



## Warrior™

### Self-Contained Breathing Apparatus (SCBA)

#### Product Specification Sheet

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##### **I. Purpose**

To establish minimum standards for open-circuit self-contained breathing apparatus (SCBA).

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##### **II. Type**

The open-circuit self-contained breathing apparatus covered by this specification shall be of the type using compressed air.

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##### **III. Approvals**

A. The apparatus shall be certified by the National Institute for Occupational Safety and Health (NIOSH) under Title 42, Part 84 of the Code of Federal Regulations for 30-, 45-, or 60-minute rated service life and for storage at temperatures between -25°F and 160°F. The apparatus shall also be certified by NIOSH as “CBRN Agent Approved” for use in chemical, biological, radiological, and nuclear (CBRN) environments.

B. The apparatus shall be compliant with all performance requirements of the National Fire Protection Association's 2007 edition of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services*.

C. All electronic components shall be certified as intrinsically safe per UL 913 for use in Classes I, II, III, Division 1, Groups C through G hazardous locations.

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##### **IV. Facepiece**

The TwentyTwenty Plus facepiece shall:

A. Be constructed (in the rims, Air Klic, and nozzle cover) of a durable, fire-resistant material. The bottom of the nozzle cover shall have a molded lip to serve as an anchor point for flash hoods. The nozzle cover shall have two openings through which the Heads-Up Display (HUD), mounted on the second stage regulator, may be easily viewed by the user. Two wireforms that attach at the juncture of the upper and lower facepiece rims shall be available as an option, providing two additional flash hood anchor points.

- B. Be available in black butyl rubber in three sizes to fit various facial shapes and sizes. The facepiece shall have a mask skirt sealing area of not less than 1½" in width. A letter (S, M, or L) shall be molded into the top of the skirt to denote the size.
- C. Contain a replaceable, non-shatter-type, polycarbonate, conical-shaped lens located to provide a satisfactory field of vision. The lens shall be coated on the outside surface to help prevent abrasion. The lens shall be secured in the facepiece by a durable plastic retainer. The lens shall have anti-fog appliqués installed on the exterior of each side of the flat surface at the bottom of the lens and shall have a permanent anti-fog coating applied to the inside.
- D. Allow air to enter the facepiece in a manner that will reduce the possibility of moisture accumulation on the lens.
- E. Employ an adjustable 5-strap silicone rubber headband assembly held in place by buckles designed to prevent inadvertent loosening. An optional 5-strap Headnet™ mesh-style assembly shall be available and shall be interchangeable with the silicone rubber headband. It shall be necessary to tighten the chin straps and the temple straps to secure the Headnet to the face. The top strap shall be stationary. All straps for both the silicone headband assembly and the Headnet shall be attached to the rim of the facepiece, rather than the silicone skirt, to reduce distortion of the sealing surface when tightened.
- F. Contain an easily removable exhalation module which employs a neoprene exhalation valve designed for easy cleaning.
- G. Utilize a Kapton® material speaking diaphragm which is retained by the facepiece nozzle and is easily removable for cleaning and maintenance.
- H. Have field-replaceable components throughout.
- I. Employ a factory-installed, removable nose cup. The nosecup shall be able to be removed and re-installed without special tools. The nosecup shall be available in three sizes and shall have a letter (S, M, or L) molded into the right side to denote the size.
- J. Have provision for mounting corrective lenses inside the facepiece. The corrective lens kit shall not require tools for installation.
- K. Have a removable adapter (Air Klic), onto which the second stage regulator attaches, which has an opening that is small enough to be easily covered by one hand for a negative pressure fit check.

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## V. Regulator System, Intermediate Pressure Hose, and RIC UAC

A. The regulator system shall be designed to operate in two independent stages. The first stage reducer shall be installed inside the backpack so that it is completely protected from damage. The second stage shall be designed to provide positive pressure during an NFPA breathing machine test at 70 psi inlet pressure.

A. The first stage regulator shall:

1. Contain an overpressurization relief valve designed to vent relief pressure to the atmosphere should failure of the regulator's primary elements occur.

2. Contain a pressure-reducing valve to reduce pressure from the cylinder to 80-150 psig. The reducing valve assembly shall be a balanced valve design and shall provide uniform flow performance throughout the full cylinder pressure range. This valve shall have an inlet filter to retain particles of 120 microns or greater, shall be in an open position against the high pressure inlet, and shall seat in the direction of air flow.

3. Be joined via a short, rugged, braided high pressure hose to a CGA handwheel with a threaded stainless steel core. This handwheel shall secure the hose to the cylinder valve. The handwheel shall incorporate a multiple swivel mechanism for easy alignment and connection to the cylinder.

4. Incorporate a Rapid Intervention Crew/Company Universal Air Connection (RIC UAC). The RIC UAC shall be located at the bottom left of the backpack, protected by the backplate and not protruding as a snag hazard. The RIC UAC system shall consist of a male fitting, a dust plug, and a relief valve designed to vent excess pressure during filling operations. The relief valve shall be designed to activate at the correct pressure in 2216 and 4500 psig versions.

5. Utilize a fill hose with a mating female fitting, which shall be purchased as a separate item and shall not be deemed part of the RIC UAC; it shall be available as a 10-foot component of the UAC Rapid Intervention Kit.

6. Incorporate quick-disconnect fittings on the fill hose and the RIC UAC assembly, which shall be able to be coupled and uncoupled with pressure in the fill hose and with the SCBA activated. The RIC UAC system shall accomplish fully filling a 30-minute SCBA cylinder in approximately 45–60 seconds.

B. The second stage regulator shall:

1. Be constructed of a durable, fire-resistant material. The upper portion of the regulator, including the shutoff button, shall be covered by a rubber boot for impact absorption.

2. Be a "pilot valve" type. It shall contain a spring-biased diaphragm, responsive to respiration demand, to actuate a pilot valve which, in turn, operates a flexible main valve to meet the user's flow demand during inhalation.

3. Utilize a .030-inch hole and a flapper valve in the diaphragm plate to flush the second stage cover with clean air in order to keep agents away from the diaphragm.
  4. Reduce pressure from 80-150 psi to .036-.054 psi.
  5. Produce a static pressure in the facepiece of 0.8 to 1.5 inches of water.
  6. Contain a 40-mesh metal screen filter at the outlet port to prevent entrance of particles into the regulator.
  7. Contain a bypass valve that provides a separate flow path around the regulator primary demand valve. In the event of a failure or blockage of the primary, the bypass valve shall be operable by either of the user's gloved hands.
  8. Employ a two-point fastening system which allows the regulator to be quickly mounted into the facepiece by pushing and turning the regulator until the two fasteners attach to the facepiece adapter. The regulator shall remain secured to the facepiece should one of the fasteners inadvertently be released.
  9. Employ a first-breath-on feature which allows the user to actuate regulator flow by inhaling after the regulator is secured to the mask.
  10. Contain a safety override button which allows the wearer to manually start the regulator flow.
  11. Not obstruct the wearer's downward vision.
  12. Contain a manual shutoff button located directly in front of the top release button to prevent loss of air after removal from the mask.
- C. The second stage regulator intermediate pressure hose shall:
1. Be attached to the second stage regulator with a swivel connector.
  2. Attach to the first stage regulator intermediate pressure hose by a two-step, push-pull pneumatic and electrical quick-disconnect fitting. The quick-disconnect fitting shall be designed so that it cannot be connected just pneumatically or just electrically; both connections must be made in order for the wearer to be able to use the SCBA.
  3. Be protected by a butyl rubber and silicone sleeve throughout its entire length.

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## **VI. Primary Audible Alarm**

The user shall have the option of choosing either a plain whistle alarm, a warbling whistle alarm, or a bell alarm.

A. All alarms shall be installed inside the top left of the backpack so that they are completely protected from damage. They shall be air-actuated, automatically operating when air pressure in the supply cylinder reaches approximately 25% of original full pressure. The alarms shall work off intermediate pressure (the pressure after reduction by the first stage regulator) and shall have a discrete start, rather than a “ramping up” effect, with constant performance across the pressure range. They shall operate without interruption until the cylinder pressure reaches approximately 100 psig. The warbling whistle shall incorporate a “shuttling piston” to create a distinctive chirping effect through frequency variations, so that the alarm is easily differentiated from other sounds in the user’s proximity.

B. The bell alarm shall be an air-actuated, self-cocking, continuous ringing bell, automatically operating when air pressure in the supply cylinder reaches approximately 25% of original full pressure.

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## **VII. Heads-Up Display (HUD) and Secondary (Redundant) Alarm**

The SCBA shall incorporate an electronic visual alarm system that informs the user of remaining cylinder pressure and acts as a redundant end-of-service-time indicator (EOSTI). The HUD shall:

A. Utilize a transducer module, installed inside the top of the backpack and protected from damage, to sense cylinder pressure and generate an electronic signal to the HUD module. The transducer module shall be joined to the first stage via a high pressure, low volume hose. The first stage regulator shall incorporate a restrictor that limits leakage to a maximum of 15 liters per minute should the hose be severed.

1. The transducer module and all other electronic components integrated into the SCBA shall utilize 4 C-cell batteries, located inside the bottom right of the backpack, protected from damage, for power. The battery compartment shall be easily accessible via a spring-loaded, slotted cap, which can be removed or secured by using a coin or a flat blade screwdriver. The batteries shall last a minimum of one year if the SCBA is used for 30 minutes a day. A picture of the correct battery orientation within the transducer module shall be part of the battery compartment.

2. An amber LED shall be integrated into the backpack to indicate battery status prior to activating the SCBA. The battery status indicator shall flash once every 10 seconds to indicate a “battery OK” mode, once every two seconds to indicate a low battery mode, and not at all to indicate a dead battery. When the low battery mode initiates, a minimum of 8 hours of battery life shall remain. The amber LED on the transducer module shall no longer show battery status once the cylinder valve has been activated, except when batteries are low (it shall continue flashing once every two seconds).

B. Utilize an electronic cable, routed through the left shoulder strap, to join the transducer module to the HUD module.

C. Incorporate a HUD module mounted to the second stage regulator. When docked in the Air Klic in the facepiece, the HUD module and second stage regulator shall align with the openings in the facepiece nozzle cover so that the user shall have an unobstructed view of the HUD while wearing the facepiece. The HUD module shall contain a “gas gauge”-style, wide-span LED display of pressure remaining. The HUD module shall:

1. Incorporate an amber square LED to inform the user of a low battery condition. When the low battery mode initiates, signified by the flashing of the amber LED, a minimum of 8 hours of battery life shall remain.

2. Contain four green LEDs. When the pressure in the cylinder is full and the cylinder valve is activated, all four green LEDs shall be lit. All four shall be continuously lit until 75% of full pressure remains. At 75% pressure remaining, the fourth green LED shall no longer be lit; the remaining three green LEDs shall be lit. All three shall be continuously lit until 52% of full pressure remains. At 52% of full pressure, the third and fourth green LEDs shall no longer be lit; the remaining two green LEDs shall be lit. At 50% pressure remaining, the second green LED shall flash for 20 seconds to indicate that the 50% level has been reached. After 20 seconds of flashing, the second green LED shall return to a continuous mode, and the two LEDs shall be continuously lit until 27% of full pressure remains. At 27% pressure remaining, the second, third, and fourth green LEDs shall no longer be lit; the remaining green LED shall be lit. At 25% pressure remaining, the remaining LED shall change color to red and shall commence flashing to indicate that the 25% level has been reached. This flashing red LED shall serve as the redundant EOSTI. The red LED shall flash continuously until 10% of full pressure remains. At 10% pressure remaining, the red LED shall commence flashing significantly faster to indicate that the 10% level has been reached. The red LED shall flash continuously until all the air in the cylinder has been consumed. At that point, all LEDs shall flash simultaneously several times; then no LEDs shall be lit.

3. Incorporate a red flashing LED on the front of the exterior of the module to inform other personnel within eyesight that the user has reached the 25% and 10% low air levels. The exterior LED shall flash significantly faster to indicate that the 10% level has been reached. A red flashing low air LED shall also be integrated into the top right side of the back of the backpack.

4. Utilize a photodiode on the top of the exterior of the module to brighten or dim the HUD pressure level LEDs in relation to the ambient light level. In bright ambient light conditions, the LEDs shall operate in the bright setting so that they can be easily seen. In low-light or no-light conditions, the LEDs shall operate in the dim setting so that they are not distracting to the user.

5. Use photoluminescent labels to identify Full (“F”), “ $\frac{3}{4}$ ,” “ $\frac{1}{2}$ ,” “ $\frac{1}{4}$ ,” and the low battery icon.

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## VIII. Cylinder

- A. The volume of the 30-minute cylinder shall be approximately 45 cubic feet when filled to 2216 psig or 4500 psig pressure and shall conform to the DOT approval or exemption numbers listed in section G below.
- B. The volume of the 45-minute cylinder shall be approximately 66 cubic feet when filled to 4500 psig pressure and shall conform to the DOT exemption numbers listed in section G below.
- C. The volume of the 60-minute cylinder shall be approximately 87 cubic feet when filled to 4500 psig pressure and shall conform to the DOT exemption numbers listed in section G below.
- D. The cylinder shall contain a closing valve which incorporates a pressure gauge to indicate the cylinder pressure at all times. The handwheel shall be at a 90° angle from the longitudinal axis of the cylinder.
- E. The cylinder shall be either an all-aluminum, fully wrapped, or hoop-wrapped design. Wrapped cylinders shall be constructed of a deep-drawn, seamless aluminum liner wound with high-strength fiberglass or carbon filaments impregnated with epoxy resin.
- F. Cylinders, less air and cylinder valves, shall not exceed the following weights:
1. 30-minute, all-aluminum, 2216 psig: 17.3 lb (DOT-3AL).
  2. 30-minute, fiberglass hoop-wrapped, 2216 psig: 11.8 lb (DOT-E-7235).
  3. 30-minute, fiberglass fully wrapped, 2216 psig: 9.4 lb (DOT-E-8059/9634).
  4. 30-minute, carbon fully wrapped, 2216 psig: 6.7 lb (DOT-E-10915).
  5. 30-minute, fiberglass fully wrapped, 4500 psig: 10.3 lb (DOT-E-8059/9634).
  6. 30-minute, carbon fully wrapped, 4500 psig: 6.4 lb (DOT-E-10915).
  7. 45-minute, carbon fully wrapped, 4500 psig: 8.6 lb (DOT-E-10915).
  8. 60-minute, carbon fully wrapped, 4500 psig: 11.6 lb (DOT-E-10915).

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## **IX. Cylinder Valve**

- A. The cylinder valve shall be fitted with a two-sided luminous boldface dial-type gauge with rubber and metal protective guards. The cylinder valve body shall be permanently coated to prevent galling and corrosion.
- B. The cylinder valve shall have as an option a large rubber-coated handwheel with a safety locking collar device to keep the handwheel locked open during use.
- C. The cylinder valve outlet shall conform with the Compressed Gas Association (CGA) standard for threaded connection: for low pressure, number 346; for high pressure, number 347.

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## **X. Harness and Backpack**

The aluminum backplate and harness assembly shall weigh approximately 5 pounds. The backpack shall be available in three sizes: standard, small, and large. No tools shall be necessary to replace any harness components, with the exception of the grab handles. No adhesives shall be necessary to secure any replaceable components. The backpack

harness shall be readily adjustable for various wearer sizes, and shall include the following components:

A. Harness straps of Kevlar<sup>®</sup>/Nomex<sup>®</sup> composite construction to provide maximum resistance to high temperatures, flame, and abrasion. The harness shall have a coating to prevent the straps from becoming limp. The edges of all harness straps shall be of a different color than the middle of the strap so that the straps are well-defined and can be differentiated from each other in low-light conditions. The reverse side of the strap shall be of a different color than the front of the strap in order to easily recognize twisted straps. The shoulder straps shall have thick, Kevlar/Nomex-covered neoprene padding attached for user comfort and shall have snap-open hose loops for ease of maintenance. All harness straps shall secure to the backpack without fasteners. The shoulder straps shall utilize parachute-style retaining and loosening buckles. The shoulder straps shall incorporate a reflective band on each strap. The ends of the straps shall contain large grab handles for ease of adjustment. The grab handles for the shoulder straps shall be of a different color than the grab handles for the waist strap for easy differentiation.

B. A two-piece Kevlar/Nomex waist strap, adjustable from both sides, with a front-release metal automotive-style belt buckle. The waist strap shall be tightened by pull-forward-style straps with parachute-style retaining and loosening buckles.

C. A waist-strap-mounted holder for the second stage regulator so that the regulator may be kept actuated in a stand-by mode during use, and so that the regulator may be stored protected from the environment when not in use. The holder shall have a provision for relief of excess pressure when the regulator is actuated, and it shall have a vacuum breaker to prevent the regulator from being accidentally actuated upon removal from the holder.

D. An aluminum backplate contoured to the user's back. The backplate shall be capable of providing up to 1000 pounds of pull force without breakage. Three handles with carabiner attachment points shall be located on the top and sides of the backplate for ease of donning, for transport, or for pulling the SCBA in a rescue scenario.

E. An easily adjustable aluminum cylinder band to properly secure various sizes of cylinders. The cylinder band shall be secured to the backpack with a cam-over style buckle with a locking release mechanism.

F. A thick, Kevlar/Nomex-covered, padded lumbar support for user comfort and safety.

G. A thick, Kevlar/Nomex-covered, upper back pad for user comfort and safety.

H. A snap hook-style mask hanger situated on the right or left shoulder strap for attachment of the facepiece in a convenient, protected, stand-by position.

I. A protective bumper on the bottom of the backplate to prevent damage to the backplate.

J. A swivel/pivot mechanism that allows the backpack's weight to be ergonomically and comfortably placed on the user's lower back in all wearing positions, both vertical and horizontal.

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**XI. Buddy Breather and Auxiliary RIT Connection**

A. A buddy breather shall be available as an optional accessory. It shall utilize a two-step, push-pull, female quick-disconnect fitting designed to prevent accidental release. The female quick-disconnect fitting shall be attached at the terminus of a separate intermediate pressure hose routed from the first stage reducer into a pouch on the left side of the backpack at the user's waist. A separate male plug with a pressure shutoff shall be located adjacent to the female quick-disconnect fitting. The "buddy" shall attach his mating male fitting to the buddy breather female quick-disconnect fitting or his mating female fitting to the buddy breather male fitting in order for both users to share the remaining air supply in both cylinders.

B. As a separate option, an auxiliary connection utilizing the same two-step, push-pull, female quick-disconnect fitting used in the buddy breather described above shall be available on the backpack. This can be used for conventional supplied air; for accepting a remote air supply from a Rapid Intervention Team; or, in conjunction with the buddy breather described above, for "daisy chaining" multiple users.

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**XII. Carrying Case**

If specified, a molded carrying case shall be provided to retain the complete apparatus and instruction card or booklet. The carrying case shall have replaceable front latches.

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**XIII. Instruction Card or Booklet**

An instruction card or booklet shall be provided with each apparatus. Instructions shall contain complete operation and maintenance procedures.

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#### **XIV. Warranty, Flow Test, and Overhaul Cycle**

A. The apparatus shall carry a limited warranty of not less than twelve (12) years, with the exception of the cylinder, which shall carry a limited warranty of not less than fifteen (15) years, the first stage regulator, which shall carry a limited warranty of not less than the lifetime of the SCBA, and the HUD, which shall carry a limited warranty of not less than two (2) years. Other electronic accessories may carry limited warranties of different durations.

B. An annual flow test shall be done by a Survivair-certified technician to meet the requirements of NFPA 1852. There shall be no mandatory overhaul cycle.

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#### **XV. Accessories**

The following NIOSH-certified accessories shall be available for the apparatus:

- A. Wireless radio communication system.
- B. Mask-mounted voice amplification system.
- C. Integrated PASS device with datalogging.
- D. Remote alarm module for integrated PASS device.
- E. Haz-mat suit pass-through fitting.
- F. Neck strap.
- G. Chest strap.
- H. APR adapter.
- I. CN/CS adapter.
- J. Integrated ultrasound firefighter locating system.
- K. Digital Heads-Up Display mounted inside the facepiece and using infrared data transmission.

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#### **XVI. Future Accessories**

The following accessories shall be available in 2008:

- A. Team communication system with 72 selectable channels with unlimited people per channel.

B. Telemetry system with PC-based software for air management, accountability, and tactical management.

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