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! **CAUTION** - The dual AC input charger may be equipped with an AC voltage select switch located on the front of the unit which will allow you to connect the charger to one of two AC supply voltages. You must be absolutely sure that the switch matches the supply voltage to which the charger will be connected.

In most cases, chargers having an external AC voltage select switch will also have a detachable power supply cord. This cord/plug assembly must match the wall receptacle to which it will be connected. If the detachable power cord is not proper for your application *DO NOT* modify. You must secure the cord that is required or call the factory for guidance. Some models may be equipped with a fixed power cord.

Installation of a charger consists of providing a proper AC power source and selecting a proper location. Even though the charger is portable, a permanent location for operation is strongly recommended. The permanent location must have enough room to bring in equipment for charging.

Always set the charger on a flat hard surface to insure proper air circulation under and around it. The area must be well ventilated, because explosive hydrogen gas is generated while charging the batteries. Exercise caution to avoid possible open flame or electrical sparks near the operation. For general safety, do not place the charger on the floor. Make sure that the AC line cord and DC output cables do not obstruct traffic.

4 Pre-operating Procedure

! **CAUTION** - Impurities in tap water will damage battery plates.

If you have a wet battery system, check fluid level in each cell and, if necessary, add enough filtered or distilled water to cover the battery plates, but do not allow fluid to rise into the cell filler necks. **IF LOW, ALWAYS FILL CELL, ONLY TO PROPER LEVEL, AFTER CHARGE CYCLE.** SEE BATTERY INSTRUCTIONS. SVR Battery systems are sealed and should not be opened. The addition of water is not required.

! **WARNING** - Hydrogen gas, formed while charging, is explosive. Avoid open flame or electrical spark near battery. To avoid accumulation of gas, be sure batteries are charged in a well-ventilated area.

! **DANGER** - Visually and manually inspect to verify the DC output cord set, plug and battery charging receptacle are in good working condition before each and every use and do not use the charger if:

9 CHARGE PROFILE CHANGE PROCEDURE

! **WARNING:** This charger may be provided with a manual selectable charge profile feature that allows for the proper charging of:

(W) = Wet gassing lead acid batteries

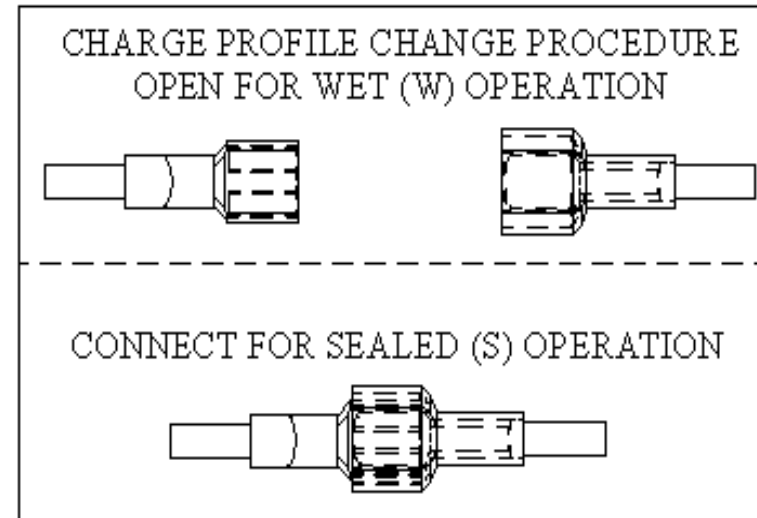
or

(S) = Sealed valve regulated (SVR), gelled/agm type lead acid batteries

Verify charge profile setting after charge begins. A flashing incomplete LED prior to the 80% LED coming on indicates a (S) sealed valve regulated profile has been selected. If not flashing, charger is in a (W) wet charging profile.

NOTE: Any chargers having a circuit with date code 9719 or earlier did not incorporate this flashing LED feature.

! **CAUTION:** Improper profile setting may damage the batteries. To change setting remove cover and follow instructions in charger.



3] CONSTANT FINISH CURRENT - To fully charge the batteries while avoiding damage to the batteries, a lower constant current is delivered to the batteries. Charge is terminated when battery is fully charged. During the charging process, the rate of voltage rise over time is constantly monitored. As long as the voltage rises faster than pre-established parameters, the control circuit will keep the charger on until finishing the 3-step I-E-I charge cycle. Otherwise, the charge cycle will be terminated. A 16 to 20 hour backup timer is also programmed into the microprocessor. This will terminate the charge cycle in 16 to 20 hours in the event that a normal shutoff does not occur.

Your charger may incorporate a different charge profile than explained above. If you wish further information on your specific charger you can call the factory. Please have nameplate data information available.

6 Normal Operation

! WARNING - FOR DUAL VOLTAGE MODELS MAKE SURE TO MOVE VOLTAGE SELECTION SWITCH TO PROPER POSITION TO MATCH AC SUPPLY VOLTAGE.

! WARNING - To reduce the risk of an electric shock, connect only to a properly grounded single-phase (3 wire) outlet. Refer to grounding instructions.

1. For dual AC voltage chargers set switch to match AC supply voltage.
2. Plug AC cord into grounded receptacle.
3. Plug DC cord into battery receptacle.
4. All LED's will flash.
5. Charge will begin after a few seconds.
6. **WARNING:** This charger may be provided with a manual selectable charge profile that allows for proper charging of:

(W) = Wet gassing lead acid batteries
or

(S) = Sealed valve regulated (SVR), gelled/agm type lead acid batteries.

Verify charge profile setting after charge begins. A flashing incomplete LED prior to the 80% LED coming in indicates a (S) sealed valve regulated profile has been selected. If not flashing, charger is in a (W) wet charging profile.

AC CIRCUIT CHECKOUT PROCEDURE FOR DUAL INPUT VOLTAGE CHARGERS

Check for proper input voltage to primary of transformer. Set meter to read AC voltage.

<u>ACTION</u>	<u>MEASURE</u>	<u>IF</u>	<u>THEN</u>
Step 1 - Set AC voltage selection switch to proper position. Step 2 - Place AC voltage test leads of meter at wall receptacle.	Measure voltage 100-130 volts AC or 200-260 volts AC	No	Check wall breaker.
Step 3 - Remove charger cover. Step 4 - Place one meter test lead on the IEC320 socket terminal that is connected to a brown wire. Place the other meter test lead on the IEC320 socket terminal that is connected to a blue wire. Step 5 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 100-130 volts AC or 200-260 volts AC	No	Replace AC cord.
Step 6 - Move meter test leads to voltage selection switch terminals where the brown and blue wires are connected. Step 7 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 100-130 volts AC or 200-260 volts AC	No	Check connections from IEC320 socket to voltage selection switch.
Step 8 - Move the meter test lead at the voltage selection switch terminal with a brown wire to the circuit breaker (referred to as the first circuit breaker) terminal that is connected to the voltage selection switch. Leave the other meter test lead as in Step 6. Step 9 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 100-130 volts AC or 200-260 volts AC	No	Check connections from the voltage selection switch to the first circuit breaker.

2- If shorted battery cells are detected during a charge cycle, the Red LED "Abnormal Cycle" will flash in a pattern of being on for 2 seconds and off for 1 second.

3- If batteries are disconnected from the charger during a charge cycle, the Yellow LED "Charger On" will turn off. The charger will also shut off.

4a- On most models, if AC power is lost during a charge cycle, the Yellow LED "Charger On" will turn off and the Red LED "Abnormal Cycle" will turn on. The battery status LED (either Yellow "80% Charge" or Red "Incomplete") will remain on. The Yellow LED "Charger On" will come back on and the Red LED "Abnormal Cycle" will turn off upon resumption of AC power.

4b- On models that are AC powered only, if AC power is lost during a charge cycle, the charger will turn off and all LED's will go out. Upon resumption of AC power, charger will go through self-diagnostic test (LED's flash) and charge cycle will restart.

5- In the event of output over-current, the Yellow LED "Charger On" will turn off and the Red LED "Abnormal Cycle" will flash. The battery status LED (either Yellow "80% Charge" or Red "Incomplete") will remain on.

7 Full Charge Sentry (FCS)

This feature was developed to maintain batteries in a charged state while they are left in storage. FCS will be found on most MAC SCR Domestic chargers. This feature is not incorporated into the Export Dual AC Voltage models. The FCS feature will be activated upon satisfaction of the following four conditions:

1. Charger is connected to the battery and AC power.
2. Battery voltage reached 2.50 volts per cell at the end of the last charge cycle.
3. Battery has been in storage for at least 14 days since the last complete charge cycle.
4. Battery voltage falls below 2.05 volts per cell.

If these conditions are met, the charger will automatically maintain the battery as required.

NOTE: A charger with FCS should not be used in applications where the charger's DC output is permanently connected to the battery. The Export charger should be selected for these applications.

ACTION

MEASURE

IF

THEN

Step 9 - Keep negative test lead as located in Step 3. Place positive test lead on #6 pin of the white 17-pin J1 connector on circuit board. Note that #1 pin of J1 connector starts on the other end of the circuit board across from the green LED.
Step 10 - Plug DC connector into receptacle. Measure voltage and unplug.

Measure Voltage
1.70vpc-2.16vpc

No

Check connection from circuit breaker or fuse to #6 pin of J1 connector on the circuit board.

Step 11 - keep negative test lead as located in Step 3. Place positive test lead on #16 on J1 connector.
Step 12 - Plug DC connector into receptacle, measure voltage and unplug.

Measure Voltage
1.70vpc-2.16vpc

No

Check connection from circuit breaker or fuse to #16 pin of J1 connector on circuit board.

Step 13 - Keep positive test lead located in Step 11. Move negative test lead to #5 pin of J1 connector on the circuit board.
Step 14 - Plug DC connector into receptacle. Measure voltage and unplug.

Measure Voltage
1.70vpc-2.16vpc

No

Check connection from shunt or fuse to #5 pin of J1 connector on the circuit board.

GENERAL SERVICE PROCEDURES

Refer to quick check guide first before working on charger or removing cover. The obvious is often missed.

If unable to diagnose from quick check, unplug AC and DC connectors, and remove cover. Carefully inspect for damaged, discolored components and loose or discolored wiring. If unable to spot problem, proceed to DC Circuit Checkout Procedure.

Quick Check Guide

- Charger does not come on - no transformer hum with charger unplugged:
- check AC voltage to charger
 - check circuit breaker
 - check for continuity through DC fuse
 - check DC plug and receptacle for good connection
 - check for loose component/wire connections

<u>PROBLEM</u>	<u>THIS MEANS</u>	<u>YOU SHOULD</u>
AC circuit breaker trips	Abnormal voltage or current spikes	Reset
	AC voltage switch in wrong position or wrong supply voltage	Correct switch
AC circuit breaker trips after reset	Possible wrong circuit breaker or transformer or SCR	Have qualified service technician inspect.
DC fuse/breaker blows	SCR short, circuit board malfunction	Same as above

<u>PROBLEM</u>	<u>THIS MEANS</u>	<u>YOU SHOULD</u>
Charger will not turn on: No LED self test or all keep flashing	No AC power	Check charger circuit breaker LEDs and supply voltage wall breaker
	Poor DC connection	Check connection from charger to battery
	Battery voltage less than 1.25 VPC	Check battery voltage
Charger will not turn on LED self test OK	No AC power	Check charger circuit breaker and supply voltage wall breaker
Charger will not turn on LED self test is partially OK	Circuit board may have failed. SCR failed	Have qualified service technician inspect
Charger will not shut off	Circuit board may have failed. SCR short	Same as above
LED's show abnormal		Refer to pages 8-9 LED Indicators - Abnormal Charge Sequence

LIMITED WARRANTY

Motor Appliance Corporation (hereafter called MAC) warrants that each new and unused MAC Commercial Battery Charger manufactured is of good workmanship and is free from any known mechanical or electrical defect(s). This warranty is contingent upon that (1) the product is installed and operated in accordance with generally accepted industrial standards and in accordance with the printed instructions provided by MAC, (2) the product is used under normal conditions for which designed, (3) the product is not subject to misuse, negligence or accident, and (4) the product received proper care, protection and maintenance under supervision of competent personnel. This limited warranty is subject to the following provisions:

- 1 **WARRANTED PRODUCTS AND PARTS. SERVICE LABOR COST IS NOT COVERED.** Subject to the exception listed below each MAC Commercial Battery Charger is warranted for a period of twenty-four (24) months from the date of manufacture. The exceptions to this warranty are as follows:
 - a AC & DC Fuses and AC & DC power cables are not warranted unless found defective upon initial installation.
 - b This warranty does not apply to a charger used in a mine or in mining operations.
 - c Damage due to voltage surges, lightning, acid spills and customer abuse are not covered by this warranty.
- 2 **NON-TRANSFERABLE WARRANTY.** This warranty is extended by MAC only to the original user (purchaser) of new equipment from MAC or one of its authorized selling organizations. The products purchased under this agreement shall be used exclusively by the buyer. There shall be no third party or beneficiary to this warranty.
- 3 **REPAIR LIMITATIONS.** The existence of claimed defects in any product covered by this warranty is subject to MAC's factory inspection and judgement. MAC's liability is limited to the repair and replacement of the defective product found by MAC or MAC's Authorized Service Centers. Return defective product pre-paid to MAC, Industrial Drive, Blytheville, AR 72315. Replacement and exchange parts will be warranted for the remainder of the original MAC Commercial Battery Charger Limited Warranty period or warranted for a period of ninety (90) days, whichever is greater.

MAC and its authorized service centers shall not be liable for direct or indirect damages in excess of such repair or replacement. In no event shall the purchaser be entitled to recover for contingent expenses resulting from but not limited to, telephone calls, telegrams, travel expenses, lodging, duties and taxes, labor, rental or replacement equipment, batteries, loss of business or profits or other commercial losses.
- 4 **CONTINUED USE OF DEFECTIVE PRODUCT.** The continued use of a MAC Commercial Battery Charger that is known to be defective **VOIDS ALL WARRANTIES.**
- 5 **REPAIRED OR MODIFIED EQUIPMENT.** Except as authorized in writing, the warranty specified does not cover any equipment that has been repaired by any party other than MAC or its authorized service centers. Except as authorized in writing, this warranty does not cover any equipment that has been modified, mechanically or electrically, by any party other than MAC.
- 6 **WARRANTY EXPENSE LIMITATION.** MAC shall limit the warranty expenses for all chargers to be paid at a maximum of the original purchase price of the charger.

EXCEPT AS STATED ABOVE, ALL OTHER WARRANTIES AND CONDITIONS, EITHER EXPRESSED OR IMPLIED, INCLUDING IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXCLUDED AND BUYER ASSUMES ALL RISK AND LIABILITY RESULTING FROM THE USE OF THE GOODS. MAC NEITHER ASSUMES NOR AUTHORIZES ANY PERSONS TO ASSUME FOR MAC ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OR USE OF THE GOODS SOLD, AND THERE ARE NO ORAL AGREEMENTS OR WARRANTIES COLLATERAL TO OR AFFECTING THIS WRITTEN WARRANTY.

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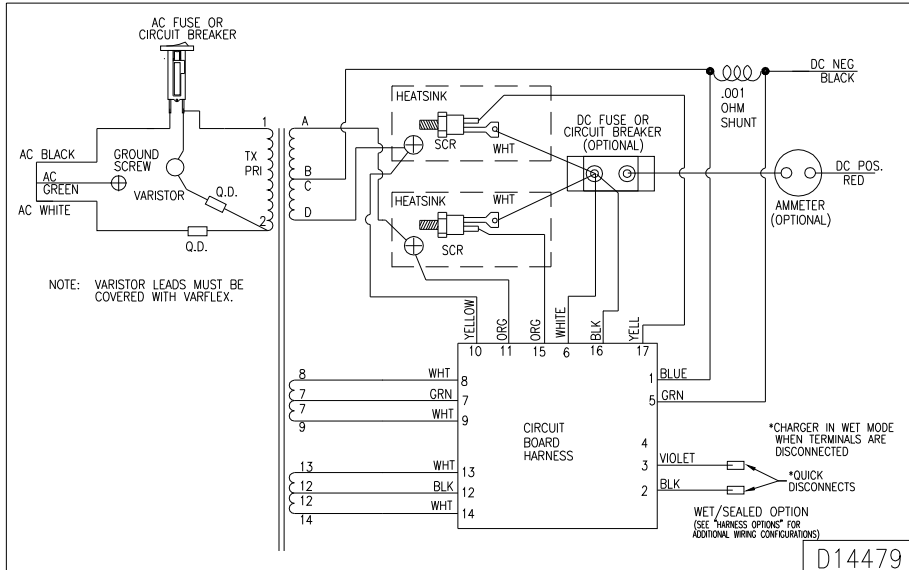
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Throughout this manual look for this symbol **!**. It means **BE ALERT - YOUR SAFETY IS INVOLVED.** If you do not follow these safety instructions, personal injury or property damage can occur.

WIRING DIAGRAMS

FOR SINGLE INPUT VOLTAGE CHARGERS

NOTE: When ordering parts, give information off the charger data nameplate.



Do not operate this charger with an extension cord. Locate cord so that it will not be stepped on, tripped over, or otherwise subjected to damage or stress.

Do not operate this charger if it has been subject to abuse, damage or improper maintenance.

Provide adequate ventilation for the batteries and charger. The convection-cooled design requires an unobstructed flow of cooling air for proper operation. Keep all charger ventilation openings at least two (2) inches (5cm) away from walls and other objects. Do not allow clothing, blankets, or other material to cover the charger.

! WARNING: Chargers can ignite flammable materials and vapors. Do not use near fuels, grain dust, solvents, or other flammables.

! WARNING: To reduce the risk of an electric shock, keep the charger dry. Do not expose it to rain. For storage, keep the charger in a building.

Grounding Instructions

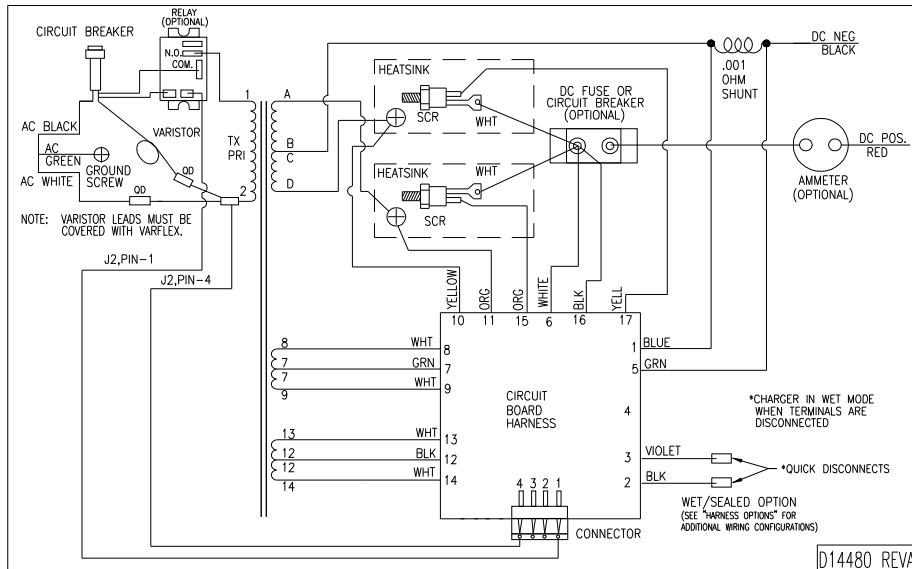
! WARNING - Improper connection of the equipment-grounding conductor can result in a risk of an electric shock.

This battery charger must be grounded to reduce the risk of electric shock. The charger is equipped with an electric cord having an equipment-grounding conductor. This plug must be connected to an appropriate receptacle that is properly installed and grounded in accordance with the National Electrical Code and all local codes and ordinances.

The conductor with insulation having an outer surface that is green, with or without yellow stripes, is the equipment-grounding conductor. If charger is to be used in other parts of the world other than USA, check local codes. If repair or replacement of the electric cord or plug is necessary, do not connect the equipment-grounding connector to a live terminal.

Installation - IMPORTANT SAFETY INSTRUCTIONS - SAVE THESE INSTRUCTIONS!

! DANGER - To reduce the risk of fire or electric shock, carefully follow these instructions.



<u>ACTION</u>	<u>MEASURE</u>	<u>IF</u>	<u>THEN</u>
Step 10 - Move the meter test lead to the other terminal of the first circuit breaker. Leave the other meter test lead as located in Step 6. Step 11 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 100-130 volts AC or 200-260 volts AC	No	Check whether the first circuit breaker popped out. If yes, perform Step 1 and reset the first circuit breaker.
Step 12 - Leave the meter test lead at the first circuit breaker terminal as located in Step 10. Move the other meter test lead to the terminal (that is connected to the voltage selection switch) of the other circuit breaker (referred to as the second circuit breaker). Step 13 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 100-130 volts AC only.	No	Check connections at voltage selection switch and to circuit breaker. If O.K. replace voltage selection switch.
Step 14 - Leave the meter test lead at the first circuit breaker as located in Step 10. Move the other meter test lead to the other terminal of the second circuit breaker. Step 15 - Plug AC cord into wall receptacle. Measure voltage and unplug	Measure voltage 100-130 volts AC only.	No	Check whether circuit breaker popped out. If yes, perform Step 1 and reset the second circuit breaker. If no, replace the second circuit breaker.

AC CIRCUIT CHECKOUT PROCEDURE

SCR CHECKOUT PROCEDURE

Unplug AC plug and DC plug.

Unplug J1 and J2 (If applicable) connector on circuit boards.

1. With VOM set to ohms, place one test lead on heatsink and the other on cathode (long stem). Should read high resistance.
2. With VOM set to ohms, place one test lead on heatsink and the other on gate (short stem). Should read high resistance.
3. With one probe on cathode and one on gate, should read low resistance; reversing probes should read low resistance.

1. The DC charging receptacle does not grip the DC output plug tightly, is loose or does not make a good electrical connection.
2. The DC output plug and/or charging receptacle feel hotter than normal.
3. The DC output plug pins or receptacle contacts are bent, corroded or are dark or bluish in appearance.
4. The DC output plug, cords, receptacle or equipment charging wiring are cut, worn, broken, or have any exposed conductors.
5. The DC output plug, cords, charger or receptacles are damaged or distressed in any way.

Using the charger with any of the above symptoms could result in a fire, property damage, or personal injury.

Have your distributor, dealer or other qualified service technician repair or replace worn or damaged parts immediately. Repairs should not be attempted by people who are not qualified.

Check that there is no open flame or electrical spark in the area.

! CAUTION - Improper AC power can damage the charger. Consult data plate on the charger to verify AC input power requirements. Note CAUTION in Installation Section.

5 Theory of Operation

The control circuit monitors battery voltage and charging current. A microprocessor and silicon controlled rectifiers (SCR's) are employed to realize a modified 2-step-E-I or 3-step I-E-I charge profile.

1] CONSTANT START CURRENT - Charge current to the batteries is maintained at a constant value during initial charge stage to ensure capacity is rapidly returned to discharged batteries until battery voltage per cell reaches a specified level.

2] CONSTANT VOLTAGE - To rapidly charge the batteries without exposing them to both high current and high voltage, the battery voltage is maintained at a steady voltage while being charged with decreasing current.

AC CIRCUIT CHECKOUT PROCEDURE FOR SINGLE INPUT VOLTAGE CHARGERS

Check for proper input voltage to primary of transformer. Set meter to read AC voltage.

<u>ACTION</u>	<u>MEASURE</u>	<u>IF</u>	<u>THEN</u>
Step 1 - Place AC voltage test leads of meter at wall receptacle.	Measure voltage 100-130 volts AC	No	Check wall breaker or fuse.
Step 2 - Remove cover. Step 3 - Place one meter test lead on the varistor leg that connects to white wire of AC cord. Place the other test lead on the charger circuit breaker terminal that is connected to black wire of AC cord. Step 4 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 100-130 volts AC	No	Replace AC cord.
Step 5 - Keep connection at varistor leg as in Step 3. Move circuit breaker connection to the other terminal of circuit breaker. Step 6 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 100-130 volts AC	No	Replace circuit breaker.
Step 7 - Plug DC connector into receptacle.	All LED's will flash through the self diagnostic sequence	No	Perform DC circuit checkout procedure.
Step 8 - Place meter test leads on terminals A & B of relay. Step 9 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 90-130 volts AC	No	Check wire harness of #4 pin connector on circuit board. If O.K. replace circuit board and retest.
Step 10 - Place on meter test lead at varistor leg as in Step 3. Place the other meter test lead at "NO" terminal of relay. Step 11 - Plug AC cord into wall receptacle. Measure voltage and unplug.	Measure voltage 90-130 volts AC	No	Replace relay.

! CAUTION: Improper profile setting may damage the batteries. To change setting remove cover and follow instructions in charger.

7. When batteries are fully charged, only the Green LED "Charge Complete" should be illuminated.

! WARNING - Do not disconnect the DC output cord from the battery receptacle when the charger is on. The resulting arcing and burning of the plug and receptacle could cause the batteries to explode. If the charger must be stopped, first press the stop button, if provided, or disconnect the AC power supply cord from its outlet, then disconnect the charger DC output plug from the battery receptacle.

LED INDICATORS

Normal Charge Sequence-

1- During the initial constant current stage, both the Yellow LED "Charger On" and the Red LED "Incomplete" will illuminate. A flashing Red LED "Incomplete" prior to the Yellow LED "80% Charge" coming on indicates a (S) Sealed Valve Regulated profile has been selected. NOTE - Early models did not incorporate this flashing LED feature.

2- When battery voltages reach 2.35 to 2.38 volts/cell, the Yellow LED "80% Charge" will illuminate.

3- When a charge cycle is terminated both the Yellow LED "80% Charge" and the Yellow LED "Charger On" will turn off. The Green LED "Complete" will then illuminate.

O	GREEN	"CHARGE COMPLETE"
O	YELLOW	"80% CHARGE"
O	RED	"INCOMPLETE"
		flashes in SVR mode
O	YELLOW	"CHARGER ON"
O	RED	"ABNORMAL CYCLE"

Abnormal Charge Sequence

1- If a charge cycle does not finish in 16 to 20 hours, only the Red LED "Abnormal Cycle" lights up. All other LED's turn off.

DC CIRCUIT CHECKOUT PROCEDURE

! CAUTION: No AC power should be applied to charger during DC circuit checkout procedure.

Charger needs battery voltage to turn on. Set meter to read DC voltage.

<u>ACTION</u>	<u>MEASURE</u>	<u>IF</u>	<u>THEN</u>
Step 1 - Attach positive and negative test leads of meter to appropriate battery system receptacle - (positive to positive and negative to negative). Measure voltage.	Measure Voltage 1.70vpc-2.16vpc	No	Check wiring
Step 2 - Remove the charger cover. Step 3 - Place negative test lead of meter where negative (black) DC cable connects to the shunt. Place positive test lead of meter where positive (white or red) DC cable connects to DC circuit breaker or fuse. Step 4 - Plug DC connector into receptacle. Measure voltage and unplug.	Measure Voltage 1.70vpc-2.16vpc	No	Check DC plug or connection to receptacle
Step 5 - Keep negative test lead as located in Step 3. Move positive test lead to other side of the circuit breaker or fuse. Step 6 - Plug DC connector into receptacle. Measure voltage and unplug.	Measure Voltage 1.70vpc-2.16vpc	No	Replace circuit breaker or fuse
Step 7a - Keep negative test lead as located in Step 3. Move positive test lead to the longer stem (cathode) of one SCR. Step 7b - Plug DC connector into receptacle. Measure and unplug. Step 8a - Keep negative test lead as located in Step 3. Move positive test lead to the longer stem (cathode) of the other SCR. Step 8b - Plug DC connector into receptacle. Measure voltage and unplug.	Measure Voltage 1.70vpc-2.16vpc	No	Check connections from SCR to circuit breaker or fuse

To verify that your charger has the FCS feature, simply connect the DC output to the battery without plugging in the AC. The LED's on the front of the charger will flash through the self-diagnostic sequence if the unit has FCS.

8 Troubleshooting

TO BE ABLE TO USE THE TROUBLE SHOOTING GUIDE SAFELY AND EFFECTIVELY IT IS IMPORTANT TO READ THIS GUIDE COMPLETELY BEFORE BEGINNING ANY TESTS.

! CAUTION - DO NOT DISASSEMBLE THE CHARGER. TAKE IT TO A QUALIFIED SERVICE TECHNICIAN WHEN SERVICE OR REPAIR IS REQUIRED. Modifying this charger for use other than that for which it was intended, repairs by persons not qualified or not using original equipment replacement parts will void the manufacturer's warranty and liability. Incorrect assembly may result in a risk of electric shock or fire. The following procedures are intended only to determine if a malfunction may exist in the charger.

! DANGER - Hazard of Electric Shock! To reduce the risk of electric shock, always disconnect both electrical cords, first from the AC outlet and then from the charger receptacle before attempting any maintenance, cleaning, repairs or service to the charger.

! WARNING - Do not operate the charger if it is malfunctioning. Personal injury or property damage could result.

Equipment Required:

Analog or digital multi-meter with alligator clip test leads

! WARNING - Use insulated test leads so your hands are never inside the charger with either AC plugged in or DC plug connected to receptacle. Always unplug both AC and DC, then move alligator clips to desired positions. Then plug in appropriate AC or DC connector as instructed in the following checkout procedures.

NOTES

NOTES