

MMR Low/High Pressure

USERS MAINTENANCE INSTRUCTIONS

WARNING

THIS MANUAL MUST BE READ CAREFULLY BY ALL PERSONS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any complex piece of equipment, the MMR Air Masks from MSA will perform as designed only if used and serviced according to the instructions. OTHERWISE, THE PRODUCT COULD FAIL TO PERFORM AS DESIGNED, AND PERSONS WHO RELY ON THE PRODUCT COULD SUSTAIN SERIOUS PERSONAL INJURY OR DEATH.

This SCBA is certified by the National Institute of Occupational Safety and Health (NIOSH) and is specifically designed to comply with National Fire Protection Association (NFPA) standards for use in fire-fighting applications.

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. Please protect yourself and your employees by following the instructions. Please read and observe the WARNINGS and CAUTIONS inside. For any additional information relative to use or repair, write or call 1-800-MSA-2222 during regular working hours.



For More Information: Call (1-800-MSA-2222) or Visit Our Website at (www.MSAnet.com)



Be Sure.
Choose MSA.

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

INTRODUCTION

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IMPORTANT NOTICE

Note: A thorough understanding of the Air Mask is essential before attempting to service or maintain this Air Mask. A user's instruction manual is supplied with each new Air Mask. Refer to the user's instructions for specific user information, such as NIOSH Approval Information, donning and doffing, or cleaning and disinfecting.

1. This SCBA will perform as designed only if used and maintained according to the manufacturer's instructions. You must read and understand these instructions before trying to use or service this product. We encourage our customers to write or call for information on this product before using it.
2. If the SCBA does not perform as specified in this manual, it must not be used until it has been checked by authorized personnel.
3. Do not alter, modify, or substitute any components without the approval of the manufacturer. Such alterations will void the NIOSH approval.
4. Inspect the SCBA regularly and maintain it according to the manufacturer's instructions. Repairs must only be made by properly trained personnel. Any additional repairs NOT covered by this manual must be done only by Certified personnel.

For more information on self-contained breathing apparatus use and performance standards, please consult the following publications: NFPA Standard 1500 (1987 edition), Fire Department Occupational Safety and Health Programs (Chapter 5) and NFPA Standard 1981 (1992 edition), SCBA Performance.

Both publications are available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 22269.

ANSI Standard Z88.5, Practices for Respiratory Protection for the Fire Service; and, ANSI Standard Z88.2, Practices for Respiratory Protection. Both publications are available from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

OSHA Safety and Health Standards (29 CFR 1910) (see specifically Part 1910.134), available from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402.

MAINTENANCE

The maintenance procedures authorized in this manual need no special training, although the user must have a

thorough understanding of the apparatus. All maintenance procedures are for prior or current designs, unless specified. Additional, advanced training is available. Contact your MSA representative for details.

⚠ WARNING

Do not attempt repairs beyond those specified in this manual. Only trained or certified personnel, authorized by MSA, are permitted to maintain and repair this apparatus. Breathing apparatus must not be repaired beyond the manufacturer's recommendations. 29 CFR Part 1910.134, Par. (f) (4) makes these requirements clear:

Replacement or repairs shall be done only by experienced persons with parts designed for the respirator. No attempt shall be made to replace components or to make adjustment or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair. Failure to follow this warning may result in serious personal injury or death.

⚠ WARNING

Do not inspect the apparatus before cleaning if there is a danger of contacting hazardous contaminants. Clean and sanitize first, then inspect. Failure to follow this precaution may cause inhalation or skin absorption of the contaminant and result in serious personal injury or death.

Tool Kit (P/N 494352)

Part Number	Description
633411	Plastic stick
53217	Hex key
604070	Christo-Lube lubricant
636061	Crowsfoot wrench, 11/16"
636062	Crowsfoot wrench, 5/8"
479853	Gauge wrench
636063	Socket, 7/16" (3/8" drive)
635957	Open-end wrench, 11/16"
633277	Driver, 3/8"
635958	Open-end wrench, 7/16"
29787	Loctite #222 Sealant
600920	Leak detection solution
28907	Pipe-sealing tape
50013	1/4" Flat-blade screwdriver
630384	Open-end wrench, 5/8" and 3/4"
636060	O-ring removal tool
633424	Open-end wrench, 9/16" and 1/2"
627971	Retaining ring pliers
494447	Socket, 1/4" deepwell (3/8" drive)
635632	Socket, 5/8" (3/8" drive)
496317	Spanner wrench (facepiece inlet quick-connect)
633426	Torque wrench, 0-150 in. lbs. (3/8" drive)

LEAK TESTING

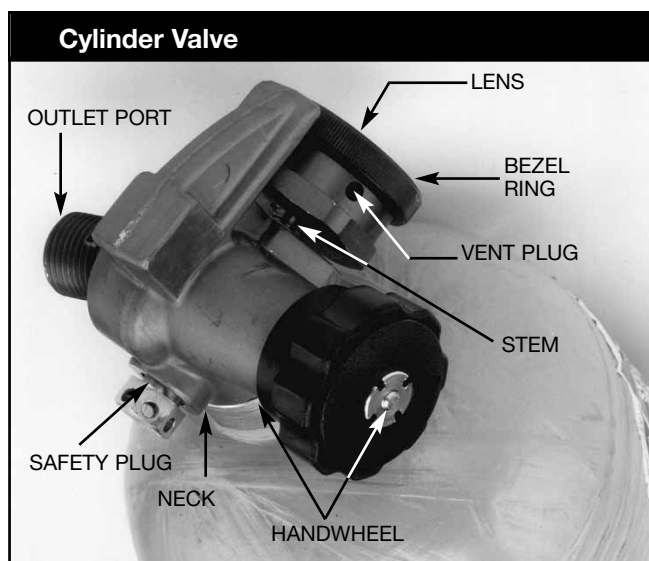
Leak Testing should be performed when the SCBA fails any of the inspection steps, following disassembly, or as part of a regularly-scheduled maintenance procedure. The SCBA must hold system pressure without leaks to provide adequate protection. The component leak test procedure is the first step in trouble-shooting. These tests ensure that you do not have a leak. Leak testing quickly identifies components which need repair or replacement. Use P/N 600920 leak test solution, or prepare a soapy water solution. Be sure to use enough soap to produce bubbles.

⚠ WARNING

Do not tighten fittings or connectors when the system is pressurized. Close the cylinder valve. Be sure nothing blocks the regulator outlet. Relieve pressure from the system by slowly opening the bypass valve. Failure to follow this precaution may cause fittings or connectors to rupture, resulting in serious personal injury or death.

CYLINDER VALVE

1. Outlet Port (Coupling Nut Connection)
 - a. Be sure that the cylinder valve handwheel is completely closed.
 - b. Draw a bubble of leak test solution across the outlet port and the two bleed holes on the thread(s).
 - c. If the bubble expands, there is an air leak through the valve. The valve must be repaired by a certified repairperson.
2. Pressure Gauge
 - a. Remove the rubber gauge guard. Apply leak test solution to the pressure gauge stem, cover, and bezel.
 - b. If bubbles appear, the pressure gauge must be replaced.



Note: On High Pressure MMR pressure gauges, apply leak test solution to the rubber vent plug or tape. If bubbles appear, the pressure gauge must be replaced.

3. Cylinder Neck
 - a. Apply leak test solution to the cylinder neck.
 - b. If bubbles appear, the cylinder must be taken out of service. The valve must be repaired by a certified repairperson.
4. Cylinder Handwheel and Safety Plug
 - a. Apply leak test solution to the cylinder handwheel and safety plug.
 - b. If bubbles appear, the valve must be repaired by a certified repairperson.

AUDI-LARM™ AUDIBLE ALARM

Connect the alarm coupling nut to the cylinder and hand-tighten. Check that the bypass valve is completely closed on the MMR, and that the shut-off valve is pushed IN, then fully open the cylinder valve.

1. Coupling Nut
 - a. Apply leak test solution to the front and back of the coupling nut.
 - b. If bubbles appear, close the cylinder valve and open the bypass valve to relieve pressure. Further hand-tighten the coupling nut.
 - c. Continuation of bubbles indicates a leak at the insert O-ring.
 - d. Close the cylinder valve and relieve pressure from the system. Be sure nothing blocks the regulator outlet, then slowly open the bypass valve.
 - e. To replace the insert O-ring, see Audi-Larm Parts Replacement.
2. Audi-Larm Insert
 - a. Apply leak test solution to the Audi-Larm Alarm. Inspect pipe threads where the insert enters the alarm. If bubbles appear, see Replacing the Coupling Nut.
3. Audi-Larm Outlet
 - a. Apply leak test solution where the high pressure hose threads into the alarm.
4. Audi-Larm Adjusting Screw
 - a. Apply leak test solution to the adjusting screw and the pipe plugs. If bubbles appear, return the alarm to a Certified MSA Air Mask Service Center.

LEAK TESTING

HIGH PRESSURE HOSE

Apply leak test solution to both hose and fittings at each joint. If bubbles appear, see High Pressure Hose section.

FIRST STAGE REGULATOR

Note: No first stage repairs (other than those specified) are permitted in User Maintenance. Return the regulator, hose, Audi-Larm Assembly, and pressure gauge to a Certified MSA Air Mask Service Center if other maintenance is necessary.

1. Adjusting Nut
 - a. Apply leak test solution to the adjusting nut. If bubbles appear, return to a Certified MSA Service Center.
2. Plug
 - a. Apply leak test solution to the plug. If bubbles appear, return the regulator to a Certified MSA Service Center.
3. Regulator Cap
 - a. Apply leak test solution to the joint between the body and the regulator cap. If bubbles appear, return to a Certified MSA Service Center.
4. Joints
 - a. Apply leak test solution to the joints between the relief valve swivel, regulator cap, and retaining ring. If bubbles appear, return to a Certified MSA Service Center.
 - b. Apply leak test solution to the joints between the relief valve body and the swivel. If bubbles appear, return to a Certified MSA Service Center.
5. Relief Valve
 - a. Apply leak test solution to the relief valve outlet. If bubbles appear, see Removing the Relief Valve Swivel section.
6. Vent Holes
 - a. Apply leak test solution across the vent holes in the body. If bubbles appear, return to a Certified MSA Service Center.

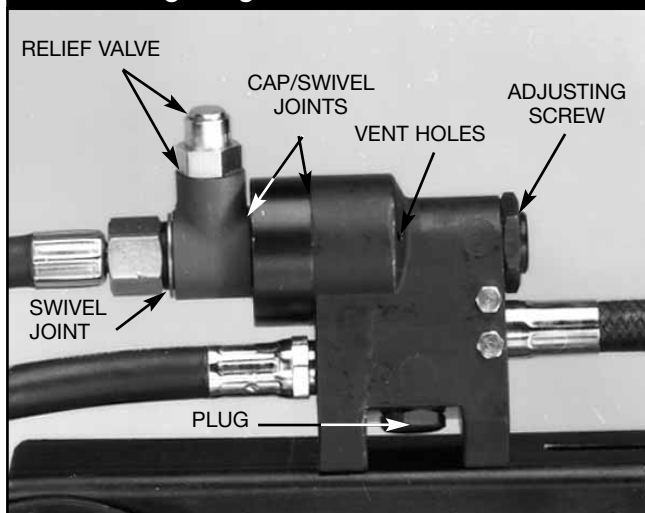
INTERMEDIATE PRESSURE HOSE

1. Apply leak test solution to the connection where the hose joins the first stage regulator.
2. Apply leak test solution to both ends of the swivel and where the hose ferrule connects to the swivel.
3. If bubbles appear at any of the joints, the leak must be corrected (see Removing the Intermediate Pressure Hose).

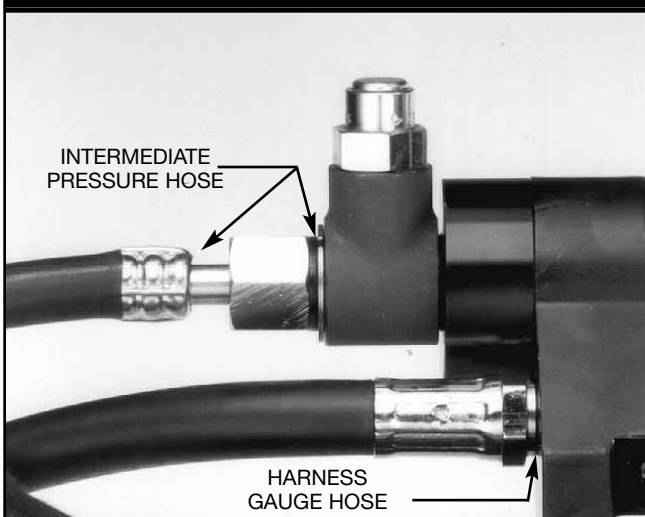
High Pressure Hose



First Stage Regulator



Intermediate Pressure Hose



LEAK TESTING

REDUNDANT ALARM/HARNESS GAUGE HOSE

1. Apply leak test solution to the hose joint where the hose connects to the first stage regulator body.
2. Slide the gauge protective cover back and apply leak test solution to the connections which join the hose, adapter, swivel and redundant alarm jam nut.
3. Apply leak test solution around the lens and bezel.
4. If bubbles appear at any of these joints, the leak must be corrected.

Refer to the appropriate component section.

LEAK TESTING QUICK-FILL® SYSTEM

The following additional locations on Air Masks equipped with the optional Quick-Fill System must be leak tested:

1. The joint on each side of the block;
2. Across the outlet fitting;
3. Where the fitting enters the block;
4. On Low Pressure Air Masks only, the location where the relief valve is installed on the Audi-Larm Alarm.
5. The swivel connection at the high pressure hose (belt mounted Quick-Fill System only).

LEAK TESTING DUAL-PURPOSE

1. The two hose connections on the Dual-Purpose junction block;
2. Both ends of the male air-line connection.

After All Components are Leak Tested

Close the cylinder valve. Be sure that nothing blocks the regulator outlet. Relieve pressure from the system by cracking the bypass valve. Use a clean, lint-free cloth to wipe the components dry.

GENERAL NOTES

The inspection and maintenance procedures authorized in this manual are classified User Maintenance. Additional, advanced training is available. Contact your MSA representative for details. Refer to the appropriate Illustrated Parts List.

IMPORTANT

You must read and understand the General Notes, Warnings, and Cautions below before performing Disassembly and Repair. General Notes is a collection of procedures common to many repairs. Details for each procedure are listed below.

Details are not repeated each time the procedure is done. Instead, a reference to the General Note appears in the text.

⚠ CAUTION

Do not attempt repairs beyond those specified in this manual. Breathing apparatus must not be repaired beyond the manufacturer's recommendations.

Note 1: Lubricate all designated O-rings with a very thin film of Christo-Lube™ lubricant (P/N 604070) before they are installed. Christo-Lube lubricant is compatible with brass and aluminum.

Note 2: Pipe-sealing tape is used on fittings with tapered threads. Wrap 1 to 1-1/2 turns of tape in a clockwise direction (looking into the threaded end of the fitting). Start at the second thread. Do not put tape on the first thread. Pieces of tape can break off and reduce air flow. Apply a thin film of Christo-Lube lubricant to the outer surface of the tape before threading the part into another component.

⚠ CAUTION

Do not over-tighten parts or you may damage the part or the fitting threads.

Note 3: All repair procedures assume that the Audi-Larm Assembly is disconnected from the apparatus cylinder.

DISASSEMBLY AND REPAIR

1. All repair procedures assume that the Audi-Larm assembly is disconnected from the apparatus cylinder.
2. Be sure the cylinder valve is completely closed.
3. Be sure that nothing blocks the regulator outlet. Open the bypass valve to relieve pressure in the system.
4. Close the bypass valve fully.

⚠ WARNING

Do not disconnect the Audi-Larm coupling nut when pressure is shown on the harness gauge. Always be sure that you have released all pressure from the regulator. Removing the coupling nut with the regulator pressurized may result in serious personal injury or death.

5. Unscrew the Audi-Larm coupling nut from the cylinder valve.

ALARM ASSEMBLY REPAIR

Insert O-ring

⚠ WARNING

Relieve all pressure from the system. Close the cylinder valve fully. Be sure that nothing blocks the regulator outlet. Open the bypass valve fully to release any trapped air.

1. Insert your fingernail or the O-ring removal tool under the O-ring (P/N 633553) and remove it. Be careful not to scratch the Alarm O-ring groove.
2. Apply a light film of Christo-Lube lubricant to the new O-ring.
3. Roll the new O-ring over the end of the insert and seat it into the O-ring groove. If the O-ring is not seated, air may leak.

Bell

1. Using a flat-blade screwdriver, unthread the existing screws and lock-washers holding the bell to the Audi-Larm housing. Discard the screws and washers.



⚠ WARNING

Do not remove the bell from the alarm housing unless the bell is damaged. If the bell is damaged replace it with a new bell.

INSTALLING NEW BELL SCREWS AND LOCK-WASHERS

1. Ensure that the bell is aligned with the raised boss (mounting pad) on the alarm housing. The rim of the bell must not touch the alarm housing at any point.



2. Apply one drop of Loctite #271 (P/N 26875) into each screw hole of boss.

3. Using a flat-blade screwdriver, thread the screws (P/N 635245) and lock-washers (P/N 54197) into the Audi-Larm body and tighten.



4. Check the bell to ensure that it is tight. You must not be able to rotate or tilt the bell by hand.

Note: If the bell rotate or tilts, contact MSA Customer Service toll free at 1-800-MSA-2222.

Coupling Nut

1. Remove the coupling nut and insert.

- a. Place a wrench on the alarm body flats to secure the body. Place a wrench on the insert flats.

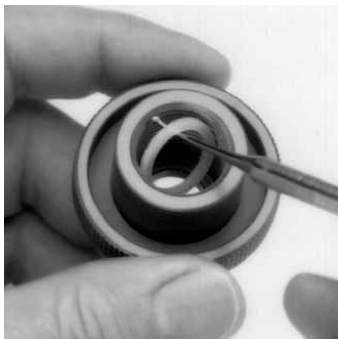


- b. Turn the wrench counter-clockwise to loosen and remove the insert.
- c. Check the alarm housing body threads to be sure they contain no pipe-sealing tape residue.

DISASSEMBLY AND REPAIR

d. Slide the coupling nut off the "back" end of the insert.

e. Remove the washer from inside the coupling nut.



2. Re-assemble the coupling nut and insert.
 - a. Slide a new washer on the back end of the insert.
 - b. Slide the coupling nut on the back end of the insert.
 - c. Apply pipe-sealing tape to the insert threads (see Note 2).
 - d. Thread the coupling nut and insert into the alarm body and tighten. Use a wrench on the flats of the insert, and a wrench on the flats on the alarm body.

CAUTION

Do not over-tighten parts or you may damage the URC Assembly body or the insert threads.

Note: The Alarm must be leak tested following any disassembly. Refer to the Leak Test section of this manual for procedures to check all connections.

This completes the URC Assembly repair procedure.

HIGH PRESSURE HOSE AND HARNESS GAUGE

All repair procedures assume that the Audi-Larm Alarm is disassembled from the cylinder. (Refer to General Note 3)

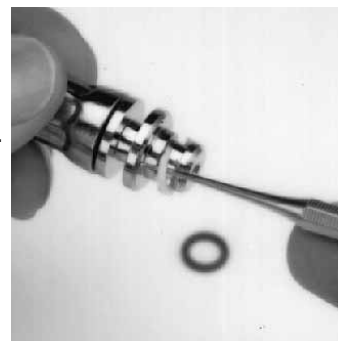
1. Removing the High Pressure Hose

a. Using a 1/4" socket, remove the two screw-pins from the regulator body.



b. Pull firmly on the high pressure hose to remove it from the regulator body.

c. Remove the old O-ring and backup ring. Be careful not to damage the O-ring seal area.



2. Removing the High Pressure Hose from Audi-Larm Assembly

a. Clamp the Audi-Larm body in a vise.

CAUTION

Be careful that you do not damage the bell or the housing with the vise. Use shields on the vise jaws.

b. Place a 5/8" wrench on the hex flats of the hose fitting. Unthread in a counter-clockwise direction to remove the high pressure hose.



c. Using the O-ring removal tool, remove the O-ring from the hose fitting. Be careful. Do not damage the O-ring seal area.

3. Installing the High Pressure Hose on the Audi-Larm Assembly

a. Use transparent tape to cover the hose fitting threads. Install a new O-ring on the high pressure hose fitting. Lubricate the O-ring (Refer to General Note 2).

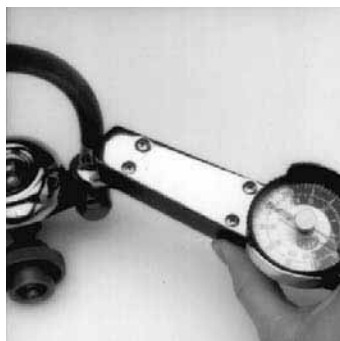


b. Clamp the Audi-Larm body in a vise. See CAUTION above. Remove tape.

c. Hand thread the hose fitting clockwise into the Audi-Larm outlet.

DISASSEMBLY AND REPAIR

- d. Tighten with a crow'sfoot wrench to a torque of 100-140 in. lbs.



4. Installing the High Pressure Hose on the First Stage Regulator
- Install a new backup ring and a new O-ring on the hose fitting. (Refer to General Note 1)
 - Insert the high pressure hose into the regulator body.
 - Insert a new screw pin into each of the two holes in the regulator body.

- d. Use a socket to tighten the pins to a torque of 10-15 in. lbs.



This completes the high pressure hose replacement procedure.

5. Removing the Second Stage Intermediate Pressure Hose from the First Stage Regulator

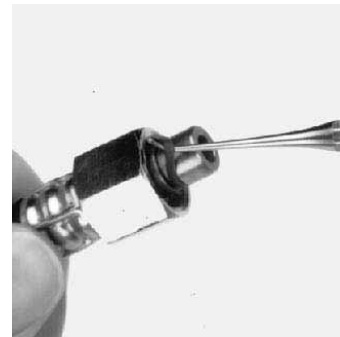
- a. Disconnect the intermediate hose from the first stage regulator. Use an open-end wrench.



- Turn the hex nut counter-clockwise. When the nut is loose, pull firmly on the hose to break the O-ring connection.
 - Unthread the hose from the shoulder strap.
6. Installing the Second Stage Intermediate Pressure Hose on the First Stage Regulator
- Thread the hose through the left shoulder strap.
 - Remove the old O-ring. Be careful not to damage

the metal seat area. Install a new O-ring. (Refer to General Note 1)

- c. Reconnect the intermediate hose if no further repair to the regulator is required. Tighten with a wrench.



7. Replacing the Intermediate Pressure Hose and two O-rings.
- The hose assembly and O-rings must be replaced if the hose is frayed or cracked or shows other signs of damage.

- b. Use the 7/16" wrench to remove the handwheel lock-nut. Remove the bypass handwheel assembly.



Note: Retaining-ring pliers must be set up for an external retaining ring.

- c. Using retaining-ring pliers, remove the exposed retaining ring.

- d. Pull the hose assembly off the bypass sleeve.



- To remove the intermediate pressure hose from the first stage.
 - Using the O-ring removal tool, remove and discard the two O-rings.
8. Installing a New Second Stage Intermediate Pressure Hose
- Place a thin film of Christo-Lube lubricant on the new O-rings. Place transparent tape over the bypass guide screws to protect the O-rings. Slide

DISASSEMBLY AND REPAIR

the new O-rings in place, using care not to nick them. Be sure to remove all transparent tape.

- b. Position the swivel with its grooved end away from the regulator housing. Push the swivel end of the hose over the bypass sleeve and onto the O-rings until the swivel contacts the retaining ring.



- c. Place a new retaining ring in the groove on the bypass sleeve.



- d. Place a thin film of Christo-Lube lubricant in the groove on the hose swivel, where the rubber rim of the hand-wheel fits.

- e. Place the bypass handwheel on the slide, making sure to line up its square hole with the square on the slide.



- f. Place a single drop of Loctite #222 thread sealant on the exposed threads of the bypass slide.

- g. Use the 7/16" wrench to thread the hand-wheel locknut on the slide.



- h. To install the intermediate pressure hose on the first stage.

- i. Pressurize the system and leak test the hose.

9. Removing the Redundant Alarm with Harness Gauge Hose from the First Stage Regulator.

- a. Use a wrench to remove the two bolts and washers that hold the first stage regulator to the backplate.



- b. Use a wrench to unscrew the hose from the regulator body.



- c. Remove the O-ring (P/N 638166). Be careful not to damage the O-ring seat area.



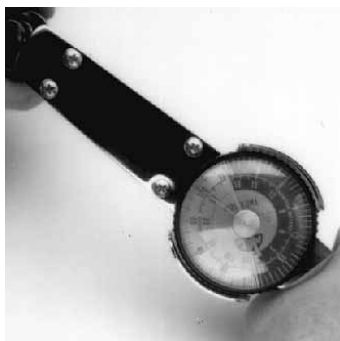
10. Installing the Harness Gauge Hose on the First Stage Regulator.

- a. Insert the hose through the right shoulder strap.

- b. Install a new O-ring and backup ring. (Refer to General Note 1)

DISASSEMBLY AND REPAIR

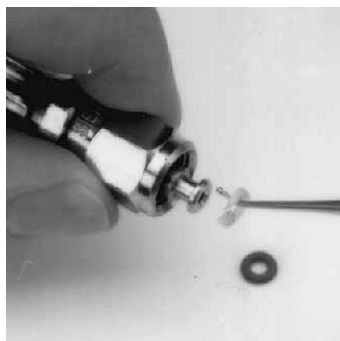
- c. Thread the redundant alarm and harness gauge hose into the regulator body. Using a crowsfoot wrench, tighten the gauge to a torque of 100-140 in. lbs.



- d. Using 7/16" bolts and washers, re-install the first stage regulator on the backplate. Tighten the bolts to a torque of 30-40 in. lbs.



11. Removing the Redundant Alarm from the Hose
- Pull the gauge guard off the back of the gauge and slide it down the hose until it clears the jam nut and hose swivel.
 - Using an open-end wrench on the jam nut and an open-end wrench on the gauge hex, loosen the jam nut on the gauge.



- c. Remove and replace the O-ring and back-up ring.

- d. Insert the hose fitting into the alarm hand-tight, then back off 1/4" turn. Using the crowsfoot on the inch-pound torque wrench, tighten the Redundant Alarm jam nut on the hose fitting to 175-200 in-lbs.

Note: Make sure the Redundant Alarm and hose end can swivel after tightening.

- Leak test all connections in Harness Gauge and Hose.
- Slip the gauge guard back over the gauge.

12. Removing the Relief Valve Swivel

⚠ CAUTION

Eye protection is required because the retaining ring may fly.

- a. Disconnect the intermediate hose assembly (See Removing Second Stage Intermediate Hose).



- b. Remove the retaining ring using the retaining ring pliers.

- c. Pull the relief valve swivel from the regulator.

- d. Using the O-ring removal tool, remove the two O-rings. Be careful. Do not damage the O-ring seal area.



13. Installing the Relief Valve Swivel.

⚠ CAUTION

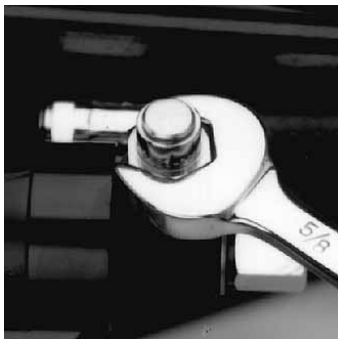
Eye protection is required because the retaining ring may fly.

- Install two new O-rings on the cap. (Refer to General Note 1)
- Install the relief valve swivel. Using the retaining ring pliers, re-install the retaining ring with its rounded side toward the swivel.
- Reconnect the hose. Using an open-end wrench, tighten the hose nut on the regulator body.

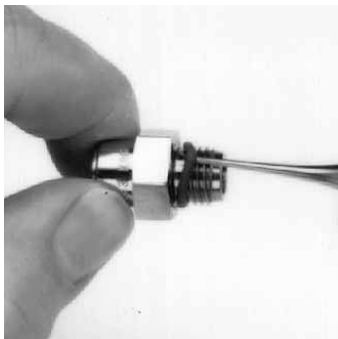
DISASSEMBLY AND REPAIR

14. Removing the Relief Valve

- a. Using a wrench, turn the relief valve counter-clockwise and unthread the valve from the swivel.



- b. Remove the O-ring from the relief valve. Be careful not to damage the O-ring seal area.



15. Installing the Relief Valve

- a. Install a new O-ring on the relief valve. (Refer to General Note 1)
- b. Thread the relief valve into the swivel clockwise by hand. Tighten with a 5/8" socket wrench.

This completes the relief valve replacement procedure.

CYLINDER GAUGE REPLACEMENT

The pressure gauges use a male thread which is threaded into the cylinder valve body. The cylinder valve does not have to be disassembled.

⚠ WARNING

Before repairing the cylinder valve, all air must be bled from the cylinder. Open the cylinder valve handwheel 1/2 turn and leave it open until all air has been exhausted. Wear hearing protection if this is done in an enclosed area to avoid possible hearing damage.

Do not attempt to repair the valve if pressure is shown on the cylinder pressure gauge. If pressure cannot be relieved by opening the cylinder valve handwheel, the cylinder must be repaired by a certified repairperson. Failure to follow this precaution may result in serious personal injury or death.

1. Removing the cylinder pressure gauge.
 - a. Remove the rubber gauge guard.
 - b. Position the cylinder valve so that the gauge is upside-down. Place a wrench on the gauge flats. Turn the gauge counter-clockwise and remove it from the cylinder valve body.
 - c. Clean out the threads in the cylinder valve body to be sure no tape residue remains.
2. Installing a new pressure gauge.
 - a. Place pipe sealing tape on the gauge threads. (Refer to General Note 2)
 - b. Place the gauge wrench on the gauge flats. Turn the gauge clockwise to tighten. Position the gauge so that it can be read in the "as-worn" position. Do not over-tighten.
 - c. Replace the rubber gauge guard.
 - d. Leak test all connections in Step 1.

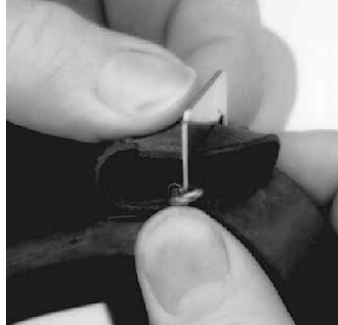
This completes the cylinder pressure gauge replacement procedures.

ULTRAVUE FACEPIECE REPAIR

Refer to Users Manual P/N 814335.

REMOVING THE FACEPIECE RUBBER HEAD HARNESS

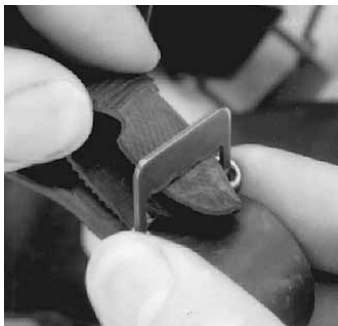
1. Lay the facepiece on a table or other flat surface.
2. Pull the back of each buckle away from the head harness and pull slightly so the head harness end-tab is at the buckle.



3. Fold the end-tab sides together, then pull each end-tab through its buckle.

INSTALLING A NEW RUBBER HEAD HARNESS

1. Lay the new head harness flat. The MSA logo is right-side up. Each strap is labeled.
2. Pick the head harness up by the strap labeled "FRONT."
3. Fold the end-tab sides together.
4. Push the end-tab under the wire roller.
5. Pull the wire roller down against the strap.



6. Re-fold the end-tab and push it through the buckle again, this time passing over the wire roller.

7. Repeat the previous steps for each remaining strap.

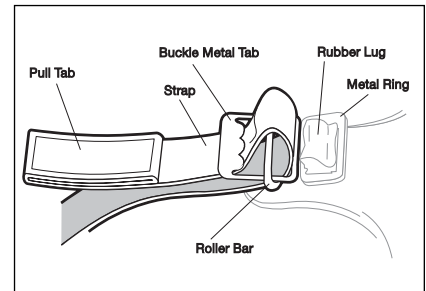


8. Check that the installed head harness is not twisted.

SPEED-ON® HEAD HARNESS

1. Thread the crown, temple, and neck straps into the buckles as follows:
 - a. With folded side down, thread the strap into the bottom section of the buckle under the roller bar.
 - b. Push roller bar down and thread the end through the top section of the buckle.
 - c. Adjust so that the pull tab extends beyond the buckle metal tab.

Note: It is important to have the folded side of the elastic strap face up, in order for the strap to lay flush against the head when it is pulled tight.



- d. Check that the installed harness straps are not twisted.

Note: Neck location buckles have an extra D-ring which is not involved in installation.



CLEANING THE SPEED-ON HEAD HARNESS

Machine wash in warm water (maximum 120°F) with a mild detergent. Dry by squeezing excess water from harness and hanging in open air. Do not dry clean. Do not bleach or use abrasive cleaners. Do not fold or store when wet.

ULTRAVUE FACEPIECE REPAIR

REPLACING THE LENS AND RING

1. Remove the facepiece lens.

- a. Loosen and remove the screw from each side of the lens retaining ring.



- b. Remove both retaining ring halves.



- c. Fold the facepiece flange back and pull the lens out of the groove.

⚠ CAUTION

The protective papers on the new lens should not be taken off until the lens is completely assembled in the facepiece.

2. Installing a new facepiece lens.

- a. Remove any dirt, lens fragments, or other debris from the groove. Line up the lens centerline marks (top and bottom) with the facepiece centerline marks.



Note: The protective papers on the lens should not be taken off until the lens is completely assembled in the facepiece.

- b. Then, insert the lens into the groove. Work the facepiece flange around the lens to seat the lens fully in the groove.

- c. Line up the lens ring centerline with the facepiece flange centerline mark. Press the ring half in place. Mount the other ring half in the same way.



- d. Press the ring halves together at the top and bottom of the facepiece so that the ends mate.
- e. Install a screw on each side.
- f. Start the screws; they should thread easily. If not, remove and re-install the screws to avoid cross-threading. Maintain hand pressure on both ring halves.
- g. As the ring halves come together, alternate tightening the left and right screws to be sure the ring seats thoroughly on the flange.

⚠ CAUTION

Do not over-tighten. Rubber must not show between the lens ring ends at the joint. If this occurs, reassemble.

- h. Remove all lens protective papers from the new lens.
- i. Don the facepiece and repeat the Facepiece Fit Check. Follow the steps in the Facepiece Fit Check.

SPEAKING DIAPHRAGM HOUSING

1. Loosen the screw on the band clamp. Remove the clamp and pull the assembly out of the facepiece.



2. Re-assemble the Speaking Diaphragm Housing.
 - a. Slide the band clamp on.

ULTRAVUE FACEPIECE REPAIR

- b. Slide the inlet assembly into the facepiece. Check that the air ducts in the housing the ducts in the facepiece.



- c. Be sure that the inlet assembly is pressed completely into the facepiece.

- d. The band clamp must be positioned so that the screw is at the 5 or 7 o'clock position. The screw head must be to the left so that it will not rub the facepiece rubber.



- e. Tighten the band clamp until the speaking diaphragm assembly is secured. Be sure that the band clamp does not pull the facepiece rubber away from the assembly. Do not over-tighten. If the facepiece rubber "bulges" out through the slots in the clamp, the clamp is too tight and must be loosened and retightened.
3. Don the facepiece and follow the steps in the Facepiece Fit Check.

REPLACE THE SPEAKING DIAPHRAGM.

1. Using the spanner wrench (P/N 461828), unscrew and remove the retainer ring from the facepiece.



2. Turn the facepiece upside down and shake out the metal speaking diaphragm.
3. Check the speaking diaphragm for damage. Replace it if it is worn or damaged.

4. Check the speaking diaphragm gasket or O-ring. Replace the gasket or O-ring if either is worn or damaged.

⚠ WARNING

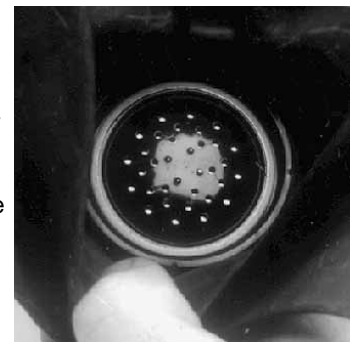
The flat gasket (used on old-style facepieces) and the O-ring (used on the new design) are NOT interchangeable. Replace the gasket with the P/N 83630 gasket only. Replace the O-ring with the P/N 629935 O-ring only. Failure to observe this precaution may cause inhalation of contaminant and result in serious respiratory injury or death.

RE-ASSEMBLE THE SPEAKING DIAPHRAGM

1. Place the gasket or O-ring in the speaking diaphragm housing groove.



2. Place the speaking diaphragm in the housing so that the outer lip rests on the gasket or O-ring. Be sure that the crimped side of the speaking diaphragm is facing toward you.

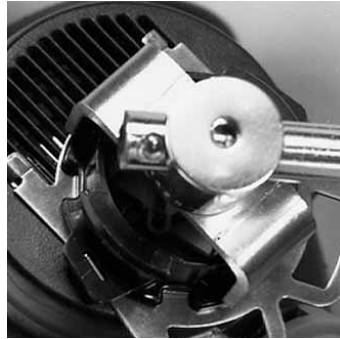


3. Replace the retainer ring and tighten using the spanner wrench.
4. Don the facepiece and check the facepiece fit.

ULTRAVUE FACEPIECE REPAIR

INHALATION DISC VALVE

1. Use the spanner wrench (P/N 496317). Press the adapter slip nut in. Turn the wrench counter-clockwise (left) to unthread the adapter.



2. Lift the neckstrap retaining ring off the housing. Note how the "fingers" line up in the housing.



3. Lift the spider gasket out of the housing, using the tab.



4. Remove the valve disc from the speaking diaphragm housing. If you cannot grasp the disc with your fingers, use a blunt object to lift one edge, then remove the disc. Be careful not to tear the soft disc.



5. Inspect the disc for tears or punctures. The disc should be very soft and pliable. Install a new disc if it is damaged or hardened.
6. Re-assemble the inhalation disc valve, spider gasket, and adapter.
 - a. Press the valve disc onto the pin in the speaking diaphragm housing.
 - b. Carefully tuck all edges of the disc under the housing lip.
 - c. Replace the spider gasket (tab up) and press it on the pin. Work the groove into place to secure the gasket.

- d. Place the neckstrap retaining ring on the housing. Line up the "fingers" with the housing.

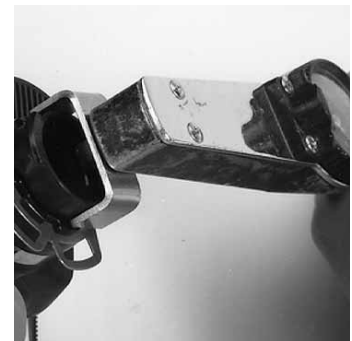


- e. Place the locking ring on the adapter.
- f. Insert the adapter assembly through the hole in the retaining ring. Start to thread the adapter slip nut into the speaking diaphragm housing.

- g. Turn the adapter so that the bayonets are horizontal. Hand-tighten the slip nut until the two adapter "wings" lock into the two large tabs in the retaining ring. Make sure that each of the two large tabs on the retaining ring are fully seated in both of the slots on the adapter "wings."



- h. Using the spanner wrench, tighten the adapter slip nut until the slip nut locks into the spring finger on the retaining ring. Continue to tighten the slip nut so that the adapter seals against the spider gasket. The slip nut should be tightened 12 to 27 in. lbs.



- i. Verify each of the following features:
 - The adapter bayonets are locked into a horizontal orientation and can NOT be rotated;
 - The slip nut is threaded completely into the face piece and locked securely; it can NOT be rotated;
 - The metal retaining ring is locked into position and can NOT be rotated;
 - There is no loose play in the assembly of parts.

ULTRAVUE FACEPIECE REPAIR

PRESSURE DEMAND EXHALATION VALVE

1. Temporarily fold the headstraps back over the front of the facepiece lens.
2. Pull the facepiece chin cup out so that you can see the inside of the exhalation valve.



3. Use the facepiece spanner wrench to loosen the valve retaining nut.

4. Unscrew and remove the retaining nut. Then, grasp the valve cover and gently pull the valve out from the underside of the facepiece.

Note: The pressure demand exhalation valve is replaced as a unit. No replacement parts are available. All components of each valve must be maintained as a unit. When cleaning the valve, do not interchange parts.

5. Installing the pressure demand exhalation valve in the facepiece:
 - a. Inspect the facepiece rubber for tears or cracks. Replace the facepiece if it is damaged. Clean the

area around the facepiece mounting hole if necessary.

Note: Rub a small amount of Never-Seez™ (P/N 29527) on the valve threads.

- b. Line up the exhalation valve threads with the facepiece mounting hole. Place one hand inside the facepiece and stretch the hole slightly.
- c. Push the valve threads into the facepiece. Use a "threading" motion to insert the valve until the valve body rests against the facepiece rubber.

Note: The "MSA" logo on the exhalation valve cover does not have to be aligned to any special position.

- d. Pull the facepiece chin cup back so that you can see the valve, then thread the retaining nut on.
- e. Tighten the retaining nut, using the spanner wrench (P/N 461828). Reposition the facepiece headstrap.
6. Inspect the exhalation valve.
7. Visually inspect the spring to see that it is located properly in its socket.

⚠ CAUTION

Do not store the facepiece with the headstraps stretched over the lens. Doing so may distort the sealing surface and affect the facepiece seal.

8. Don the facepiece and check the face-to-facepiece seal. Follow the steps in the Facepiece Fit Check.

ULTRA ELITE FACEPIECE REPAIR

REPLACING THE RUBBER HEADSTRAP

Note: To replace the standard rubber headstrap (the one with rollers and end-tabs).

To replace the standard rubber headstrap if the buckle assemblies are damaged, or to install the Speed-ON Head Harness, see Installing Speed-ON Head Harness.

1. To remove a damaged rubber headstrap from the facepiece, lay the facepiece on a table or other flat surface.
 - a. Grasp the facepiece lug with the thumb and forefinger of one hand. Grasp the headstrap metal buckle with the thumb and forefinger of the other hand.



- b. Lift the metal buckle with your thumb as you stretch the facepiece lug.

- c. Turn the facepiece and switch hands to lift on the other side of the metal buckle.
 - d. Pull the facepiece lug out of the metal buckle.
 - e. Repeat steps a through d for each remaining strap.
 - f. If you removed the headstrap to install the Speed-ON Head Harness, see Installing the Speed-ON Head Harness.
2. To install a new rubber headstrap, lay the new headstrap flat. The MSA logo should be right-side up. Each strap is labeled "Front."
 - a. Insert the facepiece lug into the metal buckle.
 - b. Hold the buckle down against the facepiece lug with the thumb and forefinger of one hand while gripping the end of the lug with the thumb and forefinger of the other hand.



- c. Pull the buckle and lug in opposite directions while twisting them from side to side to work the buckle down until it snaps in place over the lug.

- d. Repeat steps a through c for each remaining strap. Check that the installed headstrap is not twisted.

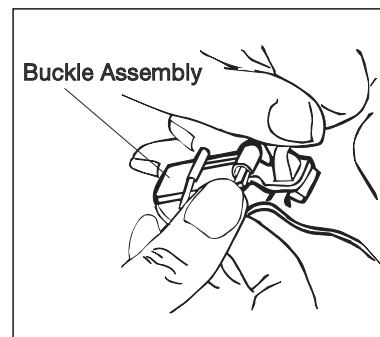
3. Don the facepiece and check the face-to-facepiece seal. Follow the Check Facepiece Fit procedure.

REMOVING THE SPEED-ON HEAD HARNESS

1. To remove a damaged Speed-ON Head Harness from the facepiece, lay the facepiece on a table or other flat surface.
2. Follow Replacing the Rubber Headstrap, steps 1a through d for each of the top three straps.
3. To remove the bottom buckles, pull the back of the buckle away from the rubber strap and pull slightly so the rubber harness end-tab is at the buckle.
4. Fold the end-tab sides together, then slide each tab through its buckle.
5. Repeat steps 3 and 4 for the other buckle.

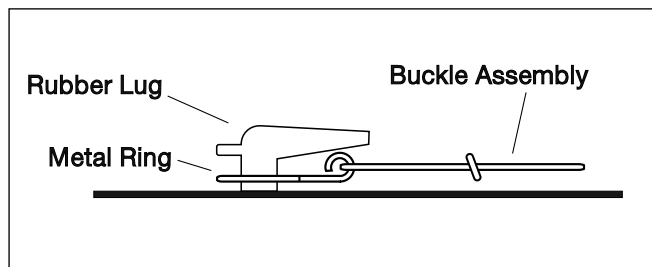
INSTALLING THE SPEED-ON HEAD HARNESS

1. Install the harness strap buckles to the facepiece rubber lug at the crown and temple locations.
 - a. Insert the long tab end of the rubber lug into the metal ring.



- b. Pull the entire rubber lug through the metal ring.

2. Refer to Kit 817088 Head Harness Installation instructions to attach the harness.



ULTRA ELITE FACEPIECE REPAIR



CLEANING SPEED-ON HEAD HARNESS

Machine wash in warm water (maximum 120°F) with a mild detergent. Hang the harness in an open area to air-dry. Do not dry clean. Do not bleach or use abrasive cleaners. Do not fold or store when wet.

REMOVING THE COMPONENT HOUSING COVER

1. Remove the two component housing cover screws and spacers. Remove the neckstrap.



2. Remove the locking ring.

3. Lift up on the cover release hook located forward of the adapter assembly opening. Once the release is lifted, you can remove the cover by pulling it away from the housing. You must tilt the cover and work it over one adapter bayonet at a time.



4. Unthread and remove the adapter assembly.

⚠ CAUTION

Be careful that you do not damage internal parts of the component housing assembly (exhalation valve, spring, retainer, or speaking diaphragm) once the cover is removed.

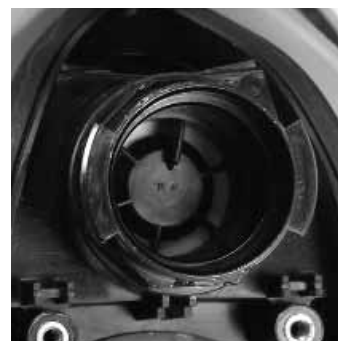
INSTALLING THE ADAPTER ASSEMBLY, LOCKING RING, AND COMPONENT HOUSING COVER

1. Holding the adapter assembly in your hand, rotate the slip nut so that the octagon flange on the slip nut lines up with the octagon flange on the adapter.



2. Thread the adapter assembly into the facepiece. Using the spanner wrench, torque the adapter to 12-27 in. lbs. If necessary, continue to torque until the top flat on the octagon is horizontal.

3. The bayonets must be in a horizontal orientation.



4. If the bayonets are not horizontal, remove the adapter assembly and turn the slip nut. Re-install the adapter assembly so that the bayonets are horizontal when the adapter assembly is torqued 12-27 in-lbs.

INSTALLING THE COMPONENT HOUSING COVER

1. Place the component housing cover over the adapter assembly. Tilt and rotate the cover to work it over one bayonet at a time.

ULTRA ELITE FACEPIECE REPAIR

2. Insert the tab on the cover into the slot in the lens ring.

3. Press in on the front of the cover until the cover hook snaps into place.



4. Install the locking ring by sliding it into the groove on the adapter. (Do not slide it into the space between the slip nut flange and the adapter flange.)
5. Place the neckstrap brackets and the spacers in the cover sockets under the locking ring. Install the phillips screws and tighten.
6. Verify each of the following features:
 - a. The adapter bayonets are locked into a horizontal position and can NOT be rotated.
 - b. The slip nut is threaded completely into the facepiece and locked securely. It can NOT be rotated.
 - c. The metal locking ring is locked into position and can NOT be rotated.
 - d. There is no loose play in the assembly of parts.
7. Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check procedures.

REMOVING THE FACEPIECE LENS AND RING

⚠ CAUTION

The protective papers on the lens should not be taken off until the lens is completely assembled in the facepiece.

Note: Remove the component housing cover and adapter assembly.

1. Using a phillips screwdriver, loosen and remove the screw from each side of the facepiece lens retaining ring.



2. Remove the upper and lower lens retaining rings.

3. Fold the facepiece flange rubber back and pull the lens out of the groove.



INSTALLING THE FACEPIECE LENS AND RING

1. Remove any dirt, lens fragments, or other debris from the groove. Line up the new lens centerline marks (top and bottom) with the facepiece centerline mark. Insert the top of the lens into the groove. Work the facepiece rubber flange around the lens to fully seat the lens in the groove. When installed correctly, the bottom lens centerline mark lines up with the bottom facepiece centerline mark.
2. Moisten the facepiece lens groove and the inside of the component housing ring.



3. Install the bottom ring. Insert the tab at the top of the component housing into the slot at the bottom center of the lower lens ring. The tab should snap into place.



4. Line up the top lens ring center-line with the facepiece rubber flange centerline mark. Press the ring into place.
5. Press the ring halves together at the top and bottom of the facepiece so that the ends mate.
6. Install a screw on each side. Start the screws. They should thread easily. If not, remove and re-install the screws to avoid cross-threading. Keep hand pressure on both ring halves.
7. As the ring halves come together, alternate tightening the left and right screws to be sure the rings seat completely on the rubber flange.

ULTRA ELITE FACEPIECE REPAIR

⚠ CAUTION

Do not over-tighten. Rubber must not show between the lens ring ends at the joint. If this happens, reassemble.

8. Remove all lens protective papers from the new lens.
9. Re-install the adapter assembly and the component housing cover.
10. Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check procedure.

⚠ CAUTION

Do not use a cover lens in a high-temperature environment. High temperatures may distort the cover lens. Or, moisture trapped between a cover lens and the facepiece lens may condense and distort vision. Always remove the cover lens before donning the facepiece.

REMOVING THE COMPONENT HOUSING ASSEMBLY

Note: Remove the component housing cover and the adapter assembly.

1. Using a small phillips screwdriver, remove the component housing ring screw. Grasp the ring with the thumb and forefinger of each hand. Gently spread the ring halves apart at the bottom.



2. When the facepiece rubber is out of the ring groove, lift the ring up away from the facepiece. You may need to pull the housing down slightly to allow enough room to remove the ring from between the housing and the lower lens ring.



3. Remove the facepiece rubber from the component housing and pull the housing and nose cup (if installed) out of the facepiece.

INSTALLING THE COMPONENT HOUSING ASSEMBLY

1. Slide the housing into the front of the facepiece.



2. Starting at the top (narrow end) of the housing, place the housing in the facepiece groove. Work the rubber all the way around the housing. Check that the housing is completely captured inside the groove and centerlines are lined up.
3. Moisten the facepiece housing area and the inside of the housing ring.
4. Insert the narrow end of the ring into the space between the lower lens ring and the facepiece housing area.



5. Line up the component housing ring mark with the facepiece centerline.

6. Starting at the top, work the housing ring down on the facepiece to capture the facepiece rubber in the ring groove. Work your way down each side of the ring until the facepiece rubber is completely captured inside the ring.



7. Gently squeeze the ring halves together at the bottom of the housing. Watch the facepiece rubber at the top as you do this. If you see any bulges or wrinkles in the facepiece rubber, it is not captured in the groove. Rework the ring around the facepiece rubber until there are no bulges or wrinkles.

ULTRA ELITE FACEPIECE REPAIR

⚠ WARNING

Bulges or wrinkles mean that the facepiece rubber is not seated correctly in the ring. Reinstall the ring to seat it correctly. Failure to follow this precaution may cause the facepiece to leak and result in serious personal injury or death.

- When the housing ring appears to be seated, grasp the outside of the ring and the inside of the housing at the top between your thumb and forefinger and squeeze them together. Then do the same with the ring halves at the bottom.

- Install the screw and tighten using a small phillips screwdriver.



⚠ CAUTION

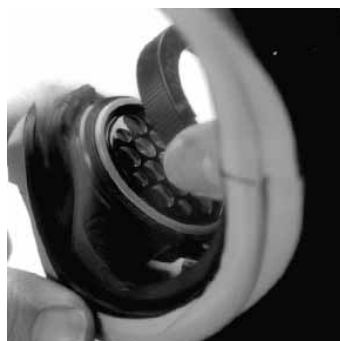
Rubber must not extrude between the component housing ring ends at the joint. If this happens, reassemble.

- Re-install the adapter assembly and the component housing cover.
- Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check procedure.
- Re-install the nose cup or air baffle (if used) in the facepiece.

REPLACING THE SPEAKING DIAPHRAGM

- Remove the baffle and nose cup (if installed) from inside the facepiece.

- Unscrew and remove the speaking diaphragm retaining ring.



- Turn the facepiece upside down and shake out the metal speaking diaphragm and gasket assembly.
- Check the speaking diaphragm and gasket assembly

for damage. Replace it if it is worn or damaged.

- Be sure that the gasket is on the diaphragm assembly. Place the diaphragm in the retaining ring. Be sure that the gasket side of the speaking diaphragm will be facing the component housing.
- Replace the retaining ring and hand tighten.
- Re-install the nose cup or air baffle (if used) in the facepiece.
- Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check procedure.

REPLACING THE INLET GASKET AND DISC VALVE

- Remove the component housing cover and the adapter assembly.
- Remove the disc from the gasket and inspect both for wear. The disc should be very soft and pliable. Install a new disc valve if it is damaged or hardened.
- To install the inhalation disc valve:
 - Gently, stretch the hole in the center of the disc valve over the gasket stem.
 - Note that the inlet gasket has a groove around it.

- With the pull-tab facing you, insert the gasket into the facepiece at an angle so that its groove captures the housing rim. The lower lip on the gasket must be placed under the rim in the component housing.



Note: You may have to bend the gasket slightly to work the groove under the rim all the way around. When installed correctly, the gasket will lay flat in the housing, and none of the spokes will be bent.

- Re-install the adapter assembly, locking ring, and component housing cover.
- Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check procedure.

HARNES REPAIR

CARRIER AND HARNES PARTS REPLACEMENT

The low pressure and high pressure carrier and harness assemblies are identical except for the approval plate, part number disc, and the labels on the cylinder band.

1. Removing the Shoulder Straps from the Carrier
 - a. **Right Strap:** Disconnect the harness gauge hose from the first stage regulator. **Left Strap:** Disconnect the intermediate pressure hose from the first stage regulator. Pull the two hoses through the shoulder strap pad.

- b. **Both Straps:** Remove the screw, washer, and tee nut where the strap attaches to the top of the carrier backplate. Note how the wear pad is installed.



- c. Remove the screw, washer, and tee nut at the friction buckle. If both shoulder straps are being removed, pay close attention to how the screws are installed and what length screws are used at each location.

2. Installing Shoulder Straps

Note: A drop of Loctite #222 thread sealant must be placed on all screws before they are threaded into tee nuts.

- a. Install the shoulder strap and wear pad on the carrier. Re-install screw, washer, and tee nut.
 - b. Reattach the friction buckle to the shoulder strap. Re-install screws, washers, and tee nuts.
 - c. **Left Strap:** Feed the intermediate pressure hose back through the shoulder strap. **Right Strap:** Feed the redundant alarm with harness gauge hose. Reconnect the hoses to the first stage regulator.
3. Removing the Adjusting Straps
 - a. Remove the screw, washer, and tee nut where the strap joins the triangular backpad and the backplate (attached in two places).
 - b. Pull the adjusting strap through the friction buckle. Pay attention to the path the strap follows for re-assembly.
 4. Installing the Adjusting Strap

Note: A drop of Loctite #222 thread sealant must be placed on all screws before they are threaded into tee nuts.

- a. Feed the new adjusting strap through the friction buckle.
- b. Secure the new adjusting strap to the triangular

backpad and backplate using a screw, washer and tee nut.

5. Removing the Waist Strap
 - a. To remove the waist strap, remove the screws, washers, and tee nuts from the triangular backpad and backplate. Save the hardware for re-assembly.
6. Installing the Waist Strap

Note: A drop of Loctite #222 thread sealant (P/N 29787) must be placed on all screws before they are threaded into tee nuts.

- a. Secure the waist strap with the screws, washers, and tee nuts saved on removal.
7. Removing the Backpad
 - a. To remove the backpad, remove the screws, washers, and tee nuts from the adjusting straps, backpad, and waist strap.
 - b. Save the hardware for re-assembly.
 8. Installing the Backpad

Note: A drop of Loctite #222 thread sealant must be placed on all screws before they are threaded into tee nuts.

- a. Secure with the screws, washers, and tee nuts saved on removal.
9. Carrier Assembly
 - a. To replace a carrier assembly, remove and replace the first stage regulator, shoulder pads, waist strap and backpad (see above).
 10. To Install MMR Decals
 - Clean the cylinder clamp.
 - Peel the decals from the tack paper, orient, and press them into place on the cylinder clamp.

This completes the carrier and harness replacement procedures.

VULCAN CARRIER AND HARNES PARTS REPLACEMENT WITH REDUNDANT ALARM

1. Removing the Shoulder Straps from Carrier
 - a. **Right Shoulder Strap:** Disconnect the Redundant Alarm with harness gauge hose from the first stage regulator using an open end wrench. Unthread and remove from shoulder strap.
 - b. Unthread the free end of the pull-strap (waist) from the shoulder strap friction buckle.

HARNES REPAIR

- c. Remove the shoulder strap from the carrier by rotating the tri-bar until it can be slid through the carrier slot.



- d. **Left Shoulder Strap:** Disconnect the second stage from first stage regulator using an open end wrench. Unthread second stage from shoulder strap.
- e. Unthread the free end of the pull-strap (waist) from the friction buckle of the shoulder strap.

- f. Remove the shoulder strap from the carrier by rotating the tri-bar until it can be slid through the carrier slot. Chest Strap (optional). See instructions P/N 10012166.



2. Removing the Pull-strap (waist) Belt Assembly from Carrier
- a. **Both Left and Right Straps:** Unthread the free end of the pull-strap (waist) from the shoulder strap friction buckle.

- b. Remove the pullstrap (waist) from the carrier by rotating the tri-bar until it can be slid through the carrier slot.



3. Connecting the Shoulder Straps Together
- a. **Right Shoulder Strap:** Attach the shoulder strap to the carrier by rotating the tri-bar until it is aligned with carrier slot. Pull on shoulder strap to ensure tri-bar is secure.
- b. Thread the free end of the pull-strap (waist) through the shoulder strap friction buckle.
- c. Slide the harness gauge hose with redundant alarm, through the entire shoulder strap tunnel.
- d. Remove the gauge hose O-ring.
- e. Install a new gauge hose O-ring with a thin film of Christo-Lube.
- f. Connect the gauge hose to the first stage regulator.
- g. Leak test all connections.
- h. **Left Shoulder Strap:** Attach the shoulder strap to the carrier by rotating the tri-bar until it is aligned with carrier slot. Pull on shoulder strap to ensure tri-bar is secure.
- i. Thread the free end of the pull-strap (waist) through the shoulder strap friction buckle.
- j. Slide the second stage pressure hose with redundant alarm, through the entire shoulder strap tunnel.
- k. Replace the second stage pressure hose O-ring with a new O-ring with a thin film of Christo-Lube.
- l. Connect the second stage pressure hose to the first stage regulator.
- m. Leak test all connections.
4. Re-assembling the Pull-strap (waist)
- a. Rotate strap tri-bar until it is aligned with carrier slot. Slide the tri-bar through the carrier slot.
- b. Pull on strap to ensure the tri-bar is secure.
- c. Thread pull-strap free end through back of friction buckle, over the top of the slide bar, and under front of the curved buckle.
5. Re-assembling Double Pull-strap (waist)
- a. Thread strap free end through back of friction buckle over the top of slide bar, and under front of the curved buckle.
6. Re-assembling Single Pull-strap (waist)
- a. Rotate strap tri-bar until it is aligned with carrier slot. Slide tri-bar through carrier slot.

CYLINDER VALVE DISASSEMBLY AND REPAIR

Note: The procedures which follow apply only to the cylinder valves listed below. A separate set of procedures for more recently-introduced cylinder valves begins under current cylinder valve disassembly and repair.

(See the Introduction for Required Tools)

Original Cylinder Valves

P/N 473664, 2216 psig Low Pressure and Dual-Purpose

P/N 494883, 3000 psig Low Pressure, P/N 473255 High Pressure and Dual-Purpose

⚠ WARNING

Before repairing the cylinder valve, bleed all air from the cylinder. Open the cylinder valve 1/2 turn and leave it open until all air is exhausted. Wear hearing protection if this is done in an enclosed area to avoid possible hearing damage. Do not attempt to repair the valve if the cylinder pressure gauge shows pressure. If you cannot relieve pressure by opening the cylinder valve handwheel, loosen the safety plug (no more than 1/4 turn). Failure to follow this precaution may result in severe personal injury or death. This warning is for all procedures.

REMOVING AND ADJUSTING THE HANDWHEEL ASSEMBLY

1. Use wrench to remove the locknut and spring. Remove the handwheel from the top of packing gland.



2. Place a 3/4" wrench on the packing gland flats. Turn the gland counter-clockwise several turns and remove it.



3. Replace the handwheel on the valve stem. Turn the handwheel counter-clockwise 10 turns.

4. Turn the valve upside-down and remove the stem, gasket, and nylon insert.



Note: If the insert shows wear, replace it.

REPLACING THE NYLON INSERT

1. Install a new nylon insert into the valve body, using the valve stem. Thread the stem finger-tight (clockwise).



2. Place a new gasket over the valve stem and seat it on the lip in the valve body.
3. Thread the packing gland into the cylinder valve body until it is finger-tight.
4. Finger-loosen the valve stem counter-clockwise until the stem stops. Be sure that the packing gland does not turn.

5. Use a torque wrench set at 120 to 140 in. lbs. with a 3/4" socket to tighten the packing gland.



6. Place the handwheel on the stem and check the valve for proper motion. The handwheel should move freely, but with some resistance. Remove the handwheel.
7. Replace the handwheel and the spring. Be sure that the valve is fully open to allow the locknut to be installed more easily. The valve stem square must fit into the square hole in the handwheel.

CYLINDER VALVE DISASSEMBLY AND REPAIR

- Using the handwheel locknut wrench, press the locknut against the spring and tighten (clockwise).



- Open and close the valve completely several times to seat the stem, nylon insert, and the valve stem gasket. Perform the leak test to check all connections.

Note: The procedure for replacing burst discs is the same for Low Pressure Air Masks and High Pressure Air Masks, However, wrench sizes, part numbers, and torque specifications are different (as noted).

REMOVING THE BURST DISC

- Place a socket on the safety plug hex flats and turn the plug counter-clockwise to remove the safety plug.



Note: The procedures for removing and installing burst discs are the same for all models of MSA apparatus. However, part number, tools, and torque specifications do vary. Refer to the following chart for specific items.

MSA SCBA Model	Socket Size	Safety Plug	Torque Ft/Lbs.	Burst Disc & Gasket Kit
2216 psig	11/16"	68550	50 - 53	482225
3000 psig	3/4"	495636	26 - 30	494928
4500 psig	9/16"	473254	21 - 25	482226

- Use a jeweler's screwdriver to punch a hole in the burst disc. Use retaining ring pliers to pull the disc out of the cylinder valve body. Discard the disc.



- Use the O-ring removal tool or plastic stick to lift the gasket out of the cylinder valve body.

INSTALLING A NEW BURST DISC FOR 2216 OR 3000 PSIG

- Insert a new gasket into the cylinder valve.

- Place a thin film of Christo-Lube on the new burst disc.



- Place new burst disc on top of the gasket. Be sure that gasket and disc lay flat.

⚠ WARNING

Be sure gasket, then burst disc, are installed in the order described. Ensure threads of burst disc area and safety plug threads are free of Christo-Lube. Failure to install properly may cause burst disc malfunction, and may result in serious personal injury or death.

⚠ CAUTION

DO NOT re-use the burst disc or the gasket. You may change the burst rating.

- Thread the safety plug into the cylinder valve body.

CYLINDER VALVE DISASSEMBLY AND REPAIR

5. Use a torque wrench with a socket to tighten the plug.



This completes the burst disc repair procedures.

CURRENT DESIGN 4500 PSIG

Installing a New 4500 Burst Disc

1. Insert a new gasket into the cylinder valve body.

⚠ WARNING

Be sure gasket, then burst disc, are installed in the order described. Failure to install properly may cause burst disc malfunction, and may result in serious personal injury or death.

⚠ CAUTION

Do not re-use the burst disc or the copper gasket.

2. Place a thin film of Snoop on the new 4500 Burst Disc. Place the new burst disc on top of the new gasket. Be sure the gasket and disc lay flat.

3. Thread the safety plug into the cylinder valve body. Use a torque wrench and socket to tighten the plug to the torque specified.



4. See Leak Testing.

This completes the burst disc repair procedure.

CYLINDER VALVE PRESSURE GAUGES

Low Pressure and High Pressure apparatus use an aluminum cylinder valve. The Low Pressure pressure gauges are secured from inside the valve body 2216 psig: P/N

473664; 3000 psig: P/N 494883. To remove the gauge, the cylinder valve must be disassembled. The High Pressure pressure gauge uses a male thread which is threaded into the cylinder valve body (P/N 473255). The cylinder valve does not have to be disassembled.

Note: To remove a Low Pressure pressure gauge the burst disc must first be removed.

REMOVING THE CYLINDER VALVE GAUGE

1. Remove the rubber gauge guard. Insert a 5/32" allen wrench into the screw. Turn the wrench counter-clockwise until the screw is completely out of the cylinder valve body.



2. Pull the pressure gauge out of the cylinder valve body.



3. Use the O-ring removal tool to lift the O-ring and gland ring out of the cylinder valve body. Discard the O-ring. Be careful not to scratch the surface of the cylinder valve body.



CYLINDER VALVE DISASSEMBLY AND REPAIR

INSTALLING A NEW LOW PRESSURE PRESSURE GAUGE

1. Install a gland ring by pressing it in place using the pressure gauge. DO NOT use a sharp tool or you may damage the gland ring.
2. Apply a thin film of Christo-Lube to the O-ring, then place the O-ring inside the gland ring and press them into place using the pressure gauge. DO NOT use a sharp tool or you may damage the O-ring.

3. Check that the two index screws on the back of the pressure gauge are tight. Insert the pressure gauge into the cylinder valve body so that the gauge needle points to the threads of the cylinder valve outlet.



4. Use a 5/32" allen wrench to insert the screw from the opposite side of the cylinder valve body. Turn the wrench clockwise to tighten the gauge.
5. Install a new burst disc, a new gasket (Burst Disc and Gasket Kit), and the safety plug.

⚠ CAUTION

DO NOT re-use the burst disc or the copper gasket. You may change the burst rating.

REMOVING THE HIGH PRESSURE PRESSURE GAUGE

1. Remove the rubber gauge protector. Unscrew and remove bezel ring and lens. Store the lens in a safe place.

2. Position the cylinder valve so that the gauge is upside-down. If the plastic center-post falls out of the gauge, apply a thin film of Christo-Lube to the part and re-install it. Place the gauge wrench on the gauge flats. Turn the gauge counter-clockwise and remove it from the cylinder valve body.



3. Clean out the threads in the cylinder valve body to be sure no tape residue remains.

RE-ASSEMBLING OR INSTALLING A NEW HIGH PRESSURE PRESSURE GAUGE (P/N 473249)

1. Apply pipe-sealing tape to gauge threads. (Refer to General Note 2).
2. Place the gauge wrench on the gauge flats. Turn the gauge clockwise to tighten. Do not over-tighten.
3. Position the gauge so that the gauge needle points to the threads of the cylinder valve outlet.
4. Replace the lens in the bezel ring and tighten the ring.
5. Replace the rubber gauge protector.
6. Refer to Leak Testing and check all connections. This completes the pressure gauge replacement procedure.

REMOVING THE CYLINDER VALVE BODY FROM THE CYLINDER

⚠ WARNING

Bleed all air from the cylinder. Open the cylinder valve handwheel 1/2 turn and leave it open until all air is exhausted. Wear hearing protection if this is done in an enclosed area to avoid possible hearing damage. Do not remove the valve if the cylinder pressure gauge shows pressure. If you cannot relieve pressure by opening the cylinder valve handwheel, loosen the safety plug (no more than 1/4 turn). Failure to follow this precaution may result in severe personal injury or death.

1. Secure the cylinder in a suitable fixture.
2. Pull off the rubber pressure gauge guard.

3. Place a 7/8" socket (12 point) or wrench on the flats on the top of the cylinder valve. Turn the socket counter-clockwise until the cylinder valve is completely out of the cylinder.



4. To remove the **old** O-ring, roll the O-ring over the threads. Discard old O-ring.



CYLINDER VALVE DISASSEMBLY AND REPAIR

CYLINDER VALVE DISASSEMBLY AND REPAIR INSTALLING THE CYLINDER VALVE BODY IN THE CYLINDER

(Low Pressure 2216 psig: P/N 473664 valve body; Low Pressure 3000 psig: P/N 494883 valve body; High Pressure; P/N 473255 valve body)

1. Secure the cylinder in a suitable fixture.
2. Use a high intensity light. Inspect the inside of the cylinder for contaminants. Remove any loose particles. Be sure that the cylinder interior is completely dry.

⚠ WARNING

DO NOT use the cylinder if it has an odor or is contaminated internally. Failure to follow this precaution may result in severe personal injury or death.

3. Clean the O-ring sealing surface on the cylinder with a clean, dry, lint-free cloth. Be sure this cylinder surface is undamaged and free from contaminants, such as dirt or tape residue.

4. Inspect the cylinder neck area. Do not use the cylinder if it has scratches, cuts, or grooves which may prevent an air-tight seal.



INSTALLING A NEW INLET TUBE

(P/N 80416) in a new cylinder valve:

1. Apply one drop of Loctite 290 to the inlet threads.
2. Thread the tube into the cylinder valve and hand-tighten using pliers. Do not over-tighten.
3. Set the valve aside for 4 hours to allow the sealant to dry.

INSTALLING CYLINDER VALVE

1. Apply a thin film of Christo-Lube lubricant on a new O-ring. (P/N 68542 for 2216 psig valves; P/N 633550 for 3000 psig valves; P/N 630926 for 4500 psig valves).

⚠ CAUTION

Apply Christo-Lube lubricant to the O-ring and the O-ring groove just before installing the cylinder valve. Do not store these parts after lubricating them. Christo-Lube may collect dirt and/or contaminants.

2. Apply two 1/16" diameter drops of Christo-Lube in the O-ring groove at locations 180 degrees apart.

3. Place a plastic thread protector or thin piece of paper over the threads, then roll the O-ring to the bottom (male thread) end of the valve body. Rotate the O-ring 1/2 to 3/4 turn to work the Christo-Lube evenly around the groove. Remove the thread protector.



4. Insert the cylinder valve into the cylinder neck slowly and carefully so that the sealing surface of the cylinder is not damaged by the tube or sharp edge of the valve threads.



P/N	ITEM	REQUIRED
473255	Al. Cylinder for High Pressure (gray, 4500 psig)	Valve 70-75 ft. pounds
473664	Al. Cylinder Valve for Low Pressure (black) (2216 psig)	70-75 ft. pounds
494883	Al. Cylinder Valve for Low Pressure (3000 psig)	70-75 ft. pounds
93998	Brass Cyl. Valve for 2216 psig Steel Cyl., bright (silver) plated	90-100 ft. pounds
460321	Brass Cylinder Valve for Composite Cyl., 2216 psig, dull, silver, cadmium plated	45-50 ft. pounds

CYLINDER VALVE DISASSEMBLY AND REPAIR

5. Use a torque wrench with a 13/16" socket to tighten the cylinder valve according to the following table:
6. Refer to Leak Testing and check all connections.

This completes the original cylinder valve replacement procedure.

CURRENT CYLINDER VALVE DISASSEMBLY AND REPAIR

⚠ WARNING

Before repairing the cylinder valve, all air must be bled from the cylinder. Open the cylinder valve handwheel 1/2 turn and leave it open until all air has been exhausted. Wear hearing protection if this is done in an enclosed area to avoid possible hearing damage. Do not attempt to repair the valve is pressure is shown on the cylinder pressure gauge. If pressure cannot be relieved by opening the cylinder valve handwheel, loosen the safety plug (no more than 1/4 turn). Failure to follow this precaution may result in serious personal injury or death.

REMOVING THE PRESSURE GAUGE

1. Remove the rubber gauge protector. Unscrew and remove bezel ring and lens. Store the lens in a safe place.
2. Position the cylinder valve so that the gauge is upside-down. If the plastic center-post falls out of the gauge, apply a thin film of Christo-Lube to the part and re-install it. Place the gauge wrench on the gauge flats. Turn the gauge counter-clockwise and remove it from the cylinder valve body.
3. Clean out the threads in the cylinder valve body to be sure no tape residue remains.

RE-ASSEMBLING OR INSTALLING A NEW PRESSURE GAUGE

1. Apply pipe-sealing tape to gauge threads. (See General Note 2).
2. Place the gauge wrench on the gauge flats. Turn the gauge clockwise to tighten. Do not over-tighten.
3. Position the gauge so that the gauge needle points to the threads of the cylinder valve outlet.
4. Replace the lens in the bezel ring and tighten the ring.
5. Replace the rubber gauge protector.
6. Refer to Leak Testing and check all connections.

This completes the pressure gauge replacement procedure.

REMOVING THE HANDWHEEL

1. Using the spanner wrench, remove the locknut and spring. Remove the handwheel from the top of the valve stem.



2. Place a 7/8" socket (deep-well) on the packing gland flats. Unscrew the packing gland from the valve body. Pull the stem out of packing gland. Remove the O-ring and valve stem washer from the packing gland.



Note: The O-ring removal tool can be used to remove O-ring from the packing gland.

3. Place the valve stem back in the valve body.



4. Replace the handwheel on the valve stem. Turn the stem until the slot drops onto the insert. Turn the handwheel counter-clockwise until the insert can be removed.



Note: If the insert shows signs of wear or damage it must be replaced.

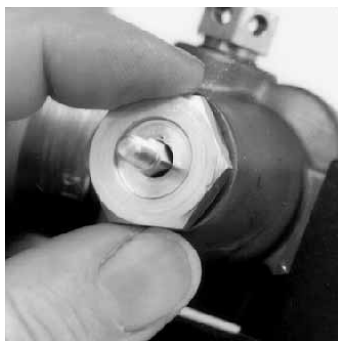
CYLINDER VALVE DISASSEMBLY AND REPAIR

INSTALLING THE INSERT

- Using the valve stem, install the insert in the valve body. Thread the stem clockwise until the insert is finger-tight.



- Place a thin film of Christo-Lube lubricant on a **new** O-ring. Place the O-ring on the packing gland.



- Place a **new** washer into the packing gland. Press the washer down to its seat.



- Insert the stem into the valve body. Turn the stem until the slot drops on the insert. Thread the packing gland into the cylinder valve until it is finger-tight.



- Turn the valve stem counter-clockwise until the stem stops. Be sure the gland does not turn.
- Using the inch-pound torque wrench with a 7/8" socket (deep-well), tighten the packing gland to 85-105 in. lbs.
- The valve stem square must fit into the square hole in the handwheel. Place the handwheel on the stem and check the valve for proper motion. The handwheel should move freely.
- Replace the spring. Be sure that the valve is fully open to allow the locknut to be installed more easily.
- Put 1 drop of Loctite #222 on the stem threads.

- Using the locknut spanner wrench, press the locknut against the spring and tighten clockwise until it is flush with the top of the handwheel.



- Open and close the valve completely several times to seat the stem, insert, and the valve stem gasket.
- Leak test the valve.

REMOVING THE BURST DISC

Note: The procedures for removing and installing burst discs are the same for all models of MSA apparatus. However, part number, tools, and torque specifications do vary. Refer to the following chart for specific items.

MSA SCBA Model	Socket Size	Safety Plug	Torque Ft/Lbs.	Burst Disc & Gasket Kit
2216 psig	11/16"	68550	50 - 53	482225
3000 psig	3/4"	495636	26 - 30	494928
4500 psig	9/16"	473254	21 - 25	482226

- Place a socket on the safety plug hex flats and turn the plug counter-clockwise to remove the safety plug.

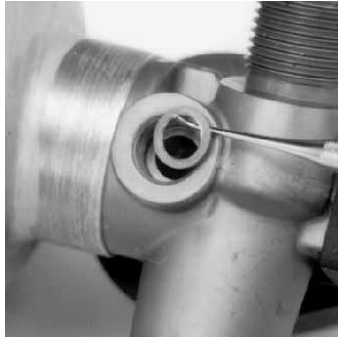


- Use a smaller screwdriver to punch a hole in the burst disc. Pull the burst disc out of the cylinder valve body. Discard the disc.



CYLINDER VALVE DISASSEMBLY AND REPAIR

3. Use the O-ring removal tool to lift the gasket out of the cylinder valve body. Be careful not to scratch the surface of the cylinder valve body.



INSTALLING A NEW BURST DISC FOR 2216 OR 3000 PSIG

1. Insert a **new** gasket into the cylinder valve body.
2. Place a thin film of Christo-Lube on the new burst disc. Place the new burst disc on top of the gasket. Be sure the gasket and disc lay flat.

⚠ WARNING

Be sure gasket, then burst disc, are installed in the order described. Ensure threads of burst disc area and safety plug threads are free of Christo-Lube. Failure to install properly may cause burst disc malfunction, and may result in serious personal injury or death. Do not reuse the burst disc or the gasket.

3. Thread the safety plug into the cylinder valve body. Use a torque wrench and socket to tighten the plug to the torque in chart.



4. Leak test the assembly. This completes the burst disc repair procedure.

CURRENT DESIGN 4500 PSIG

Installing a New 4500 Burst Disc

1. Insert a new gasket into the cylinder valve body.

⚠ WARNING

Be sure gasket, then burst disc, are installed in the order described. Failure to install properly may cause burst disc malfunction, and may result in serious personal injury or death.

⚠ WARNING

Do not re-use the burst disc or the copper gasket.

2. Place a thin film of Snoop on the new 4500 Burst Disc. Place the new burst disc on top of the new gasket. Be sure the gasket and disc lay flat.

3. Thread the safety plug into the cylinder valve body. Use a torque wrench and socket to tighten the plug to the torque specified.



4. See Leak Testing. This completes the burst disc repair procedure.

REPLACING THE CYLINDER VALVE BODY

1. To remove the cylinder valve body from the cylinder:
 - a. Secure the cylinder in a suitable fixture.
 - b. Remove the rubber pressure gauge guard.

- c. Place a 13/16" crowsfoot wrench on the flats on the end of the cylinder valve. Turn the valve counter-clockwise until the cylinder valve is completely out of the cylinder.



- d. Roll the **old** O-ring over the threads. Discard old O-ring.



Note: If the cylinder valve inlet tube is damaged, the cylinder valve inlet tube must be replaced. The inlet tube is "locked" with a non-removable thread sealant. (See Installing a New Inlet Tube)

CYLINDER VALVE DISASSEMBLY AND REPAIR

INSTALLING A NEW INLET TUBE

1. Turn the cylinder valve upside down.
2. Place **one drop** of Loctite 290 on the inlet tube threads.
3. Finger-tighten the inlet tube into the valve body.



4. Allow the sealant to cure for 4 hours.

INSPECTING INSIDE OF CYLINDER

1. Use a high intensity light to inspect the inside of the cylinder for contamination. Be sure the cylinder interior is completely dry.

CAUTION

Do not use the cylinder if it has an odor, is contaminated internally, or has any visible signs of damage. If the cylinder appears damaged return it to a Certified MSA Air Mask Service Center for repair.

2. Clean the O-ring sealing surface on the cylinder with a clean, dry, lint-free cloth. Be sure the cylinder sealing surface is undamaged and free from contaminants, such as dirt or tape residue.
3. Inspect the cylinder neck area. Do not use the cylinder if it has scratches, cuts, or grooves which may prevent an air-tight seal.

INSTALLING CYLINDER VALVE

1. Install a **new** O-ring on the cylinder valve following the steps below:

CAUTION

Apply Christo-Lube lubricant to the O-ring and the Oring groove just before installing the cylinder valve. Do not store these parts after lubricating them. Christo-Lube may collect dirt and/or contaminants.

- a. Place a thin film of Christo-Lube lubricant on the **new** O-ring. (P/N 68542 for 2216 psig valves; P/N 633550 for 3000 psig valves; or P/N 630926 for 4500 psig valves)
- b. Place two small diameter drops of Christo-Lube into the O-ring groove at locations 180 degrees apart.

- c. Place a plastic thread protector or thin piece of paper over the threads, then roll the new O-ring to the bottom (male thread) end of the valve body. Remove the thread protector.



4. Carefully insert the cylinder valve into the cylinder neck so that the sealing surface of the cylinder is not damaged by the tube or sharp edges of the valve threads.
5. Use the foot-pound torque wrench with a 13/16" crowfoot wrench to tighten the cylinder valve to 70-75 ft. lbs.
6. Leak test the assembly. This completes the cylinder replacement procedure.

TROUBLESHOOTING

Trouble	Probable Cause	Remedy
Cylinder pressure gauge reads low or high pressure	1. Cylinder temperature may be very low or high.	1. Bring cylinder indoors and let it sit until it comes up to room temperature (approximately 68F), then recheck pressure gauge. ⚠ WARNING Do not attempt to heat cylinder by using a torch or placing in an oven. Attempting to heat the cylinder in this way may cause the cylinder to rupture, resulting in serious personal injury or death.
	2. Cylinder charge may be low.	2. Change the cylinder.
	3. Gauge needle may be stuck.	3. Tap lightly on the gauge lens. If gauge reading does not change, check to be sure indicator needle is not bent or damaged. If operation or accuracy of gauge is still doubtful, replace the gauge.
	4. Cylinder valve assembly may have leaks.	4. Completely leak test cylinder valve assembly.
High Pressure Hose is leaking.	1. If leak is from the end fittings, O-rings may need to be replaced.	1. See leak testing and repair.
Harness gauge shows different pressure from cylinder valve gauge.	1. Cylinder valve may not be fully opened.	1. Fully open cylinder valve.
	2. Gauge needle may be stuck.	2. Tap lightly on the gauge lens. If gauge reading does not change, check to be sure needle is not bent or damaged.
	3. Gauge accuracy is out of tolerance.	3. Gauges are required by NIOSH to be accurate to $\pm 5\%$ of full scale. If the cylinder valve gauge has a $+5\%$ accuracy and the regulator has a -5% accuracy, then a compared reading between the two gauges may differ by 10% (e.g., 220 or 300 psig on Low Pressure; and 450 psig on High Pressure). If the gauges are within this requirement, then they are acceptable. If the gauges are not, one or both should be replaced.
	4. Orifice blocked.	4. Replace hose.
Harness gauge shows unacceptable pressure drop in check procedure.	1. Leak at high pressure hose or coupling nut.	1. Check the hand-tight coupling nut for tightness. If leak continues, leak test the high pressure connections and tighten those that are leaking.
	2. Leak through the regulator.	2. Completely leak test the regulator.
Regulator has low flow performance.	1. Cylinder valve not fully open.	1. Fully open cylinder valve handwheel.
	2. Second Stage Regulator may require adjustment.	2. Return to Certified MSA Air Mask Service Center for repair.
	3. First Stage Regulator may require adjustment.	3. Return to Certified MSA Air Mask Service Center for repair.
Audi-Larm does not ring when pressurized.	1. Audi-Larm bell is loose.	1. Install new screws and washers. Refer to PIN P/N 10041212 (Single Screw) and PIN P/N 10041213 (Dual Screw).
	2. Dirt or foreign matter may have affected the O-ring seals inside the Audi-Larm or the proper operation of the Audi-Larm striker.	2. Overhaul Audi-Larm.
	3. Internal Leak.	3. Overhaul Audi-Larm and replace piston.
Audi-Larm leaks.	1. Audi-Larm insert O-ring is leaking.	1. Try to hand-tighten coupling nut further on the cylinder valve. If this is unsuccessful, the insert O-ring may need to be replaced.
	2. Leaking at the pipe thread fitting.	2. Completely leak test all fittings on the Audi-Larm Assembly. Relieve pressure and then tighten if necessary.
Audi-Larm does not fully pressurize.	1. Cylinder pressure too low.	1. Replace cylinder with a fully pressurized cylinder.
	2. Internal leak.	2. Overhaul Audi-Larm and replace piston.
	3. External leak.	3. Replace coupling nut nipple O-ring.
Audi-Larm does not start to ring at required setting.	1. Adjustment too high.	1. Adjustment: Turn the adjusting screw counter-clockwise (out) 1/8 turn. Retest the Audi-Larm.
	2. Adjustment too low.	2. Adjustment: Turn the adjusting screw clockwise (in) 1/8 turn. Retest the Audi-Larm.
Audi-Larm does not ring continually all the way down.	1. Internal leak.	1. Overhaul Audi-Larm.
		2. Overhaul Audi-Larm and replace piston.

Note: If after performing the remedy, the Audi-Larm still does not perform properly during the Audi-Larm test, it must be replaced.