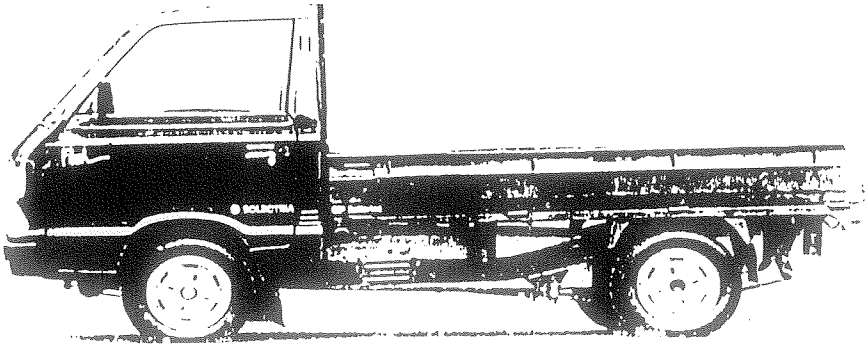
OWNER'S MANUAL

1st Edition

1999 SOLECTRIA *FLASH*

144V Lead Acid



PLEASE READ ALL INSTRUCTIONS BEFORE OPERATING THIS VEHICLE!

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I. EMERGENCY RESPONSE/SAFETY INFORMATION

WARNING!

DO NOT USE WATER ON ANY FIRE IN AN ELECTRIC VEHICLE WITH LEAD-ACID BATTERIES!

SEE NEXT PAGE FOR FIRE PROCEDURES

If the vehicle is charging and involved in an accident or is charging and appears to be on fire or smoking, unplug the vehicle or turn off the circuit breaker to the charging circuit.

If this vehicle is involved in a serious accident, a system of internal fuses are designed to protect personnel and prevent damage to vehicle components.

If the vehicle appears to be in a dormant condition, no further action is required to stabilize the vehicle other than turning off the ignition key. Note that when the ignition key is turned off, battery power to the motor controller is shut off. However, the DC-DC converter, the battery charger, the amp-hour meter and the heater continue to remain at the full pack voltage.

If the vehicle is giving off smoke and the cabin can be entered safely, then perform the following steps:

1. **Disconnect the red Service Disconnect** located under the engine service cover in the cabin, near the fuse boxes on the passenger side of the vehicle (see Diagram in Owner's or Service Manual). This will shut off all high voltage supplied from the battery pack to all vehicle components – except the battery charger.

2. **Disconnect the separate black Service Disconnect** (under the fuse boxes in the same vicinity as the red Service Disconnect) to disconnect the battery charger from high voltage.

3. **Disconnect the gray main motor controller connector.**

Once these three steps are completed, all vehicle components are now disconnected from the high-voltage battery pack.

FIRE PROCEDURE

If the battery compartments appear to be on fire or are arcing....

1. Follow the disconnect sequence described on the previous page. IF THE VEHICLE IS CHARGING, UNPLUG IT OR TURN OFF THE CIRCUIT BREAKER TO THE CHARGING CIRCUIT.

2. DO NOT USE WATER ON LEAD-ACID BATTERIES!

3. **USE CLASS D (DRY SAND) OR DRY GAS (CARBON DIOXIDE CO_2 OR HALON)-TYPE FIRE EXTINGUISHERS. Dry chemical type-extinguishers may also be used; however they may be less effective.**

4. Direct the extinguishers into any openings exhibiting arcing or fire.

5. **DO NOT ATTEMPT TO OPEN OR VENTILATE THE BATTERY COMPARTMENTS WITH AXES.** This is extremely dangerous and may initiate new arcing and fire with each ax blow.

6. If the battery compartments are ruptured, direct the extinguishers into the rupture hole.

7. Once the arcing has stopped, **clean, dry, salt-free sand** may continue to be placed on the battery. **WATER, INCLUDING RAIN, SHOULD NOT COME IN CONTACT WITH LEAD-ACID BATTERIES, EVEN AFTER ANY FIRE AND/OR ARCING STOPS.**

8. Call Solectria at 978-658-2231 at the first opportunity to receive detailed further instructions.

II. INTRODUCTION

Congratulations on purchasing a new electric drive Solectria *Flash* pickup truck! Solectria Corporation prides itself in building the most efficient, practical electric vehicles (EVs) available.

The *Flash* uses the latest in advanced electric drive components from Solectria to provide clean, energy-efficient transportation, durability and convenience. The high quality workmanship and components in your new *Flash* should provide years of trouble-free transportation and the satisfaction of driving a zero-emission vehicle.

Solectria has provided some of the key information from this manual on the inside of the sun visor on the driver's side of the vehicle. Please refer to this manual for more detailed information and explanations.

Please read this manual carefully to ensure proper operation and maintenance of the vehicle. Although the *Flash* looks similar to a gasoline-powered vehicle and is simple to drive and maintain, it does require care and preventive maintenance. Reading this manual is essential for safe, long-lasting, and trouble-free vehicle operation.

How to Use this Manual

This Owner's Manual is divided into twelve sections.

Section I covers information for emergency response personnel.

Section II is this introduction.

Section III covers safety features.

Section IV covers vehicle operation, including driving, recharging, regenerative braking and parking.

Section V	covers the drive components installed by Solectria, including the motor, motor controller, battery, and other electronic equipment used to monitor or regulate vehicle electric energy consumption.
Section VI	provides suggestions on efficient driving.
Section VII	has information on reporting safety defects.
Section VIII	contains a detailed maintenance schedule to ensure the vehicle maintains its performance.
Section IX	contains warranty information and instructions on seeking vehicle repairs.
Section X	is a troubleshooting guide for problems or minor repairs and adjustments.
Section XI	contains towing instructions.
Section XII	contains vehicle diagrams.

Happy Motoring!

Solectria Corporation

P.S. We welcome comments and suggestions for improving the *Flash* and/or this Manual. Please call or send a note on how we can better serve you.

III. SAFETY FEATURES OF THE *FLASH*

The *Flash* is designed to maximize performance while maintaining a high level of safety. The *Flash* incorporates many safety features to avoid or avert accidents as well as protect passengers in the event an accident does occur.

The *Flash* is heavier than a comparable gasoline vehicle, due to the substantial weight of the propulsion batteries. Solectria has carefully located the batteries to evenly distribute weight in the vehicle and to improve stability and handling.

The *Flash* is equipped with rear wheel regenerative braking, as well as front and rear hydraulic brakes, for efficient and effective braking under all road conditions. Immediately upon releasing the accelerator pedal, the motor controller applies the full regenerative braking power to the rear wheels, slowing the vehicle even before the hydraulic brakes are applied. For more rapid braking, the hydraulic brakes can be applied by stepping on the brake pedal, providing maximum braking power.

The regenerative braking function can be switched off to prevent sliding under slippery conditions. For more information about the regenerative braking feature, see Regenerative Braking in SECTION IV, VEHICLE OPERATION.

The battery compartment in the *Flash* is constructed of high-strength aluminum and is secured directly to the vehicle frame using high-strength stainless steel fasteners.

The battery is made up of sealed, gel battery modules requiring no watering over their life. Because the modules are sealed, no appreciable amount of dangerous fumes or gases are emitted from the battery. The 1.5 kW charging system in the vehicle, including the battery, can be safely used indoors without any mechanical building ventilation.

The battery compartment is vented to allow the release of gases that could build up in the battery compartment in the unlikely event a module seal is broken (such as in an accident). The battery compartment has a high-current in-line fuse to disconnect the batteries in the event of an electrical short, accident, or other abnormality.

The *Flash* is equipped with driver and passenger lap and shoulder belts. 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 OEM manual regarding the operation, use and maintenance of the safety belts.

IV. VEHICLE OPERATION

The *Flash* drives and handles much like a conventional gasoline-powered vehicle. Certain aspects of the vehicle, however, will seem different to the new EV driver. This section covers the *Flash's* day-to-day operational features which may be different from a conventional vehicle.

Vehicle Layout

While most items in the *Flash* are similar to those in a standard gasoline vehicle, there are a few items that are different.

Range/Power Selector

The range/power selector located on the console assembly between the seats is used to select the *Flash's* driving mode. **ALWAYS** put the selector in **NEUTRAL-START** and set the parking brake when leaving the vehicle. There are three selections for forward driving, labeled **MAX RANGE**, **NORMAL** and MAX **POWER**, and one setting, labeled **REV** for reverse. The three forward positions correspond to maximum current (i.e. maximum power) available for the motor. For maximum efficiency and range, always drive in the **MAX RANGE** mode. **NORMAL** and **MAX POWER** provide higher power levels for hard acceleration, but can substantially increase the battery load, decrease range and reduce battery life.

For maximum range, set range/power selector to **MAX RANGE**. For maximum acceleration, set range/power selector to **MAX POWER**.

Starting the Vehicle

Always turn the key to the start position with the range/power selector set to the **NEUTRAL-START** position. If the vehicle is started with the selector in **REV** or one of the three forward settings, it will not operate until the selector is first placed in **NEUTRAL-START**. This safety feature is called the neutral interlock and is designed to help prevent unintentional vehicle operation.

Ampere-Hour Meter
The digital amp-hour meter, located in the console between the seats, provides a highly accurate measure of electrical energy use in the vehicle.

- As you draw energy from the battery, the meter counts up and the red **OUT** light flashes, indicating energy consumption.

- As you put energy back in to the vehicle (during charging and regenerative braking), the meter counts down and the green **IN** light flashes, indicating energy storage.

The rate the lights blink corresponds to the amount of current going into or out of the battery. For the first few miles of driving with a fully charged battery, the regenerative braking effect will be reduced. As always, driving efficiently will extend range and maximize battery life.

Battery Charging
A wonderful benefit of owning an electric vehicle is never again pulling into a gasoline station to fill the tank. Since the *Flash* uses electricity stored in its battery as its energy source, the vehicle must instead be recharged via an extension cord and the recharging plug (located by the driver's door).

Charging the vehicle is simple. The *Flash* is equipped with an on-board electronic charger. The *Flash* charger requires 240V/60Hz AC current. To charge the vehicle, simply plug a heavy-duty (10 gauge or 12 gauge) grounded extension cord, such as the one provided with the vehicle, into the charge port located by the driver's door, and plug the other end into an appropriate electrical outlet rated for 20 amps.

WARNING!

Make sure you plug into the appropriate outlet when charging. The *Flash's* charger requires 240V AC. Plugging into the wrong outlet could cause serious damage.

WARNING!

Use only heavy gauge extension cords (minimum 12 gauge) rated for the correct voltage and current (240V/20 amps) with a grounding prong to prevent overheating of the extension cord and electrical shock. Do not remove the grounding prong from the extension cord or use an ungrounded outlet.

To avoid overloading an electrical circuit, plug the vehicle into a dedicated outlet on a circuit with no other electrical loads. Make sure the outlet is rated for the amount of current the charger draws (20 amps).

Failure to adhere to these instructions could result in electrical shock, fire, and/or damage to the charging system and vehicle.

Call Solectria at 978-658-2231 with any questions.

Once the vehicle is plugged in, the charger turns on automatically. When the battery is charging, the green **IN** light on the amp-hour meter blinks, and the amp-hour meter counts down toward zero. To avoid ever returning to a partly or fully discharged vehicle, it is a good practice to briefly check the amp-hour meter each time you plug the vehicle in to confirm it is truly charging.

Under normal conditions, the charger will overcharge the battery slightly, so the amp-hour meter will read between 00.00 and -05.00 when charging is complete. This is due to inefficiency of charging and is normal. Once an electrical load is applied, the meter automatically resets to 00.00 to give an accurate measure of the total energy consumption from the battery.

The charger turns off automatically when the battery is fully charged. Leaving the vehicle plugged in after charging is complete is good for the batteries, and is recommended. The charger maintains a "float" mode to prevent self-discharge.

The *Flash's* charger was tuned at the factory for the specific battery in the vehicle, according to the battery manufacturer's recommendations. This means the charging system provides the optimal battery charging sequence for efficient charging and long battery life.

As new battery technologies are developed or as charging procedures are updated by the battery manufacturers, Solectria may be able to reprogram the charging system to accommodate the new procedures. To ensure the charging system uses the proper charging profile, please notify Solectria before replacing the battery pack.

The Solectria *Flash* is equipped with sealed lead acid gel batteries. The vehicle should be kept plugged in whenever possible. This greatly extends battery life by ensuring the batteries stay at a high state of charge (SOC) and by preventing freezing during extended inactive periods during cold weather. **WARNING: DO NOT LEAVE A PARTIALLY OR FULLY DISCHARGED VEHICLE UNPLUGGED.**

Vehicle Starting

To turn on the *Flash* motor controller, insert the key into the ignition and turn it forward (clockwise) to the "ON" position, as you would in a conventional gasoline vehicle. You will not hear any engine noise, but do not be alarmed, as the vehicle is very quiet when not moving.

Each time the controller is turned on, it performs a 1 to 2- second self-diagnostic check. Once the diagnostic is performed, the vehicle is ready to drive (see the following section, "Driving the *Flash*").

Observe the amp-hour meter to see how much electrical energy (as measured in amp-hours) you have used from the battery. When the battery is fully charged the meter will automatically reset to 00.00 (after it has been negative).

Note: the amp-hour meter counts up as you discharge the battery, and counts down as you charge the battery. A fully-discharged battery will show 40-50 Ah on the meter.

Driving the *Flash*

Once the vehicle is turned on, **select a driving mode** using the range/power selector. For maximum driving range and battery life, drive in the **MAX RANGE** mode. If more power is needed, shift to **NORMAL** or **MAX POWER**.

Note, the range/power selector may be shifted at any time, i.e., while the vehicle is moving, with your foot on or off the accelerator pedal, etc.

To drive, **depress the accelerator pedal about halfway** and the vehicle will start to move.

The first half of the accelerator travel is the regenerative braking region, as explained in "Regenerative Braking", so you must depress the accelerator halfway down, through this zone, before the vehicle begins to move. Once moving, the vehicle speed is regulated by the accelerator pedal, which tells the motor controller how much power to give to the motor (or draw from the motor in regenerative braking).

You do not need to shift gears while driving, as the *Flash* has only one forward gear. However, if you need quick acceleration for safety, switch the range/power selector to the **NORMAL** or **MAX POWER** setting as you are driving. The vehicle speed is regulated by the degree to which you depress the accelerator pedal.

Note that as you draw more current from the battery or put more energy back into the battery, the red or green light on the amp-hour meter will flash proportionately. For extended range, as well as extended battery life, it is best to drive efficiently, by keeping the current into and out of the battery (i.e. the blink rate on the amp-hour meter) as low as reasonably possible. For more information on efficient driving, see **SECTION VI**.

Regenerative Braking

As you release the accelerator pedal past the mid-point of its travel, the motor controller switches to regenerative braking (regen) mode to slow down the vehicle while at the same time generating electricity to partially recharge the battery.

When regen braking is active, notice that the green **IN** light next to the amp-hour meter blinks. This signifies the battery is recharging with electricity produced from regen braking. This recaptured energy can be used by the vehicle when more power is demanded from the battery. Regen therefore extends range and also the life of the vehicle's batteries. Regen braking uses the same motor, controller, drive train and battery used to drive the vehicle, only the energy flow is reversed. The same amount of power, or torque, the motor provides to drive the vehicle can also be used to slow the vehicle down in regen mode.

Solectria limits the maximum regen power to somewhat lower than the maximum motor capability, but regen braking can still be quite powerful. To slow down smoothly during normal driving, the accelerator should be released more gently than in a conventional gasoline vehicle.

For rapid or emergency braking, full regen braking is engaged immediately upon releasing the accelerator. The standard hydraulic brakes may be applied at any time as in an internal combustion engine vehicle by use of the brake pedal.

With prudent driving and appropriate use of regen braking, frequent use of the brake pedal should not be required. The brake pedal gives fast deceleration for quick stops, but does so by quickly using up the vehicle's energy of motion through heat and brake pad wear. Since regen braking recaptures and stores some of that energy in the battery for additional use, Solectria recommends drivers maximize the use of regen braking to slow the vehicle under normal driving conditions. This may require driving style adjustments so that most, if not all, deceleration is performed solely with regen braking.

Regen braking is connected to the rear brake lights. As the accelerator is released through the mid-point of its travel, the motor controller begins to apply regen braking and the green **IN** light by the amp-hour meter begins to blink. As you continue to release the accelerator and regen increases to a level stronger than traditional "engine braking", the controller turns on the brake lights, indicating to other drivers that the vehicle is actively braking. The brake lights for regen are activated by a relay located under the dash that clicks as the regen lights turn on or off. Releasing the accelerator completely applies maximum regen. Regen braking can be disabled with the switch located on the floor console.

WARNING!

Under slippery road conditions, such as onwet, icy or snowy roads, set the regen braking switch to "SLIPPERY" to turn off regen braking. Regen applies braking to the rear wheels only, and under slippery conditions could cause wheel lock-up and/or sliding. Use caution during *any* braking under these conditions.

Once the vehicle slows to about 3 mph, regen braking slowly releases, and the vehicle is free-rolling. Regen braking will not bring the vehicle to a complete stop, nor will it "hold" the vehicle on a hill. To ensure the vehicle stops completely and remains stopped, apply the hydraulic brakes, by using the brake pedal as in a conventional vehicle. (The parking brake must also be used to hold the vehicle on a hill.) Without the hydraulic brake on, the vehicle may roll. Solectria recommends you always keep your foot on the brake pedal or use the parking brake when the vehicle is stopped.

Parking the Vehicle

To park the vehicle, bring it to a complete stop, place the range/power selector in **NEUTRAL-START** and ALWAYS set the parking brake.

When exiting the vehicle always leave the range/power selector in **NEUTRAL-START** and remove the key from the ignition. If parking on a hill, turn the wheels toward the curb to prevent the vehicle from rolling should the parking brake fail.

Range

The *Flash* uses highly efficient components, and is designed to have the best range possible while still maintaining a safe vehicle weight. However, it has a significantly lower range than a gasoline vehicle. Thus, driving efficiently is important. The distance you can drive depends on 1) the amount of energy you have on-board, and 2) the efficiency of your driving. At a constant 70 km/hr (45 mph) and without the use of accessories, the Solectria *Flash* can travel about 65 km (40 miles). Frequent stop and go driving and use of accessories (especially heat) can significantly decrease the range. In addition, tire pressure should be maintained at the recommended 300 kPa/44 psi (375 kPa/54 psi in the rear tires under maximum load) to maximize range.

Energy Use

The Solectria *Flash* battery can provide a maximum of about 45-50 amp-hours of energy (as displayed on the console-mounted amp-hour meter) before the vehicle begins to slow down appreciably. ***Note, it is best to recharge the battery before it reaches this state of depletion.***

The *Flash's* energy consumption can vary from 0.8 to 1.25 or more amp-hours per kilometer (1.3-2.0 amp-hr/mi). This means the vehicle range can fluctuate between 65 and 40 km (40-25 mi), depending on driving habits, the terrain, use of accessories, outside and battery temperatures, etc. Once you become familiar with the vehicle's energy consumption under different conditions, you will have a better sense of how much range to expect per charge for given road conditions.

Please refer to **SECTION VI, EFFICIENT DRIVING** for tips on driving more efficiently.

Comfort Controls

Heat

Press the red button on the console labeled **HEAT** to turn on the *Flash* electric heater. You may regulate the amount of heat by adjusting the fan speed control. *Note, the heater fan must be turned on for the heater to operate.*

Remember the electric heating runs directly off the battery. Using heat or defrost decreases range by 10-15% or more depending on usage, driving conditions, etc.

V. THE ELECTRIC DRIVE SYSTEM AND OTHER COMPONENTS

Drive System
The electric drive system is what makes the *Flash* a unique vehicle. It is important to understand the basics of its operation.

Motor Controller
The "brains" of the system are housed in the highly efficient Solectria AC induction motor controller located in the front of the electronics compartment under the seats. It controls and coordinates all electric motor functions, regenerative braking and the batteries during vehicle operation.

Battery Compartment
Directly behind the electronics compartment and beneath the truck bed is the battery compartment, which houses the battery modules connected in series to the vehicle's battery pack. This battery stores the energy used by the vehicle.

Battery
The Solectria *Flash* is equipped with sealed, lead acid gel batteries. These batteries have minimal free electrolyte available for spillage in a major accident. The *Flash* battery pack voltage is nominally 144V DC.

Battery Thermal Management System
The battery compartment is equipped with Solectria's automatic battery thermal management system, which insures the battery is maintained at a suitable working temperature in cold or hot weather.

This system is critical for maintaining vehicle range and battery life during cold weather. In addition, lead acid batteries can freeze in cold temperatures, especially if they are at a low state of charge. If temperatures are below 10°C (50°F), the vehicle should be kept plugged into an AC outlet whenever possible to maintain a fully charged battery and optimal battery temperature.

Keep the vehicle plugged in whenever it is not in use.

Motor

The propulsion motor is located under the bed, in front of the rear differential. It propels the vehicle or slows it down during regenerative braking by converting the vehicle's energy of motion directly to electricity (as regulated by the motor controller). The motor is coupled to the differential directly, through the driveshaft. There is no gearbox or transmission in the *Flash*. The motor is air-cooled.

When you depress the accelerator, an electronic signal is sent to the controller, which then converts direct current from the battery to alternating current of an appropriate form to drive the motors (or vice versa during regen braking). Solectria's efficient AC motor and controller produce sufficient torque at low speed, and the motor spins fast enough (up to 6,000 rpm) that a single gear ratio is adequate for all normal driving conditions. Therefore, the *Flash* does not have separate gearing and does not require "shifting gears" automatically or manually. Thus, unlike most gasoline vehicles with multiple gearing, the speed of the *Flash* is determined solely by the speed of the motor.

Overheat Protection

Solectria's *Flash* drive system is highly efficient (70% and 90% overall for the motor controller and motor respectively). Despite high efficiency, under high power requirements the motor and controller produce heat. The controller is 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 controller or motor may reach maximum operating temperature and limit the power output in order to protect the electronic equipment. After a few minutes of driving at reduced power, the controller or motor should cool sufficiently to allow the vehicle to be driven normally.

Limp Home Mode

The *Flash* provides consistent performance throughout most of the discharge cycle of the battery. As the battery reaches 20% state-of-charge (SOC), the motor controller begins to limit the current available from the battery. This prevents irreversible battery damage. The *Flash* then operates with progressively diminishing performance ("limp home mode") for about 5 km (3 mi). Once the battery reaches approximately 10% SOC, the motor controller shuts down to protect the battery, and the vehicle can no longer move under its own power. The vehicle should be plugged in to charge as soon as possible after driving. Allowing it to sit uncharged after a deep discharge will damage the batteries.

System Voltage

All the *Flash's* electrical drive components (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, and heater cables are all at the high voltage of the propulsion battery. Although the high voltage circuit is completely isolated from the vehicle chassis and the 12V DC system, extreme caution must be used when 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.** Please notify Solectria or a Solectria representative whenever you have electronic or battery problems. Do not attempt to make repairs on your own.

DC-DC Converter

The electrical accessories in the *Flash* are powered indirectly by the propulsion battery through the DC-DC converter, which provides 12V DC power for lights, radio, etc. The 12V system is chassis-grounded as in traditional vehicles and is completely isolated from the high voltage electrical system. The electric heater, however, operates at full battery voltage rather than through the DC-DC converter.

VI. EFFICIENT DRIVING

The *Flash* is carefully designed to provide good performance in city driving. However, the tips in this section allow you to obtain the best range possible, achieve longer battery life, and conserve energy.

Cruising
For maximum efficiency, accelerate gradually to the desired cruising speed, and then try to maintain a constant speed. Stopping and starting use considerable energy even when regenerative braking is used. Anticipate the need to slow down so deceleration is gradual and stopping is averted if possible.

Maintain a slow, steady cruising speed. Data collected by Solectria show the energy consumption of the *Flash* increases dramatically with speed. Slower cruising speeds not only save energy and extend vehicle range and battery life, but also save lives.

Energy consumption depends on your particular driving habits and driving conditions.

Acceleration
The *Flash* provides good acceleration capability for safety and functionality. Although using the full acceleration does not significantly increase wear on electronic or drive train components, it does take a toll on the batteries, and causes the vehicle to use more energy, thereby decreasing the range. This, along with deep battery discharges, will also reduce battery life.

The faster the vehicle's battery is discharged, the less total energy, or amp-hours, the battery can provide. High-power and high-acceleration driving not only use up battery energy more quickly but also decrease the total amount of battery energy available. Because of this effect, "hot rodding" can decrease vehicle range by 30% or more.

To maximize range and efficiency, accelerate gently and anticipate slowdowns. Decelerating gently provides the most benefit from regenerative braking.

Driving Modes

The **MAX RANGE** setting on the range/power selector limits the current drawn from the battery by the controller. This current limit reduces the maximum motor power output, and therefore limits the effect of "jack rabbit" starting. Setting the range/power selector to **MAX RANGE** increases overall energy efficiency while lowering vehicle performance.

In **NORMAL** or **MAX POWER** modes, the vehicle's efficiency is considerably reduced. The *Flash* may use as much as 1.25 amp-hours per kilometer, or up to 50% at a more restricted, efficient **MAX RANGE** setting. For maximum benefit, Solectria recommends driving in **MAX RANGE** mode as much as possible.

Hill Climbing

Hill climbing is energy-intensive. However, the slower you climb, the less power required. To be efficient, Solectria recommends you climb hills slowly, if possible.

The red **OUT** light by the amp-hour meter flashes quickly when using a lot of power and slowly when using less power. The less power used, the more range 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 driving periods. This indicates excessive power use and inefficient driving! The more slowly this red light blinks, the more kilometers per charge.

VII. REPORTING SAFETY DEFECTS

If you believe your vehicle has a defect which could cause a crash, injury or death, immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Solectria Corporation.

If NHTSA receives similar complaints, it may open an investigation, and if it finds 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.

To contact NHTSA, either call the Auto Safety Hotline at 1-800-424-9393 or 202-366-0123 or write to NHTSA, U.S. Department of Transportation, Washington DC 20590. You can also obtain other information about motor vehicle safety from the Hotline.

VIII. MAINTENANCE

The purpose of maintenance is to ensure the vehicle is safe to drive at all times and to maximize the life of all vehicle components. Different operating environments affect vehicle maintenance schedules. It is possible you may use the vehicle more or in worse conditions than anticipated by this maintenance schedule, but this schedule is adequate for normal driving. The schedule is specifically designed for vehicles:

- o carrying passengers and cargo within the recommended limits (450 kg/1000 lb max combined).
- o driving on reasonable road surfaces within legal driving limits.

Based on this, there is one recommended maintenance schedule for the *Flash*. Refer to the 1999 Solectria *Flash* Maintenance Schedule included in this section.

Specifically, five items should be performed by knowledgeable service personnel on a periodic basis. These six items are listed and described below. Please refer to the 1999 Solectria *Flash* Service Manual for a more complete description of these tasks.

Rotate/inspect tires

For long wear and maximum tire life, rotate the tires every 10,000 km (6000 mi). Check the tires for uneven wear or damage. If you see irregular or premature wear, check the wheel alignment. Check for damaged wheels as well. While tires and wheels are removed for inspection, perform brake system inspection.

Inspect steering and suspension

Inspect the front and rear suspension and steering for worn, damaged or loose parts, or for lack of lubrication. Replace as necessary.

Inspect brake system

It is easiest to do this when the wheels are removed for tire rotation. Inspect lines and hoses for proper hook-up, binding, leaks, cracks, chafing, etc. Inspect drum brake linings for wear and cracks. Inspect other brake parts, including drums, wheel cylinders, parking brake etc. Check parking brake alignment. You may need to inspect the brakes more often if your driving habits or conditions result in frequent braking. (If you are careful and use the regenerative brakes whenever braking is required, it will result in less wear on the conventional brakes and less maintenance expense.) Check the brake fluid level.

Change brake fluid

Drain, refill, and bleed the brake system.

Operator Inspections

In addition to the items listed above, several inspections (including tire pressure check, windshield washer fluid level check, etc.) should be performed by the vehicle's owner/operator on a weekly, monthly, biannual, or annual basis. These items are listed and described below.

Weekly

Check windshield washer fluid level

Check windshield washer fluid level in the windshield washer tank located under the driver seat and add fluid if necessary.

Monthly

Check tire pressure

Check tires for proper pressure; if low, inflate to maximum level specified on the tire sidewall (with tires supplied, inflate front tires to 300 kPa/44 psi and rear tires between 300 kPa/44 psi and 375 kPa/54 psi, according to the load being carried). If they are worn unevenly, check four-wheel alignment.

Every 6 months

Check restraint system

Inspect belt system, including webbing, buckles, latch plates, and anchors. Have the belt assembly replaced if the webbing has been cut or otherwise damaged, or if the vehicle was involved in an accident when the seat belt was in use.

Check wiper blades

Inspect wiper blade performance during use. If wipers are not effective at clearing the windshield, replace as necessary.

Every 12 months

Lubricate key lock

Lubricate the key lock cylinders with the lubricant specified in List of Fluids and Lubricants at the end of this section.

Lubricate body

Lubricate all door hinges, bed hinges, and latches. More frequent lubrication may be required when exposed to a corrosive environment.

Check parking brake performance

WARNING!

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

Park on a fairly steep hill, with the vehicle facing downhill. Keep your foot on the regular foot brake and set the parking brake. Place the range/selector switch in **NEUTRAL-START** so the motor is not applying any braking or motive force to the vehicle, and turn the key on. Slowly remove foot pressure from the regular brake pedal. Do this until the vehicle is held by the parking brake only. Call Solectria immediately if the vehicle cannot be held in place with this test. Should this occur, use extreme caution and park only on level ground to prevent the vehicle from rolling unintentionally.

Car Wash Information

CAUTION!

Although the possibility is slight, there is a chance that spraying large volumes of pressurized water into the vehicle from an automatic car wash could cause short circuits resulting in damage to the vehicle and/or injury to yourself. In general, it is safer not to use most car wash facilities and to hand wash your *Flash*.

LIST OF FLUIDS AND LUBRICANTS

Hydraulic Brake System	DOT-3, DOT-4, or SAE J1703 brake fluid
Key Lock Cylinders	Lubricate with Multi Purpose Lubricant
Parking Brake Cable Guides	Chassis lubricant or lubricant meeting requirements of NLGI #2, Category LB or GC-LB
Hood and Door Hinges	Multipurpose lubricant
Chassis Lubrication	Chassis lubricant or lubricant meeting NLGI #2, Category LB or GC-LB
Front Wheel Bearings	Wheel bearing lubricant meeting the requirements of NLGI #2, Category GC or GC-LB
Weather-strip	Dielectric silicone grease or equivalent

Maintenance Locations

Maintenance of the vehicle body, brakes, wheels, and tires can be performed at any service station or Solectria dealer.

Electronic and electric drive system maintenance must be performed by Solectria or a Solectria-approved Service Provider. Presently, Solectria's main facility is located at 33 Industrial Way, Wilmington MA 01887 USA phone 978-658-2231, fax 978-658-3224.

Solectria Electric Vehicle Scheduled Maintenance

Item	Odometer miles (km)															
	6,000 (9,600)	12,000 (19,200)	18,000 (28,800)	24,000 (38,400)	30,000 (48,000)	36,000 (57,600)	42,000 (67,200)	48,000 (76,800)	54,000 (86,400)	60000 (96,000)	66,000 (105,600)	72, 000 (115,200)	78,000 (124,800)	84,000 (134,400)	90,000 (144,000)	96,000 (153,600)
Rotate/inspect tires	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Inspect steering & suspension		x		x		x		x		x		x		x		x
Inspect brake system		x		x		x		x		x		x		x		x
Change brake fluid										x						
Write in date work performed																
Write in service provider																

Owner/Operator Inspections

Weekly

-Check windshield washer fluid level

Monthly

-Check tire pressure

Every 6 months

-Check restraint system
-Check wiper blades

Once a year

-Lubricate key lock
-Lubricate body
-Check parking brake performance

IX. WARRANTY/REPAIR

Solectria maintains a high customer satisfaction record and we want you to be satisfied with your new *Flash* pickup truck. It is important to understand how to operate the vehicle, and so we recommend reading the entire Owner's Manual.

In addition to the following information, please see Solectria's Vehicle Warranty Policy for full details.

Maintenance and Repairs
Maintenance and repairs can be performed by any qualified service outlet; however, ***warranty repairs must be performed by a Solectria-authorized dealer or service provider***. Please contact Solectria Customer Service if you have questions concerning an appropriate service facility.

Note: Removal and re-installation of components must be performed by a trained technician. (Most Solectria components are modular and can be removed by disconnecting a few contacts or loosening a few screws.)

If you experience problems with the non-EV parts in your vehicle, please contact Solectria Customer Service at 978-658-2231 to determine how to proceed.

Non-Warranted Items

Antenna
Batteries (may be covered under separate Battery Warranty)
Brake drums
Brake linings
Bulbs
Cords
Fuses
Mirrors
Plugs
Shock absorbers - rear
Leaf Springs - rear
Struts - front
Tires
Windows
Windshield washer fluid
Wiper blades

Other Exclusions

The vehicle's warranty also does not cover any damage caused by vandalism, abuse, neglect, acts of God, or any other item outside the manufacturer's control.

Receipts from regular maintenance should be retained in case questions arise concerning maintenance. Solectria reserves the right to deny warranty coverage if the vehicle has not been properly maintained. However, this decision would not be based solely on the absence of maintenance records.

Contact Solectria Corporation at 978-658-2231 to effect all necessary warranty repairs. If you are not in the vicinity or are unable to bring your vehicle to our Massachusetts facility, you may use an authorized Service Provider after contacting us. Once we confirm by phone, fax or letter, you may have the vehicle serviced and we will reimburse the repair facility directly.

CAUTION!

Do NOT attempt to open or repair "damaged" components. Doing so will completely void the warranty on that part and may present a hazardous situation.

Before removing any item, call Solectria at 978-658-2231 with information on the problem. After receiving authorization to remove the component in question, ensure that a trained person is on hand to remove the item.

When disconnecting contacts, confirm the technician knows exactly how to reconnect parts as incorrect wiring reconnections can damage components.

Service personnel should promptly package the defective or broken component and send it back to Solectria after calling Solectria Customer Service in advance at 978-658-2231 to obtain an RMA (Return Merchandise Authorization) number for tracking this return.

Transferability
The vehicle warranty is applicable to vehicles registered in the U.S. and Canada and normally operated in the U.S. or Canadaa It is provided to the original owner only and is not transferable without the prior express written authorization of Solectria.

Repair Locations
Repair of your vehicle body, suspension, brakes, wheels, tires, etc. can be performed at any service station or Solectria dealer.

Electronic and electric drive system repairs must be performed by Solectria or a Solectria-authorized Service Provider. Presently, Solectria's main facility is located at 33 Industrial Way, Wilmington MA 01887 USA, phone 978-658-2231, fax 978-658-3224.

Solectria Corporation reserves the right to make changes, improvements and alterations in vehicles it builds without incurring the obligation to make similar changes on earlier models of Solectria vehicles.

If you have questions about your warranty or repair information in general, contact Solectria for assistance at 978-658-2231.

X. TROUBLESHOOTING GUIDE

The purpose of this section is to guide the vehicle operator if something is wrong. If you have questions, contact Solectria at 978-658-2231.

NEVER open the motor controller, DC-DC converter, or any other sealed piece of electronic equipment. Doing so could damage the vehicle or cause severe injury to yourself,.and voids the warranty.

A. Vehicle will not start

1. First, check the amp-hour meter to make sure the vehicle is charged.

2. Make sure the vehicle is unplugged - it will not start if it is plugged into a charging outlet.

3. Have you tried driving? Remember, you really don't hear anything when you turn the vehicle on. Slowly press the accelerator pedal all the way to the floor.

4. Check that the key is inserted in the ignition switch and is in the "on" position. If unsure, turn everything off, wait a few seconds, insert the key, turn to "start" and release (it should now be on the "on" position), and wait 1-2 seconds.

5 Move the range/power selector to **NEUTRAL-START with your foot off the accelerator pedal,** then set the range/power selector to the desired mode.

6. Release the parking brake fully.

7. The vehicle should now drive. If it still doesn't, the problem could be mechanical or electrical. Listen carefully for the whine of the motor and controller as you depress the accelerator. If the motor does not spin at all, the problem is electrical. In this case, we recommend contacting a Solectria Repair facility to check all electrical connections from battery to motor.

CAUTION!

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 978-658-2231 BEFORE ATTEMPTING ANY ELECTRICAL REPAIRS.

B. Vehicle will not charge

1. If the vehicle is plugged into a wall outlet and the green **IN** light on the instrument panel is not flashing, it indicates the battery is not receiving power. Unplug the vehicle.

2. Check the outlet to make sure it is getting power with a voltmeter or by plugging in another device such as a lamp. If the circuit breaker is tripped or the fuse is blown, make sure the circuit is rated for the power the charger requires (20 amps).

3. Listen for a relay clicking when plugging the vehicle in. Listen for the charger cooling fan turning on. If either occurs (indicating the charger is receiving power) check the amp-hour meter. If the green **IN** light is not flashing, watch the numbers on the counter. If they are decreasing, the vehicle is being charged, but the green light is bad. Call Solectria for repair information.

4. If the vehicle still is not charging, call Solectria.

C. Batteries are not recharging or are not holding a full charge

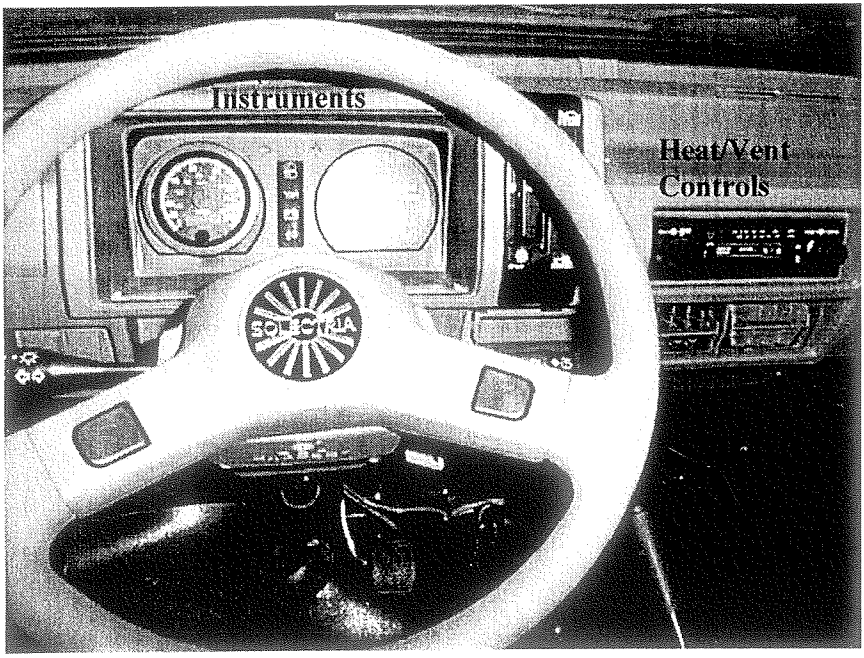
1. This may be due to improper or insufficient charging. Call Solectria at 978-658-2231 for assistance.

2. Note: Rough driving can cause battery damage which is not visible. Internal damage may shorten battery life and reduce charging ability.

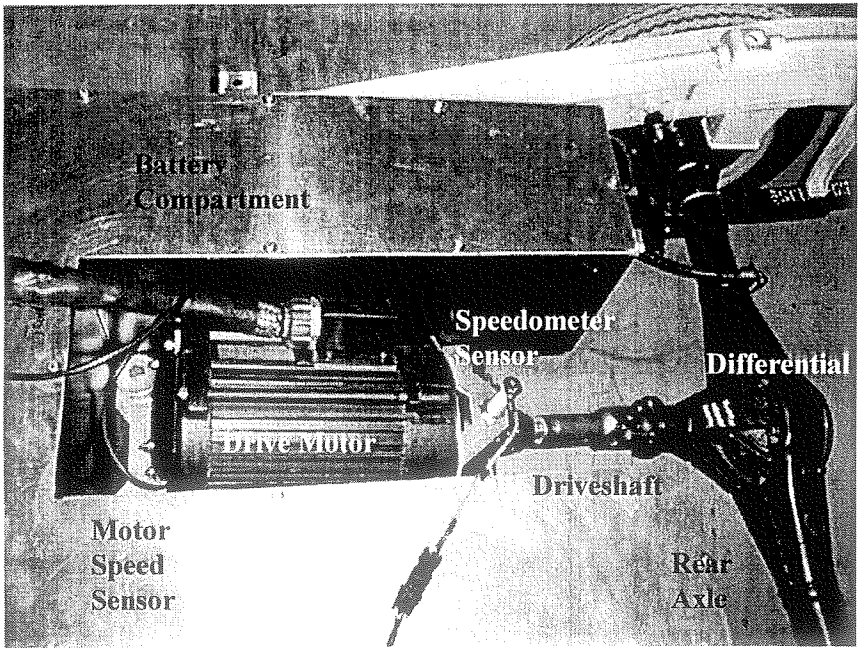
XI. TOWING INSTRUCTIONS

When towing the vehicle, pick up the rear or use a dolly on the rear wheels. If you must tow with the rear wheels rolling on the ground, be sure that the ignition key is off, so that the motor controller is turned off. Towing the vehicle with the rear wheels on the ground and the key on may damage the vehicle drive system.

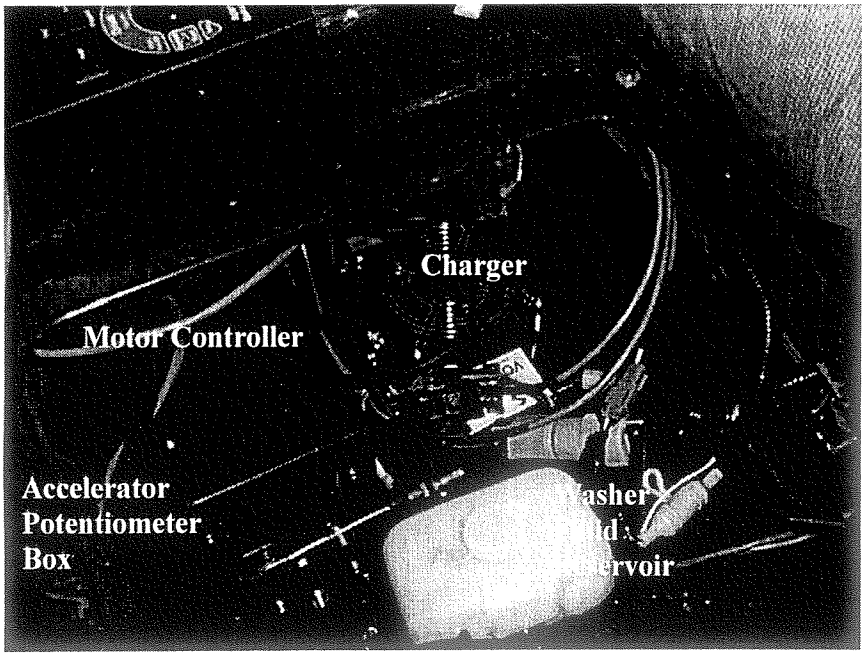
XII. VEHICLE DIAGRAMS



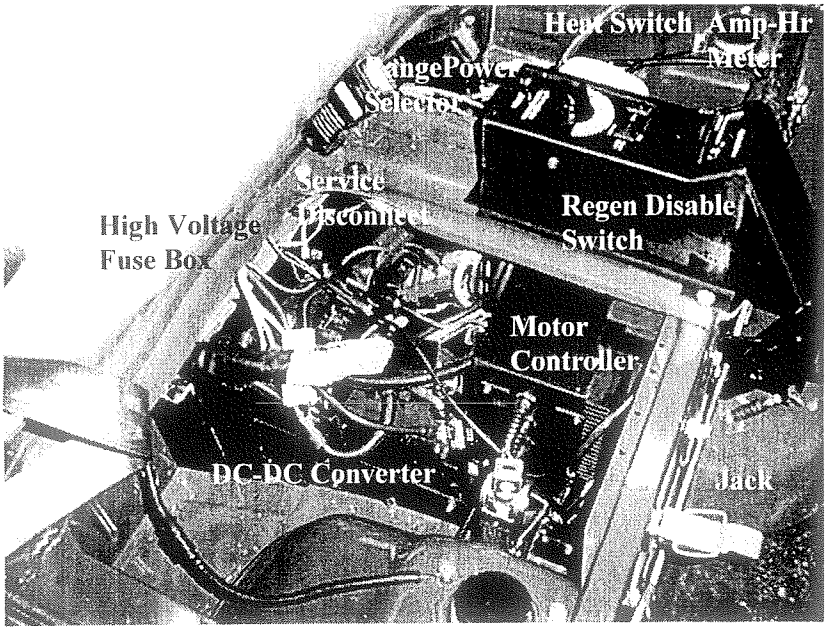
Driver Controls and Instrumentation



Flash Drive System



Electronics Compartment--Driver Side



Electronics Compartment--Passenger Side