



Owner and Operator Manual

SU5



Preface

Welcome, and congratulations on your choice of vehicle from Columbia ParCar Corp.! Your vehicle has been manufactured in full compliance with all applicable American National Standards Institute (ANSI) standards. Your safe use and operation of your vehicle is important to us. Any alteration of your Columbia ParCar vehicle that results in the vehicle being in noncompliance with applicable ANSI standards is strictly prohibited. Columbia ParCar is not responsible or liable for any damage that results from any such alteration, and all warranties for any such altered vehicles are null and void.

Personal Transport Vehicles (PTV) are not designed for over-the-road use. They do not conform to Federal Motor Vehicle Safety Standards or EPA regulations, and are not equipped for operation on public streets, roads, or highways.

Low Speed Vehicles (LSV) commonly referred to as NEV or Neighborhood Electric Vehicles meet the requirements of the National Highway Traffic & Safety Administration (NHTSA) as stated in the Code of Federal Regulations, Title 49, Part 571, Standard 500, Low Speed Vehicles.

To the best knowledge of Columbia ParCar Corp., the material contained herein is accurate as of the date this publication was approved for printing. Columbia ParCar Corp. is not liable for errors in this manual or for incidental or consequential damages that result from the use of the material in this manual. Columbia ParCar Corp. reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.

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NOTICE: In an effort to streamline product support, please ensure your vehicle is properly registered with Columbia ParCar. Registration allows for more effective product support including product updates and warranty processing. Please consult with your servicing dealer to verify or complete the registration process.

CHANGE HISTORY		
DATE	DESCRIPTION	BY
5/1/14	Issued	TS

This manual provides important safety information, operating instructions, model specifications and maintenance instructions for electric vehicles. It should be read completely before attempting to drive or service the vehicle. Failure to follow the instructions in this manual could result in property damage, severe personal injury, or death.

The information in this manual is limited to care and maintenance information only. Information covering repairs is provided in detailed service manuals available from Columbia Dealers. Such major repairs require the attention of a skilled technician and the use of special tools and equipment. Your Columbia Dealer has the facilities, experience and genuine Columbia vehicle parts and accessories to properly service Columbia vehicles.

SAFETY MESSAGES

Safety messages and other information in this manual are preceded by the words **DANGER**, **WARNING**, **CAUTION** or **NOTICE**. They are printed in bold face, and are very important. We recommend you take special notice of this information.

⚠ DANGER
Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING
Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠ CAUTION
Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
NOTICE: Notices are messages not related to personal injury. They will provide key information to prevent property damage and to assure procedures are more easily understood or implemented.

VEHICLE IDENTIFICATION NUMBER – PERSONAL TRANSPORT VEHICLES (PTV)

Each PTV vehicle contains a unique Vehicle Identification Number (VIN) label. The VIN describes facts and features of the vehicle and contains thirteen (13) digits. Figure 1-1 is an example of a VIN label.

VIN labels and can be found in several locations on the vehicle. One location will be under the steering wheel cover as shown in Figure 1-2. Access to this location is by removing the three screws holding the cover in place. A nameplate is located in the front hood compartment and has important information such as model, vehicle weights and rated capacity (load, operator and passenger). Do not exceed this rated capacity. Read carefully.

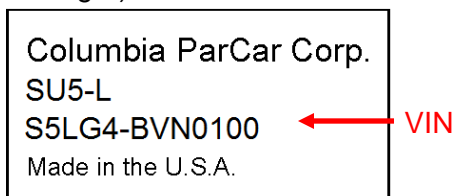


Figure 1-1



Figure 1-2

VEHICLE IDENTIFICATION NUMBER LOW SPEED VEHICLES (LSV).

The VIN is printed on a white label, affixed to the top of the dash and affixed to the steering wheel under the steering wheel cover (Figure 1-2). The VIN is also noted on the LSV Vin Label (Figure 1-3) affixed to the bottom of the front hood area.

<p>MFD BY: COLUMBIA PARCAR CORP REEDSBURG, WI 53959, USA DATE MFD: / MM/YY GVWR: KG (LBS) GAWR: FRONT - KG (LBS) GAWR: REAR - KG (LBS) TIRE SIZE: / (SIZE SPEC) COLD INF. PRESSURE (FRONT & REAR) KPA (PSI) RIMS: X MAXIMUM LOAD: KG (LBS) OCCUPANTS: (FRONT REAR) THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE. VIN: TYPE: LOW SPEED VEHICLE</p>
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Figure 1-3**VIN MATRIX Personal Transport Vehicle (PVT)**

Digit 1 thru 3 = Abbreviation (Model)	S5S (Short), S5L (Long)
Digit 4 = Power System	F = Sep Ex Regen (ACEplus) G = AC Drive, Induction Motor
Digit 5 = System Voltage	4 = 48V (8 – 6V) M = AGM (8 -6V)
Digit 6 = VIN Spacer	- = Standard # = Special Product
Digit 7= Controller Amperage	4 = 400 Amp B = 450 Amp 5 = 500 amp
Digit 8 = Brake System	V =Front & Rear Mechanical
Digit 9 = Build Year	N = 2014, P = 2015, etc.
Digit 10 Thru 13 – Build Sequence	1234

VIN MATRIX low Speed Vehicle (LSV)

Digit 1 thru 3:	5FC = CPC Manufacturer Identification
Digit 4: Line	L = Low Speed Vehicle
Digit 5: Series	S = Summit
Digit 6: Body Type	2 = 2 Person 4 = 4 person
Digit 7: Engine Type	6 =DC Power System 8 = AC Power System
Digit 8: Restraint	A = Type 1 Seat Belt Assembly B = Type 2 Seat Belt Assembly (3 Point)
Digit 9: Check Digit	Calculated per 49CFR 565.4
Digit 10: Model Year	E = 2014 F = 2015 etc.
Digit 11: Plant Location	1 = Reedsburg
Digit 12-17: Sequential Numbers	00019 - 000999

VEHICLE SPECIFICATIONS

ITEM	SPECIFICATION
Motor	5 KW AC
Drive	Direct coupled to oil bath, helical geared, rear axle
Rear Axle	16.77:1 helical gear reduction with integral differential
Charger	Built in, micro-processor control, fully sealed, anti-drive away interlock, 110-240 V AC, 50/60 Hz
Directional Control	Safety Directional Keyswitch with FL, FH (forward), R (reverse) and N (neutral)

ITEM	SPECIFICATION
Steering	Automotive rack and pinion.
Tire PSI	32 psi
Battery Deep Cycle	48 Volt: 8 - 6 volt, heavy duty, 225 Ah
Speed Control	Programmable, solid state, reduced speed reverse with diagnostic LED and calibrator interface
Brakes	Spring applied, auto- adjusting hydraulic drum on rear wheels, front disc, foot operated parking brake.

NOTICE: Always provide the complete VIN when contacting your dealer for technical assistance or maintenance and repair parts.

For your own personal reference, fill in the VIN in the space provided below:

GETTING STARTED

For personal safety before operating the vehicle, it is the operator's responsibility to read, understand and follow the basic rules of operation and maintenance instructions in this manual. If you are responsible for the use of the vehicle, it is your responsibility to inform the person or persons using the vehicle about the following basic rules of operation for their personal safety.

It is Columbia ParCar Corp's specific recommendation that the following warnings must be observed at all times. Not all are repeated throughout this manual, but the recommendations included must be observed whenever these subjects (vehicle operation hazards, battery hazards, etc.) are encountered.

Be a safe operator. Electric vehicles are only as safe as the person who is at the controls. If accidents are to be prevented, and they most certainly can be prevented, operators must accept their full measure of responsibility. While the designer, the manufacturer and the safety engineer can help minimize the possibility of an accident, their combined efforts can be erased by a single careless act.

SAFETY GUIDELINES

Observe the following guidelines for safe operation.

- Define *where* vehicles may be driven.
- Define *who* should be allowed to drive the vehicle.
- Instruct first-time drivers.
- *Maintain vehicles* in a safe driving condition.
- *Enforce safe-driving rules.*

SAFETY VEHICLE STATEMENTS

⚠ DANGER

This vehicle will not provide protection from lightning, flying objects, or other storm related hazards. If driving the vehicle in a storm, leave the vehicle and take shelter as per safety guidelines for your location.

Any modifications or changes to the vehicle that affect the stability, steering or that results in increased speed beyond factory specifications could result in vehicle damage, severe personal injury or death.

⚠ CAUTION

When replacement parts are required, use only genuine Columbia vehicle parts.

No modifications or additions, which affect the mechanical or electrical integrity and the safe operation of the unit, shall be made without the written approval of the manufacturer. If in doubt about any modification, contact your local Columbia Dealer or Columbia ParCar Customer Service.

⚠ WARNING

Follow all procedures exactly and observe all safety messages stated in this manual.

Working on vehicles without following proper procedures and using proper equipment may result in vehicle damage or personal injury.

Do not attempt to service hot motor or components. Failure to observe this warning could result in severe burns.

Always wear safety glasses or approved eye protection while servicing vehicle.

Failure to maintain vehicle properly could result in decreased vehicle performance, reliability or cause severe personal injury.

If any problems are found during scheduled maintenance or inspections, do not operate vehicle until repairs are made.

⚠ WARNING

For personal safety and to maintain stability and control, operate this vehicle under these conditions only. Failure to comply with these warnings may result in bodily injury and property damage.

All vehicles should be operated from the driver's side by authorized persons.

Never exceed the capacity ratings of the vehicle. Exceeding these limits may endanger occupants.

Personal injury may result if body parts (arms, head, and legs) are not kept inside vehicle while moving.

Do not start moving until all occupants are seated. Remain seated and hold on while vehicle is in motion.

Before leaving your seat, completely stop vehicle and lock parking brake. If vehicle is to be left unattended, turn keyswitch to "OFF" and remove key.

Do not use accelerator to hold vehicle on an incline. Use brake.

Make sure directional switch is in position for the desired direction of travel before depressing the accelerator. Do not change the directional switch while vehicle is moving.

Drive slowly in turns and up and down grades. Do not make turns on steep hills or inclines.

Do not operate while under the influence of alcohol or drugs.

Personal Transportation Vehicles are not Federal or State DOT approved and are not equipped to be operated on public roads or highways.

To avoid the risk of injury or vehicle damage, operate at maximum speed only on smooth flat surfaces.

Allow additional stopping distance when traveling at higher speeds.

These basic rules of operation, combined with courtesy and common sense, will help make driving your Columbia vehicle a safe and pleasant experience.

BATTERY DISCONNECT METHOD Figure 2-1

Batteries are located under the front seats. Before performing any vehicle service, power down the vehicle using the blue quick disconnect (arrow).

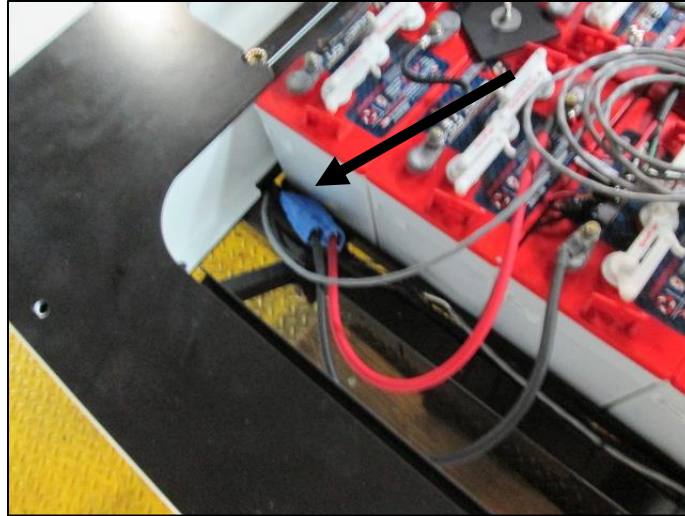


Figure 2-1

IMPORTANT FIRST STEP

Upon initial delivery, it is very important that the battery pack is properly charged. This is required if the vehicle is to be stored for later use or is to be used immediately.

- Check that the batteries are not damaged or leaking and that connections are tight.

NOTICE: The following information does NOT apply to sealed batteries.

- Remove the battery vent caps and inspect each cell for proper electrolyte level. The battery manifold assemblies on vehicles with a single point watering system will require a ¼ counterclockwise turn to be removed for this inspection.
- If the electrolyte level is below the plates add only enough water to cover the plates. See *SECTION 4 ELECTRIC SYSTEM, BATTERY INSPECTION & MAINTENANCE*.

NOTICE: Do not overfill a cell. Electrolyte expands and can overflow during charging.

- With the electrolyte level correct, use the on board charger to charge the batteries. Charging is complete when the remote LED is steady green. See *SECTION 4 ELECTRIC SYSTEM, CHARGER OPERATING INSTRUCTIONS*.
- Vehicles without a single point watering system, after charging, refill cells to below the bottom of the each cell vents. See *SECTION 4 ELECTRIC SYSTEM, BATTERY INSPECTION & MAINTENANCE*.
- Vehicles with a single point watering system will require completion of 4 to 5 charge cycles before watering.

NOTICE: If the vehicle is not going to be used the charger can remain connected to an AC source. It has the capability to test and recharge the battery pack during storage.

INSPECTING THE VEHICLE

After battery charging, perform an inspection of the vehicle to ensure that it is in safe proper working order.

Examine the contents of all packages and accessories that may have come in separate packages with this vehicle. Make sure everything listed on the packing slip is there. Items should not be broken or damaged.

Examine any visible wiring for obvious signs of damage. Check that all connections are secure.

Inspect the tires for obvious wear or damage. Check for proper tire inflation (32 psi recommended). Make sure that all wheel lugs are secure.

Check the body, seats, trim and other external parts for obvious damage. Look for body damage, jagged edges etc. that may cause personal injury.

Operate each of the following controls before turning on the power keyswitch.

- Accelerator Pedal for smooth operation.
- Braking Pedal, assure presence of a firm pedal with minimal travel.
- Check steering for responsiveness and minimal play.
- Key can only be removed when keyswitch is in the "OFF" position.

NOTICE: Each control should operate smoothly and easily without sticking or requiring excessive effort.

Check that the directional selector operates properly, the horn works and the warning buzzer sounds in reverse.

If vehicle has just been delivered, report any physical damage or missing items to the shipping company and your local Columbia Dealer.

Report any battery or service issue problems to the individual(s) responsible for correction and/or repair or contact your local Columbia Dealer for service.

⚠ DANGER

If any problems are found, do not operate vehicle until repairs are made. Failure to make necessary repairs could result in fire, severe personal injury, property damage or death. Consult your local Columbia Dealer for professional service.

VEHICLE CONTROLS



Figure 3-1



Figure 3-2

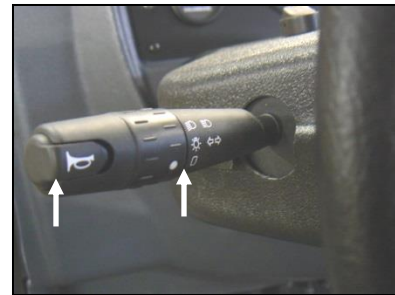


Figure 3-3

KEYSWITCH Figure 3-1

This is a five position automotive type switch and is located on the right side of the steering column. The first key position is OFF and is marked S. The second is an accessory position marked A which is not used. The third position is not marked and is not a key stop. It is not used. The fourth position marked M is the ON and powers up the vehicle. The last position marked D is not used. If the key is rotated to this position the vehicle power will be turned off.

Turning the keyswitch to OFF is highly recommended whenever vehicle is not in use. Always take the key out of the keyswitch when leaving the vehicle.

DIRECTION SELECTOR Figure 3-2

Selector is located between the seats. In the middle position the vehicle's direction signal is turned OFF or in neutral. Turning the selector to the right from the middle position moves the vehicle in forward direction (high & low speeds). Turning the direction selector to the left moves the vehicle in the reverse direction. A warning buzzer sounds when in reverse.

TURN SIGNAL/LIGHTS/HORN SWITCH Figure 3-3

The horn is activated by pushing in the button at the lever (A.). Moving lever up or down will activate the turn signals. A green light on the dash will flash indicating the turning direction. The headlights and taillights are activated by a three position selector (B). OFF is the bottom position, middle activates the parking and tail lights, and the upper position activates the headlights. High and low beams are selected by pulling back on the lever.

BRAKE, ACCELERATOR AND PARKING BRAKE Figure 3-4

Shown is the accelerator pedal (C), the brake pedal (D), the parking brake pedal (E) and the parking brake release lever (F). Each operate in the same manner as a conventional automobile.

The accelerator pedal should be fully released when changing directions.

Always apply the parking brake when leaving the vehicle. It should be firmly pressed and locked to prevent the vehicle from rolling. It remains applied until released by lifting the release lever.

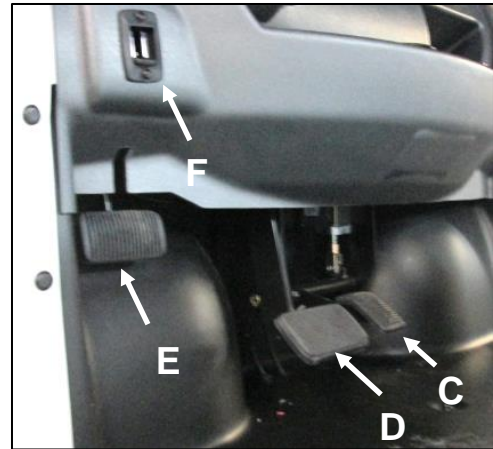


Figure 3-4

NOTICE: Never rest your foot on brake pedal while operating the vehicle. This wears the brakes, creates drag and causes excess battery discharge.

CAUTION

To avoid injury, speed in reverse should always be kept at a minimum.

MULTI-FUNCTION CLEARVIEW DISPLAY PANEL

Located on the dash, this panel contains the left and right green turn signal indicators and the AC display. This display will show the battery state of charge as a percentage of full charge, the system status, the operating speed, odometer, and direction selected (Figure 3-5).



Figure 3-5

At power on, the display will perform a self-test and load the controller data. You will see the Columbia ParCar Corp logo indicating the system is preparing for operation. (Figure 3-6).



Figure 3-6

When ready the display will indicate system OK. (Lower right corner). For ease of reading the display lighting may be reversed by pressing the top "Up Arrow" in the upper right corner. There are no other user programmable functions available (Figure 3-7).

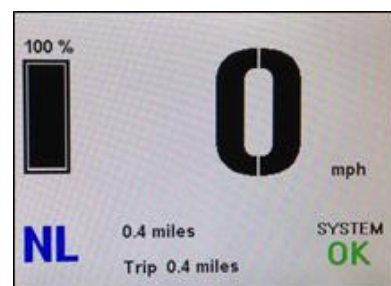


Figure 3-7

NOTICE: At 80% discharge, you must immediately charge batteries or vehicle operation will cease and permanent battery damage could occur.

In addition to standard operations, the display can also be utilized as a vehicle monitoring system. By pressing and holding the right center “Enter” button, a menu will appear with access to vehicle data, status and fault codes, should any be present. To toggle through the menu system, use the “Up” or “Down” arrows. To return to the previous screen, press and hold the right center “Enter” button again (Figure 3-8).



Figure 3-8

The Main 2 Menu will show the key “on” hours, the hours the motor has been used, the current, speed in RPM's if operating, the battery current draw during operation and the percentage the throttle pedal is depressed. This information is helpful in the event of any operational concerns (Figure 3-9).

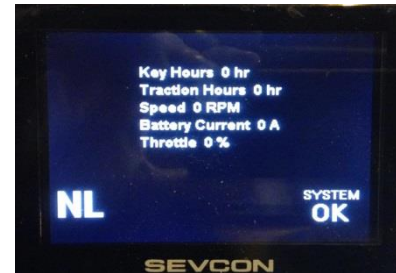


Figure 3-9

The Vehicle Status selection displays the current state of vehicle data collected at the controller (Figure 3-10).

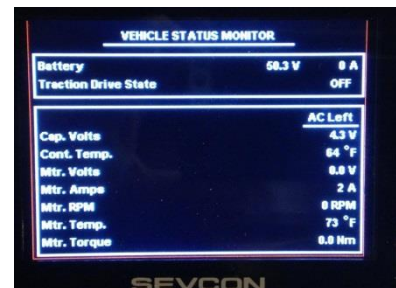


Figure 3-10

WARNINGS & OPERATING INSTRUCTION

Read this information carefully before operating the vehicle. Promptly replace if removed or damaged. Contact Columbia ParCar for replacements if needed. Part number for the Personal Transportation Vehicles vehicle decal is 53258-07 (Figure 3-11) or 43960-07 for Low Speed Vehicles (not shown).



Figure 3-11

STEERING WHEEL

The steering wheel controls the path of the vehicle exactly the same as a conventional automobile wheel.

CHARGER RECEPTACLE & REMOTE LED Figure 3-12

The charger receptacle is located on the left side of the vehicle near the driver's position. The vehicle can be equipped several different ways.

As shown in Figure 3-12 an AC cord is plugged in here for battery charging. Another configuration is this opening will have a 20' retractable electrical cord that can be pulled out and plugged into an AC outlet.



Figure 3-12

The charger is inter-locked with the traction control system which powers down the vehicle during charging. Near the receptacle is a remote multicolored LED which will indicate the battery charge status. See *SECTION 4 ELECTRIC SYSTEMS BATTERY CHARGING* for more information on this LED.

Always apply the parking brake when charging.

NOTICE: Before removing the AC cord, be sure to check the LED status lights.

HAZARD WARNING SWITCH

The hazard warning toggle switch is located on the top of the steering column.

FUSE BLOCK - 12V ELECTRICAL CIRCUIT Figure 3-13

A fuse block protecting the 12V electrical circuits of the vehicle is located under the hood. This system runs the accessories (wiper/washer, dome, etc.). The fuse block has a snap off cover for access to the fuses.



Figure 3-13

FUSE BLOCK - 48V ELECTRICAL CIRCUIT Figure 3-14

A fuse block protecting the 48V electrical circuits (horn, etc.) of the vehicle is located beneath the rear deck atop the controller assembly. The fuse block has a snap off cover for access to the fuses.

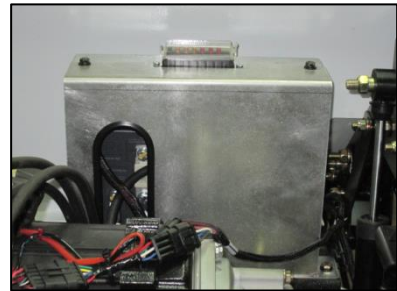


Figure 3-14

NOTICE: If fuses continue to blow and require replacement, have your Columbia Dealer check the electrical circuit.

WINDSHIELD WIPER/WASHER Figure 3-15

Wiper switch is located on the right side of the steering console. Wipers have four up positions (Figure 15):

- 0 – OFF
- 1 - OFF
- 2 - Slow
- 3 – Fast

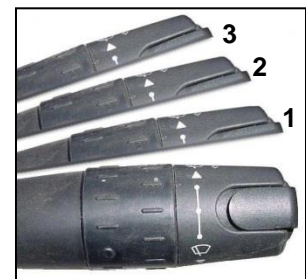


Figure 3-15

Pulling lever towards you activates the washer fluid. Pushing the switch down activated a “quick” wipe. The fluid reservoir is located under the hood (See Figure 3-13).

NOTICE: To avoid scratching the windshield always apply fluid before wiping.

TILT BED (If equipped)

The tilt bed has a remote control for raising and lowering. If maintenance or repair is required, disconnect the actuators.

SECOND SEAT Figure 3-16 (If equipped)

These seats can be raised or lowered to increase rear deck space.

NOTICE: If the vehicle is equipped with side rails they must be lower before raising or lowering the second seat.



Figure 3-16

BATTERY ACCESS

Batteries are located under the front seats.

DRIVING THE VEHICLE

- Complete the following PRE-OPERATION CHECKLIST.
- Fasten seat belts (if vehicle is so equipped).
- Insert key in power keyswitch, press brake pedal firmly, and turn key to "ON" position.
- Switch the direction selector to the direction of desired travel.
- Release the parking brake and brake pedal.
- Slowly press accelerator pedal to obtain desired vehicle speed.
- To slow or stop vehicle, remove foot from accelerator and press brake pedal.

PRE-OPERATION CHECKLIST**⚠ CAUTION**

Should any item malfunction or need adjustment, do not operate vehicle until the problem has been corrected.

ITEM	PROCEDURE
Batteries	Fully charged or adequately charged to provide power for duration of operations.
	The AC cord is disconnected from the vehicle.
	Electrolyte level in each cell covers the top of cell plates. See Section 4.10 Single Point Battery Watering System. (Does not apply to sealed batteries)
	Batteries are secure and free of corrosion.
	All terminals and connections are tight. Torque connections to 100 in. lbs.
Tire Pressure	32 psi
Lights, Horn and Reverse Buzzer	Head, tail and brake lights illuminate.
	Press horn button to sound horn.
Brakes	Brake pedal has firm pedal pressure with minimal travel.
	Parking brake has proper engagement and release.
Steering	Responsiveness and the absence of excessive free play.
Cargo	Load is secure, balanced and not top heavy.
Obstacles	Path of intended travel is free from obstructions.
Seat Belts	If equipped, driver and passenger are secured by seatbelts before moving vehicle.
Labels	All warning and operation labels in place.
Accelerator	Check for smooth operation.

IMPORTANT INFORMATION

The type of battery used in a Columbia vehicle has a service requirement which is quite different from that of an automotive battery.

The electric vehicle battery supplies all of the power to drive the vehicle. During operation the power stored in the batteries is expended. While the amperage drain rate can vary greatly depending on the type of service, the duration of use and the number of "starts" and "stops" made during a day, the batteries nevertheless progress through each duty cycle from "fully charged" to an almost depleted state.

This type of service is known as "deep cycle" service and electric vehicle batteries are specifically designed to handle this type of service. Proper performance of your Columbia vehicle can only be obtained from specified deep cycle, electric vehicle batteries.

PLEASE REVIEW IMPORTANT DANGER, AND WARNING STATEMENTS WHEN WORKING AROUND BATTERIES AND CHARGING SYSTEMS!

⚠ DANGER

Always remove key and disconnect battery pack before servicing or repairing the vehicle. See SECTION 2 SAFETY, BATTERY DISCONNECT METHOD.

Always wear full-face shield when working on or near batteries.

All batteries used in electric vehicles can explode! Batteries produce explosive hydrogen gas at all times, especially, during charging or discharging. Ventilate area when charging batteries.

Do not attempt to charge a battery if it is frozen, or if the case is bulged excessively. Frozen batteries can explode! Properly dispose of the battery.

Do not smoke around batteries. Keep sparks and flames away from batteries and the charging area. Use care to prevent an accidental arc which could cause an explosion. Use only approved insulated tools, remove jewelry such as rings, watches, chains etc. and place an insulating material (wood, plastic, rubber etc.) over all battery connections.

Never add acid to a battery.

⚠ DANGER

Battery acid is poisonous and can cause severe burns. Avoid contact with skin, eyes, or clothing.

ANTIDOTES:

EXTERNAL: Flush with water. Call a physician immediately.

INTERNAL: Drink large quantities of milk or water. Follow with milk of magnesia or vegetable oil. Call a physician immediately.

EYES: Flush with water for fifteen minutes. Call physician immediately.

⚠ WARNING

To reduce the risk of electrical shock or injury:

Do not use an ungrounded two to three-prong adapter to connect the charger to a two-prong outlet or extension cord.

The battery charger must be properly grounded. Use a three prong No. 12 AWG heavy duty power cord no more than 50 feet long.

Locate all cords so that they will not be stepped on, tripped on, or otherwise damaged. Immediately replace worn, cut, or damaged power cords or wires.

Do not connect the power cord near fuels, grain dust, solvents, thinners, or other flammables. The spark can ignite flammable materials and vapors

NOTICE: Automotive batteries should never be used for "deep cycle" application, as their useful life will be very short.

Damaged or corroded battery terminals should be replaced or cleaned as necessary. Failure to do so may cause overheating during operation. Torque connections to 100 in. lbs.

Do not attempt to recharge batteries with a charger not designed for your vehicle.

Only trained technicians should service the charger. Contact your Columbia Dealer for assistance.

NOTICE: Install surge arrestors on incoming AC power lines. Surge arrestors will help protect electrical/electronic components in the charger and vehicle from all but direct or "close proximity" lightning strikes.

BATTERY INSPECTION & MAINTENANCE

NOTICE: The following information does NOT apply to sealed batteries.

1. Check the electrolyte level on new batteries before they are put into service, and, at a minimum, once a week thereafter. Water use increases as batteries age. If the vehicle is equipped with a Single Point Battery Watering System see the information on this in this section.
2. See Figure 4-1. Never allow the electrolyte level (A) to fall below the top of the plates (C). If the plates are exposed, add only enough to cover the plates before charging.

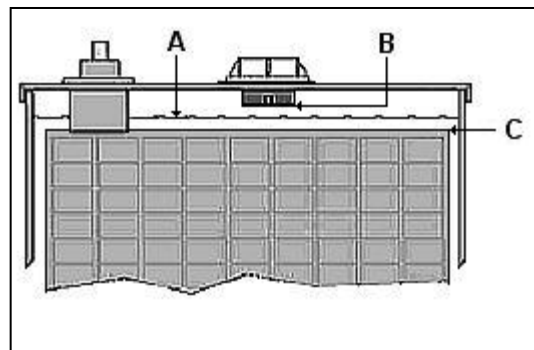


Figure 4-1

3. After batteries are fully charged, fill cells to just below the bottom of the cell vents (B), approximately 1/8" to 1/4". Electrolyte level should not touch the bottom of the cell vents.

4. Do not overfill batteries. Electrolyte expands and can overflow during charging. Water added to replace the spillage dilutes the electrolyte and reduces its specific gravity.
5. Use only distilled water. Vehicle batteries may use up to 16 quarts of water during their useful life and non-distilled water may contain harmful minerals which will have a cumulative adverse effect on battery performance and life.
6. Check to see that battery cap vent holes are clear. Plugged vent holes will not permit gas to escape from the cell and could result in battery damage. Check that all vent caps are tightly in place. Do not allow water or cleaning solution to enter cap vent holes.

For all batteries:

1. Be sure battery hold downs are properly tightened. A loose hold down may allow the battery to become damaged from vibration or jarring. A hold down that is too tight may buckle or crack the battery case.
2. Weekly inspect battery posts, clamps and cables for breakage, loose connections and corrosion. Replace any that are damaged. Batteries and connections must be clean and dry. Torque connections to 100 in. lbs.
3. Weekly an equalization charge is to be applied to the battery pack. This process balances the electrical charge in the battery pack and will extend battery life. The following procedure is used to complete this.
 - Charge the battery pack allowing the charger to go to green 100% charge.
 - Once the green LED lights unplug the power cord.
 - Wait approximately 30 seconds. Reconnect the power cord and allow the charger to complete a second charge cycle.
 - If the vehicle is not to be used, leave power cord connected. The on-board charger can test and recharge as needed.

BATTERY CLEANING

Acid-soaked debris on the battery terminal connections will cause current leakage, reduces battery efficiency, and battery life.

Hose wash battery terminal connections periodically with clean low-pressure water to keep them free of acid spillage, dirt, and other debris. Do not hose wash electronic controllers, switches, solenoids and other electrical control devices. Cover as necessary to prevent splashing. Clean battery terminal connections with baking soda (sodium bicarbonate) and water solution. Mix 5 teaspoons baking soda per quart of water. Use a stiff bristle brush, rinse with clean water and dry with a clean cloth. Torque connections to 100 in. lbs

NOTICE: Follow local ordinances and codes for proper disposal of battery cleaning waste.

CONDITIONS WHICH AFFECT CHARGING

Always schedule enough charging time so the charger attains the 100% level. Charging time is affected by age and battery condition, state of discharge, electrolyte temperature, AC line voltage, and other variables. Correct charging methods extend battery life and vehicle range between charges. If vehicle is used only occasionally, a refresher charge should be given prior to using.

New batteries need up to four hours more charging than “mature” batteries. Before the first use, completely charge new batteries. Charging time will vary based on conditions noted above but will probably be 12 hours.

Limit new batteries use between charges for the first 25 – 50 cycles. New batteries have less capacity than seasoned batteries. New batteries should not be discharged more the 20 – 30% before recharging. This will prevent premature battery failure.

Battery efficiency is affected by temperature. If the temperature of the outside air and/or batteries is below 60° F, battery capacity is reduced. Batteries will require more frequent and longer charge periods in early spring, fall and winter.

As batteries age, they finish charge at progressively higher charge rates and tend to use more distilled water. At this point in battery age, charger will automatically begin reducing charge time.

Batteries found defective must be replaced. All batteries in a vehicle should be matched according to age, capacity and brand.

BATTERY CHARGING

All current production Columbia 24/36/48 volt electric vehicles are built with a new solid state on-board, fully automatic high-frequency, programmable battery charger as standard equipment. This section explains in more detail the charger operation.

The charge status can be found on a remote multicolored LED (Figure 4-2). This LED and descriptive label will be located near the charger receptacle.

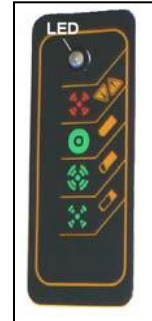


Figure 4-2

CHARGER OPERATING INSTRUCTIONS

Connect the supplied power cord to the vehicle charger receptacle and to a properly grounded wall outlet. Charger start and charge time is automatic. The remote LED will be flashing short green. If this LED is not lit check the AC connection and the AC source fuse or breaker. If this fails to correct the problem, contact your Columbia Dealer for assistance.

Charger will automatically turn on and conduct a short self-test and battery pack test. The LED will flash in sequence and then a trickle current will be applied to batteries until a minimum voltage is reached.

If the batteries meet the minimum voltage requirements of the charger, signifying they are serviceable (chargeable), the charger enters the bulk charging (higher amperage-constant current) stage. The remote LED will be flashing short green.

NOTICE: If the batteries are excessively discharged, the charger will not be able to charge the complete set of batteries. The remote LED will be flashing red.(see Red Light Charger Error Codes). It will then be necessary to follow the Special Charging for Excessively Discharged Batteries.

When the charger has completed approximately 80% state of charge the remote LED will flash long green as the last 20% of charge is returned to the batteries in the second phase (constant voltage phase).

NOTICE: You can terminate charging at this point if necessary. The vehicle can be used, but completing the charge cycle is highly recommended.

A Green LED continuously lit indicates the batteries are completely charged. The charger may now be unplugged from the AC source. If the batteries will not be used for a length of time, check monthly for the charge level. It is also acceptable to leave the charger plugged in. The charger has the capability to test and recharge if necessary.

Repeated "Short Charging", leaving the charge short of 100% will shorten operating cycle distance and reduce battery life.

A fault occurring while charging causes the remote LED to flash with a code relaying the error. Some errors may require repair by a qualified technician and others may be simply transient and will automatically recover when the fault condition is eliminated and the charger cycled by disconnecting the AC source for a minimum of 11 seconds.

NOTICE: A Yellow (Amber) flashing remote LED indicates the thermostatic control has limited the charger output due to ambient temperature conditions. It is still charging, but at a reduced rate.

RED LIGHT CHARGER ERROR CODES

1 FLASH = Battery Voltage High: Auto-recover. May be temporary condition, or wrong charger installed, i.e. 36 volt charger on 48 volt battery pack.

2 FLASH = Battery Voltage Low: Auto-recover. Confirm each individual batteries minimum voltage with a voltmeter. Two or more 6 volt batteries register less than 5.85 volts, or accumulative total pack voltage has been discharged to less than 20% remaining. Vehicle operation will cease until batteries are recharged. See *SECTION 4 ELECTRIC SYSTEM, EXCESSIVELY DISCHARGED BATTERIES*.

3 FLASH = Charge Timeout: The charging did not complete in allowed time, 12-14 hours. This may indicate a battery problem, or that the charger output was reduced due to high ambient temperatures. Disconnect AC supply, confirm sufficient ventilation, allow cool down time, and restart charger.

NOTICE: If the charger is exhibiting a 3 flash fault and it has been determined that the cause was not due to ventilation or high ambient temperature, the following procedure may restore the battery pack to normal operation.

1. Battery posts and terminals must be clean and free of corrosion.
2. For non-sealed batteries, check that electrolyte level just covers plates.
3. Plug in charger for at least a 16 hour charge.
4. Drive the vehicle for less than half the distance normally driven.
5. Repeat the above steps until the charger goes green 100% charge on a 16 hour charge.

If repeated charge cycles (5-7) do not result in a 100% green charge, the batteries are beyond useful life and will need replacement.

4 FLASH = Check Battery: The batteries could not be trickle charged up to a minimum level to start charger. This may be the result of badly discharged batteries, or one (or more) damaged cells. See *EXCESSIVELY DISCHARGED BATTERIES*.

5 FLASH = Over-Temperature: The charger shutdown due to high internal temperature. May require reset (AC unplugged) and cool down to restart charging cycle. This fault may indicate inadequate cooling airflow or high ambient air temperatures. Check for debris or blockage at cooling fins. Move the vehicle to a cooler, well ventilated area, or adjust time of day when charging.

6 FLASH = Charger Fault: A fault was detected either in the batteries or in the charger. The batteries must be tested to ensure there is no damage to one or more cells. If the batteries are found to be good, the charger may need to be replaced by a qualified technician.

A STEADY RED FAULT LED confirms an internal electrical fault of the charger and requires charger replacement and return.

CHECK / CHANGE CHARGING ALGORITHM

The charger has been programmed for use with the Columbia ParCar supplied batteries and contains algorithms for use with different batteries. Table A details these battery models.

TABLE A	
ALGORITHM	BATTERY TYPE
126	Full River 100Ah AGM
125	Full River 200Ah AGM
72	Generic 250-335 Ah Flooded Constant power dv/dt
43	Discovery AGM
42	Discover AGM 80 – 150 Ah
11	Generic 200-255 Ah Flooded Constant power dv/dt
5	Trojan 30XHS
4	US 2200, US 145 (Standard)
1	Trojan Flooded

NOTICE: For maximum battery life the correct algorithm must be used. If your battery model is not listed in Table A, contact Columbia ParCar for further information

Each time AC power is applied with the battery pack NOT connected, the charger enters an algorithm select/display mode for approximately 11 seconds. This will be displayed on the remote LED.

During this time, the current algorithm # is indicated on the LED light. A single digit algorithm # is indicated by the number of blinks separated by a pause. A two digit algorithm # is indicated by the number of blinks for the first digit followed by a short pause, then the number of blinks for the second digit followed by a longer pause.

To check/change the charging algorithm:

Disconnect the charger positive connector from battery pack. Apply AC power and after the LED test, the algorithm # will be displayed for 11 seconds.

To change the algorithm, touch the positive connector during the 11 second display period to the battery pack's positive terminal for 3 seconds and then remove. The algorithm # will advance after 3 seconds. Repeat until the desired algorithm # is displayed. A 30 second timeout is extended for every increment. Incrementing beyond the last algorithm moves back to the first algorithm. After the desired algorithm # is displayed touch the charger connector to the battery positive until the output relay is heard to click (~ 10 seconds). The algorithm is now in permanent memory.

Remove AC power from the charger and reconnect the charger positive connector to the battery pack. It is highly recommended to check a newly changed algorithm by repeating the above steps.

EXCESSIVELY DISCHARGED BATTERIES

NOTICE: Your Columbia Dealer will have the equipment and experience to perform the following battery inspections

The charger will not charge dead batteries. First establish that none of the batteries have an internal fault or bad cell. If a battery has remained too long in a discharged state (i.e. 2-4 volts each), it may be internally damaged and not capable of accepting a charge and must be replaced.

If the electrolyte Specific Gravity is low (less than 1.1098 SG) or individual battery voltage is less than 5.25 volts for three cells (10.5 volts for six cells), recharge each battery with an ordinary automotive style trickle charger at a rate of 3 to 6 amps.

It is not necessary to disconnect the battery cables, as the alligator style clips can be connected to each positive and negative battery post. Follow specific charger instructions.

⚠ DANGER

To prevent a spark from igniting the gas emitted from the batteries, always disconnect the charger AC power cord first when moving the positive/negative alligator clips.

Be sure to charge all of the batteries in the set. Each battery may require two to three hours of charging to bring it back to serviceable condition. After all batteries have been individually charged, remove the automotive charger and restart charging with the on-board charger. It may require several 8-12 hour cycles to bring severely discharged batteries back to 100% charged condition. If again the charger has the RED FAULT LED flashing there is a problem with one or more of the batteries.

SPECIFIC GRAVITY TEST

NOTICE: The following information does NOT apply to sealed batteries.

It is possible to determine a battery's ability to perform by measuring the specific gravity (sp. gr.) of each cell with a hydrometer. This is the best method to determine a defective battery.

The hydrometer readings indicate two things:

- State of Charge - The amount of electrical power stored in the battery.
- Condition - The ability of battery to store and deliver power.

NOTICE: Batteries should be fully charged before performing specific gravity tests to determine battery condition. Hydrometer tests of batteries not fully charged are misleading and inconclusive.

There are different type hydrometers. Carefully read and follow the instructions supplied with your hydrometer.

NOTICE: Specific gravity readings are at 80° F. Values need adjustment for electrolyte temperature. Reduce .004 for every 10° F below 80° F. Increase by that amount for every 10° F above.

TIPS FOR PROLONGING BATTERY LIFE

NOTICE: A common misconception is Deep Cycle Batteries develop a memory, lose capacity, or must be discharged until the BDI warning flashes and then recharged. Deep Cycle Wet Lead Acid Batteries are not like cell phone NiCad Batteries. Deep Cycle Batteries benefit from frequent charging and being maintained at as close as possible to a 100% state of charge. Plugging in the on-board charger overnight or when the vehicle is not in use for 3-5 or more days is encouraged.

- Recharge batteries as soon as they become 20% or more discharged (less than 1.238 sp. gr.).
- Make it a regular habit to plug in the charger when the vehicle is not in use. Batteries may be recharged if vehicle has been driven 15 minutes or more since the previous charge.
- Make sure your electrical outlet is operational.
- Never go below 20% state of charge (or 80% discharged) without recharging immediately. Allow 14 – 16 hours of charging.
- Batteries will provide a longer life if not deeply discharged. Batteries that are regularly deeply discharged will require more work by the charger and will have a shorter life.
- For non-sealed batteries, make it a regular habit to check (and water) your batteries after charging. Always add water after charging. This will reduce the chance for overflow due to expanding water.
- Weekly equalize the battery pack.
- If the vehicle is not operated daily the Power keyswitch should be turned off. This will power down the traction control system and reduces power loss on the batteries.
- Batteries in storage may self discharge and should be recharged when the specific gravity falls below 1.238 sp. gr. or individual battery voltage is less than 5.25 volts for three cells (10.5 volts for six cells).

BATTERY REMOVAL & INSTALLATION

- Remove battery negative (-) cables and then battery positive (+) cables.
- Remove battery hold down.
- Remove batteries from vehicle.
- To install batteries, reverse the removal procedure with the negative (-) cables being attached last. Torque connections to 100 in. lbs.

SINGLE POINT BATTERY WATERING SYSTEM (If equipped)

NOTICE: The following information does NOT apply to sealed batteries

This is a single point watering system for maintaining a sufficient electrolyte level in the batteries.

NOTICE: Do not operate this system on brand new batteries. See SECTION 3 OPERATIONS AND CONTROLS, IMPORTANT FIRST STEP for the initial check on the electrolyte level of new batteries. Complete 4 to 5 charge cycles before using the system.

System is to be used only after fully charging the batteries and batteries are warm.

The fill tube assembly which is used for adding water to the battery pack consists of a fill tube, one end having a filter screen, the other having a female coupler and a rubber squeeze bulb.

Check the battery pack water level weekly by:

- Inserting the fill tube filter end in an approved water supply.
- Attaching the female coupler to the battery pack male coupler. Squeeze the rubber ball until firm which indicates that filling is complete. Immediately disconnect the couplers by depressing the push button on the female coupler. If the water supply is left connected after the filling process is finished it could lead to an overflow.

MAINTENANCE GUIDELINES

To ensure that the vehicle is kept in a safe and correct operating condition, it must be inspected and maintained on a regular basis. Proper lubrication, electrical control adjustments, safety feature checks, etc. performed at recommended intervals will help prevent damage or failure of the unit while providing optimum performance.

Follow the guidelines below to assure proper maintenance.

- Before starting any repairs or maintenance, immobilize the vehicle by turning the power keyswitch off, removing the key and setting the park brake.
- Power down the vehicle using the blue battery quick disconnect. See *SECTION 2 SAFETY BATTERY DISCONNECT METHOD*.
- Block the chassis with jack stands before working under a raised vehicle.
- Do not use flammable fluids for cleaning parts.
- Work in a properly ventilated work area.
- Regularly inspect and maintain in safe working condition the brakes, steering mechanisms, speed and directional control mechanisms, warning devices, guards and safety devices.
- Keep the vehicle in a clean condition to minimize fire hazards and facilitate detection of loose or defective parts.

BRAKE SYSTEM

Adjustments/repairs to the brakes and emergency brake are to be completed by a trained qualified technician or your Columbia Dealer.

BRAKE FLUID MAINTENANCE

Check the brake fluid in the master cylinder periodically (under normal conditions, every 3 months). The master cylinder is located under the front hood. Use DOT 3 Motor Vehicle Brake fluid. Maintain fluid level within 1/4" of master cylinder filler opening.

TIRE CARE

See *SECTION 1 INTRODUCTION, VEHICLE SPECIFICATIONS* for recommended tire pressure. Improper inflation will shorten the life of your tires and will adversely affect performance.

NOTICE: Replacement tires must be the same size as original equipment. Increased tire load ratings are permissible but tire rating does not increase the rated load carrying capacity of the vehicle.

WHEEL & TIRE REMOVAL/INSTALLATION

Place blocks ahead of and behind the wheels that will remain on ground. Slightly loosen lug nuts. Place a jack under the side of the vehicle in contact with the frame. Raise vehicle and remove lug nuts and wheels. To install, tighten the lug nuts evenly in a star pattern until the nuts are all seated and torque to 65 ft. lbs. (88.1 N.m). Recheck lug nut torque with the vehicle on the ground.

NOTICE: The wheel may be bent if not torqued in a crossing pattern. This will cause the wheel to wobble.

CLEANING

Wash underside to remove all dirt and debris. Do not direct high pressure water at the controller, speed switches, or tops of the batteries.

Wash body and seat with a mild detergent. Do not use abrasives (bodies are painted). Frequent washings with mild soap will preserve the finish of your vehicle. For stubborn and imbedded dirt, a soft bristle brush may be used. Tar, asphalt, creosote and the like should be removed immediately to prevent staining of paint.

NOTICE: Do not use harsh detergents, abrasives or cleaning solvents that contain ammonia, aromatic solvents or alkaline material to clean cab.

MAINTENANCE SCHEDULE - OWNER/OPERATOR

Item	Operation	Weekly	Monthly	Semi-Annual
Tires	Lug nuts tight.		*	
	Check tire pressure, wear, damage. dented rims.		*	
Electrical	Check battery electrolyte level.	*		
	Apply equalization charge to the battery pack.	*		
	As required, clean battery terminals and wash cases.	*		
	Check the general condition of the electrical system (connections, frayed/broken cables).		*	
Brakes	Check pedal & park brake operation.		*	
Body and Frame	Inspect for loose hardware (bolts & nuts).	*		
	Clean body and seats, Wash as needed.	*		
Lube	Visually check suspension and differential for leakage.		*	

MAINTENANCE SCHEDULE QUALIFIED TECHNICIAN

It is recommended that the following be performed by a trained qualified technician or your Columbia Dealer.

Item	Operation	Quarterly	Semi-Annual	Annual
Tires	Front wheel alignment .		*	
Electrical	Test batteries.		*	
	Inspect motor condition and operation.			*
Brakes	Check brakes, clean, adjust, replace if needed.		*	
	Check brake fluid (when equipped)	*		
Lube	Check differential fluid level.			*
	Grease fittings.		*	
Wheel	Check wheel axle nuts for tightness & torque.		*	
	When equipped,- wheel bearings, repack, replace if needed			*

VEHICLE TROUBLESHOOTING

PROBLEM	CHECK
Will not move	Power keyswitch on. Direction Selector in desired direction. Keyswitch for loose wires or faulty switch.
	Batteries for loose terminals, corrosion, electrolyte level or state of charge.
	Motor for loose wires, open circuits or worn brushes.
Will not move with power keyswitch on and the direction selector is in the desired direction	See Controller Troubleshooting below.
Runs slow	Batteries for loose terminals, corrosion, electrolyte level or state of charge.
	Brakes dragging
	Under inflated or flat tires.
	Wheels for binding, do not spin freely.
If these test procedures do not resolve your vehicle problem, contact your Columbia Dealer for service.	

CONTROLLER TROUBLESHOOTING

The AC Drive controller sends fault codes to a Multi-Function Display as seen in figure 5-1. For codes above operator level, or general assistance with these codes, consult the service manual or your local authorized dealer.

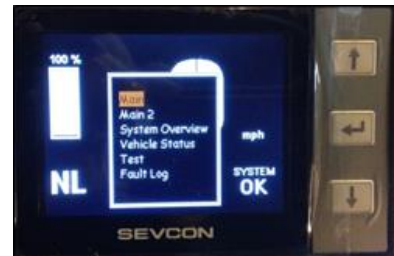


Figure 5-1

TOWING WITH THIS VEHICLE AS LEAD VEHICLE

NOTICE: If equipped with proper hitch and towing equipment observe these safety rules:

When using this vehicle as a tow vehicle to pull trailers or a properly equipped other vehicle, observe the following:

- The maximum tongue weight on this vehicle is limited to 350 pounds
- Secure vehicle to the trailer following trailer manufacturer's instruction.
- The maximum towing capacity of this vehicle is 1500 pounds for a trailer without additional electric brakes.
- The maximum towing capacity of this vehicle is 3500 pounds for a trailer equipped with operational electric brakes.
- The towing capacities are reduced by the weight of any load carried on vehicle.

TOWING THIS VEHICLE IF NON-OPERATIONAL

The front bumper is equipped with a receiver for lifting or towing.

NOTICE: This vehicle may be towed with the following precautions:

- T** Turn off key.
- O** Occupants and or cargo must be unloaded.
- W** Walk around vehicle to inspect for any loose or dragging items.
- I** Inspect lift mechanism or tow straps/chains for secure fit.
- N** No parking brake, service brake, or wheel chocks should be in place.
- G** Go no faster than 5 mph while towing vehicle.

TRANSPORTING THIS VEHICLE

NOTICE: To transport this vehicle behind an auto or truck on an approved trailer.

When trailering your vehicle over long distances or on the highway observe the following:

- Use trailers specifically designed to carry your Columbia ParCar vehicle that meets all federal, state and local requirements.
- Secure vehicle to the trailer following trailer manufacturer's instruction.
- The key should be removed from the vehicle, the parking brake firmly locked, and the wheels blocked.
- On vehicles equipped with high or wide additions or accessories be certain they are secured properly to prevent loss or damage while trailering.
- Windshields and/or sun tops may also need to be removed to prevent damage or loss.

BATTERY PREPARATION

Before storage make sure batteries are fully charged, For non-sealed batteries make sure the electrolyte is full in all cells as shown in *SECTION 4 ELECTRIC SYSTEM, BATTERY INSPECTION & MAINTENANCE*. Clean the batteries and connections as described in *SECTION 4 ELECTRIC SYSTEM, BATTERY CLEANING*.

The charger has the capability to test and recharge batteries during storage. Leave the batteries connected and the charger plugged into a reliable AC source.

If the on-board charger is not used the batteries will "self-discharge" during storage and recharging will be necessary. Table B shows the frequency for recharging.

TABLE B	
STORAGE TEMPERATURE	CHARGE AT
Below 4° C (40° F)	Every 6 months
4° C - 16° C (40° - 60° F)	Every 2 months
Above 16° C (60° F)	Once a month

The voltage or specific gravity of the electrolyte should be checked every 6 to 8 weeks using a voltmeter or hydrometer.

The batteries should be recharged to a specific gravity of approximately 1.260 sp. gr.

After charging, disconnect the batteries. See *SECTION 2 SAFETY, BATTERY DISCONNECT METHOD*.

NOTICE: Batteries in a low state of charge will freeze at higher temperatures than fully charged batteries. Do not attempt to charge a battery that is frozen or if battery case is excessively bulged. Properly dispose of battery, because frozen batteries can explode.

Table C indicates freezing points of batteries at different specific gravities.

TABLE C	
SPECIFIC GRAVITY	FREEZE POINT °F/°C
1.260	-70/-57
1.230	-39/-38
1.200	-16/-26
1.117	-2/-19
1.110	+17/-8

Notice: Specific gravity readings are at 80° F. Values need adjustment for electrolyte temperature. Reduce .004 for every 10° F below 80° F. Increase by that amount for every 10° F above

Quarterly during storage check water levels for non-sealed batteries.

VEHICLE PREPARATION

Store the vehicle in a cool place.

Maintain tire pressure at recommended PSI.

Grease suspension and continue quarterly lubrication during storage period.

Clean vehicle body, seats, battery compartment and vehicle underside.

Do not engage park brake. Block wheels to prevent movement.

NOTICE: Make sure power keyswitch is in the OFF position.

RETURNING VEHICLE TO SERVICE

- If necessary, connect the battery pack and fully recharge batteries.
- Check tire pressure and readjust if necessary. See Section 1.
- Perform Pre-Operational Checklist per Section 3.

For vehicles with a single point watering system:

- After the batteries have been fully charged, connect the system to its water supply for 3-5 seconds then disconnect regardless of whether or not the batteries are completely full.
- Return the vehicle to its regular service.
- Place the vehicle back into its regular watering schedule (waiting at least 1 week until next watering).



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