

NAVAL SHIPS' TECHNICAL MANUAL  
CHAPTER 077  
**PERSONNEL PROTECTION  
EQUIPMENT**

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## NOTE

THIS TECHNICAL MANUAL (TM) HAS BEEN DEVELOPED FROM AN INTELLIGENT ELECTRONIC SOURCE KNOWN AS STANDARD GENERALIZED MARKUP LANGUAGE (SGML). THERE IS NO LOEP. ALL CHANGES, IF APPLICABLE, ARE INCLUDED.



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## CHAPTER 077

### PERSONNEL PROTECTION EQUIPMENT

#### SECTION 1

#### INTRODUCTION

##### 077-1.1 SCOPE

077-1.1.1 This chapter provides information for the use and care of the following groups of personnel protection equipment:

- a. Life preservers
- b. Breathing apparatus and equipment
- c. Firefighting clothing
- d. Anti-flash and steam clothing

077-1.1.2 Specialized personnel protection equipment, for specific functions and materials, is covered in other NSTM chapters as indicated in [Table 077-1-1](#).

**Table 070-1-1.** References

Equipment	NSTM Chapter
Welding	074, Volume 1
High pressure hydraulic oil	262
Chemical, biological, and radiological	470 and 070
Sewage handling	593
Oil spill cleanup	593
Asbestos handling	635
Chemical handling	631 and 670

077-1.1.3 Information presented in this chapter supersedes previous versions of this chapter and other previously published instructions on how to don, wear, and care for personnel protection equipment. Information on when and how to employ personnel protection equipment is contained in the following publications:

NSTM Chapter 555, Volume 1, Surface Ship Firefighting

NSTM Chapter 555, Volume 2, Submarine Firefighting

NSTM Chapter 079, Volume 2, Damage Control - Practical Damage Control

NSTM Chapter 074, Volume 3, Gas Free Engineering

Ship's Damage Control Book

Type Commander Instructions

Type Commander Repair Party Manual

077-1.1.4 Nothing in this manual is intended to preclude the good judgment and common sense of the on-scene commander.

077-1.1.5 The Naval Sea Systems Command (NAVSEA) Damage Control and Fire Protection Engineering website at <http://www.dcfp.navy.mil> provides the damage control community a virtual shopping mall of information, updates, and history. It serves as a resource extension to NSTM S9086-CH-STM-030, Chapter 074, Volume 3, Gas Free Engineering; NSTM S9086-CN-STM-020 Chapter 079, Volume 2, Damage Control - Practical Damage Control and NSTM Chapter 077, Personnel Protection Equipment, distributing updates and new information in a timely manner via the internet. The website provides online resources to access information including:

- a. Damage Control Central is the entry point to NSTM 077; NSTM 079, Volume 2; and NSTM 074, Volume 3; for technical, training, and professional development, information, and clarification.
- b. NAVSEA damage control, fire protection, and personnel protection internet media resource data center. This section has digital photographs showing personnel properly dressed out in personnel protection equipment.
- c. Answers to frequently asked questions.
- d. Equipment and system descriptions including links to amplifying information.
- e. Research and development information.
- f. Rapid plotting.
- g. Training and professional development resources.
- h. Library of official damage control and firefighting references and publications.
- i. General information on chemical, biological, and radiological defense (CBR-D) equipment and systems information.
- j. Safety and non-development items (NDI) references to the Safety Center, Safety Bulletins, FLASH, FATHOM, and other NDI information.
- k. Gas Free Engineer and Fire Marshal information.
- l. Material Condition Assessment Check Sheets and Afloat-Self Assessment Administration Check Sheets.
- m. Damage control and firefighting training resources and sites.
- n. "What's New" area shows recent and daily updates.
- o. Damage control software module information.
- p. Media center of pictures, short video clips, and a virtual museum.
- q. Links to related sites for damage control, fire protection, and CBR-D.



## SECTION 2

### LIFE PRESERVERS

#### 077-2.1 INTRODUCTION.

077-2.1.1 This section covers the following life preservers used by the Navy:

- a. Inherently buoyant life preservers
  1. Vest Type with Collar, Type I (also called the kapok life preserver)
  2. Vest Work Type
  3. Yoke Type (also called the assault life preserver)
- b. Inflatable life preservers
  1. MK 1 Vest Type
  2. Abandon-Ship Type with Pouch (LPP-1)

077-2.1.2 Commercially available life preservers have been approved as alternatives to the existing MIL-SPEC versions of the MK-1, Inherently Buoyant Vest with Collar (Kapok), Inherently Buoyant Vest Work Type, and the abandon ship life preservers. The NSNs for these life preservers are shown on the applicable Allowance Equipage Lists. The existing MIL-SPEC life preservers are still adequate and users are not required to replace them. However, the existing MIL-SPEC life preservers are no longer in the supply system and users should order the commercial life preservers once the MIL-SPEC life preservers are no longer usable.

The intended purpose of each life preserver discussed in this section is summarized in [Table 077-2-1](#). Required accessories for each life preserver are listed in [Table 077-2-2](#). Life preserver accessories are discussed, including directions for their use and care, starting in [paragraph 077-2.5](#).

**Table 077-2-1. Life Preserver Reference**

Life Preserver Type	Life Preserver Uses
Inherently Buoyant Vest Type with Collar, Type I	All shipboard evolutions EXCEPT Flight Deck operations
Inherently Buoyant Vest Work Type	Work parties ashore and in protected waters
Inherently Buoyant Yoke Type	Troops (amphibious operations)
Inflatable MK-1 Vest Type (All colors)	All shipboard evolutions EXCEPT: 1. Performance of hot work or other activity which may damage the life preserver 2. Personnel riding aircraft
Inflatable LPP-1 Abandon-Ship Type with Pouch (Yellow)	1. General quarters(yellow) 2. Abandon ship operations(yellow) 3. Troops (Amphibious Operations)(grey)

**Table 077-2-2.** Accessory Equipment On Life Preservers

Preserver Type	Reflective Tape	Whistle (Note 1)	Distress Marker Light	Toggle Line (Buddy Line)	Sea Dye Marker	Man Over- board Indica- tor (MOBI) (Note 5)
<b>Inherently Buoyant Life Preservers</b>						
Vest Type with Collar Type I	Yes	Yes	Yes (Note 2)	No	Yes	Yes
Vest Work Type	Yes	No	No	No	No	No
Yoke Type	No	No	No	No	No	No
<b>Inflatable Life Preservers</b>						
MK-1 Vest Type	Yes	Yes	Yes (Note 3)	No	Yes (Notes 5 and 6)	Yes
Abandon Ship Type (Yellow)	No	Yes	Yes (Note 2)	Yes (Note 4)	Yes	No
Abandon Ship Type (Gray)	No	No	No	No	No	No
NOTES:						
1. The MK-1 vest type life preserver uses a flat whistle. The other life preservers use either the flat whistle or the plastic police-type whistle. Whistles shall be attached to life preservers by lanyards secured with a bowline knot.						
2. Personnel marker lights can be used in place of distress marker lights on life preservers requiring distress marker lights.						
3. The MK-1 vest type life preserver is equipped with a FIREFLY 2 or FIREFLY 3 strobe type distress marker light.						
4. A 48-inch toggle (buddy) line shall be tied to the life preserver belt with a bowline knot if a suitable toggle line is not supplied by the manufacturer.						
5. The MOBI shall be attached to the MK-1 vest type and inherently buoyant life preserver either in a pouch or attached to the belt of the life preserver.						
6. The sea dye marker shall be attached to the MK-1 vest type life preserver with a 48-inch lanyard tied with a bowline knot.						

**077-2.2 INHERENTLY BUOYANT LIFE PRESERVERS.**

077-2.2.1 TYPES. Inherently buoyant life preservers use plastic foam or fibrous glass flotation pads to provide the required buoyancy. The pads are contained in a vest or yoke style cover. The materials for the flotation pads are described in [paragraph 077-2.2.5](#). The three types of inherently buoyant life preservers are:

- a. Vest Type with Collar, Type I
- b. Vest Work Type
- c. Yoke Type (also called the assault life preserver)

077-2.2.2 VEST TYPE WITH COLLAR, TYPE I ([Figure 077-2-1](#)). This inherently buoyant life preserver is a U.S. Coast Guard approved Type I life preserver. It has two straps for securing the life preserver, a hole for the safety harness D-ring, pockets for the distress marker light and whistle, and a Velcro patch on the collar for attaching the distress marker light. Newer versions also have a pocket for the MOBI and sea dye marker. The inherently buoyant life preserver is self-righting and will keep an unconscious wearer's head face up and out of the water while awaiting rescue.



Figure 077-2-1. Inherently Buoyant Vest Type Life Preserver with Collar

077-2.2.2.1 Construction. The inherently buoyant life preserver (Figure 077-2-1) is a vest style design with a collar to provide head support. The life preserver has reflective tape and pockets to hold accessories. There is a 1-inch by 3-inch opening centered horizontally on the back of the life preserver and located vertically between the wearer's shoulder blades. The opening allows a safety harness D-ring to fit through the life preserver. The

life preserver also contains a body adjustment strap and a chest strap. The life preserver shell is fabricated from a polyurethane coated nylon material in the color orange. The body strap and chest strap are constructed from 1-inch wide nylon, polyester, or polypropylene webbing.

077-2.2.2.2 Donning and Adjusting. Procedures for donning and adjusting the life preserver are as follows:

1. Before donning the life preserver, inspect it in accordance with PMS requirements.
2. Ensure that whistle, distress marker light or PML (or both), sea dye marker, and MOBI are attached to the life preserver.
3. Don the life preserver.
4. Secure all straps and belts to ensure the life preserver fits snugly.

077-2.2.3 VEST WORK TYPE. The inherently buoyant, vest work type life preserver is used for shore activities or activities in protected waters only and is not a shipboard allowance item. Stearns Inc. Model I222 (Figure 077-2-2) is authorized for use in this application.



Figure 077-2-2. Stearns Inc. Model I222

**WARNING**

**The preserver is not self-righting and will not always keep an unconscious wearer's head face up and out of the water while awaiting rescue. Do not use outside protected waters.**

077-2.2.4 YOKE TYPE. The inherently buoyant yoke type life preserver is illustrated in Figure 077-2-3. This life preserver provides 50 pounds of buoyancy. The primary use of this type of life preserver is for pack carrying troops in amphibious operations. The life preserver is worn around the neck and can be removed with one hand without affecting the backpack.

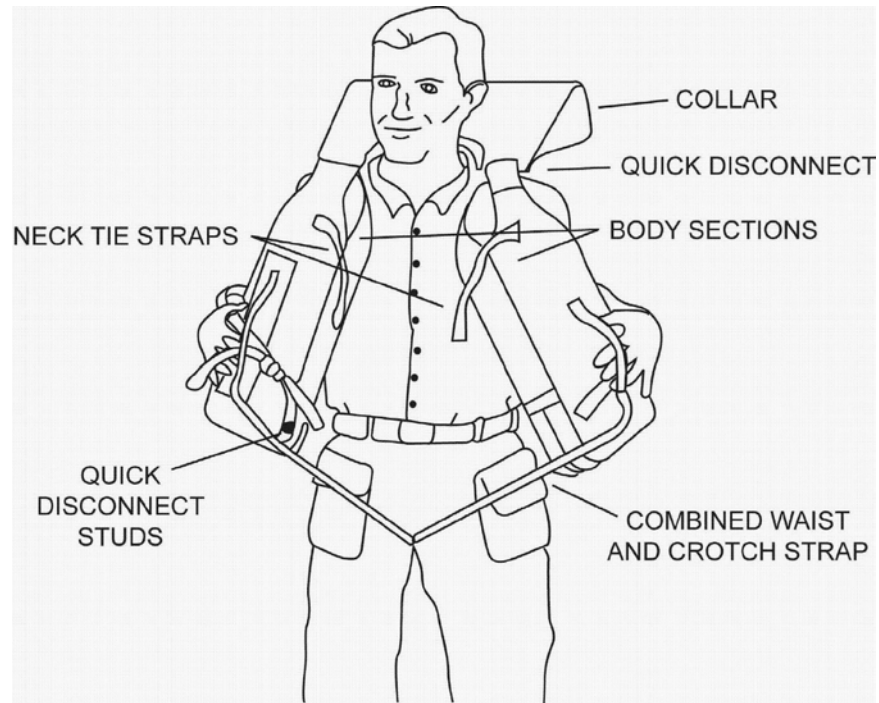


Figure 077-2-3. Yoke Type Life Preserver

077-2.2.4.1 Construction. The yoke type life preserver has two body sections and one collar flotation section which are filled with fibrous glass or plastic foam flotation pads. The life preserver is held in place by a combined waist and crotch strap designed for quick release. In addition, a quick-disconnect is provided between the left body section and the collar. This life preserver has no accessories.

077-2.2.4.2 Donning and Adjusting. The yoke type life preserver is donned and adjusted as follows:

- a. Unbuckle the quick-disconnect studs. Fully extend and straighten the combined waist and crotch strap
- b. Place the life preserver around the neck and bring it down in front, as shown in [Figure 077-2-3](#).
- c. Secure the tie straps around the neck with a bow knot. **Never tie a square knot.** Neck tie straps are tied, as shown in [Figure 077-2-4](#).

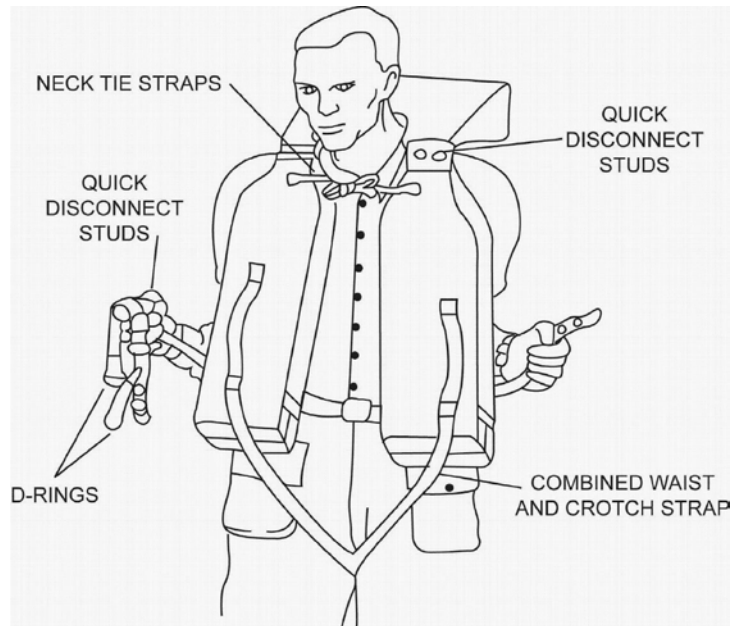


Figure 077-2-4. Arrangement of Neck Tie Straps and Combined Waist and Crotch Strap on Yoke Type Life Preserver

- d. Pass the combined waist and crotch strap through the legs from front to rear. Pass the strap around to the front of the body and under the segment of strap stitched to life preserver. See [Figures 077-2-4](#) and [077-2-5](#).
- e. Attach the quick-disconnect studs together ([Figure 077-2-5](#)).

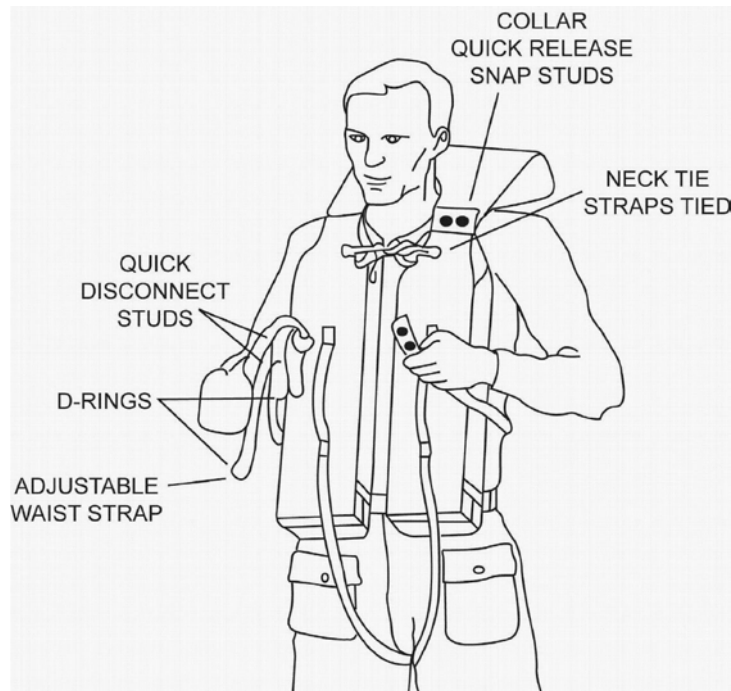


Figure 077-2-5. Quick-Disconnect Studs and D-Rings on Yoke Type Life Preserver

- f. Adjust the waist strap so that it is comfortable and snug. Tighten by pulling the strap through the D-ring, as shown in [Figure 077-2-6](#).

077-2.2.4.3 Removing the Life Preserver. The inherently buoyant, yoke type life preserver can be removed using one hand as follows:

- a. Pull the waist strap quick-release D-ring, shown in [Figure 077-2-6](#), allowing life preserver to come loose.
- b. With the left hand, grasp and pull the collar quick-release snap studs. This allows the preserver to fall free from the wearer.

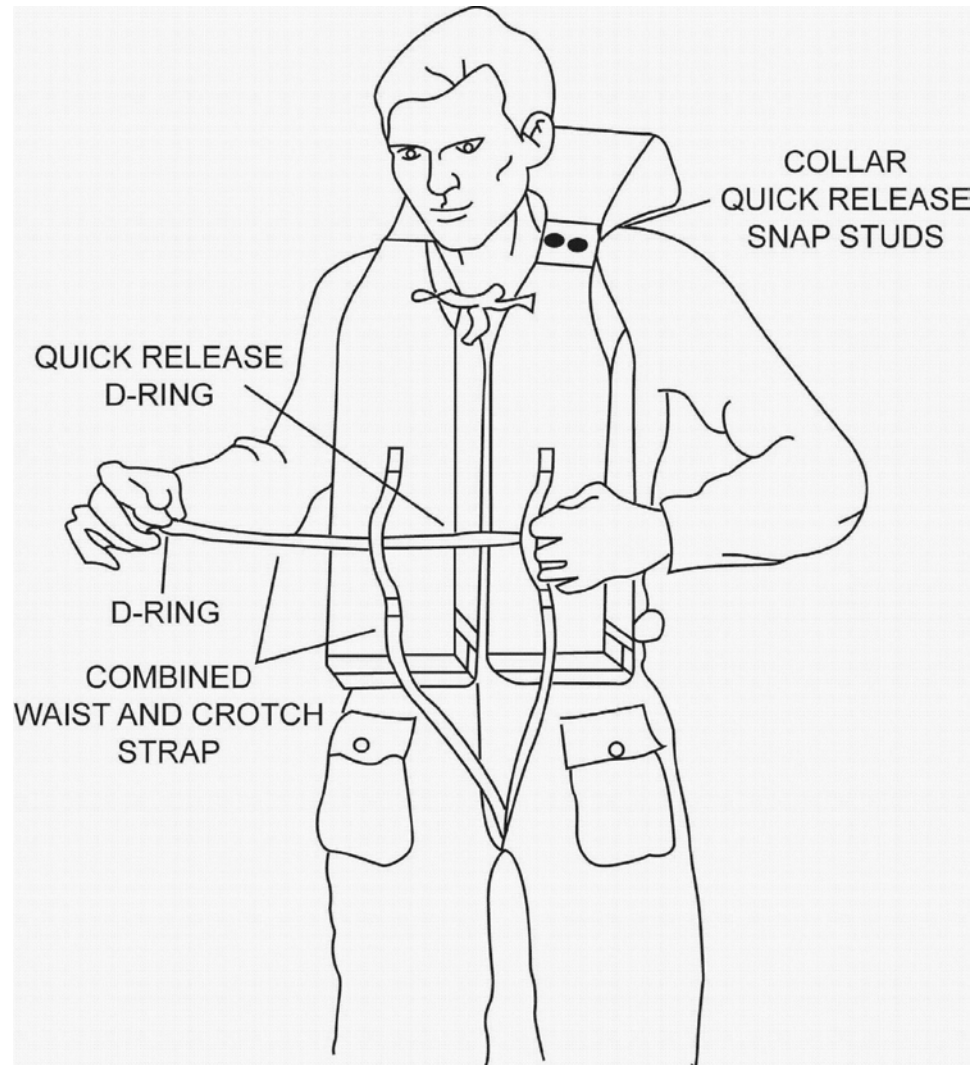


Figure 077-2-6. Final Donning Adjustment for Yoke Type Life Preserver

077-2.2.5 STOWAGE OF INHERENTLY BUOYANT LIFE PRESERVERS. Prior to storage, dry and air out life preservers, then check for damage. Stow in a dry location out of direct sunlight and between 0 degrees Celsius ( $^{\circ}$  C) (32 degrees Fahrenheit ( $^{\circ}$  F)) and 38 $^{\circ}$  C (100 $^{\circ}$  F). Heat, moisture, and light deteriorate the plastic, cloth, and thread materials used in the life preservers. A dry place is one where water or condensation does not come in contact with stowed preservers.

077-2.2.5.1 Exercise care to prevent damage caused by sharp edges when life preservers are stowed.

077-2.2.5.2 Ships transporting troops shall have the ship's entire allowance of yoke type or abandon ship type preservers available for troops. Stow these preservers in ready-use lockers.

077-2.2.6 MAINTENANCE OF INHERENTLY BUOYANT LIFE PRESERVERS. Conduct regularly scheduled maintenance of inherently buoyant life preservers and accessories in accordance with Planned Maintenance System (PMS) requirements. Immediately repair or replace damaged life preservers.

### 077-2.3 INFLATABLE LIFE PRESERVERS.

077-2.3.1 TYPES. There are two types of inflatable life preservers used by general shipboard personnel. They are either inflated by carbon dioxide (CO<sub>2</sub>) cylinders or inflated orally by the use of an oral inflation tube. These life preservers are as follows:

- a. MK-1 Vest Type
- b. Abandon-Ship Type with Pouch

077-2.3.2 MK-1 VEST TYPE. The MK-1 vest type life preserver automatically inflates, provides a minimum of 24 pounds of buoyancy, and is self-righting. The design keeps an unconscious wearer's head face up and out of the water while awaiting rescue. The MK-1 vest type life preserver has a flap, secured by Velcro, to cover the inflation assembly and oral inflation tube, and a Velcro patch on the shoulder for non-flight deck personnel to attach the distress marker light. See [Figure 077-2-7](#) for MK-1 vest type life preserver cover. The MK-1 vests are provided in seven colors to identify personnel functions ([Figure 077-2-8](#)). For non-flight deck personnel, the color of the vest shall be chosen by the ship's force. For personnel on submarines, the color of the MK-1 vest shall be green. The color designations are as follows:

- a. White - Phone talkers and medical corpsmen
- b. Red - Ordnance men
- c. Green - Catapult and arresting gear personnel
- d. Blue - Plane pushers
- e. Brown - Plane captains and mechanics
- f. Yellow - Flight deck officers and plane directors
- g. Purple - Fuel handlers

---

**WARNING**

---

**MK-1 life preservers are not authorized for use on aircraft. When submerged in water, the automatic inflation assembly will actuate and an inflated preserver could trap the wearer aboard the aircraft. MK-1 life preservers with automatic inflation assemblies shall be labeled with a warning against its use on aircraft.**





Figure 077-2-7. MK-1 Vest Type Life Preserver Cover (Shown in Brown)



Figure 077-2-8. Colors Available for MK-1 Vest Type Life Preserver Cover

077-2.3.2.1 Construction. The MK-1, shown in [Figure 077-2-7](#), consists of a cloth cover, an inflatable bladder, an inflation assembly, and accessories. The bladder is removable from the cover for cleaning and replacement of the cover or bladder.

077-2.3.2.1.1 The MK-1 vest life preserver cover is a sleeveless cardigan style with a front zipper closure. A waist strap encircling the vest can be adjusted and secured in the front with the slide buckle fastener. The right front of the MK-1 life preserver vest cover has two openings, one sized for the oral inflation tube and the other for the bladder manifold. A securing strap is provided for the cylinder. The upper right front of the MK-1 life preserver vest cover has a flap secured by hook and pile tape at the top and side to cover the oral inflation tube. The lower right front of the vest cover has a foam cushioned flap to cover the inflator/cylinder. The back of the vest contains a 1-inch by 3-inch opening to allow a safety harness D-ring to fit through the life preserver.

#### NOTE

Zippered front closures allow the use of a safety harness worn under the life preserver when working over the side. A buttonhole in the back is provided in the new cover to allow the safety harness D-ring to protrude through the cover.

The cover is available in five sizes with slack in each size so foul weather gear can be worn under the life preserver. Pockets for a whistle, distress marker light, sea dye marker, and MOBI (in newer style) are sewn onto the cover. Reflective tape is sewn across each shoulder and the back of the cover. Openings in the front of the cover are provided for the inflatable bladder's inflation assembly manifold and the oral inflation tube. A retaining loop for the inflation tube is provided above the opening of the tube. The opening for the manifold is located under an inflation assembly protective flap and is large enough to permit passage of the inflation assembly without removing it from the bladder. The protective flap completely covers the inflation assembly. A restraining strap for the CO<sub>2</sub> cylinder is sewn into the cover under the inflation assembly protective flap.

077-2.3.2.1.2 The inflatable bladder for the MK-1 ([Figure 077-2-9](#)) is a single-chamber, horseshoe-shaped bladder. One size is used to fit all vest cover sizes. An oral inflation tube and a brass manifold for the inflation assembly are provided on the right front portion of the bladder. The manifold contains a check valve to prevent leakage. The bladder provided with the commercial vests is a different design than the existing MILSPEC bladder and requires a different CO<sub>2</sub> cylinder. Therefore, care should be taken to ensure that the commercial bladder is only used in the commercial vest.



Figure 077-2-9. Inflatable Bladder for MK-1 Vest Type Life Preserver

077-2.3.2.1.3 The automatic inflation assembly holds one CO<sub>2</sub> cylinder. The bladder uses a 24-gram CO<sub>2</sub> cylinder, and the MILSPEC bladder uses a 33-gram CO<sub>2</sub> cylinder. Care should be taken to use the appropriate cylinder in each vest. Two types of inflation assemblies use a battery-powered electronic circuit device manufactured by Conax, and a chemical pill inflator produced by Stearns. When the battery-powered automatic inflation assembly is immersed in water, a battery-powered electronic circuit is completed that automatically activates the inflation mechanism. The Conax assembly uses one 12-volt battery in water, and the chemical pill dissolves to complete the automatic inflation mechanism. The automatic inflation assembly can also be activated manually by pulling a lanyard attached to an actuating lever, releasing the CO<sub>2</sub> to inflate the bladder. The Conax inflation assemblies can be actuated only once automatically but multiple times manually. The chemical pill automatic inflation assembly can be actuated automatically multiple times.

### WARNING

**Only the automatic inflation assembly is authorized for use on the MK-1 life preserver.**

### CAUTION

**Service life on the automatic inflation assembly manufactured by Conax is five years from the date of manufacturing. Inflation assembly exceeding this limit shall be replaced to ensure serviceability unless a service life extension is authorized. Refer to NAVAIR 11-100-1.1-CD, Technical Manual for Cartridge Actuated Devices (CAD) and Propellant Actuated Devices (PAD), for the latest approved service life as this limit may change through scheduled service life testing. The NAVAIR 11-100-1.1-CD, available at the CAD/PAD Virtual Fleet Support (VFS) website, <https://cadpad.ih.navy.mil>, also**

*Caution - precedes*

**includes the policy and process for obtaining a service life extension when replacement inflation assemblies are unavailable.**

**NOTE**

When ordering the automatic inflation assembly manufactured by Conax, battery and CO<sub>2</sub> cylinder must be ordered separately. Items can be ordered from DLA, the NSN for the battery is 4220-01-372-5191 and the NSN for the CO<sub>2</sub> cylinder is 4220-01-487-2878.

**NOTE**

For detailed information for ordering and management of the automatic inflation assembly manufactured by Conax, refer to NAVAIR 11-100-1.1-CD. The NAVAIR 11-100-1.1-CD is available at the CAD/PAD VFS website, <https://cad-pad.ih.navy.mil> for registered users.

077-2.3.2.1.4 Accessories included with the MK-1 life preserver are identified in [Table 077-2-2](#). For flight deck personnel, attach the distress marker light to the impact resistant flight deck crew safety helmet (also called the cranial helmet); after entering the water, secure a strip of hook tape on the back of the distress marker light. For non-flight deck personnel, the MK-1 vest has Velcro on the collar to attach the distress marker light to the vest. Lanyards or cords are used to attach the distress marker light and whistle to the vest. The lengths of the lanyards and attachment methods are provided in PMS requirements.

077-2.3.2.2 Donning and Adjusting. The MK-1 life preserver is donned as follows:

- a. Before donning the MK-1 life preserver, inspect it in accordance with PMS requirements.
- b. After the inspection, put the preserver on and secure the front closure. Zip the front closure all the way to the top, leaving the zipper tab in down position. Secure hook and pile tape closure over the zipper tab.
- c. Tighten the waist adjustment straps to keep the preserver close to the body.

077-2.3.2.3 Instructions for Use. When wearing the MK-1 life preserver, the front shall be closed and secured at all times to ensure the life preserver will not come off in the water. The MK-1 life preserver may be inflated automatically or manually.

**WARNING**

**Never inflate the life preserver before entering the water.**

077-2.3.2.3.1 The automatic inflation assembly is activated within three seconds after immersion in water to inflate the bladder. Inadvertent wetting should not activate the inflation assembly.

**WARNING**

**Conax automatic inflation assemblies can only be actuated once automatically. Replace the automatic inflation assembly after an automatic inflation.**

**Warning - precedes**

**Discard the used assembly and replace in accordance with PMS procedures. However, chemical pill auto-inflation assembly can be actuated automatically multiple times.**

**NOTE**

There have been several reported incidents of Conax automatic inflators installed on MK-1 life preservers experiencing activations after several hours of exposure to heavy rain. To reduce the risk of incidence, trim the bottom edge of the closure flap behind the inflator and any loose threads that may contact the inflator's battery housing.

077-2.3.2.3.2 Manual inflation is accomplished by pulling down on the lanyard attached to the inflation assembly. The inflation assembly can be manually operated repeatedly, as long as the CO<sub>2</sub> cylinder is replaced each time.

077-2.3.2.3.3 Oral inflation of the life preserver is required if the CO<sub>2</sub> inflation system fails or if additional inflation is desired. To accomplish this, use the following procedure:

- a. Hold inflation tube in one hand and place mouth on mouthpiece.
- b. Blow air through the mouthpiece while depressing it with the mouth or hand.
- c. Release mouthpiece after each exhalation.
- d. After inflation is achieved, lock the oral inflation valve closed by turning knurled ring up against mouthpiece as far as possible.

077-2.3.2.4 Removing the Life Preserver. The MK-1 life preserver is removed as follows:

- a. Loosen the waist adjustment straps.
- b. Open the front closure; open the hook and pile secured flap over the zipper tab, then unzip the vest.
- c. Remove the vest and stow as discussed in [paragraph 077-2.3.4](#).

077-2.3.3 ABANDON-SHIP TYPE WITH POUCH (LPP-1). The abandon ship life preserver is U.S. Coast Guard approved and provides 33 pounds of buoyancy. It does not come with a lifting strap.

077-2.3.3.1 Construction. The abandon ship life preserver consists of a waist belt and pouch for carrying the life preserver while not in use, a buoyancy chamber (with no cloth cover), and an inflation assembly.

077-2.3.3.1.1 The pouch for the abandon ship life preserver stows the buoyancy chamber. There is a separate packet that is attached to the waist belt for the distress marker light, whistle, and toggle line ([Figure 077-2-10](#)). The buoyancy chamber is a single compartment bladder. An oral inflation tube, a brass manifold for the inflation assembly, and the inflation assembly are provided on the chamber. The manifold contains a check valve to prevent leakage. Velcro is on the chamber for attaching the light. The whistle is attached to the packet.

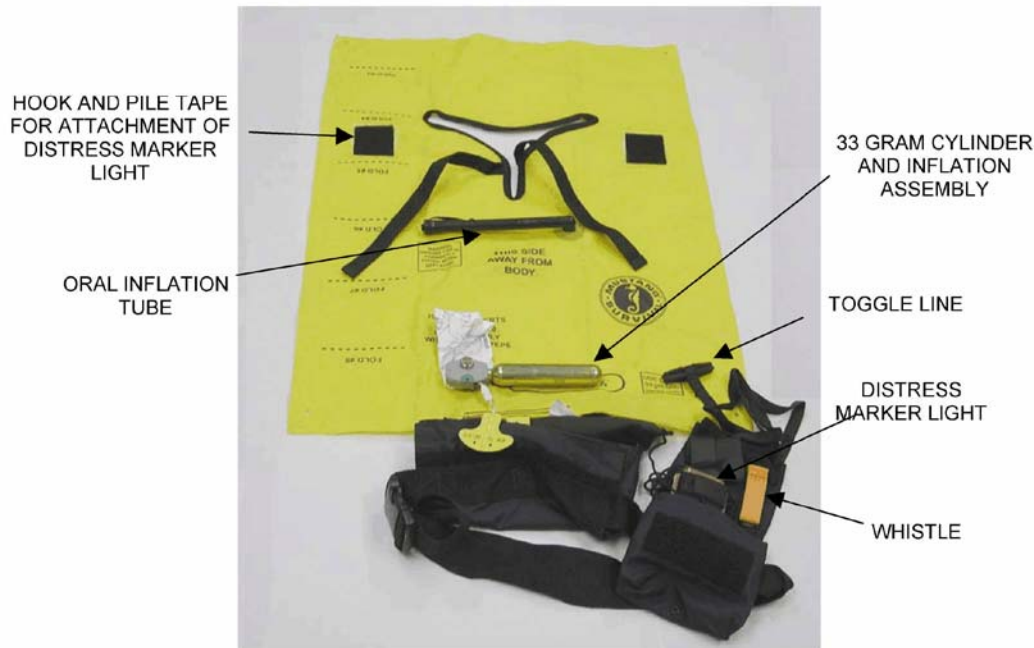


Figure 077-2-10. Abandon Ship Type Life Preserver with Pouch and Accessories

077-2.3.3.1.2 The inflation assembly is a manual actuating assembly that uses a single 33-gram CO<sub>2</sub> cylinder. The existing MILSPEC life preserver uses a 28-gram CO<sub>2</sub> cylinder. These cylinders are not interchangeable. Ensure that the proper cylinder is used for the appropriate life preserver. The cylinder is activated by pulling on a lanyard on the manual inflator. The inflation assembly is mounted on the brass manifold on the buoyancy chamber.

077-2.3.3.1.3 Accessories included with this life preserver are identified in [Table 077-2-2](#). The toggle line, used for connecting survivors to flotation devices such as life lines and to other survivors, is tied to the waist belt.

077-2.3.3.2 Donning and Adjusting.

a. With life preserver rolled up in pouch, secure waist belt. Adjust belt to allow complete and free rotation of the

pouch around the waist for donning. Ensure that the pouch opening faces up. While not in use, wear the pouch at the small of the back (Figure 077-2-11).

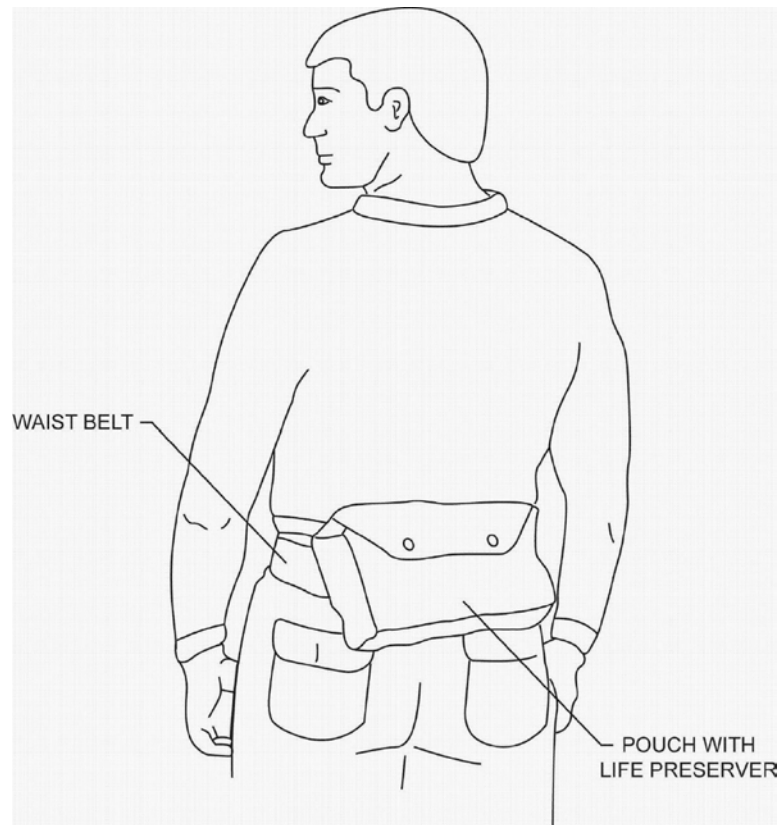


Figure 077-2-11. Abandon Ship Type Life Preserver Positioned at the Small of Back When Not in Use

- b. Rotate the pouch to the front and unfasten the pouch flap.
- c. Remove the life preserver from the pouch and unroll.
- d. Pass head through the life preserver collar.
- e. Ensure that the lower end of the preserver is out of the pouch.
- f. Stow the whistle and toggle line in the life preserver pouch. The life preserver is now in the operating position.

077-2.3.3.3 Instructions for Use. When general quarters is sounded, don life preserver with life preserver rolled up in pouch (refer to [paragraph 077-2.3.3.2, step a](#)). If relaxing of full battle dress is authorized by the Commanding Officer, and the preserver is removed, keep life preserver at hand. If the word is passed to prepare to abandon ship, don the life preserver in the operating position (refer to [paragraph 077-2.3.3.2, steps b through f](#)) and wait for the signal to abandon ship.

### WARNING

**Never inflate the life preserver before entering the water.**

077-2.3.3.3.1 After receiving the signal to abandon ship, follow the abandon ship procedure in [paragraph 077-2.4.2](#). Following entry into the water, pull the inflator lanyard down to inflate the life preserver.

077-2.3.3.3.2 Use the toggle line to attach yourself to other flotation devices or to other survivors. Loop the wooden handle around object to be attached to, such as an adjacent survivor's life preserver belt, and pass the handle back through the retaining loop on the line.

077-2.3.3.3.3 Oral inflation of this life preserver is required if the CO<sub>2</sub> inflation system fails or if additional inflation is desired. To accomplish this, follow the procedure outlined in [paragraph 077-2.3.2.3.3](#).

077-2.3.3.4 Removing the Life Preserver. The abandon-ship life preserver is removed and repacked as follows:

- a. Deflate preserver, if needed.
- b. Lift deflated preserver over head and unbuckle waist belt.
- c. Allow life preserver to dry and air out.
- d. If life preserver was manually inflated, replace the CO<sub>2</sub> cylinder.
- e. Roll preserver up and stow in pouch.
- f. Wrap toggle line around wooden toggle and stow in pouch. Stow remaining life preserver accessories within the pouch.
- g. Close pouch snaps.
- h. Stow in an appropriate location as discussed in [paragraph 077-2.3.4](#).

077-2.3.4 STOWAGE OF INFLATABLE LIFE PRESERVERS. Stow inflatable preservers in ready-use lockers. Prior to stowage, dry and air out the life preservers. Stow them in a cool, dry place out of direct sunlight and between 0° C (32° F) and 38° C (100° F). A dry place is one where water or condensation does not come in contact with the stowed preservers. Heat, moisture, and light can cause the deterioration of coated cloth and thread materials used in the construction of life preservers. Keep spare CO<sub>2</sub> cylinders free of moisture.

**WARNING**

**Do not stow spare CO<sub>2</sub> cylinders or life preservers equipped with CO<sub>2</sub> cylinders near steam lines or radiators. The heat from the steam lines or radiators could cause cylinders to explode, resulting in injury or death to personnel.**

077-2.3.4.1 Avoid sharp edges in stowage. They will increase life preserver wear and tear and may also puncture inflatable buoyancy chambers. A punctured chamber will not become buoyant, causing injury or loss of life.

077-2.3.5 MAINTENANCE OF INFLATABLE LIFE PRESERVERS. Conduct regularly scheduled preventive maintenance of inflatable life preservers and accessories in accordance with PMS requirements. PMS requirements include pre-use inspections, periodic leakage tests, functional tests, and repair procedures. Damaged preservers shall be repaired or replaced immediately. Torn or punctured buoyancy chambers shall be replaced and not repaired. Conax automatic inflators that have actuated automatically shall be replaced and discarded since the automatic actuation mechanism can be fired only once; however, chemical-pill auto inflation assembly can be actuated multiple times. The automatic inflators should not be removed from bladder manifolds except to replace the inflator. The MK-1 life preserver cover is designed to allow removal of the bladder without removing the inflation assembly from the bladder manifold.



**077-2.4 GENERAL COMMENTS - ALL LIFE PRESERVERS.**

077-2.4.1 PRECAUTIONS. Remember, the life preserver can only save your life if it is used correctly and safely. Follow all safety requirements and restrictions on use.

- a. Do not use life preserver for other than its intended purpose. For example, using it as a pillow or cushion could damage the cover, flotation pads, or buoyancy chamber. This will leave a useless life preserver when needed.
- b. Always keep life preservers clean and neatly stowed in the proper location when not in use.
- c. Ensure all required accessories, identified in [Table 077-2-2](#), are on the life preserver.
- d. Life preserver webbing and straps have a purpose. Be sure to know what those purposes are, and do not proceed to the station without securing them. Dangling webbing and straps can snag easily, causing injury.

077-2.4.2 ABANDON-SHIP PROCEDURE. If ordered to abandon a sinking ship, wear the abandon-ship inflatable life preserver with pouch.

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**WARNING**

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**Never inflate an inflatable preserver before entering the water.**

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**WARNING**

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**Do not abandon a ship surrounded by flames with the MK-1, or an inherently buoyant preserver donned. These life preservers will not permit the wearer to swim underwater, below the flames. If it is not possible to obtain an inflatable abandon ship life preserver, an inherently buoyant type, or MK-1 preserver may be used for abandoning a sinking ship if it is not surrounded by flames.**

- a. When possible, leave the ship on the windward side and from the point closest to the water so that the ship and any burning fuel will drift away. Use an abandon ship ladder to lower yourself into the water. If a ladder is not available, a well-secured line or firehose may be used.
- b. Completely adjust life preservers for injured personnel before they enter the water. Lower injured personnel into the water.
- c. If there is a need to jump, instead of lowering yourself into the water, securely fasten the life preserver and keep it close to the body. This is accomplished by folding arms across the chest and gripping the life preserver with the fingers. This prevents the life preserver from riding up and striking the chin or neck. Keep body erect and legs held together and crossed when jumping. If necessary to jump into burning water, place one hand over mouth with palm under chin and fingers split over nose. The other hand is placed on life preserver collar to keep it from riding up.
- d. Once in the water, swim away from the ship as rapidly as possible. If there is debris and oil in the water, use

the breast stroke to clear a path. If space is available, climb into a lifeboat or life raft. If there is no room in the rafts or boats, use a safety line or toggle line to attach life preserver to a raft, boat, or other personnel in the water wearing life preservers.

- e. If underwater explosions are occurring in the area, keep the head and chest out of the water and swim or float on the back. This will prevent injury to vital parts of the body such as eardrums, lungs, sinuses, and abdomen.

## **077-2.5 LIFE PRESERVER ACCESSORIES.**

**077-2.5.1 TYPES.** Life preserver accessories are used for locating personnel in the water. The accessories that are attached to the various life preservers are shown in [Table 077-2-2](#) Small items like whistles and distress marker lights may not seem important until one has gone overboard. Keep life preserver accessories attached to the life preserver. The following paragraphs discuss these accessories.

**077-2.5.2 DISTRESS MARKER LIGHTS.** Distress marker lights are attached to life preservers to provide a means for detecting persons on the surface of the water at night. The authorized distress marker lights for each type of life preserver are listed on the appropriate life preserver AELs. When the life preservers are donned, the distress marker light shall be attached high on the shoulder or on the cranial helmet (for flight deck personnel, refer to [paragraph 077-2.5.2.2](#)).

**077-2.5.2.1 Distress Marker Light Location.** The inherently buoyant vest type, the abandon ship type, and the MK-1 vest type life preservers have a loop or hook and pile tape provided for attaching the distress marker light. The MK-1 life preserver distress marker light is stowed with the light facing up in the distress marker light pouch. A lanyard tied to the light and to grommets on the pouch is wrapped around the light when stowed in the pouch.

**077-2.5.2.2 Distress Marker Light Attachment.** If hook tape is not already attached, attach hook tape to the distress marker light for attaching it to the flight deck cranial helmet. The procedure for attaching the hook tape and pile tape using adhesive is as follows:

- a. Apply adhesive to the unmarked side of the light and underside of the hook tape.
- b. Allow adhesive to become tacky, and press hook tape firmly onto prepared area.
- c. Apply adhesive to 2-inch by 2-inch area on left side of front cranial impact shell assembly between reflective tape and edge of shell assembly. Apply adhesive to underside of pile tape.
- d. Allow adhesive to become tacky, and press pile tape firmly onto prepared area.

**077-2.5.2.3 Operating Instructions.** Lights are activated by a thumb switch.

**077-2.5.2.4 Maintenance.** Test and inspect distress marker lights in accordance with PMS requirements. Repair or replace any distress marker lights requiring maintenance.

**077-2.5.3 CHEMICAL LIGHTS.** Chemical lights contain separated chemicals which produce light when mixed. The length of time the light lasts and how intense it illuminates depends on the temperature. The effectiveness of chemical lights is diminished at water temperatures below 50 °F. These lights can only be used once. There are two types of chemical lights approved for use on life preservers:

- a. Chemical Light Stick.
- b. Personnel Marker Light.

077-2.5.3.1 Chemical Light Sticks. Chemical light sticks can be used to supplement distress marker lights on life preservers. They shall be lighted for underway replenishment operations at night. The green light produced inside the tube will last 3 to 12 hours. The chemical light stick consists of a plastic tube filled with a green fluorescent compound. A vial of activating compound is suspended in the fluorescent compound.

077-2.5.3.1.1 To activate the chemical light stick:

- a. Remove from sealed foil wrapper.
- b. Bend tube. This will break the activating vial.
- c. Shake well to mix compounds together.
- d. Attach the light stick with a lanyard to the loop provided on the left shoulder of the life preserver. For the MK-1 vest, attach the light to the grommets on the distress marker light pouch.

077-2.5.3.1.2 The chemical light stick also comes in red, blue, and yellow colors. These colored light sticks are approved for marking equipment. The red and blue light sticks are used at night during underway replenishment and the yellow is used in damage control operations.

077-2.5.3.2 Personnel Marker Lights. U.S. Coast Guard approved chemical PMLs can be used in place of distress marker lights on life preservers. The yellow-green light is visible up to 8 hours for approximately one mile on a clear night. The PML consists of a plastic light tube. The light tube is protected by a black plastic sleeve and is equipped with an actuating handle. Inside the tube are fluorescent compounds and suspended glass vials of activating compounds. The PML has a safety pin for attaching it to the life preserver.

077-2.5.3.2.1 To activate the PML:

- a. Squeeze handle to break the suspended vials of activating compounds.
- b. Remove black sleeve.
- c. If the PML does not light, squeeze the handle again.
- d. Attach the PML to the loop provided on the left shoulder of the inherently buoyant vest type and abandonment type life preservers.

077-2.5.3.3 Stowage of Chemical Lights. The shelf life of the chemical light stick is about 2 years and the shelf life of the PML is about 3 years. For such a long stowage time to be achieved, the storage temperature should not exceed 52° C (125° F), and the original shipping package should be intact.

077-2.5.3.4 Maintenance of Chemical Lights. Inspect chemical lights in accordance with PMS requirements. Dispose of used lights and replace. Replace unused light sticks on a regular basis according to the expiration date. Light sticks that have exceeded their shelf life can be used in repair lockers for damage control exercises.

077-2.5.4 WHISTLES. The life preservers equipped with whistles are indicated in [Table 077-2-2](#). The whistle is used to guide rescuers.

077-2.5.4.1 Construction. Life preserver whistles are of olive drab plastic police-type or orange, flat- type construction. The MK-1 life preservers are required to be equipped with the flat, orange whistle. All other preservers may use the orange whistle as an option.

077-2.5.4.2 Secure Attachment. With the exception of the inflatable MK-1 life preservers, whistles are attached to the distress marker light loop by a lanyard or cord. The orange whistle is secured to the MK-1 life preservers with a lanyard or cord and stowed in a pocket when not in use. The lengths of the lanyard and the attachment methods are provided in PMS requirements.

077-2.5.4.3 Maintenance. Inspect the whistle in accordance with PMS requirements. If the whistle doesn't work or is damaged, replace it immediately.

077-2.5.5 REFLECTIVE TAPE. Inspect all inherently buoyant (except yoke type) life preservers, inflatable MK-1 life preservers, and ring buoys in accordance with PMS requirements to determine condition of the reflective tape.

#### NOTE

Do not add / replace reflective tape on commercial life preservers.

077-2.5.6 SEA DYE MARKER. MK-1 and inherently buoyant life preservers are equipped with a sea dye marker (NSN 6850-00-270-9986) as indicated in [Table 077-2-2](#). Ensure that the sea dye marker is attached to life preservers. The sea dye marker is used during daylight.

077-2.5.6.1 Maintenance. Inspect the sea dye marker for damage and deterioration each time the MK-1 or inherently buoyant life preserver is donned. Ensure that the packet is sealed and securely attached to the life preserver. Perform maintenance on the sea dye marker in accordance with PMS requirements.

### 077-2.6 AUXILIARY EQUIPMENT.

077-2.6.1 TYPES. The auxiliary equipment used by the Navy is intended to save lives. In addition to life preservers, the following auxiliary life saving equipment is also available to ship's force:

- a. Inherently buoyant ring buoys, with and without lights.
- b. Inflatable ring buoys.
- c. Retrieving lines.

077-2.6.1.1 These auxiliary life saving devices are located at designated areas throughout the ship.

077-2.6.1.2 A training program should be instituted aboard all ships to acquaint ship's force in the use, handling, and stowage locations of all ring buoys and associated life saving devices. This training program should stress reliance on the equipment available and of dangers that can arise from pilferage of such items as float lights and retrieving lines.

077-2.6.1.3 The training program should include instructions on the following:

- a. Tossing the inherently buoyant ring buoy.
- b. Two handed toss of the ring buoy with light.
- c. Overboard drop technique for ring buoy with light.
- d. Tossing of the inflatable ring buoy.

077-2.6.2 INHERENTLY BUOYANT RING BUOYS AND RING BUOYS WITH LIGHTS. Inherently buoyant ring buoys are available with or without lights. Ring buoys with lights are used as floating distress signals. Inherently buoyant ring buoys are available in three different sizes. The dimensions are given in [Table 077-2-3](#).

**Table 077-2-3. Dimensions Of Inherently Buoyant Ring Buoy**

<b>Dimensions (Inches)</b>		
<b>Size</b>	<b>A</b>	<b>B</b>
20-inch	20	11
24-inch	24	13
30-inch	30	17

077-2.6.2.1 Construction. Ring buoys are constructed of orange plastic material. A life line on the outer perimeter is attached to the ring at four locations by straps. Attach a retrieving line to the ring buoy life line. The length of the line shall suit the freeboard of the ship. The only markings on the ring buoys shall be the ship's name and hull number. The markings shall be distinguishable black block letters. Reflective tape shall be installed by ship's force. Use four pieces of 2-inch wide adhesive reflective tape 90 degrees apart on both sides of the ring buoy ([Figure 077-2-12](#)). Paint over the tape or remove it during wartime.

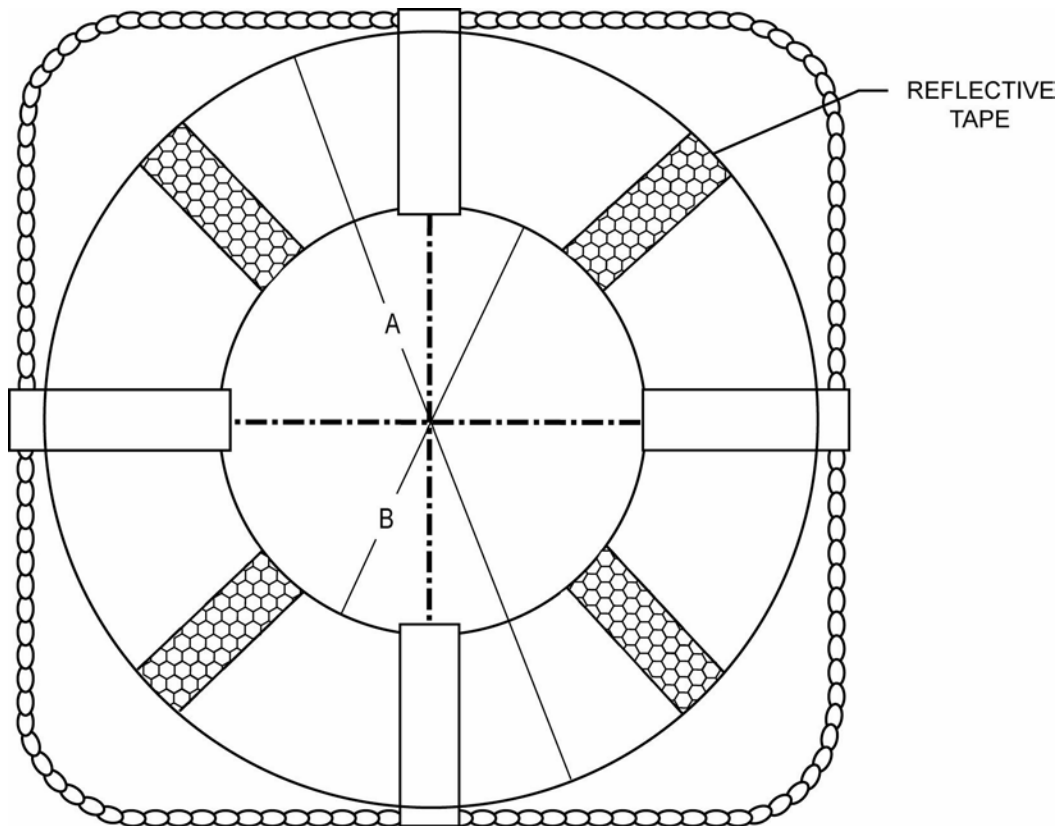


Figure 077-2-12. Inherently Buoyant Ring Buoy

**077-2.6.2.2 Ring Buoy with Light.** This is a standard inherently buoyant ring buoy with a light attached. This ring buoy is used as a floating distress signal. The ring buoy light will float upright in the water. The light is equipped with a magnetic switch which turns it on when upright in the water. A 4-foot lanyard of 1/4-inch diameter polyethylene line is used to attach the light to the ring buoy.

The light is self-contained, watertight, and vapor proof. The power source for the light is a battery inside the case. The ring buoy light has an orange plastic case which is 30-1/2 inches long. A clear dome-shaped lens is located on top and covers a lamp.

#### NOTE

A 2-inch wide strip of reflective tape should be placed completely around the light case near the lens.

**077-2.6.2.3 Stowage of Ring Buoys.** The buoy light and the mounting bracket for stowage are corrosion resistant. Ring buoys shall be available topside in the quarterdeck area, to personnel working over the side, and on paint floats alongside the ship. Stow ring buoys with lights at all man-overboard and replenishment stations. On submarines, provide ring buoys topside when surfaced for a prolonged period of time.

**077-2.6.2.3.1** Locate ring buoys on the inboard side of life railings, bulwarks, and life lines. It is desirable that ring buoys be located where sheltered from salt water and severe weather conditions.

077-2.6.2.3.2 If the ring buoy has a light attached, stow the light inverted in the mounting bracket provided. This causes the magnetic switch to open, turning the light off. The bracket is designed so the ring buoy light will release with a pull of 20 to 40 pounds of force.

077-2.6.2.4 Maintenance of Ring Buoys. Conduct regularly scheduled maintenance of ring buoys and retrieving lines in accordance with PMS requirements. Immediately repair or replace damaged ring buoys. The retrieving line should be neatly coiled so that it is easily uncoiled for use. The coil should be lashed with an easily broken cotton line.

077-2.6.2.5 Battery Replacement. Ring buoy light batteries should be replaced in accordance with PMS requirements. When the battery is changed, ensure the rubber gasket was replaced before screwing the lens tightly into place.

077-2.6.3 INFLATABLE RING BUOYS. This ring buoy inflates to a 21-inch ring buoy. The inflatable ring buoy is contained in a pouch which can be thrown (football style) with reasonable accuracy up to approximately 60 feet. Inflation is achieved with a water activated, automatic CO<sub>2</sub> inflation system. The buoy can also be manually activated. An oral inflation tube is provided if the CO<sub>2</sub> inflation system fails or additional inflation is desired. It is carried, in addition to the standard ring buoy, in boats and at deck recovery and quarterdeck watch stations.

077-2.6.3.1 Operating Instructions. Throw the ball-shaped pouch up wind or up current of the person needing help so that it will drift toward the person. Avoid throwing the pouch directly at the person. The ring buoy may hit the person and cause injury.

077-2.6.3.2 Stowage. Stow the inflatable ring buoy in ready-use lockers in boats and at deck recovery and quarterdeck watch stations.

077-2.6.3.3 Maintenance. Conduct regularly scheduled maintenance of the inflatable ring buoy and pouch in accordance with PMS requirements. Immediately repair or replace damaged ring buoys.





## SECTION 3 BREATHING APPARATUS AND EQUIPMENT

### 077-3.1 INTRODUCTION.

077-3.1.1 This section covers the following respiratory protection equipment:

- a. Self-Contained Breathing Apparatus (SCBA)
- b. Oxygen Breathing Apparatus (OBA)
- c. Emergency Escape Breathing Device (EEBD)
- d. Emergency Air Breathing (EAB) Stations and EAB Mask
- e. Supplied Air Respirator With Backup Self-Contained Breathing Apparatus (SAR/SCBA).

077-3.1.2 Each piece of equipment is described along with its intended purpose, and directions are provided for use and care. [Table 077-3-1](#) summarizes the situations for which the equipment is approved for use. Unless specifically authorized by [Table 077-3-1](#), use only respiratory protection equipment approved by the National Institute for Occupational Safety and Health (NIOSH) and only for the purpose and exposures for which the equipment is tested and approved. The definitions in [paragraphs 077-3.1.3](#) and [077-3.1.4](#) apply to the situations covered in [Table 077-3-1](#).

077-3.1.3 An emergency or casualty situation is one requiring immediate action to prevent personnel injury or equipment damage. Examples are fire, flooding, and personnel rescue.

077-3.1.4 A non-casualty situation is one which does not require immediate action to prevent personnel injury or equipment damage. Examples are spray painting and entering a void space. An emergency or casualty situation may be downgraded to a non-casualty situation by the on-scene commander once the emergency or casualty has stabilized and there is no additional immediate action required to prevent personnel injury or equipment damage.

**Table 077-3-1.** Authorized Breathing Devices

Breathing Device	NIOSH Approval Required (Note 1)	Approved for Use in the Following Situations (Note 2)	
		Emergency / Casualty	Non-Casualty
*SCBA ( <a href="#">paragraph 077-3.2</a> )	No	Yes (Note 4)	Yes (Note 3)
*OBA ( <a href="#">paragraph 077-3.3</a> )	Yes	Yes (Note 4)	Yes (Note 3)
EEBD ( <a href="#">paragraph 077-3.4</a> )	No	Yes (Note 6)	No
Air-Supplied Respirators *EAB - Submarine ( <a href="#">paragraph 077-3.5</a> )	No	Yes (Note 5)	No
SAR / SCBA ( <a href="#">paragraph 077-3.6</a> )	Yes	Yes (Note 4)	Yes (Note 3)

**Table 077-3-1. Authorized Breathing Devices - Continued**

Breathing Device	NIOSH Approval Required (Note 1)	Approved for Use in the Following Situations (Note 2)	
		Emergency / Casualty	Non-Casualty
<p>Note 1. If “Yes” is indicated below, the specific respiratory equipment must be approved by the NIOSH. NIOSH approved equipment is physically marked to indicate approval.</p> <p>Note 2. The situations listed below are defined in <a href="#">paragraphs 077-3.1.3</a> and <a href="#">077-3.1.4</a>.</p> <p>Note 3. In a non-casualty situation involving a known or potential Immediately Dangerous to Life and Health (IDLH) atmosphere, the following priority shall be observed when selecting a respirator. IDLH atmospheres are defined in NSTM S9086-CH-STM- 030, Chapter 074, Volume 3, Gas Free Engineering.</p> <ol style="list-style-type: none"> <li>1. SAR / SCBA</li> <li>2. SCBA</li> <li>3. OBA</li> </ol> <p>Note 4. In an emergency / casualty situation involving a known or potential IDLH atmosphere, the following priority shall be observed when selecting a respirator:</p> <ol style="list-style-type: none"> <li>1. SAR / SCBA</li> <li>2. SCBA</li> <li>3. OBA</li> </ol> <p>Note 5. Used to take immediate action until relieved by damage control personnel wearing SCBAs or OBAs. Used whenever the atmosphere is contaminated by smoke, toxic fumes, airborne radioactive contamination, or dust.</p> <p>Note 6. Used to escape from atmospheres where respiratory protection is necessary.</p>			

**077-3.1.5** Immediately Dangerous to Life and Health (IDLH) is defined in **NSTM S9086-CH-STM-030, Chapter 074, Volume 3, Gas Free Engineering.**

**077-3.1.6** In non-casualty situations, a Gas Free Engineer shall carefully evaluate all exposures or potential exposures before proper respiratory protection equipment is selected.

**077-3.1.7** All personnel using respiratory protection equipment in non-casualty situations shall be medically qualified and fit-tested in accordance with the requirements in Chapter B6 of Chief of Naval Operations Instruction (OPNAVINST) 5100.19B, Naval Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat. Emergency team personnel shall be trained in the use of the SCBA and properly sized for the correct fitting mask. Emergency team personnel do not require fit-testing. Mask sizing is performed using the negative pressure check that is performed during normal mask donning procedures.

### **077-3.2 SELF-CONTAINED BREATHING APPARATUS (SCBA).**

**077-3.2.1 OVERVIEW.** The SCBA and ancillary equipment replaced the OBA currently used onboard U.S. Navy ships and submarines. The surface ships have 30- and 45-minute SCBAs. Mobility evaluations were conducted through a series of shipboard mazes with the 30- and 45-minute SCBAs for endurance, egress, work rate, and mobility. The SCBA with a 45-minute cylinder is best when initially used by the Attack Team or members doing higher work rates. The SCBA with 30-minute cylinder is best when initially used by investigator, boundaryman, rapid response personnel, and personnel moving in difficult access and egress areas that are obstructed or difficult to get around. Resupply of air to personnel is either by quick-filled or changing out to full fresh cylinder. Depending on how tired the person is, the cylinder can be switched between a 30- cylinder and a 45-minute cylinder. Many times a person will feel fresher wearing a lighter weight cylinder. The goal is to be flexible, adaptable, and have the endurance to last as long as possible in a hazardous environment. The SCBA enables the user to go on and off air to conserve air in the cylinder, a feature not found in OBA. Submarines have only 30-minute cylinder SCBAs because of the tight maneuvering area onboard and access limitation. Resupply of air

to personnel in submarines is either through the charging station or changing out to full cylinder. The SCBA is a positive pressure, open-circuit, self-contained breathing device and supported with a variety of charging equipment, which provides breathing quality air to ships' damage control and firefighting personnel. All SCBAs are NIOSH approved and National Fire Protection Association (NFPA) compliant. The SCBA configuration was chosen to replace the OBA for the following reasons:

- a. The SCBA significantly upgrades the mobility and effectiveness of ship's damage control and firefighting personnel.
- b. The SCBA meets or exceeds all modern safety standards established by the NIOSH and NFPA.
- c. The SCBA is compatible with equipment used by most commercial firefighting organizations.
- d. The use of the SCBA eliminates the current problems associated with OBA chemical canister, stowage, use, and disposal.

### WARNING

**The SCBA provides positive pressure to the facepiece for the respiratory protection while performing work in objectionable, oxygen deficient, and / or unbreathable (toxic) atmospheres. The SCBA is to be used only by persons trained in the use of the respirator and only in conjunction with an organized respiratory protection program. The SCBA is not to be used for purposes other than that authorized by the shipboard respiratory protection program. The SCBA is not designed for, and must not be used, underwater.**

For additional details on the SCBA and its associated charging equipment, see available technical manuals and resources:

- a. Naval Sea Systems Command (NAVSEA) S6220-EN-MMO-010, Self-Contained Breathing Apparatus (SCBA) Scott Air-Pak 4.5 Technical Manual
- b. NAVSEA S6226-PD-MMO-010, Self-Contained Breathing Apparatus (SCBA) Breathing Air Charging System (BACS) Technical Manual
- c. NAVSEA S6220-EM-MMO-010, Breathing Air Compressor (BAC) Technical Manual
- d. Ships' System Manuals for Submarine High Pressure Air Systems (various)
- e. Damage Control and Fire Protection Engineering Website ([www.dcfp.navy.mil](http://www.dcfp.navy.mil))

**077-3.2.2 DESCRIPTION.** The SCBA system is comprised of SCBA backpack and additional spare air cylinders, plus any of the following depending upon individual ship configurations: fixed air charging stations, high pressure filter assemblies, air booster pumps, and a portable diesel and / or electric compressor as illustrated in [Figures 077-3-1](#) through [077-3-3](#).

**077-3.2.2.1** The SCBA ([Figure 077-3-1](#)) is an atmosphere-supplying respirator that supplies a breathable air source that is independent of the ambient environment and designed to be carried by the user. [Table 077-3-2](#) provides a quick reference for all four SCBA configurations that are found in the Navy's inventory. The basic SCBA consists of five major components: cylinder assembly for storing compressed breathing air, a backframe and har-

ness assembly to support the weight of the equipment, a redundant dual-path pressure reducer mounted on the backframe, a positive-pressure mask-mounted regulator fed by a low-pressure hose assembly, and a facepiece.

077-3.2.2.2 All SCBA configurations are NIOSH approved and NFPA compliant. SCBA Configuration 4 is also Chemical, Biological, Radiological, and Nuclear (CBRN) NIOSH approved.

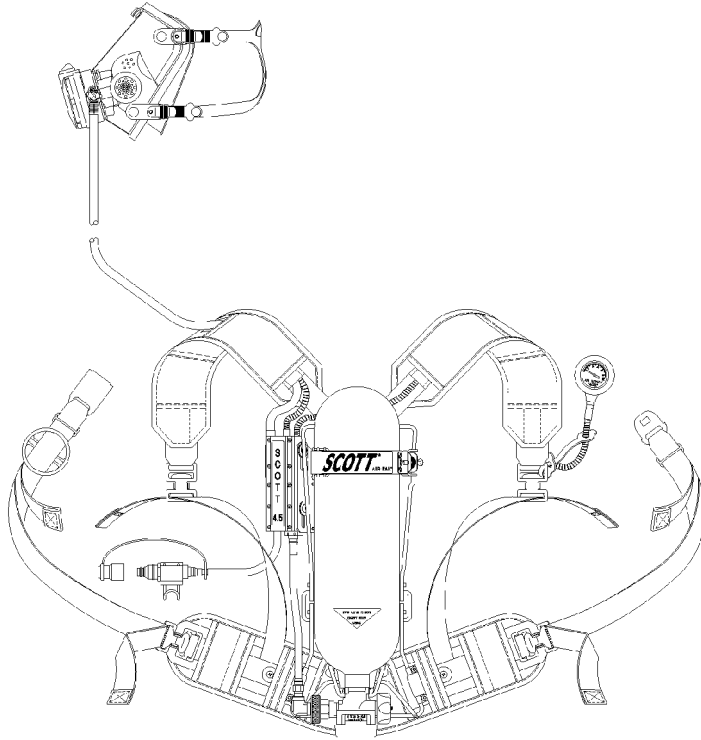


Figure 077-3-1. Self-Contained Breathing Apparatus (SCBA)

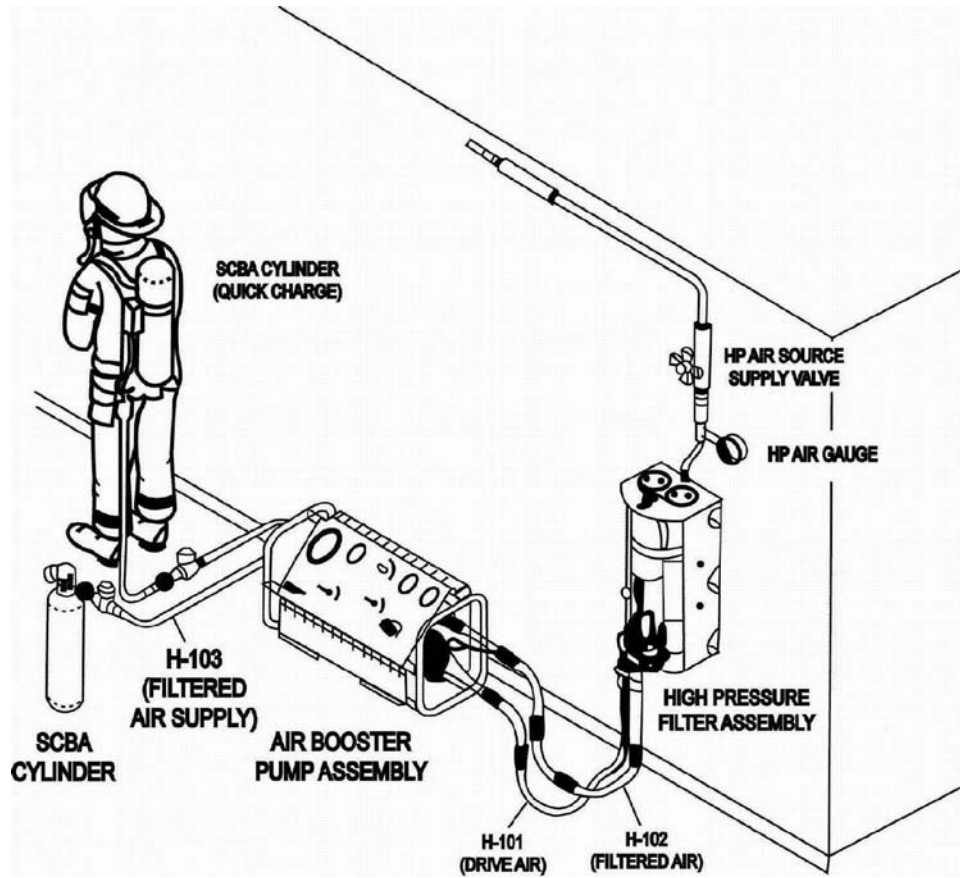


Figure 077-3-2. SCBA Breathing Air Charging System (BACS)

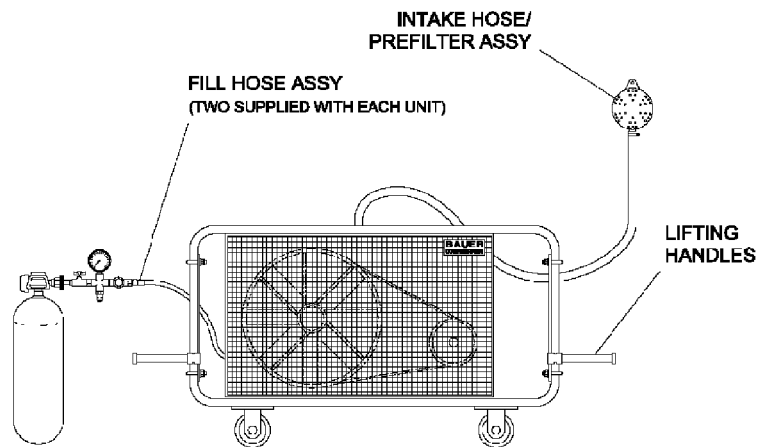


Figure 077-3-3. Breathing Air Compressor (BAC)

**Table 077-3-2.** SCBA Configuration Quick Reference

SCBA Configuration	Component / Approval / Compliance
1	1. 30- or 45-minute Fiberglass Cylinder Assembly 2. Backframe and Harness Assembly 3. Pressure Reducer 4. Quick-Charge Coupling 5. Mask-Mounted Regulator with Vibralert® 6. AV-2000® Facepiece* 7. Remote Pressure Indicator 8. High-Pressure Hose Assembly 9. NIOSH 42 Code of Federal Regulations (CFR) Part 84 Approved 10. NFPA 1981, 1992 Edition Compliant 11. NIOSH Approved
2	1. SCBA Configuration 1 Components / Approval / Compliance 2. Configuration Variations: <ol style="list-style-type: none"> <li>a. Bell Alarm Assembly (additional component)</li> <li>b. NFPA 1981, 1997 Edition Compliant instead of NFPA 1981, 1992 Edition Compliant</li> <li>c. NIOSH Approved</li> </ol>
3	1. SCBA Configuration 1 Components / Approval / Compliance 2. Configuration Variations: <ol style="list-style-type: none"> <li>a. 30- or 45-minute Carbon-Fiber Cylinder Assembly replaces 30- or 45-minute Fiberglass Cylinder Assembly</li> <li>b. Bell Alarm Assembly (additional component)</li> <li>c. NFPA 1981, 1997 Edition Compliant instead of NFPA 1981, 1992 Edition Compliant</li> <li>d. NIOSH Approved</li> </ol>
4	1. SCBA Configuration 1 Components / Approval / Compliance 2. Configuration Variations: <ol style="list-style-type: none"> <li>a. 30- or 45-minute Carbon-Fiber Cylinder Assembly replaces 30- or 45-minute Fiberglass Cylinder Assembly</li> <li>b. Mask-Mounted Regulator with Vibralert® and Heads-Up Display (HUD) replaces Mask-Mounted Regulator without HUD</li> <li>c. Rapid Intervention Crew Universal Air Connection (RIC UAC) Assembly replaces High-Pressure Hose Assembly</li> <li>d. Quick-Charge Coupling is integrated into RIC UAC Assembly</li> <li>e. AV-3000® Facepiece*</li> <li>f. NFPA 1981, 2002 Edition Compliant instead of NFPA 1981, 1992 Edition Compliant</li> <li>g. NIOSH CBRN Approved</li> </ol>

\*Denotes the facepiece model shipped with a new SCBA. However, all configurations will support use of either the AV-2000® or AV-3000® facepiece.

077-3.2.2.3 Cylinder Assembly. The cylinder assembly (Figure 077-3-4), when charged to 4,500 pounds per square inch gauge (psig), provides the user with a breathable air source for a rated duration of either 30 or 45 minutes.

- a. Cylinder. The SCBA uses two types of cylinders: composite fiberglass-filament wrapped over an aluminum liner (Configurations 1 and 2) and composite carbon-fiber wrapped over an aluminum liner (Configurations 3 and 4). All cylinders are constructed of a forged-aluminum body, are epoxy-coated, and available in two sizes. SCBA cylinders are required to have decals displaying information on the latest cylinder hydrostatic test dates.

These decals assist the operator in ensuring the cylinder inspection is current (within three years for fiberglass-wrapped cylinders or within five years for carbon-fiber wrapped cylinders).

- b. **Cylinder Valve.** The cylinder valve is both a charging point for the cylinder and a connection point for either the high-pressure hose assembly or the RIC UAC assembly. A built-in dual-reading pressure indicator displays current cylinder air pressure at all times. A handwheel provides control over the release of compressed air from the cylinder, and an elastomeric bumper on top of the cylinder valve protects internal cylinder valve mechanisms.
- c. **Burst Disc.** The copper burst disc is a critical safety feature of the SCBA, and is designed to rupture if an inadvertent over-pressurization (7,200 psig) of the cylinder is experienced.
- d. **Hanger Plate.** The hanger plate is mounted on the cylinder assembly and is used to position, support, and lock the cylinder assembly to the backframe.

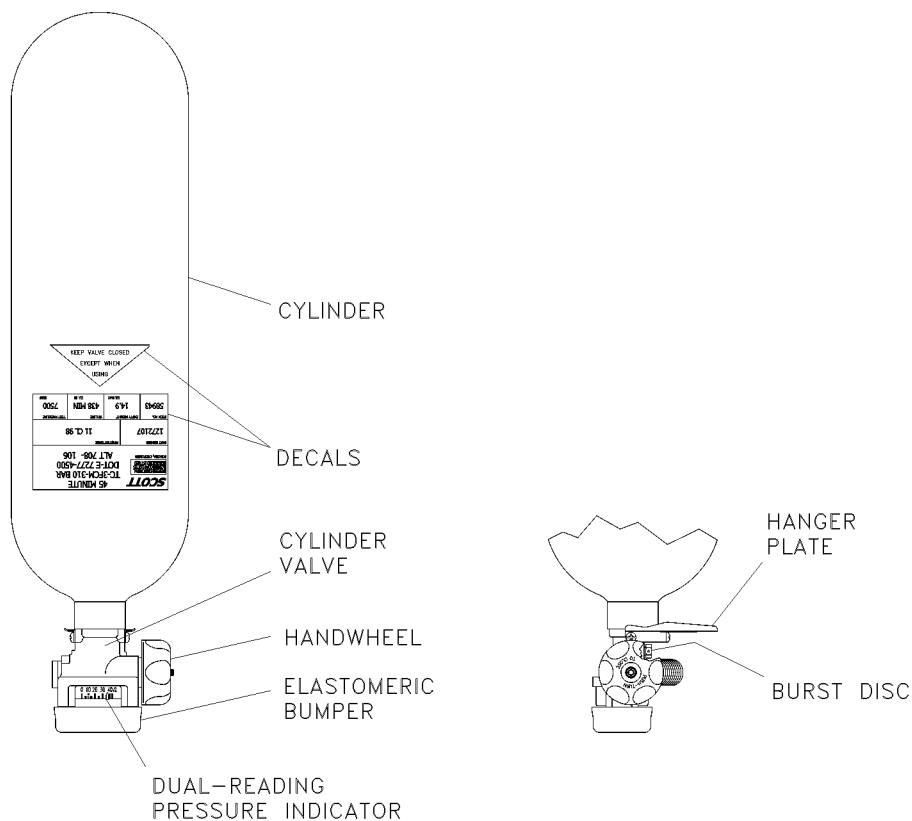


Figure 077-3-4. Cylinder Assembly Major Components

077-3.2.2.4 **Backframe and Harness Assembly.** The backframe and harness assembly (Figure 077-3-5) holds the cylinder assembly securely in place and provides for proper weight distribution of the SCBA while being worn.

- a. **Backframe.** The backframe is made of corrosion-resistant wireframe and includes a cylinder band clamp, an over-center latch mechanism that holds the dome end of the cylinder assembly securely in place, and a locking tab that engages to the hanger plate on the cylinder assembly. The design of the backframe allows the user, with the aid of an assistant, to quickly remove and replace a cylinder assembly without first doffing the SCBA. A mounting plate holding the pressure reducer is attached to the backframe.

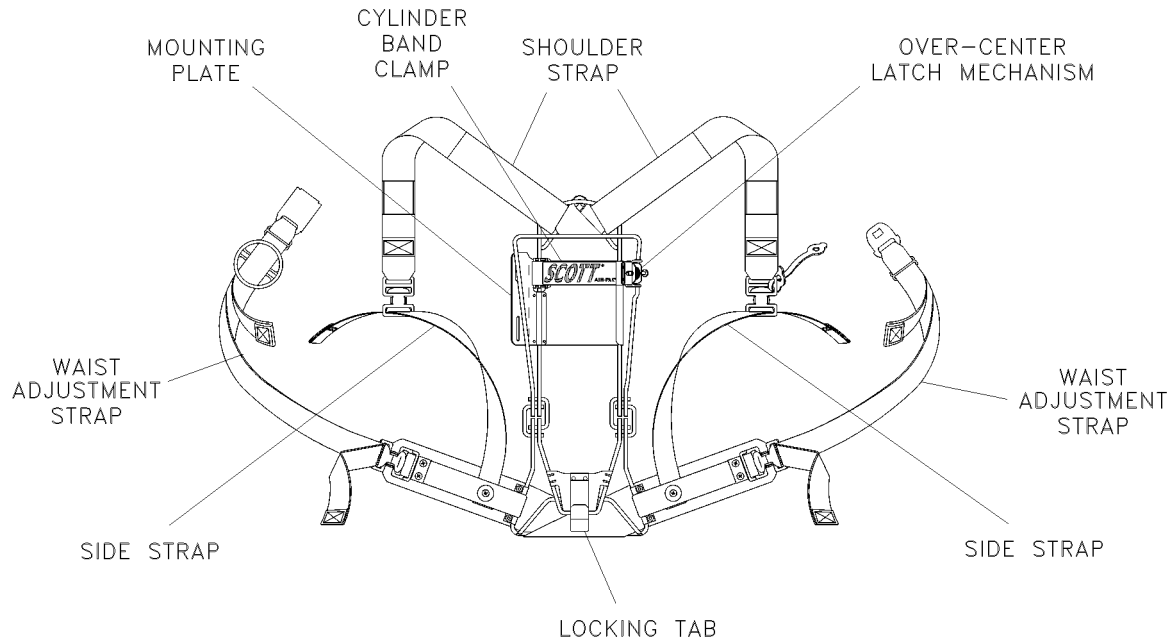


Figure 077-3-5. Backframe and Harness Assembly Major Components

- b. **Harness Assembly.** The harness assembly is attached at the top and bottom of the backframe. The harness assembly is designed to position most of the SCBA weight on the hips. Adjustable waist and side straps allow for a comfortable fit and proper distribution of the weight of the SCBA.
  1. **Pressure Reducer.** The pressure reducer (Figures 077-3-6 and 077-3-7) is a multifunctional component that is attached to the backframe on a mounting plate and, depending upon the SCBA configuration, couples to the cylinder valve through either a high-pressure hose assembly or a RIC UAC assembly.
    - (a) Internally, the pressure reducer has primary and secondary paths that reduce input pressure to nominally 100 psig and 150 psig, respectively. When cylinder pressure drops to approximately 1,000 to 1,250 psig, the secondary path is activated, causing end-of-service-time indicators to actuate. The outlet manifold of the pressure reducer incorporates a repeatable over-pressurization relief valve that prevents the attached low-pressure hose and mask-mounted regulator from being subjected to excessively high pressure.
    - (b) The pressure reducer also supports a high-pressure hose assembly (Configurations 1, 2, and 3), a quick-charge assembly (Configurations 1, 2, and 3), a RIC UAC assembly (Configuration 4), and a bell alarm (Configurations 2 and 3). On all SCBA configurations, the pressure reducer supports two other components: a mask-mounted regulator connected via a low-pressure hose and a remote pressure indicator connected via the quick-charge assembly mounting block or Visualert mounting block.



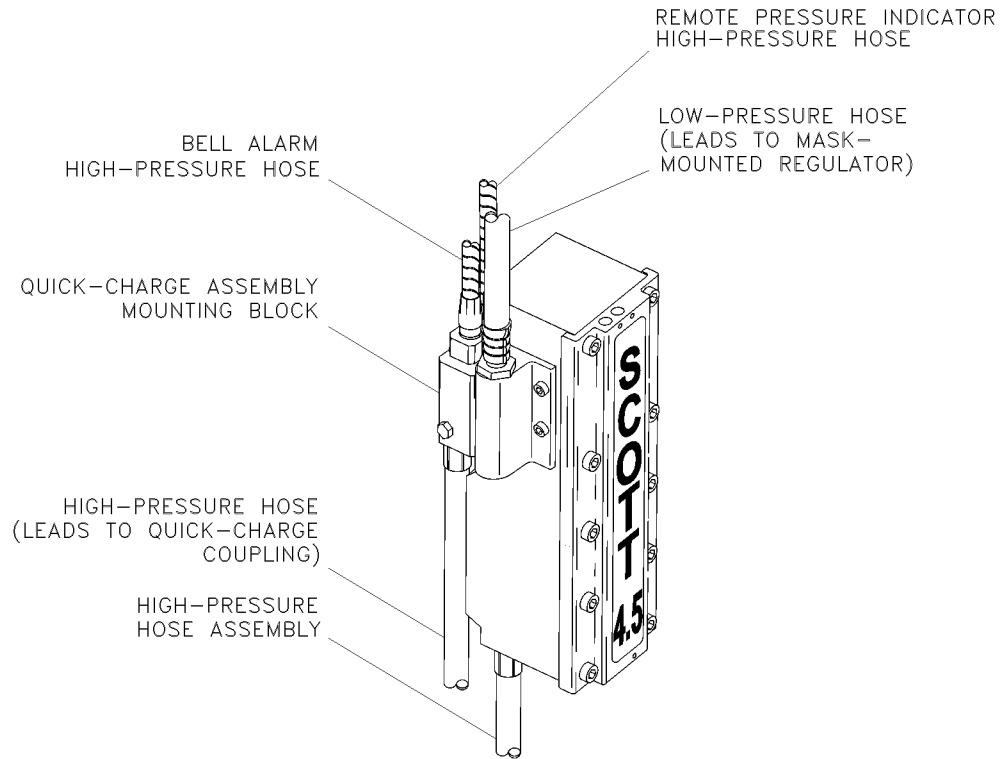


Figure 077-3-6. Pressure Reducer (Configurations 1, 2, and 3) Supported Components

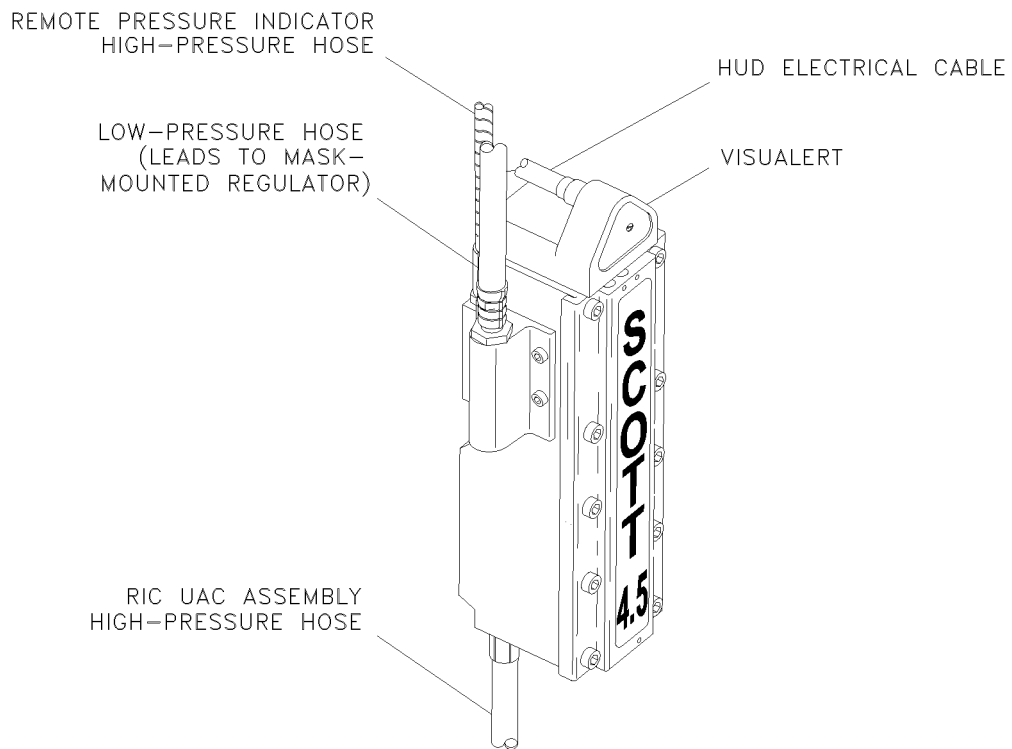


Figure 077-3-7. Pressure Reducer (Configuration 4) Supported Components

2. High-Pressure Hose Assembly. The high-pressure hose of the high-pressure hose assembly (Figure 077-3-8) directs high-pressure air from the cylinder valve to the pressure reducer during normal operation on SCBA Configurations 1, 2, and 3.

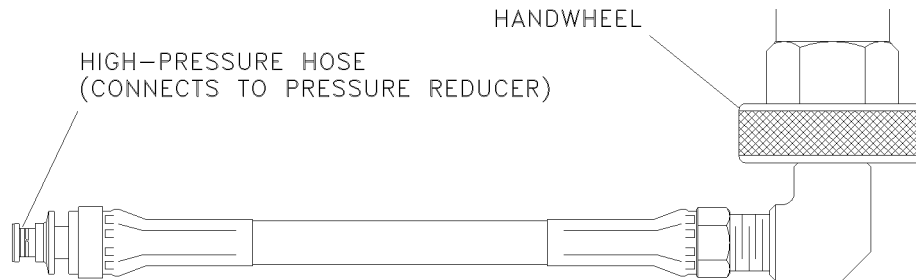


Figure 077-3-8. High-Pressure Hose Assembly

3. Quick-Charge Assembly. The quick-charge assembly (Figure 077-3-9) is mounted to the pressure reducer via the quick-charge assembly mounting block on SCBA Configurations 1, 2, and 3. The quick-charge coupling provides for recharging the cylinder with 4,500 psig Grade D compressed air without requiring removal of the cylinder. The quick-charge coupling is either located at the end of the quick-charge assembly hose, or is integrated into the RIC UAC assembly.

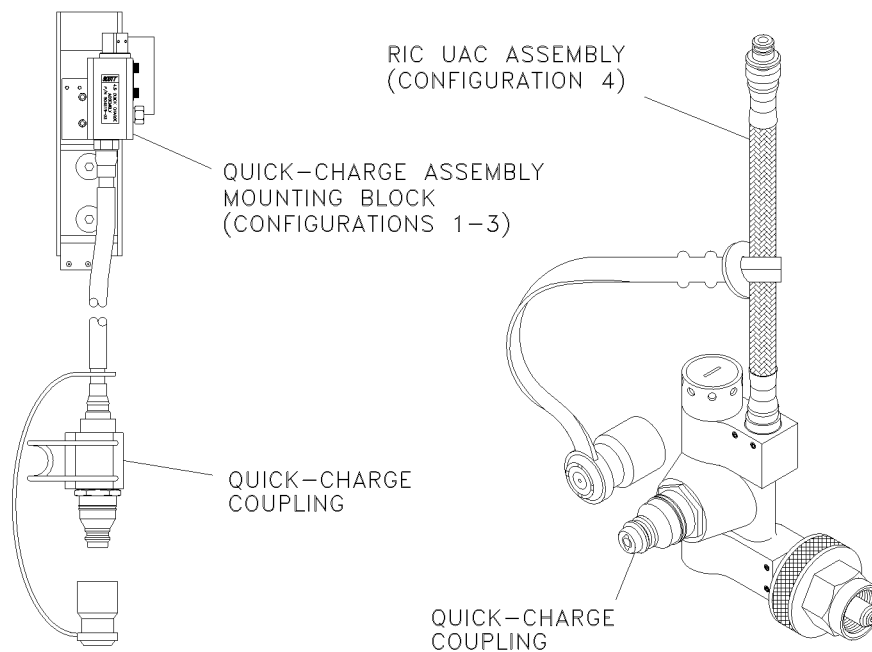


Figure 077-3-9. Quick-Charge Assembly and RIC UAC Assembly

4. RIC UAC Assembly. The RIC UAC assembly (Figure 077-3-9) directs high-pressure air from the cylinder valve to the pressure reducer during normal operation on SCBA Configuration 4. The RIC UAC assembly is equipped with a relief valve that will open at approximately 4,850 psig if the pressure of the emergency air supply exceeds the maximum pressure rating of 4,500 psig.
5. Bell Alarm. The bell alarm (Configurations 2 and 3) is located on the front, left shoulder strap of the harness assembly and is connected to the quick-charge assembly mounting block by a high-pressure hose. The bell alarm is an independent end-of-service-time indicator that provides an audible warning if cylinder air pressure falls below approximately 1,125 psig.
6. Remote Pressure Indicator. The remote pressure indicator is located on the right shoulder strap of the harness assembly and is connected to the quick-charge assembly mounting block or Visualert mounting block by a high-pressure hose. The remote pressure indicator has a luminescent face and when the cylinder valve

is open, provides the user a reading of cylinder air pressure in 500 psig increments. The green zone indicates cylinder air pressure between 4,000 to 4,500 psig and indicates sufficient pressure to begin operational use.

7. Mask-Mounted Regulator. The mask-mounted regulator ([Figure 077-3-10](#)) is connected to a low-pressure hose threaded through the left shoulder strap of the harness assembly. The mask-mounted regulator maintains airflow into the facepiece at a pressure greater than atmospheric pressure and directs airflow over the inner surface of the lens for anti-fogging purposes. The mask-mounted regulator is constructed of corrosion-resistant materials and mates with a quick 1/4 turn to the facepiece. The mask-mounted regulator is available in two models. Both have a red purge valve, air saver switch, latch mechanism, and Vibralert®. Configuration 4 mask-mounted regulators are also equipped with a HUD.

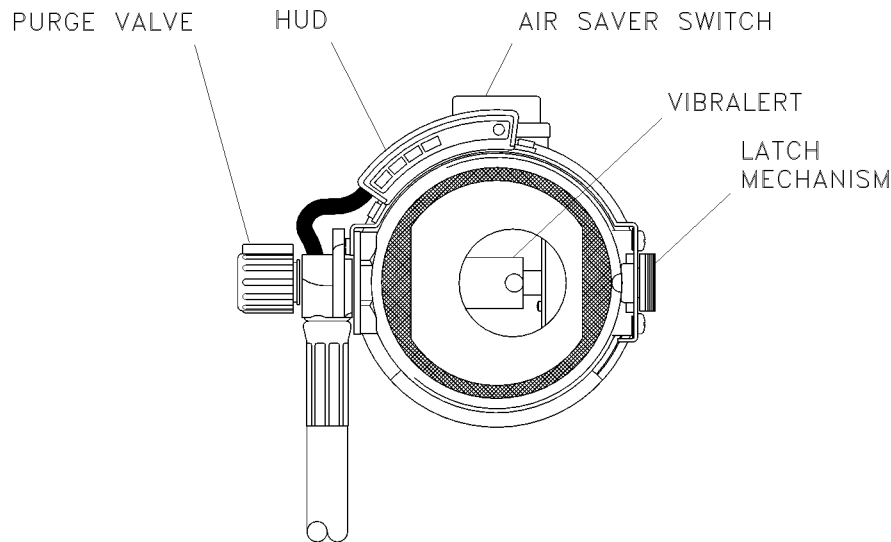


Figure 077-3-10. Mask-Mounted Regulator Components

- (a) Purge Valve. The red purge valve is situated at the inlet of the mask-mounted regulator and can be adjusted to provide a constant airflow of at least 125 liters per minute, to bleed the system of residual air at the end of operational use, or to supply constant airflow in case of mask-mounted regulator failure.
- (b) Air Saver Switch. When fully depressed, the air saver switch prevents the free flow of air when the facepiece is not donned. The air saver switch will allow airflow again once the wearer achieves a face-to-facepiece seal and inhales.
- (c) Latch Mechanism. The latch mechanism is engaged when the mask-mounted regulator is secured to the facepiece.
- (d) Vibralert®. The Vibralert® is an end-of-service-time indicator that actuates when cylinder pressure reaches approximately 900 to 1,125 psig (20 to 25 percent of capacity), or when the pressure reducer malfunctions. The Vibralert® can be felt as a vibration of the facepiece and heard as an audible alarm.
- (e) Heads-Up Display. The mask-mounted regulator on Configuration 4 comes equipped with the HUD ([Figure 077-3-11](#)). The HUD is a battery-powered, independent, end-of-service-time indicator with cylinder air level status indicators and an integrated low battery status indicator light-emitting diode (LED). The HUD provides a constant status of the air supply with five LEDs that appear at the lower level of the facepiece field of vision. The HUD LEDs signify the following when lit:
  - (1) Two rectangular green LEDs indicate cylinder air pressure is full to 3/4 full.
  - (2) One rectangular green LED indicates cylinder pressure is 3/4 to 1/2 full.
  - (3) One rectangular yellow slowly flashing LED indicates cylinder pressure is 1/2 to 1/4 full.
  - (4) One rectangular red rapidly flashing LED indicates 1/4 cylinder pressure remains.
  - (5) One round red LED indicates a low battery. The mask-mounted regulator low-pressure hose is integrated with the HUD electrical power cable. This cable connects the HUD to the pressure reducer via an electronics package called the Visualert.

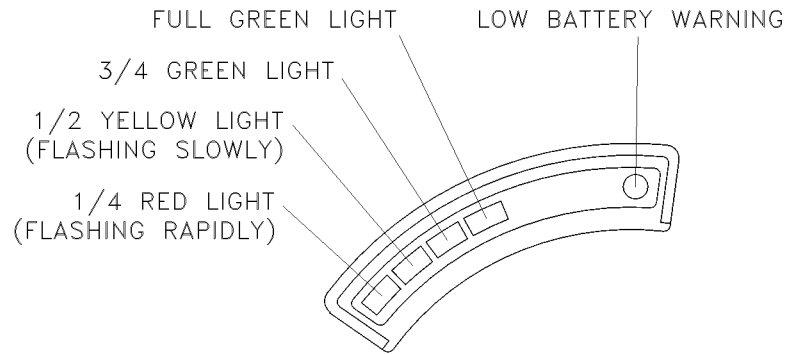


Figure 077-3-11. Heads-Up Display LEDs

077-3.2.2.5 Facepiece. The facepiece provides an airtight seal around the entire face of the user to prevent respiration of atmospheric toxins. The facepiece is available in two models: the AV-2000® and the AV-3000®. When entire SCBA assemblies are purchased, the facepiece shipped will depend upon the configuration ordered. The AV-2000® is shipped with Configurations 1, 2, and 3, and the AV-3000® is shipped with Configuration 4. However, either facepiece can be used with any configuration.

- a. Voice Amplifier. The voice amplifier is an accessory that can be used with either the AV-2000® or the AV-3000® facepiece. The voice amplifier electronically increases voice volume for clear communication and easily installs on top of the right voicemitter (as worn) with a mounting bracket assembly.
- b. AV-2000® Facepiece. AV-2000® facepiece (Figure 077-3-12) components are a head harness, lens, nosecup assembly, two inhalation check valves, two voicemitters, and an auxiliary exhalation valve assembly.
  1. AV-2000® Head Harness. The head harness for the AV-2000® facepiece consists of four adjustable rubber straps that are threaded through temple and neck buckles.
  2. AV-2000® Lens. The lens is constructed of a polycarbonate material, is anti-fogging, and is designed to meet the impact and penetration requirements of a faceshield as specified in the American National Standards Institute (ANSI) Z87.1, Practice for Occupational and Educational Eye and Face Protection.
  3. AV-2000® Nosecup Assembly. The nosecup assembly covers the nose, mouth, and chin when the facepiece is worn. The inhalation check valves are disc-shaped and are installed on each side of the nosecup assembly. The nosecup assembly attaches to the voicemitter ducts and is anchored to the lens by the auxiliary exhalation valve assembly.
  4. AV-2000® Voicemitter. The voicemitter allows the user to communicate through the facepiece when worn. The voicemitter does not enhance voice volume or clarity.
  5. AV-2000® Faceseal. The faceseal is made of rubber and affects an airtight seal around the face of the user to prevent inhalation of contaminated air sources. The faceseal of the AV-2000® is color-coded to identify the size of the facepiece as follows: green is small, black is large, and red is extra large.

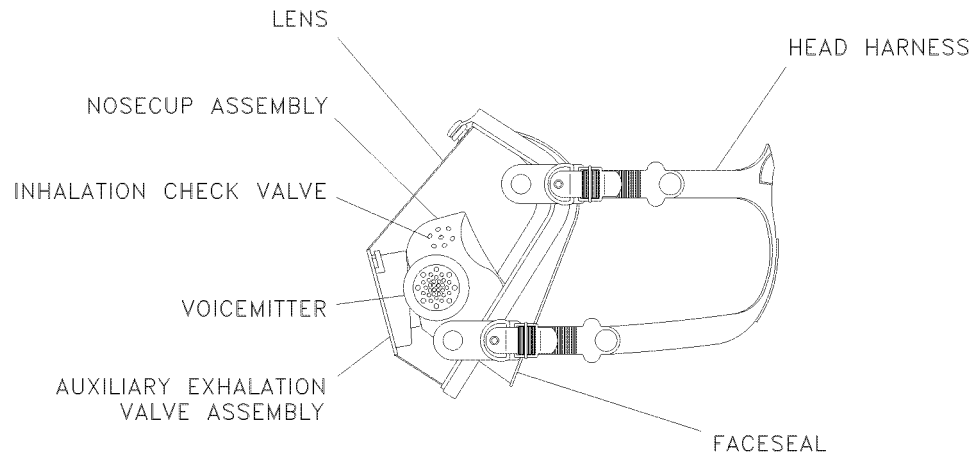


Figure 077-3-12. AV-2000® Facepiece Components

- c. AV-3000® Facepiece. AV-3000® facepiece (Figure 077-3-13) components are a head harness, lens, nosecup assembly, two inhalation check valves, and two voicemitters.
1. AV-3000® Head Harness. The six-point head harness for the AV-3000® facepiece is constructed of Kevlar® materials and consists of a head net, a neck strap, and a temple strap. The head harness temple and neck straps are threaded through pockets in the head net and are attached to the facepiece by temple and neck buckles.
  2. AV-3000® Lens. The lens is constructed of a polycarbonate material, is anti-fogging, and is designed to meet the impact and penetration requirements of a faceshield as specified in the ANSI Z87.1.
  3. AV-3000® Nosecup Assembly. The nosecup assembly covers the nose, mouth, and chin when the facepiece is worn. The inhalation check valves are rectangular-shaped and are installed on each side of the nosecup assembly. The nosecup assembly attaches to the voicemitter ducts and is anchored to the lens by a retaining ring.
  4. AV-3000® Voicemitter. The voicemitter allows the user to communicate through the facepiece when worn. The voicemitter does not enhance voice volume or clarity. The voice amplifier (refer to paragraph 077-3.2.2.5.a) is also an accessory option for the AV-3000® facepiece.
  5. AV-3000® Faceseal. The faceseal is made of rubber and affects an airtight seal around the face of the user to prevent inhalation of contaminated air sources. The size is molded into the faceseal of the AV-3000® facepiece. The sizes available are small, medium, and large.

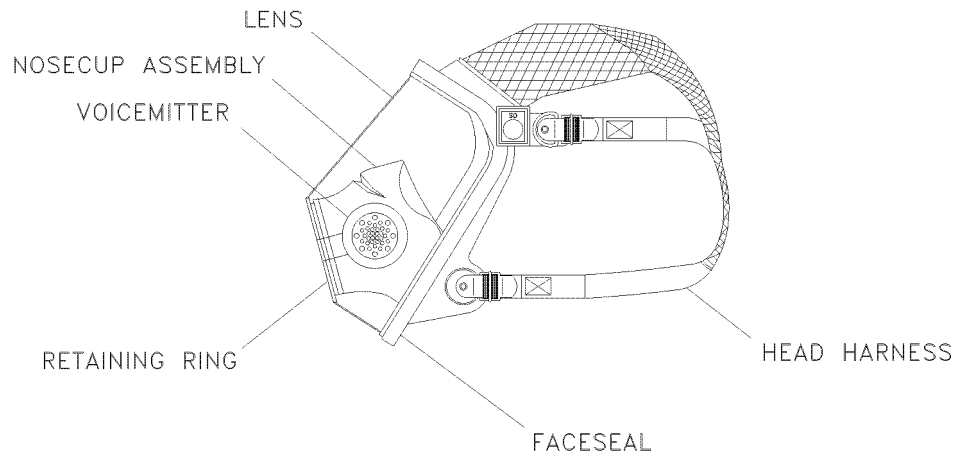


Figure 077-3-13. AV-3000® Facepiece Components

077-3.2.3 OPERATING PROCEDURES. Paragraphs 077-3.2.3.1 through 077-3.2.3.3 address the SCBA's operational use, air replenishment, and emergency operation.

077-3.2.3.1 Operational Use.

- a. Visual Inspection. Regular visual inspection is necessary prior to operation. Prior to each use, a visual inspection must be conducted and the Visual Inspection Checklist contained in NAVSEA S6220-EN-MMO-010, Appendix A, should be completed.

**WARNING**

**Damaged cylinder assemblies may suddenly leak or rupture if left charged with compressed air. Failure to inspect for damage and to depressurize damaged cylinder assemblies may result in serious injury or death to personnel.**

**WARNING**

**If any worn, broken, frayed, or damaged components are found, remove SCBA from service and tag for repair. Failure to identify and remove a defective SCBA from service may result in serious injury or death to personnel.**

1. Inspect backframe and harness assembly and facepiece for obvious damage.
  2. Visually inspect cylinder assembly for physical damage such as dents, gouges, abrasions, cuts, loose fibers, etc. in accordance with (IAW) procedures contained in NAVSEA S6220-EN-MMO-010, Appendix C.
  3. If damage is found, remove component from service, depressurize air cylinder, and tag for repair.
  4. Ensure minimum 4,000 psig reading on dual-reading pressure indicator. If below 4,000 psig, replenish air IAW paragraph 077-3.2.3.2.
  5. Ensure hanger plate (Figure 077-3-4) is firmly secured by locking tab and cylinder band clamp is tightened to properly secure installed cylinder assembly.
- b. Donning. The Donning Checklist contained in NAVSEA S6220-EN-MMO-010, Appendix A, should be completed when the following procedures are performed.

**WARNING**

**Ensure immediate location provides adequate space to safely don SCBA without causing damage to equipment or serious injury or death to personnel.**

1. Don firefighting ensemble or general quarters (GQ) anti-flash hood depending on mission.
  - (a) Place hood over head and pull face opening over head and chin so face opening in hood is around neck (Figure 077-3-14).

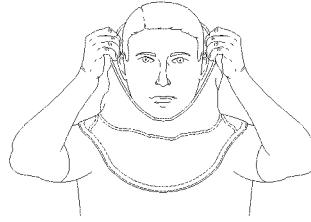


Figure 077-3-14. Pulling Hood Face Opening Over Head

- (b) Don firefighter's coverall or fire protection gear (FPG). Ensure front and collar tabs of hood are completely closed.
- (c) Don firefighter's boots.

#### NOTE

Do not attach anything to the shoulder strap spring-action buckles. Side straps could loosen during use of the SCBA.

- 2. Don SCBA using either the coat-style or the over-the-head method as appropriate.
  - (a) Don SCBA using the coat-style method as follows:
    - (1) Position backframe and harness assembly with cylinder valve on deck, cylinder assembly facing user, and fully extended side straps facing away.
    - (2) Grasp shoulder straps as shown in [Figure 077-3-15](#).

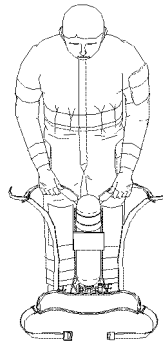


Figure 077-3-15. Positioning Backframe and Harness Assembly for Coat-Style Method

- (3) Swing backframe and harness assembly over and onto back, sliding shoulder strap over arm as shown in [Figure 077-3-16](#). Extend both arms through shoulder straps.

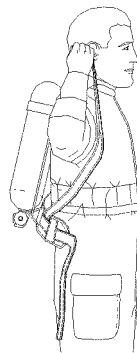


Figure 077-3-16. Positioning Backframe and Harness Assembly onto Back

- (4) Lean forward and pull down on both side straps to tighten as shown in [Figure 077-3-17](#).



Figure 077-3-17. Tightening Side Straps

**NOTE**

Ensure low-pressure hose is not behind waist adjustment strap.

- (5) Secure quick-release buckle as shown in [Figure 077-3-18](#).



Figure 077-3-18. Securing Buckle Quick-Release Buckle for Coat-Style Method

- (6) Simultaneously pull waist adjustment straps forward to tighten as shown in [Figure 077-3-19](#).

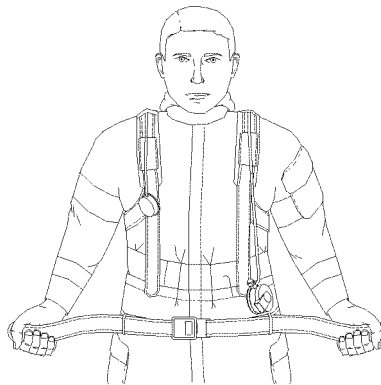


Figure 077-3-19. Tightening Waist Adjustment Straps for Coat-Style Method

- (7) Readjust side straps to ensure most of SCBA weight is on hips.
- (8) Lift hands straight up to ensure comfortable fit and proper adjustment.
- (b) Don SCBA using the over-the-head method as follows:
  - (1) Position backframe and harness assembly with cylinder valve facing up, cylinder assembly away from user, and fully extended side straps facing away.
  - (2) While on one knee, grasp sides of backframe as shown in [Figure 077-3-20](#).





Figure 077-3-20. Grasping Backframe for Over-the-Head Method

- (3) Lift backframe and harness assembly up and over head. Ensure elbows extend through loop formed by shoulder straps as shown in [Figure 077-3-21](#).



Figure 077-3-21. Lifting Backframe and Harness Assembly for Over-the-Head Method

- (4) Pull down on side straps to tighten as shown in [Figure 077-3-22](#). Stand up.



Figure 077-3-22. Tightening Side Straps for Over-the-Head Method

#### NOTE

Ensure low-pressure hose is not behind waist adjustment strap.

- (5) Secure quick-release buckle as shown in [Figure 077-3-23](#).

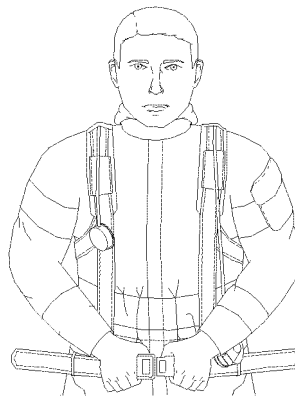


Figure 077-3-23. Securing Quick-Release Buckle for Over-the-Head Method

- (6) Simultaneously pull waist adjustment straps forward to tighten as shown in [Figure 077-3-24](#).

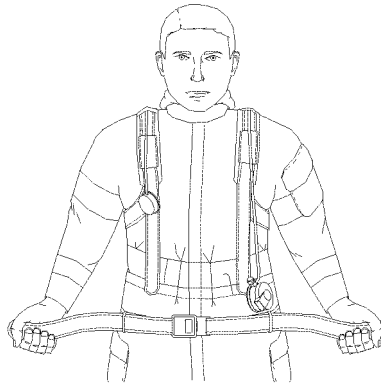


Figure 077-3-24. Tightening Waist Adjustment Straps for Over-the-Head Method

- (7) Readjust side straps to ensure most of SCBA weight is on hips.
- (8) Lift hands straight up to ensure comfortable fit and proper adjustment.
3. Ensure air saver switch on mask-mounted regulator is fully depressed and purge valve is rotated fully clockwise until closed.

**WARNING**

**For proper SCBA operation, the cylinder valve must be fully opened. SCBA use with cylinder valve partially opened may cause a reduction or sudden and complete loss of air supply, resulting in serious injury or death to personnel.**

4. Open cylinder valve by slowly turning handwheel fully away from user, then back off 1/4 turn.

**WARNING**

**If Vibralert® does not actuate or HUD (if attached) does not initialize as described, remove SCBA from service and tag for repair to prevent serious injury or death to personnel.**

5. The Vibralert® will actuate and then stop. The HUD, if attached, will initialize with all five LEDs on for approximately 20 seconds, then will display cylinder air pressure as a percentage of air remaining.
6. Ensure remote pressure indicator reading is greater than 0 psig ([Figure 077-3-25](#)). If 0 psig, replace cylinder assembly IAW [paragraph 077-3.2.3.2, step b](#).



Figure 077-3-25. Checking Remote Pressure Indicator

7. Extend head harness straps. Ensure head harness straps are not twisted and will lay flat against head.
8. To don facepiece, place chin in chin pocket and pull head harness straps over head.
9. Simultaneously pull back on ends of temple straps to tighten for a comfortable fit as shown in [Figure 077-3-26](#).



Figure 077-3-26. Tightening Temple Straps

10. Simultaneously pull back on ends of neck straps to tighten for a comfortable fit as shown in [Figure 077-3-27](#).

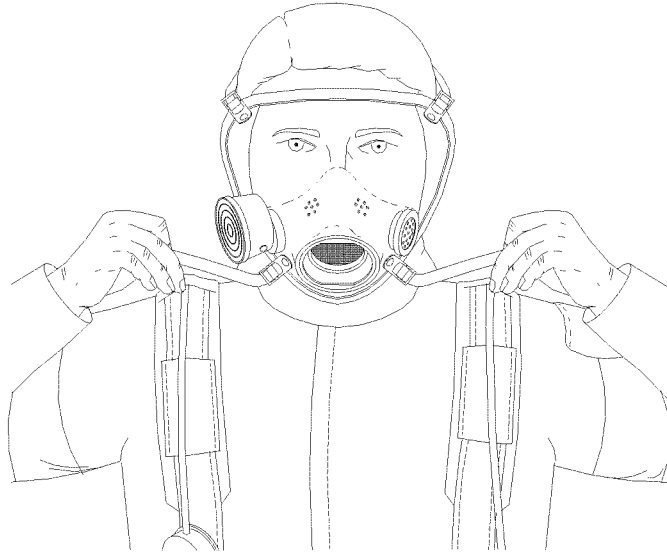


Figure 077-3-27. Tightening Neck Straps

11. Feel crown of head with one hand to ensure proper head harness strap placement. Readjust temple and neck straps as necessary until comfortable fit and proper placement is achieved. SCBA is now in place and facepiece is donned without mask-mounted regulator installed.

**NOTE**

Applying excessive pressure with hand may cause a false seal.

12. Perform a seal check by placing palm of hand over adapter port on facepiece as shown in [Figure 077-3-28](#).



Figure 077-3-28. Performing Seal Check

**NOTE**

Ensure correct size of facepiece before repeating procedure if facepiece does not seal properly.

13. Inhale and hold breath for a second so facepiece can seal to face. If facepiece does not seal to face, repeat [steps 7](#) through [12](#).
14. If equipped, turn on voice amplifier and check for operation.
15. Pull hood face opening up from neck over head and chin to cover facepiece straps ([Figure 077-3-29](#)). Ensure the SCBA facepiece and hood overlap so that no gaps in protection occur and flash hood does not impede vision through facepiece lens.



Figure 077-3-29. Pulling Hood Face Opening from Around Neck

16. Don firefighter's gloves and firefighter's helmet. The SCBA is now in standby condition but not in operational use.
- c. Go-On-Air. The following procedures mount the mask-mounted regulator to the facepiece and provide procedures for the subsequent use in an operational environment. The Go-On-Air Checklist, contained in NAVSEA S6220-EN-MMO-010, Appendix A, should be completed when the following procedures are performed.
1. Remove mask-mounted regulator from regulator holder.
  2. From perspective of user, orient purge valve ([Figure 077-3-30](#)) at 12 o'clock and air saver switch at 3 o'clock position. Insert mask-mounted regulator into adapter port and rotate counterclockwise 1/4 turn until latch mechanism engages.



Figure 077-3-30. Rotating Regulator Counterclockwise from User's Perspective

3. Attempt to rotate mask-mounted regulator to ensure latch mechanism is engaged.

**NOTE**

If air is not supplied on first inhalation, ensure cylinder valve is fully open and remote pressure indicator indicates air pressure in cylinder.

4. Inhale sharply to release air saver switch and start airflow.

**NOTE**

If free flow of air is experienced, readjust temple and neck straps of head harness.

5. Breathe normally.

**WARNING**

**Should the bell alarm, Vibralert®, or HUD activate during operational use, immediately leave area requiring SCBA protection to prevent serious injury or death.**

6. Proceed with use of SCBA.
- d. Go-Off-Air. The Doffing Checklist contained in NAVSEA S6220-EN-MMO-010, Appendix A, should be completed when the following procedures are performed.
    1. Depress air saver switch until click is heard, then release.
    2. Pull out on latch mechanism, rotate mask-mounted regulator 1/4 turn clockwise, and remove from adapter port.
    3. Stow mask-mounted regulator in regulator holder to return to standby condition.
  - e. Doffing. The Doffing Checklist contained in NAVSEA S6220-EN-MMO-010, Appendix A, should be completed when the following procedures are performed.

**WARNING**

**Doffing the SCBA must be performed only when the user is in a safe environment that does not require SCBA protection.**

1. Perform Go-Off-Air procedures IAW [step d](#).
2. Fully close cylinder valve by rotating handwheel toward user.
3. Fully open purge valve by rotating counterclockwise and bleed residual air from SCBA.
4. When airflow stops, close purge valve by rotating clockwise.

**NOTE**

The user may find it more comfortable to first relieve tension on the temple straps by loosening buckles.

5. Lift each buckle on temple and neck straps and remove facepiece from head.
6. Depress waist strap spring-action buckles and fully extend waist adjustment straps.
7. Unbuckle quick-release buckle.

**CAUTION**

**Ensure positive control is maintained during removal of the backframe and harness assembly to prevent equipment damage.**

8. Depress shoulder strap spring-action buckle and fully extend side straps.
9. Maintain firm grip of shoulder straps while removing SCBA.

077-3.2.3.2 Air Replenishment. The SCBA may be recharged with 4,500 psig Grade D air by two methods: quick-charge and cylinder assembly removal and replacement.

- a. Quick-Charge. Quick-charge of the cylinder assembly may be accomplished while wearing or using the SCBA.
  1. Go to approved charging station.

**WARNING**

**User shall ensure charging station operator inspects the SCBA for damage prior to charging. Failure to do so can cause equipment damage, resulting in serious injury or death to personnel.**

2. Monitor remote pressure indicator for indication of pressure increase during quick-charge of cylinder assembly.
  3. After quick-charge is completed, ensure dust cap is replaced on quick-charge coupling and quick-charge coupling is secured to waist adjustment strap.
- b. Cylinder Assembly Removal and Replacement. Cylinder assembly removal and replacement procedures can be performed with assistance while the SCBA is being worn or alone with the SCBA removed from back. The Cylinder Assembly Removal and Replacement Checklist contained in NAVSEA S6220-EN-MMO-010, Appendix A, should be completed.
    1. Removal.

**WARNING**

**To prevent serious injury or death to personnel, cylinder assembly removal must be performed only when the user is in a safe environment that does not require SCBA protection.**

- (a) Fully close cylinder valve by rotating handwheel (1, [Figure 077-3-31](#)) toward user if SCBA is donned, or clockwise if SCBA has been doffed.
- (b) Fully open purge valve on mask-mounted regulator by rotating counterclockwise and bleed residual air from SCBA.

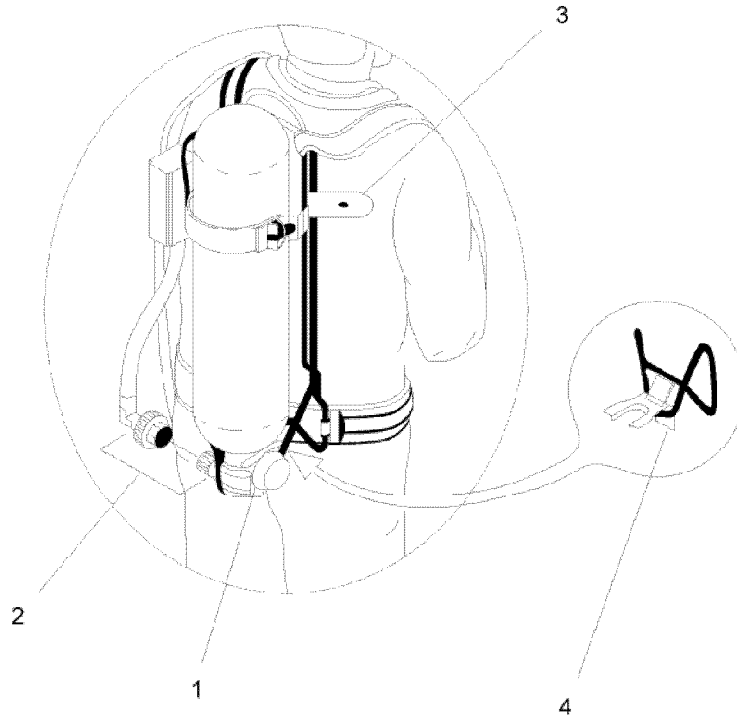


Figure 077-3-31. Cylinder Removal and Replacement

- (c) When airflow stops, close purge valve by rotating clockwise.
- (d) Check remote pressure indicator for indication of no air pressure.

**WARNING**

**Leakage of high-pressure air could cause damage to equipment and serious injury or death to personnel.**

- (e) Rotate hand coupling (2, [Figure 077-3-31](#)) counterclockwise to remove high-pressure hose assembly or RIC UAC assembly from cylinder valve.
- (f) Unsnap and pull up on over-center latch mechanism (3, [Figure 077-3-31](#)) to release cylinder band clamp.

**WARNING**

**To prevent serious injury or death to personnel, do not grab handwheel instead of cylinder valve.**

- (g) With one hand, grab cylinder valve and press on locking tab (4, [Figure 077-3-31](#)) with other hand.
  - (h) Push up on cylinder assembly approximately one inch until disengaged from backframe hook (4, [Figure 077-3-31](#)). Then pull cylinder assembly down and out of backframe and harness assembly.
2. Replacement.



**WARNING**

**Never use a cylinder assembly having a damaged cylinder valve or a cylinder valve with damaged threads. Leakage may occur, which could cause a loss of breathing air or a sudden release of high pressure air, resulting in serious injury or death to personnel.**

- Visually inspect cylinder assembly for physical damage such as dents, gouges, abrasions, cuts, loose fibers, etc. IAW procedures contained in NAVSEA S6220-EN-MMO-010, Appendix C.
- Ensure dual-reading pressure indicator reads a minimum of 4,000 psig.
- Position cylinder band clamp on bail for different sized cylinders as follows: top position for 45-minute fiberglass cylinder, middle position for 45-minute carbon-fiber cylinder, and inner position for either type 30-minute cylinder (Figure 077-3-32).

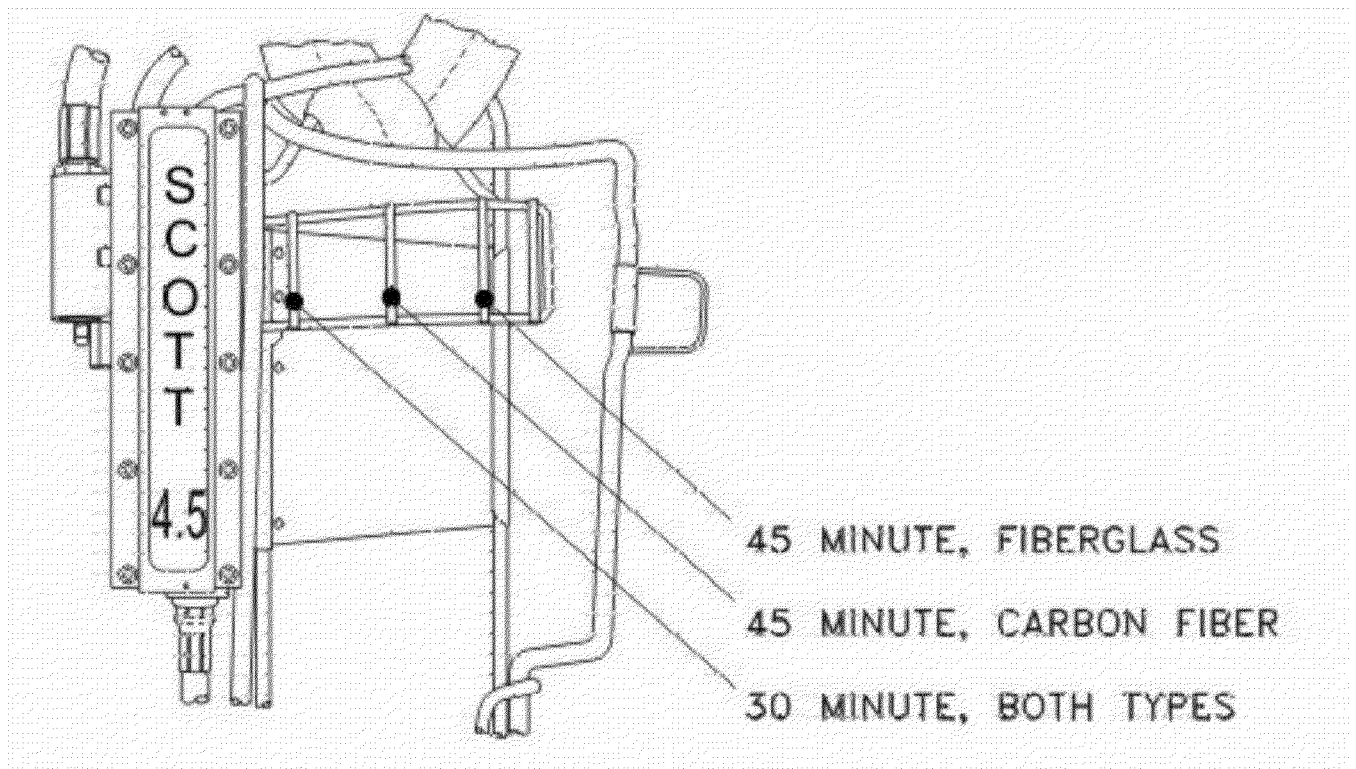


Figure 077-3-32. Cylinder Band Clamp Bail Positions

- Guide dome end of cylinder assembly upward through cylinder band clamp.
- Turn cylinder assembly so hanger plate points toward backframe and aligns with center of backframe hook in bottom of backframe.
- Push cylinder assembly down until backframe hook engages with hanger plate.

**NOTE**

Do not force over-center latch mechanism. Adjust cylinder band clamp for a snug fit by turning cylinder adjustment handwheel.

- If necessary, cylinder band clamp may be adjusted to compensate for small variations in cylinder size.

Rotate cylinder adjustment handwheel clockwise to compensate for smaller cylinders and counterclockwise for larger cylinders after cylinder band clamp is unsnapped and over-center latch mechanism is disengaged.

- (h) Push down on over-center latch mechanism until locked firmly in place and snap.

**NOTE**

Slide pressure reducer within mounting plate to assist in aligning the hand coupling to the cylinder valve.

- (i) Connect, but do not tighten, hand coupling to cylinder valve.

**CAUTION**

**Do not use a wrench to tighten hand coupling to cylinder valve. Overtightening may damage hand coupling and cylinder valve.**

- (j) Hand-tighten hand coupling by turning clockwise until seated.

077-3.2.3.3 Emergency Operation. Emergency operation procedures shall be followed immediately should the SCBA not operate in a normal manner.

- a. Should the Vibralert®, bell alarm, or HUD activate during use, even if air supply has not been depleted to approximately 1,125 psig (25 percent of full capacity), leave hazardous area at once.
- b. Should air supply be partially cut off during use, fully open purge valve by rotating counterclockwise (pointer on knob downward). Ensure cylinder valve is fully opened (turned fully counterclockwise) and leave hazardous area at once.
- c. Should air supply begin to flow freely into facepiece during use, leave hazardous area at once.
- d. Should a total and irreversible loss of SCBA protection or an airflow blockage occur, leave hazardous area at once.
- e. Once in a safe environment not requiring SCBA protection, bleed system, doff SCBA, and tag for repair.

077-3.2.4 POST-OPERATING PROCEDURES.

077-3.2.4.1 Cleaning. Clean SCBA IAW Maintenance Requirement Card (MRC) R-1.

077-3.2.4.2 Inspection. Inspect SCBA IAW MRC R-1.

077-3.2.4.3 Stowage. The SCBA and cylinder assemblies shall be stored in an approved SCBA storage locker IAW procedures contained in NAVSEA S6220-EN-MMO-010, Appendix E.

077-3.2.5 BREATHING AIR CHARGING SYSTEM. (Figures 077-3-33 and 077-3-34.)

The BACS is used by damage control and firefighting personnel to charge SCBAs to a pressure of 4,500 pounds per square inch (psi) with Grade D breathing quality air (Compressed Gas Association (CGA) Publication G-7.1, ANSI Commodity Specification for Air). The BACS can be used for charging individual SCBA cylinders or quick charging SCBA assemblies. The BACS interface requires connection to the ship's high-pressure (HP) air system (nominally 3,000 psig).

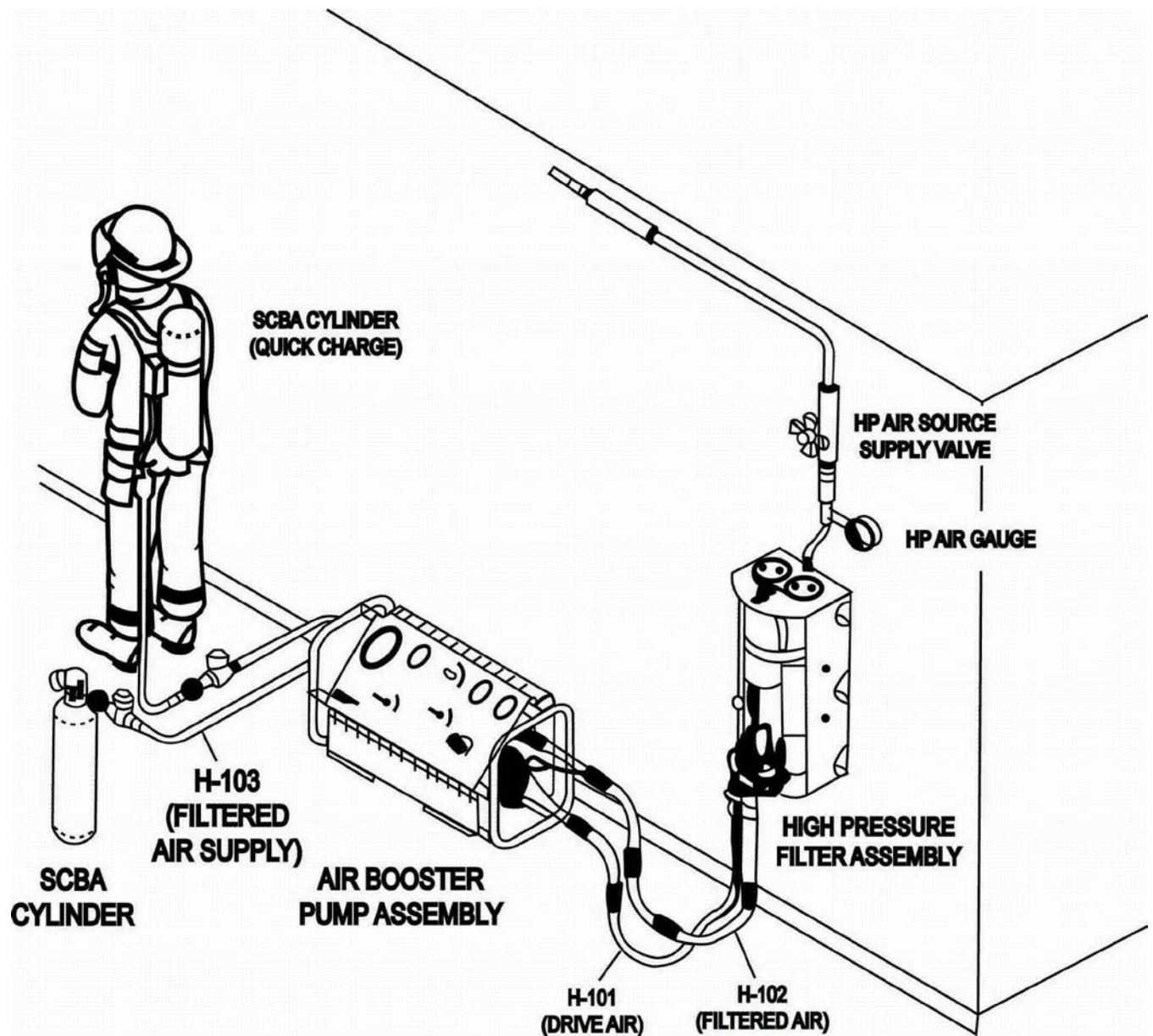


Figure 077-3-33. Breathing Air Charging System Diagram

The BACS is used as the primary method of charging SCBAs and consists of three sub-assemblies: High Pressure Filter Assembly (HPFA), Air Booster Pump Assembly (ABPA), and ancillary hoses. The HPFA is bulk-head mounted and supplies both filtered and unfiltered air to the ABPA. The HPFA filters remove moisture, carbon monoxide, oil vapor, and odor from the air.

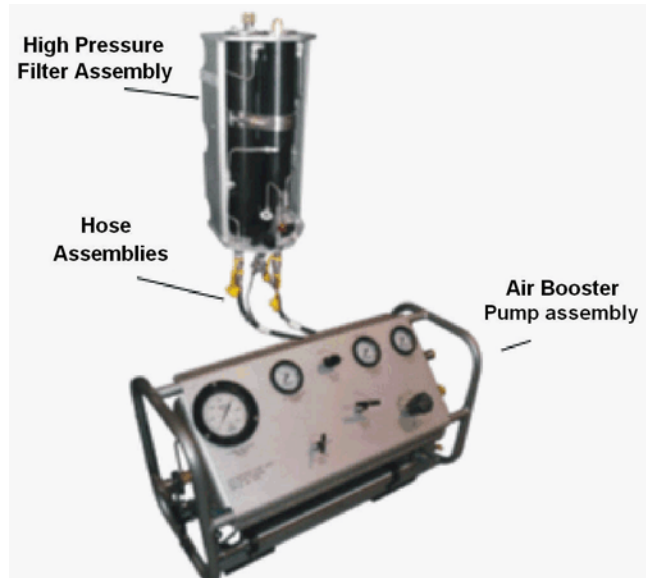


Figure 077-3-34. Breathing Air Charging System

The ABPA is portable and uses an oil-free gas booster pump. The gas booster pump is an air-driven, non-lubricated, reciprocating piston-type pump. The ABPA is used to increase the pressure of the filtered air from HPFAs to 4,500 psi from 3,000 psi. The ancillary hoses for the BACS consist of a drive air inlet hose, a filtered air inlet, and a filtered air supply hose.

For additional information refer to NAVSEA S6226-PD-MMO-010.

#### NOTE

Ships with SCBA Charging Systems are required to sample breathing air quarterly using the SCBA Breathing Air Tester (BAT). IAW NAVSURFWARCEN Message DTG 151302Z JUN 04, the chemical detection tubes for carbon monoxide and carbon dioxide used in the Gas Free Engineer (GFE) Test Kits are not the same as the SCBA BAT tubes (National Stock Number (NSN) 6665-01-473-8300). The tubes have different Part Numbers (P/Ns), NSNs, sampling methods, and detection scales and the tubes from the GFE Test Kits and SCBA BAT are not to be used interchangeably.

077-3.2.5.1 Breathing Air Charging System Configurations. The various ship classes of SCBA ships have different configurations of the BACS equipment onboard due to both the size of the ship and the availability of high-pressure air as a source for use by the BACS. The following paragraphs provide an overview of the number of BACS system components for each ship class.

- a. The ARS Class is designed with two SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is

- routed to the SCBA cylinder via the charging hose. The ship is also equipped with diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
2. The AS Class is currently not a funded install. The AS Class design package is designed with three SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
  - c. The CG Class is designed with three SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
  - d. The CV Class is designed with eight SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with four ABPAs. Air from the ship's high-pressure air system is reduced from 4,250 psi to 3,000 psi before being hard piped into the HPFA. The CV HP air system pressure is reduced to 3,000 psi so that the pressure will coincide with the nominal HP air pressure of all other ship classes thus allowing a single ABPA / HPFA configuration to be used within the fleet. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with two diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
  - e. The CVN Class is designed with eight SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with four ABPAs. Air from the ship's high-pressure air system is reduced from 4,250 psi to 3,000 psi before being hard piped into the HPFA. The CVN HP air system pressure is reduced to 3,000 psi so that the pressure will coincide with the nominal HP air pressure of all other ship classes thus allowing a single ABPA / HPFA configuration to be used within the fleet. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with two diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
  - f. The DDG 51 FLT I Class (51-71) is designed with three SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
  - g. The DDG 51 FLT II Class (72-78) is designed with three SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
  - h. The FFG Class is designed with three SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air

system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.

- i. The LCC Class is currently not a funded install. The LCC-19 Class design package is designed with three SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
- j. The LSD 41 Class is designed with three SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with two ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
- k. The LHD Class is designed with five SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with three ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with six diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
- l. The LHA Class is designed with five SCBA charging stations. Each charging station contains a HPFA and a set of connective hoses. The ship is also equipped with three ABPAs. Air from the ship's high-pressure air system is hard piped to the HPFA. The HPFA filters the air to meet CGA Grade D requirements. Then the air is directed to the ABPA where the air pressure is increased to the final pressure of 4,500 psi. Finally, the air is routed to the SCBA cylinder via the charging hose. The ship is also equipped with six diesel-driven breathing air compressors that can be used in situations when the HP air system is unavailable.
- m. The MCM Class does not have SCBA charging stations. However, the ships do have a small electric compressor that can be used to refill depleted SCBA cylinders after training exercises. The compressor is capable of producing CGA Grade D with a dew point of -65° F.

077-3.2.5.2 High Pressure Breathing Air Compressor (HPBAC). Some classes of ships do not have 3,000 psi ships service air to use as an input for the BACS. These ships need a stand-alone high-pressure compressor and air banks to hold 4,500 to 5,000 psi air to fill SCBA cylinders. The HPBAC compresses ambient air for storage in the SCBA cylinders that provide breathing air for firefighting personnel. The compressor is a radial 4-cylinder, 4-stage unit driven by an electric motor. The compressor can deliver at a charging rate of approximately 19.3 standard cubic feet per minute (scfm) at 4,500 psi. When air is compressed, water from the air and oil mist from the compressor can contaminate the air stream. These and other contaminants such as carbon monoxide and carbon dioxide are removed through a purification system that ensures breathable-quality air that is free of obnoxious taste and / or odor. Once air passes through the system, it is either stored in high-pressure storage flasks or is used to directly charge SCBA cylinders. [Figure 077-3-35](#) depicts a typical HPBAC.



Figure 077-3-35. High Pressure Breathing Air Compressor

077-3.2.5.2.1 The major components of the HPBAC include: an aluminum frame assembly, an instrument and control panel, an intake filter assembly, a model k-180 compressor, valves and valve head assemblies, cylinder and piston assemblies, cooling system condensate separators, a lubrication system, an automatic condensate drain (ACD) valve, and a Securus purification control system.

077-3.2.5.2.2 [Figure 077-3-36](#) shows the implementation of the HPBAC and BACS for the LPD 4 class of ships. The HPBAC system consists of a HPBAC, charging panel, and air storage flasks. The HPBAC is connected to a shipboard high-pressure air flask and a high-pressure breathing air-charging panel. The HPBAC charge at a rate of approximately 19 scfm, and the purification system delivers Grade D breathing air.

077-3.2.5.2.3 The following paragraphs provide an overview of the number of HPBAC system components for each ship with HPBACs.

1. a. The DDG 51 FLT IIA Class (79+) is designed with two standalone SCBA charging stations. Each charging station contains a HPBAC, a charging panel and a one 6-cubic foot ( $\text{ft}^3$ ) air storage flask. The HPBAC has an output of approximately 19 cubic feet per minute (cfm) and is capable of producing CGA Grade D air with a dew point of  $-65^\circ\text{F}$ . Each HPBAC may be operated independently through local control. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HPBACs are unavailable.
2. b. The LPD 4 Class is designed with three separate standalone SCBA charging stations. Each charging station contains a HPBAC, a charging panel and an air bank of three 8- $\text{ft}^3$  air storage flasks. The HPBAC has an output of approximately 19 cfm and is capable of producing CGA Grade D air with a dew point of  $-65^\circ\text{F}$ . Each HPBAC may be operated independently through local control. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HPBACs are unavailable.
3. c. The LPD 17 Class is designed with a breathing air circuit that connects the seven SCBA charging stations. The breathing air circuit is composed of three HPBACs, three separate air banks, and seven SCBA charging stations. The HPBAC has an output of approximately 19 cfm and is capable of producing CGA Grade D air with a dew point of  $-65^\circ\text{F}$ . These compressors can run stand alone or in a loop configuration. The Engineering Control System has a mimic display to monitor the SCBA Breathing Air System. Each air bank is composed of five 6- $\text{ft}^3$  air storage flasks. The ship is also equipped with three diesel-driven breathing air compressors that can be used in situations when the HPBACs are unavailable.

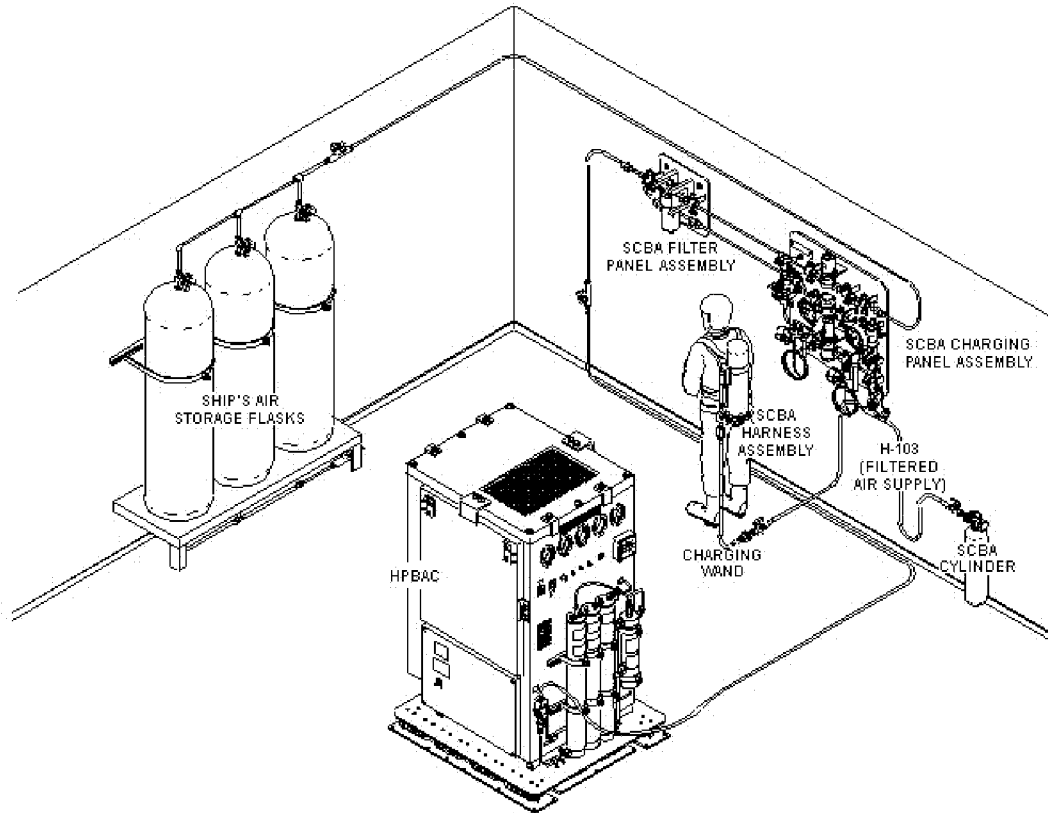


Figure 077-3-36. HPBAC and BACS for LPD 4 Class of Ships

077-3.2.5.3 Quick Fill Charging Method. The quick fill or quick charge method involves attaching an umbilical hose from the BACS H-103 hose directly to the quick fill wand on the SCBA. This is an efficient method of recharging a SCBA cylinder without having to remove it from the SCBA backpack or disconnect the high-pressure hose. The only requirements are that the SCBA and cylinder be inspected before charging them with air. [Figure 077-3-37](#) shows a damage control (DC) sailor preparing to connect the umbilical hose to the quick fill wand. The connections are simply pushed together until they “click” into place and the air flows. The cylinder is full when the cylinder pressure indicator and remote pressure indicator on the backpack both indicate 4,500 psig. Once the cylinder is full, simply pull back on the red collar on the umbilical hose and disconnect the hoses. ALWAYS REMEMBER TO REPLACE THE DUST CAPS. Quick fill is especially useful at the end of drills.





Figure 077-3-37. Quick Fill Charging Method

Following completion of a drill, personnel wearing SCBAs line up at the charging station for refill before restowing their SCBAs in the stowage lockers. [Figure 077-3-38](#) illustrates this point, either during or after drilling or casualty. The person manning the charging station inspects the SCBA and cylinder as mentioned above and then commences with the refill. Once the refill is complete, close the bottle valves, bleed the residual air pressure in the SCBA airlines with the purge valve on the mask-mounted regulator, and restow the SCBA.

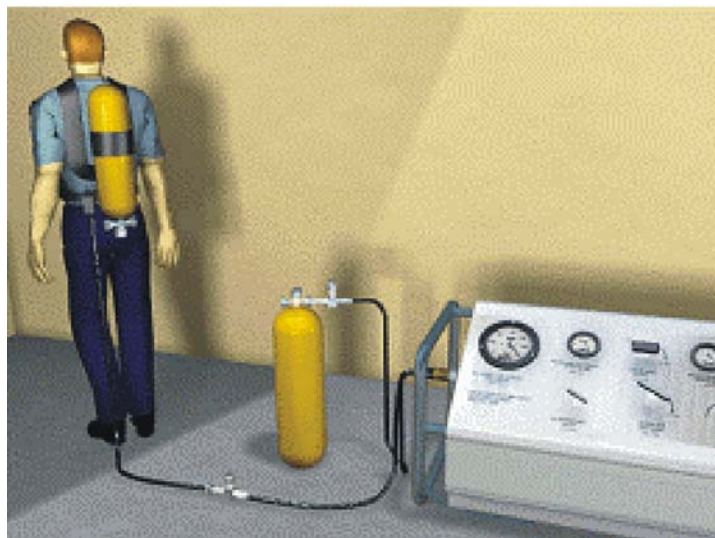


Figure 077-3-38. Quick Fill Charging Method

**077-3.2.6 EMERGENCY COMPRESSORS.** The emergency breathing air compressor (BAC) is used to provide breathing air for refilling SCBAs in situations when the BACS or HPBAC is unavailable.

The emergency BAC is a portable diesel-driven compressor used to charge SCBA cylinders when the ship has experienced a loss of electrical power or an HP air system casualty. The emergency BAC ([Figure 077-3-39](#)) consists of four major subassemblies: the diesel drive engine, the air compressor block, the air filter and purification system, and the fill hose assemblies all mounted within an enclosure on casters.

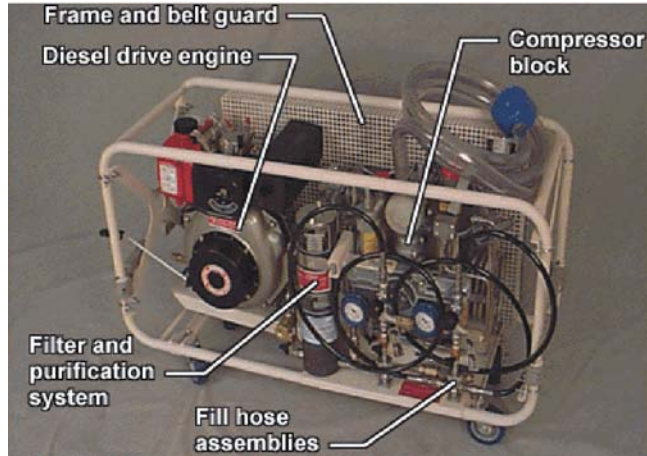


Figure 077-3-39. Emergency Breathing Air Compressor

The compressor can deliver a charging rate of approximately 6 scfm at 4,500 psi. The diesel drive engine has one cylinder and generates 6.0 horsepower at 3,600 rpm with a fuel capacity of 0.9 gallons. The purification system uses a single multi-layered air filter to remove moisture, carbon monoxide, oil vapor, and odor. The BAC delivers Grade D air to the SCBA. The fill hose assemblies consist of two six-foot flexible hoses, which deliver the 4,500 psig breathing quality air to a SCBA cylinder. The charging hoses have a relief valve, a shutoff valve, a bleed valve, a pressure gauge, and a CGA-347 fitting for connecting directly to the SCBA cylinders. Loss of electrical power causes a loss of shipboard ventilation which requires the diesel-driven compressor to be installed at a location where the following conditions are met:

- a. Natural ventilation can be used to cool the engine.
- b. A short path to weather, through a minimum of doors, reduces the opportunity for drawing air from an enclosed space.
- c. The diesel drive engine is the motive power for driving the air compressor.

For additional information refer to NAVSEA S6220-EM-MMO-010.

**07-3.2.7 TRAINING.** Before using any of the SCBA charging systems, DC personnel should receive familiarization and operational training from a certified instructor or designated trainer for the respective equipment. Subsequent to the initial training, DC personnel should familiarize themselves thoroughly with the principles of operation and safety precautions of the BACS through hands-on training under the supervision of a qualified operator. Instructions for use of the SCBA and charging systems are listed below:

- a. Scott Air-Pak 4.5 - NAVSEA S6220-EN-MMO-010.
- b. SCBA BACS - NAVSEA S6226-PD-MMO-010.
- c. BAC - NAVSEA S6220-EM-MMO-010.
- d. DDG FLT IIA HP BAC - NAVSEA S6226-SG-MMO-010.
- e. LPD 4 HP BAC - NAVSEA S9551-BP-MMC-010.
- f. LPD 17 HPBAC - NAVSEA S6220-ES-MMC-010.

### 077-3.3 OXYGEN BREATHING APPARATUS (OBA).

077-3.3.1 OVERVIEW. The OBA is a self-contained, closed circuit device which generates oxygen and allows the wearer to breathe independently of the surrounding atmosphere. Oxygen is generated by chemicals contained in a canister. The effective time limit of the oxygen supply is in excess of 45 minutes. Set the timer on the OBA for 30 minutes to allow 15 minutes to leave the area and return to fresh air.

077-3.3.2 GENERAL. When in operation, the air within the apparatus is continuously replenished with oxygen while exhaled carbon dioxide (CO<sub>2</sub>) and water vapor are removed by the chemicals in the canister. As a result of the chemical action, the OBA wearer may survive and work in a toxic atmosphere such as a smoke filled compartment. With the facepiece and canister in place, the OBA forms, with the wearer, a closed, self-sustaining system.

077-3.3.3 TRAINING. Before the OBA is used in a damage control operation or other emergency, familiarize personnel thoroughly with its principles of operation and the procedures and precautions for use. Practice OBA use frequently under supervision of a qualified operator. Instructions for use of the OBA are given in [paragraphs 077-3.3.5 through 077-3.3.6.3](#).

077-3.3.4 DESCRIPTION. The Navy Type A-4 OBA is illustrated in [Figure 077-3-40](#) with its important parts identified. On the left, the illustration shows the Type A-4 OBA as it is worn. Lower center is an optional spectacle kit which allows use of eye glasses in the facepiece. For additional details on the spectacle kit and the OBA, see NAVSEA SS600-AA-MMA-010, Oxygen Breathing Apparatus (OBA) Type A-4 Technical Manual. Submarines are authorized to use P-3 wire frame glasses in lieu of spectacle kit. Combat spectacles used with MCU-A/P or MCU-2A/P chemical protective masks are authorized for use by submarines and surface ships in lieu of the spectacle kit.

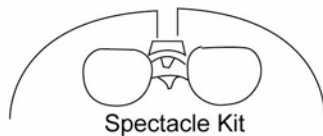
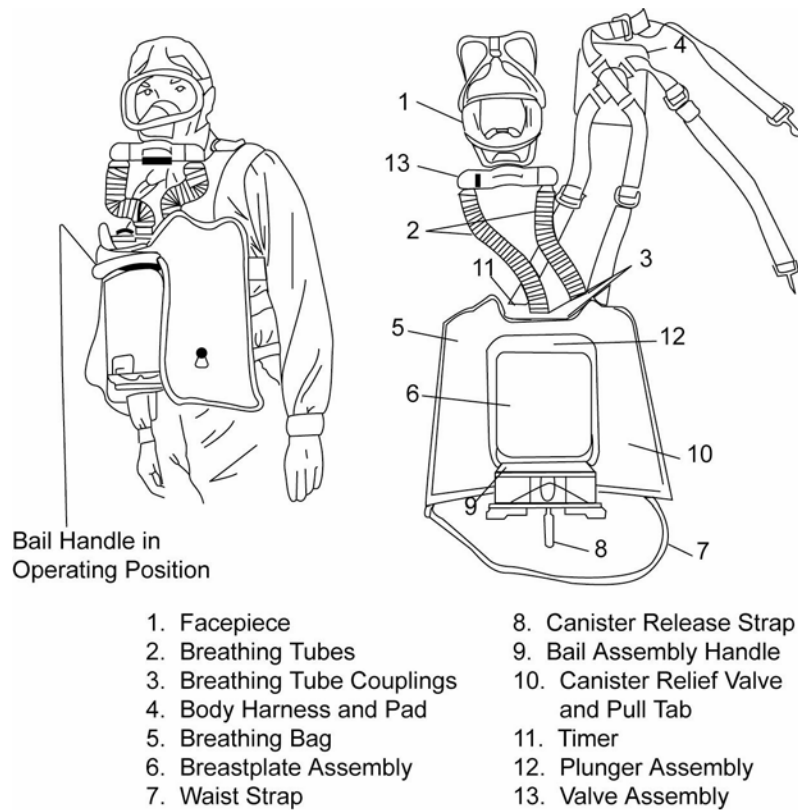


Figure 077-3-40. Navy Type A-4 Oxygen Breathing Apparatus

#### 077-3.3.4.1 Key OBA Components. (Figures 077-3-40 and 077-3-41)

- A quick starting canister contains chemicals that generate oxygen for breathing and remove CO<sub>2</sub> and water vapor from the exhaled air. The canister also contains an oxygen generating candle for quick starting.
- The facepiece is rubber with adjustable harness and breathing tubes.
- Breathing bags store reserve air made ready for breathing. The breathing bags and breathing tubes also serve to cool the air stored in the OBA. The breathing bags are equipped with a pressure relief valve to relieve excess pressure.
- A timing device warns the wearer to exit the space before the canister chemicals are used up.

**077-3.3.4.2 Quick Starting Canister.** The canister incorporates an oxygen generating candle which supplies oxygen until normal oxygen generation begins. Normal oxygen generation occurs when the wearer exhales moisture and CO<sub>2</sub>. The rate of oxygen generated is proportional to the amount of CO<sub>2</sub> and moisture in the exhaled breath. The quantity of moisture and CO<sub>2</sub> in the exhaled breath is determined by how hard the wearer is working.

**077-3.3.4.2.1 Canisters.** Canisters used for the Type A-4 OBA have a curved shape. The curved shape allows the canister to be inserted into the OBA in only one way. In addition, the back of the canister for the Type A-4 OBA has horizontal ribs and a label to identify the back side from the front side.

077-3.3.4.3 Facepiece. The facepiece is made of rubber in a face seal configuration. The facepiece contains a single wide angle lens made of scratch resistant plastic. The wide angle lens provides good vision and reduces any claustrophobic effect. The facepiece also contains a speaking diaphragm and a rubber nose cup. Air is drawn from the inhalation tube into the facepiece through flapper check valves in the nose cup and is exhaled through an opening inside the nose cup. This opening leads to a combination valve assembly immediately below the speaking diaphragm which contains the inhalation and exhalation flapper check valves. The inhalation tube is attached to one end, and the exhalation tube is attached to the other end of the combination valve assembly.

077-3.3.4.4 Timing Device. The OBA contains a timing device to warn the wearer to return to fresh air. The dial is graduated in minutes and may be set for any fraction of 60 minutes. To set the timer, the dial first needs to be turned to 60 minutes to fully wind the timer, then the timer should be wound back to 30 minutes. The timer bell will ring for several seconds when the set time has expired. When the pointed end of the timer knob is pointing directly away from the body, the warning bell will ring. When the bell rings, start leaving the area to replace the canister in fresh air.

077-3.3.4.5 Air Flow. The flow of air within the Type A-4 OBA is illustrated in [Figure 077-3-41](#). The course the air takes is as follows:

- a. Exhaled air flows down from the facepiece through the exhalation valve and tube to the canister, where it flows through a central tube to the bottom of the canister.
- b. The exhaled air then rises through the chemicals in the canister. The chemicals remove CO<sub>2</sub> and moisture while generating oxygen.
- c. The air from the canister flows into the breathing bags and then through the inhalation tube and valve to the facepiece.
- d. The automatic pressure relief valve relieves excess pressure in the breathing bags.

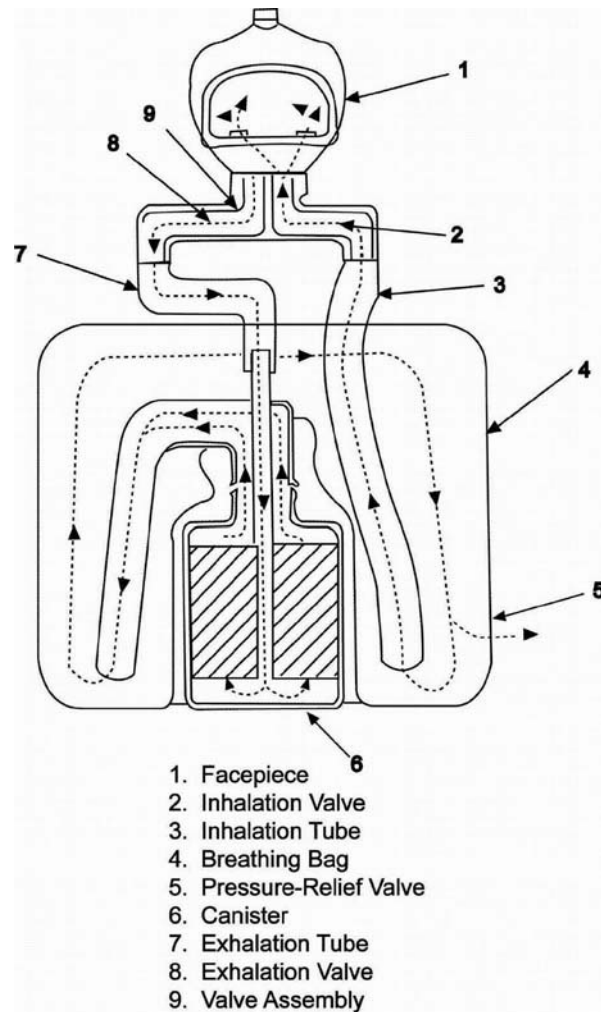


Figure 077-3-41. Navy Type A-4 Oxygen Breathing Apparatus Air Flow Diagram

077-3.3.5 DONNING AND ADJUSTING. The following are the steps for donning and adjusting the Type A-4 OBA (components are called out in [Figures 077-3-40](#) and [077-3-41](#)):

### CAUTION

**Do not raise the bail handle from the standby position to the operating position without first properly inserting a canister into the apparatus. Raising the bail handle without a properly inserted canister may damage both the plunger assembly and the guide rods.**

### NOTE

While all of the following donning and adjusting steps can be done by the wearer, assistance will significantly speed up the process and provide additional assurance that the OBA has been properly donned and adjusted. However, since help is not always available, the wearer shall be able to don and adjust the OBA without assistance.

- a. Check that the bail assembly handle is down and locked in the standby position.
- b. Attach the facepiece breathing tube quick-disconnect couplings (if unattached) to the apparatus as follows:

**NOTE**

Couplings are different sizes and color-coded to ensure proper assembly. It is possible to slide the larger coupling on the smaller nipple, but it will not latch or seal. The OBA will not function if the couplings are not properly installed.

1. Fully retract the spring loaded outer sleeve of coupling, exposing ball bearings.
  2. Push couplings firmly over nipples (black onto black and blue onto blue).
  3. Release the spring loaded outer sleeve.
  4. Test the connection. Grasp the hose at the clamp and pull lightly. If put on correctly, the coupling will not pull off.
- c. Fully extend and straighten all body harnesses and waist straps. Extend facepiece head straps and place harness strap assembly in front of the facepiece lens.
  - d. With one hand, grasp the facepiece by the combination valve assembly and the apparatus by the bail handle. With the other hand, grasp the body straps of the body harness and pad. Bring pad and harness over the head and position OBA on chest.

**NOTE**

In some situations, such as a rolling ship in heavy seas, it may be necessary for the user to have one hand free to help maintain balance. In this case the OBA can be positioned on the chest by grasping the cross bar with one hand, looping the index finger of that hand through a head harness strap, looping the thumb of that hand through the D-ring on the body harness and lifting the OBA into position. Release the D-ring and with the other hand drape the body harness pad assembly over the head and the facepiece behind the head. It is essential that the facepiece not be allowed to be suspended by the breathing tubes. If necessary, obtain assistance in donning the OBA.

- e. Run the underarm straps under the arms and attach snap hooks to the rings on the top corners of the breastplate assembly.
- f. Position the breastplate so the breathing tube quick-disconnect couplings are slightly below the shoulders. While apparatus is held in position, adjust the underarm straps and then the shoulder straps until apparatus is fitting comfortably. When adjusted correctly, the harness pad is located in the top center of the back, and head movement is not restricted when the facepiece is donned.
- g. Place the facepiece over and behind the head so it is out of the way.

**NOTE**

Use of the waist strap is optional. Allowing the OBA to hang freely from the body harness may provide greater mobility in normal use and help to prevent inadvertent bag deflation.

- h. Snap waist strap to the bracket on lower side corner of the breastplate. Adjust this strap to hold apparatus snugly to the body. Wrap excess strap under the secured part of the strap. If there is excess strap from the underarm straps, secure these under the waist strap.

**NOTE**

The waist strap can be quickly adjusted by changing the size of the waist strap loop. A nylon tie wrap attached to the loop will prevent the loop from being accidentally pulled out.

- i. Install canister in accordance with the following procedures:
  1. Remove canister tear-off cap and aluminum protective disk by pulling tab backward and downward. This exposes the copper foil seal and O-ring. Discard cap and aluminum disk. Inspect copper foil seal and O-ring to ensure both are intact. Do not puncture the copper foil seal.

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**WARNING**

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**Do not pull the lanyard when removing candle cover. Pulling the lanyard removes the cotter pin, which fires the candle and generates oxygen. The cotter pin and candle cover are shown in Figure 077-3-42. If the canister is fired while the copper foil seal is still in place, pressure will build in the canister causing the copper foil seal to rupture.**

2. To remove candle cover, hold canister upside down and rotate swivel plate 180 degrees. Pull swivel plate up and toward center of canister, as is illustrated in Figure 077-3-42. Leave cover dangling from lanyard. Do not pull lanyard.

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**WARNING**

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**Do not use an OBA which pierces the foil seal in the standby position. If the canister copper foil seal is pierced when the canister is placed in the standby position, adjust the standby stop in accordance with the OBA technical manual.**

3. With the bail handle locked in the standby (down) position, insert the canister upward into the guard with the neck up and the concave, ribbed side toward the body. The canister is correctly inserted when it is firmly retained by the canister retaining mechanism.

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**WARNING**

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**Do not pull the lanyard when removing candle cover. Pulling the lanyard removes the cotter pin, which fires the candle and generates oxygen. The cotter pin and candle cover are shown in Figure 077-3-42. If the canister is fired while the copper foil seal is still in place, pressure will build in the canister causing the copper foil seal to rupture.**



- j. The OBA may be stowed with an anti-flash hood/firefighter's hood protecting the facepiece lens. Remove the hood from around the facepiece lens, valve assembly, and breathing tubes. If the anti-flash hood is to be worn with the OBA, don the anti-flash hood and pull the face opening over the head to around the neck. Don the facepiece as indicated in the following steps.

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**WARNING**

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**If hair is allowed to penetrate the seal between the face and facepiece, it may result in loss of oxygen from the OBA and penetration of toxic fumes from the outside. To maintain an effective seal, the portion of the face contacting the seal shall be clean shaven.**

1. Insert chin into the facepiece chin stop.
2. Pull head harness strap assembly from front of facepiece over head. Ensure that harness straps are laying flat against the head.
3. First tighten both lower straps at the same time. Next tighten upper straps. Do not tighten forehead strap at this time.
4. Place both hands on head harness pad (on back of head) and push it down toward neck.
5. Retighten first the lower and then the upper straps.
6. Tighten the forehead strap if needed.

**NOTE**

When properly donned, both lower straps are tightened equally, and both upper straps are tightened equally; the facepiece is centered on the face, and the head harness pad is centered squarely on the back of the head.

7. Test the facepiece sealing. To do this, squeeze the corrugated breathing tubes together tightly with one hand. The facepiece should collapse inward while breath is held. This indicates there is a gas tight seal. Hold breath for five seconds. If a leakage is detected, readjust the head harness straps. Test the facepiece seal each time the facepiece is donned.
8. Make final adjustments to all four body harness straps to ensure that the wearer will be able to look up or down without the facepiece shifting or the breathing tubes catching on the timer.
9. If going into a standby condition, loosen the lower facepiece straps only. This allows the wearer to remove the facepiece and place it over and behind the head, out of the way until needed.

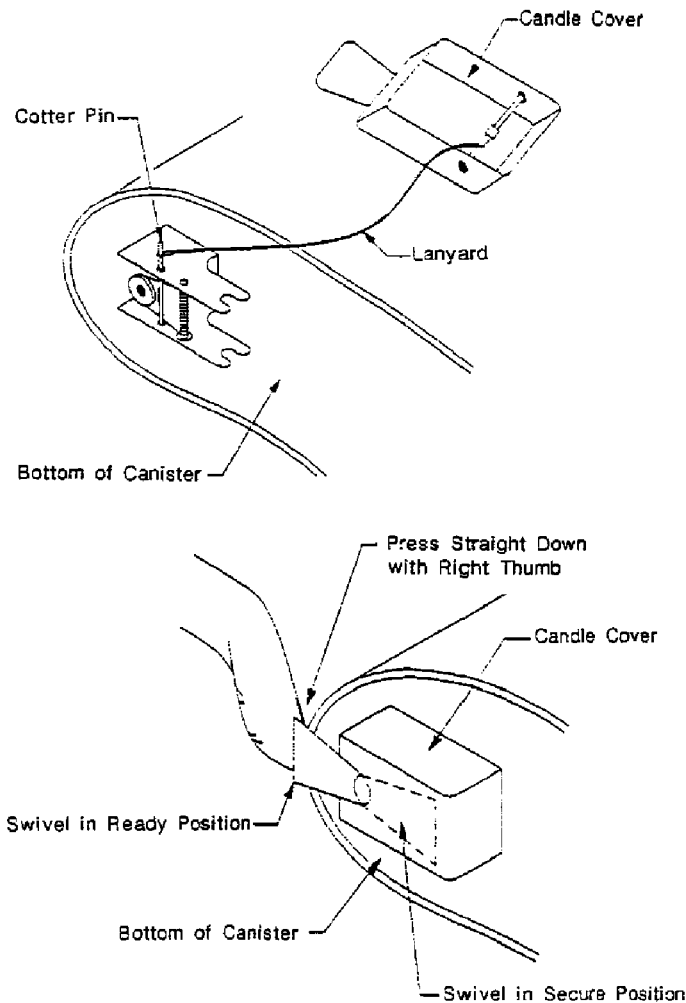


Figure 077-3-42. Candle Cover

## 077-3.3.6 PLACING OXYGEN BREATHING APPARATUS IN OPERATION.

## 077-3.3.6.1 Starting The OBA.

- a. If in a standby condition, don facepiece and retighten the lower straps. Retest facepiece seal (refer to paragraph 077-3.3.5, step j.7).

**CAUTION**

**If the metal canister cap has not been removed, attempting to raise the bail handle into the operating position may damage the plunger assembly.**

- b. Using both hands, depress tabs on bail handle to unlock bail assembly from the standby (down) position. Swing handle upward until it snaps into position. Ensure the handle is locked in position by trying to push the handle forward without depressing the tabs. The handle should not move.
- c. Once [step b](#) is completed, the canister is ready to fire. Two methods to activate the canister may be used; candle start or manual start. The candle start method is the preferred method. The two methods are described as follows:

1. Candle Start. Pull canister lanyard out, away from the body. Hold the lanyard up and visually inspect it to ensure that the cotter pin has been removed from the canister candle firing mechanism. If the cotter pin is attached to the lanyard, the canister has been fired. A small amount of harmless smoke may be present when the canister is fired.

**NOTE**

Should the lanyard break, the canister can be started by pulling out the cotter pin with a pair of pliers. Assistance should be obtained to remove the cotter pin in this manner.

2. Manual Start.
  - (a) Grasp the combination valve assembly with both hands and pull facepiece away from face enough to break the mask's seal.
  - (b) With facepiece pulled away from face, inhale deeply. Relax grip to allow facepiece to reseal on face.
  - (c) Exhale forcefully into facepiece.
  - (d) Repeat [steps a](#) through [c](#) until breathing bags remain full and oxygen is felt on face after exhaling.
  - (e) Recheck facepiece seal (refer to [paragraph 077-3.3.5, step j.7](#)).
- d. Test breathing bag tightness. Depress the left breathing bag at the pull tab with the left hand ([Figure 077-3-43](#)). Simultaneously grasp and seal off both breathing tubes with the right hand while pressing against the right breathing bag with the right elbow ([Figure 077-3-43](#)). Compress the left bag at the pull tab so the relief valve does not lift during this test. This procedure tests the canister, tube connectors, and breathing bags for tightness. If the bags do not remain inflated during the test, determine the cause of the leak and correct prior to use.

**WARNING**

**Do not pull breathing bag tab during normal operation. This will cause a loss of oxygen from the bag.**

- e. Breathe normally. The exhausted breath will cause a chemical reaction in the canister. This will generate new oxygen from the canister. There will be more oxygen in the bag than is required. Excess oxygen will vent from the bag automatically through the relief valve in the bag. If the relief valve should stick after extended stowage time, use the breathing bag pull tab to activate the relief valve. While pulling the tab, check the breathing bag with one hand to ensure bag does not deflate completely.

**WARNING**

**Once the timer bell has sounded, start leaving the contaminated atmosphere area and return to fresh air.**

- f. Once the apparatus is inflated, working, and has been leak tested, set the timer. Rotate the timer knob clockwise to 60 minutes, then set the timer for 30 minutes. Rotating the timer knob to 60 minutes before setting the timer to 30 minutes is required to completely wind the timer bell.

**NOTE**

When the timer is set for 30 minutes, the pointed end of the timer knob will be pointing directly toward the wearer. During service, check the timer frequently by feeling the timer knob position. The pointed end of the timer knob will be pointed directly away from the wearer when the bell sounds.

**NOTE**

Table 077-3-3 shows a shortened OBA donning procedure. This table may be reproduced and positioned near OBA stowage locations for quick reference. Personnel shall be familiar with the complete procedures and precautions for OBA operation prior to using the short procedure.

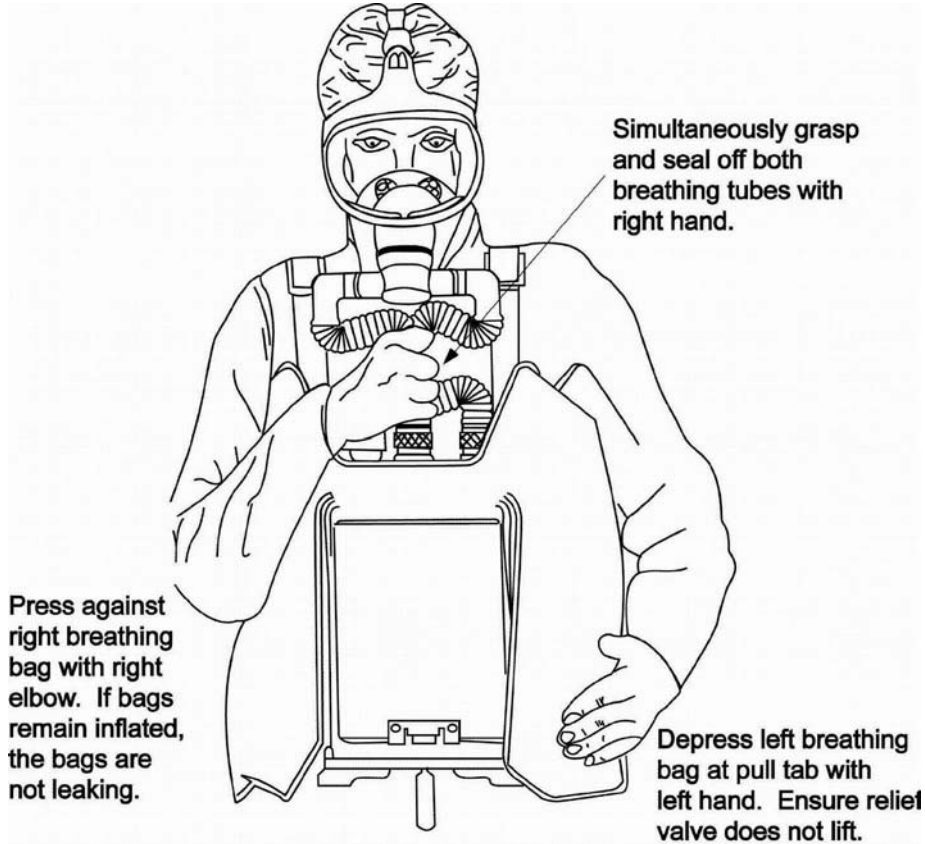


Figure 077-3-43. Testing Oxygen Breathing Apparatus for Leaks

077-3.3.6.2 Canister Removal. Remove canister in accordance with the following procedures:

**WARNING**

**Do not attempt to touch canister during removal. Expanded canisters are hot and will burn unprotected skin. In the event the expanded canister cannot be disposed of after use and has to be temporarily stowed, exercise extreme caution when handling and stowing expanded canisters. Never allow foreign material, particularly grease, oil, or water to enter neck of canister. Any of these substances can cause a violent chemical reaction and may even cause the canister to explode. Take care to prevent entry of any foreign substances in expanded canisters during temporary stowage.**

- a. If the canister has been used, remove the facepiece and put it over and behind the head in the standby position. The facepiece may be left on if another canister is going to be inserted into the OBA immediately.

- b. Depress tabs on the bail handle. This unlocks the bail handle allowing it to be pushed down. Push the bail handle down from operating position to standby position. Loosen or disconnect the waist strap to allow the OBA to swing away from body before pulling release tab. Spread legs apart, lean upper body forward, and pull canister release tab, while keeping hands away from the falling canister. The canister should drop out of OBA. If canister fails to fall out, shake the OBA. This should free the canister.
- c. If the canister still fails to drop out of the OBA, insert a thin metal rod between the inhalation and exhalation tubes, pull the release tab, and attempt to force the canister out. If this does not free the canister, set the OBA aside and allow the canister to cool. Then remove the canister using gloves.

**WARNING**

**Perform the leak test described in paragraph 077-3.3.6.1, step d, each time a fresh canister is inserted and started. If the facepiece is removed, leak test the facepiece after putting it back on (refer to paragraph 077-3.3.5, step j.7).**

077-3.3.6.3 Canister Replacement. Replacement of quick start canisters while the OBA is in use can be carried out indefinitely. Return to a non-contaminated atmosphere at the end of 30 minutes. Once in the non-contaminated atmosphere, replace the used canister with a new canister.

077-3.3.7 REMOVING OXYGEN BREATHING APPARATUS. To remove the OBA, use the following procedure:

- a. The OBA may be stowed with an anti-flash hood protecting the facepiece lens.
- b. Place the facepiece over and behind the head in the standby position and remove the canister.
- c. Loosen the waist strap; then unhook the waist strap.
- d. Loosen the shoulder straps and unhook the underarm straps from the upper corners of the breastplate assembly. Move the facepiece to the vicinity of the bail handle and grasp the facepiece and bail handle with one hand. Grasp shoulder harness, preferably at D-ring connector, with the other hand and lift the harness over head.
- e. If wet or moist, wipe down the OBA.
- f. Always clean the OBA and disinfect the facepiece after each use in accordance with Planned Maintenance System (PMS) requirements.

**Table 077-3-3.** Short Procedure For Donning The A-4 OBA

THIS SIMPLIFIED PROCEDURE ASSUMES THE OPERATOR IS ALREADY FAMILIAR WITH THE COMPLETE PROCEDURES AND PRECAUTIONS FOR OXYGEN BREATHING APPARATUS OPERATIONS AS STATED IN NAVAL SHIPS' TECHNICAL MANUAL, CHAPTER 077.

1. DON REQUIRED PROTECTIVE CLOTHING (including anti-flash hood) prior to donning OBA.
2. VERIFY THE HEAD HARNESS STRAPS are fully extended and positioned in front of the facepiece.
3. PUT YOUR HEAD THROUGH THE "V"-SHAPED OPENING OF THE SHOULDER STRAPS of the body harness.
4. ATTACH THE TWO UNDERARM STRAPS to the "D" ring on each side of the breastplate.
5. POSITION THE BREASTPLATE so the tube connections are slightly below the shoulders. Adjust the underarm straps first, then the shoulder straps for a comfortable fit. The harness pad should be located center of the back, down from the neck.
6. PLACE THE FACEPIECE OVER THE HEAD.
7. SNAP THE WAIST STRAP to the small eyelet on the lower breastplate and adjust to pull the apparatus snugly to body. Wrap the excess strap under the secured part of the strap to prevent snagging. (USE OF WAIST STRAP IS OPTIONAL).
8. REMOVE PROTECTIVE METAL CAP FROM CANISTER; ensure copper foil seal is not damaged and the rubber gasket is present.
9. REMOVE FIRING PIN COVER; let it hang by lanyard.
10. PLACE THE CANISTER IN THE OBA with canister neck up and concave side toward body.
11. DON AND ADJUST THE FACEPIECE:
  - a. Ensure that the anti-flash hood is down around the neck.
  - b. Place the facepiece over the face and pull the head harness straps over head.
  - c. Tighten the neck straps.
  - d. Tighten the side straps.
  - e. Push the head harness down toward the neck.
  - f. Adjust all head harness straps again from the bottom.
12. TEST FACEPIECE FOR PROPER SEAL by squeezing both breathing tubes and inhaling gently; if not airtight, repeat step 11.
13. WHEN READY TO ENTER THE AFFECTED COMPARTMENT, prepare the canister for activation by depressing lock tabs and swinging the bail handle upward until it snaps into position.
14. ACTIVATE CANISTER. Pull the lanyard straight out from the body, removing the cotter pin or use manual start.
15. CHECK THE COMPLETE UNIT FOR TIGHTNESS before entering a toxic or potentially toxic atmosphere by doing the following at the same time:
  - a. Squeeze both breathing tubes together.
  - b. Depress the breathing bag at the relief valve pull tab.
  - c. Press against the breathing bag with the elbow.
  - d. Ensure that the breathing bags remain inflated.
16. WIND TIMER TO 60 minutes, then set at 30 minutes.

**077-3.3.8 CANISTER DISPOSAL.** Dispose of canisters when fully or partially depleted or when the copper foil seal beneath the tear-off cap has been punctured. Jettison canisters overboard when the ship is more than 25 nautical miles from shore. Before disposal, take care to prevent any foreign substance, particularly water, oil, oily water, or grease from entering the canisters.

**077-3.3.8.1** Do not puncture sides or bottoms of canisters but ensure that the tear-off caps are removed and copper foil seals are fully punctured. This allows water to enter the canisters after they have been jettisoned overboard.

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**WARNING**

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**If necessary to puncture the copper foil seal, use a tool that is free of oil, grease, or gasoline. These substances will produce a violent reaction with canister chemicals and possibly an explosion.**

**NOTE**

If the canister tear-off cap has been removed, but the neck seal has not been damaged and the copper foil seal has not been punctured, the canister may be recapped for later use. Recap the canister with a new metal cap.

077-3.3.8.2 Used Canister Storage. If the ship is within 25 nautical miles of shore or if it is impossible to dispose of used, unusable, and unfired (with punctured copper foil seal) canisters by jettisoning them overboard (such as in a submerged submarine) do the following:

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**WARNING**

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**Never handle opened canisters without suitable hand and eye protection (rubber gloves and goggles). The canisters contain caustic chemicals that will injure the skin or eyes. Do not allow these chemicals to come in contact with the person. Never allow expended or unexpended chemicals to spill from the canister. These chemicals may cause combustion of any flammable materials with which they are brought into direct contact, especially if the materials are moist. Clean up any spills immediately. Use a scoop made of metal or nonflammable material to clean up spill.**

- a. Place the unusable and unfired canister in an empty, clean metal bucket. Puncture the copper seal of the unusable or unfired canister, if not already punctured, then fire the candle. Set aside and let the canister produce oxygen from the candle for at least 15 minutes.
- b. After cooling enough to be handled, recap canisters to be disposed with new metal cap.
- c. Wrap canisters and any spilled canister chemicals in double polybags. Stow the polybag wrapped canisters in a dry, oil-free environment until proper at-sea or shore site disposal is possible. Stow bags in a manner to protect against tearing and heat sources which could melt or ignite the bag.
- d. If [step c](#) cannot be achieved, stow canisters in sealed, clean, dry, and oil-free metal containers. Use only open head, closeable, drum-type containers with a gasket. Stow containers in a cool, oil-free space until proper at-sea or shore site disposal is possible.

077-3.3.8.3 Shore Disposal. Upon arrival in port, contact the department ashore responsible for hazardous waste management. Arrange for off loading of used or unusable OBA canisters.

077-3.3.9 PRECAUTIONS. The following precautions are for use with the OBA and quick start canister.

077-3.3.9.1 Oxygen Breathing Apparatus Precautions. Activate the OBA when ready to enter a compartment that has the possibility of a contaminated atmosphere. Ensure that the breathing bags are properly inflated before entering the compartment. If excessive time is needed for filling the bags or rapid deflation after filling occurs, conduct a leak check.

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**WARNING**

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**Do not use an OBA for diving. Water entering through the facepiece and exhalation tube will react violently with the chemicals in the canister.**

- a. The oxygen breathing apparatus, when properly fitted and operated, forms a closed breathing loop with the wearer's respiratory system. In an emergency, it can be worn in partially flooded compartments; however, exercise caution when doing so. The danger of water entering through the seal at the canister neck is negligible, but there is danger of a violent chemical reaction if water enters the canister through the facepiece and exhalation tube. Should the water level cover or partly cover the breathing bags, breathing will be more difficult. The added buoyancy at the wearer's chest can cause difficulty in balance and create a buoyant effect similar to that of a life preserver.
- b. Before entering contaminated atmosphere, check the apparatus to ensure it is gas tight in accordance with the donning and placing into operation instructions. Refer to [paragraph 077-3.3.5, step j.7](#) and [077-3.3.6.1, step d](#).
- c. Once the apparatus is tight and inflated, set the timer. Turn the timer knob clockwise to 60 minutes and then turn it back to 30 minutes. Rotating the timer knob to 60 minutes prior to setting it to 30 minutes is required to fully wind the timer bell.
- d. While in operation, frequently check the timer knob by feeling the pointed end. This is the best way to ensure that the timer is working and to check the remaining time, especially when there are high noise levels and poor visibility.
- e. Take care to protect breathing bags, breathing tubes, and facepiece from damage. If any of these are torn or pierced while working in an unsafe atmosphere, cover damage with hand and return to fresh air immediately.
- f. If canister is changed in fresh air without removing the facepiece, follow the canister starting and OBA leak checking procedures before leaving fresh air.
- g. Never release the facepiece seal in an unsafe atmosphere even if inhalation becomes difficult. Check the breathing tubes to see if they are kinked and restricting air flow. If a kinked tube is not the problem, return to fresh air immediately and have the OBA thoroughly checked.

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**WARNING**

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**Under no circumstances should the oxygen-producing candle be saved for emergency retreat from the compartment. Such practice is dangerous since candles have been known to misfire.**

- h. When the timer bell sounds, start returning to fresh air. Also return to fresh air if it becomes an effort to exhale or if the facepiece lens fogs up when inhaling.



077-3.3.9.2 Quick Start Canister Precautions. Stow canisters in a cool, dry place. Never stow canisters in the OBA. Do not remove tear-off cap until ready to insert the canister in the OBA.

- a. Insert the canister in the OBA and lock the canister in the operating position before pulling lanyard to activate the canister. Never pull the lanyard until the canister has been inserted in the OBA and is in the operating locked position. If lanyard is pulled before the canister is inserted in the OBA or the canister is not in the operating locked position, the copper foil seal will blow out.
- b. Never try to reuse a canister. Once the copper foil seal is pierced and the canister has been removed from the OBA, consider the canister expended.
- c. Used canisters are very hot. Never handle them without suitable hand protection. Never allow any substance, particularly oil, water and oil mixtures, gasoline, or grease to enter the neck of the canister. A violent reaction occurs when these substances come in contact with the oxygen producing chemicals. Never hold your face over the canister opening.
- d. Never handle opened canisters without suitable hand and eye protection (rubber gloves and goggles). The canisters contain caustic chemicals that will injure the skin or eyes. Do not allow these chemicals to come in contact with the person. Never allow expended or unexpended chemicals to spill from the canister. These chemicals may cause combustion of any flammable materials with which they are brought into direct contact, especially if the materials are moist. Clean the spill up immediately and dump overboard unless within 25 miles of land or in port. If within 25 miles of land or in port, seal the spilled material in a double poly bag and dispose of it in the same manner as expended OBA canisters. Use a dust pan or scoop made of metal or nonflammable materials to clean up spill.
- e. Never paint canisters. Rotate canister stock to allow the older canisters to be used first or for training. Use canisters with paint peeling off for shipboard training.

077-3.3.10 STOWAGE. The following criteria and precautions shall be followed when stowing OBA's and canisters

077-3.3.10.1 The following are acceptable stowage arrangements listed in order of preference:

- a. Stowed in dedicated OBA stowage lockers either inside or outside a damage control repair station.
- b. Stowed vertically inside or outside a damage control repair station when dedicated OBA lockers are not available or practical. Locate OBA's where they are not subject to damage and are shielded by ship's structural members, when possible. OBA's shall be well supported and strapped in place by an elastic shock cord. Provide a separate support for the facepiece.
- c. Stowed horizontally inside or outside a damage control repair station lying on a shelf, one high, with the facepiece on top.
- d. Stowed in Navy Standard Aviator Kit Bags and hung from installed hooks. The body of the OBA and other heavy items are to be placed in the bottom with mask and breathing hoses on top. In the same bag, stowage is available for (2) canisters, (1) anti-flash hood, (1) pair anti-flash gloves, (1) pair firefighter gloves, and (1) firefighter helmet.

077-3.3.10.2 Stow OBAs in areas that are cool and dry. This prevents the buildup of moisture which causes mildew damage. Keep OBAs away from oil, paint, and greasy substances. These are harmful to materials used in the construction of the OBA. Report any OBA not correctly stowed to the Damage Control Officer.

077-3.3.11 OXYGEN BREATHING APPARATUS CANISTER TRAINING KITS. All personnel shall attend a training session on the use of the OBA in accordance with Type Commander instructions. Use the training kits for classroom training of personnel in the use of the OBA. The training kits are used to ensure complete and realistic training for all personnel.

**NOTE**

Training with quick-start canisters is highly recommended, as funding permits.

077-3.3.11.1 General. The fully assembled training canister provides identical operation to the quick-start canister. The training canister contains a replaceable candle and removable firing mechanism, and is designed for use by 40 trainees. Each candle provides a 5-minute supply of oxygen when fired. Insert a new candle in the canister for each trainee.

077-3.3.11.2 Illustrated Views. An exploded view of the training canister is provided in [Figure 077-3-44](#). The firing mechanism assembly is illustrated in [Figure 077-3-45](#).

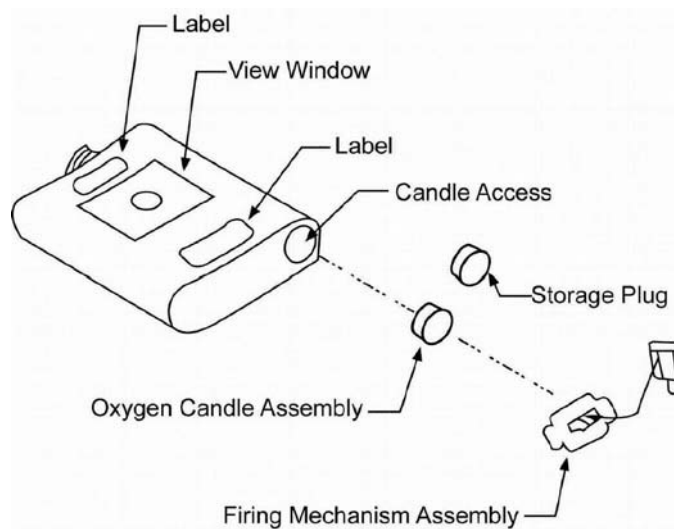


Figure 077-3-44. Exploded View of Training Canister Assembly

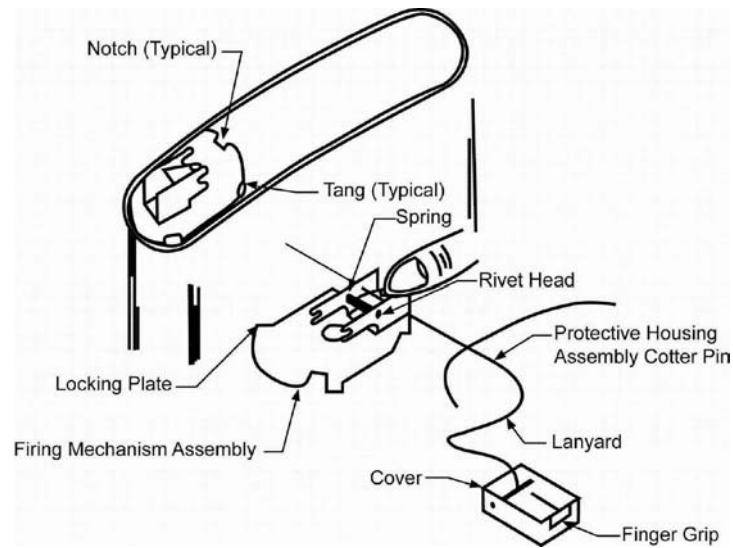


Figure 077-3-45. Detail of Training Canister Firing Mechanism Assembly

077-3.3.11.3 Training Canister Kit Contents. In each training canister kit, the following items are included:

- a. One red canister (quick-start canisters are green)
- b. One storage plug
- c. Forty oxygen candle assemblies
- d. Forty tear-off caps
- e. One firing mechanism assembly
- f. One protective housing assembly
- g. Spare items include:
  1. One storage plug
  2. One firing mechanism assembly
  3. Five protective housing assemblies

077-3.3.11.4 Training Canister Chemicals. The chemical in the training canister is not the same chemical used in the actual quick-start canister and only absorbs  $\text{CO}_2$ . This chemical does not produce oxygen. The amount of chemical in the training canister is enough to absorb  $\text{CO}_2$  for 40 trainees who are not performing any work.

077-3.3.11.5 Chemical Monitoring. A view window is provided on the training canister for checking the chemicals. If the canister view window changes from solid pink to a solid blue color, discard the canister. Also discard the training canister if it has been used by 40 trainees. Refer to [paragraph 077-3.3.11.12](#) for training canister disposal instructions.

077-3.3.11.6 Oxygen Candle. Oxygen used in the training canister is generated by a replaceable candle. The candle produces a 5-minute supply (10 liters) of oxygen. Oxygen generation starts within 15 seconds after the candle has been fired.

077-3.3.11.7 Oxygen Generation. Oxygen generation is started by firing the canister as you would a quick start canister. A small amount of harmless smoke may initially be present when fired. This is a normal condition and is a positive sign that the candle is working. Another sign that the candle is generating oxygen is the breathing bags inflating.

077-3.3.11.8 Charging Instructions for Training Canister.

077-3.3.11.8.1 For initial use or reuse of the partially used canister, use the following procedure:

- a. Remove cover from firing mechanism, then remove the mechanism and storage plug (see [Figure 077-3-44](#)). Save the storage plug, and reuse it when storing a partially used canister to prevent moisture from entering the canister body.
- b. Insert the candle assembly into the candle recess in the canister. Ensure the gasket is laying flat against the bottom of the canister.
- c. Ensure the firing mechanism is cocked and the cotter pin is in place. Place firing mechanism over the candle assembly with candle primer housing projecting through the center hole. Line the notches up with the tangs, as illustrated in [Figure 077-3-45](#).

**NOTE**

Notches and tangs are positioned so the unit can be assembled only in the correct position.

- d. Rotate firing mechanism clockwise to lock candle in place. Tighten until tangs are in contact with firing mechanism frame. Do not over tighten.
- e. Fold lanyard into candle cover. Secure candle cover on firing mechanism frame.
- f. The canister is now ready for use in the OBA.

077-3.3.11.8.2 For canisters which have previously been fired, use the following charging procedure:

- a. Secure metal tear-off cap on the canister neck. Ensure hand tab is pointing toward instruction label on ribbed side of canister.

**WARNING**

**The firing mechanism and candle will be hot after use. Wear gloves or allow items to cool before handling.**

- b. Remove firing mechanism from bottom of canister. To accomplish this, turn firing mechanism counterclockwise until tangs line up with notches.
- c. Remove used candle and discard.
- d. Hold firing mechanism with slotted end of frame pointing toward you. Raise firing hammer to cocked position.
- e. While holding firing hammer in this position, replace the cotter pin through the holes in the frame from the same side (see [Figure 077-3-45](#)).
- f. Install new candle and replace firing mechanism in training canister as described in [paragraph 077-3.3.11.8.1, steps b through f](#).
- g. Don and adjust the OBA in accordance with the procedures contained in [paragraph 077-3.3.5](#).

077-3.3.11.9 Starting the Training Canister. For starting the training canister, use the following procedure:

- a. Remove the tear-off cap from charged canister. Pull the tab straight backward and downward. Remove the disk and aluminum protector to expose the rubber gasket.

- b. To remove candle cover, hold canister upside down and rotate swivel plate 180 degrees. Pull swivel plate up toward center of canister. This is illustrated in [Figure 077-3-42](#). Leave cover dangling from lanyard. Do not pull lanyard.
- c. Insert canister, curved or ribbed side toward body, into the bail assembly. This is the standby position.
- d. Don facepiece and adjust in accordance with [paragraph 077-3.3.5, step j](#). Check facepiece for airtight fit, as outlined in [paragraph 077-3.3.5, step j.7](#).
- e. Depress tabs on bail handle and swing bail up to the locked operating position. Ensure bail handle is locked in position by pushing on the handle without pushing the tabs. The bail handle should not move.
- f. Pull lanyard straight out away from the body. This removes the cotter pin and fires the candle, inflating the breathing bags with oxygen. Leak test OBA, as outlined in [paragraph 077-3.3.6.1, step d](#).
- g. Set timer on OBA. Rotate timer knob to 60 minutes and return to 5-minute setting.
- h. After training canister has been used for 5 minutes, remove canister. To accomplish this, depress tabs on bail handle and swing bail handle to the standby position. Loosen waist straps, spread legs apart, lean upper body slightly forward, and pull on canister release tab (see [Figure 077-3-40](#)). Canister will drop out of the apparatus.
- i. If canister can be used for next trainee, recharge in accordance with [paragraph 077-3.3.11.8.1](#).
- j. Following each use of the training canister make a mark on the front of the canister with an indelible pen to indicate a use of the canister. When the canister has been used 40 times or the canister view window changes from a solid pink color to solid blue, dispose of the canister, as outlined in [paragraph 077-3.3.11.12](#).

077-3.3.11.10 Stowage. Stow training canisters in kits and lock them in special lockers (NAVSEA Dwg. No. 804-2252162) or in locked compartments. Keep the kit locked up at all times, unless being used for training. The Damage Control Officer shall have control of the keys to ensure training canisters will not be used during actual emergencies.

- a. After training is completed or if a break of more than an hour is taken, seal partially used canisters using the metal tear-off cap. Remove the oxygen candle and insert the plastic storage plug in the canister candle recess.
- b. Return the partially used canister to the special locker or compartment and lock it up. Inspect all components to ensure that they are protected from moisture, which will cause deterioration. If lockers are not provided, stow canisters in a locked, dry, cool storeroom.

077-3.3.11.11 Precautions for the Training Canister. Observe the following precautions when using the OBA training canister:

- a. This type of canister is for OBA TRAINING USE ONLY. Never use the training canister during actual emergencies. Simple exercises can be performed while the unit is in use for training purposes. Charge the training canister with a fresh candle prior to each use and only use it in the presence of an instructor. Personnel experienced and qualified in the use of an OBA shall act as instructors. The use of the training canister by any trainee shall never exceed 5 minutes.
- b. Before each use of the training canister, an instructor shall inspect the color of the chemical through the view window. The pink color in the view window indicates a safe canister. As CO<sub>2</sub> is absorbed, the color in the view window will change to a blue color. When the canister has been used by 40 trainees or if the color in the view window is completely blue (whichever occurs first), discard the canister.
- c. All trainees shall be under an instructor's supervision at all times. The instructor shall ensure that the breathing bags are inflated and continually supplying oxygen. If a low oxygen air mixture exists and is inhaled, near immediate collapse of the trainee will occur. Immediate aid shall be rendered by the instructor.
- d. Keep training canisters free of oil, water and oil mixtures, gasoline, and grease.

- e. The training canister firing mechanism and candle assembly get hot after firing the candle. Exercise care when removing training canister firing mechanism and candle assembly for recharging the canister. (Refer to [paragraph 077-3.3.11.8.1.](#))
- f. The chlorate candle used in the training canisters is subject to moisture deterioration. Therefore, do not open training kits until immediately prior to use. Keep kits closed whenever practicable. Do not remove candles from their protective wrappings until the canister is to be recharged.

**NOTE**

Only candles contained in individual cans with tear-off tops are allowed for use in training canisters. Discard older candles which are wrapped in plastic.

- g. Do not stow training canisters inside the OBA. Do not stow training canister kits in damage control lockers. Do not attempt to cock the firing mechanism while the mechanism is mounted on the training canister. Do not remove the tear-off cap until canister is to be inserted into the OBA. Do not stow the canister without the tear-off cap and plastic storage plug in place. Never stow the canister with the oxygen candle installed.

077-3.3.11.12 Disposal. After the training canister has been used by 40 trainees or if the view window is a solid blue color, dispose of the canister, as outlined in [paragraph 077-3.3.8.](#) Once a chlorate oxygen candle has been burned, it contains harmless sodium chloride (table salt) and partially oxidized iron and can be disposed in the regular trash once it has cooled.

077-3.3.12 OXYGEN BREATHING APPARATUS MAINTENANCE. Conduct routine maintenance in accordance with PMS requirements. In addition, clean the OBA and disinfect the facepiece after each use in accordance with PMS requirements.

For information on OBA corrective maintenance, see the Type A-4 OBA technical manual (NAVSEA SS600-AA-MMA-010/A-4). For information on OBA repairs beyond local capabilities, consult the Master Repairable Items List.

**077-3.4 EMERGENCY ESCAPE BREATHING DEVICE (EEBD).**

**WARNING**

**Unauthorized S-Tron EEBDs are defective and considered dangerous to personnel. They should be removed from service immediately and turned in by QDR process. To:  
Commanding Officer  
NAVICP-M Code 05614  
QDR Branch 5450 Carlisle Pike  
Mechanicsburg, PA 17055**

077-3.4.1 GENERAL. The EEBD is part of the allowance for all surface ships. The EEBD is a self-contained, emergency breathing device used for escape from compartments contaminated by smoke, fluorocarbon refrigerants, or other atmospheric toxic gases. There are currently two manufacturers producing EEBDs for the U.S. Navy: Ocenco, Inc. and Scott Aviation. Each manufacturer's device will be discussed in the following paragraphs. The EEBDs are illustrated in [Figure 077-3-46.](#) Additional details on the Ocenco M-20.2 unit can be found on MIP 6641/004 and for the Scott Aviation Unit P/N 802300 in NAVSEA SS600-AF-MMO-010. Current general information for EEBDs can be found on the Damage Control and Fire Protection Engineering Website at [www.d-cfp.navy.mil](http://www.d-cfp.navy.mil).

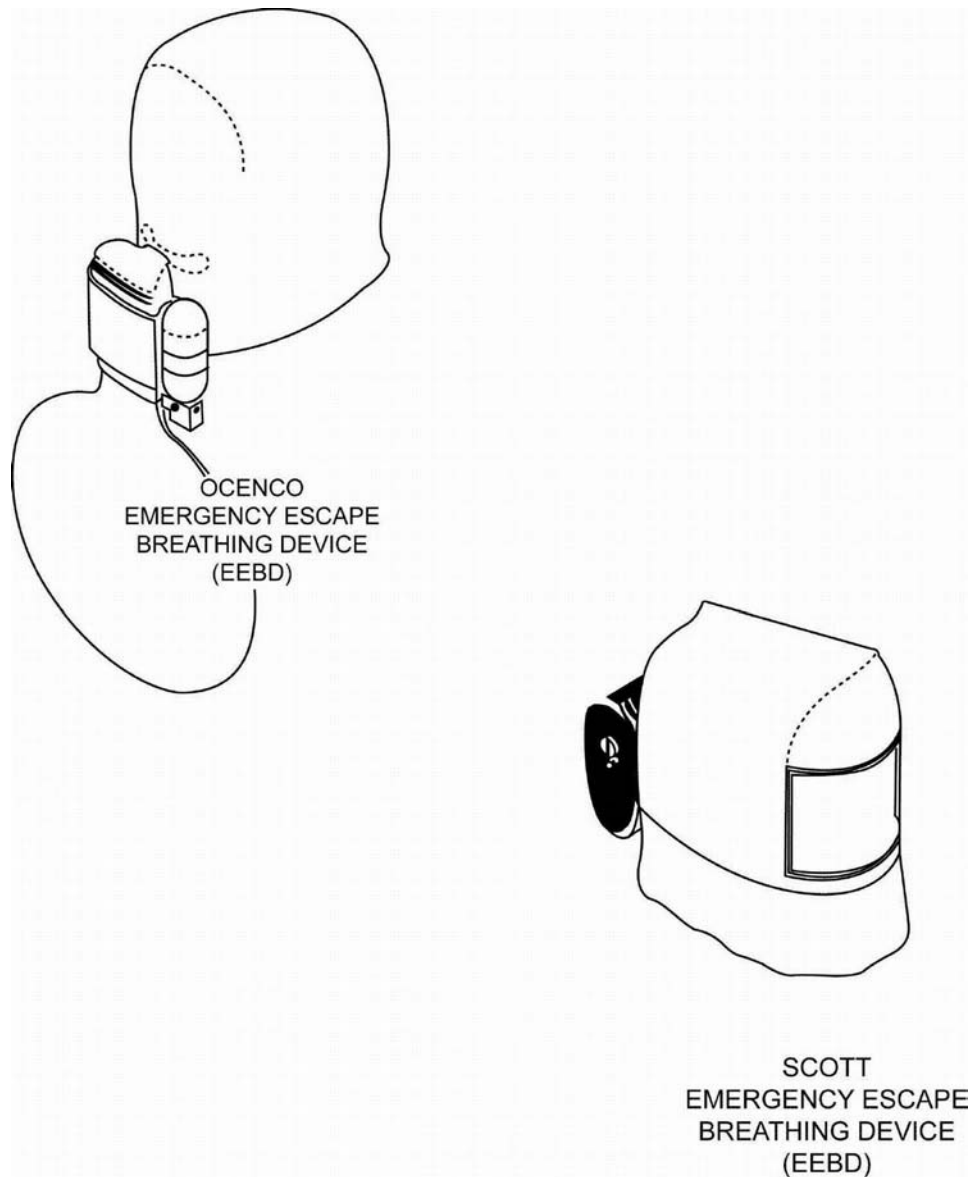


Figure 077-3-46. Emergency Escape Breathing Devices Fully Donned

#### NOTE

EEBDs are not provided for submarine personnel because sufficient quantities of air line masks are available for all personnel, and, in an emergency, it is quicker to move from compartment to compartment without taking the time to don an EEBD.

077-3.4.2 QUANTITY AND LOCATION. The total shipboard quantity for EEBDs are determined by the Damage Control Type Commander Representatives for each ship class and are found on the Allowance Equipage Lists (AELs) below:

**Table 077-3-4. EEBDs Shipboard Quantities**

Ship Class	AEL #
LHA 1	2-330024201
LHD 1	2-330024202
LPD 4	2-330024203
LSD	2-330024205
LPD 17	2-330024206
MCM	2-330024207
AGF	2-330024221
ARS 50	2-330024222
CG 47	2-330024223
DDG 51 through 78	2-330024225
DDG 79 and follow	2-330024226
FFG 7	2-330024227
LCC 19	2-330024228
CV	2-330024230
CVN	2-330024231
AS	2-330024242

EEBDs shall be provided in the following locations in priority sequence:

**WARNING**

**Large numbers of EEBDs located in close proximity to each other in berthing spaces could cause congestion and delay evacuation of the compartment. To minimize confusion, it is preferable to attach EEBDs to assigned berths.**

- a. Provide one EEBD for every berthing rack in each crew berthing and living space. This includes crew berthing, Chief Petty Officer (CPO) berthing, staterooms, troop berthing, airwings, embarked personnel, and staff berthing accommodations. Attach EEBDs to or under individual berths or locate them in the vicinity of the berth. EEBD stowage cases are prefabricated into the modular berths. EEBDs located in the vicinity of the berths must be easily located for rapid retrieval and egress from the compartment.
- b. Medical and dental spaces, locate EEBDs no more than five feet from assigned berths.
- c. All main engineering spaces shall have EEBDs equal to twice the general quarters manning (200 percent). An EEBD shall be located at each watch station. The rest of the EEBDs in the space shall be disbursed within the space to ensure coverage for personnel in remote areas and also along normal and auxiliary escape routes. Additional EEBDs may be necessary to ensure adequate coverage.
- d. Provide one EEBD for every Condition I billet or underway watch in deep spaces below the Damage Control deck and other spaces having difficult escape routes.
- e. EEBDs should also be installed in unmanned spaces having difficult escape routes which are frequently occupied during normal in port and underway conditions.
- f. Provide EEBDs in high risk manned spaces, on or above the damage control deck, which present difficulties



or hazards to evacuation or have limited or long evacuation routes. The number of EEBDs located in each space shall be equal to the general quarter manning for the space.

- g. Provide one EEBD for those individuals stationed in the repair station (repair locker leader, phone talker, and plotters). Position one EEBD in the passageway adjacent to each repair station or within the compartment for immediate access.

### NOTE

It is the responsibility of each ship to ensure that all embarked personnel are trained in the safe use of the EEBD. This includes embarked troops, flag staff, temporary additional personnel required for particular ship missions, air wing personnel, and civilian technical representatives.

077-3.4.3 OCENCO (M-20.2) EEBD UNIT. The Ocenco (M-20.2) EEBD is a phased replacement to the Scott Aviation EEBD P/N 802300-14. The Ocenco EEBD meets the new stringent U.S. Navy specifications, which includes Grade A Shock and Vibration.

077-3.4.3.1 DESCRIPTION. The Ocenco EEBD consists of an orange stowage case, a clear cover and base, a latch, a nose clip, a mouthpiece, a carbon dioxide scrubber, a breathing bag, a relief valve, an oxygen cylinder, a regulator assembly with a gauge, and an optional Teflon hood (face shield) to protect face and eyes from smoke and fire (Figure 077-3-47). The Ocenco EEBD will operate for 10 minutes after it is activated, which satisfies the time requirement to egress from engineering or berthing spaces.



Figure 077-3-47. Ocenco (M-20.2) EEBD

077-3-4.3.2 DONNING AND PLACING INTO OPERATION. The donning of the Ocenco EEBD is quick and simple; donning time is less than 10 seconds. The Ocenco EEBD can be bulkhead mounted (orange case) for quick and easy access. To don and activate the Ocenco EEBD, use the following procedures:

- a. Remove the Ocenco EEBD from the orange stowage case.

**WARNING**

**The Ocenco EEBD cannot be turned off once it has been activated.**

- b. Lift the yellow lever on the latch. Discard the latch and clear cover case. Ensure that the unit is completely separated from the clear base, which will automatically start oxygen flow into the breathing bag.
- c. Remove the unit by pulling the yellow neck strap upward or the mouthpiece upward and place the neck strap over head. Oxygen flow will begin automatically when the unit is removed from its clear base. Do not expect to hear the flow of oxygen or to see the breathing bag inflate.
- d. Immediately insert yellow mouthpiece into mouth (mandatory).
- e. Fit yellow nose clip (mandated by NIOSH) on nose. When donned properly, the nose clip will feel tight.
- f. Inhale through mouth and immediately escape.
- g. There are two additional features of the Ocenco EEBD: an adjustable neck strap and a face shield that may be used during escape. If necessary, adjust the neck strap by pulling upward on the O-ring; this may be helpful when crawling is required to escape. To fit the face shield, simply pull it over head and pull outward on the O-rings to tighten the face shield around the neck. This may be helpful to protect eyes from smoke irritation and avoid contact with direct flame.

**WARNING**

**Don an EEBD before climbing up ladders. Do not attempt to use an EEBD for firefighting.**

077-3.4.4 SCOTT AVIATION (P/N 802300-14) EEBD

077-3.4.4.1 DESCRIPTION. The Scott Aviation EEBD consists of a hood and a life support pack. The hood is made of a flame-resistant material. The hood also has a flame-resistant, clear window for viewing. The life support pack consists of an oxygen generator and a scrubber element for removing CO<sub>2</sub> and water vapor. The system maintains positive pressure inside the hood to prevent smoke and toxic gases from entering. The Scott Aviation EEBD will operate for 15 minutes after it is activated.

077-3.4.4.2 DONNING AND PLACING INTO OPERATION. The donning of the Scott Aviation EEBD is quick and simple. This makes it suitable for situations where there is little time to seek safety from contaminated atmospheres. To don the Scott Aviation EEBD, use the following procedure:

- a. Remove the Scott Aviation EEBD from its orange, plastic stowage case and grasp the vacuum-sealed bag in one hand. Pull tear strip off to fully open bag.

**NOTE**

**The Scott Aviation EEBD cannot be turned off once it has been activated.**

- b. Remove the Scott Aviation EEBD from the bag. To start the Scott Aviation EEBD, put a finger in the actuating ring with the red tape marked PULL TO ACTUATE. Pull hard until the actuation pin separates from the unit. A hissing sound will be heard indicating that the EEBD has been activated.
- c. Using both thumbs spread the neck seal apart.

- d. Lean forward and put the Scott Aviation EEBD up to your face and place chin in the opening of the neck seal. Pull the hood up and over your head.
- e. Stand straight up and pull the hood down until the head fits snugly around the head straps. Ensure the neck seal is in contact with the neck and there is no clothing or hair between the neck and the neck seal.

#### NOTE

Personnel with glasses may find it easier to don the Scott Aviation EEBD while standing straight up. Place chin in the hole and stretch the hood up and over the head.

#### WARNING

**If the hissing sound stops before reaching a safe atmosphere, remove the Scott Aviation EEBD in an area away from flames. The wearer will suffocate if the Scott Aviation EEBD is worn after the hissing stops. If an unused EEBD is available, put it into operation and don it immediately.**

077-3.4.5 EMERGENCY ESCAPE BREATHING DEVICE USE. Immediately don an EEBD when the atmosphere becomes life threatening or when ordered to evacuate the space by the watch supervisor. Don the EEBD prior to exiting a space via a vertical ladder. This is necessary due to the possibility of encountering smoke while climbing such ladders and the inherent awkwardness associated with this type of egress. Additional guidance for propulsion spaces can be found in **NSTM S9086-S3-STM-010, Chapter 555, Volume 1, Surface Ship Firefighting**. If a situation warrants exiting a space but an EEBD is not yet required, carry the EEBD and don it at the first encounter with smoke or other toxic atmospheres.

Immediately don an EEBD when the atmosphere becomes life threatening or when ordered to evacuate the space by the watch supervisor. Don the EEBD prior to exiting a space via a vertical ladder. This is necessary due to the possibility of encountering smoke while climbing such ladders and the inherent awkwardness associated with this type of egress. Additional guidance for propulsion spaces can be found in NSTM S9086-S3-STM-010, Chapter 555, Volume 1, Surface Ship Firefighting, or S9086-S3-STM-020, Volume 2, Submarine Firefighting, the main space fire doctrine. If a situation warrants exiting a space but an EEBD is not yet required, carry the EEBD and don it at the first encounter with smoke or other toxic atmospheres.

077-3.4.5.1 When response or equipment repair teams enter an area or space where there is the possibility of a life threatening situation, they shall bring sufficient EEBDs for all team members. The quantities of EEBDs are in addition to the EEBDs stowed in the area or space for assigned personnel. Keep these EEBDs nearby and readily available for use by team members. When the work has been completed, return the unused EEBDs to their normal stowage location. For disposal of used EEBDs, refer to [paragraph 077-3.4.9.1](#). Ship spent Ocenco EEBDs, freight pre-paid, to Ocenco for proper disposal.

077-3.4.5.2 After reaching an uncontaminated atmosphere away from any flame, remove the Ocenco EEBD by pulling the unit forward over head. Remove the Scott Aviation EEBD unit by grasping the back edge of the hood and pull it up and over the head. During escape with the Ocenco EEBD, it is normal for the wearer to experience an increased breathing air temperature. The breathing air temperature will be warm but not hot: a maximum temperature of 115° F may be reached only during very hard work. Do not attempt to remove the Ocenco EEBD when the breathing air feels warm; it could be a toxic atmosphere. The Scott Aviation EEBD unit makes a continuous hissing noise, ensuring the wearer that the Scott Aviation EEBD unit is generating oxygen. The hissing sound is loud enough to hear over background noise. It is important to speak loudly to anyone wearing the Scott Aviation EEBD to make yourself heard over the hissing sound.

077-3.4.5.3 Make EEBD training realistic. Personnel shall memorize EEBD stowage locations and be drilled in quick retrieval and donning of the EEBD. It is important to stress the nature of situations anticipated when an EEBD is needed. Factors such as darkness and the inherent confusion accompanying casualties and fires make it mandatory that use of the EEBD becomes automatic. Egress training is essential and should be practiced blind-folded. Normal escape routes may not be accessible. Examine every possible escape route during training for emergency situations.

077-3.4.6 PRECAUTIONS. The EEBD is a useful piece of equipment in emergencies. However, there are hazards associated with its use. Observe the following precautions:

The EEBD is a useful piece of equipment in emergencies. However, there are hazards associated with its use. Observe the following precautions:

- a. The Ocenco EEBD is rated by NIOSH for a minimum use of 10 minutes, but during an actual shipboard escape Ocenco EEBD can last between 15 to 20 minutes. In a shipboard casualty, the Ocenco EEBD can last up to 32 minutes if the user is trapped and waiting rescue.
- b. The Scott Aviation EEBD provides only 15 minutes of oxygen for the wearer. After the time has expired, noted by the stop of the hissing noise, the Scott Aviation EEBD must be removed or the wearer will suffocate.
- c. Use the EEBD only for escape from contaminated atmospheres or while awaiting rescue. Never use an EEBD for firefighting, entering voids, or other uses that require a respirator but are safe from contaminated atmospheres.

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**WARNING**

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- **Do not use an EEBD for firefighting.**
- **Do not drop the EEBD.**
- **Do not immerse EEBD in water.**
- **Do not sit on the EEBD.**
- **Do not drag an EEBD.**
- **Do not place EEBD near heat source.**
- **Do not put tape or stickers on the EEBD that would impede its opening or the reading of the gauge.**

077-3.4.7 SHELF LIFE - OCENCO EEBD. The shelf life of the Ocenco EEBD is 15 years. If the date of manufacture has passed 15 years, replace the Ocenco EEBD with a fresh unit. To ensure the Ocenco EEBD is in working condition, check the pressure gauge. If the white indicator needle does not appear in the green zone, remove the Ocenco EEBD from service. If the surrounding air temperature is above 100° F (38° C) and the needle is to the left of the green zone, allow the unit to cool down to room temperature between 65 to 75° F (18 to 24° C). There are two different gauges used on the Ocenco EEBD: gauge with red face plate and the other with spiral coil in the center. Either type is usable as long as the needle in the gauge is reading within the green zone.

077-3.4.8 SHELF LIFE - SCOTT AVIATION EEBD. The Scott Aviation EEBD is packaged in a vacuum sealed plastic bag and then placed in an orange, plastic stowage case. There is a view port in the stowage case for observing a humidity indicator and the date of manufacture. The shelf life of the Scott Aviation EEBD is 15 years, with the following exception: any Scott Aviation EEBD that has a manufactured year prior to 1987 shall have a shelf life of 16 years. If the date of manufacture has passed 15 years, replace the Scott Aviation EEBD with a fresh device. If the humidity indicator has changed color from blue to clear or pink, replace the Scott Aviation EEBD.

077-3.4.9 DISPOSAL. Safe disposal is necessary after an EEBD has been used, failed inspection, or shelf life has expired. Proper disposal of used EEBDs is required. Used and expired EEBDs must be identified, quantified, and recorded on local authorized chain of custody forms by stock number. The used and expired EEBDs are packaged for safe transportation and sent to the Defense Reutilization Marketing Office (DRMO) or Public Works Center (PWC) for disposal. Retain one copy of the chain of custody forms with signatures from DRMO or PWC.

077-3.4.9.1 Disposal of Ocenco EEBDs. If an Ocenco EEBD has been used, allow a minimum of one hour cool-down before proceeding.

- a. Label the Ocenco EEBD with felt tip marker as follows:
  1. Mark SPENT on serial number label plate if EEBD has been activated.
  2. Mark reason for removal from service on serial number label plate if EEBD has not been activated.
- b. In order to return Ocenco EEBDs to Ocenco for either disposal or a warranty claim, ships need to obtain a Returned Materials Authorization number (RMA) from the Ocenco web site, [www.ocenco.com/rma](http://www.ocenco.com/rma). Return marked Ocenco EEBD and orange stowage case, freight pre-paid, with labeling in accordance with PMS procedures to Ocenco, Incorporated, 10225 82nd Avenue, Pleasant Prairie, Wisconsin 53158-5801.

077-3.4.9.2 Disposal of Scott Aviation EEBD. If a Scott EEBD has been used, allow a one hour cool-down time before proceeding. Used Scott Aviation EEBDs and units that are unusable, because the humidity indicator has changed color from blue to clear or pink, or because the date of manufacture has passed 15 years, must be disposed of as hazardous waste. It is not necessary to activate unusable Scott Aviation EEBDs prior to disposal.

- a. Label Scott Aviation EEBDs with a felt tip marker as follows:
  1. If the device has been activated, mark SPENT on the plastic housing of device.
  2. If device has not been activated, mark UNSPENT on unopened vacuum bag.
- b. Return marked device and vacuum bag to plastic carrying case.
- c. Retain for shore disposal as hazardous material. Prepare EEBDs for shore site disposal in accordance with PMS procedures.

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**WARNING**

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**Chemicals contained in the EEBD will produce a strongly irritating solution when mixed with water. Do not immerse the EEBD in water or stow in a location where flooding is likely to occur.**

077-3.4.10 EMERGENCY ESCAPE BREATHING DEVICE MAINTENANCE. Perform maintenance on the EEBD in accordance with Planned Maintenance System (PMS) requirements. Refer to MIP 6641/004-79, Damage Control Petty Officer (DCPO) Level 4 - Equipment Test for more detail information.

077-3.4.11 TRAINING EMERGENCY ESCAPE BREATHING DEVICE UNIT. The training EEBD (Ocenco and Scott Aviation) unit is a non-functional copy of the operational EEBD. These units are labeled as training units and the newer ones are contained in blue rather than orange plastic cases. Stow and lock up the training EEBDs away from the operational units. This is to avoid mistakenly using a training unit during an emergency when darkness or smoke prevents seeing the label or color difference.

**WARNING**

**The operational EEBD unit (Ocenco and Scott Aviation) has no replacement parts. The operational EEBD unit is design to be a one-time use device only. Never have parts replaced after it has been used.**

077-3.4.12 OCENCO EEBD TRAINING UNIT. The Ocenco EEBD training units have several replacement parts, so the trainer may be used over and over. These parts include the following:

- a. Mouthpiece Mounting Kit
- b. Mouthpiece Assembly
- c. Neck Harness Assembly
- d. Noseclip Assembly
- e. Activation Cable Kit
- f. Band Assembly
- g. S-Hook

077-3.4.12.1 Maintenance of the Ocenco EEBD Training Unit. The Ocenco EEBD training unit is easily disassembled, cleaned, and reassembled for the next trainee. After use, the mouthpiece is removed by pressing the release button with a standard pencil eraser or similar object. Clean and disinfect the mouthpiece in accordance with the PMS procedures and attach a clean mouthpiece to the training unit before repacking. Ensure that the mouthpiece and training unit is dry first before storing or repacking.

077-3.4.12.2 Repacking the Ocenco EEBD Training Unit. To repack the training unit, lay the training unit, mouthpiece up on a table with the bag flat. Fold the breathing bag (comes in black or tan) into thirds lengthwise and roll it up.

077-3.4.13 SCOTT AVIATION EEBD TRAINING UNITS. The Scott Aviation EEBD training units have several replacement parts, so the trainer may be used over and over. These parts include the following:

- a. Neck Seal
- b. Lanyard

### c. Stowage Bag

The replacement training unit stowage bags are commercial resealable type and come in boxes of 500. For more realistic training, notch the bag on each end below the sealing mechanism and attach a 9 x 1-inch strip of adhesive-backed non-skid deck covering (folded in half and pressed on each side of the tear strip) above the notches. There is no substitute for realistic training. Take the time to conduct emergency egress using training EEBDs.

## 077-3.5 EMERGENCY AIR BREATHING STATIONS AND EAB MASK.

**077-3.5.1 OVERVIEW.** The EAB station supplies clean air for the submarine crew in the event of environmental contamination. Sufficient EAB stations are provided throughout the submarine to allow watch and DC personnel to move about and perform their duties under conditions of poor visibility. There are more EAB stations located in the berthing area, the command and control center, and the crew's mess area than in the less frequented areas of the submarine. The EAB stations are to be clearly labeled and operating instructions should be posted. The EAB mask (Figure 077-3-48) plugs into the EAB stations for emergency breathing air supply.

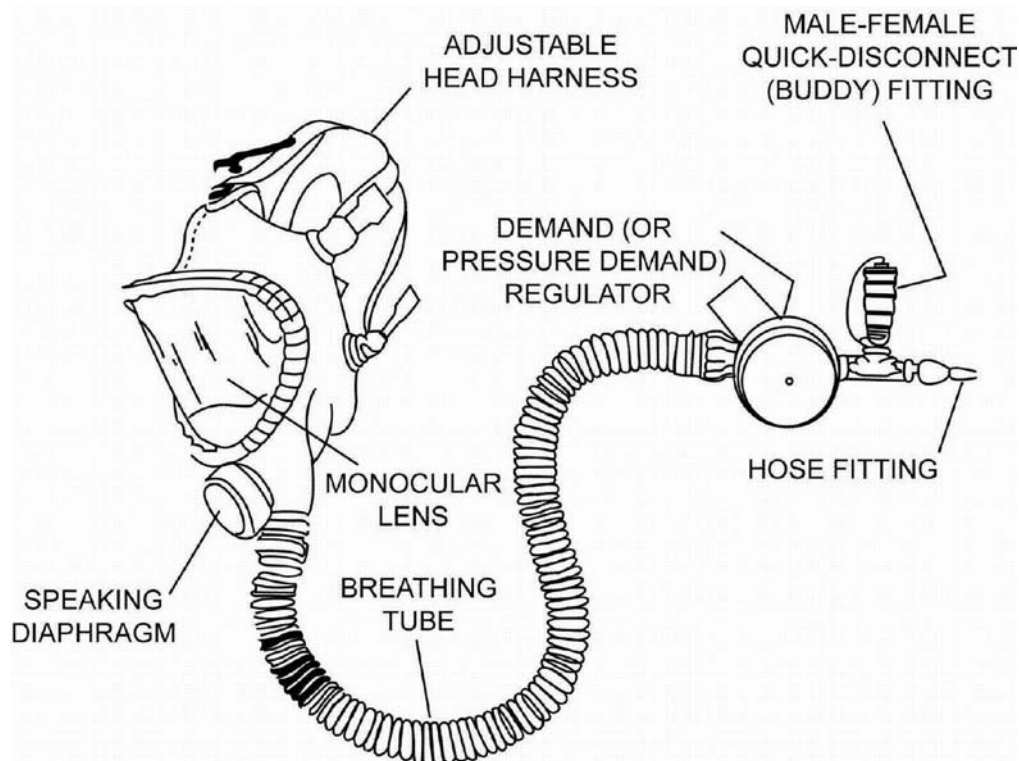


Figure 077-3-48. EAB Mask with Buddy Fitting

### 077-3.5.2 EMERGENCY AIR BREATHING STATIONS. (Figure 077-3-49.)

The EAB station is equipped with either two or four outlets which have a female sliding collar quick-disconnect coupling with an internal automatic shutoff valve. The station distributes the air to the outlets. These outlets form an airtight connection with the male quick-disconnect coupling on the supply hose. When the male quick-disconnect coupling is inserted into the manifold outlet, it unseats the automatic shutoff valve, opening a flow path from the manifold to the supply hose. At the same time, the sliding collar snaps into place, locking the male quick-disconnect coupling to the manifold. The supply hose is removed by turning the collar. Removal of the male quick-disconnect coupling shuts the automatic shutoff valve, preventing the discharge of air to the atmosphere.

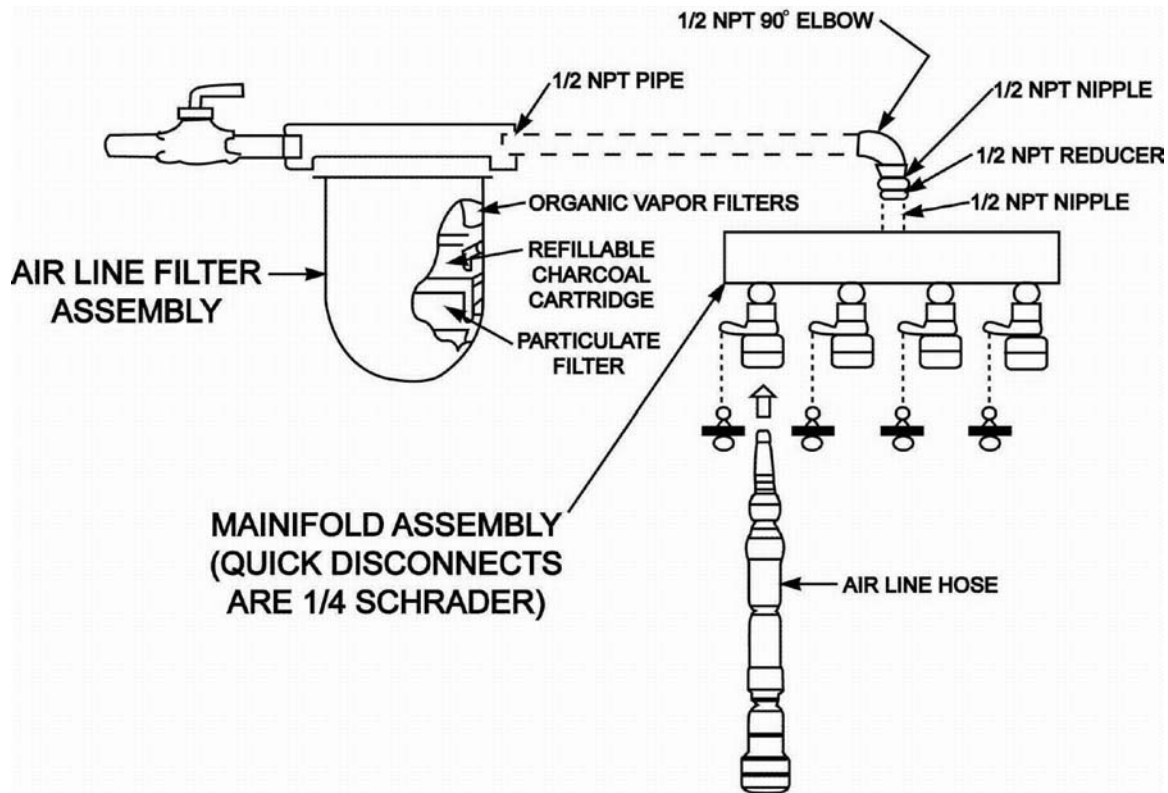


Figure 077-3-49. EAB Station

077-3.5.2.1 Individual dust covers are provided for each manifold outlet and must be removed before connecting the male quick-disconnect coupling to the outlet. When outlets are in use, the dust cover hangs from the chain attached to the manifold. When not in use, the EAB outlets should be protected by installing a dust cover.

077-3.5.2.2 Portable four-outlet manifolds are provided for use by DC personnel. These manifolds are equipped with a male quick-disconnect coupling on the inlet nipple. The male quick-disconnect coupling enables a manifold to be coupled with any outlet on a four-outlet manifold by means of the 25-foot hose provided with each manifold.

077-3.5.2.3 EAB stations are painted red and have chemical lights attached to them to help locate them during low visibility. In addition, a 12- by 6-inch red, non-slip deck tread is located under each station. When the rectangular deck tread cannot be located directly under the EAB manifold, a red, non-slip triangular tread (6 inches across the base and 9 inches long) is installed on the deck pointing towards the manifold.

077-3.5.3 EAB MASK UNIT. The EAB mask unit consists of a supply hose, demand regulator, and an EAB mask fitted with a corrugated breathing tube. These items are packaged and stowed together as an assembled unit. EAB mask units with 8-foot hoses are stowed in white stowage bags. EAB mask units with 25-foot hoses are stowed in blue stowage bags.

077-3.5.3.1 Supply Hoses. The supply hoses are equipped with male and female quick-disconnect couplings. The male end connects to the EAB manifold outlet. The female end is equipped with an internal automatic shut-off valve that connects to the demand regulator. Damage control parties with portable manifolds are provided with 25-foot hoses.

077-3.5.3.2 Demand Regulator. The demand regulator is belt-mounted and fitted with one male and one female quick-disconnect coupling. The male quick-disconnect coupling accepts the end of the supply hose fitted with the



female quick-disconnect coupling. The female quick-disconnect coupling on the regulator incorporates an automatic shutoff valve and is used as a buddy connection by inserting the male quick-disconnect coupling of another EAB user's hose. The demand regulator is a diaphragm operated valve that is opened and shut by the differential pressure created by inhaling and exhaling through the EAB mask. The demand regulator receives air from the EAB manifold by way of the regulator's supply hose, reduces it to atmospheric pressure, and delivers it to the EAB mask through the corrugated breathing tube.

077-3.5.3.3 EAB Mask. The EAB mask protects the user's eyes and respiratory system from contaminated atmosphere by forming an air tight seal with the user's face. There are two different types of EAB masks provided for use by the crew. The basic operation is the same for all two types and is explained in the description of the standard EAB mask.

077-3.5.3.3.1 The standard EAB mask is provided with a full vision lens, adjustable head harness, speaking diaphragm, and exhalation valve. When the user inhales, the face mask receives air from the demand regulator by way of the corrugated tube. When the user exhales, the demand regulator shuts and the exhalation valve in the mask opens, releasing spent air to the atmosphere.

077-3.5.3.3.2 Some EAB masks are fitted with audio projection sets to facilitate communication by watch stations and key personnel such as officers, CPOs, and damage control parties. Power is provided by batteries mounted in the microphone / amplifier unit.

077-3.5.3.3.3 Don the EAB as indicated in the following steps with the hood still covering the facepiece lens. To don the anti-flash hood, grasp the far edge of the hood neck opening and pull the hood over the neck. The EAB mask unit shall be donned as follows:

- a. Connect the EAB mask breathing tube male fitting into the air hose female fitting.
- b. Hook up the EAB station by pushing the air hose male fitting into the EAB station manifold female fitting.
- c. Attach the EAB mask regulator to the user's trouser belt, a quick-releasing fastening belt, or a safety belt (if needed). A quick-release fastening belt is preferred when the person wearing the EAB needs to don the protective clothing; it is mandatory if the regulator clip modification, described in [paragraph 077.3.5.7](#), has not been accomplished and a safety belt is not worn.
- d. Grasp the mask with both hands and insert chin into the facepiece chin strap. Pull the head harness straps from the front of the facepiece over the head; then adjust the head straps as follows:
  1. Ensure the harness straps are lying flat against the head.
  2. Tighten the lower straps at the same time and then tighten the upper straps. Do not tighten the forward strap at this time.
  3. Place both hands on head harness pad (on back of head) and push it down toward the neck.
  4. Retighten the lower straps and then the upper straps.
  5. Tighten the forward strap as needed.
  6. Test for tightness of the facepiece.
    - (a) Squeeze the breathing tube and take a deep breath. The facepiece should collapse inward while the breath is held. This indicates there is a gas tight seal.
    - (b) Hold breath for five seconds.
    - (c) If leakage is detected, readjust the head harness straps.
    - (d) Test facepiece seal each time facepiece is donned.

#### NOTE

To check the facepiece seal, hold the thumb over the male quick-disconnect coupling of the supply hose and attempt to inhale. If the air can be inhaled, the mask is either defective or not fitted properly. If the mask cannot be made airtight by

adjusting the straps, another mask must be selected and fitted. When air tightness is confirmed, connect the air supply hose to the EAB manifold and breathe normally through the mask.

077-3.5.3.3.4 Personnel can move throughout the submarine by disconnecting the supply hose from one manifold, capping the end of the hose with a finger, holding their breath, and moving to the next manifold connection.

077-3.5.4 PRECAUTIONS AND LIMITATIONS. The following are the precautions a user should take when using the EAB system:

- a. Using the system for operating air powered tools or other purposes could result in early depletion of the air filter elements.
- b. When directed to wear EABs, do not breathe the submarine's atmosphere. Use the EAB system until the Control indicates it is safe to remove EAB masks. Breathing contaminated air could result in serious damage to health.
- c. All masks should be carefully checked for air tightness when donned.
- d. Defective EAB mask units or defective components (supply hose, demand regulator, EAB mask) must be tagged out of service and must not be stowed along with properly functioning equipment.
- e. The 25-foot hose should not be used by the general crew. These hoses are provided for supervisory and DC personnel whose responsibilities require greater range of mobility.
- f. EAB users should not disconnect their supply hose from a manifold without first checking for and, if necessary, warning personnel using the buddy connection of their demand regulator.
- g. EAB users must cover the male end of their supply hose whenever it is disconnected from an EAB manifold. Failure to do so may allow contaminated air to enter the EAB mask unit.
- h. Do not allow EAB hoses to lie in watertight closures. If a door is shut while the hose is lying through the closure, the hose will be permanently damaged and the closure's watertight seal may be damaged. Failure of a watertight seal during a casualty could allow leakage of steam, water, or contaminated atmosphere between compartments.
- i. Hoses and tubes shall not be pulled or dragged. Pulling or dragging may snag or damage the hoses and their connections.
- j. If hose lengths are connected together, the overall length should never exceed 100 feet. Hose lengths greater than 100 feet interfere with operator mobility.
- k. When EAB masks are not in use, they must be stowed in the designated lockers to ensure that the masks are properly distributed throughout the submarine and available when needed.
- l. Ensure the bleed cocks on the air filter housings are shut and all the supply hoses are disconnected from the EAB manifolds for initial pressurization.
- m. Whenever any portion of the EAB system is to be isolated, individuals using the system downstream of the isolation point should be instructed to move to a manifold supplied by a different EAB header. Failure to do this and subsequently cutting off the breathing air could result in serious injury or death. Manifolds downstream of the closed isolation valve shall be tagged out of service.
- n. When depressurizing portions of the EAB system, always use the bleed cock on the air filter to bleed the residual air from the isolated portion of the EAB system. The isolated portion of the system shall remain depressurized until after all the repairs are made.
- o. The EAB mask user shall always be aware of the air hose location. The hose is not fireproof and could be breached if it comes in contact with flames, causing loss of air supply to the user and adding air to the fire. The hose is subject to fouling where there is wreckage or other obstructions. Fouling may cut off the air supply or dislodge the facepiece. Sharp objects may puncture the hose, resulting in leakage.

077-3.5.5 STOWAGE. The EAB mask locker door shall be painted red/orange with fluorescent paint so that it can be easily located during conditions of low visibility. The locker door should be labeled to indicate the quantity of masks stowed in the locker.

077-3.5.5.1 The EAB mask unit (facepiece, regulator, and extension hose) and the anti-flash hood are to be stowed connected, in a ready-for-use condition. Stow the EAB mask unit and anti-flash hood together in the stowage bag.

077-3.5.5.2 Use the anti-flash hood to protect the facepiece lens during stowage. Stow as follows:

- a. Remove the EAB facepiece by releasing the head straps at the buckles before pulling it off.
- b. With one hand, grasp the top of the anti-flash hood at the seam. Pull the other hand through the elastic face opening and out the bottom of the anti-flash hood.
- c. Grasp the top of the EAB facepiece head harness with the hand that is through the anti-flash hood.
- d. Pull the anti-flash hood down over the facepiece so the elastic face opening of the anti-flash hood is around the top of the lens ring and below the chin stop. Line up the seam on the anti-flash hood with the mold seam on the facepiece above the lens ring. If stowed properly, the EAB breathing tube will be inside the anti-flash hood and the hood will be covering the facepiece lens.

077-3.5.6 MAINTENANCE OF EAB MASKS. Inspect and test EAB masks in accordance with PMS requirements.

077-3.5.7 SUBMARINE EAB REGULATOR BELT CLIP MODIFICATION. A modification is authorized to Mine Safety Appliance (MSA) EAB regulator belt clips to facilitate removal in emergencies. Following is the procedure for modifying the clip:

- a. Remove the clip from the regulator and place it in a machinist vise, as shown in [Figure 077-3-50, step 1](#). Place a piece of 1/4-inch thick smooth flat bar between clip and each vise jaw to prevent scoring clip. Insert a piece of 1/8-inch rod (suggest using welding rod) in the clip curl.

#### CAUTION

**When the vise is closed on the clip, the curl may be crushed unless the rod is in place.**

- b. Close the vise until moderate resistance is felt. Release clip and examine the area where the curl tip contacts the arm. The curl tip should just touch the arm, as shown in [Figure 077-3-50, step 2](#).

#### NOTE

It will be necessary to over squeeze the clip to permanently deform the clip material.

- c. Repeat [step b](#) as required until the curl tip is just touching the arm along its full length.
- d. Turn the clip upside down and insert it into the vise, as shown in [Figure 077-3-50, step 2](#). Retain the flat bars and insert a 5/32-inch rod (suggest using welding rod) in the clip.

#### CAUTION

**When the vise is closed on the clip, the curl may be crushed unless the rod is in place.**

- e. Close the vise until moderate resistance is felt. Release the clip and examine the area where the curl contacts the back of the clip. The curl should just touch the back of the clip.
- f. Repeat [step e](#) as required until the curl is just touching the back of the clip along its full length.
- g. The final modified shape of the clip is shown in [Figure 077-3-50](#). Put the clip back on the regulator and try placing the regulator on and off the belt several times to ensure it can be quickly removed and there is minor resistance when placing the regulator on and off the belt.

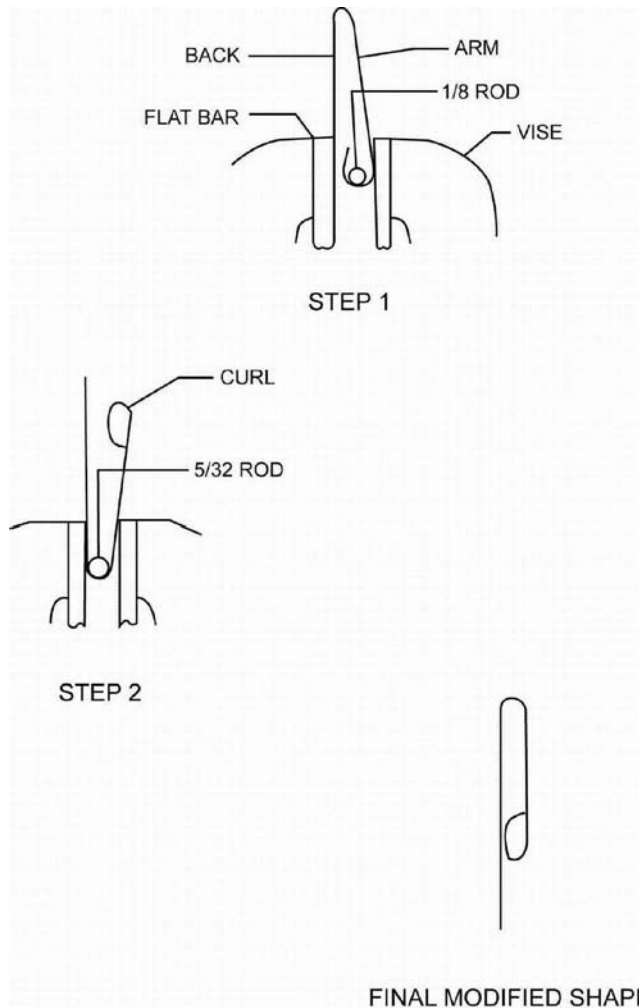


Figure 077-3-50. EAB Mask Regulator Clip Modification

### 077-3.6 SUPPLIED AIR RESPIRATOR WITH BACKUP SELF-CONTAINED BREATHING APPARATUS.

077-3.6.1 DESCRIPTION. The SAR/SCBA provides breathing air to personnel in IDLH atmospheres. The SAR/SCBA contains a full facepiece respirator operated in the pressure demand mode and is NIOSH approved respiratory protective equipment.

077-3.6.1.1 The normal supply of air for the SAR/SCBA is from compressed air cylinders mounted in a portable primary air supply pack (PASP) and inportable reserve air supply packs (RASPs). The PASP contains one compressed air cylinder, a hose manifold, a first stage pressure regulator, pressure gauges, a three-way valve, bleed valves, a relief valve, and a low pressure alarm. Each RASP contains two compressed air cylinders. The PASP

and RASP weigh about 70 pounds and can be hand carried and placed near the space to be entered. One compressed air cylinder can provide about 60 minutes of breathing air for a single user when charged to 4,500 psi. Additional cylinders can be connected to the control manifold in the PASP without interrupting the air supply to the user. This provides an indefinite supply of breathing air. Various system and individual components are depicted in [Figures 077-3-51](#) through [077-3-54](#).

077-3.6.1.2 The backup supply of air for the SAR/SCBA is from compressed air cylinders contained in a carry pouch worn by the user. The carry pouch also contains an air manifold, first stage pressure regulator, pressure gauge, cutoff valve, and a low pressure alarm. The backup compressed air cylinders have a rated air supply of 15 minutes.

077-3.6.1.3 Normal or backup air is supplied to a breathing tube attached to a second stage pressure regulator which then discharges air into the facepiece. The second stage pressure regulator is a pressure demand type which forces air into the facepiece at all times. This provides a positive pressure inside the facepiece, keeping out any harmful atmosphere if the respirator fails to properly seal to the face.

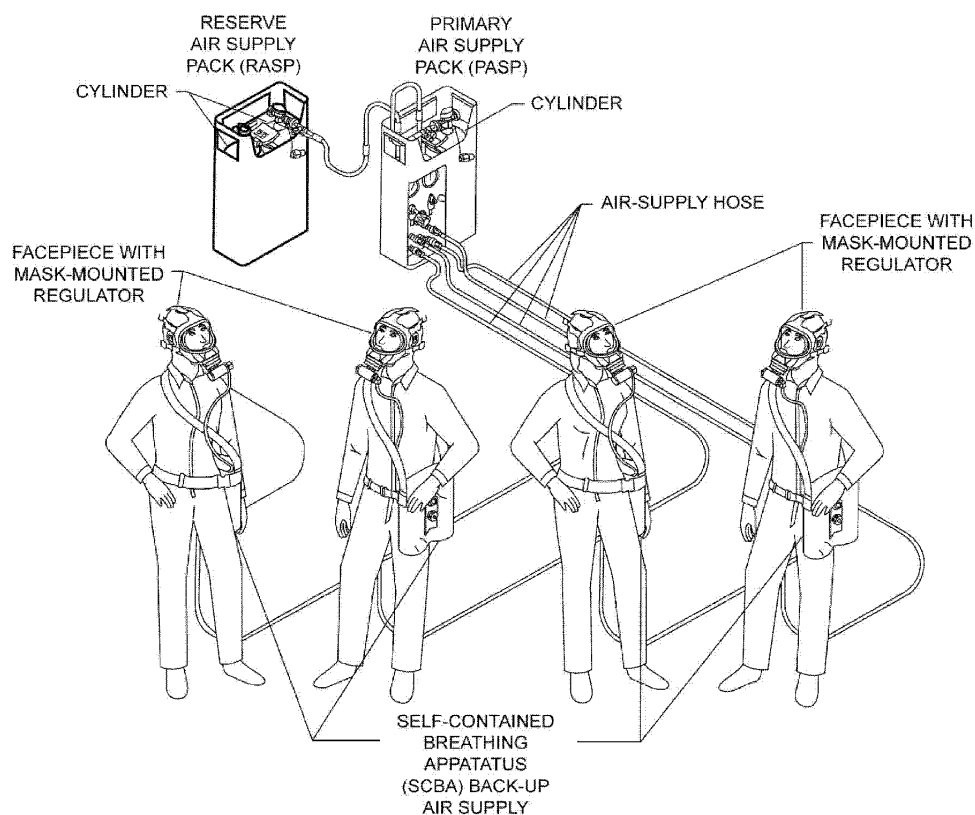


Figure 77-3-51. SAR/SCBA Components

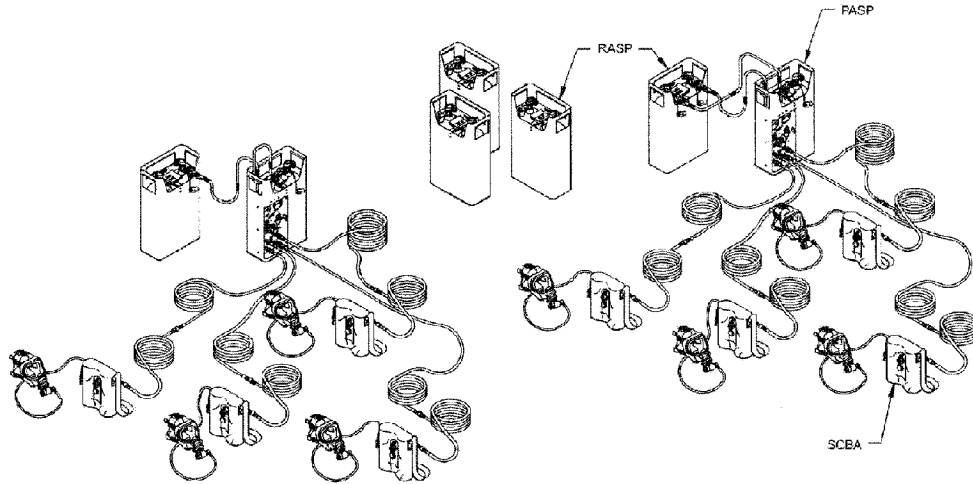


Figure 77-3-52. SAR/SCBA System

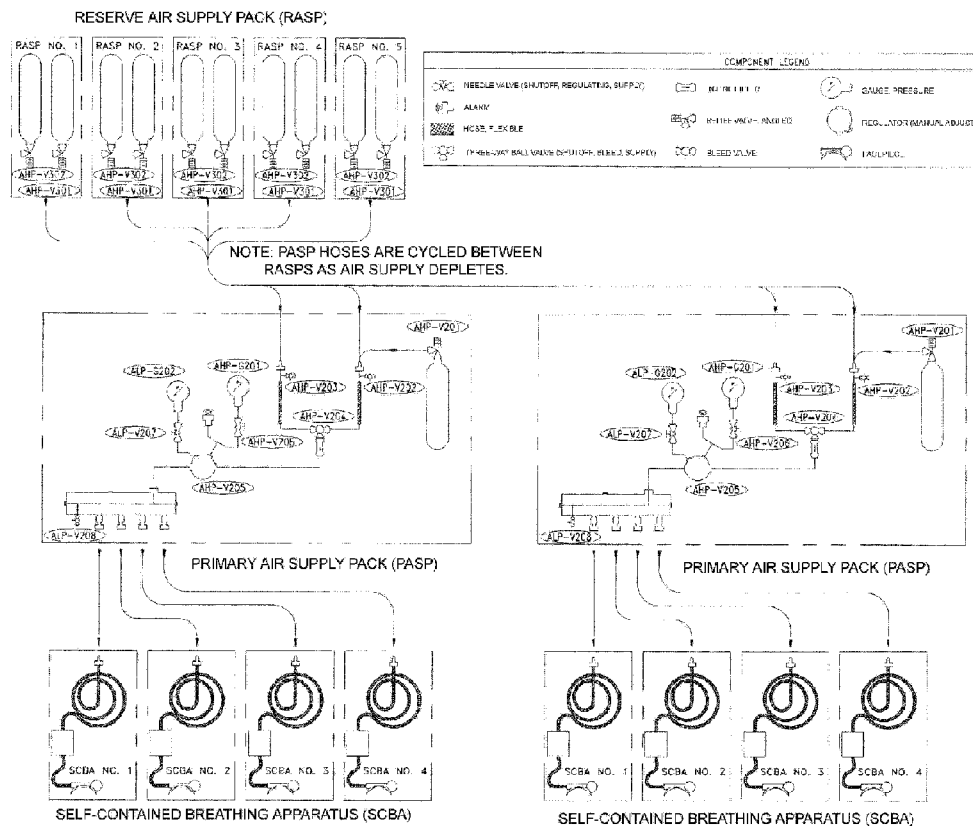


Figure 77-3-53. SAR/SCBA Controls and Indicators

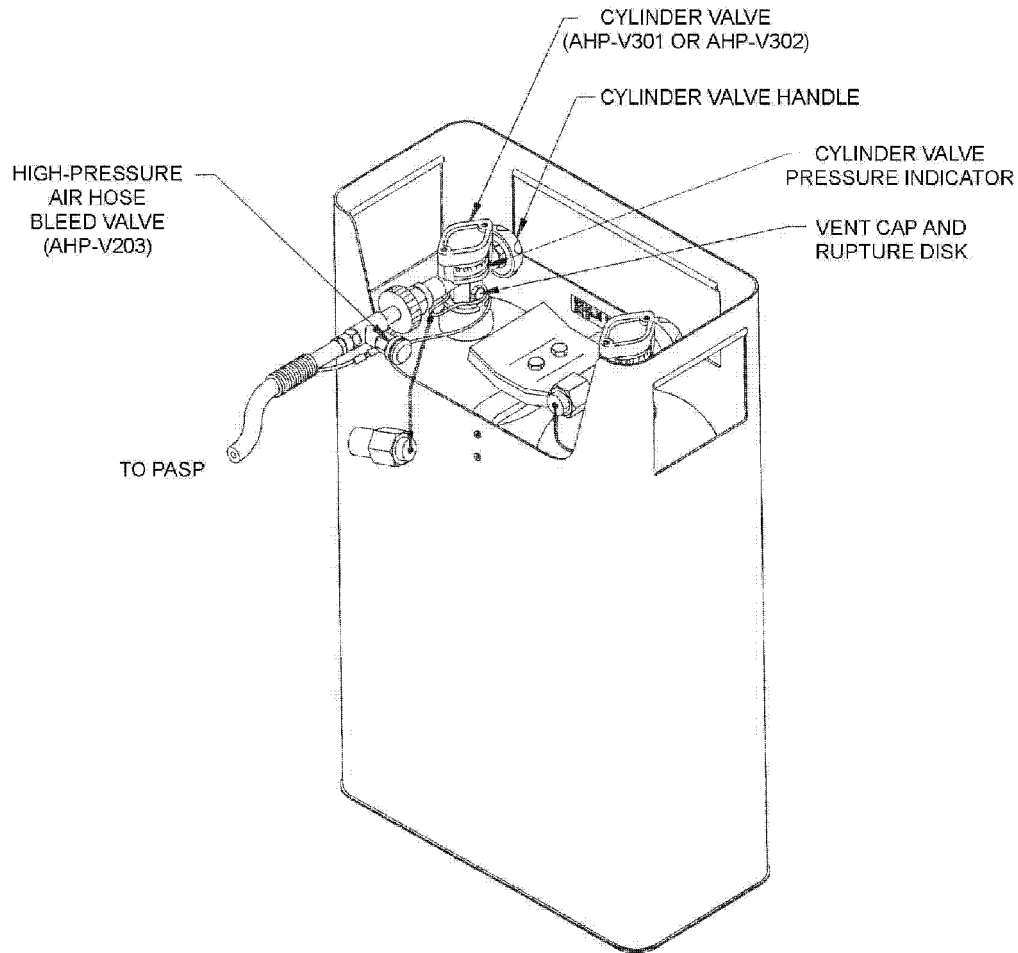


Figure 77-3-54. Reserve Air Supply Pack

## 077-3.6.2 USE.

**WARNING**

**Only properly trained and fit-tested personnel shall use a SAR/SCBA. Similarly, only properly trained personnel shall tend the normal air supply (control manifold in PASP) for the SAR/SCBA.**

## 077-3.6.2.1 Applications and Restrictions.

- The SAR/SCBA can be used in atmospheres that require respiratory protection, including IDLH atmospheres. IDLH atmospheres are defined in NSTM S9086-CH-STM-030, Chapter 074, Volume 3, Gas Free Engineering.
- This breathing device enables personnel to enter confined or enclosed spaces when such spaces need to be gas free tested.
- This breathing device enables entry into IDLH or potential IDLH spaces for rescue of personnel.
- This breathing device is not to be used for firefighting.

077-3.6.2.2 Preparation of the SAR/SCBA for Use.

- a. Perform the inspections listed in [paragraph 077-3.6.6.2](#).
- b. Locate the portable PASP and RASP in fresh air as close to the entrance of the IDLH space as possible. Position the PASP in a way that pressure gauges can be seen and that air cylinders in the RASP can be connected to the control manifold.

**WARNING**

**Ensure the installed and spare air cylinders are charged to 4,500 psi.**

- c. Check that the air cylinder in the PASP is connected to one of the hoses from the control manifold. If not connected, check the O-ring on the hose fitting before connecting it to the air cylinder. If the O-ring is missing, cut, or scarred, it must be replaced before the fitting is connected to an air cylinder.

**WARNING**

**Before connecting the plug (male) and socket (female) air hose fittings, visually inspect both for presence of foreign material in the areas to be connected. If foreign material is present it must be cleaned out before joining the fittings.**

- d. Check that the socket (female) fitting on each air hose section has a gasket installed. Assemble the air hoses by inserting the plug into the socket fitting. The fittings are equipped with a locking device in the socket sleeve that requires the notch in the sleeve to be aligned with the ball stop on the socket before the fittings can be coupled. Once coupled, the sleeve should be rotated to misalign the notch and ball stop which enables the locking feature of the joined fittings.
- e. Assemble air hose sections to provide the total length necessary for each user to move about freely in the IDLH space. Connect the air hoses into the air manifold in the PASP.

**WARNING**

**Do not exceed a maximum hose length of 300 feet.**

- f. The number of spare air cylinders that will be required depends on the number of personnel provided air and the amount of time air is supplied to them. [Table 077-3-5](#) lists the minimum number of spare cylinders in addition to the one cylinder contained in the PASP necessary to support the number of personnel for the period specified.
- g. Perform the inspections listed in [paragraph 077-3.6.6.1](#).
- h. Check that the air hose connects properly with the hose fitting at the waist belt for the carry pouch. Once the check is completed, disconnect these fittings to permit ease in donning the carry pouch.

**WARNING**

**Ensure the backup air cylinders in the carry pouch are charged to the FULL indication shown on the pressure gauge. Less than a full charge reduces the backup supply of air which may be required in an emergency for escaping from an IDLH atmosphere.**



**Table 077-3-5.** Required Number Of Spare Air Cylinders For Normal Air Supply Assuming Air Cylinders Are Charged To 4,500 Psi

Number of Personnel	Amount of Time Breathing Air Supplied		
	15 minutes	30 minutes	60 minutes
1	0 cylinders	0 cylinders	1 cylinder
2	0 cylinders	1 cylinder	2 cylinders
3	0 cylinders	1 cylinder	3 cylinders
4	1 cylinder	2 cylinders	4 cylinders

077-3.6.2.3 Use of a Safety Line. Safety harnesses and lines shall be used whenever a person equipped with a SAR/SCBA enters an IDLH atmosphere. When safety lines are used, one end is connected with a snap hook to the safety harness on the person entering the IDLH space, and the other end is held by the attendant at the entrance to the space. The line is used primarily to locate an incapacitated person. Additionally, the line can be used as a means of passing signals between the attendant and the person in the space.

1. The safety line shall be 1/2-inch diameter (or larger) nylon line (length determined by size of space). The line has a stout hook at each end, which is closed with a snap catch.
2. To locate incapacitated personnel who wear safety lines, follow the safety line to their location. Do not attempt to pull personnel out of a space using the safety line because this may cause further injury.

**WARNING**

**If at all possible, never haul stricken personnel by a line attached to the waist; this could cause internal injury. In an emergency, they may be dragged a short distance along the deck but not suspended from the waist. If it is necessary to suspend a person from a safety line, a harness should be placed on the person and the safety line connected to a Y-bridle attached to the harness shoulder straps.**

077-3.6.3 3 DONNING AND ADJUSTING THE CARRY POUCH AND FACEPIECE AND SUPPLYING BREATHING AIR TO THE FACEPIECE.

077-3.6.3.1 Don protective clothing and equipment (such as harnesses) before donning the carry pouch. Clothing or equipment worn over the carry pouch could possibly crimp air hoses, cover the pressure gauge, or cause undue discomfort.

077-3.6.3.2 The following steps provide the procedure for donning the air cylinder carry pouch.

- a. Place the carry pouch at the left hip with the pressure gauge facing away from the body.
- b. While supporting the pouch with the left hand, raise the shoulder strap over the head and place it on the right shoulder.
- c. Let the shoulder strap support the carry pouch. Wrap the belt around the waist and buckle it.

- d. Adjust the shoulder strap and waist belt for a comfortable fit. The weight of the carry pouch should be supported by the shoulder strap while the waist belt holds the pouch close to the body.

077-3.6.3.3 Use the following procedure to prepare and don the SAR/SCBA.

- a. Check the fitting connections on the breathing tube and hose on the carry pouch shoulder strap to be sure the gasket and fitting connections are in good condition. Connect the breathing tube to the hose on the shoulder strap.
- b. Check the fitting connections on the air hose from the PASP to the waist belt of the carry pouch to be sure the gasket and fitting connections are in good condition. Connect the air hose from the PASP to the air hose fitting on the waist belt of the carry pouch.
- c. Ensure that the three bleeder valves on the control manifold in the PASP are closed and that the three-way valve is aligned to the air hose connected to the air cylinder to be placed in service.

**CAUTION**

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**Remove eyeglasses before donning the facepiece. Eyeglasses will prevent the mask from sealing properly. If vision is poor without eyeglasses, spectacle kits are available for installation in the facepiece and shall be worn. Soft and gas-permeable contact lenses can be worn.**

- d. Check that the facepiece lens is clean and adjust the head straps for maximum length. Place the head straps over the top of the facepiece and let them rest against the lens on the outside of the facepiece. Insert chin against the facepiece chin stop. While holding the facepiece with one hand, use the other hand to move hair away from the forehead while placing the facepiece against the face.

**CAUTION**

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**Should hair be caught between the face and the facepiece seal, the seal will not be air tight. This will cause air leakage out of the facepiece which could allow contaminated air into the facepiece and also result in an increased rate of breathing air consumption. When donning the facepiece, care should be taken to keep hair away from the facepiece seal.**

- e. To pull the head harness over the head, start with the straps in the fully extended position. Tighten straps in pairs. Start with center straps, move down to bottom straps, then tighten top straps last.
- f. Have the attendant immediately open the supply valve on the air cylinder to be placed in service. If the air cylinder is already in service, have the attendant immediately connect the air hose into the air supply fitting in the manifold. This will provide breathing air to the facepiece. As the supply valve is opened, the attendant should adjust the pressure regulator on the control manifold to provide a discharge pressure of 60 to 80 psi, shown on the low pressure gauge downstream of the regulator. The wearer should take a few breaths to verify that breathing air is supplied to the facepiece. If air is not supplied, remove the facepiece and check for the cause of blockage to air flow. The don/doff control allows the user to stop air flow to the mask by pushing down on the control button. The user resumes air flow by donning the mask and taking a quick deep breath. This allows the user to be in a constant standby condition without wasting air. The don/doff control can also be used to clear facepiece lens fogging.

- g. When the head straps are tightened properly, the large piece of rubber on the straps should be centered in the back of the head.
- h. Hold the facepiece firmly with both hands while moving the head to gain the most comfortable fit. Position the lens for good vision. If necessary, retighten the lower straps.
- i. Check the fit of the facepiece for a gas tight seal. If the seal is not satisfactory, adjust the position of the facepiece and retighten the straps. Continue until the seal is satisfactory.

### **CAUTION**

**When a facepiece leak is detected, the user must correct it immediately by adjusting the position of the mask and tightening the facepiece straps. Any time a facepiece leak is detected that cannot be corrected, the wearer must exit the IDLH atmosphere immediately.**

- j. To receive breathing air from the carry pouch backup air supply, open the backup air supply valve. (The backup air supply shall only be used for emergencies and escapes from IDLH atmospheres.)

#### 077-3.6.4 PRECAUTIONS.

##### 077-3.6.4.1 Carry Pouch Backup Air Supply.

- a. Take care to protect the air cylinders, air hoses, regulator, and breathing tube from damage. If damage occurs while in an IDLH atmosphere, return to a safe atmosphere immediately.
- b. When the carry pouch backup air supply is activated, leave the IDLH atmosphere immediately.
- c. If there is difficulty breathing in an IDLH atmosphere, open the backup air supply valve and immediately exit the space. If the air hose from the PASP impedes escape, then disconnect the hose from the carry pouch waist belt.

##### 077-3.6.4.2 Primary Air Supply Pack.

- a. If the attendant experiences difficulty feeding breathing air hoses from the PASP through the access to the IDLH space or the hoses become kinked or the air supply is interrupted, the attendant should immediately signal personnel to exit from the IDLH atmosphere.
- b. The PASP should be attached to the deck or an adjacent bulkhead to prevent movement, especially if the ship is underway.

#### 077-3.6.5 OPERATION.

077-3.6.5.1 Carry Pouch Backup Air Supply and Facepiece. When ready to enter an IDLH atmosphere, perform the following checks:

- a. Be sure the regulator is providing sufficient breathing air to the facepiece and the pressure demand exhalation valve is operating properly. The facepiece should be slightly pressurized and the wearer should be able to breathe without laboring.

- b. Check that the air line attachment to the breathing tube does not restrict face mask mobility. This can be checked by the wearer turning his head fully to each side, then up and down to check for freedom of movement.
- c. The hose connected to the breathing tube and the supply hose from the remote PASP should not be twisted or stretched abnormally.
- d. Check that the carry pouch backup air supply cylinder pressure gauge is visible and can be viewed by the wearer. Also, check that the pressure gauge reads "FULL."

077-3.6.5.2 Primary Air Supply Pack Operation. When the PASP is providing air, the following procedures apply:

- a. The attendant shall frequently check and, if necessary, regulate the discharge pressure in a range of 60 to 80 psi. This is accomplished by manually adjusting the pressure regulator on the control manifold while monitoring the regulator discharge pressure gauge. Discharge pressures above 125 psi may cause the safety valve to lift.
- b. The attendant shall ensure that a fully charged spare air cylinder is always connected to the control manifold in the PASP using the following procedure:
  1. Check that the bleed valve in the air hose to be connected to the spare air cylinder is closed.
  2. Visually check that there is no particulate in the cylinder or hose fittings. Fasten and make the hose fitting hand tight onto the cylinder fitting.
- c. The attendant shall monitor pressure in the cylinder being discharged. This pressure is indicated on the high pressure gauge upstream of the regulator. The attendant shall align the spare cylinder to provide air when the air pressure reaches 500 psi or the low pressure alarm sounds, whichever occurs first. Table 077-3-6 lists the approximate amount of time that a single cylinder can provide air for the number of personnel listed.
- d. The procedure to align the spare cylinder to provide air is as follows:
  1. Check that the bleeder valve in the air hose connected to the air cylinder to be placed in service is closed.
  2. Open the supply valve on the air cylinder which is being brought into service.
  3. Align the three-way valve to the air cylinder being placed in service and secure the supply valve on the air cylinder which is being secured. The valve is closed by first pushing in on the valve handwheel and then twisting the handwheel closed.
  4. If necessary, adjust the pressure regulator to maintain 60 to 80 psi discharge pressure.
- e. Replace air cylinders as they become expended until all personnel have exited the IDLH space. Replace cylinders by applying [steps b](#) through [d](#) above.

**Table 077-3-6.** Approximate Duration For One Cylinder Supplying Air,  
Assuming Cylinder Is Charged To 4,500 PSI

Number of Personnel	Amount of Time One Cylinder Can Supply Air
1	60 minutes
2	30 minutes
3	20 minutes
4	15 minutes

### 077-3.6.6 INSPECTION, CLEANING, STOWAGE, AND MAINTENANCE.

077-3.6.6.1 Facepiece and Carry Pouch Backup Air Supply Inspections. Inspect the facepiece and carry pouch backup air supply before and after each use for the following:

- a. Head straps for breaks, loss of elasticity, broken or malfunctioning buckles and attachments, or excessively worn areas on the head straps which might loosen when buckled.
- b. Facepiece for dirt, cracks, tears, holes, stiffness, or distortion from stowage; cracked, badly scratched, marred, or incorrectly mounted facepiece lens; missing or broken facepiece regulator connecting ring; broken or non-functional pressure demand exhalation valve; and cracked speaking diaphragm.
- c. Air hoses for missing, torn, or cut gaskets in hose fittings; tears or cuts in the hose sections. Ensure that proper hoses are used with the SAR/SCBA. Hoses may not be interchanged or locally manufactured.
- d. Breathing tube for cracks, tears, cuts, or holes; missing, torn, or cut gaskets or sealing devices in the facepiece connection and upstream of the regulator.
- e. Air cylinders for unraveled strands, nicks, cuts, abrasions, and current hydrostatic test date.

077-3.6.6.2 Primary Air Supply Pack Inspections. Inspect the PASP before and after each use for the following:

- a. Air bottle hold-down clamp broken or loose.
- b. Air hoses for missing, torn, or cut O-rings on hose fittings; tears or cuts in hose sections.
- c. Fittings for loose or broken fittings.
- d. Gauges for cracked, broken, or missing gauge cover glass; broken or defective gauge; gauge out of calibration or with an expired calibration sticker.
- e. Air cylinder for unraveled strands, nicks, cuts, abrasions, defective supply valve and pressure gauge, and current hydrostatic test data.
- f. Valves for defective bleed valves, three-way valves, or pressure regulator valves.
- g. Proper operation using the following procedure:
  1. Check that one of the air hoses is connected to a full air cylinder and that the three-way valve is aligned to the hose connected to the air cylinder.
  2. Check that all bleed valves are closed and that the regulator is closed.
  3. Open supply valve on air cylinder and audibly check for leaks in hose, piping, and fittings.
  4. Check that the high pressure gauge reads the same pressure as pressure gauge installed on air bottle.
  5. Slowly open regulator and adjust low pressure to 60 to 80 psi. Check for audible leaks in piping and fittings downstream of the regulator.
  6. Continue opening the regulator and check that the relief valve opens when the downstream pressure reaches 140 psi.
  7. Close the regulator and open the low pressure bleed valve. Check that the relief valve closes.
  8. Close the supply valve on the air cylinder.

9. Open the bleed valve in the air hose connected to the air cylinder and check that the low pressure alarm sounds when upstream pressure reaches 500 psi.

077-3.6.6.3 Reserve Air Supply Pack Inspections. Inspect the RASPs before and after each use for the following:

- a. Air bottle hold-down clamp broken or loose.
- b. Air cylinders for unraveled strands, nicks, cuts, abrasions, defective supply valves and pressure gauges, and current hydrostatic test date.

077-3.6.6.4 Air Hose Inspections and Stowage. Air hoses should be given the following inspections before and after each use and stowed in the manner described:

- a. Hoses for tears, cuts, or abrasions more severe than scuff marks.
- b. Fittings for torn or deteriorated gaskets in socket (female) fittings; dirt, dust, or other foreign material fouling the sleeve or fitting mating surfaces.
- c. Once inspections are complete, each hose section should be coiled and have socket and plug fittings coupled to preclude foreign material entering the hose during stowage.

077-3.6.6.5 Facepiece Cleaning and Stowage. Clean and sanitize parts after each use as follows:

- a. Remove the second stage regulator from the facepiece and store in a clean dry area.
- b. Using a soft brush, clean cloth, or sponge, thoroughly hand wash the facepiece and nose cup (if present) in a warm water and mild soap solution. Immerse the facepiece in the soap solution, rinse completely, and run water through the pressure demand exhalation valve. Turn facepiece upside-down to drain water.

### CAUTION

**Do not let the cleaning solution temperature exceed 110° F (43° C).**

- c. Sanitize the facepiece using one of the following solutions. Immerse the facepiece in the disinfectant solution for 2 minutes.
  1. A 50 parts per million (ppm) chlorine and water solution (add 2 milliliters of bleach to 1 liter of water).
  2. Aqueous iodine solution, 50 ppm (povidone/iodine solution 7.5 percent).
  3. A disinfectant solution recommended by the manufacturer or other disinfecting agents used for similar applications.
- d. After rinsing, turn the facepiece upside-down and shake to remove excess water. Air dry in a clean, uncontaminated area in a way that prevents distortion of the facepiece. CAUTION Do not exceed a drying temperature of 110° F (43° C).
- e. When completely dry, reassemble all parts and place the facepiece in a clean plastic bag or other container. Stow in cases provided with the SAR/SCBA.

077-3.6.6.6 Supplied Air Respirator Maintenance. Overhaul of the respirator is required every six years by an MSA certified technician to include the following:

- a. Visually inspect and replace any suspect components of the respirator.
- b. Rebuild the second stage regulator.
- c. Perform a complete flow test of the respirator in both “airline respirator” and “SCBA” modes of operation.
- d. Label the first and second stage regulators with overhaul dates and tester information.

077-3.6.6.7 Primary Air Supply Pack Stowage. Stow the PASP in accordance with the following requirements:

- a. Ensure that the air cylinder hose fitting is fastened, hand tight, to the air cylinder. Do not stow the PASP without the air cylinder installed to preclude entry of foreign material into the hose and to protect the O-ring on the fitting.
- b. Check the air pressure on the cylinder gauge to ensure that the cylinder is charged to the required pressure.
- c. Check that the cylinder is securely fastened by the hold-down clamp.
- d. Ensure that the pack is either laid flat with the cylinder parallel with the deck or set on end with the cylinder in an upright position. Secure the pack to the deck or bulkhead to prevent movement while the ship is at sea.

077-3.6.6.8 Reserve Air Supply Pack Stowage. Stow the RASPs in accordance with the following requirements:

- a. Check the air pressure on the cylinder gauges to ensure that the cylinders are charged to the required pressure.
- b. Check that the cylinders are securely fastened by the hold-down clamps.
- c. Ensure that pack is either laid flat with the cylinders parallel with the deck or set on end with the cylinders in the upright position. Secure the packs to the deck or bulkhead to prevent movement while the ship is at sea.

077-3.6.6.9 Carry Pouch Backup Air Supply Maintenance. Recharge the air cylinders in accordance with the following procedure:

- a. Remove the cylinders from the carry pouch.
- b. Disconnect the stage regulator CGA-346 nut.
- c. Connect the filler hose to the cylinder valve connection using a CGA-346 nut.
- d. Fill cylinders to a pressure of 3,000 psi. Wait for the cylinders to cool back to ambient temperature and pressurize (top off) to a pressure of 3,000 psi.

#### NOTE

It is normal for the audible low pressure alarm to sound during the cylinder refilling process.

- e. Disconnect the filler hose, reattach the first stage regulator and place the cylinders back in the carry pouch.

- f. Test the compressed breathing air supply system in accordance with Chapter B6 of OPNAVINST 5100.19 (series) to ensure Grade D breathing air quality.
- g. Backup air supply cylinders are fiberglass and require hydrostatic testing every three years.

077-3.6.6.10 Primary and Reserve Air Supply Pack Maintenance. Recharge the air cylinders in accordance with the following steps. Do not remove the air cylinders from the packs.

- a. Connect the filler hose to the cylinder supply valve connection.
- b. Fill the cylinder to a pressure of 4,500 psi. Wait for the cylinder to cool back to ambient temperature and pressurize (top off) to a pressure of 4,500 psi.
- c. Disconnect the filler hose and reconnect the discharge hose fitting to the air cylinder in the PASP / RASP.
- d. Test the compressed breathing air supply system in accordance with Chapter B6 of OPNAVINST 5100.19 (series) to ensure Grade D breathing air quality.
- e. PASP and RASP cylinders that are fiberglass require hydrostatic testing every three years. Carbon fiber cylinders, which are not the current standard, require hydrostatic testing every five years.

For further information refer to NAVSEA SS600-AN-MMA-010, Supplied Air Respirator (SAR) with Self-Contained Breathing Apparatus (SCBA), or go to the Damage Control and Fire Protection Engineering website at [www.dcfp.navy.mil](http://www.dcfp.navy.mil).

### **077-3.7 SWITCHING BREATHING PROTECTION IN A CBR THREAT ENVIRONMENT.**

077-3.7.1 GENERAL. When conducting damage control functions in a suspected or confirmed chemical or biological warfare environment, it may be necessary to switch breathing protection while in an area that may be contaminated with toxic agents. For example, escapees from a burning machinery space would switch from a CBR protective mask to an EEED for escaping and back to a CBR protective mask when an area away from the fire and combustion gases is reached.

077-3.7.1.1 Switching types of breathing protection can be accomplished in relative safety following the guidance below when in areas potentially exposed to vapor agents. Breathing protection should not be switched when exposed to liquid or solid agents as the agent may contaminate the inside surfaces of the CBR protective gear. If the standby gear may have become contaminated with liquid or solid agent, it must be decontaminated in accordance with NSTM Chapter 470, Shipboard BW/CW Defense and Countermeasures prior to use.

077-3.7.1.2 Experience indicates that it is simpler and safer to switch OBA canisters than to switch between an OBA and a CBR protective mask and back to the OBA in a CBR environment. Therefore, if the allowance of OBA canisters permits, switching OBA canisters is preferred over switching between the OBA and CBR protective mask.

077-3.7.2 SWITCH FROM CBR PROTECTIVE MASK TO EEED AND BACK TO CBR PROTECTIVE MASK. To switch from CBR protective mask to EEED and back to CBR protective mask, perform the following steps:

- a. Open the orange case of the EEED, remove the EEED from the orange case and from the sealed bag and pull the ring to activate the EEED.



- b. Take a deep breath and hold it, close eyes tightly, remove the CBR protective mask, and quickly don the EEED in accordance with [paragraph 077-3.4.3.2](#) or [077-3.4.4.2](#). Carry the CBR protective mask while escaping.
- c. When an area that is safe from fire and combustion gases is reached, prepare the CBR protective mask for donning, take a deep breath and hold it, close eyes tightly, remove the EEED, and quickly don the CBR protective mask in accordance with NSTM Chapter 470, paragraph 470-5.2.3.

077-3.7.3 SWITCH FROM CBR PROTECTIVE MASK TO OBA. Buddy aid is necessary to accomplish the following procedures in a safe and timely manner. Practice is important.

- a. Start with the OBA on the chest with the head harness over the front of the facepiece and the facepiece over the wearer's shoulder. A fresh canister should be in the OBA with the bail in the standby position.
- b. Remove gloves and helmet (if worn), release the Velcro fastener on the neck band of the firefighter's ensemble (if worn) and pull the flash hood down around the neck.
- c. Close the OBA bail, hold the OBA facepiece in front with one hand.
- d. Light off the OBA canister quick start candle.
- e. With free hand, grasp the outlet valve assembly of the CBR protective mask, close eyes tightly, take a deep breath and hold it.
- f. Quickly remove the CBR protective mask and don the OBA facepiece. Tighten all straps of the OBA facepiece before taking a breath or opening eyes.
- g. Crimp both OBA hoses and exhale forcefully to clear OBA facepiece (eyes still closed). With hoses still crimped, inhale to collapse facepiece and confirm seal; readjust straps and recheck seal as necessary. Open eyes and resume normal breathing. Set OBA timer.
- h. Don other clothing and CBR protective equipment.

077-3.7.4 OBA CANISTER REPLACEMENT. Buddy aid is necessary to accomplish the following procedures in a safe and timely manner. Practice is important. Have CBR protective mask available in case the following procedure has to be stopped for any reason.

- a. Prepare the replacement canister by removing the cap and candle cover. Buddy should hold the canister in one hand within easy reach of the OBA wearer.
- b. OBA wearer take a deep breath and hold. Buddy crimp both OBA hoses.
- c. Quickly lower bail, pull release tab to drop used canister, grab new canister and insert, raise bail and pull lanyard to activate.
- d. Release OBA hoses, resume normal breathing and set OBA timer.



## SECTION 4

### FIREFIGHTING CLOTHING

#### 077-4.1 INTRODUCTION.

077-4.1.1 This section covers the firefighter ensemble (FFE).

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#### WARNING

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**While providing protection from external heat, firefighter's clothing reduces the body's ability to dissipate heat. This results in increased heat stress. The on-scene leader shall use common sense and good judgment in dealing with heat stress. Avoid having personnel fully dressed out until required. Guidance for reducing heat stress is contained in paragraph 077-4.2.3.**

077-4.1.2 Each item is described along with its intended purpose, and directions are provided for its use and care. Refer to NSTM Chapter 555, Volume 1; NSTM Chapter 555, Volume 2; and Chapter 079, Volume 2; for detailed information on shipboard firefighting. Visit Damage Control and Fire Protection Engineering website at [www.d-cfp.navy.mil](http://www.d-cfp.navy.mil) under DC Central, click on DC Personnel Dressout for more detailed information and descriptions on each piece of equipment.

#### 077-4.2 FIREFIGHTER ENSEMBLE.

077-4.2.1 GENERAL. The firefighter ensemble is intended to protect the firefighter from short duration flame (flash) exposure, heat, and falling debris.

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#### WARNING

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**The firefighter ensemble is not a proximity suit. It is not designed to make crash fire rescues. Prolonged contact with flames may cause the clothing to transmit dangerous heat to the body or may cause the clothing itself to burn, which could result in serious injury or death to the firefighter. The ensemble does not offer complete protection against chemical, biological, or radiological effects. Refer to NSTM Chapter 555 for guidance on the use of the firefighter ensemble in a CBR firefighting environment.**

077-4.2.1.1 The firefighter ensemble consists of the following items:

- a Fire protective gear (FPG)
- b Firefighter's hood
- c Damage control helmet

- d Firefighter's gloves (local procurement from authorized list)
- e Firefighter's boots.

**NOTE**

Helmets and boots are not required on submarines.

The firefighter ensemble is shown in [Figure 077-4-1](#).



Figure 077-4-1. Firefighter Ensemble

077-4.2.2 CONSTRUCTION. The following paragraphs provide details on the construction of the items contained in the firefighter ensemble.

077-4.2.2.1 Fire Protective Gear. The design of the FPG is a one piece, jump suit style coverall. The coveralls consist of an outer shell, a vapor barrier, and an inner fire-retardant thermal liner. The knees, bottoms of the thigh pockets, and bottoms of the legs are reinforced with leather for extra protection. The coverall has reflective markings around the upper arms, lower legs, and torso to highlight the outline of the firefighter in dense smoke or dim light. The front closure and inside lower legs have brass zippers. There are bellows pockets with Velcro closures on the outside of each thigh and one in the front of the left upper arm. The coveralls have a corduroy-faced collar with snap fasteners. The sleeves have an integral knit wristlet for wrist protection. The coveralls are

available in five different sizes (small through extra-large tall). The sleeves should be labeled on the orange tape with the size of the coveralls for rapid identification, S for small, M for medium, L for large, XL for extra large, and XLL for extra large long.

#### NOTE

The U.S. Navy has recently completed development of a new Firefighter's Coverall (Damage Control Coverall), which is currently being introduced to the fleet via the supply system. Key differences between the current coverall and the new coverall are the following:

1. A removable liner system allows the authorizing commercial cleaning facility the ability to properly clean and or decontaminate the coverall more; therefore, reducing the cost of repair and maintenance. With the removable liner system, the choice of section replacement (liner or outer shell) or replacing the complete garment is available.

2. The firefighter's coverall has new design and material features. A raglan sleeve and extra side panels were incorporated to give total freedom of movement for the firefighter. Both the shoulder and knee areas have new compressive materials added to ensure increased thermal protection. Two donning and doffing features were added, the use of a smooth / slick inner material and an increased length of leg zippers. Both features will decrease the time for donning and doffing the ensemble.

3. The new coveralls raise firefighting standard. The new ensembles exceed the year 2000 proposed firefighting standard for protective clothing.

077-4.2.2.2 Firefighter's Hood. The firefighter's hood provides protection to the head, neck, and face (except the eyes). The hood can be worn with the breathing apparatus. The hood without a breathing apparatus, illustrated in [Figure 077-4-2](#), has an elastic face closure and is available in one size fits all. The face portion can be pulled up over the nose for additional protection of the face, as illustrated in [Figure 077-4-2](#) The firefighter's hood (NSN 8415-01-462-7670) can be procured through the following vendors:

Fire Brigade Manufacturing Inc.  
P.O. Box 3571  
Shawnee, OK 74802-3571  
1-800-352-0126  
Style No. FB 227 PBI Gold

Majestic Fire Apparel, Inc.  
P.O. Box 248  
Leighton, PA 18235-0248  
610-377-6273  
<http://www.majesticfireapparel.com> Style No. PAC IX

Life Liners, Inc.  
10 Park Place  
Morristown, NJ 07960  
1-800-204-0621  
973-829-0642  
Style No. PK9790ES.



Figure 077-4-2. Firefighter's Hood

077-4.2.2.3 Damage Control Helmet. The damage control helmet is designed to protect the head, neck, and face from short duration flame (flash) exposure, heat, and falling objects. The helmet shell material is heat resistant fiberglass. The helmet is provided with a long rear brim, a face shield, a chin strap, an adjustable "ratchet-type suspension, reflective markings, and ear flaps that cover the side of the head and neck.

#### **CAUTION**

**Do not modify the damage control helmet in any manner, including removing the face shield and drilling holes to attach a light. Modification will reduce the protection provided by the helmet.**

#### **NOTE**

High-intensity helmet lights are provided for the damage control helmet in the Damage Control Repair Station (DCRS). These lights may be attached to the helmet.

077-4.2.2.4 Firefighter's Gloves. The firefighter's gloves protect against abrasions, short duration flame (flash) exposure, and heat. The five-finger cut wristlet gloves are fabricated with leather, aluminized fabric, a waterproof vapor barrier, and fire-retardant liner.

#### **NOTE**

According to Naval message NAVCLOTEXTRSCHFAC 191510Z JUL 01, all firefighter's gloves are required to have thermal and steam protection and the only approved glove to be worn with the FPG is the Shelby Steamblock Model #5229 Glove. The glove is a leather, five finger, knit wristlet style comprised of an outer shell, moisture barrier, and thermal liner. It has an additional Firewall Steamblock insulating pad between the outer shell and moisture barrier on the back of the hand and an extended body and wristlet. The glove is close fitting at the opening to restrict the entry of embers and other foreign particles. It is available in six sizes: extra small (NSN 4210-01-476-4994), small (NSN 4210-01-

476-5010), medium (NSN 4210-01-476-5017), large (NSN 4210-01-476-5024), extra large (NSN 4210-01-476-5031), and jumbo (NSN 4210-01-476-5036). Shelby Steamblock Model #5229 Gloves may be procured through the supply system or the following vendors:

Safety Equipment Company (SEC)  
1-800-226-4732

Zones 1 and 2, Region East Contract Number SP-0500-99-D-0020  
Zone 1, Region West and Central Contract Number SP-0500-99-D-0059

Lion Vallen Industries (LVI)  
1-888-848-5599  
2916 Walden Avenue, Suite 250  
Depew, NY 14043

<http://www.lionvallen.com/>

Zone 3, Region East Contract Number SP-0500-00-D-0021

Zone 2, Region West and Central Control Number SP-0500-99-0060.

077-4.2.2.5 Firefighter's Boots. The firefighter's rubber boots have steel safety toes and puncture proof steel insoles. Firefighter's boots are available in knee high length. The boots are worn inside the coveralls and are available in sizes 5 through 15. Boot sizes should be marked on boot heel for rapid identification.

077-4.2.3 REDUCTION OF HEAT STRESS FOR FIREFIGHTER ENSEMBLE. The firefighter ensemble provides significant improvement in protection from the heat of a major fire. As discussed in the warning prior to [paragraph 077-4.1.2](#), this added protection reduces the body's ability to dissipate heat, resulting in increased heat stress. The following actions can significantly reduce heat stress while using the ensemble.

- a. Don complete firefighter ensemble just prior to leaving the fire team staging area for fire zone entry. While waiting to enter fire zone, don coveralls only to the waist, tying the coverall arms around the waist. Just prior to actual entry, fully don the firefighter ensemble and breathing apparatus.
- b. Rotate firefighting personnel during prolonged firefighting. Frequency of rotation should be based on breathing apparatus operating times.
- c. Remove the firefighter ensemble as soon as possible after exiting fire zone to allow the body to cool. Plenty of fluids should be available for drinking and wash down.
- d. Once the firefighter has demonstrated the ability to properly don the ensemble, requirements to wear the firefighter ensemble for training may be relaxed, especially in hot weather. Possible training scenarios include completely donning the ensemble every second or third drill, or donning all components except the coverall.

#### 077-4.2.4 DONNING AND ADJUSTING.

077-4.2.4.1 Don the firefighter ensemble in accordance with the following procedures:

- a. Put the firefighter's hood over the head with the elastic face opening over the face.
- b. Pull out the coveralls. Keep pants and shirt on, but take off shoes or boots. Remove anything else that will interfere with donning the garment, such as items in pockets. Put on the coveralls and pull them up over shoulders. Insert thumbs through the small loops on the ends of the sleeve wristlets to anchor and keep them under the gloves.

#### NOTE

Although wearing the firefighter ensemble coveralls with only shorts and a T-shirt (or similar clothing) underneath will reduce heat stress in mildly hot

environments, the lack of clothing underneath the coveralls may increase the chances of local burns in a severely hot or steamy environment.

- c. Step into the rubber firefighter's boots. Never put on the boots before the coveralls. Secure the two zippers on the bottom of the coverall legs. Firefighter's boots are superior to normal work boots in protecting from a hot deck and from hot water on the deck. Firefighter's boots should be worn whenever the firefighter's ensemble is required. Wearing a firefighter's boot a size smaller than one's normal shoe size may improve the fit. Wear two pairs of heavy socks, if available, inside the firefighter's boot to improve the fit and increase insulation when working on a hot deck.
- d. Stand up the coverall collar and ensure that the firefighter's hood is fully inside the collar and down the chest as far as possible. Secure the coverall front body zippers and the two collar snaps.
- e. Don the breathing apparatus. Do not secure the facepiece. Refer to [Section III](#) of this manual for directions on donning, adjusting, and using the breathing apparatus.
- f. Pull the firefighter's hood face opening down around the neck. Put on the breathing apparatus facepiece, tighten the straps, and check for facepiece seal. Pull the hood backup over the facepiece straps, with the elastic opening over the face.
- g. Secure the Velcro closure on the coverall collar. Put the helmet on, secure the helmet ear flap Velcro fastener, and fasten the chin strap.

#### NOTE

Keep the breathing apparatus breathing tubes and hoses outside the coverall collar and helmet ear flap.

- h. The helmet face shield may be worn in the up or down position. If worn in the down position, loosen the face shield fasteners on the sides of the helmet brim and rotate the face shield over the facepiece.
- i. Remove the gloves from the leg pockets and put them on. Ensure that the gloves cover the coverall wristlets. Wrists should be well protected; the wristlet of the glove and the sleeve of the coverall should have a generous overlap. Gloves that are slightly oversized provide an air space between the fingers and the glove which reduces heat and burns. However, wearing over-size gloves reduces dexterity. Wearing anti-flash gloves under leather gloves may improve protection from heat. If they are available, an extra pair of gloves may be brought to the scene to replace gloves that have gotten wet or too hot.

077-4.2.4.2 To take off the gear, reverse the donning order. Remove the gloves, pull up the helmet face shield, loosen the helmet chin strap, open the helmet ear flap Velcro fastener, take the helmet off, and open the coverall collar closure. Pull the firefighter's hood down around the neck, and take off the breathing apparatus facepiece. Take off the breathing apparatus, pull off the firefighter's hood, step out of the boots, and take off the coveralls.

077-4.2.5 OPERATION. The scene leader determines the protective clothing requirements for the fire party based on an assessment of conditions at the scene of the fire.

077-4.2.5.1 In most cases, if the fire is not controlled by the rapid response team or personnel on duty in the fire space, the hose team will require the full firefighter's ensemble. Therefore, unless directed otherwise by the scene leader, the attack team leader, nozzlemen, hosemen, and accessmen should don the full firefighter's ensemble immediately upon arriving at the repair locker and then proceed to the scene of the fire.

077-4.2.5.2 During use of the firefighter ensemble, avoid direct contact with flames. Also avoid sharp and pointed objects which may tear or puncture the suit. Support personnel outside of the fire boundary shall remain in battle dress uniform.

077-4.2.6 STOWAGE. The firefighter ensemble shall be stowed in or near the damage control repair stations so that they are readily accessible, preferably in a passageway. Before being stowed, ensure that the ensemble is clean and dry.



077-4.2.7 MAINTENANCE OF FIREFIGHTER ENSEMBLE. Conduct maintenance in accordance with Planned Maintenance System (PMS) requirements. The following information on repair of the firefighting ensemble is provided and amplifies PMS requirements:

- a. Replace the coveralls if material tears penetrate the vapor barrier or if the shell is torn more than 2 inches in any one direction. For tears up to 2 inches in length, surface stitch the tear with high-temperature resistant thread. Major repairs, such as replacing a zipper, torn sections, or damaged components, can only be accomplished by authorized service centers (refer to [paragraph 077-4.2.7.2](#)). Replacing such parts is cost-effective and is recommended instead of procuring a new item.

### CAUTION

#### **Do not penetrate the vapor barrier during the repair.**

- b. Replace the helmet if the shell is cracked, or if the suspension is damaged. Replace the face shield if large scratches on either side of the shield obstruct the view. Tears in the liner, up to 2 inches in length, may be surface stitched using the same high-temperature resistant thread used to repair the coveralls.
- c. Replace the firefighter's hood if it has been damaged in any way.
- d. Replace the gloves if the inner vapor barrier is torn or punctured. Repairs of the shell are permitted and are mandatory if the leather is cut through or gouged more than 1/2-inch in length, or if the stitching is broken for more than 1/2-inch in length. For repair of damage within these limits, use the same high-temperature resistant thread used to repair the coveralls.

077-4.2.7.1 Soot and dirt buildup on the surface of the garment may eventually contribute to reduced thermal protection, especially at extreme temperatures found in shipboard fires. Also, the threat of heat exhaustion increases when the pores of the outer shell and moisture barrier become clogged with soot and dust. Instructions for routine shipboard cleaning are contained in the PMS requirements. Professional cleaning is warranted for more intensive cleaning or decontamination of garments exposed to hazardous substances. Professional cleaning can only be accomplished by authorized service centers (refer to [paragraph 077-4.2.7.2](#)).

077-4.2.7.2 These professional cleaning and repair facilities are authorized to restore the coverall to its original protective effectiveness. All repairs performed by these facilities meet U.S. Navy manufacturer's guidelines and national (NFPA) standards. The facilities offer free garment inspection / evaluation and repair costing to the Navy. The facilities are as follows:

National Safety Clean, Inc.

800-253-2690

Email: [sales@natsafe.com](mailto:sales@natsafe.com) [www.natsafe.com](http://www.natsafe.com)

(Pennsylvania)

225 Birch Street

Kennett Square, PA 19348

610-444-1700

Fax: 610-444-0135

(Texas)

8484 Gulf Freeway

Houston, TX 77017

713-644-7400

Fax: 713-644-8848

SeaWestern Fire Apparatus and Equipment

12815 N.E. 124th Street, Suite H

Kirkland, WA 98034

800-327-5312

425-821-5858

Fax: 425-823-0636

Email: [info@seawestern.com](mailto:info@seawestern.com)

[www.seawestern.com](http://www.seawestern.com)

Glove Inc.  
1950 Collins Blvd.  
Austell, GA 30106  
800-476-4568  
770-944-9186  
Fax 770-944-0012  
<http://glovesinc.com>.

### **077-4.3 FIRE RETARDANT COVERALLS.**

IAW COMNAVSURFOR Message DTG 041315Z DEC 03, fire retardant coveralls are required to be worn in all engineering spaces onboard surface ships and are considered a critical safety item. Polyester / cotton coveralls should never be worn in place of fire retardant coveralls in engineering spaces because these fabrics, unlike the fire retardant coveralls, will continue to burn once ignited. The only approved coveralls to be worn in engineering spaces are the cotton impregnated coveralls or the new NOMEX coveralls. The NOMEX fire retardant coveralls address many of the issues raised regarding the current cotton impregnated fire retardant coveralls. The new NOMEX coveralls are designed with belt loops and Velcro closures and can be safely washed in the laundry. In addition, these coveralls are significantly lighter and longer lasting than the cotton impregnated coveralls and are available in eight sizes with three different lengths.

**SECTION 5**  
**ANTI-FLASH AND STEAM CLOTHING**

**077-5.1 ANTI-FLASH CLOTHING.**

077-5.1.1 DESCRIPTION. The intended use of anti-flash clothing is to protect personnel from transient, elevated air temperatures resulting from the use of high explosive weapons and from burns caused by fire. The importance of protecting personnel from burns caused by weapons explosions or fire is a lesson learned from combat action. The clothing consists of the following items:

a. Anti-flash hood.

**NOTE**

The new gray color general quarters (GQ) anti-flash hood (National Stock Number (NSN) 4210-01-493-4694) is a phased replacement to the current brown / beige color anti-flash hood (NSN 8415-01-268-3473). The new GQ anti-flash hood can be identified by its straight tube shape and gray color. The hood is manufactured from two layers of Kevlar/FR Rayon. It is considerably more durable and costs less than the previous brown / beige colored anti-flash hood. The existing anti-flash hood (brown / beige color) can still be worn for GQ until stock is depleted. All new requisitions must specify the new GQ anti-flash hood and NSN (4210-01-493-4694) as stated above. The new GQ anti-flash hood will carry the National Fire Protection Association (NFPA) label and certified for performance by Underwriters Laboratory.

Procurement can be either through the POPS system or directly from the authorized distributors listed below by region:

Safety Equipment Company (SEC)  
Customer Service 1-800-226-4732  
Zones 1 and 2, Region East Contract Number SP-0500-99-D-0020  
Zone 1, Region West and Central Contract Number SP-0500-99-D-0059

Lion Vallen Industries (LVI)  
Customer Service 1-888-848-5599  
Zone 3, Region East Contract Number SP-0500-00-D-0021  
Zone 2, Region West and Central Control Number SP-0500-99-0060.

b. Anti-flash gloves.

All personnel shall wear normal battle dress uniforms with the above items. The gloves are made from fire-retardant cotton and one size fits all. The commanding officer will direct relaxing of battle dress to prevent heat stress. Do not hesitate to don anti-flash clothing whenever a flash threat is imminent.

077-5.1.2 DONNING. The anti-flash hood is quick and easy to don. Simply pull the hood over the head and pull down around the shoulders outside of the shirt. Adjust the hood, so the hole for the face is centered for the best possible vision. The anti-flash hood is normally worn with the eyes and nose exposed, although it may be pulled up over the nose for maximum protection. However, if it is over the nose for long periods, it may obstruct

vision or fog glasses. Pull the gloves up over the shirt sleeves until the tips of the fingers are in the fingers of the gloves and the glove gauntlet is fully extended, as shown in [Figure 077-5-1](#). To minimize burns, cover your face and eyes with your arm or hands if you see a flash.



Figure 077-5-1. Anti-Flash Clothing

## 077-5.2 STEAM PROTECTIVE CLOTHING.

077-5.2.1 GENERAL. Steam protective clothing provides limited personnel protection in steam environments at elevated temperatures. It is intended to allow personnel to approach steam leaks to permit isolation or emergency repair. The steam protective clothing provides limited personnel protection in a severe steam environment; the suit does not render the wearer impervious to burns.

077-5.2.2 TYPES. There are two types of steam protective clothing authorized for submarine use: the air-fed oven suit (steam suit) and the steam protective ensemble. Submarines are provisioned with either five air-fed oven suits (steam suits) or five steam protective ensembles. Three are for emergency use and two are for training.

077-5.2.3 RESTRICTIONS. Only submarines that have been outfitted with the Self-Contained Breathing Apparatus (SCBA) can use the steam protective ensemble. All other submarines shall use the air-fed oven suit (steam suit).

### **WARNING**

**Steam protective clothing is not designed for firefighting. Using steam protective clothing in a fire could result in personnel injury or death. Ensure equipment is positively identified as steam protected clothing before use.**

### 077-5.3 AIR-FED OVEN SUIT (STEAM SUIT).

077-5.3.1 EXPERIENCE IN CASUALTIES. The Mine Safety Appliances (MSA) steam suit has been effective protective clothing for isolating steam leaks when used in submarine casualties. In these types of casualties, the steam leaks result in steam plumes. The air supply hose can be attached to an Emergency Air Breathing (EAB) manifold sufficiently distant from the steam plume to minimize heating of the air supplied to the steam suit. See [Figures 077-5-2](#) and [077-5-3](#) for details on the steam suit.

077-5.3.2 AMBIENT STEAM ENVIRONMENT TESTS Testing of the MSA steam suit in an ambient steam environment demonstrates limited personnel protection.

077-5.3.2.1 Testing of the steam suit was performed on an instrumented, stationary mannequin using a limited number of thermocouples. As expected, the test data shows that the length of time before the onset of a second degree burn decreases with increasing steam temperature (measured by a thermocouple, as the amount of time it takes for the surface of the mannequin to rise 25° F). At steam chamber temperatures between 171 and 190° F, the shortest time before the onset of a second degree burn was 6.5 minutes. At steam temperatures ranging from 151 to 170° F and from 130 to 150° F, the shortest times before the onset of a second degree burn were 13.0 and 20.5 minutes, respectively. These may vary if a person wearing the suit is able to adjust the Cool-Flo tube to increase cooling and is able to move around, which can cause the air inside the suit to circulate and can help insulate the wearer. However, the test data shows that a burn injury is more likely in a higher temperature, ambient steam environment, and the chance of being burned increases with increases in temperature in relation to “time at temperature.”

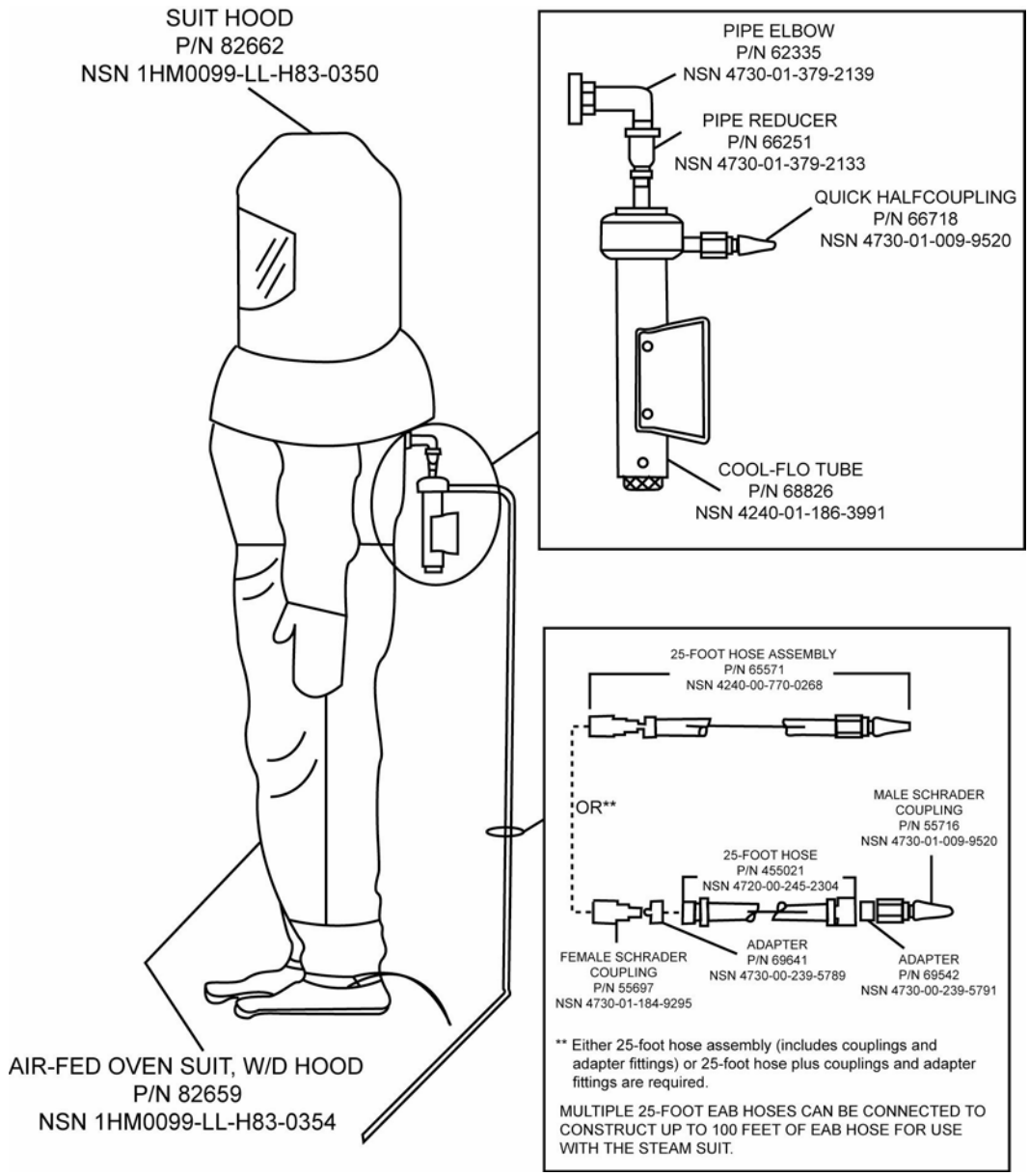


Figure 077-5-2. Air-Fed Oven Suit (Steam Suit)

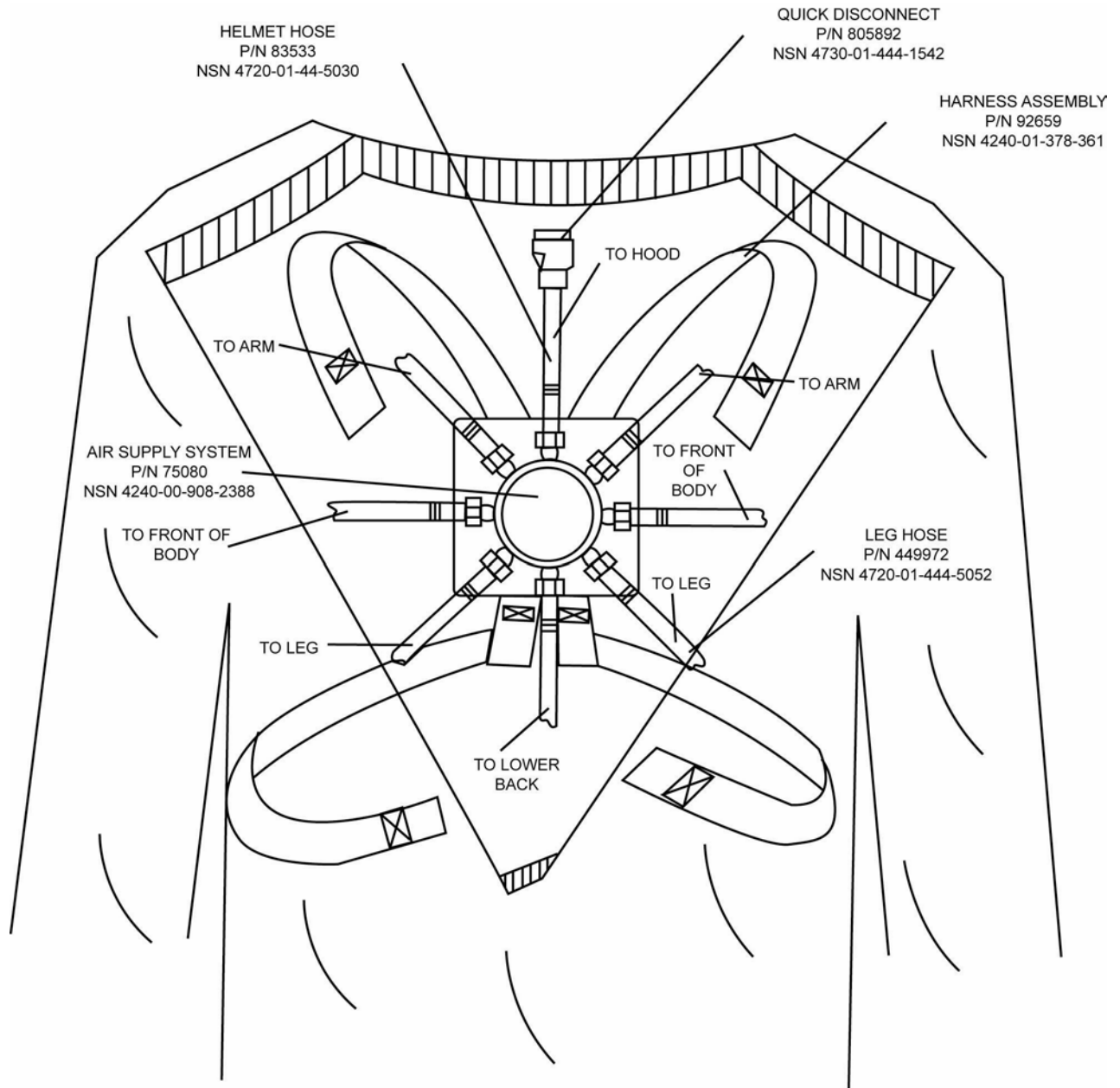


Figure 077-5-3. Harness Assembly with Air Supply System (Located Inside Air-Fed Oven Suit (Steam Suit))

077-5.3.2.2 The temperature of the supplied air is an important factor in the thermal protection provided by the steam suit. Since air is supplied to the steam suit from the EAB lines located within the affected compartment, the air supplied to the suit will be heated from the outside of the EAB hoses by the steam in the compartment as the air moves through the EAB lines and through the air supply hose. Therefore, thermal protection of the suit may be reduced because of the added outside heat.

077-5.3.3 DESCRIPTION. The air-fed oven steam suit is a one piece coverall with integral gloves and shoe covers. A hood is provided but it is not integral to the suit. The hood is fabricated over an aluminum head protector. The hood has extended front and back bibs with loops to hold the hood in position while being worn. The suit has an aluminized reflective outer coating similar to the firefighter's proximity suit.

077-5.3.3.1 The suit has an air manifold in the back, which distributes air throughout the suit to the hood, both arms, both legs, and to the front and back of the torso. Air pressure maintains a balloon effect within the suit,

which provides a protective air space around the body. This air space provides comfort and freedom to work while cooling the wearer. The air fed into the suit is vented out through the neck area.

077-5.3.3.2 The steam suit has air supplied to it from an EAB manifold through an EAB hose. The hose is attached to a Cool-Flo tube (Figure 077-5-2), which attaches to the operator and eliminates the need to disconnect from the EAB system once connected to a central location. A combination of 25 foot hoses can be connected together to form a hose up to 100 feet in length. Practice is needed to be able to keep the hose from kinking or snagging on equipment. The hose must be carried away from the suit so it does not press inflated parts of the suit against the body.

077-5.3.4 DONNING AND ADJUSTING. Don the steam suit as follows:

- a. Pull the suit on like general work coveralls. Ensure that the air distribution tubing is not crimped. Be careful while inserting shoes to ensure that the coverall's shoe covers do not tear.
- b. Pull the internal suspenders over the shoulders and adjust to support the weight of the suit on the suspenders. Properly adjusted suspenders should allow the inflated suit to lift off the wearer's shoulders.
- c. Slide arms through sleeves and insert hands into the gloves.
- d. Secure front closure and cover with the protective flap.
- e. Don appropriate hearing protection.
- f. With assistance, place the hood over head and slip arms through the loops.
- g. Have standby personnel connect the air line to the suit and the EAB manifold.
- h. Adjust the hood so that the bottom edge of the frame is out of the line of vision.
- i. Adjust the Cool-Flow tube bypass flow control knob to provide maximum comfort and maintain adequate air flow to the suit.

#### NOTE

The bypass control knob controls the amount of air that is bled to the atmosphere from the suit's supply air. Increasing the bypass flow decreases the temperature of the air supplied to the suit but also reduces the suit's internal air flow. The comfort of the suit depends on a balance between the internal flow rate and air temperature.

077-5.3.5 PRECAUTIONS. The following precautions are provided for the safety of personnel using the air-fed oven steam suit:

- a. While wearing a steam suit, avoid exposure to direct flame or hot metal.
- b. One steam suit may tax the ability of an EAB manifold and 1/4-inch air supply piping to supply enough air volume to maintain the steam suit inflated. Attaching additional EABs, air operated equipment, or steam suits to the same EAB manifold or other EAB manifolds supplied by the same 1/4-inch air supply piping decreases the performance of the suit and should not be done.
- c. The steam suit is worn with an EAB hose to allow mobility in the space without having to disconnect the suit from the EAB manifold. If the steam suit is disconnected from the EAB manifold, the cooling effect of the air entering the suit will be lost and the suit may collapse because steam may enter the suit through openings without positive closure such as under cape of the hood, potentially burning the wearer.
- d. The firefighting chemical Purple-K Powder (PKP) will damage aluminized surfaces. Avoid getting the chemical on the suit and rinse immediately if the chemical does get on the suit.
- e. Avoid pointed or sharp objects to prevent puncturing or tearing the suit. Should a suit become torn, discard it.



- f. Shipboard allowance includes a quantity of two steam suits that are to be used for training purposes only. Positively identify these suits with a large red “X” and stow them in containers marked FOR TRAINING PURPOSES ONLY. Paint these containers yellow, and stow separately from the other containers. Training suits can be used in an unlimited number of drills. Training suits should be replaced before their condition deteriorates to where they do not provide realistic training. Limit handling of suits designated for real casualties to Planned Maintenance System (PMS) maintenance procedures and actual emergency situations.
- g. Do not make repairs to the steam suit. Should the aluminized material become damaged, replace the suit.
- h. Do not use a damaged steam suit hood. Replace the hood.
- i. Steam suits only provide limited personnel protection in steam environments at elevated temperatures. Reduce abnormal temperature and pressure in steam filled spaces as much as possible before entry.
- j. Wear hearing protection when wearing a steam suit.
- k. The air distribution hoses in the MSA steam suit are susceptible to crimping. A crimped hose can cut off the air supply to areas of the wearer’s body, causing an increase in local skin temperature. Prior to donning the steam suit, ensure the air distribution hoses are not crimped.
- l. To ensure that there is proper cooling on the face. Ensure that the air distribution hose in the hood is arranged so that the holes in the hose are aimed down towards the face and across the faceplate.
- m. The EAB hose should be attached to an EAB manifold sufficiently distant from the steam leak if the steam leak results in a steam plume. This minimizes heating of the air supplied to the MSA steam suit.
- n. If entering an ambient steam environment, personnel should be briefed on required actions in order to minimize time spent in the steam environment. Additionally,
  1. If possible, prior to entry into the space, the affected space should be cooled to the maximum extent possible using the ship’s ventilation systems.
  2. Disconnecting the air supply hose stops cooling to the suit, causing the suit to collapse and steam to enter the suit, potentially burning the wearer.
  3. Personnel should adjust the Cool-Flo tube to maintain comfort. Personnel should also keep moving so that the air inside the suit circulates, helping to cool the wearer.

**077-5.3.6 STOWAGE.** Stow the air-fed oven steam suit, the hood, and the fittings in separate plastic bags. The protective lens cover should be attached to the hood. Stow the entire suit in the original shipping container. This stowage procedure will prevent damage to the aluminized surface of the suit and make the suit readily accessible for immediate use. A 25-foot EAB hose shall be stowed with each steam suit. Additional 25-foot EAB hoses that are meant to be connected together to form a hose up to 100 feet in length shall be stowed with the steam suit or stowed together in close proximity of the steam suit locker. All EAB hoses associated with the steam suit shall be marked with a metal plate designating them for steam suit use only.

**077-5.3.7 MAINTENANCE OF THE STEAM SUIT.** Perform maintenance on the steam suit after each use in accordance with PMS requirements.

**077-5.3.8 TRAINING ENSEMBLES.** Shipboard allowance includes a quantity of two suits which are to be used for training purposes only. Positively identify these suits with a large red “X” and stow in containers marked **FOR TRAINING PURPOSES ONLY** . Paint these containers yellow, and stow separately from the other suits to the maximum extent possible. Training suits can be used in an unlimited number of drills. Training suits should be replaced before their condition deteriorates to where they do not provide realistic training.

#### **077-5.4 STEAM PROTECTIVE ENSEMBLE.**

**077-5.4.1 GENERAL.** The steam protective ensemble, as shown in [Figure 077-5-4](#), consists of six components, which must be worn as prescribed below to provide the necessary protection.

**WARNING**

**Failure to wear all the components of the steam protective ensemble could result in serious personnel injury or death.**

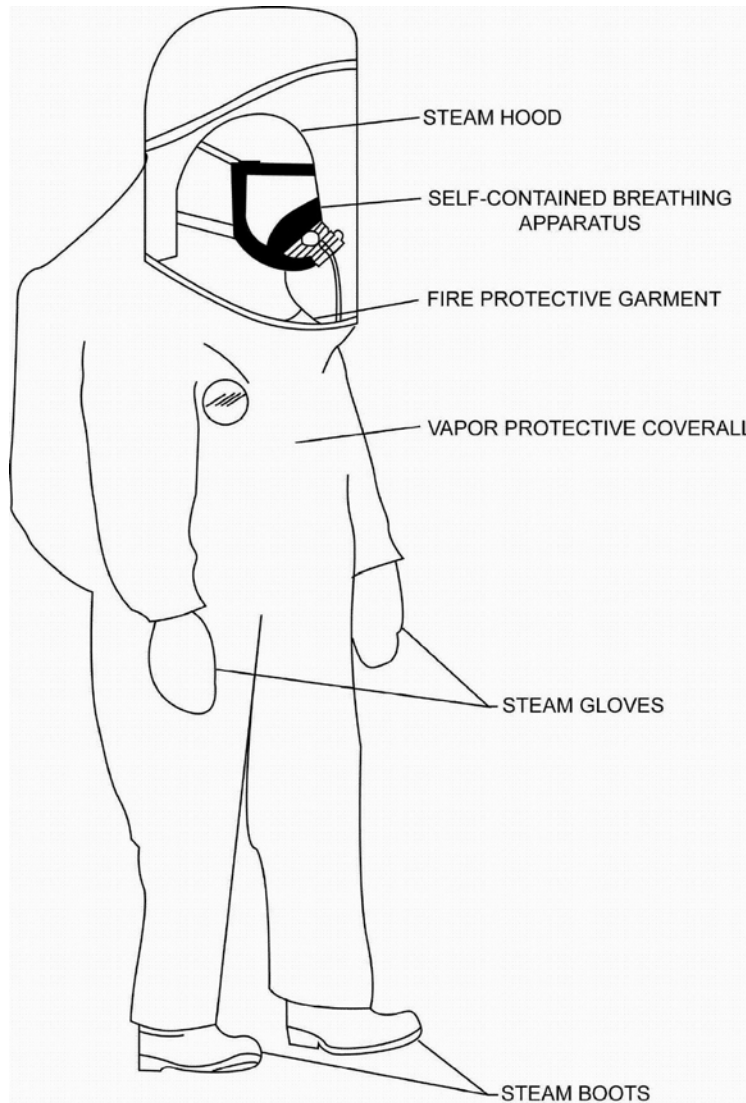


Figure 077-5-4. Steam Protective Ensemble

077-5.4.2 COMPONENTS. The six components of the steam protective ensemble are as follows:

- a. Fire Protective Garment (FPG). The FPG is a one-piece coverall with a snap-in removable liner system. The liner system is composed of a moisture barrier (liquid/fluid) and thermal liner. The coverall has a raglan sleeve design with side body gussets. In addition, the coverall has a front zipper closure, an elastic waistband, two leg zippers, two cargo pockets, reflective trim, over-the-thumb wristlets, and reinforcements in the knees, elbows, leg cuffs, and cargo pockets. The wristlets are attached to the liner system. The FPG is worn under the Vapor Protective Coverall.
- b. Vapor Protective Coverall (VPC). The VPC is a one-piece, totally encapsulating suit constructed from a single layer of composite material, which consists of multiple films applied to a tough substrate and provides steam

vapor protection. The coverall has a zipper closure with a Velcro overlap. A wide facepiece sealed into the head section provides the wearer with good visibility. Sock-like booties are an integral part of the suit. The suit is built with an expanded back for use with an SCBA. Vent valves are built into the suit to prevent over-pressurization of the suit. The vapor protective coverall comes in a sealed bag from the manufacturer and should remain in the bag until initially used.

- c. Steam Hood. The steam hood is a one-piece complete head cover, which is open at the front to accommodate the SCBA mask. The insulated hood is constructed of triple-ply knitted materials, is shoulder-length, and flared at the bottom. The hood is worn over the FPG and under the VPC. The steam hood is specifically designed for entry into steam areas and should never be replaced with other damage control equipment such as flash hoods, which do not provide adequate protection.
- d. Steam Gloves. The steam gloves are mitten style with a long wrist gauntlet that can be secured at the top with a cord quick-lock adjustment. The gloves are constructed of a rugged nylon outer shell, super grip palms, and a highly insulated inner liner. The gloves are worn over the VPC. The steam gloves are specifically designed for entry into steam areas and should never be replaced with other damage control gloves or work gloves, which do not provide adequate protection.
- e. Steam Boots. The steam boot is a shortened, insulated, rubber fire boot, about 13 inches high. It is lined with a durable high-temperature, heat-resistant liner. The boot contains a built-in shin guard, a steel toe, a mid-sole, and a shank for added protection. The boots are worn over the booties of the VPC.
- f. SCBA. The SCBA is worn over the FPG and under the VPC. Refer to [paragraph 077-3.2](#) for more information on the SCBA.

**077-5.4.3 TRAINING ENSEMBLES.** Training steam protective ensembles must be positively identified with a large red “X” and stowed in containers marked FOR TRAINING PURPOSES ONLY. Containers shall be painted yellow and located separately from other steam protective ensembles to the maximum practical extent. Training steam protective ensembles should be replaced before their condition deteriorates to where they do not provide realistic training. Upon receipt of an ordered ensemble, the oldest tactical ensemble should be converted to a training suit and the new ensemble used to replace the old tactical ensemble.

**077-5.4.4 DONNING AND ADJUSTING.** Assistance from other personnel is required when donning the steam protective ensemble. Don the ensemble as follows:

- a. Assemble all six components of the ensemble.
- b. The person donning the ensemble should remove work boots, shoes, and any metal jewelry.
- c. Pull the FPG on like general work coveralls. Close leg zippers and the front zipper. Secure the Velcro wrist adjustments.
- d. Pull the steam hood over the head and spread the apron around the shoulders outside the FPG. Pull the head portion down around the neck to allow donning of the SCBA breathing mask.
- e. Step into the VPC by inserting the feet into the booties. Bring it up to the waist until the SCBA can be donned.
- f. Put on the SCBA. Once the breathing mask has been put on, ensure that the breathing air is working. Pull up the steam hood and position the face opening around the mask.
- g. Continue donning the VPC (with assistance). Insert hands into the sleeves and secure the Velcro sleeve closures. Pull the hood over the head. Have assistance personnel close the zipper, ensuring the SCBA is properly positioned in the expanded back. Secure the Velcro flap covering the zipper.
- h. Pull on the steam boots (with assistance) over the booties and then pull the cuff bottom over the fire boots.
- i. Pull the steam gloves (with assistance) over the hand. Pull the glove gauntlet all the way over the sleeve and snug the top of the gauntlet by pushing in the quick-lock adjustment while pulling the ends of the cord.
- j. To avoid overheating the wearer and depleting SCBA air, fully seal the VPC and start SCBA air production only when the wearer is ready to enter the steam-filled space.

077-5.4.5 PRECAUTIONS. The following precautions shall be observed to ensure the safety of personnel using steam protective ensembles:

- a. Substitution of steam protective ensemble parts is not permitted. All the components must be worn as prescribed to provide the necessary protection.
- b. While wearing a steam protective ensemble, avoid exposure to direct flame or hot metal.
- c. Avoid sharp or pointed objects to prevent puncturing or tearing of the ensemble. Should any component become damaged, replace it.
- d. The steam protective ensemble provides limited personnel protection in steam environments at elevated temperatures. The length of time of personnel protection depends on the amount of air in the SCBA cylinder and the heat stress experienced by the individual. A person can be expected to be able to spend less than 15 minutes in a steam environment.
- e. Do not make repairs to any component of the steam protective ensemble. Should any component of the ensemble become damaged, replace it. The FPG can be repaired by a U.S. Navy approved commercial repair facility.
- f. After use, all components should be air dried before storage.

077-5.4.6 STOWAGE. Fold the steam protective ensemble in the following sequence to ensure it will fit into the stowage locker:

- a. Steam Boots. Place in the bottom of its assigned steam protective ensemble locker.
- b. Vapor Protective Coverall. Place the sealed bag containing the VPC into its assigned locker. If the coverall has been removed from its bag, discard the bag and stow the suit as described below:
  1. Lay the VPC out flat with the front facing up.
  2. Fold in the arms.
  3. Fold up the legs.
  4. Fold the booties back so that the soles are down, resting on legs.
  5. Fold the VPC to fit the stowage locker. The VPC can be rolled for alternate compact stowage. Ensure that the clear face shield is not creased when folded or rolled.
  6. Place the VPC in its assigned steam protective ensemble locker.
- c. Fire Protective Garment. Stow as follows:
  1. Lay the fire protective garment out flat with the front facing up.
  2. Fold in the arms.
  3. Fold up the legs.
  4. Fold the FPG to fit the stowage locker. The FPG can be rolled instead of folded for an alternative method of compact stowage.
  5. Place the FPG in its assigned steam protective ensemble locker.
- d. Steam Hood and Gloves. Place the steam hood and gloves in their assigned steam protective ensemble locker to allow for easy access.
- e. SCBA. The SCBA shall be stowed in its separate Grade A shock stowage locker.

## SECTION 6

### SAFETY HARNESES AND LANYARDS

#### 077-6.1 OVERVIEW.

There are two types of full body safety harnesses authorized for shipboard use. One is a parachute style harness and the other is a crossover style harness.

#### 077-6.2 PARACHUTE STYLE SAFETY HARNESS.

077-6.2.1 The parachute style safety harness consists of two frontal straps held in place by a horizontal connecting chest strap. The frontal straps pass over the shoulders and cross at the dorsal region of the back where the dorsal D-ring is positioned. From the dorsal region, these straps continue to the left and right leg straps. A waist belt passed through loops of the frontal straps and dorsal straps completes the ensemble. The waist belt is fitted with side D-rings for work positioning and a frontal D-ring for use with the climber safety rail system. The leg straps, chest strap, and waist belt is connected and adjusted by friction buckles. Adjustments are made to the shoulder straps using a friction adjuster. The shoulder straps are fitted with smaller D-rings for the purposes of confined space entry, extraction, and rescue.

077-6.2.2 The lanyard used with the parachute style safety harness is made of braided nylon rope with spliced thimbles. A Dyna Brake® decelerating device, designed to activate at 400 pounds of force and lengthens up to 42 inches, is attached to one end of the nylon rope. Double locking snap hooks complete the lanyard. The required length of the lanyard is six feet.

#### 077-6.3 CROSSOVER STYLE SAFETY HARNESS.

077-6.3.1 The crossover style full body harness uses shoulder straps crossing in the dorsal area where the dorsal D-ring is attached. The dorsal D-ring straps continue to the sub-pelvic strap and integral thigh straps. The shoulder straps continue down the frontal region until the straps cross at the lower chest area, where the frontal D-ring is attached, and then continue downward to attach to the sub-pelvic strap and thigh straps. The crossover design eliminates the need for a horizontal chest strap to hold the shoulder straps in place and eliminates the need for a waist belt. This design allows a greater freedom of motion and provides a greater level of protection in the event of an arrested fall. Side D-rings are provided for use in fall restraint. The leg straps use tongue and buckle leg straps for ease in adjusting among several users.

077-6.3.2 The lanyard used for the crossover style harness is a double-leg (or Y) tieback safety lanyard that provides a means for 100 percent tie-off at all times. Self-locking snap hooks require two distinct motions to attach the snap hook to an anchorage. A shock absorber, which activates at approximately 450 pounds of force, extends up to 42 inches while arresting a freefall by absorbing the energies of a fall. Two identical lanyard sections attached to the shock absorber pack can be used independently, allowing the user to be connected while developing another anchorage connection. The user can then walk along an area of fall hazards while being fully protected. A tieback D-ring can be adjusted to any position along each lanyard leg. The tieback D-ring provides a compatible connection allowing the user to wrap the lanyard around a structural member and attach the snap hook back to the tieback D-ring.



**APPENDIX A****REFERENCES****A-1.**

1. ANSI Z87.1, Practice for Occupational and Educational Eye and Face Protection
2. CGA G-7.1, ANSI Commodity Specification for Air
3. NAVAIR 11-100-1.1-CD, Cartridge Actuated Devices (CAD) and Propellant Actuated Devices (PAD) Technical Manual
4. NAVAIR 13-1-6.1-1, Aviation Crew System Inflatable Survival Equipment (Life Rafts)
5. NAVSEA S6220-EM-MMO-010, Breathing Air Compressor (BAC) Technical Manual, Revision 1, Instruction and Replacement List for Bauer Model: C-D/DV/NAVY, June 2000 (NSN 0910-LP-018-1780)
6. NAVSEA S6220-EN-MMO-010, Self-Contained Breathing Apparatus (SCBA) Scott Air-Pak Technical Manual, Revision 2, 15 October 2004 (NSN 0910-LP-103-0972)
7. NAVSEA S6220-ES-MMC-010 SCBA HP BACS for LPD-17 Class Ships Technical Manual, Operational Maintenance Manual, Organizational Level
8. NAVSEA S6226-PD-MMO-010, Self-Contained Breathing Apparatus (SCBA) Breathing Air Charging System (BACS) Technical Manual, Revision 1, Operation and Maintenance Manual with Illustrated Parts Breakdown Organizational Level, 28 August 2004 (NSN 0910-LP-103-6441)
9. NAVSEA S6226-SG-MMO-010, Self-Contained Breathing Apparatus High Pressure Breathing Air Charging System (SCBA HP BACS) for DDG-51 FLT IIA Class Ships Technical Manual, Operation and Maintenance Manual Organizational Level, 30 August 2005 (NSN 0910-LP-104-0955)
10. NAVSEA S9551-BP-MMC-010, Self-Contained Breathing Apparatus High Pressure Breathing Air Charging System (SCBA HP BACS) for LPD-4 Class Ships Technical Manual, Operation and Maintenance Manual Organizational Level, 30 September 2005 (NSN 0910-LP-102-7750)
11. NAVSEA SS600-AA-MMA-010/A-4, Oxygen Breathing Apparatus (OBA) Type A-4 Technical Manual (NSN 0910-LP-256-5100)
12. NAVSEA SS600-AF-MMO-010, Emergency Escape Breathing Device (EEBD), Scott Aviation Unit, P/N 802300, Technical Manual
13. NAVSEA SS600-AN-MMA-010, Supplied Air Respirator (SAR) with Self-Contained Breathing Apparatus (SCBA) Technical Manual, Operation and Maintenance Instructions, November 2002 (NSN 0910-LP-708-0000)
14. NAVSEA SS600-AS-OMI-010, Emergency Escape Breathing Device (EEBD) M-20.2 Technical Manual, Operation and Maintenance, 30 December 2003 (NSN 0910-LP-102-7894)
15. NAVSEA SS710-AA-MMO-010, Life Preserver Support Pkg for MK-4 Life Preserver Technical Manual, 01 April 1985 (NSN 0910-LP-306-1500)
16. NSTM Chapter 074, Volume 3, Gas Free Engineering
17. NSTM Chapter 079, Volume 2, Damage Control - Practical Damage Control
18. NSTM Chapter 079, Volume 3, Damage Control - Engineering Casualty Control
19. NSTM Chapter 470, Shipboard BW / CW Defense and Countermeasures

20. NSTM Chapter 555, Volume 1, Surface Ship Firefighting
21. NSTM Chapter 555, Volume 2, Submarine Firefighting
22. OPNAVINST 5100.19 (series), Naval Occupational Safety and Health (NAVOSH) Program Manual for Forces Afloat



## APPENDIX B

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**APPENDIX C****TECHNICAL MANUAL DEFICIENCY/EVALUATION REPORT (TMDER)****NOTE**

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