

ELECTRIC BY SCT

VW RABBIT CONVERSION

SUPPLEMENT TO
VOLKSWAGEN RABBIT OWNER'S MANUAL

INTRODUCTION

The information provided in this supplement applies only to aspects of your Electric by SCT which are different than a conventional gasoline or diesel engine Rabbit. Consequently, please read the Rabbit Owner's Manual first. In those areas in which you will need additional or different information for the Electric by SCT, you will find a section number noted at that point in your Owner's Manual. Refer to the corresponding section in this supplement for the needed information.

For more detailed operational and maintenance information, refer to the Operation, Troubleshooting and Maintenance Manual, provided under separate cover.

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1. INSTRUMENT PANEL

The instrument panel layout of your Electric by SCT is the same as that of the Rabbit L, with the following exceptions (refer to the illustration and table on p. 27 of the Rabbit Manual).

1. Motor temperature warning light
4. Motor temperature gauge
5. Tachometer
6. High beam/turn signal/indicator lights and low main battery pack state of charge warning light
12. State of charge indicator (fuel gauge)

Center Console Mounted:

20. Motor current meter
100. Dual range voltmeter - main and auxiliary

1.1 Tachometer

The tachometer indicates motor speed. The gearshift should be used to keep motor speed in the green region between 2000 and 4000 RPM. (See Section 8, "Driving Techniques")

- A. State of Charge Indicator: When the needle enters the red area at the bottom, there is approximately 30% of the maximum battery capacity. The vehicle should not be driven beyond the point when the indicator is at the bottom of the red area which is 20% maximum battery capacity and/or when the vehicle feels noticeably sluggish. See further information in 1.2, "Warning Lights - Low State of Charge."
- B. Motor Temperature Gauge: The motor temperature gauge indicates the internal temperature of the motor casing. Care should be taken to keep the indicator below the red area (above 125°C). This can be controlled by reducing the power demands on the motor by driving at a lower speed. The center of the red area is approximately 150°C which is the maximum temperature allowed. If the temperature reaches 165°C., the vehicle will shut down to protect the motor. The middle of the gauge is approximately 75°C. Normal operating temperatures are between 60° and 85°C. (See "Warning Lights - Motor Temperature" for more information concerning motor temperature and current limit.)

1.2 Warning Lights



Low State of Charge Warning Light

Lights up when the twin battery pack state of charge is near zero!! As much as three miles can be driven with care to keep operating currents around 100 amps maximum. The indicator will illuminate first while drawing high current. This is a warning to cease heavy acceleration and high current demands, and to observe the State of Charge indicator. You may continue driving to your recharge location but only at reduced current demands. Continued operation with this light on will reduce the available range. You will note that the indicator will light up at progressively lower current demands. When the light remains on while idling you should stop the vehicle, as you are at 100% depth of discharge. Further driving can damage the battery pack.



Motor Temperature Warning Light

Illuminates when motor temperature reaches 125°C. This is a warning to reduce your power demands and allow the motor to cool down. Continued hard driving will increase the temperature to 135°C, at which point the controller will automatically limit the current to 150 amps. At 165°C, the controller will shut down automatically to protect the motor.

If controller shutdown occurs, pull off the road and depress the HAZARD switch. Wait until the motor has cooled down, restart and check to see that the motor cooling blower is operating.

1.3 Ammeter

The ammeter indicates motor armature current. Plus values indicate that the motor is driving the car, and-minus (green) values indicate that it is braking the car and charging the batteries through the regenerative braking. A red zone is provided from 200 to 300 amps. Drive so that the current is not in this range, except for short periods of time. Driving for extended periods with the current in excess of 200 amps can result in overheating the motor and in range reduction.

1.4 Speedometer and Trip Meter

The speedometer unit includes a resettable trip odometer which can be used in conjunction with the State of Charge indicator to provide useful vehicle range information. You can set it to zero after fully charging the vehicle and then observe your actual range under your particular driving conditions.

1.5 Dual Range Voltmeter

The voltmeter displays either Main Battery Pack voltage or Auxiliary voltage by setting the selector switch. The vehicle should be running in order to get a meaningful reading. The Auxiliary voltage should be checked periodically while driving. An indication near 10.5 volts is reason for concern, and 9.5 volts indicates an impending shutdown of the control system.

Under normal operating conditions, the fully loaded Auxiliary voltage should not go below 10.5 volts. Therefore, if this voltage drops below 10.5 volts while driving, continue to your home base and determine what the problem is. Under no circumstances should the voltage go below 9 volts. If this should happen, the vehicle will shut itself off See the Service Manual for more information regarding the Auxiliary (Accessory) battery.

The main pack voltage should be monitored whenever the State of Charge gauge shows in the red region. A true 80% depth of discharge is Indicated when the voltage is 88 volts when the current is 250 amps (foot to the floor, current limit, max. current). An indication of 80 volts is 100%, and no further driving should be attempted except after a substantial rest or charge if possible. If only a rest is possible and it is necessary to continue, do so for 2-3 miles at reduced speed and load. **THE VEHICLE SHOULD NOT BE DRIVEN UNDER THESE CONDITIONS EXCEPT FOR EMERGENCIES. THE BATTERIES CAN BECOME DAMAGED.**

Some typical idle voltage readings are:

Main Volts	Battery State of Charge
104	0%
106	20%
110	50%
113	100%

2. STARTING

Before starting, check to see that the gearshift lever is in neutral. To start, depress the clutch pedal fully and turn the ignition switch all the way to right. **DO NOT DEPRESS THE ACCELERATOR PEDAL.** Keep the switch in that position until the main contactor comes on, as noted by sudden jump in motor speed **NOTE:** Both seat belts must be buckled to start the car.

3. OPERATING RANGE

The hints given on p. 33 of the Rabbit Manual for obtaining good fuel economy also will help you obtain the maximum possible operating range from your Electric by SCT.

4. CLIMATE CONTROLS

Heater and Controls

A gasoline hot air heater is installed in place of the normal engine hot water heater. The heater is turned on by moving the lever 'B' "Temperature Control Level", all the way to the right. In order to circulate the hot air produced by the heater into the passenger compartment, the fan control knob 'C' should be ON. Unless it is necessary to defog the windows, the fan should be on 'low speed' (first position clockwise from OFF). Running the fan at higher speeds will produce larger quantities of air, but at lower temperatures. It does not increase the heat output from the heater. Note that the heater will not operate with the ignition switch 'off'.

The heater will keep operating after the heater is turned off, even with the ignition switch turned off, until the heating element is cooled down and blown clear of residual gases. Gasoline is used to fuel the heater. The fuel tank and filler are located in the engine compartment behind and below the controller. Capacity is one U.S. gallon) which provides about 16 hours of heater operation. Regular or No-Lead gasoline may be used.

5. FUSES

Fuses are identical to those shown on p 54 of the Rabbit Manual, with the following exceptions:

Additional fuses and their locations are as follows:

- F1 Motor protection fuse (250 amp, fast acting) in battery compartment
- F2 Converter output fuse (15 amp) - Located in instrument/fuse module box on left hand side, under hood, directly above wheel well.
- F3 Motor cooling blower fuse (20 amp) - located in instrument/fuse module box on left hand side, under hood, directly above wheel well.
- F4 Instrumentation fuse (1 amp) - located in instrument/fuse module box on left hand side, under hood, directly above wheel well.
- F5 Field fuse, 20A, located in controller.
- F6 Unused
- F7 Brake relay, regen, 1 A, located in instrument/fuse module box on left hand side, under hood, directly above wheel well
- F8 In-line heater fuse, 16 A, VW type

6. TIRES

Maintaining correct tire pressures and wheel alignment is essential to obtaining optimum performance and operating range from your Electric by SCT. Recommended cold inflation pressures are 32 psi front, 36 psi rear.

When replacing tires, always select tires with a maximum inflation pressure of at least 36 psi and a load rating of at least 1025 lbs. at 36 psi.

7. BATTERIES

Your Electric by SCT has a total of 19 batteries, 18 six-volt batteries, which provide the energy to propel the vehicle, and a 12-volt battery which provides power for motor control, lights, windshield wipers, and so forth. The propulsion batteries are located in a compartment behind the seats and the 12-volt battery is located under the hood.

7.1 Checking Battery Fluid Level

Refer to the Operation Manual for complete propulsion battery information. Care and maintenance is found in the Exide supplement to this manual.

7.2 Battery Charging

See the "Exide Battery Maintenance Manual" for charging instructions.

8. DRIVING TECHNIQUES

General Tips

Your Electric by SCT was designed to operate as much as possible like a conventional internal combustion engine vehicle. There are three basic things to learn.

1. For all your low speed driving, such as in the parking lot, in forward or reverse, it is not necessary to depress the accelerator pedal to drive the car. Simply engage the clutch gradually to get the car up to speed and alternate the use of the clutch and the brake.
2. The car will stall if the service brake is depressed without disengaging the clutch. This is similar to conventional vehicles but is considerably more sensitive. For best results, always depress the clutch pedal whenever you depress the service brake.
3. Most of your braking situations can be handled with the vehicle regenerative braking. By appropriate downshifting, you will be able to come to almost a complete stop without using the service brake, except for the last few feet to complete the stop. Remember #2 above. Of course, in an emergency situation, go right to the service brake and clutch.
Maximum use of regenerative braking can increase your usable range by 20-25%.
Adjust your driving habits to use the regenerative braking.

Accelerating

In accelerating from a stop, it is not necessary to depress the accelerator as the clutch is engaged. Simply engage the clutch smoothly and gradually, and then depress the accelerator to raise the car's speed. Always start in first gear; otherwise, there is a risk of drawing too much motor current, which may cause the main contactor to go off, shutting down the motor. This is equivalent to stalling an IC engine car. (See Section 1.2. 'Main Contactor Warning Light'.) From approximately 1800 RPM up to about 4500 RPM, the motor produces constant power. Above 4500 RPM, the power decreases. Consequently, attempting to accelerate more quickly to 'revving' the motor up in each gear is fruitless. Shifts may be made at any speed between 3000 and 6500 RPM, although for smoothest shifting, the following may be used as a guide:

1st gear to 2nd gear;	3200 RPM (15 mph)
2nd gear to 3rd gear;	2600 RPM (21 mph)
3rd gear to 4th gear;	2600 RPM (30 mph)

For city driving, third gear may be more desirable than shifting to 4th gear, and then downshifting. This is particularly true with the 1981 model VW Rabbits.

Do not shift at speeds much below these speeds; otherwise, the motor speed will drop to less than 1800 RPM after the shift is completed, and there is danger of drawing too much current.

To obtain maximum operating range, keep the motor current below 200 amps (out of the red zone on the ammeter) if traffic conditions permit.

Steady Driving

While driving at a constant or near constant speed in traffic, keep the motor speed between about 3000 and 4000 RPM. This is an efficient operating range for the motor. In addition, the motor provides good braking capability in this range, so that if traffic slows down, the car can be slowed down without using the service brakes (if the rate of slowing down is not too great). Do not drive steadily at speeds in excess of 55 mph. This results in excessive battery drain and the possibility of motor overheating.

Braking

With the accelerator in the up position, the motor of the Electric by SCI provides much more effective braking than the compression braking of a conventional engine. This occurs as long as the motor speed is above about 1800 RPM, and is particularly effective at speeds in excess of 3000 RPM. By downshifting to keep the engine speed above 3000 RPM while decelerating, and by paying careful attention to the traffic flow and anticipating slow-downs, it is often possible to avoid using the service brakes entirely except for the last few feet.

CAUTION: Do not allow the motor speed to drop below 1800 RPM, with the clutch engaged, in any gear while braking. Under these conditions, the motor will keep driving the car forward, thereby reducing the effectiveness of the service brakes, and also drawing excessive current from the batteries. In first gear, disengage the clutch when the motor speed drops below 1800 RPM (about 8 mph) - A good rule to remember is to depress the clutch pedal **WHENEVER** the service brake is used.

By making good use of the braking ability of the motor, it is possible to extend the operating range of the car, since the motor returns electrical energy to the batteries in the braking mode. In addition, the life of the service brakes is extended.

Driving on Hills

When driving uphill, keep the current out of the red zone as much as possible, particularly if the grade is very long. Unless the motor speed drops below 1800 RPM, do not downshift. The car will not go any faster in the lower gear. If the speed drops below 1800 RPM, downshift and reduce speed to avoid drawing excessive current and having the main contactor go off.

When descending a hill, use the motor for braking. Shift into a gear which will allow you to maintain the desired speed without using the service brakes. Generally, the motor will provide adequate braking in a gear which provides 3000 to 4000 RPM at the desired road speed. -

Parking

CAUTION: ALWAYS SET THE PARKING BRAKES FIRMLY WHEN PARKING THE CAR. THE ELECTRIC MOTOR PROVIDES NO BRAKING CAPABILITIES WHEN IT IS AT REST. Therefore, leaving the transmission in gear is ineffective in keeping the car stopped on a grade. For protection on steep grades, in addition to that supplied by the parking brake, turn the wheel into the curb or, in the absence of a curb, block the wheels.

Restarting After 'Stall'

As noted previously, excessive current drain will cause the main contactor to go off, shutting down the motor. This condition is similar to stalling a car with a conventional engine. To restart, it is necessary to depress the clutch, turn the key to the 'off' position (left all the way), and then to the 'start' position (right all the way) until the main contactor picks up. Because of the possibility of locking the steering when the key is switched off, it is recommended that one come to a complete stop before attempting to restart.

Passing

Passing should be done with extreme care. Although the performance of your Electric by SCT is excellent by electric vehicle Standards, and adequate to stay with the flow of traffic, the maximum performance is much lower than that of most conventional cars. Familiarize yourself fully with the acceleration ability or your car before attempting any passing maneuvers on two lane roads. After such familiarization, undertake such maneuvers only with the greatest caution.

9. TECHNICAL DATA

Motor

Siemens Model IGV1, separately excited

- Rated Current: 150 amps
- Max. current: 250 amps as installed/pass. car 300 amp/pickup
- Maximum power (as installed): 16 1(14 (21 HP)
- Speed range: 1800-4500 RPM

Controller

EEV Systems Model EHV-1

- Transistorized field chopper
- Motor startup with series resistor and contactors
- Control circuitry (includes armature current limiting, motor over temperature protection, motor over current protection) powered by accessory battery.

Charger

See Exide EV Battery Maintenance manual.

10. IMPORTANT SAFETY INFORMATION

The battery pack low (ground, -108 VDC) is isolated from the chassis of the vehicle and should never be connected to the chassis. Be careful to maintain this isolation when troubleshooting, instrumenting, or charging. While charging, DO NOT start the vehicle. While charging, DO NOT remove metal boxes, or open the controller.

In general:

- Do not work inside the controller
- Do not remove cover over wire connections to controller
- Do not remove battery cover or charger

WITHOUT FIRST

- Disconnecting the charger
- Use extreme caution around components and wiring that contain 108 VDC
- Be extremely cautious when servicing the battery pack
- Removing the 250 A main fuse