

SCOTT®



SIGMA 2

Self-contained Breathing Apparatus

User Instructions

Article No. 1035017

Issue G 05. 2010



CE0086



Self-contained Breathing Apparatus

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Skelmersdale, Lancashire, WN8 9RA, England.

WARNINGS

Please Read Carefully and Fully Understand

This manual is for use by personnel trained in the use and care of compressed air breathing apparatus, and **MUST NOT** be used as a self-teaching guide by untrained users. Failure to understand or adhere to the **SIGMA 2** User Instructions may result in injury or death.

Scott Health and Safety Limited has taken great care to ensure that the information in this manual is accurate, complete and clear. However, **Training and Technical Support Services** will be pleased to clarify any points in the manual and answer questions on **SCOTT** breathing apparatus.

The following warnings are in accordance with certifying authority requirements and apply to the use of breathing apparatus in general:



Breathing apparatus users must be fully trained in the use and care of self-contained, compressed air breathing apparatus.



Ensure that the selection of the apparatus type is sufficient for the tasks being undertaken and the hazards likely to be encountered. Please refer to National Regulations for guidance.



In order to ensure the optimum performance and user safety, the apparatus must be tested and serviced in accordance with *Section 7* and the notes in *Section 1* under *Personnel Training and Servicing*.



The quality of air used to supply and charge breathing apparatus must meet the requirements of EN 12021 : 1999. See *Section 1* for details.



The wearing of beards, side-burns or spectacles may adversely affect the sealing of a facemask to the wearer's face.



The apparatus is not designed for use underwater.



The harness must not be used as a vehicle seat restraint.

DISCLAIMER

Failure to follow these instructions or misuse of the apparatus may result in: death, injury or material damage; and invalidate any warranty or insurance claims.

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1. INTRODUCTION

1.1 IMPORTANT

SIGMA 2 must be serviced in accordance with the Servicing Schedule on at least an annual basis. Please refer to notes under *Servicing*.

These instructions for the use, care and maintenance of the apparatus must be followed to ensure the correct and safe operation of **SIGMA 2**.

For any enquiries regarding the use of **SCOTT** breathing apparatus, please contact **Training and Technical Support Services** at **Scott Health and Safety Limited**.

1.2 BREATHABLE AIR

Air used to supply or charge breathing apparatus may be natural or synthetic. The composition of breathable air is given in *Table 1*.

COMPONENT	MASS % (Dry Air)	VOLUME% (Dry Air)
OXYGEN	23.14	20.948
NITROGEN	75.52	78.08
ARGON	1.29	0.93
CARBON DIOXIDE	0.05	0.031 4
HYDROGEN	0.000 003	0.000 05
NEON	0.001 270	0.001 818
HELIUM	0.000 037	0.000 524
KRYPTON	0.000 330	0.000 114
XENON	0.000 039	0.000 009

Table 1: Breathable Air

There is an increased fire risk when the oxygen content is above the value shown.

The purity/quality of air used to supply and charge breathing apparatus should be tested periodically in accordance with national regulations. If not specified otherwise, contaminants shall not exceed the permissible exposure level.

National regulations must be observed.

The mineral oil content shall be such that the air is without the odour of oil. The odour threshold is in the region of 0.3 mg/m³.

The water content shall not exceed 50 mg/m³ for 207 bar apparatus and 30 mg/m³ for 300 bar apparatus.

1.3 APPARATUS DURATION

All durations quoted are nominal, based on an Average Wearer Consumption Rate of 40 litres/minute and **FULLY CHARGED** cylinders. Actual Wearer Consumption rates vary due to many factors, such as:

1. Workload: high work rates increase consumption rates.
2. Weight of apparatus and use of heavy or restrictive clothing.
3. Work environments with extremes of heat or cold.
4. Physical fitness of the wearer.
5. Other factors include emotional stress and fatigue.

It is important that all wearers are aware of these factors and take account of them when assessing cylinder duration.

1.4 PERSONNEL TRAINING

Personnel who use self-contained, compressed air breathing apparatus must be fully trained in accordance with these instructions and national regulations.

These instructions cannot replace an accredited training course run by fully qualified instructors in the proper and safe use of **SCOTT** breathing apparatus.

Please contact **Training and Technical Support Services** or your distributor for training course details.

Training and Technical Support Services:

Scott Health and Safety Limited

Pimbo Road,
West Pimbo,
Skelmersdale,
Lancashire,
WN8 9RA,
England.

Tel: +44 (0) 1695 711711

Fax: +44 (0) 1695 711775

1.5 SERVICING

SIGMA 2 must be serviced at scheduled intervals by personnel who have completed a formal training course and hold a current certificate for servicing and repairing **SCOTT** breathing apparatus. Details of the servicing schedule are contained in the **SCOTT SIGMA 2** Service Manual, copies of which can only be obtained by registered holders of a current certificate.

Your distributor or **Training and Technical Support Services** can provide training course details and quotes for service contracts. Please see above for contact details.

1.6 SPARE PARTS AND ACCESSORIES

Our **Customer Services** Department provide an efficient, friendly, customer contact point for ordering new apparatus, spare parts and accessories. The team can also provide general information on **SCOTT** products.

Customer Services:

Scott Health and Safety Limited

Pimbo Road,
West Pimbo,
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Lancashire,
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1.7 NOTIFIED BODIES

Inspec International Limited (0194)
56 Leslie Hough Way,
Salford,
Greater Manchester,
M6 6AJ,
England.

BSI Product Services (0086)
Kitemark House,
Maylands Avenue,
Hemel Hempstead,
HP2 4SQ,
England.

2. TECHNICAL DESCRIPTION

2.1 GENERAL

SIGMA 2 is a self-contained, open circuit, compressed air, positive pressure, breathing apparatus, approved to EN 137 (self-contained open circuit breathing apparatus). It is 'CE' marked in accordance with Council Directive 89/686/EEC.

SIGMA 2 is approved for use at sea by:

Lloyds Inspectorate, in accordance with SOLAS regulation 17 and the 1980 Merchant Shipping Act.

Please call **Scott Health and Safety Limited** for further apparatus approval details.

2.2 APPARATUS DESCRIPTION

SIGMA 2 has a lightweight back-plate and harness. The two stage pneumatic system consists of a first stage reducing valve; and a Demand Valve (DV) that is attached by a bayonet fitting, to the positive pressure full facemask.

The back-plate is injection moulded polyamide/glass/carbon composite, with a fully adjustable flame retardant polyester webbing harness. The **Kevlar**TM cylinder band is fully adjustable and can accommodate one cylinder from the range listed in *Table 2*. A glass-filled polyamide cam-lock buckle facilitates quick and easy cylinder replacement. A lumbar pad, fabricated from flame retardant polyester and packed with flame retardant closed cell foam, cushions the weight of the apparatus. It is attached to the lower back-plate by means of press-studs. Pneumatic hoses run in channels moulded into the inner back-plate. Hose retaining clips are moulded on the edge of the channels. A cylinder valve retainer on the lower back-plate provides a secure mounting for the cylinder valve.

Cylinder Types	Water Volume (litres)	Charging Pressure	Free Air Volume (litres)	Nominal Duration (minutes)	Warning Period (minutes)	Total Duration (minutes)	Cylinder Charged Weight (Kg)
CYL-1200	6.0	207	1200	22	8	30	8.8
CYL-HWG-1200	6.0	207	1200	22	8	30	7.2
CYL-FWC-1300	4.7	300	1300	25	7	32	5.0
CYL-1640	6.0	300	1640	33	8	41	12.5
CYL-HWG-1640	6.0	300	1640	33	8	41	10.0
CYL-FWC-1640	6.0	300	1640	33	8	41	6.3
CYL-1800	9.0	207	1800	33	12	45	13.0
CYL-HWG-1800	9.0	207	1800	33	12	45	11.2
CYL-FWC-1800	9.0	207	1800	33	12	45	6.75
CYL-FWC-1860	6.8	300	1860	37	9	46	6.75
CYL-2240	11.0	207	2240	41	15	56	14.4
CYL-FWC-2460	9.0	300	2460	50	12	62	8.8

Table 2: Cylinders approved for use with SIGMA 2

Cylinder Material is identified by codes within the Cylinder Type. *Table 3* identifies the meaning of the cylinder material code and the specification to which the cylinder is manufactured:

Code	Material	Specification
No Code	Steel (e.g.: CYL-1200)	BS5045 Pt.1
HWG	Hoop Wrapped Glass Fibre (e.g.: CYL-HWG-1200)	HSE-AL-HW1
FWC	Fully Wrapped Carbon (e.g.: CYL-FWC-1300)	HSE-AL-FW2

Table 3: Cylinder Codes and Specifications

Durations are nominal and based on an Average Wearer Consumption Rate of 40 L/min and are for **fully charged cylinders**.

$$\text{Total Duration} = \frac{\text{Cylinder Free Air Capacity}}{\text{Average Wearer Consumption Rate}}$$

$$\text{Nominal Duration} = \text{Total Duration minus the Warning Period.}$$

$$\text{Warning Period} = \frac{\text{Cylinder Water Capacity} \times \text{Whistle Operating Pressure}}{\text{Average Wearer Consumption Rate}}$$

SIGMA 2

2.3 PNEUMATIC SYSTEM

The first stage pressure reducer has an integral cylinder connector hand-wheel. There is a sintered bronze particle filter in the reducer inlet.

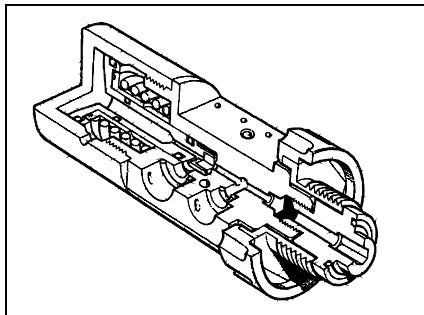
A high pressure PTCFE lined hose supplies air to a shoulder mounted pressure gauge and warning whistle.

The pressure gauge has a stainless steel case and a polycarbonate, impact resistant, splinter-proof lens. A blow-out vent prevents over pressurisation of the case. A rubber shroud provides mechanical protection.

The warning whistle operates at 55 bar. *Table 2* details the Warning Period for each apparatus and cylinder combination.

If the hose, whistle or gauge become damaged, a restrictor in the reducer body limits air loss to 25 litres/minute.

2.4 REDUCER



The pressure reducer is a simple spring and piston device that reduces the pressure of air from the cylinder to a medium pressure of between 5 and 9 bar. The operation is automatic and self-regulating such that the reducer requires no adjustment.

In the unlikely event of a malfunction in the reducer, resulting in an uncontrolled rise in the output pressure, a pressure relief valve protects the medium pressure system.

A reinforced hose supplies medium pressure air to the DV.

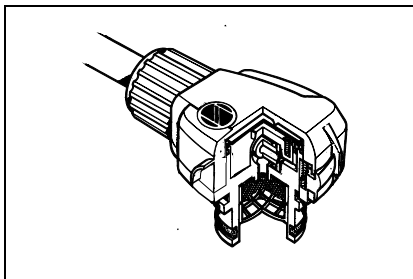
2.5 DEMAND VALVE

SIGMA 2 is available with two types of Demand Valve (DV):

- Instant air positive pressure DV (blue)
- First breath-activated DV (black).

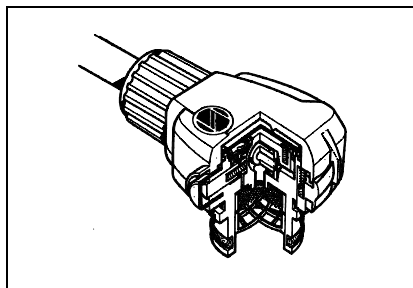
Both types of DV have a supplementary flow bypass and operate in conjunction with the spring-loaded facemask exhalation valve to maintain a positive pressure within the facemask.

The DV senses the changes in facemask air pressure that occur when the wearer breathes; and uses this to regulate the supply of air to the facemask. The DV is attached to the facemask by a quick-fit bayonet connection with a spring loaded locking catch.



Instant Air Demand Valve

The instant air DV supplies air to the facemask when the cylinder valve is opened.



First Breath Demand Valve

The first breath version can be shut by pressing a reset button on the DV and opens when the wearer takes the first breath. This permits the DV to be removed from the face-piece while the cylinder valve is open, without loss of cylinder air.

The bypass provides a constant flow of air in the unlikely event that the regulator malfunctions in a 'no flow' mode.

The bypass is opened by turning the knob through 90°. As use of the bypass consumes cylinder air rapidly, it must only be used to escape from the hazardous area.

2.6 FACEMASKS

SIGMA 2 is approved for use with: **Vision 3**, **PanaSeal** and **PanaVisor** full facemasks, all of which conform to EN 136. All are available with 5-point, fully adjustable web or net head harnesses and neck-straps. An inner mask minimises CO₂ dead space and visor misting. A speech diaphragm is fitted.



Vision 3 Facemask with Head-harness

PanaSeal is suitable for medium and smaller face sizes. **PanaVisor** is suitable for medium to larger face sizes. **Vision 3** is available in three sizes: small, medium and medium/large.



PanaSeal/PanaVisor Facemask with Head-net

Vision 3 is moulded in grey silicone, while **PanaSeal** and **PanaVisor** are non-dermatitic black neoprene, or blue silicone.

3. PRE-USE AND MONTHLY CHECKS

3.1 GENERAL

1. Check that all parts are clean and undamaged.
2. Ensure that the shoulder harness is fully slackened and that a fully charged cylinder is securely attached to the back-plate. Replace discharged cylinders.
3. Check that the harness slides freely through buckles.
4. Check that the facemask visor is clear and free from marks and damage that might impair vision. Fully slacken head-harness straps.
5. Apparatus that fails any of these checks must be serviced in accordance with the **SIGMA 2** Service Manual.

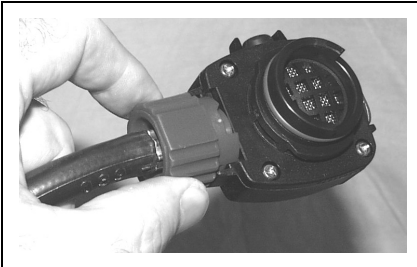
3.2 PNEUMATICS



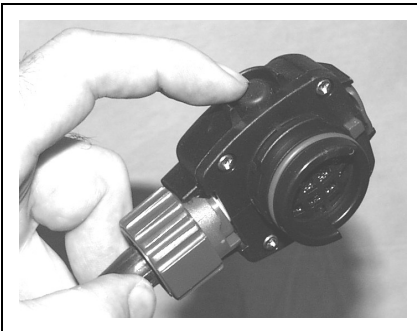
1. Check cylinder connector O-ring is clean and undamaged.
2. Screw hand-wheel connector firmly into the cylinder valve outlet.
3. Check that pressure gauge, whistle and hoses are in good condition and are not kinked or stretched.

3.3 DEMAND VALVE

1. Check that the DV O-ring is clean and undamaged.
2. Fit the DV to the facemask and check that the locking catch clicks into place. Gently twist the DV to ensure that it is securely fitted.



3. Check that the bypass valve is closed (flat area on knob is toward the face-piece).



4. On first breath DVs only, press the black reset button.

3.4 CHECK FACEMASK

1. Don the facemask (see *Section 4.2*).
2. Open the cylinder valve and check that the cylinder is full.
3. Check that the facemask pressurises. If necessary adjust the mask to obtain a leak tight fit. **DO NOT** over-tighten the harness as this distorts the mask.

3.5 POSITIVE PRESSURE, BYPASS AND LEAK TEST



1. Insert fingers in the facemask seal and check there is a steady flow of air out of the mask.
2. Remove fingers and allow mask to re-seal.



3. Open the bypass and check there is a steady flow of air into the facemask.
4. Close the bypass.
5. Close the cylinder valve, hold your breath, and monitor the pressure gauge for 10 seconds. Check that the reading does not drop during this period.

3.6 WHISTLE TEST



1. With the cylinder valve still closed, monitor the pressure gauge and breathe down air in the system. Check that the whistle sounds clearly at between 50 and 60 bar.
2. Release head-harness and remove the facemask.
3. Apparatus that passes all of these checks is now ready for use.

3.7 REPLACING CYLINDERS



1. Check that the cylinder valve is closed and slowly undo the cylinder connector hand-wheel. Remove the reducer from the cylinder.

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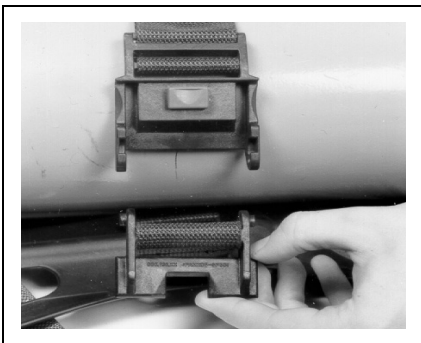
2. Grasp the sides of the cam-lock buckle with the index finger and thumb of the right hand, use the left index finger to slide back the ribbed catch and lift the buckle.

3. Open the buckle and lift the empty cylinder from the back-plate.

3.7.1 Fitting a replacement Cylinder of the same size.

1. Fit the cylinder valve through the cylinder valve retainer, connect the buckle hinge and close the cam-lock.

3.7.2 Fitting a replacement Cylinder of a different size.



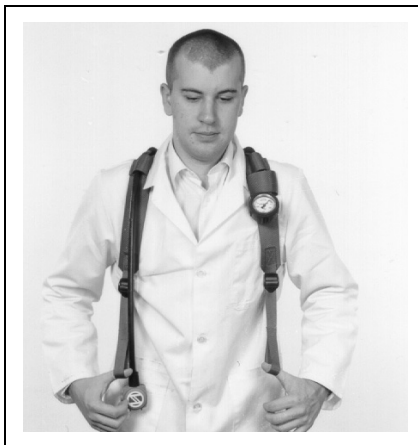
1. Adjust the length of the cylinder band to permit the buckle hinge to be connected.

2. Adjust the cylinder band length until the cylinder band grips the cylinder firmly, then close the cam-lock.

3. Tidy the free end of the cylinder band into the loops.

4. DONNING PROCEDURE

4.1 HARNESS

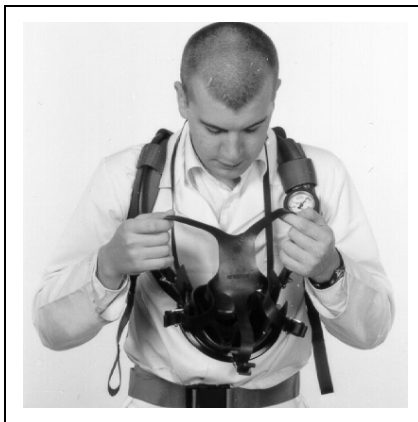


1. Don apparatus. Adjust shoulder straps for a comfortable fit, then fasten waist-belt and adjust for a snug fit.

4.2 DON FACEMASK

1. Check that the bypass is shut (and on first breath DVs, press the DV reset button).

4.2.1 Head Harness



1. Let facemask hang loosely from face and breathe normally.



2. Fit the chin into the chin-cup, pull the harness over the top of the head and tighten the straps in sequence: **bottom, middle, top**. DO NOT over-tighten.

4.2.2 Head-net



1. With the head-net straps fully extended, insert the chin into the chin-cup and use the loop at the back of the head-net to pull the head-net over the head.
2. Tighten the top strap to bring the visor and ori-nasal mask to the correct level.



3. Tighten the side straps for a firm, comfortable fit. DO NOT over-tighten as this distorts the face seal.

4.3 OPEN CYLINDER VALVE



1. Slowly open cylinder valve fully:
 - On Instant Air DVs, check that the DV free-flows into facemask until the head-harness straps are tightened.
 - On First Breath DVs, inhale sharply to start the air supply to the facemask.

4.4 FACEMASK SEAL CHECK



1. Insert fingers in facemask seal and check for a steady flow of air from the mask. Remove fingers and allow mask to re-seal.

4.5 BYPASS CHECK



1. Open the bypass and check there is a steady flow of air into the facemask.
2. Close the bypass.

4.6 LEAK TEST



1. Take a breath and hold it. Release hand-wheel locking-mechanism and close the cylinder valve.
2. Listen for leaks and monitor gauge for 10 seconds. The reading on the gauge should not fall during this period.

4.7 WHISTLE TEST



1. Slowly breathe down the air from the system and check that the whistle sounds clearly at between 50 and 60 bar.
2. If the whistle or facemask fail the test, return the apparatus for servicing, with an explanatory note attached, in accordance with the **SIGMA 2** Servicing Instructions.

4.8 CYLINDER PRESSURE

1. Open cylinder valve and check pressure gauge to ensure that cylinder has a minimum of 80% of the fully charged capacity:

For 207 bar cylinders - 170 bar.

For 300 bar cylinders - 240 bar.

2. When fully satisfied with apparatus, proceed to undertake tasks as required.

5. DOFFING INSTRUCTIONS

5.1 REMOVE FACEMASK



1. On apparatus with a First Breath DV, take a breath and press the reset button to close the air supply.

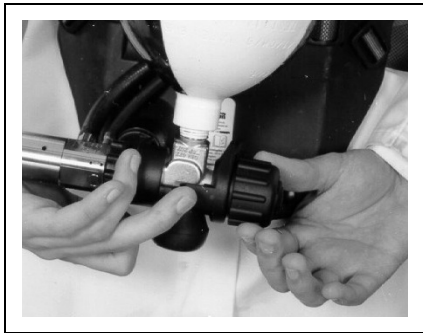


2. Pull tabs on buckles forward to release the head-harness or head-net. Remove facemask.

Note:

Instant Air DVs will free flow through mask until the cylinder valve is closed.

5.2 TURN OFF CYLINDER



1. Disengage the cylinder valve hand-wheel locking mechanism and turn hand-wheel fully clockwise to shut the valve.

5.3 REMOVE APPARATUS



1. Release the waist-belt, slacken the shoulder straps and remove the apparatus.
2. Open cylinder band, undo cylinder valve connector and remove cylinder.
3. Mark cylinder as 'empty' and return for charging.

5.4 CLEAN AND CHECK APPARATUS

1. The apparatus must be cleaned and tested in accordance with the instructions given in *Section 6 - After Use*, prior to being returned to service.

6. AFTER USE

CAUTION:

- DO NOT immerse DV or warning whistle in water. A yellow cap is provided to protect the DV outlet.
- ALWAYS use the recommended cleaning methods.
- The apparatus MUST be thoroughly dried prior to storage. Pay particular attention to the valve flaps.

6.1 CLEAN FACEMASK



1. Withdraw red locking catch, turn 90° clockwise and remove the DV from the facemask.
2. Wash and disinfect the mask thoroughly in a solution of **TriGene™** and warm water. See following *Note*.
3. Rinse the mask thoroughly in clean running water. Pay particular attention to flushing out the exhale valve.
4. Hang mask by its neck-strap and allow it to dry thoroughly away from direct heat or sunlight.
5. When dry, wipe facemask seals with **TriGene™** disinfectant wipes.
6. Polish the visor inside and out with a clean, lint-free cloth and slacken the head harness, ready for use.

Note:

TriGene™ Cleansing and Disinfecting Solution is available from **Scott Health and Safety Limited** in 1 litre and 5 litre containers under Article Numbers 2008247 and 2008248 respectively.

Pump dispensers are available for the above under Article Numbers 1017672 (1 litre) and 1017670 (5 litres).

TriGene™ Disinfecting Wipes are available from **Scott Health and Safety Limited** in packs of 20 sachets under Article Number 2004225.

6.2 CLEAN APPARATUS

CAUTION:

DO NOT use abrasive or solvent cleaners.

1. Fully slacken the shoulder straps and waist-belt. Clean off any dirt with a stiff brush or sponge with warm water and soap, followed by a thorough rinse.
2. Ensure that the pressure gauge face is clean.

6.3 DEMAND VALVE



1. Fit the protective yellow cap over the DV outlet and use a small stiff brush with a mild soap and water solution to clean around the catch.
2. If the catch does not move freely, return the apparatus for servicing.
3. Check that the orange O-ring on the DV outlet is clean and in good condition.
4. Replace O-ring if in less than perfect condition.



5. Operate the red locking catch a number of times. Ensure that it moves freely and does not stick.

6.4 CHECK APPARATUS

1. Check apparatus thoroughly for signs of wear or damage.
2. Check hoses for signs of abrasion or damage.
3. Check harness straps and stitching for signs of weakness.
4. Replace worn or damaged components in accordance with the **SIGMA 2** Service Manual.
5. If a fault is found, attach an explanatory note to the apparatus and return it for servicing.

6.5 FIT FULLY CHARGED CYLINDER

1. Fit a fully charged cylinder in accordance with the instructions contained within *Section 3 - Pre-Use and Monthly Checks*.

6.6 LEAK TEST

CAUTION:

On Instant Positive Pressure DVs (blue), DO NOT fit the yellow cap prior to opening the cylinder valve as this will damage the DV.

1. Open cylinder valve. The DV will free flow. Fit yellow protective cap over the DV outlet, airflow will cease.
2. Check pressure gauge to ensure that the cylinder is full.

3. Close cylinder valve and monitor the pressure gauge for one minute. Check that the pressure does not drop by more than 10 bar (one gauge division) in this time.

4. If apparatus fails this test it must be withdrawn from service and returned for servicing.

5. Gently lift the yellow DV cap and allow air to vent from system. Check pressure gauge and ensure that the warning whistle sounds clearly between 50 and 60 bar.

6.7 RECORD TEST DETAILS

Record test details in accordance with local regulations in a breathing apparatus logbook (available from **Scott Health and Safety Limited** under Article Number 1034745).

Information recorded usually includes:

- Name and address of employer responsible for the apparatus.
- Make, model number or mark of the apparatus, together with a description of any distinguishing features, sufficient to enable clear identification.
- The date of the examination together with the name, signature or unique authentication mark of the examiner.
- The condition of the apparatus and details of any defects found and any remedial action taken.
- Cylinder air pressure.

6.8 STORAGE

The apparatus must be stored in a clean, dry environment away from direct heat and sunlight.

Storage temperature should not exceed +40°C to -10°C.

7. SCHEDULED MAINTENANCE

7.1 MONTHLY

The apparatus should be examined and tested at least once a month in accordance with the instructions given in this manual under *Check Apparatus*.

Details of such checks should be recorded within the appropriate register and a copy kept for future inspection. Please see *Section 6.7* for details.

7.2 ANNUALLY

The apparatus must be tested and components replaced in accordance with the **SIGMA 2** Service Schedule, contained within the **SIGMA 2** Service Manual. Please refer to notes under *Personnel Training* and *Servicing* at the beginning of this manual for further details.



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