

Ultralight™ and ML-2

cap lamp systems

luminator®

power cell

817177 13 AH

luminator®

power cell plus

817178 16 AH

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 RESPIRATOR 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.

Manufactured by



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

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Ultralight
13 AH - 817171

Ultralight
16 AH - 817172

Ultralight w/Remote
13 AH - 817169

Ultralight w/Remote
16 AH - 817170

ML-2
13 AH - 817173

ML-2
16 AH - 817174

ML-2 w/Remote
16 AH - 817176

Ultralight™ Cap Lamp System

ML-2 Cap Lamp System



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IMPORTANT

Please read and observe the 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 the 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

3. This cap lamp may be used only after proper instructions and training in 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 of methane and air only.
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 per-

sonnel 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, damage to the battery, or reduced service life.

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

GENERAL DESCRIPTION

The Ultralight and ML-2 Cap Lamp System consists of a lightweight, cap mounted headpiece powered by a Luminator® (lead-acid) battery.

General Description

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, using either a parallel or modular charging system. Each battery has a transparent case with molded-in electrolyte level indicators below the filling ports.

Remote Power Connections

The Remote Power Connection allows the Cap Lamp to be used as a power source for an external remote device while still operating as light source. MSHA regulation permits this configuration as long as the external remote device current requirement does not exceed 275 milliamperes.

If using the Remote with the Ultralight or ML-2 Cap lamps, 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 with the Remote Power Connection for Ultralight Cap Lamp use only.

Preparing the Ultralight and ML-2 Cap Lamps for First Time Use

Battery Charging

Every battery must be charged before it is used for the first time. A battery may be charged with parallel or modular systems, in either standard or low profile racks, or in a single station charger. Various MSA chargers and part numbers are listed in the chart below:

1. Set power supply or charging stations to $5.0 \pm .05$ VDC.
2. Connect the battery to the charging station, following the instructions supplied with the charger.
3. To check that charging current is flowing, look at the meter (located either just above or just below the battery on rack-mounted chargers). The meter needle should swing to the far right.

Note

In some cases there will not be a meter on the charger. See the instructions for the appropriate charger.

4. Allow the battery to remain on charge for 24 hours.
5. As the battery charges, the meter needle should gradually move to the left to OFF. In other chargers, the LED lights will indicate charged condition.
6. Top off each cell with distilled water if necessary (see Watering section).

MineSpot Charging Equipment

Part No.	Description
461891	Deluxe Charger, Single Unit, 120 VAC
466490	Charger, Modular, 6-unit, 120 VAC
466491	Charger, Modular, 10-unit, 120 VAC
464734	Charger, Modular, 40-unit, 120 VAC
464714	Charger, Modular, 60-unit, 120 VAC
463746	Charger, Standard, 40-unit, 120-VAC
463747	Charger, Standard, 60-unit, 120 VAC

Routine Battery Maintenance

1. Routine Charging on Standard Rack and Charger. All batteries in this category must be charged immediately after each period of use in the following manner:
 - a. Set power supply or charging stations to $5.0 \pm .05$ VDC.
 - b. Connect the battery to the charging station following the instructions supplied with the charger.
 - c. Check meter, the needle should swing to right indicating charge, (or check LED lights).
 - d. Allow battery to remain in the rack until it is recharged. (Needle of meter will return to "OFF" or LED lights will indicate charged condition).
 - e. To remove lamp and stop charge, rotate the headpiece counterclockwise to a full stop, then lift headpiece from key and battery from the charging rack.

Note

Batteries which do not perform satisfactorily, should be removed from ser-

vice 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.

- f. 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.
 - g. If cap lamp needs cleaning, use a mild detergent and wipe. Do not submerge.
2. 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.
 3. Watering. The electrolyte level should be maintained between the two lines indicated 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 3-4 weeks, and should always be carried out when the battery is fully charged. Only distilled or deionized water should be used in topping up.

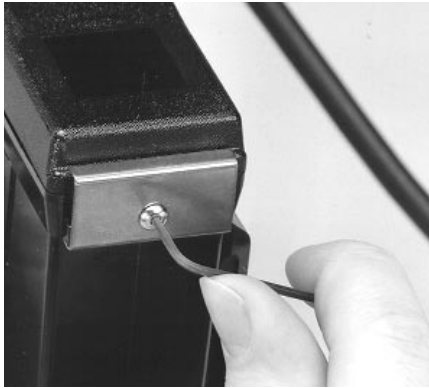
⚠ WARNING

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.

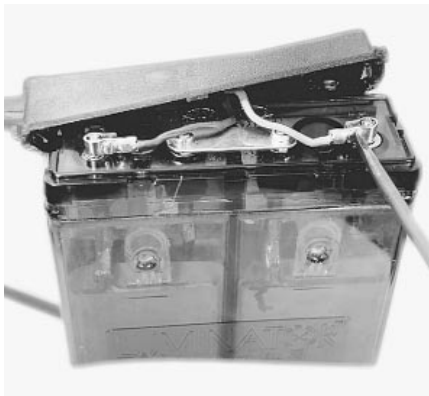
Battery Replacement

Replacing the Battery (Ultralight and ML-2)

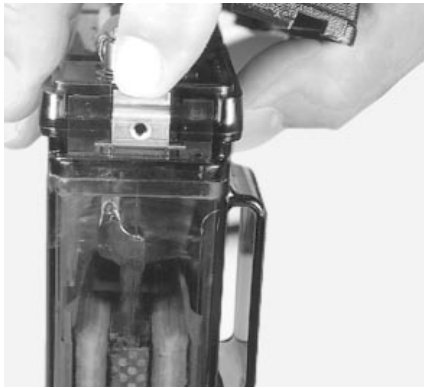
1. Remove the battery cover.
 - a. Remove the cover from your existing Caplamp battery using a 5/64" Allen wrench, and keep the cover clamps and socket dcrews for later use.



- b. Lift the battery cover off the battery.



- c. Disconnect the red and black wires from the battery terminals by loosening the screws holding the pole clamps to the posts. Carefully remove the clamps from the posts. Dispose of the old battery properly.
2. Install new battery.
 - a. Connect red conductor to positive battery pole and black conductor to negative battery pole to insure correct polarity.
 - b. Tighten cable clamps with a flat blade screwdriver.
3. Re-install the battery cover.
 - a. 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.

- b. Install the two screws and tighten, using the 5/64" allen wrench.



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

⚠ CAUTION

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.

- a. Fill the plastic bottle of the MSA Filling Device (P/N 69422, 469773, or 454052) with distilled water only, and place it at a convenient location close to the batteries to be watered.
- b. 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 push the needle forward.
- c. 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.
- d. Repeat this procedure in adjacent battery cell.

Using the Remote Power Connection

Note

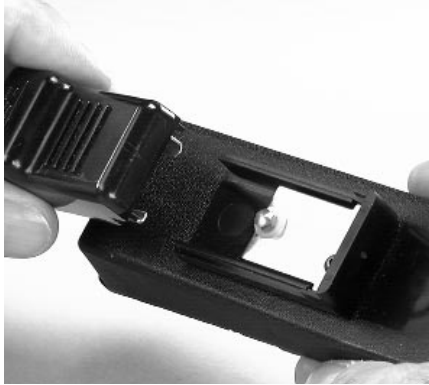
If using the Remote Power Connections with the Ultralight or ML-2 Cap Lamps, the Luminator Power Cell Plus 16 AH battery is recommended, due to higher battery demands. However, the Luminator Power Cell 13 AH has been approved for use with the Remote Power Connection with the Ultralight cap lamp.

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.



Ultralight Cap Lamp System

- Slide the remote power device's connector onto the connector on top of the battery until it stops.



- 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.

ULTRALIGHT CAP LAMP SYSTEM

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

- Bezel (cover);
- O-ring
- Main bulb and reflector assembly
- Spring
- secondary bulb
- 3-position switch
- Printed circuit board
- Charging key system

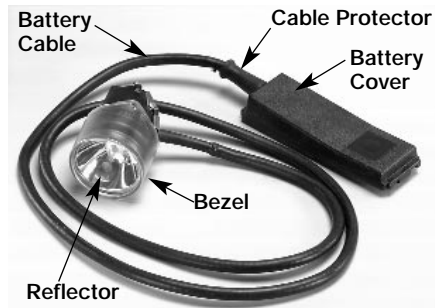
Bulbs are tungsten-halogen type construction.

The main bulb is mounted in the reflector, positioned for a tightly-focused beam at maximum light output, and then bulb and reflector are cemented together. The main bulb and reflector are held in the lamp-housing by the bulb pins, which plug into a flexible circuit board.

The secondary bulb gives enough light for the wearer to leave the mine if the bulb burns out. This bulb also plugs into the lamp-housing circuit board, but passes through the reflector. Since the bulb is not centered in the reflector, it does not give a bright, sharp spot.

The spring keeps the reflector tight against the cover bezel. An O-ring, mounted in a groove in the lamp-housing, seals against the bezel to

help keep out dirt and moisture. A stainless steel clip holds the headpiece firmly to the miner's cap. A durable, abrasion-resistant cable connects the headpiece to the battery and allows freedom of movement.



Using the Ultralight Cap Lamp System

The on-off switch is a 3-position switch, located on the headpiece. The center position is OFF. To operate the lamp:

- Place the switch forward all the way to light the primary bulb.



This bulb forms a tight spot for maximum lighting.

- Push the switch to the center position to the lamp off.
- Push the switch back all the way to light the secondary bulb. This bulb will not form a tight spot, but will give enough light to leave the mine.



⚠ CAUTION

If the main bulb fails to light, turn the secondary light on, and immediately go to a well-lit area and replace the main bulb.

MAINTENANCE OF THE ULTRALIGHT CAP LAMP SYSTEM HEADPIECE ASSEMBLY

Removing the Bezel (cover) P/N 476705

- Use a 3/32" allen wrench to thread the two allen set screws (P/N 634639) into the lamp-housing (P/N 486610).



Note

It is easier to remove the bezel by threading the set screws into the lamp-housing rather than out of the lamp-housing.

- Pull the bezel off the lamp-housing.



Maintenance

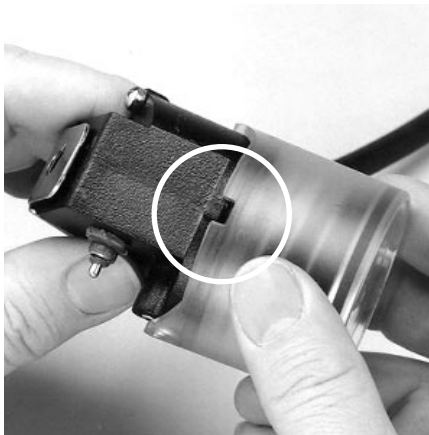
- Inspect the O-ring (P/N 632226) in the lamp-housing groove.



If the O-ring shows signs of wear or damage, replace it. The O-ring is needed to keep dust and moisture out of the lamp-housing.

Installing the Bezel

- Line up the notches in the bezel with the tabs in the lamp-housing.



- Press the bezel into place so that the side holes line up with the allen screws.
- Use a 3/32" allen wrench to thread the two set screws out of the lamp-housing until the screw heads are flush with the bezel surface.



⚠ WARNING

Do not touch the bulb while it is on. Turn the lamp off and let the bulb cool for 2 or 3 minutes before you touch it. These bulbs reach temperatures up to 400°F and you could be seriously burned.

Removing the Main Bulb and Reflector Assembly (P/N 480374)

- Remove the bezel.
- Gently lift the reflector and spring, and hold the flexible circuit board.
- Gently pull the reflector until the bulb pins are free.



- Lift the bulb and reflector and the spring (P/N 632227) out of the lamp-housing.

Removing the Secondary Bulb (P/N 476720)

- Gently pull the bulb until the pins are free of the circuit board.



Installing a new O-Ring

- Place a small amount of silicone lubricant on the O-ring.
- Gently stretch the O-ring over the lamp-housing and place it in the groove.

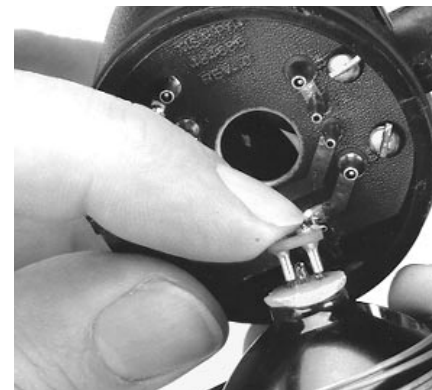
Installing a new Main Bulb and Reflector Assembly

- Insert the bulb and reflector into the spring.
- Compress the spring with your fingers.
- Line up the bulb pins with the contacts on the flexible circuit board.

Note

Check that the opening in the reflector is on the same side of the main circuit board as the contacts for the secondary bulb.

- Support the flexible circuit board with your fingers and push the reflector gently until the pins are in the flexible board contacts.



- Release the spring so it is flat on the circuit board.

Installing a new Secondary Bulb

- Insert the bulb through the opening in the reflector.
- Gently push the pins into the contacts on the circuit board.



- Re-install the bezel.

Removing the Main Circuit Board (P/N 484686)

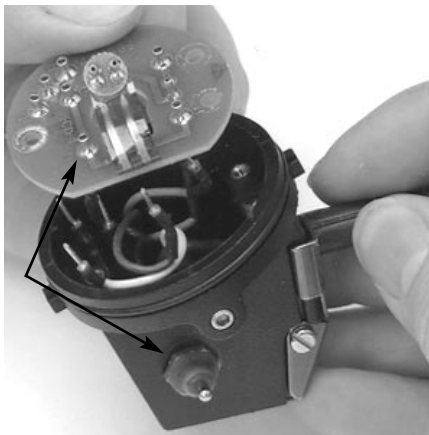
- Remove the bezel.

Maintenance

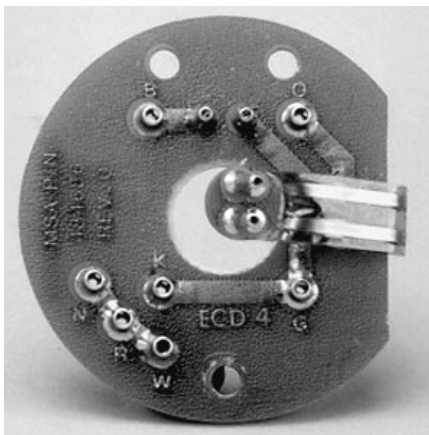
- Remove the main bulb and reflector, the spring and the secondary bulb.
- Remove the three screws (P/N 65522) and lockwashers (P/N 54278) that hold the circuit board in the lamp-housing.
- Lift the board to expose the wiring.
- Pull the seven wire pins out of the board.

Installing the new Main Circuit Board

- Position the board so that its straight side is on the same side of the headpiece as the switch;
 - its pins face up;
 - the flexible circuit board pins face up.



- Insert the wires into the pins on the bottom of the main circuit board. They must be installed as follows (the letters are on the top of the



board)

White to W Orange to O
Black to K Blue to B
Red to R Brown to N
Green to G

- Line up the holes in the board with the brass inserts into the

lamp-housing and install the three lockwashers and screws.



CAUTION

Do not over-tighten screws or you may crack the circuit board.

- Re-install the main lamp and reflector assembly, the spring and the secondary bulb.
- Re-install the bezel.

Removing the Switch and Wiring Assembly (P/N 484684)

- Remove the bezel.
- Remove the main bulb and reflector, the spring and the secondary bulb.
- Remove the main circuit board.
- Using a wrench, loosen and remove the boot (P/N 682390). Keep the boot; it will be used to secure the new switch. Take care not to damage the boot material.



- Pull the switch and wiring out of the lamp-housing.

Installing the Switch and Wiring Assembly

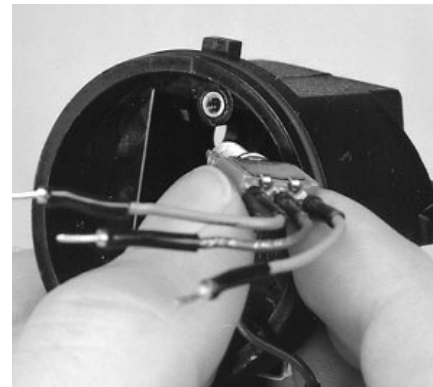
- Position the switch so that the blue wire is closest to the open

end of the lamp-housing and bend the wires so that the switch will fit in the lamp-housing.

CAUTION

Be careful not to bend the switch terminals. They may break.

- Insert the switch toggle through the hole in the lamp-housing. You may have to move the switch back and forth to fit the threaded bushing into the hole.



- Thread the boot on the switch bushing and tighten, using a wrench. Take care not to damage the boot.
- Re-install the main circuit board.
- Re-install the main bulb and reflector assembly, the spring and the secondary bulb.
- Re-install the bezel.
- Test the switch operation by pushing the toggle forward to light the main bulb, and back to light the secondary bulb.

Removing the Cap Hook (P/N 484687)

- Use a flatblade screwdriver to remove the two screws (P/N 65522) and lockwashers (P/N 51704) that hold the cap hook to the lamp-housing.



Maintenance

2. Be careful that you do not bend the cap hook as it is removed.

Installing a new Cap Hook

1. Line up the base of the cap hook with the grooves in the lamp-housing.



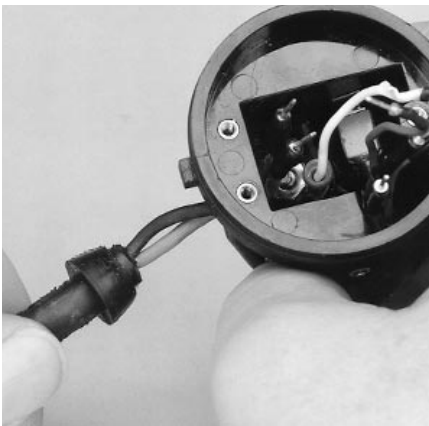
Note

The grommet portion of the cable may have to be pushed into the base of the lamp-housing.

2. Press the cap hook into place and install the two screws and lockwashers to secure it to the lamp-housing. Be careful that you do not bend the charging key.

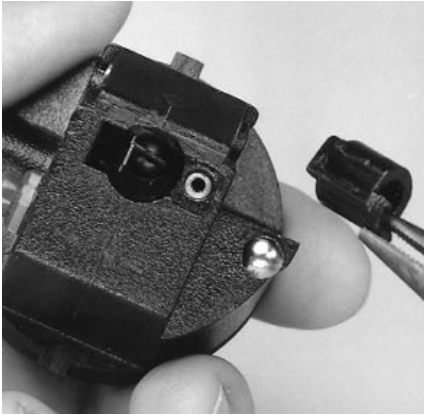
Removing the Charging Barrel (P/N 89947), Charging Contact (P/N 89948), and Contact Wire Assembly (P/N 484821)

1. Remove the bezel.
2. Remove the main lamp and reflector, the spring and the secondary bulb.
3. Remove the main circuit board.
4. Remove the cap hook.
5. Grasp the cable below the grommet and pull it out of the lamp-housing.

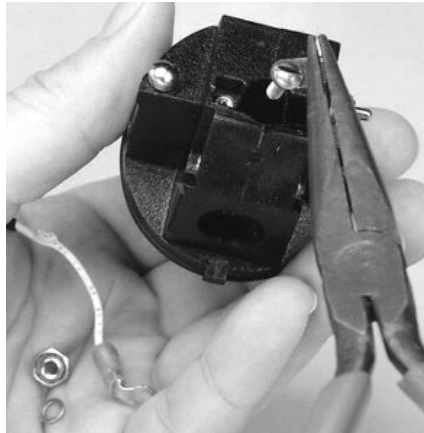


This removes the headpiece-end of the cable and battery cover assembly.

6. Using long-nose pliers, grasp the charging barrel (P/N 89947) and pull it out of the lamp-housing.

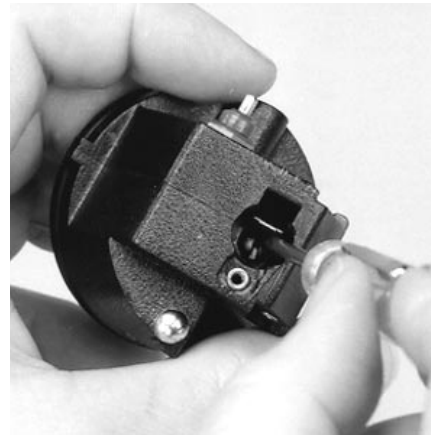


7. Unthread and remove the screw (P/N 633694), charging contact (P/N 89948), nut (P/N 50249), lockwasher (P/N 56874), and the contact wire assembly (P/N 484821) (the white wire).



Re-installing the Charging Barrel, Charging Contact, and Contact Wire Assembly

1. Insert the screw into the charging contact, then insert the screw into the hole in the center of the lamp-housing.



2. Temporarily, insert the charging barrel to hold the charging contact and screw in place.
3. Install the contact wire assembly (white wire), the lockwasher and the nut on the screw inside the headpiece.
4. Remove the charging barrel and secure the assembly by tightening the screw.
5. To re-install the charging barrel.
 - a. Position the charging barrel so that the end with the holes faces you.
 - b. Turn the charging barrel until the flat side lines up with the charging contact and the notch is on the right (at about the 5 o'clock position).
 - c. Insert the charging barrel into the lamp-housing and press it in place.



6. Re-install the cable through the hole at the bottom of the lamp-housing. Press the grommet in place.
7. Re-install the cap hook.
8. Re-install the main circuit board.
9. Re-install the main lamp and reflector, the spring and the secondary bulb.
10. Re-install the bezel.

Cable and Battery Cover Assembly

CABLE AND BATTERY COVER ASSEMBLY

Replacing the Cable

1. To separate the headpiece, cable and cover, remove battery cover clamp screws, one on each side, and slide cover clamps off sideways. Lift cover to permit access to cable clamp screws, loosen them, and carefully pry cable clamps off the battery poles.
2. To separate the cable from the cover, remove cable retaining screws and washers, then lift the cable away from the circular bosses molded in the cover and pull the cable through the cable protector.



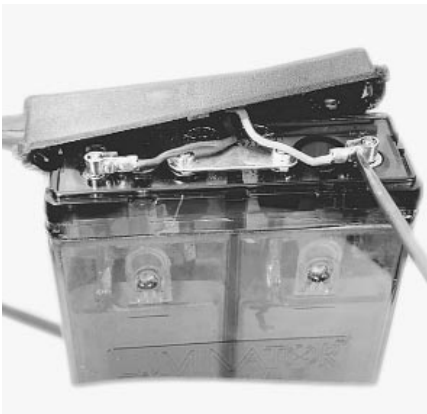
3. Lubricate approximately 6" length of other end of new cable with soapy water and insert it into the cover by pushing each terminated conductor, one at a time, through the cable protector.



Continue pushing cable until 3-1/4" of cable sheath is exposed inside the cover. Wrap cable around and through circular bosses molded in the cover and press firmly to inside top of cover. Secure in place by assembling cable retaining washers and screws.



4. Clean any foreign matter from each battery pole.
5. Fasten red conductor to positive battery pole and black conductor to negative pole to insure correct polarity.



Tighten in a position so that cover will sit squarely on battery top.

6. Slide on cover clamps.

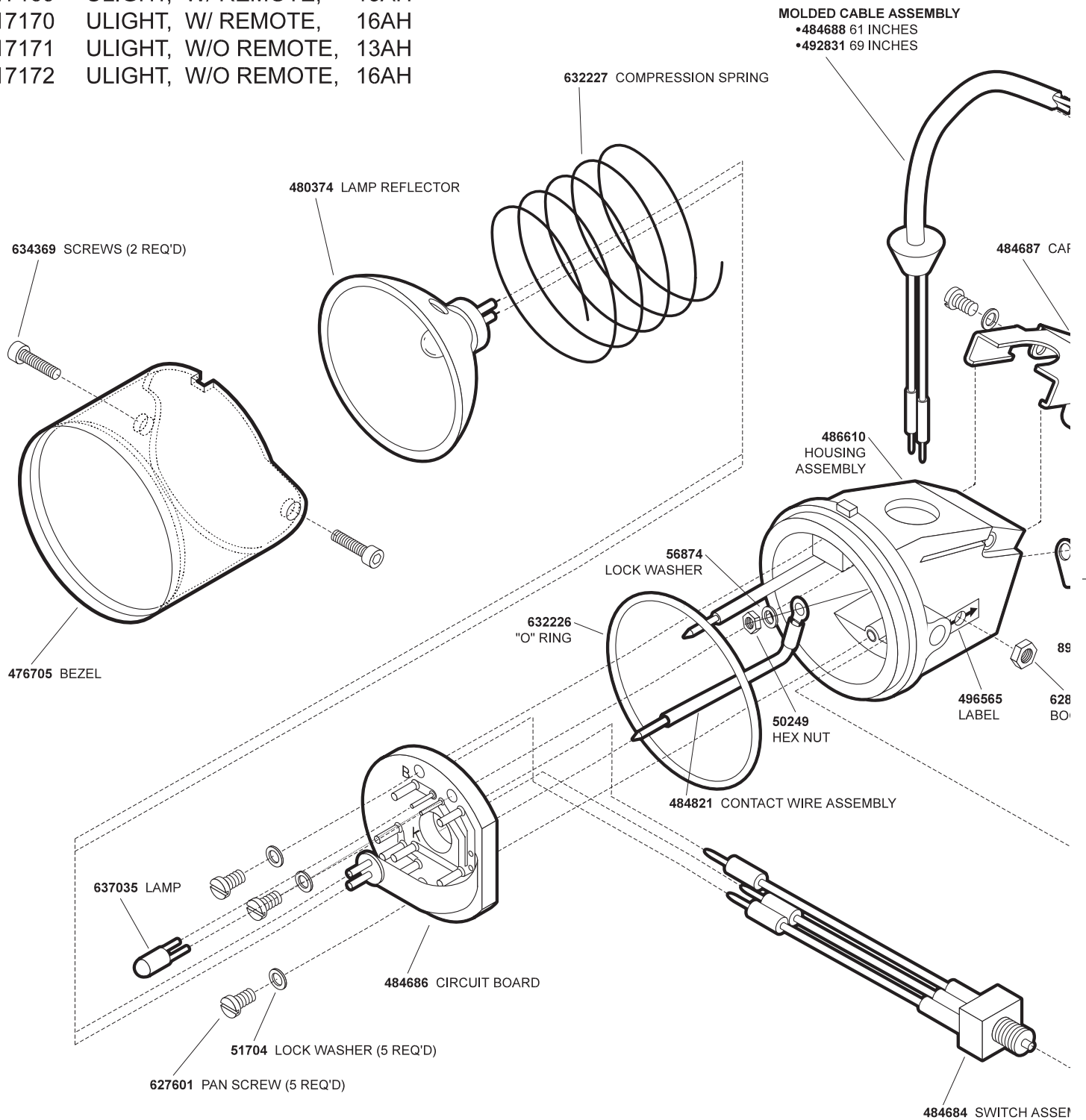


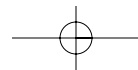
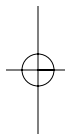
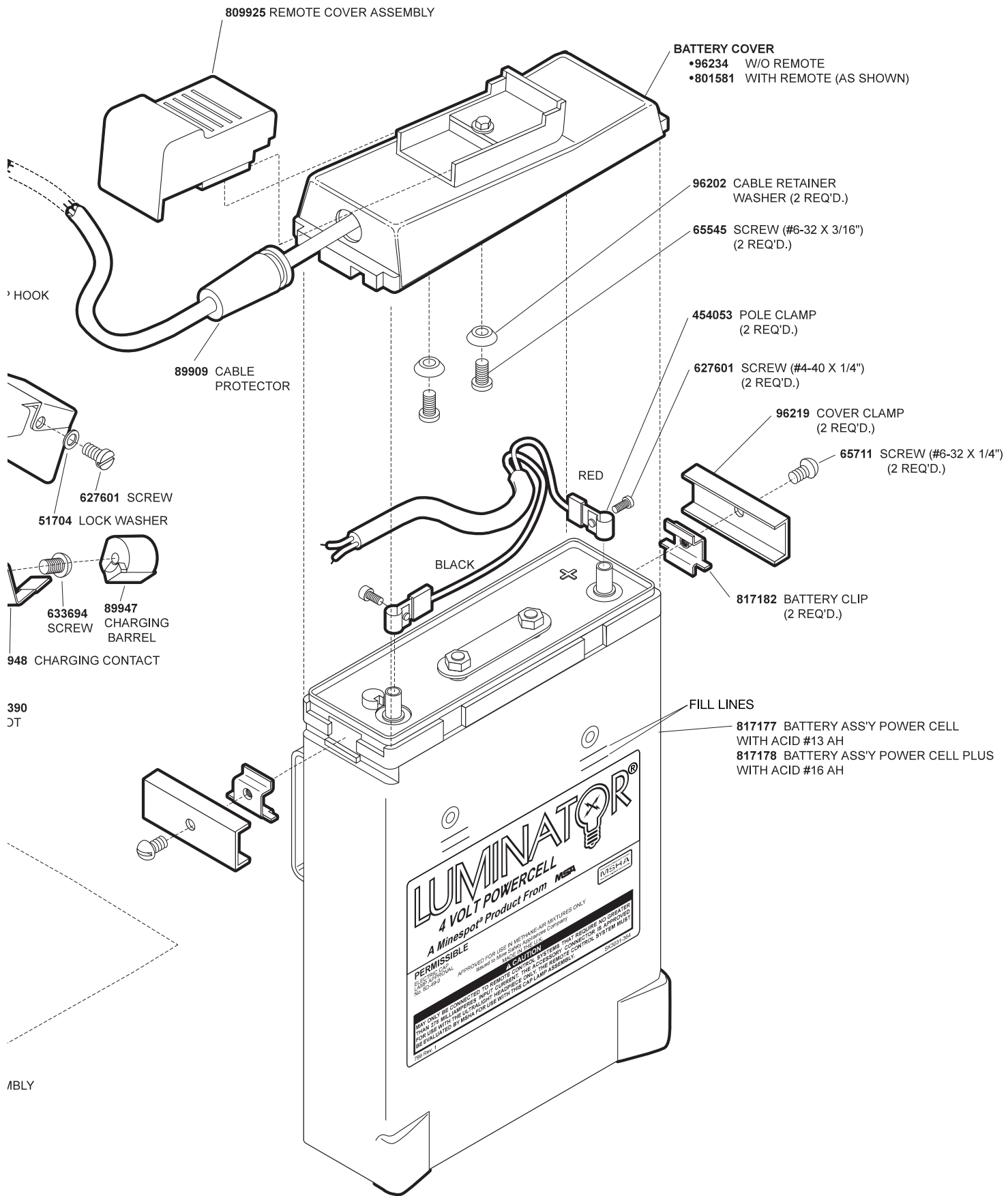
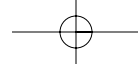
Lock in place with cover clamp screws.



ULTRALIGHT CAP LAMP SYSTEM

Part No.	Description	
817169	ULIGHT, W/ REMOTE, 13AH	
817170	ULIGHT, W/ REMOTE, 16AH	
817171	ULIGHT, W/O REMOTE, 13AH	
817172	ULIGHT, W/O REMOTE, 16AH	





LUMINATOR®
4 VOLT POWERCELL
 A Minnespot® Product From **MEGA**

APPROVED FOR USE IN METHANE-AIR MIXTURES ONLY
 Approved to Minnespot® by the American Gas Association

PERMISSIBLE
 ELECTRICAL
 No. 13-150

CAUTION
 MAY ONLY BE CONNECTED TO REMOTE CONTROL SYSTEMS THAT REQUIRE NO GREATER THAN 24 VOLT MAXIMUM INPUT SOURCE. THE ACCIDENTAL CONNECTION TO APPROVED REMOTE CONTROL SYSTEMS WILL DAMAGE THE BATTERY. THE REMOTE CONTROL SYSTEM MUST BE EVALUATED BY MEGA FOR USE WITH THIS CELL ASSEMBLY.

500000 1

ML-2 Information

ML-2 INFORMATION

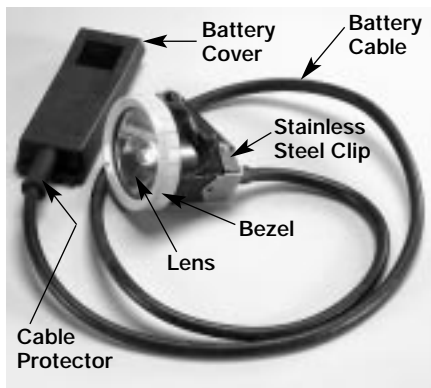
The ML-2 headpiece is made up of the lamp-housing, which contains the following parts:

- Bezel (cover)
- Lens
- Gasket
- Focusing Knob
- Two Filament Bulb
- Reflector
- Hexagonal Key Lock
- Stainless steel clip
- Charging circuit connection
- Switch knob

The bulb is a two filament bulb which permits the use of a safety filament if the primary filament burns out. The switch knob selects either filament. The gasket helps seal out dust and moisture from the headpiece.

The focusing knob adjusts the focus to a small spot or flood light. Once focused, it does not require further focusing until a new bulb is installed.

The reflector makes maximum use of light output. The hexagonal key lock locks the headpiece to ensure that the settings are not changed. The stainless steel clip attaches the headpiece to the miner's cap.



USING ML-2 CAP LAMP SYSTEM

The on-off switch knob is a 3 position switch, located on the headpiece. To operate the lamp:

1. Turn the switch knob clockwise or counterclockwise to turn on the primary filament. The primary filament provides the brightest beam of light.
2. Turn focusing knob to adjust the light beam to a spot or wide beam.
3. After use, turn the switch knob until the bulb is off.

Note

In the case of the primary filament burning out, the safety filament may be switched on by continuing to turn the switch knob. Check the bulb to be sure both filaments are in working order before use.

ML-2 MAINTENANCE

Replacing Bulb

1. Insert 3/32" hexagon wrench into the socket located at the bottom of the headpiece just in front of the charging key hole.



2. Rotate wrench one-half turn counterclockwise to unlock the bezel.
3. Unscrew the bezel assembly.
4. Remove bulb and replace with a new one.
5. Keep reflector clean and free of fingerprints.
6. Reassemble bezel assembly to headpiece and screw down firmly to obtain a tight seal.
7. Align the closest two grooves on the bezel with the two grooves on the lock cover.
8. With hexagon wrench, lock bezel in place by making one-half turn clockwise.

Replacing Reflector

1. Unlock the bezel and remove it from the headpiece (as just described for bulb replacement).



2. Remove bulb.



3. With headpiece facing up, turn focusing knob clockwise as far as it will go to move the reflector outward and free of the headpiece.



Maintenance

- Turn the headpiece downward and carefully shake reflector into palm of your hand.



- While facing headpiece, make sure that the focusing knob has been rotated to its extreme clockwise position.



- Place a new reflector into position in the headpiece so that the two pins extending from its yoke drop into the slots of the metal bushing.
- While applying a slight pressure against the reflector edge with fingers, draw the reflector inward by rotating the focusing knob counter-clockwise to its full stop position.

⚠ CAUTION

Reflector may be damaged if it is not drawn back to its extreme stop position within the headpiece before the bezel is attached and tightened.

- Insert bulb and replace the bezel assembly.

Replacing Cable

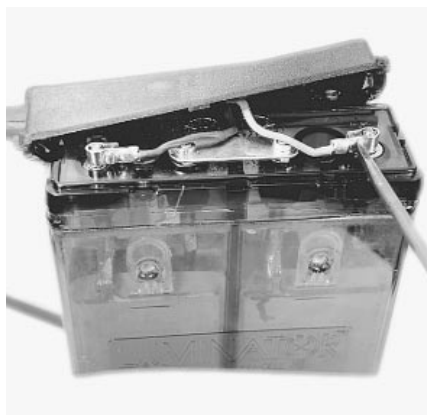
- To separate the headpiece, cable and cover, remove battery cover clamp screws, one on each side.



Slide cover clamps off sideways.



Lift cover to permit access to cable clamp screws, loosen them, and carefully pry cable clamps off the battery poles.



- To separate the cable from the cover, remove cable retaining screws and washers, then lift the cable away from the circular bosses molded in the cover and pull the cable through the cable protector.



- To separate the headpiece from the cable, use 5/64" hexagon wrench and remove three screws from each side and the top of the stainless steel clip.



Slide cap hook back along cable. Lift rubber flap on the cable end at the top rear of headpiece and remove headpiece cable screws.



- Remove cap hook from cable to be replaced and slide it on the new cable.

Maintenance

5. Fold back the rubber flap on the molded end of the new cable, insert headpiece cable screws through the exposed terminals and thread them into the threaded inserts at the top rear of headpiece housing.



Tighten screws securely.

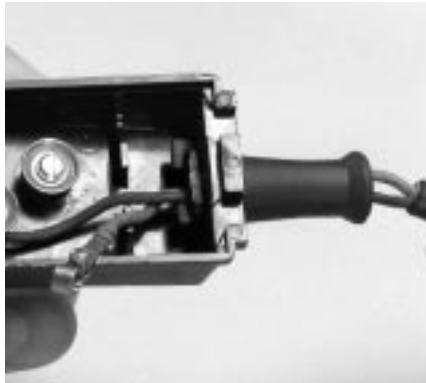


6. Slide cap hook into place over the molded end of the cable and fasten to the headpiece by inserting three cap hook locking screws.



7. Lubricate approximately 6" length of other end of new cable with soapy water and insert it into the cover by pushing each terminated

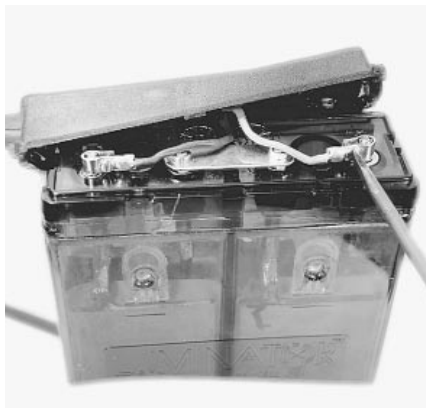
conductor, one at a time, through the cable protector.



Continue pushing cable until 3-1/4" of cable sheath is exposed inside the cover. Wrap cable around and through circular bosses molded in the cover and press firmly to inside top of cover. Secure in place by assembling cable retaining washers and screws.



8. Clean any foreign matter from each battery pole.
9. Fasten red conductor to positive battery pole and black conductor to negative pole to insure correct polarity.



Tighten in a position so that cover will sit squarely on battery top.

10. Slide on cover clamps.

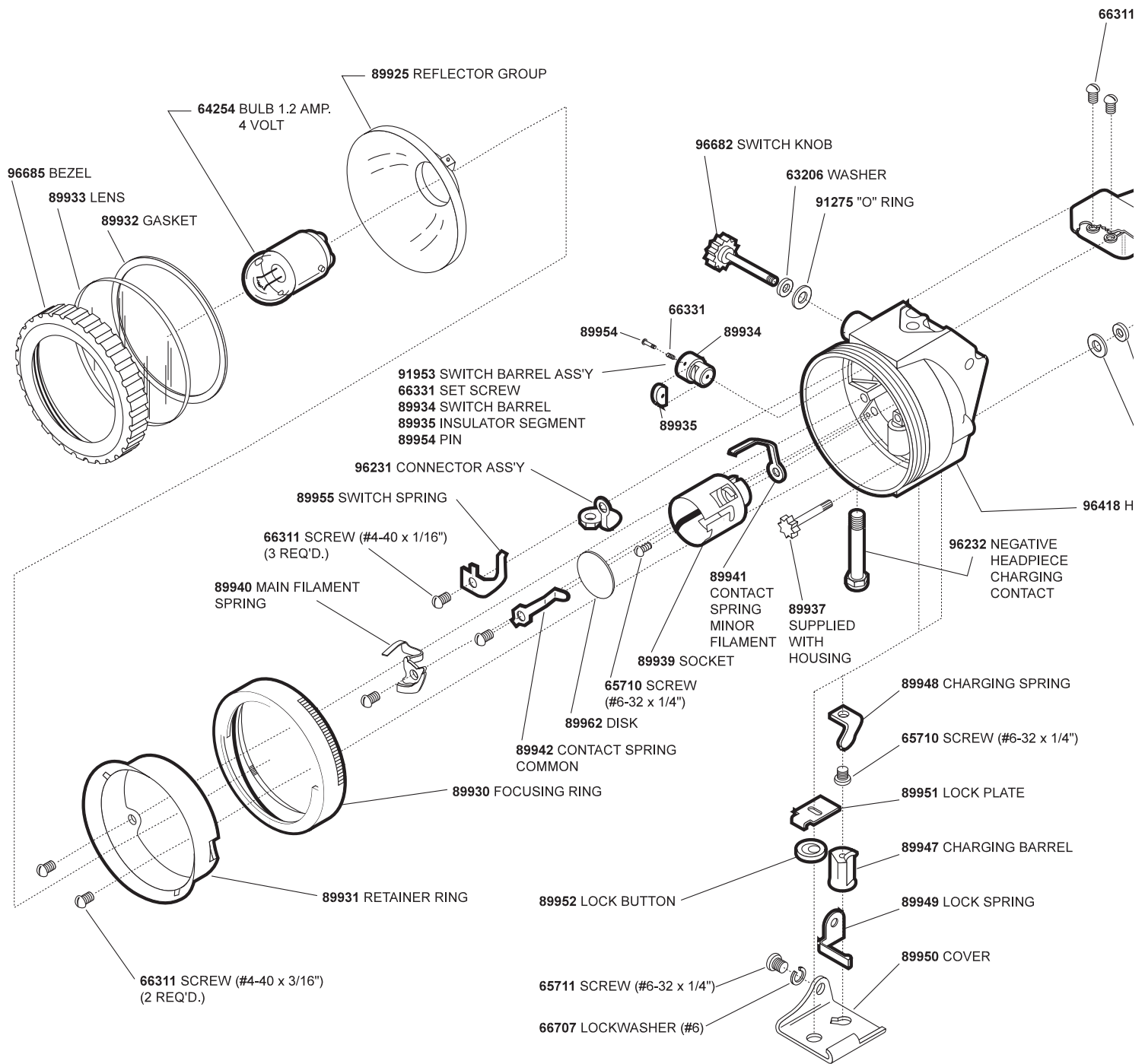


Lock in place with cover clamp screws.



ML-2 CAPLAMP SYSTEM

Part No.	Description	
817173	ML-2, W/O REMOTE	13AH
817174	ML-2, W/O REMOTE	16AH
817176	ML-2, W/ REMOTE	16AH





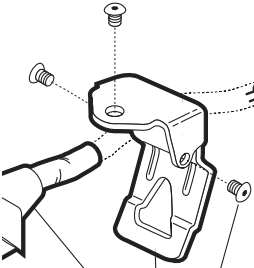
809925 REMOTE COVER ASSEMBLY

BATTERY COVER
•96234 W/O REMOTE
•801581 WITH REMOTE (AS SHOWN)

SCREW (#4-40 x 3/16")
(2 REQ'D.)

96202 CABLE RETAINER
WASHER (2 REQ'D.)

65545 SCREW (#6-32 X 3/16")
(2 REQ'D.)



89909 CABLE
PROTECTOR

454053 POLE CLAMP
(2 REQ'D.)

627601 SCREW (#4-40 X 1/4")
(2 REQ'D.)

65711 SCREW (#6-32 x 1/4")
(3 REQ'D.)

89944 CAP HOOK

454055 CABLE ASS'Y

96219 COVER CLAMP
(2 REQ'D.)

65711 SCREW
(#6-32 X 1/4")
(2 REQ'D.)

96681 FOCUSING KNOB } SUPPLIED
63206 WASHER } WITH
91275 "O" RING } HOUSING

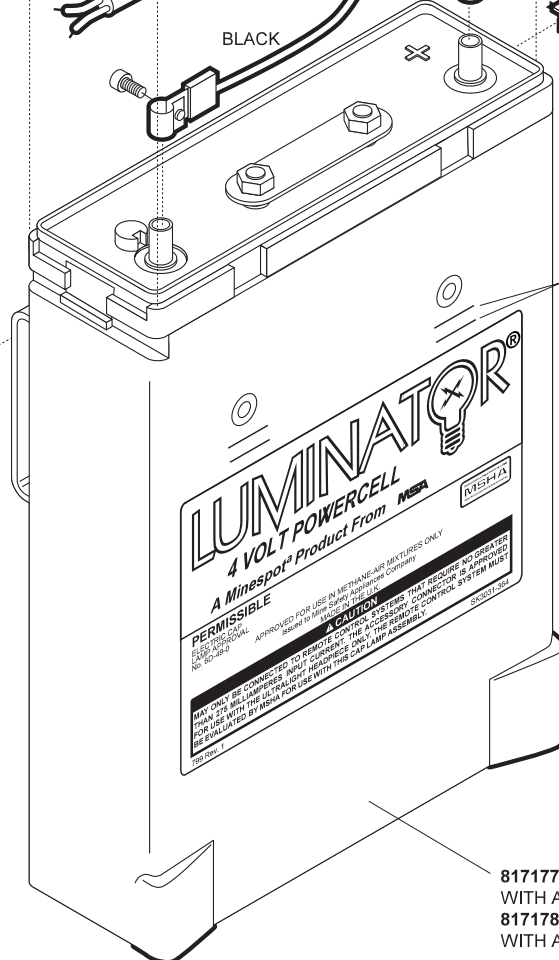
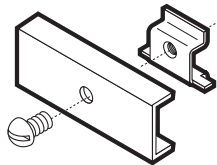
EADPIECE HOUSING ASS'Y

RED

BLACK

817182 BATTERY CLIP
(2 REQ'D.)

FILL LINES



817177 BATTERY ASS'Y POWER CELL
WITH ACID #13 AH

817178 BATTERY ASS'Y POWER CELL PLUS
WITH ACID #16 AH



Troubleshooting

PROBLEM	CAUSE
Lamp glows dimly, flickers or fails	1. Low battery capacity <ol style="list-style-type: none"> Observe the electrolyte level in the cell windows and make certain level is between the two scribed lines on the cell windows. 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.
	2. Loose connections <ol style="list-style-type: none"> Gently wiggle or pry each connection on top of the battery to make sure it is tight and working properly. Make certain solder connections of the circuit assembly (P/N 459739) are fused solidly to the poles. Check the cables for broken conductors by twisting or pulling it at various points along its length. Check the headpiece terminals and the electrical connections inside the headpiece in the same manner as those on the battery. Make sure the bulb is secure and making good contact. If the light flickers or dims when any of the preceding items are being checked, that item should be repaired or replaced. If battery appears warm on charge, this is normal and is not necessarily an indication that anything is wrong with the battery.
	3. Electrolyte Level <ol style="list-style-type: none"> Check at least once each week to see that the electrolyte level is between the two scribed lines on the cell window.
Battery not holding a charge during shift	<ol style="list-style-type: none"> Make sure charger output is set at $5.0 \pm .05$ VDC Check electrolyte level after charge Make sure connections between headpiece and battery are good; charging rack connections are good. Make sure stored batteries are boost charged before placing into service.
Battery Capacity: Loses charge during weekly use	<ol style="list-style-type: none"> 13 AH battery recommended routing is 8-10 hour discharge/16-14 hour recharge, 5 days a week. Use the 16 AH Luminator battery for greater cycle routines. Check charger. Check battery connections.

Manufactured by



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