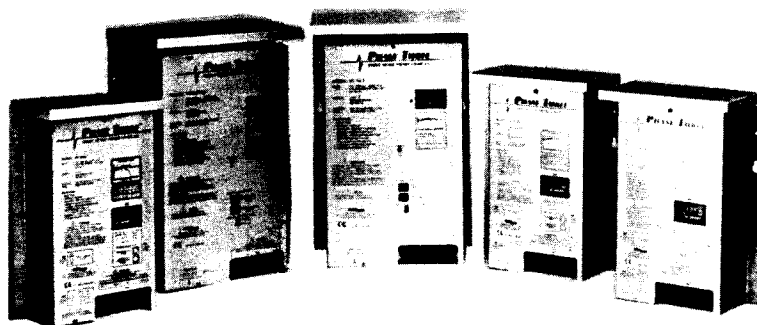


PHASE THREE™

**THREE STAGE SMART
CHARGER/
DC POWER SUPPLY**



INSTALLATION/OPERATION MANUAL

PT-CE SERIES

Models:

PT-40CE, PT-24-20CE

NEWMAR®

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I) GENERAL INFORMATION

Your Phase Three™ CE Series Battery Charger represents a new phase in charger design and performance, employing "smart" switching circuitry which puts batteries through the optimum three-step charge process, adapts for gel-cell or lead-acid batteries, features precise voltage compensation for varying battery temperature, is rated for continuous duty and is housed in a rugged stainless steel case.

Following is brief listing of some of the more important features/options of your Phase Three Charger. Each is fully detailed later in this manual:

- * Three step "smart" charging: bulk, absorption, float
- * Gel cell/lead-acid switch selects optimum charge/float voltages based on battery type
- * Multiple output banks charge independently based on demand
- * 115/230V a.c., 50-60 Hz input — can be used anywhere in the world
- * Current limited — prevents damage in case of overloading
- * Thermally controlled cooling fan allows continuous operation at full-rated output
- * High charge voltage time-out circuit prevents overcharge during continuous high amperage demand
- * Automatic high temperature power reduction — allows charger output in over-temp conditions at reduced output current without complete shutdown
- * Optional temperature compensation sensor fine tunes output voltage based on battery temperature
- * Optional Remote Panel allows remote monitoring of charger phase status and manual re-initialization of charge cycle.
- * Internal terminals allow installation of optional equalize timer connection.
- * Use as a power supply without in-line battery; allows continued use of d.c. powered electronics (when a.c. is available) in the event that batteries must be taken off-line or removed.
- * Rugged stainless steel case with optional-use drip shield provided
- * Ignition protected per USCG CFR 183.410

In addition, your Phase Three Charger carries a full one year warranty against defects in materials or workmanship from the date of purchase. Careful attention to these instructions should help you to enjoy years of trouble-free service.

II) IMPORTANT SAFETY INSTRUCTIONS

1. **SAVE THESE INSTRUCTIONS** – This manual contains important safety and operating instructions for the Phase Three CE Battery Charger.

2. Before using this battery charger, read all instructions and cautionary markings on (1) the battery charger (2) the battery, and (3) any product powered by the battery.

3. **CAUTION** – To reduce the risk of injury, charge only 6 cell (12 volt models) or 12 cell (24 volt models) gel-cell or lead-acid rechargeable batteries. Other types of batteries may burst, causing personal injury and damage.

4. Do not expose charger to rain or spray.

5. Use of an attachment not recommended or sold by NEWMAR may result in a risk of fire, electric shock or injury to persons.

6. To reduce the risk of damage to the electric plug and cord (if plugged into an a.c. outlet), **pull** by plug rather than cord when disconnecting the charger.

7. Make sure the cord is located so that it will not be stepped on, tripped over, or otherwise subjected to damage or stress.

8. An extension cord should not be used unless absolutely necessary. Use of an improper cord could result in a risk of fire and electric shock. If an extension cord must be used, make sure:

A) That pins on the plug of the extension cord are the same number, size and shape as those on the plug of the charger;

B) That the extension cord is properly wired and in good electrical condition;

C) That the wire size is large enough for the a.c. ampere rating of the Phase Three Charger. Refer to the **SPECIFICATIONS SECTION** to determine the full load input current of your Phase Three Charger, then use the chart on the following page to determine the correct gauge wire for any extension cord used.

RECOMMENDED MINIMUM AWG SIZE FOR EXTENSION CORDS FOR THE PHASE THREE CE BATTERY CHARGER

<u>a.c. Input Rating, Amperes</u> Equal to or greater than		<u>Length of Cord, Feet</u>			
		25	50	100	150
	but less than	<u>Size of Cord (AWG)</u>			
4	6	16	16	14	12
6	8	16	16	12	10
8	10	16	14	12	10

9. Do not operate the charger with a damaged cord or plug; replace them immediately.

10. Do not operate the charger if it has received a sharp blow, been dropped, or otherwise damaged; take it to a qualified serviceman.

11. Do not disassemble the charger; take it to a qualified serviceman when service or repair is necessary. Incorrect reassembly may result in a risk of electric shock and fire.

12. To reduce the risk of electric shock, disconnect the charger from a.c. source before attempting any maintenance or cleaning.

WARNING--RISK OF EXPLOSIVE GASES

1. WORKING IN THE VICINITY OF A LEAD-ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION. FOR THIS REASON, IT IS OF UTMOST IMPORTANCE THAT BEFORE INSTALLING AND USING YOUR CHARGER, YOU READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EXACTLY.

2. To reduce the risk of battery explosion, follow these instructions and those published by the battery manufacturer and by the manufacturer of any equipment you intend to use in the vicinity of the battery. Review cautionary markings on these products and on the engine.

PERSONAL PRECAUTIONS

1. Someone should be within range of your voice or close enough to come to your aid when you work near a lead-acid battery.

2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes.

3. Wear complete eye protection and clothing protection. Avoid touching your eyes while working near a battery.

4. If battery acid contacts skin or clothing, wash immediately with soap and water. If battery acid enters the eye, immediately flood the eye with running cold water for at least 10 minutes and get medical attention immediately.

5. NEVER smoke or allow a spark or flame in the vicinity of the battery or engine.

6. Be extra cautious to reduce the risk of dropping a metal tool onto the battery. It might spark or short-circuit the battery or other electrical part and cause an explosion.

7. Remove personal metal items such as rings, bracelets, necklaces and watches when working with a lead-acid battery. A lead-acid battery can produce a short-circuit current high enough to weld a ring or the like to metal, causing a severe burn.

8. Use the battery charger for charging gel-cell or flooded lead-acid batteries only. It is not intended to supply power to a low voltage electrical system other than in a starter-motor application. Do not use the charger for charging dry-cell batteries that are commonly used with home appliances. These batteries may burst and cause injury to persons and damage to property.

9. NEVER charge a frozen battery.

PREPARING TO CHARGE

1. Be sure the area around the battery is well ventilated.
2. Clean battery terminals. Be careful to keep corrosion from coming in contact with eyes.
3. Add distilled water in each cell until battery acid reaches level specified by battery manufacturer. This helps purge excessive gas from cells. Do not overfill. For a battery without cell caps, carefully follow manufacturer's recharging instructions.
4. Study all battery manufacturer's specific precautions such as removing or not removing cell caps while charging and recommended rates of charge.

GROUNDING AND a.c. POWER CORD CONNECTION

1. The charger should be grounded to reduce the risk of electric shock.
2. The Phase Three Charger is provided with an IEC certified a.c. power cord . If, for any reason, the plug on the cord must be changed or replaced, observe color coding of the a.c. wiring as follows:

Brown.....a.c. Hot (fused)
Blue.....a.c. Neutral
Green (or Green with Yellow Stripe).....a.c. Ground (safety, earth)

The charger must be plugged into an outlet that is properly installed and grounded in accordance with all local codes and ordinances.

DANGER: Never alter the a.c. cord or plug provided, unless it is absolutely necessary for use with the a.c. outlet which conforms to all relevant electrical codes. Any modification of the cord must only be done by a qualified electrician. Improper cord/ outlet connection can result in a risk of electric shock.

EXTERNAL CONNECTIONS TO THE CHARGER SHALL COMPLY WITH UL RECOMMENDATIONS AND/OR UNITED STATES COAST GUARD ELECTRICAL REGULATIONS (33CFR183, SUB-PART I)

THE INSTALLATION AND PROTECTION OF VESSEL WIRING ASSOCIATED WITH BATTERY CHARGERS SHALL COMPLY WITH ABYC STANDARDS E-8) AC ELECTRICAL SYSTEMS ON BOATS, E-9) DC ELECTRICAL SYSTEMS ON BOATS, AND A-20) BATTERY CHARGING DEVICES.

III) INSTALLATION

A) Materials Provided

The following items are provided with your Phase Three Charger (Note: Since this manual covers several models, the provided items will differ, as noted.) Check to be sure that these items have all been included in the packaging. For any missing items, contact the factory or warehouse.

- (1) IEC CERTIFIED a.c. INPUT POWER CORD.
- (1) INPUT POWER CORD CABLE CLAMP
- (1) INPUT FUSE FOR 115V a.c. APPLICATIONS (230V a.c. FUSE INSTALLED)
- (4) 1/4" RING LUGS FOR d.c. OUTPUT CONNECTION
- (1) DRIP SHIELD
- (4) SNAP-IN NYLON STAND-OFFS
- (4) PUSH-IN NYLON FASTENERS
- (1) CUSTOMER SATISFACTION/WARRANTY CARD
- (1) INSTALLATION/OPERATION MANUAL

B) Location: The charger should be mounted on a wall, bulkhead or other suitable mounting surface as close to the batteries to be charged as possible. Do not mount the charger directly over the batteries as battery fumes may cause excessive corrosion. The area should be well ventilated and free from excessive moisture, exhaust manifolds and battery fumes.

Vertical mounting is preferred in order to allow the drip shield to protect the charger from any moisture which may fall onto the charger. However, vertical mounting is acceptable since the charger is forced-air cooled. It should not be located where there is a possibility of debris being drawn into the unit through the fan.

If the charger is located in an extreme heat area, such as an unventilated engine room, and the cooling fan is unable to maintain proper operating temperature, output power will automatically be reduced to protect the charger. For maximum performance the charger should not be located in an area of extreme high temperature.

IMPORTANT: Although the charger is constructed of materials and in a manner which make it highly resistive to the corrosive effects of moisture in the environment, the charger is not waterproof. Do not mount the charger where there is a possibility of water entering the unit. Evidence of water entry into the charger will void the warranty.

C) Mounting: You will require at least (4) 1/4" screws with washers to mount the charger, and two temporary holding screws. Note that, in addition to the four permanent mounting holes in the flanges, there is a hole in each mounting flange which is "keyhole" shaped. This is provided to ease vertical installation.

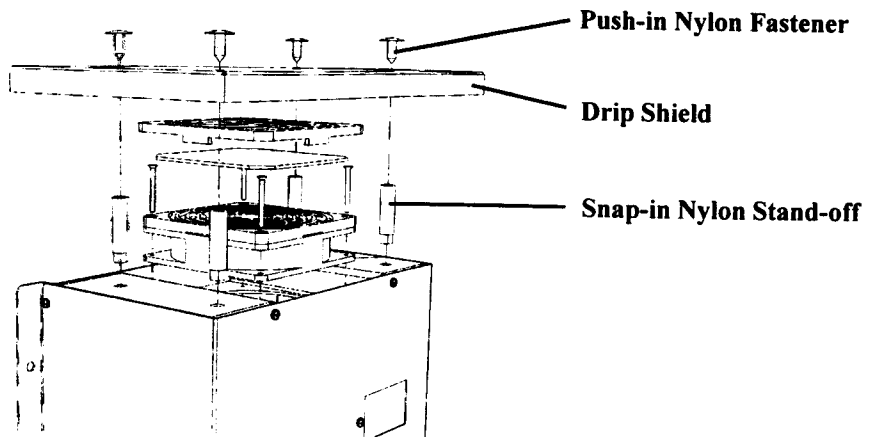
Make a mark on the wall or bulkhead where each of the keyhole slots will be located. Then drive a screw about half-way in at each of these marks. Hang the charger onto the bulkhead using the "keyhole" slots. Doing this will save you from having to support the charger's weight while you are driving in the four permanent mounting screws.

Note: The "keyhole" slots may be used for additional support screws but they are

not to be used as a permanent mounting points, by themselves.

D) Drip Shield Installation: If the charger is vertically mounted in an area where there is possibility that condensation or water leaks may occur overhead, installation of the provided drip shield is strongly recommended. Use the four nylon stand-offs and four nylon fasteners to install the drip shield as shown in FIGURE 1:

FIGURE 1: DRIP SHIELD INSTALLATION



Note: Diagram also depicts exploded view of fan and filter assembly (which have been factory installed). These will be discussed later in this manual. The nylon stand-offs and fasteners will snap into place though some force may be required if they resist.

E) d.c. Output Wiring

NOTE: (For marine applications) THE INSTALLATION AND PROTECTION OF VESSEL WIRING ASSOCIATED WITH BATTERY CHARGERS SHALL COMPLY WITH ABYC STANDARDS E-8) AC ELECTRICAL SYSTEMS ON BOATS, E-9) DC ELECTRICAL SYSTEMS ON BOATS, AND A-20) BATTERY CHARGING DEVICES.

Note: Only qualified service personnel should access the output terminals of the charger.

Pull off the black plastic terminal cover at the bottom of the front panel to expose the d.c. output terminals and attach d.c. wiring with ring lug connectors only.

Ring lug connectors have been provided to suit most common installations. If the wiring for your installation is not properly matched for the provided lugs, appropriate lugs must be obtained prior to installation.

The d.c. wire size table on this page may be used to determine the correct gauge wire, based on the model you have and the distance from the charger to the batteries.

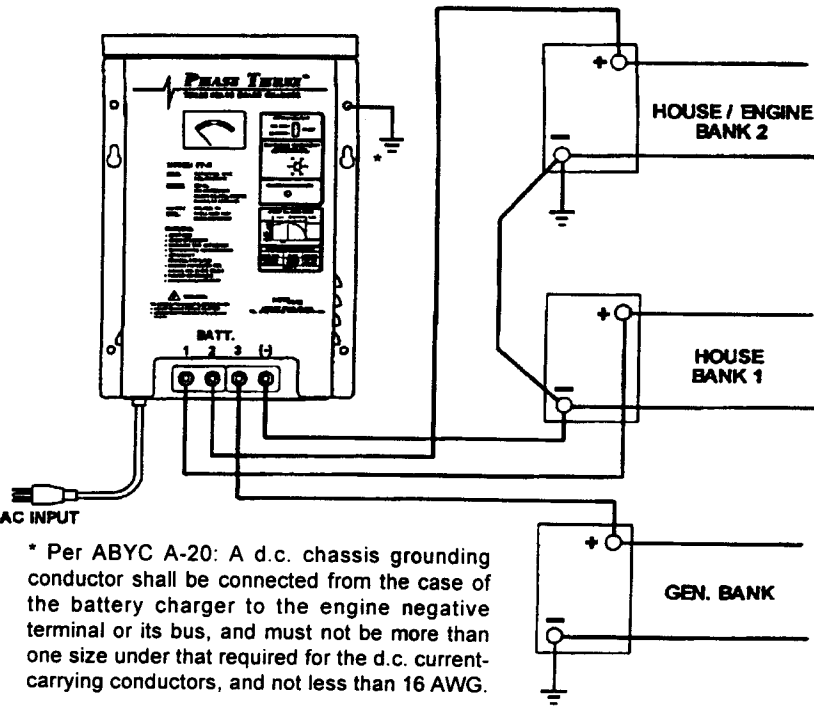
d.c. Wire Size Table:

Model	Distance from Batteries, feet		
	10	15	20
	Wire Gauge AWG (mm)		
PT - 24-20CE	#10 (6mm)	#10 (6mm)	#8 (10mm)
PT - 40CE	#6 (16mm)	#4 (25mm)	#2 (35mm)

* Based on ABYC 3% voltage drop table and NEC minimum wire size chart.

Two typical d.c. wiring configurations are illustrated in FIGURES 2 and 3. *Note: If you are only charging one or two battery banks you may simply ignore the remaining output terminal(s). The charger is able to deliver its full rated output through any single bank, if necessary.*

FIGURE 2: SIMPLE D.C. WIRING (PREFERRED METHOD)

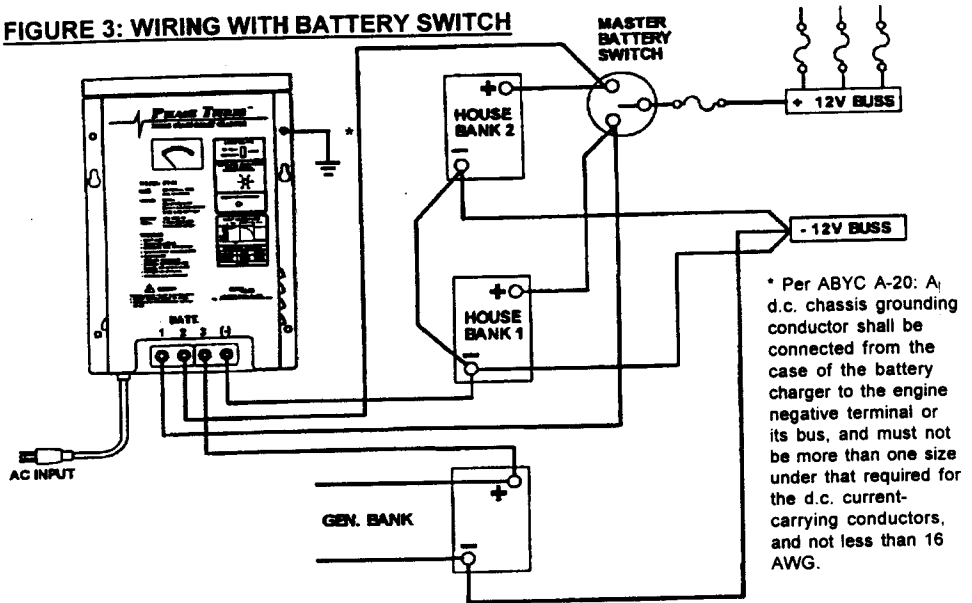


* Per ABYC A-20: A d.c. chassis grounding conductor shall be connected from the case of the battery charger to the engine negative terminal or its bus, and must not be more than one size under that required for the d.c. current-carrying conductors, and not less than 16 AWG.

Note: This diagram does not illustrate a complete system. Refer to ABYC Standards E-8) AC Electrical Systems on Boats, E-9) DC Electrical Systems on Boats, and A-20) Battery Charging Devices.

IMPORTANT: Install fuses at batteries per ABYC recommendations.

FIGURE 3: WIRING WITH BATTERY SWITCH



Note: This diagram does not illustrate a complete system. Refer to ABYC Standards E-8) AC Electrical Systems on Boats, and E-9) DC Electrical Systems on Boats, and A-20) Battery Charging Devices.

IMPORTANT: Install fuses at batteries per ABYC recommendations.

Note: If batteries are closer to charger than battery switch, wire directly to battery posts.

It is recommended that d.c. wiring from the charger to the batteries be as direct as possible. Line voltage loss and electronic noise interference of sensitive electronics are possible if the charging leads are routed through a central electrical distribution panel. Any elaborate configurations are best left to a qualified electrician.

ENSURE THAT LEADS ARE PROPERLY FUSED AT THE BATTERY. (REFER TO ABYC RECOMMENDATIONS. SEE REFERENCE APPENDIX AT THE END OF THIS MANUAL FOR ABYC CONTACT INFORMATION.)

Ensure that your connections are tight and that correct polarity is carefully observed at all times. The battery posts should be free of any rust or corrosion.

IMPORTANT NOTE: EVEN MOMENTARY REVERSE POLARITY CONNECTION MAY SEVERELY DAMAGE YOUR CHARGER. THE POSITIVE (+) TERMINAL MUST BE WIRED TO THE POSITIVE POST OF THE BATTERY AND THE NEGATIVE OR COMMON (-) TERMINAL TO THE NEGATIVE POST OF THE BATTERY OR COMMON BUS.

CAUTION: Do not attempt to increase battery bank capacity by splitting the output of one of the banks with a diode-type battery isolator. Undercharging may occur on that output bank, as a result. If you wish to add another isolated battery bank, use of NEWMAR's Battery Integrator is recommended. Contact the factory for details. Be sure to replace the black plastic terminal cover to prevent accidental shorting of the output terminals in the future.

An Important Note about the d.c Output Fuse(s): internal d.c wiring is protected by internal d.c. output fuse(s). The current limiting circuit of the Phase Three Charger should prevent these fuses from blowing under normal operating conditions. If the d.c fuse(s) blow, this may indicate a reverse polarity hook-up or an internal short.

Always disconnect a.c. to the charger before checking fuses. To check or replace the d.c. fuse, the cover must be removed. To do this requires removal of four screws from the front of the unit and three screws on each side. The d.c. fuse is mounted on the main circuit board. Be sure to replace with the same type and value as indicated on the fuse.

If the battery was connected to the charger backwards, the fuse should blow to protect d.c. wiring, however damage to internal components may also have occurred. If the replacement fuse blows, return the charger to an electronics service professional or to the factory for a thorough inspection. *Note: The internal fuses do not provide protection if there is a short in the wiring between the charger and the battery. The battery is itself a power source and charging leads should be fused at the battery per ABYC standards.*

F) Multiple Unit Parallel Wiring

If increased power or system redundancy is required, a second charger may be wired in parallel. The unit is diode protected so it will not be damaged by feedback from the second unit and current limiting will prevent overloading in the case of a failure of one of the units.

Observe the following guidelines when wiring a parallel unit.

- 1) Use only another identical charger model. Do not use a different charger model, either from NEWMAR or from another manufacturer.
- 2) Wire length and gauge and wire lug size must be identical for each charger to ensure proper load sharing.
- 3) Wire gauge for each charger must be the same used as if a single charger were wired into the system by itself.

G) a.c. Input Wiring

NOTE: (For marine applications) THE INSTALLATION AND PROTECTION OF VESSEL WIRING ASSOCIATED WITH BATTERY CHARGERS SHALL COMPLY WITH ABYC STANDARDS E-8) AC ELECTRICAL SYSTEMS ON BOATS, E-9) DC ELECTRICAL SYSTEMS ON BOATS, AND A-20) BATTERY CHARGING DEVICES.

These models are provided with an IEC certified a.c. cord which may be plugged into the charger and a proper outlet. If the plug is not suited to the available outlet, 1) obtain an IEC cord with appropriate plug or 2) obtain the correct plug for the 2)outlet and install it on the provided IEC cord. When installing the plug, pay careful attention to the pin wiring as follows:

Brown..... a.c. Hot (fused)
Blue..... a.c. Neutral
Green (or Green with Yellow Stripe) a.c. Ground (safety,earth)

As shipped from the factory, the charger is set up for 230V a.c. input. For 115V a.c. applications you must:

1) Slide the recessed 115/230 input select switch located on the left hand side of the charger into the proper position. Positions are identified on the front of the charger.

2) Replace the input fuse as explained in section 3) **Input Fuse Replacement**. The correct fuse for 115V applications is attached to the hang tag on the BATT. 1 terminal of the charger. If it is missing, see the **INPUT/OUTPUT FUSE VALUE** table in the **SPECIFICATIONS** section of this manual to determine the correct fuse value. **Warning: Do Not replace the gray slotted cap of the fuseholder without a fuse installed. It will not be retrievable. If this occurs, contact the factory.**

A power cord cable clamp has been provided to prevent accidental disconnect of the a.c. cord. After the plug has been inserted into the charger, snap the pre-formed clamp around the a.c. input cable as close to the insertion point as practicable and use a screw to fasten the clamp tightly to the wall or bulkhead on which the charger is mounted.

Hard-wiring a.c. input

If desired, the a.c. input to your charger may be hard-wired directly to the a.c. distribution panel. Install the charger end of the provided input cord as described above, then cut off the plug and splice onto three conductor marine-grade cable with crimp butt connectors, observing color codes and fuse/circuit breaker ratings as above. For all models use minimum 16 AWG cable.

All charger wiring should be made in accordance with UL, U.S. Coast Guard and/or A.B.Y.C. regulations and recommendations, as well as all relevant local codes. See REFERENCE APPENDIX for sources.

a.c. input for the charger must be plugged into an appropriate, over-current protected three prong outlet OR routed through a separate dedicated fuse or circuit breaker on an a.c. distribution panel with proper safety/earth chassis ground in accordance with all local codes and ordinances.

CAUTION (230 V a.c. applications only): If a.c. input is derived from a source consisting of two HOT leads (phase-to-phase 230V a.c. input voltage), an external fuse or circuit breaker must be used to protect the unfused (formerly NEUTRAL, now HOT) lead.

3) Input Fuse Replacement

The a.c. input of your charger is protected by an input fuse. The input fuseholder is located near the bottom of the unit on the left side. The proper value for the input fuse is indicated on the lower left corner of the front panel. *If the input fuse needs replacing it must be replaced with the proper type and value.* Use standard or fast-blow fuses. Never use a slow-blow fuse.

Caution: Ensure that a.c. power to the charger has been disconnected before attempting to open the fuseholder. To remove the fuse for replacement, insert a flat tip screwdriver into the fuseholder cover and turn counterclockwise until the spring-loaded cover releases. To replace the fuseholder cover, depress it fully into the fuseholder and turn it clockwise until it locks into position (about a quarter turn).
Warning: Do Not replace the gray slotted cap of the fuseholder without a fuse installed. It will not be retrievable. If this occurs, contact the factory.

All charger wiring should be made in accordance with UL, U.S. Coast Guard and/or A.B.Y.C. regulations and recommendations, as well as all relevant local codes. See section IX) REFERENCE APPENDIX. for sources.

IV) OPERATION

A) Three Stage Charge Regimen

The Phase Three Battery Charger features the three stage charge regimen which is widely recommended by battery manufacturers for allowing the fastest possible recharge time without loss of batteries' electrolyte (gel or liquid) which may be caused by sustained charging at higher voltages.

This three stage regimen is initiated each time a.c. is first applied, when drained batteries are most likely to be encountered. (This also occurs when the reinitialize button on the optional remote panel is activated — see section D - Remote Panel Option) The regimen proceeds as follows:

1) Bulk Charge - When batteries are significantly discharged the charger responds initially by delivering a high amount of d.c. current, at or near the charger's maximum rated output, in order to rapidly replenish them. It is during this stage that charging current is maintained at a high level as battery voltage increases. Bulk charging continues until battery voltage reaches the "charge" voltage level (where batteries are at about 75-80% of capacity). A current limit circuit prevents charger overload during this maximum output stage.

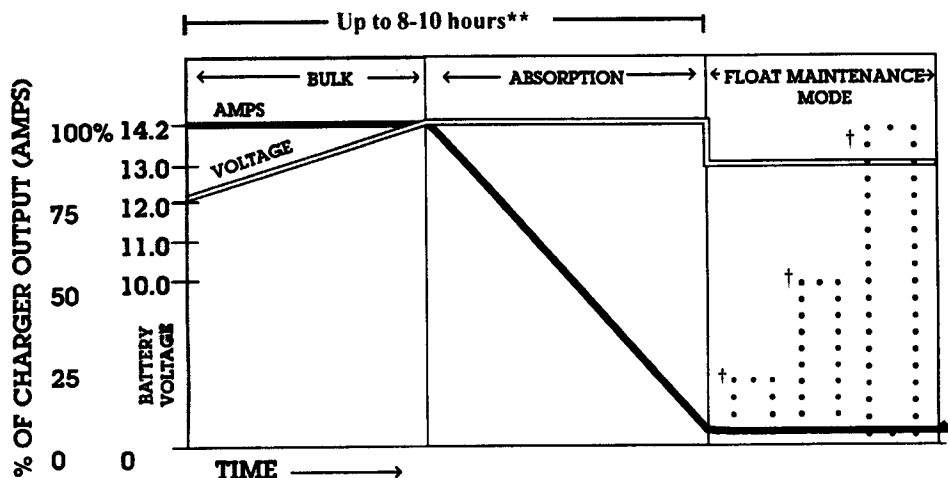
2) Absorption Charge - During this second stage of the charge cycle, battery voltage is maintained at the "charge" voltage level. Output current begins to taper off as the battery plates become saturated. Charge voltage is maintained until the current sensing circuit detects that output current has tapered to about 5-15 % of charger rating*. At this point the batteries are at about 95 % of full charge and the Phase Three charger switches to the third and final stage of the charge cycle.

* Note: The absorption phase may also be ended by the time-out circuit. See section B following for a complete explanation of the purpose and functioning of the time-out circuit.

3) Float Charge - For extended battery life the Phase Three then automatically switches to a lower float voltage level. This float charge keeps batteries at peak condition without overcharging. The charger may be left in this stage for months without attention (though periodic checks of electrolyte level in flooded batteries is recommended).

A typical 12 volt, three phase charging cycle is illustrated below.

**FIGURE 7: TYPICAL (12V) CHARGER OUTPUT GRAPH
(INTO BATTERY WITHOUT LOAD)**



* =Actual charge and float voltages depend upon gel-cell/lead acid settings and/or temperature compensation function.

** =As required by battery state of charge with an 8-10 hour maximum. Length of maximum bulk/absorption phase duration may be increased/decreased by installer adjustment at time of installation.

†=Intermittent loads

B) Time-Out Circuit

Batteries have a tendency to lose their electrolyte and may be damaged if they are maintained for long periods of time in the elevated voltage of the absorption phase. Therefore, the Phase Three Charger employs a special time-out circuit. This circuit is initialized each time a.c. is first applied to the charger (or when the re-initialize button on the optional remote panel is activated) and runs for a pre-set interval before forcing the charger to go into the float (lower voltage) mode. The functioning of the charger during this interval is as follows:

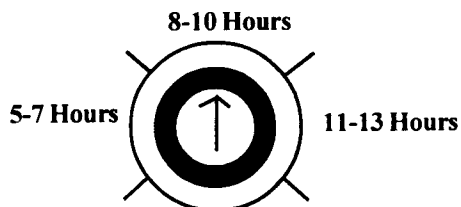
If the current demand of the batteries/load falls below 5-15 percent of the charger's output capacity prior to the circuit timing-out, the charger will automatically switch to the float mode. (For instance, with model PT-40CE, the charger will drop into float mode at about 2-6 amps output.) If demand rises to about 10-20 percent of capacity (4-8 amps with PT-40CE, for instance), the charger will return to the elevated output of the absorption phase. This switching back and forth between modes may occur until the circuit times-out (8-10 hours after a.c. is first applied), after which the charger will remain at float voltage, until the circuit is re-initialized, either by turning the charger off and then on again or by pressing the re-initialize button on the optional remote panel.

Note: The PT-CE charger is able to deliver its full rated output current while in the float mode.

Installation Note: The time-out circuit of the PT-CE charger has been set at about 8-10 hours, which is appropriate for battery systems within the capacity range specified on the front panel of the charger. If the charger is used with a battery system with a capacity near (or outside) the upper or lower ranges of the specified range of the charger, adjustment of the time-out circuit may be recommended. If the installer wishes to make this adjustment at the time of installation, the procedure is as follows (*Caution: Ensure a.c. input has been disconnected before proceeding*):

- 1) Remove the four screws on the front panel and three screws on each side of the unit.
- 2) Remove the front cover and locate the potentiometer on the small "charger function" plug-in printed circuit board which is labeled "TIMER ADJ."
- 3) Using a small flat tip screwdriver, turn the potentiometer clockwise to increase the amount of time the charger remains in the absorption mode before timing out, or counterclockwise to decrease the amount of time. The approximate ranges are illustrated below.

FIGURE 8: ADJUSTING THE TIME-OUT CIRCUIT



Note: Once the time-out circuit has put the charger into float mode, the charger will remain in this mode. Since the Phase Three Charger is well regulated, it is able to deliver its full rated output current in this mode and battery discharge will not occur (provided load current does not exceed charger rating and output wiring is properly sized).

C) Gel-Cell / Lead Acid Selector Switch

According to most battery manufacturers, the ideal charge regimen for gel-cell and wet or flooded lead acid batteries differs somewhat.

The gelled electrolyte in a sealed battery may be lost or damaged by high voltage and, once lost, cannot be replaced as it can with a wet lead acid battery. Manufacturers of gel-cells usually recommend an ideal charge voltage which is slightly lower for a gel-cell than a lead acid battery.

However, when the charger is in the float voltage mode over lengthier periods of time, gelled electrolyte in a sealed battery is not susceptible to evaporation, as is the non-immobilized electrolyte of a wet lead acid battery. This evaporation can be accelerated by the applied voltage. Consequently, the ideal float voltage is slightly higher for a gel-cell than a lead acid battery.

The ideal charge/float regimen has been programmed into the Phase Three Charger for either sealed gel-cell or flooded lead acid batteries. Simply make the proper selection for your battery type via the slide switch on the right side of the charger. The switch positions are indicated on the front panel. Use a ball point pen or similar object to slide it into the correct position.

Note: A wide variety of batteries are now available which do not conform to conventional descriptions as "gel-cell" or "lead-acid". You are advised to consult the manufacturer of your particular battery as to proper charging regimen, and use the battery type selection switch setting which most closely conforms to the recommended voltages.

See the **SPECIFICATIONS** section for the actual preset charge and float voltages for each battery type/charger model.

D) Remote Monitor Panel Option

A Remote Monitor Panel is available from NEWMAR (model RP) which will enable you to monitor the charger's status at-a-glance from a remote location. Red and green L.E.D.'s indicate whether the charger is in the bulk, absorption or float phase of the charge cycle. In addition, the panel features a re-initialize button, which, when pressed, will cause the charger to restart the three phase cycle. This resets the time-out circuit (see section B, above) Time-out Circuit, above). **Note:** The charger may not stay in the bulk or absorption mode after pressing the re-initialize button. If batteries are at or near full charge, the charger will quickly revert to the float mode.

The panel comes pre-wired with 30' of cable and 4 mounting screws. Simply install the panel at the desired location and insert the plug on the end of the cable into the remote panel jack which is located on the right side of the charger. (See FIGURE 10.) The remote panel jack is identified on the front panel. **Note:** Inadvertently, putting the remote panel plug into the temp compensation jack (or vice versa) will not harm the charger.

If additional cable length is required, additional cable is commonly available from most electronics supply retailers such as Radio Shack/Tandy. Request a 6 conductor modular-to-modular line cord (part number 279-422, 25 feet long) and 6 pin modular in-line non-reversing coupler (279-423).

E) Temperature Compensation Option

Because low battery temperature increases resistance to charging and high battery temperature reduces impedance, requiring a lower charge voltage, the ideal charging voltage will vary depending on the temperature of the battery's environment when it is being charged.

If a charger has a fixed output voltage which is ideal at, say 72° F, that same output may cause a battery charged in a consistently high temperature environment to be overcharged, resulting in excessive loss of electrolyte. Conversely, if the batteries are in a consistently cool environment, they may be chronically undercharged, resulting in sulfation of the battery plates. Either of these two conditions will shorten battery life.

Therefore, the Phase Three charger is designed to utilize an optional remote sensor (available from NEWMAR; model TCS-12/24) which provides automatic temperature compensation. The remote sensor will signal the charger to fine tune its output voltage so that it is properly matched to the temperature of the battery/battery environment. The adjustment rate is approximately -3 mV per cell per °F, or -4 mV per cell per °C. (Note: The temperature compensation option is strongly recommended for sealed, valve-regulated or gel-cell batteries.)

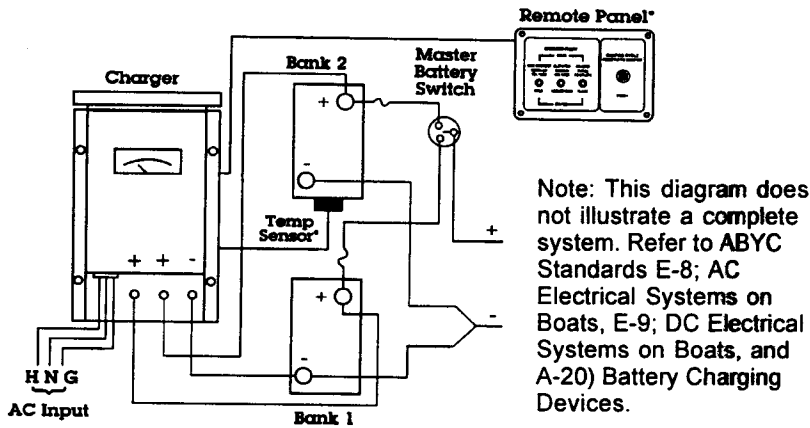
The remote sensor is provided with 30' of cable. One end of the cable is plugged into the temperature compensation jack which is located on the right side of the charger. (See FIGURE 7.) The temp sensor jack is identified on the front panel. If additional cable length is required, additional cable is commonly available from

most electronics supply retailers such as Radio Shack/Tandy. Request a 6 conductor modular-to-modular line cord (part number 279-422, 25 feet long) and 6 pin modular in-line non-reversing coupler (279-423).

The sensor itself should be mounted on the inside of the battery box, or more ideally, mounted onto one of the batteries using a clamp or a small amount of silicon-type adhesive. The sensor has a hole in the center which will accommodate a # 6 screw. If you have access to the exterior of a wall of the battery box, you may drill a hole in the wall of the box and run the screw through to mount the sensor onto the interior wall. Use caution when drilling so that you do not accidentally puncture the case of any battery inside the box.

Important note: When wiring multiple units in parallel (see section E) and using the temperature compensation option, you must use a separate sensor for each charger, and the sensors must be mounted close together in the same battery box or on the same battery for proper operation.

FIGURE 9: TEMPERATURE SENSOR AND REMOTE PANEL INSTALLATION



To give some idea of the effect of the temperature compensation sensor, the chart on the following page lists the charge/float output voltages of the charger when no sensor is installed (or when batteries are at 72° F), and at cold (50° F) or hot (90° F) battery temperature with temp sensor installed:

Temperature Compensation Chart

Battery Temperature		Output V d.c : 12 Volt Models				Output V d.c : 24 Volt Models			
		Charge		Float		Charge		Float	
		Gal-Cell	Lead Acid	Gal-Cell	Lead Acid	Gal-Cell	Lead Acid	Gal-Cell	Lead Acid
50	10	14.4	14.6	14.0	13.8	28.8	29.2	28.0	27.6
72	22.2	14.0*	14.2*	13.6*	13.4*	28.0*	28.4*	27.2*	26.8*
90	32.2	13.7	13.9	13.3	13.1	27.4	27.8	26.6	26.2

* Factory pre-set voltages without temperature compensation option installed

F) Equalize Timing Option

Some manufacturers of flooded lead-acid batteries recommend a charging process known as equalization for extended battery life. This process involves occasionally charging a wet lead-acid battery at a very high voltage for a short period of time in order to completely de-sulphate each of the battery plates, essentially equalizing their voltage. The installer of the Phase Three CE charger may choose to wire in this option at the time of installation.

Note: The equalization process is not recommended for sealed valve regulated or gel-cell batteries.

The equalize terminals (located inside the PT charger) should be wired through a manual or electric timer which provides a closed contact when engaged and an open circuit when timed out (SPST — Single Pole Single Throw). Do not use a manually operated switch for the equalize timer. This is because unless the charger is reverted to a safe float voltage in a timely manner, the batteries will almost certainly be damaged or destroyed. The timer should be a 0-12 hour type, capable of carrying a minimum of 100 mA at 5V d.c. **CAUTION: Do not install the timer in an area requiring ignition protected equipment unless it has been certified to meet ignition protection requirements.**

The equalization circuit of the Phase Three charger boosts output voltage to approximately 8 % above float voltage. Refer to the battery manufacturer's instructions when deciding the appropriate time period setting for this voltage to achieve proper equalization, while ensuring batteries are not damaged by increased battery temperature. **This installation should only be performed by a qualified technician.**

Installing the timer requires a mating connector with dual wires which are plugged into a jack on the internal charger function circuit board. The connector/wire assembly is available from NEWMAR. Request part number 873-3716-0, CFB Equalize 2 pin assembly. Proceed with the installation as follows:

(Caution: Ensure a.c. input has been disconnected before proceeding)

- 1) Disconnect the charging leads (if already attached).
- 2) Remove the charger cover assembly (as previously described).
- 3) Locate the two-pin header labeled "J2" just over the cut-out on the top of the vertically oriented charger function circuit board. Insert the mating connector and route the two control wires through the 1/4" entry hole on the bottom of the charger beside the "COMM" terminal. (The hole plug must first be removed and discarded.) Connect the wires to the timer.
- 4) Replace the cover assembly. Reconnect the charging leads and a.c. input.

G) Cooling Fan

To maximize the life of the internal components and to allow continuous operation at full rating, the Phase Three employs an automatic integral cooling fan. This fan operates whenever load and/or ambient temperature causes a rise in the heat sink temperature. Its speed automatically increases/decreases in response to

load and/or ambient temperature increase/decrease. *Note:* Under most circumstances, the fan will be in operation when the charger is on. However, it may stop completely under no load and/or low ambient temperature conditions.

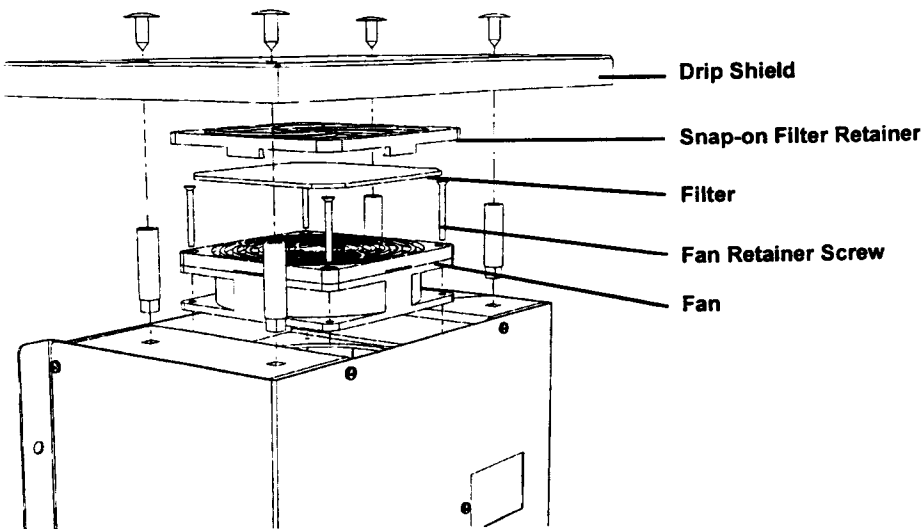
The fan is equipped with a filter to keep debris from being sucked into the charger. It is recommended that this filter be removed and rinsed with clean water occasionally to ensure adequate air flow, particularly if the charger is mounted in a dusty or particle-filled environment. Allow the filter to dry before putting it back onto the fan. If the filter is ever damaged, a replacement is available from NEWMAR. (Specify part number 999-9450-2. If obtaining a filter from another source specify a 1/4" thick filter medium of 30 PPI density which you can cut to size.)

Filter Cleaning/Replacement

To remove the fan filter for cleaning or replacement (see FIGURE 10):

- 1) Disconnect the charger from the a.c. power source.
- 2) Remove the drip shield by grasping it on either side and pulling firmly upward.
- 3) Snap off the filter retainer and remove the filter.

FIGURE 10: FAN AND FILTER ASSEMBLY



Fan Replacement

If the fan fails to operate when the charger is on and a load is applied, it may be in need of replacement. Replacement fans are available from NEWMAR. (Specify part number 999-1208-0; Refer to Replacement Fan with PCB connector.)

To remove the fan for replacement:

- 1) Disconnect the charger from the a.c. power source.
- 2) Remove the drip shield by grasping it on either side and pulling firmly upward.
- 3) Snap off the filter retainer and remove the filter.
- 4) Using a phillips screwdriver remove the four fan retainer screws holding the fan assembly in place and lift it out, taking care not to pull excessively on the fan power leads which are attached to the internal PCB.
- 5) Grasp the connector at the end of the leads firmly between two fingers and snap it out of the connector receptacle on the PCB.
- 6) Remove the fan from the fan plate.

Installing the new fan is simply the reverse of the above procedure.

NOTE: When installing the new fan, position it so that the direction-of-flow arrow molded into the top of the fan housing points into the charger.

V) APPLICATION NOTES

A) Start Up

1) Before powering up your charger, check for tight electrical connections to each battery in your system. Switch off any d.c. loads on the batteries. Apply a.c. power. Observe the d.c. ammeter on the front panel. This meter displays the total d.c. output of the charger, through all banks. It will give some indication of the overall state of charge of your batteries. If the meter is reading mid-scale or higher, it is an indication that the batteries are in a relatively low state of charge. The charger, sensing this, is supplying high current to the batteries. If the meter needle is at or near the bottom of the scale the batteries are at or nearing full charge.

2) Apply a load to the charger by switching on some lights, a pump or some other d.c. appliance. Observe the charger meter. It should read approximately the same as the expected current draw of the appliance. As current is demanded from the battery system, the charger will automatically increase its output in response to the increased load demand. When load current exceeds 10-20 % of the charger's rated capacity, the charger will go into the absorption mode and remain there until current drops below 5-15 % of capacity or until the time-out circuit cycle is complete.

Note: The Phase Three Charger is self-limiting and will rarely blow an input fuse. If the input fuse should blow upon first application of power, disconnect a.c. power to the charger and consult the TROUBLESHOOTING section of this manual.

If the input fuse does need replacing, be sure to replace it with the same type and value for continued protection. The fuse value is specified on the lower left hand corner of the charger front panel.

B) Constant Versus Occasional Use

In general, it is recommended that the charger be left connected continuously to

the a.c. distribution system so that it will be in operation whenever a.c. is available. This will maintain batteries at peak voltage and will automatically compensate for the natural self-discharge of the battery system. When a load is applied to the battery system the charger's output will automatically increase to supply the current which would otherwise draw battery voltage down. **Repeatedly allowing batteries to become completely discharged before recharging will greatly shorten their life. Leaving the charger on continuously will prevent this.**

While the output regulation of the charger will minimize battery gassing and water loss, monthly checks of the electrolyte level (for wet lead acid batteries) are still strongly recommended. Some water loss is an inevitable aspect of the charging process, and maintaining the correct electrolyte level in your batteries is the most important thing you can do to assure their maximum performance and long life.

C) Proper Load Sizing

The Phase Three Charger is rated for continuous duty (e.g., the PT-40CE can deliver up to 40 amps continuously, 24 hours a day, seven days a week). While the charger cannot be damaged by overloads that exceed this continuous rating, excessive load demands may draw battery voltage down faster than the charger can resupply it. If battery voltage continues to drop and the output current is at maximum while the charger is in service, check to see that your average d.c. loads are not exceeding the charger's rated output. If they are, you may wish to consider adding another charger in parallel to provide sufficient power for your requirements. (See section III) E) Multiple Unit Parallel Wiring.)

D) Operation With Engine

It is perfectly acceptable to allow the charger to remain on when the engine is started and while it is running. The current limit feature of the Phase Three Charger will protect against any damage due to the high current demands of engine cranking. Output diodes will prevent any back-feed of current into the charger from the alternator while the engine runs.

As the alternator starts to charge the battery, the charger output will decrease. When the battery voltage exceeds the rated output voltage of the charger it will shut off and stay off as long as the batteries are in this high state of charge. If the battery voltage should drop below the charger's rated output voltage it will automatically return to service.

E) Operation as a d.c. Power Supply (stand-alone d.c. power source) or Radar Rectifier

Most battery chargers are not suitable for powering electronic devices directly, without a battery attached to the output, as the high ripple and pulsing d.c. output (i.e., rectified a.c. output) can interfere with the operation of the device. The Phase Three charger is different. It employs a circuit that produces an extremely well-filtered d.c. output. Therefore the charger is able to power virtually any d.c. powered device (within the unit's rating) without the battery attached in-line (if, for instance, the battery must be removed for any purpose and a.c. is still available). All but the most sensitive d.c. powered electronic devices will function as normally as if powered by a battery. In addition, the current limiting circuitry enables the charger to handle the high start-up surges associated with inductive loads, such as d.c. motors in radar sets.

VI) TROUBLESHOOTING

CONDITION	POSSIBLE CAUSE	SOLUTION
		loads - L-48
		overload and/or over (See Condition)
		connected an inductor or a capacitor necessary
		reducing power output
B. Charger continues to charge at 3 amps or more—does not taper back in charge.	<ol style="list-style-type: none"> 1. d.c load still connected to batteries. (Not a problem condition) 2. Bad cell in one of the batteries to which the charger is connected. 	<ol style="list-style-type: none"> 1. Turn off main battery switch to d.c electrical panel or turn off all d.c. loads if you wish to confirm charger will output minimal amperage to fully charged batteries. 2. Check for shorted cell in all wet lead-acid batteries using a hydrometer. Replace battery if cell is shorted. Refer to manufacturer for testing maintenance-free batteries.
C. Charger does not charge	<ol style="list-style-type: none"> 1. Blown input fuse. 2. Charger is not receiving a.c. input voltage or is not receiving correct a.c. input voltage. 	<ol style="list-style-type: none"> 1. Replace fuse with another of correct value. Check to see if a.c. input select switch is in proper position. Check to see if input fuse value is correct for input a.c. voltage. 2. Using a voltmeter, confirm a.c. input voltage, check input connections. Confirm a.c. input select switch is in correct position or correct a.c. connector/adaptor is installed.
<p>Warning: Do Not replace the gray slotted cap of the fuseholder without a fuse installed. It will not be retrievable. If this occurs, contact the factory.</p>		

7) TROUBLESHOOTING (cont.)

CONDITION	POSSIBLE CAUSE	SOLUTION
[REDACTED]	[REDACTED]	[REDACTED]
Charger repeatedly blows input fuse with no batteries connected.	Internal short.	Same as above.
[REDACTED]	[REDACTED]	[REDACTED]
High output voltage measured across charger output terminals.	<ol style="list-style-type: none"> 1. Batteries not connected to charger. It is normal to read 1/2 volt higher across any output bank when no batteries are connected. 2. Equalize function activated 	<ol style="list-style-type: none"> 1. Check for tight connection of charging leads from charger to batteries. 2. Check to verify proper installation and operation of equalize timer
[REDACTED]	[REDACTED]	[REDACTED]

VII) SPECIFICATIONS

INPUT RANGE (ALL MODELS): 85-135/170-270V a.c. (via selector switch); 47-63 HZ (automatic)

Derate Models, PT24-20CE and PT-40CE from 560 watts @ 95V a.c. to 500 watts @ 85V a.c.

OUTPUT BANKS (ALL MODELS): 3

Model	Input Amps 115/230V	Output		Weight	
		Volts	Amps (Cont.)	Lbs.	Kg.
PT-40CE	8.5 / 4.3	12	40	12	5.5
PT-24-20CE	8.5 / 4.3	24	20	12	5.5

OUTPUT VOLTAGES WITHOUT TEMPERATURE COMPENSATION OPTION:

Setting	12 VOLT MODELS		24 VOLT MODELS	
	Charge @ 50 % load	Float @ .1 amp load	Charge @ 50 % load	Float @ .1 amp load
Gel-Cell	14.0V d.c.	13.6V d.c.	28.0V d.c.	27.2V d.c.
Lead Acid	14.2V d.c.	13.4V d.c.	28.4V d.c.	26.8V d.c.

TEMPERATURE COMPENSATION:

- 5 mV per cell per ° C

TEMPERATURE RATINGS:

-40°C to + 60°C; Derate linearly from 100 % @ 50°C to 75 % @ 60°C

PROTECTION: Input fuse; Output fuse for reverse polarity protection; Current limiting; Automatic high temperature power reduction; Time and load controlled high rate charge circuit; Ignition protected

INPUT/OUTPUT FUSE VALUES:

Model	a.c. Input Fuse		d.c. Output Fuse
	115V a.c.	230V a.c.	
PT-40CE	ABC-12	AGC-6	(2 ea.) ATC-30
PT-24-20CE	ABC-12	AGC-6	(1 ea.) ATC-30

CASE DIMENSIONS, BOTH MODELS: (With drip shield attached)

INCHES			CENTIMETERS		
H	W	D	H	W	D
15.25	9.7	5.25	38.7	24.6	13.4

III) BATTERY CARE TIPS

Regular maintenance and proper care will assure you reliable service from the most depended upon and sometimes most neglected items, your batteries and battery charger. NEWMAR battery chargers are designed to keep your batteries fully charged but your batteries also need proper regular maintenance to provide a maximum life of service.

ALWAYS READ AND FOLLOW THE BATTERY MANUFACTURER'S INSTRUCTIONS

Battery Installation

Batteries must be securely mounted to prevent them from falling over when the vehicle or boat is in motion. A loose battery can do serious damage. Batteries should be mounted in a battery box to contain any acid spill. Batteries give off a certain amount of hydrogen gas when they are charging. When concentrated, this gas is highly explosive. Therefore make sure they are in an accessible place with adequate ventilation for any hydrogen gas discharge.

Cleaning Batteries

Dirt and electrolyte salts can build up on the top of your batteries. This accumulation conducts electricity stored in the battery and can cause the battery to discharge by itself. Therefore, at least twice a year, it is a good idea to disconnect the battery cables and scrub the battery with a baking soda solution. Rinse with fresh water and dry with a clean cloth.

You may wish to purchase a set of terminal post corrosion prevention rings. These are alkali-saturated felt rings that slip over the battery post to reduce corrosion. Do not apply grease to any part of the battery terminals, but you may use an occasional light spray of silicone lubricant.

Routine Checks and Maintenance

Batteries should periodically be "exercised" (slowly discharged and then recharged) to keep them in top condition. New batteries may need to be exercised before they will be capable of their full rating.

If your batteries are not the sealed type, distilled water should be added to them whenever needed. The electrolyte should cover the plates by about 1/2", allowing a small air space at the top. Do not fill the cells up to the filler cap as this could cause the battery to sputter out electrolyte when it is being charged. Only distilled water should be used never plain tap water. Tap water contains chemicals and elements that can alter the properties of the electrolyte, including specific gravity. Some chemicals may also create an insulating coating on the battery plates which will retard current flow.

The rate that water is lost by the battery is dependent on several factors; battery condition, ambient temperature, battery use, charge voltage, etc. It is normal for batteries which are not maintenance-free to require topping off about once a month.

A battery's state of charge may be monitored by checking the specific gravity or by open circuit voltage. You may use the following table to evaluate the condition of your batteries:

BATTERY CONDITION TABLE

Specific Gravity Measured by Hydrometer	Open Circuit Voltage		State of Discharge @ 80° F
	12 Volt System	24 Volt System	
1.265	12.6 or more	25.2 or more	Fully Charged
1.225	12.4	24.8	25 % Discharged
1.190	12.2	24.4	50 % Discharged
1.155	12.0	24.0	75 % Discharged
1.120	11.7 or less	23.4 or less	100 % Discharged

** Note: Wait at least 5 minutes after charging or discharging before checking specific gravity or open circuit voltage. The battery's voltage needs to stabilize in order to get an accurate reading.*

Troubleshooting Your Battery System

If your battery will not accept or hold a charge, one of the following conditions may exist:

1. A BAD BATTERY. You may have a battery with an open or shorted cell, a battery without any "life" left. Check by charging the battery until all cells have a specific gravity of 1.225 or greater at 80° F. If you are unable to obtain 1.225 in each cell, replace the battery.

2. A BAD BATTERY CHARGER. If the battery open circuit voltage is low and/or the hydrometer indicates your batteries are low, the battery charger should be providing current to the batteries. If it is not, check the input fuse and check to see that you have charging voltage on the output with no battery attached. *Note: You will not get an accurate voltage reading on the output of the charger with no batteries attached. This is checked merely to ensure that you do not have an open circuit on the output.*

The battery charger has a thermal power reduction circuit to protect the charger from overheating. If you suspect this is the case, refer to the **INSTALLATION** section for information about proper charger location. See also **Cooling Fan** on page 19.

3. ELECTRICAL LEAKAGE. You may have a previously unsuspected source of current drain from the battery. To check for a leakage of this sort, disconnect the battery ground cable and connect an ammeter between the negative battery post and ground. If you have a reading over .1 amp, there is a source of current drain from the batteries which must be located and removed.

K) REFERENCE APPENDIX

* For more information about boat wiring to conform to U.S. Coast Guard regulations, write to:

Superintendent of Documents Request : 33 CFR 183 Subpart I
Government Printing Office
Washington, DC 20402

* For information about American Boat and Yacht Council recommendations for boat wiring, write to:

American Boat and Yacht Council
3069 Soloman's Island Road
Edgewater, MD 21037

Request: Standards and Recommended Practices for Small Craft.
AC systems: Section E8
DC systems: Section E9
A-20: Battery Charging Devices.

* For additional installation instructions, refer to:
ANSI NFPA 302