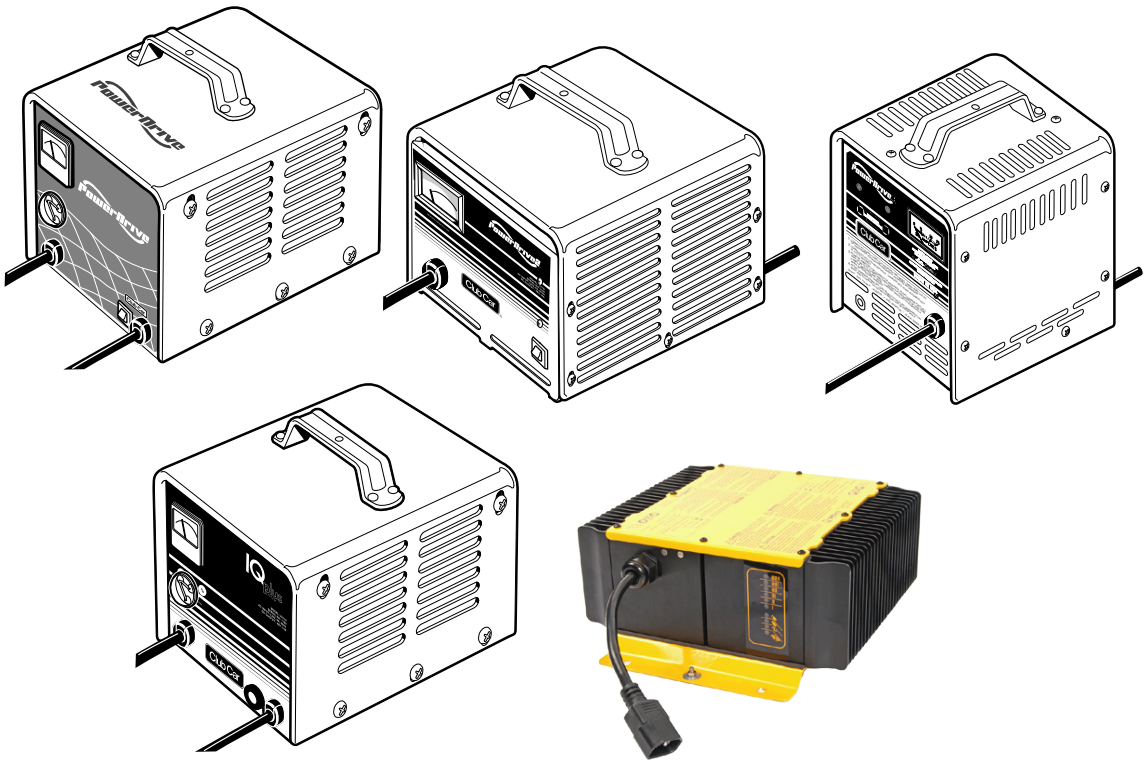
Club Car®

2008-2011 Domestic Battery Charger Maintenance and Service Manual



Domestic PowerDrive, IQ Plus and High Frequency Battery Chargers

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

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

This manual covers all aspects of typical 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, LLC; 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, LLC 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, LLC reserves the right to change specifications and designs at any time without notice and without the obligation of making changes to units previously sold.

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

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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.**
- **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.**
- **All electric vehicles:**
  To avoid unintentionally starting the vehicle, disconnect the batteries as shown (Figure 1-1, Page 1-4 thru Figure 1-8, Page 1-5).
- **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.**
- **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.**

WARNING CONTINUED ON NEXT PAGE...

⚠ WARNING

- **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.**
- **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.**
- **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, Section 4, Page 4-33.
- **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.**
- **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.**

DISABLING THE VEHICLE

1. Set the park brake.
2. Turn the key switch OFF and remove the key.
3. Place the Forward/Reverse control in the NEUTRAL position.
4. In addition, chock the wheels if servicing or repairing the vehicle.

DISCONNECTING THE BATTERIES

1. Disable the vehicle. **See Disabling The Vehicle on page 1-3.**
2. 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.
3. Disconnect the batteries, negative (–) cable first, as shown **(Figure 1-1 through Figure 1-8)**.
4. After disconnecting the batteries, wait 90 seconds for the controller capacitors to discharge.

CONNECTING THE BATTERIES

1. Ensure the Tow/Run switch is in the TOW position.
2. Connect the battery cables, positive (+) cable first.
3. Tighten battery terminals to 110 in-lb (12.4 N·m).
4. Coat terminals with Battery Terminal Protector Spray (CC P/N 1014305) to minimize corrosion..

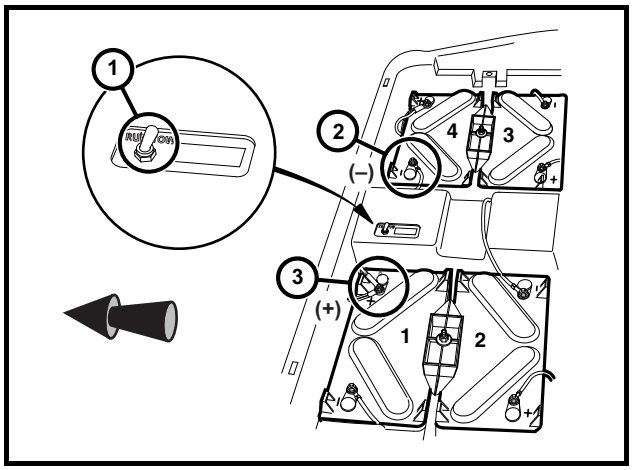

Figure 1-1 Precedent Battery Configuration – Style A 4 x 12-Volt Batteries

(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.

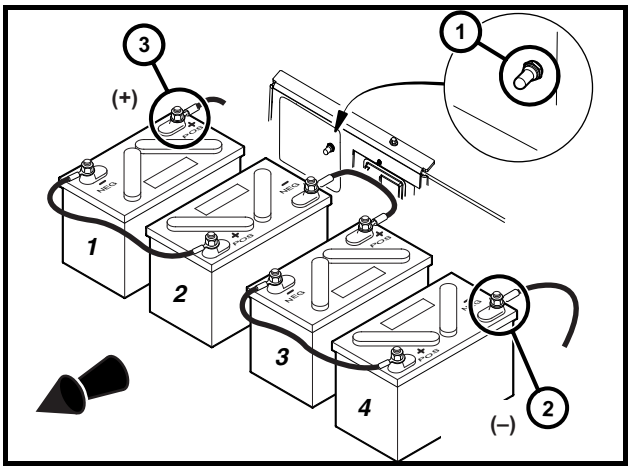

Figure 1-2 Precedent Battery Configuration – Style B 4 x 12-Volt Batteries

(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.

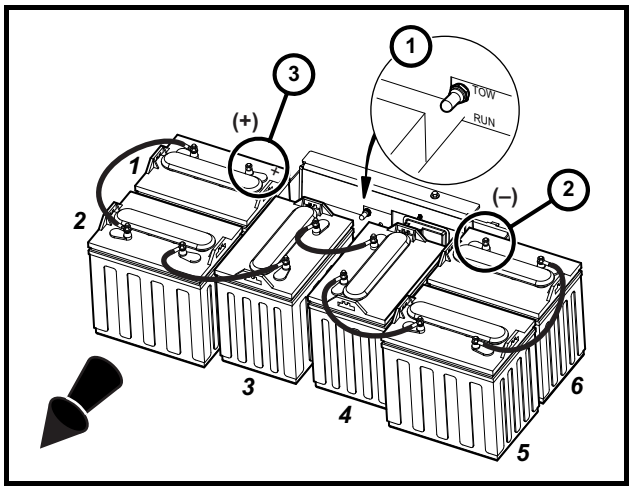

Figure 1-3 Precedent Battery Configuration – Style C 6 x 8-Volt Batteries

(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.

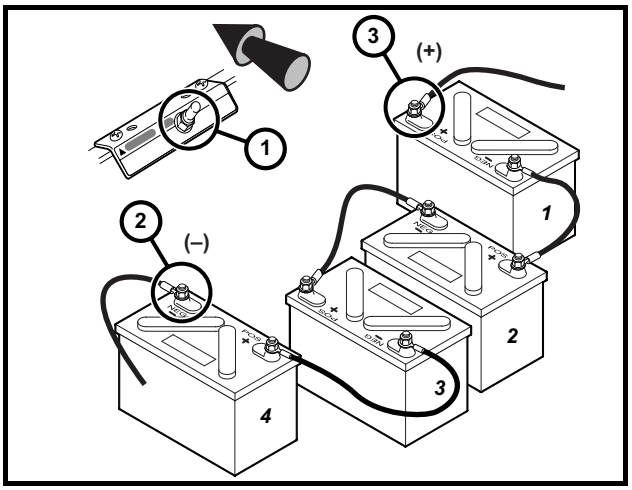

Figure 1-4 DS, DS Villager 4, 800, 810, 850 and Carry-all 232 IQ System 4x12-volt Battery Configuration

(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.

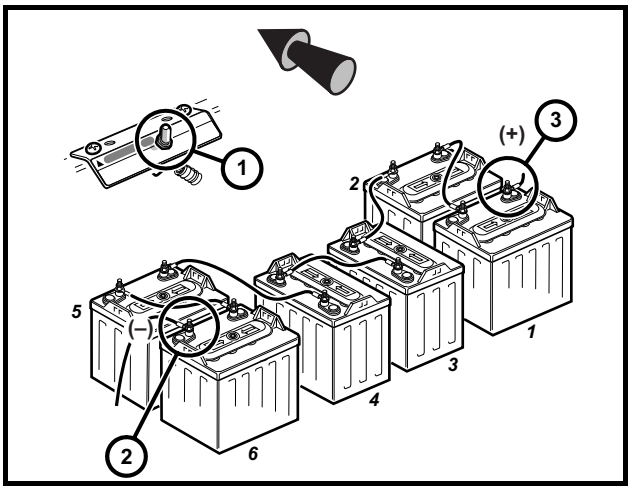

Figure 1-5 Turf1 and Carryall 1 Battery Configuration

(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.

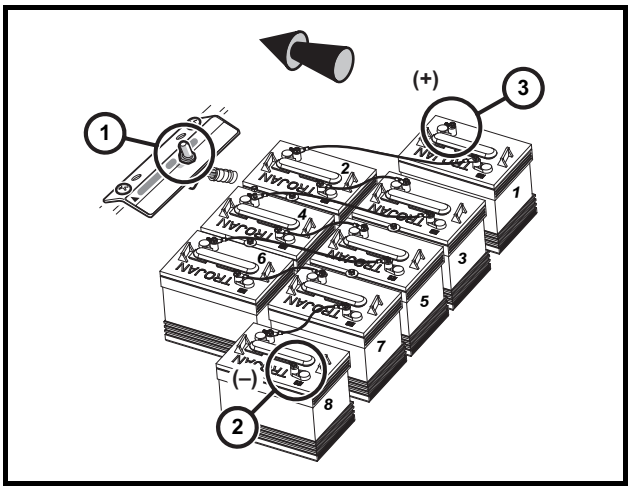

Figure 1-6 Turf 2 and 252/Carryall 2 and 252/ XRT 900 IQ Plus and Carryall 6 IQ Plus (Style B) Battery Configuration

(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.

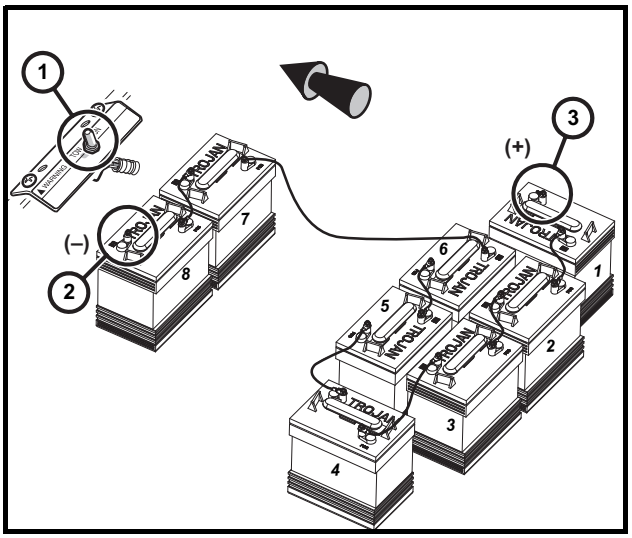

Figure 1-7 Transporter 4 and 6 IQ Plus and Carryall 6 (Style A) IQ Plus Battery Configuration

(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.

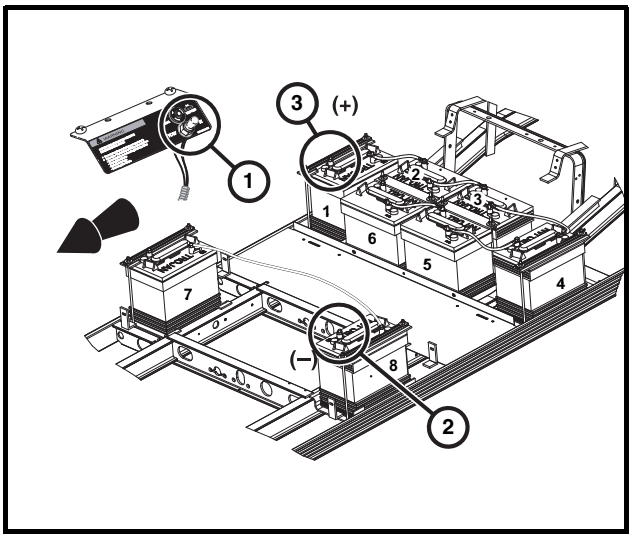

Figure 1-8 Villager 6 and 8 IQ Plus Battery Configuration

(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.

SECTION 2 – CHARGER IDENTIFICATION AND SPECIFICATIONS

BATTERY CHARGER IDENTIFICATION

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 Club Car battery charger. 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, repairing and/or replacing 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.

CHARGER NAME	CHARGER MODEL (PART NUMBER)	REFER TO
PowerDrive(external)	17930-11 (101802201) 17930-18 (101802202) 17930-19 (101802203)	Section 3 – PowerDrive Charger (External)
PowerDrive(onboard)	17935-10 (101814301) 17935-20 (101814303) 17935-30 (101814304) 17935-40 (102546901)	Section 4 – PowerDrive Charger (Onboard)
PowerDrive2	22110-11 (101802204) 22110-18 (101802205) 22110-19 (101802206)	Section 5 – PowerDrive 2 Charger (External)
PowerDrive3	26560-11 (103394401) 26560-18 (103394402) 26560-19 (103394403)	Section 6 – PowerDrive 3 – Model 26560
	26580-11 (103499101) 26580-18 (103499102) 26580-19 (103499103)	Section 7 – PowerDrive 3 – Model 26580
IQ Plus(external)	25730-11 (102847801) 25730-18 (102847802) 25730-19 (102847803)	Section 8 – IQ Plus Charger (External)
IQ Plus(onboard)	25260-11 (102837001) 25260-50 (103772401)	Section 9 – IQ Plus Charger (Onboard)
High Frequency	912-4852 (SVPP325510) algorithm #11	Section 10 – High Frequency Charger (Onboard)
High Frequency	912-4852 (SVPP325511) algorithm #26	Section 10 – High Frequency Charger (Onboard)
High Frequency	912-4852 (SVPP325512) algorithm #125	Section 10 – High Frequency Charger (Onboard)

SPECIFICATIONS

POWERDRIVE EXTERNAL CHARGER SPECIFICATIONS	PowerDrive Battery Charger		
Model number (CC P/N)	17930-11 (101802201)	17930-18 (101802202)	17930-19 (101802203)
AC input			
AC voltage: 105-128 VAC (acceptable range)	•	•	•
Frequency: 60 Hz.	•	•	•
Power consumption			
Max. AC current (amps)	10.71	10.71	10.71
DC output			
DC voltage (VDC) (start of charge cycle)	48	48	48
DC current (amps) (start of charge cycle)	17	17	17
DC voltage (VDC) (end of charge cycle)	60	60	60
DC current (amps) (end of charge cycle)	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)
Case – overall width	8.687 in. (22.1 cm)	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)	9.0 in. (22.9 cm)
AC cord length	74 in. (188 cm)	108 in. (274.3 cm)	108 in. (274.3 cm)
DC cord length	103 in. (261.6 cm)	144 in. (365.8 cm)	240 in. (609.6 cm)
Weight	31 lb (14.1 kg)	31.6 lb (14.3 kg)	33 lb (15.0 kg)
Mounting configuration			
Mounting: Set on shelf, wall mount with keyhole, or hang securely from ceiling.	•	•	•

POWERDRIVE 2 CHARGER SPECIFICATIONS	PowerDrive 2 Battery Charger		
Model number (CC P/N)	22110-11 (101802204)	22110-18 (101802205)	22110-19 (101802206)
AC input			
AC voltage: 105-128 VAC (acceptable range)	•	•	•
Frequency: 60 Hz.	•	•	•
Power consumption			
Max. AC current (amps)	9.0	9.0	9.0
DC output			
DC voltage (VDC) (start of charge cycle)	48	48	48
DC current (amps) (start of charge cycle)	13	13	13
DC voltage (VDC) (end of charge cycle)	60	60	60
DC current (amps) (end of charge cycle)	3.5	3.5	3.5
Dimensions/Weight			
Case – overall length	6.5 in. (16.5 cm)	6.5 in. (16.5 cm)	6.5 in. (16.5 cm)
Case – overall width	7.75 in. (19.7 cm)	7.75 in. (19.7 cm)	7.75 in. (19.7 cm)
Case – overall height	7.785 in. (19.8 cm)	7.785 in. (19.8 cm)	7.785 in. (19.8 cm)
AC cord length	74 in. (188 cm)	108 in. (274.3 cm)	108 in. (274.3 cm)
DC cord length	103 in. (261.6 cm)	144 in. (365.8 cm)	240 in. (609.6 cm)
Weight	24 lb (10.9 kg)	24.6 lb (11.2 kg)	26 lb (11.8 kg)
Mounting configuration			
Mounting: Set on shelf, wall mount with keyhole, or hang securely from ceiling.	•	•	•

POWERDRIVE 3 CHARGER SPECIFICATIONS	PowerDrive 3 Battery Charger Model 26560		
Model number (Part number (CCI))	26560-11 (103394401)	26560-18 (103394402)	26560-19 (103394403)
AC INPUT			
AC voltage: 105-128 VAC	•	•	•
Frequency: 60 Hz.	•	•	•
POWER CONSUMPTION			
AC current (amps)	9.5	9.5	9.5
AC wattage (watts)	1140	1140	1140
DC OUTPUT			
DC voltage (start of charge cycle)	48	48	48
DC current (start of charge cycle)	14.5	14.5	14.5
DC voltage (end of charge cycle)	60	60	60
DC current (amps) (end of charge cycle)	4.5	4.5	4.5
DIMENSIONS/WEIGHT			
Case – overall depth	7.8 in. (19.8 cm)	7.8 in. (19.8 cm)	7.8 in. (19.8 cm)
Case – overall width	7.13 in. (18.1 cm)	7.13 in. (18.1 cm)	7.13 in. (18.1 cm)
Case – overall height	9.75 in. (24.8 cm)	9.75 in. (24.8 cm)	9.75 in. (24.8 cm)
AC cord length	72 in. (182.9 cm)	104 in. (264 cm)	104 in. (264 cm)
DC cord length	104 in. (264 cm)	144 in. (365.8 cm)	240 in. (609.6 cm)
Weight	24.25 lb. (11 kg)	24.7 lb. (11.2 kg)	25.35 lb. (11.5 kg)

POWERDRIVE 3 CHARGER SPECIFICATIONS	PowerDrive 3 Battery Charger Model 26580		
Model number (Part number (CCI))	26580-11 (103499101)	26580-18 (103499102)	26580-19 (103499103)
AC INPUT			
AC voltage: 105-128 VAC	•	•	•
Frequency: 60 Hz.	•	•	•
POWER CONSUMPTION			
AC current (amps)	9.5	9.5	9.5
AC wattage (watts)	1140	1140	1140
DC OUTPUT			
DC voltage (start of charge cycle)	48	48	48
DC current (start of charge cycle)	14.5	14.5	14.5
DC voltage (end of charge cycle)	60	60	60
DC current (amps) (end of charge cycle)	4.5	4.5	4.5
DIMENSIONS/WEIGHT			
Case – overall depth	7.8 in. (19.8 cm)	7.8 in. (19.8 cm)	7.8 in. (19.8 cm)
Case – overall width	7.13 in. (18.1 cm)	7.13 in. (18.1 cm)	7.13 in. (18.1 cm)
Case – overall height	9.75 in. (24.8 cm)	9.75 in. (24.8 cm)	9.75 in. (24.8 cm)
AC cord length	72 in. (182.9 cm)	104 in. (264 cm)	104 in. (264 cm)
DC cord length	104 in. (264 cm)	144 in. (365.8 cm)	240 in. (609.6 cm)
Weight	24.0 lb. (10.89 kg)	24.5 lb. (11.11 kg)	26.0 lb. (11.8 kg)

POWERDRIVE ONBOARD CHARGER SPECIFICATIONS	PowerDrive Battery Charger (Onboard)			
Model number (CC P/N)	17935-10 (101814301)	17935-20 (101814303)	17935-30 (101814304)	17935-40 (102546901)
AC input				
AC voltage: 105-128 VAC (acceptable range)	•	•	•	•
Frequency: 60 Hz.	•	•	•	•
Power consumption				
Max. AC current (amps)	10.71	10.71	10.71	10.71
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)
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)	•	•	•	•

IQ PLUS EXTERNAL CHARGER SPECIFICATIONS	IQ Plus External Battery Charger		
Model number (CC P/N)	25730-11 (102847801)	25730-18 (102847802)	25730-19 (102847803)
AC input			
AC voltage: 105-128 VAC (acceptable range)	•	•	•
Frequency: 60 Hz.	•	•	•
Power consumption			
Max. AC current (amps)	13.0	13.0	13.0
DC output			
DC voltage (VDC) (start of charge cycle)	48	48	48
DC current (amps) (start of charge cycle)	17	17	17
DC voltage (VDC) (end of charge cycle)	60	60	60
DC current (amps) (end of charge cycle)	4.7	4.7	4.7
Dimensions/Weight			
Case – overall length	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)
Case – overall height	9.0 in. (22.9 cm)	9.0 in. (22.9 cm)	9.0 in. (22.9 cm)
AC cord length	74 in. (188 cm)	108 in. (274.3 cm)	108 in. (274.3 cm)
DC cord length	103 in. (261.6 cm)	144 in. (365.8 cm)	240 in. (609.6 cm)
Weight	31.0 lb (14.1 kg)	31.0 lb (14.1 kg)	31.0 lb (14.1 kg)
Mounting configuration			
Mounting: Set on shelf, wall mount with keyhole, or hang securely from ceiling.	•	•	•
Mounting: Onboard (secured to the vehicle)			

IQ PLUS ONBOARD CHARGER SPECIFICATIONS	IQ Plus Onboard Battery Charger	
Model number (CC P/N)	25260-11 (102837001)	25260-50 (103772401)
AC input		
AC voltage: 105-128 VAC (acceptable range)	•	•
Frequency: 60 Hz.	•	•
Power consumption		
Max. AC current (amps)	13.0	13.0
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	7.25 in. (18.4 cm)	7.25 in. (18.4 cm)
Case – overall height	9.5 in. (24.1 cm)	9.5 in. (24.1 cm)
AC cord length	17 ft. (5.2 m) (retractable)	17 ft. (5.2 m) (retractable)
DC cord length	22.0 in. (55.8 cm)	22.0 in. (55.8 cm)
Weight	37.0 lb (16.8 kg)	37.0 lb (16.8 kg)
Mounting configuration		
Mounting: Onboard (secured to the vehicle)	•	•

HIGH FREQUENCY CHARGER SPECIFICATIONS	High Frequency Battery Charger
Model number (CC P/N)	912-4852 (SVPP325512, SVPP325511 and SVPP325510)
AC input	
AC voltage – range	85-265 VAC (acceptable)
AC voltage – nominal	120 VAC / 230 VAC
Frequency	45 - 65 Hz
AC Power Factor – nominal	>0.99 @ 120 VAC / >0.98 @ 230 VAC
Power consumption	
AC current (amps)	Max: 12 Amps Nominal: 9.5 Amps rms @ 120 VAC 5 Amps rms @ 230 VAC
DC output	
DC voltage (VDC) – nominal	48 V
DC voltage (VDC) – maximum	68 V
DC current – maximum	18 Amps
Interlock current – maximum	1 Amp
Dimensions/Weight	
Case – overall length	11 in. (28 cm)
Case – overall width	9.7 in. (24.6 cm)
Case – overall height	4.3 in. (11 cm)
Weight	< 11 lbs (< 5 kg)
Mounting configuration	
Mounting: Onboard	Secured to the vehicle

SECTION 3 – POWERDRIVE 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 3-7, Page 3-9). 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 3-8, Page 3-9).**

GENERAL INFORMATION

This section includes information pertaining to service of the PowerDrive battery charger (model numbers 17930-11, 17930-18, and 17930-19). 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.

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, having recorded the amount of energy consumed as the vehicle was used, 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. The computer accomplishes this by detecting when the exact amount of energy necessary has been returned to the batteries.

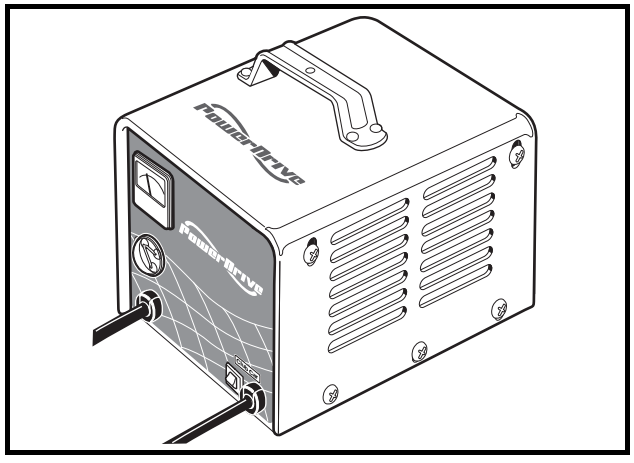

Figure 3-1 PowerDrive Battery Charger

POWERDRIVE EXTERNAL CHARGER FEATURES

- **Charge Interlock**
  PowerDrive 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. **See following WARNING.**
- **Long-Term Storage Charge**
  Vehicles with 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, unplug the charger DC cord, wait 15 seconds for the computer to reset, and plug the charger back in. **See following WARNING and CAUTION.** 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 (Figure 3-7, Page 3-9). 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 (Figure 3-8, Page 3-9).**

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.**

BATTERY WARNING LIGHT

IQ System and Excel System 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 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 25 seconds (10 seconds for Limo 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 25 seconds, at 10 second intervals (10 seconds, at 4 second intervals for Limo 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 battery warning light will repeatedly illuminate for 25 seconds, at 10 second intervals (10 seconds, at 4 second intervals for Limo vehicles), 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.

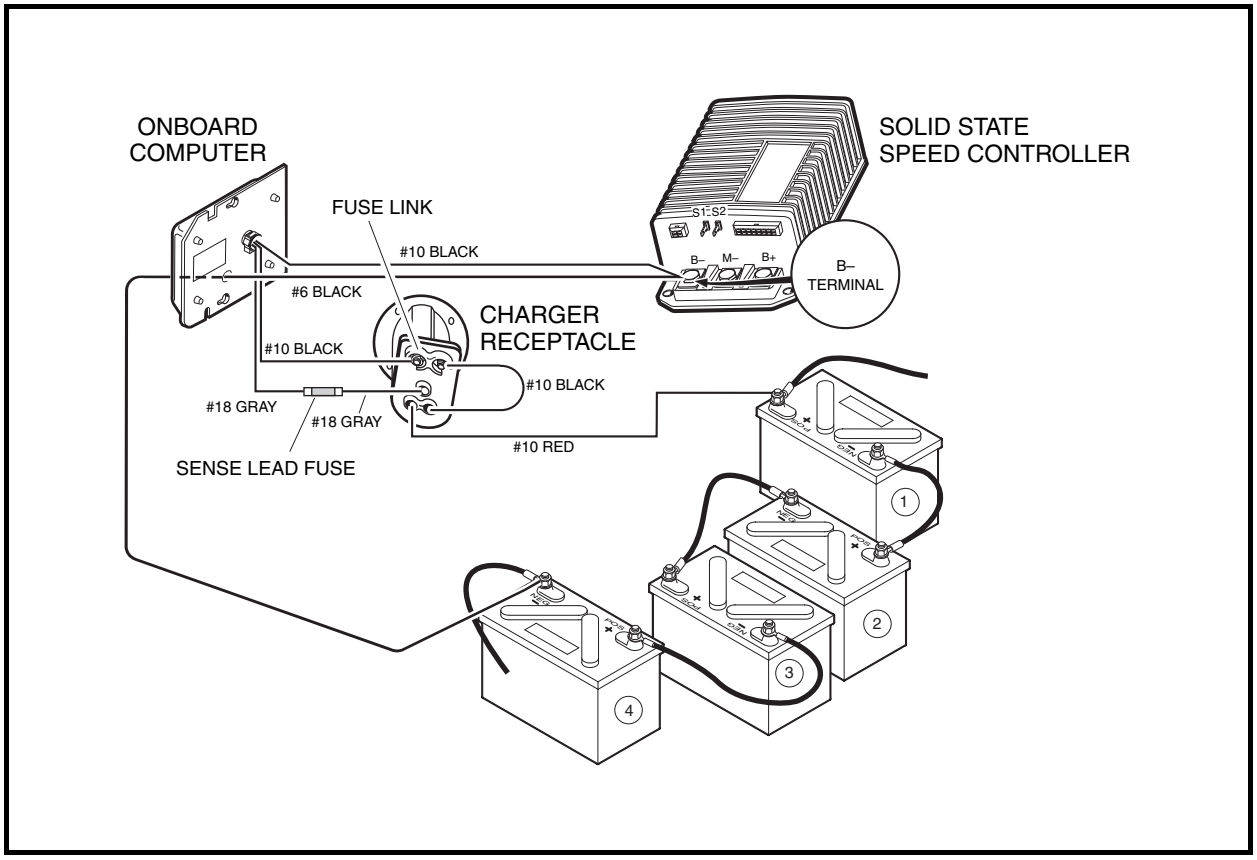

Figure 3-2 Charge Circuit and Battery Configuration – DS, DS Villager 4, 800, 810 and 850

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.

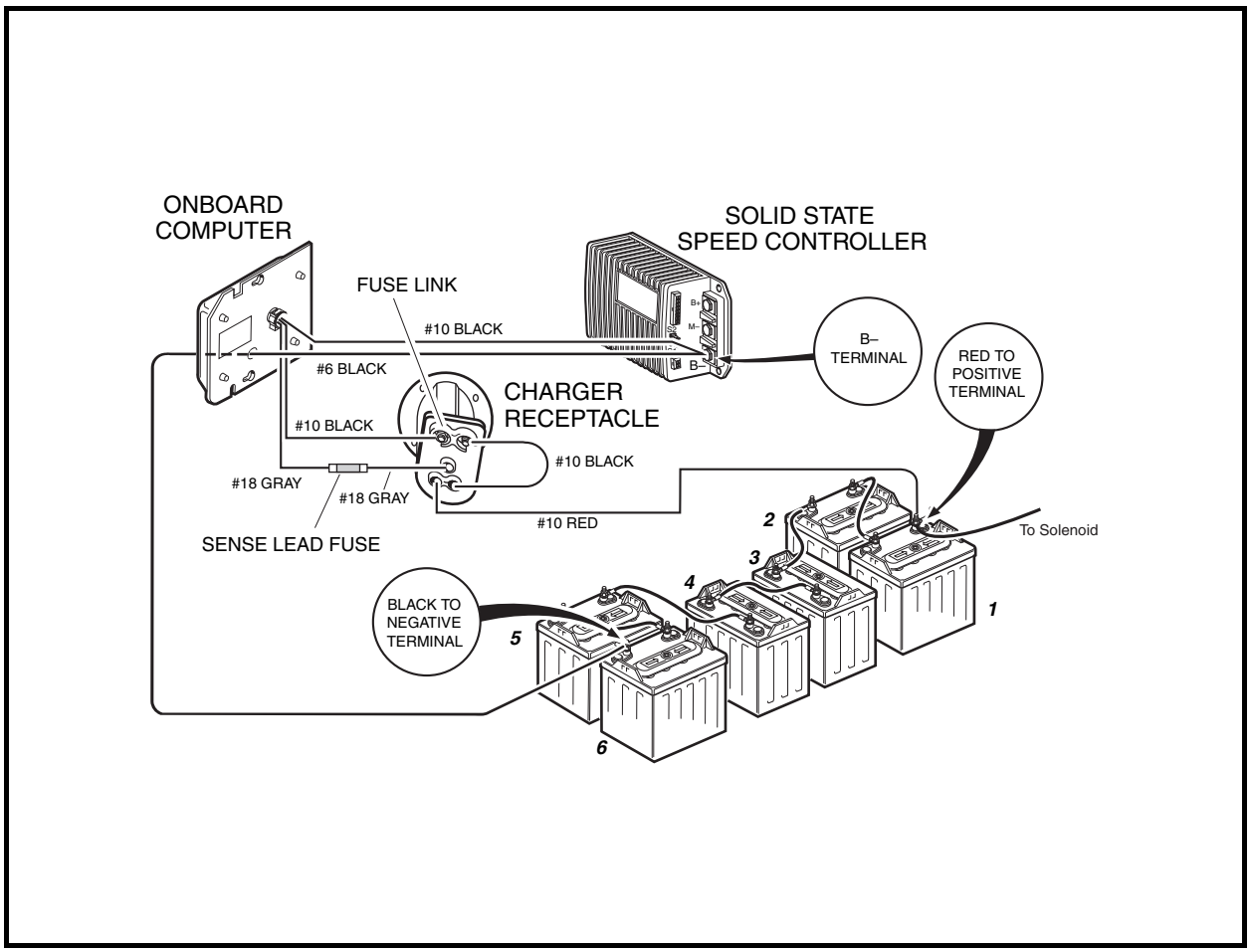

Figure 3-3 Charge Circuit and Battery Configuration – Turf 1 and Carryall 1

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.

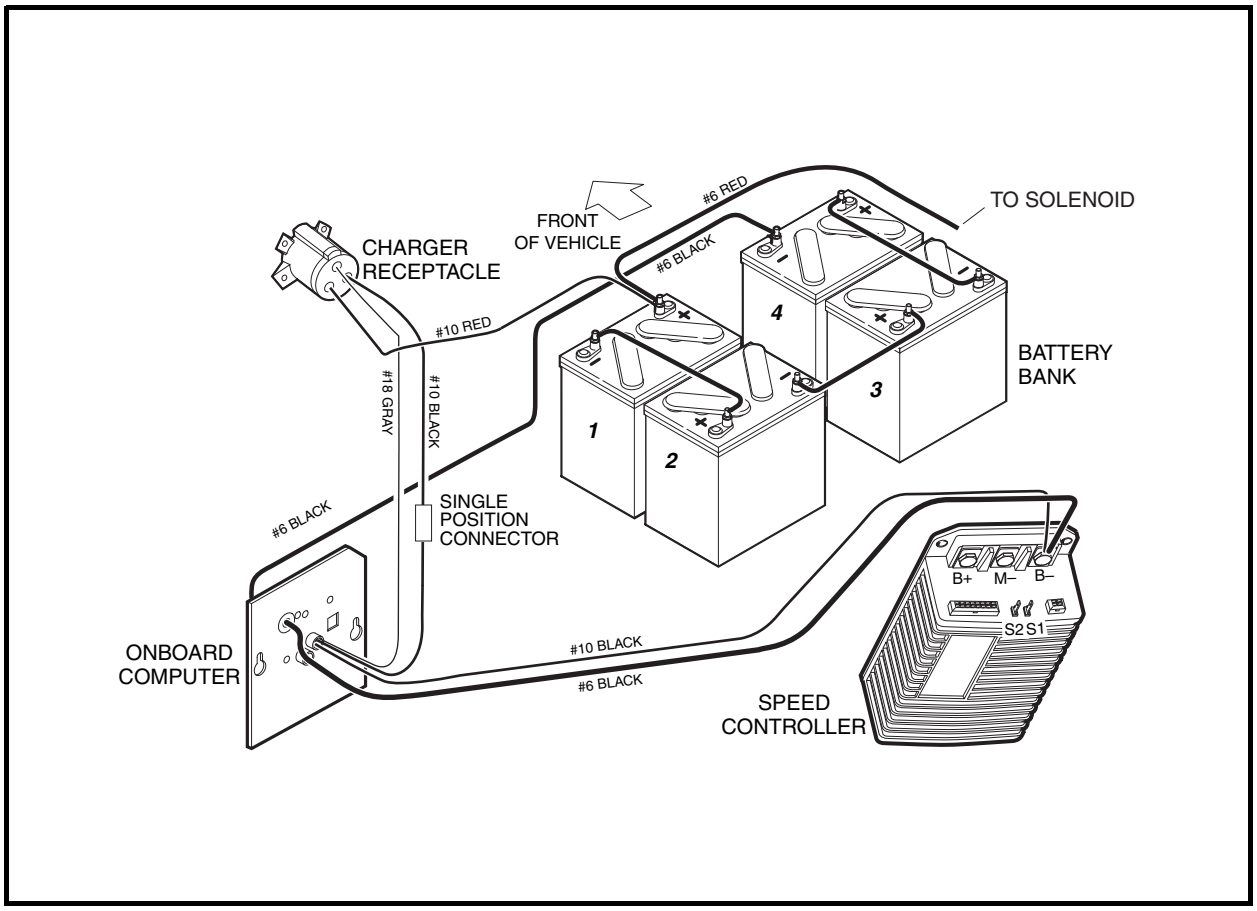

Figure 3-4 Charge Circuit and Style A Battery Configuration – 4 x 12-Volt Precedent Vehicles

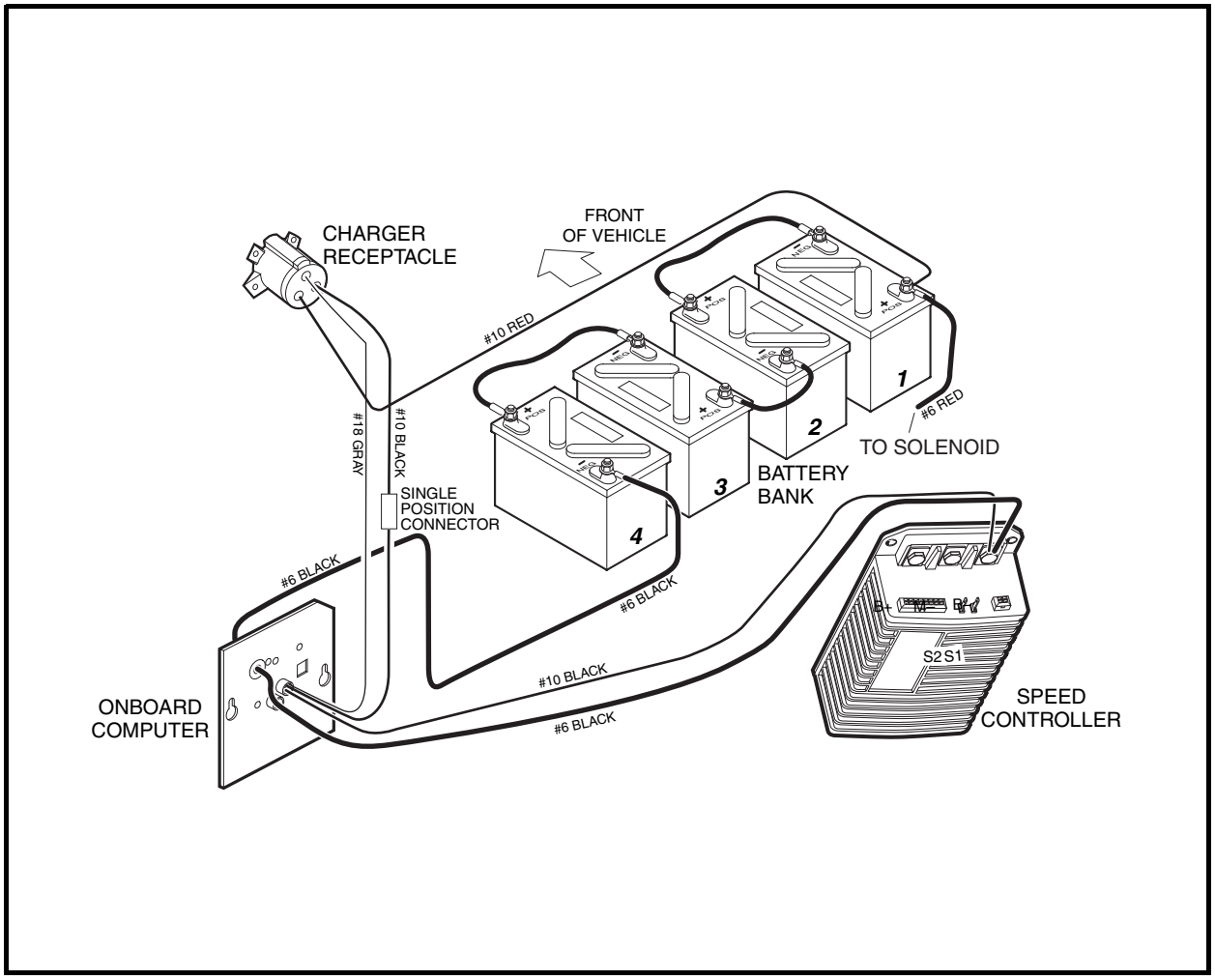

Figure 3-5 Charge Circuit and Style B Battery Configuration – 4 x 12-Volt Precedent Vehicles

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.

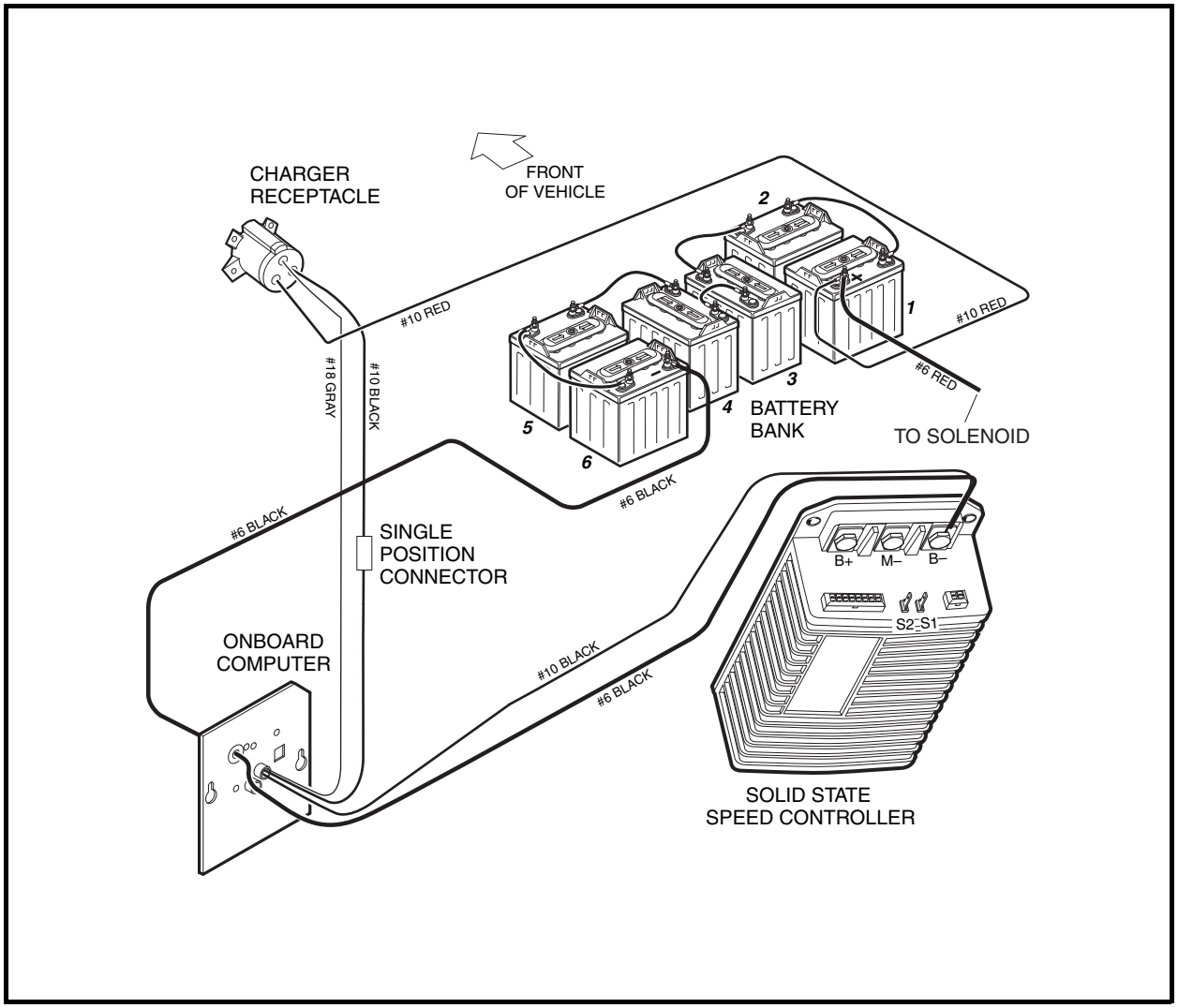

Figure 3-6 Charge Circuit and Style C Battery Configuration – 6 x 8-Volt Precedent Vehicles

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 3-7, Page 3-9). 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 3-8, Page 3-9).**
- **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 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 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.**

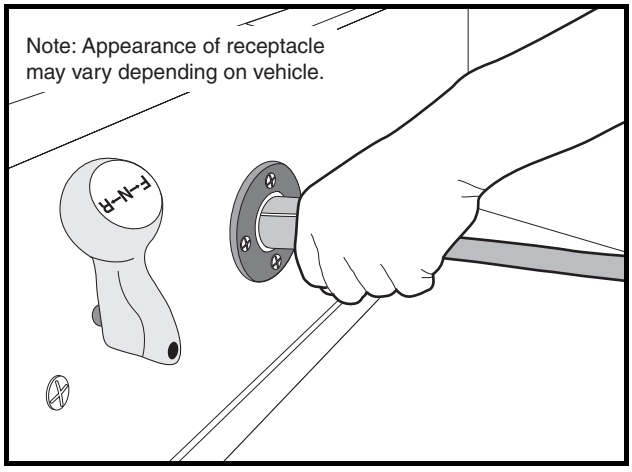

Figure 3-7 Charger Receptacle

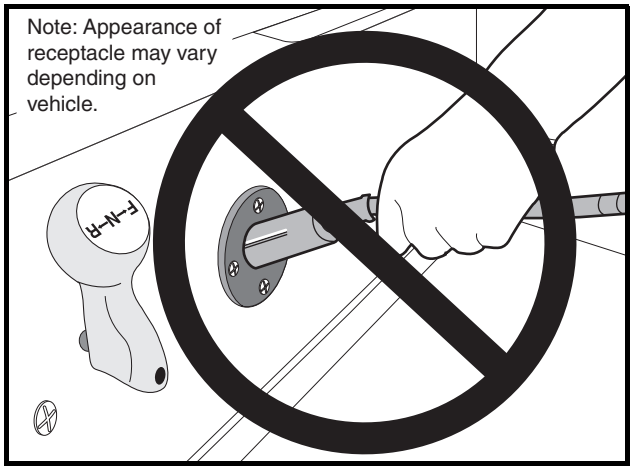

Figure 3-8 Incorrect DC Plug Removal

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.**

With charger DC output cord disconnected, connect the power supply cord to an AC supply. **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. It is for use on a nominal 120 volt, 60 hertz circuit. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electric Code and all local codes and ordinances.

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.

Mount charger by setting it on a shelf, wall mount with keyhole, or hang securely from ceiling by the handle. Do not hang charger upside down.

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 3-7, Page 3-9).**
- **Do not pull on the DC cord (Figure 3-8, Page 3-9). 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.**

WARNING CONTINUED ON NEXT PAGE...

⚠ WARNING

- **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 3-7, Page 3-9)**. 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 3-7, Page 3-9).**

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. 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). **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 (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) (CC P/N 101831801). ***See Communication Display Module in Section 11 of the appropriate maintenance and service manual.***

If charger does not appear to be operating properly, or if the batteries appear to be weak, contact your Club Car distributor/dealer.

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 3-6, Page 3-7)** and that the internal charger wiring is correct **(Figure 3-9, Page 3-11)**.

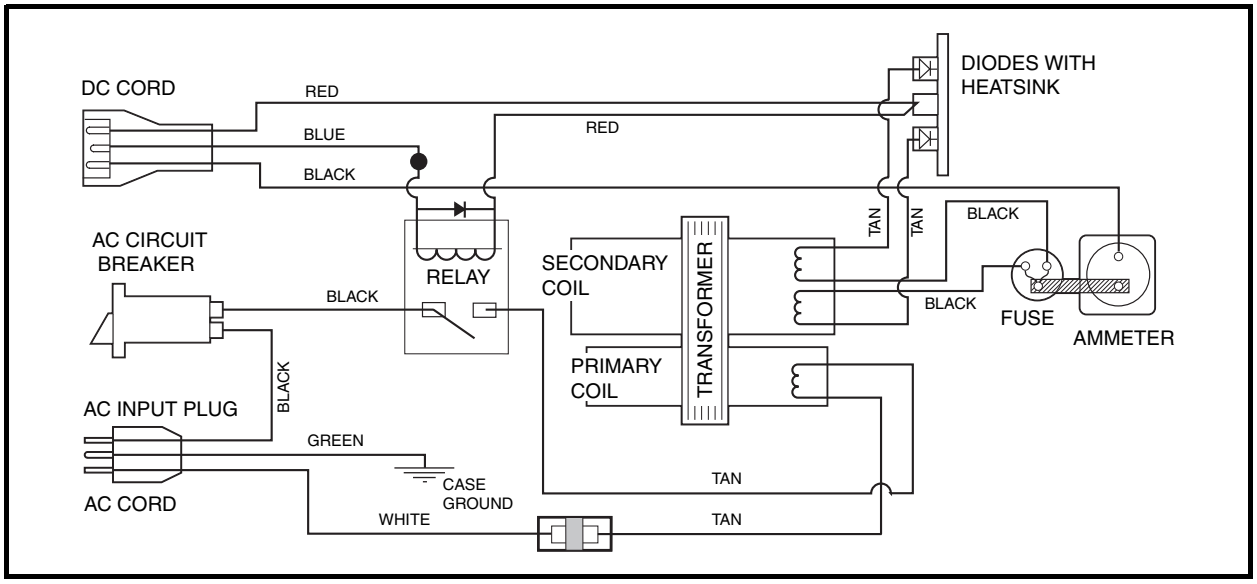

Figure 3-9 PowerDrive Battery Charger Wiring Diagram (External Charger)

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 3-27. See following NOTE.**

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

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 IQ System, PowerDrive, and Excel System 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 in the maintenance and service manual appropriate for your battery charger. If you do not have this publication, contact your Club Car representative. 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 then charge the vehicle. Normal voltage near the end of a charge cycle should be approximately 59 to 63 volts.

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 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. 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 3-9, Page 3-11 and Figure 3-10, Page 3-15).**
- **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 PowerDrive external battery chargers (model numbers 17930-11, 17930-18, and 17930-19). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

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 the batteries. **See Connecting The Batteries on page 1-4.**
	Battery voltage is too low	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-16
	Poor connection between plug and receptacle	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-16
	DC plug and cord	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-16 and Test Procedure 5 – Charger DC Circuit Continuity Test on page 3-21
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 3-19
	Gray sense lead fuse is blown (not applicable to Precedent vehicles)	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 3-16
	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 3-19
	Failed AC plug and cord	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-19
	Internal AC breaker	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-19
	Transformer primary coil	Test Procedure 6 – Transformer on page 3-22
	Relay	Test Procedure 8 – Continuity on page 3-24
	Failed ammeter	Replace ammeter
Relay closes and transformer hums but ammeter does not move	Blown charger fuse	Test Procedure 4 – Diodes on page 3-20
	Both Diodes failed	Test Procedure 4B – Both Diodes Failed on page 3-21
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 3-19
	Failed transformer	Test Procedure 6 – Transformer on page 3-22
Relay operates intermittently	Failed charger relay	Test Procedure 8 – Continuity on page 3-24
Single charger fuse link blows	Diode failed	Test Procedure 4A – Single Diode Failure on page 3-20
	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 3-21

Troubleshooting Guide continued on next page...

POWERDRIVE BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Charger output is low	One diode failed	Test Procedure 4A – Single Diode Failure on page 3-20
	Transformer coil short-circuit failure	Test Procedure 6 – Transformer on page 3-22
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 3-19
Charger turns off too soon	AC power supply was shut off	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-19
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 3-19
	Batteries may be fully charged	Test Procedure 7 – Battery State of Charge Test on page 3-23
Charger goes to 16 hour time out	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 3-19
	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 3-24
	Failed transformer	Test Procedure 6 – Transformer on page 3-22
	Incorrect charger wiring	Check battery charger wiring
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 3-19
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 3-19
	Charger failure	See Testing Charger Operation on page 3-11
	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 unplugged) (25 seconds, at 10 second intervals for Precedent vehicles)	Batteries are getting close to full discharge capacity	Recharge batteries (golf round may be completed first)
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 3-19
	Battery or batteries need to be replaced	See Batteries section in the appropriate maintenance and service manual

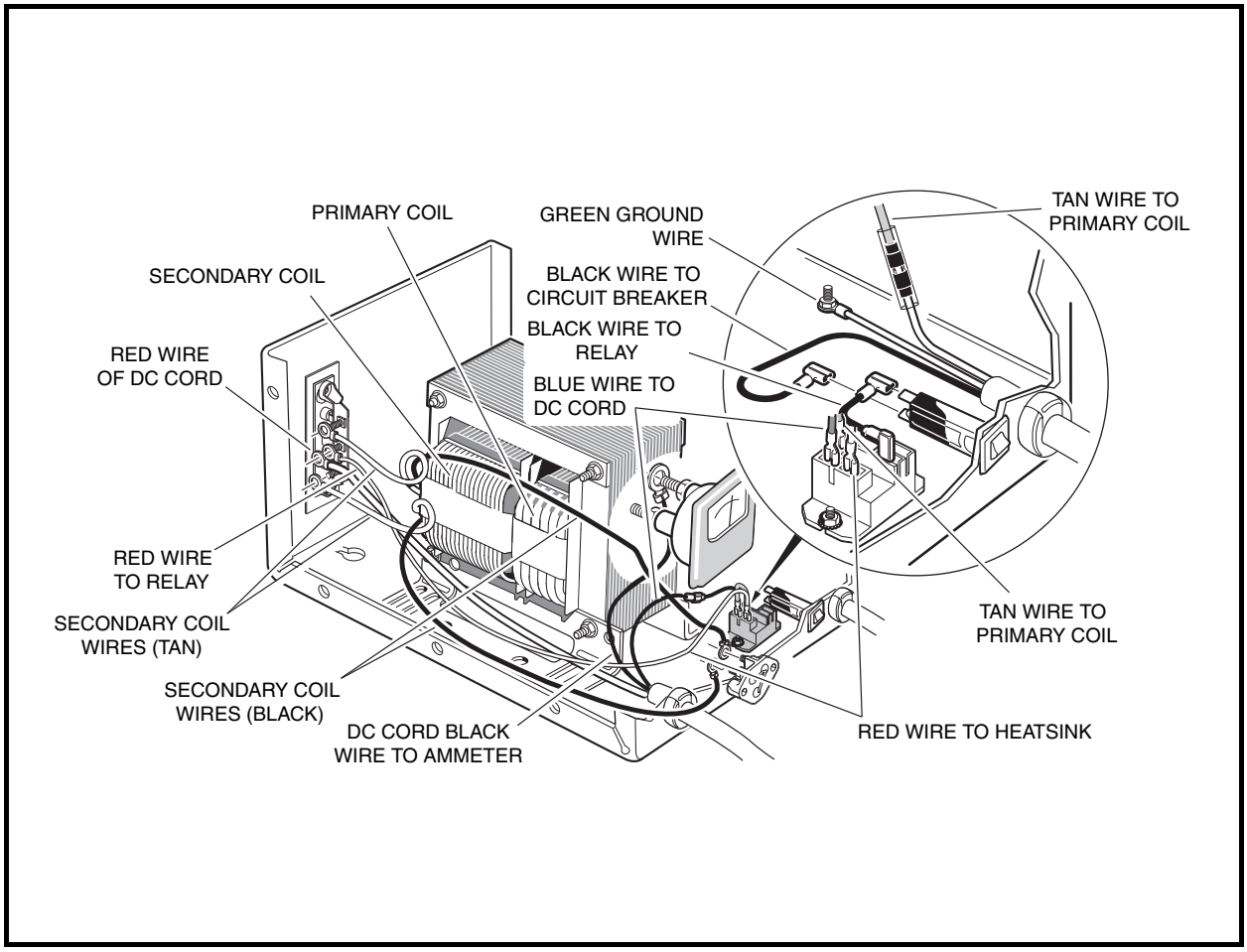

Figure 3-10 PowerDrive Battery Charger

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 and 850:** 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 and Figure 3-3, Page 3-4)**.
   3.2. Make sure the two nuts that secure the two 10-gauge black wires to the receptacle fuse assembly are tight **(Figure 3-11, Page 3-16)**.

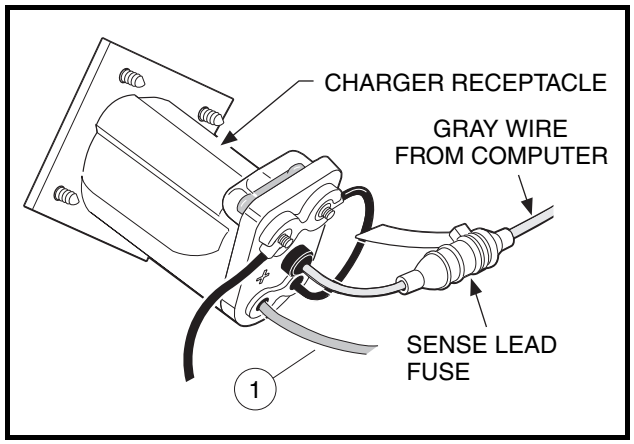

Figure 3-11 Receptacle Wire Connections (all vehicles except Precedent)

   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 3-12, Page 3-17)**.

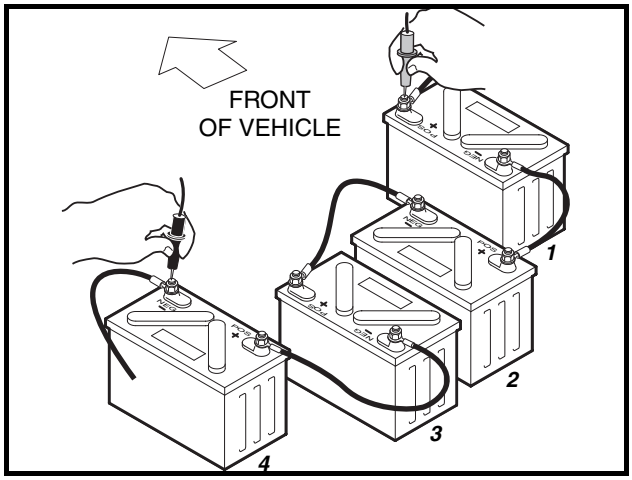

Figure 3-12 DS, DS Villager 4, 800, 810 and 850 Battery Voltage Test

4.2. **Turf 1 and Carryall 1:** 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 3-13, Page 3-17)**.

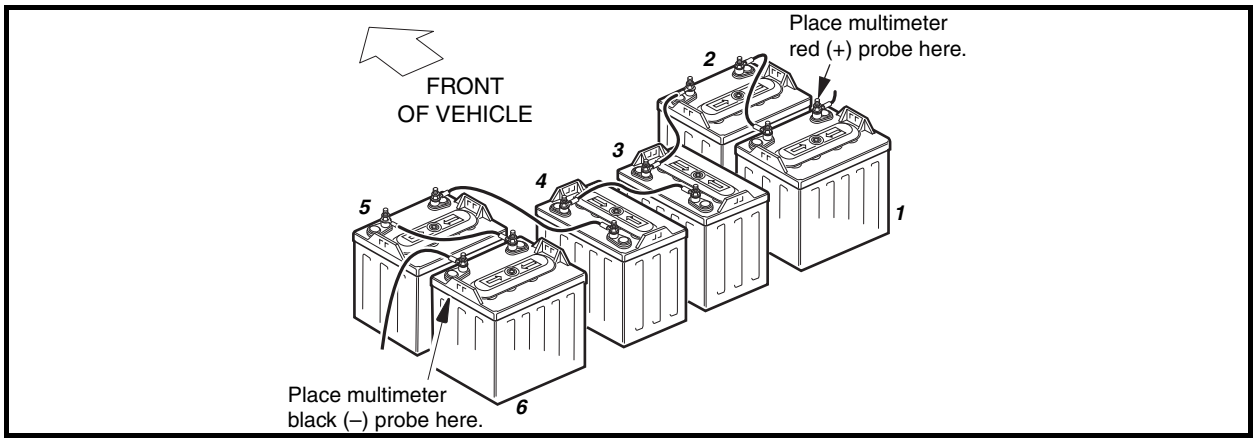

Figure 3-13 Turf 1 and Carryall 1 Battery Voltage Test

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 3-14, Page 3-18 or Figure 3-15, Page 3-18)**.

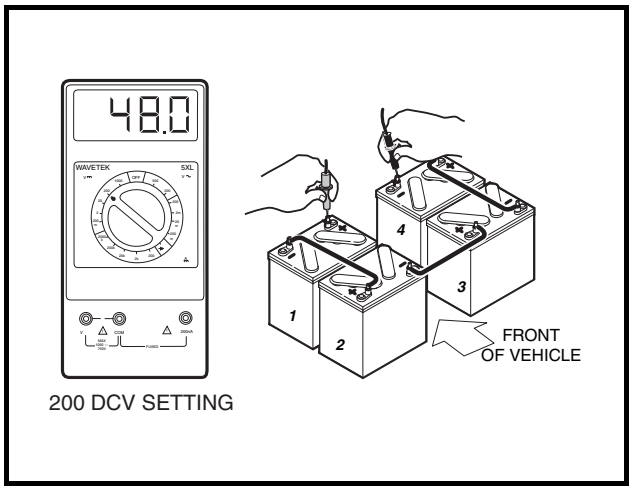

Figure 3-14 Battery Voltage Test – Style A Battery Configuration

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

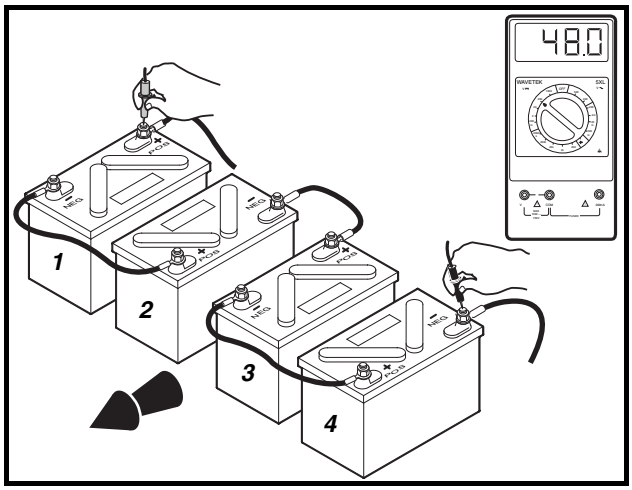

Figure 3-15 Battery Voltage Test – Style B Battery Configuration

(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 3-16, Page 3-18)**.

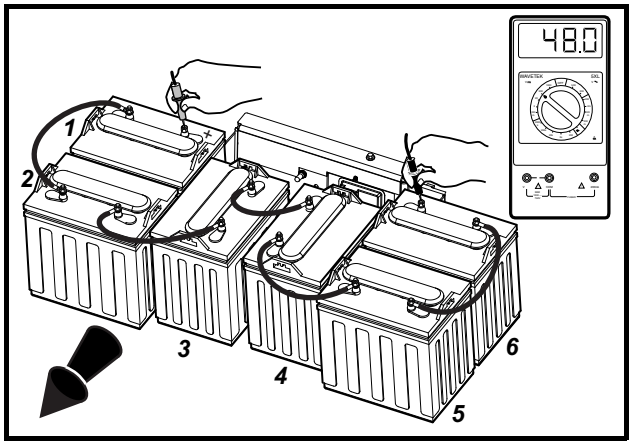

Figure 3-16 Battery Voltage Test – Style C Battery Configuration

(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 3-34.**

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 breaker 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 3-12.**
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 breaker 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 between 105 and 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
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, remove the black wire (3) from the AC circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire (4) to the AC circuit breaker **(Figure 3-22, Page 3-23)**.
   - 5.3. With relay bypassed, there should be continuity across the AC cord blades **(Figure 3-17, Page 3-19)**.

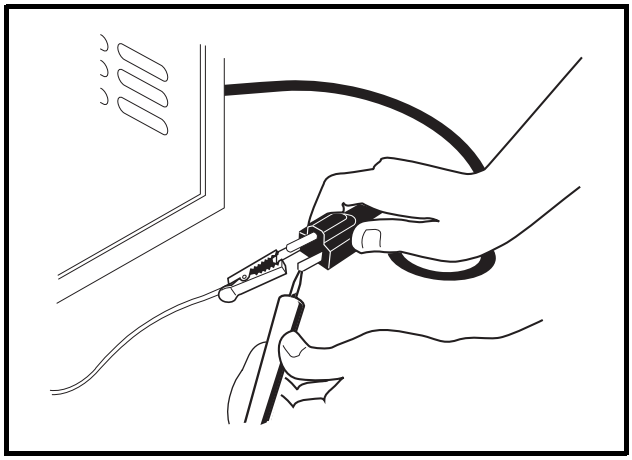

Figure 3-17 AC Cord Test

6. If the circuit is not complete, check the wiring of the AC cord, transformer primary coil wires, and internal AC circuit breaker **(Figure 3-22, Page 3-23)**.
7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, and the internal AC circuit breaker individually. **See Test Procedure 8 – Continuity on page 3-24.**
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 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 3-20 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 3-21.

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 3-18, Page 3-21)**.
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 3-18, Page 3-21)**.
5. Reverse test probes and check each diode again and note the reading **(Figure 3-19, Page 3-21)**. 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.**

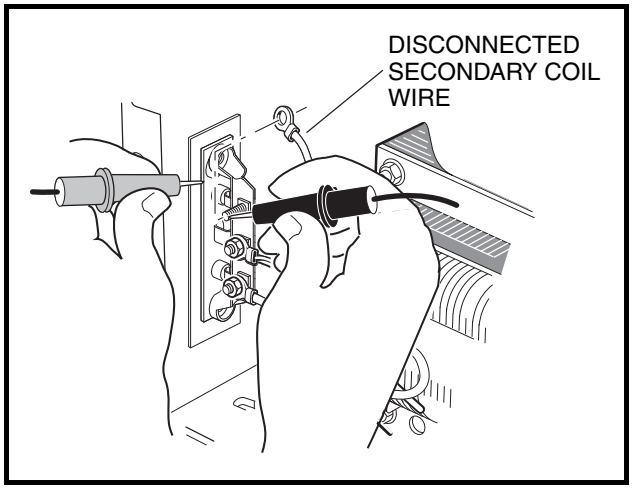

Figure 3-18 Diode Test

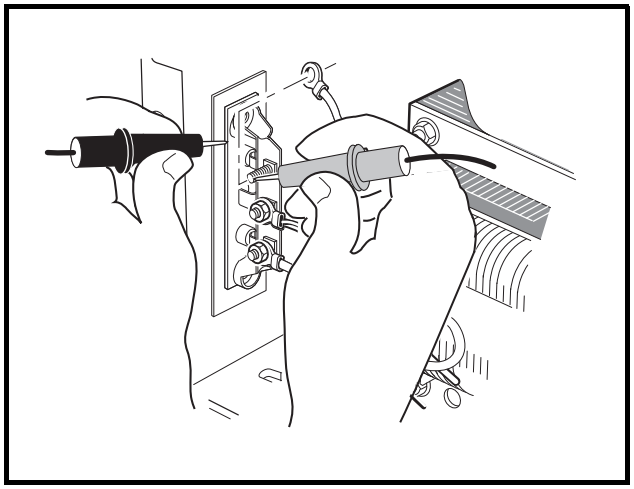

Figure 3-19 Diode Test – Probes Reversed

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 3-20. 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 3-11, Page 3-16 through Figure 3-16, Page 3-18)**. 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 3-9, Page 3-11)**. 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 (CC P/N 1011273) or multimeter set to 200 ohms, connect the test probes to the pins marked (+) and (–) on the DC plug **(Figure 3-20, Page 3-22)**. Note the reading.
3. Reverse the test probes and check the DC plug again **(Figure 3-21, Page 3-22)**. 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 3-24.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 3-20.**

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 3-20.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 3-24.**
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 3-9, Page 3-11 and Figure 3-10, Page 3-15)**. There should be no continuity.

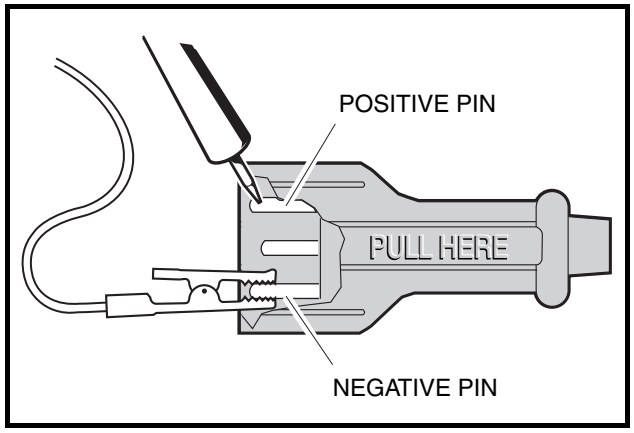

Figure 3-20 DC Plug Test

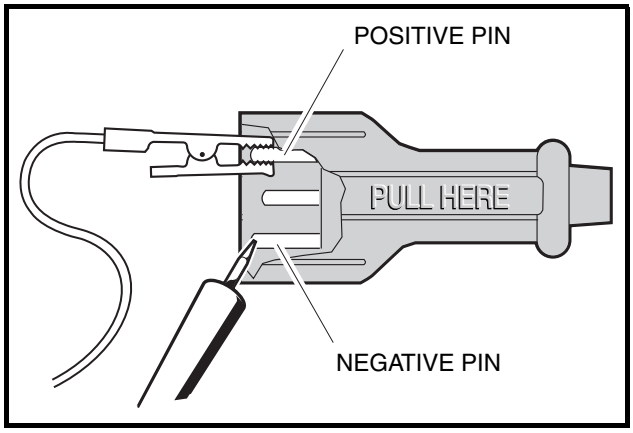

Figure 3-21 DC Plug Test – Probes Reversed

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 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 breaker, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 3-19.**

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 (1 and 5) from the heatsink **(Figure 3-22, Page 3-23)**.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   4.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire (4) to the AC circuit breaker **(Figure 3-22, Page 3-23)**. **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 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.

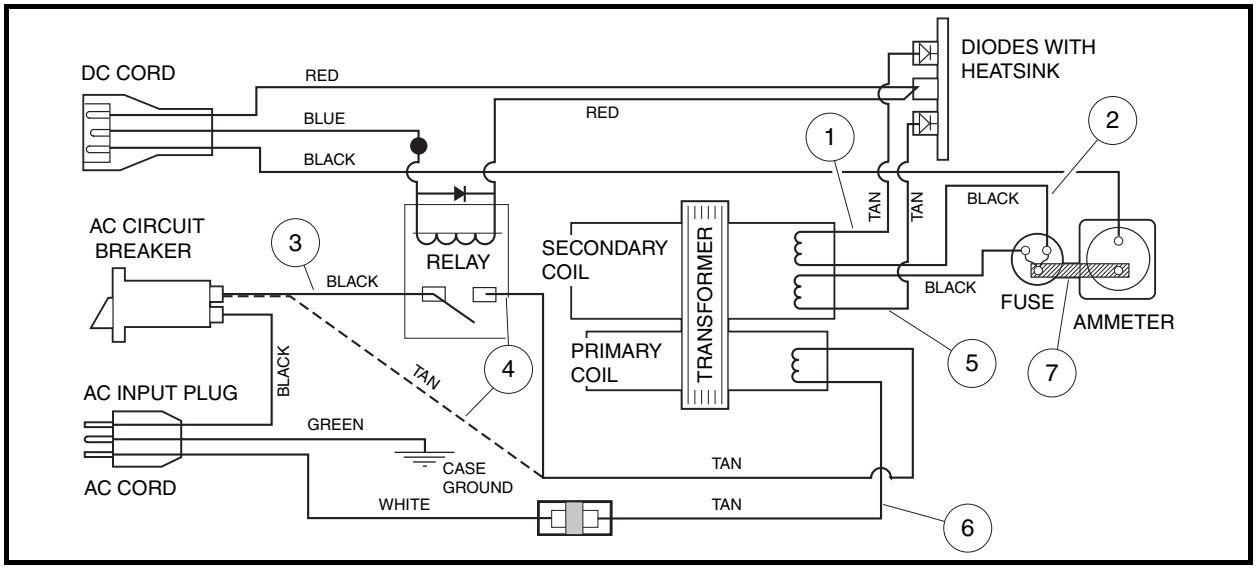

Figure 3-22 Transformer Test Wiring Diagram

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 **(Figure 3-22, Page 3-23)**.
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 3-21.**
11. When troubleshooting and repairs are complete, 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 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 then reconnect it. The ammeter should jump to a reading between 14 and 18 amps and then 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 3-19. 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 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 the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 3-23, Page 3-24)**.
4. Disconnect the black wire (1) of AC cord from charger AC circuit breaker (3).
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. 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 AC cord and plug must be replaced.
7. 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 **(Figure 3-23, Page 3-24)**. The tester should indicate continuity on only the round pin. If any other reading is obtained, the AC cord and plug must be replaced.
8. 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 plug must be replaced.

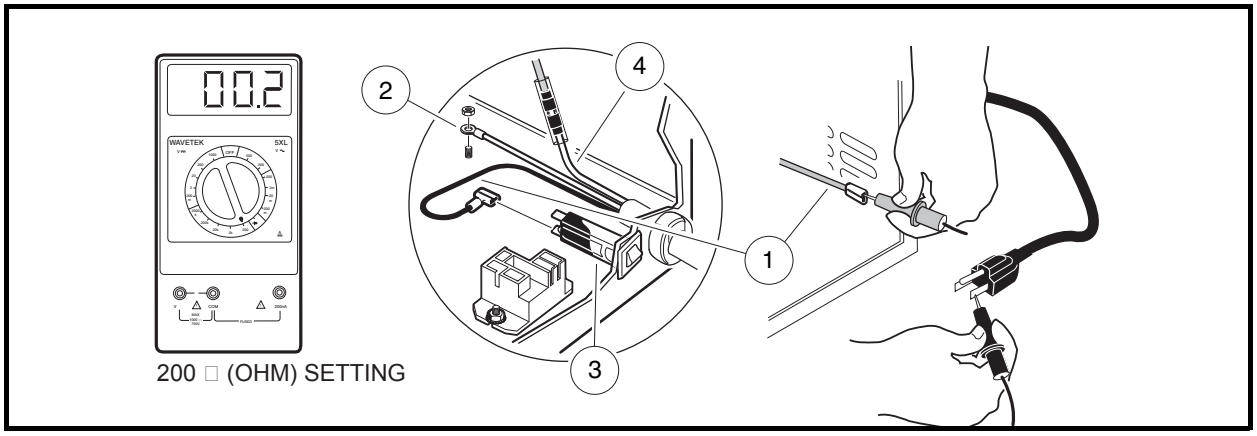

Figure 3-23 AC Cord and Plug Continuity Test

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 of the DC cord from the ammeter **(Figure 3-24, 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 registers 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 registers 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 registers 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.

Transformer

The PowerDrive battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 3-22, Page 3-23)**.

Primary Coil

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect terminals from transformer (tan) primary coil transformer wires (4 and 6) **(Figure 3-22, Page 3-23)**.
4. Place the continuity tester probes on the disconnected primary coil transformer wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.

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 (1) from the upper terminal of the heatsink **(Figure 3-22, Page 3-23)**.
4. Remove the other transformer (tan) secondary coil wire (5) from the bottom terminal of the heatsink and place the continuity test clip on the ammeter buss bar (7) **(Figure 3-22, Page 3-23)**. 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.

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 (prior to Version 3.0) due to a blown internal sense lead fuse is a symptom of a voltage supressor that has failed in a closed condition. The Version 3.0 and 4.0 onboard computers will quickly flash the battery warning light on the dash to indicate a problem with the voltage supressor.*

Relay

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove black (3) and tan (4) wires from contact terminals of the relay **(Figure 3-22, Page 3-23)**. Place continuity test probes on contact terminals 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. Place continuity test probes on contact terminals of relay. With batteries connected, insert DC plug into receptacle. The tester should indicate continuity. If tester does not indicate continuity, 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 3-9, Page 3-11 and Figure 3-10, Page 3-15).**
- **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.
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 3-25, Page 3-27)**.
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 red wire assembly that connects to the charger relay **(Figure 3-24, Page 3-27)**.
8. Using pliers, squeeze the strain relief bushing and remove the DC cord **(Figure 3-24, Page 3-27)**.

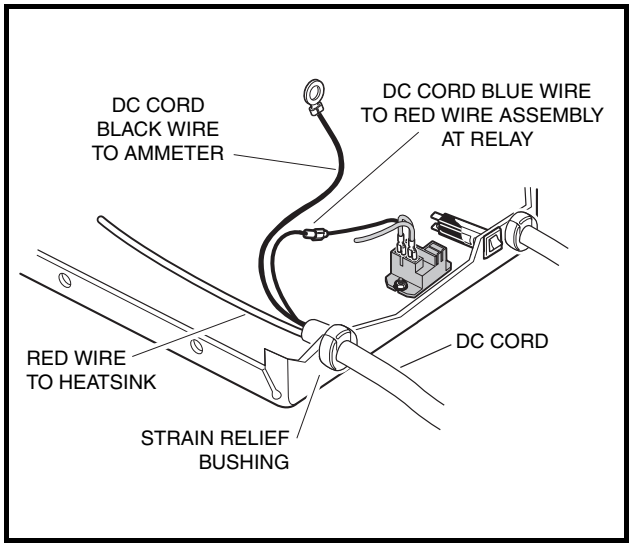

Figure 3-24 DC Cord

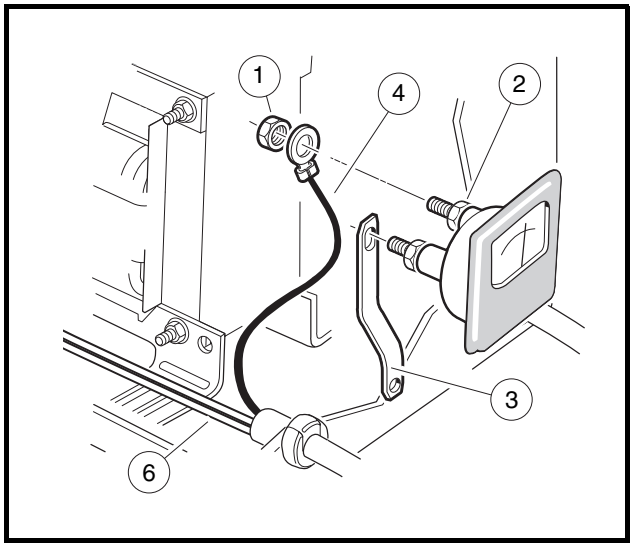

Figure 3-25 DC Cord Replacement

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 3-24, Page 3-27)**.
3. Attach the blue wire of the new DC cord to the red wire assembly at the charger relay **(Figure 3-24, Page 3-27)**.
4. Attach 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 3-25, Page 3-27)**. **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 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.**

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

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.
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 3-9, Page 3-11 and Figure 3-10, Page 3-15)**.
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 18 in-lb (2.0 N·m) **(Figure 3-9, Page 3-11 and Figure 3-10, Page 3-15)**.
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.
2. Remove the charger cover.
3. Disconnect the tan primary coil wire from the charger relay **(Figure 3-9, Page 3-11 and Figure 3-10, Page 3-15)**.
4. Disconnect the AC cord white wire from the primary coil tan wire.
5. Remove the wire tie that secures the DC cord wire to the secondary coil wire (tan).
6. Disconnect the two tan secondary coil transformer wires from the heatsink **(Figure 3-9, Page 3-11 and Figure 3-10, Page 3-15)**.
7. Disconnect the two black secondary coil transformer wires from the fuse.
8. 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) **(Figure 3-10, Page 3-15)**.
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 tan primary coil transformer wire to the charger relay.
7. Connect the other tan primary coil transformer wire to the white wire from the AC cord.
8. 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.**

9. 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.
2. Remove the charger cover.
3. Disconnect the black wire from the DC cord (5), and the buss bar (3) from the ammeter **(Figure 3-26, Page 3-30)**.
4. Remove the two nuts (2) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 3-26, Page 3-30)**.
2. Install nuts (2) and tighten until ammeter is firmly secured.
3. Connect the black wire of the DC cord (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.
7. Plug the charger into the vehicle and check ammeter for proper operation.

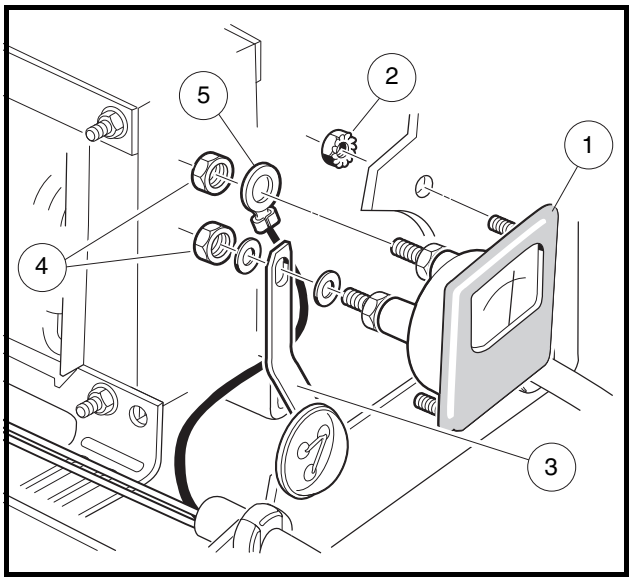

Figure 3-26 Ammeter

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.
2. Remove the charger cover.
3. Remove both black secondary coil transformer wires and the buss bar from the back of the fuse link assembly **(Figure 3-26, Page 3-30)**.
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 3-26, Page 3-30)**. 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 also Test Procedure 8 – Continuity on page 3-24.**

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) to heatsink **(Figure 3-27, Page 3-33).**
4. Disconnect the blue and red wires from the relay.
5. Disconnect the DC cord blue wire at the quick disconnect terminal**.**
6. Remove the voltage suppressor and wire assembly from the charger**.**

Voltage Suppressor Installation

1. 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). **See following NOTE.**

NOTE: *The charger relay blade connector is located off-center within the relay housing. When connecting voltage suppressor slip-on connector to relay blade connector, make sure slip-on connector is positioned so that flat side of connector is closest to relay housing* ***(Figure 3-27, Page 3-33)****.*

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.
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 3-27, Page 3-33)**.
4. Remove two nuts and lock washers attaching relay to the charger case.
5. Remove the relay.

Charger Relay Installation

1. Install in reverse order of removal. Connect wires as shown **(Figure 3-27, Page 3-33)**. Tighten nut securing relay to charger base to 18 in-lb (2.0 N·m).

CHARGER AC CIRCUIT BREAKER

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.
2. Remove the charger cover.
3. Disconnect the two black wires attached to the AC circuit breaker **(Figure 3-27, Page 3-33)**.
4. With a pair of pliers, squeeze in the retaining tabs on the sides of the AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.

AC Circuit Breaker Installation

1. 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.
2. Remove the charger cover.
3. Disconnect the AC cord black wire from the AC circuit breaker **(Figure 3-27, Page 3-33)**.
4. Disconnect the AC cord white wire from the primary coil tan wire.
5. Disconnect the AC cord green wire from the charger base **(Figure 3-27, Page 3-33)**.
6. Use a pair of pliers to grip the strain relief bushing and remove it and the AC cord from the charger.

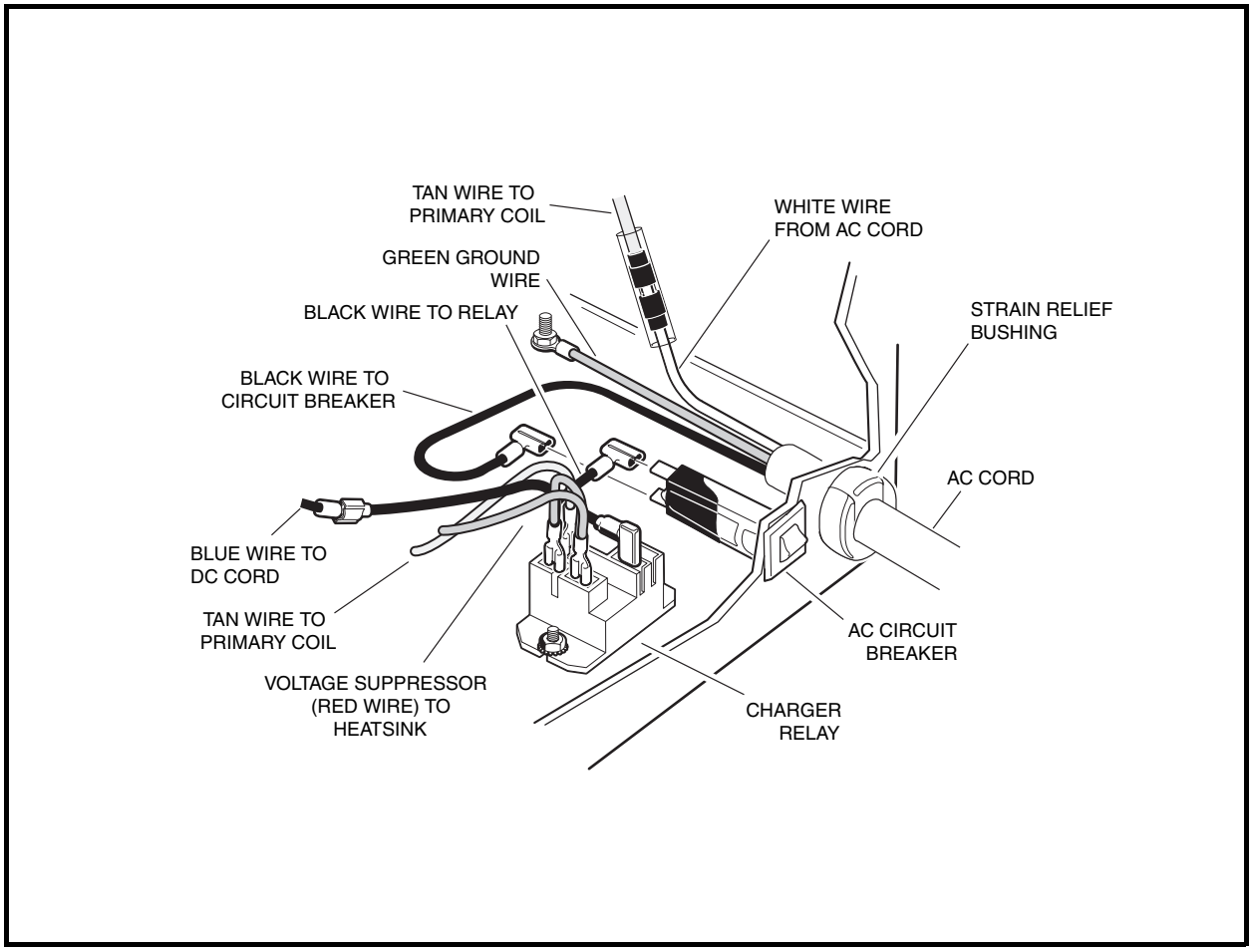

Figure 3-27 Charger Relay

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 3-27, Page 3-33)**.
2. Connect the black wire to the AC circuit breaker, the white wire to the primary coil, and 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.

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 3-9, Page 3-11 and Figure 3-10, Page 3-15).**
- **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, remove the black wire (3) from the AC circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire (4) to the AC circuit breaker **(Figure 3-28, Page 3-34)**. **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.**

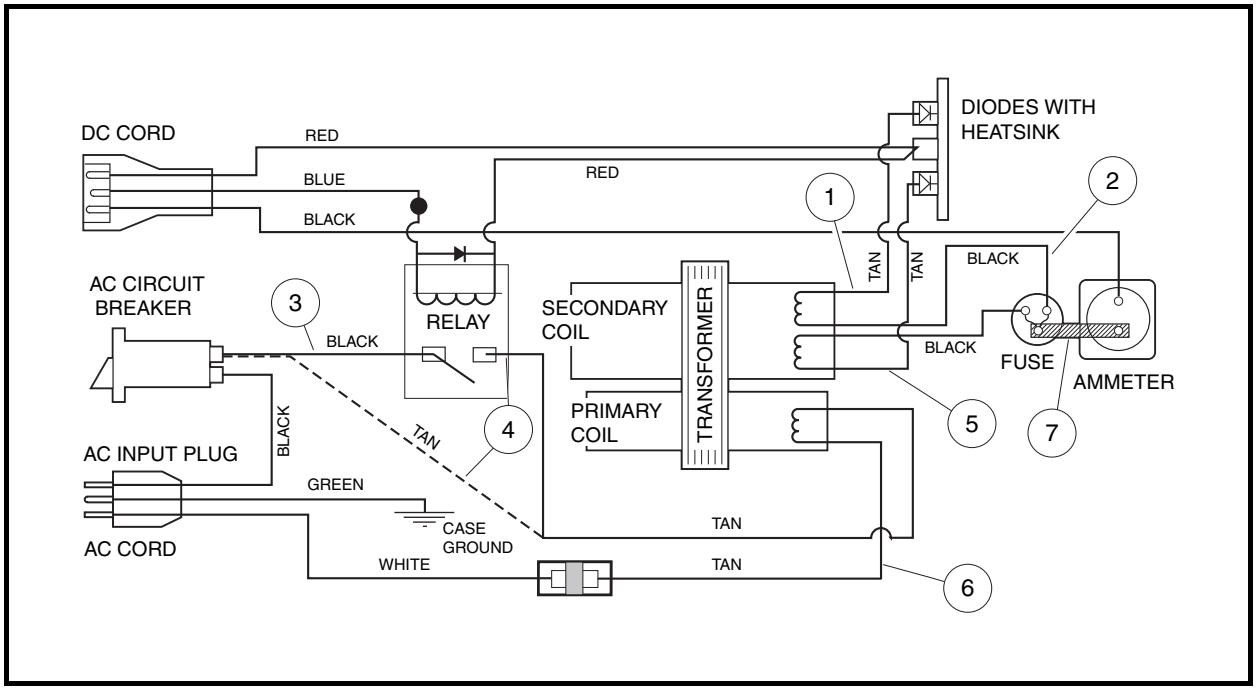

Figure 3-28 PowerDrive Charger Wiring Diagram (Relay Bypassed)

5. Plug the DC cord into the charger receptacle *first*, and 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 transformer wire (4) from AC circuit breaker and connect it to the relay. Connect the short black wire (3) from the relay to the AC circuit breaker **(Figure 3-28, Page 3-34)**. **See following WARNING.**

⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to 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 and 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 4 – 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 onboard PowerDrive battery charger. Model number 17935-10 is used on the DS Villager 4. Model number 17935-40 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).*

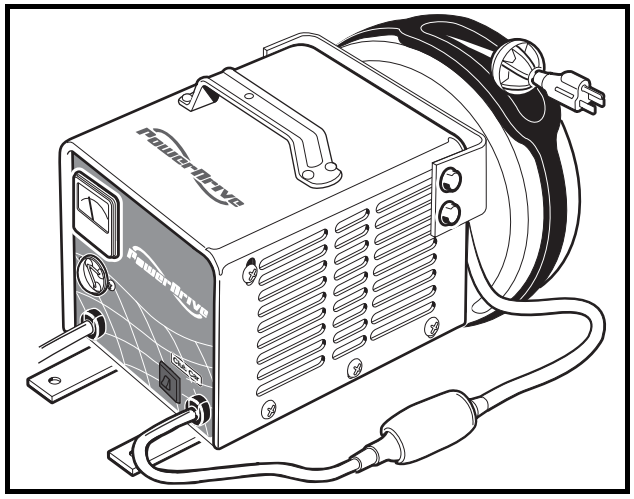

Figure 4-1 Onboard PowerDrive Battery Charger

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 4-6, Page 4-11 and Figure 4-7, Page 4-11)** or battery no. 6 **(Figure 4-8, Page 4-11)**. 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.

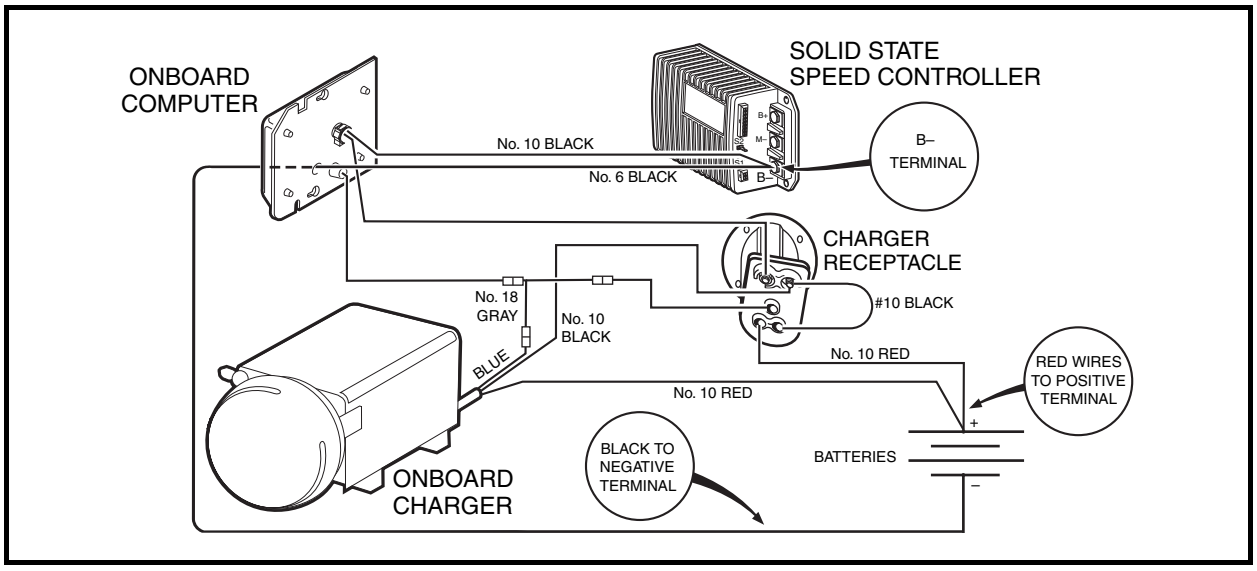

Figure 4-2 Charge Circuit – DS Villager 4

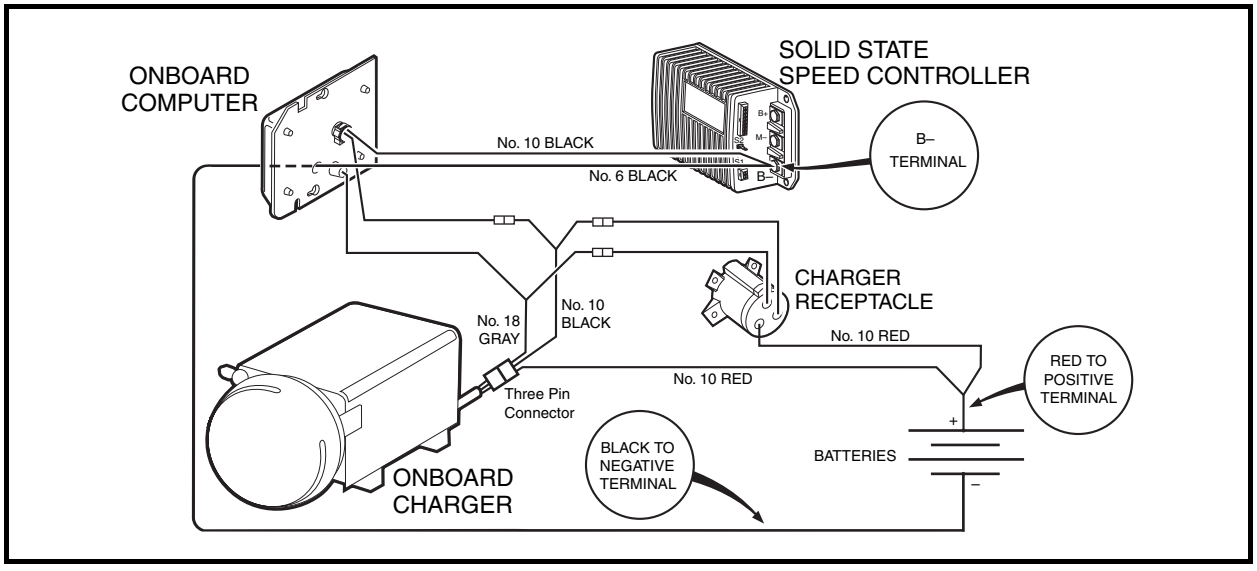

Figure 4-3 Charge Circuit – Precedent Vehicles

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.**
- **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 4-33.**
- **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 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 Specifications.**

Connect the power supply cord to an AC supply. **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 the National Electric Code and all local codes and ordinances.

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: *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) (CC 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 a 120-volt AC, 60-hertz, single-phase 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 4-4, Page 4-6)**.

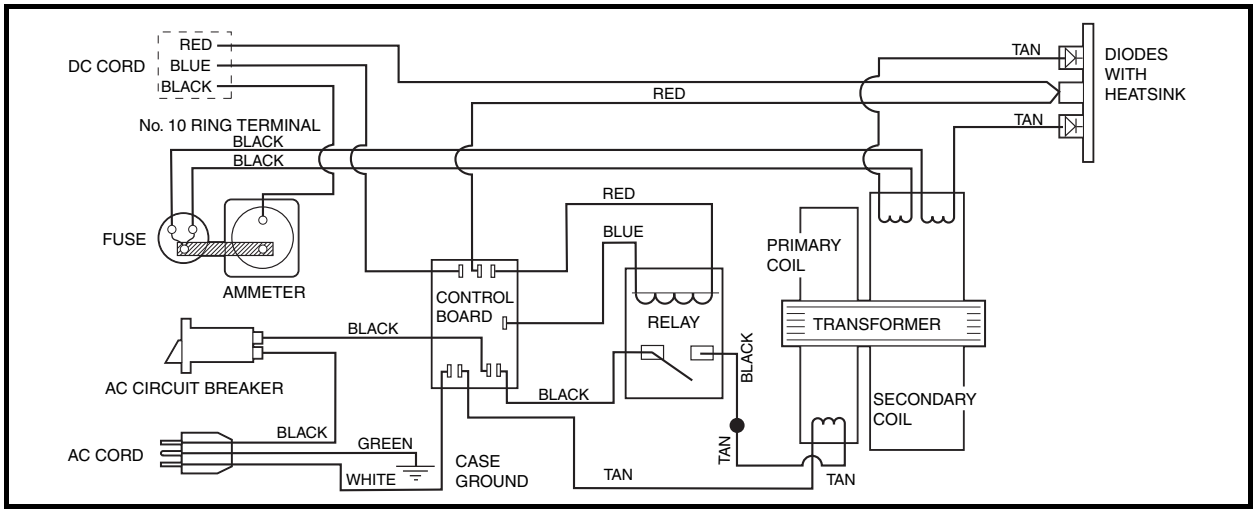

Figure 4-4 PowerDrive Onboard Battery Charger Wiring Diagram

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 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 4-7.** 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 then 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 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 4-4, Page 4-6).**
- **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 4-33.**

Use the following Troubleshooting Guide for troubleshooting export PowerDrive onboard battery chargers (model numbers 17935-10 and 17935-40). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

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 the batteries. **See Connecting The Batteries on page 1-4.**
	Battery voltage is too low	Test Procedure 1 – Battery Voltage on page 4-10
	Improper vehicle or battery charger wiring	**See Figure 4-2, Page 4-3**, **Figure 4-3, Page 4-3**, **Figure 4-4, Page 4-6**, **Figure 4-5, Page 4-10**, **Figure 4-6, Page 4-11**, **Figure 4-7, Page 4-11 and Figure 4-8, Page 4-11**
	DC circuit	Test Procedure 5 – Charger DC Circuit Continuity Test on page 4-16
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 4-12
	Gray sense lead fuse is blown	Test Procedure 1 – Battery Voltage on page 4-10
	Control board malfunction	Test Procedure 2 – Control Board on page 4-12

Troubleshooting Guide continued on next page...

POWERDRIVE ONBOARD BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
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 4-13
	Failed AC plug and cord	Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-13
	Failed AC cord reel	Test Procedure 8 – Continuity on page 4-19
	Internal AC breaker	Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-13
	Transformer primary coil	Test Procedure 6 – Transformer on page 4-17
	Relay	Test Procedure 8 – Continuity on page 4-19
Relay closes and transformer hums but ammeter does not move	Blown charger fuse	Test Procedure 4 – Diodes on page 4-14
	Both Diodes failed	Test Procedure 4B – Both Diodes Failed on page 4-15
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 4-12
	Failed transformer	Test Procedure 6 – Transformer on page 4-17
	Failed ammeter	Replace ammeter
Relay operates intermittently	Failed charger relay	Test Procedure 8 – Continuity on page 4-19
Single charger fuse link blows	Diode failed	Test Procedure 4A – Single Diode Failure on page 4-14
	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 4-15
Charger output is low	One diode failed	Test Procedure 4A – Single Diode Failure on page 4-14
	Transformer coil short-circuit failure	Test Procedure 6 – Transformer on page 4-17
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 4-12
Charger turns off too soon	AC power supply was shut off	Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-13
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 4-12
	Batteries may be fully charged	Test Procedure 7 – Battery State of Charge Test on page 4-18

Troubleshooting Guide continued on next page...

POWERDRIVE ONBOARD BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Charger goes to 16 hour time out	Onboard computer malfunction	Test Procedure 2 – Control Board on page 4-12
	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 4-19
	Failed transformer	Test Procedure 6 – Transformer on page 4-17
	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 4-13
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 4-12
	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 Section 13 – Batteries 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 4-28, Page 4-34)**. **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 4-5, Page 4-10)**. 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 4-31.**

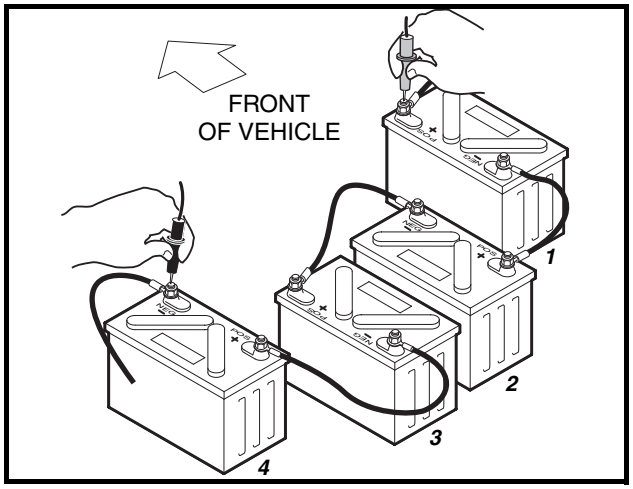

Figure 4-5 Battery Voltage Test – DS Villager 4

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 4-6, Page 4-11)** or **(Figure 4-7, Page 4-11)**.

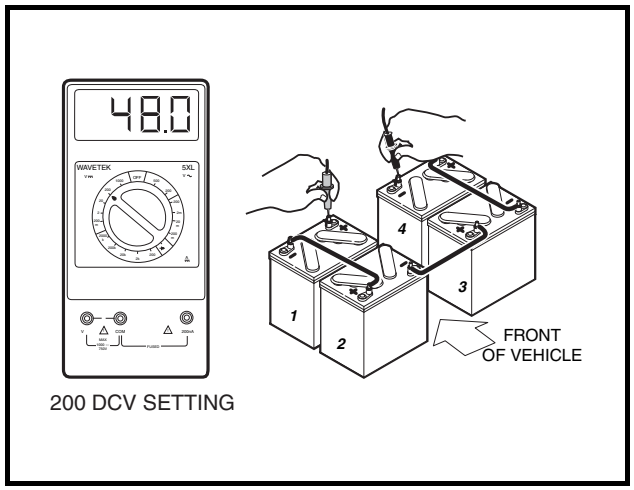

Figure 4-6 Battery Voltage Test – Precedent Style A Battery Configuration

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

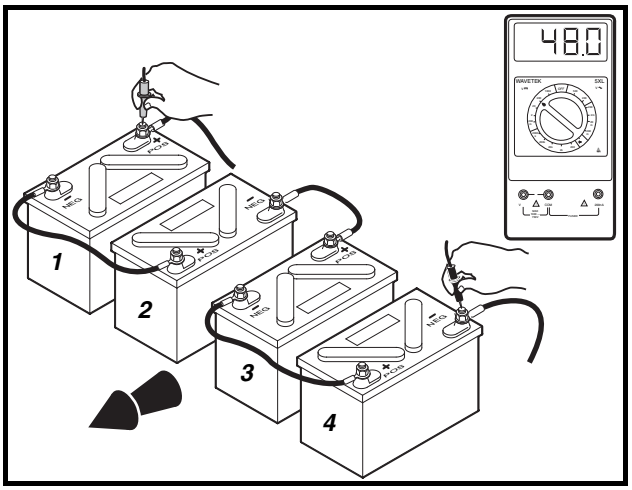

Figure 4-7 Battery Voltage Test – Precedent Style B Battery Configuration

(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 4-8, Page 4-11)**.

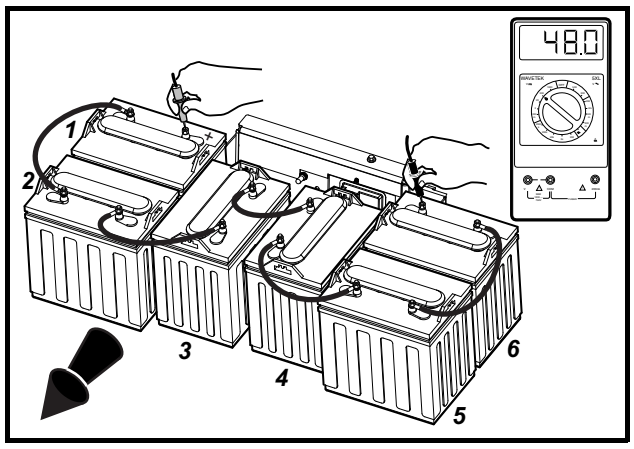

Figure 4-8 Battery Voltage Test – Precedent Style C Battery Configuration

(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 4-31.**

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.

⚠ 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 4-9, Page 4-12)**.

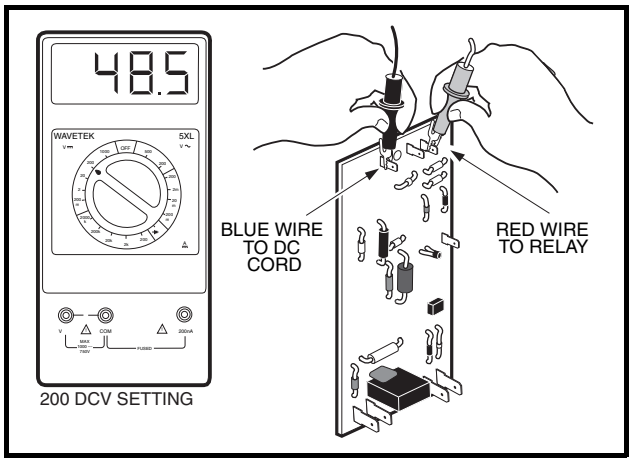

Figure 4-9 DC Circuit Test

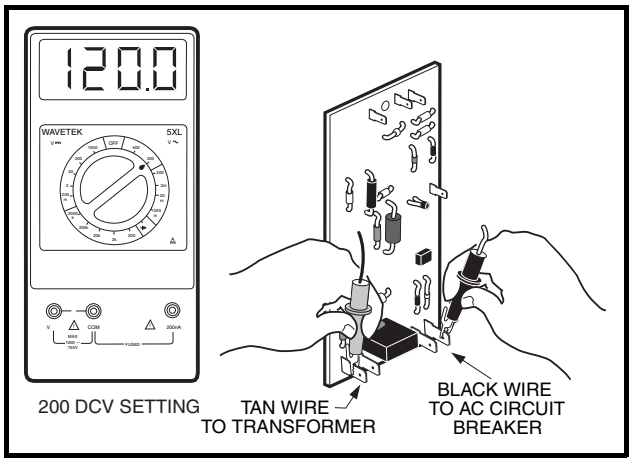

Figure 4-10 AC Circuit Test

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 tan wire from transformer primary coil at terminal on control board **(Figure 4-11, Page 4-13)**. **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 200 volts AC, onto terminal with black AC circuit breaker wire. Connect red (+) probe to terminal from which tan transformer wire was disconnected **(Figure 4-10, Page 4-12)**.
4. Connect AC cord to outlet. Reading should be approximately 110 to 128 volts AC.
5. If reading is incorrect, replace control board.

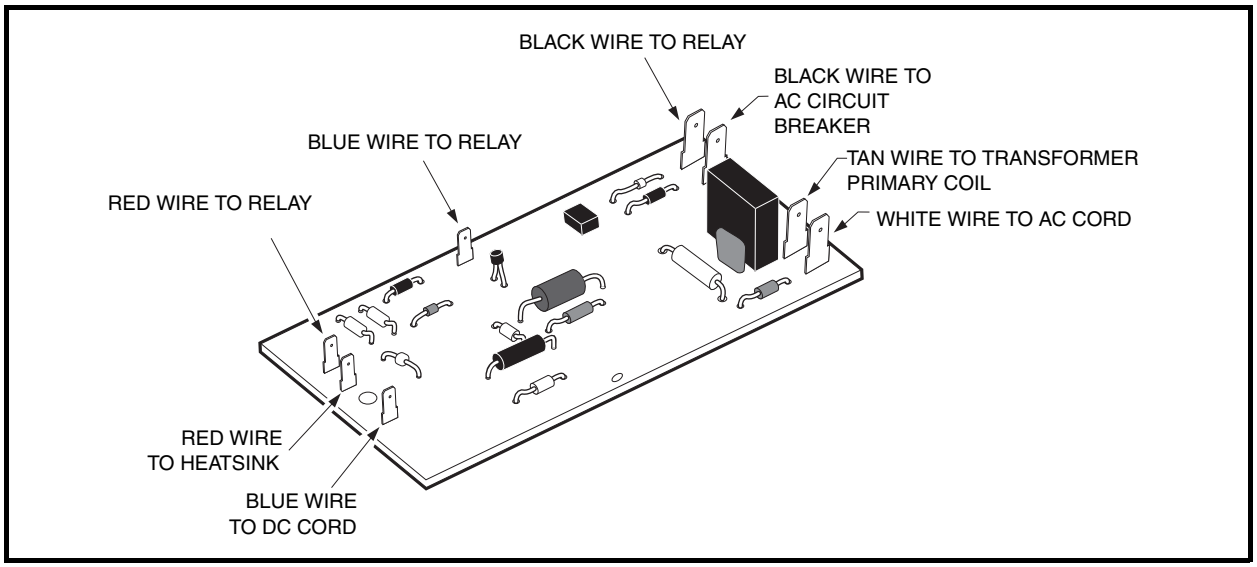

Figure 4-11 Control Board

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 breaker 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 between 105 and 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
5. Check continuity of the AC circuit.
   - 5.1. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-33.**
   - 5.2. Remove the charger cover.
   - 5.3. Bypass the relay.
     - 5.3.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 4-17, Page 4-18)**.
   - 5.4. With relay bypassed, there should be continuity across the AC cord blades **(Figure 4-12, Page 4-14)**.
6. If the circuit is not complete, check the wiring of the AC cord, AC cord reel, transformer primary coil wires, and internal AC circuit breaker **(Figure 4-17, Page 4-18)**.
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 4-19.**

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 properly connect the relay wiring could result in property damage, severe personal injury, or death.**

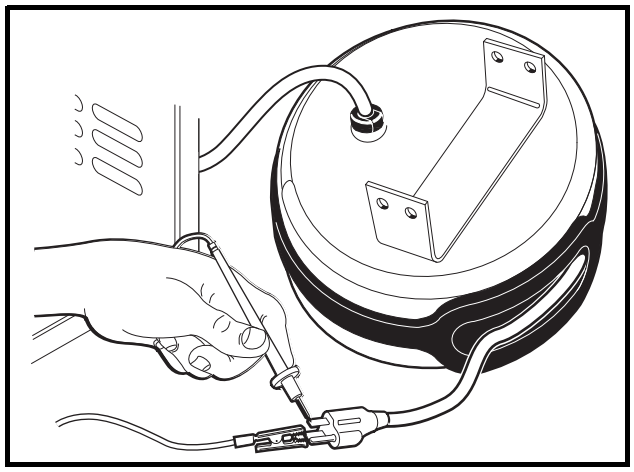

Figure 4-12 AC Circuit Continuity Test

TEST PROCEDURE 4 – DIODES

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

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 4-33.**
3. Remove the charger cover.
4. Disconnect one transformer secondary coil wire from the diode terminal **(Figure 4-13, Page 4-15)**.
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 4-13, Page 4-15)**.
6. Reverse test probes and check each diode again and note the reading **(Figure 4-14, Page 4-15)**. 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.**

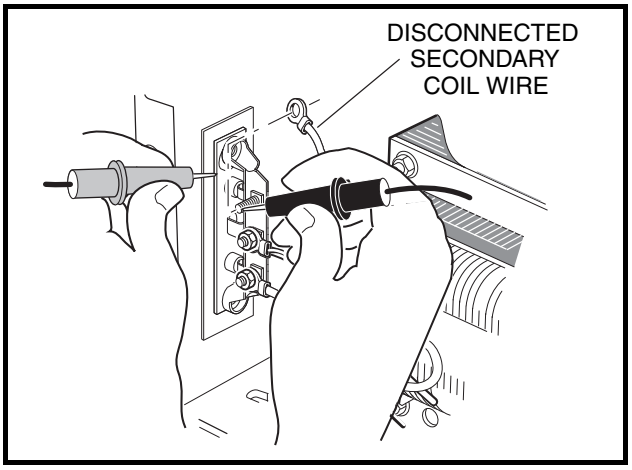

Figure 4-13 Diode Test

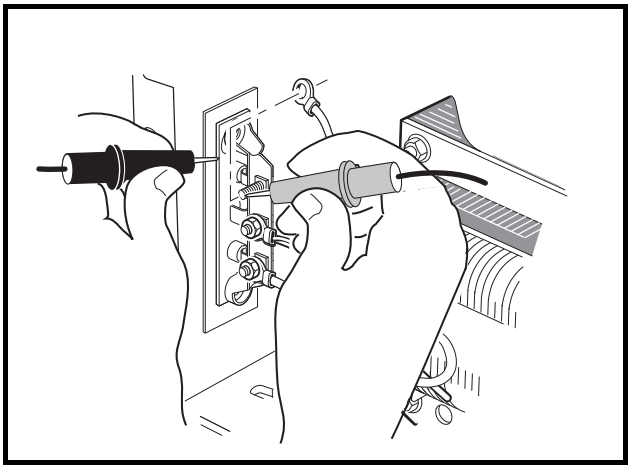

Figure 4-14 Diode Test – Probes Reversed

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 4-14. 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 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 4-4, Page 4-6)**. 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 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. Connect the batteries. **See Connecting The Batteries on page 1-4.**
3. Disconnect the DC cord blue wire (17) from the 3-way wire adapter (18) at the sense lead fuse (20) **(Figure 4-28, Page 4-34)**.
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 4-28, Page 4-34)**.
6. Using a continuity tester (CC 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 4-20, Page 4-21)**. Note the reading.
7. Reverse the test probes and check the DC cord again **(Figure 4-20, Page 4-21)**. 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 4-19.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 4-14.**
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 4-14.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 4-19.**
10. Remove the DC cord blue wire from the control board and check continuity between the DC cord red, black, and blue wires **(Figure 4-4, Page 4-6)**. There should be no continuity

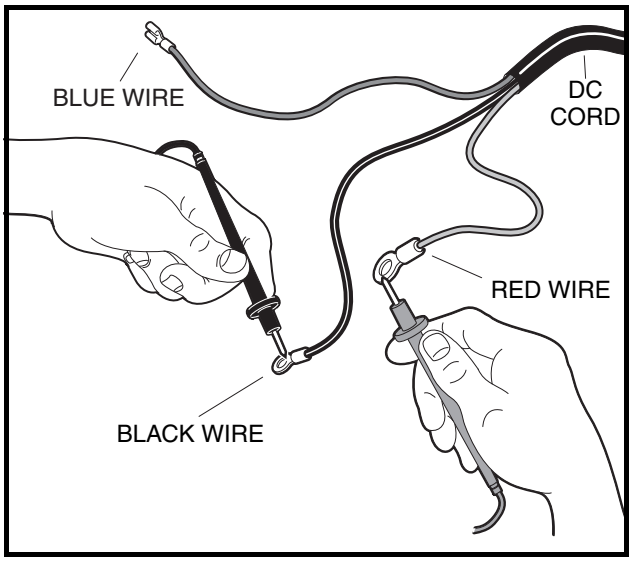

Figure 4-15 DC Cord Test – DS Villager 4 Vehicles

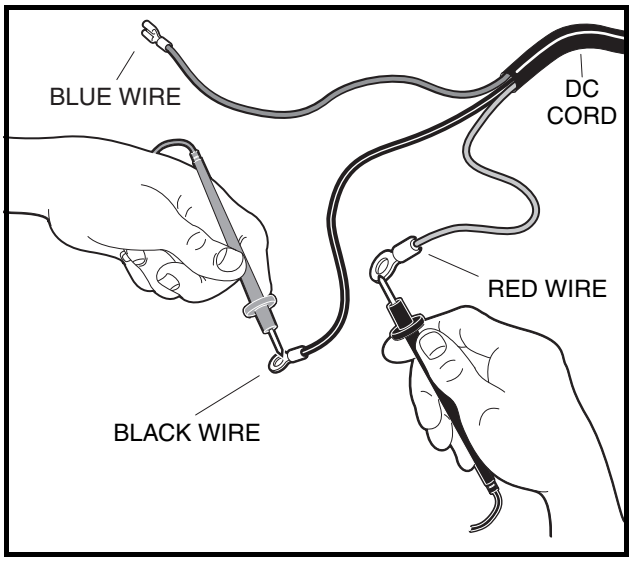

Figure 4-16 DC Cord Test (Probes Reversed) – DS Villager 4 Vehicles

Test Procedure 5B – Precedent Vehicles

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

1. Disconnect the AC cord from the wall outlet.
2. Connect the batteries. **See Connecting The Batteries on page 1-4.**
3. Disconnect the charger DC cord at the three pin connector **(Figure 4-3, Page 4-3)**.
4. Using a continuity tester (CC 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 **(Figure 4-17, Page 4-18)**. 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 4-19.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 4-14.**
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 4-14.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 4-19.**
8. Check continuity between the DC cord red, black, and blue wires **(Figure 4-4, Page 4-6)**. 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 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 breaker, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 4-13.**

1. Disconnect AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 4-33.**
3. Remove the charger cover.
4. Disconnect transformer secondary coil wires (1 and 5) from the heatsink **(Figure 4-17, Page 4-18)**.
5. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   5.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 4-17, Page 4-18)**. **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.**

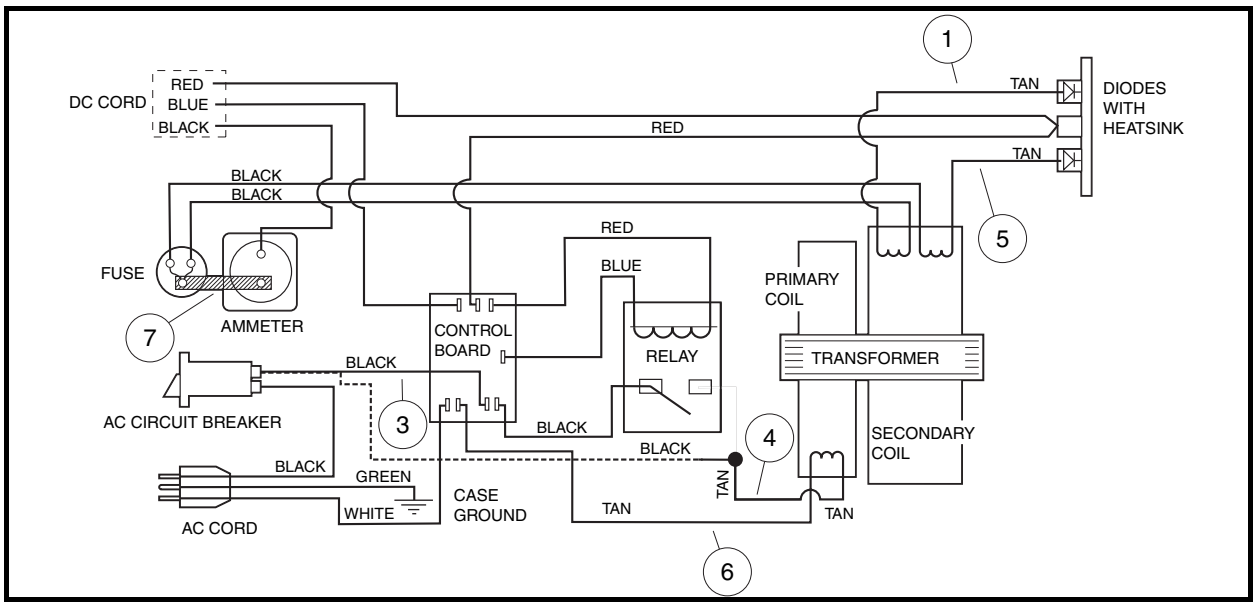

Figure 4-17 Transformer Test Wiring Diagram

6. Make sure 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 wires (1 and 5).
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 **(Figure 4-17, Page 4-18)**.
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 4-16.**
12. 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 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 then reconnect it. The ammeter should jump to a reading between 14 and 18 amps and then 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 4-12. 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 Section 13 – Batteries 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 4-33.**
3. Remove the charger cover.
4. Disconnect the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 4-18, Page 4-20)**.
5. Disconnect the black wire (1) of the short AC cord from charger AC circuit breaker.
6. Disconnect the AC cord white wire (4) from the control board **(Figure 4-17, Page 4-18)**.
7. Using a multimeter set for 200 ohms, place the red (+) probe on the terminal at the end of the black wire (1) **(Figure 4-18, Page 4-20)**. 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 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 4-18, Page 4-20)**. 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 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 4-33.**
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 4-19, Page 4-20)**.
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 4-20, Page 4-21)**.

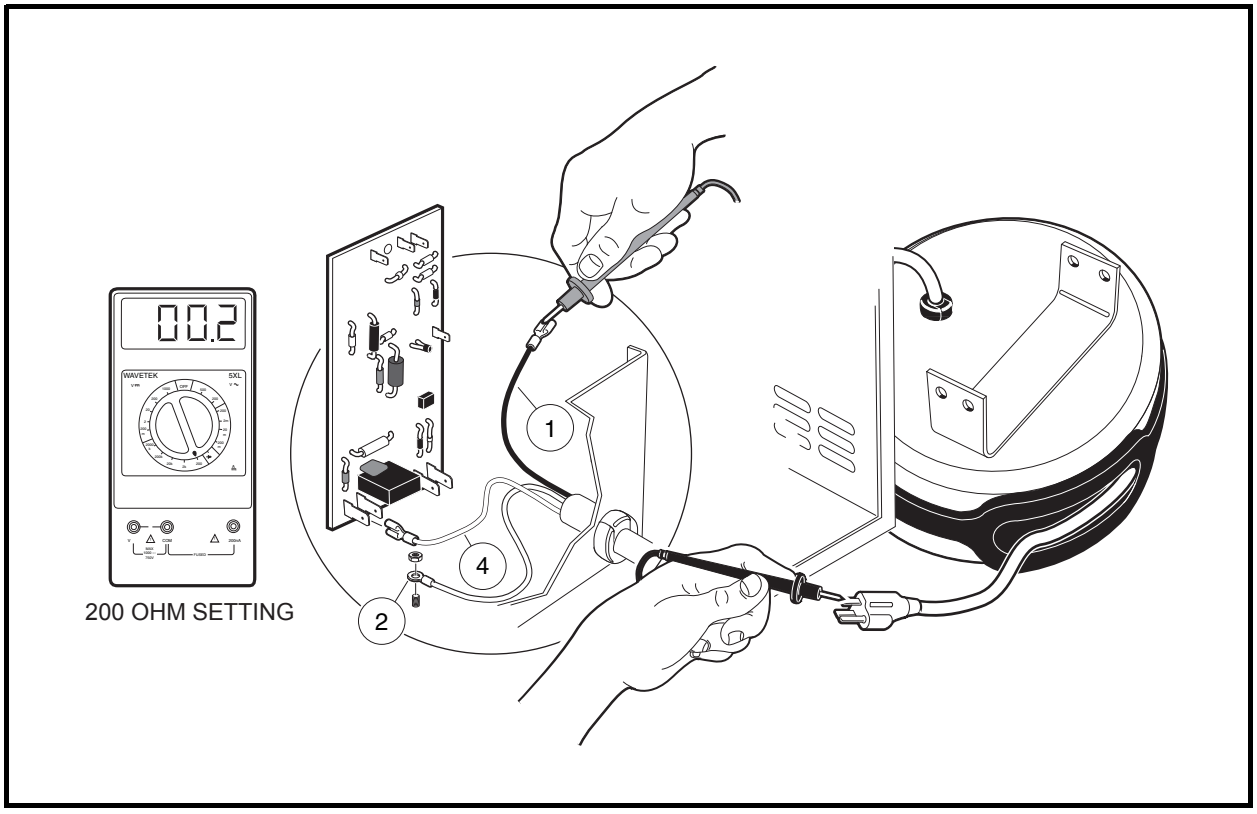

Figure 4-18 AC Cord and Retractable Cord Reel Continuity Test

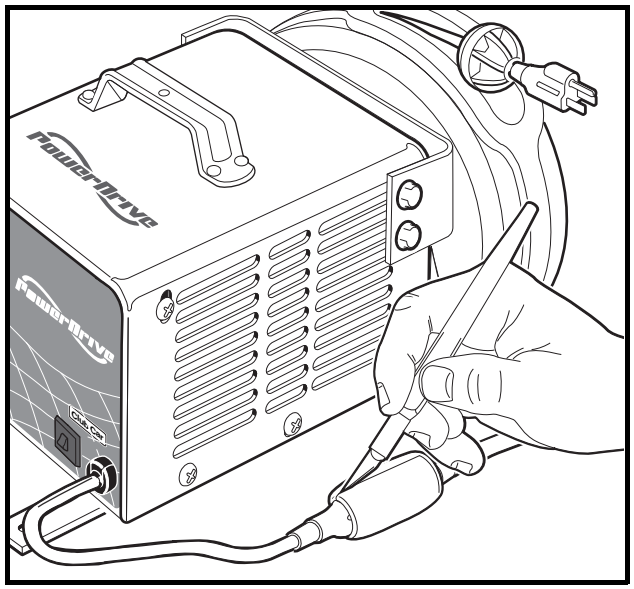

Figure 4-19 Heatshrink Removal

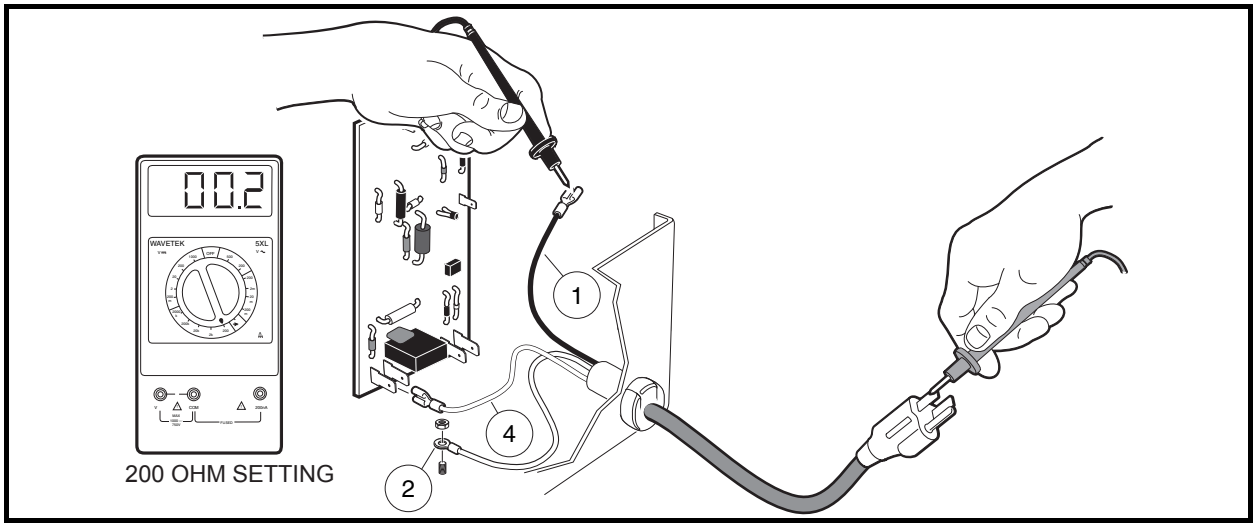

Figure 4-20 Short AC Cord Test

7. Disconnect the black wire (1) of AC cord from charger AC circuit breaker.
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 4-33.**
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 4-19, Page 4-20)**.
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 4-21, Page 4-22)**. 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.

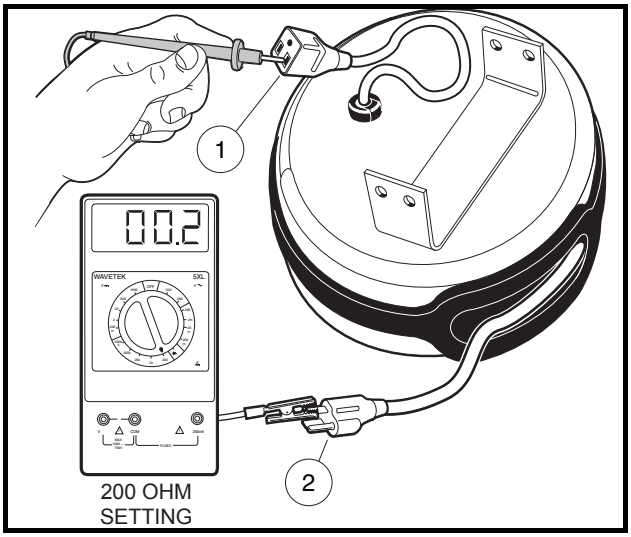

Figure 4-21 Retractable Cord Reel Test

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 4-33.**
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 4-22, Page 4-24).**
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 PowerDrive battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 4-17, Page 4-18)**.

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 4-33.**
2. Remove the charger cover.
3. Disconnect terminals from transformer (tan) primary coil transformer wires (4 and 6) **(Figure 4-17, Page 4-18)**.
4. Place the continuity test probes on the disconnected primary transformer coil wires. The tester should indicate continuity. If tester does not indicate continuity, 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 4-33.**
2. Remove the charger cover.
3. Remove the transformer (tan) secondary coil wire (1) from the upper terminal of the heatsink **(Figure 4-17, Page 4-18)**.
4. Remove the other transformer (tan) secondary coil wire (5) from the bottom terminal of the heatsink and place the continuity test clip on the ammeter buss bar (7) **(Figure 4-17, Page 4-18)**. 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 4-33.**
2. Remove the charger cover.
3. Remove black wires from contact terminals of the relay **(Figure 4-17, Page 4-18)**. Place continuity test probes on contact terminals 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.

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 4-33.**
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 4-33.**
2. Remove the charger cover.
3. Disconnect the wires from the AC circuit breaker.

4. Place the continuity test probe 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 4-4, Page 4-6).**
- **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 4-33.**

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 4-33.**
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 4-23, Page 4-24)**.
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 4-22, Page 4-24)**.
8. Using pliers, squeeze the strain relief bushing and remove the DC cord **(Figure 4-22, Page 4-24)**.

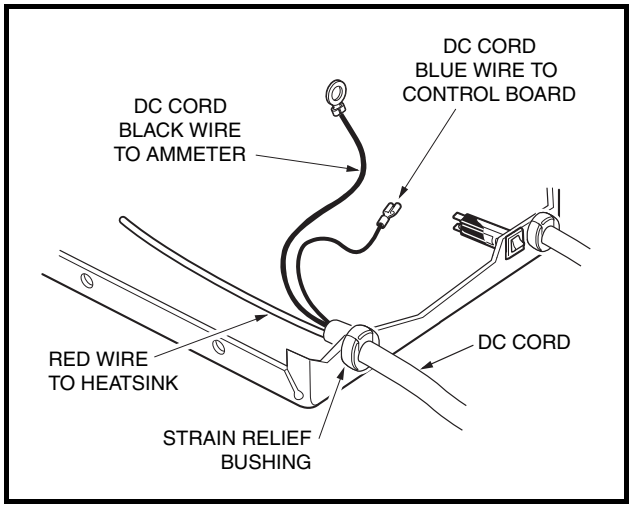

Figure 4-22 DC Cord

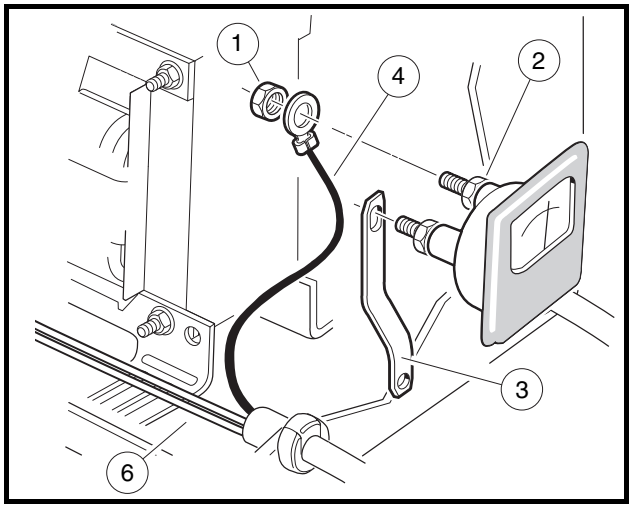

Figure 4-23 DC Cord Replacement

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 4-22, Page 4-24)**.
3. Attach the blue wire of the new DC cord to the control board **(Figure 4-22, Page 4-24)**.
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 4-23, Page 4-24)**. **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 4-33. See preceding WARNING.**
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 4-4, Page 4-6)**.
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 4-4, Page 4-6)**.
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).
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 install the charger in the vehicle. **See Onboard Charger Installation on page 4-34.**
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 4-33. See WARNING on page 4-24.**
2. Remove the charger cover.
3. Disconnect the black primary coil wire from the charger relay **(Figure 4-4, Page 4-6)**.
4. Disconnect the tan primary coil wire from the control board.
5. Remove the wire tie that secures the DC cord wire to the secondary coil wire (tan).
6. Disconnect the two tan secondary coil transformer wires from the heatsink **(Figure 4-4, Page 4-6)**.
7. Disconnect the two black secondary coil transformer wires from the fuse.
8. 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) **(Figure 4-4, Page 4-6)**.
2. 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).
3. 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).
4. Connect one secondary coil transformer wire (black) to one terminal of the fuse assembly. Tighten nut to 22 in-lb (2.5 N·m).
5. Connect the other secondary coil transformer wire (black) to the remaining terminal of the fuse assembly. Tighten nut to 22 in-lb (2.5 N·m).
6. Connect the black primary coil transformer wire to the charger relay.
7. Connect the other primary coil transformer wire to the control board.
8. 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.**

9. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 4-34.**
10. 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 4-33. See WARNING on page 4-24.**
2. Remove the charger cover.
3. Disconnect the black wire from the DC cord (5), and the buss bar (3) from the ammeter **(Figure 4-24, Page 4-27)**.
4. Remove the two nuts (2) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

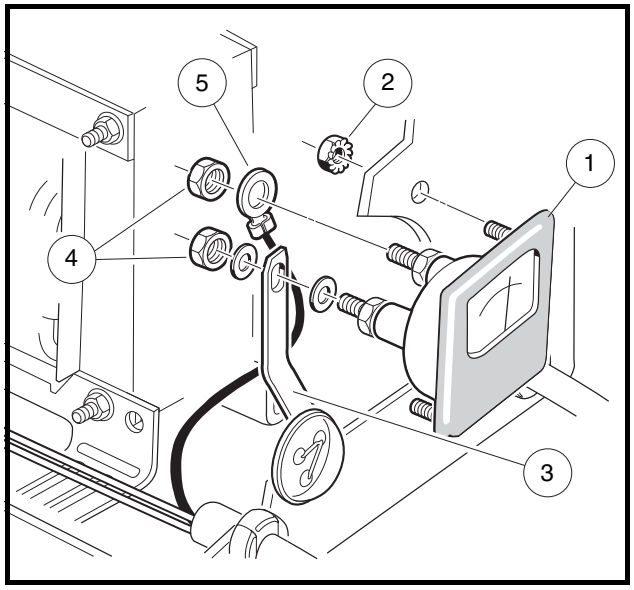

Figure 4-24 Ammeter

Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 4-24, Page 4-27)**.
2. Install nuts (2) and tighten until ammeter is firmly secured.
3. Connect the black wire of the DC cord (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 4-34.**
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 4-33. See WARNING on page 4-24.**
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 4-24, Page 4-27)**.
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 4-24, Page 4-27)**. 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 4-34.**
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 4-33. See WARNING on page 4-24.**
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 4-25, Page 4-29)**.
4. Remove two nuts and lock washers securing relay to the charger base.
5. Remove the relay.

Charger Relay Installation

Install in reverse order of removal. Connect wires as shown **(Figure 4-25, Page 4-29)**. Tighten nut securing relay to charger base to 18 in-lb (2.0 N·m).

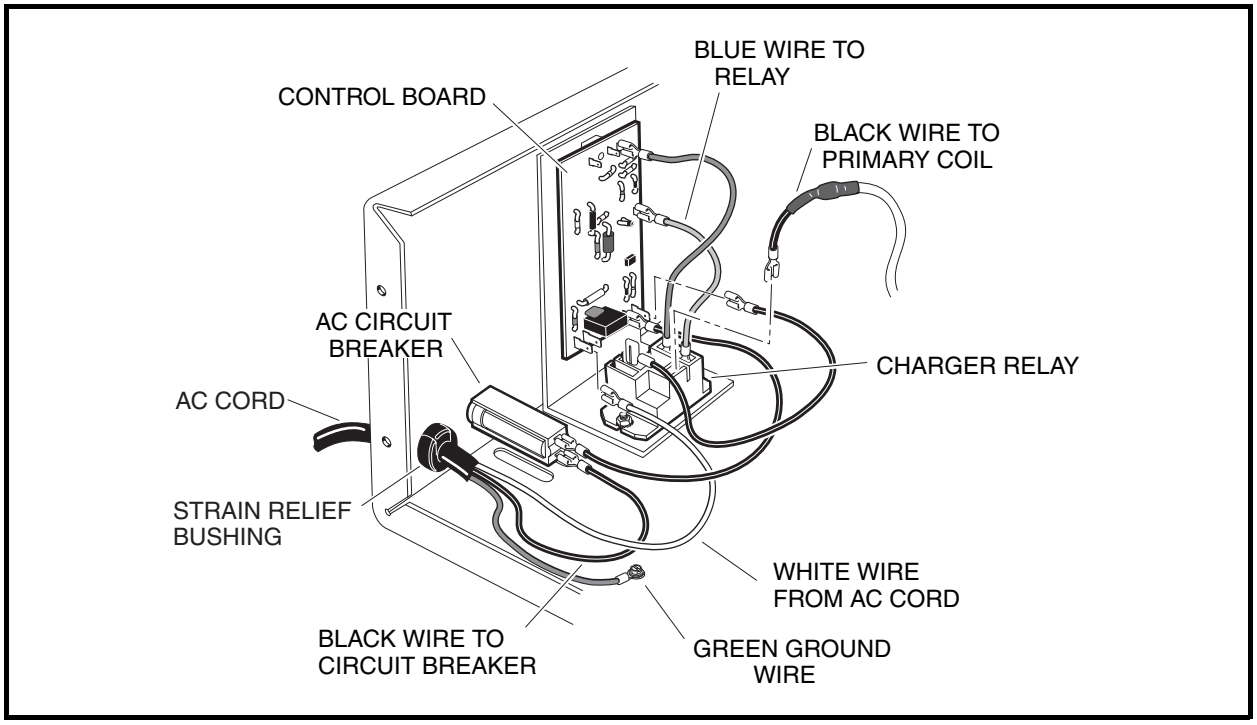

Figure 4-25 Charger Relay

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 4-33. See WARNING on page 4-24.**
2. Remove the charger cover.
3. Disconnect the two black wires attached to the AC circuit breaker **(Figure 4-25, Page 4-29)**.
4. With a pair of pliers, squeeze in the retaining tabs on the sides of the AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.

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 4-33. See WARNING on page 4-24.**
2. Remove the charger cover.
3. Disconnect the AC cord black wire from the AC circuit breaker **(Figure 4-25, Page 4-29)**.
4. Disconnect the AC cord white wire from the control board.

5. Disconnect the AC cord green wire from the charger base **(Figure 4-25, Page 4-29)**.
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 4-25, Page 4-29)**.
2. Connect the black wire to the AC circuit breaker, the white wire to the control board, and the green wire to the charger base **(Figure 4-4, Page 4-6)**. 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 4-34.**
6. Check charger for proper operation.

RETRACTABLE AC CORD REEL

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

Retractable AC Cord Reel 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 4-33. See WARNING on page 4-24.**
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 4-19, Page 4-20)**.
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 4-4, Page 4-6).**
- **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 4-33.**

If battery pack voltage is below 32 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 handle 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 4-33. See WARNING on page 4-24.**
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, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 4-26, Page 4-32)**. **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 4-34.**
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 4-33. See WARNING on page 4-24.**
9. Disconnect the transformer wire (4) from AC circuit breaker and connect it to the relay. Connect the short black wire (3) from the control board to the AC circuit breaker **(Figure 4-4, Page 4-6)**. **See following WARNING.**

⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to 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 4-34.**
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 32 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.**

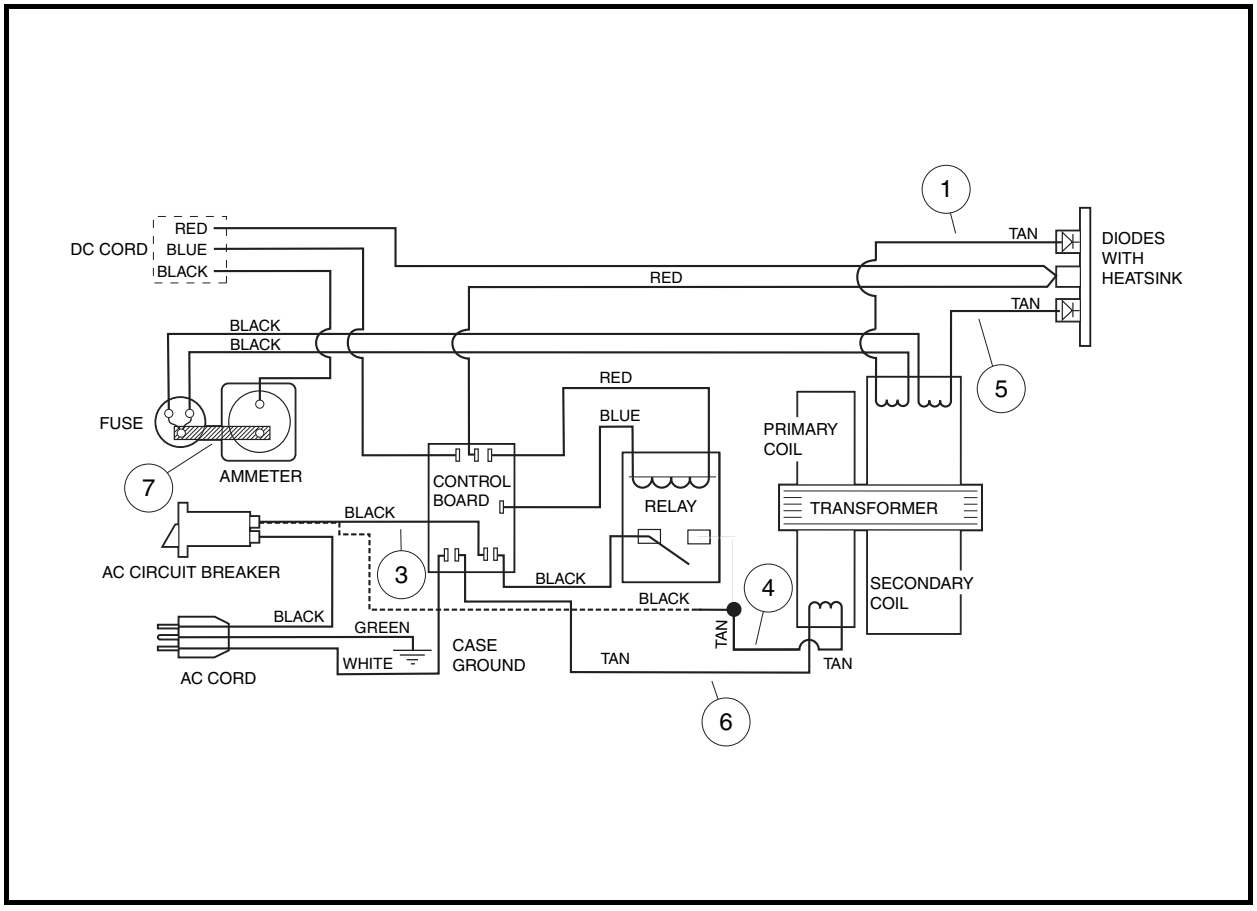

Figure 4-26 PowerDrive Onboard Charger Wiring Diagram (Relay Bypassed)

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 4-4, Page 4-6).**
- **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 4-33.**

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Onboard Charger Removal

1. Connect the batteries. **See Connecting The Batteries on page 1-4.**
2. Remove four bolts (21), flat washers (22), lock washers (23) and nuts (24) from charger mounting brackets **(Figure 4-27, Page 4-33)**.

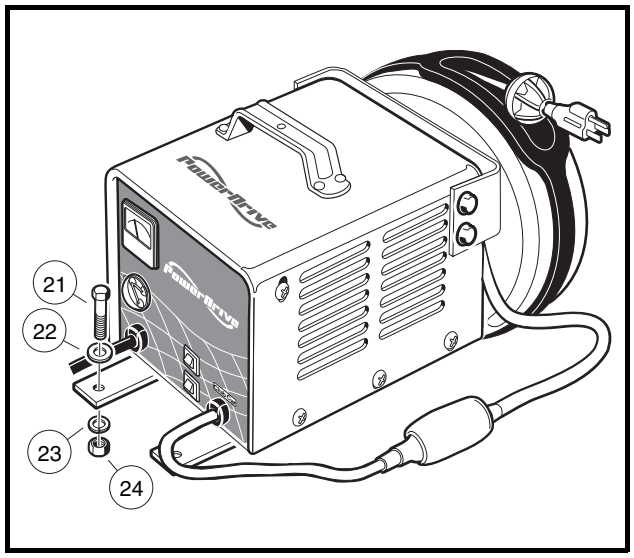


Figure 4-27 Onboard Charger Mounting – DS Villager

3. Remove 10-gauge black charger DC cord wire (19) from the charger receptacle fuse link **(Figure 4-28, Page 4-34)**.
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 4-28, Page 4-34)**.
6. Cut any wire tie(s) that secures the DC cord to the vehicle.
7. Lift charger and reel assembly from vehicle.

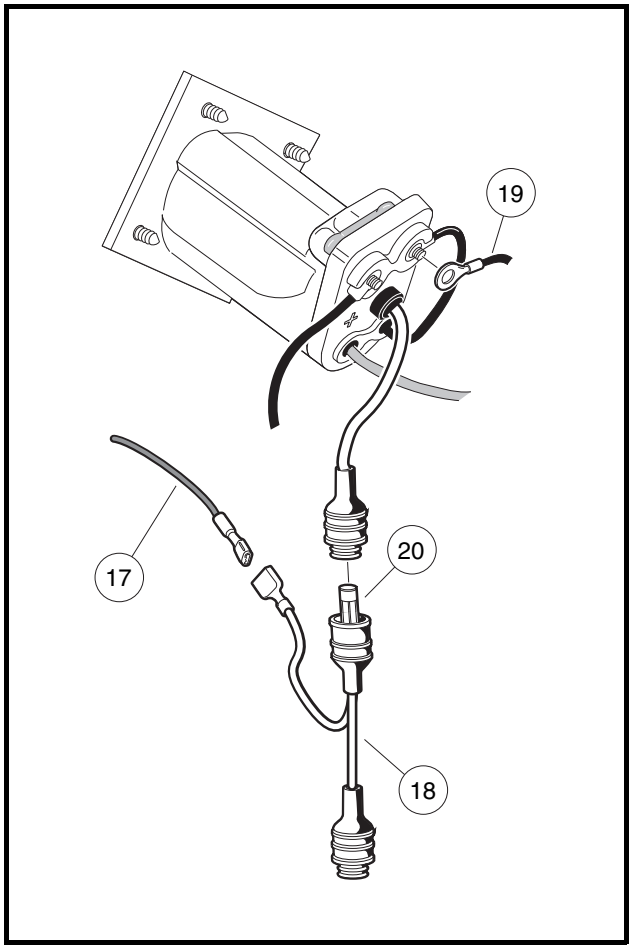


Figure 4-28 Charger DC Cord Black Wire and Blue Wire – DS Villager 4

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 4-27, Page 4-33)**.
4. Connect the batteries. **See Connecting The Batteries on page 1-4.**

PRECEDENT VEHICLES

Onboard Charger Removal

1. Connect the batteries. **See Connecting The Batteries on page 1-4.**
2. Disconnect the charger DC cord at the three pin connector (1) **(Figure 4-29, Page 4-35)**.
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 the batteries. **See Connecting The Batteries on page 1-4.**

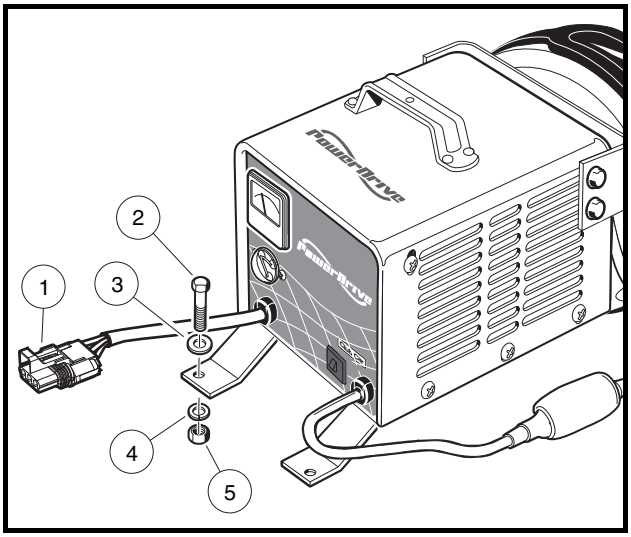


Figure 4-29 Onboard Charger Mounting – Precedent Vehicles

SECTION 5 – POWERDRIVE 2 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 5-5). 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 5-5).**

GENERAL INFORMATION

This section includes information pertaining to service of the PowerDrive 2 battery charger (model numbers 22110-11, 22110-18, and 22110-19). 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 2 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.

NOTE: ***All vehicles except Precedent:*** *Shortly after charging begins, 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). This will be repeated at one hour and at two hours into the charge cycle.*

The onboard computer, having recorded the amount of energy consumed as the vehicle was used, 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. The computer accomplishes this by detecting when the exact amount of energy necessary has been returned to the batteries.

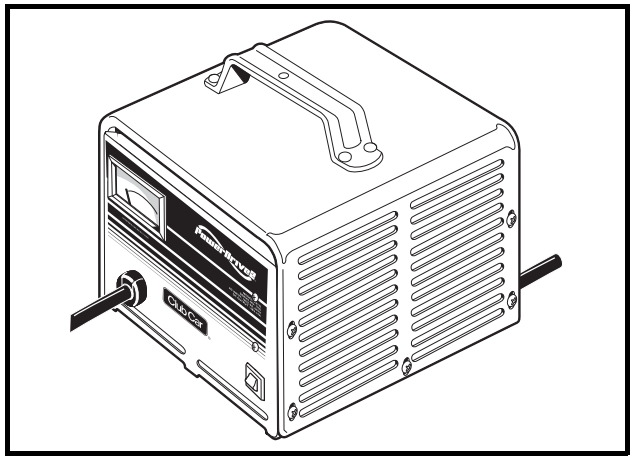


Figure 5-1 PowerDrive 2 Battery Charger

POWERDRIVE 2 BATTERY CHARGER FEATURES

- **Charge Interlock**
  PowerDrive 2 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 System, PowerDrive, and Precedent vehicles with PowerDrive 2 chargers are designed to be left connected with AC power to the charger during off-season 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.** 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 (Figure 5-4, Page 5-5). 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 (Figure 5-5, Page 5-5).**

BATTERY WARNING LIGHT

Precedent, IQ System and PowerDrive vehicles, feature a dash mounted 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 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 (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 battery warning light will repeatedly illuminate for 10 seconds, at 4 second intervals (25 seconds, at 10 second intervals for Precedent vehicles), 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:

- 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 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 (on all vehicles except Precedent vehicles), and the 18-gauge gray wire from the onboard computer. On all vehicles except Precedent vehicles, also check connections of the fuse link located on the charger receptacle **(Figure 5-2, Page 5-3 or Figure 5-3, Page 5-4)**.

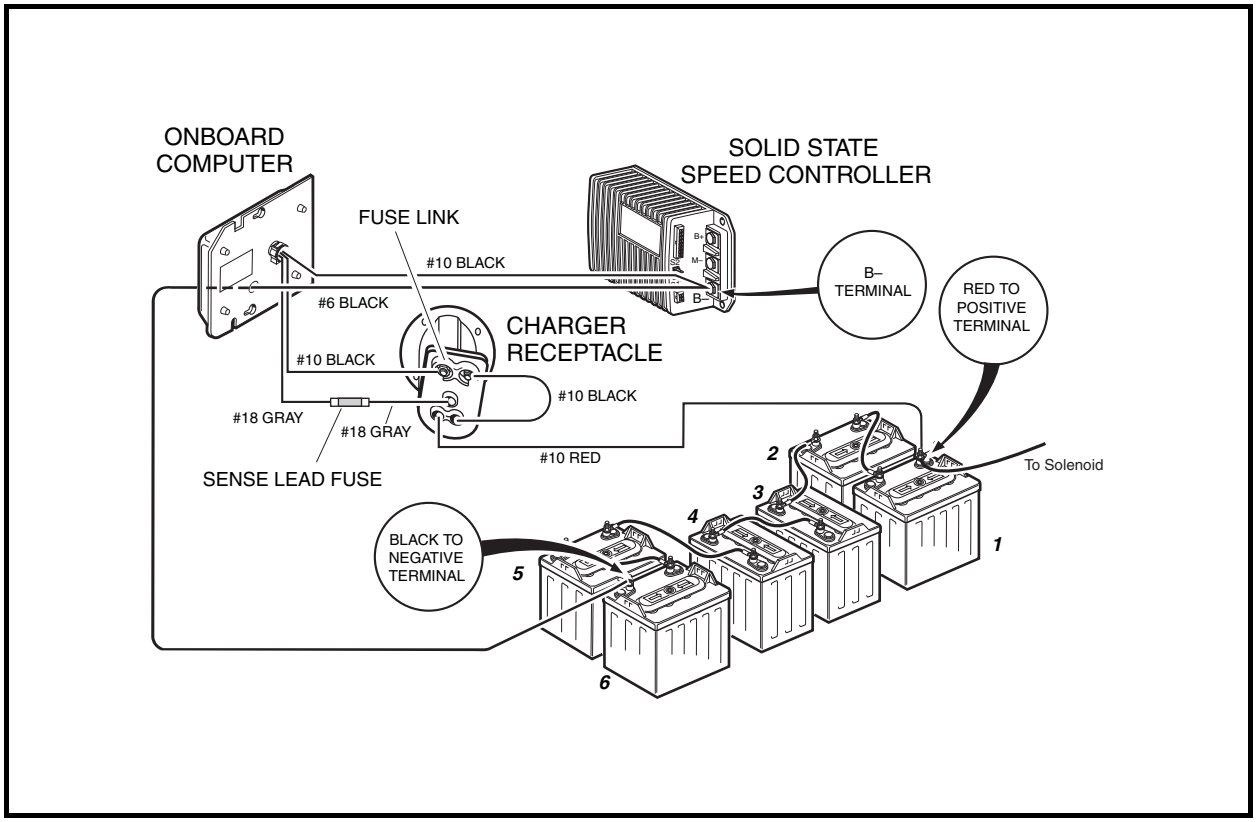


Figure 5-2 Charge Circuit and Battery Configuration – DS Vehicles

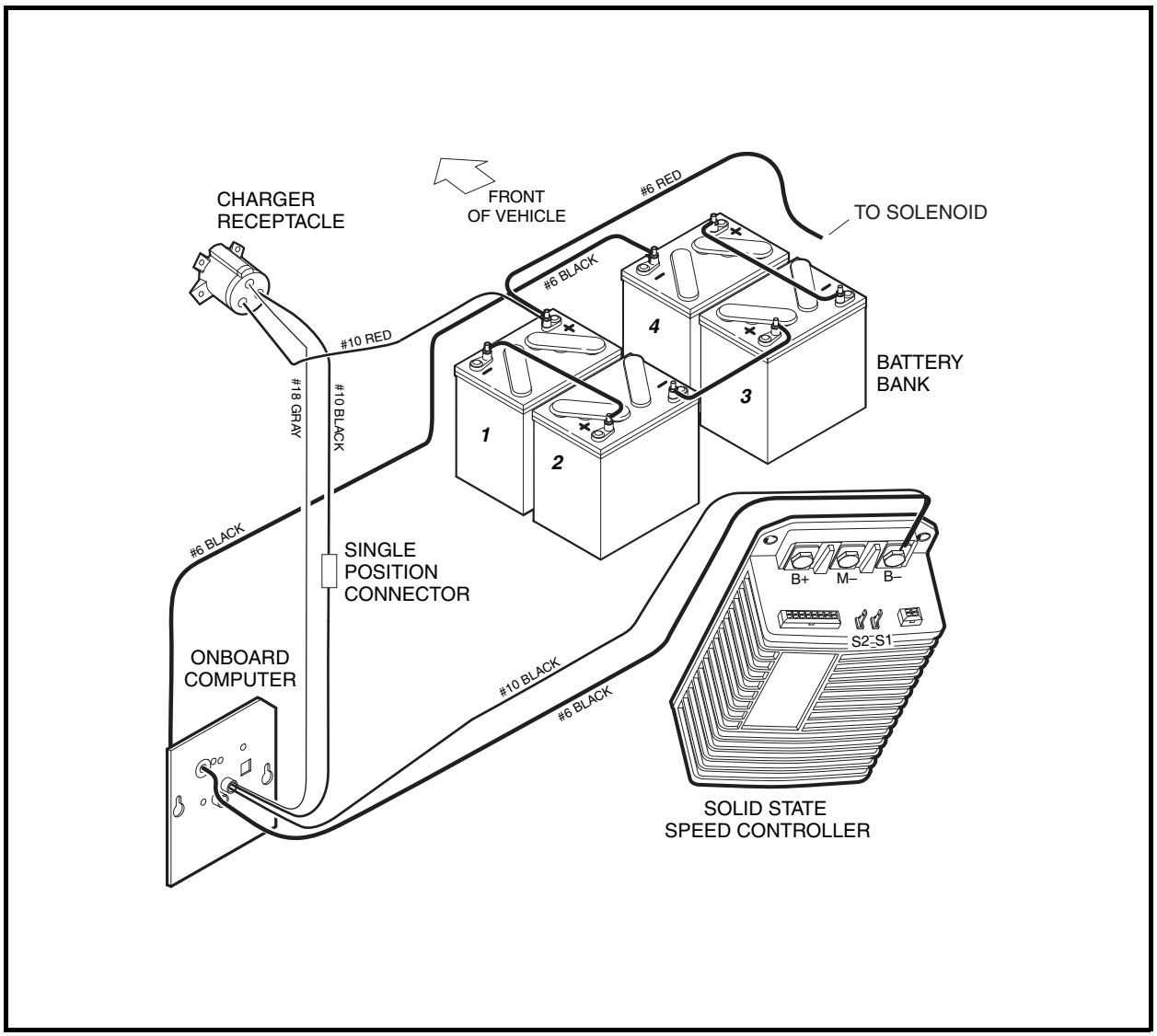


Figure 5-3 Charge Circuit and Battery Configuration – Precedent Vehicles

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 (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 5-4, Page 5-5). 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 5-5).**
- **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 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 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.**

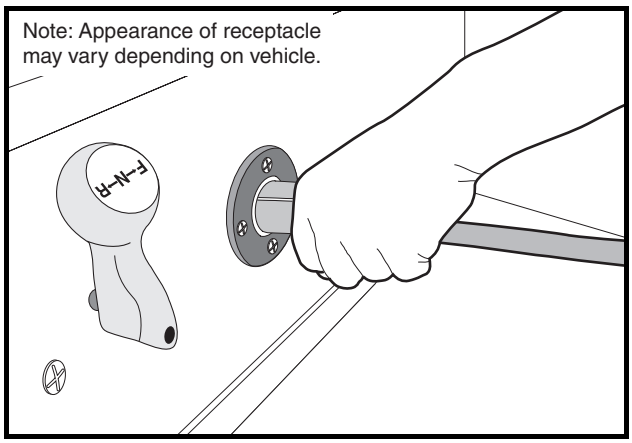


Figure 5-4 Charger Receptacle

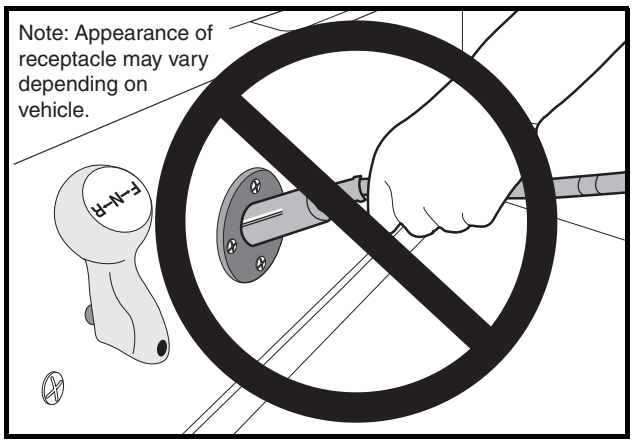


Figure 5-5 Incorrect DC Plug Removal

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.**

With charger DC output cord disconnected, connect the power supply cord to an AC supply. **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. It is for use on a nominal 120 volt, 60 hertz circuit. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electric Code and all local codes and ordinances.

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 meters)). 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 5-4, Page 5-5).**
- **Do not pull on the DC cord (Figure 5-5, Page 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 5-5)**. 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 5-5).**

3. **All vehicles except Precedent:** 10 to 20 seconds after the charger activates, it will shut off again to run a self-diagnostic program (the ammeter will drop to 0). Charging will resume in a few moments (ammeter will return to previous rate of charge).
4. **All vehicles:** 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.
5. **All vehicles except Precedent:** Monitor the ammeter for about 30 seconds. Under normal operating conditions (when the charger is on and the batteries are discharged), the ammeter will drop to zero for 2 to 3 seconds at the beginning of each charge cycle in order to perform a self-diagnostic test. This test will be repeated at one hour and two hours into the charge cycle. **See following NOTE.**

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.*

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) (CC P/N 101831801). ***See Communication Display Module 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 5-2.***

Testing Charger Operation, Continued:

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 5-8)**.

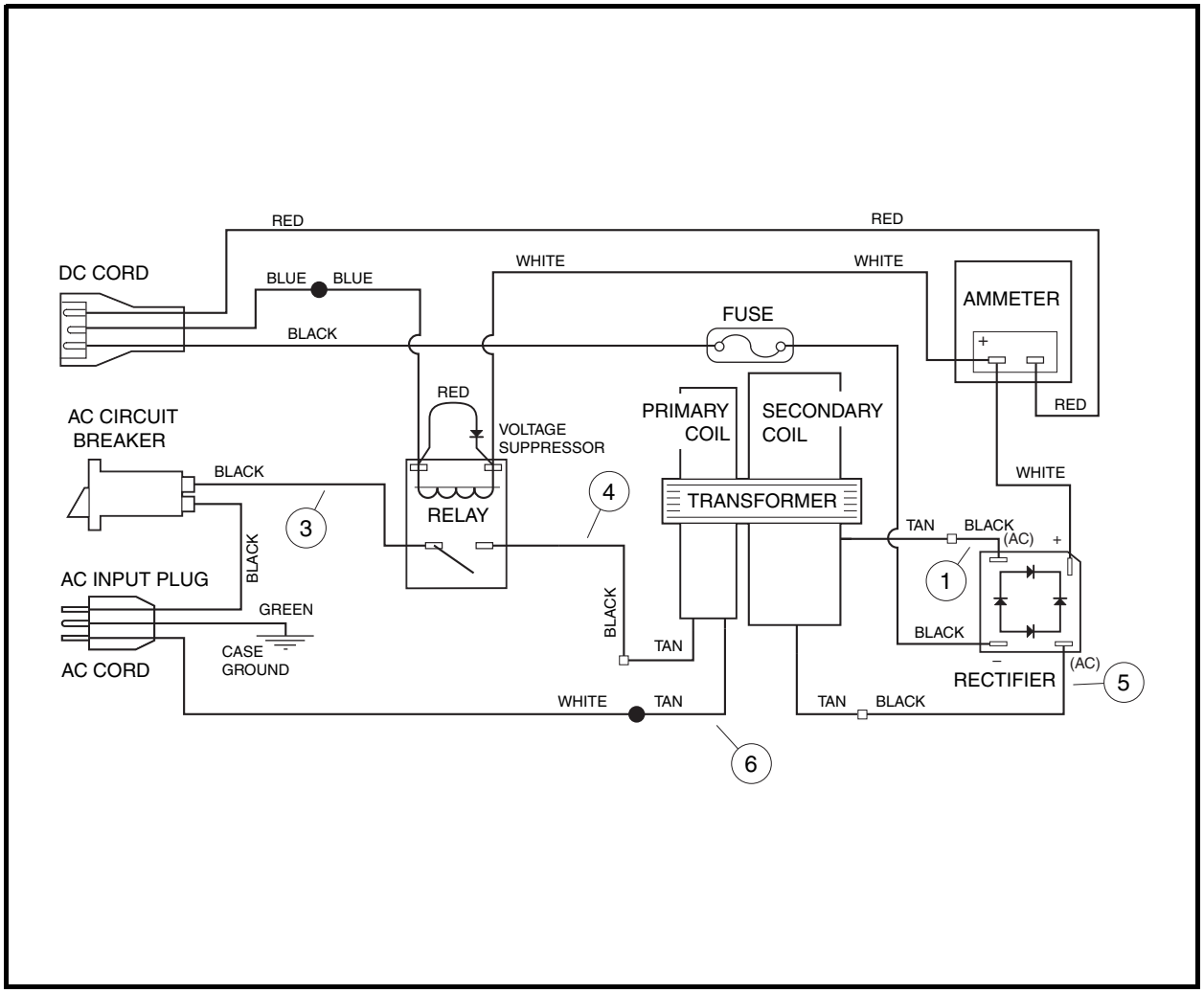


Figure 5-6 PowerDrive 2 Battery Charger Wiring Diagram (External Charger)

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 5-23. See following NOTE.**

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

CHECKING BATTERY CONDITION AFTER A CHARGE CYCLE

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 IQ System, PowerDrive, and Precedent 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. **See following NOTE.**

If the battery warning light is illuminated after a charge cycle, refer to the troubleshooting chart in the maintenance and service manual appropriate for your battery charger. If you do not have this publication, contact your Club Car representative. 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 then charge the vehicle. Normal voltage near the end of a charge cycle should be approximately 59 to 63 volts.

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 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. **All vehicles except Precedent:** 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. 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 5-8).**
- **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 PowerDrive 2 external battery chargers (model numbers 22110-11, 22110-18, and 22110-19). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

POWERDRIVE 2 BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Relay does not close, no transformer hum and ammeter does not move	Batteries disconnected	See Section 13 – Batteries in the appropriate maintenance and service manual
	Battery voltage is too low	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-13
	Poor connection between plug and receptacle	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-13
	DC plug and cord	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-13 and Test Procedure 5 – Charger DC Circuit Continuity Test on page 5-17
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 5-15
	Gray sense lead fuse is blown (not applicable to Precedent vehicles)	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 5-13
	Receptacle fuse link is blown (not applicable to Precedent vehicles)	See Section 12 – Electrical Components 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 5-15
	Failed AC plug and cord	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-15
	Transformer primary coil	Test Procedure 6 – Transformer on page 5-18
	Relay	Test Procedure 8 – Continuity on page 5-20
	Failed ammeter	Replace ammeter
Relay closes and transformer hums but ammeter does not move	Blown charger fuse	Test Procedure 8 – Continuity on page 5-20
	Failed rectifier	Test Procedure 4 – Rectifier on page 5-16
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 5-15
	Failed transformer	Test Procedure 6 – Transformer on page 5-18
Relay operates intermittently	Failed charger relay	Test Procedure 8 – Continuity on page 5-20
Charger fuse link blows or receptacle fuse link blows	Failed rectifier	Test Procedure 4 – Rectifier on page 5-16
	Loose internal fuse connection	Tighten connection
	Battery is wired in reverse polarity	Check vehicle wiring
	DC cord is wired in reverse polarity	Check battery charger wiring

POWERDRIVE 2 BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Troubleshooting Guide continued on next page...		
Charger output is low	Failed rectifier	Test Procedure 4 – Rectifier on page 5-16
	Transformer coil short-circuit failure	Test Procedure 6 – Transformer on page 5-18
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 5-15
Charger turns off too soon	AC power supply was shut off	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-15
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 5-15
	Batteries may be fully charged	Test Procedure 7 – Battery State of Charge Test on page 5-20
Charger goes to 16 hour time out	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 5-15
	Extremely discharged batteries or cold temperature	Recharge batteries
	Failed or weak battery	See Section 13 – Batteries 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 5-20
	Failed transformer	Test Procedure 6 – Transformer on page 5-18
	Incorrect charger wiring	Check battery charger wiring
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 5-15
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 5-15
	Charger failure	See Testing Charger Operation on page 5-7
	16 hour time out	See Battery Warning Light on page 5-2
	Battery or batteries need to be replaced	See Section 13 – Batteries in the appropriate maintenance and service manual
Battery warning light illuminates for ten seconds at four second intervals (with DC charger cord unplugged) (25 seconds, at 10 second intervals for Precedent vehicles)	Batteries are getting close to full discharge capacity	Recharge batteries (golf round may be completed first)
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 5-15
	Battery or batteries need to be replaced	See Section 13 – Batteries in the appropriate maintenance and service manual

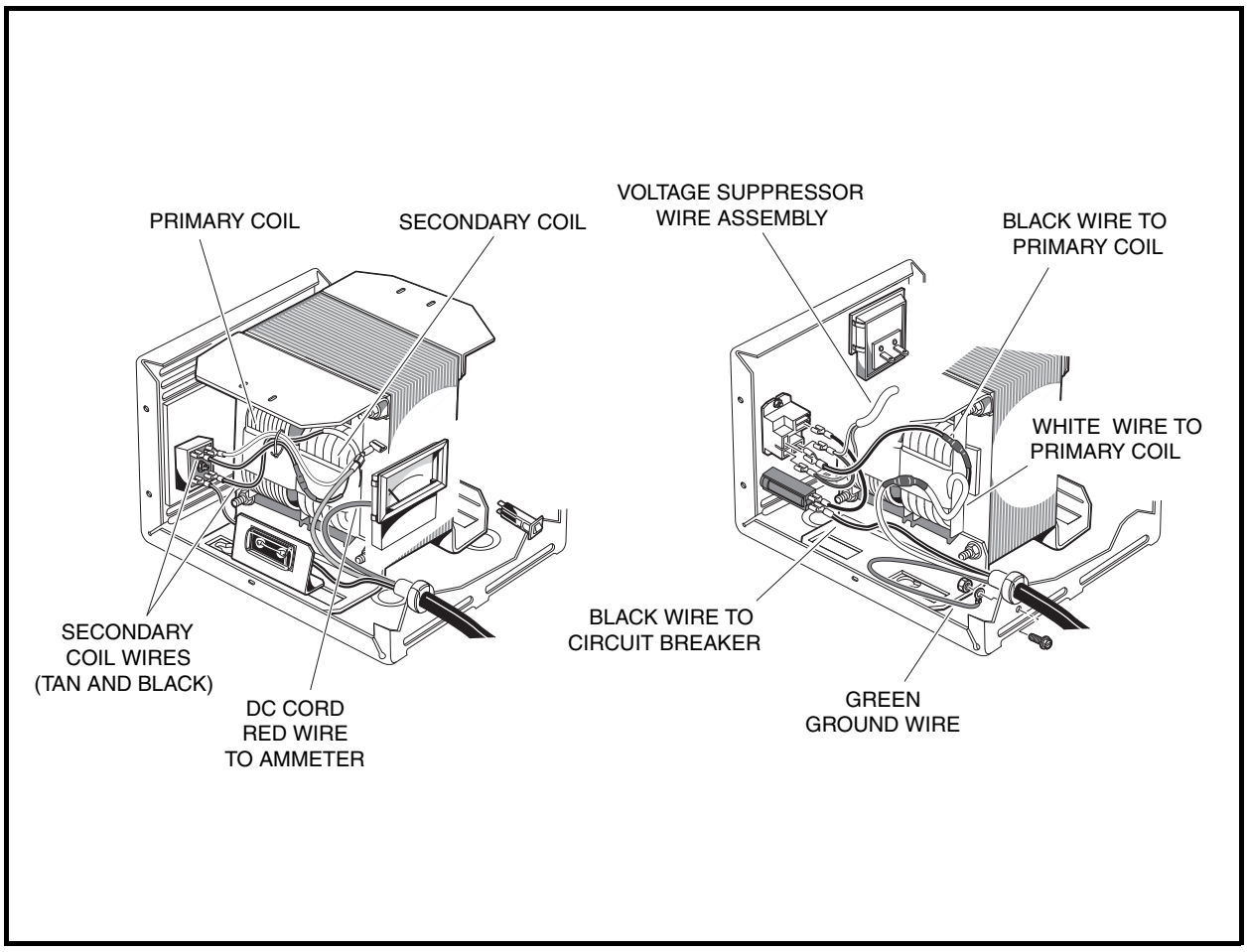


Figure 5-7 PowerDrive 2 Battery Charger

TEST PROCEDURES

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

INDEX OF TEST PROCEDURES

1. Battery Voltage and DC Plug and Receptacle
2. Onboard Computer
3. AC Power and Continuity Test of AC Circuit
4. Rectifier
5. Charger DC Circuit Continuity Test
6. Transformer
7. Battery State of Charge Test
8. Continuity

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

DS vehicles only:

3.1. Make sure the two nuts that secure the two 10-gauge black wires to the receptacle fuse assembly are tight **(Figure 5-8, Page 5-13)**.

3.2. 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.

⚠ WARNING

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

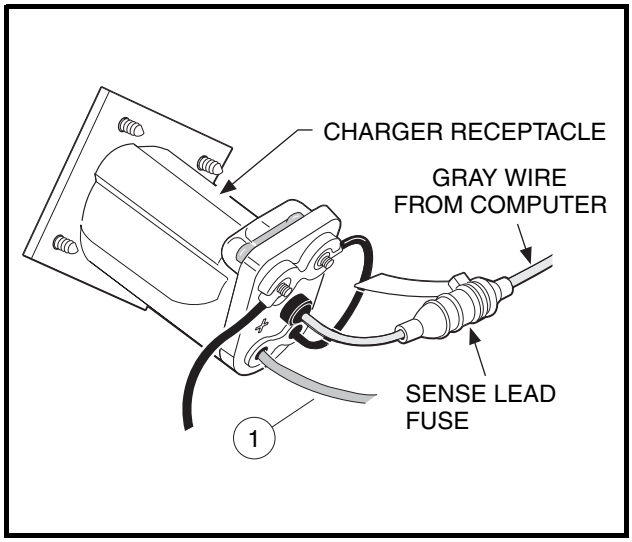


Figure 5-8 Receptacle Wire Connections (all vehicles except Precedent)

3.3. 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.

Test Procedure 1 – Battery Voltage and DC Plug and Receptacle, Continued:

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. 6 **(Figure 5-9, Page 5-14)**. 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 5-29.**

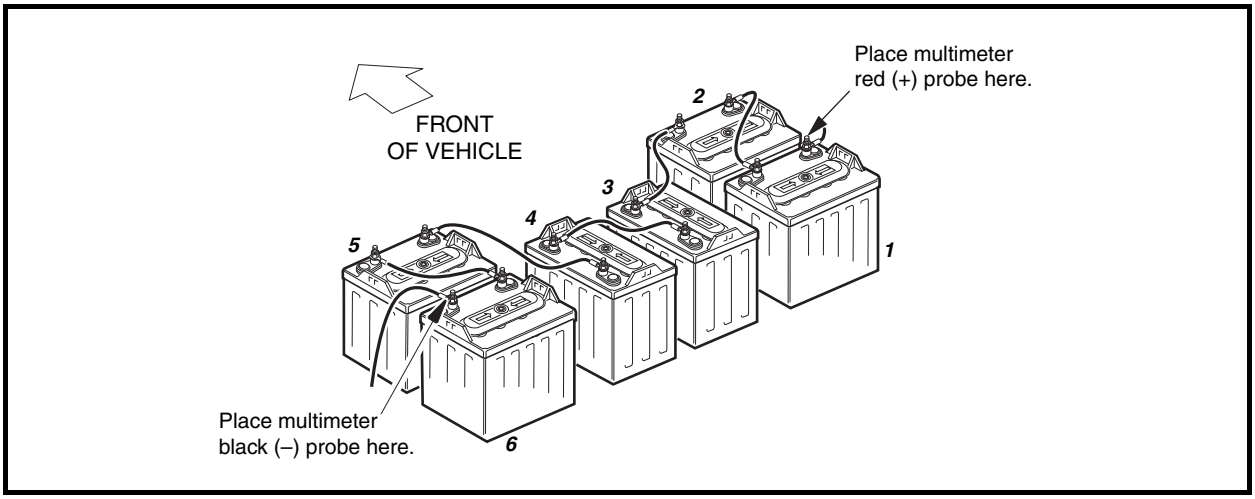


Figure 5-9 DS Battery Configuration

Precedent vehicles only:

5. 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 5-10, Page 5-14)**. 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 5-29.**

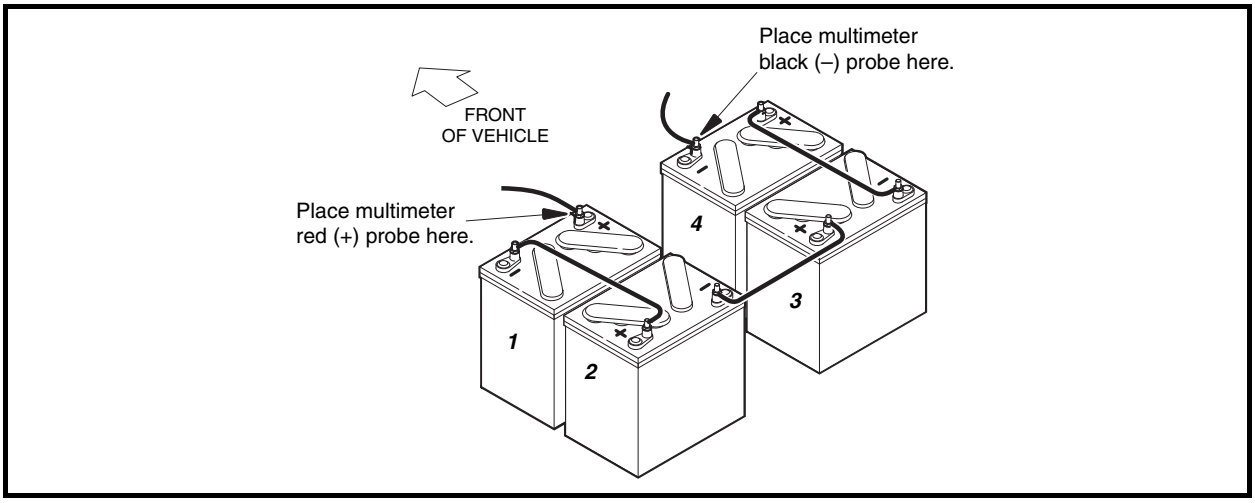


Figure 5-10 Precedent Battery Configuration

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 breaker 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 5-9.**
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 breaker 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 between 105 and 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
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, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 5-16, Page 5-19)**.
   - 5.3. With relay bypassed, there should be continuity across the AC cord blades **(Figure 5-11, Page 5-15)**.

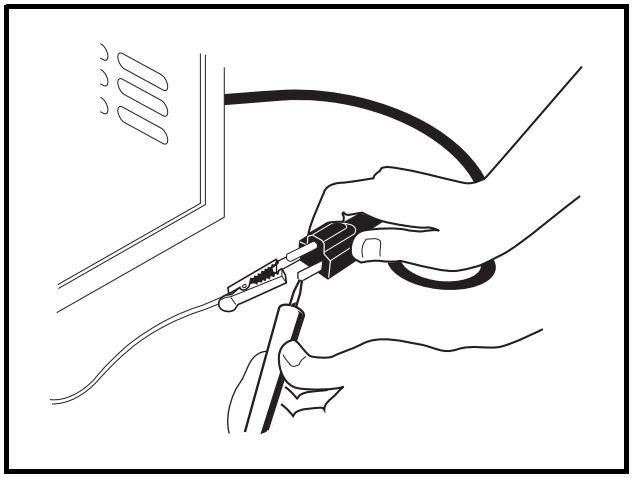


Figure 5-11 AC Cord Test

Test Procedure 3 – AC Power and Continuity Test of AC Circuit, Continued:

6. If the circuit is not complete, check the wiring of the AC cord, transformer primary coil wires, and internal AC circuit breaker **(Figure 5-16, Page 5-19)**.
7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, and the internal AC circuit breaker individually. **See Test Procedure 8 – Continuity on page 5-20.**
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 properly connect the relay wiring could result in property damage, severe personal injury, or death.**

TEST PROCEDURE 4 – RECTIFIER

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

The rectifier converts the AC voltage from the transformer secondary coil to DC voltage. This conversion is necessary since the batteries require DC voltage for charging. A failed or improperly wired rectifier could result in little or no battery charging current or a tripped 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 all four wires from the rectifier **(Figure 5-12, Page 5-16)**.

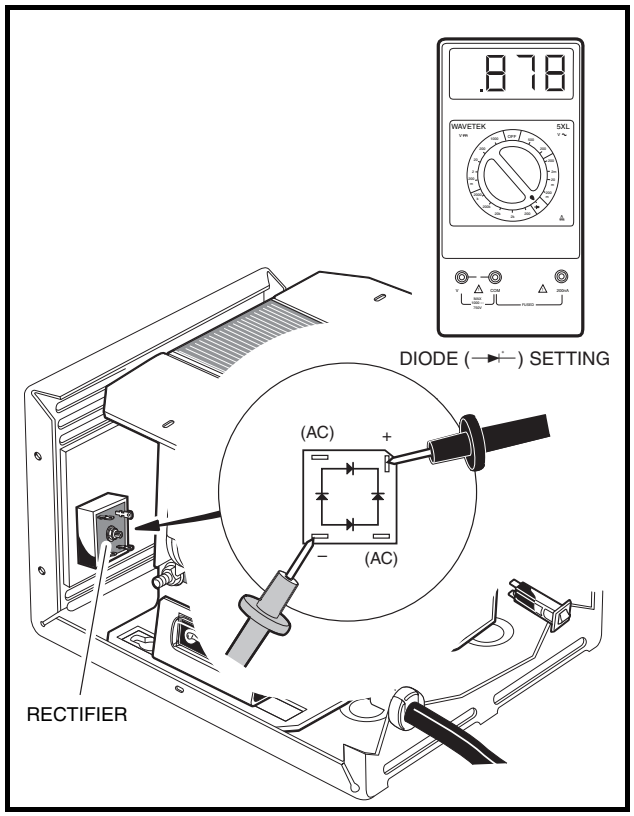


Figure 5-12 Rectifier Test

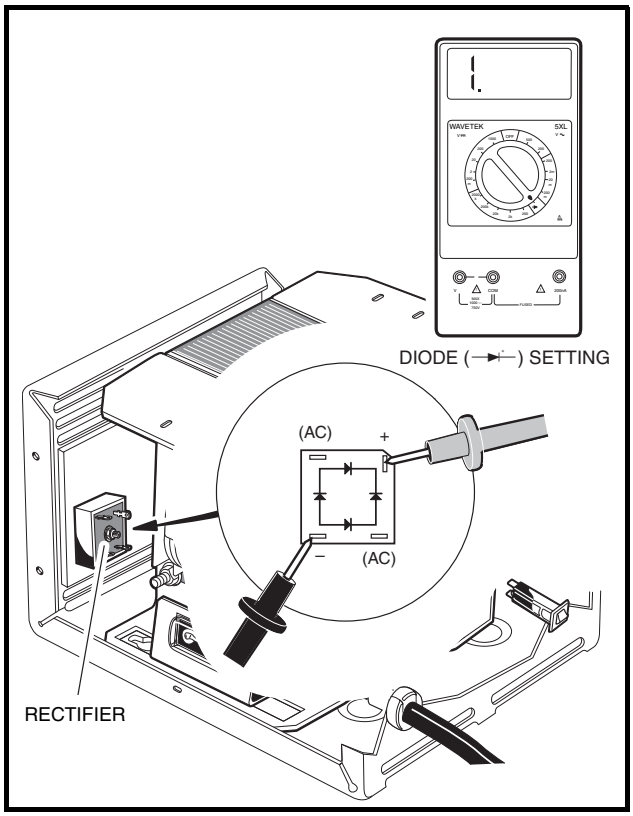


Figure 5-13 Rectifier Test – Probes Reversed

4. Using a multimeter set to the diode test function (→|←), place the black (–) probe of the multimeter on the positive (+) terminal of the rectifier. Move the positive (+) probe to each of the remaining three rectifier terminals and note the readings **(Figure 5-12, Page 5-16)**.
   4.1. The multimeter should indicate approximately 878 mV with the positive (+) probe on the negative (–) rectifier terminal.
   4.2. The multimeter should indicate approximately 483 mV with the positive (+) probe on one of the AC rectifier terminals.
   4.3. The multimeter should indicate approximately 483 mV with the positive (+) probe on the other AC rectifier terminal.
   4.4. If any other reading is obtained, the rectifier has failed and must be replaced.
5. Using a multimeter set to the diode test function (→|←), place the black (–) probe of the multimeter on the negative (–) terminal of the rectifier. Move the positive (+) probe to each of the remaining three rectifier terminals and note the readings **(Figure 5-13, Page 5-16)**. The multimeter should indicate an overload (no continuity) for all three of the reaming rectifier terminals. If any other reading is indicated, the rectifier has failed and must be replaced.
6. On rare occasions, the rectifier may fail as a result of a lightning strike at the charging location.
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.**

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 the AC cord from the wall outlet and the DC cord from the vehicle charger receptacle.
2. Using a multimeter set to the diode test function (→|←), place the positive (+) probe of the multimeter on the pin marked positive (+) on the DC plug **(Figure 5-14, Page 5-17)**. Place the negative probe (–) on the pin marked negative (–). The multimeter should indicate an overload (no continuity).

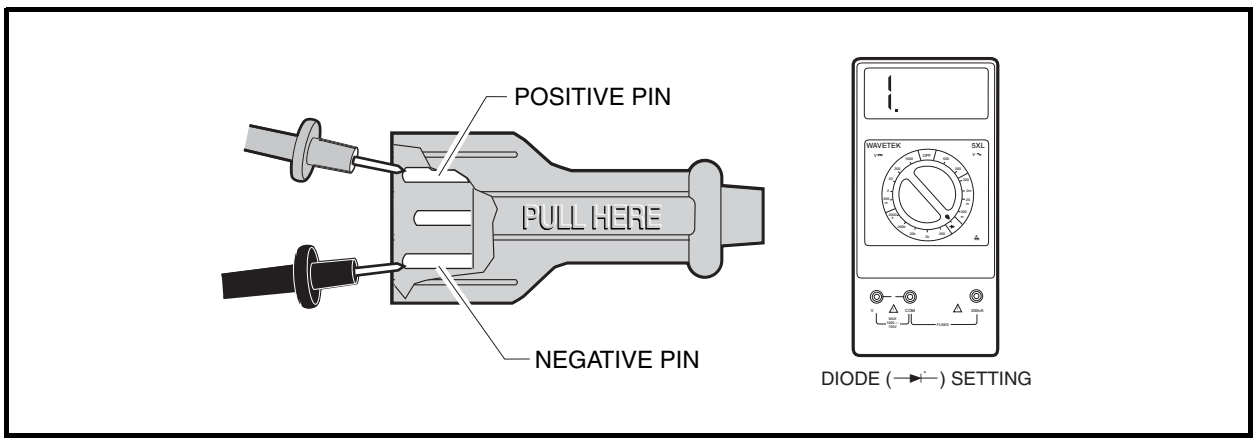


Figure 5-14 DC Plug Test

Test Procedure 5 – Charger DC Circuit Continuity Test, Continued:

3. Reverse the test probes and check the DC plug again **(Figure 5-15, Page 5-18)**. The multimeter should indicate approximately 878 mV.
4. If multimeter readings are incorrect, check the battery charger wiring **(Figure 5-6, Page 5-8)**.
5. If the multimeter indicates an overload (no continuity) in both directions, 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 5-20.** Also check the rectifier. **See Test Procedure 4 – Rectifier on page 5-16.**
6. If the multimeter indicates a voltage reading in both directions, a short circuit exists in the charger DC circuit, usually caused by a failed rectifier. **See Test Procedure 4 – Rectifier on page 5-16.** If the rectifier has not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 5-20.**

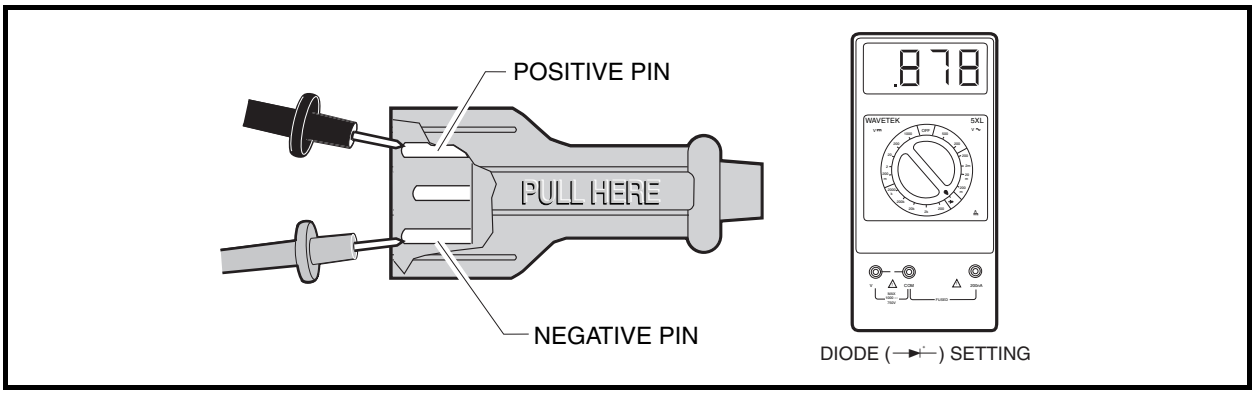


Figure 5-15 DC Plug Test – Probes Reversed

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 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 breaker, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 5-15.**

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the two black transformer secondary coil wires (1 and 5) from the rectifier **(Figure 5-16, Page 5-19)**.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   4.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 5-16, Page 5-19)**. **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 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.
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 42.5 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced **(Figure 5-16, Page 5-19)**.
10. If the voltage reading is normal (43 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 5-17.**
11. 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 properly connect the relay wiring could result in property damage, severe personal injury, or death.**

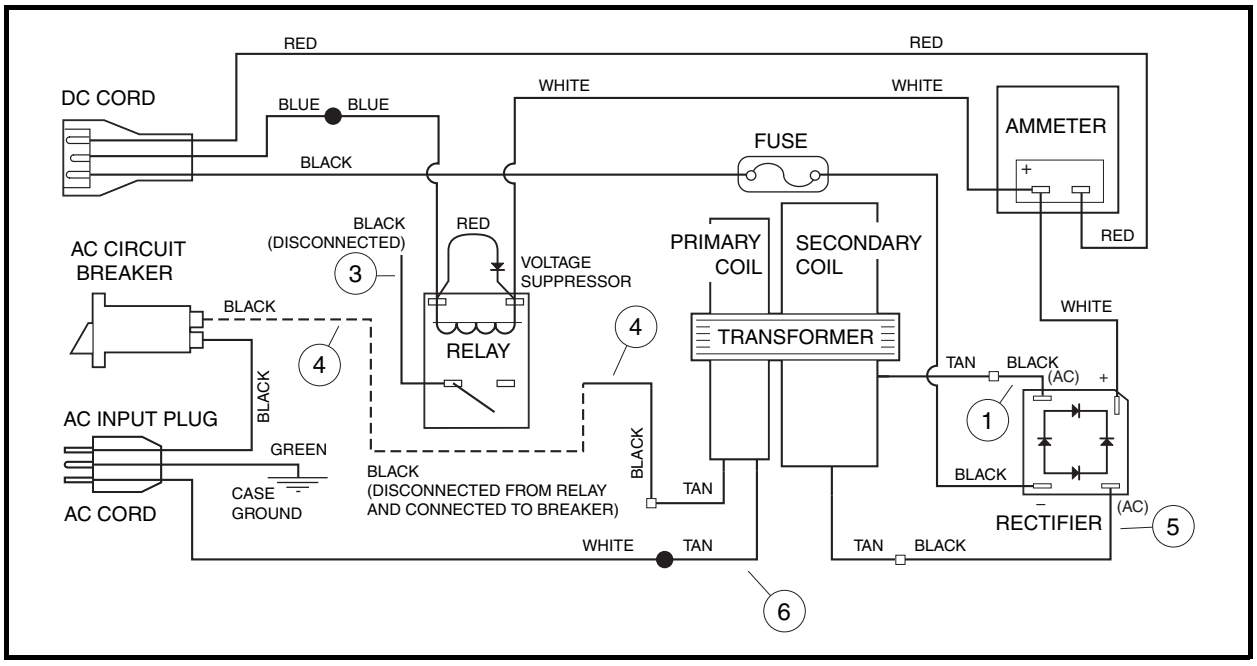


Figure 5-16 Transformer Test Wiring Diagram

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 then reconnect it. The ammeter should jump to a reading between 12 and 14 amps and then 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 5-15.**

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 5-1.

Fuse

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the DC cord black wire from the fuse 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 one fuse terminal and the black (–) probe on the other fuse terminal. The tester should indicate continuity. If the tester does not indicate continuity, then the fuse has failed and must be replaced.

AC Cord

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 5-17, Page 5-20)**.

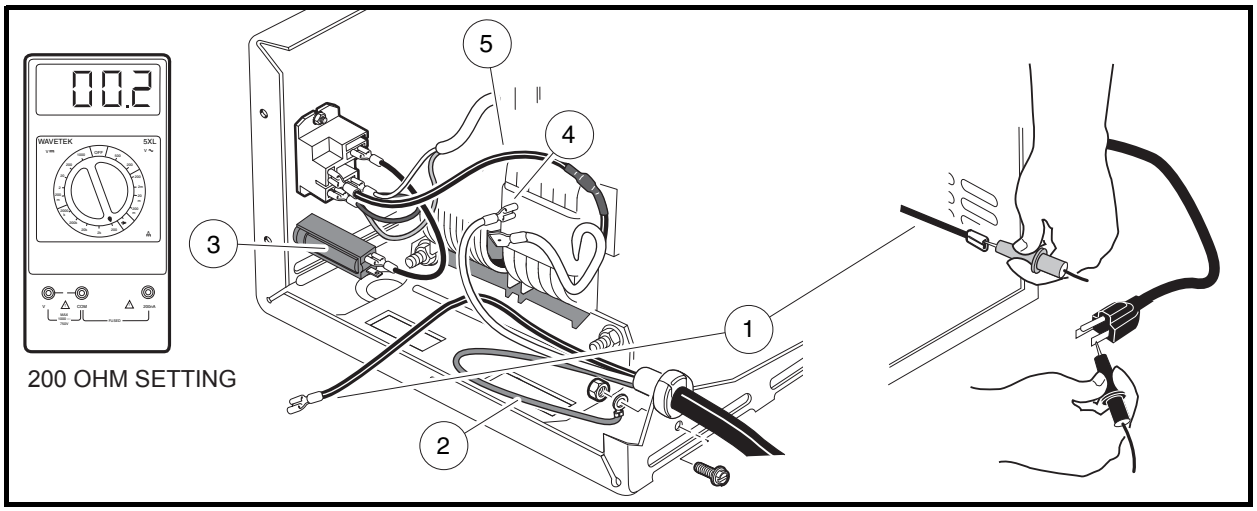


Figure 5-17 AC Cord and Plug Continuity Test

4. Disconnect the black wire (1) of AC cord from charger AC circuit breaker (3).
5. Carefully cut the heatshrink that insulates the AC cord white wire (4) where it connects to the tan primary coil wire.
6. Disconnect the AC cord white wire (4) from the primary coil tan wire.
7. 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 AC cord and plug must be replaced.
8. 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 **(Figure 5-17, Page 5-20)**. The tester should indicate continuity on only the round pin. If any other reading is obtained, the AC cord and plug must be replaced.
9. 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 plug must be replaced.
10. If the correct readings were obtained, install the AC cord. **See AC Cord Installation on page 5-29.**

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 fuse **(Figure 5-18, Page 5-24).**
4. Disconnect the red wire of the DC cord from the ammeter.
5. Disconnect the blue wire from the blue 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 test probe 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.

Transformer

The PowerDrive 2 battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 5-16, Page 5-19)**.

Primary Coil

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.

3. Carefully cut the heatshrink that insulates the AC cord white wire (4) where it connects to the tan primary coil wire **(Figure 5-17, Page 5-20)**.
4. Disconnect terminals from transformer (tan and black) primary coil transformer wires (4 and 6) **(Figure 5-16, Page 5-19)**.
5. Place the continuity tester probes on the disconnected primary coil wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.
6. If the correct readings were obtained, install the AC cord and connect the transformer primary coil wires. **See AC Cord Installation on page 5-29.**

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 (black) secondary coil wire (1) from the rectifier **(Figure 5-16, Page 5-19)**.
4. Remove the other transformer (black) secondary coil wire (5) from the rectifier.
5. Place the continuity tester probes on the disconnected secondary coil wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.

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 black wires (3 and 4) from contact terminals of the relay **(Figure 5-6, Page 5-8)**. Place continuity test probes on contact terminals 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. Place continuity test probes on contact terminals of relay. With batteries connected, insert DC plug into receptacle. The tester should indicate continuity. If tester does not indicate continuity, 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 white wire from the left ammeter terminal (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 probe 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 5-8).**
- **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

DC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove the DC cord black wire from the fuse by loosening the nut on the fuse **(Figure 5-18, Page 5-24)**.
4. Remove the DC cord red wire from the ammeter.
5. Remove the DC cord blue wire from the blue wire located in the fiberglass sheathing.
6. Using pliers, squeeze the strain relief bushing and remove the DC cord.

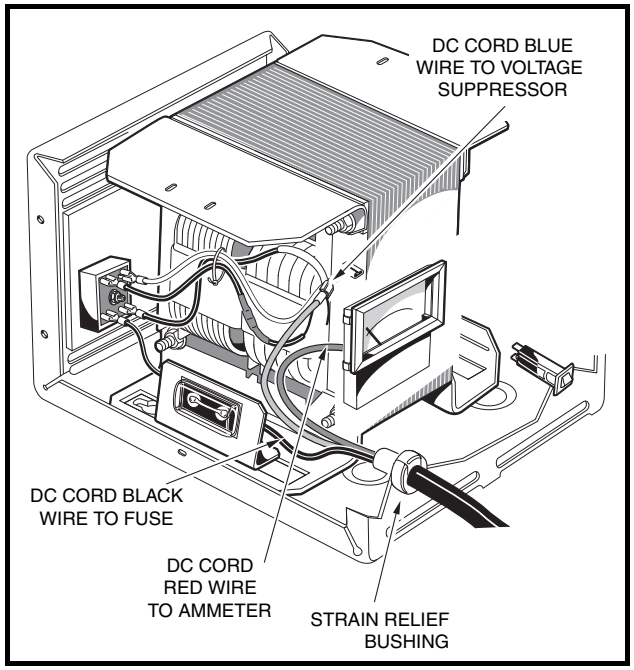


Figure 5-18 DC Cord

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 ammeter **(Figure 5-18, Page 5-24)**.
3. Attach the blue wire of the new DC cord to the blue wire located in the fiberglass sheathing.
4. Attach black wire of the new DC cord to fuse. Install the nut onto post of the fuse and tighten to 23 in-lb (2.6 N·m). **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.**

5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
6. 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).

RECTIFIER

Rectifier Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove all four wires from the rectifier **(Figure 5-6, Page 5-8)**.
4. Remove the nut (1), lock washer (2), and screw (3) from the rectifier and remove the rectifier from the heatsink **(Figure 5-19, Page 5-25)**.

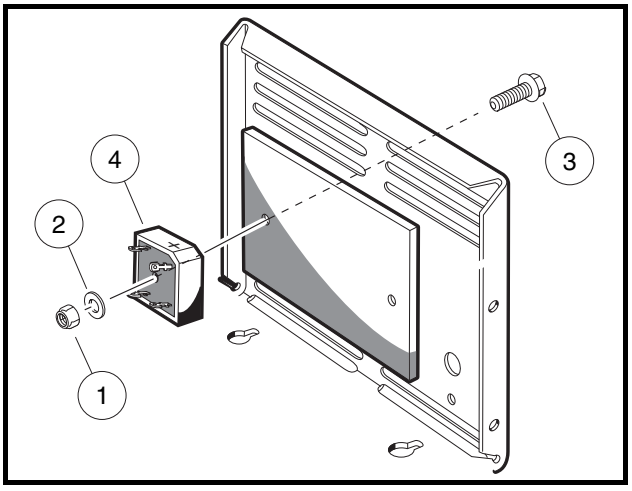


Figure 5-19 Rectifier

Rectifier Installation

1. Thoroughly clean the heatsink plate in the area where the rectifier will be mounted.
2. Apply a liberal amount of white thermal paste to the flat portion of the rectifier to ensure good thermal conductivity from the rectifier to the heatsink plate.
3. Place the rectifier against the heatsink plate so that the notch in the rectifier is oriented as shown **(Figure 5-19, Page 5-25)**. Install the screw (3), lock washer (2), and nut (1) through the hole in the charger case, heatsink plate, and rectifier. Tighten the nut to 8 in-lb (0.9 N·m).
4. Connect the white wire from the ammeter to the positive (+) terminal of the rectifier **(Figure 5-6, Page 5-8)**. **See following NOTE.**

NOTE: *The positive (+) terminal of the rectifier is marked on the edge of the rectifier case. The positive terminal can also be identified by its orientation and the notch in the rectifier case.*

5. Connect the two black transformer secondary coil wires to the AC terminals on the rectifier.
6. Connect the black wire from the charger fuse to the negative (–) rectifier terminal. **See following CAUTION.**

CAUTION

- **Improper wiring of the rectifier could result in damage to the rectifier and cause the AC circuit breaker to trip.**

7. 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.
2. Remove the charger cover.
3. Disconnect the black primary coil wire (5) from the charger relay **(Figure 5-17, Page 5-20)**.

4. Carefully cut the heatshrink that insulates the AC cord white wire (4) where it connects to the tan primary coil wire.
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. Remove the wire tie that secures the two black transformer secondary coil wires to the white wire from the ammeter.
7. Disconnect the two black secondary coil transformer wires (1 and 5) from the rectifier **(Figure 5-6, Page 5-8)**.
8. Using a 1/8 inch (3 mm) drill bit, drill the rivets that secure the transformer to the case and remove the transformer.

Transformer Installation

1. Install the transformer with primary coil to the rear of the charger case. Secure the transformer to the case with two rivets.
2. Connect the two black secondary coil transformer wires (1 and 5) to the AC terminals of the rectifier **(Figure 5-6, Page 5-8)**.
3. Connect the black transformer primary coil wire (4) to the charger relay.
4. Place a piece of heatshrink tubing over the AC cord white wire.
5. Connect the AC cord white wire to the tan primary coil wire **(Figure 5-17, Page 5-20)**.
6. Slide the heatshrink tubing over the connection and apply heat to the heatshrink to insulate the connection between the AC cord white wire and the tan primary coil wire. **See following WARNING.**

⚠ WARNING

- **Make sure the electrical connections are properly insulated. Failure to properly insulate electrical connections in the charger could result in a short circuit.**

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. 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.
2. Remove the charger cover.
3. Disconnect the DC cord red wire (1) and the white wires (3 and 4) from the ammeter **(Figure 5-20, Page 5-27)**.
4. Press the locking tabs on each side of the ammeter and remove the ammeter by gently pushing the ammeter through the front of the charger case.

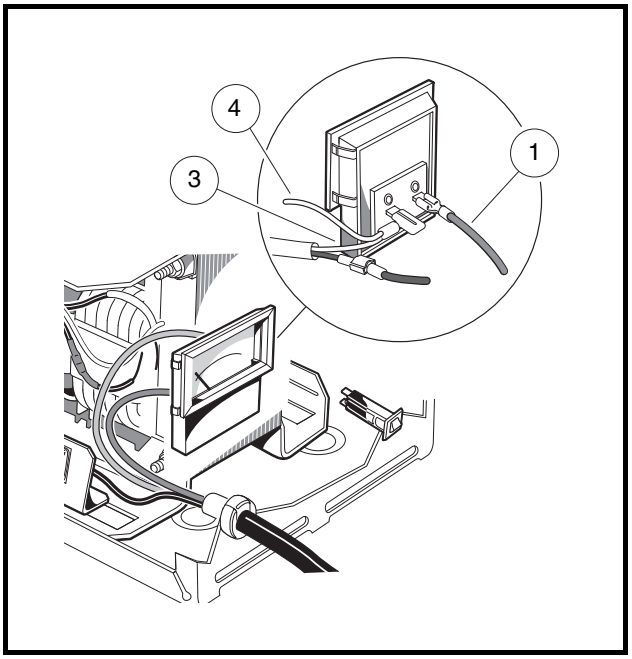


Figure 5-20 Ammeter

Ammeter Installation

1. Place the ammeter in position in the charger face and ensure that the locking tabs are secure **(Figure 5-20, Page 5-27)**.
2. Connect the DC cord red wire (1) and the white wire (3) to the ammeter terminals.
3. Install the charger cover.
4. 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. Gently press the fuse toward the transformer to remove the fuse from the mounting tab.
4. Remove the two nuts securing the two black wires to the fuse terminals and remove the fuse.

Fuse Link Installation

1. Connect the short black wire from the rectifier to one of the fuse terminal posts and install the nut. Tighten nut to 23 in-lb (2.6 N·m).
2. Connect the DC cord black wire to the other fuse terminal post and install the nut. Tighten nut to 23 in-lb (2.6 N·m).
3. Gently press the fuse assembly into the mounting tab so that the fuse link is visible from the side of the charger.
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 5-20.**

Voltage Suppressor Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the white wires (3 and 4) from the ammeter **(Figure 5-20, Page 5-27)**.
4. Disconnect the white wire from the positive (+) terminal of the rectifier.
5. Disconnect the blue, red, and white wires from the relay.
6. Disconnect the DC cord blue wire at the quick disconnect terminal**.**
7. Remove the voltage suppressor and wire assembly from the charger**.**

Voltage Suppressor Installation

1. Install in reverse order of removal. **See following NOTE.**

NOTE: *The charger relay blade connector is located off-center within the relay housing. When connecting voltage suppressor slip-on connector to relay blade connector, make sure slip-on connector is positioned so that flat side of connector is closest to relay housing.*

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.
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 5-6, Page 5-8)**.
4. Remove two screws, nuts, and lock washers attaching relay to the charger case.
5. Remove the relay.

Charger Relay Installation

1. Install in reverse order of removal. Connect wires as shown **(Figure 5-6, Page 5-8)**. Tighten nut securing relay to charger base to 18 in-lb (2.0 N·m).

CHARGER AC CIRCUIT BREAKER

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.
2. Remove the charger cover.
3. Disconnect the two black wires attached to the AC circuit breaker **(Figure 5-6, Page 5-8)**.

4. With a pair of pliers, squeeze in the retaining tabs on the sides of the AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.

AC Circuit Breaker Installation

1. Install in reverse order of removal.

CHARGER AC CORD

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

AC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the AC cord black wire from the AC circuit breaker.
4. Carefully cut the heatshrink that insulates the AC cord white wire (4) where it connects to the tan primary coil wire **(Figure 5-17, Page 5-20)**.
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. Disconnect the AC cord green wire from the charger base.
7. 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 black, white, and green leads of the new AC cord into the charger through the hole in the charger face.
2. Connect the AC cord black wire to the AC circuit breaker.
3. Place a piece of heatshrink tubing over the AC cord white wire.
4. Connect the AC cord white wire to the tan primary coil wire **(Figure 5-17, Page 5-20)**.
5. Slide the heatshrink tubing over the connection and apply heat to the heatshrink to insulate the connection between the AC cord white wire and the tan primary coil wire. **See following WARNING.**

⚠ WARNING

- **Make sure the electrical connections are properly insulated. Failure to properly insulate electrical connections in the charger could result in a short circuit.**

6. Connect the green wire to the charger base. Tighten the screw and nut on the green (ground) wire terminal to 18 in-lb (2.0 N·m).
7. Position the strain relief bushing on the AC cord.
8. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
9. 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 5-8).**
- **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 screws securing the charger cover and remove the cover from the charger.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   4.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 5-21, Page 5-31)**. **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.**

5. Plug the DC cord into the charger receptacle *first*, and 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 transformer wire (4) from AC circuit breaker and connect it to the relay. Connect the short black wire (3) from the relay to the AC circuit breaker **(Figure 5-21, Page 5-31)**. **See following WARNING.**

⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to 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 and 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.**

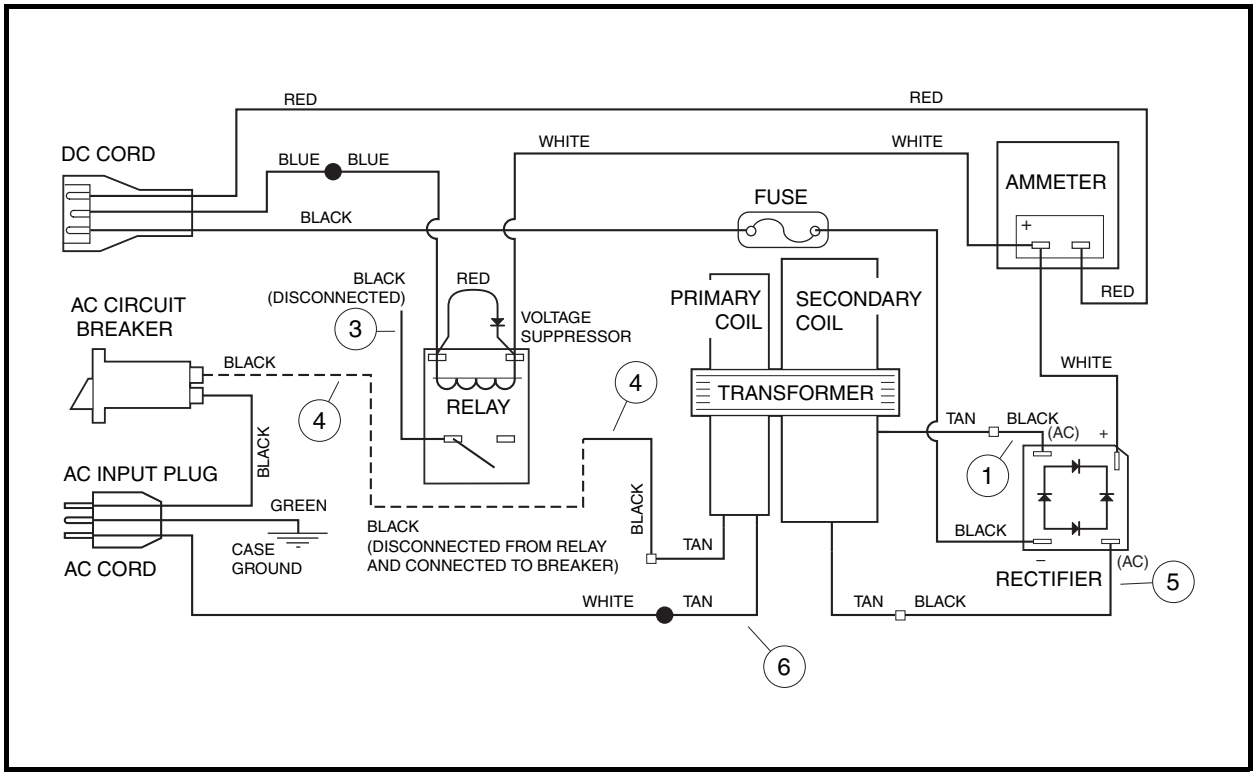


Figure 5-21 PowerDrive 2 Charger Wiring Diagram (Relay Bypassed)

SECTION 6 – POWERDRIVE 3 – MODEL 26560

⚠ 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 6-7, Page 6-9). 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 6-8, Page 6-9).**

GENERAL INFORMATION

This section includes information pertaining to service of the PowerDrive 3 battery charger (model numbers 26560-11, 26560-18, and 26560-19) **(Figure 6-1, Page 6-1)**. 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.

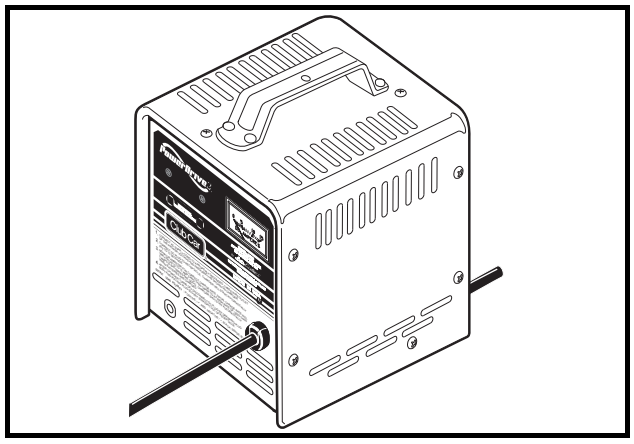


Figure 6-1 PowerDrive 3 Battery Charger

The PowerDrive 3 battery charger is automatic and has no external controls. When the charger is connected, there is a 2 to 15 second delay before charging begins.

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, having recorded the amount of energy consumed as the vehicle was used, 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. The computer accomplishes this by detecting when the exact amount of energy necessary has been returned to the batteries.

POWERDRIVE 3 BATTERY CHARGER FEATURES

- **Charge Interlock:** PowerDrive 3 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. **See following WARNING.**
- **Long-Term Storage Charge:** Vehicles with PowerDrive 3 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 and CAUTION.** 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 (Figure 6-7, Page 6-9). 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 (Figure 6-8, Page 6-9).**

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.**

BATTERY WARNING LIGHT

IQ System and Excel System 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 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 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 battery warning light will flash quickly, after inserting the DC plug, indicating the charger's voltage suppressor has failed closed.

THE CHARGE CIRCUIT

DS, 800, 810 AND 850 VEHICLES – 4 X 12-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 6-2, Page 6-3)**. 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.

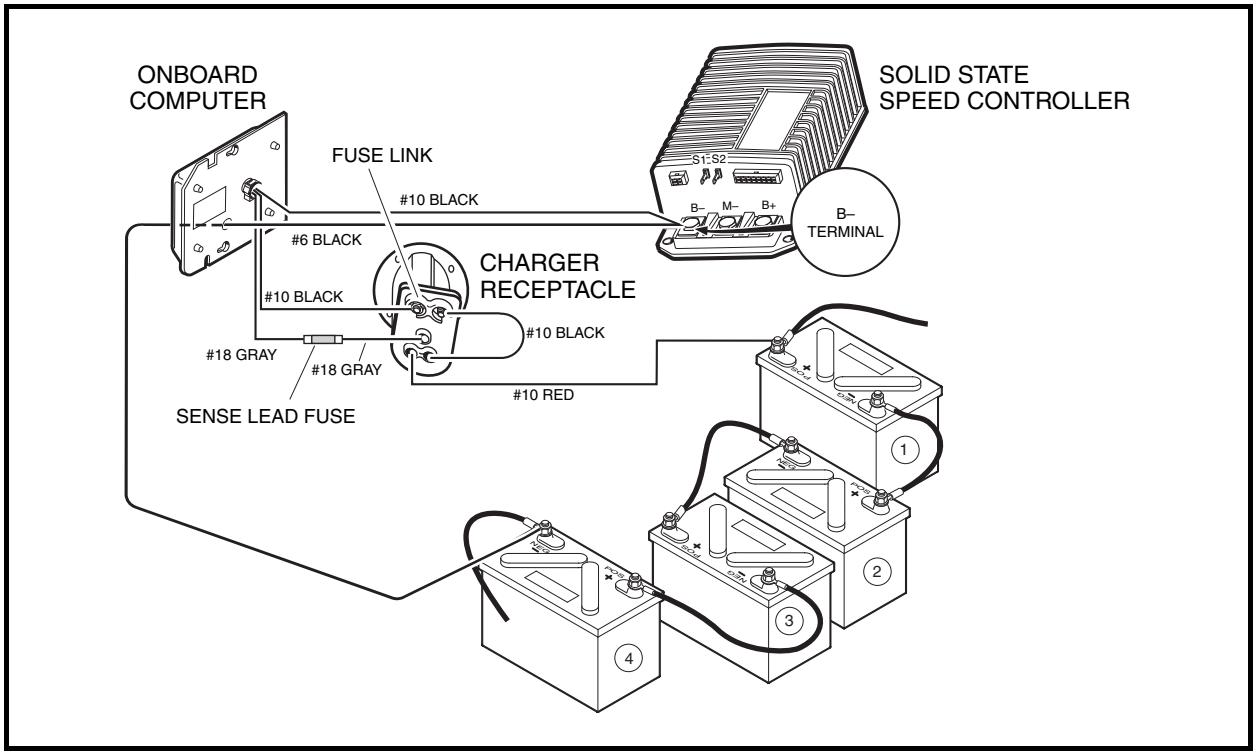


Figure 6-2 Charge Circuit and Battery Configuration – 4 x 12-Volt DS, 800, 810 and 850 Vehicles

TURF 1 AND CARRYALL 1 VEHICLES – 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 6-3, Page 6-4)**. 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.

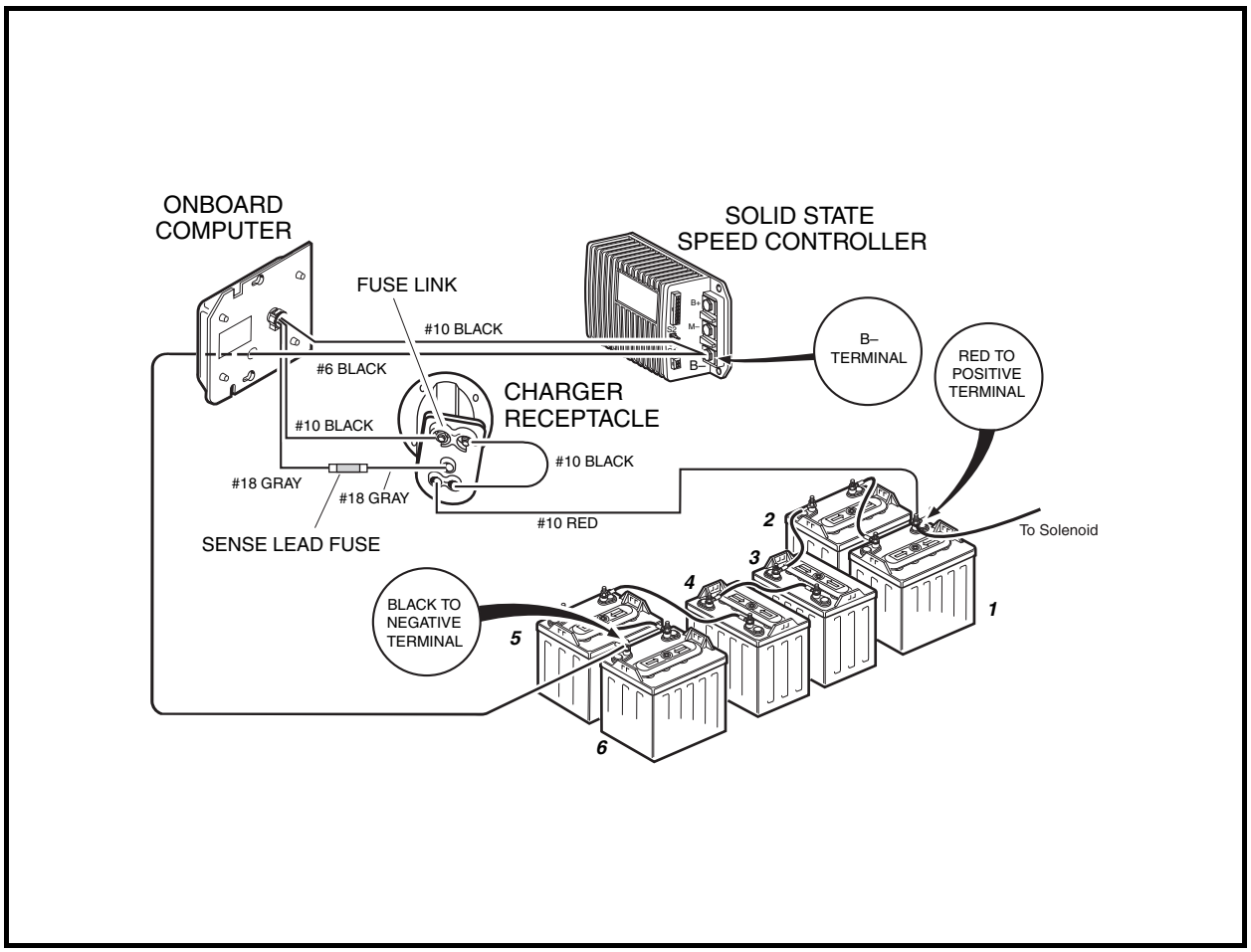


Figure 6-3 Charge Circuit and Battery Configuration – 6 x 8-Volt Turf 1 and Carryall 1 Vehicles

PRECEDENT VEHICLES – 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 6-4, Page 6-5 or Figure 6-5, Page 6-6)**. 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.

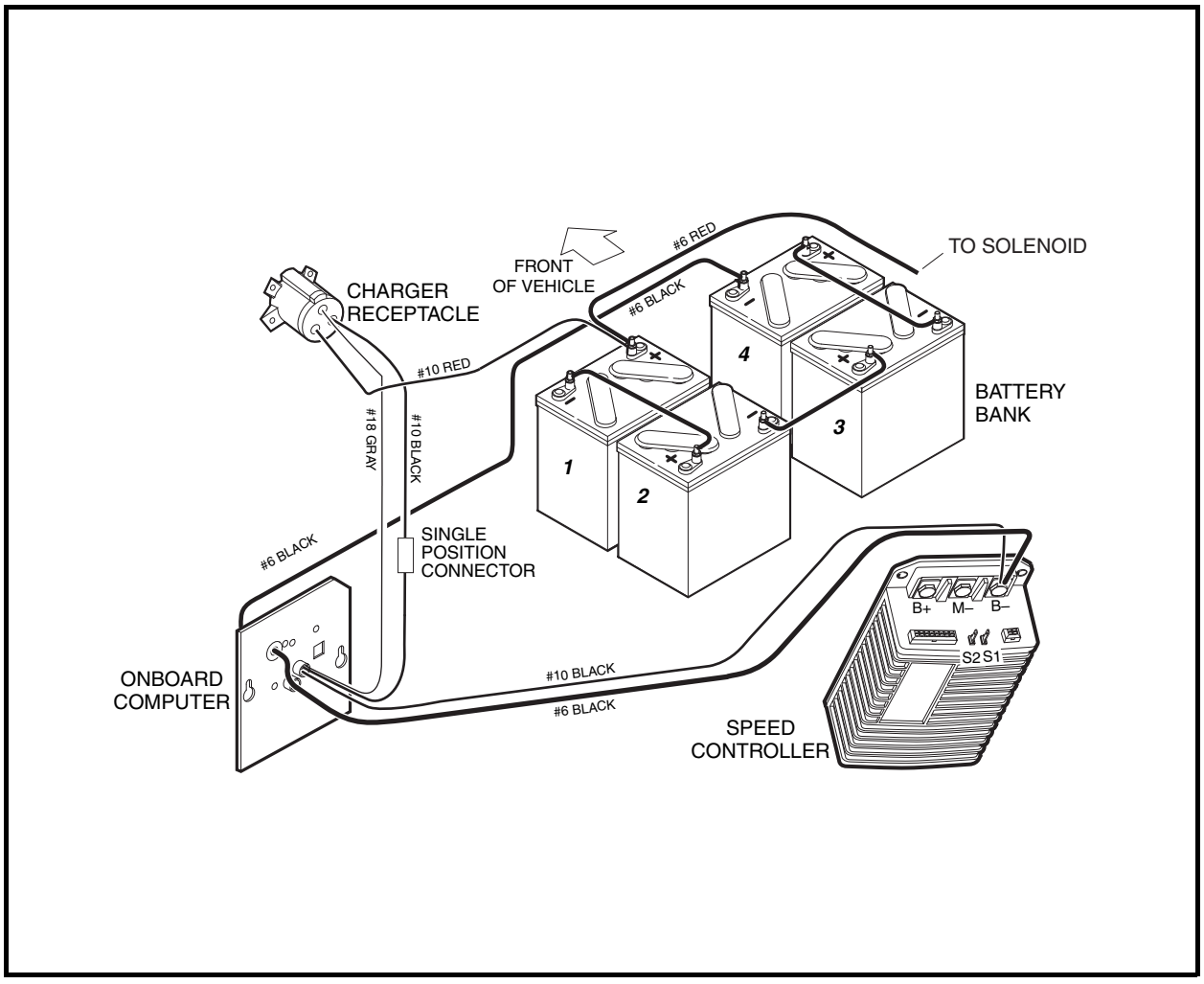


Figure 6-4 Charge Circuit and Style A Battery Configuration – 4 x 12-Volt Precedent Vehicles

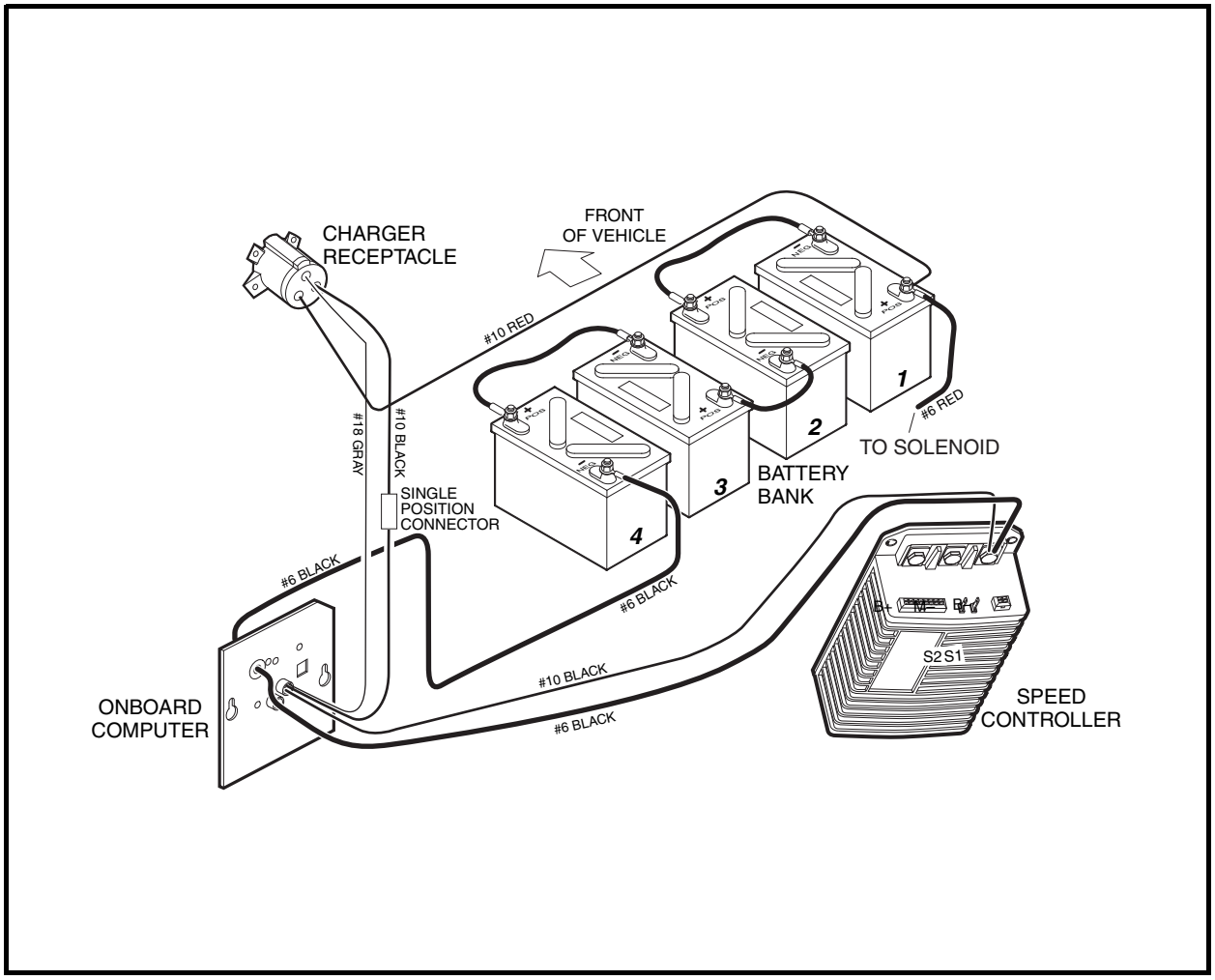


Figure 6-5 Charge Circuit and Style B Battery Configuration – 4 x 12-Volt Precedent Vehicles

PRECEDENT VEHICLES – 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 6-6, Page 6-7)**. 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.

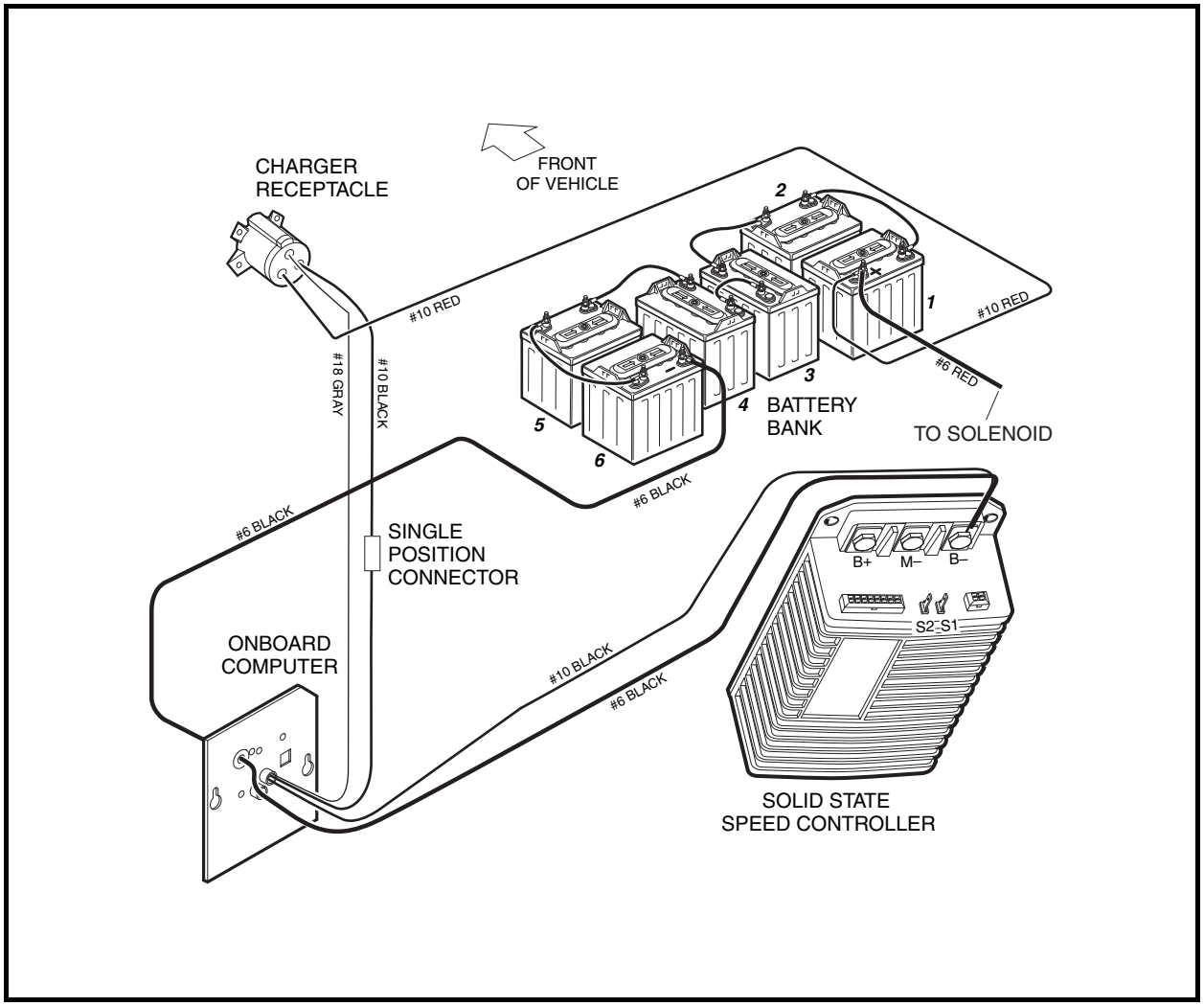


Figure 6-6 Charge Circuit and Style C Battery Configuration – 6 x 8-Volt Precedent Vehicles

CHARGER INSTALLATION AND OPERATION

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

⚠ 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 6-7, Page 6-9). 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 6-8, Page 6-9).**
- **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 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 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.**

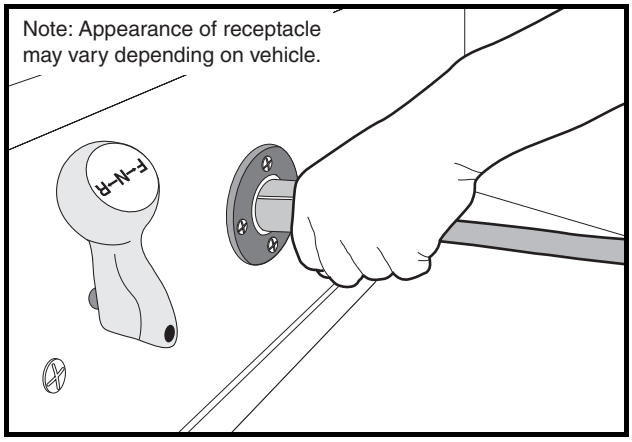


Figure 6-7 Charger Receptacle

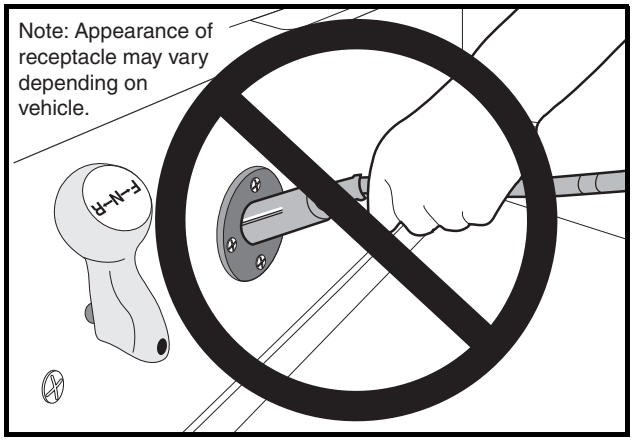


Figure 6-8 Incorrect DC Plug Removal

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.**

With charger DC output cord disconnected, connect the power supply cord to an AC supply. **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. It is for use on a nominal 120 volt, 60 hertz circuit. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electric Code and all local codes and ordinances.

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 meters)). Place all cords so they will not be stepped on, tripped over, or otherwise subject to damage or stress.

Mount charger by setting it on a shelf, wall mount with keyhole, or hang securely from ceiling by the handle. Do not hang charger upside down.

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 6-7, Page 6-9).**
- **Do not pull on the DC cord (Figure 6-8, Page 6-9). 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.**

WARNING CONTINUED ON NEXT PAGE...

⚠ WARNING

- **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 6-7, Page 6-9)**. 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 6-7, Page 6-9).**

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. 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). **See following NOTE.**

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.*

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) (CC P/N

101831801). ***See Communication Display Module in the appropriate maintenance and service supplement.***

If charger does not appear to be operating properly, or if the batteries appear to be weak, contact your Club Car distributor/dealer.

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 6-2.***

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 6-3, Page 6-4)** and that the internal charger wiring is correct **(Figure 6-9, Page 6-11)**.

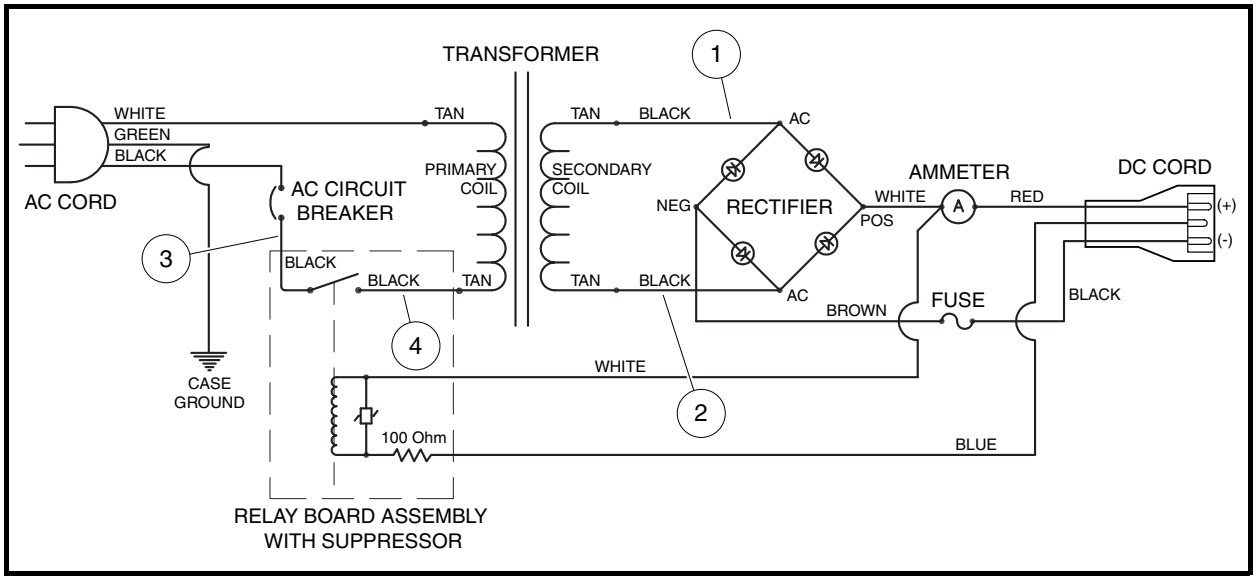


Figure 6-9 PowerDrive 3 Battery Charger Wiring Diagram (External Charger)

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 6-27. See following NOTE.**

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

CHECKING BATTERY CONDITION AFTER A CHARGE CYCLE

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

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 IQ System, PowerDrive, and Excel System 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 in the maintenance and service manual appropriate for your battery charger. If you do not have this publication, contact your Club Car representative. 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 then charge the vehicle. Normal voltage near the end of a charge cycle should be approximately 59 to 63 volts.

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 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. See additional WARNING on page 6-1.

⚠ 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 6-9, Page 6-11 and Figure 6-10, Page 6-15).**
- **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 PowerDrive 3 external battery chargers (model numbers 26560-11, 26560-18, and 26560-19). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

POWERDRIVE 3 BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Relay does not close, no transformer hum and ammeter does not move	Batteries disconnected	Connect the batteries. **See Connecting The Batteries on page 1-4.**
	Battery voltage is too low	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 6-16
	Poor connection between plug and receptacle	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 6-16
	DC plug and cord	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 6-16 and Test Procedure 5 – Charger DC Circuit Continuity Test on page 6-21
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 6-19
	Gray sense lead fuse is blown (not applicable to Precedent vehicles)	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 6-16
	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 6-19
	Failed AC plug and cord	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 6-19
	Transformer primary coil	Test Procedure 6 – Transformer on page 6-22
	Relay	Test Procedure 8 – Continuity on page 6-23
	Failed ammeter	Replace ammeter
Relay closes and transformer hums but ammeter does not move	Blown charger fuse	Test Procedure 8 – Continuity on page 6-23
	Failed rectifier	Test Procedure 4 – Rectifier on page 6-20
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 6-19
	Failed transformer	Test Procedure 6 – Transformer on page 6-22
Relay operates intermittently	Failed charger relay	Test Procedure 8 – Continuity on page 6-23
Charger fuse link blows or receptacle fuse link blows	Failed rectifier	Test Procedure 4 – Rectifier on page 6-20
	Loose internal fuse connection	Tighten connection
	Battery is wired in reverse polarity	Check vehicle wiring
	DC cord is wired in reverse polarity	Check battery charger wiring

Troubleshooting Guide continued on next page...

POWERDRIVE 3 BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Charger output is low	Failed rectifier	Test Procedure 4 – Rectifier on page 6-20
	Transformer coil short-circuit failure	Test Procedure 6 – Transformer on page 6-22
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 6-19
Charger turns off too soon	AC power supply was shut off	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 6-19
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 6-19
	Batteries may be fully charged	Test Procedure 7 – Battery State of Charge Test on page 6-23
Charger goes to 16 hour time out	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 6-19
	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 6-23
	Failed transformer	Test Procedure 6 – Transformer on page 6-22
	Incorrect charger wiring	Check battery charger wiring
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 6-19
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 6-19
	Charger failure	See Testing Charger Operation on page 6-11
	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
Battery warning light illuminates for ten seconds at four second intervals (with DC charger cord unplugged) (25 seconds, at 10 second intervals for Precedent vehicles)	Batteries are getting close to full discharge capacity	Recharge batteries (golf round may be completed first)
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 6-19
	Battery or batteries need to be replaced	See Batteries section in the appropriate maintenance and service manual

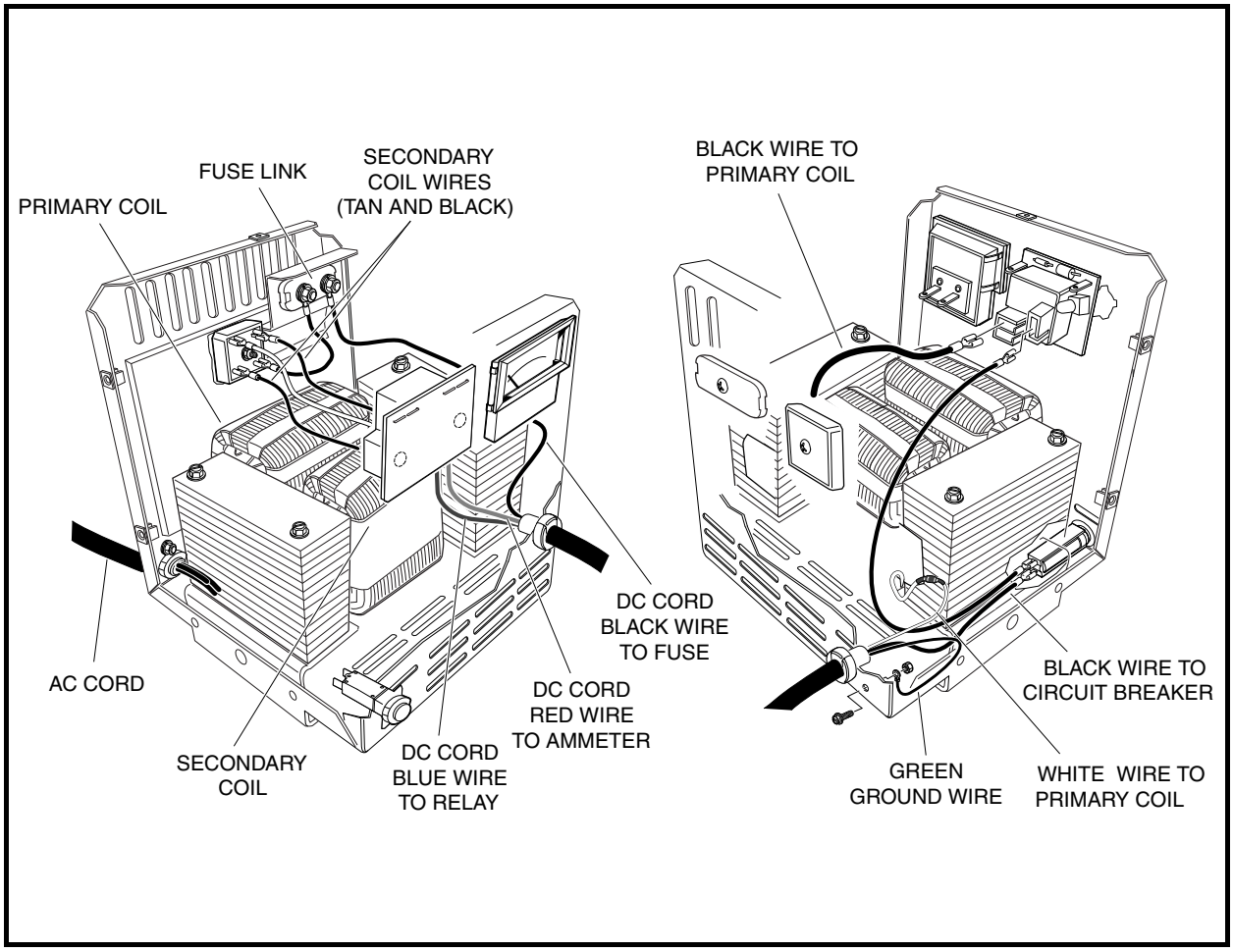


Figure 6-10 PowerDrive 3 Battery Charger Components – Model 26560

TEST PROCEDURES

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

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 6-1.

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 and 850:** Verify that the 10-gauge red wire from the charger receptacle is connected to the positive (+) post of battery no. 1 **(Figure 6-3, Page 6-4)**.
   3.2. Make sure the two nuts that secure the two 10-gauge black wires to the receptacle fuse assembly are tight **(Figure 6-11, Page 6-16)**.

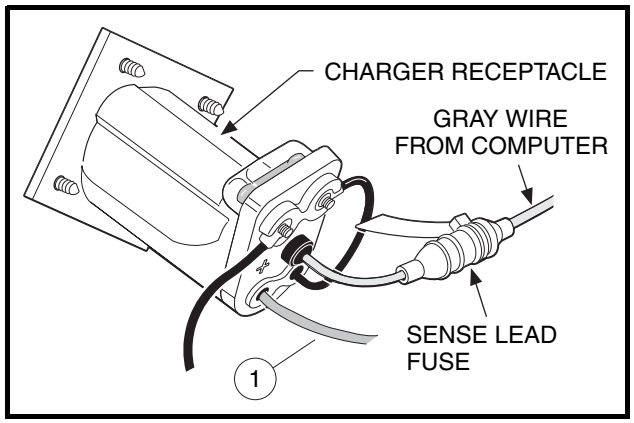


Figure 6-11 Receptacle Wire Connections (all vehicles except Precedent)

   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 6-4, Page 6-5)**.

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 6-12, Page 6-17)**.

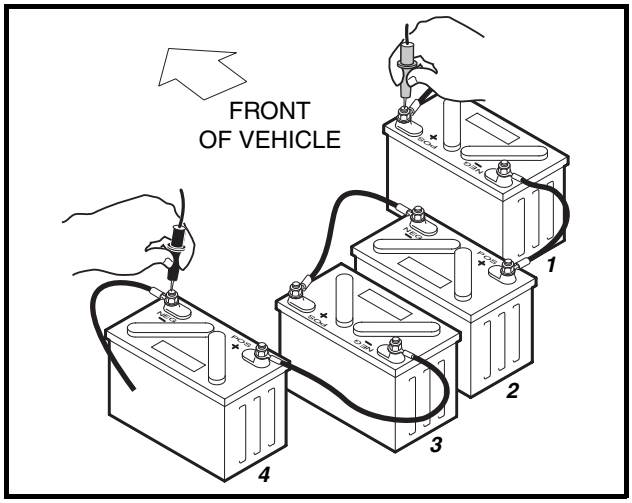


Figure 6-12 DS, DS Villager 4, 800, 810 and 850 Battery Configuration

4.2. **Turf 1 and Carryall 1:** 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 6-13, Page 6-17)**.

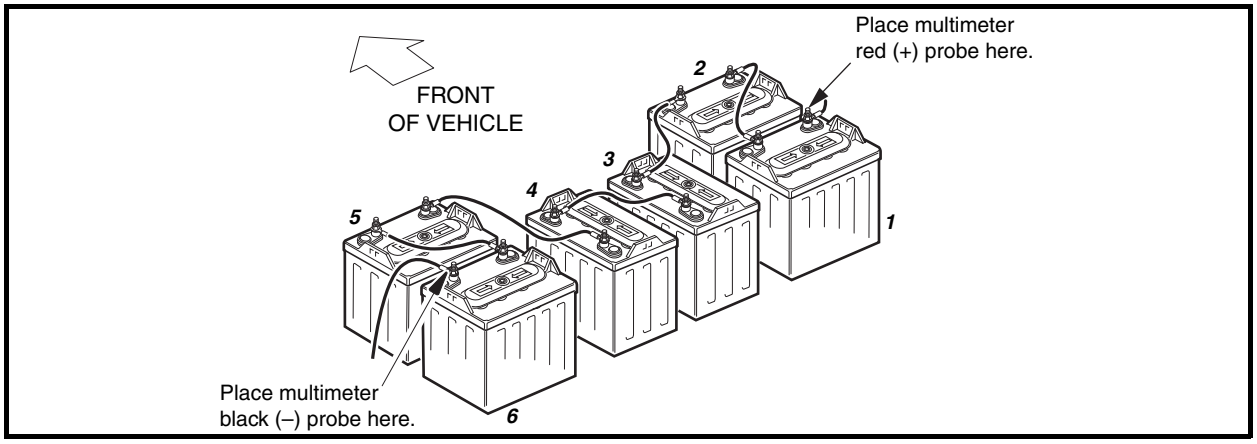


Figure 6-13 Turf 1 and Carryall 1 Battery Configuration

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 6-14, Page 6-18 or Figure 6-15, Page 6-18)**.

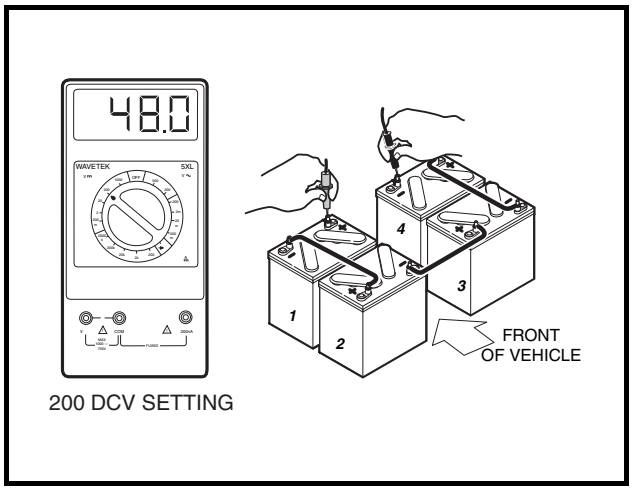


Figure 6-14 Battery Voltage Test – Precedent Style A Battery Configuration

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

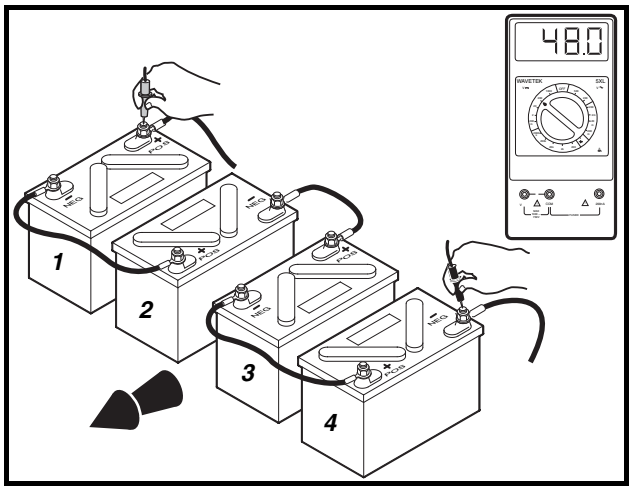


Figure 6-15 Battery Voltage Test – Precedent Style B Battery Configuration

(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 6-16, Page 6-18)**.

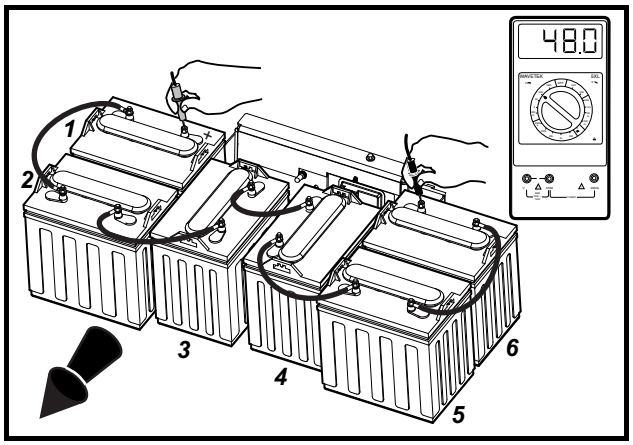


Figure 6-16 Battery Voltage Test – Precedent Style C Battery Configuration

(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 6-34.**

TEST PROCEDURE 2 – ONBOARD COMPUTER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

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 breaker 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 6-12.**
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 6-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Check the AC circuit breaker 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 between 105 and 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
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 6-34. 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.**

5.3. With relay bypassed, there should be continuity across the AC cord blades **(Figure 6-17, Page 6-19)**.

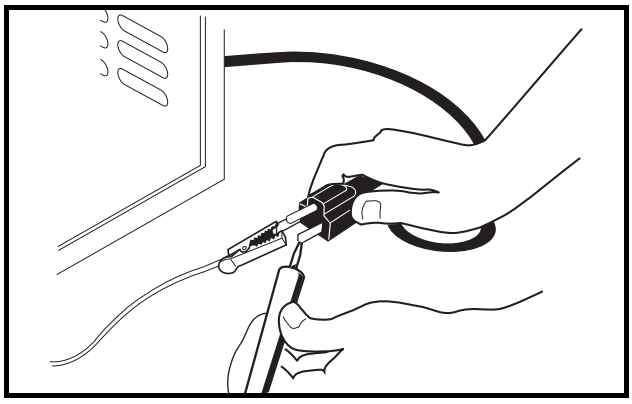


Figure 6-17 AC Cord Test

6. If the circuit is not complete, check the wiring of the AC cord, transformer primary coil wires, and internal AC circuit breaker **(Figure 6-22, Page 6-24)**.
7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, and the internal AC circuit breaker individually. **See Test Procedure 8 – Continuity on page 6-23.**
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 properly connect the relay wiring could result in property damage, severe personal injury, or death.**

TEST PROCEDURE 4 – RECTIFIER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

NOTE: *This Powerdrive 3 Model 26560 uses a rectifier mounted to an aluminum heat sink plate. A running change replaced the rectifier with two diode/heatsink assemblies. The model number changed to 26580.* ***See Section 7 – PowerDrive 3 – Model 26580.***

The rectifier converts the AC voltage from the transformer secondary coil to DC voltage. This conversion is necessary since the batteries require DC voltage for charging. A failed or improperly wired rectifier could result in little or no battery charging current or a tripped 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 all four wires from the rectifier **(Figure 6-18, Page 6-20)**.

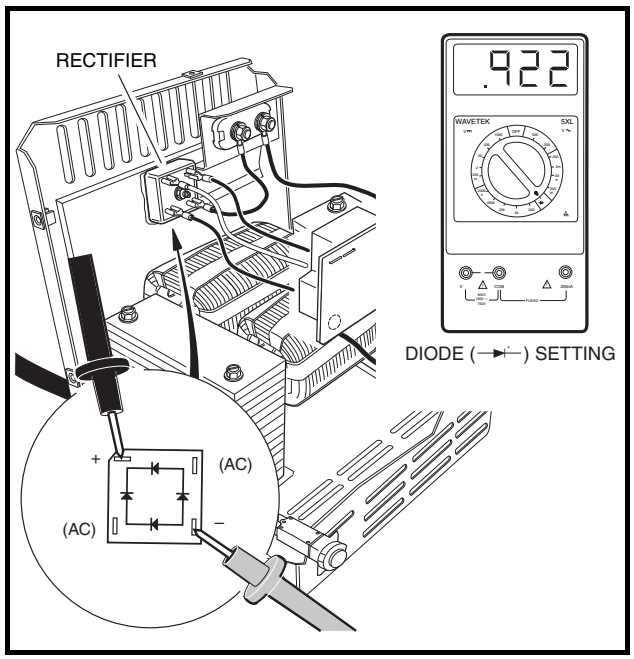


Figure 6-18 Rectifier Test

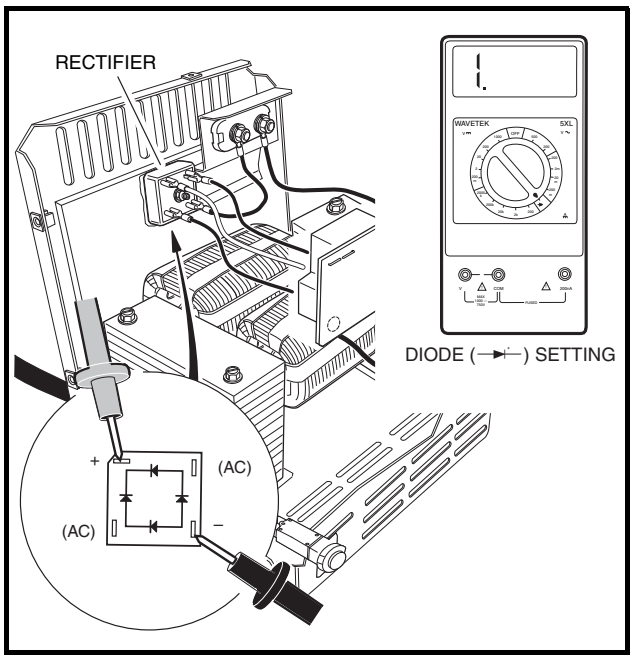


Figure 6-19 Rectifier Test – Probes Reversed

4. Using a multimeter set to the diode test function (→|←), place the black (–) probe of the multimeter on the positive (+) terminal of the rectifier. Move the positive (+) probe to each of the remaining three rectifier terminals and note the readings **(Figure 6-18, Page 6-20)**.
   4.1. The multimeter should indicate approximately 922 mV with the positive (+) probe on the negative (–) rectifier terminal.
   4.2. The multimeter should indicate approximately 496 mV with the positive (+) probe on one of the AC rectifier terminals.
   4.3. The multimeter should indicate approximately 496 mV with the positive (+) probe on the other AC rectifier terminal.
   4.4. If any other reading is obtained, the rectifier has failed and must be replaced.
5. Using a multimeter set to the diode test function (→|←), place the black (–) probe of the multimeter on the negative (–) terminal of the rectifier. Move the positive (+) probe to each of the remaining three rectifier terminals and note the readings **(Figure 6-19, Page 6-20)**. The multimeter should indicate an overload (no continuity) for all three of the remaining rectifier terminals. If any other reading is indicated, the rectifier has failed and must be replaced.
6. On rare occasions, the rectifier may fail as a result of a lightning strike at the charging location.
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.**

TEST PROCEDURE 5 – CHARGER DC CIRCUIT CONTINUITY TEST

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

1. Disconnect the AC cord from the wall outlet and the DC cord from the vehicle charger receptacle.
2. Using a multimeter set to the diode test function (→|←), place the positive (+) probe of the multimeter on the pin marked positive (+) on the DC plug **(Figure 6-20, Page 6-21)**. Place the negative probe (–) on the pin marked negative (–). The multimeter should indicate an overload (no continuity).

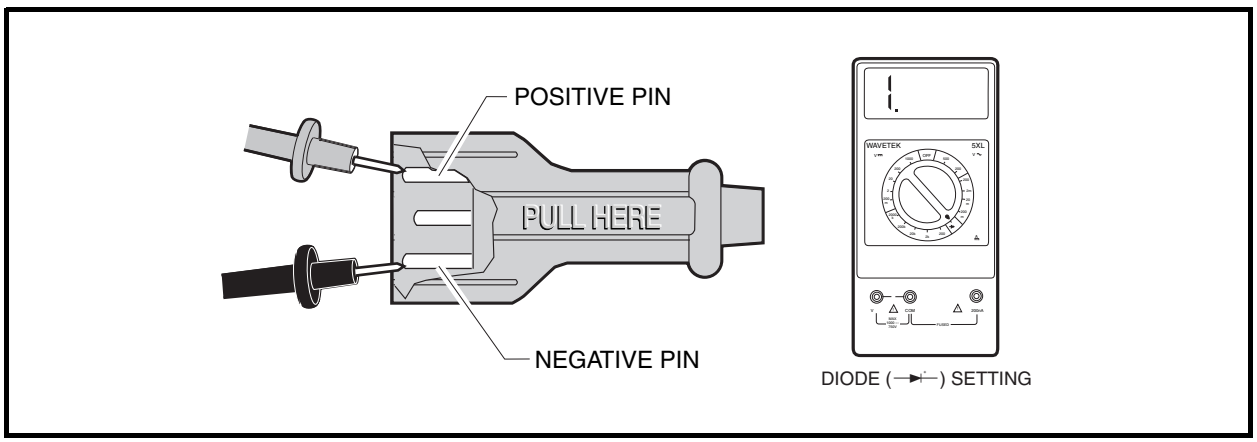


Figure 6-20 DC Plug Test

3. Reverse the test probes and check the DC plug again **(Figure 6-21, Page 6-22)**. The multimeter should indicate approximately 922 mV.
4. If multimeter readings are incorrect, check the battery charger wiring **(Figure 6-9, Page 6-11)**.
5. If the multimeter indicates an overload (no continuity) in both directions, 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 6-23.** Also check the rectifier. **See Test Procedure 4 – Rectifier on page 6-20.**
6. If the multimeter indicates a voltage reading in both directions, a short circuit exists in the charger DC circuit, usually caused by a failed rectifier. **See Test Procedure 4 – Rectifier on page 6-20.** If the rectifier has not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 6-23.**

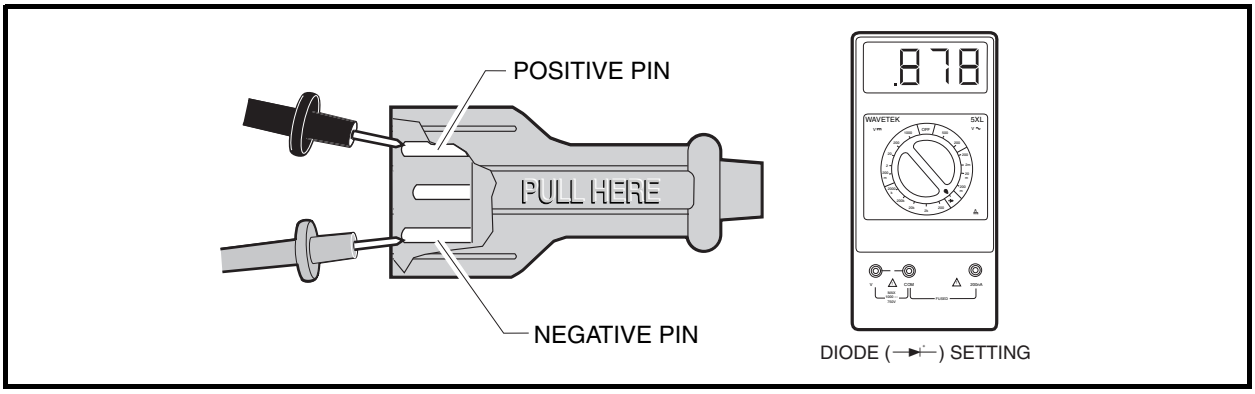


Figure 6-21 DC Plug Test – Probes Reversed

TEST PROCEDURE 6 – TRANSFORMER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

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 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 breaker, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 6-19.**

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the two black transformer secondary coil wires (1 and 2) from the rectifier **(Figure 6-9, Page 6-11)**.
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 6-34. 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 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.
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 2).
9. Connect the AC cord to the wall outlet and monitor the multimeter for the secondary coil voltage. If measured voltage is approximately 49.5 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced.
10. If the voltage reading is normal (50 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 6-21.**
11. 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 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 6-1.

1. With the batteries fully charged, disconnect the DC charger plug for approximately 20 seconds and then reconnect it. The ammeter should jump to a reading between 12 and 14 amps and then 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 6-19.**

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 6-1.

Fuse

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the DC cord black wire from the fuse and position it so it does not touch any metal part of the charger **(Figure 6-10, Page 6-15)**.
4. Using a multimeter set for 200 ohms, place the red (+) probe on one fuse terminal and the black (–) probe on the other fuse terminal. The tester should indicate continuity. If the tester does not indicate continuity, then the fuse has failed and must be replaced.

AC Cord

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 6-22, Page 6-24)**.
4. Disconnect the black wire (1) of AC cord from charger AC circuit breaker (3).
5. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire.

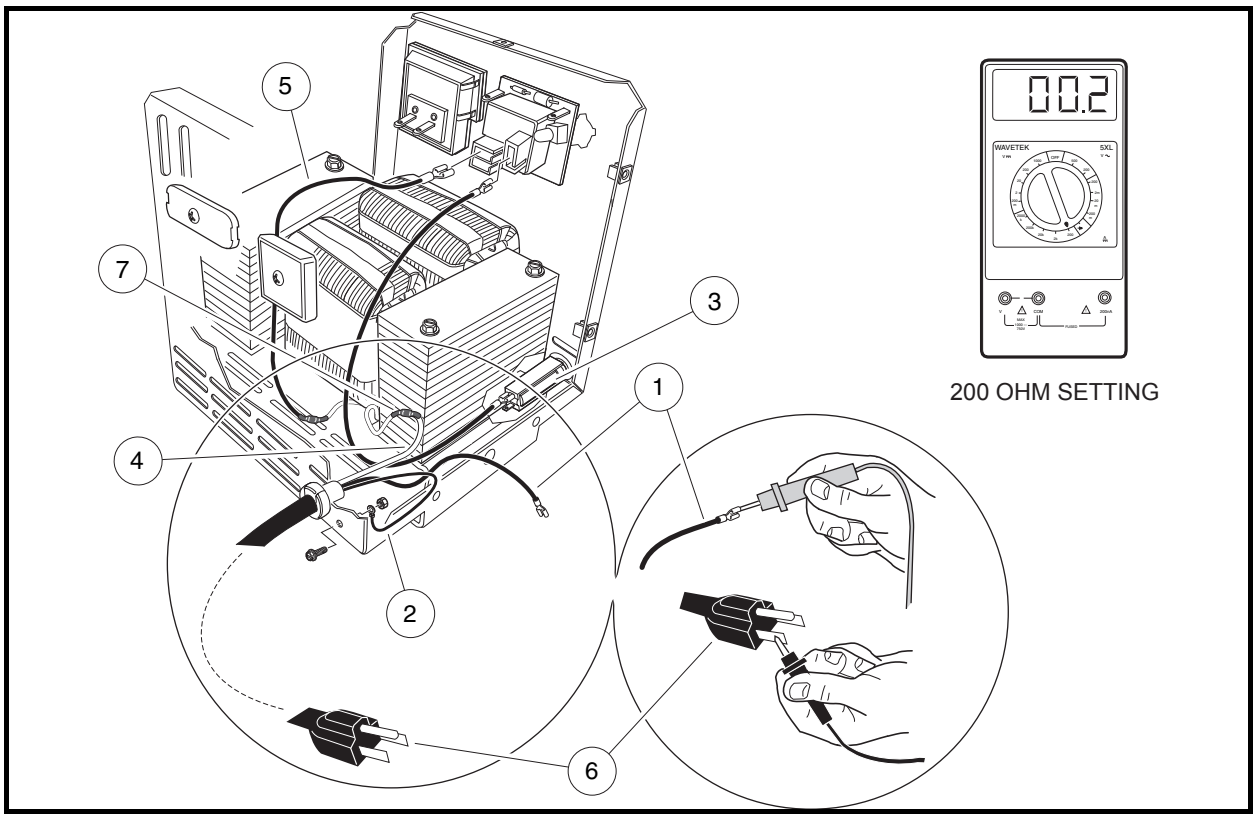


Figure 6-22 AC Cord and Plug Continuity Test

6. Disconnect the AC cord white wire (4) from the primary coil tan wire.
7. 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 (6). The tester should indicate continuity on one flat blade only. If any other reading is obtained, the AC cord and plug must be replaced.
8. 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 (6) **(Figure 6-22, Page 6-24)**. The tester should indicate continuity on only the round pin. If any other reading is obtained, the AC cord and plug must be replaced.
9. 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 (6). The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced.
10. If the correct readings were obtained, install the AC cord. **See AC Cord Installation on page 6-33.**

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 fuse **(Figure 6-23, Page 6-27).**
4. Disconnect the red wire of the DC cord from the ammeter.
5. Disconnect the blue wire from 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 test probe 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.

Transformer

The PowerDrive 3 battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 6-10, Page 6-15)**.

Primary Coil

1. Disconnect AC cord (6) from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire and disconnect the white wire (4) **(Figure 6-22, Page 6-24)**.
4. Disconnect the black primary coil wire (5) from the relay **(Figure 6-22, Page 6-24)**.
5. Place the continuity tester probes on the disconnected primary coil wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.
6. If the correct readings were obtained, install the AC cord and connect the transformer primary coil wires. **See AC Cord Installation on page 6-33.**

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 (black) secondary coil wires (1 and 2) from the rectifier **(Figure 6-9, Page 6-11)**.
4. Place the continuity tester probes on the disconnected secondary coil wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.

Voltage Suppressor – Failed Closed

The voltage suppressor, which is incorporated into the relay board assembly, 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.

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 1.5 (±.3) volts. If a reading of <.5 volt, then the voltage suppressor has shorted and the relay should be replaced. If the meter indicates an overload condition, then the voltage suppressor has failed and the relay 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 (prior to Version 3.0) due to a blown internal sense lead fuse is a symptom of a voltage supressor that has failed in a closed condition. The Version 3.0 and 4.0 onboard computers will quickly flash the battery warning light on the dash to indicate a problem with the voltage supressor.*

Relay

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove black wires (3 and 4) from contact terminals of the relay **(Figure 6-9, Page 6-11)**. Place continuity test probes on contact terminals 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. Place continuity test probes on contact terminals of relay. With batteries connected, insert DC plug into receptacle. The tester should indicate continuity. If tester does not indicate continuity, 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 white wire from the left ammeter terminal (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 probe 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 6-1.

⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 6-9, Page 6-11 and Figure 6-10, Page 6-15).**
- **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

DC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove the DC cord black wire from the fuse by loosening the nut on the fuse **(Figure 6-23, Page 6-27)**.
4. Remove the DC cord red wire from the ammeter.
5. Remove the DC cord blue wire from the relay board assembly.
6. Using pliers, squeeze the strain relief bushing and remove the DC cord.

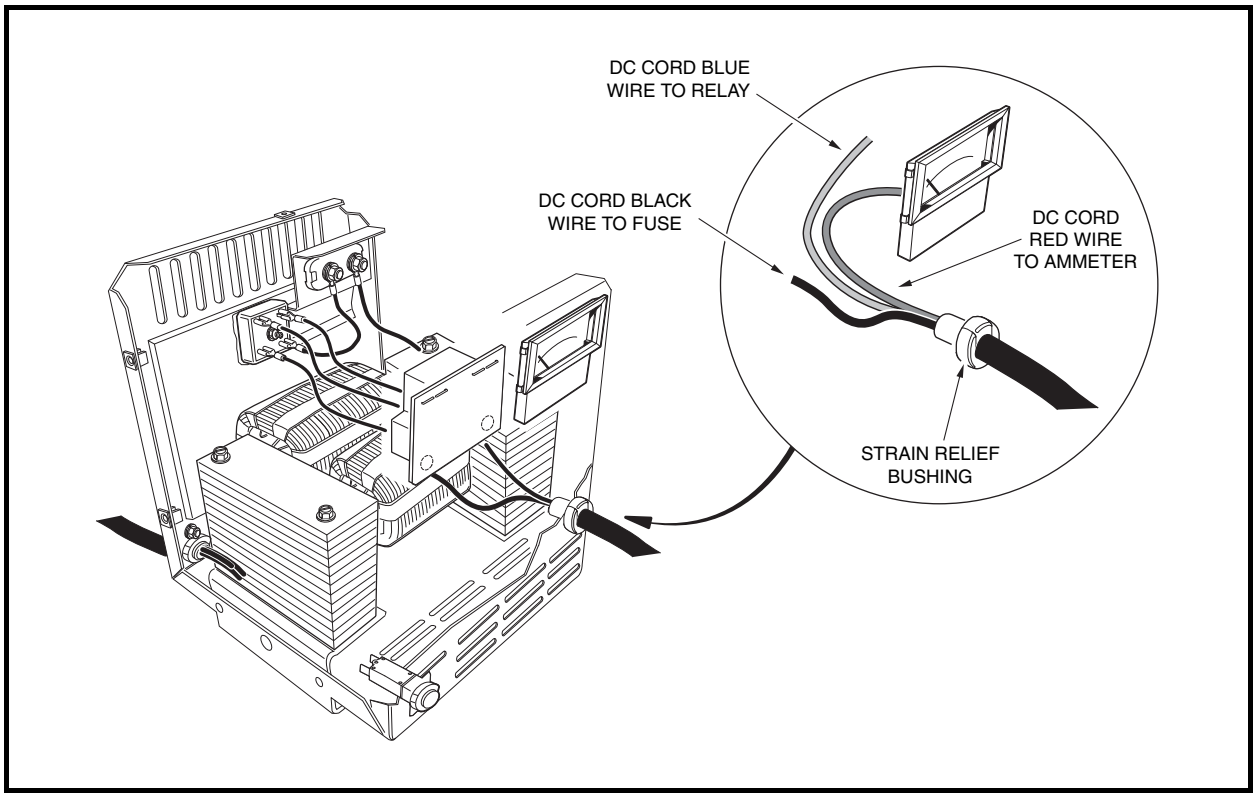


Figure 6-23 DC Cord

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 ammeter **(Figure 6-23, Page 6-27)**.
3. Attach the blue wire of the new DC cord to the relay board assembly.
4. Attach black wire of the new DC cord to fuse. Install the nut onto post of the fuse and tighten to 23 in-lb (2.6 N·m). **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.**

5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
6. 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).

RECTIFIER

NOTE: *This Powerdrive 3 Model 26560 uses a rectifier mounted to an aluminum heat sink plate. A running change replaced the rectifier with two diode/heatsink assemblies. The model number changed to 26580.* ***See Section 7 – PowerDrive 3 – Model 26580.***

Rectifier Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove all four wires from the rectifier (1) **(Figure 6-24, Page 6-28)**.
4. Gently press the fuse link (2) toward the transformer to remove it from its mounting tab.
5. Remove the screws (3) securing the rectifier/heatsink assembly (4) to the charger case.

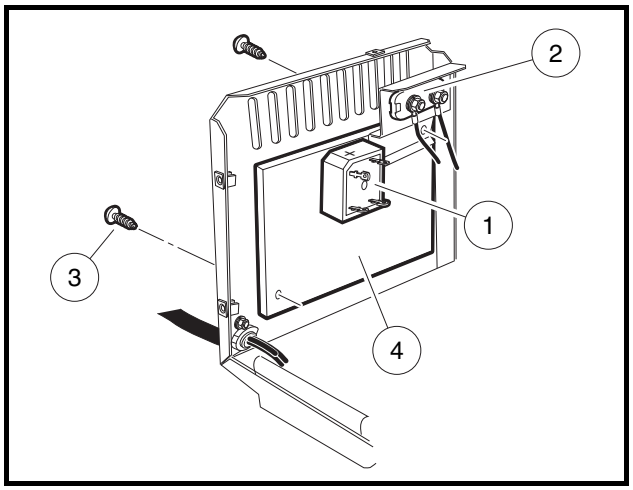


Figure 6-24 Rectifier/Heatsink Assembly

Rectifier Installation

1. Place the rectifier/heatsink assembly (4) against the charger case and secure with the screws (3) **(Figure 6-24, Page 6-28)**.
2. Connect the white wire from the ammeter to the positive (+) terminal of the rectifier **(Figure 6-9, Page 6-11)**. **See following NOTE.**

NOTE: *The positive (+) terminal of the rectifier is marked on the edge of the rectifier case. The positive terminal can also be identified by its orientation and the chamfered corner of the rectifier case.*

3. Connect the two black transformer secondary coil wires to the AC terminals on the rectifier.
4. Connect the brown wire from the charger fuse to the negative (–) rectifier terminal. **See following CAUTION.**

CAUTION

- **Improper wiring of the rectifier could result in damage to the rectifier and cause the AC circuit breaker to trip.**

5. Gently press the fuse link (2) into the mounting tab so that the fuse link is visible from the rear of the charger.
6. Install the charger cover and check charger for proper operation.

TRANSFORMER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

Transformer Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the black primary coil wire (5) from the charger relay **(Figure 6-22, Page 6-24)**.
4. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire.
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. If equipped, remove wire tie(s) securing transformer wires.
7. Disconnect the two black secondary coil transformer wires (1 and 2) from the rectifier **(Figure 6-9, Page 6-11)**.
8. Remove the four screws that secure the transformer to the mounting brackets and remove the transformer.

Transformer Installation

1. Install the transformer with primary coil to the rear of the charger case. Secure the transformer to the mounting brackets with four screws.
2. Connect the two black secondary coil transformer wires (1 and 2) to the AC terminals of the rectifier **(Figure 6-9, Page 6-11)**.
3. Connect the black transformer primary coil wire (5) to the charger relay **(Figure 6-22, Page 6-24)**.
4. Place a piece of heatshrink tubing over the AC cord white wire.
5. Connect the AC cord white wire (4) to the tan primary coil wire **(Figure 6-22, Page 6-24)**.

6. Slide the heatshrink tubing (7) over the connection and apply heat to the heatshrink to insulate the connection between the AC cord white wire and the tan primary coil wire. **See following WARNING.**

⚠ WARNING

- **Make sure the electrical connections are properly insulated. Failure to properly insulate electrical connections in the charger could result in a short circuit.**

7. If equipped, replace wire tie(s) securing transformer wires. **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. Install the charger cover and check charger for proper operation.

AMMETER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

Ammeter Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the DC cord red wire (1) and the white wires (2 and 3) from the ammeter (4) **(Figure 6-25, Page 6-31)**.
4. Press the locking tabs on each side of the ammeter and remove the ammeter by gently pushing the ammeter through the front of the charger case.

Ammeter Installation

1. Place the ammeter (4) in position in the charger face and ensure that the locking tabs are secure **(Figure 6-25, Page 6-31)**.
2. Connect the DC cord red wire (1) and the white wires (2 and 3) to the ammeter terminals.
3. Install the charger cover.
4. Plug the charger into the vehicle and check ammeter for proper operation.

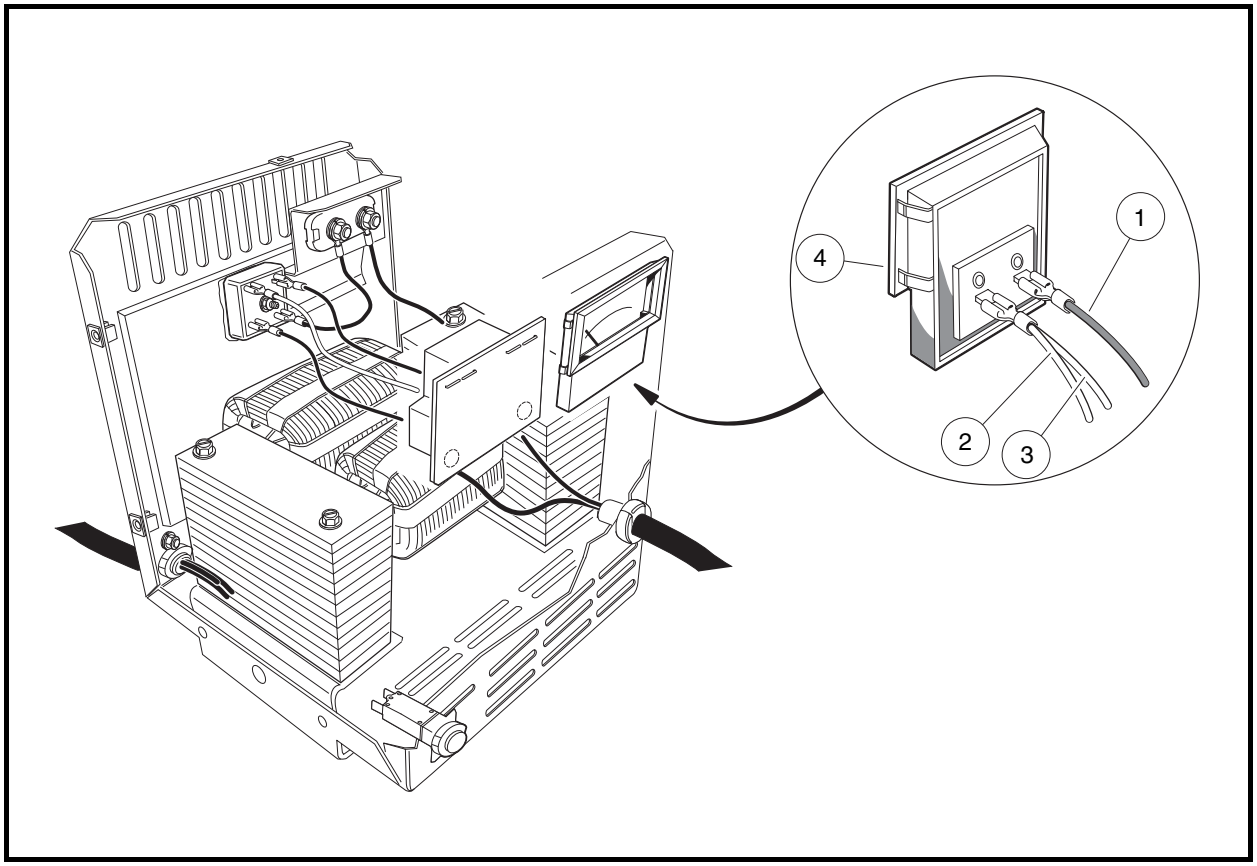


Figure 6-25 Ammeter

FUSE LINK

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

Fuse Link Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Gently press the fuse toward the transformer to remove the fuse from the mounting tab.
4. Remove the two nuts securing the two wires to the fuse terminals and remove the fuse.

Fuse Link Installation

1. Connect the short brown wire from the rectifier to one of the fuse terminal posts and install the nut. Tighten nut to 23 in-lb (2.6 N·m).
2. Connect the DC cord black wire to the other fuse terminal post and install the nut. Tighten nut to 23 in-lb (2.6 N·m).
3. Gently press the fuse assembly into the mounting tab so that the fuse link is visible from the rear of the charger.
4. Install the charger cover.

RELAY BOARD ASSEMBLY

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

Relay Board Assembly Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 6-9, Page 6-11)**.
4. Remove two screws attaching relay to the front of the charger case.
5. Remove the relay.

Relay Board Assembly Installation

Install in reverse order of removal and tighten screws firmly. Connect wires as shown **(Figure 6-9, Page 6-11)**.

CHARGER AC CIRCUIT BREAKER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 6-1.

AC Circuit Breaker Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the two black wires attached to the circuit breaker **(Figure 6-9, Page 6-11)**.
4. With a pair of pliers, squeeze in the retaining tabs on the sides of the circuit breaker and push the circuit breaker through the mounting hole in the face of the charger to remove.

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 6-1.

AC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the AC cord black wire (1) from the AC circuit breaker (3) **(Figure 6-22, Page 6-24)**.
4. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire **(Figure 6-22, Page 6-24)**.
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. Disconnect the AC cord green wire (2) from the charger base.
7. 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 black, white, and green leads of the new AC cord into the charger through the hole in the charger face.
2. Connect the AC cord black wire (1) to the AC circuit breaker (3) **(Figure 6-22, Page 6-24)**.
3. Place a piece of heatshrink tubing (7) over the AC cord white wire (4).
4. Connect the AC cord white wire (4) to the tan primary coil wire **(Figure 6-22, Page 6-24)**.
5. Slide the heatshrink tubing (7) over the connection and apply heat to the heatshrink to insulate the connection between the AC cord white wire (4) and the tan primary coil wire. **See following WARNING.**

⚠ WARNING

- **Make sure the electrical connections are properly insulated. Failure to properly insulate electrical connections in the charger could result in a short circuit.**

6. Connect the green wire (2) to the charger base. Tighten the screw and nut on the green (ground) wire terminal to 18 in-lb (2.0 N·m).
7. Position the strain relief bushing on the AC cord.
8. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
9. 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 6-1.

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 6-9, Page 6-11 and Figure 6-10, Page 6-15).**
- **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 screws securing the charger cover and remove the cover from the charger.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.

- To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 6-26, Page 6-35)**. **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*, and 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 transformer wire (4) from AC circuit breaker and connect it to the relay. Connect the black wire (3) from the relay to the AC circuit breaker **(Figure 6-26, Page 6-35)**. **See following WARNING.**

⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to 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 and 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.**

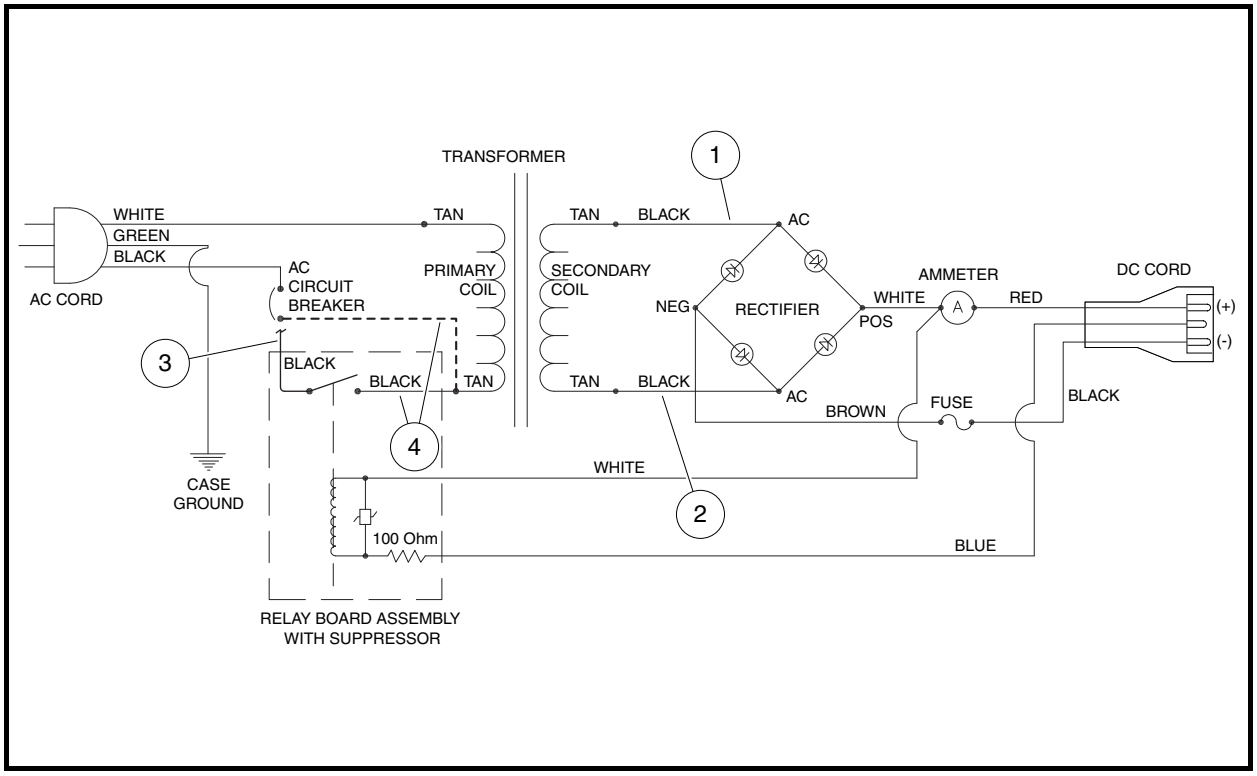


Figure 6-26 PowerDrive 3 Charger Wiring Diagram (Relay Bypassed)

SECTION 7 – POWERDRIVE 3 – MODEL 26580

⚠ 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 7-7, Page 7-9). 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 7-8, Page 7-9).**

GENERAL INFORMATION

This section includes information pertaining to service of the PowerDrive 3 battery charger (model numbers 26580-11, 26580-18, and 26580-19) **(Figure 7-1, Page 7-1)**. 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.

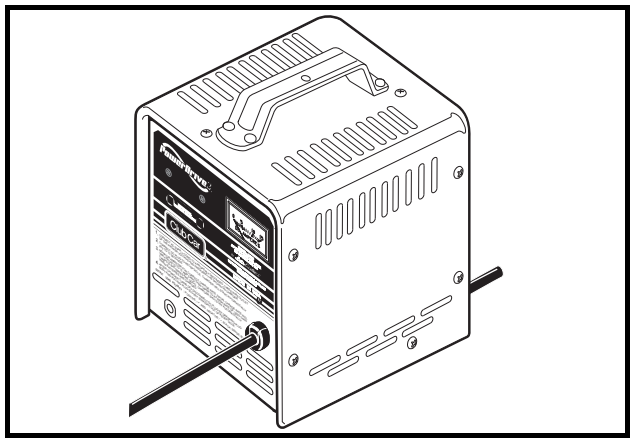


Figure 7-1 PowerDrive 3 Battery Charger

The PowerDrive 3 battery charger is automatic and has no external controls. When the charger is connected, there is a 2 to 15 second delay before charging begins.

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, having recorded the amount of energy consumed as the vehicle was used, 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. The computer accomplishes this by detecting when the exact amount of energy necessary has been returned to the batteries.

POWERDRIVE 3 BATTERY CHARGER FEATURES

- **Charge Interlock:** PowerDrive 3 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. **See following WARNING.**
- **Long-Term Storage Charge:** Vehicles with PowerDrive 3 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 and CAUTION.** 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 (Figure 7-7, Page 7-9). 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 (Figure 7-8, Page 7-9).**

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.**

BATTERY WARNING LIGHT

IQ System and Excel System 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 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 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 battery warning light will flash quickly, after inserting the DC plug, indicating the charger's voltage suppressor has failed closed.

THE CHARGE CIRCUIT

DS, 800, 810 AND 850 VEHICLES – 4 X 12-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 7-2, Page 7-3)**. 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.

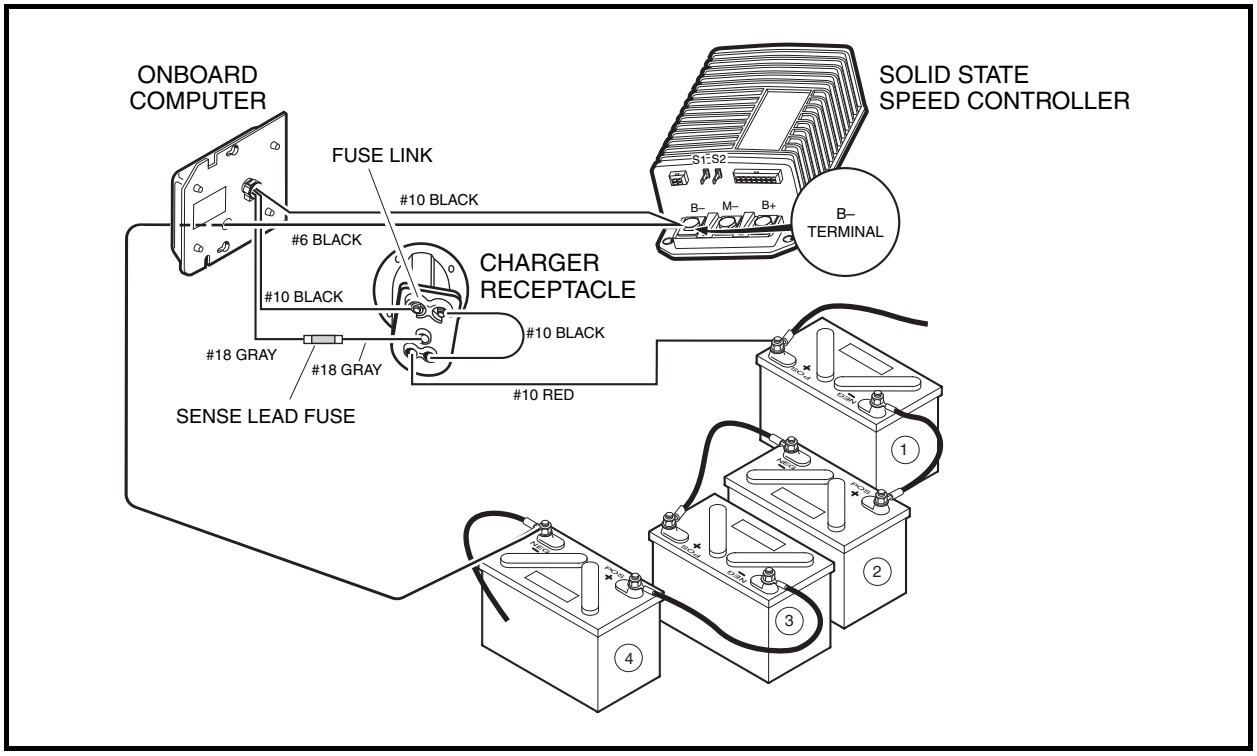


Figure 7-2 Charge Circuit and Battery Configuration – 4 x 12-Volt DS, 800, 810 and 850 Vehicles

TURF 1 AND CARRYALL 1 VEHICLES – 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 7-3, Page 7-4)**. 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.

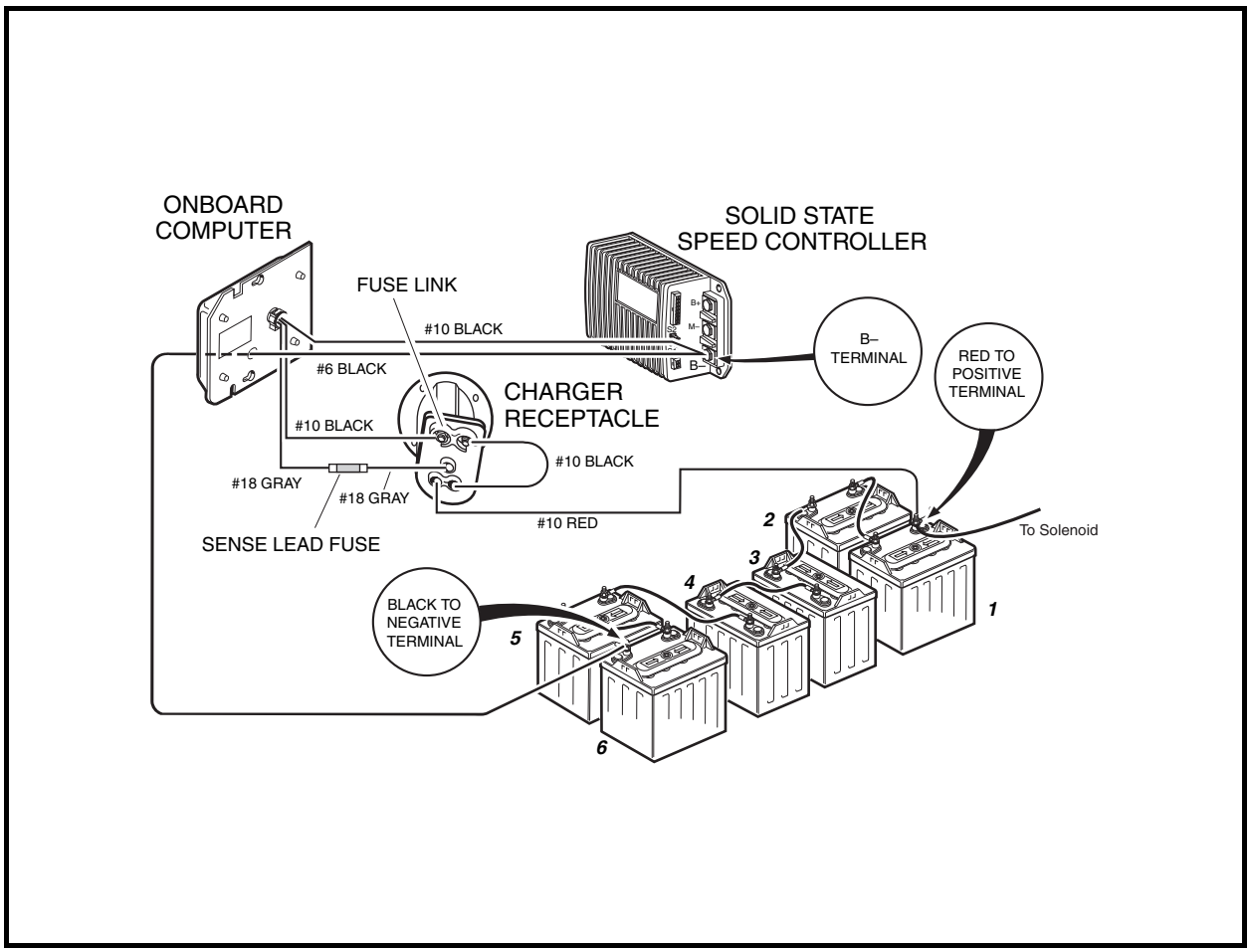


Figure 7-3 Charge Circuit and Battery Configuration – 6 x 8-Volt Turf 1 and Carryall 1 Vehicles

PRECEDENT VEHICLES – 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 7-4, Page 7-5 or Figure 7-5, Page 7-6)**. 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.

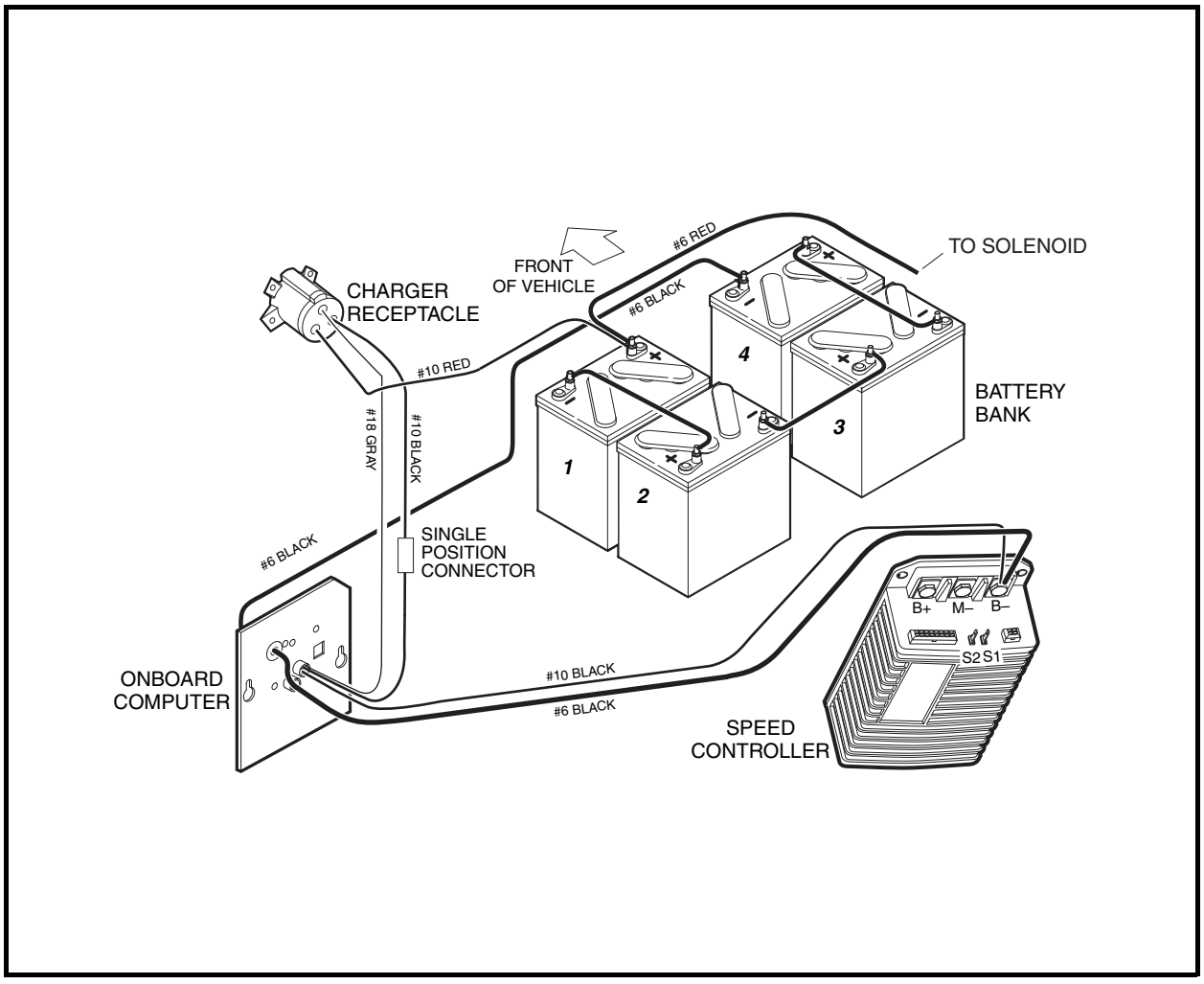


Figure 7-4 Charge Circuit and Style A Battery Configuration – 4 x 12-Volt Precedent Vehicles

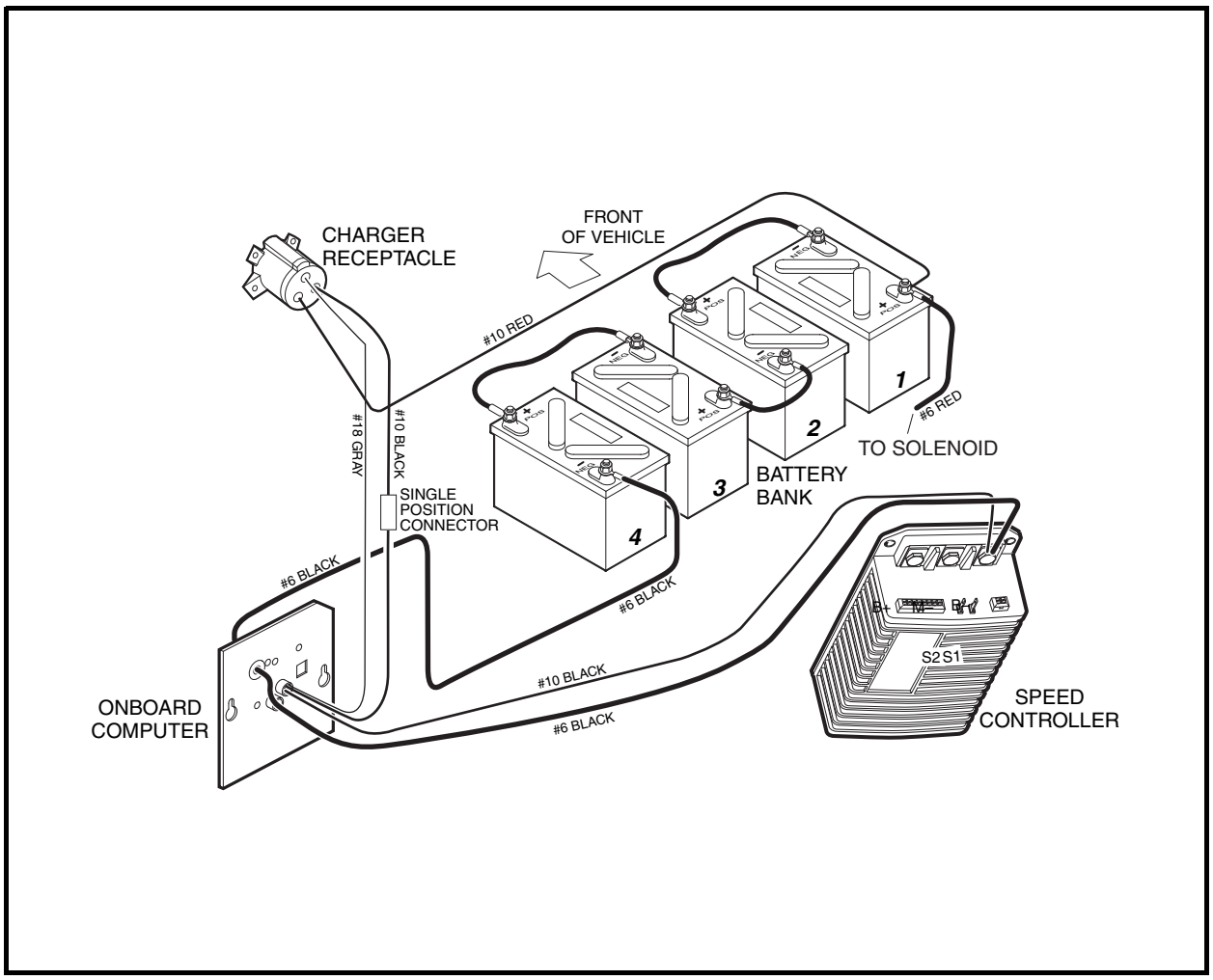


Figure 7-5 Charge Circuit and Style B Battery Configuration – 4 x 12-Volt Precedent Vehicles

PRECEDENT VEHICLES – 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 7-6, Page 7-7)**. 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.

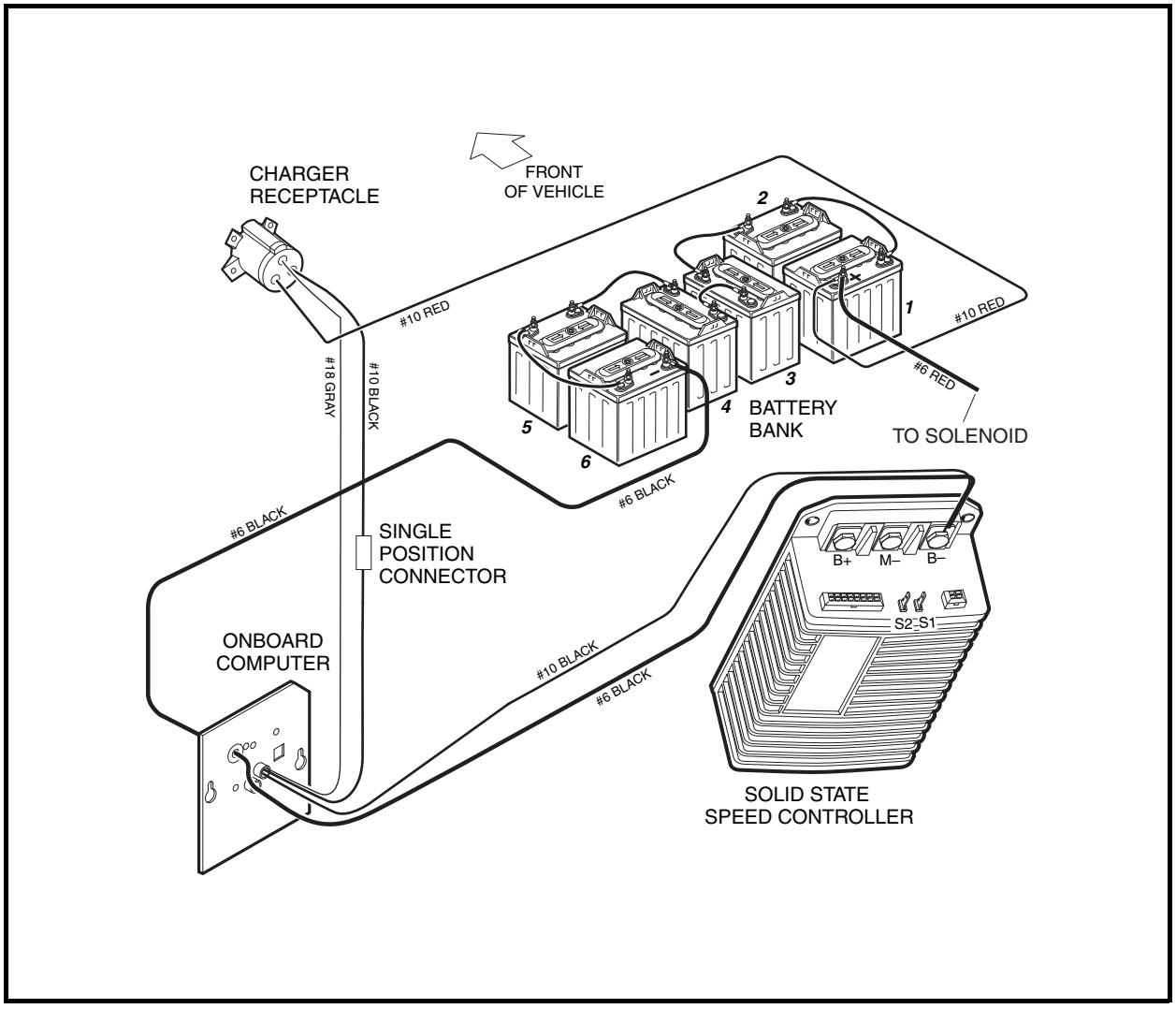


Figure 7-6 Charge Circuit and Style C Battery Configuration – 6 x 8-Volt Precedent Vehicles

CHARGER INSTALLATION AND OPERATION

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

⚠ 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 7-7, Page 7-9). 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 7-8, Page 7-9).**
- **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 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 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.**

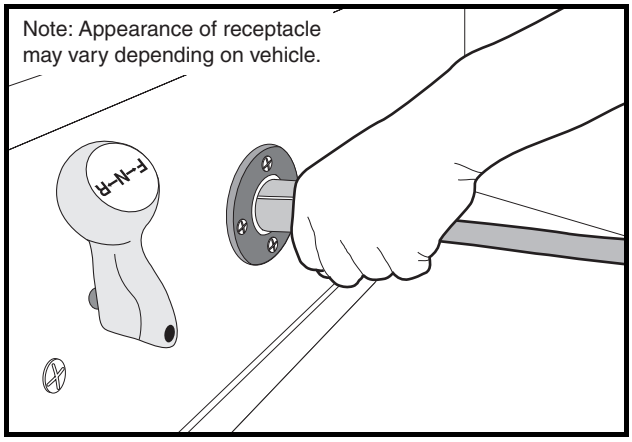


Figure 7-7 Charger Receptacle

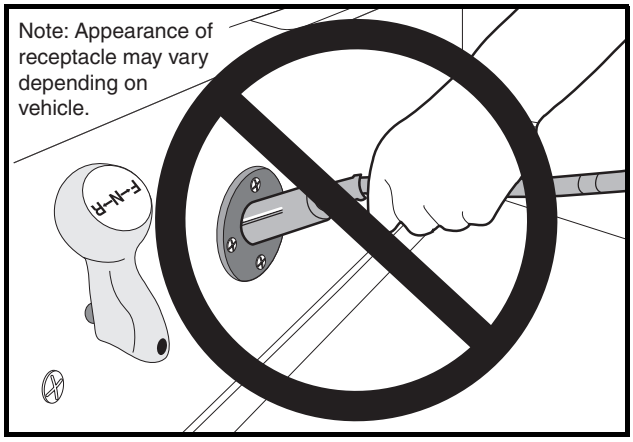


Figure 7-8 Incorrect DC Plug Removal

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.**

With charger DC output cord disconnected, connect the power supply cord to an AC supply. **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. It is for use on a nominal 120 volt, 60 hertz circuit. The AC plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electric Code and all local codes and ordinances.

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 meters)). Place all cords so they will not be stepped on, tripped over, or otherwise subject to damage or stress.

Mount charger by setting it on a shelf, wall mount with keyhole, or hang securely from ceiling by the handle. Do not hang charger upside down.

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 7-7, Page 7-9).**
- **Do not pull on the DC cord (Figure 7-8, Page 7-9). 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.**

WARNING CONTINUED ON NEXT PAGE...

⚠ WARNING

- **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 7-7, Page 7-9)**. 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 7-7, Page 7-9).**

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. 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). **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 (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) (CC P/N 101831801). ***See Communication Display Module in the appropriate maintenance and service supplement.***

If charger does not appear to be operating properly, or if the batteries appear to be weak, contact your Club Car distributor/dealer.

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 7-2.***

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 7-3, Page 7-4)** and that the internal charger wiring is correct **(Figure 7-9, Page 7-11)**.

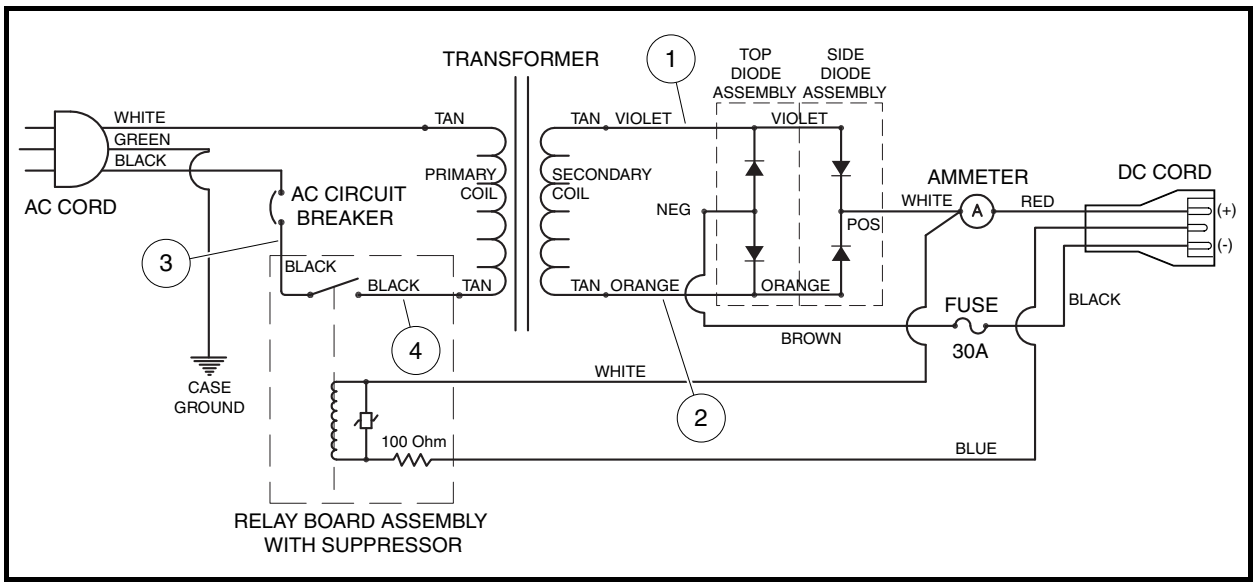


Figure 7-9 PowerDrive 3 Battery Charger Wiring Diagram (External Charger)

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 7-28. See following NOTE.**

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

CHECKING BATTERY CONDITION AFTER A CHARGE CYCLE

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

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 IQ System, PowerDrive, and Excel System 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 in the maintenance and service manual appropriate for your battery charger. If you do not have this publication, contact your Club Car representative. 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 then charge the vehicle. Normal voltage near the end of a charge cycle should be approximately 59 to 63 volts.

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 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. See additional WARNING on page 7-1.

⚠ 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 7-9, Page 7-11 and Figure 7-10, Page 7-15).**
- **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 PowerDrive 3 external battery chargers (model numbers 26580-11, 26580-18, and 26580-19). The Troubleshooting Guide encompasses the entire battery charging circuit. Test procedures specified in the Troubleshooting Guide can be found on the following pages.

POWERDRIVE 3 BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Relay does not close, no transformer hum and ammeter does not move	Batteries disconnected	Connect the batteries. **See Connecting The Batteries on page 1-4.**
	Battery voltage is too low	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 7-16
	Poor connection between plug and receptacle	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 7-16
	DC plug and cord	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 7-16 and Test Procedure 5 – Charger DC Circuit Continuity Test on page 7-21
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 7-19
	Gray sense lead fuse is blown (not applicable to Precedent vehicles)	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 7-16
	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 7-19
	Failed AC plug and cord	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 7-19
	Transformer primary coil	Test Procedure 6 – Transformer on page 7-23
	Relay	Test Procedure 8 – Continuity on page 7-24
	Failed ammeter	Replace ammeter
Relay closes and transformer hums but ammeter does not move	Blown charger fuse	Test Procedure 8 – Continuity on page 7-24
	Failed diodes	Test Procedure 4 – Diodes on page 7-20
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 7-19
	Failed transformer	Test Procedure 6 – Transformer on page 7-23
Relay operates intermittently	Failed charger relay	Test Procedure 8 – Continuity on page 7-24
Charger fuse link blows or receptacle fuse link blows	Failed diodes	Test Procedure 4 – Diodes on page 7-20
	Loose internal fuse connection	Tighten connection
	Battery is wired in reverse polarity	Check vehicle wiring
	DC cord is wired in reverse polarity	Check battery charger wiring

Troubleshooting Guide continued on next page...

POWERDRIVE 3 BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Charger output is low	Failed diodes	Test Procedure 4 – Diodes on page 7-20
	Transformer coil short-circuit failure	Test Procedure 6 – Transformer on page 7-23
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 7-19
Charger turns off too soon	AC power supply was shut off	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 7-19
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 7-19
	Batteries may be fully charged	Test Procedure 7 – Battery State of Charge Test on page 7-24
Charger goes to 16 hour time out	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 7-19
	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 7-24
	Failed transformer	Test Procedure 6 – Transformer on page 7-23
	Incorrect charger wiring	Check battery charger wiring
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 7-19
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 7-19
	Charger failure	See Testing Charger Operation on page 7-11
	16 hour time out	See Battery Warning Light on page 7-2
	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 unplugged) (25 seconds, at 10 second intervals for Precedent vehicles)	Batteries are getting close to full discharge capacity	Recharge batteries (golf round may be completed first)
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 7-19
	Battery or batteries need to be replaced	See Batteries section in the appropriate maintenance and service manual

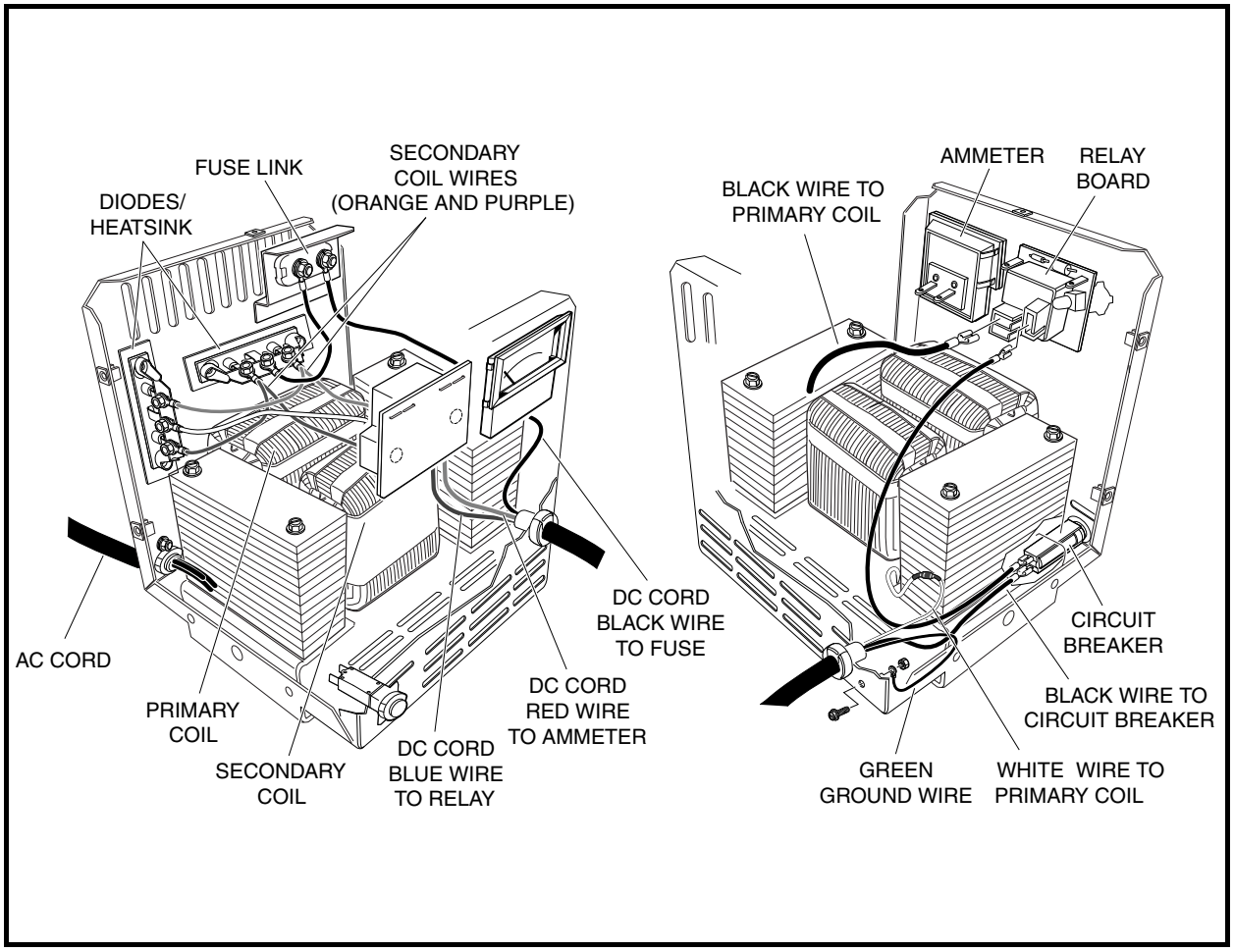


Figure 7-10 PowerDrive 3 Battery Charger Components – Model 26580

TEST PROCEDURES

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

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 7-1.

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 vehicles:** Verify that the 10-gauge red wire from the charger receptacle is connected to the positive (+) post of battery no. 1 **(Figure 7-3, Page 7-4)**.
   3.2. Make sure the two nuts that secure the two 10-gauge black wires to the receptacle fuse assembly are tight **(Figure 7-11, Page 7-16)**.

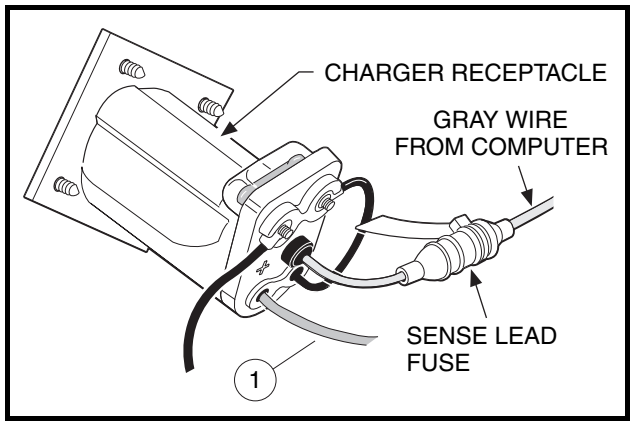


Figure 7-11 Receptacle Wire Connections (all vehicles except Precedent)

   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 7-4, Page 7-5)**.

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 7-12, Page 7-17)**.

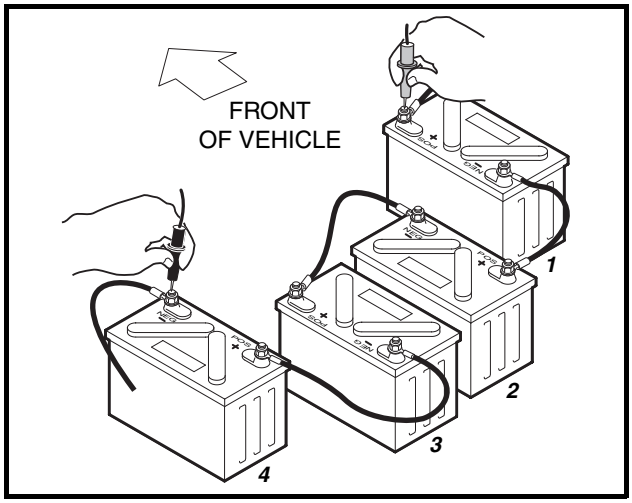


Figure 7-12 DS, DS Villager 4, 800, 810 and 850 Battery Configuration

4.2. **Turf 1 and Carryall 1:** 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 7-13, Page 7-17)**.

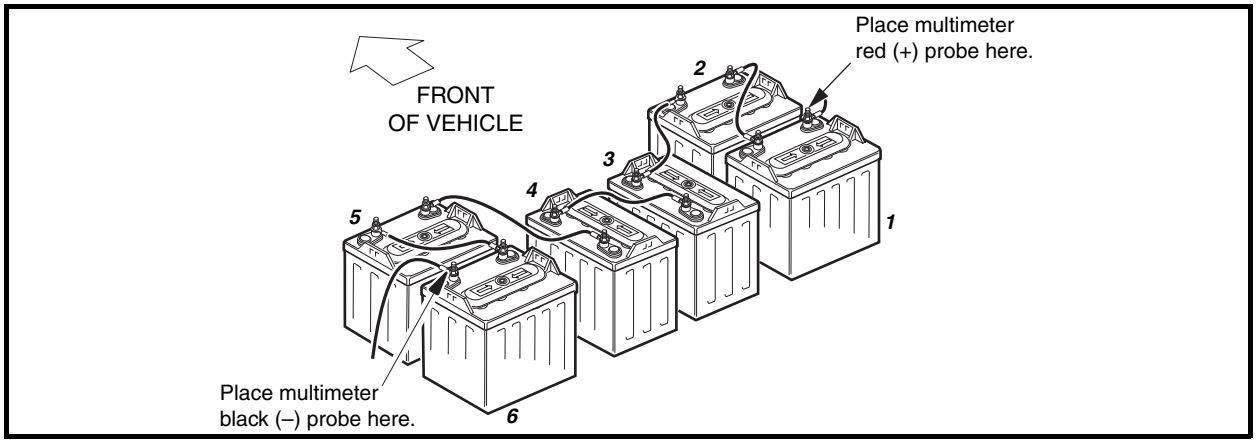


Figure 7-13 Turf 1 and Carryall 1 Battery Configuration

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 7-14, Page 7-18 or Figure 7-15, Page 7-18)**.

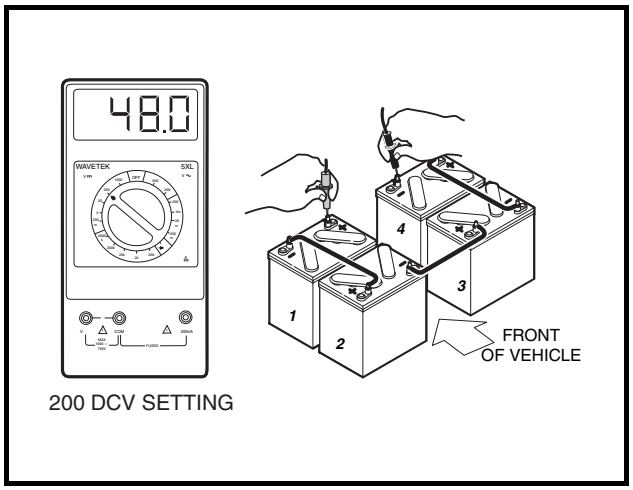


Figure 7-14 Battery Voltage Test – Precedent Style A Battery Configuration

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

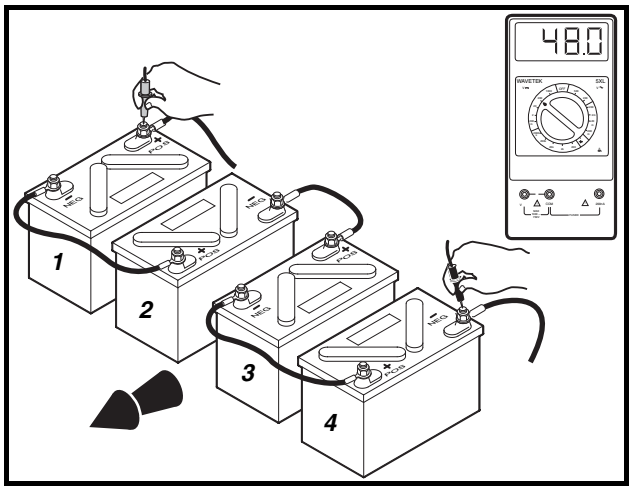


Figure 7-15 Battery Voltage Test – Precedent Style B Battery Configuration

(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 7-16, Page 7-18)**.

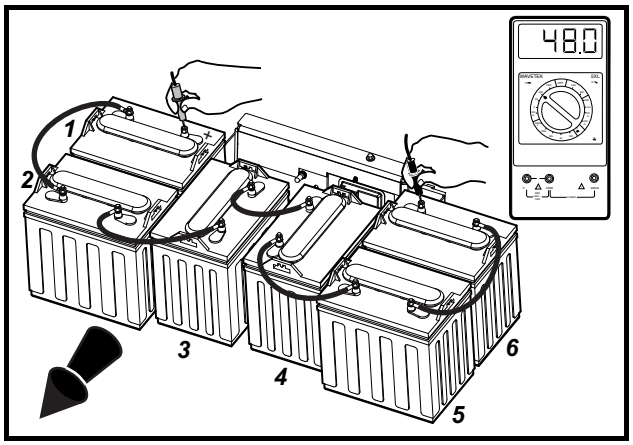


Figure 7-16 Battery Voltage Test – Precedent Style C Battery Configuration

(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 7-34.**

TEST PROCEDURE 2 – ONBOARD COMPUTER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

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 breaker 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 7-12.**
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 7-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Check the AC circuit breaker 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 between 105 and 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
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 7-34. 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.**

5.3. With relay bypassed, there should be continuity across the AC cord blades **(Figure 7-17, Page 7-19)**.

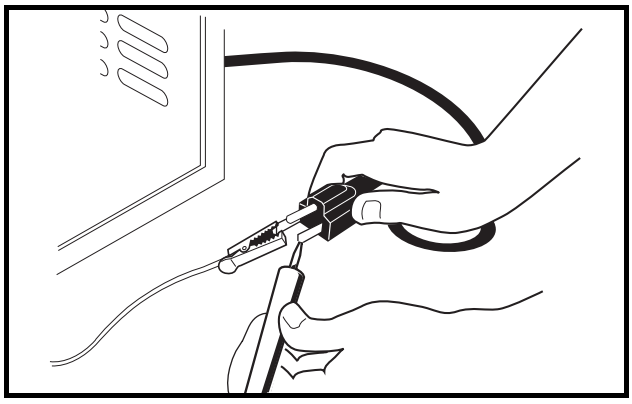


Figure 7-17 AC Cord Test

6. If the circuit is not complete, check the wiring of the AC cord, transformer primary coil wires, and internal AC circuit breaker **(Figure 7-22, Page 7-25)**.
7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, and the internal AC circuit breaker individually. **See Test Procedure 8 – Continuity on page 7-24.**
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 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 7-20 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 7-21.

NOTE: *This Powerdrive 3 Model 26580 uses two diode/heatsink assemblies. A running change installed these two diode/heatsink assemblies in place of a rectifier mounted to an aluminum heat sink plate. The model number with the rectifier was 26560.* ***See Section 6 – PowerDrive 3 – Model 26560.***

Test Procedure 4A – Single Diode Failure

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

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 diode/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 (orange or purple) from a diode terminal **(Figure 7-18, Page 7-21)**.
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 7-18, Page 7-21)**.
5. Reverse test probes and check each diode again and note the reading **(Figure 7-19, Page 7-21)**. A diode is designed to conduct current in one direction only. If a diode conducts current (shows continuity) in both directions, the entire diode/heatsink assembly must be replaced. If a diode does not conduct current (does not show continuity) in either direction, the entire diode/heatsink assembly must be replaced.
6. On rare occasions, a single fuse link may blow due to excessive heat. This can be caused by a loose fuse link connection. Check both fuse connections inside the charger to be sure they are clean and tight. The proper tightness for the fuse link terminals is 23 in-lb (2.6 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.**

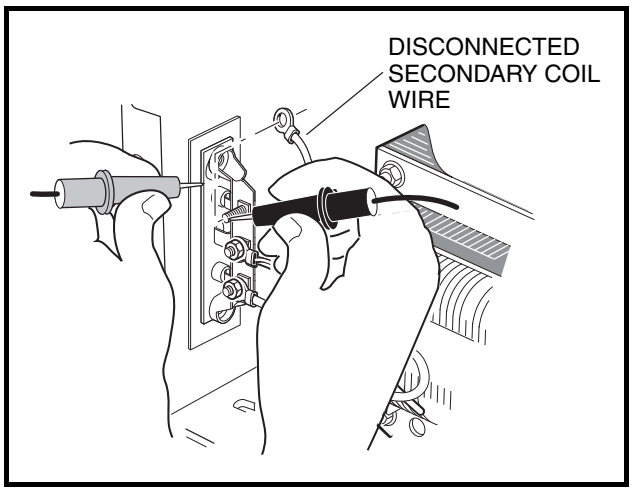


Figure 7-18 Diode Test

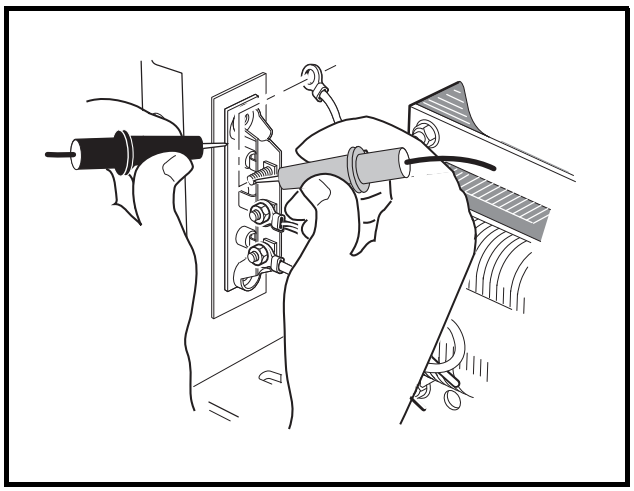


Figure 7-19 Diode Test – Probes Reversed

Test Procedure 4B – Both Diodes Failed

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

To check the diodes, use Test Procedure 4A – Single Diode Failure on page 7-20. 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 diode/heatsink assembly 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 7-11, Page 7-16 through Figure 7-16, Page 7-18)**. 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 left side of the ammeter (when viewed from inside the charger), the DC cord blue wire should be connected to the relay coil, and the DC cord black wire should be connected to the fuse link **(Figure 7-9, Page 7-11)**. If a reverse polarity connection is made between the charger and the batteries, the fuse link 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 the fuse link to blow. Be sure fuse connections are tightened to 23 in-lb (2.6 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 7-1.

1. Disconnect the AC cord from the wall outlet and the DC cord from the vehicle charger receptacle.
2. Using a multimeter set to the diode test function (→|←), place the positive (+) probe of the multimeter on the pin marked positive (+) on the DC plug **(Figure 7-20, Page 7-22)**. Place the negative probe (–) on the pin marked negative (–). The multimeter should indicate an overload (no continuity).

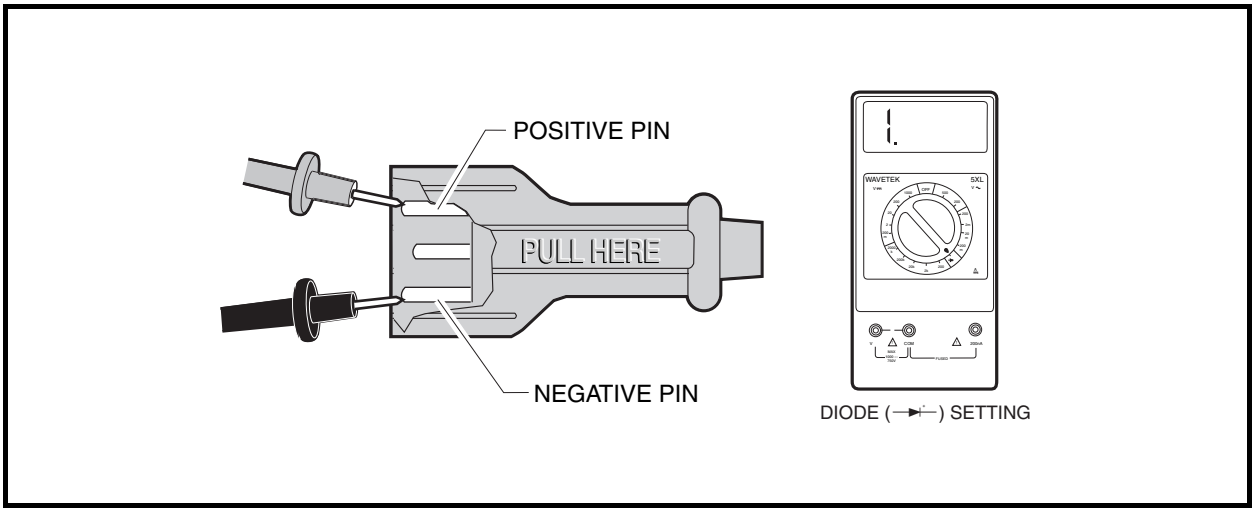


Figure 7-20 DC Plug Test

3. Reverse the test probes and check the DC plug again **(Figure 7-21, Page 7-22)**. The multimeter should indicate approximately 922 mV.
4. If multimeter readings are incorrect, check the battery charger wiring **(Figure 7-9, Page 7-11)**.
5. If the multimeter indicates an overload (no continuity) in both directions, 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 7-24.** Also check the diodes on the heatsink. **See Test Procedure 4 – Diodes on page 7-20.**
6. If the multimeter indicates a voltage reading in both directions, a short circuit exists in the charger DC circuit, usually caused by failed diodes. **See Test Procedure 4 – Diodes on page 7-20.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 7-24.**

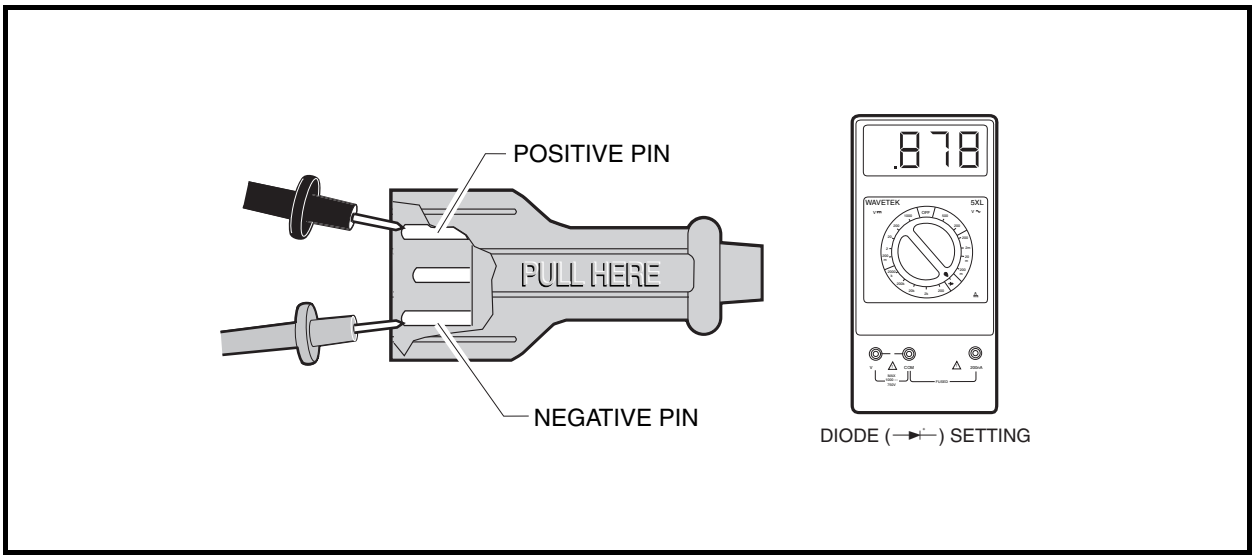


Figure 7-21 DC Plug Test – Probes Reversed

TEST PROCEDURE 6 – TRANSFORMER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

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 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 breaker, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 7-19.**

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Note wire locations for reassembly and then disconnect the orange and purple secondary coil transformer wires (1 and 2) from the diodes **(Figure 7-9, Page 7-11)**.
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 7-34. 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 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.
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 2).
9. Connect the AC cord to the wall outlet and monitor the multimeter for the secondary coil voltage. If measured voltage is approximately 49.5 volts AC or lower for the secondary coil, the transformer is shorted internally and must be replaced.
10. If the voltage reading is normal (50 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 7-21.**
11. 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 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 7-1.

1. With the batteries fully charged, disconnect the DC charger plug for approximately 20 seconds and then reconnect it. The ammeter should jump to a reading between 12 and 14 amps and then 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 7-19.**

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 7-1.

Fuse

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the DC cord black wire from the fuse and position it so it does not touch any metal part of the charger **(Figure 7-10, Page 7-15)**.
4. Using a multimeter set for 200 ohms, place the red (+) probe on one fuse terminal and the black (–) probe on the other fuse terminal. The tester should indicate continuity. If the tester does not indicate continuity, then the fuse has failed and must be replaced.

AC Cord

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 7-22, Page 7-25)**.
4. Disconnect the black wire (1) of AC cord from charger AC circuit breaker (3).
5. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire.
6. Disconnect the AC cord white wire (4) from the primary coil tan wire.
7. 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 (6). The tester should indicate continuity on one flat blade only. If any other reading is obtained, the AC cord and plug must be replaced.
8. 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 (6) **(Figure 7-22, Page 7-25)**. The tester should indicate continuity on only the round pin. If any other reading is obtained, the AC cord and plug must be replaced.
9. 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 (6). The tester should indicate continuity on only one flat blade. If any other reading is obtained, the AC cord and plug must be replaced.
10. If the correct readings were obtained, install the AC cord. **See AC Cord Installation on page 7-33.**

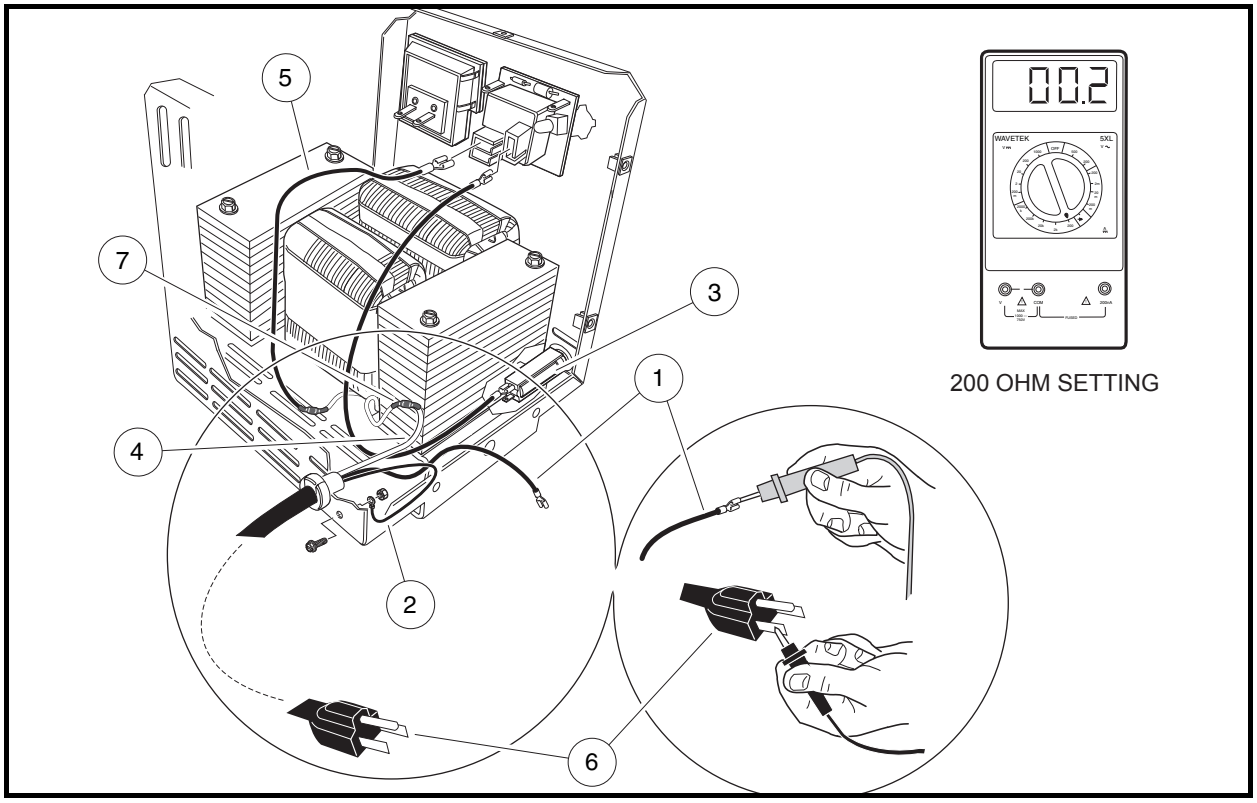


Figure 7-22 AC Cord and Plug Continuity Test

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 of the DC cord from the fuse **(Figure 7-23, Page 7-28).**
4. Disconnect the red wire of the DC cord from the ammeter.
5. Disconnect the blue wire from 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 test probe 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.

Transformer

The PowerDrive 3 battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 7-10, Page 7-15)**.

Primary Coil

1. Disconnect AC cord (6) from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire and disconnect the white wire (4) **(Figure 7-22, Page 7-25)**.
4. Disconnect the black primary coil wire (5) from the relay **(Figure 7-22, Page 7-25)**.
5. Place the continuity tester probes on the disconnected primary coil wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.
6. If the correct readings were obtained, install the AC cord and connect the transformer primary coil wires. **See AC Cord Installation on page 7-33.**

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 orange and purple transformer secondary coil wires (1 and 2) from each diode **(Figure 7-9, Page 7-11)**.
4. Place the continuity tester probes on the disconnected secondary coil wires. The tester should indicate continuity between the orange and purple wires. If tester does not indicate continuity, replace the transformer.

Voltage Suppressor – Failed Closed

The voltage suppressor, which is incorporated into the relay board assembly, 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.

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 1.5 (±.3) volts. If a reading of <.5 volt, then the voltage suppressor has shorted and the relay should be replaced. If the meter indicates an overload condition, then the voltage suppressor has failed and the relay 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 (prior to Version 3.0) due to a blown internal sense lead fuse is a symptom of a voltage supressor that has failed in a closed condition. The Version 3.0 and 4.0 onboard computers will quickly flash the battery warning light on the dash to indicate a problem with the voltage supressor.*

Relay

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove black wires (3 and 4) from contact terminals of the relay **(Figure 7-9, Page 7-11)**. Place continuity test probes on contact terminals 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. Place continuity test probes on contact terminals of relay. With batteries connected, insert DC plug into receptacle. The tester should indicate continuity. If tester does not indicate continuity, 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 white wire from the left ammeter terminal (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 probe 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 7-1.

⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 7-9, Page 7-11 and Figure 7-10, Page 7-15).**
- **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

DC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove the DC cord black wire from the fuse by loosening the nut on the fuse **(Figure 7-23, Page 7-28)**.
4. Remove the DC cord red wire from the ammeter.
5. Remove the DC cord blue wire from the relay board assembly.
6. Using pliers, squeeze the strain relief bushing and remove the DC cord.

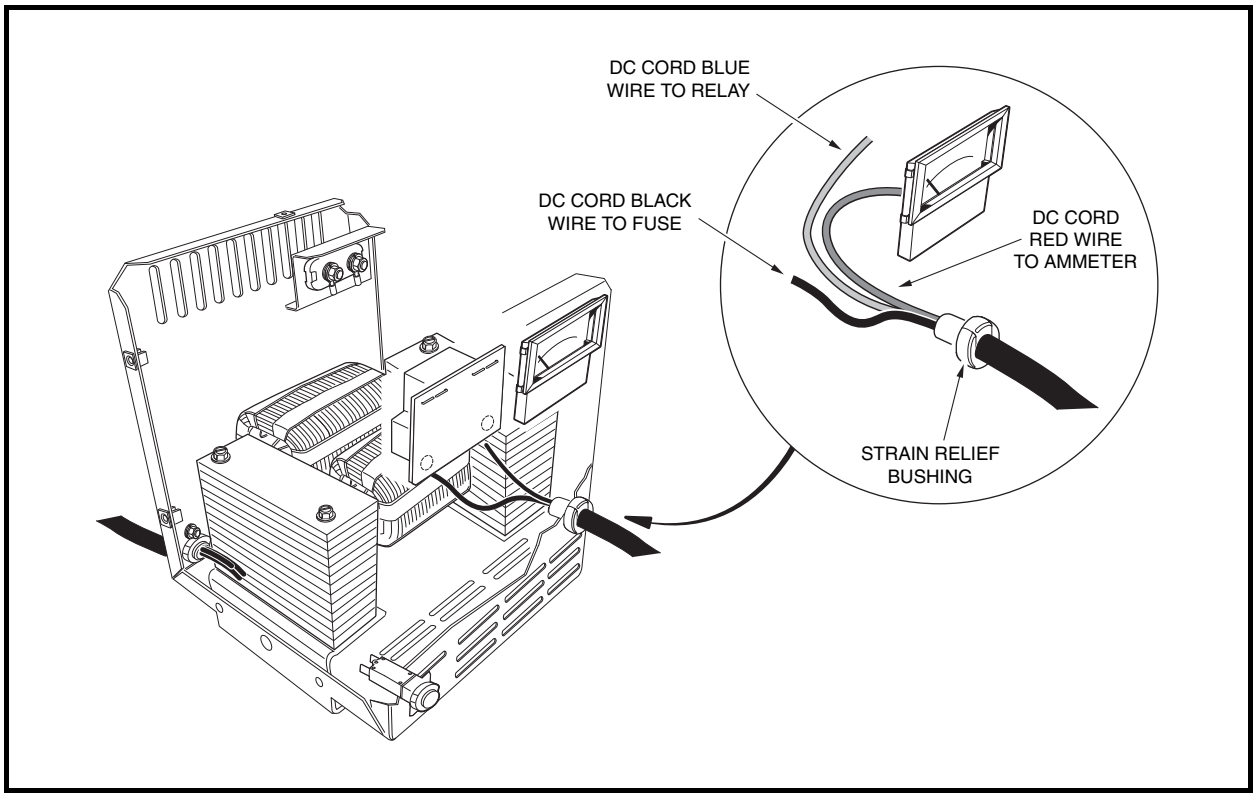


Figure 7-23 DC Cord

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 ammeter **(Figure 7-23, Page 7-28)**.
3. Attach the blue wire of the new DC cord to the relay board assembly.
4. Attach black wire of the new DC cord to fuse. Install the nut onto post of the fuse and tighten to 23 in-lb (2.6 N·m). **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.**

5. Using pliers, put the strain relief bushing on the cord and insert it into the charger base.
6. 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).

DIODE/HEATSINK

NOTE: *This Powerdrive 3 Model 26580 uses two diode/heatsink assemblies. A running change installed these two diode/heatsink assemblies in place of a rectifier mounted to an aluminum heat sink plate. The model number with the rectifier was 26560.* ***See Section 6 – PowerDrive 3 – Model 26560.***

Diode/Heatsink Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Note wire locations for reassembly and then disconnect the orange and purple secondary coil transformer wires (1 and 2) from the diode/heatsink being replaced **(Figure 7-9, Page 7-11 and Figure 7-10, Page 7-15)**.
4. Remove the white wire from the side diode/heatsink or the brown wire from the top diode/heatsink depending on which diode/heatsink is being replaced.
5. Remove the nuts and bolts that secure the diode/heatsink to the case.

Diode/Heatsink Installation

1. Place diode/heatsink against charger base. Make sure clear plastic insulator sheet is between the diode/heatsink and the charger base. Install the nuts and bolts that secure the diode/heatsink to the case. Tighten the bolts to 18 in-lb (2.0 N·m) **(Figure 7-9, Page 7-11 and Figure 7-10, Page 7-15)**.
2. Connect the white wire from the ammeter to the center terminal post on the side diode/heatsink or the brown wire from the fuse link to the center terminal post on the top diode/heatsink. Tighten nut to 18 in-lb (2.0 N·m).
3. Connect the orange and purple secondary coil transformer wires (1 and 2) to the diode/heatsink at the original locations. Tighten nuts to 18 in-lb (2.0 N·m).
4. Install the charger cover and check charger for proper operation.

TRANSFORMER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

Transformer Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the black primary coil wire (5) from the charger relay **(Figure 7-22, Page 7-25)**.
4. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire.
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. If equipped, remove wire tie(s) securing transformer wires.
7. Note wire locations for reassembly and then disconnect the orange and purple secondary coil transformer wires (1 and 2) from each diode **(Figure 7-9, Page 7-11)**.
8. Remove the four screws that secure the transformer to the mounting brackets and remove the transformer.

Transformer Installation

1. Install the transformer with primary coil to the rear of the charger case. Secure the transformer to the mounting brackets with four screws.
2. Connect the orange and purple secondary coil transformer wires (1 and 2) to the diodes at the original locations **(Figure 7-9, Page 7-11)**.
3. Connect the black transformer primary coil wire (5) to the charger relay **(Figure 7-22, Page 7-25)**.
4. Place a piece of heatshrink tubing over the AC cord white wire.
5. Connect the AC cord white wire (4) to the tan primary coil wire **(Figure 7-22, Page 7-25)**.
6. Slide the heatshrink tubing (7) over the connection and apply heat to the heatshrink to insulate the connection between the AC cord white wire and the tan primary coil wire. **See following WARNING.**

⚠ WARNING

- **Make sure the electrical connections are properly insulated. Failure to properly insulate electrical connections in the charger could result in a short circuit.**

7. If equipped, replace wire tie(s) securing transformer wires. **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. Install the charger cover and check charger for proper operation.

AMMETER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

Ammeter Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the DC cord red wire (1) and the white wires (2 and 3) from the ammeter (4) **(Figure 7-24, Page 7-31)**.
4. Press the locking tabs on each side of the ammeter and remove the ammeter by gently pushing the ammeter through the front of the charger case.

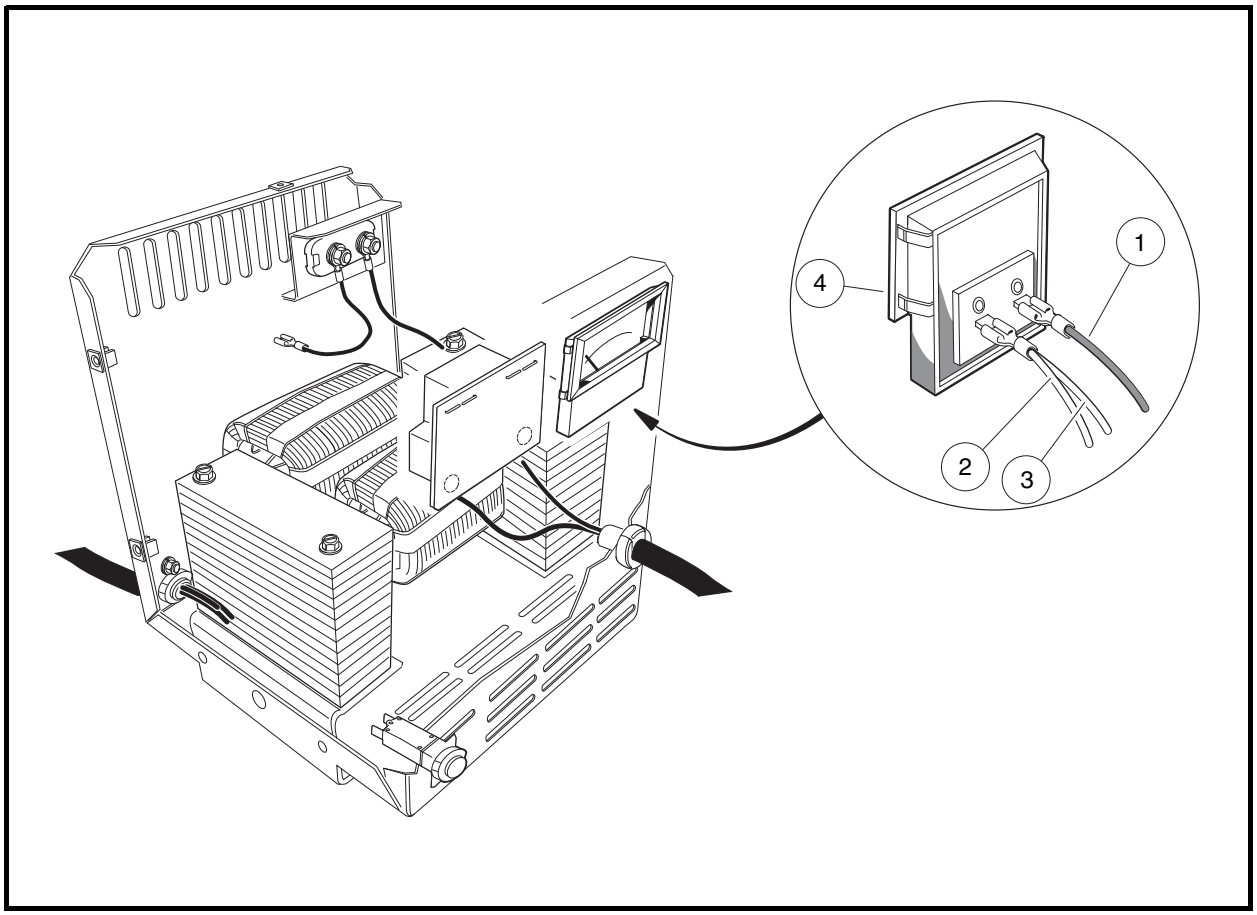


Figure 7-24 Ammeter

Ammeter Installation

1. Place the ammeter (4) in position in the charger face and ensure that the locking tabs are secure **(Figure 7-24, Page 7-31)**.
2. Connect the DC cord red wire (1) and the white wires (2 and 3) to the ammeter terminals.
3. Install the charger cover.
4. 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 7-1.

Fuse Link Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Gently press the fuse toward the transformer to remove the fuse from the mounting tab.
4. Remove the two nuts securing the two wires to the fuse terminals and remove the fuse.

Fuse Link Installation

1. Connect the short brown wire from the top diode/heatsink to one of the fuse terminal posts and install the nut. Tighten nut to 23 in-lb (2.6 N·m).
2. Connect the DC cord black wire to the other fuse terminal post and install the nut. Tighten nut to 23 in-lb (2.6 N·m).
3. Gently press the fuse assembly into the mounting tab so that the fuse link is visible from the rear of the charger.
4. Install the charger cover.

RELAY BOARD ASSEMBLY

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

Relay Board Assembly Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 7-9, Page 7-11)**.
4. Remove two screws attaching relay to the front of the charger case.
5. Remove the relay.

Relay Board Assembly Installation

Install in reverse order of removal and tighten screws firmly. Connect wires as shown **(Figure 7-9, Page 7-11)**.

CHARGER AC CIRCUIT BREAKER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 7-1.

AC Circuit Breaker Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the two black wires attached to the circuit breaker **(Figure 7-9, Page 7-11)**.
4. With a pair of pliers, squeeze in the retaining tabs on the sides of the circuit breaker and push the circuit breaker through the mounting hole in the face of the charger to remove.

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 7-1.

AC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the AC cord black wire (1) from the AC circuit breaker (3) **(Figure 7-22, Page 7-25)**.
4. Carefully cut the heatshrink (7) that insulates the AC cord white wire (4) where it connects to the tan primary coil wire **(Figure 7-22, Page 7-25)**.
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. Disconnect the AC cord green wire (2) from the charger base.
7. 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 black, white, and green leads of the new AC cord into the charger through the hole in the charger face.
2. Connect the AC cord black wire (1) to the AC circuit breaker (3) **(Figure 7-22, Page 7-25)**.
3. Place a piece of heatshrink tubing (7) over the AC cord white wire (4).
4. Connect the AC cord white wire (4) to the tan primary coil wire **(Figure 7-22, Page 7-25)**.
5. Slide the heatshrink tubing (7) over the connection and apply heat to the heatshrink to insulate the connection between the AC cord white wire (4) and the tan primary coil wire. **See following WARNING.**

⚠ WARNING

- **Make sure the electrical connections are properly insulated. Failure to properly insulate electrical connections in the charger could result in a short circuit.**

6. Connect the green wire (2) to the charger base. Tighten the screw and nut on the green (ground) wire terminal to 18 in-lb (2.0 N·m).
7. Position the strain relief bushing on the AC cord.
8. Using pliers, install the strain relief bushing and AC cord into the mounting hole in the charger face.
9. 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 7-1.

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 7-9, Page 7-11 and Figure 7-10, Page 7-15).**
- **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 screws securing the charger cover and remove the cover from the charger.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.

- To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 7-25, Page 7-35)**. **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*, and 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 transformer wire (4) from AC circuit breaker and connect it to the relay. Connect the black wire (3) from the relay to the AC circuit breaker **(Figure 7-25, Page 7-35)**. **See following WARNING.**

⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to 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 and 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.**

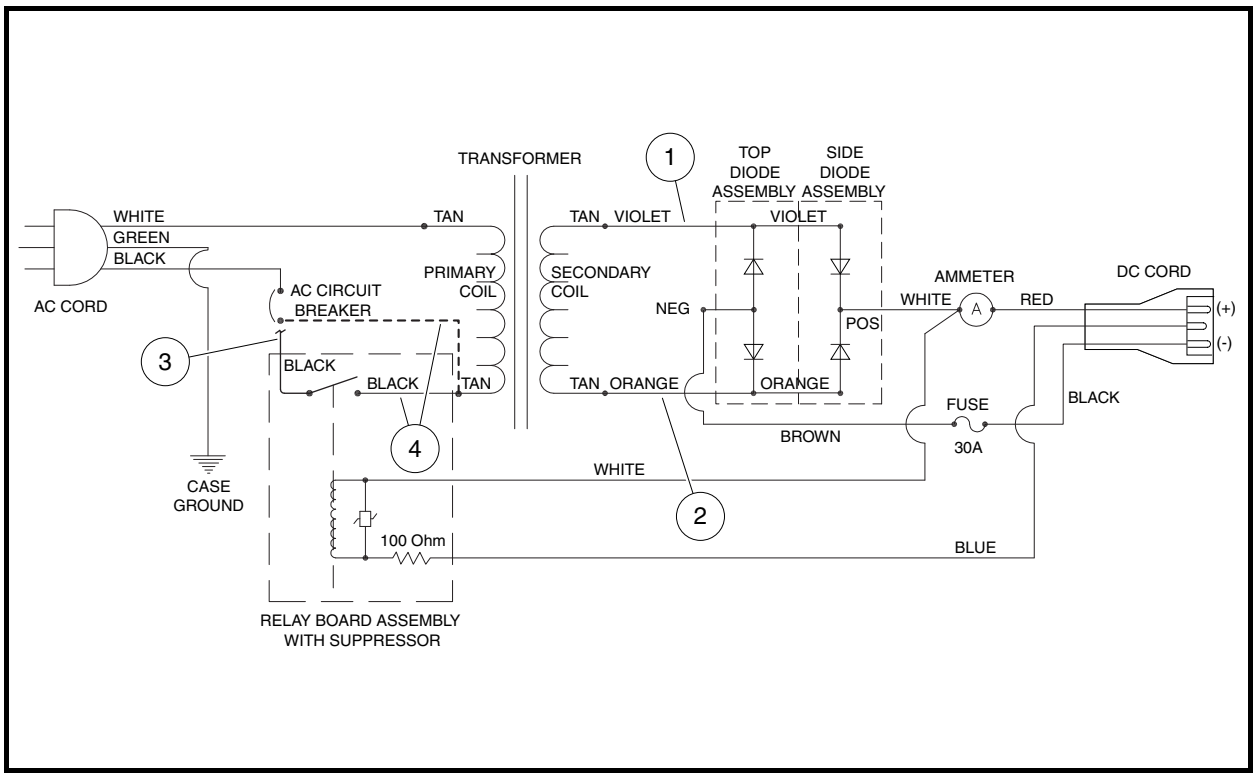


Figure 7-25 PowerDrive 3 Charger Wiring Diagram (Relay Bypassed)

SECTION 8 – 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 8-3, Page 8-7). 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 8-4, Page 8-7).**

GENERAL INFORMATION

This section includes information pertaining to service of the IQ Plus battery charger (model numbers 25730-11, 25730-18, and 25730-19). 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 8-1, Page 8-1)**. 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, having recorded the amount of energy consumed as the vehicle was used, 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. The computer accomplishes this by detecting when the exact amount of energy necessary has been returned to the batteries.

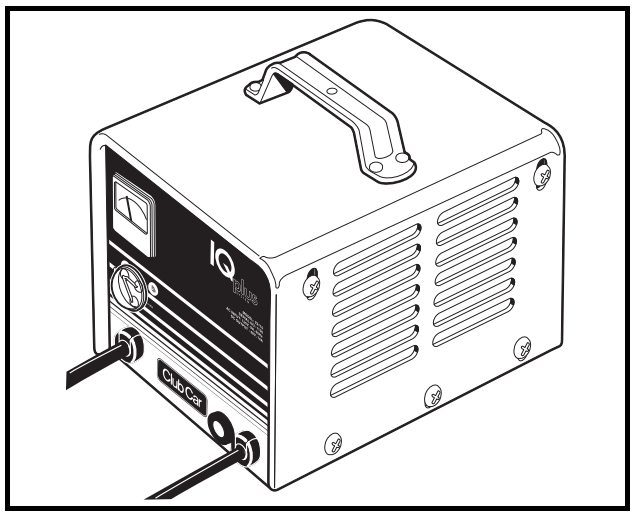


Figure 8-1 IQ Plus External Charger Model 25730-11

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.** 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 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.

UL AND CSA LISTING

When operated on a 120-volt / 60 Hz electrical system, the following IQ Plus battery chargers have been listed by Underwriters Laboratories and by the Canadian Underwriters (thereby meeting the criteria of the Canadian Standards Association).

IQ Plus external battery charger model: 25730-11.

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 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. 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. Also check connections of the fuse link located on the charger receptacle **(Figure 8-2, Page 8-3)**.

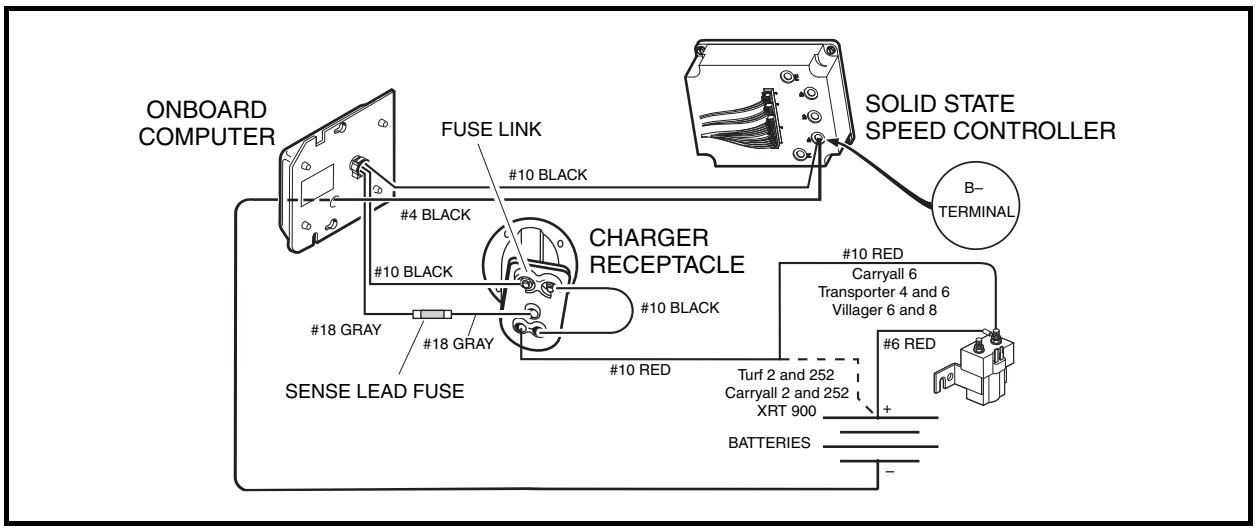


Figure 8-2 Charge Circuit

EXTERNAL CHARGER INSTALLATION AND OPERATION

⚠ 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.**
- **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...

- **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.*

EXTERNAL 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.**

With charger DC output cord disconnected, connect the power supply cord to an AC supply. **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 the National Electric Code and all local codes and ordinances.

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.**
- **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 8-3).**

WARNING CONTINUED ON NEXT PAGE...

- **Do not pull on the DC cord (Figure 8-4). 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 8-3, Page 8-7)**. 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 plug. To connect the charger plug to the vehicle receptacle, grasp the plug handle and push the plug straight into the receptacle (Figure 8-3).**

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. 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). **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) (CC P/N 101831801). ***See Communication Display Module in the appropriate maintenance and service supplement.***

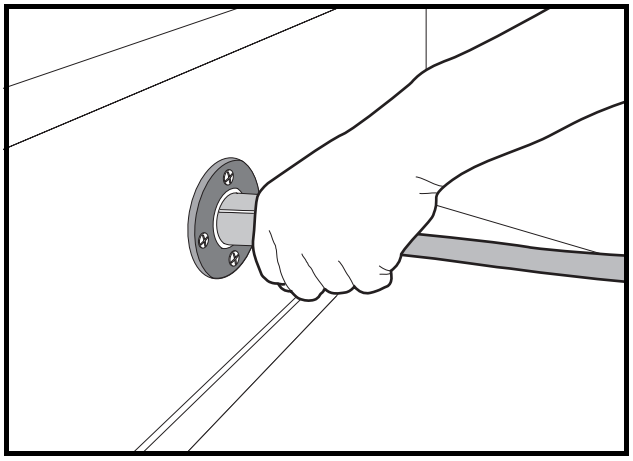


Figure 8-3 Charger Receptacle

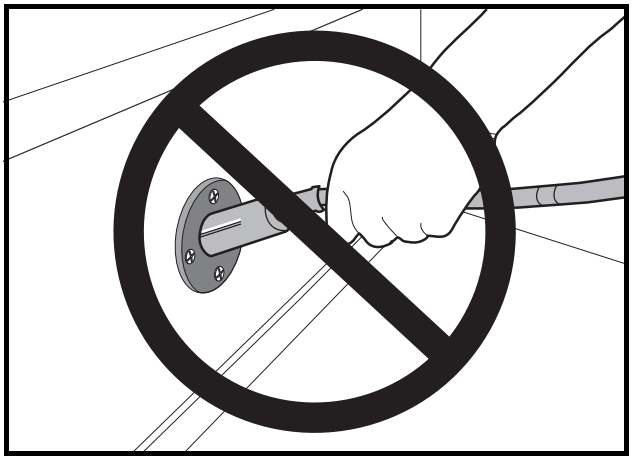


Figure 8-4 Incorrect Charger Cord Removal

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 8-3, Page 8-7)**. To disconnect the plug from the vehicle, firmly grasp the plug, not the cord **(Figure 8-4, Page 8-7)**, 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 8-3).**
- **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

Read DANGER, WARNING, and CAUTIONS beginning on page 4.

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 in the maintenance and service manual appropriate for your battery charger. If you do not have this publication, contact your Club Car representative. 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 then charge the vehicle. Normal 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 8-2.***

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 8-2, Page 8-3)** and that the internal charger wiring is correct **(Figure 8-5, Page 8-9)**.

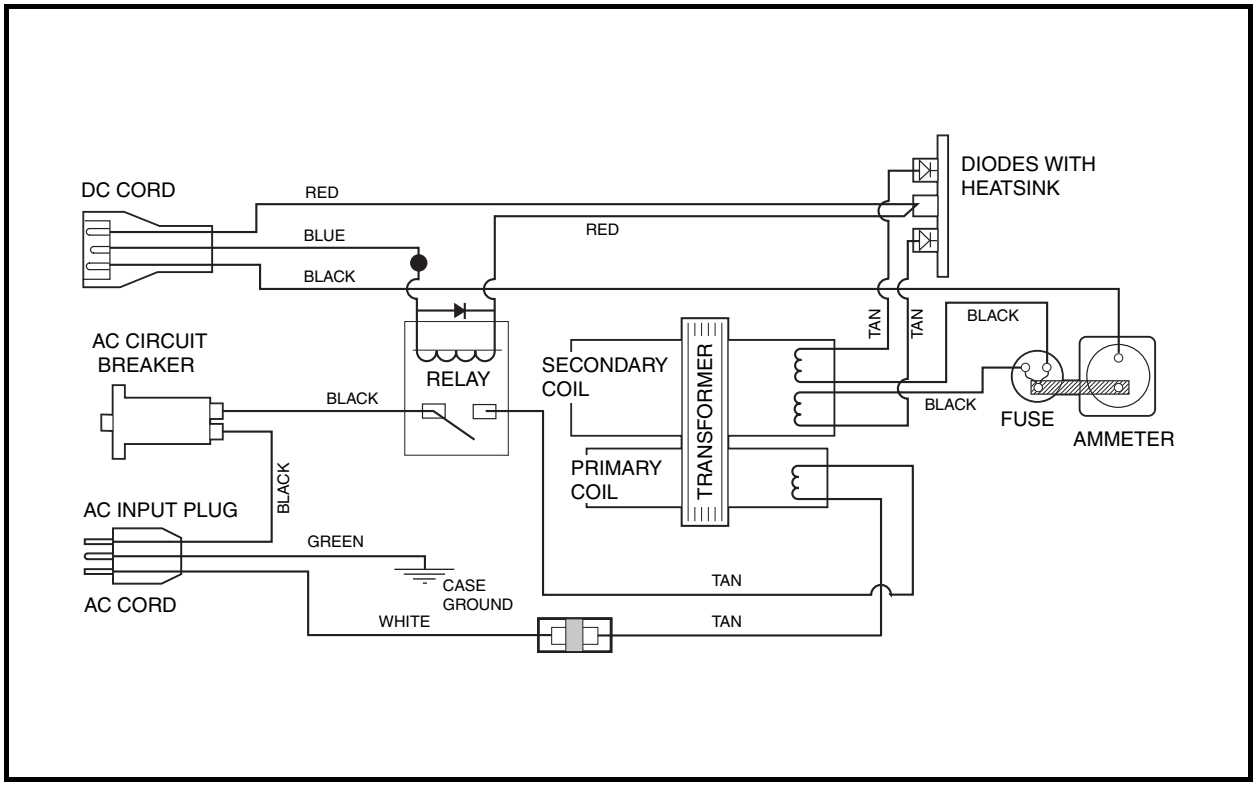


Figure 8-5 IQ Plus Battery Charger Wiring Diagram (External Charger)

TROUBLESHOOTING

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

⚠ 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 8-5, Page 8-9).**
- **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 IQ Plus external battery chargers (model numbers 25730-11, 25730-18, and 25730-19). 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 BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Relay does not close, no transformer hum and ammeter does not move	Batteries disconnected	Connect the batteries. **See Connecting The Batteries on page 1-4.**
	Battery voltage is too low	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 8-13
	Poor connection between plug and receptacle	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 8-13
	DC plug and cord	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 8-13 and Test Procedure 5 – Charger DC Circuit Continuity Test on page 8-17
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 8-15
	Gray sense lead fuse is blown	Test Procedure 1 – Battery Voltage and DC Plug and Receptacle on page 8-13
	Receptacle fuse link is blown	See Electrical Components section in the appropriate maintenance and service manual
	Poor connection of 10-gauge black wire or 18-gauge gray wire at the onboard computer	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 8-15
	Failed AC plug and cord	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 8-15
	Internal AC breaker	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 8-15
	Transformer primary coil	Test Procedure 6 – Transformer on page 8-18
	Relay	Test Procedure 8 – Continuity on page 8-20
	Failed ammeter	Replace ammeter
Relay closes and transformer hums but ammeter does not move	Blown charger fuse	Test Procedure 4 – Diodes on page 8-16
	Both Diodes failed	Test Procedure 4B – Both Diodes Failed on page 8-17
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 8-15
	Failed transformer	Test Procedure 6 – Transformer on page 8-18
Relay operates intermittently	Failed charger relay	Test Procedure 8 – Continuity on page 8-20
Single charger fuse link blows	Diode failed	Test Procedure 4A – Single Diode Failure on page 8-16
	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 8-17

Troubleshooting Guide continued on next page...

IQ PLUS BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Charger output is low	One diode failed	Test Procedure 4A – Single Diode Failure on page 8-16
	Transformer coil short-circuit failure	Test Procedure 6 – Transformer on page 8-18
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 8-15
Charger turns off too soon	AC power supply was shut off	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 8-15
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 8-15
	Batteries may be fully charged	Test Procedure 7 – Battery State of Charge Test on page 8-19
Charger goes to 16 hour time out	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 8-15
	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 8-20
	Failed transformer	Test Procedure 6 – Transformer on page 8-18
	Incorrect charger wiring	Check battery charger wiring
Battery warning light illuminates for ten seconds at four second intervals (with DC charger cord plugged in)	AC power interrupted	Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 8-15
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 8-15
	Charger failure	See Testing Charger Operation on page 8-8
	16 hour time out	See Battery Warning Light on page 8-2
	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 unplugged)	Batteries are getting close to full discharge capacity	Recharge batteries (golf round may be completed first)
	Onboard computer malfunction	Test Procedure 2 – Onboard Computer on page 8-15
	Battery or batteries need to be replaced	See Batteries section in the appropriate maintenance and service manual

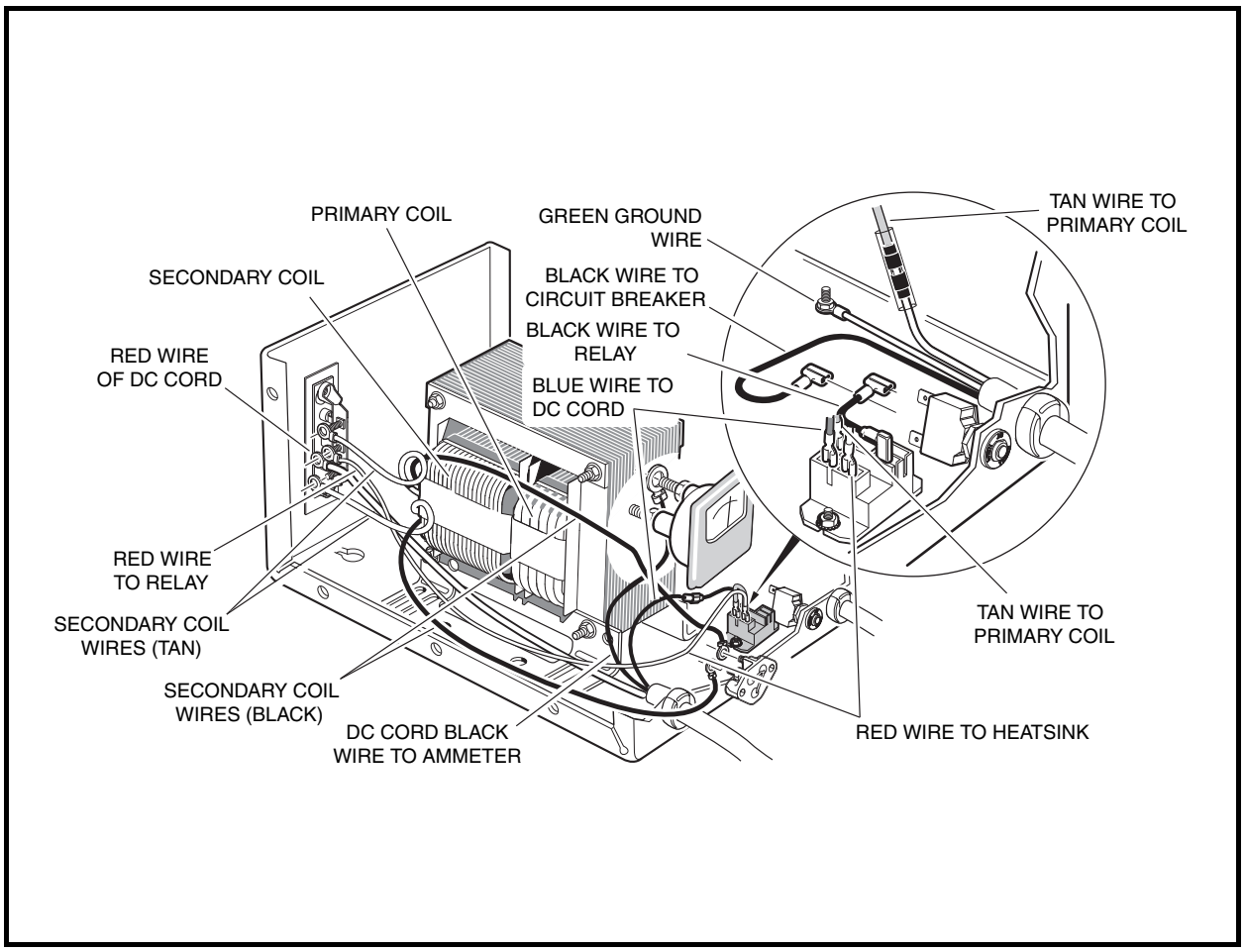


Figure 8-6 IQ Plus Battery Charger

TEST PROCEDURES

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

INDEX OF TEST PROCEDURES

1. Battery Voltage and DC Plug and Receptacle
2. Onboard Computer
3. AC Power and Continuity Test of AC Circuit
4. Diodes
5. Charger DC Circuit Continuity Test
6. Transformer
7. Battery State of Charge Test
8. Continuity

TEST PROCEDURE 1 – BATTERY VOLTAGE AND DC PLUG AND RECEPTACLE

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

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 8-2, Page 8-3)**.
   - 3.2. **Carryall 2/252, Turf 2/252 and XRT 900:** Verify that the 10-gauge red wire from the charger receptacle is connected to the positive (+) post of battery no. 1 **(Figure 8-2, Page 8-3)**.
   - 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 8-7, Page 8-13)**.
   - 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.**

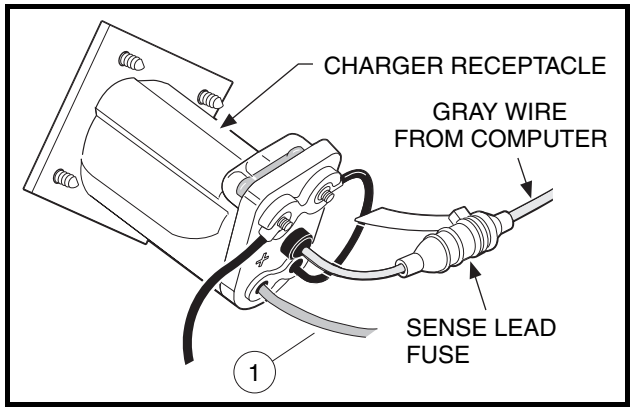


Figure 8-7 Receptacle Wire Connections

   - 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 8-8, Page 8-14)**. 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 8-29.**

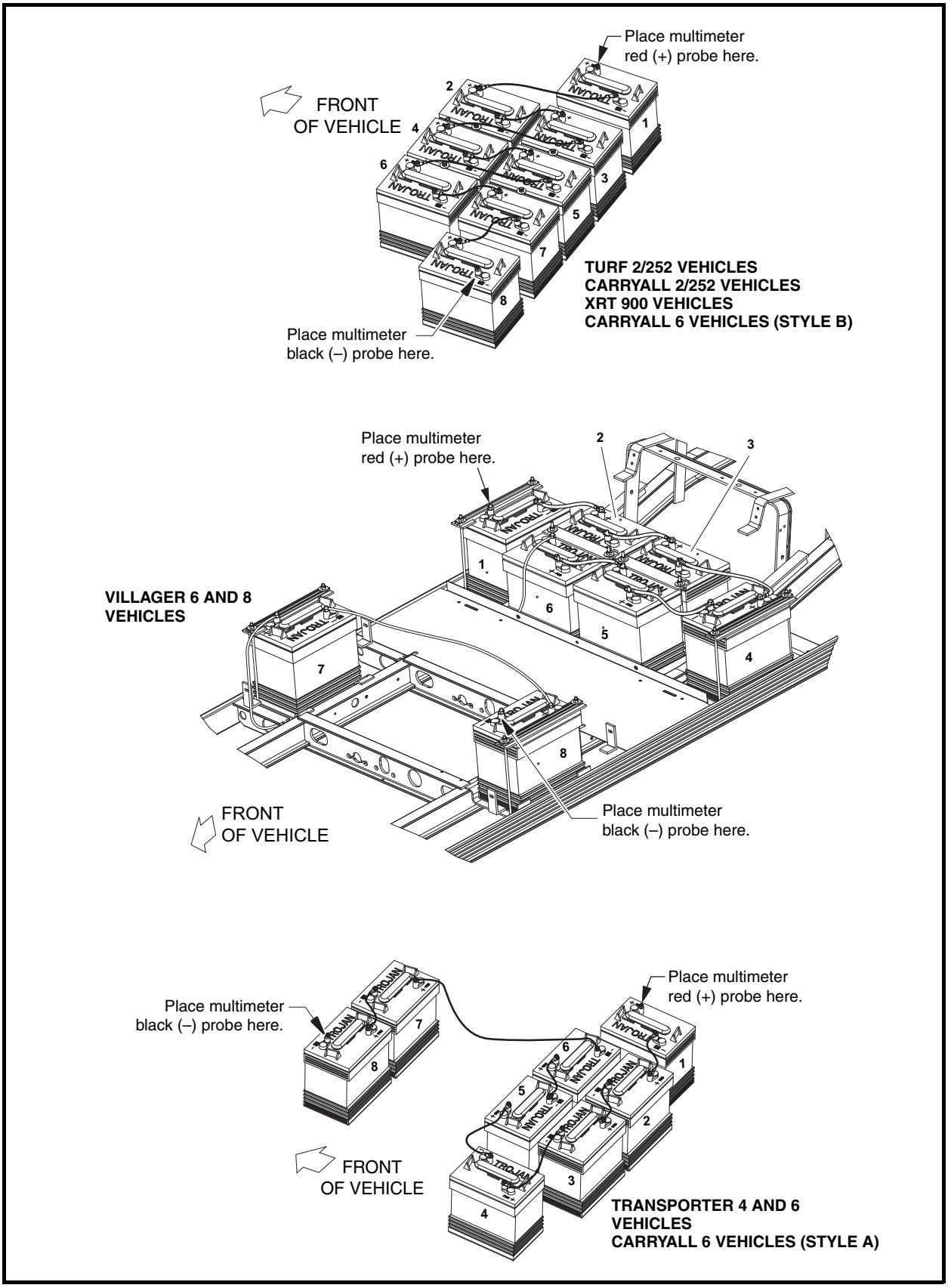


Figure 8-8 IQ Plus Battery Configuration

TEST PROCEDURE 2 – ONBOARD COMPUTER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

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 breaker 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 8-9.**
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 8-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Check the AC circuit breaker 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 between 105 and 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
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, remove the black wire (3) from the AC circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire (4) to the AC circuit breaker **(Figure 8-14, Page 8-19)**.
   - 5.3. With relay bypassed, there should be continuity across the AC cord blades **(Figure 8-9, Page 8-15)**.

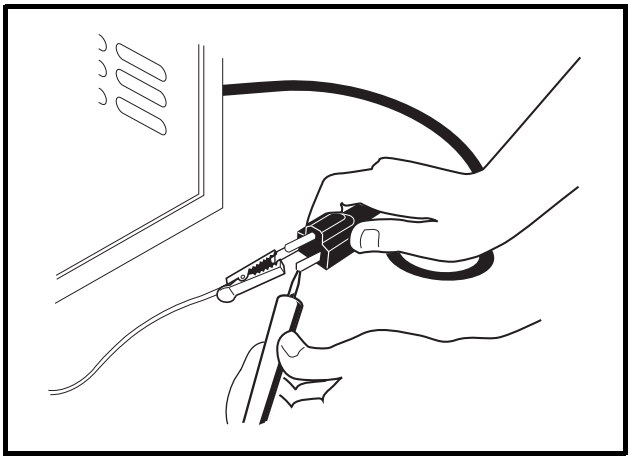


Figure 8-9 AC Cord Test

6. If the circuit is not complete, check the wiring of the AC cord, transformer primary coil wires, and internal AC circuit breaker **(Figure 8-14, Page 8-19)**.
7. If the charger is wired correctly, check the continuity of the AC cord, transformer primary coil, and the internal AC circuit breaker individually. **See Test Procedure 8 – Continuity on page 8-20.**
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 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 8-16 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 8-17.

Test Procedure 4A – Single Diode Failure

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

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 8-10, Page 8-17)**.
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 8-10, Page 8-17)**.
5. Reverse test probes and check each diode again and note the reading **(Figure 8-11, Page 8-17)**. 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.
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.**

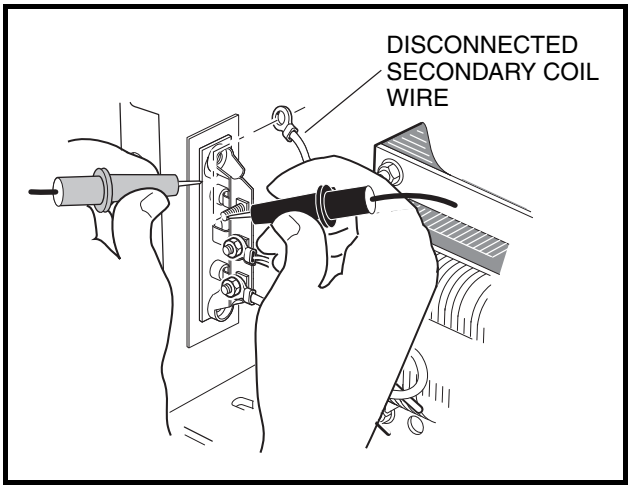


Figure 8-10 Diode Test

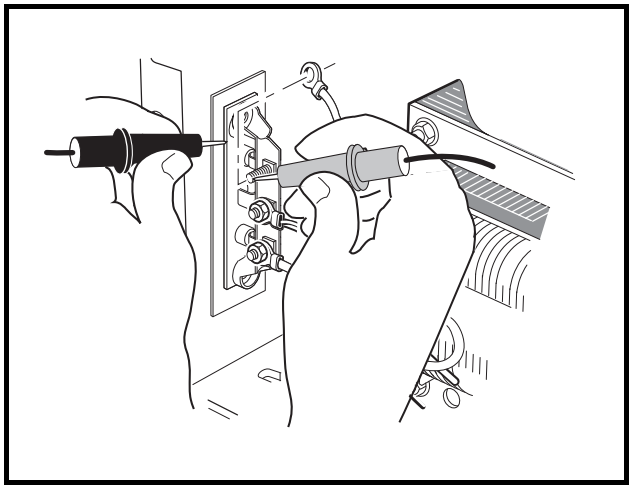


Figure 8-11 Diode Test – Probes Reversed

Test Procedure 4B – Both Diodes Failed

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

To check the diodes, use Test Procedure 4A – Single Diode Failure on page 8-16. 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 8-2, Page 8-3)**. 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 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 8-5, Page 8-9)**. 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 8-1.

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Using a continuity tester (CC P/N 1011273) or multimeter (CC P/N 1011480) set to 200 ohms, connect the test probes to the pins marked (+) and (–) on the DC plug **(Figure 8-12, Page 8-18)**. Note the reading.
3. Reverse the test probes and check the DC plug again **(Figure 8-13, Page 8-18)**. 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 8-20.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 8-16.**

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 8-16.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 8-20.**
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 8-5, Page 8-9 and Figure 8-6, Page 8-12)**. There should be no continuity.

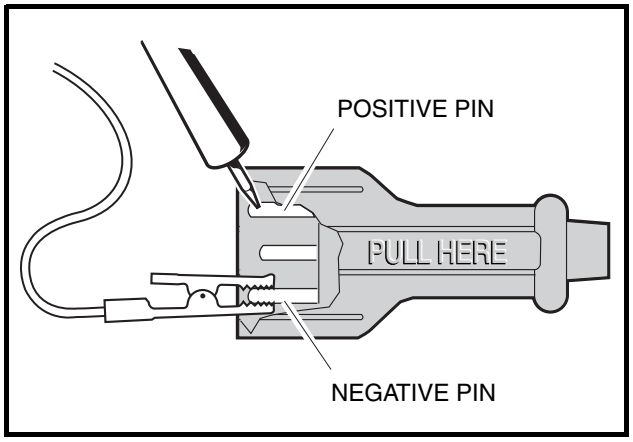


Figure 8-12 DC Plug Test

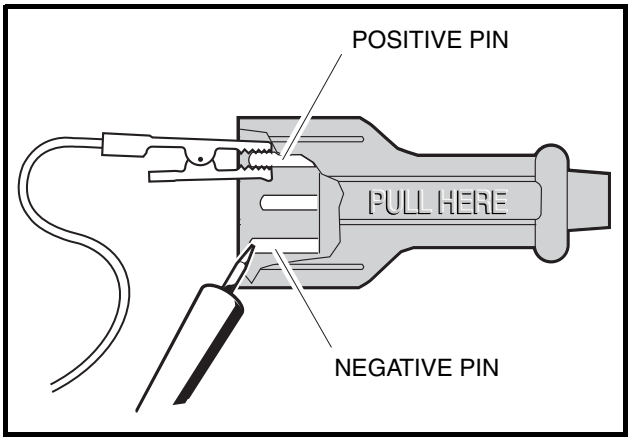


Figure 8-13 DC Plug Test – Probes Reversed

TEST PROCEDURE 6 – TRANSFORMER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

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 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 breaker, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Test of AC Circuit on page 8-15.**

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 (1 and 5) from the heatsink **(Figure 8-14, Page 8-19)**.
4. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   4.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire (4) to the AC circuit breaker **(Figure 8-14, Page 8-19)**. **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 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.

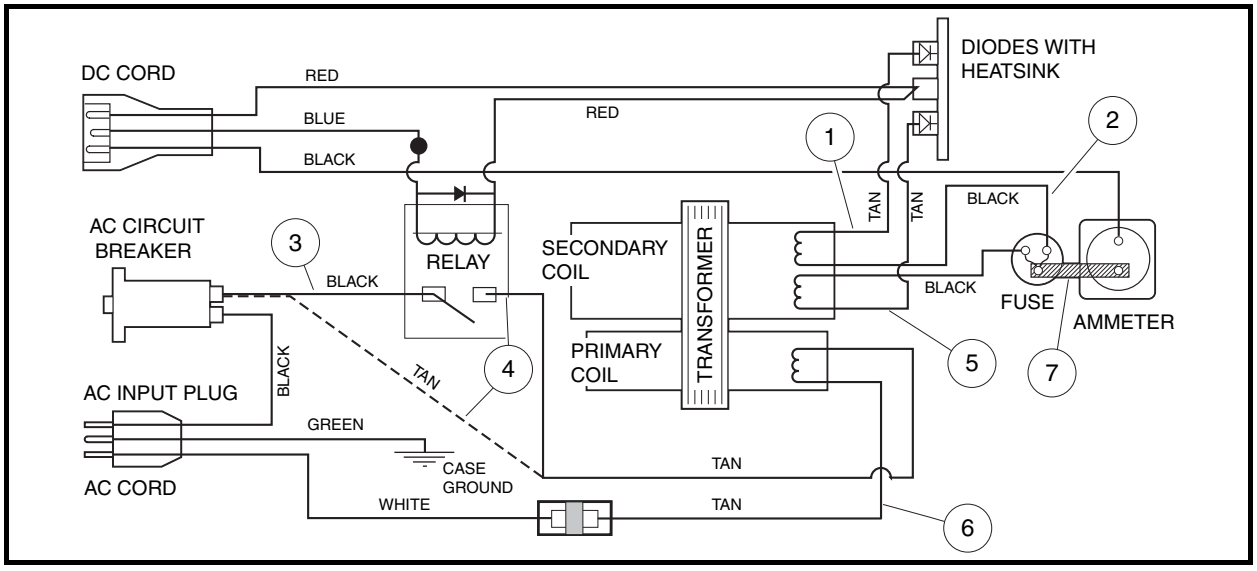


Figure 8-14 Transformer Test Wiring Diagram

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 **(Figure 8-14, Page 8-19)**.
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 8-17.**
11. When troubleshooting and repairs are complete, 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 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 8-1.

1. With the batteries fully charged, disconnect the DC charger plug for approximately 20 seconds and then reconnect it. The ammeter should jump to a reading between 14 and 18 amps and then 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 8-15. 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 8-1.

AC Cord

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 8-15, Page 8-20)**.
4. Disconnect the black wire (1) of AC cord from charger AC circuit breaker (3).
5. Disconnect the AC cord white wire (4) from the primary coil tan wire.
6. 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 AC cord and plug must be replaced.
7. 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 **(Figure 8-15, Page 8-20)**. The tester should indicate continuity on only the round pin. If any other reading is obtained, the AC cord and plug must be replaced.
8. 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 plug must be replaced.

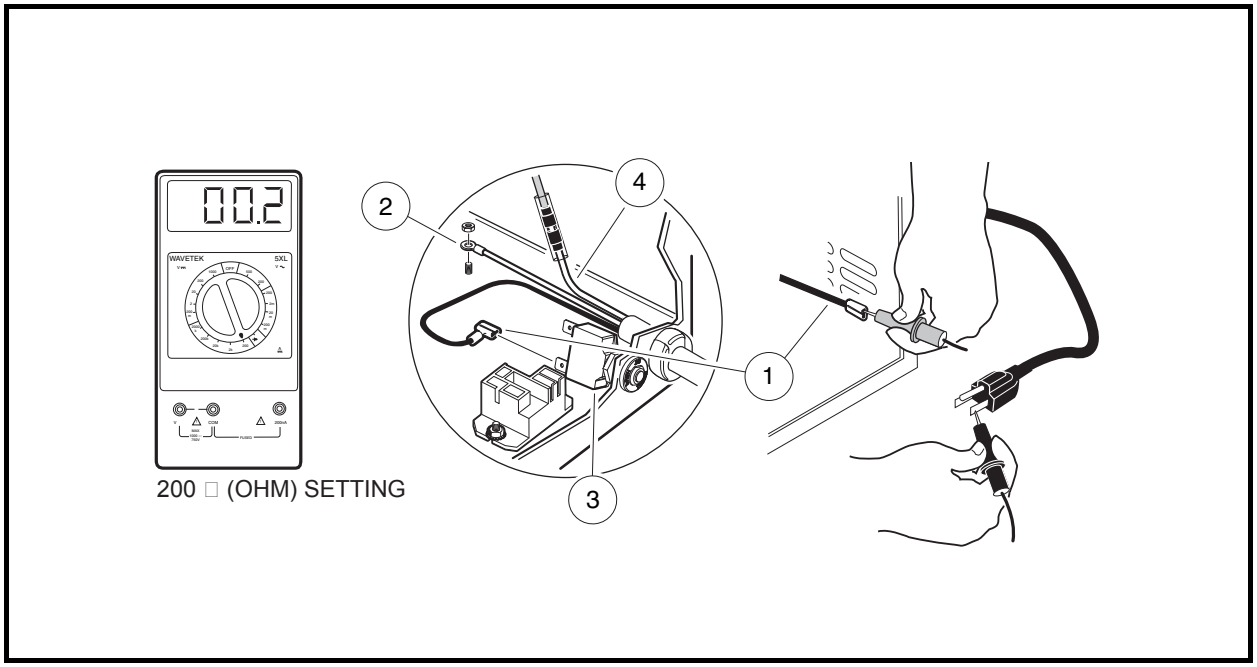


Figure 8-15 AC Cord and Plug Continuity Test

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 of the DC cord from the ammeter **(Figure 8-16, Page 8-23).**
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 registers 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 registers 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 registers 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.

Transformer

The IQ Plus battery charger transformer has two sets of coils: a primary coil and a secondary coil **(Figure 8-14, Page 8-19)**.

Primary Coil

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect terminals from transformer (tan) primary coil transformer wires (4 and 6) **(Figure 8-14, Page 8-19)**.
4. Place the continuity tester probes on the disconnected primary coil transformer wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.

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 (1) from the upper terminal of the heatsink **(Figure 8-14, Page 8-19)**.
4. Remove the other transformer (tan) secondary coil wire (5) from the bottom terminal of the heatsink and place the continuity test clip on the ammeter buss bar (7) **(Figure 8-14, Page 8-19)**. 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.

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 black (3) and tan (4) wires from contact terminals of the relay **(Figure 8-14, Page 8-19)**. Place continuity test probes on contact terminals 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. Place continuity test probes on contact terminals of relay. With batteries connected, insert DC plug into receptacle. The tester should indicate continuity. If tester does not indicate continuity, 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 8-1.

⚠ WARNING

- **Knowledge of battery charger wiring and component terminology is required before attempting any repair (Figure 8-5, Page 8-9).**
- **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 8-1.

DC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
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 8-17, Page 8-23)**.
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 red wire assembly that connects to the charger relay **(Figure 8-16, Page 8-23)**.
8. Using pliers, squeeze the strain relief bushing and remove the DC cord **(Figure 8-16, Page 8-23)**.

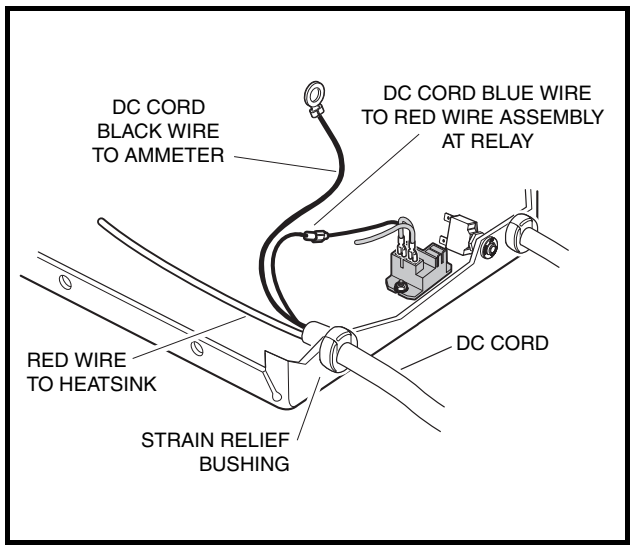


Figure 8-16 DC Cord

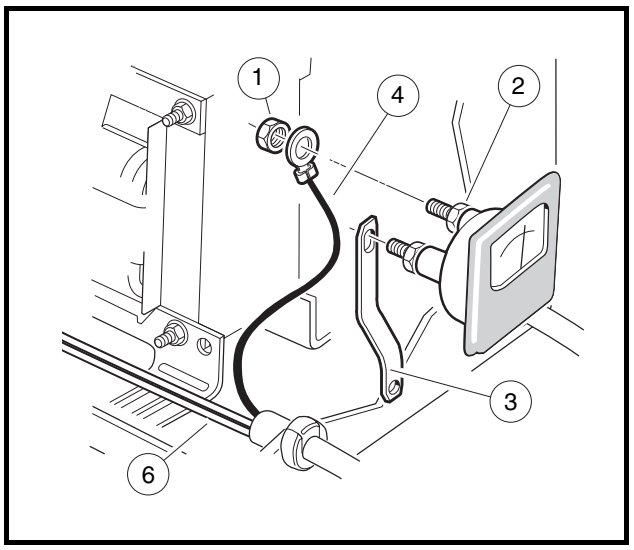


Figure 8-17 DC Cord Replacement

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 8-16, Page 8-23)**.
3. Attach the blue wire of the new DC cord to the red wire assembly at the charger relay **(Figure 8-16, Page 8-23)**.
4. Attach 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 8-17, Page 8-23)**. **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 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.**

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

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

Heatsink Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 8-5, Page 8-9 and Figure 8-6, Page 8-12)**.
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 18 in-lb (2.0 N·m) **(Figure 8-5, Page 8-9 and Figure 8-6, Page 8-12)**.
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 8-1.

Transformer Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the tan primary coil wire from the charger relay **(Figure 8-5, Page 8-9 and Figure 8-6, Page 8-12)**.
4. Disconnect the AC cord white wire from the primary coil tan wire.
5. Remove the wire tie that secures the DC cord wire to the secondary coil wire (tan).
6. Disconnect the two tan secondary coil transformer wires from the heatsink **(Figure 8-5, Page 8-9 and Figure 8-6, Page 8-12)**.
7. Disconnect the two black secondary coil transformer wires from the fuse.
8. 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) **(Figure 8-6, Page 8-12)**.
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 tan primary coil transformer wire to the charger relay.
7. Connect the other tan primary coil transformer wire to the white wire from the AC cord.
8. 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.**

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

AMMETER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

Ammeter Removal

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 DC cord (5), and the buss bar (3) from the ammeter **(Figure 8-18, Page 8-26)**.
4. Remove the two nuts (2) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 8-18, Page 8-26)**.
2. Install nuts (2) and tighten until ammeter is firmly secured.
3. Connect the black wire of the DC cord (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.
7. Plug the charger into the vehicle and check ammeter for proper operation.

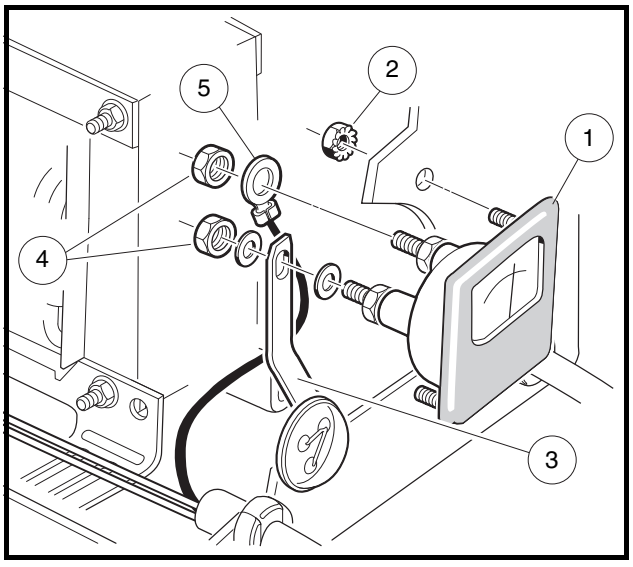


Figure 8-18 Ammeter

FUSE LINK

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

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 buss bar from the back of the fuse link assembly **(Figure 8-18, Page 8-26)**.
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 8-18, Page 8-26)**. 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 8-1.

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 8-20.**

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) to heatsink **(Figure 8-19, Page 8-29).**
4. Disconnect the blue and red wires from the relay.
5. Disconnect the DC cord blue wire at the quick disconnect terminal**.**
6. Remove the voltage suppressor and wire assembly from the charger**.**

Voltage Suppressor Installation

1. 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). **See following NOTE.**

NOTE: *The charger relay blade connector is located off-center within the relay housing. When connecting voltage suppressor slip-on connector to relay blade connector, make sure slip-on connector is positioned so that flat side of connector is closest to relay housing* ***(Figure 8-19, Page 8-29)****.*

CHARGER RELAY

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

Charger Relay Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 8-19, Page 8-29)**.
4. Remove two nuts and lock washers attaching relay to the charger case.
5. Remove the relay.

Charger Relay Installation

1. Install in reverse order of removal. Connect wires as shown **(Figure 8-19, Page 8-29)**. Tighten nut securing relay to charger base to 18 in-lb (2.0 N·m).

CHARGER AC CIRCUIT BREAKER

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

AC Circuit Breaker Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the two black wires attached to the AC circuit breaker **(Figure 8-19, Page 8-29)**.
4. With a pair of pliers, squeeze in the retaining tabs on the sides of the AC circuit breaker and remove the circuit breaker through the mounting hole in the face of the charger.

AC Circuit Breaker Installation

1. Install in reverse order of removal.

CHARGER AC CORD

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

AC Cord Removal

1. Disconnect AC cord from the wall outlet and DC plug from the vehicle receptacle.
2. Remove the charger cover.
3. Disconnect the AC cord black wire from the AC circuit breaker **(Figure 8-19, Page 8-29)**.
4. Disconnect the AC cord white wire from the primary coil tan wire.
5. Disconnect the AC cord green wire from the charger base **(Figure 8-19, Page 8-29)**.
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 black, white, and green leads of the new AC cord into the charger through the hole in the charger face **(Figure 8-19, Page 8-29)**.
2. Connect the black wire to the AC circuit breaker, the white wire to the primary coil, and 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.

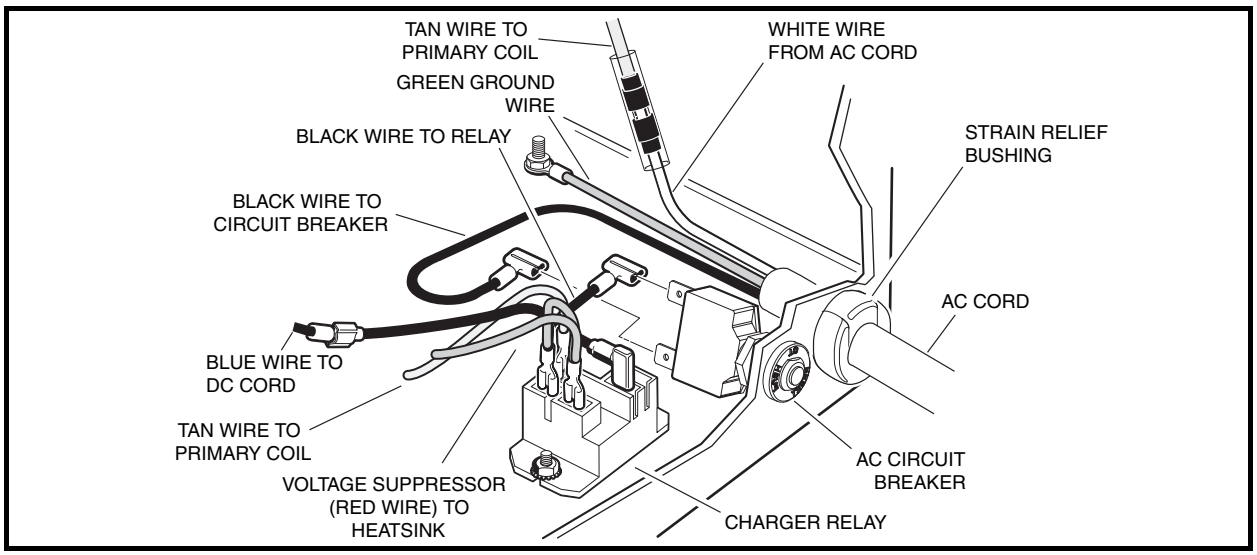


Figure 8-19 Charger Relay

CHARGING A BATTERY PACK THAT HAS LOW VOLTAGE

See General Warning, Section 1, Page 1-1. See additional WARNING on page 8-1.

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 8-5, Page 8-9).**
- **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, remove the black wire (3) from the AC circuit breaker and disconnect the tan wire (4) from the relay. Connect the tan wire (4) to the AC circuit breaker **(Figure 8-20, Page 8-30)**. **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.**

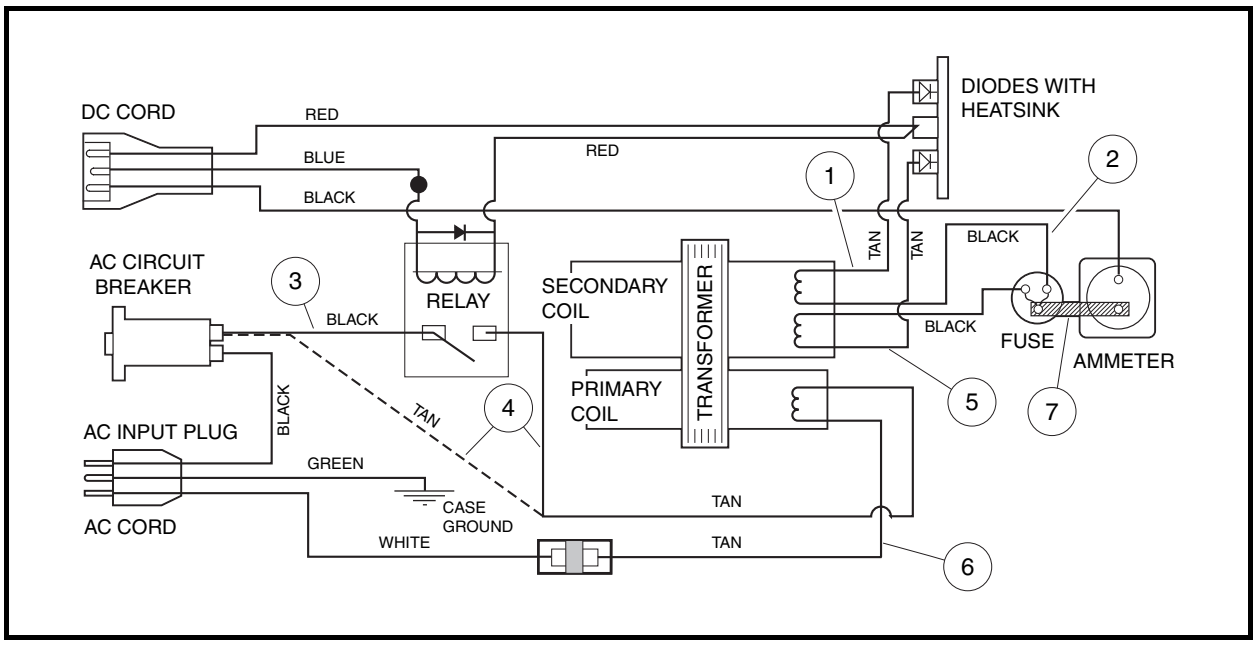


Figure 8-20 IQ Plus Charger Wiring Diagram (Relay Bypassed)

5. Plug the DC cord into the charger receptacle *first*, and 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 transformer wire (4) from AC circuit breaker and connect it to the relay. Connect the short black wire (3) from the relay to the AC circuit breaker **(Figure 8-20, Page 8-30)**. **See following WARNING.**

⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to 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 and 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 9 – 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 onboard IQ Plus battery charger (model numbers 25260-11 and 25260-50) as installed in IQ Plus vehicles. For battery charger models other than those listed above, refer to the appropriate section in the appropriate battery charger maintenance and service manual.

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 9-1, Page 9-1)**. 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, having recorded the amount of energy consumed as the vehicle was used, 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. The computer accomplishes this by detecting when the exact amount of energy necessary has been returned to the batteries.

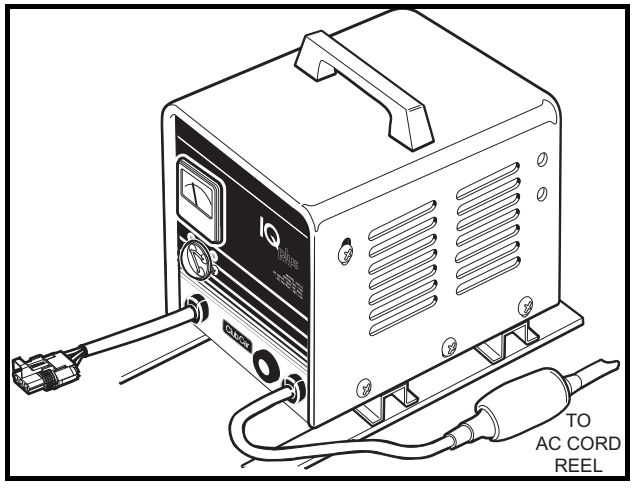


Figure 9-1 Onboard IQ Plus Battery Charger

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 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.

UL AND CSA LISTING

When operated on a 120-volt / 60 Hz electrical system, the following IQ Plus battery chargers have been listed by Underwriters Laboratories and by the Canadian Underwriters (thereby meeting the criteria of the Canadian Standards Association).

IQ Plus onboard battery charger models: 25260-11 and 25260-50.

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 neg-

ative (–) post of battery no. 8 **(Figure 9-4, Page 9-10)**. 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, or 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 9-2, Page 9-3)**.

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.

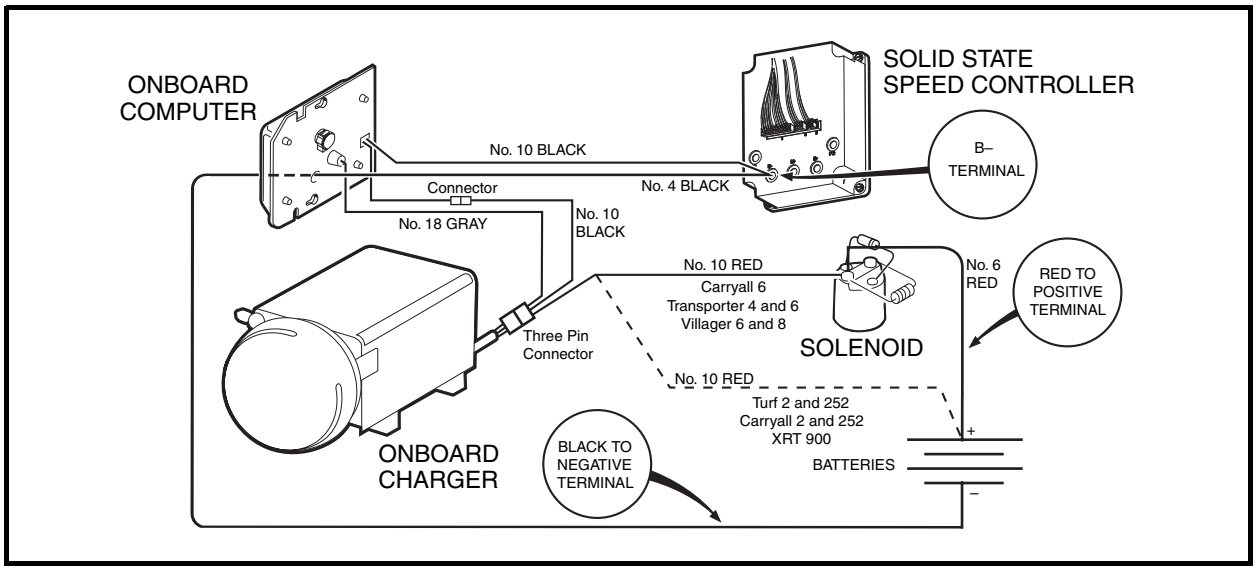


Figure 9-2 Charge Circuit

ONBOARD CHARGER OPERATION

⚠ 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.**

WARNING CONTINUED ON NEXT PAGE...

- **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.**
- **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 and remove the battery charger from the vehicle. See Onboard Charger Removal on page 9-31.**
- **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.**
- **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.**

Connect the power supply cord to an AC supply. **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 the National Electric Code and all local codes and ordinances.

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.

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) (CC P/N 101831801). ***See Communication Display Module in the appropriate maintenance and service supplement.***

CHECKING BATTERY CONDITION WITH AN ONBOARD CHARGER

Read DANGER, WARNING, and CAUTIONS beginning on page 9-3.

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 in the maintenance and service manual appropriate for your battery charger. If you do not have this publication, contact your Club Car representative. If the specified test procedures identify no problems, plug the AC cord into the wall outlet and let it charge until the charger shuts off automatically. If a problem is found, correct it and then charge the vehicle. Normal voltage near the end of a charge cycle should be approximately 59 to 63 volts DC.

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 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. Connect the AC power supply cord to a 120-volt AC, 60-hertz, single-phase 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 9-2.***

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 9-2, Page 9-3)** and that the internal charger wiring is correct **(Figure 9-3, Page 9-6)**.

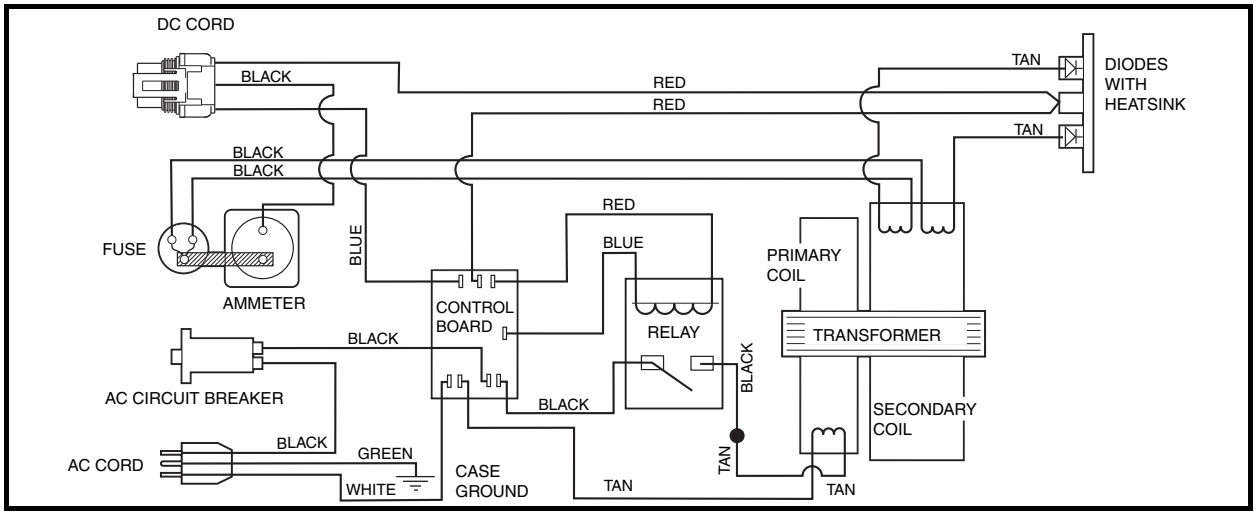


Figure 9-3 IQ Plus Onboard Battery Charger Wiring Diagram

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 9-3, Page 9-6).**
- **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 9-31.**

Use the following Troubleshooting Guide for troubleshooting the IQ Plus onboard battery charger (model numbers 25260-11 and 25260-50). 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 the batteries. **See Connecting The Batteries on page 1-4.**
	Battery voltage is too low	Test Procedure 1 – Battery Voltage on page 9-9
	Improper vehicle or battery charger wiring	**See Figure 9-2, Page 9-3**, **Figure 9-3, Page 9-6 and Figure 9-4, Page 9-10**
	DC circuit	Test Procedure 5 – Charger DC Circuit Continuity Test on page 9-14
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 9-11
	Gray sense lead fuse is blown	Test Procedure 1 – Battery Voltage on page 9-9
	Control board malfunction	Test Procedure 2 – Control Board on page 9-11
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 9-12
	Failed AC plug and cord	Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 9-12
	Failed AC cord reel	Test Procedure 8 – Continuity on page 9-17
	Internal AC breaker	Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 9-12
	Transformer primary coil	Test Procedure 6 – Transformer on page 9-15
	Relay	Test Procedure 8 – Continuity on page 9-17
Relay closes and transformer hums but ammeter does not move	Blown charger fuse	Test Procedure 4 – Diodes on page 9-13
	Both Diodes failed	Test Procedure 4B – Both Diodes Failed on page 9-14
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 9-11
	Failed transformer	Test Procedure 6 – Transformer on page 9-15
	Failed ammeter	Replace ammeter

Troubleshooting Guide continued on next page...

IQ PLUS ONBOARD BATTERY CHARGER TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSES	CORRECTIVE ACTION
Relay operates intermittently	Failed charger relay	Test Procedure 8 – Continuity on page 9-17
Single charger fuse link blows	Diode failed	Test Procedure 4A – Single Diode Failure on page 9-13
	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 9-14
Charger output is low	One diode failed	Test Procedure 4A – Single Diode Failure on page 9-13
	Transformer coil short-circuit failure	Test Procedure 6 – Transformer on page 9-15
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 9-11
Charger turns off too soon	AC power supply was shut off	Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 9-12
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 9-11
	Batteries may be fully charged	Test Procedure 7 – Battery State of Charge Test on page 9-17
Charger goes to 16 hour time out	Onboard computer malfunction	Test Procedure 2 – Control Board on page 9-11
	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 9-17
	Failed transformer	Test Procedure 6 – Transformer on page 9-15
	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 9-12
	Onboard computer malfunction	Test Procedure 2 – Control Board on page 9-11
	Charger failure	See Testing Charger Operation on page 9-6
	16 hour time out	See Battery Warning Light on page 9-2
	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 9-2, Page 9-3)**.
   - 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 9-4, Page 9-10)**. 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 9-29.**

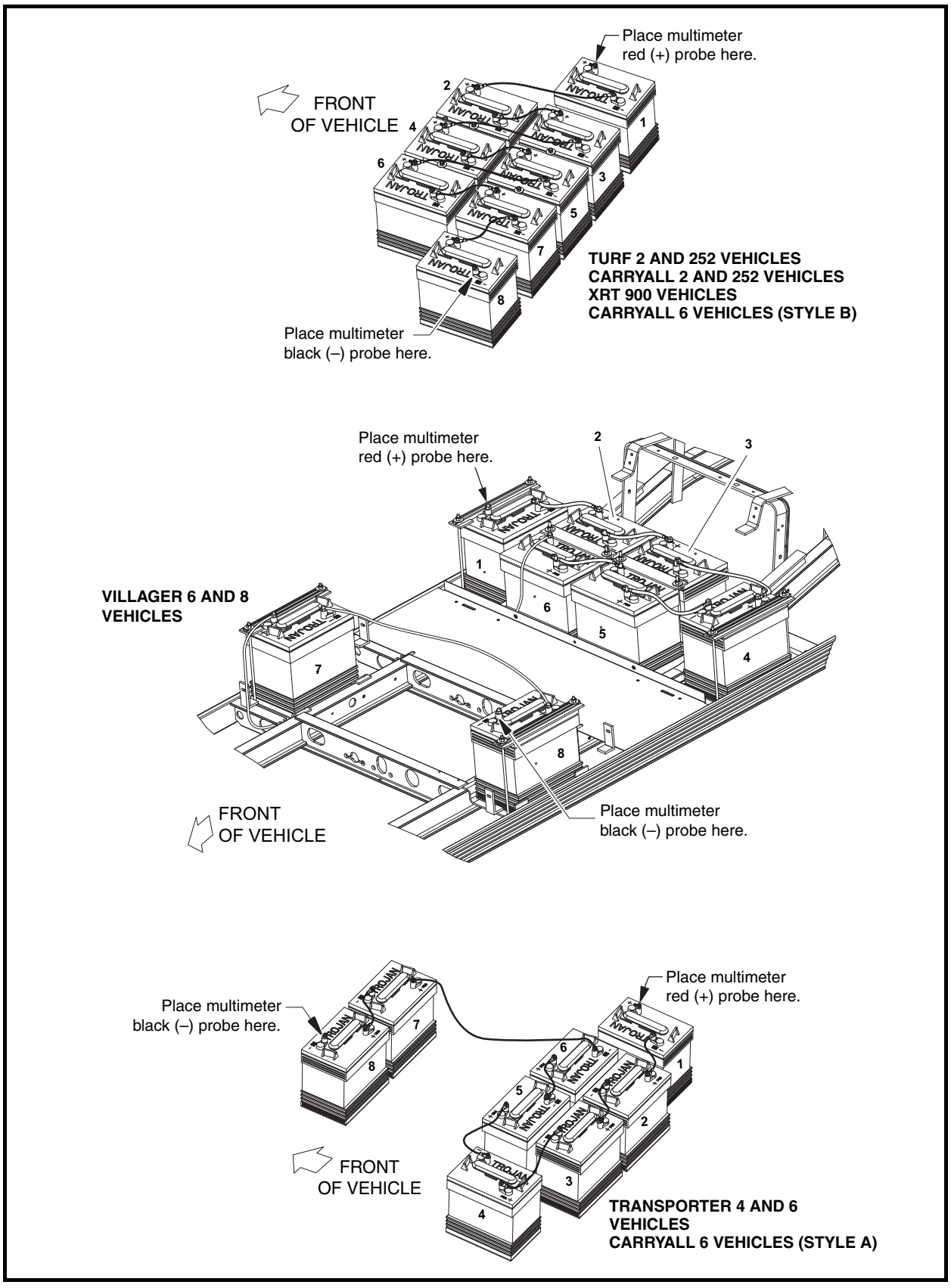


Figure 9-4 Battery Configurations

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 9-5, Page 9-11)**.

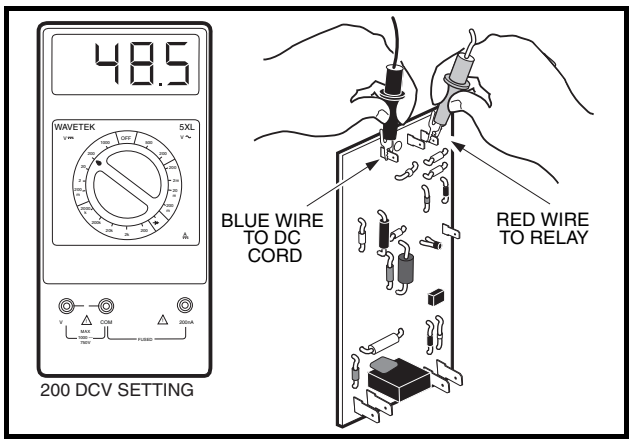


Figure 9-5 DC Circuit Test

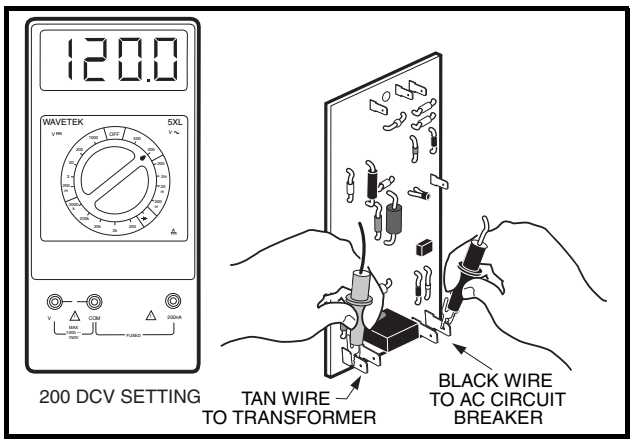


Figure 9-6 AC Circuit Test

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 tan wire from transformer primary coil at terminal on control board **(Figure 9-7, Page 9-12)**. **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 200 volts AC, onto terminal with black AC circuit breaker wire. Connect red (+) probe to terminal from which tan transformer wire was disconnected **(Figure 9-6, Page 9-11)**.
4. Connect AC cord to outlet. Reading should be approximately 110 to 128 volts AC.
5. If reading is incorrect, replace control board.

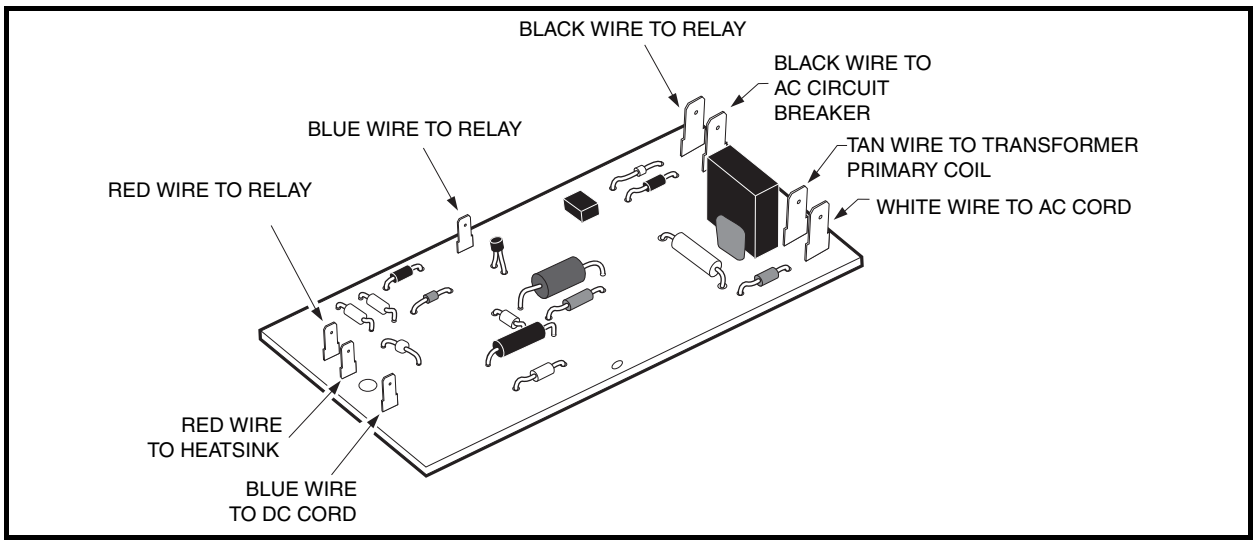


Figure 9-7 Control Board

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 breaker 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 between 105 and 128 volts. If proper voltage is not present, have building wiring checked by a licensed electrical contractor.
5. Check continuity of the AC circuit.
   - 5.1. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
   - 5.2. Remove the charger cover.
   - 5.3. Bypass the relay.
     - 5.3.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 9-11, Page 9-16)**.
   - 5.4. With relay bypassed, there should be continuity across the AC cord blades **(Figure 9-8, Page 9-13)**.
6. If the circuit is not complete, check the wiring of the AC cord, AC cord reel, transformer primary coil wires, and internal AC circuit breaker **(Figure 9-11, Page 9-16)**.
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 9-17.**
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 properly connect the relay wiring could result in property damage, severe personal injury, or death.**

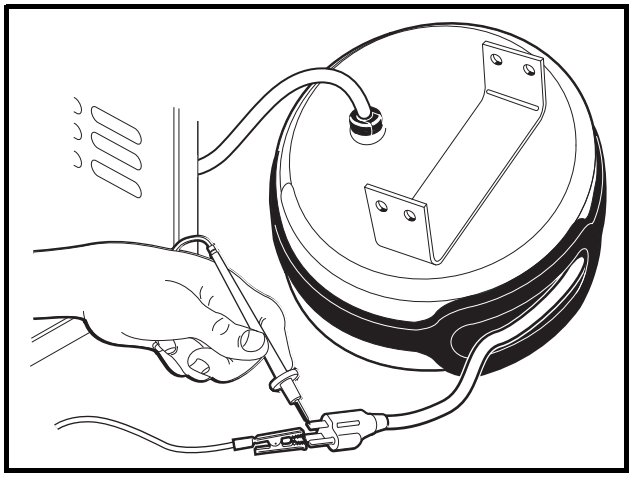


Figure 9-8 AC Circuit Continuity Test

TEST PROCEDURE 4 – DIODES

Use Test Procedure 4A – Single Diode Failure on page 9-13 for single diode failures and testing of individual diodes. If both diodes have failed, use Test Procedure 4B – Both Diodes Failed on page 9-14.

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 9-31.**
3. Remove the charger cover.
4. Disconnect one transformer secondary coil wire from the diode terminal **(Figure 9-9, Page 9-14)**.
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 9-9, Page 9-14)**.
6. Reverse test probes and check each diode again and note the reading **(Figure 9-10, Page 9-14)**. 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.**

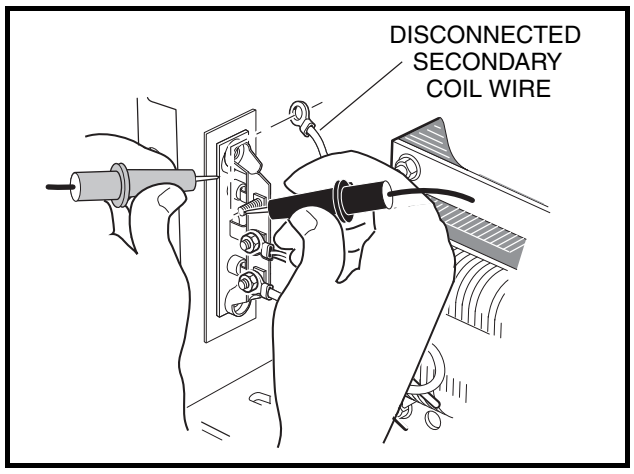


Figure 9-9 Diode Test

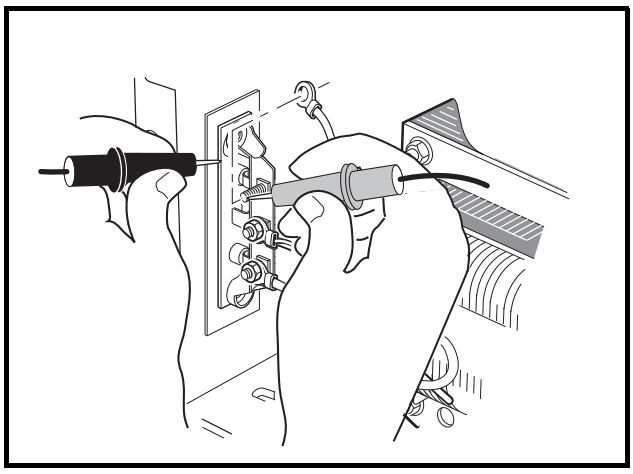


Figure 9-10 Diode Test – Probes Reversed

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 9-13. 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 9-2, Page 9-3)**.
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 9-3, Page 9-6)**. 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 vehicle's 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 9-2, Page 9-3)**. 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 and discharge the controller. **See Disconnecting The Batteries on page 1-3.**

3. Disconnect the charger DC cord at the three pin connector (8) **(Figure 9-11, Page 9-16)**.
4. Using a continuity tester (CC P/N 1011273) or multimeter set to 200 ohms, connect the test probes to the DC cord black wire and red wire terminals in the three pin connector **(Figure 9-11, Page 9-16)**. 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 9-17.** Also check the diodes (heatsink). **See Test Procedure 4 – Diodes on page 9-13.**
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 9-13.** If diodes have not failed, check the DC cord for a short circuit. **See Test Procedure 8 – Continuity on page 9-17.**
8. Check continuity between the DC cord red, black, and blue wires **(Figure 9-3, Page 9-6)**. 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 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 breaker, and charger wiring. **See Test Procedure 3 – AC Power and Continuity Check of AC Circuit on page 9-12.**

1. Disconnect AC cord from the wall outlet.
2. Remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
3. Remove the charger cover.
4. Disconnect transformer secondary coil wires (1 and 5) from the heatsink **(Figure 9-11, Page 9-16)**.
5. To apply AC power directly to the transformer primary coil, the relay must be bypassed.
   5.1. To bypass the relay, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 9-11, Page 9-16)**. **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.**

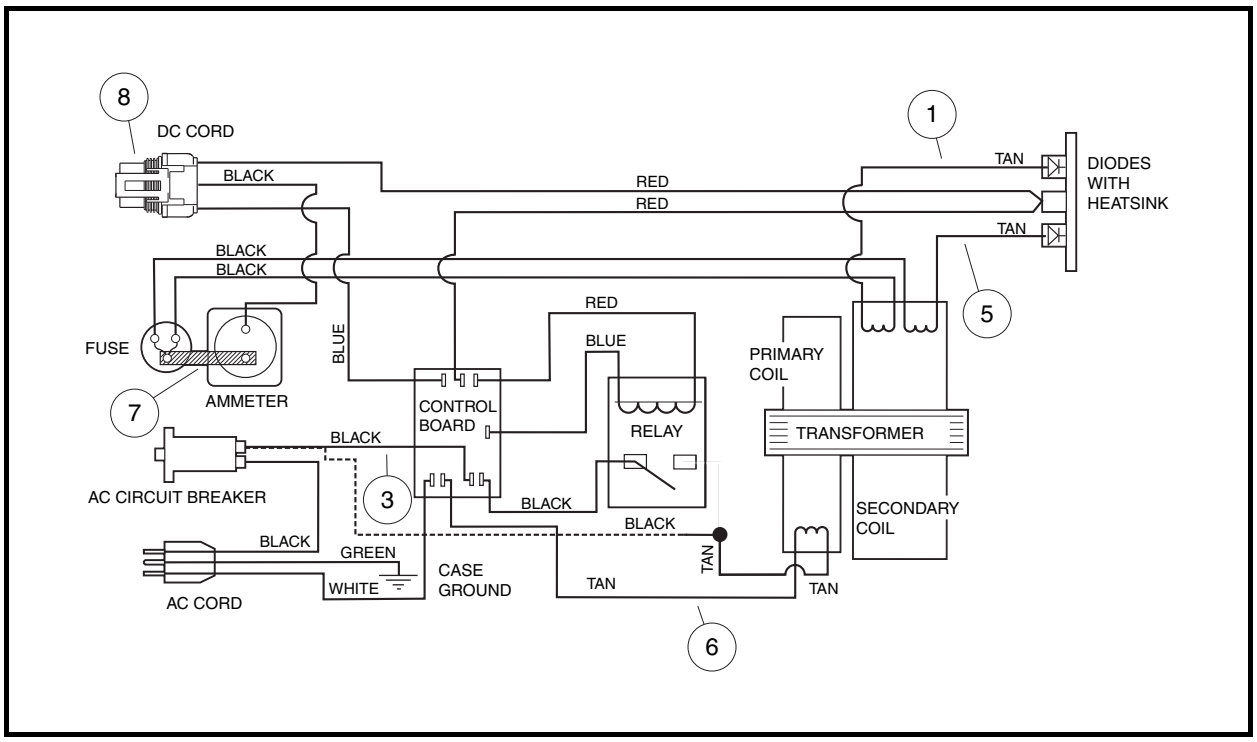


Figure 9-11 Transformer Test Wiring Diagram

6. Make sure 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 wires (1 and 5).
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 **(Figure 9-11, Page 9-16)**.
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 9-14.**
12. 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 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 DC charger plug for approximately 20 seconds and then reconnect it. The ammeter should jump to a reading between 14 and 18 amps and then 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 9-11. 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.

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 9-31.**
3. Remove the charger cover.
4. Disconnect the green wire (2) from charger case and position it so it does not touch any metal part of the charger **(Figure 9-12, Page 9-18)**.
5. Disconnect the black wire (1) of the short AC cord from charger AC circuit breaker.
6. Disconnect the AC cord white wire (4) 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 wire (1) **(Figure 9-12, Page 9-18)**. 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 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 9-12, Page 9-18)**. 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 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.

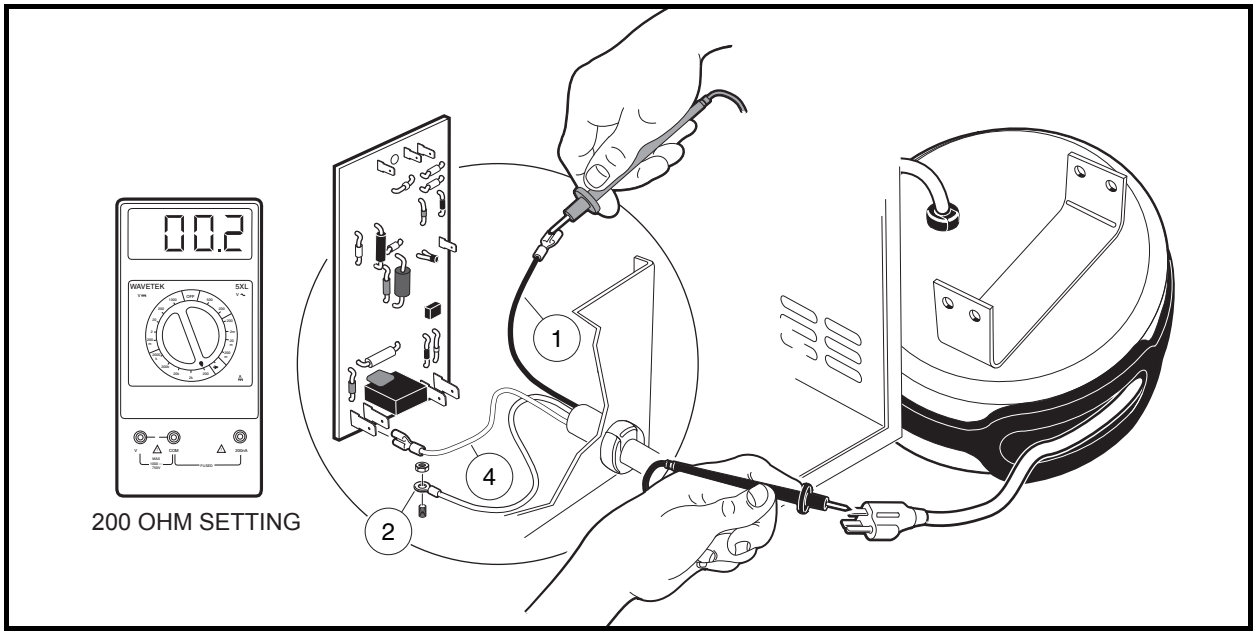


Figure 9-12 AC Cord and Retractable Cord Reel Continuity Test

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 9-31.**
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 9-13, Page 9-18)**.

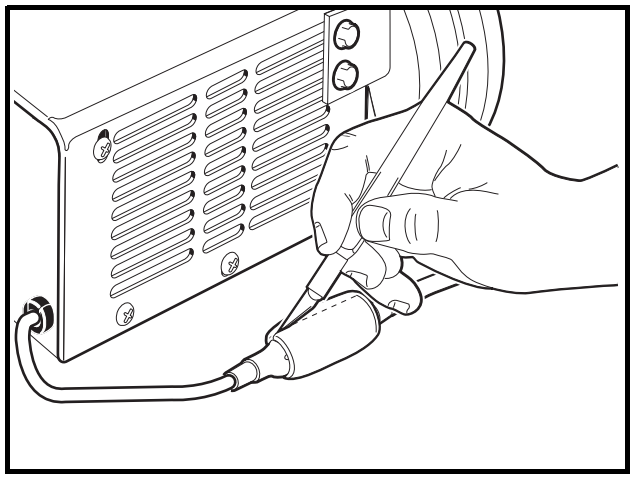


Figure 9-13 Heatshrink Removal

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 9-14, Page 9-19)**.

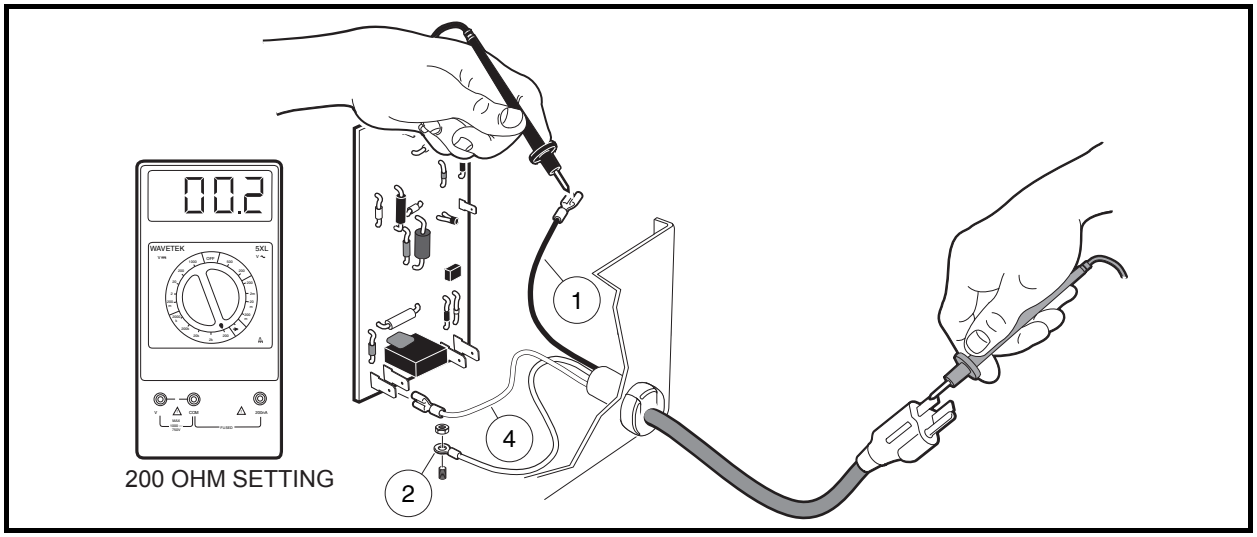


Figure 9-14 Short AC Cord Test

7. Disconnect the black wire (1) of AC cord from charger AC circuit breaker.
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 primary coil tan wire. 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 9-31.**
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 9-13, Page 9-18)**.
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 9-15, Page 9-20)**. 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.

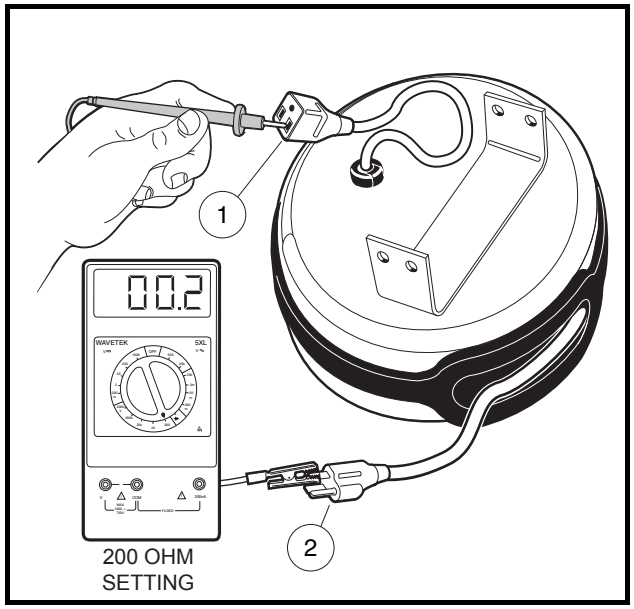


Figure 9-15 Retractable Cord Reel Test

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 AC cord from the wall outlet and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
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 9-16, Page 9-22).**
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 AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
2. Remove the charger cover.
3. Disconnect terminals from transformer (tan) primary coil wires (4 and 6) **(Figure 9-11, Page 9-16)**.
4. Place the continuity test probes on the disconnected primary transformer coil wires. The tester should indicate continuity. If tester does not indicate continuity, replace the transformer.

Secondary Coil

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
2. Remove the charger cover.
3. Remove the transformer (tan) secondary coil wire (1) from the upper terminal of the heatsink **(Figure 9-11, Page 9-16)**.
4. Remove the other transformer (tan) secondary coil wire (5) from the bottom terminal of the heatsink and place the continuity test clip on the ammeter buss bar (7) **(Figure 9-11, Page 9-16)**. 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 AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
2. Remove the charger cover.
3. Remove black wires from contact terminals of the relay **(Figure 9-11, Page 9-16)**. Place continuity test probes on contact terminals 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.

Ammeter

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
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 AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
2. Remove the charger cover.
3. Disconnect the wires from the AC circuit breaker.
4. Place the continuity test probe 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 9-3, Page 9-6).**
- **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 9-31.**

DC CORD

DC Cord Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31.**
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 9-17, Page 9-22)**.
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 9-16, Page 9-22)**.
8. Using pliers, squeeze the strain relief bushing and remove the DC cord **(Figure 9-16, Page 9-22)**.

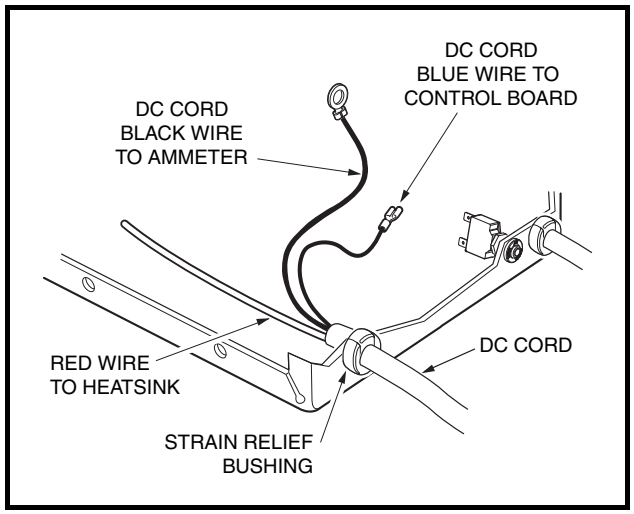


Figure 9-16 DC Cord

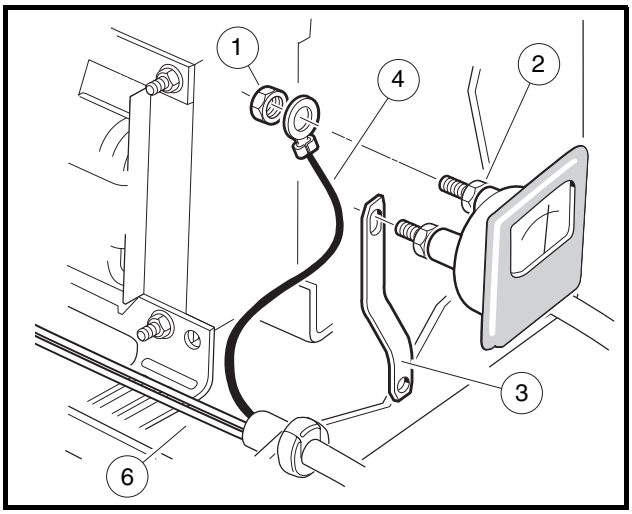


Figure 9-17 DC Cord Replacement

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 9-16, Page 9-22)**.

3. Attach the blue wire of the new DC cord to the control board **(Figure 9-16, Page 9-22)**.
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 9-17, Page 9-22)**. **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 9-31. See preceding WARNING.**
2. Remove the charger cover.
3. Remove both secondary coil transformer wires (tan) from the heatsink **(Figure 9-3, Page 9-6)**.
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 9-3, Page 9-6)**.
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).
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 install the charger in the vehicle. **See Onboard Charger Installation on page 9-31.**
6. Check charger for proper operation.

TRANSFORMER

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

Transformer Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**
2. Remove the charger cover.
3. Disconnect the black primary coil wire from the charger relay **(Figure 9-3, Page 9-6)**.
4. Disconnect the tan primary coil wire from the control board.
5. Remove the wire tie that secures the DC cord wire to the secondary coil wire (tan).
6. Disconnect the two tan secondary coil transformer wires from the heatsink **(Figure 9-3, Page 9-6)**.
7. Disconnect the two black secondary coil transformer wires from the fuse.
8. 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) **(Figure 9-3, Page 9-6)**.
2. 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).
3. 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).
4. Connect one secondary coil transformer wire (black) to one terminal of the fuse assembly. Tighten nut to 22 in-lb (2.5 N·m).
5. Connect the other secondary coil transformer wire (black) to the remaining terminal of the fuse assembly. Tighten nut to 22 in-lb (2.5 N·m).
6. Connect the black primary coil transformer wire to the charger relay.
7. Connect the other primary coil transformer wire to the control board.
8. 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.**

9. Install the charger cover and install the charger in the vehicle. **See Onboard Charger Installation on page 9-31.**
10. Check charger for proper operation.

AMMETER

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

Ammeter Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**

2. Remove the charger cover.
3. Disconnect the DC cord black wire (5) and the buss bar (3) from the ammeter **(Figure 9-18, Page 9-25)**.
4. Remove the two nuts (2) that secure the ammeter to the charger face.
5. Remove the ammeter from the face of the charger.

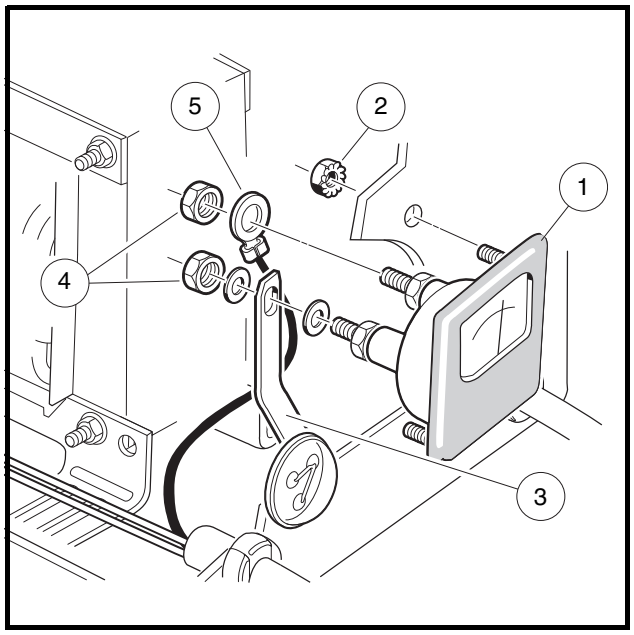


Figure 9-18 Ammeter

Ammeter Installation

1. Place the ammeter in position in the charger face **(Figure 9-18, Page 9-25)**.
2. Install nuts (2) and tighten until ammeter is firmly secured.
3. Connect the black wire (5) of the DC cord 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 9-31.**
7. Check charger for proper operation.

FUSE LINK

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

Fuse Link Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**
2. Remove the charger cover.
3. Remove both black secondary coil transformer wires and the buss bar from the back of the fuse link assembly **(Figure 9-18, Page 9-25)**.
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 9-18, Page 9-25)**. 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 9-31.**
5. Check charger for proper operation.

CHARGER RELAY

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

Charger Relay Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**
2. Remove the charger cover.
3. Disconnect all wires from the relay **(Figure 9-19, Page 9-27)**.
4. Remove two nuts and lock washers securing relay to the charger base.
5. Remove the relay.

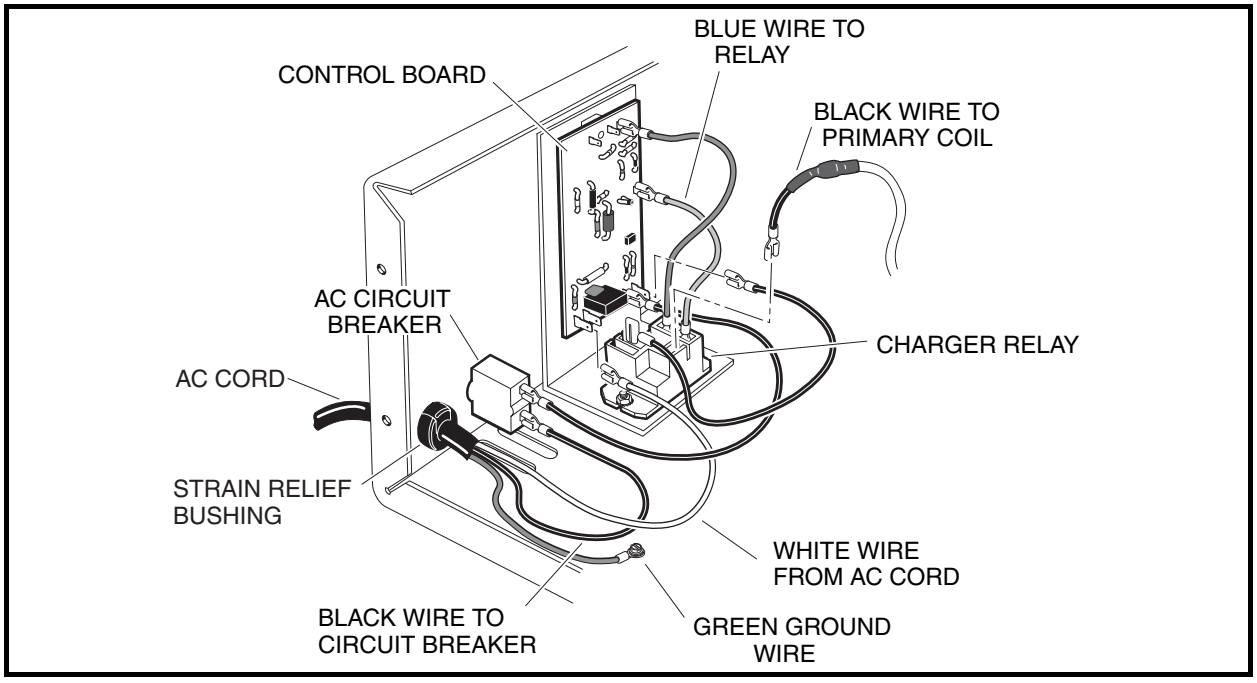


Figure 9-19 Charger Relay

Charger Relay Installation

Install in reverse order of removal. Connect wires as shown **(Figure 9-19, Page 9-27)**. Tighten nuts securing relay to charger base to 18 in-lb (2.0 N·m).

CHARGER AC CIRCUIT BREAKER

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

AC Circuit Breaker Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**
2. Remove the charger cover.
3. Disconnect the two black wires attached to the AC circuit breaker **(Figure 9-19, Page 9-27)**.
4. Remove the nut, on the front face of the charger, that secures the breaker and remove the breaker from the charger.

AC Circuit Breaker Installation

1. Install in reverse order of removal. Tighten nut firmly.

CHARGER AC CORD AND RETRACTABLE CORD REEL

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

Short AC Cord Removal

1. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**
2. Remove the charger cover.

3. Disconnect the AC cord black wire from the AC circuit breaker **(Figure 9-19, Page 9-27)**.
4. Disconnect the AC cord white wire from the control board.
5. Disconnect the AC cord green wire from the charger base **(Figure 9-19, Page 9-27)**.
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 9-19, Page 9-27)**.
2. Connect the black wire to the AC circuit breaker, the white wire to the control board, and the green wire to the charger base **(Figure 9-3, Page 9-6)**. 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 9-31.**
6. Check charger for proper operation.

RETRACTABLE AC CORD REEL

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

Retractable AC Cord Reel Removal

1. Disconnect retractable AC cord from AC outlet. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**
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 9-13, Page 9-18)**.
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 9-20, Page 9-29)**.
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.

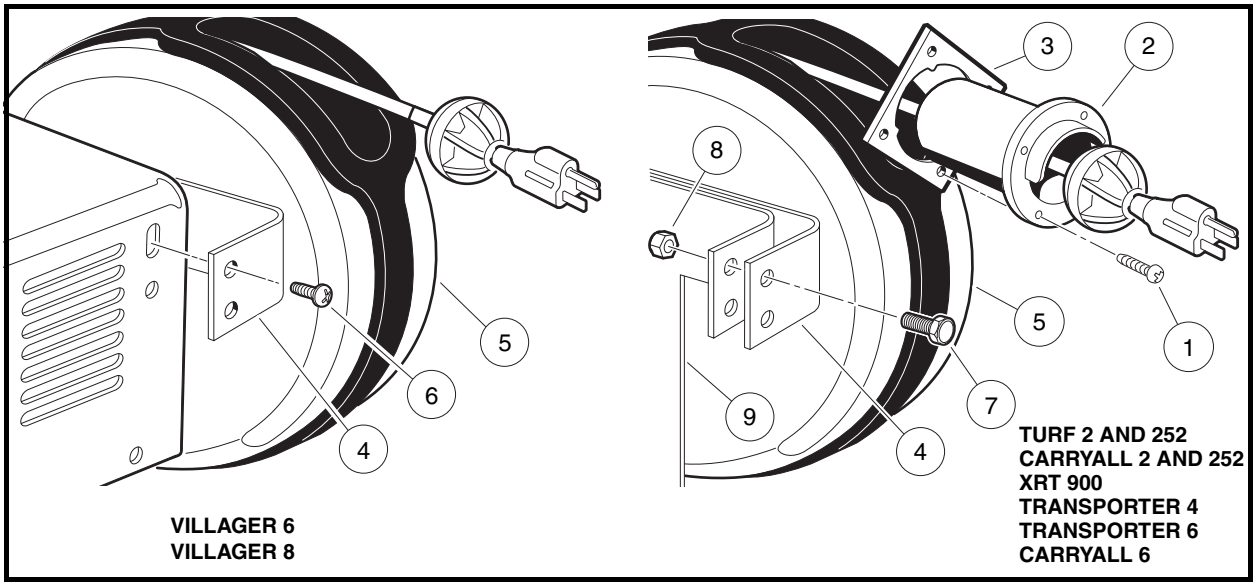


Figure 9-20 Retractable Cord Reel Mounting Details

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 9-3, Page 9-6).**
- **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 9-31.**

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 handle in the NEUTRAL position.
2. Disconnect the AC cord and remove the battery charger from the vehicle. **See Onboard Charger Removal on page 9-31. See WARNING on page 9-22.**
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, remove the black wire (3) from the AC circuit breaker and disconnect the black wire (4) from the relay. Connect the black wire (4) to the AC circuit breaker **(Figure 9-21, Page 9-30)**. **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 9-31.**

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 9-31. See WARNING on page 9-22.**
9. Disconnect the transformer wire (4) from AC circuit breaker and connect it to the relay. Connect the short black wire (3) from the control board to the AC circuit breaker **(Figure 9-3, Page 9-6)**. **See following WARNING.**

⚠ WARNING

- **The relay wiring must be properly connected prior to placing the charger back into normal service. Failure to 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 9-31.**
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.**

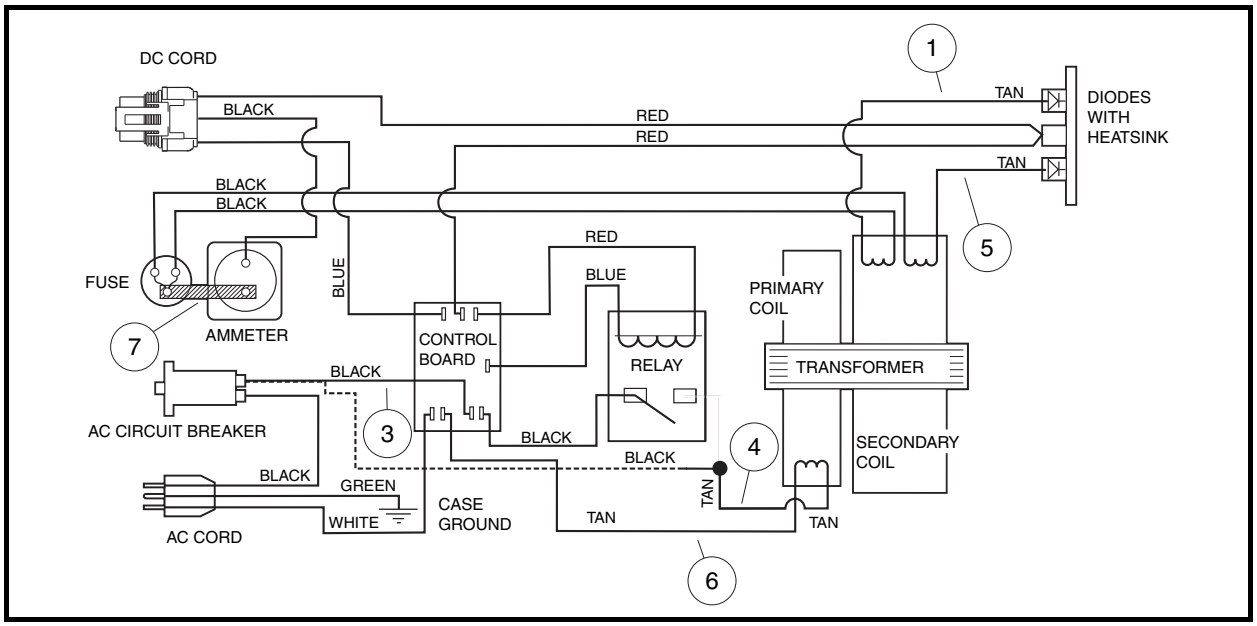


Figure 9-21 IQ Plus Onboard Charger Wiring Diagram (Relay Bypassed)

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 9-3, Page 9-6).**
- **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 9-31.**

Onboard Charger Removal

1. Disconnect the batteries and discharge the controller. **See Disconnecting The Batteries on page 1-3.**
2. Disconnect the charger DC cord at the three pin connector (1) **(Figure 9-22, Page 9-32)**.
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 9-13, Page 9-18)**.
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) (CC P/N 1017189) over the short AC cord and connect the short AC cord to the retractable cord reel **(Figure 9-22, Page 9-32)**. Slide the tubing over the connection and carefully apply heat to shrink it.
4. Connect the batteries. **See Connecting The Batteries on page 1-4.**

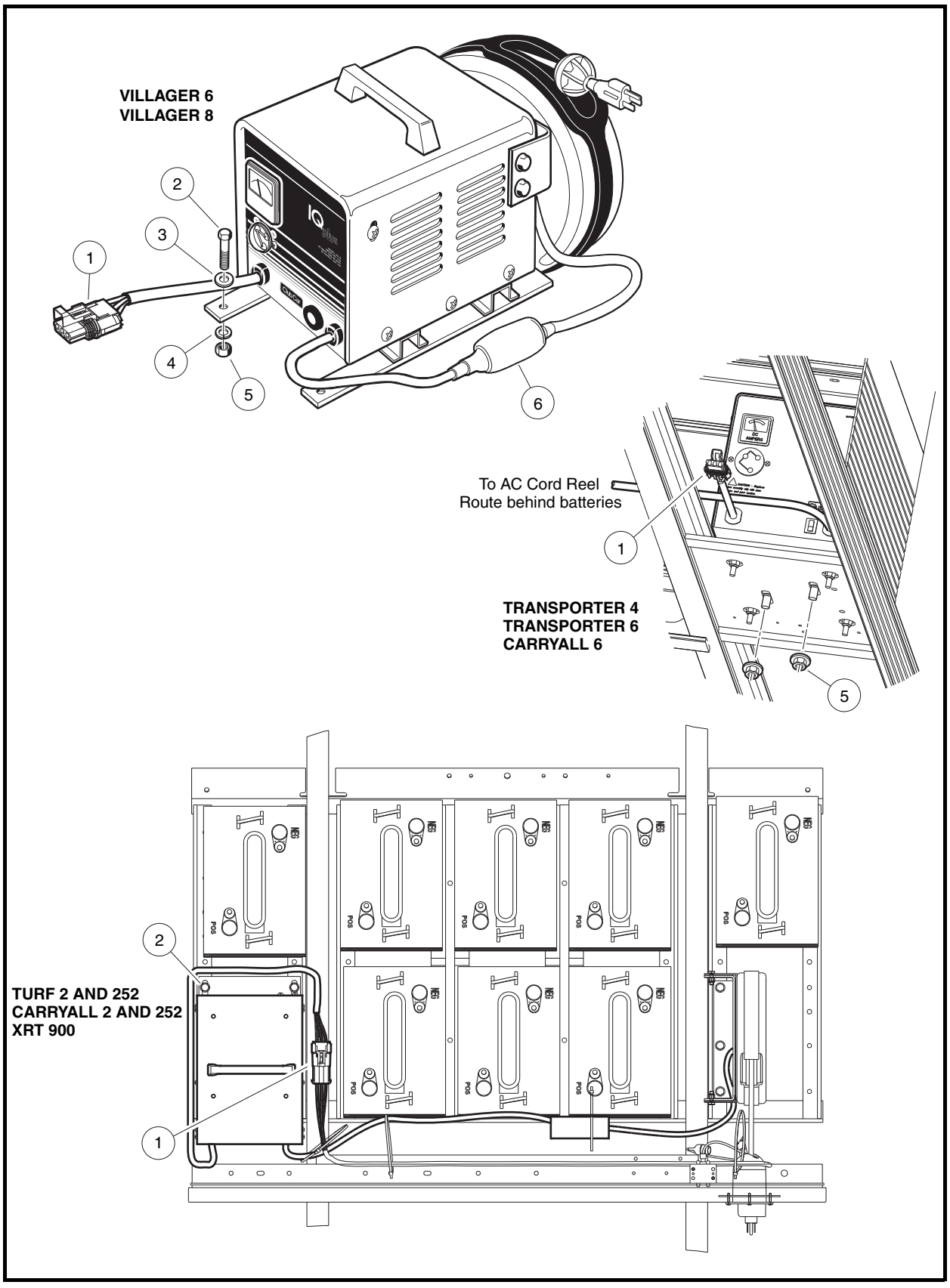


Figure 9-22 Onboard Charger Mounting Details

SECTION 10 – HIGH FREQUENCY 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 High Frequency battery charger (model number 912-4852). 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 High Frequency Battery Charger functions as an integral part of the vehicles' electrical system and will not work with other electric vehicles. The charger is programmed with a specific charge algorithm that is appropriate to the specific battery type used in the vehicle. **See Battery Charger Identification on page 2-1.** When the charger AC cord is connected, LED lights on the charger and dash perform start-up self-test (LEDs light up in sequence).

The charger utilizes sophisticated charge termination criterion to shut off automatically, preventing the possibility of either undercharging or overcharging. The charger accomplishes this by monitoring battery voltage, charge current, charge time and using strict dV/dt termination criterion.

Figure 10-1 High Frequency Battery Charger

FEATURES

- **Charge Interlock**
  When the AC power cord is inserted into a wall receptacle, the charger 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**
  This charger is designed to be left connected to AC power during off-season or long-term storage. Be sure to check the charger monthly to ensure the charger is operating correctly during storage. The charger will enter maintenance mode if supported by the charge algorithm or automatically activate if battery voltage drops <2.1 Volts per cell (24 cells is 50.4 Volts) or 30 days have elapsed. 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.

UL AND CSA LISTING

When operated on a 120-volt / 60 Hz electrical system, this battery charger has been listed by Underwriters Laboratories and by the Canadian Underwriters (thereby meeting the criteria of the Canadian Standards Association).

CE COMPLIANCE

This battery charger is compliant with the EU EMC Directive 2004/108/EC.

IP (INGRESS PROTECTION) RATING

The enclosure of the charger has been tested successfully to EN60529, meeting IP66. The AC supply inlet is rated to IP20, which is suitable for indoor use only. Keep all AC connections clean and dry.

HOW TO IDENTIFY CHARGE ALGORITHM NUMBER

The algorithm numbers offered can be found in **Battery Charger Identification on page 2-1**. The charger can display its algorithm number by initiating Algorithm Display Mode. To enter Algorithm Display Mode, do the following:

1. Unplug the AC power supply cord from the wall outlet.
2. Disconnect the heavy-gauge red wire from the positive (+) post of battery no. 1.
3. Plug the AC power supply cord into the wall outlet. **See following NOTE.**

NOTE: *When the charger AC cord is connected, LED lights on the charger and dash perform start-up self-test (LEDs light up in sequence).*

4. After the start-up self-test, the 80% LED will display a series of flashes that represent the algorithm number **(Figure 10-2, Page 10-3)**. *[Example: Algorithm number 125 is represented as "one flash", pause, "two flashes", pause, "five flashes".]* The charger will not repeat this series of flashes. To see the number again, repeat steps 1 and 3 with a 20 second pause between them.

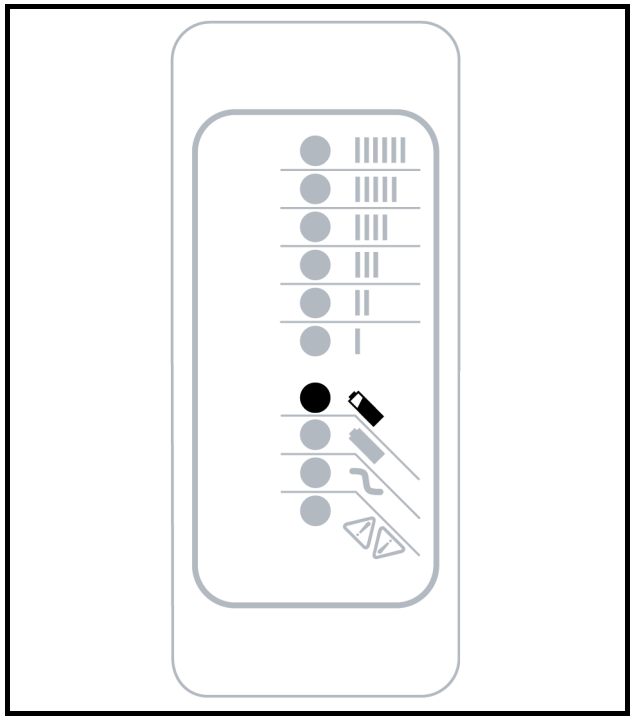


Figure 10-2 80% LED Flashes in Algorithm Display Mode

THE CHARGE CIRCUIT

The charge circuit consists of the onboard charger, batteries and charger information light **(Figure 10-3, Page 10-4)**.

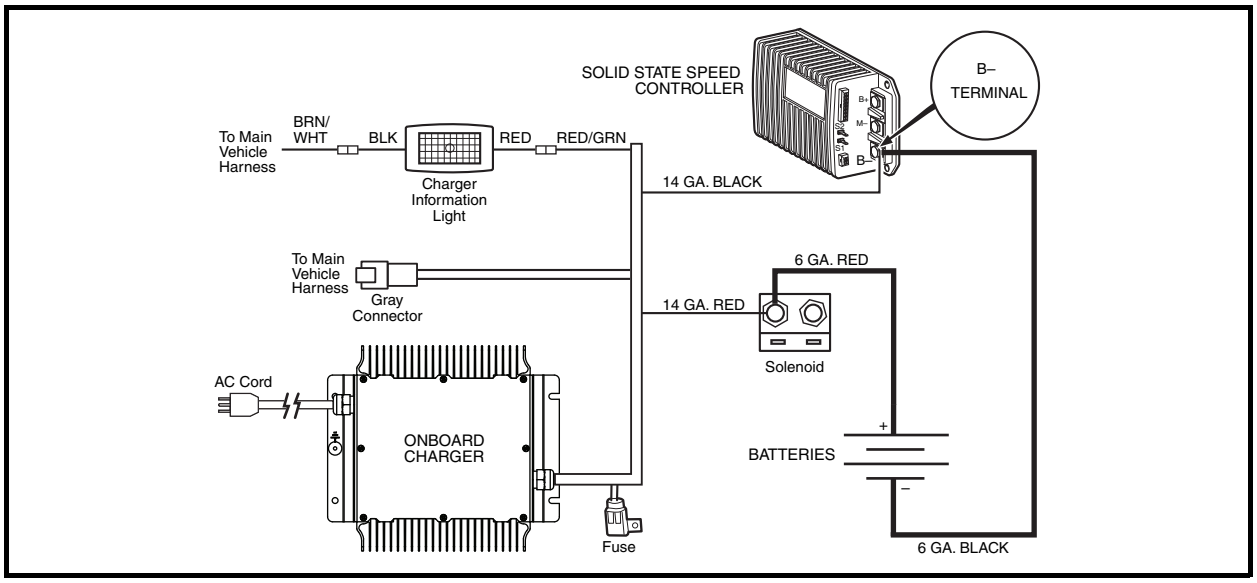


Figure 10-3 Charge Circuit

ONBOARD CHARGER OPERATION

⚠ DANGER

- **Battery – Explosive gases! Do not smoke. Keep sparks and flames away from the vehicle and service area. Ventilate when charging or operating vehicle in an enclosed area. Wear a full face shield and rubber gloves when working on or near batteries.**
- **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.**
- **Risk of electric shock. Connect charger power cord to an outlet that has been properly installed and grounded in accordance with all local codes and ordinances. A grounded outlet is required to reduce risk of electric shock; do not use ground adapters or modify plug.**
- **Do not touch uninsulated portion of output connector or uninsulated battery terminals.**
- **Disconnect the AC supply before making or breaking the connections to the battery.**
- **Do not open or disassemble charger.**
- **Do not operate this charger if the AC supply cord is damaged or if the charger has received a sharp blow, been dropped, or otherwise damaged in any way. Refer all repair work to the manufacturer or qualified personnel.**

DANGER CONTINUED ON NEXT PAGE

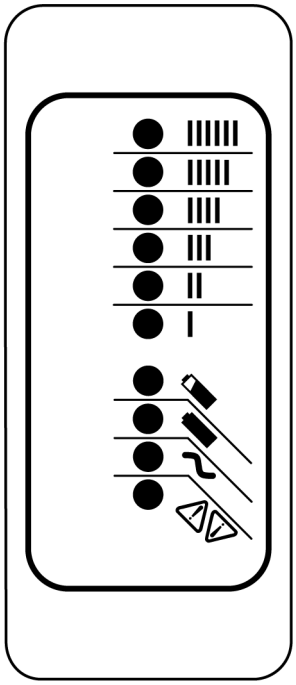
- **This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.**

⚠ WARNING

- **The high frequency battery charger is programmed with an algorithm that matches the type and design specifications of the batteries originally installed in the vehicle. Never use this charger to charge batteries of a different type and design specification. Doing so will damage the non-matching batteries and greatly reduce their life span. If the batteries can not be replaced with the same as original, the charger must be replaced with one that matches the replacement batteries. See Battery Charger Identification on page 2-1.**
- **Do not attempt to charge frozen batteries or batteries with bulged cases. Discard the battery in accordance with all environmental laws or return to an authorized Club Car dealer. Frozen batteries can explode.**
- **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.**
- **Use only an appropriately sized AC power cord. See AC Power Connection on page 10-7.**
- **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 remove the battery charger from the vehicle. See removal procedure in the appropriate maintenance and service manual.**
- **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.**
- **Have worn, cut, or damaged power cords or wires replaced immediately.**
- **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.**
- **Ensure battery connections are clean and properly tightened.**
- **Wear safety glasses or approved eye protection when servicing the vehicle or battery charger. Wear a full face shield and rubber gloves when working on or near batteries.**
- **Do not wear loose clothing or jewelry such as rings, watches, chains, etc., when servicing the vehicle or battery charger.**
- **Use insulated tools when working near batteries or electrical connections. Use extreme caution to avoid shorting of components or wiring.**

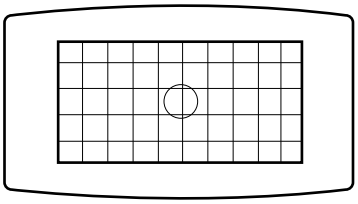
CHARGER DISPLAYS

10-LED display on charger:



LED Color		Indication (following "Power-On Self Test")	
Ammeter (Amber)		Solid:	Displays approximate scale of current output during bulk phase.
		Flashing:	High internal charger temperature. Output reduced. Also displays algorithm #1-6 for 11 seconds if no battery is connected.
80% Charge (Amber)		Solid:	Bulk charge phase complete, 80% charged. In Absorption phase.
		Flashing:	With no battery connected, indicates algorithm # selected by number of flashes.
100% Charge (Green)		Solid:	Charging complete. Charger in Maintenance Mode.
		Flashing:	Absorption phase complete. In Finish phase
AC On (Amber)		Solid:	AC Power good
		Flashing:	Low AC Voltage. Check voltage and power cord length (see above for guidelines).
Fault (Red)		Flashing:	Charger error. Reset charger power and refer to Troubleshooting Instructions below.

Charger Information Light (Single-LED display mounted on dash of vehicle):



LED Color	Indication (following "Power-On Self Test" in which each light will flash once in order from red, to green and amber)	
Green	Solid:	Charging complete. Charger in Maintenance Mode.
	Flashing:	*Short:* <80% Charge. *Long:* >80% Charge.
Amber	Flashing:	Reduced Power Mode: Low AC Voltage or High internal charger temperature.
Red	Flashing:	Charger error. Reset charger power and refer to Troubleshooting Instructions below.

AC POWER CONNECTION

⚠ CAUTION

- **Charger enclosure may be hot during charging. Use hand protection if handling the charger while charging.**

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.*

Only use **ONE** charger on a single 15 amp circuit or the circuit may become overloaded. **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 the National Electric Code and all local codes and ordinances.

The AC power cord must be 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.

CHARGING BATTERIES

NOTE: *Batteries should be put on charge even if they have been used for only a short time, i.e., 10 minutes. The charger is automatic and will turn off when batteries are fully charged. If the charger does not seem to be operating properly, or if the batteries seem weak, contact a local Club Car distributor/dealer.*

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.

When temperatures fall below 65 °F (18.3 °C), batteries charged in unheated areas should be placed on charge as soon as possible after use. Batteries are warmest immediately after use, while cold batteries require more time to fully charge.

1. Insert the onboard charger AC plug into a dedicated and properly wired AC receptacle to begin a charge cycle. **See Section 2 – Charger Identification and Specifications.**

NOTE: *Only connect **ONE** charger to a single 15 amp circuit or the circuit may become overloaded.*

2. Place the charger AC cord so it will not be stepped on, tripped over, or otherwise subject to damage or stress.
3. Do not place items in the compartment where the battery charger is installed. Locate the charger with adequate ventilation.

After the charger is plugged in, the vehicle's control circuit is locked out, preventing operation of the vehicle, as well as the possibility of subsequent damage to the charger and vehicle.

Once the lockout is actuated, the charger turns on and performs a Power-On Self Test in which the Charger Information Light on the dash will flash each color once starting with red, then green, and amber. If test is successful, charging will start and the green light will flash.

The charger monitors battery voltage, charge current and charge time to determine when the batteries are properly charged. The charger will shut off by itself and the green light will stop flashing and remain on.

The vehicle's control circuit lockout remains activated until the charger AC plug is disconnected from the AC receptacle.

MAINTENANCE

Read DANGER, WARNING, and CAUTIONS beginning on page 10-4.

To ensure trouble-free performance, it is very important to follow an established preventive maintenance program. Regular and consistent maintenance can prevent vehicle downtime and expensive repairs that can result from neglect.

Any charger not functioning correctly should be removed from use until it is properly repaired. This will prevent further damage to the vehicle and avoid the possibility of injury due to unsafe conditions.

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

⚠ WARNING

- **If any problems are found during scheduled inspection or service, do not operate the vehicle until repairs are made. Failure to make necessary repairs could result in fire, property damage, severe personal injury, or death.**
- **Do not wear loose clothing or jewelry, such as rings, watches, chains, etc., when servicing the charger.**

- Do not expose charger to oil, dirt, mud or direct heavy water spray when cleaning vehicle.
- Keep all AC connections clean and dry.
- If the detachable input power supply cord set is damaged, replace with a cord that meets the following criteria:

For North America:	UL or CSA listed/approved detachable cord, 3 conductor, 16AWG minimum, and rated SJT; terminating in a grounding type IEC 60320 C14 plug rated 250V, 13A minimum.
For all other countries:	Safety approved detachable cord, 3 conductor, 1.5mm²; minimum, rated appropriately for industrial use. The cord set must be terminated on one end with a grounding type input connector appropriate for use in the country of destination and, on the other end, an output grounding type IEC 60320 C14 plug.

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 10-3, Page 10-4).**
- **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 and Installation on page 10-22.**

If a fault occurs, count the number of red flashes (on the charger or dash) between pauses and refer to the table below:

HIGH FREQUENCY BATTERY CHARGER TROUBLESHOOTING GUIDE

RED FLASHES	CAUSE	SOLUTION
☀	Battery High Voltage	Ensure battery set is rated 48 volts and composed of 24 cells. **See Test Procedure 1 – Battery Voltage Using Multimeter on page 10-10.** If not, replace with correct battery set. Reset charger (interrupt AC power for 15 seconds).
☀☀	Battery Low Voltage	Ensure battery set is rated 48 volts and composed of 24 cells. Also, check the voltage of each individual battery. **See Test Procedure 1 – Battery Voltage Using Multimeter on page 10-10.** If not, replace with correct battery set. Reset charger (interrupt AC power for 15 seconds).
☀☀☀	Charge Timeout caused by battery pack not reaching required voltage. Charger output was reduced due to high temperatures	Check for loose or corroded connections. Check for old or defective batteries. **See Test Procedures on page 10-10.** Operate charger at a lower ambient temperature.
☀☀☀☀	Check Battery: battery could not be trickle charged up to minimum voltage	Check for shorted or damaged cells. **See Test Procedure 1 – Battery Voltage Using Multimeter on page 10-10.**
☀☀☀☀☀	Over-Temperature: Charger shut down due to high internal temperature.	Check for dirty, obstructed, or damaged cooling fins. Clean if necessary and ensure sufficient cooling air flow. Reset charger (interrupt AC power for 15 seconds).
☀☀☀☀☀☀	Charger Internal Fault	Reset charger (interrupt AC power for 15 seconds). Return to qualified service depot if fault persists.

TEST PROCEDURES

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

INDEX OF TEST PROCEDURES

TEST PROCEDURE 1 – BATTERY VOLTAGE USING MULTIMETER

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

1. 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 (for 4 x 12-volt battery set), battery no. 6 (for 6 x 8-volt battery set), or battery no. 8 (for 8 x 6-volt battery set).
2. Normal no-load voltage should be between 50 and 52 volts for a fully charged battery set. Normal no-load voltage of an individual battery should not be less than 0.5 volts of the other 7 batteries (for 8 x 6-volt battery set) or 0.7 volts of the other 5 batteries (for 6 x 8-volt battery set) or 1.0 volt of the other 3 batteries (for 4 x 12-volt battery set).

TEST PROCEDURE 2 – BATTERY CONDITION USING CHARGER – ALL BATTERIES

The easiest way to monitor the condition of a vehicle's batteries is simply to observe the Charger Information Light (usually found on the dash) at the end of the charge cycle. After a full charge, disconnect the charger AC plug, wait 30 seconds and reconnect the charger AC plug. The red LED in the Charger Information Light will flash quickly and then flash slowly within 10 to 20 minutes, indicating sound, fully charged batteries.

NOTE: *Batteries near the end of their useful lives may not allow the battery charge current to taper and the red Charger Information Light will continue to flash quickly.* ***See Batteries Section in the appropriate maintenance and service manual.***

Continued poor performance may indicate a problem in the vehicle electrical system, brakes or battery charger. If the problem is not found in the vehicle or charging system, proceed to the on-charge voltage test. If the red LED in the Charger Information Light does not change to a slow flash, the batteries should be tested further using the on-charge voltage test.

TEST PROCEDURE 3 – ON-CHARGE BATTERY VOLTAGE USING CHARGER AND MULTIMETER – ALL BATTERIES

When the batteries are fully charged, disconnect the charger DC plug. Wait 20 to 30 seconds and reconnect the DC plug to restart the charger. After 5 minutes, use a multimeter to check and record the voltage of the battery set as well as the individual batteries. Set the multimeter to 200 volts DC. Place the red (+) probe on the positive (+) post of battery no. 1 and the black (–) probe on the negative (–) post of battery no. 4 (for 4 x 12-volt battery set), battery no. 6 (for 6 x 8-volt battery set), or battery no. 8 (for 8 x 6-volt battery set). Record reading. Then set multimeter to 20 volts DC and place the red (+) probe on the positive (+) post and the black (–) probe at the negative (–) post of each battery. Record the readings.

The on-charge voltage for the set should be between 56.0 volts and 63.0 volts depending on the age and state of charge of the batteries being tested.

For 6 volt batteries: If individual batteries read above 7.0 volts and are within 0.5 volts of each other, go to the hydrometer test (flooded lead-acid batteries) or discharge test (gel cell or AGM batteries). If any battery reads below 7.0 volts and not within 0.5 volts of those batteries above 7.0 volts, replace battery. If readings are below 7.0 volts but within 0.5 volts of each other, the batteries are old.

For 8 volt batteries: If individual batteries read above 9.3 volts and are within 0.7 volts of each other, go to the hydrometer test (flooded lead-acid batteries) or discharge test (gel cell or AGM batteries). If any battery reads below 9.3 volts and not within 0.7 volts of those batteries above 9.3 volts, replace battery. If readings are below 9.3 volts but within 0.7 volts of each other, the batteries are old.

For 12 volt batteries: If individual batteries read above 14.0 volts and are within 1.0 volt of each other, go to the hydrometer test (flooded lead-acid batteries) or discharge test (gel cell or AGM batteries). If any battery reads below 14.0 volts and not within 1.0 volt of those batteries above 14.0 volts, replace battery. If readings are below 14.0 volts but within 1.0 volt of each other, the batteries are old.

Old batteries may have enough capacity left to last several more months. Go to hydrometer test (flooded lead-acid batteries) or discharge test (gel cell or AGM batteries).

TEST PROCEDURE 4 – HYDROMETER TEST – FLOODED LEAD-ACID BATTERIES ONLY

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

Performing the Hydrometer Test

1. Be sure batteries have sufficient electrolyte to cover plates by approximately 1/2 inch (13 mm) and are fully charged prior to beginning test. If water must be added, recharge the batteries before performing the hydrometer test.
2. Remove the vent cap. Using a battery thermometer (CC P/N 1011767), record electrolyte temperature of the no. 2 cell.
3. Squeeze the rubber bulb of the hydrometer and insert into the cell. Slowly release the bulb, drawing electrolyte up into the glass tube of the hydrometer.
4. When the float rises off the bottom, adjust the electrolyte level so that the float rides free of the bottom but does not strike the top of the glass tube. Remove the hydrometer from the cell and release the pressure from the bulb.
5. Hold the hydrometer vertically, ensuring that the float is not touching the sides of the barrel. Hold the hydrometer at eye level and read the scale at the level of electrolyte **(Figure 10-4, Page 10-12)**.
6. Record the reading and return the electrolyte to the cell from which it was taken. Replace vent cap.
7. Repeat steps 2 through 6 on all cells.

Hydrometer Calibration

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

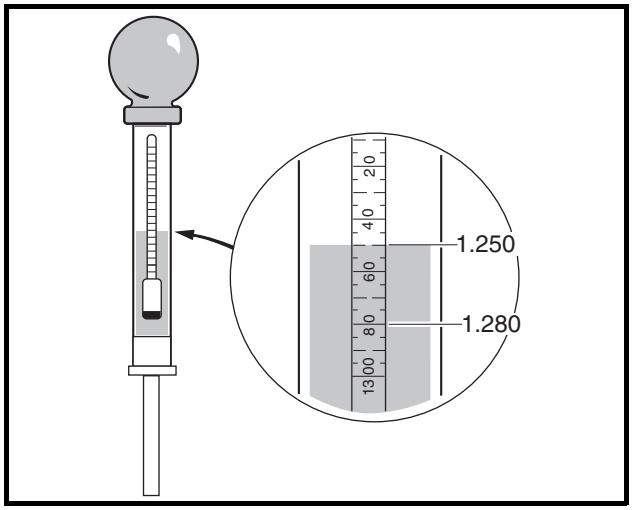


Figure 10-4 Hydrometer Test

View at eye level.

Interpreting the Results of the Hydrometer Test: 12-Volt Batteries

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

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

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

VEHICLE NO.	BATTERY NO.	ELECTROLYTE TEMPERATURE	CORRECTION FACTOR	CORRECTED SPECIFIC GRAVITY						REQUIRED ACTION
				CELL 1	CELL 2	CELL 3	CELL 4	CELL 5	CELL 6	
12	1	20 °F (–6.6 °C)	–0.024	1.275 – 0.024 = 1.251	1.280 – 0.024 = 1.256	1.280 – 0.024 = 1.256	1.275 – 0.024 = 1.251	1.280 – 0.024 = 1.256	1.280 – 0.024 = 1.256	Sound Battery – Fully Charged
54	3	50 °F (10 °C)	–0.012	1.260 – 0.012 = 1.248	1.200 – 0.012 = 1.188	1.270 – 0.012 = 1.258	1.265 – 0.012 = 1.253	1.270 – 0.012 = 1.258	1.260 – 0.012 = 1.248	Bad no. 2 Cell
38	2	100 °F (37.8 °C)	+.008	1.200 + 0.008 = 1.208	1.180 + 0.008 = 1.188	1.170 + 0.008 = 1.178	1.200 + 0.008 = 1.208	1.180 + 0.008 = 1.188	1.198 + 0.008 = 1.198	Discharged Battery – Recharge and Recheck
22	4	80 °F (26.7 °C)	.000	1.240 – 0 = 1.240	1.245 – 0 = 1.245	Float does not rise	1.235 – 0 = 1.235	1.250 – 0 = 1.250	1.240 – 0 = 1.240	no.3 Cell Dead – Replace Battery

Interpreting the Results of the Hydrometer Test: 8-Volt Batteries

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

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

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

VEHICLE NO.	BATTERY NO.	ELECTROLYTE TEMPERATURE	CORRECTION FACTOR	CORRECTED SPECIFIC GRAVITY				REQUIRED ACTION
				CELL 1	CELL 2	CELL 3	CELL 4	
12	1	20 °F (-6.6 °C)	– 0.024	1.275 –0.024 = 1.251	1.280 – 0.024 = 1.256	1.280 – 0.024 = 1.256	1.280 – 0.024 = 1.256	Sound Battery – Fully Charged
35	6	90 °F (32.2 °C)	+ 0.004	1.155 + 0.004 = 1.159	1.165 + 0.004 = 1.169	1.160 + 0.004 = 1.164	1.165 – 0.004 = 1.169	Discharged Battery – Recharge
54	3	50 °F (10 °C)	– 0.012	1.260 –0.012 = 1.248	1.200 – 0.012 = 1.188	1.270 – 0.012 = 1.258	1.270 – 0.012 = 1.258	Bad no. 2 Cell
69	5	80 °F (26.7 °C)	0.000	1.250 – 0 = 1.250	1.255 – 0 = 1.255	1.230 – 0 = 1.230	1.250 – 0 = 1.250	Weak no. 3 Cell – Catch-up Charge
38	2	100 °F (37.8 °C)	+ 0.008	1.200 + 0.008 = 1.208	1.180 + 0.008 = 1.188	1.170 + 0.008 = 1.178	1.180 + 0.008 = 1.188	Discharged Battery – Recharge and Recheck
22	4	80 °F (26.7 °C)	0.000	1.240 – 0 = 1.240	1.245 – 0 = 1.245	Float does not rise	1.250 – 0 = 1.250	no.3 Cell Dead – Replace Battery

Interpreting the Results of the Hydrometer Test: 6-Volt Batteries

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

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

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

VEHICLE NO.	BATTERY NO.	ELECTROLYTE TEMPERATURE	CORRECTION FACTOR	CORRECTED SPECIFIC GRAVITY			REQUIRED ACTION
				CELL 1	CELL 2	CELL 3	
12	1	20 °F (-6.6 °C)	– 0.024	1.275 –0.024 = 1.251	1.280 – 0.024 = 1.256	1.280 – 0.024 = 1.256	Sound Battery – Fully Charged
35	6	90 °F (32.2 °C)	+ 0.004	1.155 + 0.004 = 1.159	1.165 + 0.004 = 1.169	1.160 + 0.004 = 1.164	Discharged Battery – Recharge
54	3	50 °F (10 °C)	– 0.012	1.260 –0.012 = 1.248	1.200 – 0.012 = 1.188	1.270 – 0.012 = 1.258	Bad no. 2 Cell
69	5	80 °F (26.7 °C)	0.000	1.250 – 0 = 1.250	1.255 – 0 = 1.255	1.230 – 0 = 1.230	Weak no. 3 Cell – Catch-up Charge
38	2	100 °F (37.8 °C)	+ 0.008	1.200 + 0.008 = 1.208	1.180 + 0.008 = 1.188	1.170 + 0.008 = 1.178	Discharged Battery – Recharge and Recheck
22	4	80 °F (26.7 °C)	0.000	1.240 – 0 = 1.240	1.245 – 0 = 1.245	Float does not rise	no.3 Cell Dead – Replace Battery

TEST PROCEDURE 5 – DISCHARGE TEST – ALL BATTERIES

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

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

Performing the Discharge Test

1. Be sure the batteries are fully charged and that the electrolyte level is correct in all cells.
2. Connect the tester leads to the positive (+) post of battery no.1 and negative (–) post of battery no. 4 last (Style A and B 4 x 12-Volt Precedent) **(Figure 10-5, Page 10-15) and (Figure 10-6, Page 10-15)** or no. 6 last (Style C 6 x 8-Volt Precedent) **(Figure 10-7, Page 10-15)**.
3. Check and record the electrolyte temperature of the battery packs. Check cell no. 2 (second cell from positive post) in each battery.

4. Reset discharge machine and turn the tester ON.
5. When the batteries have been discharging for approximately 60 minutes, set the discharge machine to function 3 and check battery set voltage. Check voltage every 10 minutes throughout the rest of the test. As soon as the battery set voltage reaches 0.5 volts above the shut-off point (42.0 volts), use a multimeter to measure individual battery voltages. Measure and record the voltage of each battery to the nearest 0.01 volt. **See following NOTE.**

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

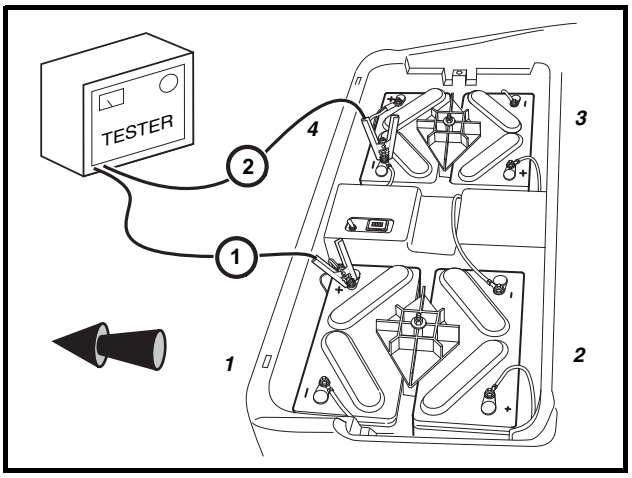


Figure 10-5 Battery Discharge Test – Precedent Style A Battery Configuration

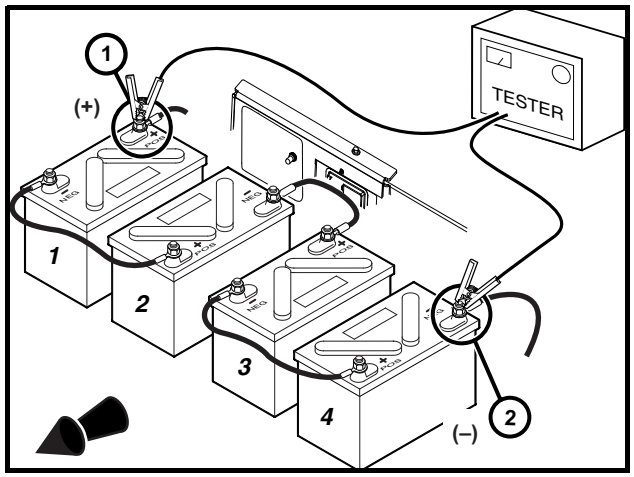


Figure 10-6 Battery Discharge Test – Precedent Style B Battery Configuration

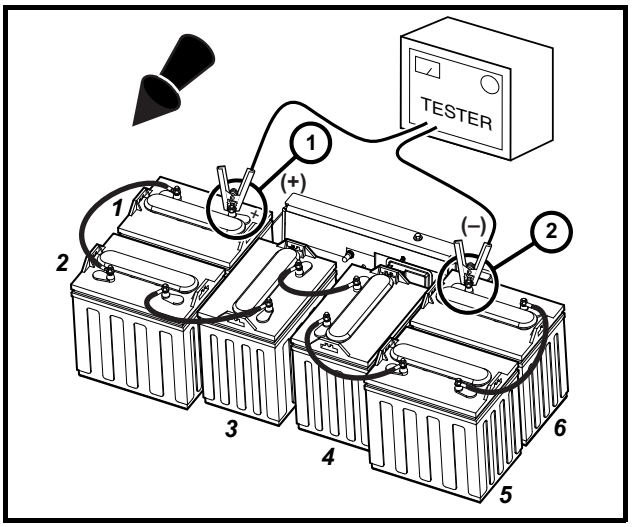


Figure 10-7 Battery Discharge Test – Precedent Style C Battery Configuration

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

Interpreting Discharge Test Results: 12-Volt Batteries

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

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

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

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

Interpreting Discharge Test Results: 8-Volt Batteries

1. If discharge time is 60 minutes or higher, the problem is not with the batteries.
2. If discharge times are low (less than 60 minutes), replace batteries below 6.7 volts.

BATTERY VOLTAGES						BATTERY CONDITION
1	2	3	4	5	6	
7.00 V	7.00 V	7.00 V	7.00 V	7.00 V	7.00 V	Excellent
7.07 V	7.07 V	7.22 V	6.50 V	7.07 V	7.07 V	Battery no. 4 is near end of useful life
7.20 V	7.20 V	6.67 V	7.33 V	6.27 V	7.33 V	Battery nos. 3 and 5 are near end of useful life

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

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

Interpreting Discharge Test Results: 6-Volt Batteries

1. If discharge time is 60 minutes or higher, the problem is not with the batteries.
2. If discharge times are low (less than 60 minutes), replace batteries below 5.0 volts.

BATTERY VOLTAGES								BATTERY CONDITION
1	2	3	4	5	6	7	8	
5.25 V	5.25 V	5.25 V	5.25 V	5.25 V	5.25 V	5.25 V	5.25 V	Excellent
5.30 V	5.30 V	5.45 V	4.70 V	5.30 V	5.30 V	5.30 V	5.30 V	Battery no. 4 is near end of useful life
5.40 V	5.40 V	5.00 V	5.40 V	4.60 V	5.40 V	5.40 V	5.40 V	Battery nos. 3 and 5 are near end of useful life

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

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

BATTERY TROUBLESHOOTING EXAMPLES: 12-Volt Batteries

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

Example 1

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

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

*Battery no. 3 appears suspect. Battery nos. 1 and 4 are also suspect. Next, a hydrometer test (flooded lead-acid batteries only) or discharge test should be conducted on all batteries.

Hydrometer test results:

CELL NUMBER	BATTERY NUMBER			
	1	2	3	4
Cell 1 (Positive Post)	1.200*	1.265	1.300	1.250
Cell 2	1.285	1.275	1.290	1.270
Cell 3	1.265	1.270	1.275	1.265
Cell 4 (Negative Post)	1.275	1.270	1.285	1.265
Cell 5	1.270	1.265	1.280	1.270
Cell6	1.275	1.280	1.280	1.260

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

Discharge test results:

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

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

Example 2

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

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

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

BATTERY TROUBLESHOOTING EXAMPLES: 8-Volt Batteries

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

Example 1

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

BATTERY NO.	1	2	3	4	5	6
On-Charge Voltage	10.15 V	10.60 V	9.80* V	10.16 V	10.56 V	10.61 V

*Battery no. 3 appears suspect. Batteries no. 1 and 4 are also suspect. Next, a hydrometer test (flooded lead-acid batteries only) or discharge test should be conducted on all batteries.

Hydrometer test results (flooded lead-acid batteries only):

CELL NUMBER	BATTERY NUMBER					
	1	2	3	4	5	6
Cell 1 (Positive Post)	1.200*	1.265	1.300	1.250	1.280	1.260
Cell 2	1.285	1.275	1.290	1.270	1.295	1.265
Cell 3	1.265	1.270	1.275	1.265	1.280	1.275
Cell 4 (Negative Post)	1.275	1.270	1.285	1.265	1.275	1.275

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

Discharge test results:

BATTERY NO.	1	2	3	4	5	6
Discharge Voltage	5.44* V	7.33 V	7.73 V	7.15 V	7.43 V	7.41 V

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

Example 2

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

BATTERY NO.	1	2	3	4	5	6
On-Charge Voltage	10.48 V	9.77* V	10.53 V	10.57 V	10.55 V	10.33 V

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

BATTERY TROUBLESHOOTING EXAMPLES: 6-Volt Batteries

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

Example 1

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

BATTERY NO.	1	2	3	4	5	6	7	8
On-Charge Voltage	7.40 V	7.60 V	7.10* V	7.40 V	7.70 V	7.80 V	7.80 V	7.80 V

*Battery no. 3 appears suspect. Batteries no. 1 and 4 are also suspect. Next, a hydrometer test (flooded lead-acid batteries only) or discharge test should be conducted on all batteries.

Hydrometer test results (flooded lead-acid batteries only):

CELL NUMBER	BATTERY NUMBER							
	1	2	3	4	5	6	7	8
Cell 1 (Positive Post)	1.200*	1.265	1.300	1.250	1.280	1.260	1.260	1.260
Cell 2	1.285	1.275	1.290	1.270	1.295	1.265	1.265	1.265
Cell 3 (Negative Post)	1.265	1.270	1.275	1.265	1.280	1.275	1.275	1.275

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

Discharge test results:

BATTERY NO.	1	2	3	4	5	6	7	8
Discharge Voltage	3.80* V	5.25 V	5.65 V	5.25 V	5.50 V	5.60 V	5.70 V	5.30 V

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

Example 2

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

BATTERY NO.	1	2	3	4	5	6	7	8
On-Charge Voltage	7.40 V	7.10* V	7.45 V	7.6 V	7.65 V	7.50 V	7.55 V	7.65 V

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

CHARGER REPAIRS

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

NOTE: *The high frequency charger offers no replacement parts. If necessary, the charger must be replaced.* ***See Onboard Charger Removal and Installation, Section 10, Page 10-22.***

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 10-3, Page 10-4).**
- **Prior to servicing the charger, disconnect the AC power supply cord from the wall outlet and remove the battery charger from the vehicle.**

Onboard Charger Removal

1. Disconnect the batteries and discharge the controller. **See Disconnecting The Batteries on page 1-3.**
2. Remove the wire ties securing the AC cord to the body.
3. Disconnect the charger AC cord from the charger harness.
4. Disconnect the charger harness 10-pin plug from charger.
5. Remove four lock nuts (5) securing charger to charger mounting plate.
6. Remove charger from vehicle.

Onboard Charger Installation – Precedent Vehicles

1. Installation is reverse of removal.
2. Tighten four lock nuts to 40 in-lb (5.4 N·m).
3. Connect the batteries. **See Connecting The Batteries on page 1-4.**

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 2-1.**

B

C

D

High Frequency charger (onboard)

IQ Plus charger (external)

IQ Plus charger (onboard)

PowerDrive 2 charger

PowerDrive 3 charger (Model 26560)

PowerDrive 3 charger (Model 26580)

PowerDrive charger (external)

PowerDrive charger (onboard)

W

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NOTES

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