1995 SOLECTRIA

E-10 Electric Pickup Truck

OWNER'S MANUAL

5th Edition

SOLECTRIA

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1. INTRODUCTION

Congratulations! You've purchased a new Solectria *E-10*, the most efficient, practical electric pickup truck available. The *E-10* offers clean, energy-efficient transportation with the durability and convenience of a pickup truck.

Your *E-10* is a new 1995 Chevrolet S-10 body, modified with advanced Solectria electric drive components. Solectria Corporation is confident that the high quality workmanship and components in your new *E-10* will provide you with years of trouble-free transportation and the satisfaction that comes from driving a zero-emission vehicle.

Please carefully read this manual and the 1995 Chevy S-10 manual provided to ensure proper operation and maintenance of your electric vehicle (EV). Reading these manuals is essential to the safe, long-lasting and trouble-free operation of your vehicle. Although the *E-10* looks similar to a gasoline-powered vehicle and is simple to drive and maintain, it requires different care and some preventive maintenance. Also, remember to keep both manuals in the vehicle at all times so that they are available when you need to refer to them. In addition, Solectria has attached a quick reference guide to the driver's side sun visor with basic information about your *E-10*.

Throughout the manual, you'll see warnings, cautions and notes. Please pay special attention to these wherever they appear, since they are included for your protection.

- WARNINGS!, which appear in gray boxes, will advise you of things that may cause *serious* damage to you, others and/or the truck.
- CAUTIONS, which are in plain white boxes, explain things that may result in damage to the truck.
- *NOTES*, which appear in italicized type, are reminders of things you should be aware of regarding your *E-10*.

Solectria welcomes your suggestions for improving the *E-10* and/or this owner's manual. Call us or send a note with your ideas on how we can make this truck or manual better.

Happy clean air motoring!

2. BASIC GUIDELINES/DO'S & DON'TS

BASIC GUIDELINES:

Here are some basic things to remember about your EV. Many of these things are explained in greater detail later in the manual and this section is meant to serve only as an overview. While your EV may look like a conventional, gas-powered vehicle, it *is* different, so read on!

- There are no gears to shift when driving your Solectria EV, just one forward/off/reverse switch. The switch should be in the "off" position when starting the vehicle, then switched to forward or reverse to drive.

- You won't hear any engine noise when you start your *E-10* or whenever it is stopped. The only noise you may hear is low humming.

- You must push the accelerator pedal past the halfway point before the vehicle will begin to move from a stop.

- Unlike a gas-powered vehicle with a fuel gauge that shows a decrease as gas is used, your EV's amp-hour meter, which measures energy consumption, shows an increase as energy is consumed. In other words, the more energy your truck uses, the larger the numbers shown on the amp-hour meter and the closer your truck is to approaching the equivalent of "empty" in a gas-powered vehicle. For maximum battery life, **Solectria recommends not exceeding 45.00 to 50.00 on the amp-hour meter**. When your truck's battery is fully charged, the amp-hour meter will read 00.00 (similar to a full level on a gas gauge). *The meter may also show a negative number, which simply means that the batteries have been "conditioned" during charging*.

- Your EV has a power saver control that allows you to control energy consumption. For city driving, Solectria recommends turning the power saver knob to the "efficient driving" setting (9 o'clock position or lower) for adequate acceleration and maximum driving range. For highway driving, leave the power saver knob at "efficient driving." If you need to accelerate quickly, such as when entering a highway, you can increase the power saver setting momentarily to "power" to get to your desired speed rapidly. Once you have merged safely into the flow of traffic, return to the "efficient driving" setting to drive efficiently at highway speeds. For maximum efficieny, when driving at lower speeds on secondary highways for example, turn the power saver knob to the "cruise" setting.

- If your EV becomes sluggish when driving, this means it's operating in the "limp home" mode. In other words, there is very little charge left in the battery and the EV is conserving what little energy is left. The vehicle can still be driven between five and 10 miles at reduced speeds of 25-30 mph, but it must be plugged in as soon as possible to recharge.

- In addition to standard hydraulic brakes, your EV has regenerative braking (explained in detail later in the manual). When you take your foot off the accelerator, the truck automatically slows down -- similar to engine drag or downshifting in a gasoline-powered vehicle.

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- **ALWAYS** set the parking brake before leaving your vehicle. If the parking brake is not set, the vehicle may roll.

- For maximum performance and battery life, **your *E-10* should be plugged in whenever it is not in use**.

- Your *E-10* will never need gasoline, but it will need to be plugged in regularly to recharge. Always check that the batteries are charging once the truck is plugged in by making sure the green amp-hour light is blinking.

- Your EV will not operate if it is plugged in, so don't forget to unplug it before driving.

DO'S & DON'TS:

- Do use your *E-10* for on-road driving only. Never use the truck for off-road driving since this could cause serious damage to the vehicle and injure the driver and passengers.

- Do wash your *E-10* by hand as needed. Using a drive-through auto wash facility is also okay, but Solectria recommends handwashing whenever possible.

- Don't try to jump-start your *E-10* from another vehicle or jump-start another vehicle with your *E-10*. It is hazardous and will damage both vehicles. The *E-10's* main batteries are at a much higher voltage than a conventional truck's electrical system, and its 12-volt DC-DC converter cannot provide nearly enough amperage to jump-start a conventional truck engine.

- Don't use the *E-10* to tow a trailer. It is not designed to pull a significant load.

- Don't park over or near flammable materials. Although the *E-10* has no exhaust system, some electrical components may get very warm or hot.

- Please don't drink and drive or ride with someone who has been drinking. Drunken driving is responsible for some 18,000 motor vehicle-related deaths and over 300,000 injuries a year.

3. *E-10* SAFETY FEATURES

The *E-10* was designed to maximize performance while maintaining a high level of safety. It incorporates many safety features to help avoid or avert accidents and protect passengers if an accident occurs.

Neutral Interlock System: When the truck is first started, the *E-10's* drive unit will not operate if the forward/off/reverse switch is in either the forward or reverse position. To start driving, simply set the switch to neutral or "off" and then to forward or reverse as needed. You also may want to get into the habit of turning the switch to "off/neutral" whenever you turn off your vehicle.

Weight: Because of the roughly 1,200-lb. weight of the propulsion battery, the curb weight of the *E-10* is a few hundred pounds higher than the original Chevrolet truck from which it was converted. To improve stability and handling as well as crash safety, Solectria deliberately and carefully located the battery boxes as low as possible on the truck frame, without significantly affecting vehicle ground clearance. This low center of gravity of the battery and the vehicle improves braking performance and stability during hard braking and in an accident, making the truck less likely to roll or pitch forward.

Brake Systems: The *E-10* is equipped with three types of brakes for efficient and effective braking under all road conditions:

1) vacuum-assisted power front disc brakes,
2) rear power brakes, and
3) rear regenerative or regen braking.

When the accelerator pedal is released, the motor controller immediately applies full regen braking power to the rear wheels, slowing the vehicle even before the hydraulic brakes are applied. Under extremely slippery conditions such as snow- or ice-covered roads, the regenerative braking function should be disabled from the cab--by switching the toggle switch to "slippery"--to prevent the rear wheels from sliding. Read *Regenerative Braking* in *SECTION 4, VEHICLE OPERATION* for more information about the regen braking feature. For more rapid braking with maximum braking power, the hydraulic brakes can be applied by stepping on the brake pedal.

Battery: The battery boxes in your *E-10* truck are made of high-strength aluminum and are secured with high-grade fasteners to the vehicle frame, outside the cab area. The battery is made up of sealed, starved-electrolyte battery modules which require no maintenance over the life of the battery. These modules are sealed to prevent the emittance of any dangerous fumes or gases from the battery. In the unlikely event that a module seal is broken, such as in an accident, the battery boxes are vented to release any gases that may build up. In addition, both battery boxes have high-current, in-line fuses to disconnect the battery in the event of an electrical short, accident or overcurrent system failure.

Air Bag/Seat Belts: The *E-10* is equipped with a driver's-side air bag. This airbag is provided by Chevrolet and is intended as a supplemental restraint system. Solectria strongly urges you and your passengers to always wear seat belts when driving or riding in the vehicle. Please familiarize yourself with the information provided in the Chevrolet S-10 manual regarding the operation, use and maintenance of the airbag system.

Charger Interlock System: As mentioned before, your *E-10's* drive unit will not operate if the truck is plugged in. You can, however, use the heater and most other accessories when it is plugged in. (Do not operate the air conditioner if the truck is plugged in.) Before driving, you can warm up the truck cab while the truck is plugged in without using any energy from the batteries; the charger will supply the power used by these accessories as long as the truck is plugged in.

4. VEHICLE OPERATION

The Solectria *E-10* was built to provide you with trouble-free commuting under normal urban driving conditions.

Although it drives and handles much like a conventional gas-powered vehicle, the *E-10* is different. This section covers the day-to-day operational features of the *E-10* and is divided as follows:

A. Layout of Vehicle Controls
B. Starting Your Vehicle
C. Driving the *E-10*, including Regenerative Braking
D. Range
E. Parking the Vehicle
F. Vehicle Charging
G. Comfort Controls/Audio System

A. LAYOUT OF VEHICLE CONTROLS

While most items in the *E-10* are similar to those in a Chevrolet S-10, there are a few items that are different. The features below are all grouped together in the black floor console located in the center of the cab, beneath the dashboard.

1) ***Ammeter*** -- The ammeter indicates the electrical current going out of or into the battery. During rapid acceleration, you may draw as much as 300 amps. During regenerative braking, the ammeter may go as low as -120 amps.

2) ***Voltmeter*** -- The voltmeter measures the voltage of the battery pack. It is normal for the voltmeter to fluctuate up and down as you change the demand for energy from the battery. An increase in current demand, for example when climbing a hill, will result in a decrease in battery terminal voltage. With no significant electrical load on the battery, the voltmeter can be used to provide a rough idea of the state of charge of the batteries. The “nominal” or average voltage of the truck is 144 volts.

3) ***Forward/Off/Reverse Switch***-- This black rotary switch replaces the gear-shift lever of your conventional automobile. There are no gears to shift in the *E-10*, only one position for "forward," one for "reverse" and one for neutral or "off." When the truck is first turned on, the switch must be in the "off" position before switching to forward or reverse and actually driving the vehicle. This neutral interlock feature prevents you from accidentally driving the vehicle when starting it.

4) ***Ampere-Hour Meter (Amp-Hour Meter)***-- Similar to a fuel gauge in a conventional vehicle, the amp-hour meter provides a highly accurate measure of electrical current used in your electric vehicle. As the truck draws current from the battery, the meter counts up and the red **OUT** light flashes, indicating energy consumption. When current is put back into your truck (during charging and regenerative braking), the meter counts down and the green **IN** light flashes, indicating energy storage. The rate that the lights blink corresponds to the amount of current going into or out of the battery pack. Note, the amp-hour meter works opposite of a gas gauge; i.e., when the battery is fully charged and the maximum number of amp-hours are available (similar to a full tank of gas), the amp-hour meter will read 00.00. For maximum battery life, Solectria recommends not exceeding 45.00 to 50.00 on the amp-hour meter. The lower the number of amp-hours discharged between charges, the longer the life of the battery.

5) ***Power Saver*** -- Instructions for use of the power saver are located in *SECTION 5, EFFICIENT DRIVING*.

6) ***Regenerative Braking Disable Switch***--See the regenerative braking information under "DRIVING THE *E-10*," later in this section.

B. STARTING YOUR VEHICLE

To start your *E-10*, be sure the charging cord is unplugged and the selector switch is off. Insert the key into the ignition, as you would in a conventional vehicle, and turn it forward in a clockwise direction to the "run" position. You do not need to turn the key to the "start" position. Since the truck is silent when it is not moving, you will not hear any engine noise. Also remember, you don't need to step on the accelerator when starting the truck as you do in a conventional gas-powered vehicle.

Each time the vehicle is turned on, the motor controllers perform a one- to two-second diagnostic check to make sure they are performing properly. Once the diagnostic is performed, the truck is ready to drive.

CAUTION

Don't accidentally break off the key in the ignition switch by attempting to "crank the starter."

C. DRIVING THE *E-10*

Now that the truck is ready to drive, you should select forward or reverse by using the "forward/off/reverse" rotary switch on the floor console.

NOTE

Remember, when the truck is first turned on, the switch must be in the "off" position before it is put into "forward" or "reverse." If the truck is in the "forward" or "reverse" position when the truck is turned on, you will need to turn it back to the "off" position, and then select "forward" or "reverse" before the vehicle will drive. This is a safety feature to prevent accidental driving when starting the vehicle.

To drive, step on the brake pedal while releasing the parking brake, then step on the accelerator pedal. Press down on the accelerator slowly at first, until you get a feel for the pedal. The first half of the accelerator's range is the regenerative braking region, explained in the following section. You must press the accelerator beyond the halfway point, down through this range, before the vehicle will begin to move. Once the truck is moving, you can regulate the vehicle speed with the accelerator pedal, which tells the motor controllers how much power to send to the motors. Remember, since the *E-10* has only one forward gear, you do not need to shift gears while driving. To extend your driving distance and the battery life, it is best to drive efficiently; see *SECTION 5, EFFICIENT DRIVING.*

Regenerative Braking

When you release the accelerator pedal past the halfway point, the motor controller switches to the regenerative braking or "regen" mode. This slows the vehicle and at the same time generates electricity to store in the battery. When regen braking is active, the green light on the amp-hour meter will blink. This tells you that the battery is recharging with the electricity produced from braking. This recaptured energy is used by the vehicle when you demand more power from the battery. In other words, regen braking extends the range of the *E-10's* battery.

To slow down smoothly during normal driving, release the accelerator more gently than in a conventional vehicle. For rapid or emergency braking, take your foot off the accelerator pedal quickly -- full regen braking will engage automatically. You can also apply the standard hydraulic brakes by stepping on the brake pedal, as in a conventional vehicle.

With careful driving, you should be able to eliminate frequent use of the brake pedal. Using the regular hydraulic brakes will give you fast deceleration for quick stops, but it rapidly uses up energy from the truck's forward motion in the form of heat and wear on the brake pads. In other words, this energy can't be used for driving the vehicle. Since regenerative braking recaptures this energy and stores it in the battery for additional use, Solectria recommends that you maximize the use of regen braking to slow the vehicle under normal driving conditions. This may require a slight adjustment to your driving habits so that most, if not all, deceleration is performed with regenerative braking.

Regen braking is connected to the truck's rear brake lights. As you release the accelerator past the halfway point, the motor controllers begin to apply regen braking and the green light on the amp-hour meter begins to blink slowly. Lifting your foot completely off the accelerator applies maximum regen and causes the motor controller to turn on the rear brake lights, indicating to the drivers behind you that the truck is actively braking. Regen braking can be turned off manually with the disable switch located on the floor console.

WARNING!

Under slippery road conditions, regen braking should be used cautiously. Regen applies braking to your rear wheels only, and under such conditions could cause wheel lockup and sliding. When road conditions are extremely slippery, such as on icy or snowy roads, regen braking should be disabled by turning the toggle switch to "slippery."

Once the vehicle slows to about three miles per hour, regen braking slowly releases, and the vehicle is free-rolling. Regen braking will *not* bring the vehicle to a complete stop or "hold" it on a hill; you must apply the hydraulic brakes, as in a conventional vehicle. Without the hydraulic brake on, the vehicle may roll.

Limp Home Mode: When the batteries reach a low state-of-charge (roughly 20 percent), the *E-10*'s drive system will protect them from harmful over-discharge and will begin operating in the "limp home" mode. The vehicle will become sluggish, to conserve what little power is left in the batteries, and can only be driven for short distance--approximately four to five miles--at reduced speeds of 25-30 mph. You may want to turn on the hazard lights while driving in the limp home mode. Once you reach your destination, the truck must be plugged in as soon as possible to recharge. Note, the hazard lights will continue to operate for an hour or more even after the batteries have become almost fully discharged. Under normal driving conditions (flat roads, mild weather, etc.) you can expect to consume one amp hour per mile with the maximum recommended discharge being 50 amp hours, therefore you should be able plan accordingly to avoid entering the "limp home" mode. Also note, as the truck's batteries age, the capacity (amp hours) available will decrease slowly.

D. RANGE

Your *E-10* uses highly efficient components and was designed to have the best range possible while still maintaining a safe vehicle weight. It was tested in the SAE 6034 driving cycle, a combination of urban and highway driving, and achieved a range of 56 miles. In a constant speed test at 45 mph, the *E-10* achieved a range of 75 miles. However, it has a significantly lower distance range than a gas-powered vehicle, so driving efficiently is crucial. See *SECTION 5, EFFICIENT DRIVING* for tips on driving more efficiently.

The distance you can drive depends on two things:

1) the amount of energy available, and
2) the efficiency of your driving.

The amount of energy available is determined primarily by the type and age of batteries that have been installed in your truck; please refer to the information supplied with your battery or contact Solectria for information on the amount of energy expected with the battery you have. Note, always keeping the vehicle plugged in whenever it is not in use will give you the highest range and longest battery life.

Following is the approximate range you can expect from your *E-10* in mild weather with minimal use of accessories.

- With gentle driving, keeping speeds under 45 mph and using the "efficient driving" power saver setting, you can expect to travel 50-60 miles and use approximately 50-55 amp hours.

- For mixed city and highway driving, using the "cruise" setting occasionally, you can expect to drive 40-50 miles and use roughly 45-50 amp hours.

- When driving hard, in hilly terrain or over 60 mph and using the "power" setting frequently, you can expect a range of 30-40 miles using approximately 40-45 amp hours.

E. PARKING THE VEHICLE

To park, bring the vehicle to a complete stop, turn the forward/off/reverse switch to "off" and set the parking brake. When parking on a hill, turn the wheels so that if the vehicle rolls, the front wheels will run into the curb. If parked facing up hill, turn the wheels away from the curb; if parked facing down hill, turn the wheels toward the curb. Turn the ignition key off and remove it. The vehicle is now secured.

WARNING!

Whenever the vehicle is parked, the PARKING BRAKE MUST BE USED to secure the vehicle, since the drive system will not prevent the truck from rolling.

F. VEHICLE CHARGING

One of the nicest benefits of being an EV owner is never again needing to pull into a gas station to fill up the tank. Since the *E-10* uses electricity stored in its battery as its source of energy, the vehicle must simply be plugged in to recharge.

Charging the vehicle is designed to be very easy. Your *E-10* truck is equipped with a charging system which operates in a range from 208-240V AC. To charge your vehicle, simply plug a heavy-duty 12-gauge, grounded extension cord into the charge port located on the side of the truck under the "gas" cap. Plug the other end into an appropriate electrical outlet rated for 20 amps.

WARNING!

Plugging into the wrong outlet could seriously damage the charger. The outlet used must be rated for 20 amps or more. The charger runs on either 208V or 240V. Use only heavy-gauge extension cords, minimum 12-gauge, with a grounding prong to prevent electrical shock or fire due to malfunction. Do not remove the grounding prong from the extension cord or use an ungrounded outlet. Failure to adhere to these instructions could result in electrical shock, fire and/or damage to the charging system and vehicle.

To avoid overloading an electrical circuit, plug the vehicle into a dedicated outlet on a circuit without other electrical loads. Make sure that the outlet you are using is rated for the amount of current the charger will draw. If you have any questions, please call Solectria at (508) 658-2231.

Once the truck is plugged in, the charger will turn on automatically. When the battery is charging, the green light on the amp-hour meter blinks, and the amp-hour meter counts down toward zero. The charger will turn off automatically when the batteries are fully charged. Leaving the vehicle plugged in after charging is complete will not harm the battery or the charger. In fact, for maximum performance and battery life, always leave the vehicle plugged in when not in use.

Under normal conditions, the charger will overcharge the batteries slightly, so the amp-hour meter will read between 0.00 and -5.00 when charging is complete. Once an electrical load is applied, for example when the interior light turns on, the meter will automatically reset to 0.00 to give an accurate measure of the total energy drawn from the battery.

Charger Tuning: The *E-10* chargers have been tuned at the factory for the specific battery in your truck, according to the battery manufacturer's recommendations. This means that the charging system provides the optimal charging sequence for your battery for efficient charging and long life of the battery. As new battery technologies are developed or as charging procedures are updated by battery manufacturers, Solectria can reprogram your *E-10's* charging system. To ensure that the charging system uses the proper procedure, please notify Solectria before replacing the *E-10* battery pack. For more on battery replacement, see Solectria's Service Manual.

Batteries: The standard *E-10* is equipped with lead acid batteries. Solectria recommends that you always keep the vehicle plugged in whenever you can. This ensures that the batteries stay at a high state of charge, prevents freezing problems during extended inactive periods in the cold and greatly extends

battery life.

For more information about recommended charging procedures for your specific battery, if other than lead acid, read the information supplied separately on the battery pack or contact Solectria for supplemental battery information.

Thermal Management System (Optional): Your *E-10* may be equipped with a thermal management system that allows it to operate more efficiently in cold weather. This system operates in conjunction with the charging system and, under cold-weather conditions, the EV should be plugged in whenever possible. You should also avoid leaving the EV unplugged for extended periods of time (i.e. four to six hours) in extremely cold temperatures.

G. COMFORT CONTROLS/AUDIO SYSTEM

Heating: To turn on the *E-10* electric heater, press the square red button on the floor console and turn the round heater control selector to heat, vent, defrost or other setting. The selector must be on in order for the heater to operate. You may regulate the amount of heat by controlling the fan speed. Solectria recommends setting the recirculate switch to "recirculate" for the most effective and quickest heating of the truck cab. If there is excessive humidity/fog inside the cab, use the "fresh air" setting to defrost the windows, then return the switch to "recirculate."

Preheat (Optional): Preheat is a system where the electric vehicle's heat is programmed to turn on at a certain time before you start a trip so the truck is warm and comfortable as soon as you get into the vehicle. Since the heater uses power from the wall outlet and not from the batteries, the range of the truck is not decreased. To run the preheat, make sure the truck is plugged in. Set the recirculate/fresh air control to "recirculate." Setting the vent selector to "defrost" rather than "vent" will clear the windshield when the preheat comes on, but the truck cab may not get as warm. Set the timer to "run," then set both output switches to "AUTO." The green light on the top right corner of the preheat display will turn on to show that the unit is ready and will now turn on preheat at the next programmed time. For timer setting instructions, refer to Solectria's "Preheat Quick Reference."

Air Conditioning (Optional): Turn the round heater/AC control selector on the truck's dash console to max, norm or bi-lev AC to start the air conditioning. Use the selector to direct the air to the desired location. Set the recirculate/fresh air switch to the "recirculate" mode to help cool the vehicle faster and reduce the drain on the batteries. To cool the cab, drive for the first few minutes with the air conditioning off and the windows open to disperse the hot air inside quickly; then close the windows and turn the air conditioner on to bring the cab to a comfortable temperature.

NOTE

Remember that both the heater and the air conditioner run directly off the battery. Using them will decrease your range by 10-15 percent or more depending on heating /cooling usage, driving conditions, etc.

Audio System (Optional): If your truck is equipped with a radio/cassette deck system, follow the stereo owner's manual for the unit, provided with your vehicle (in the glove box).

5. EFFICIENT DRIVING

Solectria's *E-10* trucks have been carefully designed to provide good performance in city and highway driving. The tips in this section allow you to get the best range possible, achieve longer battery life and conserve energy.

CRUISING

For maximum efficiency, accelerate gradually to the desired cruising speed, then try to maintain a constant speed. Stopping and starting uses a considerable amount of energy even with the regenerative braking feature. Anticipate the need to slow down so that deceleration is gradual and sudden stopping is averted as much as possible. When accelerating, use the amp-hour meter as a guideline; driving at lower currents means a prolonged battery life. Operating with the power saver at the "efficient driving" setting (9 o'clock position) or less is the most efficient way of driving and accelerating.

Maintain a slow, steady cruising speed. The energy consumption of your *E-10* truck increases dramatically with speed. The following graph demonstrates

this effect on energy consumption at various cruising speeds. Slower cruising speeds save energy and extend vehicle range and battery life, and also save lives.

Your energy consumption will depend on your particular driving habits and driving conditions. Note that the truck uses twice as much power to cruise at 65 mph as at 50 mph.

For maximum efficiency while highway driving, your speed should range from 45-50 mph. Once you are traveling at highway speeds, you should be able to cruise using no more than 100 amps on the ammeter gauge.

ACCELERATION

The *E-10* has been equipped with good acceleration capability for safety and enjoyment. Although using the full acceleration often does not significantly increase wear on any electronic or drive train components, it takes a toll on the batteries and causes the vehicle to use more energy, thereby decreasing the truck's range. Typically, the faster you discharge the vehicle's battery, the less energy or amp-hours the battery can provide, so that high-power and high-acceleration driving not only uses up the battery's energy more quickly but also decreases the total amount of energy available from the battery. Because of this effect, "hot rodding" (i.e., accelerating and stopping frequently) can decrease the vehicle range by as much as 30 percent or more.

To maximize your range and efficiency, accelerate gently and anticipate slow downs to enable you to decelerate gradually. Decelerating gradually will allow you to get the most benefit from regenerative braking. A practiced driver, under normal driving conditions, should be able to decelerate using only the regenerative braking. This will save wear and tear on the truck's brake pads.

POWER SAVER CONTROL

The power saver control knob limits the current drawn from the battery by the controller. This current limit reduces the maximum power output of the motor, and therefore limits the effect of "jack rabbit" starting. It has three marked settings--power, efficient driving and cruise--with variable settings in between.

Frequently using the "power" setting (12 o'clock position or higher) can reduce the vehicle's efficiency considerably. With the high-power acceleration and high-speed driving capacity of the *E-10*, the truck may use as much as 1.5 to 2 amp-hours per mile, or up to 50 percent more than consumption at a more restricted, efficient power saver setting such as "efficient driving" or "cruise." The "power" setting is best used for quick acceleration, such as when entering highways. Once you have merged safely with the flow of traffic, set the knob back to the "efficient driving" mode. (Note, if you can comfortably, accelerate at the "efficient driving" setting rather than the "power" setting.)

Turning the power saver knob to the "efficient driving" setting (9 o'clock position or lower) increases overall energy efficiency while lowering vehicle performance. For maximum benefit, Solectria recommends that you put the power saver at the "efficient driving" setting while maintaining a level of comfort for your driving needs. For long trips, it is important to drive energy-efficiently, monitor your energy use, and keep the power saver control at the "efficient driving" or "cruise" settings, using "power" only as needed to accelerate.

HILL CLIMBING

Hill climbing is an energy-intensive task. However, the more slowly you climb, the less power is required. To be efficient, it is recommended that you climb hills slowly, whenever possible. If the vehicle's performance is too low, turn the power saver knob to "power" momentarily while climbing the hill and then back to "efficient driving" when descending the hill.

The red light on the battery level/amp-hour meter flashes quickly when the truck is using power at a fast rate and slowly when the truck is using less power. The lower the power used, the more range you will get per battery charge. As a rule, try not to let the red light blink so quickly that it appears to be solidly lit for extended periods of driving. This indicates that you are using excessive power and are not driving efficiently! The slower this red light blinks, the more miles you will get per charge.

TIRE MAINTENANCE

Keep tires fully inflated. Under-inflated tires use significantly more energy with each mile driven and reduce the vehicle's range.

6. MAINTENANCE SCHEDULE

Routine maintenance helps ensure that your vehicle is safe to drive at all times and maximizes the life of the truck. It is possible that you may use your truck more, or in worse conditions than are anticipated by this maintenance schedule, but the schedule should be adequate for normal commuting and around-town driving.

NOTE

If you drive often in dusty or salty conditions, or in heavy rains, inspect and lubricate the chassis and drive shaft twice as often.

The schedule below is specifically designed for trucks that:

- carry passengers and cargo within the legal limits. (The limits can be found on the edge of the driver's door.)
- are driven on reasonable road surfaces.

RECOMMENDED MAINTENANCE SCHEDULE AND EXPLANATION FOR *E-10* TRUCK:

A) Chassis lubrication and inspection: Every 6,000 miles or six months lubricate front suspension, ball joints, steering linkage, parking brake cable guides, universal joints and brake pedal springs. Inspect front and rear suspension and steering system for damaged parts, signs of wear or lack of lubrication. Inspect power steering lines and hoses for cracks, leaks or chafing. Make sure drive belt between power steering motor and unit is not frayed or chafed. The drive belt is purposely loose. You should have a 1/4-inch deflection when a slight force is applied to the center of the belt span.

B) Drive shaft lubrication: Every 6,000 miles or six months lubricate U-joints and splines of drive shaft.

C) Driveline service: Every 6,000 miles or six months check rear axle and drive hub fluid level and add fluid as needed. Check fluid level using level window on rear axle and plug on side of drive hub. Refill as needed.

D) Drive belt inspection: First at 1,000 miles, then every 6,000 miles or six months thereafter, inspect drive belt for tension and wear. Belts should have deflection of 1/4 -inch when a five-pound force is applied at the center of the span section. Adjust/replace if necessary.

E) Tire and wheel inspection/rotation and brake inspection: First at 6,000 miles, then every 12,000 miles, check tires for uneven wear or damage. If you see irregular or premature wear, check wheel alignment. Check for damaged wheels as well. For long wear and maximum tire life, rotate tires every 12,000 miles or 12 months. Also, keep tires fully inflated for higher efficiency and better vehicle range.

While tires and wheels are removed for inspection, perform brake system inspection. Inspect lines and hoses for binding, leaks, cracks, chafing, etc. Inspect disc brake pads for wear and rotors for surface condition. Inspect drum brake linings for wear and cracks. Inspect other brake parts, including drums, wheel cylinders, parking brake, etc. Check parking brake adjustment. Brakes may need to be inspected more often if your driving habits or conditions result in frequent braking. (If you are careful and use regen braking whenever braking is required, it will result in less wear on conventional brakes and less maintenance expense.) Check the brake fluid level.

NOTE

A low fluid level can indicate worn disc brake pads which may need to be serviced. Also, if a brake warning light comes on or flashes at any time, something may be wrong with the brake system. Have it inspected and repaired at once.

F) Drive belt replacement: Every 24,000 miles or two years replace drive belts connecting motors to center pulley. Check all components for wear. Note: Belts should not be tight, just snug so that there is a 1/4-inch deflection when five pounds of pressure is applied halfway between the pulleys. (Call Solectria for replacement part information.)

G) Front wheel bearing repack: Every 30,000 miles clean and repack front wheel bearings (or at each brake relining, whichever occurs first.)

H) Drive axle and hub service: Every 24,000 miles or three years completely drain fluid and refill rear differential and drive hub.

Maintenance Locations: Maintenance of truck body, disc and drum brakes, wheels, tires, front suspension, etc. can be performed at any service station or Chevrolet S-10 dealer. Electronic and electric drive system maintenance MUST be performed by Solectria or a Solectria-approved repair facility. Solectria's main facility is located at 68 Industrial Way, Wilmington, MA 01887. See *SECTION 7, WARRANTY/REPAIR* for more information on maintenance and repairs.

RECOMMENDED OWNER INSPECTIONS:

The following inspections should be conducted by the owner regularly, at the intervals recommended below.

A) Every month of truck operation:

- Windshield washer fluid level -- check windshield washer fluid level in windshield washer tank and add fluid as needed.

- Tire wear and inflation -- check tires for proper pressure; if they appear low, inflate to the maximum level as specified on the tire sidewall.

B) Four times a year:

- Tailgate and bed hinge lubrication -- lubricate tailgate latch bolt, handle assembly pivot points and hinges with lubricants recommended on the list at the end of this section. Also, lubricate bed hinges.

C) Once every year:

- Key lock -- lubricate key lock cylinders with lubricant specified on "List of Fluids and Lubricants" at the end of this section.

- Body lubrication -- lubricate all body hinges, latches and locks (doors, hood, charging port door and glove box). Lubricate seat adjustment hardware. More frequent lubrication may be required when exposed to a corrosive environment.

- Steering column lock -- while parked with parking brake set, turn key to LOCK and make sure steering wheel is locked. Turn key to ON and make sure steering wheel has full play.

- Parking brake mechanism -- With vehicle parked facing down hill, apply brake pedal and set parking brake. Turn the key on and the forward/off/reverse rotary switch to "off," so motor is not applying any braking or motive force to the vehicle. Slowly lift foot from brake pedal. Continue until vehicle is secured by parking brake only.

WARNING!

The vehicle could move during this check. Make sure there is sufficient room in front of the vehicle so that, should it roll, you could stop it with the foot brake without injury to people or damage to property.

- Hood latch operation -- pull hood release inside the truck. Secondary latch should keep hood from opening all the way. Make sure hood closes firmly.

- Lap and shoulder belts condition and operation -- inspect all of the components of the seat belt system for proper operation. Pull the webbing all the way out and replace if damaged or frayed.

- Underbody flushing -- at least once every spring, use plain water to flush any corrosive materials from the underbody. Take care to thoroughly clean any areas where mud and other debris can collect, being careful not to spray water into the battery box, directly at the motor or onto electrical connections.

LIST OF FLUIDS AND LUBRICANTS

Hydraulic Brake System	Delco Supreme 11® Brake Fluid (GM Part No. 1052535 or equivalent DOT-3 brake fluid.)
Power Steering System	GM Power Steering Fluid (GM Part No. 1050017 or equivalent) conforming to GM Specification 9985010
Key Lock Cylinders	Lubricate with Multi Purpose Lubricant (GM Part No. 12345120) or synthetic 5W-30 engine oil.
Chassis Lubrication	Chassis lubricant (GM Part No. 1052497 or equivalent) or lubricant meeting NLGI Grade 2, Category LB or GC-LB.
Front Wheel Bearings	Wheel bearing lubricant meeting requirements of NLGI Grade 2, Category GC or GC-Lb (GM Part No. 1051344 or equivalent)
Rear Differential	Axle Lubricant SAE 75W-90 GL-5 synthetic Gear Lubricant
Drive Shaft	Chassis lubricant (GM Part No. 1052497 or equivalent) or lubricant meeting NLGI Grade 2, Category LB or GC-LB.
Rear Pulley Hub	Fill with SAE15W-40 or 10W-30 motor oil
Hood Latch Assembly a) Pivots and Spring Anchor b) Release Pawl	 Engine Oil Chassis Lubricant (GM Part No. 1052497 or equivalent) or lubricant meeting requirements of NLGI Grade 2, Category LB or GC-LB.
Weatherstrip	Silicone grease (GM Part No. 1052863) or equivalent.
Tailgate Handle Pivot Points, Hinges, Latch Bolt and Linkage, and Bed Hinges	Multi-purpose lubricant meeting requirements of GM Part No. 9985164
Weather Strips	Spray-A-Squeak (GM Part No. 1052277)

7. WARRANTY/REPAIR

We want you to be completely satisfied with your new *E-10* pickup truck. Solectria has and intends to maintain a very high customer satisfaction record. The mechanical and electronic components we engineer, manufacture and install are designed for many years of nearly maintenance-free use in a demanding mobile environment. In the unlikely event that the need for warranty service should arise, use your vehicle warranty policy as a guide in correcting the problem.

To get the best performance from your truck, it is very important that you fully understand how to operate it properly. Reading this manual and the Owner's Manual prepared by the original vehicle manufacturer (Chevrolet/General Motors Corporation) in their entirety will help you get the most out of your EV.

Solectria offers three warranty options. The Standard One-Year Warranty, detailed below, is provided at no additional charge upon purchase of a vehicle from us. A Comprehensive One-Year Warranty and a Comprehensive Three-Year Warranty offering additional coverage are available, and you may contact Solectria for more information regarding these extended warranties.

If you ever have any questions about this warranty policy or maintenance and repair information in general, please contact Solectria at (508) 658-2231 for assistance. Your comments and concerns are very important to us.

Warranty Specifics:

No warranty repairs can be administered without prior approval from Solectria.

This warranty policy applies only to the original owner of the vehicle and is not transferable.

This warranty policy applies only to customers located in the United States.

The terms and conditions of this warranty are subject to change without notice.

Solectria Corporation reserves the right to make changes, improvements and alterations in subsequent vehicles that it builds without incurring the obligation to make similar changes on earlier Solectria models and without notification to current or former customers.

Exclusions -- What's Not Covered:

All OEM vehicle parts (i.e., parts produced by General Motors or its subsidiaries) are covered to the extent that your GM dealer is willing to cover them. No warranty is expressed or implied on any GM parts. (In our experience, most GM dealers will perform warranty-related work.)

None of the following wear items are covered by any of Solectria's warranty options:

- Batteries.
- Drive belt(s).

- Extension cord.
- Plug.
- Brake linings, pads, drums and rotors (except for brake parts when required in conjunction with repair to a covered part).

Under no circumstances does this warranty cover routine maintenance or damage caused by misuse, accident, alteration, lack of maintenance, or use of incorrect lubricants. Routine maintenance includes all work covered in *SECTION 6, MAINTENANCE SCHEDULE* of this manual and in Solectria's Service Manual. Whenever maintenance is performed, keep all records and receipts in one place.

This warranty also does not cover damage or corrosion due to after-market products, environment or chemical treatments. Additionally, coverage does not apply if the odometer has been disconnected or the mileage reading has been altered.

Use of charging equipment other than that designed and installed by Solectria, particularly rapid charging equipment operating at power levels above 3kW, will void the warranty on any components which could be affected by the charging of the vehicle.

This warranty is void if any component or vehicle body labeling or emblems are removed. Finally, opening or tampering with any electronic component will void the warranty on that component and may void the entire warranty. Electronic components include the following: motor controller, DC-DC converter, battery charger(s), amp-hour meter, motor(s), air conditioner motor and controller, and power steering motor and controller.

Standard One-Year Warranty:

The Standard One-Year Warranty is offered at no additional charge to all customers. This warranty shall pay for the repair or replacement , at Solectria's discretion, of any covered part that is defective in materials or workmanship in the manner described below. Complete coverage applies, at no charge, to any vehicle defect that is due to materials or workmanship by Solectria, occurring within the first 12 months or 12,000 miles of vehicle ownership, whichever comes first, with the following exception.

The electric motor, including motor casing, stators, rotors, wiring, shaft, shaft seals and lubrication is warranted for three years or 36,000 miles, whichever comes first, regardless of which warranty option is chosen. Coverage of this item is **not** extended beyond the initial three years or 36,000-mile period under any of the warranty options.

Parts covered under this warranty include the following:

- Electronic motor controller - case, electrical connections, electronic circuitry.
- Transmission - transmission case and all internal parts, seals and gaskets, pulleys and shafts (not including drive belt/s).
- DC-DC converter used for 12V accessories operation - whole DC-DC converter and wiring harnesses.
- Battery charger - charger box, electrical connections, internal circuitry (extension cord or plug not included).
- Steering - rack and pinion steering unit, steering gear housing , linkages, main and intermediate steering shafts and couplings, power steering motor, power steering controller, power steering pump and hoses.
- Front/rear suspension - upper and lower control arms, upper and lower ball joints, king pins and bushings. (Front and rear end alignments, wheel balance and

shock absorber replacement /repair not included.)

- Brakes - master cylinder, calipers and wheel cylinders, combination valve, all lines and fittings, backing plates, springs, clips and retainers, self adjusters, parking brake linkage, cables, brake components and vacuum pumps. Excludes linings, pads, drums, and rotors (except when required in conjunction with repair to a covered part).
- Air conditioning - compressor and compressor seals, condenser, evaporator, pulley and heater blower.
- Corrosion (rust through) coverage - any body sheet metal panel that rusts through due to corrosion. Sheet metal panels may be repaired or replaced.

The cost of labor involved in diagnosing and servicing the vehicle, including the removal and reinstallation of components, is not covered. However, during the first 90 days, any labor fees incurred by Solectria personnel will be waived. Pre-approved labor fees incurred by others who perform warranty repair during this 90-day period will be reimbursed by Solectria at a rate not to exceed $60 per hour. Reimbursement of labor costs will occur only after a reasonable effort is made to address the problem by telephone. All repairs by non-Solectria personnel must be pre-approved in writing by Solectria. Failure to obtain advance authorization will void this warranty.

Following the initial 90-day grace period, all labor incurred by Solectria or service representatives acting on behalf of Solectria for the diagnosis of the problem or the removal or reinstallation of the component(s) will be billed to the customer at Solectria's current basic service rate, $60 per hour as of June, 1995, and will be billed at Solectria's standard labor times for the specific task. All labor required for the actual repair to the faulty component will be covered in full for the first year or 12,000 miles, whichever comes first.

Technical support by telephone is available at no charge during the initial 12-month or 12,000-mile period, whichever comes first. Technical support by telephone after this period may be billable depending on the level of service requested.

All vehicle components are designed to be completely modular in nature. Most are easily removable following disconnection of a few connectors, bolts and/or plugs. All servicing should be done only by trained and qualified personnel.

If diagnosis cannot be completed by reference to this Solectria Owner's Manual or to the Maintenance Manual, please contact an authorized Solectria service center for further assistance and for Solectria's decision as to the most appropriate way of resolving the specific problem. Any cost to the vehicle owner associated with the diagnosis of a problem is generally not reimbursable.

In many cases, telephone advice can be sufficient to resolve the problem. If telephone diagnosis proves unsuccessful, the customer is responsible for the cost of returning the faulty unit or vehicle to an authorized Solectria service center. In most cases, this will be to Solectria's main facility at 68 Industrial Way, Wilmington, MA 01887. The cost of returning the unit or vehicle is not reimbursable. Once the faulty unit is returned, Solectria will either repair or replace the defective unit at Solectria's discretion. Solectria will assume the responsibility and expense of returning the unit to the customer.

Turnaround time of repairs will be kept to a minimum and will be done on a "good faith, best effort" basis.

WARRANTY REPAIRS & MAINTENANCE:

NOTE

No warranty repairs can be performed without prior approval from Solectria. Warranty repairs must be performed by an authorized dealer or service division.

How To Get Warranty Repair Approval --

- Contact Solectria Corporation at (508) 658-2231 and report the warranty repair needed.
- Once you receive written approval for the repair from Solectria--via fax or letter--have the truck serviced by an authorized facility.
- Send the repair receipt/s to: Solectria Corporation, 68 Industrial Way, Wilmington, MA 01887, and your reimbursement will be mailed to you.

Who Can Service Your Truck? --

- **Solectria Technicians --** Service on electric and electronic components should be done by Solectria technicians or Solectria-approved, trained mechanics in your area (who are familiar with your truck's drive system and other Solectria electronics/systems). These components include the motor, controller, gearbox, belt drive, batteries, 12-volt DC-DC converter, amp-hour meter, heater, air-conditioner motor and motor controller (if installed), power steering motor controller and brake vacuum system.

NOTE

Only Solectria Corporation or Solectria-approved service centers will be able to repair major electrical components. Do not attempt to open or repair "damaged" components. Doing so will completely void the warranty on that part.

Once information on a non-functioning, warranted component is phoned or faxed to Solectria, Solectria will send you a replacement part as as soon as possible.

CAUTION

Any removal and re-installation of components must be performed by a trained technician. Most Solectria components are modular (can be removed by disconnecting a few contacts or loosening a few screws). Before removing any item, call us with information on the problem. After receiving authorization to remove the component in question, make sure a trained technician is on hand to remove the item. When disconnecting contacts, confirm that the technician knows exactly how to reconnect parts since incorrect wiring reconnections can damage components. Promptly package the component and send insured via UPS to Solectria (Solectria will reimburse all shipping costs).

- **Service Station or Chevy Dealer --** Brakes, body work, wheels, tires and the air conditioner compressor and condenser can be serviced by any service station or Chevrolet dealer. Routine maintenance and repairs may be performed by any qualified service outlet. Note: Chevrolet dealers are probably the best source for all conventional truck parts.

If you are not in the area and are unable to bring your truck to our Massachusetts facility, you may use an authorized facility after contacting us first to approve all necessary repairs.

Regular maintenance receipts should be retained in case questions arise concerning maintenance. Receipts should be transferred to subsequent owners of the truck. Solectria reserves the right to deny warranty coverage if the vehicle has not been properly maintained, however, this decision will not be based solely on the absence of maintenance records.

8. TROUBLESHOOTING GUIDE

This section is designed to give you some guidance on what to do if you suspect or know that something is wrong with your *E-10* pick-up truck. You are strongly cautioned not to open the motor controller, the DC-DC converter or any other sealed piece of electronic equipment. Doing so could damage the truck and cause severe injury to yourself.

Below are some common problems and how to address them.

TRUCK WILL NOT START

- First, check the amp-hour and voltage meters to make sure you have power. The amp-hour meter should be near zero after charging and the voltage should be over 150V DC.

- Make sure that you have unplugged the truck—it will not start if the truck is plugged into a charging outlet.

- Have you tried driving it? Remember, you don't hear any noise when the truck is on. Also remember that the accelerator pedal must be pressed down more than halfway before the truck will move.

- Check to see that the key is inserted in the ignition switch and the switch is in the "on" position. If you are not sure, turn everything off, including the forward/off/reverse switch. Wait a few seconds, then insert the key, turn to "run" and release (it should now be at the "on" position), and wait one to two seconds more.

- Turn the rotary switch on the console to the "off" position, then to the "forward" or "reverse" position.

- Are the accessories, such as headlights, power steering, radio, etc., working?

- Release the parking brake fully. (Note: If you are on a hill and starting up it, you will not want to release your parking brake until you push down on the accelerator and feel the truck straining against it.) Always keep your foot on the conventional hydraulic brake whenever you release the parking brake.

- Your truck should now drive. If it still doesn't, the problem could be mechanical or electrical. Listen carefully for the whine of the motors and controllers as you depress the accelerator. If you can hear the motors spinning fast but the vehicle does not move, you may need to replace the drive belts. At this point, you will need an experienced mechanic or will need to contact a Solectria repair facility.

- If the motors do not spin at all, the problem is electrical. In this case, we recommend contacting a Solectria repair facility which will check all electrical connections from the battery box to the motors.

WARNING!

WORKING WITH HIGH VOLTAGE SYSTEMS IS DANGEROUS, AND CAN RESULT IN SERIOUS INJURY IF DONE IMPROPERLY. IT MUST ONLY BE ATTEMPTED BY TRAINED TECHNICIANS. PLEASE CALL SOLECTRIA AT (508) 658-2231 BEFORE ATTEMPTING ANY ELECTRICAL REPAIRS OR INSPECTIONS.

TRUCK WILL NOT CHARGE

- If you have plugged your truck into a wall outlet and the green light on your amp-hour meter is not flashing after 5-10 seconds, this indicates that you are not getting any power to your battery. Unplug your truck.

- Check the outlet to make sure it is getting power by testing it with an AC voltmeter or other test instrument. If the circuit breaker tripped or the fuse is blown, make sure the circuit is rated for the power that the chargers require (20 amp rating circuit breaker).

- Make sure that all chargers are plugged in.

- Listen for a clicking noise in the chargers when plugging the truck in. Listen for the charger cooling fans to turn on after 5-10 minutes. If either occurs, indicating that the charger is receiving power, check the amp-hour meter. If the green light is not flashing, watch the numbers on the counter. If they are decreasing, then the truck is being charged, but the green light is defective. Call Solectria for repair information.

- With the AC line disconnected, unplug the charger DC lines (Molex connector with white and green wires) and check for voltage on the truck side with a DC voltmeter. If no voltage registers, the fuse labeled "chargers" in the DC junction box under the hood is blown. Replace the fuse.

- If the truck still is not charging, call Solectria at (508) 658-2231.

BATTERIES ARE NOT RECHARGING OR ARE NOT HOLDING A FULL CHARGE

- This may be due to improper or insufficient charging. Please call Solectria at (508) 658-2231 for more assistance.

NOTE

Rough driving can cause damage to batteries which may not be visible on the outside. Internal damage may cause the batteries to have a shorter life and reduced charging ability.

9. REPORTING SAFETY DEFECTS

How To Report A Safety Defect:

If you believe your vehicle has a defect which could cause a crash, injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) by calling the Auto Safety Hotline toll-free at 1-800-424-9393 (or 366-0123 in the Washington, D.C. area) or writing to: NHTSA, U.S. Department of Transportation, Washington, D.C. 20590. You can also obtain other information about motor vehicle safety from the hotline.

If NHTSA receives similar complaints, it may open an investigation and, if it finds that a safety defect exists in a group of vehicles, it may order a recall

and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Solectria.

In addition, notify Solectria Corporation, in lieu of General Motors, by calling (508) 658-2231, or writing to: Solectria Corporation, 68 Industrial Way, Wilmington, MA 01887.

10. HOW YOUR EV WORKS

What makes your electric vehicle different from a gas-powered vehicle? Read the section below for a better understanding of how your EV works. This section isn't required reading to operate your *E-10* and is included simply for your information.

DRIVE SYSTEM

The electric drive system is what makes the *E-10* unique. It consists of the batteries, motor controllers and motors.

Batteries: A large black battery box (visible under the truck bed) houses most of the battery, which is located directly below the controllers. The remainder of the battery is located in a smaller battery box under the hood. These two battery units are connected in series to form the battery pack which stores the energy your truck uses, much as a fuel tank does on a conventional vehicle. Standard Solectria *E-10* trucks are equipped with sealed, starved-electrolyte lead acid batteries which are maintenance-free. *E-10* battery voltage is 144V DC.

The battery boxes may be equipped with Solectria's optional battery thermal management system, which maintains a warm battery working temperature in cold weather. This system is critical for maintaining vehicle range and life of the battery in cold weather. Since lead acid batteries can freeze under extremely cold conditions, especially at low states of charge, it is best to keep the truck plugged into an AC outlet during subfreezing temperatures to maintain a fully-charged battery and optimal battery temperature.

When you step on the accelerator, an electronic signal is sent to the controllers, which then convert DC power from the battery to AC power of an appropriate form to drive the motors (or vice versa in the regen braking mode). This turns the drive shaft, which drives the wheels directly. Solectria's efficient AC induction motors and controllers produce sufficient torque at low speed and spin fast enough (up to 14,000 rpm) that a single gear ratio is adequate for all normal driving conditions. Therefore, the *E-10* does not have separate gearing and does not require "shifting gears" automatically or manually. Thus, unlike most gas vehicles with multiple gears, the speed of the *E-10* pickup is determined solely by the speed of the motors.

Solectria's *E-10* drive system is highly efficient, ranging between 75-92 percent overall for the motor controller and motor. In spite of this high efficiency, the motor and controller will produce heat under high power requirements. Controllers are equipped with thermally-switched cooling fans to maintain operating temperatures under heavy load. Under extreme conditions of hot weather and extended high power demand, the motor or controller may reach its maximum operating temperature and shut down to protect the electronics in the controller. Once the motor or controller has cooled after a few minutes, it will automatically restart and allow the truck to be driven.

The *E-10* will provide consistent performance throughout most of the discharge cycle of the battery. As the battery reaches a 20 percent state-of-charge, the motor controller begins to limit the current available from the battery to prevent irreversible damage being done to the battery. The *E-10* will operate under this progressively diminishing performance or "limp home" mode for four to five miles. Once the battery reaches approximately 10 percent state-of-charge, the motor controller will shut down and the vehicle will not move in order to protect the battery. Note, since the hazard lights use very little power, they will continue to operate for an hour or more even though the battery is almost fully discharged.

Motor Controllers: The "brains" of the system are housed in the highly efficient Solectria AC motor controllers mounted under the truck bed, on top of

the rear battery box (see diagram on page X). They control and coordinate all functions of the electric motors, regenerative braking and the battery during vehicle operation.

Motors: The drive motors are the two silver cylinders with cooling fins, mounted at the rear of the truck under the bed. These motors propel the truck or slow it down during regenerative braking by converting the energy of vehicle motion directly into electricity (as regulated by the motor controllers). Each motor is connected by a wiring harness to one of the controllers. The motors operate in parallel and drive the rear wheels via drive belts, connected by the drive shaft to the differential. The belts are protected by a cover, which can be removed for servicing.

All of the *E-10's* electrical drive components (i.e. the battery, motor controller and motor) and interconnecting wiring are potentially at or above the nominal battery voltage of 144V. In addition, the battery charger, amp-hour meter shunt, DC-DC converter, input cables, air conditioner motor and controller cables and heater cables are all at the high voltage of the battery pack.

WARNING!

Although the high voltage circuit is completely isolated from the vehicle chassis and the 12V DC system, extreme caution must be exercised whenever handling any high voltage component. All servicing of high voltage components must be performed by experienced, qualified service personnel. Treat all connectors and conductors as live until they are verified to be de-energized by proper monitoring equipment. Failure to follow these rules may result in electrical shock, fire, damage to the vehicle and other property and possibly death. Whenever you have electronic problems or traction battery problems, please notify Solectria or a Solectria representative before attempting to make repairs on your own.

WARNING!

The truck bed can be tilted up to gain access to the AC motors, controllers and the rear battery box. This procedure should only be performed by authorized, trained fleet service personnel. A MINIMUM OF TWO SERVICE PERSONNEL IS REQUIRED TO LIFT THE BED; NEVER ATTEMPT THIS MANEUVER ALONE. NEVER LEAVE THE BED UP WITHOUT THE PROP ROD IN PLACE. NEVER MOVE OR JACK THE VEHICLE WITH THE BED RAISED. DO NOT LIFT THE BED WHEN THE TRUCK IS PARKED ON AN INCLINE OR IN WINDY CONDITIONS. FAILURE TO HEED THESE WARNINGS COULD RESULT IN SERIOUS INJURY OR DEATH.

POWER STEERING

Your truck is equipped with power steering, provided by a brush permanent magnet motor and controller located under the hood. This motor powers a power steering pump in a similar manner to a gasoline engine vehicle.

POWER BRAKES

The *E-10* hydraulic service brakes are power-assisted, using the original Chevrolet power brake assembly. The vacuum for the power brake system is provided by a vacuum pump and a vacuum canister.

DC-DC CONVERTER

The electrical accessories in the *E-10* truck are powered indirectly by the main traction battery through the DC-DC converter, which provides 12V power for lights, radio, etc. The 12V system is chassis-grounded, as in gasoline vehicles, and is completely isolated from the high voltage electrical system.

HEAT

The vehicle is heated by an electrical resistance element and a circulation fan.

11. GLOSSARY OF EV TERMS

ammeter - an instrument for measuring the strength of an electric current in terms of amperes
ampere (amp) - the standard unit for measuring the strength of an electric current
amp-hour - the rate at which current is consumed
DC-DC converter - converts truck's high voltage battery to 12V DC for use in many of the truck's accessories
efficiency - the percentage of energy output of a device as a function of input
electric vehicle - vehicle powered by electricity
energy density - the amount of energy per battery mass
isolation - a condition in which there is no conductive path between two elements
lead acid batteries
limp home mode - safety feature to protect battery from harmful overdischarge by conserving available energy
motor controller - electronic device to drive and control motor, driven from batteries
NiCad batteries
power saver control - feature allowing vehicle operator to control amount of energy drawn from motors depending on driving needs
psi - refers to pounds of air pressure per square inch in a tire, for purposes of this manual
range - distance that can be travelled on a single charge
regenerative braking - braking that allows the motor to act as a generator to put energy back into the battery as a method of slowing down the truck
voltage - electromotive force, or diffical potential, expressed in volts
voltmeter - instrument used to measure voltage
watt hours per mile - energy used from the battery (DC) or from wall charging (AC) per miles driven

12. INDEX

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