



# Fire Protection Training

Procedures Handbook 4300

PERSONAL PROTECTIVE EQUIPMENT

**TOPIC:** Self Contained Breathing Apparatus (SCBA) Types and Components

**TIME FRAME:** 1 Hour

**LEVEL OF INSTRUCTION:**

**BEHAVIORAL OBJECTIVE:**

*Condition:* A written quiz

*Behavior:* The student will be able to identify three (3) types of SCBA used by CDF and the components of an MSA Self Contained Breathing Apparatus

*Standard:* With a minimum of 70% accuracy

**MATERIALS NEEDED:**

- Chalkboard
- Handouts
- MSA self contained breathing apparatus

**REFERENCES:**

- IFSTA, Essentials of Fire Fighting, 2nd Edition, Chapter 4
- IFSTA, Self Contained Breathing Apparatus, 1st Edition, Chapter 4
- CDF, Health and Safety Procedures Handbook (1700)

**PREPARATION:** In the fire service a self contained breathing apparatus (SCBA) is the tool which allows us to operate safely in an oxygen deficient or contaminated atmosphere. To use this tool effectively it is important that the user understand the intended uses of different types of breathing apparatus and be familiar with the components and operation of these apparatus.



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SELF CONTAINED BREATHING  
APPARATUS (SCBA) TYPES  
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PRESENTATION	APPLICATION
<p><b>I. TYPES OF SELF CONTAINED BREATHING APPARATUS</b></p> <p>A. The Determination As to Whether a Self Contained Breathing Apparatus Is Open or Closed Circuit Depends Upon What Happens to the Exhaled Air.</p> <ol style="list-style-type: none"> <li>1. Closed circuit - exhaled air in this type apparatus is filtered or scrubbed of carbon dioxide (CO<sub>2</sub>), the amount of oxygen used in that last inhalation is replenished from a small compressed oxygen bottle within the self contained breathing apparatus and then the same air is reused or 'rebreathed' by the wearer. <ol style="list-style-type: none"> <li>a. This type unit is not widely used in the fire service.</li> </ol> </li> <li>2. Open circuit - exhaled air in this type apparatus is exhaled through an exhalation valve to the outside environment. <ol style="list-style-type: none"> <li>a. This type unit is the most widely used for fire service applications</li> </ol> </li> </ol> <p><b>II. WHEN TO USE A SELF-CONTAINED BREATHING APPARATUS</b></p> <p>A. A SCBA Shall Be Worn Whenever an Employee Is "...Working In, or When Likely to be Exposed to, an Oxygen Deficient Atmosphere or Dusts, Mists, Fumes, Vapors, Gases, or Chemicals of Such Concentrations or Duration as to Cause Injury..."</p>	<p>What is the primary difference between an open circuit and a closed circuit S.C.B.A.?</p> <p>Information Sheet #1</p>







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<ul style="list-style-type: none"><li>(5) Cylinder pressure at start of work period</li><li>(6) Condition of SCBA - leaks lessen time</li><li>c. Cylinder types<ul style="list-style-type: none"><li>(1) Steel cylinders<ul style="list-style-type: none"><li>(a) Weight - 23 pounds</li><li>(b) Hydrostatic test - 5 year intervals</li><li>(c) Full steel construction</li></ul></li><li>(2) Composite cylinders<ul style="list-style-type: none"><li>(a) Fully wound</li><li>(b) Weight - 13 pounds</li><li>(c) Hydrostatic test 3 year interval</li><li>(d) Light weight seamless aluminum liner with fiberglass type material wrapped around circumference and diagonally around long axis of the cylinder</li></ul></li></ul></li><li>d. Cylinder pressures<ul style="list-style-type: none"><li>(1) High pressure cylinder - 4500 psi</li><li>(2) Low pressure cylinder<ul style="list-style-type: none"><li>(a) 3000 psi</li><li>(b) 2015 psi</li></ul></li></ul></li></ul>	



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<ul style="list-style-type: none"><li>e. Rule of thumb -1 minute working time per 100 psi in the cylinder</li><li>f. A cylinder may be filled 10% over its rated capacity in the following cases:<ul style="list-style-type: none"><li>(1) Between the date of manufacture and the first required hydrostatic test date</li><li>(2) When a "+" is affixed with the hydrostatic test stamp.</li></ul></li></ul> <p>B. Cylinder Valve Assembly</p> <ul style="list-style-type: none"><li>1. Cylinder valve handwheel - opens/closes cylinder valve</li><li>2. Cylinder valve - must always be fully open when the SCBA is in use</li><li>3. Cylinder pressure gauge<ul style="list-style-type: none"><li>a. Will register cylinder pressure without regard as to whether the cylinder valve is open or closed.</li><li>b. If pressure reading differs + or - 100 psi from reading on regulator pressure gauge, place apparatus out of service</li></ul></li></ul> <p>C. High Pressure Hose and Audi-larm</p> <ul style="list-style-type: none"><li>1. High pressure hose assembly<ul style="list-style-type: none"><li>a. Takes air from compressed air cylinder to the regulator at cylinder pressure. Consists of:<ul style="list-style-type: none"><li>(1) High pressure hose coupling</li><li>(2) High pressure hose</li></ul></li></ul></li></ul>	



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<ul style="list-style-type: none"><li>b. Is not designed to be charged while in storage</li></ul> <p>2. Audi-Larm</p> <ul style="list-style-type: none"><li>a. Audible low pressure warning device located adjacent to the cylinder valve assembly</li><li>b. Piston is armed automatically when cylinder valve is opened, provided the cylinder has at least 850 psi of compressed air<ul style="list-style-type: none"><li>(1) In the event the Audi-Larm fails to arm place the unit out of service</li><li>(2) Failure to arm indicates:<ul style="list-style-type: none"><li>(a) High pressure hose not bled off when last used.</li><li>(b) Compressed air cylinder has less than 850 psi</li><li>(c) Audi-Larm out of adjustment or inoperative</li><li>(d) Restriction or blockage in cylinder valve or high pressure hose coupling</li></ul></li></ul></li></ul>	<p>What must a firefighter do, if involved in suppressing a structure fire, when the Audi-Alarm begins to ring?</p> <p>CDF policy is to notify your "buddy" and both exit the structure immediately.</p>



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<p>c. Audi-Larm will automatically begin ringing when pressure in the cylinder is low:</p> <ul style="list-style-type: none"><li>(1) Starts ringing in the 570-540 psi range<ul style="list-style-type: none"><li>(a) Normally 4-6 minutes of air remaining</li></ul></li><li>(2) Rings continuously down to 200 psi then automatically shuts off.<ul style="list-style-type: none"><li>(a) Normally 2 minutes of air remaining.</li></ul></li></ul> <p>D. Regulator</p> <ul style="list-style-type: none"><li>1. Regulator reduces the high pressure cylinder air to a breathable pressure</li><li>2. A pressure demand regulator is required by law for all Fire Department applications<ul style="list-style-type: none"><li>a. Pressure - A positive pressure, slightly above atmospheric pressure, is supplied continuously to the facepiece when the mainline valve is open<ul style="list-style-type: none"><li>(1) A safety feature, in the event that a leak develops this facepiece pressure forces non-respirable air, toxics, and smoke out</li></ul></li><li>b. Demand - An increased volume of air is supplied to meet the wearers' needs when the wearer inhales</li></ul></li><li>3. Types of regulators<ul style="list-style-type: none"><li>a. Mask mounted</li></ul></li></ul>	<p>Information Sheet #3</p>



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<p>b. Waist strap mounted</p> <ul style="list-style-type: none"><li>(1) By-pass valve<ul style="list-style-type: none"><li>(a) Red six sided knob</li><li>(b) Closed during normal operation</li><li>(c) Opened when needed to unfog facepiece lens</li><li>(d) Opened when regulator malfunctions</li><li>(e) Opened when buddy breathing necessary</li></ul></li><li>(2) Mainline valve<ul style="list-style-type: none"><li>(a) Yellow round knob</li><li>(b) Open during normal operation</li><li>(c) Closed whenever bypass valve is being used due to regulator malfunction</li><li>(d) Closed whenever facepiece is not in use</li></ul></li></ul> <p>c. Regulator pressure gauge</p> <ul style="list-style-type: none"><li>(1) Displays pressure in cylinder only when mainline valve is open</li><li>(2) Any time the regulator pressure gauge differs from the cylinder pressure gauge by " ñ " 100 pounds the unit is to be placed out of service</li></ul>	



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<ul style="list-style-type: none"><li>d. Outlet port cover<ul style="list-style-type: none"><li>(1) Reduces the amount of water and debris entering regulator</li></ul></li><li>E. Breathing Tube<ul style="list-style-type: none"><li>1. Breathing tube or low pressure hose<ul style="list-style-type: none"><li>a. Transports air from regulator to the facepiece</li><li>b. Corrugated to resist collapse and/or crushing</li><li>c. Is subject to cracking at the base of the grooves and should be inspected frequently.</li><li>d. Is susceptible to abrasions</li></ul></li></ul></li><li>F. Facepiece<ul style="list-style-type: none"><li>1. Purpose<ul style="list-style-type: none"><li>a. Protects the wearer from breathing contaminated, toxic, or otherwise non-respirable air present in the environment</li><li>b. Supplies wearer with cool respirable air</li></ul></li><li>2. Sizes<ul style="list-style-type: none"><li>a. Facepieces come in three sizes:</li></ul></li></ul></li></ul>	<p>What must be done if a difference of " ñ " 100 PSI is noticed between the cylinder pressure gage reading and the regulator pressure gage reading?</p>



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<ul style="list-style-type: none"><li>(1) Small - gray lens ring</li><li>(2) Medium - black lens ring</li><li>(3) Large - gold lens ring<ul style="list-style-type: none"><li>(a) Because of facial configurations some persons may not be able to get a good seal with a MSA facepiece. These persons should not be assigned duties requiring the use of SCBA.</li></ul></li><li>3. In order for the facepiece to protect your respiratory tract you must establish and maintain a good face - facepiece seal</li></ul>	<p>NOTE: Fit test should be done on every student to check seal.</p> <ul style="list-style-type: none"><li>1. Qualitative test - use isoamyl acetate (Banana oil) or an approved irritant to determine if student can smell the substance which indicates a leak</li><li>- or -</li><li>2. Quantitative test - actual sample of air in facepiece to determine presence of contaminants. (very expensive)</li></ul>



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<ul style="list-style-type: none"><li>a. Illegal to wear following:<ul style="list-style-type: none"><li>(1) Glasses where temples break seal</li><li>(2) Nomex hood if it interferes with seal</li><li>(3) Beards or gross sideburns which break seal</li></ul></li><li>b. Face - facepiece seal is checked by both inhaling and exhaling during donning procedure<ul style="list-style-type: none"><li>(1) Upon inhaling the facepiece should collapse against your face</li><li>(2) Upon exhaling there should be no noticeable escape of air from the face - facepiece seal</li><li>(3) Exhalation also tests exhalation value</li><li>(4) In the event of slight leaks the positive pressure within the facepiece should force contaminated air out of the facepiece</li></ul></li><li>c. Facepiece components<ul style="list-style-type: none"><li>(1) Head harness or spider<ul style="list-style-type: none"><li>(a) Five straps to secure facepiece to face</li><li>(b) When storing DO NOT wrap harness back over the</li></ul></li></ul></li></ul>	<p>Even "slight" leaks reduce working time significantly</p>



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<p>lens. This distorts facepiece and prevents seal</p> <p>(c) When tightening head harness sequence must be chin, temple, and forehead.</p> <p>(2) Lens</p> <p>(a) Enables wearer to see out</p> <p>(b) Susceptible to scratching</p> <p>(c) Field of vision adjusted by top strap</p> <p>(d) Fogging is a problem due to cool lens contacting humid warm breath or humid hot fire environment.</p> <p>(3) Exhalation valve</p> <p>(a) Spring loaded so that valve only opens when wearer exhales</p> <p>(i) Keeps non-respirable air from entering</p> <p>(ii) Maintains positive pressure in facepiece</p> <p>(b) Must be kept clean so it doesn't hang open allowing contaminated air in.</p>	<p>Fogging may be inside or outside the facepiece</p>



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<ul style="list-style-type: none"> <li>(4) Speaking diaphragm</li> <li>(5) Neckstrap               <ul style="list-style-type: none"> <li>(a) Utilize "o" ring kit on breathing tube to reduce amount of water and debris falling into facepiece</li> </ul> </li> <li>(6) Nosecup               <ul style="list-style-type: none"> <li>(a) Channels air directly to exhalation valve to reduce lens fogging</li> <li>(b) Required by law if used at temperature below 320 F</li> </ul> </li> <li>(7) Spectacle kit               <ul style="list-style-type: none"> <li>(a) Enables the wearer to wear glasses without temple piece breaking the face to facepiece seal</li> </ul> </li> </ul>	<p>Why is it important to keep exhalation valve clean?</p>
<p>G. Harness and carrier assembly</p> <ul style="list-style-type: none"> <li>1. Harness components           <ul style="list-style-type: none"> <li>a. Shoulder straps               <ul style="list-style-type: none"> <li>(1) Nomex cover</li> <li>(2) Stainless steel cable interior</li> </ul> </li> <li>b. Chest Strap</li> </ul> </li> </ul>	<p>Information Sheet #4</p>



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<ul style="list-style-type: none"> <li>(1) Should be used to limit side to side shifting of apparatus on the back</li> <li>c. Waist strap               <ul style="list-style-type: none"> <li>(1) Should be drawn as tight as possible across backplate to ensure comfortable fit, reduce fatigue, and to secure unit to user</li> </ul> </li> <li>2. Carrier assembly               <ul style="list-style-type: none"> <li>a. Components                   <ul style="list-style-type: none"> <li>(1) Backplate</li> <li>(2) Cylinder locking band</li> <li>(3) Cylinder clamping lever</li> </ul> </li> </ul> </li> </ul>	
<p><b>IV. MAINTENANCE AND INSPECTION</b></p> <ul style="list-style-type: none"> <li>A. All Repairs and Part Replacement Must Be Done by Certified Repairperson           <ul style="list-style-type: none"> <li>1. Exceptions:               <ul style="list-style-type: none"> <li>a. Cleaning after each use</li> <li>b. Exchange of depleted cylinder for new cylinder</li> </ul> </li> </ul> </li> <li>B. Inspections:           <ul style="list-style-type: none"> <li>1. The entire SCBA shall be inspected fully when coming on shift</li> </ul> </li> </ul>	<p>Who is allowed to make repairs on a malfunctioning S.C.B.A.?</p> <p>Information Sheet #5</p>



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<p>2. Cylinder pressure shall be checked and recorded daily</p> <ul style="list-style-type: none"><li>a. Cylinders on operational SCBA SHALL be exchanged when the pressure falls below 1800 psi.</li><li>b. Cylinders on operational SCBA should be exchanged whenever they are not full.</li></ul>	



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## ***SUMMARY:***

A self contained breathing apparatus is designed to keep you from suffering irreparable harm. In order to remain a part of an effective team you must wear this equipment and wear it properly. Knowing when to wear it is important, actually doing it is more important.

## ***EVALUATION:***

A written quiz.

## ***ASSIGNMENT:***

To be determined by instructor(s).