

# ML-3

## cap lamp system

### instructions

#### WARNING

THIS MANUAL, INCLUDING THE WARNINGS AND CAUTIONS INSIDE, MUST BE READ AND FOLLOWED CAREFULLY BY ALL PERSONS WHO USE OR MAINTAIN THIS PRODUCT, INCLUDING THOSE WHO HAVE ANY RESPONSIBILITY INVOLVING ITS SELECTION, APPLICATION, SERVICE, OR REPAIR. THIS CAP LAMP SYSTEM WILL PERFORM AS DESIGNED ONLY IF USED AND MAINTAINED ACCORDING TO THE INSTRUCTIONS. OTHERWISE IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT COULD SUSTAIN SERIOUS PERSONAL INJURY OR DEATH.

The warranties made by MSA with respect to the product are voided if the product is not installed, used, and serviced in accordance with the instructions in this manual. We encourage our customers to write or call for a demonstration of this equipment prior to use or for any additional information relative to use or repairs. Call 1-800-MSA-2222 during regular working hours, or 1-800-MSA-5555 after working hours or during emergencies.

Manufactured by

**MSA**

MINE SAFETY APPLIANCES COMPANY  
PITTSBURGH, PENNSYLVANIA, U.S.A. 15230

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## ML-3 Cap Lamp System



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### IMPORTANT

Pay close attention to Warnings and Cautions in this manual. A WARNING describes a condition that may cause severe personal injury or death if allowed to happen. A CAUTION describes a condition that may cause moderate injury or property damage if allowed to happen.

#### **⚠ WARNING**

1. An adequate mine lighting program must include assessment of mine lighting requirements, integration of appropriate MSHA regulation, selection of proper equipment, and instruction and training in use, inspection and maintenance of equipment. (See MSHA regulations, Title 30 CFR, Part 19).
2. The cap lamp system will perform as designed only if used and maintained according to the manufacturer's instructions. Supervisors and users must read and understand these instructions before trying to use or service this product. We encourage our customers to

write or call their MSA distributor or call MSA Customer Service for information on this product before using it. To reach the nearest MSA office, call 1-800-MSA-2222 during normal business hours, or 1-800-MSA-5555 after hours or during emergencies.

3. This cap lamp may be used only after proper instructions and training of its use.
4. Do not alter, modify, or substitute any components without the approval of MSA. Such alterations will void the MSHA approval for use in a hazardous atmosphere.
5. Inspect the cap lamp and battery after each use and maintain them according to MSA's instructions. Repairs must be made by properly trained personnel only.
6. Follow MSA's instructions for first time and routine cap lamp use. The battery must not be left "on charge" indefinitely, (see Storing Idle Batteries section). Doing so may cause internal gases to vent, which may lead to accumulation of combustible gases in the lamp room, dam-

age to the battery, or reduced service life.

Failure to follow the above can result in serious personal injury or death.

### GENERAL DESCRIPTION

The ML-3 Cap Lamp System consists of cap mounted headpiece powered by a Luminator® (lead-acid) battery.

The basis of the headpiece in which some of the internal connections are integral. A selector switch is incorporated, which can switch on either the large main bulb or the small secondary bulb. The main bulb is held in the reflector in a focussed position by a screwed boss form which a lead connects to one of the cable termination points. The small bulb holder is positioned at the top of the headpiece, being connected internally to the cable termination. The reflector fits over the small bulb and has a rubber gasket around the rim to seal against the headpiece lens.

The battery covers are made of metal or plastic. When the metal cover is positioned on the top of the battery, it

# Preparing for Use

is further secured by a lock device which fits at the end opposite to the angle clamp. The lock device fits over the end of the cover, and is secured in position by a slotted screw. After the screw is tightened, it can be filled with wax to detect any unauthorized person tampering with the battery.

Depending on the Luminator battery used, the cap lamp is designed to operate at full brilliance for a minimum of an 8-10 hour shift, with reserve energy if needed. At the end of each shift the battery is recharged in a single- or multiple-station charging unit. The Luminator Power Cell (13 AH) is designed to operate at cycle routines of 8-10 hours discharge/16-14 hour recharge 5 days/week (max). If the routines are increased, the Luminator Power Cell Plus (16 AH) is recommended. Battery charging connection is made through the headpiece. Each battery has a transparent case with molded-in electrolyte level indicators below the filling ports.

## Remote Power Connections

**(only available with plastic cover)**  
The Remote Power Connection allows the Cap Lamp to be used as a power source for an external remote device while still operating as a light source. MSHA regulation permits this configuration as long as the external remote device current requirement does not exceed 275 milliamps.

If using the Remote with the ML-3 Cap Lamp, the Luminator Power Cell Plus 16 AH battery is recommended, due to higher battery demands. However, the Luminator Power Cell 13 AH has been approved.

## PREPARING THE ML-3 CAP LAMP FOR FIRST TIME USE

### Battery Charging

Every battery must be charged before it is used for the first time.

1. Allow the battery to remain on charge for 24 hours.
2. Top off each cell with distilled water if necessary (see Filling Battery). Never fill over top of fill line.

#### Note

Batteries which do not perform satisfactorily, should be removed from service and cycled - charged 16 hours, discharged 8 hours. Repeat

several times until battery responds. If battery does not respond after three or four cycles, it should be replaced.

3. After weekly shifts, the battery should be placed on the charger following the instructions included with the charger, and left to charge the remainder of the weekend.
4. If cap lamp needs cleaning, use a mild detergent and wipe. Do not submerge in water.

### Storage of Batteries

All stored batteries with acid should be boost charged for 24 hours every 3 months, and immediately before being placed into regular service. Recommended storage temperatures 32°F to 80°F.

### Filling Battery

The electrolyte level should be maintained between the two lines below the filling and venting hole i.e. slightly above the top of the battery plate.



Normally topping up should not be necessary more often than once every 4-6 weeks, and should always be carried out when the battery is fully charged. Only distilled or deionized water should be used in topping off.

## WARNING

**The electrolyte level of all batteries should be checked once each week, and after battery is charged.**

**Water only when battery is fully charged. If the battery is over-topped, there is a possibility that electrolyte may leak out under certain conditions.**

1. Fill the plastic bottle of the MSA Filling Device (P/N 69422 or 469773) with distilled water only, and place it at a convenient location close to the batteries to be watered.
2. Insert the nozzle or needle of the Filling Tube into the small hole provided in the battery window. Depending on the style of filling device, squeeze the bottle or the bottle handle.
3. Fill until the electrolyte level is centered between the two scribed lines below the cell window. The battery may have to be tilted back slightly to allow the water to flow.
4. Repeat this procedure in adjacent battery cell.

## CAUTION

**The Electrolyte is corrosive and can cause burns. Take proper precautions to avoid skin and eye contact. Contact MSA for battery Materials Safety Data Sheet (MSDS). Phone 1-800-MSA-2222.**

## USING THE REMOTE POWER CONNECTION

### Note

If using the Remote Power Connections with the ML-3 Cap Lamp, the Luminator Power Cell Plus 16 AH battery is recommended, due to higher battery demands. However, the Luminator Power Cell 13 AH has been approved.

1. To access the battery power for an external remote device, remove the connector cover located on the top of the battery. Keep the cover for later use.
2. Slide the remote power device's connector onto the connector on top of the battery until it stops.



# Cap Lamp System

- At end of shift, or when finished using the external device, remove the external connection from the battery top and reinstall the cover. Place the battery on charge as described in the Routine Battery Maintenance section.
- Refer to Illustrated Parts List for replacement components.

## CAP LAMP SYSTEM

### Replacing Battery (Metal Cover)

- To remove battery cover, remove the wax seal (if applicable) from the lock screw hole.
- Remove locking clamp hex screws with allen key.



- Remove locking clamp.



- Lift up locking clamp end of cover and slide cover back and off battery.

### Removing Cable Wires from Battery

- Loosen cable clamp screws from each terminal of battery. (Do not lose the cable clamp screws.)
- Lift each cablewire (lead) from battery terminal.

### Replacing Battery Cover (Metal)

- Attach cable wire (leads) to battery.
- Connect brown conductor to posi-

tive battery pole.

- Connect blue conductor to negative battery pole to ensure correct polarity.
- Tighten cable clamp screws with a flat blade screwdriver. (Do not overtighten.)
- Turn battery so the vent holes are facing you.
- Place the battery cover end with the rim to the left of the battery vent holes.



#### Note

Ensure that the cable leads lie properly on the battery top without being trapped or pinched.

- Press down on the battery cover.
- Place the lock clamp and screw over the battery cover, with the tab on top of the battery cover.



#### Note

The battery cover should be tested immediately after reassembly on to the battery, and at prescribed intervals, to determine that there is no electrical leakage beneath them. This is best done with a 0 to 6 voltmeter (200 ohms per volt). The test can be carried out on the frame with the charge switched on, by putting the voltmeter positive lead to the positive spring contact on the

charging frame, and the voltmeter negative lead to the battery cover. This will reveal a 'negative' leakage to the battery cover. Reversing the leads, and putting the voltmeter negative on to the charging frame negative key, will reveal any 'positive' leakage. If either of these faults are found, the cover should be removed and the fault rectified.

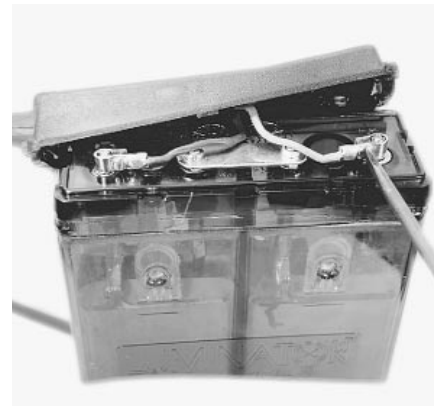
- Tighten the hex screw of lock-clamp, add wax seal if applicable. (do not overtighten).

### Replacing Battery (Plastic Cover)

- Remove the battery cover.
  - Use a 5/16" allen wrench to remove the screws from the cover clamps. Remove the clamps from the battery case.



- Lift the battery cover off the battery. Each end will have an adapter clip behind the cover clamp. Keep these for further use.
- Loosen cable clamp screws from each terminal of battery. (Do not lose the cable clamp screws.)
- Lift each cable wire (lead) from battery terminal.



### Installing New Battery

- Connect red conductor to positive battery pole and black conductor

# ML-3 Repair

to negative battery pole to insure correct polarity.

2. Tighten cable clamp screws with a flat blade screwdriver. (Do not overtighten.)

## Reinstalling the Battery Cover

1. Check both ends of the battery for the adapter clips.



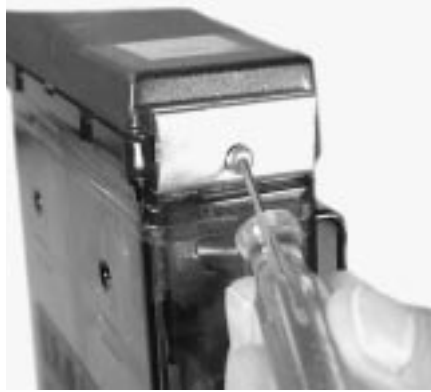
Replace the battery cover. It must fit squarely on top of the battery. Slide a cover clamp on each end of the battery and cover.



### Note

The mounting hole in each clamp is slightly off-center. Install the clamp so that the hole is below center.

2. Install the two screws and tighten, using the 5/64" allen wrench. (Do not overtighten.)



## USING ML-3 CAP LAMP SYSTEM

The ML-3 headpiece is made up of the lamp-housing, which contains the following parts:

- Bezel (ring)
- Lens
- Gasket
- Reflector
- Main Bulb
- Secondary Bulb

The on-off switch knob is located on the headpiece. To operate the lamp:

1. Turn the switch knob clockwise to main bulb or counterclockwise to secondary bulb.
2. After use, turn the switch knob until both bulbs are off.

## Repairing the Headpiece

Only the small insulated screwdriver should be used, as this allows the screws to be secured tightly enough without fear of a short circuit or other damage. The switch should be placed in the off position. If a bulb is being replaced it should be tested in the headpiece before final reassembly to verify that it will light. When reassembling the headpiece, it would be ensured that the gasket is correctly fitted around the reflector. The location of the reflector is by two projections which fit either side of the pin that rests against the envelope of the pilot bulb. The bezel ring should be screwed down firmly and the lock pin placed so that it fits into one of the recesses of the bezel ring and firmly screwed tight. The countersunk hole in the locking boss can be filled with the special sealing wax.

## ⚠ WARNING

It is essential that all contacts in the headpiece are tight, so that no resistance is developed which

might increase the time necessary to obtain an efficient charge or might reduce the light output of the lamp. In order to obtain the maximum light possible, the outside of the lens glass should be cleaned thoroughly.

The headpiece may be supplied with a 1.0A main bulb, or with a 0.75A. Both bulbs are interchangeable.

## REPLACING BULBS (MAIN AND SECONDARY PILOT BULB)

### Removing the Bezel Ring

1. Remove wax seal (if applicable) from lock screw.
2. Unscrew and back out lock screw by using special allen key.



3. Unscrew and remove bezel ring from headpiece housing.
4. Remove glass (lens) and reflector with sealing channel from headpiece housing.

### Note

Inspect all parts for cracks or other damage.

### Replacing the Main Bulb

1. Lift reflector out of housing, making sure not to break the bushing connection.



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2. Unscrew reflector from bushing by holding bushing and unscrewing reflector.



3. Remove main bulb.
4. Place the new main bulb through the reflector.



5. Hold the bushing and screw the reflector onto the bushing. (Do not overtighten.)



## Replacing Secondary Bulb

1. Remove bezel ring (use Remove Bezel Ring procedures).
2. Remove reflector from headpiece

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3. Unscrew secondary bulb from side socket assembly of head-piece housing.



4. Thread the new secondary bulb into the socket assembly. (Do not overtighten.)
5. Place the hole in the reflector over the secondary bulb.



6. Reassemble the glass (lens) and bezel to the headpiece assembly.

## Reassembling the Bezel Ring

When the lens is in position over the reflector, bezel ring is screwed firmly in place. The bezel ring is locked in position by a hex headed lock screw that fits into a countersunk hole and then enters one of the slots in the bezel ring. The countersunk hole enclosing the lock pin can be filled with wax if desired.



## Replacing the Reflector

1. Remove the bezel ring and lens.
2. Remove the reflector from main bulb bushing.
3. Remove gasket around reflector.

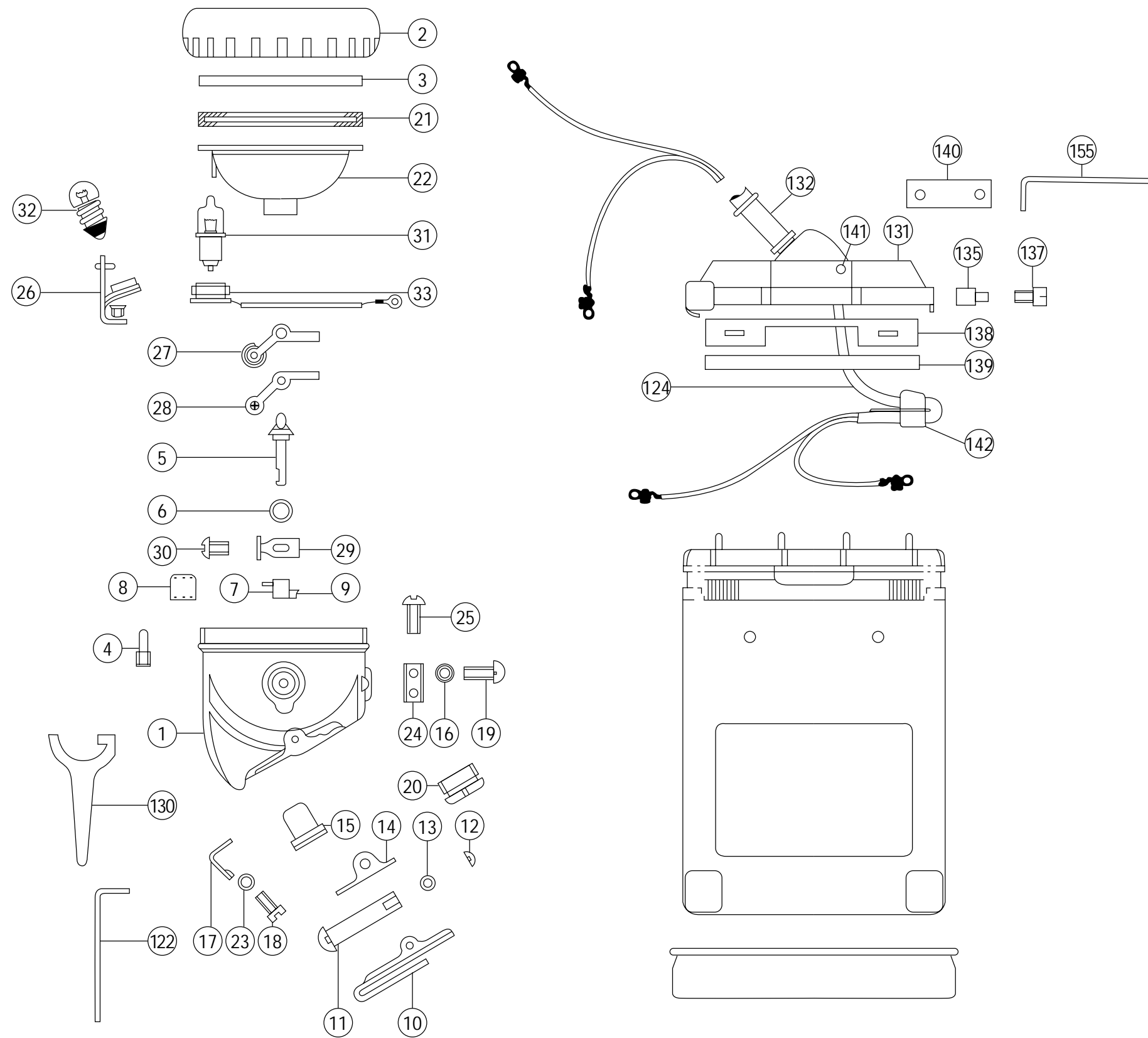


4. Place the gasket around the new reflector. Ensure the gasket is in place all the way around reflector.
5. Thread the reflector onto the bushing.



6. Reassemble the lens and bezel ring (see Reassembling of Bezel Ring).

# ML-3 Diagram



## Item List

- 1 Lamp Housing .....
  - 2 Bezel Ring .....10014213
  - 3 Glass Lens .....10014214
  - 21 Sealing Channel.....10014216
  - 22 Reflector .....10014210
  - 26 Small Bulb Socket
  - 31 Main Bulb 4V 1.0A .....10014215  
Halogen .....
  - 31 Main Bulb 4V 0.75A .....10014212  
Halogen (not shown)
  - 32 Small Bulb 4V 0.46A.....10014217
  - 33 Prefocus Reflector
  - 124 Cable .....10014218
  - 27 Large Bulb/Switch Connection
- Headpiece Contact Kit 10014519**
- 28 Small Bulb/Switch Connection Assembly
  - 29 Switch Connection
  - 30 3/16" B HD Screw
  - 16 Positive Contact Sealing Washer
  - 5 Switch Knob
- Switch Knob Kit 10014515**
- 6 Switch Knob Sealing Washer
  - 7 Switch Blade
  - 8 Switch Blade Cowl
  - 9 Grub Screw
  - 16 Positive Contact Sealing Washer
- Charging Screw Kit 10014517**
- 19 Charging Contact Screw
  - 24 Large Bulb Socket Block
  - 25 Large Bulb Socket Screw

**Lock Contact Kit 10014516**

- 14 Lock Spring
- 15 Lock Barrel
- 17 Lock Contact
- 18 Lock Contact Screw
- 23 Lock Contact Sealing Washer

**Cap Clip Kit 10014518**

- 10 Cap Clip
- 11 Cap Clip Screw
- 12 Cap Clip Nut
- 13 Spring Washer Steel

**Battery Cover Kit (Metal) 10014220**

- 131 Battery Cover Assembly (Metal)
- 132 Cable Gland
- 135 Lock Clamp & Bush Assembly
- 137 Battery Lock Screw
- 138 Insulating Pad PVC
- 139 Battery Top Gasket
- 140 Blank Number Check
- 141 Flat Head Rivet
- 142 Cable Lock

**Tool Kit 10014219**

- 122 Allen Key for Lock Pin
- 155 Allen Key for Battery Cover Lock
- 130 Key for Cable Gland Screwdriver (not shown)

**Note:** Only certain replacement items above may be purchased individually. All others, as noted, must be purchased in kit form.

# ML-3 Repair

## Troubleshooting

PROBLEM	CAUSE
Bulb glows dimly, flickers or fails	1. Low battery capacity <ol style="list-style-type: none"> <li>Observe the electrolyte level in the cell windows and make certain level is between the two scribed lines on the cell windows.</li> <li>Continuous use of battery that has not been fully charged will cause it to lose its capacity. This may be corrected by cycling the battery several times (discharge 8 hours and recharge 16 hours). Repeat this procedure 3 times. If battery does not respond, replace with a new one.</li> <li>Battery not charged.</li> </ol>
	2. Loose connections <ol style="list-style-type: none"> <li>Gently wiggle or pry each connection on top of the battery to make sure it is tight and working properly.</li> <li>Check the cables for broken conductors by twisting or pulling it at various points along its length.</li> <li>Check the headpiece terminals and the electrical connections inside the headpiece in the same manner as those on the battery.</li> <li>Make sure the bulb is secure and making good contact.</li> <li>If the light flickers or dims when any of the preceding items are being checked, that item should be repaired or replaced.</li> <li>If battery appears warm on charge, this is normal and is not necessarily an indication that anything is wrong with the battery.</li> </ol>
	3. Electrolyte Level <ol style="list-style-type: none"> <li>Check at least once each week to see that the electrolyte level is between the two scribed lines on the cell window.</li> </ol>
Battery not holding a charge during shift	<ol style="list-style-type: none"> <li>Make sure charger output is correct.</li> <li>Check electrolyte level after charge.</li> <li>Make sure connections between headpiece and battery are good; charging rack connections are good.</li> <li>Make sure stored batteries are boost charged before placing into service.</li> </ol>
Battery Capacity: Loses charge during weekly use	<ol style="list-style-type: none"> <li>13 AH battery recommended for 8-10 hour discharge/16-14 hour charge, 5 days a week. Use the 16 AH Luminator battery for greater cycle routines.</li> <li>Check charger.</li> <li>Check battery connections.</li> </ol>

<b>The Following Assemblies have Battery with Acid and 13 Amps</b>			
<b>Complete Cap Lamp Assembly Number</b>	<b>Headpiece and Cover Assembly</b>	<b>Main Bulb Amp</b>	<b>Battery Cover</b>
10010590 10010592	10010624 10010625	1.0 .75	Stainless Steel Stainless Steel
10010594 10010596	10010626 10010627	1.0 .75	Plastic Plastic
10010598 10010610	10010628 10010629	1.0 .75	Plastic w/Remote Plastic w/Remote
<b>The Following Assemblies have Battery with Acid and 16 Amps</b>			
10010612 10010614	10010624 10010625	1.0 .75	Stainless Steel Stainless Steel
10010616 10010618	10010626 10010627	1.0 .75	Plastic Plastic
10010620 10010622	10010628 10010629	1.0 .75	Plastic w/Remote Plastic w/Remote