



## AIR-PAK® 75™ /2.2/3.0/4.5

### SELF CONTAINED BREATHING APPARATUS - **BID SPECIFICATIONS**

NFPA 1981, 2007 Edition

NOTE: To select Air-Pak 2.2/3.0/4.5, refer to harness & backframe “wireform” section; for Air-Pak 75, refer to “one-piece aluminum version” backframe section.

#### **General Requirements**

One (or more) open circuit, self-contained breathing apparatus consisting of the following major sub-assemblies: 1) cylinder and valve assembly for storing breathing air under pressure; 2) full facepiece assembly; 3) an automatic dual path redundant pressure reducing regulator; 4) a removable, facepiece-mounted, positive pressure breathing regulator with air-saver switch, low-pressure alarm and purge valve; 5) a harness and backframe assembly for supporting the equipment on the body of the wearer; 6) a shoulder strap mounted, remote gauge indicating cylinder pressure; 7) a heads-up display (HUD) redundant low-pressure alarm; 8) a rapid intervention crew/universal air connection (RIC/UAC); and 9) certified to the NIOSH Chemical, Biological, Radiological and Nuclear (CBRN) standard.

The unit shall be covered by a warranty providing protection against defects in materials or workmanship. This warranty shall be for a period of 10 years on the SCBA, except for the pressure reducer, which shall be covered for 15 years. Electronic components shall be warranted for three years. The SCBA shall be certified by NIOSH as conforming to the Code of Federal Regulations, 42 CFR 84. This apparatus, without modification, shall be NIOSH certified. The apparatus shall meet all requirements of NFPA-1981 Standard on Open-Circuit Self-Contained Breathing Apparatus, 2007 Edition.

Successful bidder agrees to provide, at his own expense, a factory-trained instructor for such time as the department head shall require for complete instruction in the operation and maintenance of the apparatus. Any exceptions to these specifications must be detailed in a separate attachment, and failure to do so will automatically disqualify the bidder. Successful bidder must be a factory-authorized distributor to sell the equipment specified herein.

#### **Cylinder & Valve Assembly Type and Requirements**

The cylinder threads shall be straight with an O-ring or quad-ring gasket type seal. The cylinder valve shall be a “fail open” type, constructed of forged aluminum and designed such that no stem packing or packing gland nuts are required. It shall contain an upper and lower seat such that the pressure will seal the stem on the upperseat, thus preventing leakage past the stem. No adjustment shall be necessary during the life of the valve. The cylinder valve outlet shall be a modification of the Compressed Gas Association (CGA) standard threaded connection number 346 for breathing air (Proposed CGA connection No. 347) with a tri-lobe ergonomically designed hand-wheel.

The valve shall be constructed such that damage will not occur if the coupling is over-torqued by hand. Each cylinder valve shall consist of the following: 1) a hand activated valve mechanism with a spring-loaded, positive action, ratchet type safety lock and lock-out release for selecting “lock open service” or “non-lock open service”; 2) an upstream connected frangible disc safety relief device; 3) a dual reading pressure gauge indicating cylinder pressure at all times; 4) an elastomeric bumper; 5) an angled outlet. Each cylinder and valve assembly shall be equipped with a hanger bracket for positive locking attachment of the assembly to the backframe.

The SCBA shall maintain all NIOSH and NFPA standards with any of the following types of cylinders listed as provided by the SCBA manufacturer.

#### ***Aluminum, hoop-wrap & full-wrap cylinders***

The cylinder shall be manufactured in accordance with DOT specifications and have a working pressure of 2216 psig. The cylinder shall be an aluminum type; a lightweight composite consisting of an aluminum inner shell and hoop wrapped with resin impregnated glass filament; or a lightweight composite type with an aluminum inner shell and fully-wrapped with resin impregnated glass filament.

#### ***Carbon cylinders***

The cylinder shall be manufactured in accordance with DOT specifications and have a working pressure of 2216, 3000, or 4500 psig. The cylinder shall be lightweight, composite type cylinder consisting of an aluminum alloy inner shell, with a total overwrap of carbon fiber, fiberglass and an epoxy resin.

#### ***Kevlar cylinders***

The cylinder shall be manufactured in accordance with DOT specifications and have a working pressure of 3000 or 4500 psig. The cylinder shall be lightweight, composite type cylinder consisting of an aluminum alloy inner shell, totally overwrapped with resin impregnated Kevlar and glass filament.

Type	Pressure (psig)	Duration (minutes)	H <sub>2</sub> O Capacity (in <sup>3</sup> )	Free Gas Capacity (SCF)
Aluminum	2216	30	523	45
Hoop-wrap	2216	30	523	45
Full-wrap	2216	30	523	45
Carbon	2216	30	523	45
Kevlar	3000	30	514	59.1
Carbon	3000	30	515	59
Kevlar	4500	30	285	45
	4500	45	412	66
	4500	60	547	87
Carbon	4500	30	283	45
	4500	45	418	66
	4500	60	550	87

## **Facepiece Assembly**

### ***AV-2000® Facepiece***

The full facepiece assembly shall fit persons of varying facial shapes and sizes with minimal visual interference. It shall be available in three color-coded sizes and maintain NIOSH certification of the apparatus regardless of the size used. The color coded face seal shall be constructed of a blend of proprietary material and be secured to the lens by a U-shaped channel frame that is retained to the lens using five fastener assemblies, four of which also serve as attachments points for the head harness. A detachable bayonet-style mounting adapter for the voice amplifier can be installed at the factory.

The lens shall be a single, replaceable, modified cone configuration constructed of a non-shatter type polycarbonate material and be designed to meet the impact and penetration requirements of a faceshield as specified in ANSI Z87.1 paragraphs 5.2.8.1 and 5.2.8.2, shall have a silica based coating to resist abrasion, chemical attack and meet the requirements of NFPA-1981 for lens abrasion. The lens shall have an anti-fog coating to reduce fogging in stand-by mode.

The facepiece shall have a large diameter inlet serving as the female half of a quarter (1/4) turn coupling which mates with the positive pressure breathing regulator. Multi-directional voicemitters shall be lens mounted on both sides of the facepiece lens and ducted directly to an integral silicone nosecup to enhance voice transmission and minimize fogging of the lens. The voicemitter ducts and nosecup shall be easily removable without the use of tools.



The head harness shall be a four-point suspension made in the fashion of a net hood to minimize interference between securing of the facepiece and the wearing of head protection and be constructed of a para-aramid material. Two flame resistant elastic straps, attached to the lens in four locations, shall provide adjustment for proper face sealing. A four-point attachment rubber head harness shall also be available.

### **AV-3000™ Facepiece**

The full facepiece assembly shall fit persons of varying facial shapes and sizes with minimal visual interference. It shall be available in three color-coded sizes and maintain NIOSH certification of the respirator regardless of the size used. The face seal shall be constructed of a blend of proprietary material and be secured to the lens by a U-shaped channel frame that is retained to the lens using two fasteners. A detachable bayonet-style mounting adapter for the voice amplifier shall be installed at the factory.

The lens shall be a single, replaceable, modified cone configuration constructed of a non-shatter type polycarbonate material and shall meet the impact and penetration requirements of a faceshield as specified in ANSI Z87.1 paragraphs 5.2.8.1 and 5.2.8.2, it shall have a silica based coating to resist abrasion and chemical attack and meet the requirements of NFPA-1981, for lens abrasion. The lens shall have an anti-fog coating to reduce fogging of the lens.



The facepiece shall have a large diameter inlet serving as the female half of a quarter (1/4) turn coupling which mates with the positive pressure breathing regulator. Multi-directional voicemitters shall be lens mounted on both sides of the facepiece lens and ducted directly to an integral silicone nosecup to enhance voice transmission. The voicemitters, ducts, and nosecup shall be easily removable without the use of tools. The facepiece shall have a minimum of three sizes of nose cups.

The head harness shall be a six-point quad suspension made in the fashion of a net hood to minimize interference between securing of the facepiece and the wearing of head protection and be constructed of a para-aramid material. Two flame resistant elastic straps, attached to the facepiece in four locations, shall provide adjustment for proper face sealing.

### **Pressure Reducer**

The pressure-reducing regulator shall be mounted on the backframe and be coupled to the cylinder valve through a short length of internally armored high pressure hose with a hand coupling for engagement and sealing within the cylinder valve outlet. In lieu of a manual by-pass, the pressure-reducing regulator shall include a back-up pressure-reducing valve connected in parallel with the primary pressure reducing valve and an automatic transfer valve for redundant control. The back-up pressure reducing valve shall also be the means of activating the low-pressure alarm devices in the facepiece-mounted breathing regulator. This warning shall denote a switch from the primary reducing valve to the back-up reducing valve whether from a malfunction of the primary reducing valve or from low cylinder supply pressure.

A press-to-test valve shall be included to allow bench testing of the back-up reducing valve. The pressure-reducing regulator shall have extended temperature range dynamic O-ring seals composed of fluorosilicone elastomer. The pressure reducing regulator shall have incorporated a reseatable over-pressurization relief valve which shall prevent the attached low pressure hose and facepiece-mounted breathing regulator from being subjected to high pressure.

A standard dual-outlet manifold shall also have provision for connection of an optional airline supply for extended duration use while reserving the cylinder



supply for egress. The airline supply hose length shall be up to 300 feet and require an inlet pressure range of 60 to 115 psig, depending on the length of supply hose used. A check valve within the outlet manifold shall prevent the external release of cylinder air in the event the airline supply is either not used or disconnected. Switching from airline supply to cylinder supply shall be accomplished manually by the user, by opening the cylinder valve to prevent inadvertent use of the cylinder supply without the user's knowledge. The outlet manifold shall also contain a second outlet port capable of being fitted with an auxiliary supply hose to support a second breathing regulator for the purpose of rescue only. The auxiliary hose shall be located on the primary wearer's right shoulder and be terminated with a female quick connect fitting which can be easily connected and disconnected by trained individuals with a gloved hand and/or in low light conditions. The coupling shall also be guarded against inadvertent disconnect during use of the equipment. When operated in this mode, supplying two breathing regulators, the primary wearer's pressure reducer shall be capable of simultaneously supplying each regulator with a flow of at least 200 liters per minute while maintaining positive pressure in the respective facepieces.

An optional Dual EBSS shall be available in-lieu of the optional airline supply and shall have one of each of the following requirements; (1) a manifold with one each of a female socket and male plug, both of which have check valves, (2) 40" minimum low-pressure hose, (3) a containment system with means of attaching the manifold to the waist belt with a ¼-turn action, (4) a pouch for storing the hose, and (5) a dust cap for the female socket and male plug. The Dual EBSS system shall be on the wearer's left side and shall be capable of allowing for six (6) feet of hose between like systems.

The manifold shall be made of aluminum and be anodized black. The female socket and male plug shall have spacing, no less than 15° off-center. The female socket shall have a double action to disengage, noted as a "push-in/pull-back". The female socket shall have an internal check valve. The male plug shall have an external check valve. The hose shall be made of high temperature rubber capable of sustaining a maximum 250 psig of pressure.

The containment system shall include a pouch and shall be made of para-aramid materials and shall be capable of storing 36" of hose. The pouch shall be attached to the SCBA by pull-the-dot fasteners.

### **Rapid Intervention Crew/Universal Air Connection (RIC/UAC)**

The SCBA shall incorporate a RIC/UAC fitting to be compliant with the 2007 edition of the NFPA 1981 Self-Contained Breathing Apparatus standard. The RIC/UAC shall be an integral part of the high-pressure hose that attaches the cylinder valve to the first stage pressure reducer. The RIC/UAC inlet connection shall be within 4" (4-inches) of the tip of the CGA threads of the cylinder valve. The RIC/UAC shall consist of a connection for attaching a high-pressure air source and a self-resetting relief valve allowing a higher pressure than that of the SCBA to be attached to the SCBA. The RIC/UAC shall have a check valve to prevent the loss of air when the high-pressure air source has been disconnected.



### **Facepiece-Mounted Positive Pressure Regulator**

The facepiece-mounted positive pressure-breathing regulator shall supply and maintain air to the facepiece to satisfy the needs of the user at a pressure greater than atmospheric by no more than 1.5 inches of water pressure static. The breathing regulator shall maintain this positive pressure during flows of up to 500 standard liters per minute. The regulator shall also meet or exceed a dynamic flow requirement of remaining positive while supplying a minute volume of 160 liters.

The breathing regulator shall have attached a low pressure hose which shall be threaded through the left shoulder strap to couple to the pressure reducing regulator mounted on the backframe. An optional regulator shall be available with a quick connect coupling in line for use with the optional outlet manifold and accessory hose to allow the breathing regulator to be disconnected from the unit and reconnected to the auxiliary hose of a second unit in the event rescue is required. The quick connect coupling shall be easily connected and disconnected by trained individuals with a gloved hand and/or in low light conditions. The coupling shall also be guarded against inadvertent disconnect during use of the equipment. The low-pressure hose shall be equipped with a swivel attachments at the facepiece mounted regulator.

The breathing regulator outlet port shall be configured as the male half of a quarter (1/4) turn coupling which mates with the facepiece and shall be equipped with a doughnut-shaped gasket which provides the seal against the

mating surface of the facepiece. The regulator cover shall be fabricated of a flame resistant, high impact plastic. The breathing regulator shall also have an integral low-pressure alarm device that shall combine an audible alarm with simultaneous vibration of the facepiece. This alarm device shall indicate either low cylinder pressure or primary first stage regulator failure. The breathing regulator shall have a demand valve to deliver air to the user, activated by a diaphragm responsive to respiration. The demand valve shall use an extended temperature range dynamic O-ring seal composed of a fluorosilicone elastomer. This diaphragm shall include the system exhalation valve and shall be constructed from a high strength butyl elastomer.

A purge valve shall be situated at the inlet of the breathing regulator and shall be capable of delivering airflow of between 125 and 175 standard liters per minute. The breathing regulator shall be arranged to direct the incoming air over the inner surface of the facepiece for defogging purposes. The components of the breathing regulator shall be constructed of materials that are not vulnerable to corrosion. The flame resistant cover shall contain an air saver switch and pressure demand bias mechanism. It shall reactivate and supply air only in the positive pressure mode when the wearer affects a face seal and inhales. This device shall not affect the breathing flow through the system while in operation.

### **End-Of-Service Indicators**

The SCBA shall have two end-of-service (EOS) indicators. The primary EOS shall be the integral low-pressure alarm device that shall combine an audible alarm with simultaneous vibration of the facepiece. The primary EOS shall be located in the Facepiece-Mounted Positive Pressure Regulator.

The HUD shall serve as the secondary EOS indicator. It shall be mounted in the user's field of vision on the second stage regulator. It shall display one-quarter bottle increments including full bottle pressure and continuing to 25% of maximum bottle pressure. The display shall not have a numerical representation of bottle pressure. At one-half bottle pressure, one "yellow" LED shall be illuminated and flash at a rate not to exceed one (1x) time per second. At one-quarter bottle pressure, one "red" LED shall be illuminated and flash at a rate not to exceed ten (10x) times per second. The HUD shall have a low battery indication that is distinct and distinguishable from the bottle pressure indications.

### **Control Console with Heads-up Display (HUD)**

The pressure gauge shall be an integral part of the control console assembly. The control console shall come with a mechanical (analog) pressure gauge that is angled at 30°. The control console shall contain a photo sensing diode to dim and brighten the HUD as the light environment changes. The HUD shall operate on two "AA" batteries that are located in the control console assembly. The battery life of the SCBA with HUD only shall be no less than 200 hours.

The HUD shall be intrinsically safe per ANSI/ UL 913 Class I, Groups C and D, Class II, Groups E, F, and G, Hazardous Locations and certified to CAN/CSA Std C22.2 No. 57-92 when operated on two AA alkaline batteries.

### **Harness and Backframe Assembly**

#### ***Wireform Version***

A lightweight, adjustable, lumbar support style harness and backframe assembly shall be used to carry the cylinder and valve assembly and the pressure reducing regulator assembly. The backframe shall be a corrosion resistant wire form structure. The backframe shall include an over-the-center, adjustable tri-slide fixture, a para-aramid strap and a double-locking latch assembly to secure 30, 45 or 60 minute cylinders. The cylinder and valve assembly shall be positioned on the backframe by the combination of a guarded hook on the backframe and a hanger bracket on the cylinder and valve assembly.

The harness assembly shall be arranged so the majority of the weight is carried on the hips and be attached to the backframe by use of threaded fasteners for ease of replacement. All load-carrying portions of the harness shall be constructed of para-aramid fiber. It shall have a flexible, waist belt and two shoulder straps. The waist belt shall have a quick release metal structural buckle for easy connection and separation and two web adjusters, one on each side. Adjustment of the waist belt shall be accomplished by simultaneously pulling forward on the free end of the web at each hip-located adjuster. Each shoulder strap shall connect to the rear section of the waist belt at one end and to the rigid section of the backframe at the other end. Each shoulder strap shall have a web adjuster for quick adjustment and release of the shoulder straps. The shoulder strap shall be fitted with a Drag Rescue Loop (DRL) capable of being deployed in an emergency situation to drag a downed firefighter to safety. The backframe shall include accommodation and





mounting spaces suitable for installation of a distress alarm integrated with the SCBA. These mounting spaces shall permit installation of an alarm sensor module in an area between the cylinder hanger locking mechanism and the backframe.

### **One-Piece Aluminum Version**

A lightweight, lumbar support style backframe and harness assembly shall be used to carry the cylinder and valve assembly and the pressure reducing regulator assembly. The backframe shall be a solid, one-piece black powder-coated aluminum frame that is contoured to follow the shape of the user's back. The backframe shall include a mounting for the pressure reducer. This mounting shall contain a slide-type bracket permitting positioning of the pressure reducer to accommodate connection to either an angled or straight-type cylinder valve.

The backframe shall include an over-the-center, adjustable tri-slide fixture, a para-aramid strap and a double-locking latch assembly to secure 30, 45 or 60 minute cylinders. The harness assembly shall consist of a one size black para-aramid strap with a yellow stripe. This harness shall include box-stitched construction with no screws or bolts. The harness assembly shall incorporate parachute-type, quick-release buckles and shall include shoulder and hip pads. The harness shall include a seat-belt type waist attachment. The shoulder strap shall be fitted with a Drag Rescue Loop (DRL) capable of being deployed in an emergency situation to drag a downed firefighter to safety. The one-piece aluminum backframe should include integrated donning/carry handles. The handles shall allow the user to easily don the SCBA in the "over-head" style and also allow the user to carry the SCBA. The backframe shall include accommodation and mounting spaces suitable for installation of a distress alarm integrated with the SCBA. These mounting spaces shall permit installation of an alarm sensor module in an area between the cylinder hanger locking mechanism and the backframe.

### **EPIC™ Voice Amplifier (Optional)**

The respirator shall have a facepiece-mounted voice amplification device to electronically project the user's voice. The device shall weigh no more than 5.6 ounces 161 (grams) and its size shall not exceed the following dimensions: Length: 3.50 in.; (8.89 cm); width: 2.0 in. (5.08 cm); depth (extension from voicemitter): 1.75 inches (4.44 cm).

The voice amplification device shall be mounted to the facepiece by means of a bracket that is secured around the voicemitter of the facepiece. The device shall contain a bayonet-style mounting adapter that enables the user to insert the voice amplifier into the bracket and secure it with a quarter-turn counterclockwise when it shall lock into place. The device shall contain a thumb latch to permit removal when it is pressed and the device is rotated a quarter-turn clockwise.



The device shall contain a momentary on/off switch with a tactile indication and audible click when depressed. The switch shall be covered with a sheath made of a silicone material. The device shall contain an LED which illuminates green when the device is activated and flashes once per second when a low battery condition (approximately 2 hours of battery life remaining) is present. The LED shall be visible to the user while wearing a facepiece.

The device shall contain an automatic shut down mechanism that deactivates the voice amplifier approximately 20 minutes after last use. Designed to conserve battery life when a user forgets to turn off the voice amplifier, the voice amplifier shall be reactivated after shut down by pressing the on/off switch.

The device shall be powered by three AAA alkaline batteries, which shall permit up to 20 hours of continuous operation (based on 25% transmit; 75% non-transmit) with a fully- charged battery. The batteries shall be contained in a gasketed compartment secured in place by means of a fastener. The door of the battery compartment shall be user-replaceable.

The microphone shall be located on the surface of the bayonet mounting adapter and voice projection shall be facilitated by means of a circular gasket that seals the device to the communications mounting bracket.

## **Distress Alarm Integrated with SCBA (Optional PASS Device)**

### ***General Specifications***

The distress alarm shall be capable of integration with a NIOSH certified self-contained breathing apparatus, and this integrated SCBA and distress alarm system shall retain NIOSH certification. The system shall meet all requirements of NFPA-1982 Standard on Personal Alert Safety Systems (PASS), 2007 Edition. Operation of this distress alarm shall be initiated with the opening of the valve of an SCBA charged cylinder. A visual indication of automatic mode activation shall consist of a green flashing LED on the system's control module.

### ***Dual Alarms***

The system shall incorporate dual visual and audible alarms, which shall be activated in a pre-alarm mode when the system remains motionless for approximately 20 seconds. A full alarm shall be activated in the event the system remains motionless for approximately 30 seconds along with a 500 Hz audible signal. Visual signals shall consist of a green flashing LED when the system is in operation and red flashing LEDs to indicate pre-alarm mode, full alarm mode and a low battery condition. The system's LED signals shall be located on a control console assembly mounted on the user's right shoulder strap. The system shall have a visual LED indicator to check the battery condition while the system is not in use.

The Alarm signal shall be in a frequency range of 1 kHz to 4 kHz and consist of three primary frequencies. Sound pressure level shall be >95 dBA. The Pre-alarm signal shall be in a frequency range of 1 kHz to 2 kHz and consist of two primary frequencies, the sound pressure level shall ramp up in two distinct steps from 60 to >100 dBA.

### **Control Console**

The pressure gauge shall be an integral part of the control console assembly. The control console shall come with a mechanical (analog) pressure gauge that is angled at 30°. The control console assembly shall contain push buttons for manual operation of the distress alarm. A yellow color-coded push button shall permit system re-set; a red color-coded push button shall permit manual activation of the full alarm mode. Both push buttons shall be designed to minimize accidental activation. The system shall feature a "hands-free" re-set capability that may be activated by means of a slight movement of the SCBA when the system is in a pre-alert mode.



The control console shall contain an edge lit pressure gauge that requires no action by the user to turn on except open the cylinder valve. It shall also contain a photo sensing diode to dim and brighten the HUD as the environment changes.

### **Sensor Module**

The system shall include a sensor module mounted to the SCBA backframe and located in an area between the cylinder and backframe in a manner designed to protect the assembly from damage. The sensor module shall contain dual sound emitters for the audible alarm and dual visual "buddy" indicators. The sensor module shall operate on six "AA" batteries that are located in the control console assembly. The battery life of the SCBA with PASS only shall be no less than 200 hours.

The visual indicators shall flash as follows; 1) when the device is in pre-alert as defined by NFPA 1982, 2007 Edition; 2) when the device is in full-alert as defined by NFPA 1982, 2007 Edition; and 3) when the SCBA has reached ¼-bottle pressure as defined by 42 CFR.

### **Intrinsically Safe**

The distress alarm system shall be listed as intrinsically safe in accordance with ANSI/UL 913 Class I, Groups C and D, Class II, Groups E, F, and G, Hazardous locations.

Distress Alarm Integrated with SCBA (Optional Pak-Tracker™ Device)

Refer to Bid Specification document H/S 6558.

H/S 6637A 9/07

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