# BMR
# 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 BMR 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.**

MSA Safety Products Division • ISO 9001 CERTIFIED Quality System • MSA Instrument Division

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

# INTRODUCTION

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Before you begin, get the appropriate illustrated Parts List for the SCBA.

**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, Fire Department Occupational Safety and Health Programs and NFPA Standard 1981, 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 inspection and maintenance procedures authorized in this manual are classified User Maintenance. The user is limited maintenance. No special training is required, 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.**

# LEAK-TESTING

## LEAK-TESTING

The SCBA must "hold" system pressure without leaks to provide adequate protection. Perform the "Air-Tightness Test" as a first step in trouble-shooting. Perform the following component leak-tests to be sure you do not have a slow 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.

**Note:** Many procedures include the statement "remove the component from service." This means that no further maintenance is possible. Return the component to a repairperson or to a certified service center.

**⚠ 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 main-line valve. Failure to follow this warning may cause fittings or connectors to rupture, resulting in serious personal injury or death.**

## CYLINDER VALVE

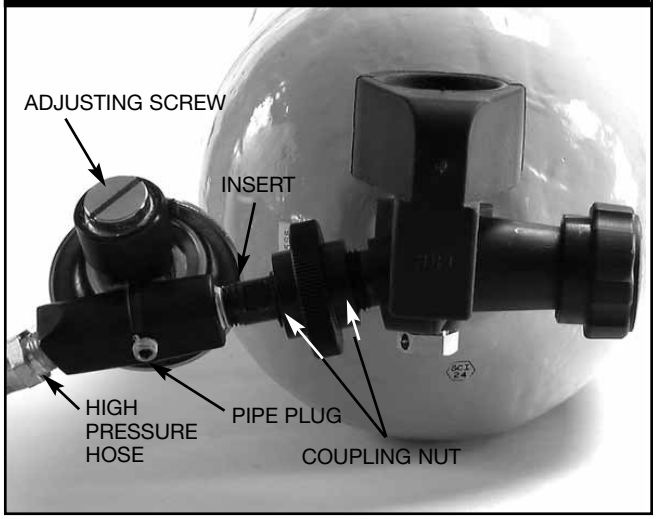
1. Outlet Port (coupling nut connection)
   a. Be sure that the cylinder valve handwheel is completely closed.
   b. Draw a bubble of leak-test solution across the valve outlet port. Use your fingers to cover the two bleed holes in the threads.
   c. If the bubble expands, there is an air leak through the valve. It must be repaired by a certified repairperson.
2. Cylinder Neck
   a. Apply leak-test solution to the cylinder neck.
   b. If bubbles appear, remove the cylinder from service.
3. Cylinder Valve Handwheel and Safety Plug
   a. Apply leak test solution to the cylinder handwheel and safety plug.
   b. If bubbles occur at the cylinder handwheel, or the safety plug, there is an air leak through the valve. Remove the cylinder from service.
4. Pressure Gauge
   a. Remove rubber gauge guard. Apply leak-test solution to the pressure gauge stem.
   b. If bubbles appear, there is an air leak through the valve. Remove the cylinder from service.
   c. On high pressure gauges, apply leak-test solution to the rubber vent plug or tape. If bubbles appear, there is an air leak through the valve. Remove the cylinder from service.

## AUDIBLE ALARM

Connect the alarm coupling nut to the cylinder and hand-tighten until it can go no further. Check that the regulator main-line and bypass valves are completely closed. 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, relieve pressure and 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 main-line valve.
   e. Remove the coupling nut and check that the O-ring on the insert is in position. To replace the O-ring, see Audi-Larm Repair.

**Audi-Larm Audible Alarm**




2. Audi-Larm Insert
   a. Apply leak-test solution to the Audi-Larm insert pipe threads. If bubbles appear, there is an air leak around the valve threads. See Audi-Larm Repair.
3. 45 Degree Elbow (prior design)
   a. Apply leak-test solution where the elbow threads into the alarm. If bubbles appear, see Audi-Larm Repair.
4. Audi-Larm Adjusting Screw
   a. Apply leak-test solution to the adjusting screw and the pipe plug.
   b. If bubbles appear, return the alarm to a certified MSA Air Mask Service Center.
   5. Audi-Larm Bell
   a. If the bell is loose or missing see Audi-Larm Repair.

# LEAK TESTING

### HIGH PRESSURE HOSE

1. Hose Fittings
   a. Apply leak-test solution to both hose end-fittings at each joint.
   b. If bubbles appear, see High Pressure Hose.
2. 90 Degree Elbow
   a. Apply leak-test solution to the elbow threads or the Quick-Fill fitting at the regulator.
   b. If bubbles appear, see Regulator Repair.

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### REGULATOR VALVE LEAK TEST

1. Main-line and bypass valve
   a. Remove the diaphragm cap, spring, and diaphragm.
   b. Close both the main-line and bypass valves; open the cylinder valve completely.
   c. Draw a bubble over the regulator outlet. Place one finger over the aspirator hole and fully depress the lever assembly. The bubble must not expand or break within 15 seconds. If it does, remove the regulator from service.
   d. Repeat the previous step with the lever assembly free. Air bubbles indicate a leak. Remove the regulator from service.
2. Admission Valve
   a. Fully open the main-line valve.
   b. Draw a bubble over the regulator outlet. Place a finger over the aspirator hole. Do not depress the lever arms.
   c. The bubble must not expand or burst for at least 15 seconds. A leak indicates that the admission valve must be replaced. Remove the regulator from service.
   d. Re-assemble diaphragm cap, spring, and diaphragm (see Diaphragm).

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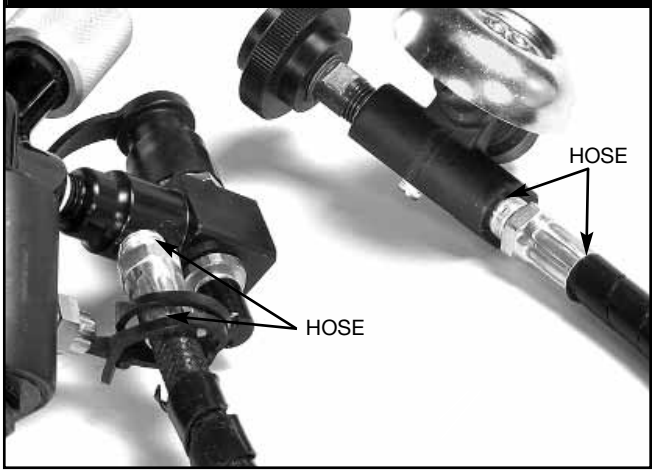
### REGULATOR BODY LEAK TESTS

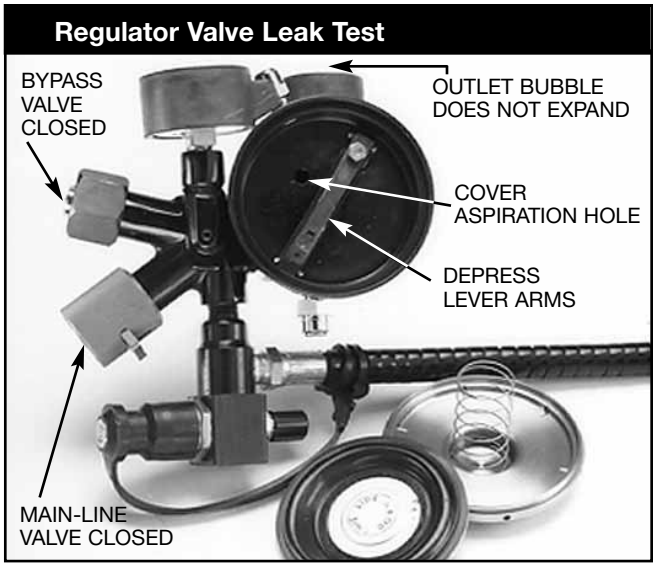
1. Main-line and bypass valves
   a. Fully open the main-line valve.
   b. Apply leak-test solution around the main-line valve handwheel. If bubbles develop, remove the regulator from service.
   c. Close the main-line valve.
   d. Place the soap solution around the bypass valve handwheel.
   e. Do not block the regulator outlet while the bypass valve is open. Open the bypass valve 1/8 turn.
   f. Bubbles indicate there is an air leak through the valve.
   g. Close the bypass valve. Remove the regulator from service.
2. Regulator Body

**Note:** Be sure that the main-line valve is fully open. Be sure that the bypass valve is fully closed.

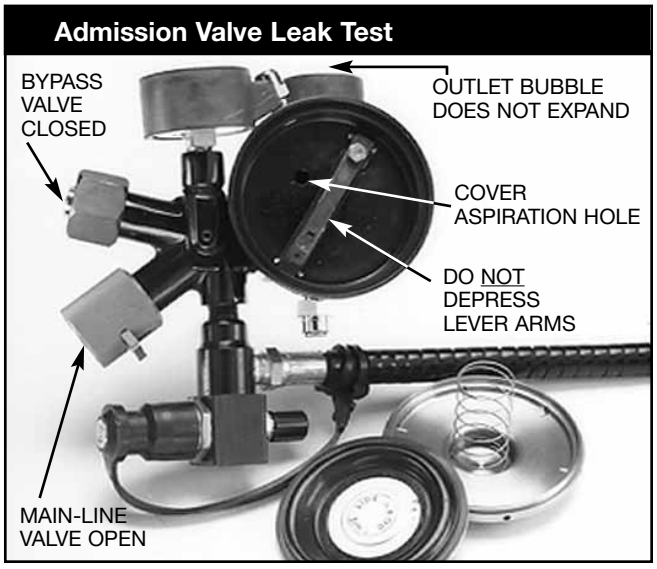
**High Pressure Hose**




**Regulator Valve Leak Test**




**Admission Valve Leak Test**



# LEAK TESTING

a. Apply leak-test solution to the pressure gauge threads. Also check the rubber vent plug on high pressure gauges.
b. If bubbles appear, remove the regulator from service.
c. Apply leak-test solution to the following locations on the outside of the regulator body: Reducing valve (first stage connection); Weep hole; Bellows retainer and adjusting screw; Set screw (below the pressure gauge); High pressure relief valves.
d. If bubbles appear at any of these locations, the regulator must be returned to a Certified MSA Air Mask Service Center.

3. Leak-test the low pressure relief valve (P/N 626501).

**⚠ WARNING**

**Do not try to adjust or repair the low pressure relief valve. Tampering may cause the relief valve to fail to operate, resulting in serious personal injury, death, or damage to equipment.**

a. Cover the regulator outlet with the rubber outlet protector and place your hand over top of the outlet cover to be sure the cover is not leaking.
b. Open the main-line valve slowly.
c. Apply leak-test solution to the cap.
d. If bubbles appear, remove the regulator from service.

4. After all components have been leak-tested close the cylinder valve. Be sure that nothing blocks the regulator outlet. Relieve pressure from the system by gently pressing down on the lever arm assembly. Do not use the bypass valve to relieve pressure.
a. Use a clean, lint-free cloth to wipe the regulator body dry.
b. Check that the lever assembly is correctly positioned: Small arm on top.
c. Hold the regulator cap and place the spring in the hub. Place the diaphragm hub on top of the spring so that the words "this side down" face you.
d. Press the yellow diaphragm ring into the cap. Insert the assembly and screw the cap into the regulator body and hand-tighten (if necessary).
e. Close the main-line valve.

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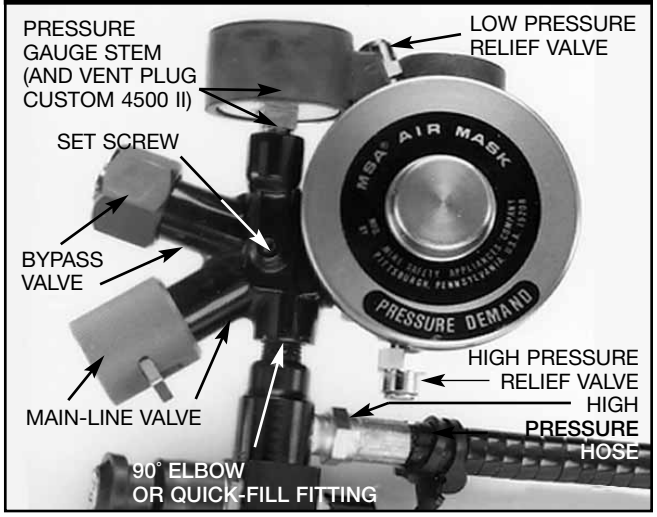
### LEAK-TESTING THE DUAL-PURPOSE

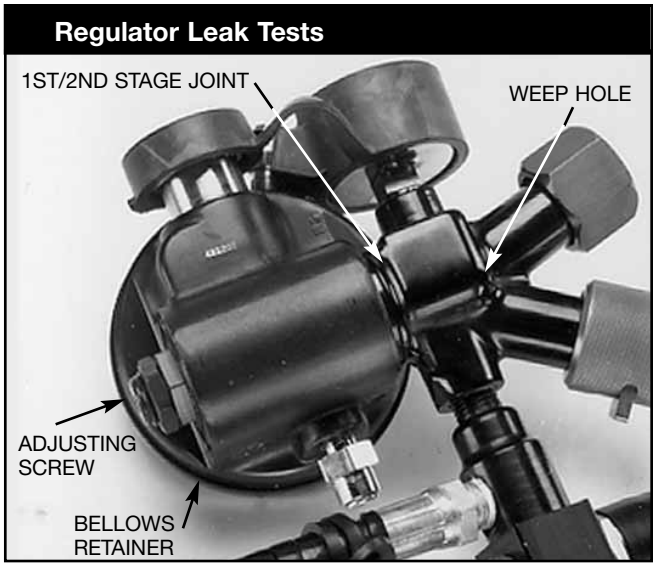
1. Regulator air-line inlet
a. Connect the regulator and Audi-Larm to a cylinder that is pressurized to a minimum of 1200 psig, low pressure, 2000 psig, high pressure.
b. Be sure that the bypass and main-line valves are closed.

**Note:** Unscrew the diaphragm cap and remove the spring. Replace the diaphragm cap.

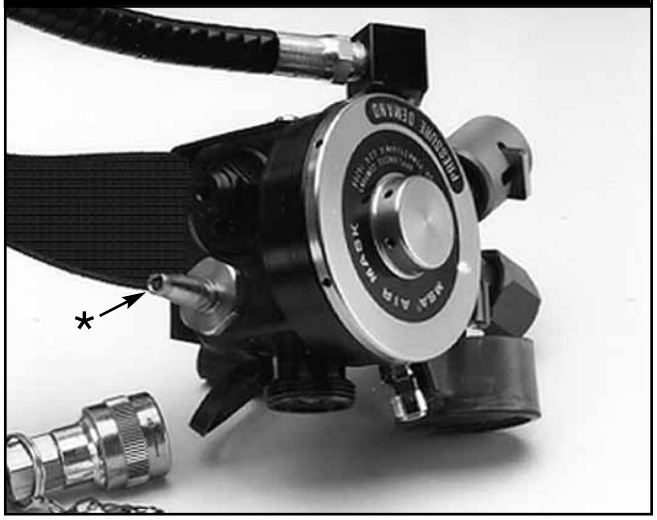
**Regulator Leak Tests**




**Regulator Leak Tests**




**Dual-Purpose Regulator Air-line Inlet**

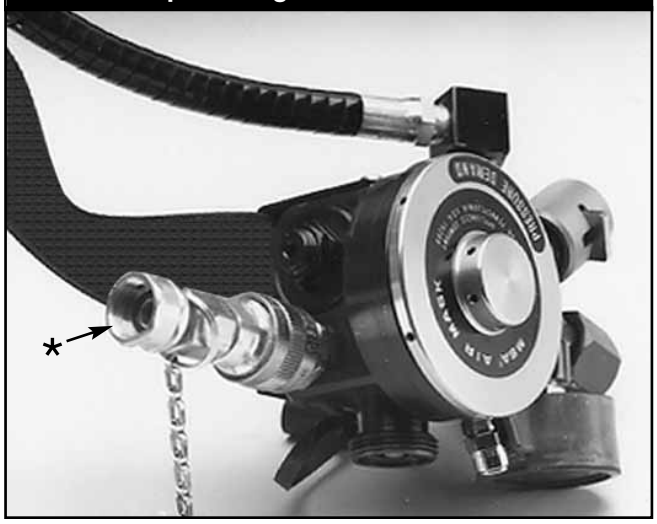


# LEAK TESTING

c. Open the cylinder valve fully.
d. Open the main-line valve fully.
e. Apply leak-test solution around the inlet. If bubbles appear, relieve pressure from the system. Remove the regulator from service.
f. Apply leak-test solution to the end of the air-line inlet. If bubbles appear in less than 5 seconds, remove the regulator from service.
g. Install an approved quick-disconnect on the plug.
h. Draw a bubble across the quick-disconnect. The bubble must not expand or break within 5 seconds. If bubbles appear, remove the quick-disconnect. Remove the regulator from service.

**Note:** Be sure to re-install the diaphragm spring after performing the leak-tests.

**Dual-Purpose Regulator Air-line Inlet**




**LEAK-TESTING THE QUICK-FILL® SYSTEM**

1. Make sure the main-line and the bypass valves are closed.

**⚠ CAUTION**

**Do not connect an Low Pressure Air Mask to a 4500 psig cylinder. Although the Low Pressure quick-fill block has a relief valve to prevent pressurization, connecting to a 4500 psig cylinder is a dangerous and potentially unsafe condition**.

2. Make sure the cylinder is fully pressurized before leak testing.
3. Remove dust cover.
4. Open the cylinder valve fully.
5. Apply leak test solution to both sides of the quick-fill block, fitting and hose end.

**⚠ CAUTION**

**If leaks are found, depressurize the system before performing any maintenance. Close the cylinder valve fully. Be sure that nothing is blocking the regulator outlet. Open the bypass valve to release any trapped air. Close the bypass fully.**

6. Be sure that the cylinder valve is fully closed, that all pressure is relieved from the system, and that the main-line valve and bypass are fully closed.
7. Install the dust cover on the male quick-fill coupling. The Air Mask is now ready for service. Read and be sure that you fully understand the instructions for operating the Quick-Fill System.

# REGULATOR DISASSEMBLY AND REPAIR

## 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 O-rings with a very thin film of Christo-Lube® (P/N 604070) just before they are installed. Do not store parts after lubricating them. Christo-Lube may collect dirt and/or contaminants. Christo-Lube is compatible with brass and aluminum.

**Note 2:** Pipe-sealing tape is used on the threads of the following parts before they are re-assembled:

- regulator pressure gauge
- 90 degree elbow
- high pressure hose (both ends).
- Audi-Larm coupling nut threaded insert.
- 45 degree elbow (prior design)

Wrap 1 to 1-1/2 turns of the 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 to the tape before threading it into the fitting.

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## REGULATOR REPAIR

Remove the regulator from the SCBA waist-strap and remove the Audi-Larm from the air cylinder before you repair them.

1. Be sure that the cylinder valve is completely closed.
2. Be sure that nothing blocks the regulator outlet.
3. Open the main-line valve slowly to release any trapped air.
4. Close the main-line valve fully. Christo-Lube is a registered trademark for Lubrication Technologies.

**⚠ WARNING**

**Do not disconnect the Audi-Larm coupling nut when pressure is shown on the regulator gauge. Always be sure that you have released all pressure from the regulator. Close the cylinder valve fully. Be sure that nothing blocks the regulator outlet. Open the main-line valve fully to release any trapped air. Removing the coupling nut with the regulator pressurized may result in serious personal injury, death, or damage to equipment. Use eye protection when servicing the product.**

5. Unscrew the Audi-Larm coupling nut from the cylinder valve.
6. Remove the two screws, washers, and tee nuts holding the female belt buckle to the waist-strap. Then, slide the regulator and mounting bracket off the waist strap.

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## DIAPHRAGM

1. If the regulator diaphragm is torn or has any visible damage, the diaphragm must be replaced, as follows:
   a. Remove the regulator cap and spring.

b. Lift out the diaphragm by grasping the yellow ring.

2. If the tape holding the ring to the diaphragm is loose, frayed, or partially peeled away from the yellow ring and diaphragm, the diaphragm must be replaced.
3. Using a new diaphragm, re-assemble the low pressure side of the regulator. Use a clean, lint-free cloth to wipe the regulator body dry.

# REGULATOR DISASSEMBLY AND REPAIR

a. Check that the lever assembly is correctly positioned: Small arm on top.

b. Hold the regulator cap and place the spring in the hub. Place the diaphragm hub on top of the spring with the words "this side down" facing you.

c. Press the yellow diaphragm ring into the cap. Insert the assembly and screw the cap into the regulator body and hand-tighten.

d. Close the main-line valve.

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**PRESSURE GAUGE**
P/N 95278 2216 psig or 3000 psig
P/N 473250 4500 psig

1. Fold the rubber gauge protector back over the relief valve. Unthread the bezel ring and bezel counter-clockwise.

2. Stretch the "U" shaped rubber around the relief valve, and pull it out from between the gauge and the relief valve.
3. To remove the pressure gauge place an open-end wrench on the pressure gauge flats. Position the regulator with the gauge dial facing down so that any debris falls out as the gauge is removed. With the gauge dial facing down, turn the wrench to loosen. Remove the gauge and throw it away. Be sure to remove any tape from the regulator port.
4. To install a pressure gauge:
   a. Apply pipe-sealing tape to the gauge threads. See Note 2.
   b. If gauge has two screws on the back of the pressure gauge are tight. Then apply one drop of Loctite #222 to each screw.

**⚠ CAUTION**

**Do not over-tighten or you may damage the regulator body or the pressure gauge threads.**

c. Screw the gauge stem into the regulator and tighten with an open-end wrench. The dial should point in the position shown. **Do not over-tighten or you may damage the regulator body or the pressure gauge threads. Leak-test the gauge.**

**⚠ CAUTION**

**Do not touch the gauge needle. If it is bumped it may not give an accurate reading.**

5. To install the rubber gauge protector:
   a. Position the new gauge protector (P/N 801143) so that the "U" shape side straddles the low pressure relief valve. Stretch the rubber and slip it between the gauge and the relief valve.

b. Pull the gauge protector back over the relief valve. Place the lens on the gauge and screw the bezel ring clockwise until it is hand-tight only.

c. Stretch the gauge protector over the bezel ring and the gauge.
d. Tap the gauge lens lightly with your finger to make sure it is secure. Place the dust cover over the regulator outlet as you would do for normal storage and regulator protection.

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**90 DEGREE ELBOW**

1. To remove the 90 degree elbow:
   P/N 473577 Low Pressure
   P/N 473248 High Pressure
   a. Remove regulator mounting bracket (P/N 473420 for SCBA; P/N 475909 for Dual-Purpose) from the regulator by removing three mounting screws and washers.

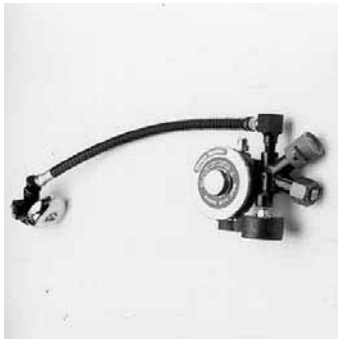
   b. Hold the regulator firmly. Place a wrench on the elbow flats and unscrew it. Be sure to remove all pipe-sealing tape from the regulator port threads.

**Note:** If the sintered filter (P/N 476441) has been removed, replace the filter before installing the 90 degree elbow.

   c. Use a 6" adjustable wrench to remove the hose fitting from the 90 degree elbow.
2. Apply pipe-sealing tape to the threads of the new elbow. See Note 2.
   a. Check that the high pressure hose end-fitting is clean. Remove any tape debris.
   b. Apply pipe-sealing tape to the end-fitting threads.


   c. Thread the hose end-fitting into the 90 degree elbow and tighten, using a 6" adjustable wrench on the hose fitting and a wrench on the elbow flats.

   d. Thread the 90 degree elbow into the regulator and tighten, using a wrench on the elbow flats. Check that the 90 degree elbow is aligned as shown below. Do not over-tighten or you may damage the elbow or the end-fitting threads. Leak-test to check all connections.



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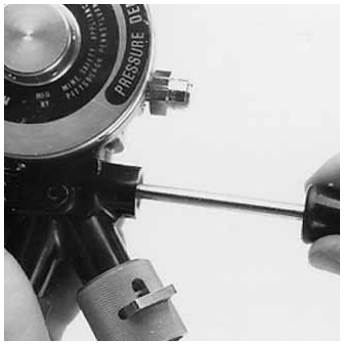
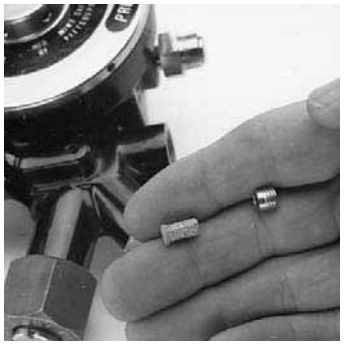
**SINTERED INLET FILTER**
(located at the base of the 90 degree elbow port of the regulator).

1. Remove the 90 degree elbow.
2. To remove the sintered filter:
   a. Turn the regulator upside down (filter faces down).



   b. Place a 3/16" nut driver on the filter and unthread (counter-clockwise).

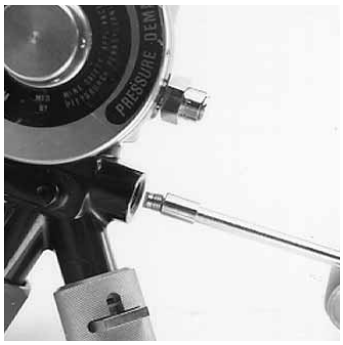
3. To replace the bronze sintered filter:
   a. Hold the filter in one hand with the filter flange (larger diameter) end down.



   b. Slide the non-threaded end of filter holder on the filter.

# REGULATOR DISASSEMBLY AND REPAIR

c. Insert the filter and holder into a 3/16" nut driver so that the filter flange end is up.



**Note:** Use a nut driver, not a socket and ratchet wrench. If the filter is over-tightened it will snap off.

d. Turn the regulator so that the threaded hole for the 90 degree elbow is facing down. Insert the filter holder, filter, and nut driver into the hole. Tighten the filter holder finger-tight only.

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**HIGH PRESSURE HOSE**

1. Turn the regulator so that the 90 degree elbow is down.

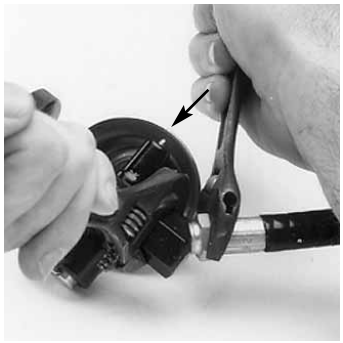
a. Place a wrench on the flats of the 90 degree elbow. Place a second wrench on the hex hose fitting at the 90 degree elbow and unthread the hose.

b. Remove all tape debris from the threads inside the 90 degree elbow.

c. Place a wrench on the flats of the Audi-Larm. Place a second wrench on the hex flats of the hose end-fitting and unthread the hose. Remove all tape debris from the threads inside the Audi-Larm.

2. To install a new hose, apply pipe-sealing tape to the threads of both hose end-fittings See Note 2.

a. Thread the hose end-fitting into the Audi-Larm first and tighten using one wrench on the hex flats of the hose and a second wrench on the flats of the Audi- Larm. **Do not over-tighten or you may damage the elbow or the end-fitting threads.**



b. Thread the other end of the hose end-fitting into the 90 degree elbow and tighten, using a wrench on the hose hex flats and a second wrench on the flats of the 90 degree elbow. Do not over-tighten or you may damage the elbow or the end-fitting threads.

c. Check that the elbow is lined up as shown. Leak-test to check all connections.

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**45 DEGREE ELBOW (PRIOR DESIGN)**

1. To separate the Audi-Larm and 45 degree elbow, place a 3/4" wrench on the Audi-Larm body flats. Place a wrench on the flats of the 45 degree elbow. Unthread the elbow.

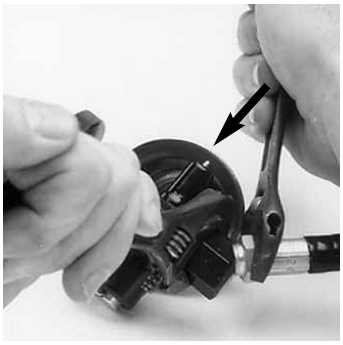
2. Place a wrench or a 7/8" wrench on the flats of the elbow. Place a second wrench on the hex flats of the hose end-fitting and unthread the hose.

3. Remove all tape debris from the hose end-fitting threads.
4. Turn the elbow so that the hose end is down and remove all tape debris from the threads.
5. To install the 45 degree elbow:
   a. Apply pipe-sealing tape to the hose end-fitting threads. See General Note 2.
   b. Thread the hose end-fitting into the 45 degree elbow and tighten, using one wrench on the hex flats of the hose and a second wrench on the flats of the 45 degree elbow. **Do not over-tighten or you may damage the elbow or the end-fitting threads.**

# REGULATOR DISASSEMBLY AND REPAIR

c. Apply pipe-sealing tape to the elbow threads.
d. Thread the 45 degree elbow into the Audi-Larm and tighten, using a 7/8" wrench on the flats of the 45 degree elbow, and a wrench on the Audi-Larm body. **Do not over-tighten or you may damage the elbow or the end-fitting threads.**

6. Hold the Audi-Larm body so that the striker that hits the bell is pointed up.



7. Check that the narrowest flat of the elbow (about 1/8" wide) lines up with the wrench flat on the coupling nut side of the alarm. Leak-test the 45 degree elbow.

**⚠ WARNING**

**You must check the 45 degree elbow alignment. If the elbow is not positioned as shown, stress on the high pressure hose may be increased. Failure to follow this precaution may cause the hose to leak or break and result in serious personal injury or death.**

---

**LOW PRESSURE RELIEF VALVE**

**⚠ WARNING**

**Do not try to adjust or repair the low pressure relief valve. Discard it. Tampering may change the relief valve setting, resulting in serious personal injury, death, or damage to equipment.**

1. Place a wrench on the hex flats of the valve. Unthread and remove the valve.

2. Apply one drop of Loctite 290 (P/N 600469) to the new valve threads. Rub the Loctite 290 into the valve threads.
   a. Thread the new valve into the regulator body. With the diaphragm cap, spring, and diaphragm removed, check that the valve does not extend through the inside of the regulator body by more than 1 to 2 threads.
   b. Set the regulator aside. Loctite 290 must cure (harden) for 4 hours.
3. To replace the diaphragm spring, and diaphragm cap:

   a. Hold the regulator cap and place the spring in the hub. Place the diaphragm hub on top of the spring with the words "this side down" facing you.

   b. Press the yellow diaphragm ring into the cap. Insert the assembly and screw the cap into the regulator body and hand-tighten.

---

**HIGH PRESSURE RELIEF VALVE**
P/N 481999 Low Pressure
P/N 482000 High Pressure

**⚠ WARNING**

**Do not try to adjust or repair the high pressure relief valve. Discard it. Tampering may change the relief valve setting, resulting in serious personal injury, death, or damage to equipment.**

# REGULATOR DISASSEMBLY AND REPAIR

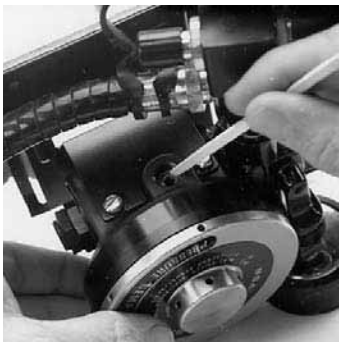
1. Place a wrench on the flats at the base of the valve and loosen it.


**⚠ WARNING**

**Do not place a wrench on the silver locknut. Any adjustment of the relief valve may cause the relief valve setting to be changed, and result in serious personal injury, death, or damage to equipment.**

2. Remove the gasket from the valve port.
   New P/N 42911 Gasket (Low Pressure)
   New P/N 473246 Gasket (High Pressure)

3. Install the new gasket so that it is flat on the bottom of the valve port.



4. Thread the new high pressure relief valve into the regulator body.
5. Place a wrench on the flats at the base to the valve and tighten it against the gasket. Leak-test to be sure there are no air leaks.

**⚠ CAUTION**

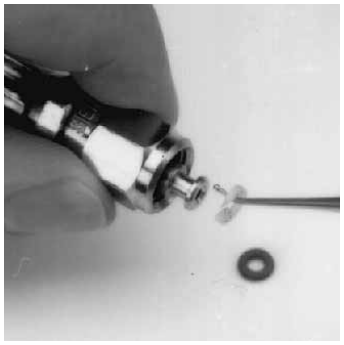
**If the relief valve continues to leak, the regulator must be returned to a certified Air Mask Service Center for repair.**

---

**REMOVING/INSTALLING REDUNDANT ALARM**

1. Removing the Redundant Alarm from the Hose
   a. 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.
   b. Using a open-end wrench on the jam nut and a 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.

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

# ALARM DISASSEMBLY AND REPAIR

**AUDI-LARM REPAIR**

The Audi-Larm must be disconnected from the apparatus cylinder.

---

**INSERT O-RING**

**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. (P/N 54197) into the Audi-Larm body and tighten.

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.

---

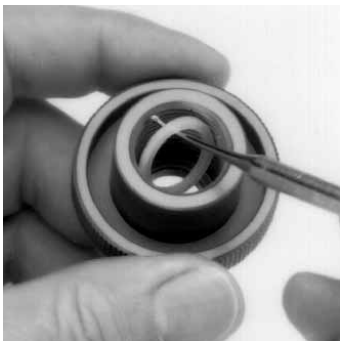
**COUPLING NUT**

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.
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.

# ULTRAVUE FACEPIECE REPAIR

**FACEPIECE FIT CHECK**
Refer to Users Maintenance Manual (P/N 804010).

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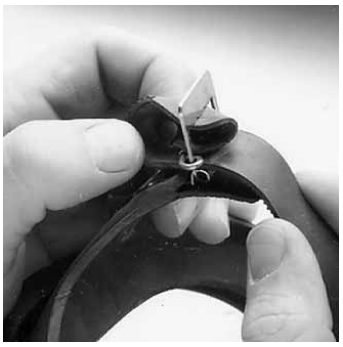
**RUBBER HEAD HARNESS**

1. To remove a damaged headstrap from the facepiece, lay the facepiece on a table or other flat surface.
   a. Pull the back of each buckle away from the headstrap, then pull slightly so the headstrap end-tab is at the buckle.



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

2. To install a new rubber headstrap, lay the new headstrap flat. The MSA logo should be right-side up. Each strap is labeled. Pick the headstrap up by the strap labeled "FRONT."
   a. Fold the end-tab sides together.
   b. Push the headstrap end-tab under the wire roller.
   c. Pull the wire roller down against the strap.

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

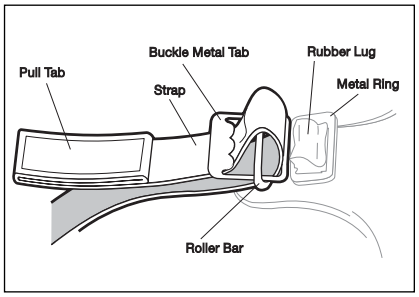
   e. Repeat steps a through d for each remaining strap. Check that the headstrap is not twisted.

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

**SPEED-ON® HEAD HARNESS**

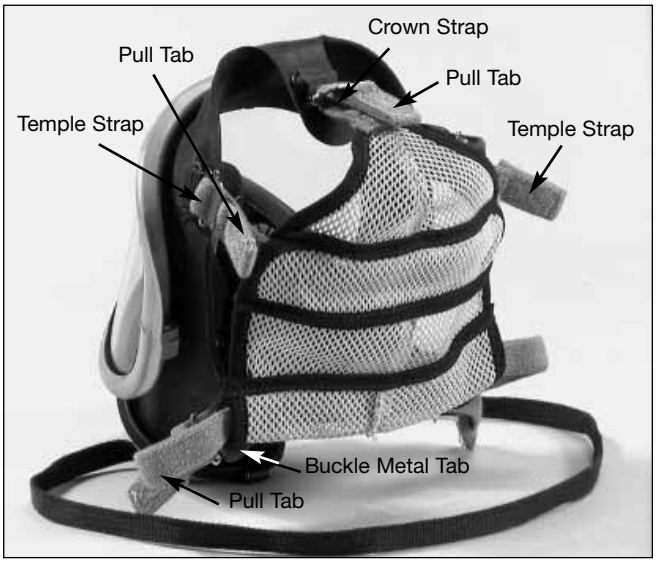
1. Thread the crown, temple, and neck straps into the buckles as follows:
   a. With folded side down, thread the strap into the bottom section of the buckle under the roller bar.
   b. Push roller bar down and thread the end through the top section of the buckle.
   c. Adjust so that the pull tab extends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

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**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 LENS AND RING**

1. Remove the facepiece lens.

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

b. Remove both retaining ring halves.


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

2. Installing the new facepiece lens.


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

**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. Press the ring halves together at the top and bottom of the facepiece so that the ends mate.
d. Install a screw on each side.
e. 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.
f. 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 happens, reassemble.**

g. Remove all lens protective papers from the new lens.
h. Don the facepiece and check the face-to-facepiece seal. Follow the steps in the Facepiece Fit Check.
i. Install a cover lens to protect the facepiece polycarbonate lens during storage.

**⚠ CAUTION**

**Do not use a cover lens in a high-temperature environment, such as firefighting. 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.**

---

**SPEAKING DIAPHRAGM HOUSING**

1. Loosen the band clamp screw to remove the entire Inlet (P/N 470039). Remove the clamp and pull the assembly out of the facepiece.

2. To re-assemble the entire speaking diaphragm housing in the facepiece:
   a. Slide the band clamp over the inlet.

b. Slide the assembly into the facepiece. Check that the air ducts in the housing are lined up with the ducts in the facepiece.

c. Be sure that the 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 inlet is secured. Be sure that the band clamp will 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 re-tightened.

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

---

**SPEAKING DIAPHRAGM**

1. Unscrew the retainer ring, using the facepiece spanner wrench (P/N461828).

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 follow this warning may cause inhalation of contaminant and result in serious respiratory injury or death.**

5. To re-assemble the speaking diaphragm, place the gasket or O-ring in the groove of the speaking diaphragm housing.

6. Place the speaking diaphragm in the housing so that the rolled lip rests on the gasket or O-ring. Be sure that the crimped side of the speaking diaphragm is facing up (away from the gasket or O-ring).

7. Replace the retainer ring and tighten using the spanner wrench.
8. Don the facepiece and check the face-to-facepiece seal. Follow the steps in the Facepiece Fit Check.

---

**INHALATION DISC VALVE**

1. Push in on the facepiece coupling nut and turn it until its tabs fit into the slots in the adapter.
2. Twist the coupling nut counter-clockwise (left) to unscrew the adapter assembly.

3. Lift the spider gasket out of the coupling nut housing by its tab.

4. Remove the valve disc from the coupling nut housing. If you cannot grasp the disc with your fingers, use a blunt object, such as a ballpoint pen 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. To install the inhalation disc valve:
   a. Press the valve disc on the pin in the coupling nut 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.
   d. Thread the coupling nut adapter into the coupling nut housing and hand-tighten.
   e. Remove the gasket from the coupling nut and check it for tears or cuts. Replace it with a new gasket if it is damaged. Press the gasket in place in the coupling nut.

---

**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.

# ULTRAVUE FACEPIECE REPAIR

**BREATHING TUBE OR INSERTS**

1. Place a small screwdriver under the clamp and twist it to pry the clamp off.

2. Remove the threaded insert, breathing tube insert, and coupling nut.

**THREADED INSERT ON THE FACEPIECE END OF THE BREATHING TUBE**

1. Slide an open clamp over the cuff of the breathing tube.
2. Moisten the insert and push it into the breathing tube.

**Note:** The coupling nut must be placed on the breathing tube insert before the insert is installed in the breathing tube.

3. Position the clamp and tighten it using pliers. Close the clamp as tightly as possible and be sure that the locking tongue is aligned and engaged.

4. Hold the fitting and firmly pull on the tube to be sure that the connection is tight. Use the same procedures on the opposite end of the tube.
5. Check the breathing tube for leaks.

# NOTES

# ULTRA ELITE FACEPIECE REPAIR

## REPLACING THE RUBBER HEADSTRAP

**Note:** To replace the standard rubber headstrap (the one with rollers and end-tabs), see Ultravue Facepiece Repair.

To replace the standard rubber headstrap if the buckle assemblies are damaged or to install the SpeeD-ON Head Harness, follow the steps below.

1. To remove a damaged rubber head strap 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 up with your thumb as you stretch the facepiece lug.
   c. Turn the facepiece and switch hands to pry up 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 Harness, go to column 2, Installing the SpeeD-ON 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. Pick the headstrap up by the strap 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.

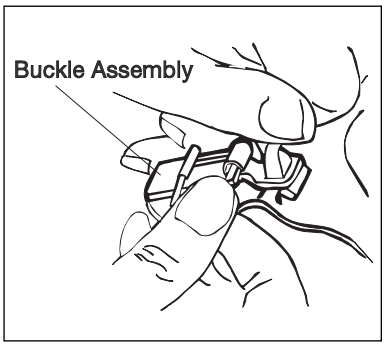

   c. Pull the buckle and lug in opposite directions while twisting them from side to side to work the buckle down until it snaps in place over the lug.
   d. Repeat steps a through d for each remaining strap. Check that the installed headstrap is not twisted.
3. Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check.

## REMOVING THE SPEED-ON HEAD HARNESS

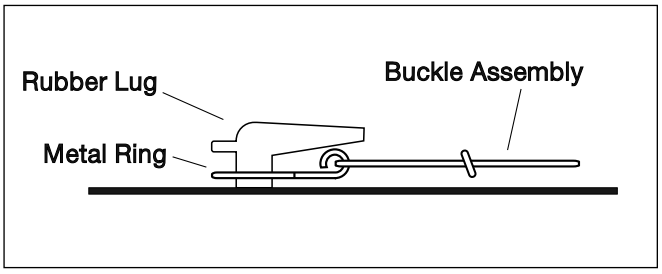
1. To remove a damaged SpeeD-ON Head Harness from the facepiece, lay the facepiece on a table or other flat surface.
2. Follow Replacing the Rubber Headstrap, steps 1a-d for each of the top three straps.
3. To remove the bottom buckles, pull the back of the buckle away from the rubber strap and pull 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

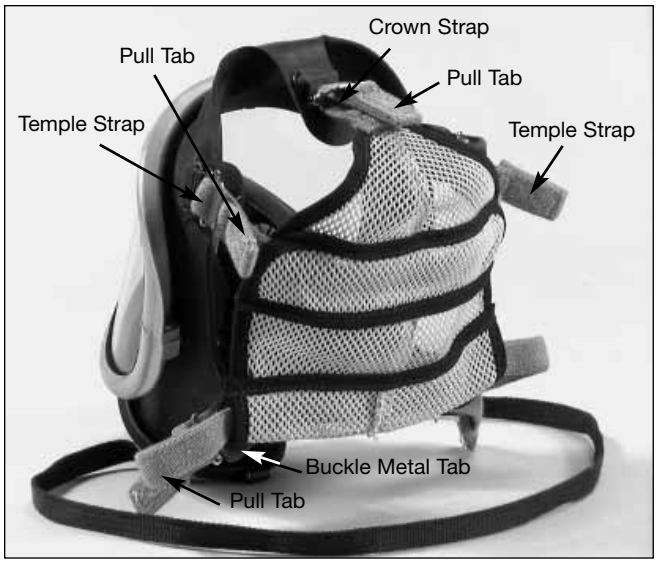
1. Install the harness strap buckles to the facepiece rubber lug at the crown and temple locations.




   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. Unthread and remove the adapter assembly.

2. Remove the two component housing cover screws and the neckstrap.

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.

**⚠ CAUTION**

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

### TO INSTALL THE COMPONENT HOUSING COVER

1. Place the component housing cover over the housing.
2. Insert the tab on the top of the cover into the slot in the bottom of the lens ring.
3. Press in on the front of the cover until the cover hook snaps in place.
4. Line up the screw holes in the cover with the threaded inserts in the housing.
5. Place the neckstrap retaining brackets in the component housing cover sockets. Install the phillips screws and tighten to secure the housing and neckstrap.
6. insert the adapter assembly in the facepiece and hand-tighten.
7. Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check.

### 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 adapter assembly and component housing cover.

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 center-line marks (top and bottom) with the facepiece center-line 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 center-line mark lines up with the bottom facepiece center-line mark.
2. Moisten the facepiece lens groove and the inside of the 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 center-line mark. Press the ring into place.
5. Press the ring halves together at the top an 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.

**⚠ 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 component housing and the adapter assembly.
10. Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check.
11. Install a cover lens to protect the facepiece polycarbonate lens during storage.

**⚠ 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 adapter assembly and the component housing cover.

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 nosecup (if installed) out of the facepiece.

# ULTRA ELITE FACEPIECE REPAIR

## 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 the 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.

**⚠ WARNING**

**Bulges or wrinkles mean that the facepiece rubber is not seated correctly in the ring. Re-install 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.**

8. 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.
9. 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.**

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

---

## REPLACING THE INLET GASKET AND DISC VALVE

1. Push in on the facepiece coupling nut and turn it until its tabs fit into the slots in the adapter.
2. Twist the coupling nut counter-clockwise (left) to unscrew the adapter assembly.
3. Remove the inlet gasket and disc valve by pulling on the gasket pull-tab.
4. 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.
5. To install the inhalation disc valve:
   a. *Gently*, stretch the hole in the center of the disc valve over the gasket stem.
   b. Note that the inlet gasket has a groove around its inside.

c. With the pull-tab facing you, insert the gasket into the facepiece at an angle so that its groove captures the housing rim.

**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.

d. Thread the coupling nut adapter into the component housing and hand-tighten.
e. Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check.

**REPLACING THE SPEAKING DIAPHRAGM**

1. Remove the nosecup or air baffle (if installed) from inside the facepiece.
2. Unscrew and remove the speaking diaphragm retaining ring.
3. Turn the facepiece upside down and shake out the metal speaking diaphragm and gasket assembly.
4. Check the speaking diaphragm and gasket assembly for damage. Replace it if it is worn or damaged.
5. 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.
6. Replace the retaining ring and hand-tighten.
7. Re-install the nosecup (if used) in the facepiece.
8. Don the facepiece and check the face-to-facepiece seal. Follow the Facepiece Fit Check.

# NOTES

# HARNESS REPAIR

**HARNESS REPAIR**

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.

---

**REMOVING THE SHOULDER STRAPS FROM THE CARRIER**

1. 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.
    a. Remove the screw, washer, and tee nut at the 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. Re-attach the buckle to the shoulder strap. Re-install screws, washers, and tee nuts.
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 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 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 regulator, shoulder pads, waist strap and backpad (see above).
10. To Install Decals.
    a. Clean the cylinder clamp.
    b. 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.

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**VULCAN CARRIER AND HARNESS 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.

    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:** Unthread the free end of the pull-strap (waist) from the friction buckle of the shoulder strap.

e. 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 pull-strap (waist) from the carrier by rotating the tri-bar until it can be slid through the mounting slot.
3. Connecting the Shoulder Straps to the Carrier
   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 tribar is secure.
   b. Thread the free end of the pull-strap (waist) through the shoulder strap friction buckle.
   c. Slide the 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 audible alarm.
   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 mounting 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.
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.

# 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 _ turn). Failure to follow this precaution may result in severe personal injury or death. This warning is for all procedures.

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### 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 lit 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

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

9. 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**

1. Place a socket on the safety plug hex flats an 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 BMR 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 |

2. Use a jeweler's screw-driver 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.

3. 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**

1. Insert a new gasket into the cylinder valve.

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

3. 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.**

4. 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. 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.

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**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.

---

**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.

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**REASSEMBLING OR INSTALLING A NEW HIGH PRESSURE PRESSURE GAUGE (P/N 473249)**

1. Apply pipe-sealing tape to gauge threads. (See Note #3).
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.

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**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 O-ring (P/N 68542 for 2216 psig valves; P/N 633550 for 3000 psig valves; P/N 630926 for 4500 psig valves), roll the O-ring over the threads.

5. If the cylinder valve inlet tube is damaged, the entire cylinder valve must be replaced. The inlet tube is "locked" with a non-removable thread sealant.

# 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.
4. Apply a thin film of Christo-Lube lubricant on a new O-ring.

**⚠ 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.**

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

6. 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.

7. 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.

8. Use a torque wrench with a 13/16" socket to tighten the cylinder valve according to the following table:

| 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 |

9. Refer to Leak-Testing and check all connections.

This completes the original cylinder valve replacement procedure.

# CYLINDER VALVE DISASSEMBLY AND REPAIR

## 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 _ 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.

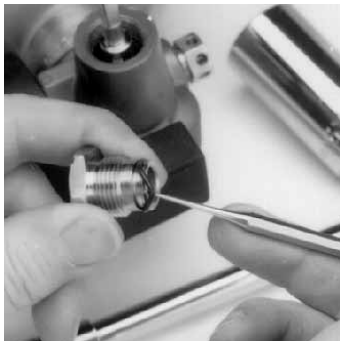
### REASSEMBLING OR INSTALLING A NEW PRESSURE GAUGE

1. Apply pipe-sealing tape to gauge threads. (See Note #3).
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

1. Using the valve stem, install the insert in the valve body. Thread the stem clockwise until the insert is fingertight.
2. Place a thin film of Christo-Lube lubricant on a **new** O-ring. Place the O-ring on the packing gland.

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

4. 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.
5. Turn the valve stem counter-clockwise until the stem stops. Be sure the gland does not turn.
6. Using the inch-pound torque wrench with a 7/8" socket (deep-well), tighten the packing gland to 85-105 in. lbs.
7. 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.
8. Replace the spring. Be sure that the valve is fully open to allow the locknut to be installed more easily.
9. Put 1 drop of Loctite #222 on the stem threads.

10. Using the locknut spanner wrench, press the locknut against the spring and tighten clockwise until it is flush with the top of the handwheel.
11. Open and close the valve completely several times to seat the stem, insert, and the valve stem gasket.
12. Leak-test the valve.

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### 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.

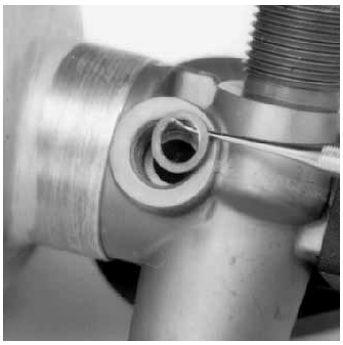
| MSA SCBA Model | Socket Size | Safety Plug | Torque Ft/Lbs. | Burst Disc & Gasket Kit |
|---|---|---|---|---|
| 2216 psig | 11/16” | 68550 | 50 - 53 | 482225 |
| 3000 psig | 3/4” | 495636 | 26 - 30 | 494928 |
| 4500 psig | 9/16” | 473254 | 21 - 25 | 482226 |

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

2. 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.



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**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.**

**⚠ CAUTION**

**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.

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**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.

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**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.

# CYLINDER VALVE DISASSEMBLY AND REPAIR

d. Roll the O-ring (P/N 68542 for 2216 psig valves; P/N 633550 for 3000 psig valves; or P/N 630926 for 4500 psig valves) over the threads.

e. If the cylinder valve inlet tube is damaged it must be removed using a wrench or pliers.

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**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.

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**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**.

**INSTALLING CYLINDER VALVE**

1. 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.
2. Inspect the cylinder neck area. Do not use the cylinder if it has scratches, cuts, or grooves which may prevent an air-tight seal.
3. Install a new O-ring on the cylinder valve following the steps below:

**⚠ 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.**

a. Place a thin film of Christo-Lube lubricant on the new O-ring.
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 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" crowsfoot wrench to tighten the cylinder valve to 70-75 ft. lbs.
6. Leak-test the assembly. This completes the cylinder replacement procedure.

# NOTES

# 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 68˚F), then recheck pressure gauge.<br>**⚠ WARNING**<br>**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. | If leak is from the end-fittings, hose may need tightened. | Tighten hose (wherever leak is present). If the leak is from underneath the crimped end-fitting, the hose must be replaced. |
| | If leak is from under the hose cover, the hose inner tube may have been pinched. | Remove the spiral hose cover and check for leaks; if leak persists, then the hose must be replaced. If the leak does not continue, then the leak may have been due to a slight amount of gas permeation through the hose. This is a normal physical characteristic of all elastomers. The hose does not need replaced. If hose integrity is still doubtful, then replace the hose. |
| Regulator gauge shows different pressure from cylinder valve gauge. | Main-line valve may not be fully open. | Fully open main-line valve. |
| | Gauge needle may be stuck. | Tap lightly on the gauge lens. If gauge reading does not change, check to be sure indicator needle is not bent or damaged. |
| | Gauge accuracy is out of tolerance. | Gauges are required by NIOSH ±5% of full scale. If the cylinder valve gauge has a ±5% accuracy and the regulator gauge a -5% accuracy, then a compared reading between the two gauges may differ by 10% (220 psig for 2216 psig cylinders, 300 for 3000 psig cylinders, and 450 for 4500 psig cylinders). If the gauges are within this requirement, then they are acceptable. To replace a regulator gauge. Cylinder valves must be replaced by a repair person or by a Certified Service Center. |

# TROUBLESHOOTING

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Regulator main-line valve and handwheel are leaking. | Valve stem gasket is worn out. | May need to replace valve stem gasket. Return to a repairperson. |
| | Packing gland is too tight. | May need to be replaced. Return to a repairperson. |
| Regulator gauge shows unacceptable pressure drop. | Leak at high pressure hose or coupling nut. | Check the handtight coupling nut to be sure it's tight. If leak continues, leak-test the high pressure connections and tighten those that are leaking. |
| | Bypass valve is not fully closed. | Tighten the bypass valve handwheel. |
| | Leak through the regulator. | Completely leak-test the regulator. |
| Regulator has low flow performance | Cylinder valve not fully open or cylinder does not contain minimum pressure. | Fully open cylinder valve handwheel and be sure to use a cylinder charged to at least 1200 psig. |
| | Main-line valve not fully open. | Fully open main-line valve hand-wheel. |
| | | If low flow continues, return to a repairperson. |
| Audi-Larm does not ring when pressurized. | Audi-Larm bell is loose. | Install new screws and washers. Refer to PIN P/N 10041212 (Single Screw) and PIN P/N 10041213 (Dual Screw). |
| | Dirt or foreign matter may have affected the O-ring seals inside the Audi-Larm or the proper operation of the Audi-Larm striker. | Overhaul Audi-Larm. |
| | Internal Leak. | Overhaul Audi-Larm. |
| | | Overhaul Audi-Larm and replace piston. |
| Audi-Larm leaks. | Audi-Larm insert O-ring is leaking. | Try to hand-tighten coupling nut further on the cylinder valve. If this is unsucessful, the insert O-ring may need to be replaced. |
| | Leaking at the pipe thread fitting, | Completely leak test all fittings on the Audi-Larm assembly. Relieve pressure and then tighten if necessary. |
| Audi-Larm does not fully pressurize. | Cylinder pressure too low. | Replace cylinder with a fully pressurized cylinder. |
| | Internal leak. | Overhaul Audi-Larm and replace piston. |
| | External leak. | Replace coupling nut nipple O-ring. |
| Audi-Larm does not start to ring at required setting. | Adjustment too high. | Adjustment: Turn the adjusting screw counter-clockwise (out) 1/8 turn. Retest the Audi-Larm |
| | Adjustment too low. | Adjustment: Turn the adjusting screw clockwise (in) 1/8 turn. Retest the Audi-Larm |
| Audi-Larm does not ring continually all the way down to 200psig or lower. | Internal leak | Overhaul Audi-Larm. |
| | | 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.