longer route for those cars.

Make your check payable to Silicon Valley EAA and mail completed registration form to: Pat Hardage, 1085 Tasman Dr. #732, Sunnyvale, CA 94088

CAR NUMBER

RALLY/DISPLAY REGISTRATION FORM SILICON VALLEY EAA

SEPTEMBER 21, 1996

CHARGING

I will need charging at the event: ☐ before ☐ after (please attach requirements)

VEHICLE TYPE

Basic Mfg.	Year	Seating Capacity
First run (as electric)	Year	Payload if truck (lbs.)
Frontal area	sq. ft. (height x width)	
Curb Weight (before conversion) lbs.	(After conversion) lbs.	
Number of Drive batteries	Mfg.	Voltage

BATTERIES

model type (lead/acid, nicad) other (please specify)
Tie-down provision (Yes / No) Accessory battery (Yes / No)
DC/DC converter (Yes / No)

TIRES

Brand and Model	Front	Rear
Size	Front	Rear

BODY

☐ Metal ☐ Fiberglass ☐ Other (please specify)

TRANSMISSION

(circle one) Manual 3 4 5 speed Automatic 3 4 speed
Clutch used (Yes / No)

DRIVE AXLE RATIO

	Differential	Chain
--	--------------	-------

MOTOR

Mfg. and Model	Continuous HP rating	Peak rating
☐ D.C. ☐ Series wound ☐ Shunt ☐ Compound		
☐ P.M. ☐ A.C.		

CONTROL SYSTEM

Electronic Chopper (Mfg.)	Model	Chop. freq.
☐ Diode Switching	☐ Relay	

LIABILITY STATEMENT

I hereby absolve the Electric Auto Association, all officers of the EAA, rally officials, and any city or corporation permitting use of its property for conducting the rally, of any responsibility for problems, accidents or damages caused or created as result of my participation in the rally. It is my responsibility to abide by the California Motor Vehicle Code.

Name _____ Telephone _____
Address _____
Car License # _____ State _____
Signed Insurance Co. _____

Bye-Bye Buck-A-Gallon

For those of us who used to estimate the cost of a fill-up by making gallons equal dollars, the last few months have been a shock. "Buck-a-gallon" gasoline is no more. "Two-buck-a gallon", already a reality in some cities for full-serve premium, looms on the horizon.

According to Road and Track's Daily Auto Update, April/May gas prices hit a 15 year high. The average price increased 6.7 cents per gallon in the last month, according to the American Automobile Association.

AAA's monthly Fuel Gauge Survey average price of self-serve regular unleaded gasoline is \$1.307 per gallon, 11.1 cents more than a year ago. Prices jumped 17.8 cents in the last three months. This month's price is highest pre-Memorial Day figure since 1981 when gasoline averaged \$1.377 per gallon.

Average US price per month (self-serve regular unleaded)

Nov95	Dec95	Jan96	Feb96	Mar96	Apr96
\$1.123	\$1.118	\$1.139	\$1.129	\$1.18	1.24

May average US gas prices for the last 5 years:

1991	1992	1993	1994	1995
\$1.161	\$1.139	\$1.132	\$1.105	\$1.196

Average price by grade (all unleaded), plus monthly increase

Self-serve reg.	Self-serve mid.	Self-serve premium
\$1.307	\$1.397	\$1.478
6.4	+6.6	

Ref: R&T's DAILY AUTO UPDATE for Thursday, May 16, 1996

Gas Tax Cut Goes to Senate

May 22, 1996

WASHINGTON (AP)House Republicans pushed through a suspension of part of the gasoline tax and promised more cuts later. Many Democrats went along, but others denounced the temporary roll back. Republican, Rep. John Edward Porter of Illinois, decried political motives: "This legislation simply represents cynicism and I want personally no part of it."

The bill, adopted Tuesday evening on a 301-108 vote, would cut the federal gas tax by 4.3 cents per gallon through Dec. 31. That represents the amount added in 1993 by President Clinton and Congress. A motorist driving 12,000 miles a year, and getting 20 miles per gallon, should benefit by about \$15 between now and the end of the year if prices at the pump reflect the full cut — which isn't guaranteed.

Dole sought to capitalize on motorists' anger over a 20-cents-a-gallon increase in gasoline prices since early February. "This is about putting fuel in Bob Dole's campaign for the presidency that was stalled and out of gas on the side of the road," said Rep. George Miller, D-Calif.

Just before passage, the House rejected, 225-183, a Democratic move that would have penalized oil companies that refused to pass the tax cut to consumers. But that measure, too, was largely symbolic. It provided no means of enforcement.

Source: America Online Newsbriefs

Gas: Why So High ?

by Clare Bell

Despite the recent wallet-pinching rise in gasoline, the major expense of driving cannot be blamed on increasing fuel prices. Americans are driving bigger vehicles that guzzle more gas and they are driving them more.

In 1973, when the Arab oil embargo prompted the first fuel crisis, 1 in 10 new light-duty vehicles were vans and pickups. Now, due to the appealing image of pickups, 4X4's and sport-utilities, that figure has risen to 4 out of every 10. In 1973, American vehicles went 5,350 miles per person. In 1994, they did 7,900.

Reaction to the first gas crunch, rising prices and the Corporate Fuel Economy Standard pushed the average to 20.22 in 1985. The cost of driving a mile actually peaked in 1979, at 51 % above 1973. By 1994, it was one third less than in 1973. By 1994, the exchange of early '80's compacts for mid-1990's behemoths dropped the average MPG to 19.31.

Even so, "[Today's fuel cost] is no way near what the cost per mile was in 1973," Schipper said, commenting on recent price increases. "In terms of the cost curve, we're back to 1987."

Why are we just getting hit now?

For a long time the cost of driving was held low by two trends that cancelled each other out. Though fuel prices increased in the early '80's, fuel economy also rose. When fuel economy declined in the '90's, gas prices fell.

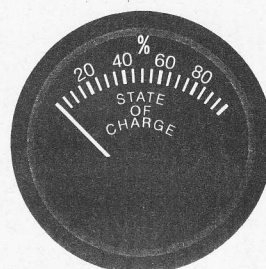
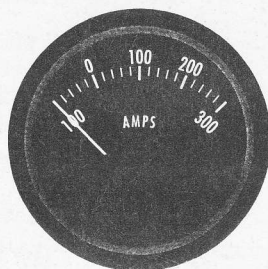
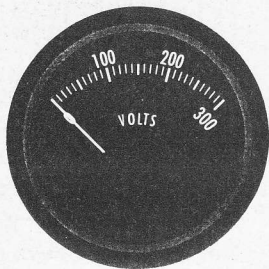
Now, fuel economy is continuing to decline and price per gal. is up so the cost per mile is climbing steeply. A recent lifting of speed limits also contributes. We used to drive an average of 59 mph with the 55 mph speed limit. That has now risen to 69.

In addition, Americans now work/shop farther from home. We have grown used to static gas prices even as costs of everything else has risen.

We are perpetuating the gas crisis by driving bigger cars faster and farther, Shipper feels, and adds "In a sense, we asked for this."

Ref: Matthew L. Wald, "How America Perpetuates Its Gas Crisis, New York Times News Service, 5/4/96

Electric Vehicle Instruments



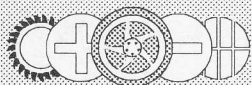
Analog Instruments to Monitor

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- ▼ MOTOR TEMP.
- ▼ VEHICLE SPEED

High quality instruments for electric vehicles are available in a number of scale ranges, included expanded scale voltmeters for *fuel quantity*. Voltage and temperature instruments may be ordered with a optional *solid-state super bright warning light feature* which will warn of a battery "LOW FUEL" or a "HIGH TEMPERATURE" condition. Instruments are available in 2" & 3" round automotive style case made of MIL-SPEC nylon. Contact your local dealer or the factory for ranges available.

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World Wide Web Home Page: <http://www.primenet.com/~ecoelec>
Desert Lightning Information: <http://www.primenet.com/~ecoelec/convnew.html>
On-line Components Catalog: <http://www.primenet.com/~ecoparts>

SunDay Challenge Calls for Entries

Cocoa, FL 6/19/96 — Alternative energy car racers - here's your chance to shine. The Florida Solar Energy Center (FSEC) is calling all cars for the fifth annual SunDay Challenge, a 70 mile road rally from Cocoa to Orlando. This non-gas-guzzling "alternative" to the Daytona 500 is set for September 21, 1996. The SunDay Challenge promotes innovative alternative-energy vehicles, gives the public "an up-close opportunity to see some of the latest technological designs... and demonstrates the viability of practical alternative-powered cars," said Bill Young, a research engineer at FSEC.

To enter, teams must complete an entry form and return it by Sept. 6, 1996. The Challenge goes at FSEC's new site on the Cocoa campus of Brevard Community College/University to Walt Disney World's EPCOT Center in Orlando.

The classes include:

- Commuter solar and electric - vehicles which travel at normal traffic speeds, have a 70 mile range and use photovoltaics (solar cells) or alternative fuels.

- Tour de Sol racing - a one-person EV optimized for efficient racing at speeds up to 65 mph for 100-200 miles, with onboard photovoltaics (solar cells).

- Cross-continental - vehicles that are designed to travel long distances on photovoltaics alone.

- Other alternative-power - vehicles that use a power source other than gasoline or diesel.

Access: For information about the SunDay Challenge, please contact Bill Young at (407) 638-1458 or fax (407) 638-1010.

Woof, Woof, Here Comes an EV!

Jersey Central Power and Light and Hunterdon Polytech have come up with a nifty way to use their Tour de Sol entry after the race. They'll donate the vehicle, a converted Chevy S-10 pickup truck, to the Seeing Eye, a Morristown, NJ organization that matches Seeing Eye dogs with blind human partners. Seeing Eye will use the EV truck to train the dogs to recognize the quieter sounds of an EV on the road.

JCP&L sponsored Hunterdon's vehicle by donating a gas-powered Chevy S-10 and a conversion kit to the school.



Calling All Cars...
Alternative Energy Racers:
Enter Your Vehicle In The Rally



⚙ SunDay Challenge™ '96 ⚙
September 21 - 23, 1996

Begins Saturday at the new site of the Florida Solar Energy Center on the Cocoa Campus of Brevard Community College/University of Central Florida in Cocoa, and culminates later in the day at Epcot Center, Walt Disney World in Orlando, Florida. Spectators welcome at the electric, solar, and clean fuel vehicle rally and exhibits.

For more information, contact:
Florida Solar Energy Center®
SunDay Challenge Race Committee
1679 Clearlake Road
Cocoa, FL 32922
(407) 638-1458/FAX (407) 638-1010
<http://www.fsec.ucf.edu>
*Epcot admission free required

What IS Power Factor?

by Lee A. Hart

If power is all that simple, why can't you get more of it out of the wall and into your EV without blowing your breakers? The answer involves the behavior of AC systems and a quantity known as Power Factor.

AC Ain't So Easy

In a DC system, wattage is easy to find. Volts x amps = watts. Volts and amps can be measured with any simple meter.

In an AC system it ain't so easy. Suppose you connect a big transformer to the AC line with no load on its secondary. A voltmeter reads 120 VAC, and an ammeter indicates 10 amps of current flowing in the primary. 120 volts x 10 amps = 1200 watts. Yet nothing gets hot. Where is the energy going?

Watt-eating Inductance

If you check the watt-hour meter on the side of your house, you will also find it is not moving. That's because an unloaded transformer is highly inductive. You are drawing reactive power (measured in VA) but no real power (measured in watts). An oscilloscope would show that the current waveform lags the voltage waveform by almost 90 degrees. When the voltage is at its peak, the current is zero; when the current peaks the voltage is zero. If you carefully multiplied the instantaneous voltage and current waveforms at every point and averaged the result, you would find it to be nearly zero (The value would be exactly zero for a perfect inductor).

It is too tedious to do this every time we want to measure AC wattage, so a correction factor was devised.

In an AC circuit, real power is given by: volts x amps x PF = watts.

PF is the Power Factor, which is defined as the cosine of the phase angle between the voltage and current waveforms. In the more general case, PF = watts (real power or what a wattmeter measures) / VA (apparent power or what

you get if you simply multiply volts x amps).

Purely resistive loads (such as a resistor, light bulb, toaster, etc.) have a PF of 1. Inductive loads (such as induction motors, transformers, and fluorescent lamp ballasts) and capacitive loads (capacitors, filters, battery chargers, synchronous motors) have PF's around 0.5 to 0.8.

Crest Factor

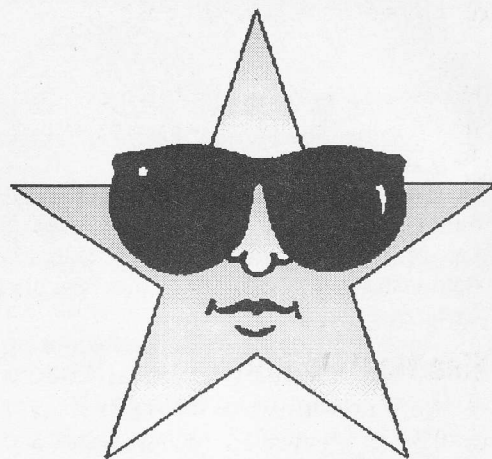
Historically, most devices had fairly good power factors; they may cause a phase shift, but at least the current is still basically a sine wave. But recent electronic devices such as light dimmers, computers, switching power supplies, capacitor-input filters, and some battery chargers produce bizarrely distorted current waveforms. These distortions cause much higher power distribution losses.

Crest factor is the ratio between peak current and average current. Circuits with rectifiers, charging capacitors or batteries can easily have crest factors of 10 or more (AC line current is 100 amps peak, 10 amps average). A crest factor of 10 means losses in wiring and connectors are 100 times higher! No wonder these devices cause great consternation among utility companies!

Basic Power Factor Correction

If your current waveform is basically sinusoidal; just out of phase with the voltage, power factor correction is straightforward. If the load is inductive, add capacitance across the AC line to cancel it. If the load is capacitive, add inductance.

Since devices with a motor or transformer are inductive, adding an input capacitor will REDUCE input current! If the waveform is mildly distorted, such as that of a transformer feeding a rectifier that has a capacitive load (or a battery; batteries look like capacitors), you need a more complex passive filter. A one- or two-pole LC filter, for example.



Twinkle, twinkle, little star
Power equals I squared R

(Burma Shave)

If the waveform is highly distorted (high crest factor), passive filter components become too big to be practical.

Electronic Power Factor Correction

This is when devices start using electronic or active PF correction. Basically, PF correction circuits actively force the AC line current to match the AC line voltage. A common power factor corrector has 3 stages:

1. An input rectifier with no filter, to produce pulsating DC
2. A DC-DC converter that steps this up to a semi-regulated DC voltage so the current drawn from the pulsating supply is proportional to its voltage. (This forces input current to match input voltage)
3. A second DC-DC converter that provides isolation and steps the high voltage down to the desired output voltage

So What?

Since power factor does not make your watt-hour meter spin faster, why do you care? Because a device with a low power factor has to draw MORE current to get the SAME power. A charger with a

continued on page 4

Power

continued from previous page

0.5 power factor draws TWICE the amps from the AC line for a given number of charging watts.

And when you double the amps, you *quadruple* the resistive losses in all the supply wiring and connectors. That's due to power loss through the line resistance, $P = I^2 \times R$.

Electrical Pollution

Poor power and crest factors mess up the AC line waveform. Instead of a clean pure stable sine wave that makes US power the envy of the world, the top gets clipped off and the sides are distorted. This makes other products work less efficiently. Motors run hotter, computers crash more often, etc.

Plugging in a device that distorts the supply waveform is a form of electrical pollution. You are dumping your garbage into everyone else's power — LH

Lee wrote this excellent discussion in response to questions from Internet EV Discussion List members

Mark Bahlke and David Volkenand. CE thought it deserved publication here.

Access: Lee Hari, 4209 France Ave. N., Robbinsdale, MN 55422 USA, phone (612) 533-3226

e-mail XURQ03A@prodigy.com

Electric Karts Jump

by Paul Compton

Tuesday last week I drove over to Gloucester to see Morgan Nicholas at Electromech Raceway. Those of you who were out in Phoenix will have seen the two very tidy British karts in the Friday night drags and in various demo runs around the circuit.

Morgan has an indoor karting centre in the centre of Gloucester next to Toys'R'US near the historic docks. The track gets little use in the middle of the day so I was able to put in some solo laps in one of the karts. I go karting fairly frequently and am used to the standard indoor kart with a 7hp 4 stroke engine and centrifugal clutch. The technique is to floor the throttle to get the clutch to bite as soon as possible. In the gasoline kart, progress off the line always feels unexciting to say the least. Not so in the electric kart.

I was driving one of the quicker karts with either a higher current limit, higher voltage, or different gearing, but the same chassis as the regular hire karts. Progress is exceptionally smooth with low speed maneuvering being particularly easy.

Seriously FUN

However when you press the pedal to its full extent all hell breaks loose. You get a loud squeal and a lurch to one side as the rear end breaks traction and then very rapid acceleration. Immediately a corner appears, and with a quick dab of the single rear brake, you turn in and then slide wide as instant power oversteer makes itself known. This thing has so much torque that oversteer is available in every corner. I take the next few corners a little easier and work some heat into the soft compound slicks. The steering weights up a little more as the rubber comes up to working temperature, and still there is enough torque to get severely out of shape round any of the bends. This is seriously FUN.

A Five-incher?

What motor is used to propel this 350 lb. kart to over 60 mph? (and the faster versions to over 100) An Advanced DC 5 inch, yes that's right a 5 inch. These are originally rated for 12 volts, however Electrometer re-bands the armature for high rpm and run the motor at 48-72 volt adjusting the brushes for best commutation. Amazingly the motor doesn't even get too hot to touch.—PC

paul.compton@BBSRC.AC.UK (COMPTON)

Electromech can be contacted on Tel No. +44 1452 311211

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Board Briefs

from minutes by Stan Skokan, acting secretary

Meeting began at the Cornells' in Pleasant Hill, CA at 10:00 AM. H. Bell, Cornell, Slominski and Skokan were present. C. Bell participated via speakerphone, Koch sent a proxy to the Chair. Cygan arrived at 10:30.

Vice-chair Brooks has resigned from the Board due to family medical emergency and job relocation. The Board hopes that he will rejoin us later through EV activities at his new location.

Barnes has resigned as Board Secretary due to his relocation to Washington, D.C. He will remain as a Board member at large.

Newsletter

C. Bell reported from a field location in Colorado. She is doing more newsletter preparation in order to facilitate the desktop publishing end and reduce costs. The budget appropriation will be adjusted accordingly. CEV will run info on pending EV legislation in Sacramento. Bell proposed that EAA do the EV Buyer's Guide or similar publication. She will contact Phil Terpstra in Hawaii to determine his intentions.

T. Cygan moved to accept the March 30 minutes as recorded by Barnes. Skokan seconded.

Cygan moved to accept the June 29 agenda, with the addition of a discussion of radio advertising by Slominski. Slominski seconded.

Committee Reports

Treasury

Slominski - Advertising income was reduced this year due to prepayments. Expenses should be tightly monitored for the rest of the year.

800#

Cornell - 392 call received in 1st six months of 1996, 270 info packages mailed out. 253 personal calls to Cornells' home phone of which 114 were inquiries for information and 145 result-

ed in packages sent out. Anna also presented a new EAA introductory page.

Activities

Cornell - Number of EV events is increasing everywhere.

Chapter Relations

H. Bell - To solve the confusion about who holds the latest Chapter Listing, June Munro and Mike Slominski will provide updates to C. Bell, who will hold and publish the chapter list periodically.

Board Elections

Anna Cornell is Election Committee Chair. Slominski will add calls for nominations to his chapter mailings and an announcement will run in August CE. Nominations should be received by Aug. 31. The ballot will run in the Oct. issue of CE. Lough, Koch and Slominski are up for reelection this year. T. Cygan, who completed Batson's term, will run for election. One more vacancy needs to be filled for Brooks.

Buyer's Guide

Clare will call Terpstra. Write-ups: General-Clare. Major automakers - Stan. Resources, Tony/ Ruth. We will consider requesting the mailing lists from Electrifying Times and Home

Power in order to increase circulation.

800 voice response

Cygan showed a voice modem acquired for testing. He will report results at the next meeting.

WWW

Cygan reported on Web pages and activities. 2500 hits since January 1996. EAA Web page addresses will be published in CE.

Radio Advertising

Slominski reported on data presented at previous meeting. The Board would like to run an inexpensive \$150 trial radio spot. If successful, it could serve a model for radio campaigns run by other chapters.

Meeting adjourned. The next meeting will be held Aug. 31 at Skokan's in Redwood City.—SS

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- AVAILABILITY AND PERFORMANCE OF ELECTRIC AND HYBRID ELECTRIC TRANSIT BUSES
- ELEMENTS OF A SUSTAINABLE TRANSPORTATION SYSTEM
- HOW TO INTEGRATE ELECTRIC VEHICLES INTO YOUR FLEET
- SERVICE AND MAINTENANCE OF ELECTRIC VEHICLES
- THE FUNDAMENTALS OF BUILDING AN ELECTRIC VEHICLE

16-18 SEPTEMBER 1996
Madison Square Garden, NYC

Northeast Sustainable Energy Association
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GM EV-1 Steering Specs

As discussed in SAE paper #960255:

Steering: Electro-Hydraulically power-assisted end take-off rack-and pinion.

Steering Gear

Rear Mounted Rack-and-Pinion

40 mm Piston Diameter

Reduced Cylinder Tube Thickness

Machined Quiet Valve with Enlarged Valve Body Holes

Curved, Squeeze Cast Aluminum Tie Rod Outers

Mass 8.3 kg (with fluid)

E*H Steer (TM) Pump/Motor Assembly

Three Phase, 180V rms, AC Induction Motor

Low Displacement Vane Pump

Rubber Isolated Aluminum Housing

Power Minimizing Control Algorithm

Software Flow Control and Pressure Relief

Maximum Flow 3.8 L/min

Maximum Pressure 5.9 MPa

+/- 1.0 MPa

Mass 4.95 kg

Intermediate Shaft:

High Angle, Double Cardan Joint

Low Friction, Low Lash

Plastic Injected Slip Joint

Mass 1.20 kg

Power Steering Fluid:

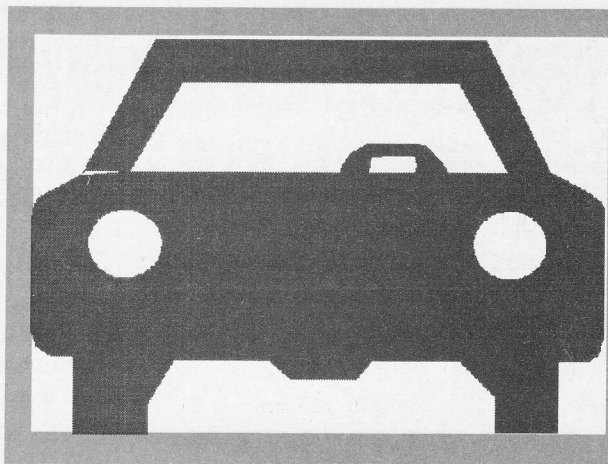
Kinematic Viscosity:

18.3 cSt max @ +40 deg C

5.2-5.6 cSt @ +100 deg C

Viscosity Index 245 minimum

Shear Stability (Change of Kinematic Viscosity @+100 deg C):



+/- 3.0% after 30 cycles

+/- 5.0% after 300 cycles

Color Dark Blue

From: eadams@CLDX.COM (Eric Adams), 96-05-02 14:44:40 EDT

Announcing EV Chatter

by Mary Ann Chapman, EcoElectric Co.

A new EV discussion forum is in the works. The name of the channel is EVChatter and will be held on DALnet. To locate the DALnet server nearest you, use IRC, then type /finger servers@dal.net. The first meeting in the channel will be held on Saturday, June 29, 1996 at 8:00, EST. Then participants can decide on a weekly meeting time. The channel will be open at all times. —MAC

Desert Lightning Pricing

EcoElectric Corporation is pleased to announce new pricing for the Desert Lightning electric pickup. Effective immediately, the truck is priced at \$30,700, including automatic transmission, two-point watering system, and Goodyear Invicta low rolling resistance tires. Optional air-

conditioning is an additional \$1,000. For fleet purchases of 25 or more trucks, we offer the reduced price of \$27,700. Both prices include three-year bumper-to-bumper warranty, including full replacement warranty on the Trojan T-145 bat-

teries (subject of course to restrictions related to misuse and abuse).

Mary Ann Chapman, CEO

Access:EcoElectric

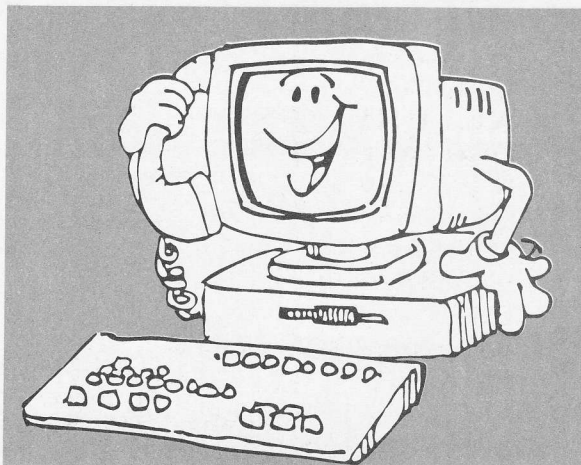
Corporation, <http://www.primenet.com/~eco-elec>

Vehicles: email: ecoelec@primenet.com

Fax: 520(or 602)-770-9908 Phone: 520(or 602)-770-9444

Components: email: ecoparts@primenet.com

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<http://www.primenet.com/~ecoparts>



News in Brief

Compiled by Ruth M. Shipley from information provided by Environmental Information Networks. If reprinted, please credit Ruth Shipley and CE.

Charging Stations in AZ by Fall '96

In preparation for the arrival of GM's EV-1 in showrooms later this year, the Arizona Public Service Co. (APS) will build 10 public EV charging stations. The stations will be located within about 10 miles of each other near APS offices and facilities and will allow EV owners to recharge their vehicles while away from home. Many will be located in parking garages and shopping centers. The stations will be able to provide a full recharge, good for approximately 70 miles of driving, in about two hours. The chargers, the first to be installed by APS, are seen as an initial step leading eventually to an extensive network of such facilities around the state. Recharging will be free until APS can devise a system for users to make payments.

(ARIZONA REPUBLIC, PHOENIX GAZETTE: 5/17)

Toyota, Matsushita to Produce Batteries

Toyota Motor Corp. and Matsushita Electric Industrial Co., Ltd. will invest \$18.6 billion in capital to form a company to produce and sell nickel-metal hydride batteries for use in EVs. The company will be provisionally named Panasonic EV Energy Company, Ltd. and Matsushita Battery Industrial Company of America (MBIA), and Toyota Automatic Loom Works Ltd. will be part of the venture. Matsushita has already produced a NiMH battery with a 135-mile range in urban areas between charges. The battery is currently being used in Toyota's RAV4, a light sport-utility vehicle which the company is making available for fleet buyers in the US. MBIA president Seiko Kabumoto said the rechargeable batteries will be manufactured in the US.

(REUTER: 5/20)

Horizon Batteries Win at Tour De Sol

Three EVs powered by Horizon batteries took first place in various competitive categories in the 1996 American Tour de Sol Race. Each of the winning EVs had traveled more than 100 miles on a single charge to cross the finish line in Washington, D.C., on May 16. A 1994 Ford Ranger, the "Ohm Ranger," won Best Utility Vehicle recognition for the New York State Electric and Gas (NYSEG)/Neocon team. A four-door Solectria Force won "best sedan using lead-acid batteries" in the production vehicle class for the Connecticut Commuter Electric Vehicle Demonstration Project (CCEVDP) team. The New Hampshire Technical Institute's "Sungoo" vehicle took first place in the student-built and the two-passenger commuter vehicle using lead-acid batteries categories.

(BUSINESS WIRE: 5/22)

New York Hangs Tough on Mandate

While Massachusetts has modified its original EV mandate, New York will not budge. Automakers had agreed to produce a cleaner gasoline-powered car beginning with the 1997 model year, some four years earlier than originally planned. But if Massachusetts and New York keep their EV mandates, automakers say they can not adopt the nationwide program.

Like California, Massachusetts has chosen to drop EV mandates in 1998 and 2000, while keeping the 10 percent mandate for 2003. New York Governor George Pataki, on the other hand, has remained adamant about adopting California's original 2% EV mandate. The Environmental Protection Agency said it will finalize its rule allowing for a national LEV program, a voluntary program expected to go into effect in 2001.

(AUTOMOTIVE NEWS: 5/27)

GM's Annual Report Showcases EV-1

The glossy cover of the 1995 General Motors annual report features "The EV1 Electric Vehicle: Teamwork in Action," and depicts the sporty two-seater surrounded by members not only of the GM EV platform team, but GM employee-members from Delco Propulsion Systems, Delphi Automotive Systems Divisions, Delco Electronics and members from the Lansing Craft Center in Michigan, where the vehicle is being built. Saturn employees represent the marketing arm of the EV1. Although GM's EV program is about \$400 million in the red, the company made \$152.6 billion in sales in 1995, up from \$150 billion in 1994. Stockholders are told that "GM led the industry with the development of the technologies in the concept EV that was first shown in 1990. Along the way GM has patented a total of 23 inventions that can be applied to EVs as well as to other future products."

(EVNEWS: MAY 1996)

Toyota Moves Ahead with RAV4

Despite on-going patent lawsuits filed by Ovonic Battery Co. regarding its nickel-metal hydride (NiMH) battery technology, Toyota has confirmed its plans to put the RAV4 EV into production with plans to market it in late 1997 to fleet buyers in the US and Japan. The vehicle, which will be built in Japan, uses NiMH batteries and is capable of reaching a speed of 125 kilometers an hour and a range of about 200 kilometers, according to the automaker. The RAV4 EV is a compact, front-wheel-drive, four-passenger, two-door vehicle with an onboard charger. It has a permanent magnet AC induction motor mounted under the hood and uses regenerative braking. Toyota said the performance of the RAV4 EV will be closely monitored to provide data for the development of the next generation of EVs.

(AUSTRALIAN AP: 6/4)

EV Fair Educates Teachers, Students

Innovations in EV technology were showcased at the first-ever "EduFaire" that took place recently at Nobel Middle School in Northridge, CA. The fair featured rides and drives in EVs and on electric-powered bicycles as well as information from environmental groups. During a two-week study program preceding the fair, the students of the math/science technology magnet school built EVs. Awards were presented to 12 students for excellence in vehicle design, creative writing, and the race of model EVs. The South Coast Air Quality Management District (SCAQMD) and California Air Resources Board (CARB) contributed materials to the curriculum. A coalition of some of the 16 participating organizations will work with teachers to develop and improve the curriculum of the "model" school EV program.

(BUSINESS WIRE: 6/6)

Swiss Government Offers EV Incentive

Switzerland's government has announced that it will cover 50% of the consumer costs associated with the purchase of an EV that meets minimum efficiency standards. Specifically, vehicles must use 20 kilowatts or less to travel 100 kilometers (approx. 60 miles). Next year the requirements will become 25% more strict, and will increase by 50% in the year 2000. At present, over 30 vehicles have been tested for conformance to the efficiency standards at the Engineering School in the city of Biel. Most of the vehicles have been approved, including models manufactured by Peugeot and Citroen. The government's incentive will apply only to vehicles purchased in the city of Mendriso, which hopes to replace 8% of the total number of vehicles with EVs by the turn of the century.

(CALSTART NEWSNOTES: 6/7)

Automakers at Odds With Weld

Representatives of seven leading carmakers, including GM, appeared at a state Department of Environmental Protection hearing held recently in Boston to protest Massachusetts Governor Weld's latest attempt to force them to sell EVs. A new Weld administration proposal would require automakers to sell 3,750 EVs in Massachusetts by the year 2000. Weld wants the carmakers to sell the same number of EVs in Massachusetts that they have offered to sell in California. To sweeten the deal, Weld said the state itself would buy hundreds of EVs. Automakers say the technology is not ready and Massachusetts does not have the legal right to order EV sales. Still, GM considers the Northeast "a critical market" for EVs in the future.

(BOSTON GLOBE: 6/8)

Israeli Company Makes Fuel Cell/Battery Hybrid

As the battery vs. fuel cell debate continues, a Jerusalem-based company is developing a third way to power EVs — a fuel cell/battery hybrid. Electric Fuel Ltd.'s zinc/air battery has at least five times the energy density of state-of-the-art lead-acid batteries, according to the company's chief scientist, Jonathan Goldstein. The company claims that a compact Opel station wagon achieves a range of about 218 miles using the battery system, while a Mercedes Benz van can travel close to 187 miles. The vehicles can then be "refueled" by exchanging the zinc battery plates in a few minutes. The spent zinc plates are electrochemically recycled at a regeneration plant using off-peak electricity. The German and

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Swedish postal services and the South African utility Escom are testing the battery.

(HYDROGEN & FUEL CELL LETTER: JUNE 1996)

Atlanta Gets Station Cars

Utility company Georgia Power is offering the use of some of its EVs as station cars in the Atlanta area. Battery charging infrastructure will be available at three stations operated by the Metropolitan Atlanta Rapid Transit Authority (MARTA) — the West End station, which is close to many of the major Olympic venues, MARTA headquarters at Lindbergh, and Dunwoody. A trial demonstration of the station car program will use Geo Prism and Chevrolet S10 pickup trucks that have been converted by US Electricar. As bonafide electric station car vehicles become available for the project, they will be phased in. Employees of MARTA, Georgia Power, and the Southern Company, Georgia Power's parent company, will participate in the station car demonstration initially.

(NATIONAL STATION CAR ASSOCIATION: JUNE 1996)

Fry-o-lator Trailer Powers Hopper EV

by Michael Bianchi

Tom Hopper (the man I want to be when I grow up) is here with his bio-diesel auxiliary power trailer. He > drove < his Hopper EV plus trailer hybrid to New York City from Concord, New Hampshire. "It was great fun. It was raining cats and dogs when we left and I would have probably given a lot of money for a real good defroster. The windshield is Lexan, which has an affinity for moisture that doesn't quit." He plans to replace the glazing with glass and get a good defroster someday soon.

He has been using the "pure" EV all this fall going to school (the New Hampshire Technical Institute, where he teaches) every day, rain or shine. He used the data collected from those trips, which included turnpikes doing 70 mph and country roads doing 40. His average speed was 35 mph, his average

power consumption was 3.5 kW. He then designed the engine to give 3.5 kW at its "sweet spot", which is at 2550 rpm. "It gives me energy so I can drive at 40 mph, steady state." The engine is manually controlled from the driver's position.

Tom hopes to demonstrate that his 5 gallon tank can give him a 500 mile range. In fact he hopes to drive it back to Concord from Washington DC. "I have no trailer [to carry the vehicle], but I have confidence. I'll stay on the blue roads; more scenic." Since last year the motor has been changed from a Solectria GU motor to a GT, "which has more torque, and the gear ratio has been changed so I have more torque off the line and less high end speed," to pull the 300 pound trailer.

And the exhaust smells like a restaurant. 10 to 20% of the fuel is used Fry-o-lator oil. Yet he gets 127,000 BTUs per gallon out of it, and that is what Diesel fuel is.

Finally, Tom has added a stereo radio/cassette, "mainly for entertainment for everybody else." And because he is a kid at heart, which is why he is still here.

Date: Thu, 16 May 1996 06:06:44 -0400

From: Michael H Bianchi
<bianchi@BELLCORE.COM>

Subject: NESEA American Tour de Sol: More Snippets

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Event Calendar

Aug. 5-6 - Edison Electric Institute Electric Vehicle Conference, Troy, MI. Annual symposium and exhibition including new products and ride'n'drive. Sponsored by the EEI Fleet Management Committee, held at the Troy Marriott. Contact: Rick Temchin, Edison Electric Institute, 202-508-5558; or Sherry Craig, 202-508-5561.

Aug. 5-8 - Future Transportation Technology Conference, Vancouver, British Columbia, Canada. The Society of Automotive Engineers International Future Transportation Technology Conference & Exposition (FTT), being held at The Coast Plaza at Stanley Park, Vancouver, Canada, will address advanced technology in the field of automobile development, design and engineering. Contact: Kerry Demoratz at SAE, 412-772-7131, fax 512-776-0002.

Aug. 5-13 - Sun Sprint of the Rockies, Aspen, Colorado to Moab, Utah Contact: tel. 907-872-3882

Aug. 15 - Thursday Night Thunder (FLR) on ESPN, tel. 317-848-8937

Sept. 16-18 - NESEA Sustainable Transportation and S/EV96 Symposium and Expo, New York, NY. The eighth annual NESEA symposium and expo being held at Madison Square Garden will bring together a broad coalition of transportation planners, electric and hybrid electric industry representatives, business people, policy makers, engineers, students and concerned citizens to foster the growth of the electric vehicle industry, and the development of a sustainable transportation vision for the nation. Concurrently held sessions, and an extensive trade show have made the event the major electric vehicle conference in the U.S. Contact: Northeast Sustainable Energy Association, 50 Miles St., Greenfield, MA 01301, tel 413-774-6051, fax 413-774-6053.

Sept. 20-26 - Beijing '96 International EV Exhibition. Symposium, trade talks, technology exchanges and exhibits. Sponsored by the Chinese Society of Environmental Science and the Chinese Electrotechnical Society Electric Vehicle Institute. Contact: Jian Lai, President, Chinese Electrotechnical Society Electric Vehicle Institute, tel 86-10-50-13-779.

Sept. 30-Oct. 3 - NiCad 96, Sitges, Spain. Biennial Nickel-Cadmium Battery Conference, organized by the International Cadmium Association. Presentations and discussions of the latest developments in batteries, their applications, and recycling. Held at Hotel Gran Sitges-Barcelona, near Barcelona. Contact: International Cadmium Association, European Office, 42 Weymouth Street, London Win 3LQ, United Kingdom; tel +44 171 499 8425; +44 171 486 4007.

Oct. 11 - Transportation 2010, Dayton, OH — A regional day-long symposium sponsored by The Engineers Club of Dayton and the Global Electric Auto Association will include presentations by EV and HEV industry leaders and ride'n'drive. Contact The Engineers Club of Dayton, 110 E. Monument Avenue, Dayton, OH 45402; tel. 513-228-2148, fax 513-228-4794.

Oct. 13-16 - EVS-13, Osaka, Japan. 13th biennial international electric vehicle symposium, including addresses by major figures in industry and government, panels, exhibits, ride'n'drives. Contact: EVS-13, c/o Inter Group Corp., 7-5 17 Akasaka, minato-ku, Tokyo 107, Japan.

Dec. 2-5 - 2nd SAE Global Vehicle Development Conference, Detroit, MI — Symposium featuring 70 presentations from industry leaders on global automotive topics including vehicle development, sourcing and regulatory issues. Held at the Westin Hotel, Detroit — Under the sponsorship of the Society of Automotive Engineers. Contact: SAE Promotions, tel. 412-772-7131, email: meetings@sae.org

(From the Web page maintained by the Phoenix Chapter EAA on behalf of the National Electric Auto Association for monthly national publication in Current EVents. Prepared by Kathy A. Watson and Lynette Racine, email evchndlr@xxx.com.

EAA Board Candidates WANTED

Chapters, do you want more say in determining EAA policy and practices? Do you have a vision of how EAA should grow and develop? Choose your best and brightest as your representative to realize that vision.

EAA National is seeking nominations for Board members. We need to fill the slot left vacant by Bruce Brooks' resignation. Board Members Steve Lough, Ken Koch and Mike Slominski are up for re-election this year. Tony Cygan, who completed Bob Batson's term, will also run. Chapters are asked to submit the names of candidates to Anna Cornell, Election Committee Chair. Bios and pictures are also needed for publication in CE.

The Board encourages nominations from outside the California San Francisco Bay Area. Despite logistical problems, our Board members from Colorado, Arizona, Southern California and Sacramento have already made great contributions to EAA National. We would especially like to strengthen ties with EV-progressive cities such as Sacramento.



EV Want Ads

For Sale

For Sale: '91 SOLECTRIA FORCE. New batteries, excellent condition. \$12,500 or best offer. Call Pete (617) 326-3436. (Boston)

For Sale: '78 FIAT X1-9. 108V, 6" Advanced DC, PMC controller, Sevcon DC/DC, K&W charger, 60 mph, 40-50 mile range, \$4200/obo. Call (206) 631-1280. (Seattle)

For Sale: '83 CHEVY S-10 BLAZER. 20 6V 2300'S 9' advanced DC, Curtis 1221B, heavy duty suspension, seats five, complete documentation. Asking \$14,000/will negotiate. Call Tony (407) 382-9598. (Florida)

For Sale: '76 SEBRING VANGUARD CITICAR. 48V, 40 mph with chargers/spares. Great learners car. Daily driver. \$1,200/obo. Gary Warren Siess, 139 Richards Avenue, Dover, New Jersey 07801. (201) 366-2894. (New Jersey)

For Sale: '77 TRIUMPH SPITFIRE. 96V (new 12V Trojan SH5s). 8" Advance DC motor. PMC controller, K&W charger, new paint, leather. Mint. \$12,000. Call (206) 762-4404. (Seattle, WA)

For Sale: '78 VW DIESEL RABBIT. Runs, two door, stick, new front window gasket, aluminum mag wheels, Castro Valley, \$350/obo. John, (510) 886-0218.

Member Want Ads

Print clearly or submit typed copy of your ad with your name, address, and phone number. The EAA is not responsible for the accuracy of ads. Want ads must be received before the 1st of each month and must include payment to run in the next issue of CE.

\$10 for the first 35 words. Each additional word, 25 cents. Want Ads are available to EAA members for the sale of electric vehicles, equipment and parts only.

If you want to run your ad in more than one issue, please specify and include payment for each issue requested.

For corrections or updates, please send a written note or fax to EAA Want Ads @ 408.374.8750. Photographs of your vehicles may be submitted with your ad. If room is available, we run one photo each issue. These photos will not be returned.

Send your Member Want Ad request and check made payable to: EAA Want Ads, 18297 Baylor Avenue, Saratoga, CA 95070



PHOTO: '91 Solectria Force (See Want Ad listing above.)

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12 ads	\$50 ea

Ads may be placed for 1, 3 or 12 months. Camera-ready copy for each ad must be submitted along with payment. Ads may be submitted on diskette in TIF or EPS format on the PC or MAC. For 12 ads, an invoice will be billed quarterly. A minimum of 3 ads need to be prepaid per quarter.

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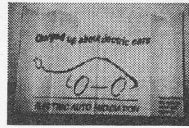
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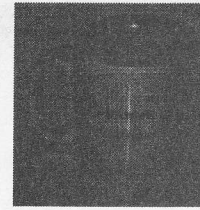
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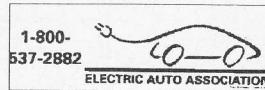
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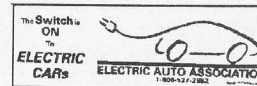
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Printed materials

CE	Selected Current EVents (<i>specify specific issue</i>)	\$ 3.00 each issue
CEFY	Current EVents - Full year (<i>specify specific year</i>)	\$20.00 each year
PB001	Discovered:The Perfect EV Battery	\$ 2.00
FW001	Flywheel Energy Storage	\$ 5.00
BG1996	1996 Buyer's Guide to Electric Vehicles (Feb 96 issue CE)	\$ 5.00
BG1995	1995 Buyer's Guide to Electric Vehicles (Feb 95 issue CE)	\$ 5.00
TT001	Team Tucson Land Speed Record Plans	\$ 5.00
IDX001	EAA Current Events Index - 10 Years!	\$ 4.00
XA100	EAA XA-100 Hybrid	\$ 5.00

Other EV Items

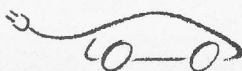
PN001	Ball point pen with "EAA, 800 phone # & Charging....Future"	\$ 1.00
CS001	Current Solutions/Motor Show Video Tape (14 minute runtime)	\$14.00
WL001	Window Literature Holder (fits pages 8.5 x 11 inch)	\$22.00
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