

**MOTOR
APPLIANCE
CORPORATION**

601 International Ave.
Washington, MO 63090

PHONE (636) 239-2772
FAX (636) 239-5652

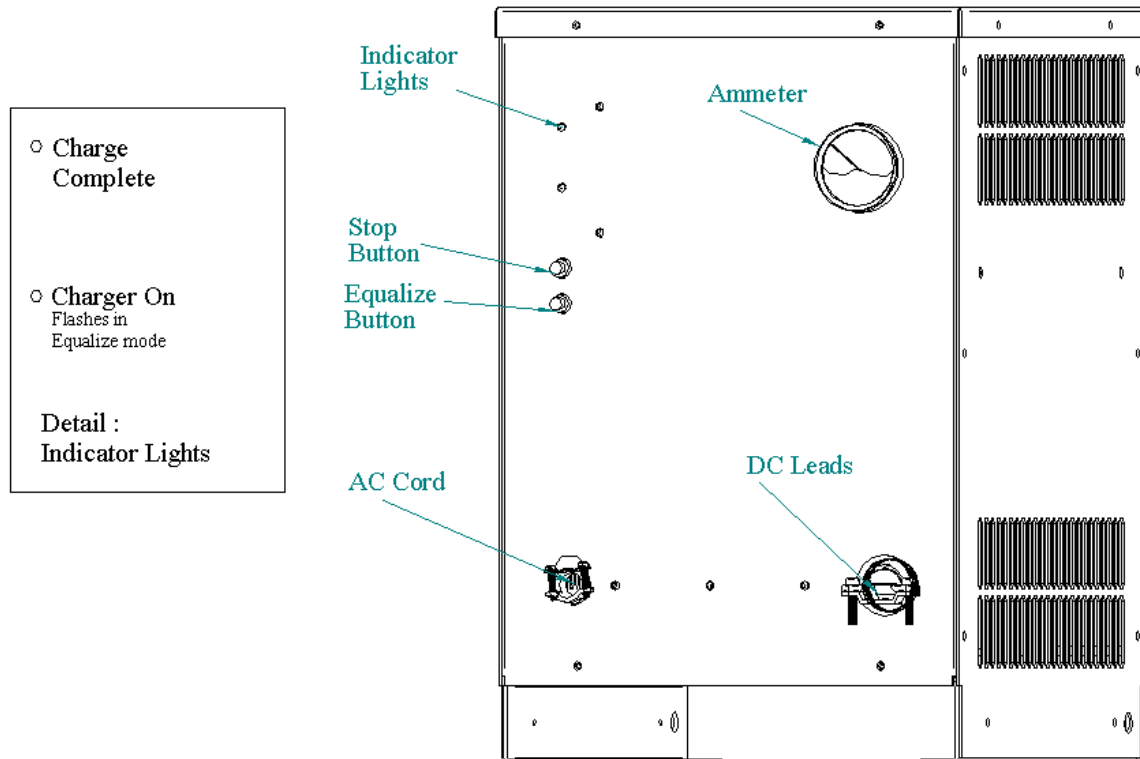
BATTERY CHARGER

MICROPROCESSOR CONTROL dv/dt

INSTRUCTION

MODELS: PAC640 - PAC660 - PAC675 - PAC1240 - PAC1260- PAC1830 - PAC1860

M16591 rev.A



FEATURES

dv/dt microprocessor control circuit - State of the art microprocessor monitors battery condition and automatically determines when to shut the charger off.
Auto start/stop - Starts automatically after connecting charger to the battery. Eliminates potential operator error. No timers to set. Charger automatically stops after battery receives proper charge.
Fail-safe protection - Internal backup timer terminates

charge cycle in the event abnormal conditions prevent normal charger shut down.
AC Interrupt Protection - In the event of an AC power interruption the charger automatically restarts upon the resumption of AC power.
Charge Complete Status Light - Charger is off and battery is fully charged.
Charger On Status Light - Charger is energized and charging the battery.
Equalize Button - Extends the charge cycle by 100 minutes.
Energy Savings - Significant

reductions in the cost required to charge a battery are made possible by the microprocessor control circuit. This is especially true with partially discharged batteries. Instead of running for a fixed period of time the automatic control terminates the charge cycle when the batteries are full.

For OPERATION and CHARGE CYCLE -
See page 2.

INSTALLATION

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, the charger may be made accessible by keeping it on a sturdy, roller-type stand or using the optional caster kit.

For general safety, make sure that the AC line cord and DC output cables do not obstruct traffic.

PRE-OPERATING PROCEDURE

Open cover on battery case and remove vent caps from battery.

Check that each vent cap is clean and that each vent hole is open.

CAUTION Impurities in tap water will damage battery plates.

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. **ALWAYS FILL CELL AFTER CHARGE CYCLE ONLY TO PROPER FILL LEVEL.**

SEE BATTERY INSTRUCTIONS.

Check the specific gravity of each cell to determine the need for charging.

Recharge the battery if any cell indicates a reading of 1.250 or less.

Replace vent caps before charging.

OPERATING PROCEDURE

Make sure the pre-operating procedure has been performed.

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.

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.

WARNING An ungrounded or improperly grounded AC power source can cause severe electrical shock to the user.

Connect the AC line cord into a properly grounded AC power source.

Disconnect the battery from the electrical system at the DC connector.

Connect the battery DC connector to the charger DC

connector being careful to match polarity. The charger will start after a short delay.

After the charge is complete disconnect the DC connector from the battery. If the charge cycle needs to be interrupted, use STOP button to turn the charger off.

Disconnect the AC line cord from the power source.

Remove each battery cell vent cap and check the fluid level.

CAUTION Impurities in tap water will damage battery plates.

Add, if necessary, enough filtered or distilled water to each cell to cover the battery plates, but not enough to allow fluid to rise into the cell filler neck.

Replace the battery cell vent caps.

Reconnect the battery to the electrical system.

ORDERING PARTS

When ordering parts, be sure to include all of the following:

- Battery charger Model no. (see data plate)
- Battery charger Spec no. (see data plate)
- Battery charger Serial no. (see data plate)
- Part Number
- Part Name
- Quantity of parts required.

OPERATION

Operation is completely automatic. Just connect battery to the charger and the automatic circuit takes control of the charge operation. By analyzing the rate of change in battery voltage, the charge control determines when the batteries are completely charged each time - no overcharging or undercharging. The automatic control is designed to extend battery life and reduce operation costs.

CHARGE CYCLE

In a typical charge sequence, when the charger is connected to the battery, the control circuit goes through an automatic self-diagnostic check. Indicator lights flash indicating the check is in progress. Following a short delay the charger initiates charge and the yellow Charger On indicator illuminates. At this stage in the charge cycle the battery is gassing freely. Charger On light remains on until batteries are charged, then the green Complete Light will come on and remain on until batteries are disconnected.

THEORY OF OPERATION

The control circuit monitors rate of change of battery voltage. The microprocessor reads voltage at specific time intervals and stores the reading on memory. The stored reading is compared with the next reading. As long as the voltage rises faster than pre-established parameters, the microprocessor keeps cycling. As a battery approaches full charge, the rate of change of voltage rise decreases. The automatic control determines if this rate of rise is proper to terminate the charge cycle.

TROUBLE SHOOTING GUIDE

INDICATOR LAMP SELF TEST

DC power only on - Both lights flash through one sequence, checking for AC power.

DC power + AC power - Both lights flash through a second sequence to check for AC power. If AC is connected, there is a short delay and the charger turns on.

ALL MAINTENANCE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL.

■ WILL NOT TURN ON. NO SELF-TEST.

- Charge plug not connected to battery.
 - Connect DC plug.

TURN WALL CIRCUIT OFF-DISCONNECT BATTERY PLUG

- Check that the circuit, battery, and charger are correct voltage.
- Loose DC connection to control circuit.
 - Clean and tighten. Repair as found.
 - Check control circuit lead connections at both ends.

■ WILL NOT TURN ON. SELF-TEST GOES THROUGH ONE SEQUENCE.

- Check AC connection.

■ DOES NOT TURN OFF.

- Control circuit failure
 - Replace as required.

■ EARLY TURN OFF (BATTERY NOT CHARGED). LESS THAN ONE HOUR RUN TIME.

- Loose DC connection
 - Check all connections from battery to control board.
 - If charger voltage and battery voltage are not matched, battery voltage being higher, charger will shut off a few seconds after turn on.

■ TROUBLESHOOTING OTHER THAN CONTROL CIRCUIT.

Your charger incorporates very simple and reliable designs, which make troubleshooting relatively easy. Repair procedure involves testing individual components and isolating defective parts. The sequence of this procedure normally follows the flow of electricity through the circuit. Test procedures will be faster and more complete when a simple AC/DC volt-ohmmeter is available and continuity tester (light) can be used.

WARNING: Electric Shock Hazard - Before checking charger disconnect AC supply cord from receptacle and DC plug from batteries. Discharge capacitors with insulated screwdriver.

NOTE: For testing, charger will not operate unless connected to proper battery voltage.

DIODE/CAPACITOR CHECKOUT PROCEDURE

QUICK TIP - A shorted diode can be diagnosed by checking for continuity at positive and negative of plug contacts. If test shows open, DC fuse is probably blown - check for continuity. To bypass open DC fuse, check continuity for

shorted diode at positive and negative lugs behind DC fuse. Reverse the ohmmeter probes. A shorted diode will show continuity on both tests.

To isolate defective diode, unbolt connection at end of flexible lead to isolate from circuit. Set ohmmeter to RX100 range.

Test#1 - Place one ohmmeter lead on aluminum heatsink and the other probe at end of loose flexible lead.

Test#2 - Reverse the position of the ohmmeter probes.

Good Diode - The ohmmeter needle should deflect on either test #1 or #2 - not both.

Short Diode - The ohmmeter needle will deflect on both tests #1 and #2. Replace diode.

Open Diode - The needle will not deflect in either test #1 or #2. Replace diode.

CAPACITOR CHECKOUT PROCEDURE

CAUTION - Short out capacitors with insulated screwdriver before performing test.

Disconnect leads. Set ohmmeter to RX100 scale. Connect meter leads to capacitor.

Good capacitor - Needle will deflect toward right and then be followed by a deflection in the opposite direction. Reverse ohmmeter probes to validate test accuracy.

Shorted capacitor - Needle deflects toward right and remains. Replace.

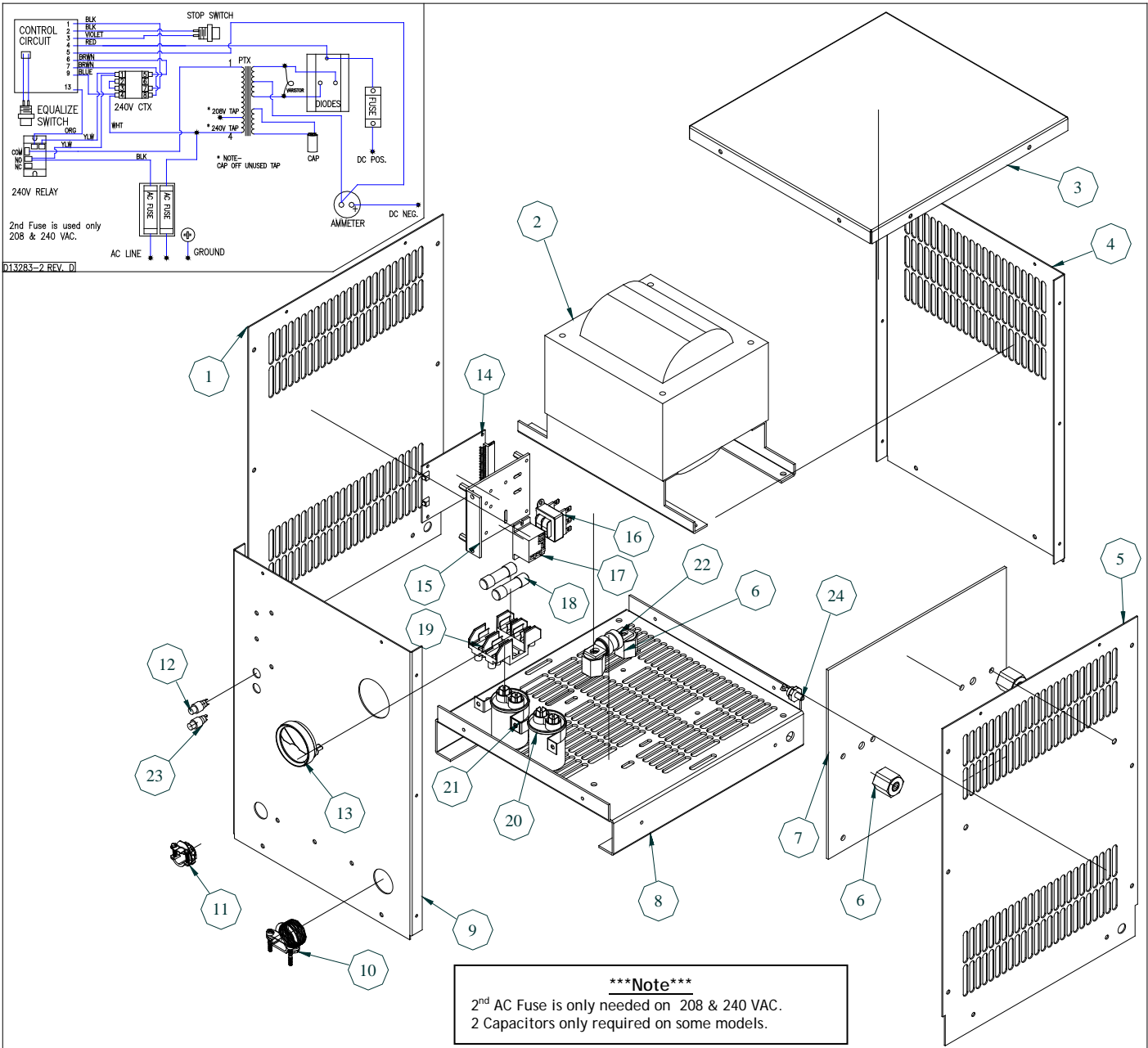
Open capacitor - No needle deflection. Replace.

■ OVERCHARGES DOES NOT TAPER

- Charger and battery not properly matched
 - Check specifications on both battery and charger.
- Excessive battery temperature causing suppressed voltage.
 - Allow battery to cool.
- Defective battery or poor DC connection
 - Check battery voltage while charger is on. The charger rate is controlled by the battery state of charge, which will adjust the output to the proper level if the battery is in good condition. If voltage does not come up to finish rate this may indicate a bad cell within the battery or a marginal DC connection between the battery and the charger. Look for hot terminals or connectors by feeling for heat carefully. Cell condition may be checked by testing cell voltage on all cells (with charger off, or open circuit) and will show bad cell voltage lower than others. Specific gravity should be checked in each cell. A 40- point difference may indicate a potential problem with a faulty cell.

PART IDENTIFICATION

- | | | |
|--|---|---|
| <ul style="list-style-type: none"> 1) Case Side, Right 2) Power Transformer 3) Case Top 4) Case Back 5) Case Side, Left 6) Standoff 7) Heatsink 8) Case Base | <ul style="list-style-type: none"> 9) Case Front 10) DC Cable Clamp 11) AC Cord Clamp 12) Stop Button 13) Ammeter 14) Control Circuit 15) Circuit Bracket 16) Control Transformer | <ul style="list-style-type: none"> 17) Relay 18) Ac Fuse 19) AC Fuse Block 20) Capacitor 21) Capacitor Strap 22) DC Fuse 23) Equalize Button 24) Diodes |
|--|---|---|



Statement of Warranty

Motor Appliance Corporation guarantees all MAC Battery Chargers to be free from defects in material and workmanship for a period of twelve months from date of manufacture.

MAC will, at their option, repair or replace FOB factory, or the nearest MAC Authorized Service Facility, at their expense, any MAC battery Charger failing due to defects in material and/or workmanship during the guarantee period.

MAC will not be responsible for any consequential damage or the labor to remove, or reinstall Battery Chargers on the equipment with which they

are used. Our liability shall be limited to the repair or replacement of defective Battery Chargers only.

Under no circumstances will MAC be responsible for any expense in connection with repairs made by anyone other than the factory or authorized service facility, unless such repairs have been specifically authorized in writing by the factory.

All Battery Chargers requiring repair are to be shipped, freight prepaid to our factory or nearest service facility. All return shipments are made FOB our factory or service facility.