

The City of Escondido Fire Department has developed and implemented a comprehensive respiratory program to ensure compliance with Local, State, and Federal laws concerning several aspects of Self-Contained Breathing Apparatus (SCBA). The primary regulation that provides direction and establishes the foundation for our respiratory program is the State of California's Occupational Safety and Health Administration's (CAL-OSHA) *Title 8, Section 5144 of the California Code of Regulations*. The respiratory program administrator, as identified on the Department's *Areas of Responsibility* document, ensures compliance with this standard. Additionally, every respirator in the Department meets or exceeds the respiratory selection requirements determined by the National Institute of Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). The SCBA used by the department is the 5.5 Scott AIR-PAK X3. This Scott 5.5 AIR-PAK X3 is an open-circuit, positive pressure breathing apparatus that also meets or exceeds the National Fire Protection Association (NFPA) 1981 (2013 edition) Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service. Due to the increased threat of terrorism and/or other malicious acts, all department SCBAs have been tested and certified by NIOSH for emergency responses involving chemical, biological, radiological and nuclear hazards.



Shown here is a Scott 5.5 AIR-PAK X3 integrated with the Scott PAK-ALERT Alert PASS device. These harnesses feature a padded Kevlar harness with alligator clip buckles, 45-minute cylinders and remote PASS controls integrated into the remote gauge console. Regardless of the features, NFPA established the maximum harness weight not to exceed 35 pounds, with the X3 weighing just over 28 pounds. Firefighters should understand how our SCBA's operate and how to use them properly. Even at incidents where they are not required, it may still be beneficial to use your SCBA.

Firefighters should also understand the proper application and maintenance of the PASS (Personal Alarm Safety System) device. This safety device will activate, via a loud shrill alarm, when a lack of movement is detected. For example, if a firefighter becomes overcome by smoke and is incapacitated, a lack of movement will be detected by the PASS device, which activates an alarm system. This alarm will help other firefighters in locating and rescuing fellow firefighters. Specific operations of the PAK-ALERT Alert PASS device are included in this training chapter.

This training chapter is part of a comprehensive SCBA program that must be reviewed annually. The SCBA program is designed to assist department personnel with the knowledge, skills and ability to properly use the respiratory equipment in various situations and environments. Documentation of this annual review and training is required to comply with the requirements outlined in the CAL-OSHA regulations.

This respiratory program is written specifically for the Scott 5.5 AIR-PAK X3. Procedures that you must be familiar with are: donning and doffing, emergency operations, maintenance, testing procedures, cleaning procedures, component specifications, medical evaluations and proper operation of the department air compressor.

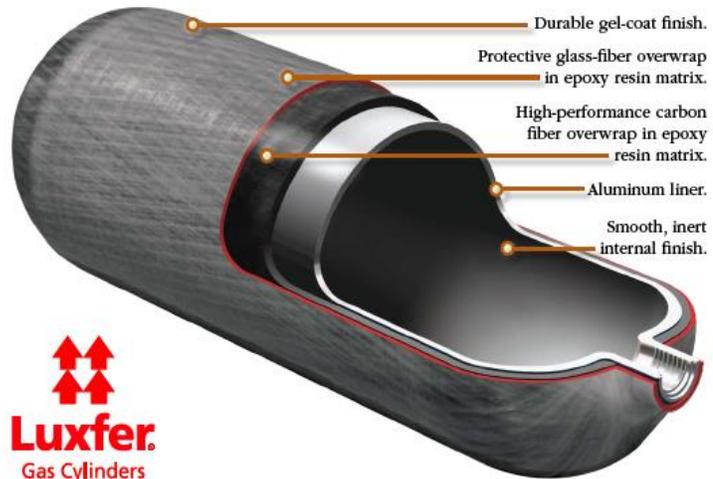
Objectives:

- Identify any situation/operation that requires the use of an SCBA.
- Describe the maintenance procedures for daily, monthly, and after use inspections of the Scott 5.5 AIR-PAK X3.
- Perform a maintenance inspection on a Scott 5.5 AIR-PAK X3 and identify components of the unit that need replacing or repair.
- Demonstrate ability to properly don and doff the Scott 5.5 AIR-PAK X3, perform safety checks and if the unit is not in working order, describe the procedures to remove an SCBA from service.
- Outline the procedures to be performed if the SCBA you are wearing fails to operate properly during operation including the application and operation of the Emergency Breathing Support System (EBSS) and Rapid Intervention/Universal Air Coupling (RIC/UAC).
- Describe the function of the PASS (Personal Alarm Safety System), Rapid Intervention/Universal Air Coupling (RIC/UAC) and the Vibralert System and the circumstances under which they operate.
- Explain the operation and application of the purge valve and donning switch.
- Demonstrate proper communication techniques.
- Describe the operational procedures to set-up and operate an Air-Supply cart.
- Identify the medical evaluation process and documentation requirements.
- Demonstrate how to properly operate the air compressor.
- Review all SCBA related maintenance and training documents.

SPECIFICATIONS

Air Cylinders

The Department uses a 5500 psig, 45 minute for firefighting apparatus. Also, in use, are the 5500 psig, 75 minute RIC bag cylinder and 4500 psig, 60 minute, confined space/air cart cylinder. Scott cylinder construction styles utilize an aluminum cylinder with a resin matrix and external carbon wrap. A valve is attached as an integral part of the unit. The air within the cylinder must meet the requirements for grade "D" breathing air described in the American National Standards Institute (ANSI). See section 704.00 – Air Compressor for breathing air requirements. All cylinders are tested and maintained by the Department of Transportation shipping container specification regulations. Other key points are:



- The cylinder constitutes the main weight of a SCBA.
- Firefighting cylinders contain 66-cubic feet of air compressed to 5,500 (psi) and rated to provide (45) forty-five minutes of air.
- Non-firefighting cylinders
 - RIC bag cylinders contain 111-cubic feet of air compressed to 5,500 (psi) and rated to provide (75) seventy-five minutes of air.
 - Confined space/air cart cylinders contain 87 cubic feet of air compressed to 4,500 (psi) and rated to provide (60) sixty minutes of air.

Note: The rated air times are accurate only under non-working conditions. Several factors affect the firefighter's ability to use SCBA's effectively that may reduce the actual user timeframe. These factors may include physical, medical, and mental limitations.

- A fire resistive protective sleeve may be used to protect the cylinder from damage encountered from normal use.
- The cylinder valve can be turned on by rotating the valve knob counter-clockwise a minimum of three full turns.

- All composite cylinders are hydrostatically tested within a 3-year period, carbon cylinders every 5-years. All cylinders have a 15-year service life.
- Use the cylinder's three digit inventory number for all documentation and tracking.
- Cylinders should be filled as soon as practical at a rate of 300 - 600 psi a minute to avoid excessive heating of the cylinder. Allow cylinders to cool and top off if necessary. A completely filled cylinder should read "FULL" on the cylinder gauge.
- The cylinder valve contains a non-resettable safety disc that will rupture if the internal pressure exceeds 7,000 psi.

Warning: Cylinders or cylinder protective sleeves which show evidence of exposure to high heat or flame (external finish or carbon wrap), decals charred or missing, gauge lens is melted, elastomeric bumper distorted, or physical damage to the cylinder shall be removed from service and a property accountability form must be completed.



Face Piece

In compliance with American National Standards Institute (ANSI) Z88.2 (1992) *Respiratory Protection*, all department personnel are issued a face-piece (mask) and fit tested annually. Therefore, it is the responsibility of each firefighter to properly maintain, clean and disinfect the issued mask. The department has purchased the SCOTT AV3000HT mask that is constructed of a hard-coated polycarbonate plastic lens that is bonded to a chevron type (rubber) face seal. The 5-point hood harness is constructed of a Kevlar fabric and is attached to the mask. Kevlar straps are fastened to the upper and lower portions of the mask and are used to tighten the mask to the users face. Nose cups are utilized to direct exhaled air and reduce carbon dioxide build-up and internal face piece condensation (fogging). Built-in dual *Voicemitter* assemblies assist in communications. An external voice amplifier is also issued to each employee and should be attached to the *Voicemitter* to enhance communications.



Mask-Mounted Regulator Assembly

This assembly connects directly onto the mask and is connected to the low-pressure air hose leading from the high-pressure reducer. A quick connect fitting allows firefighters to attach their personal regulator to the low-pressure hose. The mask-mounted regulator has a durable black plastic housing and a plastic diaphragm cover. Connected to the shell are the red purge knob and a black button with a rubber boot on it. Components of the mask-mounted regulator include: a diaphragm, demand lever, piston lever, purge valve, linkage for air shutoff, and the Vibralert low-air warning device. An additional component of the mask mounted regulator is the heads-up display (HUD). The HUD allows the wearer to monitor cylinder air pressure, as well as provides a secondary notification of the wearer's PASS and/or Vibralert activation. The light patterns are as follows:

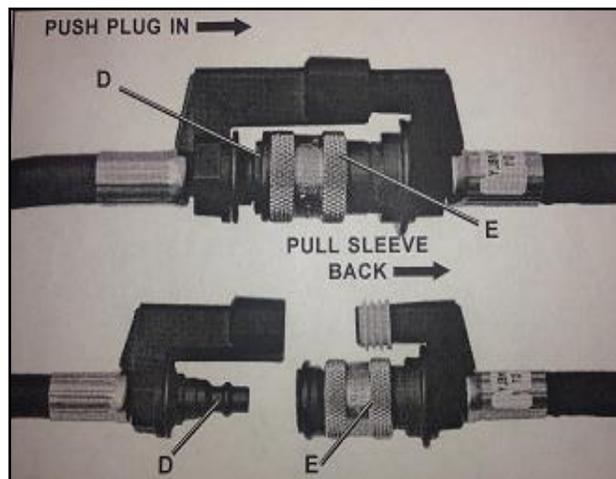
- 2 solid green lights = cylinder full
- 1 solid green light = cylinder $\frac{3}{4}$ full
- 1 flashing amber LED = cylinder $\frac{1}{2}$ full
- 1 rapidly flashing red LED = cylinder at 33% (will be accompanied by the Vibralert)
- Alternate flashing of all HUD lights = PASS in pre-alarm
 - If full PASS alarm is reached, the light indicators will return to the level of the cylinder as described above



The regulator responds to the breathing requirements of the user and delivers a NFPA minimum of 400 liters per minute while maintaining a positive pressure with respect to the ambient atmosphere. This positive pressure prevents contaminants from entering the mask. It is the responsibility of each firefighter to properly maintain, clean and disinfect the issued mask

Mask Regulator Low-Pressure Hose Quick Disconnect

All department SCBA's are equipped with a quick connect fitting that allows firefighters to attach their personal mask regulator to the low-pressure hose and HUD plug. To connect the mask regulator to the low-pressure hose, line up the HUD connections, and firmly press the male and female ends together. A "click" should be heard to indicate a proper connection. This should be followed by tugging on the connection to confirm proper engagement. To disconnect the mask regulator from the low-pressure hose, press the connections together while pulling back on the female collar. This will release the connection.



Donning Switch

The black rectangular shaped button located on top of the regulator assembly activates the Airsaver switch. Depressing the button will block the demand lever and stop airflow. Inhale sharply to automatically start the flow of air. Breathe normally to ensure proper operation. Free flowing air will occur during the following situations:

- The mask *is removed* from your face.
- The mask *is dislodged* breaking the seal between it and your face.
- The regulator *is removed* from the mask.
- **Stop airflow by depressing the Airsaver switch!**

End of Service Time Indicators (EOSTI)

All department harnesses are equipped with two independent low-air notification systems. The Vibralert is a gentle tapping created within the regulator assembly that vibrates the SCBA mask. A secondary low-air indicator is in the form of the HUD air monitoring system, as described in the *Mask-Mounted Regulator Assembly* section of this manual. This indicator will activate in conjunction with the Vibralert system. These low air indicators activate when approximately 33% (1800 psi) of air pressure remains in the cylinder or if a malfunction occurs in the high-pressure reducer. In either event, leave the hazardous area at once. Activation of these indicators also occur when opening the cylinder valve slowly. This method provides a quick check to confirm the indicators are in working order. **DO NOT use an SCBA if the low air indicators are not functioning properly.**

Purge Valve

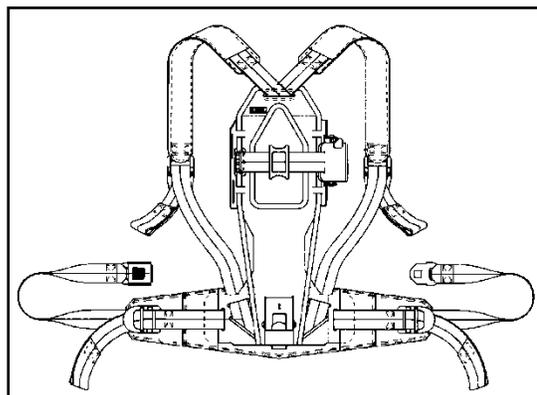
The purge knob on the side of the mask-mounted regulator is a manual override allowing the user to create a constant flow of air into the face piece at a flow of up to 225 liters per minute. This valve allows for a free-flow of air and is used to bleed off the air to change cylinders, clear mask fogging, or if there is a mask regulator failure. It is opened fully by turning the Purge Knob counter-clockwise. To close the valve, rotate the Purge Knob clockwise.

Pressure Reducer/High Pressure Hose

The pressure reducer is mounted on the backpack frame assembly and coupled to the air cylinder through a Snap Change fitting. The pressure-reducing regulator takes an inlet pressure of approximately 5500 psi and reduces it to 85-110 psi at the primary reducing valve (primary stage). An automatic transfer valve for redundant control activates a backup pressure-reducing valve (secondary stage). The secondary valve also activates the dual low air indicator system. These indicator systems activate when the internal pressure switches from the primary to the secondary valve. This switch occurs when an air cylinder is below 33% of the cylinders capacity or the primary reducing valve fails. A press-to-test button is included to allow bench testing of the secondary valve. This bench test function is not intended for daily checks.

Back-frame and Harness

A lightweight, adjustable, lumbar support-style harness and back-frame assembly is designed so that all the SCBA components are attached to the back-frame and the majority of the weight (approximately 28 lbs.) is carried on the hips. This back-frame is constructed of a solid aluminum alloy that follows the users back. Air cylinders are secured on the back-frame through the Snap Change cylinder valve and pressure reducer. An adjustable strap, with cylinder latch, secures the main body of the air cylinder. Adjustable waist and shoulder straps



are also attached to the back-frame and are secured with alligator style fasteners. Wide-bodied pads are provided to help distribute the weight along the shoulders and hips. A belt-mounted regulator holder is used to keep the regulator clean and should be used to minimize foreign debris from entering into the regulator as well as to help prevent damage. Visible “buddy” lights have been designed into the Air Pak to alert team members of air levels and PASS activation of their partners and mimic what the wearer is seeing on the HUD. A unit ID number and letter identifying the apparatus are provided to complete the appropriate documentation.

Remote Pressure Gauge

Department SCBA's have a remote gauge which allows the user to read the air cylinder pressure without having to remove the SCBA. This incandescent gauge is integrated into the Personal Alert Safety System and is located on the right shoulder. The gauge indicates the amount of air in the tank (e.g., ¼, full, etc.). The remote gauge should correspond with the cylinder gauge with a slight difference +/- 200 psi. The remote gauge also serves as the control console for the PASS via the red alarm activation button and the yellow reset button. The console also has an indicator light informing the user of current situations, such as cylinder air levels, Vibralert and PASS activation. The light indicators match that which is illuminated on the Heads up Display (HUD).



PASS Components

All SCBA's have been provided with an integrated Personal Alert Safety System (PASS) intended to assist in locating a firefighter who is incapacitated or in need of assistance. Firefighters shall activate a PASS device before entering any situation where a life hazard may exist. The following outlines the operation of the PASS system:

Automatic Device Operation

Opening the cylinder valve and pressurizing the respirator automatically activates the Scott PAK-ALERT distress alarm. Three quick chirps from the sensor module indicate activation. On activation, a green light on the control console located with the remote gauge on the right shoulder will flash approximately once a second. This is the automatic mode. In the automatic mode the PASS device constantly monitors the firefighter's movements by using a motion sensor module that is located at the base of the back-frame assembly under the cylinder valve. If the sensor module does not detect any movement for 20 seconds, the PASS device will signal a pre-alert alarm. When a pre-alert occurs, the green flashing light on the control console changes to red and is accompanied by an audible alarm. If the user is not in need of assistance, movement of the respirator normally resets the pre-alert. When reset, the red light returns to green and the audible alert goes silent.

Note: The motion sensor module is under the air cylinder valve and not in the control console. Actual movement of the respirator back-frame is required to reset. Shaking the control console will not reset the PASS device.

If the user is incapacitated or in need of assistance and cannot move, the PASS device will go into full alarm 8-10 seconds after the pre-alert starts. A loud universal alarm,

accompanied by the flashing of the red signal lights on the control console, HUD and harness indicates full alarm. The full alarm condition can only be cleared by manually pressing the yellow reset button located on the side of the control console *twice*. This will silence the alarm and the red light will return to green flashing once per second. The unit has now returned to an automatic mode.

The PASS device also can be manually activated by pressing and holding down the red button located on the front of the console module. The alarm can be activated at any time, even when the respirator is not pressurized. Pressing the yellow reset button twice can silence the alarm.

Note: The PAK-ALERT distress alarm cannot be turned off if the respirator cylinder valve is open and/or pressure remains in the respirator.

When use of the PASS device is no longer required, first close the cylinder valve on the respirator, and then vent the residual air from the system by opening the purge valve. Once the airflow stops, close the purge valve and turn off the PASS by pressing the yellow reset button twice. The green flashing light will go out and a “two-tone” signal will be heard from the sensor module.

The PAK-ALERT distress alarm utilizes 6 AA batteries located on the right side of the back frame. When the batteries begin to approach the end of their useful life, the red light indicator on the HUD will illuminate and begin to flash and the green lights on the back frame and control module will go out. While in the low battery condition, the PASS and HUD will continue to operate for a period of time greater than the longest duration cylinder available for the respirator. However, the batteries must be replaced before the respirator can be used again. Every apparatus will have a SCBA packet in the toolbox that contains replacement batteries.



Dual Emergency Breathing Support System

The department SCBA's entire are equipped with a dual manifold Emergency Breathing Support System (EBSS). The EBSS includes an accessory hose with both male and female quick disconnects which may be used to either supply or receive air. This allows a firefighter the ability to connect with another firefighter using the dual manifold without interrupting their air supply. In the event of high-pressure reducer malfunction, the mask regulator low-pressure hose can be connected directly to another firefighter's EBSS manifold.

The Dual EBSS manifold allows the following connections:

- *Connecting two dual EBSS manifolds together.* If the firefighter requiring support and the firefighter offering support both have dual EBSS manifolds, the two manifolds may be connected together either male-to-female or female-to-male to establish the link.
- *Low Pressure hose to Dual EBSS.* If the firefighter requiring support does not have a dual EBSS manifold, the firefighter requiring support must disconnect their quick connect mask regulator from the low-pressure hose coupling. Then connect the mask regulator low-pressure hose to the dual EBSS of the firefighter offering support.



When the need for EBSS arises, the firefighter rendering assistance is for escape only. **Firefighters must understand the result of adding a second person to their respiratory system will consume the air in their cylinder faster.** The actual duration obtained will depend on the rate at which each user is breathing and the amount of air exchanged with each breath. Therefore, it is important to remember that regardless of the circumstances, the firefighters engaged in emergency breathing operations must immediately exit the IDLH atmosphere.



Note: A Rapid Intervention Crew (RIC) equipped with a RIC bag will have the same dual EBSS capabilities and a 75-minute cylinder. The firefighter needing assistance will be connected to the RIC air system and not to RIC personnel. Specific information on RIC operations can be found in the Emergency

Operations Manual and are not included in this training chapter.
RIC / Universal Air Connection (UAC)

All of the department SCBA's and RIC bags are equipped with a RIC/UAC emergency fill connection which permits emergency replenishment of an approved SCBA breathing air supply cylinder from an approved air supply source while in use. This is not a Quick Charge attachment and must not be used for routine recharging of the cylinder, for "buddy breathing", for transferring air from another SCBA cylinder, or any unapproved use. The RIC UAC is for emergency use only when the respirator user is incapacitated within the hazardous atmosphere.



RIC/UAC emergency use:

- Visually inspect the UAC connections for damage. If damage of either the supply side or receiver side the UAC coupling, and alternate means of air provision must be found.
- Verify that the cylinder valve on the user's respirator is open by turning the cylinder valve fully counterclockwise (approximately 2 ½ full turns).
- Remove the dust cap from the RIC UAC coupling on the respirator and from the matching coupling on the RIC UAC filling hose assembly. Visually inspect both couplings for dirt or damage. Remove any dirt or contamination from the couplings.
- Connect the RIC UAC filling hose assembly by pushing the quick disconnect coupling on the RIC UAC filling hose assembly on to the coupling on the respirator until the quick disconnect sleeve "clicks" into place.
- Slowly open the RIC UAC filling hose assembly valve to pressurize the supply line and begin air flow to the cylinder.
 - Continually monitor the pressure gauge on the respirator user's cylinder while filling. The air from the supply cylinder will stop flowing when the pressure in the respirator user's cylinder equals the remaining pressure in the portable air supply (pressures will balance). Disconnect the RIC UAC filling hose assembly. To disconnect RIC UAC filling hose assembly, pull the coupling sleeve away from the respirator until the coupling disengages