



## **MSA Information Packet**

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## What is an Air Purifying Respirator, APR?

An APR is a device that covers your mouth and nose to prevent the inhalation of hazardous substances. APRs remove such substances from the air before it is inhaled, or supply an in-dependent source of clean air.

A common misconception is that a simple dust mask will protect you from a wide variety of hazards. Although a few hazards can be reduced through the use of a dust mask, there are a wide variety of respirators, each designed for a specific type of hazard.

These respirators must be NIOSH/MSHA approved and certified.

There are two main kinds of respirators:

1. **Air Purifying:** As their name implies, air-purifying respirators clean contaminated air and allow employees to breathe without an additional air source. Different types of air purifying respirators can remove gas, vapor, particulates, or a combination of these. Air-purifying respirators can only be used where the air has enough oxygen, 19.5% minimum, to sustain life, and cannot be used where contaminant concentrations exceed certain limits.

Air-purifying respirator types include:

- **Chemical Cartridge**
  - Protect against specific gases and vapors.
  - Purify inhaled air.
  - Provide non-emergency respiratory protection.
  - Are not used for extremely toxic materials, odorless materials, or eye irritants.
- \* **Particulate Filter**
  - \* Protect against airborne particulates such as dust, mist, metal fumes, and smoke. Will not protect against gases, vapors, or oxygen deficiency. (An example is a Hepa filter that traps fine dust particles.)
- **Combination Particulate Filter/Chemical Cartridge Powered Air-Purifying Respirators**
  - \* Force air through the filters.
  - \* Provide positive pressure air into facepiece, with the facepiece leakage outward.
  - \* Protect against gases, vapors and particulates.

2. Air-supplying: These respirators provide a supply of breathable air independent of the work place air.

Air-supplying respirators include:

- \* Supplied Air Respirators
  - \* Uses an air line connected to a remote air source.
  - \* Used for escape from atmospheres that are immediately dangerous to life and health.
  - \* Used for specific gases, vapors and particulates.
  - \* The airline hose cannot exceed 300 feet.
  - Air supply meets Grade “D” breathing air.
- Self Contained Breathing Apparatus (SCBA)
  - Uses pressurized air tank, usually worn on the back.
  - Time limited (usually less than 30 minutes).
  - Used for specific gases, vapors and particulates.
  - Used for escape from atmospheres immediately dangerous to life and health.
  - Used in an oxygen deficient atmosphere.
  - When used in atmospheres immediately dangerous to life and health, a buddy system and a back up team are required.
  - Air supply meets Grade “D” breathing air.

### **MSA Air Purifying Respirator Adapters**

Each engine and truck will be equipped with a “Truck Kit”. Each Truck Kit contains 4 APR adapters providing firefighters with the ability to convert their MSA SCBA mask to an APR. The Truck Kit contains 2 types of cartridge/filters, P100 (Hepa filter) and WMD (weapons of mass destruction).

#### **P100 Particulate Filter**

- The P100 is to be used only in a “Condition Green” environment.
- The P100 will not filter out any chemicals, only particles.
- MSA recommends that you attach a P100 particulate filter on each side of the adapter.
- Use particulate filters one time and dispose of them.
- Replacement P100 filter/cartridges will be obtained from Station 1 supplies.

#### **WMD Chemical Cartridge**

- The WMD chemical cartridge (in a foil wrap) is to be employed only when you are authorized.

- The chemical cartridge is designed to protect the user from nerve, blister and teargas agents. Additionally, they are designed to the same specifications as the military chemical cartridge.
- You are to use one of the foil wrapped chemical cartridge. NOTE: If a single WMD chemical cartridge is used, the other adapter port must be fitted with the Inlet Cap.
- Once the foil wrap is opened the filter must be used and then disposed of. Do not keep a filter in service if the foil bag has been opened.
- Replacement WMD chemical cartridge will be obtained from the SCBA Project Officer.

### Donning

Turn the adapter handwheel counterclockwise until it stops. Hold the handwheel in this position and push the adapter into the facepiece inlet until it stops. Release the handwheel and ensure that the handwheel returns to a fully clockwise position that the facepiece bayonet is fully engaged by the adapter handwheel. Pull gently on the adapter to ensure it is securely fastened to the facepiece.

### Attaching Cartridge/Filter

Carefully attach the cartridge/filter to the adapter bayonet connectors by first aligning the cutouts on the cartridge/filter with the lugs on the bayonet connectors. Make sure the small lug on the bayonet aligns with the small cutout on the cartridge/filter. Push down and turn the cartridge/filter clock-wise by hand until the stops are engaged.

Test For Tightness Before Each Use

The respirator must be subjected to the Tightness Test before each use by the following Method:

Negative Pressure Method – Place your palms over the cartridge(s) lightly. Gently inhale so that the facepiece collapses slightly and hold your breath. The facepiece will remain collapsed while the breath is held unless there is a leak in the seal.

If any leakage is detected around the facial seal, readjust head harness straps and repeat the test until there is no leakage. If other than facial seal leakage is detected, investigate and correct the condition before testing again. The respirator must pass the tightness tests above before the respirator is used.

Leave area immediately if:

- A. Breathing becomes difficult.
- B. Dizziness or other distress occurs.
- C. You taste or smell contaminate.
- D. You experience nose or throat irritation.

NOTE: Return to an uncontaminated area before removing the respirator.

## **Operation and Maintenance of The MSA Pressure-Demand Self-Contain Breathing Apparatus (SCBA)**

### **Introduction:**

The Santa Clara Fire Department is presently using MSA pressure-demand type SCBA's. This piece of equipment is vital to the survival of every firefighter and must be maintained with the utmost care. Failure to take care of your SCBA could cost you your life.

### **Information:**

The MSA SCBA's provide respiratory protection and are approved as a 30-minute duration unit when fully charged.

The air cylinder has a capacity of 45 cubic feet when charged to 4500 psi and comes with a pressure gauge at the cylinder valve.

This unit provides redundant low air-warning devices that automatically arms when the cylinder valve is opened and signals the user when the air pressure in the cylinder falls to approximately 1175 psi. This allows the wearer approximately seven (7) minutes to return to fresh air. The actual time depends on the work load/physical condition of the wearer.

A SCBA consists of the following sub-assemblies:

- first stage regulator
  - second stage regulator
  - air cylinder and valve
  - Audi-Larm audible alarm
  - carrier and harness
  - facepiece
  - NightFighter Heads-Up Display System/ICM (Integrated Computer Module) Gauge
  - Universal Rescue Connection (URC)
1. The first stage regulator is a "balanced-type" pressure reducer that keeps the pressure to the mask-mounted regulator at approximately 90 psig throughout the entire operation pressure range of the cylinder. The first stage regulator has a redundancy feature to minimize the possibility of a failure. The regulator uses a large sintered filter that is easy to replace. The filter captures particulates that may be in the air stream.

2. The second stage pressure-demand regulator maintains positive pressure in the facepiece while in use. A slide button (top release button) on top of the regulator stops airflow. To stop airflow, push the button in. To restart the regulator inhale sharply. The regulator attaches to the facepiece with a push to connect connector. The regulator delivers large flow rates accurately and quickly.
3. The air cylinder and valve consists of a tank and a cylinder valve assembly. The cylinder valve includes a valve body, cylinder valve inlet tube, handwheel, safety disk (burst disk) and pressure gauge. The pressure gauge shows the air pressure in the cylinder continuously. A handwheel is used to open and close the cylinder valve.
4. The Audi-Larm audible alarm rings when there is approximately 25% of the SCBA's rated service time remaining. The alarm also rings when the cylinder valve is first opened, providing an audible indication that the alarm is properly "cocked". A high-pressure hose delivers air at cylinder pressure from the alarm to the first stage regulator.
5. The carrier consists of a backplate, a cylinder band with latch to hold the cylinder, and a harness, consisting of shoulder, chest and waist-strap with a belt mount to secure the second stage regulator.
6. The facepiece is available in three sizes, small, medium and large. The facepiece lens is super-hardcoated to meet the requirements of NFPA 1981. This process gives the clear polycarbonate lens superior abrasion and chemical protection. The facepiece has a low-resistance, pressure-demand exhalation valve designed for easy cleaning. An inhalation check valve in the inlet housing keeps moisture and contaminants out of the mask-mounted regulator. The facepiece has a speaking diaphragm for clear, short-range communication. The facepiece is stocked with a nose cup and Speed-ON™ harness. This harness is made of flame and heat resistant materials, and features a five-point suspension.
7. The NightFighter Heads-Up Display System allows a user to clearly and easily see air cylinder volume while wearing a SCBA. The NightFighter Heads-Up Display System consists of three separate assemblies:
  - Bracket assembly attached to an Ultra Elite Facepiece.
  - Receiver mounted on the Bracket assembly.
  - Transmitter assembled to the gauge line.

The NightFighter Heads-Up Display System's Receiver shows the user the air cylinder volume in one-quarter cylinder increments, from a full cylinder to an empty cylinder, by a LED light logic pattern. The NightFighter Heads-Up Display System's Transmitter is assembled to the gauge line hose. The Transmitter sends a signal to the Receiver (on the facepiece) of the air cylinder content. The LED Lights in the Receiver will automatically adjust for the brightness outside of the

facepiece. The NightFighter Heads-Up Display System operates using four standard AAA alkaline batteries and notifies the user when the batteries need to be replaced, two batteries for the Receiver and two batteries for the Transmitter. **Use only Duracell or Eveready AAA alkaline batteries. Use of other batteries will void the Intrinsic Safety approval.**

### **Low Battery Warnings**

The Receiver will indicate a Yellow LED light after going through the start up sequence, if a low battery condition is detected with the Receiver or Transmitter.

- If there is a Low Battery in the Receiver, single Yellow LED will flash.
  - If there is a Low Battery in the Transmitter, double short Yellow LED flashes
  - If there are Low Batteries in the Receiver and Transmitter, the Yellow LED will alternate single and double flashes.
8. All NFPA approved SCBA are equipped with an Audi-Larm body that includes a URC Assembly (Universal Rescue Connection) fitting. A shoulder mounted URC, is located on the gauge hose line. The URC Assembly is a male quick-fill inlet for use by Rapid Intervention Crews for emergency transfilling a SCBA

The URC allows for Transfilling air from a relatively full SCBA cylinder to another SCBA cylinder that is low.

- Transfilling between users of SCBA should be performed only during life-threatening emergencies, or simulated training exercises. After approximately 45-60 seconds, pressure between the secondary air source and the SCBA cylinder will be equal. Both donor and receiver must return to fresh air immediately following the procedure.
- Do not transfill if the donor's air cylinder is less than 2000 psig or the donor's audible alarms have activated or NightFighter Heads-Up Display System/ICM (Integrated Computer Module) Unit Gauge is flashing. Failure to follow this warning may result in shorter escape time to return to fresh air, causing serious personal injury or death.

Do not lubricate the Quick-Fill Fittings. Do not permit oil, grease, or other contaminants to come in contact with the Quick-Fill Fittings.

Always ensure that the dust cover on the URC is in place. The dust cover prevents dirt, water and debris from entering the fitting, and acts as a redundant seal.

If the dust cover will not stay on the URC Assembly male fitting because air is leaking:

- Immediately reconnect the Quick-Fill System hose to seal off the leak and return to fresh air.
- If you cannot reconnect the hose, reach behind and close the cylinder valve. Air pressure in the regulator will drop, and the leak will slow down. Quickly replace the protective dust cap on the SCBA or URC

Assembly male fitting. This will form a redundant seal. Open the cylinder valve and return to fresh air immediately.

### **ICM (Integrated Computer Module) 2000**

The ICM 2000 is a multimode, battery-powered, low-pressure warning device that will give audible and visible warning that air cylinder pressure has reached approximately 25% of service life. There are two warning indicators:

1. The Pressure gauge face and the digital display blink.
2. An audible alarm repeats single tone bursts.

The ICM 2000 Gauge turns on automatically when the user opens the SCBA cylinder valve. As the pressure reaches approximately 200 psig, both visible and audible alarms activate automatically, indicating that the unit is functional. When the system is fully pressurized, the alarm enters the Monitor (normal) Mode. The unit remains in sensor mode until the user shuts off the cylinder air, bleeds off the air pressure to less than 200 psig and presses the Yellow reset button twice in quick succession.

If the user is motionless for approximately 18 seconds the ICM 2000 goes into a pre-alarm. During pre-alarm, the device sounds 3 progressively louder tones and the RED light flashes slowly. Movement of the unit cancels the pre-alarm. If the user remains motionless for 12 more seconds (approx.) the ICM 2000 goes into full alarm. During full alarm the PASS repeatedly sounds two high-pitched tones followed by a buzz. During full alarm the RED lights also flash rapidly.

The center red (alarm) button activates the full alarm mode with or without air pressure. To reset the full alarm mode press the yellow button twice-in quick succession.

If the ICM 2000's 9-volt battery is low the unit will beep every 5 seconds

The ICM 2000 Thermal alarm (Thermistor) will activate if the wearer is exposed to more than a pre-set limit of time/temperature, the unit will sound a tone every 3 seconds. The alarm will self-cancel depending on the severity of the conditions. This may occur even though the temperature is above the thermal curve.

### **WARNINGS**

1. Do not wear eyeglasses under the facepiece. The temples or sidebars on eyeglasses will prevent an airtight seal. If you must wear glasses, install the spectacle kit.
2. The facepiece may not seal properly with your face if you have a beard, gross sideburns or similar physical characteristics.

3. Only use Christo-Lube for lubricating the external O-ring on the second stage.
4. You may use the By-pass valve to exhaust air pressure from the regulator and hose.
5. Connect the regulator hose coupling to the air cylinder hand tight only. DO NOT use a wrench.
6. Wear proper protective clothing for exposure to gases and vapors that are skin-absorbable.
7. Under no circumstances should an SCBA be used underwater.
8. Never remove the facepiece except in a safe, non-hazardous, non-toxic atmosphere (Condition GREEN).

### **Emergency Procedures**

You must know what to do automatically if the regulator fails to function, or if the pressure gauge is damaged! To receive air from the cylinder to the facepiece under Emergency conditions:

1. Open the by-pass valve slowly. This will give you a constant flow of air directly from the cylinder through a separate by-pass port in the outlet of the regulator.
2. Partially close the cylinder valve for a controlled airflow to the facepiece.
3. Return to fresh air **immediately!** Your air supply is greatly reduced in such an emergency.
4. If the air mask free-flows, **immediately** open the by-pass valve and partially close cylinder valve to control airflow.
5. Return to fresh air.
6. If your low-pressure alarms activate, **immediately** return to fresh air.

### **Care and Maintenance of the SCBA**

Regular inspections, maintenance and testing shall be conducted as indicated in this document.

#### A. Daily Check

**If the apparatus does not function properly during any of the following inspections, it must be removed from service.**

- 1) Tug on the pull rope to release the cylinder restraint device.
- 2) Confirm that cylinder pressure is satisfactory (4000 psig minimum).

- 3) Open the cylinder valve fully to pressurize the NightFighter Heads-Up Display System.
- 4) Looking through the facepiece lens at the LED panel, all LED's must illuminate at the top of the receiver. The NightFighter Heads-Up Display System receiver and Transmitter must be no more than 15 inches apart; otherwise the Receiver's LED lights may not function. The Receiver must go through all LED light patterns when the system is pressurized.
- 5) Compare the regulator gauge with the cylinder gauge. Readings must be within 225 psig of each other.
- 6) Close the cylinder valve fully. If the needle on the ICM 2000 drops more than 100 psi in 10 seconds do not use the SCBA until the leak is repaired.
  - CHECK FITTINGS FOR TIGHTNESS
  - MAKE SURE EMERGENCY BY-PASS VALVE IS COMPLETELY CLOSED (SNUG)
  - CHECK THE CONDITION OF THE "O" RING IN THE HIGH PRESSURE HOSE AT THE CYLINDER VALVE MATING POINT.
  - IF THE LEAK PERSISTS, SEND THE UNIT IN FOR REPAIR.
- 7) Open the bypass slowly.
- 8) Watch the drop in pressure on the Pressure Gauge and the point at which the Alarm systems activate including when the NightFighter Heads-Up Display System Receiver begins to flash. The Alarm systems should activate at approximately 1175 psig.
- 9) The alarms should continue until the air pressure is approximately 200 psig or less. If any of the alarm systems do not function properly, the apparatus must be removed from service.
- 10) When the pressure is bled from the system press the yellow (RESET/OFF) button twice in quick succession to turn the ICM off.
- 11) The NightFighter Heads-Up Display System will automatically turn itself OFF approximately 60 seconds after the apparatus is depressurized

Before walking away from your SCBA, be sure that:

- Cylinder valve is closed
- High-pressure line is bled
- Bypass valve is closed
- Dust caps are in place
- Waist and shoulder straps are not tangled
- Cylinder pressure is satisfactory (4000 psi minimum)
- Ensure that the cylinder restraint device is properly latched and the pull rope is accessible.

#### B. Weekly Check

All SCBA's will be given a complete operational test every week as follows:

1. Open the cylinder valve and don the facepiece. Breathe through the apparatus until satisfied that it is functioning properly. Then close the cylinder valve.
2. Check the cylinder pressure gauge and top off the cylinder if the gauge reads less than 4000 psi.

### C. Monthly Check

All SCBA's will be given a monthly check to include:

- Visually inspect, checking for worn harness, worn hoses, damaged valves, leaks, etc.
- Check first and second stage regulators for damage and leaks.
- Check inhalation and exhalation valve, Speed-ON™ harness, etc. on the mask.
- Check hydrostatic test date (must be within 5 years).

If the latest hydrostatic test date is over 5 years, remove the cylinder from service and send it to the fire station handling SCBA repair for replacement. NOTE: Low-pressure cylinders are to be removed from service if the hydrostatic test date is over 3 years.

Check the cylinder pressure gauge and top off the cylinder if the gauge reads less than 4000 psi.

### D. After Use

Immediately after each use, breathing apparatus will be cleaned (see "Cleaning and Disinfecting the SCBA", below) and checked in accordance with the daily, weekly and monthly checks. Air cylinders should be checked in accordance with "Inspection Procedures for MSA Carbon Fiber Air Cylinders" (see below).

All air cylinders attached to MSA breathing apparatus or carried as spares will be filled to a pressure of 4500 psi. All cylinders will be topped off whenever the pressure drops below 4000 psi.

### **Cleaning and Disinfecting the SCBA**

In general, only the facepiece requires cleaning and disinfecting after each use. Only "MSA Cleaner-Sanitizer II" is to be used for this purpose. The other components of the SCBA should be cleaned anytime they become soiled.

If the components of the SCBA other than the facepiece need cleaning, a sponge or soft/medium brush with mild soap and water may be used. Care should be taken to avoid introducing water or contaminants into the second stage regulator.

Do not disassemble the second stage regulator. If the internal spaces of the second stage regulator become contaminated, send the unit to the fire station handling SCBA repair for service by a MSA certified repair technician. When drying the SCBA, **do not** expose it to direct sunlight or use a heat source.

#### Cleaning the Facepiece

1. Add one 2 oz. package of "Cleaner-Sanitizer II" to one gallon of warm water that is less than 120°F.
2. Remove electronic device(s) from the mask.
3. If the mask is equipped with a voice amplifier, swivel the rubber plug into place to protect the electrical connections.
4. Remove the nose cup
5. Thoroughly wash the facepiece and nose cup in the sanitizer. A soft brush or sponge can be used to scrub the facepiece.
6. Rinse the facepiece and flush clean water through the exhalation valve.
7. Dry thoroughly.
8. Reattach electronic device(s)
9. Reinstall the nose cup
10. Place mask back on the engine or truck and on top of the mask bag to dry.

\*Note: In some situations, the exhalation valve at the bottom of the mask may become stuck due to residual debris or contaminants. Check the exhalation valve for proper function by depressing the valve stem and ensuring that the valve returns freely to its closed position.

#### Cleaning the SCBA cylinder and harness

1. Use a soft/medium bristle brush or sponge, mild soap and warm water to wash away accumulated soils and debris.
2. Take care when cleaning around the regulator to avoid introducing water or debris into the second stage regulator outlet. Ensure that the regulator outlet is covered when cleaning around this area.
3. Hang to air dry.

#### Returning the SCBA to service

1. After all components are reassembled, inspect the unit, following the daily and monthly SCBA check procedures.

#### **Inspection Procedure for MSA Composite Air Cylinders**

The MSA carbon fiber cylinder is a vital part of the SCBA and should be maintained properly. It is important that the inspection steps listed below be performed **after each use and before refilling**, since the carbon fiber cylinder overwrap can be damaged from the impact of sharp objects and severe abrasions.

The following visual inspections shall be made:

1. Inspect for damage from heat exposure. Common signs of heat exposure are:
  - a. Charring or burning of the overwrap.
  - b. Burning or sintering of the cylinder surface.
  - c. Distortion of the cylinder or cylinder valve.
  - d. Used safety relief devices.
  - e. Melted valve parts.

If any evidence of heat exposure is detected, remove the cylinder from service.

2. Inspect the cylinder neck for cracks, folds or other flaws. Neck cracks are normally detected by testing the neck after charging operations have been completed, with a soap solution. If any damage to the neck is detected, remove the cylinder from service.
3. Inspect the cylinder for cuts, digs and gouges. Flaws or cuts in the overwrap of the cylinder exceeding 0.09 inch in depth and 1.0 inch in length are not acceptable. Cylinders with flaws equal to or exceeding these limits must be removed from service.
4. Inspect the cylinder for abrasion. Cylinders with abrasions totaling more than 4 square inches surface area and exceeding 0.045 inch deep must be removed from service.
5. Inspect the cylinder for loose bands of fiber peeling from the cylinder. If evidence of loose or peeling bands 1/8 inch or wider are observed, remove the cylinder from service.

Notes:

1. Carbon fiber wrapped cylinders are hydrostatically tested every 5 years and can be tested a total of 3 times (a maximum life of 15 years).
3. **Only soap and water are to be used** to clean these cylinders. No petroleum products are to be used.
4. Only paints containing epoxy or water-based paints are to be used.

**Damaged SCBA,s**

In order to prevent the inadvertent use of damaged equipment, the Department shall provide DAMAGED ITEM TAGS. A supply of these tags shall be carried on all apparatus. The tags shall be immediately attached when an SCBA is found to be damaged or is not functioning properly, including at the scene of an emergency.

The red tag shall be attached to one of the following affected parts:

- The backplate/regulator assembly (attach to the second stage regulator)

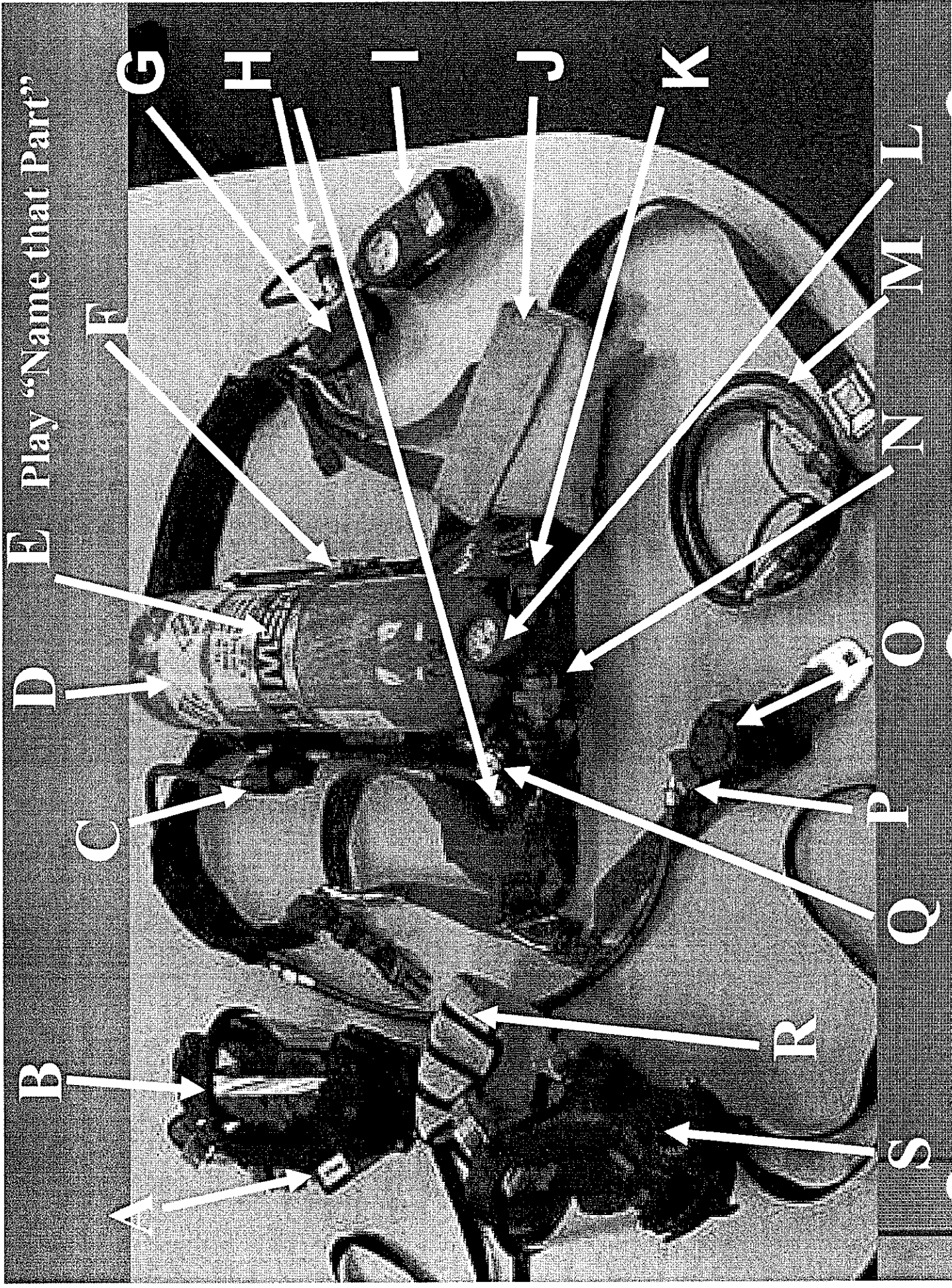
- The facepiece
- The air cylinder (attach to the cylinder valve)

When completing the tag, use the name of the person who was using the SCBA at the time it was damaged or malfunctioned.

If you're SCBA needs repair:

- Coordinate with your B/C on delivering the damaged item to Station 9
- Drop-off equipment on the low bench next to the shop
- If the mask, Heads Up Display (HUD), or mask bag needs repair drop-off all three items as a unit.
- If any item on the backpack assembly needs repair, drop-off the entire backpack including the bottle.
- Complete a Damaged Item Tag and attach it to the out of service item
- A clipboard with blank Damaged Item Tags will be available on the low bench
- Proceed into the shop and obtain a spare behind the sliding closet door
- Your damaged equipment will be repaired and returned to you. Arrange to return any spare you have as soon as possible.

For additional information, consult Fire Chief's Directive 311



E Play "Name that Part"

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

# Quiz Answer Sheet

■ A- \_\_\_\_\_

■ B- \_\_\_\_\_

■ C- \_\_\_\_\_

■ D- \_\_\_\_\_

■ E- \_\_\_\_\_

■ F- \_\_\_\_\_

■ G- \_\_\_\_\_

■ H- \_\_\_\_\_

■ I- \_\_\_\_\_

■ J- \_\_\_\_\_

■ K- \_\_\_\_\_

■ L- \_\_\_\_\_

■ M- \_\_\_\_\_

■ N- \_\_\_\_\_

■ O- \_\_\_\_\_

■ P- \_\_\_\_\_

■ Q- \_\_\_\_\_

■ R- \_\_\_\_\_

■ S- \_\_\_\_\_

# Quiz Answers

- A - Heads Up Display
  - B - Facepiece
  - C - First Stage Regulator
  - D - Cylinder
  - E - Adjustable Cylinder Band
  - F - Latch Wing
  - G - HUD Sending Unit
  - H - URC
  - I - ICM
  - J - URC Hose Pouch
  - K - Cylinder Valve
  - L - Cylinder Gauge
  - M - URC Hose
  - N - Cylinder Valve Coupling Nut
  - O - Second Stage Regulator
  - P - Bypass Valve
  - Q - Audi Alarm Bell
  - R - Speed On Head Harness
  - S - Voice Amplifier
-