

**Club Car**®

**2005**  
PRECEDENT



# Maintenance And Service



**IQ System  
Electric Vehicles**



## FOREWORD

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Club Car vehicles are designed and built to provide the ultimate in performance efficiency; however, proper maintenance and repair are essential for achieving maximum service life and continued safe and reliable operation.

This manual provides detailed information for the maintenance and repair of the electric Precedent vehicles, and should be thoroughly reviewed prior to servicing the vehicle. The procedures provided herein must be properly implemented, and the DANGER, WARNING, and CAUTION statements must be heeded.

This manual was written for the trained technician who already possesses knowledge and skills in electrical and mechanical repair. If the technician does not have such knowledge and skills, attempted service or repairs to the vehicle may render the vehicle unsafe. For this reason, Club Car advises that all repairs and/or service be performed by an authorized Club Car distributor/dealer representative or by a Club Car factory-trained technician.

It is the policy of Club Car, Inc. to assist its distributors and dealers in continually updating their service knowledge and facilities so they can provide prompt and efficient service for vehicle owners. Regional technical representatives, vehicle service seminars, periodic service bulletins, maintenance and service manuals, and other service publications also represent Club Car's continuing commitment to customer support.

This manual covers all aspects of typical vehicle service; unique situations, however, do sometimes occur when servicing a vehicle. If it appears that a service question is not answered in this manual, you may write to us at: Club Car, Inc.; P.O. Box 204658; Augusta, Georgia 30917; Attention: Technical Services, or contact a Club Car Technical Service Representative at (706) 863-3000, ext. 3580.

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This manual effective August 2, 2004.

## **WARNING**

- **Read Section 1 – Safety before attempting any service on the vehicle.**
- **Before servicing vehicle, read complete section(s) and any referenced information that may be relevant to the service or repair to be performed.**

**NOTE:** *This manual represents the most current information at the time of publication. Club Car, Inc. is continually working to further improve its vehicles and other products. These improvements may affect servicing procedures. Any modification and/or significant change in specifications or procedures will be forwarded to all Club Car dealers and will, when applicable, appear in future editions of this manual.*

*Club Car, Inc. reserves the right to change specifications and designs at any time without notice and without the obligation of making changes to units previously sold.*

*There are no warranties expressed or implied in this manual. See the limited warranty found in the vehicle owner's manual or write to Club Car, Inc., P.O. BOX 204658, Augusta, Georgia 30917-4658 USA, Attention: Warranty Department.*

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**SECTION i – INDEX**

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# SECTION 1 – SAFETY

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To ensure the safety of those servicing Club Car vehicles, and to protect the vehicles from possible damage resulting from improper service or maintenance, the procedures in this manual must be followed.

It is important to note that throughout this manual there are statements labeled DANGER, WARNING, or CAUTION. These special statements relate to specific safety issues, and must be read, understood, and heeded before proceeding with procedures. There are statements labeled NOTE, which provide other essential service or maintenance information.

## **▲ DANGER**

- A DANGER indicates an immediate hazard that will result in severe personal injury or death.

## **▲ WARNING**

- A WARNING indicates an immediate hazard that could result in severe personal injury or death.

## **▲ CAUTION**

- A CAUTION with the safety alert symbol indicates a hazard or unsafe practice that could result in minor personal injury.

## **CAUTION**

- A CAUTION without the safety alert symbol indicates a potentially hazardous situation that could result in property damage.

## GENERAL WARNINGS

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The following safety statements must be heeded whenever the vehicle is being operated, repaired, or serviced. Other specific safety statements appear throughout this manual and on the vehicle.

## **▲ DANGER**

- **Battery – Explosive gases! Do not smoke. Keep sparks and flames away from the vehicle and service area. Ventilate when charging or operating vehicle in an enclosed area. Wear a full face shield and rubber gloves when working on or near batteries.**
- **Battery – Poison! Contains acid! Causes severe burns. Avoid contact with skin, eyes, or clothing. Antidotes:**
  - **External: Flush with water. Call a physician immediately.**
  - **Internal: Drink large quantities of milk or water. Follow with milk of magnesia or vegetable oil. Call a physician immediately.**
  - **Eyes: Flush with water for 15 minutes. Call a physician immediately.**

**⚠ WARNING**

- Only trained technicians should service or repair the vehicle or battery charger. Anyone doing even simple repairs or service should have knowledge and experience in electrical and mechanical repair. The appropriate instructions must be used when performing maintenance, service, or accessory installation.
- Follow the procedures exactly as stated in this manual, and heed all DANGER, WARNING, and CAUTION statements in this manual as well as those on the vehicle and battery charger.
- Lift only one end of the vehicle at a time. Use a suitable lifting device (chain hoist or hydraulic floor jack) with 1000 lb. (454 kg) minimum lifting capacity. Do not use lifting device to hold vehicle in raised position. Use approved jack stands of proper weight capacity to support the vehicle and chock the wheels that remain on the floor. When not performing a test or service procedure that requires movement of the wheels, lock the brakes.
- Improper use of the vehicle or failure to properly maintain it could result in decreased vehicle performance, severe personal injury, or death.
- Any modification or change to the vehicle that affects the stability or handling of the vehicle, or increases maximum vehicle speed beyond factory specifications, could result in severe personal injury or death.
- Check the vehicle for proper location of all vehicle safety and operation decals and make sure they are in place and are easy to read.
- Wear safety glasses or approved eye protection when servicing the vehicle or battery charger. Wear a full face shield and rubber gloves when working on or near batteries.
- Do not wear loose clothing or jewelry such as rings, watches, chains, etc., when servicing the vehicle or battery charger.
- Use insulated tools when working near batteries or electrical connections. Use extreme caution to avoid shorting of components or wiring.
- Prior to leaving the vehicle unattended or servicing the vehicle, turn the key switch OFF, remove the key, and place the Forward/Reverse switch in the NEUTRAL position. Chock the wheels when servicing the vehicle.
- Place Tow/Run switch in the TOW position before disconnecting or connecting the batteries. Failure to heed this warning could result in a battery explosion or severe personal injury.
- To avoid unintentionally starting the vehicle, disconnect the batteries as shown (Figure 1-1).
- After disconnecting the batteries, wait 90 seconds for the controller capacitors to discharge.
- Do not leave children unattended on vehicle.

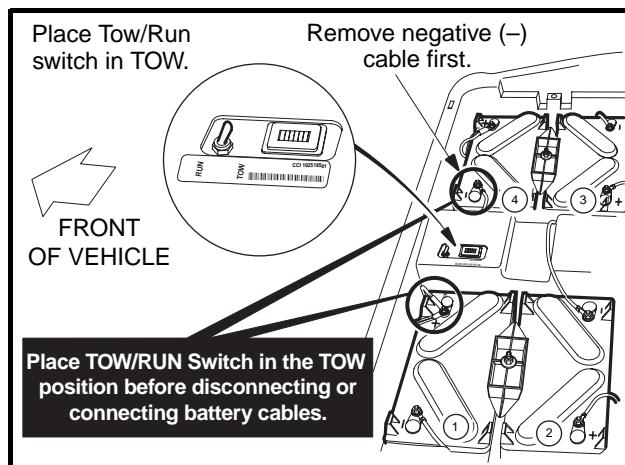


Figure 1-1 Battery Disconnection

## SECTION 2 – VEHICLE SPECIFICATIONS

SPECIFICATIONS	Two-Passenger Electric Vehicle	Four-Passenger Electric Vehicle
<b>POWER SOURCE</b>		
<b>Drive motor:</b> Direct drive, 48 volts DC, shunt-wound, 3.2 hp	•	•
<b>Transaxle:</b> Double reduction helical gear with 12.3:1 direct drive axle	•	•
<b>Electrical system:</b> 48 volts DC, reduced speed reverse	•	•
<b>Batteries:</b> High capacity, deep cycle, 12 volt	•	•
<b>Charger:</b> Automatic, 48-volt; UL and CSA listed	•	•
<b>Engine:</b> 4-cycle OHV, 286 cc, 9.0 hp rated, single-cylinder, air-cooled, with pressure lubrication system		
<b>Fuel system:</b> Side-draft carburetor with float bowl, fixed jets, fuel filters, and impulse fuel pump		
<b>Governor:</b> Automatic ground-speed sensing, internally geared in unitized transaxle		
<b>Ignition:</b> Transistor electronic ignition with electronic RPM limiter		
<b>Unitized transaxle:</b> Fully synchronized forward and reverse with neutral and reduced speed reverse (11.8:1 forward, 17.1:1 reverse)		
<b>Torque converter:</b> Automatic, variable-speed, dry type		
<b>Electrical system:</b> 12 volt, 500 cca at 0 °F (-17.8 °C), 650 at 32 °F (0 °C). 105-minute reserve capacity and 35-amp charging capacity		
<b>STEERING/SUSPENSION/BRAKES</b>		
<b>Steering:</b> Self-adjusting rack and pinion	•	•
<b>Suspension:</b> Front and rear tapered mono-leaf springs with dual hydraulic shocks	•	•
<b>Brakes:</b> Dual rear wheel self-adjusting brakes with cast iron drums and single brake pedal with automatic-release park brake	•	•
<b>BODY/CHASSIS</b>		
<b>Frame/Chassis:</b> Aluminum and composite	•	•
<b>Front and rear body:</b> Dupont Surlyn® Reflections	•	•
<b>Body finish:</b> High-gloss molded-in color	•	•
<b>Tires:</b> 18 x 8.5 – 8 tubeless, 4 ply rated	•	•
<b>DIMENSIONS/WEIGHT</b>		
<b>Overall length</b>	91.5 in. (232 cm)	104 in. (264 cm)
<b>Overall width</b>	47.25 in. (120 cm)	47.25 in. (120 cm)
<b>Overall height (with canopy)</b>	68.5 in. (174 cm)	71 in. (180 cm)
<b>Overall height (at steering wheel)</b>	48.0 in. (122 cm)	48.0 in. (122 cm)
<b>Wheelbase</b>	65.5 in. (166 cm)	65.5 in. (166 cm)
<b>Ground clearance</b>	4.5 in. (11 cm)	4.5 in. (11 cm)
<b>Front wheel tread</b>	34.5 in. (88 cm)	34.5 in. (88 cm)
Vehicle Specifications continued on next page...		

<b>SPECIFICATIONS</b>	<b>Two-Passenger Electric Vehicle</b>	<b>Four-Passenger Electric Vehicle</b>
<b>Rear wheel tread</b>	38.6 in. (98 cm)	38.6 in. (98 cm)
<b>Weight</b> (standard electric vehicle with canopy, with batteries)	855 lb. (388 kg)	970 lb. (440 kg)
<b>Weight</b> (standard gasoline vehicle with canopy, with battery, without fuel)		
<b>Forward speed</b>	12-15 mph (19-24 km/h)	
<b>Curb clearance circle</b> (diameter)	17 ft - 4in. (528 cm)	17 ft - 4 in. (528 cm)
<b>Standard seating capacity</b>	2	4
<b>LIQUID CAPACITIES</b>		
<b>Transaxle</b>	22 oz. (.67 liters)	22 oz. (.67 liters)
<b>Engine crankcase</b> (without filter)		
<b>Engine crankcase</b> (with filter)		
<b>Unitized transaxle</b>		
<b>Fuel tank</b>		
<b>TIRE PRESSURE</b>		
<b>Front and rear</b>	18-20 psi (1.24-1.38 bars)	18-20 psi (1.24-1.38 bars)



## SECTION 3 – GENERAL INFORMATION

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### **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

### **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

Important features unique to the different models covered in this manual are highlighted. Club Car, Inc. recommends the owner/operator read and understand this manual and pay special attention to features specific to their vehicle(s).

Refer to the owner's manual provided with the vehicle for information on the following topics:

- Pre-Operation and Daily Safety Checklist
- Controls and Indicators
- Driving Instructions
- Towing
- Transporting on a Trailer
- Subsequent Owner Registration
- Warranties

## SERIAL NUMBER IDENTIFICATION

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The serial number of the vehicle is printed on a bar code decal mounted on the passenger side inner dash (Figure 3-1).

**NOTE:** Always have the vehicle serial number available when ordering parts or making inquiries.

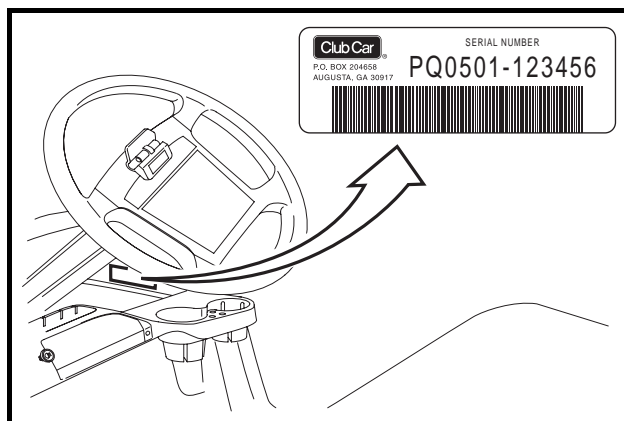


Figure 3-1 Serial Number Decal

## SAFETY COMMITTEE

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If the golf car is to be rented or is part of a fleet, we strongly recommend that a safety committee be appointed. One of the main concerns of this committee should be the safe operation of the golf cars.

This should include at a minimum:

- Where golf cars should be driven.
- Ensuring that proper warnings of driving hazards are displayed and visible. See below for list of signs available from Club Car Service Parts Department.
- Who should and who should not drive golf cars.
- Instructing first time drivers.
- Maintaining golf cars in a safe driving condition
- How various rules are to be enforced.

The safety committee should include all these items and such others as the committee feels necessary or appropriate. Warning signs available from Club Car are listed below.

WARNING SIGN	CCI P/N
Sharp Left	S9911211
Sharp Right	S9921211
Steep Hill	S9931211

## STORAGE

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See General Warnings, Section 1, Page 1-1.

### **⚠ WARNING**

- Turn the key switch OFF, remove the key, and leave the Forward/Reverse switch in the NEUTRAL position during storage. This is to prevent unintentionally starting the vehicle or a fire hazard.
- Do not attempt to charge frozen batteries or batteries with bulged cases. Discard the battery. Frozen batteries can explode.

### **⚠ CAUTION**

- Batteries in low state of charge will freeze at low temperatures.
- To avoid exposing electrical components to moisture and subsequent damages, do not use any type of pressure washing or steam cleaning equipment to wash the vehicle.
- Place Tow/Run switch in the TOW position.

## PREPARING THE ELECTRIC VEHICLE FOR EXTENDED OFF-SEASON STORAGE

1. Fully charge batteries. **See Section 13 – Batteries.**
2. Batteries should be clean and free of corrosion. Wash tops and terminals of batteries with a solution of baking soda and water (1 cup (237 mL) baking soda per 1 gallon (3.8 L) of water). Rinse solution off batteries. Do not allow this solution to enter the batteries. Be sure terminals are tight. Let the terminals dry and then coat them with Battery Terminal Protector Spray (CCI P/N 1014305).
3. Store vehicle in a cool, dry place. This will minimize battery self-discharge.
4. Adjust tires to recommended tire pressure. **See Section 2 – Vehicle Specifications.**
5. Perform all semiannual periodic lubrication. **See Periodic Lubrication Schedule, Section 10, Page 10-3..**
6. Thoroughly clean front body, rear body, seats, battery compartment, and underside of vehicle.
7. Do not engage the park brake. Chock the wheels to prevent the vehicle from rolling.
8. Keep batteries fully charged during storage.
  - Leave chargers plugged in during storage. The onboard computer will automatically activate the charger when necessary. If the battery charger is left plugged in during extended storage, the electrolyte should be checked monthly to ensure that proper level is maintained. AC power should also be checked periodically.
  - If charger cannot remain plugged in, or AC power will not be available during extended storage, disconnect the batteries for storage. See WARNING “To avoid unintentionally starting...” in **General Warnings, Section 1, Page 1-1.**

### **CAUTION**

- **Check the vehicle monthly to ensure the charger is operating correctly during storage.**

## RETURNING THE STORED ELECTRIC VEHICLE TO SERVICE

1. If necessary, connect batteries.
2. Fully charge batteries.

### **⚠ WARNING**

- **Do not attempt to charge frozen batteries or batteries with bulged cases. Discard the battery. Frozen batteries can explode.**
3. Adjust tire to recommended pressure. **See Section 2 – Vehicle Specifications.**
  4. Perform the Pre-Operation and Daily Safety Checklist. **See Section 10 – Periodic Maintenance.**



## SECTION 4 – BODY AND TRIM

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### **▲ DANGER**

- See General Warnings, Section 1, Page 1-1.

### **▲ WARNING**

- See General Warnings, Section 1, Page 1-1.

## CLEANING THE VEHICLE

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See General Warnings, Section 1, Page 1-1.

### **CAUTION**

- Do not use detergents or cleaning solvents that contain ammonia, aromatic solvents, or alkali materials on body panels or seats.
- Do not allow battery acid to drip on body panels. Battery acid will cause permanent damage. Wash spilled battery acid from body panels immediately.

Club Car Precedent vehicles are equipped with Surlyn<sup>®</sup> front and rear bodies. Use only commercially available automotive cleaners with a sponge or soft cloth for normal cleaning. A garden hose at normal residential water pressure is adequate.

Club Car does not recommend any type of pressure washing or steam cleaning. Such a process (especially if the vehicle has a Surlyn rear body that is removed) will expose electrical components to moisture. Moisture entering electrical components can result in water damage and subsequent component failure.

Use non-abrasive wax products. Do not use abrasive leveling or rubbing compounds; these will permanently dull the gloss. Battery acid, fertilizers, tars, asphalt, creosote, paint, or chewing gum should be removed immediately to prevent possible stains. **See following CAUTION and NOTE.**

### **CAUTION**

- Use of leveling or rubbing compounds will permanently dull finish of vehicle.
- Do not apply wax products to the black plastic material of the front and rear underbody, the front bumper, or the textured area of the rear beauty panel marked “NO STEP.” Wax will cause these surfaces to become discolored.

*NOTE: Dispose of waste water properly.*

## SEAT

To preserve seat appearance, clean regularly with mild soap or detergent applied with a sponge or soft cloth. Use a soft bristle brush to clean areas that are especially soiled. Use the following guidelines:

**Light Soiling:** A solution of 10% liquid dish soap and warm water applied with a soft, damp cloth is recommended. A soft bristle brush may be used if necessary. Wipe off any residue with a water dampened cloth.

**Difficult Stains:** Dampen a soft, white cloth with a solution of 10% household bleach (sodium hypochlorite) and 90% water. Rub gently to remove stain, then rinse with a water dampened cloth to remove bleach concentration.

**More Difficult Stains:** Perform previous procedure using full-strength bleach, or allow bleach to puddle on affected area for approximately 30 minutes. Rinse with a water dampened cloth to remove any remaining bleach concentration.

### **CAUTION**

- To prevent damage to the vehicle when removing difficult stains or heavy soiling, remove the seat bottom from the vehicle first.

## FRONT AND REAR BODY REPAIR

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See General Warnings, Section 1, Page 1-1.

### STRESS LINES OR STREAKS

Repeatedly flexing the Surlyn body can cause white stress lines or streaks in the finish. To remove them:

1. Hold a heat gun 12 inches (30 cm) away from the affected area, with the gun on its lowest heat setting.
2. Slowly wave the heat gun back and forth over the affected area until the streak fades.
3. It may be necessary to move the gun closer to the body to fade the streak, but under no circumstance should the gun be held closer than 6 inches (15 cm) to the body.

### **CAUTION**

- **Holding the heat gun too close to the body could melt the body or damage the finish.**

### MINOR IMPACT DAMAGE/DEFORMATIONS

Minor impact damage to a Surlyn body can be repaired using a procedure similar to the one used to remove stress lines. To remove deformations resulting from minor impact damage:

1. Hold a heat gun 12 inches (30 cm) away from the affected area, with the gun on its lowest heat setting.
2. Periodically remove the heat gun and bend the body, using a push block, in the opposite direction of the deformation.
3. Continue heating and bending the body until the original shape returns. Under no circumstance should the gun be held closer than 6 inches (15 cm) to the body. **See preceding CAUTION.**

### MINOR SCRATCHES AND SURFACE BLEMISHES

For minor scratches or blemishes in the Surlyn body that do not penetrate the finish:

1. Thoroughly clean the affected area using a strong, non-abrasive detergent and hot water, then clean with Ultra-Kleen<sup>®</sup> Solvent Cleaner to remove any oil-based contaminants.
2. Lightly buff imperfection with a clean soft cloth or buff pad. Do not use any kind of rubbing (abrasive) compound on body assemblies.
3. Wax the entire body part to restore luster and weather protection.

### GOUGES, PUNCTURES, TEARS, LARGE SCRATCHES, AND ABRASIONS

Touch-up is not recommended. Replace the entire body part or have it repaired by a professional paint and body repair shop with experience repairing Surlyn bodies.

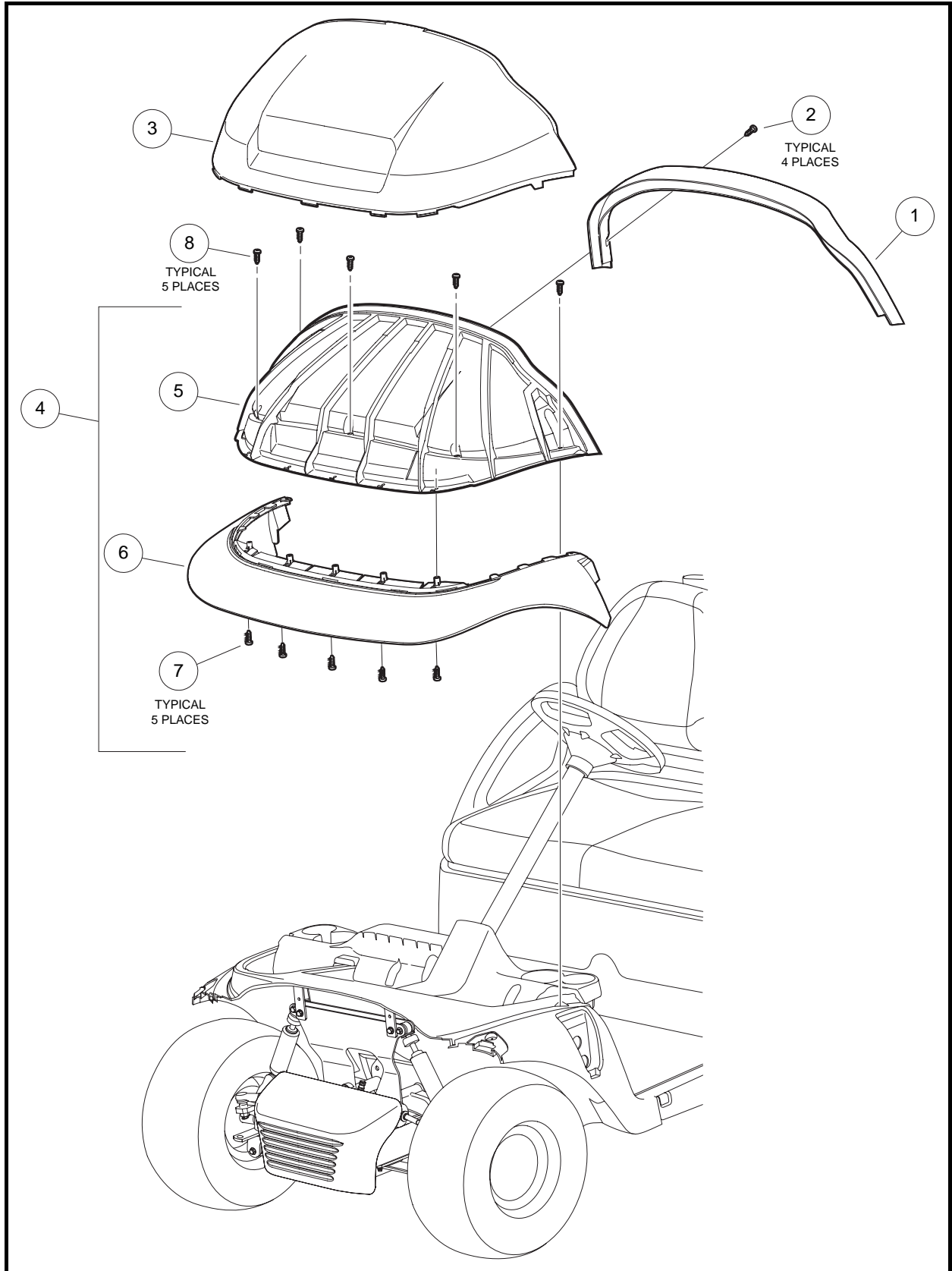


Figure 4-1 Front Body

## FRONT BODY

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See General Warnings, Section 1, Page 1-1.

### FRONT BODY REMOVAL

1. Remove the four screws (2) and pull the brow cap (1) from the brow and fascia assembly (4) (**Figure 4-1, Page 4-3**).
2. Pull the front beauty panel (3) up and away from the brow and fascia assembly (4), disengaging the snap tabs.
3. If the vehicle is equipped with a canopy, loosen the canopy support cover then loosen, but do not remove, the front canopy support bolts. If there is no canopy, remove the non-canopy cover.
4. Remove the five screws (8) and lift the brow and fascia assembly (4) from the front underbody.
5. Remove the five screws (7) to separate the front fascia (6) from the brow (5).

### FRONT BODY INSTALLATION

1. Install fascia (6) to brow (5) with five screws (7). Tighten screws to 3.3 ft-lb (4.5 N-m) (**Figure 4-1, Page 4-3**).
2. Install brow and fascia assembly (4) to front underbody with five screws (8). Tighten screws to 1.8 ft-lb (2.5 N-m).
3. Install front beauty panel (3) over brow (5). Tabs on the forward edge of the front beauty panel should fit into slots between the fascia and the brow.
4. Position brow cap (1) to cover the edge of both the brow (5) and the front beauty panel (3). Secure brow cap (1) with four screws (2). Tighten screws to 3.3 ft-lb (4.5 N-m).

## FRONT BUMPER

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The underbody bracket (1) connects the front suspension to the front underbody (**Figure 4-2, Page 4-5**). Each bracket is secured in place by two taptite screws (2) tightened to 13 ft-lb (17.6 N-m).

The front bumper (3) is attached to the vehicle frame rails by nuts (5) and bolts (4). The nuts (5) need to go on top of the bumper attaching brackets, always insert the bolts (4) through the bottom. The nuts are tightened to 13.3 ft-lb (18 N-m).

## INSTRUMENT PANEL

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See General Warnings, Section 1, Page 1-1.

### INSTRUMENT PANEL REMOVAL

1. Remove two screws (5) at sides and one screw (4) on top of instrument panel (3) (**Figure 4-3, Page 4-5**).
2. Tilt instrument panel up to release it from the dash assembly (1).
3. Disconnect the electrical connector on the passenger side of the instrument panel (3) and remove the panel.
4. Remove two barrel fasteners (7) to release dash tray (6).
5. Remove three screws (2) and remove dash assembly (1) from vehicle.



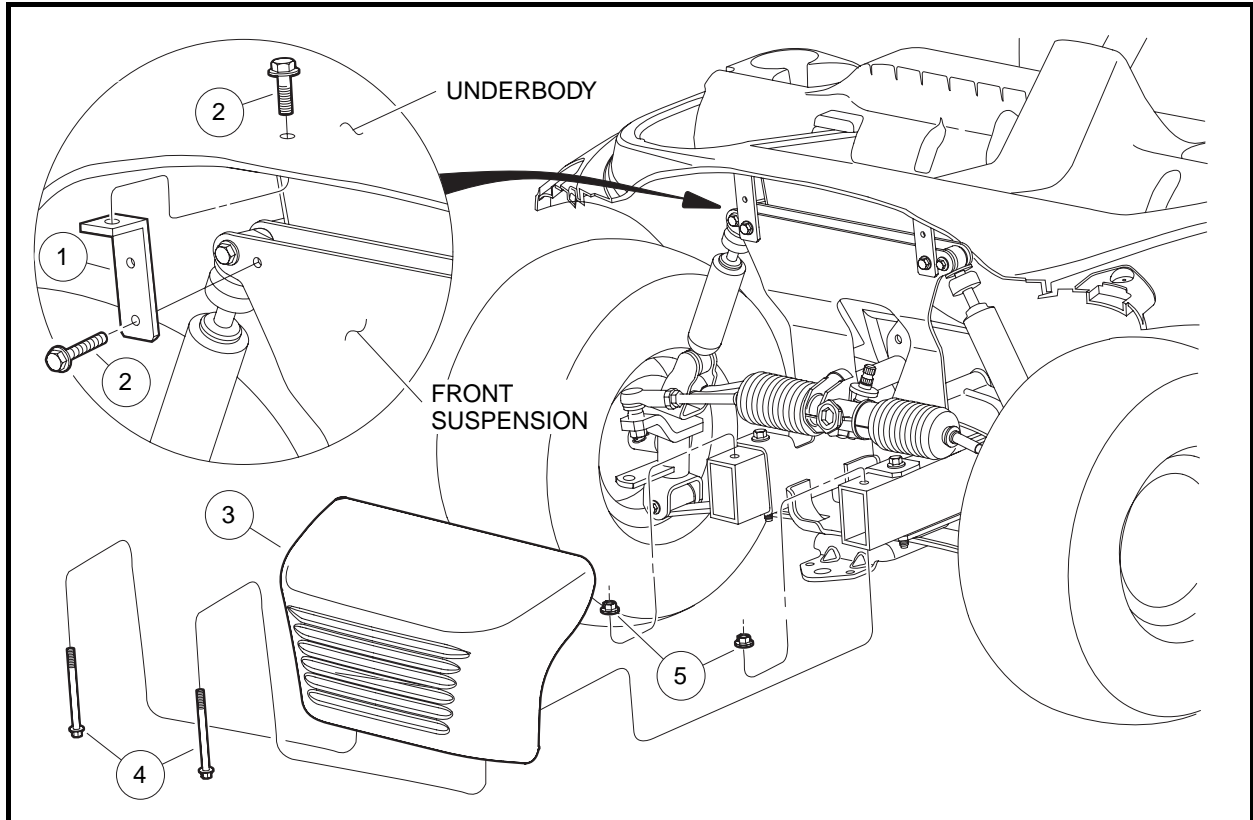


Figure 4-2 Bracket and Front Bumper

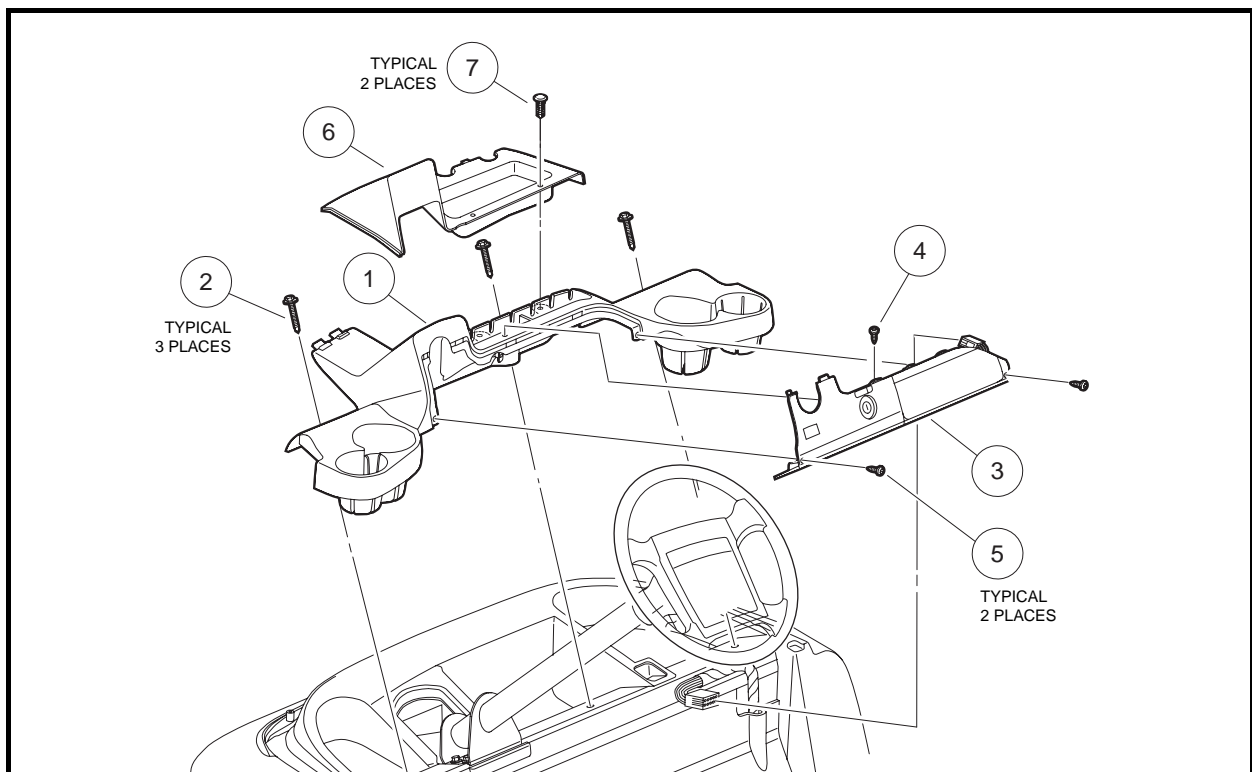


Figure 4-3 Instrument Panel

## INSTRUMENT PANEL INSTALLATION

1. Position dash assembly (1) on vehicle. Make sure tabs on the forward edge engage to front underbody. Secure assembly in place with three screws (2) (**Figure 4-3, Page 4-5**). Tighten screws to 8.8 ft-lb (12 N·m).
2. Position dash tray (6) in dash and secure with two barrel fasteners (7).
3. Install the instrument panel.
  - 3.1. Connect the electrical connector on the instrument panel to the harness connector.
  - 3.2. Position the instrument panel (3) on the dash assembly. Make sure tabs on upper edge properly engage with the corresponding slots on the dash assembly. Ensure that there are no wires exposed or pinched during positioning.
  - 3.3. Secure instrument panel to the dash assembly with screws (4 and 5). Tighten screws to 1.8 ft-lb (2.5 N·m).

## FLOOR MAT AND RETAINERS

See General Warnings, Section 1, Page 1-1.

The floor mat retainers secure the floor mat to the vehicle and also provide a clean appearance to the side of the vehicle. Normally, if only the floor mat (3) needs to be removed, the screws (2) can be loosened slightly to allow the floor mat to be slid from beneath the retainers (1) (**Figure 4-4, Page 4-6**).

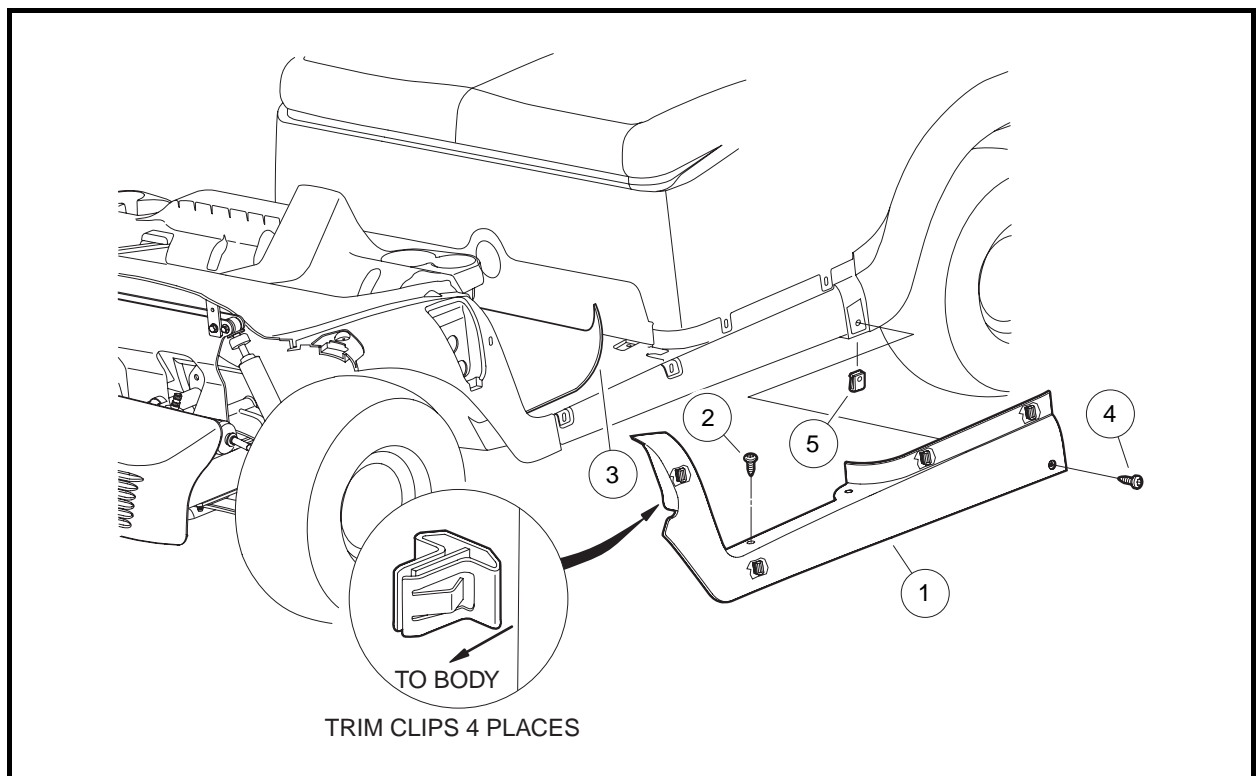


Figure 4-4 Floor Mat Retainer

## FLOOR MAT RETAINER REMOVAL

1. Remove screws (2) from top of retainer (1) (**Figure 4-4, Page 4-6**).
2. Remove screw (4) from lower rear corner of retainer. This screw threads into a J-clip (5) that is attached to the rear underbody.
3. Carefully pull on retainer to separate the trim clips from their respective slots. Trim clips do not normally need to be removed from the retainer.

## FLOOR MAT RETAINER INSTALLATION

1. Position the retainer on the vehicle and press firmly to engage the trim clips to the vehicle (**Figure 4-4, Page 4-6**).
2. Install one screw (4) at the lower rear of the retainer. Tighten screw to 1.8 ft-lb (2.5 N·m).
3. Ensure the floor mat is properly positioned beneath the top flange of the retainer and install two screws (2). Tighten screws to 4.4 ft-lb (6.0 N·m).

## KICK PLATE AND CHARGER RECEPTACLE BEZEL

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See General Warnings, Section 1, Page 1-1.

## KICK PLATE AND CHARGER RECEPTACLE BEZEL REMOVAL

1. If charger bezel (4) requires removal, use charger bezel tool (CCI P/N 102562401) to remove bezel from the kick plate (**Figure 4-5, Page 4-8**).
2. Remove floor mat. **See Floor Mat and Retainers, Section 4, Page 4-6.**
3. Remove three screws (1) that hold the kick plate (2) to the vehicle.
4. Remove the two front screws (3) that hold the beauty panel to the vehicle. Raise the forward portion of the rear beauty panel to disengage it from the tabs on the upper portion of the kick plate.
5. Remove kick plate from vehicle.

## KICK PLATE AND CHARGER RECEPTACLE BEZEL INSTALLATION

1. Position the kick plate (2) on the vehicle and secure with three screws (1) (**Figure 4-5, Page 4-8**). Ensure front lower edge of rear beauty panel mates with the kick plate. Tighten screws to 3.3 ft-lb (4.5 N·m).
2. Install two front screws (3) to secure the rear beauty panel. Tighten screws to 3.7 ft-lb (5 N·m).
3. Install floor mat. **See Floor Mat and Retainers, Section 4, Page 4-6.**
4. Snap charger bezel (4) in place on the kick plate.

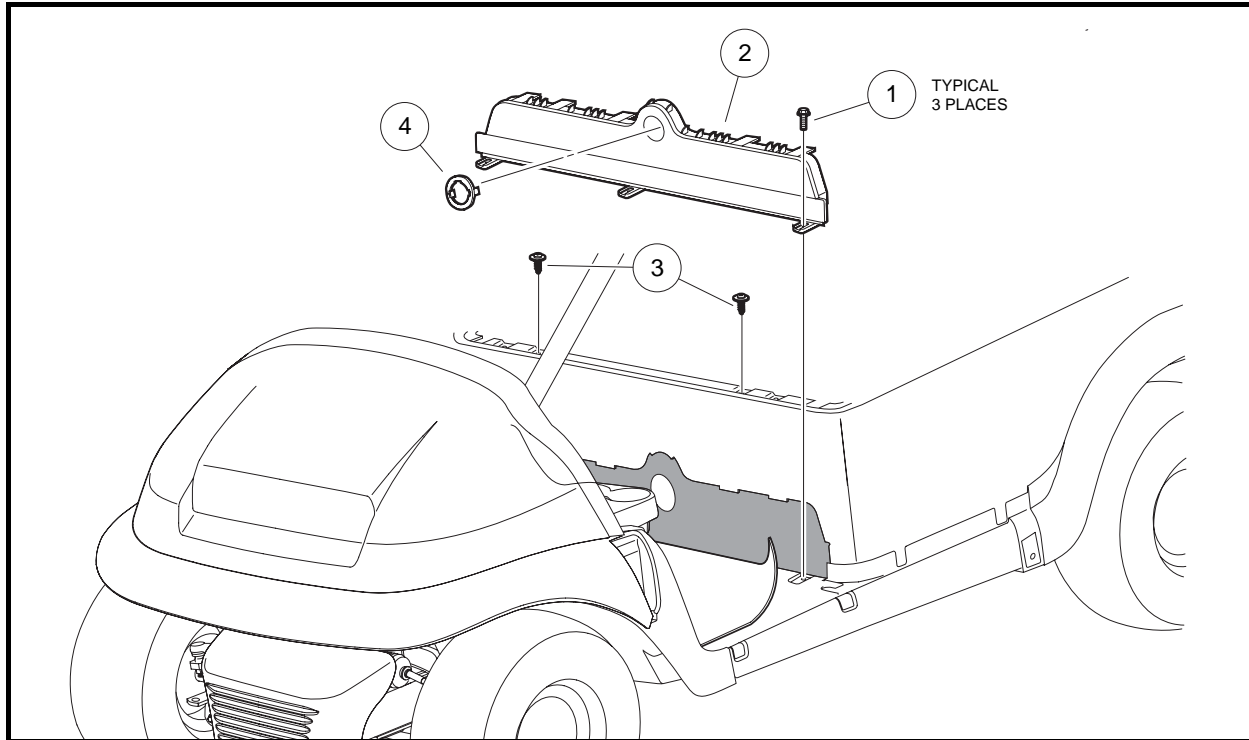


Figure 4-5 Kick Plate and Charger Receptacle Bezel

## REAR BODY – TWO-PASSENGER VEHICLES

See General Warnings, Section 1, Page 1-1.

### UNIVERSAL ACCESSORY MOUNTING

The Structural Accessory Module (SAM) includes two threaded inserts on both the driver side and the passenger side (**Figure 4-6, Page 4-8**). These inserts serve as common attachment points for various accessories. Accessories that can be mounted to the SAM include single or dual sand bottles, sand bucket, and the club cleaner.

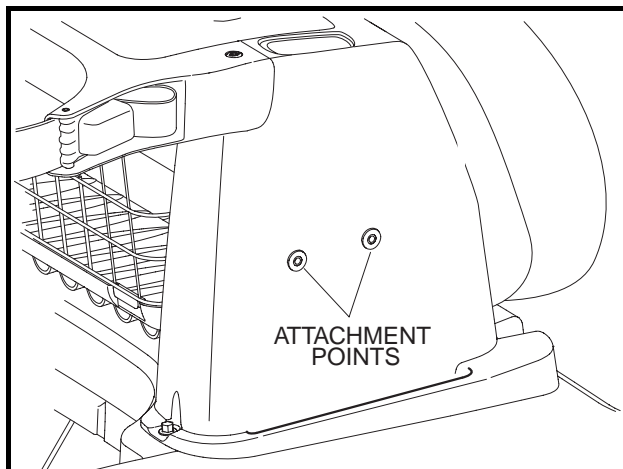


Figure 4-6 Universal Accessory Mounting

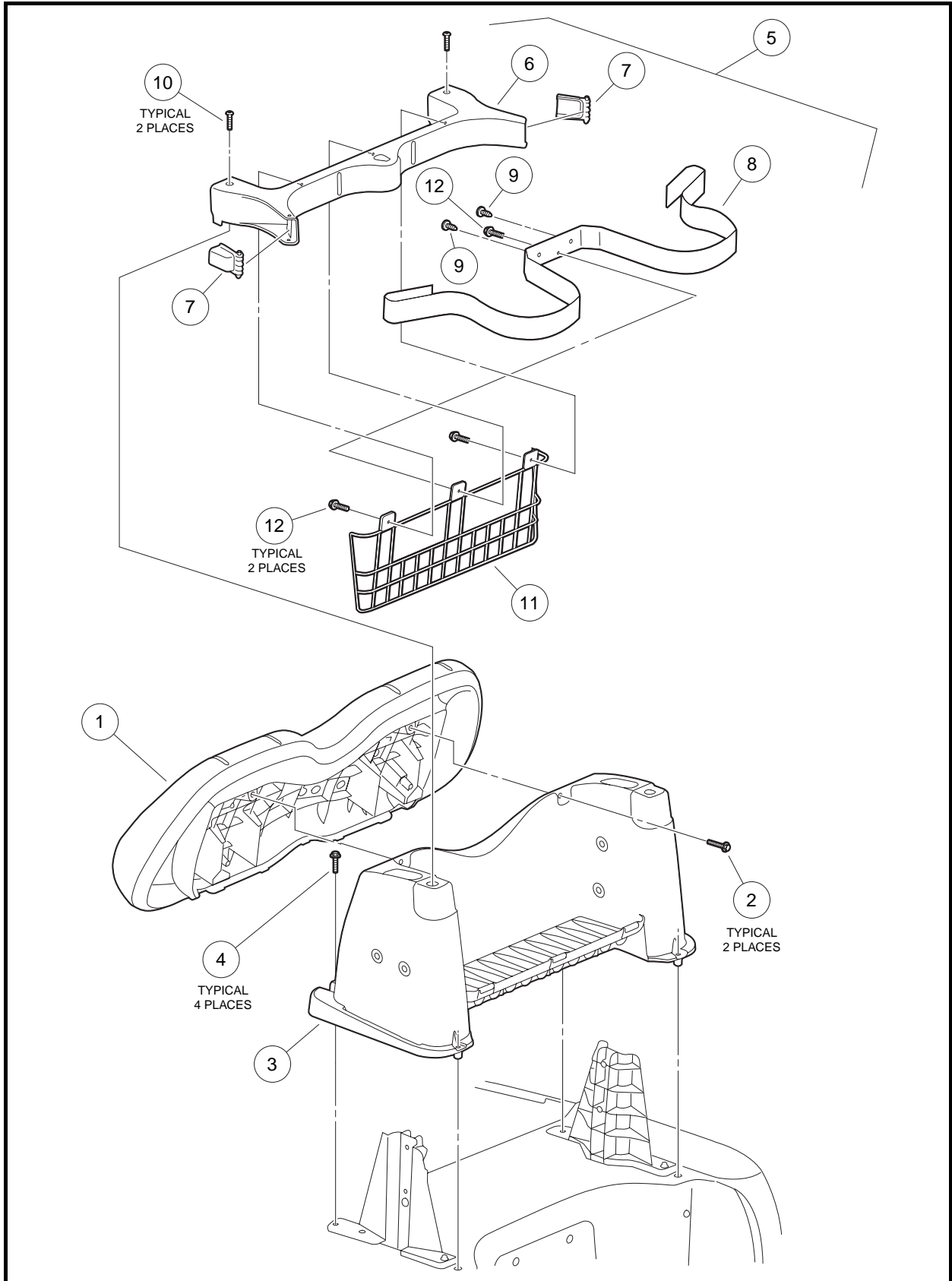


Figure 4-7 Backrest and SAM

## BACKREST AND STRUCTURAL ACCESSORY MODULE (SAM)

### SAM Removal

1. If the vehicle has a canopy, the rear upright supports must be removed from the SAM.
1. Remove four bolts (4) to release the SAM (3) from the vehicle (**Figure 4-7, Page 4-9**)

### SAM Installation

1. Position the SAM (3) over its mounting holes and secure with four screws (4). Tighten screws to 53 in-lb (6 N·m) (**Figure 4-7, Page 4-9**).

### Backrest

The backrest (1) is secured to the SAM (3) with two screws (2) (**Figure 4-7, Page 4-9**). When replacing the backrest, tighten screws (2) to 5.9 ft-lb (8 N·m).

### Bag Rack Removal

1. Remove two screws (10) to release the bag hoop (6) and related components from the SAM (3) (**Figure 4-7, Page 4-9**).
2. Bag strap (8) may be released by removing two plastic barrel connectors (9) and one screw (12).
3. Bag strap buckles (7) may be snapped out of bag hoop (6).

### Bag Rack Installation

Installation is the reverse of removal. Tighten screw (12) to 4.8 ft-lb (6.5 N·m) and screws (10) to 11.8 ft-lb (16 N·m) (**Figure 4-7, Page 4-9**).

### Sweater Basket

The sweater basket (11) is secured to the bag hoop assembly by three screws (12). Tabs on the upper edge of the basket align with holes in the bag hoop (6) for installation purposes. Tighten screws (12) to 4.8 ft-lb (6.5 N·m) to secure the sweater basket (**Figure 4-7, Page 4-9**).

## REAR BODY COMPONENTS (TWO-PASSENGER)

### Rear Beauty Panel Removal

1. Remove SAM. **See SAM Removal on page 4-10.**
2. Remove one screw (3) from each canopy support bracket (1 and 2) (**Figure 4-8, Page 4-11**). Remove canopy supports.
3. Remove four screws (13) attaching the rear beauty panel (12) to the fuel bucket.
4. Remove two screws (14) and remove Forward/Reverse switch housing (15) from vehicle.
5. Disconnect electrical wires from the Forward/Reverse switch (16).
6. Lift rear beauty panel from vehicle.

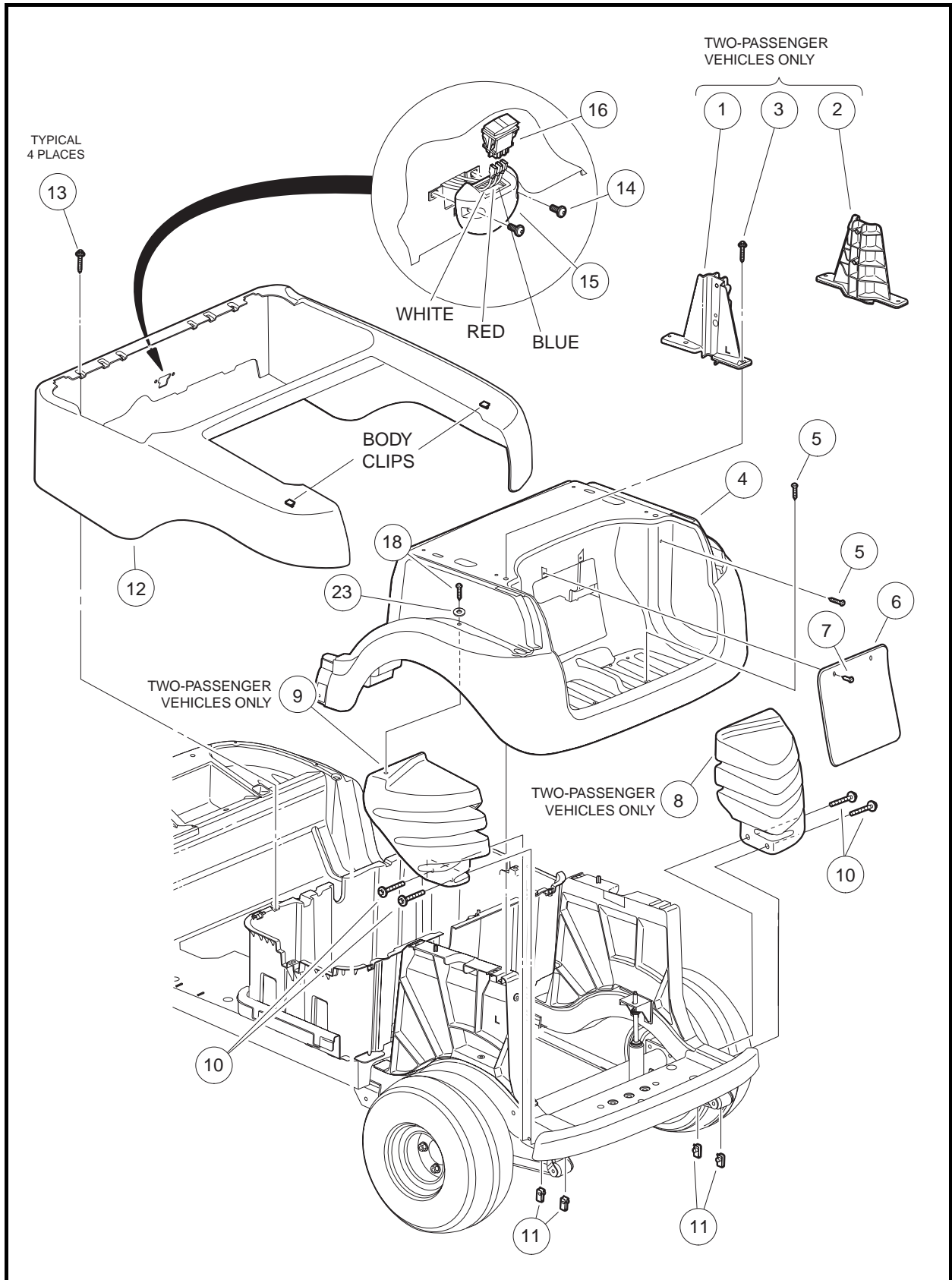


Figure 4-8 Rear Body Components

## Rear Beauty Panel Installation

1. Install rear beauty panel (12) on vehicle. Make sure body clips on the rear of the beauty panel engage the mating slot in the rear underbody. Secure beauty panel in place with four screws (13). Tighten screws to 3.7 ft-lb (5 N·m) **(Figure 4-8, Page 4-11)**.
2. Connect the three wires to the Forward/Reverse switch (16) as shown.
3. Position the Forward/Reverse switch housing (15) on the front of beauty panel (12) and secure with two screws (14). Tighten screws to 20 in-lb (2.3 N·m).
4. Position canopy support brackets (1 and 2) on vehicle and secure each with one screw (3). Tighten screws to 53 in-lb (6 N·m).

## Access Panel

Access panel (6) is secured to the rear underbody (4) with two expanding screws (7) **(Figure 4-8, Page 4-11)**. When replacing the panel, tighten screws (7) enough to hold the panel in place.

## Rear Underbody Removal

1. Remove four screws (5) attaching the rear underbody (4) to vehicle **(Figure 4-8, Page 4-11)**.
2. Remove two screws (18) and washers (23) that attach the underbody to the two liners (8 and 9).
3. Lift the rear edge of the rear underbody (4) until the front portion slides out from beneath the front underbody. Remove the rear underbody from the vehicle.

## Rear Underbody Installation

1. Install rear underbody (4) on the vehicle **(Figure 4-8, Page 4-11)**. Install two washers (23) and screws (18) to secure the underbody to the two wheel liners (8 and 9) and install four screws (5) to secure the underbody to the vehicle. Tighten screws (5 and 18) to 3.7 ft-lb (5 N·m).

## Wheel Liner Removal

1. Remove bolts (10) to release liners (8 and 9) from vehicle **(Figure 4-8, Page 4-11)**.

## Wheel Liner Installation

1. Position liners (8 and 9) on vehicle and secure with bolts (10). Bolts (10) thread into J-clips (11) attached to the inner-frame rail. Tighten bolts to 4.4 ft-lb (6 N·m).

## REAR BODY – FOUR-PASSENGER VEHICLES

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See General Warnings, Section 1, Page 1-1.

## SEAT BACKS

### Seat Back Removal

Remove screws (9 or 13) securing seat back (8 or 11) to seat support and remove the seat back **(Figure 4-11, Page 4-15)**.



## Seat Back Installation

Secure seat back (8 or 11) to seat support with screws (9 or 13). Tighten screws to 71 in-lb (8 N·m) (**Figure 4-11, Page 4-15**).

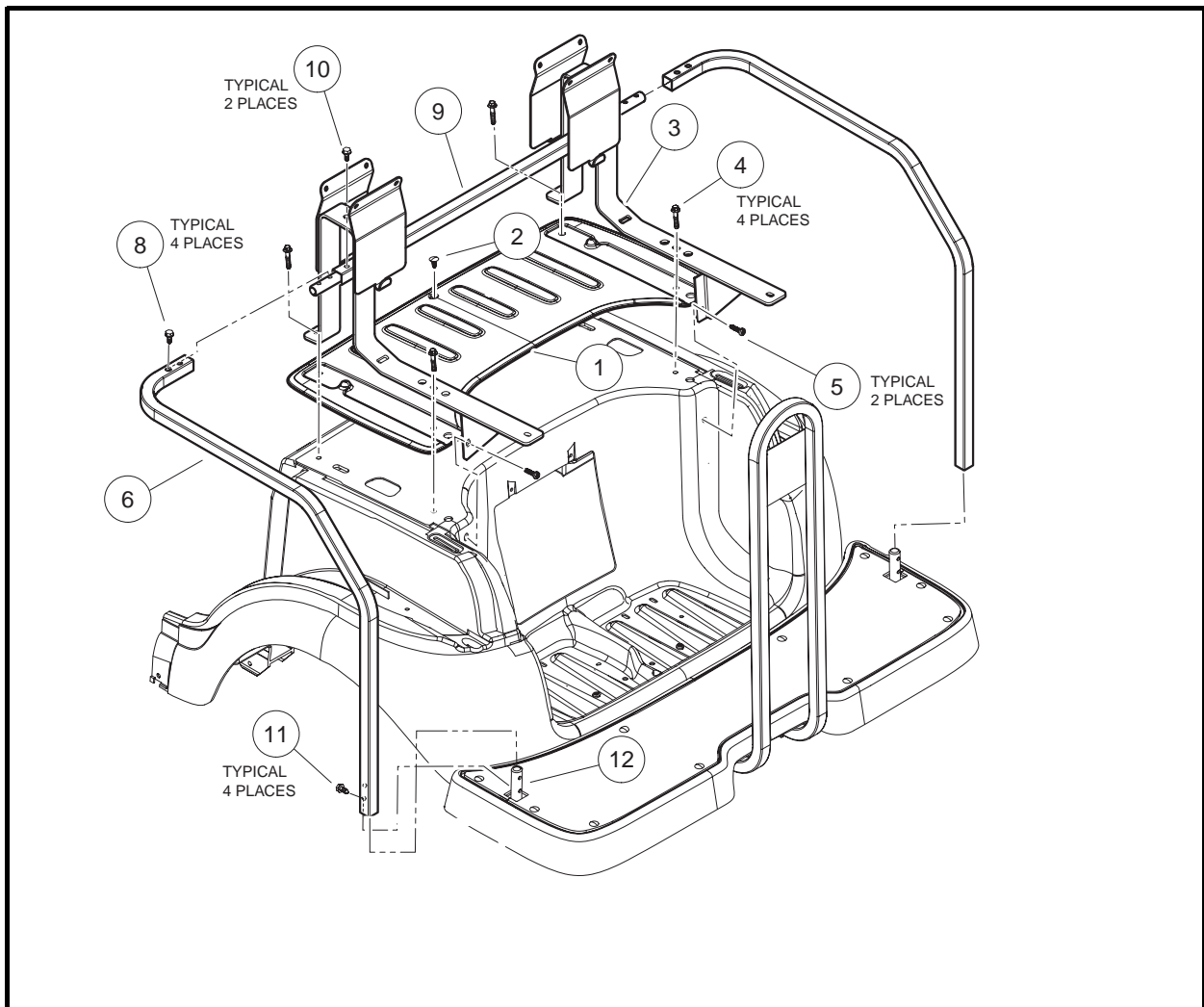
## SEAT SUPPORT

### Seat Support Removal

1. Remove screws (8 and 11) securing the rear hip restraints (6) and remove the hip restraints from the vehicle (**Figure 4-9, Page 4-13**).
2. Remove the screws (5) and bolts (4) from the seat support (3) and remove the seat support from the vehicle.

### Seat Support Installation

1. Install in the reverse order of removal.
2. Tighten bolts (4) to 53 in-lb (6 N·m). Tighten screws (5) to 44 in-lb (5 N·m). Tighten bolts (8 and 11) to 124 in-lb (14 N·m) (**Figure 4-9, Page 4-13**).



**Figure 4-9 Seat Supports (Four-Passenger Vehicles)**

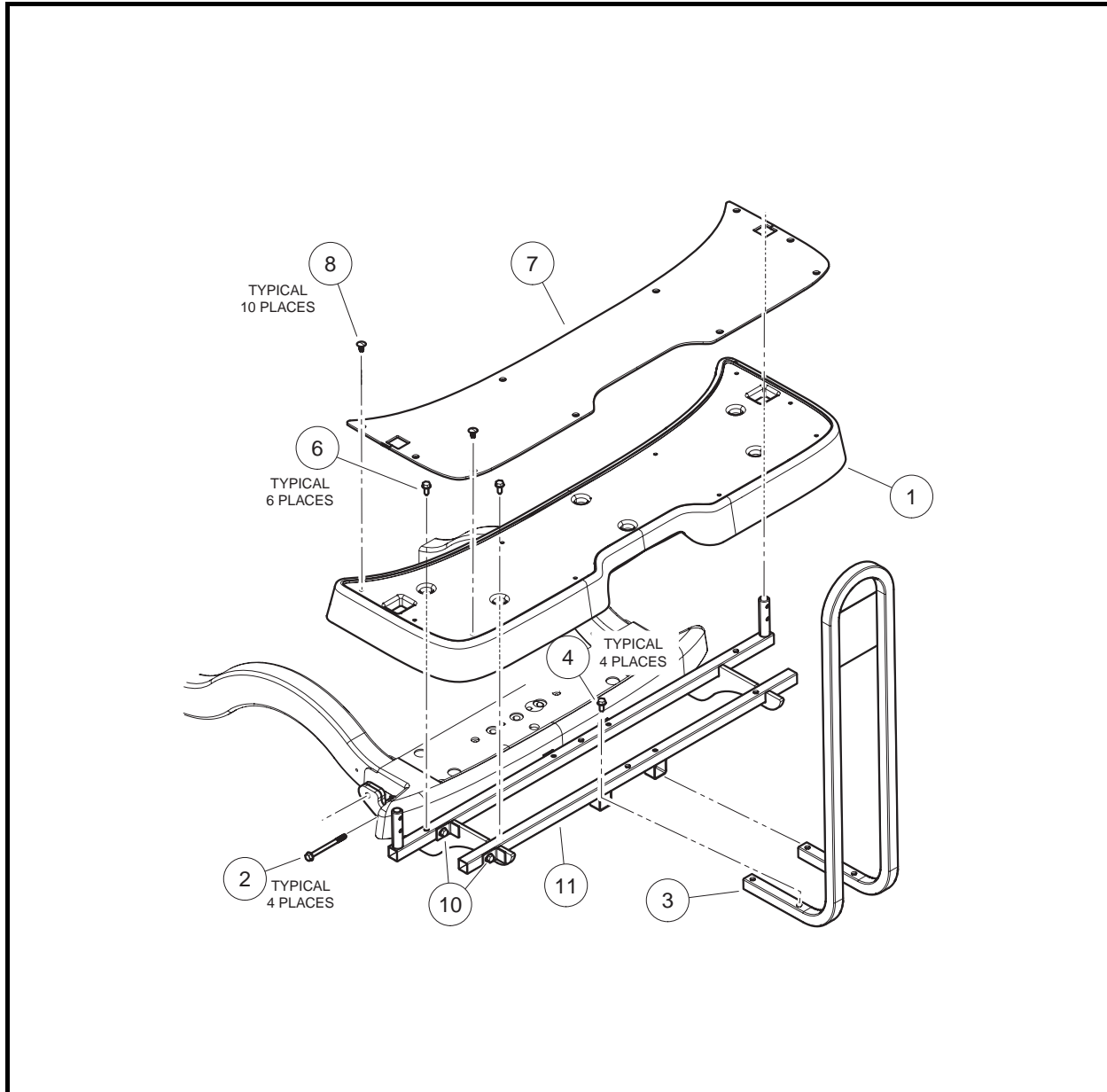


Figure 4-10 Foot Deck (Four-Passenger Vehicles)

## FOOT DECK

### Foot Deck Removal

3. Remove screws (8 and 11) securing the rear hip restraints (6) and remove the hip restraints from the vehicle (**Figure 4-9, Page 4-13**).
4. Remove the four bolts (2) securing the foot deck (1) to the vehicle frame (**Figure 4-10, Page 4-14**).

### Foot Deck Installation

1. Install foot rest in reverse order of removal.
2. Tighten bolts (2) to 71 in-lb (8 N·m) (**Figure 4-10, Page 4-14**)

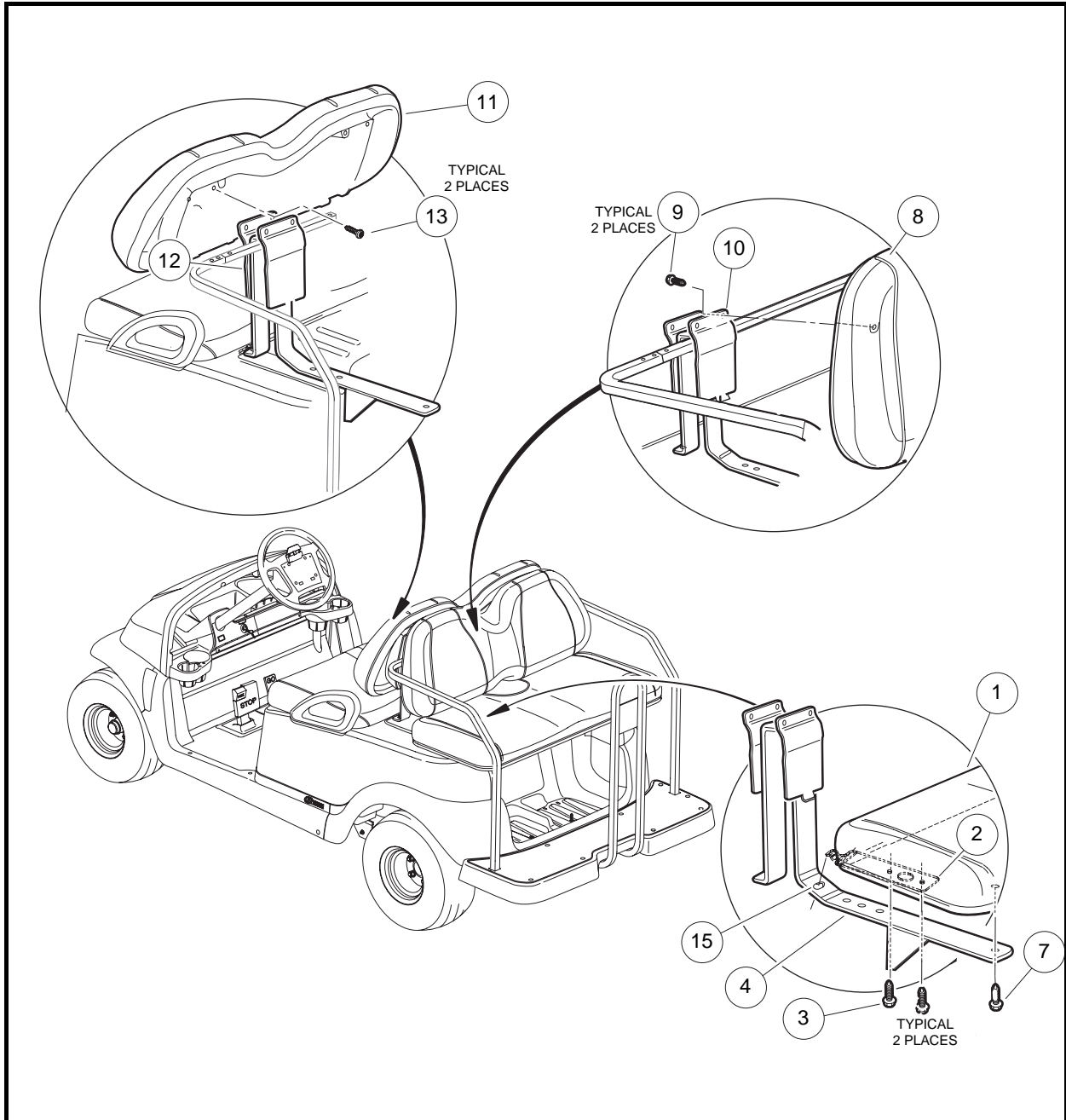


Figure 4-11 Seats (Four-Passenger Vehicles)

## REAR BODY COMPONENTS (FOUR-PASSENGER)

### Rear Beauty Panel Removal

1. Remove seat support. **See Seat Support Removal on page 4-13.**
2. Remove four screws (13) attaching the rear beauty panel (12) to the fuel bucket (**Figure 4-8, Page 4-11**).
3. Remove two screws (14) and remove the Forward/Reverse switch housing (15) from vehicle.
4. Disconnect electrical wires from the Forward/Reverse switch (16).
5. Lift rear beauty panel from vehicle.

## Rear Beauty Panel Installation

1. Install rear beauty panel (12) on vehicle. Make sure body clips on the rear of the beauty panel engage the mating slot in the rear underbody. Secure beauty panel in place with four screws (13). Tighten screws to 3.7 ft-lb (5 N·m) **(Figure 4-8, Page 4-11)**.
2. Connect the three wires to the Forward/Reverse switch (16) as shown.
3. Position the Forward/Reverse switch housing (15) on the front of beauty panel (12) and secure with two screws (14). Tighten screws to 20 in-lb (2.3 N·m).
4. Install seat support. **See Seat Support Installation on page 4-13.**

## Access Panel

Access panel (6) is secured to the rear underbody (4) with two expanding screws (7) **(Figure 4-8, Page 4-11)**. When replacing the panel, tighten screws (7) enough to hold the panel in place.

## Rear Underbody Removal

1. Remove four screws (5) attaching the rear underbody (4) to vehicle **(Figure 4-8, Page 4-11)**.
2. Lift the rear edge of the rear underbody (4) until the front portion slides out from beneath the front underbody. Remove the rear underbody from the vehicle.

## Rear Underbody Installation

1. Install rear underbody (4) on the vehicle **(Figure 4-8, Page 4-11)**. Install four screws (5) to secure the underbody to its vehicle. Tighten screws (5 and 18) to 3.7 ft-lb (5 N·m).

# CANOPY – TWO-PASSENGER

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See General Warnings, Section 1, Page 1-1.

## **CAUTION**

- To prevent damage to the canopy, do not remove the canopy supports (3, 7, and 10) from the vehicle without first removing the canopy (1) **(Figure 4-12, Page 4-17)**.

## TWO-PASSENGER CANOPY REMOVAL

1. Remove the two nuts (9) and two bolts (8) from the canopy (1) and each front canopy support (7 and 10) **(Figure 4-12, Page 4-17)**.
2. Remove the nuts (5) and bolts (4) from the canopy (1) and each rear support (3).
3. Lift canopy (1) away from front canopy supports (7 and 10) and rear supports (3).
4. Remove screws (14) securing front canopy support covers to front body.
5. Slide canopy support covers (12 and 13) up front canopy supports (7 and 10) to gain access to bolts (11).
6. Remove two bolts (11) from each front canopy support (7 and 10) and remove canopy supports from the vehicle.
7. Remove two bolts (6) from each rear support (3) and pull rear supports from vehicle.

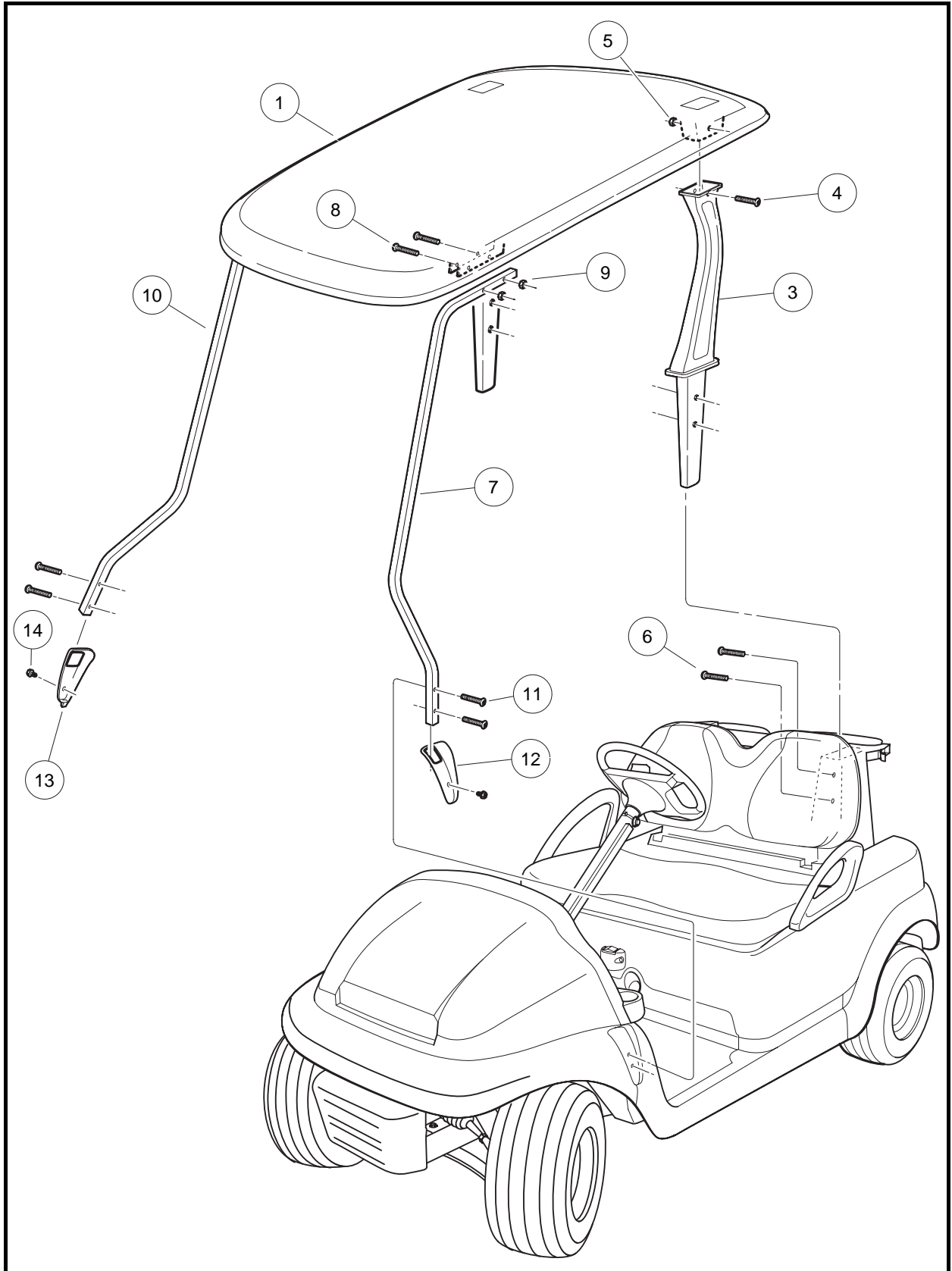


Figure 4-12 Precedent Two-Passenger Canopy

## TWO-PASSENGER CANOPY INSTALLATION

1. Install the front canopy supports.
  - 1.1. Ensure the front supports are properly oriented to the correct side of the vehicle as shown **(Figure 4-12, Page 4-17)**. The lower profile of each support follows the profile of the vehicle. If the supports are placed on the wrong side of the vehicle, they will not follow the vehicle's profile.
  - 1.2. Align the holes in the lower portion of each front support (7 and 10) with the corresponding holes in the vehicle. Insert two bolts (11) through each front support into the threaded holes in the vehicle. The bolts are color-coded with gold thread lock. Only finger-tighten the bolts at this time.
  - 1.3. Slide the covers (12 and 13) over the front supports. The covers are marked DRIVER and PASS to identify them as going on the driver side or passenger side respectively. Do not install the screws (14) yet.
2. Insert the two rear canopy supports (3) into the openings on the top of the Structural Accessory Module (SAM).
3. From the inside of the basket, insert two bolts (6) through the basket wall and into each support. The bolts are color-coded with blue thread-lock. Finger-tighten the bolts to avoid cross-threading the threads in the supports. **See following CAUTION.**

### **CAUTION**

- **Using tools to thread the bolts could prevent proper feel of the bolt as it captures the female threads in the support. This could result in damage to the components.**
4. Position the canopy on top of the front and rear supports. Ensure that the front supports are properly positioned between the molded tabs on the underside of the canopy and that the molded protrusions at the rear of the canopy extend into the top of the rear supports.
  5. Secure the canopy to the front supports with four bolts (8) and lock nuts (9). Use two bolts on each support, inserting the bolts from the inside. Tighten the lock nuts to 50 in-lb (5.6 N·m).
  6. Secure the canopy to the rear supports with two bolts (4) and locknuts (5). Tighten the lock nuts to 50 in-lb (5.6 N·m).
  7. At the rear supports (3), tighten the four bolts (6) to 31 in-lb (3.5 N·m).
  8. At the front supports (7 and 10), tighten the four bolts (11) to 18.4 ft-lb (25 N·m).
  9. Position each cover (12 and 13) over its respective support. A hole in each cover should be aligned with a corresponding hole in the support. Secure the cover to the support with a screw (14). Tighten the screws (14) to 31 in-lb (4.6 N·m).

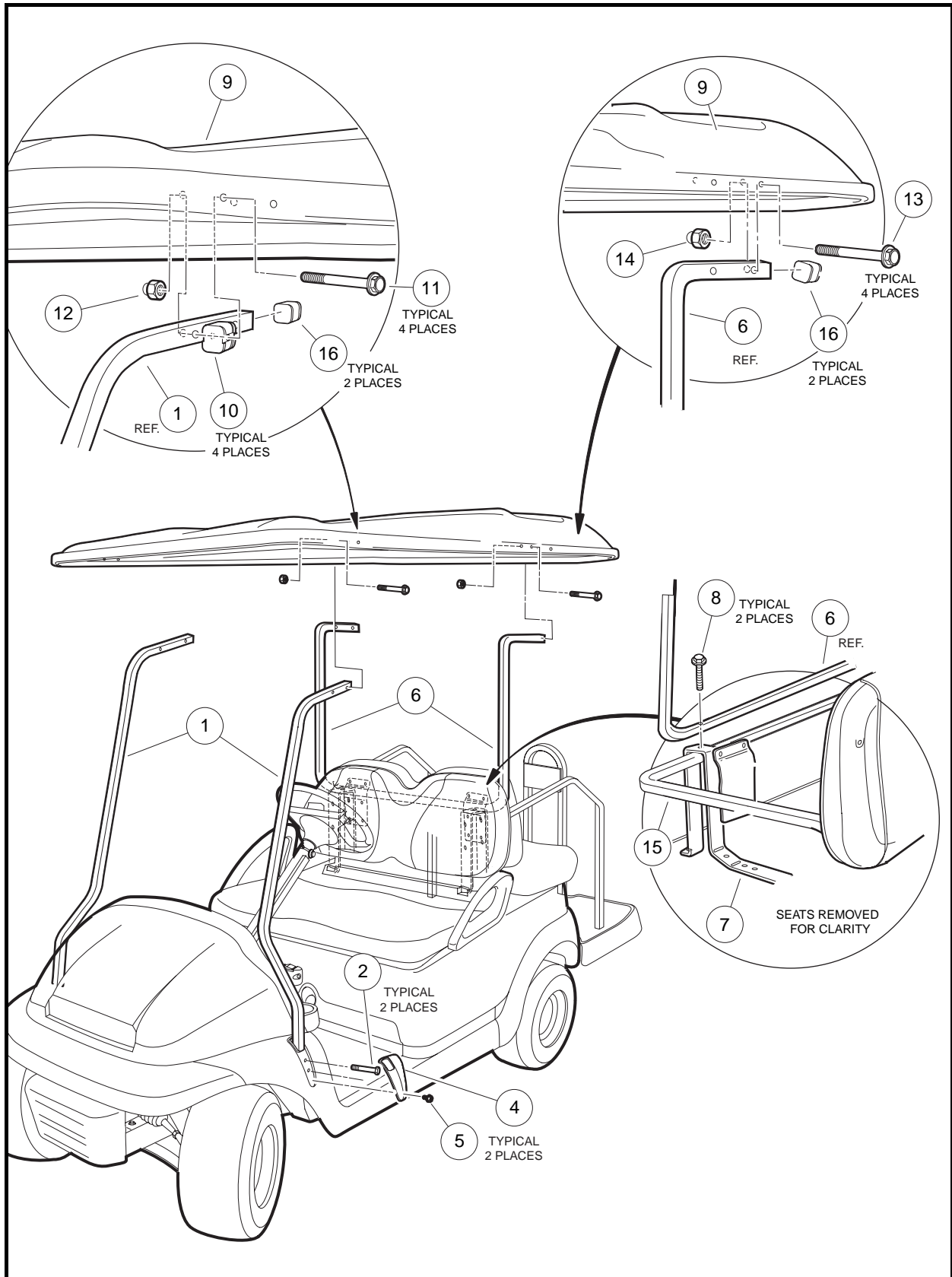


Figure 4-13 Precedent Four-Passenger Canopy

## CANOPY – FOUR-PASSENGER

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See General Warnings, Section 1, Page 1-1.

### **CAUTION**

- To prevent damage to the canopy, do not remove the canopy supports (1 and 6) from the vehicle without first removing the canopy (9) (Figure 4-13, Page 4-19).

### FOUR-PASSENGER CANOPY REMOVAL

1. Remove the two nuts (12), two bolts (11), and spacers (10) from the canopy (9), and each front canopy support (1) (Figure 4-13, Page 4-19).
2. Remove the nuts (14) and bolts (13) from the canopy (9) and the rear support (6).
3. Lift canopy (9) away from front canopy supports (1) and rear support (6).
4. Remove screws (5) securing front canopy support covers to front body.
5. Slide canopy support covers (4) up front canopy supports (1) to gain access to bolts (2).
6. Remove two bolts (2) from each front canopy support (1) and remove the canopy supports from the vehicle.
7. Remove two bolts (8) from the rear support (3) and remove rear support from vehicle.

### FOUR-PASSENGER CANOPY INSTALLATION

1. Install the front canopy supports.
  - 1.1. Ensure the front supports are properly oriented to the correct side of the vehicle as shown (Figure 4-13, Page 4-19). The lower profile of each support follows the profile of the vehicle. If the supports are placed on the wrong side of the vehicle, they will not follow the vehicle's profile.
  - 1.2. Align the holes in the lower portion of each front support (1) with the corresponding holes in the vehicle. Insert two bolts (2) through each front support into the threaded holes in the vehicle. The bolts are color-coded with gold thread lock. Only finger-tighten the bolts at this time.
  - 1.3. Slide the front support covers (4) over the front supports (1). The covers are marked DRIVER and PASS to identify them as going on the driver side or passenger side respectively. Do not install the screws (5) yet.
2. Remove the two bolts that secure the hip restraint (15) to the seat supports (7).
3. Align the rear canopy support (6) with the top of the seat supports (7) and secure with two bolts (8) as shown. Tighten the hardware to 124 in-lb (14 N·m).
4. Secure the front of the canopy (9) to the front supports (1) with four spacers (10), bolts (11), and cap-nuts (12). Tighten the hardware to 10 ft-lb (13.6 N·m).
5. Secure the rear of the canopy (9) to the rear canopy support (6) with four bolts (13) and cap-nuts (14). Tighten the hardware to 10 ft-lb (13.6 N·m).
6. Tighten the four bolts (2) installed in step 1.2 to 18 ft-lb (25 N·m).
7. Secure each front support cover (4) with one screw (5). Tighten the hardware to 53 in-lb (6 N·m).



# SECTION 5 – ACCELERATOR AND BRAKE PEDAL GROUP

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## **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

## **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

## PEDAL GROUP

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See General Warnings, Section 1, Page 1-1.

### PEDAL GROUP REMOVAL

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Remove screws (1). Pull floor mat retainer (3) away from the vehicle (**Figure 5-1, Page 5-1**).
3. Pull floor mat (2) over the pedal group to gain access to the pedal group hardware.
4. Lift off cover plate (7) (**Figure 5-2, Page 5-2**).
5. Loosen jam nuts (4 and 5) on each side of turnbuckle (6).
6. Nut (4) has a left-hand thread.

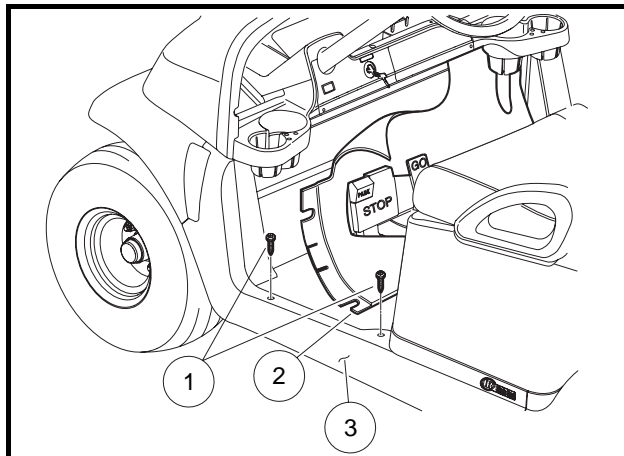


Figure 5-1 Pedal Group Access

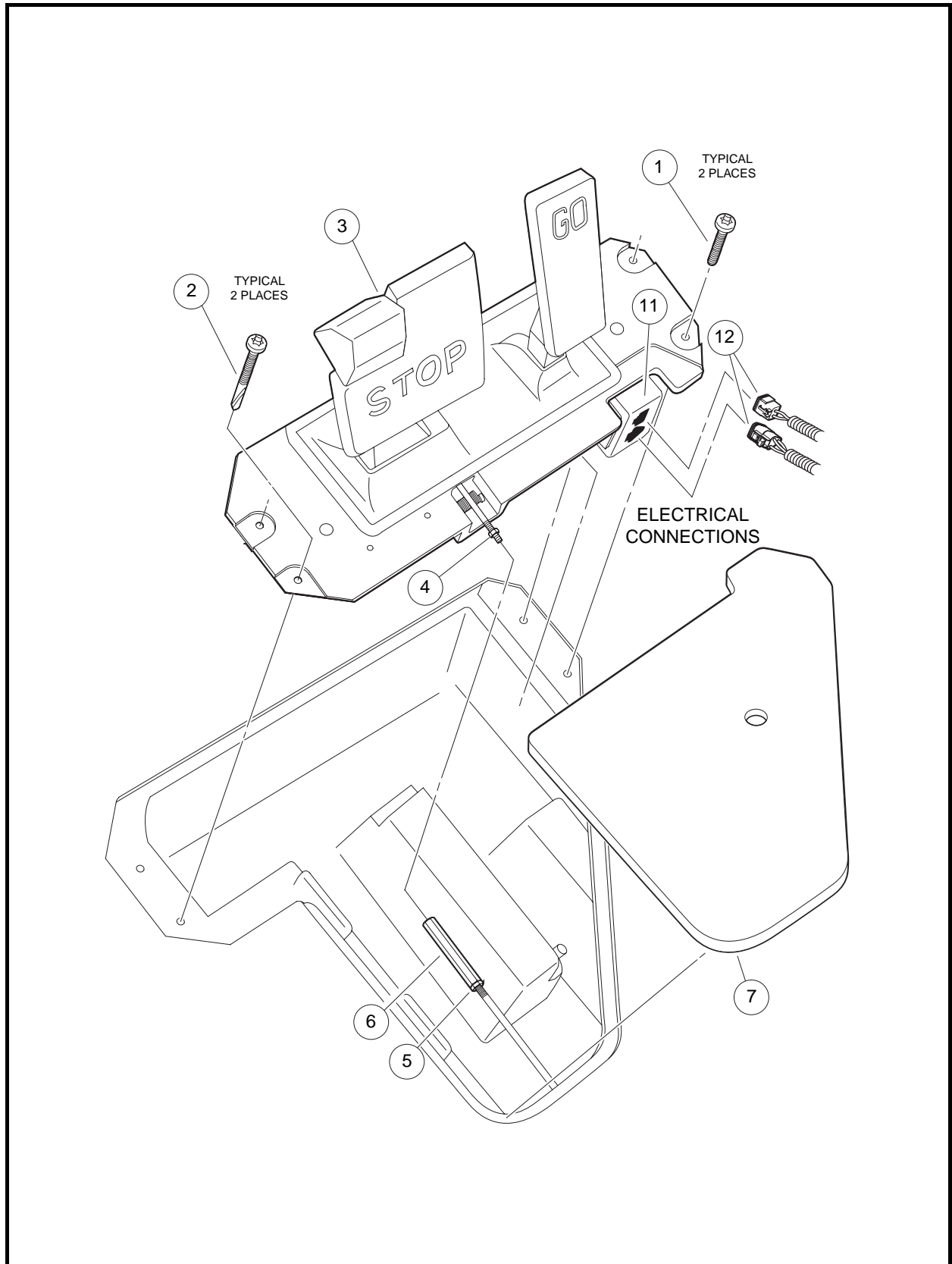
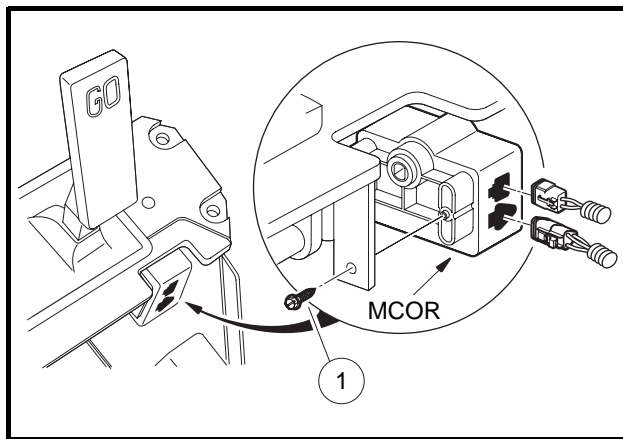


Figure 5-2 Pedal Group

**Pedal Group Removal, Continued:**

7. Loosen turnbuckle (6) until the threaded rod from the pedal group is free of the turnbuckle.
8. Remove two screws (2) on the driver side of the pedal group and two screws (1) on the passenger side of the pedal group.
9. Slightly lift pedal group from the vehicle to gain access to the connections to the MCOR on the passenger side of the pedal group.
10. Disconnect the electrical connectors at the MCOR.
11. Remove two screws (1) to separate the MCOR from the pedal group (**Figure 5-3, Page 5-3**).



**Figure 5-3 MCOR Removal**

**MCOR**

The pedal group for the Precedent electric vehicle includes a Motor Controller Output Regulator (MCOR) mounted on the side of the pedal group. The MCOR detects the position of the GO pedal and sends a corresponding voltage to the motor controller.

**DEBRIS SHIELDS**

Debris shields on the top face of the pedal group prevent excessive debris from contacting the moving parts of the pedal group. Both shields (3 and 4) are held in place with screws (1) and washers (2) (**Figure 5-4, Page 5-5**). When shields are replaced, tighten screws (1) to 53 in-lb (6 N·m).

**BRAKE RETURN SPRING****▲ CAUTION**

- **Spring is under tension. Use caution when working with springs.**

The brake return spring (5) provides the pressure needed to return the brake pedal to its upright position (**Figure 5-4, Page 5-5**). One end of the spring attaches to a hook on pedal (11) and the other end attaches to pedal base (12).

## PAWL ASSEMBLY

The pawl assembly (6) serves to lock the brakes when the PARK pedal is pressed. The pawl assembly also releases the brakes when either the STOP or GO pedal is pressed (**Figure 5-4, Page 5-5**). The pawl assembly is serviced as a unit. The replacement unit includes two snap rings (7), pin (8), spring (9), and pawl unit (6). When replacing the unit, ensure spring (9) is properly positioned to be held in place when the pin (8) is installed. Secure the pin with two snap rings (7).

## ACCELERATOR RETURN SPRING

The accelerator return spring assembly (10) consists of two springs and three T-shaped bars secured by two crosspins (**Figure 5-4, Page 5-5**). The assembly is replaced as a unit. The replacement unit includes a pin that keeps the spring compressed so it can be installed in the pedal group. Replace the assembly as follows:

### **⚠ CAUTION**

- **Spring is under tension. Use caution when working with springs.**

1. With the pedal group removed from the vehicle and debris shield removed, remove the accelerator return spring assembly.
2. To install accelerator return spring assembly, position the accelerator return spring unit in the pedal group with the lower crosspin of the assembly positioned in the pedal group, and secure it in place with the clip (1) (**Figure 5-5, Page 5-6**).
3. Position upper crosspin in the tab on the pedal group (**Figure 5-6, Page 5-6**).
4. Push accelerator pedal forward to compress the springs in the assembly. While the springs are compressed, pull pin from both T-shaped bars then release the pedal (**Figure 5-7, Page 5-6**).

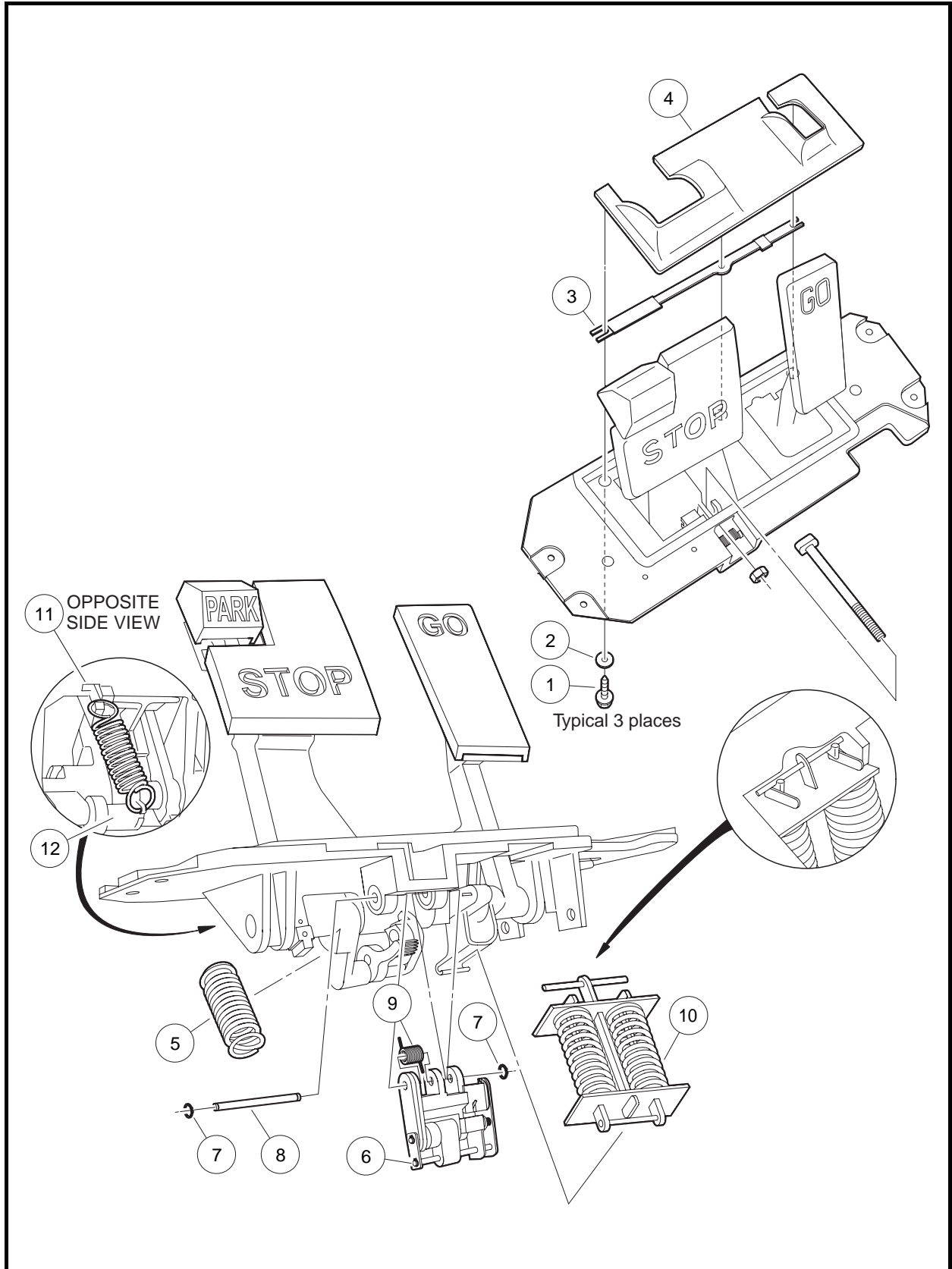


Figure 5-4 Brake Pedal

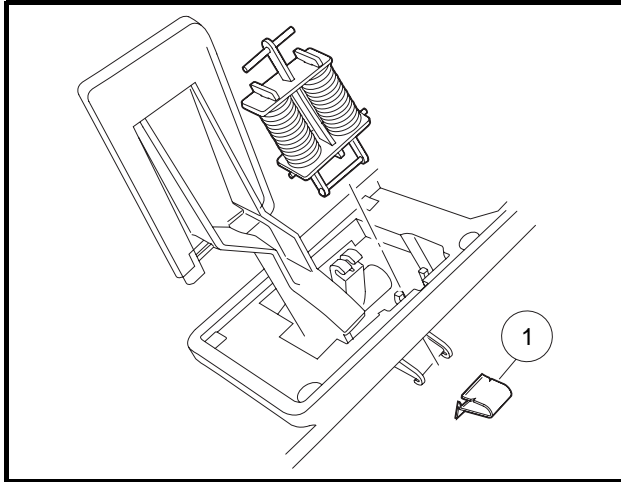


Figure 5-5 Accelerator Spring Clip

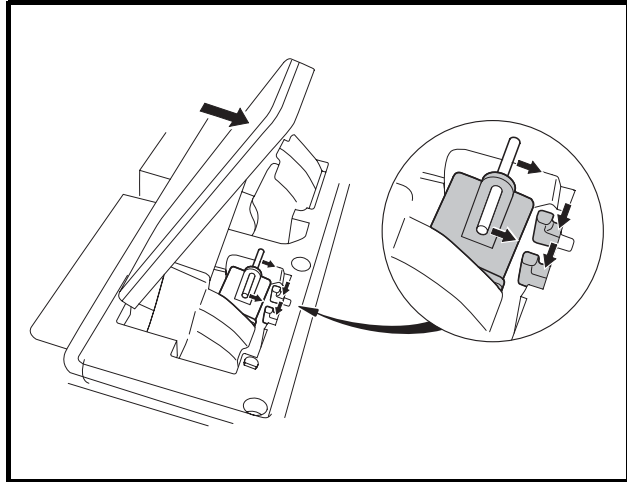


Figure 5-6 Accelerator Spring Upper Crosspin

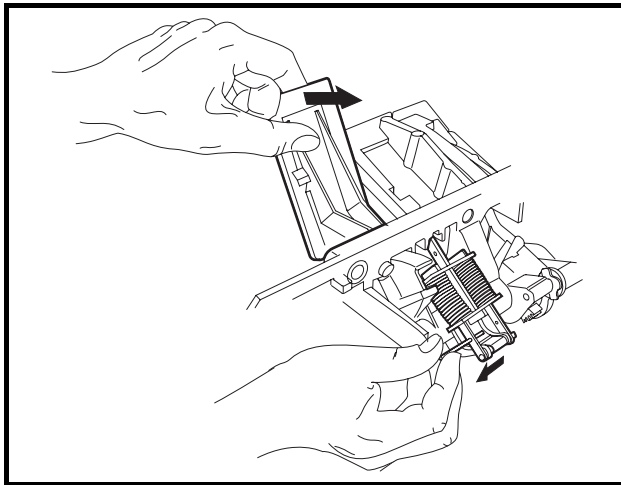


Figure 5-7 Accelerator Spring Pin Removal

## PEDAL GROUP INSTALLATION

1. Place the MCOR on the pedal group and secure with two screws (1) (**Figure 5-3, Page 5-3**). Tighten screws to 23 in-lb (2.6 N·m).
2. Connect the wire harness (12) to the MCOR (11) (**Figure 5-2, Page 5-2**).

**NOTE:** Connectors will only fit together in one orientation.

3. Position the pedal group in vehicle and secure with two screws (2) on the driver side and two screws (1) on the passenger side. Tighten driver side screws (2) to 12 ft-lb (16.3 N·m). Tighten passenger side screws (1) to 5 ft-lb (6.8 N·m).
4. Use the turnbuckle (6) to connect the rod from the pedal group to the brake actuator rod. Ensure the ends of the brake cables do not slip out of the brake equalizer during this procedure.
5. Adjust the brake cable equalizer tension. **See Brake Cable Equalizer Adjustment, Section 6, Page 6-9.**
6. Place floor cover plate (7) over the floor opening (**Figure 5-2, Page 5-2**).
7. Install the floor mat (2) over the pedal group. Make sure tabs on floor mat sides are beneath the sill (3). Tighten screws (1) to 53 in-lb (6 N·m) (**Figure 5-1, Page 5-1**).

## SECTION 6 – WHEEL BRAKE ASSEMBLIES

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### **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

### **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.
- Some aftermarket brake shoes contain asbestos fiber, and asbestos dust is created when these brake mechanisms are handled. Wear approved eye and respiratory protection when disassembling and cleaning brake mechanisms. Inhalation of asbestos could result in severe personal injury or death. Do not use compressed air or aerosol sprays to clean the brake mechanism. Clean brake mechanism using the negative pressure enclosure/hepa vacuum system or low pressure/wet cleaning method per OSHA/29 CFR - 1910.1001.

## GENERAL INFORMATION

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Precedent Golf Cars are equipped with self-adjusting, mechanically-expanding shoe drum brakes on each rear wheel.

## BRAKE SHOE REMOVAL

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See General Warnings, Section 1, Page 1-1. See also Warning on Page 6-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Place chocks at the front wheels. Loosen, but do not remove, lug nuts on rear wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jack stands under the axle tubes to support the vehicle. See **WARNING “Lift only one end...”** in **General Warnings, Section 1, Page 1-2.**
3. Gain access to the pedal group by removing the floor mat and access panel. See **Pedal Group Removal, Section 5, Page 5-1.**
4. Loosen the two jam nuts (1 and 3) on either side of turnbuckle (2) (**Figure 6-1, Page 6-2**). Note that the forward jam nut (1) is a left-hand thread. Thread each nut approximately 1/2 inch (12.7 mm) away from the turnbuckle.
5. Loosen turnbuckle (2) to release tension on the equalizer bracket (4) that pulls on the heads of the brake cables.
6. Remove the rear wheels and then the brake drums. If the brake drums were easily removed, proceed to step 8.

### **⚠ CAUTION**

- Worn or damaged brake drums cannot be machined to refinish them. Replace as necessary.

**NOTE:** When servicing vehicles with severely worn brake shoes and when the drums cannot be removed by normal methods, proceed to step 7 to minimize damage to the brake cluster and brake components.

**Brake Shoe Removal, Continued:**

7. Remove brake drums and badly worn brake shoes.
  - 7.1. On the back of each brake cluster assembly, locate the heads of two brake shoe retainer pins. It may be necessary to remove sealant material around the head of each pin.

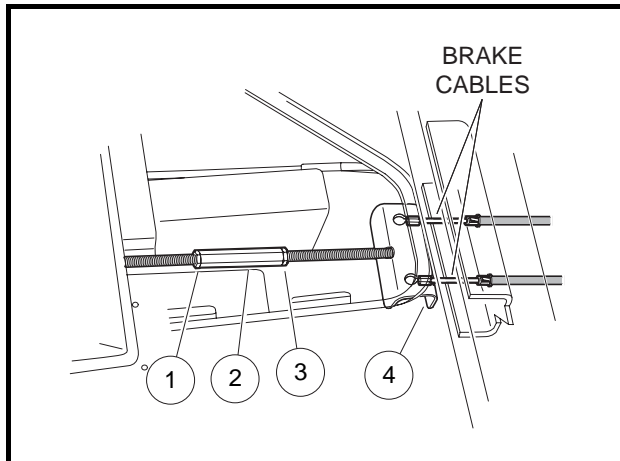


Figure 6-1 Loosen Turnbuckle

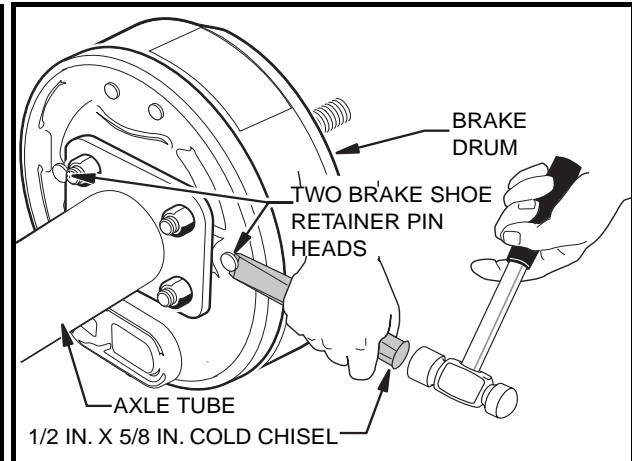


Figure 6-2 Shoe Retainer Pins

- 7.2. Insert a 1/2 inch x 5/8 inch cold chisel under the head of each pin and shear them off as illustrated (**Figure 6-2, Page 6-2**). This will release the shoes from the backing plate, allowing them to pivot away from the inside of the brake drum, which should then allow the brake drum to be pulled free. After completing step 8, skip step 9.

**NOTE:** Although step 8 allows easier access to the brake shoes, it is not imperative to do so in order to remove the brake shoes.

8. Remove the axle.
  - 8.1. Using 90° snap ring pliers (CCI P/N 1012560), remove the axle retaining ring (1) (**Figure 6-3, Page 6-2**).
  - 8.2. Pull the axle shaft (2) from the axle tube (**Figure 6-3, Page 6-2**).

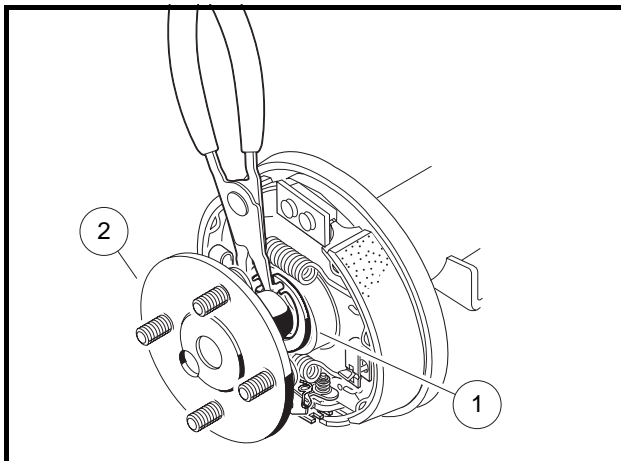


Figure 6-3 Remove Axle Retaining Ring



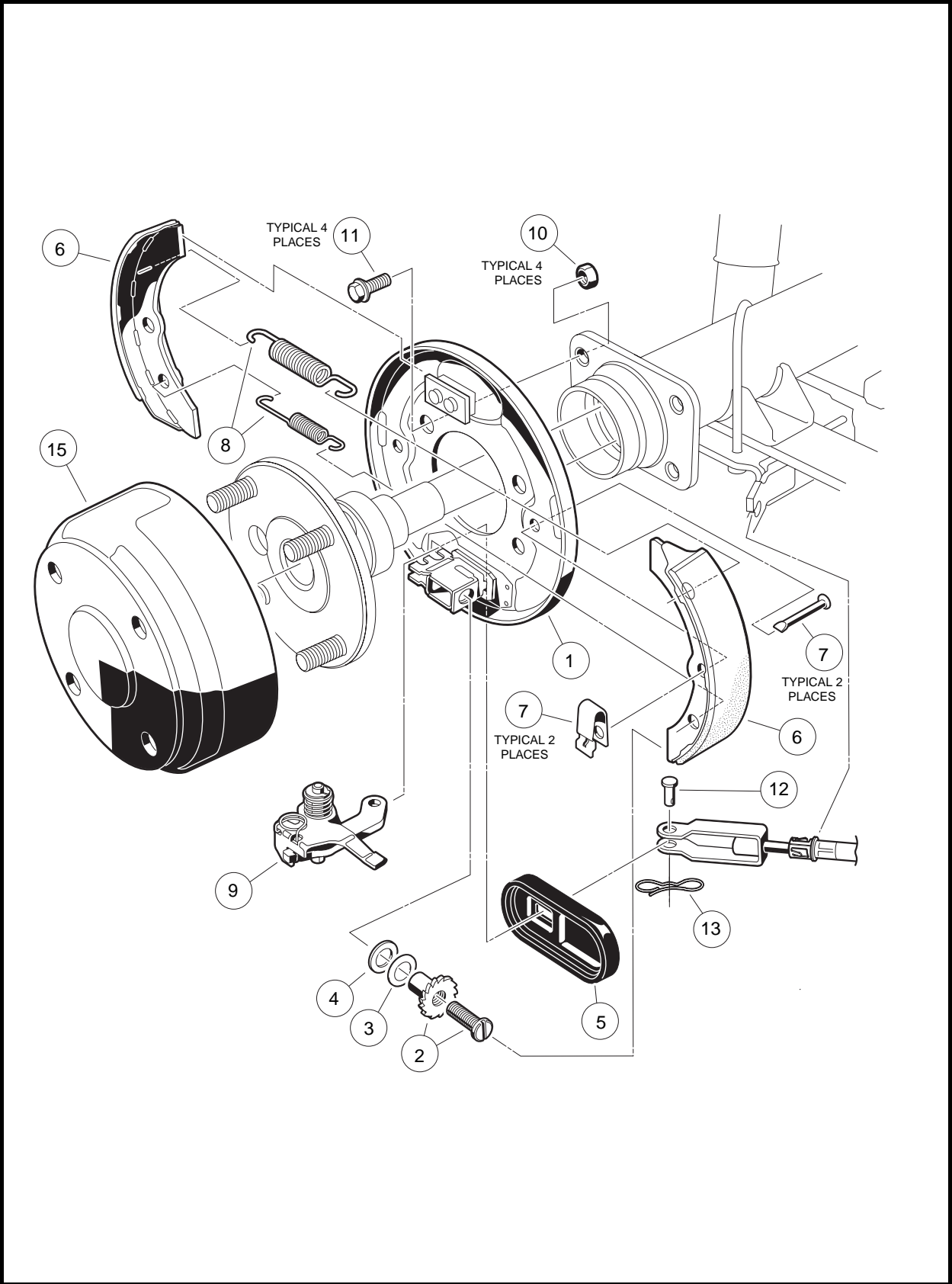


Figure 6-4 Self-adjusting Wheel Brake Assembly

**Brake Shoe Removal, Continued:**

9. Using needle nose pliers, turn the clip retainer pin (1) 90° to remove the shoe retainer clip (2) (**Figure 6-5, Page 6-4**).

**⚠ CAUTION**

- The brake shoes are under pressure and can release suddenly when brake shoe retainers are removed.

10. Grasp both brake shoes and pull them, together with the springs, out of the brake assembly as shown (**Figure 6-6, Page 6-4**).

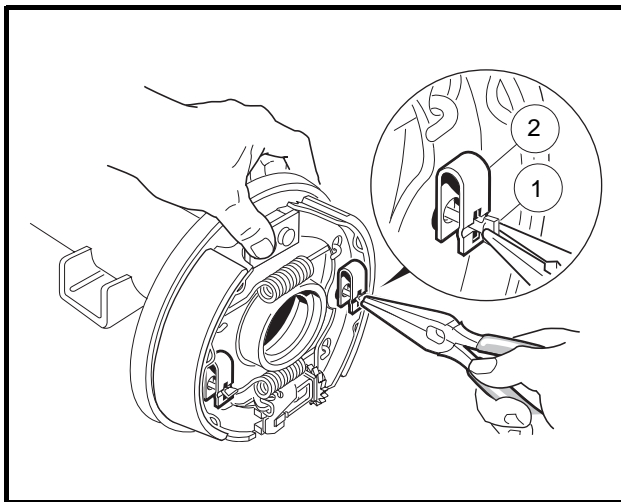


Figure 6-5 Remove Shoe Retainer Clip

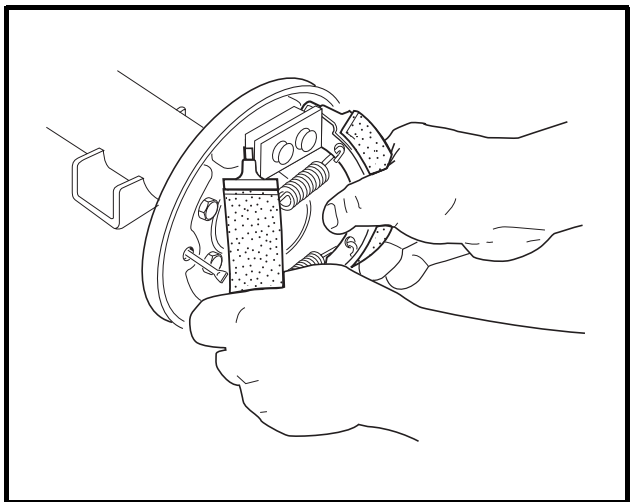


Figure 6-6 Remove Brake Shoes

11. Remove adjuster wheel (1) with two washers (2 and 3) from the backing plate (**Figure 6-7, Page 6-4**).

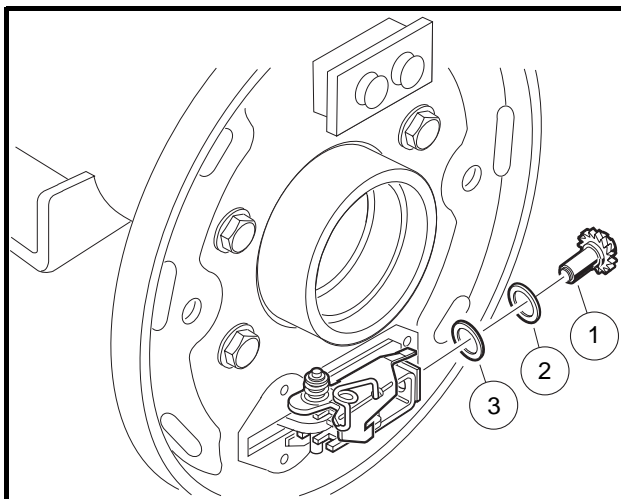


Figure 6-7 Remove Adjuster Wheel

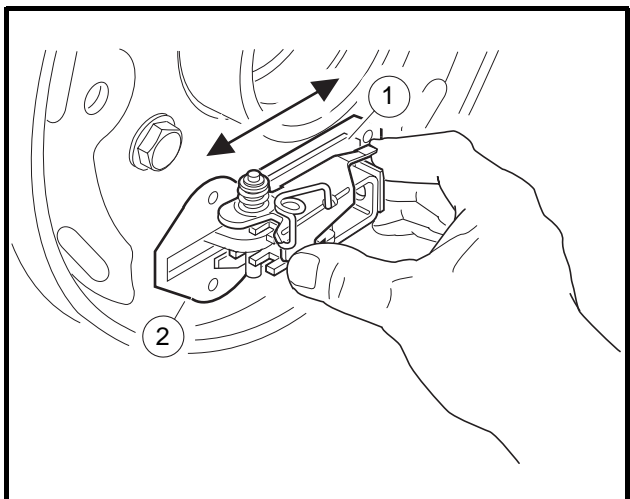


Figure 6-8 Lubricate Slide and Slide Plate

## BRAKE ASSEMBLY CLEANING

See General Warnings, Section 1, Page 1-1. See also Warning on Page 6-1.

1. Carefully clean the brake backing plate and all of its mechanical components.
2. Remove the rubber boot from backing plate and wipe with a clean damp cloth.
3. Lubricate the slide (1) and slide plate (2) with dry moly lubricant (CCI P/N 1012151) on both sides of the backing plate (**Figure 6-8, Page 6-4**). After lubricating, work the slide back and forth to ensure that it slides smoothly and easily. Install rubber boot onto backing plate.

### **⚠ WARNING**

- **Apply grease carefully when performing the following steps. Do not allow any grease to get onto the friction surfaces of the brake shoe pads or the brake drum. Failure to heed this warning could cause diminished brake performance, possibly resulting in property damage or severe personal injury.**
4. Use a small brush to carefully apply a light coat of white lithium NLGI #2 grease (Dow Corning® BR2-Plus or equivalent) on each of the six raised bosses on the brake backing plate (**Figure 6-9, Page 6-5**). See preceding **WARNING**.
  5. Use a small brush to carefully apply a light coat of white lithium NLGI #2 grease (Dow Corning BR2-Plus or equivalent) to each end of both brake shoes and into the slots in the brake shoe mounting block as shown (**Figure 6-10, Page 6-5**). See preceding **WARNING**.

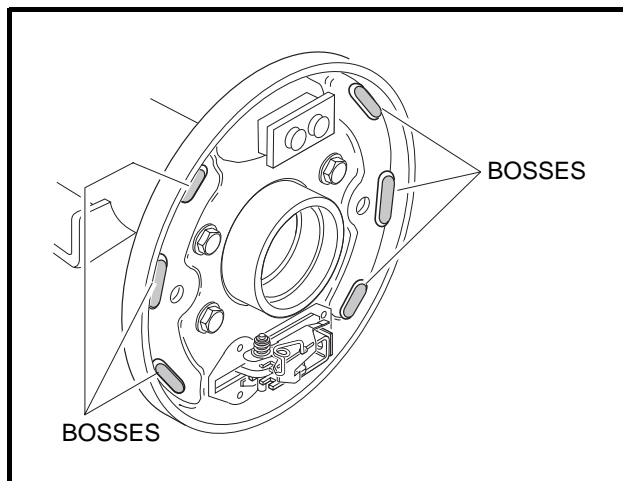


Figure 6-9 Apply Grease On Bosses

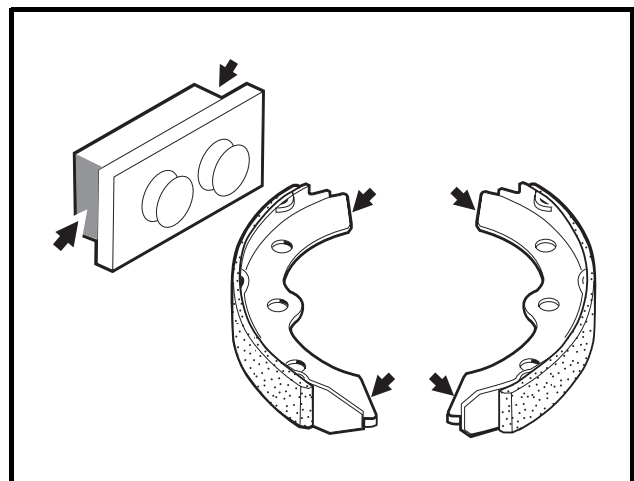


Figure 6-10 Apply Grease To Brake Shoes and Slots

6. Use a small brush to carefully apply a light coat of white lithium NLGI #2 grease (Dow Corning BR2-Plus or equivalent) to the brake adjuster assembly, adjuster wheel shoe slots, and the shaft of the adjuster wheel as shown (**Figure 6-11, Page 6-6**). See preceding **WARNING**.
7. Install the adjuster wheel (1) and two washers (2 and 3) into the adjuster assembly (**Figure 6-7, Page 6-4**).

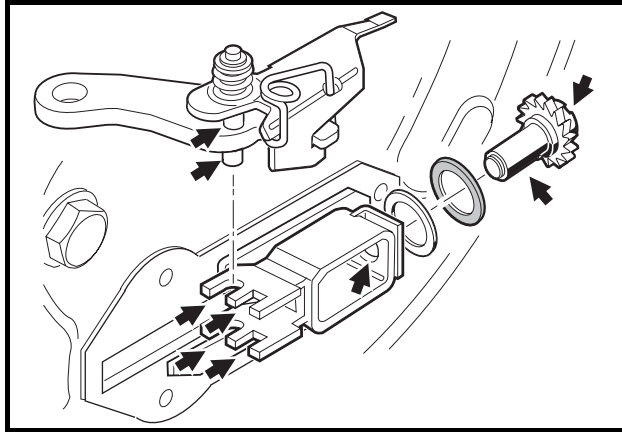


Figure 6-11 Apply Grease To Brake Adjuster

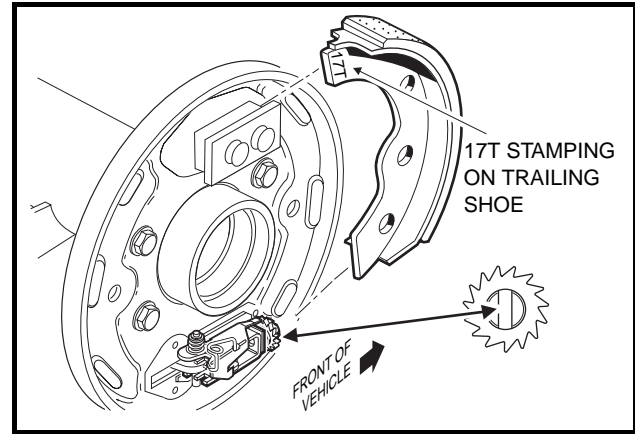


Figure 6-12 Install Adjuster Wheel, Trailing Shoe

## BRAKE SHOE INSTALLATION

See General Warnings, Section 1, Page 1-1. See also Warning on Page 6-1.

1. Turn the adjusting wheel screw so that the shoe slot is vertical, then position the trailing shoe in the slots in the shoe mounting block and adjuster assembly (Figure 6-12, Page 6-6). See following NOTE.

**NOTE:** The trailing shoe has 17T stamped into the tip of the shoe flange (Figure 6-12, Page 6-6). The leading shoe is stamped 17L. When installing the shoes, the stamping on both shoes should be oriented to the top of the brake assembly. When installing the shoes on the passenger side of the vehicle, the side of the trailing shoe flange marked 17T should be facing out and be visible. On the driver side, the 17L on the leading shoe should be facing out and be visible.

When installed on the backing plate, the **leading** shoe (stamped 17L) is **always** oriented toward the **rear** of the vehicle.

2. Install the shoe retainer clip, using pliers to compress the clip (1) while turning the retainer pin (2) into position (Figure 6-13, Page 6-6).
3. Attach the springs onto the trailing shoe already installed. Then hold the leading shoe next to the trailing shoe, correctly oriented, and attach the springs to it (Figure 6-14, Page 6-6).

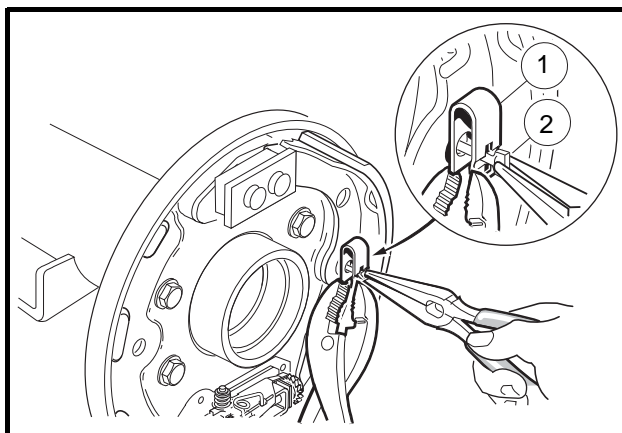


Figure 6-13 Install Trailing Shoe Retainer Clip

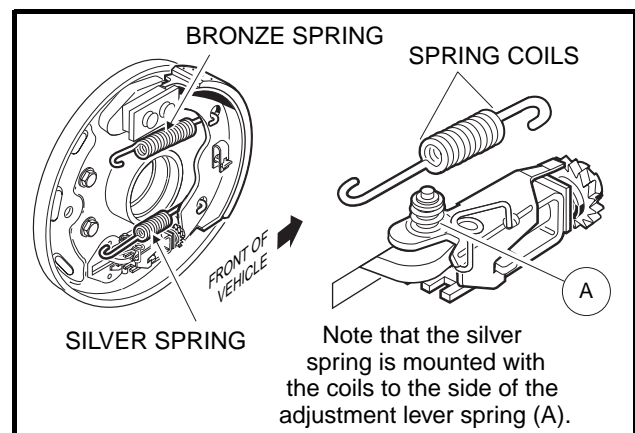
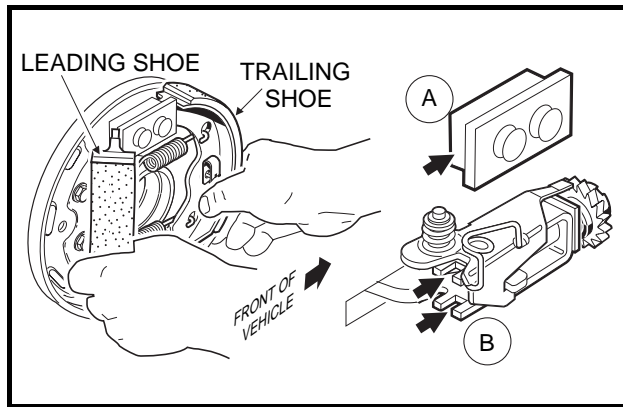
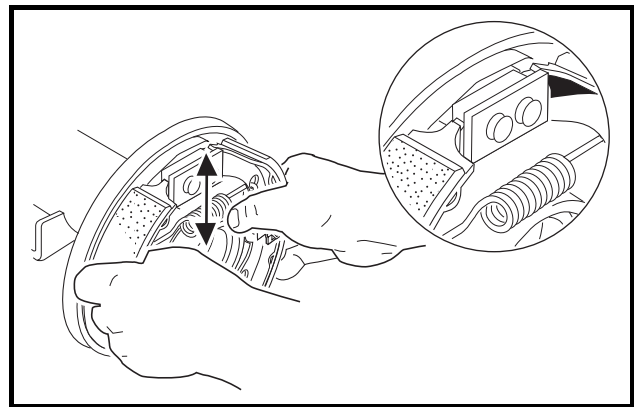


Figure 6-14 Attach Springs

4. While maintaining spring attachment on both shoes, position tips of leading shoe in the mounting slots and then push shoe into place. Hold shoe in position and install retaining clip (**Figure 6-15, Page 6-7**).
5. After the shoes are installed, move them together up and down and side to side to make sure that they will easily slide approximately 1/4 to 3/8 inch (6.3 to 9.5 mm) without binding (**Figure 6-16, Page 6-7**).

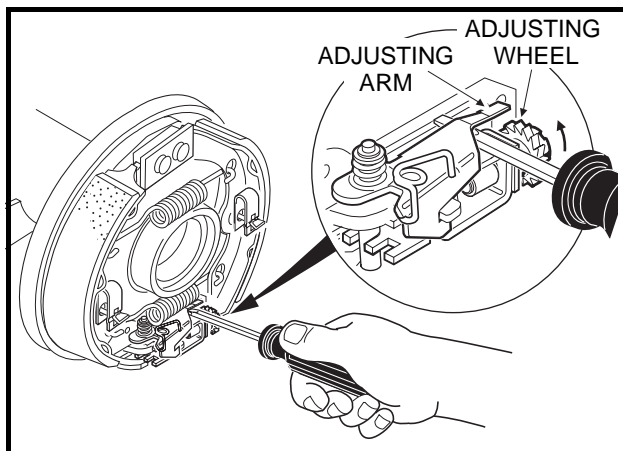


**Figure 6-15** Install Leading Shoe



**Figure 6-16** Check Shoe Positions

6. Place a flatblade screwdriver under the adjusting arm and raise the arm off of the adjusting wheel. While holding the arm up, turn the wheel upward until it stops (**Figure 6-17, Page 6-7**). Remove the screwdriver.



**Figure 6-17** Set Adjusting Wheel

7. Install the rear axle onto the transaxle. **See following NOTE.**

**NOTE:** There is a LEFT and RIGHT side axle. The splined portions on the axles that insert into the transaxle case are two different lengths. The longest length spline is the LEFT, or driver side axle.

- 7.1. Insert the splined end of the axle shaft into the axle tube. Be careful not to damage the seal on the inside of the axle tube hub. Advance the shaft through to the bearing on the shaft, and rotate it to align the shaft splines with the splined bore of the differential gear. Continue advancing the shaft until the bearing on the axle is firmly seated within the axle tube hub seat.

**Brake Shoe Installation, Continued:**

- 7.2. Using 90° internal snap ring pliers (0.090 tip) (CCI P/N 1012560), attach the internal retaining ring into the axle tube hub so that it seats against the axle bearing assembly and into the machined slot in the inside wall of the axle tube hub (**Figure 6-3, Page 6-2**).
- 7.3. Place a 1/4 to 3/8 - inch (6 - 10 mm) diameter rod against the retaining ring and tap lightly at four or five locations to ensure it is properly seated. **See following WARNING.**

**⚠ WARNING**

- **Be sure retaining ring is properly seated in groove. If ring is not properly installed, the axle assembly will separate from the transaxle and damage the axle assembly and other components. Loss of vehicle control could result in severe personal injury or death.**

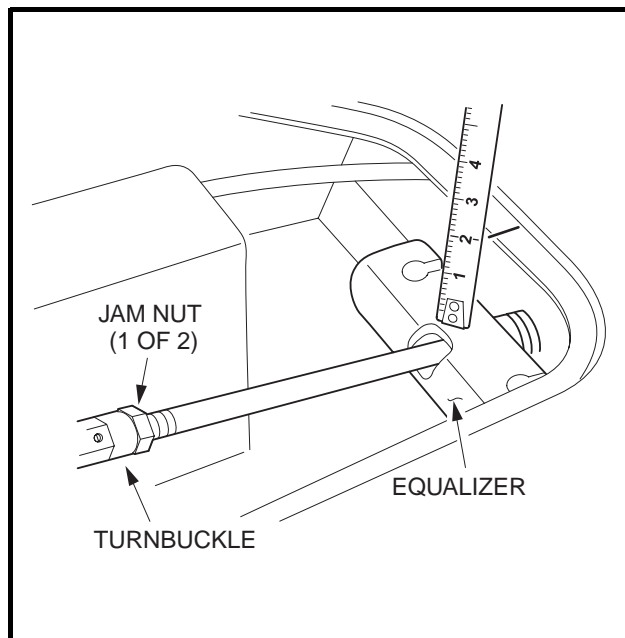
**⚠ CAUTION**

- **Before installing axle shaft, clean any residual oil from the exposed end of the axle tube and from the oil seal area.**

8. Install the brake drum, and make sure that it is properly seated. **See following NOTE.**

**NOTE:** *If drum installation is difficult, the brake shoes may need to be adjusted vertically in the mounting slots.*

9. After the drum is installed, make sure the axle and drum turn freely and then install the wheel. **See Wheel Installation, Section 8, Page 8-1.**
10. Adjust brake cable equalizer. **See Brake Cable Equalizer Adjustment on page 6-9.**



**Figure 6-18 Equalizer Adjustment**

## BRAKE CABLE EQUALIZER ADJUSTMENT

See General Warnings, Section 1, Page 1-1. See also Warning on Page 6-1.

1. After maintenance on the brake system is complete, lower the vehicle onto the floor. With the brake pedal in the full up or at rest position, adjust the turnbuckle until the proper brake tension is achieved. The turnbuckle is properly adjusted when the distance from the top of the equalizer to the upper flange surface is 2 inches  $\pm$  1/16 inch (51 mm  $\pm$  1.6 mm).
2. Ensure that both threaded rods are visible in the witness holes of the turnbuckle before the jam nuts are tightened (**Figure 6-18, Page 6-8**).
3. Tighten the rear jam nut first (labeled 1 of 2) to 13 ft-lb (17.5 N·m) (**Figure 6-18, Page 6-8**), then tighten the front jam nut to 13 ft-lb (17.5 N·m). **See following WARNING.** For optimal performance, drive the vehicle and apply the brakes approximately 20 times to burnish the shoes, center the clusters, and adjust the brake mechanism.

### **⚠ WARNING**

- **Reduced braking force could result if the jam nuts are not tightened in the proper sequence.**

4. Once steps 2 and 3 are complete, recheck the 2-inch specification listed in step 1. If the measurement has not changed, the adjustment is complete. If the measurement has changed, perform steps 1 through 3 again.
5. Replace access panel and floor mat.
  - 5.1. Place floor cover plate (7) over the floor opening. **See Figure 5-2, Section 5, Page 5-2.**
  - 5.2. Install the floor mat (2) over the pedal group. Make sure tabs on floor mat sides are beneath the sill (3). Tighten screws (1) to 53 in-lb (6 N·m). **See Figure 5-1, Section 5, Page 5-1.**

## BRAKE CLUSTER REMOVAL AND INSTALLATION

See General Warnings, Section 1, Page 1-1. See also Warning on Page 6-1.

### Brake Cluster Removal

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Place chocks at the front wheels and loosen the lug nuts on the rear wheels. Lift the rear of the vehicle with a chain hoist or floor jack. Place jack stands under the axle tubes to support the vehicle. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Gain access to the pedal group by removing the floor mat and access panel. **See Pedal Group Removal, Section 5, Page 5-1.**
4. Loosen the two jam nuts (1 and 3) on either side of turnbuckle (2) (**Figure 6-1, Page 6-2**). Note that the forward jam nut (1) is a left-hand thread. Thread each nut approximately 1/2 inch (12.7 mm) away from the turnbuckle.
5. Loosen turnbuckle (2) to release tension on the equalizer bracket (4) that pulls on the heads of the brake cables.
6. Remove lug nuts and rear wheels and then the brake drums.

**NOTE:** *When servicing vehicles with self-adjusting brakes with badly worn brake shoes and when the drums cannot be removed by normal methods, perform Step 7 of Brake Shoe Removal on page 6-2, then continue with this procedure.*

*Although step 7 below allows easier access to the brake shoes, it is not imperative to do so in order to remove the brake shoes.*

7. Remove the axle.
  - 7.1. Using 90° snap ring pliers (CCI P/N 1012560), remove the axle retaining ring (1) (**Figure 6-3, Page 6-2**).
  - 7.2. Pull the axle shaft (2) from the axle tube (**Figure 6-3, Page 6-2**).
8. Remove bow tie locking pin (13) and clevis pin (12) from brake cable (**Figure 6-4, Page 6-3**).

**Brake Cluster Removal, Continued:**

9. Remove four bolts (11) and lock nuts (10) that mount the brake assembly to the transaxle (**Figure 6-4, Page 6-3**).
10. Remove brake assembly from transaxle.

**BRAKE CLUSTER INSTALLATION**

1. Install in reverse order of disassembly. Use new bow tie locking pins when installing brake cables.

**⚠ CAUTION**

- **Before installing axle shaft, clean any residual oil from the exposed end of the axle tube and from the oil seal area.**
2. Be sure bolts (11) (CCI P/N 1014153) and new lock nuts (10) (CCI P/N 1013924) are used to mount the brake assembly (**Figure 6-4, Page 6-3**).
  3. Tighten bolts to 30 ft-lb (40.6 N·m).
  4. Install the rear axle onto the transaxle. **See following NOTE.**

**NOTE:** *There is a LEFT and RIGHT side axle. The splined portions on the axles that insert into the transaxle case are two different lengths. The longest length spline is the LEFT, or driver side axle.*

- 4.1. Insert the splined end of the axle shaft into the axle tube. Be careful not to damage the seal on the inside of the axle tube hub. Advance the shaft through to the bearing on the shaft, and rotate it to align the shaft splines with the splined bore of the differential gear. Continue advancing the shaft until the bearing on the axle is firmly seated within the axle tube hub seat.
- 4.2. Using 90° internal snap ring pliers (0.090 tip) (CCI P/N 1012560), attach the internal retaining ring into the axle tube hub so that it seats against the axle bearing assembly and into the machined slot in the inside wall of the axle tube hub.
- 4.3. Place a 1/4 to 3/8 - inch (6 - 10 mm) diameter rod against the retaining ring and tap lightly at four or five locations to ensure it is properly seated. **See following WARNING.**

**⚠ WARNING**

- **Be sure retaining ring is properly seated in groove. If ring is not properly installed, the axle assembly will separate from the transaxle and damage the axle assembly and other components. Loss of vehicle control could result in severe personal injury or death.**
5. Tighten lug nuts on rear wheels, using a crisscross pattern, to 55 ft-lb (74.6 N·m). **See Wheel Installation, Section 8, Page 8-1.**
  6. Adjust the brakes. **See Brake Cable Equalizer Adjustment on page 6-9.**

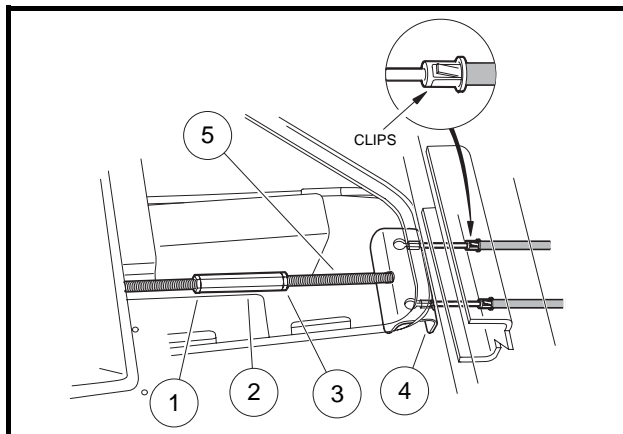


## BRAKE CABLE REMOVAL AND INSTALLATION

See General Warnings, Section 1, Page 1-1. See also Warning on Page 6-1.

### Brake Cable Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Place chocks at the front wheels.
3. Gain access to the pedal group by removing the floor mat and access panel. See **Pedal Group Removal, Section 5, Page 5-1.**
4. Loosen the two jam nuts (1 and 3) on either side of turnbuckle (2) (**Figure 6-19, Page 6-11**). Note that the forward jam nut (1) is a left-hand thread. Thread each nut approximately 1/2 inch (12.7 mm) away from the turnbuckle.
5. Loosen turnbuckle (2) until the bolt (5) is free of the turnbuckle.



**Figure 6-19 Loosen Brake Cables**

6. Rotate the bolt (5) and equalizer bracket (4) to the upright position then slip the cable heads out of the bracket.
7. Remove nut (1) from the bolt (2) that secures front of the leaf spring (**Figure 6-21, Page 6-12**). Do not remove bolt (2).
8. Remove the mounting tab (3) of the brake cable from the bolt.
9. Using brake cable release tool (CCI P/N 102555501), compress the retaining clips on the end of the cable housing enough to slide the cable end out of the hole in the frame.
10. Remove bow tie locking pin (1) and the clevis pin (2) from the brake lever on each wheel and pull the clevis (3) away from the lever. (**Figure 6-20, Page 6-12**).
11. Using brake cable release tool (CCI P/N 102555501), compress the retaining clips on the end of the cable housing enough to slip the cable end out of the bracket (4) and remove the brake cable from the vehicle.

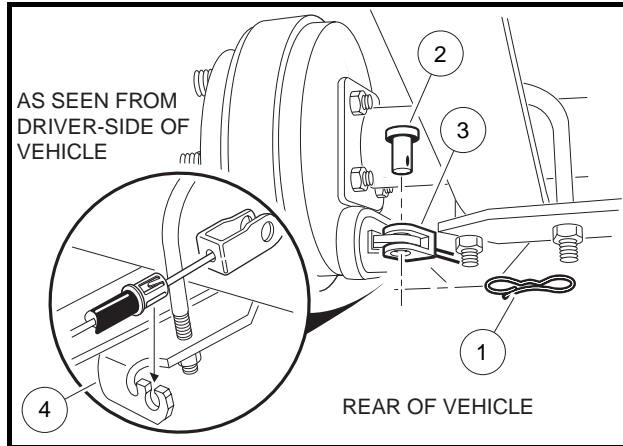


Figure 6-20 Disconnect Cables at Rear Brakes

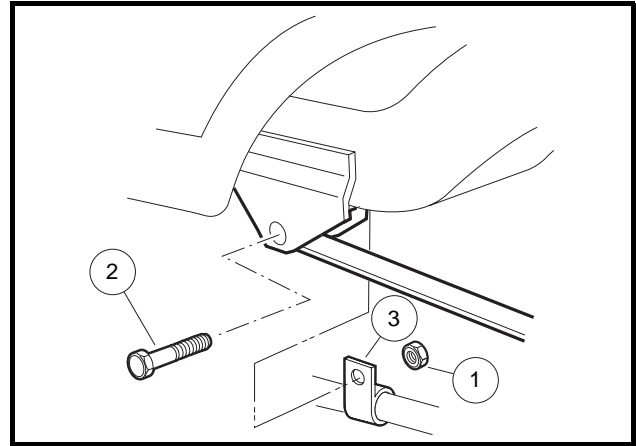


Figure 6-21 Brake Cable Mounting Tab

## Brake Cable Installation

**NOTE:** The driver-side and passenger-side brake cables are not interchangeable. The driver-side cable is shorter than the passenger-side cable. Make sure the correct cable is used on the correct side.

Be sure to orient the cable so that the clevis end goes to the wheel rather than to the equalizer bracket.

1. Insert the end of the new brake cable through the hole in the frame (**Figure 6-19, Page 6-11**). Push on the cable housing so the clips on the housing ends secure the housing in the hole.
2. Hold the bolt (5) and the equalizer bracket (4) in the upright position and slip the cable head through the hole on top of the bracket. Pivot the equalizer to the horizontal position to capture the cable heads in the equalizer.
3. Insert the rear cable housing into the shock mount bracket (4) (**Figure 6-20, Page 6-12**). Push the cable housing end into the bracket to ensure the clips on the housing end secure the cable in position.
4. At the rear wheel brake, connect the cable to the brake actuator arm using new clevis pin (2) and new bow tie locking pin (1) (**Figure 6-20, Page 6-12**).
5. Place tab (3) on cable housing over the forward leaf spring mounting bolt (2) (**Figure 6-21, Page 6-12**). Install nut (1). Tighten nut to 18.4 ft-lb (25 N·m).
6. Adjust the brakes. **See Brake Cable Equalizer Adjustment on page 6-9.**

# SECTION 7 – STEERING AND FRONT SUSPENSION

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## **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

## **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

## GENERAL INFORMATION

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Steering is controlled through a rack and pinion steering assembly that is connected by a steering column to a steering wheel. No manual adjustment to the rack and pinion gear assembly is required. A spring loaded self-adjusting mechanism is incorporated into the assembly.

## STEERING WHEEL

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See General Warnings, Section 1, Page 1-1.

## STEERING WHEEL REMOVAL

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. If scorecard holder is secured to steering wheel with screws, remove the two mounting screws (8) (**Figure 7-3, Page 7-3**).
3. Remove the scorecard holder plate (1).
4. Match mark the steering wheel (7) and steering column shaft (9) so when the steering wheel is removed it can be placed back in exactly the same position on steering column shaft.
5. Loosen the steering wheel bolt (6) and back it off approximately 1/4 inch (6 mm). Do not remove the bolt.
6. If it is difficult to remove the steering wheel, use the steering wheel puller (CCI P/N 102061201) to remove steering wheel.
  - 6.1. Place the puller anvil (4) through the top opening of the steering wheel (**Figure 7-1, Page 7-2**).
  - 6.2. Insert the anvil feet through the two slots in the base plate (marked “B”) (5) as shown (**Figure 7-1, Page 7-2**).
  - 6.3. Rotate the anvil screw (6) clockwise until the base plate contacts the bottom of the steering wheel where it attaches to the steering column (**Figure 7-2, Page 7-2**).
  - 6.4. Using a 1/2 inch drive air impact wrench, tighten the anvil screw (6) until the steering wheel breaks free from the steering shaft.
  - 6.5. Remove the steering wheel puller.

**Steering Wheel Removal, Continued:**

- 6.6. Remove the steering wheel bolt (6) and the steering wheel (7) from the steering column (9) (Figure 7-3, Page 7-3).

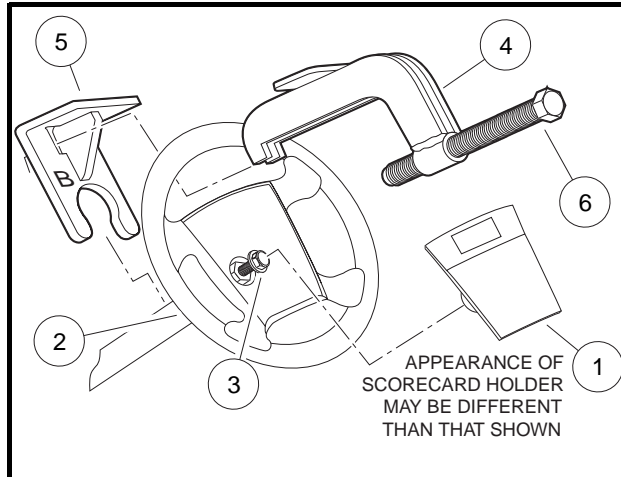


Figure 7-1 Steering Wheel Puller

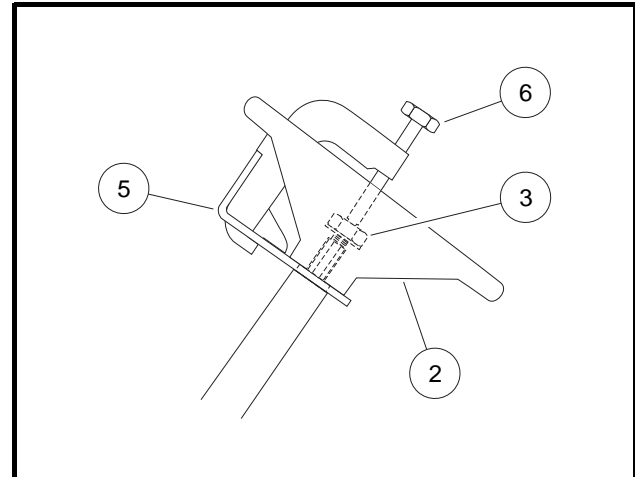


Figure 7-2 Steering Wheel Puller

**STEERING WHEEL INSTALLATION**

**NOTE:** To minimize corrosion and to make future removal of the steering wheel easier, apply a small amount of oil or anti-seize compound to steering shaft before installing the steering wheel.

1. Install the steering wheel (7) on the steering column shaft (9). Be sure to align the match marks placed on the wheel and steering column in step 4 above (Figure 7-3, Page 7-3).
2. Install the steering wheel bolt (6) and tighten to 13 ft-lb (17.6 N·m).
3. Install the scorecard plate (1).
4. If required, install the plate mounting screws (8). Tighten screws to 16 in-lb (1.8 N·m).

**STEERING COLUMN**

See General Warnings, Section 1, Page 1-1.

**STEERING COLUMN REMOVAL**

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in General Warnings, Section 1, Page 1-1.
2. Remove the steering wheel as previously instructed.
3. Remove the dash insert, instrument panel, dash assembly, and front bumper. See **Section 4 – Body and Trim.**

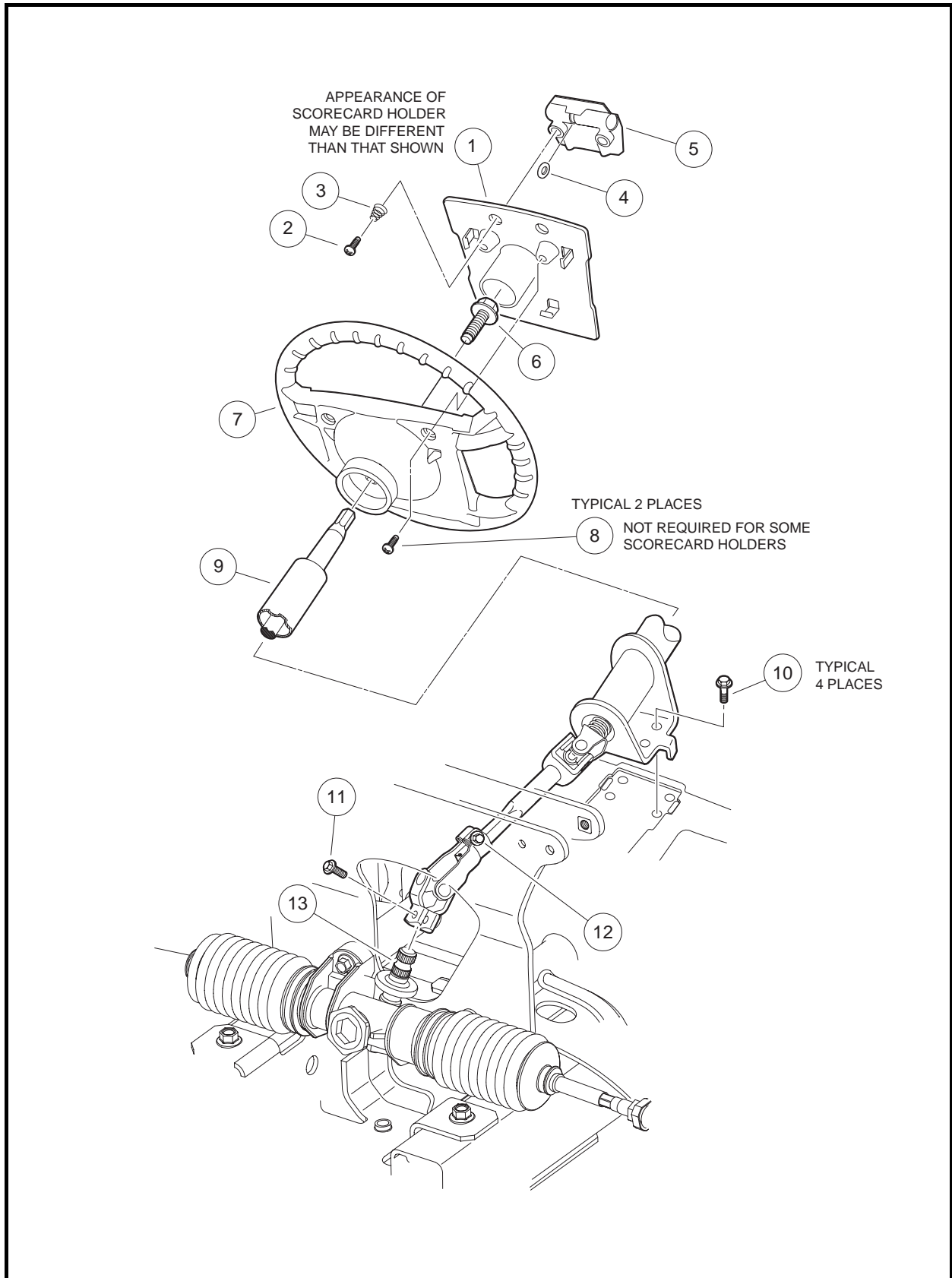


Figure 7-3 Steering Column

**Steering Column Removal, Continued:**

4. Loosen the bolt (11) that attaches the steering column universal joint to the stud on the steering gear **(Figure 7-3, Page 7-3)**.
5. Remove the four bolts (10) that attach the steering column to the frame.
6. Remove the steering column from the vehicle.

**STEERING COLUMN INSTALLATION**

1. For ease of assembly and to prevent corrosion, apply a light coat of anti-seize or lubricating compound to the splined stud extending from the steering gear.
2. Insert the end of the steering column with the universal joint through the front underbody. Position universal joint over splined stud on the steering gear. Leave bolt (11) loose until steering column is mounted to frame in step 3 **(Figure 7-3, Page 7-3)**.
3. Align the holes in the steering column mounting bracket with holes in the vehicle frame. Secure column to frame with four bolts (10). Tighten bolts to 18.4 ft-lb (25 N·m).
4. Tighten universal joint bolt (11) to 18.4 ft-lb (25 N·m). Verify bolt (12) torque is 18.4 ft-lb (25 N·m).
5. Install front bumper, dash assembly, dash insert, and instrument panel. **See Section 4 – Body and Trim.**

**RACK AND PINION**

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**See General Warnings, Section 1, Page 1-1.**

**RACK AND PINION REMOVAL**

1. Remove the front bumper as instructed. **See Section 4 – Body and Trim.**
2. Remove the retaining pins (1) and tie rod end retaining nuts (2) **(Figure 7-4, Page 7-5)**.
3. Remove the tie rod ends (3) from the spindle assemblies.
4. Remove the three bolts (5) from the steering rack and pinion assembly mounting bracket.
5. Remove the bolt (6) from the universal joint, then remove the rack and pinion assembly and universal joint from the vehicle.

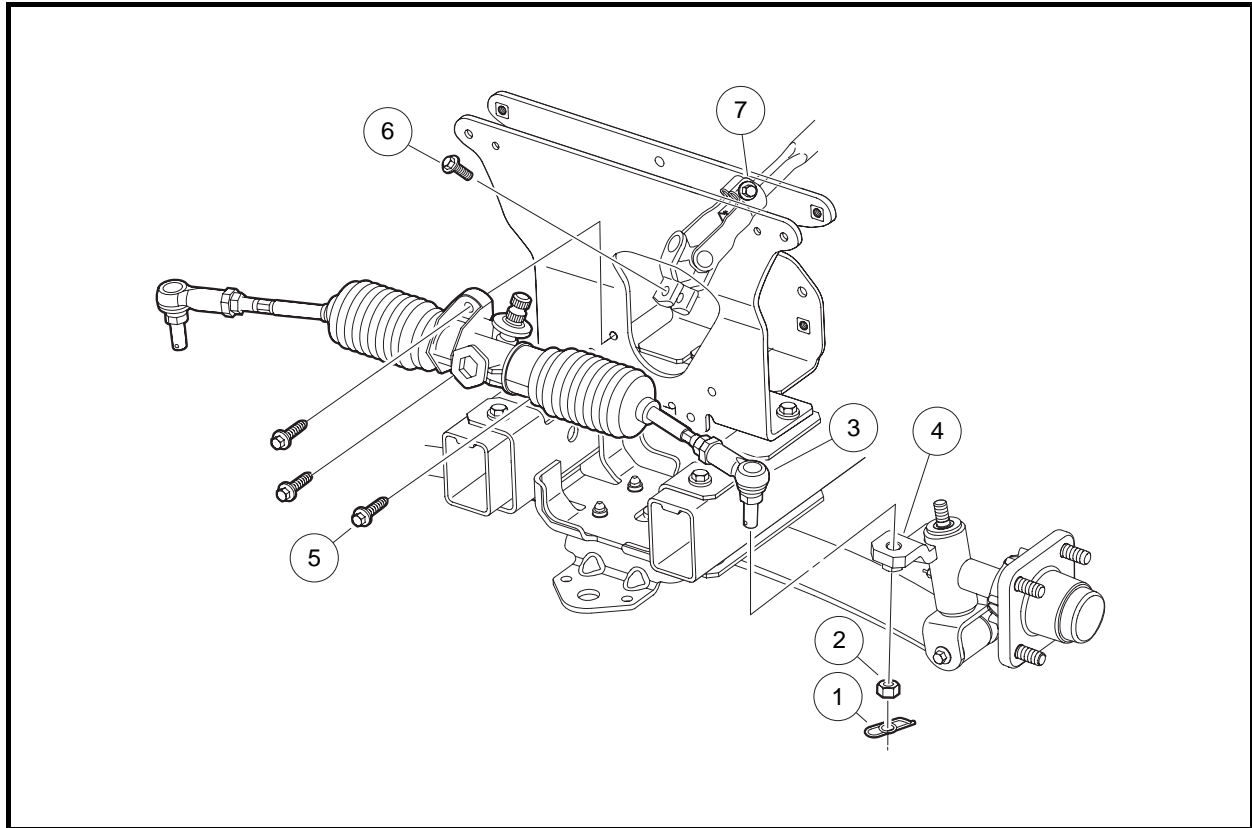


Figure 7-4 Rack and Pinion Removal

## RACK AND PINION DISASSEMBLY

1. Remove the two tie rod ends (12) and inspect for excessive wear (**Figure 7-5, Page 7-6**).
2. Remove clamps (10 and 21) from bellows (9) (**Figure 7-5, Page 7-6**).

**NOTE:** If the dust seal bellows are secured with a metal clamp, remove the clamp. Do not reuse the clamp when the rack and pinion is reassembled. Use a plastic wire tie to secure the dust seal bellows.

3. Remove the two hex nuts (11) and slide off both of the dust seal bellows (9) from ball joints (8).
4. Remove rack screw nut (14), rack guide screw (13), rack guide pressure spring (15) and the rack guide (16).
5. Remove the universal joint assembly from the pinion (5) by removing the bolt and then sliding off the universal joint.
6. Remove the dust seal (**Figure 7-6, Page 7-7**).
7. Remove the large snap ring (4) (**Figure 7-7, Page 7-7**).
8. Remove pinion (5) from the housing (17) (**Figure 7-8, Page 7-7**). If removal is difficult, install the universal joint onto the pinion and place a fork or a large open-end wrench under the universal joint (**Figure 7-8, Page 7-7**). Gently pry the pinion from the housing.
9. Remove the universal joint from the pinion (5).

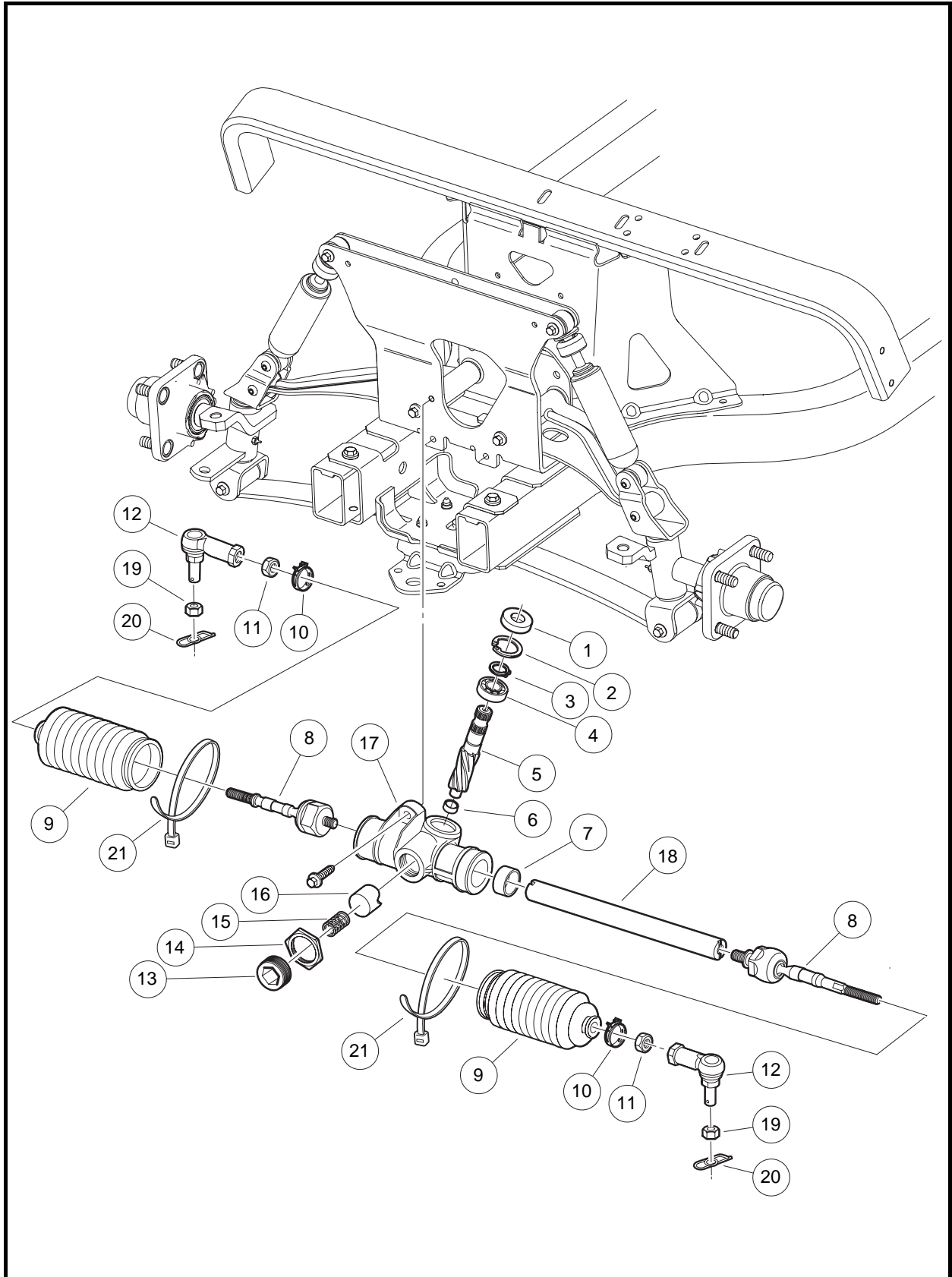
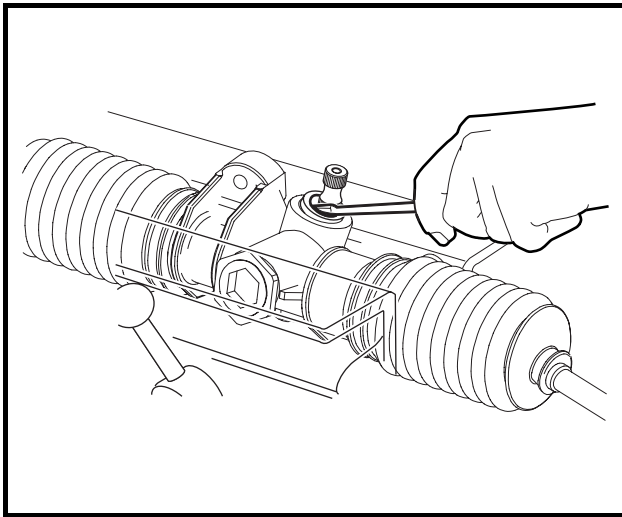
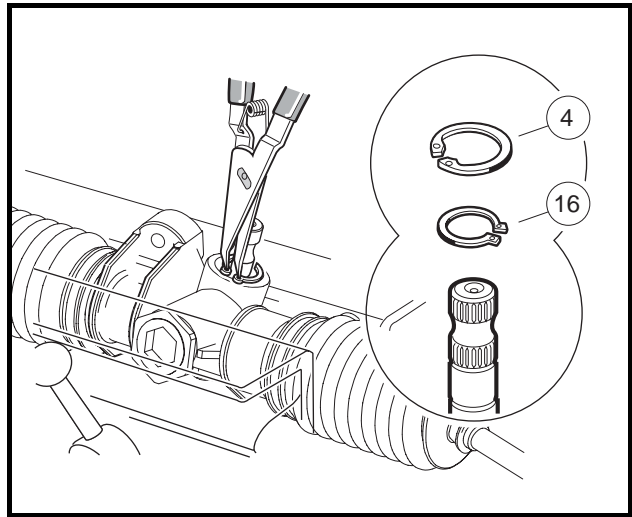
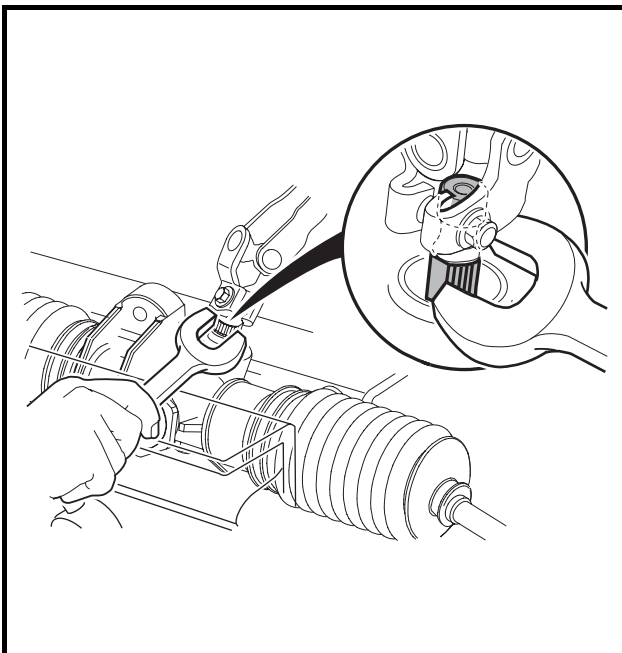
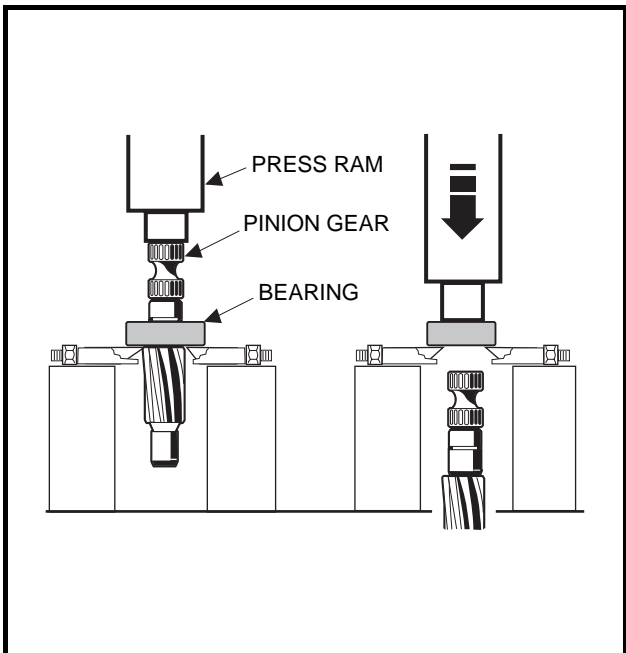


Figure 7-5 Steering Gear



**Rack and Pinion Disassembly, Continued:**

10. If the ball bearing (4) (**Figure 7-5, Page 7-6**) has been damaged, remove the C-type stop ring (16) (**Figure 7-7, Page 7-7**) and press the bearing off (**Figure 7-9, Page 7-7**).
11. Inspect the bushing (7) and needle bearing (6) for excessive wear. If wear is excessive, replace the entire assembly (**Figure 7-5, Page 7-6**).
12. Inspect the ball joints (8) for wear. If one or both of the ball joints (8) are excessively worn, remove and replace the ball joint from the rack (18).
13. Remove the rack (18) from housing (17).

**Figure 7-6 Remove Dust Seal****Figure 7-7 Pinion Snap Rings****Figure 7-8 Remove Pinion from Housing****Figure 7-9 Remove Bearing from Pinion**

## RACK AND PINION ASSEMBLY

1. Apply a liberal amount of EP grease to the teeth of the rack (18), then slide the rack through the bushing (7) and housing (17) (**Figure 7-5, Page 7-6**).

### **CAUTION**

- In step 2, do not press against the outer race of the bearing.
2. If the pinion bearing (4) was removed, grease a new bearing before installation. Press new bearing onto pinion shaft, exerting all pressure on the inner race. Then install the C-type stop ring (3). **See previous CAUTION.**
  3. Install pinion (5) and bearing (4) assembly into the housing (17). Make sure the rack gear teeth will mesh with the gear teeth on the pinion. The rack may need to be rotated slightly while lightly tapping on the pinion-bearing assembly with a rubber mallet. **See following CAUTION.**

### **CAUTION**

- Do not force the pinion-bearing assembly into the housing. The gear teeth or the small bearing could be damaged.
4. Install the large snap ring (2).
  5. Use a socket to apply pressure evenly and press in a new dust seal (**Figure 7-10, Page 7-9**).
  6. Apply a small amount of grease to the rack guide (16) where it comes into contact with the rack (18) (**Figure 7-5, Page 7-6**).
  7. Install the ball joints (8) onto the rack (18) by securing the rack in a vise using wood blocks between the rack and the jaws of the vise to protect the rack from damage. Tighten the ball joints to 60 ft-lb (81 N·m).
  8. Tap a flange into the notch on the rack (**Figure 7-11, Page 7-9**).
  9. Place a few drops of Loctite 222 to the threads of the screw (14) (**Figure 7-5, Page 7-6**).
  10. Install the rack guide (16), pressure spring (15) and screw (13). The screw should be threaded-in until it bottoms out and then backed out 1/4 turn (**Figure 7-5, Page 7-6**).
  11. Insert a 3/8-inch, 1/4-drive, deep-well socket into the steering column end of the universal joint (2) and tighten the bolts (1) to 15 ft-lb (20.3 N·m) (**Figure 7-13, Page 7-9**).
  12. Use a torque wrench connected to the 3/8-inch deep-well socket to measure the resistance of the rack and pinion. Rotational resistance should measure 7 to 15 in-lb (0.8 to 1.7 N·m).
  13. If measured resistance is not 7 to 15 in-lb (.8 to 1.7 N·m), adjust the screw (13) until correct setting is achieved. Tighten the nut (14) to 28 ft-lb (38 N·m) (**Figure 7-12, Page 7-9**).

**NOTE:** When tightening the nut (14), make sure the screw (13) does not change adjustment (**Figure 7-12, Page 7-9**).

14. Install the two dust seal bellows (9) (**Figure 7-5, Page 7-6**).
15. Install new bellows clamps (wire ties) (10 and 21).
16. Install the tie rod ends (12) to each end of rack (18). Tighten the tie rod end jam nuts (11) to 20 ft-lb (27 N·m) (**Figure 7-5, Page 7-6**).

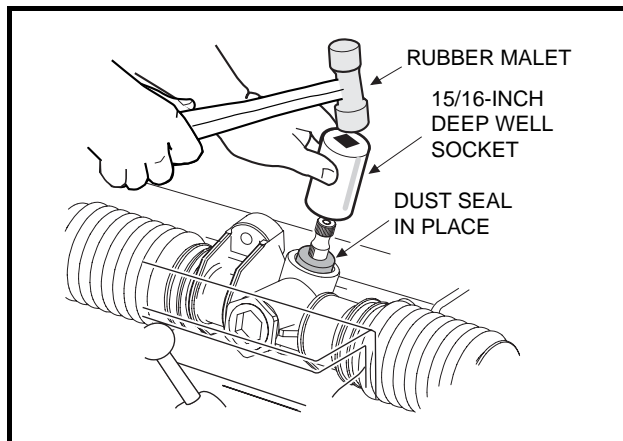
## RACK AND PINION INSTALLATION

1. To minimize corrosion, apply a light coat of anti-seize lubricating compound to the splined portion of the steering column universal joint.
2. Align the flat portion of the shaft (13) spline with the bolt hole in the upper universal joint and then slide the shaft into the universal joint. Install the bolt and tighten to 18.4 ft-lb (25 N·m) (**Figure 7-3, Page 7-3**).
3. Simultaneously position the assembly over the mounting holes and slide the universal joint over the square end of the steering column.
4. Install three screws to secure the assembly to the vehicle. Tighten screws to 22 ft-lb (30 N·m).
5. Install the tie rod ends (3) into the left- and right-hand spindle tabs (4), and then install the retaining nuts (2) (**Figure 7-4, Page 7-5**). See following **WARNING**.

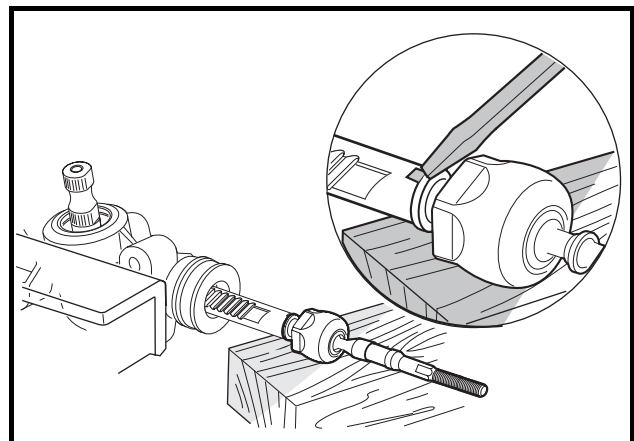
### **⚠ WARNING**

- Do not operate vehicle until toe-in is adjusted and ball joints are secured.

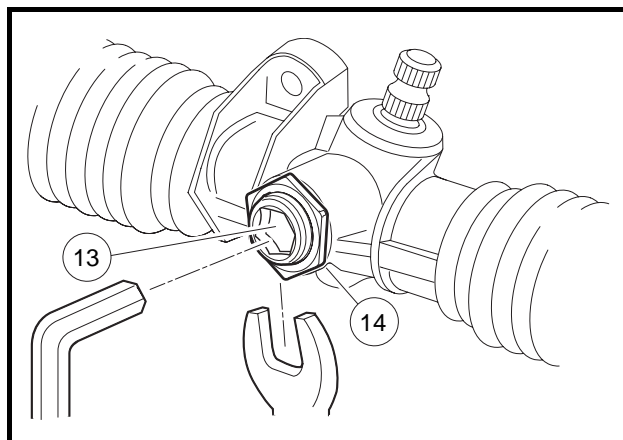
6. Adjust the toe-in. See **Toe-in Adjustment** on page 7-11.



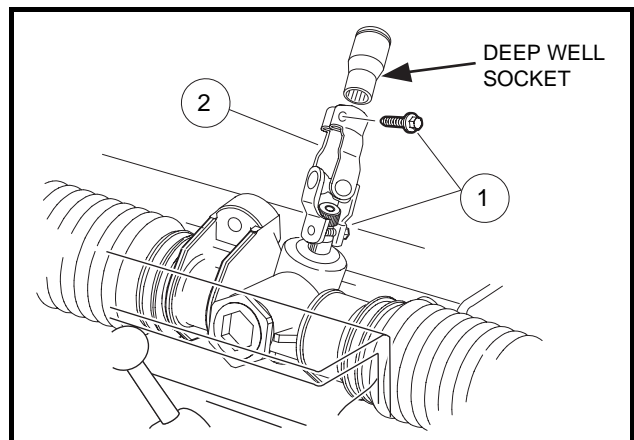
**Figure 7-10** Press In Dust Seal



**Figure 7-11** Install Ball Joint



**Figure 7-12** Rack and Pinion Adjustment



**Figure 7-13** Rack and Pinion Resistance

## FRONT SUSPENSION

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See General Warnings, Section 1, Page 1-1.

### LUBRICATION

Two grease fittings are provided (one in each spindle housing). Lubricate these fittings at the recommended interval with the proper lubricant. **See Periodic Lubrication Schedule, Section 10, Page 10-3.**

### CAUTION

- To ensure proper lubrication, raise front of vehicle to lubricate. See General Warnings, Section 1, Page 1-1.

### WHEEL ALIGNMENT

Wheel alignment is limited to equalizing the camber angle of each front wheel and adjusting toe-in of the front wheels.

***NOTE:** Prior to making any front suspension adjustments, inspect components for wear or damage and repair or replace as necessary.*

### Camber Adjustment

1. Check each front wheel with a framing square. At the floor (or ground), there should be an equal amount of space between each tire and the framing square (**Figure 7-14, Page 7-11**).
2. Loosen, but do not remove, the four bolts (17) that secure the leaf spring (13) to the bottom spring plate (16) (**Figure 7-19, Page 7-16**). **See also Figure 7-15, Page 7-11.**
3. Loosen, but do not remove, the hex nut (8) on the adjustment eccentric (7) (**Figure 7-15, Page 7-11**) in the center of the spring. **See also Figure 7-19, Page 7-16.**
4. Use a 7 mm deep well socket to rotate the eccentric (**Figure 7-15, Page 7-11**).
5. After adjusting camber, use a crisscross pattern to tighten the four spring retaining bolts (17) (**Figure 7-19, Page 7-16**) to 23 ft-lb (31 N·m). Then roll the vehicle forward one full tire revolution and recheck the camber. **See also Figure 7-14, Page 7-11.**
6. Tighten the hex nut (8) on the adjustment eccentric (7) to 10 ft-lb (13.5 N·m) (**Figure 7-15, Page 7-11**). **See also Figure 7-19, Page 7-16.**

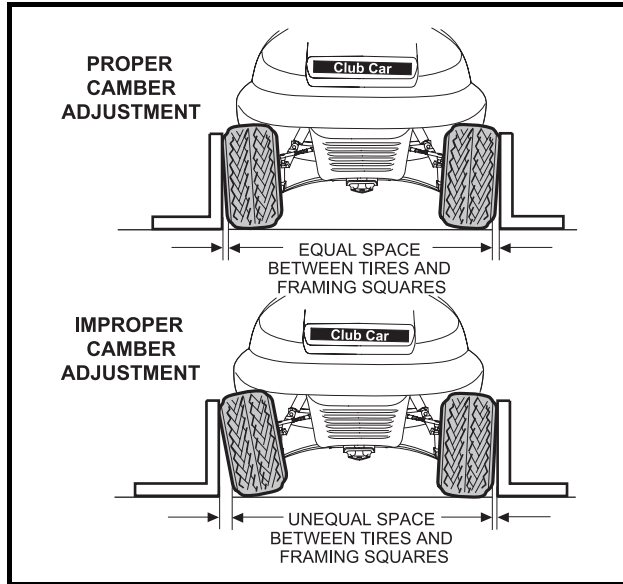


Figure 7-14 Check Camber

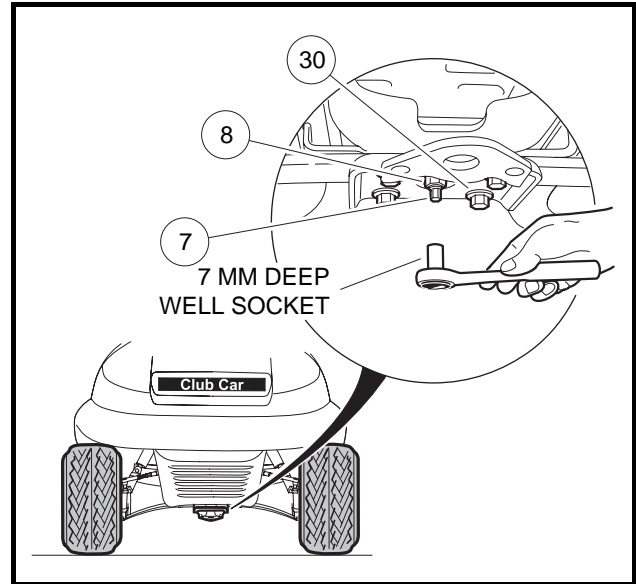


Figure 7-15 Adjust Camber

### Toe-in Adjustment

1. On a level surface, roll the vehicle forward, then stop. Make sure the front wheels are pointed straight ahead. Do not turn the steering wheel again during this procedure.
2. On each front tire, mark (as closely as possible) the center of the tread face that is oriented toward the rear of the vehicle. The marks should be even with the bottom surfaces of the vehicle frame.
3. Measure the distance between the marks on the rear-facing surfaces of the tires, and then roll the vehicle forward one and one-half wheel revolution until the marks appear on the forward-facing surfaces of the tires at about the same height from the floor (**Figure 7-16, Page 7-11**).

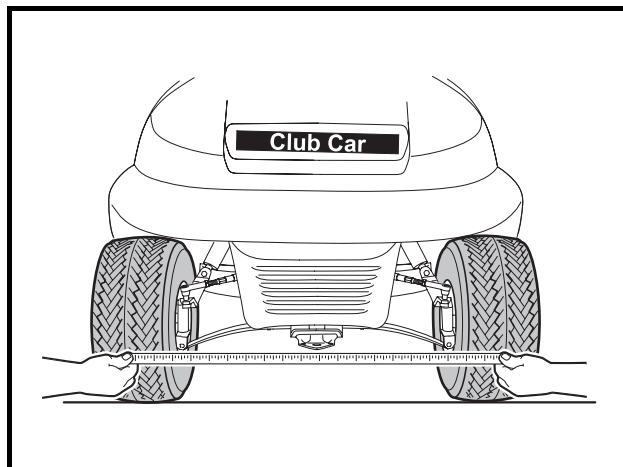


Figure 7-16 Check Toe-In

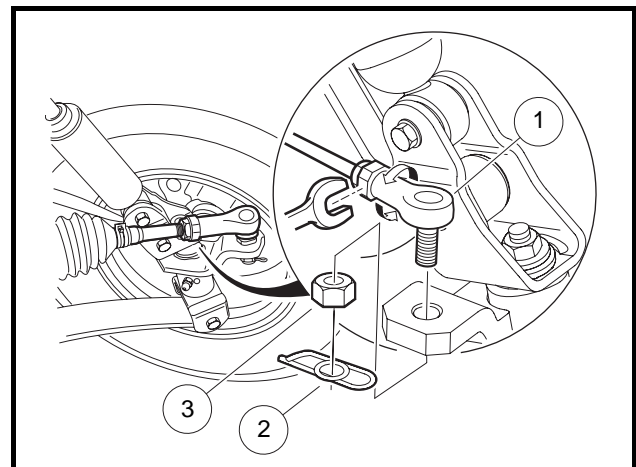


Figure 7-17 Adjust Toe-In

4. Measure the distance between the marks on the forward-facing surfaces of the tires (**Figure 7-16, Page 7-11**).

**NOTE:** The front measurement must be less than the rear measurement.

**Toe-in Adjustment, Continued:**

5. Subtract the measurement on the front of the tires from the measurement on the rear of the tires. The difference is the toe-in. Proper toe-in is 5/16 inch (7.8 mm).
6. If adjustment is necessary, proceed as follows:
  - 6.1. Loosen the jam nut on each tie rod end (1) (**Figure 7-17, Page 7-11**).
  - 6.2. Remove the retaining pin (2) and nut (3) that secure the tie rod to the spindle. Raise the male threads out of the spindle.
  - 6.3. Rotate tie rod end in or out as required.
  - 6.4. Attach male thread to spindle tab and recheck the toe-in.
  - 6.5. As necessary repeat steps 6.1 through 6.4.
  - 6.6. Secure tie rod ends with nuts (3) and tighten to 70 ft-lb (95 N·m). Install retaining pins (2).
  - 6.7. Tighten jam nuts. Tighten to 26 ft-lb (35 N·m).
  - 6.8. After toe-in adjustment is made and with wheels in the straight ahead position, the steering wheel should be at the center of its travel. There should be equal travel to the left and right.

## FRONT SUSPENSION COMPONENTS

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See General Warnings, Section 1, Page 1-1.

### TIE ROD END REMOVAL

1. Loosen jam nuts (13) to allow later rotation of the tie rod ends (12) (**Figure 7-18, Page 7-15**).
2. Remove the retaining pins (15) and retaining nuts (14).
3. Lift male thread of tie rod from the hole in the spindle tab.
4. Remove the tie rod ends from the steering gear.
5. To minimize corrosion, apply a light coat of anti-seize lubricating compound to the threads where the tie rod ends are installed.

### TIE ROD INSTALLATION

1. Thread tie rod ends (12) onto steering gear to a depth of 1/2 inch (12.5 mm) (**Figure 7-18, Page 7-15**).

#### **⚠ WARNING**

- The tie rod ends must be threaded into the rod at least 5/16 of an inch (8 mm). Failure to thread deep enough may cause tie rod ends to separate from the rod during adjustment or while being operated, possibly resulting in loss of vehicle control and severe personal injury.
2. Install tie rod ends (12) into the spindle tabs. Install the retaining nuts (14) and retaining pins (15) (**Figure 7-18, Page 7-15**).
  3. Adjust wheel toe-in. See **Toe-in Adjustment on page 7-11**.

## LEAF SPRING REMOVAL

1. Loosen lug nuts on both front wheels and raise front of vehicle with a chain hoist or floor jack. Place jack stands under the aluminum rails of the vehicle frame just aft of the front suspension. Lower the vehicle onto the jack stands. **See General Warnings, Section 1, Page 1-1.**
2. Remove both front wheels.
3. Remove the bolts (8) from the bottom of each kingpin (7) **(Figure 7-19, Page 7-16).**
4. Remove the four bolts (17) and bottom spring plate (16).
5. Remove leaf spring (13).
6. Check the condition of the urethane bushings (15) and steel sleeves (14). Replace any that are worn or damaged.

## LEAF SPRING INSTALLATION

1. Install urethane bushings (15) and steel sleeves (14) into leaf spring eyes **(Figure 7-19, Page 7-16).**
2. Install leaf spring (13), bottom spring plate (16), and four bolts (17). Using a crisscross pattern sequence, tighten bolts to 23 ft-lb (31 N·m).
3. Install spring in kingpins (7) with bolts (8). Tighten to 17 ft-lb (23 N·m).
4. Install the wheels and finger tighten the lug nuts.
5. Lower the vehicle and finish tightening lug nuts (using a crisscross pattern) to 55 ft-lb (74.6 N·m).
6. Adjust camber and toe-in. **See Wheel Alignment on page 7-10.**

## KINGPIN AND STEERING SPINDLE REMOVAL

1. Remove the front hub. **See Front Hub Removal on page 7-17.**
2. Remove retaining pins (15) and nuts (14), then remove tie rod ends (12) from the tabs on the spindles **(Figure 7-18, Page 7-15).**
3. Remove the nut (1) and conical washer (2) from the top of the kingpin (7) **(Figure 7-19, Page 7-16).**
4. Raise the upper clevis from the kingpin.
5. Slide the spindle (3) off the kingpin (7).
6. Remove the wave washer (6) and inspect it. If the washer is broken or has a wave bottom to wave crest height dimension of less than 0.040 inch (1 mm), it must be replaced.
7. Remove bolt (8) from bottom of kingpin (7) and remove kingpin.
8. Inspect the kingpin and spindle. If either is worn or damaged, it must be replaced.
9. Inspect the bushings (4). If the bushings are worn or damaged, remove them and press in new ones.

## KINGPIN AND STEERING SPINDLE INSTALLATION

1. Inspect all parts and replace them as necessary.
2. Install the kingpin (7) over the leaf spring eye. Insert the bolt (8) **(Figure 7-19, Page 7-16).** Tighten the bolt to 17 ft-lb (23 N·m).
3. Install the wave washer (6) on the kingpin.
4. Install the steering spindle on the kingpin. Place upper clevis over the kingpin threads and install conical washer (2) and nut (1). Tighten the nut to 50 ft-lb (68 N·m).

**Kingpin and Steering Spindle Installation, Continued:**

5. Attach the tie rod ends (12) to the spindle tabs, than install and tighten the nuts (14) to 70 ft-lb (95 N·m). Install the retaining pins (15) **(Figure 7-18, Page 7-15)**.
6. Install front hub and wheel. **See Hub Installation on page 7-17.**

**CONTROL ARM REMOVAL**

1. Loosen lug nuts on both front wheels and raise front of the vehicle with a chain hoist or floor jack. Place jack stands under the front aluminum rails of the vehicle frame and lower the vehicle onto the jack stands.
2. Remove wheel.
3. Remove bolts (17) and move rack and pinion to allow clearance for bolt (19) **(Figure 7-18, Page 7-15)**.
4. Remove bolts (11 and 19).
5. Remove the control arm (6).
6. Inspect the bushings (7) and sleeves (8 and 9) in the control arm and replace them if necessary.

**CONTROL ARM INSTALLATION**

1. Install the control arm in reverse order of removal. Tighten the control arm bolts (11 and 19) to 20 ft-lb (27 N·m) **(Figure 7-18, Page 7-15)**. Tighten three rack and pinion mounting bolts (17) to 22 ft-lb (30 N·m)
2. Install the wheels and adjust the wheel alignment as instructed on page 7-10.

**SHOCK ABSORBER REMOVAL**

1. Inspect the shock absorbers for fluid leakage at the point where the shaft enters the shock absorber body. Leaking shock absorbers should be replaced.
2. Remove the upper bolt (18) **(Figure 7-18, Page 7-15)**.
3. Remove the lower bolt (10).
4. Remove the shock absorber.

**SHOCK ABSORBER INSTALLATION**

**NOTE:** When installing shock absorbers, make sure front shocks have identical part numbers.

1. Install the shock absorber by reversing the removal procedure.
2. Tighten the bolts to 20 ft-lb (27 N·m).



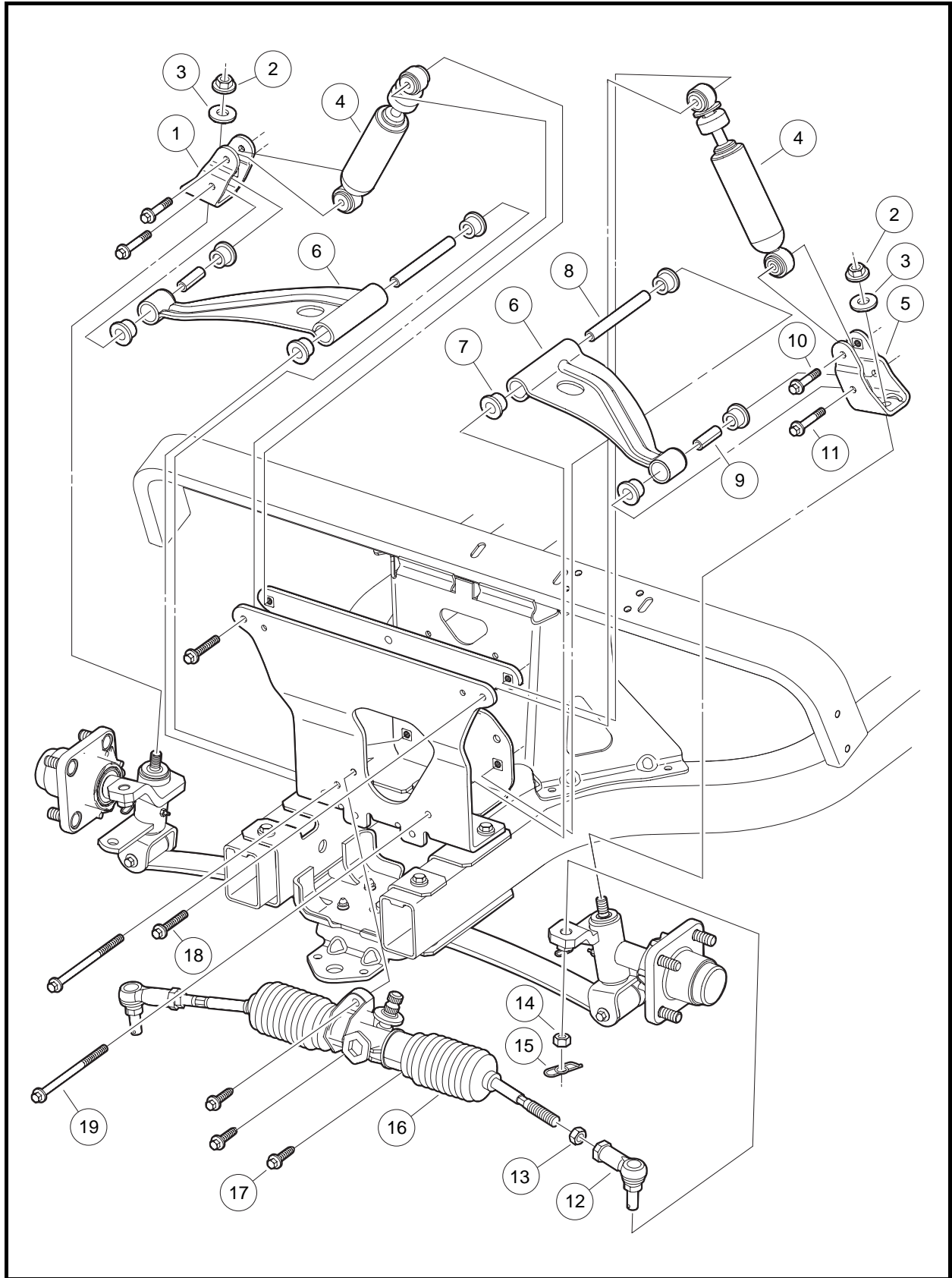


Figure 7-18 Upper Front Suspension Assembly

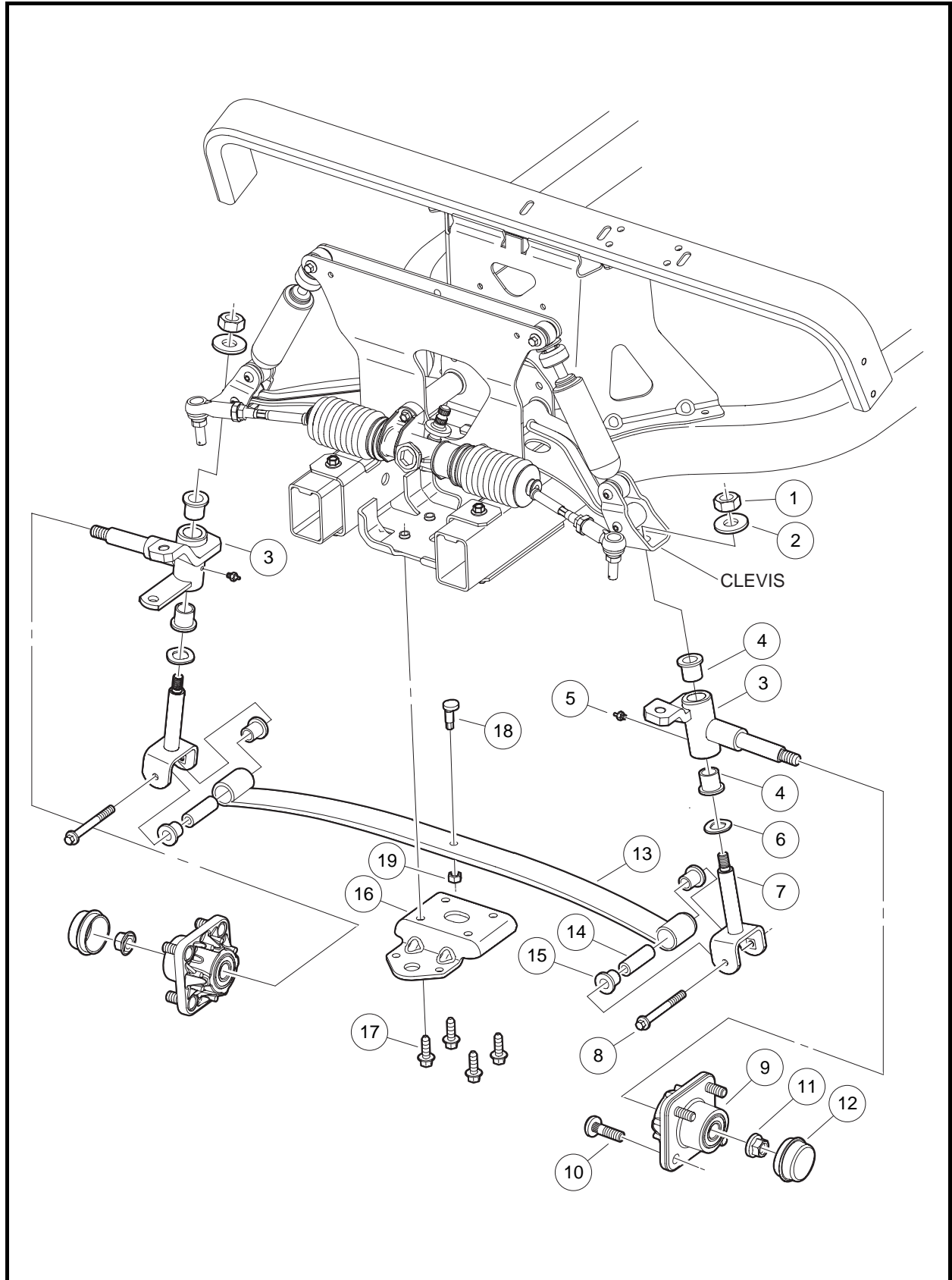


Figure 7-19 Lower Front Suspension Assembly

## FRONT WHEEL BEARINGS AND HUBS

See General Warnings, Section 1, Page 1-1.

**NOTE:** The front wheel bearings are pressed into the spindle and are not serviceable. If excessive free-play is detected the entire hub should be replaced.

### FRONT WHEEL FREE PLAY INSPECTION

1. Raise the front of the vehicle.
2. Use your hands to attempt to rock the wheel and hub assembly back and forth on the spindle. Movement of the wheel and hub on the spindle indicates that the hub bearing is worn; therefore, the hub assembly must be replaced. **See Front Hub Removal on page 7-17.**

### FRONT HUB REMOVAL

1. Remove the front wheels. **See Wheel Removal, Section 8, Page 8-1.**
2. Remove dust cap (12) and lock nut (11) (**Figure 7-19, Page 7-16**).
3. Slide the hub assembly (9) off of the spindle shaft (3).
4. Lightly sand spindle shaft to clean away any light rust.
5. Inspect the surface of the spindle shaft for surface damage. It should be clean and smooth. If severe pitting from rust or corrosion has occurred, replace the spindle assembly. **See Kingpin and Steering Spindle Removal on page 7-13.**

### HUB INSTALLATION

1. Clean and apply a light coat of anti-seize lubricant to the spindle shaft (3).
2. Slide the hub assembly (9) onto the spindle shaft (**Figure 7-19, Page 7-16**).
3. Install a new flanged lock nut (11) and tighten to 36 ft-lb (50 N·m).
4. Rotate the hub. The hub should rotate smoothly without binding, side play, or any indication of rough spots during rotation.
5. Install the dust cap (12) using a rubber mallet and tapping lightly around the edge of the cap.
6. Repeat the procedure for the opposite wheel.
7. Install wheels and finger-tighten lug nuts.
8. Lower the vehicle and finish tightening lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).

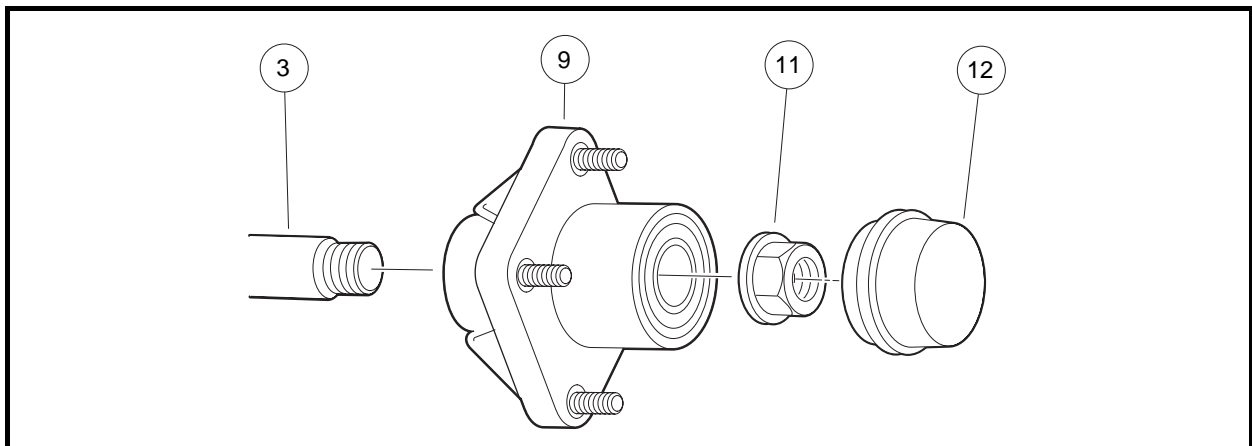


Figure 7-20 Front Wheel Hub



# SECTION 8 – WHEELS AND TIRES

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## **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

## **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

## GENERAL INFORMATION

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Maximum tire life and good vehicle handling qualities are directly related to proper wheel and tire care.

- Keep tires properly inflated. **See Section 2 – Vehicle Specifications.**
- Keep lug nuts properly tightened.
- Keep the front end aligned and adjusted.

## **⚠ WARNING**

- **Tires affect vehicle handling. When selecting a replacement tire, use only original equipment or comparable tires.**

## WHEELS

---

**See General Warnings, Section 1, Page 1-1.**

### WHEEL REMOVAL

1. Slightly loosen the lug nuts on the wheel to be removed.
2. Raise the end of the vehicle from which the wheel is to be removed. Make sure that the wheels are off the ground. **See General Warnings, Section 1, Page 1-1.**
3. Remove the lug nuts and remove the wheel.

### WHEEL INSTALLATION

1. Install wheel(s) and tighten the lug nuts, using a crisscross pattern, until they are snug.
2. Lower the vehicle and finish tightening lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).

## TIRES

See General Warnings, Section 1, Page 1-1.

### TIRE REMOVAL

**NOTE:** Tire must be removed or installed from the valve stem side of the rim.

1. Remove the tire and wheel assembly from the vehicle as instructed above.
2. Remove the valve cap and valve core and allow air to escape from the tire.
3. If possible, use a tire machine to remove the tire from the rim.
  - 3.1. If a tire machine is not available, loosen both tire beads by applying pressure to the tire side walls and pushing the tire bead away from the rim flange and into the rim well (**Figure 8-1, Page 8-2, Detail A**).
  - 3.2. With the valve stem side of the wheel up, use a tire tool to carefully start the upper bead over the edge of the wheel rim (**Figure 8-1, Page 8-2, Detail B**).

### CAUTION

- To avoid damage to the tire, do not use excessive force when starting the bead over the edge of the rim.
- 3.3. When top bead is free of the rim, pull the bead from the bottom side of the rim up into the upper part of the rim well. Insert the tire tool under the lower bead as shown (**Figure 8-1, Page 8-2, Detail C**) and carefully pry the lower bead over the rim flange.
  - 3.4. Once the lower bead is started over the rim flange, the tire can be removed from the rim by hand.

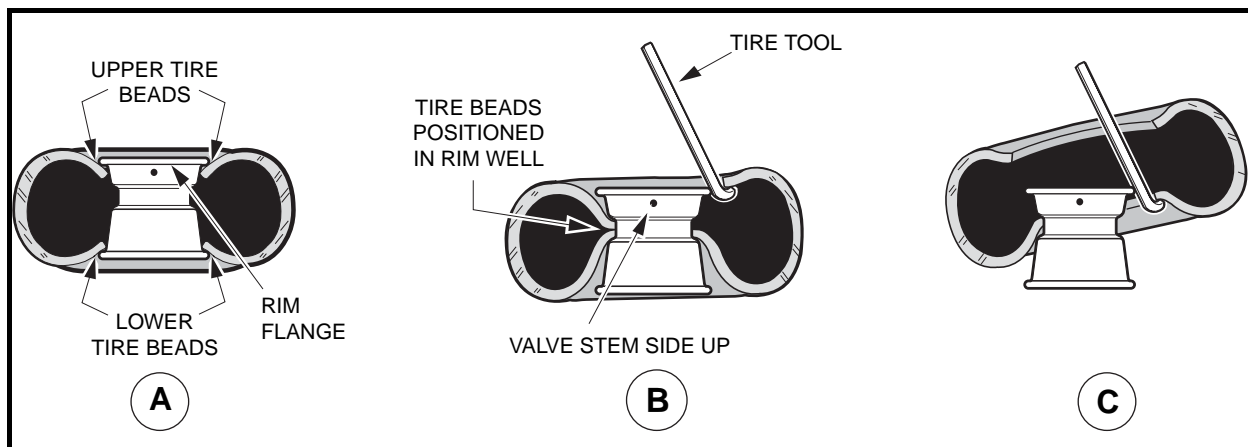


Figure 8-1 Tire Removal

### TIRE REPAIR

1. Determine the location and cause of the air leak:
  - 1.1. Remove the wheel. **See Wheel Removal on page 8-1.** Inflate the tire to no more than 20 psi (1.38 Bars).
  - 1.2. Immerse the tire in water and then mark the point where bubbles are formed by escaping air.
  - 1.3. Determine the cause of the air leak. **See following NOTE.**

**NOTE:** An air leak could be due to a punctured casing, faulty valve core, improperly seated valve stem, or improperly seated tire bead.

*Small holes in the casing can be plugged using a standard automotive tubeless tire repair kit available at your local Club Car dealer.*

2. When the cause of the air leak has been determined, remove tire from the rim and repair as required. **See Tire Removal on page 8-2.**

## TIRE INSTALLATION

### **⚠ WARNING**

- **While mounting or inflating tire, keep hands, fingers, etc. from exposed areas between the tire bead and rim.**

1. Clean both tire beads to remove dirt or other foreign matter.
2. Where the tire beads seat, clean the wheel rim with a wire brush. Wipe away any debris with a clean cloth.

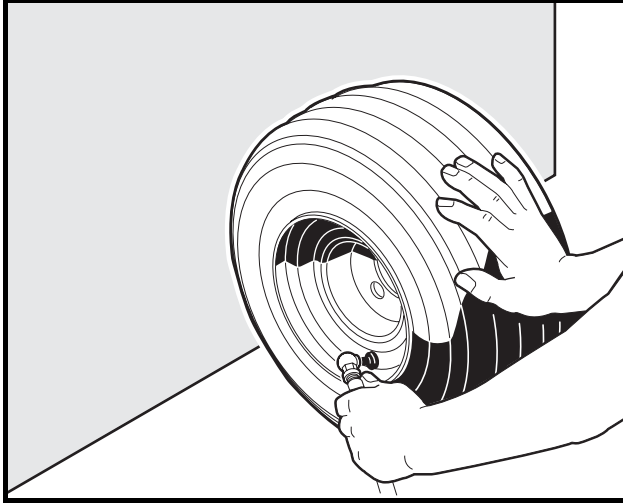
**NOTE:** Because tubeless tires require a perfect seal in order to seat, keeping the tire and rim clean is very important.

3. Apply a liberal amount of tire-mounting lubricant (soap and water solution) to both tire beads and rim flanges.
4. Install the tire on the rim from the valve stem side. If there is no tire machine available, use a rubber mallet and tire iron.
5. Remove the valve core, and position tire so that both beads are on the rim flange narrow bead seats.
6. Place tire and wheel assembly against wall in upright position and push it against wall while inflating tire to 30-35 psi (2.07-2.42 Bars). The three-point contact (wall, floor, and hand) will help ensure that beads snap into place and form a proper seal as tire is inflated (**Figure 8-2, Page 8-4**). **See following WARNING.**

### **⚠ WARNING**

- **Do not use a compressed air source with pressure over 100 psi (6.90 Bars). Due to low pressure requirements of a small tire, over-inflation could be reached almost instantly with a high pressure air supply. Over-inflation could cause tire to explode, possibly resulting in severe personal injury.**

7. Quickly remove the air nozzle and install the valve core.
8. Adjust air pressure in tire to recommended pressure. **See Section 2 – Vehicle Specifications.**
9. Immerse the wheel and tire assembly in water to make sure there are no leaks.



**Figure 8-2 Inflation Tire**



# SECTION 9 – REAR SUSPENSION

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## **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

## **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

## GENERAL INFORMATION

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The rear suspension of the Precedent vehicle is completely independent. It consists of two leaf springs controlled by two shock absorbers mounted between the springs and the vehicle frame.

## SHOCK ABSORBERS

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See General Warnings, Section 1, Page 1-1.

### SHOCK ABSORBER REMOVAL AND INSPECTION

1. Check shock absorbers (7) for damage or fluid leakage at the point where the shaft enters the shock absorber body. Replace damaged or leaking shock absorbers (**Figure 9-1, Page 9-2 or Figure 9-4, Page 9-5**).
2. To remove a shock absorber, remove the nut (5), cup washer (9) and rubber bushings (10) from the stem at the top of the shock absorber.
3. Remove the nut (5), cup washer (9), and rubber bushings (10) from lower mounting stem.
4. Compress the shock absorber to remove it.

### SHOCK ABSORBER INSTALLATION

1. To install, reverse the removal procedure.
2. On the upper and lower shock absorber mounting stems, tighten the nuts until the rubber bushing expands to the size of the cup washer.

## LEAF SPRINGS (TWO-PASSENGER VEHICLES)

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See General Warnings, Section 1, Page 1-1.

### LEAF SPRING REMOVAL (TWO-PASSENGER VEHICLES)

1. Loosen, but do not remove, lug nuts on tire and wheel assembly on the side from which the spring is to be removed. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame crossmember forward of the spring mounting tabs. Lower the vehicle to let the jack stands support the vehicle (**Figure 9-2, Page 9-3**). See following **WARNING**.

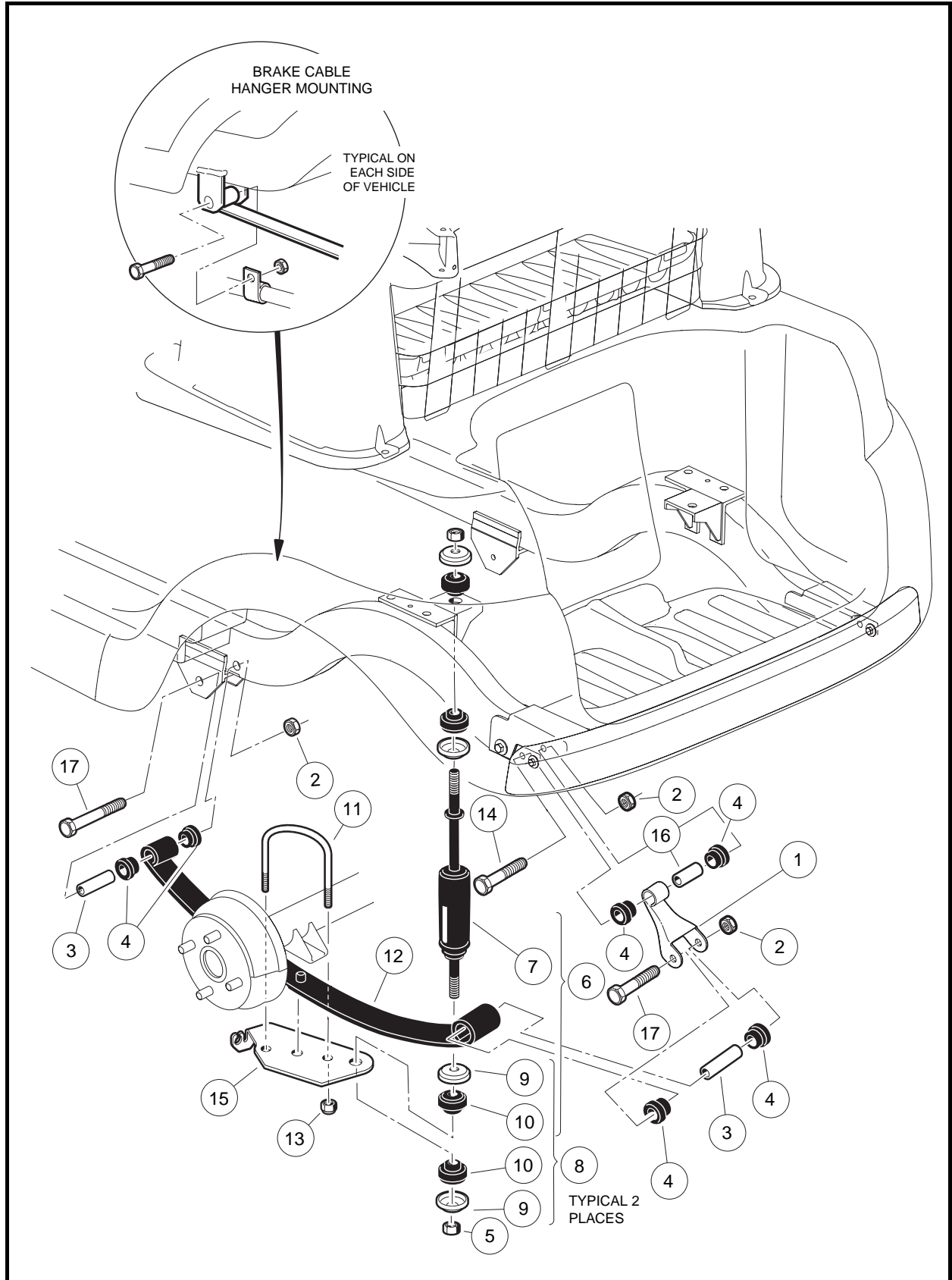
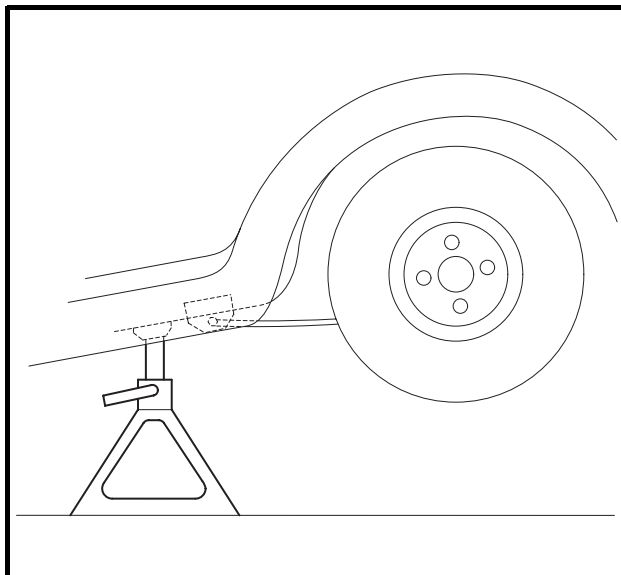
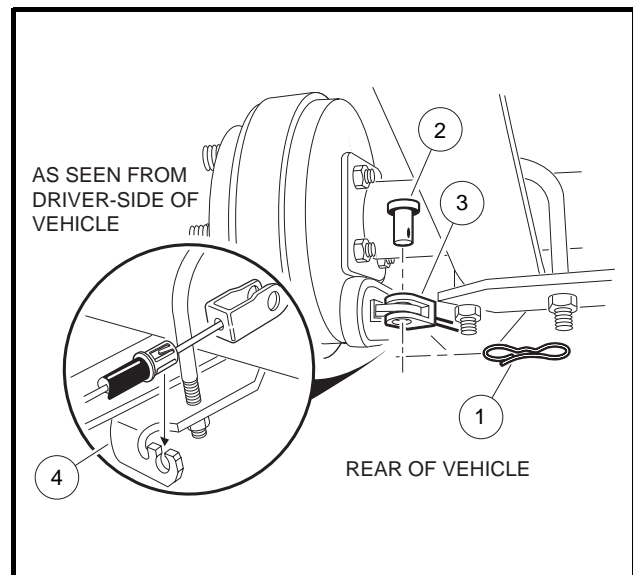


Figure 9-1 Rear Suspension Assembly and Mounting (Two-Passenger Vehicles)

**Leaf Spring Removal (Two-Passenger Vehicles), Continued:**** WARNING**

- **Lift only one end of the vehicle at a time. Use a suitable lifting device (chain hoist or hydraulic floor jack) with 1000 lb. (454 kg) minimum lifting capacity. Do not use lifting device to hold vehicle in raised position. Use approved jack stands of proper weight capacity to support the vehicle and chock the wheels that remain on the floor. When not performing a test or service procedure that requires movement of the wheels, lock the brakes.**
2. Place a floor jack under the transaxle differential casing to support, but not lift, the drivetrain. Raise it just enough to relieve tension on the shock absorbers without compressing them.
  3. Remove the tire and wheel assembly on the side from which the spring is to be removed.
  4. Remove the bow tie locking pin (1) and the clevis pin (2) at the brake lever and brake cable connection, and remove cable end (3) from the brake lever (Figure 9-3, Page 9-3). Detach the brake cable from the shock mount bracket (4).
  5. Remove the nut (5), cup washer (9), and rubber bushings (10) from the lower mounting stem of the shock absorber (Figure 9-1, Page 9-2).
  6. Remove the nuts (13) and the U-bolt (11) securing the spring to the transaxle. Remove the shock mount bracket (15) and the U-bolt.
  7. Remove the bolt (17) and nut (2) attaching the rear of the spring to the shackle (1).
  8. Remove the nut (2) and bolt (17) attaching the front of the spring to the vehicle frame and remove the spring.
  9. Inspect the bushings (4) and sleeves (3) in the spring eyes and replace them if they are worn or damaged.

**Figure 9-2 Support Vehicle on Jack Stands****Figure 9-3 Disconnect Brake Cable**

## LEAF SPRING INSTALLATION (TWO-PASSENGER VEHICLES)

1. To install the springs, reverse the removal procedure. **See following CAUTION.**

### **⚠ CAUTION**

- **When positioning the spring on the transaxle, be sure to insert the locating bolt on the spring in the locating hole in the transaxle saddle.**
2. Tighten the nuts on the U-bolts to 25 ft-lb (34 N·m).
  3. Tighten nuts (2) on spring mounting bolts (17) to 15 ft-lb (20.3 N·m) **(Figure 9-1, Page 9-2).**

## LEAF SPRINGS (FOUR-PASSENGER VEHICLES)

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**See General Warnings, Section 1, Page 1-1.**

## LEAF SPRING REMOVAL (FOUR-PASSENGER VEHICLES)

1. Loosen, but do not remove, lug nuts on tire and wheel assembly on the side from which the spring is to be removed. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame crossmember forward of the spring mounting tabs. Lower the vehicle to let the jack stands support the vehicle **(Figure 9-2, Page 9-3). See following WARNING.**

### **⚠ WARNING**

- **Lift only one end of the vehicle at a time. Use a suitable lifting device (chain hoist or hydraulic floor jack) with 1000 lb. (454 kg) minimum lifting capacity. Do not use lifting device to hold vehicle in raised position. Use approved jack stands of proper weight capacity to support the vehicle and chock the wheels that remain on the floor. When not performing a test or service procedure that requires movement of the wheels, lock the brakes.**
2. Place a floor jack under the transaxle differential casing to support, but not lift, the drivetrain. Raise it just enough to relieve tension on the shock absorbers without compressing them.
  3. Remove the tire and wheel assembly on the side from which the spring is to be removed.
  4. Remove the bow tie locking pin (1) and the clevis pin (2) at the brake lever and brake cable connection, and remove cable end (3) from the brake lever **(Figure 9-3, Page 9-3)**. Detach the brake cable from the shock mount bracket (4).
  5. Remove the nut (5), cup washer (9), and rubber bushings (10) from the lower mounting stem of the shock absorber **(Figure 9-4, Page 9-5)**.
  6. Remove the nuts (13) and the U-bolt (11) securing the spring and jounce bumper to the transaxle. Remove the shock mount bracket (15), jounce bumper bracket (20), and the U-bolt (11).
  7. Remove the bolt (17) and nut (2) attaching the rear of the spring to the shackle (1).
  8. Remove the nut (2) and bolt (17) attaching the front of the spring to the vehicle frame and remove the spring.
  9. Inspect the bushings (4) and sleeves (3) in the spring eyes and replace them if they are worn or damaged.

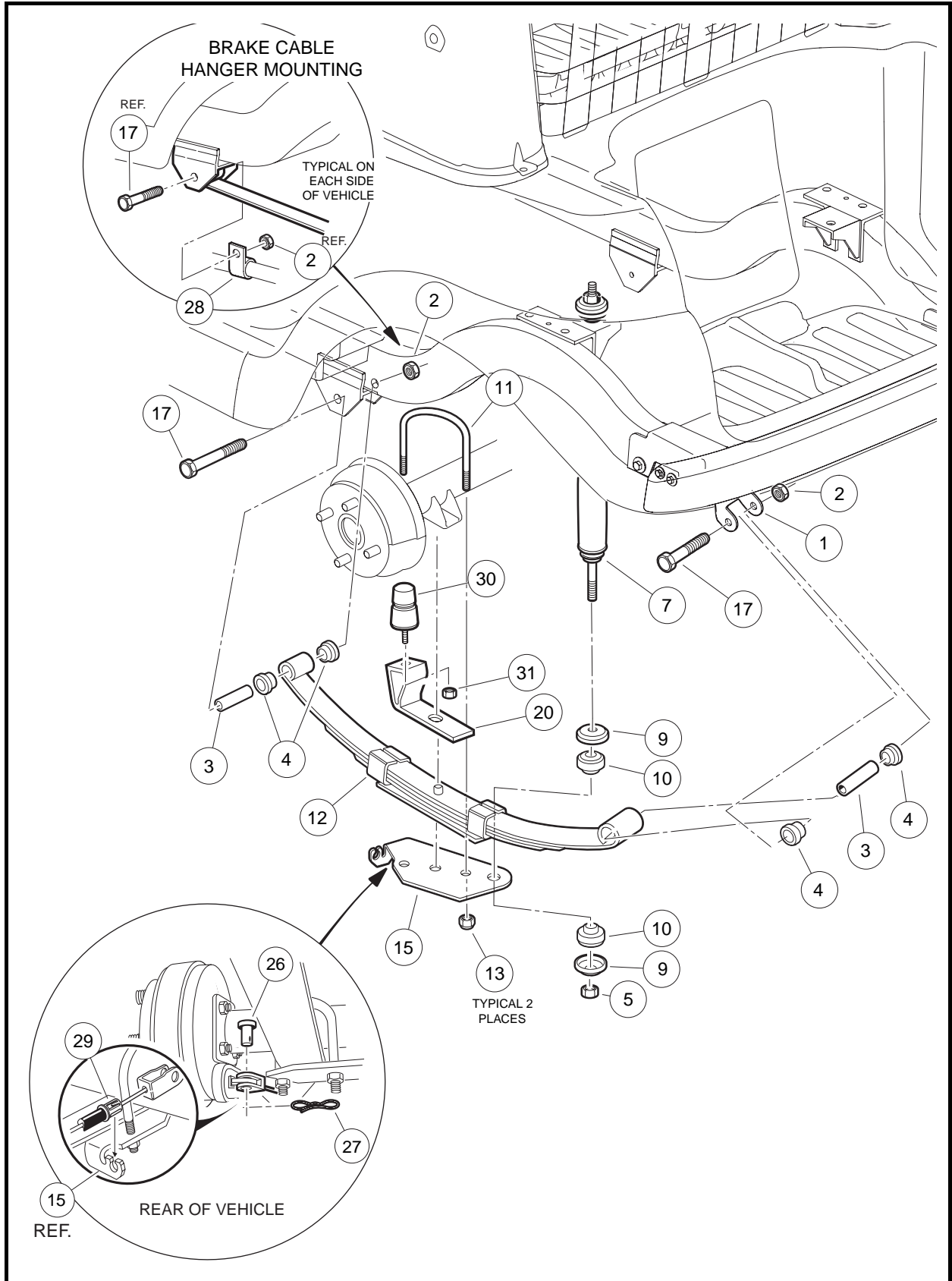


Figure 9-4 Rear Suspension Assembly and Mounting (Four-Passenger Vehicles)

## LEAF SPRING INSTALLATION (FOUR-PASSENGER VEHICLES)

1. To install the springs, reverse the removal procedure. **See following CAUTION.**

### **⚠ CAUTION**

- **When positioning the spring on the transaxle, be sure to insert the locating bolt on the spring in the locating hole in the transaxle saddle.**
2. Tighten the nuts on the U-bolts to 25 ft-lb (34 N·m).
  3. Tighten nuts (2) on spring mounting bolts (17) to 15 ft-lb (20.3 N·m) **(Figure 9-4, Page 9-5).**

# SECTION 10 – PERIODIC MAINTENANCE

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## **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

## **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

## GENERAL INFORMATION

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To ensure trouble-free vehicle performance, it is very important to follow an established preventive maintenance program. Regular and consistent vehicle maintenance can prevent vehicle downtime and expensive repairs that can result from neglect. Any vehicle not functioning correctly should be removed from use until it is properly repaired. This will prevent further damage to the vehicle and avoid the possibility of injury due to unsafe conditions.

Contact your local Club Car distributor/dealer to perform all repairs and semiannual and annual periodic service.

## PERIODIC SERVICE SCHEDULE

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## **⚠ WARNING**

- Service, repairs, and adjustments must be made per instructions in the appropriate section of this manual.

**NOTE:** *If the vehicle is constantly subjected to heavy use or severe operating conditions, the preventive maintenance procedure should be performed more often than recommended in the periodic service and lubrication schedules.*

*Both the Periodic Service Schedule and the Periodic Lubrication Schedule must be followed to keep vehicle in optimum operating condition.*

PERIODIC SERVICE SCHEDULE – ELECTRIC VEHICLES		
REGULAR INTERVAL	SERVICE	
Daily service by owner	Batteries	Charge batteries (after each daily use only).
Weekly service by owner	Batteries	Check electrolyte level. Add water if necessary. <b>See Section 13 – Batteries.</b>
Monthly service by owner or trained technician	Batteries	Wash battery tops and clean terminals with baking soda/water solution. Apply Battery Terminal Protector Spray (CCI P/N 1014305) to battery terminals.
	Tires	Check air pressure and adjust if necessary. <b>See Section 2 – Vehicle Specifications.</b>
	General vehicle	Thoroughly wash vehicle including the underside.
Semiannual service by trained technician only (every 50 hours of operation or 100 rounds of golf)	Brake system	Check brake shoes; replace if necessary. <b>See Section 6 – Wheel Brake Assemblies.</b>
		Lubricate brake system per Lubrication Schedule. <b>See Section 6 – Wheel Brake Assemblies.</b>
		Check brake cables for damage; replace if necessary.
	Electrical wiring and connections	Check for tightness and damage; replace if necessary.
Front wheel alignment and camber	Check and adjust as required. <b>See Section 7 – Steering and Front Suspension.</b>	
Annual service by trained technician only (every 100 hours of operation or 200 rounds of golf)	Batteries	If batteries are not performing as expected, see <b>See Section 13 – Batteries.</b>
	Pedal group	Lubricate all rotating joints. <b>See Periodic Lubrication Schedule on page 10-3.</b>
	General Vehicle	Check for loose hardware; tighten if necessary.

### WARNING

- If any problems are found during scheduled inspection or service, do not operate the vehicle until repairs are made. Failure to make necessary repairs could result in fire, property damage, severe personal injury, or death.



## PERIODIC LUBRICATION SCHEDULE

See General Warnings, Section 1, Page 1-1.

PERIODIC LUBRICATION SCHEDULE			
REGULAR INTERVAL	SERVICE	LUBRICATION POINT	RECOMMENDED LUBRICANT
Semiannually by owner or trained technician (every 50 hours of operation or 100 rounds of golf)	Charger receptacle	1	WD-40
	Brake system, per maintenance and service manual.	2	Dry Moly Lube (CCI P/N 1012151), white lithium grease NLGI #2
	Front suspension (two fittings)	3	Chassis Lube - EP NLGI Grade 2
Annually by trained technician only (every 100 hours of operation or 200 rounds of golf)	Check/fill transaxle to plug level	4	22 oz. (0.67 liters) SAE 30 WT. API Class SE, SF, or SG Oil (or higher)
	Pedal group	5	Dupont™ Performance Dry Multi-Use Lubricant

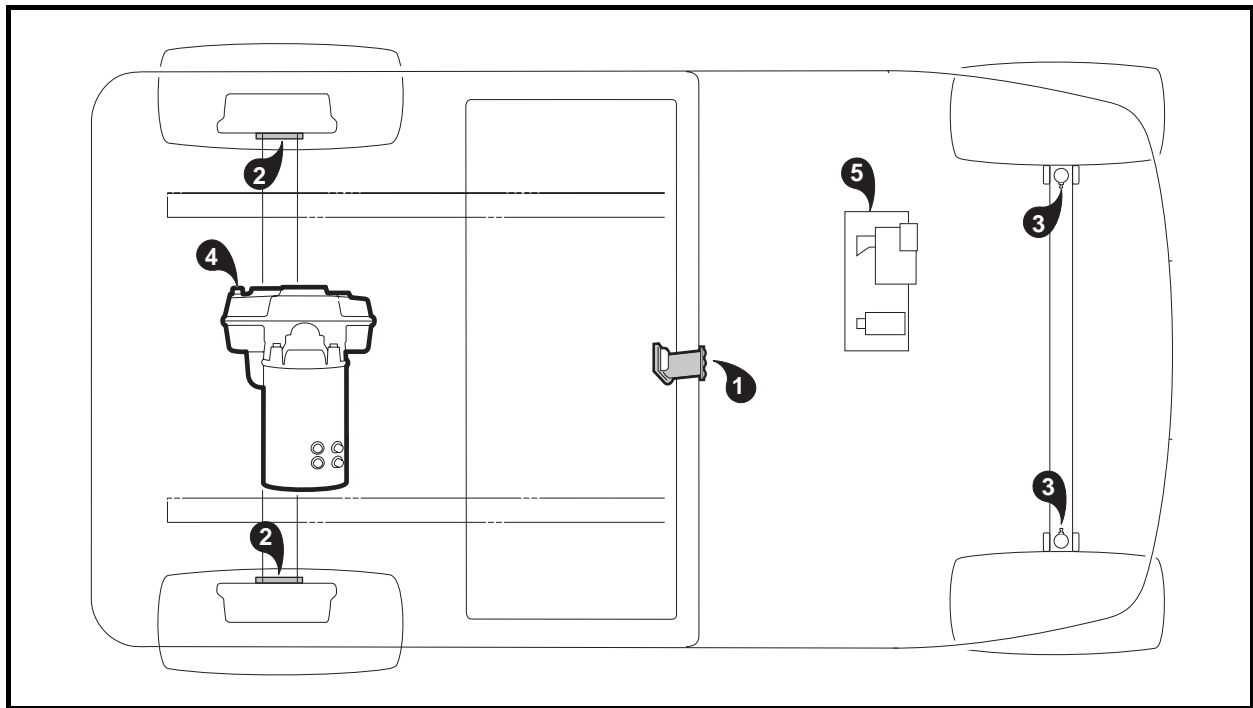


Figure 10-1 Vehicle Lubrication Points



# SECTION 11 – ELECTRICAL SYSTEM AND TESTING

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## **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

## **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.
- Shorting of battery terminals can cause personal injury or death.
  - Do not place component mounting plate directly on top of batteries when removing or installing plate.
  - Remove plate from vehicle completely.

## GENERAL INFORMATION

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The IQ System vehicle uses a 48-volt electrical system that is powered by four 12-volt lead-acid batteries and includes an onboard computer. The IQ System vehicle uses a shunt-wound 3.2 hp motor and includes several additional features.

- **Shunt-Wound Motor:** The shunt-wound motor, unlike a series motor, is designed so that the speed controller is able to vary the amount of current passing through the field coils independently from the current passing through the armature.
- **Motor Braking:** Under certain conditions a shunt-wound motor also has the ability to act as an electrical brake to slow the vehicle. There are three features of the IQ electrical system which will activate the motor braking function: Zero Speed Detect, Pedal Down Motor Braking, and Pedal Up Motor Braking (adjustable with the IQDM-P handset).
- **Zero Speed Detect:** This prevents the vehicle from rolling away uncontrolled should the driver park on a slope and leave the vehicle without locking the park brake. The vehicle will roll at about 1 mph (1.6 km/h). If the zero speed detect function remains engaged for two seconds or more, a warning buzzer will sound to alert the driver that motor braking has been activated.

## **⚠ WARNING**

- **Zero-Speed Detect will not limit vehicle speed to 1 mph (1.6 km/h) on very steep grades. Do not operate vehicle on slopes exceeding 20% grades.**
- **Pedal Down Motor Braking:** This feature helps to control vehicle downhill speed. Motor braking is activated when the vehicle reaches the programmed top speed and holds the vehicle at that speed. Motor braking is automatically disengaged when vehicle speed slows below the programmed top speed.

(continued on page 11-7)

WIRING DIAGRAMS

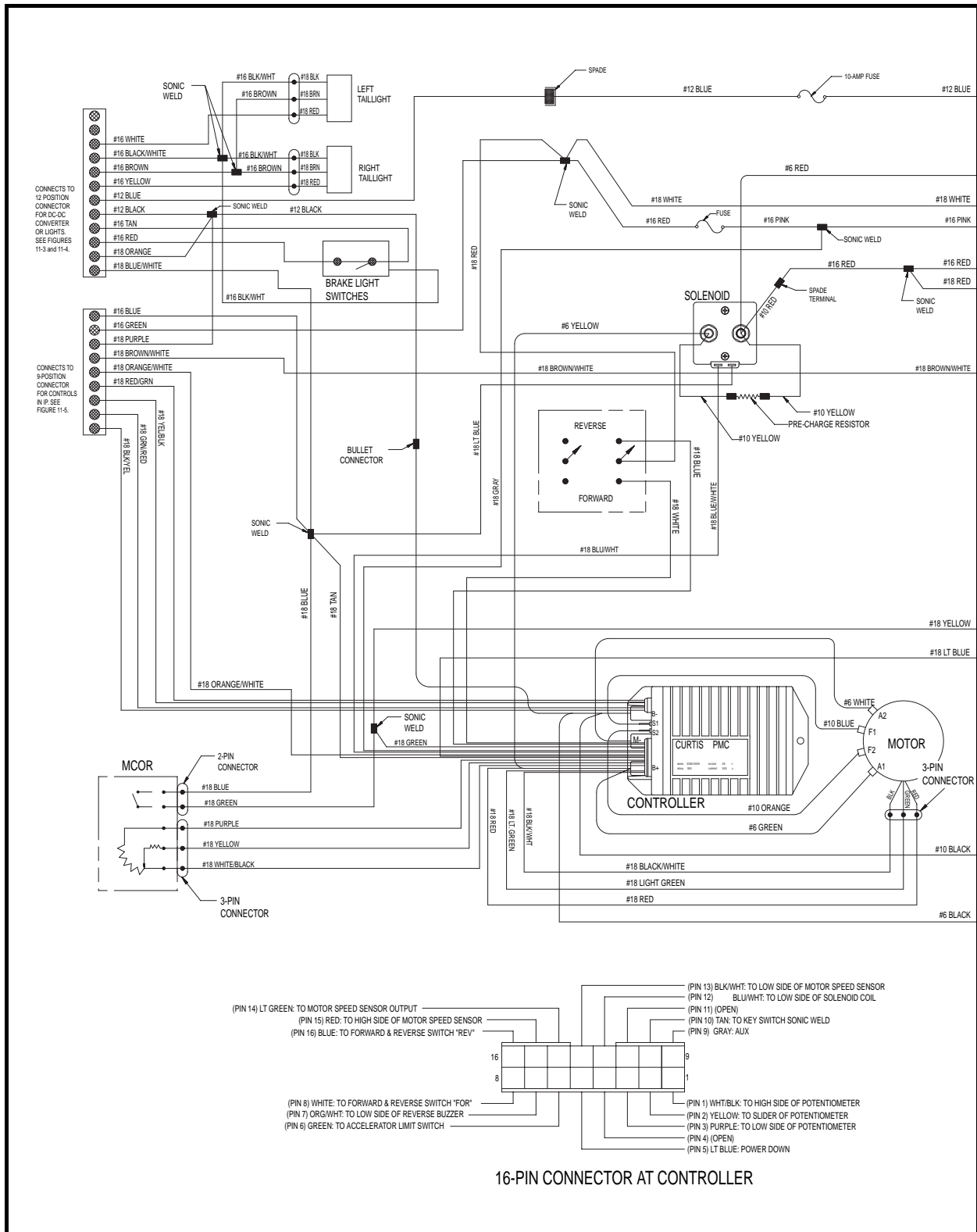
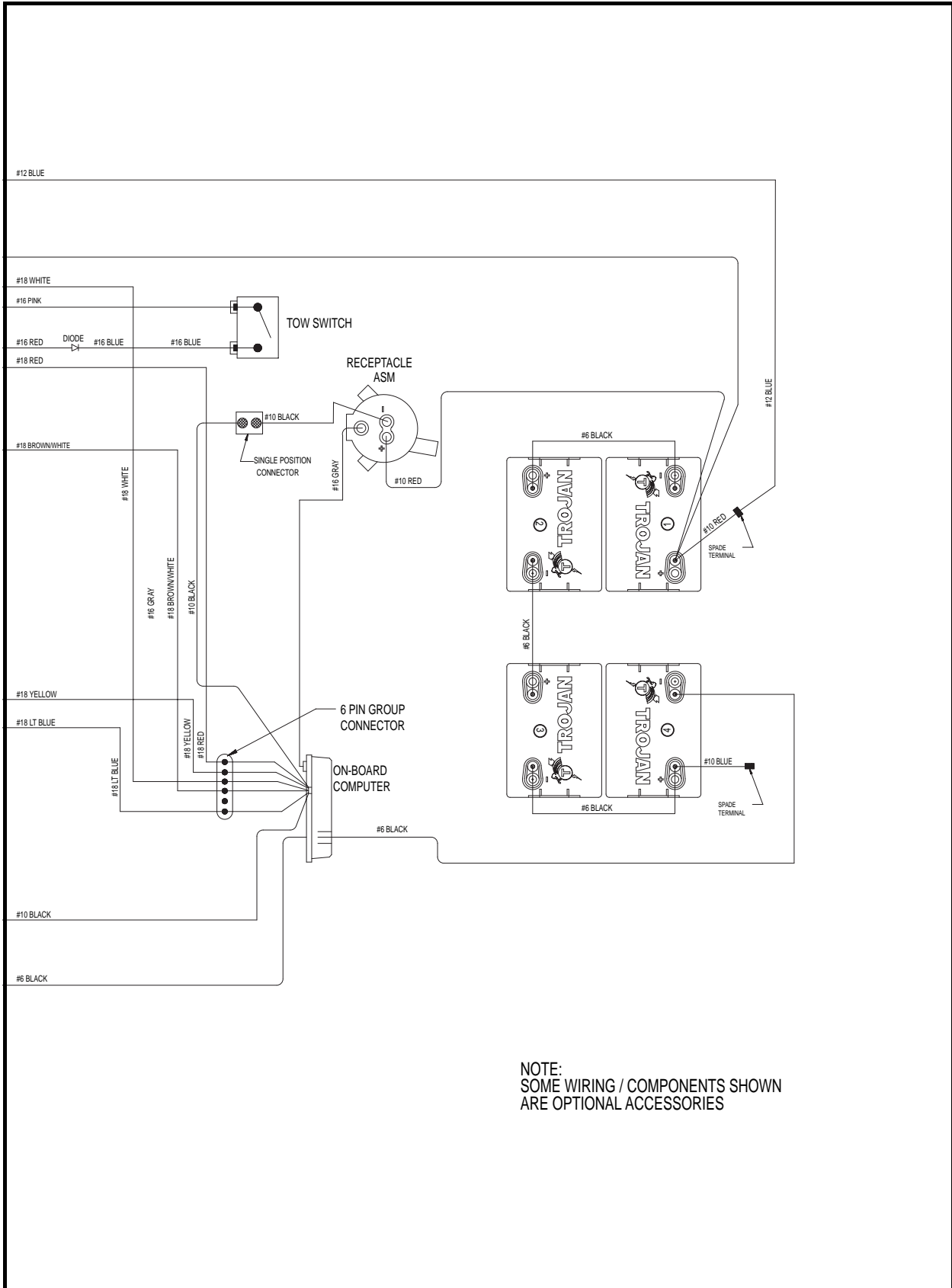


Figure 11-1 Precedent Electric Vehicle Wiring Diagram



NOTE:  
SOME WIRING / COMPONENTS SHOWN  
ARE OPTIONAL ACCESSORIES

Figure 11-2 Precedent Electric Vehicle Wiring Diagram

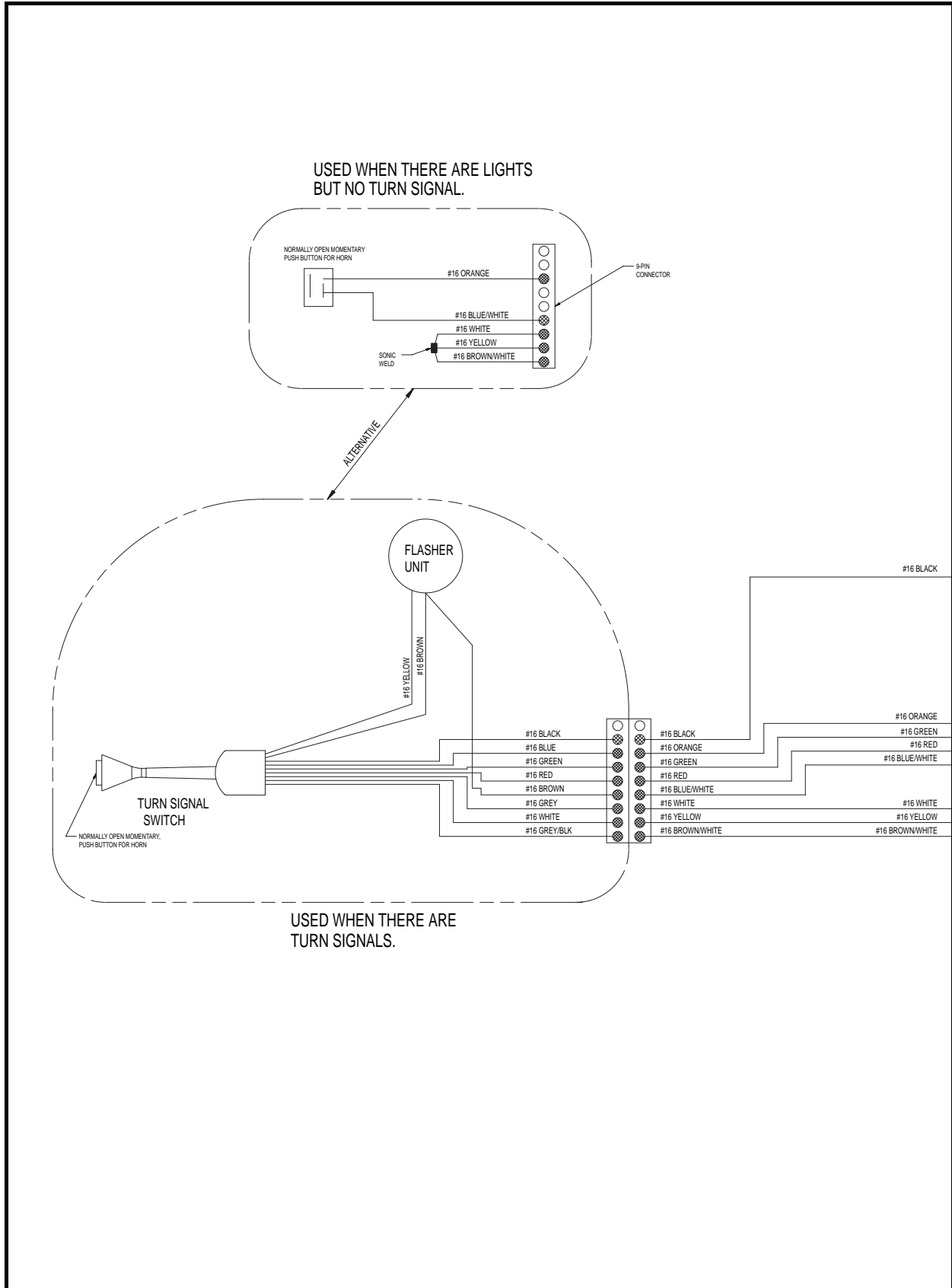


Figure 11-3 Precedent Electric Vehicle Accessory Wiring Diagram

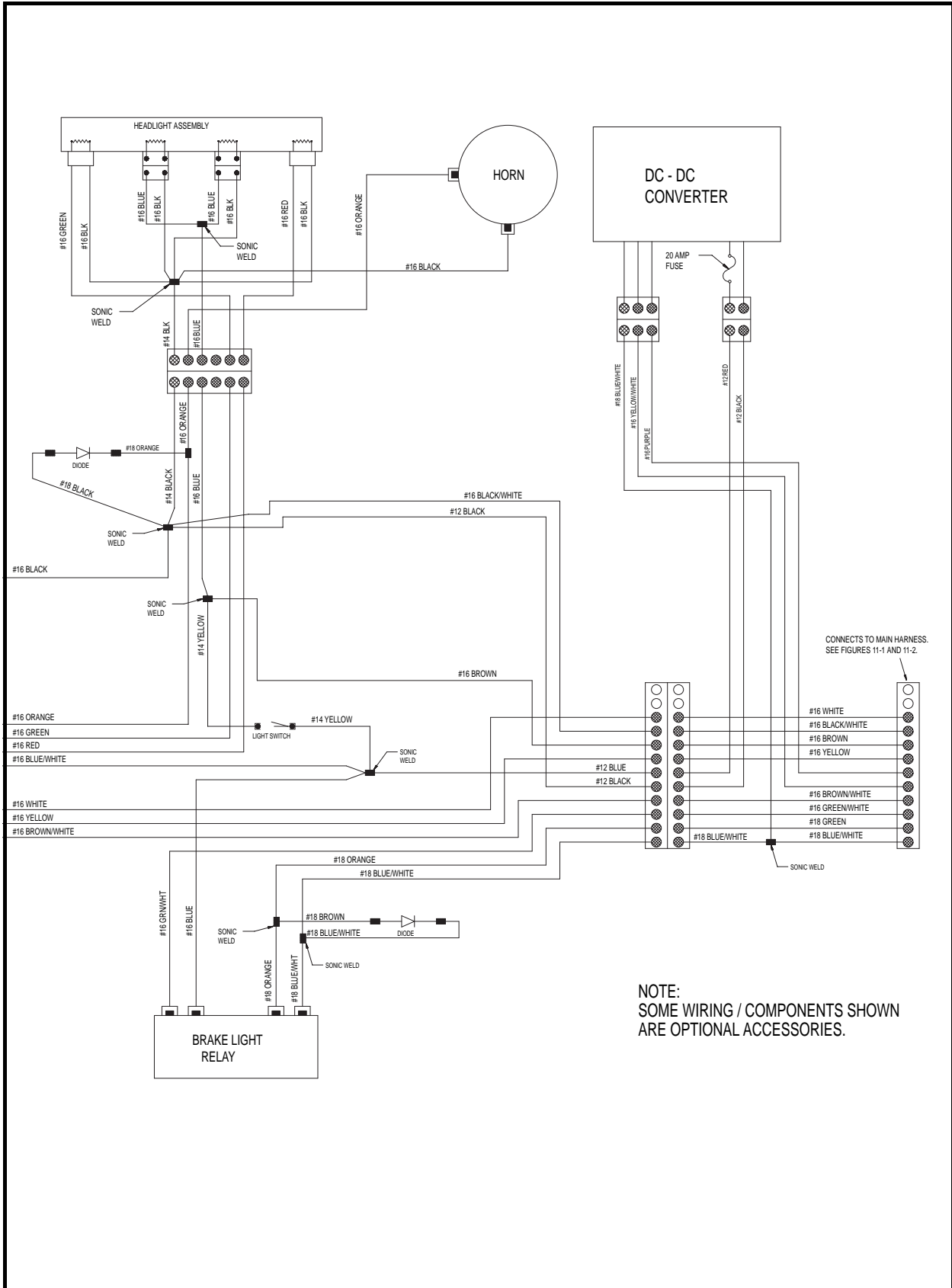


Figure 11-4 Precedent Electric Vehicle Accessory Wiring Diagram

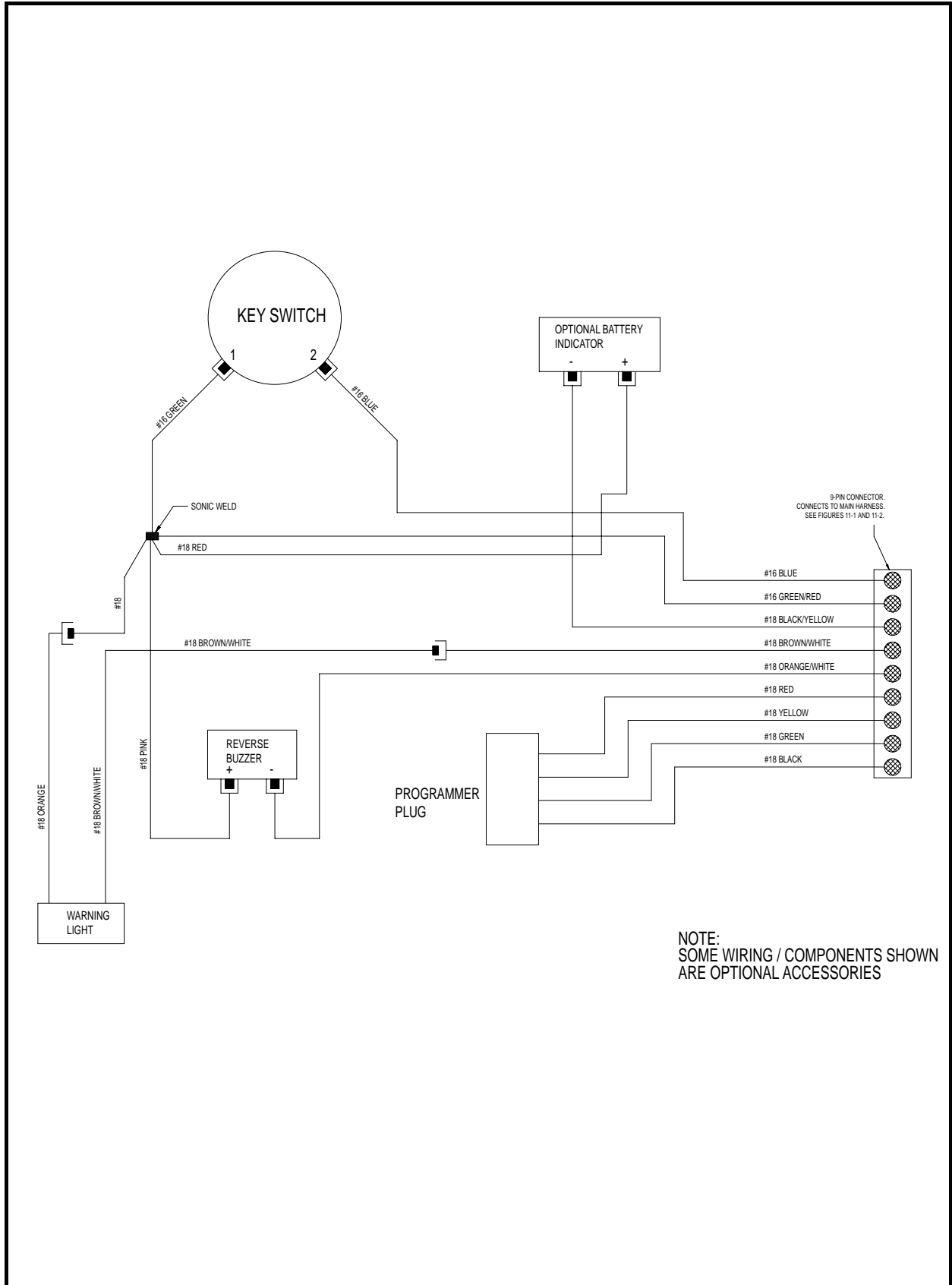


Figure 11-5 Precedent Electric Vehicle Instrument Panel Wiring Diagram



**General Information, Continued:**

- **Pedal Up Motor Braking:** When vehicle speed is above 11 mph (17.7 km/h), releasing the accelerator pedal will activate motor braking, which slows the vehicle speed. Once vehicle speed slows to below approximately 11 mph (17.7 km/h), with the accelerator pedal still released, motor braking will be deactivated and the vehicle will coast freely. This feature is selectable. Contact your Club Car dealer/distributor to inquire about this selectable feature.
- **Regenerative Braking:** When motor braking is activated, the vehicle motor acts as a generator, slowing the vehicle as it creates energy that is used to charge the batteries.
- **Tow/Run Switch:** When the Tow/Run switch is in the RUN position, the vehicle will function normally. When the switch is in the TOW position, power to the OBC and controller is shut off, disabling the vehicle operating circuit and zero speed detect, allowing the vehicle to be towed.
- **Motor Protection Circuit:** The operator should never attempt to hold the vehicle on an incline by pressing the accelerator pedal instead of the brake pedal, as motor overheating could result. By reducing the current to the motor during such an occurrence, the motor protection circuit reduces the possibility of motor damage. When this situation arises, a *motor stall fault* is recorded by the speed controller and will be displayed on an IQDM handset in the Diagnostic History menu. **See the IQDM Owner's Manual.**
- **High Pedal Detect:** This function prevents unexpected vehicle movement if the key switch is turned ON after the accelerator is pressed, or the accelerator pedal is pressed when Forward/Reverse switch is used to change the direction of travel. The vehicle will not move until the accelerator is released and pressed again. When this situation arises, a *HPD fault* is recorded by the speed controller and will be displayed on an IQDM handset in the Diagnostic History menu. **See the IQDM Owner's Manual.**
- **Onboard Computer (OBC):** The OBC, 1) monitors battery condition, 2) monitors the number of energy units used by the vehicle, 3) determines the number of energy units required to recharge the batteries and shuts the charger off when this number is reached, 4) determines when to activate regenerative motor braking, 5) locks out vehicle movement while the charger is plugged into the vehicle charger receptacle, 6) stores operating data, which can be read by the Communication Display Module (CDM). **See Communication Display Module (CDM) on page 11-38.**

## TROUBLESHOOTING

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The following troubleshooting guides will be helpful in identifying operating difficulties should they occur. The guides include the symptom, probable cause(s) and suggested checks. The procedures used in making these checks can be found in the referenced sections of this maintenance and service manual.

### TROUBLESHOOTING THE VEHICLE WITH THE IQDM

Club Car recommends the use of the IQDM handset for troubleshooting vehicles equipped with the IQ electrical system. Troubleshooting Guide 1 is to be used in conjunction with the IQDM handset. Refer to the IQDM Owner's Manual for operating instructions. **See following WARNING.**

#### **⚠ WARNING**

- **The vehicle operator should not monitor the IQDM while the vehicle is in motion. A technician can monitor the IQDM while traveling as a passenger in the vehicle. Failure to heed this warning could result in severe personal injury or death.**

In the event that the vehicle is not functioning properly after completing Troubleshooting Guide 1, the technician should proceed to Troubleshooting Guide 2.

If an IQDM handset is unavailable, the technician should proceed to Troubleshooting Guide 2.

## TROUBLESHOOTING GUIDE 1

The following troubleshooting guide is intended for use with an IQDM handset. For IQDM operating instructions, refer to the IQDM Owner's Manual. **See following NOTE.**

**NOTE:** Before troubleshooting the vehicle, check the diagnostic history from the Special Diagnostics Menu. Note any fault codes.

TROUBLESHOOTING GUIDE 1		
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
<b>Test Menu – THROTTLE % value does not increase as the accelerator pedal is pressed</b>  <b>or</b> <b>Diagnostic Menu – THROTTLE FAULT 1 fault code</b>	Loose or disconnected three-pin connector at the MCOR or broken wire	Repair and/or connect the three-pin connector to the MCOR
	Loose or disconnected 16-pin connector at speed controller or broken wire	Repair and/or connect the 16-pin connector to the speed controller
<b>Test Menu – HEATSINK °C indicates that temperature is above 85 °C (145 °F)</b>  <b>or</b> <b>Diagnostic Menu – THERMAL CUTBACK fault code</b>	Over-adjusted brakes	Section 6 – Wheel Brake Assemblies in the appropriate maintenance and service manual
	Vehicle is over-loaded	Ensure that vehicle is not over-loaded before returning to operation
<b>Test Menu – ARM PWM value does not reach 100% when vehicle is at full speed</b>	Failed MCOR	Test Procedure 4 – MCOR Voltage on page 11-17
<b>Test Menu – SPEED PULSES menu item indicates that speed pulses are OFF when the vehicle is in motion</b>  <b>or</b> <b>Diagnostic Menu – SPEED SENSOR fault code</b>	Loose or disconnected motor speed sensor or broken wire	Repair and/or connect the three-pin connector to the motor speed sensor
	Loose or disconnected 16-pin connector at speed controller or broken wire	Repair and/or connect the 16-pin connector to the speed controller
	Failed motor speed sensor	Test Procedure 13 – Motor Speed Sensor on page 11-34
<b>Test Menu – FOOT INPUT menu item indicates that the MCOR internal limit switch is always ON or always OFF.</b>	Loose or disconnected two-pin connector at the MCOR or broken wire	Repair and/or connect the two-pin connector to the MCOR
	Loose or disconnected 16-pin connector at speed controller or broken wire	Repair and/or connect the 16-pin connector to the speed controller
	Failed MCOR	Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20
<b>Test Menu – FORWARD INPUT and/or REVERSE INPUT does not indicate the correct reading</b>  <b>or</b> <b>Diagnostic Menu – PROC/WIRING fault code</b>	Loose or disconnected Forward/Reverse rocker switch (quick disconnect terminals) or broken wire	Repair and/or connect the quick disconnect terminals to the Forward/Reverse switch
	Loose or disconnected Forward/Reverse rocker switch (three-pin connector) or broken wire	Repair and/or connect the three-pin connector from the Forward/Reverse switch to the wire harness
	Loose or disconnected 16-pin connector at speed controller or broken wire	Repair and/or connect the 16-pin connector to the speed controller
	Failed Forward/Reverse rocker switch	Test Procedure 15 – Forward/Reverse Rocker Switch on page 11-36
Troubleshooting Guide continued on next page...		

TROUBLESHOOTING GUIDE 1		
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
<b>Test Menu – MAIN CONT (solenoid) does not indicate ON when the solenoid should be activated.</b>  <b>or</b>  <b>Diagnostic Menu – MAIN CONT DNC (main contactor (solenoid) did not close) fault code</b>	Speed controller logic malfunction	Disconnect the batteries and allow the speed controller capacitors to discharge. <b>See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.</b> Reconnect the batteries and see if the symptom returns.
	Loose, broken, or disconnected wire(s) at solenoid or B+ speed controller terminal	Repair and/or connect the loose or disconnected wire(s)
	Loose or disconnected 16-pin connector at speed controller or broken wire	Repair and/or connect the 16-pin connector to the speed controller
	Failed solenoid	Replace solenoid. <b>See Solenoid Removal, Section 12, Page 12-12.</b>
<b>Test Menu – KEY INPUT does not indicate ON when key switch is in the ON position</b>	Loose or disconnected wires at key switch terminals or broken wire	Repair and/or connect the quick disconnect terminals to the Forward/Reverse switch
	Loose or disconnected 16-pin connector at speed controller or broken wire	Repair and/or connect the 16-pin connector to the speed controller
	Failed key switch	Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20
<b>Diagnostic Menu – THROTTLE FAULT 1 fault code</b>	Loose or disconnected three-pin connector at the MCOR or broken wire	Repair and/or connect the three-pin connector to the MCOR
	Loose or disconnected 16-pin connector at speed controller or broken wire	Repair and/or connect the 16-pin connector to the speed controller
	Failed MCOR	Test Procedure 4 – MCOR Voltage on page 11-17
<b>Diagnostic Menu – HW FAILSAFE (Hardware Failsafe) fault code</b>	Armature drive FET's (field-effect transistors) inside speed controller have failed	Replace the speed controller. <b>See Speed Controller Removal, Section 12, Page 12-11.</b>
	Speed controller logic malfunction	Disconnect the batteries and allow the speed controller capacitors to discharge. <b>See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.</b> Reconnect the batteries and see if the symptom returns.
<b>Diagnostic Menu – MAIN WELDED (main solenoid contacts welded) fault code</b>	solenoid contacts have failed closed	Replace solenoid. <b>See Solenoid Removal, Section 12, Page 12-12.</b>
<b>Diagnostic Menu – MAIN DRIVER ON or MAIN DRIVER OFF fault code</b>	Speed controller logic malfunction	Disconnect the batteries and allow the speed controller capacitors to discharge. <b>See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.</b> Reconnect the batteries and see if the symptom returns.
	Failure of the FET that controls the solenoid coil	Replace the speed controller. <b>See Speed Controller Removal, Section 12, Page 12-11.</b>
Troubleshooting Guide continued on next page...		

TROUBLESHOOTING GUIDE 1		
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
<b>Diagnostic Menu – MAIN COIL FAULT fault code</b>  or  <b>Diagnostic Menu – MAIN DROPOUT fault code</b>	Solenoid coil has failed in an open condition	Replace solenoid. <b>See Solenoid Removal, Section 12, Page 12-12.</b>
<b>Diagnostic Menu – FIELD MISSING fault code</b>	Loose or disconnected motor field coil wires at motor or speed controller or broken wire	Repair and/or connect the field coil wires
	Failure of the motor field windings	Section 15a – Motor (Model 5BC59JBS6365)
	Failure of the FET's that control field current	Replace the speed controller. <b>See Speed Controller Removal, Section 12, Page 12-11.</b>
<b>Diagnostic Menu – HPD (high pedal detect) fault code</b>	Operator error	Train operators to fully remove foot from accelerator pedal before turning key switch to the ON position or changing the selected direction with the Forward/Reverse switch
<b>Diagnostic Menu – LOW BATTERY fault code</b>	Batteries require charging	Place batteries on battery charger and allow them to fully charge
	Improperly maintained or failed batteries	Section 13 – Batteries
<b>Diagnostic Menu – MOTOR STALL fault code</b>	Operator error	Train operators to use the brake to hold the vehicle on a hill, rather than holding the vehicle on a hill using the accelerator pedal
<b>Diagnostic Menu – OPEN ARMATURE fault code</b>	Loose or disconnected motor armature wires at motor or speed controller or broken wire	Repair and/or connect the motor armature wires
	Failure of the motor armature or brushes	Section 15a – Motor (Model 5BC59JBS6365)
	Failure of the FET's that control armature current	Replace the speed controller. <b>See Speed Controller Removal, Section 12, Page 12-11.</b>

## TROUBLESHOOTING GUIDE 2

TROUBLESHOOTING GUIDE 2		
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Vehicle does not operate	Batteries – Batteries discharged	Charge batteries
	Batteries – Battery connections	Check vehicle wiring. <b>See Wiring Diagrams on page 11-2.</b>
	Battery charger is connected to the vehicle – Solenoid lockout feature has disabled the vehicle	Disconnect the battery charger from the vehicle
	Onboard computer failure	Test Procedure 2 – Onboard Computer Solenoid Lockout Circuit on page 11-15
	Key switch and MCOR limit switch circuit	Check for loose or disconnected wires at key switch and MCOR
	Failed key switch	Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20
	Failed MCOR	Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20. See also Test Procedure 4 – MCOR Voltage on page 11-17.
	Forward/Reverse rocker switch	Test Procedure 15 – Forward/Reverse Rocker Switch on page 11-36
	Solenoid – loose wires	Test Procedure 3 – Solenoid Activating Coil on page 11-16
	Solenoid – failed coil	Test Procedure 3 – Solenoid Activating Coil on page 11-16
	Speed controller thermal cutback	Allow controller to cool and ensure that vehicle is not over-loaded before returning to operation
	16-pin connector at speed controller	Check for loose or disconnected wires at the 16-pin connector. <b>See also Test Procedure 9 – 16-Pin Connector on page 11-22.</b>
	High pedal detect	Cycle accelerator pedal
	Motor stall	Cycle accelerator pedal
	Motor Failure	<b>See Section 15a – Motor (Model 5BC59JBS6365).</b>
Speed controller failure	Replace speed controller. <b>See Speed Controller Removal, Section 12, Page 12-11.</b>	
Troubleshooting Guide continued on next page...		

<b>TROUBLESHOOTING GUIDE 2</b>		
<b>SYMPTOM</b>	<b>POSSIBLE CAUSES</b>	<b>CORRECTIVE ACTION</b>
<b>Vehicle runs slowly</b>	Speed sensor disconnected or failed	Test Procedure 13 – Motor Speed Sensor on page 11-34
	Incorrect speed setting	To change the programmed top speed of the vehicle, an IQDM-P handset must be used
	Wiring – improperly wired	Check vehicle wiring. <b>See Wiring Diagrams on page 11-2.</b>
	Batteries – Batteries discharged	Charge batteries
	MCOR malfunction	Test Procedure 4 – MCOR Voltage on page 11-17
	Motor – loose wires	Inspect and tighten all wire connections at the motor.
	Failed motor	Replace motor. <b>See Motor Removal, Section 15a, Page 15a-3.</b>
	Vehicle is over-loaded	Ensure that vehicle is not over-loaded before returning to operation.
	Speed controller failure	Replace speed controller. <b>See Speed Controller Removal, Section 12, Page 12-11.</b>
	Brakes – improperly adjusted	<b>See Section 6 – Wheel Brake Assemblies.</b>
	Tires – under-inflated or flat tires	<b>See Section 8 – Wheels and Tires.</b>
<b>Vehicle operates, but motor braking function does not</b>	Wiring – improperly wired	Check vehicle wiring. <b>See Wiring Diagrams on page 11-2.</b>
	Speed sensor disconnected or failed	Test Procedure 13 – Motor Speed Sensor on page 11-34
<b>Vehicle will run in forward, but not in reverse or will run in reverse but not forward</b>	Forward/Reverse rocker switch – improperly wired	Test Procedure 15 – Forward/Reverse Rocker Switch on page 11-36
	Motor – improperly wired	Check motor wiring. <b>See Wiring Diagrams on page 11-2.</b>
	Speed controller – improperly wired or failed speed controller FET	Check vehicle wiring. <b>See Wiring Diagrams on page 11-2.</b>
<b>Vehicle operates, but battery charger does not charge batteries</b>	Onboard computer – gray wire	Test Procedure 11 – Onboard Computer Gray Wire on page 11-33
	Battery charger connections – loose wires at receptacle or batteries	Check wire connections and tighten if necessary.
	Battery charger	Refer to the appropriate battery charger maintenance and service manual.

## TEST PROCEDURES

Using the following procedures, the entire IQ electrical system can be tested without major disassembly of the vehicle.

### **⚠ WARNING**

- If wires are removed or replaced, make sure wiring and wire harness is properly routed and secured. Failure to properly route and secure wiring could result in vehicle malfunction, property damage, personal injury, or death.

For many tests the electronics module cover must be removed to gain access to the various components that are mounted on the component mounting plate. Remove screw (1) and remove cover (2) (**Figure 11-6, Page 11-13**). See following **WARNING**.

### **⚠ WARNING**

- Shorting of battery terminals can cause personal injury or death.
  - Do not place component mounting plate directly on top of batteries when removing or installing plate.
  - Remove plate from vehicle completely.

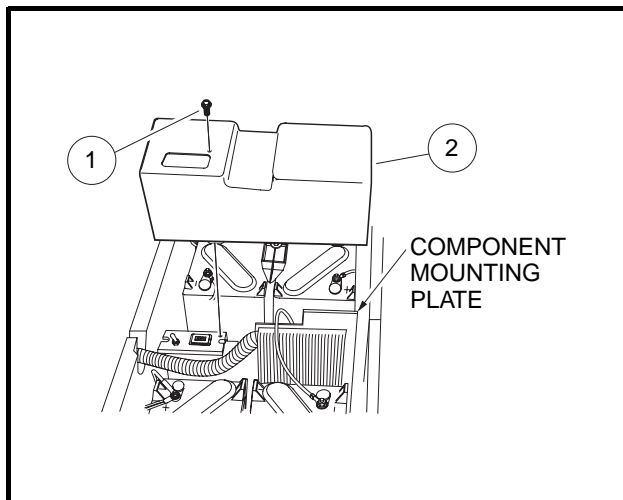


Figure 11-6 Electronic Module Cover

After test procedures are completed, be sure to replace the cover. See following **CAUTION**.

### **CAUTION**

- Exposure to water may damage electronic components.
  - Do not operate vehicle without the cover properly installed.
  - Do not direct a water stream in area of the cover.

## INDEX OF TEST PROCEDURES

1. Batteries / Voltage Check
2. Onboard Computer Solenoid Lockout Circuit
3. Solenoid Activating Coil
4. MCOR Voltage
5. A1 and A2 Motor Voltage
6. Tow/Run Switch
7. Battery Pack Voltage (Under Load)
8. Key Switch and MCOR Limit Switch Circuit
9. 16-Pin Connector
10. Onboard Computer Silicon-Controlled Rectifier (SCR) Circuit
11. Onboard Computer Gray Wire
12. Voltage at Charger Receptacle Red Wire Socket
13. Motor Speed Sensor
14. Solenoid Continuity
15. Forward/Reverse Rocker Switch
16. Reverse Buzzer
17. Rebooting the Onboard Computer
18. Battery Warning Light

## TEST PROCEDURE 1 – BATTERIES / VOLTAGE CHECK

**See General Warnings, Section 1, Page 1-1.**

**NOTE:** *The batteries must be properly maintained and fully charged in order to perform the following test procedures. Battery maintenance procedures, including watering information and allowable mineral content, can be found in Section 13 of this manual. See **Battery Care, Section 13, Page 13-2.***

The battery voltage can be displayed with the IQDM handset. If an IQDM handset is not available, proceed to Batteries / Voltage Check without the IQDM Handset on page 11-15.

### Batteries / Voltage Check with the IQDM Handset

1. Connect the IQDM to the vehicle as described in the IQDM Owner's Manual.
2. Access the Test menu and select BATT VOLTAGE by using the SCROLL DISPLAY buttons. The IQDM should indicate at least 48 volts with the batteries fully charged. If not, check for loose battery connections or a battery installed in reverse polarity. **Refer to Section 13 – Batteries for further details on battery testing.**



## Batteries / Voltage Check without the IQDM Handset

1. With batteries connected and using a multimeter set to 200 volts DC, place red (+) probe on the positive (+) post of battery no. 1 and the black (–) probe on the negative (–) post of battery no. 4 (**Figure 11-7, Page 11-15**). The multimeter should indicate at least 48 volts with the batteries fully charged. If not, check for loose battery connections or a battery installed in reverse polarity. Refer to Section 13 – Batteries for further details on battery testing.

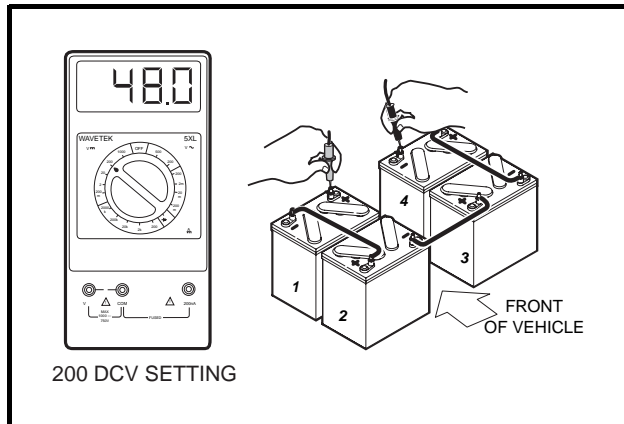


Figure 11-7 Battery Test

## TEST PROCEDURE 2 – ONBOARD COMPUTER SOLENOID LOCKOUT CIRCUIT

### See General Warnings, Section 1, Page 1-1.

The solenoid lockout circuit disables the vehicle when the battery charger is plugged into the vehicle. Use the following procedure to test the solenoid lockout circuit:

1. With batteries connected, place the Tow/Run switch in the RUN position.
2. Using a multimeter set to 200 volts DC, place black (–) probe on battery no. 4 negative post and red (+) probe (with insulation-piercing probe) on the light blue onboard computer wire (at a point between the OBC and the six-pin connector). The reading should be approximately 48-50 volts (full battery voltage). If the reading is not 48-50 volts, proceed to step 3. If the reading is 48-50 volts, proceed to Test Procedure 3 – Solenoid Activating Coil on page 11-16.
3. Place insulation-piercing probe on the light blue 18-gauge wire at a point between OBC six-pin connector and main wire harness. If reading is 48-50 volts, check the wire terminal connectors inside six-pin connector at OBC six-pin connector. Make sure pins are properly aligned inside housing. Make sure wire colors match and are connected to the correct terminals.
4. If reading is zero volts, plug the charger DC cord into the vehicle charger receptacle. If the dash light illuminates for 10 seconds, the OBC is now powered-up. Unplug the DC cord; the reading at the OBC light blue wire should be approximately 48-50 volts. If the vehicle now operates normally, the DC cord has powered up the electrical system. The electrical system should also power-up when the accelerator pedal is pressed. To check the accelerator pedal function, see Test Procedure 4 – MCOR Voltage on page 11-17.
5. If the dash light illuminates for 10 seconds and the vehicle does not operate:
  - 5.1. Using a multimeter set to 200 volts DC, place black (–) probe on battery number 4 and place red (+) probe (with insulation-piercing probe) on light blue 18-gauge wire at OBC six-pin connector.
  - 5.2. With Tow/Run switch in the RUN position, the voltage reading should be approximately 48 volts.

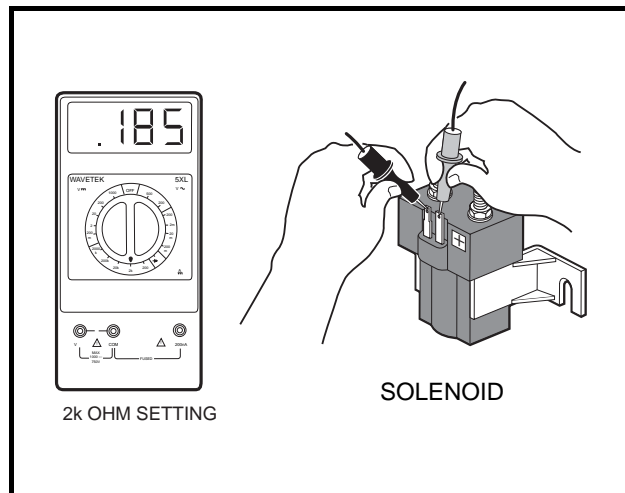
**Test Procedure 2 – Onboard Computer Solenoid Lockout Circuit, Continued:**

6. If the dash light does not illuminate and the vehicle does not operate, check the OBC activation circuit.
  - 6.1. Using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the red 18-gauge wire located on the OBC side of the six-pin connector. The reading should be approximately 48 volts. If the reading is incorrect, test the Tow/Run switch and connecting wires. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**
  - 6.2. Using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the red 18-gauge wire (harness side of six-pin connector). Multimeter should indicate 48 volts. If voltage is correct, check connections in the six-pin connector. If connections are correct, OBC activation circuit has failed. Replace OBC.

**TEST PROCEDURE 3 – SOLENOID ACTIVATING COIL**

**See General Warnings, Section 1, Page 1-1.**

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Remove the two small wire terminals from the solenoid.
3. Place red (+) probe of the multimeter on the positive (+) solenoid terminal. Place the black (–) probe on the other small solenoid terminal. A reading of 180 to 190 ohms should be obtained (**Figure 11-8, Page 11-16**). If not, replace the solenoid.



**Figure 11-8 Activating Coil Test**

## TEST PROCEDURE 4 – MCOR VOLTAGE

### See General Warnings, Section 1, Page 1-1.

The accelerator position, which is proportional to the MCOR voltage, can be displayed with the IQDM handset. If an IQDM handset is not available, proceed to MCOR Voltage Test without the IQDM Handset on page 11-17.

### MCOR Voltage Test with the IQDM Handset

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2. See also following WARNING.**

#### **⚠ WARNING**

- **The key switch should be placed in the OFF position and left in the OFF position for the duration of this test.**
2. Connect the IQDM to the vehicle as described in the IQDM Owner's Manual.
  3. Access the Test menu and select THROTTLE % by using the SCROLL DISPLAY buttons.
  4. The IQDM should indicate 0 % with the pedal not pressed. While monitoring the IQDM display screen, slowly press the accelerator pedal. As the pedal is pressed, the IQDM should indicate a rise from 0 % (pedal not pressed) to 100 % (pedal fully pressed).
  5. If the MCOR does not operate as described in step 4, proceed to MCOR Voltage Test without the IQDM Handset on page 11-17.

### MCOR Voltage Test without the IQDM Handset

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2. See also following WARNING.**

#### **⚠ WARNING**

- **The key switch should be placed in the OFF position and left in the OFF position for the duration of this test.**
2. With the batteries connected, place Tow/Run switch in RUN. Using a multimeter set to 200 volts DC, place red (+) probe on battery no. 1 positive post and place black (–) probe (with insulation-piercing probe) on the purple wire at a point close to the three-pin connector at the MCOR. The reading should be approximately 48-50 volts (full battery voltage).
  3. If reading is zero volts, check the purple wire continuity from the three-pin connector at the MCOR to the 16-pin connector at the speed controller. Check terminal positions in three-pin connector at the MCOR and the 16-pin connector. If all of the continuity readings are correct and the connectors are wired correctly, replace the speed controller.
  4. With multimeter set to 20 volts DC, place the black (–) probe on battery no. 4 negative post and the red (+) probe (with insulation-piercing probe) on the white/black wire at a point close to the three-pin connector at the MCOR. The reading should be approximately 4.65 volts.
  5. If reading is zero volts, check the white/black wire continuity from the three-pin connector at the MCOR to the 16-pin connector at the speed controller. Check terminal positions in three-pin connector at the MCOR and the 16-pin connector. If all of the continuity readings are correct and the connectors are wired correctly, replace the speed controller.

**MCOR Voltage Test without the IQDM Handset, Continued:**

6. With multimeter set to 20 volts DC, place the black (–) probe on battery no. 4 negative post and the red (+) probe (with insulation-piercing probe) on the no. 18 yellow wire at a point close to three-pin connector at the MCOR. The reading should be approximately 0.32 volts with the pedal up. Slowly press the accelerator pedal and note the readings on the multimeter. As the pedal is pressed, the reading should increase until it reaches 4.65 volts when the pedal is fully pressed.
7. If reading does not increase as the pedal is pressed, replace the MCOR.
8. If the reading is not approximately 4.60 volts with the pedal fully pressed, the vehicle will not operate at rated top speed. Check the MCOR resistance.
  - 8.1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
  - 8.2. Disconnect the 16-pin connector at the speed controller.
  - 8.3. Using a multimeter set for 20k ohms, connect the red (+) probe of the multimeter to the yellow wire at the MCOR three-pin connector with an insulation piercing probe. Connect black (–) probe to the purple wire with an insulation-piercing probe.
  - 8.4. With the accelerator pedal fully up (not pressed), the multimeter should read approximately 1k ohms.
  - 8.5. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should rise as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate between 5.67k ohms and 7.43k ohms.
  - 8.6. Using a multimeter set for 20k ohms, connect the red (+) probe of the multimeter to the yellow wire at the MCOR three-pin connector with an insulation piercing probe. Connect black (–) probe to the white/black wire with an insulation-piercing probe.
  - 8.7. With the accelerator pedal fully up (not pressed), the multimeter should indicate between 5.67k ohms and 7.43k ohms.
  - 8.8. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should drop as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate approximately 1k ohms.
  - 8.9. If the MCOR does not operate as described, replace the MCOR.

**TEST PROCEDURE 5 – A1 AND A2 MOTOR VOLTAGE****See General Warnings, Section 1, Page 1-1.**

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2. See also following WARNING.**

** WARNING**

- **Keep people and equipment clear from rotating rear wheels. Do not allow persons under the car. Contact with rotating rear wheels could result in serious personal injury.**
2. With the batteries connected and using a multimeter set to 200 volts DC, place the black (–) probe on the A2 motor terminal (white wire) and connect the red (+) probe to the A1 (green wire) motor terminal.
  3. With Tow/Run switch in the RUN position, place the Forward/Reverse switch in the FORWARD position, turn key switch to the ON position and slowly press accelerator pedal.
  4. As the accelerator pedal is pressed, the voltage reading should increase from approximately 5 volts RMS when the MCOR limit switch closes, to approximately 48 volts RMS with the accelerator pedal fully pressed.

- 4.1. If there is no voltage reading, check the MCOR. **See Test Procedure 4 – MCOR Voltage on page 11-17.** Also check the continuity of the large posts of the solenoid. **See Test Procedure 14 – Solenoid Continuity on page 11-35.**
- 4.2. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
- 4.3. Check continuity on A1 and A2 motor terminal posts and continuity of the F1 and F2 motor terminal posts. Also, check continuity of all motor wires. **See Section 15a – Motor (Model 5BC59JBS6365).**

## TEST PROCEDURE 6 – TOW/RUN SWITCH

**See General Warnings, Section 1, Page 1-1.**

### Tow/Run Switch Test with the IQDM Handset

1. With the Tow/Run switch in the RUN position, connect the IQDM to the vehicle as described in the IQDM Owner's Manual.
2. Immediately after the IQDM is connected to the vehicle, the screen should display a copyright notice and the IQDM model number.
3. If the IQDM display screen is blank, drive the vehicle a short distance to activate the onboard computer.
4. If the IQDM display screen begins to work after the vehicle has been driven, turn the key switch to the OFF position and proceed to step 5; otherwise, perform the following procedure, Tow/Run Switch Test without the IQDM Handset.
5. With the IQDM still connected to the vehicle, place the Tow/Run Switch in the TOW position and wait 90 seconds.
6. If the IQDM display screen goes blank after 90 seconds, the Tow/Run switch and connecting wires are operating correctly.
7. If the IQDM display screen is still active after 90 seconds, the switch has failed closed. Replace the Tow/Run switch. **See Tow/Run Switch Removal, Section 12, Page 12-6.**

### Tow/Run Switch Test without the IQDM Handset

1. With the batteries connected and using a multimeter set on 200 volts DC, connect the black (–) probe to the negative post of battery no. 4 and connect red (+) probe (with insulation-piercing probe) on the pink wire close to the connector on the Tow/Run switch.

#### **⚠ WARNING**

- **The key switch should be placed in the OFF position and left in the OFF position for the duration of this test.**
2. With the Tow/Run switch in the RUN position, the reading should be approximately 48-50 volts. With the switch in the TOW position, the reading should be below approximately 5 volts.
  3. If the reading is above 5 volts with the switch in the TOW position, replace the switch.
  4. If the reading is below 5 volts with switch in the RUN position, check continuity of the blue 18-gauge wire from the large post of the solenoid to the connector at the Tow/Run switch.
  5. If the continuity readings are correct, replace the Tow/Run switch.

## TEST PROCEDURE 7 – BATTERY PACK VOLTAGE (UNDER LOAD)

See General Warnings, Section 1, Page 1-1.

1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.
2. Connect the tester leads to the positive (+) post of battery no.1 and negative (-) post of battery no. 4 (Figure 11-9, Page 11-20)

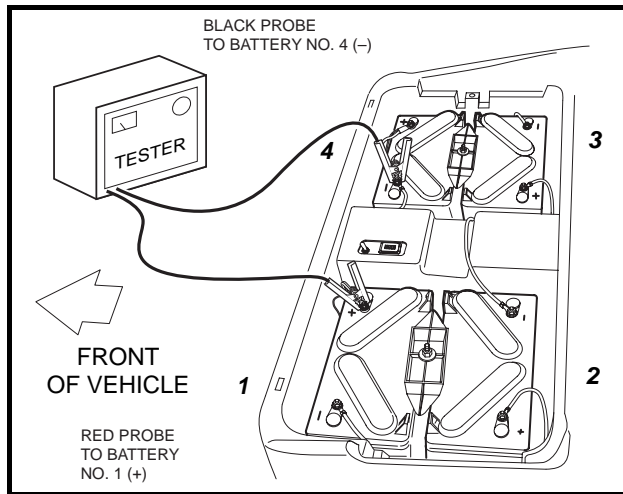


Figure 11-9 Battery Discharge Test

3. Turn the discharge machine on and record the voltage reading of battery pack while under load.
4. A fully charged set of batteries in good condition should read between 46-49 volts while under load.
5. A reading of 32-46 volts indicates discharged or failed batteries. Each battery should be checked with a multimeter while under load.
6. A reading of 32 volts or less will not activate discharge machine. If the voltage of the batteries is below 32 volts, the batteries are deeply discharged or have failed.
7. Recording the battery pack voltage reading while under load provides a more accurate diagnosis of the condition of the batteries. When the discharge machine is ON, it places the battery pack under load and many times can help determine if one or more batteries in the set have failed. Testing battery voltage while the batteries are not under load will not always indicate the true condition of the batteries. For more information about the batteries, refer to Section 13 – Batteries.

## TEST PROCEDURE 8 – KEY SWITCH AND MCOR LIMIT SWITCH CIRCUIT

See General Warnings, Section 1, Page 1-1.

### Key Switch and MCOR Limit Switch Circuit Test with the IQDM Handset

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
2. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
3. Connect the IQDM to the vehicle as described in the IQDM Owner’s Manual.
4. Test the key switch.
  - 4.1. Access the Test menu and select KEY INPUT by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the key switch is in the OFF position.

- 4.2. While monitoring the IQDM display screen, turn the key switch to the ON position. The IQDM should indicate ON.
- 4.3. If the IQDM does not indicate that KEY INPUT is ON when the key switch is in the ON position, proceed to the following procedure, Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset. If the key switch functions as described, proceed to the following step. **See following NOTE.**

**NOTE:** The key switch *MUST* function properly in order to test the MCOR limit switch with the IQDM handset.

5. Test the MCOR limit switch.
  - 5.1. Select FOOT INPUT on the Test menu by using the SCROLL DISPLAY buttons on the IQDM.
  - 5.2. The IQDM should indicate that FOOT INPUT is OFF when the accelerator pedal is not pressed, regardless of the key switch position.
  - 5.3. With the key switch in the ON position, press the accelerator pedal. The IQDM should indicate that FOOT INPUT is ON when the accelerator pedal is pressed.
6. If any reading is obtained that is not described in steps 4 and 5, perform the following steps:
  - 6.1. Check the wiring of the key switch and MCOR. **See Wiring Diagrams on page 11-2.**
  - 6.2. Check the continuity of the key switch wires and the MCOR limit switch wires.
7. If the problem was not found, proceed to the following procedure, Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset on page 11-21.

### Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
4. Test the key switch.
  - 4.1. Remove the instrument panel. **See step 2 of Key Switch Removal, Section 12, Page 12-1.**
  - 4.2. Using a multimeter set to 200 ohms, place the red (+) probe on the key switch terminal with the blue wire. Place the black (–) probe on the other key switch terminal.
  - 4.3. With the key switch in the OFF position, the multimeter should indicate that continuity is not present.
  - 4.4. With the key switch in the ON position, the multimeter should indicate that continuity is present.
  - 4.5. If any other reading is obtained, replace the key switch. **See Key Switch Removal, Section 12, Page 12-1.**
  - 4.6. If the key switch operates as described in the previous steps, install the instrument panel in the reverse order of removal and proceed to the following step.
5. Test the MCOR limit switch. **See following NOTE.**

**NOTE:** Make sure that the key switch is operating correctly and that the key switch and instrument panel are properly installed before proceeding.

- 5.1. With batteries connected and using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the green wire close to the two-pin connector on the MCOR.

**Key Switch and MCOR Limit Switch Circuit Test without the IQDM Handset, Continued:**** WARNING**

- **The Forward/Reverse switch must be in the neutral position to avoid personal injury due to contact with rotating wheels.**
- 5.2. With Tow/Run switch in the RUN position, key switch in the ON position, and Forward/Reverse rocker switch in the NEUTRAL position, the voltage reading should be zero volts. When the accelerator pedal is pressed, the voltage reading should be approximately 48 volts (full battery voltage).
  - 5.3. If the voltage reading is 48 volts when the accelerator pedal is not pressed, replace the MCOR. **See MCOR Removal, Section 12, Page 12-7.**
  - 5.4. If the voltage reading is zero volts when the accelerator pedal is pressed, check the limit switch circuit using the following test procedures.
    - 5.4.1. Using a multimeter set to 200 volts DC, place black (–) probe on battery no. 4 negative post and the place red (+) probe (with insulation-piercing probe) on the blue wire where it connects to the MCOR. With the key switch ON, the reading should be approximately 48 volts (full battery voltage).
    - 5.4.2. If the reading is zero volts, check the continuity of the blue wire that goes from the key switch to the MCOR.
    - 5.4.3. If the reading is approximately 48 volts, proceed to the following step.
    - 5.4.4. Using a multimeter set to 200 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the green wire where it connects to the MCOR. With the Tow/Run switch in the RUN position, the key switch ON, the Forward/Reverse rocker switch in NEUTRAL and the accelerator pedal pressed, the reading should be approximately 48 volts (full battery voltage).
    - 5.4.5. If the reading is zero volts, test the continuity of the MCOR limit switch and the green wire. If the limit switch does not pass the continuity test, replace the MCOR. **See MCOR Removal, Section 12, Page 12-7.**

**TEST PROCEDURE 9 – 16-PIN CONNECTOR****See General Warnings, Section 1, Page 1-1.**

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Disconnect the 16-pin connector from the speed controller. Inspect terminal ends inside plug to ensure they are in position and seated in plug housing. If any terminals look like they are not pushed all the way into the connector, gently push the terminals until they are firmly seated in the 16-pin connector. After each terminal has been pushed into the housing, gently pull on the wire to ensure it is locked into place.
3. Check wires in the plug to make sure none are broken at the terminal pin crimp. Repair or replace as required.
4. Check the wire colors of each wire and make sure that the colors for each pin position match the wire colors in the wiring diagram. **See Wiring Diagrams on page 11-2.**
5. When connecting the 16-pin connector to the controller, push plug into controller receptacle with enough force to lock plug into place. An audible click will be heard when plug is properly seated to the controller.

A procedure is provided for testing each of the wires in the 16-pin connector. Refer to the following chart for the appropriate procedure for each pin in the 16-pin connector.



If the results of any of the referenced procedures are different from those described in the procedure, check the continuity of the wires in the wire harness and test the connected components with the appropriate test procedures. **See Index of Test Procedures on page 11-14.**

SPEED CONTROLLER 16-PIN CONNECTOR WIRE	TEST PROCEDURE
Pin 1 – White/Black (18-gauge)	Test Procedure 9A – Pins 1, 2, and 3 on page 11-23
Pin 2 – Yellow (18-gauge)	
Pin 3 – Purple (18-gauge)	
Pin 4 – Open (No wire)	
Pin 5 – Light Blue (18-gauge)	Test Procedure 9B – Pin 5 on page 11-24
Pin 6 – Green (18-gauge)	Test Procedure 9C – Pin 6 on page 11-25
Pin 7 – Orange/White (18-gauge)	Test Procedure 9D – Pin 7 on page 11-27
Pin 8 – White (18-gauge)	Test Procedure 9E – Pins 8 and 16 on page 11-28
Pin 9 – Gray (18-gauge)	Test Procedure 9F – Pin 9 on page 11-29
Pin 10 – Tan (18-gauge)	Test Procedure 9G – Pin 10 on page 11-30
Pin 11 – Open (no wire)	
Pin 12 – Blue/White (18-gauge)	Test Procedure 9H – Pin 12 on page 11-31
Pin 13 – Black/White (18-gauge)	Test continuity of each wire and perform Test Procedure 13 – Motor Speed Sensor on page 11-34
Pin 14 – Light Green (18-gauge)	
Pin 15 – Red (18-gauge)	
Pin 16 – Blue (18-gauge)	Test Procedure 9E – Pins 8 and 16 on page 11-28

### Test Procedure 9A – Pins 1, 2, and 3

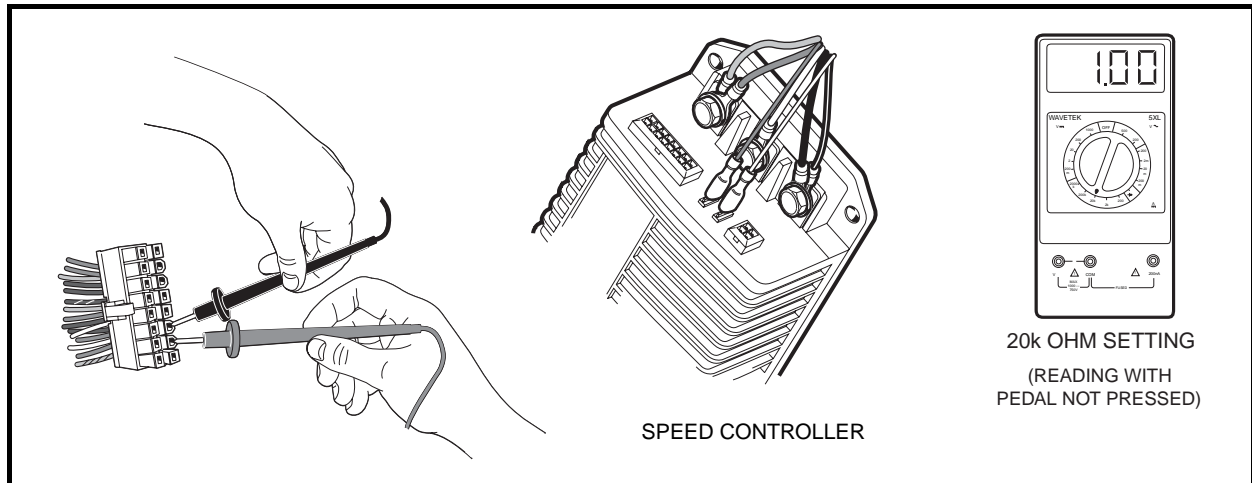
#### See General Warnings, Section 1, Page 1-1.

Pins 1, 2, and 3 in the 16-pin connector provide a connection point from the MCOR potentiometer to the speed controller.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.
4. Using a multimeter set for 20k ohms, insert the red (+) probe of the multimeter into pin 2 (yellow wire) of the 16-pin connector. **See following CAUTION.** Insert the black (–) probe into pin 3 (purple wire) of the 16-pin connector (**Figure 11-10, Page 11-24**).

#### **CAUTION**

- **Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.**
5. With the accelerator pedal fully up (not pressed), the multimeter should read approximately 1k ohms.
  6. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should rise as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate between 5.67k ohms and 7.43k ohms.

**Test Procedure 9A – Pins 1, 2, and 3, Continued:****Figure 11-10 Pins 1, 2, and 3 Test**

7. Using a multimeter set for 20k ohms, insert the red (+) probe of the multimeter into pin 2 (yellow wire) at the 16-pin connector. Connect the black (–) probe into pin 1 (white/black wire). **See previous CAUTION.**
8. With the accelerator pedal fully up (not pressed), the multimeter should indicate between 5.67k ohms and 7.43k ohms.
9. Slowly press the accelerator pedal while monitoring the multimeter. The resistance should drop as the pedal is pressed. When the pedal is all the way to the floor, the multimeter should indicate approximately 1k ohms.
10. If any other reading is observed, check the continuity of the wires in the wire harness.

**Test Procedure 9B – Pin 5****See General Warnings, Section 1, Page 1-1.**

Pin 5 in the 16-pin connector provides a connection point for the solenoid lockout circuit from the onboard computer to the speed controller.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.
4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 5 (light blue wire) of the 16-pin connector. **See following CAUTION.** Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (**Figure 11-11, Page 11-25**).

**CAUTION**

- **Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.**

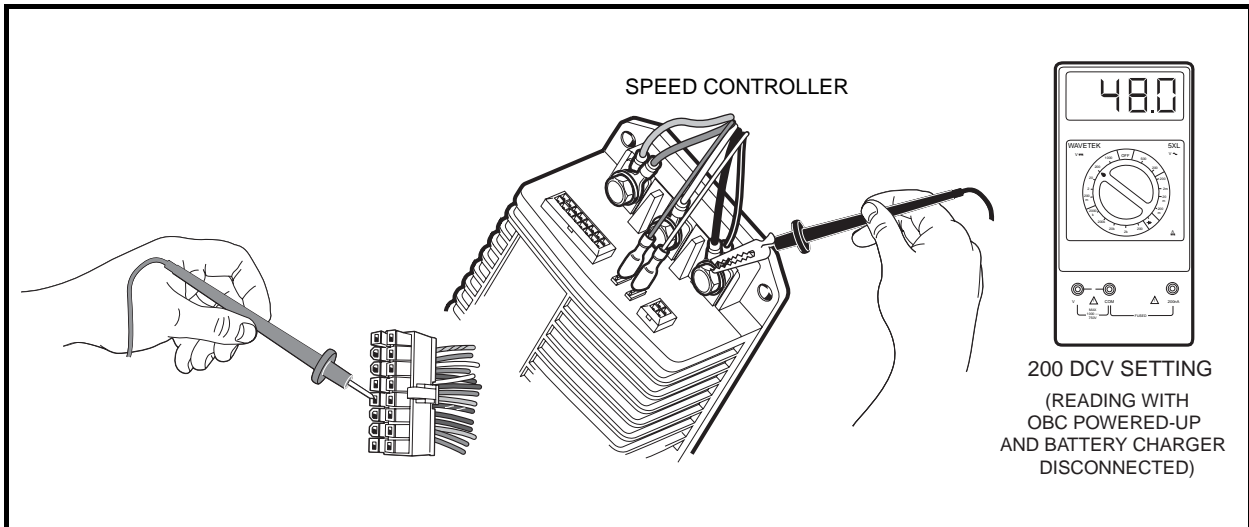


Figure 11-11 Pin 5 Test

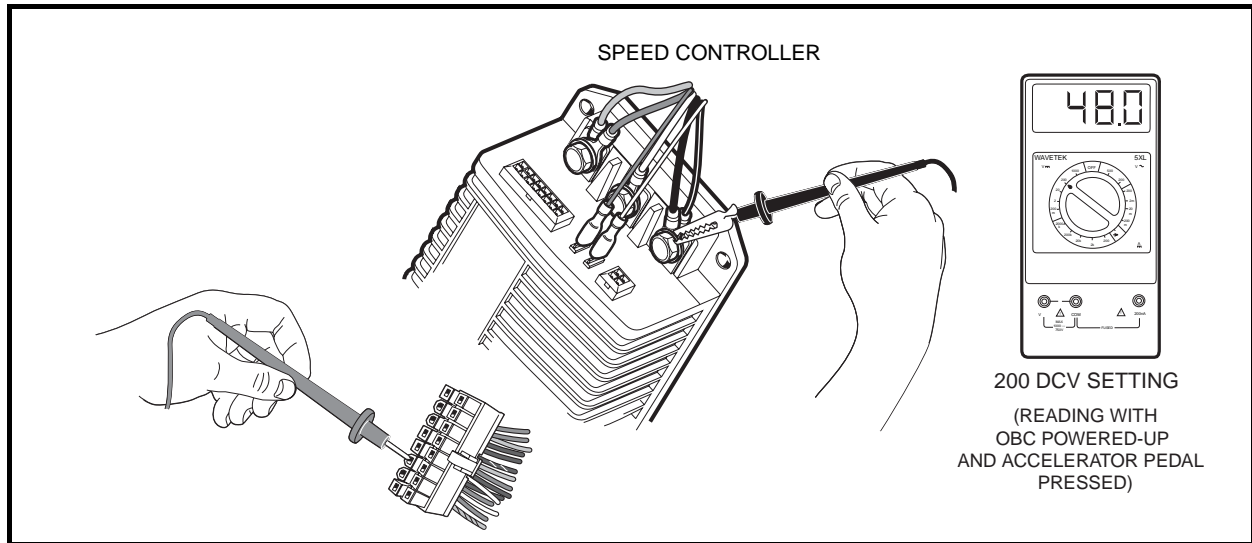
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N-m).
6. Place the Tow/Run switch in the RUN position.
7. The multimeter should indicate zero volts DC at this time.
8. While monitoring the multimeter, plug the battery charger into the vehicle charger receptacle.
9. After a short delay, the onboard computer should power-up (come out of sleep mode), charger relay should click, and the ammeter on the charger should indicate that the vehicle batteries are being charged.
10. The multimeter should indicate zero volts DC while the charger is connected to the vehicle.
11. While observing the multimeter, disconnect the DC plug from the vehicle charger receptacle.
12. The multimeter should indicate full battery voltage when the charger is not connected to the vehicle.
13. If any other reading is obtained, check the following items:
  - Continuity of the wires in the wire harness
  - Onboard computer for proper operation. **See Test Procedure 11 – Onboard Computer Gray Wire on page 11-33.**
  - Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**

### Test Procedure 9C – Pin 6

#### See General Warnings, Section 1, Page 1-1.

Pin 6 in the 16-pin connector provides a connection point for the MCOR limit switch to the speed controller.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.

**Test Procedure 9C – Pin 6, Continued:****Figure 11-12 Pin 6 Test**

4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 6 (green wire) of the 16-pin connector. **See following CAUTION.** Using an alligator clip, connect the black (-) probe to the B- terminal of the speed controller (**Figure 11-12, Page 11-26**).

**⚠ CAUTION**

- **Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.**
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).
  6. Place the Tow/Run switch in the RUN position, key switch in the ON position, and Forward/Reverse switch in the FORWARD position.
  7. The multimeter should indicate zero volts DC at this time.
  8. While monitoring the multimeter, slowly press the accelerator pedal and hold the pedal at approximately 20% of full travel.
  9. After a short delay, the onboard computer should power-up (come out of sleep mode).
  10. The multimeter should indicate full battery voltage (approximately 48 volts) when the accelerator pedal is pressed.
  11. While observing the multimeter, release the accelerator pedal.
  12. The multimeter should indicate zero volts when the accelerator pedal is not pressed.
  13. If any other reading is obtained, check the following items:
    - Continuity of the wires in the wire harness
    - Onboard computer for proper operation. **See Test Procedure 11 – Onboard Computer Gray Wire on page 11-33.**
    - Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**
    - Key switch and MCOR limit switch for proper operation. **See Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20.**

## Test Procedure 9D – Pin 7

### See General Warnings, Section 1, Page 1-1.

Pin 7 in the 16-pin connector provides a connection point for the reverse buzzer to the speed controller.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.
4. Place a jumper wire with an alligator clip between the B– terminal of the speed controller (use alligator clip for this connection) and pin 7 (orange/white wire) of the 16-pin connector (**Figure 11-13, Page 11-27**). **See following CAUTION.**

### **CAUTION**

- Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).
  6. Place the Tow/Run switch in the RUN position.
  7. The reverse buzzer should sound when the Tow/Run switch is in the RUN position.
  8. If any other activity is observed, check the following items:
    - Continuity of the wires in the wire harness
    - Reverse buzzer for proper operation. **See Test Procedure 16 – Reverse Buzzer on page 11-37.**
    - Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**

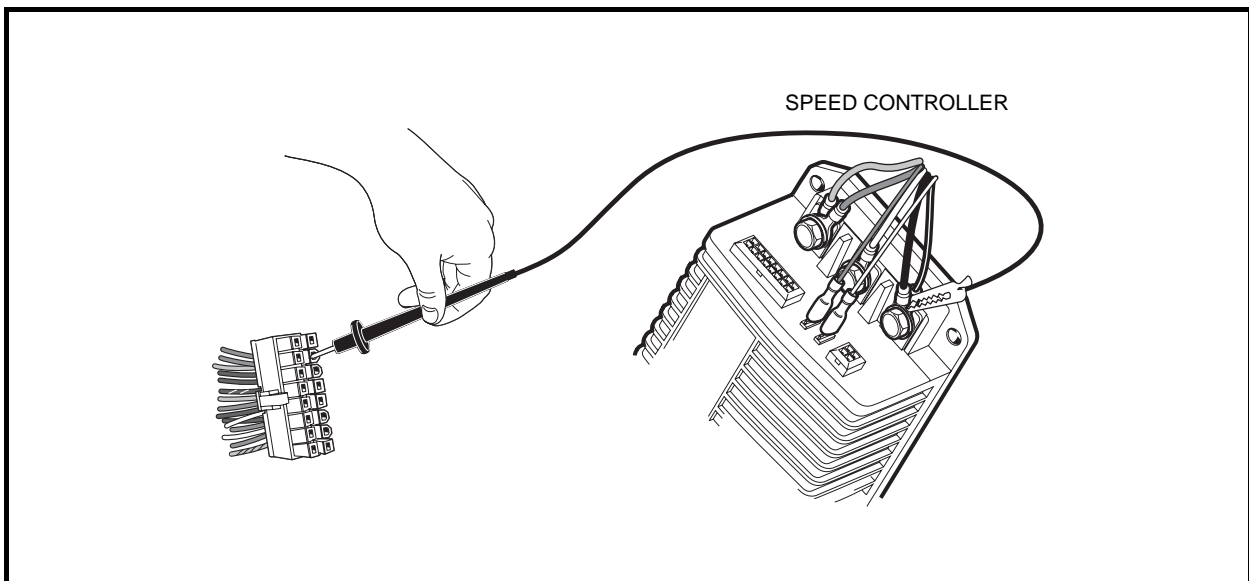


Figure 11-13 Pin 7 Test

## Test Procedure 9E – Pins 8 and 16

### See General Warnings, Section 1, Page 1-1.

Pins 8 and 16 in the 16-pin connector provide a connection point for the Forward/Reverse rocker switch to the speed controller. The switch provides a +48 volt signal to the speed controller through pin 8 when the Forward/Reverse switch is in the FORWARD position and provides a +48 volt signal on pin 16 when the Forward/Reverse switch is in the REVERSE position.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame crossmember between the spring mount and side stringer, just forward of each rear wheel. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.
4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 8 (white wire) of the 16-pin connector. **See following CAUTION.** Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (**Figure 11-14, Page 11-29**).

### **CAUTION**

- **Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.**
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).
  6. Place the Tow/Run switch in the RUN position and the Forward/Reverse switch in the NEUTRAL position. The multimeter should indicate zero volts DC at this time.
  7. While monitoring the multimeter, place the Forward/Reverse switch in the REVERSE position. The multimeter should still indicate zero volts.
  8. Place the Forward/Reverse switch in the FORWARD position. The multimeter should indicate full battery voltage (approximately 48 volts).
  9. Insert the red (+) probe of the multimeter into pin 16 (blue wire) of the 16-pin connector. Leave the black (–) probe (alligator clip) connected to the B– terminal of the speed controller. **See previous CAUTION.**
  10. Place the Forward/Reverse switch in the NEUTRAL position. The multimeter should indicate zero volts DC at this time.
  11. While monitoring the multimeter, place the Forward/Reverse switch in the FORWARD position. The multimeter should still indicate zero volts.
  12. Place the Forward/Reverse switch in the REVERSE position. The multimeter should indicate full battery voltage (approximately 48 volts).
  13. If any other reading is obtained, check the following items:
    - Continuity of the wires in the wire harness
    - Forward/Reverse switch for proper operation. **See Test Procedure 15 – Forward/Reverse Rocker Switch on page 11-36.**

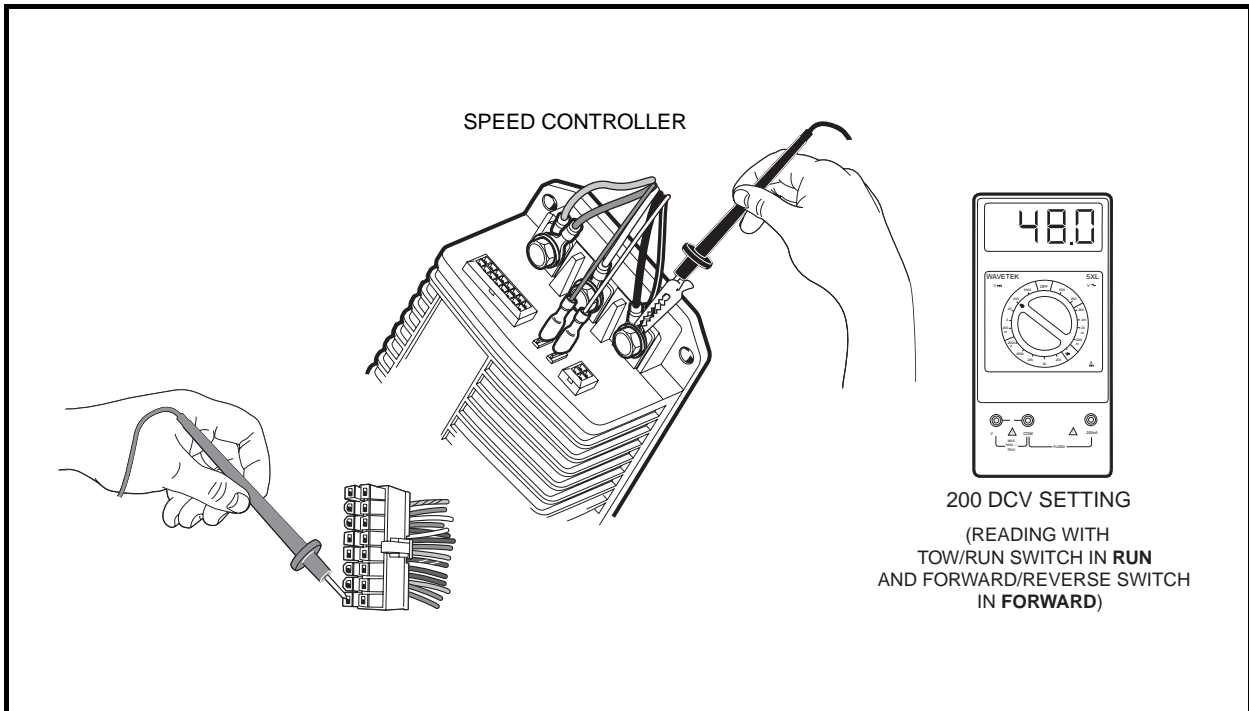


Figure 11-14 Pins 8 and 16 Test

- Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**

### Test Procedure 9F – Pin 9

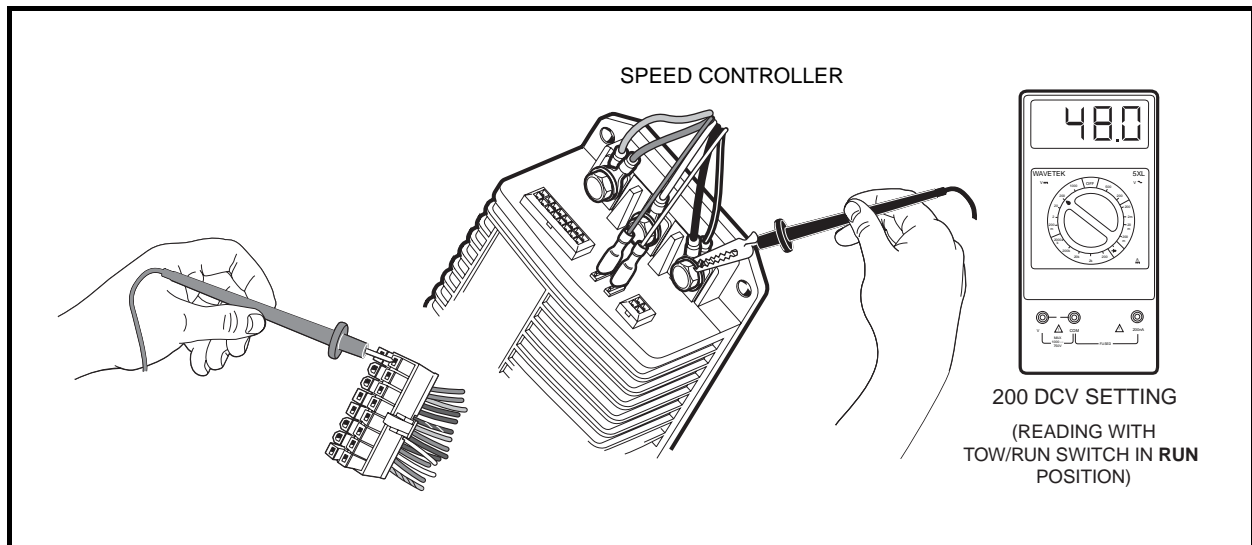
**See General Warnings, Section 1, Page 1-1.**

Pin 9 in the 16-pin connector provides a connection point for the Tow/Run switch to the speed controller. The switch provides a +48 volt signal to the speed controller through pin 9 when the Tow/Run switch is in the RUN position.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.
4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 9 (gray wire) of the 16-pin connector. **See following CAUTION.** Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (**Figure 11-15, Page 11-30**).

### **CAUTION**

- **Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.**
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).
  6. With the Tow/Run switch in the TOW position, the multimeter should indicate zero volts.
  7. Place the Tow/Run switch in the RUN position.

**Test Procedure 9F – Pin 9, Continued:****Figure 11-15 Pin 9 Test**

8. With the Tow/Run switch in the RUN position, the multimeter should indicate full battery voltage (approximately 48 volts).
9. If any other reading is obtained, check the following items:
  - Continuity of the wires in the wire harness
  - Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**

**Test Procedure 9G – Pin 10****See General Warnings, Section 1, Page 1-1.**

Pin 10 in the 16-pin connector provides a connection point for the key switch to the speed controller. The key switch provides a +48 volt signal to the speed controller through pin 10 when the key switch is in the ON position.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.
4. Using a multimeter set for 200 volts DC, insert the red (+) probe of the multimeter into pin 10 (tan wire) of the 16-pin connector. **See following CAUTION.** Using an alligator clip, connect the black (–) probe to the B– terminal of the speed controller (**Figure 11-16, Page 11-31**).

**CAUTION**

- **Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.**



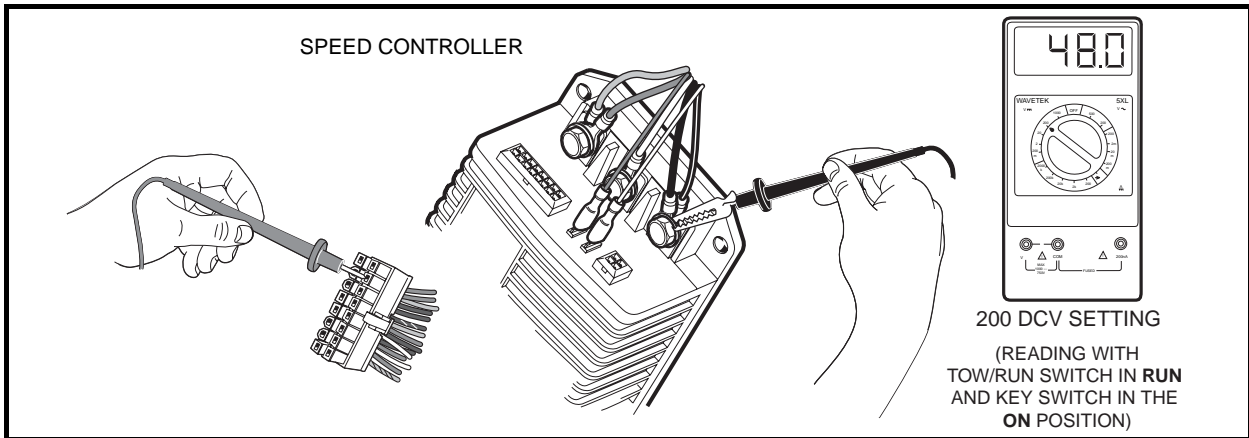


Figure 11-16 Pin 10 Test

5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).
6. With the Tow/Run switch in the TOW position, the multimeter should indicate zero volts.
7. Place the Tow/Run switch in the RUN position and the key switch in the ON position.
8. With the key switch in the ON position, the multimeter should indicate full battery voltage (approximately 48 volts). With the key switch in the OFF position, the reading should be zero volts.
9. If any other reading is obtained, check the following items:
  - Continuity of the wires in the wire harness
  - Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**
  - Key switch for proper operation. **See Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20.**

## Test Procedure 9H – Pin 12

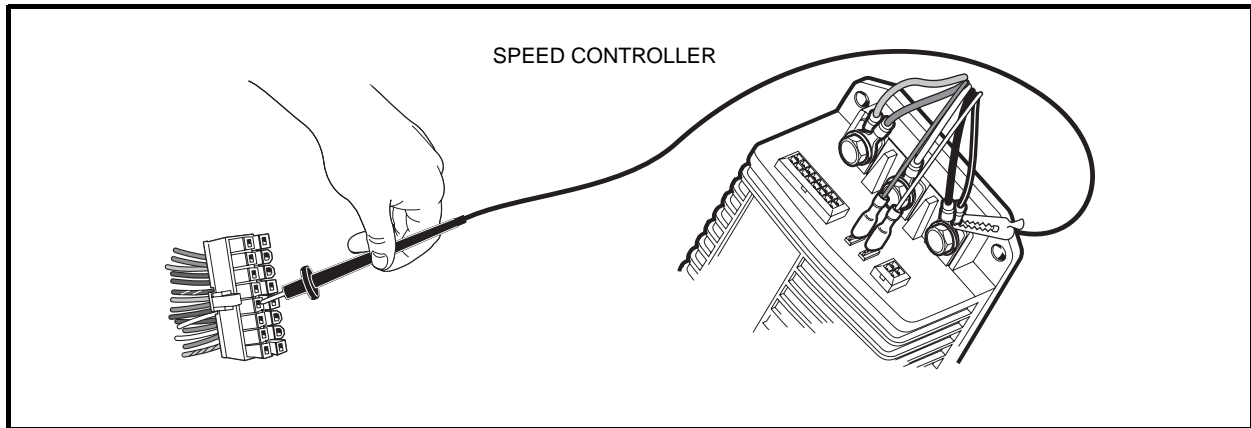
### See General Warnings, Section 1, Page 1-1.

Pin 12 in the 16-pin connector provides a connection point for the solenoid coil to the speed controller. The speed controller activates the solenoid coil by providing a ground to the solenoid coil at the appropriate time.

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.**
2. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Disconnect the 16-pin connector at the speed controller.
4. Place a jumper wire with an alligator clip between the B– terminal of the speed controller (use alligator clip for this connection) and pin 12 (blue/white wire) of the 16-pin connector (**Figure 11-17, Page 11-32**). **See following CAUTION.**

### **CAUTION**

- **Do not fully insert probes into the 16-pin plug. Doing so can result in a poor connection.**
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

**Test Procedure 9H – Pin 12, Continued:****Figure 11-17 Pin 12 Test**

6. Place the Tow/Run switch in the RUN position and the key switch in the ON position.
7. The solenoid should click when the key switch is placed in the ON position.
8. If any other activity is observed, check the following items:
  - Continuity of the wires in the wire harness
  - Reverse buzzer for proper operation. **See Test Procedure 16 – Reverse Buzzer on page 11-37.**
  - Tow/Run switch for proper operation. **See Test Procedure 6 – Tow/Run Switch on page 11-19.**
  - Key switch for proper operation. **See Test Procedure 8 – Key Switch and MCOR Limit Switch Circuit on page 11-20.**
  - Solenoid for proper operation. **See Test Procedure 14 – Solenoid Continuity on page 11-35.**

## TEST PROCEDURE 10 – ONBOARD COMPUTER SILICON-CONTROLLED RECTIFIER (SCR) CIRCUIT

### See General Warnings, Section 1, Page 1-1.

The silicon controlled rectifier (SCR), located inside the onboard computer, acts as a switch on the negative side of the circuit.

This allows the onboard computer (OBC) to control the battery charging current.

Use the following procedure to test the SCR:

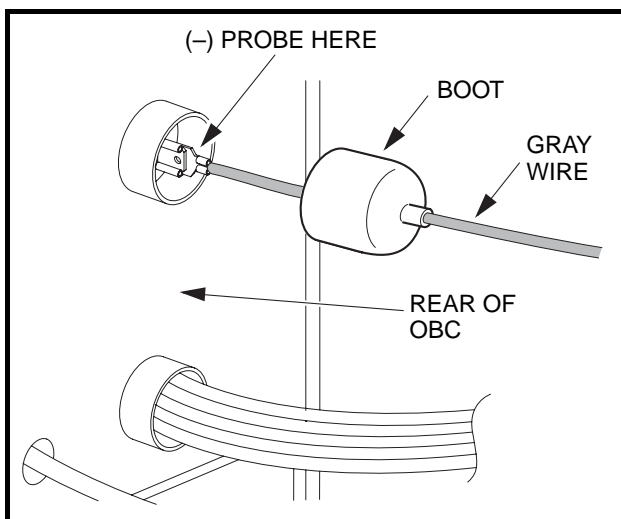
1. With batteries connected and using a multimeter set to 200 volts DC, place the red (+) probe on the positive post of battery no. 1 and place the black (–) probe on the charger receptacle socket that has the black 10-gauge wire attached to it. The reading should be approximately 36-42 volts.
2. If the reading is zero volts, check the black 10-gauge wire connection to the OBC connector. Check the continuity of the black 10-gauge wires. If the wires and connections are okay, the SCR has failed. Replace the OBC. If the reading is correct, proceed to the following step.
3. Plug in AC and DC cords. When the battery charger relay clicks on, reading should be approximately 48 volts (full battery voltage). If the reading does not rise from approximately 40 volts to full battery voltage when the DC cord is plugged in and the relay clicks on, check the following items:
  - Black wire terminal socket in the charger receptacle.

- Onboard computer gray wire. See **Test Procedure 11 – Onboard Computer Gray Wire** on page 11-33.
- Red wire at the charger receptacle. See **Test Procedure 12 – Voltage at Charger Receptacle Red Wire Socket** on page 11-33.

## TEST PROCEDURE 11 – ONBOARD COMPUTER GRAY WIRE

See **General Warnings, Section 1, Page 1-1.**

1. With batteries connected and the DC cord disconnected, pull back on the boot on the gray wire connection at the OBC (**Figure 11-18, Page 11-33**). Using a multimeter set to 200 volts DC, connect the red (+) probe to the positive post of battery no. 1 and black (-) probe to gray 16-gauge wire at the OBC connection. Reading should be approximately 48 volts. If reading is zero volts, replace the OBC.



**Figure 11-18 OBC Connections**

2. If the reading in step 1 is 48 volts, plug the DC cord into the vehicle's charger receptacle. The voltage reading should drop to approximately 4.0 volts before the charger relay clicks on.
3. When the charger relay is activated, the reading should rise to approximately 48 volts.
4. If voltage does not drop to approximately 4.0 volts when the DC cord is plugged in and then rise to approximately 48 volts when the charger relay clicks on, the gray wire circuit in the OBC has failed. Replace the OBC.

## TEST PROCEDURE 12 – VOLTAGE AT CHARGER RECEPTACLE RED WIRE SOCKET

See **General Warnings, Section 1, Page 1-1.**

1. With batteries connected, DC cord disconnected, and using a multimeter set to 200 volts DC, place the black (-) probe on the negative post of battery no. 4 and place the red (+) probe on the charger receptacle socket connected to the red 10-gauge wire. The reading should be 48-50 volts (full battery voltage).
2. If the reading is zero volts, check the continuity of the 10-gauge red wire from the positive post of battery no. 1 to the receptacle socket.

## TEST PROCEDURE 13 – MOTOR SPEED SENSOR

See General Warnings, Section 1, Page 1-1.

### Motor Speed Sensor Test with the IQDM Handset

#### **⚠ CAUTION**

- Perform the following procedure only on a level surface. To avoid injury or property damage, ensure that the path of the vehicle is clear before pushing vehicle.
1. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
  2. Connect the IQDM to the vehicle as described in the IQDM Owner's Manual.
  3. Access the Test menu and select SPEED PULSES by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the vehicle is at rest.
  4. While monitoring the IQDM display screen, slowly push the vehicle a short distance (about 3 feet (1 meter)). The IQDM should indicate ON for speed sensor pulses while the wheels are in motion.
  5. If the IQDM does not indicate ON while the wheels are in motion, proceed to the following procedure, Motor Speed Sensor Test without the IQDM Handset.

### Motor Speed Sensor Test without the IQDM Handset

1. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
2. With batteries connected, disconnect the three-pin connector at the motor speed sensor.
3. Check voltage at black/white wire:
  - 3.1. Using a multimeter set to 200 volts DC, place the red (+) probe on the battery no. 1 positive post and place the black (–) probe on the black/white wire terminal socket in the three-pin connector. The voltage reading should be 48 to 50 volts (full battery voltage).
  - 3.2. If the reading is zero volts, check the continuity of the black/white wire from the 16-pin connector at the speed controller to the three-pin connector at the motor speed sensor. If the continuity is correct, replace the speed controller.
4. Check voltage at the red motor speed sensor wire:
  - 4.1. With Tow/Run switch in the RUN position and using a multimeter set to 20 volts DC, place the black (–) probe on the battery no. 4 negative post and place red (+) probe on red wire terminal socket in three-pin connector. The voltage reading should be approximately 15-16 volts.
  - 4.2. If the voltage reading is zero volts, check the continuity of the red wire from the 16-pin connector at the speed controller to the three-pin connector at the motor speed sensor. If the wire continuity is correct, replace the speed controller.
  - 4.3. If the reading is below 14 volts, replace the speed controller.
  - 4.4. If the voltage reading is correct, proceed to the following step.
5. Check voltage at the light green wire:
  - 5.1. Using a multimeter set to 20 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe on the light green wire female terminal in the three-pin connector at the motor speed sensor. The voltage reading should be from 4.60 to 4.90 volts.
  - 5.2. If the voltage is zero volts, check the continuity of the light green wire from the 16-pin connector at the speed controller to the three-pin connector at the motor speed sensor. If the continuity is correct, replace the speed controller.
  - 5.3. If reading is below 3.50 volts, check the continuity of the wires and plug and replace the speed controller if necessary.

6. Reconnect the three-pin connector at the motor speed sensor. Using a multimeter set to 20 volts DC, place the black (–) probe on the battery no. 4 negative post and place the red (+) probe (with insulation-piercing probe) on the green wire between the three-pin connector and the motor speed sensor.
  - 6.1. Raise one rear wheel off ground. Slowly turn the rear wheel to rotate the motor armature. As the armature rotates, the voltage reading should alternate from zero to approximately 4.85 volts. The voltage reading will fluctuate from zero to 4.85 volts and back to zero four times for each revolution of the motor armature.

**NOTE:** The voltage reading of 4.85 is an approximate reading. The actual reading may vary from 4.50 to 5.00 volts.

6.2. Replace the speed sensor if:

- There is no voltage reading.
- The voltage reading is not above 3.50.
- The voltage reading does not fluctuate as the motor is turned.

## TEST PROCEDURE 14 – SOLENOID CONTINUITY

See General Warnings, Section 1, Page 1-1.

1. Place chocks at the front wheels and lift the rear of the vehicle with a chain hoist or floor jack. Position jack stands under the frame rails just forward of each spring mount. See **WARNING “Lift only one end...”** in General Warnings, Section 1, Page 1-2.
2. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in General Warnings, Section 1, Page 1-1.
3. Disconnect the three wires that are crimped together from the forward large post of the solenoid.
4. Using a multimeter set to 200k ohms, place the black (–) probe on one solenoid large post and place the red (+) probe on the other large post. The reading should be no continuity.
5. Connect the three wires crimped together to the forward large solenoid post. Install washer and nut on large solenoid post and tighten to 77 in-lb (8.7 N·m).
6. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).

### **WARNING**

- **Keep people and equipment clear from rotating rear wheels. Do not allow persons under the car. Contact with rotating rear wheels could result in serious personal injury.**
7. Place the Tow/Run switch in the RUN position, turn the key switch to the ON position, place the Forward/Reverse rocker switch in the FORWARD position, and press the accelerator pedal. The solenoid should click and the multimeter should indicate continuity. If the reading is no continuity, replace the solenoid.

## TEST PROCEDURE 15 – FORWARD/REVERSE ROCKER SWITCH

See General Warnings, Section 1, Page 1-1.

### Forward/Reverse Rocker Switch Test with the IQDM Handset

1. Turn the key switch to the OFF position and place the Forward/Reverse switch in the NEUTRAL position.
2. Connect the IQDM to the vehicle as described in the IQDM Owner's Manual.
3. Test FORWARD INPUT.
  - 3.1. Access the Test menu and select FORWARD INPUT by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the Forward/Reverse switch is in the NEUTRAL or REVERSE position.
  - 3.2. Place the Forward/Reverse switch in the FORWARD position. The IQDM should indicate that FORWARD INPUT is ON. If the IQDM indicates any other reading, check vehicle wiring. **See Wiring Diagrams on page 11-2.** Also check the 16-pin connector at the speed controller. **See Test Procedure 9 – 16-Pin Connector on page 11-22.**
4. Test REVERSE INPUT.
  - 4.1. Access the Test menu and select REVERSE INPUT by using the SCROLL DISPLAY buttons. The IQDM should indicate OFF when the Forward/Reverse switch is in the NEUTRAL or FORWARD position.
  - 4.2. Place the Forward/Reverse switch in the REVERSE position. The IQDM should indicate that REVERSE INPUT is ON. If the IQDM indicates any other reading, check vehicle wiring. **See Wiring Diagrams on page 11-2.** Also check the 16-pin connector at the speed controller. **See Test Procedure 9 – 16-Pin Connector on page 11-22.**
5. If the IQDM displays readings other than those described above and the wiring is found to be correct, proceed to the following procedure, Forward/Reverse Rocker Switch Test without the IQDM Handset.

### Forward/Reverse Rocker Switch Test without the IQDM Handset

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Remove the two screws securing the rocker switch case to the vehicle body.
3. Remove switch from car. **See Forward/Reverse Rocker Switch Removal, Section 12, Page 12-3.**
4. Disconnect the three wires from the rocker switch. Using a multimeter set to 200 ohms, place the black (–) probe on the blue wire terminal 3 position on the rocker switch, and place the red (+) probe on the red wire terminal 2 position. With the switch in NEUTRAL or REVERSE, there should be no continuity. With the switch in FORWARD, there should be continuity. If the readings are incorrect, replace the switch.
5. Place the black (–) probe on the white wire terminal 1 position on the rocker switch and place the red (+) probe on the red wire terminal. With the switch in REVERSE, there should be continuity. If the readings are incorrect, replace the switch.

## TEST PROCEDURE 16 – REVERSE BUZZER

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Remove the instrument panel. See **step 2 of Key Switch Removal, Section 12, Page 12-1.**
3. Disconnect the orange/white and pink wires from the reverse buzzer.
4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m).
5. Place the key switch in the OFF position and the Tow/Run switch in the RUN position.
6. Using a multimeter set to 200 volts DC, place the black (–) probe on battery no. 4 negative post and place the red (+) probe on the pink wire terminal end that was disconnected from the reverse buzzer. The reading should be approximately 48 volts (full battery voltage).
  - 6.1. If the voltage reading is correct, proceed to step 7.
  - 6.2. If reading is zero volts, check pink wire continuity and Tow/Run switch. See **Test Procedure 2 – Onboard Computer Solenoid Lockout Circuit on page 11-15. See also Test Procedure 6 – Tow/Run Switch on page 11-19.**
  - 6.3. If the continuity readings are not correct, repair or replace the pink wire.
  - 6.4. If the continuity readings are correct, proceed to step 7.
7. Place the Forward/Reverse switch in REVERSE. Using a multimeter set to 200 volts DC, place the black (–) probe on the orange/white wire terminal end (that was disconnected from the reverse buzzer) and place the red (+) probe on battery no. 1 positive post. The reading should be approximately 48 volts (full battery voltage).
  - 7.1. If the voltage reading is correct, replace the reverse buzzer.
  - 7.2. If reading is zero volts, check orange/white wire continuity and connection at Pin 7 in 16-Pin connector.
  - 7.3. If there is no continuity in the orange/white wire, or the Pin 7 terminal in the 16-Pin connector is not properly seated, repair or replace as required.
  - 7.4. If the orange/white wire continuity and 16-Pin connector are correct and there is no voltage at the orange wire, replace the controller.

## TEST PROCEDURE 17 – REBOOTING THE ONBOARD COMPUTER

See General Warnings, Section 1, Page 1-1.

It is possible the onboard computer (OBC) can become “locked up”, causing the OBC solenoid lockout circuit to malfunction. If this condition is suspected, restart the computer as follows:

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1. See following NOTE.**

**NOTE:** Wait at least 90 seconds for the capacitors in the speed controller to discharge. The capacitors in the speed controller must be fully discharged in order to reboot the OBC.

2. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
3. Place Tow/Run switch in the RUN position.
4. Test drive the vehicle. If the vehicle functions normally the problem is corrected. If the problem still exists, refer to Wiring Diagrams on page 11-2.

## TEST PROCEDURE 18 – BATTERY WARNING LIGHT

See **General Warnings, Section 1, Page 1-1.**

1. Reboot the OBC and drive the vehicle a short distance. When vehicle is first driven, the battery warning light should illuminate for 10 seconds. **See Test Procedure 17 – Rebooting the Onboard Computer on page 11-37.** If the battery warning light does not illuminate when rebooting the OBC, proceed to step 2.
2. Turn key switch OFF, place Tow/Run switch in TOW and place Forward/Reverse rocker switch in NEUTRAL.
3. Disconnect the six-pin connector at the OBC.
4. Remove the wedge lock from the six-pin connector housing that is connected to the vehicle wire harness. Remove the brown/white wire from the connector plug.
5. Using a jumper wire with an alligator clip at each end, connect one alligator clip to the negative post of battery no. 1 and the other alligator clip to the brown/white wire terminal socket that was removed from the six-pin connector plug.
6. Install the wedgelock in the six-pin connector housing and reconnect the six-pin connector plug. Place the Tow/Run switch in the RUN position and the battery light should illuminate. If the light does not illuminate, replace the battery warning light assembly.

## COMMUNICATION DISPLAY MODULE (CDM)

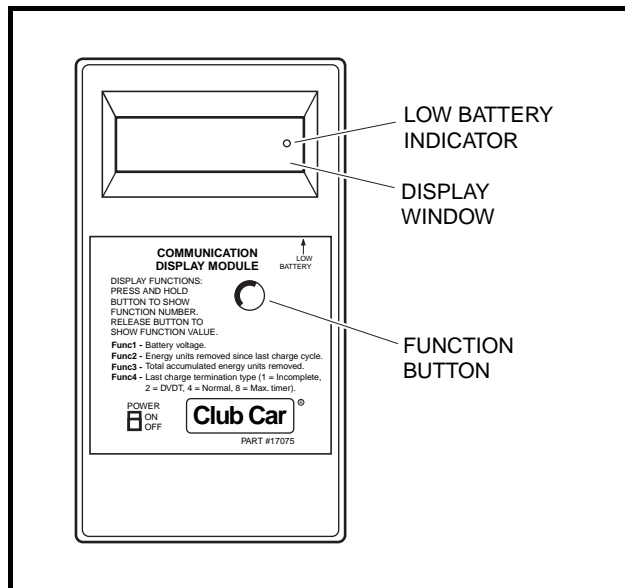


Figure 11-19 CDM

The CDM can be used to retrieve from the onboard computer four important items of information that can be useful in troubleshooting the IQ System vehicle. To access one of these items, the item's corresponding Function Code must be selected on the CDM. This is done by pressing the Function Button until the desired function code is displayed in the window. **See Figure 11-19, Page 11-38 for CDM features.** Releasing the button when the desired code is displayed will display the data. Function codes and corresponding data are as follows:



- **F1 – Battery voltage:**

This displays the battery pack's current state of charge. A reading of less than 48 volts indicates that the batteries need to be charged. If a reading of less than 48 volts is obtained immediately after a charge cycle, there may be a problem in the charge circuit.

- **F2 – Energy units removed since last charge cycle:**

If the display reads over 75 (the vehicle battery warning light should be illuminated), the vehicle batteries need to be recharged before being used again. This data can be used to make sure all vehicles in a fleet receive equal usage on a short-term basis.

- **F3 – Total accumulated energy units removed since initial vehicle start-up:**

This information is most useful in making sure that all vehicles in a fleet receive equal usage over long periods of time.

- **F4 – Last charge termination type (1 = incomplete, 2 = DVDT, 4 = normal, 8 = max. timer):**

A 1, 2, 4, or 8 will be displayed.

**1** – Indicates the last charge cycle was incomplete and the batteries were not fully charged. Batteries should be charged again at the earliest opportunity.

**2** – Indicates a back-up charge program was employed by the OBC to complete the charge cycle. A DVDT charge may be displayed the first few times a new set of batteries is charged, and the first time a set of batteries is charged after the batteries have been disconnected and reconnected. A problem may exist if persistent DVDT readings are obtained.

**4** – Indicates the last charge cycle was normal.

**8** – Indicates the charger ran for sixteen hours and shut itself off without completing the charge cycle. This means there may be a problem in the charge circuit.

The CDM also has a low battery indicator, which illuminates when CDM batteries are weak and need to be replaced. Weak batteries in the CDM may cause the CDM to register inaccurate information or no information.

## USING THE CDM TO RETRIEVE DATA FROM THE ONBOARD COMPUTER

1. Turn the CDM ON.
2. Position CDM on seat bottom so it is aligned directly with the battery warning light. Ensure CDM infrared LED receiver is pointed at battery warning light and there is a clear path between them. **See following NOTE.**

**NOTE:** *If, by positioning CDM on seat bottom, the CDM is unable to collect the data stream from the onboard computer, hold CDM approximately 6 inches (15.2 cm) from battery warning light.*

3. Wait approximately 30 seconds for a value to appear in the display window.
4. If a value does not appear in the display window after 30 seconds, try adjusting the aim of the CDM and repeating step 3 until a value appears. If there is still no reading, check for weak batteries in the CDM.
  - 4.1. Adjust aim of CDM.
  - 4.2. Drive vehicle a short distance to ensure OBC is not in powerdown mode.
  - 4.3. Check for weak batteries in CDM.
  - 4.4. If reading is still not obtained, go to the CDM Troubleshooting Guide on page 11-40.

### Using the CDM to Retrieve Data from the Onboard Computer, Continued:

Once a value has been obtained in the display window, the CDM may be removed from its receiving position and the data reviewed. The CDM will hold the values for F1, F2, F3, and F4 until the CDM is turned OFF or it receives another line of data from the same or another onboard computer. Use the following procedure to review the data stored in the CDM:

- The value currently displayed will be F1 (battery voltage).
- To view F2, press and hold the button on the CDM. When "Func 2" appears in the display window, release the button. The value for F2 will then be displayed.
- To view F3, press and hold the button on the CDM until "Func 3" appears in the display window. Release the button. The value for F3 will be displayed.
- To view F4, press and hold the button on the CDM until "Func 4" appears in the display window. Release the button. The value for F4 will be displayed.

**NOTE:** The values of all four functions can be recalled by pressing and releasing the CDM button.

## CDM TROUBLESHOOTING GUIDE

Use the following chart as a starting point for troubleshooting problems with communication between the CDM and onboard computer. Contact your Club Car representative for more comprehensive information.

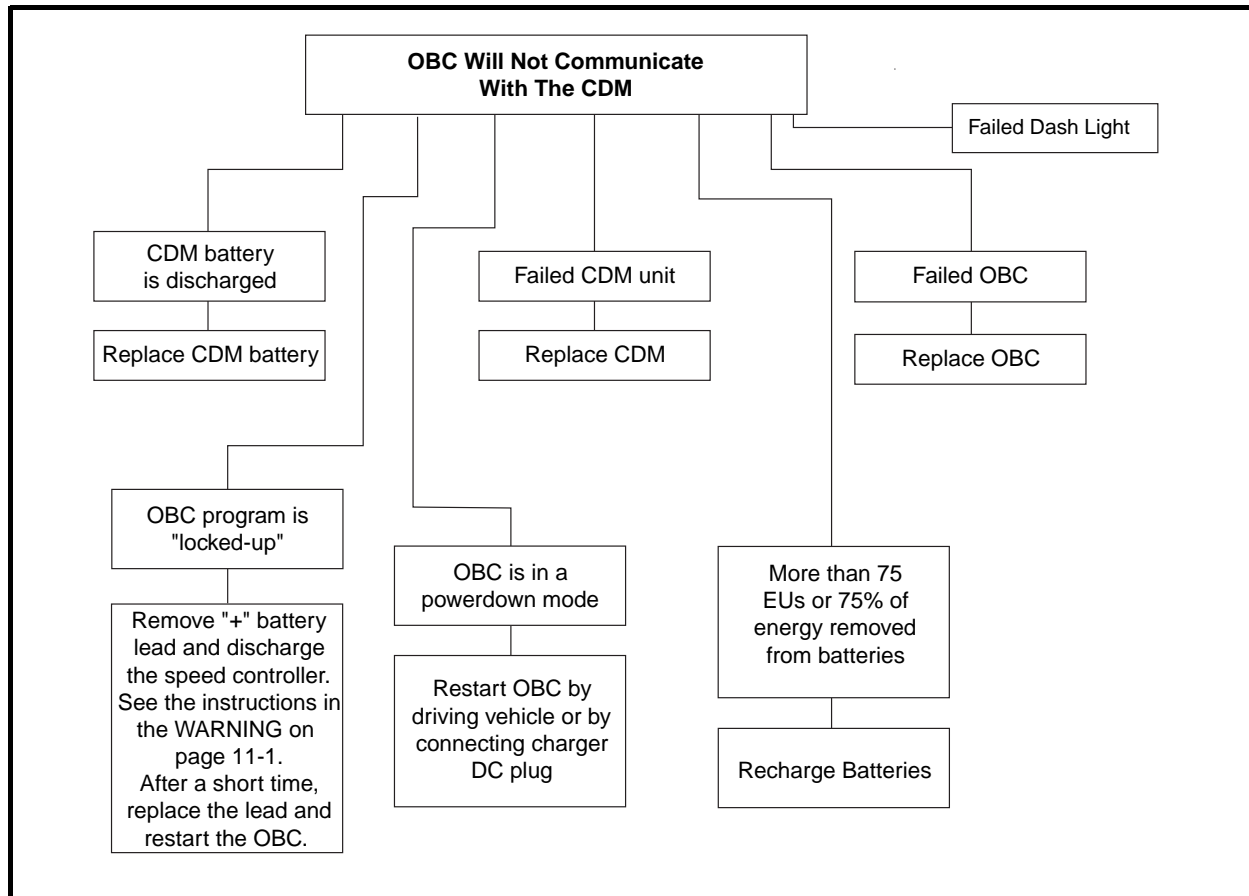


Figure 11-20 Flow Chart – CDM Troubleshooting Guide

## SECTION 12 – ELECTRICAL COMPONENTS

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### **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

### **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

## KEY SWITCH

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See General Warnings, Section 1, Page 1-1.

### Testing the Key Switch

See Test Procedure 8, Section 11, Page 11-20.

### Key Switch Removal

1. Disconnect the battery cables as instructed. See **WARNING** “To avoid unintentionally starting...” in **General Warnings, Section 1, Page 1-2**.
2. Remove the instrument panel (**Figure 12-1, Page 12-1**).
  - 2.1. Remove three screws (1) from the instrument panel (2) (**Figure 12-1, Page 12-1**).
  - 2.2. Rotate the instrument panel up and away from the dash to disengage the tabs at the top of the panel.
  - 2.3. Disconnect the electrical connector (3) to the instrument panel.

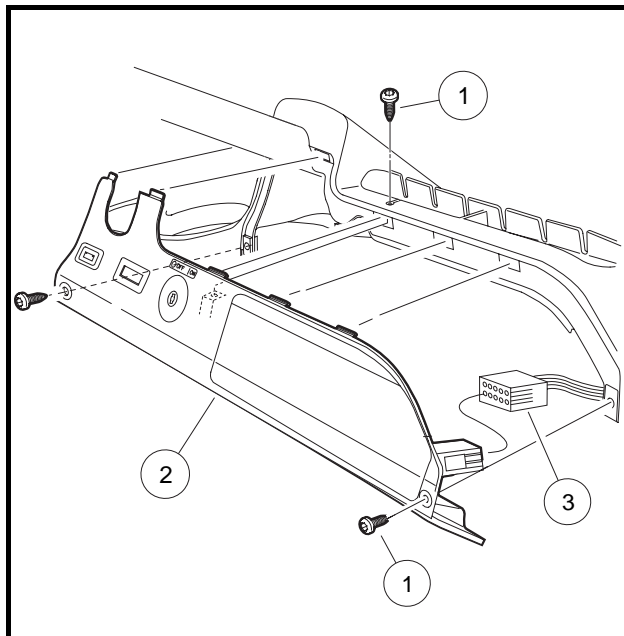


Figure 12-1 Instrument Panel Removal

**Key Switch Removal, Continued:**

3. Disconnect the wires from the key switch.
4. From the back of the instrument panel, push down on the retaining tabs surrounding the key switch (4) and remove the key switch cap (8). Hold the key switch and remove the switch retaining nut (6) from the outside of the instrument panel. **(Figure 12-2, Page 12-2).**

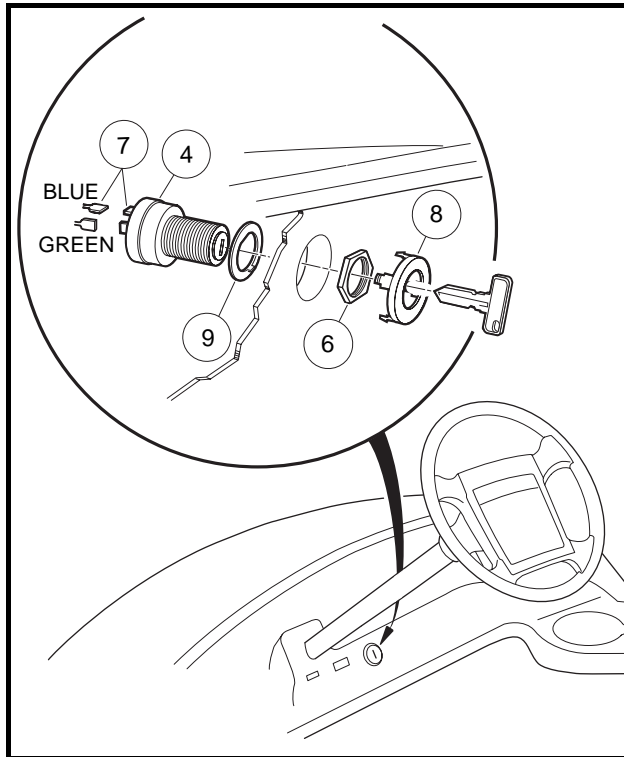


Figure 12-2 Key Switch

**Key Switch Installation**

1. Position the key switch and flat washer (9) in the instrument panel, then install and tighten the switch retaining nut (6) to 40 in-lb (4.5 N·m). Install key switch cap (8) in center dash **(Figure 12-2, Page 12-2)**.
2. Connect the blue and green wires to the key switch terminals. Either orientation is correct. **See Wiring Diagrams, Section 11, Page 11-2.**
3. Install the instrument panel.
  - 3.1. Connect the electrical connector (3) **(Figure 12-1, Page 12-1)**.
  - 3.2. Position the instrument panel (2) on the dash assembly. Make sure tabs on upper edge properly engage with the corresponding slots on the dash assembly. Ensure that there are no wires exposed or pinched during positioning.
  - 3.3. Secure instrument panel to the dash assembly with three screws (1). Tighten screws to 1.8 ft-lb (2.5 N·m).
4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

## BATTERY WARNING LIGHT

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See General Warnings, Section 1, Page 1-1.

### Testing the Battery Warning Light

See Test Procedure 18, Section 11, Page 11-38.

### Battery Warning Light Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Remove instrument panel. See **step 2 of Key Switch Removal on page 12-1.**
3. Disconnect the wires at the warning light.
4. Press the two retaining tabs (11) and remove the light from the center dash (**Figure 12-3, Page 12-3**).

### Battery Warning Light Installation

1. Install in reverse order of removal.
2. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N-m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

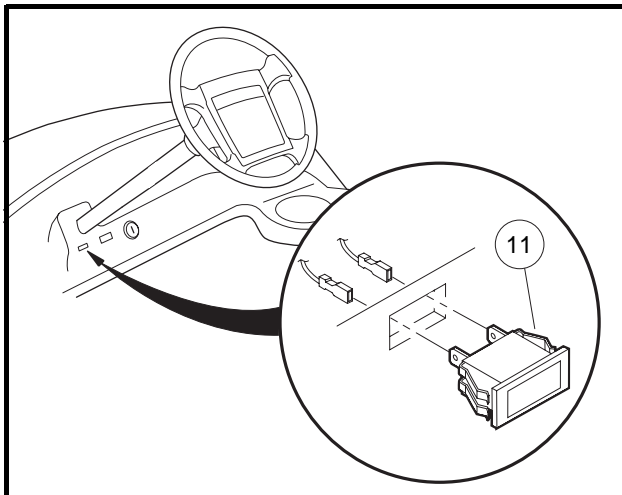


Figure 12-3 Battery Warning Light

## FORWARD/REVERSE ROCKER SWITCH

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See General Warnings, Section 1, Page 1-1.

### Testing the Forward/Reverse Rocker Switch

See Test Procedure 15, Section 11, Page 11-36.

### Forward/Reverse Rocker Switch Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**

2. Remove two screws (2) that hold Forward/Reverse rocker switch housing (1) to the vehicle (**Figure 12-4, Page 12-4**).
3. Remove the three wires from the rocker switch.
4. Press in on the locking tabs on each side of switch (3), and push switch out of housing.

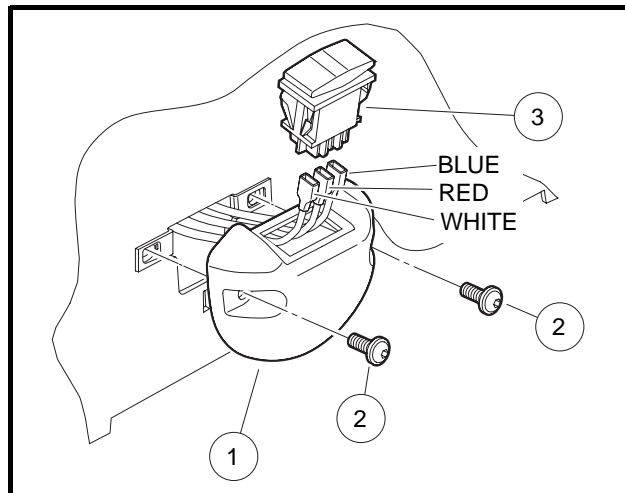


Figure 12-4 Forward/Reverse Rocker Switch

### Forward/Reverse Rocker Switch Installation

1. Route the three wires through bezel. Connect the three wires to the rocker switch (3), exactly as shown in (**Figure 12-4, Page 12-4**).
2. Orient the rocker switch (3) so the terminals are towards the front of the housing (1). Push rocker switch (3) into housing (1) (**Figure 12-4, Page 12-4**).
3. Place the housing in position on the body and install the two screws (2). Tighten to 20 in-lb (2.3 N·m).
4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
5. Place the Tow/Run switch in the RUN position.
6. Inspect the vehicle for proper operation.

#### **⚠ WARNING**

- **Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.**
- **Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.**
- **Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.**

## ELECTRONICS MODULE COVER

See General Warnings, Section 1, Page 1-1.

The electronics module cover needs to be removed to gain access to the electronics module, the Tow/Run switch, and hour meter.

### Electronics Module Cover Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2**.
2. Remove the screw (1) that holds the cover (2) over the electronics module (**Figure 12-5, Page 12-5**).
3. Hold battery wire out of way and lift cover (2) off the vehicle.

### Electronics Module Cover Installation

1. Hold battery wire out of way and place cover (2) over the electronics module.
2. Install screw (1) to secure cover in place. Tighten screw to 3.4 ft-lb (4.6 N·m).

### CAUTION

- **Exposure to water may damage electronic components.**
  - **Do not operate vehicle without this cover properly installed.**
  - **Do not direct water stream in the area of the cover.**

3. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

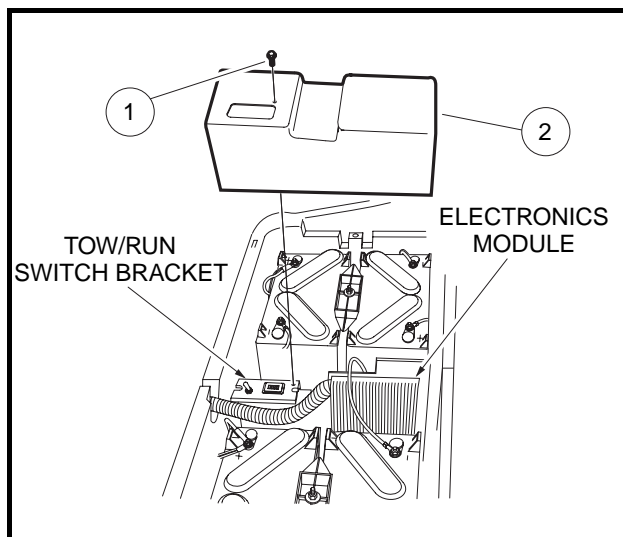


Figure 12-5 Electronics Module Cover

## TOW/RUN SWITCH

See General Warnings, Section 1, Page 1-1.

### Testing the Tow/Run Switch

See Test Procedure 6, Section 11, Page 11-19.

### Tow/Run Switch Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2**.
2. Remove the electronics module cover. See **Electronics Module Cover Removal** on page 12-5.
3. Remove Tow/Run switch boot/hex nut (1) (**Figure 12-6, Page 12-6**).
4. Remove Tow/Run switch (2) from bracket.
5. Disconnect the two wires (3) and remove switch.

### Tow/Run Switch Installation

1. Installation is reverse of removal. Make sure flat on switch is aligned with the flat on bracket. Tighten Tow/Run switch boot/hex nut (1) to 16 in-lb (1.8 N·m) (**Figure 12-6, Page 12-6**).
2. Install the electronics module cover. See **Electronics Module Cover Installation** on page 12-5.
3. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

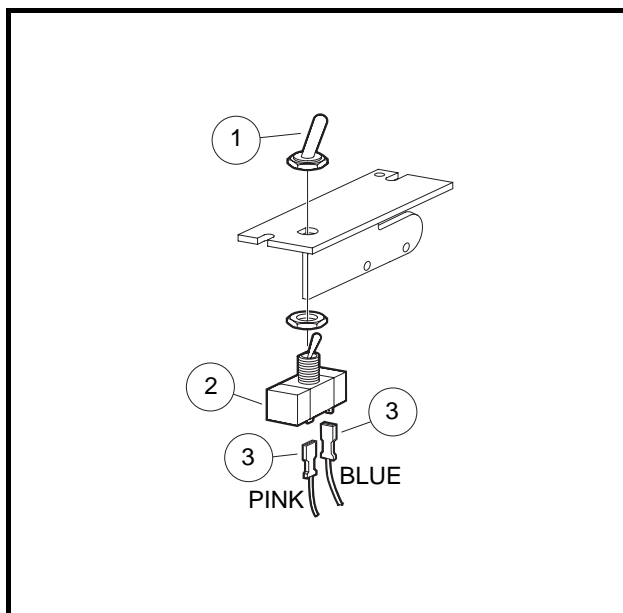


Figure 12-6 Tow/Run Switch



## MOTOR CONTROLLER OUTPUT REGULATOR (MCOR)

See General Warnings, Section 1, Page 1-1.

### Testing the MCOR

See Section 11, Test Procedure 4, Page 11-17 and Test Procedure 8, Page 11-20.

### MCOR Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Remove pedal group. See **Pedal Group Removal, Section 5, Page 5-1.**
3. Disconnect the two-pin and three-pin connectors (1) from the MCOR (2) (**Figure 12-7, Page 12-7**).
4. Remove the hex-head screws (3) connecting the MCOR to the pedal group.

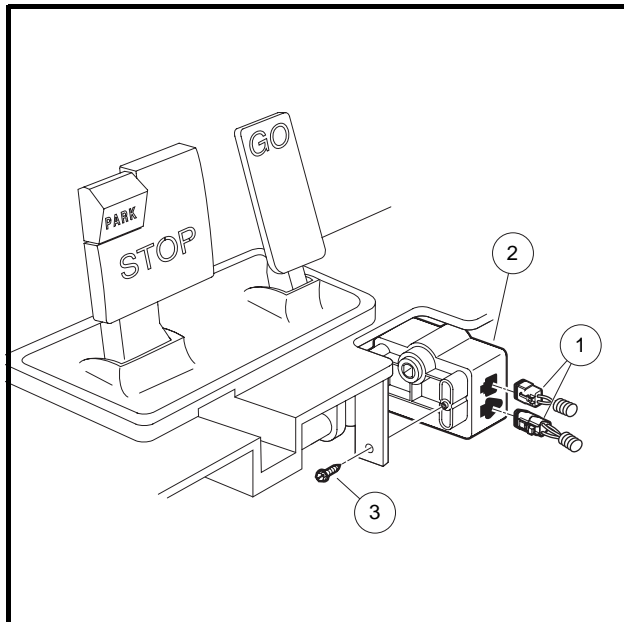


Figure 12-7 Motor Controller Output Regulator

### MCOR Installation

1. Secure the MCOR (2) to the pedal group with two hex-head screws (3) (**Figure 12-7, Page 12-7**). Tighten screws to 23 in-lb (2.6 N·m).
2. Connect the two-pin and three-pin connectors (1) from the wire harness to the MCOR.
3. Install the pedal group. See **Pedal Group Installation, Section 5, Page 5-6.**
4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

## REVERSE BUZZER

See General Warnings, Section 1, Page 1-1.

### Testing the Reverse Buzzer

See Test Procedure 16, Section 11, Page 11-37.

### Reverse Buzzer Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Remove instrument panel. See **step 2 of Key Switch Removal on page 12-1.**
3. Disconnect the 18-gauge pink and orange/white wires from reverse buzzer.
4. Remove the two screws from the reverse buzzer. Remove the reverse buzzer from the dash panel.

### Reverse Buzzer Installation

1. Install the reverse buzzer in the reverse order of removal. Pink wire must be connected to the positive terminal. Tighten screws to 4 in-lb (0.45 N·m).
2. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

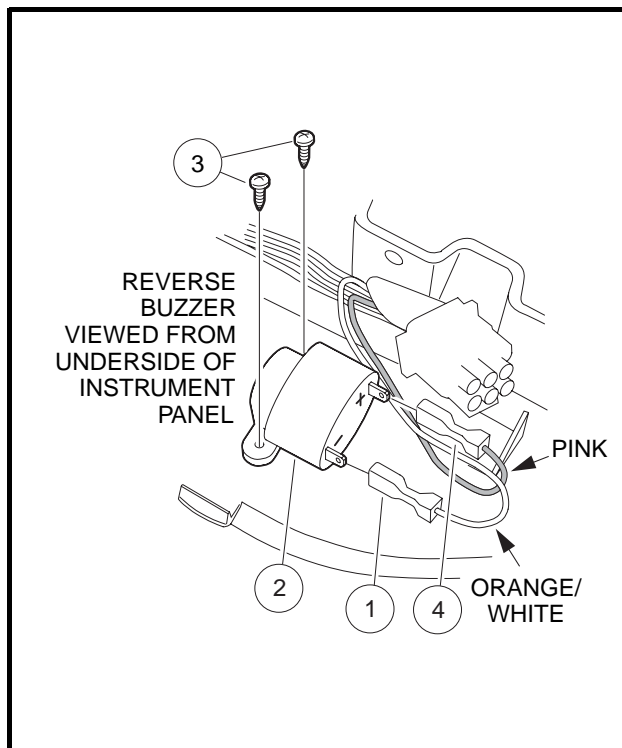


Figure 12-8 Reverse Buzzer

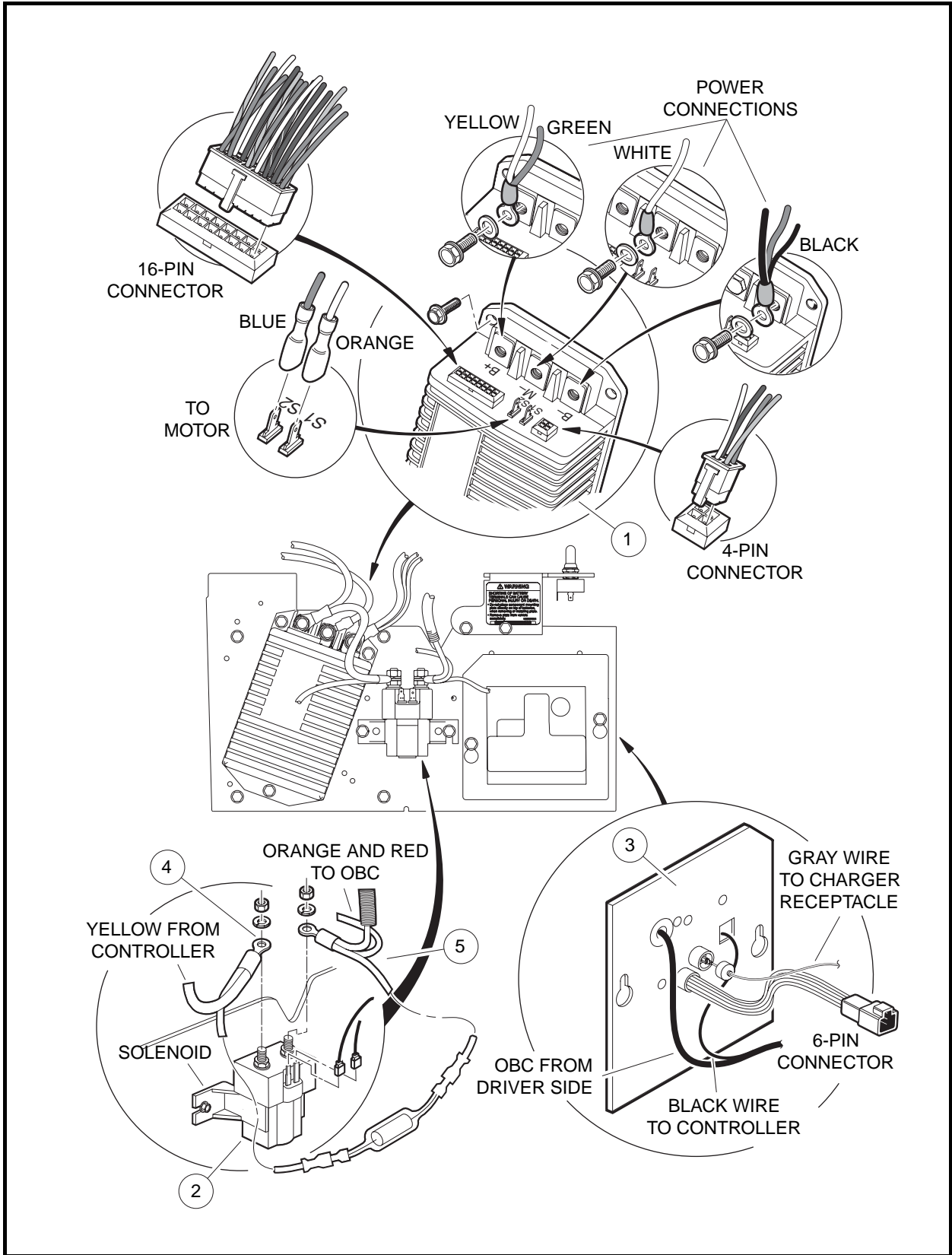


Figure 12-9 Electronics Module Removal

## ELECTRONICS MODULE

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### See General Warnings, Section 1, Page 1-1.

While it is not necessary to remove the electronics module from the vehicle, access to individual components may be easier with the module removed.

### Electronics Module Removal

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Remove the electronics module cover. **See Electronics Module Cover Removal on page 12-5.**
3. Remove three power-connection screws on top of the controller (1) and remove the wires from the screw threads (**Figure 12-9, Page 12-9**).
4. Disconnect the 16-pin connector, 4-pin connector, and the spade connectors from the top of the controller.
5. Remove two nuts on top of the solenoid (2) posts and remove the wires from the posts.
6. Disconnect the spade connectors on the front of the solenoid.
7. On driver side of the electronic module, separate the 6-pin connector and disconnect all leads to the on-board computer (OBC) (3) and two wires to tow switch.
8. Lift the electronics module from the vehicle. **See following WARNING.**

#### **⚠ WARNING**

- **Shorting of battery terminals can cause personal injury or death.**
  - **Do not place component mounting plate directly on top of batteries when removing or installing plate.**
  - **Remove plate from vehicle completely.**

### Electronics Module Installation

1. Insert the electronics module into the vehicle. Ensure the orientation is correct, with the computer toward the front, the controller toward the rear, and both facing the passenger side of the vehicle.
2. Complete connections to the computer, the controller, and the solenoid per the electrical schematics. **See Wiring Diagrams, Section 11, Page 11-2.**
3. Tighten bolts on the controller to 9 ft-lb (12.2 N·m).
4. Tighten nuts on the solenoid to 6.4 ft-lb (8.7 N·m).
5. Install electronic module cover. **See Electronics Module Cover Installation on page 12-5.**
6. Inspect the vehicle for proper operation.

#### **⚠ WARNING**

- **Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.**
- **Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.**
- **Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.**

## SOLID STATE SPEED CONTROLLER

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See General Warnings, Section 1, Page 1-1.

### Testing the Solid State Speed Controller

See Test Procedure 5, Section 11, Page 11-18.

### Speed Controller Removal

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Remove electronics module cover. **See Electronics Module Cover Removal on page 12-5.**
3. Remove electronics module assembly from the vehicle. **See Electronics Module Removal on page 12-10.**
4. Remove the three self-tapping screws (1) that hold the controller to the component mounting plate and remove the controller from the vehicle (**Figure 12-10, Page 12-12**).

### Speed Controller Installation

1. Install the three self-tapping screws (1) that hold the controller to the component mounting plate and tighten to 5.5 ft-lb (7.5 N·m) (**Figure 12-10, Page 12-12**).
2. Install electronic module assembly in the vehicle. **See Electronics Module Installation on page 12-10.**
3. Install electronics module assembly cover. **See Electronics Module Cover Installation on page 12-5.**
4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
5. Place the Tow/Run switch in the RUN position.
6. Inspect the vehicle for proper operation.

#### **⚠ WARNING**

- **Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.**
- **Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.**
- **Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.**

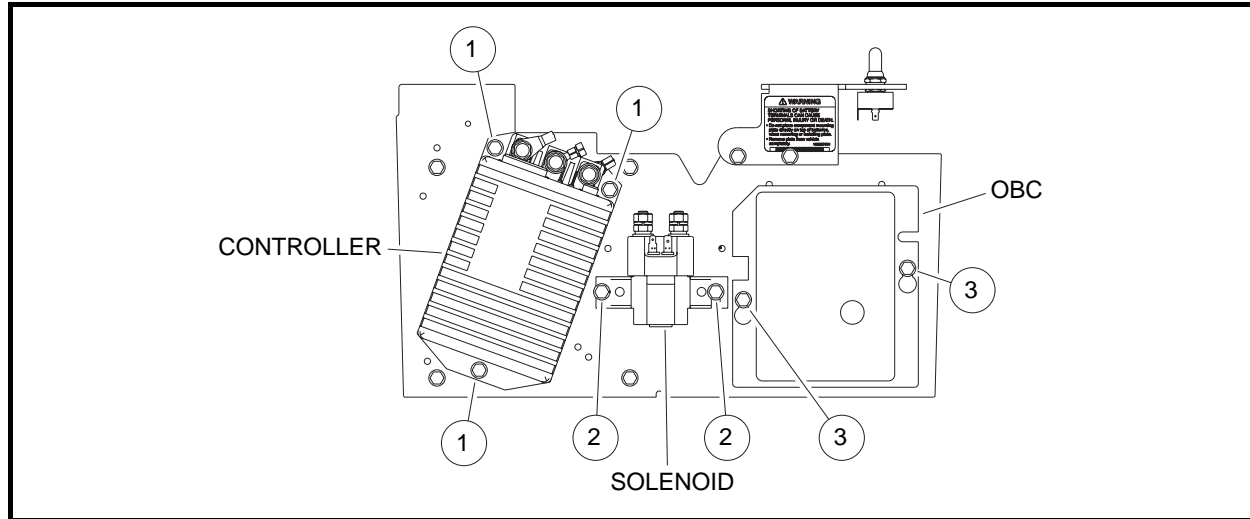


Figure 12-10 Component Mounting Plate

## SOLENOID

See **General Warnings, Section 1, Page 1-1.**

The solenoid is located on the passenger side of the electrical component mounting plate.

### Testing the Solenoid

See **Section 11, Test Procedure 3, Page 11-16 and Test Procedure 14, Page 11-35.**

### Solenoid Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Remove electronics module cover. See **Electronics Module Cover Removal on page 12-5.**
3. Remove 4 wires from solenoid.
4. Loosen both solenoid mounting screws (2) (**Figure 12-10, Page 12-12**).
5. Rotate solenoid up in front and slide off of the component mounting plate.

### Solenoid Installation

1. Mount solenoid onto component mounting plate with screws (2) (**Figure 12-10, Page 12-12**).
2. Tighten screws (2) to 5.5 ft-lb (7.5 N·m).
3. Connect yellow (4) and red (5) wires (**Figure 12-9, Page 12-9**). Tighten to 72 - 84 in-lb (8 - 9.5 N·m).
4. Install electronics module cover. See **Electronics Module Cover Installation on page 12-5.**
5. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

## ONBOARD COMPUTER (OBC)

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See General Warnings, Section 1, Page 1-1.

### Testing the Onboard Computer

See Section 11, Test Procedure 2, Page 11-15, Test Procedure 10, Page 11-32, and Test Procedure 11, Page 11-33.

### Onboard Computer Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2**.
2. Remove electronics module cover. See **Electronics Module Cover Removal on page 12-5**.
3. Disconnect wires (**Figure 12-9, Page 12-9**).
4. Loosen, but do not remove, the two self-tapping screws (3) holding OBC to component mounting plate (**Figure 12-10, Page 12-12**).
5. Slide OBC upwards to align heads of self-tapping screws (3) with the two key holes in the OBC face plate and remove OBC.

### Onboard Computer Installation

1. Install the OBC onto the component mounting plate by aligning the two holes on the OBC face plate with two holes on component mounting plate. Slide OBC down and align heads of self-tapping screws (3) with smaller part of two holes in OBC face plate (**Figure 12-10, Page 12-12**). Tighten screws to 5.5 ft-lb (7.5 N·m).
2. Connect wires (**Figure 12-9, Page 12-9**). Make sure all connections are fully seated and boot on gray sense lead is properly seated.
3. Install electronics module cover. See **Electronics Module Cover Installation on page 12-5**.
4. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

## CHARGER RECEPTACLE

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See General Warnings, Section 1, Page 1-1.

The charger cord, plug, and receptacle are wear items and should be inspected daily. Visually inspect them for cracks, loose connections, and frayed wiring; they must be replaced when worn or damaged. If charger plug or receptacle show signs of corrosion or the plug is difficult to insert or remove, the receptacle contacts and plug terminals should be cleaned with a good electrical contact cleaner or lightly sprayed with electrical contact cleaner. The plug should then be inserted and removed several times to ensure ease of insertion, ease of removal, and good electrical contact.

### Testing the Charger Receptacle

See Test Procedure 12, Section 11, Page 11-33.

See also the appropriate battery charger maintenance and service manual.

### Charger Receptacle Inspection

Inspect the receptacle for cracks, loose connections and frayed wiring.

**NOTE:** Disassembly of the charger receptacle, for the purpose of removal or installation, is not recommended.

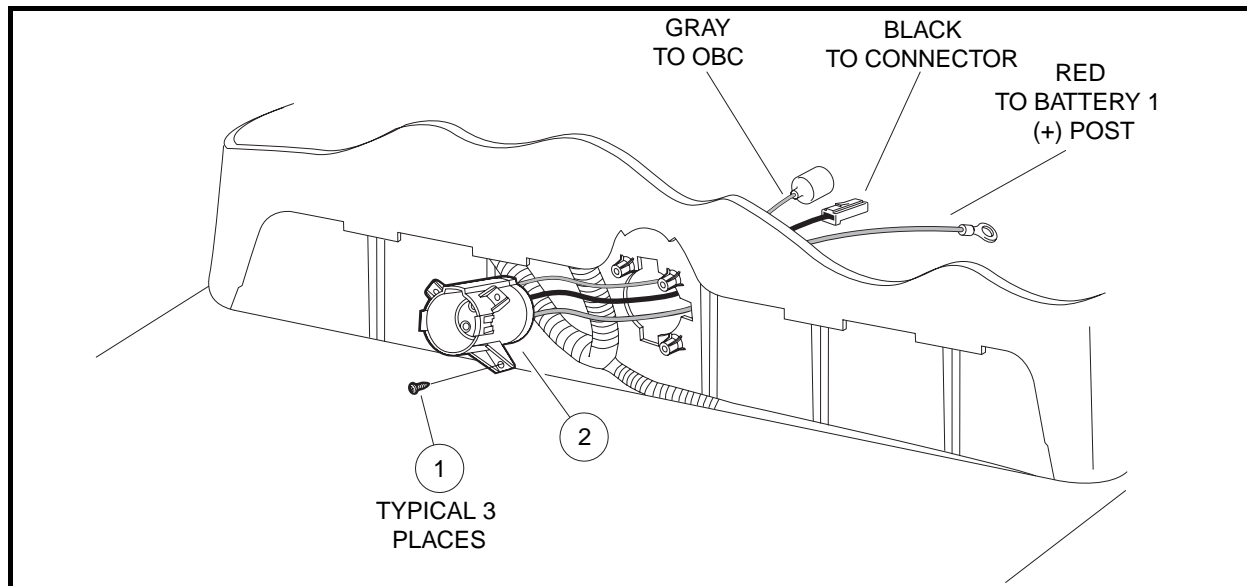


Figure 12-11 Charger Receptacle

### Charger Receptacle Removal

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Remove electronic module cover.
3. Remove kick plate. **See Kick Plate and Charger Receptacle Bezel, Section 4, Page 4-7.**
4. Remove the 10-gauge red wire from the positive post of battery no. 1 (**Figure 12-11, Page 12-14**).
5. Disconnect the black wire from its connector.
6. Disconnect the gray wire from the OBC.
7. Remove the three screws (1) that secure the charger receptacle (2) to the bucket.

### Charger Receptacle Installation

1. Insert the wires through the hole in the bucket (**Figure 12-11, Page 12-14**).
2. Insert receptacle (2) into bucket.
3. Install the three screws (1) that secure the receptacle to the bucket. Tighten screws to 16 in-lb (1.8 N·m).
4. Connect gray wire to the OBC. Make sure boot is properly seated.
5. Connect the black wire to the mating connector. Make sure connector is fully seated.
6. Connect the red wire to the positive post of battery no. 1.
7. Install kick plate. **See Kick Plate and Charger Receptacle Bezel, Section 4, Page 4-7.**
8. Place the Tow/Run switch in the TOW position and connect the battery cables, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.



## SECTION 13 – BATTERIES

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### **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

### **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.
- Battery – Explosive gases! Do not smoke. Keep sparks and flames away from the vehicle and service area. Ventilate when charging or operating vehicle in an enclosed area. Wear a full face shield and rubber gloves when working on or near batteries.
- Battery – Poison! Contains acid! Causes severe burns. Avoid contact with skin, eyes, or clothing. Antidotes:
  - External: Flush with water. Call a physician immediately.
  - Internal: Drink large quantities of milk or water. Follow with milk of magnesia or vegetable oil. Call a physician immediately.
  - Eyes: Flush with water for 15 minutes. Call a physician immediately.
  - Use insulated tools when working near batteries or electrical connections. Use extreme caution to avoid shorting of components or wiring.

## GENERAL INFORMATION

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The batteries supplied with an electric Club Car vehicle are different from those supplied with an automobile. The outward appearance of these two batteries is similar, but the operating characteristics are very different. The Club Car electric vehicle battery is a deep-cycle battery, and the automotive battery is a “starting, lighting and ignition” (SLI) battery. They should never be substituted for one another.

## BATTERY REPLACEMENT

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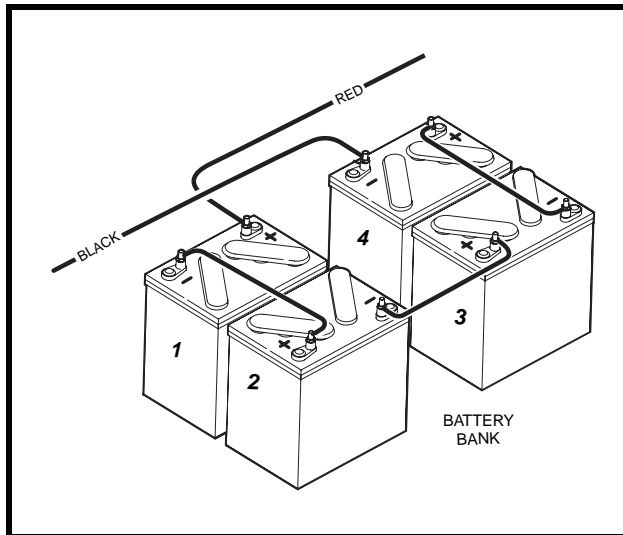
See General Warnings, Section 1, Page 1-1.

### **⚠ WARNING**

- To prevent electrolyte leakage from the battery vents, batteries must be kept in an upright position. Tipping a battery beyond a 45° angle in any direction can allow a small amount of electrolyte to leak out the vent hole. Do not exceed this 45° angle when lifting, carrying, or installing batteries. Battery acid can cause severe personal injury to skin or eyes, and can damage clothing.
1. Before removing batteries, note the orientation of the batteries and the connecting wires. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-1.** Remove remaining wires and batteries. **See Wiring Diagrams, Section 11, Page 11-2.**
  2. Visually inspect the new batteries for any damage that may have occurred in transit.

**Battery Replacement, Continued:**

3. If the battery cables are to be reused, inspect them for broken or frayed wires, damaged terminals, or worn insulation. Remove any corrosion on the connectors. A solution of baking soda and water (1 cup (237 mL) baking soda per 1 gallon (3.8 L) of water) does an excellent job of neutralizing and removing the corrosion. Be careful not to allow the baking soda solution to enter the battery.



**Figure 13-1 IQ System Battery Configuration**

4. Check and clean the battery rack and hold-downs. The nuts and bolts on the hold-downs may corrode. It is therefore advised they be cleaned periodically and replaced as necessary.
5. Install batteries in the proper orientation (**Figure 13-1, Page 13-2**). Install battery hold-downs. The hold-downs should be tight enough so batteries do not move while vehicle is in motion, but not so tight as to crack or buckle battery case. Tighten to 97.4 in-lb (11 N·m), alternating between hold-down bolts.
6. Install wires in proper sequence (**Figure 13-1, Page 13-2**). Install black wire to negative post of battery no. 4 last. Make sure all connections are tight. Tighten to 110 in-lb (12.4 N·m). Coat all terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize future corrosion.
7. Give the batteries a full charge prior to operation. This ensures all the batteries are fully charged and the cells are equalized prior to use.

## BATTERY CARE

**See General Warnings, Section 1, Page 1-1.**

### PREVENTIVE MAINTENANCE

To keep batteries in sound operating condition, follow these steps on a regular basis.

1. Any corrosion build-up on or around batteries should be removed immediately. Terminal connections should be clean and tight. Any frayed or worn wires should be replaced. After all cables have been connected, coat all terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to help prevent future corrosion.

2. Batteries should be clean and free of corrosion. Wash tops and terminals of batteries with a solution of baking soda and water (1 cup (237 mL) baking soda per 1 gallon (3.8 L) of water). Rinse solution off batteries. Do not allow this solution to enter the batteries. Be sure terminals are tight. Let the terminals dry and then coat them with Battery Terminal Protector Spray (CCI P/N 1014305). **See Self-Discharge on page 13-3.**
3. Maintain proper electrolyte level. **See Electrolyte Level on page 13-3.**
4. Batteries should be properly charged every day they are used. Check the batteries periodically to see that they are in a full state of charge. **See Battery Charging on page 13-4.**
5. Keep hold-downs tight. **See Vibration Damage on page 13-4.**

## SELF-DISCHARGE

Contaminants on dirty batteries can provide a path for a small current draw that can slowly discharge batteries, thus wasting valuable energy. To prevent self-discharge, batteries should always be kept clean.

Hot weather also has an effect on a battery's self-discharge rate. The higher the temperature, the quicker a set of batteries will discharge. In hotter climates, batteries should be checked more often. When storing batteries, keep in a cool place. **See Battery Storage on page 13-12.**

## ELECTROLYTE LEVEL

### **⚠ CAUTION**

- Do not allow battery acid from battery caps or hydrometer to drip onto the front or rear body of the vehicle. Battery acid will cause permanent damage. Wash immediately.

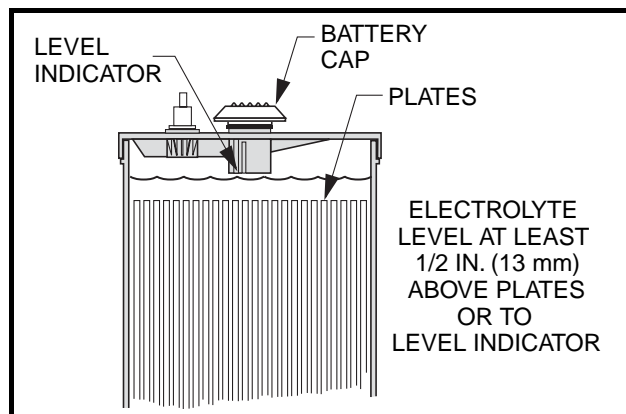


Figure 13-2 Battery Electrolyte Level

Add water only after charging unless the electrolyte is below the level of the plates. If the electrolyte level is below the level of the plates, add just enough water to cover the plates and then charge the batteries. After charging, fill with water to the level indicator. Filling a battery to the level indicator before charging will result in overfilling because the electrolyte level will rise during charging and some of the electrolyte may bubble out of the cap. This reduces the battery's capacity and corrodes the metal parts around it.

**Electrolyte Level, Continued:**

The electrolyte level should be checked weekly to be sure electrolyte is at its proper level (**Figure 13-2, Page 13-3**). Never allow the electrolyte level to fall below the tops of the plates because this will cause the exposed part of the plate to become permanently inactive. For best results, use a battery watering gun to add water to batteries. Check the electrolyte level more frequently in hot weather or when batteries are old.

**MINERAL CONTENT**

For the longest battery life, use distilled water in batteries. However, if tap water is to be used, be sure the mineral contents are below these levels:

IMPURITY	ALLOWABLE CONTENT (PARTS PER MILLION)
Suspended matter	Trace
Total solids	100.0
Calcium and Magnesium Oxides	40.0
Iron	5.0
Ammonia	8.0
Organic matter	50.0
Nitrates	10.0
Nitrites	5.0
Chloride	5.0

**VIBRATION DAMAGE**

The battery hold-downs should always be tight enough to keep the battery from bouncing. Battery life may be severely shortened if the battery hold-downs are too loose. Battery hold-downs should be tightened to 97 in-lb (11 N·m). Excessive vibration causes the plates to shed prematurely and shortens the life of the battery. It may also cause acid to leak out of the vent caps and corrosion to build up on surrounding metal parts. The acid which is lost reduces the capacity of the battery and cannot be replaced. Battery hold-downs should NOT be so tight as to crack or buckle the battery case. This may cause leaks which would dry out a cell or cause internal short circuits. **See Battery Replacement on page 13-1.**

**BATTERY CHARGING****See General Warnings, Section 1, Page 1-1.**

The charger supplied with the Club Car electric vehicle resolves the most common problems associated with battery charging. Undercharging and overcharging are prevented provided the charger is allowed to shut off by itself. Also, all cells are automatically given an equalization charge at low current, which prolongs battery life. Batteries should never be left in a discharged state, as this too affects the internal components and can reduce the capacity of the battery. The batteries should be charged every day they are used. However, the batteries should not be charged if they have not been used.

## CHARGER SHUTS OFF AFTER 16 HOURS

This may be due to 1) new batteries, 2) hard use, or 3) cold temperatures. A catch-up charge may be necessary when these conditions are present. On those days when all or some of the vehicles do not get used, check the batteries for state of charge. Any battery with a specific gravity lower than 1.250 will need a catch-up charge. If the problem continues after a catch-up charge has been performed, check the battery charger. **See Section 14 – Battery Charger.**

## DEEP-DISCHARGE

Never discharge batteries to the point the vehicle will no longer operate. This will considerably shorten the cycle life of the batteries, and may permanently damage the batteries. It is possible the batteries will not accept a charge if they are completely discharged. The deeper the discharge, the harder it is on the batteries. For this reason, it is recommended that Club Car electric vehicle batteries be charged after each use (provided the charge cycle will not be interrupted and the charger will be allowed to shut off automatically). Placing the batteries on charge after each use reduces the depth of discharge and prolongs battery life.

## EARLY EXCESSIVE DISCHARGING

When vehicle batteries are new, they do not reach their full capacity until they have been used and recharged 20 to 50 times. If they are excessively discharged early in their life, their effective service life will be shortened. It is advisable to limit the use of any vehicle with new batteries for at least the first four weeks and then gradually increase their range.

## INCOMING AC SERVICE

Make sure the incoming AC line service is sufficient. If circuit breakers are tripping, fuses blow during the night or the charger does not give the required starting rate when sound batteries are put on charge, an AC line problem exists. The electrical service to the vehicle storage facility should be sufficient to deliver adequate voltage and current to each charger with all the chargers turned on. If not, consult your local power company or electrical contractor. **See Section 14 – Battery Charger.**

## FLEET ROTATION

Rotate vehicle usage. It is very hard on batteries if the last vehicles in at night are the first ones out in the morning. Spread the workload evenly, giving all vehicles the same amount of use. This will keep your fleet in balance and will not overwork certain sets of batteries.

**NOTE:** *When vehicles are being rotated, the Club Car CDM (Communication Display Module) can be a very helpful service tool. Monitoring the value of function 3 with the CDM simplifies vehicle usage scheduling. See Communication Display Module (CDM), Section 11, Page 11-38.*

## NUMBERING VEHICLES AND CHARGERS

Return the vehicles to the same charger each night if possible. If the vehicles are put in a storage facility at random and a vehicle dies while in use and testing shows the batteries are sound, then the problem is most likely with the charger. However, finding the problem charger may prove to be quite time consuming. Numbering the vehicles and the chargers and returning each vehicle to its designated charger each night can significantly reduce the amount of time spent troubleshooting a problem.

## BATTERY TROUBLESHOOTING CHART

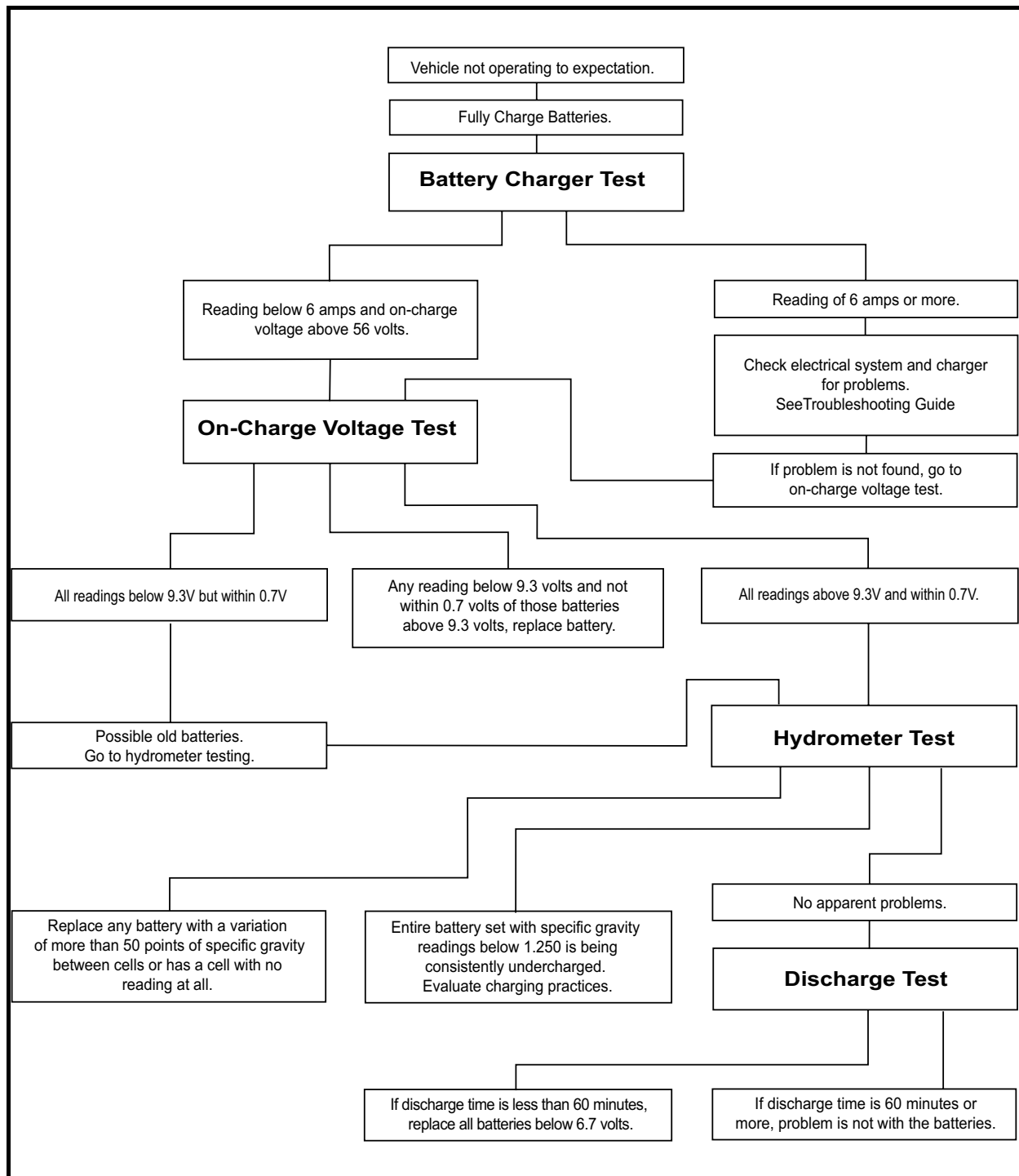


Figure 13-3 Battery Troubleshooting Chart

## BATTERY TESTING

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### See General Warnings, Section 1, Page 1-1.

Four tests have been developed to help diagnose problems with batteries that have not performed as expected. Because each test becomes progressively more detailed and time-consuming, begin with the first test and follow through with the other tests until the problem has been identified as outlined in the Battery Troubleshooting Chart (**Figure 13-3, Page 13-6**).

### BATTERY CHARGER TEST

The easiest way to monitor the condition of a vehicle's batteries is simply to observe the reading on the battery charger ammeter at the end of the charge cycle. After a full charge, disconnect the charger DC plug, wait 20 to 30 seconds and reconnect the charger DC plug. The ammeter needle will jump to 15 amps or more and then taper to below 6 amps within 10 to 20 minutes, indicating sound, fully charged batteries.

Continued poor performance may indicate a problem in the vehicle electrical system, brakes or battery charger. If the problem is not found in the vehicle or charging system, proceed to the on-charge voltage test. Batteries that remain at 8 amps or higher should be tested further using the on-charge voltage test.

### ON-CHARGE VOLTAGE TEST

When the batteries are fully charged, disconnect the charger DC plug. Wait 20 to 30 seconds and reconnect the DC plug to restart the charger. After 5 minutes, use a multimeter to check and record the voltage of the battery set as well as the individual batteries. Set the multimeter to 200 volts DC. Place the red (+) probe on the positive (+) post of battery no. 1 and the black (-) probe on the negative (-) post of battery no. 4 (**Figure 13-1, Page 13-2**). Record reading. Then set multimeter to 20 volts DC and place the red (+) probe on the positive (+) post and the black (-) probe at the negative (-) post of each battery. Record the readings.

The on-charge voltage for the set should be between 56.0 volts and 63.0 volts depending on the age and state of charge of the batteries being tested. If individual batteries read above 14.0 volts and are within 1.0 volts of each other, go to the hydrometer test. If any battery reads below 14.0 volts and not within 1.0 volts of those batteries above 14.0 volts, replace battery. If readings are below 14.0 volts but within 1.0 volts of each other, the batteries are old. Old batteries may have enough capacity left to last several more months. Go to hydrometer test. **See Battery Troubleshooting Chart on page 13-6 and the examples on the following pages.**

### HYDROMETER TEST

A hydrometer measures the specific gravity of the battery's electrolyte. The higher the specific gravity, the higher the state of charge of the batteries. A fully charged battery should read between 1.250 and 1.280 at 80 °F (26.7 °C). Never add acid to batteries to obtain a higher specific gravity.

#### Performing the Hydrometer Test

1. Be sure batteries have sufficient electrolyte to cover plates by approximately 1/2 inch (13 mm) and are fully charged prior to beginning test. If water must be added, recharge the batteries before performing the hydrometer test.
2. Remove the vent cap. Using a battery thermometer (CCI P/N 1011767), record electrolyte temperature of the no. 2 cell.
3. Squeeze the rubber bulb of the hydrometer and insert into the cell. Slowly release the bulb, drawing electrolyte up into the glass tube of the hydrometer.
4. When the float rises off the bottom, adjust the electrolyte level so that the float rides free of the bottom but does not strike the top of the glass tube. Remove the hydrometer from the cell and release the pressure from the bulb.

**Performing the Hydrometer Test, Continued:**

5. Hold the hydrometer vertically, ensuring that the float is not touching the sides of the barrel. Hold the hydrometer at eye level and read the scale at the level of electrolyte (**Figure 13-4, Page 13-8**).
6. Record the reading and return the electrolyte to the cell from which it was taken. Replace vent cap.
7. Repeat steps 2 through 6 on all cells.

**Hydrometer Calibration**

Most hydrometers are calibrated to read correctly at 80 °F (26.7 °C). The readings obtained as described above must be corrected for temperature. For each 10 °F (5.6 °C) above 80 °F (26.7 °C), add 0.004 to the reading. For each 10 °F (5.6 °C) below 80 °F (26.7 °C), subtract 0.004 from the reading.

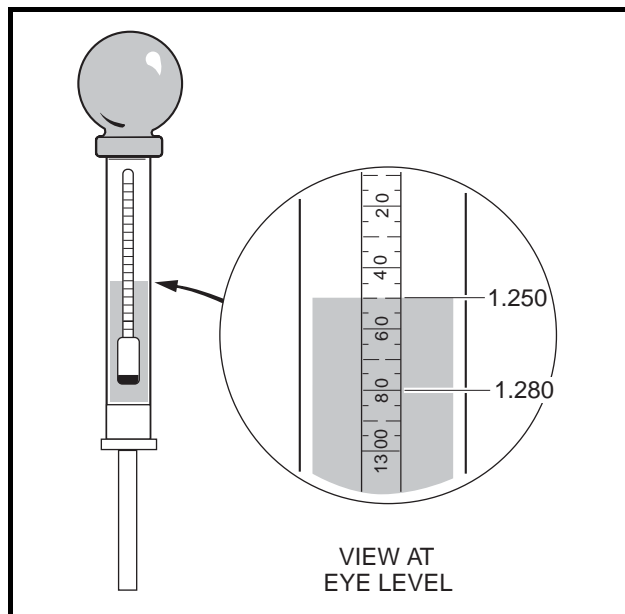


Figure 13-4 Hydrometer

**Interpreting the Results of the Hydrometer Test**

The approximate state of charge can be determined from the following table:

SPECIFIC GRAVITY (TEMPERATURE CORRECTED)	APPROXIMATE STATE OF CHARGE
1.250-1.280	100%
1.220-1.240	75%
1.190-1.210	50%
1.160-1.180	25%

If the difference between the cells is 0.020 or more, the low cell should be suspected. It may require a catch-up charge or it may be a weak cell. When the variations between cells reach 0.050 or more, the battery with the low cell should be replaced.



VEHICLE NO.	BATTERY NO.	ELECTROLYTE TEMPERATURE	CORRECTION FACTOR	CORRECTED SPECIFIC GRAVITY						REQUIRED ACTION
				CELL 1	CELL 2	CELL 3	CELL 4	CELL 5	CELL 6	
12	1	20 °F (-6.6 °C)	-0.024	1.275 - 0.024 = 1.251	1.280 - 0.024 = 1.256	1.280 - 0.024 = 1.256	1.275 - 0.024 = 1.251	1.280 - 0.024 = 1.256	1.280 - 0.024 = 1.256	Sound Battery - Fully Charged
54	3	50 °F (10 °C)	-0.012	1.260 - 0.012 = 1.248	1.200 - 0.012 = 1.188	1.270 - 0.012 = 1.258	1.265 - 0.012 = 1.253	1.270 - 0.012 = 1.258	1.260 - 0.012 = 1.248	Bad no. 2 Cell
38	2	100 °F (37.8 °C)	+0.008	1.200 + 0.008 = 1.208	1.180 + 0.008 = 1.188	1.170 + 0.008 = 1.178	1.200 + 0.008 = 1.208	1.180 + 0.008 = 1.188	1.198 + 0.008 = 1.198	Discharged Battery - Recharge and Recheck
22	4	80 °F (26.7 °C)	.000	1.240 - 0 = 1.240	1.245 - 0 = 1.245	Float does not rise	1.235 - 0 = 1.235	1.250 - 0 = 1.250	1.240 - 0 = 1.240	no.3 Cell Dead - Replace Battery

### DISCHARGE TEST

If the previous tests have failed to identify the problem, conduct a discharge test. The discharge test comes closest to simulating actual vehicle operating conditions by continuously drawing current from the batteries until voltage drops to 42.0 volts.

The discharge test is the hardest test on the batteries and the most time-consuming to perform. Use the battery discharge tester (CCI P/N 101831901).

### Performing the Discharge Test

1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.
2. Connect the tester leads to the positive (+) post of battery no.1 and negative (-) post of battery no. 4 (Figure 13-5, Page 13-9).

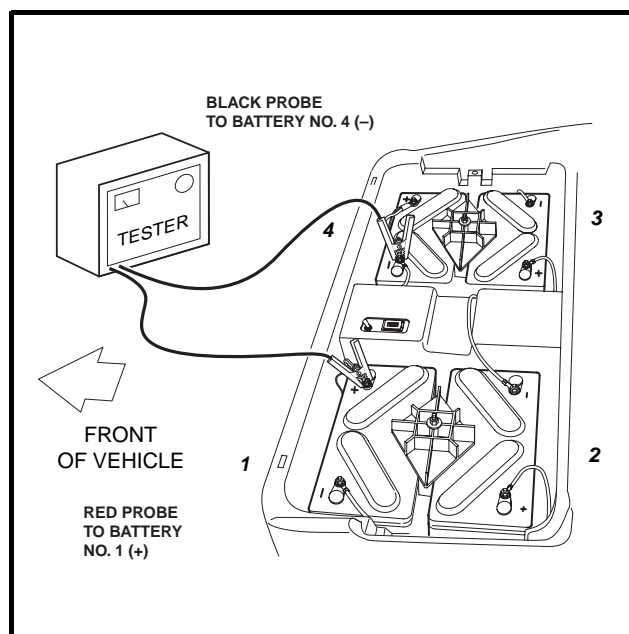


Figure 13-5 Battery Discharge Test

**Performing the Discharge Test, Continued:**

3. Check and record the electrolyte temperature of the battery packs. Check cell no. 2 (second cell from positive post) in each battery.
4. Reset discharge machine and turn the tester ON.
5. When the batteries have been discharging for approximately 60 minutes, set the discharge machine to function 3 and check battery set voltage. Check voltage every 10 minutes throughout the rest of the test. As soon as the battery set voltage reaches 0.5 volts above the shut-off point (42.0 volts), use a multimeter to measure individual battery voltages. Measure and record the voltage of each battery to the nearest 0.01 volt.

**NOTE:** The tester will shut off automatically when shut-off voltage is reached.

**Interpreting Discharge Test Results**

1. If discharge time is 60 minutes or higher, the problem is not with the batteries.
2. If discharge times are low (less than 60 minutes), replace batteries below 10.05 volts.

BATTERY VOLTAGES				BATTERY CONDITION
1	2	3	4	
10.50 V	10.50 V	10.50 V	10.50 V	Excellent
10.60 V	10.60 V	10.83 V	9.75 V	Battery no. 4 is near end of useful life
10.8 V	10.8 V	10.01 V	9.41 V	Battery nos. 3 and 4 are near end of useful life

3. In general, battery sets that discharge in less than 60 minutes at 78 °F (25.6 °C) on the discharge test will typically not hold a charge for an entire work shift. However, discharge time is dependent on the electrolyte temperature. The table shown gives the discharge times, at various temperatures, of a set of batteries that delivers 62 minutes at 80 °F (26.7 °C).

ELECTROLYTE TEMPERATURE	DISCHARGE TIME TO SHUT-OFF POINT	ELECTROLYTE TEMPERATURE	DISCHARGE TIME TO SHUT-OFF POINT
40-49 °F (4-9 °C)	40 Minutes	85-89 °F (29-32 °C)	64 Minutes
50-59 °F (10-15 °C)	45 Minutes	89-99 °F (32-37 °C)	66 Minutes
60-64 °F (16-18 °C)	50 Minutes	100-109 °F (38-43 °C)	68 Minutes
65-69 °F (18-21 °C)	54 Minutes	110-119 °F (43-48 °C)	70 Minutes
70-74 °F (21-23 °C)	57 Minutes	120-129 °F (49-54 °C)	72 Minutes
75-79 °F (24-26 °C)	60 Minutes	130-150 °F (54-66 °C)	74 Minutes
80-84 °F (27-29 °C)	62 Minutes	*****	*****

## BATTERY TROUBLESHOOTING EXAMPLES

The following information represents a few examples of troubleshooting battery problems.

### Example 1

Vehicle no. 68 was suspected of having a bad battery due to its performance. As a result, the battery charger test was performed. After a full charge, the battery charger ammeter read 8.0 amps. Next, the on-charge voltage test was performed and the following results were recorded:

BATTERY NO.	1	2	3	4
On-Charge Voltage	15.22 V	15.90 V	14.70* V	15.24 V

\*Battery no. 3 appears suspect. Battery nos. 1 and 4 are also suspect. Next, a hydrometer test should be conducted on all batteries.

### Hydrometer test results:

CELL NUMBER	BATTERY NUMBER			
	1	2	3	4
Cell 1 (Positive Post)	1.200*	1.265	1.300	1.250
Cell 2	1.285	1.275	1.290	1.270
Cell 3	1.265	1.270	1.275	1.265
Cell 4 (Negative Post)	1.275	1.270	1.285	1.265
Cell 5	1.270	1.265	1.280	1.270
Cell 6	1.275	1.280	1.280	1.260

\*After the hydrometer test, it appears that battery no. 1 is the problem. Next, the discharge test was performed.

### Discharge test results:

BATTERY NO.	1	2	3	4
Discharge Voltage	8.16* V	10.99 V	11.60 V	10.72 V

\*After a discharge test which lasted 45 minutes, battery no. 1 is clearly shown to be the problem. Battery no. 4 should be watched a little more closely but appears to be okay. Battery no. 1 should be replaced with a battery that has about the same age and usage as the other batteries in the set.

### Example 2

Vehicle no. 70 was also suspected of having a bad battery due to its performance. The battery charger test showed 7.0 amps after a full charge. After confirming there were no problems with the electrical system, charger or brakes, the on-charge voltage was recorded as follows:

BATTERY NO.	1	2	3	4
On-Charge Voltage	15.72 V	14.66* V	15.80 V	15.85 V

\*Battery no. 2 was immediately suspected as the problem. After checking battery no. 2 with a hydrometer, it was discovered that the negative post cell was completely dead. Battery no. 2 should be replaced with a battery that has the same age and usage as the other batteries in the set.

## BATTERY STORAGE

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### See General Warnings, Section 1, Page 1-1.

When storing batteries during the off-season or when maintaining a replacement stock, follow these guidelines:

1. Keep the batteries clean and free of corrosion. **See Battery Care on page 13-2.**
2. Batteries that are in vehicles for winter storage should be left disconnected in the vehicles if the batteries are not going to be connected to a charger.
3. Fully charge the batteries prior to storage.
4. Store in a cool area. The colder the area in which the batteries are stored, the less the batteries will self-discharge. Batteries stored at 0 °F (–17.8 °C) will discharge very little over a four-month period. Batteries stored at 80 °F (26.7 °C) will have to be recharged every few weeks.
5. 48-volt Club Car electric vehicles and compatible battery chargers are designed to be left connected, with AC power to the charger ON, during off-season storage. The storage charge feature will automatically charge the batteries as needed throughout the storage period.

## CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

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See the appropriate battery charger maintenance and service manual.

## SECTION 14 – BATTERY CHARGER

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Refer to the appropriate battery charger maintenance and service manual.



# SECTION 15A – MOTOR (MODEL 5BC59JBS6365)

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## **DANGER**

- See General Warnings, Section 1, Page 1-1.

## **WARNING**

- See General Warnings, Section 1, Page 1-1.

## GENERAL INFORMATION

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The IQ System vehicle is equipped with a 48-volt DC, shunt-wound, reversible traction motor. The shunt-wound motor is designed for use on the IQ System vehicle only. Club Car recommends that motors requiring major repair be sent to a qualified motor repair shop; however, there are many relatively simple tasks that can be performed by a technician with general knowledge and experience in electric motor repair.

## MOTOR IDENTIFICATION

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There are two types of motors used in 2005 model year IQ System electric vehicles: Model 5BC59JBS6365 (gray housing), and EJ4-4001 (black housing). Do not attempt to service a motor that has not been properly identified. If the motor cannot be properly identified, contact your local Club Car dealer or distributor.

## EXTERNAL MOTOR TESTING

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Using a multimeter or continuity tester, the following tests can be performed without disassembling the motor.

***NOTE:** Tag the motor wires for identification before disconnecting.*

### TEST PROCEDURE 1 – INTERNAL SHORT CIRCUITS

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-1.**
2. Using two wrenches to prevent posts from turning, disconnect wires from terminals on motor.
3. Using a multimeter set to 200 ohms, place black (–) probe on motor housing. Scratch through paint to ensure a good connection. Place red (+) probe on A1, A2, F1, and F2 terminals respectively (**Figure 15a-1, Page 15a-2**). Multimeter should indicate no continuity. If readings are incorrect, motor will need to be removed from the vehicle and repaired by a qualified technician. See **Motor Removal on page 15a-3.**
  - 3.1. An incorrect reading from the A1 or A2 terminal indicates three possible problems: a grounded A1 or A2 terminal, a grounded wire in the brush area, or a grounded armature/commutator. An incorrect reading for the F1 or F2 terminal indicates a possible grounded F1 or F2 terminal or field coil.

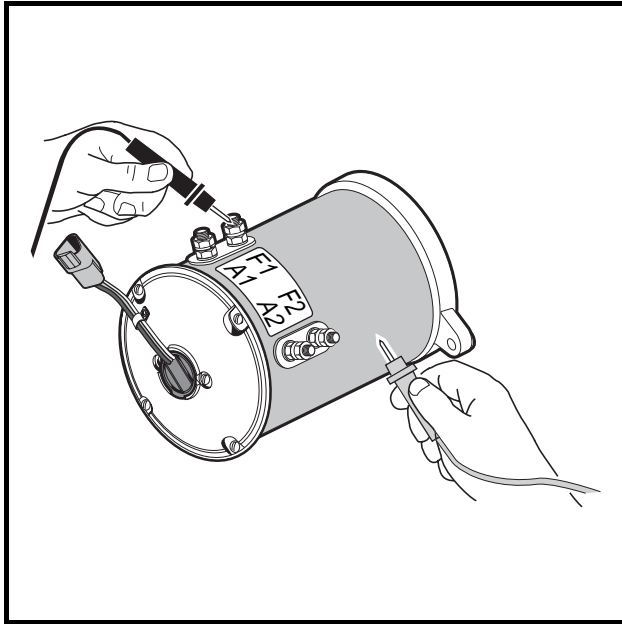
**External Motor Testing, Continued:**

Figure 15a-1 Motor Short Circuit Test

**TEST PROCEDURE 2 – ARMATURE CIRCUIT OPEN**

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-1.**
2. Using two wrenches to prevent the posts from turning, disconnect wires from the A1 and A2 terminals on the motor. Using a multimeter set to 200 ohms, place the red (+) probe on the A1 terminal and black (-) probe on the A2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See **Motor Removal on page 15a-3.**

**TEST PROCEDURE 3 – FIELD CIRCUIT OPEN**

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-1.**
2. Using two wrenches to prevent the post from turning, disconnect wires from the F1 and F2 terminals on the motor. Using a multimeter set to 200 ohms, place the red (+) probe on the F1 terminal and the black (-) probe on the F2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open field coil or bad connections at the terminals may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See **Motor Removal on page 15a-3.**



## MOTOR

See General Warnings, Section 1, Page 1-1.

### Motor Removal

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-1.**
2. Using two wrenches to prevent posts from turning, disconnect wires from terminals on motor. Label the wires to ensure proper reconnection.
3. Slightly loosen all the lug nuts on both rear wheels.
4. Place floor jack under transaxle and raise rear of vehicle (**Figure 15a-2, Page 15a-3**) then place jack stands under frame crossmember between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jack stands support the vehicle (**Figure 15a-3, Page 15a-3**). See following **WARNING**.

### **⚠** WARNING

- Lift only one end of the vehicle at a time. Use a suitable lifting device (chain hoist or hydraulic floor jack) with 1000 lb. (454 kg) minimum lifting capacity. Do not use lifting device to hold vehicle in raised position. Use approved jack stands of proper weight capacity to support the vehicle and chock the wheels that remain on the floor. When not performing a test or service procedure that requires movement of the wheels, lock the brakes.

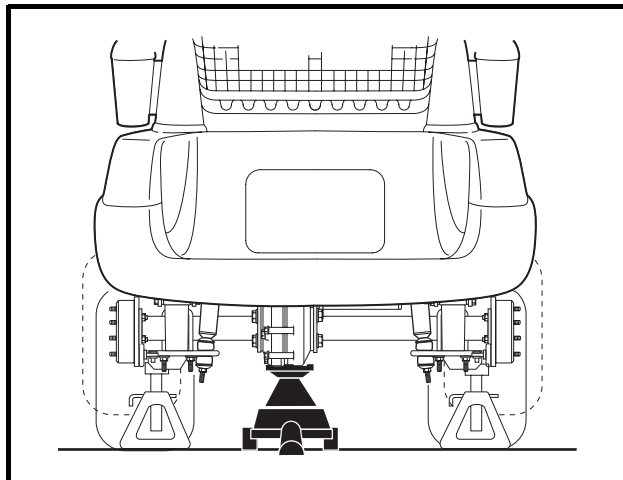


Figure 15a-2 Lift Vehicle with Floor Jack

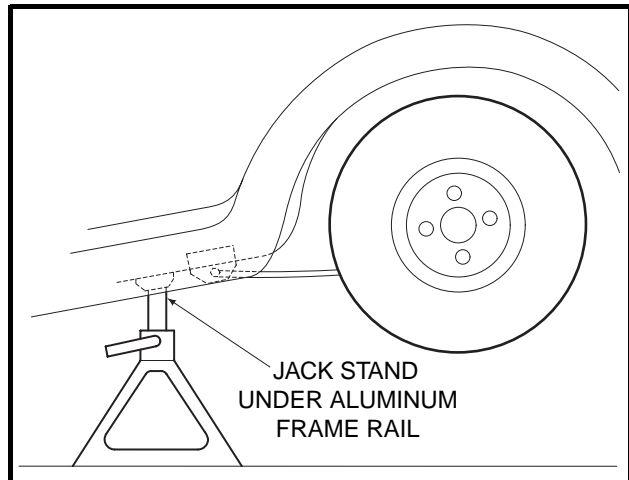


Figure 15a-3 Vehicle Supported on Jack Stands

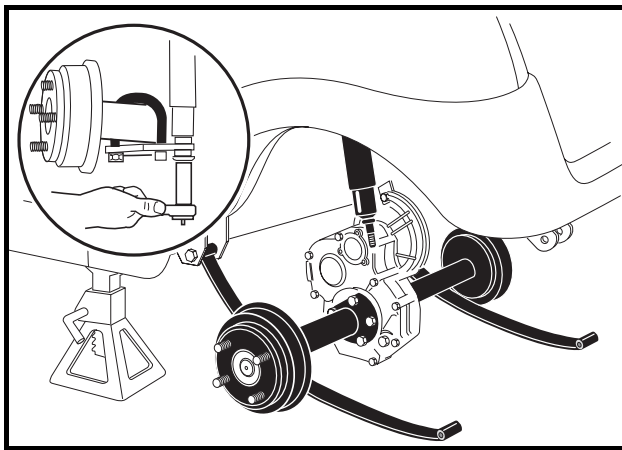
5. Remove both rear wheels.
6. Remove the nut, cup washer, and bushing from the bottom side of the shock absorber. Compress the shock absorber (pushing upwards) to move it out of the way (**Figure 15a-4, Page 15a-4**).
7. Remove the nuts and bolts mounting the rear leaf springs to the shackles.

**Motor Removal, Continued:**

- To gain easier access to the motor, lower the transaxle as low as it will go. If more room is needed, remove the jack from beneath the transaxle and allow the springs to rest on the floor (**Figure 15a-4, Page 15a-4**). See following **WARNING**.

**⚠ WARNING**

- **Hot! Do not attempt to service hot motor, this could result in severe burns.**
- **Do not position fingers under motor when sliding motor off of the input shaft in step 10. Fingers may get pinched when motor disengages.**



**Figure 15a-4 Lower Axle**

- Remove the four bolts that mount the motor to the transaxle (**Figure 15a-19, Page 15a-15**).
- Carefully slide the motor away from the transaxle until the motor spline disengages the input shaft and remove the motor from the vehicle.

**Motor Disassembly**

- Before beginning disassembly, place match marks on the motor end shield and stator shell, then place the motor in a vice with wooden blocks as shown (**Figure 15a-5, Page 15a-5**).
- Remove the four bolts (8) securing the end shield (10) to the stator shell (2).
- Remove the two screws (9) attaching the end shield to the bearing retainer.
- Lift stator shell (2) off of armature (17).
- Remove two screws (11) attaching brush rigging (12) to the stator shell (2) (**Figure 15a-10, Page 15a-8**).
- Mark the brush terminal posts (A1 and A2) (13) to identify their positions in the stator shell, then remove the nuts (6) and flat washers (5) (**Figure 15a-10, Page 15a-8**). From the outside, push the posts through the stator shell wall into the interior of the stator shell.
- Carefully remove the brush rigging and the terminal posts from the stator shell.
- To remove brush springs (14) from the rigging, lift the spring extensions out and over the brush mounts and then slide the springs off their mounting tabs (**Figure 15a-6, Page 15a-5**).

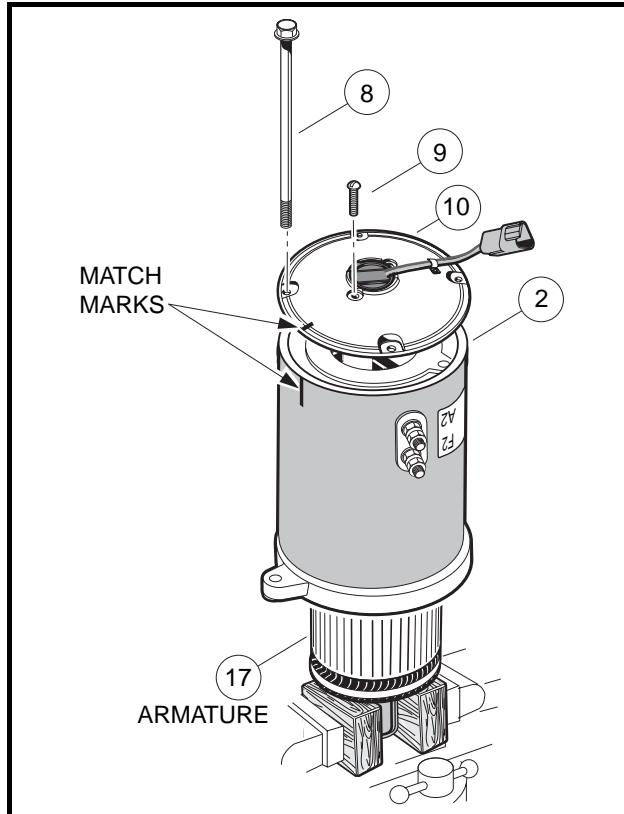


Figure 15a-5 Motor Disassembly

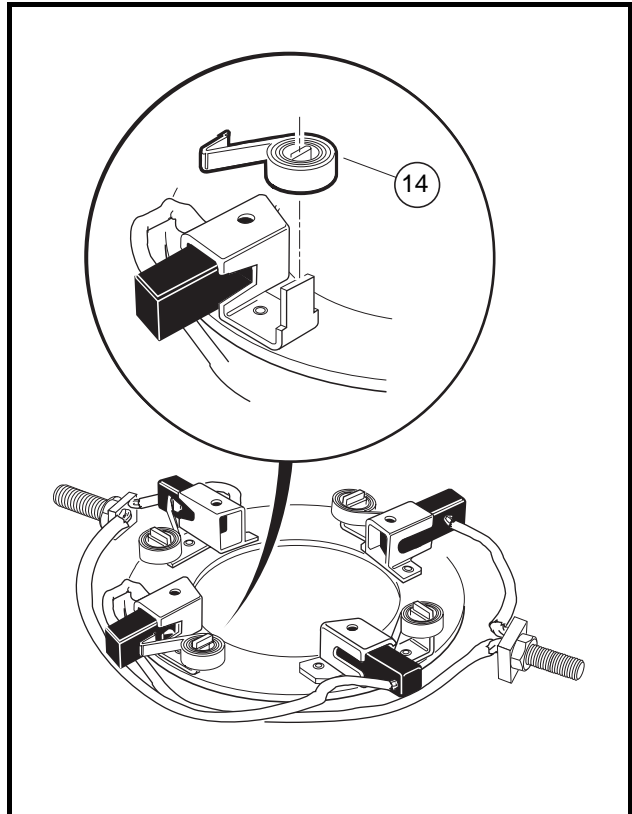


Figure 15a-6 Brush Spring Removal

## MOTOR COMPONENT TESTING AND INSPECTION

See General Warnings, Section 1, Page 1-1.

### ARMATURE

#### Visual Inspection

Disassemble the motor and carefully inspect the armature for the following characteristics:

- Burned, charred or cracked insulation
- Improperly cured varnish
- Thrown solder
- Flared armature windings
- Damaged armature core laminations
- Worn, burned or glazed commutators
- Dirty or oily commutators
- Raised commutator bars
- Worn armature bearing or shaft

**Visual Inspection, Continued:**

A dirty or oily commutator should be cleaned and wiped dry. Abnormalities identified during the inspection can help determine original cause of failure. Slight roughness of the commutator can be polished smooth with 400 grit or finer sandpaper. **See following CAUTION and NOTE.**

**CAUTION**

- Do not use emery cloth to polish the commutator. Particles of emery are conductive and may short-circuit the commutator bars. Do not use oil or lubricants on the commutator or brushes.

**NOTE:** Oil on the commutator may indicate a faulty transaxle input shaft oil seal.

**Armature Ground Test****⚠ CAUTION**

- Do not submerge the armature in solvent.

**NOTE:** Before testing the armature, wipe it clean with a clean cloth. Remove any carbon dust and metal particles from between the commutator bars.

1. With a multimeter set to 200 ohms, place one probe on the commutator and the other on the armature core. The multimeter should indicate no continuity (**Figure 15a-7, Page 15a-6**). If the reading is incorrect, replace the armature.

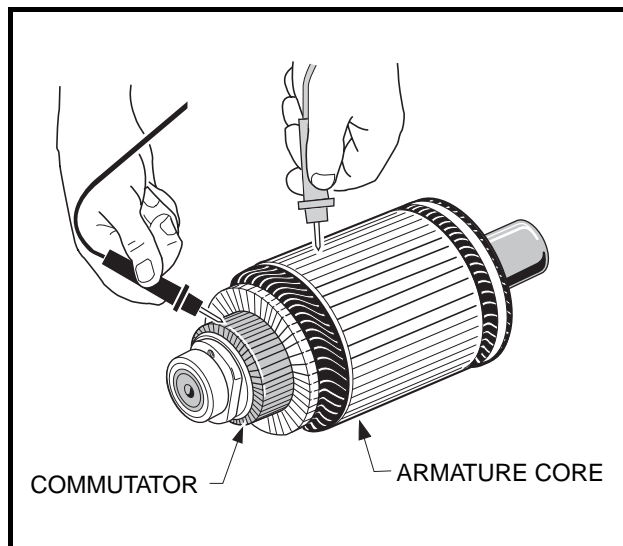


Figure 15a-7 Armature Test

**FIELD WINDINGS INSPECTION**

Burned or scorched insulation on the field windings indicates the motor has overheated due to overloads or grounded or shorted coil windings. If the insulation on the field windings is scorched, replace the motor or the stator shell assembly.

## MOTOR COMPONENTS

1. Inspect the insulators (4 and 7) for cracks or other damage (**Figure 15a-10, Page 15a-8**).
2. Inspect the brushes (13) for damage or excessive wear. Replace brushes if required. **See following NOTE.**
3. Inspect the brush springs (14) (**Figure 15a-10, Page 15a-8**). Replace springs that are discolored from heat (light gold or blue tinted). Replace springs which apply a force of less than 16 oz. (**Figure 15a-8, Page 15a-7**).

### CAUTION

- **When checking brush spring tension, do not over-extend the spring. Using excessive force will damage the spring.**

**NOTE:** When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging. Refer to Motor Assembly for brush installation. **See Motor Assembly on page 15a-10.**

When replacing brushes, replace all four brushes. Never replace only two.

Install the brushes in the same rigging 180° apart from each other.

## BEARING INSPECTION

1. Using a clean cloth, wipe the carbon dust off of the bearing. Inspect the bearing by spinning it by hand and checking for both axial (A) and radial (B) play (**Figure 15a-9, Page 15a-7**).
2. Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearing and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing. Do not remove the bearing from the armature shaft unless it is to be replaced.

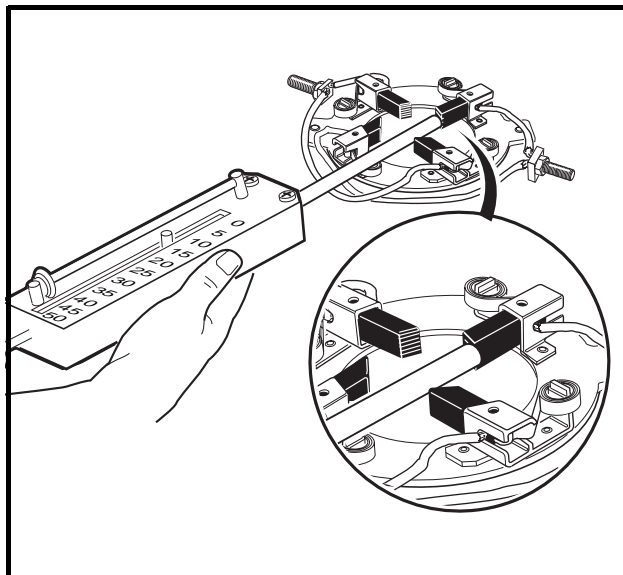


Figure 15a-8 Brush Spring Tension Test

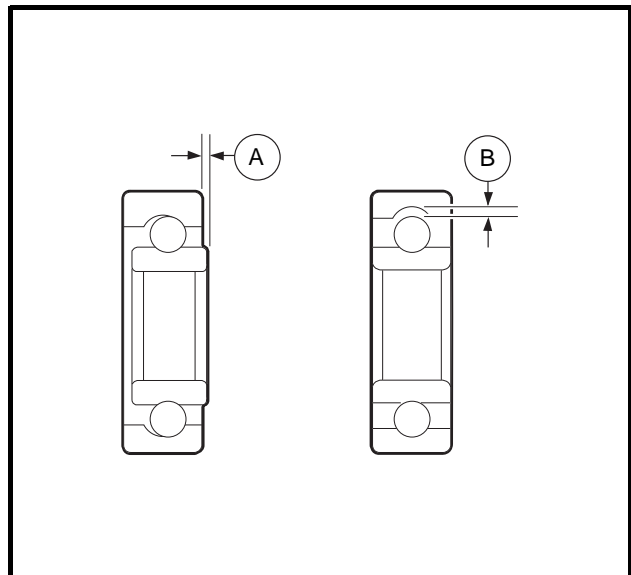


Figure 15a-9 Inspect Bearing

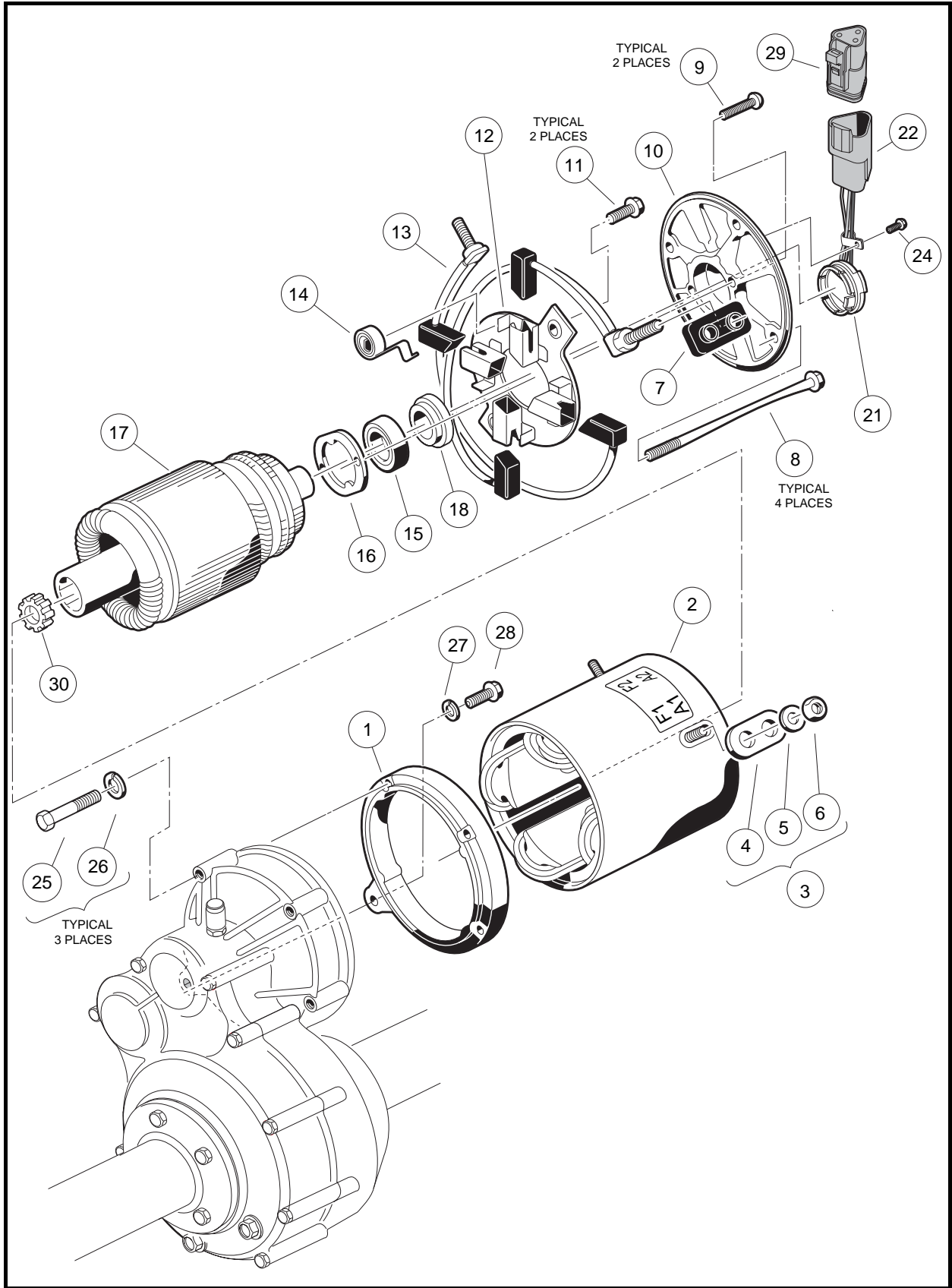


Figure 15a-10 Motor

## BEARING REMOVAL

1. Place the wedge attachment tool (CCI P/N 1012812) between the bearing (15) and the armature (17) (**Figure 15a-10, Page 15a-8**). Make sure the wedge attachment tool is supporting the inner race of the bearing. If a press is not available, secure a bearing puller (CCI P/N 1012811) to the bearing and pull the bearing off of the end of the armature shaft. Support the shaft so it will not drop when the bearing is removed (**Figure 15a-11, Page 15a-11**). Discard the bearing and speed sensor magnet. **See following NOTE.**

**NOTE:** The speed sensor magnet will be pressed off by the bearing when the bearing is removed.

## BEARING INSTALLATION

1. Press a new bearing (15) onto the armature (**Figure 15a-10, Page 15a-8**). Use an arbor press that exerts pressure on the inner race only. **See following NOTE.**

**NOTE:** Make sure the bearing retainer (16) is positioned on the armature shaft before the bearing is pressed onto the armature (**Figure 15a-10, Page 15a-8**).

*An arbor with an outside diameter of less than 5/8 inch (16 mm) should be used to press the bearing onto the armature.*

2. Install the speed sensor magnet. **See Speed Sensor Magnet Installation on page 15a-9.**

## SPEED SENSOR MAGNET INSPECTION

Inspect the speed sensor magnet (18) for rust, wear, and cracks (**Figure 15a-10, Page 15a-8**). Replace the magnet if necessary.

## SPEED SENSOR MAGNET REMOVAL

1. To remove the speed sensor magnet (18), remove the motor bearing (**Figure 15a-10, Page 15a-8**). **See Bearing Removal on page 15a-9.**

## SPEED SENSOR MAGNET INSTALLATION

1. Using a solid bearing driver with a diameter of no less than 1 inch (2.54 cm), press the motor speed sensor magnet (18) onto the shaft until the magnet hub is flush with the armature shaft.

## RECONDITIONING THE MOTOR

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**See General Warnings, Section 1, Page 1-1.**

Motor reconditioning must be performed by a qualified motor repair technician. The use of proper tools and procedures is absolutely essential for successful motor reconditioning.

## Motor Specifications

Any rework must be performed by a qualified technician. Motor service specifications are listed in the following table.

ITEM	SERVICE LIMIT
Commutator diameter (minimum)	2.265 in. (66.675 mm)
Commutator concentric with armature shaft within	0.001 in. (0.0254 mm)
Limit depth of cut when machining commutator	0.005 in. (0.127 mm)
Bar to bar runout should not exceed	0.002 in. (0.00508 mm)
If undercut of segment insulator is less than 0.016 inch (0.406 mm), it should be undercut to	0.031 in. (0.8 mm)
Machined face of commutator	8-16 microinches (203.2-406.4 nm)
Field coil resistance (IQ System, 3.20 hp)	1.61 ohms

## MOTOR ASSEMBLY

See General Warnings, Section 1, Page 1-1.

1. If the bearing has been removed, replace the bearing. See **Bearing Installation on page 15a-9.**
2. Install the brushes. See **following NOTE.**

**NOTE:** When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging. Refer to Motor Assembly for brush installation. See **Motor Assembly on page 15a-10.**

*When replacing brushes, replace all four brushes. Never replace only two.*

*Install the brushes in the same rigging 180° apart from each other.*

- 2.1. With brush rigging facing down and held slightly above stator shell, insert the two terminal posts through insulators in stator shell wall at the A1 and A2 positions. Insert brush holder screws through the holes in the brush rigging and into the threaded holes in the mounting bracket (**Figure 15a-12, Page 15a-12**). Tighten the screws to 20 in-lb (2.3 N·m).
- 2.2. One at a time, push brush spring extensions back from brushes and slide the brushes back until they are completely retracted into their mounting slots. Then position the brush springs against the sides of the brushes so that spring pressure will hold them in the retracted position (**Figure 15a-6, Page 15a-5**).



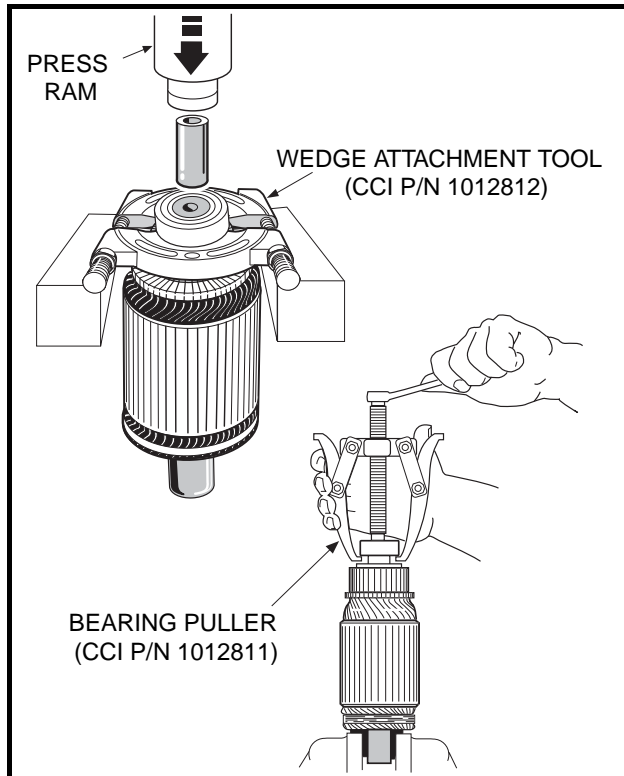


Figure 15a-11 Bearing Removal

- 2.3. Slide the armature, bearing end first, into the stator shell. Make sure the brushes are held back while positioning the armature for proper commutator/brush contact. Release the brushes and place the springs outside the brushes so the brushes are being held against the commutator. **See following CAUTION.**

### CAUTION

- If the motor is being assembled with the armature standing on end as the commutator is positioned, make sure the brushes are held back. Do not allow the brushes to support the weight of the stator shell. The brushes can be easily damaged by this weight.

3. Install the end shield onto the stator shell.

- 3.1. Attach the end shield (10) to bearing retainer (16) by aligning the two holes in the bearing retainer with the two mating holes in the end shield and installing the screws (9) (**Figure 15a-10, Page 15a-8**). Tighten the screws to 17 in-lb (1.9 N·m). **See following NOTE.**

**NOTE:** Use a long screw with the same thread specifications as the mounting screws to maintain hole alignment while starting the first mounting screw (**Figure 15a-13, Page 15a-12**).

- 3.2. Align the match marks on the end shield and the stator shell, then install the four screws (8) (**Figure 15a-10, Page 15a-8**). Tighten the screws to 90 in-lb (10 N·m).

**NOTE:** Make sure the motor speed sensor wires located on the end shield are aligned between the terminals on the motor housing.

4. Make sure the armature turns freely. If it does not turn freely, disassemble the motor to find the problem. Make sure the bearing is properly seated in the end shield when assembling the motor.

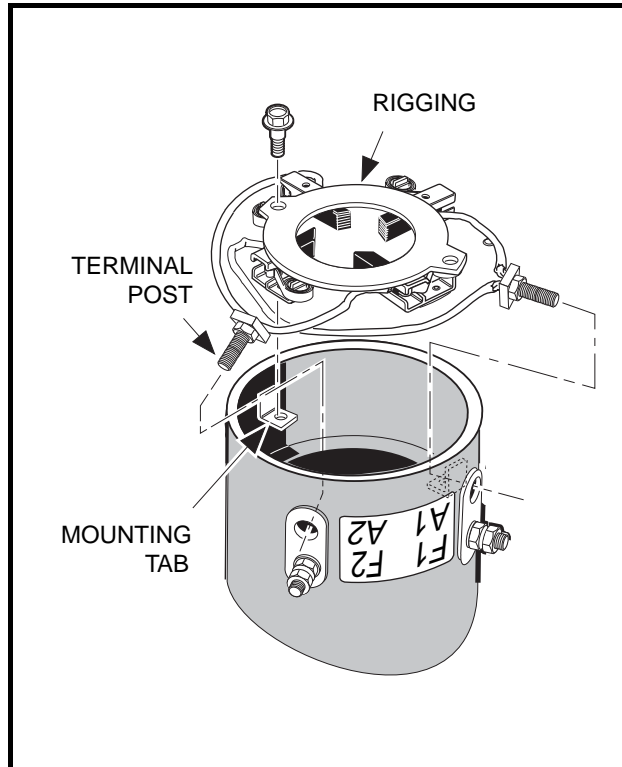
**Motor Assembly, Continued:**

Figure 15a-12 Brush Installation

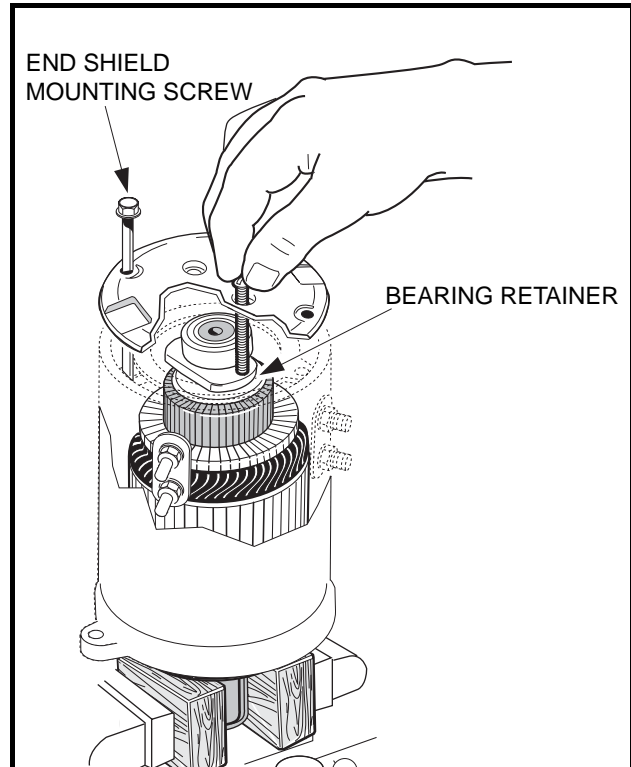


Figure 15a-13 End Shield Installation

**MOTOR INSTALLATION****See General Warnings, Section 1, Page 1-1.**

1. Clean the transaxle input shaft.
  - 1.1. Spray the input shaft thoroughly with CRC<sup>®</sup> Brakleen™ or equivalent brake cleaner degreaser.
  - 1.2. Wipe input shaft with a clean cloth.
  - 1.3. Inspect the grooves of the input shaft and remove any remaining debris.
  - 1.4. Repeat steps 1.1 through 1.3 until input shaft is clean.
2. Lubricate the transaxle input shaft.
  - 2.1. Squeeze approximately 1/2 inch (1.3 cm) of moly-teflon lubricant (CCI P/N 102265201) from tube onto a putty knife as shown (**Figure 15a-14, Page 15a-13**).
  - 2.2. Rotate wheels to rotate input shaft.
  - 2.3. Apply motor coupling grease evenly to the rotating input shaft starting at approximately 1/8 inch (3.1 mm) from the end of the shaft and working back toward the transaxle (away from the end of the shaft) (**Figure 15a-15, Page 15a-13**).
  - 2.4. The grease should be evenly distributed in the grooves to a width of approximately 3/8 inch (9.5 mm).
  - 2.5. Using a flat screwdriver, clean the grease out of one of the grooves to allow air to escape when the motor is pushed onto the input shaft.

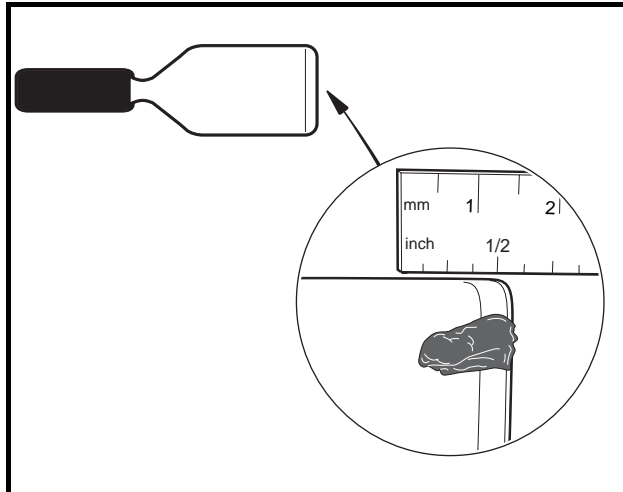


Figure 15a-14 Grease on Putty Knife

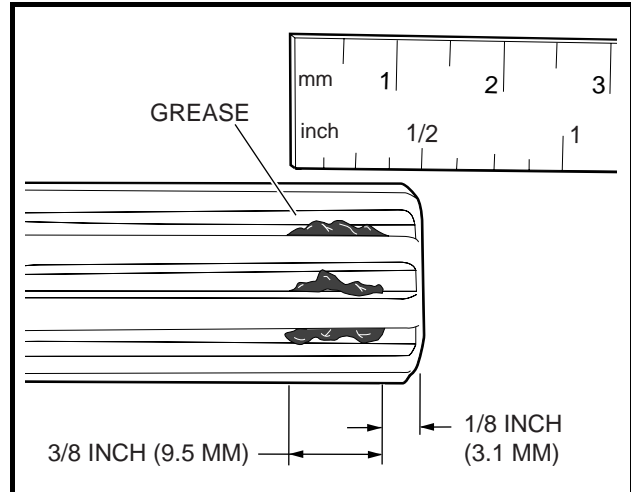


Figure 15a-15 Application of grease to Input Shaft Grooves

- 2.6. Check the chamfer and end of the input shaft to ensure these areas are completely clean of grease as shown (Figure 15a-16, Page 15a-13).
3. Install the molded bumper.
  - 3.1. With the flat side toward the bottom of the coupling, install the molded bumper (30) into the motor coupling (Figure 15a-10, Page 15a-8). See following NOTE.

**NOTE:** The motor coupling and the new molded bumper must be free of grease and debris.

- 3.2. Ensure that the installed bumper is seated at the bottom of the coupling.
4. Install motor on transaxle.
  - 4.1. Slide the motor coupling onto the transaxle input shaft. See following NOTE.

**NOTE:** The coupling will push any excess grease on the input shaft along the shaft toward the transaxle.

When the motor is pushed onto the input shaft, the motor adapter ring (1) will not bottom out against the transaxle housing (Figure 15a-10, Page 15a-8). There will be approximately 1/16 inch (1.6 mm) gap between the motor adapter ring and transaxle housing as shown (Figure 15a-17, Page 15a-13).

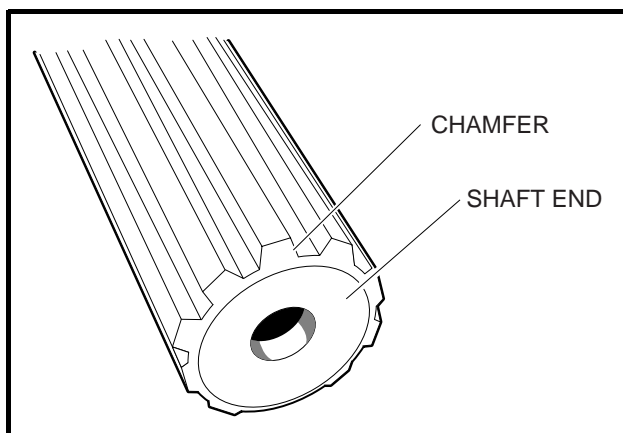


Figure 15a-16 Clean Chamfer and Input Shaft End

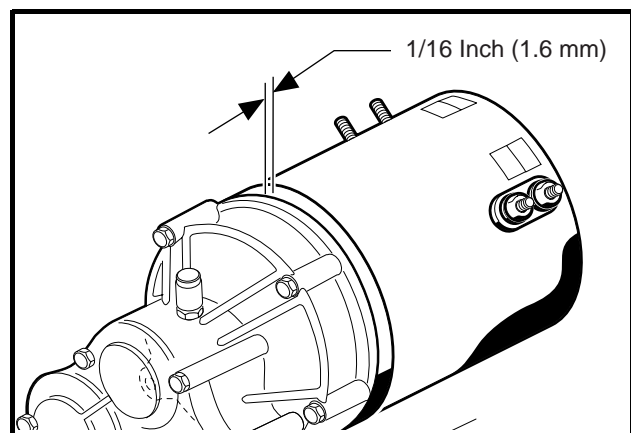


Figure 15a-17 Gap at Motor and Transaxle

**Motor Installation, Continued:**

- 4.2. Loosely install four motor bolts and washers that secure the motor to the transaxle. Do not tighten.
- 4.3. Begin finger tightening the bolts (1 and 2) in the sequence indicated (**Figure 15a-19, Page 15a-15**). Continue tightening by hand until the motor is seated in the transaxle housing. **See following CAUTION and NOTE.**

**CAUTION**

- **Make sure the motor is properly seated in the transaxle housing.**

**NOTE:** Failure to install and tighten the motor mounting bolts in the proper sequence and to the proper tightness may result in motor noise during operation.

- 4.4. Tighten the right bolt (1) to 65 in-lb (7.3 N·m).
- 4.5. Tighten the left bolt (2) to 65 in-lb (7.3 N·m).
- 4.6. Tighten the center bolt (3) to 65 in-lb (7.3 N·m) (**Figure 15a-19, Page 15a-15**).
- 4.7. Tighten the bolt (24) inserted through the tab to 155 in-lb (17.5 N·m) (**Figure 15a-18, Page 15a-15**).
- 4.8. Install the motor wires, making sure they are connected to the correct motor terminals and that the terminal orientation is correct. **See Wiring Diagrams, Section 11, Page 11-2.** Using two wrenches to prevent the posts from turning, tighten the terminal retaining nuts to 65 in-lb (7.3 N·m).
- 4.9. Secure the white, orange, green, and blue wires with a wire tie so that none of the motor wires will scrub the motor or transaxle when the vehicle is in operation.
- 4.10. Connect the three-pin speed sensor wire to the vehicle wire harness.
5. If using a chain hoist, lower the vehicle and guide the leaf springs into the shackles. If using a floor jack, raise the transaxle until the leaf springs can be guided into the shackles.
6. Insert the mounting bolts through the spring shackles and the bushings in the leaf spring eyes and install lock nuts. Tighten the bolts to 23 ft-lb (31 N·m). **See Section 9 – Rear Suspension in the appropriate maintenance and service manual.**
7. Install the shock absorbers. Tighten nut until rubber bushing expands to the diameter of the cup washer.
8. If removed, install wheels and finger tighten the lug nuts.
9. Lift vehicle and remove jack stands. Lower vehicle to the floor and tighten lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).
10. Place the Tow/Run switch in the TOW position and connect the batteries, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
11. Place the Tow/Run switch in the RUN position.
12. Inspect the vehicle for proper operation. **See following WARNING.**

**WARNING**

- **Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.**
- **Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.**
- **Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.**

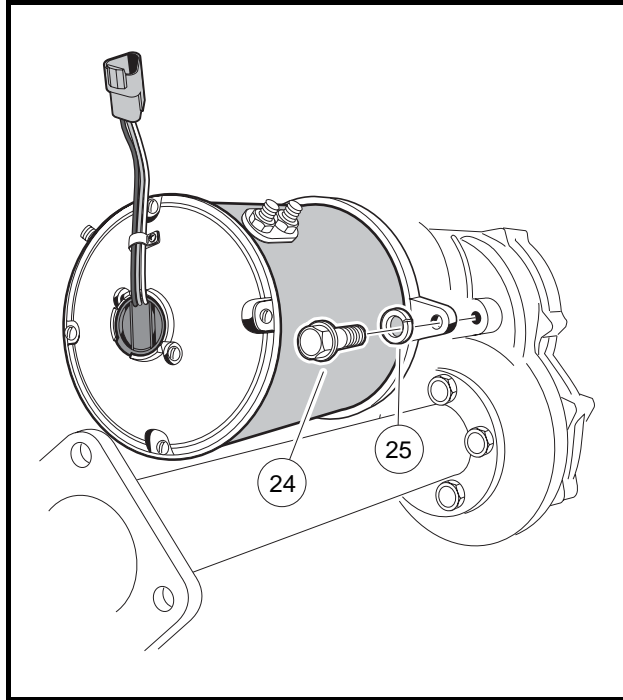


Figure 15a-18 Motor Installation

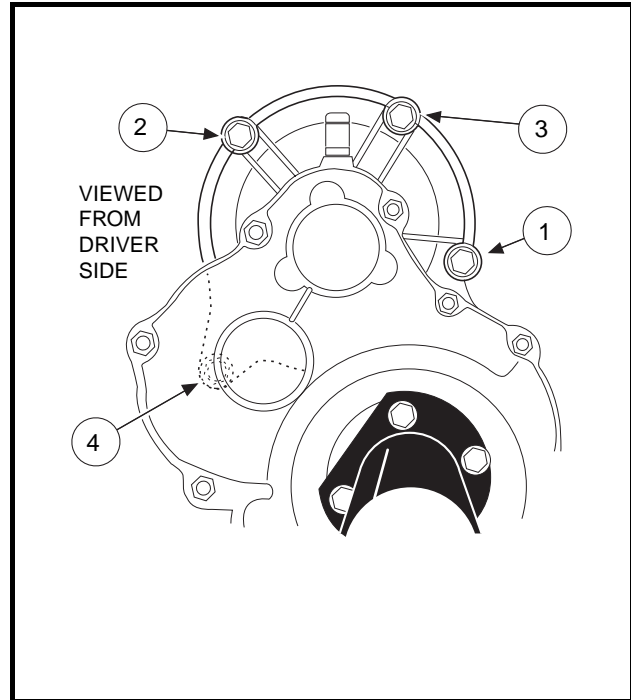


Figure 15a-19 Motor Mount

## MOTOR SPEED SENSOR

See General Warnings, Section 1, Page 1-1.

### Testing the Motor Speed Sensor

See Test Procedure 13, Section 11, Page 11-34.

### Motor Speed Sensor Removal

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Disconnect the three-pin connector (22) from the vehicle wire harness (**Figure 15a-20, Page 15a-16**).
3. Using a screwdriver, gently pry the motor speed sensor (21) from recessed area on the motor end shield.

### Motor Speed Sensor Installation

1. Position the motor speed sensor (21) as shown and firmly press the speed sensor into the motor end shield. Sensor should fit flush against the motor (**Figure 15a-20, Page 15a-16**).
2. Connect the three-pin connector (22) to the vehicle wire harness.
3. Place the Tow/Run switch in the TOW position and connect the batteries, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.

Motor Speed Sensor Installation, Continued:

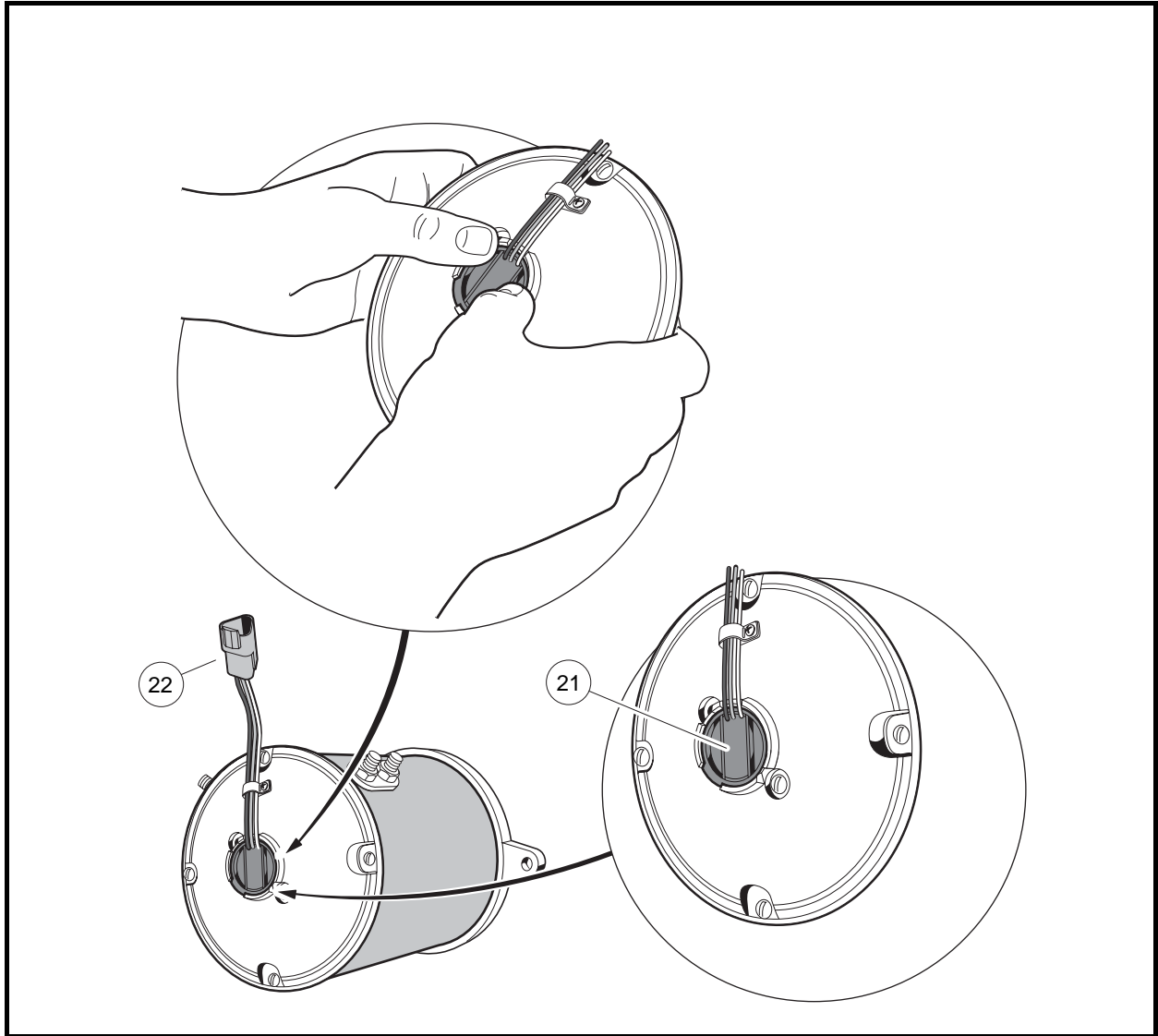


Figure 15a-20 IQ Motor Speed Sensor

## SECTION 15B – MOTOR (MODEL EJ4-4001)

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### **⚠ DANGER**

- See General Warnings, Section 1, Page 1-1.

### **⚠ WARNING**

- See General Warnings, Section 1, Page 1-1.

## GENERAL INFORMATION

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The IQ System vehicle is equipped with a 48-volt DC, shunt-wound, reversible traction motor. The shunt-wound motor is designed for use on IQ System vehicles only. Club Car recommends that motors requiring major repair be sent to a qualified motor repair shop; however, there are many relatively simple tasks that can be performed by a technician with general knowledge and experience in electric motor repair.

## MOTOR IDENTIFICATION

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There are two types of motors used in 2005 model year IQ System electric vehicles: Model 5BC59JBS6365 (gray housing), and EJ4-4001 (black housing). Do not attempt to service a motor that has not been properly identified. If the motor cannot be properly identified, contact your local Club Car dealer or distributor.

## EXTERNAL MOTOR TESTING

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The following tests can be performed without disassembling the motor using a multimeter or continuity tester.

**NOTE:** Tag the motor wires for identification before disconnecting.

### TEST PROCEDURE 1 – INTERNAL SHORT CIRCUITS

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Disconnect wires from terminals on motor using two wrenches to prevent posts from turning.
3. With a multimeter set to 200 ohms, place black (–) probe on motor housing. Scratch through paint to ensure a good connection. Place red (+) probe on A1, A2, S1, and S2 terminals respectively. Multimeter should indicate no continuity between the motor housing and all individual terminals. If readings are incorrect, motor will need to be removed from the vehicle and repaired by a qualified technician. See **Motor Removal on page 15b-2.**
  - 3.1. An incorrect reading from the A1 or A2 terminal indicates three possible problems: a grounded A1 or A2 terminal, a grounded wire in the brush area, or a grounded armature/commutator. An incorrect reading for the S1 or S2 terminal indicates a possible grounded S1 or S2 terminal or field coil.

## TEST PROCEDURE 2 – ARMATURE CIRCUIT OPEN

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Disconnect wires from the A1 and A2 terminals on the motor using two wrenches to prevent posts from turning. Set a multimeter to 200 ohms and place the red (+) probe on the A1 terminal and black (–) probe on the A2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open or poor contact in a brush assembly and/or open armature windings may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See **Motor Removal on page 15b-2.**

## TEST PROCEDURE 3 – FIELD CIRCUIT OPEN

See General Warnings, Section 1, Page 1-1.

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Disconnect wires from the S1 and S2 terminals on the motor using two wrenches to prevent posts from turning. Set a multimeter to 200 ohms and place the red (+) probe on the S1 terminal and the black (–) probe on the S2 terminal. The multimeter should indicate continuity. If the reading is incorrect, a possible open field coil or bad connections at the terminals may be the cause. The motor will need to be removed from the vehicle and repaired by a qualified technician. See **Motor Removal on page 15b-2.**

## MOTOR

See General Warnings, Section 1, Page 1-1.

## MOTOR REMOVAL

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in **General Warnings, Section 1, Page 1-2.**
2. Disconnect wires from the terminals on the motor using two wrenches to prevent posts from turning. Label the wires to ensure proper reconnection.
3. Slightly loosen all the lug nuts on both rear wheels.
4. Place floor jack under transaxle and raise rear of vehicle (**Figure 15b-1, Page 15b-3**) then place jack stands under frame crossmember between the spring mount and the side stringer, just forward of each rear wheel. Lower the vehicle to let the jack stands support the vehicle (**Figure 15b-2, Page 15b-3**). See following **WARNING**.

### **⚠ WARNING**

- Lift only one end of the vehicle at a time. Use a suitable lifting device (chain hoist or hydraulic floor jack) with 1000 lb. (454 kg) minimum lifting capacity. Do not use lifting device to hold vehicle in raised position. Use approved jack stands of proper weight capacity to support the vehicle and chock the wheels that remain on the floor. When not performing a test or service procedure that requires movement of the wheels, lock the brakes.



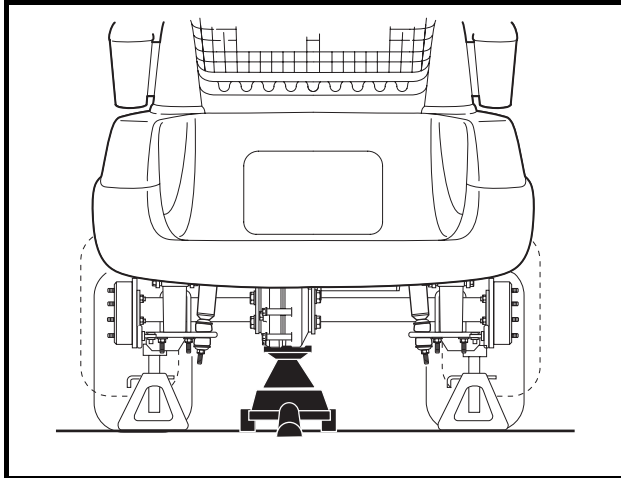


Figure 15b-1 Lift Vehicle with Floor Jack

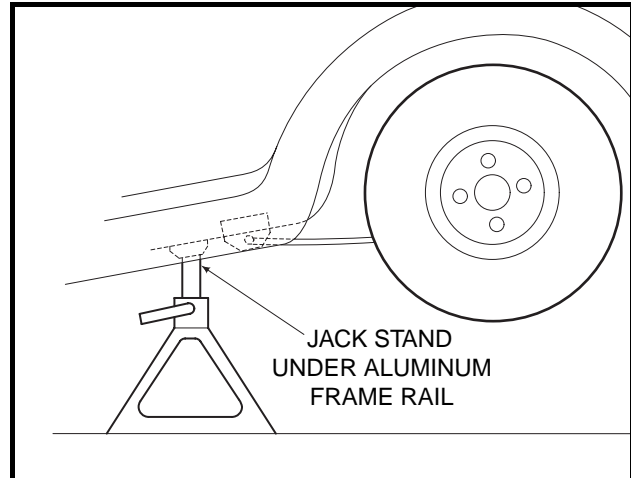


Figure 15b-2 Vehicle Supported on Jack Stands

5. Remove both rear wheels.
6. Remove the nut, cup washer, and bushing from the bottom side of the shock absorber. Compress the shock absorber (pushing upwards) to move it out of the way (**Figure 15b-3, Page 15b-3**).
7. Remove the nuts and bolts mounting the rear leaf springs to the shackles.
8. To gain easier access to the motor, lower the transaxle as low as it will go. If more room is needed, remove the jack from beneath the transaxle and allow the springs to rest on the floor (**Figure 15b-3, Page 15b-3**).

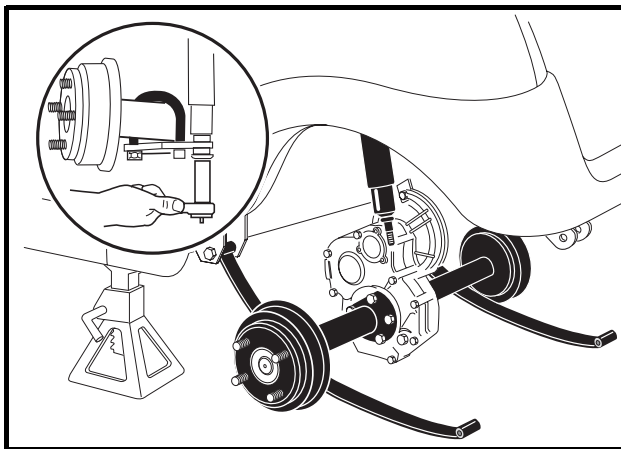


Figure 15b-3 Lower Axle

9. Remove the four bolts that mount the motor to the transaxle (**Figure 15b-24, Page 15b-15**). See following **CAUTION**.

### **⚠ CAUTION**

- **Do not position fingers under motor when sliding motor off of the input shaft in step 9. Fingers may get pinched when motor disengages.**
10. Carefully slide the motor away from the transaxle until the motor spline disengages the input shaft and remove the motor from the vehicle.

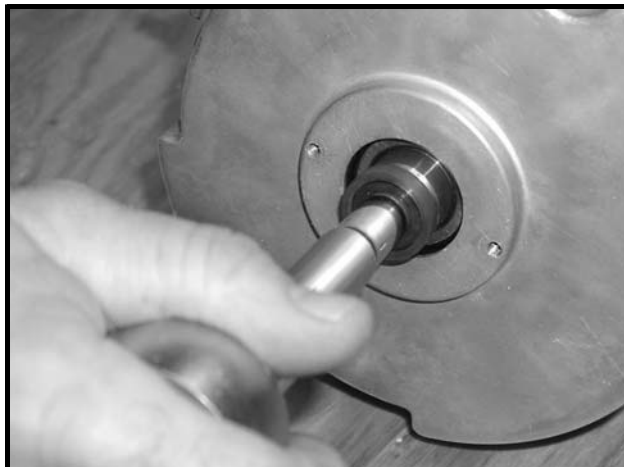


Figure 15b-4 Speed Sensor Magnet



Figure 15b-5 End Cap

## MOTOR DISASSEMBLY

1. Before beginning disassembly, place match marks on the motor end cap and motor frame.
2. Remove speed sensor and magnet.
  - 2.1. Remove the two screws (25) that secure the speed sensor (10) to the end cap (11) (**Figure 15b-15, Page 15b-10**).
  - 2.2. Remove the screw securing the magnet to the armature shaft (**Figure 15b-4, Page 15b-4**).
  - 2.3. Inspect the speed sensor magnet. **See Speed Sensor Magnet Inspection on page 15b-9.**
3. Loosen, but do not remove, the two screws securing the end cap to the motor frame (**Figure 15b-5, Page 15b-4**).



Figure 15b-6 End Cap Disengagement



Figure 15b-7 End Cap Removal

4. Orient the motor so that the splined end of the armature is facing down.
5. Inspect the area where the end cap mates with the motor frame. If the end cap appears to be loose where it connects to the motor frame, proceed to step 6; otherwise, disengage the end cap from the motor frame using the following procedure:
  - 5.1. With the end cap bolts loose (about 1/4 inch between the end cap and the head of the bolt), place a socket on the head of the bolt. **See following CAUTION.**

## **CAUTION**

- **Ensure that there is sufficient thread engagement of the end cap bolts before proceeding. Performing the procedure without having adequate thread engagement could damage the motor frame, end cap, or end cap bolts.**

- 5.2. Gently tap each bolt, alternating between blows, until the end cap and motor frame become disengaged (**Figure 15b-6, Page 15b-4**).
6. Remove the two end cap bolts.
7. Remove the end cap and armature from the motor frame (**Figure 15b-7, Page 15b-4**).
8. Inspect the brush springs for proper tension. **See Motor Brush, Spring, and Terminal Insulator Inspection on page 15b-8.**
9. Remove the armature from the end cap bearing. **See following CAUTION and NOTE.**

## **⚠ CAUTION**

- **Removing the armature from the end cap requires two people: one to operate the press, and another to hold the armature. Failure to heed this CAUTION could result in personal injury and/or damage to the armature resulting from an unsupported armature falling after it becomes disengaged from the end cap bearing.**

**NOTE:** *Replacement of the end cap bearing is recommended if the armature is removed.*

- 9.1. Place the end cap in a press with the armature facing down.
- 9.2. Place a bearing press tool with an outer diameter smaller than that of the armature shaft between the press ram and the armature shaft (**Figure 15b-8, Page 15b-6**).
- 9.3. Have an assistant support the armature while the press is activated.
10. Inspect the armature for wear and damage. **See Armature Inspection and Testing on page 15b-6.**
11. Inspect the motor frame and field windings. **See Motor Frame and Field Windings Inspection on page 15b-8.**
12. Remove the brush rigging.
  - 12.1. Mark the brush terminal posts (A1 and A2).
  - 12.2. Remove the two nuts securing the brush terminals (A1 and A2) to the end cap (**Figure 15b-9, Page 15b-6**).
  - 12.3. Remove the two screws and the brush rigging to the end cap (**Figure 15b-10, Page 15b-6**).
13. Inspect the terminal insulators. **See Terminal Insulator Inspection on page 15b-9.**
14. Remove the bearing from the end cap.
  - 14.1. Remove the retaining ring that secures the bearing in the end cap (**Figure 15b-11, Page 15b-6**).
  - 14.2. Use an arbor press to remove the bearing from the end cap.
15. Inspect the bearing for wear and damage. **See Bearing Inspection on page 15b-9.**



Figure 15b-8 Armature Removal

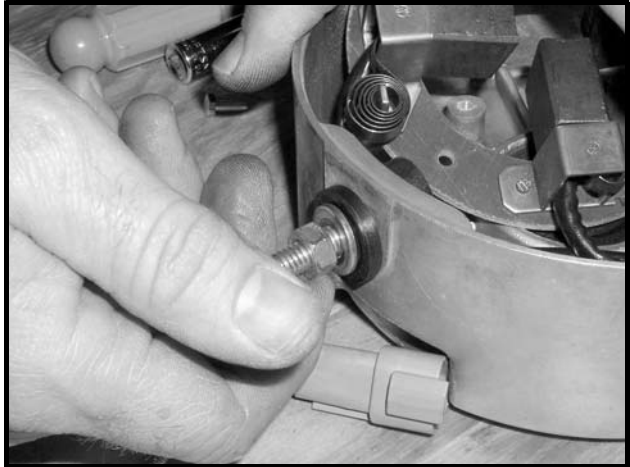


Figure 15b-9 A1 and A2 Terminals



Figure 15b-10 Brush Rigging



Figure 15b-11 Bearing Retaining Ring

## MOTOR COMPONENT TESTING AND INSPECTION

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See General Warnings, Section 1, Page 1-1.

### ARMATURE INSPECTION AND TESTING

1. Remove the motor from the vehicle. See **Motor Removal** on page 15b-2.
2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.

### Visual Inspection

- Burned, charred or cracked insulation
- Improperly cured varnish
- Thrown solder
- Flared armature windings

- Damaged armature core laminations
- Worn, burned or glazed commutators
- Dirty or oily commutators
- Raised commutator bars
- Worn armature bearing or shaft

A dirty or oily commutator should be cleaned and wiped dry. Abnormalities identified during the inspection can help determine original cause of failure. Slight roughness of the commutator can be polished smooth with 400 grit or finer sandpaper. **See following CAUTION and NOTE.**

### **CAUTION**

- **Do not use emery cloth to polish the commutator. Particles of emery are conductive and may short-circuit the commutator bars. Do not use oil or lubricants on the commutator or brushes.**

**NOTE:** Oil on the commutator may indicate a faulty transaxle input shaft oil seal.

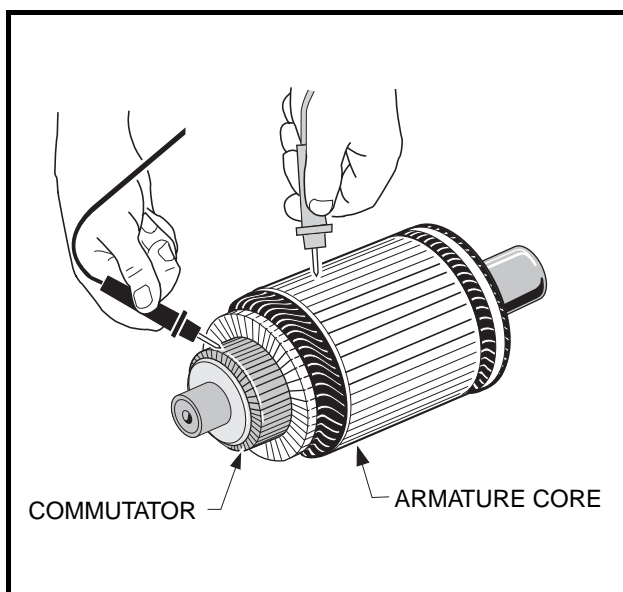
## Armature Ground Test

### **CAUTION**

- **Do not submerge the armature in solvent.**

**NOTE:** Before testing the armature, wipe it clean with a clean cloth. Remove any carbon dust and metal particles from between the commutator bars.

1. With a multimeter set to 200 ohms, place one probe on the commutator and the other on the armature core. The multimeter should indicate no continuity (**Figure 15b-12, Page 15b-7**). If the reading is incorrect, replace the armature.



**Figure 15b-12 Armature Test**

## MOTOR FRAME AND FIELD WINDINGS INSPECTION

1. Remove the motor from the vehicle. **See Motor Removal on page 15b-2.**
2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.
3. Burned or scorched insulation on the field windings indicates the motor has overheated due to overloads or grounded or shorted coil windings. If the insulation on the field windings is scorched, replace the motor or the stator shell assembly.

## MOTOR BRUSH, SPRING, AND TERMINAL INSULATOR INSPECTION

### Brush Spring Tension Test

1. Remove the motor from the vehicle. **See Motor Removal on page 15b-2.**
2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.
3. Inspect the brush springs (14) (**Figure 15b-15, Page 15b-10**). Replace springs that are discolored from heat (light gold or blue tinted).
4. Test the brush springs for proper tension.
  - 4.1. Place a C-shaped steel plate on a scale.
  - 4.2. Place the end of the C-shaped plate so that it is between the spring and the brush as shown (**Figure 15b-13, Page 15b-9**).
  - 4.3. Gently pull the scale to obtain the spring tension reading. **See following CAUTION.**

### **CAUTION**

- **When checking brush spring tension, do not over-extend the spring. Using excessive force will damage the spring.**

- 4.4. Replace springs which require a force of less than 35 oz. (990 grams) (**Figure 15b-13, Page 15b-9**). **See following NOTE.**

**NOTE:** *When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging. Refer to Motor Assembly for brush installation. **See Motor Assembly on page 15b-11.***

*When replacing brushes, replace all four brushes. Never replace only two.*

*Install the brushes in the same rigging 180° apart from each other.*

### Brush Inspection

1. Remove the motor from the vehicle. **See Motor Removal on page 15b-2.**
2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 15b-4.
3. Inspect the brushes (13) for damage or excessive wear (**Figure 15b-15, Page 15b-10**). Replace brushes if required. **See preceding NOTE.**
4. Use dial calipers or a micrometer to measure the brush length. The minimum-allowable brush length is 0.62 inches (16 mm). Replace the set of brushes as required. **See preceding NOTE.**

## Terminal Insulator Inspection

1. Remove the motor from the vehicle. **See Motor Removal on page 15b-2.**
2. Remove the terminal insulators by performing steps 1 through 12 of Motor Disassembly on page 15b-4.
1. Inspect the insulators (4 and 6) for cracks or other damage (**Figure 15b-15, Page 15b-10**). Replace insulators as required.

## Bearing Inspection

**NOTE:** Replacement of the end cap bearing is highly-recommended if the end cap is removed from the motor. The following procedure is provided as a guideline for determining general bearing failure.

1. Remove the motor from the vehicle. **See Motor Removal on page 15b-2.**
2. Remove the bearing by performing steps 1 through 14 of Motor Disassembly on page 15b-4.
3. Use a clean cloth to wipe the carbon dust off of the bearing. Inspect the bearing by spinning it by hand and checking for both axial (A) and radial (B) play (**Figure 15b-14, Page 15b-9**).
4. Replace the bearing if it is noisy, does not spin smoothly, or has excessive play. Check the bearing and replace if rusted, worn, cracked, or if there is an abnormal color change in the metal of the bearing.

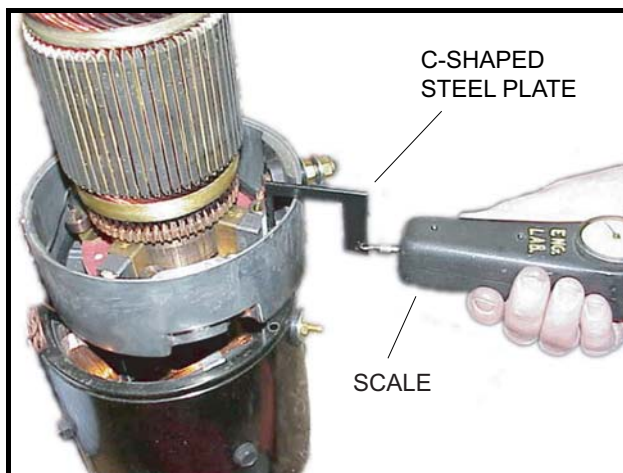


Figure 15b-13 Brush Spring Tension Test

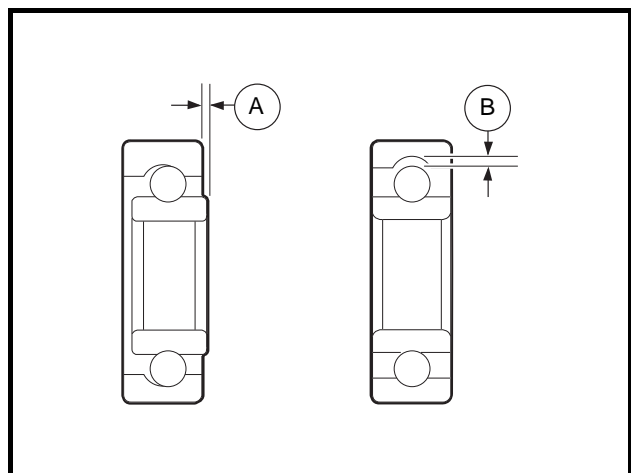


Figure 15b-14 Bearing Inspection

## Speed Sensor Magnet Inspection

Inspect the speed sensor magnet (24) for rust, wear, and cracks (**Figure 15b-15, Page 15b-10**). Replace the magnet if necessary.

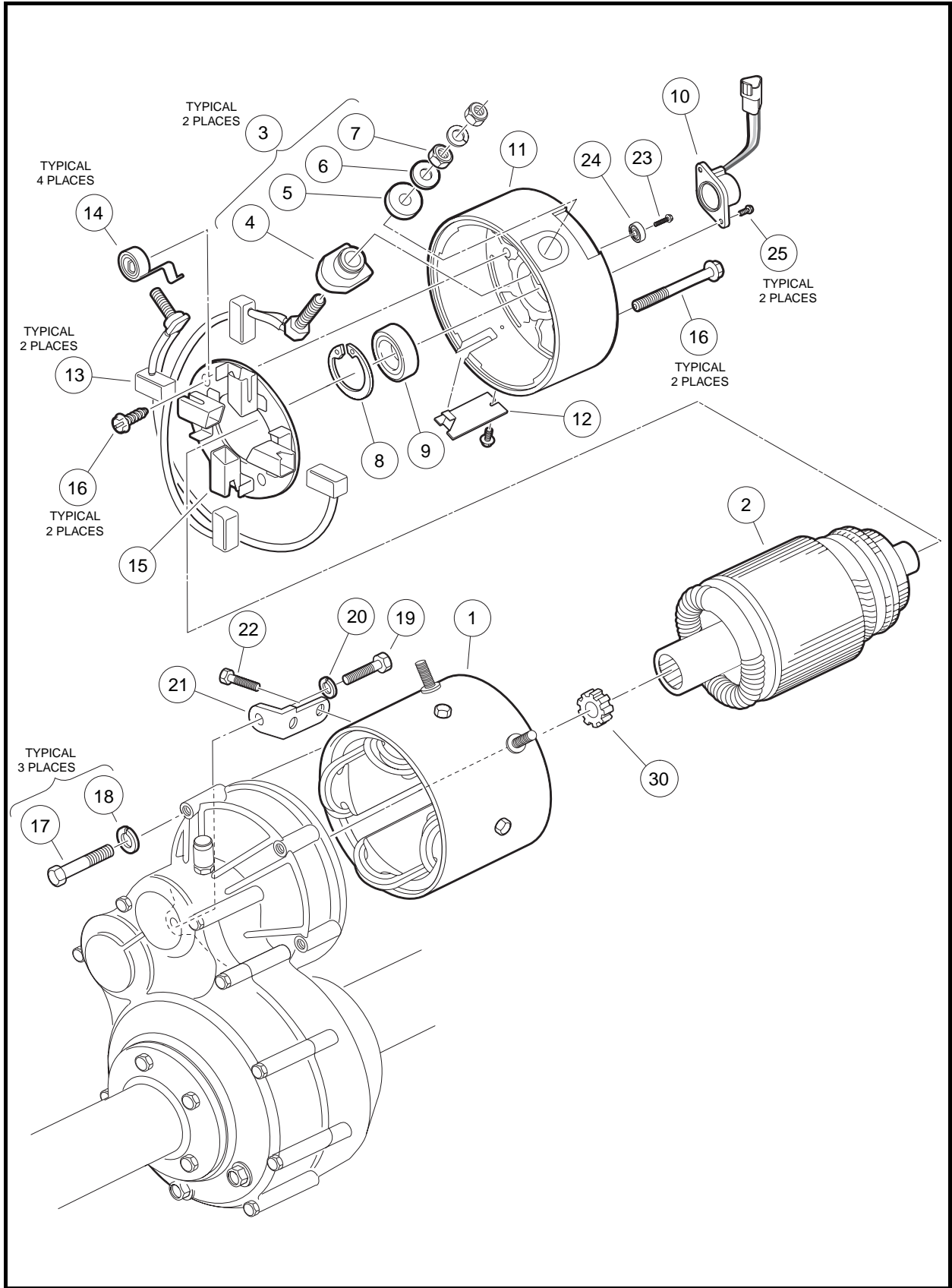


Figure 15b-15 Motor



## RECONDITIONING THE MOTOR

See General Warnings, Section 1, Page 1-1.

Motor reconditioning must be performed by a qualified motor repair technician. The use of proper tools and procedures is absolutely essential for successful motor reconditioning.

### Motor Specifications

Any rework must be performed by a qualified technician. Motor service specifications are listed in the following table.

ITEM	SERVICE LIMIT
Commutator diameter (minimum)	2.80 in. (71.10 mm)
Commutator concentric with armature shaft within	0.003 in. (0.08 mm)
Bar to bar runout should not exceed	0.005 in. (0.013 mm)
Undercut of segment insulator after machining commutator	0.040 in. (1.0 mm)
Armature resistance at 75 °F (24 °C)	0.012 ohms between bar 1 and bar 15
Field coil resistance at 75 °F (24 °C)	1.75 ohms

## MOTOR ASSEMBLY

See General Warnings, Section 1, Page 1-1.

1. Replace the bearing.
  - 1.1. Use an arbor press to install a new bearing into the end cap. To help avoid damaging the bearing, apply pressure only to the outer race when installing the bearing.
  - 1.2. Install the retaining ring to secure the bearing (**Figure 15b-11, Page 15b-6**).
2. Install the brushes and brush rigging. **See following NOTE.**

**NOTE:** When installing new brushes, remove and replace brushes one at a time. This method ensures the terminals and brushes will be properly positioned in the rigging.

When replacing brushes, replace all four brushes. Never replace only two.

Install the brushes in the same rigging 180° apart from each other.

- 2.1. Insert the brushes into the brush rigging as shown (**Figure 15b-16, Page 15b-12**).
- 2.2. Insert the two terminal posts through insulators (4) in the end cap (11) wall at the A1 and A2 positions (**Figure 15b-15, Page 15b-10**).
- 2.3. Place external insulators (5) and washers (6) on each terminal post, and secure terminal with nuts (7). Tighten nuts (7) to 100 in-lb (11.3 N·m). Ensure that the terminal posts do not rotate when tightening the nuts (**Figure 15b-15, Page 15b-10**).
- 2.4. Secure the brush rigging to the end cap with two screws. Tighten the screws to 25 in-lb (2.8 N·m) (**Figure 15b-10, Page 15b-6**).

**Motor Assembly, Continued:**

Figure 15b-16 Brush Rigging



Figure 15b-17 Retracted Brushes

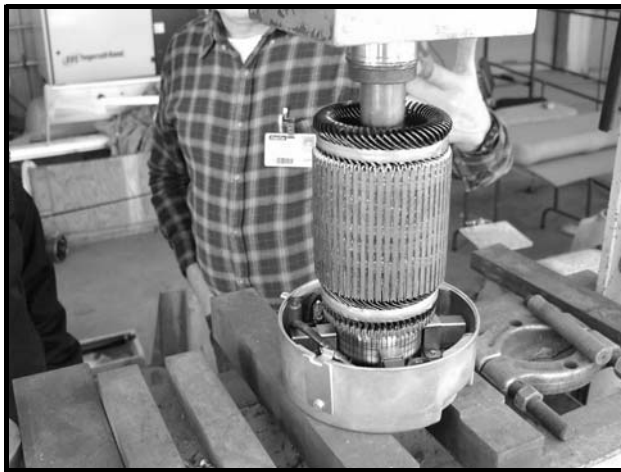


Figure 15b-18 Armature Installation

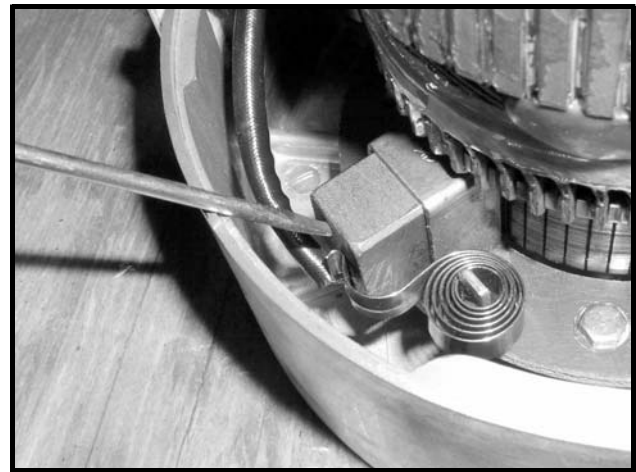


Figure 15b-19 Brush Setting

- 2.5. One at a time, push the brushes back until they are completely retracted into their mounting slots and the spring pressure holds them in the retracted position as shown (**Figure 15b-17, Page 15b-12**).
3. With the brushes retracted, use an arbor press to press the armature shaft into the end cap bearing (**Figure 15b-18, Page 15b-12**). See following **CAUTION**.

**CAUTION**

- **Make sure the brushes are held back. Do not allow the brushes to support the weight of the commutator. The brushes can be easily damaged by this weight.**
4. Gently press each brush with a small screwdriver until the spring rests on the end of each brush as shown (**Figure 15b-19, Page 15b-12**).
  5. Align the match marks on the end cap and the motor frame (1) and secure with two bolts (16) (**Figure 15b-15, Page 15b-10**). Tighten bolts to 130 in-lb (14.7 N·m).
  6. Install the speed sensor magnet (24) with screw (23). Tighten to 65 in-lb (7.3 N·m).
  7. Install the speed sensor (10) with screws (25). Tighten to 25 in-lb (2.8 N·m).
  8. Make sure the armature turns freely. If it does not turn freely, disassemble the motor to find the problem.

## MOTOR INSTALLATION

### See General Warnings, Section 1, Page 1-1.

1. Clean the transaxle input shaft.
  - 1.1. Spray the input shaft thoroughly with CRC® Brakleen™ or equivalent brake cleaner degreaser.
  - 1.2. Wipe input shaft with a clean cloth.
  - 1.3. Inspect the grooves of the input shaft and remove any remaining debris.
  - 1.4. Repeat steps 1.1 through 1.3 until input shaft is clean.
2. Lubricate the transaxle input shaft.
  - 2.1. Squeeze approximately 1/2 inch (1.3 cm) of moly-teflon lubricant (CCI P/N 102243403) from tube onto a putty knife as shown (**Figure 15b-20, Page 15b-13**).
  - 2.2. Rotate wheels to rotate input shaft.
  - 2.3. Apply motor coupling grease evenly to the rotating input shaft starting at approximately 1/8 inch (3.1 mm) from the end of the shaft and working back toward the transaxle (away from the end of the shaft) (**Figure 15b-21, Page 15b-13**).
  - 2.4. The grease should be evenly distributed in the grooves to a width of approximately 3/8 inch (9.5 mm).
  - 2.5. Use a flat screwdriver to clean the grease out of one of the grooves and allow air to escape when the motor is pushed onto the input shaft.

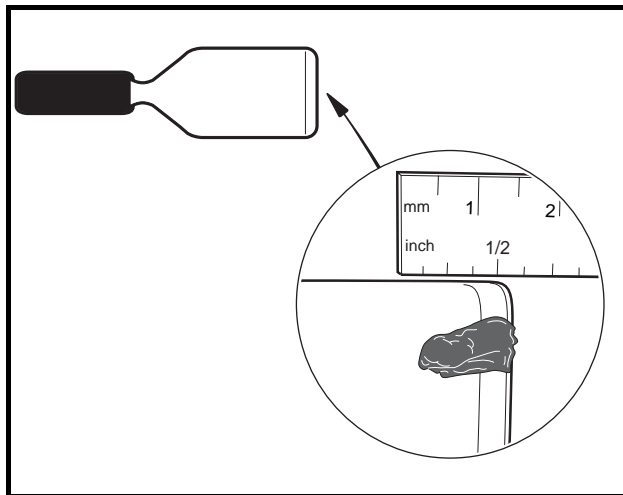


Figure 15b-20 Grease on Putty Knife

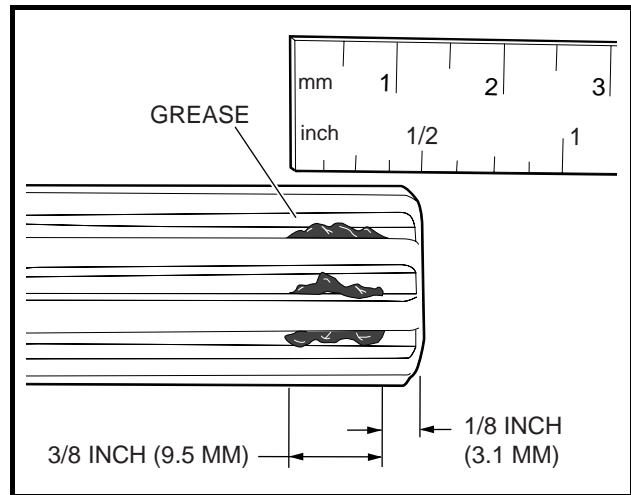


Figure 15b-21 Application of grease to Input Shaft Grooves

- 2.6. Check the chamfer and end of the input shaft to ensure these areas are completely clean of grease as shown (**Figure 15b-22, Page 15b-14**).
3. Install the molded bumper.
  - 3.1. With the flat side toward the bottom of the coupling, install the molded bumper (30) into the motor coupling (**Figure 15b-15, Page 15b-10**). **See following NOTE.**

**NOTE:** The motor coupling and the new molded bumper must be free of grease and debris.

- 3.2. Ensure that the installed bumper is seated at the bottom of the coupling.

**Motor Installation, Continued:**

4. Install motor on transaxle.
  - 4.1. Slide the motor coupling onto the transaxle input shaft. **See following NOTE.**

**NOTE:** The coupling will push any excess grease on the input shaft along the shaft toward the transaxle.

When the motor is pushed onto the input shaft, the motor housing will not bottom out against the transaxle housing (**Figure 15b-15, Page 15b-10**). There will be approximately 1/16 inch (1.6 mm) gap between the motor adapter ring and transaxle housing as shown (**Figure 15b-23, Page 15b-14**).

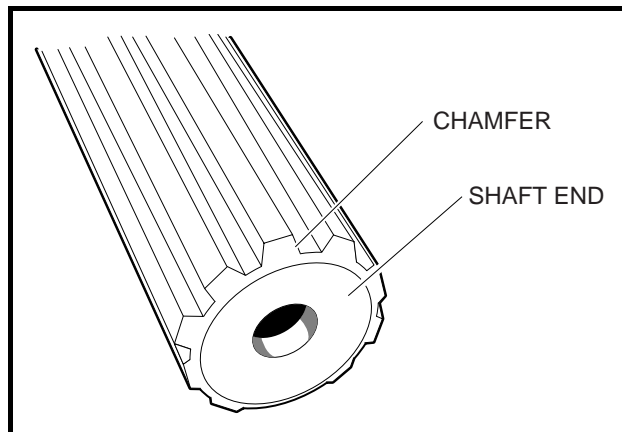


Figure 15b-22 Clean Chamfer and Input Shaft End

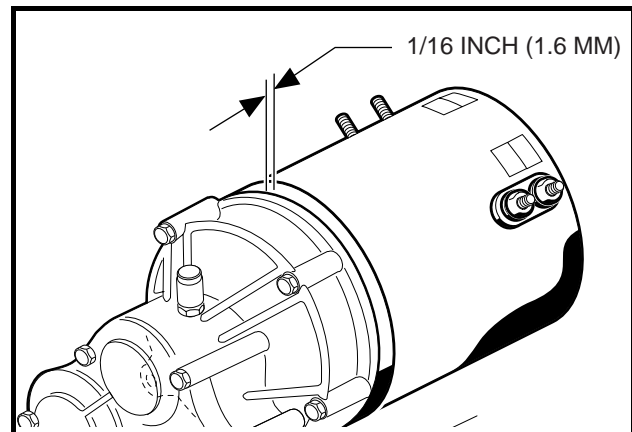


Figure 15b-23 Gap at Motor and Transaxle

- 4.2. Loosely install the four bolts that secure the motor to the transaxle. Do not tighten.
- 4.3. Begin finger-tightening the bolts (1 and 2) in the sequence indicated (**Figure 15b-24, Page 15b-15**). Continue tightening by hand until the motor is seated in the transaxle housing. **See following CAUTION and NOTE.**

**CAUTION**

- Make sure the motor is properly seated in the transaxle housing.

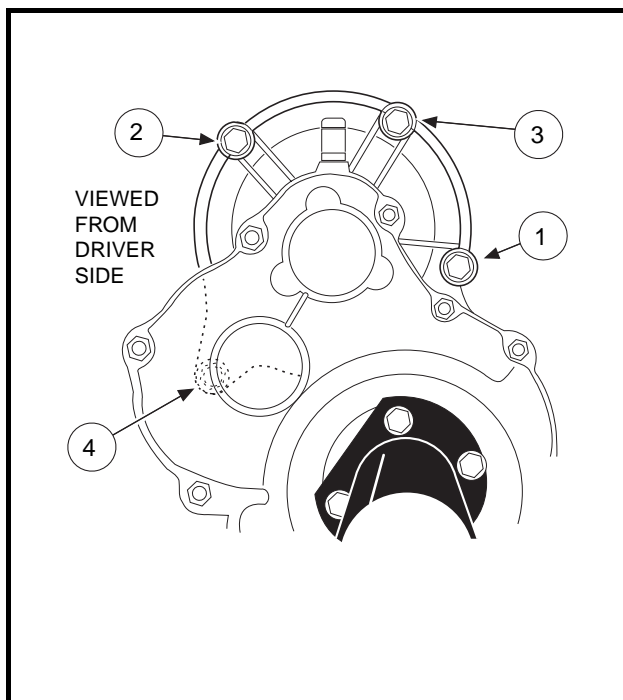
**NOTE:** Failure to install and tighten the motor mounting bolts in the proper sequence and to the proper tightness may result in motor noise during operation.

- 4.4. Tighten the right bolt (1) to 65 in-lb (7.3 N·m).
- 4.5. Tighten the left bolt (2) to 65 in-lb (7.3 N·m).
- 4.6. Tighten the center bolt (3) to 65 in-lb (7.3 N·m) (**Figure 15b-24, Page 15b-15**).
- 4.7. Tighten the bolt (4) inserted through the L-bracket to 155 in-lb (17.5 N·m) (**Figure 15b-24, Page 15b-15**).
- 4.8. Install the motor wires, making sure they are connected to the correct motor terminals and that the terminal orientation is correct. **See Wiring Diagrams, Section 11, Page 11-2.** Tighten the terminal retaining nuts to 65 in-lb (7.3 N·m).
- 4.9. Secure the white, orange, green, and blue wires with a wire tie so that none of the motor wires will scrub the motor or transaxle when the vehicle is in operation.
- 4.10. Connect the three-pin speed sensor wire to the vehicle wire harness.

5. If using a chain hoist, lower the vehicle and guide the leaf springs into the shackles. If using a floor jack, raise the transaxle until the leaf springs can be guided into the shackles.
6. Insert the mounting bolts through the spring shackles and the bushings in the leaf spring eyes and install lock nuts. Tighten the bolts to 23 ft-lb (31 N·m). **See Section 9 – Rear Suspension in the appropriate maintenance and service manual.**
7. Install the shock absorbers. Tighten nut until rubber bushing expands to the diameter of the cup washer.
8. If removed, install wheels and finger tighten the lug nuts.
9. Lift vehicle and remove jack stands. Lower vehicle to the floor and tighten lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).
10. Place the Tow/Run switch in the TOW position and connect the batteries, positive (+) cable first. Tighten battery terminals to 110 in-lb (12.4 N·m) and coat terminals with Battery Terminal Protector Spray (CCI P/N 1014305) to minimize corrosion.
11. Place the Tow/Run switch in the RUN position.
12. Inspect the vehicle for proper operation. **See following WARNING.**

### **⚠ WARNING**

- **Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.**
- **Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.**
- **Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.**



**Figure 15b-24 Motor Mount**



## SECTION 16 – TRANSAXLE (TYPE G)

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### **▲ DANGER**

- See General Warnings, Section 1, Page 1-1.

### **▲ WARNING**

- See General Warnings, Section 1, Page 1-1.

## LUBRICATION

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**See General Warnings, Section 1, Page 1-1.**

There are two plugs located on the lower half of the transaxle housing. The upper plug (21) (as viewed when the vehicle is on a level surface) is used as a lubricant level indicator (**Figure 16-5, Page 16-3**). When the vehicle is parked on a level surface, the lubricant level should be even with the bottom of the hole. The lower plug (22) is for draining the lubricant. When draining the lubricant, the upper plug should be removed so the lubricant will drain faster. Be sure the drain plug is installed before filling. **See following NOTE.**

***NOTE:** Recycle or dispose of used oil or lubricant in accordance with local, state, and federal regulations.*

## AXLE BEARING AND SHAFT

---

**See General Warnings, Section 1, Page 1-1.**

### AXLE SHAFT

#### Axle Shaft and Oil Seal Removal

1. Disconnect the battery cables as instructed. **See WARNING “To avoid unintentionally starting...” in General Warnings, Section 1, Page 1-2.**
2. Place chocks at the front wheels. Loosen lug nuts on rear wheels and lift the rear of the vehicle with a chain hoist or floor jack. Place jack stands under the axle tubes to support the vehicle. **See WARNING “Lift only one end...” in General Warnings, Section 1, Page 1-2.**
3. Remove the rear wheel and brake drum. **See Section 6 – Wheel Brake Assemblies and Section 8 – Wheels and Tires.**
4. Use 90° internal snap ring pliers to remove the internal retaining ring (6) from the axle tube (**Figure 16-5, Page 16-3**). **See also Figure 16-1, Page 16-2.**
5. Remove the axle, retaining ring, and bearing assembly by pulling the axle straight out of the housing.
6. If necessary, remove the axle oil seal and adapter ring.
  - 6.1. Use a bearing puller (CCI P/N 1016417) to remove the axle seal and adapter ring from the axle tube (**Figure 16-2, Page 16-2**). **See following CAUTION and NOTE.**

### **CAUTION**

- **Do not scar or damage the inside surfaces of the tube when removing the oil seal and adapter ring. A damaged tube might have to be replaced.**

**Axle Shaft and Oil Seal Removal, Continued:**

**NOTE:** Do not discard the adapter ring. If the adapter ring is lost or damaged, the axle tube will have to be replaced.

- 6.2. Use a press to separate the axle oil seal (15) from the adapter ring (39) (**Figure 16-3, Page 16-2**). Retain the adapter ring and discard the oil seal.
7. Inspect the axle shaft assembly to be sure the bearing and collar have not slipped and are still seated against the shoulder on the axle shaft.
8. Inspect bearing (5) (**Figure 16-5, Page 16-3**). If the bearing in a Type G transaxle is worn or damaged, the entire axle shaft assembly (1 or 2) must be replaced.

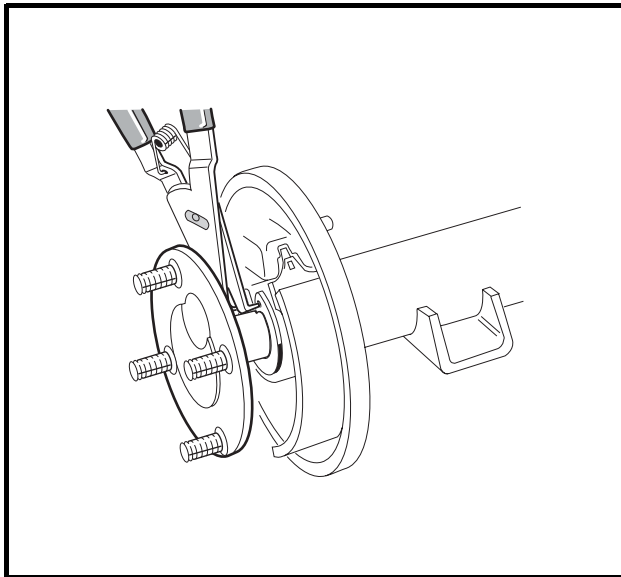


Figure 16-1 Axle Tube

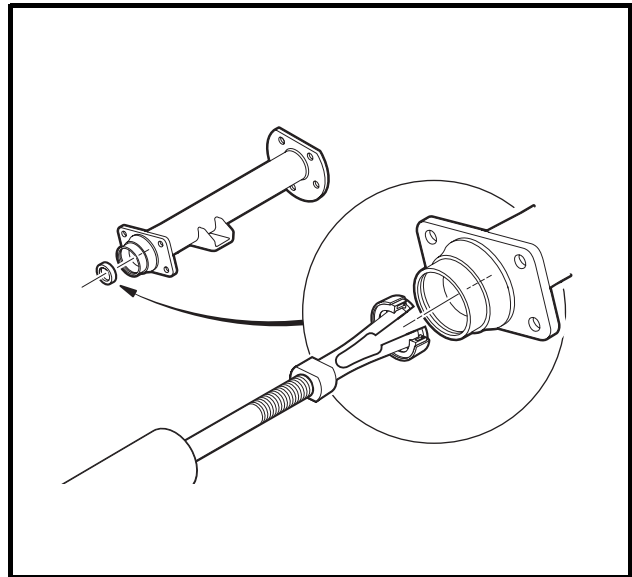


Figure 16-2 Axle Seal and Adapter Ring Removal

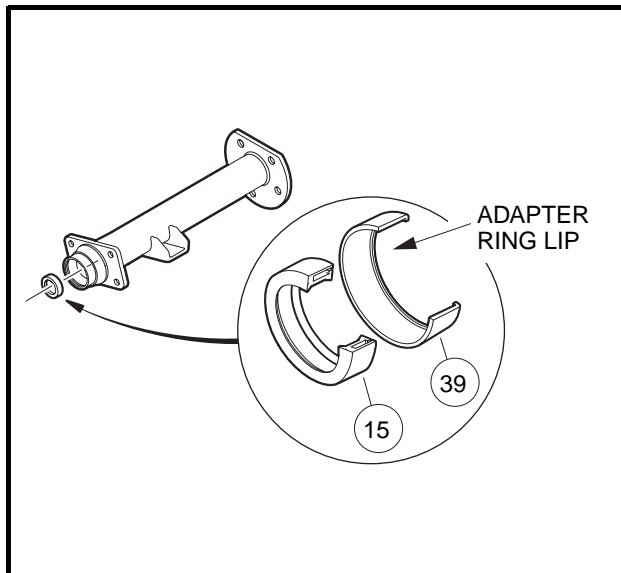


Figure 16-3 Axle Seal and Adapter Ring

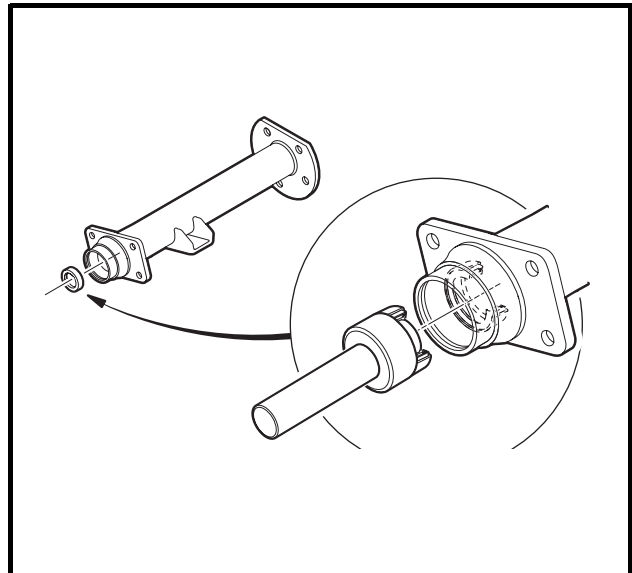


Figure 16-4 Axle Seal and Adapter Ring Installation



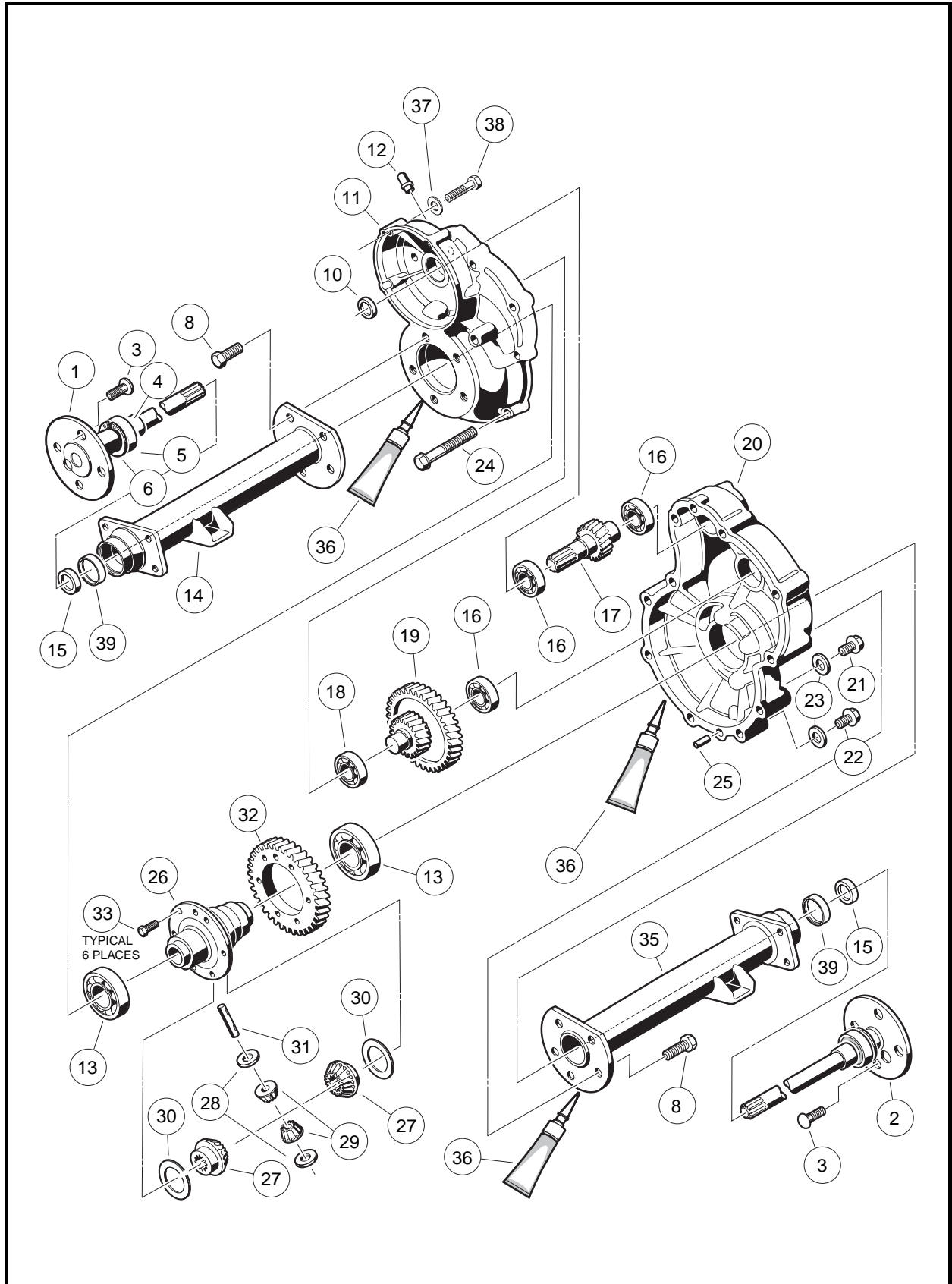


Figure 16-5 Transaxle – Type G

## Axle Shaft and Oil Seal Installation

1. If previously removed, install a new oil seal.
  - 1.1. Clean seal seat in the adapter ring (39) (**Figure 16-3, Page 16-2**).
  - 1.2. Place a new seal (15) in the adapter ring with the seal lip facing toward the adapter ring lip (**Figure 16-3, Page 16-2**). Use an axle seal tool (CCI P/N 1014162) and mallet to tap it in until it seats firmly in position (**Figure 16-3, Page 16-2**). A hydraulic press may also be used with the axle seal tool.
  - 1.3. Clean adapter ring seat(s) in the axle tube (14 or 35) (**Figure 16-5, Page 16-3**).
  - 1.4. Apply Loctite<sup>®</sup> 603 to the outer diameter of the adapter ring.
  - 1.5. Place the oil seal and adapter ring assembly into the axle tube with the seal lip facing away from the bearing (**Figure 16-4, Page 16-2**). Use an axle seal tool (CCI P/N 1014162) and mallet to tap it in until it seats firmly in position. **See following CAUTION.**

### **CAUTION**

- **Clean any residual oil from the exposed end of the axle shaft and from the oil seal area prior to installing the axle shaft to prevent oil from coming in contact with brakes.**
2. Install the rear axle into the transaxle. **See following NOTE.**
    - 2.1. Insert the shaft, splined end first, through the seal and into the axle tube. Be careful not to damage the seal on the inside of the axle tube hub. Advance the shaft through to the bearing on the shaft, then rotate it to align the shaft splines with the splined bore of the differential side gear (27) (**Figure 16-5, Page 16-3**). Continue advancing the shaft until the bearing on the axle is firmly seated within the axle tube hub seat.
    - 2.2. Use a pair of snap ring pliers to install the retaining ring (6) inside axle tube hub so that it seats against the axle bearing assembly and into the machined slot in the inside wall of the axle tube hub (**Figure 16-5, Page 16-3**).
- NOTE:** *If the retaining ring (6), axle bearing (5), or sleeve (4) must be replaced, the entire axle shaft assembly (1 or 2) must be replaced (**Figure 16-5, Page 16-3**).*
- 2.3. Place a 1/4 to 3/8-inch (6 to 10 mm) diameter rod against the retaining ring and tap lightly at four to five locations around the retaining ring to ensure it is properly seated. **See following WARNING.**

### **WARNING**

- **Be sure the retaining ring is properly seated in its groove. If the ring is not properly installed, the axle assembly will separate from the transaxle and damage the axle assembly and other components. Loss of vehicle control could result, causing severe personal injury or death.**
3. If a new oil seal was installed, allow 24 hours before operating the vehicle to allow the Loctite 603 to fully cure.

## AXLE BEARING

Do not remove the axle bearing (5) from a Type G transaxle. If bearing is worn or damaged, the entire axle assembly (1 or 2) must be replaced (**Figure 16-5, Page 16-3**).

## TRANSAXLE

See General Warnings, Section 1, Page 1-1.

### TRANSAXLE REMOVAL

1. Disconnect the battery cables as instructed. See **WARNING “To avoid unintentionally starting...”** in General Warnings, Section 1, Page 1-2.
2. Place chocks at the front wheels and slightly loosen lug nuts on both rear wheels. See **WARNING “Lift only one end...”** in General Warnings, Section 1, Page 1-2.
3. Place a floor jack under the transaxle and raise the rear of the vehicle. Position jack stands under the aluminum frame rails forward of the spring mount. Lower the vehicle to let the jack stands support the vehicle (Figure 16-6, Page 16-5). See **WARNING “Lift only one end of the vehicle...”** in General Warnings, Section 1, Page 1-1.
4. Remove the rear wheels, then thread one lug nut onto a stud on each rear hub. This will keep the brake drums on the hubs.
5. Remove the bow tie pins (1) and brake cable clevis pins (3). Use tool (CCI P/N 10255501) to compress tangs on cable end and remove cable end from bracket (4) (Figure 16-7, Page 16-5).

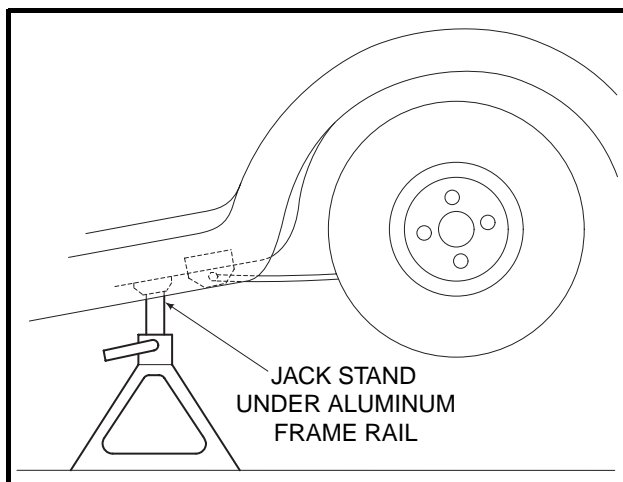


Figure 16-6 Vehicle Supported on Jack Stands

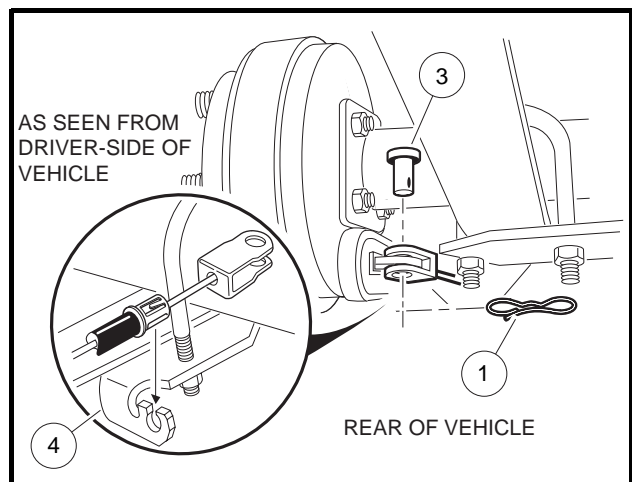


Figure 16-7 Brake Cable

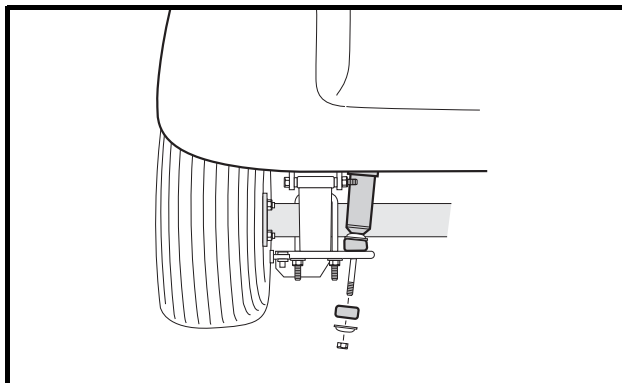


Figure 16-8 Disconnect Shocks

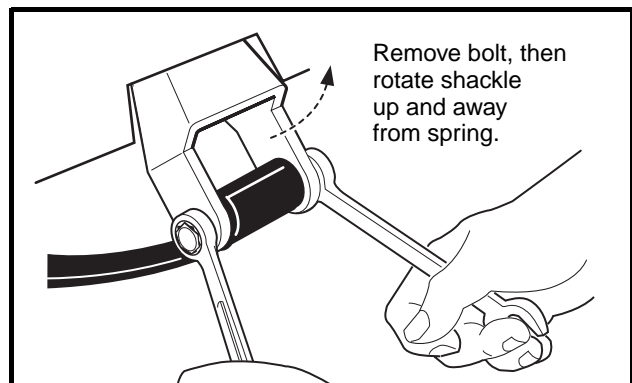


Figure 16-9 Shackles

**Transaxle Removal, Continued:**

6. Disconnect the shock absorbers from their lower mounts (**Figure 16-8, Page 16-5**).
7. Disconnect the four motor wires. Use two wrenches to prevent the post from turning.
8. With a floor jack supporting the transaxle, remove lower spring shackle nuts and bolts. Position shackles so they are clear of springs (**Figure 16-9, Page 16-5**).
9. If a chain hoist was used to raise the vehicle, lift the vehicle high enough to permit easy access and clearance for removal of the motor. If a floor jack was used to raise the vehicle, lower the transaxle enough to permit easy access and clearance for removal of the motor.
10. Remove the three motor mounting bolts (**Figure 16-11, Page 16-6**) and the motor positioning bolt (**Figure 16-12, Page 16-7**), mounting the motor to the transaxle. **See following CAUTION.**

**⚠ CAUTION**

- **Do not position fingers under motor when sliding motor off of the input shaft. Fingers may get pinched when motor disengages.**

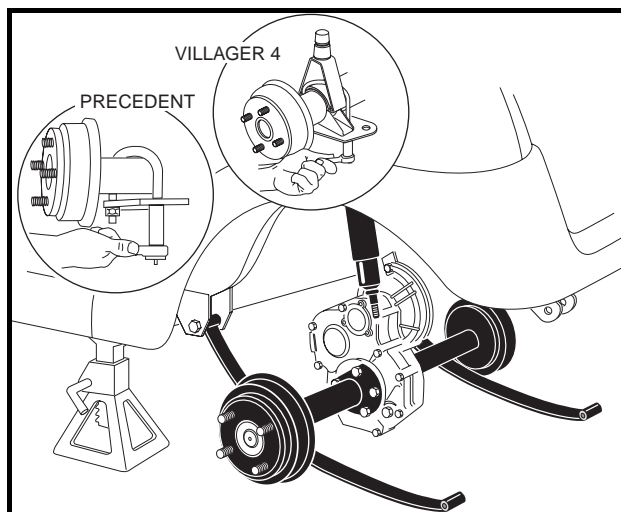


Figure 16-10 Leaf Springs

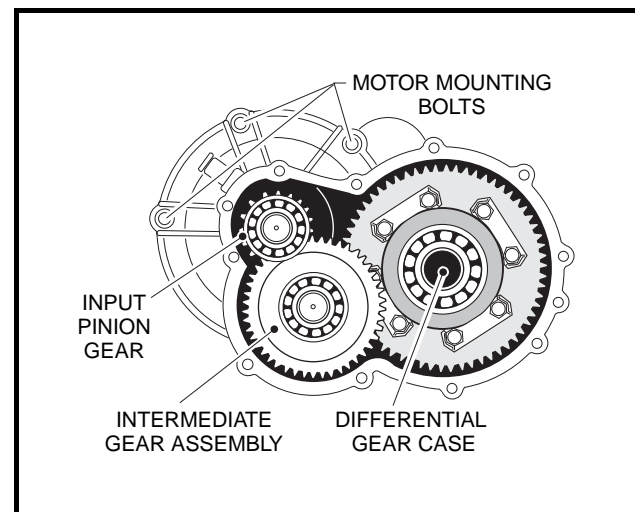


Figure 16-11 Motor Mounting Bolts

11. Carefully remove the motor from the transaxle. Slide the motor away from the transaxle until the motor spline becomes disengaged from the input shaft, then lift motor out. **See preceding WARNING.**
12. If a floor jack was used, pull floor jack from beneath the transaxle and allow the springs to rest on the floor.
13. Remove the U-bolts attaching the transaxle to the leaf springs (**Figure 16-10, Page 16-6**).
14. Carefully lift each end of the transaxle off its positioning pin (on the leaf spring) and slide the transaxle to the rear and out of the vehicle.
15. Drain the lubricant from the transaxle and remove the axle shafts. **See Axle Shaft and Oil Seal Removal on page 16-1. See following NOTE.**

**NOTE:** *Recycle or dispose of used oil or lubricant in accordance with local, state, and federal regulations.*

16. Remove the brake assemblies if required. **See Brake Cluster Removal, Section 6, Page 6-9.**

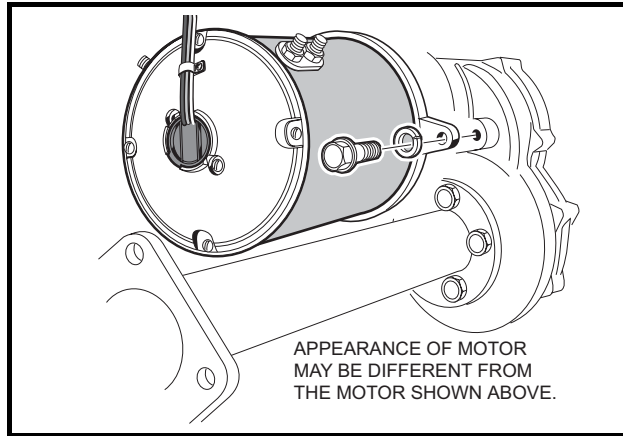


Figure 16-12 Motor Positioning Bolt

## TRANSAXLE DISASSEMBLY, INSPECTION, AND ASSEMBLY

See General Warnings, Section 1, Page 1-1.

### TRANSAXLE DISASSEMBLY AND INSPECTION

1. To detach axle tubes (14 and 35) from the transaxle housing, remove the bolts (8) (**Figure 16-5, Page 16-3**).
2. Remove 11 bolts (24) that hold housing together.
3. Pull the halves of the housing (11 and 20) apart. If necessary, tap lightly on the spline of the input pinion (17). **See following CAUTION.**

#### **CAUTION**

- To prevent damage to the housing mating seal surfaces, use caution when separating halves.
4. Remove input pinion gear (17) by pulling gear out while rocking intermediate gear assembly (19). Lift intermediate gear assembly and differential gear case unit out simultaneously (**Figure 16-5, Page 16-3**). **See following CAUTION.**

#### **CAUTION**

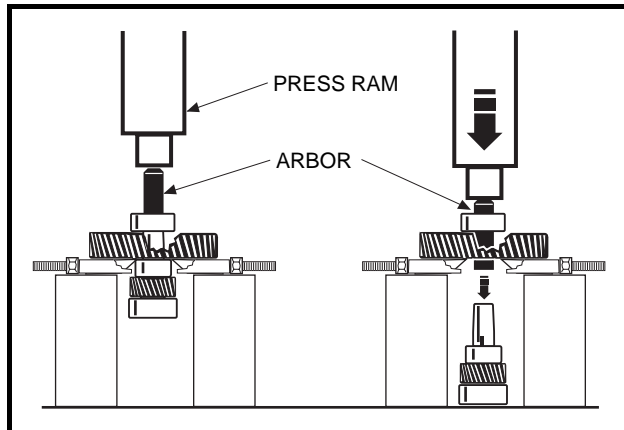
- Do not damage gears. Use extreme care when handling them.
5. Use a bearing puller or arbor press to remove bearings (16) from the input pinion gear. If the oil seal (10) is damaged, replace it (**Figure 16-5, Page 16-3**). **See also Figure 16-13, Page 16-8. See following CAUTION.**

#### **CAUTION**

- Do not reuse bearings after removing them. Replace bearings with new ones.
6. To disassemble the intermediate gear assembly, press off together the bearing (16) and the gear (19) (**Figure 16-5, Page 16-3**). **See also Figure 16-13, Page 16-8.**

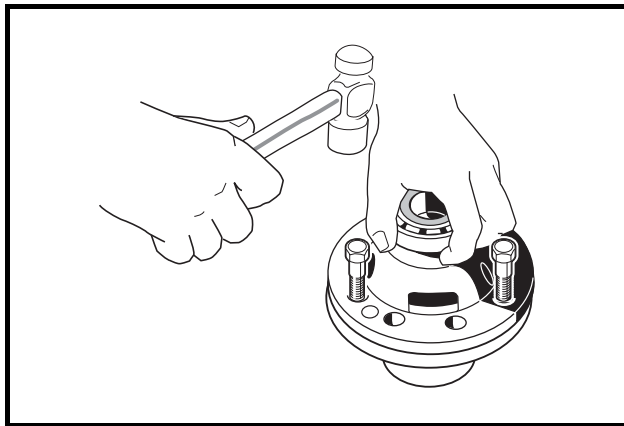
**Transaxle Disassembly and Inspection, Section 16, Page 16-8**

7. Press the bearing (18) off the intermediate gear assembly (**Figure 16-5, Page 16-3**).



**Figure 16-13** Intermediate Gear Assembly

8. Disassemble the differential gear case:
- 8.1. Remove the hex bolts (33) and the ring gear (32) from the differential case (**Figure 16-5, Page 16-3**).
  - 8.2. Remove the ring gear.
  - 8.3. Separate the differential gear case housing. If necessary, install two of the hex bolts (removed previously in step 8.1.) into the differential gear unit and, while holding the unit slightly above the work area, lightly tap the bolt heads (**Figure 16-14, Page 16-8**). Remove the two bolts.



**Figure 16-14** Separate Housing

- 8.4. Remove the differential pin (31) by pushing pin through differential gear case from one side (**Figure 16-5, Page 16-3**). See also **Figure 16-15, Page 16-9**.
- 8.5. Remove the idler gears and thrust plates (1 and 2) (**Figure 16-16, Page 16-9**).

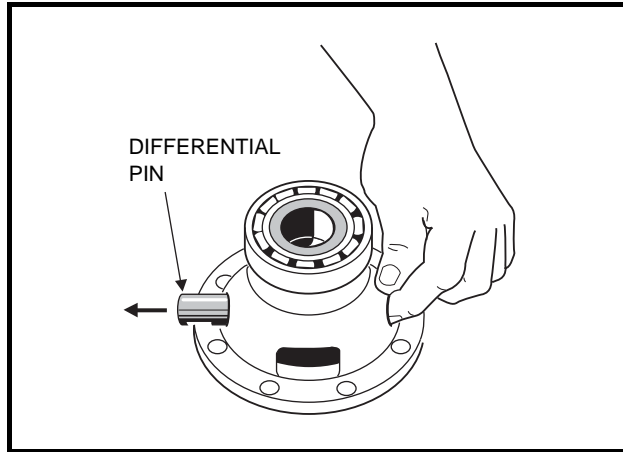


Figure 16-15 Differential Pin

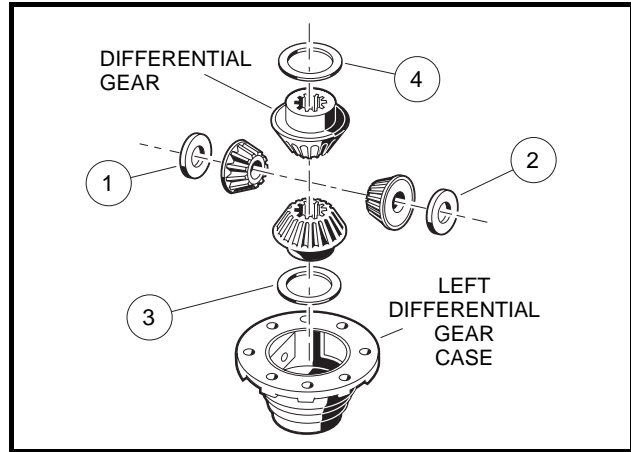


Figure 16-16 Left Differential

8.6. Remove the differential gears and thrust plates (3 and 4).

8.7. Inspect the bearings (13) of the differential case (26) and replace them if they are damaged (Figure 16-5, Page 16-3). To remove them, press them off. **See following CAUTION.**

### **CAUTION**

- Do not reuse bearings after removing them. Replace bearings with new ones.

9. Inspect parts for wear or damage. Any worn or damaged parts should be replaced. **See following NOTE.**

**NOTE:** Damaged or worn gears should be replaced as sets.

## TRANSAXLE ASSEMBLY

### **CAUTION**

- Do not press against the bearing outer race.
- The housing and all parts must be wiped clean and dry before reassembly.

1. If bearings (13) were removed during disassembly, install new bearings using an arbor press (Figure 16-5, Page 16-3).
2. Assemble the differential gear case.
  - 2.1. Install the pin (31) (Figure 16-5, Page 16-3). Apply a small amount of oil to all thrust plates and to both ends of the pin.
  - 2.2. Install the hex bolts (33) and output gear (32). Tighten bolts to 58 ft-lb (78.6 N·m).
3. Press a new bearing (18) onto the intermediate gear assembly (Figure 16-5, Page 16-3).
4. Press new bearing (16) onto input pinion gear (17).
5. Apply grease to the lip of the new oil seal (10) and install the seal using a transaxle pinion seal tool (CCI P/N 1014161). The lip of the oil seal should face the inside of the transaxle housing. Make sure the seal is firmly seated.
6. Install the differential assembly, the intermediate gear assembly, and the input pinion gear simultaneously. Be sure all bearings are seated properly in the housing. Rotate the input shaft to check for smooth gear operation (Figure 16-11, Page 16-6).

**Transaxle Assembly, Continued:**

7. Install both dowel pins (25) in the transaxle housing (20) **(Figure 16-5, Page 16-3)**.
8. Install left half of transaxle housing:
  - 8.1. Place a 1/8-inch (3 mm) bead of Three Bond liquid gasket on mating surface of housing.
  - 8.2. Install left half of transaxle housing (20) **(Figure 16-5, Page 16-3)**.
  - 8.3. Install eleven bolts (24) in the case housing and tighten to 19 ft-lb (25.7 N·m). Type G transaxles have no shims or gasket.
  - 8.4. Install axle tube (14 and 35) with bolts (8) **(Figure 16-5, Page 16-3)**. Tighten the bolts to 37 ft-lb (50.2 N·m).
9. Install the brake assemblies as instructed. **See Brake Cluster Installation, Section 6, Page 6-10.**
10. Apply a small amount of grease to the lip of the oil seal (15) **(Figure 16-5, Page 16-3)**. **See following CAUTION.**

** CAUTION**

- **Clean any residual oil from the exposed end of the axle shaft and from the oil seal area prior to installing the axle shaft to prevent oil from coming in contact with brakes.**

11. Install the rear axle onto the transaxle.
  - 11.1. Insert the splined end of the axle shaft into the axle tube. Be careful not to damage the seal on the inside of the axle tube hub. Advance the shaft through to the bearing on the shaft, and rotate it to align the shaft splines with the splined bore of the differential gear. Continue advancing the shaft until the bearing on the axle is firmly seated within the axle tube hub seat.
  - 11.2. Using 90° internal snap ring pliers (0.090 tip) (CCI P/N 1012560), attach the internal retaining ring into the axle tube hub so that it seats against the axle bearing assembly and into the machined slot in the inside wall of the axle tube hub **(Figure 16-5, Page 16-3)**.
  - 11.3. Place a 1/4 to 3/8-inch (6 to 10 mm) diameter rod against the retaining ring and tap lightly at four or five locations to ensure it is properly seated. **See following WARNING.**

** WARNING**

- **Be sure retaining ring is properly seated in its groove. If ring is not properly installed, the axle assembly will separate from the transaxle and damage the axle assembly and other components. Loss of vehicle control could result in severe personal injury or death.**
12. Make sure the drain plug (22) is installed in the transaxle and tightened to 23 ft-lb (31 N·m). Fill the transaxle, through the level indicator hole, with 22 ounces of SAE 30 API Class SE, SF, or SG oil (a higher grade may also be used). Install and tighten the level indicator plug (21) to 23 ft-lb (31 N·m).

## TRANSAXLE INSTALLATION

---

**See General Warnings, Section 1, Page 1-1.**

1. If using a chain hoist, raise the vehicle and place transaxle in position on the jack stands. If using a floor jack, lower the jack stands to their lowest settings and place the transaxle in position on the jack stands.
2. Align the center hole in the saddle of the transaxle with the pilot bolt in the leaf spring assembly.



3. Install the two U-bolts, jounce bumper mount (if required), and spacers, lock washers, and nuts. Tighten the nuts to 25 ft-lb (34 N·m). Tighten the U-bolt nuts so an equal amount of thread is visible on each leg of the bolt.
4. Install the motor. **See Motor Installation, Section 15a, Page 15a-12, or Motor Installation, Section 15b, Page 15b-13.**
5. If using a chain hoist, lower the vehicle while guiding the leaf springs into the rear spring shackles. If using a floor jack, raise the differential while guiding the leaf springs into the rear spring shackles. Then raise the jack stands to support the transaxle.
6. Connect the four motor wires. Tighten the retaining nuts to 65 in-lb (7.3 N·m). Use two wrenches to prevent the posts from turning. **See following NOTE.**

**NOTE:** *If the motor wires were not tagged when disconnected, refer to the wiring diagram for proper connection. See Wiring Diagrams, Section 11, Page 11-2.*

7. Insert bolts through the spring shackles and bushings in the leaf spring eyes. Secure bolts with lock nuts. Tighten to 15 ft-lb (20.3 N·m).
8. Connect the brake cables using new bow tie pins (1) (**Figure 16-7, Page 16-5**).
9. Install the shock absorbers. Tighten shock absorber retaining nuts until the rubber bushings expand to the same size as the cup washers.
10. Install the rear wheels and finger-tighten the lug nuts.
11. Lift the vehicle and remove the jack stands.
12. Lower vehicle and tighten the lug nuts, using a crisscross pattern, to 55 ft-lb (74.6 N·m).
13. Inspect the vehicle to check for proper operation. **See following WARNING.**

### **WARNING**

- **Make sure that the vehicle operates in the forward direction when the Forward/Reverse switch is in the FORWARD position.**
- **Make sure that the vehicle operates in the reverse direction when the Forward/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Reverse switch is in REVERSE.**
- **Make sure that the vehicle does not operate when the Forward/Reverse switch is in the NEUTRAL position.**



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