

H2S BREATHING APPARATUS

This section covers self contained breathing apparatus and escape masks.

SELF CONTAINED BREATHING APPARATUS (SCBA)

Specialised breathing apparatus is required to work in ambient air with an H₂S concentration above 10 ppm. Only positive (pressure) demand SCBA shall be used. In the positive pressure mode the breathing apparatus regulator provides a constant regular air supply to the facemask, which maintains a higher pressure inside the facemask than the outside ambient air. A positive faceseal is necessary to retain air inside the face mask and to eliminate outward leakage (waste of air supply). In the event of a poor facemask seal, air flows outward thereby preventing the entry of outside contaminated air.

The most commonly found model is the Scott Air Pak IIA. It is the Industry Standard and is field worthy, durable and certified by relevant government agencies. It provides a 30 minutes air supply under moderate working stress and less time under high stress conditions. Some clients use the same mask and control system but with a central air supply connected by hoses. This is known as the “cascade” type. This type may be worn for several hours as the air supply may be very large. With this type of equipment a small 5 minute air supply is failure of the central carried individually to facilitate escape in case of system.

USING THE SCOTT AIRPAK IIA S.C.B.A.

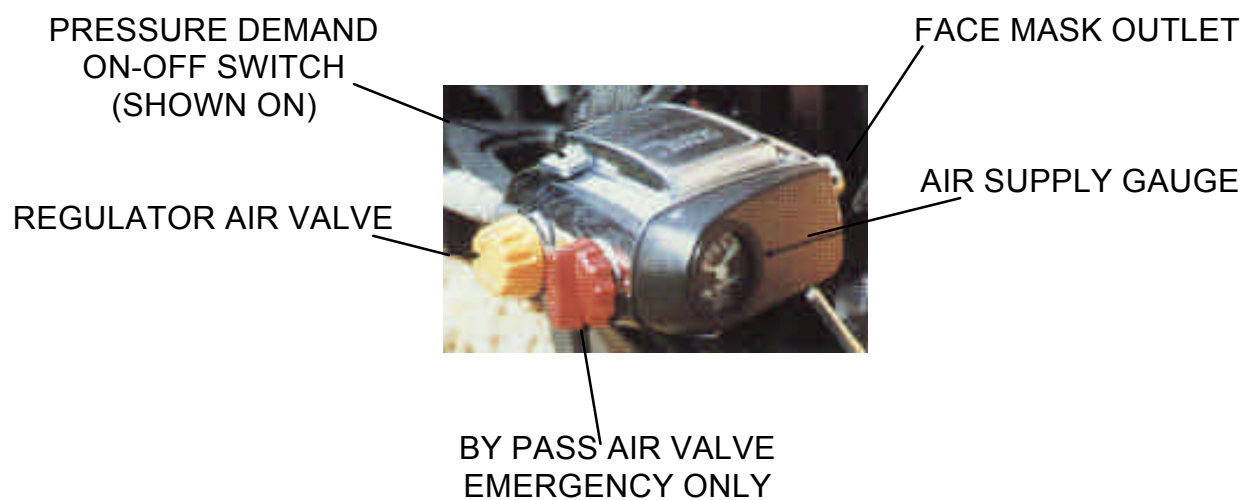
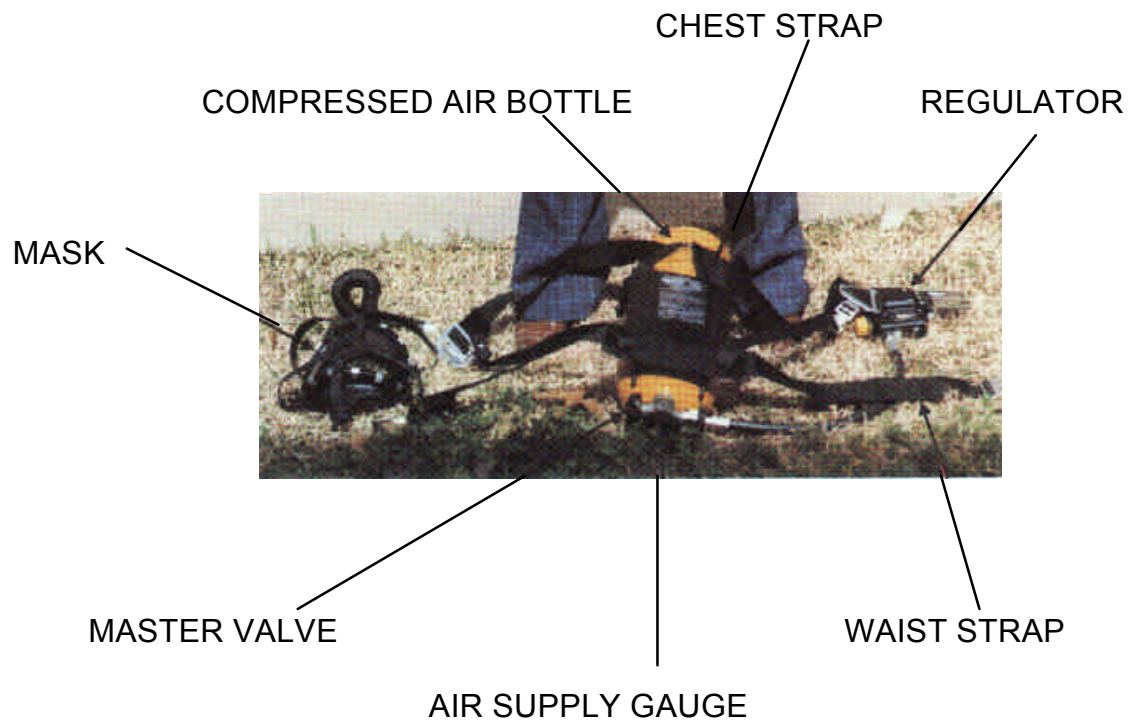
There are two methods of donning the Scott Air Pak IIA.

NORMAL - Prior to entering a contaminated area.

EMERGENCY - Donning in an H₂S atmosphere.

Both methods must be learned, practised and a person must practically demonstrate that he is able to use the equipment.

KNOW THE PARTS



NORMAL METHOD

1. OPEN CONTAINER :



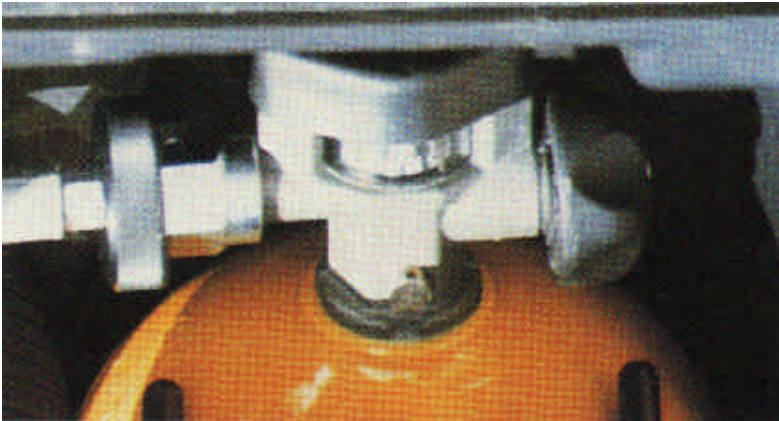
Pull out the two plastic latches and raise the lid.

NOTE: apply pressure to the centre of the latch to open.

2. **CHECK RED EMERGENCY BY PASS VALVE IS CLOSED**, It is located on regulator, turn fully clockwise until closed (about 1 turn).
3. **CHECK YELLOW REGULATOR VALVE IS OPEN**, TURN ANTICLOCKWISE UNTIL FULLY OPEN (about 1½ turns). To close depress clip ratchet and turn clockwise.
4. **PLACE PRESSURE DEMAND SWITCH OFF**, it is located on the regulator.

As a standard practice equipment must be stored with valves in the above positions. In case of emergency the user would then only have to turn on the MASTERVALVE and donn the mask.

5. **TURN MASTER VALVE ON :** The master valve is located at top of the bottle on the side of the manifold opposite the hose outlet.



Turn it anticlockwise 2½ turns.

Note : To close the valve push valve knob inwards and turn Clockwise.

Note that bell rings momentarily. There should be no further flow of air. This provides a function check of the pak-alarm.

6. **STAND AT THE BOTTOM OF THE BOTTLE :** at opposite end from master valve.

7. **LIFT OUT MASK AND PLACE ON THE FAR LEFT, REGULATOR ON YOUR LEFT :** (This is very important as failure to do this will result in the face mask falling between the cylinder and regulator when picked up).

8. **GRIP BACK PACK FRAME WITH BOTH HANDS :**



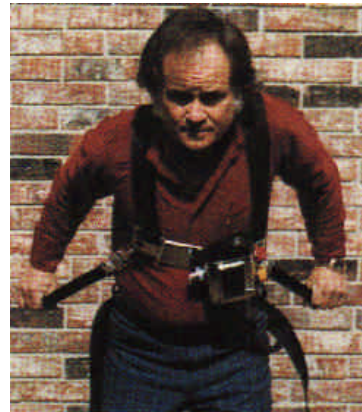
Ensure straps lie at sides of your hands and have been fully extended (they should have been packed like this)

It is essential that there are no straps/hoses between your hands at this time.

9. PICK UP WHOLE UNIT, AND, BENDING SLIGHTLY, REST IT ON YOUR NECK AND SHOULDERS.



10. FASTEN CHEST STRAP - PULL TIGHT - tighten by pulling side straps.



11. STAND UP AND ALLOW BOTTLE TO SLIDE DOWN YOUR BACK.

12. FASTEN WAIST STRAP, PULL TIGHT.



13. **INSTALL FACE MASK,** - Caution. Some trainees may suffer claustrophobia at this time.

First place chin into mask



pull straps overhead



14. **TIGHTEN STRAPS**

First lower straps



then middle straps



then top strap
if necessary to
remove slack.



15. FLIP SWITCH UP TO PRESSURE DEMAND MODE **ON**

Check that air leaks out of mask when an intentional leak is made and then stops when released.



16. Use the red BYPASS valve to give a comfortable air flow in case of any defect in the regulator during use, and then escape.

Move/turn head side to side, up and down and ensure seal is maintained.

Walk about , bend down, pick up objects to familiarize yourself with this new working environment.

EQUIPMENT IS NOW READY FOR USE

SPECIAL PROBLEMS IN RESPIRATOR USE

FACIAL HAIR :

Facial hair laying between the sealing surface of the respirator facepiece and the wearer's skin will prevent an effective seal. Even one day's growth of stubble may permit unacceptable loss of air in the pressure demand mode and may in some cases allow contaminated air to enter.

CONTACT LENSES :

Contact lenses are a definite hazard and should not be worn while wearing a respirator.

CORRECTIVES SPECTACLES :

Corrective spectacles with temple bars or straps that interfere with the respirator face seal shall not be used as it will permit excessive contaminant penetration. Optional fittings to take corrective lenses are available - see master order, Chapter 11.

PSYCHOLOGICAL DISTURBANCE :

Psychological disturbances such as Claustrophobia are a definite hazard to the wearer of a respirator and must be carefully evaluated during training.

MISCELLANEOUS SEALING PROBLEMS :

Sealing problems vary according to the individual; some are pronounced, others are not detected until a fit test is performed. The more noticeable ones are scars, hollow temples, very prominent cheek bones, deep skin creases, the lack of teeth or dentures.

DISCOMFORT :

A person wearing an SCBA is going to be subject to some because breathing is more difficult , sight is somewhat discomfort restricted, movement and voice communication may be restricted or lacking. Only through training and familiarization drills can most of these discomforts be reduced to a minimum.

Proficiency

To be considered proficient the user must be able to put equipment on within one minute. This is the maximum time considered practical for person to have been given the alarm, hold his breath, put on the equipment and breath with it.

Most people - with training, can donn the equipment in less than 30 seconds.

OBTAINING AN EFFECTIVE SEAL IS MANDATORY FOR USING SCBA
note that different types of masks may seal more or less effectively.

EMERGENCY USE OF SCBA

- OPEN THE CASE
- TURN ON MASTER VALVE AT TOP OF BOTTLE
- FLIP PRESSURE DEMAND ON
- PUT ON MASK
- SWING PRESSURE PAK OVER SHOULDER
- ESCAPE
- FIT PRESSURE PAK PROPERLY
- RETURN TO WORK AREA FOR RESCUE ONLY
- ENGINEER DISCRETION TO FINISH OR ABANDON RUN



“MINUTE VOLUME AIR FLOW RATES”

Activity	Cubic Feet of air per minute	Minute Volume liters per minute	Endurance with 45 cu ft Airpak minutes
Sleep	0.2	6.0	
Rest	0.3	9.3	
Light work	0.7	19.7	64
Medium work	1.0	29.2	45
Medium heavy work	1.4	40	32
Heavy work	2.1	59.5	21
Maximum work	4.6	132.0	10

The above quoted table is from the Los Alamos Scientific Laboratory of The University of California Manual LA -6671-M entitled “A Guide to Industrial Respiratory Protection”.

The Scott Airpak is rated "30 minutes".

CONSERVATION OF AIR :

When using the self-contained breathing apparatus (SCBA) the conservation of air is extremely important because the air we learn to conserve may be the air that is needed to rescue one or more victims or to get us out of a hazardous area. To conserve air the wearer of the SCBA must develop proper breathing control; this is slow, free, rhythmic breathing (no skip breathing or extra shallow breaths). To acquire conservation breathing habits requires experience, which can only be gained through organized training and practice during timed wearing of the unit while performing various tasks.

Excitement, emotions and fears will cause the wearer of the SCBA to consume air at a needless rate. The wearer must remain as calm as possible and relaxed in any and all situations to help conserve air and to react and think logically. Work should be accomplished at a steady pace so as “not to over-exert and expend too much energy and waste air. The wearer’s physical condition also plays an important part in his air consumption rate.

When the SCBA is not needed, the face piece can be removed. That is if you are in a safe atmosphere and if your clothing is safe. If clothing is contaminated with crude or mud containing H_2S it must be removed out doors while wearing an SCBA. DO NOT ENTER AN ENCLOSED AREA TO CHANGE YOUR CLOTHING.

TALKING OFF THE UNIT

- PRESSURE DEMAND SWITCH OFF
- LOOSEN FACE MASK STRAPS BY STROKING HAND FORWARD OVER STRAPS.
- REMOVE MASK BY LIFTING FROM CHIN FIRST
- UNFASTEN WAIST STRAP
- RELEASE TABS
- UNFASTEN CHEST STRAP AND SWING UNIT OFF LEFT SHOULDER
- PROTECT CROTCH
- TURN OFF MASTER VALVE
- BLEED OFF REGULATOR PRESSURE BY BREATHING IN FACE UNIT OR CRACKING BYPASS.
- EXTEND ALL STRAPS
- REFILL UNIT
- STERILISE FACE MASK AND AIR DRY
- REPACK

AIR-PAK

MONTHLY INSPECTION AND MAINTENANCE

- | | | |
|----------------------------|---|---------------------------------|
| 1. COMPLETENESS | 2.1. FULLY CHARGED CYLINDER | 3.1. FULLY CHARGED CYLINDER |
| A. MASK ASSEMBLY | 2.2. CONDITION CHECK | 3.2. CONDITION CHECK |
| B. CYLINDER & VALVE | A. MASK & BREATHING TUBE-
INCLUDING EXHALATION VALVE | 3.3. LEAK CHECK |
| C. HARNESS ASSEMBLY | B. HARNESS ASSEMBLY | A. CYLINDER VALVE |
| D. REGULATOR & HOSE | | B. REGULATOR |
| 2. CYLINDER PRESSURE | 2.3. CLEAN & DISINFECT | 3.4. DON UNIT/OPERATIONAL CHECK |
| 3. Ready For Immediate Use | 2.4. OPERATIONAL CHECK | 3.5. CORRECT DEFICIENCIES |
| | 2.5. Ready For Immediate Use | 3.6. Ready For Immediate Use |

DETAILED INSTRUCTIONS

1.COMPLETENESS

Make sure all the required components are available - Mask and breathing tube assembly, cylinder and valve assembly, harness and backplate assembly complete with all straps.

2.CYLINDER PRESSURE

Check the ICC or DOT specification on the neck of the cylinder. The older Air-Paks will have an ICC3AA1800 designation, Providing a "+" sign follows the last hydrostatic test date, the cylinder should be charged to 1800 psi + 10% or 1800 + 180 or 1980 psi. The DOT 3AA2015 and SP6498 cylinders should be charged to 2216 psi. Also check to make sure the cylinder is still within hydrostatic test date. It must be tested every 5 years.

3.CONDITION CHECK

Visually examine the breathing tube and facepiece assembly, including the exhalation valve for any signs of wear, deterioration, wrinkling or broken parts.

Pull or stretch the breathing tube to check for cracking or checking. If excessive have it replaced.

4. CLEANING & DISINFECTING

Depending upon the cleaning procedure adopted, each worker/fire fighter should be briefed on the cleaning procedure and each designated individual shall clean each device within a specified time. In addition to cleaning the entire device, the facepiece and breathing tube should be disinfected. The following procedure is the ANSI recommendation:

- Separate facepiece and breathing tube from remainder of device.
- Wash facepiece and breathing tube in cleaner disinfectant or detergent solution. Use a sponge to facilitate removal of dirt.
- Rinse completely in clean, warm water.
- Air-dry in a clean area.
- Damp sponge the regulator, harness and backplate.
- Inspect all parts as prescribed in Steps 1, 2, 3, 5, and 6.

- (g) Reassemble device and arrange in storage rack or container in ready position.

Cleaner-disinfectant solutions are available that clean effectively and also contain an antibacterial agent. Alternatively, rubber parts may be washed in a liquid detergent solution, then immersed in either: 1) a hypochlorite solution (50 ppm of chlorine) for 2 minutes; 2) an aqueous iodine solution (50 ppm of iodine) for 2 minutes; or 3) a quaternary ammonium solution (200 ppm of quaternary ammonium compounds in water of less than 500 ppm total hardness). To prevent dermatitis and damage to parts, immersion times shall be adhered to, and disinfectants shall be thoroughly rinsed from disinfected parts.

Strong cleaning and disinfecting agents can damage parts. Vigorous mechanical agitation shall not be used. Solvents other than water should be used with Caution.

Spare facepieces and breathing tubes should be available for use in the event a second alarm sounds while the original facepieces and tubes are being cleaned or are drying.

5. LEAK CHECK

Apply soapy water to the cylinder to valve connector, the relief device, the pressure gauge connection, the regulator hose to valve connection and to the regulator. Open the cylinder valve and apply soapy water to the valve stem. Expanding bubbles indicate leakage. Test the regulator by turning off the cylinder valve to observe any decrease in pressure as indicated on the regulator gauge. A decrease in pressure indicates leakage. Use soapy water to isolate.

6. OPERATIONAL CHECK

Check the integrity of the diaphragm by gently pressurizing the regulator outlet with an exhalation. There should be no indication of escaping air from the regulator. Don the apparatus and operate it in a normal manner. Air should flow to the wearer only during inhalation or when the by-pass valve is opened. Any other air flow in the facepiece would indicate a malfunction. Observe that the Pak-Alarm rings between 520/620 psig. If the apparatus does not function in the prescribed manner, tag for repair.

7. REPAIRS (CORRECT DEFICIENCIES)

All repairs to the apparatus are limited by the amount and degree of repair as authorized by the manufacturer and the training received by the individual. If you have any question, please contact Scott Aviation.



● BEFORE EACH USE ● AFTER EACH USE ● MONTHLY INSPECTION

REPACKING

The unit must be repacked so that it is ready for emergency use.

Repacking to ensure that the airpak is ready for immediate use should be done by the same person in the district. This person must be assigned by the district manager and should be the mechanic (when trained).

The purpose of repacking is to ensure that the equipment is ready for immediate use and that it is packed to the same standard and the same way every time.

Use the AIRPAK chart opposite for detailed check.

MONTHLY INSPECTION

1. CHECK COMPLETENESS
2. CHECK CYLINDER IS FULLY CHARGED
3. CHECK EQUIPMENT IS CLEAN AND STERILISED
4. CHECK STRAPS FULLY EXTENDED
5. PLACE MASK STRAPS OVER THE FRONT OF THE MASK. SEE PHOTOGRAPH.
6. CHECK VALVES ARE IN CORRECT POSITION :
 - . RED BYPASS CLOSED
 - . YELLOW REGULATOR VALVE OPEN
 - . PRESSURE DEMAND SWITCH OFF
 - . MASTER VALVE CLOSED
7. PACK AS SHOWN
8. PLACE RITE LABEL OVER LATCH.

A control sheet for following monthly maintenance checks is given in Chapter 11.

PACKING

MASTER VALVE CLOSED

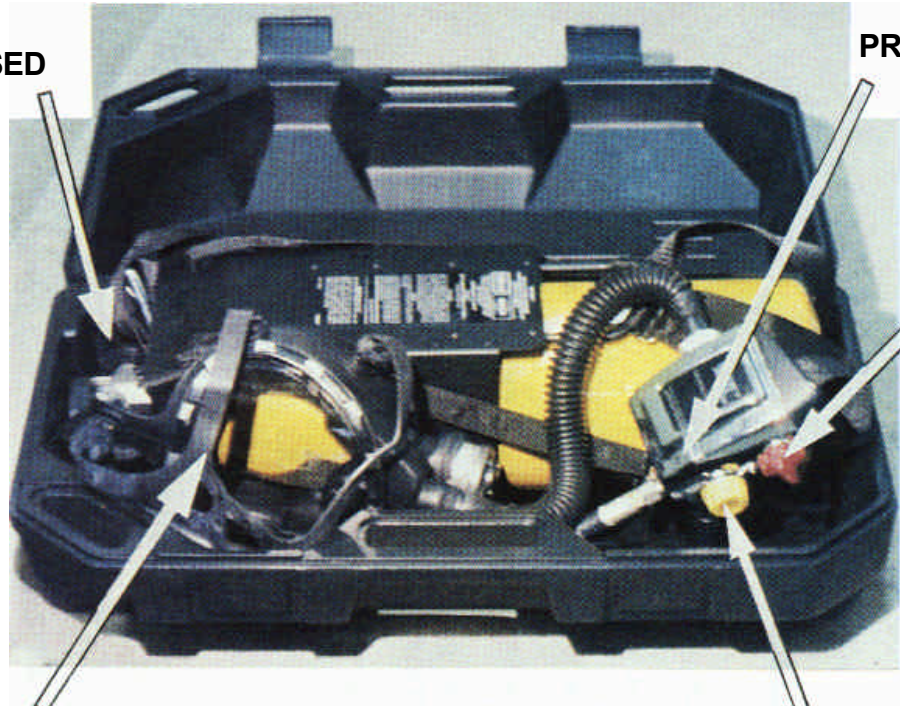
PRESSURE DEMAND OFF

BYPASS VALVE CLOSED

HEAD STRAPS OVER

REGULATOR VALVE OPEN

ALL STRAPS FULLY EXTENDED



FILLING

The filling of airpak cylinders must be done by trained personnel with special equipment. We cannot use the WAC-A/B/C for WST as this has no, air filter and uses mineral oil as a lubricant. It is best to find a local contractor or our client to provide this service.

Compressed air used to fill SCBA must meet the following quality which is called "grade D breathing air".

Oxygen content		19 - 23%
Balance predominantly Nitrogen		
Hydrocarbon (Condensed)	<	5 mg/M ³
Carbon Monoxide	<	20 ppm
Carbon Dioxide	<	1000 ppm

Dreager Sniffer and detector tubes must be used to check contents for recording. See the equipment section for tube part numbers for ordering.

AIRPAK MAINTENANCE

Maintenance is performed at two levels as a MONTHLY INSPECTION and as a COMPLETE OVERHAUL.

Depending on use, the complete overhaul should be done between 1 year and 2½ years. Every second complete overhaul involves hydraulic testing of the cylinder (5 year validation).

Apart from the continental United States and Canada, only one other Airpak service centre exists - in Al Khobar, Saudi Arabia. One may be opened early 1982 in Singapore. Some clients have their own specially trained personnel who are qualified to work on the equipment.

Apart from the monthly inspection shown opposite NO FURTHER WORK MUST BE DONE ON THE EQUIPMENT UNLESS PERFORMED BY A PERSON CERTIFIED BY THE MANUFACTURER. Suitable 2 day courses are re-conducted at owners expense by the manufacturer or his assigned agents.

Components used in repairs and maintenance shall be manufacturers specified parts.

PURPOSE

The heart of the Scott Air-Pak is the demand regulator. It automatically functions to reduce high air cylinder storage pressures to lower usable pressures and to supply this usable breathing air to the user upon demand. The regulator supplies breathing air to the facepiece in proportion to the amount of air demanded by the user.

OPERATION

Air at cylinder pressure enters the regulator at the inlet connector. Passage F leads to gauge A which indicates the cylinder supply pressure. Air from passage F also flows through the normally open main-line valve at orifice E and through passage D, to the first stage valve C. Valve C throttles the high pressure air down to a lower pressure. Inside the bellows chamber N, this lower pressure is maintained by the spring loaded bellows assembly P. If the pressure inside the bellows chamber tends to increase, the bellows expands causing lever O to close the first stage valve C. If the chamber pressure tends to decrease, the bellows assembly P contracts causing lever O to release the first stage valve C, allowing air to enter. Through this action the bellows chamber pressure is maintained at a constant preset pressure.

The low pressure air is conveyed through passage R to the demand valve J. Operation of the demand valve is dependent upon movement of the diaphragm K. When the pressure in the main chamber L is reduced by inhalation, the diaphragm K is forced inward (toward the chamber) by ambient pressure acting on the outside of the diaphragm. This depression of the diaphragm tilts the demand valve J causing the low pressure air to flow past the demand valve seat into the main chamber L and out the facepiece connection M to the user. When in-halation ceases, the pressure inside the main chamber increases causing the diaphragm to return to its original position. This permits the valve spring to close the demand valve J and shut off the flow of low pressure air. During exhalation the regulator remains in this condition, ready to repeat the operation cycle at the next inhalation.

Positive pressure regulators use a different front cover which has a spring loaded mechanism that deflects diaphragm K until positive pressure is built

up and maintained in main chamber L. This spring maintains a positive pressure in the main chamber L and facepiece.

EMERGENCY FUNCTIONS

During normal operation, the main-line valve (yellow knob) is fully open and locked while the by-pass valve (red knob) is closed. In the event of regulator malfunction, the by-pass valve provides an adjustable flow of air into the main chamber L via passage B. If the by-pass valve is needed, it should be turned on first, then the main-line valve closed. The by-pass valve may be adjusted to meter the amount of air required by the user while completely by-passing the regulator mechanism during egress from the contaminated environment.

In the event that the demand valve J should stick open, orifice Q would limit the volume of air flow. Pressure build-up is prevented by the facepiece ex-halation valve and by outward leakage around the facepiece periphery.

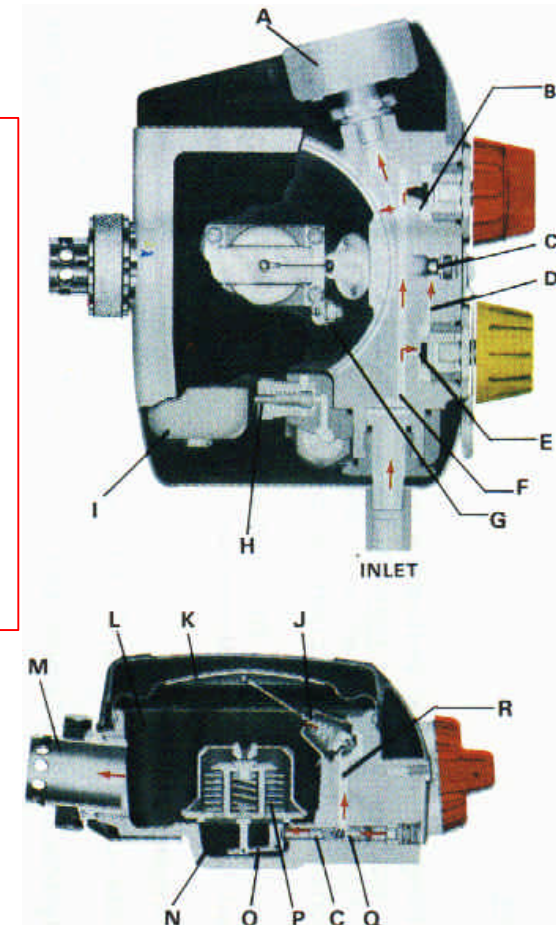
If the pressure in passage R should exceed the preset level, relief valve G will protect the regulator mechanism by discharging the air in a continuous flow and at a reduced rate into the main chamber. This continuous flow of air provides a warning for conversion to by-pass operation.

PAK-ALARM® OPERATION

The Pak-Alarm is mounted in the base of the regulator. It contains a pressure sensing piston and disc which actuate a reciprocating piston H. As the cylinder pressure falls to approximately 570 psi, the pressure sensing piston depresses the disc. Depression of the disc causes air to flow to the reciprocating piston H which strikes the bell I. As the reciprocating piston strikes the bell I, a small amount of air is allowed to escape. This action reduces the pressure, permitting the piston spring to return the reciprocating piston to its original position. Pressure is then allowed to rapidly rebuild, causing continual ringing of the bell until the cylinder pressure falls below 200 psi.

AIR-PAK® REGULATOR

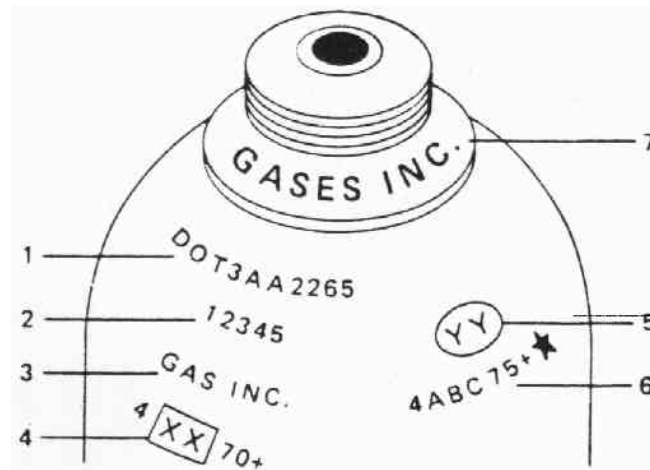
- | | |
|---|--|
| A | Pressure Gauge |
| B | Passage |
| C | First Stage Valve |
| D | Air Passage |
| E | Orifice |
| F | Air Passage |
| G | Relief Valve |
| H | Reciprocating Piston |
| I | Bell |
| J | Demand Valve |
| K | Diaphragm |
| L | Main Chamber |
| M | Facepiece Connection
(Regulator Outlet) |
| N | Bellows Chamber |
| O | Lever |
| P | Bellows Assembly |
| Q | Orifice |
| R | Passage |



AIR CYLINDERS

Cylinders are an important asset in the storage of large quantities of certified compressed breathing air for use with hoseline SCBA.

1. Typical Cylinder Markings:



1. Cylinder Specification consisting of three sections:

- (a) DOT - Department of Transportation (Formerly ICC - Interstate Commerce Commission) Regulatory body which governs use of cylinders.
- (b) 3AA- Specification of type and material of cylinder construction.
- (c) 2265- Service pressure in pounds per square inch.

2. 12345- Cylinder serial number (See Note A)

3. Gas Inc. - Identifying symbol (See Note A)

4. Manufacturing Data:

- (a) 4-70 - Date of manufacture and original test date
- (b) (XX) - Inspector's official mark
- (c) + - Cylinder qualifies for 110% filling

5. (YY) - Manufacturer's identifying symbol

6. Retest Markings:

- (a) 4-75 - Date of first 5 year hydrostatic retest
- (b) ABC - Retester identifying symbol
- (c) + - Cylinder requalifies for 100% filling
- (d) - Cylinder qualifies for 10 year retest interval

7. Neck ring owner's identification

NOTES:

- A. Serial number and identifying symbol may be that of purchaser, user or manufacturer.
- B. "Spun" or "Plug" must be stamped near DOT mark when an end closure in the finished cylinder has been welded by the spinning process, or affected by plugging.
- C. Markings "5" and "6" are usually shown diametrically opposite other markings on the cylinder neck.

The above information was taken from the U.S.A. "Compressed Gas Association Inc., Pamphlet C-1 Page 9".