Basic Operation of the Open-Circuit Self-Contained Breathing Apparatus (SCBA)

SCOTT Air-Pack 4.5
SCBA Issues

- SCBA Upgrades, Changes and Options
- Technical and Operational Information
- Carbon Fiber vs. Fiberglass
- Flash Hood Interface
SCBA Upgrades, Changes and Options

- Cricket Alarm
- Exhalation Valve
- 4 Strap Head Harness
- Black Harness Material
- Spectacle Kit
- Carbon Fiber Cylinder
**OBA Con**
- Chemical canister stowage/cost/disposal
- Nearly 100% O2 delivered to face piece
- No positive pressure
- Deflation of breathing bag

**SCBA Pro**
- Positive pressure maintained
- NIOSH and NFPA approved as required by OPNAV
- Compatible with equipment used by most contemporary FF orgs
- In conjunction with BACS, can recharge in **60 sec while user is still breathing on system**
SCBA: cylinder-fed, open circuit, provides breathable **air** to fire fighter

Replacement for A-4 OBA
Principles of Operation
SCBA Components and Component Parts
Air Cylinder and Valve Assembly

Cylinder
- Holds 4500 psi compressed air
- Fully wrapped composite construction
- Breathing quality air (Grade D) **not oxygen**
- Only durations of 30 and 45 minutes are used by Navy
- Stored in lockers throughout ship on SCBA backpack and as spares
- **15 year service life, requires hydrostatic testing every 3 years**
- Label contains manufacturer’s name, date of manufacture, hydrostatic test information and DOT exemption number
Air Cylinder and Valve Assembly (Cont’d.)

DOT Exemptions:

<table>
<thead>
<tr>
<th></th>
<th>Fiberglass</th>
<th>Carbon Fiber</th>
</tr>
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<tbody>
<tr>
<td>Luxfer</td>
<td>E9634</td>
<td>E10915</td>
</tr>
<tr>
<td>SCI</td>
<td>E7277</td>
<td>E10945</td>
</tr>
</tbody>
</table>
Air Cylinder and Valve Assembly (Cont'd.)

Valve
- Located at neck of cylinder
- Open and back off ¼ turn
- Connection: CGA-347 (standard for breathing air in the pressure range of 3000-5000 psi)
- Burst disc: actuates when pressure inside air cylinder reaches about 7200 psi
Air Cylinder and Valve Assembly (Cont'd.)

Pressure Indicator
- Located on valve assembly at neck of cylinder
- Provides continuous indication of air cylinder pressure
- Does not require calibration (shall *not* have “No Cal Required” sticker)
Cylinder Hang Plate

- Located on valve assembly at neck of cylinder
- Provides mechanism for securing air cylinder to SCBA backpack
Backpack and Harness Assembly

Backpack

- Corrosion resistant wire frame and cylinder hook (mates to cylinder hang plate)
Cylinder Band and Latch Assembly

- Adjustable band and latch that secures air cylinder to backpack
- Fine adjustment can be made using vernier adjustment while toggle lever is open (proper adjustment = not able to turn with finger pressure when latched)
Backpack and Harness Assembly (Cont'd.)

Harness Assembly

- Consists of two adjustable shoulder straps and an adjustable waist strap with pads
- Waist belt has quick-release buckle and adjusters and houses holder for second stage regulator
- Shoulder straps have pull up, push-to-release adjusters for quick adjustment
- Flame and heat resistant Kevlar
Remote Pressure Indicator
- Located in front on right side shoulder strap
- When air cylinder valve is open, provides continuous remote indication of air cylinder pressure
- Face is fully luminescent
- Does not require calibration (shall not have “No cal Required” sticker)
Backpack and Harness Assembly (Cont'd.)

Bell Alarm (Cricket Alarm)
- Located in front on left side shoulder strap
- When air cylinder pressure is at 23-27% of capacity, will provide a steady dinging sound to audibly alert the user of the situation
Backpack and Harness Assembly (Cont'd.)

High Pressure Hose

- Located between cylinder valve and First-Stage regulator ("pressure reducer")
- Delivers air at cylinder pressure to the First-Stage regulator
- Hose is attached to air cylinder valve by the coupling nut. The high pressure seal is made by the coupling nut o-ring.

*Before disconnecting the coupling nut, ensure all air is bled from the high pressure hose. Air left in the hose may cause the o-ring to dislodge, resulting in inability to make a seal.*
First-Stage Regulator
(Pressure Reducer)
First-Stage Regulator
(Pressure Reducer) (Cont'd.)

First-Stage Regulator
- Mounted to the left of the air cylinder
- Reduces cylinder pressure to about 100 psi
- Uses a redundant dual path reducing system; secondary path automatically supplies air if primary path fails
First-Stage Regulator
(Pressure Reducer) (Cont'd.)

Pressure Relief Valve
- Located on the side of the First-Stage regulator
- Reseatable relief valve; actuates above 185 psi
Quick Charge Assembly

- Located adjacent to the waist strap on the left side of the wearer
- Air cylinder refillable without removing the air cylinder and while continuing to breathe on the SCBA
Second-Stage Regulator
(EZ-Flow Regulator)

Low Pressure Hose
- Located between pressure reducer and second stage regulator
- Provides pressure of ~100 psig to second stage regulator
Regulator

- Located at the end of the low pressure hose and connects to the face piece
- Demand regulator maintains a positive pressure in the face piece at all times
- If face piece or seal is broken, air will flow freely from regulator

Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)
Purge Valve

- Red knob located on the left side of regulator (as viewed when wearing)
- Purge valve manually overrides the Second-Stage regulator
- Provides a constant flow of air to the face piece
- *Used for emergencies only; exit space immediately if breathing with purge valve*
- Can also be used to clear fogging in face piece
- Rotate handle ccw (away from wearer) to open
Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)

Air Saver Switch
- Black button on top of regulator
- Stops air flow from the Second-Stage regulator
- Press and release to actuate
- Inhale sharply to disengage
Second-Stage Regulator
(EZ-Flow Regulator) (Cont'd.)

Removal Lever
- Black tab on right side of regulator
- Used to “unlock” Second-Stage regulator from face piece in order to remove it
- To use, push tab away face and hold while turning
Second-Stage Regulator (EZ-Flow Regulator) (Cont'd.)

“Vibralert” Alarm Assembly

- Housed within the Second-Stage regulator
- Alarm will sound when 20-25% of cylinder air remains
- Alarm will also activate to indicate a problem in the First-Stage regulator
Face Piece

Face Seal

- Available in three sizes: small (green), large (black), and Xlarge (red)
- Made of a blend of natural and synthetic rubber
Face Piece (Cont'd.)

Lens

- Single, replaceable, wide angle, clear lens
- Made of polycarbonate with a silicone-based coating to resist abrasion and chemical attack
Face Piece (Cont'd.)

Head Harness
- Connected to the face piece by quick adjusting buckles and snap retainers
- Made of synthetic rubber
Face Piece (Cont'd.)

Voice Amplifier
- Located in a mounting bracket over the right side voicemitter
- Powered by one 9-volt battery
SCBA Donning Procedure
Inspect SCBA: quick visual inspection for any obvious damage that would preclude safe and proper use of the SCBA
<table>
<thead>
<tr>
<th>Inspection Item</th>
<th>Conditions/Defects</th>
</tr>
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<tbody>
<tr>
<td>Inspect Face piece:</td>
<td>rubber deterioration, cracks, tears, holes, tackiness</td>
</tr>
<tr>
<td>Inspect Head Harness:</td>
<td>breaks; missing straps; loss of elasticity; buckles</td>
</tr>
<tr>
<td></td>
<td>corroded, damaged</td>
</tr>
<tr>
<td></td>
<td>strap serrations worn</td>
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<tr>
<td>Inspect Lens:</td>
<td>cracks, scratches, loss of tightness to face piece, regulator inlet coupling deformed or damaged</td>
</tr>
</tbody>
</table>
SCBA Donning Procedure (Cont'd.)

Inspect Backpack: cuts, tears, abrasions, signs of chemical or heat damage, inoperative buckles, damage to wire frame
Inspect Cylinder: minimum pressure allowed is 4000 psi; check cylinder for charring, dents, gouges or cuts that may have penetrated fiberglass or carbon fiber.
Inspect Hoses: cuts, cracks, abrasions, bulges, wrinkles, loose or inoperative connections
SCBA Donning Procedure (Cont'd.)

EZ-Flow Regulator
- Check casing for damage, dirt or debris
- Actuate purge valve, air saver switch and removal lever
- Check sealing gasket
SCBA Donning Procedure (Cont'd.)

Don SCBA (coat method or over-the-head)
- Most of the weight (85%) should be carried on the waist/hips
- Check all straps for correct adjustment
SCBA Donning Procedure (Cont'd.)

Don Face Piece
- Spread face piece straps from inside with thumbs
- Place chin in chin cup
- Pull harness over head and smooth straps
- Ensure all hair is away from seal
- Tighten neck straps first, then temple straps
Perform Negative Pressure Check

- Place hand over face piece opening for second stage regulator
- Inhale and hold your breath
- Listen/feel for inward air leakage
- Adjust face piece as needed until seal is maintained
Open Air Cylinder Valve

- First depress air saver switch
- Ensure purge valve is closed,
- Open cylinder valve, close \( \frac{1}{4} \) turn, and listen for Vibralert to sound during initial equalization (*the bell alarm may or may not sound at this time*)
SCBA Donning Procedure (Cont'd.)

To Begin Operation ("go on air")
- Attach Second-Stage regulator to face piece lock in place
- Inhale sharply to begin flow of air
- Breathe with purge valve open to experience breathing in free flowing air
- Close the purge valve, press air saver switch and disconnect regulator from face piece

*Wait to engage the air saver switch until just prior to pulling the regulator away from the mask*
Breathing Air Replenishment
Breathing Air Replenishment

Air Cylinder Change-out
- Assume leaning rest position
- Assistant closes air cylinder valve
- Wearer bleeds system through purge valve and stows regulator in waist clip
- Assistant disconnects air cylinder coupling nut, unsnaps toggle latch & lever and locking tab and removes cylinder (*Grasp cylinder valve securely while doing this!!!*)
Breathing Air Replenishment (Cont'd.)

Air Cylinder Change-out (Cont'd.)

- Assistant obtains full cylinder and announces cylinder pressure to wearer
- Assistant replaces full cylinder on backpack making sure it is secure
- The cylinder may easily be installed by running the cylinder up through the bottom of the cylinder band
- Check coupling nut o-ring
- Attach hose
- Open air cylinder valve (back ¼ turn)
- Check for leaks
- Verify air pressure on remote indicator
Breathing Air Replenishment (Cont'd.)

Quick Charge

- BACS operator will:
  - inspect cylinder and backpack
  - remove dust cap from quick charge couplings and inspect couplings for dirt or damage
  - grasp hose below coupling and push couplings together until QDs click

- Air flow starts automatically; monitor pressure increase on remote gauge
- Air flow stops automatically when cylinder is full
Breathing Air Replenishment (Cont'd.)

Quick Charge

- disengage quick charge coupling
- reinstall dust caps on both couplings
- ensure quick charge hose is attached firmly to harness before dismissing SCBA wearer
SCBA Doffing Procedure

- Ensure purge valve is closed, press air saver switch
- Disconnect regulator from face piece
- Close air cylinder valve
- Bleed air from system through purge valve and stow Regulator in waist clip
- Doff SCBA using coat method (Do not hold by the hoses)
- Perform MRC R-1 and R-2 after each use (R-1 refers to M-1 which is in-depth inspection of unit. Read/perform M-1 with students.)
SCBA Doffing Procedure (Cont'd.)

- Mix 2 tablespoons of Wescodyne G in a pail containing 1.5 gallons of water not to exceed temperature of 110°F
- Prepare two more buckets containing 2 gallons of fresh water each. Temperature should not exceed 110°F
- Agitate each face piece for 15 seconds with a total immersion time of 2 minutes in the bucket containing Wescodyne
- Agitate each face piece for 15 seconds in each of the buckets containing the fresh water rinse