# EXPORT

PowerDrive®

&

IQplus SYSTEM

# BATTERY CHARGERS

Club Car®

## 2008 MAINTENANCE & SERVICE MANUAL

Manual No. 103373122 Edition Code 0408A00000

# FOREWORD

Club Car battery chargers are designed and built to provide unsurpassed performance efficiency among chargers in their class; 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 export Club Car battery chargers, and should be thoroughly reviewed prior to servicing the charger. 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 has 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 or charger may render the vehicle or charger unsafe. For this reason, Club Car advises that all repairs and/or service be performed by an authorized Club Car distributor/dealer representative or by a Club Car factory-trained technician.

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

This manual covers all aspects of typical battery charger service; unique situations, however, do sometimes occur when servicing a charger. If it appears that a service question is not answered in this manual, you may write to us at: Club Car, Inc.; P.O. Box 204658; Augusta, Georgia 30917; Attention: Technical Services.


This manual effective August 6, 2007.

## ⚠ WARNING

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

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

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

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

# CONTENTS

## SECTION 1 – SAFETY



## SECTION 2 – CHARGER IDENTIFICATION AND SPECIFICATIONS



## SECTION 3 – EXPORT POWERDRIVE BATTERY CHARGER (EXTERNAL)

## SECTION 4 – EXPORT POWERDRIVE CHARGER (ONBOARD)

## SECTION 5 – EXPORT IQ PLUS CHARGER (EXTERNAL)



## SECTION 6 – EXPORT IQ PLUS CHARGER (ONBOARD)

## SECTION i – INDEX

# SECTION 1 – SAFETY

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

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

### ⚠ DANGER

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

### ⚠ WARNING

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

### ⚠ CAUTION

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

### CAUTION

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

## GENERAL WARNING

The following safety statements must be heeded whenever the vehicle or battery charger is being operated, repaired, or serviced. Service technicians should become familiar with these general safety statements, which can be found throughout this manual. Also, other specific warnings appear throughout this manual and on the vehicle and battery charger.

### ⚠ 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 space. Wear a full face shield and rubber gloves when working on or near batteries.**
- **Battery – Poison! Contains acid! Causes severe burns. Avoid contact with skin, eyes, or clothing. Antidotes:**
  - **External: Flush with water. Call a physician immediately.**
  - **Internal: Drink large quantities of milk or water. Follow with milk of magnesia or vegetable oil. Call a physician immediately.**
  - **Eyes: Flush with water for 15 minutes. Call a physician immediately.**

## ⚠ WARNING

- **Do not leave children unattended on vehicle.**
- **Only trained technicians should repair or service the vehicle or battery charger. Anyone doing even simple repairs or service should have knowledge and experience in electrical and mechanical repair.**
- **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.**
- **Check the vehicle owner's manual for proper location of all vehicle safety and operation decals and make sure they are in place and are easy to read.**
- **Improper use of the vehicle or failure to properly maintain it could result in decreased vehicle performance, severe personal injury, or death.**
- **Any modification or change to the vehicle that affects the stability or handling of the vehicle, or increases maximum vehicle speed beyond factory specifications, could result in severe personal injury or death.**
- **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.**
- **Moving parts! Do not attempt to service the vehicle while it is running.**
- **Hot! Do not attempt to service hot motor or resistors. Failure to heed this warning could result in severe burns.**
- **Use insulated tools when working near batteries or electrical connections. Use extreme caution to avoid shorting of components or wiring.**
- **For vehicles with cargo beds, remove all cargo before raising the bed or servicing the vehicle. If the vehicle is equipped with a prop rod, ensure that it is securely engaged while bed is raised. Do not close bed until all persons are clear of cargo bed area. Keep hands clear of all crush areas. Do not drop cargo bed; lower gently and keep entire body clear. Failure to heed this warning could result in severe personal injury or death.**
- **Prior to servicing the vehicle or leaving the vehicle unattended, turn the key switch OFF, remove the key, and place the Forward/Reverse handle or switch in the NEUTRAL position. Chock the wheels when servicing the vehicle.**
- **All electric vehicles:**
  **To avoid unintentionally starting the vehicle, disconnect the batteries as shown (Figure 1-1, Page 1-4 through Figure 1-10, Page 1-6).**
- **IQ System and IQ Plus vehicles:**
  - **Place Tow/Run switch in the TOW position before disconnecting or connecting the batteries. Failure to heed this warning could result in a battery explosion or severe personal injury.**
  - **After disconnecting the batteries, wait 90 seconds for the controller capacitors to discharge.**
- **Never push objects of any kind into the battery charger case through the ventilation slots. Failure to heed this warning could result in an electrical short circuit that could result in a fire.**
- **Do not use a battery charger if the cord, plug, or receptacle is damaged in any way. Replace worn or damaged parts immediately. Failure to heed this warning could result in a fire, property damage, severe personal injury, or death.**
- **Do not use a battery charger if it has received a sharp blow, was dropped, or was otherwise damaged. Make sure it is operating properly before putting it back in use.**

**WARNING CONTINUED ON NEXT PAGE...**

## ⚠ WARNING

- **External battery chargers:**
  **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**
- **Onboard battery chargers:**
  **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and remove the battery charger from the vehicle. See Onboard Charger Removal on page 4-36 and 6-34.**
- **If wires are removed or replaced, make sure wiring and wire harness are properly routed and secured. Failure to properly route and secure wiring could result in vehicle malfunction, property damage, personal injury, or death.**
- **If battery wire terminals are damaged or corroded, they should be replaced or cleaned as necessary. Failure to do so may cause them to overheat during operation and could result in a fire, property damage, or personal injury.**
- **IQ Plus vehicles:**
  - **Use only 4-gauge (AWG) wires with low-resistance terminals to replace battery wires on IQ Plus models.**
  - **Only IQ Plus chargers should be used with IQ Plus vehicles. Long-term use of a PowerDrive battery charger with IQ Plus vehicles will damage the batteries.**
- **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.**

## ⚠ CAUTION

- **Be sure to check the batteries and charger monthly to maintain correct battery water level and ensure the charger is operating correctly during storage.**

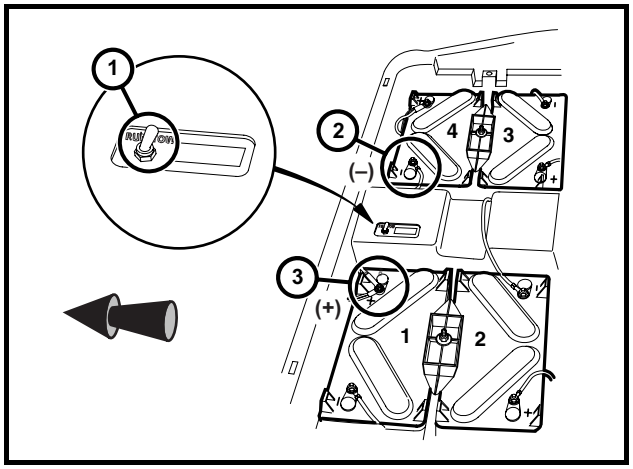


**Figure 1-1 Precedent Battery Configuration – Style A 4 x 12-Volt Batteries**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

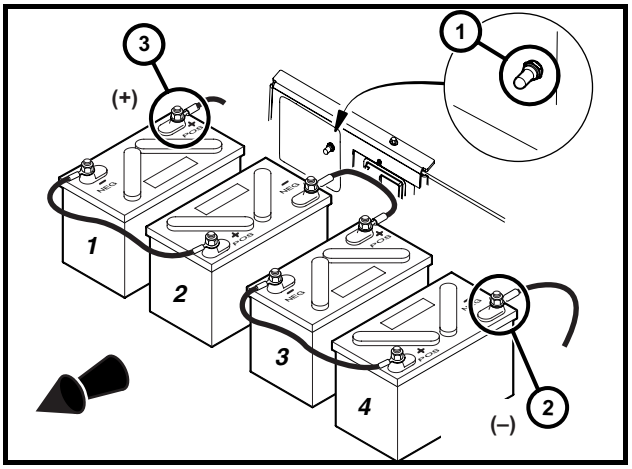


**Figure 1-2 Precedent Battery Configuration – Style B 4 x 12-Volt Batteries**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

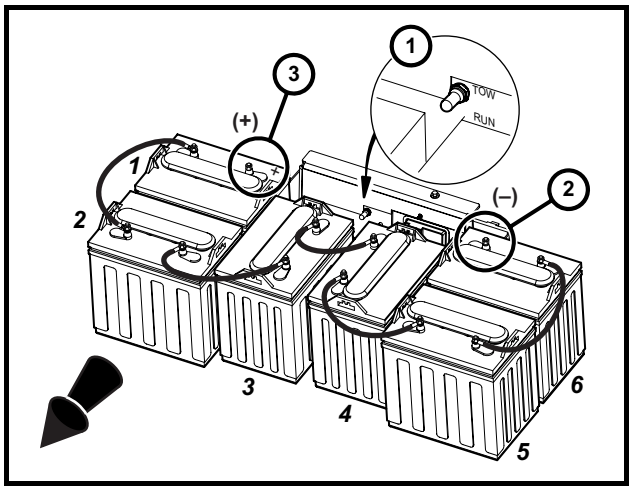


**Figure 1-3 Precedent Battery Configuration – Style C 6 x 8-Volt Batteries**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

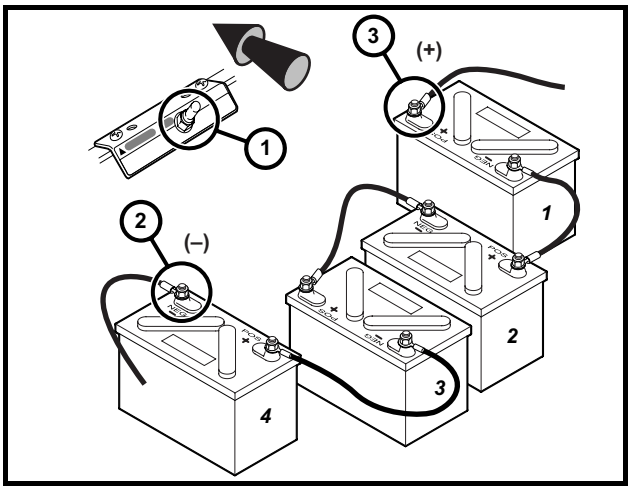


**Figure 1-4 DS, DS Villager 4, 800, 810 and 850 - 12-Volt Battery Configuration**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

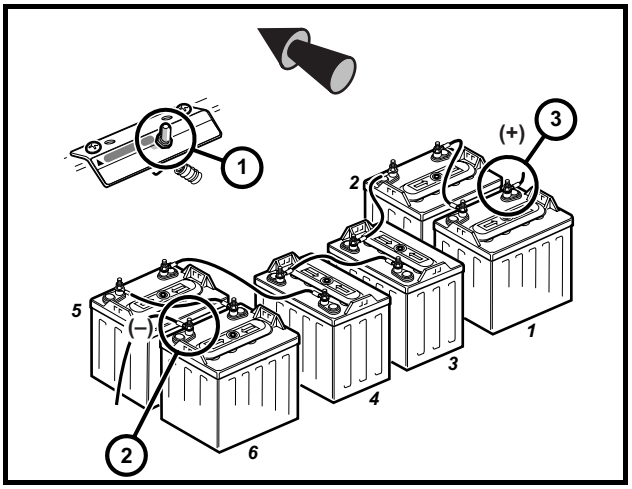


**Figure 1-5 Turf1 and Carryall 1 Battery Configuration**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

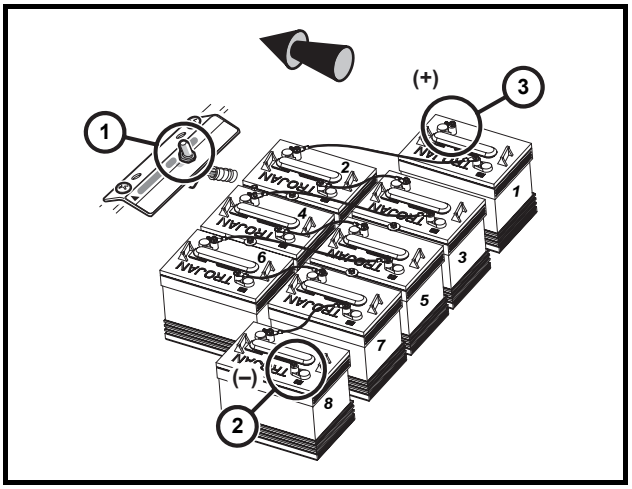


**Figure 1-6 Turf 2 and 252/Carryall 2 and 252/XRT 900 IQ Plus Battery Configuration**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

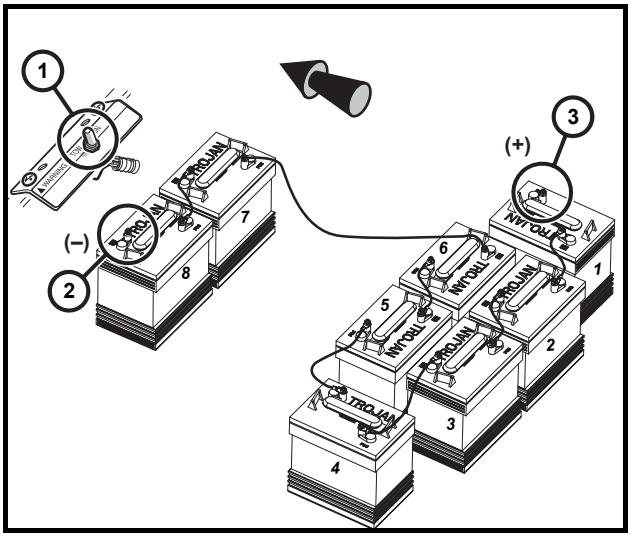


**Figure 1-7 Transporter 4 and 6 and Carryall 6 IQ Plus Battery Configuration**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

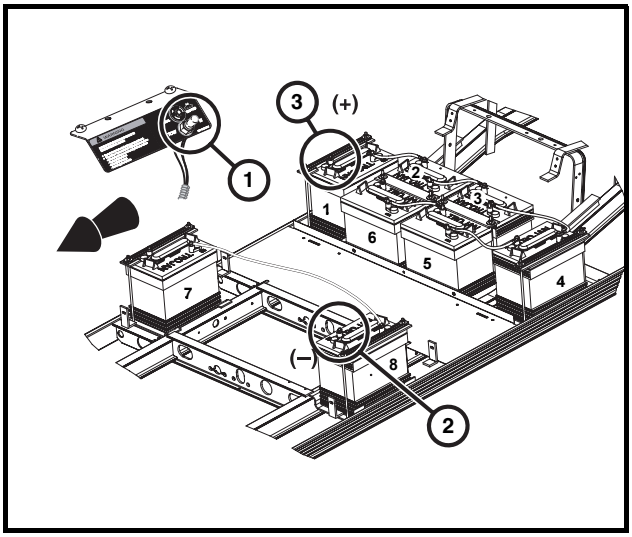


**Figure 1-8 Villager 6 and 8 IQ Plus Battery Configuration**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

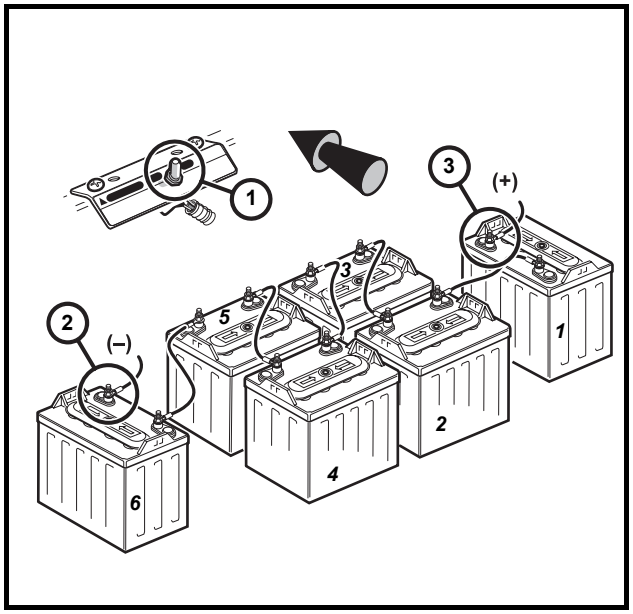


**Figure 1-9 Limo (Manual Brake) Battery Configuration**

(Viewed from driver side of vehicle)
1. Place TOW/RUN Switch in TOW before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

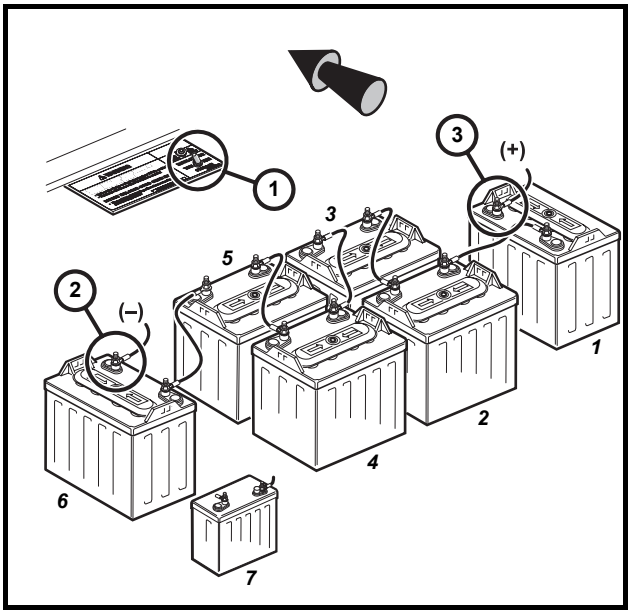


**Figure 1-10 Limo (AutoBrake) Battery Configuration**

(Viewed from driver side of vehicle)
1. Place TOW/STORAGE/RUN Switch in STORAGE before disconnecting or connecting battery cables.
2. Remove negative battery cable.
3. Remove positive battery cable.
Connect battery cables in reverse order.

# SECTION 2 – CHARGER IDENTIFICATION AND SPECIFICATIONS

## GENERAL INFORMATION

There are several different battery charger models available. It is important to properly identify the battery charger type and model number before attempting to service a battery charger. **See Battery Charger Identification on page 2-6.**

## BATTERY CHARGER SPECIFICATIONS

| EXPORT POWERDRIVE EXTERNAL CHARGER SPECIFICATIONS | Export PowerDrive External Battery Charger | |
|---|---|---|
| **MODEL NUMBER (CCI P/N)** | 18780-11 (101831503) | 18780-18 (101831504) |
| **AC INPUT** | | |
| **AC voltage:** 100, 200, 220, or 240 VAC (selectable) | • | • |
| **AC voltage (acceptable range):** at 100 VAC setting | 95-105 | 95-105 |
| **AC voltage (acceptable range):** at 200 VAC setting | 190-210 | 190-210 |
| **AC voltage (acceptable range):** at 220 VAC setting | 209-231 | 209-231 |
| **AC voltage (acceptable range):** at 240 VAC setting | 228-252 | 228-252 |
| **Frequency:** 50 Hz. / 60 Hz. | • | • |
| **POWER CONSUMPTION** | | |
| **Max. AC current (amps)** at 100 VAC / 50 Hz. | 13.6 | 13.6 |
| **Max. AC current (amps)** at 100 VAC / 60 Hz. | 12.4 | 12.4 |
| **Max. AC current (amps)** at 200 VAC / 50 Hz. | 6.9 | 6.9 |
| **Max. AC current (amps)** at 200 VAC / 60 Hz. | 6.3 | 6.3 |
| **Max. AC current (amps)** at 220 VAC / 50 Hz. | 6.9 | 6.9 |
| **Max. AC current (amps)** at 220 VAC / 60 Hz. | 6.3 | 6.3 |
| **Max. AC current (amps)** at 240 VAC / 50 Hz. | 5.9 | 5.9 |
| **Max. AC current (amps)** at 240 VAC / 60 Hz. | 5.1 | 5.1 |
| **DC OUTPUT** | | |
| **DC voltage (VDC) (start of charge cycle)** | 48 | 48 |
| **DC current (amps) (start of charge cycle)** | 17 | 17 |
| **DC voltage (VDC) (end of charge cycle)** | 60 | 60 |
| **DC current (amps) (end of charge cycle)** | 3.5 | 3.5 |
| **DIMENSIONS/WEIGHT** | | |
| **Case – overall length** | 10.25 in. (26 cm) | 10.25 in. (26 cm) |
| **Case – overall width** | 8.687 in. (22.1 cm) | 8.687 in. (22.1 cm) |

| EXPORT POWERDRIVE EXTERNAL CHARGER SPECIFICATIONS | Export PowerDrive External Battery Charger | |
|---|---|---|
| **MODEL NUMBER (CCI P/N)** | 18780-11 (101831503) | 18780-18 (101831504) |
| **Case – overall height** | 9.0 in. (22.9 cm) | 9.0 in. (22.9 cm) |
| **AC cord length** | 72 in. (182.9 cm) | 108 in. (274.3 cm) |
| **DC cord length** | 103 in. (261.6 cm) | 144 in. (365.8 cm) |
| **Weight** | 35 lb (15.9 kg) | 35.8 lb (16.2 kg) |
| **MOUNTING CONFIGURATION** | | |
| **Mounting:** Set on shelf, wall mount with keyhole, or hang securely from ceiling | • | • |

| EXPORT POWERDRIVE ONBOARD CHARGER SPECIFICATIONS | Export PowerDrive Onboard Battery Charger | | | |
|---|---|---|---|---|
| **Model number (CCI P/N)** | 17790-10 (101831601) | 17790-11 (101831602) | 17790-12 (101831603) | 17790-40 (102546902) |
| **AC INPUT** | | | | |
| **AC voltage:** 100, 200, 220, or 240 VAC (selectable) | • | • | • | • |
| **AC voltage (acceptable range):** at 100 VAC setting | 95-105 | 95-105 | 95-105 | 95-105 |
| **AC voltage (acceptable range):** at 200 VAC setting | 190-210 | 190-210 | 190-210 | 190-210 |
| **AC voltage (acceptable range):** at 220 VAC setting | 209-231 | 209-231 | 209-231 | 209-231 |
| **AC voltage (acceptable range):** at 240 VAC setting | 228-252 | 228-252 | 228-252 | 228-252 |
| **Frequency:** 50 Hz. / 60 Hz. | • | • | • | • |
| **POWER CONSUMPTION** | | | | |
| **Max. AC current (amps)** at 100 VAC / 50 Hz. | 13.6 | 13.6 | 13.6 | 13.6 |
| **Max. AC current (amps)** at 100 VAC / 60 Hz. | 12.4 | 12.4 | 12.4 | 12.4 |
| **Max. AC current (amps)** at 200 VAC / 50 Hz. | 6.9 | 6.9 | 6.9 | 6.9 |
| **Max. AC current (amps)** at 200 VAC / 60 Hz. | 6.3 | 6.3 | 6.3 | 6.3 |
| **Max. AC current (amps)** at 220 VAC / 50 Hz. | 6.9 | 6.9 | 6.9 | 6.9 |
| **Max. AC current (amps)** at 220 VAC / 60 Hz. | 6.3 | 6.3 | 6.3 | 6.3 |
| **Max. AC current (amps)** at 240 VAC / 50 Hz. | 5.9 | 5.9 | 5.9 | 5.9 |
| **Max. AC current (amps)** at 240 VAC / 60 Hz. | 5.1 | 5.1 | 5.1 | 5.1 |
| **DC OUTPUT** | | | | |
| **DC voltage (VDC) (start of charge cycle)** | 48 | 48 | 48 | 48 |
| **DC current (amps) (start of charge cycle)** | 17 | 17 | 17 | 17 |
| **DC voltage (VDC) (end of charge cycle)** | 60 | 60 | 60 | 60 |
| **DC current (amps) (end of charge cycle)** | 3.5 | 3.5 | 3.5 | 3.5 |
| **DIMENSIONS/WEIGHT** | | | | |
| **Case – overall length** | 10.25 in. (26 cm) | 10.25 in. (26 cm) | 10.25 in. (26 cm) | 10.25 in. (26 cm) |
| **Case – overall width** | 8.687 in. (22.1 cm) | 8.687 in. (22.1 cm) | 8.687 in. (22.1 cm) | 8.687 in. (22.1 cm) |
| **Case – overall height** | 9.437 in. (24 cm) | 9.437 in. (24 cm) | 9.437 in. (24 cm) | 9.437 in. (24 cm) |

**Specifications continued on next page...**

| EXPORT POWERDRIVE ONBOARD CHARGER SPECIFICATIONS | Export PowerDrive Onboard Battery Charger | | | |
|---|---|---|---|---|
| **Model number (CCI P/N)** | 17790-10 (101831601) | 17790-11 (101831602) | 17790-12 (101831603) | 17790-40 (102546902) |
| **AC cord length** | 17 ft. (5.2 m) (retractable) | 17 ft. (5.2 m) (retractable) | 17 ft. (5.2 m) (retractable) | 17 ft. (5.2 m) (retractable) |
| **DC cord length** | 80.5 in. (204.5 cm) | 129.5 in. (328.9 cm) | 162.5 in. (412.8 cm) | 9.5 in. (24 cm) |
| **Weight** | 37 lb (16.8 kg) | 37.7 lb (17.1 kg) | 38.2 lb (17.3 kg) | 37 lb (16.8 kg) |
| **MOUNTING CONFIGURATION** | | | | |
| **Mounting:** Onboard (secured to the vehicle) | • | • | • | • |

| EXPORT IQ PLUS EXTERNAL CHARGER SPECIFICATIONS | Export IQ Plus External Battery Charger | |
|---|---|---|
| **Model number (CCI P/N)** | 25880-11 (102892901) | 25880-18 (102892902) |
| **AC INPUT** | | |
| **AC voltage:** 100, 200, 220, or 240 VAC (selectable) | • | • |
| **AC voltage (acceptable range):** at 100 VAC setting | 95-105 | 95-105 |
| **AC voltage (acceptable range):** at 200 VAC setting | 190-210 | 190-210 |
| **AC voltage (acceptable range):** at 220 VAC setting | 209-231 | 209-231 |
| **AC voltage (acceptable range):** at 240 VAC setting | 228-252 | 228-252 |
| **Frequency:** 50 Hz. / 60 Hz. | • | • |
| **POWER CONSUMPTION** | | |
| **Max. AC current (amps)** at 100 VAC / 50 Hz. | 16.0 | 16.0 |
| **Max. AC current (amps)** at 100 VAC / 60 Hz. | 14.6 | 14.6 |
| **Max. AC current (amps)** at 200 VAC / 50 Hz. | 7.6 | 7.6 |
| **Max. AC current (amps)** at 200 VAC / 60 Hz. | 7.4 | 7.4 |
| **Max. AC current (amps)** at 220 VAC / 50 Hz. | 7.0 | 7.0 |
| **Max. AC current (amps)** at 220 VAC / 60 Hz. | 6.7 | 6.7 |
| **Max. AC current (amps)** at 240 VAC / 50 Hz. | 6.4 | 6.4 |
| **Max. AC current (amps)** at 240 VAC / 60 Hz. | 6.1 | 6.1 |
| **DC OUTPUT** | | |
| **DC voltage (VDC) (start of charge cycle)** | 48 | 48 |
| **DC current (amps) (start of charge cycle)** | 17 | 17 |
| **DC voltage (VDC) (end of charge cycle)** | 60 | 60 |
| **DC current (amps) (end of charge cycle)** | 4.7 | 4.7 |
| **DIMENSIONS/WEIGHT** | | |
| **Case – overall length** | 10.25 in. (26 cm) | 10.25 in. (26 cm) |
| **Case – overall width** | 8.687 in. (22.1 cm) | 8.687 in. (22.1 cm) |
| **Case – overall height** | 9.0 in. (22.9 cm) | 9.0 in. (22.9 cm) |
| **AC cord length** | N/A | N/A |
| **DC cord length** | 103 in. (261.6 cm) | 144 in. (365.8 cm) |
| **Weight** | 34.8 lb (15.8 kg) | 35.3 lb (16.0 kg) |
| **MOUNTING CONFIGURATION** | | |
| **Mounting:** Set on shelf, wall mount with keyhole, or hang securely from ceiling. | • | • |

| EXPORT IQ PLUS ONBOARD CHARGER SPECIFICATIONS | Export IQ Plus Onboard Battery Charger |
|---|---|
| **Model number (CCI P/N)** | 25660-40 (102893001) |
| **AC INPUT** | |
| **AC voltage:** 100, 200, 220, or 240 VAC (selectable) | • |
| **AC voltage (acceptable range):** at 100 VAC setting | 95-105 |
| **AC voltage (acceptable range):** at 200 VAC setting | 190-210 |
| **AC voltage (acceptable range):** at 220 VAC setting | 209-231 |
| **AC voltage (acceptable range):** at 240 VAC setting | 228-252 |
| **Frequency:** 50 Hz. / 60 Hz. | • |
| **POWER CONSUMPTION** | |
| **Max. AC current (amps)** at 100 VAC / 50 Hz. | 16.0 |
| **Max. AC current (amps)** at 100 VAC / 60 Hz. | 14.6 |
| **Max. AC current (amps)** at 200 VAC / 50 Hz. | 7.6 |
| **Max. AC current (amps)** at 200 VAC / 60 Hz. | 7.4 |
| **Max. AC current (amps)** at 220 VAC / 50 Hz. | 7.0 |
| **Max. AC current (amps)** at 220 VAC / 60 Hz. | 6.7 |
| **Max. AC current (amps)** at 240 VAC / 50 Hz. | 6.4 |
| **Max. AC current (amps)** at 240 VAC / 60 Hz. | 6.1 |
| **DC OUTPUT** | |
| **DC voltage (VDC) (start of charge cycle)** | 48 |
| **DC current (amps) (start of charge cycle)** | 17 |
| **DC voltage (VDC) (end of charge cycle)** | 60 |
| **DC current (amps) (end of charge cycle)** | 4.7 |
| **DIMENSIONS/WEIGHT** | |
| **Case – overall length** | 11.75 in. (29.9 cm) |
| **Case – overall width** | 7.25 in. (18.4 cm) |
| **Case – overall height** | 9.5 in. (24.1 cm) |
| **AC cord length** | 17 ft. (5.2 m) (retractable) |
| **DC cord length** | 21.5 in. (54.6 cm) |
| **Weight** | 37.0 lb (16.8 kg) |
| **MOUNTING CONFIGURATION** | |
| **Mounting:** Onboard (secured to the vehicle) | • |

# BATTERY CHARGER IDENTIFICATION

The battery charger can be identified by the model number printed on the charger. Refer to the appropriate section of this manual, as indicated in the chart below, for information on troubleshooting and repairing the battery charger. Do not attempt to service a battery charger that cannot be properly identified. If a charger cannot be identified, contact your local Club Car dealer or distributor.

| BATTERY CHARGER NAME AND MODEL NUMBER | REFER TO |
|---|---|
| Export PowerDrive External Battery Charger 18780-11 (101831503) | Section 3 – Export PowerDrive Battery Charger (External) |
| Export PowerDrive External Battery Charger 18780-18 (101831504) | |
| Export PowerDrive Onboard Battery Charger 17790-10 (101831601) | Section 4 – Export PowerDrive Charger (Onboard) |
| Export PowerDrive Onboard Battery Charger 17790-11 (101831602) | |
| Export PowerDrive Onboard Battery Charger 17790-12 (101831603) | |
| Export PowerDrive Onboard Battery Charger 17790-40 (102546902) | |
| Export IQ Plus External Battery Charger 25880-11 (102892901) | Section 5 – Export IQ Plus Charger (External) |
| Export IQ Plus External Battery Charger 25880-18 (102892902) | |
| Export IQ Plus Onboard Battery Charger 25660-40 (102893001) | Section 6 – Export IQ Plus Charger (Onboard) |

# SECTION 3 – EXPORT POWERDRIVE BATTERY CHARGER (EXTERNAL)

### ⚠ DANGER

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

### ⚠ WARNING

- **See General Warning, Section 1, Page 1-1.**
- **The battery charger DC plug must be pulled slowly from the receptacle (Figure 3-8, Page 3-10). Jerking or pulling the DC cord out quickly could cause arcing that could damage the plug and receptacle and could cause batteries to explode (Figure 3-9, Page 3-10).**

## GENERAL INFORMATION

This section includes information pertaining to service of the Export PowerDrive battery charger (model numbers 18780-11 and 18780-18). Depending on the geographic region, the charger provided with your vehicle may be a different model. Do not attempt to service a battery charger that has not been properly identified. If a charger cannot be properly identified, contact your local Club Car dealer or distributor.

The PowerDrive battery charger is automatic and has no external controls **(Figure 3-1, Page 3-1)**. When the charger is connected, there is a 2 to 15 second delay before charging begins. **See following NOTE.**

***NOTE:*** *At one hour and at two hours into the charge cycle, the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero). Charging will resume in a few moments (ammeter returns to previous rate of charge).*

The onboard computer (OBC) records the amount of energy consumed as the vehicle is used, then directs the charger to replace exactly the amount of energy needed to fully replenish the batteries. The charger shuts off automatically, preventing the possibility of either undercharging or overcharging.

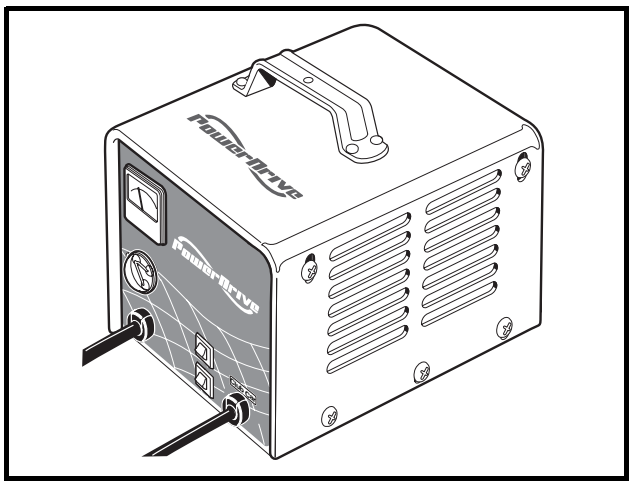


**Figure 3-1 PowerDrive Battery Charger (Export)**

## POWERDRIVE CHARGER FEATURES

- **Charge Interlock**:
  PowerDrive battery charger DC plugs have three pins rather than two blades that most standard charger plugs have. Two of these pins are the positive and negative leads as on standard chargers; the third pin is a sensing lead that is the communication link between the charger and the onboard computer. When the charger plug is plugged into the vehicle receptacle, the onboard computer locks out the vehicle drive system. This prevents the possibility of driving the vehicle while the charger is plugged in and potentially damaging the vehicle and charger.
- **Long-Term Storage Charge:**
  PowerDrive chargers are designed to be left connected with AC power to the charger, during off-season or long-term storage. The onboard computer will automatically activate the charger every 15 days. To return the vehicle to service, disconnect the DC cord from the vehicle, wait 15 seconds and plug the DC cord back in. **See following WARNING.** The charger will activate. Allow the vehicle to complete one full charge cycle before putting it into service.

### ⚠ WARNING

- **The charger plug must be pulled slowly from the receptacle. 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.**

## BATTERY WARNING LIGHT

The 48-volt electric vehicle features a dash mounted battery warning light (above the steering column) that, when the vehicle is in operation, indicates low battery voltage or, when the vehicle is being charged, indicates a charging problem. The battery warning light is controlled by the onboard computer.

When the batteries receive an incomplete charge because 1) the DC power cord is disconnected, 2) AC power to charger is interrupted, 3) automatic charger shut-off occurs after 16 hours of operation, or 4) charger malfunctions, the warning light will indicate as follows:

- The battery warning light will not illuminate if the charge is 90% or more complete. The onboard computer will retain in memory the amount of charge needed to fully replenish the batteries and will complete the charge during the next charge cycle.
- When the charger DC cord is unplugged during a charge cycle, the battery warning light will illuminate and remain illuminated for 10 seconds if the charge is less than 90% complete but the vehicle has enough power for 30 minutes of operation. This will alert the fleet operator that the vehicle may be used, but that it must be charged to completion as soon as possible.
- The battery warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, if the charger times out at 16 hours and the batteries are not sufficiently charged. This indicates an abnormal charge cycle. The charger and batteries should be checked by your Club Car distributor/dealer.
- The battery warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, during a charge cycle (with the DC plug still connected) if AC power to the charger is interrupted. The light will go out when AC power is restored.

# THE CHARGE CIRCUIT

## DS, DS VILLAGER 4, 800, 810 AND 850

The vehicle charge circuit consists of the following components:

- charger receptacle
- receptacle fuse link
- sense lead fuse
- onboard computer
- batteries

The negative terminal of the receptacle is connected to the onboard computer **(Figure 3-2, Page 3-3)**. The 10-gauge black wire from the onboard computer connects to the B– terminal on the speed controller, and the 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 4. The positive terminal of the charger receptacle is connected to the positive (+) post of battery no. 1. The gray wire (sense lead) from the charger receptacle is connected to the sense lead fuse, which is connected to the gray wire from the onboard computer.

If the charger works with one vehicle, but does not work with another vehicle, then most likely the problem is in the vehicle charge circuit. Check the connections between the 18-gauge gray wire from the charger receptacle, the sense lead fuse, and the 18-gauge gray wire from the onboard computer. In addition, check the charger receptacle fuse link and its connections.

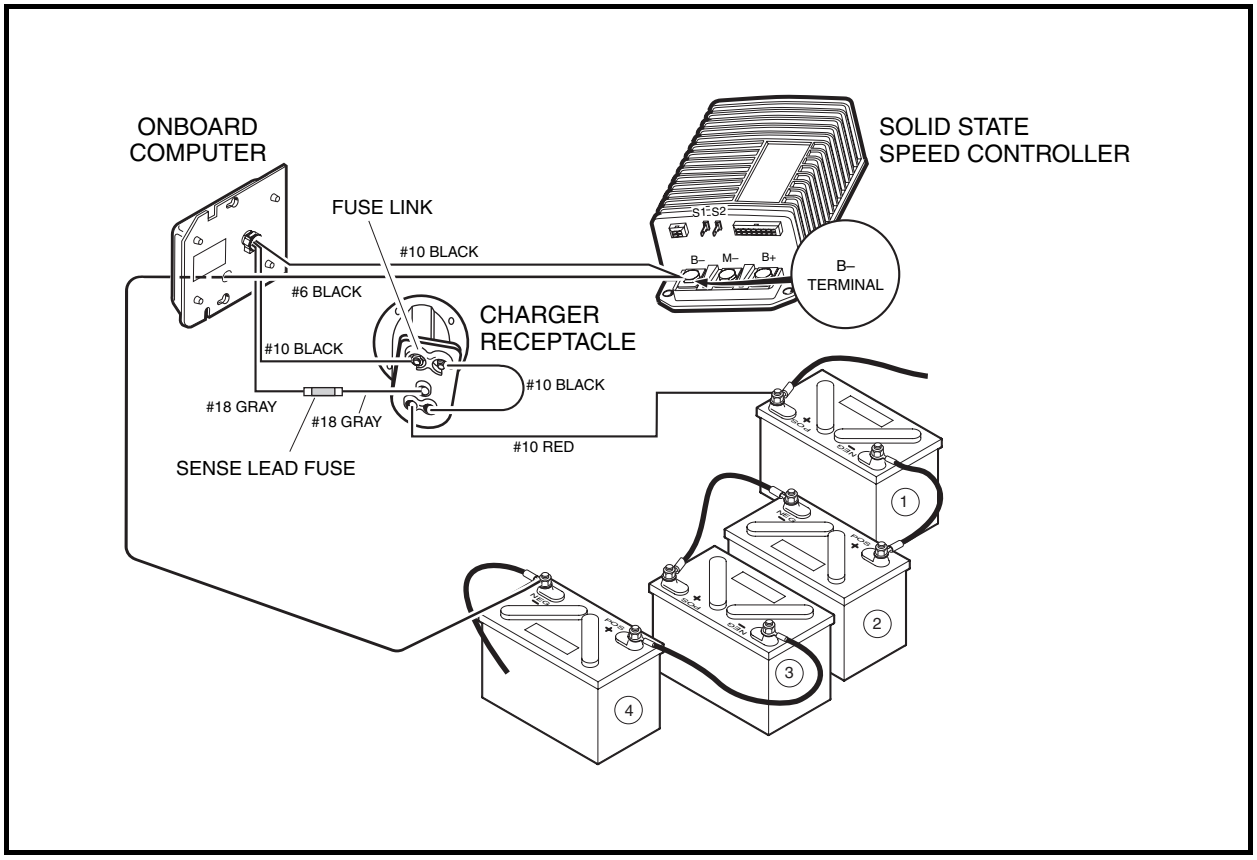


**Figure 3-2 Charge Circuit and Battery Configuration – DS, DS Villager 4, 800, 810 and 850**

## TURF 1 AND CARRYALL 1

The vehicle charge circuit consists of the following components:

- charger receptacle
- receptacle fuse link
- sense lead fuse
- onboard computer
- batteries

The negative terminal of the receptacle is connected to the onboard computer **(Figure 3-3, Page 3-4)**. The 10-gauge black wire from the onboard computer connects to the B– terminal on the speed controller, and the 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 6. The positive terminal of the charger receptacle is connected to the positive (+) post of battery no. 1. The gray wire (sense lead) from the charger receptacle is connected to the sense lead fuse, which is connected to the gray wire from the onboard computer.

If the charger works with one vehicle, but does not work with another vehicle, then most likely the problem is in the vehicle charge circuit. Check the connections between the 18-gauge gray wire from the charger receptacle, the sense lead fuse, and the 18-gauge gray wire from the onboard computer. In addition, check the charger receptacle fuse link and its connections.

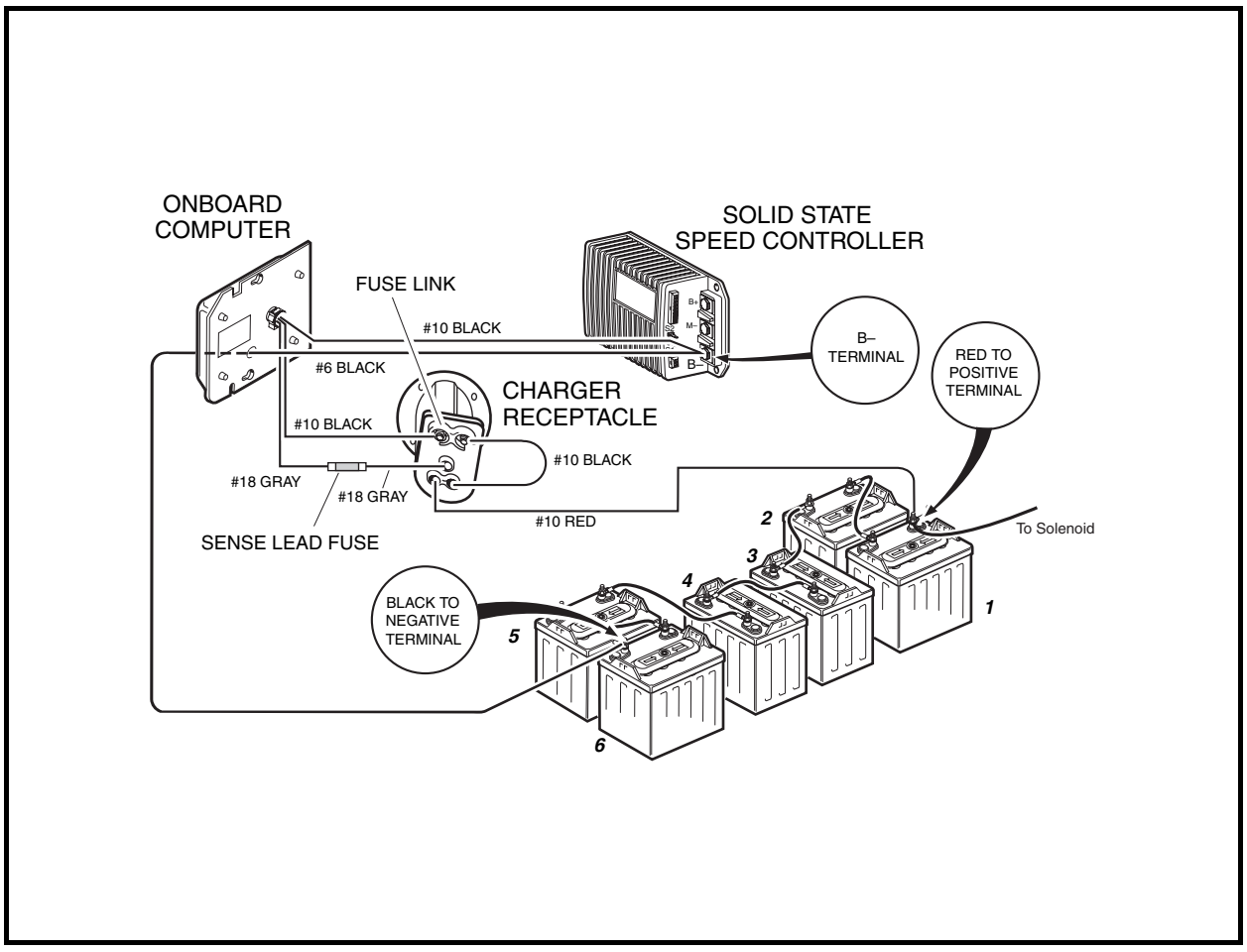


**Figure 3-3 Charge Circuit and Battery Configuration – Turf 1 and Carryall 1**

## PRECEDENT – 4 X 12-VOLT

The vehicle charge circuit consists of the following components:

- charger receptacle
- onboard computer
- batteries

The negative terminal of the receptacle is connected to the onboard computer **(Figure 3-4, Page 3-5 or Figure 3-5, Page 3-6)**. The 10-gauge black wire from the onboard computer connects to the B– terminal on the speed controller, and the 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 4. The positive terminal of the charger receptacle is connected to the positive (+) post of battery no. 1. The gray wire from the onboard computer is connected to the charger receptacle.

If the charger works with one vehicle, but does not work with another vehicle, then most likely the problem is in the vehicle charge circuit. Check wire continuity and connections between the charger receptacle, onboard computer and batteries.

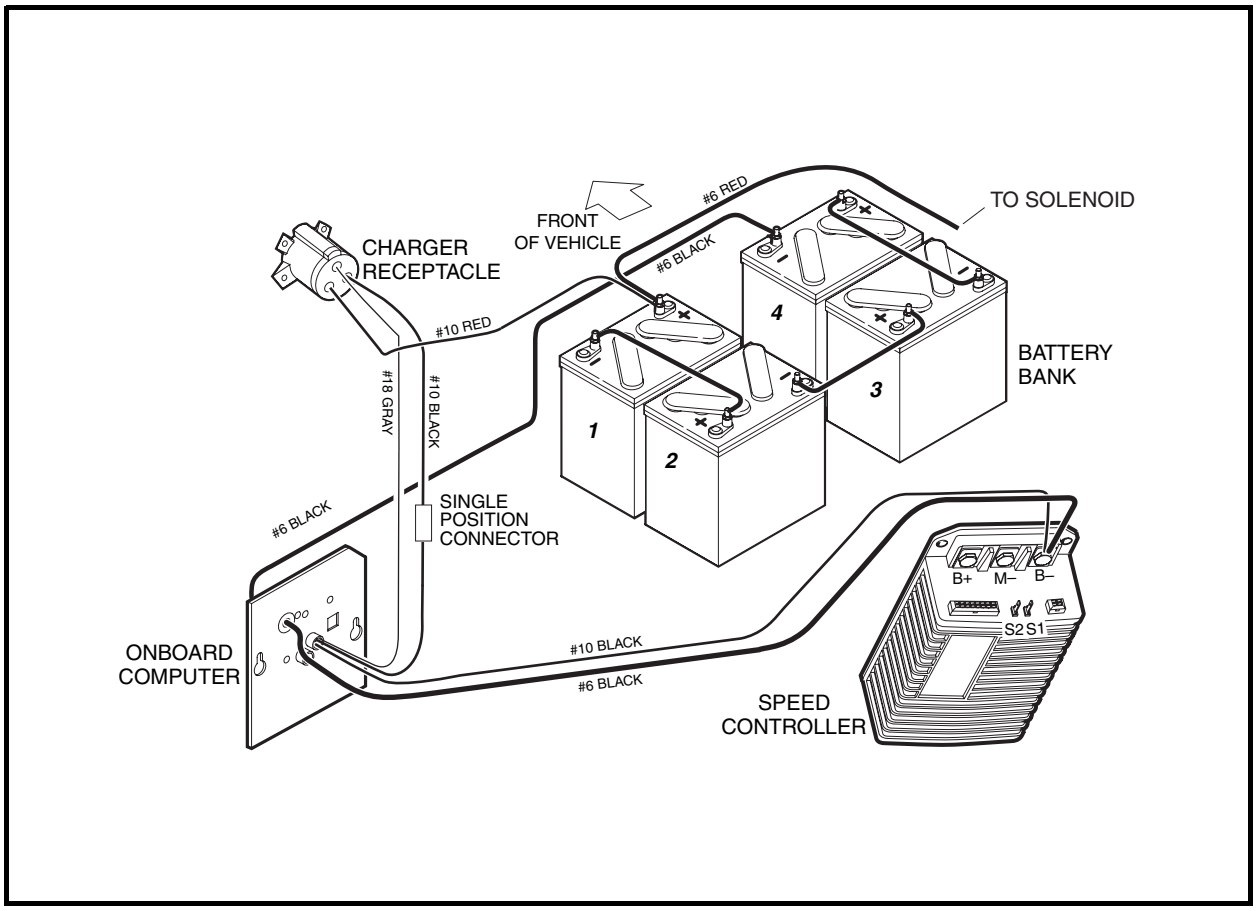


**Figure 3-4 Charge Circuit and Style A Battery Configuration – 4 x 12-Volt Precedent Vehicles**

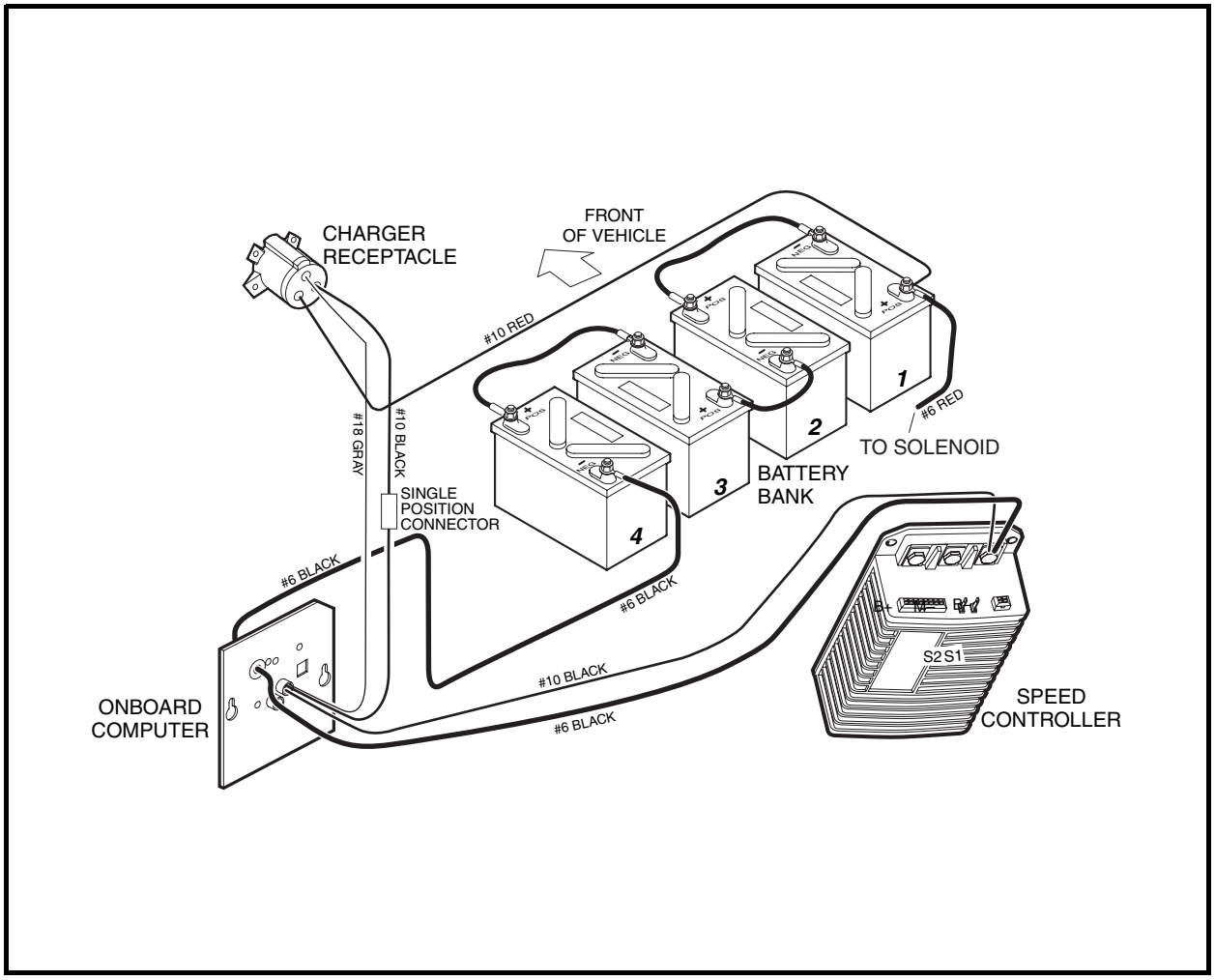


**Figure 3-5 Charge Circuit and Style B Battery Configuration – 4 x 12-Volt Precedent Vehicles**

## PRECEDENT – 6 X 8-VOLT

The vehicle charge circuit consists of the following components:

- charger receptacle
- onboard computer
- batteries

The negative terminal of the receptacle is connected to the onboard computer **(Figure 3-6, Page 3-7)**. The 10-gauge black wire from the onboard computer connects to the B– terminal on the speed controller, and the 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 6. The positive terminal of the charger receptacle is connected to the positive (+) post of battery no. 1. The gray wire from the onboard computer is connected to the charger receptacle.

If the charger works with one vehicle, but does not work with another vehicle, then most likely the problem is in the vehicle charge circuit. Check wire continuity and connections between the charger receptacle, onboard computer and batteries.

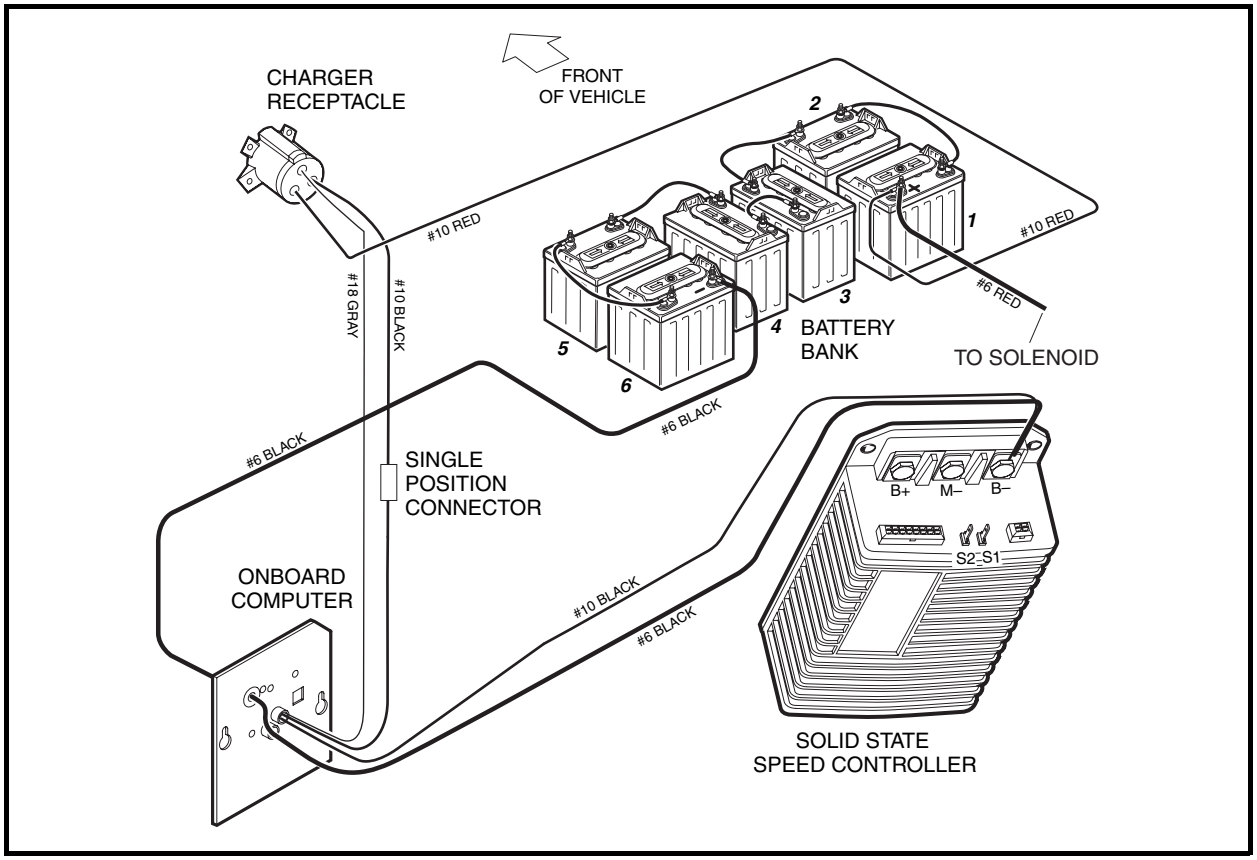


**Figure 3-6 Charge Circuit and Style C Battery Configuration – 6 x 8-Volt Precedent Vehicles**

## LIMO – 6 X 8-VOLT

The vehicle charge circuit consists of the following components:

- charger receptacle
- receptacle fuse link
- sense lead fuse
- onboard computer
- batteries

The negative terminal of the receptacle is connected to the onboard computer **(Figure 3-7, Page 3-8)**. The 10-gauge black wire from the onboard computer connects to the B– terminal on the speed controller, and the 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 6. The positive terminal of the charger receptacle is connected to the positive (+) post of battery no. 1. The gray wire from the onboard computer is connected to the charger receptacle.

If the charger works with one vehicle, but does not work with another vehicle, then most likely the problem is in the vehicle charge circuit. Check the connections between the 18-gauge gray wire from the charger receptacle, the sense lead fuse, and the 18-gauge gray wire from the onboard computer. In addition, check the charger receptacle fuse link and its connections**.**

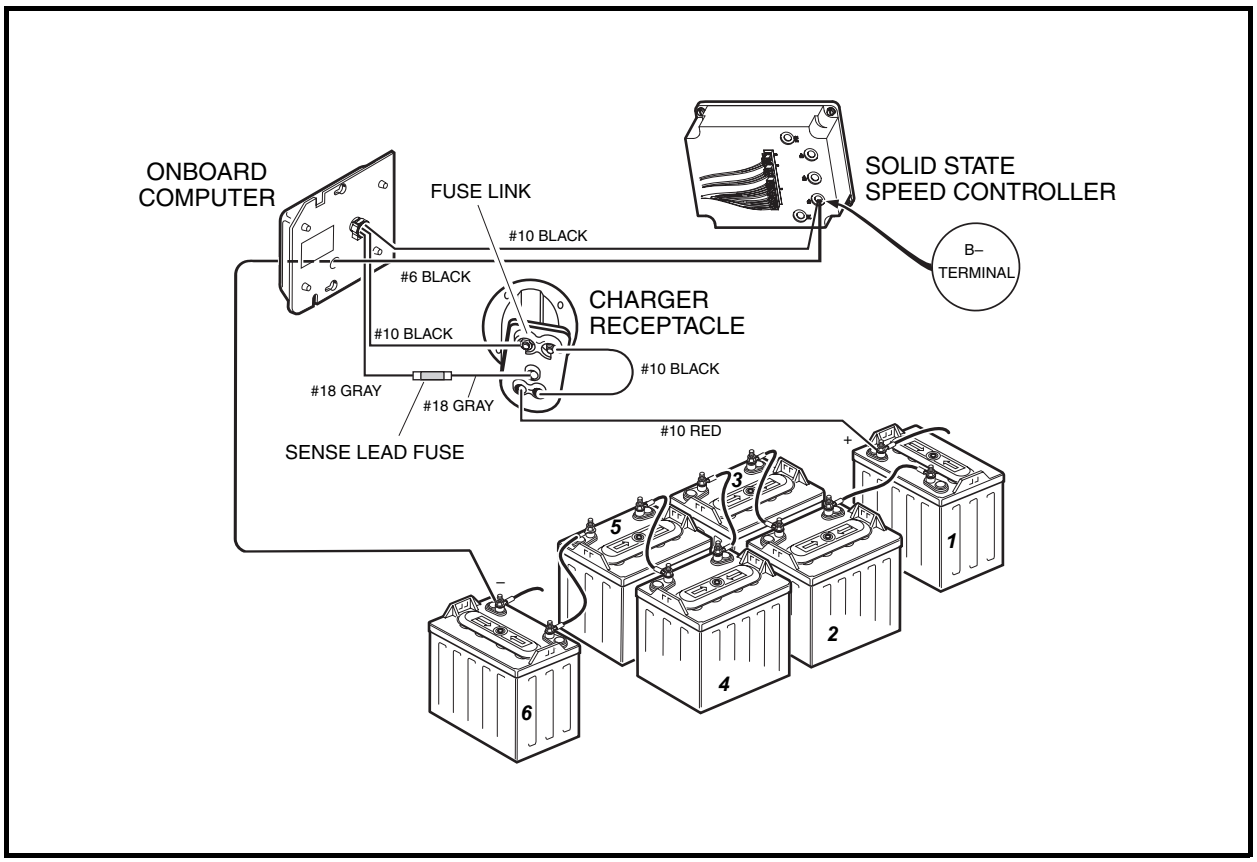


**Figure 3-7 Charge Circuit and Battery Configuration – Limo Electric Vehicles**

# CHARGER INSTALLATION AND OPERATION

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.**

## ⚠ 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 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.**

## ⚠ WARNING

- **Do not bypass the sense lead fuse (not applicable to Precedent vehicles).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**
- **The battery charger DC plug must be pulled slowly from the receptacle (Figure 3-8, Page 3-10). Jerking or pulling the DC cord out quickly could cause arcing that could damage the plug and receptacle and could cause batteries to explode (Figure 3-9, Page 3-10).**
- **Do not connect the charger to battery packs that are not compatible with the DC output voltage specified on the charger. Overheating and transformer burnout will result.**
- **Do not use a battery charger if the cord, plug, or receptacle is damaged in any way. Replace worn or damaged parts immediately. Failure to heed this warning could result in a fire, property damage, severe personal injury, or death.**
- **Do not use a battery charger if it has received a sharp blow, was dropped, or was otherwise damaged. Make sure it is operating properly before putting it back in use.**
- **Each charger should have its own branch circuit protection (circuit breaker or fuse) rated in accordance with applicable national electrical codes and regulations. Improper AC supply circuit protection may result in a fire. See Battery Charger Specifications, Section 2, Page 2-1 for maximum current draw.**
- **Improper connection of the equipment-grounding conductor can result in an electrical shock.**
- **Do not use an adapter to plug charger into a two-blade outlet or extension cord. Extension cord or outlet must accept grounded three-blade plug. The use of an improper extension cord could result in fire or electric shock.**
- **Chargers can ignite flammable materials and vapors. Do not use near fuels, grain dust, solvents, thinner, or other flammables.**
- **Keep charger dry – Do not expose to rain.**
- **Do not block or cover the charger ventilation slots. The slots provide ventilation and prevent the charger from overheating.**
- **Do not allow clothing, blankets, or other materials to cover the charger.**
- **Do not allow the charger to operate for more than 30 minutes at 19 or more amperes.**
- **Install surge arrestors on incoming AC power lines. Surge arrestors will help protect electrical components in the charger and on the vehicle from all but direct or close lightening strikes.**

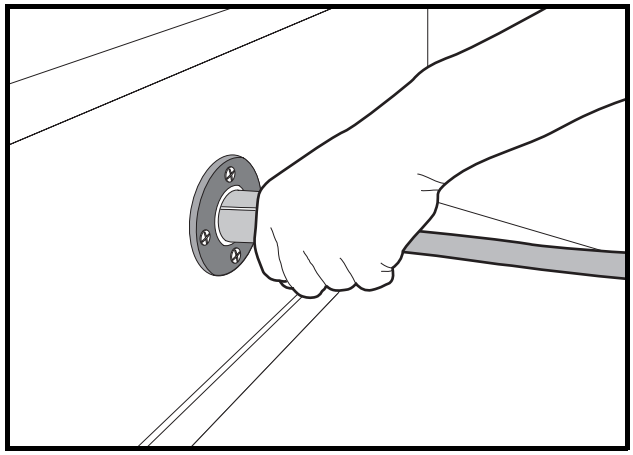

**Figure 3-8 Charger Receptacle**

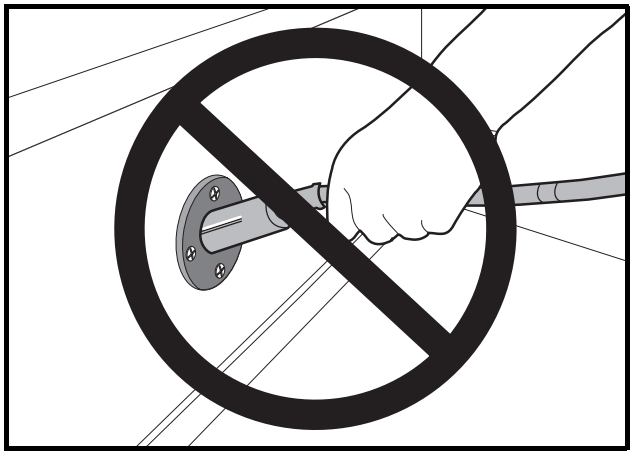

**Figure 3-9 Incorrect DC Plug Removal**

## AC POWER CONNECTION

The AC line to which the charger is to be connected must be of the proper AC input voltage for the charger and must be capable of supplying sufficient current. **See Section 2 – Charger Identification and Specifications.** If the battery charger is equipped with a multi-position switch for variable AC input voltage, the switch must be set for the correct voltage before the AC cord is connected **(Figure 3-10, Page 3-10)**. **See following CAUTION and NOTE.**

### CAUTION

- **Failure to set the AC input voltage selector switch to the correct voltage could result in damage to the battery charger or batteries.**

***NOTE:*** *Make sure that the AC cord provided with your charger has the proper AC plug for your location. If it does not, contact your Club Car representative to obtain the proper cord or plug.*

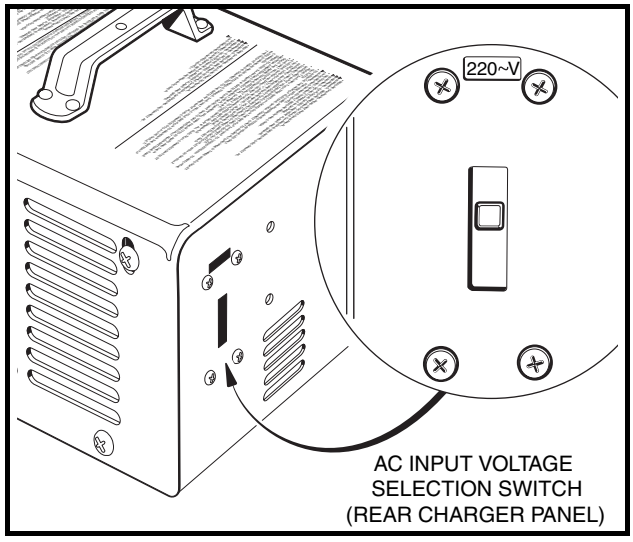


**Figure 3-10 AC Input Voltage Selection Switch**

With charger DC cord disconnected, connect the power supply cord to an AC supply within the acceptable voltage range. **See Battery Charger Specifications, Section 2, Page 2-1.**

To reduce the risk of electric shock, the battery charger must be grounded. The charger is equipped with an AC electric cord with an equipment-grounding conductor and a grounding type plug. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with all applicable national and local electrical codes and regulations.

The use of an extension cord with the charger should be avoided. If an extension cord must be used, use a three-conductor no. 12 AWG (American Wire Gauge) or no. 14 SWG (British Standard Wire Gauge), heavy-duty cord with ground, properly wired and in good electrical condition. Keep it as short as possible (no more than 12 feet (3.7 m)). Place all cords so they will not be stepped on, tripped over, or otherwise subject to damage or stress.

Ensure that the charger ventilation slots are unobstructed and that there is adequate ventilation.

## CHARGING BATTERIES

### ⚠ WARNING

- **Do not bypass the sense lead fuse (not applicable to Precedent vehicles).**
- **Be sure the fuse link is clean and tight (not applicable to Precedent vehicles).**
- **Be sure all wire connections at the receptacle are clean and tight.**
- **Do not rock or bend the plug. To connect the charger plug to the vehicle receptacle, grasp the plug handle and push the plug straight into the receptacle (Figure 3-8, Page 3-10).**
- **Do not pull on the DC cord (Figure 3-9, Page 3-10). Do not twist, rock or bend the plug. To disconnect the charger plug from the vehicle receptacle, grasp the plug by the handle and pull the plug straight out of the receptacle.**
- **Do not connect a charger to the receptacle if the charger cord, plug, or the vehicle receptacle is broken, damaged in any manner, or does not make a good electrical connection. Fire or personal injury can result. Have it replaced by a qualified service person immediately. Failure to follow these instructions could result in damage to the charger cord, the plug, and (or) the vehicle receptacle.**
- **Do not use a charger if:**
  - **The plug is too loose or does not make a good connection.**
  - **The plug and receptacle feel hotter than normal during charge.**
  - **The plug pin or receptacle contacts are bent or corroded.**
  - **The plug, receptacle, or cords are cut, worn, have any exposed wires or are damaged in any way.**
- **Using the charger with any of the above symptoms could result in a fire, property damage, personal injury, or death.**

1. With the charger DC cord disconnected from the vehicle charger receptacle, connect the AC power supply cord to an AC outlet designed to provide the proper AC voltage for the charger.
2. Connect the charger DC plug to the vehicle charger receptacle located on the seat support panel **(Figure 3-8, Page 3-10).** The charger will activate automatically within 2 to 15 seconds after the DC plug is connected. **See following WARNING.**

**⚠ WARNING**

- **Do not rock or bend the DC plug. To connect the charger plug to the vehicle receptacle, grasp the plug handle and push the plug straight into the receptacle (Figure 3-8, Page 3-10).**

3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 15 to 19 amps, depending upon the condition and depth of discharge of the batteries. Slight variations in the initial charge rate may also result from AC line input voltages that are higher or lower than the nominal input voltage. Higher AC line voltages increase the initial charge rate while lower AC line voltages reduce the initial charge rate.
4. Monitor the ammeter. Under normal operating conditions (when the charger is on and the batteries are discharged), the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero) one hour and two hours into the charge cycle. **See following NOTE.**

***NOTE:*** *Batteries should be put on charge at the end of each day even if the vehicle has been used for only a short amount of time (even if for only 10 minutes).*

*When air temperatures fall below 65 °F (18.3 °C), batteries charged in unheated areas should be placed on charge as soon as possible after use. Cold batteries require more time to fully charge.*

*New batteries will not deliver their full range until the vehicle has been driven and recharged from 20 to 50 times.*

*Vehicles should be restricted to 40 to 50 energy units of discharge between charges until the batteries have been properly seasoned (20 to 50 charge cycles). For maximum battery life, Club Car recommends that electric vehicles always be recharged after 40 to 50 energy units of discharge or each night in order to avoid deep discharging the batteries. Charging between rounds will also extend battery life; use the CDM (Communication Display Module) (CCI P/N 101831801).* ***See Communication Display Module (CDM) in Section 11 of the appropriate maintenance and service manual.***

## TESTING CHARGER OPERATION

1. With the DC plug disconnected from the vehicle charger receptacle, insert the AC cord into an outlet. The charger relay should NOT close. A multimeter set to volts DC and connected across the DC plug positive (+) and negative (–) pins should indicate zero volts. No transformer hum should be heard.
2. Disconnect the AC cord from the wall outlet and connect the DC plug to the receptacle. The charger relay should close with an audible click after a 2 to 15 second delay. **See following NOTE.**

***NOTE:*** *Monitor the charge cycle to make sure the charger turns off properly. If the charge cycle is interrupted, and the batteries are less than 90% charged, the battery warning light will illuminate intermittently.* ***See Battery Warning Light on page 3-2.***

3. If the charger does not operate exactly as described above, refer to the wiring diagram and make sure that the vehicle is wired correctly **(Figure 3-2, Page 3-3 through Figure 3-7, Page 3-8)** and that the internal charger wiring is correct **(Figure 3-11, Page 3-13)**.

## DC CORD AND PLUG INSPECTION

The charger cord, plug, and receptacle are wear items and should be inspected daily. Visually inspect them for cracks, loose connections, and frayed wiring; they must be replaced when worn or damaged. If charger plug or receptacle show signs of corrosion or the plug is difficult to insert or remove, the receptacle contacts

and plug terminals should be cleaned with a good electrical contact cleaner. The plug should then be inserted and removed several times to ensure ease of insertion, ease of removal, and good electrical contact. **See Charger Receptacle in Section 12 of the appropriate maintenance and service manual for receptacle removal and installation. See also DC Cord Removal on page 3-30. See following NOTE.**

***NOTE:*** *If the warning tag has been damaged or removed from the DC cord, have it replaced immediately.*

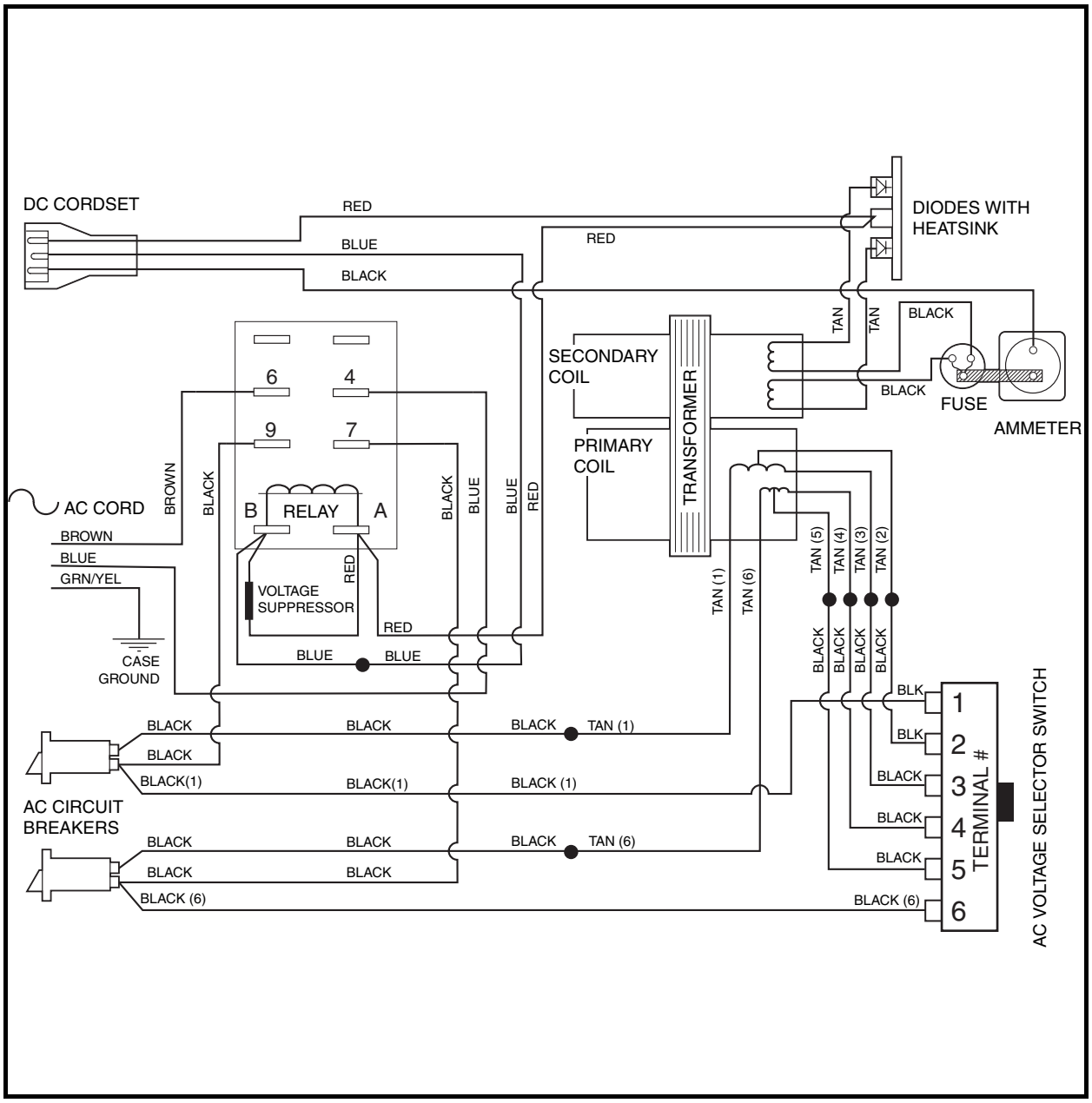


**Figure 3-11 PowerDrive Export Charger Wiring Diagram**

# CHECKING BATTERY CONDITION AFTER A CHARGE CYCLE

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

It is common practice for technicians to check the condition of a set of batteries after they have been charged to ensure they have received a complete charge before the vehicle is used. With the PowerDrive battery charger this practice is not necessary. The onboard computer controls and monitors the charge cycle. If any problem occurs during a charge cycle, the battery warning light, located above the steering column in the center dash panel, will illuminate intermittently.

If the battery warning light is illuminated after a charge cycle, refer to the troubleshooting chart. **See Troubleshooting on page 3-14.** If the specified test procedures identify no problems, plug the DC cord into the vehicle and let it charge until the charger shuts off automatically. If a problem is found, correct it and charge the vehicle. Normal battery voltage near the end of a charge cycle should be approximately 59 to 63 volts DC while the charger is still operating.

## START CHARGE CYCLE

1. Disconnect the DC plug from the vehicle charger receptacle.
2. Wait 20 seconds, then reconnect the DC cord to the vehicle receptacle. **See following NOTE.**

***NOTE:*** *The charger will not operate unless a delay of approximately 20 seconds is observed.*

3. Monitor the ammeter for the charge rate. If the batteries are close to being fully charged, the charge cycle will begin and the charge current will begin to taper within a few minutes.

# TROUBLESHOOTING

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### ⚠ 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.**

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 3-11, Page 3-13).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**

Use the following Troubleshooting Guide for troubleshooting export PowerDrive external battery chargers (model numbers 18780-11 and 18780-18). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

## EXPORT POWERDRIVE BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Relay does not close, no transformer hum and ammeter does not move** | Batteries disconnected | Connect batteries. **See Figure 3-2, Page 3-3 through Figure 3-7, Page 3-8** |
| | Battery voltage is too low | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-18 |
| | Poor connection between plug and receptacle | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-18 |
| | DC plug and cord | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-18 and Test Procedure 5 – Charger DC Circuit Continuity Test on page 3-23 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 3-21 |
| | Gray sense lead fuse is blown (not applicable to Precedent vehicles) | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-18 |
| | Receptacle fuse link is blown (not applicable to Precedent vehicles) | See Electrical Components section in the appropriate maintenance and service manual |
| | Poor connection at 10-gauge black wire or 18-gauge gray wire at the OBC (applicable to Precedent vehicles only) | Check wire connections |
| **Relay closes with an audible click but no transformer hum and ammeter does not move** | Improper AC outlet voltage | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-21 |
| | Failed AC plug and cord | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-21 |
| | Internal AC breaker | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-21 |
| | Transformer primary coil | Test Procedure 6 – Transformer on page 3-24 |
| | Relay | Test Procedure 8 – Continuity on page 3-26 |
| | Failed ammeter | Replace ammeter |
| **Relay closes and transformer hums but ammeter does not move** | Blown charger fuse | Test Procedure 5 – Charger DC Circuit Continuity Test on page 3-23 |
| | Both diodes failed | Test Procedure 4B – Both Diodes Failed on page 3-23 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 3-21 |
| | Failed transformer or voltage switch | Test Procedure 6 – Transformer on page 3-24 |
| **Relay operates intermittently** | Failed charger relay | Test Procedure 8 – Continuity on page 3-26 |
| **Single charger fuse link blows** | Diode failed | Test Procedure 4A – Single Diode Failure on page 3-22 |
| | Loose internal fuse connection | Tighten connection |

**Troubleshooting Guide continued on next page...**

## EXPORT POWERDRIVE BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Both charger fuse links blow or receptacle fuse link blows** | Battery is wired in reverse polarity | Check vehicle wiring |
| | DC cord is wired in reverse polarity | Check battery charger wiring |
| | Both diodes failed | Test Procedure 4B – Both Diodes Failed on page 3-23 |
| **Charger output is low** | One diode failed | Test Procedure 4A – Single Diode Failure on page 3-22 |
| | Transformer coil short-circuit failure | Test Procedure 6 – Transformer on page 3-24 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 3-21 |
| **Charger turns off too soon** | AC power supply was shut off | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-21 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 3-21 |
| | Batteries may be fully charged | Test Procedure 7 – Battery State of Charge Test on page 3-25 |
| **Charger goes to 16 hour time out** | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 3-21 |
| | Extremely discharged batteries or cold temperature | Recharge batteries |
| | Failed or weak battery | See Batteries section in the appropriate maintenance and service manual |
| **AC line fuse blows or AC circuit breaker trips** | AC cord is shorted | Test Procedure 8 – Continuity on page 3-26 |
| | Failed transformer or voltage switch | Test Procedure 6 – Transformer on page 3-24 |
| | Incorrect charger wiring | Check battery charger wiring |
| | Incorrect AC voltage selector switch position | Check switch position for proper incoming AC voltage selection |
| **Battery warning light illuminates for ten seconds, at four second intervals (with DC charger cord plugged in) (25 seconds, at 10 second intervals for Precedent vehicles)** | AC power interrupted | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-21 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 3-21 |
| | Charger failure | See Testing Charger Operation on page 3-12 |
| | 16 hour time out | See Battery Warning Light on page 3-2 |
| | Battery or batteries need to be replaced | See Batteries section in the appropriate maintenance and service manual |
| **Battery warning light illuminates for ten seconds, at four second intervals (with DC charger cord disconnected) (25 seconds, at 10 second intervals for Precedent vehicles)** | Batteries are getting close to full discharge capacity | Recharge batteries |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 3-21 |
| | Battery or batteries need to be replaced | See Batteries section in the appropriate maintenance and service manual |

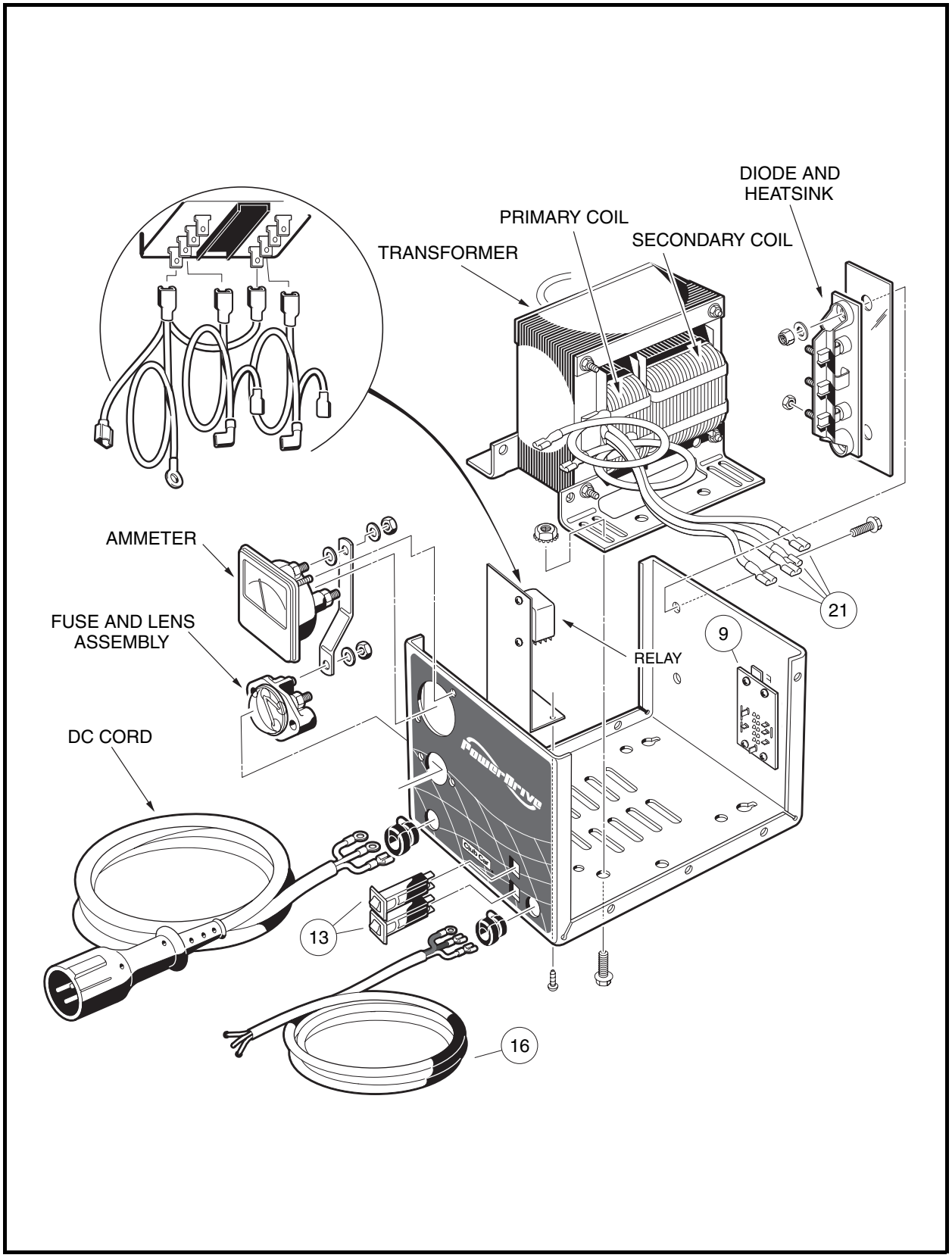


**Figure 3-12 PowerDrive Battery Charger (Export) – Exploded View**

# TEST PROCEDURES

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.**

## INDEX OF TEST PROCEDURES



## TEST PROCEDURE 1 – BATTERY VOLTAGE AND DC PLUG AND RECEPTACLE

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.**

1. Check the DC plug and the vehicle charger receptacle for damage, dirt, corrosion, 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 to the charger receptacle.
   3.1. **DS, DS Villager 4, Turf 1, Carryall 1, 800, 810, 850 and Limo vehicles:** Verify that the 10-gauge red wire from the charger receptacle is connected to the positive (+) post of battery no. 1 **(Figure 3-2, Page 3-3**, **Figure 3-3, Page 3-4 and Figure 3-7, Page 3-8)**.
   3.2. Make sure the two nuts that secure the two 10-gauge black wires to the receptacle fuse assembly are tight **(Figure 3-13, Page 3-18)**.

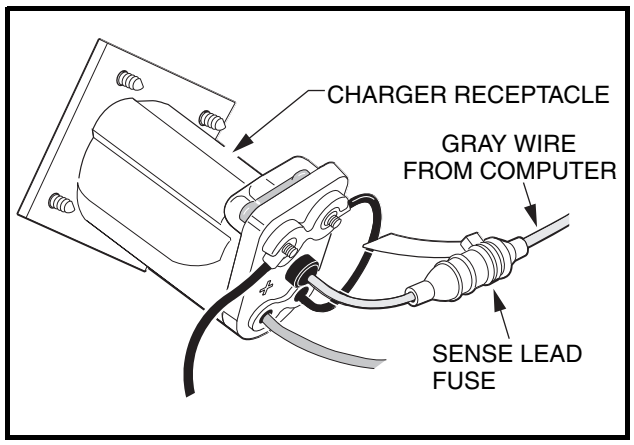


**Figure 3-13 Receptacle Wire Connections (all vehicles except Precedent)**

   3.3. Check the connections of the 18-gauge gray wire from the receptacle to the sense lead fuse, and from the sense lead fuse to the onboard computer gray wire. **See following WARNING.**

## ⚠ WARNING

- **Do not bypass the sense lead fuse.**

3.4. Remove the gray sense lead fuse and check it for continuity with a multimeter set to 200 ohms. The resistance should be less than 2 ohms.

3.5. **Precedent:** Verify that the 10-gauge red wire from the charger receptacle is connected to the positive (+) post of battery no. 1 **(Figure 3-4, Page 3-5**, **Figure 3-5, Page 3-6 and Figure 3-6, Page 3-7)**.

4. Check battery pack voltage.

4.1. **DS, DS Villager 4, 800, 810 and 850:** With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 4 **(Figure 3-14, Page 3-19)**.

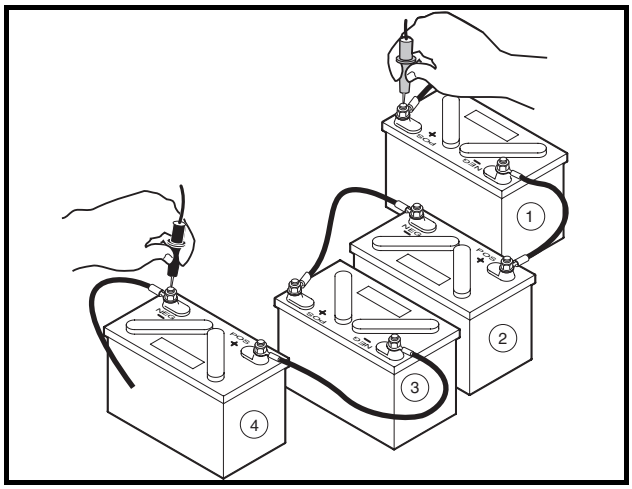


**Figure 3-14 DS, DS Villager 4, 800, 810 and 850 Battery Voltage Test**

4.2. **Turf 1, Carryall 1 and Limo:** With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 6 **(Figure 3-15, Page 3-19 and Figure 3-16, Page 3-19)**.

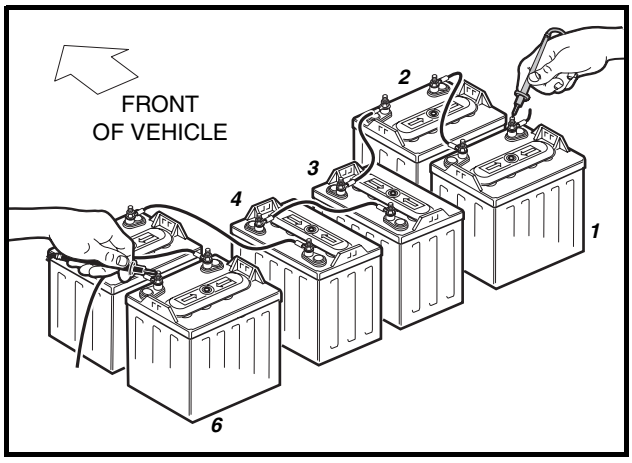


**Figure 3-15 Turf 1 and Carryall 1 Battery Voltage Test**

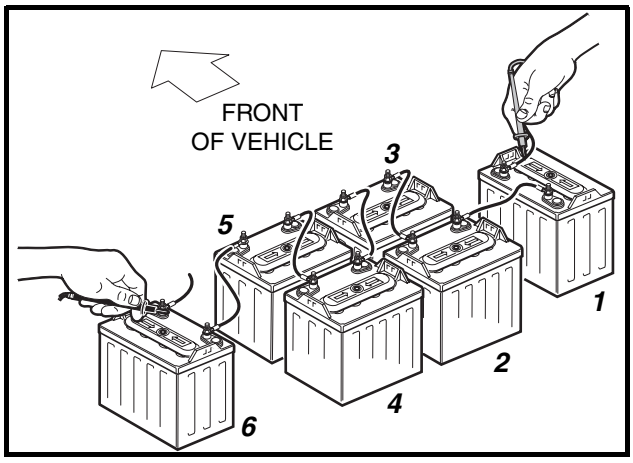


**Figure 3-16 Limo Battery Voltage Test**

4.3. **Style A and B 4 x 12-Volt Precedent only:** With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 4 **(Figure 3-17, Page 3-20 or Figure 3-18, Page 3-20)**.

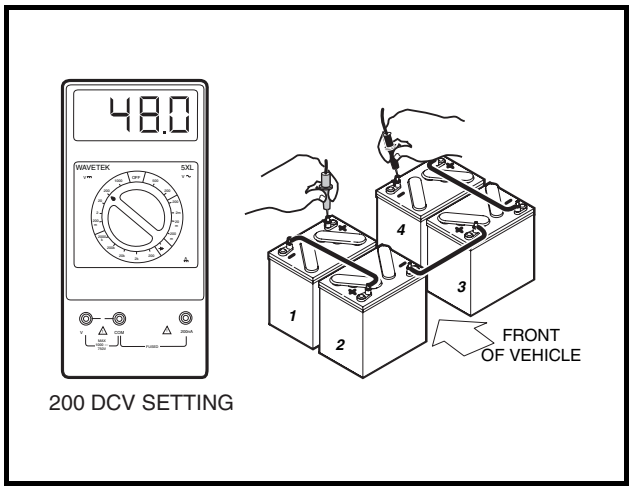


**Figure 3-17 Battery Voltage Test – Precedent Style A Battery Configuration**

(Viewed from driver side of vehicle)
1. RED probe to battery no. 1 (+).
2. BLACK probe to battery no. 4 (-).

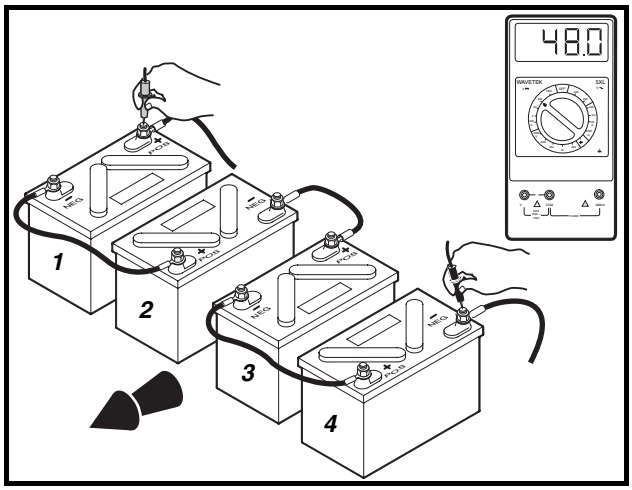


**Figure 3-18 Battery Voltage Test – Precedent Style B Battery Configuration**

(Viewed from driver side of vehicle)
1. RED probe to battery no. 1 (+).
2. BLACK probe to battery no. 4 (-).

4.4. **Style C 6 x 8-Volt Precedent only:** With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 6 **(Figure 3-19, Page 3-20)**.

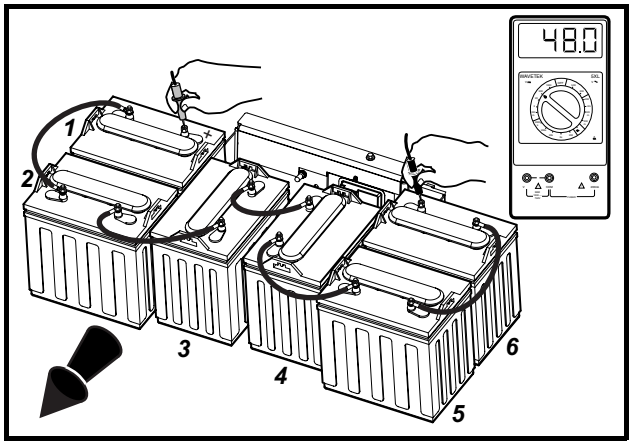


**Figure 3-19 Battery Voltage Test – Precedent Style C Battery Configuration**

(Viewed from driver side of vehicle)
1. RED probe to battery no. 1 (+).
2. BLACK probe to battery no. 6 (-).

5. Normal no-load voltage should be between 50 and 52 volts for fully charged batteries. The voltage of the battery pack must be over 32 volts DC to allow the onboard computer to close the charger relay**.** If battery pack voltage is too low to start charger, temporarily bypass the charger relay. **See Charging a Battery Pack that has Low Voltage on page 3-37.**

## TEST PROCEDURE 2 – ONBOARD COMPUTER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

1. Select a second charger that is normally connected to another vehicle and is known to operate properly. Leave the AC cord of the second charger connected to the AC outlet that it normally is connected to. This will ensure that AC power is present.
2. Check the AC circuit breakers on the front of the charger and reset if necessary.
3. Insert the DC cord from the second charger into the receptacle of the vehicle that is not charging properly.
4. If the second charger fails in the same manner as the first charger, then the vehicle charging circuit is not functioning properly. **See Troubleshooting on page 3-14.**
5. Connect the first charger into another vehicle that is known to be functioning properly. If the charger performs as it should, then the charger is not in need of repair.

## TEST PROCEDURE 3 – AC POWER AND CONTINUITY TEST OF AC CIRCUIT

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Check the AC circuit breakers on the front of the charger and reset if necessary.
3. Check the AC line fuse or circuit breaker in the storage facility.
4. With a multimeter set to 500 volts AC, check incoming AC voltage. Insert multimeter test probes into AC wall outlet; voltage should be within the range specified in the following chart. If proper voltage is not present and the voltage selector switch is set for the correct voltage for your area, have building wiring checked by a licensed electrical contractor.

| SETTING ON AC VOLTAGE SELECTOR SWITCH | MINIMUM AC VOLTAGE PERMITTED | MAXIMUM AC VOLTAGE PERMITTED |
|---|---|---|
| 100 Volts AC | 95 | 105 |
| 200 Volts AC | 190 | 210 |
| 220 Volts AC | 209 | 231 |
| 240 Volts AC | 228 | 252 |

5. Check continuity of the AC circuit.
   - 5.1. Remove the charger cover.
   - 5.2. Bypass the relay.
     - 5.2.1. To bypass the relay, locate the black wire that goes from the circuit breaker to terminal 9 on the relay. Disconnect the black wire from the relay terminal **(Figure 3-11, Page 3-13).**
     - 5.2.2. Disconnect the brown wire from relay terminal 6.
     - 5.2.3. Use a jumper wire with alligator clips to connect the black wire from relay terminal 9 to the brown wire from relay terminal 6.
     - 5.2.4. Disconnect the black wire from relay terminal 7.
     - 5.2.5. Disconnect the blue wire from relay terminal 4.
     - 5.2.6. Use a jumper wire with alligator clips to connect the black wire from relay terminal 7 to the blue wire from relay terminal 4.
   - 5.3. With relay bypassed, there should be continuity across the AC cord blades **(Figure 3-20, Page 3-22)**.

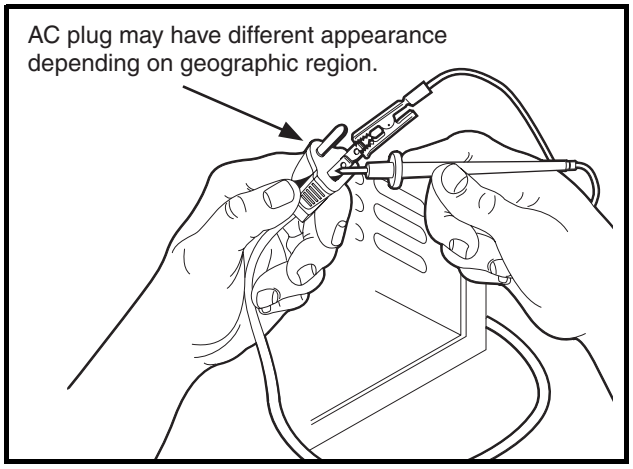


**Figure 3-20 AC Cord Test**

6. If the circuit is not complete, check the wiring of the AC cord (16), transformer primary coil wires (21), internal AC circuit breakers (13), voltage selector switch (9), and jumper wires **(Figure 3-12, Page 3-17).**
7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, internal AC circuit breakers, and the jumper wires individually. **See Test Procedure 8 – Continuity on page 3-26.**
8. When troubleshooting and repairs are complete, remove the jumper wire and properly connect the relay wiring. **See following WARNING.**

### ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

## TEST PROCEDURE 4 – DIODES

Use Test Procedure 4A – Single Diode Failure on page 3-22 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 3-23.

### Test Procedure 4A – Single Diode Failure

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

A single diode failure is indicated by the failure of one fuse link (closed circuit diode) or by the charger output being low (open circuit diode). If a diode has failed, the entire heatsink must be replaced. To check diodes:

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect one transformer secondary coil wire from the diode terminal **(Figure 3-21, Page 3-23).**
4. Using a low voltage continuity tester or multimeter set to the diode test function, connect the red (+) test probe to the diode mounting plate and the black (–) test probe to a diode terminal and note the reading **(Figure 3-21, Page 3-23).**
5. Reverse test probes and check each diode again and note the reading **(Figure 3-22, Page 3-23).** A diode is designed to conduct current in one direction only. If a diode conducts current (shows continuity) in both directions, the entire heatsink with diodes must be replaced. If a diode does not conduct current (does not show continuity) in either direction, the entire heatsink must be replaced.

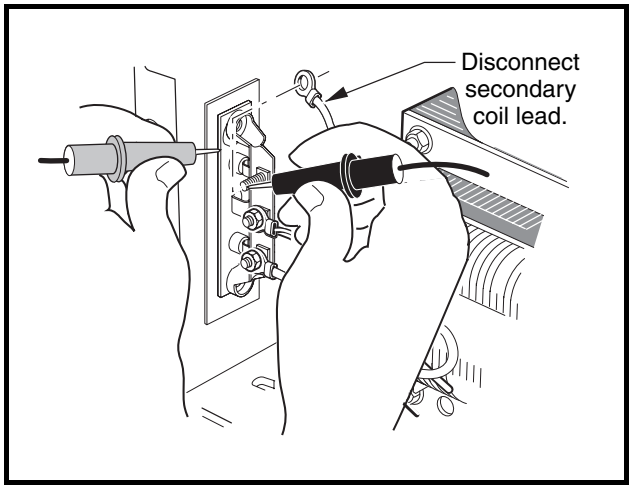


Figure 3-21 Diode Test

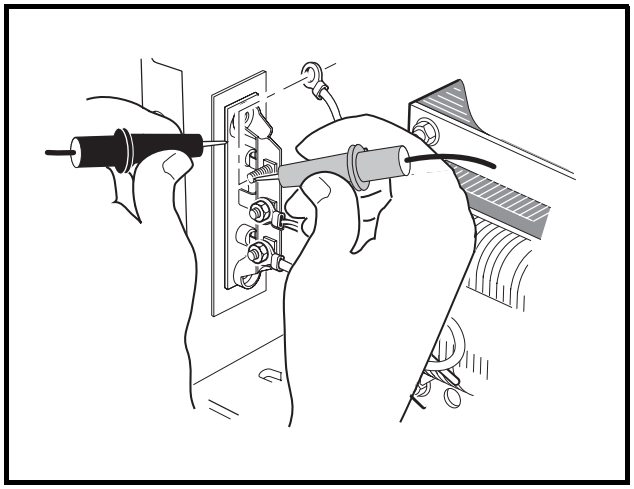

Figure 3-22 Diode Test – Probes Reversed

6. On rare occasions, a single fuse link may blow due to excessive heat. This can be caused by a loose internal fuse connection. Check all three fuse connections inside the charger to be sure they are clean and tight. The proper tightness for the fuse link connections is 22 in-lb (2.5 N·m).
7. Ensure the charger is wired properly and all connections are clean and tight. **See following CAUTION**.

**CAUTION**

- **If connections are not clean and tight, excessive heat will be created and the charger may become damaged.**

## Test Procedure 4B – Both Diodes Failed

## See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

To check the diodes, use Test Procedure 4A – Single Diode Failure on page 3-22. If both diodes have failed closed, both charger fuse links will be blown. If both diodes have failed open, the relay will close and the transformer will hum, but the ammeter will not indicate any output and the AC circuit breakers may trip off. If both diodes have failed open or closed, the entire heatsink must be replaced. To determine why both diodes failed:

1. Check the batteries and the receptacle to ensure that they are wired in the correct polarity **(Figure 3-2, Page 3-3 through Figure 3-7, Page 3-8)**. Also check the voltage and polarity at the receptacle.
2. Make sure the charger is wired correctly: the DC cord red wire should be connected to the center terminal of the heatsink, the DC cord blue wire should be connected to the relay coil, and the DC cord black wire should be connected to the left side of the ammeter (when viewed from inside the charger) **(Figure 3-11, Page 3-13)**. If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is connected to the vehicle, whether or not the AC cord is plugged into an outlet.
3. On rare occasions, both diodes may fail as a result of a lightning strike at the charging location.
4. Excessive heat due to a loose connection may also cause both fuse links to blow. Be sure fuse connections are tightened to 22 in-lb (2.5 N·m).
5. Ensure that the charger and vehicle are wired properly and all connections are clean and tight.

## TEST PROCEDURE 5 – CHARGER DC CIRCUIT CONTINUITY TEST

## See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Using a continuity tester (CCI P/N 1011273) or multimeter (CCI P/N 1011480) set to 200 ohms, connect the test probes to the pins marked (+) and (–) on the DC plug **(Figure 3-23, Page 3-24)**. Note the reading.
3. Reverse the test probes and check the DC plug again **(Figure 3-24, Page 3-24)**. The circuit should show continuity in only one direction.
4. If the circuit does not show continuity in either direction and the charger fuse is not blown, individually check all connections and the continuity of the DC cord and ammeter. **See Test Procedure 8 – Continuity on page 3-26.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 3-22.**

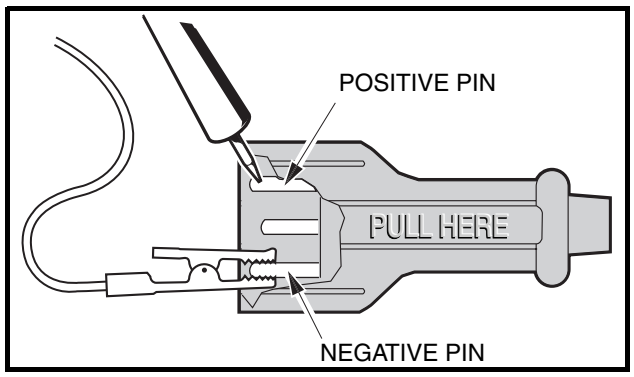


**Figure 3-23 DC Plug Test**

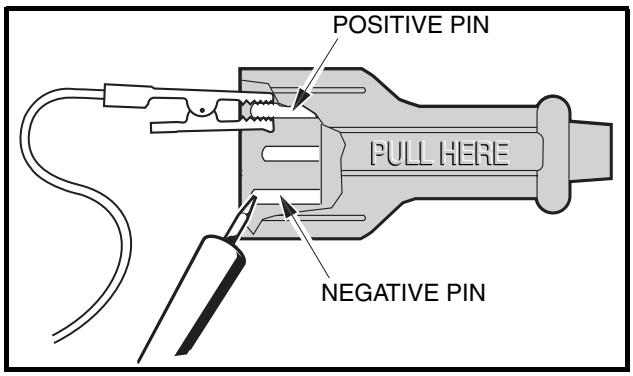


**Figure 3-24 DC Plug Test – Reversed Probes**

5. If the circuit shows continuity in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes. **See Test Procedure 4 – Diodes on page 3-22.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 3-26.**
6. Remove the DC cord blue wire from the red wire connected to the charger relay and check continuity between the positive and negative pins and middle pin on the DC plug **(Figure 3-11, Page 3-13)**. There should be no continuity.

## TEST PROCEDURE 6 – TRANSFORMER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

Failure of the transformer may be caused by aging or a short circuit in adjacent coil turns. If the transformer has failed, the ammeter will indicate low output or no output; however, the transformer may hum. A blown AC line fuse or tripped AC circuit breaker in the charger or the storage facility may be caused by an improperly wired charger, an improper setting of the AC voltage selector switch, or a failed transformer.

An AC circuit test should be done before performing this test procedure to ensure the continuity of the AC cord, internal AC circuit breakers, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-21.**

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect transformer secondary coil wires from the heatsink **(Figure 3-25, Page 3-25)**.
4. To apply AC power directly to the transformer primary coil, bypass the relay. **See Charging a Battery Pack that has Low Voltage on page 3-37. See following DANGER.**

## ⚠ 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.**

5. Make sure that the voltage selector switch (on the back of the charger) is set for the appropriate incoming AC voltage. Also ensure that the secondary coil wires are not touching one another. With the relay bypassed, insert the AC plug into an outlet.

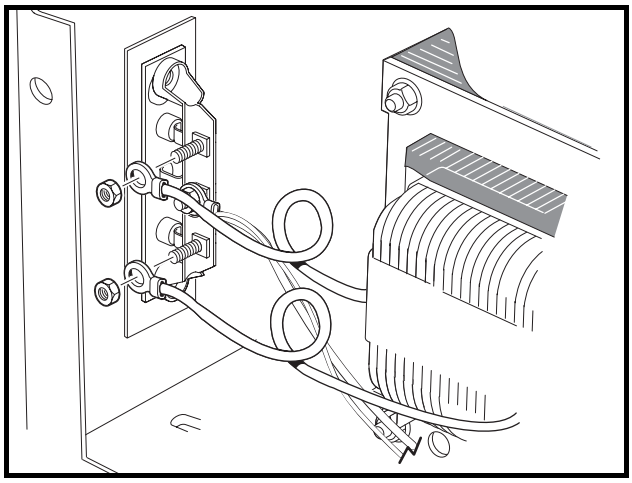

**Figure 3-25 Remove Secondary Coil Wires From Heatsink**

6. If the AC line fuse does not blow or the AC circuit breaker does not trip, check the transformer secondary coil voltage.
7. Disconnect AC cord from the wall outlet.
8. Using alligator clips and a multimeter set to 500 volts AC, connect the multimeter probes to the secondary transformer coil wires.
9. Connect the AC cord to the wall outlet and monitor the multimeter for the secondary coil voltage. If measured voltage is approximately 85 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced.
10. If the voltage reading is normal (86 volts AC or higher), the transformer is operational. Disconnect the AC plug from the wall receptacle and check the continuity of the DC circuit. **See Test Procedure 5 – Charger DC Circuit Continuity Test on page 3-23.**
11. When troubleshooting and repairs are complete, remove jumper wire and properly connect relay wiring. **See following WARNING.**

## ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

## TEST PROCEDURE 7 – BATTERY STATE OF CHARGE TEST

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.**

1. With the batteries fully charged, disconnect the DC charger plug for approximately 20 seconds and reconnect it. The ammeter should jump to a reading between 14 and 18 amps and taper to below 5 amps within 15 minutes.
2. If the charger does not taper to below 5 amps within 15 minutes, batteries may not be receiving a full charge and the onboard computer should be checked. **See Test Procedure 2 – Onboard Computer on page 3-21. See following NOTE.**

***NOTE:*** *Batteries near the end of their useful lives may not allow the battery charge current to taper below 5 amps.* ***See Section 13 – Batteries in the appropriate maintenance and service manual.***

## TEST PROCEDURE 8 – CONTINUITY

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### AC Cord

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect green/yellow wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 3-26, Page 3-26).**
4. Disconnect brown wire (1) of AC cord from charger relay terminal 6.
5. Disconnect the blue wire (4) from the charger relay terminal 4.
6. Using a multimeter set for 200 ohms, place the red (+) probe on the terminal at the end of the brown wire (1). Test for continuity on each of the flat blades and on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the AC cord and plug must be replaced.
7. Place the red (+) probe on the end of the green/yellow wire (2) and with the black (–) probe check for continuity on both flat blades and on the ground pin of the AC plug. The tester should indicate continuity on only the ground pin. If any other reading is obtained, the AC cord and plug must be replaced.
8. Place red (+) probe on the blue wire and check for continuity on both flat blades and on the round pin of the AC plug. The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced.

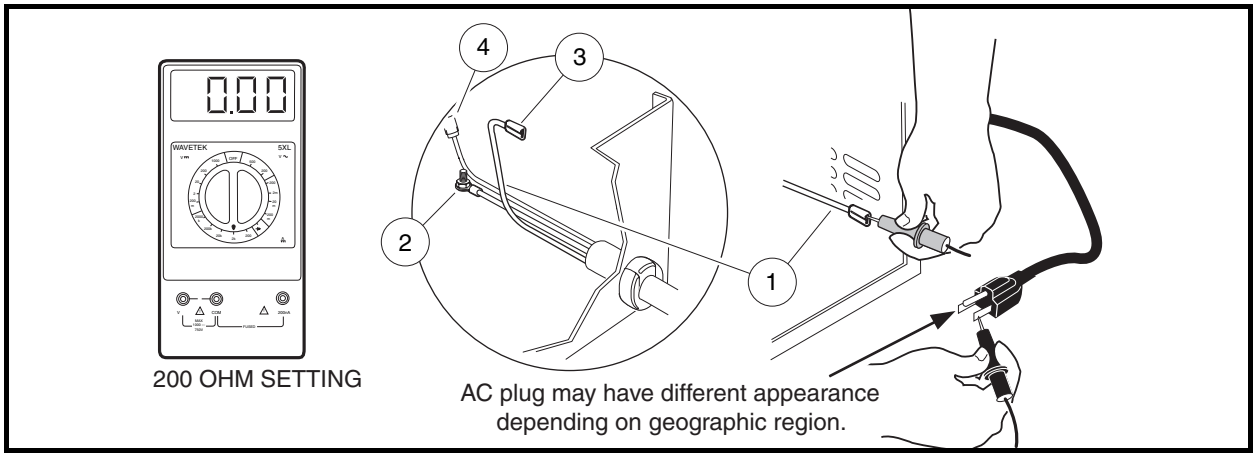


**Figure 3-26 AC Plug**

## DC Cord

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. To check the continuity of the DC cord, disconnect the black wire of the DC cord from the ammeter **(Figure 3-27, Page 3-27)**.
4. Disconnect the red wire of the DC cord from the heatsink.
5. Disconnect the blue wire from the red wire assembly that connects to the charger relay.
6. Place the clip of the continuity tester on the red wire of the DC cord.
7. Place the continuity test probe on the positive (+) pin of the DC plug (positive (+) and negative (–) pins are identified on the plug). If tester does not indicate continuity, the DC cord must be replaced.
8. Place the continuity test probe on the negative (–) pin of the DC plug. The tester should indicate no continuity. If tester indicates continuity, the DC cord must be replaced.
9. Place the continuity test probe on the unmarked (middle) pin of the DC plug. The tester should indicate no continuity. If tester indicates continuity, the DC cord must be replaced.
10. Move the continuity tester clip to the black wire of the DC cord.
11. Place the continuity test probe on the negative (–) pin of the DC plug. The tester should indicate continuity. If tester does not indicate continuity, the DC cord must be replaced.
12. Place the continuity test probe on the unmarked (middle) pin of the DC plug. The tester should indicate no continuity. If tester indicates continuity, the DC cord must be replaced.
13. Move continuity test probe to the blue wire of the DC cord. Check for continuity at the middle pin. The tester should indicate continuity. If tester does not indicate continuity, replace DC cord.

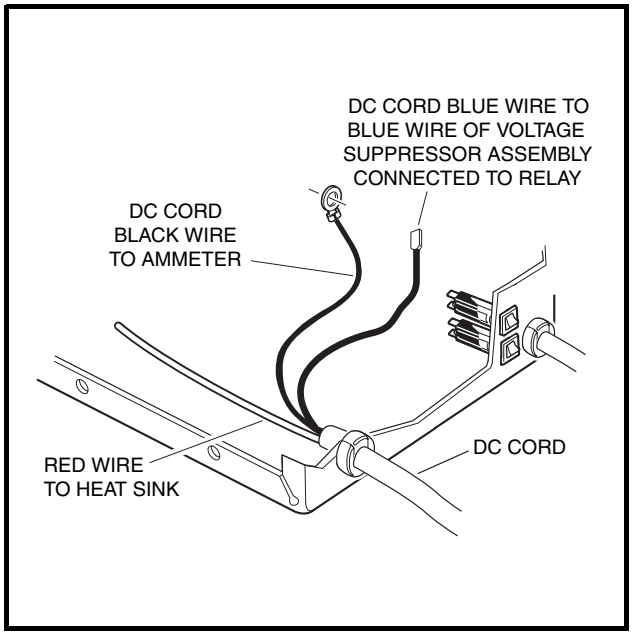


**Figure 3-27 DC Cord**

## Transformer

The PowerDrive battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 3-11, Page 3-13)**.

### Primary Coil

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the black wires marked 1 and 6 from the AC circuit breakers.
4. Disconnect the wires marked 2, 3, 4 and 5 from the voltage selector switch.
5. Place the continuity tester probes on the primary coil transformer wires disconnected above in pairs until all of the combinations in the following chart have been tested.
6. If the continuity readings agree with the chart, replace the voltage selector switch. If the continuity readings differ from the chart, replace the transformer.

**PRIMARY COIL CONTINUITY / NO CONTINUITY CHART**

| | | NEGATIVE PROBE | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** |
| **POSITIVE PROBE** | **1** | | Continuity | Continuity | No Continuity | No Continuity | No Continuity |
| | **2** | Continuity | | Continuity | No Continuity | No Continuity | No Continuity |
| | **3** | Continuity | Continuity | | No Continuity | No Continuity | No Continuity |
| | **4** | No Continuity | No Continuity | No Continuity | | Continuity | Continuity |
| | **5** | No Continuity | No Continuity | No Continuity | Continuity | | Continuity |
| | **6** | No Continuity | No Continuity | No Continuity | Continuity | Continuity | |

### Secondary Coil

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove the transformer (tan) secondary coil wire from the upper terminal of the heatsink **(Figure 3-11, Page 3-13)**.
4. Remove the other transformer (tan) secondary coil wire from the bottom terminal of the heatsink and place the continuity test clip on the ammeter buss bar **(Figure 3-12, Page 3-17)**. Test for continuity between the buss bar and each of the secondary coil wires (tan). The tester should indicate continuity on both secondary coil wires. If tester does not indicate continuity on both secondary coil wires, replace transformer. Ensure that the fuse is intact and not blown.

## Voltage Suppressor – Failed Closed

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Using a multimeter set to the diode test function (→|←), place the black (–) probe of the multimeter on the sense lead pin (short pin) of the DC plug. Place the red (+) probe on the positive (+) pin of the DC plug. The multimeter should indicate no tone. If a tone is emitted (indicating a closed circuit) then the voltage suppressor has failed and should be replaced. **See following NOTE.**

***NOTE:*** ***All vehicles except Precedent:*** *Repeated failure of sense lead fuses is a symptom of a voltage supressor that has failed in a closed condition.*

***Precedent vehicles only:*** *Failure of the onboard computer due to a blown internal sense lead fuse is a symptom of a voltage supressor that has failed in a closed condition.*

## Relay

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove the brown wire from terminal 6 of the relay and black wire from terminal 9 of the relay **(Figure 3-11, Page 3-13)**. Place continuity tester leads on terminals 6 and 9 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.
4. Remove the blue wire from terminal 4 of the relay and black wire from terminal 7 of the relay **(Figure 3-11, Page 3-13)**. Place continuity tester leads on terminals 4 and 7 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.
5. With batteries connected, insert the DC plug into a receptacle. The tester should indicate continuity on terminals 6 and 9 and continuity on relay terminals 4 and 7. If tester does not indicate continuity on both sets of contacts, the relay must be replaced.

## Ammeter

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the black wire from the left ammeter post (as viewed from inside the charger).
4. Place the continuity tester clip on one of the ammeter posts.
5. Place the continuity test probe on the other ammeter post. The tester should indicate continuity. If the tester does not indicate continuity, replace the ammeter.

## AC Circuit Breaker

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the wires from the AC circuit breaker.
4. Place the continuity test probes on the two terminals of the AC circuit breaker. The tester should indicate continuity. If the tester does not indicate continuity, replace the AC circuit breaker.

# CHARGER REPAIRS

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.**

**⚠ WARNING**

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 3-11, Page 3-13).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**

## DC CORD

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.**

### DC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See preceding WARNING.**
2. Remove the charger cover.
3. Remove the DC cord black wire (4) from the ammeter by loosening the nut (1). Support the terminal as the nut is loosened to prevent rotation of the connection **(Figure 3-28, Page 3-30)**.
4. Remove nut attaching the red wire (6) of the charger DC cord to the heatsink.
5. Disconnect the DC cord blue wire from the blue wire of the voltage suppressor assembly connected to the relay (coil) terminal **(Figure 3-27, Page 3-27)**.
6. Remove wire ties securing the blue wire to the black transformer wire. Note the location of the wire ties.
7. Using pliers, squeeze the strain relief bushing and remove the DC cord.

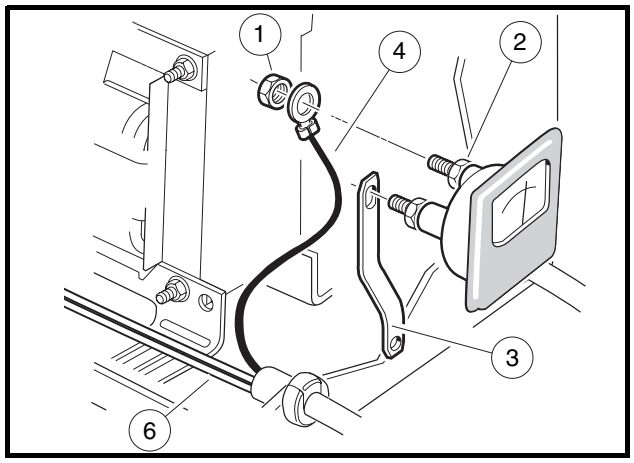


**Figure 3-28 DC Cord Replacement**

### DC Cord Installation

1. Insert the leads of the new DC cord through the hole in the charger base.
2. Attach the red wire of the new DC cord to the center terminal of the heatsink and tighten the nut to 18 in-lb (2.0 N·m) **(Figure 3-27, Page 3-27)**.

3. Attach the blue wire of the new DC cord to the blue wire of the voltage suppressor assembly connected to the relay (coil) terminal.
4. Attach the black wire (4) of the new DC cord to ammeter. Install nut (1) onto post of ammeter slightly more than finger tight. While holding the inside nut (2), tighten the outside nut (1) 1/4 turn **(Figure 3-28, Page 3-30)**. **See following CAUTION.**

**CAUTION**

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
6. Secure the blue wire to the black wire in the locations noted in step 6 of DC Cord Removal.
7. Tie the wires together as they were before the wire tie was removed. **See following WARNING.**

**⚠ WARNING**

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

8. Position the charger cover on the base. Install the mounting screws, starting with the bottom holes. Tighten the screws to 11 in-lb (1.2 N·m).

## HEATSINK

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### Heatsink Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 3-11, Page 3-13 and Figure 3-12, Page 3-17)**.
4. Remove the two red wires from the heatsink.
5. Remove the nuts and bolts that secure the heatsink to the case.

### Heatsink Installation

1. Place heatsink against charger base. Make sure clear plastic insulator sheet is between the heatsink and the charger base. Install the nuts and bolts that secure the heatsink to the case. Tighten the bolts to 22 in-lb (2.5 N·m) **(Figure 3-11, Page 3-13 and Figure 3-12, Page 3-17)**.
2. Connect the red wire from the DC cord and the red wire from the charger relay to the center terminal post on the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
3. Connect one of the secondary coil transformer wires (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
4. Connect the other secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Install the charger cover and check charger for proper operation.

## TRANSFORMER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### Transformer Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Note the locations of wire ties and remove the wire ties.
4. Disconnect the black primary coil leads from the AC circuit breakers and the voltage selector switch **(Figure 3-11, Page 3-13 and Figure 3-12, Page 3-17)**.
5. Disconnect the two tan secondary coil transformer wires from heatsink.
6. Disconnect the two black secondary coil transformer wires from the fuse.
7. Remove the four bolts and nuts that mount the transformer to the case and remove the transformer.

### Transformer Installation

1. Install the transformer with the secondary coil to the rear of the charger case. Tighten the four bolts and nuts to 28 in-lb (3.2 N·m) **(Figure 3-12, Page 3-17)**.
2. Connect one secondary coil transformer wire (black) to one terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m).
3. Connect the other secondary coil transformer wire (black) to the remaining terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m).
4. Connect one secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Connect the other secondary coil transformer wire (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
6. Connect the black primary coil transformer wire marked 1 to the top terminal of the top AC circuit breaker.
7. Connect the black primary coil transformer wire marked 6 to the top terminal of the bottom AC circuit breaker.
8. Connect each of the remaining black primary coil transformer wires marked 2, 3, 4, and 5 to the corresponding terminals marked on the voltage selector switch.
9. Set the voltage selector switch to the appropriate voltage matching the incoming AC electrical service that will be used to power the charger.
10. Tie the wires together as they were before the wire tie was removed. **See following WARNING.**

**⚠ WARNING**

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

11. Install the charger cover and check charger for proper operation.

## AMMETER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### Ammeter Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Using two wrenches to prevent the posts from turning, disconnect the DC cord black wire (5) and buss bar (3) from the ammeter **(Figure 3-29, Page 3-33)**.
4. Remove the two nuts (2) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

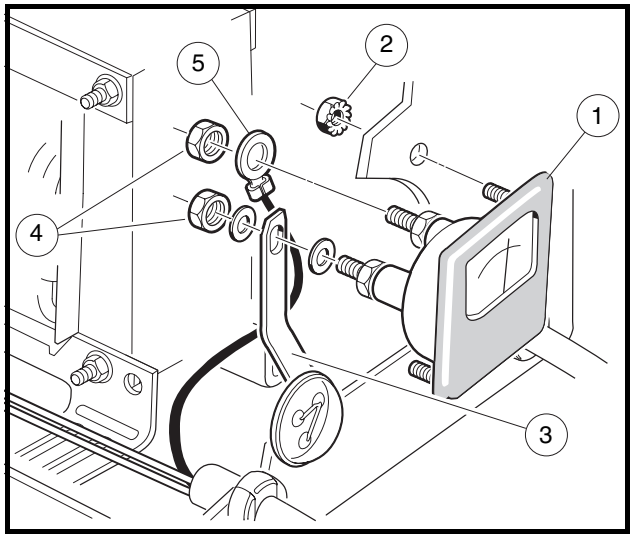


**Figure 3-29 Ammeter**

### Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 3-29, Page 3-33)**.
2. Install the nuts (2) and tighten until ammeter is firmly secured.
3. Connect the DC cord black wire (5) to the left (as viewed from inside the charger) post of the ammeter.
4. Connect the buss bar (3) from the fuse link to the right post of the ammeter. Place flat washers on both sides of the buss bar.
5. Thread nuts (4) onto both posts of the ammeter until just past finger tight. While holding the inside nut, tighten the outside nut 1/4 turn. **See following CAUTION.**

**CAUTION**

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

6. Install the charger cover.
7. Plug the charger into the vehicle and check ammeter for proper operation.

## FUSE LINK

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### Fuse Link Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Remove both black secondary coil transformer wires and the buss bar (3) from the back of the fuse link assembly **(Figure 3-29, Page 3-33)**.
4. Remove screws from the front of the charger and remove the fuse link assembly.

### Fuse Link Installation

1. Place clear plastic cover over fuse assembly and install mounting screws from front of charger face. The center branch of the fuse assembly should be in the upper left corner when viewed from the front of the charger.
2. Install the buss bar (3) over the center branch of the fuse assembly and ammeter post **(Figure 3-29, Page 3-33)**. Tighten to 22 in-lb (2.5 N·m).
3. Install a secondary coil transformer wire (black) onto one of the two remaining terminals on the back of the fuse assembly. Install the remaining secondary coil transformer wire (black) onto the remaining terminal. Tighten to 22 in-lb (2.5 N·m).
4. Install the charger cover.

## VOLTAGE SUPPRESSOR

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

The voltage suppressor, which is incorporated into a wire assembly in the charger, protects the onboard computer by capturing very high, but very brief voltage spikes which occur due to the collapse of the electrical field in the charger relay when the charger is disconnected from the vehicle. **See Test Procedure 8 – Continuity on page 3-26.**

### Voltage Suppressor Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Remove nut attaching voltage suppressor (18-gauge red wire) to heatsink.
4. Disconnect blue wire to DC cord at quick disconnect terminal.
5. Disconnect the voltage suppressor wire assembly from charger relay.

### Voltage Suppressor Installation

Install in reverse order of removal. Tighten nut attaching voltage suppressor (18-gauge red wire) to heatsink to 18 in-lb (2.0 N·m).

## CHARGER RELAY

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### Charger Relay Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 3-30, Page 3-35)**.
4. Remove the two screws and nuts attaching relay to relay mounting bracket **(Figure 3-30, Page 3-35)**.
5. Remove the relay.

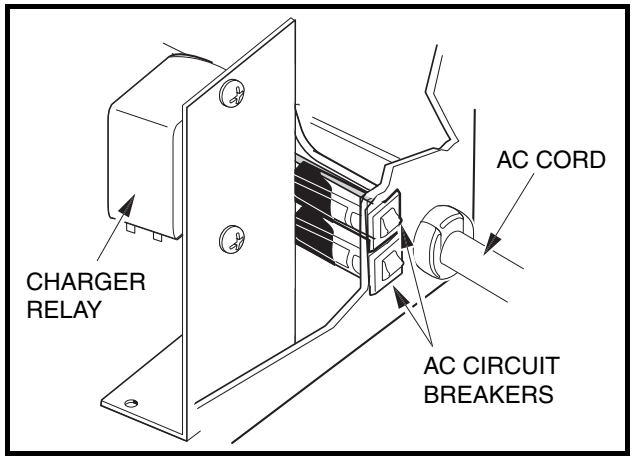


**Figure 3-30 Charger Relay**

### Charger Relay Installation

Install in reverse order of removal. Connect wires as shown **(Figure 3-11, Page 3-13)**. Tighten hardware securing relay to relay mounting bracket to 18 in-lb (2.0 N·m).

## CHARGER AC CIRCUIT BREAKERS

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### AC Circuit Breaker Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Disconnect the two black wires attached to top circuit breaker **(Figure 3-11, Page 3-13)**.
4. Disconnect the two black wires attached to bottom circuit breaker.
5. With a pair of pliers, squeeze in the retaining tabs on the sides of the top AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.
6. Repeat step 5 for the removal of the bottom circuit breaker.

### AC Circuit Breaker Installation

Install in reverse order of removal.

## CHARGER AC CORD

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

### AC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 3-30.**
2. Remove the charger cover.
3. Disconnect the brown wire from the AC cord from terminal 6 at the relay **(Figure 3-11, Page 3-13)**.
4. Disconnect the blue wire from the AC cord from terminal 4 at the relay **(Figure 3-11, Page 3-13)**.
5. Disconnect the AC cord green/yellow wire at the charger base **(Figure 3-11, Page 3-13)**.
6. Use a pair of pliers to grip the strain relief bushing and remove it and the AC cord from the charger.

### AC Cord Installation

1. Insert the brown, blue, and green/yellow leads of the new AC cord into the charger through the hole in the charger face **(Figure 3-11, Page 3-13)**.
2. Connect the brown wire to terminal 6 at the charger relay, the blue wire to terminal 4 at the charger relay, and the green/yellow wire to the charger base. Tighten the screw on the green/yellow wire terminal to 18 in-lb (2.0 N·m). **(Figure 3-11, Page 3-13)**.
3. Position the strain relief bushing on the AC cord.
4. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
5. Install the charger cover.

# CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

## See General Warning, Section 1, Page 1-1. See additional WARNING on page 3-1.

If battery pack voltage is below 34 volts, the charger will not activate. The charger relay will have to be bypassed to activate the charger. **See following WARNING.**

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 3-11, Page 3-13).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**

1. Turn key switch OFF and place the Forward/Reverse handle in the NEUTRAL position. Leave the batteries connected.
2. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
3. Remove the charger cover.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   - 4.1. To bypass the relay, locate the black wire that goes from the circuit breaker to terminal 9 on the relay. Disconnect the black wire from the relay terminal **(Figure 3-31, Page 3-38)**.
   - 4.2. Disconnect the brown wire from relay terminal 6.
   - 4.3. Use a jumper wire with alligator clips to connect the black wire from relay terminal 9 to the brown wire from relay terminal 6 **(Figure 3-31, Page 3-38)**.
   - 4.4. Disconnect the black wire from relay terminal 7.
   - 4.5. Disconnect the blue wire from relay terminal 4.
   - 4.6. Use a jumper wire with alligator clips to connect the black wire from relay terminal 7 to the blue wire from relay terminal 4 **(Figure 3-11, Page 3-13)**. **See following DANGER.**

### ⚠ 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.**

5. Plug the DC cord into the charger receptacle first, then plug the AC cord into an electrical outlet.
6. The charger should activate and begin to charge the batteries. Allow the charger to operate for one or two hours. **See following WARNING.**

### ⚠ WARNING

- **Do not leave the vehicle unattended while it is charging. A charger operating with a bypassed relay could short circuit and possibly cause a fire.**

7. After one or two hours, disconnect the charger AC cord from the electrical outlet first. Then disconnect the DC cord from the charger receptacle in the vehicle.
8. Disconnect the jumper wires from the relay wires and connect each wire to the original terminal on the relay **(Figure 3-31, Page 3-38)**. **See following WARNING.**

## ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

9. Install the charger cover and the retaining screws.
10. Plug the DC cord into the charger receptacle, then plug the AC cord into an electrical outlet.
11. Allow the charger to continue charging the batteries until the charger shuts off automatically.
12. When the charge cycle is complete, test the batteries again. If the battery pack voltage is above 34 volts and the vehicle will not operate, it will be necessary to troubleshoot the vehicle's electrical system to determine which electrical component has failed. **See Section 11 – Electrical System and Testing in the appropriate maintenance and service manual.**

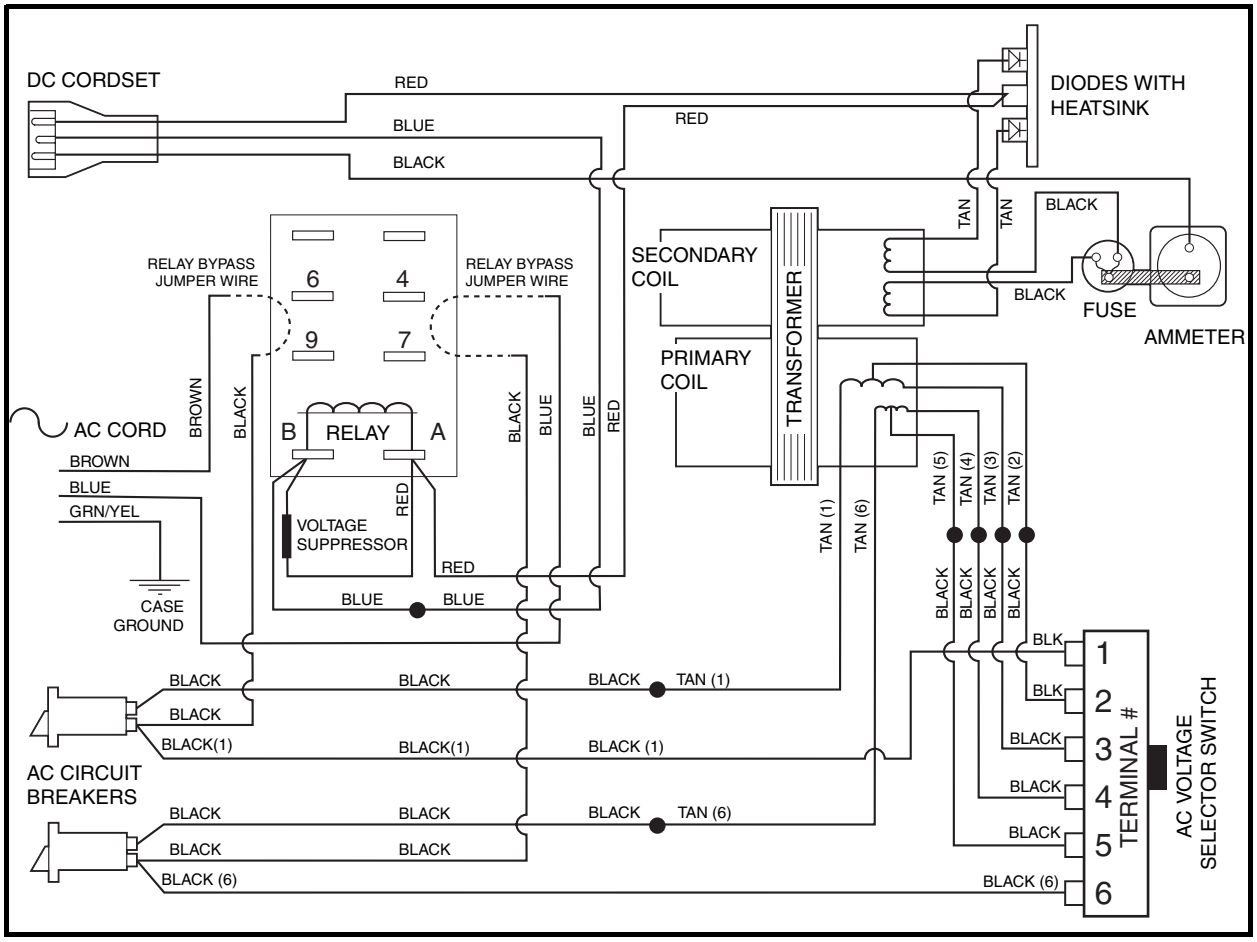


**Figure 3-31 Export PowerDrive Charger Wiring Diagram (Relay Bypassed)**

# SECTION 4 – EXPORT POWERDRIVE CHARGER (ONBOARD)

### ⚠ DANGER

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

### ⚠ WARNING

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

## GENERAL INFORMATION

This section includes information pertaining to service of the Export onboard PowerDrive battery charger. Model number 17790-10 is used on the DS Villager 4. Model number 17790-40 is used on Precedent golf cars. Depending on the geographic region, the charger provided with your vehicle may be a different model. Do not attempt to service a battery charger that has not been properly identified. If a charger cannot be properly identified, contact your local Club Car dealer or distributor.

For battery chargers with model numbers listed above that are installed in vehicles other than DS and Precedent vehicles, contact your local Club Car dealer or distributor.

The PowerDrive battery charger is automatic and has no external controls **(Figure 4-1, Page 4-1)**. When the AC cord is plugged in, there is a 2 to 15 second delay before charging begins. The onboard computer (OBC) records the amount of energy consumed as the vehicle is used, then directs the charger to replace exactly the amount of energy needed to fully replenish the batteries. The charger shuts off automatically, preventing the possibility of either undercharging or overcharging. **See following NOTE.**

***NOTE:*** *At one hour and at two hours into the charge cycle, the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero). Charging will resume in a few moments (ammeter returns to previous rate of charge).*

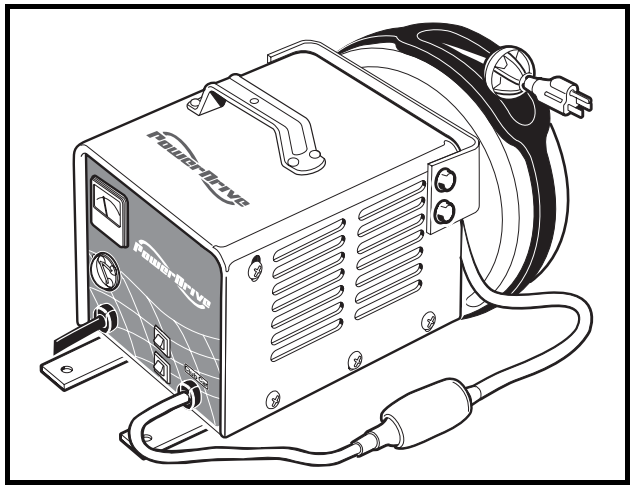


**Figure 4-1 Export PowerDrive Onboard Battery Charger**

## POWERDRIVE ONBOARD CHARGER FEATURES

- **Charge Interlock:** When the AC power cord is inserted into a wall receptacle, the onboard computer locks out the vehicle's drive system. This prevents the possibility of driving the vehicle while the charger is plugged in and potentially damaging the vehicle and charger.
- **Long-Term Storage Charge:** PowerDrive chargers are designed to be left connected with AC power to the charger, during off-season or long-term storage. The onboard computer will automatically activate the charger every 15 days. To return the vehicle to service, disconnect the AC cord from the wall outlet, wait 15 seconds and then plug the AC cord back in. The charger will activate. Allow the vehicle to complete one full charge cycle before putting it into service.

## BATTERY WARNING LIGHT

The 48-volt electric vehicle features a dash-mounted battery warning light that alerts the operator to any problems with the batteries or charging system. The battery warning light is controlled by the onboard computer (OBC).

When the batteries receive an incomplete charge because 1) AC power to charger is interrupted, 2) automatic charger shut-off occurs after 16 hours of operation, or 3) charger malfunctions, the battery warning light will indicate as follows:

- The battery warning light will not illuminate if the charge is 90% or more complete. The onboard computer will retain in memory the amount of charge needed to fully replenish the batteries and will complete the charge during the next charge cycle.
- When the charger AC cord is unplugged during a charge cycle, the battery warning light will illuminate and remain illuminated for 10 seconds (25 seconds for Precedent vehicles) if the charge is less than 90% complete but the vehicle has enough power for 60 minutes of operation. This will alert the operator that the vehicle may be used, but that it must be charged to completion as soon as possible.
- The battery warning light will repeatedly illuminate for 10 seconds, at 4 second intervals (25 seconds, at 10 second intervals for Precedent vehicles), if the charger times out at 16 hours and the batteries are not sufficiently charged. This indicates an abnormal charge cycle. The charger and batteries should be checked by your Club Car distributor/dealer.

# THE CHARGE CIRCUIT

For vehicles with onboard chargers, the charge circuit consists of the following components:

- onboard charger
- onboard computer
- batteries

**DS Villager 4:**

The black wire from the charger is connected to the fuse link, along with the short black receptacle wire, on the charger receptacle **(Figure 4-2, Page 4-3)**. One 10-gauge black wire from the onboard computer connects to other side of the charger receptacle fuse link. The other 10-gauge black wire from the onboard computer connects to the B– terminal on the speed controller, and the 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 4. The red wire of the charger is connected to the positive (+) post of battery no. 1. The blue wire (sense lead) from the charger is connected, through a 3-way wire adapter at the sense lead fuse, to the gray wire that connects the charger receptacle to the onboard computer.

**Precedent Vehicles:**

The 10-gauge black wire from the charger becomes two wires in the adapter harness **(Figure 4-3, Page 4-3)**. One wire connects to the onboard computer black lead wire. The second wire connects to the charger receptacle black lead wire. The 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 4 **(Figure 4-7, Page 4-12 and Figure 4-8, Page 4-12)** or battery no. 6 **(Figure 4-9, Page 4-13)**. The 10-gauge red wire of the charger is connected to the positive (+) post of battery no. 1. The 18-gauge gray wire from the charger becomes two wires in the adapter harness. One wire connects to the onboard computer. The second wire connects to the charger receptacle gray lead wire.

To check the charge circuit, check the connections between the 18-gauge gray wire from the OBC, the sense lead fuse, DC cord red wire, DC cord black wire, and the wire connections between the batteries.

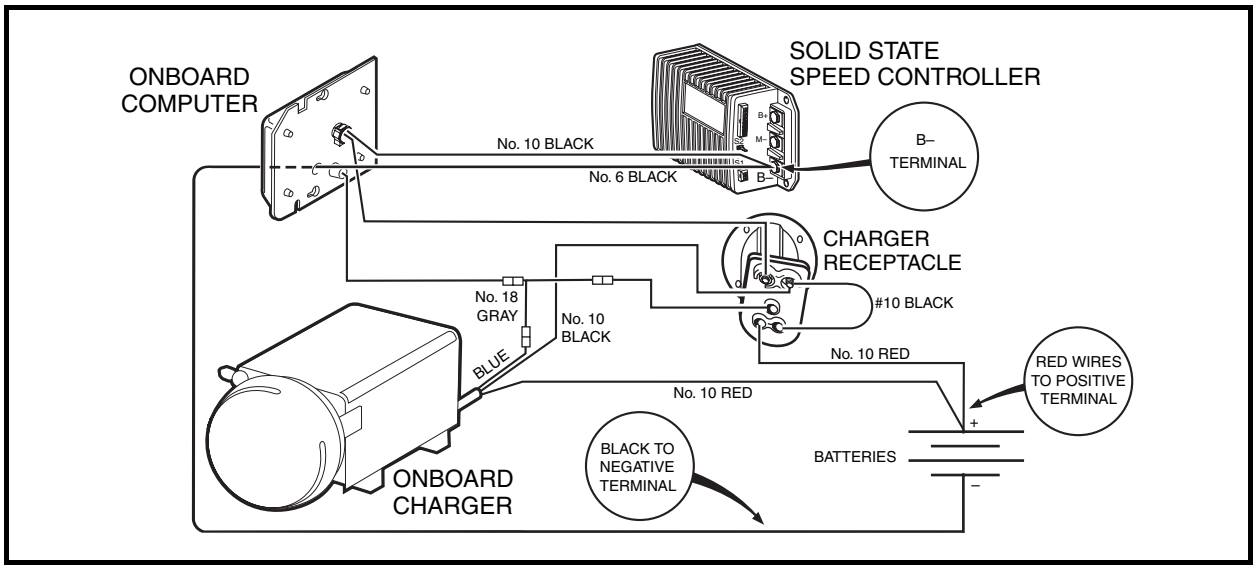


**Figure 4-2 Charge Circuit – DS Villager 4**

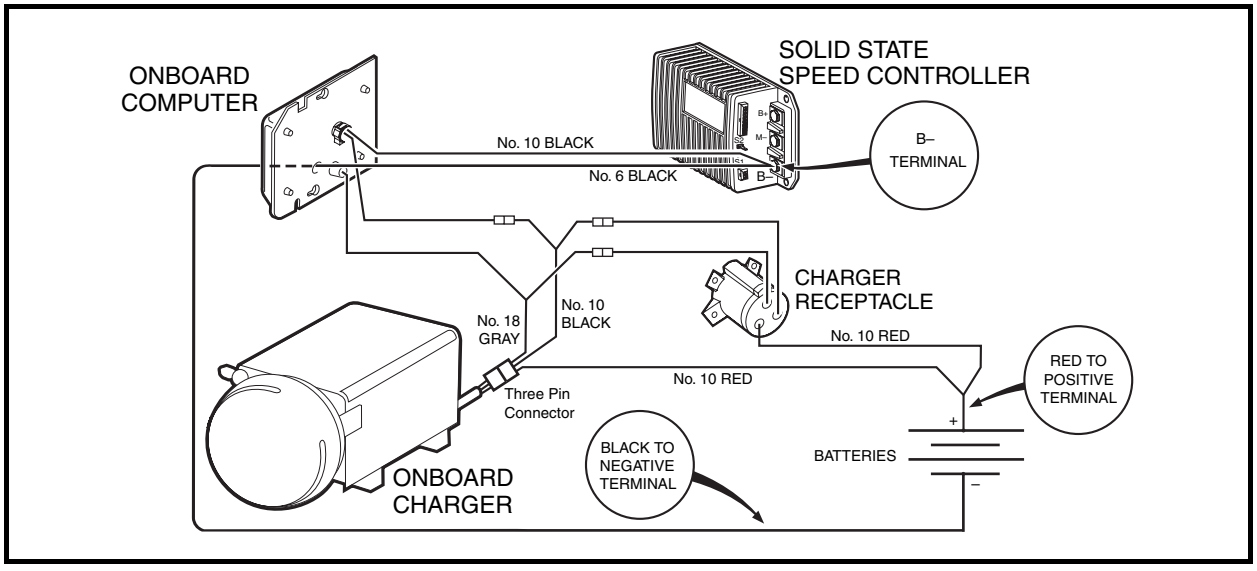


**Figure 4-3 Charge Circuit – Precedent Vehicles**

# CHARGER OPERATION

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

## ⚠ 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 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.**

## ⚠ WARNING

- **Do not bypass the sense lead fuse (not applicable to Precedent vehicles).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 4-35.**
- **Do not connect the charger to battery packs that are not compatible with the DC output voltage specified on the charger. Overheating and transformer burnout will result.**
- **Do not use a battery charger if the cord or plug is damaged in any way. Replace worn or damaged parts immediately. Failure to heed this warning could result in a fire, property damage, severe personal injury, or death.**
- **Do not use a battery charger if it has received a sharp blow, was dropped, or was otherwise damaged. Make sure it is operating properly before putting it back in use.**
- **Each charger should have its own 15 or 20 ampere branch circuit protection (circuit breaker or fuse), in accordance with the National Electrical Code ANSI/NFPA 70, and local codes and ordinances. Improper AC supply circuit protection may result in a fire.**
- **Improper connection of the equipment-grounding conductor can result in an electrical shock.**
- **Do not use an adapter to plug charger into a two-blade outlet or an extension cord. AC outlet must accept grounded three-blade plug. The use of an extension cord could result in fire or electric shock.**
- **Do not operate a battery charger if it has received a sharp blow, was dropped, or was otherwise damaged. Make sure it is operating properly before putting it back in use.**
- **Chargers can ignite flammable materials and vapors. Do not use near fuels, grain dust, solvents, thinner, or other flammables.**
- **Keep charger dry – Do not expose to rain.**
- **Do not block or cover the charger ventilation slots. The slots provide ventilation and prevent the charger from overheating.**
- **Do not allow clothing, blankets, or other materials to cover the charger.**
- **Do not allow the charger to operate for more than 30 minutes at 19 or more amperes.**
- **Install surge arrestors on incoming AC power lines. Surge arrestors will help protect electrical components in the charger and on the vehicle from all but direct or close lightening strikes.**

## AC POWER CONNECTION

The AC line to which the charger is to be connected must be of the proper AC input voltage for the charger and must be capable of supplying sufficient current. **See Section 2 – Charger Identification and Specifica-**

**tions.** If the battery charger is equipped with a multi-position switch for variable AC input voltage, the switch must be set for the correct voltage before the AC cord is connected **(Figure 4-4, Page 4-5)**. **See following CAUTION.**

## CAUTION

- **Failure to set the AC input voltage selector switch to the correct voltage could result in damage to the battery charger or batteries.**

***NOTE:*** *Make sure that the AC cord provided with your charger has the proper AC plug for your location. If it does not, contact your Club Car representative to obtain the proper cord or plug.*

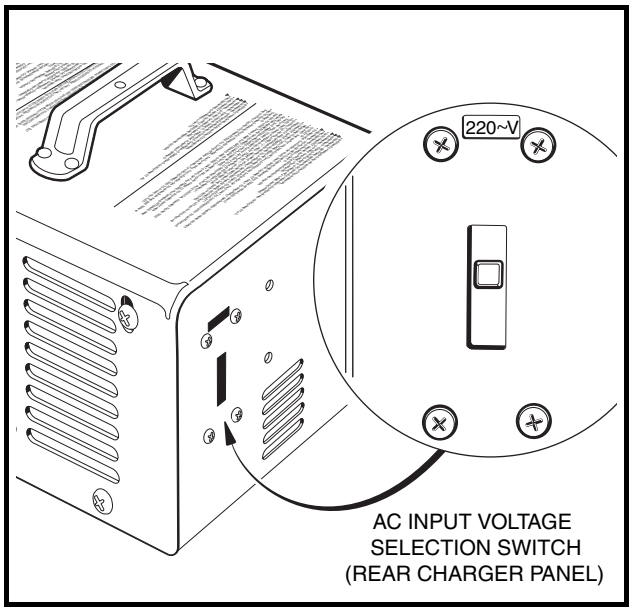


**Figure 4-4 AC Input Voltage Selection Switch**

Connect the power supply cord to an AC supply within the acceptable voltage range. **See Section 2 – Charger Identification and Specifications.**

To reduce the risk of electric shock, the battery charger must be grounded. The charger is equipped with an AC electric cord with an equipment-grounding conductor and a grounding type plug. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with all applicable national and local electrical codes and regulations.

Place the charger AC cord so it will not be stepped on, tripped over, or otherwise subject to damage or stress. The use of an extension cord with the onboard charger should be avoided.

Do not place items in the compartment where the battery charger is installed. Ensure that the charger ventilation slots are unobstructed.

## NORMAL CHARGER OPERATION

1. Connect the AC power supply cord into an AC outlet designed to provide the proper AC voltage for the charger.
2. The charger will activate automatically within 2 to 15 seconds.

3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 15 to 19 amps, depending upon the condition and depth of discharge of the batteries. Slight variations in the initial charge rate may also result from AC line input voltages that are higher or lower than the nominal input voltage. Higher AC line voltages increase the initial charge rate while lower AC line voltages reduce the initial charge rate.
4. Monitor the ammeter. Under normal operating conditions (when the charger is on and the batteries are discharged), the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero) one hour and two hours into the charge cycle. **See following CAUTION and NOTE.**

## CAUTION

- **Do not connect an external charger to the receptacle of a vehicle equipped with an onboard charger while the onboard charger is activated. Charging overload will damage the onboard computer and may cause battery damage.**

***NOTE:*** *If the batteries are in a fully charged state and the vehicle has not been driven, the onboard computer will not perform the self-diagnostic test after the charge cycle starts.*

*Batteries should be put on charge at the end of each day even if the vehicle has been used for only a short amount of time (even if for only 10 minutes).*

*When air temperatures fall below 65 °F (18.3 °C), batteries charged in unheated areas should be placed on charge as soon as possible after use. Cold batteries require more time to fully charge.*

*New batteries will not deliver their full range until the vehicle has been driven and recharged from 20 to 50 times.*

*Vehicles should be restricted to 40 to 50 energy units of discharge (or 36 holes of golf) between charges until the batteries have been properly seasoned (20 to 50 charge cycles). For maximum battery life, Club Car recommends that electric vehicles always be recharged after 40 to 50 energy units of discharge or each night in order to avoid deep discharging the batteries. Charging between rounds will also extend battery life; use the CDM (Communication Display Module) (CCI P/N 101831801).* ***See Communication Display Module in Section 11 of the appropriate maintenance and service manual.***

## TESTING CHARGER OPERATION

1. Connect the AC power supply cord to an electrical outlet. The charger relay should not close immediately, but should close with an audible click after a delay of 2 to 15 seconds. **See following NOTE.**

***NOTE:*** *Monitor the charge cycle to make sure the charger turns off properly. If the charge cycle is interrupted, and the batteries are less than 90% charged, the battery warning light will illuminate intermittently.* ***See Battery Warning Light on page 4-2.***

2. If the charger does not operate exactly as described above, refer to the wiring diagram and make sure that the vehicle is wired correctly **(Figure 4-2, Page 4-3)** and that the internal charger wiring is correct **(Figure 4-5, Page 4-7)**.

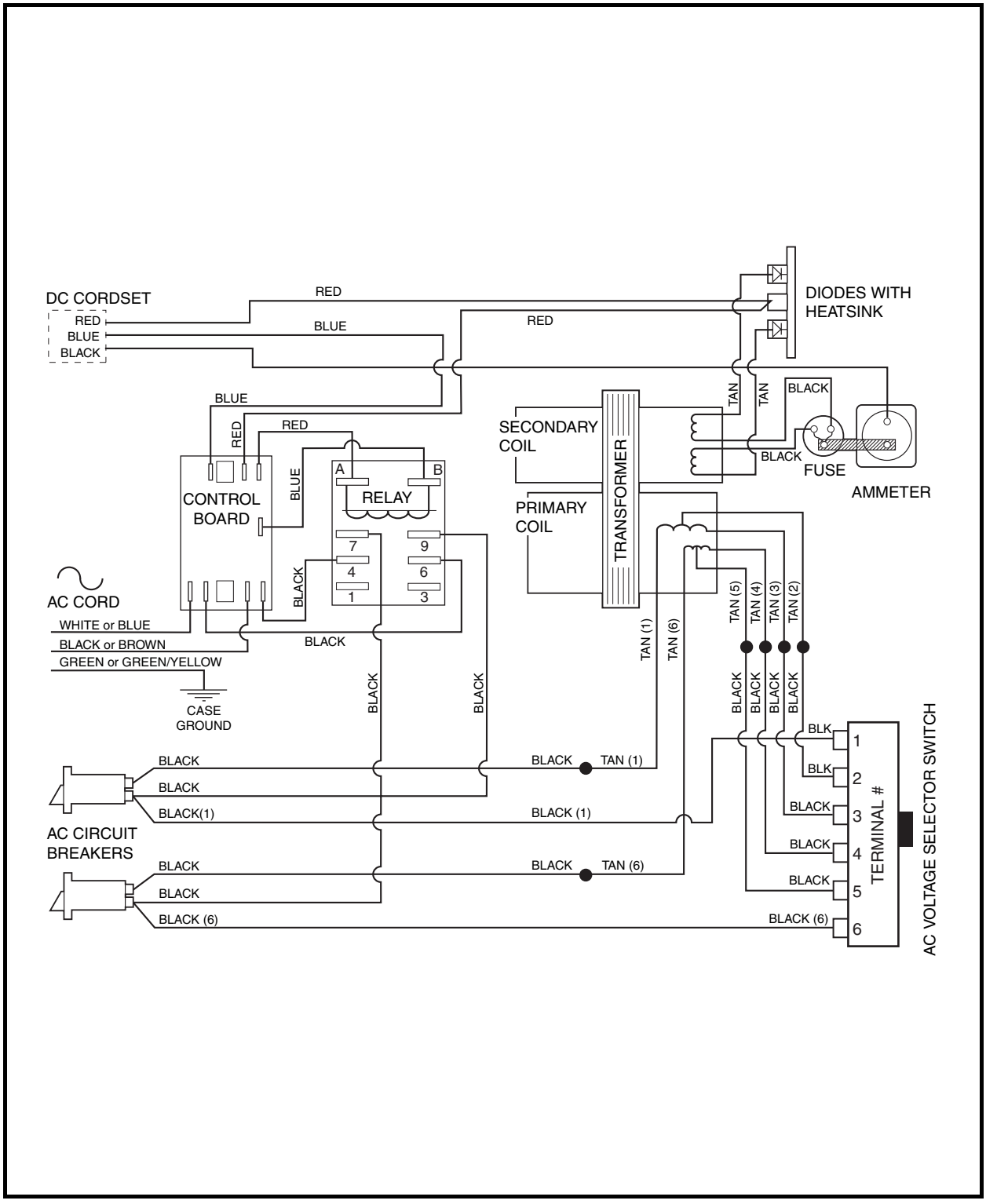


**Figure 4-5 Export PowerDrive Onboard Battery Charger Wiring Diagram**

# CHECKING BATTERY CONDITION

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

It is common practice for technicians to check the condition of a set of batteries after they have been charged to ensure they have received a complete charge before the vehicle is used. With the PowerDrive battery charger this practice is not necessary. The onboard computer controls and monitors the charge cycle. If any problem occurs during a charge cycle, the battery warning light, located above the steering column in the center dash panel, will illuminate intermittently.

If the battery warning light is illuminated after a charge cycle, refer to the troubleshooting chart. **See Troubleshooting on page 4-9.** If the specified test procedures identify no problems, plug the AC cord into a wall outlet and let it charge until the charger shuts off automatically. If a problem is found, correct it and charge the vehicle. Normal battery voltage near the end of a charge cycle should be approximately 59 to 63 volts DC while the charger is still operating.

### Start Charge Cycle

1. Disconnect the AC plug from the wall outlet.
2. Wait 20 seconds, then reconnect the AC cord to the wall outlet. **See following NOTE.**

***NOTE:*** *The charger will not operate unless a delay of approximately 20 seconds is observed.*

3. Monitor the ammeter for the charge rate. If the vehicle has not been driven since the last charge cycle and the batteries are fully charged, the onboard computer will not perform a self-diagnostic test. The charge cycle will begin and the ammeter will not drop to zero. If the vehicle has been driven, even if only a few feet, the onboard computer will perform the self-diagnostic test; the ammeter will drop to zero for 2 to 3 seconds before the charge cycle continues. If the batteries are close to being fully charged, the charge cycle will begin and the charge current will begin to taper within a few minutes.

# TROUBLESHOOTING

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

### ⚠ 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.**

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 4-5, Page 4-7).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 4-35.**

Use the following Troubleshooting Guide for troubleshooting export PowerDrive onboard battery chargers (model numbers 17790-10 and 17790-40). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

## EXPORT POWERDRIVE ONBOARD BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Relay does not close, no transformer hum and ammeter does not move** | Batteries disconnected | Connect batteries. **See Figure 4-6, Page 4-12 through Figure 4-9, Page 4-13** |
| | Battery voltage is too low | Test Procedure 1 – Battery Voltage on page 4-11 |
| | Improper vehicle or battery charger wiring | **See Figure 4-2, Page 4-3**, **Figure 4-3, Page 4-3**, **Figure 4-5, Page 4-7**, **Figure 4-6, Page 4-12**, **Figure 4-7, Page 4-12**, **Figure 4-8, Page 4-12 and Figure 4-9, Page 4-13** |
| | DC circuit | Test Procedure 5 – Charger DC Circuit Continuity Test on page 4-18 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 4-13 |
| | Gray sense lead fuse is blown | Test Procedure 1 – Battery Voltage on page 4-11 |
| | Control board malfunction | Test Procedure 2 – Control Board on page 4-13 |
| **Relay closes with an audible click but no transformer hum and ammeter does not move** | Improper AC line voltage | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-15 |
| | Failed AC plug and cord | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-15 |
| | Failed AC cord reel | Test Procedure 8 – Continuity on page 4-21 |
| | Internal AC breaker | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-15 |
| | Transformer primary coil | Test Procedure 6 – Transformer on page 4-19 |
| | Relay | Test Procedure 8 – Continuity on page 4-21 |
| **Relay closes and transformer hums but ammeter does not move** | Blown charger fuse | Test Procedure 4 – Diodes on page 4-16 |
| | Both Diodes failed | Test Procedure 4B – Both Diodes Failed on page 4-17 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 4-13 |
| | Failed transformer or voltage switch | Test Procedure 6 – Transformer on page 4-19 |
| | Failed ammeter | Replace ammeter |
| **Relay operates intermittently** | Failed charger relay | Test Procedure 8 – Continuity on page 4-21 |
| **Single charger fuse link blows** | Diode failed | Test Procedure 4A – Single Diode Failure on page 4-16 |
| | Loose internal fuse connection | Tighten connection |

**Troubleshooting Guide continued on next page...**

## EXPORT POWERDRIVE ONBOARD BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Both charger fuse links blow or receptacle fuse link blows** | Battery is wired in reverse polarity | Check vehicle wiring |
| | DC cord is wired in reverse polarity | Check battery charger wiring |
| | Both diodes failed | Test Procedure 4B – Both Diodes Failed on page 4-17 |
| **Charger output is low** | One diode failed | Test Procedure 4A – Single Diode Failure on page 4-16 |
| | Transformer coil short-circuit failure | Test Procedure 6 – Transformer on page 4-19 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 4-13 |
| **Charger turns off too soon** | AC power supply was shut off | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-15 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 4-13 |
| | Batteries may be fully charged | Test Procedure 7 – Battery State of Charge Test on page 4-20 |
| **Charger goes to 16 hour time out** | Onboard computer malfunction | Test Procedure 2 – Control Board on page 4-13 |
| | Extremely discharged batteries or cold temperature | Recharge batteries |
| | Failed or weak battery | See Batteries section in the appropriate maintenance and service manual |
| **AC line fuse blows or AC circuit breaker trips** | AC cord is shorted | Test Procedure 8 – Continuity on page 4-21 |
| | Failed transformer or voltage switch | Test Procedure 6 – Transformer on page 4-19 |
| | Incorrect AC voltage selector switch position | Check switch position for proper incoming AC voltage selection |
| **Battery warning light illuminates for ten seconds at four second intervals (25 seconds, at 10 second intervals for Precedent vehicles)** | AC power interrupted | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-15 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 4-13 |
| | Charger failure | See Testing Charger Operation on page 4-6 |
| | 16 hour time out | See Battery Warning Light on page 4-2 |
| | Battery or batteries need to be replaced | See Batteries section in the appropriate maintenance and service manual |
| | Batteries are getting close to full discharge capacity | Recharge batteries as soon as possible |

# TEST PROCEDURES

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

## INDEX OF TEST PROCEDURES



## TEST PROCEDURE 1 – BATTERY VOLTAGE

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

### Test Procedure 1A – DS Villager 4

1. Check the wire connections between the vehicle and battery charger **(Figure 4-2, Page 4-3)**.
   1.1. Verify that the 10-gauge red wire of the charger is connected to the positive (+) post of battery no. 1.
   1.2. Verify the connection of the 10-gauge black wire from the onboard computer and the 10-gauge black wire from the battery charger at the fuse link on the charger receptacle.
   1.3. Check the connections of the DC cord blue wire (17), from the charger, and the gray wire, from the onboard computer, to the the 3-way wire adapter (18) **(Figure 4-29, Page 4-36)**. **See following WARNING.**

**⚠ WARNING**

- **Do not bypass the sense lead fuse.**

   1.4. Remove the gray sense lead fuse and check it for continuity with a multimeter set to 200 ohms. The resistance should be less than 2 ohms.
2. With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 4 **(Figure 4-6, Page 4-12)**. Normal no-load voltage should be between 50 and 52 volts for fully charged batteries. The voltage of the battery pack must be over 34 volts DC to allow the onboard computer to close the charger relay. If battery pack voltage is too low to start charger, temporarily bypass the charger relay. **See Charging a Battery Pack that has Low Voltage on page 4-33.**

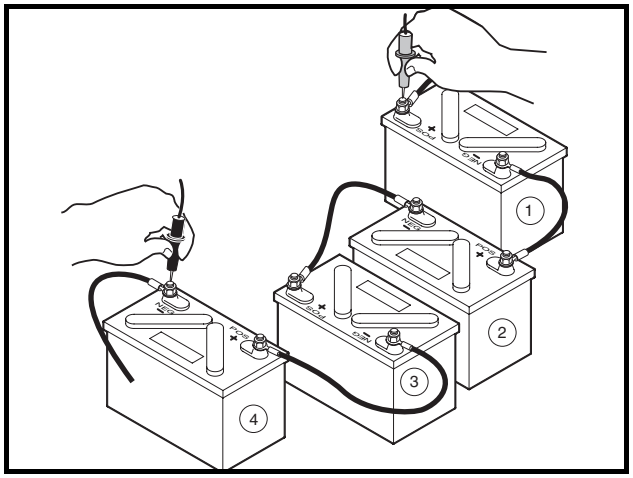


**Figure 4-6 Battery Voltage Test – DS Villager 4**

## Test Procedure 1B – Precedent Vehicles

1. Check the wire connections between the vehicle and battery charger **(Figure 4-3, Page 4-3)**.
   1.1. Verify that the 10-gauge red wire of the charger is connected to the positive (+) post of battery no. 1.
   1.2. Verify the connection of the 10-gauge black wires in the charger adapter harness. One wire connects to the onboard computer black lead wire. The second wire connects to the charger receptacle black lead wire.
   1.3. Verify the connection of the 18-gauge gray wires in the charger adapter harness. One wire connects to the onboard computer. The second wire connects to the charger receptacle gray lead wire.
2. **Style A and B 4 x 12-Volt Precedent only:** With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 4 **(Figure 4-7, Page 4-12)** or **(Figure 4-8, Page 4-12)**.

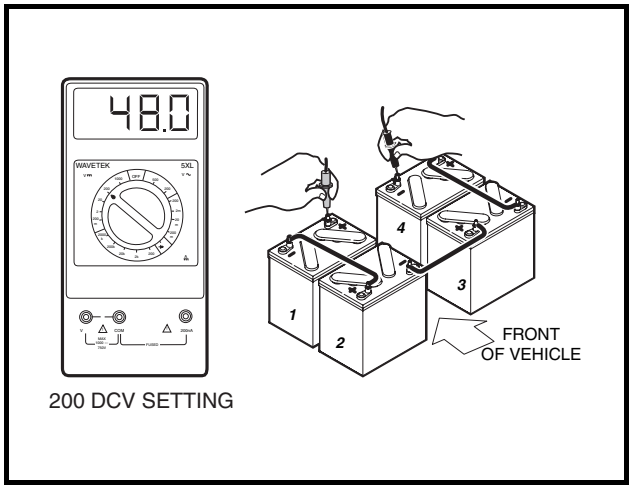


**Figure 4-7 Battery Voltage Test – Precedent Style A Battery Configuration**

(Viewed from driver side of vehicle)
1. RED probe to battery no. 1 (+).
2. BLACK probe to battery no. 4 (-).

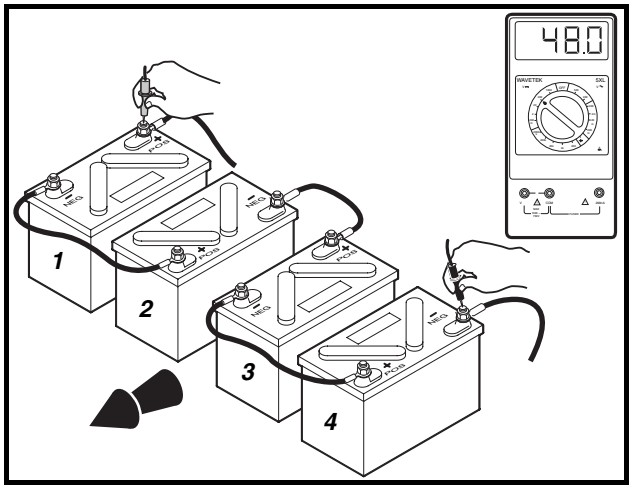


**Figure 4-8 Battery Voltage Test – Precedent Style B Battery Configuration**

(Viewed from driver side of vehicle)
1. RED probe to battery no. 1 (+).
2. BLACK probe to battery no. 4 (-).

3. **Style C 6 x 8-Volt Precedent only:** With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 6 **(Figure 4-9, Page 4-13)**.

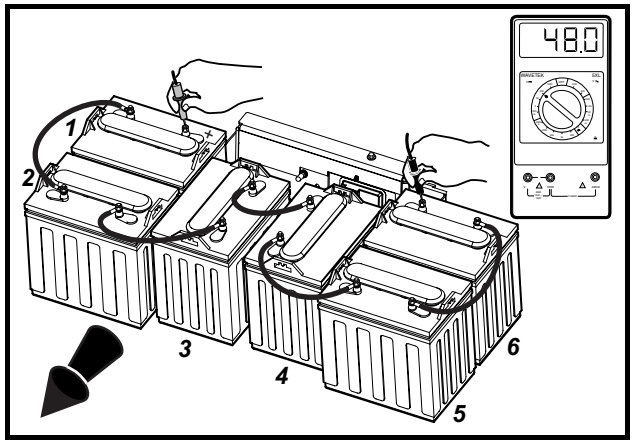


**Figure 4-9 Battery Voltage Test – Precedent Style C Battery Configuration**

(Viewed from driver side of vehicle)
1. RED probe to battery no. 1 (+).
2. BLACK probe to battery no. 6 (-).

4. Normal no-load voltage should be between 50 and 52 volts for fully charged batteries. The voltage of the battery pack must be over 32 volts DC to allow the onboard computer to close the charger relay. If battery pack voltage is too low to start charger, temporarily bypass the charger relay. **See Charging a Battery Pack that has Low Voltage on page 4-33.**

## TEST PROCEDURE 2 – CONTROL BOARD

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

## DC Circuit Test

1. Disconnect AC cord from outlet. DC cord red, black, and blue wires remain connected to the vehicle. All wires remain connected to the control board. Set multimeter to 200 volts DC. **See following DANGER.**

### ⚠ DANGER

- **Do not touch any wire or component in the battery charger while DC power is present. Failure to heed this warning will result in an electric shock.**

2. Place black (–) probe of multimeter on terminal with blue DC cord wire and red (+) probe to terminal with red relay wire **(Figure 4-10, Page 4-14)**.
3. Multimeter should indicate full battery voltage (approximately 47-50 volts). If reading is incorrect, replace control board.

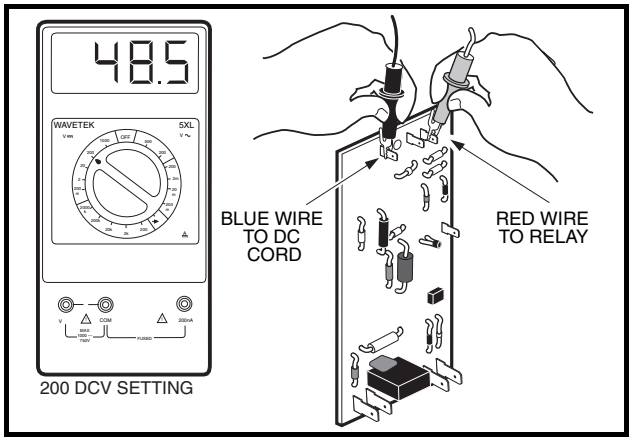


Figure 4-10 DC Circuit Test

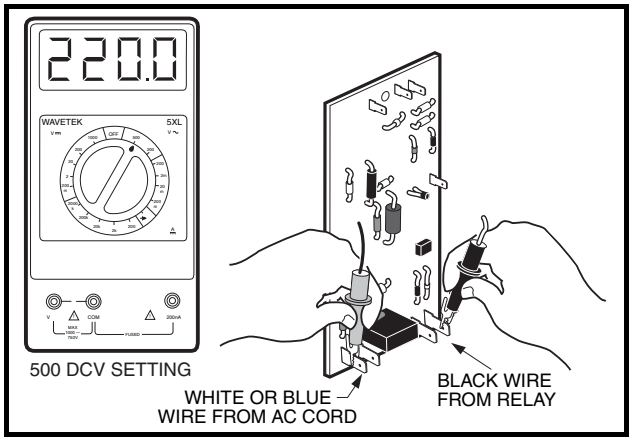


Figure 4-11 AC Circuit Test

## AC Circuit Test

1. Disconnect AC cord from outlet. DC cord red, black, and blue wires remain connected to vehicle. Set multimeter to volts AC.
2. Disconnect white or blue wire of AC cord at terminal on control board **(Figure 4-12, Page 4-14)**. **See following DANGER.**

### ⚠ 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.**

3. Place black (–) probe of multimeter, set to 500 volts AC, onto terminal with black wire from relay. Connect red (+) probe to terminal from which the white or blue AC cord wire was disconnected **(Figure 4-11, Page 4-14)**.
4. Connect AC cord to outlet. Reading should be input voltage from outlet.
5. If reading is incorrect, replace control board.

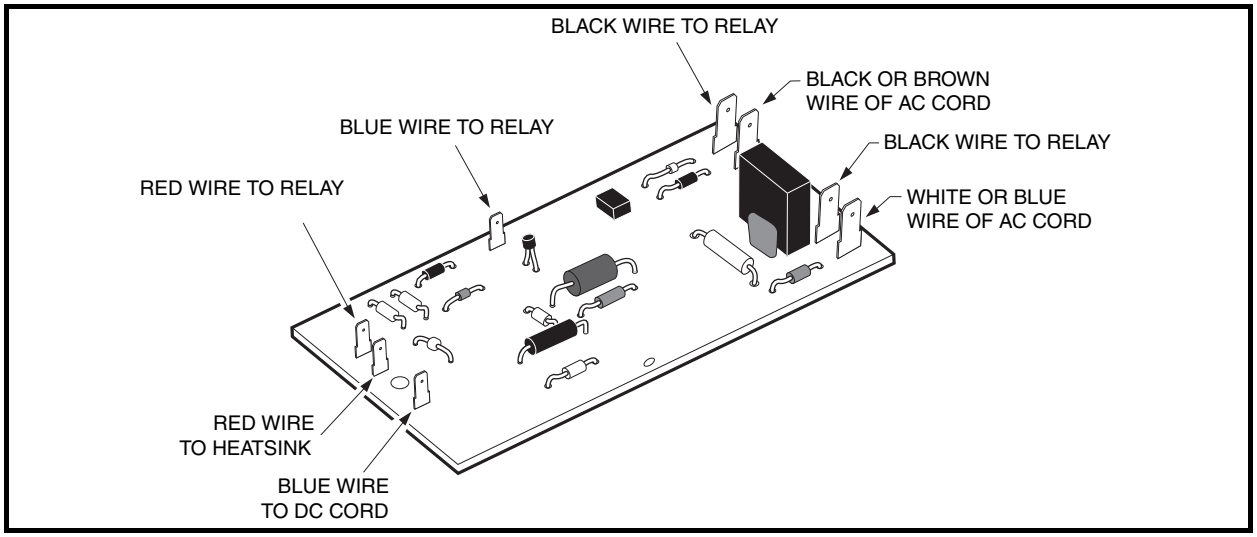


Figure 4-12 Control Board

## TEST PROCEDURE 3 – AC POWER AND CONTINUITY CHECK OF AC CIRCUIT

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

1. Disconnect the AC power supply cord from the wall outlet.
2. Check the AC circuit breakers on the front of the charger and reset it if necessary.
3. Check the AC line fuse or circuit breaker in the storage facility.
4. With a multimeter set to 500 volts AC, check incoming AC voltage. Insert multimeter test probes into AC wall outlet; voltage should be within the range specified in the following chart. If proper voltage is not present and the voltage selector switch is set for the correct voltage for your area, have building wiring checked by a licensed electrical contractor.

| SETTING ON AC VOLTAGE SELECTOR SWITCH | MINIMUM AC VOLTAGE PERMITTED | MAXIMUM AC VOLTAGE PERMITTED |
|---|---|---|
| 100 Volts AC | 95 | 105 |
| 200 Volts AC | 190 | 210 |
| 220 Volts AC | 209 | 231 |
| 240 Volts AC | 228 | 252 |

5. Check continuity of the AC circuit.
   5.1. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
   5.2. Remove the charger cover.
   5.3. Bypass the relay. **See Charging a Battery Pack that has Low Voltage on page 4-33.**
   5.4. With relay bypassed, there should be continuity across the AC cord blades **(Figure 4-13, Page 4-16)**.
6. If the circuit is not complete, check the wiring of the AC cord, AC cord reel, transformer primary coil wires (21), internal AC circuit breakers (13), and voltage selector switch (9) **(Figure 4-5, Page 4-7)**.
7. If the charger is wired correctly, check the continuity of the AC cord, AC cord reel, transformer primary coil, and the internal AC circuit breaker individually. **See Test Procedure 8 – Continuity on page 4-21.**
8. When troubleshooting and repairs are complete, properly connect the relay wiring. **See following WARNING.**

### ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

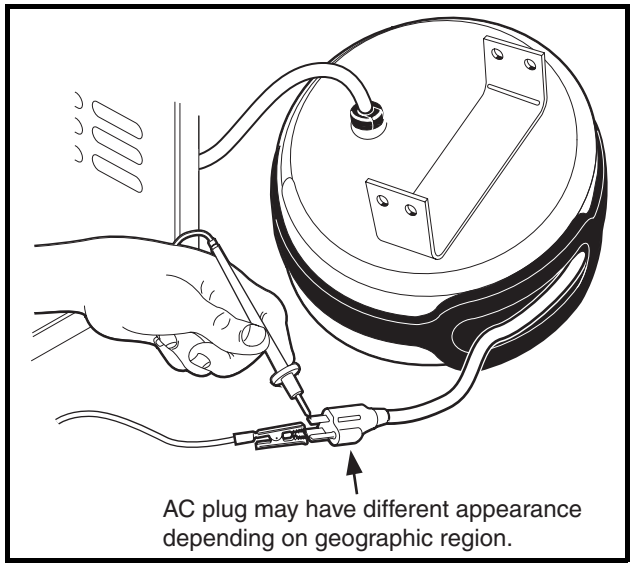


**Figure 4-13 AC Circuit Continuity Test**

## TEST PROCEDURE 4 – DIODES

Use Test Procedure 4A – Single Diode Failure on page 4-16 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 4-17.

### Test Procedure 4A – Single Diode Failure

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

A single diode failure is indicated by the failure of one fuse link (closed circuit diode) or by the charger output being low (open circuit diode). If a diode has failed, the entire heatsink must be replaced. To check diodes:

1. Disconnect AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
3. Remove the charger cover.
4. Disconnect one transformer secondary coil wire from the diode terminal **(Figure 4-14, Page 4-17)**.
5. Using a low voltage continuity tester or multimeter set to the diode test function, connect the red (+) test probe to the diode mounting plate and the black (–) test probe to a diode terminal and note the reading **(Figure 4-14, Page 4-17)**.
6. Reverse test probes and check each diode again and note the reading **(Figure 4-15, Page 4-17)**. A diode is designed to conduct current in one direction only. If a diode conducts current (shows continuity) in both directions, the entire heatsink with diodes must be replaced. If a diode does not conduct current (does not show continuity) in either direction, the entire heatsink must be replaced.
7. On rare occasions, a single fuse link may blow due to excessive heat. This can be caused by a loose internal fuse connection. Check all three fuse connections inside the charger to be sure they are clean and tight. The proper tightness for the fuse link connections is 22 in-lb (2.5 N·m).
8. Ensure the charger is wired properly and all connections are clean and tight. **See following CAUTION.**

**CAUTION**

- **If connections are not clean and tight, excessive heat will be created and the charger may become damaged.**

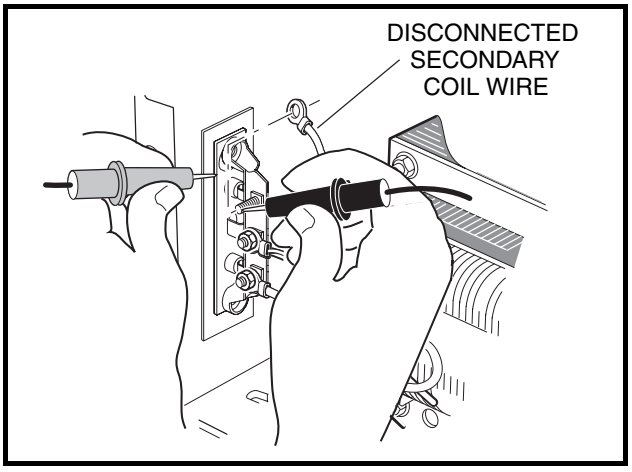


**Figure 4-14 Diode Test**

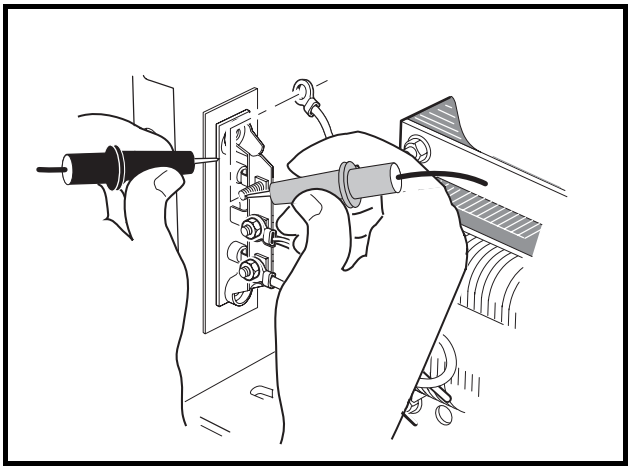

**Figure 4-15 Diode Test – Probes Reversed**

## Test Procedure 4B – Both Diodes Failed

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

To check the diodes, use Test Procedure 4A – Single Diode Failure on page 4-16. If both diodes have failed closed, both charger fuse links will be blown. If both diodes have failed open, the relay will close and the transformer will hum, but the ammeter will not indicate any output and the AC circuit breaker may trip off. If both diodes have failed open or closed, the entire heatsink must be replaced. To determine why both diodes failed:

1. Check the batteries and the receptacle to ensure that they are wired in the correct polarity. **(Figure 4-2, Page 4-3)**.
2. Make sure the charger is wired correctly: The DC cord red wire should be connected to the center terminal of the heatsink, the DC cord blue wire should be connected to the control board, and the DC cord black wire should be connected to the left side of the ammeter (when viewed from inside the charger) **(Figure 4-5, Page 4-7)**. If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is connected to the vehicle, whether or not the AC cord is plugged into an outlet.
3. Make sure the charger is wired to the vehicle correctly; the DC cord red wire should be connected to the same large post as the 6-gauge red wire connected to the positive (+) post of battery no. 1. The DC cord blue wire should be connected to the sense lead fuse. The DC cord black wire should be connected to the terminal block located on the vehicle component mounting plate **(Figure 4-2, Page 4-3)**. If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is connected to the vehicle, whether or not the AC cord is plugged into an outlet.
4. On rare occasions, both diodes may fail as a result of a lightning strike at the charging location.
5. Excessive heat due to a loose connection may also cause both fuse links to blow. Be sure fuse connections are tightened to 22 in-lb (2.5 N·m).
6. Ensure that the charger and vehicle are wired properly and all connections are clean and tight.

## TEST PROCEDURE 5 – CHARGER DC CIRCUIT CONTINUITY TEST

### Test Procedure 5A – DS Villager 4

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

1. Disconnect the AC cord from the wall outlet.
2. Disconnect the batteries as instructed. **See General Warning on page 1-1.**
3. Disconnect the DC cord blue wire (17) from the 3-way wire adapter (18) at the sense lead fuse (20) **(Figure 4-29, Page 4-36)**.
4. Disconnect the DC cord red wire from the positive (+) post of battery no. 1.
5. Disconnect the DC cord black wire (19) from the charger receptacle fuse link **(Figure 4-29, Page 4-36)**.
6. Using a continuity tester (CCI P/N 1011273) or multimeter set to 200 ohms, connect the test probes to the DC cord black wire and the DC cord red wire **(Figure 4-16, Page 4-18)**. Note the reading.
7. Reverse the test probes and check the DC cord again **(Figure 4-17, Page 4-18)**. The circuit should show continuity in only one direction.
8. If the circuit does not show continuity in either direction and the charger fuse is not blown, individually check all connections and the continuity of the DC cord and ammeter. **See Test Procedure 8 – Continuity on page 4-21.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 4-16.**
9. If the circuit shows continuity in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes. **See Test Procedure 4 – Diodes on page 4-16.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 4-21.**
10. Remove the DC cord blue wire from the control board and check continuity between the DC cord red, black, and blue wires **(Figure 4-5, Page 4-7)**. There should be no continuity.

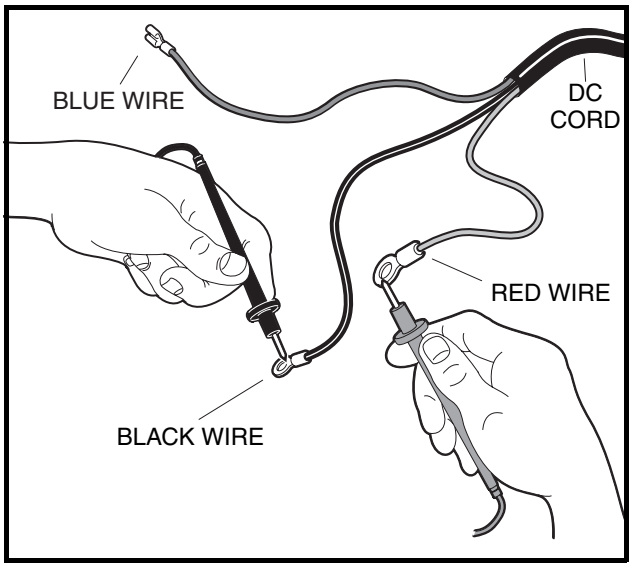


**Figure 4-16 DC Cord Test – DS Villager 4**

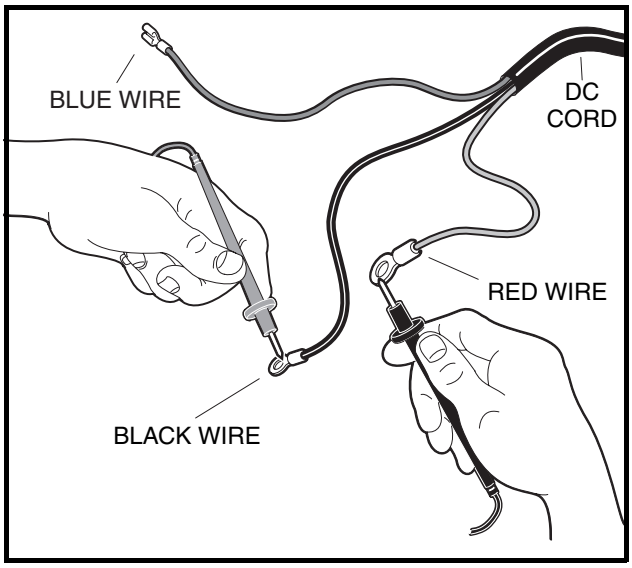


**Figure 4-17 DC Cord Test (Probes Reversed) – DS Villager 4**

## Test Procedure 5B – Precedent Vehicles

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

1. Disconnect the AC cord from the wall outlet.
2. Disconnect the batteries as instructed. **See General Warning, Section 1, Page 1-1.**
3. Disconnect the charger DC cord at the three pin connector **(Figure 4-3, Page 4-3)**.
4. Using a continuity tester (CCI P/N 1011273) or multimeter set to 200 ohms, connect the test probes to the charger DC cord black wire and red wire terminals in the three pin connector. Note the reading.
5. Reverse the test probes and check the DC cord again. The circuit should show continuity in only one direction.
6. If the circuit does not show continuity in either direction and the charger fuse is not blown, individually check all connections and the continuity of the DC cord and ammeter. **See Test Procedure 8 – Continuity on page 4-21.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 4-16.**
7. If the circuit shows continuity in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes. **See Test Procedure 4 – Diodes on page 4-16.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 4-21.**
8. Check continuity between the DC cord red, black, and blue wires **(Figure 4-5, Page 4-7)**. There should be no continuity.

## TEST PROCEDURE 6 – TRANSFORMER

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

Failure of the transformer may be caused by aging or a short circuit in adjacent coil turns. If the transformer has failed, the ammeter will indicate low output or no output; however, the transformer may hum. A blown AC line fuse or tripped AC circuit breaker in the charger or the storage facility may be caused by an improperly wired charger, an improper setting of the AC voltage selector switch, or a failed transformer.

An AC circuit test should be done before performing this test procedure to ensure the continuity of the AC cord, AC cord reel, internal AC circuit breakers, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-15.**

1. Disconnect AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
3. Remove the charger cover.
4. Disconnect transformer secondary coil wires from the heatsink **(Figure 4-18, Page 4-20)**.
5. To apply AC power directly to the transformer primary coil, bypass the relay. **See Charging a Battery Pack that has Low Voltage on page 4-33. See following DANGER.**

### ⚠ 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.**

6. Make sure that the voltage selector switch (on the back of the charger) is set for the appropriate incoming AC voltage. Also ensure that the secondary coil wires are not touching one another. With the relay bypassed, insert the AC plug into an outlet. If the AC line fuse blows or AC circuit breaker trips, the transformer is shorted internally and must be replaced.
7. If the AC line fuse does not blow or the AC circuit breaker does not trip, check the transformer secondary coil voltage.

8. Disconnect AC cord from the wall outlet.
9. Using alligator clips and a multimeter set to 500 volts AC, connect the multimeter probes to the secondary transformer coil tan wires.

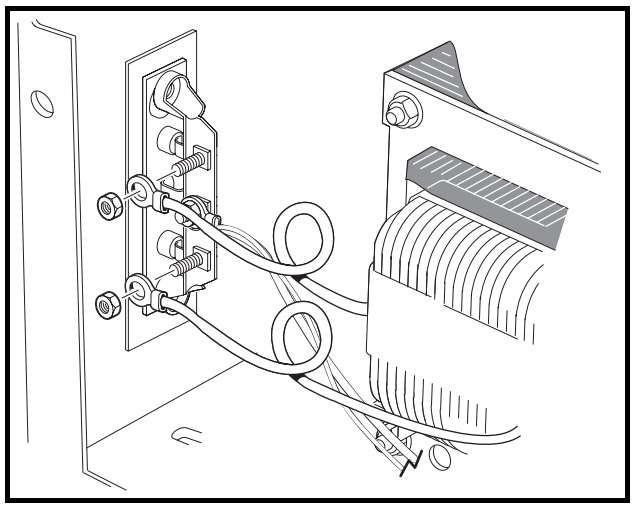

**Figure 4-18 Remove Secondary Coil Wires From Heatsink**

10. Connect the AC cord to the wall outlet and monitor the multimeter for the secondary coil voltage. If measured voltage is approximately 85 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced.
11. If the voltage reading is normal (86 volts AC or higher), the transformer is operational. Disconnect the AC plug from the wall receptacle and check the continuity of the DC circuit. **See Test Procedure 5 – Charger DC Circuit Continuity Test on page 4-18.**
12. When troubleshooting and repairs are complete, remove jumper wire and properly connect relay wiring. **See following WARNING.**

### ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

## TEST PROCEDURE 7 – BATTERY STATE OF CHARGE TEST

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

1. With the batteries fully charged, disconnect the AC charger plug for approximately 20 seconds and reconnect it. The ammeter should jump to a reading between 14 and 18 amps and taper to below 5 amps within 15 minutes.
2. If the charger does not taper to below 5 amps within 15 minutes, batteries may not be receiving a full charge and the onboard computer should be checked. **See Test Procedure 2 – Control Board on page 4-13. See following NOTE.**

***NOTE:*** *Batteries near the end of their useful lives may not allow the battery charge current to taper below 5 amps.* ***See Batteries section in the appropriate maintenance and service manual.***

## TEST PROCEDURE 8 – CONTINUITY

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

## Short AC Cord and Retractable Cord Reel

Check continuity of the short AC cord and retractable cord reel at the same time.

1. Disconnect the AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
3. Remove the charger cover.
4. Disconnect the green or green/yellow wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 4-19, Page 4-22)**.
5. Disconnect the black or brown wire (1) of the short AC cord from the control board.
6. Disconnect the AC cord white or blue wire (4) from the control board **(Figure 4-19, Page 4-22)**.
7. Using a multimeter set for 200 ohms, place the red (+) probe on the terminal at the end of the black or brown wire (1) **(Figure 4-19, Page 4-22)**. With the black (-) probe, test for continuity on each of the flat blades and then on the round pin of the AC plug (on the retractable cord reel). The tester should indicate continuity on one flat blade only. If any other reading is obtained, the short AC cord and retractable cord reel must be tested independently of each other.
8. Place the red (+) probe on the end of the green or green/yellow wire (2) and with the black probe check for continuity on both flat blades and on the round pin of the AC plug (on the retractable cord reel) **(Figure 4-19, Page 4-22)**. The tester should indicate continuity on only the round pin. If any other reading is obtained, the short AC cord and retractable cord reel must be tested independently of each other.
9. Place the red (+) probe on the white or blue wire (4) and check for continuity on both flat blades and on the ground pin of the AC plug (on the retractable cord reel). The tester should indicate continuity on only one flat blade. If any other reading is obtained, the short AC cord and retractable cord reel must be tested independently of each other.
10. If the correct readings are obtained in all of the previous steps, the short AC cord and the retractable cord reel are functioning properly. If any of the readings are incorrect, proceed to the following test procedures to determine which of the two components has failed.

## Short AC Cord without Retractable Cord Reel

Check continuity of the short AC cord without the retractable cord reel.

1. Disconnect the AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
3. Remove the heatshrink from the AC cord connection between the short AC cord and the retractable cord reel by gently cutting the heatshrink tubing **(Figure 4-20, Page 4-22)**.
4. Disconnect the short AC cord from the retractable cord reel.
5. Remove the charger cover.
6. Disconnect the black or brown wire (1) of AC cord from the control board.
7. Using a multimeter set for 200 ohms, place the red (+) probe on the terminal at the end of the black or brown wire (1). Test for continuity on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the short AC cord must be replaced. Disconnect the green or green/yellow wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 4-21, Page 4-22)**.

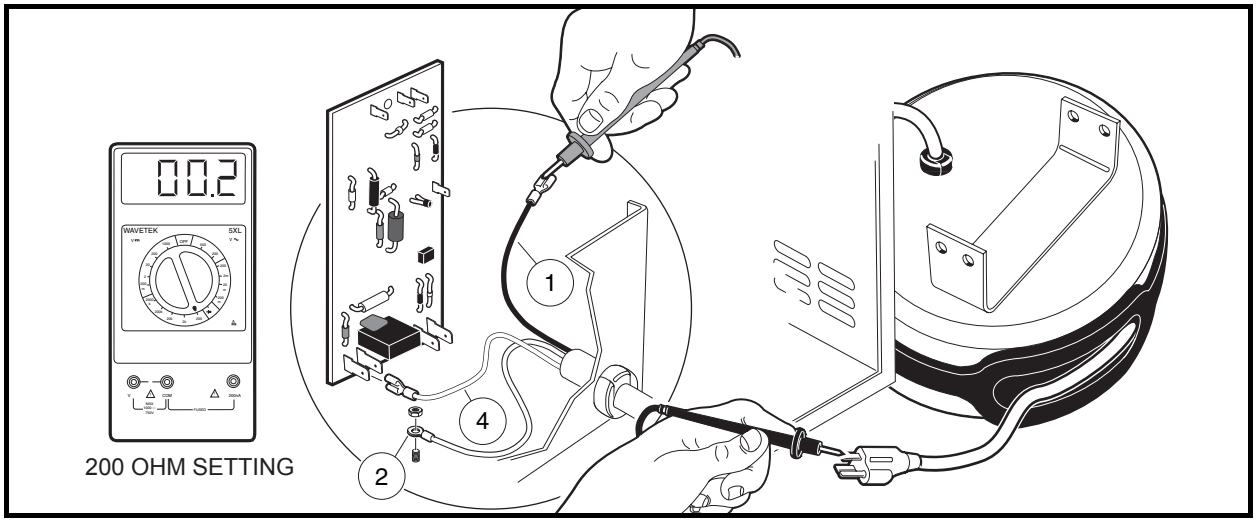


**Figure 4-19 AC Cord and Retractable Cord Reel Continuity Test**

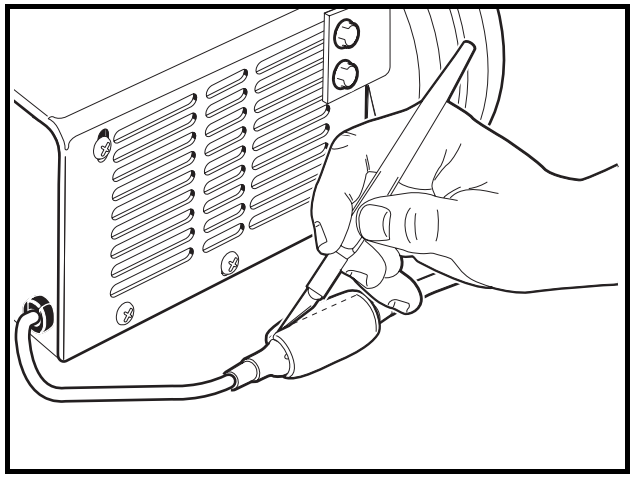

**Figure 4-20 Heatshrink Removal**

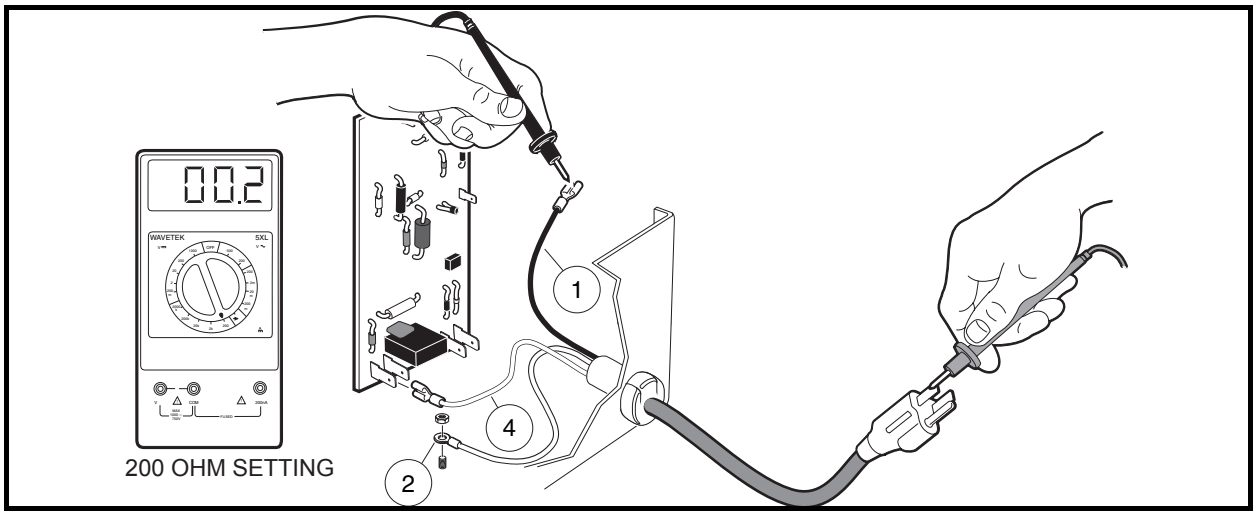


**Figure 4-21 Short AC Cord Test**

8. Place the red (+) probe on the end of the green or green/yellow wire (2) and with the black probe check for continuity on both flat blades and on the round pin of the AC plug. The tester should indicate continuity on only the round pin. If any other reading is obtained, the AC cord and retractable cord reel must be tested independently of each other.
9. Disconnect the AC cord white or blue wire (4) from the control board. Place the red (+) probe on the white or blue wire (4) and check for continuity on both flat blades and on the ground pin of the AC plug. The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord and retractable cord reel must be tested independently of each other.
10. If the correct readings are obtained in all of the previous steps, the short AC cord is functioning properly. Proceed to the following test procedure to test the retractable cord reel.

## Retractable Cord Reel

Check continuity of the AC cord and retractable cord reel at the same time.

1. Disconnect the AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
3. Remove the heatshrink from the AC cord connection between the short AC cord and the retractable cord reel by gently cutting the heatshrink tubing **(Figure 4-20, Page 4-22)**.
4. Disconnect the short AC cord from the retractable cord reel.
5. Using a multimeter set for 200 ohms, place the red (+) probe in one of the flat blade openings of the cord reel receptacle (1) **(Figure 4-22, Page 4-23)**. Test for continuity at the cord reel AC plug (2) on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the cord reel must be replaced.
6. Place the red (+) probe into the other flat blade opening of the cord reel receptacle (1). Test for continuity on the cord reel AC plug (2) on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the cord reel must be replaced.

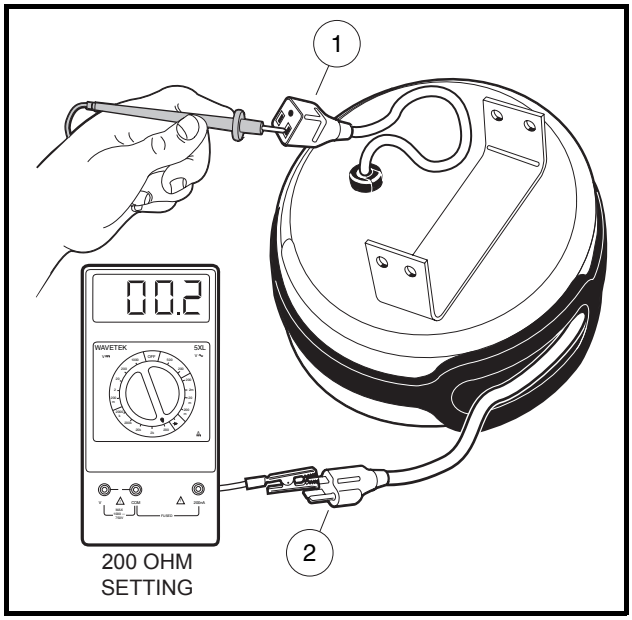


**Figure 4-22 Retractable Cord Reel Test**

7. Place the red (+) probe into the top-center opening of the cord reel receptacle (1). Test for continuity on the cord reel AC plug (2) on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on only the round pin. If any other reading is obtained, the retractable cord reel must be replaced.
8. If the correct readings are obtained in all of the previous steps, the retractable cord reel is functioning properly.

## DC Cord

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
2. Remove the charger cover.
3. To check the continuity of the DC cord, disconnect the black wire of the DC cord from the ammeter **(Figure 4-23, Page 4-27).**
4. Disconnect the red wire of the DC cord from the heatsink.
5. Disconnect the blue wire from the control board.
6. Using a multimeter set for 200 ohms, place the red (+) probe on the red wire of the DC cord. Test for continuity on each of the wires on the other end of the DC cord. The tester should indicate continuity on the red DC cord wire only. If any other reading is obtained, the DC cord must be replaced.
7. Place the red (+) probe on the blue wire of the DC cord. Test for continuity on each of the wires on the other end of the DC cord. The tester should indicate continuity on the blue DC cord wire only. If any other reading is obtained, the DC cord must be replaced.
8. Place the red (+) probe on the black wire of the DC cord. Test for continuity on each of the wires on the other end of the DC cord. The tester should indicate continuity on the black DC cord wire only. If any other reading is obtained, the DC cord must be replaced.

## Transformer

The PowerDrive battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 4-27, Page 4-34)**.

### Primary Coil

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
2. Remove the charger cover.
3. Disconnect the black wires marked 1 and 6 from the AC circuit breakers.
4. Disconnect the wires marked 2, 3, 4 and 5 from the voltage selector switch.
5. Place the continuity tester probes on the primary coil transformer wires disconnected above in pairs until all of the combinations in the following chart have been tested.
6. If the continuity readings agree with the chart, replace the voltage selector switch. If the continuity readings differ from the chart, replace the transformer.

### Secondary Coil

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
2. Remove the charger cover.
3. Remove the transformer (tan) secondary coil wire from the upper terminal of the heatsink **(Figure 4-5, Page 4-7)**.

| PRIMARY COIL CONTINUITY / NO CONTINUITY CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | NEGATIVE PROBE | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| POSITIVE PROBE | 1 | | Continuity | Continuity | No Continuity | No Continuity | No Continuity |
| | 2 | Continuity | | Continuity | No Continuity | No Continuity | No Continuity |
| | 3 | Continuity | Continuity | | No Continuity | No Continuity | No Continuity |
| | 4 | No Continuity | No Continuity | No Continuity | | Continuity | Continuity |
| | 5 | No Continuity | No Continuity | No Continuity | Continuity | | Continuity |
| | 6 | No Continuity | No Continuity | No Continuity | Continuity | Continuity | |

4. Remove the other transformer (tan) secondary coil wire from the bottom terminal of the heatsink and place the continuity test clip on the ammeter buss bar (3) **(Figure 4-24, Page 4-27)**. Test for continuity between the buss bar and each of the secondary coil wires (tan). The tester should indicate continuity between the buss bar and both of the secondary coil wires. If tester does not indicate continuity on both secondary coil wires, replace transformer. Ensure that the fuse is intact and not blown.

## Relay

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
2. Remove the charger cover.
3. Remove the black wire from terminal 6 of the relay and black wire from terminal 9 of the relay **(Figure 4-26, Page 4-31)**. Place continuity tester leads on terminals 6 and 9 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.
4. Remove the black wire from terminal 4 of the relay and black wire from terminal 7 of the relay **(Figure 4-26, Page 4-31)**. Place continuity tester leads on terminals 4 and 7 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.
5. Connect charger DC cord to batteries **(Figure 4-6, Page 4-12 through Figure 4-9, Page 4-13)**. Use jumper wires if necessary. The tester should indicate continuity on relay terminals 6 and 9 and terminals 4 and 7. If tester does not indicate continuity on both sets of contacts, the relay must be replaced.

## Ammeter

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
2. Remove the charger cover.
3. Disconnect the black wire from the left ammeter post (as viewed from inside the charger).
4. Place the continuity tester clip on one of the ammeter posts.
5. Place the continuity test probe on the other ammeter post. The tester should indicate continuity. If the tester does not indicate continuity, replace the ammeter.

### AC Circuit Breaker

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
2. Remove the charger cover.
3. Disconnect the wires from the AC circuit breaker.
4. Place the continuity test probes on the two terminals of the AC circuit breaker. The tester should indicate continuity. If the tester does not indicate continuity, replace the AC circuit breaker.

## CHARGER REPAIRS

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

**⚠ WARNING**

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 4-5, Page 4-7).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 4-35.**

### DC CORD

### DC Cord Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35.**
2. Remove the charger cover.
3. Remove the DC cord black wire (4) from the ammeter by loosening the nut (1). Support the terminal as the nut is loosened to prevent rotation of the connection **(Figure 4-24, Page 4-27)**.
4. Remove nut attaching the red wire (6) of the charger DC cord to the heatsink.
5. Remove the wire tie that secures the DC cord wire to the secondary coil wire (tan).
6. Remove the wire tie on the DC cord near the strain relief bushing.
7. Disconnect the DC cord blue wire from the control board **(Figure 4-23, Page 4-27)**.
8. Using pliers, squeeze the strain relief bushing and remove the DC cord **(Figure 4-23, Page 4-27)**.

### DC Cord Installation

1. Insert the leads of the new DC cord through the hole in the charger base.
2. Attach the red wire of the new DC cord to the center terminal of the heatsink and tighten the nut to 18 in-lb (2.0 N·m) **(Figure 4-23, Page 4-27)**.
3. Attach the blue wire of the new DC cord to the control board **(Figure 4-23, Page 4-27)**.
4. Attach black wire of the new DC cord to ammeter. Install nut (1) onto post of ammeter slightly more than finger tight. While holding the inside nut (2), tighten the outside nut (1) 1/4 turn **(Figure 4-24, Page 4-27)**. **See following CAUTION.**

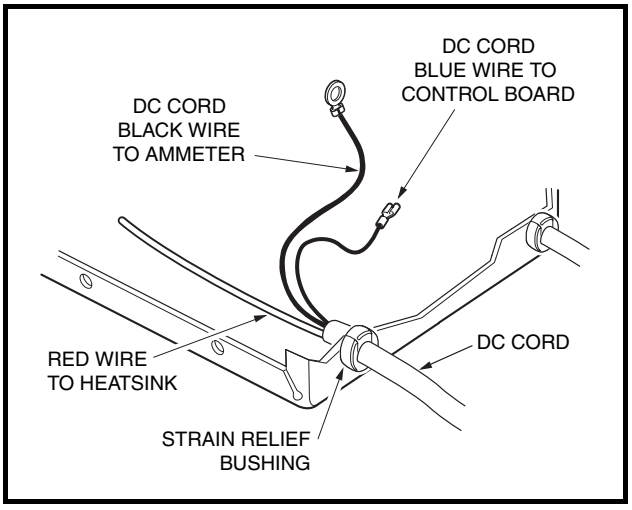


Figure 4-23 DC Cord

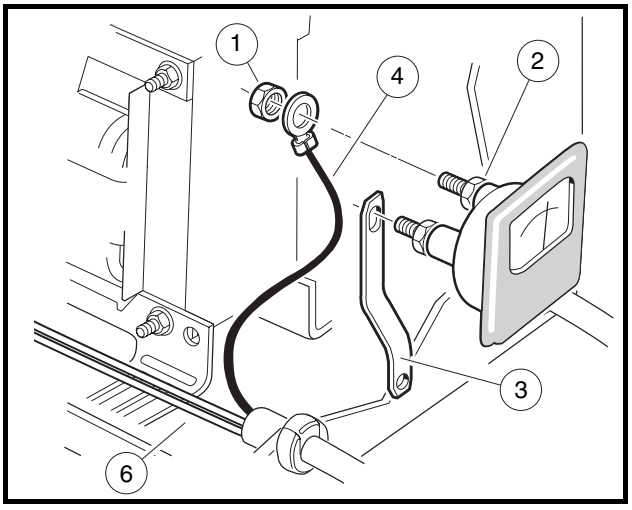


Figure 4-24 DC Cord Replacement

## CAUTION

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
6. Tie the wires together as they were before the wire ties were removed. **See following WARNING.**

## ⚠ WARNING

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

7. Position the charger cover on the base. Install the mounting screws, starting with the bottom holes. Tighten the screws to 11 in-lb (1.2 N·m).

# HEATSINK

## Heatsink Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See preceding WARNING.**
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 4-18, Page 4-20)** and remove the two red wires from the heatsink.
4. Remove the nuts and bolts that secure the heatsink to the case.

## Heatsink Installation

1. Place heatsink against charger base. Make sure clear plastic insulator sheet is between the heatsink and the charger base. Install the nuts and bolts that secure the heatsink to the case. Tighten the bolts to 22 in-lb (2.5 N·m).
2. Connect the red wire from the DC cord and the red wire from the control board to the center terminal post on the heatsink **(Figure 4-5, Page 4-7)**. Tighten nut to 18 in-lb (2.0 N·m).

3. Connect one of the secondary coil transformer wires (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m) **(Figure 4-18, Page 4-20)**.
4. Connect the other secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Install charger cover and install charger in vehicle. **See Onboard Charger Installation on page 4-36.**
6. Check charger for proper operation.

## TRANSFORMER

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

### Transformer Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
2. Remove the charger cover.
3. Note the locations of wire ties and remove the wire ties.
4. Disconnect the black primary coil leads from the AC circuit breakers and the voltage selector switch **(Figure 4-26, Page 4-31 and Figure 4-27, Page 4-34)**.
5. Disconnect the two tan secondary coil transformer wires from heatsink **(Figure 4-18, Page 4-20)**.
6. Disconnect the two black secondary coil transformer wires from the fuse.
7. Remove the four bolts and nuts that mount the transformer to the case and remove the transformer.

### Transformer Installation

1. Install the transformer with secondary coil to the rear of the charger case. Tighten the four bolts and nuts to 28 in-lb (3.2 N·m).
2. Connect one secondary coil transformer wire (black) to one terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m) **(Figure 4-5, Page 4-7)**.
3. Connect the other secondary coil transformer wire (black) to the remaining terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m).
4. Connect one secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Connect the other secondary coil transformer wire (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
6. Connect the black primary coil transformer wire marked 1 to the top terminal of the top AC circuit breaker.
7. Connect the black primary coil transformer wire marked 6 to the top terminal of the bottom AC circuit breaker.
8. Connect each of the remaining black primary coil transformer wires marked 2, 3, 4, and 5 to the corresponding terminals marked on the voltage selector switch.
9. Set the voltage selector switch to the appropriate voltage matching the incoming AC electrical service that will be used to power the charger.
10. Tie the wires together as they were before the wire tie was removed. **See following WARNING.**

**⚠ WARNING**

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

11. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 4-36.**
12. Check charger for proper operation.

## AMMETER

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

### Ammeter Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
2. Remove the charger cover.
3. Using two wrenches to prevent the posts from turning, disconnect the DC cord black wire (5) and buss bar (3) from the ammeter **(Figure 4-25, Page 4-29)**.
4. Remove the two nuts (2) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

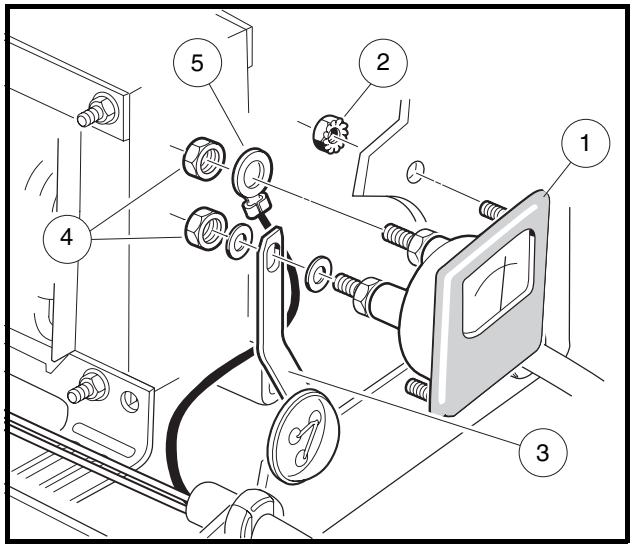


**Figure 4-25 Ammeter**

### Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 4-25, Page 4-29)**.
2. Install nuts (2) and tighten until ammeter is firmly secured.
3. Connect the DC cord black wire (5) to the left (as viewed from inside the charger) post of the ammeter.
4. Connect the buss bar (3) from the fuse link to the right post of the ammeter. Place flat washers on both sides of the buss bar.

5. Thread nuts (4) onto both posts of ammeter until just past finger tight. While holding the inside nut, tighten the outside nut (4) 1/4 turn. **See following CAUTION.**

**CAUTION**

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

6. Install charger cover and install charger in vehicle. **See Onboard Charger Installation on page 4-36.**
7. Check charger for proper operation.

## FUSE LINK

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

### Fuse Link Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
2. Remove the charger cover.
3. Remove both black secondary coil transformer wires and the buss bar (3) from the back of the fuse link assembly **(Figure 4-25, Page 4-29)**.
4. Remove screws from the front of the charger and remove the fuse link assembly.

### Fuse Link Installation

1. Place clear plastic cover over fuse assembly and install mounting screws from front of charger face. The center branch of the fuse assembly should be in the upper left corner when viewed from the front of the charger.
2. Install the buss bar (3) over the center branch of the fuse assembly and ammeter post **(Figure 4-25, Page 4-29)**. Tighten to 22 in-lb (2.5 N·m).
3. Install a secondary coil transformer wire (black) onto one of the two remaining terminals on the back of the fuse assembly. Install the remaining secondary coil transformer wire (black) onto the remaining terminal. Tighten to 22 in-lb (2.5 N·m).
4. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 4-36.**
5. Check charger for proper operation.

## CHARGER RELAY

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

### Charger Relay Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 4-26, Page 4-31)**.
4. Remove the two screws and nuts attaching relay to mounting bracket.
5. Remove the relay.

## Charger Relay Installation

Install in reverse order of removal. Connect wires as shown **(Figure 4-26, Page 4-31)**. Tighten nuts securing relay to mounting bracket to 18 in-lb (2.0 N·m).

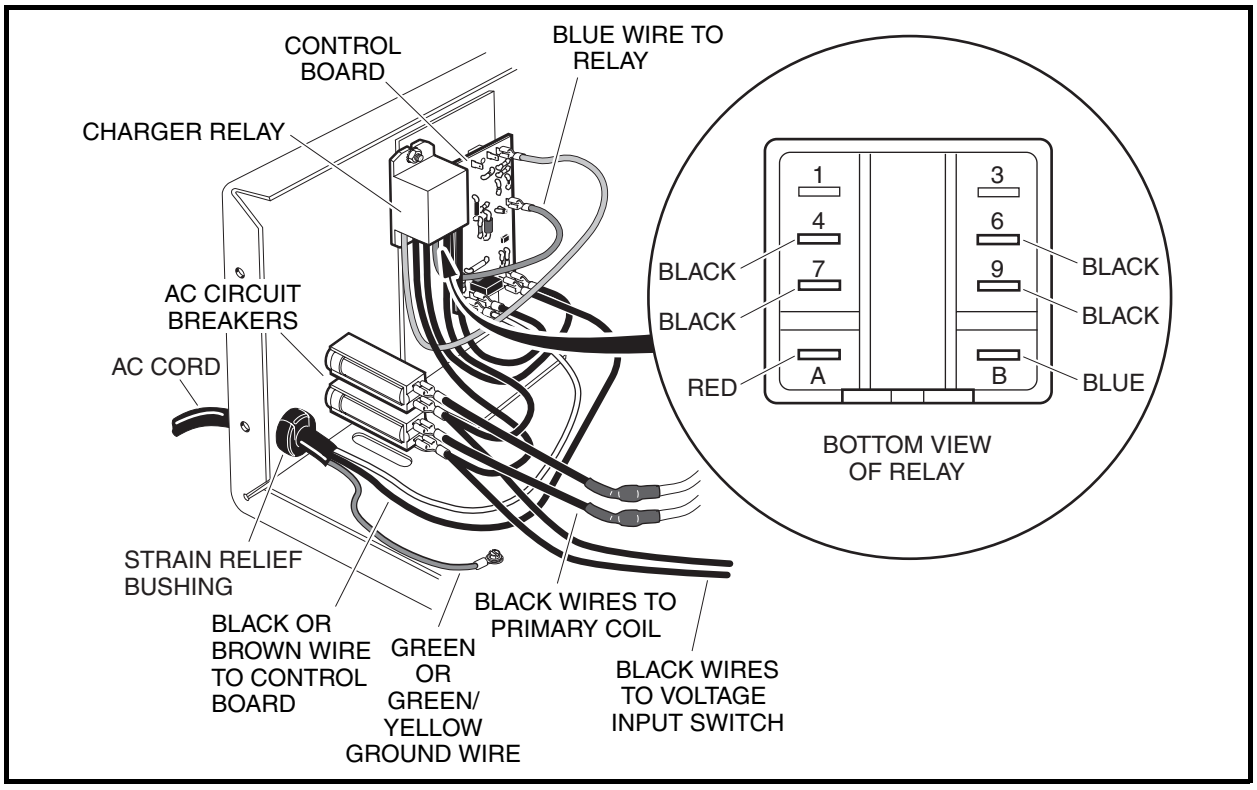


**Figure 4-26 Charger Relay**

## CHARGER AC CIRCUIT BREAKER

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

## AC Circuit Breaker Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
2. Remove the charger cover.
3. Disconnect the two black wires attached to top circuit breaker **(Figure 4-26, Page 4-31)**.
4. Disconnect the two black wires attached to bottom circuit breaker.
5. With a pair of pliers, squeeze in the retaining tabs on the sides of the top AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.
6. Repeat step 5 for the removal of the bottom circuit breaker.

## AC Circuit Breaker Installation

Install in reverse order of removal.

## CHARGER AC CORD AND RETRACTABLE CORD REEL

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

### Short AC Cord Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
2. Remove the charger cover.
3. Disconnect the AC cord black wire from the AC circuit breaker **(Figure 4-26, Page 4-31)**.
4. Disconnect the AC cord white wire from the control board.
5. Disconnect the AC cord green wire from the charger base **(Figure 4-26, Page 4-31)**.
6. Use a pair of pliers to grip the strain relief bushing and remove it and the AC cord from the charger.

### Short AC Cord Installation

1. Insert the black, white, and green leads of the new AC cord into the charger through the hole in the charger face **(Figure 4-26, Page 4-31)**.
2. Connect the black wire and white wire to the control board **(Figure 4-5, Page 4-7)**. Connect the green wire to the charger base. Tighten the screw on the green (ground) wire terminal to 18 in-lb (2.0 N·m).
3. Position the strain relief bushing on the AC cord.
4. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
5. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 4-36.**
6. Check charger for proper operation.

### Retractable AC Cord Reel Removal

1. Disconnect retractable AC cord from AC outlet. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
2. Remove the charger cover.
3. Remove the heatshrink from the AC cord connection between the short AC cord and the retractable cord reel by gently cutting the heatshrink tubing **(Figure 4-20, Page 4-22)**.
4. Disconnect the short AC cord from the retractable cord reel.

### Retractable AC Cord Reel Installation

Install in reverse order of removal.

# CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

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

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 4-5, Page 4-7).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 4-35.**

If battery pack voltage is below 34 volts, the charger will not activate. The charger relay will have to be bypassed to activate the charger.

1. Turn key switch OFF and place the Forward/Reverse switch in the NEUTRAL position.
2. Disconnect the AC and DC cords and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
3. Remove the charger cover.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   - 4.1. To bypass the relay, locate the black wire that goes from the circuit breaker to terminal 9 on the relay. Disconnect the black wire from the relay terminal **(Figure 4-27, Page 4-34)**.
   - 4.2. Disconnect the black wire from relay terminal 6.
   - 4.3. Use a jumper wire with alligator clips to connect the black wire from relay terminal 9 to the black wire from relay terminal 6 **(Figure 4-27, Page 4-34)**.
   - 4.4. Disconnect the black wire from relay terminal 7.
   - 4.5. Disconnect the black wire from relay terminal 4.
   - 4.6. Use a jumper wire with alligator clips to connect the black wire from relay terminal 7 to the black wire from relay terminal 4 **(Figure 4-27, Page 4-34)**. **See following DANGER.**

### ⚠ 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.**

5. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 4-36.**
6. Plug the AC cord into an electrical outlet. The charger should activate and begin charging.
7. Allow to charge for one or two hours. **See following WARNING.**

### ⚠ WARNING

- **Do not leave the vehicle unattended while it is charging. A charger operating with a bypassed relay could short circuit and possibly cause a fire.**

8. After one or two hours, disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-35. See WARNING on page 4-26.**
9. Disconnect the jumper wires from the relay wires and connect each wire to the original terminal on the relay **(Figure 4-27, Page 4-34)**. **See following WARNING.**

## ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

10. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 4-36.**
11. Plug the AC cord into an electrical outlet.
12. Allow the charger to continue charging the batteries until the charger shuts off automatically.
13. When the charge cycle is complete, test the batteries again. If the battery pack voltage is above 34 volts and the vehicle will not operate, it will be necessary to troubleshoot the vehicle's electrical system to determine which electrical component has failed. **See Section 11 – Electrical System and Testing in the appropriate maintenance and service manual.**

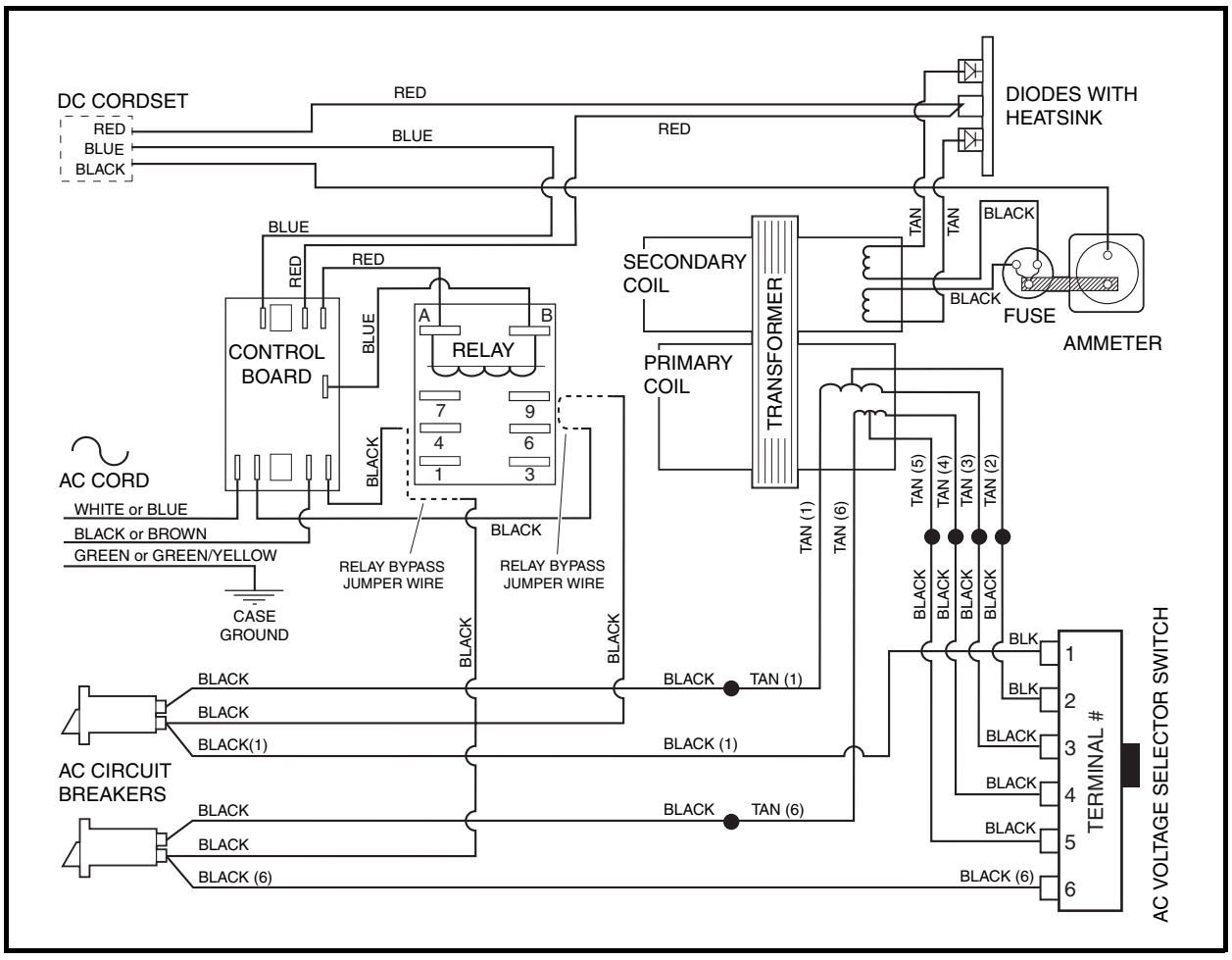


**Figure 4-27 PowerDrive Onboard Charger Wiring Diagram (Relay Bypassed)**

# ONBOARD CHARGER REMOVAL AND INSTALLATION

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

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 4-5, Page 4-7).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 4-35.**

## DS VILLAGER 4

## Onboard Charger Removal

1. Disconnect the batteries as instructed. **See General Warning, Section 1, Page 1-1.**
2. Remove four bolts (21), flat washers (22), lock washers (23) and nuts (24) from charger mounting brackets **(Figure 4-28, Page 4-35)**.

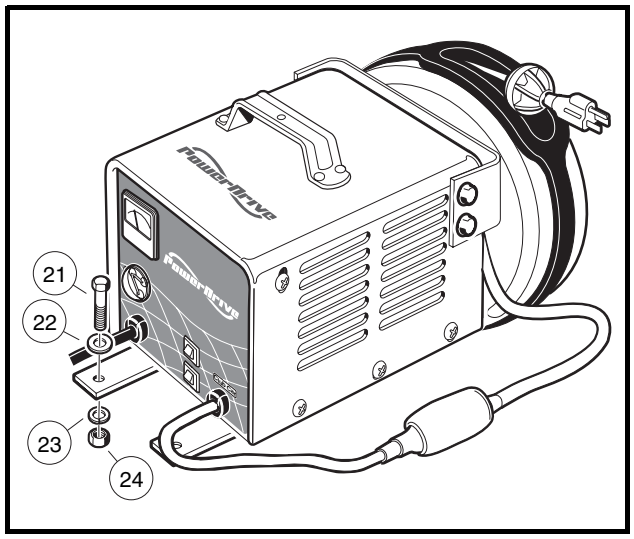


**Figure 4-28 Onboard Charger Mounting – DS Villager**

3. Remove 10-gauge black charger DC cord wire (19) from the charger receptacle fuse link **(Figure 4-29, Page 4-36)**.
4. Remove 10-gauge red charger DC cord wire from the positive (+) post of battery no. 1. **See Section 1 – General Warning.**
5. Disconnect the 10-gauge charger DC cord blue wire (17) from the 3-way wire adapter (18) at the sense lead fuse (20) **(Figure 4-29, Page 4-36)**.
6. Cut any wire tie(s) that secures the DC cord to the vehicle.
7. Lift charger and reel assembly from vehicle.

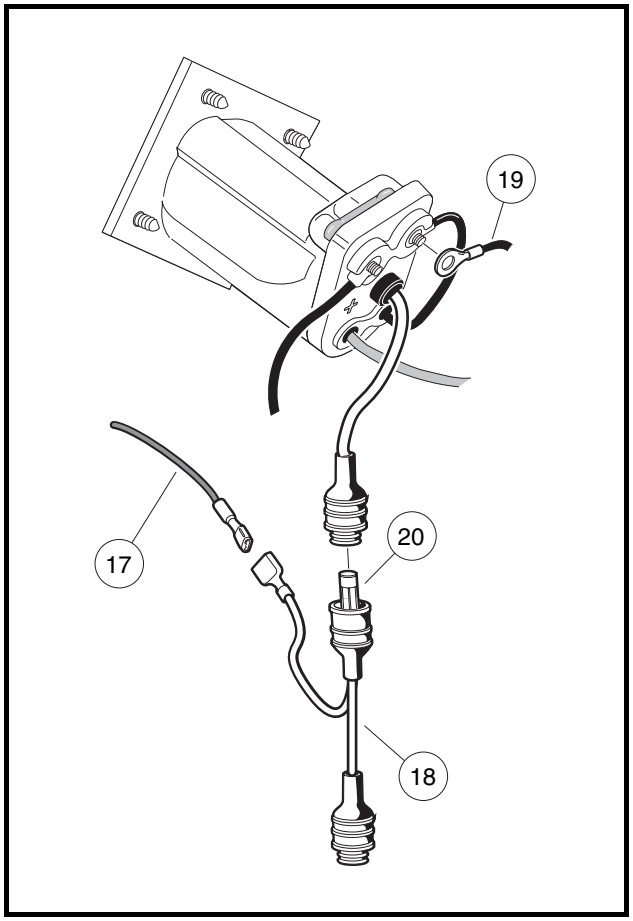


**Figure 4-29 Charger DC Cord Black Wire and Blue Wire – DS Villager 4**

## Onboard Charger Installation

1. Installation is reverse of removal.
2. Tighten hardware securing the black DC cord wire to 23 in-lb (2.6 N·m) and the red DC cord wire to 144 in-lb (16 N·m).
3. Install four bolts (21), flat washers (22), lock washers (23) and nuts (24) securing charger to chassis and tighten to 108 in-lb (12 N·m) **(Figure 4-28, Page 4-35)**.
4. Connect battery cables, positive (+) cable first, and tighten to 144 in-lb (16 N·m).

# PRECEDENT VEHICLES

## Onboard Charger Removal

1. Disconnect the batteries as instructed. **See General Warning, Section 1, Page 1-1.**
2. Disconnect the charger DC cord at the three pin connector (1) **(Figure 4-30, Page 4-37)**.
3. Remove four bolts (2), flat washers (3), lock washers (4) and nuts (5) securing charger to chassis.
4. Lift charger assembly from vehicle.

## Onboard Charger Installation

1. Installation is reverse of removal.
2. Install four bolts (2) and nuts (5) securing charger to chassis and tighten to 108 in-lb (12 N·m).
3. Connect battery cables, positive (+) cable first, and tighten to 110 in-lb (12.4 N·m).

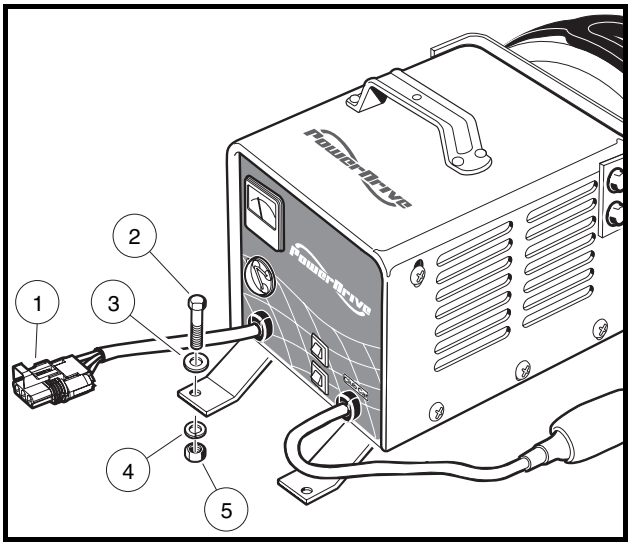


**Figure 4-30 Onboard Charger Mounting – Precedent Vehicles**

# SECTION 5 – EXPORT IQ PLUS CHARGER (EXTERNAL)

### ⚠ DANGER

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

### ⚠ WARNING

- **See General Warning, Section 1, Page 1-1.**
- **The battery charger DC plug must be pulled slowly from the receptacle (Figure 5-4, Page 5-7). Jerking or pulling the DC cord out quickly could cause arcing that could damage the plug and receptacle and could cause batteries to explode (Figure 5-5, Page 5-7).**

## GENERAL INFORMATION

This section includes information pertaining to service of the Export IQ Plus battery charger (model numbers 25880-11 and 25880-18). Depending on the geographic region, the charger provided with your vehicle may be a different model. Do not attempt to service a battery charger that has not been properly identified. If a charger cannot be properly identified, contact your local Club Car dealer or distributor.

The IQ Plus battery charger is automatic and has no external controls **(Figure 5-1, Page 5-1)**. When the charger is connected, there is a 2 to 15 second delay before charging begins. **See following NOTE.**

***NOTE:*** *At one hour and at two hours into the charge cycle, the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero). Charging will resume in a few moments (ammeter returns to previous rate of charge).*

The onboard computer (OBC) records the amount of energy consumed as the vehicle is used, then directs the charger to replace exactly the amount of energy needed to fully replenish the batteries. The charger shuts off automatically, preventing the possibility of either undercharging or overcharging.

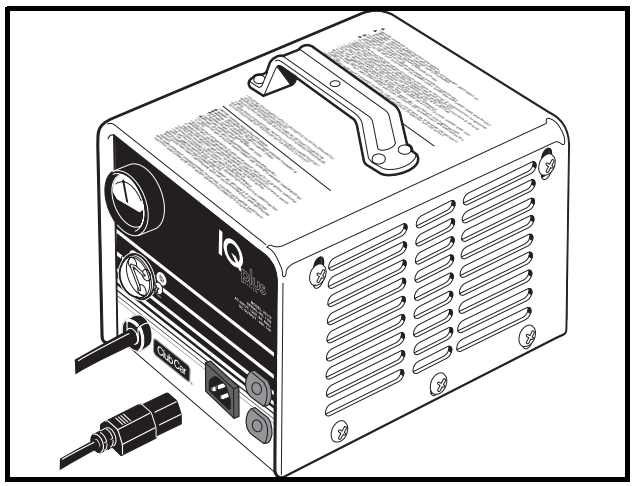


**Figure 5-1 IQ Plus External Charger (Export) Model 25880-11**

## IQ PLUS EXTERNAL CHARGER FEATURES

- **Charge Interlock**
  IQ Plus battery charger DC plugs have three pins rather than two blades common on most standard charger plugs. Two of these pins are the positive and negative leads as on standard chargers; the third pin is a sensing lead that is the communication link between the charger and the onboard computer. When the charger plug is plugged into the vehicle receptacle, the onboard computer locks out the vehicle drive system. This prevents the possibility of driving the vehicle while the charger is plugged in and potentially damaging the vehicle and charger.
- **Long-Term Storage Charge**
  IQ Plus vehicles with IQ Plus chargers are designed to be left connected with AC power to the charger, during off-season or long-term storage. The onboard computer will automatically activate the charger every 15 days. To return the vehicle to service, unplug the charger DC cord, wait 15 seconds for the computer to reset and plug the charger back in. **See following WARNING.** Allow the vehicle to complete one full charge cycle before putting it into service. This will ensure the batteries are at their optimum charge prior to returning the vehicle to service.

### ⚠ WARNING

- **The charger plug must be pulled slowly from the receptacle. 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.**

## BATTERY WARNING LIGHT

IQ Plus vehicles feature a dash mounted battery warning light (above the steering column) that, when the vehicle is in operation, indicates low battery voltage or, when the vehicle is being charged, indicates a charging problem. The battery warning light is controlled by the onboard computer.

When the batteries receive an incomplete charge because 1) the DC power cord is disconnected, 2) AC power to charger is interrupted, 3) automatic charger shut-off occurs after 16 hours of operation, or 4) charger malfunctions, the warning light will indicate as follows:

- The battery warning light will not illuminate if the charge is 90% or more complete. The onboard computer will retain in memory the amount of charge needed to fully replenish the batteries and will complete the charge during the next charge cycle.
- When the charger DC cord is unplugged during a charge cycle, the battery warning light will illuminate and remain illuminated for 10 seconds if the charge is less than 90% complete but the vehicle has enough power for 60 minutes of operation. This will alert the operator that the vehicle may be used, but that it must be charged to completion as soon as possible.
- The battery warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, if the charger times out at 16 hours and the batteries are not sufficiently charged. This indicates an abnormal charge cycle. The charger and batteries should be checked by your Club Car distributor/dealer.
- The battery warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, during a charge cycle (with the DC plug still connected) if AC power to the charger is interrupted. The light will go out when AC power is restored.

# THE CHARGE CIRCUIT

The vehicle charge circuit consists of the following components:

- charger receptacle
- receptacle fuse link
- onboard computer
- batteries

The negative terminal of the receptacle is connected to the onboard computer. The 10-gauge black wire from the onboard computer connects to the B– terminal on the speed controller, and the 4-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 8. The positive terminal of the charger receptacle is connected to the positive (+) post of battery no. 1 (depending on the specific vehicle model, this connection to positive (+) post of battery no. 1 is sometimes made through another electrical component such as a solenoid, or main power fuse). The gray wire (sense lead) from the charger receptacle is connected to the sense lead fuse, which is connected to the gray wire from the onboard computer.

If the charger works with one vehicle, but does not work with another vehicle, then most likely the problem is in the vehicle charge circuit. Check the connections between the 18-gauge gray wire from the charger receptacle, the sense lead fuse, and the 18-gauge gray wire from the onboard computer. Also check connections of the fuse link located on the charger receptacle **(Figure 5-2, Page 5-3)**.

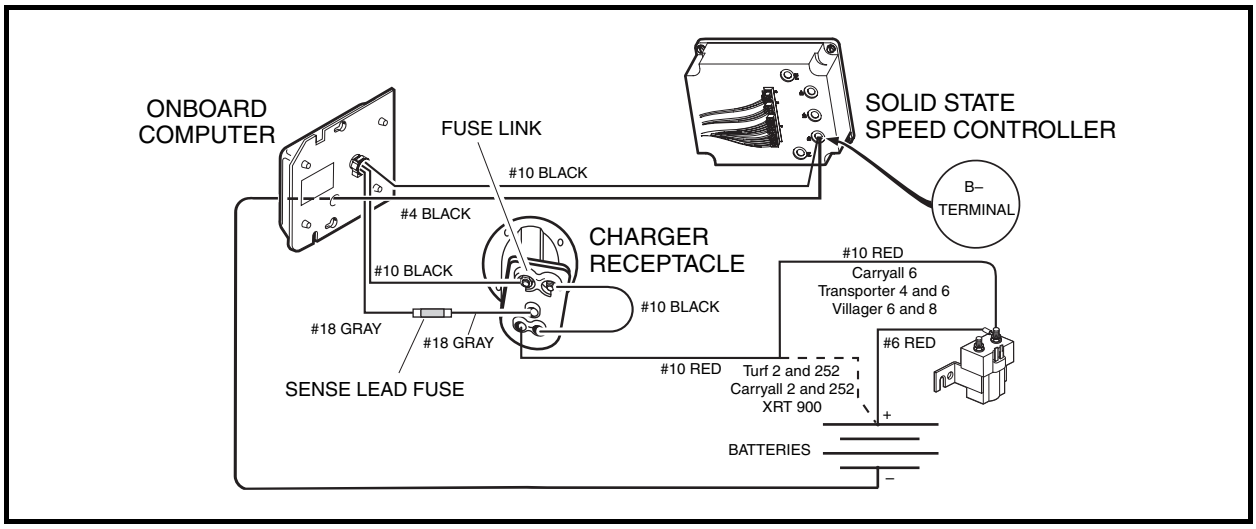


**Figure 5-2 Charge Circuit**

# EXTERNAL CHARGER INSTALLATION AND OPERATION

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.**

## ⚠ 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 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.**

## ⚠ WARNING

- **Do not bypass the sense lead fuse.**
- **Only trained technicians should repair or service the charger. Contact your nearest Club Car distributor/dealer.**
- **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.**
- **Connect the charger AC supply cord to a properly grounded, three-wire outlet of the proper voltage and frequency as shown on the charger.**
- **Do not use an adapter to plug the charger with a three-prong plug into a two-prong outlet. Improper connection of the equipment-grounding conductor can result in a fire or an electrical shock.**
- **An extension cord or electrical outlet must accept a three-prong plug. Extension cord should be a three-wire no. 12 AWG (American Wire Gauge), and be as short as possible. The use of improper extension cord could result in fire or an electrical shock.**
- **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.**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**
- **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.**
- **Never push objects of any kind into the charger through cabinet slots. They may touch dangerous voltage points or cause an electrical short circuit that could result in fire or electrical shock.**
- **Do not connect the charger to battery packs that are not compatible with the DC output voltage specified on the charger. Overheating and transformer burnout will result.**
- **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 parts.**
- **Do not use a battery charger if the cord, plug, or receptacle is damaged in any way. Replace worn or damaged parts immediately. Failure to heed this warning could result in a fire, property damage, severe personal injury, or death.**

**WARNING CONTINUED ON NEXT PAGE...**

### ⚠ WARNING

- **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 block or cover the charger ventilation slots. The slots provide ventilation and prevent the charger from overheating.**
- **Do not allow clothing, blankets, or other material to cover the charger.**
- **Do not allow the charger to operate for more than 30 minutes at 19 or more amperes.**
- **Install surge arrestors on incoming AC power lines. Surge arrestors will help protect electrical components in the charger and on the vehicle from all but direct or close lightening strikes.**

### ⚠ CAUTION

- **Be sure to check the batteries and charger monthly to maintain correct battery water level and ensure the charger is operating correctly during storage.**

***NOTE:*** *Charger operation instructions in the language of the user should be printed on or permanently affixed to the top of the charger. If these instructions are not found on the charger, contact your Club Car representative.*

## AC POWER CONNECTION

The AC line to which the charger is to be connected must be of the proper AC input voltage for the charger and must be capable of supplying sufficient current. **See Section 2 – Charger Identification and Specifications.** If the battery charger is equipped with a multi-position switch for variable AC input voltage, the switch must be set for the correct voltage before the AC cord is connected **(Figure 5-3, Page 5-6)**. **See following CAUTION.**

### CAUTION

- **Failure to set the AC input voltage selector switch to the correct voltage could result in damage to the battery charger or batteries.**

***NOTE:*** *Make sure that the AC cord provided with your charger has the proper AC plug for your location. If it does not, contact your Club Car representative to obtain the proper cord or plug.*

With charger DC cord disconnected, connect the power supply cord to an AC supply within the acceptable voltage range. **See Section 2 – Charger Identification and Specifications.**

To reduce the risk of electric shock, the battery charger must be grounded. The charger is equipped with an AC electric cord with an equipment-grounding conductor and a grounding type plug. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with all applicable national and local electrical codes and regulations.

The use of an extension cord with the charger should be avoided. If an extension cord must be used, use a three-conductor no. 12 AWG (American Wire Gauge) or no. 14 SWG (British Standard Wire Gauge), heavy-duty cord with ground, properly wired and in good electrical condition. Keep it as short as possible (no more than 12 feet (3.7 m)). Place all cords so they will not be stepped on, tripped over, or otherwise subject to damage or stress.

Ensure that the charger ventilation slots are unobstructed and that there is adequate ventilation.

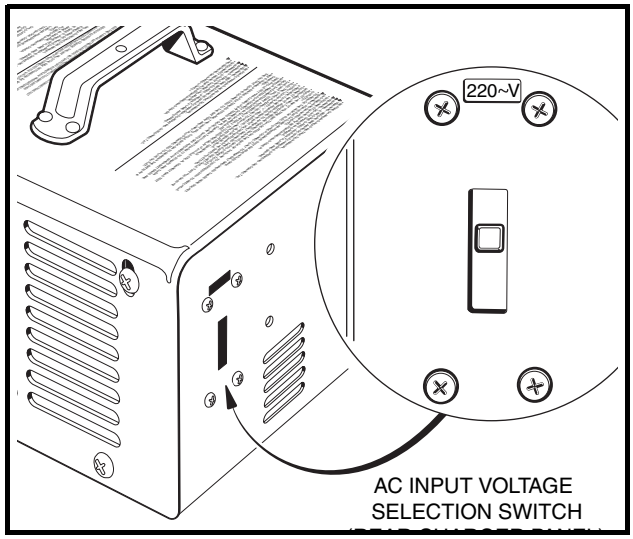


**Figure 5-3 AC Input Voltage Selection Switch**

## CHARGING BATTERIES

### ⚠ WARNING

- **Do not bypass the sense lead fuse.**
- **Be sure the fuse link is clean and tight.**
- **Be sure all wire connections at the receptacle are clean and tight.**
- **Do not rock or bend the plug. To connect the charger plug to the vehicle receptacle, grasp the plug handle and push the plug straight into the receptacle (Figure 5-4).**
- **Do not pull on the DC cord (Figure 5-5). Do not twist, rock or bend the plug. To disconnect the charger plug from the vehicle receptacle, grasp the plug by the handle and pull the plug straight out of the receptacle.**
- **Do not connect a charger to the receptacle if the charger cord, plug, or the vehicle receptacle is broken, damaged in any manner, or does not make a good electrical connection. Fire or personal injury can result. Have it replaced by a qualified service person immediately. Failure to follow these instructions could result in damage to the charger cord, the plug, and (or) the vehicle receptacle.**
- **Do not use a charger if:**
  - **The plug is too loose or does not make a good connection.**
  - **The plug and receptacle feel hotter than normal during charge.**
  - **The plug pin or receptacle contacts are bent or corroded.**
  - **The plug, receptacle, or cords are cut, worn, have any exposed wires or are damaged in any way.**
- **Using the charger with any of the above symptoms could result in a fire, property damage, personal injury, or death.**

1. With the charger DC cord disconnected from the vehicle charger receptacle, connect the AC power supply cord to an AC outlet designed to provide the proper AC voltage for the charger.
2. Connect the charger DC plug to the vehicle charger receptacle located on the seat support panel **(Figure 5-4, Page 5-7)**. The charger will activate automatically within 2 to 15 seconds after the DC plug is connected. **See following WARNING.**

## ⚠ WARNING

- **Do not rock or bend the DC plug. To connect the charger plug to the vehicle receptacle, grasp the plug handle and push the plug straight into the receptacle (Figure 5-4, Page 5-7).**

3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 15 to 19 amps, depending upon the condition and depth of discharge of the batteries. Slight variations in the initial charge rate may also result from AC line input voltages which are higher or lower than the nominal input voltage. Higher AC line voltages increase the initial charge rate while lower AC line voltages reduce the initial charge rate.
4. Monitor the ammeter. Under normal operating conditions (when the charger is on and the batteries are discharged), the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero) one hour and two hours into the charge cycle. **See following NOTE.**

***NOTE:*** *Batteries should be put on charge at the end of each day even if the vehicle has been used for only a short amount of time (even if for only 10 minutes).*

*When air temperatures fall below 65 °F (18.3 °C), batteries charged in unheated areas should be placed on charge as soon as possible after use. Cold batteries require more time to fully charge.*

*New batteries will not deliver their full range until the vehicle has been driven and recharged from 20 to 50 times.*

*Vehicles should be restricted to 40 to 50 energy units of discharge between charges until the batteries have been properly seasoned (20 to 50 charge cycles). For maximum battery life, Club Car recommends that electric vehicles always be recharged after 40 to 50 energy units of discharge or each night in order to avoid deep discharging the batteries; use the CDM (Communication Display Module) (CCI P/N 101831801).* ***See Communication Display Module (CDM) in Section 11 of the appropriate maintenance and service supplement.***

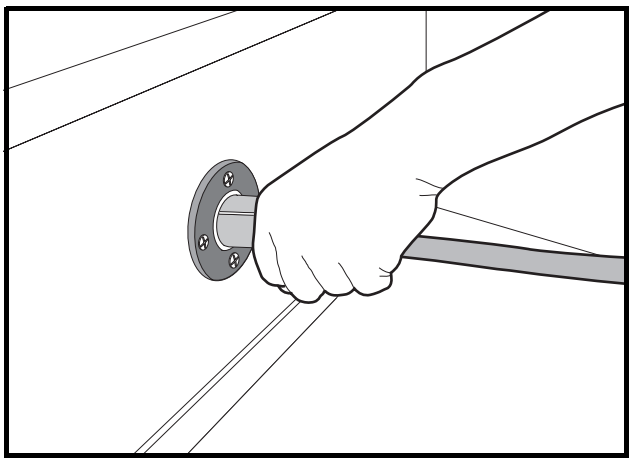

**Figure 5-4 Charger Receptacle**

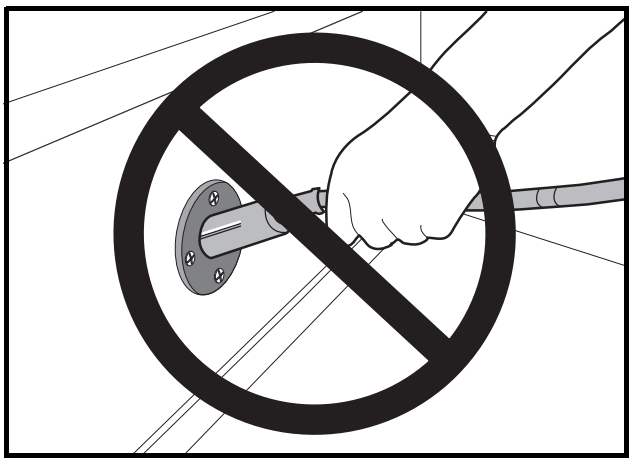

**Figure 5-5 Incorrect Charger Cord Removal**

### EXTERNAL CHARGER PLUG AND RECEPTACLE

When inserting the DC plug into the vehicle receptacle, align the raised guide on the plug with the guide slot in the receptacle and slowly push the plug straight in **(Figure 5-4, Page 5-7)**. To disconnect the plug from the vehicle, firmly grasp the plug, not the cord **(Figure 5-5, Page 5-7)**, and slowly pull plug straight out. **See following WARNING and CAUTION.**

#### ⚠ WARNING

- **Do not rock or bend the plug. To connect the charger plug to the vehicle receptacle, grasp the plug handle and push the plug straight into the receptacle (Figure 5-4).**
- **The battery charger DC plug must be pulled slowly from the receptacle. Jerking or pulling the DC cord out quickly could cause arcing that could damage the plug and receptacle and could cause batteries to explode.**
- **Do not use a battery charger if the cord, plug, or receptacle is damaged in any way. Replace worn or damaged parts immediately. Failure to heed this warning could result in a fire, property damage, severe personal injury, or death.**

#### ⚠ CAUTION

- **Do not connect an external charger to the receptacle of a vehicle equipped with an onboard charger while the onboard charger is activated. Charging overload will damage the onboard computer and may cause battery damage.**

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

***NOTE:*** *If the warning tag has been damaged or removed from the DC cord, have it replaced immediately.*

## CHECKING BATTERY CONDITION WITH AN EXTERNAL CHARGER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

It is common practice for technicians to check the condition of a set of batteries after they have been charged to ensure they have received a complete charge before the vehicle is used. With the IQ Plus vehicles, this is not necessary; the onboard computer controls and monitors the charge cycle. If any problem occurs during a charge cycle, the battery warning light, located above the steering column in the center dash panel, will illuminate intermittently.

If the battery warning light is illuminated after a charge cycle, refer to the troubleshooting chart. **See Troubleshooting on page 5-10.** If the specified test procedures identify no problems, plug the DC cord into the vehicle and let it charge until the charger shuts off automatically. If a problem is found, correct it and charge the vehicle. Normal battery voltage near the end of a charge cycle should be approximately 59 to 63 volts DC.

### START CHARGE CYCLE

1. Disconnect the DC plug from the vehicle charger receptacle.
2. Wait 20 seconds, then reconnect the DC cord to the vehicle receptacle. **See following NOTE.**

***NOTE:*** *The charger will not operate unless a delay of approximately 20 seconds is observed.*

3. Monitor the ammeter for the charge rate. If the batteries are close to being fully charged, the charge cycle will begin and the charge current will begin to taper within a few minutes.

## TESTING CHARGER OPERATION

1. With the DC plug disconnected from the vehicle charger receptacle, insert the AC cord into an outlet. The charger relay should NOT close. A multimeter set to volts DC and connected across the DC plug positive (+) and negative (–) pins should indicate zero volts. No transformer hum should be heard.
2. Disconnect the AC cord from the wall outlet and connect the DC plug to the receptacle. The charger relay should close with an audible click after a 2 to 15 second delay. **See following NOTE.**

***NOTE:*** *Monitor the charge cycle to make sure the charger turns off properly. If the charge cycle is interrupted, and the batteries are less than 90% charged, the battery warning light will illuminate intermittently.* ***See Battery Warning Light on page 5-2.***

3. If the charger does not operate exactly as described above, refer to the wiring diagram and make sure that the vehicle is wired correctly **(Figure 5-2, Page 5-3)** and that the internal charger wiring is correct **(Figure 5-6, Page 5-9)**.

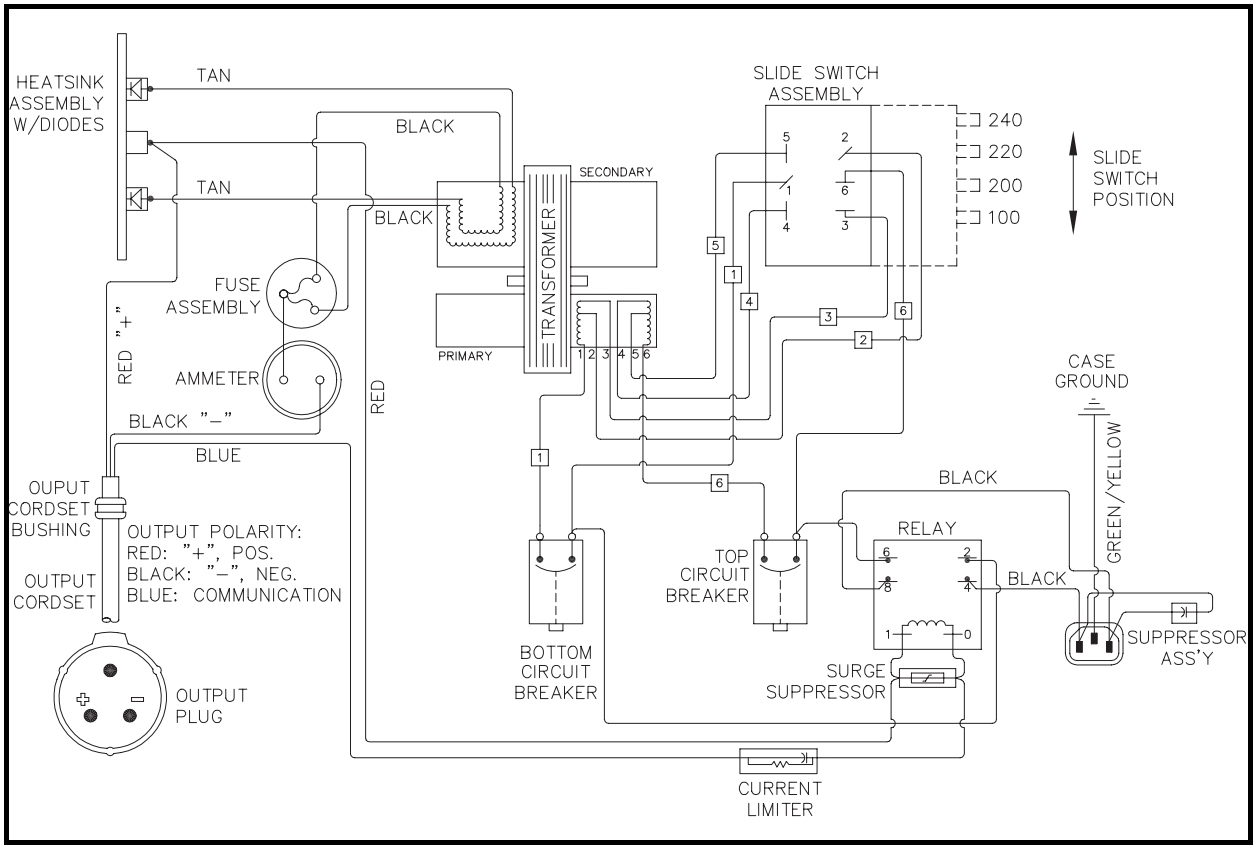


**Figure 5-6 Export IQ Plus Battery Charger Wiring Diagram (External Charger)**

# TROUBLESHOOTING

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.**

## ⚠ 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.**

## ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 5-6, Page 5-9).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**

Use the following Troubleshooting Guide for troubleshooting export IQ Plus external battery chargers (model numbers 25880-11 and 25880-18). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

## EXPORT IQ PLUS BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Relay does not close, no transformer hum and ammeter does not move** | Batteries disconnected | Connect batteries. **See Figure 5-9, Page 5-16** |
| | Battery voltage is too low | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-14 |
| | Poor connection between plug and receptacle | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-14 |
| | DC plug and cord | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-14 and Test Procedure 5 – Charger DC Circuit Continuity Test on page 5-20 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 5-17 |
| | Gray sense lead fuse is blown (not applicable to Precedent vehicles) | Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-14 |
| | Receptacle fuse link is blown (not applicable to Precedent vehicles) | See Electrical Components section in the appropriate maintenance and service manual |
| | Poor connection at 10-gauge black wire or 18-gauge gray wire at the OBC (applicable to Precedent vehicles only) | Check wire connections |
| **Relay closes with an audible click but no transformer hum and ammeter does not move** | Improper AC outlet voltage | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-17 |
| | Failed AC plug and cord | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-17 |
| | Internal AC breaker | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-17 |
| | Transformer primary coil | Test Procedure 6 – Transformer on page 5-20 |
| | Relay | Test Procedure 8 – Continuity on page 5-22 |
| | Failed ammeter | Replace ammeter |
| **Relay closes and transformer hums but ammeter does not move** | Blown charger fuse | Test Procedure 5 – Charger DC Circuit Continuity Test on page 5-20 |
| | Both diodes failed | Test Procedure 4B – Both Diodes Failed on page 5-19 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 5-17 |
| | Failed transformer or voltage switch | Test Procedure 6 – Transformer on page 5-20 |
| **Relay operates intermittently** | Failed charger relay | Test Procedure 8 – Continuity on page 5-22 |
| **Single charger fuse link blows** | Diode failed | Test Procedure 4A – Single Diode Failure on page 5-18 |
| | Loose internal fuse connection | Tighten connection |

**Troubleshooting Guide continued on next page...**

## EXPORT IQ PLUS BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Both charger fuse links blow or receptacle fuse link blows** | Battery is wired in reverse polarity | Check vehicle wiring |
| | DC cord is wired in reverse polarity | Check battery charger wiring |
| | Both diodes failed | Test Procedure 4B – Both Diodes Failed on page 5-19 |
| **Charger output is low** | One diode failed | Test Procedure 4A – Single Diode Failure on page 5-18 |
| | Transformer coil short-circuit failure | Test Procedure 6 – Transformer on page 5-20 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 5-17 |
| **Charger turns off too soon** | AC power supply was shut off | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-17 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 5-17 |
| | Batteries may be fully charged | Test Procedure 7 – Battery State of Charge Test on page 5-22 |
| **Charger goes to 16 hour time out** | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 5-17 |
| | Extremely discharged batteries or cold temperature | Recharge batteries |
| | Failed or weak battery | See Batteries section in the appropriate maintenance and service manual |
| **AC line fuse blows or AC circuit breaker trips** | AC cord is shorted | Test Procedure 8 – Continuity on page 5-22 |
| | Failed transformer or voltage switch | Test Procedure 6 – Transformer on page 5-20 |
| | Incorrect charger wiring | Check battery charger wiring |
| | Incorrect AC voltage selector switch position | Check switch position for proper incoming AC voltage selection |
| **Battery warning light illuminates for ten seconds, at four second intervals (with DC charger cord plugged in) (25 seconds, at 10 second intervals for Precedent vehicles)** | AC power interrupted | Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-17 |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 5-17 |
| | Charger failure | See Testing Charger Operation on page 5-9 |
| | 16 hour time out | See Battery Warning Light on page 5-2 |
| | Battery or batteries need to be replaced | See Batteries section in the appropriate maintenance and service manual |
| **Battery warning light illuminates for ten seconds, at four second intervals (with DC charger cord disconnected) (25 seconds, at 10 second intervals for Precedent vehicles)** | Batteries are getting close to full discharge capacity | Recharge batteries |
| | Onboard computer malfunction | Test Procedure 2 – Onboard Computer on page 5-17 |
| | Battery or batteries need to be replaced | See Batteries section in the appropriate maintenance and service manual |

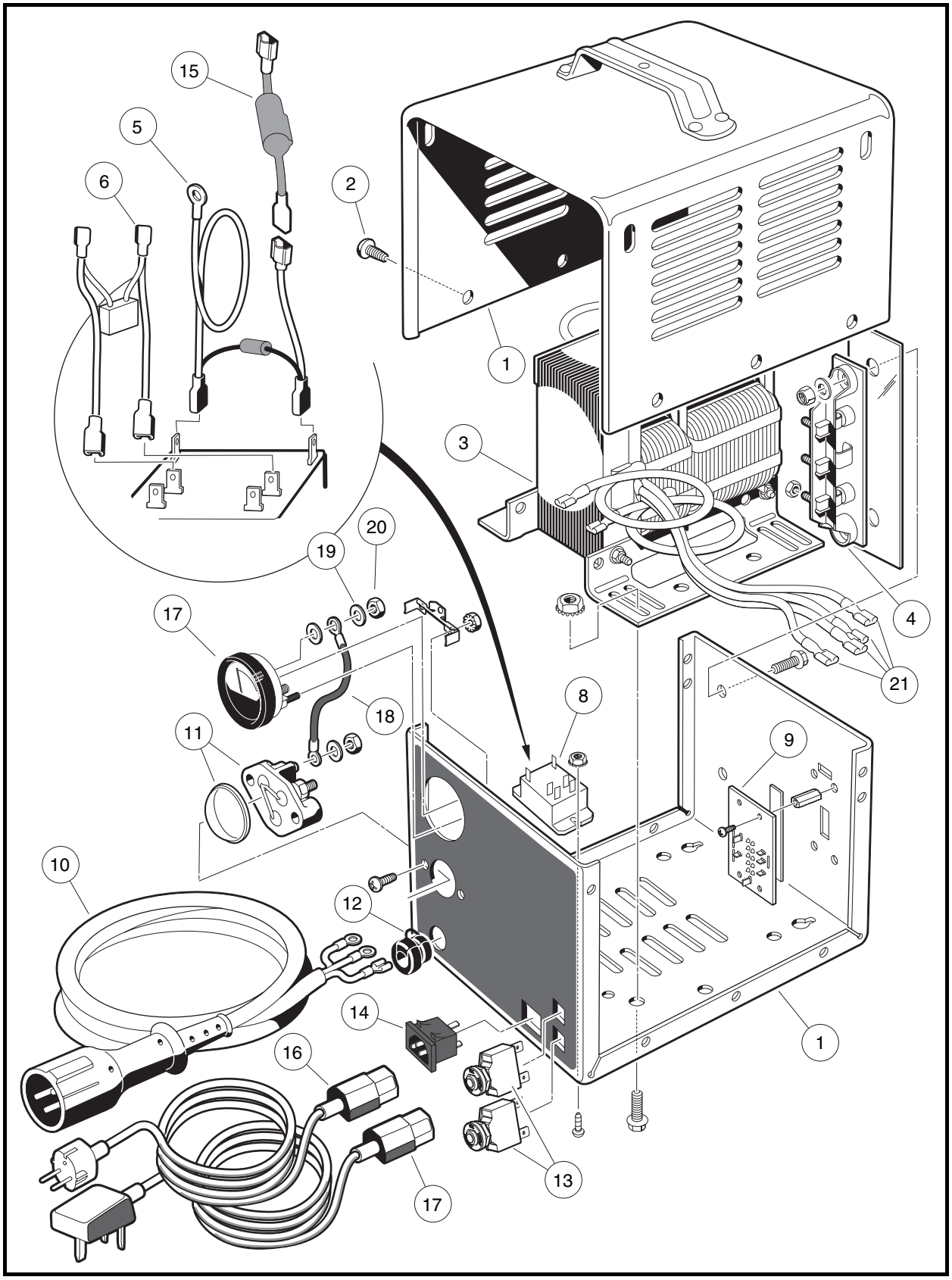


**Figure 5-7 IQ Plus Battery Charger (Export) – Exploded View**

# TEST PROCEDURES

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.**

## INDEX OF TEST PROCEDURES



## TEST PROCEDURE 1 – BATTERY VOLTAGE AND DC PLUG AND RECEPTACLE

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.**

1. Check the DC plug and the vehicle charger receptacle for damage, dirt, corrosion, 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 to the charger receptacle:
   - 3.1. **Carryall 6, Transporter 4 and 6, and Villager 6 and 8:** Verify that the 10-gauge red wire from the charger receptacle is connected to the same large post of the solenoid as the 6-gauge red wire that connects to the positive (+) post of battery no. 1 **(Figure 5-2, Page 5-3)**.
   - 3.2. **Carryall 2 and Turf 2:** Verify that the 10-gauge red wire from the charger receptacle is connected to the positive (+) post of battery no. 1 **(Figure 5-2, Page 5-3)**.
   - 3.3. Verify the 10-gauge red wire of the charger receptacle is connected to the main harness red wire at three wire plug.
   - 3.4. Make sure the two nuts that secure the two 10-gauge black wires to the receptacle fuse assembly are tight **(Figure 5-8, Page 5-15)**.

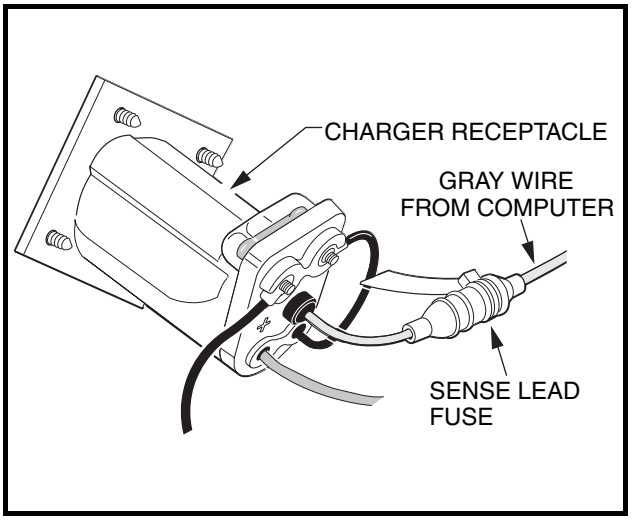


**Figure 5-8 Receptacle Wire Connections**

3.5. Check the connections of the 18-gauge gray wire from the receptacle to the sense lead fuse, and from the sense lead fuse to the onboard computer gray wire. **See following WARNING.**

**⚠ WARNING**

- **Do not bypass the sense lead fuse.**

3.6. Remove the gray sense lead fuse and check it for continuity with a multimeter set to 200 ohms. The resistance should be less than 2 ohms.

4. With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 8 **(Figure 5-9, Page 5-16)**. Normal no-load voltage should be between 50 and 52 volts for fully charged batteries. The voltage of the battery pack must be over 32 volts DC to allow the onboard computer to close the charger relay. If battery pack voltage is too low to start charger, temporarily bypass the charger relay. **See Charging a Battery Pack that has Low Voltage on page 5-34.**

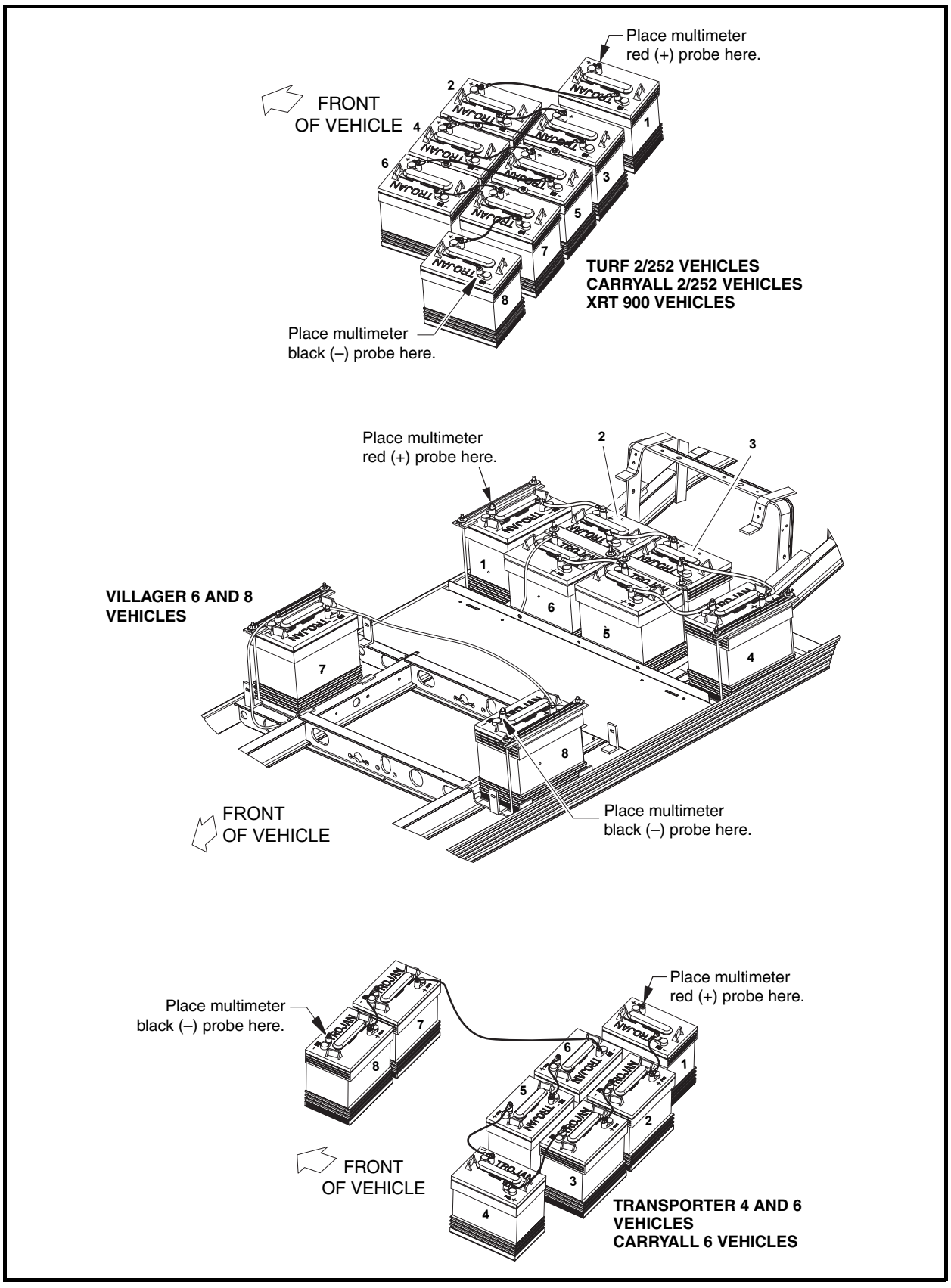


**Figure 5-9 IQ Plus Battery Configuration**

## TEST PROCEDURE 2 – ONBOARD COMPUTER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

1. Select a second charger that is normally connected to another vehicle and is known to operate properly. Leave the AC cord of the second charger connected to the AC outlet that it normally is connected to. This will ensure that AC power is present.
2. Check the AC circuit breakers on the front of the charger and reset it if necessary.
3. Insert the DC cord from the second charger into the receptacle of the vehicle that is not charging properly.
4. If the second charger fails in the same manner as the first charger, then the vehicle charging circuit is not functioning properly. **See Troubleshooting on page 5-10.**
5. Connect the first charger into another vehicle that is known to be functioning properly. If the charger performs as it should, then the charger is not in need of repair.

## TEST PROCEDURE 3 – AC POWER AND CONTINUITY TEST OF AC CIRCUIT

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Check the AC circuit breakers on the front of the charger and reset if necessary.
3. Check the AC line fuse or circuit breaker in the storage facility.
4. With a multimeter set to 500 volts AC, check incoming AC voltage. Insert multimeter test probes into AC wall outlet; voltage should be within the range specified in the following chart. If proper voltage is not present and the voltage selector switch is set for the correct voltage for your area, have building wiring checked by a licensed electrical contractor.

| SETTING ON AC VOLTAGE SELECTOR SWITCH | MINIMUM AC VOLTAGE PERMITTED | MAXIMUM AC VOLTAGE PERMITTED |
|---|---|---|
| 100 Volts AC | 95 | 105 |
| 200 Volts AC | 190 | 210 |
| 220 Volts AC | 209 | 231 |
| 240 Volts AC | 228 | 252 |

5. Check continuity of the AC circuit.
   5.1. Remove the charger cover.
   5.2. Bypass the relay. **See step 4 of Charging a Battery Pack that has Low Voltage on page 5-34.**
   5.3. With relay bypassed, there should be continuity across the AC cord blades **(Figure 5-10, Page 5-18)**.

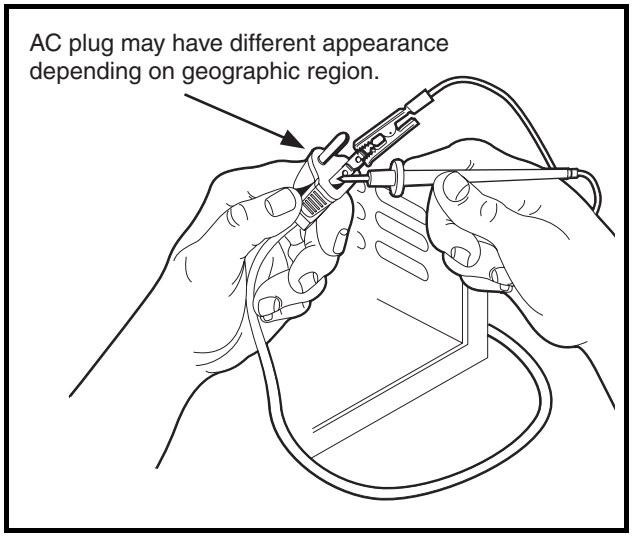


**Figure 5-10 AC Cord Test**

6. If the circuit is not complete, check the wiring of the AC cord (16 or 17), AC charger receptacle (14), transformer primary coil wires (21), internal AC circuit breakers (13), voltage selector switch (9), and jumper wires **(Figure 5-7, Page 5-13)**.
7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, internal AC circuit breakers, and the jumper wires individually. **See Test Procedure 8 – Continuity on page 5-22.**
8. When troubleshooting and repairs are complete, remove the jumper wire and properly connect the relay wiring. **See following WARNING.**

### ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

## TEST PROCEDURE 4 – DIODES

Use Test Procedure 4A – Single Diode Failure on page 5-18 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 5-19.

### Test Procedure 4A – Single Diode Failure

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

A single diode failure is indicated by the failure of one fuse link (closed circuit diode) or by the charger output being low (open circuit diode). If a diode has failed, the entire heatsink must be replaced. To check diodes:

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect one transformer secondary coil wire from the diode terminal **(Figure 5-11, Page 5-19)**.
4. Using a low voltage continuity tester or multimeter set to the diode test function, connect the red (+) test probe to the diode mounting plate and the black (–) test probe to a diode terminal and note the reading **(Figure 5-11, Page 5-19)**.

5. Reverse test probes and check each diode again and note the reading **(Figure 5-12, Page 5-19)**. A diode is designed to conduct current in one direction only. If a diode conducts current (shows continuity) in both directions, the entire heatsink with diodes must be replaced. If a diode does not conduct current (does not show continuity) in either direction, the entire heatsink must be replaced.
6. On rare occasions, a single fuse link may blow due to excessive heat. This can be caused by a loose internal fuse connection. Check all three fuse connections inside the charger to be sure they are clean and tight. The proper tightness for the fuse link connections is 22 in-lb (2.5 N·m).
7. Ensure that the charger is wired properly and all connections are clean and tight. **See following CAUTION.**

## CAUTION

- **If connections are not clean and tight, excessive heat will be created and the charger may become damaged.**

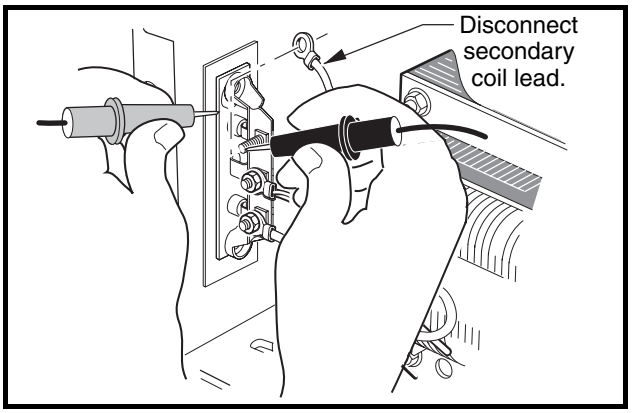


**Figure 5-11 Diode Test**

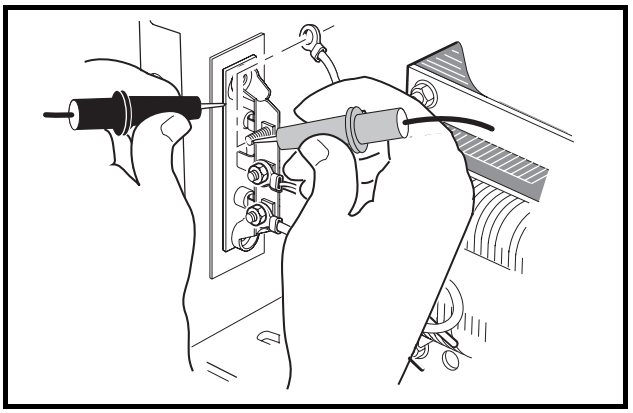

**Figure 5-12 Diode Test – Probes Reversed**

### Test Procedure 4B – Both Diodes Failed

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

To check the diodes, use Test Procedure 4A – Single Diode Failure on page 5-18. If both diodes have failed closed, both charger fuse links will be blown. If both diodes have failed open, the relay will close and the transformer will hum, but the ammeter will not indicate any output and the AC circuit breakers may trip off. If both diodes have failed open or closed, the entire heatsink must be replaced. To determine why both diodes failed:

1. Check the batteries and the receptacle to ensure that they are wired in the correct polarity **(Figure 5-2, Page 5-3)**. Also check the voltage and polarity at the receptacle.
2. Make sure the charger is wired correctly: the DC cord red wire should be connected to the center terminal of the heatsink, the DC cord blue wire should be connected to the limiter, which connects to the relay coil, and the DC cord black wire should be connected to the left side of the ammeter (when viewed from inside the charger) **(Figure 5-6, Page 5-9)**. If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is connected to the vehicle, whether or not the AC cord is plugged into an outlet.
3. On rare occasions, both diodes may fail as a result of a lightning strike at the charging location.
4. Excessive heat due to a loose connection may also cause both fuse links to blow. Be sure fuse connections are tightened to 22 in-lb (2.5 N·m).
5. Ensure that the charger and vehicle are wired properly and all connections are clean and tight.

## TEST PROCEDURE 5 – CHARGER DC CIRCUIT CONTINUITY TEST

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Using a continuity tester (CCI P/N 1011273) or multimeter (CCI P/N 1011480) set to 200 ohms, connect the test probes to the pins marked (+) and (–) on the DC plug **(Figure 5-13, Page 5-20)**. Note the reading.
3. Reverse the test probes and check the DC plug again **(Figure 5-14, Page 5-20)**. The circuit should show continuity in only one direction.
4. If the circuit does not show continuity in either direction and the charger fuse is not blown, individually check all connections and the continuity of the DC cord and ammeter. **See Test Procedure 8 – Continuity on page 5-22.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 5-18.**
5. If the circuit shows continuity in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes. **See Test Procedure 4 – Diodes on page 5-18.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 5-22.**
6. Remove the DC cord blue wire from the current limiter (15) connected to the charger relay and check continuity between the positive and negative pins and middle pin on the DC plug **(Figure 5-6, Page 5-9 and Figure 5-7, Page 5-13)**. There should be no continuity.

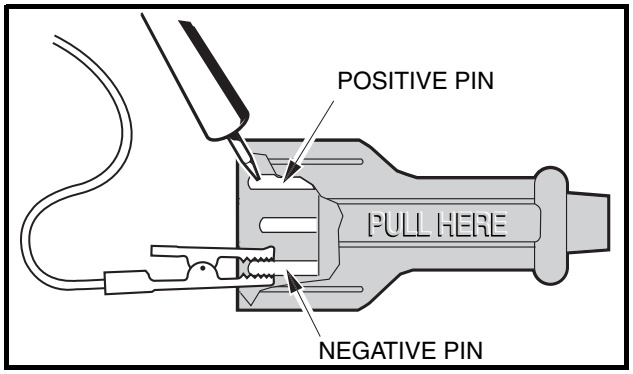


**Figure 5-13 DC Plug Test**

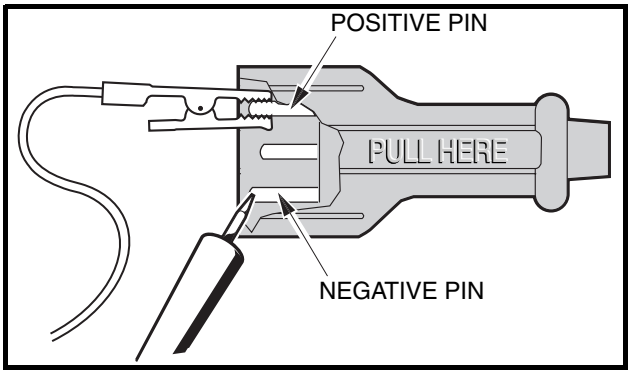


**Figure 5-14 DC Plug Test – Probes Reversed**

## TEST PROCEDURE 6 – TRANSFORMER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

Failure of the transformer may be caused by aging or a short circuit in adjacent coil turns. If the transformer has failed, the ammeter will indicate low output or no output; however, the transformer may hum. A blown AC line fuse or tripped AC circuit breaker in the charger or the storage facility may be caused by an improperly wired charger, an improper setting of the AC voltage selector switch, or a failed transformer.

An AC circuit test should be done before performing this test procedure to ensure the continuity of the AC cord, internal AC circuit breakers, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-17.**

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect transformer secondary coil wires from the heatsink **(Figure 5-15, Page 5-21)**.
4. To apply AC power directly to the transformer primary coil, bypass the relay. **See step 4 of Charging a Battery Pack that has Low Voltage on page 5-34. See following DANGER.**

## ⚠ 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.**

5. Make sure that the voltage selector switch (on the back of the charger) is set for the appropriate incoming AC voltage. Also ensure that the secondary coil wires are not touching one another. With the relay bypassed, insert the AC plug into an outlet. If the AC line fuse blows or AC circuit breaker trips, the transformer is shorted internally and must be replaced.

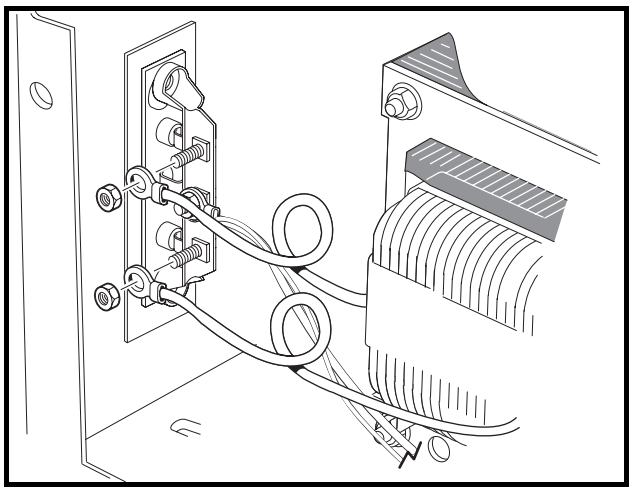

**Figure 5-15 Remove Secondary Coil Wires From Heatsink**

6. If the AC line fuse does not blow or the AC circuit breaker does not trip, check the transformer secondary coil voltage.
7. Disconnect AC cord from the wall outlet.
8. Using alligator clips and a multimeter set to 500 volts AC, connect the multimeter probes to the secondary transformer coil wires (1 and 5).
9. Connect the AC cord to the wall outlet and monitor the multimeter for the secondary coil voltage. If measured voltage is approximately 85 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced.
10. If the voltage reading is normal (86 volts AC or higher), the transformer is operational. Disconnect the AC plug from the wall receptacle and check the continuity of the DC circuit. **See Test Procedure 5 – Charger DC Circuit Continuity Test on page 5-20.**
11. When troubleshooting and repairs are complete, remove jumper wire and properly connect relay wiring. **See following WARNING.**

## ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

## TEST PROCEDURE 7 – BATTERY STATE OF CHARGE TEST

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

1. With the batteries fully charged, disconnect the DC charger plug for approximately 20 seconds and reconnect it. The ammeter should jump to a reading between 14 and 18 amps and taper to below 5 amps within 15 minutes.
2. If the charger does not taper to below 5 amps within 15 minutes, batteries may not be receiving a full charge and the onboard computer should be checked. **See Test Procedure 2 – Onboard Computer on page 5-17. See following NOTE.**

***NOTE:*** *Batteries near the end of their useful lives may not allow the battery charge current to taper below 5 amps.* ***See Batteries section in the appropriate maintenance and service manual.***

## TEST PROCEDURE 8 – CONTINUITY

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### AC Cord and Battery Charger AC Receptacle

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the green/yellow wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 5-16, Page 5-23)**.
4. Disconnect black wire of AC receptacle from charger relay terminal 4.
5. Disconnect other black wire of AC receptacle from the charger relay terminal 8.
6. Using a multimeter set for 200 ohms, place the red (+) probe on the terminal at the end of the black wire removed from relay terminal 4 (4). Test for continuity on each of the flat blades and on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the AC cord or AC charger receptacle (on the front panel) may be damaged. **See AC Cord on page 5-22. See also AC Charger Receptacle on page 5-23.**
7. Place the red (+) probe on the end of the green/yellow wire (2) and with the black probe check for continuity on both flat blades and on the ground pin of the AC plug. The tester should indicate continuity on only the ground pin. If any other reading is obtained, the AC cord or AC charger receptacle (on the front panel) may be damaged. **See AC Cord on page 5-22. See also AC Charger Receptacle on page 5-23.**
8. Place the red (+) probe on the blue wire and check for continuity on both flat blades and on the ground pin of the AC plug. The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced.

### AC Cord

1. Disconnect the AC cord from the AC receptacle (on front of battery charger) and the incoming AC outlet.
2. Using a multimeter, set for 200 ohms, place the red (+) probe into one of the side terminals in the end of the AC cord as shown **(Figure 5-17, Page 5-23)**. Test for continuity on each of the flat blades and on the round pin of the AC plug. The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord has failed and must be replaced.
3. Using a multimeter, set for 200 ohms, place the red (+) probe into the other side terminal in the end of the AC cord. Test for continuity on each of the flat blades and on the round pin of the AC plug. The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord has failed and must be replaced.

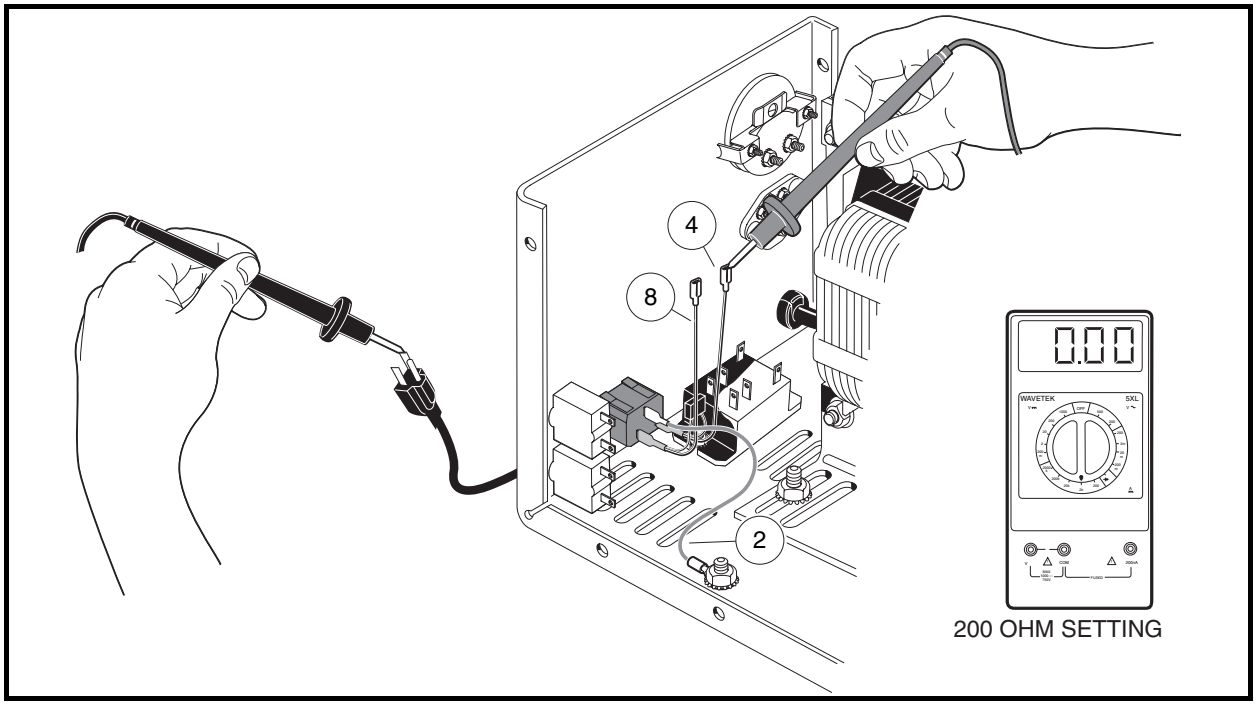


**Figure 5-16 AC Plug and AC Charger Receptacle Continuity Test**

4. Using a multimeter, set for 200 ohms, place the red (+) probe into the center terminal in the end of the AC cord. Test for continuity on each of the flat blades and on the round pin of the AC plug. The tester should indicate continuity on the ground pin only. If any other reading is obtained, the AC cord has failed and must be replaced.

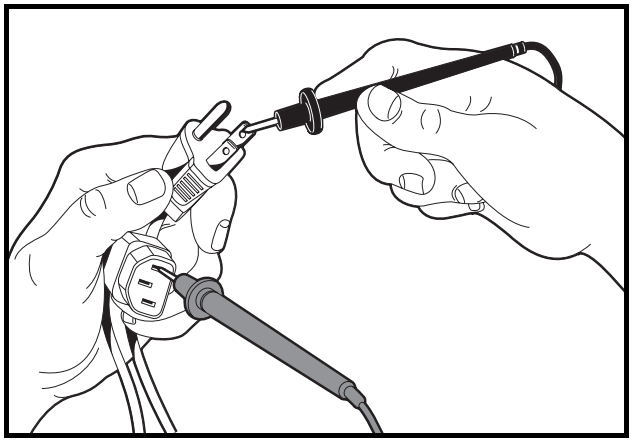

**Figure 5-17 AC Cord Test**

## AC Charger Receptacle

1. Disconnect the AC cord from the AC receptacle (on front of battery charger) and the incoming AC outlet. Disconnect the battery charger from the vehicle.
2. Disconnect black wire from charger relay terminal 4 (4) **(Figure 5-18, Page 5-24 and Figure 5-6, Page 5-9)**.

3. Disconnect green/yellow wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 5-18, Page 5-24)**.
4. Using a multimeter, set for 200 ohms, place the red (+) probe on the terminal at the end of the black wire removed from relay terminal 4 (4) **(Figure 5-18, Page 5-24)**. Test for continuity on the appropriate pin of the AC charger receptacle (on front of charger). The tester should indicate continuity on the ground pin only. If any other reading is obtained, the AC charger receptacle or connecting wires have failed and must be replaced.
5. Put the red (+) probe on the end of the green/yellow wire (2) and with the black (–) probe check for continuity on the appropriate pin of the AC charger receptacle **(Figure 5-18, Page 5-24 and Figure 5-6, Page 5-9)**. The tester should indicate continuity on the ground pin only. If any other reading is obtained, the AC charger receptacle or connecting wires have failed and must be replaced.
6. Disconnect black wire from charger relay terminal 8 (8) **(Figure 5-18, Page 5-24)**. Put the red (+) probe on the black wire (8) and check for continuity on the appropriate pin of the AC charger receptacle. The tester should indicate continuity on the ground pin only. If any other reading is obtained, the AC charger receptacle or connecting wires have failed and must be replaced.

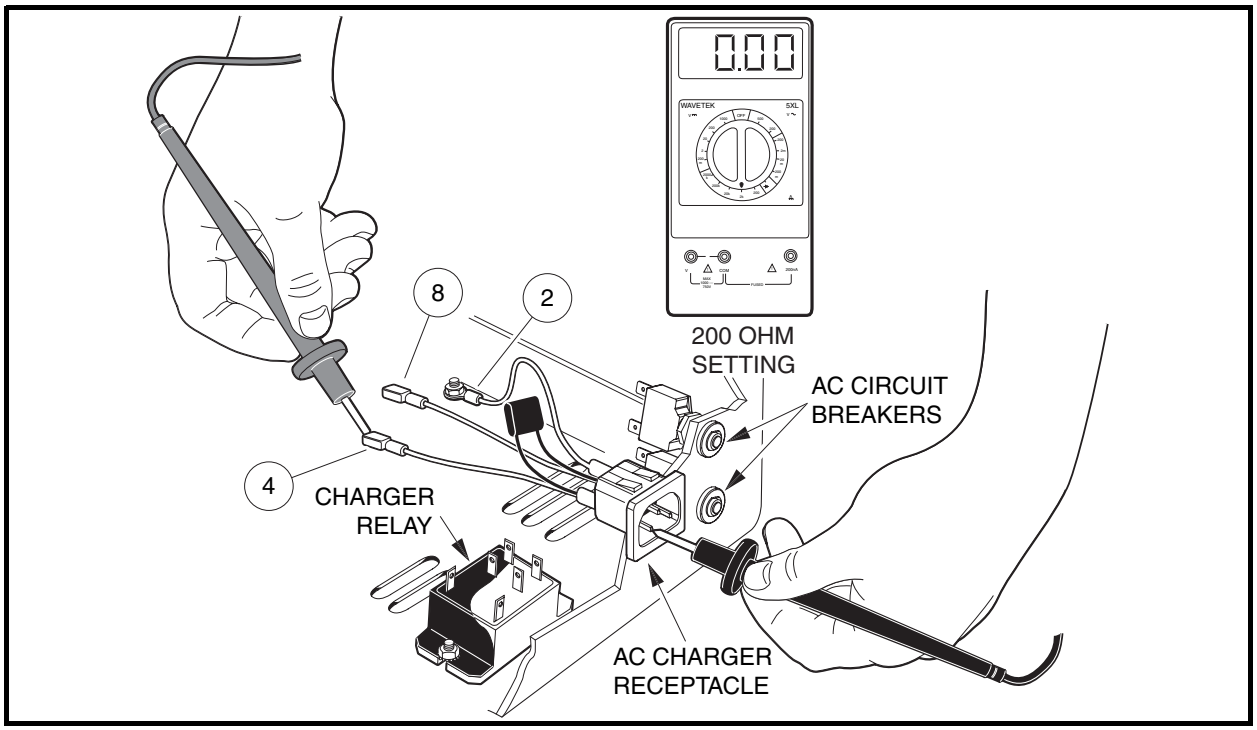


**Figure 5-18 AC Charger Receptacle Continuity Test**

## DC Cord

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. To check the continuity of the DC cord, disconnect the black wire (17) of the DC cord from the ammeter **(Figure 5-19, Page 5-25)**.
4. Disconnect the red wire (19) of the DC cord from the heatsink.
5. Disconnect the blue wire (18) from the limiter (15), which connects to the red wire assembly that connects to the charger relay.

6. Place the clip of the continuity tester on the red wire (19) of the DC cord.
7. Place the continuity test probe on the positive (+) pin of the DC plug (positive (+) and negative (–) pins are identified on the plug). If tester does not indicate continuity, the DC cord must be replaced.
8. Place the continuity test probe on the negative (–) pin of the DC plug. The tester should indicate no continuity. If tester indicates continuity, the DC cord must be replaced.
9. Place the continuity test probe on the unmarked (middle) pin of the DC plug. The tester should indicate no continuity. If tester indicates continuity, the DC cord must be replaced.
10. Move the continuity tester clip to the black wire (17) of the DC cord.
11. Place the continuity test probe on the negative (–) pin of the DC plug. The tester should indicate continuity. If tester does not indicate continuity, the DC cord must be replaced.
12. Place the continuity test probe on the unmarked (middle) pin of the DC plug. The tester should indicate no continuity. If tester indicates continuity, the DC cord must be replaced.
13. Move continuity test probe to the blue wire (18) of the DC cord. Check for continuity at the middle pin. The tester should indicate continuity. If tester does not indicate continuity, replace DC cord.

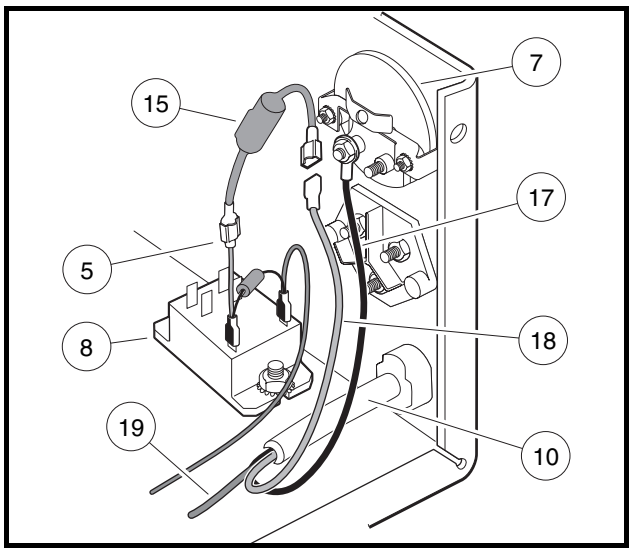


**Figure 5-19 DC Cord, Relay, and Limiter**

## Transformer

The IQ Plus battery charger transformer has two sets of coils: a primary coil and a secondary coil.

**Primary Coil**

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the black wires marked 1 and 6 from the AC circuit breakers.
4. Disconnect the wires marked 2, 3, 4 and 5 from the voltage selector switch.
5. Place the continuity tester probes on the primary coil transformer wires disconnected above in pairs until all of the combinations in the following chart have been tested.
6. If the continuity readings agree with the chart, replace the voltage selector switch. If the continuity readings differ from the chart, replace the transformer.

| PRIMARY COIL CONTINUITY / NO CONTINUITY CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | NEGATIVE PROBE | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| POSITIVE PROBE | 1 | | Continuity | Continuity | No Continuity | No Continuity | No Continuity |
| | 2 | Continuity | | Continuity | No Continuity | No Continuity | No Continuity |
| | 3 | Continuity | Continuity | | No Continuity | No Continuity | No Continuity |
| | 4 | No Continuity | No Continuity | No Continuity | | Continuity | Continuity |
| | 5 | No Continuity | No Continuity | No Continuity | Continuity | | Continuity |
| | 6 | No Continuity | No Continuity | No Continuity | Continuity | Continuity | |

**Secondary Coil**

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove the transformer (tan) secondary coil wire from the upper terminal of the heatsink **(Figure 5-15, Page 5-21)**.
4. Remove the other transformer (tan) secondary coil wire from the bottom terminal of the heatsink and place the continuity test clip on the ammeter post with the short black jumper wire (7) **(Figure 5-20, Page 5-30)**. Test for continuity between the jumper wire and each of the secondary coil wires (tan). The tester should indicate continuity on both secondary coil wires. If tester does not indicate continuity on both secondary coil wires, replace transformer. Ensure that the fuse is intact and not blown.

## Voltage Suppressor – Failed Closed

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Using a multimeter set to the diode test function (→|←), place the black (–) probe of the multimeter on the sense lead pin (short pin) of the DC plug. Place the red (+) probe on the positive (+) pin of the DC plug. The multimeter should indicate no tone. If a tone is emitted (indicating a closed circuit) then the voltage suppressor has failed and should be replaced. **See following NOTE.**

***NOTE:*** *Repeated failure of sense lead fuses is a symptom of a voltage supressor that has failed in a closed condition.*

## Relay

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove the black wire from terminal 6 of the relay and black wire from terminal 8 of the relay **(Figure 5-6, Page 5-9)**. Place continuity tester leads on terminals 6 and 8 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.

4. Remove the black wire from terminal 2 of the relay and black wire from terminal 4 of the relay **(Figure 5-6, Page 5-9)**. Place continuity tester leads on terminals 2 and 4 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.
5. With batteries connected, insert the DC plug into a receptacle. The tester should indicate continuity on terminals 6 and 8 and continuity on relay terminals 2 and 4. If tester does not indicate continuity on both sets of contacts, the relay must be replaced.

### Ammeter

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the black wire from the left ammeter post (as viewed from inside the charger).
4. Place the continuity tester clip on one of the ammeter posts.
5. Place the continuity test probe on the other ammeter post. The tester should indicate continuity. If the tester does not indicate continuity, replace the ammeter.

### AC Circuit Breaker

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the wires from the AC circuit breaker.
4. Place the continuity test probes on the two terminals of the AC circuit breaker. The tester should indicate continuity. If the tester does not indicate continuity, replace the AC circuit breaker.

## CHARGER REPAIRS

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

**⚠ WARNING**

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 5-6, Page 5-9).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**

### DC CORD

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### DC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See preceding WARNING.**
2. Remove the charger cover.
3. Remove the DC cord black wire (17) from the ammeter by loosening the nut. Support the terminal as the nut is loosened to prevent rotation of the connection **(Figure 5-19, Page 5-25).**
4. Remove nut attaching the red wire (19) of DC cord onto the heatsink.

5. Disconnect the DC cord blue wire (18) from the limiter (15), which connects to the red wire assembly that connects to the charger relay.
6. Remove the wire ties that secure the blue wire (18) to the black transformer wire. Note the location of the wire ties.
7. Using pliers, squeeze the strain relief bushing and remove the DC cord.

### DC Cord Installation

1. Insert the leads of the new DC cord through the hole in the charger base.
2. Attach the red wire of the new DC cord to the center terminal of the heatsink and tighten the nut to 18 in-lb (2.0 N·m).
3. Attach the blue wire of new DC cord to the limiter (15) **(Figure 5-19, Page 5-25)**.
4. Attach the black wire (17) of the new DC cord to ammeter. Install nut onto post of ammeter slightly more than finger tight. While holding the inside nut, tighten the outside nut 1/4 turn. **See following CAUTION.**

**CAUTION**

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
6. Secure the blue wire to the black wire in the locations noted in step 6 of DC Cord Removal.
7. Tie the wires together as they were before the wire tie was removed. **See following WARNING.**

**⚠ WARNING**

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

8. Position the charger cover on the base. Install the mounting screws, starting with the bottom holes. Tighten the screws to 11 in-lb (1.2 N·m).

## HEATSINK

**See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.**

### Heatsink Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 5-27.**
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 5-6, Page 5-9 and Figure 5-7, Page 5-13)**.
4. Remove the two red wires from the heatsink.
5. Remove the nuts and bolts that secure the heatsink to the case.

### Heatsink Installation

1. Place heatsink against charger base. Make sure clear plastic insulator sheet is between the heatsink and the charger base. Install the nuts and bolts that secure the heatsink to the case. Tighten the bolts to 22 in-lb (2.5 N·m) **(Figure 5-6, Page 5-9 and Figure 5-7, Page 5-13)**.

2. Connect the red wire from the DC cord and the red wire from the charger relay to the center terminal post on the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
3. Connect one of the secondary coil transformer wires (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
4. Connect the other secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Install the charger cover and check charger for proper operation.

## TRANSFORMER

## See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### Transformer Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 5-27.**
2. Remove the charger cover.
3. Note the locations of wire ties and remove the wire ties.
4. Disconnect the black primary coil leads from the AC circuit breakers and the voltage selector switch **(Figure 5-6, Page 5-9 and Figure 5-7, Page 5-13)**.
5. Disconnect the two tan secondary coil transformer wires from heatsink.
6. Disconnect the two black secondary coil transformer wires from the fuse.
7. Remove the four bolts and nuts that mount the transformer to the case and remove the transformer.

### Transformer Installation

1. Install the transformer with the secondary coil to the rear of the charger case. Tighten the four bolts and nuts to 28 in-lb (3.2 N·m) **(Figure 5-7, Page 5-13)**.
2. Connect one secondary coil transformer wire (black) to one terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m).
3. Connect the other secondary coil transformer wire (black) to the remaining terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m).
4. Connect one secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Connect the other secondary coil transformer wire (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
6. Connect the black primary coil transformer wire marked 6 to the bottom terminal of the top AC circuit breaker.
7. Connect the black primary coil transformer wire marked 1 to the bottom terminal of the bottom AC circuit breaker.
8. Connect each of the remaining black primary coil transformer wires marked 2, 3, 4, and 5 to the corresponding terminals marked on the voltage selector switch.
9. Set the voltage selector switch to the appropriate voltage matching the incoming AC electrical service that will be used to power the charger.
10. Tie the wires together as they were before the wire tie was removed. **See following WARNING.**

**⚠ WARNING**

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

11. Install the charger cover and check charger for proper operation.

## AMMETER

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### Ammeter Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 5-27.**
2. Remove the charger cover.
3. Using two wrenches to prevent the posts from turning, disconnect the two black wires from the ammeter (17) **(Figure 5-20, Page 5-30)**.
4. Remove the two nuts (22) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

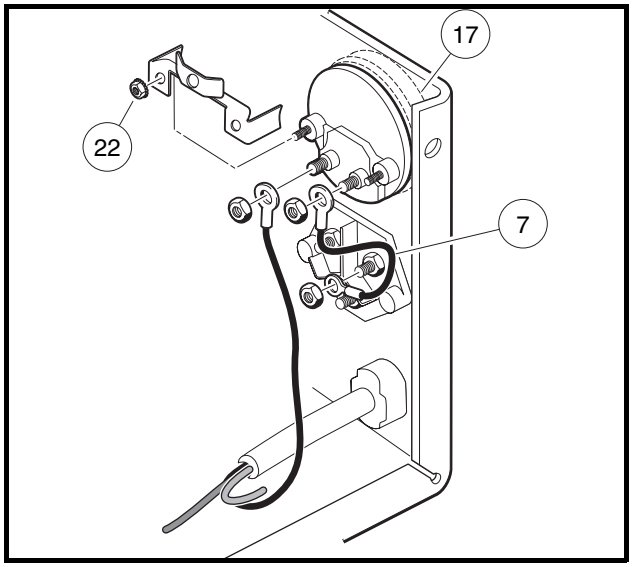


**Figure 5-20 Ammeter**

### Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 5-20, Page 5-30)**.
2. Install the nuts (22) and tighten until ammeter is firmly secured.
3. Connect the two black wires to the ammeter posts.
4. Thread nuts onto both posts of the ammeter until just past finger tight. While holding the inside nut, tighten the outside nut 1/4 turn. **See following CAUTION.**

**CAUTION**

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

5. Install the charger cover.
6. Plug the charger into the vehicle and check ammeter for proper operation.

## FUSE LINK

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### Fuse Link Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove both black secondary coil transformer wires and the black jumper wire (18) from the back of the fuse link assembly (11) **(Figure 5-7, Page 5-13)**.
4. Remove screws from the front of the charger and remove the fuse link assembly.

### Fuse Link Installation

1. Place clear plastic cover over fuse assembly (11) and install mounting screws from front of charger face. The center branch of the fuse assembly should be in the upper left corner when viewed from the front of the charger.
2. Install the jumper wire (18) over the center branch of the fuse assembly and ammeter post **(Figure 5-7, Page 5-13)**. Tighten to 22 in-lb (2.5 N·m).
3. Install a secondary coil transformer wire (black) onto one of the two remaining terminals on the back of the fuse assembly. Install the remaining secondary coil transformer wire (black) to the remaining terminal. Tighten to 27 in-lb (3.0 N·m).
4. Install the charger cover.

## VOLTAGE SUPPRESSOR

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

The voltage suppressor, which is incorporated into a wire assembly in the charger, protects the onboard computer by capturing very high, but very brief voltage spikes which occur due to the collapse of the electrical field in the charger relay when the charger is disconnected from the vehicle. **See also Test Procedure 8 – Continuity on page 5-22.**

### Voltage Suppressor Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove nut attaching voltage suppressor (18-gauge red wire) (2) to heatsink **(Figure 5-21, Page 5-32)**.
4. Disconnect the limiter (4) at the quick disconnect terminal on the relay side.
5. Disconnect the voltage suppressor wire assembly from charger relay (3).
6. Remove the white fiberglass sleeve from the red heatsink wire. Retain the sleeve for use when installing the new voltage suppressor.

### Voltage Suppressor Installation

1. Place the white fiberglass sleeve over the red wire that connects to the heatsink.
2. Install in reverse order of removal. Tighten nut attaching voltage suppressor (18-gauge red wire) to heatsink to 18 in-lb (2.0 N·m).

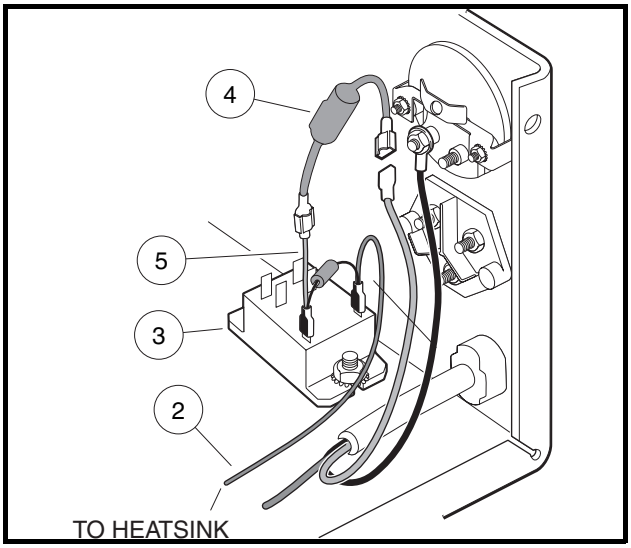


**Figure 5-21 Voltage Suppressor**

## CHARGER RELAY

## See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### Charger Relay Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 5-27.**
2. Remove the charger cover.
3. Disconnect all wires from the relay (00) **(Figure 5-7, Page 5-13)**.
4. Remove the two screws and nuts attaching relay to the charger case.
5. Remove the relay.

### Charger Relay Installation

Install in reverse order of removal. Connect wires as shown **(Figure 5-6, Page 5-9)**. Tighten hardware securing relay to charger base to 18 in-lb (2.0 N·m).

## CHARGER AC CIRCUIT BREAKERS

## See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### AC Circuit Breaker Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 5-27.**
2. Remove the charger cover.

3. Disconnect the two black wires attached to top circuit breaker **(Figure 5-6, Page 5-9)**.
4. Disconnect the two black wires attached to bottom circuit breaker.
5. With a pair of pliers, squeeze in the retaining tabs on the sides of the top AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.
6. Repeat step 5 for the removal of the bottom circuit breaker.

### AC Circuit Breaker Installation

Install in reverse order of removal.

## AC CHARGER RECEPTACLE

### See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

### AC Charger Receptacle Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle. **See WARNING on page 5-27.**
2. Remove the charger cover.
3. Disconnect the two black wires from the AC charger receptacle **(Figure 5-6, Page 5-9)**.
4. Disconnect the green/yellow wire from the AC charger receptacle.
5. Press the retaining tabs on the top and bottom of the AC charger receptacle and remove the AC charger receptacle from the font of the charger.

### AC Charger Receptacle Installation

1. Press the AC charger receptacle into the opening in the front panel of the battery charger.
2. Connect the green/yellow (ground) wire to the center terminal of the AC charger receptacle.
3. Connect the two black wires to the bottom terminals of the AC charger receptacle.
4. Install the charger cover.

# CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

## See General Warning, Section 1, Page 1-1. See additional WARNING on page 5-1.

If battery pack voltage is below 34 volts, the charger will not activate. The charger relay will have to be bypassed to activate the charger. **See following WARNING.**

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 5-6, Page 5-9).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and the DC plug from the vehicle charger receptacle.**

1. Turn key switch OFF and place the Forward/Reverse handle in the NEUTRAL position. Leave the batteries connected.
2. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
3. Remove the charger cover.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   - 4.1. To bypass the relay, locate the black wire that goes from the circuit breaker to terminal 2 on the relay. Disconnect the black wire from the relay terminal **(Figure 5-22, Page 5-35)**.
   - 4.2. Disconnect the black wire from relay terminal 4.
   - 4.3. Use a jumper wire with alligator clips to connect the black wire from relay terminal 2 to the black wire from relay terminal 4 **(Figure 5-22, Page 5-35)**.
   - 4.4. Disconnect the black wire from relay terminal 6.
   - 4.5. Disconnect the black wire from relay terminal 8.
   - 4.6. Use a jumper wire with alligator clips to connect the black wire from relay terminal 6 to the black wire from relay terminal 8 **(Figure 5-22, Page 5-35)**. **See following DANGER.**

### ⚠ 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.**

5. Plug the DC cord into the charger receptacle *first*, then plug the AC cord into an electrical outlet.
6. The charger should activate and begin to charge the batteries. Allow the charger to operate for one or two hours. **See following WARNING.**

### ⚠ WARNING

- **Do not leave the vehicle unattended while it is charging. A charger operating with a bypassed relay could short circuit and possibly cause a fire.**

7. After one or two hours, disconnect the charger AC cord from the electrical outlet *first*. Then disconnect the DC cord from the charger receptacle in the vehicle.
8. Disconnect the jumper wires from the relay wires and connect each wire to the original terminal on the relay **(Figure 5-22, Page 5-35)**. **See following WARNING.**

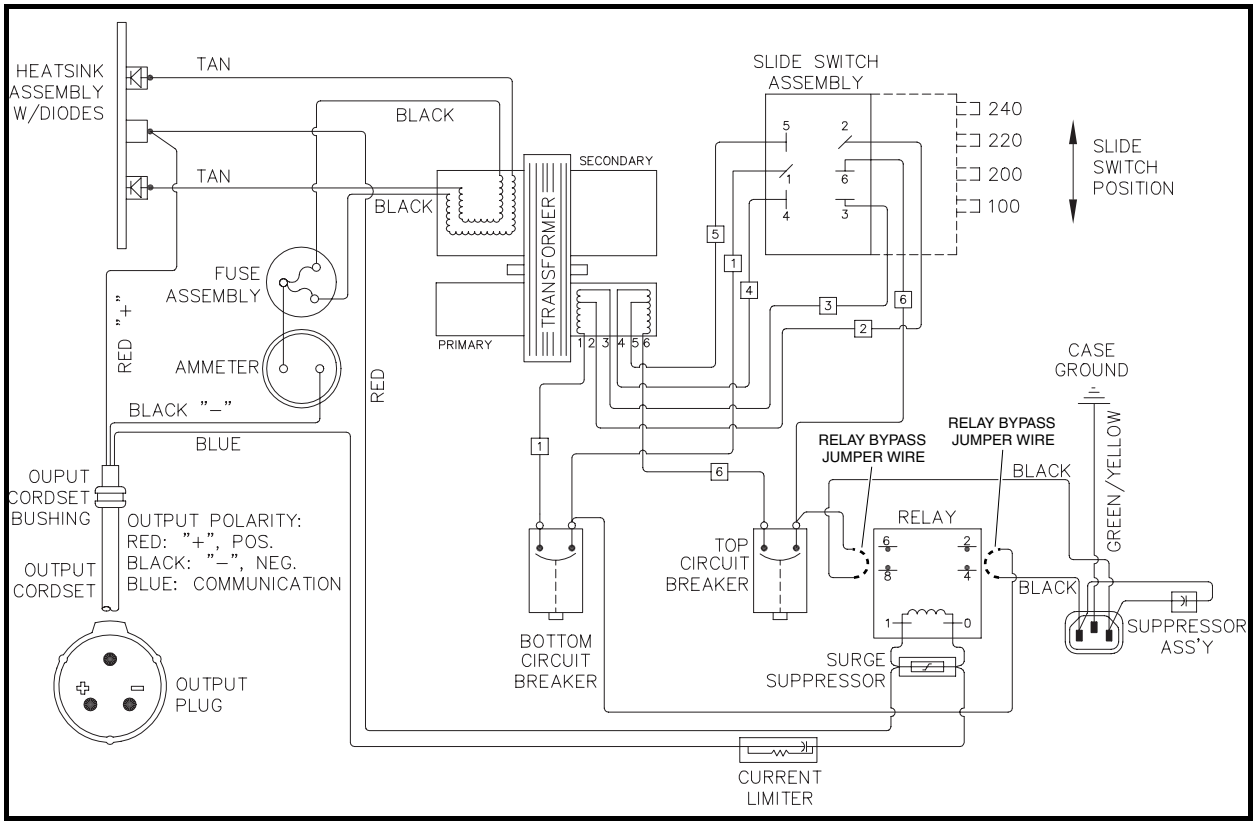


**Figure 5-22 Export IQ Plus Charger Wiring Diagram (Relay Bypassed)**

## ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

9. Install the charger cover and the retaining screws.
10. Plug the DC cord into the charger receptacle, then plug the AC cord into an electrical outlet.
11. Allow the charger to continue charging the batteries until the charger shuts off automatically.
12. When the charge cycle is complete, test the batteries again. If the battery pack voltage is above 34 volts and the vehicle will not operate, it will be necessary to troubleshoot the vehicle's electrical system to determine which electrical component has failed. **See Section 11 – Electrical System and Testing in the appropriate maintenance and service manual.**

# SECTION 6 – EXPORT IQ PLUS CHARGER (ONBOARD)

### ⚠ DANGER

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

### ⚠ WARNING

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

## GENERAL INFORMATION

This section includes information pertaining to service of the Export onboard IQ Plus battery charger (model number 25660-40) as installed in IQ Plus vehicles. Depending on the geographic region, the charger provided with your vehicle may be a different model. Do not attempt to service a battery charger that has not been properly identified. If a charger cannot be properly identified, contact your local Club Car dealer or distributor.

For battery chargers with model numbers listed above that are installed in vehicles other than IQ Plus vehicles, contact your local Club Car dealer or distributor.

The IQ Plus battery charger is automatic and has no external controls **(Figure 6-1, Page 6-1)**. When the AC cord is plugged in, there is a 2 to 15 second delay before charging begins. **See following NOTE.**

***NOTE:*** *At one hour and at two hours into the charge cycle, the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero). Charging will resume in a few moments (ammeter returns to previous rate of charge).*

The onboard computer (OBC) records the amount of energy consumed as the vehicle is used, then directs the charger to replace exactly the amount of energy needed to fully replenish the batteries. The charger then shuts off automatically, preventing the possibility of either undercharging or overcharging.

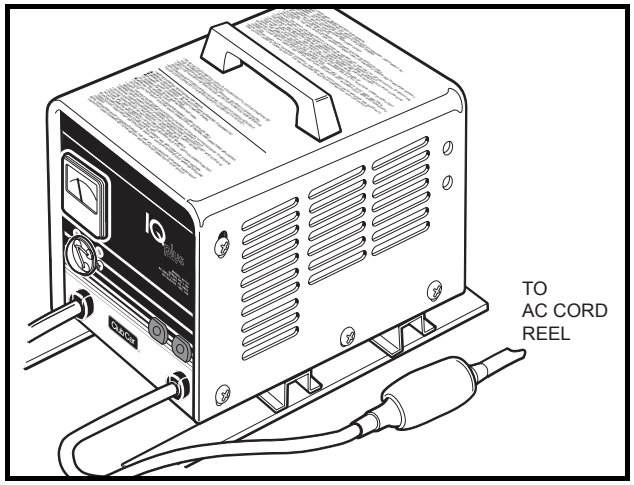


**Figure 6-1 Onboard IQ Plus Battery Charger**

## IQ PLUS ONBOARD CHARGER FEATURES

- **Charge Interlock**
  When the AC power cord is inserted into a wall receptacle, the onboard computer locks out the vehicle drive system. This prevents the possibility of driving the vehicle while the charger is plugged in and potentially damaging the vehicle and charger.
- **Long-Term Storage Charge**
  IQ Plus chargers are designed to be left connected with AC power to the charger, during off-season or long-term storage. The onboard computer will automatically activate the charger every 15 days. To return the vehicle to service, disconnect the AC cord from the wall outlet, wait 15 seconds and then plug the AC cord back in. The charger will activate. Allow the vehicle to complete one full charge cycle before putting it into service.

## BATTERY WARNING LIGHT

IQ Plus vehicles feature a dash mounted battery warning light (above the steering column) that, when the vehicle is in operation, indicates low battery voltage or, when the vehicle is being charged, indicates a charging problem. The battery warning light is controlled by the onboard computer.

When the batteries receive an incomplete charge because 1) AC power to charger is interrupted, 2) automatic charger shut-off occurs after 16 hours of operation, or 3) charger malfunctions, the battery warning light will indicate as follows:

- The battery warning light will not illuminate if the charge is 90% or more complete. The onboard computer will retain in memory the amount of charge needed to fully replenish the batteries and will complete the charge during the next charge cycle.
- When the charger AC cord is unplugged during a charge cycle, the battery warning light will illuminate and remain illuminated for 10 seconds if the charge is less than 90% complete but the vehicle has enough power for 60 minutes of operation. This will alert the operator that the vehicle may be used, but that it must be charged to completion as soon as possible.
- The battery warning light will repeatedly illuminate for 10 seconds, at 4 second intervals, if the charger times out at 16 hours and the batteries are not sufficiently charged. This indicates an abnormal charge cycle. The charger and batteries should be checked by your Club Car distributor/dealer.

# THE CHARGE CIRCUIT

For vehicles with onboard chargers, the charge circuit consists of the following components:

- onboard charger
- onboard computer
- batteries

The 10-gauge black wire from the charger connects to the onboard computer black lead wire. The 6-gauge black wire (also on the controller B– terminal) goes through the onboard computer and connects to the negative (–) post of battery no. 8 **(Figure 6-5, Page 6-11)**. The 10-gauge red wire of the charger is connected to the positive (+) post of battery no. 1 for Turf 2/252, Carryall 2/252 and XRT 900 vehicles, and the large post of the solenoid (battery side) for Carryall 6, Villager and TransPorter vehicles. The 18-gauge gray wire from the charger connects to the onboard computer **(Figure 6-2, Page 6-3)**.

To check the charge circuit, check the connections between the 18-gauge gray wire from the OBC, DC cord red wire, DC cord black wire, and the wire connections between the batteries.

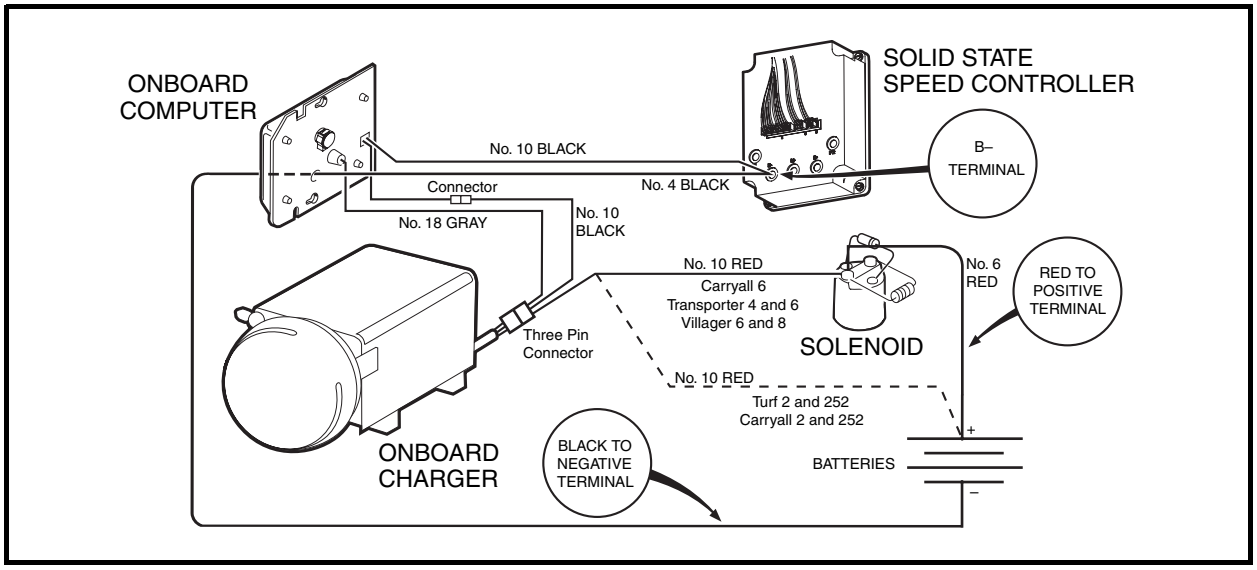


**Figure 6-2 Charge Circuit**

## ONBOARD CHARGER OPERATION

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

#### ⚠ 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 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.**

#### ⚠ WARNING

- **Only trained technicians should repair or service the charger. Contact your nearest Club Car distributor/dealer.**
- **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.**
- **Connect the charger AC supply cord to a properly grounded, three-wire outlet of the proper voltage and frequency as shown on the charger.**
- **Do not use an adapter to plug the charger with a three-prong plug into a two-prong outlet. Improper connection of the equipment-grounding conductor can result in a fire or an electrical shock.**

**WARNING CONTINUED ON NEXT PAGE...**

- **Do not use an extension cord.**
- **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.**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 6-34.**
- **Never push objects of any kind into the charger through cabinet slots. They may touch dangerous voltage points or cause an electrical short circuit that could result in fire or electrical shock.**
- **Do not use a battery charger if the cord or plug is damaged in any way. Replace worn or damaged parts immediately. Failure to heed this warning could result in a fire, property damage, severe personal injury, or death.**
- **Do not operate the charger if it has received a sharp blow, was dropped, or otherwise damaged in any way. Make sure it is operating properly before putting it back in use.**
- **Have worn, cut, or damaged power cords or wires replaced immediately.**
- **Do not block or cover the charger ventilation slots. The slots provide ventilation and prevent the charger from overheating.**
- **Do not allow clothing, blankets, or other material to cover the charger.**
- **Do not allow the charger to operate for more than 30 minutes at 19 or more amperes.**
- **Install surge arrestors on incoming AC power lines. Surge arrestors will help protect electrical components in the charger and on the vehicle from all but direct or close lightening strikes.**

## ONBOARD CHARGER AC POWER CONNECTION

The AC line to which the charger is to be connected must be of the proper AC input voltage for the charger and must be capable of supplying sufficient current. **See Section 2 – Charger Identification and Specifications.** If the battery charger is equipped with a multi-position switch for variable AC input voltage, the switch must be set for the correct voltage before the AC cord is connected **(Figure 6-3, Page 6-5)**. **See following CAUTION.**

### CAUTION

- **Failure to set the AC input voltage selector switch to the correct voltage could result in damage to the battery charger or batteries.**

***NOTE:*** *Make sure that the AC cord provided with your charger has the proper AC plug for your location. If it does not, contact your Club Car representative to obtain the proper cord or plug.*

Connect the power supply cord to an AC supply within the acceptable voltage range. **See Section 2 – Charger Identification and Specifications.**

To reduce the risk of electric shock, the battery charger must be grounded. The charger is equipped with an AC electric cord with an equipment-grounding conductor and a grounding type plug. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with all applicable national and local electrical codes and regulations.

Place the charger AC cord so it will not be stepped on, tripped over, or otherwise subject to damage or stress.

The use of an extension cord with the onboard charger must be avoided.

Do not place items in the compartment where the battery charger is installed. Ensure that the charger ventilation slots are unobstructed.

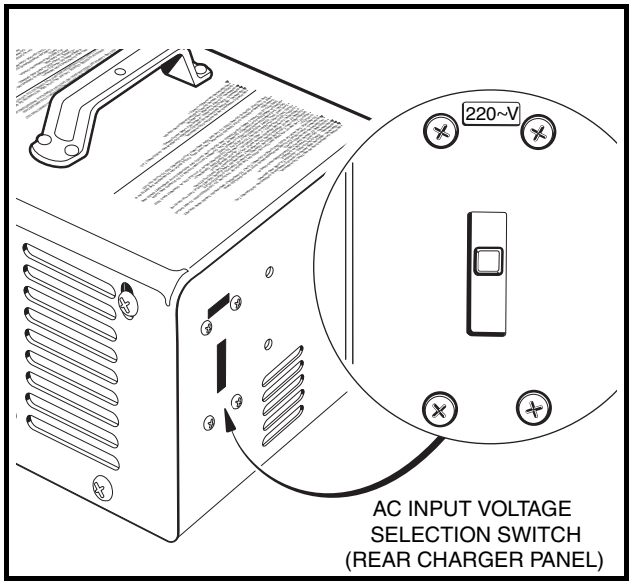


**Figure 6-3 AC Input Voltage Selection Switch**

## CHARGING BATTERIES

1. Connect the AC power supply cord to an AC outlet designed to provide the proper AC voltage for the charger.
2. The charger will activate automatically within 2 to 15 seconds.
3. Monitor the ammeter for the correct charge rate. The initial charge rate will vary from 15 to 19 amps, depending upon the condition and depth of discharge of the batteries. Slight variations in the initial charge rate may also result from AC line input voltages which are higher or lower than the nominal input voltage. Higher AC line voltages increase the initial charge rate while lower AC line voltages reduce the initial charge rate.
4. Monitor the ammeter for about 30 seconds. Under normal operating conditions (when the charger is on and the batteries are discharged), one hour and at two hours into the charge cycle, the charger will shut off in order to run a self-diagnostic program (ammeter will drop to zero). **See following CAUTION and NOTE.**

### ⚠ CAUTION

- **Do not connect an external charger to the receptacle of a vehicle equipped with an onboard charger while the onboard charger is activated. Charging overload will damage the onboard computer and may cause battery damage.**

***NOTE:*** *Batteries should be put on charge at the end of each day even if the vehicle has been used for only a short amount of time (even if for only 10 minutes).*

*When air temperatures fall below 65 °F (18.3 °C), batteries charged in unheated areas should be placed on charge as soon as possible after use. Cold batteries require more time to fully charge.*

*New batteries will not deliver their full range until the vehicle has been driven and recharged from 20 to 50 times.*

*Vehicles should be restricted to 40 to 50 energy units of discharge between charges until the batteries have been properly seasoned (20 to 50 charge cycles). For maximum battery life, Club Car recommends that electric vehicles always be recharged after 40 to 50 energy units of discharge or*

*each night in order to avoid deep discharging the batteries; use the CDM (Communication Display Module) (CCI P/N 101831801).* ***See Communication Display Module in the appropriate maintenance and service supplement.***

## TESTING CHARGER OPERATION

1. Connect the AC power supply cord to an electrical outlet. The charger relay should not close immediately, but should close with an audible click after a delay of 2 to 15 seconds. **See following NOTE.**

***NOTE:*** *Monitor the charge cycle to make sure the charger turns off properly. If the charge cycle is interrupted, and the batteries are less than 90% charged, the battery warning light will illuminate intermittently.* ***See Battery Warning Light on page 6-2.***

2. If the charger does not operate exactly as described above, refer to the wiring diagram and make sure that the vehicle is wired correctly **(Figure 6-2, Page 6-3)** and that the internal charger wiring is correct **(Figure 6-4, Page 6-6)**.

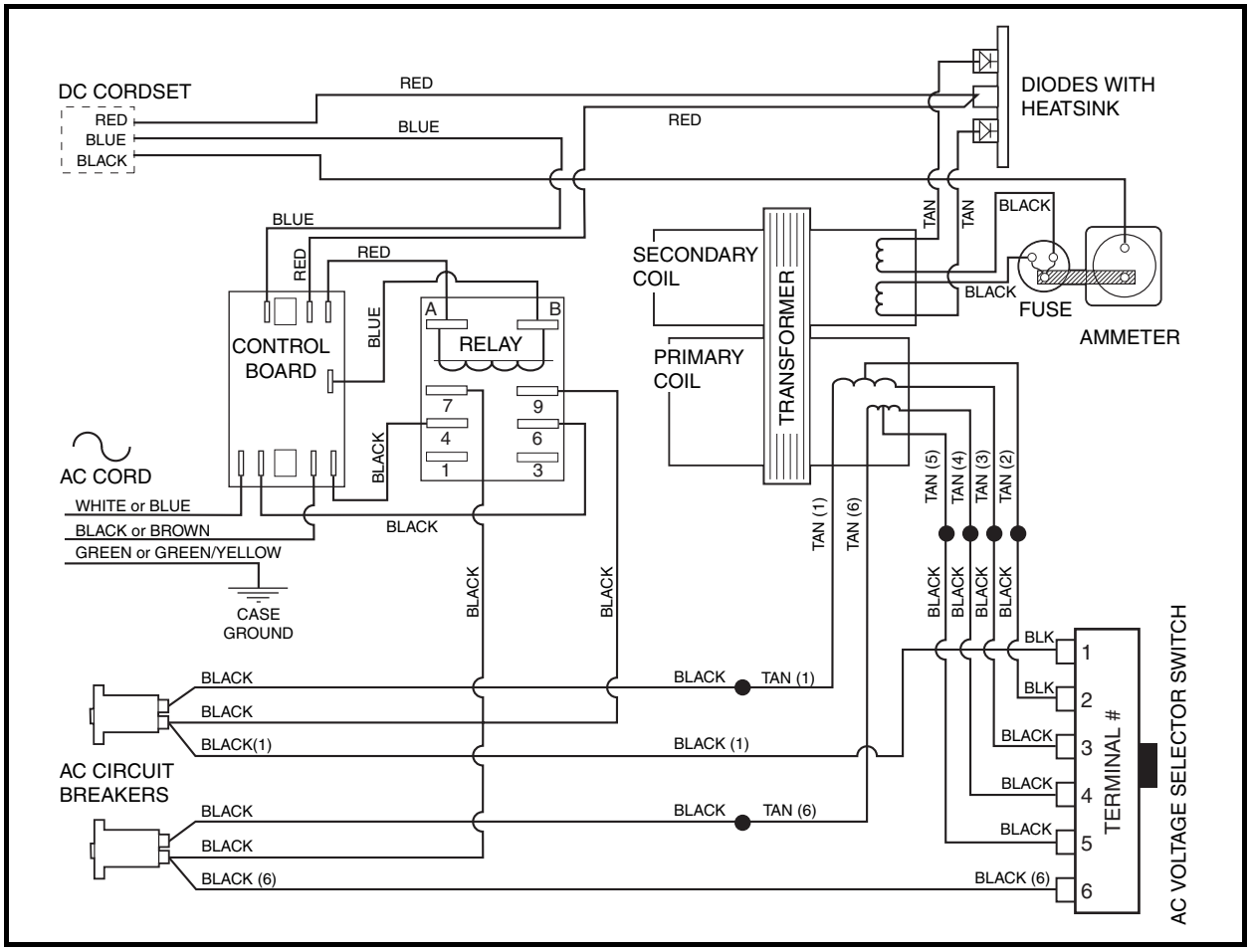


**Figure 6-4 Export IQ Plus Onboard Battery Charger Wiring Diagram**

# CHECKING BATTERY CONDITION WITH AN ONBOARD CHARGER

## Read DANGER, WARNING, and CAUTIONS beginning on page 6-3.

It is common practice for technicians to check the condition of a set of batteries after they have been charged to ensure they have received a complete charge before the vehicle is used. With IQ Plus vehicles, this is not necessary; the onboard computer controls and monitors the charge cycle. If any problem occurs during a charge cycle, the battery warning light, located above the steering column in the center dash panel, will illuminate intermittently.

If the battery warning light is illuminated after a charge cycle, refer to the troubleshooting chart. **See Troubleshooting on page 6-7.** If the specified test procedures identify no problems, plug the AC cord into a wall outlet and let it charge until the charger shuts off automatically. If a problem is found, correct it and charge the vehicle. Normal battery voltage near the end of a charge cycle should be approximately 59 to 63 volts DC while the charger is still operating.

### START CHARGE CYCLE

1. Disconnect the AC plug from the wall outlet.
2. Wait 20 seconds, then reconnect the AC cord to the wall outlet. **See following NOTE.**

***NOTE:*** *The charger will not operate unless a delay of approximately 20 seconds is observed.*

3. Monitor the ammeter for the charge rate. If the vehicle has not been driven since the last charge cycle and the batteries are fully charged, the onboard computer will not perform a self-diagnostic test. The charge cycle will begin and the ammeter will not drop to zero. If the vehicle has been driven, even if only a few feet, the onboard computer will perform the self-diagnostic test; the ammeter will drop to zero for 2 to 3 seconds before the charge cycle continues. If the batteries are close to being fully charged, the charge cycle will begin and the charge current will begin to taper within a few minutes.

# TROUBLESHOOTING

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

### ⚠ 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.**

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 6-4, Page 6-6).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 6-34.**

Use the following Troubleshooting Guide for troubleshooting the export IQ Plus onboard battery charger (model number 25660-40). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

## IQ PLUS ONBOARD BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Relay does not close, no transformer hum and ammeter does not move** | Batteries disconnected | Connect batteries **(Figure 6-5, Page 6-11)** |
| | Battery voltage is too low | Test Procedure 1 – Battery Voltage on page 6-10 |
| | Improper vehicle or battery charger wiring | **See Figure 6-2, Page 6-3**, **Figure 6-4, Page 6-6 and Figure 6-5, Page 6-11** |
| | DC circuit | Test Procedure 5 – Charger DC Circuit Continuity Test on page 6-16 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 6-12 |
| | Gray sense lead fuse is blown | Test Procedure 1 – Battery Voltage on page 6-10 |
| | Control board malfunction | Test Procedure 2 – Control Board on page 6-12 |
| **Relay closes with an audible click but no transformer hum and ammeter does not move** | Improper AC line voltage | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 6-13 |
| | Failed AC plug and cord | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 6-13 |
| | Failed AC cord reel | Test Procedure 8 – Continuity on page 6-18 |
| | Internal AC breaker | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 6-13 |
| | Transformer primary coil | Test Procedure 6 – Transformer on page 6-16 |
| | Relay | Test Procedure 8 – Continuity on page 6-18 |
| **Relay closes and transformer hums but ammeter does not move** | Blown charger fuse | Test Procedure 4 – Diodes on page 6-14 |
| | Both Diodes failed | Test Procedure 4B – Both Diodes Failed on page 6-15 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 6-12 |
| | Failed transformer | Test Procedure 6 – Transformer on page 6-16 |
| | Failed ammeter | Replace ammeter |
| **Relay operates intermittently** | Failed charger relay | Test Procedure 8 – Continuity on page 6-18 |
| **Single charger fuse link blows** | Diode failed | Test Procedure 4A – Single Diode Failure on page 6-14 |
| | Loose internal fuse connection | Tighten connection |
| **Both charger fuse links blow or receptacle fuse link blows** | Battery is wired in reverse polarity | Check vehicle wiring |
| | DC cord is wired in reverse polarity | Check battery charger wiring |
| | Both diodes failed | Test Procedure 4B – Both Diodes Failed on page 6-15 |

**Troubleshooting Guide continued on next page...**

## IQ PLUS ONBOARD BATTERY CHARGER TROUBLESHOOTING GUIDE

| SYMPTOM | POSSIBLE CAUSES | CORRECTIVE ACTION |
|---|---|---|
| **Charger output is low** | One diode failed | Test Procedure 4A – Single Diode Failure on page 6-14 |
| | Transformer coil short-circuit failure | Test Procedure 6 – Transformer on page 6-16 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 6-12 |
| **Charger turns off too soon** | AC power supply was shut off | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 6-13 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 6-12 |
| | Batteries may be fully charged | Test Procedure 7 – Battery State of Charge Test on page 6-18 |
| **Charger goes to 16 hour time out** | Onboard computer malfunction | Test Procedure 2 – Control Board on page 6-12 |
| | Extremely discharged batteries or cold temperature | Recharge batteries |
| | Failed or weak battery | See Batteries section in the appropriate maintenance and service manual |
| **AC line fuse blows or AC circuit breaker trips** | AC cord is shorted | Test Procedure 8 – Continuity on page 6-18 |
| | Failed transformer | Test Procedure 6 – Transformer on page 6-16 |
| | Incorrect charger wiring | Check battery charger wiring |
| **Battery warning light illuminates for ten seconds at four second intervals** | AC power interrupted | Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 6-13 |
| | Onboard computer malfunction | Test Procedure 2 – Control Board on page 6-12 |
| | Charger failure | See Testing Charger Operation on page 6-6 |
| | 16 hour time out | See Battery Warning Light on page 6-2 |
| | Battery or batteries need to be replaced | See Batteries section in the appropriate maintenance and service manual |
| | Batteries are getting close to full discharge capacity | Recharge batteries as soon as possible |

# TEST PROCEDURES

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

## INDEX OF TEST PROCEDURES



## TEST PROCEDURE 1 – BATTERY VOLTAGE

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

1. Check the wire connections between the vehicle and battery charger **(Figure 6-2, Page 6-3)**.
   1.1. Verify that the 10-gauge red wire from the battery charger is connected to the positive (+) post of battery no. 1 for Turf 2/252, Carryall 2/252 and XRT 900 vehicles, or the large post of the solenoid (battery side) for Carryall 6, Villager and TransPorter vehicles.
   1.2. Verify the connection of the 10-gauge black wire from the onboard computer to the 10-gauge black wire from the battery charger.
   1.3. Check the connection of the 18-gauge gray wire from the charger to the onboard computer gray wire.
   1.4. **Turf 2/252, Carryall 2/252 and XRT 900 Only:** Check the fuse in the 18-gauge gray wire.
2. With a multimeter set to 200 volts DC, measure the voltage of the battery pack between the positive (+) post of battery no. 1 and the negative (–) post of battery no. 8 **(Figure 6-5, Page 6-11)**. Normal no-load voltage should be between 50 and 52 volts for fully charged batteries. The voltage of the battery pack must be over 34 volts DC to allow the onboard computer to close the charger relay**.** If battery pack voltage is too low to start charger, temporarily bypass the charger relay. **See Charging a Battery Pack that has Low Voltage on page 6-31.**

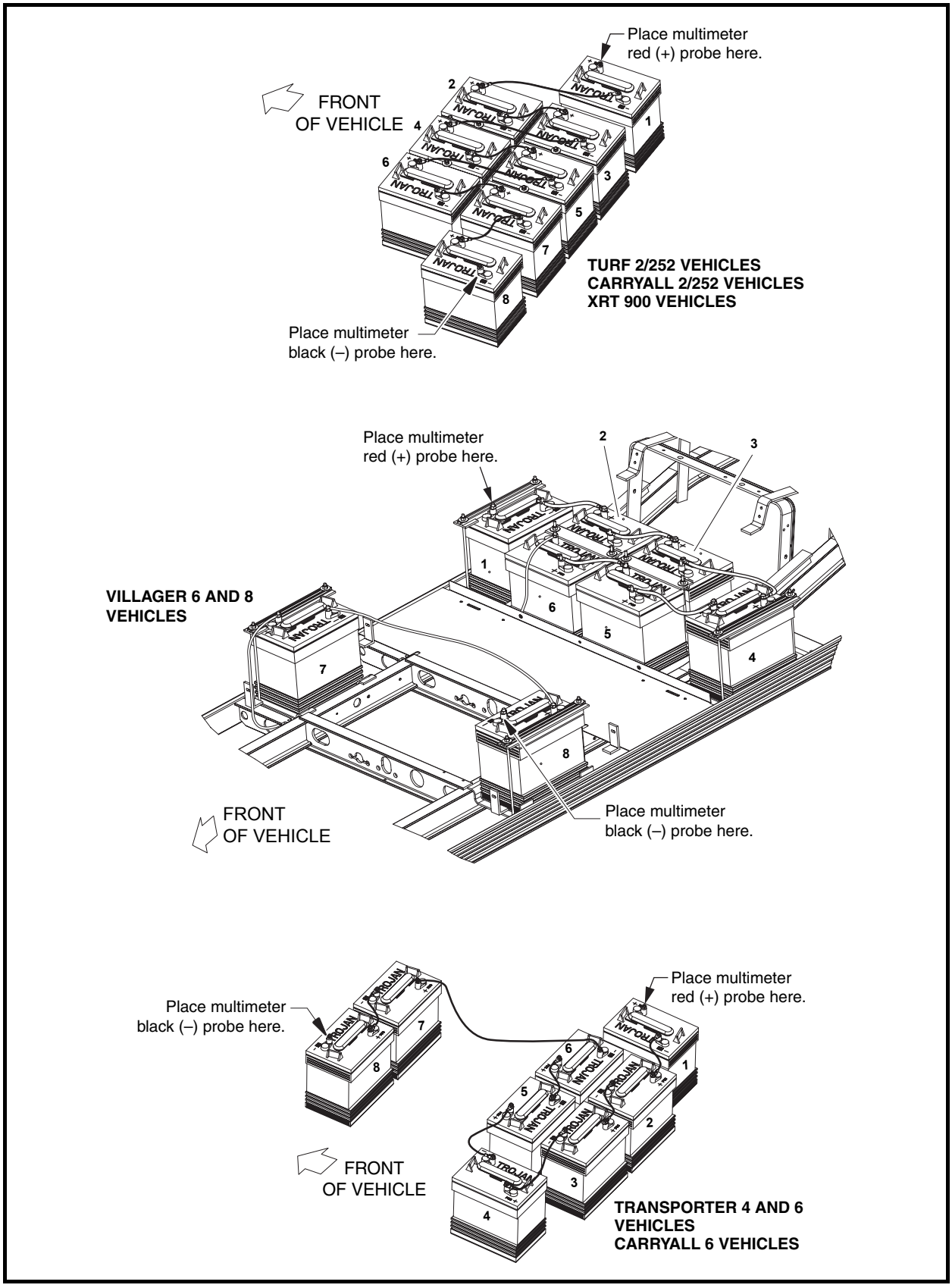


**Figure 6-5 Battery Configurations**

## TEST PROCEDURE 2 – CONTROL BOARD

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

### DC Circuit Test

1. Disconnect AC cord from outlet. DC cord red, black, and blue wires remain connected to the vehicle. All wires remain connected to the control board. Set multimeter to 200 volts DC. **See following DANGER.**

**⚠ DANGER**

- **Do not touch any wire or component in the battery charger while DC power is present. Failure to heed this warning will result in an electric shock.**

2. Place black (–) probe of multimeter on terminal with blue DC cord wire and red (+) probe to terminal with red relay wire **(Figure 6-6, Page 6-12)**.

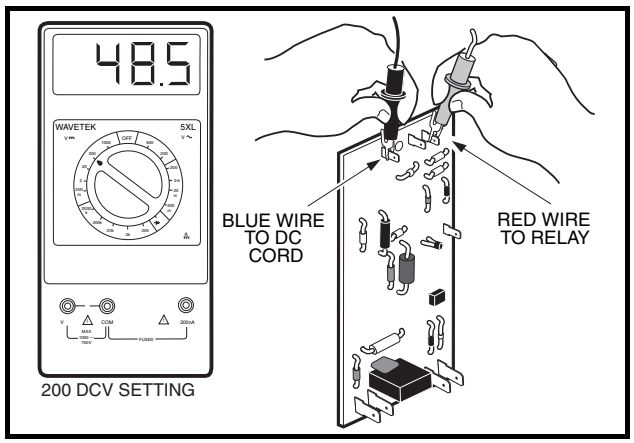


**Figure 6-6 DC Circuit Test**

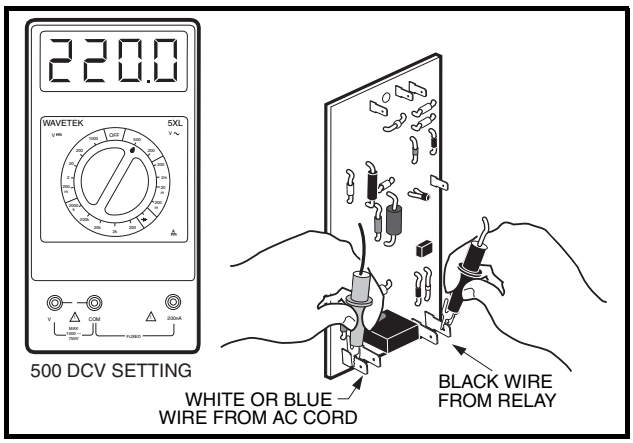


**Figure 6-7 AC Circuit Test**

3. Multimeter should indicate full battery voltage (approximately 47-50 volts). If reading is incorrect, replace control board.

### AC Circuit Test

1. Disconnect AC cord from outlet. DC cord red, black, and blue wires remain connected to vehicle. Set multimeter to volts AC.
2. Disconnect white or blue wire of AC cord at terminal on control board **(Figure 6-8, Page 6-13)**. **See following DANGER.**

**⚠ 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.**

3. Place black (–) probe of multimeter, set to 500 volts AC, onto terminal with black wire from relay. Connect red (+) probe to terminal from which the white or blue AC cord wire was disconnected **(Figure 6-7, Page 6-12)**.
4. Connect AC cord to outlet. Reading should be input voltage from outlet.
5. If reading is incorrect, replace control board.

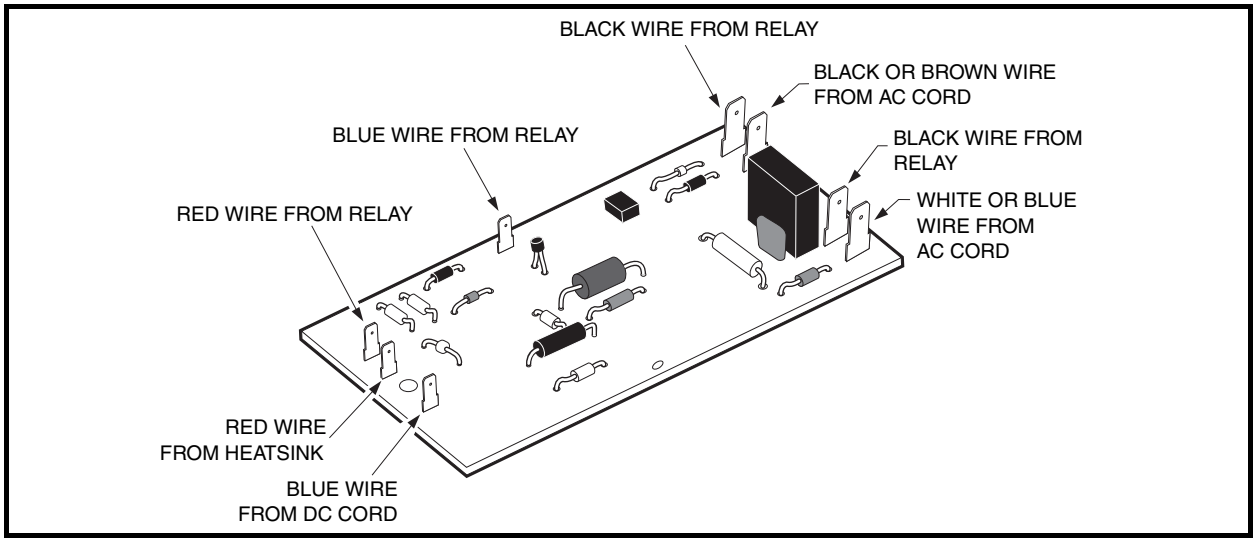


**Figure 6-8 Control Board**

## TEST PROCEDURE 3 – AC POWER AND CONTINUITY CHECK OF AC CIRCUIT

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

1. Disconnect the AC power supply cord from the wall outlet.
2. Check the AC circuit breakers on the front of the charger and reset it if necessary.
3. Check the AC line fuse or circuit breaker in the storage facility.
4. With a multimeter set to 500 volts AC, check incoming AC voltage. Insert multimeter test probes into AC wall outlet; voltage should be within the range specified in the following chart. If proper voltage is not present and the voltage selector switch is set for the correct voltage for your area, have building wiring checked by a licensed electrical contractor.

| SETTING ON AC VOLTAGE SELECTOR SWITCH | MINIMUM AC VOLTAGE PERMITTED | MAXIMUM AC VOLTAGE PERMITTED |
|---|---|---|
| 100 Volts AC | 95 | 105 |
| 200 Volts AC | 190 | 210 |
| 220 Volts AC | 209 | 231 |
| 240 Volts AC | 228 | 252 |

5. Check continuity of the AC circuit.
   5.1. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
   5.2. Remove the charger cover.
   5.3. Bypass the relay. **See Charging a Battery Pack that has Low Voltage on page 6-31.**
   5.4. With relay bypassed, there should be continuity across the AC cord blades **(Figure 6-9, Page 6-14)**.
6. If the circuit is not complete, check the wiring of the AC cord, AC cord reel, transformer primary coil wires (21), internal AC circuit breakers (13), and voltage selector switch (9) **(Figure 6-4, Page 6-6)**.
7. If the charger is wired correctly, check the continuity of the AC cord, AC cord reel, transformer primary coil, and the internal AC circuit breaker individually. **See Test Procedure 8 – Continuity on page 6-18.**

8. When troubleshooting and repairs are complete, properly connect the relay wiring. **See following WARNING.**

**⚠ WARNING**

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

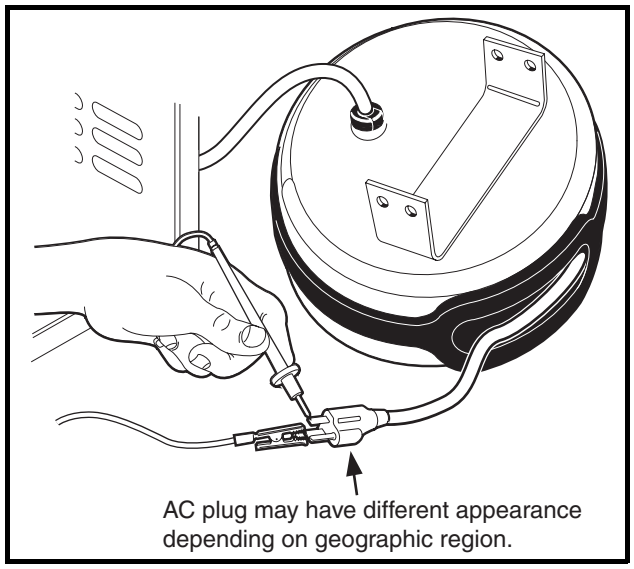


**Figure 6-9 AC Circuit Continuity Test**

## TEST PROCEDURE 4 – DIODES

Use Test Procedure 4A – Single Diode Failure on page 6-14 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 6-15.

### Test Procedure 4A – Single Diode Failure

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

A single diode failure is indicated by the failure of one fuse link (closed circuit diode) or by the charger output being low (open circuit diode). If a diode has failed, the entire heatsink must be replaced. To check diodes:

1. Disconnect AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
3. Remove the charger cover.
4. Disconnect one transformer secondary coil wire from the diode terminal **(Figure 6-10, Page 6-15)**.
5. Using a low voltage continuity tester or multimeter set to the diode test function, connect the red (+) test probe to the diode mounting plate and the black (–) test probe to a diode terminal and note the reading **(Figure 6-10, Page 6-15)**.
6. Reverse test probes and check each diode again and note the reading **(Figure 6-11, Page 6-15)**. A diode is designed to conduct current in one direction only. If a diode conducts current (shows continuity) in both directions, the entire heatsink with diodes must be replaced. If a diode does not conduct current (does not show continuity) in either direction, the entire heatsink must be replaced.

7. On rare occasions, a single fuse link may blow due to excessive heat. This can be caused by a loose internal fuse connection. Check all three fuse connections inside the charger to be sure they are clean and tight. The proper tightness for the fuse link connections is 22 in-lb (2.5 N·m).
8. Ensure that the charger is wired properly and all connections are clean and tight. **See following CAUTION.**

## CAUTION

- **If connections are not clean and tight, excessive heat will be created and the charger may become damaged.**

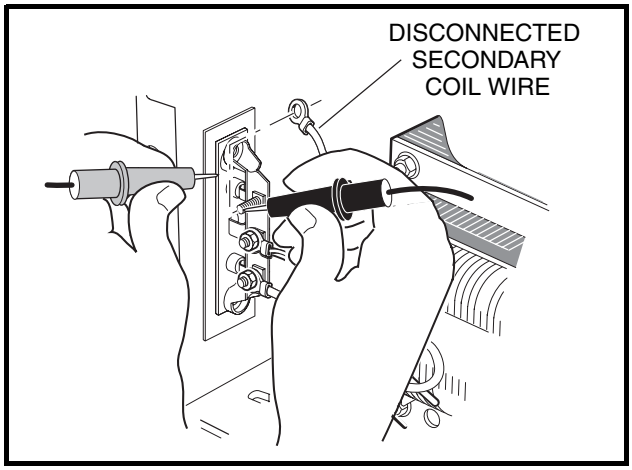


**Figure 6-10 Diode Test**

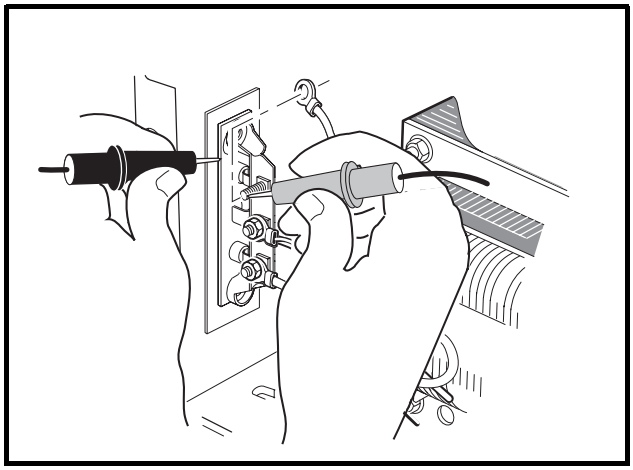

**Figure 6-11 Diode Test – Probes Reversed**

## Test Procedure 4B – Both Diodes Failed

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

To check the diodes, use Test Procedure 4A – Single Diode Failure on page 6-14. If both diodes have failed closed, both charger fuse links will be blown. If both diodes have failed open, the relay will close and the transformer will hum, but the ammeter will not indicate any output and the AC circuit breaker may trip off. If both diodes have failed open or closed, the entire heatsink must be replaced. To determine why both diodes failed:

1. Check the batteries and the receptacle to ensure that they are wired in the correct polarity. **(Figure 6-2, Page 6-3)**.
2. Make sure the charger is wired correctly: The DC cord red wire should be connected to the center terminal of the heatsink, the DC cord blue wire should be connected to the control board, and the DC cord black wire should be connected to the left side of the ammeter (when viewed from inside the charger) **(Figure 6-4, Page 6-6)**. If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is connected to the vehicle, whether or not the AC cord is plugged into an outlet.
3. Make sure the charger is wired to the vehicle correctly; the DC cord red wire should be connected to the same large solenoid post as the 6-gauge red wire connected to the positive (+) post of battery no. 1. The DC cord blue wire should be connected to the sense lead fuse. The DC cord black wire should be connected to the terminal block located on the vehicle component mounting plate **(Figure 6-2, Page 6-3)**. If a reverse polarity connection is made between the charger and the batteries, both fuse links will blow when the DC cord is connected to the vehicle, whether or not the AC cord is plugged into an outlet.
4. On rare occasions, both diodes may fail as a result of a lightning strike at the charging location.

5. Excessive heat due to a loose connection may also cause both fuse links to blow. Be sure fuse connections are tightened to 22 in-lb (2.5 N·m).
6. Ensure that the charger and vehicle are wired properly and all connections are clean and tight.

## TEST PROCEDURE 5 – CHARGER DC CIRCUIT CONTINUITY TEST

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

1. Disconnect the AC cord from the wall outlet.
2. Disconnect the batteries as instructed. **See General Warning, Section 1, Page 1-1.**
3. Disconnect the charger DC cord at the three pin connector (8) **(Figure 6-23, Page 6-35)**.
4. Using a continuity tester (CCI P/N 1011273) or multimeter set to 200 ohms, connect the test probes to the charger DC cord black wire and red wire terminals in the three pin connector. Note the reading.
5. Reverse the test probes and check the DC cord again. The circuit should show continuity in only one direction.
6. If the circuit does not show continuity in either direction and the charger fuse is not blown, individually check all connections and the continuity of the DC cord and ammeter. **See Test Procedure 8 – Continuity on page 6-18.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 6-14.**
7. If the circuit shows continuity in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes. **See Test Procedure 4 – Diodes on page 6-14.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 6-18.**
8. Check continuity between the DC cord red, black, and blue wires **(Figure 6-4, Page 6-6)**. There should be no continuity.

## TEST PROCEDURE 6 – TRANSFORMER

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

Failure of the transformer may be caused by aging or a short circuit in adjacent coil turns. If the transformer has failed, the ammeter will indicate low output or no output; however, the transformer may hum. A blown AC line fuse or tripped AC circuit breaker in the charger or the storage facility may be caused by an improperly wired charger, an improper setting of the AC voltage selector switch, or a failed transformer.

An AC circuit test should be done before performing this test procedure to ensure the continuity of the AC cord, AC cord reel, internal AC circuit breakers, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 6-13.**

1. Disconnect AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
3. Remove the charger cover.
4. Disconnect transformer secondary coil wires from the heatsink **(Figure 6-12, Page 6-17)**.
5. To apply AC power directly to the transformer primary coil, bypass the relay. **See Charging a Battery Pack that has Low Voltage on page 6-31. See following DANGER.**

### ⚠ 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.**

6. Make sure that the voltage selector switch (on the back of the charger) is set for the appropriate incoming AC voltage. Also ensure that the secondary coil wires are not touching one another. With the relay bypassed, insert the AC plug into an outlet. If the AC line fuse blows or AC circuit breaker trips, the transformer is shorted internally and must be replaced.
7. If the AC line fuse does not blow or the AC circuit breaker does not trip, check the transformer secondary coil voltage.
8. Disconnect AC cord from the wall outlet.
9. Using alligator clips and a multimeter set to 500 volts AC, connect the multimeter probes to the secondary transformer coil tan wires.

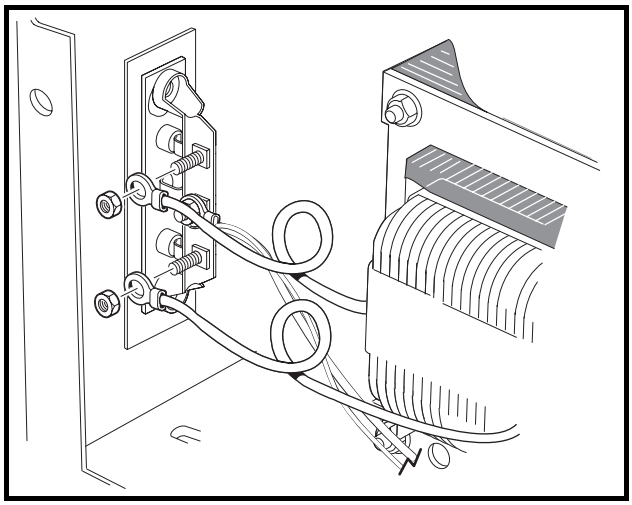

**Figure 6-12 Remove Secondary Coil Wires From Heatsink**

10. Connect the AC cord to the wall outlet and monitor the multimeter for the secondary coil voltage. If measured voltage is approximately 85 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced.
11. If the voltage reading is normal (86 volts AC or higher), the transformer is operational. Disconnect the AC plug from the wall receptacle and check the continuity of the DC circuit. **See Test Procedure 5 – Charger DC Circuit Continuity Test on page 6-16.**
12. When troubleshooting and repairs are complete, remove jumper wire and properly connect relay wiring. **See following WARNING.**

## ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

## TEST PROCEDURE 7 – BATTERY STATE OF CHARGE TEST

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

1. With the batteries fully charged, disconnect the AC charger plug for approximately 20 seconds and reconnect it. The ammeter should jump to a reading between 14 and 18 amps and taper to below 5 amps within 15 minutes.
2. If the charger does not taper to below 5 amps within 15 minutes, batteries may not be receiving a full charge and the onboard computer should be checked. **See Test Procedure 2 – Control Board on page 6-12. See following NOTE.**

***NOTE:*** *Batteries near the end of their useful lives may not allow the battery charge current to taper below 5 amps.* ***See Batteries section in the appropriate maintenance and service manual.***

## TEST PROCEDURE 8 – CONTINUITY

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

### Short AC Cord and Retractable Cord Reel

Check continuity of the short AC cord and retractable cord reel at the same time.

1. Disconnect the AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
3. Remove the charger cover.
4. Disconnect the green or green/yellow wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 6-13, Page 6-19)**.
5. Disconnect the black or brown wire (1) of the short AC cord from the control board.
6. Disconnect the AC cord white or blue wire (4) from the control board **(Figure 6-13, Page 6-19)**.
7. Using a multimeter set for 200 ohms, place the red (+) probe on the terminal at the end of the black or brown wire (1) **(Figure 6-13, Page 6-19)**. With the black (-) probe, test for continuity on each of the flat blades and then on the round pin of the AC plug (on the retractable cord reel). The tester should indicate continuity on one flat blade only. If any other reading is obtained, the short AC cord and retractable cord reel must be tested independently of each other.
8. Place the red (+) probe on the end of the green or green/yellow wire (2) and with the black probe check for continuity on both flat blades and on the round pin of the AC plug (on the retractable cord reel) **(Figure 6-13, Page 6-19)**. The tester should indicate continuity on only the round pin. If any other reading is obtained, the short AC cord and retractable cord reel must be tested independently of each other.
9. Place the red (+) probe on the white or blue wire (4) and check for continuity on both flat blades and on the ground pin of the AC plug (on the retractable cord reel). The tester should indicate continuity on only one flat blade. If any other reading is obtained, the short AC cord and retractable cord reel must be tested independently of each other.
10. If the correct readings are obtained in all of the previous steps, the short AC cord and the retractable cord reel are functioning properly. If any of the readings are incorrect, proceed to the following test procedures to determine which of the two components has failed.

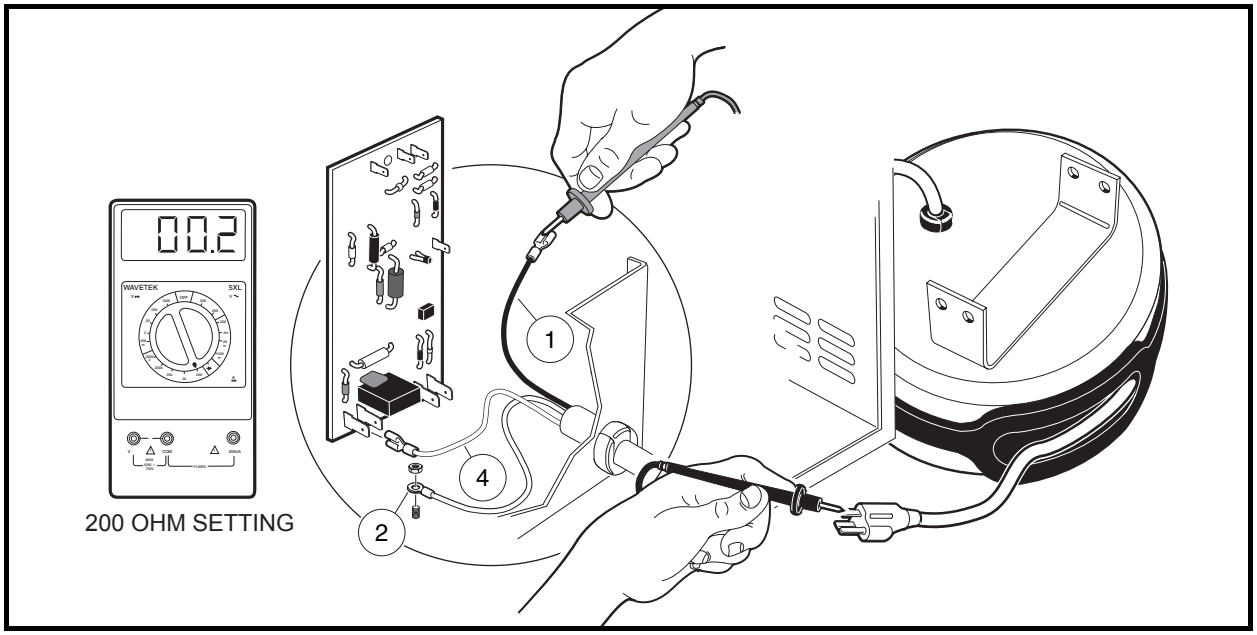


**Figure 6-13 AC Cord and Retractable Cord Reel Continuity Test**

## Short AC Cord without Retractable Cord Reel

Check continuity of the short AC cord without the retractable cord reel.

1. Disconnect the AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
3. Remove the heatshrink from the AC cord connection between the short AC cord and the retractable cord reel by gently cutting the heatshrink tubing **(Figure 6-14, Page 6-19)**.

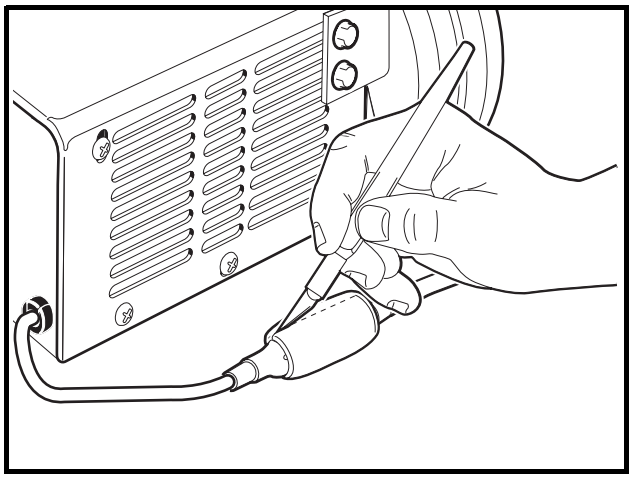

**Figure 6-14 Heatshrink Removal**

4. Disconnect the short AC cord from the retractable cord reel.
5. Remove the charger cover.
6. Disconnect the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 6-15, Page 6-20)**.

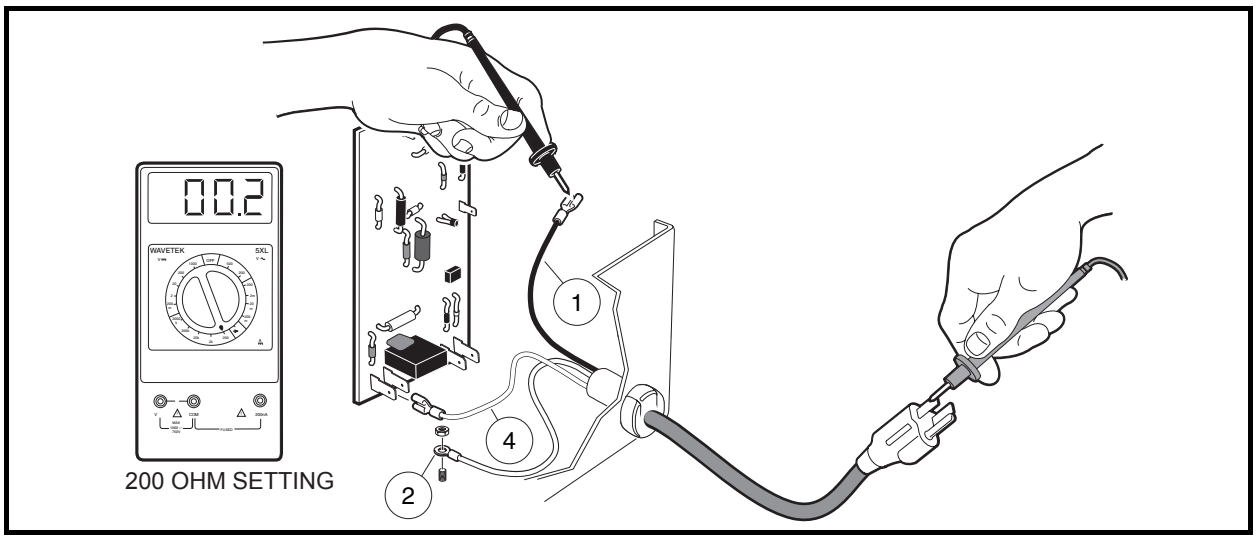


**Figure 6-15 Short AC Cord Test**

7. Disconnect the black wire (1) of AC cord from the control board.
8. Using a multimeter set for 200 ohms, place the red (+) probe on the terminal at the end of the black wire (1). Test for continuity on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the short AC cord must be replaced.
9. Place the red (+) probe on the end of the green wire (2) and with the black probe check for continuity on both flat blades and on the round pin of the AC plug. The tester should indicate continuity on only the round pin. If any other reading is obtained, the AC cord and retractable cord reel must be tested independently of each other.
10. Disconnect the AC cord white wire (4) from the control board. Place the red (+) probe on the white wire (4) and check for continuity on both flat blades and on the ground pin of the AC plug. The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord and retractable cord reel must be tested independently of each other.
11. If the correct readings are obtained in all of the previous steps, the short AC cord is functioning properly. Proceed to the following test procedure to test the retractable cord reel.

## Retractable Cord Reel

Check continuity of the AC cord and retractable cord reel at the same time.

1. Disconnect the AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
3. Remove the heatshrink from the AC cord connection between the short AC cord and the retractable cord reel by gently cutting the heatshrink tubing **(Figure 6-14, Page 6-19)**.
4. Disconnect the short AC cord from the retractable cord reel.
5. Using a multimeter set for 200 ohms, place the red (+) probe in one of the flat blade openings of the cord reel receptacle (1) **(Figure 6-16, Page 6-21)**. Test for continuity at the cord reel AC plug (2) on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the cord reel must be replaced.

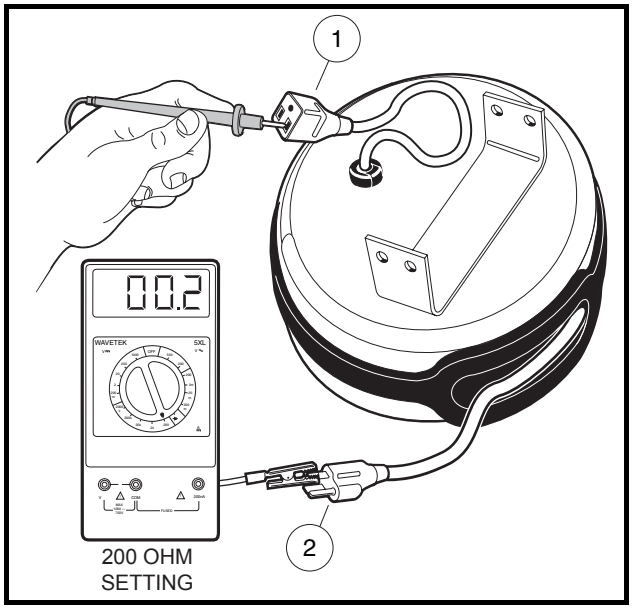


**Figure 6-16 Retractable Cord Reel Test**

6. Place the red (+) probe into the other flat blade opening of the cord reel receptacle (1). Test for continuity on the cord reel AC plug (2) on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on one flat blade only. If any other reading is obtained, the cord reel must be replaced.
7. Place the red (+) probe into the top-center opening of the cord reel receptacle (1). Test for continuity on the cord reel AC plug (2) on each of the flat blades and then on the round pin of the AC plug. The tester should indicate continuity on only the round pin. If any other reading is obtained, the retractable cord reel must be replaced.
8. If the correct readings are obtained in all of the previous steps, the retractable cord reel is functioning properly.

## DC Cord

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
2. Remove the charger cover.
3. To check the continuity of the DC cord, disconnect the black wire of the DC cord from the ammeter **(Figure 6-17, Page 6-24).**
4. Disconnect the red wire of the DC cord from the heatsink.
5. Disconnect the blue wire from the control board.
6. Using a multimeter set for 200 ohms, place the red (+) probe on the red wire of the DC cord. Test for continuity on each of the wires on the other end of the DC cord. The tester should indicate continuity on the red DC cord wire only. If any other reading is obtained, the DC cord must be replaced.
7. Place the red (+) probe on the blue wire of the DC cord. Test for continuity on each of the wires on the other end of the DC cord. The tester should indicate continuity on the blue DC cord wire only. If any other reading is obtained, the DC cord must be replaced.
8. Place the red (+) probe on the black wire of the DC cord. Test for continuity on each of the wires on the other end of the DC cord. The tester should indicate continuity on the black DC cord wire only. If any other reading is obtained, the DC cord must be replaced.

## Transformer

The IQ Plus battery charger transformer has two sets of coils: a primary coil and a secondary coil.

**Primary Coil**

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
2. Remove the charger cover.
3. Disconnect the black wires marked 1 and 6 from the AC circuit breakers.
4. Disconnect the wires marked 2, 3, 4 and 5 from the voltage selector switch.
5. Place the continuity tester probes on the primary coil transformer wires disconnected above in pairs until all of the combinations in the following chart have been tested.
6. If the continuity readings agree with the chart, replace the voltage selector switch. If the continuity readings differ from the chart, replace the transformer.

| PRIMARY COIL CONTINUITY / NO CONTINUITY CHART | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | NEGATIVE PROBE | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| POSITIVE PROBE | 1 | | Continuity | Continuity | No Continuity | No Continuity | No Continuity |
| | 2 | Continuity | | Continuity | No Continuity | No Continuity | No Continuity |
| | 3 | Continuity | Continuity | | No Continuity | No Continuity | No Continuity |
| | 4 | No Continuity | No Continuity | No Continuity | | Continuity | Continuity |
| | 5 | No Continuity | No Continuity | No Continuity | Continuity | | Continuity |
| | 6 | No Continuity | No Continuity | No Continuity | Continuity | Continuity | |

**Secondary Coil**

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
2. Remove the charger cover.
3. Remove the transformer (tan) secondary coil wire from the upper terminal of the heatsink **(Figure 6-12, Page 6-17)**.
4. Remove the other transformer (tan) secondary coil wire from the bottom terminal of the heatsink and place the continuity test clip on the ammeter buss bar (3) **(Figure 6-18, Page 6-24)**. Test for continuity between the buss bar and each of the secondary coil wires (tan). The tester should indicate continuity between the buss bar and both of the secondary coil wires. If tester does not indicate continuity on both secondary coil wires, replace transformer. Ensure that the fuse is intact and not blown.

## Relay

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
2. Remove the charger cover.
3. Remove the black wire from terminal 6 of the relay and black wire from terminal 9 of the relay **(Figure 6-20, Page 6-29)**. Place continuity tester leads on terminals 6 and 9 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.
4. Remove the black wire from terminal 4 of the relay and black wire from terminal 7 of the relay **(Figure 6-20, Page 6-29)**. Place continuity tester leads on terminals 4 and 7 of the relay. The tester should indicate no continuity. If tester indicates continuity, the relay contacts have failed closed and the relay must be replaced.
5. Connect charger DC cord to batteries **(Figure 6-5, Page 6-11)**. Use jumper wires if necessary. The tester should indicate continuity on relay terminals 6 and 9 and terminals 4 and 7. If tester does not indicate continuity on both sets of contacts, the relay must be replaced.

## Ammeter

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
2. Remove the charger cover.
3. Disconnect the black wire from the left ammeter post (as viewed from inside the charger).
4. Place the continuity tester clip on one of the ammeter posts.
5. Place the continuity test probe on the other ammeter post. The tester should indicate continuity. If the tester does not indicate continuity, replace the ammeter.

## AC Circuit Breaker

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
2. Remove the charger cover.
3. Disconnect the wires from the AC circuit breaker.
4. Place the continuity test probes on the two terminals of the AC circuit breaker. The tester should indicate continuity. If the tester does not indicate continuity, replace the AC circuit breaker.

# CHARGER REPAIRS

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

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 6-4, Page 6-6).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 6-34.**

## DC CORD

## DC Cord Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34.**
2. Remove the charger cover.
3. Remove the DC cord black wire (4) from the ammeter by loosening the nut (1). Support the terminal as the nut is loosened to prevent rotation of the connection **(Figure 6-18, Page 6-24)**.
4. Remove nut attaching the red wire (6) of the charger DC cord to the heatsink.
5. Remove the wire tie that secures the DC cord wire to the secondary coil wire (tan).
6. Remove the wire tie on the DC cord near the strain relief bushing.
7. Disconnect the DC cord blue wire from the control board **(Figure 6-17, Page 6-24)**.
8. Using pliers, squeeze the strain relief bushing and remove the DC cord **(Figure 6-17, Page 6-24)**.

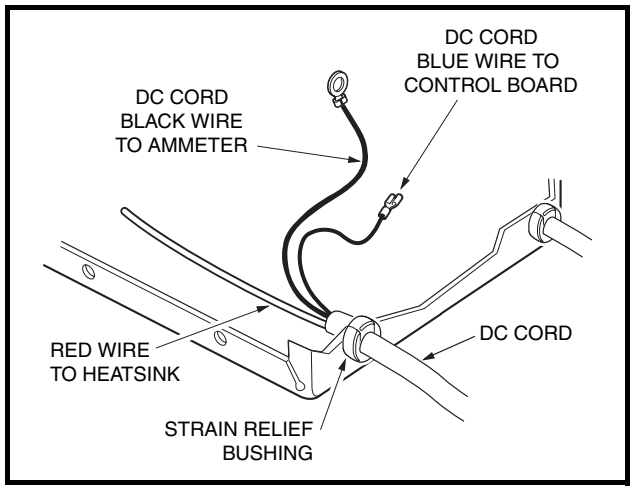


**Figure 6-17 DC Cord**

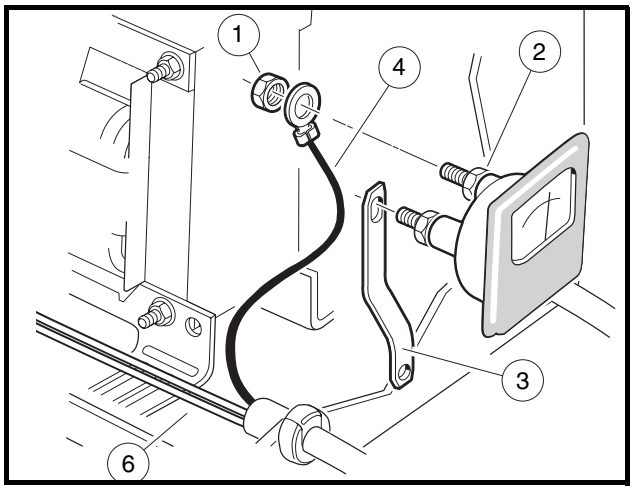


**Figure 6-18 DC Cord Replacement**

## DC Cord Installation

1. Insert the leads of the new DC cord through the hole in the charger base.

2. Attach the red wire of the new DC cord to the center terminal of the heatsink and tighten the nut to 18 in-lb (2.0 N·m) **(Figure 6-17, Page 6-24)**.
3. Attach the blue wire of the new DC cord to the control board **(Figure 6-17, Page 6-24)**.
4. Attach black wire of the new DC cord to ammeter. Install nut (1) onto post of ammeter slightly more than finger tight. While holding the inside nut (2), tighten the outside nut (1) 1/4 turn **(Figure 6-18, Page 6-24)**. **See following CAUTION.**

**CAUTION**

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
6. Tie the wires together as they were before the wire ties were removed. **See following WARNING.**

**⚠ WARNING**

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

7. Position the charger cover on the base. Install the mounting screws, starting with the bottom holes. Tighten the screws to 11 in-lb (1.2 N·m).

## HEATSINK

### Heatsink Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See preceding WARNING.**
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 6-12, Page 6-17)**.
4. Remove the two red wires from the heatsink.
5. Remove the nuts and bolts that secure the heatsink to the case.

### Heatsink Installation

1. Place heatsink against charger base. Make sure clear plastic insulator sheet is between the heatsink and the charger base. Install the nuts and bolts that secure the heatsink to the case. Tighten the bolts to 22 in-lb (2.5 N·m).
2. Connect the red wire from the DC cord and the red wire from the control board to the center terminal post on the heatsink. Tighten nut to 18 in-lb (2.0 N·m) **(Figure 6-4, Page 6-6)**.
3. Connect one of the secondary coil transformer wires (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m) **(Figure 6-12, Page 6-17)**.
4. Connect the other secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 6-34.**
6. Check charger for proper operation.

## TRANSFORMER

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

### Transformer Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
2. Remove the charger cover.
3. Note the locations of wire ties and remove the wire ties.
4. Disconnect the black primary coil leads from the AC circuit breakers and the voltage selector switch **(Figure 6-20, Page 6-29 and Figure 6-22, Page 6-33)**.
5. Disconnect the two tan secondary coil transformer wires from heatsink **(Figure 6-12, Page 6-17)**.
6. Disconnect the two black secondary coil transformer wires from the fuse.
7. Remove the four bolts and nuts that mount the transformer to the case and remove the transformer.

### Transformer Installation

1. Install the transformer with secondary coil to the rear of the charger case. Tighten the four bolts and nuts to 28 in-lb (3.2 N·m).
2. Connect one secondary coil transformer wire (black) to one terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m) **(Figure 6-4, Page 6-6)**.
3. Connect the other secondary coil transformer wire (black) to the remaining terminal of the fuse. Tighten nut to 22 in-lb (2.5 N·m).
4. Connect one secondary coil transformer wire (tan) to the top terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
5. Connect the other secondary coil transformer wire (tan) to the bottom terminal post of the heatsink. Tighten nut to 18 in-lb (2.0 N·m).
6. Connect the black primary coil transformer wire marked 1 to the top terminal of the top AC circuit breaker.
7. Connect the black primary coil transformer wire marked 6 to the top terminal of the bottom AC circuit breaker.
8. Connect each of the remaining black primary coil transformer wires marked 2, 3, 4, and 5 to the corresponding terminals marked on the voltage selector switch.
9. Set the voltage selector switch to the appropriate voltage matching the incoming AC electrical service that will be used to power the charger.
10. Tie the wires together as they were before the wire tie was removed. **See following WARNING.**

**⚠ WARNING**

- **Make sure wiring is properly routed and secured. Failure to properly route and secure wiring could result in charger malfunction, property damage, or severe personal injury.**

11. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 6-34.**
12. Check charger for proper operation.

## AMMETER

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

### Ammeter Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
2. Remove the charger cover.
3. Using two wrenches to prevent the posts from turning, disconnect the DC cord black wire (5) and the buss bar (3) from the ammeter **(Figure 6-19, Page 6-27)**.
4. Remove the two nuts (2) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

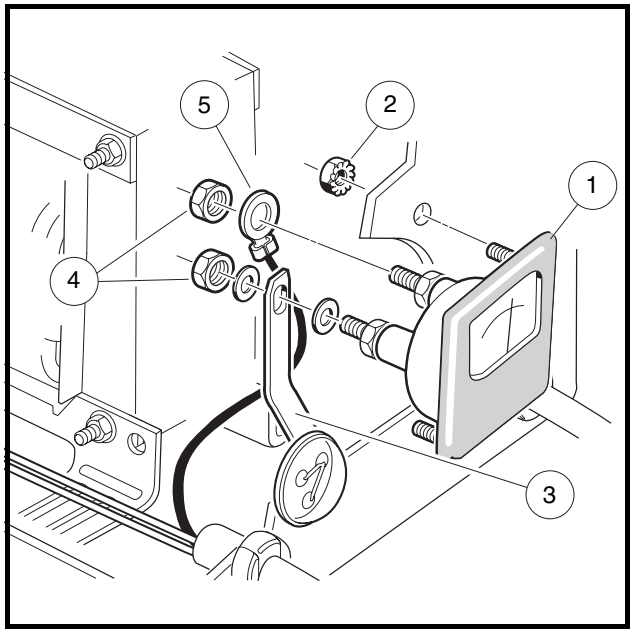


**Figure 6-19 Ammeter**

### Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 6-19, Page 6-27)**.
2. Install nuts (2) and tighten until ammeter is firmly secured.
3. Connect the DC cord black wire (5) to the left (as viewed from inside the charger) post of the ammeter.
4. Connect the buss bar (3) from the fuse link to the right post of the ammeter. Place flat washers on both sides of the buss bar.
5. Thread nuts (4) onto both posts of ammeter until just past finger tight. While holding the inside nut, tighten the outside nut (4) 1/4 turn. **See following CAUTION.**

**CAUTION**

- **Do not allow ammeter post to rotate as the nut is tightened. Rotation of the post could result in a damaged ammeter.**

6. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 6-34.**
7. Check charger for proper operation.

## FUSE LINK

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

### Fuse Link Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
2. Remove the charger cover.
3. Remove both black secondary coil transformer wires and the buss bar (3) from the back of the fuse link assembly **(Figure 6-19, Page 6-27)**.
4. Remove screws from the front of the charger and remove the fuse link assembly.

### Fuse Link Installation

1. Place clear plastic cover over fuse assembly and install mounting screws from front of charger face. The center branch of the fuse assembly should be in the upper left corner when viewed from the front of the charger.
2. Install the buss bar (3) over the center branch of the fuse assembly and ammeter post **(Figure 6-19, Page 6-27)**. Tighten to 22 in-lb (2.5 N·m).
3. Install a secondary coil transformer wire (black) onto one of the two remaining terminals on the back of the fuse assembly. Install the remaining secondary coil transformer wire (black) onto the remaining terminal. Tighten to 22 in-lb (2.5 N·m).
4. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 6-34.**
5. Check charger for proper operation.

## CHARGER RELAY

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

### Charger Relay Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 6-20, Page 6-29)**.
4. Remove the two screws and nuts attaching relay to mounting bracket.
5. Remove the relay.

### Charger Relay Installation

Install in reverse order of removal. Connect wires as shown **(Figure 6-20, Page 6-29)**. Tighten nuts securing relay to mounting bracket to 18 in-lb (2.0 N·m).

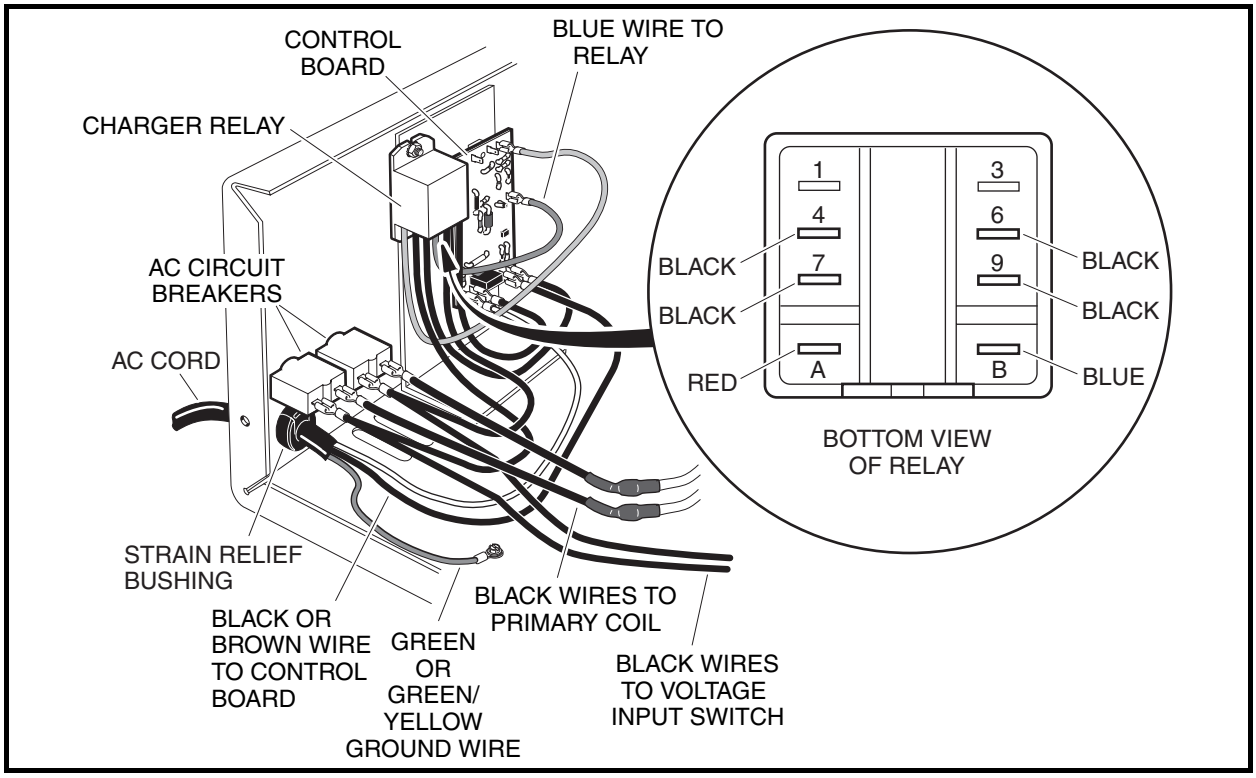


**Figure 6-20 Charger Relay**

## CHARGER AC CIRCUIT BREAKER

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

### AC Circuit Breaker Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
2. Remove the charger cover.
3. Disconnect the two black wires attached to top circuit breaker **(Figure 6-20, Page 6-29)**.
4. Disconnect the two black wires attached to bottom circuit breaker.
5. With a pair of pliers, squeeze in the retaining tabs on the sides of the top AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.
6. Repeat step 5 for the removal of the bottom circuit breaker.

### AC Circuit Breaker Installation

Install in reverse order of removal.

## CHARGER AC CORD AND RETRACTABLE CORD REEL

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

### Short AC Cord Removal

1. Disconnect the DC cord, the AC cord from the wall outlet, and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**

2. Remove the charger cover.
3. Disconnect the AC cord black wire from the AC circuit breaker **(Figure 6-20, Page 6-29)**.
4. Disconnect the AC cord white wire from the control board.
5. Disconnect the AC cord green wire from the charger base **(Figure 6-20, Page 6-29)**.
6. Use a pair of pliers to grip the strain relief bushing and remove it and the AC cord from the charger.

## Short AC Cord Installation

1. Insert the black, white, and green leads of the new AC cord into the charger through the hole in the charger face **(Figure 6-20, Page 6-29)**.
2. Connect the black wire and white wire to the control board **(Figure 6-4, Page 6-6)**. Connect the green wire to the charger base. Tighten the screw on the green (ground) wire terminal to 18 in-lb (2.0 N·m).
3. Position the strain relief bushing on the AC cord.
4. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
5. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 6-34.**
6. Check charger for proper operation.

## Retractable AC Cord Reel Removal

1. Disconnect retractable AC cord from AC outlet. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
2. Remove the heatshrink from the AC cord connection between the short AC cord and the retractable cord reel by gently cutting the heatshrink tubing **(Figure 6-14, Page 6-19)**.
3. Disconnect the short AC cord from the retractable cord reel.
4. **Carryall 2/252, Turf 2/252, XRT 900, Carryall 6 and Transporter 4 and 6:** Remove four screws (1) securing the cord reel housing (2), and its backing plate (3), to vehicle **(Figure 6-21, Page 6-31)**.
5. Remove hardware securing U-shaped bracket (4) of retractable cord reel assembly (5).
   5.1. **Villager 6 and 8:** Remove four screws (6) securing U-shaped bracket to charger.
   5.2. **Carryall 2/252, Turf 2/252, XRT 900, Carryall 6 and Transporter 4 and 6:** Remove four bolts (7) and locknuts (8) securing U-shaped bracket to vehicle (9).
6. Lift retractable cord reel assembly from vehicle.

## Retractable AC Cord Reel Installation

1. Install in reverse order of removal.
2. Install and tighten U-shaped bracket hardware securing retractable cord reel assembly.
   2.1. **Villager 6 and 8:** Tighten four screws (6) to 13 in-lb (1.5 N·m).
   2.2. **Carryall 2/252, Turf 2/252, XRT 900, Carryall 6 and Transporter 4 and 6:** Tighten four bolts (7) and locknuts (8) to 65 in-lb (7.3 N·m).
3. **Carryall 2/252, Turf 2/252, XRT 900, Carryall 6 and Transporter 4 and 6:** Tighten four screws (1), securing the cord reel housing (2), and its backing plate (3), to 16 in-lb (1.8 N·m).
4. Place new heatshrink tubing over the short AC cord and connect the short AC cord to the retractable cord reel. Slide the tubing over the connection and carefully apply heat to shrink it.

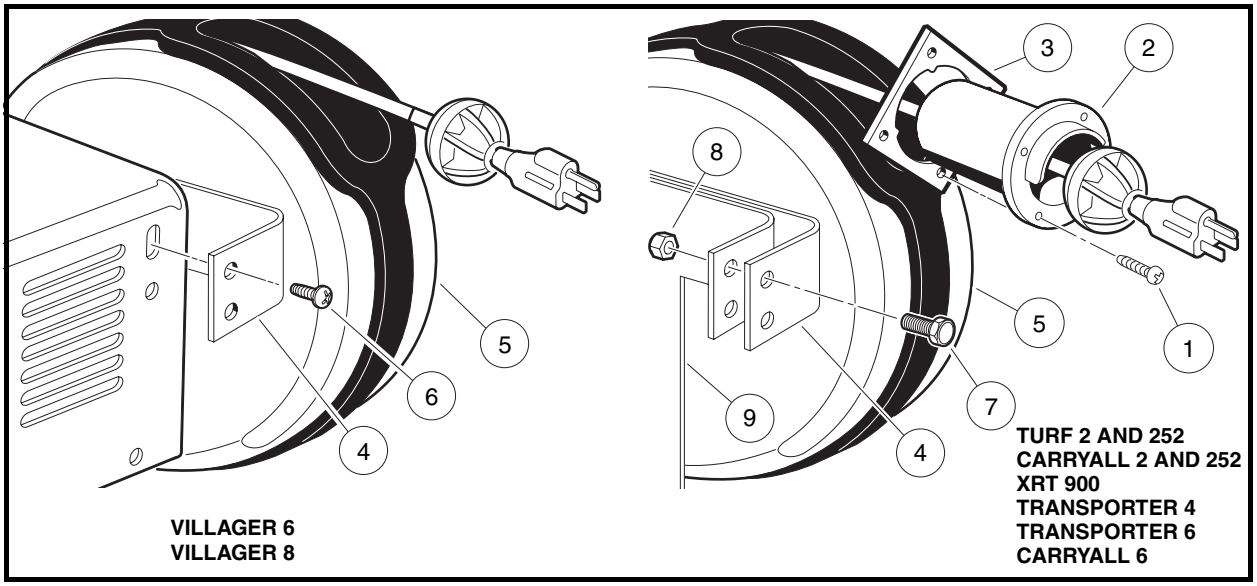


**Figure 6-21 Retractable Cord Reel Mounting Details**

## CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

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

**⚠ WARNING**

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 6-4, Page 6-6).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 6-34.**

If battery pack voltage is below 34 volts, the charger will not activate. The charger relay will have to be bypassed to activate the charger.

1. Turn key switch OFF and place the Forward/Reverse switch in the NEUTRAL position.
2. Disconnect the AC and DC cords and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
3. Remove the charger cover.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   - 4.1. To bypass the relay, locate the black wire that goes from the circuit breaker to terminal 9 on the relay. Disconnect the black wire from the relay terminal **(Figure 6-22, Page 6-33)**.
   - 4.2. Disconnect the black wire from relay terminal 6.
   - 4.3. Use a jumper wire with alligator clips to connect the black wire from relay terminal 9 to the black wire from relay terminal 6 **(Figure 6-22, Page 6-33)**.
   - 4.4. Disconnect the black wire from relay terminal 7.
   - 4.5. Disconnect the black wire from relay terminal 4.
   - 4.6. Use a jumper wire with alligator clips to connect the black wire from relay terminal 7 to the black wire from relay terminal 4 **(Figure 6-22, Page 6-33)**. **See following DANGER.**

### ⚠ 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.**

5. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 6-34.**
6. Plug the AC cord into an electrical outlet.
7. The charger should activate and begin to charge the batteries. Allow the charger to operate for one or two hours. **See following WARNING.**

### ⚠ WARNING

- **Do not leave the vehicle unattended while it is charging. A charger operating with a bypassed relay could short circuit and possibly cause a fire.**

8. After one or two hours, disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 6-34. See WARNING on page 6-24.**
9. Disconnect the jumper wires from the relay wires and connect each wire to the original terminal on the relay **(Figure 6-22, Page 6-33)**. **See following WARNING.**

### ⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to remove the jumper wire and properly connect the relay wiring could result in property damage, severe personal injury, or death.**

10. Install charger cover and install charger in vehicle. **See Onboard Charger Installation on page 6-34.**
11. Plug the AC cord into an electrical outlet.
12. Allow the charger to continue charging the batteries until the charger shuts off automatically.
13. When the charge cycle is complete, test the batteries again. If the battery pack voltage is above 34 volts and the vehicle will not operate, it will be necessary to troubleshoot the vehicle's electrical system to determine which electrical component has failed. **See Section 11 – Electrical System and Testing in the appropriate maintenance and service manual.**

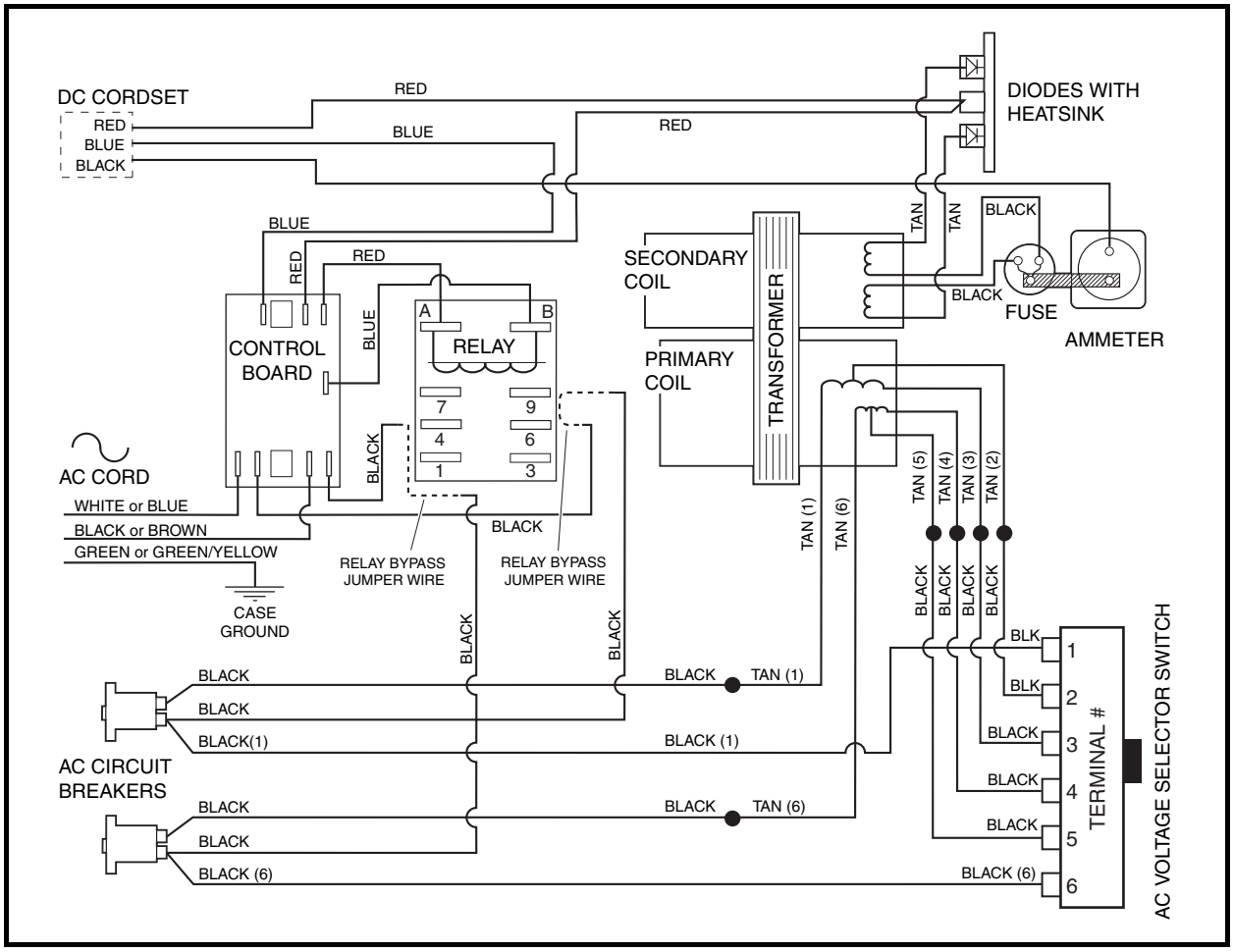


**Figure 6-22 IQ Plus Onboard Charger Wiring Diagram (Relay Bypassed)**

# ONBOARD CHARGER REMOVAL AND INSTALLATION

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

### ⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 6-4, Page 6-6).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet, disconnect the DC cord from the vehicle, and remove the battery charger from the vehicle. See Onboard Charger Removal on page 6-34.**

## Onboard Charger Removal

1. Disconnect the batteries as instructed. **See General Warning, Section 1, Page 1-1.**
2. Disconnect the charger DC cord at the three pin connector (1) **(Figure 6-23, Page 6-35)**.
3. **For Carryall 2/252 and 6, Turf 2/252, XRT 900 and Transporter 4 and 6 vehicles:** Carefully remove the heatshrink tubing from the AC cord connection and disconnect the short AC cord from the retractable cord reel **(Figure 6-14, Page 6-19)**.
4. Remove hardware securing charger to chassis.
   4.1. **Villager 6 and 8:** Remove four bolts (2), flat washers (3), lock washers (4) and nuts (5) from charger mounting plates.
   4.2. **Carryall 2/252, Turf 2/252 and XRT 900:** Remove two bolts (2) from topside of charger mounting plate.
   4.3. **Carryall 6 and Transporter 4 and 6:** Remove two nuts (5) from underside of charger mounting plate.
5. Lift charger assembly from vehicle.

## Onboard Charger Installation

1. Installation is reverse of removal.
2. Install and tighten hardware securing charger to chassis.
   2.1. **Villager 6 and 8:** Tighten four bolts (2) and nuts (5) to 108 in-lb (12 N·m).
   2.2. **Carryall 2/252, Turf 2/252 and XRT 900:** Tighten two bolts (2) to 108 in-lb (12 N·m).
   2.3. **Carryall 6 and Transporter 4 and 6:** Tighten two nuts (5) to 108 in-lb (12 N·m).
3. **For Carryall 2/252 and 6, Turf 2/252, XRT 900 and Transporter 4 and 6 vehicles:** Place new heat-shrink tubing (6) (CCI P/N 1017189) over the short AC cord and connect the short AC cord to the retractable cord reel **(Figure 6-23, Page 6-35)**. Slide the tubing over the connection and carefully apply heat to shrink it.
4. Connect battery cables, positive (+) cable first, and tighten to 110 in-lb (12.4 N·m).

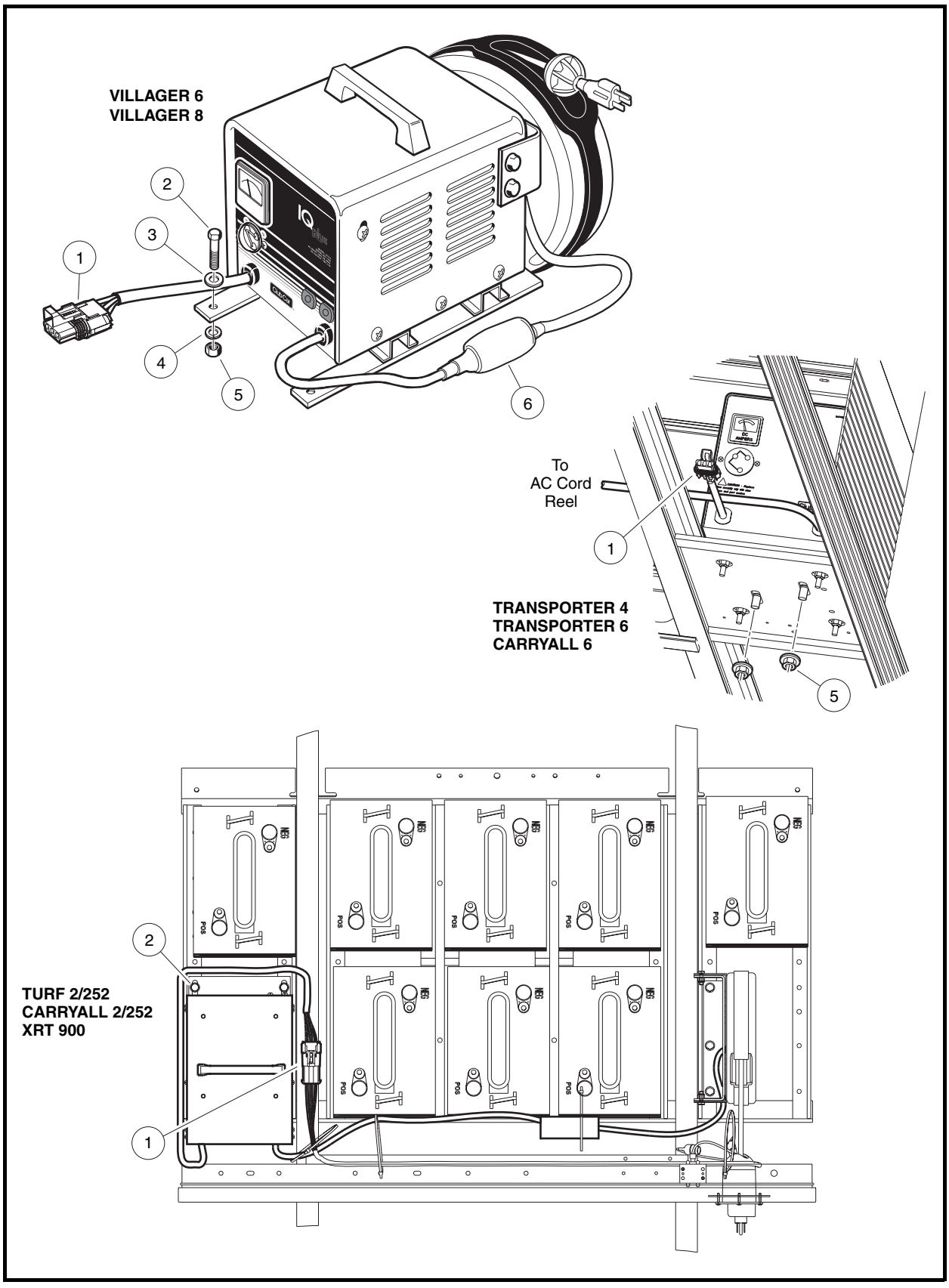


**Figure 6-23 Onboard Charger Mounting Details**

The following index is grouped in sections, one section for each type of battery charger in the manual. Make sure that the battery charger has been properly identified before using the index. **See Battery Charger Identification, Section 2, Page 2-6.**

## IQ Plus charger (onboard)



## PowerDrive charger (external)

## PowerDrive charger (onboard)

## S



## T



## W

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