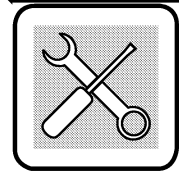


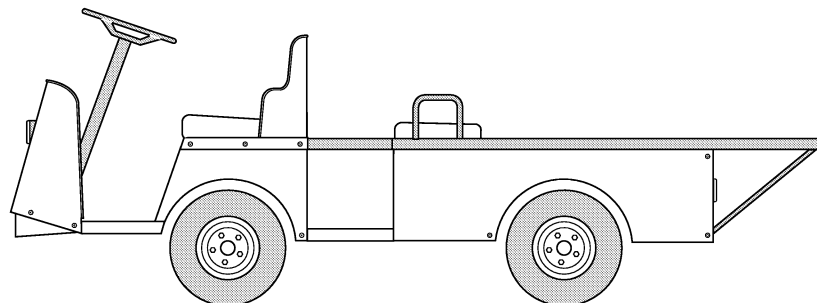
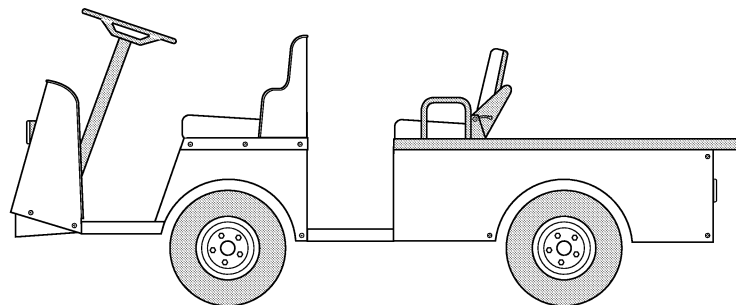
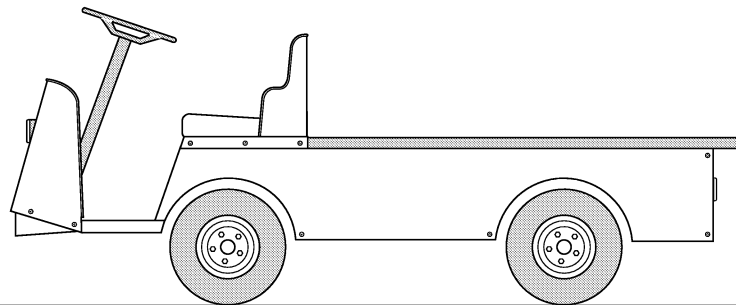
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a **TEXTRON** Company



# TECHNICIAN'S REPAIR AND SERVICE MANUAL



## **ELECTRIC POWERED CARGO AND PERSONNEL CARRIERS (875/881 SERIES)**

STARTING MODEL YEAR: 2000

REVISED: 11/2000

# SAFETY

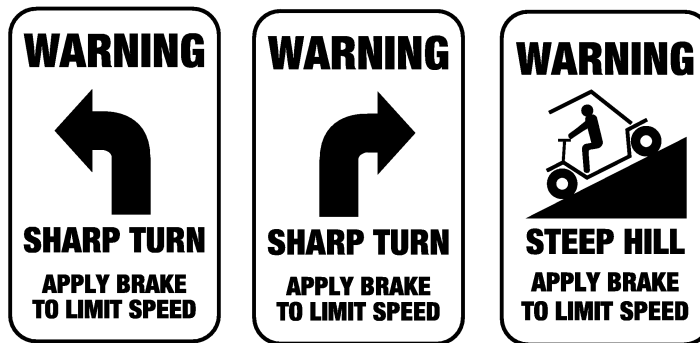
Read and understand all labels located on the vehicle. For any questions on any of the information, contact an E-Z-GO representative for clarification.

Always replace any damaged or missing labels.

On steep hills it is possible for vehicles to coast at greater than normal speeds encountered on a flat surface. To prevent loss of vehicle control and possible serious injury, speeds should be limited to no more than the maximum speed on level ground. (See vehicle specification.) Limit speed by applying the service brake.

Catastrophic damage to the drive train components due to excessive speed may result from driving the vehicle above specified speed. Damage caused by excessive speed may cause a loss of vehicle control, is costly, is considered abuse and will not be covered under warranty.

If the vehicle is to be used in a commercial environment, signs similar to the one illustrated should be used to warn of hills that could result in an unsafe coasting condition.



Be sure that this manual remains as part of the permanent service record should the vehicle be re-sold.

## NOTES, CAUTIONS AND WARNINGS

Throughout this guide **NOTE**, **CAUTION** and **WARNING** will be used.

**NOTE** A **NOTE** indicates a condition that should be observed.

**CAUTION** A **CAUTION** indicates a condition that may result in damage to the vehicle.

**WARNING** A **WARNING** indicates a hazardous condition which could result in severe injury or death.

Please observe these **NOTES**, **CAUTIONS** and **WARNINGS**; be aware that servicing a vehicle requires mechanical skill and a regard for conditions that could be hazardous. Improper service or repair may damage the vehicle or render it unsafe.

(NOTES, CAUTIONS AND WARNINGS CONTINUED ON INSIDE OF BACK COVER)

# **TECHNICIAN'S REPAIR AND SERVICE MANUAL**

## **ELECTRIC CARGO AND PERSONNEL CARRIERS (875 SERIES)**

### **VEHICLES**

**875E**

**875PE**

**875AE**

**881E**

E-Z-GO Division of Textron reserves the right to make design changes without obligation to make these changes on units previously sold and the information contained in this manual is subject to change without notice.

E-Z-GO Division of Textron 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.

**CUSTOMER SERVICE DEPARTMENT IN USA PHONE: 1-800-241-5855 FAX: 1-800-448-8124**

**OUTSIDE USA PHONE: 010-1-706-798-4311, FAX: 010-1-706-771-4609**

**E-Z-GO DIVISION OF TEXTRON, INC., P.O.BOX 388, AUGUSTA, GEORGIA USA 30903-0388**



## **NOTES**

To obtain a copy of the limited warranty applicable to the vehicle, call or write a local distributor, E-Z-GO Branch or the E-Z-GO Warranty Department with vehicle serial number and manufacturer code.

The use of non E-Z-GO parts may void the warranty.

Overfilling of batteries may void the warranty.

### **BATTERY PROLONGED STORAGE**

All batteries will self discharge over time. The rate of self discharge varies depending on the ambient temperature and the age and condition of the batteries.

A fully charged battery will not freeze in winter temperatures unless the temperature falls below -75° F (-60° C).

For winter storage, the batteries must be clean, fully charged and disconnected from any source of electrical drain. The battery charger and the controller are both sources of electrical drain. For vehicles with portable chargers, unplug the battery charger DC plug from the vehicle receptacle. For vehicles with on-board chargers, disconnect the charger harness from the battery terminals.

As with all electric vehicles, the batteries must be checked and recharged as required or at a minimum of 30 day intervals.

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# SAFETY INFORMATION

This manual has been designed to assist the owner-operator in maintaining the vehicle in accordance with procedures developed by E-Z-GO. Adherence to these procedures and troubleshooting tips will ensure the best possible service from the product. To reduce the chance of personal injury and/or property damage, the following instructions must be carefully observed:

## GENERAL

Many vehicles are used for a variety of tasks beyond the original intended use of the vehicle; therefore it is impossible to anticipate and warn against every possible combination of circumstances that may occur. No warnings can take the place of good common sense and prudent driving practices.

Good common sense and prudent driving practices do more to prevent accidents and injury than all of the warnings and instructions combined. E-Z-GO strongly suggests that the owner-operator read this entire manual paying particular attention to the CAUTIONS and WARNINGS contained therein. It is further recommended that employees and other operators be encouraged to do the same.

If you have any questions, contact your closest E-Z-GO representative or write to the address on the back cover of this publication, Attention: Product Service Department.

E-Z-GO Division of Textron reserves the right to make design changes without obligation to make these changes on units previously sold and the information contained in this manual is subject to change without notice.

E-Z-GO Division of Textron 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.

This vehicle conforms to the current applicable standard for safety and performance requirements.

These vehicles are designed and manufactured for off-road use. They do not conform to Federal Motor Vehicle Safety Standards and are not equipped for operation on public streets. Some communities may permit these vehicles to be operated on their streets on a limited basis and in accordance with local ordinances.

With electric powered vehicles, be sure that all electrical accessories are grounded directly to the battery (-) post. **Never use the chassis or body as a ground connection.**

Refer to GENERAL SPECIFICATIONS for vehicle seating capacity.

**Never modify the vehicle in any way that will alter the weight distribution of the vehicle, decrease its stability or increase the speed beyond the factory specification. Such modifications can cause serious personal injury or death.** Modifications that increase the speed and/or weight of the vehicle will extend the stopping distance and may reduce the stability of the vehicle. Do not make any such modifications or changes. E-Z-GO prohibits and disclaims responsibility for any such modifications or any other alteration which would adversely affect the safety of the vehicle.

Vehicles that are capable of higher speeds must limit their speed to no more than the speed of other vehicles when used in a golf course environment. Additionally, speed should be further moderated by the environmental conditions, terrain and common sense.

## GENERAL OPERATION

Always use the vehicle in a responsible manner and maintain the vehicle in safe operating condition.

Always read and observe all warnings and operation instruction labels affixed to the vehicle.

Always follow all safety rules established in the area where the vehicle is being operated.

Always reduce speed to compensate for poor terrain or conditions.



## **SAFETY INFORMATION**

- Always apply service brake to control speed on steep grades.
- Always maintain adequate distance between vehicles.
- Always reduce speed in wet areas.
- Always use extreme caution when approaching sharp or blind turns.
- Always use extreme caution when driving over loose terrain.
- Always use extreme caution in areas where pedestrians are present.

## **MAINTENANCE**

- Always maintain your vehicle in accordance with the manufacturer's periodic service schedule.
- Always ensure that mechanics performing repairs are trained and qualified to do so.
- Always follow the manufacturer's directions if you do any maintenance on your vehicle. Be sure to disable the vehicle before performing any maintenance. Disabling includes removing the key from the key switch and removal of a battery wire.
- Always insulate any tools used within the battery area in order to prevent sparks or battery explosion caused by shorting the battery terminals or associated wiring. Remove the batteries or cover exposed terminals with an insulating material.
- Always check the polarity of each battery terminal and be sure to rewire the batteries correctly.
- Always use specified replacement parts. Never use replacement parts of lesser quality.
- Always use recommended tools.
- Always determine that tools and procedures not specifically recommended by the manufacturer will not compromise the safety of personnel nor jeopardize the safe operation of the vehicle.
- Always support the vehicle using wheel chocks and safety stands. Never get under a vehicle that is supported by a jack. Lift the vehicle in accordance with the manufacturer's instructions.
- Never attempt to maintain a vehicle in an area where exposed flame is present or persons are smoking.
- Always be aware that a vehicle that is not performing as designed is a potential hazard and must not be operated.
- The manufacturer cannot anticipate all situations, therefore people attempting to maintain or repair the vehicle must have the skill and experience to recognize and protect themselves from potential situations that could result in severe personal injury or death and damage to the vehicle. Use extreme caution and, if unsure as to the potential for injury, refer the repair or maintenance to a qualified mechanic.
- Always test drive the vehicle after any repairs or maintenance. All tests must be conducted in a safe area that is free of both vehicular and pedestrian traffic.
- Always replace damaged or missing warning, caution or information labels.
- Always keep complete records of the maintenance history of the vehicle.



# **SAFETY INFORMATION**

## **VENTILATION**

Hydrogen gas is generated in the charging cycle of batteries and is explosive in concentrations as low as 4%. Because hydrogen gas is lighter than air, it will collect in the ceiling of buildings necessitating proper ventilation. Five air exchanges per hour is considered the minimum requirement.

Never charge a vehicle in an area that is subject to flame or spark. Pay particular attention to natural gas or propane gas water heaters and furnaces.

Always use a dedicated 15 amp circuit for each battery charger. Do not permit other appliances to be plugged into the receptacle when the charger is in operation.

Non E-Z-GO chargers must be installed and operated in accordance with charger manufacturers recommendations or applicable electrical code (whichever is higher).



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# GENERAL INFORMATION & ROUTINE MAINTENANCE



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## SERIAL NUMBER PLATE LOCATION

The serial and manufacturing numbers are located on a plate on the driver side seat support (Ref Fig. 1 on page A-1).

Design changes take place on an on-going basis. In order to obtain correct components for the vehicle, the manufacturing date and serial number must be provided when ordering service parts.

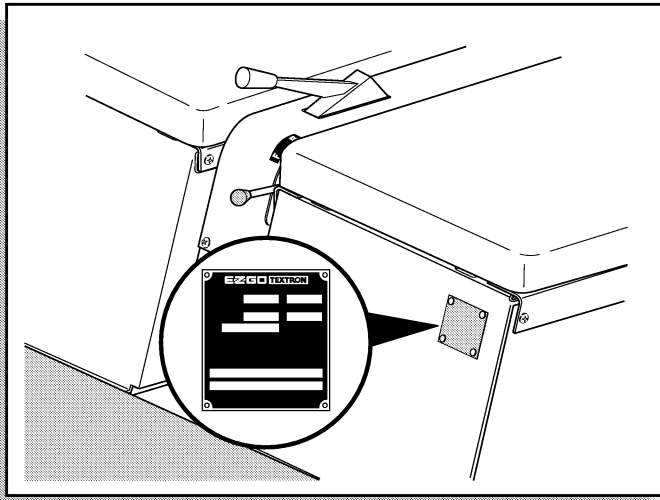


Fig. 1 Serial Number Plate Location

## SERVICING THE ELECTRIC VEHICLE

**NOTE** Read and understand the following text and warnings before attempting to service vehicle.

In any product, components will eventually fail to perform properly as the result of normal use, age, wear or abuse.

It is virtually impossible to anticipate all possible component failures or the manner in which each component may fail.

A vehicle requiring repair indicates that the vehicle is no longer functioning as designed and should be considered potentially hazardous. Use extreme care when working on any vehicle. When diagnosing, removing or replacing any components that are not operating correctly, take the time to consider the safety of yourself and others around you if the component should move unexpectedly.

Some components are heavy, spring loaded, highly corrosive, explosive, may produce amperage or reach high temperatures. Battery acid and hydrogen gas could result in serious bodily injury to the technician/mechanic and bystanders, if not treated with the utmost caution. Be careful not to place hands, face, feet or body in a location

that could expose them to injury should an unforeseen dangerous situation occur.



**Before attempting any type of servicing operations, read and understand all Notes, Cautions and Warnings in this manual.**

It is in the best interest of both vehicle owner and servicing dealer to carefully follow the procedures recommended in this manual. Adequate preventative maintenance, applied at regular intervals, is the best guarantee for keeping the E-Z-GO vehicle both dependable and economical



**To reduce the possibility of causing an electrical arc, which could result in a battery explosion, turn off all electrical loads from the batteries before removing any heavy gauge battery wires.**



**Wear eye protection when working on or around vehicle. In particular, use care when working around the batteries, or when using solvents or compressed air.**

**Servicing requiring adjustments to be made to the powertrain while the motor is running, must be made with both drive wheels raised.**

**Never operate vehicle at full throttle for more than 4-5 seconds while vehicle is in a "no load" condition.**

Before a new vehicle is put into operation, it is recommended that the items shown in the INITIAL SERVICE CHART be performed (Ref Fig. 2 on page A-1).

| ITEM      | SERVICE OPERATION                       |
|-----------|---|
| Batteries | Charge batteries                        |
| Seats     | Remove protective plastic covering      |
| Brakes    | Check operation and adjust if necessary |
|           | Check hydraulic brake fluid level       |
| Tires     | Check pressure                          |

Fig. 2 Initial Service Chart

Vehicle batteries must be fully charged before initial use.

# GENERAL INFORMATION & ROUTINE MAINTENANCE

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## ROUTINE MAINTENANCE

This vehicle will give years of satisfactory service providing it receives regular maintenance. Refer to the Periodic Service Schedule (Ref Fig. 7 on page A-5) for appropriate service intervals. Refer to Lubrication Points (Ref Fig. 3 on page A-2) for appropriate lubrication locations.

**CAUTION** Do not use more than three (3) pumps of grease in each grease fitting at any one time. Excess grease may cause grease seals to fail or grease migration into areas that could damage components.

**NOTE** Some maintenance items must be serviced more frequently on vehicles used under severe driving conditions.

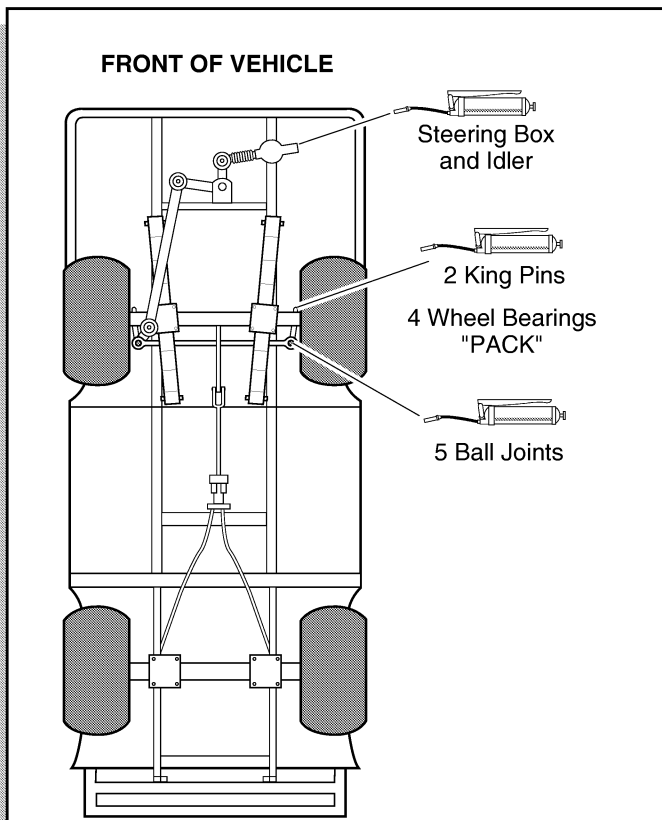


Fig. 3 Lubrication Points

## REAR AXLE

The only maintenance required for the first five years is the periodic inspection of the lubricant level. The rear axle is provided with a lubricant level check/fill plug located on the bottom of the differential. Unless leakage is evident, the lubricant need only be replaced after five years.

## Checking the Lubricant Level

Clean the area around the check/fill plug and remove plug. The correct lubricant level is just below the bottom of the threaded hole. If lubricant is low, add as required. Add lubricant slowly until lubricant starts to seep from the hole. Install the check/fill plug. In the event that the lubricant is to be replaced, the vehicle must be elevated and the oil pan removed or the oil siphoned out through the check/fill hole (Ref Fig. 4 on page A-2).

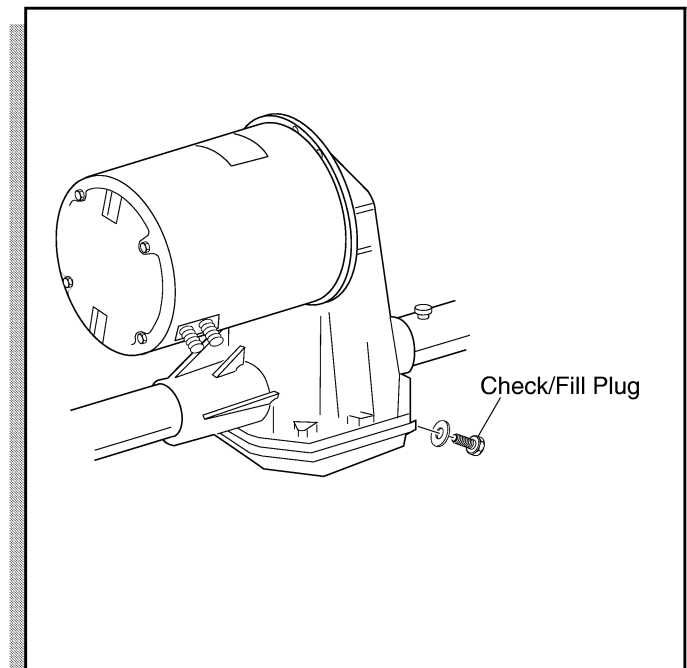


Fig. 4 Add, Check and Drain Rear Axle Lubricant

## DAILY BRAKE TEST

After the vehicle has been put into service, it is recommended that the brakes be checked daily by performing the following test:

**⚠ WARNING ⚠** All driving brake tests must be done in a safe location with regard for the safety of all personnel.

Depress the brake pedal. The pedal should have some free travel and then become hard. A brake pedal that has no free travel, excessive free travel or a spongy feel is indicating that a brake inspection is required. A brake pedal that falls after it is applied indicates a leak in the master or wheel cylinders. Check for adequate brake fluid level. Adjust brakes if required and inspect system for fluid leaks.

# GENERAL INFORMATION & ROUTINE MAINTENANCE

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## TIRES

Tire condition should be inspected on a daily basis. Inflation pressures should be checked when the tires are cool. For additional information, refer to WHEELS AND TIRES section.

## CARE AND CLEANING OF THE VEHICLE

**CAUTION** To prevent cosmetic damage, do not use any abrasive or volatile solvents to clean plastic parts.

It is important that proper techniques and cleaning materials be used.

Normal cleaning of vinyl seats and plastic or rubber trim require the use of a mild soap solution applied with a sponge or soft brush and wipe with a damp cloth.

Removal of oil, tar, asphalt, shoe polish, etc. will require the use of a commercially available vinyl/rubber cleaner.

The painted surfaces of the vehicle provide attractive appearance and durable protection. Frequent washing with lukewarm or cold water is the best method of preserving the painted surfaces.

Do not use hot water, strong soap or harsh chemical detergents.

Rubber parts should be cleaned with non-abrasive household cleaner.

Occasional cleaning and waxing with non-abrasive products designed for 'clear coat' automotive finishes will enhance the appearance and durability of the painted surfaces.

Corrosive materials used as fertilizers or for dust control can collect on the underbody of the vehicle. These materials could cause corrosion of underbody parts. It is recommended that the underbody be flushed occasionally with plain water. Thoroughly clean any areas where mud or other debris can collect. Sediment packed in closed areas should be loosened to ease its removal, taking care not to chip or otherwise damage paint.

## VEHICLE CARE PRODUCTS

To help maintain the vehicle, E-Z-GO has several products, available through a local Distributor, an E-Z-GO Branch, or the E-Z-GO Service Parts Department.

- Touch-up paint specially formulated to match vehicle colors for use on both metal and TPO (plastic) bodies. (P/N28140-G\*\* and 28432-G\*\*)

- Multi-purpose Battery Protectant formulated to form a long-term, flexible, non-tacky, dry coating that will not crack, peel or flake over a wide temperature range. (P/N 75500-G01)
- White Lithium Grease designed to provide lubrication protection in areas where staining or discoloring is a problem, or in areas of extreme temperature ranges. (P/N 75502-G01)
- Penetrant/Lubricant, a 4-in-1 product that penetrates the most stubborn of frozen parts, lubricates leaving a light lubricating film, prevents corrosion by adhering to wet or dry surfaces and displaces moisture, sealing against future moisture return. (P/N 75503-G01)
- Multi-purpose Cleaner and Degreaser that contains natural, environmentally safe solvents. (P/N 75504-G01)
- Multi-purpose Hand Cleaner is an industrial strength cleaner containing no harsh solvents, yet gently lifts grease off hands. May be used with or without water. (P/N 75505-G01)
- Battery Cleaner that promotes easy, non-violent neutralization of battery acids and battery acid crystals. The resulting sodium salts are water soluble and easily washed away. (P/N 75506-G01)
- Battery Maintenance Kit for complete battery cleaning and watering, with battery maintenance instructions. (P/N 25587-G01)
- Biodegradable Cleaner that cleans the toughest dirt and heavy soils by breaking down grease to be easily wiped or rinsed away. (P/N 75507-G01)
- Multi-purpose Value Pack sampler package including 4 ounce (118 ml) aerosol cans of Battery Protector, Penetrant/Lubricant, White Lithium Grease, and Carburetor and Choke Cleaner. (P/N 75508-G01)
- Plexus plastic cleaner and polish removes minor scratches from windshield. (P/N 28433-G\*\*)

## TOP AND WINDSHIELD



**The top does not provide protection from roll over or falling objects.**

**The windshield does not provide protection from tree limbs or flying objects.**

Clean with lots of water and a clean cloth. Minor scratches may be removed using a commercial plastic polish or Plexus plastic cleaner available from E-Z-GO.

# GENERAL INFORMATION & ROUTINE MAINTENANCE

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## TRAILERING



**Personal injury to occupants of other highway vehicles may occur if**

**vehicle and contents are not adequately secured to trailer.**

**Do not ride on vehicle being trailered.**

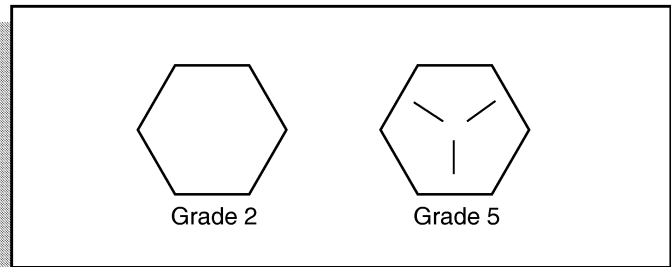
**Do not tow trailered vehicle with top at speeds in excess of 50 mph (80 kph).**

If the vehicle is to be transported on a trailer at highway speeds, the windshield and top must be removed and the seat bottom secured. Always check that the vehicle and contents are adequately secured before trailering the vehicle. The rated capacity of the trailer used must exceed the weight of the vehicle (See GENERAL SPECIFICATIONS for vehicle weight) and load plus 1000 lbs (454 kg). Lock the parking brake and secure the vehicle to the trailer using ratchet tie downs.

## HARDWARE

Periodically the vehicle should be inspected for loose fasteners. Fasteners should be tightened in accordance with the Torque Specifications table (Ref Fig. 6 on page A-4).

In general two grades of hardware are used in the vehicle. Grade 5 hardware can be identified by the three marks on the hexagonal head. Unmarked hardware is Grade 2 (Ref Fig. 5 on page A-4).



**Fig. 5 Bolt Grades**

## TORQUE SPECIFICATIONS

### ALL TORQUE FIGURES ARE IN FT. LBS. (Nm)

Unless otherwise noted in text, tighten all hardware in accordance with this chart. The table below specifies 'lubricated' torque figures. Fasteners that are plated or lubricated when installed are considered 'wet' and require approximately 80% of the torque required for 'dry' fasteners.

| BOLT SIZE | 1/4"     | 5/16"      | 3/8"       | 7/16"      | 1/2"       | 9/16"       | 5/8"         | 3/4"         | 7/8"         | 1"           |
|-----------|----------|------------|------------|------------|------------|-------------|--------------|--------------|--------------|--------------|
| Grade 2   | 4<br>(5) | 8<br>(11)  | 15<br>(20) | 24<br>(33) | 35<br>(47) | 55<br>(75)  | 75<br>(102)  | 130<br>(176) | 125<br>(169) | 190<br>(258) |
| Grade 5   | 6<br>(8) | 13<br>(18) | 23<br>(31) | 35<br>(47) | 55<br>(75) | 80<br>(108) | 110<br>(149) | 200<br>(271) | 320<br>(434) | 480<br>(651) |

**Fig. 6 Torque Specifications**



# GENERAL INFORMATION & ROUTINE MAINTENANCE

*Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings*

## PERIODIC SERVICE SCHEDULE

|   |   |           |
|---|---|-----------|
| ✓ Check   | ◆ Clean, Adjust, etc.   | ▲ Replace |
| <b>NOTE:</b> Some maintenance items must be serviced more frequently on vehicles used under severe driving conditions |   |           |
| <b>DAILY</b>  |   |           |
| BODY  | ◆ Clean body components as required   |           |
| SERVICE BRAKE   | ✓ Check brake performance, smooth operation and adjust if required  |           |
| PARKING BRAKE   | ✓ Check brake performance and adjust if required  |           |
| REVERSE WARNING DEVICE  | ✓ Check operation when direction selector is in reverse   |           |
| TIRES   | ✓ Examine for cuts, excessive wear and pressure (See GENERAL SPECIFICATIONS section)  |           |
| WHEELS  | ✓ Check for bent rims, missing or loose lug nuts  |           |
| BATTERIES   | ✓ Recharge to full charge state after each day's use  |           |
| CHARGER / RECEPTACLE  | ✓ Inspect connector system at each charge   |           |
| <b>MONTHLY - 20 HOURS (includes items listed in previous tables &amp; the following)</b>                              |   |           |
| BATTERIES   | ◆ Clean batteries and terminals with 1/4 cup (60 ml) baking soda to 1 1/2 gallons (6 liters) water solution, rinse with clear water<br>✓ Check charge condition and all connections |           |
| WIRING  | ✓ Check all wiring for loose connections and broken/missing insulation  |           |
| ACCELERATOR   | ✓ Check for smooth movement   |           |
| CHARGER / RECEPTACLE  | ◆ Clean connections, keep receptacles free of dirt and foreign matter   |           |
| DIRECTION SELECTOR  | ✓ Check attachment, tighten as required   |           |
| STEERING ASSEMBLY   | ✓ Check for abnormal play, tightness of all hardware  |           |
| TIE RODS/LINKAGES   | ✓ Check for excessive play, bent components or loose connections  |           |
| REAR AXLE   | ✓ Check for leakage, add SAE oil as required  |           |
| <b>QUARTERLY - 50 HOURS (includes items listed in previous tables &amp; the following)</b>                            |   |           |
| FRONT AXLE  | ✓ Check for damage to axle and loose or missing hardware  |           |
| FRONT SHOCK ABSORBERS   | ✓ Check for oil leakage and loose fasteners   |           |
| FRONT SPRINGS   | ✓ Check for loose hardware, cracks at attachments   |           |
| FRONT WHEEL ALIGNMENT   | ✓ Check for unusual tire wear. Align, if required. (See FRONT SUSPENSION AND STEERING section)  |           |
| PARKING BRAKE   | ✓ Check for bent/binding linkage rod<br>✓ Check for damage or wear<br>◆ Lubricate, use light oil. DO NOT LUBRICATE CABLES   |           |

**Fig. 7 Periodic Service Schedule**

# GENERAL INFORMATION & ROUTINE MAINTENANCE

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

|   |   |
|---|---|
| HYDRAULIC BRAKE FLUID   | ✓ Check level, add if required and check for leakage (DOT 3)  |
| REAR SHOCK ABSORBERS  | ✓ Check for oil leakage, loose mounting hardware  |
| <b>SEMI-ANNUAL - 125 HOURS (includes items listed in previous tables &amp; the following)</b> |   |
| DIRECTION SELECTOR  | ✓ Check for wear and smooth movement (lubricate shaft with light oil if required)                   |
| KING PINS   | ✓ Check for excessive play and tightness of retaining nuts<br>◆ Lubricate, use wheel bearing grease |
| STEERING ASSEMBLY   | ◆ Lubricate linkage, use wheel bearing grease   |
| TIE RODS/LINKAGES   | ◆ Lubricate, use wheel bearing grease   |
| REAR AXLE   | ✓ Check for unusual noise and loose or missing mounting hardware                                    |
| <b>ANNUAL - 250-300 HOURS (includes items listed in previous tables &amp; the following)</b>  |   |
| FRONT WHEEL BEARINGS  | ◆ Adjust per FRONT SUSPENSION AND STEERING section<br>◆ Pack, use multi-purpose grease              |
| REAR AXLE   | ✓ Check lubricant, add lubricant (SAE 30 oil) as required<br>▲ Replace lubricant after 5 years      |
| SERVICE BRAKES  | ◆ Clean and adjust per Brakes Section<br>✓ Check brake shoe linings per BRAKES section              |

**Fig. 7 Periodic Service Schedule**

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Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## GENERAL

The following text is provided as recommended by part II of ASME/ANSI B56.8-1988. E-Z-GO strongly endorses the contents of this specification.

## PART II FOR THE USER

### 4 GENERAL SAFETY PRACTICES

#### 4.1 Introduction

**4.1.1** Like other machines, carriers can cause injury if improperly used or maintained. Part II contains broad safety practices applicable to carrier operations. Before operation, the user shall establish such additional specific safety practices as may reasonably be required for safe operation.

#### 4.2 Stability

**4.2.1** Experience has shown that this vehicle, which complies with this standard, is stable when properly operated and when operated in accordance with specific safety rules and practices established to meet actual operating terrain and conditions. However, improper operation, faulty maintenance, or poor housekeeping may contribute to a condition of instability and defeat the purpose of the standard. Some of the conditions which may affect stability are failure of the user to follow safety practices; also, ground and floor conditions, grade, speed, loading, the operation of the carrier with improper loads, battery weight, dynamic and static forces, and the judgement exercised by the carrier operator.

(a) The user shall train carrier operators to adhere strictly to the operating instructions stated in this Standard.

(b) The user shall survey specific operating conditions and environment, and establish and train carrier operators to comply with additional, specific safety practices.

#### 4.3 Nameplates, Markings, Capacity, and Modifications

**4.3.1** The user shall maintain in a legible condition all nameplates, warnings, and instructions which are supplied by the manufacturer.

**4.3.2** The user shall not perform any modification or addition which affects capacity or safe operation, or make any change not in accordance with the owner's

manual without the manufacturer's prior written authorization. Where authorized modifications have been made, the user shall ensure that capacity, operation, warning, and maintenance instruction plates, tags, or decals are changed accordingly.

**4.3.3** As required under paras. 4.3.1 or 4.3.2, the manufacturer shall be contacted to secure new nameplates, warnings, or instructions which shall then be affixed in their proper place on the carrier.

#### 4.4 Fuel Handling and Storage

**4.4.1** The user shall supervise the storage and handling of liquid fuels (when used) to be certain that it is in accordance with appropriate paragraphs of ANSI/NFPA 505 and ANSI/NFPA 30.

**4.4.2** Storage and handling of liquefied petroleum gas fuels shall be in accordance with appropriate paragraphs of ANSI/NFPA 505 and ANSI/NFPA 58. If such storage or handling is not in compliance with these standards, the user shall prevent the carrier from being used until such storage and handling is in compliance with these standards.

#### 4.5 Changing and Charging Storage Batteries for Electric Personnel and Burden Carriers

**4.5.1** The user shall require battery changing and charging facilities and procedures to be in accordance with appropriate paragraphs of ANSI/NFPA 505.

**4.5.2** The user shall periodically inspect facilities and review procedures to be certain that appropriate paragraphs of ANSI/NFPA 505, are strictly complied with, and shall familiarize carrier operators with it.

#### 4.6 Hazardous Locations

**4.6.1** The user shall determine the hazard classification of the particular atmosphere or location in which the carrier is to be used in accordance with ANSI/NFPA 505.

**4.6.2** The user shall permit in hazardous areas only those carriers approved and of the type required by ANSI/NFPA 505.

#### 4.7 Lighting for Operating Areas

**4.7.1** The user, in accordance with his responsibility to survey the environment and operating conditions, shall determine if the carrier requires lights and, if so, shall equip the carrier with appropriate lights in accordance with the manufacturer's recommendations.

# SAFETY

Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## 4.8 Control of Noxious Gases and Fumes

**4.8.1** When equipment powered by internal combustion engines is used in enclosed areas, the atmosphere shall be maintained within limits specified in the American Conference of Governmental Industrial Hygienists publication, "Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment". This shall be accomplished by ventilation provided by the user, and/or the installation, use, and proper maintenance of emission control equipment recommended or provided by the manufacturer of the equipment.

## 4.9 Warning Device(s)

**4.9.1** The user shall make periodic inspections of the carrier to be certain that the sound-producing and/or visual device(s) are maintained in good operating condition.

**4.9.2** The user shall determine if operating conditions require the carrier to be equipped with additional sound-producing and/or visual devices and be responsible for providing and maintaining such devices, in accordance with the manufacturer's recommendations.

## 5 OPERATING SAFETY RULES AND PRACTICES

### 5.1 Personnel and Burden Carrier Operator Qualifications

**5.1.1** Only persons who are trained in the proper operation of the carrier shall be authorized to operate the carrier. Operators shall be qualified as to visual, auditory, physical, and mental ability to safely operate the equipment according to Section 5 and all other applicable parts of this Standard.

### 5.2 Personnel and Burden Carrier Operators' Training

**5.2.1** The user shall conduct an operators' training program.

**5.2.2** Successful completion of the operators' training program shall be required by the user before operation of the carrier. The program shall be presented in its entirety to all new operators and not condensed for those claiming previous experience.

**5.2.3** The user should include in the operators' training program the following:

(a) instructional material provided by the manufacturer;

(b) emphasis on safety of passengers, material loads, carrier operator, and other employees;

(c) general safety rules contained within this Standard and the additional specific rules determined by the user in accordance with this Standard, and why they were formulated;

(d) introduction of equipment, control locations and functions, and explanation of how they work when used properly and when used improperly, and surface conditions, grade, and other conditions of the environment in which the carrier is to be operated;

(e) operational performance tests and evaluations during, and at completion of, the program.

### 5.3 Personnel and Burden Carrier Operator Responsibility

**5.3.1** Operators shall abide by the following safety rules and practices in paras. 5.4, 5.5, 5.6, and 5.7.

### 5.4 General

**5.4.1** Safeguard the pedestrians at all times. Do not drive carrier in a manner that would endanger anyone.

**5.4.2** Riding on the carrier by persons other than the operator is authorized only on personnel seat(s) provided by the manufacturer. All parts of the body shall remain within the plan view outline of the carrier.

**5.4.3** When a carrier is to be left unattended, stop carrier, apply the parking brake, stop the engine or turn off power, turn off the control or ignition circuit, and remove the key if provided. Block the wheels if machine is on an incline.

**5.4.4** A carrier is considered unattended when the operator is 25 ft. (7.6 m) or more from the carrier which remains in his view, or whenever the operator leaves the carrier and it is not within his view. When the operator is dismounted and within 25 ft. (7.6 m) of the carrier still in his view, he still must have controls neutralized, and the parking brake(s) set to prevent movement.

**5.4.5** Maintain a safe distance from the edge of ramps and platforms.

**5.4.6** Use only approved carriers in hazardous locations, as defined in the appropriate safety standards.

**5.4.7** Report all accidents involving personnel, building structures, and equipment.

Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

**5.4.8** Operators shall not add to, or modify, the carrier.

**5.4.9** Carriers shall not be parked or left unattended such that they block or obstruct fire aisles, access to stairways, or fire equipment.

## 5.5 Traveling

**5.5.1** Observe all traffic regulations, including authorized speed limits. Under normal traffic conditions keep to the right. Maintain a safe distance, based on speed of travel, from a carrier or vehicle ahead; and keep the carrier under control at all times.

**5.5.2** Yield the right of way to pedestrians, ambulances, fire trucks, or other carriers or vehicles in emergency situations.

**5.5.3** Do not pass another carrier or vehicle traveling in the same direction at intersections, blind spots, or at other dangerous locations.

**5.5.4** Keep a clear view of the path of travel, observe other traffic and personnel, and maintain a safe clearance.

**5.5.5** Slow down or stop, as conditions dictate, and activate the sound-producing warning device at cross aisles and when visibility is obstructed at other locations.

**5.5.6** Ascend or descend grades slowly.

**5.5.7** Avoid turning, if possible, and use extreme caution on grades, ramps, or inclines; normally travel straight up and down.

**5.5.8** Under all travel conditions the carrier shall be operated at a speed that will permit it to be brought to a stop in a safe manner.

**5.5.9** Make starts, stops, turns, or direction reversals in a smooth manner so as not to shift the load, endanger passengers, or overturn the carrier.

**5.5.10** Do not indulge in dangerous activities, such as stunt driving or horseplay.

**5.5.11** Slow down when approaching, or on, wet or slippery surfaces.

**5.5.12** Do not drive carrier onto any elevator unless specifically authorized to do so. Approach elevators slowly, and then enter squarely after the elevator car is properly leveled. Once on the elevator, neutralize the controls, shut off power, and set parking brakes. It is advisable that all other personnel leave the elevator before a carrier is allowed to enter or exit.

**5.5.13** Avoid running over loose objects, potholes, and bumps.

**5.5.14** To negotiate turns, reduce speed to improve stability, then turn hand steering wheel or tiller in a smooth, sweeping motion.

## 5.6 Loading

**5.6.1** Handle only stable and safely arranged loads. When handling off-center loads which cannot be centered, operate with extra caution.

**5.6.2** Handle only loads within the capacity of the carrier as specified on the nameplate.

**5.6.3** Handle loads exceeding the dimensions used to establish carrier capacity with extra caution. Stability and maneuverability may be adversely affected.

## 5.7 Operator Care of Personnel and Burden Carriers

**5.7.1** At the beginning of each shift during which the carrier will be used, the operator shall check the carrier condition and inspect the tires, warning devices, lights, battery(s), speed and directional controllers, brakes, and steering mechanism. If the carrier is found to be in need of repair, or in any way unsafe, the matter shall be reported immediately to the designated authority and the carrier shall not be operated until it has been restored to safe operating condition.

**5.7.2** If during operation the carrier becomes unsafe in any way, the matter shall be reported immediately to the designated authority, and the carrier shall not be operated until it has been restored to safe operating condition.

**5.7.3** Do not make repairs or adjustments unless specifically authorized to do so.

**5.7.4** The engine shall be stopped and the operator shall leave the carrier while refueling.

**5.7.5** Spillage of oil or fuel shall be carefully and completely absorbed or evaporated and fuel tank cap replaced before starting engine.

**5.7.6** Do not operate a carrier with a leak in the fuel system or battery(s).

**5.7.7** Do not use open flames for checking electrolyte level in storage battery(s) or liquid level in fuel tanks.

# 6 MAINTENANCE PRACTICES

## 6.1 Introduction

**6.1.1** Carriers may become hazardous if maintenance is neglected. Therefore, maintenance facilities,

# SAFETY

*Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings*

trained personnel, and procedures shall be provided. Such facilities may be on or off the premises.

## 6.2 Maintenance Procedures

**6.2.1** Maintenance and inspection of all carriers shall be performed in conformance with the manufacturer's recommendations and the following practices.

(a) A scheduled preventive maintenance, lubrication, and inspection system shall be followed.

(b) Only qualified and authorized personnel shall be permitted to maintain, repair, adjust, and inspect carriers.

(c) Before undertaking maintenance or repair, follow the manufacturer's recommendations for immobilizing the carrier.

(d) Block chassis before working underneath it.

(e) Before disconnecting any part of the engine fuel system of a gasoline or diesel powered carrier with gravity feed fuel systems, be sure shutoff valve is closed, and run engine until fuel system is depleted and engine stops running.

(f) Before disconnecting any part of the engine fuel system of LP gas powered carriers, close the LP gas cylinder valve and run the engine until fuel in the system is depleted and the engine stops running.

(g) Operation to check performance of the carrier shall be conducted in an authorized area where safe clearance exists.

(h) Before commencing operation of the carrier, follow the manufacturer's instructions and recommended procedures.

(i) Avoid fire hazards and have fire protection equipment present in the work area. Do not use an open flame to check level or leakage of fuel, battery electrolyte, or coolant. Do not use open pans of fuel or flammable cleaning fluids for cleaning parts.

(j) Properly ventilate the work area.

(k) Handle LP gas cylinders with care. Physical damage, such as dents, scrapes, or gouges, may dangerously weaken the tank and make it unsafe for use.

(l) Brakes, steering mechanisms, speed and directional control mechanisms, warning devices, lights, governors, guards, and safety devices shall be inspected regularly and maintained in a safe operating condition.

(m) Special carriers or devices designed and approved for hazardous area operation shall be inspected to ensure that maintenance preserves the original approved safe operating features.

(n) Fuel systems shall be checked for leaks and condition of parts. If a leak is found, action shall be taken to prevent the use of the carrier until the leak has been eliminated.

(o) The carrier manufacturer's capacity, operation, and maintenance instruction plates, tags, or decals shall be maintained in legible condition.

(p) Batteries, motors, speed and directional controllers, limit switches, protective devices, electrical conductors, and connections shall be inspected and maintained in conformance with manufacturers recommended procedures.

(q) Carriers shall be kept in a clean condition to minimize fire hazards and facilitate detection of loose or defective parts.

(r) Modifications and additions which affect capacity and safe machine operation shall not be performed by the customer or user without manufacturer's prior written authorization; where authorized modifications have been made, the user shall ensure that capacity, operation, warning, and maintenance instruction plates, tags, or decals are changed accordingly.

(s) Care shall be taken to ensure that all replacement parts are interchangeable with the original parts and of a quality at least equal to that provided in the original equipment.

## End of ASME/ANSI B56.8-1988, Part II



Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## NOTES, CAUTIONS AND WARNINGS

Throughout this manual, the following **NOTES**, **CAUTIONS** and **WARNINGS** are used. For the protection of all personnel and the vehicle, be aware of and observe the following:

**NOTE** A *NOTE* indicates a condition that should be observed.

**CAUTION** A *CAUTION* indicates a condition that may result in damage to the vehicle or surrounding facilities.

**WARNING** A *WARNING* indicates a hazardous condition which could result in serious injury or death.

## IMPORTANT SAFETY WARNING

In any product, components will eventually fail to perform properly as the result of normal use, age, wear or abuse.

It is virtually impossible to anticipate all possible component failures or the manner in which each component may fail.

Be aware that a vehicle requiring repair indicates that the vehicle is no longer functioning as designed and therefore should be considered potentially hazardous. Use extreme care when working on any vehicle. When diagnosing, removing or replacing any components that are not operating correctly, take the time to consider the safety of yourself and others around you if the component should move unexpectedly.

Some components are heavy, spring loaded, highly corrosive, explosive or may produce high amperage or reach high temperatures. Battery acid and hydrogen gas could result in serious bodily injury to the technician/mechanic and bystanders if not treated with utmost caution. Be careful not to place hands, face, feet or body in a location that could expose them to injury should an unforeseen situation occur.

Always use the appropriate tools listed in the tool list and wear approved safety equipment.

## MODIFICATIONS TO VEHICLE

Do not modify the vehicle in any manner that will change the weight distribution of the vehicle.

**WARNING** Changes to the weight distribution or the center of gravity may make it unstable or prone to roll over resulting in injury or death to the operator or passenger.

## GENERAL MAINTENANCE

When any maintenance procedure or inspection is performed, it is important that care be exercised to insure the safety of the technician/mechanic or bystanders and to prevent damage to the vehicle.

Always read and understand the **entire** relevant manual section (chapter) before attempting any inspection or service.

## BEFORE SERVICING THE VEHICLE

Before attempting to inspect or service a vehicle, be sure to read and understand the following warnings:

**WARNING** Before working on vehicle, remove all jewelry (watches, rings, etc.).

**Be sure that no loose clothing or hair can become caught in the moving parts of the powertrain.**

**Use care not to contact hot objects.**

**Before attempting to operate or adjust the powertrain, the rear of the vehicle must be raised and supported on jack stands.**

**Wear OSHA approved clothing and eye protection when working on anything that could expose the body or eyes to potential injury. In particular, use care when working with or around batteries, compressed air or solvents.**

**Always turn the key switch to 'OFF' and remove the key before disconnecting a live circuit.**

**When connecting battery cables, pay particular attention to the polarity of the battery terminals. Never confuse the positive and negative cables.**

**Set the parking brake before performing any work on the vehicle.**

**If repairs are to be made that will require welding or cutting, the batteries must be removed.**

**Keep all smoking materials, open flame or spark from gasoline or batteries.**

# SAFETY

Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## Additional Warnings

Before working on the electrical system, be sure to read and understand the following warnings that pertain to electrical system repair or maintenance:



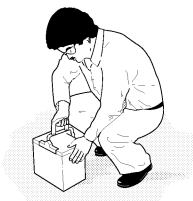
**Keep all smoking materials, open flame or sparks away from the batteries.**

**Hydrogen gas is generated in the charging cycle of batteries and is explosive in concentrations as low as 4%. Because hydrogen gas is lighter than air, it will collect in the ceiling of buildings necessitating proper ventilation. Five air exchanges per hour is considered the minimum requirement.**

**Be sure that the key switch is off and all electrical accessories are turned off before starting work on vehicle.**

**The batteries should always be removed before any servicing or repairs that will generate sparks.**

**Never disconnect a circuit under load at a battery terminal.**



**Use proper lifting techniques when moving batteries. Always lift the battery with a commercially available battery lifting device. Use care not to tip batteries when removing or installing them; spilled electrolyte can cause burns and damage.**

**The electrolyte in a storage battery is an acid solution which can cause severe burns to the skin and eyes. Treat all electrolyte spills to the body and eyes with extended flushing with clear water. Contact a physician immediately.**



**Always wear a safety shield or approved safety goggles when adding water or charging batteries.**

**Any electrolyte spills should be neutralized with a solution of 1/4 cup (60 ml) of sodium bicarbonate (baking soda) dissolved in 1 1/2 gallons (6 liters) of water and flushed with water.**

**Overfilling batteries may result in electrolyte being expelled from the battery during the charge cycle. Electrolyte may cause personal injury and damage to the vehicle and storage facility.**

**Aerosol containers of battery terminal protectant must be used with extreme care. Insulate the metal container to prevent the metal can from contacting battery terminals which could result in an explosion.**

## BATTERY REMOVAL

### Tool List

### Qty. Required

|  |   |
|--|---|
| Insulated wrench, 1/2" .....               | 1 |
| Socket, 1/2", 3/8" drive .....             | 1 |
| Extension, 12", 3/8" drive .....           | 1 |
| Ratchet, 3/8" drive .....                  | 1 |
| Battery carrier .....                      | 1 |
| Torque wrench (in. lbs.), 3/8" drive ..... | 1 |

### NOTE

In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers etc.) that are removed must always be installed in their original positions unless otherwise specified. Non-specified torques are as shown in the table contained in Section "A".



**Wrap wrenches with vinyl tape to prevent the possibility of a dropped wrench from 'shorting out' a battery, which could result in an explosion and severe personal injury or death.**

Turn vehicle key to 'OFF' and remove. Insure all optional electrical accessories are turned OFF.

Using an insulated wrench, remove the main negative (-) cable (BL-), the main positive (+) cable (BL+) then all other cables from the vehicle batteries. Remove the battery hold downs by removing the hardware and lifting the retainer from the batteries.

Remove the batteries using a commercial battery carrier.

## BATTERY INSTALLATION

If the batteries have been cleaned and any acid in the battery rack area neutralized on a regular basis, no corrosion to the battery racks or surrounding area should be present. If any corrosion is found, it should be immediately removed with a putty knife and a wire brush. The area should be washed with a solution of sodium bicarbonate (baking soda) and water and thoroughly dried before priming and painting with a corrosion resistant paint.

The batteries should be placed into the battery tray and the battery hold downs tightened to 45 - 55 in. lbs. (5 - 6 Nm) torque, to prevent movement, but not tight enough to cause distortion of the battery cases.

Inspect all cables and terminals. Clean any corrosion from the battery terminals or the cable terminals with a solution of sodium bicarbonate (baking soda) and wire brush if required.

# SAFETY

Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

Use care to connect the battery cables as shown (Ref Fig. 1 on page B-7). **Connect the main positive (+) battery cable (BL+) first**, other battery connecting cables, and then **connect the main negative (-) cable (BL-) last**. Tighten the battery post hardware to 60 - 90 in. lbs. (7 - 10 Nm). Protect the battery terminals and battery cable terminals with a commercially available protective coating.

**⚠ WARNING ⚠** *Aerosol containers of battery terminal protectant must be used with extreme care. Insulate the metal container to prevent the metal can from contacting battery terminals which could result in an explosion.*

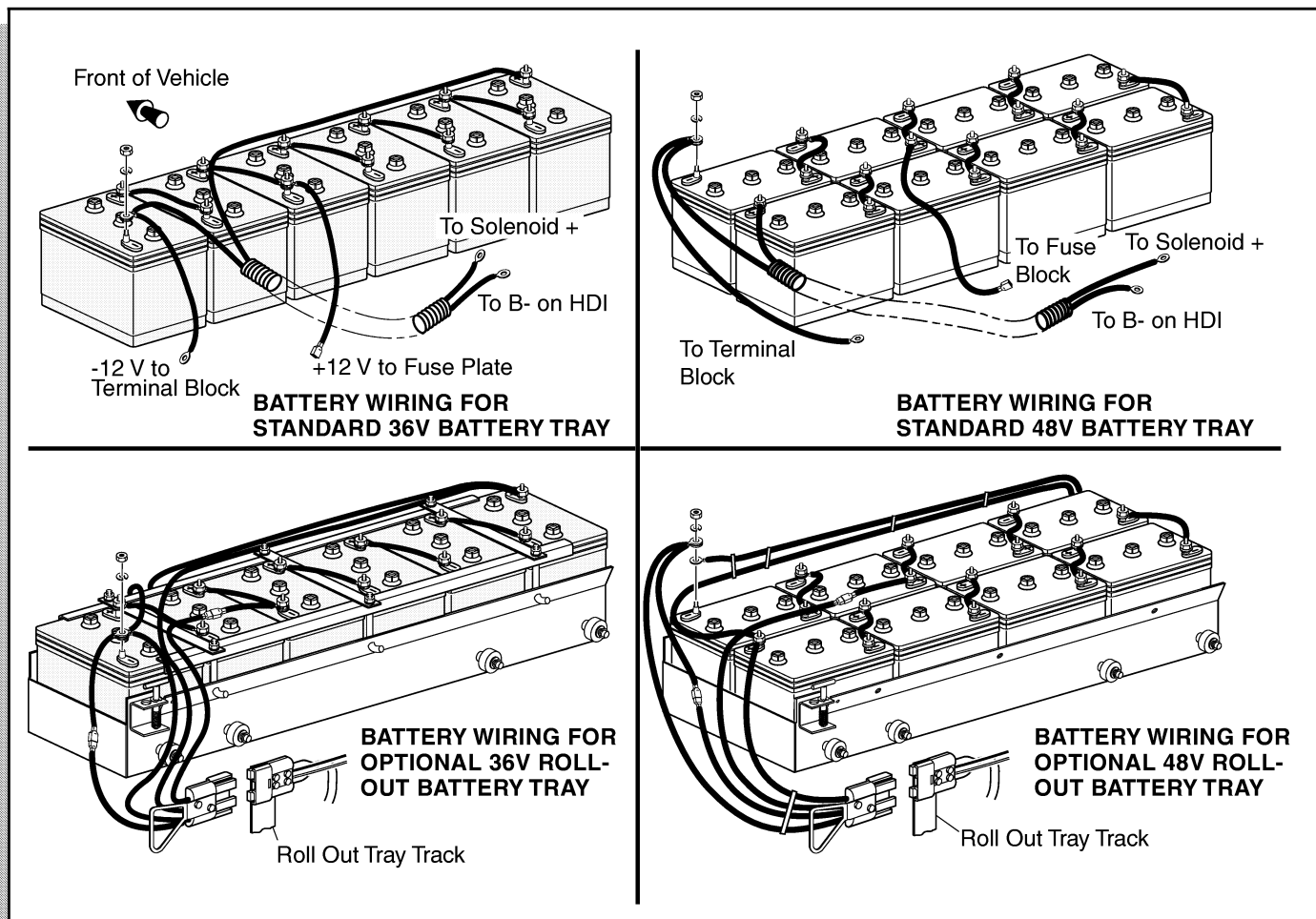


Fig. 1 Battery Connections

# SAFETY

Read all of Section A and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## LIFTING THE VEHICLE

Some servicing operations may require the vehicle be raised. It is recommended this vehicle be lifted on one side or the other or the entire vehicle be lifted. Do not attempt to raise only the front end or rear end of the vehicle.

| Tool List         | Qty. Required |
|-------------------|---------------|
| Floor jack.....   | 1             |
| Jack stands ..... | 4             |
| Chocks .....      | 4             |



**WARNING** To prevent possible injury or death, be sure the vehicle is on a firm and level surface. Never get under a vehicle while it is supported by a jack. Use jack stands and test the stability of the vehicle on the stands. Always place chocks in front and behind the wheels not being raised. Use extreme care since the vehicle is extremely unstable during the lifting process.



**CAUTION** When lifting the vehicle, position jack stands only in the areas indicated.

Install chocks in front and behind each wheel not being raised. Place the jack under the frame directly behind the front wheel on the side to be lifted as indicated (Ref Fig. 2 on page B-8). Raise the vehicle and locate a jack stand under the outer end of the rear axle. Place a jack stand under the outer end of the front axle.

Lower the jack and test the stability of the vehicle on the two jack stands.

If the entire vehicle is to be lifted, follow the same procedure at the other side of the vehicle.

Lower the jack and test the stability of the vehicle on the four jack stands.

Lower the vehicle by reversing the lifting sequence.

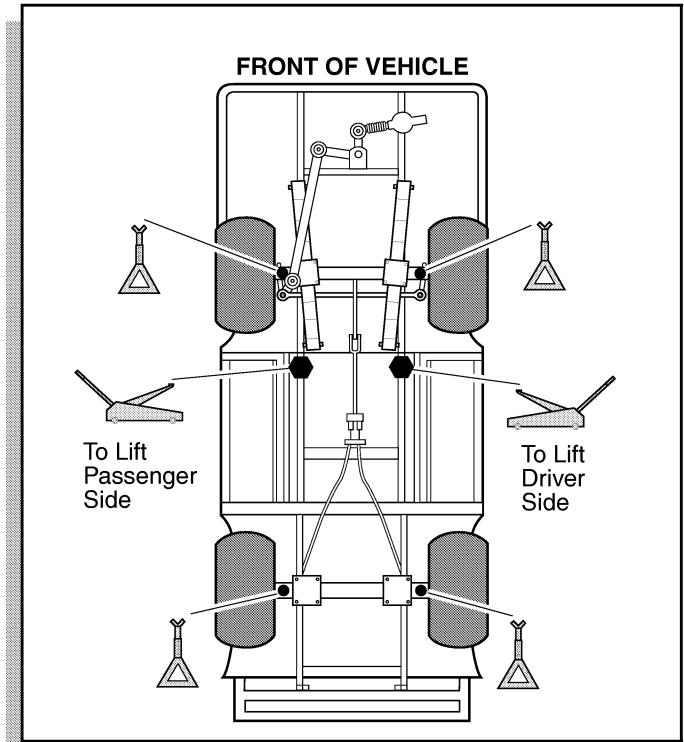


Fig. 2 Lifting the Vehicle



# BODY

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**BODY**

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## BODY

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

### BODY

**NOTE** In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers etc.) that are removed must always be installed in their original positions unless otherwise specified. Non-specified torques are as shown in the table in Section A.

#### General



**Batteries should always be removed before any servicing that could generate sparks or repairs**

**that require welding or cutting.**

Most body components are held in place with conventional removable hardware (nuts, bolts, washers and screws). Some components are mounted with metal rivets that can be removed by drilling into the head with a **sharp** drill bit that is **slightly** larger than the shank of the rivet (Ref Fig. 1 on page C-1). Care must be exercised when drilling to prevent the drill from being forced through and damaging components located directly behind the rivet. The best way to prevent this from occurring is to use a sharp drill bit that requires very little pressure to cut successfully and to place a piece of protective sheet metal between the surface being drilled and components directly behind it.

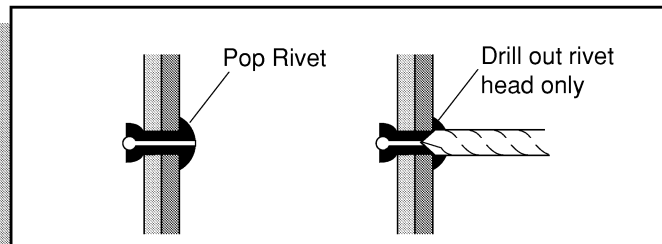


Fig. 1 Drill Out Metal Rivet

### BODY COMPONENT AND CARGO DECK REPLACEMENT

None of the metal body panels need to be removed to perform any servicing operations.

The body components and cargo deck components can be replaced by removing the securing hardware, replacing the component and securing with hardware in the same orientation as removed. The illustrations on the following pages indicate the assembly methods for the various components.

**NOTE** If the driver side front seat panel is to be replaced, the serial number plate must be removed from the old front seat panel and reinstalled on the replacement panel (Ref Fig. 2 on page C-2).

# BODY

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

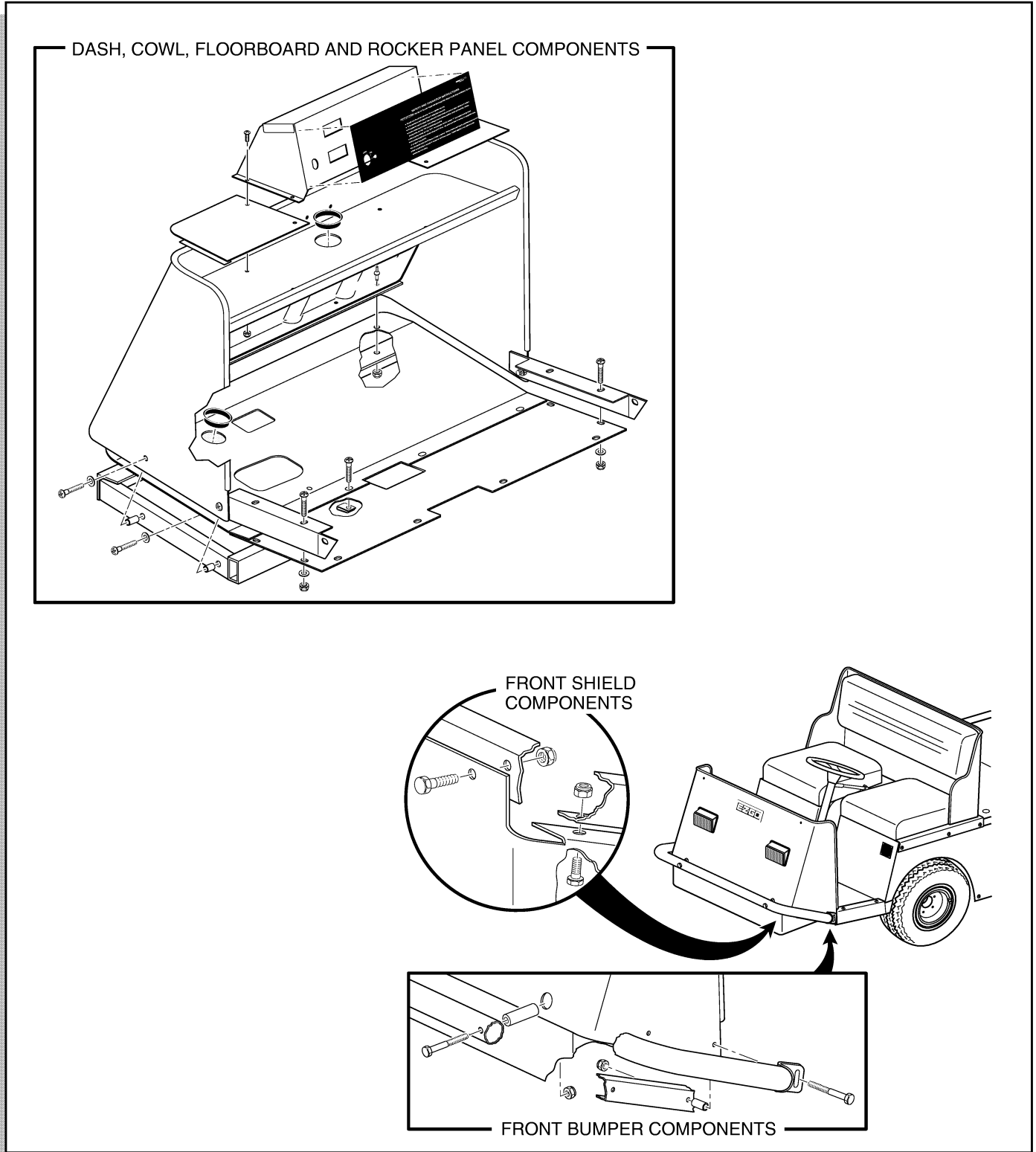


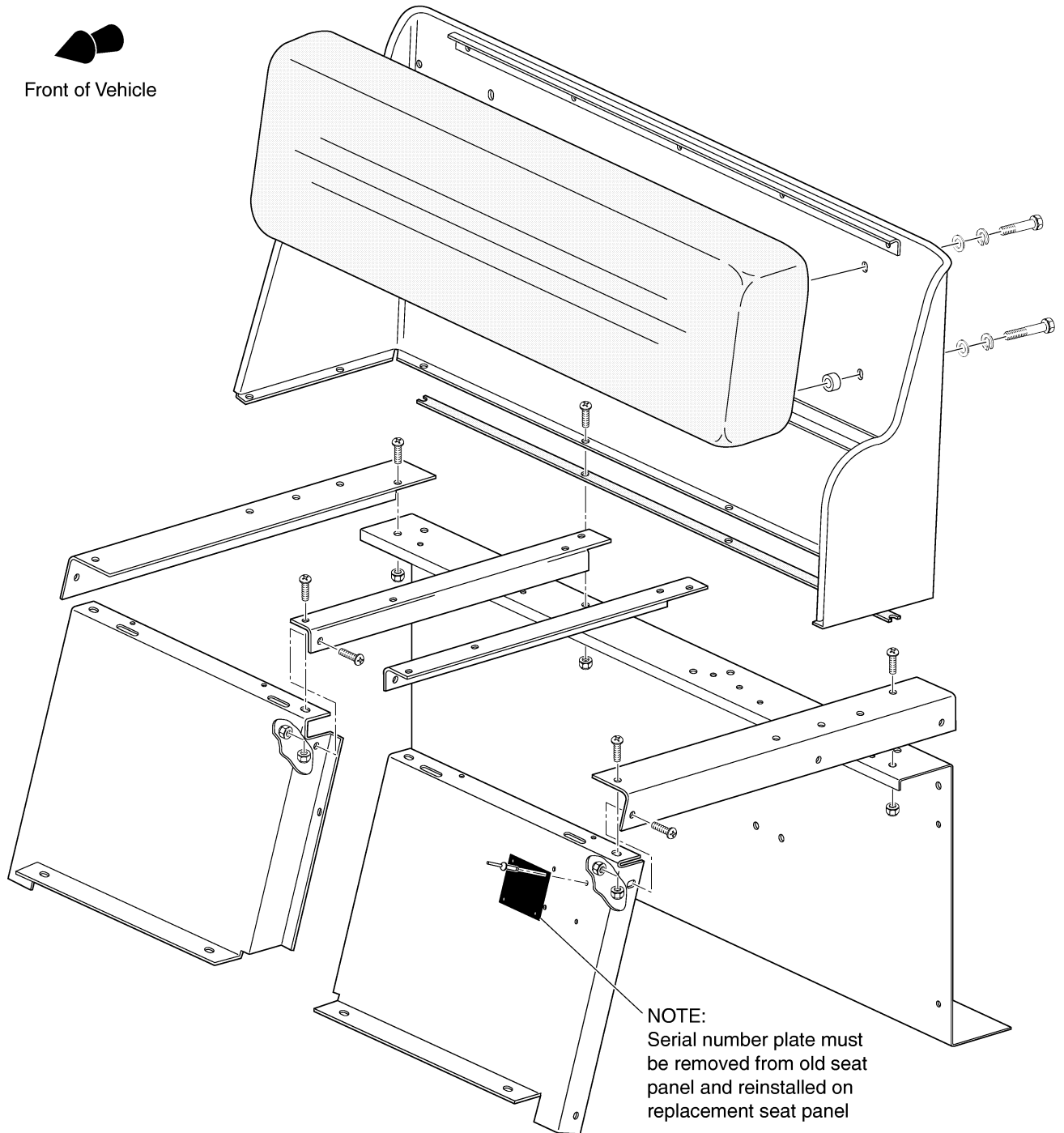
Fig. 2 Body Components (Front)



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



Front of Vehicle



**Fig. 3 Body Components (Seat)**

# BODY

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

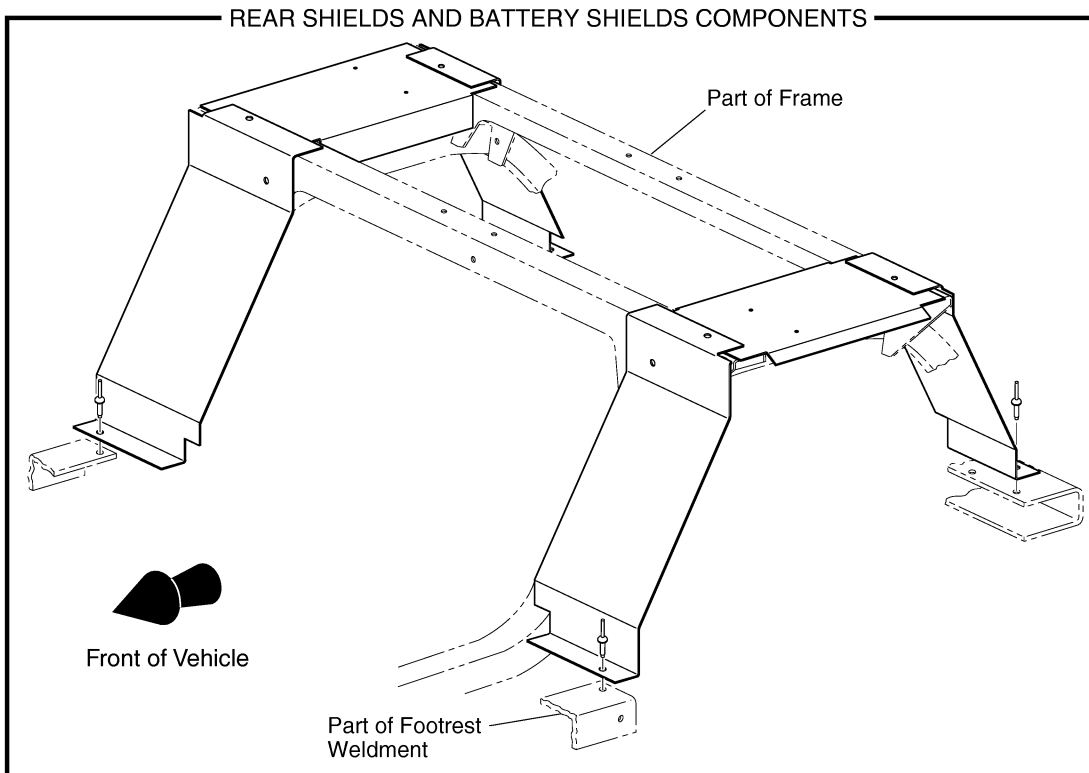
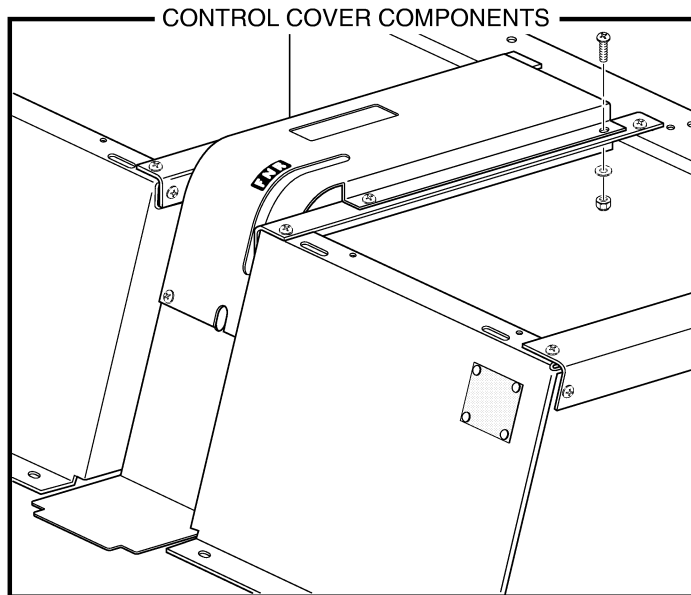
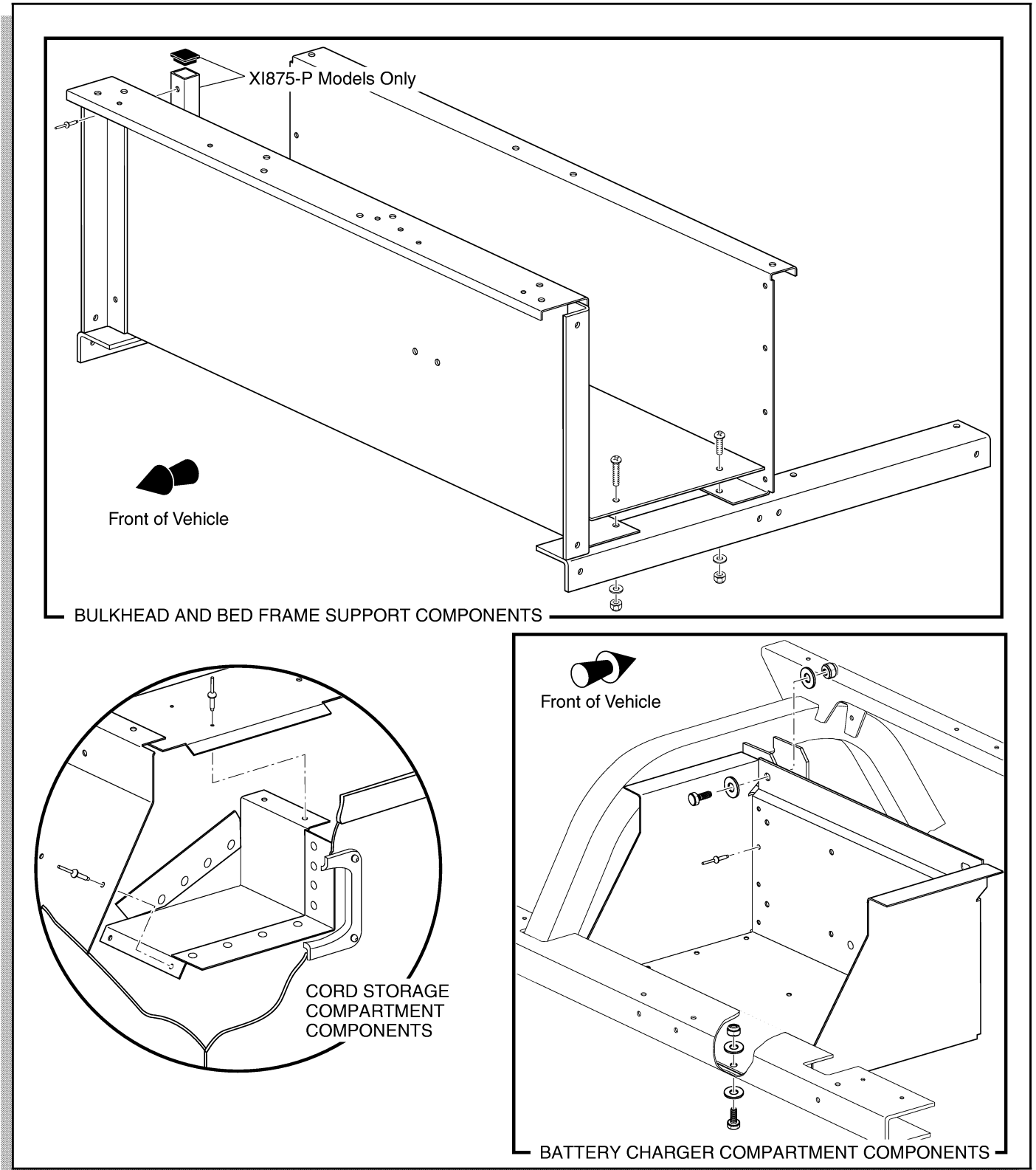


Fig. 4 Control Cover and Battery Shields

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 5 Body Components (Rear)**

# BODY

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

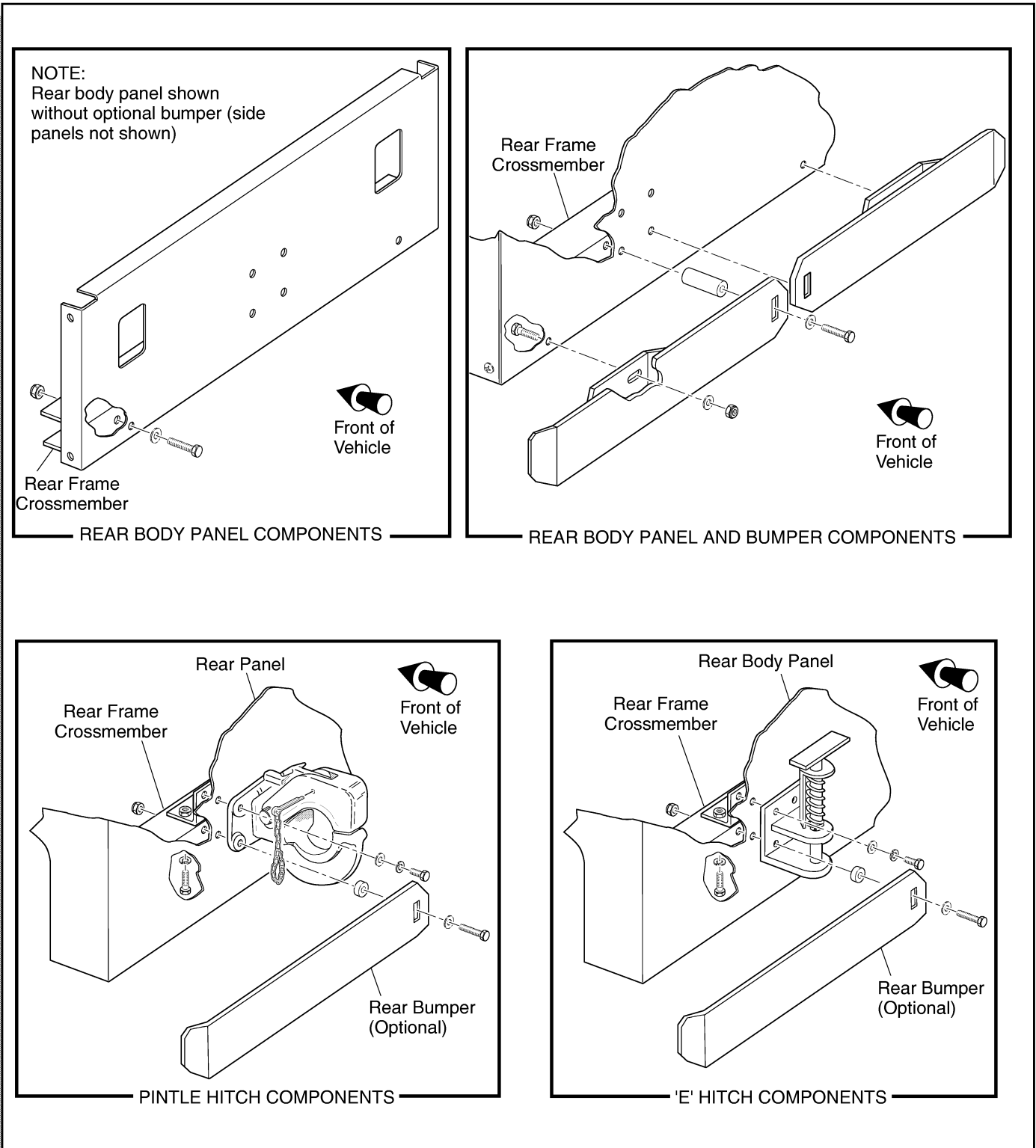
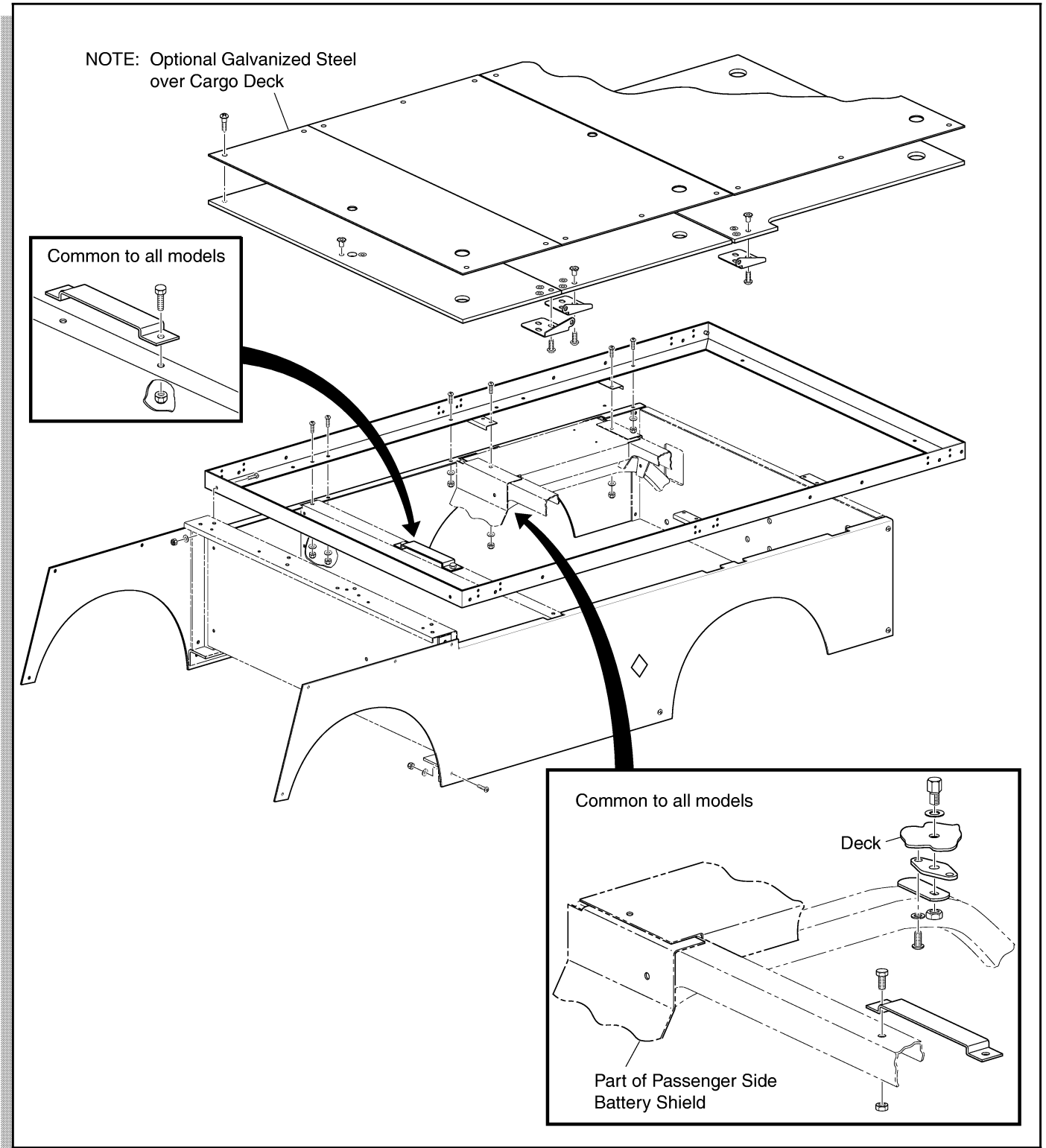


Fig. 6 Rear Body Panel with Optional Bumper and Hitches

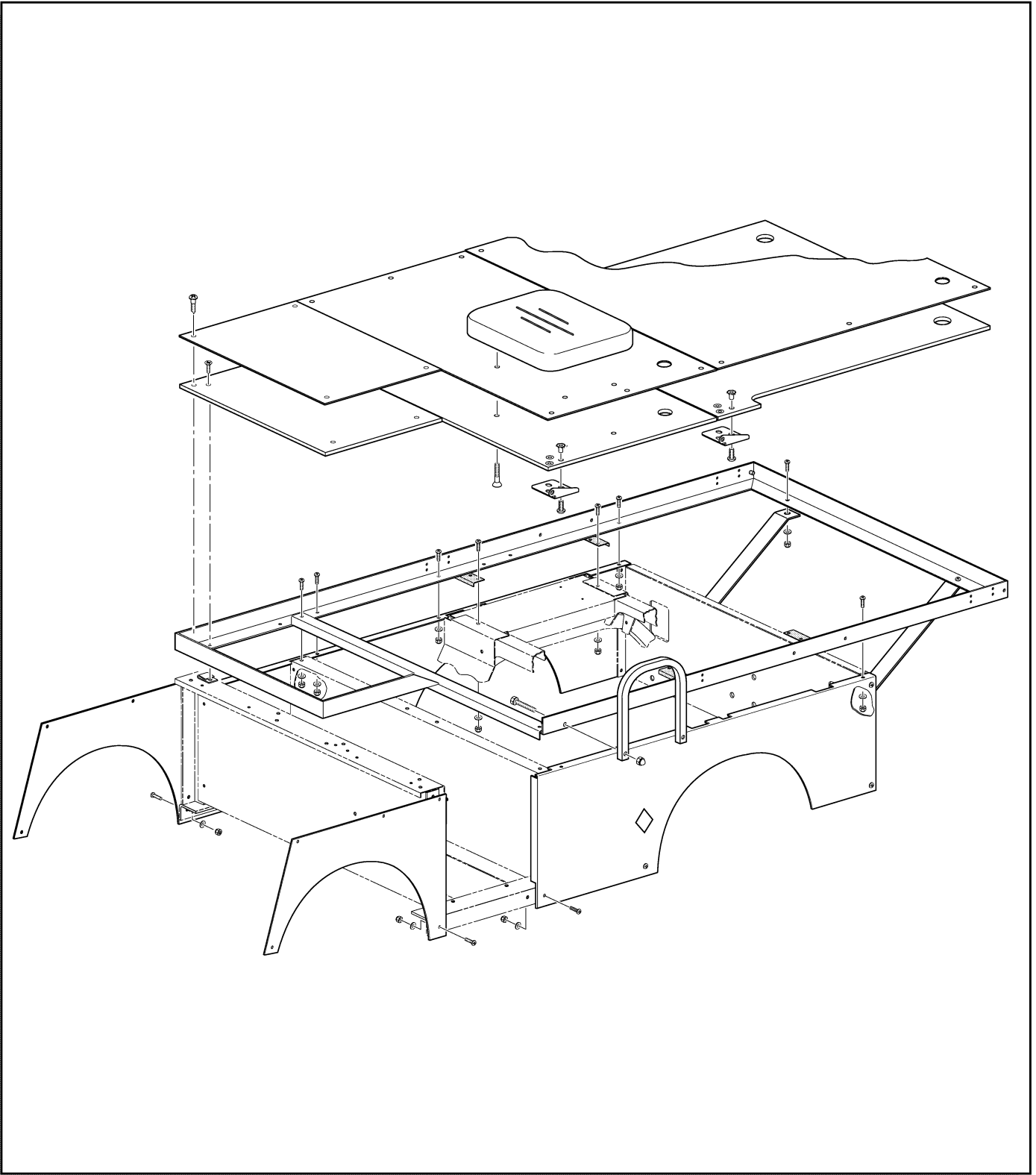
Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 7 Cargo Deck for Industrial 875E**

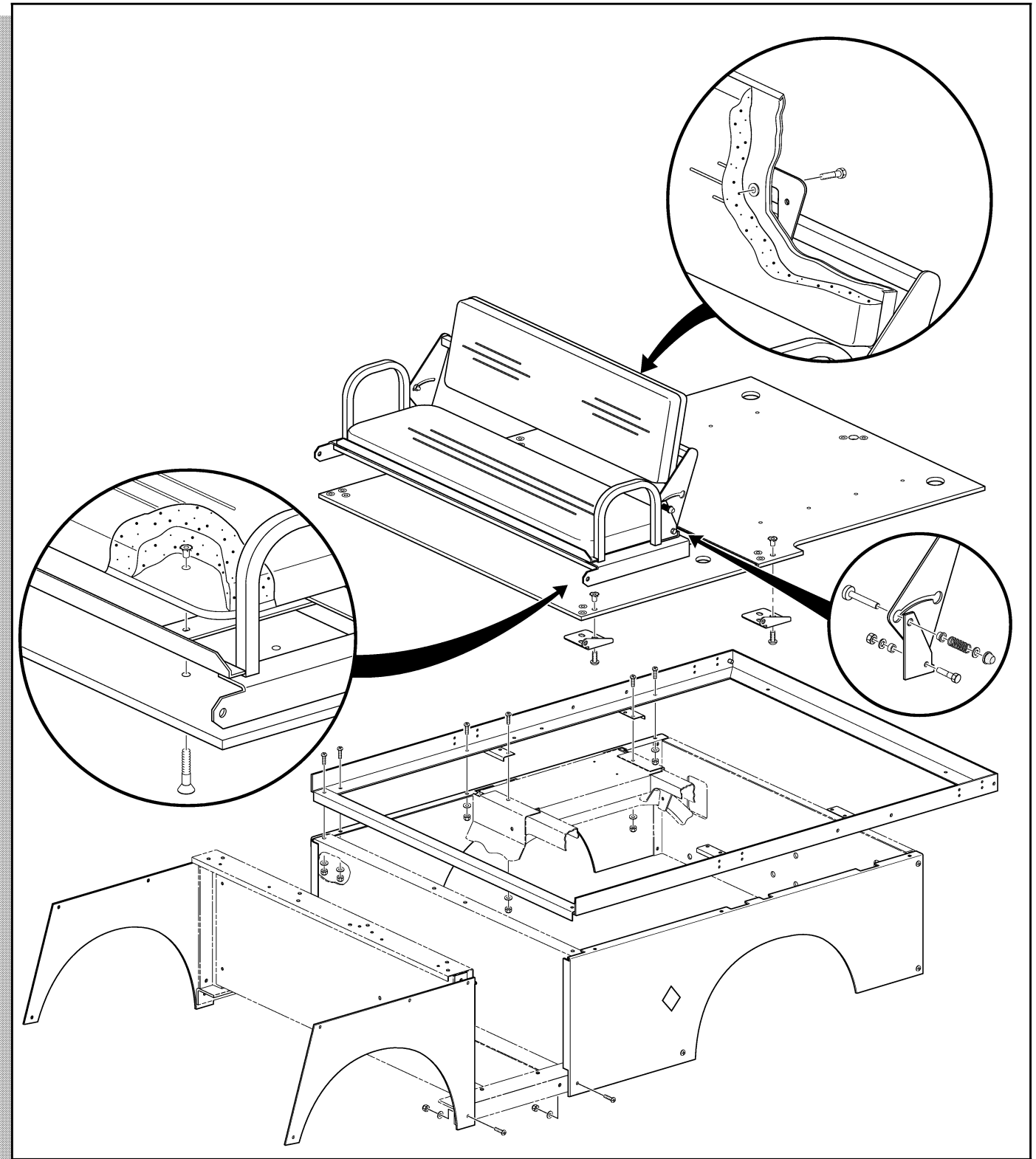
# BODY

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 8 Cargo Deck for Industrial 875AE**

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 9 Cargo Deck for Industrial 875PE**

# BODY

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

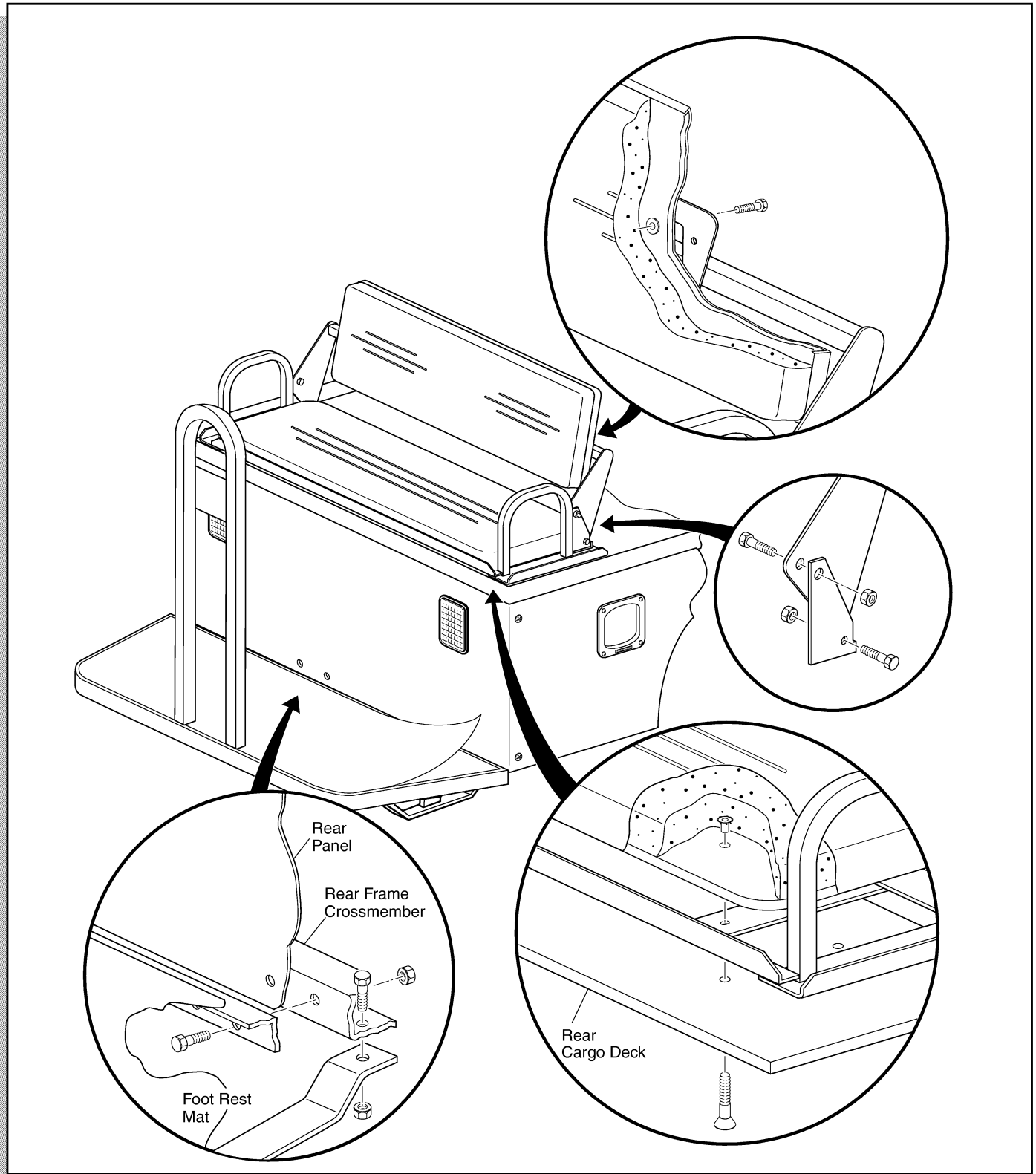
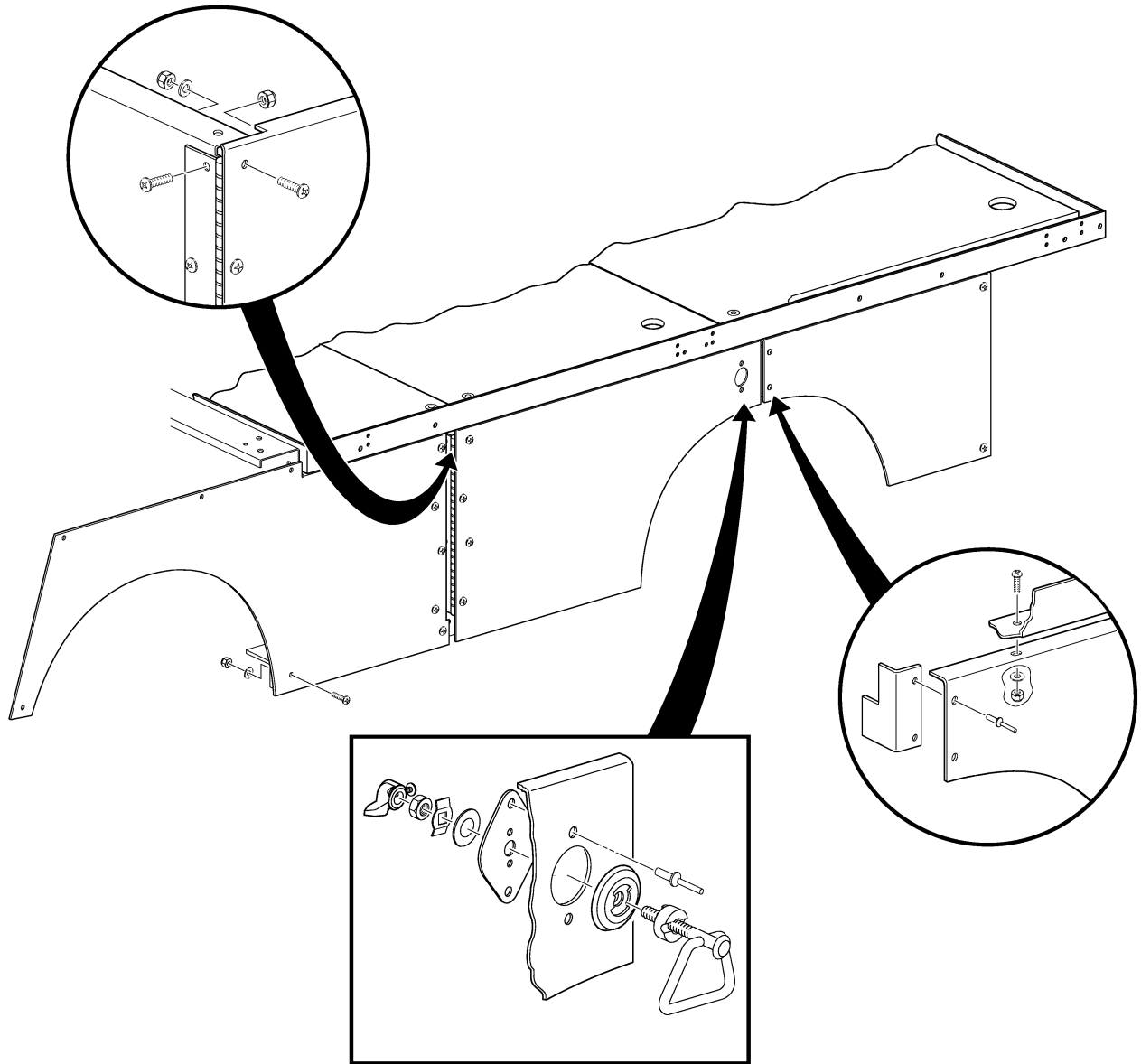


Fig. 10 Rear Facing Seat Option for Industrial 875PE



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

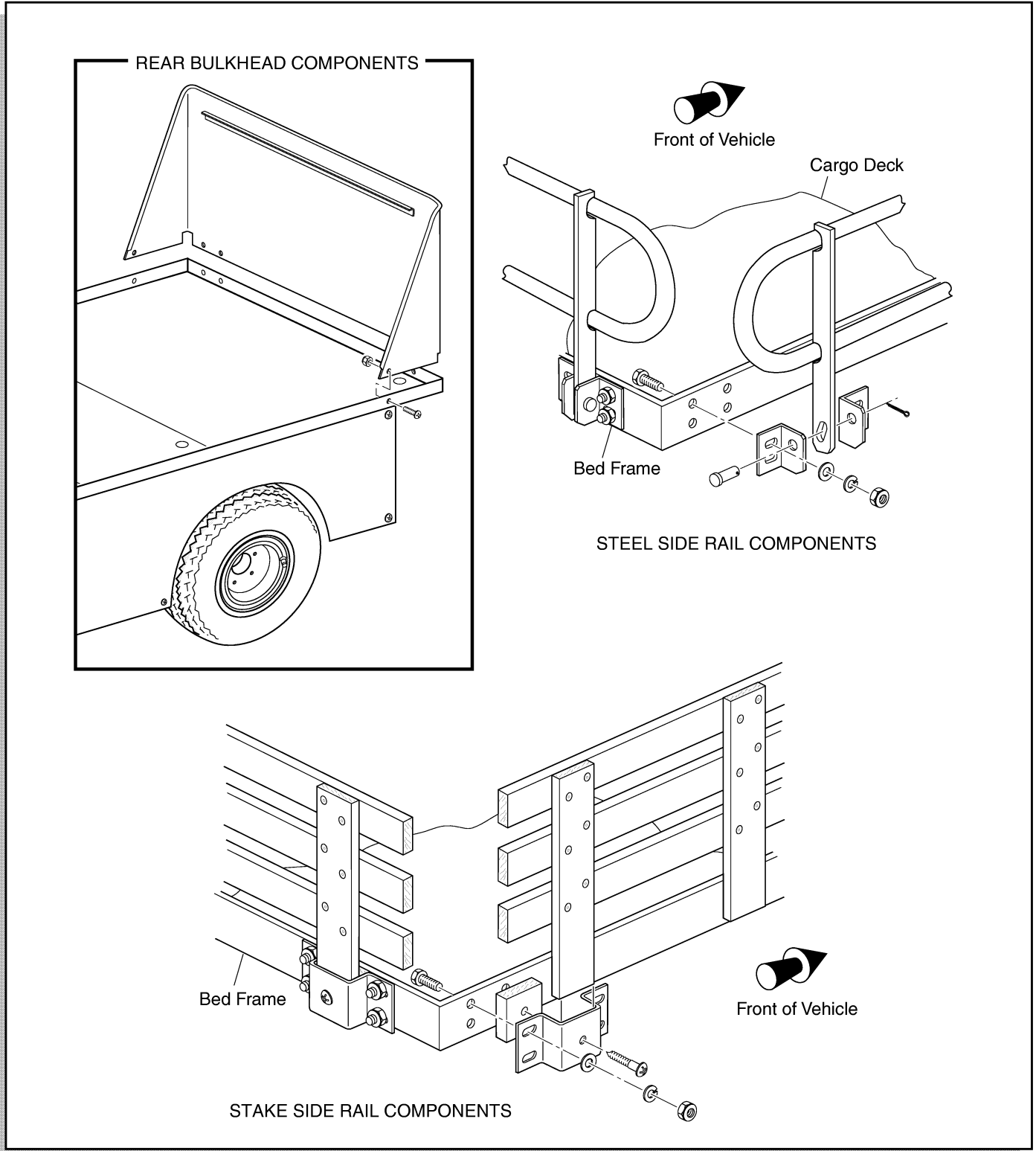
NOTE: 875 model shown;  
875-P, 875-A and 881 models similar



**Fig. 11 Roll Out Battery Tray Option**

# BODY

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 12 Cargo Deck Options**

# WHEELS AND TIRES



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# WHEELS AND TIRES

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## WHEEL AND TIRE SERVICE

| Tools List                              | Qty. Required |
|---|---------------|
| Lug Wrench, 3/4" .....                  | 1             |
| Impact wrench, 1/2" drive.....          | 1             |
| Impact socket, 3/4", 1/2" drive.....    | 1             |
| Torque wrench, 1/2" drive, ft. lbs..... | 1             |

Tire condition should be inspected on a daily basis. Inflation pressures should be checked on a weekly basis when the tires are cool.



**Never exceed inflation pressure rating on tire sidewall.**

Tire inflation should be determined by the condition of the terrain. See GENERAL SPECIFICATIONS section for recommended tire inflation pressure. For outdoor applications with major use on grassy areas, the following should be considered. On hard turf, it is desirable to have a **slightly** higher inflation pressure. On very soft turf, a lower pressure prevents tires from cutting into the turf. For vehicles being used on paved or hard surfaces, tire inflation pressure should be in the higher allowable range, but under no condition should inflation pressure be higher than recommended on tire sidewall. **All four tires** should have the same pressure for optimum handling characteristics. Be careful not to overinflate. Due to the low volume of these small tires, overinflation can occur in a matter of seconds. Be sure to install the valve dust cap after checking or inflating.



**Use caution when inflating tires. Due to the low volume of these small**

**tires, overinflation can occur in a matter of seconds. Overinflation could cause the tire to separate from the wheel or cause the tire to explode, either of which could cause personal injury.**

### Tire Repair

The vehicle is fitted with tubeless tires mounted on one piece rims.

Generally, the most cost effective way to repair a flat tire resulting from a puncture in the tread portion of the tire is to use a commercial tire plug.

**NOTE** *Tire plug tools and plugs are available at most automotive parts outlets and have the advantage of not requiring the tire be removed from the wheel.*

If the tire is flat, remove the wheel and inflate the tire to the maximum recommended pressure for the tire.

Immerse the tire in water to locate the leak and mark with chalk. Insert tire plug in accordance with manufacturer's specifications.

If the tire is to be removed or mounted, the tire changing machine manufacturer's recommendations must be followed in order to minimize the possibility of personal injury.



**Pressurize tire with small amount of air applied intermittently to seat**

**beads. Never exceed the tire manufacturer's recommendation.**

**Protect face and eyes from escaping air when removing valve core.**

**Be sure mounting/demounting machine is anchored to floor.**

**Wear safety equipment when mounting/demounting tires.**

Follow all instructions and safety warnings provided by the mounting/demounting machine manufacturer.

### Wheel Installation

With the valve stem to the outside, mount the wheel onto the hub with lug nuts. Finger tighten lug nuts in a 'cross sequence' pattern (Ref Fig. 1 on page D-2). Then, tighten lug nuts to 50 - 85 ft. lbs. (68 - 115 Nm) torque in 20 ft. lbs. (27 Nm) increments following the same 'cross sequence' pattern.



**NOTE** *It is important to follow the 'cross sequence' pattern when installing lug nuts. This will assure even seating of the wheel against the hub.*



**To prevent injury caused by a broken socket, use only sockets designed**

**for impact wrench use. Never use a conventional socket.**



**Do not tighten lug nuts to more than 85 ft. lbs. (115 Nm) torque.**

# WHEELS AND TIRES

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

Tire style may vary

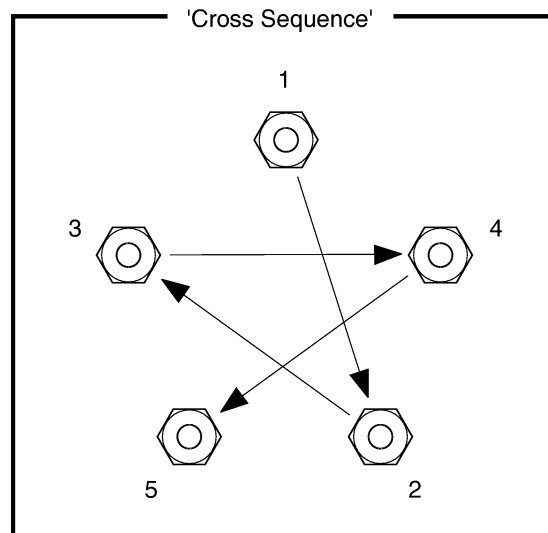
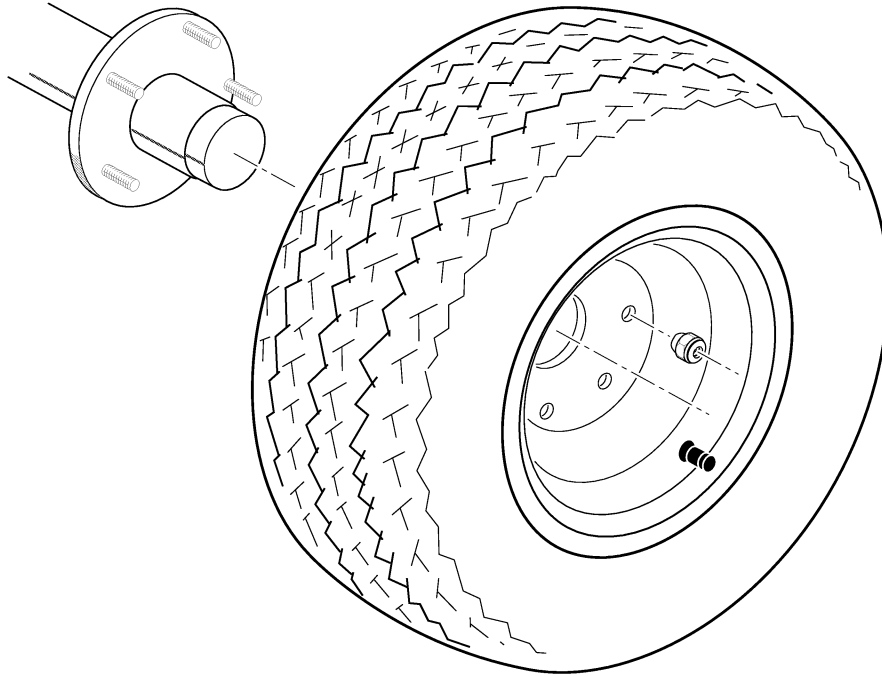


Fig. 1 Wheels and Tires

# FRONT SUSPENSION AND STEERING



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# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## FRONT SUSPENSION

**NOTE** In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers, etc.) that are removed must always be installed in their original positions unless otherwise specified. Non-specified torque specifications are as shown in the table contained in Section A.

**WARNING** To reduce the possibility of personal injury, follow the lifting procedure in

Section B of this manual. Place wheel chocks in front and behind wheels that are not to be raised. Check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.

### Shock Absorber Replacement

| Tool List                       | Qty. Required |
|---------------------------------|---------------|
| Wrench, 9/16" .....             | 1             |
| Wrench, 15/16" .....            | 1             |
| Socket, 15/16", 1/2" drive..... | 1             |
| Ratchet, 1/2" drive.....        | 1             |

Lift and remove the two front seats to gain access to the shock absorbers. Remove the nut (1) and bolt (2) securing the bottom of the shock absorber (3) to the front axle (4) (Ref Fig. 1 on page E-1). Compress shock absorber to permit bottom to clear the mounting bracket.

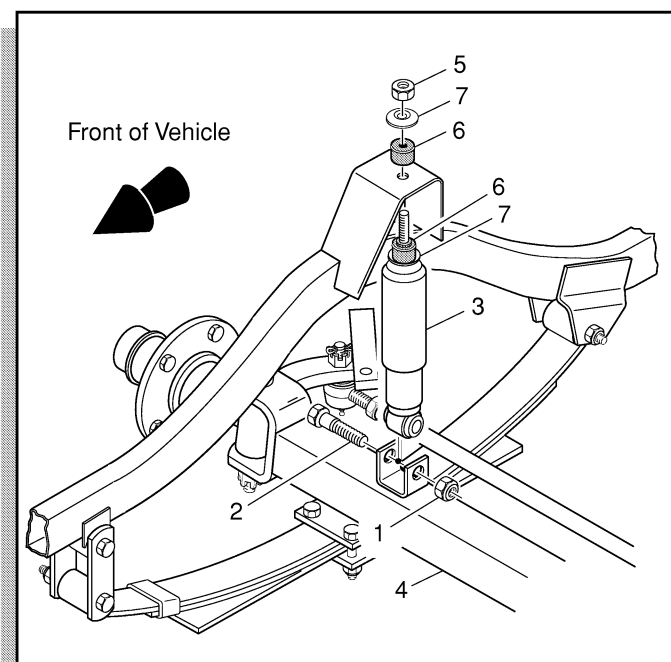


Fig. 1 Shock Absorber Replacement

Loosen the nut (5) securing the top of the shock absorber to the vehicle frame and then rotate the shock absorber while holding the nut in place with a wrench.

Remove the shock absorber.

Installation of shock absorber is the reverse of disassembly. Tighten the bottom bolt and nut firmly. The top mounting nut should be tightened until the rubber bushings (6) expand to the diameter of the shock absorber washers (7) (Ref Fig. 1 on page E-1).

### Front Axle Removal

| Tool List                       | Qty. Required |
|---------------------------------|---------------|
| Needle nose pliers.....         | 1             |
| Plastic faced hammer.....       | 1             |
| Wrench, 9/16".....              | 1             |
| Socket, 9/16", 1/2" drive.....  | 1             |
| Socket, 3/4", 1/2" drive.....   | 1             |
| Wrench, 15/16".....             | 1             |
| Socket, 15/16", 1/2" drive..... | 1             |
| Ratchet, 1/2" drive.....        | 1             |

Lift and support entire vehicle and remove front wheels.

Remove the nuts (1) and bolts (2) securing the bottom of the shock absorbers (3) to the front axle (4) (Ref Fig. 2 on page E-1).

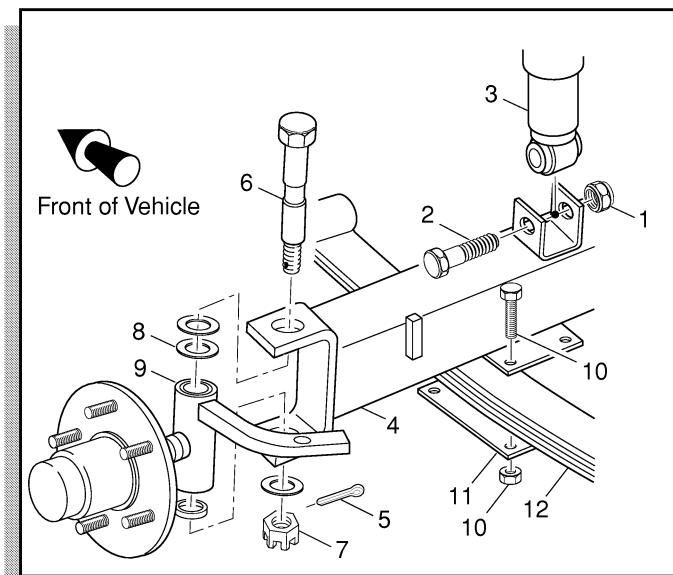


Fig. 2 Front Axle Replacement

Remove the cotter pin (5) from the king pin (6). Loosen the castellated nut (7) until the threaded end of the king pin is protected and tap the nut with a plastic faced hammer to loosen the king pin.

# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

Remove the castellated nut (7), king pin (6) and thrust washer (8) from the spindle (9). Swing the spindle out of the way.

Remove hardware (10) and mounting plates (11) securing the leaf springs (12) to the front axle (4). The front axle can be removed.

## Front Axle Installation

### Tool List Qty. Required

- Torque wrench, 1/2" drive, ft. lbs. .... 1
- Socket, 15/16", 1/2" drive ..... 1

Front axle installation is the reverse order of disassembly.

Tighten the castellated nut (7) to 40 ft. lbs. (54 Nm) torque. If a cotter pin (5) cannot be aligned with the hole in the king pin (6), continue **tightening** until a new cotter pin can be inserted.

Tighten the leaf spring hardware (10) to 23 ft. lbs. (31 Nm) torque.

Check for smooth rotation of wheel and an absence of play when the wheel is grasped by the outside of the tire.

## Front Spring Replacement

### Tool List Qty. Required

- Wrench, 9/16" ..... 1
- Wrench, 3/4" ..... 1
- Socket, 9/16", 1/2" drive ..... 1
- Socket, 3/4", 1/2" drive ..... 1
- Ratchet, 1/2" drive ..... 1
- Torque wrench, 1/2" drive, ft. lbs. .... 1

**NOTE** Failure of a single spring will result in overstressing the other spring, therefore E-Z-GO recommends replacing front springs as a set.

Lift the entire vehicle and support on jack stands as instructed in the SAFETY section. Remove the front wheels and support the front axle with jack stands.

Remove hardware (1) and mounting plate (2) securing the spring (3) to the axle (4) (Ref Fig. 3 on page E-2).

Remove hardware (5) securing the rear end of the spring to the welded bracket on the frame.

Remove hardware (6) and spring shackles (7) securing the spring to the frame at the front of the vehicle.

Remove the front spring.

Remove the bushings (8) from the old spring and install into new spring (3).

Repeat at opposite side of vehicle.

Spring installation is the reverse order of disassembly.

Tighten all hardware to 23 ft. lbs. (31 Nm) torque.

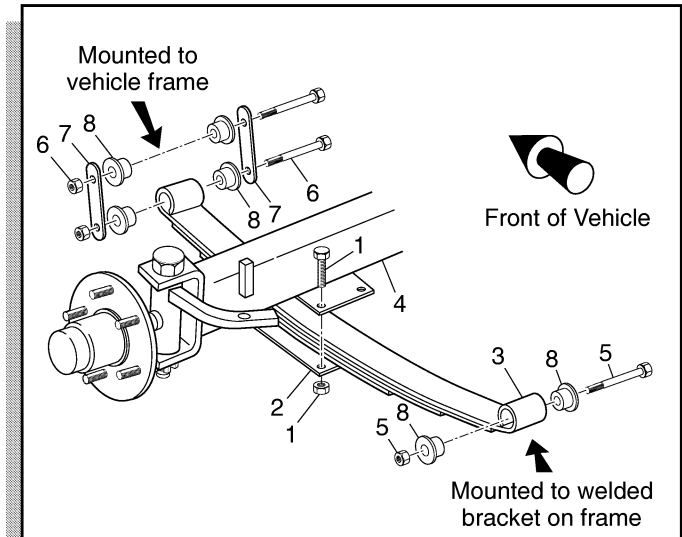


Fig. 3 Front Spring Replacement

## Tie Rod, Wheel Bearing and King Pin Inspection

### Tool List Qty. Required

- Floor jack ..... 1
- Jack stands ..... 2
- Wheel chocks ..... 4

Lift the side of the vehicle to be checked and support on jack stands as instructed in the SAFETY section. Grasp the tie rod and check for any vertical motion which would indicate a worn condition and require replacement. Grasp the top and bottom of the wheel and use a rocking motion to check for loose wheel bearings or excessive king pin movement which indicates a worn condition.

## Tie Rod End Replacement

### Tool List Qty. Required

- Needle nose pliers ..... 1
- Wrench, 9/16" ..... 1
- Wrench, 11/16" ..... 1
- Ball joint separator ..... 1
- Tape measure ..... 1
- Torque wrench, 1/2" drive, ft. lbs. .... 1
- Socket, 11/16", 1/2" drive ..... 1

Remove the cotter pin (1) from the tie rod end (2) and remove the castellated nut (3) (Ref Fig. 4 on page E-3).

# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

Insert a ball joint separator between the worn tie rod end and the spindle (4) and separate.

**NOTE** The tie rod ends differ from side to side. One side has left-hand threads and the other side has right-hand threads.

Grip the flat in the center of the threaded tube (5) with wrench and loosen the jam nut (6). Remove the tie rod end from the threaded tube.

Install replacement tie rod end into threaded tube. Adjust tie rod to 27" (69 cm) between the center of tie rod ends and tighten jam nut (6) to 36 - 40 ft. lbs. (48 - 54 Nm) (Ref Fig. 4 on page E-3). Secure tie rod to spindle in reverse order of disassembly. Tighten the castellated nut (3) to a **minimum** of 36 ft. lbs. (48 Nm) torque and continue tightening as required in order to insert a new cotter pin. Maximum torque is 50 ft. lbs. (68 Nm).

**NOTE** Toe in must be checked and adjusted as necessary before being returned to service (Ref Fig. 5 on page E-3).

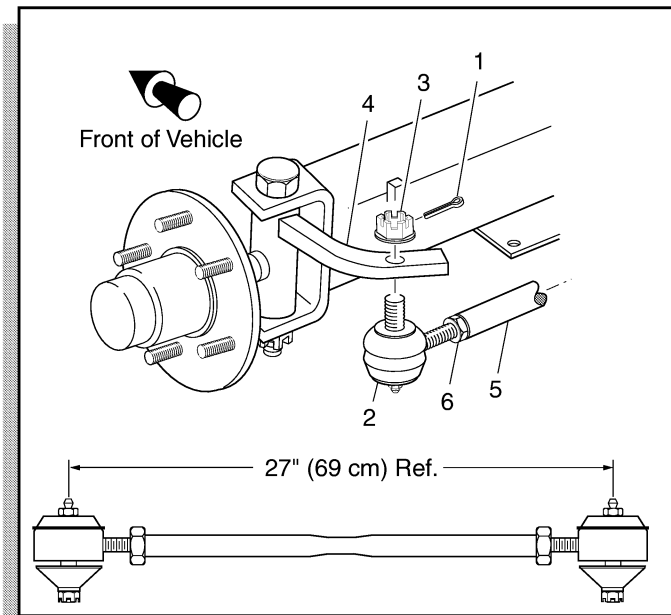


Fig. 4 Tie Rod End Replacement and Adjustment

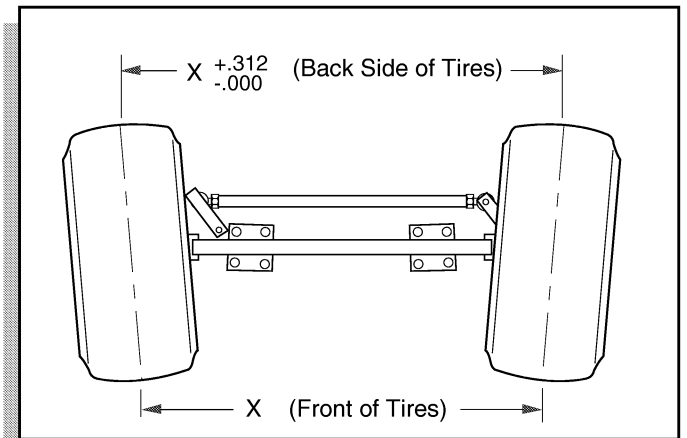


Fig. 5 Toe In Adjustment

# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## King Pin Bushing Replacement

| Tool List                                 | Qty. Required |
|---|---------------|
| Pliers .....                              | 1             |
| Wrench, 15/16".....                       | 1             |
| Sizing reamer, .875" .....                | 1             |
| Socket, 15/16", 1/2" drive .....          | 1             |
| Torque wrench, ft. lbs., 1/2" drive ..... | 1             |
| Inside micrometer, 1".....                | 1             |

Remove the spindle assembly (1) and clean the king pin bushings (2) with solvent (Ref Fig. 6 on page E-4). If the inside diameter of the bearings are worn to .880" (22.35 mm) or greater, replacement is necessary.

Press out the old bearings and press new ones into the spindle until flush with the spindle housing.

**NOTE** As a result of the press operation, the bearing inside diameter will close slightly. Use an .875" diameter sizing reamer to correctly size the new bearings.

Reinstall the king pin (5) and tighten the castellated nut (3) to 40 ft. lbs. (54 Nm) **minimum** torque. If a new cotter pin (4) cannot be aligned with the hole in the king pin, continue tightening until a cotter pin can be inserted.

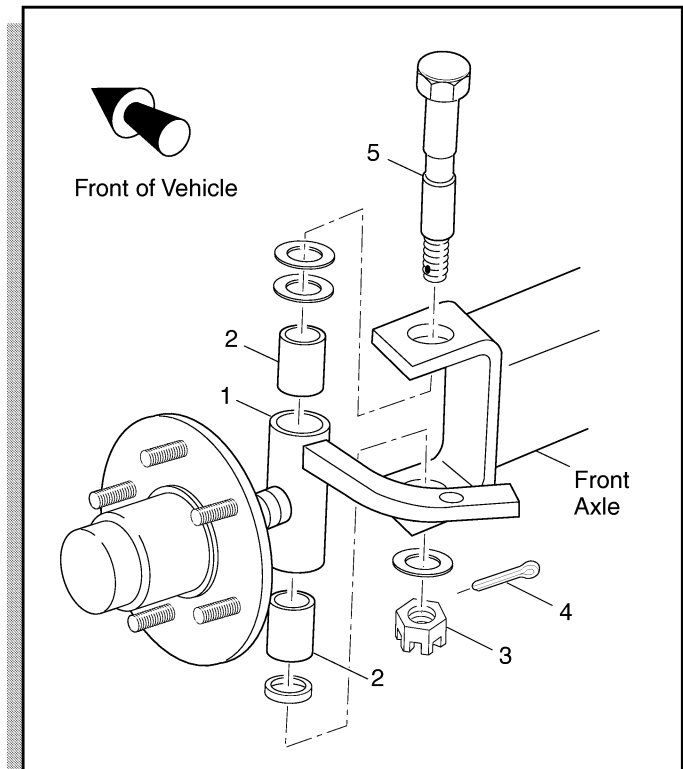


Fig. 6 King Pin Bushing Replacement

# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## STEERING

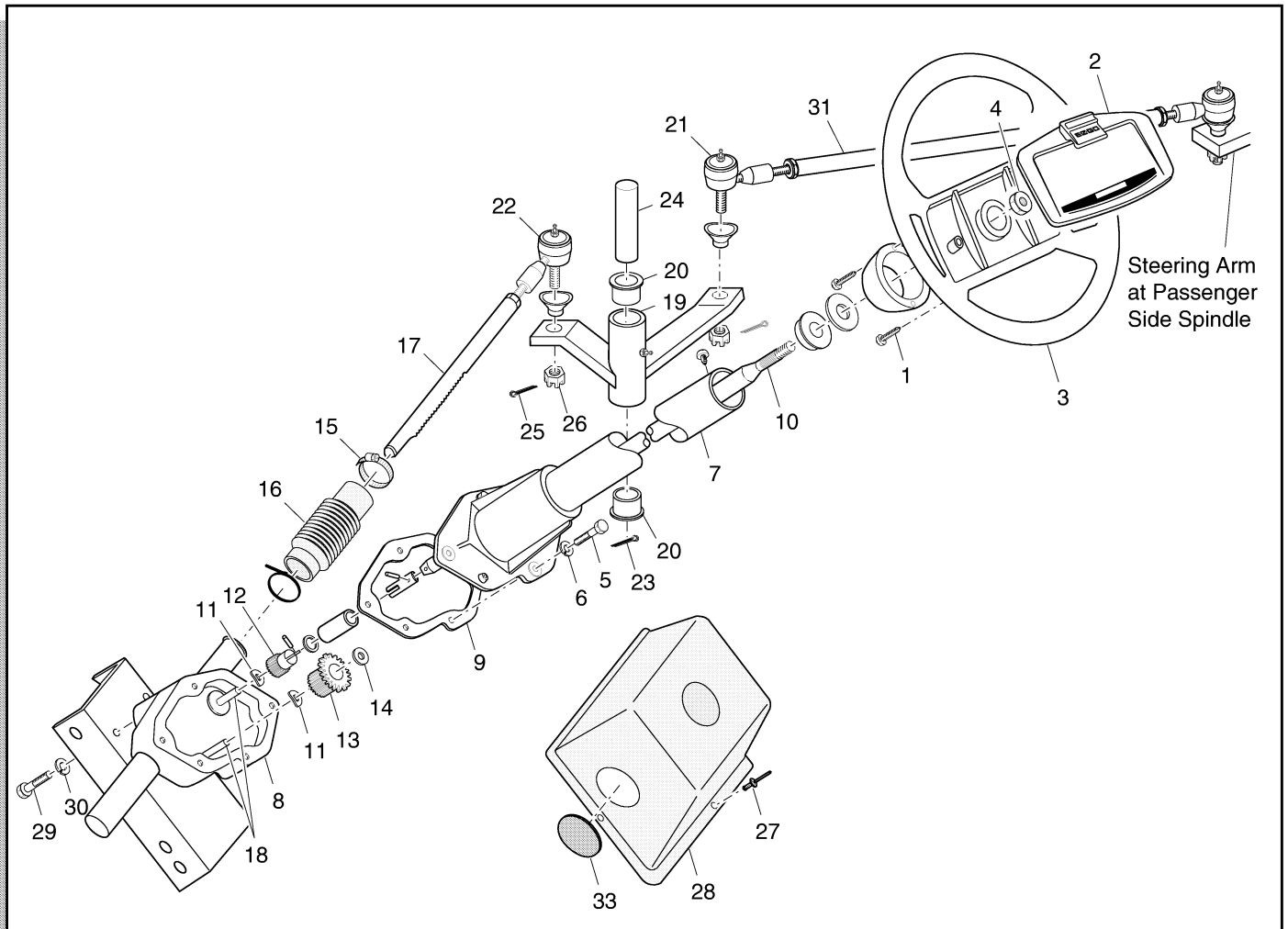


Fig. 7 Steering Components

### Steering Wheel Replacement

#### Tool List

|                                 | Qty. Required |
|---------------------------------|---------------|
| Phillips screwdriver .....      | 1             |
| Socket, 15/16", 1/2" drive..... | 1             |
| Ratchet, 1/2" drive.....        | 1             |
| Plastic faced hammer .....      | 1             |
| Ball peen hammer.....           | 1             |
| Torque wrench, 1/2" drive ..... | 1             |

**NOTE** To maintain correct orientation when replacing steering wheel, first turn wheels straight ahead.

To remove OLD STYLE steering wheel, remove the two screws (1) that attach the clipboard (2) to the steering

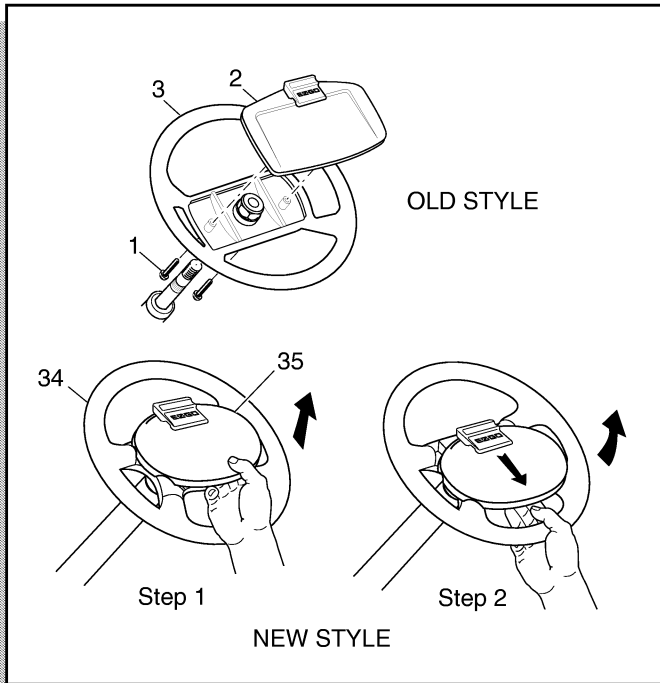
wheel (3) and remove the clipboard (Ref Fig. 8 on page E-6).

**CAUTION** To prevent damage to the clipboard on the NEW STYLE steering wheel, perform the following removal procedure. Do not use a screwdriver to push or pry the retaining tabs.

From the front side of the NEW STYLE steering wheel (34), remove the clipboard (35) by first pulling straight up on the bottom of the clipboard to release the two bottom retaining tabs. Then, using thumb for leverage as shown, reach from behind steering wheel with fingertips to first pull down, and then push up to release the two top clipboard retaining tabs (Ref Fig. 8 on page E-6).

# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 8 Clipboard Removal**

Loosen the steering wheel retaining nut (4) two to three turns. **DO NOT REMOVE NUT AT THIS TIME.** Apply upward pressure to the steering wheel. Place a plastic faced hammer against the steering wheel nut and strike plastic faced hammer sharply with a ball peen hammer (Ref Fig. 9 on page E-6).

**CAUTION** Do not strike the steering nut or the end of the steering shaft directly with the ball peen hammer.

When steering wheel is loosened, remove retaining nut and remove steering wheel.

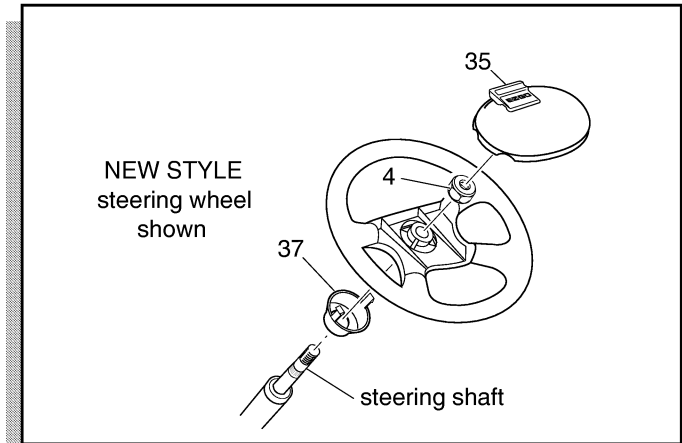
Prior to replacement, assemble the NEW STYLE replacement steering wheel by aligning the retaining tabs on the rear collar hub (37) with slots in back of steering wheel. Squeeze tabs to allow insertion of hub. **Do not force.** Squeeze hub on top and bottom to fully seat.

Replace steering wheel by first lightly coating the splines of the steering shaft with a commercially available anti-seize compound. With the vehicle wheels in the straight ahead position, align the steering wheel on the steering shaft and slide wheel on shaft. Tighten the steering wheel nut (4) to 10 - 15 ft. lbs. (13 - 20 Nm) torque.

For NEW STYLE steering wheels, inspect the four retaining tabs on the clipboard (35) for white stress lines. If stress lines are present, replace clipboard. Install by carefully pressing, first the top two, then the bottom two

retaining tabs into the matching slots in steering wheel (Ref Fig. 9 on page E-6).

For OLD STYLE steering wheels, replace clipboard (2) and tighten the clipboard screws (1) firmly (Ref Fig. 8 on page E-6).



**Fig. 9 Steering Wheel Replacement**

## Steering Column/Shaft Replacement

### Tool List

### Qty. Required

|  |   |
|--|---|
| Socket, 1/2", 1/2" drive .....           | 1 |
| Ratchet, 1/2" drive .....                | 1 |
| Torque wrench, 1/2" drive, ft. lbs. .... | 1 |

Remove the steering wheel as previously described. Remove the four bolts (5) and washers (6) that secure the steering column (7) to the gear housing (8) (Ref Fig. 7 on page E-5). Lift the steering column and gasket (9) away from the gear housing and slide them over the steering shaft (10). The steering shaft (10) and pinion gear (12) can be pulled from the gear pin (18).

Replace steering shaft in reverse order of removal. Replace gaskets. Tighten the four bolts (5) in sequence to 14 - 18 ft. lbs. (19 - 24 Nm) torque (Ref Fig. 10 on page E-7).

## Gear and Rack Removal

### Tool List

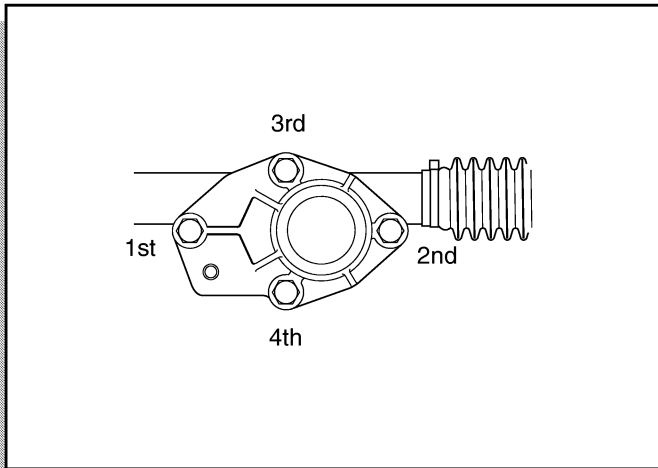
### Qty. Required

|                                  |   |
|----------------------------------|---|
| Straight blade screwdriver ..... | 1 |
|----------------------------------|---|

Remove steering column from gear housing as previously described. When removing gears, **make note** of the position of the spring washers (11), one under the pinion (12) and one under the reduction gear (13) (Ref Fig. 7 on page E-5). Be sure the spring washers are properly positioned when reassembling the gears. The

# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 10 Bolt Tightening Sequence**

flat washer (14) is placed on top of the reduction gear (13).

Loosen the clamp (15) securing the bellows (16). Slide the rack and rod end assembly (17) out. Clean all parts with solvent and check for wear. Inspect mesh of rack and rod end assembly (17), pinion (12) and reduction gear (13). If worn, replace as a set.

**NOTE** If rack end ball joint is worn or damaged, the rack and rod end assembly must be replaced as a complete unit.

Gear pins (18) **must** be lubricated prior to reassembly.

Replace worn or damaged parts with new parts. Repack gear housing with a high quality gear grease. (E-Z-GO recommends multi-purpose grease.) Apply grease liberally to gear pins (18), rack and gears before reassembly.

Reassemble all parts in reverse order of removal.

## Idler Assembly Inspection and Replacement

If the idler assembly (19) is worn or has excessive play, the flanged bearings (20) must be replaced (Ref Fig. 7 on page E-5).

| Tool List                        | Qty. Required |
|----------------------------------|---------------|
| Locking pliers .....             | 1             |
| Wrench, 11/16" .....             | 1             |
| Ball joint separator .....       | 1             |
| Socket, 11/16", 1/2" drive ..... | 1             |
| Torque wrench, 1/2" drive .....  | 1             |

To remove the idler (19), disconnect the tie rod end (21) at the bottom of the idler assembly and the rack end ball joint (22) at the top of the idler assembly (Ref Fig. 7 on

page E-5). Refer to procedure outlined under **Steering Assembly Removal** later in this section.

Lift the vehicle following procedures and safety information in the SAFETY Section of this manual. Remove cotter pin (23). Using a pair of locking pliers, rotate idler shaft (24) back and forth while pulling downwards until the idler shaft is removed. Remove the idler assembly.

Before reinstalling idler assembly, coat idler shaft and bearings with multi-purpose grease. Install in the reverse order of removal. Tighten castellated nuts to 36 ft. lbs. (48 Nm) torque and continue tightening as required to insert new cotter pins. Maximum torque is 44 ft. lbs. (59 Nm). After installation is complete, add grease to the idler assembly through the fitting on the side.

# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## Steering Assembly Removal

| Tool List                     | Qty. Required |
|-------------------------------|---------------|
| Needle nose pliers.....       | 1             |
| Wrench, 11/16".....           | 1             |
| Ball joint separator.....     | 1             |
| Plastic faced hammer.....     | 1             |
| Drill, 3/8".....              | 1             |
| Drill bit, 3/16".....         | 1             |
| Socket, 1/2", 1/2" drive..... | 1             |
| Ratchet, 1/2" drive.....      | 1             |

Turn the steering wheel full travel to the right to correctly position the rack end ball joint.

Remove the cotter pin (25) from castellated nut (26) and loosen nut until it protects ball joint stud threads (Ref Fig. 7 on page E-5). Using a ball joint separator as a lever, apply pressure to ball joint and tap nut with a plastic faced hammer to release ball stud from idler. Remove nut and lift stud from idler.

Remove rivets (27) securing the steering cover (28). The rivets can be removed by drilling into the head with a drill bit that is slightly larger than the shank of the rivet (Ref Fig. 11 on page E-8). Care must be exercised when drilling to prevent the drill from being forced through and damaging components that may be directly behind.

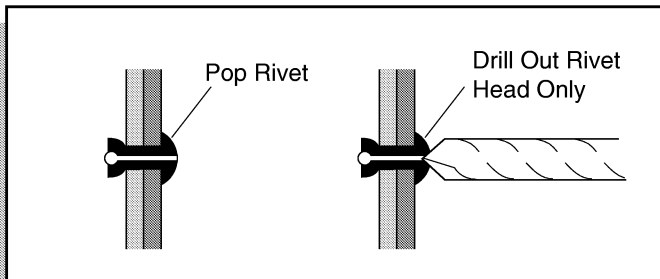


Fig. 11 Drill Out Metal Rivet

Remove three bolts (29) and lock washers (30) securing steering box to frame and lift assembly out of vehicle.

## Steering Assembly Installation

| Tool List                       | Qty. Required |
|---------------------------------|---------------|
| Socket, 11/16", 1/2" drive..... | 1             |
| Torque wrench, 1/2" drive.....  | 1             |
| Rivet gun.....                  | 1             |

Assemble steering unit to frame with hardware (29 and 30) and tighten to 18 - 23 ft. lbs. (24 - 31 Nm) torque (Ref Fig. 7 on page E-5).

**CAUTION** The rack and rod assembly (17) comes factory adjusted (Ref Fig. 12 on page E-8). Do not adjust this assembly under any circumstance. Any adjustments must be made to the tie rod assembly going to the steering arm.

With the rack and rod end assembly (17) already set to pre-determined dimension (Ref Fig. 12 on page E-8), secure to upper arm of idler with castellated nut (26) and cotter pin (25). Tighten castellated nut to 36 ft. lbs. (48 Nm) torque and continue tightening as required in order to insert a new cotter pin. Maximum torque is 44 ft. lbs. (59 Nm).

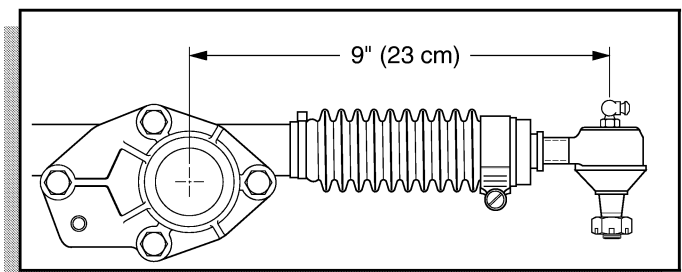


Fig. 12 Factory Adjusted Steering Unit

Turn steering shaft completely to the left and then to the right bringing the spindle arms against the stops. If the spindle arms do not rest against the stops in both directions, adjust the tie rod assembly (31) going to the steering arm.

Position the steering cover (28) and secure with metal rivets (27).

## MAINTENANCE

Good routine maintenance of the front suspension and steering consists of routine lubrication (See "Lubrication Points" and the "Periodic Service Schedule" in Section A). Be sure to use only the recommended lubricants. Maintain the correct adjustment of the front bearings and repack them in accordance with the "Periodic Service Schedule" or if a bearing replacement is required. Routine examination of the tires will provide indications if an alignment is required.

## Lubrication

| Tool List                       | Qty. Required |
|---------------------------------|---------------|
| Grease gun.....                 | 1             |
| Straight blade screwdriver..... | 1             |

Grease the idler assembly, all ball joints, king pin bushings and steering gear housing per "Periodic Service Schedule" in Section A. The grease fitting on the steering



# FRONT SUSPENSION AND STEERING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

gear housing is accessed by removing the hole plug (33) on the driver side of the steering cover (28) (Ref Fig. 7 on page E-5).

**CAUTION** Do not use more than three (3) pumps of grease in each grease fitting at any one time. Excess grease may cause grease seals to fail or grease migration into areas that could damage components.

## Inspecting and Packing Wheel Bearing

| Tool List                      | Qty. Required |
|--------------------------------|---------------|
| Floor jack .....               | 1             |
| Jack stands .....              | 2             |
| Wheel chocks.....              | 4             |
| Bearing packer .....           | 1             |
| Grease gun .....               | 1             |
| Wrench, 1 1/2" .....           | 1             |
| Needle nose pliers .....       | 1             |
| Non-ferrous punch .....        | 1             |
| Ball peen hammer.....          | 1             |
| Ratchet, 1/2" drive.....       | 1             |
| Socket, 3/4", 1/2" drive.....  | 1             |
| Extension, 6", 1/2" drive..... | 1             |

Lift the vehicle and support on jack stands as per SAFETY section. Rotate the front wheel and feel for any roughness. Grasp the outside of the tire and rock it. If any movement is detected, the wheel bearing may require replacement/adjustment. If wheel bearing is satisfactory, a worn king pin/bushing is indicated. See "King Pin Bushing Replacement".

Remove the wheel.

Remove the dust cap (1), cotter pin (2), castellated nut (3), outer roller bearing (4) and the hub assembly (5) (Ref Fig. 13 on page E-9).

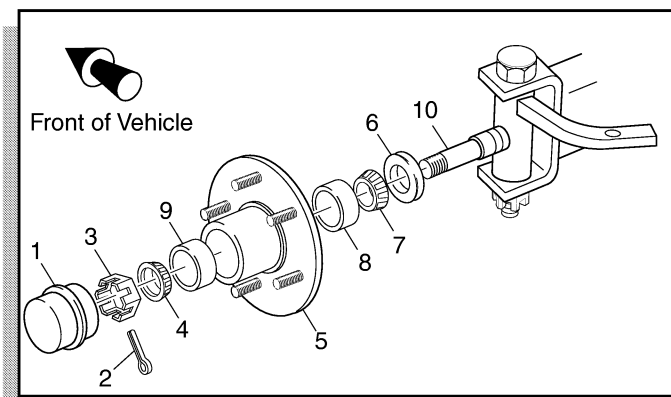


Fig. 13 Front Spindle and Bearing

Remove the inner bearing seal (6), roller bearing (7) and bearing race (8, 9) by tapping lightly around the bearing race through the hub using a soft non-ferrous punch. Tap the punch in a circular pattern to avoid damaging the bore of the hub. Clean all bearings, seal, hub and dust cap in solvent and dry thoroughly. Inspect for signs of damage. Pitting or a blue coloration of the rollers will require replacement of the bearing. If the roller portion of the bearing is to be replaced, the race (8, 9) must also be replaced.

The front wheel bearings are tapered roller type and must be packed with grease at installation, or any time that the bearing is removed for inspection. It is recommended that a bearing packer attached to a grease gun be used; however, manual packing is acceptable if done correctly. To pack a bearing manually requires that a dab of grease be placed in the palm of the hand and the bearing be dipped in the grease. Force the grease up through and around all of the rollers until the entire bearing is coated in grease. Fill the area between the rollers with grease and apply a light coating to the bearing race. Install bearing in race.

## Seal Installation

Clean the hub seal surface to remove grease and press the inner bearing seal into place with the flange side of the seal facing into the bore (Ref Fig. 14 on page E-9). Tap gently into place with a seal installation tool until it is flush with the outside of the hub assembly. Lubricate the seal surface with a light oil.

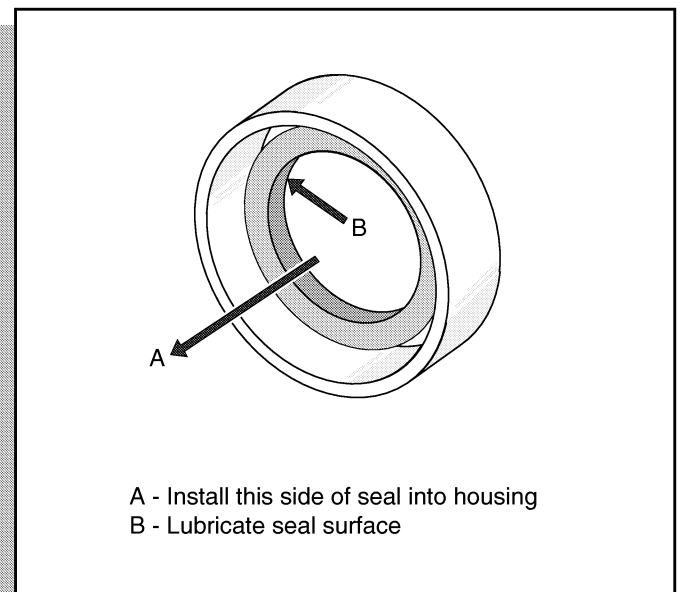


Fig. 14 Seal Installation

# FRONT SUSPENSION AND STEERING

*Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings*

## Bearing Adjustment

With the hub and bearings assembled onto spindle and the castellated nut (3) loosely installed, mount the wheel to the hub. Rotate the wheel while tightening the castellated nut. If required, tighten castellated nut until slight resistance is felt.

Rotate the wheel 2 - 3 more turns to displace excess grease. If required, tighten castellated nut again until slight resistance is felt. If the cotter pin hole in the spindle (10) aligns with a slot in the castellated nut, insert a new cotter pin (Ref Fig. 13 on page E-9). If the hole does not align, the castellated nut must be **loosened** to align with the **closest available** slot in the nut.

Check for smooth and free rotation of the wheel and an absence of play when the wheel is grasped by the outside of the tire. Bend the cotter pin against the flats of the castellated nut. Replace dust cap (1).

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# ELECTRONIC SPEED CONTROL



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## GENERAL

The Electronic Speed Control system consists of two separate units, the pedal box and the controller.

### Pedal Box

The Pedal Box assembly is a modularized unit that contains the accelerator pedal, return spring and an enclosed box that contains the pedal position micro switch and a solid state Inductive Throttle Sensor (ITS) that is activated by a moving plunger attached to the accelerator pedal. To access the pedal box, remove the nuts and washers from the behind the access panel and screws from the front (Ref Fig. 1 on page F-1). Pull out on the end of the control cover and remove the access panel. The ITS and plunger are accessed by removing the top cover on the pedal box.

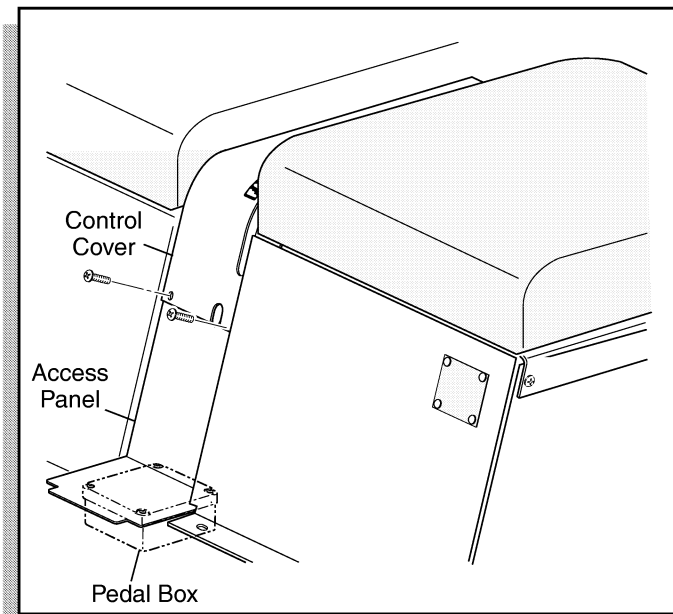


Fig. 1 Access to Pedal Box

### Controller

The Controller is a solid state unit activated by a solenoid. Both are located under the rear panel of the cargo deck (Ref Fig. 3 on page F-2).

A diode is positioned between the two coil terminals on the solenoid. Its orientation is critical (Ref Fig. 2 on page F-1). The cathode side of the diode, identified with a silver band, is oriented to the solenoid terminal with the red wires attached.

**CAUTION** If the diode is incorrectly oriented, the pedal box micro switch and the direction selector micro switch may be permanently damaged.

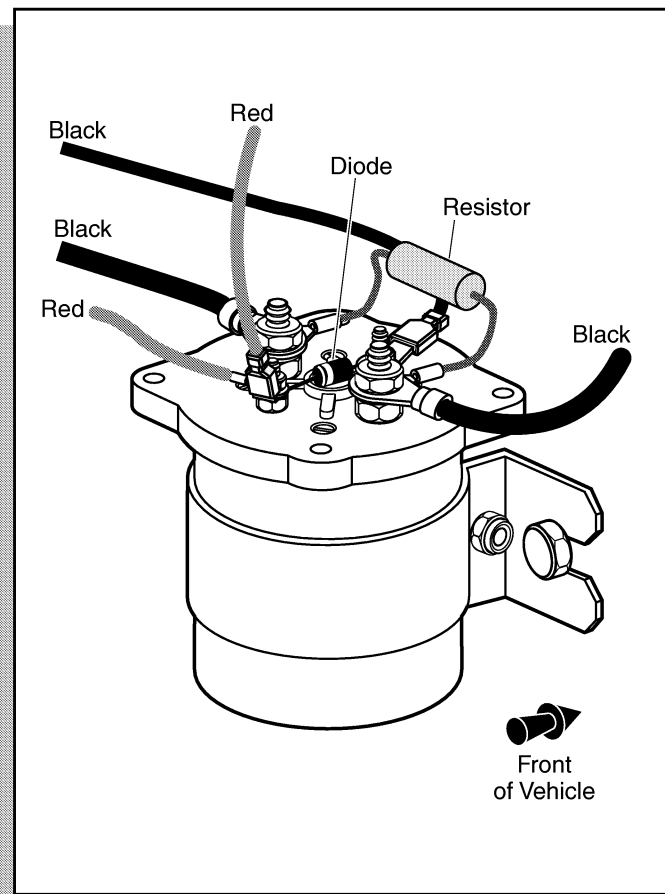


Fig. 2 Diode and Resistor on Solenoid

The pedal box and controller are connected by a four pin connector (Ref Fig. 3 on page F-2). Early production models are connected with GelTek® sealant strip to keep out moisture. If the four pin connector is disconnected, it must be reconnected and another strip of sealant applied. Wrap the connector with the strip, closing up any gaps in the strip and cover with electrical tape. The GelTek® strip can be ordered from the Service Parts Department, part number 28326-G01.

The controller is wired to the batteries and develops a regulated power supply for the ITS. The plunger position relative to the ITS varies the voltage which is fed back to the controller which interprets the change in voltage and supplies the appropriate power to the motor.

The ITS unit and the controller are both solid state units that contain no user serviceable parts. **The testing procedures are designed to test the basic functionality of the power and control wiring systems.** Once the functionality of the wiring has been confirmed, the remaining tests are used to identify which of the components (controller or ITS) must be replaced.

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

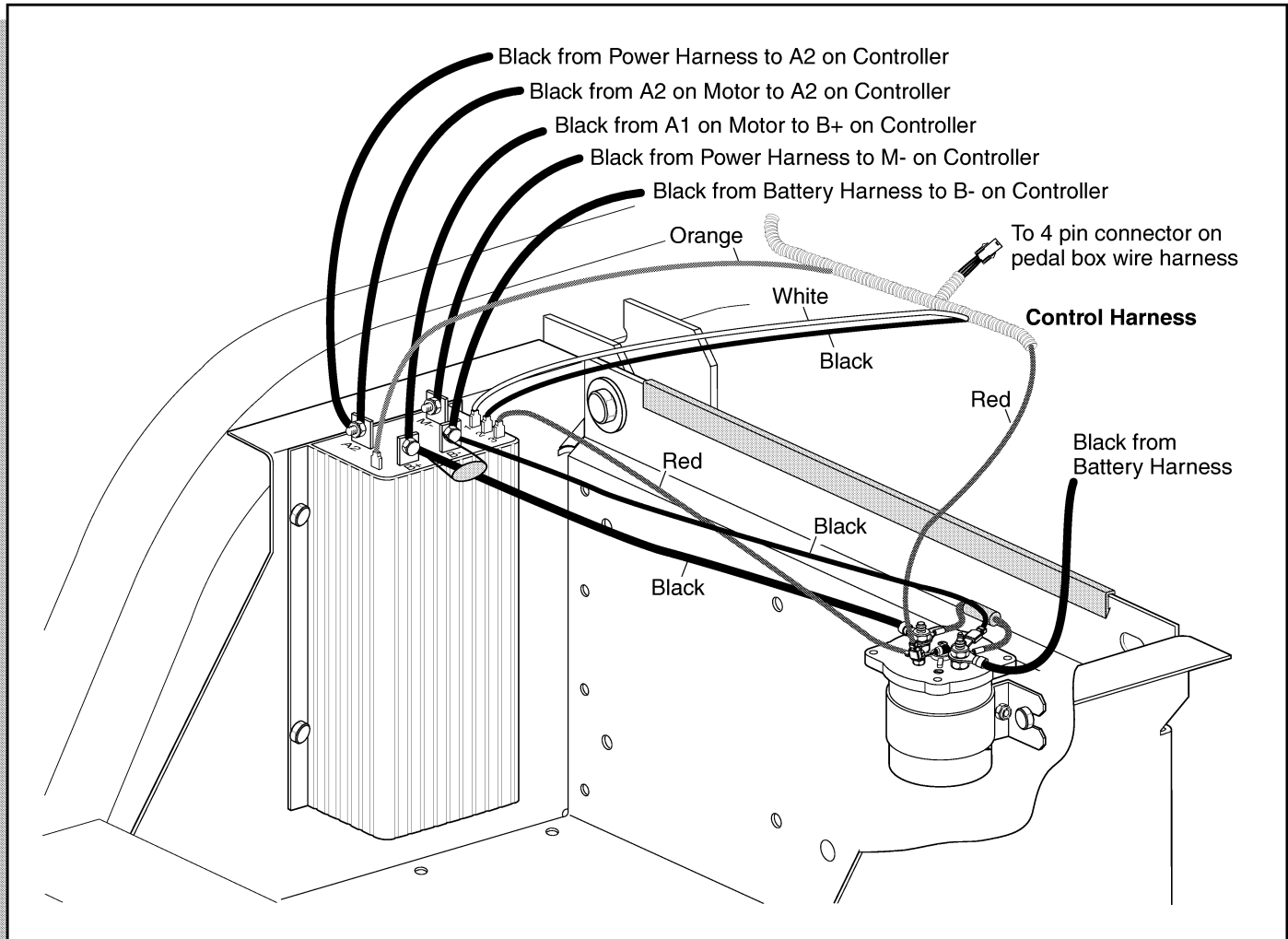


Fig. 3 Controller and Solenoid

## GENERAL TROUBLESHOOTING

### Tool List

|   | Qty. Required |
|---|---------------|
| Floor jack.....                           | 1             |
| Jack stands .....                         | 2             |
| Wheel chocks .....                        | 4             |
| Jumper wire (with alligator clips) .....  | 1             |
| DVOM (digital volt ohm meter) .....       | 1             |
| Socket, 3/8", 3/8" drive .....            | 1             |
| Ratchet, 3/8" drive .....                 | 1             |
| Torque wrench, in. lbs., 3/8" drive ..... | 1             |
| Torque wrench, ft. lbs., 3/8" drive ..... | 1             |
| Extension, 6", 3/8" drive .....           | 1             |
| Insulated wrench, 9/16" .....             | 1             |

|                                   |   |
|-----------------------------------|---|
| Wrench, 1/2" .....                | 1 |
| Wrench, 7/16" .....               | 1 |
| Phillips screwdriver, large ..... | 1 |
| Phillips screwdriver, small ..... | 1 |
| Shop towel .....                  | 1 |
| Allen wrench, .050" .....         | 1 |

### Symptoms

If the vehicle does not operate, operates poorly or intermittently, proceed to the following procedure:

### Testing

It is unlikely that the mechanical adjustment of the pedal box has changed, therefore the initial tests will be conducted with a DVOM to identify the failed component.

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

A typical DVOM is shown in illustrations. A recommended DVOM is available through the E-Z-GO Service Parts Department as P/N 27481-G01. Any DVOM may be used; however, the accuracy, controls, displays and features may vary depending on the make and model. Always follow the meter manufacturer's recommendations and instructions for the use and care of the meter.

To assure accurate readings, be sure to set the meter to the closest voltage reading above the expected voltage.



**To prevent unexpected movement of the vehicle, always raise the entire vehicle before conducting any tests.**

**Never operate vehicle at full throttle for more than 4-5 seconds while vehicle is in a "no-load" condition.**

Raise the vehicle and support on jack stands (Refer to the Lifting Procedure in Section 'B' Safety). Test the vehicle stability before proceeding.

Place the direction selector in 'F' and turn the key switch to 'ON'. Depress the accelerator pedal until the micro switch in the pedal box activates which should cause the solenoid to make an audible click.

## Testing Battery Voltage

It is important to determine the condition of the battery set before proceeding with any electrical troubleshooting. An open voltage test is of little use since a battery that has deteriorated to the point of requiring replacement can still show six volts or higher in an open voltage test. If there is any doubt as to the adequacy of the battery set, charge the batteries and perform a load test using a discharge machine. If batteries are satisfactory, recharge battery set.

With the adequacy of the batteries confirmed, use a DVOM connected directly to the battery terminal posts to determine the open voltage of the set (Ref Fig. 4 on page F-3). In the following tests, this voltage level will be used as a reference. Some loss due to resistance or wires and connectors may be indicated by readings that could be up to one volt less than the reference voltage. No reading indicates an "open" condition and the battery wires should be inspected for a broken or disconnected wire or component.

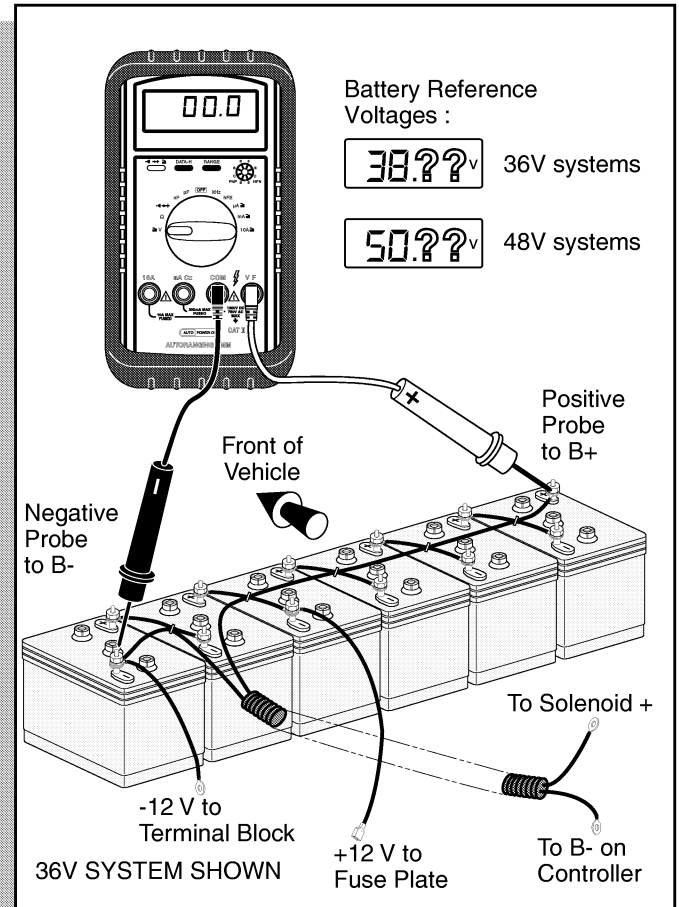


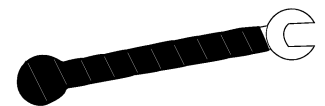
Fig. 4 Battery Reference Voltage

## Continuity Check



**Before attempting to perform a continuity check, turn the key switch to 'OFF' and place the direction selector in neutral.**

**Using an insulated wrench, remove the B+ wire from the battery to disconnect power supply.**



**Continuity checks must be performed with the power off.**

If the solenoid does not function, the micro switches, solenoid, key switch and four pin connector should be checked for continuity.

Turn the key switch to 'OFF' and place the direction selector in neutral before disconnecting power by removing the B+ connection to the battery. **Always use insulated wrenches when working on batteries.** To check

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

for continuity, set the DVOM to the  $K\Omega$  setting and select 'Continuity'. The meter will give an audible signal when it detects continuity. If the meter does not have a continuity setting, set it to  $K\Omega$ , the meter will indicate 0.00 when it detects continuity.

## Testing a Switch for Continuity

Place one probe on one contact of the switch, place the second probe on the second terminal of the switch (Ref Fig. 5 on page F-4).

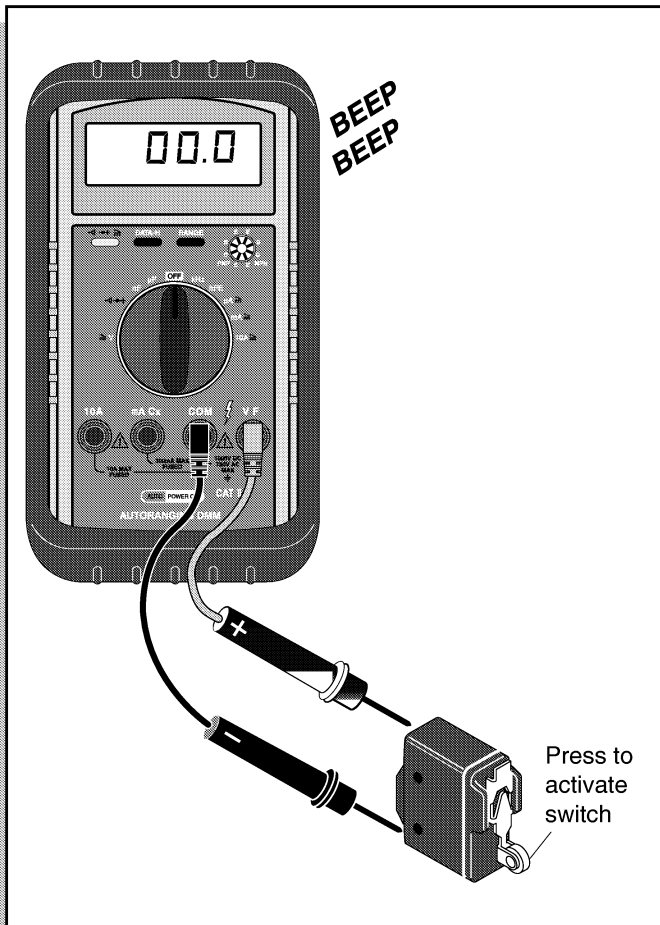


Fig. 5 Continuity Check of Switch

Actuating a normally open (NO) switch will cause the DVOM to show 0.00 or give an audible indication when the switch is operated. A normally closed (NC) switch will cause the meter to show 0.00 or give an audible indication when the probes are attached without activating switch. The audible indicator will stop and the meter display will indicate a value greater than 0 when the switch is activated.

The change in display or audible indicator demonstrates that the switch is functioning.

## Testing a Solenoid for Continuity

Place one probe on one of the large terminals and the other probe on the second large terminal (Ref Fig. 6 on page F-4). If the meter shows 0.00 or gives an audible indication, the solenoid terminals are "welded" closed and **the solenoid must be replaced**. See replacement procedure toward end of this section.

If the continuity test indicates that contacts are not "welded" and the wiring to the solenoid coil is good, the coil has failed and **the solenoid must be replaced**. See replacement procedure toward end of this section.

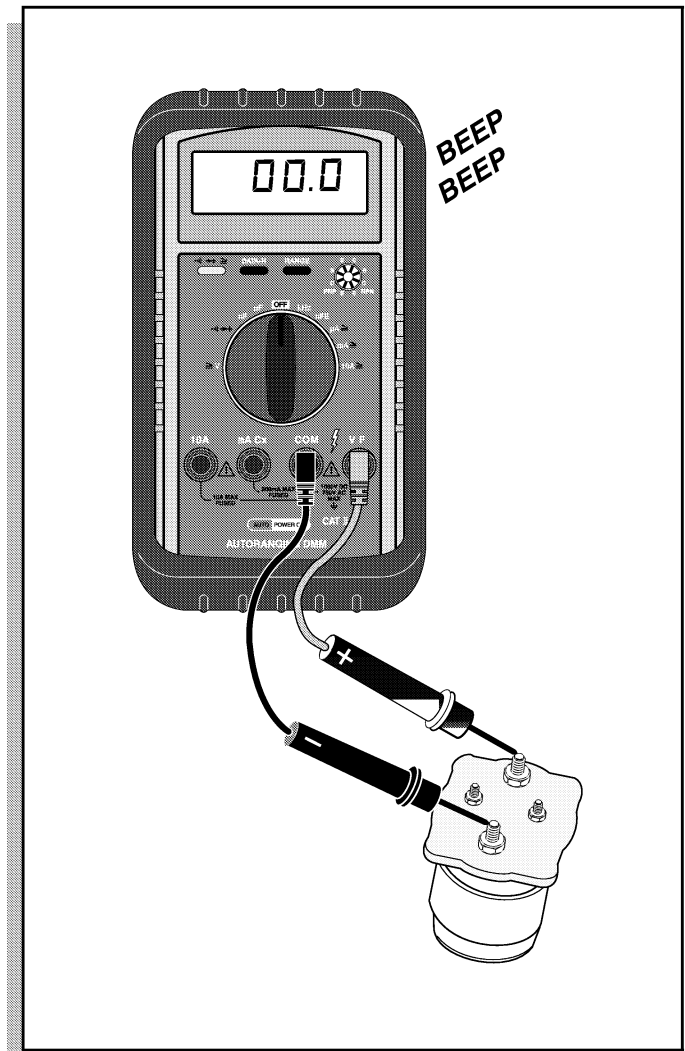


Fig. 6 Continuity Check of Solenoid



# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## TROUBLESHOOTING DIAGRAMS

The simplified troubleshooting diagram is a quick ESC diagnosis (Ref Fig. 7 on page F-5). Use this diagram to perform initial troubleshooting. Follow the indicated step

numbers to the information in the detailed troubleshooting diagram.

It is vital to the safety of the technician and assistants that all warnings and safety procedures in this section be followed.

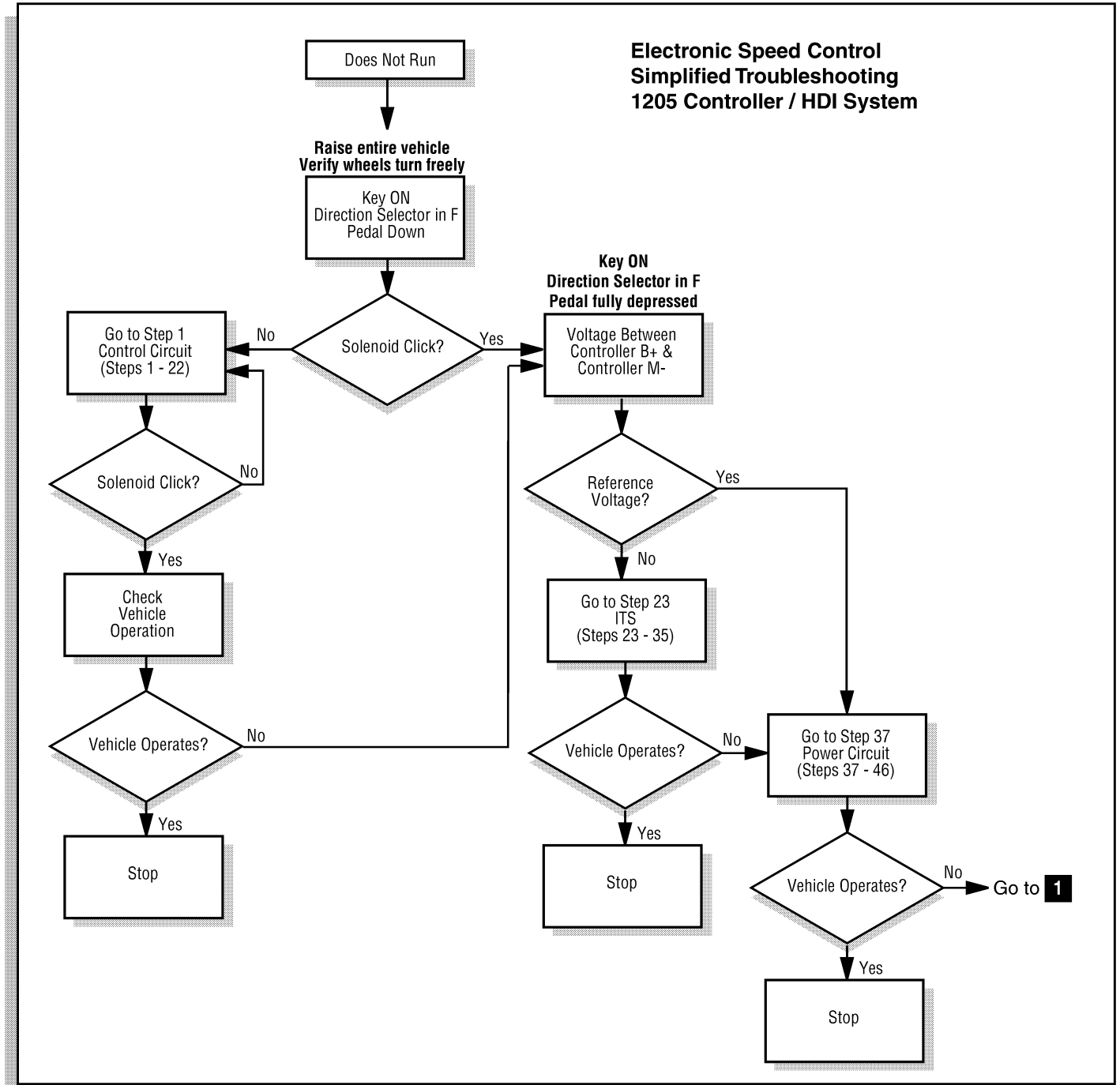
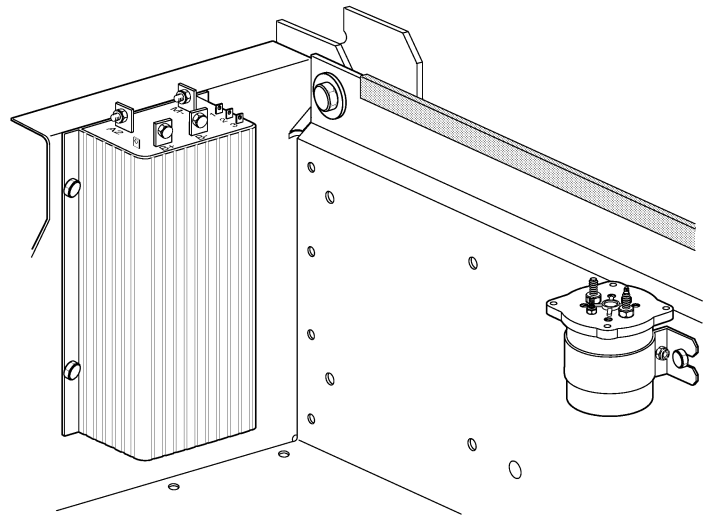


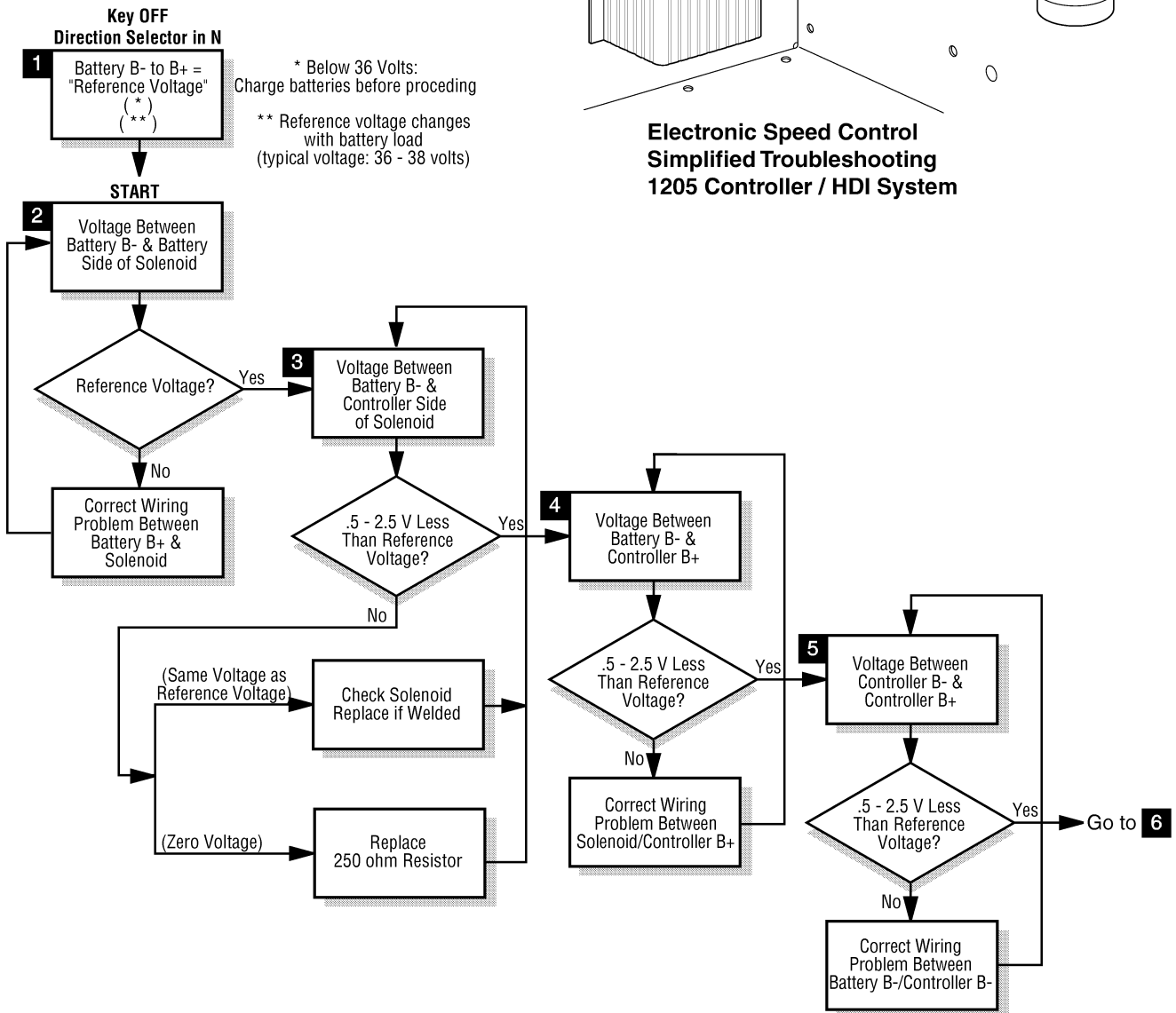
Fig. 7 Simplified Troubleshooting Diagram

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Electronic Speed Control  
Simplified Troubleshooting  
1205 Controller / HDI System**



**Fig. 8 Detailed Troubleshooting Diagram (Sheet 1 of 8)**

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

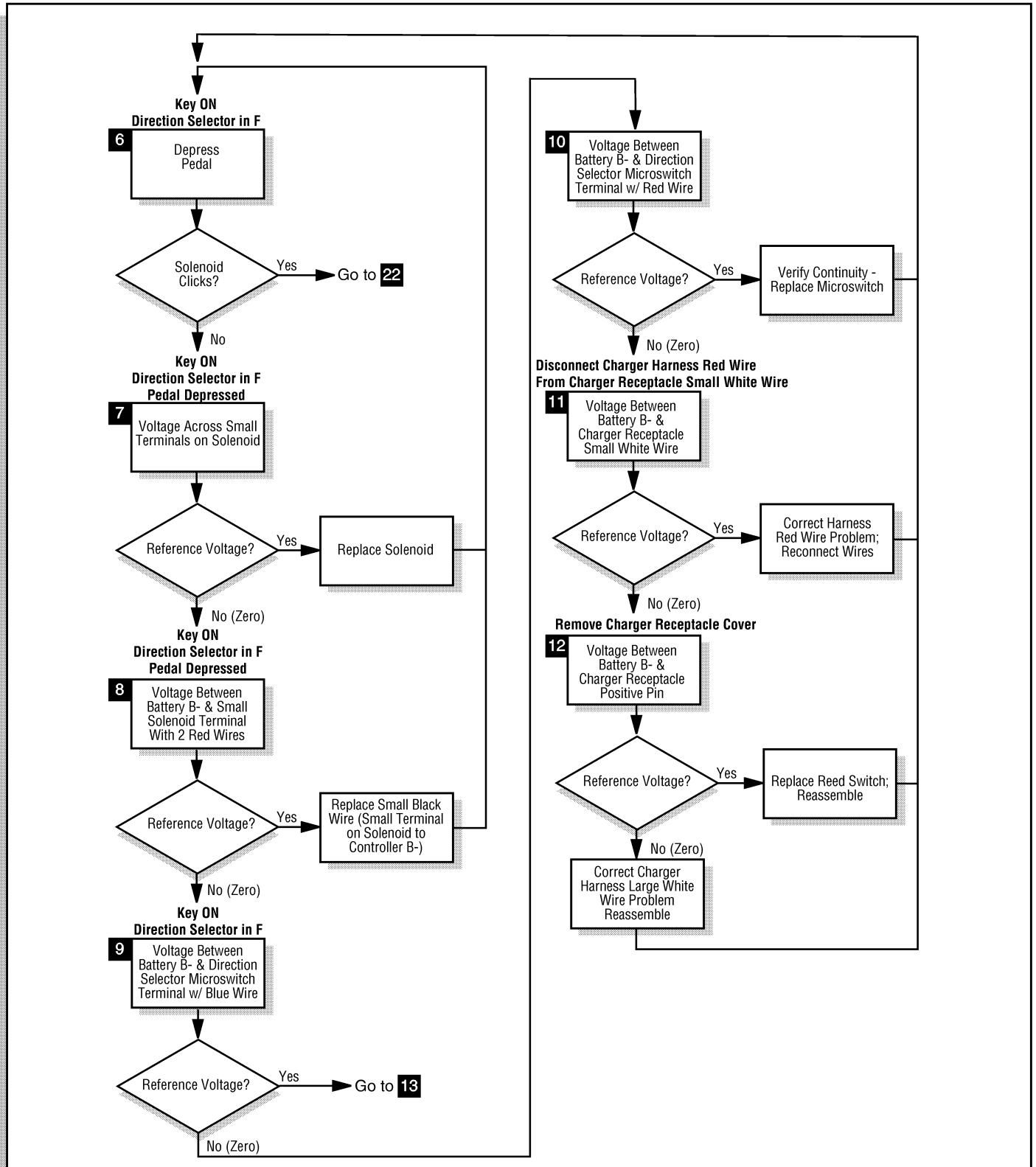


Fig. 9 Detailed Troubleshooting Diagram (Sheet 2 of 8)

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

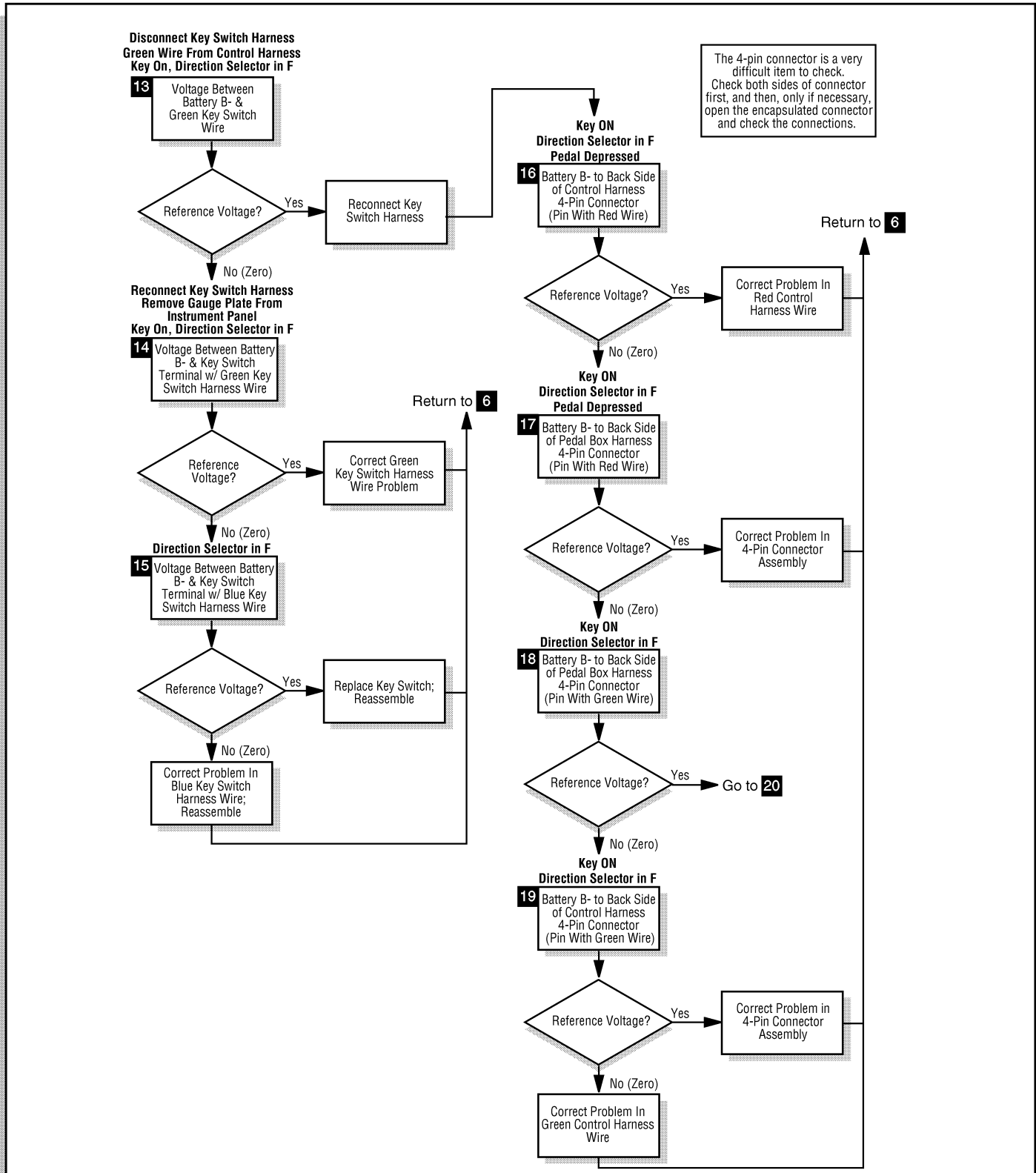


Fig. 10 Detailed Troubleshooting Diagram (Sheet 3 of 8)

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

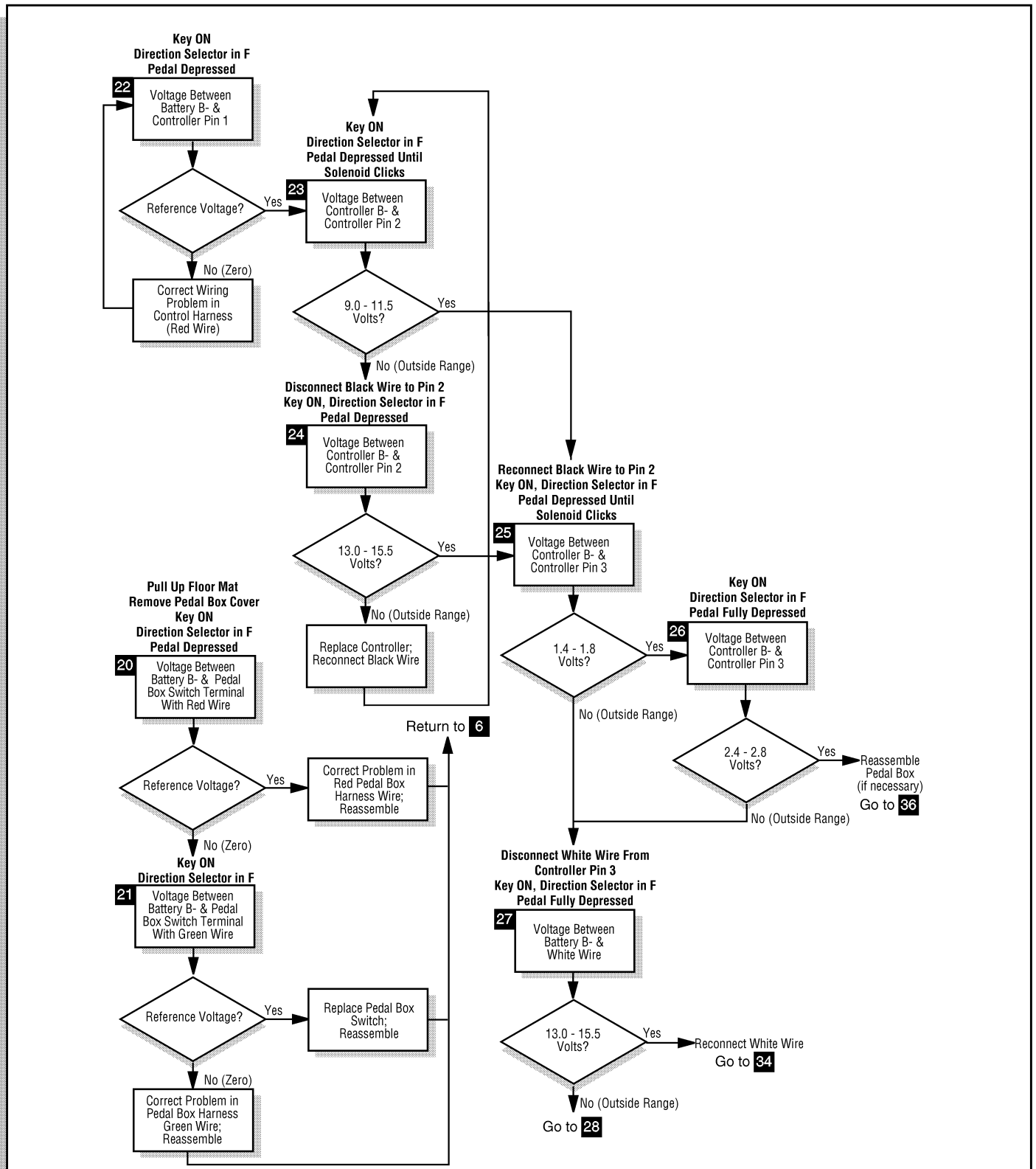


Fig. 11 Detailed Troubleshooting Diagram (Sheet 4 of 8)

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

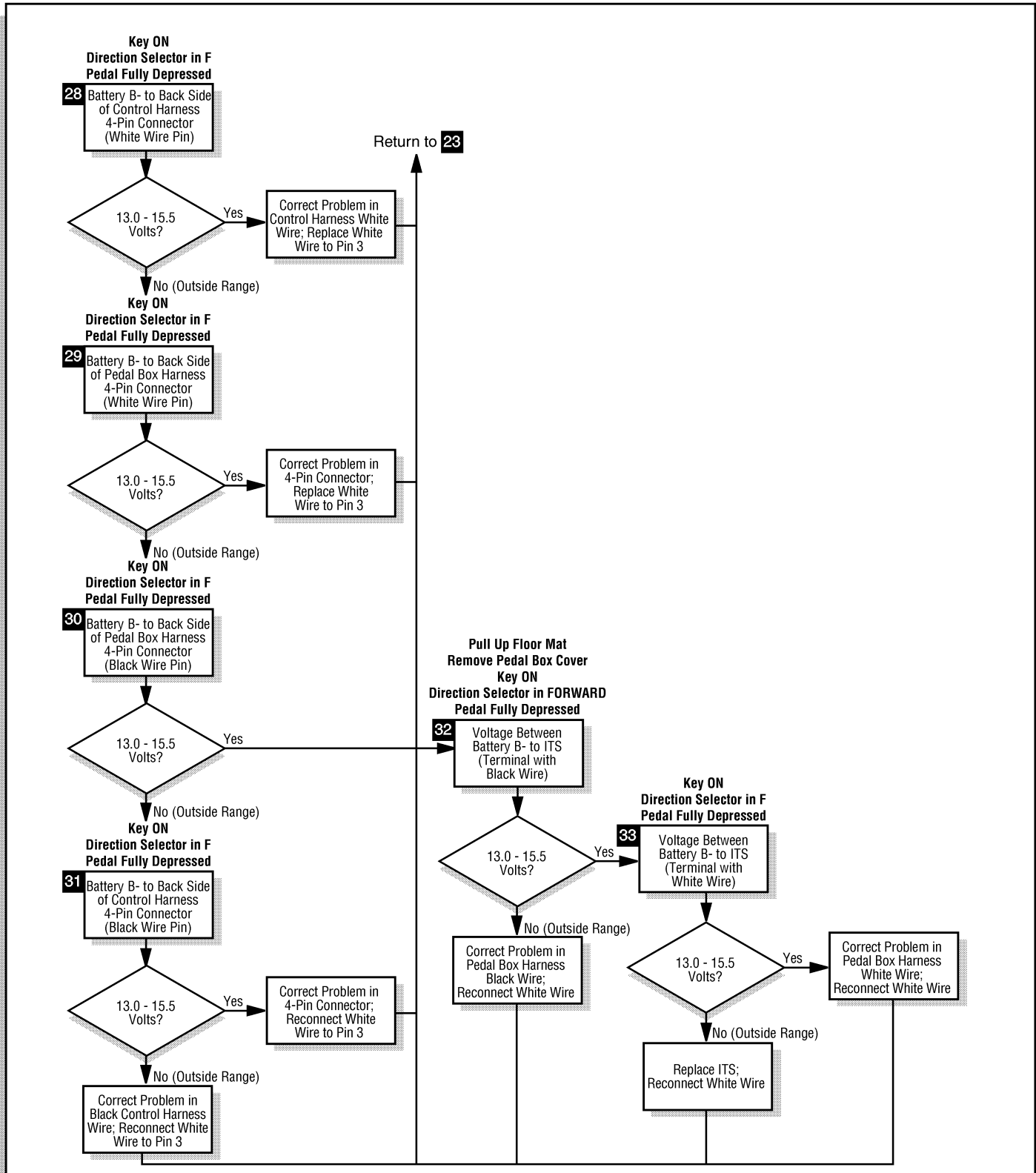
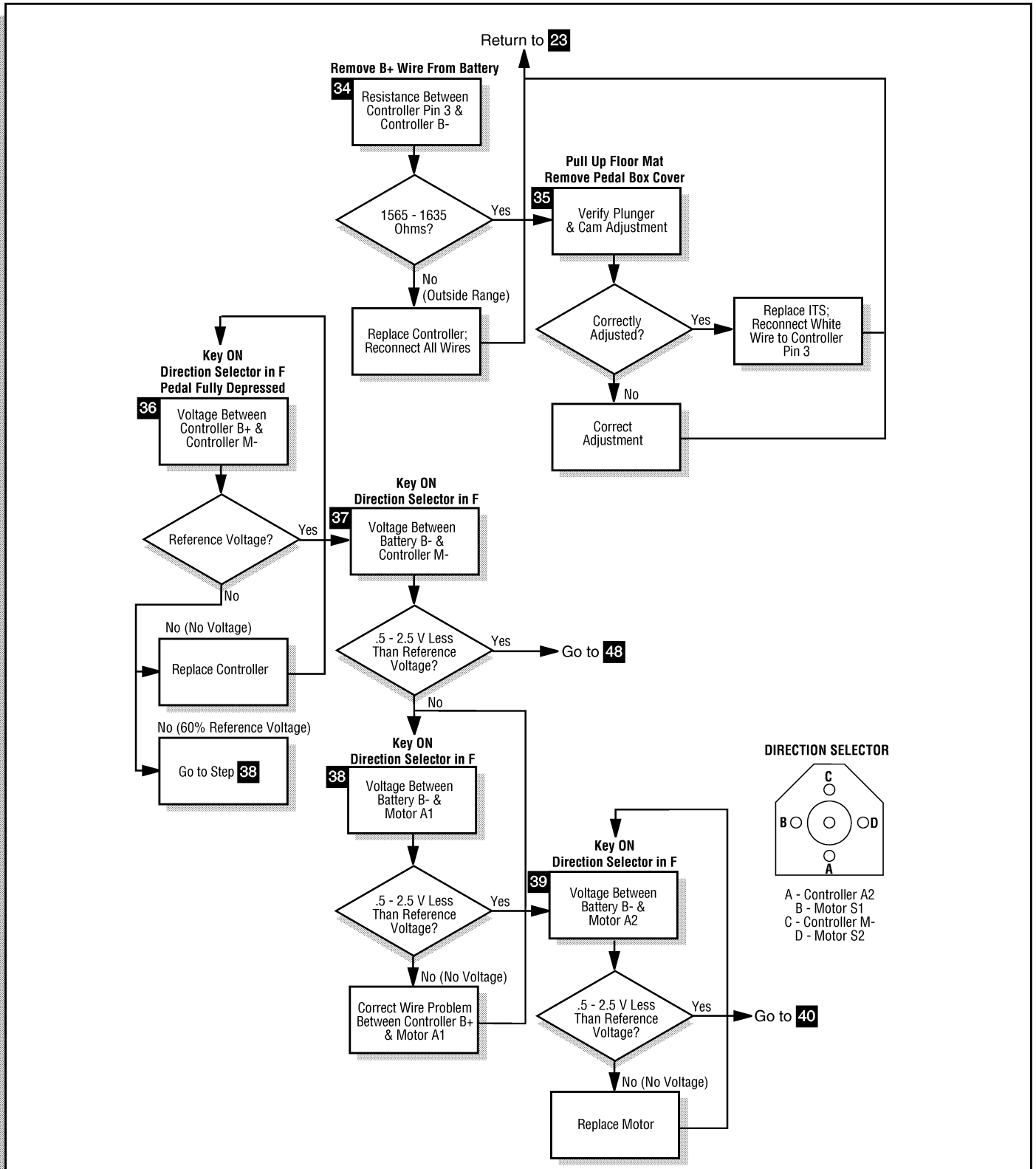


Fig. 12 Detailed Troubleshooting Diagram (Sheet 5 of 8)

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 13 Detailed Troubleshooting Diagram (Sheet 6 of 8)**

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

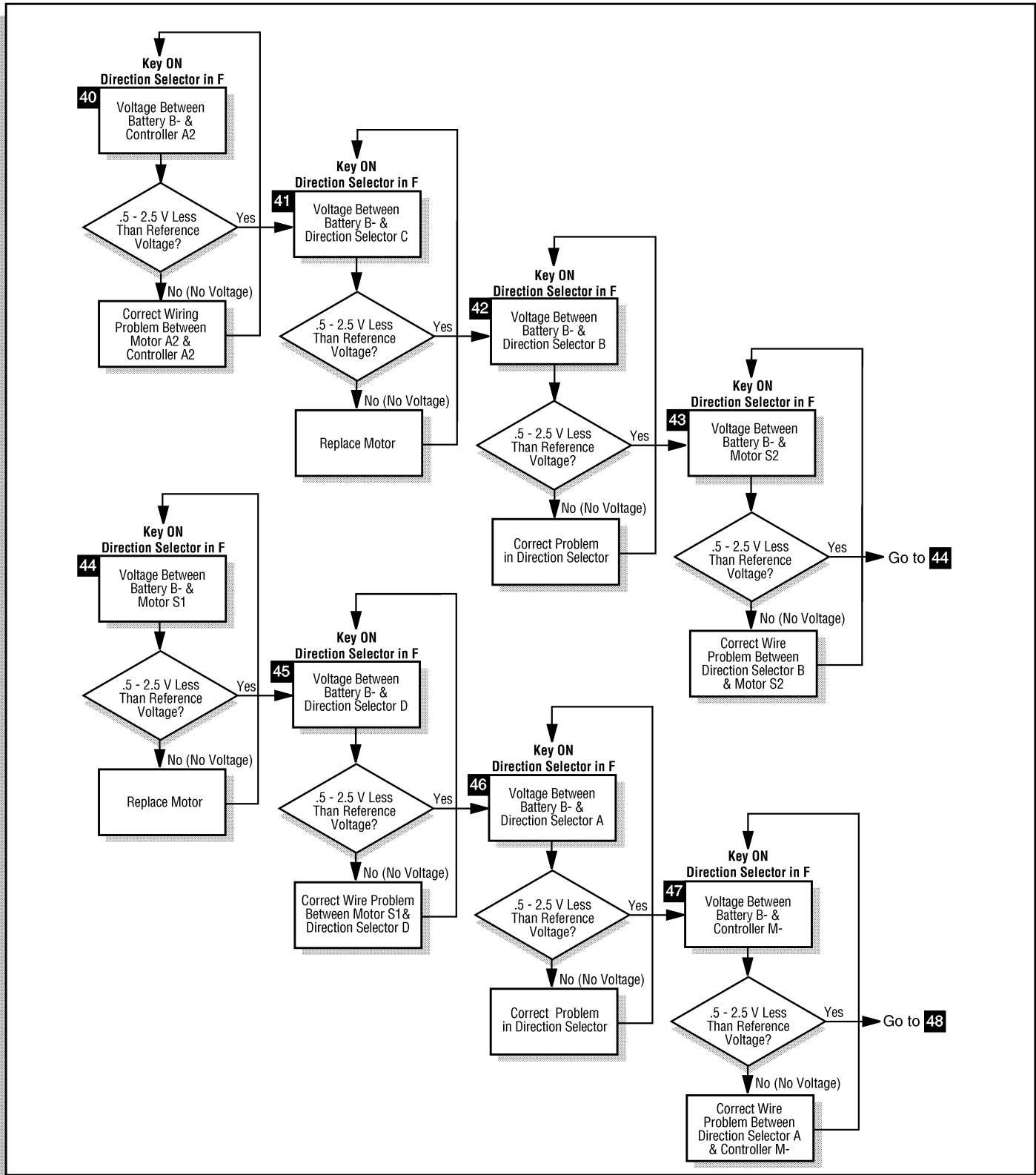


Fig. 14 Detailed Troubleshooting Diagram (Sheet 7 of 8)



# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

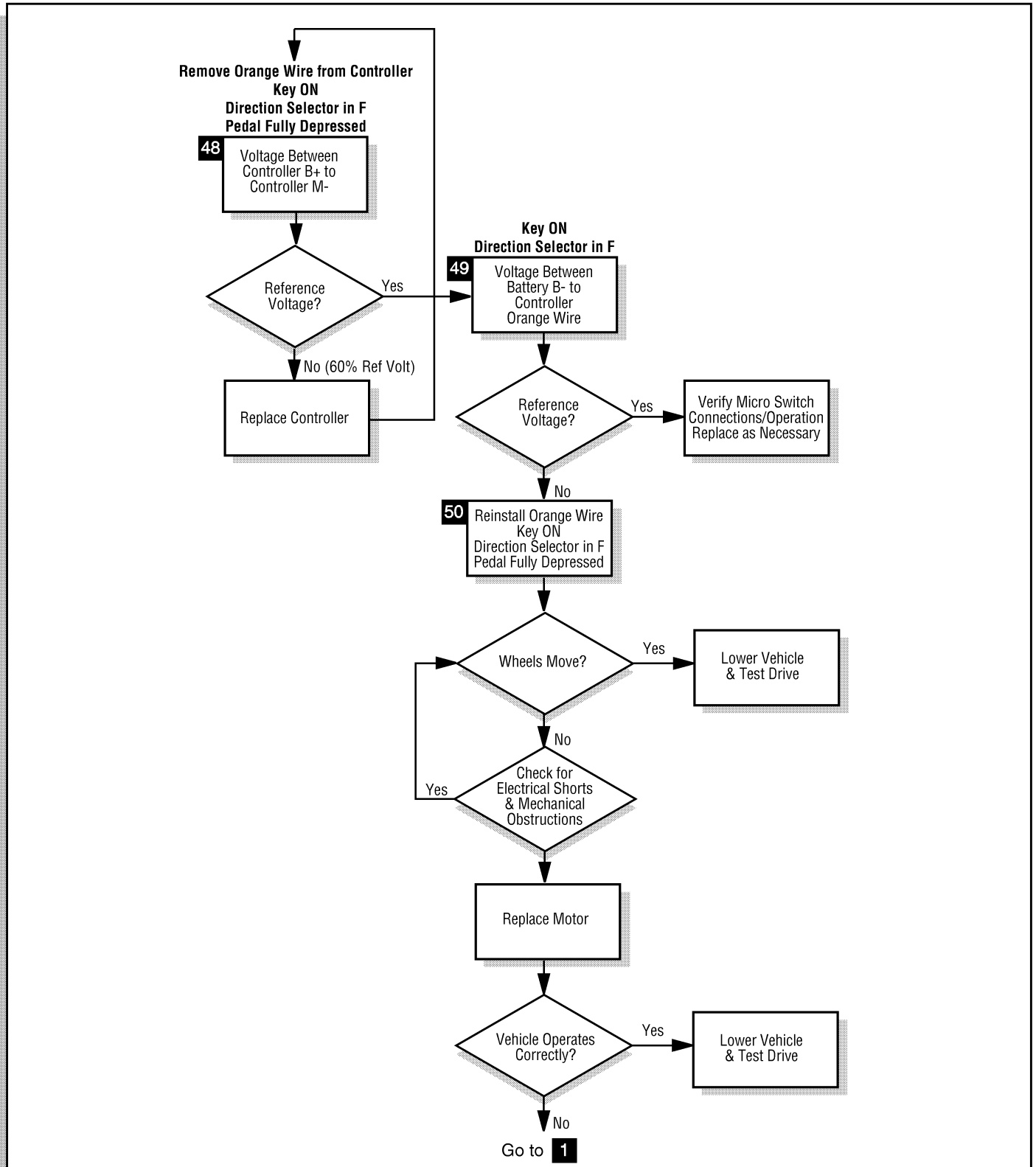


Fig. 15 Detailed Troubleshooting Diagram (Sheet 8 of 8)

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## INDUCTIVE THROTTLE SENSOR (ITS) TESTING AND REPLACEMENT

| Tool List                          | Qty. Required |
|------------------------------------|---------------|
| Phillips screwdriver.....          | 1             |
| Wrench, 7/16".....                 | 1             |
| Nut driver, 7/16".....             | 1             |
| Drill bit, 17/64".....             | 1             |
| DVOM (digital volt ohm meter)..... | 1             |

Engage the parking brake. Raise the vehicle and support on jack stands (Refer to Lifting Procedure in the SAFETY section). Test the vehicle stability before proceeding.

To access the pedal box, remove the nuts and washers from the behind the access panel and screws from the front (Ref Fig. 16 on page F-14).

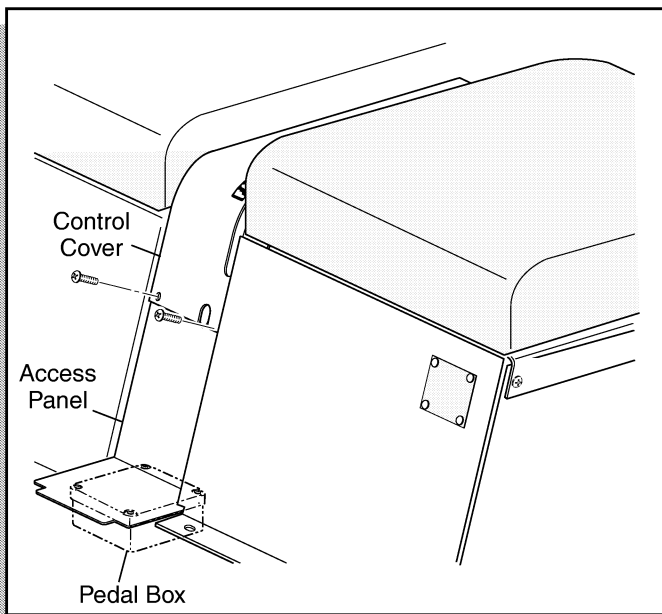


Fig. 16 Access to Pedal Box

Pull out on the end of the control cover and remove the access panel. Remove the four screws securing the cover to the pedal box to access the ITS and plunger (Ref Fig. 17 on page F-14).

With the DVOM set to volts, probe the white wire at the ITS with the positive probe and attach the negative probe to the B- at battery. Place the direction selector in 'F' and turn the key switch to 'ON'. Depress the accelerator pedal. As the solenoid clicks the meter should read 1.4 - 1.8 through 2.4 - 2.8 volts at full pedal (Ref Fig. 19 on page F-16). If the reading is out of specification, **the ITS sensor must be replaced.**

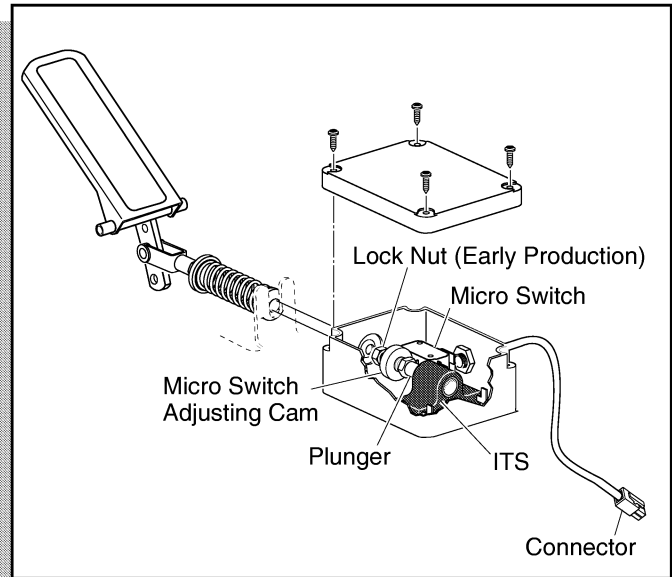


Fig. 17 ITS and Plunger

**CAUTION** The ITS attaches to the plastic pedal box with two plastic studs and two speed nuts. Be careful not to overtighten the nuts which could strip the plastic studs but be sure to tighten the nuts enough to prevent movement of the ITS.

Carefully remove the two wires that are attached to the ITS and carefully remove the nuts securing the ITS to the pedal box studs.

Install a new ITS being careful to align the ITS and not to over tighten the retaining nuts. Reattach the wiring.

With the accelerator pedal in the full up position, insert a drill bit (17/64" for early production vehicles - a 7/32" for later production) between the plunger and the face of the ITS. This is to verify gap for adjustment. (Ref Fig. 18 on page F-15). (Early production vehicles can be identified by the presence of setscrews in the micro switch adjusting cam and the cam/plunger lock nut shown in Fig. 17.) For early production vehicles adjustment is made by loosening the lock nut at the cam and rotating the plunger until the desired dimension is achieved. Firmly tighten the lock nut. For later production vehicles loosen the lock nut at the accelerator yoke clevis and rotate the plunger and rod until the desired dimension is achieved. Firmly tighten the lock nut.

Recheck voltage as previously indicated to verify ITS is working properly.

Replace the plastic cover and press it firmly into place before tightening the cover screws.

Slide the access panel up under the control cover and reinstall hardware (Ref Fig. 1 on page F-1).

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

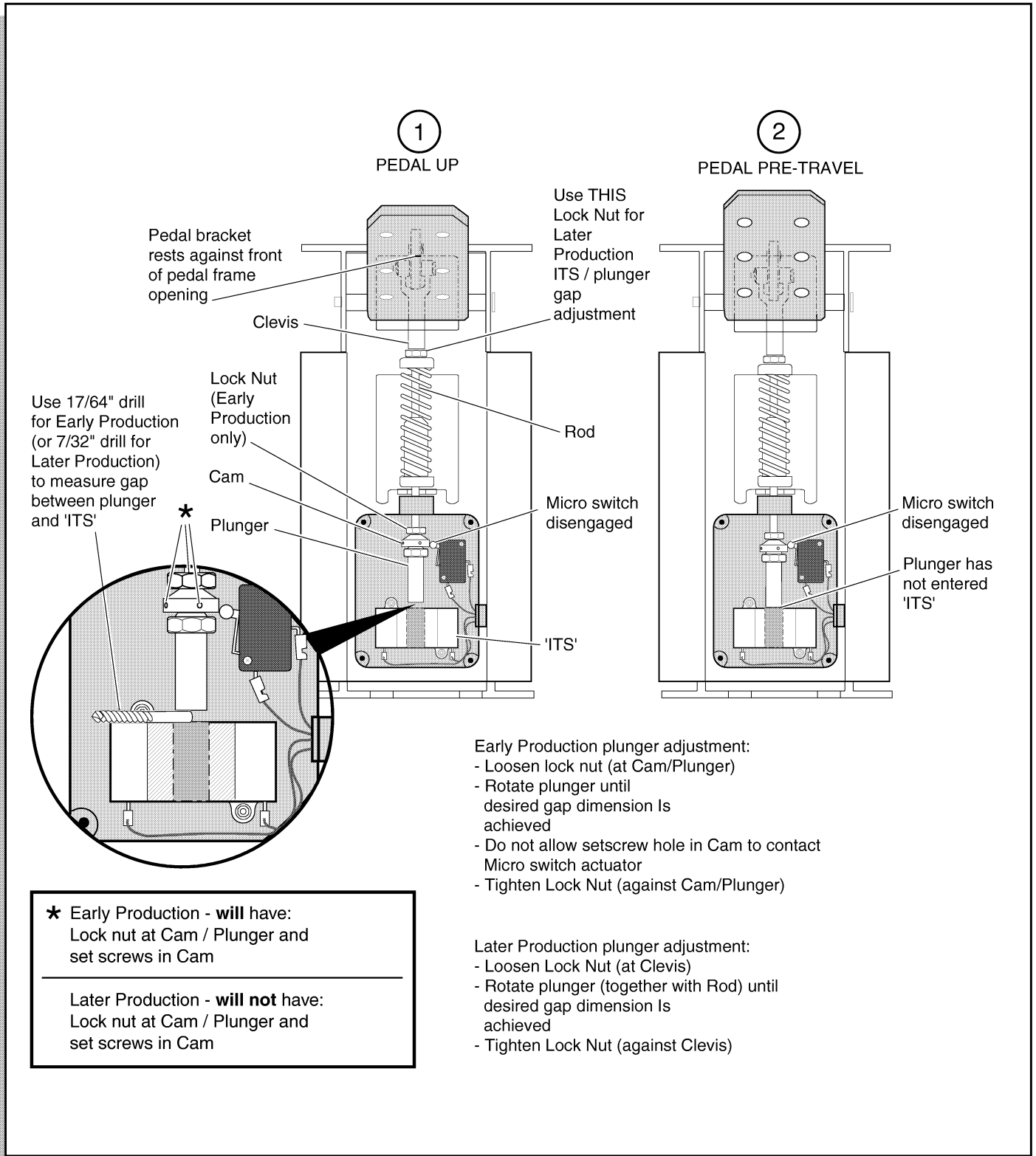
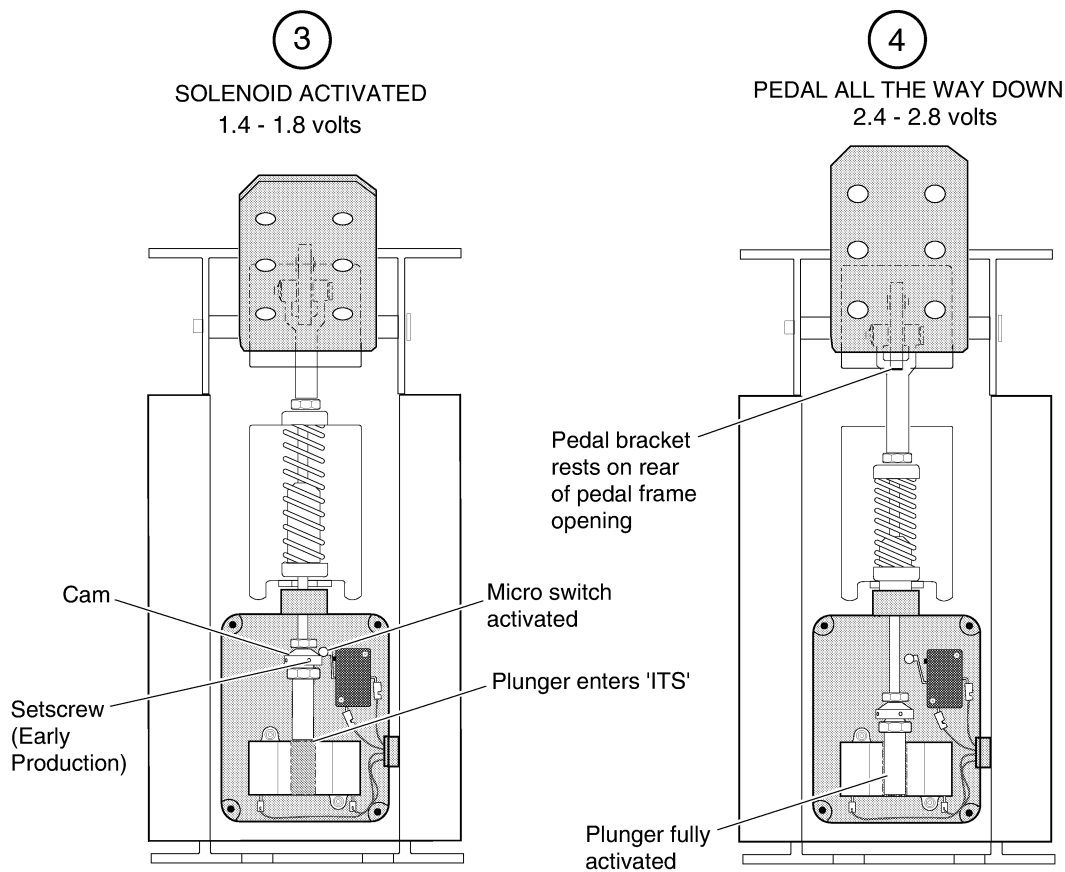


Fig. 18 ITS Adjustment (Sheet 1 of 2)

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



- Early Production micro switch adjustment:
- Loosen setscrew
  - Rotate cam along threads on plunger until correct adjustment is achieved
  - Do not allow setscrew hole to contact micro switch actuator
  - Tighten setscrew

- Later Production micro switch adjustment:
- No adjustment necessary here

With pedal all the way down:  
Plunger should be flush with or extend beyond rear of 'ITS'

Fig. 19 ITS Adjustment (Sheet 2 of 2)

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## CONTROLLER REPLACEMENT

| Tool List                       | Qty. Required |
|---------------------------------|---------------|
| Wrench, 7/16" .....             | 1             |
| Socket, 7/16", 3/8" drive ..... | 1             |
| Ratchet, 3/8" drive.....        | 1             |
| Wrench, 1/2" .....              | 1             |
| Insulated wrench, 1/2" .....    | 1             |
| Shop towel .....                | 1             |
| Screwdriver, large .....        | 1             |

Raise the cargo deck panels and/or rear seat to access the batteries and electrical compartment.



**The B+ wire must be removed before discharging the controller.**

**Discharge the controller by shorting the B+ and B- terminals of the controller with a large screwdriver. Be sure to hold the insulated portion of the screwdriver.**

Using an insulated wrench, remove the B+ wire from the battery.

Note the location of the wiring to the controller. Remove securing hardware and all wiring from controller. Remove the mounting bolts from the controller and remove the controller.

Install the new controller. Replace wiring at controller. Replace B+ wire.

Lower cargo deck panels and/or rear seat.

## SOLENOID REPLACEMENT

| Tool List                       | Qty. Required |
|---------------------------------|---------------|
| Insulated wrench, 1/2" .....    | 1             |
| Shop towel.....                 | 1             |
| Wrench, 7/16" .....             | 1             |
| Socket, 7/16", 3/8" drive ..... | 1             |
| Ratchet, 3/8" drive .....       | 1             |
| Wrench, 1/2" .....              | 1             |
| Wrench, 5/16" .....             | 1             |

Raise the cargo deck panels and/or rear seat to access the batteries and electrical compartment.



**The B+ wire must be removed before discharging the controller.**

Using an insulated wrench, remove the B+ wire from the battery.

Note the location of the wiring to the solenoid. Remove the securing hardware and all wiring from solenoid. Remove the mounting bolts from the solenoid and remove solenoid.

Install the new solenoid. Replace wiring at solenoid. Replace B+ wire.

Lower cargo deck panels and/or rear seat.

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

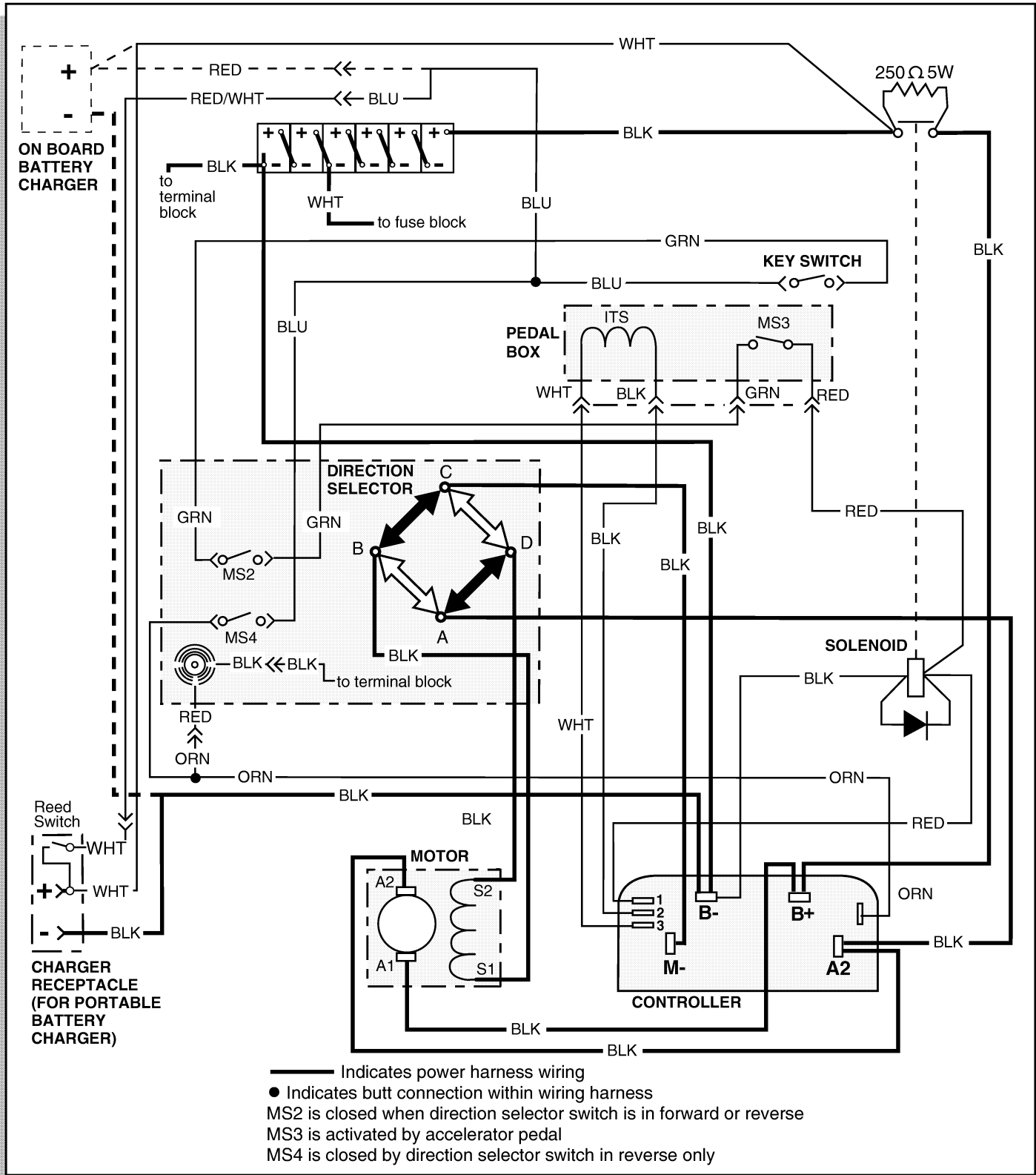


Fig. 20 36V Wiring Diagram - Standard Battery Tray

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

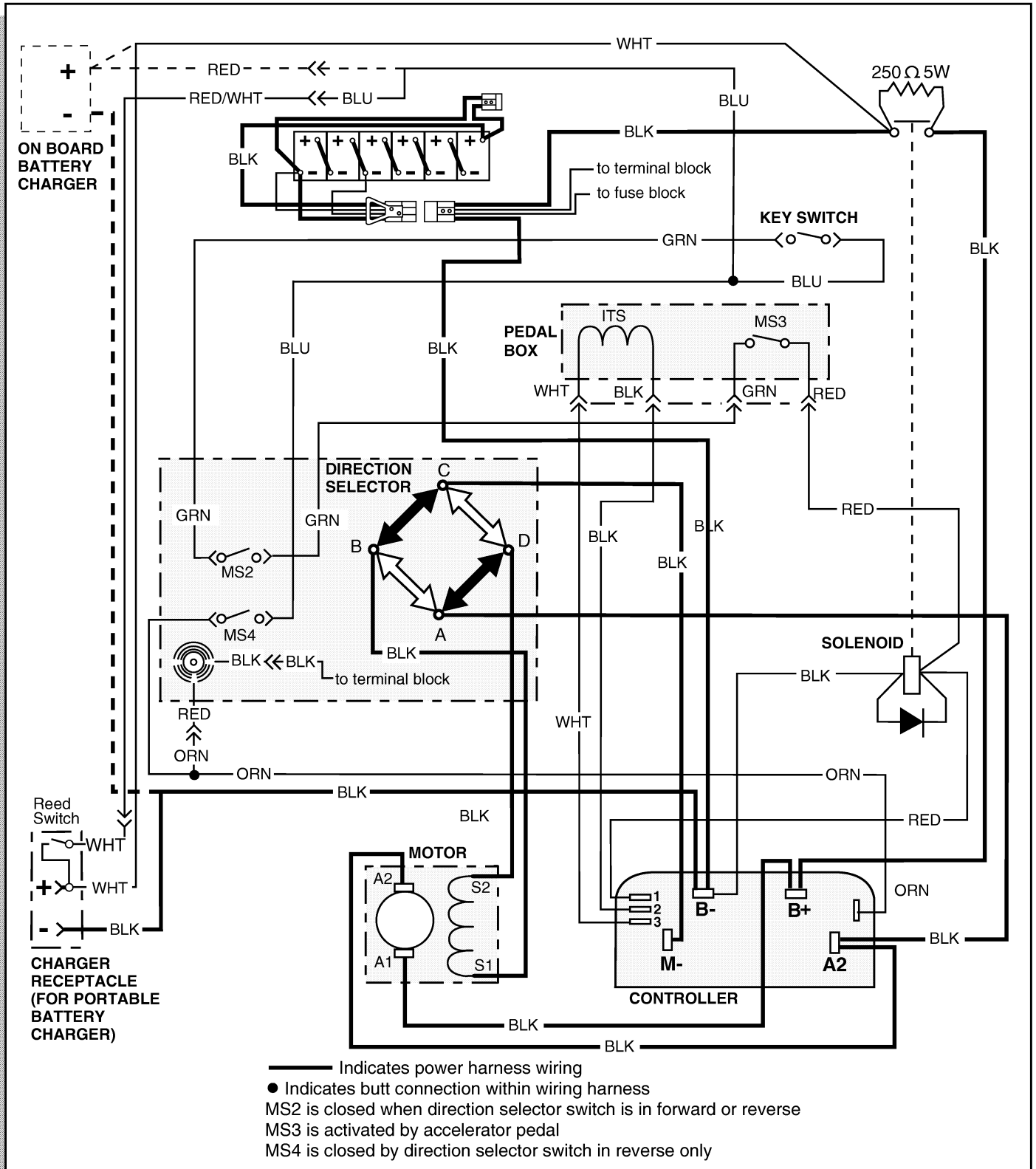


Fig. 21 36V Wiring Diagram - Rollout Battery Tray

# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

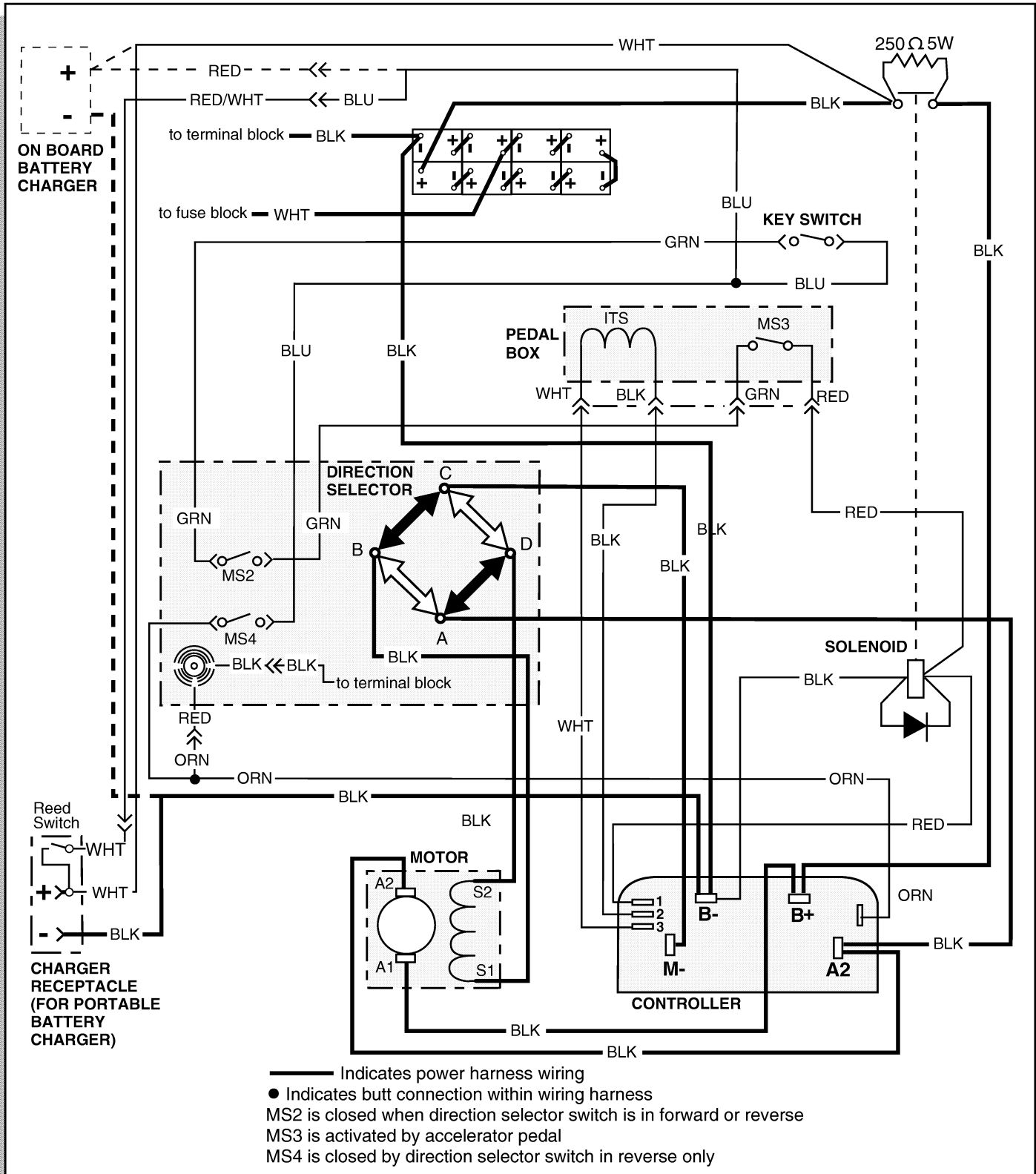


Fig. 22 48V Wiring Diagram - Standard Battery Tray



# ELECTRONIC SPEED CONTROL

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

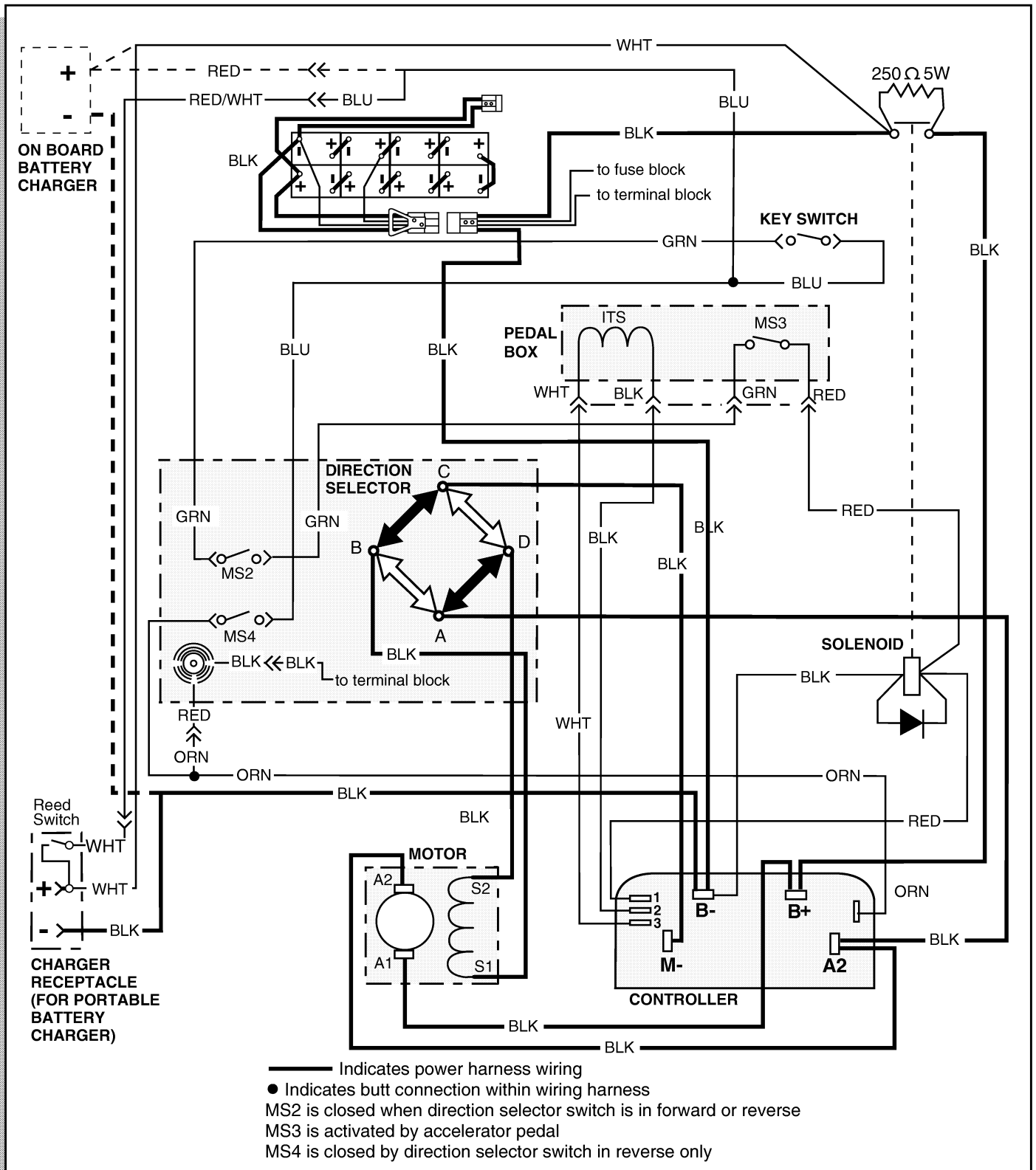


Fig. 23 48V Wiring Diagram - Rollout Battery Tray

# **ELECTRONIC SPEED CONTROL**

*Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings*

**Notes:** \_\_\_\_\_

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# ACCESSORY WIRING

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# ACCESSORY WIRING



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## DIGITAL VOLT OHM METER

A typical DVOM is shown (Ref Fig. 1 on page G-1). A recommended DVOM is available through the E-Z-GO Service Parts Department as P/N 27481-G01. For the purpose of this section, the red probe (+) and black probe (-) are used. Any DVOM may be used, however the controls, displays, accuracy and features may vary depending on the make and model. Always follow the meter manufacturer's recommendations and instructions for the use and care of the meter.

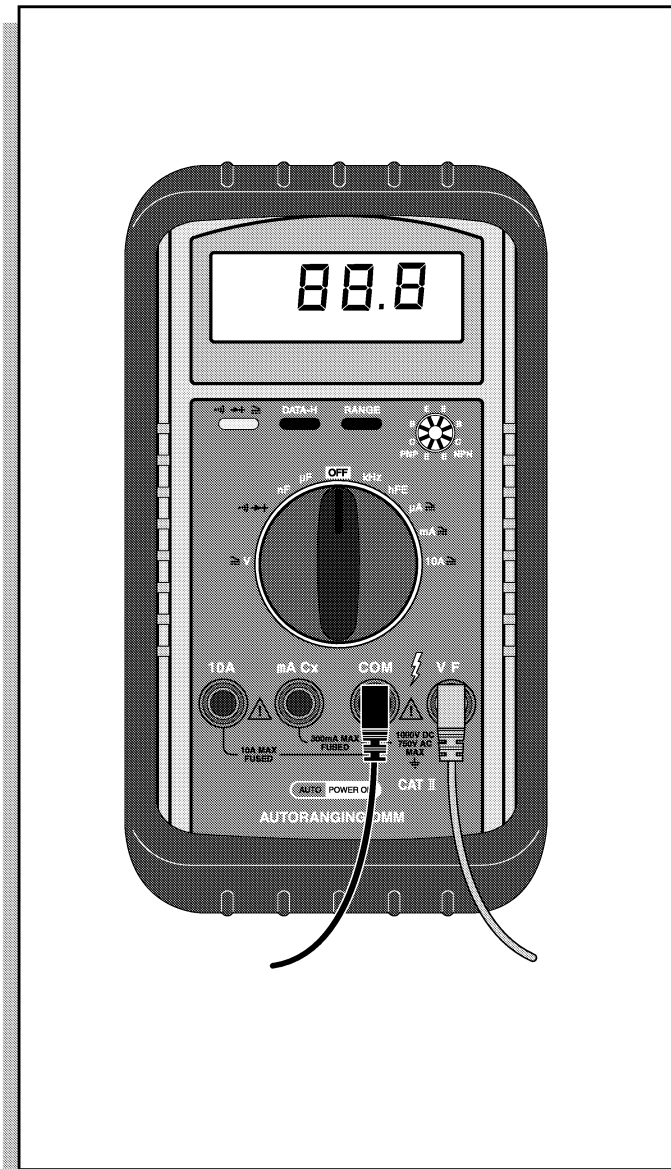


Fig. 1 DVOM

## TROUBLESHOOTING

In order to effectively troubleshoot the circuits that include the horn, lighting, brake/turn signals and gauges, the technician must be able to use the wiring diagram and a DVOM.

The wiring diagram shows the path followed by a voltage or signal from its origination point to its destination (Ref Fig. 2 on page G-2). Each wire is indicated by color.

The technician should use simple logic troubleshooting in order to reduce the number of steps required to isolate the problem.

**Example 1:** If the vehicle will not start and none of the lights function (or burn dimly) the battery should be tested before trying to troubleshoot the lighting circuit.

**Example 2:** If a problem occurs in the lighting circuit that results in only one of the headlights not working, there is no reason to check battery wiring or the fuse since it is obvious that voltage is present. Since bulbs will burn out over time, the obvious place to start is at the headlight that is not functioning. If power is present at the connector and the ground wiring is satisfactory, the only possibilities that exist are a burned out bulb or a poor contact between the connectors and the headlight.

If power is not present but the other headlight functions, a wiring problem is indicated between the two headlights.

In some cases where battery voltage is expected, the easiest way to test the circuit is to set the DVOM to DC volts and place the negative (-) probe of the DVOM on the negative battery terminal. Move the positive (+) probe to each wire termination starting at the battery and working out to the device that is not working. Be sure to check both sides of all switches and fuses.

When no battery voltage is found, the problem lies between the point where no voltage is detected and the last place that voltage was detected. In circuits where no voltage is expected, the same procedure may be used except that the DVOM is set to continuity. Place the negative (-) probe on a wire terminal at the beginning of the circuit and work towards the device that is not working with the positive (+) probe. When continuity is no longer indicated, a failed conductor or device is indicated.

# ACCESSORY WIRING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

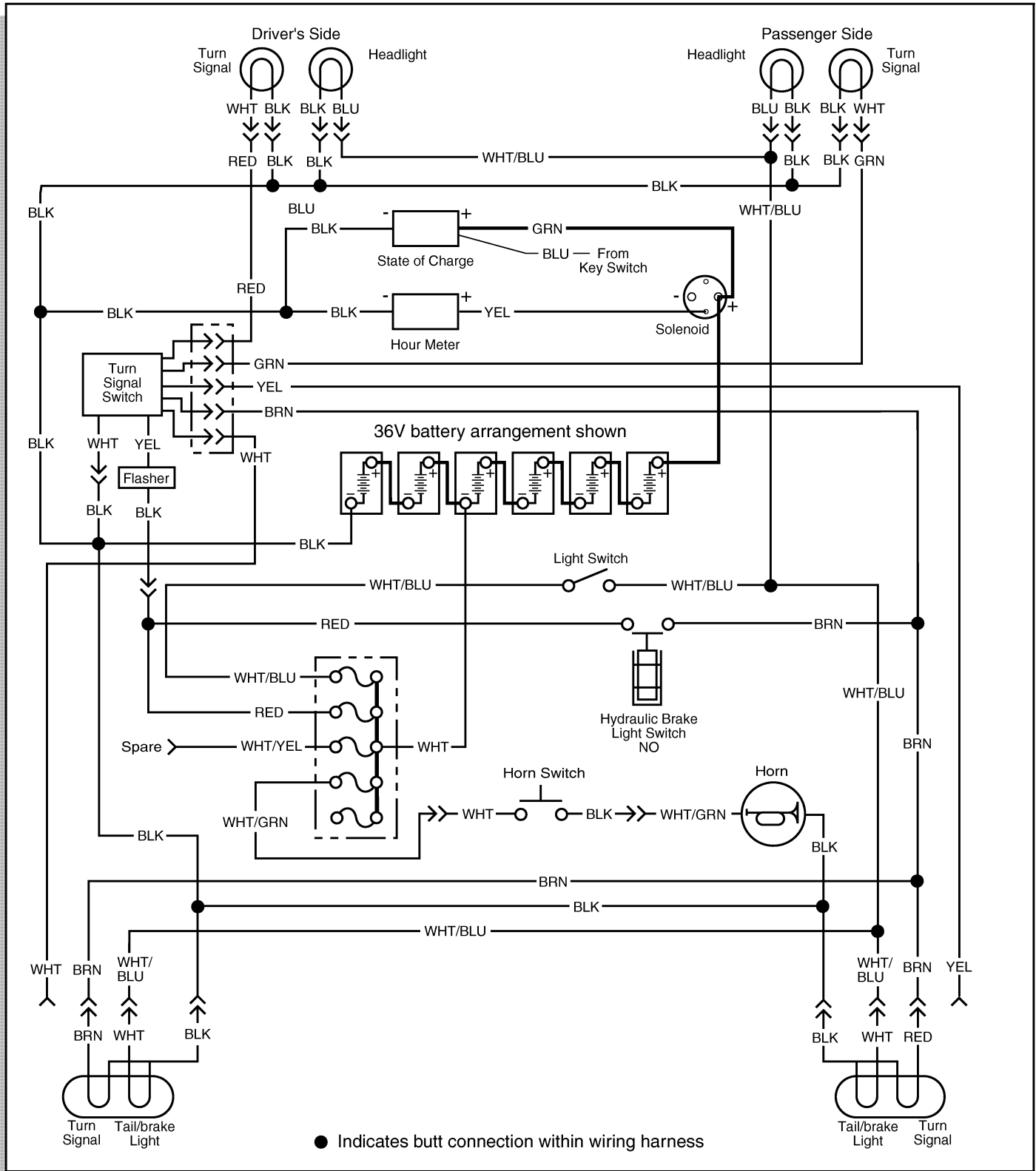


Fig. 2 Wiring Diagram

# ACCESSORY WIRING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## POWER SUPPLY

| Tool List  | Qty. Required |
|------------|---------------|
| DVOM ..... | 1             |

### 1. CHECK FOR LOOSE OR BARE WIRES

Check for loose wires at each terminal connection and for worn insulation or bare wires touching the frame. **Bare wires may cause a short circuit.**

**NOTE** *If any DVOM readings indicate a faulty wire, it is recommended that the condition of the terminals and wire junction be examined. A faulty wire should be replaced with one of the same gauge and color and wired between the correct components and wire tied to the harness bundle. The faulty wire should be cut back close to the harness and the ends protected with vinyl electrical tape.*

### 2. CHECK BATTERY CONDITION

Check for adequate battery volts (nominal 12 VDC) by setting DVOM to 30 VDC range and place the red probe (+) to the third negative (-) battery post from the driver side with the white wire attached. Place the black probe (-) to the first negative (-) battery post on the driver side with the black wire attached. A reading of 11 VDC or greater indicates adequate battery condition. No reading indicates (a) a poor connection between the probes and the battery terminals; (b) a broken wire or loose terminals; (c) a faulty DVOM. A voltage reading below 11 volts indicates poor battery condition and the vehicle should be recharged before proceeding with the test.

**NOTE** *Due to the resistance of the wires involved within the harness, voltage readings may be somewhat lower than battery voltage. A reading of 1 volt below battery voltage is acceptable.*

### 3. CHECK WHITE POWER WIRE

Firmly attach black probe (-) to the first negative(-) battery post on the driver side with the black wire attached and the red probe (+) to the terminal on the side of the fuse block where the white wire is connected. A reading of battery voltage indicates that the white wire is in good condition.

**NOTE** *The white wire supplies power to the entire fuse block.*

### 4. CHECK FUSE

Place the red probe (+) to each wire terminal on the fuse block. A reading of battery voltage indicates that the fuse is in good condition. No reading indicates a faulty fuse; replace with a good 15 amp fuse.

## ACCESSORY WIRING

After determining that there is power to the fuse panel, and the fuse is good, continue checking the circuit using the procedures previously used to check the power supply, i.e. loose or rusted connections, bare wires, continuity of the wiring from terminal to terminal, operating condition of switch, etc.

Use the wiring diagram (Ref Fig. 2 on page G-2), and illustrations (Ref Fig. 3 on page G-4) to check correct wiring and wire routing. If there is power at the fuse end of the wire, there must also be power at the other end of the wire at the switch or electrical accessory, and eventually at the ground connection. Electricity must flow from the fuse panel through the full length of the circuit to the ground connection. Any interruption of electricity flow must be corrected, whether by repairing or replacing the wire, the switch or accessory.

# ACCESSORY WIRING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

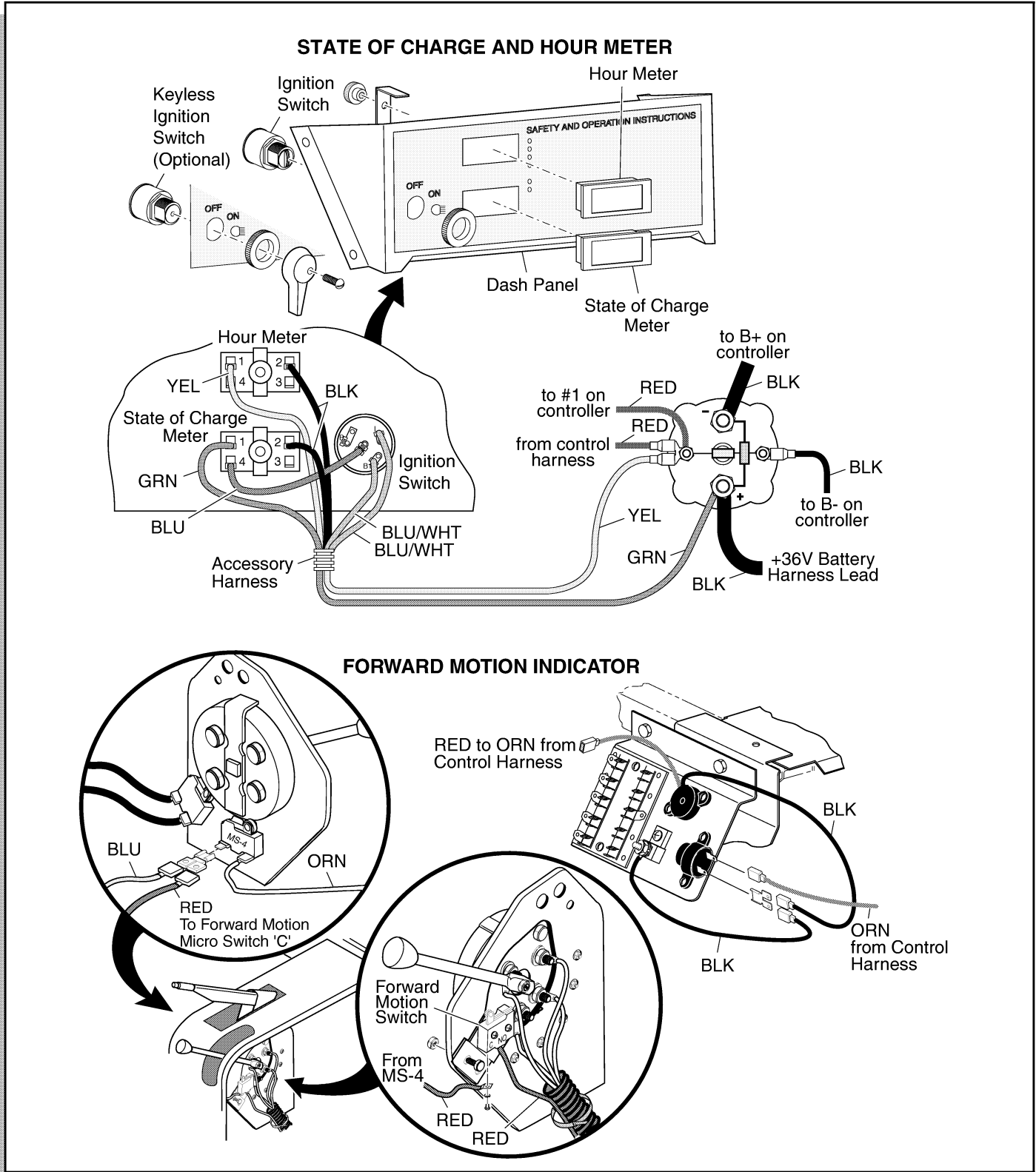


Fig. 3 Electrical Accessories



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**MOTOR**

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## MOTOR

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

### GENERAL

**CAUTION** Do not hold vehicle on hill by using accelerator and motor. Leaving motor in a stalled condition for more than 3-4 seconds will raise the commutator bars resulting in unacceptable noise and accelerated brush wear and cause permanent damage to motor.

Disassembly of the motor is not recommended except to replace a worn or noisy bearing. If the motor is disassembled, it should be cleaned of any dirt buildup and the brush length checked. Replace brushes if required.

Neither the motor housing nor armature is available as service items, therefore in the unlikely event of a failure in either of these components, the entire motor must be replaced.

### Motor Removal

**WARNING** Disconnect the negative (-) battery cable with an insulated wrench before attempting to remove wires from the motor (see safety procedures in SAFETY section of this manual). The shorting of motor wires could cause an explosion.

#### Tool List Qty. Required

|                                 |   |
|---------------------------------|---|
| Insulated wrench, 1/2" .....    | 1 |
| Chalk or paint pen .....        | 1 |
| Socket, 7/16", 3/8" drive ..... | 1 |
| Ratchet, 3/8" drive .....       | 1 |

Using an insulated wrench, disconnect the negative (-) battery cable from the battery (Ref Fig. 1 on page H-1). (Standard 36V system shown - see SAFETY section for other systems.) Remove all wires from the motor.

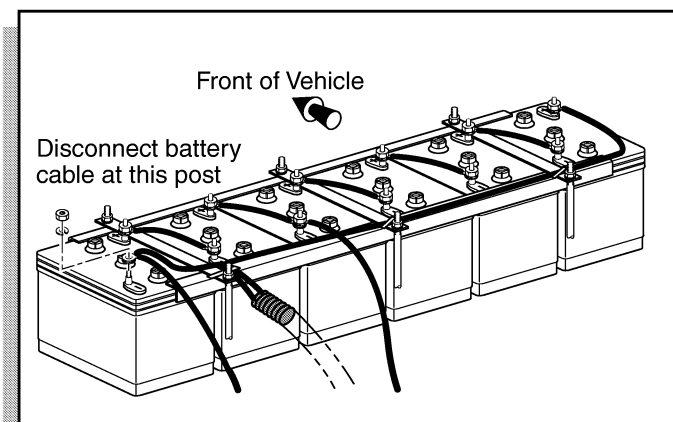


Fig. 1 Disconnect Battery Cable

Mark both the axle and motor housings to permit realignment during assembly of the motor to the rear axle (Ref Fig. 2 on page H-1).

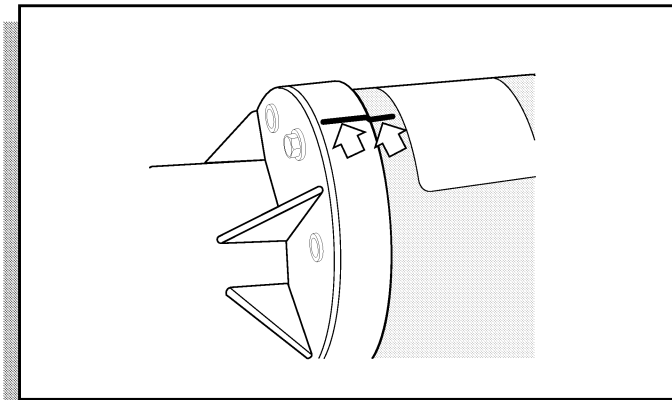


Fig. 2 Mark Axle and Motor

**CAUTION** Take care not to damage the splines when removing and reassembling the motor to the rear axle housing.

Remove the three bolts that secure the motor to the axle housing and carefully slide the motor straight out from the axle splines.

### Motor Disassembly

#### Tool List Qty. Required

|                                  |   |
|----------------------------------|---|
| Straight blade screwdriver ..... | 1 |
| Ratchet, 3/8" drive .....        | 1 |
| Socket, 3/8", 3/8" drive .....   | 1 |
| Plastic faced hammer .....       | 1 |

Remove bearing cap (1) (Ref Fig. 3 on page H-2).

Remove bolts (2) that hold the commutator end cover (3) to the motor housing (4).

Pull on commutator end cover to remove armature (5) and cover (as an assembly) from the housing. A light tap on the end cover may be necessary to loosen.

### Bearing Replacement

#### Tool List Qty. Required

|                          |   |
|--------------------------|---|
| Heat gun or lamp .....   | 1 |
| Arbor press .....        | 1 |
| Bearing driver set ..... | 1 |
| Snap ring pliers .....   | 1 |

**CAUTION** Do not use a torch to heat the commutator end cover. Only a moderate amount of heat should be applied. Excessive heat will damage the end cover and bearing.

# MOTOR

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

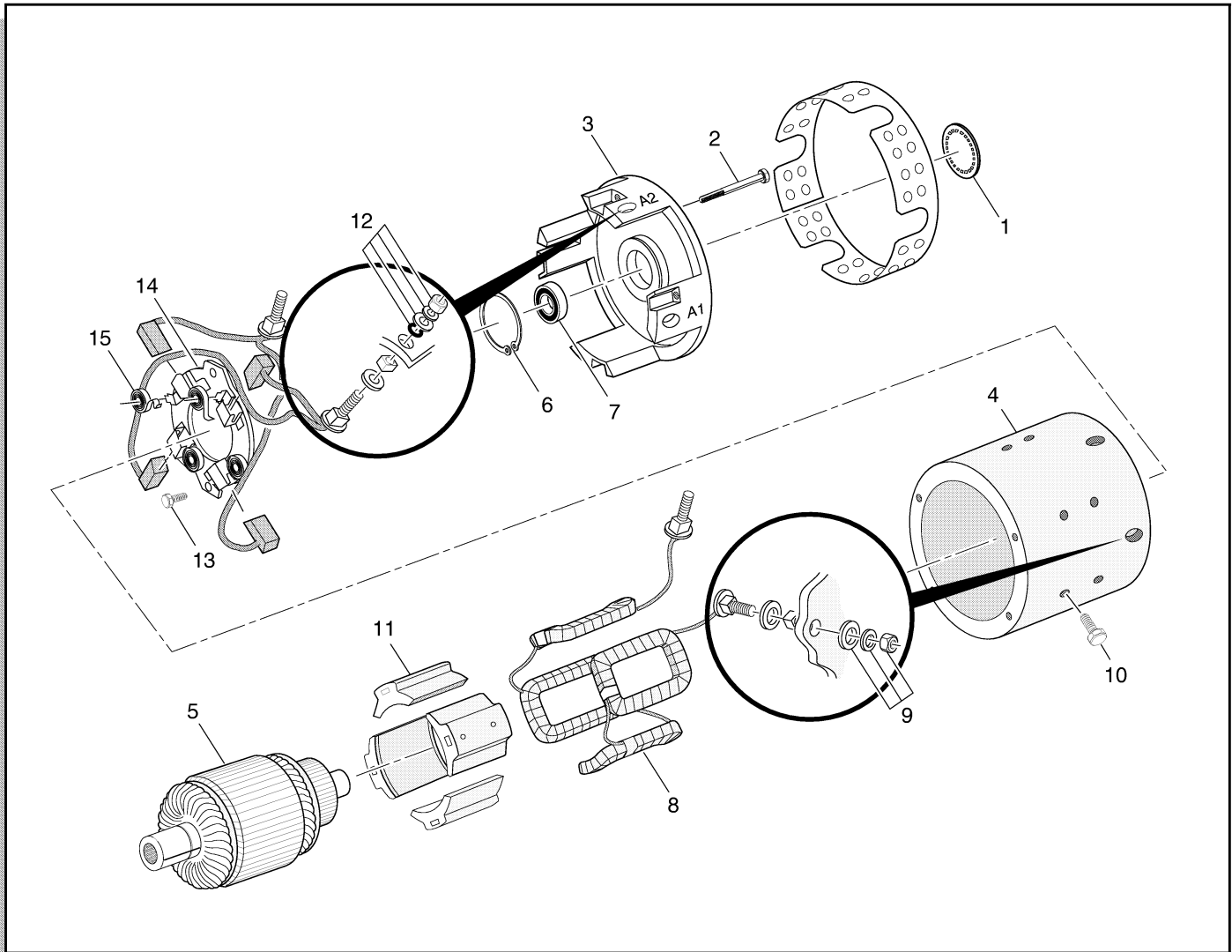


Fig. 3 Motor Components

Proper support must be given to the commutator end cover during press operations. Inadequate and/or uneven support will cause the end cover to fracture.

To aid disassembly, heat only the commutator end cover before attempting removal of the armature.

Once heated, place the commutator end cover/armature assembly in press, giving as much support to the end cover as possible, and press the armature out of the bearing.

Push back each brush until its spring (15) is resting against the side of the brush. This keeps the brushes out of the way during bearing replacement (Ref Fig. 5 on page H-3).

Remove internal snap ring (6) and heat the commutator end cover again. Press bearing (7) out from commutator end cover (3).

**CAUTION** When installing bearing into end cover, apply pressure against the bearing's outer race to avoid bearing damage.

Press the new bearing into the commutator end cover using heat again to aid installation.

Install the snap ring.

**NOTE** If brushes are to be replaced, proceed now to 'Brush Replacement' before installing the armature.

For proper location, the armature has a positive stop feature.

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

**CAUTION** When installing armature into the bearing/end cover assembly, support the bearing's inner race to avoid damage.

Press the armature into the new bearing using moderate heat to aid installation.

Release brushes against commutator. Ensure the springs are seated against the rear of the brushes and are able to move freely.

## Field Coil Replacement

| Tool List                     | Qty. Required |
|-------------------------------|---------------|
| Wrench, 1/2" .....            | 1             |
| Ratchet, 3/8" drive.....      | 1             |
| Socket, 1/2", 3/8" drive..... | 1             |

To replace field coil (8), remove field coil terminal hardware (9) at S1 and S2 (Ref Fig. 3 on page H-2).

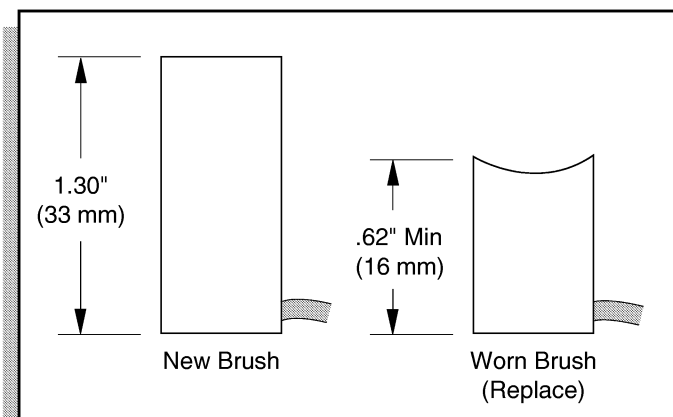
Remove bolts (10) that secure field coil retainers (11) to motor housing (4). Remove the field coils.

Replacement field coils are installed in reverse order of removal.

## Brush Replacement

| Tool List                      | Qty. Required |
|--------------------------------|---------------|
| Wrench, 1/2" .....             | 1             |
| Ratchet, 1/4" drive.....       | 1             |
| Socket, 5/16", 1/4" drive..... | 1             |

Brushes should be measured as shown and replaced when the minimum dimension of .62" (16 mm) is reached (Ref Fig. 4 on page H-3).

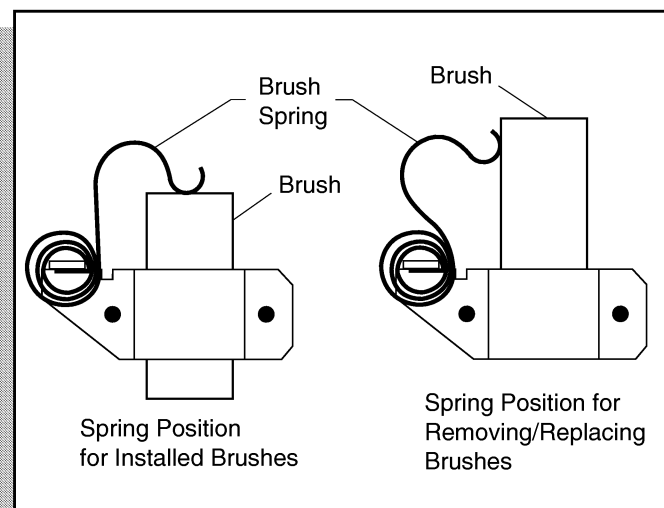


**Fig. 4 Brush Wear**

Remove brush terminal hardware (12) at A1 and A2 (Ref Fig. 3 on page H-2).

Remove screws (13) securing brush plate (14). Remove brushes, rigging and brush plate.

Pull back each brush until each of the springs (15) rest against the side of its brush (Ref Fig. 5 on page H-3). Remove brushes and replace with new brush replacement kit. Locate springs against the side of each brush.



**Fig. 5 Securing Brushes**

Install terminals and brush plate using reverse order of removal. Install armature (commutator end) through brush plate and press into new bearing using moderate heat to aid installation. Position brushes against commutator. Ensure the springs are seated against the rear of the brushes and are able to move freely.

## Motor Assembly

| Tool List                                 | Qty. Required |
|---|---------------|
| Socket, 3/8", 3/8" drive .....            | 1             |
| Torque wrench, in. lbs., 3/8" drive ..... | 1             |

Align the commutator end cover with the holes in the motor housing and assemble (Ref Fig. 3 on page H-2). Secure the commutator end cover to the motor housing with bolts (2) and tighten to 90 in. lbs. (10 Nm) torque.

## Motor Tests

The armature and motor housing are not available as individual parts. No testing is recommended to determine the specific area of failure. When a test of the power wiring system indicates that the system is operating correctly and the vehicle either does not run or runs poorly, the motor is the only remaining component and must be replaced.

# MOTOR

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## Motor Installation

### Tool List

### Qty. Required

Socket, 7/16", 3/8" drive ..... 1

Torque wrench, in. lbs., 3/8" drive ..... 1

Be sure that a bumper spline is installed between the motor input pinion shaft and splines. Apply a small quantity of **molybdenum** grease to the **male** portion of the spline. Carefully mate the motor spline with the input shaft of the rear axle. Align the orientation marks and install the mounting hardware. Tighten to 168 in. lbs. (19 Nm) torque.

Connect the four motor wires to motor (Ref Fig. 6 on page H-4). Tighten the nuts to 66 in. lbs. (7 Nm) torque.

| MOTOR<br>TERMINAL | FROM                 |
|-------------------|----------------------|
| A2                | Controller A2        |
| A1                | Controller B+        |
| S2                | Direction Selector D |
| S1                | Direction Selector B |

**Fig. 6 Motor Wiring**

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## BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

### SAFETY

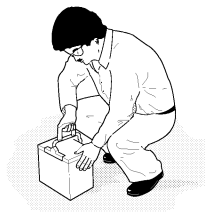
**NOTE** Always observe the following warnings when working on or near batteries:

**WARNING** Keep all smoking materials, open flame or sparks away from the batteries.

Hydrogen gas is formed when charging batteries. Do not charge batteries without adequate ventilation. A 4% concentration of hydrogen gas is explosive.

Be sure that the key switch is off and all electrical accessories are turned off before starting work on vehicle.

Never disconnect a circuit under load at a battery terminal.



Batteries are heavy. Use proper lifting techniques when moving them. Always lift the battery with a commercially available battery lifting device. Use care not to tip batteries when removing or installing them; spilled electrolyte can cause burns and damage.

The electrolyte in a storage battery is an acid solution which can cause severe burns to the skin and eyes. Treat all electrolyte spills to the body and eyes with extended flushing with clear water. Contact a physician immediately.

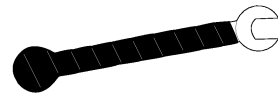


Always wear a safety shield or approved safety goggles when adding water or charging batteries.

Any electrolyte spills should be neutralized with a solution of 1/4 cup (60 ml) sodium bicarbonate (baking soda) dissolved in 1 1/2 gallons (6 liters) of water and flushed with water.

Overfilling batteries may result in electrolyte being expelled from the battery during the charge cycle. Expelled electrolyte may cause damage to the vehicle and storage facility.

Aerosol containers of battery terminal protectant must be used with extreme care. Insulate the metal container to prevent the metal can from contacting battery terminals which could result in an explosion.



Wrap wrenches with vinyl tape to prevent the possibility of a dropped wrench from 'shorting out' a battery, which could result in an explosion and severe personal injury or death.

### BATTERY

A battery is defined as two dissimilar metals immersed in an acid. If the acid is absent or if the metals are not dissimilar, a battery has not been created. The batteries most commonly used in these vehicles are lead acid.

A battery does not store electricity, but is able to produce electricity as the result of a chemical reaction which releases stored chemical energy in the form of electrical energy. The chemical reaction takes place faster in warm conditions and slower in cold conditions. Temperature is important when conducting tests on a battery and test results must be corrected to compensate for temperature differences.

As a battery ages, it still performs adequately except that its **capacity** is diminished. Capacity describes the time that a battery can continue to provide its design amperes from a full charge.

A battery has a maximum life, therefore good maintenance is designed to maximize the **available** life and reduce the factors that can reduce the life of the battery.

### BATTERY MAINTENANCE

| Tool List                                   | Qty. Required |
|---|---------------|
| Insulated wrench, 1/2" .....                | 1             |
| Battery carrier .....                       | 1             |
| Hydrometer.....                             | 1             |
| Battery maintenance kit P/N 25587-G01 ..... | 1             |

#### At Each Charging Cycle

**WARNING** Never attach a battery charger to a vehicle that is to be unattended beyond the normal charging cycle. Overcharging could cause damage to the vehicle batteries and result in extreme overheating. The charger should be checked after 24 hours and unplugged after the charge cycle is complete.

Before charging the batteries, inspect the plug of the battery charger and vehicle receptacle housing for dirt or debris.

# BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

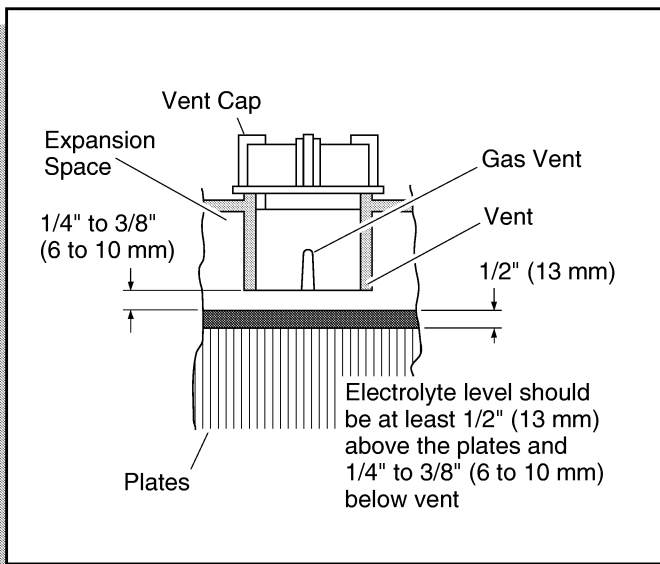
Charge the batteries after each days use.

## Monthly

- Inspect all wiring for fraying, loose terminations, corrosion or deterioration of insulation.
- Check that the electrolyte level is correct and add suitable water as required.
- Clean the batteries and wire terminations.

## Electrolyte Level and Water

The correct level of the electrolyte is 1/2" (13 mm) above the plates in each cell (Ref Fig. 1 on page J-2).



**Fig. 1 Correct Electrolyte Level**

This level will leave approximately 1/4" - 3/8" (6 - 10 mm) of space between the electrolyte and the vent tube. The electrolyte level is important since **any portion** of the plates exposed to air will be ruined beyond repair. Of equal importance is too much water which will result in electrolyte being forced out of the battery due to gassing and the increase in volume of the electrolyte that results from the charging cycle.

**CAUTION** Do not overfill batteries. The charging cycle will expel electrolyte and result in component damage.

Unless the electrolyte is at or below the plates, all watering should be done after charging.

A battery being charged will 'gas' with the majority of the gassing taking place at the end of the charging cycle. This gas is hydrogen which is lighter than air. Water and sulfuric acid droplets will be carried out of the battery

vents by the hydrogen gas; however, this loss is minimal. If the battery electrolyte level is too high, the electrolyte will block the vent tube and the gas will **force** it out of the vent tube and battery cap. The water will evaporate but the sulfuric acid will remain where it can damage vehicle components and the storage facility floor. Sulfuric acid loss will weaken the concentration of acid within the electrolyte and reduce the life of the battery.

Over the life of the battery, a considerable amount of water is consumed. It is important that the water used be pure and free of contaminants that could reduce the life of the battery by reducing the chemical reaction. The water must be distilled or purified by an efficient filtration system. Water that is not distilled should be analyzed and if required, filtration installed to permit the water to meet the requirements of the water purity table (Ref Fig. 2 on page J-2).

| Impurity                         | Parts Per Million |
|----------------------------------|-------------------|
| Color .....                      | Clear             |
| Suspended .....                  | Trace             |
| Total Solids .....               | 100               |
| Calcium & Magnesium Oxides ..... | 40                |
| Iron .....                       | 5                 |
| Ammonia .....                    | 8                 |
| Organic & Volatile Matter .....  | 50                |
| Nitrites .....                   | 5                 |
| Nitrates .....                   | 10                |
| Chloride .....                   | 5                 |

**Fig. 2 Water Purity Table**

Even if the water is colorless, odorless, tasteless and fit for drinking, the water should be analyzed to see that it does not exceed the impurity levels specified in the table.

Automatic watering devices such as the one included in the E-Z-GO Battery Maintenance Kit (P/N 25587-G01) can be used with an approved water source (Ref Fig. 3 on page J-3). These watering devices are **fast and accurate** to use and maintain the correct electrolyte level within the battery cells.

**NOTE** The watering device should only be used if the electrolyte level is less than 1/2" (13 mm) above top of plates.

# BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

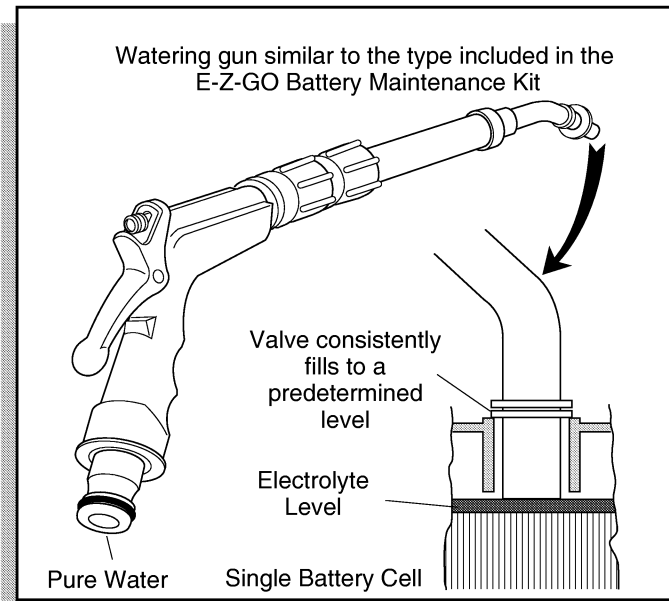


Fig. 3 Automatic Watering Gun

## Cleaning Batteries

When cleaning the outside of the batteries and terminals, do not use a water hose without first spraying with a solution of sodium bicarbonate (baking soda) and water to neutralize any acid deposits.

Use of a water hose without first neutralizing any acid, will move acid from the top of the batteries to another area of the vehicle or storage facility where it will attack the metal structure or the concrete/asphalt floor. After hosing down the batteries, a residue will be left on the batteries which is conductive and will contribute to the discharge of the batteries.

**CAUTION** To prevent battery damage, be sure that all battery caps are tightly installed.

The correct cleaning technique is to spray the top and sides of the batteries with a solution of sodium bicarbonate (baking soda) and water. This solution is best applied with a garden type sprayer equipped with a **non metallic spray wand**. The solution should consist of 1/4 cup (60 ml) of sodium bicarbonate (baking soda) mixed with 1 1/2 gallons (6 liters) of clear water (Ref Fig. 4 on page J-3). In addition to the batteries, special attention should be paid to metallic components adjacent to the batteries which should also be sprayed with the sodium bicarbonate (baking soda) solution.

Allow the solution to sit for at least three minutes; use a soft bristle brush or cloth to wipe the tops of the batteries in order to remove any residue that could cause the self

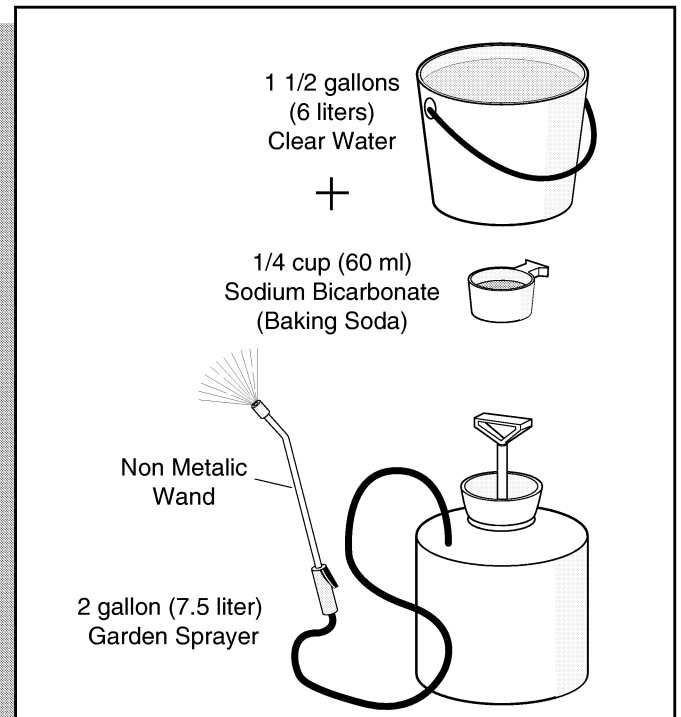


Fig. 4 Preparing Acid Neutralizing Solution

discharge of the battery. Rinse the entire area with low pressure clear water. All of the items required for complete battery cleaning and watering are contained in the E-Z-GO Battery Maintenance Kit (P/N 25587-G01).

Cleaning should take place once a month or more often under extreme conditions.

## Prolonged Storage

**CAUTION** Battery charger and controller must be disconnected since they will contribute to the premature discharge of batteries. Other electronic devices may also need to be disconnected.

During periods of storage, the batteries will need attention to keep them maintained and prevent discharge.

In high temperatures the chemical reaction is faster, while low temperatures cause the chemical reaction to slow down. A vehicle that is stored at 90° F (32° C) will lose .002 of specific gravity each day. If a fully charged battery has a specific gravity of 1.275, and the battery is allowed to sit unused, it will become partially discharged. When it reaches 1.240, which it will do in less than twenty days, it should be recharged. If a battery is left in a discharged state, sulfating takes place on and within the plates. This condition is not reversible and will cause permanent damage to the battery. In order to prevent

# BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

damage, the battery should be recharged. A hydrometer (E-Z-GO P/N 50900-G1) can be used to determine the specific gravity and therefore the state of charge of a battery.

In winter conditions, the battery must be fully charged to prevent the possibility of freezing (Ref Fig. 5 on page J-4). A fully charged battery will not freeze in temperatures above -75° F (-60° C). Although the chemical reaction is slowed in cold temperatures, the battery must be stored fully charged, and disconnected from any circuit that could discharge the battery. For portable chargers, disconnect the charging plug from the vehicle receptacle. For on-board chargers, disconnect the charging harness from the batteries. The batteries must be cleaned and all deposits neutralized and removed from the battery case to prevent self discharge. The batteries should be tested or recharged at thirty day minimum intervals.

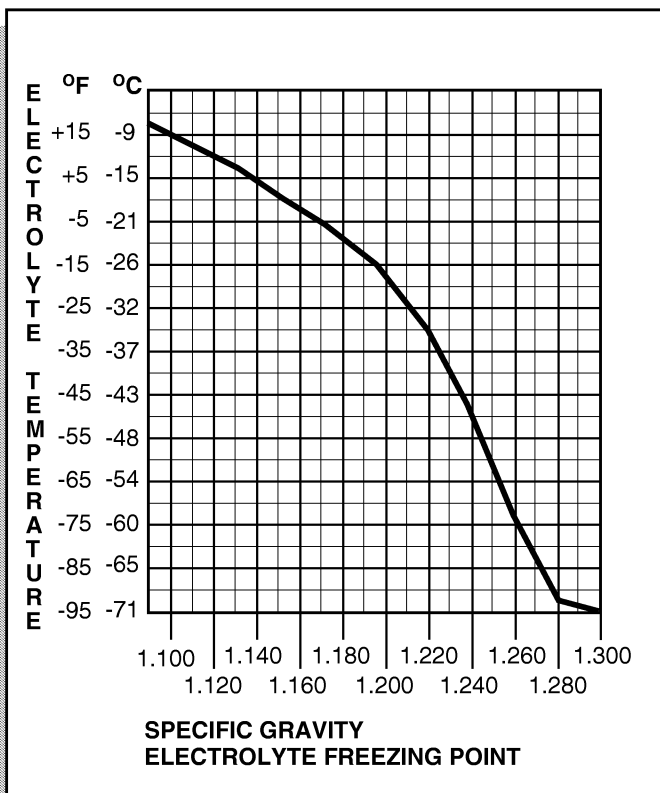


Fig. 5 Freezing Point of Electrolyte

## Battery Installation

If the batteries have been cleaned and any acid in the battery rack area neutralized, no corrosion to the battery racks or surrounding area should be present. Any corrosion found should be immediately removed with a putty knife and a wire brush. The area should be washed with

a solution of sodium bicarbonate (baking soda) and water and thoroughly dried before priming and painting with a corrosion resistant paint.

The batteries should be placed into the battery racks and the battery hold downs tightened to 45 - 55 in. lbs. (5 - 6 Nm) torque, to prevent movement but not tight enough to cause distortion of the battery cases.

Inspect all wires and terminals. Clean any corrosion from the battery terminals or the wire terminals with a solution of sodium bicarbonate (baking soda) and brush clean if required.

Use care to connect the battery wires as shown (Ref Fig. 6 on page J-4). (36V systems shown - see SAFETY section for other systems.) Tighten the battery post hardware to 60 - 90 in. lbs. (7 - 10 Nm) torque.

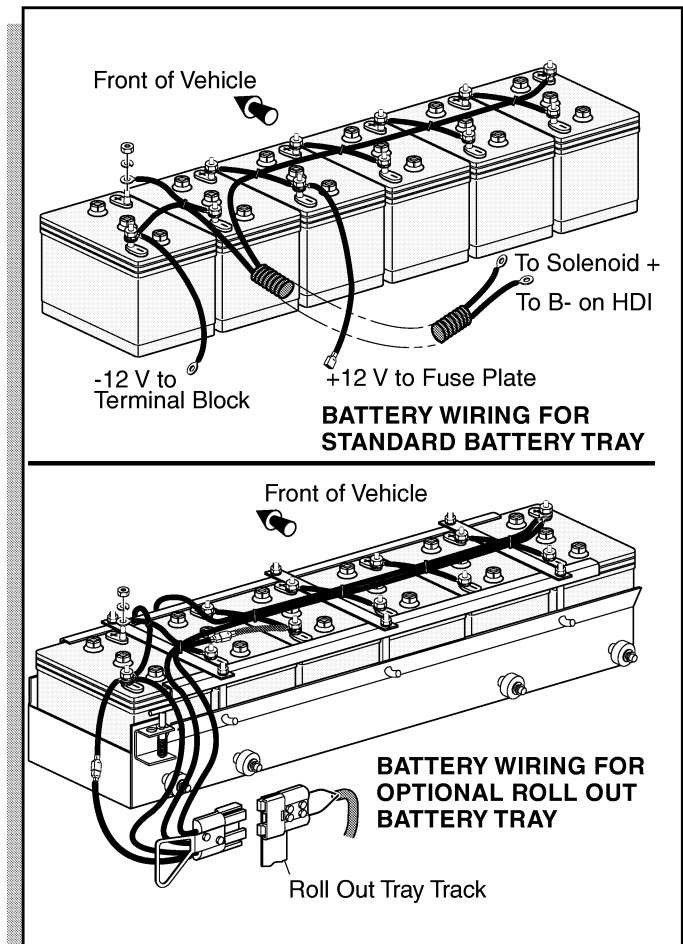


Fig. 6 Battery Connections



**Aerosol containers of battery terminal protectant must be used**

# BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

**with extreme care. Insulate the metal container to prevent the metal can from contacting battery terminals which could result in an explosion.**

Protect the battery terminals and battery wire terminals with a commercially available protective coating.

## Battery Charging

The battery charger is designed to fully charge the battery set. If the batteries are severely deep cycled, some automatic battery chargers contain an electronic module that may not activate and the battery charger will not function. Automatic chargers will determine the correct duration of charge to the battery set and will shut off when the battery set is fully charged. Always refer to the instructions of the specific charger used.

Before charging, the following should be observed:

**CAUTION** Do not overfill batteries. The charging cycle will expel electrolyte and result in component damage.

- The electrolyte level in all cells must be at the recommended level and cover the plates.
- The charging must take place in an area that is well ventilated and capable of removing the hydrogen as that is generated by the charging process. A **minimum** of five air exchanges per hour is recommended.
- The charging connector components are in good condition and free from dirt or debris.
- The charger connector is fully inserted into the vehicle receptacle.
- The charger connector/cord set is protected from damage and is located in an area to prevent injury that may result from personnel running over or tripping over the cord set.
- The charger is automatically turned off during the connect/disconnect cycle and therefore no electrical arc is generated at the DC plug/receptacle contacts.

**NOTE** In some portable chargers, there will be a rattle present in the body of the charger DC plug. This rattle is caused by an internal magnet contained within the charger plug. The magnet is part of the interlock system that prevents the vehicle from being driven when the charger plug is inserted in the vehicle charging receptacle.

## AC Voltage

Battery charger output is directly related to the input voltage. If multiple vehicles are receiving an incomplete charge in a normally adequate time period, low AC voltage could be the cause and the power company should be consulted.

## TROUBLESHOOTING

In general, troubleshooting will be done for two distinct reasons. First, a battery that performs poorly and is outside of the manufacturers specification should be identified in order to replace it under the terms of the manufacturer's warranty. Different manufacturers have different requirements. Consult the battery manufacturer or an E-Z-GO representative for specific requirements.

The second reason is to determine why a particular vehicle does not perform adequately. Performance problems may result in a vehicle that runs slowly or in a vehicle that is unable to operate for the time required.

A new battery must **mature** before it will develop its maximum capacity. Maturing may take up to 100 charge/discharge cycles. After the maturing phase, the older a battery gets, the lower the capacity. The only way to determine the capacity of a battery is to perform a load test using a discharge machine.

A cost effective way to identify a poorly performing battery is to use a hydrometer to identify a battery in a set with a lower than normal specific gravity. Once the particular cell or cells that are the problem are identified, the suspect battery can be removed and replaced. At this point there is nothing that can be done to salvage the battery; however, the individual battery should be replaced with a good battery of the same brand, type and approximate age.

## Hydrometer

A hydrometer (E-Z-GO P/N 50900-G1) is used to test the state of charge of a battery cell (Ref Fig. 7 on page J-6). This is performed by measuring the density of the electrolyte, which is accomplished by measuring the specific gravity of the electrolyte. The greater the concentration of sulfuric acid, the more dense the electrolyte becomes. The higher the density, the higher the state of charge.

**WARNING** To prevent a battery explosion, never insert a metal thermometer into a battery. Use a hydrometer with a built in thermometer that is designed for testing batteries.

# BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

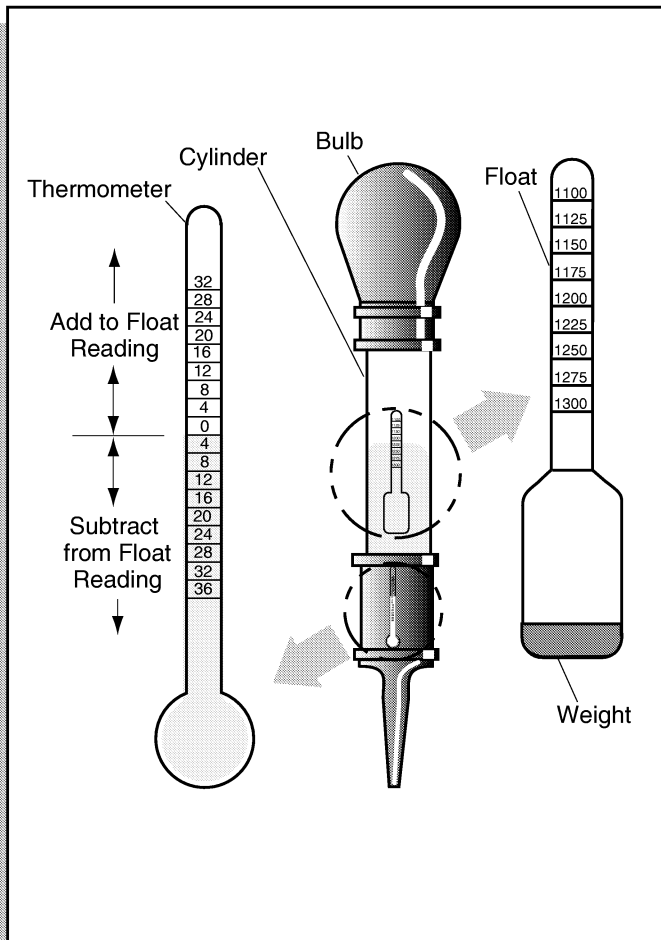


Fig. 7 Hydrometer

Specific gravity is the measurement of a liquid that is compared to a baseline. The baseline is water which is assigned a base number of 1.000. The concentration of sulfuric acid to water in a new golf car battery is 1.280 which means that the electrolyte weighs 1.280 times the weight of the same volume of water. A fully charged battery will test at 1.275 - 1.280 while a discharged battery will read in the 1.140 range.

**NOTE** Do not perform a hydrometer test on a battery that has just been watered. The battery must go through at least one charge and discharge cycle in order to permit the water to adequately mix with the electrolyte.

The temperature of the **electrolyte** is important since the hydrometer reading must be corrected to 80° F (27° C). High quality hydrometers are equipped with an internal thermometer that will measure the temperature of the electrolyte and will include a conversion scale to correct the float reading. It is important to recognize that the

electrolyte temperature is significantly different from the ambient temperature if the vehicle has been operated.

## Using A Hydrometer

1. Draw electrolyte into the hydrometer several times to permit the thermometer to adjust to the electrolyte temperature and note the reading. Examine the color of the electrolyte. A brown or gray coloration indicates a problem with the battery and is a sign that the battery is nearing the end of its life.
2. Draw the minimum quantity of electrolyte into the hydrometer to permit the float to float freely without contacting the top or bottom of the cylinder.
3. Hold the hydrometer in a vertical position at eye level and note the reading where the electrolyte meets the scale on the float.
4. Add or subtract four points (.004) to the reading for every 10°F (6°C) the electrolyte temperature is above or below 80° F (27° C). Adjust the reading to conform with the electrolyte temperature, e.g., if the reading indicates a specific gravity of 1.250 and the electrolyte temperature is 90° F (32° C), **add** four points (.004) to the 1.250 which gives a corrected reading of 1.254. Similarly if the temperature was 70° F (21°C), **subtract** four points (.004) from the 1.250 to give a corrected reading of 1.246 (Ref Fig. 8 on page J-7).
5. Test each cell and note the readings (corrected to 80° F or 27° C). A variation of fifty points between any two cell readings (example 1.250 - 1.200) indicates a problem with the low reading cell(s).

As a battery ages the specific gravity of the electrolyte will decrease at full charge. This is not a reason to replace the battery, providing all cells are within fifty points of each other.

Since the hydrometer test is in response to a vehicle exhibiting a performance problem, the vehicle should be recharged and the test repeated. If the results indicate a weak cell, the battery or batteries should be removed and replaced with a good battery of the same brand, type and approximate age.

# BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

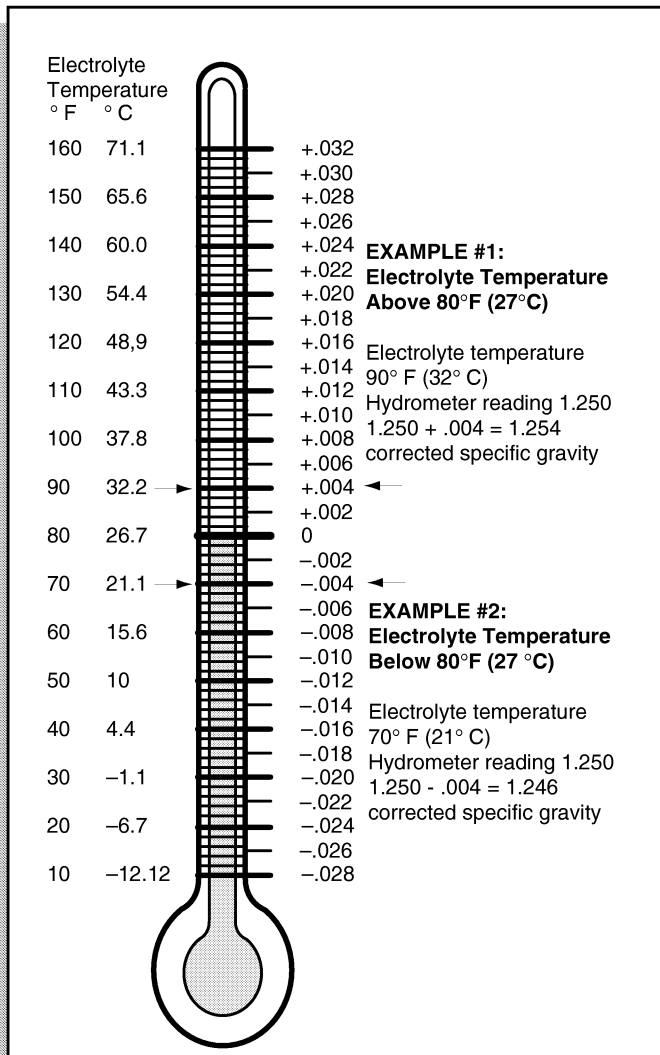


Fig. 8 Hydrometer Temperature Correction

## BATTERY CHARGERS

### Portable Charger Installation

**WARNING** Portable chargers should be mounted on a platform above the ground, or in such a manner as to permit the maximum air flow underneath and around the charger. If the charger is mounted so that insufficient air flow can enter the louvers, overheating may result which could cause serious damage to the charger and potential for fire.

Portable chargers are shipped with the vehicle. Prior to vehicle or charger operation, the charger must be removed and mounted on a platform or wall above the

ground to permit maximum air flow around and underneath the charger. A dedicated 15 amp circuit is required for the charger. If the charger is operated in an outdoor location, rain and sun protection must be provided (Ref Fig. 9 on page J-7).

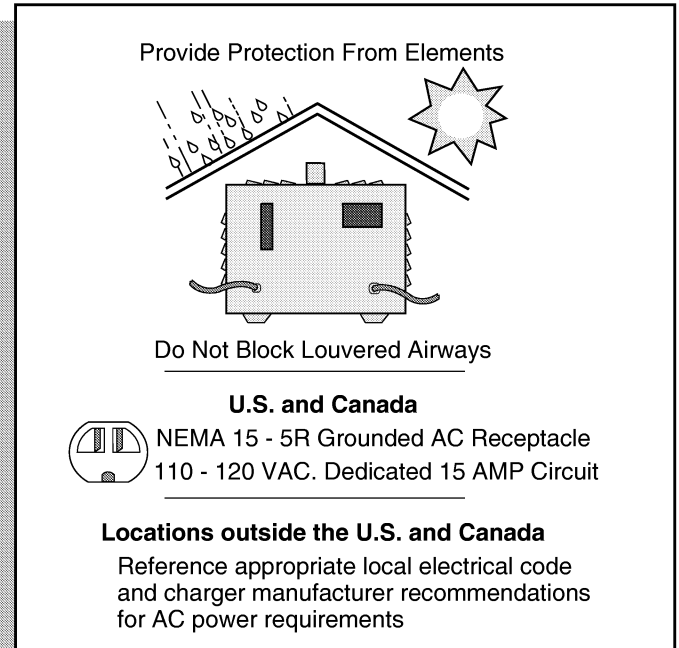


Fig. 9 Charger Installation

The charger may remain plugged into the AC outlet. To charge the vehicle, refer to the instruction label on charger.

The charging (DC) cord is equipped with a polarized connector which fits into a matching receptacle on the vehicle (Ref Fig. 10 on page J-7).

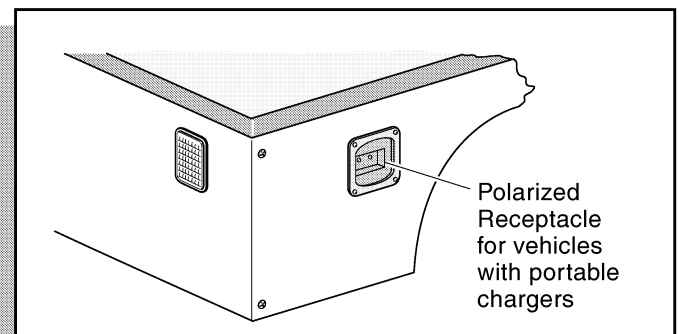


Fig. 10 Polarized Receptacle

The power (AC) cord is equipped with an appropriate plug. If the charger is equipped with a grounding plug, do not attempt to remove or bend the ground plug.

# BATTERIES AND CHARGING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**WARNING** An ungrounded electrical device may become a physical hazard that could result in an electrical shock or electrocution.

## NOTE

If your vehicle is to be charged with a charger other than a PowerWise™ charger, refer to the manufacturer's instructions supplied with the charger.

## On-board Charger

The on-board charger is located under the rear cargo deck panel (or rear facing seat). It is wired directly to the batteries, only requiring it be plugged into a dedicated 15 amp AC outlet to be operational (Ref Fig. 11 on page J-8).

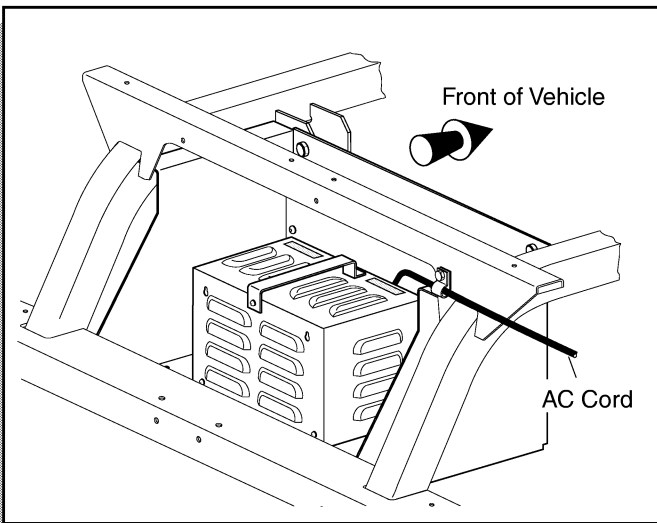


Fig. 11 On-board Charger

When charge cycle is complete, replace cord into the cord storage compartment (Ref Fig. 12 on page J-8).

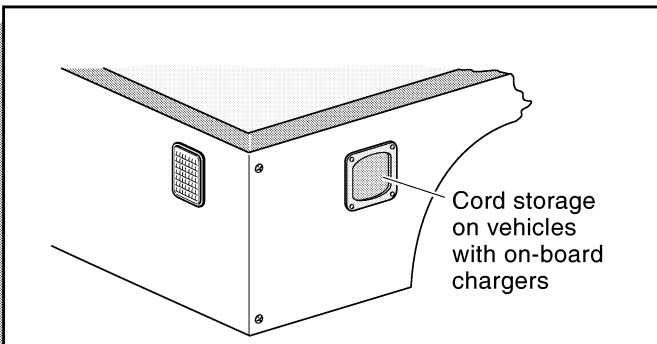


Fig. 12 Cord Storage Compartment

## ROLL OUT BATTERY TRAY

Optional roll out battery trays and dollies allow the vehicle to be operated continuously without taking the vehicle out of service for battery charging.

### Battery Tray Removal.

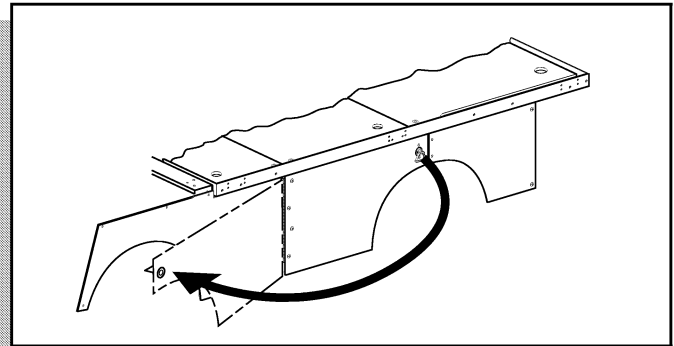


Fig. 13 Accessing Roll Out Battery Tray

To remove the discharged set of batteries, fully open the roll out battery tray access door panel (Ref Fig. 13 on page J-8). Move the roll out battery tray dolly into position and fully engage the guide tabs onto the outside of both sides of the vertical walls of the roll out battery tray track. It may be necessary to lift up slightly on the back of the dolly to initially engage the tabs of the dolly. Disconnect the quick disconnect wire harness plug. Disengage the dolly winch lock and play out the winch rope until the snap hook can be hooked into the TOP hole of the battery tray lock pin bracket. Engage the winch lock. Lift up and hold the lock pin to release tray for removal. Pull tray slightly outward and release pin. Stand behind the dolly, and hold the dolly engaged to the vehicle with a foot against one of the dolly's rear support legs (for 48V vehicles brace foot against the dolly's lower, rear horizontal crossmember). Crank the battery tray out of the vehicle and onto the dolly. Move the dolly and battery tray away from the vehicle and to a safe place for charging. Close and secure the roll out battery tray access door panel

### 36V Battery Tray Installation

To install a charged 36V battery tray into the vehicle, fully open the roll out battery tray access door panel. Move the roll out battery tray dolly into position and fully engage the guide tabs onto both sides of the vertical walls of the roll out battery tray track. Disengage the dolly winch lock. While standing behind the dolly, and holding the dolly engaged to the vehicle with a foot against one of the dolly's rear support legs, unhook the snap hook and push the battery tray onto the battery tray track. Ensure that the locking pin locks into place. Remove the



## BATTERIES AND CHARGING

*Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings*

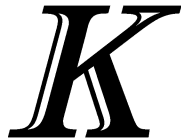
dolly. Connect the quick disconnect wire harness plug. Close and secure the roll out battery tray access door panel.

### **48V Battery Tray Installation**

To install a charged 48V battery tray into the vehicle, fully open the roll out battery tray access door panel. Move the roll out battery tray dolly into position and fully engage the guide tabs onto both sides of the vertical walls of the roll out battery tray track. Disengage the dolly winch lock and play out enough winch rope to unhook the snap hook from the top hole of the battery tray lock pin bracket and hook it to the BOTTOM hole. Play out enough winch rope to loop the rope around the dolly pulley and take up the slack with the winch handle. Engage the winch lock. Move the roll out battery tray dolly into position and fully engage the guide tabs onto both sides of the vertical walls of the roll out battery tray track. Stand behind the dolly, and hold the dolly engaged to the vehicle with foot against the dolly's lower, rear horizontal crossmember. Crank the battery tray off of the dolly and into the vehicle. Continue to crank until the third set of rollers is well onto the track. Hold the battery tray in the vehicle with one hand and disengage the snap hook with the other. Push the tray into the vehicle fully ensuring that the locking pin locks into place. Remove the dolly. Connect the quick disconnect wire harness plug. Close and secure the roll out battery tray access door panel.



# BATTERY CHARGER



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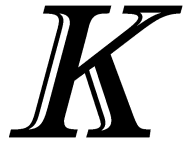
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# BATTERY CHARGER



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## DESCRIPTION

The PowerWise™ battery charger is automatic and is designed specifically for charging electric vehicle batteries.

The charger type is known as ferroresonant. The term is applied to a charger that starts the charge at a relatively high rate of charge and continuously reduces the rate as the batteries become nearer to the full charge condition.

The battery charger can be connected to a vehicle that has been driven any distance and will charge the batteries fully before shutting itself off. The charger has a 3 second delay before turn on after plugging receptacle into vehicle.

The electronic module within the charger samples the battery voltage during the charging period. If the module senses that the battery voltage has risen, it continues the charge. If the module senses no change, it determines that the batteries are fully charged and shuts the charger off.

## UNDERSTANDING THE CHARGER

The battery charger reacts to unusual situations in various ways.

1. If the charger is disconnected from the vehicle during the charge cycle, it will shut off immediately.
2. If the AC power is interrupted, the charge cycle will continue normally for the remainder of the cycle when the power is restored.
3. If the batteries become fully charged in a short period of time (under 2 hours), the charger will shut off. If the open circuit battery voltage drops to the point that charge is required the charger will turn itself on until the batteries are fully charged.
4. The charger features an internal timer that will permit no more than 16 hours of continuous charge.



**To prevent electrical shock or arc, which could cause serious body injury or damage to the facility or charger, unplug the charger from both the AC and DC power sources before starting any repair or maintenance procedure.**

## OPENING THE CHARGER



**Lethal voltages are present when charger is plugged in and the cover is removed.**

**If you have any doubts regarding your ability to safely perform the following test be sure to have the charger repaired by a trained electrician/technician.**

**Use extreme care not to permit the uninsulated portion of test leads to contact any other component or the chassis of the charger.**

1. Remove the screws (1 and 2) securing the front and rear of the handle (3) (Ref Fig. 1 on page K-1). This handle acts as a “key” and must be removed to permit the charger cover (4) to be removed.
2. Remove remaining screws (5) from sides and cover.
3. Tilt rear of the cover up and forward to release it from the front face (6) of the charger.
4. Assembly is in the reverse order of disassembly.

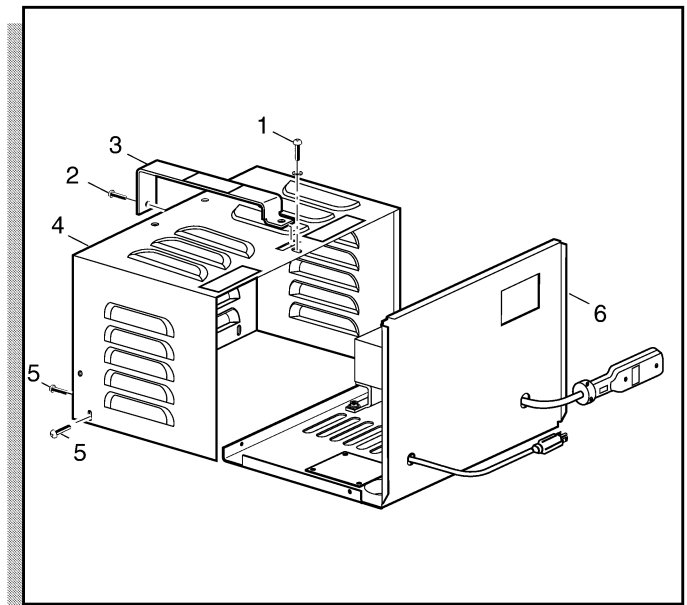


Fig. 1 Opening the Charger

# BATTERY CHARGER

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## TROUBLESHOOTING

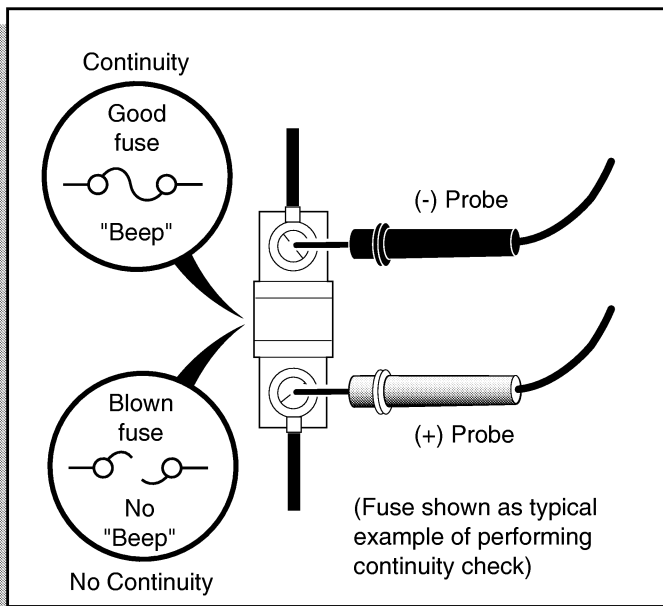
| Tool List                 | Qty. Required |
|---------------------------|---------------|
| Digital VOM .....         | 1             |
| Phillips screwdriver..... | 1             |

### Continuity Checks



**Before attempting to perform a continuity check, disconnect the battery charger from both AC and DC power sources.**

To check for continuity, set the DVOM to  $K\Omega$  setting and select 'Continuity'. The meter will give an audible signal when it detects continuity. If the meter does not have a continuity setting, set the meter then to  $K\Omega$ , the meter will indicate "0" when continuity is detected (Ref Fig. 2 on page K-2).

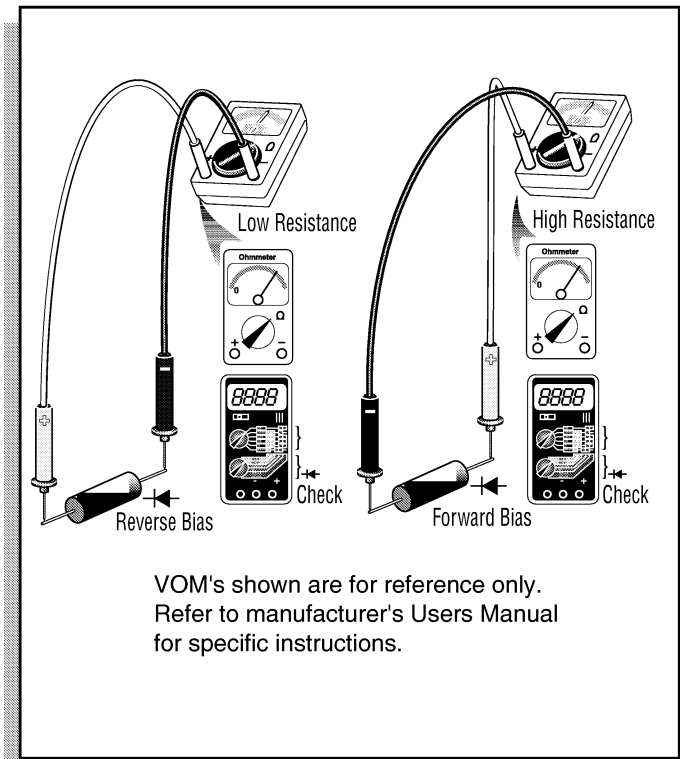


**Fig. 2 Continuity Check**

## Diode Test Procedures

| Tool List         | Qty. Required |
|-------------------|---------------|
| Digital VOM ..... | 1             |

To test the diode, disconnect the battery charger AC power cord. With the DVOM set at highest ohms range available, place probes on diode as shown (Ref Fig. 3 on page K-2). A reading other than that shown indicates the diode is bad. Replace as necessary.

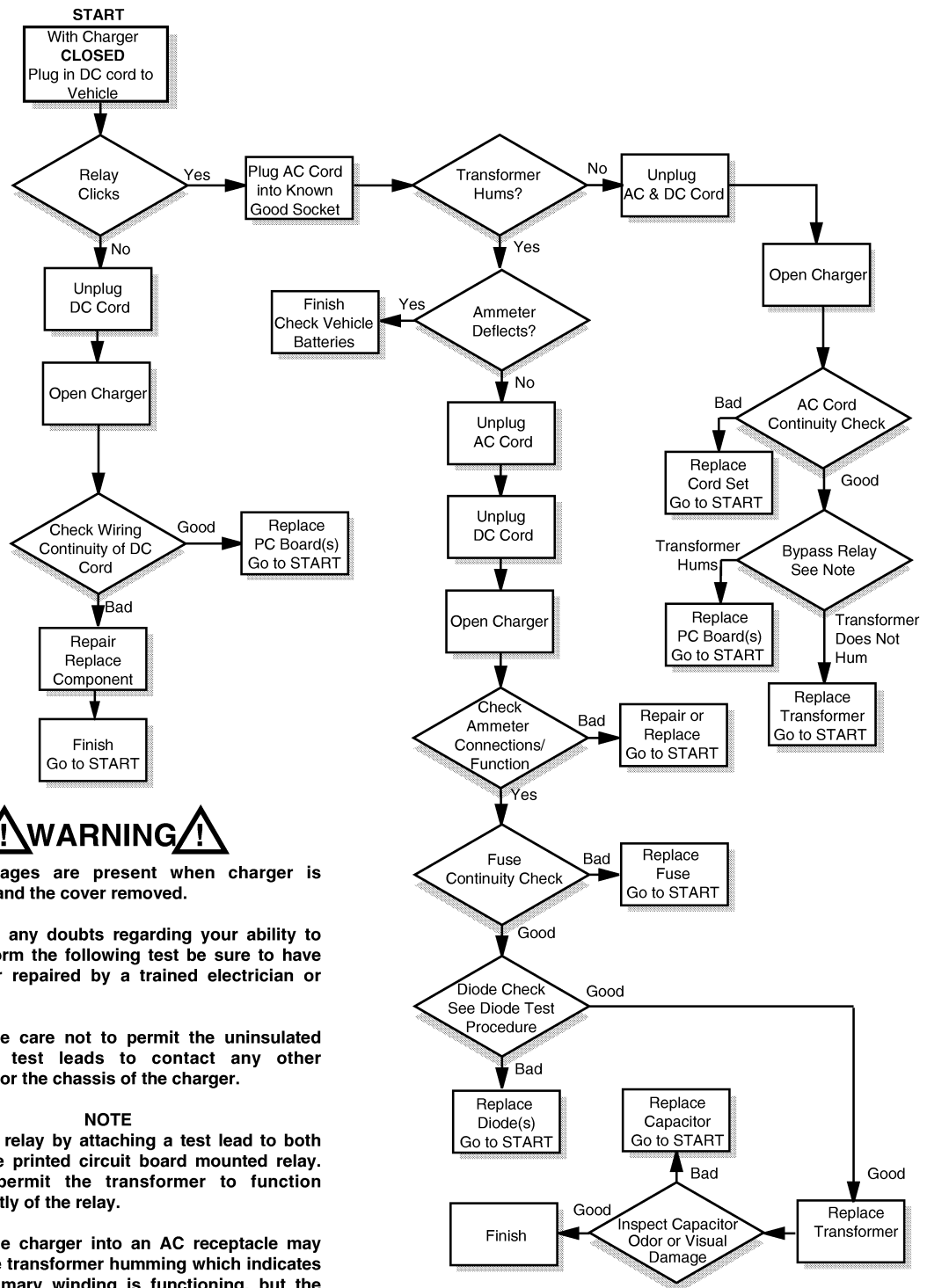


**Fig. 3 Diode Test Procedures**

A simple but effective method of troubleshooting a battery charger that does not operate is to follow the sequenced procedures (Ref Fig. 4 on page K-3).

# BATTERY CHARGER

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



## ⚠️ WARNING ⚠️

Lethal voltages are present when charger is plugged in and the cover removed.

If you have any doubts regarding your ability to safely perform the following test be sure to have the charger repaired by a trained electrician or technician.

Use extreme care not to permit the uninsulated portion of test leads to contact any other component or the chassis of the charger.

### NOTE

Bypass the relay by attaching a test lead to both wires at the printed circuit board mounted relay. This will permit the transformer to function independently of the relay.

Plugging the charger into an AC receptacle may result in the transformer humming which indicates that the primary winding is functioning, but the printed circuit board has failed. If the transformer does not hum the transformer has failed.

Fig. 4 Troubleshooting Sequence

# BATTERY CHARGER

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

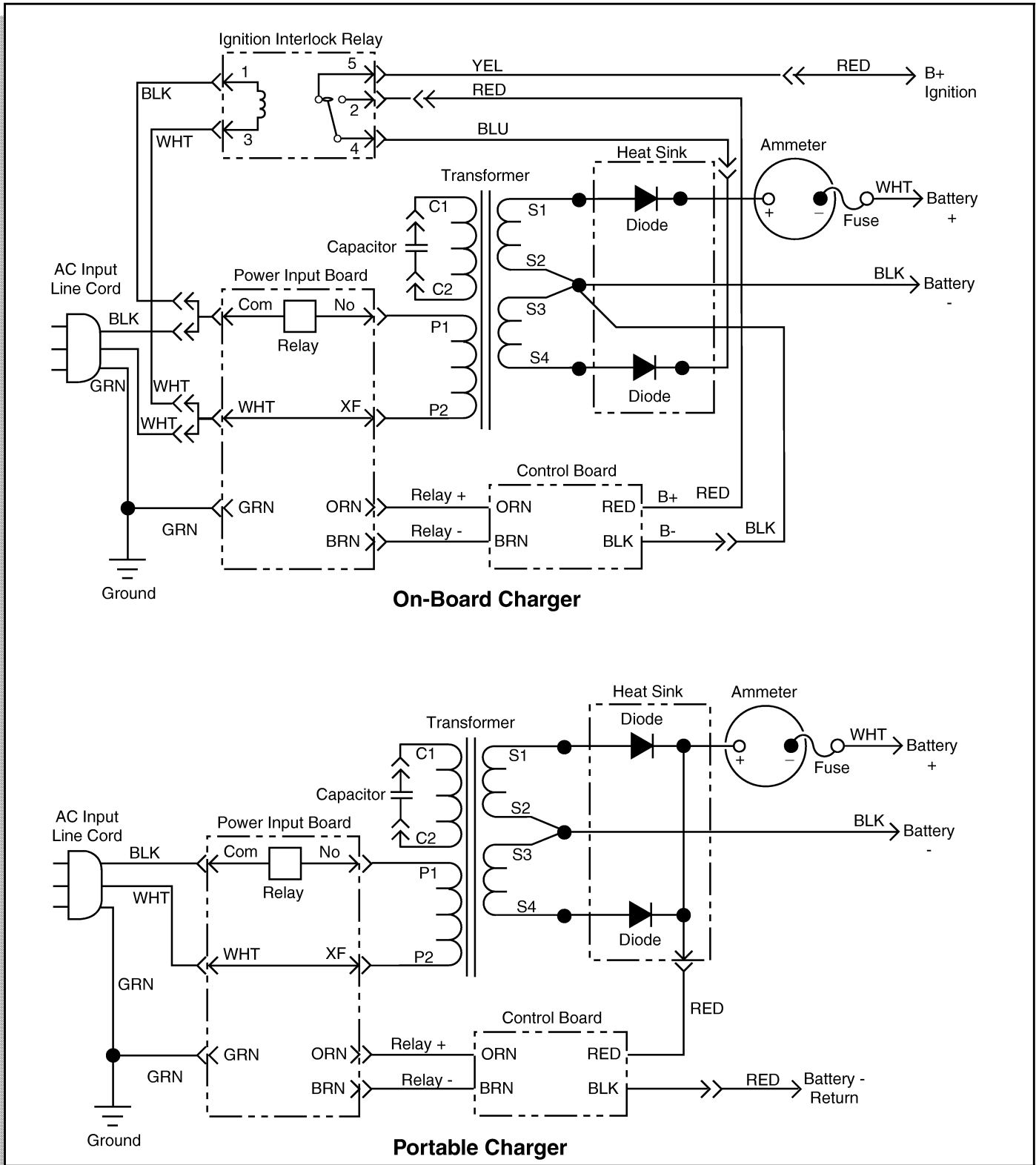


Fig. 5 PowerWise™ Charger Wiring Diagrams



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# **BRAKES**

Notes:

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## BRAKES

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

**NOTE** To assure correct braking performance, all periodic maintenance, inspections and procedures must be performed as indicated in the Periodic Service Schedule in Section 'A' of this manual. **It is important that a Daily Brake Performance Test be performed and the entire brake system be serviced in accordance with the Periodic Service Schedule.**

The brake system must be bled whenever **any part of the brake system** has been replaced.

### DAILY BRAKING PERFORMANCE TEST

Depress the brake pedal. The pedal should have some free play and then become hard. A brake pedal that has no free travel, excessive free travel or a spongy feel is indicating that a brake inspection is required. A brake pedal that falls after it is applied indicates a leak in the master or wheel cylinders. Check for adequate brake fluid level. Adjust brakes if required and inspect system for fluid leaks.

### HOW THE BRAKE SYSTEM WORKS

A hydraulic system is used to actuate the brakes. The system transmits the power required to activate the friction surfaces (shoes or pads) of the braking system from the pedal to the individual brake units at each wheel.

The hydraulic system operates as follows:

When at rest, the entire system is full of brake fluid. Upon application of the brake pedal, fluid trapped in front of the master cylinder piston is forced through the lines to the wheel cylinders. Here, it forces the pistons outwards against the brake shoes or pads which in turn contact the brake drum or disc. Upon release of the brake pedal, a spring located inside the master cylinder immediately returns the piston to the normal position. The brake shoe return springs retract the brake shoes and wheel cylinders which returns the brake fluid to its original position within the master cylinder. Refer to 'Front Hydraulic Disc Brakes' for additional information.

### BRAKE MASTER CYLINDER FLUID

It is important to maintain proper fluid levels in the brake master cylinder. The fill cap for the cylinder is located under the seat. To prevent contamination when checking the fluid, wipe off any dirt from the fill cap before removing it. Fluid level should be maintained at 1/8" (3 mm) below the top of the housing. Use DOT 3 standard automotive brake fluid.

**NOTE** Hydraulic brake systems must be totally flushed if the fluid becomes contaminated with water, dirt or other corrosive chemicals. To flush, bleed the entire system until all brake fluid has been replaced with fresh DOT 3 standard automotive brake fluid.

### MASTER CYLINDER SERVICING

Just like any other brake parts, master cylinders require periodic service. The usual reason for a master cylinder failure is the cylinder seals (cups) deteriorate. Fluid leaks past the cups and shows as an external leak. A common symptom is a 'spongy' brake pedal that goes all the way to the floor when all the other brake components are in good condition. The rubber parts wear with usage or deteriorate with age or fluid contamination. Corrosion or deposits formed in the cylinder bore due to moisture or dirt in the hydraulic system may result in wear of the cylinder bore or related parts. Remove corrosion or deposits using a suitable size cylinder hone. If corrosion or deposits cannot be removed, discard master cylinder and replace with new one. The fluid level in the reservoir should be checked periodically. When required, clean brake fluid should be added to maintain the fluid level 1/8" (3 mm) from the top of the reservoir.

#### Master Cylinder Removal and Rebuild

| Tool List              | Qty. Required |
|------------------------|---------------|
| Vise .....             | 1             |
| Snap ring pliers ..... | 1             |
| Alcohol.....           | A/R           |
| Shop towels.....       | A/R           |

**CAUTION** During this process, it is likely that brake fluid will leak from the master cylinder. Avoid allowing brake fluid to contact the painted body components of the vehicle. Wipe off immediately.

Clean the area around the master cylinder to prevent dirt and grease from contaminating the cylinder or hydraulic lines.

Disconnect the brake light terminal and the brake lines at the branch tee (Ref Fig. 1 on page L-2).

Remove the hardware that secures the master cylinder to the vehicle and remove the master cylinder from the vehicle (Ref Fig. 1 on page L-2).

Remove the reservoir cover and drain the brake fluid from the reservoir.

Remove the rubber boot. Place master cylinder in vise with protective jaws.

# BRAKES

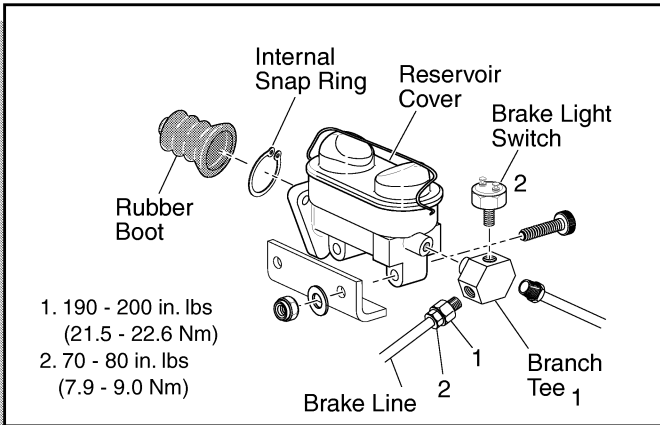
Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

Using snap ring pliers, remove the internal snap ring to release the piston and spring assembly and remove from master cylinder.

Thoroughly clean the master cylinder in clean alcohol. **Do not use petroleum products for cleaning.** Dry thoroughly before reassembly. Lubricate all new rubber parts with fresh, clean brake fluid. Hone and clean the cylinder if necessary.

Place the new piston and spring assembly into the master cylinder oriented the same as the one removed. Reinstall snap ring.

Replace reservoir cover and rubber boot.



**Fig. 1 Rebuilding Master Cylinder**

## Master Cylinder Installation

Reinstall hardware securing master cylinder to frame.

Reinstall brake lines and brake light terminal to branch tee.

Replace brake fluid into reservoir and bleed system per 'Bleeding Brakes'.

## BRAKE LINKAGE

### Tool List

### Qty. Required

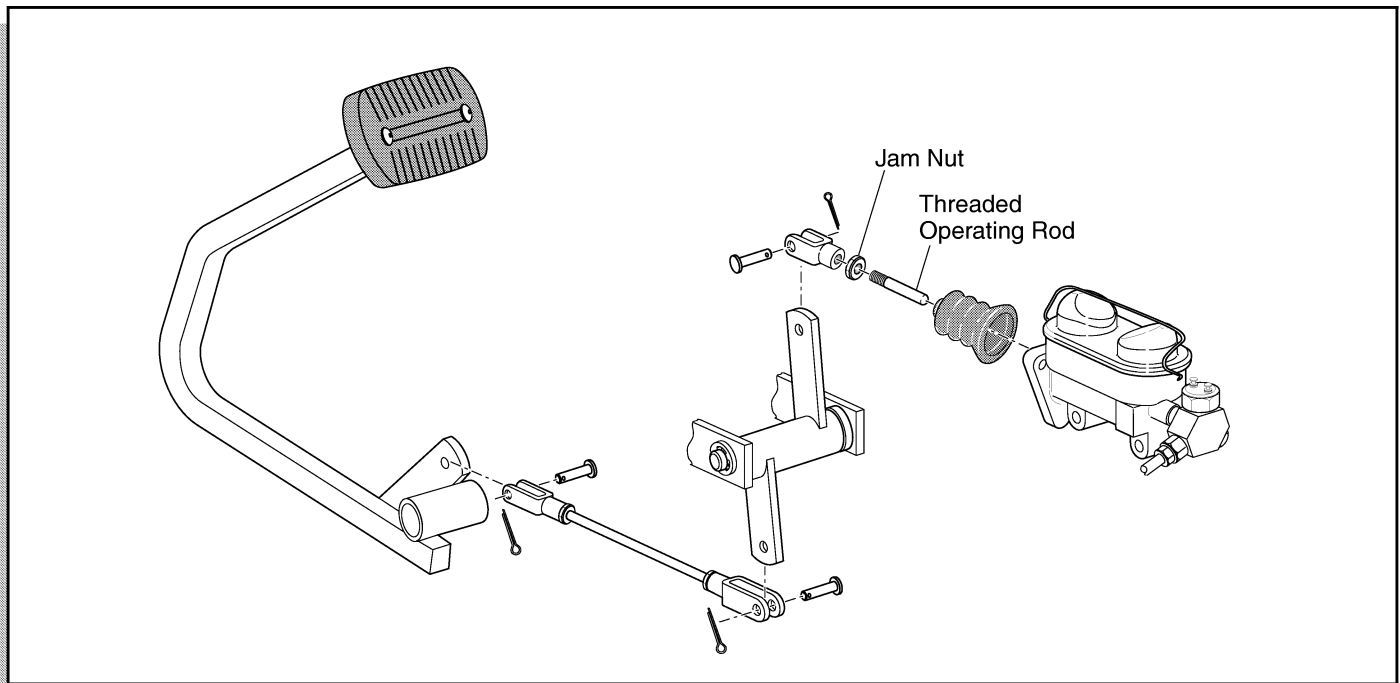
Wrench, 9/16" ..... 1

The brake pedal linkage is set at the factory. However, if the master cylinder should have to be removed for any reason, the pedal will require readjustment.

The master cylinder is located under the seat and is connected to the brake pedal by clevis yokes, threaded rods and a pivot (Ref Fig. 2 on page L-2). The threaded operating rod should be snug against the master cylinder piston (inside cylinder, under rubber boot) with no pressure on the piston.

To adjust, loosen jam nut on the rod and turn the rod in the desired direction until it becomes snug against the piston. Tighten jam nut firmly.

**NOTE** The master cylinder has built in free travel.



**Fig. 2 Brake Linkage Adjustment**

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## BRAKE SHOE ADJUSTMENT

| Tool List                  | Qty. Required |
|----------------------------|---------------|
| Lug wrench, 3/4" .....     | 1             |
| Jack.....                  | 1             |
| Jack stands .....          | 4             |
| Brake adjusting tool ..... | 1             |
| Rubber faced hammer .....  | 1             |

The vehicle is equipped with an automotive type brake drum and shoe system on the rear wheels. Should the braking be inadequate, adjustment should be made at the wheel brake. Use the following adjustment procedure:

1. At the brake to be adjusted, loosen the lug nuts 1/2 turn.

**⚠ WARNING ⚠** *Never work on a vehicle supported by a jack alone. To prevent possible personal injury, the vehicle must be supported on jack stands during this procedure.*

2. Raise the vehicle enough so that the wheel turns freely. (See SAFETY Section for procedure and safety information.) Remove the lug nuts and wheel.
3. Remove the brake drum and inspect the brake shoes to determine that at least .060" (1.52 mm) brake shoe material remains.

**NOTE** *If the brake drum cannot be removed, the brake shoes may need to be retracted by rotating the star wheel in the opposite direction to that shown (Ref Fig. 3 on page L-3). The star wheel is accessed through the slot in the brake drum and adjusted with a brake adjusting tool or a flat blade screwdriver. If after retracting the shoes, the brake drum still remains in place, tap brake drum with a plastic faced hammer to release it from wheel bolts.*

- a) If shoe replacement is not required, the shoes must be adjusted. Replace brake drum. Note that the slot in drum must be aligned with adjuster.
- b) Rotate the star wheel adjuster one full turn at a time through opening in drum until the brake shoes contact the brake drum (Ref Fig. 3 on page L-3).
- c) Loosen star wheel 3 'clicks'. Rotate the brake drum, if any drag is encountered, the star wheel may be loosened one additional 'click'. If the drum still binds, repeat the adjustment procedure. If the drum continues to bind, the drum should be checked for a warped or out of round condition.

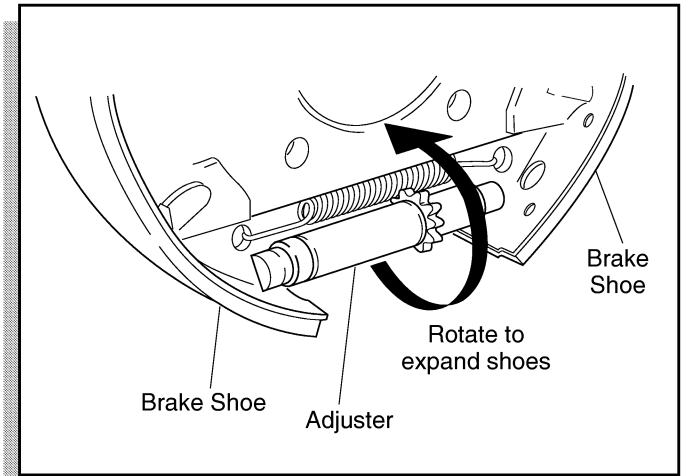


Fig. 3 Brake Shoe Adjustment

## BRAKE SHOE REPLACEMENT

| Tool List               | Qty. Required |
|-------------------------|---------------|
| Wrench, 11/16" .....    | 1             |
| Needle nose pliers..... | 1             |
| Brake cleaner .....     | A/R           |
| Brake lubricant .....   | A/R           |

**NOTE** *The factory recommends changing all brake shoes at the same time because proper adjustment will result in even wear of all brake shoes.*

*Prior to making the repairs included in this section, check the pedal adjustment, the cylinder fluid level and the brake shoe adjustment.*

The shoes should be replaced whenever **any** portion of the shoe material is less than .060" (1.52 mm), the braking effect has diminished or the brakes start squeaking and proper adjustment does not remedy the problem. Always replace both shoes at both wheels. Use the following procedure for shoe replacement:

1. At the rear wheels, loosen the lug nuts 1/2 turn.

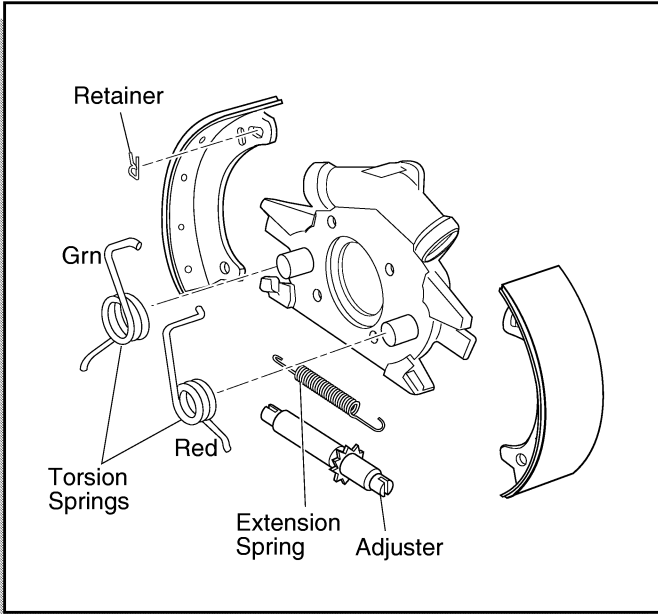
**⚠ WARNING ⚠** *Never work on a vehicle supported by a jack alone. To prevent possible personal injury, the vehicle must be supported on jack stands during this procedure.*

2. Raise the vehicle and support with jack stands. (See SAFETY Section for procedure and safety information.)
3. Remove wheel and brake drum as described in previous section.

# BRAKES

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

- To remove the shoes, remove the extension spring from the hole in each brake shoe. Remove the torsion springs and retainers. Remove the adjuster. With these springs removed, the brake shoes can be removed (Ref Fig. 4 on page L-4).



**Fig. 4 Brake Shoe Replacement**

- Separate, clean and lubricate the adjuster with commercially available products. Screw the adjuster together to achieve its shortest length.
- Reassemble the brake in the reverse order of assembly. Note that the slot in the drum must be in line with adjuster.
- After assembly, the brakes should be adjusted as previously detailed.

## BRAKE SYSTEM INSPECTION

Brake failure usually occurs as either a gradual decrease in braking effect from the shoe material being worn away, a loss of braking at one wheel or a sudden and complete failure with no brakes working except the parking brake.

Should the brakes at one wheel become ineffective while the brakes at the other wheel functions properly, remove the wheel and drum. Inspect the brake for a leaking or inoperative wheel cylinder assembly.

Complete brake failure usually indicates a loss of hydraulic fluid pressure. Check the fluid level at the master cylinder. If the cylinder is full, inspect the master cylinder for a defective piston seal which will allow the fluid to escape

around the piston. A master cylinder repair kit is available through the Service Parts Department (E-Z-GO P/N 28066-G02). Tubing joints and the wheel cylinder seals are locations that should be checked for leaks. If the inspection does not reveal a leak, fill the master cylinder with brake fluid. While you observe the vehicle, have an assistant depress the brake pedal. The brake fluid will be forced out of the defect, making the leaking point readily apparent.

**NOTE** Care should be taken to prevent brake fluid from coming into contact with the brake shoes. If the brake shoes should become wet, remove the brake drum and wipe the brake shoes and drum until they are dry.

The hydraulic system may be checked for leaks by applying pressure to the pedal gradually and steadily. If the pedal sinks very slowly to the floor, the system has a leak. This is not to be confused with a springy or spongy feel due to the compression of air within the lines.

Check for leaks along all lines and at brake assembly. If no external leaks are apparent, the problem is inside the master cylinder.

**CAUTION** Do not allow brake fluid to contact painted surfaces. Wipe off immediately.

After making any repairs to the hydraulic lines, wheel cylinders or master cylinder, the brakes must be bled to remove any trapped air. A bleeder valve is located at each wheel cylinder for this purpose.

## BLEEDING BRAKES

| Tool List             | Qty. Required |
|-----------------------|---------------|
| Tubing.....           | A/R           |
| Clean container ..... | 1             |
| Brake fluid.....      | A/R           |

The hydraulic brake system must be free of air to operate properly. Air can enter the system when hydraulic parts are disconnected for servicing or replacement, or when the fluid level in the master cylinder reservoir is very low. Air in the system will give the brake pedal a spongy feeling upon application.

**NOTE** An assistant will be necessary to perform this procedure.

Use a clean cloth to wipe off the master cylinder reservoir and wheel cylinder bleeder valves (Ref Fig. 6 on page L-5). Clean each fitting before opening to prevent contaminating the system. Open the master cylinder reservoir and top off with standard automotive brake fluid.

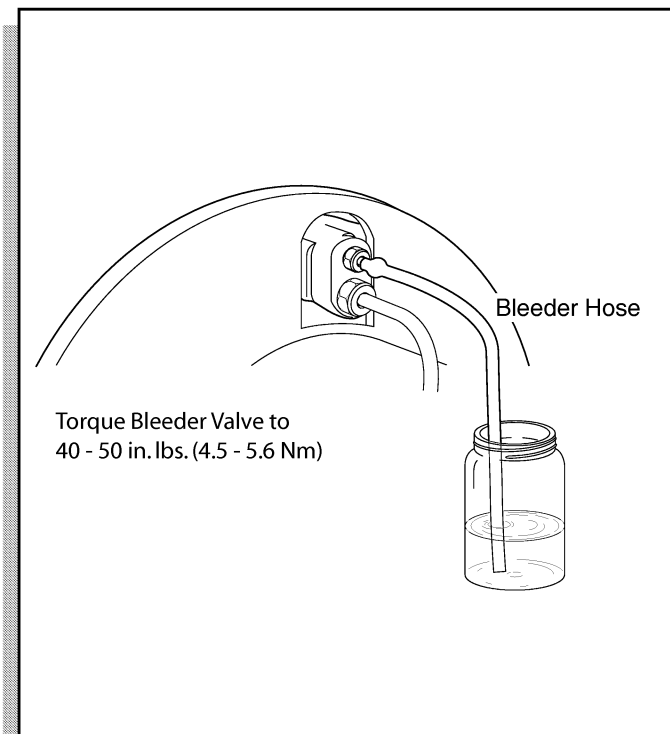
Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Never reuse any excess fluid or return to the original container. Dispose**

**of brake fluid properly.**

Attach a short length of clear hose to the wheel cylinder bleed valve and insert the other end into a suitable clean container containing fresh, clean brake fluid (Ref Fig. 5 on page L-5). Check the fluid level in the master cylinder frequently during this operation to prevent air from entering the lines.

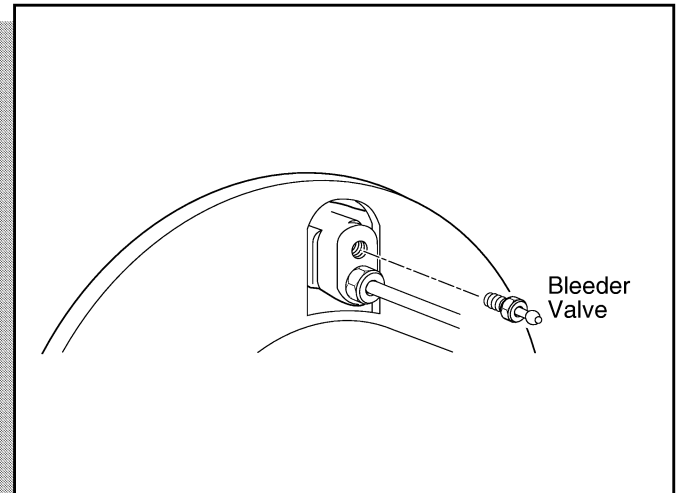


**Fig. 5 Bleeding Brakes**

Starting with the passenger side rear brake and going to the driver side rear brake, bleed the brakes using the following procedure:

**NOTE** *The bleeder valve at the wheel cylinder must be closed at the end of each stroke and before the brake pedal is released to insure that air cannot enter the system. It is also important that the brake pedal be returned to full 'up' position.*

Open the bleeder valve and have an assistant depress brake pedal **gently** until fluid flows into container. Close the bleeder valve and have the assistant slowly release the brake pedal. Repeat the process until no bubbles can be seen leaving the bleeder valve. Close the valve and move to the next brake.



**Fig. 6 Bleeder Valve**

## FRONT HYDRAULIC DISC BRAKES (OPTIONAL)

The vehicle may be equipped with optional front hydraulic disc brakes.

The brakes have sliding calipers that are free to move in a fixed bracket. The caliper bore is located on the inboard side of the caliper housing and contains the piston that directs force against the brake pads supported within the caliper. The braking forces are applied on each side of the rotor.

The piston pushes the inboard brake pad directly and simultaneously hydraulic pressure slides the caliper in a clamping action which forces the caliper to apply the outboard brake pad.

The actual applying movement is small. The unit merely grips during application, relaxes upon release, and the pads do not retract an appreciable distance from the rotor. The fluid inlet port and the bleeder screw are located on the inboard side of the caliper. A dust boot is fitted into a circumferential groove on the piston and into a recess at or near the outer end of the cylinder bore.

A scratched piston, nicked seal, or a sludge or varnish deposit which lifts the sealing edge away from the piston will cause a fluid leak. A leak could develop if calipers are not reconditioned when new pads are installed. Dust and road grime, gradually accumulating behind the dust boot, could be carried into the seal when the piston is pressed inward to accommodate new thick linings. Old seals may have taken a "set" and prevent proper seating in the

# BRAKES

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

retainer groove and on the piston. Therefore, when reconditioning calipers, new seals should be installed.

The rotors should be turned as part of the brake overhaul procedure. A rotor thickness of .250" (6.35 mm) minimum must be maintained. Rotors with less than .250" (6.35 mm) thickness must be replaced.

Brake overhaul kits and individual components are available from the E-Z-GO Service Parts Department. Refer to the Service Parts Manual for part numbers, descriptions and illustrations.

Refer to the brake manufacturers instructions for overhaul procedures and maintenance information that is provided with each kit.

## PARKING BRAKE

The parking brake is operated by a lever located between the front seats through cables to the rear wheel brake mechanical actuators (Ref Fig. 7 on page L-6).

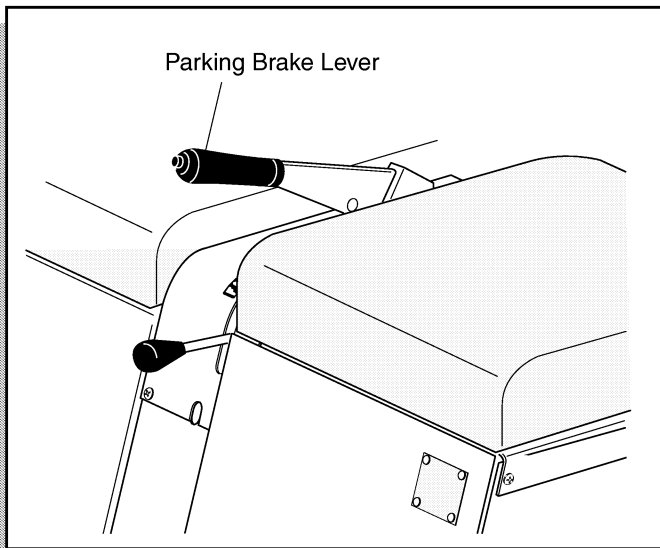


Fig. 7 Parking Brake

## Lubrication

**CAUTION** When lubricating parking brake, be sure to use the recommended dry spray lubricant. Commercial grease can attract dirt and accelerate wear.

The parking brake lever requires periodic lubrication with a dry graphite or molybdenum disulfide lubricant. Raise the lever and spray into the underside to access the pivot arm and ratchet mechanism of the parking brake. See

Section A - Periodic Service Schedule for recommended lubrication schedule.

## Adjustment

After brakes are adjusted at each wheel, the parking brake can be adjusted by rotating the spherical nut on the parking brake linkage (Ref Fig. 8 on page L-6). Rotate the spherical nut until .06" - .10" (1.5 - 2.5 mm) gap is obtained between the equalizer and fitting. Secure with jam nut.

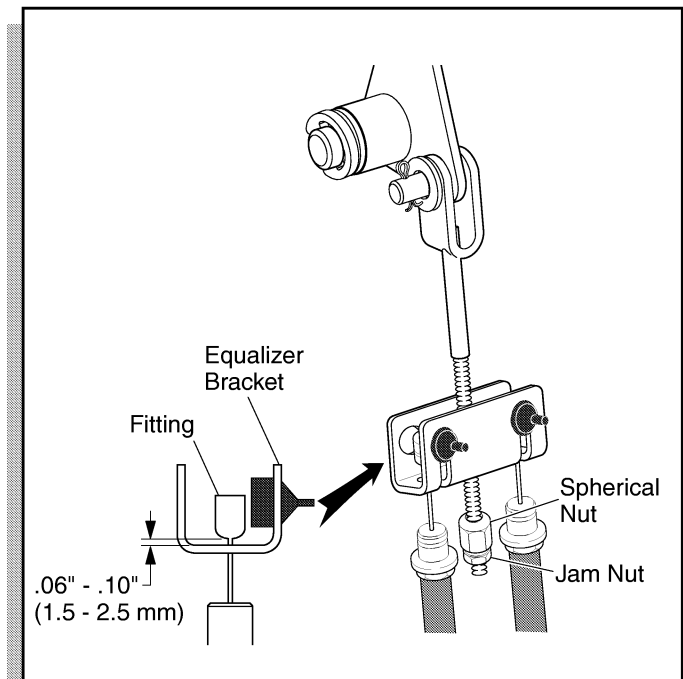


Fig. 8 Parking Brake Adjustment

## Cable Replacement

Cables should be replaced when they become inoperable. Cable replacement consists simply of disconnecting the present cable, installing new cable and adjusting.



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# REAR SUSPENSION

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## REAR SUSPENSION

**NOTE** In the following text, there are references to removing/installing bolts etc. Additional hardware (nuts, washers etc.) that are removed must always be installed in their original positions unless otherwise specified. Non specified torque specifications are as shown in the table contained in Section "A".

### GENERAL

The rear suspension consists of the rear axle and attachments that secure it to the springs and shock absorbers. Rear axle removal is covered in the REAR AXLE section.

### Shock Absorber Removal

| Tool List           | Qty. Required |
|---------------------|---------------|
| Wrench, 1/2" .....  | 1             |
| Wrench, 3/4" .....  | 1             |
| Wrench, 9/16" ..... | 1             |

Raise the rear cargo deck panel to allow access to the top of the shock absorbers.

Compress the shock absorber (4). Remove the bottom shock absorber nut (1) and washer (2). Retain spacer (3) for use in reassembly (Ref Fig. 1 on page M-1). Remove the top shock absorber nut (5), washer (6) and bushing (7).

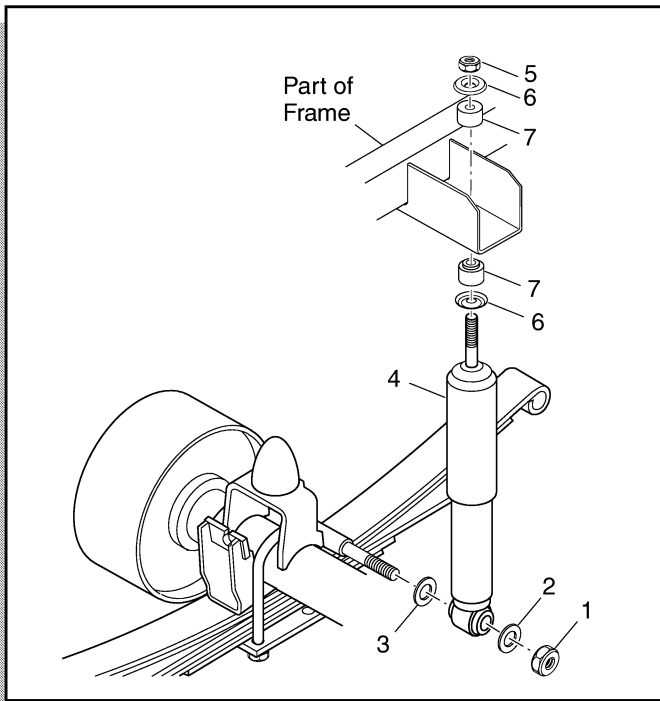


Fig. 1 Shock Absorber Replacement

Remove the shock absorber (4).

### Shock Absorber Installation

Shock absorber installation is in the reverse order of disassembly except that the shock absorber nut (5) located at the top must be tightened until the shock absorber bushings (7) expand to the diameter of the shock absorber washer (6).

### Rear Spring Removal

| Tool List                                | Qty. Required |
|--|---------------|
| Wheel chocks .....                       | 4             |
| Jack stands .....                        | 6             |
| Floor jack.....                          | 1             |
| Lug wrench, 3/4" .....                   | 1             |
| Socket, 9/16", deepwell, 1/2" drive..... | 1             |
| Ratchet, 1/2" drive.....                 | 1             |
| Wrench, 3/4" .....                       | 1             |

**WARNING** Be sure the vehicle is on a firm and level surface. Never get under a vehicle while it is supported by a jack. Use safety stands and test the stability of the vehicle on the stands. Always place chocks in front and behind the wheels that are not to be raised. Use extreme care since the vehicle is extremely unstable during the lifting process.

**NOTE** If both springs are to be replaced and the rear axle is not to be removed, it is important to remove and replace one spring at a time. Springs must be replaced in sets, never replace just one.

The shock absorbers do not have to be removed to replace springs.

Lift the entire vehicle and support on jack stands as instructed in the SAFETY section. Remove the rear wheels. Place a floor jack under the center section of the rear axle (1) (Ref Fig. 2 on page M-2) and raise the axle just enough to place a second set of jack stands under the axle tubes.

With both the rear axle and the frame supported, the lock nuts (2) and mounting plate (3) securing the spring (4) to the axle can be removed (Ref Fig. 2 on page M-2).

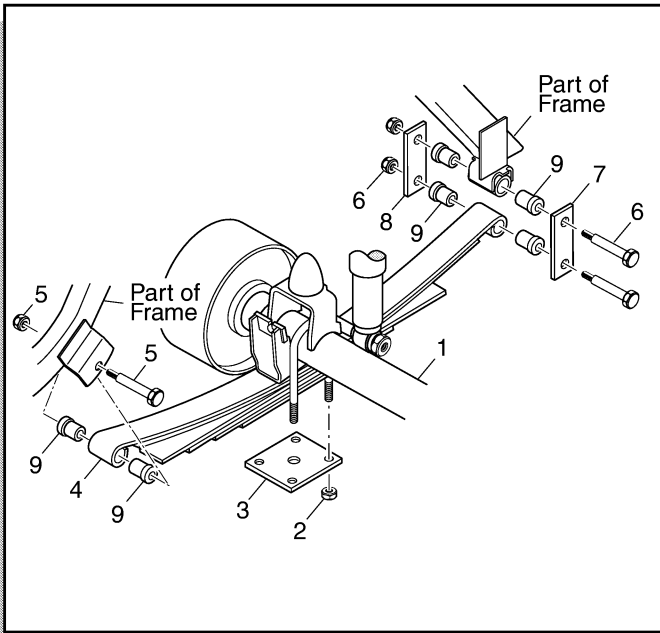
Remove hardware (5) securing the front end of the spring to the welded bracket on the frame.

Remove hardware (6) and spring shackles (7, 8) securing the spring to the frame at the rear of the vehicle.

Remove the spring.

# REAR SUSPENSION

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 2 Spring Replacement**

## Rear Spring Installation

### Tool List

### Qty. Required

|   |   |
|---|---|
| Torque wrench, ft. lbs., 1/2" drive ..... | 1 |
| Socket, 9/16", deepwell, 1/2" drive ..... | 1 |
| Wrench, 3/4" .....                        | 1 |

**NOTE** *The hardware may be assembled either toward the inside or outside of the vehicle, but the spring shackle with the larger hole (7) must be on the side that the shoulder bolt is inserted.*

Remove the bushings (9) from the old spring. Install new bushings into new spring (4).

Spring installation is in the reverse order of disassembly with the spring oriented so that the shortest distance between the eye and locating pin is towards the front of vehicle.

Tighten front (5) and rear (6) spring mounting hardware to 21 - 25 ft. lbs. (28 - 34 Nm) torque.

Tighten axle mounting hardware (2) to 16 - 20 ft. lbs. (22 - 27 Nm) torque.

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| Fig. 9 Components Orientation.....             | N - 4 |



# REAR AXLE



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

For further axle information, see Electric Rear Axle Manual E-Z-GO P/N 28148-G01.

## REAR AXLE REMOVAL

| Tool List                                | Qty. Required |
|--|---------------|
| Wrench, 1/2" insulated .....             | 1             |
| Lug wrench, 3/4" .....                   | 1             |
| Wheel chocks.....                        | 4             |
| Jack stands .....                        | 6             |
| Floor jack .....                         | 1             |
| Needle nose pliers .....                 | 1             |
| Flare nut wrench, 3/8" .....             | 1             |
| Wrench, 3/4" .....                       | 1             |
| Socket, 9/16", deepwell, 1/2" drive..... | 1             |
| Ratchet, 1/2" drive.....                 | 1             |

Raise cargo deck panel to gain access to the motor and axle.

**⚠ WARNING ⚠** *To reduce the possibility of personal injury, follow the lifting procedure in the SAFETY section of this manual. Place wheel chocks in front and behind each wheel not being raised and check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.*

*The rear axle assembly is top heavy. To reduce the possibility of personal injury while removing the rear axle, be sure to support the motor with an overhead hoist when separating from springs.*

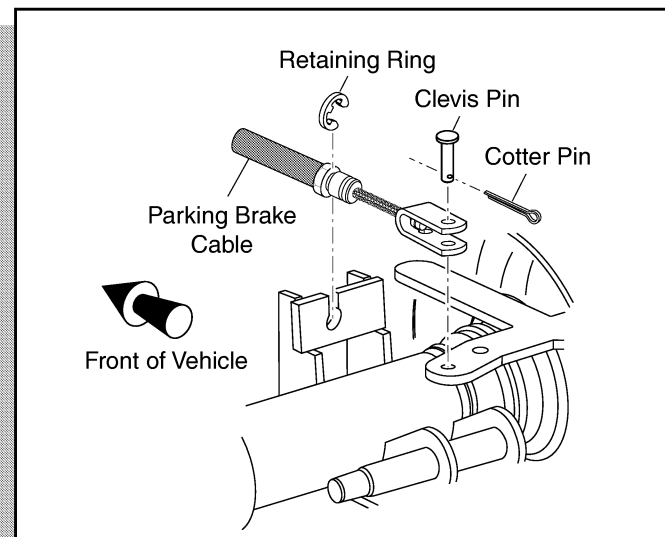
*If no hoist is available, a second person should hold the motor in the correct position until the springs are removed. Both persons should remove the rear axle and motor assembly.*

Loosen both rear wheels by rotating each lug nut approximately one turn.

Lift the entire vehicle according to lifting procedure in the SAFETY section. Place two additional jacks under the rear axle to support the axle when hardware is removed.

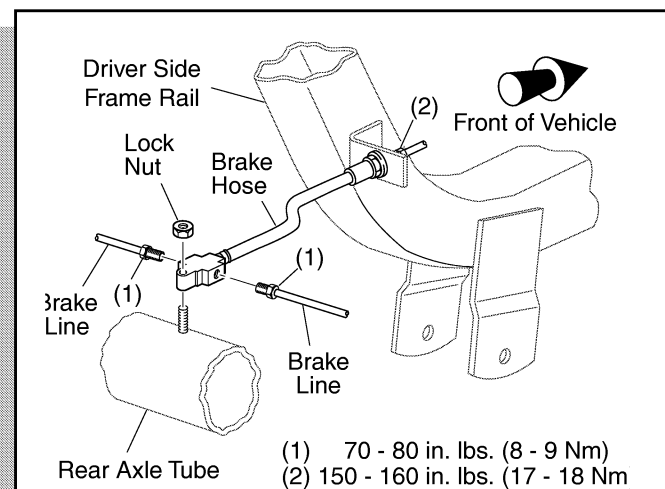
Disable the electrical system to the motor by turning the key switch to the 'OFF' position and remove battery wire (B-).

Disconnect the parking brake cables from their actuating levers and axle brackets (Ref Fig. 1 on page N-1).



**Fig. 1 Disconnecting Parking Brake Cables**

Disconnect the hydraulic brake line at the "T" connection on the axle housing (Ref Fig. 2 on page N-1). Drain fluid and discard. Bleeding the hydraulic brakes is mandatory.



**Fig. 2 Disconnecting Brake Lines**

Remove the four wires connected to the motor. Remove the hardware (1) securing the bottom of the shock absorber (2) to the axle and compress the shock absorber (Ref Fig. 3 on page N-2). Being careful to prevent the axle assembly (3) from rotating, remove the 'U' bolt hardware (4) and spring plate (5). Remove hardware (6) securing the springs (7) to the shackles at the rear of the vehicle. Allow rear of springs to rest on floor.

The rear axle and motor assembly can now be lifted off the jack stands and lowered to rest the tires on the floor. Roll the axle and motor assembly out from under vehicle.

# REAR AXLE

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

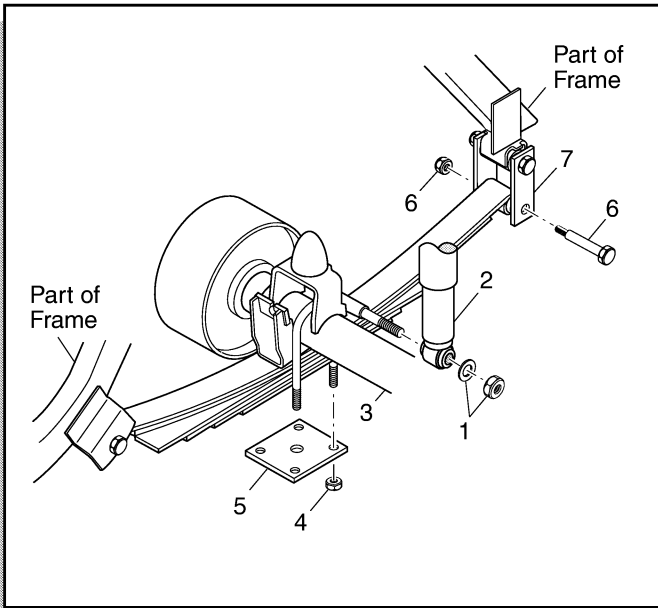


Fig. 3 Rear Axle Removal

## AXLE SHAFT DISASSEMBLY

**CAUTION** The rear axle is a precision assembly, and therefore any repair or replacement of parts must be done with extreme care in a clean environment. Before attempting to perform any service on the axle, read and understand all of the following text and illustrations before disassembling the unit.

Handle all splines with extreme care.

**WARNING** To reduce the possibility of personal injury, follow the lifting procedure in the SAFETY section of this manual. Place wheel chocks in front of and behind the front wheels and check the stability of the vehicle on the jack stands before starting any repair procedure. Never work on a vehicle that is supported by a jack alone.

### Axle Shaft Removal

| Tool List                      | Qty. Required |
|--------------------------------|---------------|
| Lug wrench, 3/4" .....         | 1             |
| Wheel chocks .....             | 4             |
| Jack stands.....               | 2             |
| Floor jack .....               | 1             |
| Flare nut wrench, 3/8".....    | 1             |
| Ratchet, 1/2" drive .....      | 1             |
| Socket, 1/2", 1/2" drive ..... | 1             |
| Puller .....                   | 1             |

Loosen rear wheel lug nuts on the side of vehicle to be serviced. Lift side of vehicle according to lifting procedure in SAFETY section. Remove wheel and brake drum (Ref Fig. 5 on page N-2) (refer to BRAKES section).

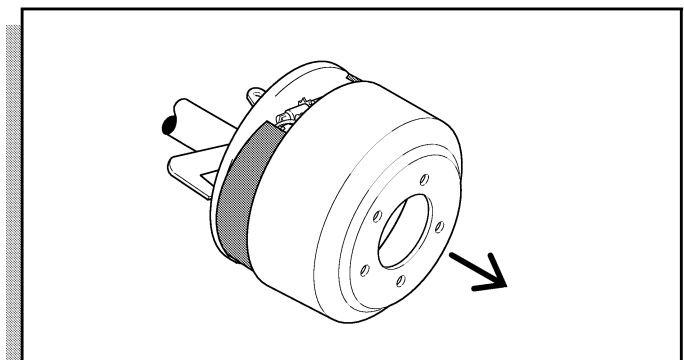


Fig. 5 Removing Brake Drum

Disconnect hydraulic brake line from the wheel cylinder. Line up the hole in the axle shaft flange with the backing plate nuts and remove the backing plate nuts which hold

## REAR AXLE INSTALLATION

### Tool List Qty. Required

|   |   |
|---|---|
| Torque wrench, ft. lbs., 1/2" drive ..... | 1 |
| Socket, 1/2", 3/8" drive .....            | 1 |
| Torque wrench, in. lbs., 3/8" drive ..... | 1 |

Installation is in the reverse order of disassembly. Tighten rear spring mounting hardware (6) to 21 - 25 ft. lbs. (28 - 34 Nm) torque. Tighten axle mounting hardware (4) to 16 - 20 ft. lbs. (22 - 27 Nm) torque.

Reconnect the motor wires to motor (Ref Fig. 4 on page N-2). Tighten motor terminal hardware to 66 in. lbs. (8 Nm) torque.

| MOTOR TERMINAL | FROM                 |
|----------------|----------------------|
| A2             | Controller A2        |
| A1             | Controller B+        |
| S2             | Direction Selector D |
| S1             | Direction Selector B |

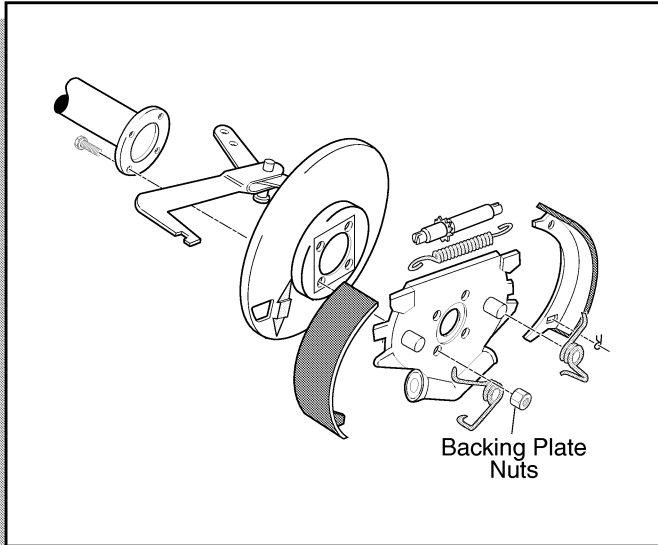
Fig. 4 Motor Wiring

Bleed the hydraulic brake system per BRAKES section.



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

the axle shaft assembly in the axle (Ref Fig. 6 on page N-3).



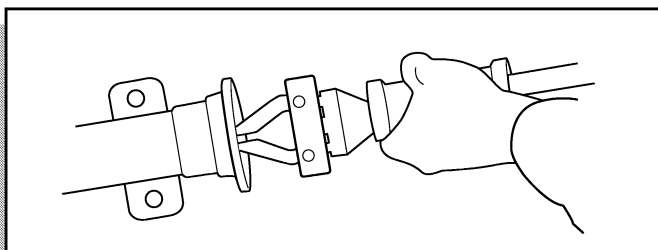
**Fig. 6 Removing Backing Plate Nuts**

Remove the axle shaft assembly by grasping the axle shaft assembly and pulling free. The axle shaft assembly includes axle shaft, wiper seal, brake assembly, gasket, bearing and retainer.

**NOTE** The wheel bearing assembly and retainer ring are cemented together with an epoxy adhesive and in most cases the bearing assembly will remain intact on the axle shaft. If it does not, the bearing assembly and retainer ring must be removed from the axle housing with an internal puller.

**CAUTION** Do not damage bore of axle housing when removing oil seal.

Remove oil seal from axle housing using puller. Discard seal and replace with new one at time of assembly (Ref Fig. 7 on page N-3).



**Fig. 7 Removing Oil Seal with Puller**

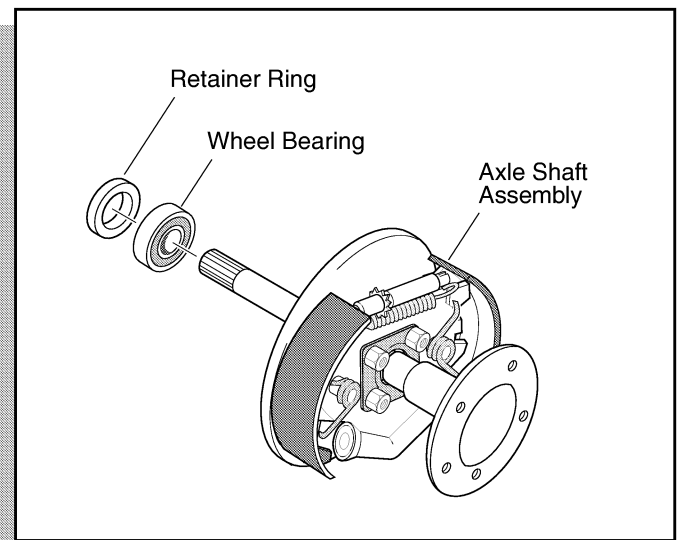
**NOTE** It is recommended that whenever a bearing, seal or 'O' ring is removed, it be replaced with a new one regardless of mileage. Always wipe the seals and 'O'

rings with a light oil before installing.

## Bearing Removal

| Tools List             | Qty. Required |
|------------------------|---------------|
| Center punch.....      | 1             |
| Ball peen hammer ..... | 1             |
| Drill .....            | 1             |
| Drill bit, 1/4" .....  | 1             |
| Chisel .....           | 1             |
| Arbor press.....       | 1             |

Place axle shaft assembly in a vise. Center punch the outside of the retainer ring (Ref Fig. 8 on page N-3).



**Fig. 8 Wheel Bearing Removal**

Drill 1/4" (6 mm) hole in the outside of the retainer ring to a depth approximately 3/4 the thickness of the ring.

**CAUTION** Drilling completely through could damage the axle shaft.

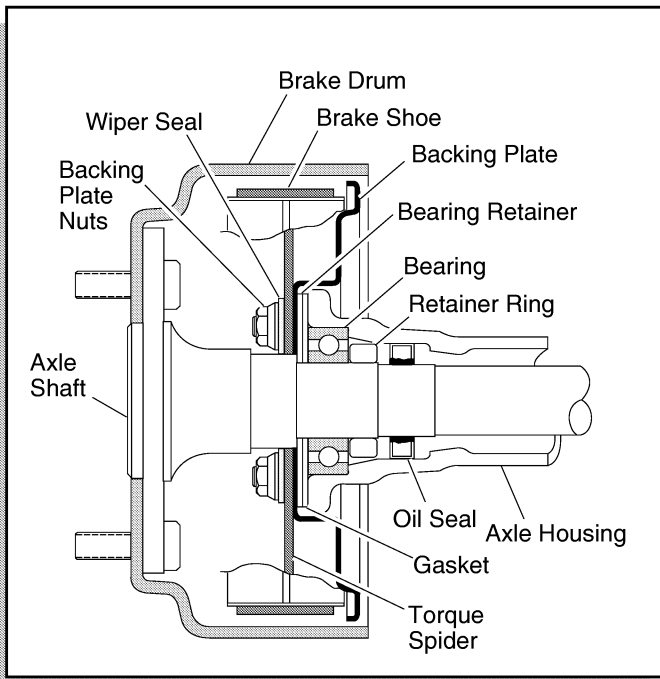
After drilling, position a chisel across the hole and strike sharply to break the ring. Replace with a new ring at time of assembly.

Support the axle shaft assembly in a suitable press. Press on the end of the axle shaft until the wheel bearing assembly and brake assembly are removed.

It is important to note the order of components for axle shaft assembly, especially note the correct orientation for the wheel bearing assembly (Ref Fig. 8 on page N-3).

# REAR AXLE

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings



**Fig. 9 Components Orientation**

## AXLE SHAFT ASSEMBLY

### Bearing Installation

Inspect shaft for possible damage, replace if damage is evident. In the following order, place new wiper seal, brake assembly, bearing retainer and new grease packed bearing assembly (with unit bearing rib ring toward flanged end of shaft) on the axle shaft.

Support the bearing assembly in a suitable press. Press axle shaft assembly until bearing is firmly seated against axle shaft shoulder.

Slide new retainer ring on the axle shaft and support the shaft in suitable press.

Press the retainer ring firmly against bearing.

### Axle Shaft Installation

#### Tools List

#### Qty. Required

|   |   |
|---|---|
| Seal driver .....                         | 1 |
| Machinist Rule, 6" .....                  | 1 |
| Torque wrench, ft. lbs., 1/2" drive ..... | 1 |

Install new oil seal into axle housing and set to original depth of  $1 \frac{7}{32} \pm .010$ " (31 mm  $\pm$  .25 mm) from the outer flange of the axle tube.

After seal has been installed, grease lip of seal.

Assemble bolts and new gasket on axle housing. Then install axle shaft assembly into axle housing. Care should be taken not to damage gasket, oil seal, or bearing. Line up holes of brake assembly and wiper seal. Push axle shaft as far as possible into axle housing.

Start backing plate nuts on bolts by hand. Tighten nuts in a diagonal pattern to assure the retainer ring and wheel bearing assembly are drawn evenly into axle housing. Tighten backing plate nuts to 37 - 45 ft. lbs (50 - 61 Nm) torque.

Install brake drum and connect the hydraulic brake line to the wheel cylinder. Bleed the hydraulic brake system per BRAKES section.

## AXLE COMPONENTS INSPECTION

### Roller Bearing

It is recommended, that whenever the bearings are removed, they are replaced with new ones regardless of mileage.

### Oil Seals

Inspect oil seals for signs of leaking. Look for cuts or cracks. Be sure the spring on the inside of the seal lip is in place.

### Axle Shaft Seal Surface

Inspect sealing surface of axle shaft. Replace if seal has grooved the surface more than  $\frac{1}{64}$ " (.4 mm).



**PAINT**

**TABLE OF CONTENTS FOR SECTION 'P'**

| <b>SECTION TITLE</b>        | <b>PAGE NO.</b> |
|-----------------------------|-----------------|
| PAINTING .....              | P - 1           |
| Minor Scratches.....        | P - 1           |
| Larger Scratches .....      | P - 1           |
| Complete Panel Repair ..... | P - 1           |



# PAINT



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## PAINTING

Follow the manufacturer's recommendations for specific painting procedures and information.



**All painting must be done in an area with adequate ventilation to safely**

**disperse harmful vapors.**

**Wear eye protection and respirator, following manufacturer's instructions, to protect from overspray and vapors.**

### CAUTION

Provide protection from overspray to vehicle and surrounding area.

## Minor Scratches

For minor scratches, E-Z-GO suggests the following steps be taken to repair the Durashield™ body:

- I. Thoroughly clean the surface to be repaired with alcohol and dry.
- II. Touch up damaged area with sequential coats (two coats minimum recommended, allowing 30 - 45 minutes between coats, increasing to 45 - 60 minutes in higher humidity) using brush on touch-up paint, until coating layer is visible, slightly above the surface of the part.
- III. Use 400 grit "wet" sand paper to blend touch up area level with the rest of the part being repaired. Use a polishing compound (3M Finesse or automotive grade) to renew gloss and to further blend and transition newly painted surface.
- IV. (Optional but recommended) Follow this process with clear coat to renew and protect depth of finish.
- V. Wax or polish with Carnauba base product, available at any automotive parts distributor.

## Larger Scratches

For larger scratches, E-Z-GO suggests the following steps be taken to repair the Durashield™ body:

- I. Thoroughly clean the surface to be repaired with alcohol and dry.
- II. Mask the area to be painted (common masking tape is adequate) prior to repair and use aerosol type touch-up paint.

- III. Apply spray touch up paint in light even overlapping strokes. Multiple coats may be applied to provide adequate coverage and finish. Always remember to shake the can for a minimum of one minute to mix the paint and achieve the best color match.
- IV. After painting, allow to dry overnight. Smooth the mask lines using 400 grit "wet" sand paper to blend touch up area level with the rest of the part being repaired. Use a polishing compound (3M Finesse or automotive grade) to renew gloss and to further blend and transition newly painted surface.
- V. (Optional but recommended) Follow this process with clear coat to renew and protect depth of finish.
- VI. Wax or polish with Carnauba base product, available at any automotive parts distributor.

## Complete Panel Repair

In situations where large panels or areas must be painted, touch up paint is not recommended. In such cases professional painting or panel replacement is called for. E-Z-GO suggests body panel replacement be considered as a cost effective alternative to painting. If the decision to repaint is taken, the task can be accomplished by any paint and body shop.

The finish will include an application of a primer coat, a base color coat and a clear coat. E-Z-GO does not supply these materials due to the variety of paint manufacturers and the preferences of the individual painter.

Most paint manufacturers can perform a computer paint match to assure accurate color matching.



# TROUBLESHOOTING



## TABLE OF CONTENTS FOR SECTION 'Q'

| SECTION TITLE  | PAGE NO. |
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| ELECTRICAL SYSTEM .....                                | Q - 1    |
| Basic Electrical Power System Troubleshooting .....    | Q - 2    |
| Basic Electrical Troubleshooting for Accessories ..... | Q - 2    |
| SUSPENSION AND STEERING .....                          | Q - 3    |





# TROUBLESHOOTING



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## ELECTRICAL SYSTEM

| Condition                            | Possible Cause   | Correction   |
|--------------------------------------|--|--|
| VEHICLE WILL NOT MOVE                | Key 'OFF' or no direction selected   | Turn key 'ON' and select direction   |
|                                      | Batteries discharged   | Charge batteries   |
|                                      | Batteries unable to be charged   | Load test and replace batteries that cannot be charged   |
|                                      | Corroded or loose battery connections  | Clean and tighten battery connections<br>Apply a coat of commercial terminal protectant to all terminals   |
|                                      | Corroded or loose battery connections to ESC controller, direction switch or motor | Repair or replace faulty wiring  |
|                                      | Solenoid has failed  | Replace solenoid   |
|                                      | Key switch has failed  | Replace key switch   |
|                                      | Micro switch at direction selector switch has failed                               | Replace micro switch   |
|                                      | Connector loose or separated   | Install connector correctly  |
|                                      | Faulty motor   | Repair or replace motor<br>Test by checking continuity of field coils (S1 - S2) and armature (A1 - A2)<br>Check for continuity of armature to ground and field coils to ground which indicates a shorted condition |
| Faulty ESC system                    | Test and replace components as indicated by test procedure                         |  |
| Ignition interlock switch has failed | Replace reed switch (portable)<br>Replace relay (on-board charger)                 |  |
| VEHICLE SPEED ERRATIC                | Faulty ESC system  | Test and replace components as indicated by test procedure   |
| NO REDUCED SPEED IN REVERSE          | Faulty ESC system  | Test and replace components as indicated by test procedure   |
| MOTOR NOISY                          | Damaged bearing  | Replace bearing  |
|                                      | Raised commutator bar(s)   | Replace motor  |
|                                      | Loose motor mounting hardware  | Tighten  |
| BATTERIES WILL NOT CHARGE            | Charger not functioning correctly  | Repair or replace charger  |
|                                      | Vehicle charging wiring faulty   | Repair or replace wiring   |

# TROUBLESHOOTING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

| Condition                                | Possible Cause                    | Correction  |
|--|-----------------------------------|---|
| BATTERIES WILL NOT CHARGE<br>(Continued) | Vehicle/charger connector damaged | Replace connector                                   |
|  | Battery case damage               | Replace battery                                     |
|  | Low electrolyte level             | Maintain correct electrolyte level                  |
|  | Battery capacity deficient        | Hydrometer/load test<br>Replace battery if required |
|  | Damaged battery                   | Replace battery                                     |

## Basic Electrical Power System Troubleshooting

To diagnose electrical problems in the electrical power system, refer to the ELECTRONIC SPEED CONTROL section.

## Basic Electrical Troubleshooting for Accessories

To diagnose electrical problems in the vehicle electrical wiring system, refer to the ACCESSORY WIRING section.

# TROUBLESHOOTING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

## SUSPENSION AND STEERING

| Condition        | Possible Cause   | Correction   |
|------------------|--|--|
| UNEVEN TIRE WEAR | Incorrect tire pressure  | Inflate to recommended pressure  |
|                  | Improper alignment (Incorrect toe in)  | Align front tires  |
| STIFF STEERING   | Water has entered steering box and may freeze in cold conditions                       | Remove steering column, pinion and bearing and remove water before adding grease<br>Inspect gasket for good seal   |
|                  | Excessive grease in steering box has migrated into steering rack bellows or rack cover | Raise the vehicle and observe the rack bellows while moving the steering from lock to lock<br>Any distortion of the bellows may indicate that an excess of grease has built up in the bellows<br>Remove the bellows and remove excess grease |
|                  | Insufficient lubricant in king pins, rod ends, idler bushing or steering box           | Add one pump of lubricant to each grease fitting and operate steering from lock to lock. <b>Do not over grease</b><br>If steering does not return to acceptable condition proceed to next step   |
|                  | Bent rack  | Remove rack and place on flat surface with rack teeth up<br>If a .015" (.381 mm) feeler gauge will pass under the rack, the rack must be replaced  |
| PLAY IN STEERING | Steering wheel loose   | Inspect splines - replace steering wheel, if required<br>Tighten steering wheel nut  |
|                  | Steering components worn   | Replace  |
|                  | Loose wheel bearings   | Adjust or replace  |
| VIBRATION        | Steering components worn   | Replace  |
|                  | Damaged wheel bearings   | Replace  |
|                  | Out of round tires, wheels or brake drums  | Inspect and replace if out of round  |
|                  | Loose lug nuts   | Tighten to 50 - 85 ft. lbs. (68 - 115 Nm)  |

# TROUBLESHOOTING

*Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings*

| Condition                  | Possible Cause               | Correction                      |
|----------------------------|------------------------------|---------------------------------|
| STEERING PULLS TO ONE SIDE | Incorrect tire pressure      | Inflate to recommended pressure |
|                            | Dragging wheel brakes        | Adjust                          |
|                            | Suspension component failure | Repair                          |
|                            | Improper alignment           | Align                           |

# LIGHTNING PROTECTION AND GROUNDING



## TABLE OF CONTENTS FOR SECTION 'R'

| SECTION TITLE                                    | PAGE NO. |
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| Ground Systems .....                             | R - 1    |
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| Equipment Fault and Personal Safety System ..... | R - 1    |
| Ground Network Requirements .....                | R - 1    |
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| Materials .....                                  | R - 2    |
| Earth Electrode System .....                     | R - 2    |
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# LIGHTNING PROTECTION AND GROUNDING



Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

|                        |                                  |   |
|------------------------|----------------------------------|---|
| GS-726-006             | REVISION:<br>A                   | TITLE:  |
| EFFECTIVE:<br>10/19/92 | SUPERCEDES:<br>Rev -, ECN 027194 | General Specification: Lightning Protection and Grounding |

## 1. Grounding Requirements

For the purpose of this specification, building ground systems should serve two primary functions: personal safety and equipment protection. In order to be effective, all elements and functions of building ground system must receive equal consideration in design and installation. Once installed, it is up to the owner to adequately maintain the system by implementing periodic inspections and ground tests in order to determine its effectiveness.

## 2. Ground Systems

All electronic equipment is inherently related to earth by capacitive coupling, accidental or incidental contact and intentional connection. The earth forms a natural readily available form of common potential reference for all electrical circuits. For maximum effectiveness, grounding must be looked at from a total system viewpoint, with various sub-systems comprising the total facility ground system. The interconnection of the various sub-systems into a building ground system will provide a direct path, of known low impedance, between earth and the various electrical and other equipment. This effectively extends an approximation of ground reference throughout the building. The total building ground system is composed of an earth electrode system, a lightning protection system and an equipment fault protective system.

**Resistance To Earth:** The resistance to earth of the ground system should not exceed 10 ohms. Where the resistance of 10 ohms cannot be obtained due to high soil resistivity, rock formations or other abnormal conditions, alternate methods for reducing the resistance to earth must be considered.

**Chemical Treatments:** No salt, coke or other chemicals may be used to treat the soil in order to obtain the required ground resistance readings. Approved methods of enhancement are bentonite clay or the GEM product for ground enhancement as manufactured by Erico Products of Solon, Ohio.

**Ground Tests:** The resistance to earth of the ground system shall be measured by the "Fall of Potential Method". Acceptable resistance meters/testers are those manufactured by Bidle or AEMC.

## 3. Lightning Protection Requirements

The external lightning protection system shall be designed and installed by a contractor who specializes in the lightning protection field. The contractor must be listed with Underwriters Laboratories Inc. and be in good standing. All work shall be under the direct supervision of a Certified Master Installer with current credentials from the Lightning Protection Institute.

The materials and design for the structure will comply with the most recent edition of the National Fire Protection Association Lightning Protection Code, NFPA 780 and the Materials Standard for Safety from Underwriters Laboratories UL96. Materials for this project may be those of Harger Lightning Protection, 1066 Campus Drive, Mundelein, Illinois (800-842-7437).

Upon completion of the project, the contractor will supply to the owner the Master Label issued by Underwriters Laboratories.

## 4. Equipment Fault and Personal Safety System

The standard method of providing an equipment fault protection ground network is to run a good ground conductor (green wire) through the conduit together with the AC distribution system. This method is required for all types of conduit, including metallic.

## 5. Ground Network Requirements

Install the conduit in accordance with local regulations or as prescribed by the National Electrical Code.



# LIGHTNING PROTECTION AND GROUNDING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

|                        |                                  |   |
|------------------------|----------------------------------|---|
| GS-726-006             | REVISION:<br>A                   | TITLE:  |
| EFFECTIVE:<br>10/19/92 | SUPERCEDES:<br>Rev -, ECN 027194 | General Specification: Lightning Protection and Grounding |

## 6. External Grounding Requirements

For optimum results, earth electrode installation must be accomplished early in the construction of a new site. The earth electrode system should be established at the same time utilities are installed to insure proper interconnection of all utility grounds/systems.

For existing sites, the earth electrode installation shall be constructed using the most economical means possible in order to meet the intent of this specification.

Prior to the installation or design of the ground system, a survey should be taken in order to determine the earth resistivity, types of soil or any man made features that may have a significant effect upon the efficiency of the grounding system. Based on the information gathered, deviations from this specification (Exceeding normal requirements) may be necessary in order to achieve desired results.

## 7. Materials

**Ground Rod Electrodes:** Ground rod electrodes shall have a minimum diameter of 5/8" and be no less than 10'-0" in length. Rods may be copper, copper-clad steel or stainless steel. Galvanized steel rods are not permitted unless it is determined that the galvanized rod will have a longer life expectancy due to soil conditions.

**Ground Rod Spacing:** Ground rods shall not be spaced at intervals exceeding 60'-0" around the perimeter of the structure.

**Ground Loop Conductor:** In no case shall the ground loop conductor be smaller than a 2/0 AWG bare, stranded, soft drawn copper wire. The ground loop must be installed at least 24" below grade and be at least 24" away from the structure. All bends in the conductor shall have a minimum radius of 8" and be no less than 90 degrees.

**Ground Mats:** In areas where electrodes cannot be driven, a ground mat consisting of a #6 solid copper or a copper-copper clad steel mesh, utilizing a 12" x 12" cross pattern may be used. All inter-connections in the mesh shall be brazed or silver soldered.

**Ground Plates:** Ground plates if utilized shall be 24" x 24" x .032" thick solid copper. Ground plates should only be used if a ground rod cannot be driven.

**Ground Connections:** Unless otherwise specified or approved by the owner, all connections below grade shall be by exothermic weld (Cadweld). Where exothermic welds may not be practical, UL approved grounding clamps that utilize two bolts for pressure may be used. NOTE: Prior approval must be obtained in order to use a mechanical connection below grade.

## 8. Earth Electrode System

The earth electrode system consists of a network of earth electrode rods, plates, mats or grids and their interconnecting conductors. The extensions into the building are used as the principle grounding point for connecting to the ground system serving the building. Ground potential is established by electrodes in the earth.

An electrode may be a metallic water pipe that has no isolation joints, a system of buried, driven rods interconnected with a bare wire that normally forms a ring around the building or a ground plane of horizontal buried wires. Depending upon soil conditions, building design and the existing water pipe networks, an electrode may be a combination of any of the above mentioned systems.



# LIGHTNING PROTECTION AND GROUNDING

Read all of Section B and this section before attempting any procedure. Pay particular attention to all Notes, Cautions and Warnings

|                        |                                  |   |
|------------------------|----------------------------------|---|
| GS-726-006             | REVISION:<br>A                   | TITLE:  |
| EFFECTIVE:<br>10/19/92 | SUPERCEDES:<br>Rev -, ECN 027194 | General Specification: Lightning Protection and Grounding |

## 9. Lightning Protection System

The lightning protection system provides a non-destructive path to ground for lightning energy contacting or induced onto or in a building. To effectively protect from lightning damage, air terminals are installed according to the National Fire Protection Association Lightning Protection Code (NFPA 780). Air terminals will intercept the discharge to keep it from penetrating or structurally damaging the building. This is done by providing a low impedance path from the air terminals to the earth electrode system.

## 10. Equipment Fault and Personal Safety System

The equipment fault protective system ensures that personnel are protected from shock hazard and equipment is protected from damage or destruction resulting from faults (lightning induced surges) that may develop in the electrical system. Deliberately engineered ground conductors (green wire safety ground) shall be provided throughout the AC distribution system to afford electrical paths of sufficient capacity, so that protective devices can operate promptly and efficiently. The use of conduit for grounding in lieu of a dedicated green wire is unacceptable.

Install the green wire ground (#6 stranded) with the AC power distribution conductors. There shall be no green wires spliced within the conduit. All splices shall be performed at the appropriate junction boxes.

Bond the ground conductor to all pull boxes, junction boxes and power panels.

In existing facilities where an existing conduit is not large enough to accommodate an additional ground conductor, or where a conduit section is insulated from other conduit sections, an external ground conductor may be installed to maintain continuity. All mounting hardware and connectors shall be UL approved.

All DC chargers are to be grounded to the green wire ground using UL approved connectors. At no point should the chargers be isolated from the grounding system.

All interior grounding should return to a single ground point. From this location it is then connected to the exterior ground system. Optional Interior Ground Halo: If an interior ground halo is to be installed around the inside perimeter of the structure, this conductor (#2/0 green insulated minimum) shall be securely fastened to the structure.

All connections to the halo shall be made using UL listed connectors.

Transient Voltage Surge Suppression: TVSS shall be provided at the main electrical service entrance panel. Protection at this point shall be as follows:

- UL 1449 Listed device

- 25,000 ampere surge capacity with maximum 495 volt clamping voltage

- Protection should be Line to Ground, Neutral to Ground and Line to Neutral

- Internally fused for safety

- Failure mode indicator lights

Suppression may be as the 14000 series of Harger Lightning Protection, Inc., 1066 Campus Drive, Mundelein, IL (800-842-7437), or MBP 120EFI series from EFI Electronics Corporation, 2415 South 2300 West, Salt Lake City, UT (801-977-9009).







# GENERAL SPECIFICATIONS

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# GENERAL SPECIFICATIONS



## INDUSTRIAL / WORKHORSE® 875E

|   |   |
|---|---|
| WEIGHT (without batteries) .....  | 995 lbs. (451 kg)   |
| GROUND CLEARANCE (at differential) .....                                      | 5 in (12.7 cm)  |
| TIRES .....   | 5.70 x 8 (6 ply rated, LRC)   |
| TIRE PRESSURE .....   | 70 psi (483 kPa)  |
| LOAD CAPACITY (including operator, passenger,<br>cargo and accessories) ..... | 3,000 lbs (1360 kg)   |
| CHASSIS .....   | Welded high yield strength tubular steel with powder coat paint   |
| BODY & FINISH .....   | Heavy duty four way diamond pattern body panels, modified acrylic<br>topcoat over polyester primer  |
| SAFETY .....  | Removable dash mounted key switch, reverse warning indicator,<br>'deadman' accelerator control, integral handgrip on hip restraints,<br>forward/reverse selector with 'neutral' and electric horn |
| LIGHTING PACKAGE .....  | Dual halogen headlights, taillights, brake lights   |
| STEERING WHEEL .....  | Pencil holder integrated in clipboard   |
| BRAKES .....  | Dual rear wheel, hydraulic drum brakes. Hand operated parking brake<br>with manual adjustment. Optional front hydraulic brakes  |
| FRONT SUSPENSION .....  | Leaf springs with hydraulic shock absorbers   |
| REAR SUSPENSION .....   | Leaf springs with hydraulic shock absorbers   |
| STEERING .....  | Self-compensating double reduction rack and pinion  |
| SEATING .....   | Formed fabric backed vinyl covers over cushion foam. Seating for<br>operator and one passenger  |
| SPEED .....   | 12 - 14 mph (19 - 22 kph)   |
| TRANSAXLE .....   | High efficiency differential with helical gears, 14.78:1 ratio  |
| CLASSIFICATION .....  | UL (Underwriters Laboratory) Approved type "E" classification   |

### 36 VOLT VEHICLE:

|                         |   |
|-------------------------|---|
| ELECTRICAL SYSTEM ..... | 36 volt DC, six 6 volt heavy duty, deep cycle storage batteries (107<br>minute, 220 amp hour @ 20 hour discharge rate)  |
| SPEED CONTROL .....     | Solid state controller, 400 amp rated   |
| MOTOR .....             | 36 volt DC, high efficiency series wound, brazed armature, solid<br>copper windings, vented, 2 hp at 2800 rpm, 3 hp at 2350 rpm   |
| CHARGER .....           | PowerWise™ on board or portable fully automatic, 21 amp DC output<br>at 36 volts; input 110 - 120 volts, 9.5 amps, 60 cycle AC, Underwriters<br>Laboratory (UL) Listed, CSA Certified, anti-drive away charger/vehicle<br>interlock |

### 48 VOLT VEHICLE:

|                         |  |
|-------------------------|--|
| ELECTRICAL SYSTEM ..... | 48 volt DC, eight 6 volt heavy duty deep cycle batteries (107 minute,<br>220 amp hour @ 20 hour discharge rate)  |
| SPEED CONTROL .....     | Solid State HDI Controller, 350 amp rated  |
| MOTOR .....             | Heavy duty, 48 volt DC, high efficiency series wound, brazed armature,<br>solid copper windings, vented, 5.5 hp (4.0 kw) at 1980 rpm   |
| CHARGER .....           | On board or portable fully automatic, 21 amp DC output at 48 volts;<br>input 110 - 120 volts, 12.2 amps, 60 cycle AC, Underwriters Laboratory<br>(UL) Listed, CSA Certified, anti-drive away charger/vehicle interlock |

Specifications subject to change without notice.



# GENERAL SPECIFICATIONS

## INDUSTRIAL / WORKHORSE® 875PE

|   |   |
|---|---|
| WEIGHT (without batteries) .....  | 1,038 lbs. (471 kg)   |
| GROUND CLEARANCE (at differential) .....                                      | 5 in (12.7 cm)  |
| TIRES .....   | 5.70 x 8 (6 ply rated, LRC)   |
| TIRE PRESSURE .....   | 70 psi (483 kPa)  |
| LOAD CAPACITY (including operator, passenger,<br>cargo and accessories) ..... | 2,000 lbs (907 kg)  |
| CHASSIS .....   | Welded high yield strength tubular steel with powder coat paint   |
| BODY & FINISH .....   | Heavy duty four way diamond pattern body panels, modified acrylic topcoat over polyester primer   |
| SAFETY .....  | Removable dash mounted key switch, reverse warning indicator, 'deadman' accelerator control, integral handgrip on hip restraints, forward/reverse selector with 'neutral' and electric horn |
| LIGHTING PACKAGE .....  | Dual halogen headlights, taillights, brake lights   |
| STEERING WHEEL .....  | Pencil holder integrated in clipboard   |
| BRAKES .....  | Dual rear wheel, hydraulic drum brakes. Hand operated parking brake with manual adjustment. Optional front hydraulic brakes   |
| FRONT SUSPENSION .....  | Leaf springs with hydraulic shock absorbers   |
| REAR SUSPENSION .....   | Leaf springs with hydraulic shock absorbers   |
| STEERING .....  | Self-compensating double reduction rack and pinion  |
| SEATING .....   | Formed fabric backed vinyl covers over cushion foam. Seating for operator and three passengers; seating for five passengers optional  |
| SPEED .....   | 12 - 14 mph (19 - 22 kph)   |
| TRANSAXLE .....   | High efficiency differential with helical gears, 14.78:1 ratio  |
| CLASSIFICATION .....  | UL (Underwriters Laboratory) Approved type "E" classification   |

### 36 VOLT VEHICLE:

|                         |  |
|-------------------------|--|
| ELECTRICAL SYSTEM ..... | 36 volt DC, six 6 volt heavy duty, deep cycle storage batteries (107 minute, 220 amp hour @ 20 hour discharge rate)  |
| SPEED CONTROL .....     | Solid state controller, 400 amp rated  |
| MOTOR .....             | 36 volt DC, high efficiency series wound, brazed armature, solid copper windings, vented, 2 hp at 2800 rpm, 3 hp at 2350 rpm   |
| CHARGER .....           | PowerWise™ on board or portable fully automatic, 21 amp DC output at 36 volts; input 110 - 120 volts, 9.5 amps, 60 cycle AC, Underwriters Laboratory (UL) Listed, CSA Certified, anti-drive away charger/vehicle interlock |

### 48 VOLT VEHICLE:

|                         |  |
|-------------------------|--|
| ELECTRICAL SYSTEM ..... | 48 volt DC, eight 6 volt heavy duty deep cycle batteries (107 minute, 220 amp hour @ 20 hour discharge rate)   |
| SPEED CONTROL .....     | Solid State HDI Controller, 350 amp rated  |
| MOTOR .....             | Heavy duty, 48 volt DC, high efficiency series wound, brazed armature, solid copper windings, vented, 5.5 hp (4.0 kw) at 1980 rpm  |
| CHARGER .....           | On board or portable fully automatic, 21 amp DC output at 48 volts; input 110 - 120 volts, 12.2 amps, 60 cycle AC, Underwriters Laboratory (UL) Listed, CSA Certified, anti-drive away charger/vehicle interlock |

Specifications subject to change without notice.

# GENERAL SPECIFICATIONS



## INDUSTRIAL 875AE

|   |   |
|---|---|
| WEIGHT (without batteries) .....  | 995 lbs. (451 kg)   |
| GROUND CLEARANCE (at differential) .....                                      | 5 in (12.7 cm)  |
| TIRES .....   | 5.70 x 8 (6 ply rated, LRC)   |
| TIRE PRESSURE .....   | 70 psi (483 kPa)  |
| LOAD CAPACITY (including operator, passenger,<br>cargo and accessories) ..... | 2000 lbs (907 kg)   |
| CHASSIS .....   | Welded high yield strength tubular steel with powder coat paint   |
| BODY & FINISH .....   | Heavy duty four way diamond pattern body panels, modified acrylic topcoat over polyester primer (White)   |
| SAFETY .....  | Removable dash mounted key switch, reverse warning indicator, 'deadman' accelerator control, integral handgrip on hip restraints, forward/reverse selector with 'neutral' and electric horn |
| LIGHTING PACKAGE .....  | Dual halogen headlights, taillights, brake lights   |
| STEERING WHEEL .....  | Pencil holder integrated in clipboard   |
| BRAKES .....  | Dual rear wheel, hydraulic drum brakes. Hand operated parking brake with manual adjustment. Optional front hydraulic brakes   |
| FRONT SUSPENSION .....  | Leaf springs with hydraulic shock absorbers   |
| REAR SUSPENSION .....   | Leaf springs with hydraulic shock absorbers   |
| STEERING .....  | Self-compensating double reduction rack and pinion  |
| SEATING .....   | Formed fabric backed vinyl covers over cushion foam. Seating for operator, one passenger and patient attendant  |
| SPEED .....   | 12 - 14 mph (19 - 22 kph)   |
| TRANSAXLE .....   | High efficiency differential with helical gears, 14.78:1 ratio  |
| CLASSIFICATION .....  | UL (Underwriters Laboratory) Approved type "E" classification   |

### 36 VOLT VEHICLE:

|                         |  |
|-------------------------|--|
| ELECTRICAL SYSTEM ..... | 36 volt DC, six 6 volt heavy duty, deep cycle storage batteries (107 minute, 220 amp hour @ 20 hour discharge rate)  |
| SPEED CONTROL .....     | Solid state controller, 400 amp rated  |
| MOTOR .....             | 36 volt DC, high efficiency series wound, brazed armature, solid copper windings, vented, 2 hp at 2800 rpm, 3 hp at 2350 rpm   |
| CHARGER .....           | PowerWise™ on board or portable fully automatic, 21 amp DC output at 36 volts; input 110 - 120 volts, 9.5 amps, 60 cycle AC, Underwriters Laboratory (UL) Listed, CSA Certified, anti-drive away charger/vehicle interlock |

### 48 VOLT VEHICLE:

|                         |  |
|-------------------------|--|
| ELECTRICAL SYSTEM ..... | 48 volt DC, eight 6 volt heavy duty deep cycle batteries (107 minute, 220 amp hour @ 20 hour discharge rate)   |
| SPEED CONTROL .....     | Solid State HDI Controller, 350 amp rated  |
| MOTOR .....             | Heavy duty, 48 volt DC, high efficiency series wound, brazed armature, solid copper windings, vented, 5.5 hp (4.0 kw) at 1980 rpm  |
| CHARGER .....           | On board or portable fully automatic, 21 amp DC output at 48 volts; input 110 - 120 volts, 12.2 amps, 60 cycle AC, Underwriters Laboratory (UL) Listed, CSA Certified, anti-drive away charger/vehicle interlock |

Specifications subject to change without notice.



# GENERAL SPECIFICATIONS

## INDUSTRIAL / WORKHORSE® 881E

|   |   |
|---|---|
| WEIGHT (without batteries) .....  | 1144 lbs. (519 kg)  |
| GROUND CLEARANCE (at differential) .....                                      | 5 in (12.7 cm)  |
| TIRES .....   | 5.70 x 8 (8 ply rated, LRD)   |
| TIRE PRESSURE .....   | 70 psi (483 kPa)  |
| LOAD CAPACITY (including operator, passenger,<br>cargo and accessories) ..... | 3,000 lbs (1360 kg)   |
| CHASSIS .....   | Welded high yield strength tubular steel with powder coat paint   |
| BODY & FINISH .....   | Heavy duty four way diamond pattern body panels, modified acrylic topcoat over polyester primer   |
| SAFETY .....  | Removable dash mounted key switch, reverse warning indicator, 'deadman' accelerator control, integral handgrip on hip restraints, forward/reverse selector with 'neutral' and electric horn                                 |
| LIGHTING PACKAGE .....  | Dual halogen headlights, taillights, brake lights   |
| STEERING WHEEL .....  | Pencil holder integrated in clipboard   |
| BRAKES .....  | Hydraulic, 4 wheel brakes standard, Drum type on rear, disc type on front. Hand operated parking brake with manual adjustment.  |
| FRONT SUSPENSION .....  | Leaf springs with hydraulic shock absorbers   |
| REAR SUSPENSION .....   | Leaf springs with hydraulic shock absorbers   |
| STEERING .....  | Self-compensating double reduction rack and pinion  |
| SEATING .....   | Formed fabric backed vinyl covers over cushion foam. Seating for operator and one passenger   |
| SPEED .....   | 12 - 14 mph (19 - 22 kph)   |
| ELECTRICAL SYSTEM .....   | 48 volt DC, eight 6 volt heavy duty deep cycle batteries (107 minute, 220 amp hour @ 20 hour discharge rate)  |
| SPEED CONTROL .....   | Solid State HDI Controller, 350 amp rated   |
| MOTOR .....   | Heavy duty, 48 volt DC, high efficiency series wound, brazed armature, solid copper windings, vented, 5.5 hp (4.0 kw) at 1980 rpm   |
| TRANSAXLE .....   | High efficiency differential with helical gears, 14.78:1 ratio  |
| CHARGER .....   | PowerWise™ on board or portable fully automatic, 21 amp DC output at 48 volts; input 110 - 120 volts, 12.2 amps, 60 cycle AC, Underwriters Laboratory (UL) Listed, CSA Certified, anti-drive away charger/vehicle interlock |
| CLASSIFICATION .....  | UL (Underwriters Laboratory) Approved type "E" classification   |

Specifications subject to change without notice.



# GENERAL SPECIFICATIONS

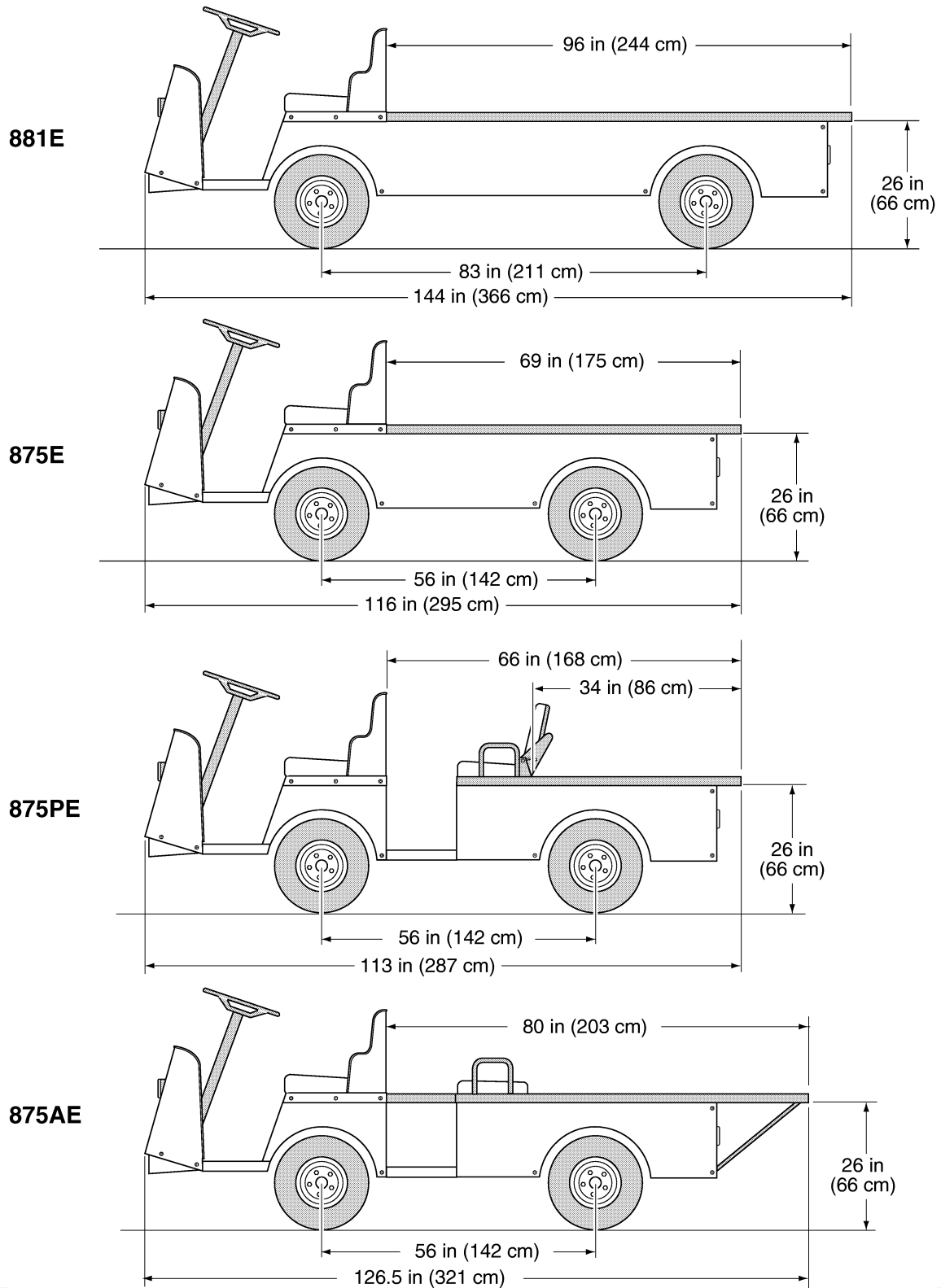


Fig. 1 Vehicle Dimensions

# GENERAL SPECIFICATIONS

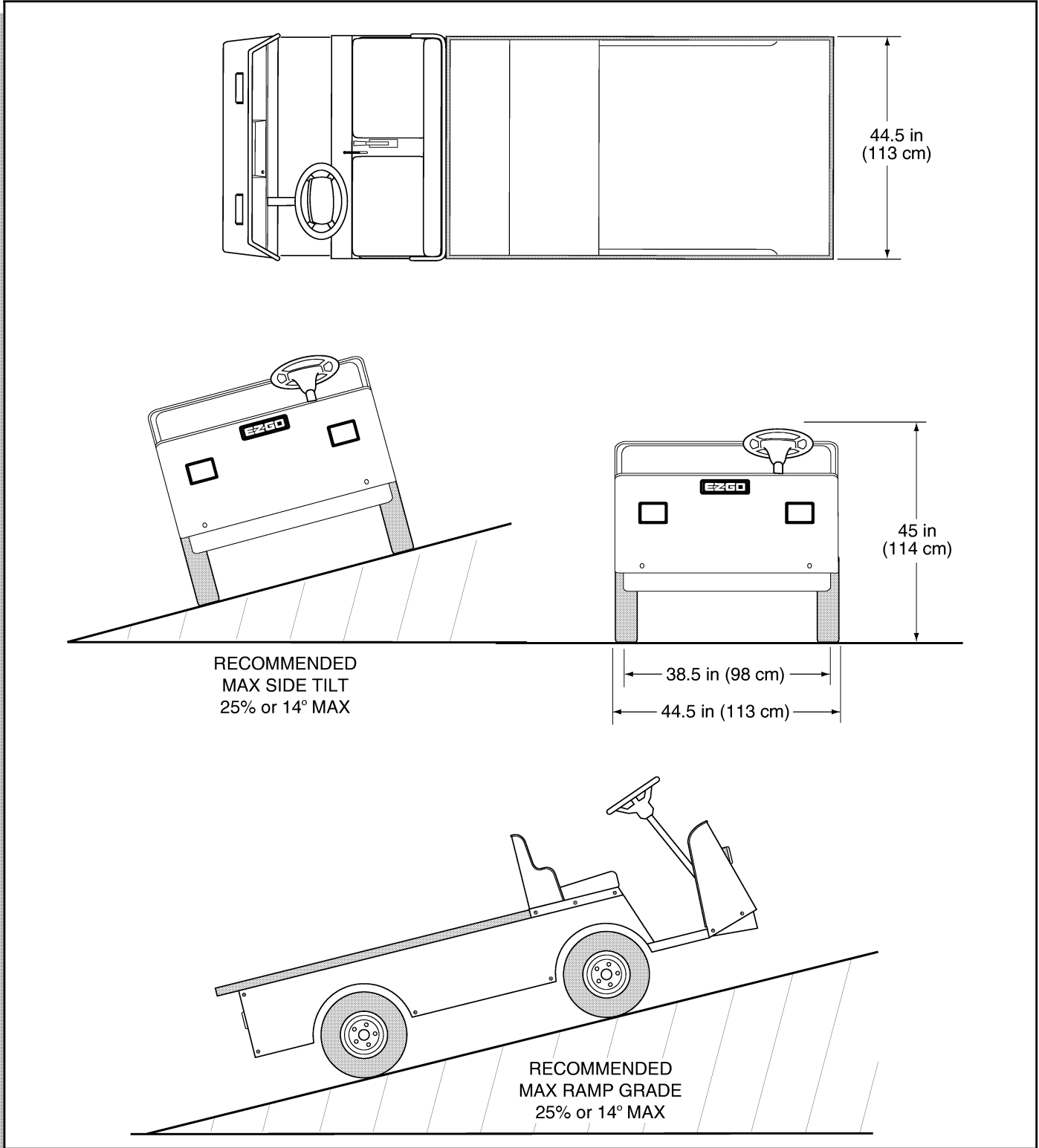


Fig. 2 Vehicle Dimensions and Incline Specifications

## GENERAL SPECIFICATIONS

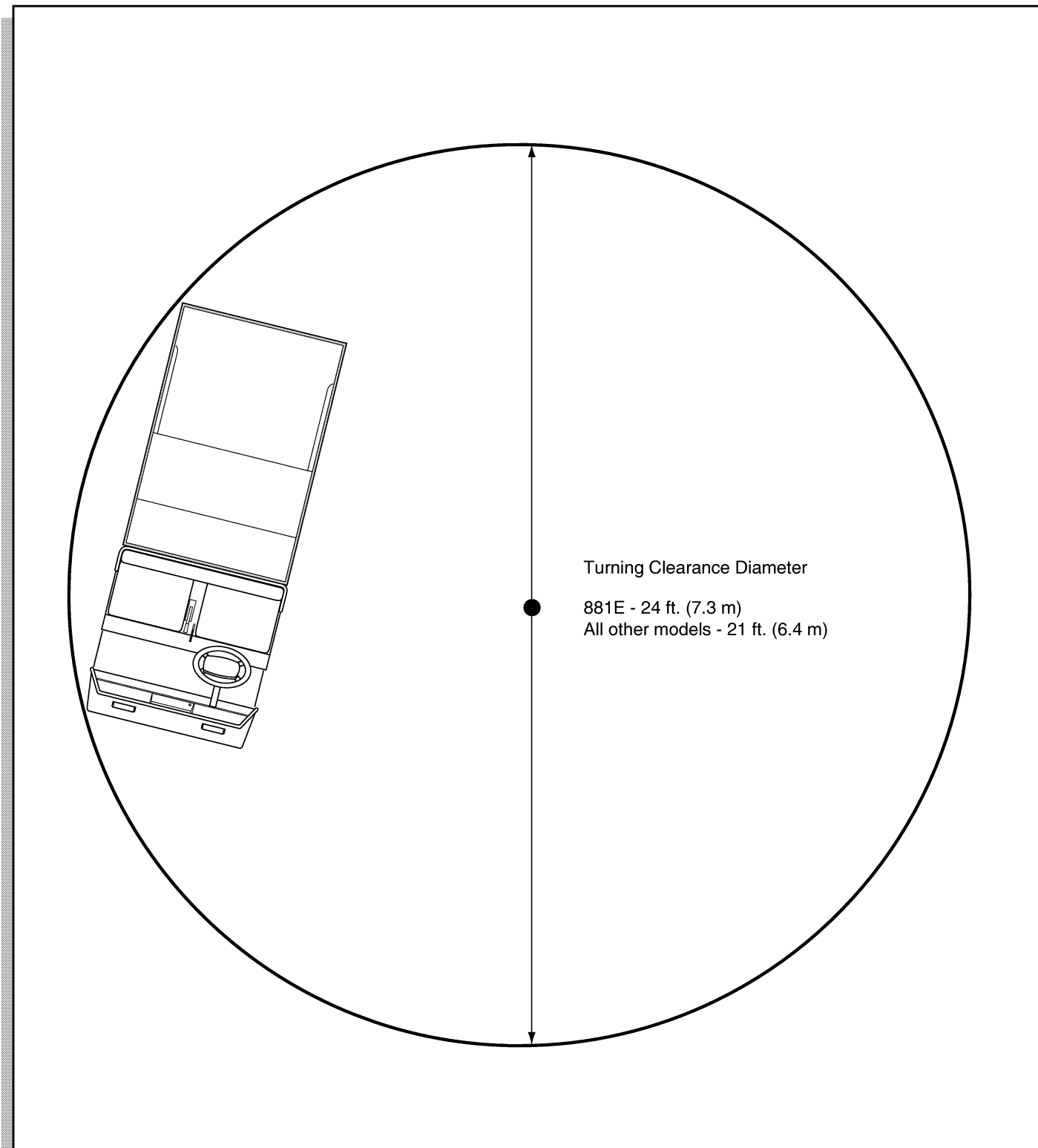


Fig. 3 Vehicle Turning Clearance Diameter



**NOTE**

Read and understand the following warnings before attempting to operate the vehicle:



**To prevent personal injury or death, observe the following:**

**When vehicle is to be left unattended, engage parking brake, move direction selector to neutral, turn key to 'OFF' position and remove key.**

**Drive vehicle only as fast as terrain and safety considerations allow. Consider the terrain and traffic conditions. Consider environmental factors which effect the terrain and the ability to control the vehicle.**

**Avoid driving fast down hill. Sudden stops or change of direction may result in a loss of control. Use service brake to control speed when traveling down an incline.**

**Use extra care and reduced speed when driving on poor surfaces, such as loose dirt, wet grass, gravel, etc.**

**All travel should be directly up or down hills.**

**Use extra care when driving the vehicle across an incline.**

**Stay in designated areas and avoid steep slopes. Use the parking brake whenever the vehicle is parked.**

**Keep feet, legs, hands and arms inside vehicle at all times.**

**Avoid extremely rough terrain.**

**Check area behind the vehicle before operating in reverse.**

**Make sure the direction selector is in correct position before attempting to start the vehicle.**

**Slow down before and during turns. All turns should be executed at reduced speed.**

**Always bring vehicle to a complete stop before shifting the direction selector.**

**See GENERAL SPECIFICATIONS for standard vehicle load and seating capacity.**

**NOTE**

Read and understand the following text and warnings before attempting to service vehicle:

In any product, components will eventually fail to perform properly as the result of normal use, age, wear or abuse. It is virtually impossible to anticipate all possible component failures or the manner in which each component may fail.

Be aware that a vehicle requiring repair indicates that the vehicle is no longer functioning as designed and therefore should be considered potentially hazardous. Use extreme care when working on any vehicle. When diagnosing, removing or replacing any components that are not operating correctly, take time to consider the safety of yourself and others around you should the component move unexpectedly.

Some components are heavy, spring loaded, highly corrosive, explosive or may produce amperage or reach high temperatures. Battery acid and hydrogen gas could result in serious bodily injury to the technician/mechanic and bystanders if not treated with the utmost caution. Be careful not to place hands, face, feet or body in a location that could expose them to injury should an unforeseen situation occur.



**Before working on the vehicle, remove all jewelry (rings, watch,**

**necklaces, etc.).**

**Be sure no loose clothing or hair can contact moving parts.**

**Use care not to touch hot objects.**

**Raise entire vehicle and support on jack stands before attempting to run or adjust powertrain.**

**Wear eye protection when working on or around the vehicle. In particular, use care when working around batteries, using solvents or compressed air.**

**Hydrogen gas is formed when charging batteries. Do not charge batteries without adequate ventilation.**

**Do not permit open flame or anyone to smoke in an area that is being used for charging batteries. A concentration of 4% hydrogen gas or more is explosive.**



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