

Tempo, Tempo Connect, and Tempo 2+2 Maintenance and Service Manual



Electric Vehicle with ERIC Charging System Gasoline Vehicle with Kohler ECH440 Engine Gasoline Vehicle with Subaru EX-40 Engine

INTRODUCTION

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 and gasoline-powered 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 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.

Club Car offers a full line of training and continuing education classes for technicians who want to learn more about our products. For more information, contact your local dealer or Club Car's Technical Services department for a list of upcoming classes.

This manual covers all aspects of typical vehicle service; however, unique situations sometimes occur when servicing a vehicle. If it appears that a service question is not answered in this manual, please contact your nearest authorized Club Car dealer or distributor for assistance.

To find your local authorized Club Car dealer, visit www.clubcardealer.com, call 1-800-ClubCar (1-800-258-2227), or scan this Quick Response (QR) code to be taken to the Club Car dealer locator. Refer to Figure 1. Download a QR code reader such as RedLaser or Barcode Scanner to your cell phone or tablet.

If you would prefer to write to us, direct your letter to: Club Car LLC, Attention: Marketing Services, P.O. Box 204658, Augusta, Georgia 30917-4658 USA.

Dealer Locator QR Code



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INTRODUCTION

TECHNICAL PUBLICATION CUSTOMER SATISFACTION ONLINE SURVEY

Let your voice be heard!

Please participate in the Technical Publication customer satisfaction online survey.

This survey takes less than five minutes to complete and your responses will help examine current performance and identify areas for future improvement.

Our top priority is to provide timely, accurate, and user friendly manuals.

The online survey can be found at http://bit.ly/1w9uFMh or using the QR Code below.

Online Survey QR Code



WARNING

- Read Safety on page 1-1 before attempting any service on the vehicle.
- Before servicing the 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 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 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.

NOTICES

Important features unique to the different models covered in this manual are highlighted. Club Car, LLC 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

SERIAL NUMBER DECAL

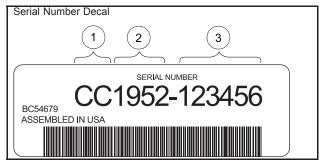
- Towing
- · Transporting on a Trailer
- · Subsequent Owner Registration
- Warranties

MODEL IDENTIFICATION

The serial number of each vehicle is printed on a bar code decal mounted either below the passenger side cup holder or above the accelerator or brake pedal (Example: CC5819–123456) .

The two letters (1) at the beginning of the serial number indicate the vehicle model. The following four digits (2) indicate the model year and production week during which the vehicle was built. The six digits (3) following the hyphen represent the unique sequential number assigned to each vehicle built within a given model year. **See following NOTE.**

NOTE: Have the vehicle serial number available when ordering parts or making inquiries.



2843B

Figure -1 Serial Number Decal

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SAFETY DETAILS

WARNING

• This owner's manual should be read completely before attempting to drive or service the vehicle. Failure to follow the instructions in this manual could result in property damage, severe personal injury, or death.

It is important to note that some vital statements throughout this manual and on the decals affixed to the vehicle are preceded by the words DANGER, WARNING, or CAUTION. For your protection, we recommend that you take special notice of these safety precautions. Safety precautions are essential and must be followed.

If any of the operation or safety decals on the vehicle become damaged, have been removed or cannot be easily read, they should be replaced immediately to avoid possible property damage, personal injury, or death. Contact your distributor/dealer.

A 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.

A 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 SAFETY

GENERAL WARNINGS

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

A 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.
- Gasoline Flammable! Explosive! Do not smoke. Keep sparks and flames away from the vehicle and service area. Service only in a well-ventilated area.
- Do not operate engine in an enclosed area without proper ventilation. The engine produces carbon monoxide, which is an odorless, deadly poison.
- The vehicle will not provide protection from lightning, flying objects, or other storm-related hazards. If caught in a storm while driving a Club Car vehicle, exit the vehicle and seek shelter in accordance with applicable safety guidelines for your location.

WARNING

- 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.
- · Children requiring a child safety seat must not ride in vehicle.
- · Do not leave children unattended on vehicle.
- Prior to leaving the vehicle unattended or servicing the vehicle, set the park brake, place the Forward/Neutral/Reverse handle or switch in the NEUTRAL position, turn the key switch to the OFF position, and remove the key. Chock the wheels when servicing the vehicle.
- 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 electrical system, 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.
- 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.
- 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.

WARNING CONTINUED ON NEXT PAGE

WARNING

• Use insulated tools when working near batteries or electrical connections. Use extreme caution to avoid shorting of components or wiring.

- · Ensure battery connections are clean and properly tightened.
- 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.

Electric vehicles only:

- Place Run/Tow 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 an electric vehicle, disconnect the batteries and discharge the controller. See Disconnect the Batteries – Electric Vehicles on page 1-4.

Gasoline vehicles only:

- To avoid unintentionally starting a gasoline vehicle, disconnect the battery and spark plug wire. See Disconnect the Battery Gasoline Vehicles on page 1-3.
- Frame ground Do not allow tools or other metal objects to contact frame when disconnecting battery
 cables or other electrical wiring. Do not allow a positive wire to touch the vehicle frame, engine, or
 any other metal component.

DISABLING THE VEHICLE

- 1. Park the vehicle on a solid level surface.
- 2. Engage the park brake to prevent vehicle movement.
- 3. Turn the key to OFF.
- 4. Remove the key.
- 5. Set the Forward/Neutral/Reverse control (FNR) to N.
- 6. Put chocks against the wheels.

DISCONNECT THE BATTERY - GASOLINE VEHICLES

- 1. Disable the vehicle.
- 2. Disconnect the negative (-) cable (1) (Figure 1-1, Page 1-4).

General Warnings SAFETY

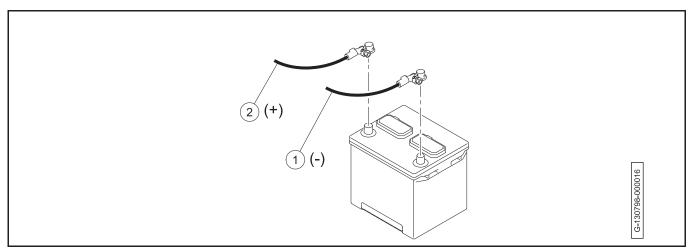


Figure 1-1 Gasoline Vehicle Battery

3. Disconnect the positive (+) cable (2).

CONNECT THE BATTERY - GASOLINE VEHICLES

- 1. Connect the positive (+) cable (2) (Figure 1-1, Page 1-4).
- 2. Connect the negative (-) cable (1).
- 3. Tighten the hardware to 41 lb·in (4.3 N·m).
- 4. Apply battery terminal protector spray to the battery terminals.

DISCONNECT THE BATTERIES – ELECTRIC VEHICLES

1. Disable the vehicle.

A DANGER

- Batteries disconnected or connected with the Run/Tow switch set to RUN can cause a battery
 explosion and serious personal injury. Set the Run/Tow switch to TOW before the batteries are
 disconnected or connected.
- 2. Set the Run/Tow switch to TOW.
- 3. Disconnect the negative (-) cable (1) (Figure 1-2, Page 1-5).

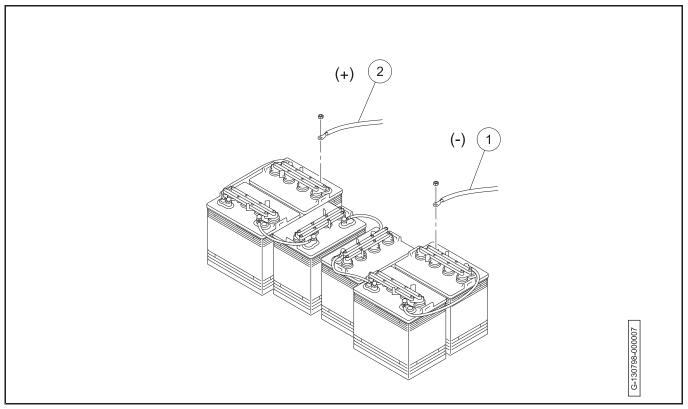


Figure 1-2 Disconnect Electric Vehicle Batteries

- 4. Disconnect the positive (+) cable (2).
- 5. Wait 90 seconds for the controller capacitors to discharge.

CONNECT THE BATTERIES - ELECTRIC VEHICLES

▲ DANGER

- Batteries disconnected or connected with the Run/Tow switch set to RUN can cause a battery
 explosion and serious personal injury. Set the Run/Tow switch to TOW before the batteries are
 disconnected or connected.
- Set the Run/Tow switch to TOW.
- 2. Connect the positive (+) cable (2) (Figure 1-3, Page 1-6).

General Warnings SAFETY

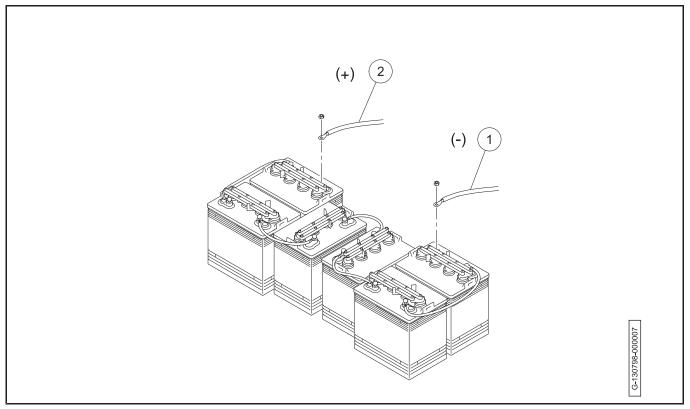


Figure 1-3 Connect Electric Vehicle Batteries

- 3. Connect the negative (-) cable (1).
- 4. Tighten the hardware to 110 lb·in (12.4 N·m).
- 5. Apply battery terminal protector spray to the battery terminals.

RECYCLING LEAD-ACID BATTERIES

A WARNING

• Lead-acid batteries contain lead (Pb), other metals, acids and other compounds. If improperly handled, they can contaminate both water and soil, causing environmental damage and personal injury.

Lead-acid batteries are identified by the symbol shown below and should be properly recycled (Figure 1-4). They cannot be disposed as municipal waste and must be collected separately. Responsibility for environmental protection must be shared, not only by the manufacturers of the batteries, but by people who use the batteries as well. Please contact your nearest Club Car dealer or distributor for information on how to properly recycle your batteries.

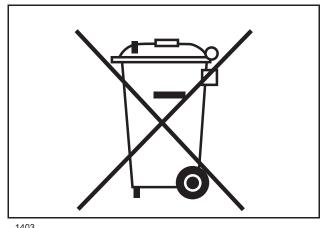
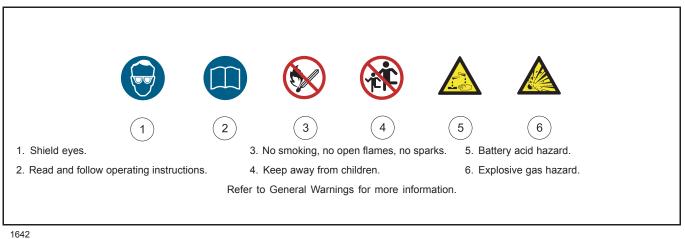


Figure 1-4 Dispose of Lead-acid Batteries Properly

INTERNATIONAL SAFETY SYMBOLS ON BATTERIES

Anyone using, repairing, or servicing the vehicle must understand and heed the safety symbols on the vehicle battery or batteries.



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Figure 1-5 International Safety Symbols on Batteries

SAFETY

Pagination Page

SECTION 2 — VEHICLE SPECIFICATIONS

ELECTRIC - VEHICLE SPECIFICATIONS

DIMENSIONS

DESCRIPTION	2 PASSENGER	4 PASSENGER
Length	91.5 in (232 cm)	104 in. (264 cm)
Width	47.25 in (120 cm)	47.25 in (120 cm)
Height - at steering wheel	48.0 in (122 cm)	48.0 in (122 cm)
Height - with canopy	68.5 in (174 cm)	71 in (180 cm)
Ground clearance	4.5 in (11 cm)	4.5 in (11 cm)
Front wheel tread	34 in (88 cm)	34 in (88 cm)
Rear wheel tread	38.6 in. (98 cm)	38.6 in. (98 cm)
Wheelbase	65.5 in. (166 cm)	65.5 in. (166 cm)

PERFORMANCE

DESCRIPTION	2 PASSENGER	4 PASSENGER
Forward speed (On Level Ground)	12 to 15 mph (19 to 24 km/h) - factory setting 19 mph (30.6 km/h) - maximum	
Curb To Curb	207.8 in (528 cm)	207.8 in (528 cm)

TIRES

DESCRIPTION	2 PASSENGER	4 PASSENGER
Go to the approved wheel and tire assemblies matrix on http://www.clubcar.com for information		
regarding tire type, inflation pressure, and lugnut torque.	•	•

ELECTRIC MOTOR

DESCRIPTION	2 PASSENGER	4 PASSENGER
Motor Type: 48V DC motor	•	•
Motor Horsepower: 3.1 hp (2.3 kW)	•	•

BATTERIES

DESCRIPTION	2 PASSENGER	4 PASSENGER
Battery Type: 8V high capacity deep cycle flooded lead acid	•	•
Battery Quantity: 6	•	•

NOISE AND VIBRATION

DESCRIPTION	2 PASSENGER	4 PASSENGER
Drive-by Noise Level To Operator EN 12053:2001	68.5 dBA (± 2)	68.5 dBA (± 2)
Vibration At Driver's Seat EN 13059:2002	0.6 (m/s²)² (± 0.114)	0.8 (m/s²)² (± 0.072)

TRANSAXLE

DESCRIPTION	2 PASSENGER	4 PASSENGER
Fluid Capacity: 22 fl-oz (0.67 l)	•	•

VEHICLE WEIGHTS AND LOAD CAPACITIES

▲ WARNING

- If the rated capacities of the vehicle are exceeded, property damage, serious personal injury, or death can occur. Do not exceed the rated capacity of the vehicle. Rated capacity is for level surfaces only.
- Too much weight in the vehicle can affect the vehicles handling, or cause component failure, resulting in loss of control of the vehicle and serious personal injury. Do not exceed the vehicle load capacities.
- · Do not tow when the cargo capacity is exceeded.

VEHICLE WEIGHTS AND LOAD CAPACITIES	2 PASSENGER	4 PASSENGER
Vehicle Dry Weight	689 lb (312.3 kg)	804 lb (312.3 kg)
Vehicle Curb Weight	909 lb (412.5 kg)	1024 lb (464.5 kg)
Occupant Capacity	400 lb (181 kg)	800 lb (363 kg)
Cargo Capacity	100 lb (45.4 kg)	Not Applicable
Trailer Tongue Weight	Not Applicable	Not Applicable
Gross Trailer Weight	Not Applicable	Not Applicable
Vehicle Rated Capacity	Not Applicable	Not Applicable
Vehicle Combination Rated Capacity	Not Applicable	Not Applicable
Maximum Gross Vehicle Weight	Not Applicable	Not Applicable
Maximum Gross Vehicle Combination Weight	Not Applicable	Not Applicable

TERM	DEFINITION
Vehicle Dry Weight	The vehicle dry weight is the weight of the vehicle with no batteries.
Vehicle Curb Weight	The vehicle curb weight is the weight of the vehicle with the batteries installed.
Occupant Capacity	The occupant capacity is the maximum permitted weight for occupants to operate the vehicle safely.
Cargo Capacity	The cargo capacity is the maximum weight of a load that the vehicle can have in the cargo area. The cargo capacity includes the weight of optional equipment.
Trailer Tongue Weight	The trailer tongue weight is the maximum permitted weight applied by the trailer tongue onto the trailer hitch.

TABLE CONTINUED ON NEXT PAGE

TERM	DEFINITION
Gross Trailer Weight	The gross trailer weight is the trailer weight plus the weight of the load on the trailer.
Vehicle Rated Capacity	The vehicle rated capacity is the maximum weight on the vehicle. This capacity includes the weight of: bed load, cargo, occupants, and optional equipment.
Vehicle Combination Rated Capacity	The vehicle combination rated capacity is the maximum weight on the vehicle with a trailer. This capacity includes: vehicle rated capacity and the gross trailer weight.
Maximum Gross Vehicle Weight	The maximum gross vehicle weight is the vehicle weight plus the vehicle rated capacity.
Maximum Gross Vehicle Combination Weight	The maximum gross vehicle combination weight is the maximum gross vehicle weight plus the gross trailer weight.

KOHLER ECH440 - VEHICLE SPECIFICATIONS

DIMENSIONS

DIMENSIONS		
DESCRIPTION	2 PASSENGER	4 PASSENGER
Length	91.5 in (232 cm)	104 in. (264 cm)
Width	47.25 in (120 cm)	47.25 in (120 cm)
Height - at steering wheel	48.0 in (122 cm)	48.0 in (122 cm)
Height - with canopy	68.5 in (174 cm)	71 in (180 cm)
Ground clearance	4.5 in (11 cm)	4.5 in (11 cm)
Front wheel tread	34 in (88 cm)	34 in (88 cm)
Rear wheel tread	38.6 in. (98 cm)	38.6 in. (98 cm)
Wheelbase	65.5 in. (166 cm)	65.5 in. (166 cm)

PERFORMANCE

DESCRIPTION	2 PASSENGER	4 PASSENGER
Forward speed (On Level Ground)	12 to 15 mph (19 to 24 km/h) - factory setting 19 mph (30.6 km/h) - maximum	
Curb To Curb	207.8 in (528 cm)	207.8 in (528 cm)

TIRES

DESCRIPTION	2 PASSENGER	4 PASSENGER
Go to the approved wheel and tire assemblies matrix on http://www.clubcar.com for information	_	_
regarding tire type, inflation pressure, and lugnut torque.	•	•

GASOLINE ENGINE

DESCRIPTION	2 PASSENGER	4 PASSENGER
Horsepower 14 hp (10.4 kw) at 3600 rpm (per SAE J1940)	•	•
Fuel Type Gasoline with less than 10% ethanol rating	•	•
Fuel Capacity 5.6 gal (21.2 l)	•	•
Engine Oil Capacity	39 fl-oz (1.1 l)	39 fl-oz (1.1 l)

BATTERY

DESCRIPTION	2 PASSENGER	4 PASSENGER
Battery Type: 12V no-maintenance	•	•
Battery Quantity: 1	•	•

NOISE AND VIBRATION

DESCRIPTION	2 PASSENGER	4 PASSENGER
Drive-by Noise Level To Operator EN 12053:2001	77.6 dBA (± 2)	83.8 dBA (± 2)
Vibration At Driver's Seat EN 13059:2002	0.8 (m/s²)² (± 0.25)	0.8 (m/s²)² (± 0.23)

TRANSAXLE

DESCRIPTION	2 PASSENGER	4 PASSENGER
Fluid Capacity: 67.6 fl-oz (2 l)	•	•

VEHICLE WEIGHTS AND LOAD CAPACITIES

WARNING

- If the rated capacities of the vehicle are exceeded, property damage, serious personal injury, or death can occur. Do not exceed the rated capacity of the vehicle. Rated capacity is for level surfaces only.
- Too much weight in the vehicle can affect the vehicles handling, or cause component failure, resulting in loss of control of the vehicle and serious personal injury. Do not exceed the vehicle load capacities.
- · Do not tow when the cargo capacity is exceeded.

VEHICLE WEIGHTS AND LOAD CAPACITIES	2 PASSENGER	4 PASSENGER
Vehicle Dry Weight	651 lb (295 kg)	768 lb (348 kg)
Vehicle Curb Weight	688 lbs (312 kg)	805 lbs (365 kg)
Occupant Capacity	400 lbs (181.4 kg)	800 lb (363 kg)
Cargo Capacity	100 lbs (45.3 kg)	Not Applicable
Trailer Tongue Weight	Not Applicable	Not Applicable
Gross Trailer Weight	Not Applicable	Not Applicable

TABLE CONTINUED ON NEXT PAGE

VEHICLE WEIGHTS AND LOAD CAPACITIES	2 PASSENGER	4 PASSENGER
Vehicle Rated Capacity	Not Applicable	Not Applicable
Vehicle Combination Rated Capacity	Not Applicable	Not Applicable
Maximum Gross Vehicle Weight	Not Applicable	Not Applicable
Maximum Gross Vehicle Combination Weight	Not Applicable	Not Applicable

TERM	DEFINITION
Vehicle Dry Weight	The vehicle dry weight is the weight of the vehicle with no fuel.
Vehicle Curb Weight	The vehicle curb weight is the weight of the vehicle with the fuel tank filled.
Occupant Capacity	The occupant capacity is the maximum permitted weight for occupants to operate the vehicle safely.
Cargo Capacity	The cargo capacity is the maximum weight of a load that the vehicle can have in the cargo area. The cargo capacity includes the weight of optional equipment.
Trailer Tongue Weight	The trailer tongue weight is the maximum permitted weight applied by the trailer tongue onto the trailer hitch.
Gross Trailer Weight	The gross trailer weight is the trailer weight plus the weight of the load on the trailer.
Vehicle Rated Capacity	The vehicle rated capacity is the maximum weight on the vehicle. This capacity includes the weight of: bed load, cargo, occupants, and optional equipment.
Vehicle Combination Rated Capacity	The vehicle combination rated capacity is the maximum weight on the vehicle with a trailer. This capacity includes: vehicle rated capacity and the gross trailer weight.
Maximum Gross Vehicle Weight	The maximum gross vehicle weight is the vehicle weight plus the vehicle rated capacity.
Maximum Gross Vehicle Combination Weight	The maximum gross vehicle combination weight is the maximum gross vehicle weight plus the gross trailer weight.

SUBARU EX-40 - VEHICLE SPECIFICATIONS

DIMENSIONS

DESCRIPTION	2 PASSENGER	4 PASSENGER
Length	91.5 in (232 cm)	104 in. (264 cm)
Width	47.25 in (120 cm)	47.25 in (120 cm)
Height - at steering wheel	48.0 in (122 cm)	48.0 in (122 cm)
Height - with canopy	68.5 in (174 cm)	71 in (180 cm)
Ground clearance	4.5 in (11 cm)	4.5 in (11 cm)
Front wheel tread	34 in (88 cm)	34 in (88 cm)
Rear wheel tread	38.6 in. (98 cm)	38.6 in. (98 cm)
Wheelbase	65.5 in. (166 cm)	65.5 in. (166 cm)

Р	Е	R	F	O	R	ľ	NΑ	4٨	V	С	Ε

DESCRIPTION	2 PASSENGER	4 PASSENGER	
Forward speed (On Level Ground)	12 to 15 mph (19 to 24 km/h) - factory setting 19 mph (30.6 km/h) - maximum		
Curb To Curb	207.8 in (528 cm)	207.8 in (528 cm)	

TIRES

DESCRIPTION	2 PASSENGER	4 PASSENGER
Go to the approved wheel and tire assemblies matrix on http://www.clubcar.com for information	_	_
regarding tire type, inflation pressure, and lugnut torque.	•	•

GASOLINE ENGINE

DESCRIPTION	2 PASSENGER	4 PASSENGER
Horsepower 14 hp (10.4 kw) at 3600 rpm (per SAE J1940)	•	•
Fuel Type Gasoline with less than 10% ethanol rating	•	•
Fuel Capacity 5.9 gal (23 l)	•	•
Engine Oil Capacity	40 fl-oz (1.2 l)	40 fl-oz (1.2 l)

BATTERY

DESCRIPTION	2 PASSENGER	4 PASSENGER
Battery Type: 12V no-maintenance	•	•
Battery Quantity: 1	•	•

NOISE AND VIBRATION

DESCRIPTION	2 PASSENGER	4 PASSENGER
Drive-by Noise Level To Operator EN 12053:2001	75.5 dBA (± 2)	75.5 dBA (± 2)
Vibration At Driver's Seat EN 13059:2002	0.7 (m/s²)² (± 0.21)	0.7 (m/s²)² (± 0.21)

TRANSAXLE

DESCRIPTION	2 PASSENGER	4 PASSENGER
Fluid Capacity: 67.6 fl-oz (2 l)	•	•

VEHICLE WEIGHTS AND LOAD CAPACITIES

A WARNING

• If the rated capacities of the vehicle are exceeded, property damage, serious personal injury, or death can occur. Do not exceed the rated capacity of the vehicle. Rated capacity is for level surfaces only.

WARNING CONTINUED ON NEXT PAGE

WARNING

- Too much weight in the vehicle can affect the vehicles handling, or cause component failure, resulting
 in loss of control of the vehicle and serious personal injury. Do not exceed the vehicle load capacities.
- Do not tow when the cargo capacity is exceeded.

VEHICLE WEIGHTS AND LOAD CAPACITIES	2 PASSENGER	4 PASSENGER
Vehicle Dry Weight	651 lb (295 kg)	768 lb (348 kg)
Vehicle Curb Weight	688 lbs (312 kg)	805 lbs (365 kg)
Occupant Capacity	400 lbs (181.4 kg)	800 lb (363 kg)
Cargo Capacity	100 lbs (45.3 kg)	Not Applicable
Trailer Tongue Weight	Not Applicable	Not Applicable
Gross Trailer Weight	Not Applicable	Not Applicable
Vehicle Rated Capacity	Not Applicable	Not Applicable
Vehicle Combination Rated Capacity	Not Applicable	Not Applicable
Maximum Gross Vehicle Weight	Not Applicable	Not Applicable
Maximum Gross Vehicle Combination Weight	Not Applicable	Not Applicable

TERM	DEFINITION
Vehicle Dry Weight	The vehicle dry weight is the weight of the vehicle with no fuel.
Vehicle Curb Weight	The vehicle curb weight is the weight of the vehicle with the fuel tank filled.
Occupant Capacity	The occupant capacity is the maximum permitted weight for occupants to operate the vehicle safely.
Cargo Capacity	The cargo capacity is the maximum weight of a load that the vehicle can have in the cargo area. The cargo capacity includes the weight of optional equipment.
Trailer Tongue Weight	The trailer tongue weight is the maximum permitted weight applied by the trailer tongue onto the trailer hitch.
Gross Trailer Weight	The gross trailer weight is the trailer weight plus the weight of the load on the trailer.
Vehicle Rated Capacity	The vehicle rated capacity is the maximum weight on the vehicle. This capacity includes the weight of: bed load, cargo, occupants, and optional equipment.
Vehicle Combination Rated Capacity	The vehicle combination rated capacity is the maximum weight on the vehicle with a trailer. This capacity includes: vehicle rated capacity and the gross trailer weight.
Maximum Gross Vehicle Weight	The maximum gross vehicle weight is the vehicle weight plus the vehicle rated capacity.
Maximum Gross Vehicle Combination Weight	The maximum gross vehicle combination weight is the maximum gross vehicle weight plus the gross trailer weight.

Pagination Page

A DANGER

· See General Warnings on page 1-2.

A DANGER

- Fuel is flammable and explosive. Do not attempt to drain fuel when the engine is hot or while it is running.
- Fuel is flammable and explosive. Do not operate the vehicle when fuel is spilled. Correctly clean the spilled fuel.
- Fuel is flammable and explosive. Keep the fuel in an approved fuel container. Keep the fuel container in a ventilated area away from sparks and heat sources.
- · Fuel is toxic. Keep fuel out of the reach of children.
- Fuel is toxic. Do not siphon fuel from the vehicle.

WARNING

See General Warnings on page 1-2.

WARNING

- Unintended vehicle operation can cause serious personal injury or death. Before leaving the vehicle or during vehicle maintenance, disable the vehicle.
- Unintended vehicle operation can cause serious personal injury or death. Before leaving the vehicle or during vehicle maintenance, disable the vehicle. Set the Run/Tow switch to TOW.
- Frozen battery acid can cause damage including leaks and explosions. If the battery acid freezes, replace the battery before charging or use. Batteries in a low state of charge will freeze at low temperatures. Keep the batteries in a high state of charge.

A CAUTION

• 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.

ELECTRIC VEHICLE EXTENDED STORAGE

EXTENDED STORAGE PREPARATION - ELECTRIC

Keep sufficient water levels in each battery cell for a minimum of two weeks before extended storage to make sure proper mixing of water and battery acid. If necessary, add water as necessary then correctly charge batteries.

NOTE: It takes approximately five charge cycles with a minimum of 10-amp hours of use after each charge to correctly mix the water with battery acid.

1. Turn off all electronic accessories.

- 2. Set the Forward/Neutral/Reverse control (FNR) to N.
- 3. Turn the key to OFF.
- 4. Remove the key. Keep the key in a safe area.
- 5. Put chocks against the wheels.

NOTE: Do not engage the park brake.

- 6. Remove all cargo and personal items.
- 7. Run/Tow switch position:

NOTE: The charge indicator light is disabled when the Run/Tow switch is set to TOW.

- 7.1. On vehicles equipped with Visage that will have remote monitoring, set the Run/Tow switch to RUN.
- 7.2. On vehicles equipped with Visage that will not have remote monitoring, set the Run/Tow switch TOW.
- 7.3. **On all other vehicles**, set the Run/Tow switch to TOW.
- 8. Clean the batteries.
- 9. Tighten all battery cable connections to 110 lb in (12.4 N·m).
- 10. Keep the vehicle in a cool and dry area to keep battery self-discharge to a minimum.
- 11. Adjust pressure in each tire to recommended tire pressure.
- 12. Clean the vehicle.
- 13. **If one or more conditions cannot be done while in storage,** disconnect the negative (-) battery cable. Make sure that the negative (-) battery cable does not touch the battery terminal.
 - The battery charger must stay connected to an electric outlet
 - AC electrical power will be available during storage
 - Battery acid levels will be kept at a sufficient level while in storage
- 14. If all conditions can be done while in storage, do as follows:
 - The battery charger must stay connected to an electric outlet
 - AC electrical power will be available during storage
 - Battery battery acid levels will be kept at a sufficient level while in storage
- 14.1. Connect the battery charger to the vehicle. Keep battery chargers connected during storage. The charger will automatically connect when necessary.
- 14.2. Examine the battery acid level and charger function monthly.

NOTE: The charger is operating correctly when the blue light is ON and the triangular

light is OFF.

RETURN TO SERVICE FROM EXTENDED STORAGE - ELECTRIC

- 1. Clean the batteries.
- 2. If the batteries were disconnected, connect the batteries.
- 3. Fully charge the batteries.
- 4. Set the Run/Tow switch to RUN.
- 5. Set the Forward/Neutral/Reverse control (FNR) to N.
- 6. Adjust the pressure in each tire to the recommended tire pressure.

- 7. Have a trained technician lubricate the vehicle.
- 8. Do a daily pre-operation safety checklist.
- 9. Do a vehicle performance inspection.

GASOLINE VEHICLE EXTENDED STORAGE

See General Warnings on page 1-2.

EXTENDED STORAGE PREPARATION - GASOLINE

1. Examine the battery state of charge (SOC) condition. If the SOC is weak, charge the battery.

NOTE: Use an automotive-type 12-volt battery charger rated at 10-amps or less.

- 2. Turn off all accessories.
- 3. Set the Forward/Neutral/Reverse control (FNR) to N.
- 4. Turn the key to OFF.
- 5. Remove the key. Keep the key in a safe area.
- 6. Put chocks against the wheels.

NOTE: Do not engage the park brake.

- 7. Remove all cargo and personal items.
- 8. Fill the fuel tank.
- 9. Add a fuel stabilizer. Refer to the fuel stabilizer manufacturer's instructions.
- 10. Disconnect the fuel vent line from the fuel tank vent nipple.
- 11. Plug the fuel tank vent nipple with a slip-on vinyl cap (1) **(Figure 3-1, Page 3-4)**. Make sure that the connection is air tight.

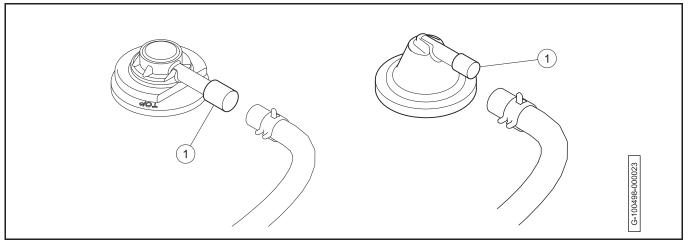


Figure 3-1 Left: Kohler / Right: Subaru

- 12. Disconnect the battery.
- 13. Clean the battery.

- 14. Prepare the engine for extended storage:
- 14.1. Disconnect the spark plug wire (1) (Figure 3-2, Page 3-5).

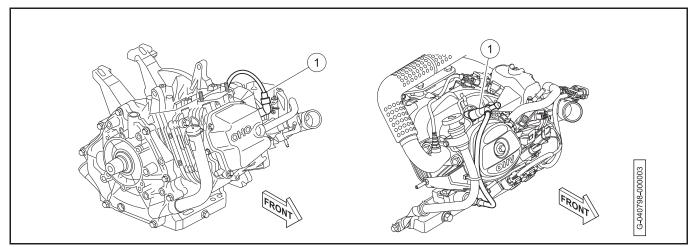


Figure 3-2 Left: Subaru / Right: Kohler

- 14.2. Use a spark plug socket to remove the spark plug.
- 14.3. Put 0.5 fl-oz (14.2 ml) of SAE 10 weight oil into the spark plug hole.
- 14.4. Turn the engine crankshaft by hand several times.
- 14.5. Apply a thin layer of high temperature antiseize lubricant to the spark plug threads.
- 14.6. Use a spark plug socket to install and tighten the spark plug to 20 lb·ft (27 N·m).
- 14.7. Connect the spark plug wire.
- 15. Keep the vehicle in a cool and dry area to keep battery self-discharge to a minimum.
- 16. Adjust pressure in each tire to recommended tire pressure.
- 17. Clean the vehicle.

RETURN TO SERVICE FROM EXTENDED STORAGE - GASOLINE

- 1. Clean the battery.
- 2. Connect the fuel system:
- 2.1. Remove and discard the slip-on vinyl cap (1) from the fuel tank vent nipple (Figure 3-3, Page 3-6).

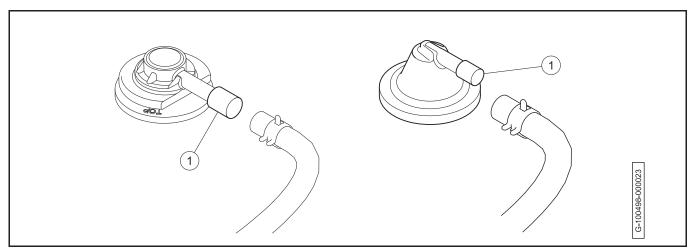


Figure 3-3 Left: Kohler / Right: Subaru

WARNING

- Fuel is flammable and explosive. Make sure that the fuel tube is fully connected.
- 2.2. Connect the vent tube to the fuel tank vent nipple.
- 3. Connect the battery.
- 4. Set the Forward / Neutral / Reverse control (FNR) to N.
- 5. Set the Maintenance/Operate switch to MAINTENANCE.
- 6. Start and run the engine.

NOTE: The engine exhaust may smoke for a short time after returning to service.

- 7. Turn the key to OFF.
- 8. Set the Maintenance/Operate switch to OPERATE.
- 9. Adjust the pressure in each tire to the recommended tire pressure.
- 10. Have a trained technician lubricate the vehicle.
- 11. Do a daily pre-operation safety checklist.
- 12. Do a vehicle performance inspection.

SECTION 4 — BODY AND TRIM

A DANGER

· See General Warnings on page 1-2.

WARNING

· See General Warnings on page 1-2.

CLEANING THE WINDSHIELD

CAUTION

· Do not use a household window cleaner.

Use a soft towel and water to clean the windshield. Use mild soap as necessary.

CLEANING THE VEHICLE EXTERIOR

CAUTION

- Do not use detergents or cleaning solvents that contain ammonia, aromatic solvents, or alkali materials on body panels or seats.
- · 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.
- Moisture will cause electrical component damage. Do not use a pressure washer or steam cleaner to clean the vehicle.

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.

Use a commercially available aluminum cleaner paste and fine grade (No. 00) steel wool to remove oxidation or discoloration from aluminum.

Use non-abrasive wax products. Do not use abrasive leveling or rubbing compounds; these will permanently dull the gloss. Fertilizers, tars, asphalt, creosote, paint, or chewing gum should be removed immediately to prevent possible stains.

NOTE: Dispose of waste water properly.

CLEANING THE VEHICLE INTERIOR

CAUTION

- Moisture will cause electrical component damage. Do not use a pressure washer or steam cleaner to clean the vehicle.
- To prevent damage to the vehicle when removing difficult stains or heavy soiling, remove the seat bottom from the vehicle first.

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.

BODY REPAIR

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.

CAUTION

- Holding the heat gun too close to the body could melt the body or damage the finish. Do not hold the heat gun closer than 6 inches (15 cm) to the body.
- 3. It may be necessary to move the gun closer to the body to fade the streak. Do not hold the gun closer than 6 inches (15 cm) to the body.

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.

CAUTION

- · Holding the heat gun too close to the body could melt the body or damage the finish. Do not hold the heat gun closer than 6 inches (15 cm) to the body.
- Continue heating and bending the body until the original shape returns. Do not hold the gun closer than 6 inches (15 cm) to the body.

MINOR SCRATCHES AND SURFACE BLEMISHES

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

- Thoroughly clean the affected area using a strong, non-abrasive detergent and hot water, then clean with Ultra-Kleen® Solvent Cleaner to remove any oil-based contaminants.
- Lightly buff imperfection with a clean soft cloth or buff pad. Do not use any kind of rubbing (abrasive) compound 2. on body assemblies.
- 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.

4

Seat Hinge BODY AND TRIM

SEAT HINGE

The seat bottom (1) is attached to the vehicle with two hinges (3) that hook into slots in the body.

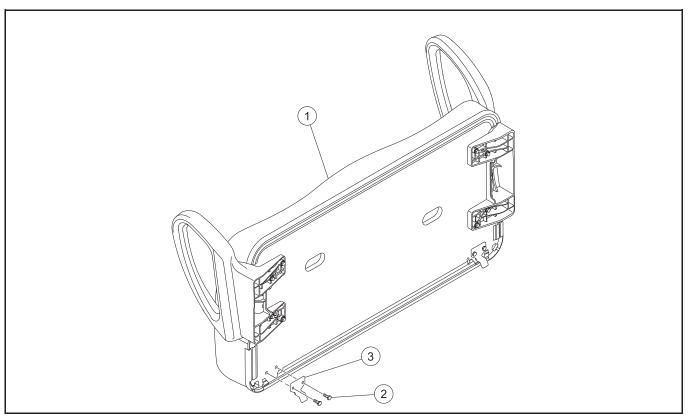


Figure 4-1 Seat Bottom Hinge

SEAT HINGE REMOVAL

- 1. Remove the seat bottom (1) from the vehicle (Figure 4-1).
- 2. Remove the screws (2).
- 3. Remove the hinge (3).

SEAT HINGE INSTALLATION

- 1. Align the hinge (3) onto the seat bottom (1) (Figure 4-1).
- 2. Install the screws (2). Tighten the screws to 75 lb·in (8.5 N·m).

HIP RESTRAINT

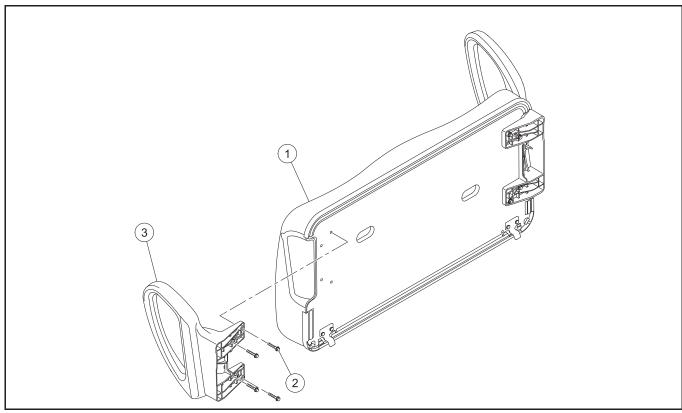


Figure 4-2 Hip Restraint

HIP RESTRAINT REMOVAL

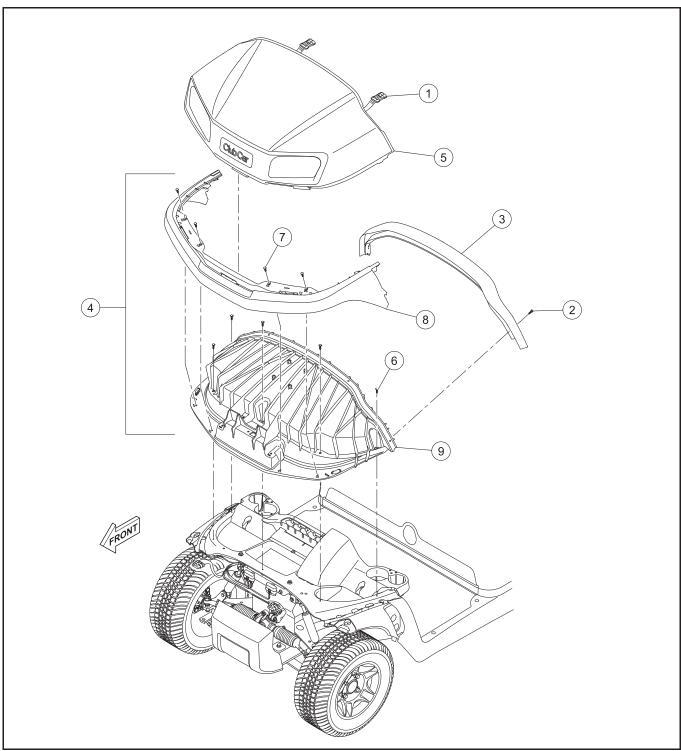
- 1. Remove the seat bottom (1) from the vehicle (Figure 4-2).
- 2. Remove the screws (2).
- 3. Remove the hip restraint (3).

HIP RESTRAINT INSTALLATION

- 1. Align the hip restraint (3) onto the seat bottom (1) (Figure 4-2).
- 2. Install the screws (2). Tighten the screws to 65 lb·in (7.3 N·m).

Front Body BODY AND TRIM

FRONT BODY



G-140198-000018

Figure 4-3 Front Body

FRONT BODY REMOVAL

- 1. Disconnect the two headlight harnesses (1) (Figure 4-3, Page 4-6).
- 2. Remove the four screws (2).
- 3. Remove the brow cap (3) from the brow and fascia assembly (4).
- 4. Pull the front beauty panel (5) up and away from the brow and fascia assembly to disengage the snap tabs.
- 5. If the vehicle is equipped with a canopy:
- 5.1. Remove the front canopy strut cover screws.
- 5.2. Slide the front canopy strut covers up the front canopy struts.
- 5.3. Loosen the canopy support screws. Do not remove the screws.
- 6. If the vehicle is not equipped with a canopy:
- 6.1. Remove the non-canopy cover screws.
- 6.2. Remove the non-canopy cover.
- 7. Remove the five screws (6).
- 8. Remove the brow and fascia assembly from the front underbody.
- 9. Remove the four screws (7).
- 10. Remove the fascia (8) from the brow (9).

FRONT BODY INSTALLATION

- 1. Install the fascia (8) onto the brow (9) (Figure 4-3, Page 4-6).
- 2. Install the four screws (7). Tighten the screws to 40 lb·in (4.5 N·m).
- 3. Install the brow and fascia assembly (4) onto front underbody.
- 4. Install the five screws (6). Tighten the screws to 31 lb·in (3.5 N·m).
- 5. Install the front beauty panel (5) onto the brow. Make sure that the tabs on the front beauty panel are in the slots between the fascia and the brow.
- 6. Position the brow cap (3) to cover the edge of both the brow and the front beauty panel.
- 7. Install the four screws (2). Tighten the screws to 25 lb·in (2.8 N·m).
- 8. Connect the two headlight harnesses (1).
- 9. If the vehicle is equipped with a canopy:
- 9.1. Tighten the canopy support screws to 18.4 lb·ft (25 N·m).
- 9.2. Slide the front canopy strut covers down the front canopy struts.
- 9.3. Tighten the front canopy strut cover screws to 31 lb·in (4.6 N·m).
- 10. If the vehicle is not equipped with a canopy:
- 10.1. Install the non-canopy covers.
- 10.2. Install the non-canopy cover screws. Tighten the non-canopy cover screws to 31 lb·in (4.6 N·m).

4

FRONT BUMPER

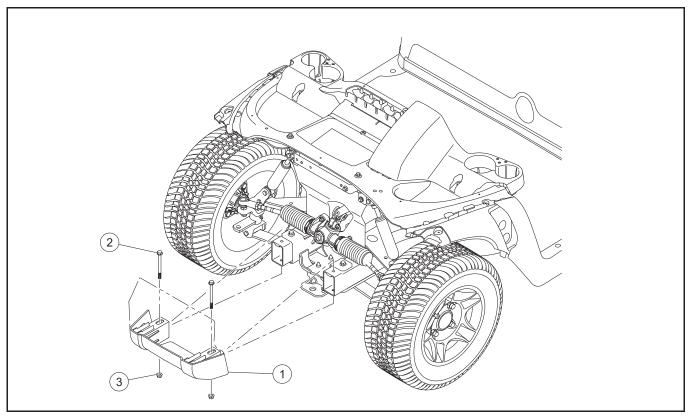


Figure 4-4 Front Bumper

FRONT BUMPER REMOVAL

- 1. Remove the nuts (3) (Figure 4-4).
- 2. Remove the bolts (2).
- 3. Remove the front bumper (1).

FRONT BUMPER INSTALLATION

- 1. Align the front bumper (1) onto the frame (Figure 4-4).
- 2. Install the bolts (2) and nuts (3).
- 3. Tighten the nuts to 13.3 lb·ft (18 N·m).

UNDERBODY BRACKET

The underbody bracket (1) is connected to the front suspension on the front underbody.

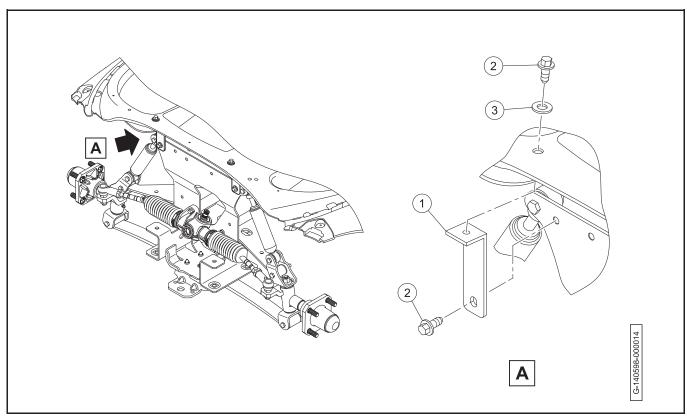


Figure 4-5 Underbody Bracket

UNDERBODY BRACKET REMOVAL

- 1. Remove the two screws (2) and washer (3) (Figure 4-5).
- 2. Remove the underbody bracket (1).

UNDERBODY BRACKET INSTALLATION

- 1. Put the underbody bracket (1) into position on the vehicle (Figure 4-5).
- 2. Install the washer (3) screws (2). Tighten the screws to 13 lb·ft (17.6 N·m).

4

Headlights

BODY AND TRIM

HEADLIGHTS

The headlights are not adjustable. Drivers-side shown. Passengers-side is typical.

HEADLIGHT REMOVAL

- 1. Remove the front beauty panel.
- 2. Disconnect the headlight connector (1) from the front lighting harness (2)(Figure 4-6).

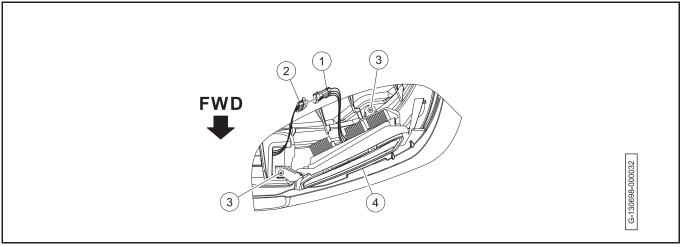


Figure 4-6

- 3. Remove the screws (3).
- 4. Remove the headlight assembly (4).
- 5. Remove the screws (1) and headlight housing (2) from the headlight (3) (Figure 4-7).

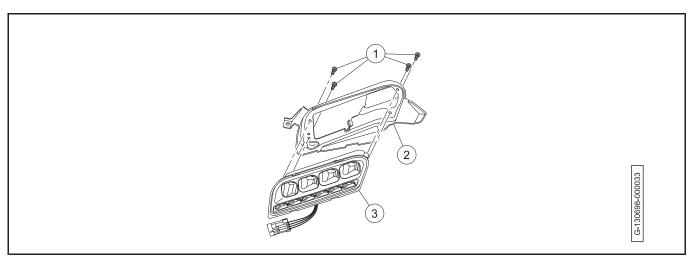


Figure 4-7

HEADLIGHT INSTALLATION

Install the headlight housing (1) onto the headlight (2) (Figure 4-8).

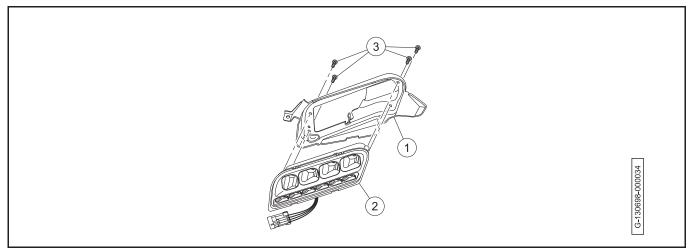


Figure 4-8

- Install the screws (3). Tighten the screws from 26.5 to 35.5 lb·in (3 to 4 N·m). 2.
- 3. Attached the foot (1) of the headlight housing to the cleat (2) (Figure 4-9).

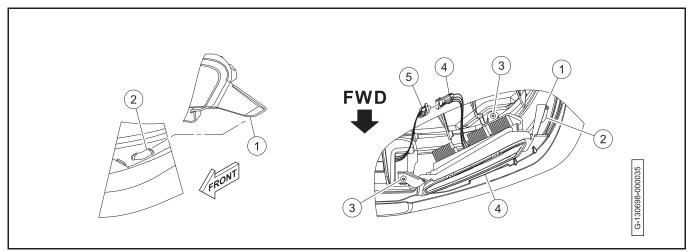


Figure 4-9

- 4. Install the screws (3). Tighten the screws from 26.5 to 35.5 lb·in (3 to 4 N·m).
- Disconnect the headlight connector (4) from the front lighting harness (5). 5.
- 6. Install the front beauty panel.

Instrument Panel BODY AND TRIM

INSTRUMENT PANEL

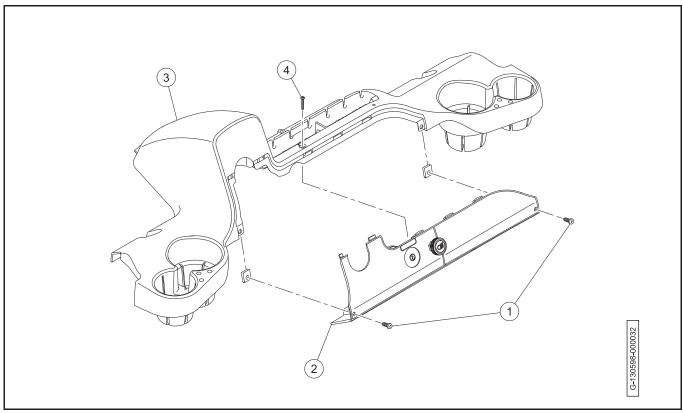


Figure 4-10 Instrument Panel

INSTRUMENT PANEL REMOVAL

- 1. Remove the screws (1 and 4) (Figure 4-10).
- 2. Tilt instrument panel (2) up to release it from the dash assembly (3).
- 3. Disconnect the electrical connector on the passenger side.

INSTRUMENT PANEL INSTALLATION

- 1. Connect the electrical connector on the passenger side (Figure 4-10).
- 2. Install the instrument panel (2) into the dash assembly (3). Make sure that the tabs on the instrument panel engage in the slots on the dash assembly.
- 3. Make sure that electrical wires are not exposed or pinched.
- 4. Install the screws (1 and 4). Tighten the screws to 22 lb·in (2.5 N·m).

DASH ASSEMBLY

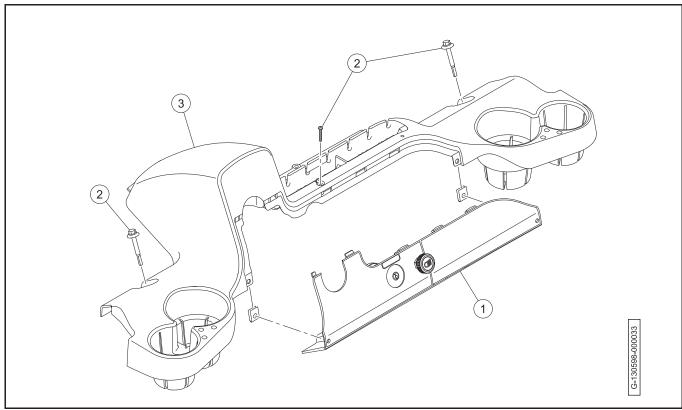


Figure 4-11 Dash Assembly

DASH ASSEMBLY REMOVAL

- 1. Remove the instrument panel (1) (Figure 4-11).
- 2. Remove the screws (2).
- 3. Disconnect the USB receptacle.
- 4. Remove the dash assembly (3).

DASH ASSEMBLY INSTALLATION

- 1. Put the dash assembly (3) on vehicle (**Figure 4-11**). Make sure tabs on the forward edge engage to front underbody.
- 2. Connect the USB receptacle.
- 3. Install the screws (2). Tighten the screws to 8.8 lb·ft (12 N·m).
- 4. Install the instrument panel (1).

Floor Mat and Retainers BODY AND TRIM

FLOOR MAT AND RETAINERS

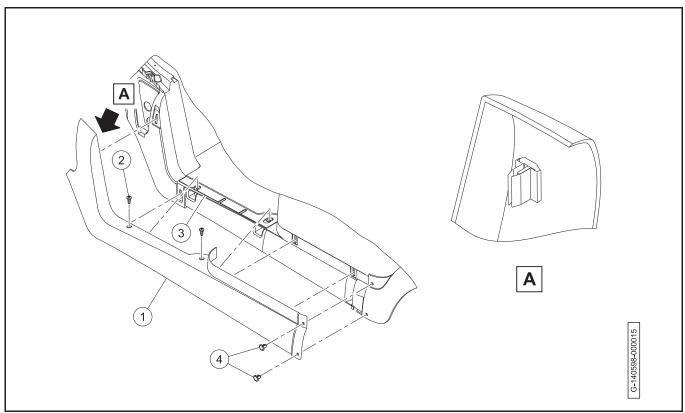


Figure 4-12 Floor Mat And Retainers

FLOOR MAT REMOVAL

- 1. Remove the screws (2) (Figure 4-12).
- 2. Remove the floor mat (3) from under the floor mat retainers (1).

FLOOR MAT INSTALLATION

- 1. Install the floor mat (3) under the floor mat retainers (Figure 4-12).
- 2. Install the screws (2). Tighten the screws to 4.4 lb·ft (6.0 N·m).

FLOOR MAT RETAINER REMOVAL

- 1. Remove the screws (2) (Figure 4-12).
- 2. Remove the push rivets (4).
- 3. Carefully pull on floor mat retainer (1) 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

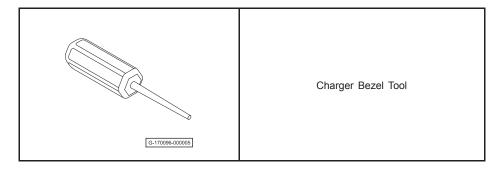
Position the floor mat retainer (1) on the vehicle and press firmly to engage the trim clips to the vehicle (Figure 4-12).

- 2. Make sure that the floor mat (3) is correctly positioned beneath the top flange of the floor mat retainer.
- 3. Install the two screws (2). Do not tighten the screws.
- 4. Install the push rivets (4) (Figure 4-12, Page 4-14).
- 5. Tighten the two screws (2) to 4.4 lb·ft (6.0 N·m).

KICK PLATE AND CHARGER RECEPTACLE BEZEL - ELECTRIC VEHICLES

KICK PLATE AND CHARGER RECEPTACLE BEZEL REMOVAL

Special Tools Needed



NOTE: Refer to the Illustrated Parts Catalog for service tool part numbers.

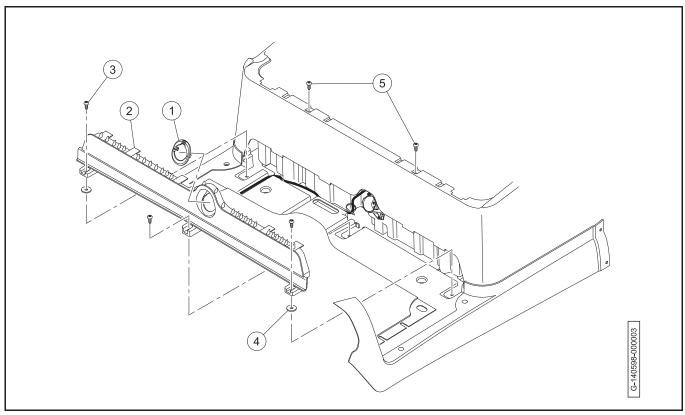


Figure 4-13 Kick Plate and Charger Receptacle Bezel Removal

- 1. Use the charger bezel tool to remove charger receptacle bezel (1) from the kick plate (2) (Figure 4-13, Page 4-16).
- 2. Remove the floor mat.
- 3. Remove three screws (3) and washers (4).
- 4. Remove the two front screws (5).
- 5. Raise the forward portion of the rear beauty panel to disengage it from the tabs on the upper portion of the kick plate.
- 6. Remove the kick plate from vehicle.

KICK PLATE AND CHARGER RECEPTACLE BEZEL INSTALLATION

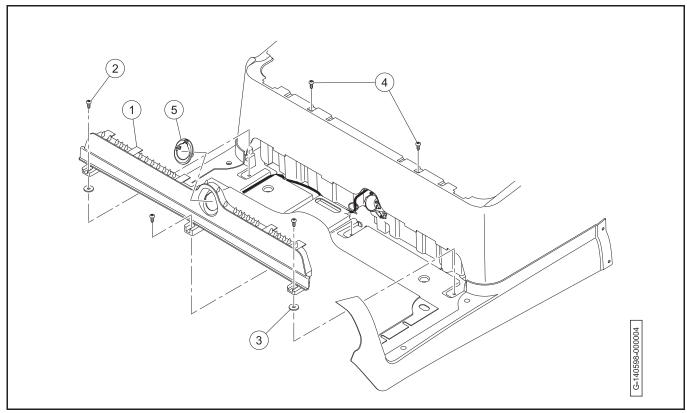


Figure 4-14 Kick Plate and Charger Receptacle Bezel Installation

- 1. Install the kick plate (3).
- 2. Make sure that the front lower edge of the rear beauty panel mates with the kick plate.
- 3. Install the three screws (1) and washers (2). Tighten the screws to 3.3 lb·ft (4.5 N·m).
- 4. Install the two front screws (5). Tighten screws to 3.7 lb·ft (5 N·m).
- 5. Install the floor mat.
- 6. Install the charger receptacle bezel (4).

KICK PLATE - GASOLINE VEHICLES

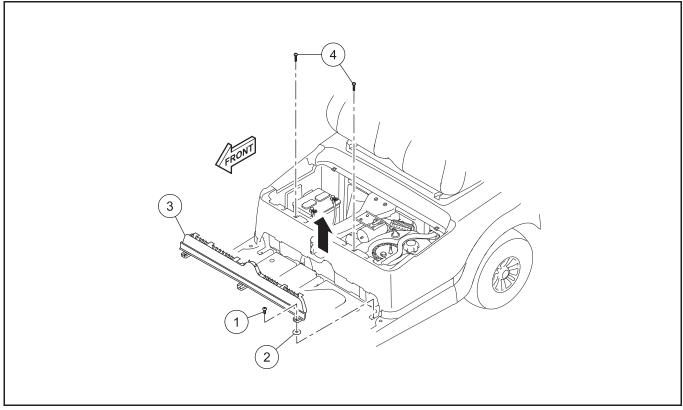


Figure 4-15 Kick Plate - Gasoline Vehicles

KICK PLATE REMOVAL

- 1. Remove the floor mat.
- 2. Remove the three screws (1) and washers (2).
- 3. Remove the two front screws (4).
- 4. 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 the kick plate (3) from vehicle.

KICK PLATE INSTALLATION

- 1. Install the kick plate (3).
- 2. Install the three screws (1) and washers (2). Tighten the screws to 3.3 lb·ft (4.5 N·m).
- 3. Install two front screws (4). Tighten the screws to 3.7 lb·ft (5 N·m).
- 4. Install the floor mat.

ACCESS PANEL

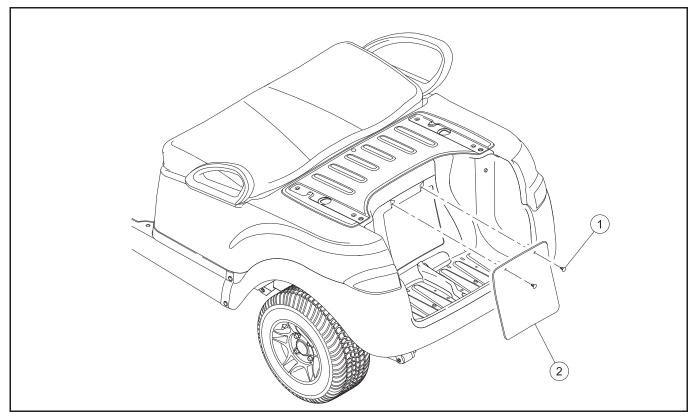


Figure 4-16 Access Panel

ACCESS PANEL REMOVAL

- 1. Remove the two push rivets (1) (Figure 4-16).
- 2. Remove the access panel (2).

ACCESS PANEL INSTALLATION

- 1. Install the access panel (2) onto the rear underbody (Figure 4-16).
- 2. Install the two push rivets (1).

VISAGE DISPLAY UNIT OVERHEAD BASKETS

OVERHEAD BASKET REMOVAL

1. Remove the screw (1) (Figure 4-17, Page 4-20).

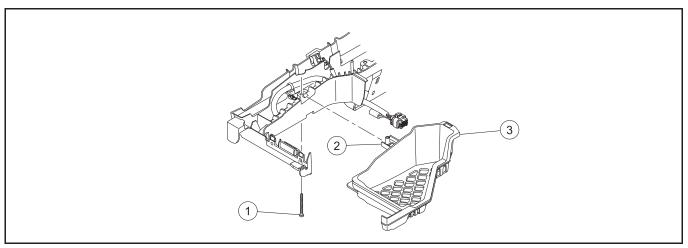


Figure 4-17 Overhead Basket

2. Release the tab (2) and remove the overhead basket (3).

OVERHEAD BASKET INSTALLATION

- 1. Align the overhead basket (3) with the display unit support (Figure 4-17, Page 4-20).
- 2. Push the overhead basket forward until the tab (2) locks.
- 3. Install the screw (1). Tighten the screw to 17.7 lb·in (2.0 N·m).

OVERHEAD SPEAKER BASKET REMOVAL

1. Remove the screw (1) (Figure 4-18, Page 4-21).

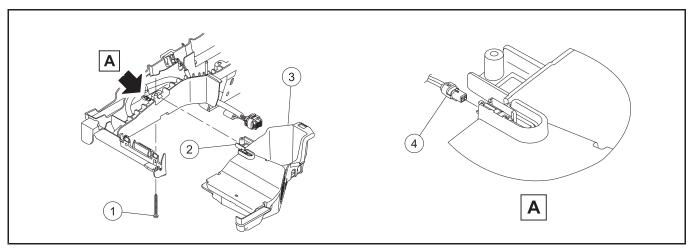


Figure 4-18 Overhead Speaker Basket

- 2. Release the tab (2) and remove the overhead speaker basket (3).
- 3. Disconnect the electrical connector (4).

OVERHEAD SPEAKER BASKET INSTALLATION

- 1. Connect the electrical connector (4) (Figure 4-18, Page 4-21).
- 2. Align the overhead speaker basket (3) with the display unit support.
- 3. Push the overhead speaker basket forward until the tab (2) locks.
- 4. Install the screw (1). Tighten the screw to 17.7 lb·in (2.0 N·m).

TWO-PASSENGER - CANOPY

TWO-PASSENGER CANOPY REMOVAL

CAUTION

• To prevent damage to the canopy, do not remove the canopy supports from the vehicle without first removing the canopy.

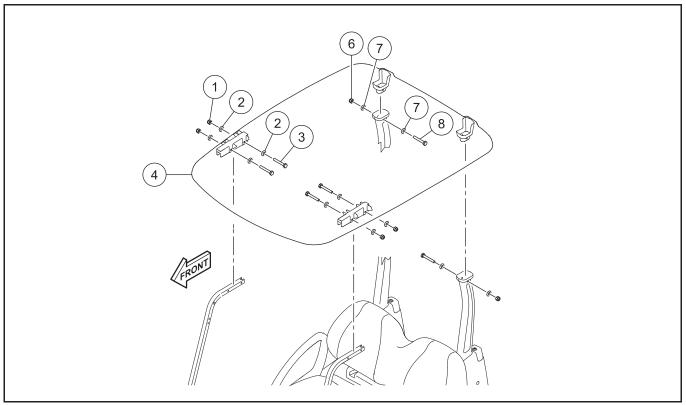


Figure 4-19 Two-Passenger Canopy Removal

- 1. Remove the nuts (1), washer (2), and bolts (3) from the canopy (4) and each front canopy strut (Figure 4-19).
- 2. Remove the nuts (6), washer (7), and bolts (8) from the canopy and each rear canopy support.
- 3. Remove the canopy.

TWO-PASSENGER CANOPY INSTALLATION

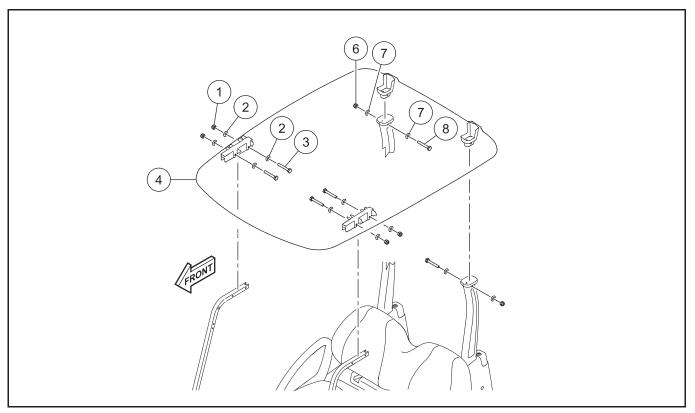


Figure 4-20 Two-Passenger Canopy Installation

- 1. Put the canopy (4) on top of the front and rear canopy supports (**Figure 4-20**). Make sure that the front supports are correctly positioned between the molded tabs on the underside of the canopy. Make sure that the molded protrusions at the rear of the canopy extend into the top of the rear supports.
- 2. Install the bolts (3), washers (2), and nuts (1). Tighten the hardware to 50 lb·in (5.6 N·m).
- 3. Install the bolts (8), washers (7), and nuts (6). Tighten the hardware to 50 lb·in (5.6 N·m).

TWO-PASSENGER CANOPY WITH VISAGE DISPLAY UNIT REMOVAL

CAUTION

- To prevent damage to the canopy, do not remove the canopy supports from the vehicle without first removing the canopy.
- 1. Remove the overhead baskets. See Display Unit Overhead Basket.
- 2. Remove the nuts (1), washers (2), and bolts (3) from each front canopy strut (Figure 4-21, Page 4-24).

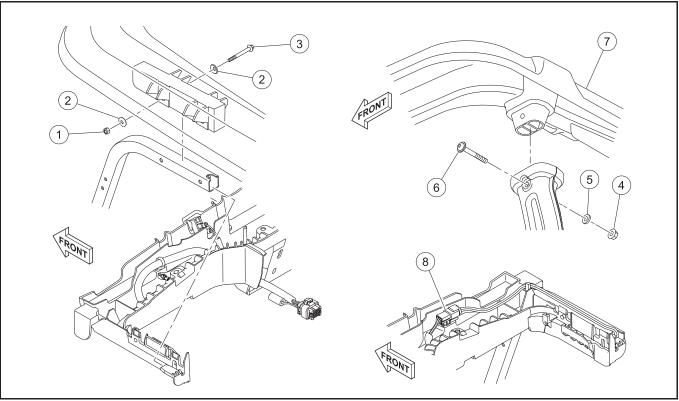


Figure 4-21 Two-Passenger Canopy With Visage Display Unit Removal

- 3. Remove the nuts (4), washer (5), and bolts (6) from each rear canopy support.
- 4. Remove the canopy (7).
- 5. Disconnect the canopy harness (8).
- 6. Remove the screws (9) (Figure 4-22, Page 4-24).

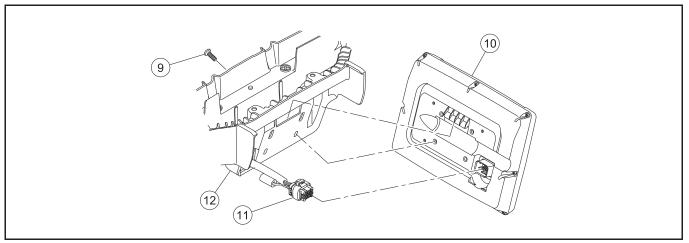


Figure 4-22 Visage Display Unit Removal

- 7. Remove the Visage display unit (VDU) (10) from the display unit support.
- 8. Disconnect the display unit harness (11).
- 9. Remove the display unit support (12).

TWO-PASSENGER CANOPY WITH VISAGE DISPLAY UNIT INSTALLATION

1. Put the tabs of the display unit support (12) into the front canopy struts (Figure 4-23, Page 4-25).

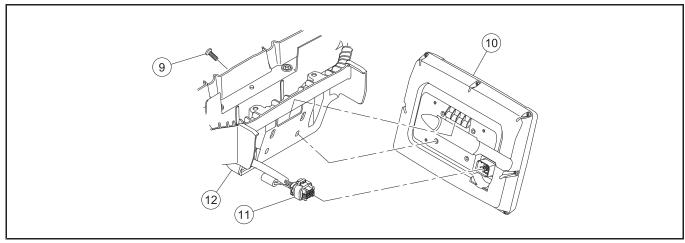


Figure 4-23 Visage Display Unit Installation

- 2. Install the display unit support onto the front canopy struts.
- 3. Connect the display unit harness (11).
- 4. Install the Visage display unit (VDU) (10) onto the display unit support.
- 5. Install the screws (9). Tighten the screws to 24 lb·in (2.7 N·m).
- 6. Make sure that the strut harness is routed correctly.

7. Connect the strut harness to the canopy harness (8) (Figure 4-24, Page 4-26).

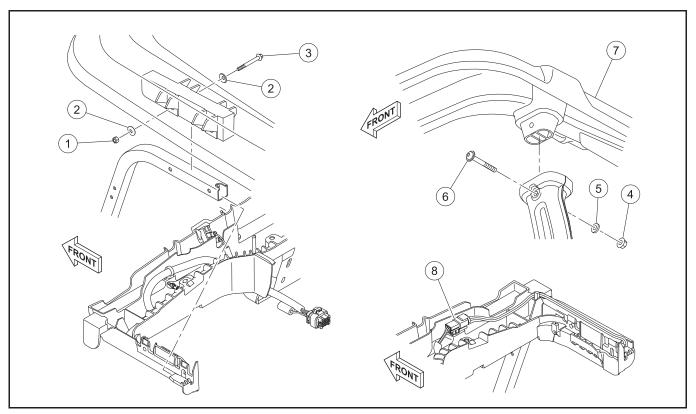


Figure 4-24 Two-Passenger Canopy With Display Unit Installation

- 8. Install the canopy (7) on top of the front and rear canopy supports.
- 9. Install the bolts (3), washers (2), and nuts (1). Tighten the hardware to 50 lb·in (5.6 N·m).
- 10. Install the bolts (6), washers (5), and nuts (4). Tighten the hardware to 50 lb·in (5.6 N·m).
- 11. Install the overhead baskets. See Display Unit Overhead Basket.

TWO-PASSENGER FRONT CANOPY STRUT REMOVAL

CAUTION

- To prevent damage to the canopy, do not remove the canopy supports from the vehicle without first removing the canopy.
- 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.

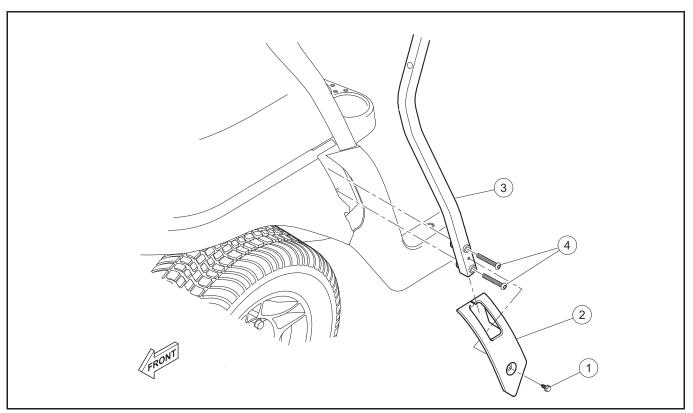


Figure 4-25 Front Canopy Strut Removal

- 1. Remove the canopy.
- 2. Remove the screw (1) (Figure 4-25).
- 3. Slide the front canopy strut cover (2) up the front canopy strut (3).
- 4. Remove the screws (4) and the front canopy strut.

TWO-PASSENGER FRONT CANOPY STRUT INSTALLATION

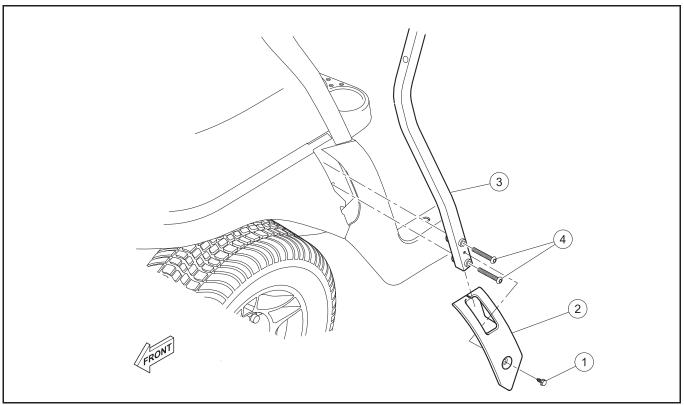


Figure 4-26 Front Canopy Strut Installation

- 1. Install the front canopy strut (3) onto the vehicle (Figure 4-26).
- 2. Install the front canopy strut cover (2) onto the front canopy strut.
- 3. Install the screws (4). Tighten the screws to 18.4 lb·ft (25 N·m).
- 4. Install the screw (1). Tighten the screw to 31 lb·in (4.6 N·m).
- 5. Install the canopy.

TWO-PASSENGER REAR CANOPY SUPPORT REMOVAL

CAUTION

- To prevent damage to the canopy, do not remove the canopy supports from the vehicle without first removing the canopy.
- 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.

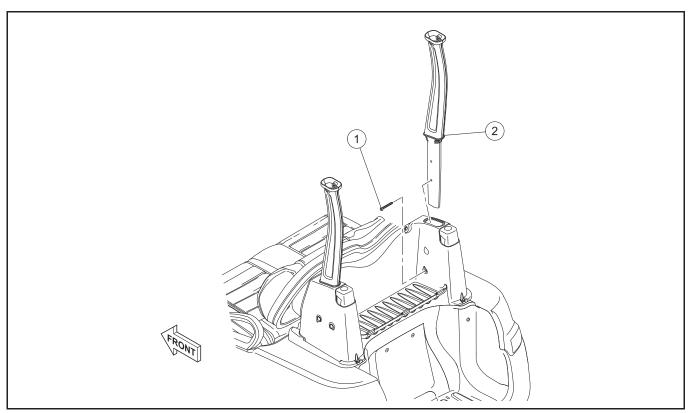


Figure 4-27 Rear Canopy Support Removal

- 1. Remove the canopy.
- 2. Remove the screw (1) (Figure 4-27).
- 3. Remove the rear canopy support (2).

TWO-PASSENGER REAR CANOPY SUPPORT INSTALLATION

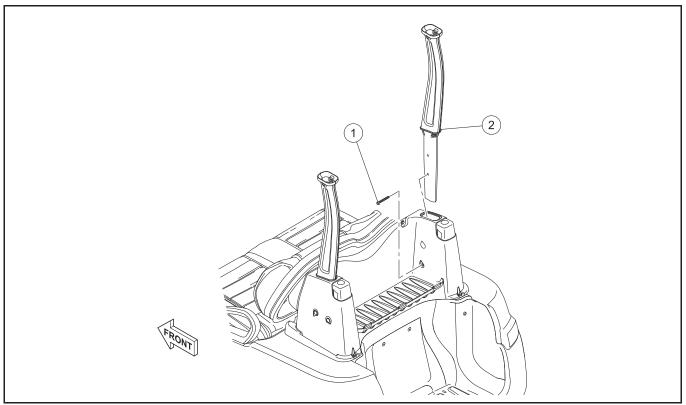


Figure 4-28 Rear Canopy Support Installation

- 1. Install the rear canopy support (2) into the structural accessory module (SAM) (Figure 4-28).
- 2. Install the screw (1). Tighten the screw to 88 lb·in (10 N·m).
- 3. Install the canopy.

TWO-PASSENGER - REAR BODY

UNIVERSAL ACCESSORY MOUNTING

The Structural Accessory Module (SAM) includes two mounting locations on both the driver side and the passenger side. These serve as common attachment points for various accessories. Accessories that can be mounted on the SAM include single or dual sand bottles, sand bucket, and the club cleaner.

STRUCTURAL ACCESSORY MODULE (SAM)

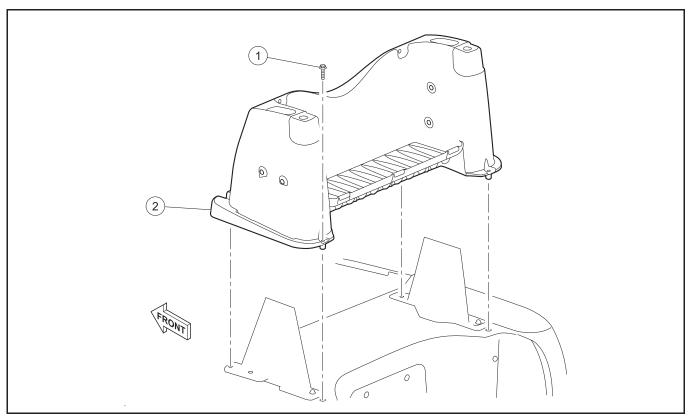


Figure 4-29 SAM

SAM Removal

- 1. If the vehicle has a canopy, remove the rear canopy supports from the SAM (2) (Figure 4-29).
- 2. Remove the four bolts (1).

SAM Installation

- 1. Position the SAM (2) over its mounting holes (Figure 4-29).
- 2. Install the four screws (1). Tighten the screws to 71 lb·in (8 N·m).

SEAT BACK

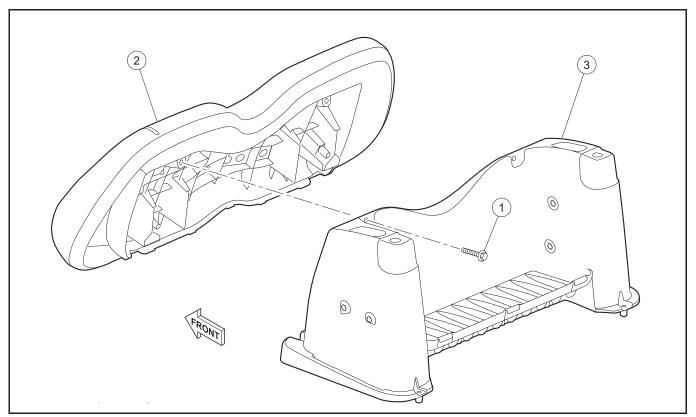


Figure 4-30 Seat Back

Seat Back Removal

- 1. Remove the two screws (1) (Figure 4-30).
- 2. Remove the seat back (2) from the SAM (3).

Seat Back Installation

- 1. Put the seat back (2) on the SAM (3) (Figure 4-30).
- 2. Install the two screws (1). Tighten the screws to 51 lb·in (5.8 N·m).

BAG RACK ASSEMBLY

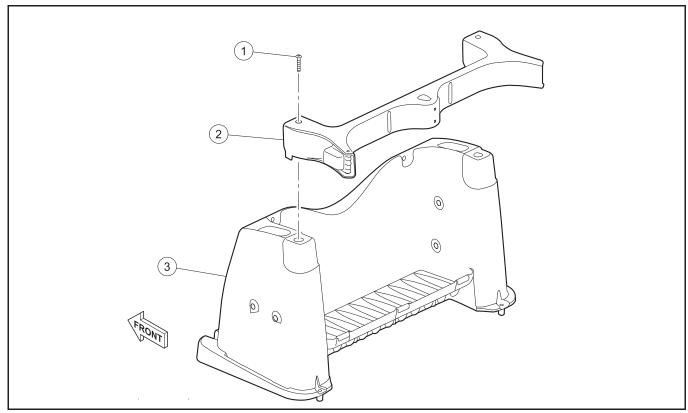


Figure 4-31 Bag Rack

Bag Rack Removal

- 1. Remove the two screws (1) (Figure 4-31).
- 2. Remove the bag rack (2) from the SAM (3).

Bag Rack Installation

- 1. Install the bag rack (2) onto the SAM (3) (Figure 4-31).
- 2. Install the two screws (1). Tighten the screws to 53 lb·in (6 N·m).

BAG STRAP

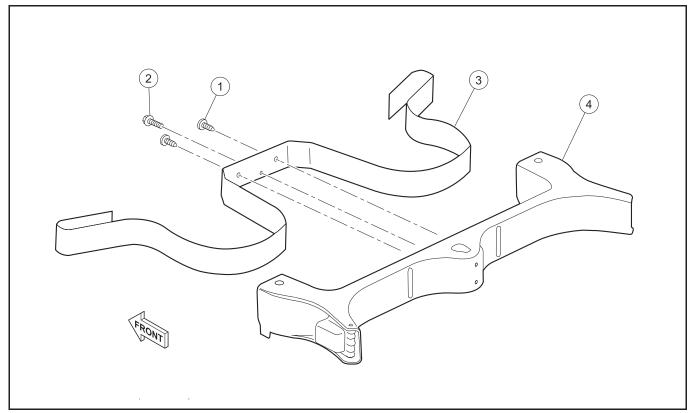


Figure 4-32 Bag Strap

Bag Strap Removal

- 1. Remove the push rivets (1) and screw (2) (Figure 4-32).
- 2. Remove the bag strap (3) from the bag rack (4).

Bag Strap Installation

- 1. Install the bag strap (3) onto the bag rack (4) (Figure 4-32).
- 2. Install the push rivets (1) and screw (2). Tighten the screw to 31 lb·in (3.5 N·m).

SWEATER BASKET

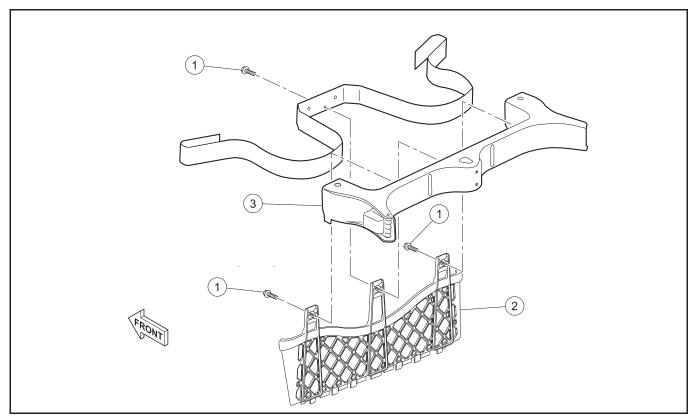


Figure 4-33 Sweater Basket

Sweater Basket Removal

- 1. Remove the three screws (1) (Figure 4-33).
- 2. Remove the sweater basket (2) from the bag rack (3).

Sweater Basket Installation

- 1. Install the sweater basket (2) onto the bag rack (3) (Figure 4-33).
- 2. Install the three screws (1). Tighten the screws to 31 lb·in (3.5 N·m).

REAR BEAUTY PANEL

Two-passenger rear beauty panel procedures.

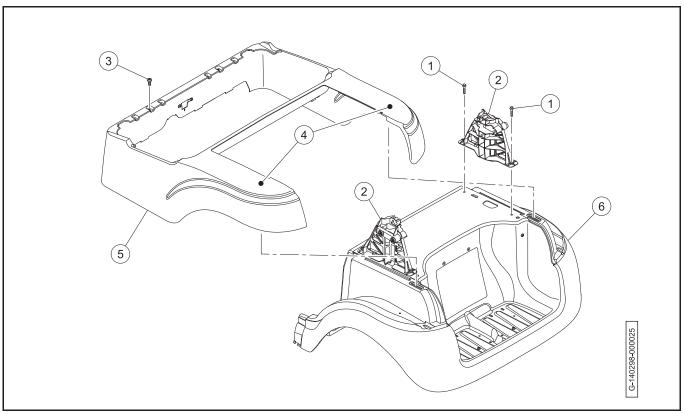


Figure 4-34 Rear Beauty Panel

Rear Beauty Panel Removal

- 1. Remove the structural accessory module (SAM).
- 2. Remove the screws (1) (Figure 4-34).
- 3. Remove the canopy support brackets (2).
- 4. Remove the four screws (3).
- 5. Remove the Forward / Neutral / Reverse control (FNR).
- 6. Disengage the two body clips (4) of the rear beauty panel (5) from the slots in the rear underbody (6).
- 7. Remove the rear beauty panel from vehicle.

Rear Beauty Panel Installation

- 1. Install the rear beauty panel (5) onto vehicle (Figure 4-34).
- 2. Make sure that the two body clips (4) engage the slots in the rear underbody (6).
- 3. Install the four screws (3). Tighten the screws to 44 lb·in (5 N·m).
- 4. Install the Forward / Neutral / Reverse control (FNR).
- 5. Put the canopy support brackets (2) on the vehicle.
- 6. Install the screw (1). Tighten the screw to 53 lb·in (6 N·m).

REAR UNDERBODY

Two-passenger rear underbody procedures.

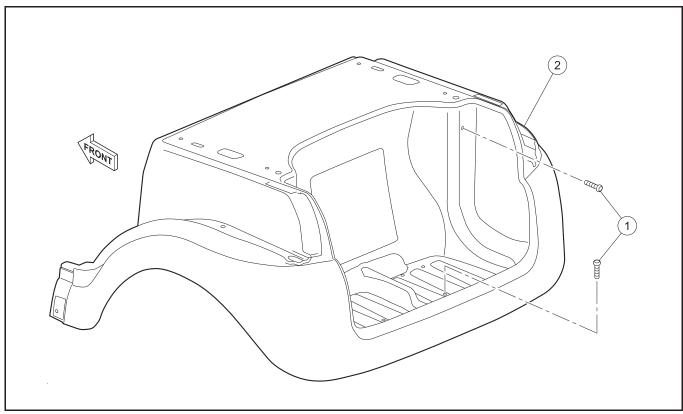


Figure 4-35 Rear Underbody

Rear Underbody Removal

- 1. Remove the structural accessory module (SAM).
- 2. Remove the rear beauty panel.
- 3. Remove remove the four screws (1) (Figure 4-35).
- 4. Lift the rear edge of the rear underbody (2) until the front portion slides out from beneath the front underbody. Remove the rear underbody from the vehicle.

Rear Underbody Installation

- 1. Install the rear underbody (2) onto the vehicle (Figure 4-35).
- 2. Install the four screws (1). Tighten the screws to 71 lb·in (8 N·m).

REAR CROSSMEMBER

Two-passenger rear crossmember procedures.

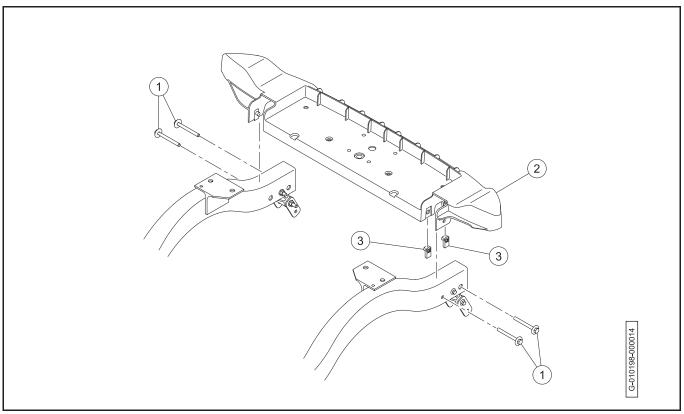


Figure 4-36 Rear Crossmember

Rear Crossmember Removal

- 1. Remove the four bolts (1) (Figure 4-36) .
- 2. Remove the rear crossmember (2).

Rear Crossmember Installation

- 1. Install the rear crossmember (2) onto the vehicle (Figure 4-36).
- 2. Make sure that the J-clips (3) are installed on the inside of the frame rail.
- 3. Install the four bolts (1). Tighten the bolts to 56 lb·in (6.35 N·m).

2+2 - MONSOON CANOPY

MONSOON CANOPY REMOVAL

CAUTION

- To prevent damage to the canopy, do not remove the canopy supports from the vehicle without first removing the canopy.
- 1. Remove the nuts (1), washers (2), and bolts (3) from the front canopy strut (4) (Figure 4-37).

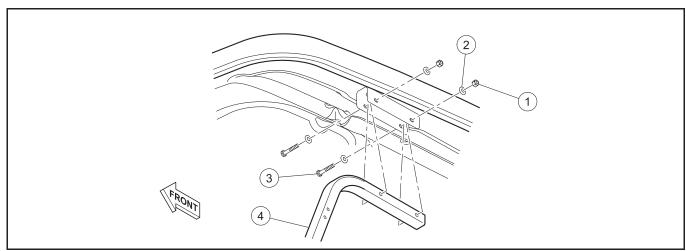


Figure 4-37 Canopy Removal - Front Canopy Strut

- 2. Remove the screws (5) (Figure 4-38).
- 3. Remove the canopy (6).

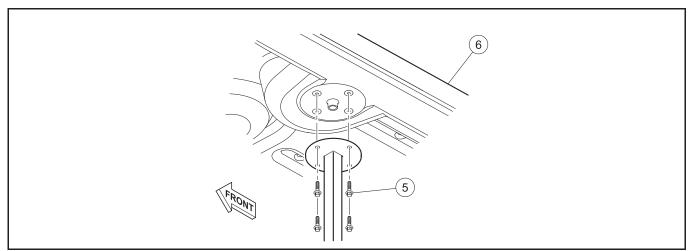


Figure 4-38 Canopy Removal - Rear Canopy Support

MONSOON CANOPY INSTALLATION

- 1. Put the canopy (6) on top of the front and rear canopy supports (Figure 4-39).
- 2. Install the screws (5). Tighten the screws to 80 lb·in (9 N·m).

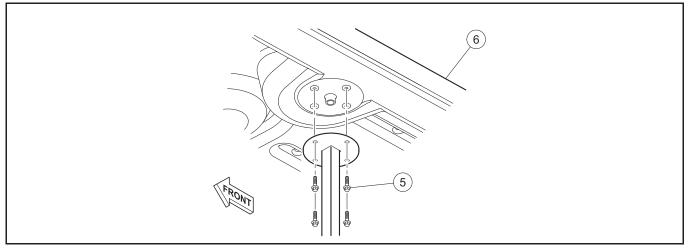


Figure 4-39 Canopy Installation - Rear Canopy Support

3. Install the bolts (3), washers (2), and nuts (1) to secure the front canopy strut (4) (Figure 4-40). Tighten the hardware to 80 lb·in (9 N·m).

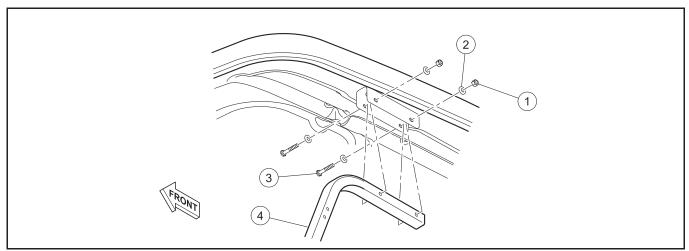


Figure 4-40 Canopy Installation - Front Canopy Strut

2+2 FRONT CANOPY STRUT REMOVAL

CAUTION

- To prevent damage to the canopy, do not remove the canopy supports from the vehicle without first removing the canopy.
- 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.

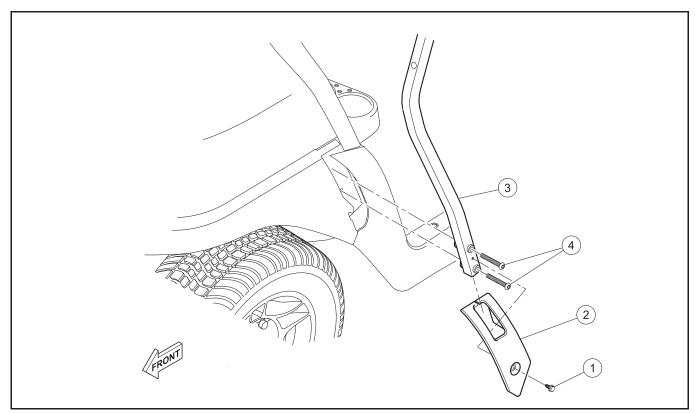


Figure 4-41 Front Canopy Strut Removal

- 1. Remove the canopy.
- 2. Remove the screw (1) (Figure 4-41).
- 3. Slide the front canopy strut cover (2) up the front canopy strut (3).
- 4. Remove the screws (4) and the front canopy strut.

2+2 FRONT CANOPY STRUT INSTALLATION

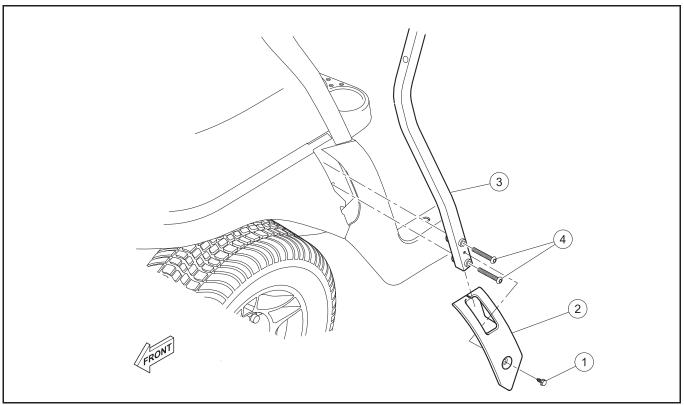


Figure 4-42 Front Canopy Strut Installation

- 1. Install the front canopy strut (3) onto the vehicle (Figure 4-42).
- 2. Install the front canopy strut cover (2) onto the front canopy strut.
- 3. Install the screws (4). Tighten the screws to 18.4 lb·ft (25 N·m).
- 4. Install the screw (1). Tighten the screw to 31 lb·in (4.6 N·m).
- 5. Install the canopy.

2+2 REAR CANOPY SUPPORT REMOVAL

CAUTION

- To prevent damage to the canopy, do not remove the canopy supports from the vehicle without first removing the canopy.
- 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.

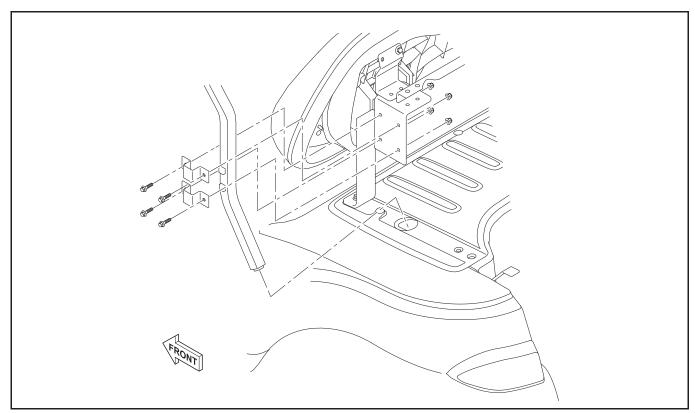


Figure 4-43 Rear Canopy Support Removal

- 1. Remove the canopy.
- 2. Remove the screws (1) and brackets (2) (Figure 4-43).
- 3. Remove the rear canopy support (3).

2+2 REAR CANOPY SUPPORT INSTALLATION

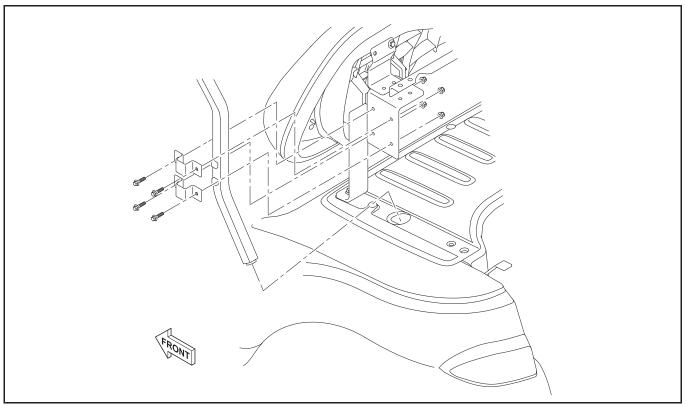


Figure 4-44 Rear Canopy Support Installation

- 1. Install the rear canopy support (3) into the rear underbody (Figure 4-44).
- 2. Install the brackets (2) onto the rear canopy support.
- 3. Install the screws (1). Tighten the screws to 80 lb·in (9 N·m).

2+2 - REAR BODY

SEAT BACKS

Seat Back Removal

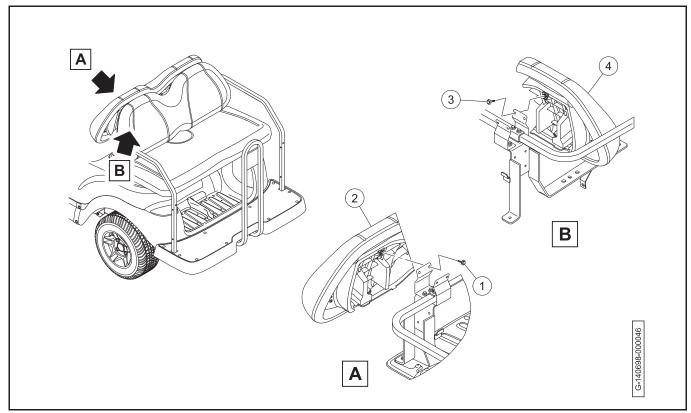


Figure 4-45

- 1. Remove the screws (1) from the front seat back (2) (Figure 4-45).
- 2. Remove the front seat back.
- 3. Remove the screws (3) from the rear seat back (4).
- 4. Remove the rear seat back.

Seat Back Installation

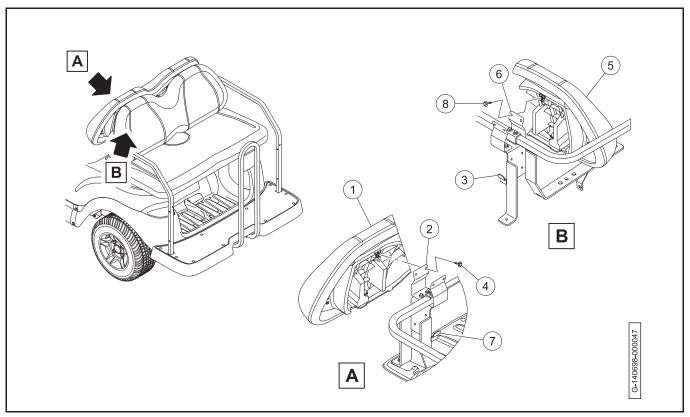


Figure 4-46 Seat Back Installation

- 1. Install the front seat back (1) onto the seat support (2). Make sure the seat support tab (3) is installed in the front seat back (Figure 4-46).
- 2. Install the screws (4). Tighten the screw to 4.4 lb·ft (6 N·m).
- 3. Install the rear seat back (5) onto the seat support (6). Make sure the seat support tab (7) is installed in the rear seat back.
- 4. Install the screws (8). Tighten the screw to 4.4 lb·ft (6 N·m).

FIXED REAR SEAT

2+2 fixed rear seat procedures.

Fixed Rear Seat Bottom Removal

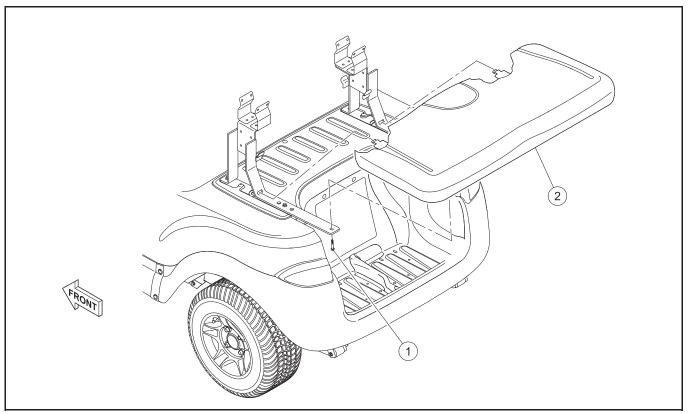


Figure 4-47 Fixed Rear Seat Bottom

- 1. Remove the screws (1) (Figure 4-47).
- 2. Lift and remove the rear seat bottom (2).

Fixed Rear Seat Bottom Installation

- 1. Install the rear seat bottom tabs into the seat supports. Lower the rear seat bottom (2) onto the seat supports (Figure 4-47).
- 2. Install the screws (1). Tighten the screws to 4.4 lb·ft (6 N·m).

Fixed Rear Seat Hinge Removal

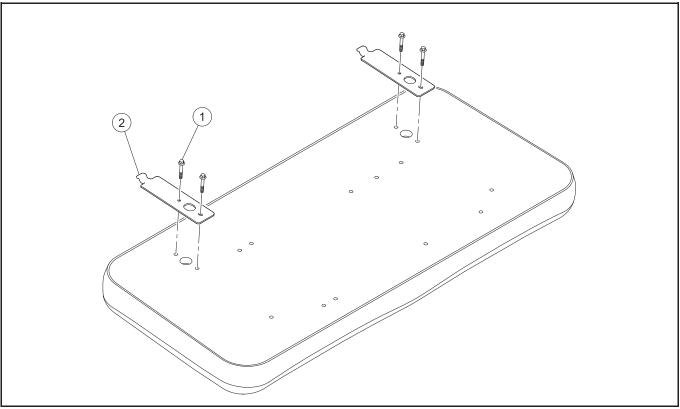


Figure 4-48 Fixed Rear Seat Hinge

- 1. Remove the rear seat bottom.
- 2. Remove the screws (1) (Figure 4-48).
- 3. Remove the hinge (2).

Fixed Rear Seat Hinge Installation

- 1. Install the hinge (2) onto the rear seat bottom (Figure 4-48).
- 2. Install the screws (1). Tighten the screws to 4.4 lb·ft (6 N·m).

Fixed Rear Seat Hip Restraint Removal

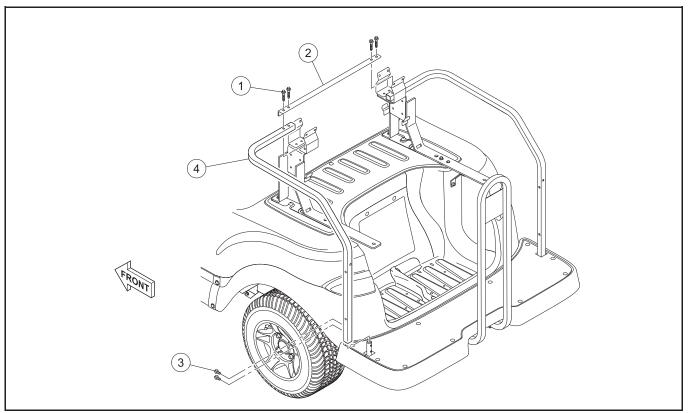


Figure 4-49 Fixed Rear Seat Hip Restraint

- 1. Remove the screws (1) (Figure 4-49).
- 2. Remove the strut angle (2).
- 3. Remove the screws (3).
- 4. Lift and remove the hip restraint (4).

Fixed Rear Seat Hip Restraint Installation

- 1. Install the rear hip restraint (4) onto the foot deck.
- 2. Install the screws (3). Tighten the screws to 4.4 lb·ft (6 N·m) (Figure 4-49).
- 3. Install the strut angle (2) on the rear hip restraint.
- 4. Install the screws (1). Tighten the screws to 4.4 lb·ft (6 N·m).

FOLD-DOWN REAR SEAT

2+2 fold-down rear seat procedures.

Fold-Down Rear Seat Bottom Removal

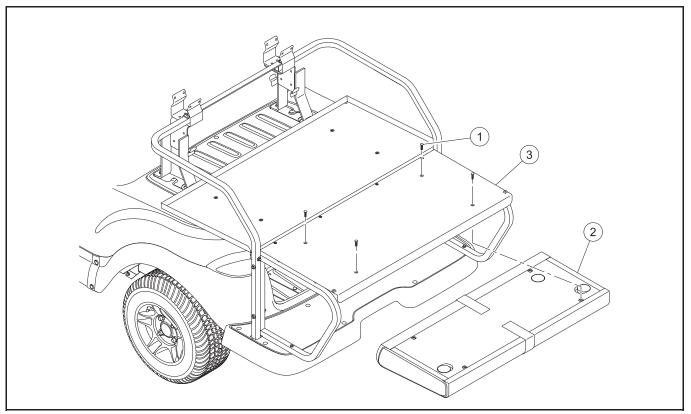


Figure 4-50 Fold-Down Rear Seat Bottom

- 1. Remove the screws (1) (Figure 4-50).
- 2. Remove the rear seat bottom (2) from the fold-down hinge (3).

Fold-Down Rear Seat Bottom Installation

- 1. Put the rear seat bottom (2) onto the fold-down hinge (3) (Figure 4-50).
- 2. Install the screws (1). Tighten the screws to 6.6 lb·ft (9 N·m).

Fold-Down Rear Seat Assembly Removal

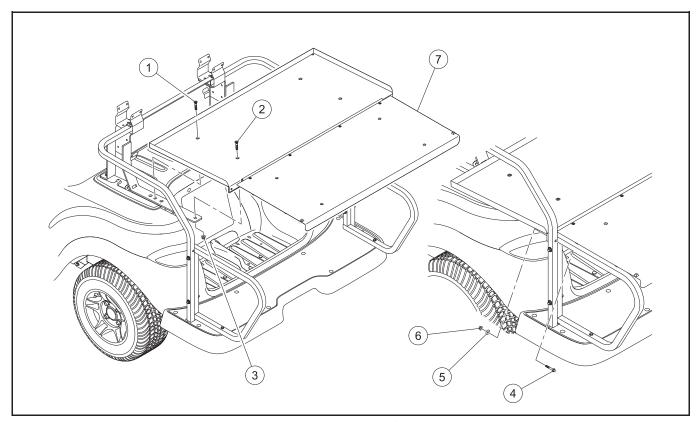


Figure 4-51 Fold-Down Rear Seat Assembly

- 1. Remove the screws (1) (Figure 4-51).
- 2. Remove the bolts (2) and nuts (3).
- 3. Remove the bolts (4) washers (5), and nuts (6).
- 4. Remove the rear seat assembly (7).

Fold-Down Rear Seat Assembly Installation

- 1. Put the rear seat assembly (7) onto the vehicle (Figure 4-51).
- 2. Install the screws (1). Tighten the screws to 13 lb·ft (17.5 N·m).
- 3. Install the bolts (2) and nuts (3). Tighten the nuts to 13 lb·ft (17.5 N·m).
- 4. Install the bolts (4), washers (5) and nuts (6). Tighten the bolts to 8.5 lb·ft (11.5 N·m).

Fold-Down Rear Seat Hip Restraint Removal

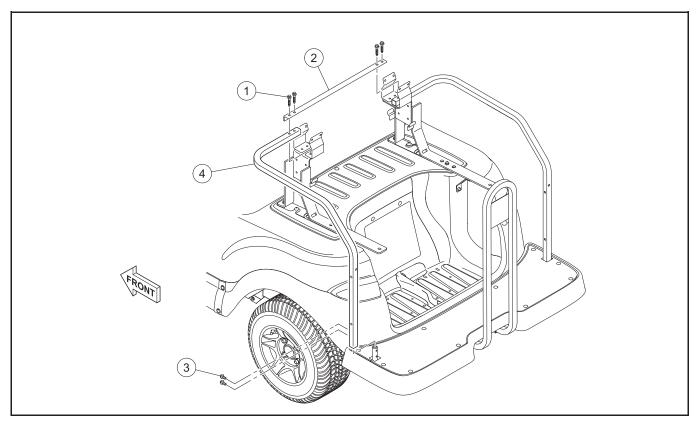


Figure 4-52 Fold-Down Rear Seat Hip Restraint

- 1. Remove the screws (1) (Figure 4-52).
- 2. Remove the strut angle (2).
- 3. Remove the screws (3).
- 4. Lift and remove the hip restraint (4).

Fold-Down Rear Seat Hip Restraint Installation

- 1. Install the rear hip restraint (4) onto the foot deck (Figure 4-52).
- 2. Install the screws (3). Tighten the screws to 4.4 lb·ft (6 N·m).
- 3. Install the strut angle (2) on the rear hip restraint.
- 4. Install the screws (1). Tighten the screws to 4.4 lb·ft (6 N·m).

Side Frame Removal

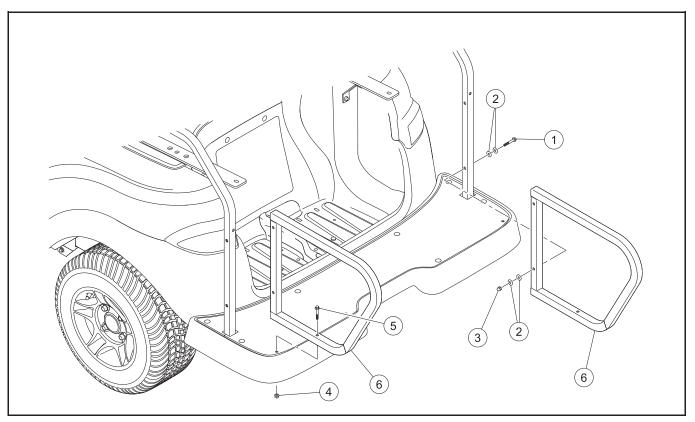


Figure 4-53 Side Frame

- 1. Remove the bolt (1), washers (2), and nut (3) (Figure 4-53).
- 2. Remove the nut (4) and bolt (5).
- 3. Remove the side frame (6).

Side Frame Installation

- 1. Install the side frame (6) onto the foot deck (Figure 4-53).
- 2. Install the nut (4) and bolt (5). Tighten the bolt to 8.5 lb·ft (11.5 N·m).
- 3. Install the nut (1), washers (2), and bolt (3). Tighten the bolt to 8.5 lb·ft (11.5 N·m).

SEAT SUPPORT

2+2 seat support procedures.

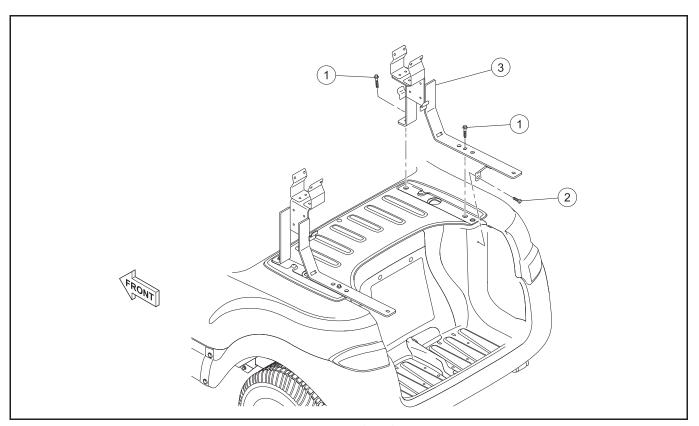


Figure 4-54 2+2 Seat Support

Seat Support Removal

- 1. Remove the seat backs.
- 2. Remove the hip restraints.
- 3. Remove the rear seat bottom assembly.
- 4. Remove the screws (1) (Figure 4-54).
- 5. Remove the screw (2).
- 6. Remove the seat support (3).

Seat Support Installation

- 1. Install the seat support (3) onto the vehicle (Figure 4-54).
- 2. Install the screw (2). Tighten the screw to 13 lb·ft (17.5 N·m).
- 3. Install the screws (1). Tighten the screws to 7 lb·ft (10 N·m).
- 4. Install the rear seat bottom assembly.
- 5. Install the hip restraints.
- 6. Install the seat backs.

FOOT DECK - 2+2

2+2 foot deck procedures.

Foot Deck Removal

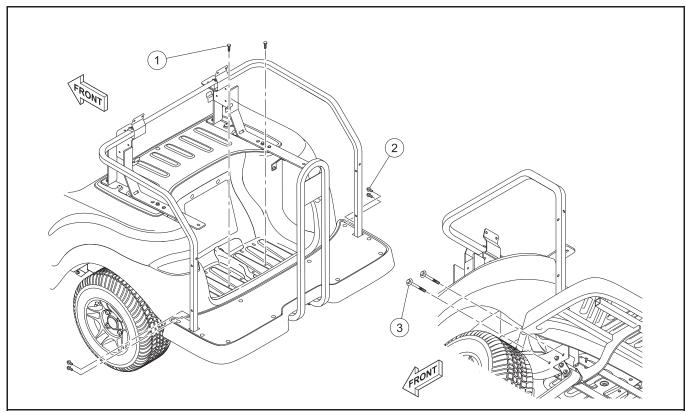


Figure 4-55 Foot Deck (2+2) Removal

- 1. Support the foot deck.
- 2. Remove the screws (1) (Figure 4-55).
- 3. Remove the screws (2).
- 4. Remove the bolts (3) and the foot deck.

Foot Deck Disassembly

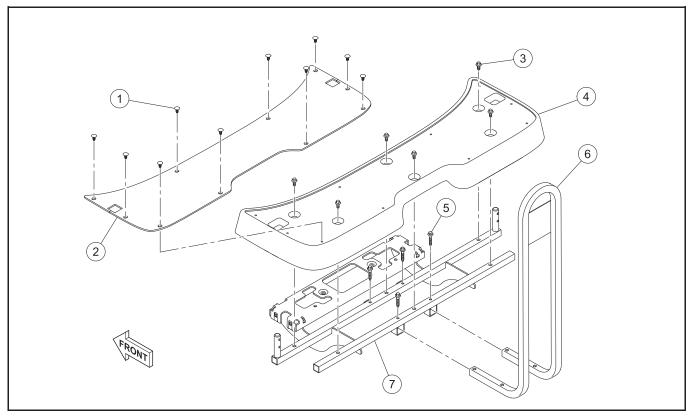


Figure 4-56 Foot Deck (2+2) Disassembly

- 1. Remove the push rivets (1) (Figure 4-56).
- 2. Remove the floormat (2).
- 3. Remove the screws (3).
- 4. Remove the foot deck (4).
- 5. Remove the screws (5).
- 6. Remove the handrail (6) from the foot deck support (7).

Foot Deck Assembly

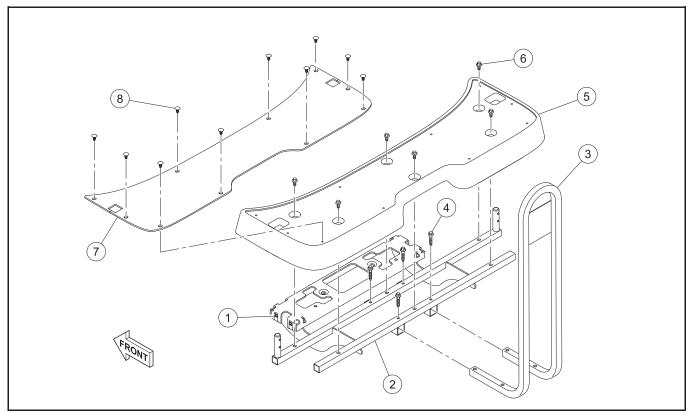


Figure 4-57 Foot Deck (2+2) Assembly

- 1. Make sure the J-clips (1) are installed on the foot deck support (2) (Figure 4-57).
- 2. Install the handrail (3) into the foot deck support.
- 3. Install the screws (4). Tighten the bolts to 5.5 lb·ft (7.5 N·m).
- 4. Install the foot deck (5) onto the foot deck support.
- 5. Install the screws (6). Tighten the screws to 6 lb·ft (8 N·m).
- 6. Install the floormat (7) onto the foot deck.
- 7. Install the push rivets (8).

Foot Deck Installation

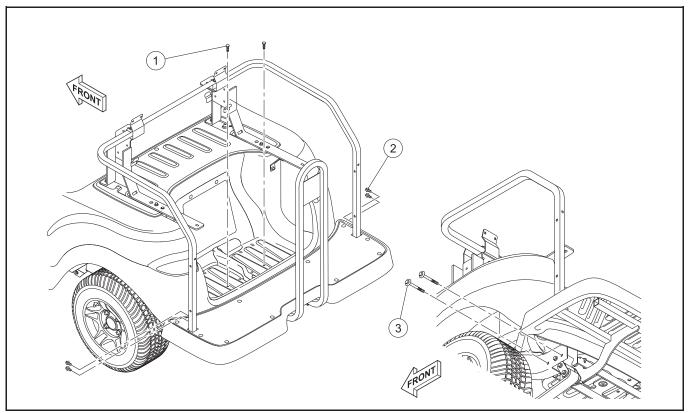


Figure 4-58 Foot Deck (2+2) Installation

- 1. Support the foot deck.
- 2. Install the bolts (3) (Figure 4-58). Tighten the bolts to 22 lb·ft (30 N·m).
- 3. Install the screws (2). Tighten the screws to 13 lb·ft (18 N·m).
- 4. Install the screws (1). Tighten the screws to 7 lb·ft (10 N·m).

REAR BEAUTY PANEL (2+2 VEHICLES)

2+2 rear body component procedures.

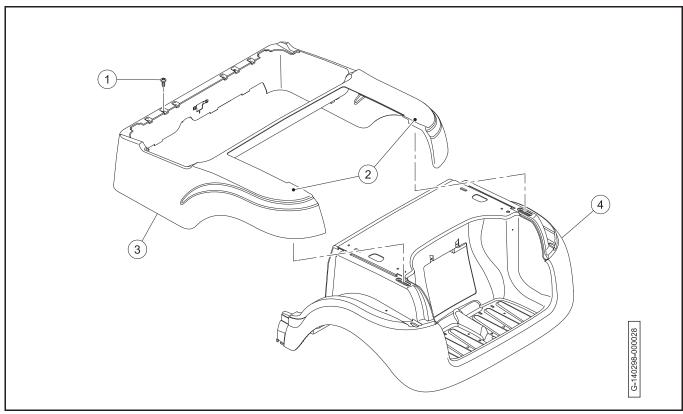


Figure 4-59 2+2 Rear Beauty Panel

Rear Beauty Panel Removal

- 1. Remove the front seat bottom.
- 2. Remove the rear seat assembly.
- 3. Remove the forward / neutral / reverse (FNR) control.
- 4. Remove the screws (1) (Figure 4-59).
- 5. Disengage the two body clips (2) under the rear of the beauty panel (3) from the slots in the rear underbody (4).
- 6. Remove the rear beauty panel from the rear underbody.

Rear Beauty Panel Installation

- 1. Install the rear beauty panel (3) on the rear underbody (4). Make sure body clips (2) on the rear of the beauty panel engage the slots in the rear underbody (Figure 4-59).
- 2. Install the screws (1). Tighten the screws to 44 lb·in (5 N·m).
- 3. Install the FNR control.
- 4. Install the rear seat assembly.
- 5. Install the front seat bottom.

REAR UNDERBODY

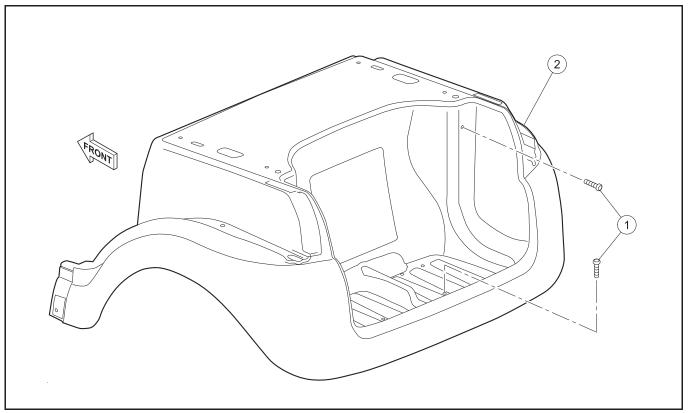


Figure 4-60 2+2 Rear Underbody

Rear Underbody Removal

- 1. Remove the rear beauty panel.
- 2. Remove the access panel.
- 3. Remove the screws (1) (Figure 4-60).
- 4. Lift the rear edge of the rear underbody (2) until the front portion slides out from beneath the front underbody. Remove the rear underbody from the vehicle.

Rear Underbody Installation

- 1. Install the rear underbody (2) on the vehicle (Figure 4-60).
- 2. Install the screws (1). Tighten the screws to 71 lb·in (8 N·m).
- 3. Install the access panel.
- 4. Install the rear beauty panel.

A DANGER

• See General Warnings on page 1-2.

WARNING

• See General Warnings on page 1-2.

PEDAL GROUP - ELECTRIC VEHICLE

PEDAL GROUP REMOVAL

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 2. Remove the floor mat retainer (1) (Figure 5-1).

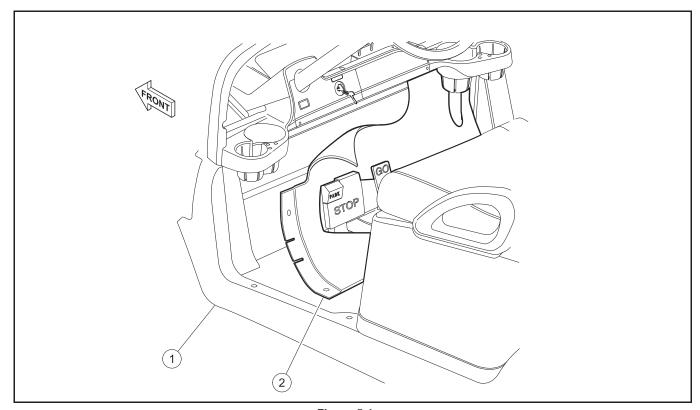


Figure 5-1

3. Pull the floor mat (2) over the pedal group.

4. Remove the fastener (3) (Figure 5-2).

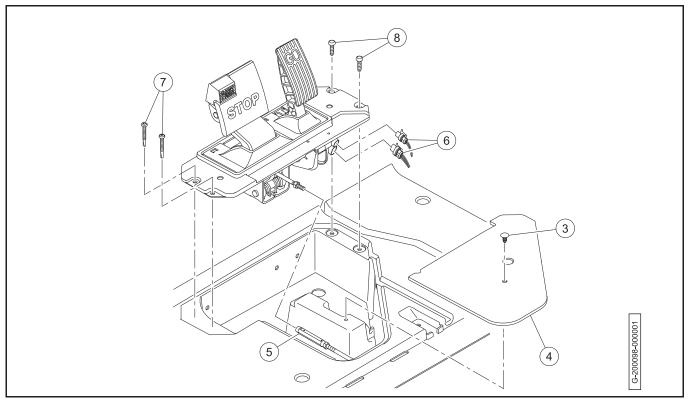


Figure 5-2 Pedal Group Removal

- 5. Remove the cover (4).
- 6. Loosen the jam nuts on each side of the turnbuckle (5).
- 7. Remove the turnbuckle from the pedal assembly.
- 8. Disconnect the wire harnesses (6).
- 9. Remove the screws (7 and 8).
- 10. Remove the pedal group.

PEDAL GROUP INSTALLATION

1. Connect the wire harnesses (1) (Figure 5-3).

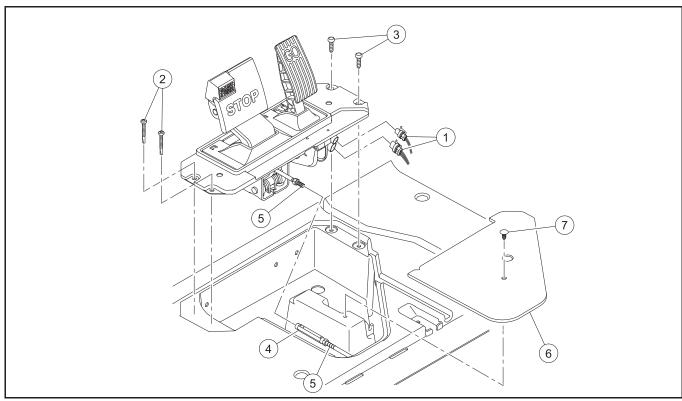


Figure 5-3 Pedal Group Installation

- 2. Install the driver side screws (2). Tighten the driver side screws to 97 lb·in (11 N·m).
- 3. Install the passenger side screws (3). Tighten the passenger side screws to 18 lb·in (2 N·m).
- 4. Remove the turnbuckle (4).
- 5. Apply Loctite® 242 to the threads (5) of both the rods.
- 6. Install the turnbuckle.
- 7. Adjust the brake cable equalizer tension.
- 8. Install the cover (6).
- 9. Install the fastener (7).

10. Install the floor mat (8) over the pedal group (Figure 5-4).

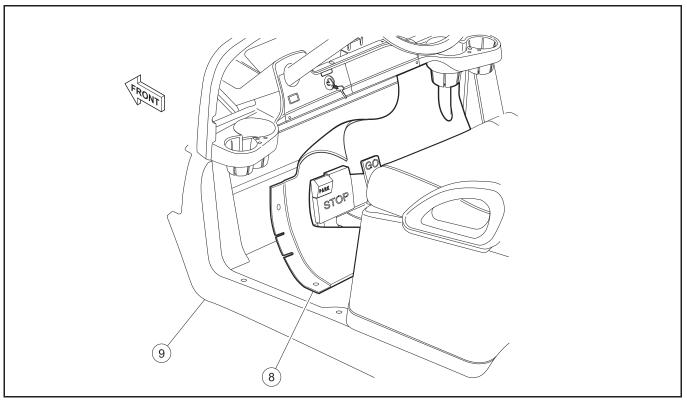


Figure 5-4 Floor Mat and Retainer Installation

- 11. Install the floor mat retainer (9).
- 12. Connect the batteries. See Connect the Batteries Electric Vehicles, Section 1, Page 1-5.

PEDAL GROUP - GASOLINE VEHICLE

See General Warnings on page 1-2.

PEDAL GROUP REMOVAL

- 1. Disconnect battery and spark plug wire.
- 2. Remove the floor mat retainer (1) (Figure 5-5).

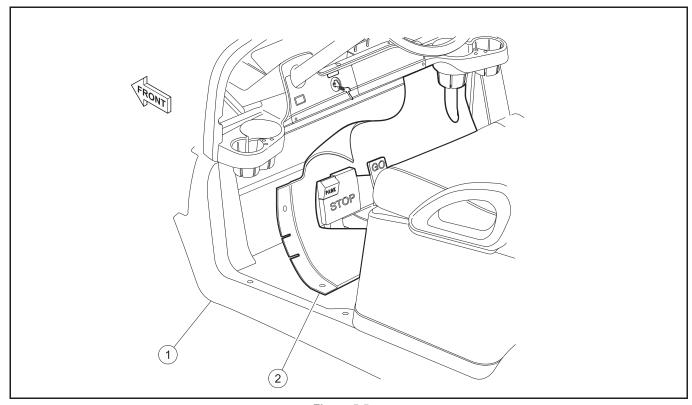


Figure 5-5

3. Pull the floor mat (2) over the pedal group.

4. Remove the fastener (3) (Figure 5-6).

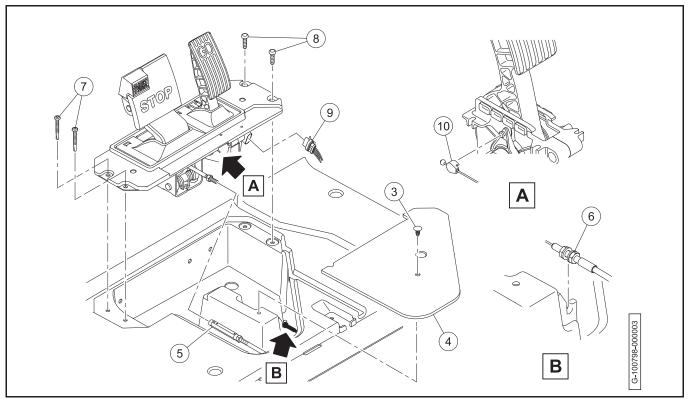


Figure 5-6

- 5. Remove the cover plate (4).
- 6. Loosen the jam nuts on each side of turnbuckle (5).
- 7. Remove the turnbuckle from the pedal assembly.
- 8. Loosen the two nuts (6) on the accelerator cable and lift the cable from its mounting bracket.
- 9. Remove the screws (7 and 8).
- 10. Disconnect the wire harness (9).
- 11. Disconnect the accelerator cable clip (10) from the accelerator pedal.
- 12. Remove the pedal group.

THROTTLE POSITION SENSOR

The pedal group for the vehicle includes a throttle position sensor mounted on the side of the accelerator pedal assembly. The throttle position sensor detects the position of the accelerator pedal and sends a voltage to the solenoid and forward/reverse limit switches. The throttle position sensor itself is not intended to be replaced. If sensor is determined to need replacing through test procedures found in this manual, the accelerator pedal assembly must be replaced. See Accelerator Pedal on page 5-10.

PEDAL GROUP INSTALLATION

1. Connect the accelerator cable clip (1) to the accelerator pedal (Figure 5-7).

CAUTION

• Make sure the accelerator cable is properly seated to the pedal group.

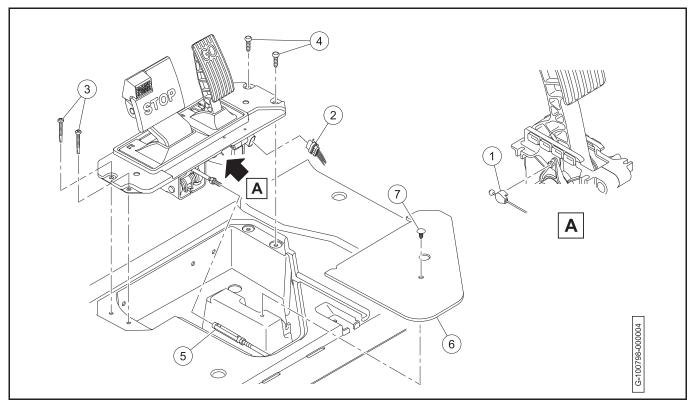


Figure 5-7

- 2. Connect the wire harness (2) to the throttle position sensor.
- 3. Install the pedal group in vehicle.
- 4. Install the screws (3). Tighten the screws to 97 lb·in (11 N·m).
- 5. Install the screws (4). Tighten the screws to 18 lb·in (2 N·m).
- 6. Adjust the engine rpm.
- 7. Install the cover (6).
- 8. Install the fastener (7).

9. Install the floor mat (8) over the pedal group (Figure 5-8).

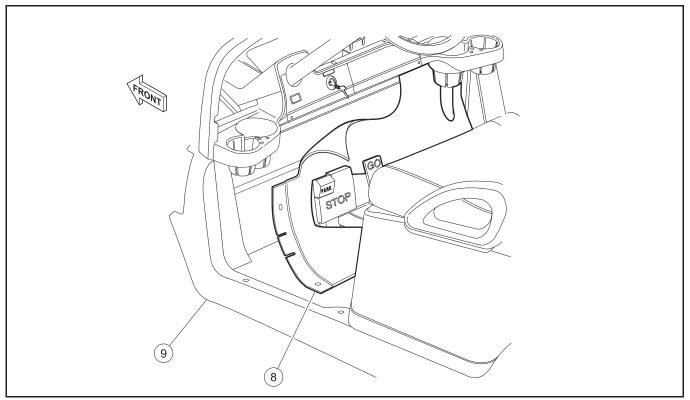


Figure 5-8

- 10. Install the floor mat retainer (9).
- 11. Connect battery and spark plug wire.

DEBRIS SHIELDS

Debris shields on the top face of the pedal group prevent excessive debris from contacting the moving parts of the pedal group.

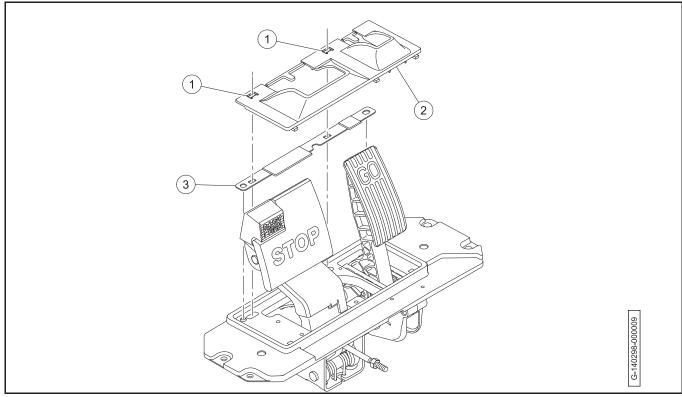


Figure 5-9 Debris Shields

DEBRIS SHIELDS REMOVAL

- 1. Use a flat blade screw driver to release the tabs (1) and remove the primary debris shield (2) (Figure 5-9).
- 2. Remove the auxiliary debris shield (3).

DEBRIS SHIELDS INSTALLATION

- 1. Install the auxiliary debris shield (3) (Figure 5-9).
- 2. Install the primary debris shield (2).
- 3. Make sure that the tabs (1) are locked in position.

ACCELERATOR PEDAL

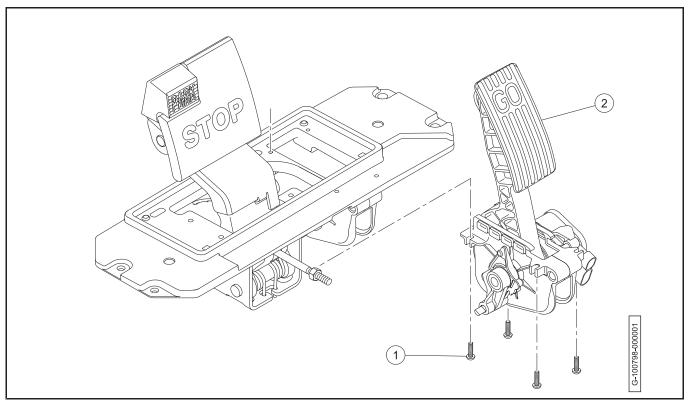


Figure 5-10 Electric vehicle shown. Gasoline vehicle is typical.

ACCELERATOR PEDAL REMOVAL

- 1. Remove the pedal group.
- 2. Remove the debris shields.
- 3. Remove the screws (1) (Figure 5-10).
- 4. Turn the accelerator pedal assembly (2) and remove through bottom of pedal group mounting plate.

ACCELERATOR PEDAL INSTALLATION

- 1. Install the accelerator pedal assembly (2) through bottom of pedal group mounting plate (Figure 5-10).
- 2. Make sure that the park brake release is installed in the brake pedal assembly.
- 3. Install the screws (1). Tighten the screws to 38 lb·in (4.3 N·m).
- 4. Install the debris shields.
- 5. Install the pedal group.

BRAKE PEDAL

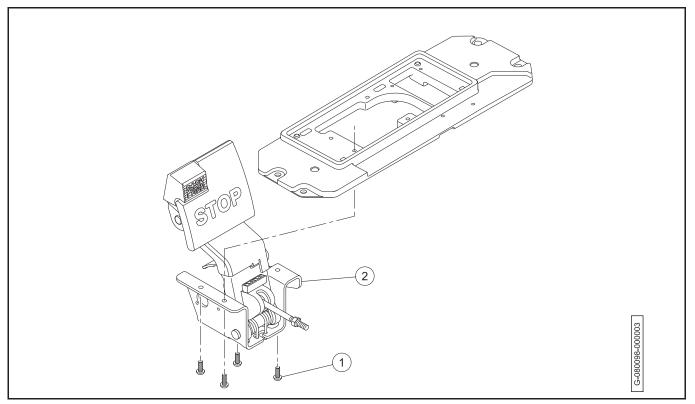


Figure 5-11

BRAKE PEDAL REMOVAL

- 1. Remove the pedal group.
- 2. Remove the debris shields.
- 3. Remove the screws (1) (Figure 5-11).
- 4. Remove the brake pedal assembly (2) through bottom of pedal group mounting plate.

BRAKE PEDAL INSTALLATION

- 1. Install the brake pedal assembly (2) through bottom of pedal group mounting plate (Figure 5-11).
- 2. Install the screws (1). Tighten the screws to 100 lb·in (11.3 N·m).
- 3. Install the debris shields.
- 4. Install the pedal group.

Pagination Page

A WARNING

Asbestos Dust Warning

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

The vehicle is equipped with self-adjusting, mechanically-expanding shoe, drum brakes on each rear wheel.

BRAKE SHOE REMOVAL

A CAUTION

- · Worn or damaged brake drums cannot be machined to refinish them. Replace as necessary.
- 1. Disable the vehicle.
- Electric Vehicle: Disconnect the batteries and discharge the controller.
 Gasoline Vehicle: Disconnect battery and spark plug wire.
- 3. Loosen the lug nuts on the rear wheels.
- 4. Lift the rear of the vehicle.

A 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.
- 5. Remove the rear wheels.
- 6. Remove the floor mat.
- 7. Remove the pedal access panel.

8. Loosen the left-hand thread jam nut (1) and right-hand thread jam nut (2) (Figure 6-1).

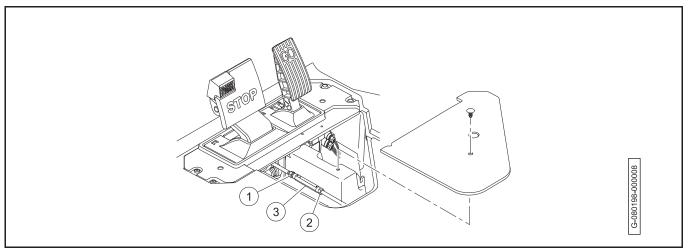


Figure 6-1

- 9. Loosen the turnbuckle (3) to release tension on the bell crank.
- 10. Remove the lugs nuts from the rear wheel.
- 11. Remove the rear wheel.
- 12. Remove the brake drum (1) (Figure 6-2). If the brake drum cannot be easily removed:

NOTE: When servicing vehicles with severely worn brake shoes and when the drums cannot be removed by normal methods, use the following steps to minimize damage to the brake cluster and brake components.

12.1. Use a 1/2 inch x 5/8 inch cold chisel to shear off the head of each pin (2).

NOTE: 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.

NOTE: It may be necessary to remove the sealant material around the head of each pin.

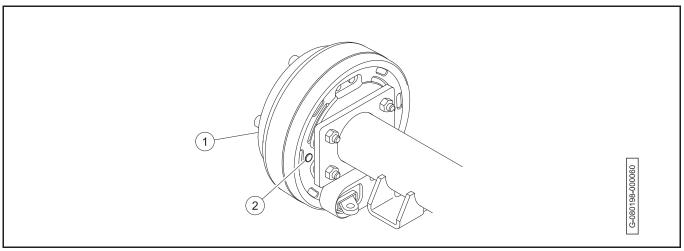


Figure 6-2

12.2. Remove the brake drum.

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- Electric Vehicle: Remove the axle shaft.
 Gasoline Vehicle: Remove the wheel hub assembly.
- 14. Using needle nose pliers, turn the retainer pin (1) 90° to remove the shoe retainer clip (2) (Figure 6-3).

A CAUTION

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

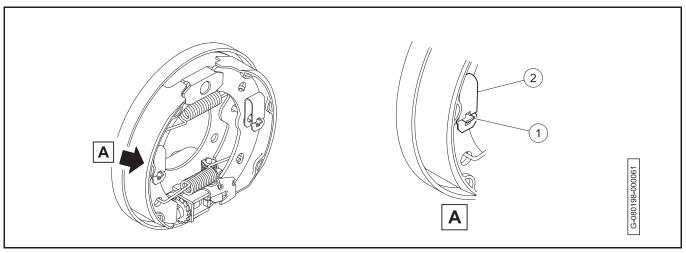


Figure 6-3

15. Hold both brake shoes and pull them, together with the springs, out of the brake assembly (Figure 6-4).

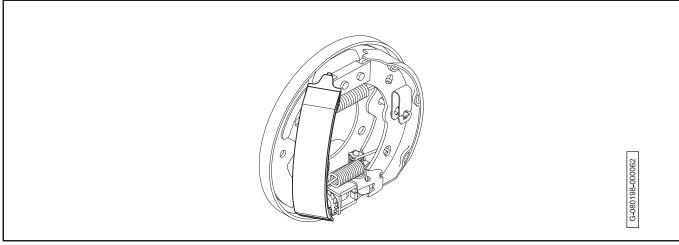


Figure 6-4

16. Remove adjuster wheel (1) with two washers (2 and 3) from the backing plate (Figure 6-5).

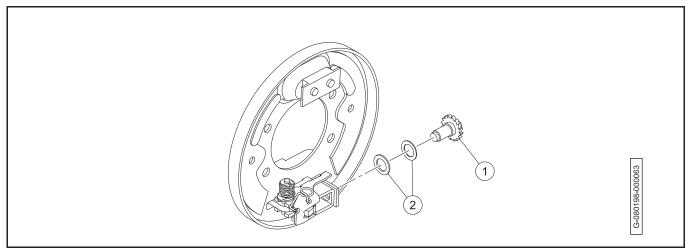


Figure 6-5

17. Clean the brake assembly.

BRAKE ASSEMBLY CLEANING

1. Carefully clean the brake backing plate (1) and all of its mechanical components (Figure 6-6).

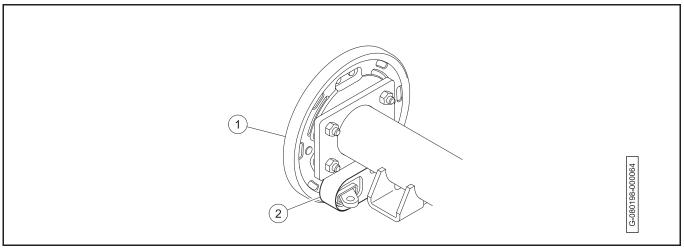


Figure 6-6

2. Remove the dust cover (2) from backing plate and wipe with a clean damp cloth.

3. Lubricate the slide (1) with dry moly lubricant (Figure 6-7).

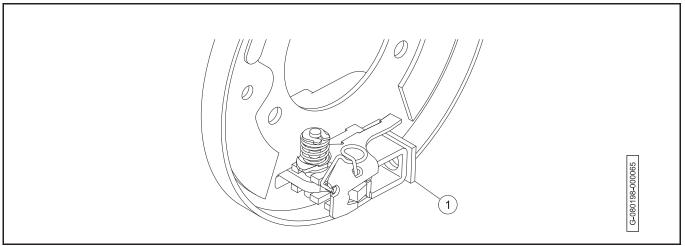


Figure 6-7

- 4. Make sure that the slide can easily move back and forth.
- 5. Install the dust cover onto the backing plate.

A 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.
- 6. Use a small brush to carefully apply a light coat of white lithium NLGI #2 grease (Dow Corning® BR2-Plus or equivalent) on the raised bosses (1) on the brake backing plate (Figure 6-8).

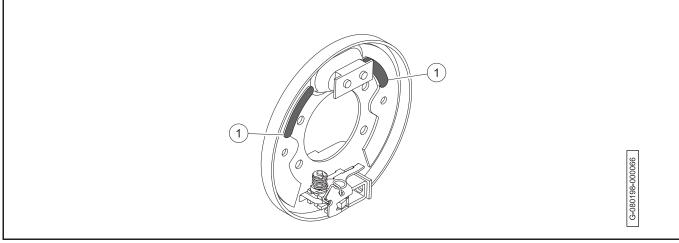


Figure 6-8

7. 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 6-9).

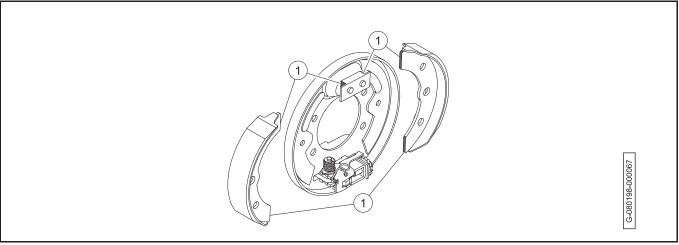


Figure 6-9

8. 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 6-10).

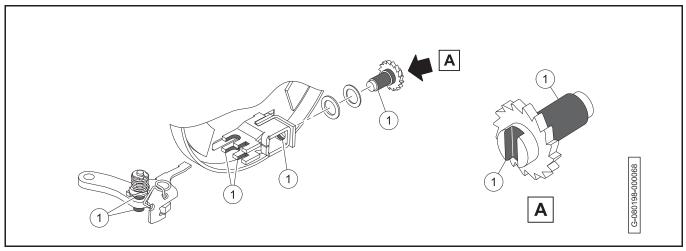


Figure 6-10

BRAKE SHOE INSTALLATION

WARNING

- When installing brake shoes, the shoes must be oriented with tips stamped 10 inserted into the
 mounting block anchor piston slots rather than into the brake actuator slots. Incorrectly installed
 brake shoes will be too tight and make adjustment of the brake impossible.
- 1. Install the adjuster wheel (1) and two washers (2) into the adjuster assembly (Figure 6-11).

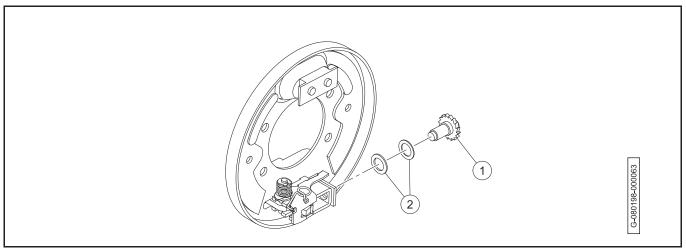


Figure 6-11

2. Turn the adjusting wheel screw so that the shoe slot is vertical (A) (Figure 6-12).

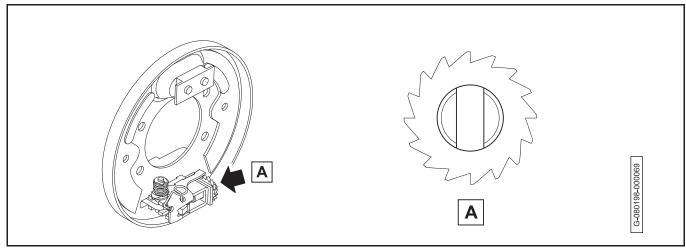


Figure 6-12

3. Install the first shoe (1) in the slots in the mounting block anchor piston (2) and the brake actuator (3) (Figure 6-13). Make sure that the stamped end of the shoe in the mounting block anchor piston. See detail A.

NOTE: 10 is stamped into one of the shoe flanges.

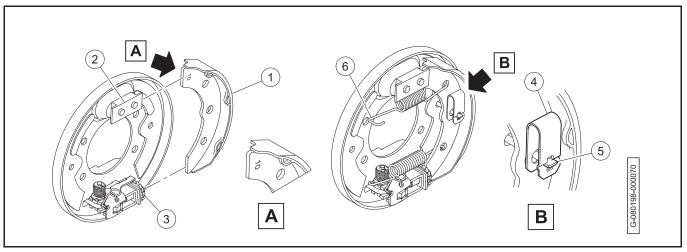


Figure 6-13

- 4. Use pliers to compress and install the shoe retainer clip (4), while turning the retainer pin (5) into position.
- 5. Attach the springs (6) onto the first shoe.
- 6. Hold the second brake shoe next to the first shoe and attach the springs to it. Make sure that the stamped end of the shoe will be in the mounting block anchor piston.
- 7. Install the second shoe (1) in the slots in the shoe mounting block (A) and the adjuster assembly (B) (Figure 6-14).

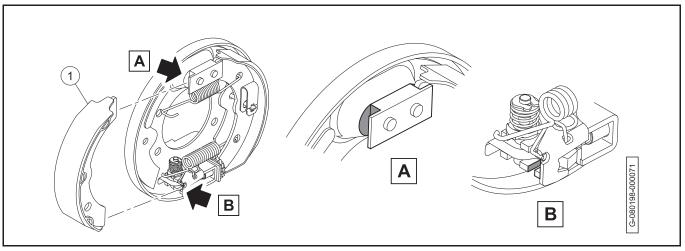


Figure 6-14

- 8. Hold the second brake shoe in position and install the shoe retainer clip, while turning the retainer pin into position.
- 9. Make sure that the brake shoes can move together up and down and side to side approximately 1/4 to 3/8 inch (6.3 to 9.5 mm) without binding.

10. Use a flatblade screwdriver to lift the adjusting arm (1) off of the adjusting wheel (2) (Figure 6-15).

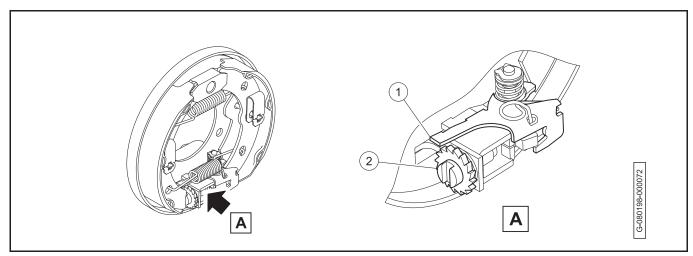


Figure 6-15

- 11. Turn the adjusting wheel upward until it stops.
- 12. Remove the screwdriver.
- Electric Vehicle: Install the axle shaft.
 Gasoline Vehicle: Install the wheel hub assembly.
- 14. Install the brake drum. Make sure that the brake drum is properly seated.

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

- 15. Make sure that the axle and drum turn freely.
- 16. Install the wheels.
- 17. Lower the rear of the vehicle.
- 18. Remove the turnbuckle (1) (Figure 6-16).

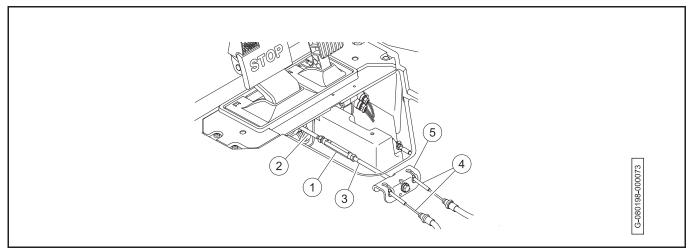


Figure 6-16

- 19. Apply Loctite® 242 to the threaded ends of the pedal group rod (2) and the brake actuator rod (3).
- 20. Install the turnbuckle. Make sure that the brake cables (4) are installed in the brake equalizer (5).

- 21. Adjust the brake cable equalizer.
- 22. Electric Vehicle: Connect the batteries.

Gasoline Vehicle: Connect battery and spark plug wire.

BRAKE CABLE EQUALIZER ADJUSTMENT

- 1. Make sure that the brake pedal is in the fully up position.
- 2. Adjust the turnbuckle (1) until the distance (A) between the top of the brake cable equalizer (2) and the upper flange surface (3) is 2 inches $(\pm 1/16)$ (51 mm (± 1.6) (Figure 6-17).

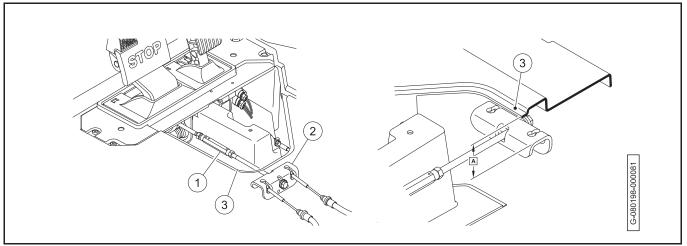


Figure 6-17

3. Make sure that the threaded rods are visible in the holes (1) of the turnbuckle (2) (Figure 6-18, Page 6-10).

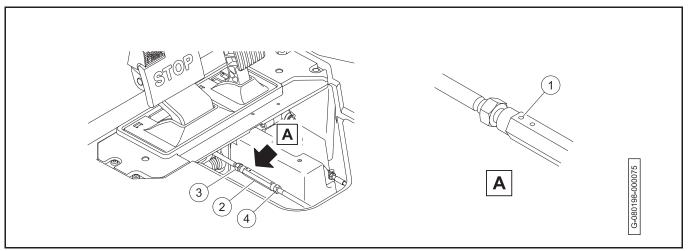


Figure 6-18

4. Snug the front (3) jam nut and rear jam nut (4) to their respective surfaces, then back the nuts off 1/4 to 3/8 inch (6.4 to 9.5 mm) and apply Loctite® 242 on the threads for both front and rear jam nuts.

▲ WARNING

- Reduced braking force could result if the jam nuts are not tightened in the proper sequence.
- 5. Tighten the rear jam nut first to 208 lb·in (23.5 N·m), then tighten the front jam nut to 208 lb·in (23.5 N·m). 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.
- 6. Measure the distance between the top of the brake cable equalizer and the upper flange surface.
- 7. If the measurement is 2 inches (±1/16) (51 mm (±1.6), the adjustment is complete.
- 8. If the measurement is not 2 inches $(\pm 1/16)$ (51 mm (± 1.6) :
- 8.1. Repeat the adjustment procedure.
- 9. Install the access panel.
- 10. Install the floor mat.

BRAKE CLUSTER

BRAKE CLUSTER REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect battery and spark plug wire.
- 3. Loosen the lug nuts on the rear wheel.
- 4. Lift the rear of the vehicle.

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.
- 5. Release the park brake.
- 6. Remove the floor mat.
- 7. Remove the pedal access panel.
- 8. Loosen the left-hand thread jam nut (1) and right-hand thread jam nut (2) (Figure 6-19).

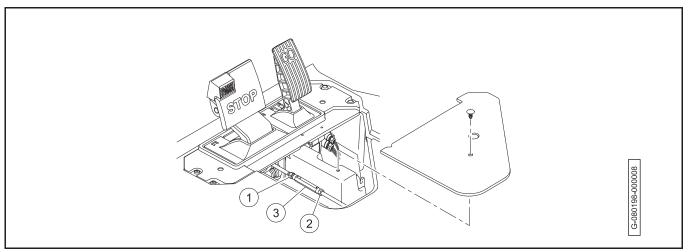


Figure 6-19

- 9. Loosen the turnbuckle (3) to release tension on the bell crank.
- 10. Remove the lugs nuts from the rear wheel.
- 11. Remove the rear wheel.

12. Remove and discard the bow tie pin (1) (Figure 6-20).

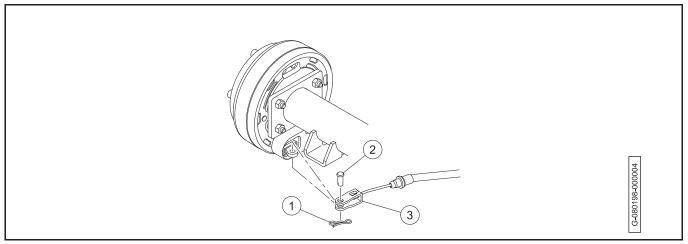


Figure 6-20

- 13. Remove the clevis pin (2).
- 14. Remove the brake cable (3) from the brake actuator arm.
- 15. Remove the brake drum (1) (Figure 6-21). If the brake drum cannot be easily removed:

NOTE: When servicing vehicles with severely worn brake shoes and when the drums cannot be removed by normal methods, use the following steps to minimize damage to the brake cluster and brake components.

15.1. Use a 1/2 inch x 5/8 inch cold chisel to shear off the head of each pin (2).

NOTE: 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.

NOTE: It may be necessary to remove the sealant material around the head of each pin.

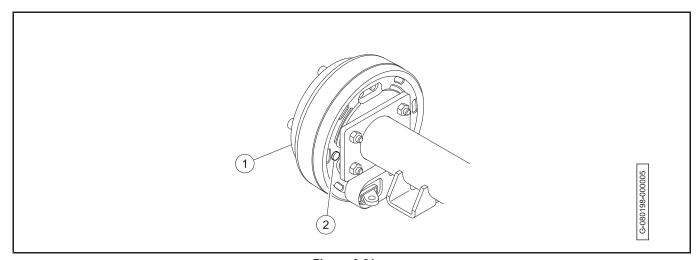


Figure 6-21

- 15.2. Remove the brake drum.
- 16. Remove the brake shoes.

17. **Electric Vehicle:** Remove the axle shaft.

Gasoline Vehicle: Remove the wheel hub assembly.

18. Remove the bolts (1) and lock nuts (2) (Figure 6-22). Discard the lock nuts.

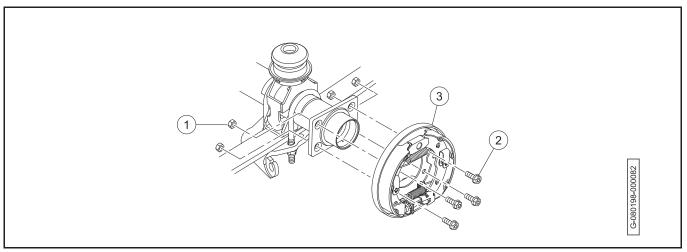


Figure 6-22

19. Remove the brake cluster (3).

BRAKE CLUSTER INSTALLATION

A CAUTION

- Before installing axle shaft, clean any residual oil from the exposed end of the axle tube and from the oil seal area.
- 1. Install the brake cluster (1) on the spindle (Figure 6-23).

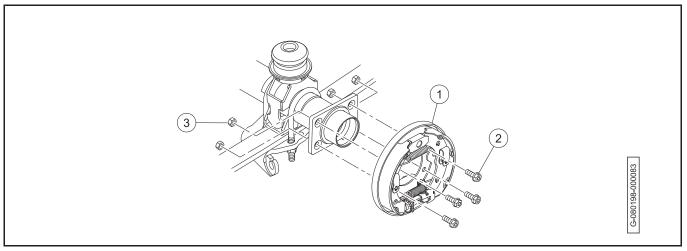


Figure 6-23

- 2. Install the bolts (2) and new lock nuts (3). Tighten the bolts to 30 lb·ft (40.6 N·m).
- 3. If the retainer pins were sheared during removal, install new retainer pins. Install the shoe retainer clips.

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- Electric Vehicle: Install the axle shaft.
 Gasoline Vehicle: Install the wheel hub assembly.
- 5. Install the brake drum.
- 6. Install the brake cable (1) on the brake actuator arm (Figure 6-24).

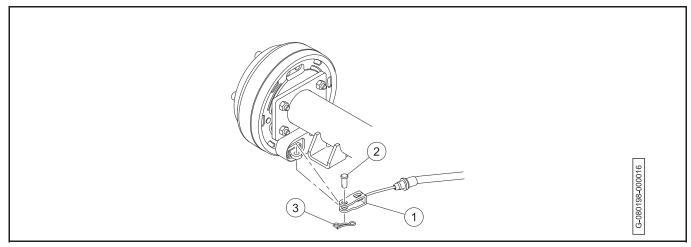


Figure 6-24

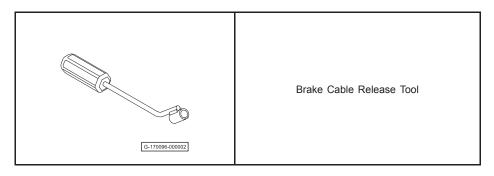
- 7. Install the brake cable clevis pin (2).
- 8. Install the new bow tie pin (3).
- 9. Install the rear wheels.
- 10. Lower the rear of the vehicle.
- 11. Adjust the brake cable equalizer.
- 12. Install the pedal access panel.
- 13. Install the floor mat.
- 14. Electric Vehicle: Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

BRAKE CABLE

BRAKE CABLE REMOVAL

Special Tools Needed



NOTE: Refer to the Illustrated Parts Catalog for service tool part numbers.

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Remove the floor mat.
- 4. Remove the pedal access panel.
- 5. Loosen the left-hand thread jam nut (1) and right-hand thread jam nut (2) 1/2 inch (12.7 mm) away from the turnbuckle (3).

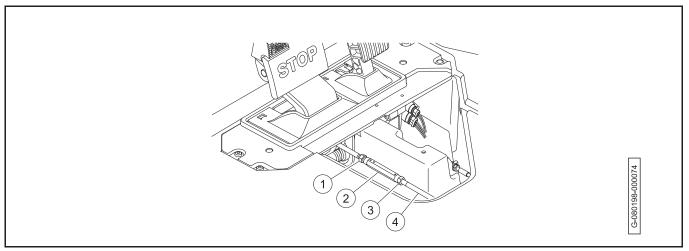


Figure 6-25

6. Remove the turnbuckle from the brake actuator rod (4).

7. Lift the brake actuator rod and equalizer bracket (1) (Figure 6-26).

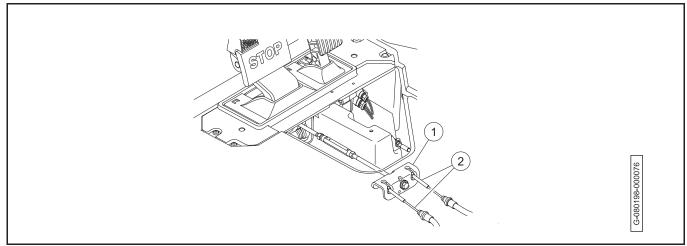


Figure 6-26

- 8. Remove the brake cables (2) from the equalizer bracket.
- 9. Remove the nut (1) (Figure 6-27). Do not remove bolt (2).

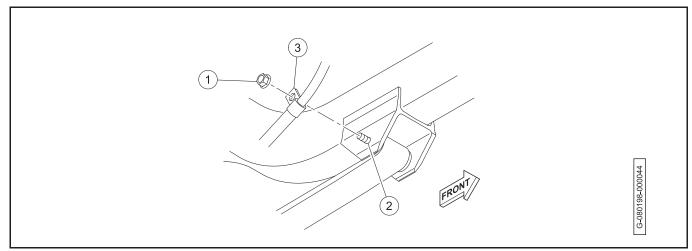


Figure 6-27

10. Remove the mounting tab (3) of the brake cable from the bolt.

11. Use a brake cable release tool to compress the retaining clips (1) on the end of the cable housing enough to slide the cable end out of the hole in the frame (Figure 6-28).

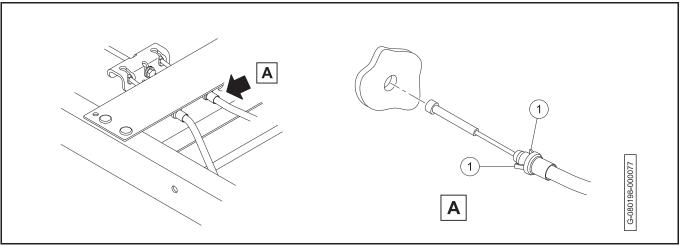


Figure 6-28

12. Remove and discard the bow tie locking pin (1) (Figure 6-29).

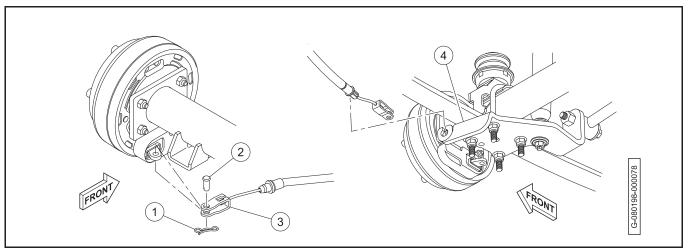


Figure 6-29

- 13. Remove the clevis pin (2).
- 14. Remove the brake cable (3) from the brake actuator arm.
- 15. Use a brake cable release tool to 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.

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 6-30). Push on the cable housing so the clips on the housing ends secure the housing in the hole.

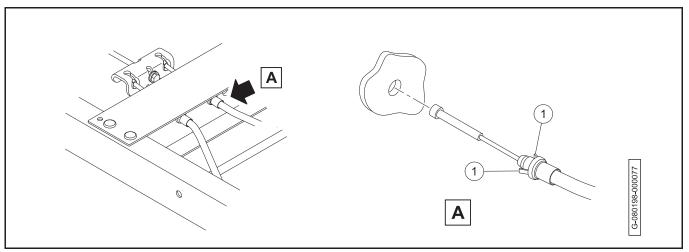


Figure 6-30

2. Hold the brake actuator rod (1) and the equalizer bracket (2) 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.

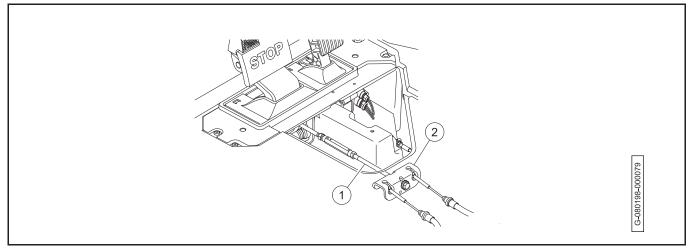


Figure 6-31

3. Insert the rear cable housing into the shock mount bracket (1) (Figure 6-32).

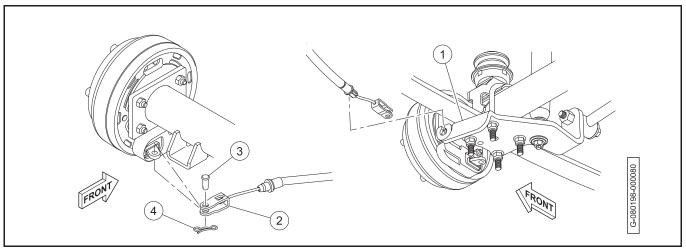


Figure 6-32

- 4. Make sure that the clips on the housing end secure the cable in position.
- 5. Install the brake cable (2) on the brake actuator arm.
- 6. Install the brake cable clevis pin (3).
- 7. Install the new bow tie pin (4).
- 8. Install the clamp (1) on the leaf spring bolt (2) (Figure 6-33).

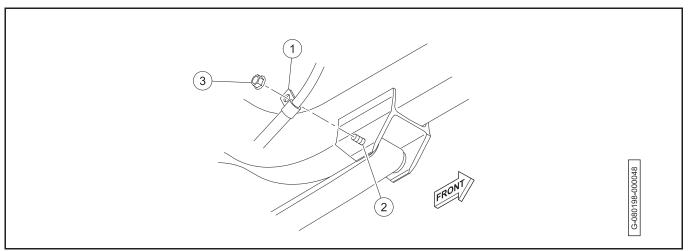


Figure 6-33

- 9. Install the nut (3). Tighten the nut to 18.4 lb·ft (25 N·m).
- 10. Adjust the brake cable equalizer.
- 11. **Electric Vehicle:** Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

A DANGER

• See General Warnings on page 1-2.

WARNING

• See General Warnings on page 1-2.

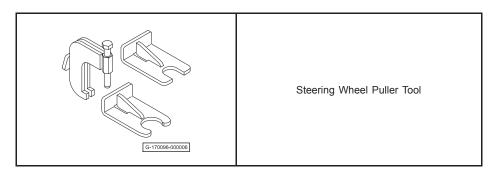
GENERAL INFORMATION

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

STEERING WHEEL REMOVAL

Special Tools Needed



NOTE: Refer to the Illustrated Parts Catalog for service tool part numbers.

- 1. Disable the vehicle.
- Electric Vehicle: Disconnect the batteries and discharge the controller.
 Gasoline Vehicle: Disconnect battery and spark plug wire.
- 3. Rotate steering wheel to a straight ahead position.

CAUTION

· Do not turn the steering until the steering wheel has been installed.

4. Remove the screws (1) (Figure 7-1).

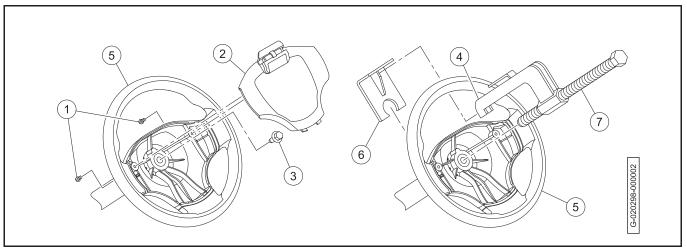


Figure 7-1

- 5. Remove the cover (2).
- 6. Remove the steering wheel retaining bolt (3).
- 7. Put the puller anvil (4) through the top opening of the steering wheel (5).
- 8. Insert the anvil feet through the two slots in the base plate (marked "B") (6).
- 9. Turn the anvil screw (7) clockwise until the base plate contacts the bottom of the steering wheel at the steering column.
- 10. Use a 1/2-inch drive air impact wrench to tighten the anvil screw until the steering wheel releases from the steering shaft.
- 11. Remove the steering wheel from the steering column.

STEERING WHEEL INSTALLATION

1. Apply a small amount of oil or anti-seize compound to steering shaft (1) (Figure 7-2).

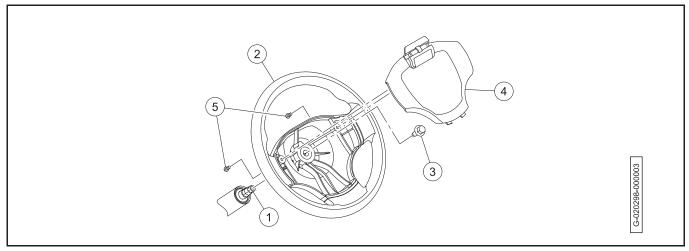


Figure 7-2

2. Install the steering wheel (2) on the steering shaft.

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- 3. Install steering wheel retaining bolt (3). Tighten the bolt to 37 lb·ft (50 N·m).
- 4. Put the cover (4) on the steering wheel.
- 5. Install the screws (5). Tighten the screws to 15 lb·in (1.7 N·m).

STEERING COLUMN

STEERING COLUMN REMOVAL

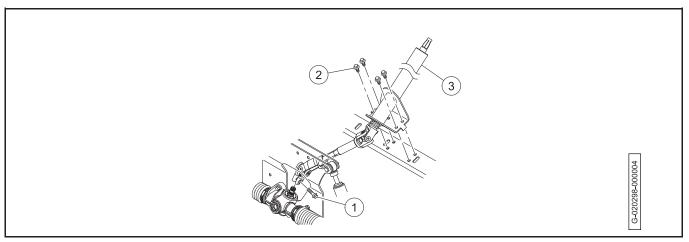


Figure 7-3 Steering Column Removal

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect battery and spark plug wire.
- 3. Remove the steering wheel.
- 4. Remove the dash insert, instrument panel, dash assembly, and front bumper.
- 5. Remove the bolt (1) (Figure 7-3).
- 6. Remove the bolts (2).
- 7. Remove the steering column (3) from the vehicle.

STEERING COLUMN INSTALLATION

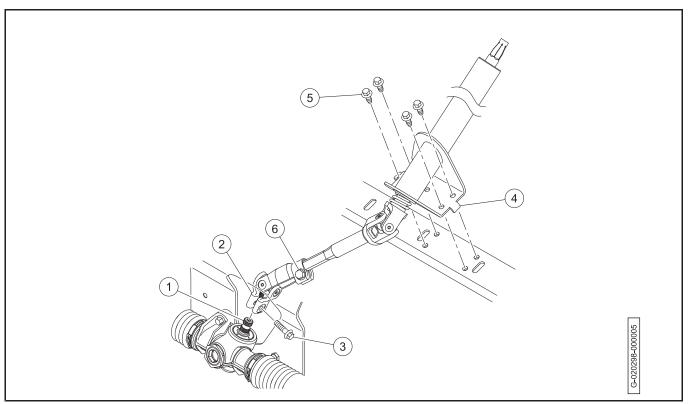


Figure 7-4 Steering Column Installation

- 1. Apply a light coat of anti-seize or lubricating compound to the pinion shaft (1) (Figure 7-4).
- 2. Install the universal joint (2) onto pinion shaft.
- 3. Install the bolt (3) and tighten by hand. Do not fully tighten the bolt.
- 4. Install the steering column mounting bracket (4) on the vehicle frame.
- 5. Install the bolts (5). Tighten the bolts to 18.4 lb·ft (25 N·m).
- 6. Tighten the bolt (3) to 18.4 lb·ft (25 N·m).
- 7. Make sure that the upper universal joint bolt (6) is tighten to 18.4 lb·ft (25 N·m).
- 8. Install front bumper, dash assembly, dash insert, and instrument panel.
- 9. Install the steering wheel.
- 10. **Electric Vehicle:** Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

RACK AND PINION

CAUTION

• Front impacts that bend tie rods and/or drag links can possibly damage internal steering gear components. The manufacturer recommends inspecting the rack and pinion and replacing if damaged.

RACK AND PINION INSPECTION

- 1. Look for obvious damage to the chassis, where the rack and pinion is mounted, and the rack and pinion housing. Particularly check the housing for broken mounting points.
- 2. Compare the toe-in against the specification. See Tow-in Adjustment.
- 3. If obvious visible damage is found, such as a bent tie rod, check the steering gear for abnormal free-play, noise, binding or clunking while it is under a load. With the steering system fully assembled and all four tires on the ground/floor, turn the steering wheel from stop to stop. While turning, feel for any binding, clunking or tight/loose spots. Listen for unusual noises. Replace the rack and pinion as an assembly if any is found.
- 4. In the event of an known impact and obvious visible damage is not found in the method described above, disconnect the tie rods and/or drag links from the spindles. Turn the steering wheel from stop to stop. While turning, feel for any binding or tight/loose spots. Listen for unusual noises. Replace the rack and pinion as an assembly if any is found.

RACK AND PINION REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Remove the front bumper.
- 4. Remove the tie rod end retaining nuts (1) (Figure 7-5, Page 7-5).

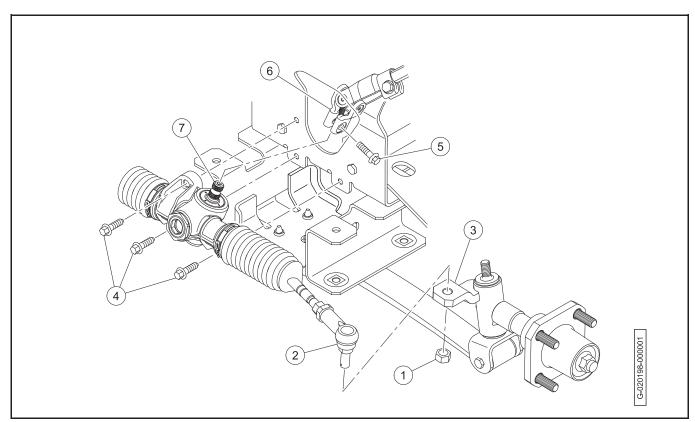


Figure 7-5

- 5. Remove the tie rod ends (2) from the spindle tabs (3).
- 6. Remove the bolts (4).
- 7. Remove the bolt (5) from the universal joint (6).

- 8. Remove the universal joint from the pinion shaft (7).
- 9. Remove the rack and pinion assembly.

RACK AND PINION INSTALLATION

1. Apply a light coat of anti-seize lubricating compound to the pinion shaft (1) (Figure 7-6).

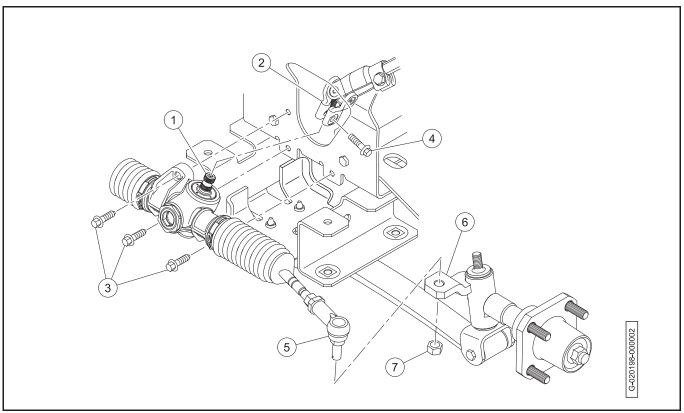


Figure 7-6 Rack and Pinion Installation

- 2. Install the universal joint (2) onto the pinion shaft.
- 3. Install the screws (3). Tighten the screws to 22 lb·ft (30 N·m).
- 4. Install the bolt (4). Tighten the bolt to 18.4 lb·ft (25 N·m).
- 5. Install the tie rod ends (5) into the spindle tabs (6)
- 6. Install the retaining nuts (7).

A WARNING

- · Do not operate vehicle until toe-in is adjusted and ball joints are secured.
- 7. Adjust the toe-in. See Tow-in Adjustment.
- 8. **Electric Vehicle:** Connect the batteries. **Gasoline Vehicle:** Connect the battery and spark plug wire.
- 9. Test drive the vehicle before returning it to service.

FRONT SUSPENSION

See General Warnings on page 1-2.

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 Schedules on page 10-8.

CAUTION

• To ensure proper lubrication, raise front of vehicle to lubricate. See General Warnings on page 1-2.

WHEEL ALIGNMENT

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

CAUTION

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

Camber Adjustment

- 1. Park the vehicle on a solid level surface.
- 2. Check each front wheel with a framing square. At the floor, there should be an equal amount of space (A) between each tire and the framing square (Figure 7-7).

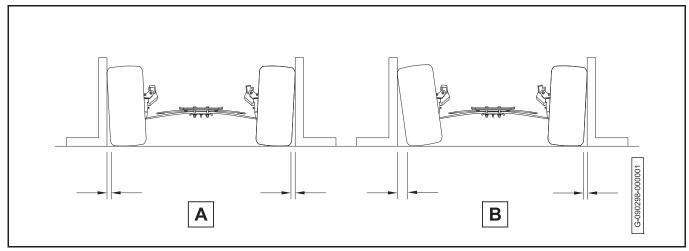


Figure 7-7 Check Camber

- 3. If there is not an equal amount of space (B) between each tire and the framing square (Figure 7-7), go to step 4.
- 4. Loosen the four bolts (1). Do not remove the bolts (Figure 7-8).

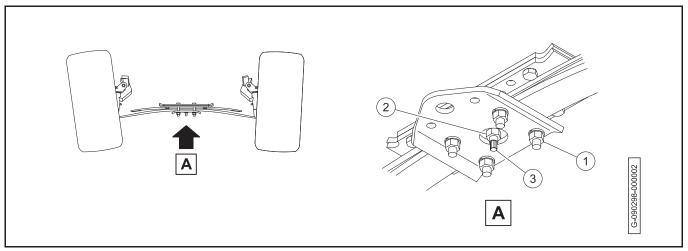


Figure 7-8 Adjust Camber

- 5. Loosen the nut (2) on the adjustment eccentric (3) in the center of the spring. Do not remove the nut.
- 6. Use a 7 mm deep well socket to rotate the adjustment eccentric and adjust the camber.
- 7. Tighten the four bolts in a crisscross pattern to 37 lb·ft (50 N·m).
- 8. Move the vehicle forward one full tire revolution.
- 9. Check the camber.
- 10. When the camber adjustment is complete, tighten the nut on the adjustment eccentric to 10 lb·ft (13.5 N·m).

Toe-in Adjustment

- 1. Park the vehicle on a solid level surface.
- 2. Roll the vehicle forward, then stop the vehicle.
- 3. Make sure the front wheels are pointed straight ahead.

CAUTION

- Do not turn the steering wheel again during this procedure.
- 4. On each front tire, mark (as closely as possible) the center of the tread face that is toward the rear of the vehicle. The marks should be even with the bottom surfaces of the vehicle frame.
- 5. Measure the distance between the marks on the rear-facing surfaces of the tires.
- 6. Roll the vehicle forward one and a half wheel revolutions until the marks appear on the forward facing surfaces of the tires at about the same height from the floor.

7. Measure the distance between the marks on the forward-facing surfaces of the tires (Figure 7-9).

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

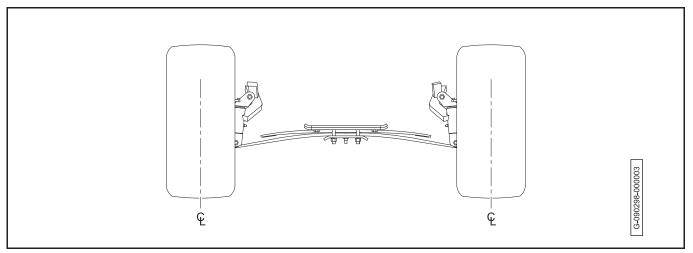


Figure 7-9 Check Toe-In

- 8. 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 3/8 inch $(\pm 1/8)$ $(9.5 \text{ mm } (\pm 3.2))$.
- 9. If toe-in adjustment is necessary:
- 9.1. Loosen the jam nuts (1) on both ends of each drag link (2) (Figure 7-10).

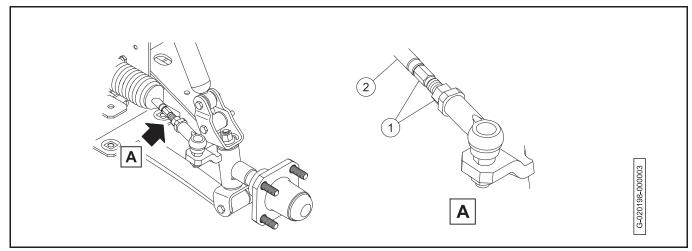


Figure 7-10

- 9.2. To increase the toe-in, rotate both drag links equally counterclockwise.
- 9.3. To decrease the toe-in, rotate both drag links equally clockwise.
- 9.4. Maintain an equal distance from the ball joint to the end of the threads on each drag link (Figure 7-11).

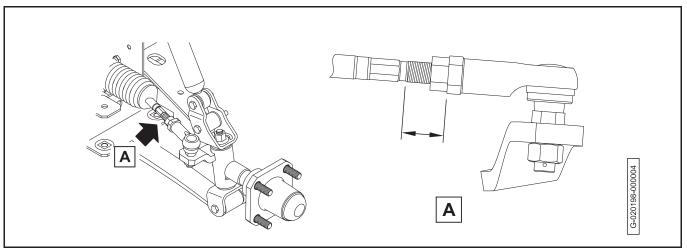


Figure 7-11

- 9.5. Tighten the jam nuts on both ends of each drag link to 26 lb·ft (35 N·m).
- 9.6. Check the toe-in.
- 9.7. Repeat the adjustment procedure if necessary.
- 9.8. After the 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

See General Warnings on page 1-2.

TIE ROD END REMOVAL

- Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- Loosen the jam nut (1) (Figure 7-12).

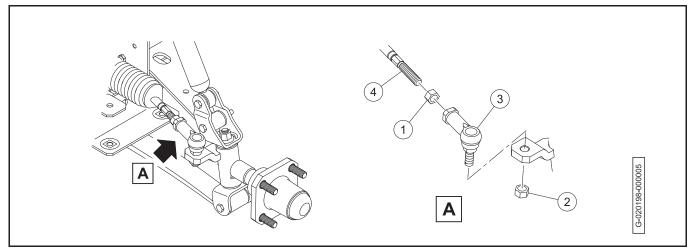


Figure 7-12

- 4. Remove the retaining nut (2).
- 5. Lift the tie rod (3) from the hole in the spindle tab.
- 6. Remove the tie rod end from the drag link.
- 7. Apply a light coat of anti-seize lubricating compound to the threads (4).

TIE ROD INSTALLATION

1. Install tie rod end (1) onto the drag link (2) to a depth of 1/2 inch (12.5 mm) (Figure 7-13).

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.

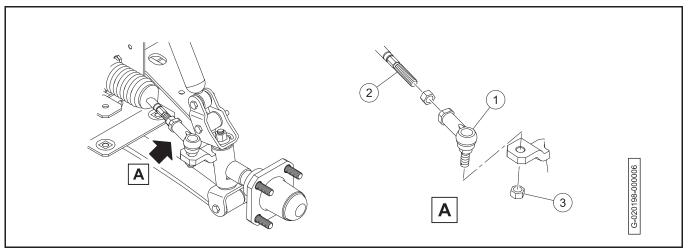


Figure 7-13

- 2. Install the tie rod end into the spindle tab.
- 3. Install the retaining nut (3).
- 4. Adjust the wheel toe-in.
- Electric Vehicle: Connect the batteries.
 Gasoline Vehicle: Connect the battery and spark plug wire.

LEAF SPRING REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Remove the front wheels.

4. Remove the bolts (1) from the bottom of each kingpin (2) (Figure 7-14).

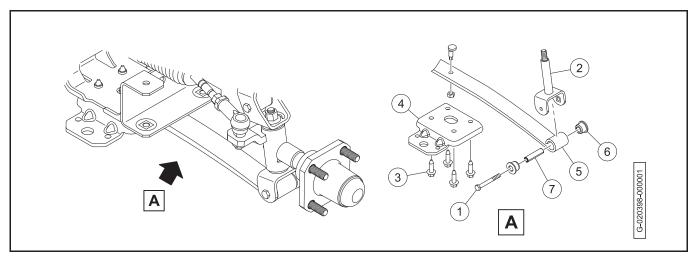


Figure 7-14

- 5. Remove the four bolts (3) and bottom spring plate (4).
- 6. Remove the leaf spring (5).
- 7. Check the condition of the urethane bushings (6) and steel sleeves (7). Replace any that are worn or damaged.

LEAF SPRING INSTALLATION

1. Install the urethane bushings (1) and steel sleeves (2) into leaf spring eyes (Figure 7-15).

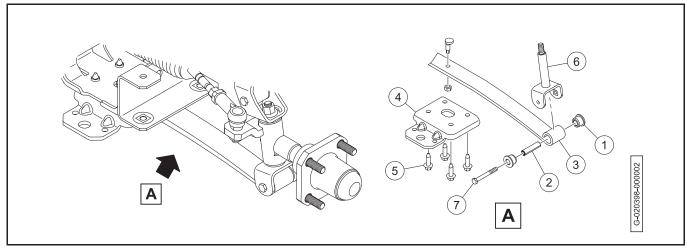


Figure 7-15

- 2. Install the leaf spring (3), bottom spring plate (4), and four bolts (5). Tighten the bolts in a crisscross pattern to 37 lb·ft (50 N·m).
- 3. Install the kingpins (6) on the leaf spring with the bolts (7). Tighten the bolts to 30 lb·ft (41 N·m).
- 4. Install the front wheels.
- 5. Adjust the camber and toe-in.
- Electric Vehicle: Connect the batteries.
 Gasoline Vehicle: Connect the battery and spark plug wire.

KINGPIN AND STEERING SPINDLE REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Remove the front wheels.
- 4. Remove and discard the lock nut (1) (Figure 7-16).

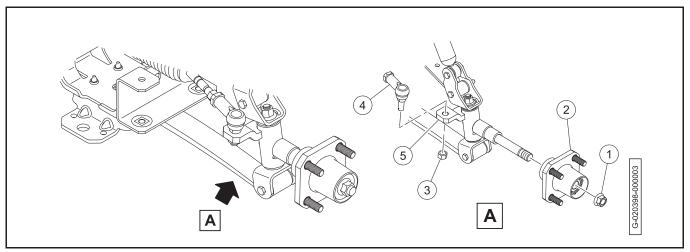


Figure 7-16

- 5. Remove the front hub (2).
- 6. Remove the retaining nut (3).
- 7. Remove tie rod end (4) from the tabs (5) on the spindles.
- 8. Remove the nut (1) (Figure 7-17, Page 7-14).

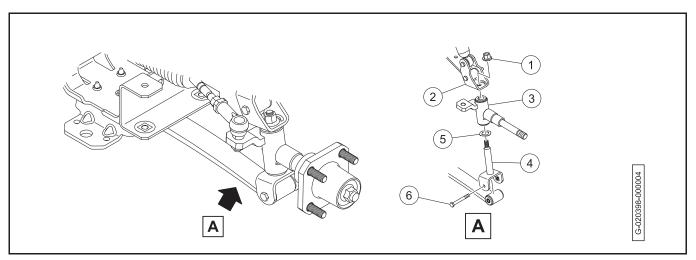


Figure 7-17

- 9. Raise the upper clevis (2) and slide the spindle (3) off of the kingpin (4).
- 10. Remove the wave washer (5).
- 11. Inspect the wave washer.
- 11.1. If the wave washer is broken, replace the washer.

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- 11.2. If the wave washer bottom to crest height dimension is less than 0.040 inch (1 mm), replace the washer.
- 12. Remove the bolt (6) and the kingpin.
- 13. Inspect the kingpin and spindle. If either is worn or damaged, it must be replaced.
- 14. Inspect the spindle bushings. If the bushings are worn or damaged, remove them and press in new ones.

NOTE: New bushings may not fit the kingpin after installing them into the spindle). Ream new bushings as required.

14.1. After installing new bushings, ream bushings to 0.753 inch (±0.0005) (19.13 mm (±0.013)).

KINGPIN AND STEERING SPINDLE INSTALLATION

- 1. Inspect all parts and replace them as necessary.
- 2. Install the kingpin (1) over the leaf spring eyes (Figure 7-18).

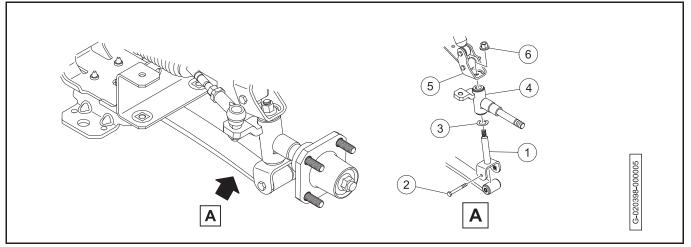


Figure 7-18

- 3. Install the bolt (2). Tighten the bolt to 30 lb·ft (41 N·m).
- 4. Install the wave washer (3) on the kingpin.
- 5. Install thespindle (4) on the kingpins.
- 6. Put the upper clevis (5) over the kingpin threads and install nuts (6). Tighten the nuts to 70 lb·ft (95 N·m).
- 7. Install the tie rod end (1) to the spindle tab (2) (Figure 7-19, Page 7-16).

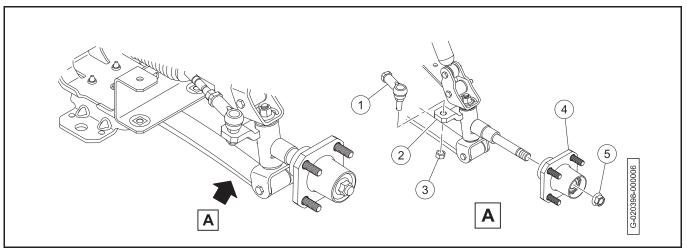


Figure 7-19

- 8. Install the nut (3). Tighten the nut to 70 lb·ft (95 N·m).
- 9. Install the front hubs (4).
- 10. Install the nut (5).
- 11. Install the front wheels.
- 12. Adjust the camber and toe-in.
- 13. **Electric Vehicle:** Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

CONTROL ARM REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Remove the front wheels.
- 4. Remove the bolts (1) (Figure 7-20).

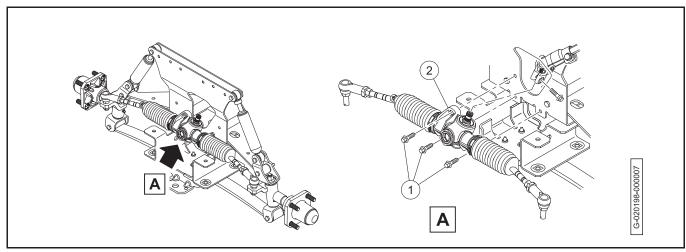


Figure 7-20

- 5. Move the rack and pinion (2) to allow clearance for the control arm bolts.
- 6. Remove the bolts (1 and 2) (Figure 7-21).

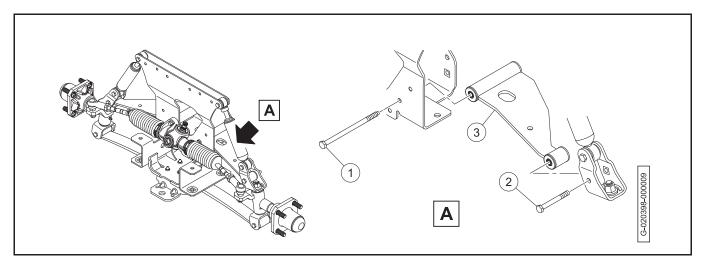


Figure 7-21

- 7. Remove the control arm (3).
- 8. Inspect the bushings and sleeves in the control arm. Replace as necessary.

CONTROL ARM INSTALLATION

1. Put the control arm (1) into position on the vehicle (Figure 7-22).

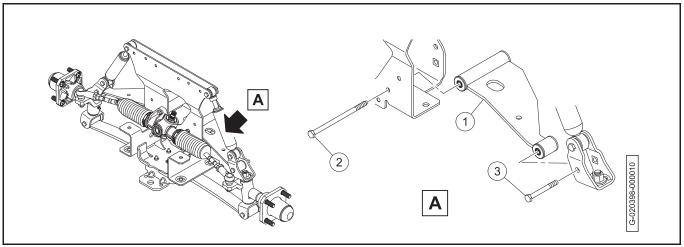


Figure 7-22

- 2. Install the bolts (2 and 3). Tighten the bolts to 30 lb·ft (41 N·m).
- 3. Move the rack and pinion (1) into position (Figure 7-23).

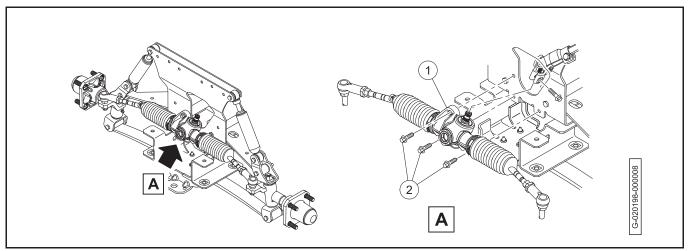


Figure 7-23

- 4. Install the bolts (2). Tighten the bolts to 22 lb·ft (30 N·m).
- 5. Install the front wheels.
- 6. Adjust the camber and toe-in.
- Electric Vehicle: Connect the batteries.
 Gasoline Vehicle: Connect the battery and spark plug wire.

FRONT SHOCK ABSORBER INSPECTION

- 1. Examine the area (1) where the shaft enters the shock absorber body (Figure 7-24).
- 1.1. If there is fluid leakage, replace the shock absorber.

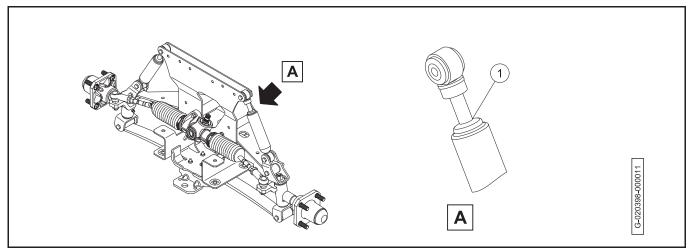


Figure 7-24

FRONT SHOCK ABSORBER REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Remove the upper bolt (1) (Figure 7-25).

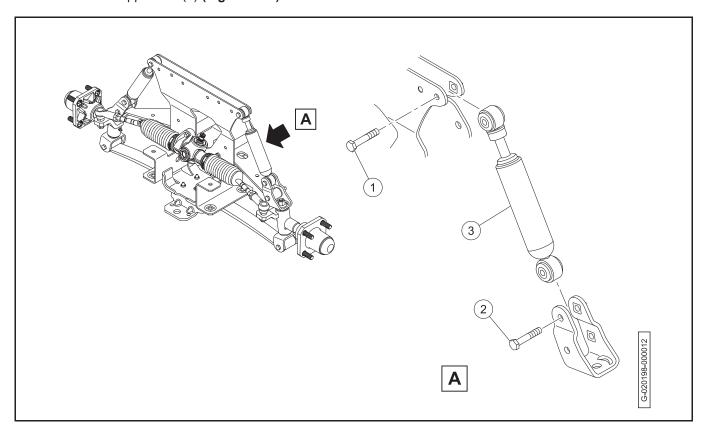


Figure 7-25

- 4. Remove the lower bolt (2).
- 5. Remove the shock absorber (3).

FRONT SHOCK ABSORBER INSTALLATION

- 1. Make sure that the front shock absorbers (3) have the same part number (Figure 7-25).
- 2. Install the shock absorber.
- 3. Install the bolts (1 and 2). Tighten the bolts to 16 lb·ft (21 N·m).
- 4. **Electric Vehicle:** Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

FRONT WHEEL HUBS

FRONT WHEEL FREE PLAY INSPECTION

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.

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Lift the front of the vehicle.
- 4. Try to move the wheel and hub assembly back and forth on the spindle.
- 5. If the wheel and hub move on the spindle, replace the hub assembly.

FRONT WHEEL HUB REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Remove the front wheels.
- 4. Remove the dust cap (1) (Figure 7-26).

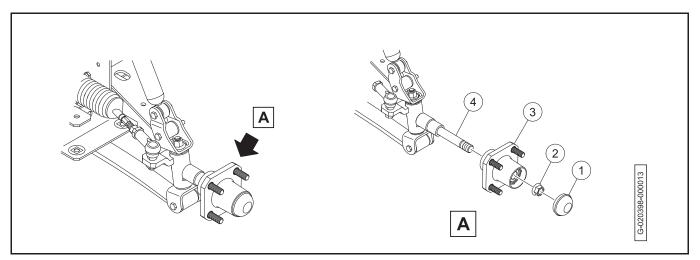


Figure 7-26

- 5. Remove and discard the lock nut (2).
- 6. Remove the hub assembly (3).
- 7. Inspect the surface of the spindle shaft (4) for surface damage. The spindle shaft must be clean and smooth.
- 8. If the spindle shaft has severe pitting from rust or corrosion, replace the spindle assembly.

FRONT WHEEL HUB INSTALLATION

1. Apply a light coat of anti-seize lubricant to the spindle shaft (1) (Figure 7-27).

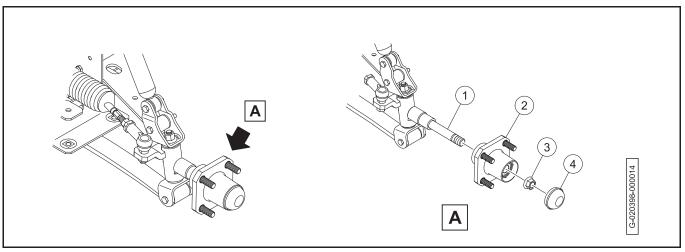


Figure 7-27

- 2. Install the hub assembly (2) onto the spindle shaft.
- 3. Install the new lock nut (3). Tighten the lock nut to 50 lb·ft (68 N·m).
- 4. Rotate the hub. The hub should rotate smoothly without binding, side play, or any indication of rough spots.
- 5. Install the dust cap (4).
- 6. Install the front wheels.
- 7. **Electric Vehicle:** Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

A DANGER

• See General Warnings on page 1-2.

WARNING

• See General Warnings on page 1-2.

GENERAL INFORMATION

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

- · Keep tires properly inflated.
- · 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.

LIFT THE VEHICLE

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. 8 Lift The Vehicle WHEELS AND TIRES

LIFT THE FRONT OF THE VEHICLE

Use a jack and jack stands rated for the vehicle.

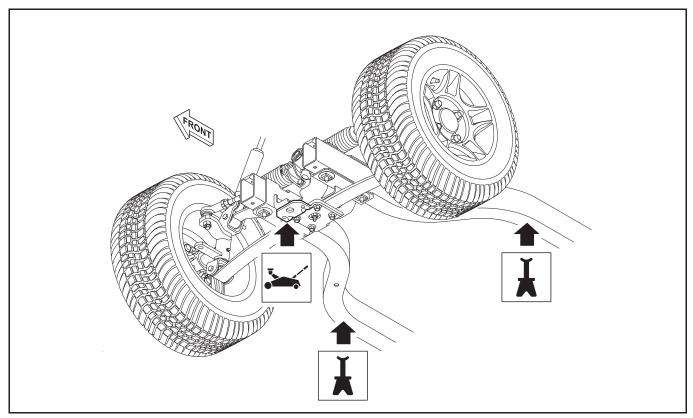


Figure 8-1

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect battery and spark plug wire.
- 3. Place the jack in the center of the lift point (Figure 8-1, Page 8-2).
- 4. Lift the front of the vehicle.
- 5. Put jack stands under the frame rails.
- 6. Lower the vehicle onto the jack stands.

LOWER THE FRONT OF THE VEHICLE

Use a jack and jack stands rated for the vehicle.

- 1. Place the jack in the center of the lift point (Figure 8-1, Page 8-2).
- 2. Lift the front of the vehicle.
- 3. Remove the jack stands.
- Lower the vehicle.

LIFT THE REAR OF THE VEHICLE

Use a jack and jack stands rated for the vehicle (Figure 8-2, Page 8-3).

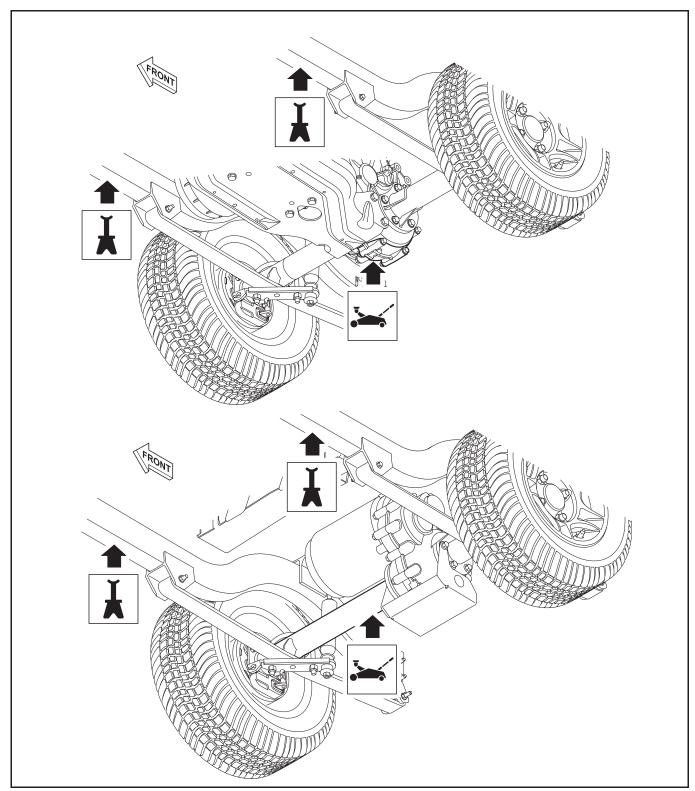


Figure 8-2 Top: Gasoline / Bottom: Electric

1. Disable the vehicle.

8 Tires

WHEELS AND TIRES

- Electric Vehicle: Disconnect the batteries and discharge the controller.
 Gasoline Vehicle: Disconnect battery and spark plug wire.
- 3. Place the jack in the center of the lift point (Figure 8-2, Page 8-3).
- 4. Lift the rear of the vehicle.
- 5. Put jack stands under the frame rails.
- 6. Lower the vehicle onto the jack stands.

LOWER THE REAR OF THE VEHICLE

Use a jack and jack stands rated for the vehicle.

- 1. Place the jack in the center of the lift point (Figure 8-2, Page 8-3).
- 2. Lift the front of the vehicle.
- 3. Remove the jack stands.
- Lower the vehicle.

TIRES

See General Warnings on page 1-2.

TIRE PRESSURE MEASUREMENT

- 1. Disable the vehicle.
- 2. Remove the valve stem cap.
- 3. Use a pressure gauge to measure the tire pressure.
- 4. Adjust the tire pressure to meet the recommended tire pressure. Go to the approved wheel and tire assemblies matrix on http://www.clubcar.com for information regarding tire type, inflation pressure, and lug nut torque.
- 5. Install the valve stem cap.

TIRE REMOVAL

The tire must be removed from the valve stem side of the rim.

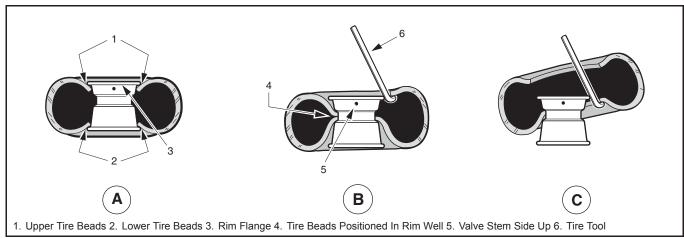
- 1. Remove the wheel assembly. See Wheel Assembly Removal.
- 2. Remove the valve cap and valve core.

NOTE: This will allow air to escape from the tire.

3. If possible, use a tire machine to remove the tire from the rim.

ires 8

4. 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 8-3, Page 8-5, Detail A).



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Figure 8-3 Tire Removal

5. Position the wheel assembly with the valve stem up.

CAUTION

- To avoid damage to the tire, do not use excessive force when starting the bead over the edge of the rim.
- 6. Use a tire tool to carefully start the upper bead over the edge of the wheel rim (Figure 8-3, Page 8-5, Detail B).
- 7. 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 8-3, Page 8-5, Detail C) and carefully pry the lower bead over the rim flange.
- 8. Once the lower bead is started over the rim flange, the tire can be removed from the rim by hand.

TIRE REPAIR

- Determine the location and cause of the air leak:
- 1.1. Remove the wheel. See Wheel Assembly Removal.
- 1.2. Inflate the tire to no more than 20 psig (138 kPa).
- 1.3. Immerse the tire in water and then mark the point where bubbles are formed by escaping air.
- 1.4. 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.

When the cause of the air leak has been determined, remove tire from the rim and repair as required. See Tire Removal. B Tire

Tires WHEELS AND TIRES

TIRE INSTALLATION

A WARNING

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

The tire must be installed from the valve stem side of the rim.

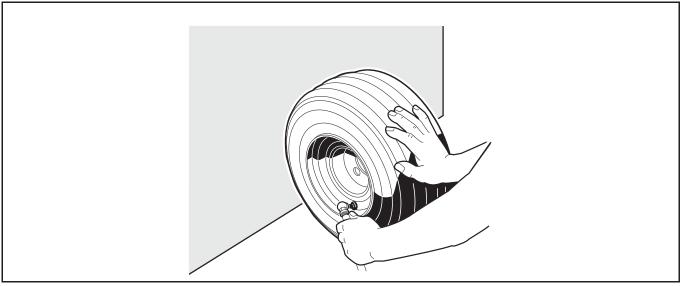
- 1. Clean both tire beads to remove dirt or other foreign matter.
- Where the tire beads seat, clean the wheel rim with a wire brush. Wipe away any debris with a clean cloth.

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

- 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 to 35 psig (207 to 242 kPa). 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 8-4, Page 8-6). See following WARNING.

WARNING

• Do not use a compressed air source with pressure over 100 psig (689 kPa). 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.



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Figure 8-4

- 7. Quickly remove the air nozzle and install the valve core.
- 8. Adjust air pressure in tire to recommended pressure.
- 9. Immerse the wheel and tire assembly in water to make sure there are no leaks.

WHEEL ASSEMBLY

See General Warnings on page 1-2.

WHEEL ASSEMBLY REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect battery and spark plug wire.
- 3. Remove the wheel cover.
- 4. Loosen the lug nuts.
- 5. Lift the front or rear of the vehicle. See Lift The Vehicle.
- 6. Remove the lug nuts.
- 7. Remove the wheel assembly.

WHEEL ASSEMBLY INSTALLATION

- 1. Disable the vehicle.
- 2. Align the wheel assembly onto the hub of the vehicle.

NOTE: Make sure that the valve stem points to the outer side of the vehicle.

NOTE: Make sure that the tire tread is in the correct direction of travel.

- 3. Install the lug nuts with the taper to the vehicle.
- 4. Tighten the lug nuts until they are hand-tight.
- 5. Lower the front or rear of the vehicle. See Lift The Vehicle section.
- 6. Tighten the lug nuts to the recommended torque specification in a crisscross pattern.
- 7. Install the wheel cover.
- Electric Vehicle: Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

Pagination Page

See General Warnings Section.

GENERAL INFORMATION

The rear suspension and powertrain of the vehicle move independently from the vehicle frame. It consists of two leaf springs controlled by two shock absorbers mounted between the springs and the vehicle frame.

SHOCK ABSORBERS

The following procedures are the same for all vehicles.

REAR SHOCK ABSORBER INSPECTION

Examine the area (1) where the shaft enters the shock absorber body (Figure 9-1, Page 9-1).

1. If there is fluid leakage, replace the shock absorber.

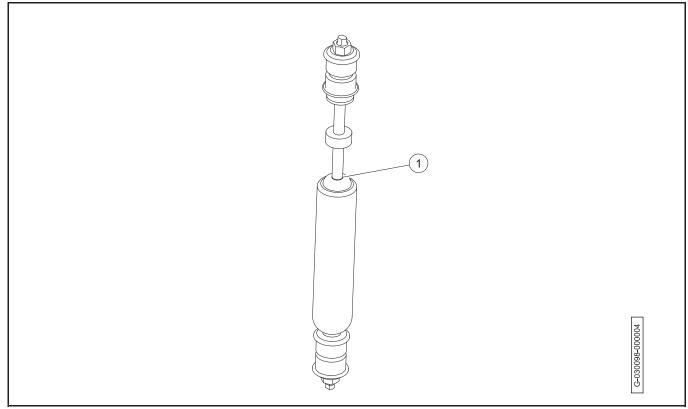


Figure 9-1 Rear Shock Absorber Inspection

REAR SHOCK ABSORBER REMOVAL

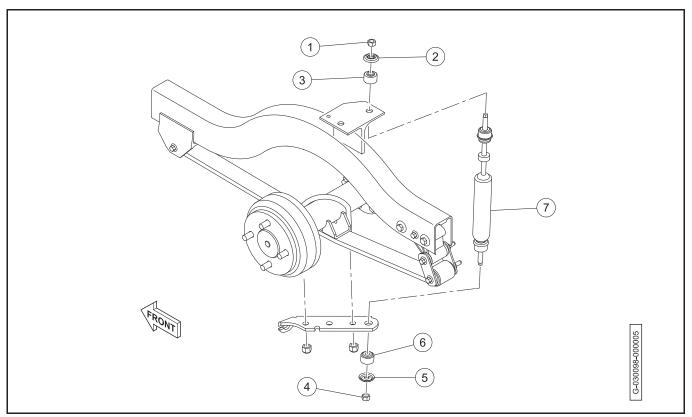


Figure 9-2 Rear Shock Absorber Removal

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect battery and spark plug wire.
- 3. Remove the nut (1), cup washer (2), and rubber bushing (3) from the top of the shock absorber (Figure 9-2, Page 9-2).
- 4. Remove the nut (4), cup washer (5), and rubber bushing (6) from bottom of the shock absorber.
- 5. Compress and remove the shock absorber (7).

REAR SHOCK ABSORBER INSTALLATION

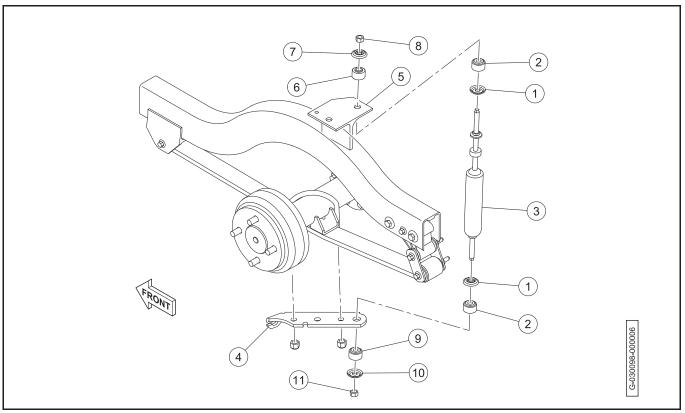


Figure 9-3 Rear Shock Absorber Installation

- 1. Install the cup washers (1) and rubber bushings (2) onto the shock absorber (3) (Figure 9-3, Page 9-3).
- 2. Install the bottom stem of the shock absorber into the shock mount bracket (4).
- 3. Install the top stem of the shock absorber into the frame shock mount (5).
- 4. Install the rubber bushing (6), cup washer (7), and nut (8) onto the top of the shock absorber.
- 5. Install the rubber bushing (9), cup washer (10), and nut (11) onto the top of the shock absorber.
- 6. Tighten the nuts until the rubber bushings expand to the size of the cup washer.
- 7. **Electric Vehicle:** Connect the batteries. **Gasoline Vehicle:** Connect battery and spark plug wire.

9 Panhard and Bracket REAR SUSPENSION

PANHARD AND BRACKET

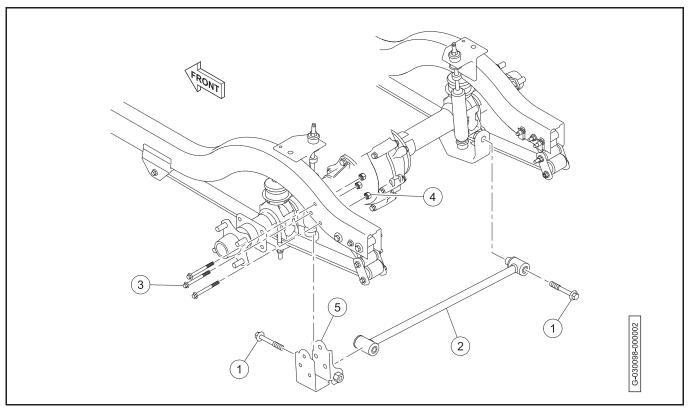


Figure 9-4 Panhard and Bracket

PANHARD AND BRACKET REMOVAL

- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect battery and spark plug wire.
- 3. Remove the bolts (1) (Figure 9-4, Page 9-4).
- 4. Remove the panhard (2).
- 5. Remove the bolts (3) and nuts (4).
- 6. Remove the bracket (5).

PANHARD AND BRACKET INSTALLATION

- 1. Put the bracket (5) into position on the frame (Figure 9-4, Page 9-4).
- 2. Install the bolts (3) and nuts (4). Tighten the bolts to 18.5 lb·ft (25 N·m).
- 3. Put the panhard (2) into position on the vehicle.
- 4. Install the bolts (1). Tighten the bolts to 92 lb·ft (125 N·m).
- Electric Vehicle: Connect the batteries.
 Gasoline Vehicle: Connect battery and spark plug wire.

LEAF SPRINGS (TWO-PASSENGER)

LEAF SPRING REMOVAL (TWO-PASSENGER)

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.
- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Lift the rear of the vehicle.
- 4. Put 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.
- 5. Remove the tire and wheel assembly on the side from which the spring is to be removed.
- 6. Remove the bow tie locking pin (1) and the clevis pin (2) (Figure 9-5).

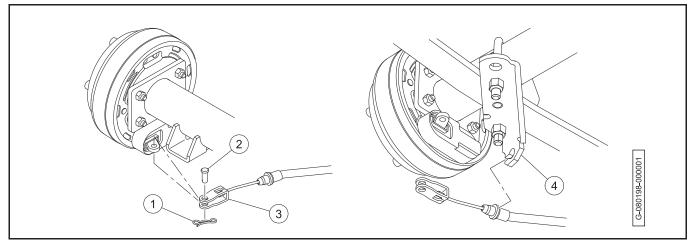


Figure 9-5

- 7. Remove the cable end (3) from the brake lever.
- 8. Remove the brake cable from the shock mount bracket (4).

9. Remove the nut (5), cup washer (6), and rubber bushing (7) from the bottom stem of the shock absorber (Figure 9-6).

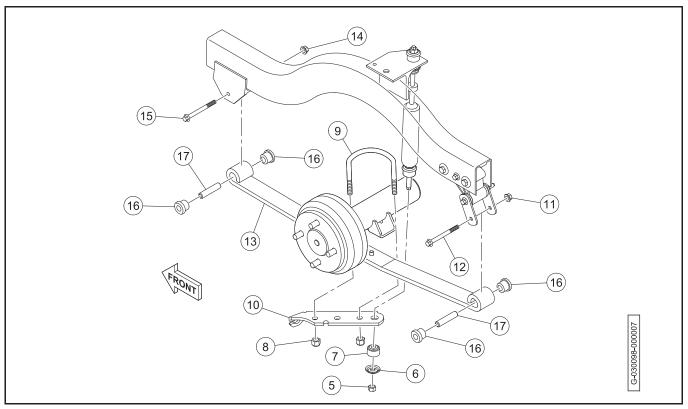


Figure 9-6 Leaf Spring Removal - Two-Passenger

- 10. Remove the nuts (8) and the U-bolt (9) securing the spring to the transaxle.
- 11. Remove the shock mount bracket (10) and the U-bolt.
- 12. Remove the nut (11) and bolt (12) from the rear of the leaf spring (13).
- 13. Remove the nut (14) and bolt (15) from the front of the leaf spring and remove the leaf spring.
- 14. Remove the bushings (16) and sleeves (17) in the spring eyes.

LEAF SPRING INSTALLATION (TWO-PASSENGER)

A 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.
- 1. Examine the bushings and sleeves. Replace as necessary.
- 2. Thoroughly coat the bushings and sleeves with Lubriplate 130-AA or a comparable lubricant.
- 3. Make sure that the bushings are fully seated.
- 4. Make sure that the inner sleeve is centered within the bushings.
- 5. Install the front of the leaf spring (1) onto the vehicle frame (Figure 9-7).

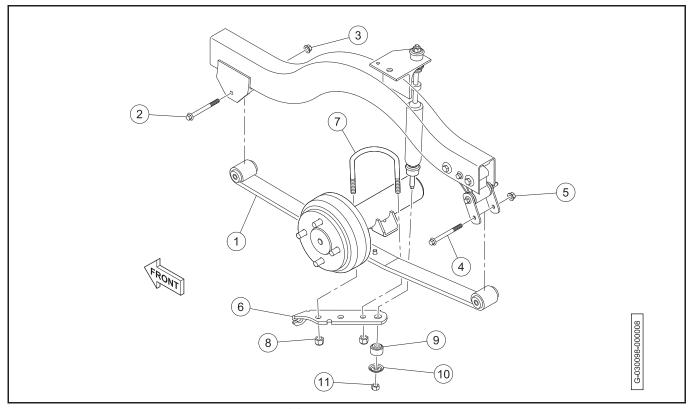


Figure 9-7 Leaf Spring Installation - Two-Passenger

- 6. Install the bolt (2) and nut (3). Tighten the nut to 18.5 lb·ft (25 N·m).
- 7. Install the rear of the leaf spring onto the shackle.
- 8. Install the bolt (4) and nut (5). Tighten the nut to 18.5 lb·ft (25 N·m).
- 9. Install the shock mount bracket (6), U-bolt (7), and nuts (8). Tighten the nuts to 25 lb·ft (34 N·m).
- 10. Install the bottom stem of the shock absorber into the shock mount bracket.
- 11. Install the rubber bushing (9), cup washer (10), and nut (11). Tighten the nut until the rubber bushing expands to the size of the cup washer.

12. Install the brake cable onto the shock mount bracket (1) (Figure 9-8).

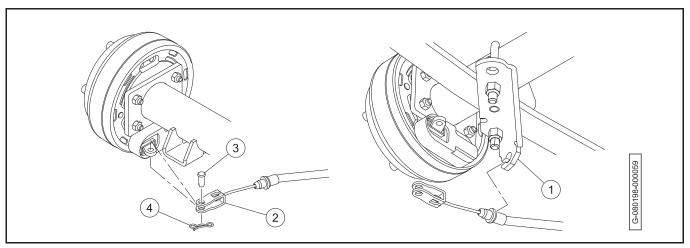


Figure 9-8

- 13. Install the cable end (2) onto the brake lever.
- 14. Install the clevis pin (3) and the bow tie locking pin (4).
- 15. Lower and remove the floor jack under the transaxle.
- 16. Install the tire and wheel assembly.
- 17. Lower the rear of the vehicle.
- Electric Vehicle: Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

LEAF SPRINGS (FOUR-PASSENGER)

See General Warnings on page 1-2.

LEAF SPRING REMOVAL (FOUR-PASSENGER)

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.
- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Lift the rear of the vehicle.
- 4. Put 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.
- 5. Remove the tire and wheel assembly on the side from which the spring is to be removed.
- 6. Remove the bow tie locking pin (1) and the clevis pin (2) (Figure 9-9, Page 9-9).

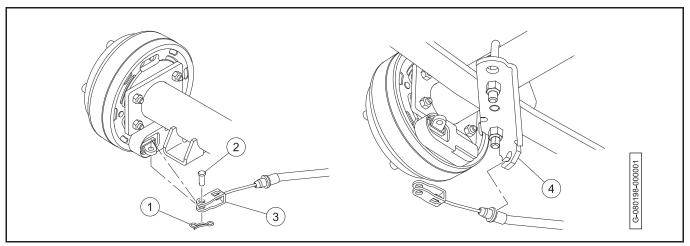


Figure 9-9

- 7. Remove the cable end (3) from the brake lever.
- 8. Remove the brake cable from the shock mount bracket (4).
- 9. Remove the nut (5), cup washer (6), and rubber bushing (7) from the bottom stem of the shock absorber (**Figure 9-10**, **Page 9-9**).

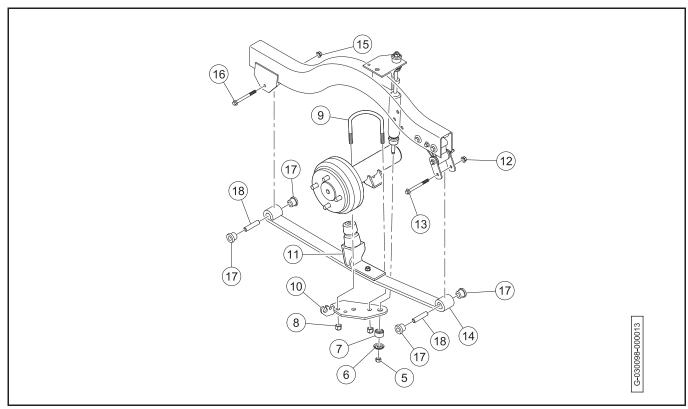


Figure 9-10 Leaf Spring Removal - Four-Passenger

- 10. Remove the nuts (8) and the U-bolt (9) securing the spring to the transaxle.
- 11. Remove the shock mount bracket (10), jounce bumper (11), and the U-bolt.
- 12. Remove the nut (12) and bolt (13) from the rear of the leaf spring (14).

- 13. Remove the nut (15) and bolt (16) from the front of the leaf spring and remove the leaf spring.
- 14. Examine the bushings (17) and sleeves (18) in the spring eyes.
- 14.1. If the bushings or sleeves are worn or have damage, replace them.

LEAF SPRING INSTALLATION (FOUR-PASSENGER)

A 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.
- Install the front of the leaf spring (1) onto the vehicle frame (Figure 9-11, Page 9-10).

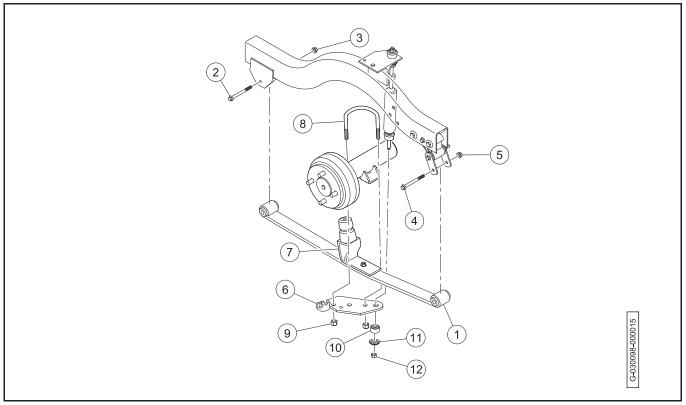


Figure 9-11 Leaf Spring Installation (Four-Passenger)

- 2. Install the bolts (2) and nut (3). Tighten the nut to 18.5 lb·ft (25 N·m).
- 3. Install the rear of the leaf spring onto the shackle.
- 4. Install the bolt (4) and nut (5). Tighten the nut to 18.5 lb·ft (25 N·m).
- 5. Install the shock mount bracket (6), jounce bumper (7), U-bolts (8), and nuts (9). Tighten the nuts to 45 lb·ft (60 N·m).
- 6. Install the bottom stem of the shock absorber into the shock mount bracket.
- 7. Install the rubber bushing (10), cup washer (11), and nut (12). Tighten the nut until the rubber bushing is the same size as the cup washer.
- 8. Install the brake cable onto the shock mount bracket (1) (Figure 9-12, Page 9-11).

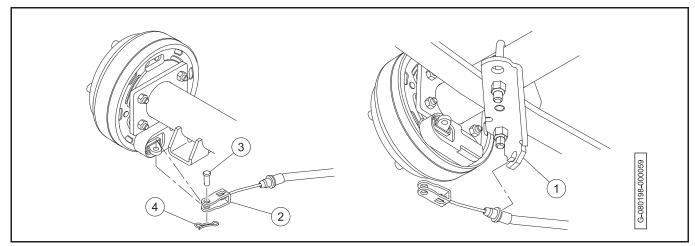


Figure 9-12

- 9. Install the cable end (2) onto the brake lever.
- 10. Install the clevis pin (3) and the bow tie locking pin (4).
- 11. Lower and remove the floor jack under the transaxle.
- 12. Install the tire and wheel assembly.
- 13. Lower the rear of the vehicle.
- 14. Electric Vehicle: Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

LEAF SPRINGS (FOUR-PASSENGER - HEAVY DUTY WITH PANHARD)

LEAF SPRING REMOVAL (FOUR-PASSENGER - HEAVY DUTY WITH PANHARD)

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.
- 1. Disable the vehicle.
- 2. **Electric Vehicle:** Disconnect the batteries and discharge the controller. **Gasoline Vehicle:** Disconnect the battery and spark plug wire.
- 3. Lift the rear of the vehicle.
- 4. Put 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.
- 5. Remove the tire and wheel assembly on the side from which the spring is to be removed.
- 6. Remove the bow tie locking pin (1) and the clevis pin (2) (Figure 9-13).

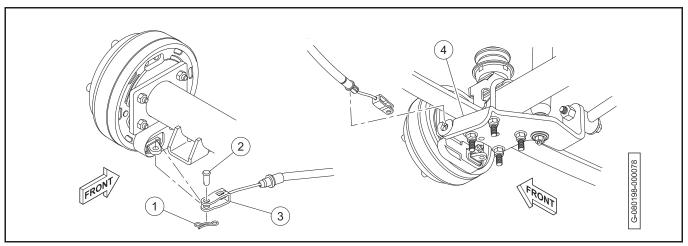


Figure 9-13

- 7. Remove the cable end (3) from the brake lever.
- 8. Remove the brake cable from the shock mount bracket (4).
- 9. Remove the nut (5), cup washer (6), and rubber bushings (7) from the lower mounting stem of the shock absorber (Figure 9-14).

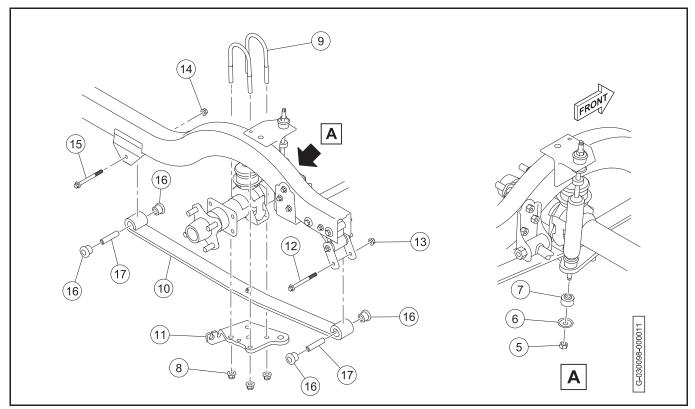


Figure 9-14 Leaf Spring Removal (Four-Passenger - Heavy Duty With Panhard)

- 10. Remove the nuts (8) U-bolts (9), and shock mount bracket (11).
- 11. Remove the bolt (12) and nut (13) attaching the rear of the (10) leaf spring to the shackle.
- 12. Remove the nut (14) and bolt (15) attaching the front of the leaf spring to the vehicle frame and remove the spring.

13. Inspect the bushings (16) and sleeves (17) in the spring eyes and replace them if they are worn or damaged.

LEAF SPRING INSTALLATION (FOUR-PASSENGER - HEAVY DUTY WITH PANHARD)

A 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.
- 1. Install the front of the leaf spring (1) onto the vehicle frame (Figure 9-15).

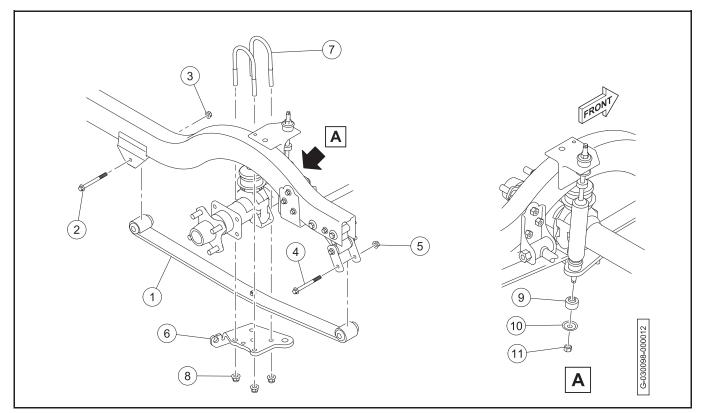


Figure 9-15 Leaf Spring Installation (Four-Passenger - Heavy Duty With Panhard)

- 2. Install the bolt (2) and nut (3). Tighten the nut to 18.5 lb·ft (25 N·m).
- 3. Install the rear of the leaf spring onto the shackle.
- 4. Install the bolt (4) and nut (5). Tighten the nut to 18.5 lb·ft (25 N·m).
- 5. Install the shock mount bracket (6), U-bolts (7), and nuts (8). Tighten the nuts to 45 lb·ft (60 N·m).
- 6. Install the bottom stem of the shock absorber into the shock mount bracket.
- 7. Install the rubber bushing (9), cup washer (10), and nut (11). Tighten the nut until the rubber bushing is the same size as the cup washer.

8. Install the brake cable onto the shock mount bracket (1) (Figure 9-16).

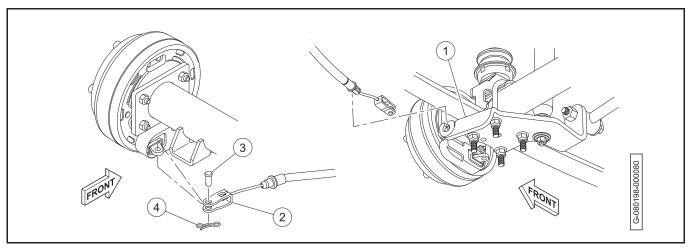


Figure 9-16

- 9. Install the cable end (2) onto the brake lever.
- 10. Install the clevis pin (3) and the bow tie locking pin (4).
- 11. Lower and remove the floor jack under the transaxle.
- 12. Install the tire and wheel assembly.
- 13. Lower the rear of the vehicle.
- 14. Electric Vehicle: Connect the batteries.

Gasoline Vehicle: Connect the battery and spark plug wire.

GENERAL INFORMATION

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.

PRE-OPERATION AND DAILY SAFETY CHECKLIST

Each Club Car vehicle has been thoroughly inspected and adjusted at the factory; however, upon receiving your new vehicle(s), you should become familiar with its controls, indicators, and operation. Carefully inspect each vehicle to ensure that it is in proper working condition before accepting delivery.

Use the following checklist as a guide to inspect the vehicle. This checklist should be used daily to ensure that the vehicle is in proper working condition and in conjunction with the Performance Inspection on page 10-2, and the Periodic Service Schedules on page 10-4. Any problems should be corrected by a Club Car distributor/dealer or a trained technician.

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.

All Vehicles

- General: All the parts should be in place and properly installed. Be sure that all nuts, bolts, and screws are tight.
- Safety and information decals: Check to ensure that all safety and information decals are in place.
- Tires: Visually inspect tires for wear, damage, and proper inflation on a daily basis.
- Performance Inspection: Inspect as instructed. See Performance Inspection on page 10-2.

Electric Vehicles

- Batteries: Check electrolyte to ensure that it is at its proper level (Figure 14-3, Page 14-10). Check battery posts. Wires should be tight and free of corrosion. Charge batteries fully before first use of vehicle.
- Charger cord, plug, and receptacle: Visually inspect for cracks, loose connections, and frayed wiring.

WARNING

• Be sure the plastic has been removed from the seat bottom before operating the vehicle. Failure to do so may result in a fire, property damage, personal injury, or death.

Gasoline Vehicles

- Battery: Check battery posts. Wires should be tight and free of corrosion and battery should be fully charged.
- Engine: Check for proper engine oil level.
- Fuel: Check fuel level. See . Check fuel tank, lines, cap, pump, fuel filters, and fuel injector for fuel leakage.

WARNING

• Be sure the plastic has been removed from the seat bottom before operating the vehicle. Failure to do so may result in a fire, property damage, personal injury, or death.

PERFORMANCE INSPECTION

After you have familiarized yourself with the vehicle controls and have read and understood the driving instructions, take the vehicle for a test drive.

Use the following checklist in conjunction with the Daily Pre-Operation and Safety Checklist as a guide to inspect the vehicle and check daily for proper operation. Any problems should be corrected by a Club Car distributor/dealer or a trained technician.

All Vehicles

- Forward/Neutral/Reverse switch: Check for proper operation.
- Brakes: Be sure the brakes function properly. When brake pedal is pressed using moderate pressure, the vehicle should come to a smooth, straight stop. If the vehicle swerves or fails to stop, stops abruptly, or makes a grinding or squeaking noise, have the brake system checked and adjusted as required. Continued, moderate brake pedal pressure should be able to lock the wheels, but using lesser pressure should also permit a slow, gradual deceleration.
- Park brake: When latched, the park brake should lock the wheels and hold the vehicle stationary (on an incline of 20% or less). It should release when either the accelerator or brake pedal is pressed.
- Reverse buzzer: The reverse buzzer will sound as a warning when the Forward/Neutral/Reverse handle or switch is in the REVERSE position.
- Steering: The vehicle should be easy to steer and should not have any play in the steering wheel.
- **General:** Listen for any unusual noises such as squeaks or rattles. Check the vehicle's ride and performance. Have a Club Car distributor/dealer or a trained technician investigate anything unusual.

Electric Vehicles

- Accelerator: With the key switch in the ON position and the Forward/Neutral/Reverse switch in the FORWARD position, as the accelerator pedal is pressed, the motor should start and the vehicle should accelerate smoothly to full speed. When the pedal is released it should return to the original position. All Club Car vehicles operate at reduced speed in reverse.
- Walk Away Braking: With the vehicle parked on level ground and the park brake disengaged, place the Run/Tow switch in the RUN position and attempt to push the vehicle. Motor braking should engage and cause resistance to rolling ((moving at no more than 1 to 3 mph) (1.6 to 4.8 km/h)) with the Forward/Neutral/Reverse switch in any position. When walk away motor braking is engaged, the reverse buzzer should emit a distinct pattern of beeps. See following WARNING.

WARNING

- Walk Away Braking will not limit vehicle speed to 3 mph (4.8 km/h) on very steep grades. Do not
 operate vehicle on slopes exceeding 20% grades.
- Motor Braking: Accelerate down an incline with the accelerator pedal fully pressed. When the vehicle reaches maximum programmed speed, motor braking should engage and limit the vehicle to its maximum programmed speed. On very steep grades, the vehicle may slightly exceed its maximum programmed speed, requiring the use of the brake pedal. Also, travel downhill with the accelerator pedal partially pressed. Motor braking should limit speed to less than top speed and maintain speeds proportional to the accelerator pedal position. On a level surface, accelerate the vehicle to full speed and then release the accelerator pedal. Motor braking should smoothly slow the vehicle to a complete stop or else allow the vehicle to coast freely, depending on the selected controller setting.

Gasoline Vehicles

• Accelerator: With the key switch in the ON position and the Forward/Neutral/Reverse switch in the FORWARD position, as the accelerator pedal is pressed, the engine should start and the vehicle should accelerate smoothly to full speed. When the pedal is released it should return to the original position. All Club Car vehicles operate at reduced speed in reverse.

• Governor: Check maximum speed of the vehicle. The vehicle should operate at 12 to 15 mph (19 to 24 km/h) on a level surface.

NOTE: The 12 to 15 mph (19 to 24 km/h) is for fleet golf cars. There is an optional 19 mph (30 km/h) speed kit available for non-fleet golf cars, these vehicles should be set between 18.5 and 19.5 mph (29.7 and 31.3 km/h).

MAINTENANCE

See General Warnings on page 1-2.

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. Use the Pre-Operation and Daily Safety Checklist beginning on page 10-2, the Performance Inspection, and the following Periodic Service Schedules and Periodic Lubrication Schedules to keep the vehicle in proper working condition.

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.

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.
- 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.

Electric vehicles:

- · Hot! Do not attempt to service hot motor. Attempting to do so could cause severe burns.
- To avoid unintentionally starting the vehicle, disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.

Gasoline vehicles:

- · Moving parts: Do not attempt to service gasoline vehicle while the engine is running.
- Hot! Do not attempt to service hot engine or exhaust system. Failure to heed this warning could result in severe burns.
- To avoid unintentionally starting the vehicle, disconnect battery and spark plug wire(s). See Disconnect the Battery Gasoline Vehicles on page 1-3.

WARNING CONTINUED ON NEXT PAGE

WARNING

 Frame ground – Do not allow tools or other metal objects to contact frame when disconnecting batteries or other electrical wiring. Never allow a positive wire to touch the vehicle frame, engine, or other metal component.

PERIODIC SERVICE SCHEDULES

WARNING

- Service, repairs, and adjustments must be made per instructions in the maintenance and service manual.
- 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.

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 Periodic Lubrication Schedule must be followed to keep vehicle in optimum operating condition.

ELECTRIC VEHICLE - PERIOD SERVICE SCHEDULE

INTERVAL	DESCRIPTION	
Initial: 6 weeks	Single Point Wattering System (SPWS): Establish a watering interval. SPWS: Make sure the valves operate correctly. Examine the battery acid level of all the batteries. Add water if necessary.	
	Do the Pre-Operation and Daily Safety Checklist.	
Daily	Do the Performance Inspection.	
	Charge the batteries after daily use.	
Weekly	No SPWS: Examine the battery acid level of all the batteries. Add water if necessary.	
	SPWS: Add water to the batteries. Make the SPWS is operates correctly.	
	Batteries:	
	Clean the batteries.	
Monthly	Clean the battery compartment.	
	Make sure that the battery cables are tight.	
	Make sure that the battery hold-downs are tight.	
	Examine the tire pressure.	
	Clean the entire vehicle.	

TABLE CONTINUED ON NEXT PAGE

INTERVAL	DESCRIPTION
Quantarily	Do an inspection of the deionizer.
Quarterly	Do an inspection of the SPWS.
	Use WD-40 to lubricate the battery charger receptacle.
	Have a trained technician examine and lubricate the brake system:
	Examine the brake shoes. Replace as necessary.
	Lubricate the brake system.
	Examine the brake cables. Replace as necessary.
	Examine the brake equalizer adjustment. Adjust as necessary.
50 hours / 6 months / 100 rounds of golf	Have a trained technician examine the electrical system:
	Make sure the connections are tight.
	Examine the wiring and connectors for damage. Replace as necessary.
	Examine the Motor Controller Output Regulator (MCOR).
	Have a trained technician examine and lubricate the front suspension:
	Examine the front wheel alignment. Adjust as necessary.
	Lubricate the front suspension.
	Have a trained technician examine the batteries:
100 hours / 6 months / 200 rounds of golf	Examine the battery acid level of all battery cells. Add water as necessary.
	If the batteries are not performing as expected, test the batteries. See Electric Vehicle Troubleshooting and Electrical System.
	Have a trained technician examine the safety decals. Replace if damaged or illegible.
	Have a trained technician examine the transaxle fluid. Fill as necessary.
	Have a trained technician lubricate the pedal group. Lubricate all rotating components.
	Have a trained technician examine the vehicle for loose hardware. Tighten as necessary.

GASOLINE VEHICLE - PERIODIC SERVICE SCHEDULE

INTERVAL	DESCRIPTION
Initial: 100 hours	Change the engine oil.
	Do the Pre-Operation and Daily Safety Checklist.
Daily	Do the Performance Inspection.
	Examine the engine oil level.
	Examine the tire pressure.
	Clean the engine compartment and underside of the vehicle. Do not was the engine when it is hot.
Monthly	Examine the engine air intake. Clean as necessary.
	Clean the area around the exhaust. Remove all debris.
	Clean the vehicle.
	Clean the battery.
	Examine the air filter. Replace as necessary. Examine the hose for damage. Make sure that the hose clamps are tight.
	Have a trained technician examine and lubricate the front suspension:
	Examine the front wheel alignment. Adjust as necessary.
	Lubricate the front suspension.
	Have a trained technician examine the electrical system:
50 hours / 6 months / 100 rounds of golf	Make sure the connections are tight.
	Examine the wiring and connectors for damage. Replace as necessary.
	Have a trained technician examine and lubricate the brake system:
	Examine the brake shoes. Replace as necessary.
	Lubricate the brake system.
	Examine the brake cables. Replace as necessary.
	Examine the brake equalizer adjustment. Adjust as necessary.
	Have a trained technician lubricate the shift cable pivots.

TABLE CONTINUED ON NEXT PAGE

INTERVAL	DESCRIPTION	
	Have a trained technician examine the drive belt and starter/generator belt. Replace and adjust as necessary.	
	Have a trained technician examine the engine:	
	Examine the engine for leaks around gaskets, fill plug, etc.	
	Examine the air filter. Replace as necessary.	
	Examine, clean, and gap the spark plug. Replace as necessary.	
	Have a trained technician examine air intake system:	
	Examine the air filter. Replace as necessary.	
	Examine the hose for damage.	
100 hours / 12 months / 200 rounds of golf	Make sure that the hose clamps are tight.	
	Have a trained technician lubricate the pedal group. Lubricate all rotating components.	
	Have a trained technician examine the vehicle for loose hardware. Tighten as necessary.	
	Have a trained technician examine the safety decals. Replace if damaged or illegible.	
	Have a trained technician examine the transaxle fluid. Fill as necessary.	
	Have a trained technician examine the vehicle top speed.	
	Have a trained technician examine the:	
	Drive belt and starter/generator belt. Replace and adjust as necessary.	
	Safety decals. Replace if damaged or illegible.	
	Transaxle fluid. Fill as necessary.	
	Vehicle for loose hardware. Tighten as necessary.	
	Vehicle top speed. Adjust as necessary.	
	Have a trained technician lubricate all rotating components of the pedal group.	
200 hours / 12 months	Change the engine oil.	
200 hours / 24 months / 400 rounds of golf	Kohler ECH440: Check and adjust valve clearance as needed. Subaru EX-40: Check and adjust valve lash as needed.	

PERIODIC LUBRICATION SCHEDULES

ELECTRIC VEHICLE - PERIODIC LUBRICATION SCHEDULE

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

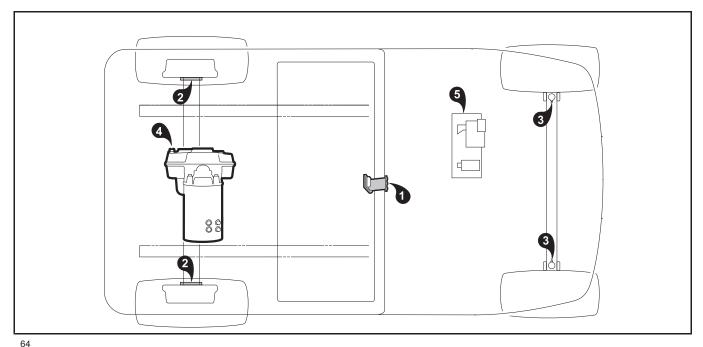


Figure 10-1 Lubrication Points – Electric Vehicles

GASOLINE VEHICLE - PERIODIC LUBRICATION SCHEDULE

PERIODIC LUBRICATION SCHEDULE – GASOLINE VEHICLES			
REGULAR INTERVAL	SERVICE	LUBRICATION POINTS	RECOMMENDED LUBRICANT
	Shifter cable pivots	•	Dry Moly Lube
Semiannually by owner or trained technician (every 50 hours of operation or every 100 rounds of golf)	Brake system, per maintenance and service manual.	2	Dry Moly Lube, 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	Transaxle: Check/fill to plug level	4	67.6 fl-oz (2 L) SAE 80W-90 API Class GL-5
operation or every 200 rounds	Pedal group (as required)	5	Dupont™ Performance Dry Multi-Use Lubricant
First change 100 hours – additional change every 200 hours of operation or annually, whichever comes first	Change engine oil	6	40 fl-oz (1.2 L) 10W-30 or 5W-30 grade SE or higher. See also Figure 28-3, Page 28-5.

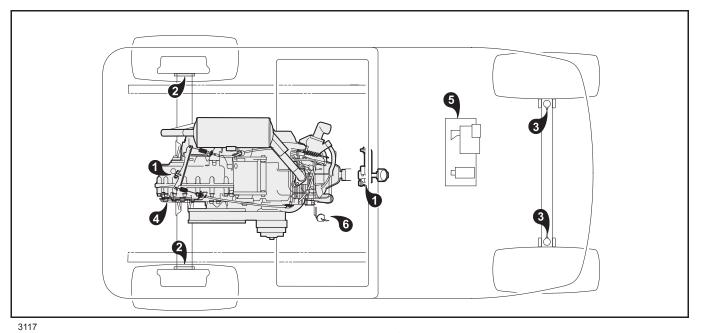


Figure 10-2 Lubrication Points – Gasoline Vehicles

AIR FILTER

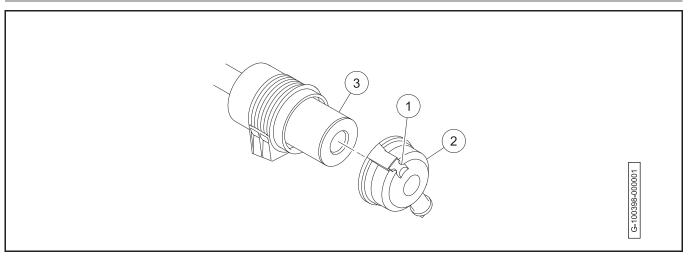


Figure 10-3 Air Filter

AIR FILTER REMOVAL

Before the air filter is removed:

· Disable the vehicle.

To remove the air filter:

- 1. Release the latch (1) (Figure 10-3, Page 10-10).
- 2. Remove the air cleaner cover (2).
- 3. Remove the air filter (3).

AIR FILTER INSTALLATION

- 1. Use a wet lint-free cloth to clean the inside of the air filter container.
- 2. Install the air filter (3) (Figure 10-3, Page 10-10).
- 3. Install the air cleaner cover (2).
- 4. Engage the latch (1).

KOHLER ECH440 - ENGINE OIL

Vehicles with Subaru EX-40, see Subaru EX-40 - Engine chapter.

KOHLER ECH440 - ENGINE OIL VISCOSITY

Select the engine oil viscosity for your environmental conditions.

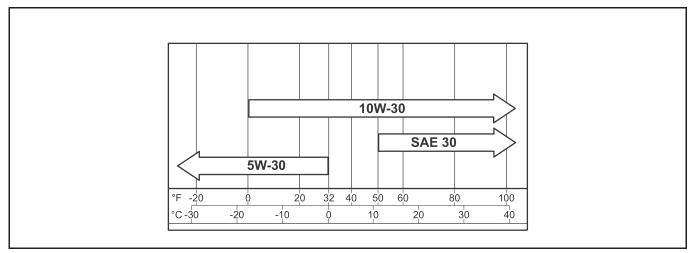


Figure 10-4 Engine Oil Viscosity

KOHLER ECH440 - ENGINE OIL LEVEL INSPECTION

Before the engine oil is examined:

· Disable the vehicle.

To examine the engine oil:

Remove the dipstick (1) (Figure 10-5, Page 10-11).

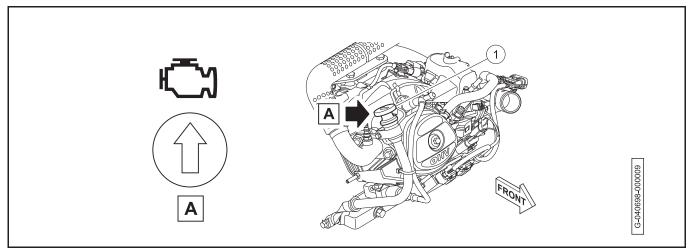


Figure 10-5 Dipstick

- 2. Make sure that there is oil on the dipstick.
- 3. Install the dipstick.
- 4. Start and operate the engine for three minutes. If the low oil warning light stays on, turn off the engine immediately.
- Turn off the engine. 5.
- 6. Wait two minutes.
- 7. Remove and clean the dipstick.
- Install the dipstick. 8.

- 9. Remove the dipstick.
- 10. Make sure that the oil level is between the maximum (1) and minimum (2) indicators (Figure 10-6, Page 10-12).

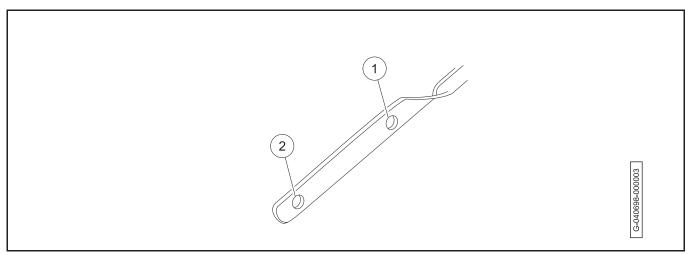


Figure 10-6 Dipstick Indicators

- 11. If the oil level is below the minimum indicator, add engine oil.
- 12. Install the dipstick.

NOTE: Make sure that the arrow points towards the engine.

KOHLER ECH440 - ENGINE OIL REPLACEMENT

CAUTION

• Hot engine oil will cause skin burns. Do not change the engine oil when the engine is hot. Let the engine temperature decrease before the oil is changed.

A CAUTION

• Too much engine oil can decrease engine performance and damage the engine. Do not exceed the recommended engine oil capacity.

Before the engine oil is replaced:

- · Disable the vehicle.
- · Disconnect the battery.

To replace the engine oil:

1. Remove the dipstick (1) (Figure 10-7, Page 10-13).

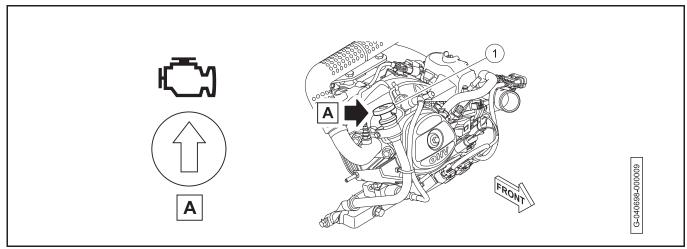


Figure 10-7 Dipstick

Clean the area around the oil drain plug (2) (Figure 10-8, Page 10-13).

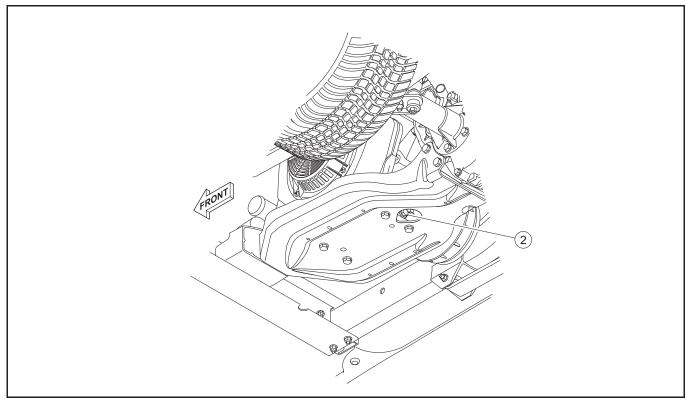


Figure 10-8 Oil Drain Plug

- 3. Put a drain pan below the oil drain plug.
- Remove the oil drain plug. 4.
- Drain the oil fully. 5.
- Clean the oil drain plug. 6.
- Examine the gasket on the oil drain plug for damage. Replace if necessary. 7.
- 8. Install the oil drain plug and tighten to 13 lb·ft (18 N·m).

9. Add 39 fl-oz (1.1 l) of recommended engine oil (Figure 10-9, Page 10-14).

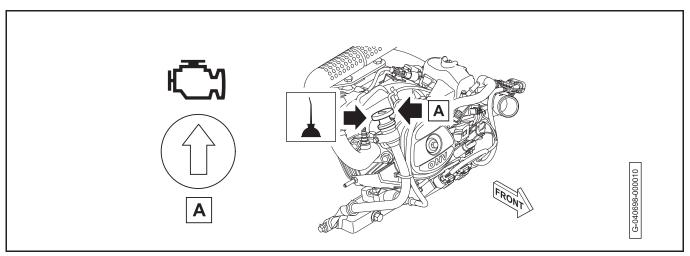


Figure 10-9 Engine Oil Fill Location

- 10. Install the dipstick.
- 11. Connect the battery.

KOHLER ECH440 - ADD ENGINE OIL

CAUTION

• Do not remove the dipstick while the engine is on.

A CAUTION

• Too much engine oil can decrease engine performance and damage the engine. Do not exceed the recommended engine oil capacity.

Before engine oil is added:

· Disable the vehicle.

To add engine oil:

1. Remove the dipstick (1) (Figure 10-7, Page 10-13).

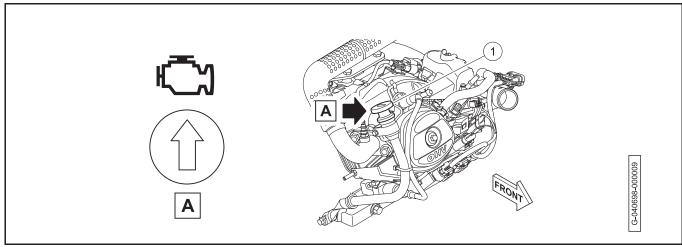


Figure 10-10 Dipstick

Add engine oil until the oil level is between the maximum (1) and minimum (2) indicators (Figure 10-11, Page 10-15).

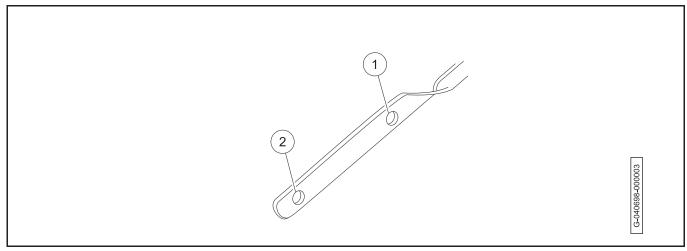


Figure 10-11 Dipstick Indicators

Install the dipstick.

VEHICLE MAINTENANCE

REFUEL

A DANGER

- Fuel is flammable and explosive. Do not add fuel with the key set to ON. Before fuel is added, turn the key switch to OFF.
- Fuel is flammable and explosive. Do not fill the fuel tank when the engine is on or hot. Wait for the engine temperature to decrease before fuel is added.
- Fuel is flammable and explosive. Do not operate the vehicle when fuel is spilled. Correctly clean the spilled fuel.
- · Fuel is toxic. Do not siphon fuel from the vehicle.
- · Fuel is toxic. Keep fuel out of reach of children.
- Fuel is flammable and explosive. Keep the fuel in an approved fuel container. Keep the fuel container in a ventilated area away from sparks and heat sources.
- Fuel is flammable and explosive. To avoid electric arc caused by static electricity, the fuel storage/pumping device must be grounded. If the pump is not grounded, the vehicle must be grounded to the pump before and during the fueling operation.

CAUTION

- A fuel with an alcohol content that exceeds 10% by volume (like E15 and E85) will cause vehicle damage and void the warranty. Only use the recommended fuel type.
- Do not repeatedly attempt to start a vehicle when the fuel pump is dry (no gas in tank). Doing so can damage the fuel pump.
- Turn the key to OFF.
- 2. Let the engine cool.
- 3. Lift the seat bottom.

Remove the fill cap (1) (Figure 10-12).

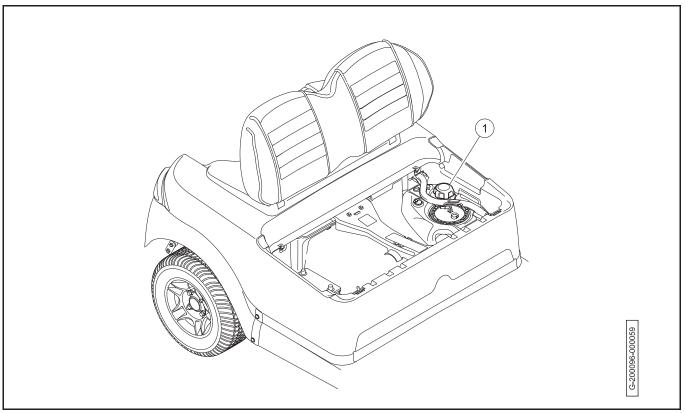


Figure 10-12

- Fill the fuel tank with the recommended fuel. 5.
- 6. Install the fuel cap.
- 7. Lower the seat bottom.

Pagination Page

SECTION 11 — CONTROLLER DIAGNOSTIC TOOL (CDT)

A DANGER

• See General Warnings on page 1-2.

WARNING

• See General Warnings on page 1-2.

NOTE: The information presented in this section addresses the following:

- The Controller Diagnostic Tool (CDT) handheld programmer which replaced the IQDM series 2 handset.
- How to use the CDT to troubleshoot the vehicle and to adjust controller parameters that affect vehicle behavior.
- The controller with OS version 34 or version 35. The OS version can be viewed in the System Info menu of the CDT. See System Info on page 11-5.

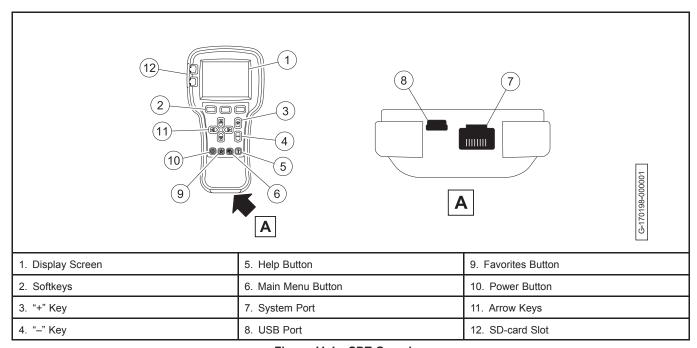


Figure 11-1 CDT Overview

GENERAL INFORMATION

The CDT is used to adjust and save parameter settings of the controller, monitor real-time data, and perform diagnostics and troubleshooting of the electric vehicle.

FEATURES

• Batteries: Two AA batteries provide power for the CDT's real-time clock and they allow for use of the CDT when not connected to a vehicle.

- Convenient parameter adjustment: You can easily adjust a wide range of parameters to customize vehicle performance. These settings can then be saved as a unique .cpf (Cab Provisioning Format) file and stored. Multiple .cpf files can be stored and restored as needed.
- **Diagnostics and troubleshooting:** Existing faults as well as all the accumulated faults in the system's fault history file are listed in clear language. Suggestions for clearing each fault are also provided.
- Help function: Help screens give descriptions of adjustable parameters, monitored variables, and faults.
- PC interface: Files can be downloaded from a PC (onto an Secure Digital (SD) card or into the programmer directly through its USB connector) for installation into the controller.
- Plot and Log: The plot and log programs allow you to look at variables over time, either in graphical format or as data files you can upload in a spreadsheet program, such as Microsoft Excel.
- Real-time monitoring: Values of monitored data variables are displayed in easy-to-read formats.
- **SD-card support:** An SD card provides additional memory capacity. This is where any screenshots you take will be stored. SD cards can be used to deliver software upgrades, and can be used in multiple programmers to install identical software.
- · Softkeys: Three versatile softkeys provide multiple functions, depending on context.
- Update: The handheld programmer can update its own software.

PLUGGING THE CDT INTO THE VEHICLE

- Connect one end of the cable to the port located on the bottom of the CDT.
- 2. Connect the cable adaptor to the CDT cable.
- 3. Find the communication port on the vehicle (Figure 11-2, Page 11-2).

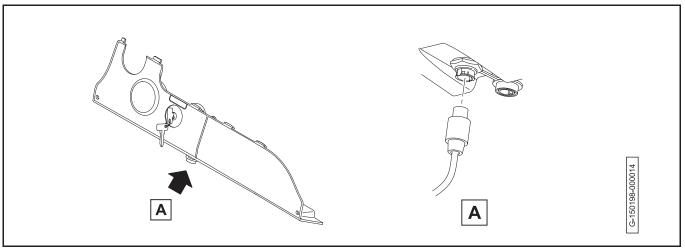


Figure 11-2

- 4. Remove the dust cap from the communication port.
- 5. Align the keyed portion of the plug with the communication port and insert plug into port.

11

INTRODUCTORY DISPLAY

Immediately after the CDT is connected to the vehicle, it begins loading controller information. During this time, the loading status is shown as a percentage, the CDT's software version is given, and status/information icons appear in the upper right corner. Once loading is complete, the screen displays the Main Menu.

NOTE: If the Power button is used to turn ON the handset and the handset is not connected to a vehicle, the message "No System Detected" will be displayed.

In the event that the handset does not display any information, or the screen is difficult to read, refer to the CDT troubleshooting procedures. **See CDT Troubleshooting on page 11-27.**

QUICK REFERENCE GUIDE - ERIC CHARGING SYSTEM

Mode is set to zero (0). Current Sense Fault: Clear the Fault History in CDT. If fault does not return and car operates normally, do not replace controller. If fault remains in System Faults, or Fault History after clearing, and car will not operate, replace controller. FLD Missing: Check in order: orange or blue wire broke or disconnected at motor/controller, short in motor. If good, replace controller. High Speed WalkAway: This is a symptom, not a cause. Most likely due to driver error. If not, check speed sensor on motor and key switch for proper operation. HPD: Check throttle %. If at zero (0), is a driver issue. Main Driver Overcurrent: Replace controller. Main Dropout: Solenoid or any component before it in circuit could be a fault. Check components from key switch to solenoid and connections. for propor operation. Main Dropout 2: Symptom more than the cause; see other faults that accompany Main Dropout 2. Main Weld: Replace solenoid. If it doesn't correct fault of car running at half speed, check accessory wiring. Motor Stall: If car moves freely, issue not with vehicle, operator error. Code A,B,C. Lockout Fault: This is a symptom, not a cause. Inspect and test the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock circuit. If no problems are found in the charger interlock				
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	See Figure 11-4 on page 11-30.			
	The DC cord is plugged into the car for more than 10 minutes. Unplug			
	DC Cord.			
	The charger interlock circuit has failed. Check for voltage on Light Blue	15 Amp fuse in the harness has failed.		
	wire in pin 5 of 16-pin connector. See Test Procedure 11 – Charger	·		
· · · · ·	Interlock on page 12-26.			
	Run/Tow switch is in "Tow" position. Switch to "Run" position.	Sonic weld(s) in Tow switch circuit failed (wire harnesses varv: see		
wiring schematic for that model car)	•	1		
	The Tow circuit has failed. Check Tow switch, 16-pin connector, and	 		
	wire harness.			

SYSTEM INFO

The System Info menu is accessed by using the arrow keys to highlight System Info and pressing the Select softkey to activate the menu.

The *System Info* selection displays information pertaining to the controller. The information provided from this menu selection includes:

MODEL NUMBER

Displays the model number of the controller.

SERIAL NUMBER

Displays the serial number of the controller.

HARDWARE VERSION

Displays the controller hardware version. See following NOTE.

NOTE: This manual covers hardware version 5.

PROTOCOL VERSION

Displays the controller protocol version.

PARAM BLOCK VERSION

Displays a number that represents the default parameter settings at time of manufacture.

MFG DATE CODE

Displays the date the controller was manufactured.

OS VERSION

Displays the controller operating system software version. See following NOTE.

NOTE: This manual spans OS version 34 and version 35.

SM VERSION

Displays the version number of the Start Manager software in the controller.

VCL APP VERSION

Displays the version number of the Vehicle Control Language application software in the controller.

PARAMETERS

The Parameters menu is accessed by using the arrow keys to highlight Parameters and pressing the Select softkey to activate the menu.

The Parameters menu is where you can view and modify the settings of the controller's adjustable parameters. Navigate through this complex menu using the arrow keys, +/- keys, and softkeys. **The parameters displayed will depend on the access level of the handset.**

Be aware when changing parameter settings, the new values replace the earlier values. If you make adjustments that you don't like, and wish you could return to the earlier values, you cannot do this unless you have written down those earlier settings (which is unlikely) or unless you have saved them. To save your parameter settings, use the "Save .cpf File" function in the Programming menu; see Plot & Log on page 11-26. Your parameter settings will then be saved in a .cpf file. You can save as many .cpf files as you desire, and you can create unique names for them. If you prefer, each .cpf can automatically be given a name consisting of the date and time when it was created; see the "Text for save as" item in the HHP menu; see Plot & Log on page 11-26. For information on creating names, see **Using the Keyboard** in the CDT Owner's Manual.

SETTINGS

Speed Setting

The vehicle's top speed can be changed by selecting values 1 through 3. If a value of 4 is displayed for the speed setting, a special access code has been entered to place the vehicle in "private speed mode." A speed setting of 4 cannot be selected with the *speed setting* menu item. For additional information on speed setting 4, refer to *Code A, Code B, and Code C*. **See Code A, Code B, and Code C on page 11-8.**

SPEED SETTING	DESCRIPTION	VEHICLE SPEED
1	Commercial speed	8.0 mph (12.9 km/h)
2	Slow golf speed	11.4 mph (18.3 km/h)
3	Normal golf speed	Typical 14.8 mph (23.8 km/h). See S3 FWD Speed on page 11-7.
4	Private speed mode	19.2 mph (30.9 km/h)

NOTE: Present speed values for each speed setting may be observed in the Monitor menu. See Vehicle Speeds on page 11-13.

Fast Accel

Fast accel (fast acceleration) is an option that can be enabled or disabled. With fast accel turned on, the vehicle will accelerate at a noticeably faster rate. With this feature turned off, the vehicle speed will gradually increase, even if the accelerator is quickly pressed to the floor. Turn the feature on or off by pressing "+" or "-" on the change value button.

Pedal Up Mode

Three options exist for *pedal up mode* (motor braking). When the accelerator pedal is released, motor braking will slow the vehicle to "near zero speed" when pedal up motor braking is enabled (option 1 or 2). If pedal up motor braking is disabled (option 0), the vehicle will coast to a stop when the accelerator pedal is released. **See following NOTE.**

Change the settings of the Pedal Up Mode by pressing "+" or "-" on the change value button.

NOTE: Pedal Up Mode does not affect top vehicle speed. When the vehicle is going down an incline, the motor braking function will activate to prevent the vehicle from exceeding the speed setting defined in the Program menu, regardless of Pedal Up Mode setting (0,1, or 2). **See Speed Setting on page 11-6.**

Parameters

When going down an incline with the accelerator pedal partially pressed, the motor braking function will activate to assist the operator in maintaining a speed less than the top speed setting. For example, if the vehicle is going down an incline with the accelerator pedal pressed half way, the motor braking function will activate to assist the operator in maintaining a speed approximately half of the speed setting defined in the Program Menu.

PEDAL UP MODE SETTING	MODE	OPERATION DESCRIPTION
0	Off	Pedal up motor braking is disabled
1	Mild pedal up	Mild pedal up motor braking
2	Aggressive pedal up	Aggressive pedal up motor braking

Speed Cal

The speed cal (speed calibration) menu item allows the user to fine tune the vehicle speed. This feature cannot be used to increase the vehicle speed. The range for speed calibration is 0 to 30. Each time the number is increased, the top speed will be decreased by 0.1 mph (0.16 km/h). The top vehicle speed will be determined by the speed setting menu item and the speed calibration setting. For example, if the speed setting is set for a value of 2 (11.4 mph (18.3 km/h)), and the speed calibration is set for 5, the total top speed of the vehicle should be approximately 10.9 mph (17.5 km/h).

NOTE: The SPEED CAL function will not be necessary in most golf applications since the speed setting 3 is finely adjustable with S3 FWD SPEED. **See S3 FWD Speed on page 11-7.**

S3 FWD Speed

The s3 fwd speed option allows for adjustability of the SPEED 3 speed setting. From the factory, s3 fwd speed will be set to one of 4 options: 12.4, 13.2, 14.0 and 14.8 mph (20.0, 21.3, 22.6 and 23.8 km/h, respectively). The default s3 fwd speed is 14.8 mph (23.8 km/h). The s3 fwd speed may be adjusted with the handset from 11.4 to 14.8 mph (18.3 to 23.8 km/h) in 0.1 mph (0.16 km/h) increments. The speed value chosen for s3 fwd speed may also be observed in the monitor menu. See Vehicle Speeds on page 11-13.

To fine tune vehicle top speed in normal golf speed range (12.4 to 14.8 mph (20.0 to 23.8 km/h)):

- 1. Access the *program* menu, then the *speed setting* menu with the navigation keys.
- 2. Select Speed Setting 3 with the change value buttons.
- 3. Access the program menu and the s3 fwd speed menu with the navigation keys.
- 4. Use the change value buttons to select desired speed.

Control Mode

The *control mode* option is used to configure the 1515 controller for different modes of speed control operation. Four modes are avaiable:

- 0 = Standard: Uses maximum speeds defined by the S1 through S4 Fwd Speed, Rev Speed and Speed Cal parameters.
- 1 = LIN (Local Interconnect bus) (i.e. Guardian or Visage): Uses maximum speeds assigned to a particular location or area as defined by the fleet operator; however, these defined speeds can not override maximums set in the S1 through S4 Fwd Speed, Rev Speed and Speed Cal parameters.
- 2 = ES-Protocol (UpLink): Uses maximum speeds assigned to a particular location or area as defined by the fleet
 operator; however, these defined speeds can not override previously set values from other control mode options. To
 avoid this, after changing the control mode to 2, cycle power to the controller by placing the Run/Tow Switch in the
 TOW position for 30 seconds. Then return it to RUN.
- 3 = Deterrent Demo Mode: Uses maximum speeds defined by the *deterrent demo* setting to demonstrate the automatic speed control features of Guardian and UpLink. **See Deterrent Demo on page 11-8.**

Anti-Tamper

The *anti-tamper* setting defines maximum speed if the Anti-Tamper fault is triggered (e.g. controller is disconnected from the Guardian or Visage system). These speeds can only be activated if the Control Mode option is set to 1 (Guardian/Visage) and are intended to be a deterrent. Factory default setting is 1.

- 0 = OFF; uses controller configured speed (S1 through S4 Fwd Speed, Rev Speed and Speed Cal parameters) even if the Anti-Tamper fault is triggered
- 1 = 2 mph
- 2 = 0 mph
- 3 = 7 mph

Deterrent Demo

The deterrent demo setting defines maximum speed of Control Mode 3.

- 0 = Controller configured speed (S1 through S4 Fwd Speed, Rev Speed and Speed Cal parameters)
- 1 = 10 mph
- 2 = 7 mph
- 3 = 2 mph

Braking

The *braking* menu item allows the user to turn this function ON or OFF. With it ON, the vehicle maintains the regen motor braking "feel" of the Excel system. With it OFF, regen motor braking is less aggressive and the vehicle mimics the "feel" of the IQ system.

For example: A *Pedal Up Mode* setting of 2 = 150 amps of regen motor braking. Setting *Excel Braking* to ON increases regen by 30 amps for a total of 180 amps and a more aggressive braking action.

WalkAway Deterrent

The walkaway deterrent menu item allows the user to turn this function ON or OFF. Walkaway deterrent is triggered by the High Speed WalkAway fault. With it ON, the reverse buzzer will sound immediately upon the key switch being turned OFF at speeds above 2 mph. With it OFF, the buzzer will cycle on and off at a higher frequency (7.5 Hz vs. 2.5 Hz).

Battery Type

The battery type menu item is intended to be used with Guardian/Visage so that the type of battery could be determined and displayed when remotely monitoring vehicles.

Charger Control

Beep Option

The *Beep Option* controls use of the reverse buzzer to sound a confirmation that charging has started: 0 = OFF, 1 = 1 beep, 2 = 3 beeps. From the factory, the *Beep Option* will be set to 2.

AMP HOURS

Reset Trip Amp Hours

The reset trip amp hours menu item allows the user to reset counter to zero (0). To reset, set to ON and then immediately back to OFF. To review or validate, proceed to Amp Hours Display on page 11-13 under the Monitor Menu.

ACCESS CODES

Code A, Code B, and Code C

The code entries are used to place the vehicle in "private speed mode", speed setting code 4. Each vehicle has a unique code for placing the vehicle in this mode. A vehicle programmed for "private speed mode", speed setting 4,

Monitor Mena

does not conform to ANSI Z130.1 – American National Standard for Golf Cars – Safety and Performance Specifications because it is capable of speeds in excess of 15 mph (24.1 km/h). For more information on this feature, contact your local Club Car distributor or dealer.

NOTE: If controller is replaced, the information below must be entered into the new controller. **See Controller Installation, Section 13, Page 13-5.**

VEHICLE ID

S/N ASCII Letter 1

S/N ASCII Letter 2

The two-letter serial number prefix is coded as two separate ASCII characters per the following table. For example, serial number JE1401-000001 would have 74 for S/N ASCII Letter 1 and 69 for S/N ASCII Letter 2.

ASCII NUMBER	ASCII CHARACTER	ASCII NUMBER	ASCII CHARACTER
65	Α	78	N
66	В	79	0
67	С	80	Р
68	D	81	Q
69	E	82	R
70	F	83	S
71	G	84	Т
72	Н	85	U
73	I	86	V
74	J	87	W
75	К	88	Х
76	L	89	Υ
77	M	90	Z

Vehicle Date of Manufacture

Four digit number programmed by vehicle manufacturer. **Example:** 1401 represents Model Year 2014, week 1.

Vehicle S/N

Six digit number programmed by vehicle manufacturer.

Vehicle Decal

Decal number ranging from 0 to 999 and programmed by vehicle manufacturer.

MONITOR MENU

The *Monitor* menu is accessed by using the arrow keys to highlight *Monitor* and pressing the *Select* softkey to activate the menu.

All information in the *Monitor* menu is updated in real time, allowing the trained technician to troubleshoot the vehicle by monitoring the handset as the key switch is cycled, Forward/Neutral/Reverse switch is activated, etc. **See following NOTE.**

NOTE: Values appearing in these menus represent approximate measurements made by the controller and may differ from measurements made by external instruments.

Since the *Monitor* menu is updated while the vehicle is in operation, the trained technician has the ability to monitor the status of several components in conditions or locations where a problem with vehicle performance has been reported. **See following WARNING.**

WARNING

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

The following parameters can be monitored in real time with the handset from the *Monitor* menu:

BATT VOLTAGE

Displays the current battery voltage at the controller.

V_{MIN} I

Displays volts (minimum) at a certain amperage. This is a setting parameter used with the Low SOC (State of Charge) detection fault.

SIGNED BATTERY CURRENT

While driving the vehicle, this displays either the current being pulled out of the batteries or the current being returned to the batteries during regenerative motor braking. It has a range from negative (–) 300 amps to positive (+) 300 amps.

BDI PERCENT

Battery Discharge Indicator (BDI) Percent displays the current battery state of charge as a percent. It is based on several parameters monitored by the controller.

SPEED

Vehicle speed in mph.

THROTTLE

Indicates the position of the accelerator pedal from 0% (pedal not pressed) between 95 and 100% (pedal fully pressed). This item can be monitored when the key switch is in the ON or OFF position.

TEMPERATURE

Displays the temperature (in degrees Celsius) of the controller heatsink. During normal operating conditions, the heatsink temperature should be below 185 $^{\circ}$ F (±9) (85 $^{\circ}$ C (±5)). **See following NOTE.**

NOTE: Anything that adds resistance (i.e. improper brake adjustment, low air pressure in tires, low battery voltage, etc.) can cause the operating current to be higher than normal. This higher current increases the temperature of the controller heatsink.

ARM CURRENT

Displays the motor armature current (in amperes).

FIELD CURRENT

Displays the motor field current (in amperes).

ARMATURE PWM

Displays motor armature PWM (pulse width modulation). The range of pulse width modulation is 0% to 100%. When the vehicle is operating at full speed, the pulse width modulation should be at 100%.

FIELD PWM

Displays motor field PWM (pulse width modulation). The range of pulse width modulation is 0% to 100%. When the vehicle is in operation, the pulse width modulation will fluctuate in response to the terrain and throttle input.

SPEED PULSES

The speed pulses menu item displays the activity of the motor speed sensor. With the key switch in the OFF position, the Forward/Neutral/Reverse switch in the NEUTRAL position, and the vehicle at rest, the handset should indicate that speed pulses are off. When the vehicle is gently pushed a short distance, the handset should indicate that speed pulses are on.

FOOT INPUT

Indicates the status of the MCOR (Motor Controller Output Regulator) internal limit switch: on or off. When the accelerator pedal is unpressed, the handset should indicate that the limit switch is off. When the accelerator pedal is pressed and the key switch is in the ON position, the display should indicate that the limit switch is on.

KEY INPUT

Displays the position of the key switch: OFF or ON.

FORWARD INPUT

With the Forward/Neutral/Reverse switch in the NEUTRAL or REVERSE position, the handset should indicate that the forward input is off. When the Forward/Neutral/Reverse switch is placed in the FORWARD position, the handset should indicate that the forward input is on.

REVERSE INPUT

With the Forward/Neutral/Reverse switch in the NEUTRAL or FORWARD position, the handset should indicate that the reverse input is off. When the Forward/Neutral/Reverse switch is placed in the REVERSE position, the handset should indicate that the reverse input is on.

MODE SWITCH INPUT

This menu is reserved for possible future use and has no application at this time.

CHARGER INHIBIT

Displays charger connection. When the charger is connected and the controller does not drive (inhibited), the handset indicates ON. When the charger is not connected and the controller is allowed to drive, the handset indicates OFF.

MAIN CONT DRIVER

Displays the present solenoid (main contactor) state. When the controller energizes the solenoid coil, the handset indicates ON. When the controller de-energizes the solenoid coil, the handset indicates OFF.

LED DRIVER

Displays the present state of pin 11 in the controller 16-pin connector that operates the charge indicator light on the dash. When pin 11 is activated, power is provided to the light and the handset indicates that the LED Driver is ON. When pin 11 is not activated, the handset indicates that the LED Driver is OFF.

PASSWORD TRIES (OEM ACCESS LEVEL ONLY)

A password is required to place the vehicle in "private speed mode" (speed setting 4). The controller will log unsuccessful and unauthorized attempts to place the controller in "private speed mode". If repeated attempts are unsuccessful, the controller will permanently lock out access to "private speed mode". In the event that "private speed mode" is locked out, the controller must be removed and shipped to Club Car before it can ever be placed in "private speed mode". See Code A, Code B, and Code C on page 11-8.

ODOMETER

Displays approximate distance travelled in miles.

BDI INFO

Load Line SOC

Load Line SOC is the state of charge estimation based upon battery voltage during a defined discharge current (between 50 and 60 amps).

Load Line Valid

Load Line Valid is an indication (Load Line Valid = 1) that the discharge current is between 50 and 60 amps.

BDI Int Factor

BDI Int Factor is an auto-adjusting correction factor for estimating state of charge based upon the difference between the currently estimated state of charge and the Load Line SOC.

Open Circuit Voltage Start

Open Circuit Voltage Start is the voltage, as determined by the controller, following a cycle of the Run/Tow switch or coming out of sleep mode.

Open Circuit SOC Start

Open Circuit SOC Start is the estimated state of charge following a cycle of the Run/Tow switch or coming out of sleep mode.

BATTERY MONITOR

These menu items reset every time the vehicle is charged.

Lowest Battery Voltage

Displays the lowest battery pack voltage reached since the last charge.

I Batt at Lowest Volts

Displays the current through the controller at the lowest battery pack voltage.

Highest Battery Voltage

Displays the highest battery pack voltage after being charged.

CHARGING TOTALS

These menu items accumulate totals for the life of the vehicle.

Completed Charges

Displays the number of completed charge cycles.

Interrupted Charges

Displays the number of interrupted charge cycles.

Storage Charges

Displays the number of storage charge cycles.

AMP HOURS DISPLAY

Signed Battery Current

While driving the vehicle, this displays either the current being pulled out of the batteries or the current being returned to the batteries during regenerative motor braking. It has a range from negative (–) 300 amps to positive (+) 300 amps.

Amp Hours

Displays total accumulated amp hours removed from batteries since initial vehicle start-up.

Regen Amp Hours

Displays total accumulated amp hours returned to the batteries from regenerative braking since initial vehicle start-up.

Charge Amp Hours

Displays amp hours removed from batteries since the last charge.

Charge Regen Amp Hours

Displays amp hours returned to the batteries from regenerative braking since the last charge.

Trip Amp Hours

Displays amp hours removed from batteries since trip amp hours was reset. See Reset Trip Amp Hours on page 11-8.

Trip Regen Amp Hours

Displays amp hours returned to the batteries from regenerative braking since trip amp hours was reset.

LIN

Relates to communication between the controller and the Guardian/Visage device (if equipped).

Charger

Additional

VEHICLE SPEEDS

Press right arrow to display programmed speeds for each speed setting. See Code A, Code B, and Code C on page 11-8.

PEDAL COUNTERS

Accumulates accelerator pedal usage.

FAULT COUNTERS

The Fault Counters indicate how many times each fault type has been recorded since the last clearing of fault history. **See following Faults Menu section.**

FAULT COUNT ODOMETERS

The Fault Count Odometers indicate the odometer reading associated with the last occurrence of each fault type. Will indicate 0.0 (miles) if the fault occurred before the last clearing of fault history.

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DIAGNOSTICS MENU

CAUTION

• A failed motor will damage the controller. Always inspect the motor before replacing the controller. See External Motor Testing, Section 16, Page 16-1.

NOTE: The software is subject to frequent updates, and this manual may span many versions. Be aware that some faults listed in this manual may not display in the CDT, indicating older software.

Sometimes the fault circuits catch a temporary event that is not a true fault in the system. It is good practice to turn the control system OFF and back ON again to see if the fault clears by itself.

The *Diagnostics* menu is accessed by using the arrow keys to highlight *Diagnostics* and pressing the *Select* softkey to activate the menu. Under the Diagnostics menu are two folders: *Present Errors* and *Fault History*.

Faults displayed in the *Diagnostics* menu will aid the trained technician in troubleshooting the vehicle. Faults displayed often indicate which components in the electrical system need to be tested.

Since the *Diagnostics* menu is updated while the vehicle is in operation, the trained technician has the ability to monitor the occurrence of faults in conditions or locations where a problem with vehicle performance has been reported. **See following WARNING.**

WARNING

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

PRESENT ERRORS FOLDER

The Fault History folder displays all existing faults in chronological order. An item in this folder can only be removed by remedying the fault. As long as the fault exists, it will be included in the Present Errors folder. The "number" in the upper right corner of the screen indicates the number of present faults and which fault is highlighted. Example: "1/3" means the first of three total faults is highlighted.

FAULT HISTORY FOLDER

The Fault History folder displays all of the faults detected by the controller since the last time the fault history has been cleared. The faults displayed in this folder may or may not be currently active. Once a fault has been detected, it is stored in the memory of the controller for display on the Fault History folder. Each detected fault is listed only once, even if the fault has occurred multiple times. You can clear the entire contents of this folder to allow a fresh Fault History to be started.

CAUSES OF FAULTS

Some common causes of faults are:

- · Loose, broken, or disconnected wires or connectors
- · Failed components
- Improper adjustment or installation of electrical or mechanical components (examples: brake adjustment, improper MCOR installation)
- · Improper wiring of electrical components

As shown above, there are many possible causes for faults to occur, and the controller has a programmed reaction to each fault that is based on the fault currently detected. The technician should be familiar with the detected faults and the controller's reactions to faults to ensure a proper diagnosis.

An example of a possible mis-diagnosis of a vehicle due to a fault: If the three-pin speed sensor wire has been disconnected, the controller will detect a *speed sensor* fault. When a *speed sensor* fault is detected, the controller responds to the fault by limiting the vehicle speed to 1/2 of its normal top speed. If the technician reaches the conclusion that the vehicle is running slowly because batteries are heavily discharged, he has made an improper diagnosis of the problem.

The controller should be checked for fault codes before any service is performed.

After detecting a fault, the controller will respond in one or more of the following ways:

- · A. Reduce vehicle speed to zero by reducing armature current
- · B. Reduce vehicle speed to zero by reducing field current to zero
- · C. Turn off the solenoid
- · D. Cause the vehicle to run at slow speed
- · E. Gradually reduce the armature current limit
- F. Quickly reduce the armature current until speed sensor pulses occur
- · G. Reduce field current and beep reverse buzzer at a fast rate
- · H. Limits vehicle speed per Anti-Tamper setting
- · J. Adds the occurrence to the fault counter
- · K. Activates a warning device
- · L. Locks out Private Speed Mode

CONTROLLER FAULT	CONTROLLER RESPONSE	VEHICLE RESPONSE
HW FAILSAFE	A, B, C	Vehicle comes to a stop
THROTTLE FAULT	A, C	Vehicle comes to a stop
SPEED SENSOR	D	Vehicle runs at slow speed
MAIN WELDED	D	Vehicle runs at slow speed
MAIN DRIVER ON	A, B	Vehicle comes to a stop
MAIN DRIVER OFF	A, C	Vehicle comes to a stop
MAIN COIL OPEN	А	Vehicle comes to a stop
FIELD MISSING	A, B, C	Vehicle comes to a stop
HPD	А	Vehicle comes to a stop
OVERVOLTAGE	A, B, G	Vehicle slows and beeps
LOW BATTERY VOLTAGE	E	Top speed is reduced
THERMAL CUTBACK	Е	Top speed is reduced
MOTOR STALL	J	None
MAIN DROPOUT (1 and 2)	A, C	Vehicle comes to a stop
MAX PASSWORD TRIES	L	Vehicle continues to only reach a top speed determined by the Speed Setting
INCORRECT PASSWORD	J	None
MAIN DRIVER OVERCURRENT	A, B	Vehicle comes to a stop
CURRENT SENSE FAULT	A, B, C	Vehicle comes to a stop
M- SHORTED	A, B, C	Vehicle comes to a stop
ANTI-TAMPER	Н	Top speed is reduced
HIGH SPEED WALKAWAY	J, K	Vehicle beeps
LOCKOUT FAULT	J	None
LOW SOC	J, K	Charge indicator light ON

FAULT RECOVERY

When a fault is detected by the controller, the controller will attempt to recover from the fault and resume normal operation. In the case of an intermittent problem, such as a loose wiring connection, the controller **may** be able to recover and operate normally for a while, but the problem should be repaired before placing the vehicle in service.

Depending on the type of fault, the controller will attempt to recover either immediately after the condition clears or after the accelerator pedal has been cycled (released and pressed again).

CONTROLLER FAULT	CONTROLLER ATTEMPTS TO RECOVER
HW FAILSAFE	When key switch is cycled
THROTTLE FAULT	When condition clears
SPEED SENSOR	When condition clears
MAIN WELDED	When condition clears
MAIN DRIVER ON	When condition clears
MAIN DRIVER OFF	When accel. pedal is cycled
MAIN COIL OPEN	When accel. pedal is cycled
FIELD MISSING	When accel. pedal is cycled
HPD	When accel. pedal is cycled
OVERVOLTAGE	When condition clears
LOW BATTERY VOLTAGE	When condition clears
THERMAL CUTBACK	When condition clears
MOTOR STALL	When condition clears
MAIN DROPOUT (1 and 2)	When accel. pedal is cycled
MAX PASSWORD TRIES	When Run/Tow switch is cycled
INCORRECT PASSWORD	When Run/Tow switch is cycled
MAIN DRIVER OVERCURRENT	When condition clears
CURRENT SENSE FAULT	Within controller
M- SHORTED	When key switch is cycled
ANTI-TAMPER	When condition clears
HIGH SPEED WALKAWAY	When condition clears
LOCKOUT FAULT	When condition clears
LOW SOC	When condition clears

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FAULT DESCRIPTIONS

The following faults can be detected by the Excel System controller and seen under both the *Monitor Menu* and *Diagnostics Menu*:

INCORRECT PASSWORD (OEM ACCESS LEVEL ONLY)

Each vehicle has a password in the form of a unique set of codes used to place the vehicle in "private speed mode". If a set of codes has been entered incorrectly, the *incorrect password* fault is declared. For additional information on codes, refer to Code A, Code B, and Code C. See Code A, Code B, and Code C on page 11-8. See also Password Tries (OEM Access Level Only) on page 11-12.

MAX PASSWORD TRIES (OEM ACCESS LEVEL ONLY)

The *max password tries* fault is declared when the incorrect password fault has been declared several times. In the event that the *max password tries* fault is indicated, the controller must be removed and shipped to Club Car before it can ever be placed in "private speed mode". See Code A, Code B, and Code C on page 11-8. See also Password Tries (OEM Access Level Only) on page 11-12.

THROTTLE FAULT

If the MCOR (Motor Controller Output Regulator) voltage is less than 0.20 volts or greater than 4.80 volts, the controller detects a *throttle fault*.

What it means: If the voltage seen by the controller coming out of the MCOR is not within specified limits, this fault occurs and the controller de-energizes the solenoid coil. Perform additional diagnostic if vehicle is running.

What to do: Replace MCOR. See following NOTE.

NOTE: Newer controllers may, infrequently, read voltages above or below limits and give a false fault.

LOW BATTERY VOLTAGE (UNDERVOLTAGE)

If the battery voltage falls below 34 volts ±5%, the *low battery voltage* fault is detected by the controller.

What it means: Could be a symptom, not a cause. Voltage coming into the controller is at, or less than, 34 volts.

What to do: Check battery voltage under a load.

OVERVOLTAGE

If the controller detects that the battery voltage is too high (68.4 to 75.6 volts DC), the overvoltage fault is detected.

What it means: This is a symptom that occurs when the controller sees 72 or more volts. Reverse Buzzer beeps when fault occurs and the car will freewheel.

What to do: Check to see if car has been towed without being put into "Tow" mode. Check charger relay because, in Excel vehicles, bypassing the relay in the charger could cause the controller to read an overvoltage fault. Note too that Excel vehicles, on hilly courses, may see this fault if the driver turns the key switch off while the vehicle is in motor braking mode.

THERMAL CUTBACK

If the controller heatsink temperature is found to be in excess of 185 °F (\pm 9) (85 °C (\pm 5)) or below –13 °F (\pm 9) (–25 °C (\pm 5)), the *thermal cutback* fault is detected.

What it means: Heatsink temperature rises above 185 °F (85 °C).

What to do: Monitor Heatsink Temp, battery voltage, brakes dragging, car under extreme loads, low or no air pressure in tire(s).

ANTI-TAMPER FAULT

If communication with the Visage or Guardian unit is interrupted, the controller registers an anti-tamper fault.

What it means: This is a symptom, not a cause. The controller is set to communicate with a Visage or Guardian unit and it is unable to.

What to do: Clear the Fault History in the CDT. Ensure wiring is connected and inspect for damaged wires. If the vehicle is not or no longer going to be equipped with these services, change Control Mode setting to zero (0).

HPD

The *HPD* (High Pedal Detect) fault is detected if the accelerator pedal is already depressed when the key switch is turned to the ON position. This fault is also detected if the accelerator pedal is pressed when the selected direction is changed by pressing the Forward/Neutral/Reverse switch. This fault, when not caused by the operator, can indicate that the pedal limit switch has failed closed.

What it means: The pedal is depressed before the key switch and/or the FNR is switched on. This is a safety control and the controller must see the pedal engaged last in the following sequence: key switch first, FNR second, and then pedal last.

What to do: Check throttle percentage and, if at 0, issue is driver error.

MAIN DRVR OVERCURRENT

If the current on the relay driver exceeds 120 mA, or the current on the solenoid driver exceeds 6 A, a *main driver* overcurrent fault is detected.

LOCKOUT FAULT

If the controller receives a signal that the charger interlock is activated while the vehicle is being driven, the controller registers a *lockout fault* and may prevent the vehicle from operating.

What it means: This is a symptom, not a cause. The controller should only see charger interlock activated when the charger's DC cord (external charger) is connected to the vehicle or AC cord (onboard charger) is connected to an AC outlet. One possible cause is failure of the 10k ohm resistor in the charger interlock circuit.

What to do: Clear the Fault History in the CDT. If the fault does not return and the car operates normally, do not replace the controller. If the fault continues to occur, inspect and test the charger interlock circuit. See Test Procedure 11 – Charger Interlock on page 12-26. If the 10k ohm resistor has failed, replace resistor. If no problems are found in the charger interlock circuit, replace the controller.

LOW SOC

If the controller sees that the battery pack has reached a low state of charge (SOC), the controller registers a *low SOC fault*.

What it means: This is a symptom, not a cause. The controller records the number of times this occurs.

What to do: Charge batteries. If fault occurs more frequently than normal, test battery pack. Section 14 — Electric Vehicle - Batteries

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MAIN WELDED

If the controller detects that the solenoid contacts are welded closed, a main welded fault is detected.

What it means: The solenoid contact is welded closed and will not dropout when pedal is released, or key switch is turned to OFF, or FNR is switched to N.

What to do: Replace solenoid. If vehicle continues to operate at half speed, check accessory wiring.

HIGH SPEED WALKAWAY

If the controller receives a signal to activate walk away braking while the vehicle is moving at a speed greater than 2 mph (3.2 km/h), the controller registers a *high speed walkaway fault*.

What it means: This is a symptom, not a cause. The key switch was turned to OFF while the vehicle was coasting faster than 2 mph (3.2 km/h).

What to do: Most likely, this is due to driver error. If not, check speed sensor on motor and key switch for proper operation.

SPEED SENSOR

If the controller does not detect pulses from the speed sensor while the controller outputs power (greater than 75% armature PWM) to the motor, a *speed sensor* fault is detected.

What it means: Speed sensor is not working. Check connection.

What to do: Replace speed sensor.

MAIN DRIVER ON

If the field-effect transistor (FET) that controls the closing of the solenoid contacts is found to be energized when it should not be, a *main driver on* fault is detected by the controller.

What it means: The controller FET controlling the energizing of the solenoid is on (or energized) when it should not be. This causes main contactors to stay engaged. Pin 12 provides ground for the solenoid coil when FORWARD, REVERSE, KEY, or FOOT INPUT is present at the controller. If the ground continues to be present once either KEY, FOOT, FORWARD or REVERSE INPUT is removed, *main driver on* is detected.

What to do: Replace controller.

MAIN COIL OPEN

If the controller determines that the solenoid is not closing as a result of a solenoid coil failure, a *main coil open fault* is detected.

What it means: An open circuit in the solenoid coil. It could be in either the ground side or B+ side of the circuit.

What to do: Check for a broken or disconnected blue wire on the B+ side of the solenoid coil, a broken or disconnected blue/white wire on the B- side of the solenoid coil, a broken coil wire inside the solenoid which would result in zero ohms resistance reading, a defective coil which could result in very low coil resistance (usually less than 40 ohms; large solenoids should read 180 to 190 ohms; small solenoids 200 to 250 ohms), a broken blue/white wire at the 16-pin controller plug or its terminal is loose in the 16-pin plug.

MAIN DROPOUT (1 OR 2)

If the controller detects that the solenoid contacts have opened while the vehicle is in operation, a *main dropout* fault is detected.

What it means: Occurs when the solenoid coil losses ground causing the main contact to lose connection. With Main Dropout 2, the solenoid drops out while the vehicle is in regen/motor braking. Main Dropout 2 is usually a symptom more than a cause.

What to do: Check the following components: key switch, MCOR, batteries, battery cables, FNR, solenoid coil, solenoid contacts, and controller 16-pin connector.

MOTOR STALL

If the motor current is high and there is no movement of the vehicle wheels for a short period of time, a *motor stall* is detected by the controller. This fault can be caused by an operator holding the vehicle on a hill by depressing the accelerator pedal instead of the brake pedal.

What it means: This fault appears anytime current is running to the motor and no movement of the armature is registered.

What to do: In most cases this is an operator issue holding the vehicle on an incline with the accelerator pedal, not the brake pedal. See following NOTE.

NOTE: In rare cases, it could be a controller or drivetrain issue. If the vehicle rolls, the drivetrain is okay. Check to see if Armature Current spikes to 250 amps when accelerator pedal is pressed. If so, replace controller.

MAIN DRIVER OFF

If the FET that controls the closing of the solenoid is **not** energized when it should be, a *main driver off* fault is detected by the controller.

What it means: This is the exact opposite of *main driver on*. The controller FET controlling the energizing of the solenoid is off (or not energized) when it should be.

What to do: Replace controller.

CURRENT SENSE FAULT

What it means: If there are problems with the armature current sensor circuitry, a *current sense* fault is detected and the controller de-energizes the solenoid coil.

What to do: Clear the Fault History in the CDT. If the fault does not return and the car operates normally, do not replace the controller. If the fault remains in System Faults or Fault History after clearing and the car will not operate, replace the controller.

M- SHORTED

If an uncontrolled current path is detected from the motor to B- (bypassing the MOSFETs), an M- shorted fault is detected.

FLD (FIELD) MISSING

If the controller is operating at a duty cycle of greater than 90% (almost full speed) and the field current is less than 3 amps, a *field missing* fault is detected by the controller.

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CAUTION

 A failed motor will ruin a controller. If a new controller is installed in a vehicle with a bad motor, the bad motor will blow the field FET in the new controller. Always check the motor before replacing a controller when a FLD Missing fault is shown.

What it means: Not necessarily a controller issue.

What to do: Check in this order: connections and continuity of orange and blue motor field wires, short in motor, and then controller. See External Motor Testing, Section 16, Page 16-1.

HW FAILSAFE

The armature drive FETs (field effect transistors) regulate the armature current. If the controller detects a failure of the armature drive FETs or circuitry, a *hardware failsafe* fault is detected.

What it means: A catastrophic failure internal to the controller on either the power board or the logic board.

What to do: Check motor before replacing controller.

FAULT HISTORY

The *fault history* menu can be useful in determining the cause of a vehicle problem; however, the fault history alone should not be the factor that determines when a component is replaced. Some faults detected by the controller are not the result of a failed component, and are instead the result of vehicle operator error. If a fault appears in the *fault history* menu, the trained technician should attempt to determine when and where the fault has occurred. For example, if the *motor stall* fault is present in the fault history, the trained technician may be able to determine the location on the course where an operator has held the vehicle on a hill by using the accelerator pedal.

CLEAR FAULT HISTORY

After a repair has been made, the fault history should be cleared. This will enable the trained technician to properly troubleshoot the vehicle in the future, in the event that another problem occurs. It is recommended that the fault history be cleared in order to avoid the replacement of a component that caused a fault in the past, but has been replaced and is now functioning correctly. For example, if the MCOR (Motor Controller Output Regulator) was disconnected and the controller detected a fault code associated with the throttle, the fault history should be cleared so that any future problem is not diagnosed incorrectly as a throttle problem. **See Fault History Folder on page 11-15.**

PROGRAMMING

The *Programming* menu is accessed by using the arrow keys to highlight *Programming* and pressing the *Select* softkey to activate the menu.

The *Programming* menu selection allows the user to save and restore parameter settings files (.cpf files). These files contain controller information and are saved to the internal memory or SD card. Once saved, they can be used for future reference or emailed when the CDT or SD card is connected to a PC. For information on how to save and restore these files, refer to the manual supplied with the CDT.

CLONING

Use the "Restore .cpf File" function to clone a controller with a saved .cpf file stored in the CDT.

If using an OEM-level CDT, after you highlight a stored .cpf file and choose "Restore," a pop-up window will ask whether you want to enable Advanced Cloning ("Yes"/"No") using the softkeys. This choice is not offered in the User-level CDT. Without Advanced Cloning (if you select "No"), an OEM-level CDT will restore only those parameters up to and including OEM level. Advanced Cloning ("Yes") restores all parameters, including those at a higher level. This makes a true clone by copying parameters that cannot be seen at the OEM level. It is recommended to enable Advanced Cloning.

FAVORITES

The Favorites menu is accessed by pressing the Favorites key (9) (Figure 11-1, Page 11-1). This menu can also be accessed by using the arrow keys to highlight Favorites and pressing the Select softkey to activate the menu. Return to the Main Menu at any time by pressing the Main Menu key (6).

The *Favorites* menu selection consists of the custom set of items you have created. Typically, you will want to include the parameters you most frequently adjust, along with the monitor items you most frequently check. This way you can go directly to these items more easily than by navigating through the entire Parameters and Monitor menus.

Any item or folder in the Parameters or Monitor menu can be added to Favorites. Once added, it can be renamed if desired. When you add a ready-made folder from the Parameters or Monitor menu, the folder icon will appear in the Favorites menu with a star on it. Although you can rename a ready-made folder, you are not allowed to rename any of the items within that folder. You can also create folders of your own to hold specific sets of items; these folders will be indicated with the usual folder icon. You may want to create a folder for each type of vehicle or application, or for each customer.

HHP SETTINGS

The *HHP Settings* menu is accessed by using the arrow keys to highlight *HHP Settings* and pressing the *Select* softkey to activate the menu.

The *HHP Settings* menu selection allows the user to adjust the appearance of the screen displays, adjust several aspects of the handheld programmer's functionality, and displays information pertaining to the handset.

MENU ITEM	DESCRIPTIONS
Access Level	The Access Level of the programmer can be set to its own level or to any lower level: OEM, Dealer, Service, User. Setting the Access Level to a lower level allows you to see what a person with that level programmer would see. For example, a dealer could set the Access Level to User, to see what a person with a User-level programmer would see.
Language	You can select English, Deutsch, Français, Italiano, or Español for the screen text.
Left Handed Soft Keys	Selecting "Yes" for Left Handed Soft Keys reverses the position of items in the softkey text line, to make the keys more convenient for left-handed people.
Backlight	Here you can set the brightness of the programmer's LCD display—from 100% to 20%, in 5% increments.
Keytone	You can choose between several tones to sound each time you press a key, or you can turn the keytone Off for silent programmer operation.

MENU ITEM	DESCRIPTIONS
Auto Poweroff (battery)	You can set the idle time before the programmer will automatically power off when it is powered by its own batteries (i.e., when the control system is not running, or when the programmer is not connected to the control system).
Auto Poweroff (ext)	You can set the idle time before the programmer will automatically power off when it is being powered by the controller.
Exit menus with left arrow	The left-arrow key () is used to navigate backwards within menus. When set to Yes, you can use the left-arrow key to leave the presently displayed screen and return to the next higher (i.e., previous) screen; using the left-arrow key will eventually return you to the Main Menu. When set to No, you must use the appropriate softkeys (Exit, Cancel) and the Main Menu key () to leave the present screen and reach the Main Menu. You may find this setting preferable if you use the table screens frequently, as it eliminates any possible confusion caused by the left-arrow key having two functions: moving one cell to the left, and exiting the table altogether.
Enable Screenshot	The Yes/No setting of this item determines whether the programmer will allow screenshots to be taken; see Section 14 for a description of this function. When set to "No," if you attempt to take a screenshot—by pressing the Power key () followed by the Favorites key ()—the power command is ignored and the screen jumps to the Favorites menu in response to the Favorites key command.
Show only empty battery	A battery icon showing the state-of-charge of the programmer's battery can be displayed in the upper right corner of the screen. If you do not want the icon to be displayed except as a warning when the battery is empty, set this to "Yes."
Text for save as	When you create a new .cpf file, the field at the top of the keyboard screen is either blank ("No text") or is automatically filled with the date and time in this format: YYYY_MM_DD_HHMM ("Date/Time").
Keyboard help text	When set to On, every time you enter the keyboard screen a pop-up explains how to use the keyboard. When set to Off, no pop-up appears as you enter the keyboard screen, but you can still use the Help key (?) at any time.
Remember Last View	When set to On, when you select a menu from the Main Menu screen, you will be returned to the screen you were on before you last exited that menu. When set to Off, each time you select a menu from the Main Menu screen, you will go to the selected root menu. It does not matter what you did the last time you used that menu.
Delete Cache File	This item is different from the other HHP items, because it is a procedure instead of an adjustable setting. The first time you connect the programmer to a system, menu cache files are created. If you encounter problems when connecting, you can delete the cache files and retry connecting. To delete the cache files, select this item and press the right-arrow key ().
Date & Time	This folder contains eight items. Show Date/Time in header. The date and time are typically displayed at the top of the Main Menu screen. However, if you do not use batteries in the handheld programmer and there is no real-time clock in the connected control system, you can set this item to "Off," since it would not provide accurate information. 12h/24h. Here you can select the format used to display the time. Date Format. Several options are available: the year appearing first or last, and the month appearing before the day or the day appearing before the month. Year, Month, Day, Hour, and Minute allow you to set the date and the time for your time zone.
About	This folder contains information about the programmer similar to what is shown in the System Info menu for each of the modules in the control system: model number, software version, hardware version, serial number, etc.

PLOT & LOG

The *Plot & Log* menu selection allows the user, with the Plot program, to plot real-time variables on the CDT display screen; or, with the Log program, to create a log file of variable values to view later in a spreadsheet program on a PC.

The first step is to add the desired items to the Plot Variable List or the Log Variable List. While in the *Monitor* menu or *Parameters* menu, highlight an item and press the "Add to" softkey. In the next screen, highlight Plot or Log and press the "Select" softkey to view the list. To add the item to the list, press the "Add" softkey followed by the "Finish" softkey; you can include up to five items. To remove an item from a Variable List, select it and press the "Delete" softkey.

PLOT

In the Plot Variables list, a colored circle beside each variable shows the color that will be used to represent that variable in the plot. The colors are in a fixed order. If you want to use specific colors for specific variables, use the "Move Down" and "Move Up" softkeys to achieve the desired combinations. Use the left-arrow key to return to the Plot & Log menu.

To open the plotting program, highlight Plot and press the right-arrow key. The vertical axis is always used for the variables being plotted, and the horizontal axis is always used for time. For On/Off items, On = 1 and Off = 0 on the plot. Press the "Start" softkey to begin plotting data. Press the "Stop" softkey to stop plotting data and freeze the plot. You have the option of pressing the "Start" softkey to resume the plot.

LOG

To create a log of the items in your Log Variable List, highlight Log and press the right-arrow key. Then, in the "Start Logging" window, press the "OK" softkey. Select the location where you want to save the .xls file, and after pressing the "Save As" softkey and naming the .xls file, press the "OK" softkey. The display will now show the Plot & Log menu with a flashing red dot next to Log, indicating that logging is in progress. To stop logging, press the right-arrow key, and then in the "Stop Logging" screen, press the "OK" softkey.

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CDT TROUBLESHOOTING

In the event that the handset does not function as described in this manual, the following troubleshooting guide should be studied and the referenced test procedures should be performed to troubleshoot the handset.

TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
	Handset cord and/or adaptor is disconnected	See Plugging the CDT into the Vehicle on page 11-2.
	Vehicle batteries – loose terminals or corrosion	Section 14 — Electric Vehicle - Batteries
	Vehicle batteries – improperly wired	Section 14 — Electric Vehicle - Batteries
	Vehicle batteries – batteries failed	Section 14 — Electric Vehicle - Batteries
	Vehicle batteries – batteries not fully charged	Section 14 — Electric Vehicle - Batteries
	Handset cord has failed	Test Procedure 1 – Handset Cord on page 11-28
	Handset cord adaptor has failed	Test Procedure 2 – Handset Cord Adaptor on page 11-28
Handset display screen is blank	CDT port (mounted under instrument panel assembly) has failed	Test Procedure 3 – CDT Ports on page 11-29
	Contrast Setting is too light	See Backlight under HHP Settings menu
	Controller is in power-down mode (vehicle unused and not charged for 72 hours)	Connect charger or drive the vehicle a short distance and reconnect the handset to the vehicle
	Charger has been connected and charging for more than 10 minutes	Disconnect charger, wait 30 seconds and reconnect charger
	Loose vehicle wire harness connections	Test Procedure 3 – CDT Ports on page 11-29
	Controller malfunction	Section 12 — Electric Vehicle - Troubleshooting and Electrical System
	Handset has failed	Replace handset
Display screen shows jumbled or undecipherable characters	Controller malfunction	Section 12 — Electric Vehicle - Troubleshooting and Electrical System
	Handset malfunction	Disconnect the CDT cord from the vehicle. Wait a few seconds and reconnect the handset to the vehicle
	Loose connection at CDT port	Test Procedure 3 – CDT Ports on page 11-29
	Intermittent handset cord failure	Test Procedure 1 – Handset Cord on page 11-28
	Intermittent handset cord adaptor failure	Test Procedure 2 – Handset Cord Adaptor on page 11-28
	Loose vehicle wire harness connections	Test Procedure 3 – CDT Ports on page 11-29

TROUBLESHOOTING GUIDE		
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Handset is "locked-up" – buttons do not	Handset malfunction	Disconnect the CDT cord from the vehicle. Wait a few seconds and reconnect the handset to the vehicle
	Vehicle batteries – loose terminals or corrosion	Section 14 — Electric Vehicle - Batteries
	Vehicle batteries – improperly wired	Section 14 — Electric Vehicle - Batteries
respond	Vehicle batteries – batteries failed	Section 14 — Electric Vehicle - Batteries
	Vehicle batteries – batteries not fully charged	Section 14 — Electric Vehicle - Batteries
	Controller malfunction	Section 12 — Electric Vehicle - Troubleshooting and Electrical System

CONNECTION TESTS

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.

Index of Test Procedures

- 1 Handset Cord
- 2 Handset Cord Adaptor
- 3 CDT Ports

TEST PROCEDURE 1 – Handset Cord

See General Warnings on page 1-2.

- 1. Using a multimeter set for 200 ohms, place the red (+) probe into one of the terminals on the end of the cord with the square plug.
- 2. Place the black (–) probe on each of the pins, one at a time, on the plug on the other end of the cord.
- 3. The multimeter should indicate continuity on only one pin. If any other reading is obtained, the cord must be replaced.
- 4. Repeat the procedure three more times, each time with the red (+) probe inserted into a different terminal on the end of the cord with the square plug.

TEST PROCEDURE 2 – Handset Cord Adaptor

See General Warnings on page 1-2.

The procedure for testing the handset cord adaptor is similar to the cord test.

1. Using a multimeter set for 200 ohms, place the red (+) probe into one of the terminals on the end of the adapter with the square plug.

- 2. Place the black (–) probe on each of the pins, one at a time, on the other plug of the adaptor.
- 3. The multimeter should indicate continuity on only one pin. If any other reading is obtained, the adaptor must be replaced.
- 4. Repeat the procedure three more times, each time with the red (+) probe inserted into a different terminal on the end of the adaptor with the square plug.

TEST PROCEDURE 3 - CDT Ports

See General Warnings on page 1-2.

- 1. Disable the vehicle.
- 2. Disconnect the batteries and discharge the controller. See General Warnings on page 1-2.
- 3. Remove the three screws (1 and 2) (Figure 11-3, Page 11-29).

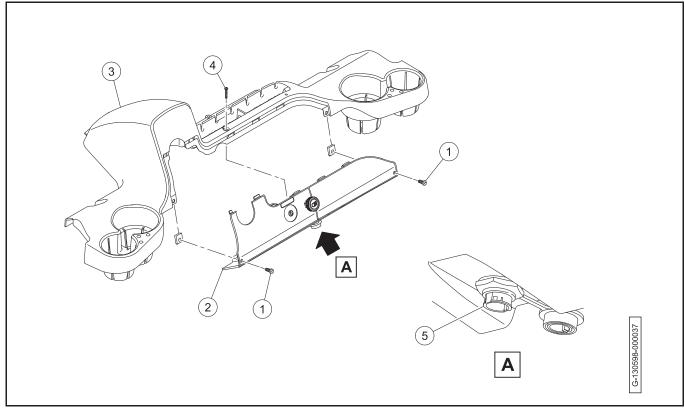


Figure 11-3

- 4. Tilt the instrument panel (3) up to release it from the dash assembly (4).
- 5. Disconnect the instrument panel harness from the main harness.
- 6. Inspect the connector contacts for damage and corrosion. Repair and replace as necessary.
- 7. Inspect the CDT port (5) for damage and corrosion. Repair and replace as necessary.
- 8. Connect the instrument panel harness to the main harness.
- 9. Install the instrument panel in the dash assembly.
- 10. Install the three screws. Tighten the screws to 22 lb·in (2.5 N·m).
- 11. Disconnect the batteries and discharge the controller.
- 12. Remove the electronics module cover.

13. Disconnect the four-pin connector (1) from the controller (2) (Figure 11-4).

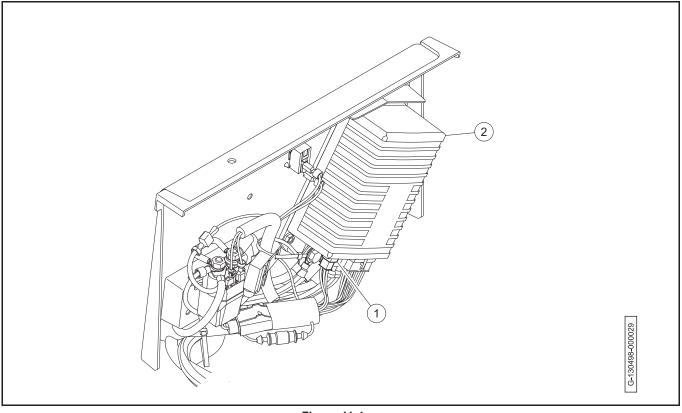


Figure 11-4

- 14. Connect the handset cord to the handset.
- 15. Connect the other end of the handset cord (without the adapter) to the four-pin connector of the controller.
- 16. Connect the vehicle batteries, positive (+) cable first.
- 17. If the handset functions when connected directly to the controller, the handset cord adaptor or vehicle wire harness should be tested. Adaptor: See Test Procedure 2 Handset Cord Adaptor. Wire harness: See Troubleshooting and Electrical System.
- 18. Install the electronics module cover.

A DANGER

See General Warnings on page 1-2.

WARNING

- See General Warnings on page 1-2.
- · 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

The Excel vehicle with ERIC Charging system uses a 48-volt electrical system with a shunt-wound, 3.1 hp motor that is powered by six 8-volt lead-acid batteries and charged by a high-frequency charger. The Excel vehicle with ERIC Charging system includes several additional features.

ACCESSORIES

For powered accessories that need to be controlled by the key switch, use the gray wire with a female bullet connector located behind the instrument panel.

CHARGE INDICATOR LIGHT

Electric vehicles have a dash mounted charge indicator light. The charge indicator light is controlled by pin 11 of the controller.



The charge indicator lamp gives a visual indication when:

- The battery state of charge (SOC) is less than 20%. Charge the batteries as quickly as possible.
- The batteries start to charge.

NOTE: The multi-purpose buzzer will operate three times. The number of flashes and beeps can vary depending on the Beep Option setting.

Figure 12-1

STATUS	CONDITION
OFF	Normal Operation
ON (Constant)	Battery SOC is less than 20% but more than 10%.
ON (Flash ON and OFF)	Battery SOC is less than 10%.
ON (Flash ON and OFF three times)	The batteries charging has started.

FEATURES

- Shunt-Wound Motor: The shunt-wound motor, unlike a series motor, is designed so that the 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 two features of the Excel electrical system that will activate the motor braking function: Walk Away Braking and Motor Braking (adjustable with the CDT handset).
- Walk Away Braking: This feature 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 to 3 mph (1.5 to 4.8 km/h). If the walk away braking function remains engaged for two seconds or more, a warning buzzer will sound to alert the driver that motor braking has been activated.

WARNING

- Walk Away Braking will not limit vehicle speed to 3 mph (4.8 km/h) on very steep grades. Do not operate vehicle on slopes exceeding 20% grades.
- **Motor Braking:** When going down an incline with the accelerator pedal partially pressed, the motor braking function will activate to assist the operator in maintaining a speed less than the speed setting. For example, if the vehicle is going down an incline with the accelerator pedal pressed half way, the motor braking function will activate to assist the operator in maintaining a speed approximately half of the speed setting defined in the Program Menu.
- 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.
- Run/Tow Switch: When the Run/Tow switch is in the RUN position, the vehicle will function normally. When the switch is in the TOW position, power to the controller is shut off, disabling the vehicle operating circuit and walk away braking, 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 controller and will be displayed on an CDT handset in the Diagnostic History menu. See Motor Stall on page 11-22.
- **High Pedal Detect:** This function prevents unexpected vehicle movement if the key switch is turned ON after the accelerator is pressed. The vehicle will not move until the accelerator is released and pressed again. When this situation arises, a *HPD fault* is recorded by the controller and will be displayed on an CDT handset in the Diagnostic History menu. **See HPD on page 11-20.**

BATTERY WIRING DIAGRAM

2-passenger vehicle battery cables are all 6-gauge.

4-passenger vehicle battery cables are all 4-gauge.

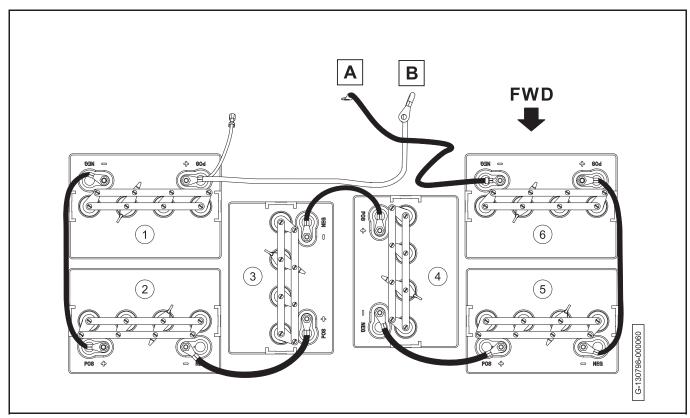


Figure 12-2 Battery Wiring Diagram

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FUSE AND RELAY LOCATIONS

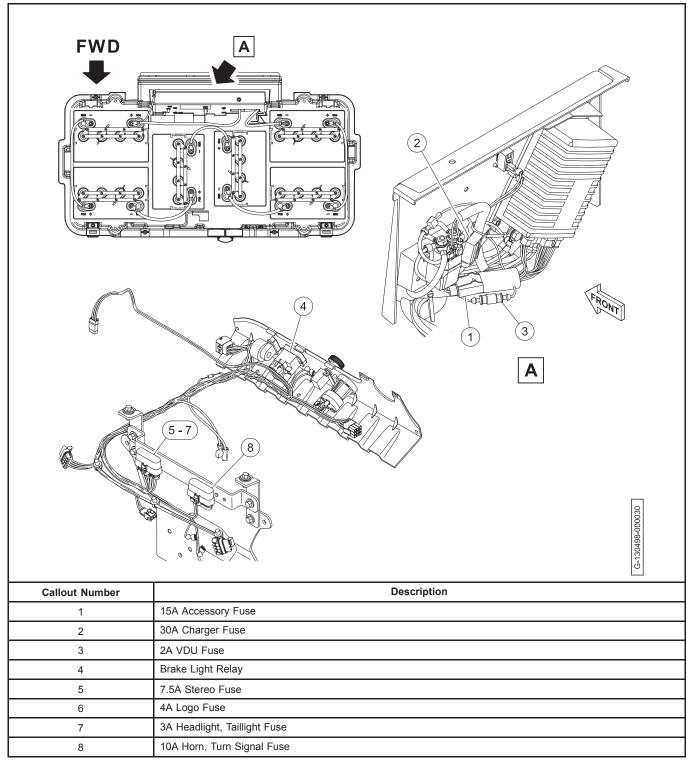


Figure 12-3

MAIN HARNESS SONIC WELD AND 10K OHM LOCATIONS

The item numbers represent the sonic weld numbers. Example sonic weld 1 = item number (1).

The locations shown are approximate.

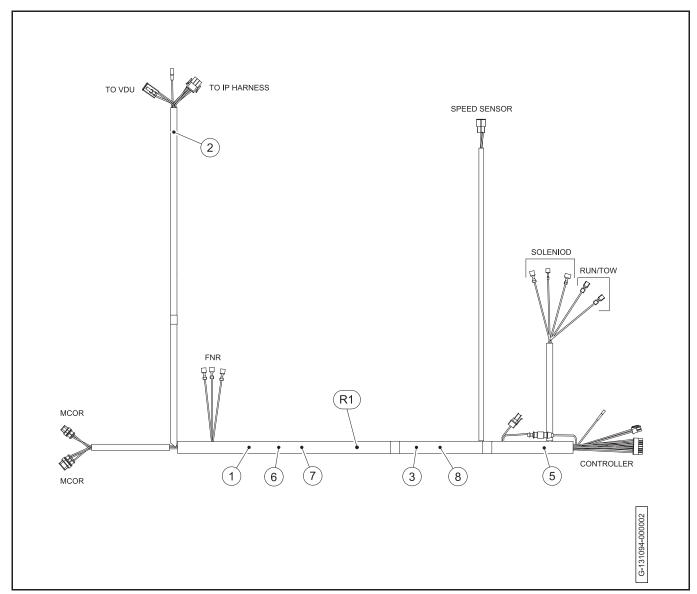


Figure 12-4

TROUBLESHOOTING

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 for making these checks can be found in the referenced sections of this maintenance and service manual.

TROUBLESHOOTING THE VEHICLE WITH THE CDT

Club Car recommends the use of the CDT handset for troubleshooting vehicles equipped with the Excel electrical system. Troubleshooting Guide 1 is to be used in conjunction with the CDT handset. **See Controller Diagnostic Tool (CDT) on page 11-1** for operating instructions. **See following WARNING.**

WARNING

• The vehicle operator should not monitor the CDT while the vehicle is in motion. A technician can monitor the CDT 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 CDT handset is unavailable, the technician should proceed to Troubleshooting Guide 2.

TROUBLESHOOTING GUIDE 1

The following troubleshooting guide is intended for use with an CDT handset. 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
Monitor Menu – THROTTLE % value does not increase as the accelerator pedal is pressed or Diagnostic Menu – THROTTLE FAULT fault code	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 controller or broken wire	Repair and/or connect the 16-pin connector to the controller
	Failed MCOR	Test Procedure 12 – MCOR Voltage on page 12-27
Monitor Menu – TEMPERATURE °C indicates	Over-adjusted brakes	Section 6 – Wheel Brake Assemblies
that temperature is above 85 °C (145 °F) or Diagnostic Menu – THERMAL CUTBACK fault code	Vehicle is overloaded	Ensure that vehicle is not overloaded before returning to operation
Monitor Menu – ARM PWM value does not reach 100% when vehicle is at full speed	Failed MCOR	Test Procedure 12 – MCOR Voltage on page 12-27

POSSIBLE CAUSES	CORRECTIVE ACTION
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 controller or broken wire	Repair and/or connect the 16-pin connector to the controller
Failed motor speed sensor	Test Procedure 13 – Motor Speed Sensor on page 12-29
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 controller or broken wire	Repair and/or connect the 16-pin connector to the controller
Failed MCOR	Test Procedure 5 – Key Switch Circuit on page 12-18
Loose or disconnected Forward/Neutral/Reverse rocker switch (quick disconnect terminals) or broken wire	Repair and/or connect the quick disconnect terminals to the Forward/Neutral/Reverse switch
Loose or disconnected Forward/Neutral/Reverse rocker switch (three-pin connector) or broken wire	Repair and/or connect the three-pin connector from the Forward/Neutral/Reverse switch to the wire harness
Loose or disconnected 16-pin connector at controller or broken wire	Repair and/or connect the 16-pin connector to the controller
Failed Forward/Neutral/Reverse rocker switch	Test Procedure 7 – Forward/Neutral/Reverse Rocker Switch on page 12-22
Controller logic malfunction	Disconnect the batteries and allow the controller capacitors to discharge. See WARNING "To avoid unintentionally starting" in General Warnings on page 1-2. Reconnect the batteries and see if the symptom returns.
Loose, broken, or disconnected wire(s) at solenoid or B+ controller terminal	Repair and/or connect the loose or disconnected wire(s)
Loose or disconnected 16-pin connector at controller or broken wire	Repair and/or connect the 16-pin connector to the controller
Failed solenoid	Replace solenoid. See Solenoid Removal on page 13-19.
Loose or disconnected wires at key switch terminals or broken wire	Repair and/or connect the quick disconnect terminals to the Forward/Neutral/Reverse switch
Loose or disconnected 16-pin connector at controller or broken wire	Repair and/or connect the 16-pin connector to the controller
	Test Procedure 5 – Key Switch Circuit on page
	Loose or disconnected motor speed sensor or broken wire Loose or disconnected 16-pin connector at controller or broken wire Failed motor speed sensor Loose or disconnected two-pin connector at the MCOR or broken wire Loose or disconnected 16-pin connector at controller or broken wire Failed MCOR Loose or disconnected Forward/Neutral/Reverse rocker switch (quick disconnect terminals) or broken wire Loose or disconnected Forward/Neutral/Reverse rocker switch (three-pin connector) or broken wire Loose or disconnected 16-pin connector at controller or broken wire Failed Forward/Neutral/Reverse rocker switch Controller logic malfunction Loose, broken, or disconnected wire(s) at solenoid or B+ controller terminal Loose or disconnected 16-pin connector at controller or broken wire Failed solenoid Loose or disconnected wires at key switch terminals or broken wire Loose or disconnected fo-pin connector at controller or broken wire

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
	Loose or disconnected three-pin connector at the MCOR or broken wire	Repair and/or connect the three-pin connector to the MCOR
Diagnostic Menu – THROTTLE FAULT fault code	Loose or disconnected 16-pin connector at controller or broken wire	Repair and/or connect the 16-pin connector to the controller
	Failed MCOR	Test Procedure 12 – MCOR Voltage on page 12-27
	Armature drive FETs (field-effect transistors) inside controller have failed	Replace the controller. See Controller Removal on page 13-5.
Diagnostic Menu – HW FAILSAFE (Hardware Failsafe) fault code	Controller logic malfunction	Disconnect the batteries and allow the controller capacitors to discharge. See WARNING "To avoid unintentionally starting" in General Warnings on page 1-2. Reconnect the batteries and see if the symptom returns.
Diagnostic Menu – MAIN WELDED (main solenoid contacts welded) fault code	solenoid contacts have failed closed	Replace solenoid. See Solenoid Removal on page 13-19.
Diagnostic Menu – MAIN DRIVER ON or MAIN DRIVER OFF fault code	Controller logic malfunction	Disconnect the batteries and allow the controller capacitors to discharge. See WARNING "To avoid unintentionally starting" in General Warnings on page 1-2. Reconnect the batteries and see if the symptom returns.
	Failure of the FET that controls the solenoid coil	Replace the controller. See Controller Removal on page 13-5.
Diagnostic Menu – MAIN COIL FAULT fault code or Diagnostic Menu – MAIN DROPOUT (1 or 2) fault code	Solenoid coil has failed in an open condition	Replace solenoid. See Solenoid Removal or page 13-19.
	Loose or disconnected motor field coil wires at motor or controller or broken wire	Repair and/or connect the field coil wires
Diagnostic Menu – FIELD MISSING fault code	Failure of the motor field windings	Section 16 — Electric Vehicle - Motor
	Failure of the FETs that control field current	Replace the controller. See Controller Removal on page 13-5.
Diagnostic Menu – HPD (high pedal detect) fault code	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/Neutral/Reverse switch
Diagnostic Menu – LOW BATTERY fault code	Batteries require charging	Place batteries on battery charger and allow them to fully charge
	Improperly maintained or failed batteries	Section 14 — Electric Vehicle - Batteries
Diagnostic Menu – MOTOR STALL fault code	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

TROUBLESHOOTING GUIDE 2

In the event that the vehicle is not functioning properly after completing Troubleshooting Guide 1, use Troubleshooting Guide 2.

If an CDT handset is unavailable, use Troubleshooting Guide 2.

TROUBLESHOOTING GUIDE 2		
SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
	Batteries – batteries discharged	Charge batteries
	Batteries – battery connections	Check vehicle wiring.
	Battery charger is connected to the vehicle - charger interlock feature has disabled the vehicle	Disconnect the battery charger from the vehicle
	Charger interlock failure	Test Procedure 11 – Charger Interlock on page 12-26
	Key switch and MCOR limit switch circuit	Check for loose or disconnected wires at key switch and MCOR
	Failed key switch	Test Procedure 5 – Key Switch Circuit on page 12-18
Vehicle does not operate	Failed MCOR	Test Procedure 5 – Key Switch Circuit on page 12-18. See also Test Procedure 12 – MCOR Voltage on page 12-27.
	Forward/Neutral/Reverse rocker switch	Test Procedure 7 – Forward/Neutral/Reverse Rocker Switch on page 12-22
	Solenoid – loose wires	Test Procedure 8 – Solenoid Activating Coil on page 12-24
	Solenoid – failed coil	Test Procedure 8 – Solenoid Activating Coil on page 12-24
	Controller thermal cutback	Allow controller to cool and ensure that vehicle is not over-loaded before returning to operation
	16-pin connector at controller	Check for loose or disconnected wires at the 16-pin connector. See also Test Procedure 16 – 16-Pin Connector on page 12-32.
	High pedal detect	Cycle accelerator pedal
	Motor stall	Cycle accelerator pedal
	Motor Failure	Section 16 — Electric Vehicle - Motor
	Controller failure	Replace controller. See Controller Removal on page 13-5.
	Motor – motor connections	Check for loose or disconnected wires
	Controller – Motor and power connections	Check for loose or disconnected wires

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
	Speed sensor disconnected or failed	Test Procedure 13 – Motor Speed Sensor on page 12-29
	Incorrect speed setting	To change the programmed top speed of the vehicle, an CDT handset must be used
	Wiring – improperly wired	Check vehicle wiring.
	Batteries – batteries discharged	Charge batteries
	MCOR malfunction	Test Procedure 12 – MCOR Voltage on page 12-27
Vehicle runs slowly	Motor – loose wires	Inspect and tighten all wire connections at the motor.
	Failed motor	Replace motor. See Motor Removal on page 16-4.
	Vehicle is over-loaded	Ensure that vehicle is not over-loaded before returning to operation.
	Controller failure	Replace controller. See Controller Removal on page 13-5.
	Brakes – improperly adjusted	Section 6 — Wheel Brake Assemblies
	Tires – under-inflated or flat tires	Section 8 — Wheels and Tires
Vehicle operates but has points in pedal travel where it does not maintain speed nor accelerate	MCOR malfunction	Test Procedure 12 – MCOR Voltage on page 12-27
Vehicle reaches top speed before 100% pedal travel is reached	Controller – failed throttle resistor(s)	Replace controller. See Controller Removal on page 13-5.
Valeigla annuatura haut marten haut inn famation	Wiring – improperly wired	Check vehicle wiring.
Vehicle operates, but motor braking function does not	Speed sensor disconnected or failed	Test Procedure 13 – Motor Speed Sensor on page 12-29
	Forward/Neutral/Reverse rocker switch – improperly wired	Test Procedure 7 – Forward/Neutral/Reverse Rocker Switch on page 12-22
Vehicle will run in forward, but not in reverse or will run in reverse but not forward	Motor – improperly wired	Check motor wiring.
wiii run in reverse dut not lorward	Controller – improperly wired or failed controller FET	Check vehicle wiring.
	Charger interlock failure	Test Procedure 11 – Charger Interlock on page 12-26
Vehicle operates, but battery charger does not charge batteries	Battery charger connections – loose plug or wires at charger, receptacle or batteries	Check wire connections and tighten if necessary.
	Battery charger	

TEST PROCEDURES

Using the following procedures, the entire 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. See Electronics Module Cover on page 13-10. 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.

After test procedures are completed, be sure to replace the cover. **See Electronics Module Cover on page 13-10. 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.

TESTING BASICS

- To use the CDT, the Run/Tow switch must be in the RUN position. The Run/Tow switch provides power to the logic board and power board inside the controller.
- Battery Pack Voltage (BPV) will be referenced throughout the test procedures. BPV is accessed in Test Procedure
 1 Batteries / Voltage Check (BPV) on page 12-12.
- The Run/Tow switch powers the key switch, controller, Forward/Neutral/Reverse switch, 15-amp fuse, and reverse buzzer.
- The key switch powers the MCOR 2-pin circuit, Forward/Neutral/Reverse switch, solenoid, and the female bullet connector (W34 shown on .
- The MCOR 3-pin circuit, motor speed sensor circuit, the communication point for the car device (white/black wire in position 13 of the 16 pin connector), and charge indicator light is powered by the controller (with Run/Tow switch in RUN).
- The 2-amp fuse is powered directly by the batteries via the solenoid and carries BPV to the connected car device. No switch is involved.
- The term "back-probe" refers to probing the side of a connector that the wire enters. This is usually done when the connector must remain connected to a device. **See following CAUTION.**

CAUTION

- · Be careful not to damage the wire or terminal when back-probing.
- · When testing voltage, the batteries must remain connected.
- When testing voltage, unless specifically directed to do otherwise in a procedure, connect the black (–) probe of the multimeter to the negative post of battery no. 6 (6 x 8-Volt battery set) or the B- terminal of the controller, whichever is easier to access.
- When testing controller functions, the Run/Tow switch must be in the RUN position. The TOW position removes power to the controller.
- Several test can be performed by accessing components through the access panel in the rear body. If greater
 access is required, the two center batteries can be removed and the component mounting plate leaned forward;
 place the two center batteries on the floorboard and reconnect two of the existing battery cables. Use a third,
 "service only" cable that is long enough to connect the two batteries just for troubleshooting.

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- 2 48-Volt Battery Pack Voltage Under Load
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- 7 Forward/Neutral/Reverse Rocker Switch
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- 14 A1 and A2 Motor Voltage
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- 18 Charge Indicator Light
- 19 4-Pin Connector (for Connected Car Device)

TEST PROCEDURE 1 – Batteries / Voltage Check (BPV)

See General Warnings on page 1-2.

Special Tools Needed

- Controller Diagnostic Tool (CDT)
- Multimeter

Before the test procedure: The batteries must be properly maintained and fully charged in order to perform the following test procedures.

NOTE: Battery maintenance procedures, including watering information and allowable mineral content, can be found in the Battery section of this manual.

NOTE: This is a voltage test.

The battery voltage can be displayed with the CDT handset. **See following NOTE.** If an CDT handset is not available, proceed to step 5.

NOTE: The voltage displayed through the CDT shows what the controller reads. If the controller is not operating correctly, it may display a different voltage from what the battery pack voltage (BPV) really is. Always compare and confirm with readings obtained using a multimeter in the following procedure.

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Connect the CDT to the vehicle.
- 3. Go to the Monitor menu.
- 4. Select BATT VOLTAGE. The CDT should indicate at least 48 volts.
- 4.1. If the CDT indicates 48 volts, go to step 5.
- 4.2. If the CDT does not indicate 48 volts, check for loose battery connections or a battery installed in reverse polarity. Refer to Electric Vehicle Batteries on page 14-1 for further details on battery testing.
- 5. Make sure that the batteries are connected.
- 6. Set a multimeter to measure 200 volts DC.
- 7. Put the red (+) probe on the positive (+) post of battery number (1) (Figure 12-5, Page 12-13).

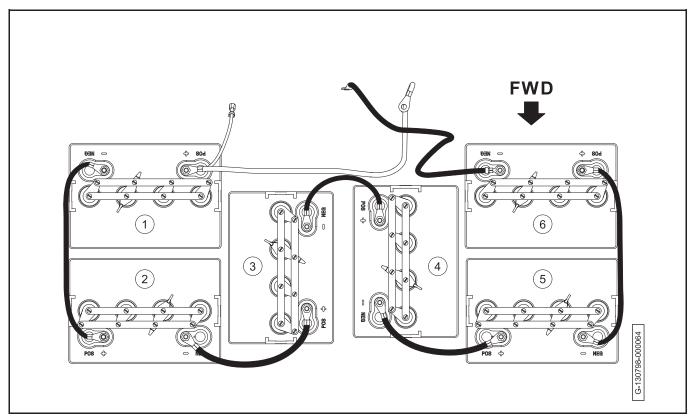


Figure 12-5

- 8. Put the black (–) probe on the negative (–) post of battery number (6).
- 9. The multimeter should indicate at least 48 volts.
- 9.1. If the measurement is less than 48 volts, check for loose battery connections or a battery installed in reverse polarity. Refer to Electric Vehicle Batteries on page 14-1 for further details on battery testing.

TEST PROCEDURE 2 – 48-Volt Battery Pack Voltage Under Load

See General Warnings on page 1-2.

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 Electric Vehicle - Batteries on page 14-1.

Special Tools Needed

- Battery Discharge Machine, 36V / 48V
- Multimeter

Before the test procedure: Make sure that the batteries are fully charged and that the electrolyte level is correct in all cells.

NOTE: This is a voltage test.

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Connect the discharge machine positive (+) lead to the positive (+) post of battery number (1) (Figure 12-6, Page 12-14).

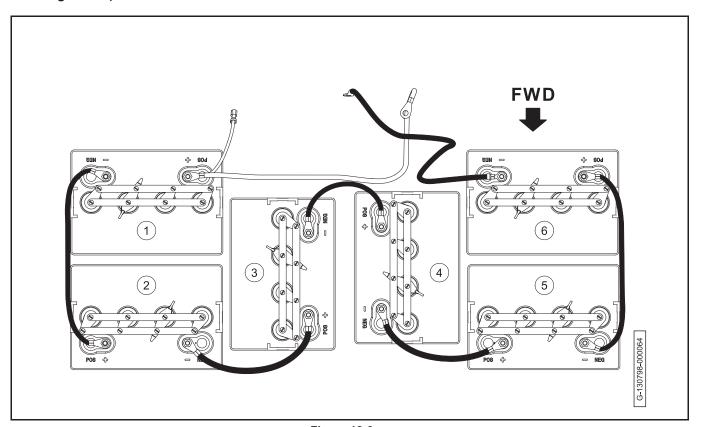


Figure 12-6

- 3. Connect the discharge machine negative (–) lead to the negative (–) post of battery number (6).
- 4. Set the discharge machine to ON. Record start time.

- 5. Discharge the batteries to less than 42.5 volts.
- 6. Use a multimeter to measure the voltage of each battery. Record the readings.
- 7. When the discharge machine shuts off, record the stop time.
- 8. Measure the temperature of the electrolyte in each battery.

Electrolyte Temperature	Start to Stop Time Minutes
Over 90°F	63
80° - 89°F	60
75° - 79°F	59
70° - 74°F	58
65° - 69°F	57
60° - 64°F	56
55° - 59°F	54
50° - 54°F	53
45° - 49°F	51
40° - 44°F	50
35° - 39°F	48
30° - 34°F	46

- 9. If the start to stop time minutes are the same or more than shown in the table, the batteries are good.
- 10. If the start to stop time minutes are less than shown in the table:
- 10.1. Replace any battery with a voltage reading less than 6.7 volts.
- 10.2. If all battery voltage readings are more than 6.7 volts, replace all six batteries.

11.

TEST PROCEDURE 3 - Run/Tow Switch

See General Warnings on page 1-2.

Special Tools Needed

- · Controller Diagnostic Tool (CDT)
- Multimeter

NOTE: This is a voltage test.

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Disable the vehicle.
- 3. Set the Run/Tow switch to RUN.
- 4. Connect the CDT to the vehicle (Figure 12-7).

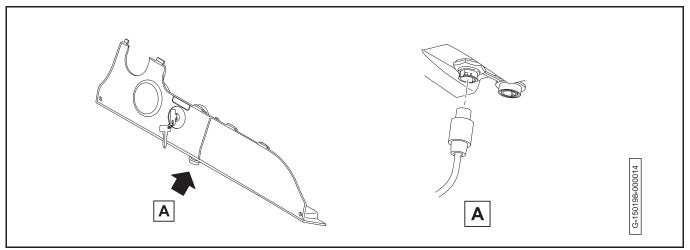


Figure 12-7

- 4.1. If the CDT operates correctly, go to step 5.
- 4.2. If the CDT does not operate:
 - 4.2.1. See Test Procedure 3 CDT Ports.
 - 4.2.2. Go to step 8.
- 5. Set the Run/Tow Switch to TOW.
- 6. If the CDT display screen goes blank, the Run/Tow switch and connecting wires are operating correctly.
- 7. If the CDT display screen is still active, the switch has failed closed. Replace the Run/Tow switch.
- 8. Make sure that the key switch is set to OFF.

WARNING

- The key switch should be placed in the OFF position and left in the OFF position for the duration of this test.
- 9. Remove the electronics module cover.
- 10. Set a multimeter to measure voltage.
- 11. Measure the voltage of the pink wire (1) on the Run/Tow switch (Figure 12-8).

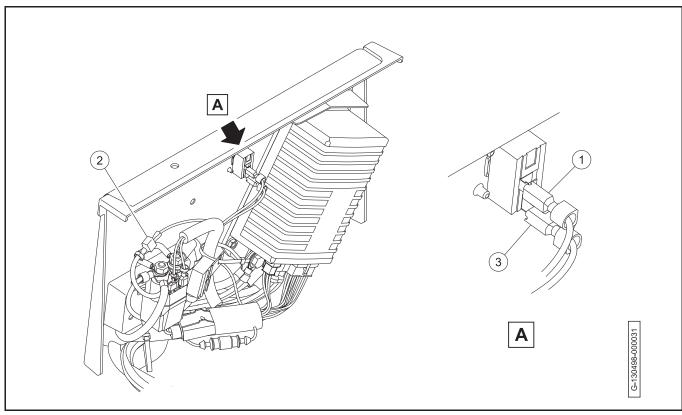


Figure 12-8

- 11.1. If pink wire reading is BPV, go to step 11.3.
- 11.2. If there is no voltage, inspect the pink to red wire connector (2) at the solenoid.
 - 11.2.1. Repair and replace as necessary.
 - 11.2.2. Go to step 11.3.
- 11.3. Set the Run/Tow switch to RUN.
- 12. Measure the voltage of the pink wire and light green wire (3) on the Run/Tow switch.
- 12.1. If the pink wire and green wire readings are BPV, go to step 13.
- 12.2. If the light green wire reading is less than 5 volts, replace the Run/Tow switch.
- 13. Set the Run/Tow switch to TOW.
- 14. Measure the voltage of the light green wire.
- 14.1. If the reading is less than 5 volts, the switch is good.
- 14.2. If the reading is BPV, replace the Run/Tow switch.

TEST PROCEDURE 4 - 15-Amp Fuse

See General Warnings on page 1-2.

NOTE: This is a continuity and voltage test.

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Disable the vehicle.
- 3. Set a multimeter to measure continuity.

- Remove the electronics module cover.
- 5. Remove the 15A fuse (1).

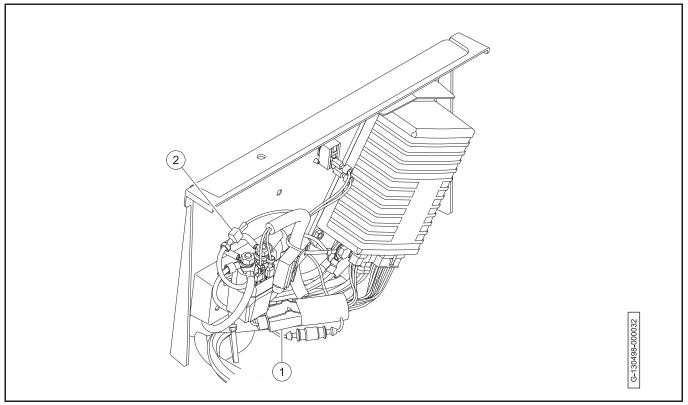


Figure 12-9

- 6. Measure the continuity of the fuse.
- 6.1. If there is continuity, go to step 7.
- 6.2. If there is no continuity, replace the fuse. Go to step 7.
- 7. Set the Run/Tow switch to RUN.
- 8. Set a multimeter to measure voltage.
- 9. Measure the voltage of the pink wire on the 15A fuse holder.
- 9.1. If the reading is BPV, the circuit is good.
- 9.2. If the reading is not BPV:
 - 9.2.1. Inspect the red to pink wire connection (2) near the solenoid.
 - 9.2.2. Test the Run/Tow switch.
 - 9.2.3. Test sonic welds 5 and 8 on the main harness.
 - 9.2.4. Inspect the wires and connectors in the circuit.

TEST PROCEDURE 5 – Key Switch Circuit

See General Warnings on page 1-2.

NOTE: This is a voltage test.

The MCOR provides FOOT INPUT to the controller.

The key switch provides KEY INPUT to the controller.

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.

Key Switch and MCOR Limit Switch Circuit Test with the CDT Handset

- 1. Park the vehicle on a solid level surface.
- 2. Turn the key to OFF.
- 3. Set the Forward/Neutral/Reverse control (FNR) to N.
- 4. Put chocks against the front wheels.
- 5. Lift the rear of the vehicle.
- 6. Connect the CDT to the vehicle.
- 7. Test the key switch.
- 7.1. Access the Monitor menu and select KEY INPUT by using the SCROLL DISPLAY buttons. The CDT should indicate OFF when the key switch is in the OFF position.
- 7.2. While monitoring the CDT display screen, turn the key switch to the ON position. The CDT should indicate ON
- 7.3. If the CDT 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 CDT 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 CDT handset.

- 8. Test the MCOR limit switch.
- 8.1. Select FOOT INPUT on the Monitor menu by using the SCROLL DISPLAY buttons on the CDT.
- 8.2. The CDT should indicate that FOOT INPUT is OFF when the accelerator pedal is not pressed, regardless of the key switch position.
- 8.3. With the key switch in the ON position, press the accelerator pedal. The CDT should indicate that FOOT INPUT is ON when the accelerator pedal is pressed.
- 9. If any reading is obtained that is not described in steps 4 and 5, perform the following steps:
- 9.1. Check the wiring of the key switch and MCOR.
- 9.2. Check the continuity of the key switch wires and the MCOR limit switch wires.
- If the problem was not found, proceed to the following procedure, Key Switch and MCOR Limit Switch Circuit Test without the CDT Handset.

Key Switch and MCOR Limit Switch Circuit Test without the CDT Handset

- 1. If necessary, see Testing Basics on page 12-11.
- 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 on page 1-2.
- 3. Place the Run/Tow switch in the RUN position and the Forward/Neutral/Reverse switch in the NEUTRAL position.
- Pin 6 Green Wire: Access the controller by removing the access panel in the rear body. See following NOTE.

NOTE: The easiest way to test the key switch and MCOR Limit Switch is to check the pin 6 green wire in the 16-pin connector. Pin 6 is the end of this circuit.

- 4.1. Locate and connect an insulation-piercing probe to the pin 6 green wire in the 16-pin connector.
- 4.2. With the key switch in the OFF position and the accelerator pedal at rest, the green wire should show zero (0) volts.
- 4.3. With the key switch in the ON position and the accelerator pedal pressed, the green wire should show BPV which is FOOT INPUT to controller.
 - If it shows BPV, then the key switch, MCOR and related wiring is functioning properly.
 - If not, first check the key switch and then the MCOR limit switch.
- 5. **Key Switch:** Remove instrument panel to access the back of the key switch but do not disconnect wires. **See Key Switch Removal, Section 13, Page 13-15.**

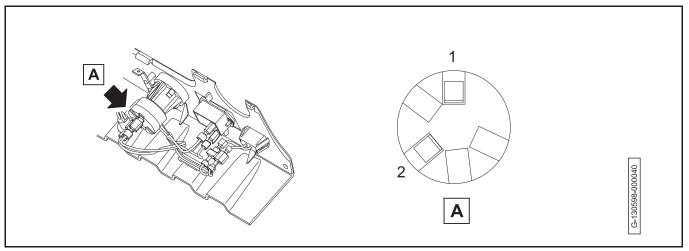


Figure 12-10

- 5.1. With the key switch in the OFF position:
 - The green wire should show BPV coming to the switch.
 - The blue wire should show zero (0) volts. If it shows BPV, the switch has failed CLOSED and must be replaced.
- 5.2. With the key switch in the ON position:
 - The blue wire should show BPV passing through the key switch to the MCOR. If it does not show BPV, the switch has failed OPEN and must be replaced.
- 6. **MCOR Limit Switch (FOOT INPUT):** Remove floormat and cover plate to access the MCOR. **See Pedal Group Removal on page 5-5.**
- 6.1. With the key switch in the ON position:
 - With an insulation-piercing probe, check voltage of the blue wire in the MCOR 2-pin connector. It should show BPV coming to the MCOR. If not, check wiring.
 - With an insulation-piercing probe, check voltage of the green wire in the MCOR 2-pin connector. It should show zero (0) volts with the accelerator pedal at rest. Press the accelerator pedal and the green wire should show BPV passing through the MCOR to the controller for FOOT INPUT. If not, replace MCOR. See MCOR Removal on page 13-16.

TEST PROCEDURE 6 – MCOR Limit Switch Circuit

See General Warnings on page 1-2.

NOTE: This is a voltage test.

The MCOR provides FOOT INPUT to the controller.

The key switch provides KEY INPUT to the controller.

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.

Key Switch and MCOR Limit Switch Circuit Test with the CDT Handset

- Park the vehicle on a solid level surface.
- 2. Turn the key to OFF.
- 3. Set the Forward/Neutral/Reverse control (FNR) to N.
- 4. Put chocks against the front wheels.
- 5. Lift the rear of the vehicle.
- 6. Connect the CDT to the vehicle.
- 7. Test the key switch.
- 7.1. Access the Monitor menu and select KEY INPUT by using the SCROLL DISPLAY buttons. The CDT should indicate OFF when the key switch is in the OFF position.
- 7.2. While monitoring the CDT display screen, turn the key switch to the ON position. The CDT should indicate ON.
- 7.3. If the CDT 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 CDT 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 CDT handset.

- 8. Test the MCOR limit switch.
- Select FOOT INPUT on the Monitor menu by using the SCROLL DISPLAY buttons on the CDT.
- 8.2. The CDT should indicate that FOOT INPUT is OFF when the accelerator pedal is not pressed, regardless of the key switch position.
- 8.3. With the key switch in the ON position, press the accelerator pedal. The CDT should indicate that FOOT INPUT is ON when the accelerator pedal is pressed.
- 9. If any reading is obtained that is not described in steps 4 and 5, perform the following steps:
- 9.1. Check the wiring of the key switch and MCOR.
- 9.2. Check the continuity of the key switch wires and the MCOR limit switch wires.
- If the problem was not found, proceed to the following procedure, Key Switch and MCOR Limit Switch Circuit Test without the CDT Handset.

Key Switch and MCOR Limit Switch Circuit Test without the CDT Handset

- 1. If necessary, see Testing Basics on page 12-11.
- 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 on page 1-2.

- 3. Place the Run/Tow switch in the RUN position and the Forward/Neutral/Reverse switch in the NEUTRAL position.
- 4. Pin 6 Green Wire: Access the controller by removing the access panel in the rear body. See following NOTE.

NOTE: The easiest way to test the key switch and MCOR Limit Switch is to check the pin 6 green wire in the 16-pin connector. Pin 6 is the end of this circuit.

- 4.1. Locate and connect an insulation-piercing probe to the pin 6 green wire in the 16-pin connector.
- 4.2. With the key switch in the OFF position and the accelerator pedal at rest, the green wire should show zero (0) volts.
- 4.3. With the key switch in the ON position and the accelerator pedal pressed, the green wire should show BPV which is FOOT INPUT to controller.
 - If it shows BPV, then the key switch, MCOR and related wiring is functioning properly.
 - If not, first check the key switch and then the MCOR limit switch.
- 5. **Key Switch:** Remove instrument panel to access the back of the key switch but do not disconnect wires. **See Key Switch Removal, Section 13, Page 13-15.**
- 5.1. With the key switch in the OFF position:
 - The green wire should show BPV coming to the switch.
 - The blue wire should show zero (0) volts. If it shows BPV, the switch has failed CLOSED and must be replaced.
- 5.2. With the key switch in the ON position:
 - The blue wire should show BPV passing through the key switch to the MCOR. If it does not show BPV, the switch has failed OPEN and must be replaced.
- MCOR Limit Switch (FOOT INPUT): Remove floormat and cover plate to access the MCOR. See Pedal Group Removal on page 5-5.
- 6.1. With the key switch in the ON position:
 - With an insulation-piercing probe, check voltage of the blue wire in the MCOR 2-pin connector. It should show BPV coming to the MCOR. If not, check wiring.
 - With an insulation-piercing probe, check voltage of the green wire in the MCOR 2-pin connector. It should show zero (0) volts with the accelerator pedal at rest. Press the accelerator pedal and the green wire should show BPV passing through the MCOR to the controller for FOOT INPUT. If not, replace MCOR. See MCOR Removal on page 13-16.

TEST PROCEDURE 7 - Forward/Neutral/Reverse Rocker Switch

See General Warnings on page 1-2.

NOTE: This is a voltage test.

The Forward/Neutral/Reverse Switch provides FORWARD INPUT and REVERSE INPUT to the controller.

If the controller sees both FORWARD INPUT and REVERSE INPUT at the same time, the reverse buzzer will sound in all FNR positions and the vehicle will not operate in either direction. Common causes of this include corrosion across the contacts inside the switch, water inside the switch, or a switch that has failed CLOSED.

Forward/Neutral/Reverse Rocker Switch Test with the CDT Handset

- 1. Turn the key switch to the OFF position and place the Forward/Neutral/Reverse switch in the NEUTRAL position.
- 2. Connect the CDT to the vehicle.
- 3. Test FORWARD INPUT.
- 3.1. Access the Monitor menu and select FORWARD INPUT by using the SCROLL DISPLAY buttons. The CDT should indicate OFF when the Forward/Neutral/Reverse switch is in the NEUTRAL or REVERSE position.

- 3.2. Place the Forward/Neutral/Reverse switch in the FORWARD position. The CDT should indicate that FORWARD INPUT is ON. If the CDT indicates any other reading, check vehicle wiring. Also check the 16-pin connector at the controller. See Test Procedure 16 16-Pin Connector on page 12-32.
- 4. Test REVERSE INPUT.
- 4.1. Access the Monitor menu and select REVERSE INPUT by using the SCROLL DISPLAY buttons. The CDT should indicate OFF when the Forward/Neutral/Reverse switch is in the NEUTRAL or FORWARD position.
- 4.2. Place the Forward/Neutral/Reverse switch in the REVERSE position. The CDT should indicate that REVERSE INPUT is ON. If the CDT indicates any other reading, check vehicle wiring. Also check the 16-pin connector at the controller. **See Test Procedure 16 16-Pin Connector on page 12-32.**
- 5. If the CDT displays readings other than those described above and the wiring is found to be correct, proceed to the following procedure, **Forward/Neutral/Reverse Rocker Switch Test without the CDT Handset**.

Forward/Neutral/Reverse Rocker Switch Test without the CDT Handset

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Place the Run/Tow switch in the RUN position and the Forward/Neutral/Reverse switch in the NEUTRAL position.
- 3. Remove Forward/Neutral/Reverse switch from its housing by carefully prying up each side with a small, flat-tip screwdriver.
- 4. Back-probe the following three wires connected to the Forward/Neutral/Reverse switch in each position:

4.1. Orange Wire

The orange wire provides power to the switch and should show BPV coming to the switch in all three
positions.

If the orange wire does not show BPV, check the 15-amp fuse, Run/Tow switch, red-to-pink wire spade terminal connection and related wiring.

4.2. Brown Wire

- The brown wire should show BPV in FORWARD.
- The brown wire should show zero (0) volts in NEUTRAL and REVERSE

If the brown wire shows voltage in NEUTRAL, the switch may have corrosion across the contacts or the switch has failed CLOSED and must be replaced. **See Forward/Neutral/Reverse Switch (FNR) Removal on page 13-11.**

If the brown wire does not show BPV in FORWARD, the switch may have corrosion on the contact or the switch has failed OPEN and must be replaced. **See Forward/Neutral/Reverse Switch (FNR) Removal on page 13-11.**

4.3. Blue Wire

- The blue wire should show BPV in REVERSE.
- The blue wire should show zero (0) volts in NEUTRAL and FORWARD.

If the blue wire shows voltage in NEUTRAL, the switch may have corrosion across the contacts or the switch has failed CLOSED and must be replaced. **See Forward/Neutral/Reverse Switch (FNR) Removal on page 13-11.**

If the blue wire does not show BPV in REVERSE, the switch may have corrosion on the contact or the switch has failed OPEN and must be replaced. **See Forward/Neutral/Reverse Switch (FNR) Removal on page 13-11.**

5. When installing the Forward/Neutral/Reverse switch into its housing, orient the three wire terminals towards the front of the vehicle (i.e. biased closer to the front of the switch housing and farther from the rear body).

TEST PROCEDURE 8 - Solenoid Activating Coil

See General Warnings on page 1-2.

NOTE: This is a resistance test.

Be aware that one of two different solenoids may be found on the vehicle. Visually, the production solenoid is smaller than the service replacement. On the labels, the larger service replacement solenoid has SOL0605 and the smaller production solenoid has SOL5006. Internally, specifications and test results differ between the two.

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 3. Access the solenoid by removing the electronics module cover. See Electronics Module Cover on page 13-10.
- 4. Remove the two small wire terminals from the solenoid.
- 5. Place red (+) probe of the multimeter on the positive (+) solenoid terminal. Place the black (–) probe on the other small solenoid terminal.
 - A reading of 200 to 250 ohms should be obtained for factory-installed solenoids (Figure 12-11, Page 12-24). If not, replace the solenoid.
 - A reading of 180 to 190 ohms should be obtained for service replacement solenoids (Figure 12-12, Page 12-24). If not, replace the solenoid.

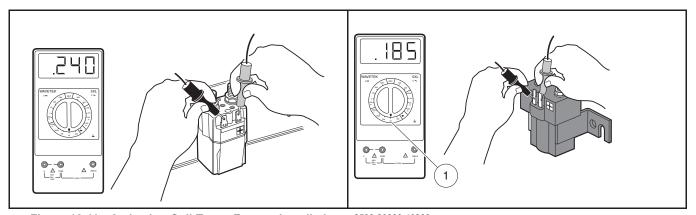


Figure 12-11 Activating Coil Test – Factory-installed Solenoid

2500-20000-10283

Figure 12-12 Activating Coil Test – Service Replacement
Solenoid

TEST PROCEDURE 9 – Pre-Charge Resistor

See General Warnings on page 1-2.

NOTE: This is a resistance test.

- 1. If necessary, see Testing Basics on page 12-11.
- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 3. Access the solenoid by removing the access panel in the rear body.
- 4. Measure resistance between the two large posts of the solenoid. The reading should be approx. 250 Ohms. If not, replace the pre-charge resistor using most of the steps found in **Solenoid Removal on page 13-19**.

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 Place the Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries – Electric Vehicles on page 1-5.

TEST PROCEDURE 10 – Solenoid Continuity

See General Warnings on page 1-2.

Solenoid Continuity Test with the CDT Handset

- 1. If necessary, see Testing Basics on page 12-11.
- 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 on page 1-2.
- 3. Connect the CDT to the vehicle.
- Access the Monitor menu and select MAIN CONT DRIVER by using the SCROLL DISPLAY buttons. The CDT should indicate OFF.
- 5. Turn the key switch to the ON position and place the Forward/Neutral/Reverse switch in the FORWARD position.
- 6. Press the accelerator pedal. When the controller energizes the solenoid coil, the CDT should indicate ON. If not, check the KEY, FORWARD, REVERSE and FOOT INPUTS to the controller. Also check the 16-pin connector at the controller. See Test Procedure 16 16-Pin Connector on page 12-32.
- 7. If the CDT displays readings other than those described above and the wiring is found to be correct, proceed to the following procedure, **Solenoid Continuity Test without the CDT Handset**.

Solenoid Continuity Test without the CDT Handset

- 1. If necessary, see Testing Basics on page 12-11.
- 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 on page 1-2.
- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 4. Disconnect the 6-gauge yellow wire and pre-charge resistor from large post of solenoid. See following NOTE.

NOTE: When disconnecting heavy gauge wires from solenoid, use a second wrench on the lower nut of the terminal post to hold post steady, preventing damage to the solenoid.

If the pre-charge resistor is not disconnected, the meter will read approx. 250 Ohms.

- 5. Check for continuity between the two large posts of the solenoid. The reading should be no continuity. If continuity is found, the solenoid has failed CLOSED and must be replace. **See Solenoid Removal on page 13-19.**
- 6. Reconnect the 6-gauge yellow wire and pre-charge resistor to the solenoid and secure with washer and nut. Tighten nut to 77 in·lb (8.7 N·m).
- 7. Place the Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.

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.
- 8. Change the multimeter to measure resistance.
- 9. Place the Run/Tow switch in the RUN position, turn the key switch to the ON position, place the Forward/Neutral/Reverse rocker switch in the FORWARD position, and press the accelerator pedal. The rear

tire should rotate and the multimeter should show a change in resistance. If not, replace the solenoid. **See Solenoid Removal on page 13-19.**

TEST PROCEDURE 11 – Charger Interlock

See General Warnings on page 1-2.

Controller Interlock Function Test with the CDT Handset

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Connect the CDT to the vehicle.
- Access the Monitor menu and select CHARGER INHIBIT by using the SCROLL DISPLAY buttons. The CDT should indicate OFF.
- 4. For external charger: Insert the charger DC cord into the vehicle's charger receptacle.

For onboard charger: Insert the onboard charger AC plug into an AC outlet.

- 5. In a few seconds, the CDT should indicate ON and the vehicle can no longer be driven. If not, check the KEY, FORWARD, REVERSE and FOOT INPUTS to the controller.
 - If the CDT does not indicate ON, check circuit wiring and DC plug connection. See the following procedure
 Testing the Interlock Circuit.
 - If the CDT does indicate ON, but the vehicle can still be driven, replace the controller. See Controller Removal, Section 13, Page 13-5.

Testing the Interlock Circuit

The charger interlock circuit consists of a 48V power source through the RUN/TOW switch, three sonic welds, a 15-amp fuse, a 10k Ohm resistor, a bullet connector, the charger receptacle blue wire and DC plug. **See following NOTE.** Use the following procedure to test the charger interlock circuit:

NOTE: The following steps involve testing voltage and resistance.

At the charger end of the DC cord, the black wire and blue wire are crimped together in the same fork terminal. This closes the circuit once the DC cord plug is inserted into the charger receptacle.

- 1. With batteries connected, place the Run/Tow switch in the RUN position.
- 2. Remove electronics module cover. See Electronics Module Cover Removal, Section 13, Page 13-10.
- 3. Check 15-amp fuse: See Test Procedure 4 15-Amp Fuse on page 12-17.
- 4. **Check power:** Using a multimeter set to 200 volts DC, place red (+) probe (with insulation-piercing probe) on the light blue wire (pin 5 of the 16-pin connector) and black (–) probe on B- terminal of controller. The reading should be approximately 42 to 46 volts. If the reading is not approximately 42 to 46 volts, proceed to check the 10k Ohm resistor. If the reading is approximately 42 to 46 volts, check continuity of circuit wires.
- 5. **Check 10k Ohm resistor:** Set multimeter to 20k Ohms. Remove the 15-amp fuse. With the red (+) probe (with insulation-piercing probe) still on the light blue wire (pin 5 of the 16-pin connector), place the black (–) probe to the red wire terminal in the 15-amp fuse holder. The reading should be approximately 10.0k Ohms. If the reading is not approximately 10.0k Ohms, replace the resistor or main wire harness **(Figure 12-4, Page 12-5)**.
- 6. **Check continuity:** Set multimeter to Continuity test. With the red (+) probe (with insulation-piercing probe) still on the light blue wire (pin 5 of the 16-pin connector), place the black (–) probe in the blue wire terminal of the charger receptacle. The meter should beep to indicate continuity. If not, check bullet connector of blue wires.

Next, probe from the pink wire terminal in the 15-amp fuse holder to the large solenoid post with the red wires attached. The meter should beep to indicate continuity. If not, verify Run/Tow switch is in RUN and check the red-to-pink wire spade connector near the solenoid.

If the meter does not indicate continuity, check and repair related connections, Run/Tow switch and wiring. If necessary, replace affected wire harness, charger receptacle or Run/Tow switch.

7. When finished, install 15-amp fuse and fuse cover.

TEST PROCEDURE 12 - MCOR Voltage

See General Warnings on page 1-2.

NOTE: This is a voltage test.

The accelerator position, which is proportional to the MCOR voltage, can be displayed with the CDT handset. If an CDT handset is not available, proceed to **MCOR Voltage Test without the CDT Handset**.

The following are potential MCOR symptoms:

- · Vehicle will not drive due to no FOOT INPUT to the controller.
- Vehicle will not reach top speed because MCOR does not reach 100% throttle position.
- · Vehicle does not maintain speed nor will it accelerate due to MCOR having a "dead-spot" in its pedal travel.
- The voltage signal from the MCOR randomly or sporadically fluctuates with pedal at rest, during pedal travel and with pedal fully pressed.

MCOR Voltage Test with the CDT Handset

 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 on 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.
- Connect the CDT to the vehicle.
- 3. Access the Monitor menu and select THROTTLE % by using the SCROLL DISPLAY buttons.
- 4. The CDT should indicate 0% with the pedal not pressed. While monitoring the CDT display screen, slowly press the accelerator pedal. As the pedal is pressed, the CDT should indicate a steady, incremental rise from 0% (pedal not pressed) to 100% (pedal fully pressed). **See following NOTE.**

NOTE: Observe closely to see if throttle input percentage randomly or sporadically fluctuates with pedal at rest, during pedal travel and with pedal fully pressed. If it fluctuates, the MCOR is defective and must be replaced.

- 5. If the MCOR passes the previous test, press and hold the accelerator pedal to the floor. By hand, gently move the pedal from side to side and see if the throttle input percentage fluctuates from 100%. If it fluctuates, the MCOR is defective and must be replaced.
- 6. If throttle input percentage does not reach 100% in the previous steps, proceed to MCOR Voltage Test without the CDT Handset.

MCOR Voltage Test without the CDT Handset

 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 on 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 Run/Tow 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/white wire at a point close to the three-pin connector at the MCOR. The reading should be approximately 48 to 50 volts (full battery voltage).
- 3. If reading is zero volts, check the purple/white wire continuity from the three-pin connector at the MCOR to the 16-pin connector at the 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 controller.
- 4. With multimeter set to 20 volts DC, place the black (–) probe on battery no. 6 (6 x 8-Volt battery set) negative post and the red (+) probe (with insulation-piercing probe) on the white 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 wire continuity from the three-pin connector at the MCOR to the 16-pin connector at the 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 controller.
- 6. With multimeter set to 20 volts DC, place the black (–) probe on battery no. 6 (6 x 8-Volt battery set) negative post and the red (+) probe (with insulation-piercing probe) on the yellow wire at a point close to three-pin connector at the MCOR. The reading should be zero (0) 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 approximately 4.65 volts when the pedal is fully pressed.
- 7. If reading does not increase as the pedal is pressed, replace the MCOR. See following NOTE.

NOTE: Observe closely to see if voltage randomly or sporadically fluctuates with pedal at rest, during pedal travel and with pedal fully pressed. If it fluctuates, the MCOR is defective and must be replaced.

TEST PROCEDURE 13 – Motor Speed Sensor

See General Warnings on page 1-2.

Motor Speed Sensor Test without any Tool

A 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. Place the Forward/Neutral/Reverse switch in the REVERSE position to verify reverse buzzer is functioning properly. If not, repair or replace the buzzer.
- 2. With Run/Tow switch in the RUN position, turn the key switch to the OFF position and place the Forward/Neutral/Reverse switch in the NEUTRAL position.
- 3. Slowly push the vehicle a short distance (about 3 feet (1 meter)). The reverse buzzer should sound and motor braking should engage while the vehicle is rolling.
- 4. If the reverse buzzer does not sound and motor braking does not engage while the vehicle is rolling, replace the Motor Speed Sensor.

Motor Speed Sensor Test with the CDT Handset

A 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/Neutral/Reverse switch in the NEUTRAL position.
- 2. Connect the CDT to the vehicle.
- 3. Access the Monitor menu and select SPEED PULSES by using the SCROLL DISPLAY buttons. The CDT should indicate OFF when the vehicle is at rest.
- 4. While monitoring the CDT display screen, slowly push the vehicle a short distance (about 3 feet (1 meter)). The CDT should indicate ON for speed sensor pulses while the wheels are in motion.
- 5. If the CDT does not indicate ON while the wheels are in motion, proceed to the following procedure.

Motor Speed Sensor Test without the CDT Handset

NOTE: This is a voltage test.

- 1. Turn the key switch to the OFF position and place the Forward/Neutral/Reverse switch in the NEUTRAL position.
- 2. With batteries connected, disconnect the three-pin connector at the motor speed sensor.
- 3. Check voltage at purple/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 purple/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 purple/white wire from the 16-pin connector at the controller to the three-pin connector at the motor speed sensor. If the continuity is correct, replace the controller.
- 4. Check voltage at the red motor speed sensor wire:

- 4.1. With Run/Tow switch in the RUN position and using a multimeter set to 20 volts DC, place the black (–) probe on the battery no. 6 (6 x 8-Volt battery set) negative post and place red (+) probe on red wire terminal socket in three-pin connector. The voltage reading should be approximately 15 to 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 controller to the three-pin connector at the motor speed sensor. If the wire continuity is correct, replace the controller.
- 4.3. If the reading is below 14 volts, replace the 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. 6 (6 x 8-Volt battery set) 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 controller to the three-pin connector at the motor speed sensor. If the continuity is correct, replace the controller.
- 5.3. If reading is below 3.50 volts, check the continuity of the wires and plug and replace the 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. 6 (6 x 8-Volt battery set) 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 any of the following results occur:
 - 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 – A1 and A2 Motor Voltage

See General Warnings on page 1-2.

NOTE: This is a voltage test.

 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 on 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 Run/Tow switch in the RUN position, place the Forward/Neutral/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. **See following NOTE.**

NOTE: Voltage can vary depending on controller speed setting as well as which zone a Guardian equipped vehicle is located.

Example: Speed setting 1 may only read 30 volts.

- 4.1. If there is no voltage reading, check the MCOR. See MCOR Voltage on page 12-27. Also check the continuity of the large posts of the solenoid. See Solenoid Continuity on page 12-25.
- 4.2. Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 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. Section 16 Electric Vehicle Motor

TEST PROCEDURE 15 – Voltage at Charger Receptacle Red Wire Socket

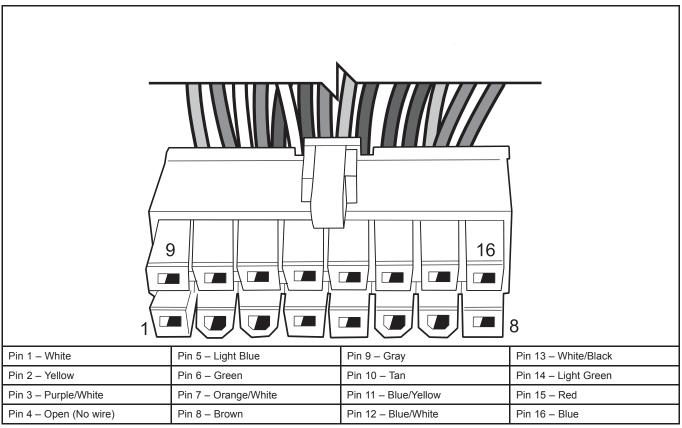
See General Warnings on page 1-2.

NOTE: This is a voltage test.

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Probe the charger receptacle socket connected to the red, 10-gauge wire. The reading should be BPV.
- 3. If the reading is zero volts, check the following items:
 - The 30-amp fuse (located near solenoid) in the 10-gauge red wire of the charger receptacle harness.
 - Continuity of the 10-gauge red wire from the solenoid to the receptacle socket.
 - Continuity of the 6-gauge red wire from the positive post of battery no. 1 to the solenoid.
- 4. If the reading is less than BPV, inspect related wiring and connections for tightness, damage and corrosion.

TEST PROCEDURE 16 - 16-Pin Connector

See General Warnings on page 1-2.



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Figure 12-13 Pin And Wire Color

Inspection and General Information

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 2. Disconnect the 16-pin connector from the 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.
- 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 as shown in **Figure 12-13**, **Page 12-32**.
- 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. For testing, wires have been grouped together based on purpose as either controller input or controller output. Tests vary whether the 16-pin must be connected or disconnected from the controller to get the appropriate result.

If 16-pin must be disconnected:

- 1. Keep the 16-pin connector disconnected from the controller.
- 2. With Run/Tow switch in the TOW position, reconnect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.
- 3. Place the Run/Tow switch in the RUN position and then check the appropriate wires.

If 16-pin must be connected:

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 2. Connect the 16-pin connector to the controller. See following NOTE.

NOTE: 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.

- With Run/Tow switch in the TOW position, reconnect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.
- Place the Run/Tow switch in the RUN position and then check the appropriate wires.

Refer to the following tables. Each table contains the following information:

- · What function the wire performs.
- Whether or not the 16-pin connector must remain connected during the test.
- The appropriate test result for each pin.

If results differ 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.**

Testing Controller Inputs

CONTROLLER INPUTS	PERFORM TEST WITH 16-PIN CONNECTED TO CONTROLLER? (IF YES, BACK-PROBE TO TEST)	TEST PROCEDURE
THROTTLE INPUT Pin 2 – Yellow	Yes	Range of zero (0) volts (with accelerator pedal at rest) to 4.65 volts (with accelerator pedal fully pressed) from MCOR 3-pin circuit
GROUND FOR PINS 1 AND 15 Pin 3 – Purple/White	Yes	BPV measured between solenoid post with red wires and pin 3
CHARGER INTERLOCK INPUT Pin 5 – Light Blue	Yes	Approx. 42 to 46 volts (can vary depending on BPV) with charger disconnected. See Test Procedure 11 – Charger Interlock on page 12-26.
FOOT INPUT Pin 6 – Green	No	BPV from MCOR limit switch (Key switch must be ON)
REVERSE BUZZER INPUT Pin 7 – Orange/White	No	BPV from Reverse Buzzer with Run/Tow switch in RUN (Key switch either ON or OFF)

TABLE CONTINUED ON NEXT PAGE

CONTROLLER INPUTS	PERFORM TEST WITH 16-PIN CONNECTED TO CONTROLLER? (IF YES, BACK-PROBE TO TEST)	TEST PROCEDURE
FORWARD INPUT Pin 8 – Brown	No	BPV from Forward/Neutral/Reverse switch in FWD (Key switch either ON or OFF)
B+ INPUT Pin 9 – Gray Powers the controller logic and power boards.	No	BPV from Run/Tow switch in RUN
KEY SWITCH INPUT Pin 10 – Tan	No	BPV from Key switch in ON
SOLENOID INPUT Pin 12 – Blue/White	No	BPV from Solenoid Activating Coil (result of Key switch in ON)
SPEED SENSOR INPUT Pin 14 – Light Green	Yes	Alternates from zero (0) to approx. 4.85 volts depending on speed sensor position. Rotate rear wheel to see voltage switch (Key switch either ON or OFF)
REVERSE INPUT Pin 16 – Blue	No	BPV from Forward/Neutral/Reverse switch in REV (Key switch either ON or OFF)

Testing Controller Outputs

CONTROLLER OUTPUTS	PERFORM TEST WITH 16-PIN CONNECTED TO CONTROLLER? (IF YES, BACK-PROBE TO TEST*)	TEST PROCEDURE
THROTTLE OUTPUT Pin 1 – White Supplies approximately 5 volts in MCOR 3-pin circuit.	Yes	4 to 5 volts measured between pin 1 and B- terminal on controller (Key switch either ON or OFF)
CHARGE INDICATOR LIGHT OUTPUT Pin 11 – Blue/Yellow Supplies a positive (+), controlled current source to power the charge indicator light on the instrument panel.	Yes* Do not back-probe for this test.	Start a charging session. After a few seconds, light should flash. Can also be seen under LED Driver in the Monitor menu of the CDT.
CONNECTED CAR OUTPUT Pin 13 – White/Black Supplies approximately 13 volts to the Guardian/Visage unit.	Yes	Approximately 13 volts measured between pin 1 and B- terminal on controller (Key switch either ON or OFF)
SPEED SENSOR OUTPUT Pin 15 – Red Supplies approximately 15 to 16 volts to the motor speed sensor.	Yes	Approximately 15 to 16 volts measured between pin 1 and B- terminal on controller (Key switch either ON or OFF)

TEST PROCEDURE 17 – Reverse Buzzer

See General Warnings on page 1-2.

NOTE: This is a voltage test.

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 3. Remove the instrument panel. See Key Switch Removal, Section 13, Page 13-15.
- 4. Disconnect the orange/white and pink wires from the reverse buzzer.
- 5. Place the Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.
- 6. Place the key switch in the OFF position and the Run/Tow switch in the RUN position.
- 7. Using a multimeter set to 200 volts DC, place the black (–) probe on battery no. 6 (6 x 8-Volt battery set) 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).
- 7.1. If the voltage reading is correct, proceed to step 8.
- 7.2. If reading is zero volts, check wire continuity, 9-pin connector, 15-amp fuse and Run/Tow switch. **See Test Procedure 3 Run/Tow Switch on page 12-15.**
- 7.3. If the continuity readings are not correct, repair or replace the pink wire.
- 7.4. If the continuity readings are correct, proceed to step 8.
- 8. Place the Forward/Neutral/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).
- 8.1. If the voltage reading is correct, replace the reverse buzzer.
- 8.2. If reading is zero volts, check orange/white wire continuity and connection at Pin 7 in 16-Pin connector.
- 8.3. 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.
- 8.4. 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 18 – Charge Indicator Light

See General Warnings on page 1-2.

- 1. With batteries connected, Run/Tow switch in the RUN position and the key switch in the OFF position, connect charger DC cord to vehicle.
- 2. In a few seconds, the light will flash three times and the reverse buzzer simultaneously will sound three times to indicate charging has begun. **See following NOTE.**

NOTE: The number of flashes and beeps can vary depending on the Beep Option setting. **See Beep Option**, **Section 11, Page 11-8.**

- 3. If charge indicator light does not flash three times, disconnect charger DC cord from vehicle and connect an CDT to the vehicle.
- Access the Monitor menu and select LED Driver by using the SCROLL DISPLAY buttons. The CDT should indicate OFF.
- 5. Reconnect charger DC cord to vehicle.
- 6. In a few seconds, the CDT should quickly display ON just once while the dash-mounted charge indicator light flashes three times. **See following NOTE.**

NOTE: The CDT will still flash ON even with a failed or missing charge indicator light.

7. If the CDT quickly displays ON but the charge indicator light still does not flash, check the following items:

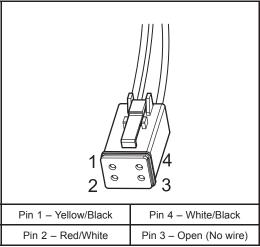
- Condition of the blue/yellow wire terminal in the 16-pin connector.

- Condition of the 9-pin connector behind instrument panel.
- Condition of the yellow/green wire terminal in the instrument panel wire harness.
- Continuity of the wires in the wire harnesses.
- 8. If no problems exist in the above items, replace the charge indicator light.

TEST PROCEDURE 19 – 4-Pin Connector (for Connected Car Device)

See General Warnings on page 1-2.

NOTE: This is a voltage and continuity test.



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Figure 12-14 4-Pin Connector

- 1. If necessary, see Testing Basics on page 12-11.
- 2. Check for continuity between pin 1 (yellow/black wire) (Figure 12-14, Page 12-36) and pin 3 (purple/white wire) of the 16-pin connector. It should indicate continuity. If not, check sonic welds no. 1 and no. 2.
- 3. Probe pin 2 (red/white wire). It should show BPV. If not, check 2-amp fuse. See following NOTE.

NOTE: The red/white wire has BPV with the Run/Tow switch in either position.

4. Probe pin 4 (white/black wire). It should show approximately 13 volts supplied by the controller. If not, check wiring and then controller. **See following NOTE.**

NOTE: The white/black wire only has voltage with the Run/Tow switch in the RUN position.

If pin 4 has no voltage, the controllers LIN (Local Interconnect bus) may have failed. The vehicle can be driven if it is not used with Guardian or Visage and will not show any symptoms. Otherwise, Guardian or Visage will disable the vehicle until communication is restored.

See General Warnings, Section 1, Page 1-2.

BATTERY CONDITION INDICATOR

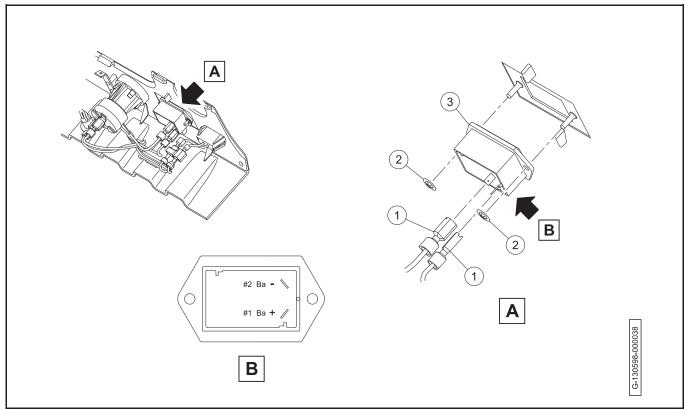


Figure 13-1

BATTERY CONDITION INDICATOR REMOVAL

- 1. Disconnect the batteries and discharge the controller.
- 2. Remove the instrument panel.
- 3. Disconnect the battery condition indicator wires (1) (Figure 13-1).
- 4. Remove the push-on retainers (2).
- 5. Remove the battery condition indicator (3).

BATTERY CONDITION INDICATOR INSTALLATION

- 1. Install the battery condition indicator (3) with the push-on retainers (2) (Figure 13-1).
- 2. Connect the red wire to the positive (+) terminal.
- 3. Connect the black/yellow wire to the negative (-) terminal.
- 4. Install the instrument panel.
- 5. Connect the batteries.

CHARGE INDICATOR LIGHT

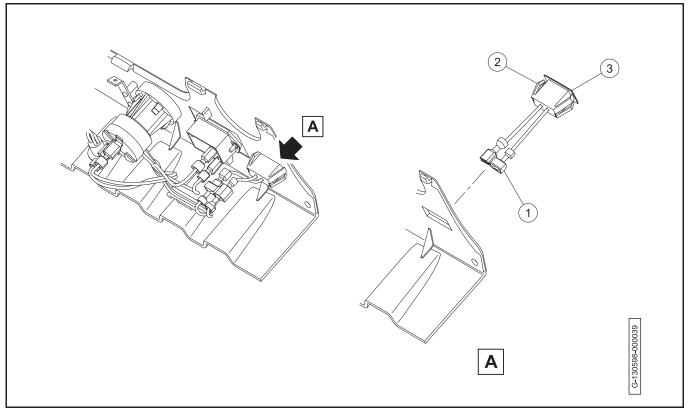


Figure 13-2

CHARGE INDICATOR LIGHT REMOVAL

- 1. Disconnect the batteries and discharge the controller.
- 2. Remove the instrument panel.
- Disconnect the charge indicator light wires (1) (Figure 13-2). 3.
- Push the lock tabs (2) on both sides and remove the charge indicator light (3).

CHARGE INDICATOR LIGHT INSTALLATION

- Push the charge indicator light (3) into the hole in the instrument panel until the retaining tabs (2) engage (Figure 1.
- Connect the charge indicator light wires (1). 2.
- Install the instrument panel. 3.
- 4. Connect the batteries.

CHARGER RECEPTACLE

For charger receptacle inspection and maintenance information, See Inspection And Maintenance, Section 15, Page 15-21.

CHARGER RECEPTACLE REMOVAL

- 1. Disable the vehicle.
- 2. Disconnect the batteries and discharge the controller.
- 3. Remove the kick plate.
- 4. Remove the 10-gauge red wire (1) from the solenoid (Figure 13-3, Page 13-3).

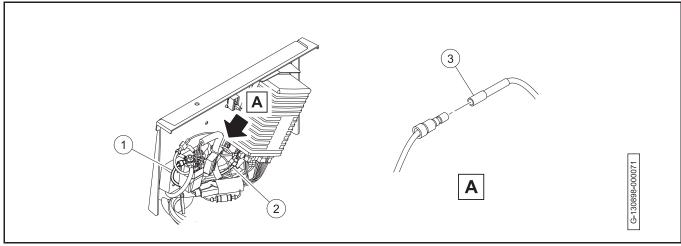


Figure 13-3

- 5. Disconnect the 10-gauge black wire (2) from the controller B- terminal.
- 6. Disconnect the light blue wire from light blue wire (3) on the main harness.
- 7. Remove the three screws (1) that secure the charger receptacle (2) to the bucket (Figure 13-4, Page 13-3).

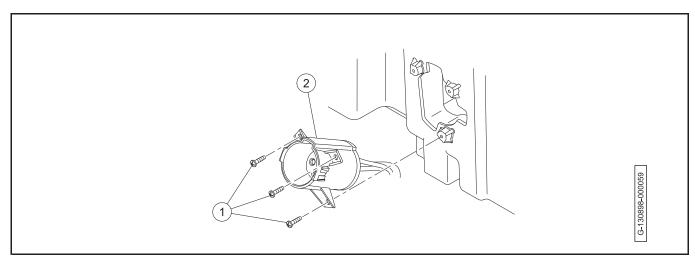


Figure 13-4

CHARGER RECEPTACLE INSTALLATION

- 1. Put the wires through the hole in the bucket.
- 2. Install the charger receptacle (2) in the bucket (Figure 13-5).

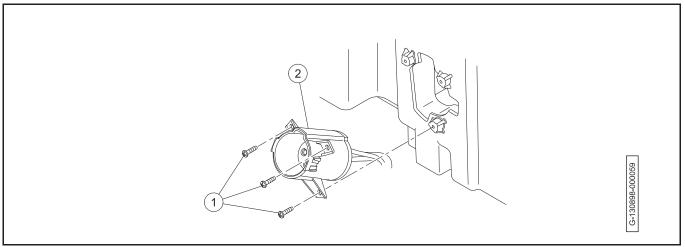


Figure 13-5

3. Install the screws (1). Tighten the screws to 16 in·lb (1.8 N·m).

A CAUTION

- Make sure that the routing of the wires is correct.
- 4. Connect the 10-gauge red wire (1) to solenoid (Figure 13-6). Tighten nut 72 to 84 in lb (8 to 9.5 N·m).

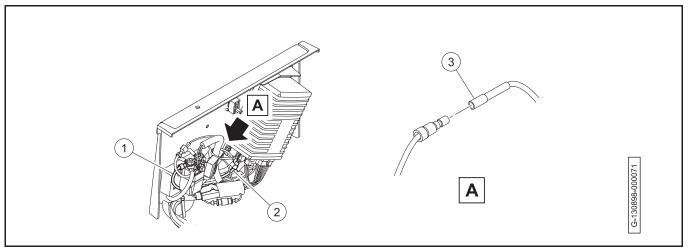


Figure 13-6

- 5. Connect the 10-gauge black wire (2) to the controller B- terminal. Tighten the bolt to 108 in lb (12.2 N·m).
- 6. Connect the light blue wire to light blue wire (3) on the main harness.
- 7. Install the kick plate.
- 8. Connect the batteries.

Page 13-4 Tempo, Tempo Connect, and Tempo 2+2 Maintenance and Service Manual

CONTROLLER

CONTROLLER REMOVAL

- Disconnect the batteries and discharge the controller (1).
- 2. Remove the electronics module cover.
- 3. Remove the three screws (2).
- Disconnect the 16-pin connector, 4-pin connector, and spade connectors (3 and 4). 4.
- 5. Remove the screw (5) nearest the B- terminal of the controller. Loosen the remaining two self-tapping screws (9) that secure the controller and remove controller from vehicle.

CONTROLLER INSTALLATION

- Install controller (1) on the two self-tapping screws (9). Install third self-tapping screw (9) and tighten to 5.5 ft·lb (7.5 N·m) (Figure 13-8, Page 13-9).
- 2. Connect the 16-pin connector, 4-pin connector, and spade connectors to the controller (1).
- Connect the the heavy gauge wires to the controller (1) per the electrical schematics. Tighten terminal screws (6) 3. on the controller to 108 in lb (12.2 N·m).
- 4. Return electronics module cover (8) to its original location. See Electronics Module Cover Installation on page 13-10.
- Place the Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.
- Place the Run/Tow switch in the RUN position. 6.
- 7. If vehicle is equipped with the Guardian SVC system, perform the following additional steps for proper setup.
- Connect an CDT to the CDT port on the vehicle. 7.1.
- 7.2. Select Program, Settings, Control Mode and set the value to 1.
- 7.3. Select Program, Settings, Anti Tamper and set the value to 0.
- 7.4. Select Program, Vehicle ID, Vehicle S/N and enter the last six digits of the vehicle serial number.

NOTE: The speed for scrolling values may be increased by utilizing the bookmark keys (yellow buttons) in combination with the data inc/dec key (+/-).

- 7.5. Select Program, Vehicle ID, Vehicle Decal and enter the number on the Vehicle Number Decal.
- Select Program, Vehicle ID, Vehicle Date of Manufacture and enter the number on the model year and 7.6. week from the vehicle serial number.
- 7.7. Select Information, Software Version and verify the value is 13 or higher. If not, contact a Club Car Technical Representative.
- 7.8. Place the Run/Tow switch in the TOW position for 30 seconds. Then return it to RUN.
- Inspect the vehicle for proper operation.

WARNING

 Make sure that the vehicle operates in the forward direction when the Forward/Neutral/Reverse switch is in the FORWARD position.

WARNING CONTINUED ON NEXT PAGE

WARNING

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

DC TO DC CONVERTER

DC TO DC CONVERTER REMOVAL

- 1. Disable the vehicle.
- 2. Disconnect the batteries and discharge the controller.
- 3. Disconnect the electrical connectors (1) (Figure 13-7, Page 13-7).

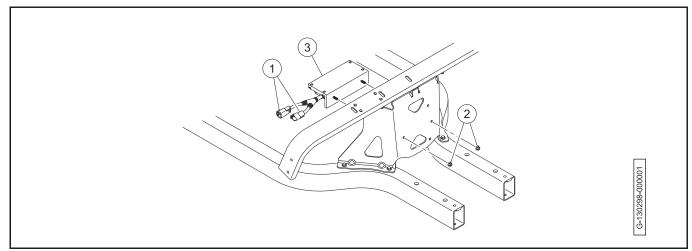


Figure 13-7 DC To DC Converter

- 4. Remove the nuts (2).
- 5. Remove the DC to DC converter (3).

DC TO DC CONVERTER INSTALLATION

- 1. Install the DC to DC converter (3) on the vehicle (Figure 13-7, Page 13-7).
- 2. Install the nuts (2). Tighten the nuts to 65 lb·in (7.3 N·m).
- 3. Connect the electrical connectors (1).
- 4. Connect the batteries.

ELECTRONICS MODULE

See General Warnings on page 1-2.

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

- Disconnect the batteries and discharge the controller (1). See Disconnect the Batteries Electric Vehicles on page 1-4.
- 2. Remove the batteries from the vehicle to provide enough room to access the controller (1) (Figure 13-8, Page 13-9). See Battery Replacement on page 14-5.
- 3. Remove the bolt (2) that secures the electronics module (3) to the battery bucket.
- 4. Pull electronics module (3) forward and disconnect the heavy gauge wires from the controller (1) and solenoid (4).
- 5. Disconnect the 16-pin connector, 4-pin connector, and spade connectors from the controller (1).
- 6. Disconnect the spade connectors on the front of the solenoid (4).
- 7. Disconnect the two wires from Run/Tow switch (5).
- 8. Lift the electronics module (3) 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.

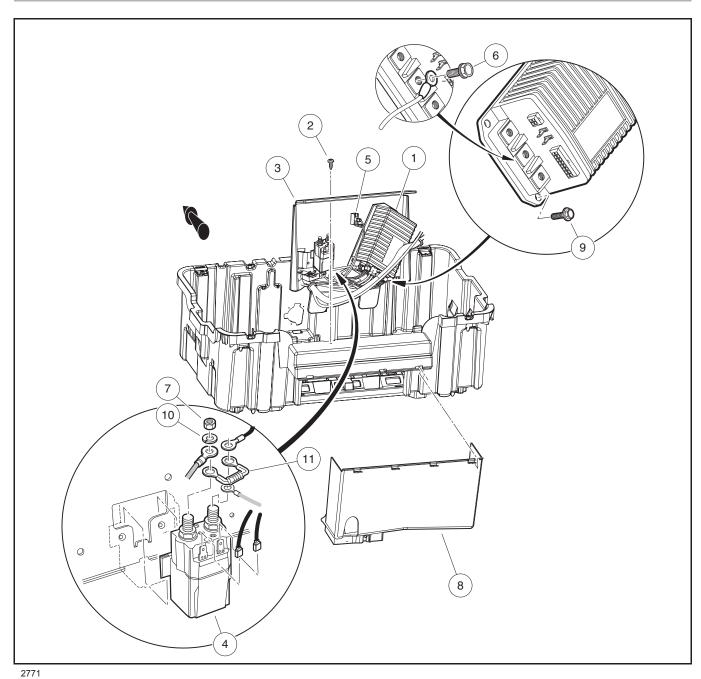


Figure 13-8 Controller and Solenoid Removal

ELECTRONICS MODULE INSTALLATION

- 1. Return electronics module (3) to its location in vehicle but leave it tilted forward.
- 2. Complete connections to the controller (1), the Run/Tow switch (5) and the solenoid (4) per the electrical schematics.
- 3. Tighten bolts (6) on the controller to 108 in·lb (12.2 N·m).
- 4. Tighten nuts (7) on the solenoid to 6.4 ft·lb (8.7 N·m).

- 5. Set electronics module in place and secure with bolt (2) **(Figure 13-8, Page 13-9)**. Tighten bolt to 40 in·lb (4.5 N·m).
- 6. Install the batteries and battery cables in their original locations. See Battery Replacement on page 14-5.
- Place the Run/Tow switch (5) in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.
- 8. Place the Run/Tow switch (5) in the RUN position.
- 9. Inspect the vehicle for proper operation. See following WARNINGS.

WARNING

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

ELECTRONICS MODULE COVER

See General Warnings on page 1-2.

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

ELECTRONICS MODULE COVER REMOVAL

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 2. Remove the two plastic rivets (1) that secure the access panel (2) to the vehicle (Figure 13-9, Page 13-11).
- 3. Remove cover (5) by first releasing the four tabs (3) from the matching holes in the hood of the battery bucket. Then, maneuver the cover to release the two hooks (4) that secure the cover to the battery bucket.

CAUTION

• Be careful not to break the two hooks (4) on the bottom of the cover. Push the bottom of the cover up to release the hooks before pulling cover away from battery bucket.

ELECTRONICS MODULE COVER INSTALLATION

- 1. Install cover (5) by first hooking the four tabs (3) into the matching holes in the hood of the battery bucket (**Figure 13-9, Page 13-11**). Then, use the two hooks (4) to secure the cover to the battery bucket.
- Place access panel (2) on vehicle and secure with the two plastic rivets (1). See following CAUTION.

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 Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.

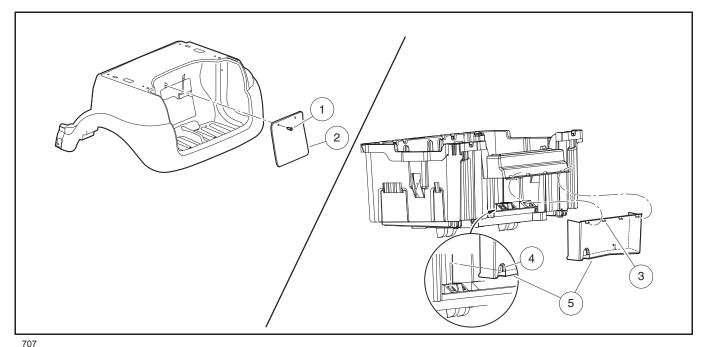


Figure 13-9 Access and Remove Electronics Module Cover

FORWARD/NEUTRAL/REVERSE SWITCH (FNR)

FORWARD/NEUTRAL/REVERSE SWITCH (FNR) REMOVAL

- 1. Disable the vehicle.
- 2. Disconnect the batteries and discharge the controller.
- 3. Remove the screws (1) (Figure 13-10, Page 13-12).

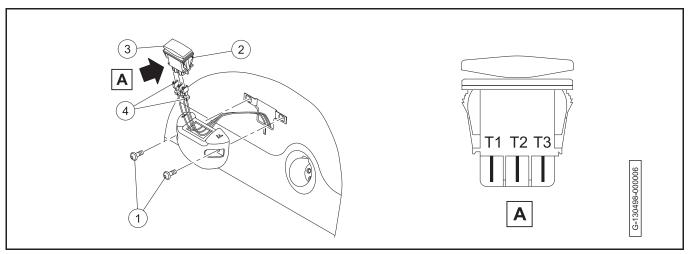


Figure 13-10

- 4. Push in on the locking tabs (2) and remove the rocker switch (3).
- 5. Disconnect the wires (4).

FORWARD/NEUTRAL/REVERSE SWITCH (FNR) INSTALLATION

1. Put the wires (4) through the housing (Figure 13-11, Page 13-13).

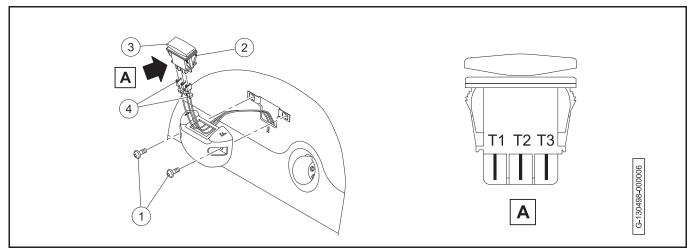


Figure 13-11

- Make sure that the rocker switch terminals are towards the front of the vehicle.
- 3. Connect the blue wire to T1. See graphic detail A.
- 4. Connect the orange wire to T2.
- 5. Connect the brown wire to T3.
- 6. Push the rocker switch (3) into housing.
- 7. Make sure that the locking tabs (2) engage.
- 8. Install the housing with the screws (1). Tighten the screws to 20 lb·in (2.3 N·m).
- 9. Connect the batteries.
- 10. Make sure that the vehicle operates correctly.

A WARNING

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

HEADLIGHT SWITCH

HEADLIGHT SWITCH REMOVAL

Disable the vehicle.

- 2. Disconnect the batteries and discharge the controller.
- 3. Remove the instrument panel.
- 4. Disconnect the wires from the headlight switch.
- 5. Loosen the set screw (1) (Figure 13-12, Page 13-14).

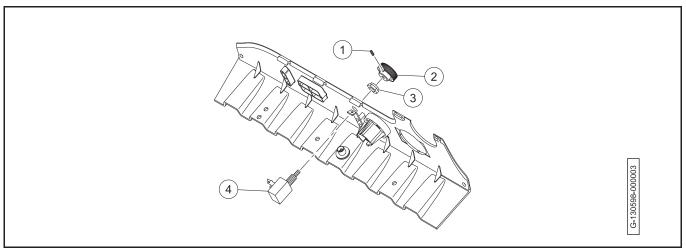


Figure 13-12 Headlight Switch

- 6. Remove the threaded knob (2).
- 7. Remove the nut (3).
- 8. Remove the headlight switch (4).

HEADLIGHT SWITCH INSTALLATION

- 1. Install the headlight switch (4) into the instrument panel (Figure 13-12, Page 13-14).
- 2. Install the nut (3). Tighten the nut to 2.2 lb·in (0.25 N·m).
- 3. Install the threaded knob (2).
- 4. Tighten the set screw (1).
- 5. Install the blue and black wires onto the headlight switch terminals.
- 6. Install the instrument panel.
- 7. Connect the batteries.

KEY SWITCH

KEY SWITCH REMOVAL

- 1. Disable the vehicle.
- 2. Disconnect the batteries and discharge the controller.
- 3. Remove the instrument panel.
- 4. Make a note of the wire connections.
- 5. Disconnect the wires from the key switch.
- 6. Push on the retaining tabs and remove the key switch cap (1) (Figure 13-13, Page 13-15).

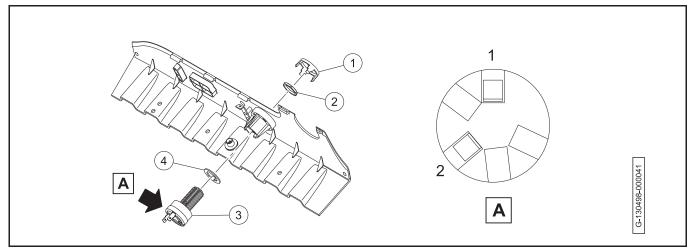


Figure 13-13

- 7. Remove the retaining nut (2).
- 8. Remove the key switch (3) and washer (4).

KEY SWITCH INSTALLATION

- 1. Install the washer (4) onto the key switch (3) (Figure 13-13, Page 13-15).
- 2. Install the key switch into the instrument panel. Make sure that the key switch position is correct.
- 3. Install the retaining nut (2). Tighten the retaining nut to 40 lb·in (4.5 N·m).
- 4. Install the key switch cap (1). Make sure that the retaining tabs engage.
- 5. Connect the green wire to terminal 1.
- 6. Connect the blue wire to terminal 2.
- 7. Install the instrument panel.
- 8. Connect the batteries.

MOTOR CONTROLLER OUTPUT REGULATOR (MCOR)

The Motor Controller Output Regulator (MCOR) is mounted on the side of the pedal group. The MCOR detects the position of the accelerator pedal and sends a corresponding voltage to the controller.

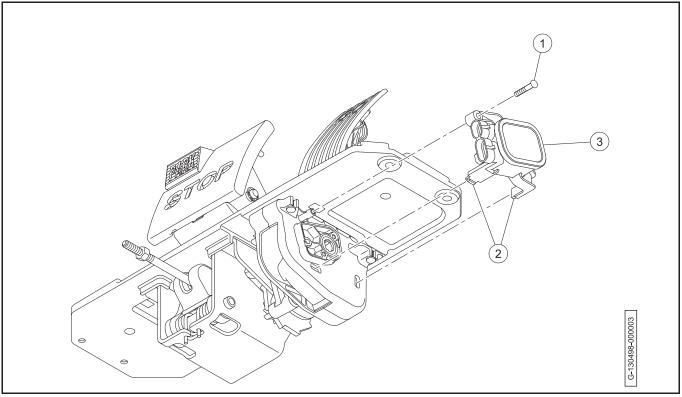


Figure 13-14

MCOR REMOVAL

- 1. Disconnect the batteries and discharge the controller.
- 2. Remove the pedal group.
- 3. Remove the screw (1) (Figure 13-14).
- 4. Disconnect the tabs (2) from the accelerator pedal and remove the motor controller output regulator (MCOR) (3).

MCOR INSTALLATION

1. Install the MCOR (3) onto the accelerator pedal.

NOTE: Rotate the pedal back and forth if necessary to align the D-shaped end of shaft with the MCOR.

- 2. Make sure that the two tabs (2) engage.
- 3. Install the screw (1). Tighten the screw to 19 lb·in (2.1 N·m).
- 4. Install the pedal group.
- 5. Connect the batteries.

MULTI-PURPOSE BUZZER

MULTI-PURPOSE BUZZER REMOVAL

- 1. Disable the vehicle.
- 2. Set the Run/Tow-Stow switch to TOW/STOW.
- 3. Remove the high voltage interlock fuse (HVIL).
- 4. Remove the instrument panel.
- 5. Disconnect the wires from the multi-purpose buzzer.
- 6. Remove the screws (1) (Figure 13-15, Page 13-17).

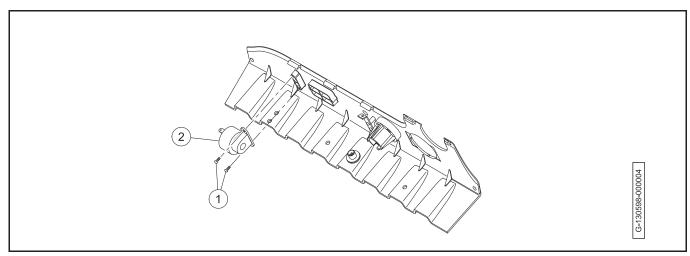


Figure 13-15 Multi-Purpose Buzzer

7. Remove the multi-purpose buzzer (2).

MULTI-PURPOSE BUZZER INSTALLATION

- 1. Install the multi-purpose buzzer (2) with the screws (1) **(Figure 13-15, Page 13-17)**. Tighten the screws to 4 lb·in (0.45 N·m).
- 2. Connect the orange wire to the positive (+) terminal.
- 3. Connect the black wire to the negative (-) terminal.
- 4. Install the instrument panel.
- 5. Install the high voltage interlock fuse (HVIL).
- 6. Set the Run/Tow-Stow switch to RUN.

RUN/TOW SWITCH

See General Warnings on page 1-2.

TESTING THE RUN/TOW SWITCH

See Test Procedure 3 - Run/Tow Switch on page 12-15.

RUN/TOW SWITCH REMOVAL

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 2. Remove the electronics module cover to access back side of the Run/Tow switch (2). **See Electronics Module Cover Removal on page 13-10.**
- 3. Remove Run/Tow switch boot/hex nut (1) (Figure 13-16, Page 13-18).
- 4. Remove Run/Tow switch (2) from electronics module and disconnect the pink wire (3) and light green wire (4).

RUN/TOW SWITCH INSTALLATION

- 1. Installation is reverse of removal. Make sure flat on switch is aligned with flat part of D-shaped hole in electronics module (Figure 13-16, Page 13-18). Tighten Run/Tow switch boot/hex nut (1) to 16 in·lb (1.8 N·m).
- 2. Place the Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.

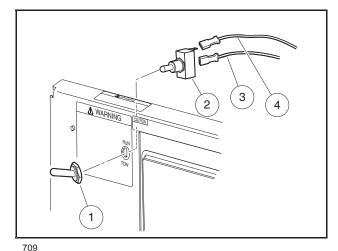


Figure 13-16 Run/Tow Switch

SOLENOID

See General Warnings on page 1-2.

The solenoid is located on the rear side of the electronics module.

TESTING THE SOLENOID

See Test Procedure 8 – Solenoid Activating Coil on page 12-24 and Test Procedure 10 – Solenoid Continuity on page 12-25.

SOLENOID REMOVAL

- Disconnect the batteries and discharge the controller (1). See Disconnect the Batteries Electric Vehicles on page 1-4.
- 2. Remove the electronics module cover (8) to access the solenoid (4). See Electronics Module Cover Removal on page 13-10.
- Disconnect the heavy gauge wires from the solenoid (4) by removing the nuts (7) and washers (10) (Figure 13-8, Page 13-9).
- 4. Disconnect the spade connectors from the solenoid (4).
- 5. Slide solenoid (4) up to disengage the mounting tabs and remove from mounting plate.

SOLENOID INSTALLATION

- 1. Slide solenoid (4) into mounting plate (Figure 13-8, Page 13-9).
- 2. With resistor (11) in place as shown, connect the four wires to the appropriate solenoid terminals. **See**. Tighten the nuts (7) that secure the heavy-gauge yellow and red wires to 72 to 84 in·lb (8 to 9.5 N·m).
- 3. Return electronics module cover (8) to its original location. See Electronics Module Cover Installation on page 13-10.
- 4. Place the Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.

USB RECEPTACLE

The 5-volt, 2.1 amp USB receptacle supplies electricity to power and charge portable devices. The USB receptacle is not for movement of data.

The USB receptacle will only operate when a shielded USB cord is connected. When the USB receptacle is not in use, remove the shielded USB cord to prevent battery drain.

USB RECEPTACLE REMOVAL

- 1. Disable the vehicle.
- Set the Run/Tow-Stow switch to TOW/STOW.
- 3. Remove the high voltage interlock fuse (HVIL).
- 4. Remove the instrument panel.
- 5. Disconnect the USB receptacle wires (1) (Figure 13-17, Page 13-20).

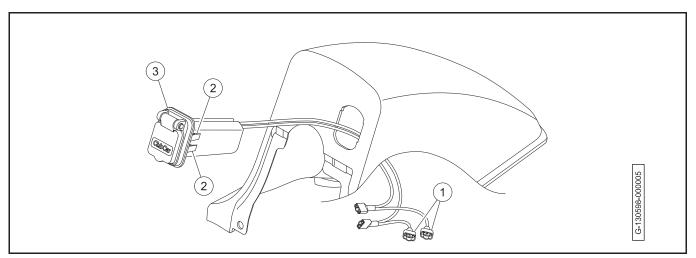


Figure 13-17 USB Receptacle

6. Push the lock tabs (2) on both sides and remove the USB receptacle (3).

USB RECEPTACLE INSTALLATION

- 1. Put the USB receptacle wires (1) into the dash (Figure 13-17, Page 13-20).
- 2. Push the USB receptacle (3) into the dash.
- 3. Make sure that the locking tabs (2) engage.
- 4. Connect the orange/blue instrument panel wire to the red USB receptacle wire.
- 5. Connect the black instrument panel wire to the black USB receptacle wire.
- 6. Install the instrument panel.
- 7. Install the high voltage interlock fuse (HVIL).
- 8. Set the Run/Tow-Stow switch to RUN.

A DANGER

· See General Warnings on page 1-2.

A WARNING

· See General Warnings on page 1-2.

A 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.
- Charge batteries in a well-ventilated area only. Batteries emit hydrogen while being charged. Hydrogen is an explosive gas and must never exceed a level of 2% of the air.
- 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

- 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.
- Use insulated tools when working near batteries or electrical connections. Use extreme caution to avoid shorting of components or wiring.
- Ensure battery connections are clean and properly tightened. See Battery Care on page 14-6.

CAUTION

· On all vehicles, turn off all accessories before charging batteries.

NOTE: Recycle or dispose of discarded batteries in accordance with local, state, and federal regulations.

GENERAL INFORMATION

The batteries supplied with an electric 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 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 TESTING BASICS - 8 VOLT

See General Warnings on page 1-2.

OBSERVATION

Inspect the battery compartment for the following items:

- · Rusted, corroded, or broken battery posts
- · Rusted, corroded, loose or broken wires
- · Low or overfilled electrolyte levels
- · Cracked, punctured, or bulging battery cases
- · Loose, over-tightened, missing, or improperly placed battery hold-downs
- Incorrect orientation of batteries (i.e. terminal posts)
- · Poor, fair, or proper cleanliness of batteries
- · Added electric accessories
- Use of a single-point watering system (SPWS)

MEASURING VOLTAGE OF BATTERY SET

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. 6. Record the reading.

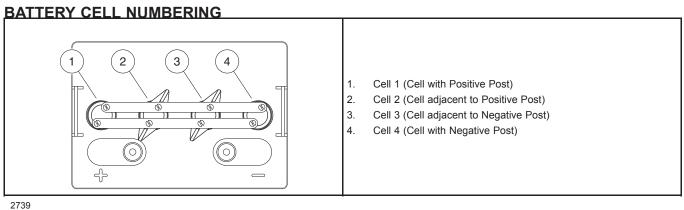


Figure 14-1 Battery Cell Numbering - 8 Volt

BATTERY TESTING – 8 VOLT

See General Warnings on page 1-2.

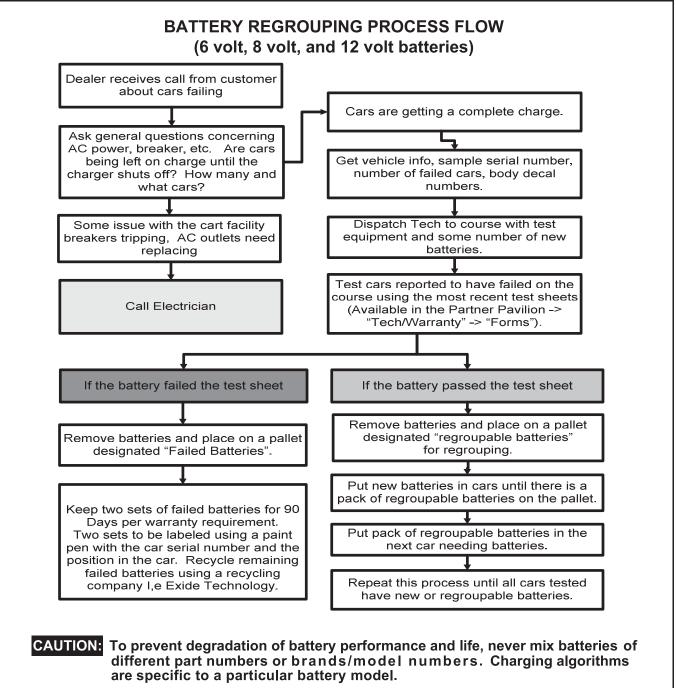
Test procedures not available at time of publication. Refer to any Bulletin that is released concerning testing for Model Year 2015.

BATTERY REGROUPING

CAUTION

To prevent degradation of battery performance and life, never mix batteries of different part numbers
or brands/model numbers. Anytime a different model of battery is used, the charging algorithm must
be changed to match it. For vehicles with PowerDrive charger, the vehicles' onboard computer must
be changed to one that is specific to the battery installed. For vehicles with high-frequency charger
(e.g. ERIC or QuiQ), the charger must be reprogrammed with the appropriate algorithm specific to
the battery installed.

Regrouping is now Club Car's standard battery replacement method. Regrouping is the practice of placing batteries of similar condition together in one vehicle. For example, if there was an issue with the batteries in two cars and the battery test indicated three failed batteries in each car, after removing the failed batteries, there will be six good batteries remaining. Install the six remaining good batteries together in one car and install NEW batteries in the other car. We recommend regrouping batteries in as many cars as possible at a given opportunity to minimize mixing old and new batteries together in one battery pack. A training video for regrouping is available to view in the Partner Pavilion under "Tech/Warranty" and then "Training Videos". Contact your regional Tech Support person to assist you in the regrouping process if needed.



1. Install all new batteries or all regroupable batteries of the same brand and model or part number; do not mix new with regroupable except for the last car regrouped.

2. Accurate and accumulative Amp Hours are required for Warranty claims. Make sure to have battery lights on hand to replace ones that may be defective so you can capture every car's Amp Hour reading.

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Figure 14-2 Battery Regrouping Process Flow

BATTERY REPLACEMENT

See General Warnings on page 1-2.

A WARNING

- · Wear steel-toe shoes when replacing batteries.
- 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.
- When replacing batteries in the Single Point Watering System, place the battery cap from the new replacement battery onto the used battery being removed from the car. Important safety warnings on the battery cap must remain with the battery after it has been removed from the car

CAUTION

- To prevent degradation of battery performance and life, never mix batteries of different part numbers
 or brands/model numbers. Anytime a different model of battery is used, the charging algorithm must
 be changed to match it. For vehicles with PowerDrive charger, the vehicles' onboard computer must
 be changed to one that is specific to the battery installed. For vehicles with high-frequency charger
 (e.g. ERIC or QuiQ), the charger must be reprogrammed with the appropriate algorithm specific to
 the battery installed.
- Before removing batteries, note the orientation of the batteries and the connecting wires. Disconnect the battery
 cables and discharge the controller as instructed. See Disconnect the Batteries Electric Vehicles on
 page 1-4. Remove remaining wires and batteries.
- 2. Visually inspect the new batteries for any damage that may have occurred in transit. New batteries will not deliver their full capabilities until they have been discharged and recharged 50 to 70 times. To obtain the maximum service life from new batteries, restrict vehicles with new batteries to one hour of operation between charges for the first two months vehicle is in service. Batteries should be fully charged before first use of new vehicle, before first use of a vehicle after storage, and before use each day.
- 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.
- 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. Regroup batteries as required. See Battery Regrouping on page 14-3.
- 6. Install regrouped or new batteries in the proper orientation. 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 hold-down retaining nuts to 72 in·lb (8.1 N·m), alternating between hold-down bolts.
- 7. Install wires in proper sequence. Install black wire to negative post of battery no. 6 (6 x 8-Volt battery set) last. See Connect the Batteries Electric Vehicles on page 1-5.
- 8. If replacement batteries have a different part number than the batteries removed, either replace the vehicles' onboard computer or reprogram the high-frequency charger. **See preceding CAUTION.**
- 9. 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 on page 1-2.

WATER QUALITY

Water purity is the most important factor in the performance and life span of the vehicle batteries. Club Car is, therefore, placing increased importance on battery water quality.

Outlined below are four battery watering procedures, grouped into two categories: Preferred and Alternate methods. Club Car recommends the use of a deionizer or distilled water. Alternate methods of reverse osmosis or tap water are allowable but should be avoided since water quality can change from day to day depending on additives, water main leaks, etc.

Preferred Methods

- **Distilled Water:** Distilled water is the most common type of water used in batteries. Distilled water is created by boiling water, collecting the steam, and allowing the steam to condense back into water. The distilling process results in water that is free of minerals that can lead to the degradation of battery performance and life.
- **Deionized Water:** Deionized water is created by inducing electrically charged resins that attract and bind to sodium, calcium, iron, copper, chloride, and bromide ions. The result of this electrical filtering is purified water, which contains little to no mineral ions. To make sure the deionized water remains at a high quality, replace the filter in the deionizer per the manufacturer's recommendations.
- **Deionized Systems:** The Service Parts Department at Club Car offers two deionizer systems: one for vehicles equipped with the Single Point Watering System (SPWS), and one for vehicles without SPWS, (used in combination with AM10818 Battery Watering Nozzle Gun).

Alternate Methods

- Reverse Osmosis: Reverse osmosis involves forcing water through a membrane that allows water to pass while trapping solids. The choice of membrane used determines the amount of solids or impurities that get trapped and hence the purity quality of the filtered water. In addition, the usage frequency of the membrane can also contribute to the filtered water quality. Due to the variance in water quality consistency, Club Car recommends the use of the deionizer or distilled water.
- Tap Water: While the use of tap water without filtering is an alternate method of battery watering, its use should be limited due to the levels of dissolved minerals and chemicals that can degrade battery performance and life. If unfiltered tap water is used, regular water analyses must be conducted to check for impurities. The following chart lists the maximum allowable minerals, solids, and contaminates in parts per million and their impact on battery performance. Water testing, however, is expensive, and water quality can change from day to day depending on additives, water main leaks, etc. Due to the cost and labor of performing water quality tests, Club Car recommends the use of distilled water or a deionizer.

IMPURITY	ALLOWABLE CONTENT (PARTS PER MILLION)	EFFECTS OF IMPURITY
Suspended matter	Trace	N/A
Total solids	100.0	N/A
Organic and volatile matter	50.0	Corrosion of positive plates
Ammonia	8.0	Slight self-discharge of both plates

TABLE CONTINUED ON NEXT PAGE

IMPURITY	ALLOWABLE CONTENT (PARTS PER MILLION)	EFFECTS OF IMPURITY
Antimony	5.0	Self-discharge, reduces life, lower on-charge voltage
Arsenic	0.5	Self-discharge, can form poisonous gas
Calcium	40.0	Increase of positive plate shedding
Chloride	5.0	Loss of capacity in plates, greater loss in positive plates
Copper	5.0	Increased self-discharge, lower on-charge voltage
Iron	3.0	Increased self-discharge, lower on-charge voltage
Magnesium	40.0	Reduced life
Nickel	None allowed	Intense lowering of on-charge voltage
Nitrates	10.0	Increased sulfation of negative plate
Nitrites	5.0	Plate corrosion, loss of capacity, reduced life
Platinum	None allowed	Violent self-discharge, lower on-charge voltage
Selenium	2.0	Positive plate shedding
Zinc	4.0	Slight self-discharge of negative plates

DEIONIZER

Deionizer systems for SPWS configured fleets became standard with Model Year 2014 fleet golf orders.

Regular Maintenance

This system requires regular preventative maintenance on at least a quarterly basis.

• Check all screens and/or filters on water supplies. Clean or replace all filters / line strainers as necessary. Failure to do so can cause a reduction in the water pressure and flow rates needed to operate the system properly. A filter screen can be found on the inlet of all regulators, and a line strainer on all supply hoses. Be sure to replace the deionizer filter cartridge as indicated by the water quality light. The Deionizer system has a battery-powered, water quality light. Deionizer filters have a limited life cycle and are disposable. Life cycle of the filter will vary based on incoming water quality and water usage. If the deionizer system is equipped with a water quality light, press the button to check. Replace filter immediately if the red light comes ON indicating service is required.

Replacement filters are available from Club Car Service Parts.

- Inspect the condition of all tubing, connections, and couplers. Make sure that all parts are in good working condition, secure, leak free, and properly connected. The coupler must have an O-ring and the dust cover properly attached.
- Clean optical indicator of the water quality light. If the optical indicator is dirty, clean it by wiping with a cloth.

Decals

Starting December 2013, new decals were installed on the deionizer wall bracket and the deionizer filter. The blue, deionizer wall bracket decal is a Filter Replacement Record Log. The yellow filter decal is a Fleet Inspection Record Log. Use these decals to record filter replacement activity and fleet inspection activity. For convenience, both decals have a QR code for ordering replacement filters.

Seasonal Maintenance

Water supplies must be drained and stored in an empty state if they will be exposed to freezing temperatures. Failure to do so can cause permanent damage.

Single point watering systems will require seasonal maintenance if vehicles are taken out of service or put into storage for a period of 6 weeks or longer. To prepare the SPWS, ensure the feed tube and coupler are on top of battery. Then, use the following steps to bring vehicle back into service:

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

BATTERY CARE – VEHICLES EQUIPPED WITH THE SINGLE-POINT WATERING SYSTEM

To keep batteries in good working condition, follow this maintenance program on a regular basis:

1. Keep the batteries clean and free of corrosion. Wash tops and terminals of batteries with a solution of baking soda and water; use 1 cup (237 mL) baking soda per 1 gallon (3.8 L) of water. Rinse solution off of the batteries. Do not allow this solution to enter the battery. Be sure terminals are tight. Let the terminals dry and then coat with Battery Terminal Protector Spray. **See following NOTE.**

NOTE: Dispose of waste water properly.

2. The battery hold-downs should be tight enough so that the batteries do not move while the vehicle is in motion, but not so tight as to crack or buckle the battery case. For 8-volt batteries, tighten hold-down retaining nuts to 106 in·lb (12 N·m). The terminal connections should be clean and tight, and any worn insulation or frayed wires should be replaced. Tighten battery terminals to proper torque. See Connect the Batteries – Electric Vehicles on page 1-5. See following WARNING.

WARNING

- If battery wire terminals are damaged or corroded, replace or clean them as necessary. Failure to
 do so may cause them to overheat during operation and could result in fire, property damage, or
 personal injury.
- 3. After use, charge the batteries. The batteries should never be left discharged any longer than absolutely necessary (do not leave discharged overnight).
- 4. Water the batteries monthly or according to the watering interval. See Establishing the Watering Interval for New Vehicles on page 14-8. See Watering Batteries with the SPWS on page 14-11.

CAUTION

- The watering interval must adequately maintain the electrolyte level above the top of the plates. See Figure 14-3.
- Water the batteries only AFTER charging.

NOTE: Bottled distilled water, with the hand pump is recommended for private consumer SPWS applications.

Establishing the Watering Interval for New Vehicles

If you do not already have a battery watering interval for your vehicles, manually check the battery water level weekly to establish the correct watering interval. Thereafter, water batteries according to the established interval. During periods of heavy use, add additional watering as required.

Single-Point Watering System (SPWS) Maintenance

1. For vehicles newly equipped with the Single-Point Watering System, the initial electrolyte level check on all battery cells verifies that all the valves in the SPWS are functioning correctly. **See Periodic Service Schedules on page 10-4.** If a valve fails to open, the cell will eventually dry out. The initial one-time inspection of all cells will identify any occurrence of a valve that fails to open. If a valve fails to close, it will become evident due to

the cell overflowing during routine watering. Either failure scenario is rare, but should be monitored in the initial inspection and during routine watering sessions. Replace malfunctioning valves to ensure maximum battery life. **See following CAUTION.**

CAUTION

- · After checking the electrolyte, fully tighten the battery caps to prevent electrolyte leakage.
- 2. After the initial six-week inspection, manually check the electrolyte level at least once per year, particularly after long-term storage or any other period of vehicle inactivity. **See preceding CAUTION.**

BATTERY CARE - VEHICLES WITHOUT THE SINGLE-POINT WATERING SYSTEM

To keep batteries in good working condition, follow this maintenance program on a regular basis:

1. Keep the batteries clean and free of corrosion. Wash tops and terminals of batteries with a solution of baking soda and water; use 1 cup (237 mL) baking soda per 1 gallon (3.8 L) of water. Rinse solution off of the batteries. Do not allow this solution to enter the battery. Be sure terminals are tight. Let the terminals dry and then coat with Battery Terminal Protector Spray. See following NOTE.

NOTE: Dispose of waste water properly.

 Check the electrolyte level weekly (Figure 14-3). Add water only after charging unless the electrolyte level is below the top of the plates. In this case, add just enough water to cover the plates, charge, and then check the level again. Never charge batteries if plates are exposed above electrolyte level. For best battery life, add only distilled water. See following CAUTION and NOTE.

A CAUTION

· Do not overfill the batteries.

NOTE: A battery watering gun or bottle is available from your authorized Club Car dealer.

3. The battery hold-downs should be tight enough so that the batteries do not move while the vehicle is in motion, but not so tight as to crack or buckle the battery case. For 8-volt batteries, tighten hold-down retaining nuts to 106 in·lb (12 N·m). The terminal connections should be clean and tight, and any worn insulation or frayed wires should be replaced. Tighten battery terminals to proper torque. See Connect the Batteries – Electric Vehicles on page 1-5. See following WARNING.

WARNING

- If battery wire terminals are damaged or corroded, replace or clean them as necessary. Failure to
 do so may cause them to overheat during operation and could result in fire, property damage, or
 personal injury.
- 4. After use, charge the batteries. The batteries should never be left discharged any longer than absolutely necessary (do not leave discharged overnight).

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 14-13.**

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.

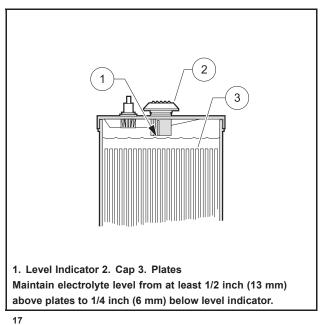


Figure 14-3 Battery Electrolyte Level

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.

The electrolyte level should be checked weekly to be sure electrolyte is at its proper level (Figure 14-3, Page 14-10). 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.

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. **See step 6. of Battery Replacement on page 14-5.** 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 14-5.**

SINGLE POINT WATERING SYSTEM (SPWS)

WARNING

• When replacing batteries in the Single Point Watering System, place the battery cap from the new replacement battery onto the used battery being removed from the car. Important safety warnings on the battery cap must remain with the battery after it has been removed from the car

CAUTION

- · Water the batteries only AFTER charging.
- Use water that meets the quality standards shown on page 14-6. Maximize battery life by removing
 ions and heavy metals from water with the use of a single point watering system deionizer. A deionizer
 for vehicles with SPWS, Club Car Part Number 105166801 is available from Service Parts (DC powered
 water quality indicator light). Replacement cartridge: 104005901. Bottled distilled water, with hand
 pump, Club Car Part Number 104006101, is recommended for private consumer applications.

INITIAL MAINTENANCE OF THE SPWS

After six weeks of operation, remove the valves from the batteries and manually check the battery water level to ensure that the SPWS is not leaving any cells dry. This initial electrolyte level check on all the battery cells verifies that all the valves in the SPWS are functioning correctly. If a valve fails to open, the cell will eventually dry out. The initial one-time inspection of all cells will identify any occurrence of a valve that fails to open. If a valve fails to close, it will become evident due to the cell overflowing during routine watering. Either failure scenario is rare, but should be monitored in the initial inspection and during routine watering sessions. Replace malfunctioning valves to ensure maximum battery life.

After the initial six-week inspection, manually check the battery water levels at least once per year, particularly after winter storage or any other period of vehicle inactivity. **See following NOTE.**

NOTE: For the longest battery life, be sure the mineral contents of the water meet the minimum requirements as stated in the vehicle's appropriate maintenance and service manual. **See Battery Care on page 14-6.**

WATERING BATTERIES WITH THE SPWS

Checking the Water Flow Rate

 Connect the water hose with the built-in screen filter (2) to the water faucet (1) (Figure 14-4). See following CAUTION.

CAUTION

- · Make sure the screen filter is clean.
- Do not use a longer garden hose than provided with the System (20 feet), as a decrease in water pressure could overfill the batteries and damage the refill system.
- 2. Before screwing the hose-end assembly (3) onto the opposite end of the water hose, check the screen filter (4) inside the end of the assembly to make sure it is clean **(Figure 14-4)**.
- 3. Connect the purger (5) to the female coupler (8) on the end of the hose-end assembly (Figure 14-5).

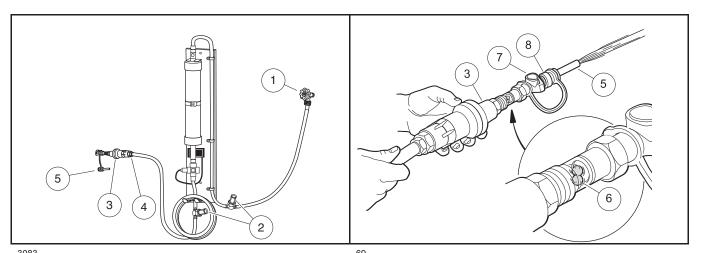


Figure 14-4 Connecting Hose with Filter to Water Source

Figure 14-5 Checking the Water Flow Rate

4. Completely open the water faucet until the water flows out of the hose-end assembly (3), and note the movement of the red flow indicator balls (6). **See following NOTE.**

NOTE: This step also eliminates any trapped air from the water hose.

The water flow rate must be at least 2 gallons per minute (7.6 L per minute) and the water pressure must be no more than 100 psig (689.5 kPa) when static (no flow) for the SPWS to function properly.

- 5. Check the water quality light on the deionizer to make sure the light is green in color, indicating acceptable water quality. If the light indicates unacceptable water quality, the cartridge must be replaced.
- 6. After ensuring adequate water flow rate and water quality, press the grey button (7) on the end of the female coupler (8) to disconnect the purger from the pressure regulator.

Refilling the Batteries

1. Locate the battery fill coupling (9) on the driver side of the battery compartment, remove the dust cover (10) from the male connector (Figure 14-6), and connect the hose-end assembly (3) (Figure 14-7). The water flow will begin immediately.

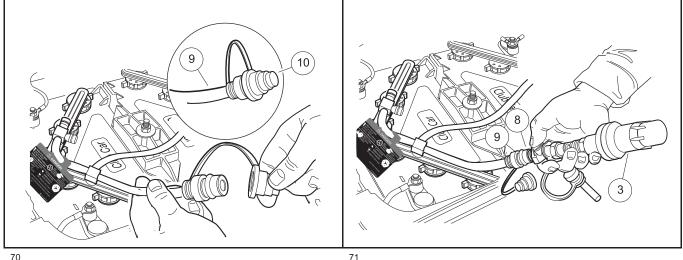


Figure 14-6 Dust Cap

Figure 14-7 Connecting Hose-end Assembly to Battery Fill Connector

2. The red flow indicator balls should swirl, indicating that the batteries are being filled. See following CAUTION.

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CAUTION

- If at any time water overflows from the batteries, immediately stop the refill process, disconnect the pressure regulator from the battery fill coupling, and call for service.
- 3. When the red flow indicator balls stop moving, immediately press the grey button to disconnect the hose-end assembly from the battery fill coupling (9), and squeeze the dust cover (10) to lightly secure it to the male connector of the battery fill coupling (Figure 14-6).
- 4. Place the battery fill coupling into the space between the battery bucket and the car body. Leaving the fill coupling on top of the battery bank or tucked between the batteries and the battery bucket can result in coupling damage.
- 5. Turn the water faucet off when finished filling the vehicle(s).

BATTERY STORAGE

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. **See following NOTE.**

NOTE: When vehicles are being rotated, the CDT (Controller Diagnostic Tool) can be a very helpful service tool. Monitoring the value of the Odometer or Amp-Hours with the CDT simplifies vehicle usage scheduling. **See Monitor Menu, Section 11, Page 11-9.**

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 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 discharged and recharged 50 to 70 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.

Pagination Page

See General Warnings on page 1-2.

A DANGER

- The charging area must be ventilated. Hydrogen level in the air must never exceed 2%. The total volume of air in the charging area must be changed at least five times per hour. Exhaust fans should be located at the highest point of the roof. Contact a local HVAC engineer.
- Do not charge the vehicle batteries with the vehicle covered or enclosed. Any enclosure or cover should be removed or unzipped and pulled back when batteries are being charged. An accumulation of hydrogen gas could result in an explosion.
- Modern Carbon Monoxide (CO) detectors come equipped with sensors that can detect and alert at gas levels below 2%. Make sure proper ventilation is used when charging batteries.

WARNING

- Only trained technicians should repair or service the charger. Contact your nearest Club Car distributor/dealer.
- This vehicle is not intended for use by persons (including children) with reduced physical, sensory or
 mental capabilities, or lack of experience and knowledge, unless they have been given supervision or
 instruction concerning use of the vehicle by a person responsible for their safety. Children should be
 supervised to ensure that they do not play with the vehicle.
- Do not operate the charger if it has received a sharp blow, was dropped, or otherwise damaged in any way.
- · Have worn, cut, or damaged power cords or wires replaced immediately.
- Do not connect a stationary charger to the receptacle if the charger cord, plug, or the vehicle receptacle is broken, damaged, or does not make a good electrical connection. Fire or personal injury can result. Have a qualified technician replace the damaged parts.
- Do not use near fuels, grain dust, solvents, thinners, or other flammables. Chargers can ignite flammable materials and vapors.
- Do not expose to rain or any liquid. Keep the charger dry.
- When the charger is on, the charger DC cord may be disconnected from the vehicle receptacle slowly.
 Jerking or pulling the DC cord out quickly could cause arcing and burning that could damage the plug and receptacle and could cause batteries to explode.
- Do not cover the charger cooling fins. Do not allow clothing, blankets, or other material to cover the charger. The fins dissipate heat and protect the charger from overheating.
- Cooling fins will become hot during charging. Do not touch. Use the handle.
- A battery charger cord, plug or vehicle charge receptacle that has damage or a bad electrical
 connection can cause a fire, property damage, personal injury, or death. Do not use a battery charger
 that has damage, fell, or was hit. Put the cords in an area to prevent them from being stepped on,
 tripped over, or subjected to damage or stress. Speak with your local dealer or distributor for repairs.
- Each charger should have its own dedicated 15 or 20 ampere separately protected (circuit breaker or fuse) single phase branch circuit, in accordance with all applicable electrical codes for the location.

CAUTION

- Study all general information and DANGER, WARNING, CAUTION, and NOTE statements in the Battery Charger section.
- The high-frequency battery charger was specifically designed for use with the high-frequency charging system. Do not use the high-frequency battery charger with other operating systems, and do not use other charger models with high-frequency charging system vehicles.
- The battery charger provided with this vehicle is approved for use only with the battery type
 originally shipped with the vehicle. Using a different battery type (different brand, different capacity,
 etc.) can cause under or overcharging and subsequent battery damage unless the charger is first
 reprogrammed with a new charging algorithm. Club Car only recommends OEM replacement batteries.
 Contact your authorized Club Car dealer/distributor with any questions about battery and charger
 compatibility or algorithm updates.
- · Before charging batteries, turn off all accessories on the vehicle.
- If using an onboard charger, be sure the AC plug is unplugged from the outlet before attempting to drive the vehicle.
- · Be sure the AC cord is properly wound up on the reel before driving the vehicle.
- The battery charger will not operate outside of the minimum and maximum AC Input ranges.
- Do not mount the charger in exceptionally hot locations, such as on a tin exterior wall with southern or western exposure, with chargers stacked together and especially with heatsinks next to each other, etc.

GENERAL INFORMATION

This section includes information, troubleshooting, and service procedures pertaining to the external and onboard battery chargers. Do not attempt to service a battery charger that has not been properly identified. If a battery charger cannot be properly identified, contact your local Club Car dealer or distributor.

The battery charger has no internal parts or components to service or repair. It only has a few external repairs that can be performed. If an internal component needs repair, the battery charger must be replaced.

Because the battery charger has a storage charge feature that automatically checks and recharges the battery as necessary, the battery charger can remain plugged to the vehicle throughout the storage period.

The battery charger is automatic and has no external controls. It functions as an integral part of the vehicles' electrical system and will not work with other electric vehicles. The battery charger is programmed with a specific charge algorithm that is appropriate to the specific battery type used in the vehicle. When the AC cord is connected, the battery charger performs a start-up self-test (all three charger status indicators on the front of the charger flash ON at the same time).

The battery charger supplied with the vehicle resolves the most common problems associated with battery charging. The battery charger utilizes sophisticated charge termination criterion to shut off automatically, preventing the possibility of either undercharging or overcharging. The charger accomplishes this by monitoring battery voltage, charge current, charge time and using strict dV/dt termination criterion.

The battery should never be left in a discharged state, as this too affects the internal components and can reduce the capacity of the battery. The battery should be charged every day they are used. However, the battery should not be charged if they have not been used.

IC 650 BATTERY CHARGER SPECIFICATIONS

MANUFACTURER INFORMATION	
Manufacturer	Delta Q Technologies
Model Name	ERIC
Model Number	IC650-048-CC - without display panel IC650-048-COMM - with display panel
DIMENSIONS AND WEIGHT	•
Length	9.9 in (25.1 cm)
Width	7.3 in (18.5 cm)
Height	3.1 in (7.9 cm)
Weight	5.3 lb (2.4 kg)
OPERATIONAL TEMPERATURE	
Temperature Range: Charging times will be longer when operating outside the temperature range	-40° F to 104° F (-40° C to 40° C)
AC INPUT	
Voltage	85 to 270 VAC minimum/maximum 100 to 240 VAC maximum efficiency range
Current	7.5 A maximum
Frequency	50 to 60 Hz
DC OUTPUT	
Voltage	48 VDC nominal 72 VDC maximum
Current	13.5 A maximum

GOVERNMENTAL AND INDUSTRY CERTIFICATIONS

EUROPEAN CONFORMITY

The battery charger is European conformity (CE) certified per:

- EU 2014/30/EU Electromagnetic Compatibility Directive
- 2014/35/EU Low Voltage Equipment Directive
- 2014/65/EU Restriction of Hazardous Substances Directive
- LV Directives EN 60335-1:2012 and EN 60335-2-29:2004

EMC Directives EN 61000-3-2: 2014, EN 61000-3-3: 2013, EN 61000-6-2: 2005, EN 61000-6-4: 2007

FEDERAL COMMUNICATIONS COMMISSION

The battery charger is Federal Communications Commission (FCC) certified.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in an industrial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

INTERNATIONAL PROTECTION MARKING

The battery charger has an International Protection Marking (IP) certification of IP66.

The battery charger enclosure has an International Protection Marking (IP) certification of IP46.

The battery charger USB receptacle with the dust cover has an International Protection Marking (IP) certification of IP66.

The AC supply connector has an International Protection Marking (IP) certification of IP20.

NOTE: The AC supply connector is applicable for indoor use only. Keep all AC connections clean and dry.

The AC supply connector is applicable for indoor use only. Keep all AC connections clean and dry.

UNDERWRITERS LABORATORIES AND CANADIAN STANDARDS ASSOCIATION

Listed by Underwriters Laboratories (UL) and Canadian Underwriters. Meets the criteria of the Canadian Standards Association (CSA).

FEATURES

AC ELECTRICAL CORD AND PLUG

The AC electric cord has an equipment-grounding conductor and grounding type plug. The AC plug must be connected to a correctly rated ground fault circuit interrupter (GFCI) receptacle with arc flash protection. The receptacle must be installed and grounded in accordance with the National Electrical Code, local codes, and local ordinances.

Two IC650 battery chargers can be on a single phase branch circuit protected by a 15A circuit breaker or fuse.

WARNING

 An extension cord is not recommended. Incorrect connection of the charger AC cord to an extension cord can cause a fire or an electrical shock.

Use of an extension cord with the charger is not recommended. Precautions when the use of an extension cord is necessary:

- The extension cord must accept a three-prong plug.
- The extension cord must be as short as possible and not exceed 12 ft (3.7 m).
- The extension cord must be a three-wire No. 12-AWG (American Wire Gauge) or No. 14-SWG (British Standard Wire Gauge).
- · Make sure that cords will not be stepped on, tripped over, or subject to damage or stress.

ONBOARD BATTERY CHARGER INTERFACE

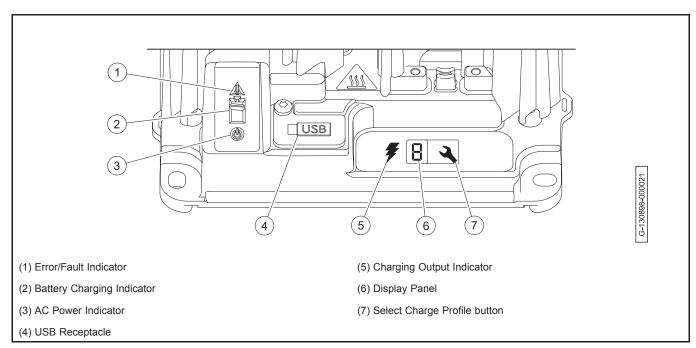


Figure 15-1 Battery Charger Interface

STATUS INDICATOR LIGHTS

LIGHT	STATUS		STATUS EXPLANATION	
	Red (Constant)		Charger fault condition. See Charger Troubleshooting.	
G-130892-000001	Orange (Flash On and Off)		External error condition - caution. See Charger Troubleshooting.	
G-130032-000001	(Flash	Green On and Off)	USB port is active.	
	Green (Constant)		Safe to remove the USB flash drive.	
		Green (Constant)	Charging is complete. Batteries are fully charged.	
		Green (Constant)		
		Green (Flash On and Off)	Charging is in progress. Batteries have reached a high state of charge.	
		Green (Constant)		
		Off		
		Green (Flash On and Off)	Charging is in progress. Batteries have not reached a high state of charge.	
	Blue (Constant)		AC power to charger is present.	

The following table is for battery chargers with a display panel.

LIGHT	STATUS	STATUS EXPLANATION	
7	Yellow (Constant)	The charger output is active. There is a potential risk of electric shock.	
F code E code		Internal fault condition has caused the charging to stop. See the Battery Charger Fault Codes for more information.	
		External error condition has caused the charging to stop. See the Battery Charger Error Codes for more information.	
	P code	The charger programming mode is active.	
	USB code	The USB interface is active. Do not remove the USB flash drive.	

BATTERY CHARGING INTERLOCK

External Battery Charger: The battery charging interlock is a safety feature that prevents possible damage to the battery charger and vehicle. The battery charging interlock will automatically engage when the DC cord is connected to the vehicle. The vehicle will not operate when the DC cord is connected.

NOTE: The AC cord does not have to be connected for the battery charging interlock to operate.

Onboard Battery Charger: The battery charging interlock is a safety feature that prevents possible damage to the battery charger and vehicle. The battery charging interlock will automatically engage when the AC cord is connected to a power source. The vehicle will not operate when the AC cord is connected.

EXTERNAL BATTERY CHARGER MOUNTING

A CAUTION

· If the battery charger is not correctly attached, it can fall and cause damage and personal injury. Do not hang the battery charger by its handle or cord. Correctly attach the battery charger.

NOTE: This section is applicable to an external battery charger. The onboard battery chargers are installed on the vehicle.

Mount the external battery charger in a position that gives it sufficient airflow and the indicator lights are visible.

A strain relief and drip loop is necessary to prevent damage to the charger. The strain relief prevents tension on the AC plug. The drip loop prevents water damage to the AC plug.

HOW TO MAKE A STRAIN RELIEF AND DRIP LOOP

A strain relief and drip loop is necessary to prevent damage to the charger. The strain relief prevents tension on the AC plug. The drip loop prevents water damage to the AC plug.

1. Connect the AC cord (1) into the AC plug (Figure 15-2, Page 15-8).

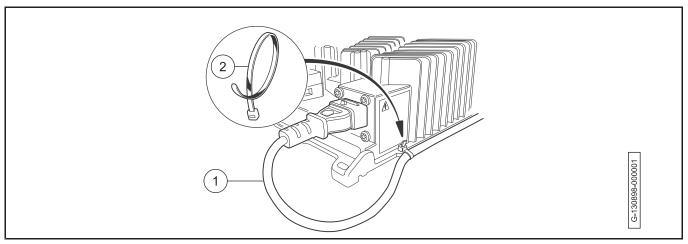


Figure 15-2 Strain Relief and Drip Loop

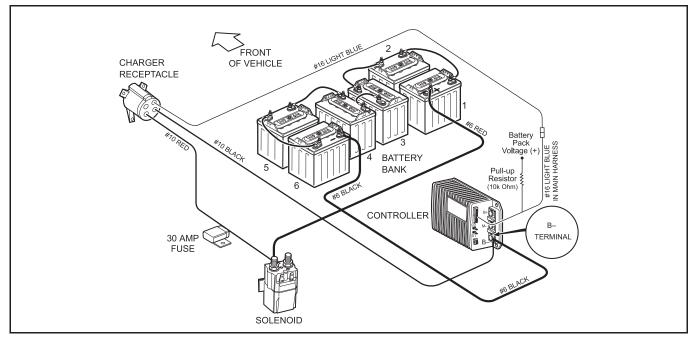
- 2. Supply sufficient AC cord to make a drip loop and strain relief.
- 3. Secure the AC cord to the battery charger with a plastic cable tie (2).

THE CHARGE CIRCUIT

EXTERNAL CHARGE CIRCUIT

The external charge circuit consists of the:

- · Charger receptacle
- · Interlock wire
- Controller
- Solenoid
- Battery pack



2788

Figure 15-3 Charge Circuit – External High-Frequency Charger

ONBOARD CHARGE CIRCUIT

The onboard charge circuit consists of the:

- · Interlock wire
- Controller
- Solenoid
- Battery pack

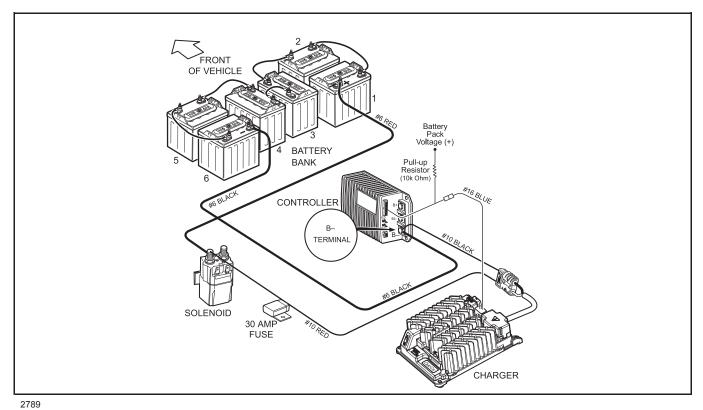


Figure 15-4 Charge Circuit – Onboard High-Frequency Charger

BATTERY CHARGER OPERATION

CHARGING WITH EXTERNAL CHARGER

- 1. Turn the key to OFF.
- 2. Turn off all accessories.
- 3. Connect the AC cord to the charger.
- 4. Connect the AC cord to the power source.

CAUTION

- Incorrect removal and installation of the DC cord can cause DC cord damage and vehicle charger receptacle damage. Do not twist, bend, or move the DC cord plug side to side. Do not pull on the DC cord. Hold the plug handle and push the plug straight into the vehicle charger receptacle.
- 5. Connect the DC cord to the vehicle charger receptacle (1).

NOTE: The vehicle will start to charge in 2 to 10 seconds.

The charge indicator light will flash and the multi-purpose buzzer will operate when the vehicle starts to charge.

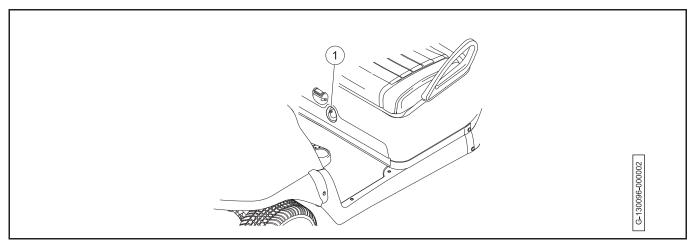


Figure 15-5 Vehicle Charger Receptacle

▲ DANGER

- If the DC cord is removed too fast, arcing and burning can cause damage to the plug, receptacle, and cause the batteries to explode. Remove the DC cord slow.
- 6. Before vehicle operation, disconnect the DC cord from the vehicle charger receptacle.

CHARGING WITH ONBOARD CHARGER

- 1. Turn the key to OFF.
- 2. Turn off all accessories.
- 3. Connect the AC cord (1) to the power source.

NOTE: The vehicle will start to charge in 2 to 10 seconds.

The charge indicator light will flash and the multi-purpose buzzer will operate when the vehicle starts to charge.

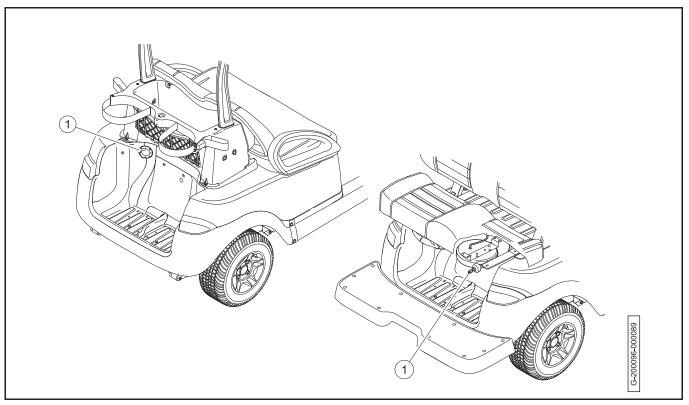


Figure 15-6 AC Cord

- 4. Before vehicle operation:
- 4.1. Disconnect the AC cord from the power source.
- 4.2. Retract the AC cord.

ALGORITHM

CAUTION

The battery charger provided with this vehicle is approved for use only with the battery type
originally shipped with the vehicle. Using a different battery type (different brand, different capacity,
etc.) can cause under or overcharging and subsequent battery damage unless the charger is first
reprogrammed with a new charging algorithm. Club Car only recommends OEM replacement batteries.
Contact your authorized Club Car dealer/distributor with any questions about battery and charger
compatibility or algorithm updates.

EXTERNAL BATTERY CHARGER

How To View Algorithm - External Battery Charger

- 1. Format a USB 2.0 flash drive as FAT16 or FAT32. Make sure the USB is blank.
- 2. Connect the AC cord to the battery charger.
- 3. Connect the AC cord to the power source.
- 4. Disconnect the DC cord from the vehicle.
- 5. Wait until only the blue light (1) is on (Figure 15-7).

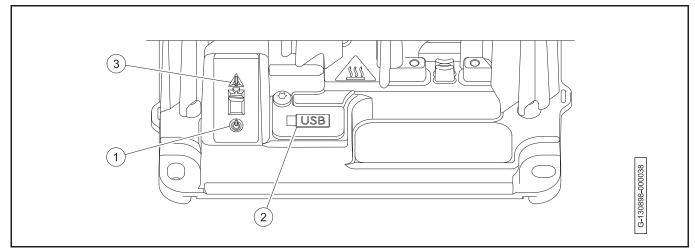
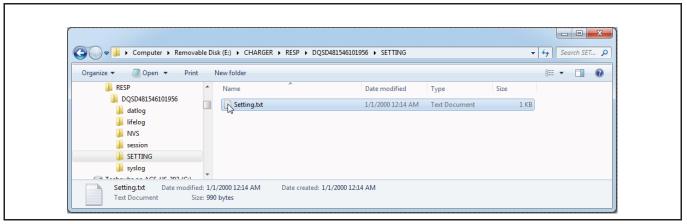


Figure 15-7 USB Dust Cover

- 6. Remove the USB dust cover (2).
- Connect the USB flash drive to the battery charger. The green triangle light (3) will flash for approximately 10 seconds.
- 8. When the green triangle light is constant, remove the USB flash drive.
- 9. Install the USB dust cover.
- 10. Connect the USB flash drive to a PC.
- 11. Open the USB flash drive.

Algorithm

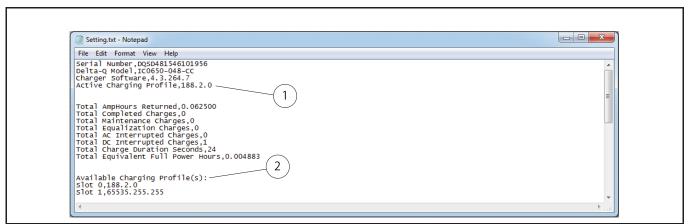
Go to CHARGER/RESP/Battery charger serial number/SETTING (Figure 15-8). 12.



G-130898-000051

Figure 15-8 Setting.txt File Location

Open the Setting.txt file (Figure 15-9). 13.



G-130898-000052

Figure 15-9 Setting.txt File

The Active Charging Profile (1) displays the active algorithm.

The Available Charging Profile(s) (2) displays the algorithms that are loaded on the battery charger.

- JCI battery algorithm 31.2.0
- Trojan battery algorithm 188.2.0

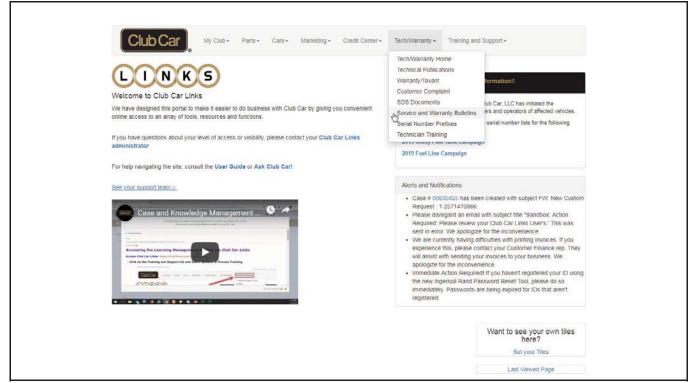
How To Install Trojan Algorithm - External Battery Charger

CAUTION

• This procedure is for external chargers only. Do not use this procedure on an onboard charger.

The Trojan battery algorithm is for Trojan T875 and T890 8-Volt batteries. For all other battery algorithms, see Update Battery Charger With USB.

- 1. Format a USB 2.0 flash drive as FAT16 or FAT32. Make sure the USB is blank.
- 2. Login to Club Car Links via https://www.clubcar.com.
- 3. Click on the Tech/Warranty drop-down menu and select Service and Warranty Bulletins (Figure 15-10).

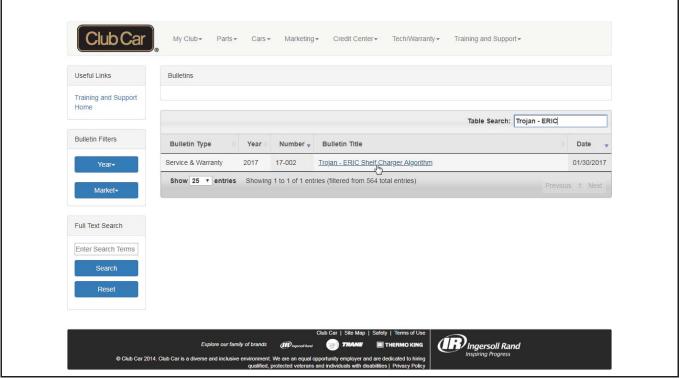


G-130898-000050

Figure 15-10 Service and Warranty Bulletins

4. Find the Trojan - ERIC Shelf Charger Algorithm.

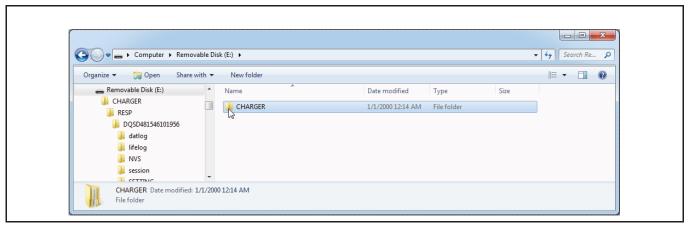
5. Click on the Trojan - ERIC Shelf Charger Algorithm link (Figure 15-11).



G-130898-000053

Figure 15-11 Trojan - ERIC Shelf Charger Algorithm

- 6. Open the Trojan ERIC Shelf Charger Algorithm.zip file.
- 7. Copy the CHARGER folder to the USB flash drive (Figure 15-12).



G-130898-000049

Figure 15-12 CHARGER Folder

- 8. Safely eject the USB flash drive from the computer.
- 9. Connect the AC cord to the battery charger.
- 10. Connect the AC cord to the power source.
- 11. Disconnect the DC cord from the vehicle.

12. Wait until only the blue light (1) is on (Figure 15-13).

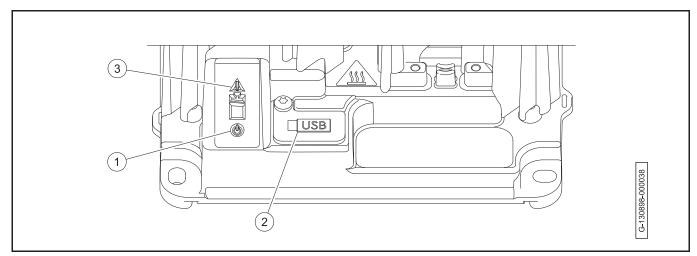


Figure 15-13 USB Dust Cover

- 13. Remove the USB dust cover (2).
- 14. Connect the USB flash drive to the battery charger. The blue light and green triangle light (3) will turn off and on for approximately three minutes.
- 15. When the blue light and green triangle light are constant, remove the USB flash drive.
- 16. Install the USB dust cover.

ONBOARD BATTERY CHARGER

How To View Algorithm - Onboard Battery Charger

- 1. Disconnect the AC cord from the battery charger. Wait 30 seconds.
- 2. Push and hold the Select Charge Profile button (1) (Figure 15-14, Page 15-18).

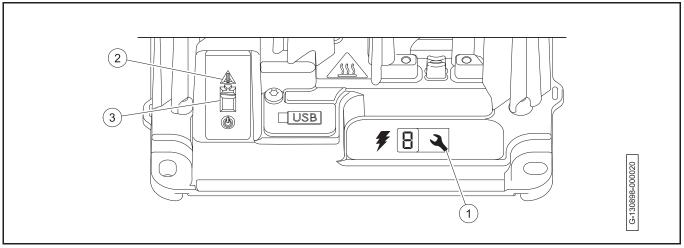


Figure 15-14 Algorithm Change

- 3. While pushing the Select Charge Profile button, connect the AC cord to the battery charger.
- 4. Continue to push the Select Charge Profile button until the Error/Fault Indicator (2) illuminates amber and the Battery Charging Indicator (3) is flashing green.

NOTE: Wait approximately 25 seconds.

- 5. Release the Select Charge Profile button.
- 6. Push and release the Select Charge Profile button to advance through the charging algorithms.

NOTE: The selected charging profile will be displayed up to three times (P-0-3-1 for Profile 31).

BATTERIES	ALGORITHM NUMBER	
JCI	31	
Trojan	188	

How To Change Algorithm - Onboard Battery Charger

- Disconnect the AC cord from the battery charger. Wait 30 seconds.
- 2. Push and hold the Select Charge Profile button (1) (Figure 15-14, Page 15-18).

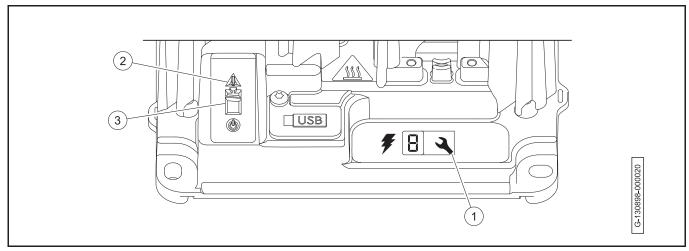


Figure 15-15 Algorithm Change

- 3. While pushing the Select Charge Profile button, connect the AC cord to the battery charger.
- 4. Continue to push the Select Charge Profile button until the Error/Fault Indicator (2) illuminates amber and the Battery Charging Indicator (3) is flashing green.

NOTE: Wait approximately 25 seconds.

- 5. Release the Select Charge Profile button.
- 6. Push and release the Select Charge Profile button to advance through the charging algorithms.

NOTE: The selected charging profile will be displayed up to three times (P-0-3-1 for Profile 31).

BATTERIES	ALGORITHM NUMBER
JCI	31
Trojan	188

- When the desired charging algorithm is displayed, push and hold the Select Charge Profile until the Error/Fault Indicator and Battery Charging Indicator turns off and the AC Power Indicator remains on (approximately 10 seconds).
- 8. Push and release the Select Charge Profile button to view the selected algorithm.

UPDATE BATTERY CHARGER WITH USB

- Contact Club Car to obtain the required algorithm, software, and settings files for the correct battery charger and vehicle model.
- 2. Format a USB 2.0 flash drive as FAT16 or FAT32. Make sure that the USB flash drive is blank.
- Connect the AC cord to the battery charger. 3.
- Connect the AC cord to the power source. 4.
- Disconnect the DC cord from the vehicle. 5.
- Wait until only the blue light (1) is on (Figure 15-13). 6.

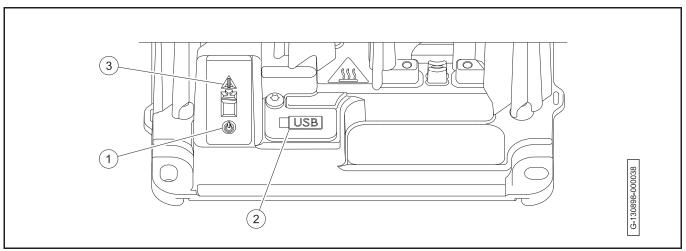


Figure 15-16 USB Dust Cover

- 7. Remove the USB dust cover (2).
- Connect the USB flash drive to the battery charger. The blue light and green triangle light (3) will turn off and on for approximately three minutes.
- 9. When the blue light and green triangle light are constant, remove the USB flash drive.
- Install the USB dust cover. 10.

INSPECTION AND MAINTENANCE

To ensure trouble-free performance, it is very important to follow an established preventive maintenance program. Regular and consistent maintenance can prevent vehicle downtime and expensive repairs that can result from neglect.

Any charger 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.

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.
- · Do not wear loose clothing or jewelry, such as rings, watches, chains, etc., when servicing the charger.

A DANGER

- To prevent fire, immediately replace battery charger DC cord plug and receptacle if the following conditions exist:
 - Plug pins have worn nickel plating and copper is exposed.
 - Plug requires an inordinate amount of force to insert into receptacle, especially if accompanied by a "grinding" feel.

WARNING

• If pins are bent, the plug must be replaced immediately. The plug is not serviceable. Do not attempt to repair the plug or straighten bent pins.

ELECTRICAL CORDS

CAUTION

An electrical short in the DC cord can cause the 30 amp fuse to blow. If there is damage to the DC cord, replace the DC cord.

Examine electrical cords for wear and damage before use. Immediately replace electrical cords for:

- Cracks
- Cuts
- · Frayed wiring
- · Insulation damage
- · Loose connections
- · Splices

Make sure that the DC electrical cord has the warning tag attached and that the warning tag is readable. Replace a missing or damaged warning tag immediately.

ELECTRICAL PLUGS AND RECEPTACLES

Examine electrical plugs for wear and damage before use. Immediately replace electrical plugs for:

- · Bent pins
- Corrosion
- Cracks
- · Loose connections
- · Missing pins
- · Worn pins

CLEAN THE ELECTRICAL PLUGS AND RECEPTACLES

A DANGER

- Lubricating the plug and receptacle with the AC cord connected to a power source can cause property damage, electrical shock, serious injury, and death. Do not lubricate the plug and vehicle charge receptacle with the AC cord connected to a power source.
- 1. Disconnect the AC cord from the power source.
- 2. Disconnect the AC cord from the battery charger.
- 3. Disconnect the DC cord from the vehicle charge receptacle.
- 4. Apply electrical contact cleaner to the electrical plugs and receptacles. Refer to the manufacturer instructions.
- 5. Clean the electrical plugs and receptacles.
- 6. Clean the receptacle contacts.
- 7. Lubricate the electrical plugs and receptacles with WD-40®.
- 8. Make sure that the DC cord can be easily connected and disconnected.

BATTERY CHARGER USB RECEPTACLE

The movement of charger data and download of the charge algorithm is done through the USB receptacle. Use of the USB receptacle is for approved persons and technicians.

The USB receptacle can have intermittent connectivity because of environmental contaminates. Always install the USB dust cover to protect the USB receptacle.

CLEAN THE USB RECEPTACLE

- 1. Disconnect the DC cord from the vehicle charge receptacle.
- 2. Disconnect the AC cord from the power source.
- 3. Carefully remove large contaminates.
- 4. Use compressed air in short intervals to remove dust and smaller contaminates.
- Clean the port with a cotton swab and rubbing alcohol or electronics cleaner solvent. Let sufficient time for the alcohol or solvent to dry.
- 6. If contamination continues, apply dielectric grease to the USB receptacle.
- Install the USB dust cover.

BATTERY CHARGER TROUBLESHOOTING

A DANGER

• Do not touch any wire or component in the battery charger while AC power is present. Failure to heed this warning will result in an electric shock.

A WARNING

- Knowledge of battery charger wiring and component terminology is required before attempting any repair. See The Charge Circuit on page 15-9.
- Prior to servicing the external charger, disconnect the DC plug from the vehicle charge receptacle and the AC power supply cord from the wall outlet.
- Prior to servicing the onboard charger, disconnect the AC power supply cord from the wall outlet and remove the battery charger from the vehicle.

NUMBERING VEHICLES AND CHARGERS

Number the vehicle and battery charger. Use the same battery charger to charge the battery. If the vehicle dies while in use and testing shows the battery is good, then the problem is most likely with the battery charger.

AC POWER SOURCE

Make sure that the AC power source meets the AC Input specifications. The electrical service to the vehicle storage facility must supply adequate voltage, current, and frequency to each charger with all the chargers turned on. If not, consult your local power company or electrical contractor.

Symptoms of an AC power source problem include:

- · Circuit breakers trip
- Fuses blow
- · Battery does not fully charge during adequate time

TERMINAL BLOCK COVER

The terminal block cover prevents water exposure and prevents a short across the terminals, which will blow the 30-amp fuse.

RESET POWER – EXTERNAL CHARGER

Before replacing the charger, reset the charger in case the failure was caused by a temporary situation.

- 1. Disconnect the DC cord from the vehicle.
- 2. Disconnect the AC cord from the AC power source.
- 3. When the red triangle status indicator light turns off, wait 30 seconds.
- 4. Connect the AC cord to the AC power source.
- 5. When the blue status indicator light turns on, connect the DC cord to the vehicle.
- 6. If the triangular status indicator flashes orange, see Battery Charger Error Codes.
- 7. If the triangular status indicator is solid red, see Battery Charger Fault Codes.
- 8. If the light does not come back on, charge the vehicle as usual.

RESET POWER - ONBOARD CHARGER

Before replacing the charger, reset the charger in case the failure was caused by a temporary situation.

- 1. Disconnect the AC cord from the AC power source.
- 2. Disconnect the DC cord from the battery charger.
- 3. When the red triangle status indicator light turns off, wait 30 seconds.
- 4. Connect the AC cord to the AC power source.
- 5. When the blue AC status indicator light comes on, connect the DC cord to the battery charger.
- 6. If the triangular status indicator flashes orange, see Battery Charger Error Codes.
- 7. If the triangular status indicator is solid red, see Battery Charger Fault Codes.
- 8. If the light does not come back on, charge the vehicle as usual.

EXTERNAL CHARGER TROUBLESHOOTING INDICATORS

If a fault occurs, count the number of red flashes (on the charger or dash) between pauses and refer to the table below:

EXTERNAL CHARGER TROUBLESHOOTING GUIDE				
CHECK STATUS INDICATOR LIGHT	STATUS	STATUS EXPLANATION	POSSIBLE CAUSES (check in order shown)	SOLUTIONS
OFF	AC power to charger is NOT present.	1. AC cord connection	Unplug and inspect AC cord. Reconnect and attempt to charge again.	
		AC power supply was shut off	Verify AC power is present and charge again. See AC Power and Continuity Test of AC Circuit on page 15-30.	
		AC circuit breaker is tripped	Reset AC circuit breaker and charge again.	
		Improper AC outlet voltage	Test AC outlet voltage and correct if necessary. See AC Power and Continuity Test of AC Circuit on page 15-30.	
			5. Failed AC plug or cord	Replace cord. See AC Power and Continuity Test of AC Circuit on page 15-30.

TABLE CONTINUED ON NEXT PAGE

EXTERNAL CHARGER TROUBLESHOOTING GUIDE				
		Erroneous event (an unknown variable; something occurred to the charger or vehicle that was not the fault of either)	Reset charger power. See Reset Power – External Charger on page 15-24. Reconnect DC cord to vehicle. If status goes away, continue using charger.	
			2. Battery high voltage	Ensure battery set is rated 48 volts and composed of 24 cells. See Battery Voltage Using Multimeter on page 15-29. If not, replace with correct battery set. Reset charger power. See Reset Power – External Charger on page 15-24.
	Charger unable to	3. Battery low voltage	Ensure battery set is rated 48 volts and composed of 24 cells. Also, check the voltage of each individual battery. See Battery Voltage Using Multimeter on page 15-29. If not, replace with correct battery set. Reset charger power. See Reset Power – External Charger on page 15-24.	
		complete charge. (Usually not related to charger	Charge timeout caused by battery pack not reaching required voltage.	Check for loose or corroded connections. Check for old or defective batteries. See Test Procedures on page 15-29.
G-130892-000001 Flashing orange	itself. Something occurred to prevent the charger from completing the charge. Check external factors	5. Bad battery pack	Test battery pack health. Look for shorted or damaged cells. See Battery Condition Using Charger on page 15-29. See also Electric Vehicle - Batteries on page 14-1.	
		6. AC voltage out-of-range	Test and inspect incoming AC power. See AC Power and Continuity Test of AC Circuit on page 15-30.	
		first.)	7. Ambient temperature too hot (above 104 °F (40 °C))	Check for dirty, obstructed, or damaged cooling fins. Clean if necessary and ensure sufficient cooling air flow. Chargers stacked on top of or located too close to each other. Move chargers farther apart. If issue continues, wait for ambient temperature to cool or relocate charger to a cooler environment.
			8. Ambient temperature too cold (below -40 °F (-40 °C))	Wait for ambient temperature to warm or relocate charger to a warmer environment.
			9. Bad DC connection	Inspect charger receptacle, receptacle harness connections and DC cord connection to charger. See DC Plug and Receptacle on page 15-29. See Charger DC Circuit Continuity Test on page 15-30.
		10. Corroded or loose connections	Clean or tighten connections.	
G-130892-000001	Solid red	Charger error	Charger abnormality	Reset charger power. See Reset Power – External Charger on page 15-24. Reconnect DC cord to vehicle. If status goes away, proceed to charge again. See Charger Output Test on page 15-31. If status occurs again during the next charge cycle, attempt to charge with another identical charger. If charge is successful, proceed to step 2. If status occurs again, troubleshoot the AC power supply, vehicle and battery pack.
		2. Charger internal fault	Replace charger.	

ONBOARD BATTERY CHARGER ERROR CODES

The "E" codes will appear in the display panel followed by three numbers and a period to indicate the different conditions.

ERROR CODES	DESCRIPTION	SOLUTIONS
E-0-1-2	Reverse polarity error	This error will automatically clear once the condition has been
	Possible Cause:	corrected.
	 Battery is connected the wrong way around 	Make sure that the battery wires are connected correctly.
E-0-1-3	Battery does not take current	
	Possible Cause:	This error will automatically clear once the battery charger power is reset.
	 Electrical device connected between the battery charger and the battery, which passes through voltage but not cur- rent 	Reset the battery charger power. If problem continues, contact Club Car.
	Error in the BMS/VCM software configuration	
E-0-1-3	USB operation failed (software)	This error will automatically clear once the battery charger power is reset.
E-0-1-8 E-0-2-6	Possible Causes: • USB flash drive not formatted correctly	Make sure the USB flash drive is correctly formatted and not corrupted.
		Try to update the battery charger again.
E-0-1-7 E-0-2-7	USB operation failed (hardware)	 This error will automatically clear once the battery charger power is reset. Remove and install the USB flash drive. Disconnect the AC cord from the power source for a minimum of 30 seconds. Try to update the battery charger again.
	Algorithm error	This error will automatically clear once the battery charger
E-0-2-0		power is reset.
E-0-2-8	Possible Cause: • The algorithm is not compatible with the software version	Install the latest software and algorithm. Select the correct algorithm.
E-0-2-3	High AC voltage error (>270VAC) Possible Cause: • AC power source voltage is too high	This error will automatically clear once the condition has been corrected.
		NOTE: The dash display will display SERVIC. Vehicle fault code 77 will automatically clear once the condition has been corrected.
		Connect the battery charger to an AC source that provides stable AC between 85 - 270 VAC / 45 - 65 Hz.
E-0-2-4	Charger failed to turn on properly	This error will automatically clear once the battery charger power is reset. 1. Disconnect the AC input for 30 seconds. Connect the AC
		input.

TABLE CONTINUED ON NEXT PAGE

ERROR CODES	DESCRIPTION	SOLUTIONS
E-0-2-5	Low AC voltage oscillation error Possible Causes: • The AC power source is unstable • The AC power source is undersized and/or the input cables are too long or too small	This error will automatically clear once the battery charger power is reset. **NOTE: The dash display will display SERVIC. Vehicle fault code 78 will automatically clear once the condition has been corrected.** 1. Connect the charger to an AC source that provides stable AC between 85 - 270 VAC / 45 - 65 Hz.
E-0-3-1	ADC error Possible Causes: • Internal battery charger error	This error will automatically clear once the battery charger power is reset. 1. Reset the battery charger power. 2. If problem continues, contact Club Car.
E-0-3-7 E-0-4-1	Configuration error Possible Causes: • The battery charger software configuration is incorrect	This error will automatically clear once the battery charger power is reset. 1. Install the latest software and algorithm.
E-0-3-9	Button error Possible Causes: • The Select Charge Profile button is not operating correctly.	This error will automatically clear once the battery charger power is reset. 1. Reset the battery charger power. 2. If problem continues, contact Club Car.
E-0-4-2 E-0-4-4 E-0-4-6	CAN communication error Possible Cause: • Error communicating on the CAN bus	This error will automatically clear once the battery charger power is reset. 1. Check the battery charger CAN connections. 2. Check for contamination on the CAN bus harness.
E-0-4-7	Platform overvoltage alarm Possible Causes: • A battery or some other source has been connected to the charger that exceeds the hardware's design limits • VCM/BMS issue	This error will automatically clear once the battery charger power is reset. 1. Make sure the correct battery is installed. 2. If the problem continues, contact Club Car.

ONBOARD BATTERY CHARGER FAULT CODES

The "F" codes will appear in the display panel followed by three numbers and a period to indicate the different conditions.

BATTERY CHARGER FAULT CODES					
FAULT CODE	DESCRIPTION	SOLUTIONS			
F-0-0-1					
F-0-0-2	Internal charger fault	This error will automatically clear once the battery			
F-0-0-3	5 6	charger power is reset.			
F-0-0-4	Possible Causes:	Reset the battery charger power.			
F-0-0-5	Internal failures due to vibration	If the problem continues, contact Club Car.			
F-0-0-6		z a.o p. oz.a oz.a.a.a.o, oz.a.a.			

TEST PROCEDURES

See General Warnings on page 1-2.

When the upper green light is flashing, indicating the charger is in finish charge, it is okay to begin a battery discharge test if so desired.

Index of Test Procedures

- 1 Battery Voltage Using Multimeter
- 2 DC Plug and Receptacle
- 3 Battery Condition Using Charger
- 4 On-Charge Battery Voltage Using Charger And Multimeter
- 5 AC Power and Continuity Test of AC Circuit
- 6 Charger DC Circuit Continuity Test
- 7 Charger Output Test

TEST PROCEDURE 1 – Battery Voltage Using Multimeter

- 1. Check battery pack voltage. See Measuring Voltage of Battery Set, Section 14, Page 14-2.
- 2. Normal no-load voltage should be between 50 and 52 volts for a fully charged battery set. Normal no-load voltage of an individual battery should not be less than 0.7 volts of the other 5 batteries (for 6 x 8-volt battery set).

TEST PROCEDURE 2 - DC Plug and Receptacle

- 1. Check the DC plug and the vehicle charger receptacle for damage, dirt, corrosion, bent pins or any condition that might prevent a sound electrical connection.
- 2. Inspect the receptacle contacts to ensure that they are not damaged and they are firmly seated within the receptacle.
- 3. Check the wire connections from the charger receptacle.
- 3.1. Verify that the 10-gauge red wire from the charger receptacle is connected to the large post of solenoid with 6-gauge red wire (**Figure 15-3**, **Page 15-9**).
- 3.2. Verify that the 10-gauge black wire from the charger receptacle is connected to the B- terminal of controller.
- 3.3. Verify that the 16-gauge light blue wire from the charger receptacle is connected to the light blue wire bullet connector from the main wire harness.
- 4. With batteries connected, DC cord disconnected, and using a multimeter set to 200 volts DC, place the black (–) probe in the charger receptacle socket connected to the black 10-gauge wire and place the red (+) probe in the charger receptacle socket connected to the red 10-gauge wire. The reading should be 48 to 50 volts (full battery voltage).
- 5. If the reading is not 48 to 50 volts, check the following items:
 - The 30-amp fuse (located near solenoid) in the 10-gauge red wire of the charger receptacle harness.
 - Continuity of the 10-gauge red wire from the solenoid to the receptacle socket.
 - Continuity of the 6-gauge red wire from the positive post of battery no. 1 to the solenoid.

TEST PROCEDURE 3 – Battery Condition Using Charger

The easiest way to monitor the condition of a vehicle's batteries is simply to observe the Charger Status Indicators on the charger at the end of the charge cycle. After a full charge, disconnect the charger DC plug, wait 30 seconds and reconnect the charger DC plug. The battery-shaped status indicator will be green with the upper half flashing at first and then stay on continuously within 10 to 20 minutes, indicating sound, fully charged batteries.

NOTE: Batteries near the end of their useful lives may not allow the battery charge current to taper and the upper half of the battery-shaped status indicator will continue to flash. **Section 14** — **Electric Vehicle - 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. If the upper half of the battery-shaped status indicator does not stop flashing, the batteries should be tested further using the on-charge voltage test.

TEST PROCEDURE 4 – On-Charge Battery Voltage Using Charger And Multimeter

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. 6 (for 6 x 8-volt battery set). 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.

Old batteries may have enough capacity left to last several more months.

TEST PROCEDURE 5 - AC Power and Continuity Test of AC Circuit

- 1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
- 2. Check the AC line fuse or circuit breaker in the storage facility.
- 3. With a multimeter set to 500 volts AC, check incoming AC voltage. Insert multimeter test probes into AC wall outlet; voltage should be between 85 and 270 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
- 4. If the charger will not power ON, check AC cord connections.
- 5. If the charger is connected correctly, check continuity of the AC cord wires.

TEST PROCEDURE 6 – Charger DC Circuit Continuity Test

- 1. Disconnect the AC cord from the wall outlet and the DC cord from the vehicle charger receptacle.
- 2. Remove DC terminal block cover. See Terminal Block Cover Removal on page 15-52.
- 3. Note polarity and loosen screws securing DC cord wires. Pull wires from DC terminals on charger.
- 4. Check continuity of the DC cord wires from plug pin to fork terminal.
- 5. When finished, attach DC cord white wire to positive terminal (+) and black wire to negative terminal (–) with torx screws. **See following NOTE.** Tighten torx screws to 39.8 in·lb (4.5 N·m).

NOTE: The positive symbol (+) and negative symbol (-) are molded into the terminal block for easy identification.

Install terminal block cover. See Terminal Block Cover Installation on page 15-32.

TEST PROCEDURE 7 – Charger Output Test

Without a Meter: Connect DC cord and start a charge cycle. If buzzer sounds three times, then charger is functioning. Both a confirmed connection with the charger and a rise in battery pack voltage are required for buzzer to sound three times. **See following NOTE.**

NOTE: The number of flashes and beeps can vary depending on the Beep Option setting. **See Beep Option**, **Section 11, Page 11-8.**

With a Meter: A clamp meter can be used to measure current in the red battery cable (connected to the positive (+) post of battery no. 1) while charging. Current can reach just over 13-amps at the beginning of a charge session and taper down to approximately 5-amps near the end.

EXTERNAL CHARGER REPAIRS

▲ WARNING

- Knowledge of battery charger wiring and component terminology is required before attempting any repair.
- Prior to servicing the charger, disconnect the DC cord from the vehicle charge receptacle and the AC cord from the AC outlet.

NOTE: This charger has no internal components to service or repair. It only has a few external repairs that can be performed. If an internal component needs repair, the charger must be replaced.

TERMINAL BLOCK COVER REMOVAL

- 1. Disconnect the DC cord from the vehicle charge receptacle.
- 2. Disconnect the AC cord from the AC power source.
- 3. Push in the mounting tabs (1) and remove the terminal block cover (Figure 15-17, Page 15-32).

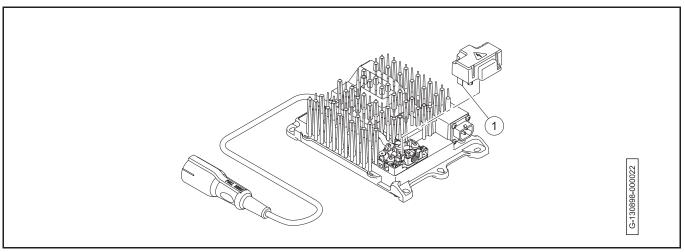


Figure 15-17 Terminal Block Cover

TERMINAL BLOCK COVER INSTALLATION

WARNING

- The terminal block cover on the DC terminal block must be installed correctly to comply with UL code. This cover prevents water exposure and prevents a short across the DC terminals.
- 1. Align the terminal block cover with the terminal block.
- 2. Push the terminal block cover until the mounting tabs (1) lock (Figure 15-17, Page 15-32).

DC CORD REMOVAL

- 1. Disconnect the DC cord from the vehicle charge receptacle.
- 2. Disconnect the AC cord from the AC power source.
- 3. Remove the terminal block cover.
- 4. Remove the screws (1) (Figure 15-18, Page 15-33).

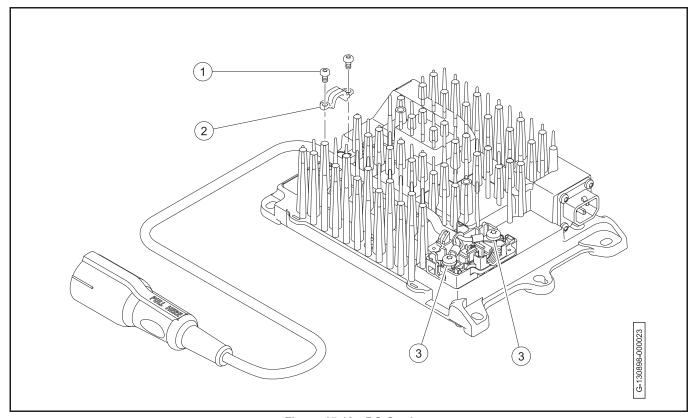


Figure 15-18 DC Cord

- 5. Remove the clamp (2).
- 6. Loosen the screws (3).
- 7. Pull the wires from DC terminals on battery charger.

DC CORD INSTALLATION

1. Attach the white DC cord wire to the positive (+) terminal (5) (Figure 15-19, Page 15-34).

NOTE: The positive symbol (+) and negative symbol (–) are molded into the terminal block.

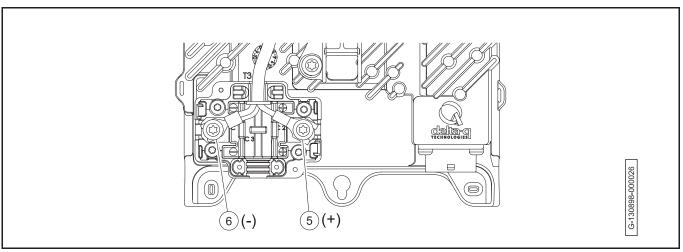


Figure 15-19 Wire Installation

- 2. Attach the black and green DC cord wires to the negative (-) terminal (6).
- 3. Tighten the screws (1) to 39.8 lb·in (4.5 N·m) (Figure 15-20, Page 15-34).

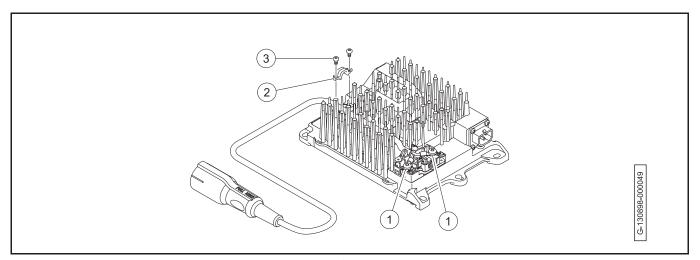


Figure 15-20 Clamp Installation

- 4. Install the terminal block cover.
- 5. Install the clamp (2).
- 6. Install the screws (3). Tighten the screws to 27.4 lb·in (3.1 N·m).

HANDLE REMOVAL

1. Remove the screws (1) (Figure 15-21, Page 15-35).

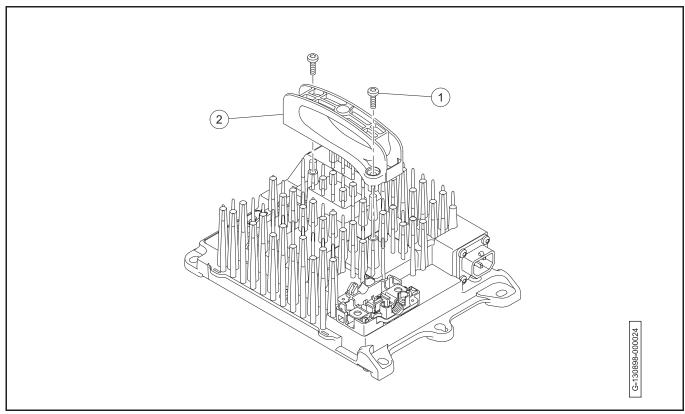


Figure 15-21 Handle

2. Remove the handle (2).

HANDLE INSTALLATION

- 1. Install the handle (2) on the battery charger (Figure 15-21, Page 15-35).
- 2. Install the screws (1). Tighten the screws to 39.8 lb·in (4.5 N·m).

FOOT REMOVAL

- 1. Disconnect the DC cord from the vehicle charge receptacle.
- 2. Disconnect the AC cord from the AC power source.
- 3. If the battery charge is mounted, remove the battery charger.
- 4. Squeeze the barbs (1) on the foot (2) and push the foot out of charger mounting tab (Figure 15-22, Page 15-36).

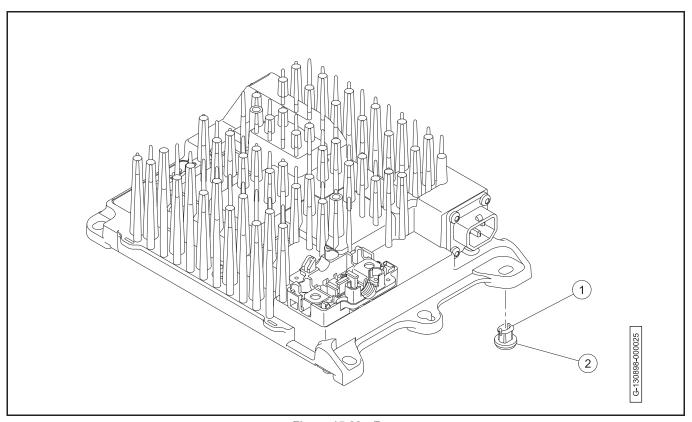


Figure 15-22 Foot

FOOT INSTALLATION

- 1. Push the foot (2) into hole in charger mounting tab until the barbs (1) come through and secure foot in place (Figure 15-22, Page 15-36).
- 2. If required, mount the battery charger. See External Battery Charger Mounting.

ONBOARD CHARGER REPAIRS

WARNING

- Knowledge of battery charger wiring and component terminology is required before attempting any repair.
- · Prior to servicing the charger, disconnect the AC cord from the AC outlet.

NOTE: This charger has no internal components to service or repair. It only has a few external repairs that can be performed. If an internal component needs repair, the charger must be replaced.

TWO-PASSENGER ONBOARD CHARGER

Two-Passenger Onboard Charger Removal

- 1. Disable the vehicle.
- 2. Set the Run/Tow switch to TOW.
- 3. Disconnect the batteries.
- 4. Disconnect the AC cord from AC power source.
- 5. Disconnect the DC cord from the onboard charger harness (1) (Figure 15-23, Page 15-37).

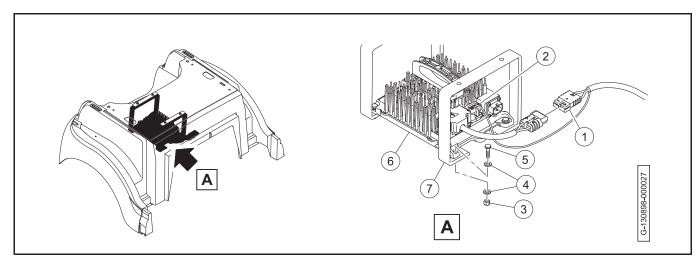


Figure 15-23 Onboard Charger

- 6. Disconnect the connector (2).
- 7. Remove the nuts (3), washers (4), and bolts (5).
- 8. Remove the onboard charger (6) from the bracket (7).

Two-Passenger Onboard Charger Installation

1. Connect the DC cord to the onboard charger harness (1) (Figure 15-24).

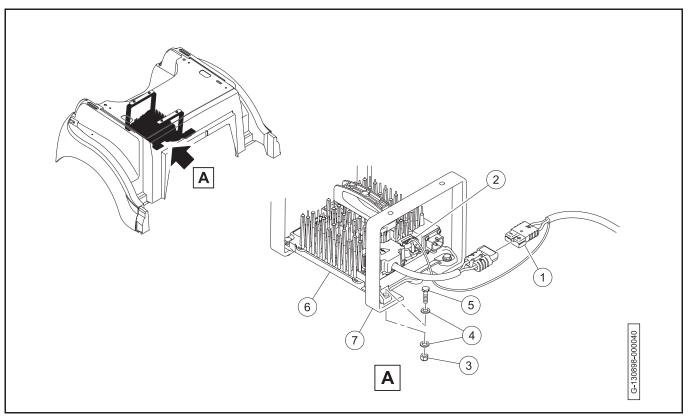


Figure 15-24 Onboard Charger

- 2. Connect the connector (2).
- 3. Put the onboard charger (5) on the bracket (6).
- 4. Install the bolts (5), washers (4), and nuts (3). Tighten the bolts to 13 lb·in (1.5 N·m).
- 5. Set the Run/Tow switch to TOW.
- 6. Connect the batteries.

Two-Passenger AC Cord Reel Removal

- 1. Disable the vehicle.
- 2. Disconnect the batteries.
- 3. Disconnect the AC cord from AC power source.
- 4. Disconnect the AC cord (1) from the battery charger (Figure 15-25, Page 15-39).

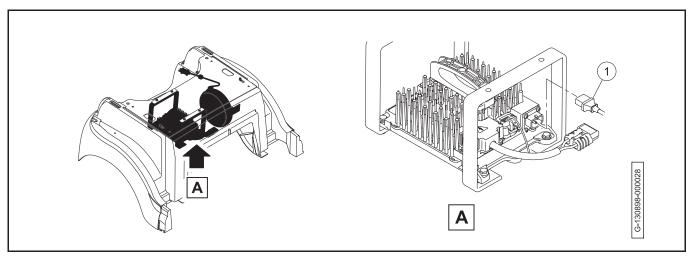


Figure 15-25 Disconnect From Battery Charger

5. Remove the screws (2) (Figure 15-26, Page 15-39).

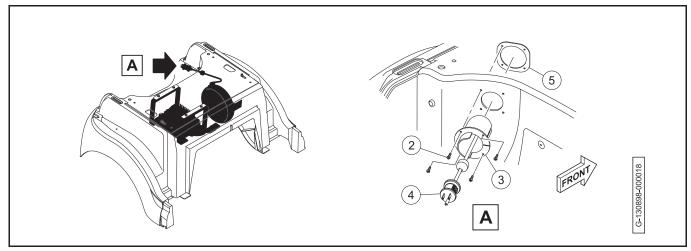


Figure 15-26 Cord Housing Removal

- 6. Remove the cord housing (3).
- 7. Remove the AC cord (4) from the cord housing.
- 8. Remove the backing plate (5).

9. Remove the nuts (6), washers (7), and bolts (8) (Figure 15-27, Page 15-40).

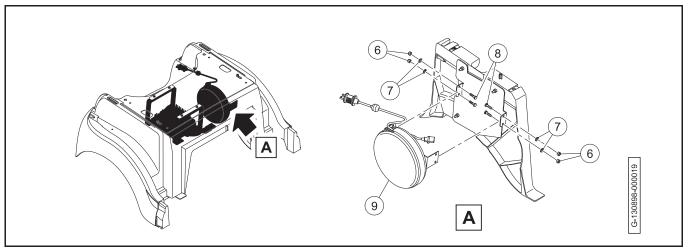


Figure 15-27 AC Cord Reel Removal

10. Remove the AC cord reel (9).

Two-Passenger AC Cord Reel Installation

1. Install the AC cord reel (9) on the cord reel plate (Figure 15-28, Page 15-40).

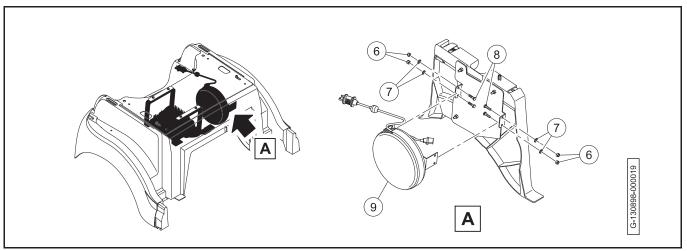


Figure 15-28 AC Cord Reel Installation

2. Install the bolts (8), washers (7), and nuts (6). Tighten the nuts to 88.5 lb·in (10 N·m).

3. Install the backing plate (5) on the AC cord (4) (Figure 15-29, Page 15-41).

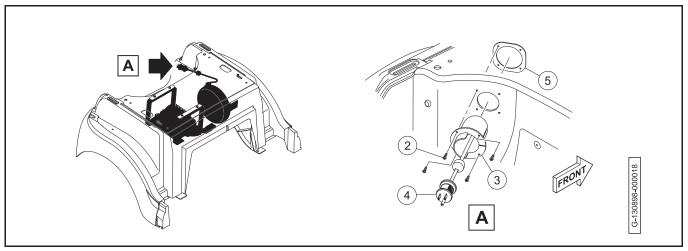


Figure 15-29 Cord Housing Installation

- 4. Put the AC cord through the cord housing (3).
- 5. Install the cord housing on the underbody.
- 6. Install the screws (2). Tighten the screws to 13 lb·in (1.5 N·m).
- 7. Connect the AC cord (1) to the battery charger (Figure 15-30, Page 15-41).

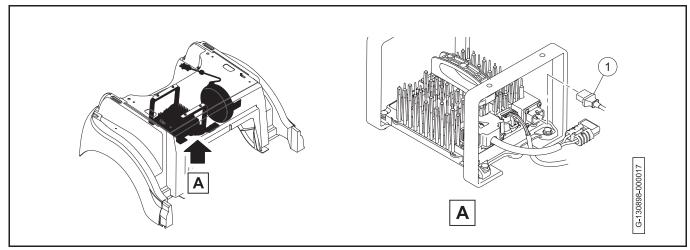


Figure 15-30 Connect To Battery Charger

Connect the batteries.

FIXED REAR SEAT ONBOARD CHARGER

Fixed Rear Seat Onboard Charger Removal

- 1. Disable the vehicle.
- 2. Set the Run/Tow switch to TOW.
- 3. Disconnect the batteries and discharge the controller.
- 4. Disconnect the AC cord from the AC power source.
- 5. Lift rear-facing seat bottom and support in the raised position.
- 6. Remove the screws (1) and the charger shield (2) (Figure 15-31).

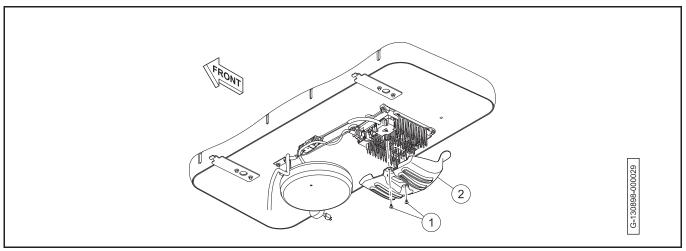


Figure 15-31 Charger Shield Removal

7. Disconnect the AC cord (3) from battery charger (4) (Figure 15-32).

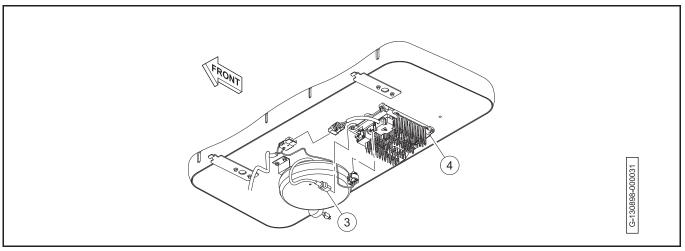


Figure 15-32 AC Cord Removal

8. Disconnect the charger harness (5) from the charger power harness (6) (Figure 15-33).

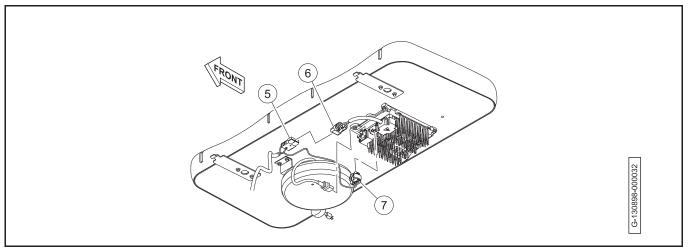


Figure 15-33 Charger Harness Connections

- 9. Disconnect the 14-pin connector (7) from battery charger.
- 10. Remove the screws (8). Retain the insulator (9) (Figure 15-34).

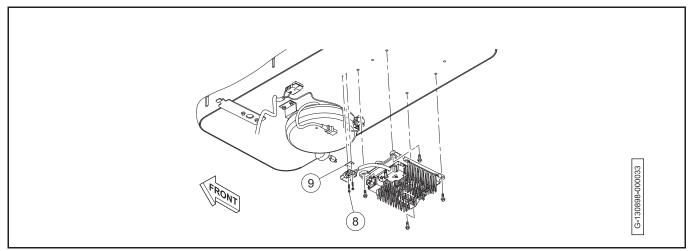


Figure 15-34 Charger Power Harness Connector Screws

11. Remove the bolts (10) and the battery charger (Figure 15-35).

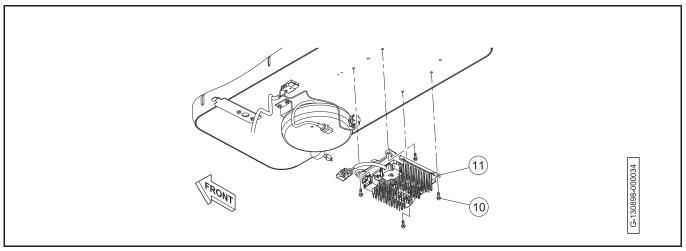


Figure 15-35 Battery Charger Removal

Fixed Rear Seat Onboard Charger Installation

1. Install the battery charger (1) and the bolts (2) (Figure 15-36). Tighten the bolts to 53 in·lb (6 N·m).

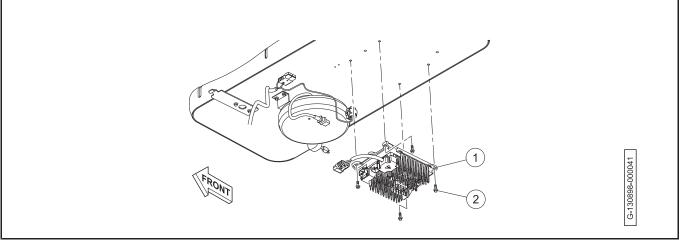


Figure 15-36 Battery Charger Installation

2. Install the insulator (3) and the screws (4) (Figure 15-37). Tighten the screws to 11 in·lb (1.25 N·m).

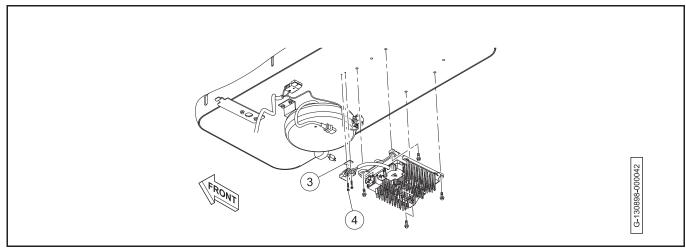


Figure 15-37 Charger Power Harness Connector Screws

3. Connect the charger harness (5) from the charger power harness (6) (Figure 15-38).

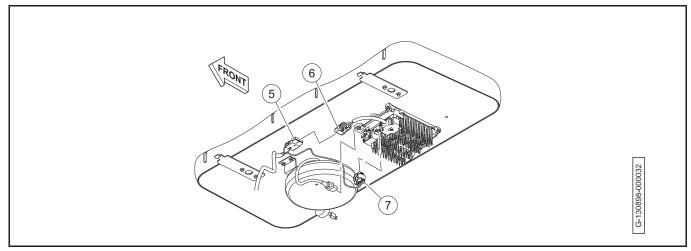


Figure 15-38 Charger Harness Connections

4. Connect the 14-pin connector (7) to the battery charger.

5. Connect the AC cord (8) to battery charger (Figure 15-39).

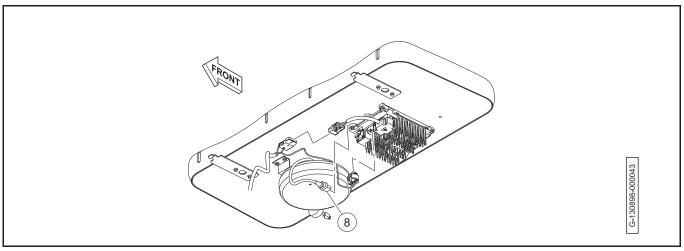


Figure 15-39 AC Cord Installation

6. Install the charger shield (9) and the screws (10) (Figure 15-40). Tighten the screws to 17 in·lb (2 N·m).

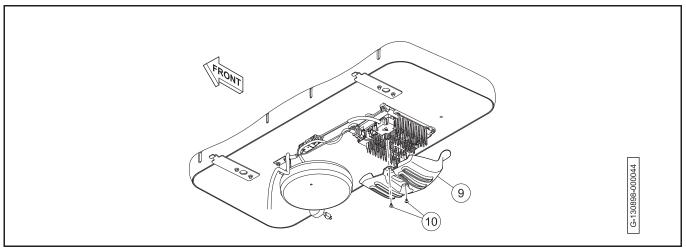


Figure 15-40 Charger Shield Installation

- 7. Lower rear-facing seat bottom.
- 8. Set the Run/Tow switch to TOW.
- 9. Connect the batteries.

Fixed Rear Seat AC Cord Reel Removal

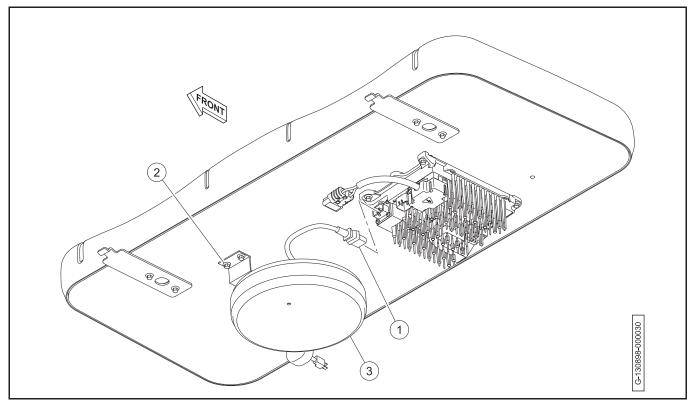


Figure 15-41 AC Cord

- 1. Disable the vehicle.
- 2. Set the Run/Tow switch to TOW.
- 3. Disconnect the batteries and discharge the controller.
- 4. Disconnect the AC cord from the AC power source.
- 5. Lift rear-facing seat bottom and support in the raised position.
- 6. Disconnect the AC cord (1) from the battery charger .
- 7. Remove the screws (2) and the AC cord reel (3).

Fixed Rear Seat AC Cord Reel Installation

- 1. Install the AC cord reel (3) and screws (2) . Tighten the screws to 53 in·lb (6 N·m).
- 2. Connect the AC cord (1) to the battery charger.
- 3. Lower rear-facing seat bottom.
- 4. Set the Run/Tow switch to TOW.
- 5. Connect the batteries.

FOLD-DOWN REAR SEAT ONBOARD CHARGER

Fold-Down Rear Seat Onboard Charger Removal

- 1. Disable the vehicle.
- 2. Set the Run/Tow switch to TOW.
- 3. Disconnect the batteries and discharge the controller.
- 4. Disconnect the AC cord from the AC power source.
- 5. Remove the screws (1) and the charger shield (2) (Figure 15-31).

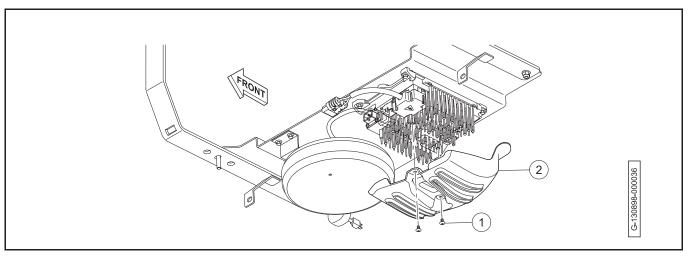


Figure 15-42 Charger Shield Removal

6. Disconnect the AC cord (3) from battery charger (4) (Figure 15-32).

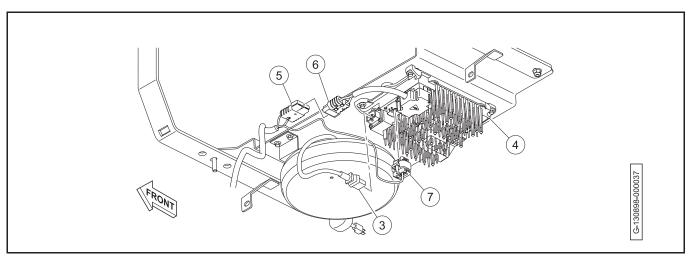


Figure 15-43 Harness Connections

- 7. Disconnect the charger harness (5) from the charger power harness (6).
- 8. Disconnect the 14-pin connector (7) from battery charger.

9. Remove the nuts (8), screws (9), and insulator (10) (Figure 15-34). Retain the insulator.

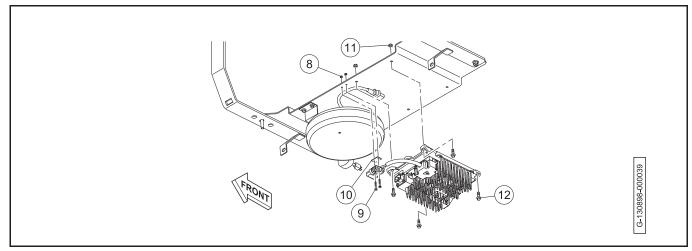


Figure 15-44 Battery Charger Removal

10. Remove the nuts (11), bolts (12), and the battery charger.

Fold-Down Rear Seat Onboard Charger Installation

1. Install the battery charger (1), bolts (2), and nuts (3) (Figure 15-45). Tighten the nuts to 115 in·lb (13 N·m).

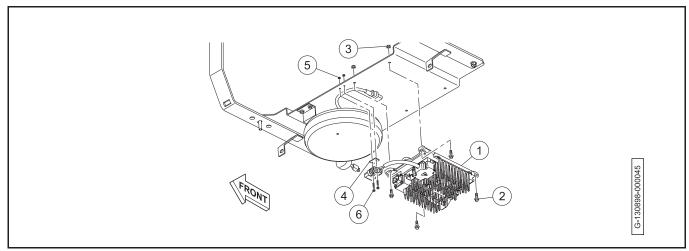


Figure 15-45 Battery Charger Installation

2. Install the insulator (4), nuts (5), and screws (6). Tighten the nuts to 17 in·lb (2 N·m).

3. Connect the charger harness (7) from the charger power harness (8) (Figure 15-46).

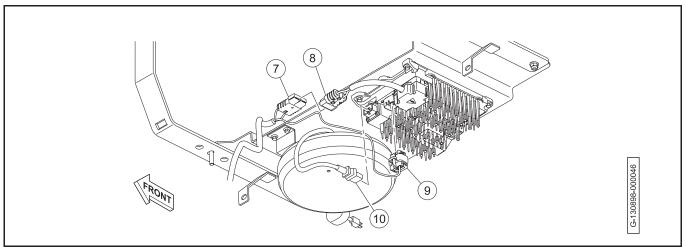


Figure 15-46 Harness Connections

- 4. Connect the 14-pin connector (9) to the battery charger.
- 5. Connect the AC cord (10) to battery charger.
- 6. Install the charger shield (11) and the screws (12) (Figure 15-47). Tighten the screws to 17 in·lb (2 N·m).

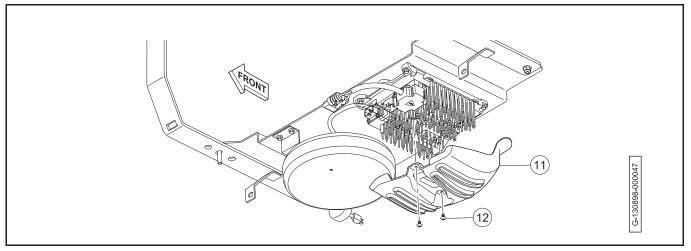


Figure 15-47 Charger Shield Installation

- 7. Set the Run/Tow switch to TOW.
- 8. Connect the batteries.

Fold-Down Rear Seat AC Cord Reel Removal

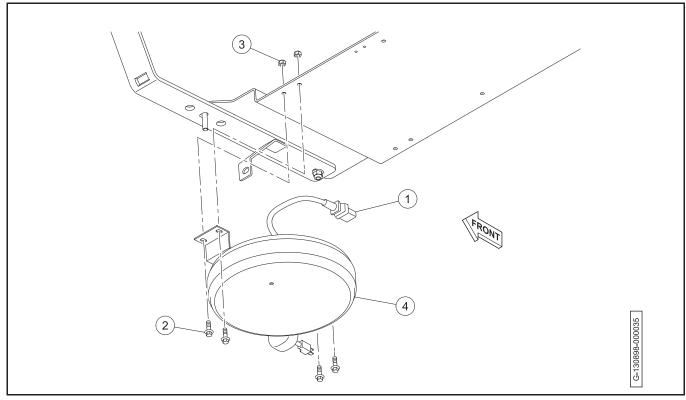


Figure 15-48 AC Cord

- 1. Disable the vehicle.
- 2. Set the Run/Tow switch to TOW.
- 3. Disconnect the batteries and discharge the controller.
- 4. Disconnect the AC cord from the AC power source.
- 5. Lift rear-facing seat bottom and support in the raised position.
- 6. Disconnect the AC cord (1) from the battery charger .
- 7. Remove the nuts (2), screws (3), and the AC cord reel (4).

Fold-Down Rear Seat AC Cord Reel Installation

- 1. Install the AC cord reel (4), screws (3), and nuts (2). Tighten the nuts to 115 in·lb (13 N·m).
- 2. Connect the AC cord (1) to the battery charger.
- 3. Lower rear-facing seat bottom.
- 4. Set the Run/Tow switch to TOW.
- 5. Connect the batteries.

TERMINAL BLOCK COVER REMOVAL

- 1. Disconnect the AC cord from AC power source.
- 2. Disconnect the DC cord from the charger harness.
- 3. Push the tabs (1) in and remove the terminal block cover (2) (Figure 15-49, Page 15-52).

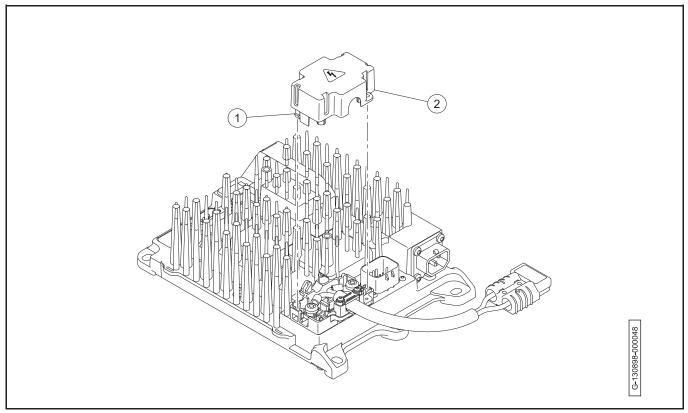


Figure 15-49 Onboard Charger Terminal Block Cover

TERMINAL BLOCK COVER INSTALLATION

▲ WARNING

- The terminal block cover on the DC terminal block must be installed properly to comply with UL code. This cover prevents water exposure and prevents a short across the DC terminals.
- 1. Install the terminal block cover (2) onto the terminal block (Figure 15-49, Page 15-52).
- 2. Push down until the tabs (1) lock into place.

DC CORD REMOVAL

- 1. Disable the vehicle.
- 2. Disconnect the batteries.
- 3. Disconnect the AC cord from AC power source.
- 4. Disconnect the DC cord from the onboard charger harness.
- 5. Remove the terminal block cover.
- 6. Remove the screws (1) (Figure 15-50, Page 15-53).

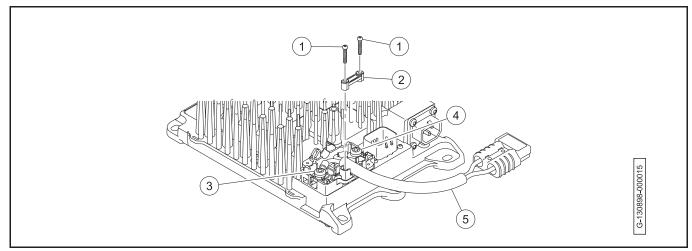


Figure 15-50 Onboard Charger DC Cord

- 7. Remove the clamp (2).
- 8. Loosen the terminal screws (3 and 4).
- 9. Remove the DC cord (5).

DC CORD INSTALLATION

1. Attach the red DC cord wire to positive (+) terminal (4).

NOTE: The positive symbol (+) and negative symbol (-) are molded into the terminal block.

- 2. Attach the black DC cord wire to the negative (-) terminal (3).
- 3. Tighten the terminal screws to 39.8 lb·in (4.5 N·m).
- 4. Install the clamp (2).
- 5. Install the screws (1). Tighten the screws to 7.5 lb·in (0.85 N·m).
- 6. Install the terminal block cover.
- 7. Connect the DC cord (5) to the onboard charger harness.
- 8. Connect the batteries.

Pagination Page

A DANGER

See General Warnings on page 1-2.

WARNING

• See General Warnings on page 1-2.

GENERAL INFORMATION

The vehicle is equipped with a 48-volt DC, shunt-wound, reversible traction motor. The shunt-wound motor is designed for use in Excel System vehicles. 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.

EXTERNAL MOTOR TESTING

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

NOTE: Observe the following before testing the motor:

- · This is only testing continuity.
- Tag the motor wires for identification before disconnecting.
- Remove motor wire from one of the "A" terminals and one of the "F" terminals if testing while motor is in vehicle.
- When disconnecting wires from motor terminals, use a second wrench on the lower nut of the terminal post to hold post steady.
- Scrape a small amount of paint from motor housing (ground) and use this location when testing motor terminals to electrical ground.

Index of Test Procedures

- 1 Motor Continuity Test
- 2 Internal Short Circuits
- 3 Armature Circuit Open
- 4 Field Circuit Open

TEST PROCEDURE 1 – Motor Continuity Test

See General Warnings on page 1-2.

- 1. Disable the vehicle.
- 2. Disconnect the batteries and discharge the controller.
- 3. Disconnect the wires from the motor.
- 4. Set a multimeter to check for continuity.
- 5. Check the continuity readings between the motor terminals below:

MOTOR TERMINALS	CONTINUITY TEST RESULT
A1 to A2 F1 to F2	Continuity
A1 to F1 A1 to F2	No Continuity
A2 to F1 A2 to F2	No Continuity
A1 to Ground A2 to Ground	No Continuity
F1 to Ground F2 to Ground	No Continuity

- 6. If readings are correct, reconnect the motor wires. See Motor Installation on page 16-15.
- 7. Connect the batteries. See Connect the Batteries Electric Vehicles, Section 1, Page 1-5.

TEST PROCEDURE 2 - Internal Short Circuits

See General Warnings on page 1-2.

- 1. Place vehicle on a level surface.
- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles, Section 1, Page 1-4.
- Disconnect wires from terminals on motor using two wrenches to prevent posts from turning.
- 4. 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, F1, and F2 terminals respectively while rolling the vehicle slowly to rotate the armature. Multimeter should indicate no continuity between the motor housing and all individual terminals. If readings indicate continuity, motor will need to be removed from the vehicle and repaired by a qualified technician. See Motor Removal on page 16-4.
- 4.1. 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.
- 5. If readings are correct, reconnect the motor wires. See Motor Installation on page 16-15.
- 6. Connect the batteries. See Connect the Batteries Electric Vehicles, Section 1, Page 1-5.

TEST PROCEDURE 3 – Armature Circuit Open

See General Warnings on page 1-2.

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles, Section 1, Page 1-4.
- 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 16-4.**
- 3. If reading is correct, reconnect the motor wires. See Motor Installation on page 16-15.
- 4. Connect the batteries. See Connect the Batteries Electric Vehicles, Section 1, Page 1-5.

TEST PROCEDURE 4 – Field Circuit Open

See General Warnings on page 1-2.

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles, Section 1, Page 1-4.
- 2. Disconnect wires from the F1 and F2 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 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 16-4.**
- 3. If reading is correct, reconnect the motor wires. See Motor Installation on page 16-15.
- 4. Connect the batteries. See Connect the Batteries Electric Vehicles, Section 1, Page 1-5.

MOTOR

See General Warnings on page 1-2.

MOTOR REMOVAL

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles, Section 1, Page 1-4.
- 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 16-1, Page 16-4) 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 16-2, Page 16-4). 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.

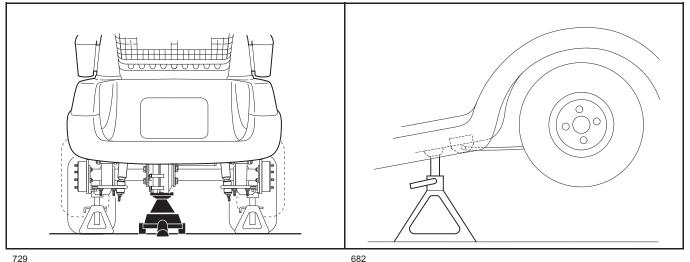


Figure 16-1 Lift Vehicle with Floor Jack

Figure 16-2 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 16-3, Page 16-5)**.
- 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 16-3, Page 16-5).

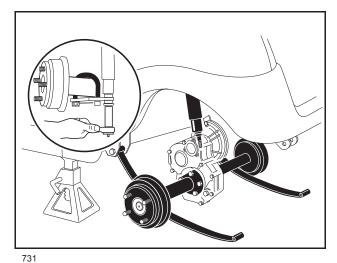


Figure 16-3 Lower Axle

Remove the bolts and lock washers that secure the motor to the transaxle (Figure 16-24, Page 16-17). See following CAUTION.

A 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.

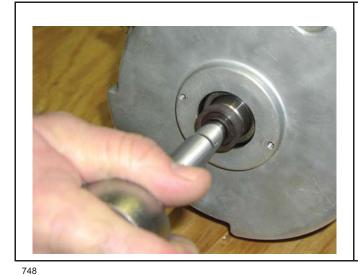




Figure 16-4 Speed Sensor Magnet

Figure 16-5 End Cap

MOTOR DISASSEMBLY

- Before beginning disassembly, place match marks on the motor end cap and motor frame.
- Remove speed sensor and magnet.

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- 2.1. Remove the two screws (25) that secure the speed sensor (10) to the end cap (11) **(Figure 16-15, Page 16-12)**.
- 2.2. Remove the screw securing the magnet to the armature shaft (Figure 16-4, Page 16-5).
- 2.3. Inspect the speed sensor magnet. See Speed Sensor Magnet Inspection on page 16-11.
- 3. Loosen, but do not remove, the two screws securing the end cap to the motor frame (Figure 16-5, Page 16-5).





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Figure 16-6 End Cap Disengagement

Figure 16-7 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 (6.3 mm) 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 16-6, Page 16-6).
- 6. Remove the two end cap bolts.
- 7. Remove the end cap and armature from the motor frame (Figure 16-7, Page 16-6).
- 8. Inspect the brush springs for proper tension. See Motor Brush, Spring, and Terminal Insulator Inspection on page 16-10.
- 9. Remove the armature from the end cap bearing. See following CAUTION and NOTE.

A 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 16-8**, **Page 16-7**).
- 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 16-8.
- 11. Inspect the motor frame and field windings. See Motor Frame and Field Windings Inspection on page 16-10.
- 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 16-9, Page 16-7).
- 12.3. Remove the two screws and the brush rigging to the end cap (Figure 16-10, Page 16-8).
- 13. Inspect the terminal insulators. See Terminal Insulator Inspection on page 16-10.
- 14. Remove the bearing from the end cap.
- 14.1. Remove the retaining ring that secures the bearing in the end cap (Figure 16-11, Page 16-8).
- 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 16-11.





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Figure 16-8 Armature Removal

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Figure 16-9 A1 and A2 Terminals





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Figure 16-10 Brush Rigging

Figure 16-11 Bearing Retaining Ring

MOTOR COMPONENT TESTING AND INSPECTION

See General Warnings on page 1-2.

ARMATURE INSPECTION AND TESTING

- 1. Remove the motor from the vehicle. See Motor Removal on page 16-4.
- 2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 16-5.

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 (1) and the other on the armature core (2). The multimeter should indicate no continuity (Figure 16-12, Page 16-9). If the reading is incorrect, replace the armature.

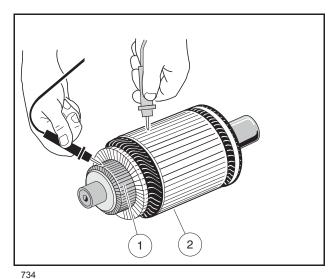


Figure 16-12 Armature Test

MOTOR FRAME AND FIELD WINDINGS INSPECTION

- 1. Remove the motor from the vehicle. See Motor Removal on page 16-4.
- 2. Remove the and cap and armature by performing steps 1 through 7 of Motor Disassembly on page 16-5.
- 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 16-4.
- 2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 16-5.
- 3. Inspect the brush springs (14) **(Figure 16-15, Page 16-12)**. 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 16-13, Page 16-11).
- 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 ozf (0.99 kgf) (Figure 16-13, Page 16-11). 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 on page 16-13 for brush installation.

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 16-4.
- 2. Remove the end cap and armature by performing steps 1 through 7 of Motor Disassembly on page 16-5.
- 3. Inspect the brushes (13) for damage or excessive wear (Figure 16-15, Page 16-12). 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 16-4.
- 2. Remove the terminal insulators by performing steps 1 through 12 of Motor Disassembly on page 16-5.
- 3. Inspect the insulators (4 and 6) for cracks or other damage (Figure 16-15, Page 16-12). 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 16-4.
- 2. Remove the bearing by performing steps 1 through 14 of Motor Disassembly on page 16-5.
- 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 16-14, Page 16-11).
- 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.

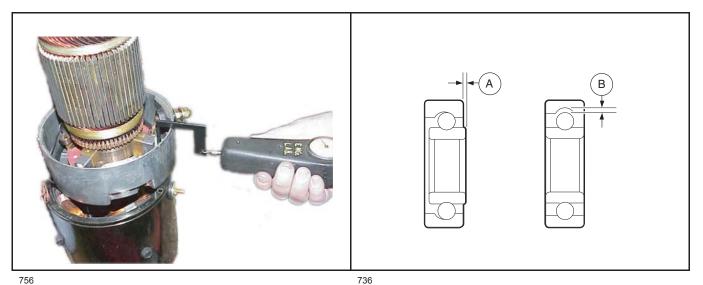


Figure 16-13 Brush Spring Tension Test

Figure 16-14 Bearing Inspection

Speed Sensor Magnet Inspection

Inspect the speed sensor magnet (24) for rust, wear, and cracks (Figure 16-15, Page 16-12). Replace the magnet if necessary.

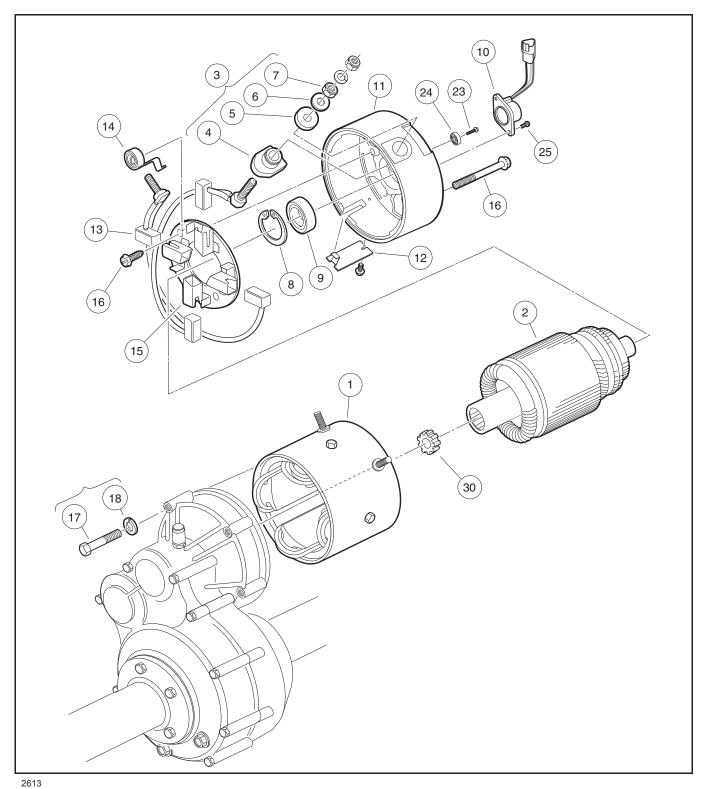


Figure 16-15 Electric Motor (EJ8-4001A)

RECONDITIONING THE MOTOR

See General Warnings on page 1-2.

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 on page 1-2.

- 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 16-11, Page 16-8).
- 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 16-16, Page 16-14).
- 2.2. Insert the two terminal posts through insulators (4) in the end cap (11) wall at the A1 and A2 positions (Figure 16-15, Page 16-12).
- 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 16-15, Page 16-12).
- 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 16-10, Page 16-8).
- 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 16-17**, **Page 16-14**).





Figure 16-16 Brush Rigging

Figure 16-17 Retracted Brushes



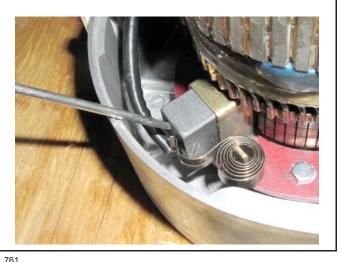


Figure 16-18 Armature Installation

Figure 16-19 Brush Setting

3. With the brushes retracted, use an arbor press to press the armature shaft into the end cap bearing (Figure 16-18, Page 16-14). 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 16-19, Page 16-14).
- 5. Align the match marks on the end cap and the motor frame (1) and secure with two bolts (16) (Figure 16-15, Page 16-12). 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 20 in·lb (2.2 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 on page 1-2.

- 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 from tube onto a putty knife as shown (Figure 16-20, Page 16-15).
- 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 16-21, Page 16-15).
- 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.

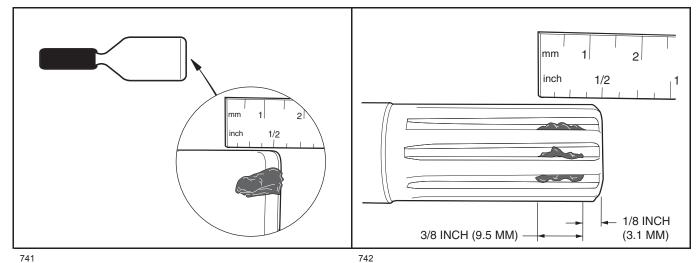


Figure 16-20 Grease on Putty Knife

742 Figure 16-21 Application of grease to Input Shaft Grooves

Page 16-15

- 2.6. Check the chamfer (1) and end (2) of the input shaft to ensure these areas are completely clean of grease as shown (Figure 16-22, Page 16-16).
- 3. Install the molded bumper.
- 3.1. With the flat side toward the bottom of the coupling and the cupped side toward the transaxle input shaft, install the molded bumper (30) into the motor coupling (Figure 16-15, Page 16-12). 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.

- 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 16-15, Page 16-12). There will be approximately 1/16 inch (1.6 mm) gap between the motor adapter ring and transaxle housing as shown (Figure 16-23, Page 16-16).

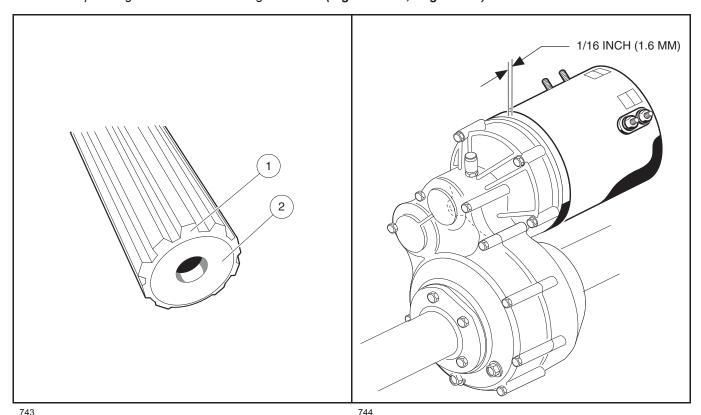


Figure 16-22 Clean Chamfer and Input Shaft End

Figure 16-23 Gap at Motor and Transaxle

- 4.2. Loosely install the three bolts and lock washers that secure the motor to the transaxle (Figure 16-24, Page 16-17). Do not tighten.
- 4.3. Begin finger-tightening the bolts (1, 2, and 3) in the sequence indicated. 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 center bolt (3) to 100 in·lb (11.3 N·m).
- 4.5. Tighten the left and right bolts (1 and 2) to 100 in·lb (11.3 N·m).
- 4.6. Retighten all three bolts (1, 2 and 3) to 100 in lb (11.3 N·m).
- 4.7. Install the motor wires, making sure they are connected to the correct motor terminals and that the terminal orientation is correct. **See page**. Hold the bottom nut of stud with wrench and tighten the terminal retaining

- nuts. For 5/16 inch (8mm) diameter studs, tighten the nuts to 100 in·lb (11 N·m). For 1/4 inch (6.3mm) diameter studs, tighten the nuts to 45 in·lb (5.0 N·m).
- 4.8. 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.
- 4.9. 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 Leaf Spring Installation (Two-Passenger) on page 9-7. See Leaf Spring Installation (Four-Passenger) on page 9-10.
- 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. Connect the batteries. See Connect the Batteries Electric Vehicles, Section 1, Page 1-5.
- 11. Place the Run/Tow 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/Neutral/Reverse switch is in the FORWARD position.
- Make sure that the vehicle operates in the reverse direction when the Forward/Neutral/Reverse switch is in the REVERSE position. The reverse buzzer will sound as a warning when the Forward/Neutral/Reverse switch is in REVERSE.
- Make sure that the vehicle does not operate when the Forward/Neutral/Reverse switch is in the NEUTRAL position.

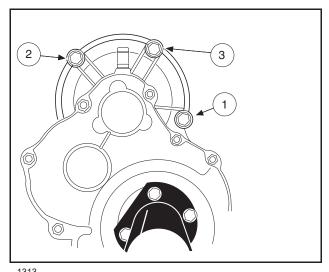


Figure 16-24 EJ8–4001A Motor Mounting Bolts and Tightening Sequence

Pagination Page

A DANGER

· See General Warnings on page 1-2.

WARNING

· See General Warnings on page 1-2.

LUBRICATION

See General Warnings on page 1-2.

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 17-5, Page 17-3). 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 on page 1-2.

AXLE SHAFT

Axle Shaft and Oil Seal Removal

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 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 on page 1-2.
- 3. Remove the rear wheel and brake drum. Section 6 Wheel Brake Assemblies Section 8 Wheels and Tires
- 4. Use 90° internal snap ring pliers to remove the internal retaining ring (6) from the axle tube (Figure 17-5, Page 17-3). See also Figure 17-1, Page 17-2.
- 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 to remove the axle seal and adapter ring from the axle tube (Figure 17-2, Page 17-2). 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.

NOTE: Do not discard the adapter ring. If the adapter ring is lost or damaged, the axle tube will have to be replaced. Varying rear axle configurations have been installed on vehicles. If replacing axle tubes, take note of individual axle tube lengths to ensure proper fit.

- 6.2. Use a press to separate the axle oil seal (15) from the adapter ring (39) **(Figure 17-3, Page 17-2)**. 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 17-5, Page 17-3)**. If the bearing in a Type G transaxle is worn or damaged, the entire axle shaft assembly (1 or 2) must be replaced.

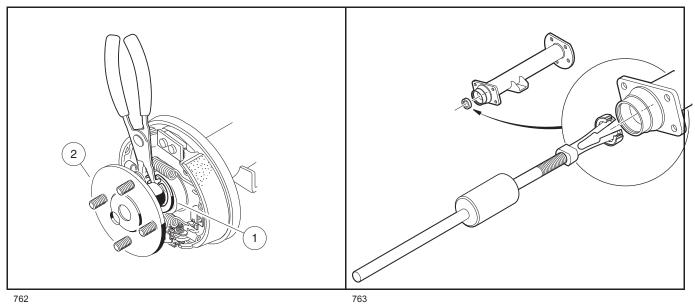


Figure 17-1 Remove Internal Retaining Ring

Figure 17-2 Axle Seal and Adapter Ring Removal

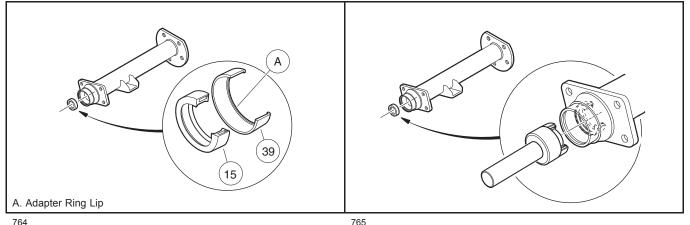


Figure 17-3 Axle Seal and Adapter Ring

Figure 17-4 Axle Seal and Adapter Ring Installation

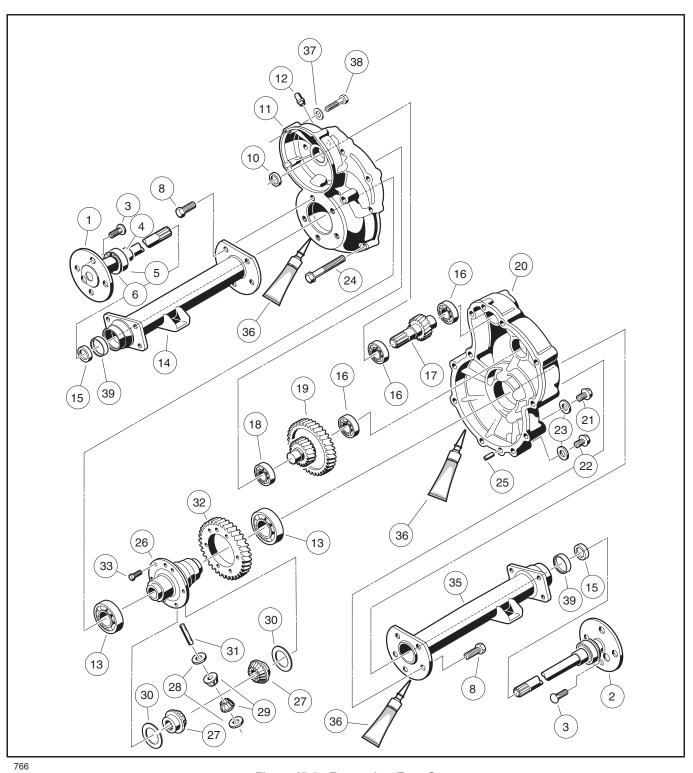


Figure 17-5 Transaxle - Type G

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 17-3, Page 17-2).
- 1.2. Place a new seal (15) in the adapter ring with the seal lip facing toward the adapter ring lip (Figure 17-3, Page 17-2). Use an axle seal tool and mallet to tap it in until it seats firmly in position (Figure 17-3, Page 17-2). 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 17-5, Page 17-3).
- 1.4. Apply Loctite® 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 17-4, Page 17-2). Use an axle seal tool 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 17-5, Page 17-3). 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 17-5, Page 17-3).

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 17-5, Page 17-3).

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 17-5, Page 17-3)**.

TRANSAXLE REMOVAL

See General Warnings on page 1-2.

- Disconnect the batteries and discharge the controller. See Disconnect the Batteries Electric Vehicles on page 1-4.
- 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 on 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 17-6, Page 17-5). See WARNING "Lift only one end of the vehicle..." in General Warnings on page 1-2.
- 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 brake cable release tool to compress tangs on cable end and remove cable end from bracket (4) (Figure 17-7, Page 17-5).

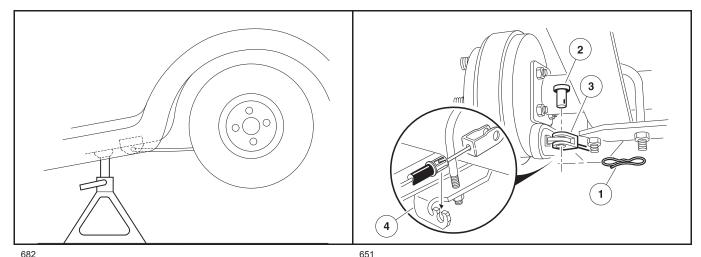


Figure 17-6 Vehicle Supported on Jack Stands

Figure 17-7 Brake Cable

- 6. Disconnect the shock absorbers from their lower mounts (Figure 17-8, Page 17-6).
- 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 17-9, Page 17-6).
- 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 (1) (Figure 17-11, Page 17-6) securing the motor to the transaxle. See following CAUTION.

A CAUTION

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

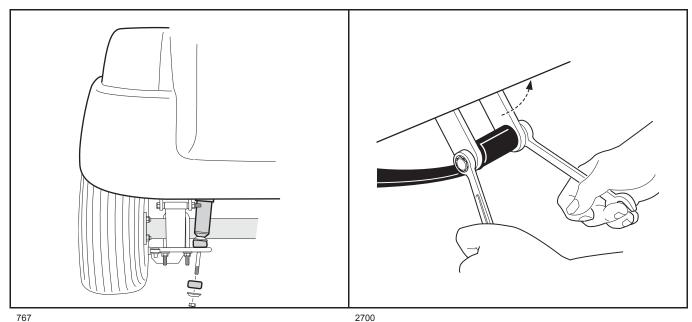


Figure 17-8 Disconnect Shocks

- Figure 17-9 Shackles
- 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 17-10, Page 17-6).
- 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 17-1. 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 on page 6-12.

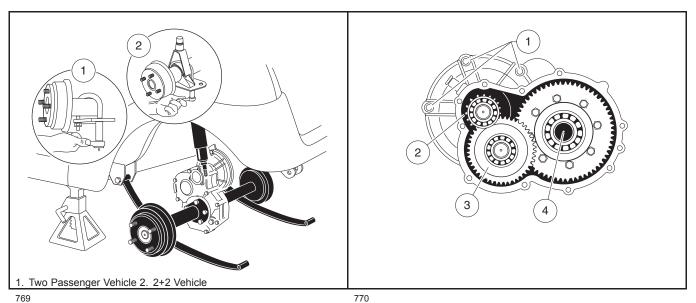


Figure 17-10 Leaf Springs

Figure 17-11 Motor Mounting Bolts

Page 17-6 Tempo, Tempo Connect, and Tempo 2+2 Maintenance and Service Manual

TRANSAXLE DISASSEMBLY, INSPECTION, AND ASSEMBLY

See General Warnings on page 1-2.

TRANSAXLE DISASSEMBLY AND INSPECTION

- 1. To detach axle tubes (14 and 35) from the transaxle housing, remove the bolts (8) (Figure 17-5, Page 17-3).
- 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

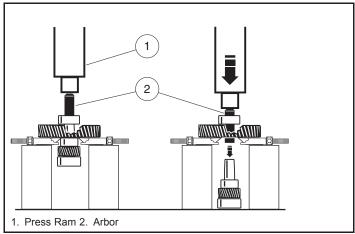
- · To prevent damage to the housing mating seal surfaces, use caution when separating halves.
- Remove input pinion gear (17) by pulling gear out while rocking intermediate gear assembly (19). Lift intermediate
 gear assembly and differential gear case unit out simultaneously (Figure 17-5, Page 17-3). 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 17-5, Page 17-3). See also Figure 17-12, Page 17-7. 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 17-5, Page 17-3). See also Figure 17-12, Page 17-7.
- 7. Press the bearing (18) off the intermediate gear assembly (Figure 17-5, Page 17-3).



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Figure 17-12 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 17-5, Page 17-3).
- 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 17-13**, **Page 17-8**). Remove the two bolts.

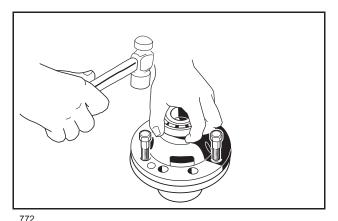


Figure 17-13 Separate Housing

- 8.4. Remove the differential pin (31) by pushing pin through differential gear case from one side (Figure 17-5, Page 17-3). See also Figure 17-14, Page 17-8.
- 8.5. Remove the idler gears (1 and 2) and thrust plates (3 and 4) (Figure 17-15, Page 17-8).

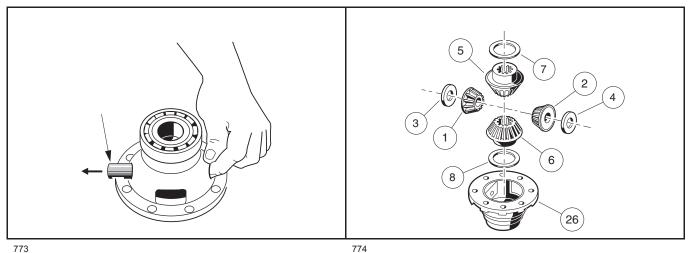


Figure 17-14 Differential Pin

Figure 17-15 Left Differential

- 8.6. Remove the differential gears (5 and 6) and thrust plates (7 and 8).
- 8.7. Inspect the bearings (13) of the differential case (26) and replace them if they are damaged (Figure 17-5, Page 17-3). 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 17-5, Page 17-3).
- 2. Assemble the differential gear case.
- 2.1. Install the pin (31) **(Figure 17-5, Page 17-3)**. 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).
- Press a new bearing (18) onto the intermediate gear assembly (Figure 17-5, Page 17-3).
- 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. 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 (4), the intermediate gear assembly (3), and the input pinion gear (2) simultaneously. Be sure all bearings are seated properly in the housing. Rotate the input shaft to check for smooth gear operation (Figure 17-11, Page 17-6).
- 7. Install dowel pin(s) (25) (if originally installed) in the transaxle housing (20) (Figure 17-5, Page 17-3).
- 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 17-5, Page 17-3).
- 8.3. Install 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 17-5, Page 17-3). Tighten the bolts to 37 ft·lb (50.2 N·m).
- 9. Install the brake assemblies as instructed. See Brake Cluster Installation on page 6-14.
- 10. Apply a small amount of grease to the lip of the oil seal (15) (Figure 17-5, Page 17-3). See following CAUTION.

A 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), 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 17-5, Page 17-3).
- 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 fl-oz 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 on page 1-2.

- 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 on page 16-15.
- 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 motor wires, making sure they are connected to the correct motor terminals and that the terminal orientation is correct. Hold the bottom nut of stud with wrench and tighten the terminal retaining nuts. For 5/16 inch (8mm) diameter studs, tighten the nuts to 100 in·lb (11 N·m). For 1/4 inch (6.3mm) diameter studs, tighten the nuts to 45 in·lb (5.0 N·m). **See following NOTE.**

NOTE: If the motor wires were not tagged when disconnected, refer to the wiring diagram for proper connection. See .

- 7. Insert bolts through the spring shackles and bushings in the leaf spring eyes. Secure bolts with lock nuts. Tighten to 18.5 ft·lb (25 N·m).
- 8. Connect the brake cables using new bow tie pins (1) (Figure 17-7, Page 17-5).
- 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. Place the Run/Tow switch in the TOW position and connect the batteries. See Connect the Batteries Electric Vehicles on page 1-5.
- 14. 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/Neutral/Reverse switch is in the FORWARD position.

WARNING CONTINUED ON NEXT PAGE

WARNING

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

Pagination Page