SCBA/SCUBA FILL STATION SPECIFICATIONS

General Arrangement

The air compressor system shall be a turnkey, packaged appliance designed to deliver high pressure breathing air in compliance with the most current NFPA and CGA air quality standards for the refilling of SCBA and SCUBA cylinders. The system shall include the high pressure air compressor, electric motor, air purifier, fill station and all operating and cylinder fill controls as specified below. The system must also be designed to incorporate an integral air storage system as specified below. All components shall be completely assembled and tested by the manufacturer as a system and incorporated within a single appliance requiring only electrical power supply to operate. The system shall be designed with all cylinder refilling, operator controls and performance indicators located on panels at the front of the appliance allowing “at sight” operator monitoring. The appliance shall comply with the currently applicable OSHA specifications as well as state and local electrical codes.

The external construction of the high pressure breathing air compressor system shall be appliance-like. All structural fasteners shall be concealed and all access panels shall include concealed hinges and push button latches. One full height door shall be provided for maintenance access to the compressor. The door shall include a shutdown switch to prevent exposure to running gear in the event it is opened while the compressor is in operation.

A full length access door for fill station panel maintenance shall also be provided. Additionally, the fill station shall include a unique “SwingAway” feature designed to provide complete access to air flow control components and piping behind the panels. This is all done without having to move the appliance away from the wall and is accomplished using heavy-duty hinges and wheels that easily allows ONE operator to perform the task.

The compressor and fill control panels shall be ergonomically designed and feature graphic design technology to group all control components and indicators logically and by function. For maximum clarity and visibility, colored lines shall isolate each control component group. Each group shall then be located within a graphic flow control schematic background and identified with permanent text integral to the panel surfaces. High visibility colored text shall identify and provide operator instructions for all critical functions.

The cabinet configuration shall permit installation with the rear “against the wall” and to include up to four appliance mounted storage cylinders as specified below.

The appliance shall include an ambient air flow control design that directs the necessary volume of cooling air to the compressor.

All high pressure air plumbing shall be rated for 6000 psig working pressure and utilize seamless stainless steel tubing. All high pressure air tube connections shall use compression type design fittings.

The electrical control system shall include motor control components with UL, NEMA or IEC approval and 12vdc control circuit housed within a UL® listed, NEMA enclosure. The breathing air system manufacturer shall be a NRTL (Nationally Recognized Testing Laboratory) Licensed Panel Shop as per UL® 508A standard.

An adapter must be supplied to allow for SCUBA tank filling. Primary setup of the fill station will be for SCBAs

Compressor

The ambient air intake and compression shall be through an air-cooled, reciprocating, fourstage compressor designed for continuous duty at 6000 psig working pressure. The compressor shall have a minimum charging rate of 14.0 cfm. The air compressor design shall include a heavy-duty crankcase supporting the crankshaft with ball bearings on each end. Lubrication shall be accomplished by controlled splash of oil from the crankcase sump aided by pressure induced migration from the totally sealed crankcase. The crankcase shall be piped back to the inlet cylinder to maintain proper crankcase pressure and eliminate any discharge of oil contaminated air to the atmosphere. The cylinder arrangement shall be a balanced “V” configuration featuring double-acting, ringed pistons assuring maximum balance and air volume delivery efficiency while operating at a maximum compressor speed of 1700 RPM.

Each stage of compression shall be protected with a safety relief valve. The cylinders shall include cooling fins to dissipate heat into the cooling air flow from the compressor’s integral flywheel fan. Individually mounted coolers shall be located after each compression stage to cool the discharged air to 18□F. above ambient temperature.

Accumulated condensation from cooling the compressed air shall be collected in moisture separators mounted on the compressor and discharged to an automatic internal, timed drain system for proper collection and disposal.

Prior to shutdowns, the compressor shall be allowed to run unloaded (with opened drains) for a timed period (Purge Cycle) in order to purge all cylinders, separators and crankcase of damaging condensation that develops as compressors cool down.

The compressor control panel shall also include a condensate purge test switch in order to verify proper operation of the automatic condensate drain system on demand.

- □ The ambient air filter element shall be located in a housing piped to the compressor air intake and inlet port with a connection to facilitate connecting to outside air intake piping.

Electric Motor

The compressor shall be v-belt driven by a NEMA design, 10-hp, open drip proof electric motor wired for the electrical conditions as shown below:

60 Hertz Current
1 Phase, 208/230 volts

The motor shall be located under the compressor and driven via v-belt drive arrangement utilizing a hinged motor base to facilitate belt tension adjustment. The compressor and motor base shall include neoprene mounts to isolate vibration from the appliance.

Electrical Control System

The breathing air compressor shall include all the necessary controls to assure safe, efficient operation and monitor performance. The control system shall be of an anti-flutter circuit design and include a latched fault protection circuit to prevent automatic restarting after an abnormal fault has occurred. As a minimum, the control system must include the following:

- Air pressure switch to automatically start and stop the compressor based on demand.
- High air temperature shutdown switch and gauge with a thermo-well installed sensor that measures temperature directly from the air stream. Cylinder surface sensors are not acceptable.
- Low oil level shutdown switch.
- Magnetic, across-the-line starter with electric motor overload protection.
- Compressor access door safety shutdown switch.
- *Compressed air electronic carbon monoxide (CO) detector with pre-set warning, shutdown limits and audible alarm. A shutdown audible alarm shall be supplied for all abnormal conditions.*

Instrumentation

The control system must include all monitoring devices as indicated below. These shall be mounted on a control panel located at the front of the compressor with all indicators and gauges grouped logically and each group positioned within a graphic flow control schematic and identified with integral text. The panel background color shall be matte black shade with a textured finish to eliminate glare. Panel component and indicator groups shall be offset by colored lines to enhance operational visibility and safety.

The compressor's instrumentation panel shall also be engineered for quick and convenient access to all key electrical control components, minimizing the need to use the appliance maintenance access door. Indicator lights, pressure switch and all control wiring shall be accessible for routine maintenance and adjustments through hinged, "knockdown" sub-panels located on the front of the compressor. The operator control panel should CO and H_2O monitoring. The unit must be designed to allow full integral installation of any future upgrades without the use of external wiring, piping or remotely mounted components.

As a minimum, the instrumentation required is as follows:

- Compressor inter-stage and final pressure gauges.
- Hour-meter.
- Compressor final stage temperature gauge.
- Independent illuminated power ON and OFF buttons.
- Normal high air pressure shutdown indicator light.
- Purge cycle indicator light and test switch.
- General fault shutdown indicator light.
- Emergency stop button.
- Digital CO monitor panel with actual content display in parts per million (PPM) and prompter software keypad for calibration. A flow panel with factory plumbed calibration gases shall be included.

Air Purification System

The high pressure air purification system shall be a multi-chamber arrangement that utilizes disposable cartridges manufactured to provide breathing air that meets or exceeds NFPA and CGA Grade “E” specifications and all other equivalent and recognized standards in use worldwide.

All system components shall be rated for 6000 psig working pressure with a four-to-one safety factor. All chambers in the system shall be constructed of 304 stainless steel to enhance safety and corrosion resistance.

The purification system shall be sized to process 35,000 cubic feet of air at 70^{o}F and compressed to 6000 psig between cartridge changes. The system shall include the following:

- Final separator chamber connected to the automatic condensate drain system.
- Check valve to prevent back pressure to the compressor.
- One (1) purifier cartridge chamber.
- Pressure maintaining valve to assure that the system is maintained pressurized in order to attain the rated processing capacity of the air purification cartridge.
- Safety relief valve.
- Stem-mounted gauge for system pressure verification.

The system shall be designed so that filling cannot occur in the event that the purification cartridge is not installed.

High Pressure Air Storage

The breathing air storage system shall be integral to the appliance and include all the cylinders, plumbing and hardware installed in accordance with all current ASME or UN/ISO codes, as specified below:

- Four (4) UN/ISO 6000 PSI cylinders each with a capacity of 509 cubic feet of air at 6000 psig. The piping of air storage shall be arranged for cascade filling.

SCBA/SCUBA Cylinder Fill Enclosure

The appliance shall include an integral fill enclosure for filling two (2) SCBA cylinders simultaneously or separately.

The fill station shall be designed for filling one (1) SCUBA cylinder with a maximum height of 30-½” and a maximum diameter of 7-¾”, including service valve, boot and fill attachment. The enclosure shall be designed to contain the impact of suddenly expanded high pressure air and all displaced fragments in the unlikely event of a cylinder or fill component rupture.

The fill station containment design must be UL® (Underwriters Laboratories) classified and for maximum operator safety certified to meet NFPA 1901-2009 standards. The UL® testing certificate must be included with the bid or request for quotation and included with the operator’s manual when the system is shipped.

The fill station loading door must be designed to be trapped behind the fill enclosure cabinet frame when closed and include an automatic, safety interlock to prevent filling unless the loading door is completely closed. A safety relief valve, to prevent over pressurizing SCBA/SCUBA cylinders above 4750 psig, shall also be included.
The fill station must allow the fill process to be accomplished from the front. The fill station shall be of a design that does not require the operator to have to hold up or otherwise support the weight of the cylinders being filled while connecting them to the fill whips.

The front loading door shall be designed so that, when opened, sleeves that hold the SCBA/SCUBA cylinders tilt forward to ease loading and minimize operator fatigue. Two ( ) fill

whips, each fitted with a cylinder fill adapter and shut-off valve, shall be located within the enclosure.

Access Door Control: For maximum operator comfort and ease of use, the fill station access door shall include an air actuator handle designed to provide power assisted, effortless operation when opening and closing. When fully closed, the door shall trip a safety interlock allowing air flow to the fill station. The access door shall be supported on the enclosure frame with an adjustable bearing bushing on each side assuring a balanced and smooth rotation when opening and closing. A damper strut shall secure the assembly to the enclosure so that it does not require operator support and to cushion the access door landing when opened.

The access door design must be fail-safe, permitting manual operation in the event of air pressure loss in the power assist circuit.

Air Flow Controls

All air flow components and indicators shall be mounted on a control panel located at the front of the unit grouped logically with each group positioned within a graphic flow control schematic and identified with integral text. The panel background color shall be matte black shade with a textured finish to eliminate glare. Panel component and indicator groups shall be offset by colored lines to enhance operational visibility and safety.

For maximum clarity and safety, the flow control panel shall be divided by function, assuring that the regulated SCBA/SCUBA fill controls are located in a dedicated area apart from air storage management, cascade and air reel control components. The SCBA regulator and controls shall be mounted on a recessed, forward tilt panel, which enhances visibility and operator ergonomics. In order to minimize operator handling of pressurized components, a fill hose(s) pressure vent valve shall be located on the air flow control panel to relieve all fill hoses of pressure after opening the front loading door and before disconnection from the SCBA/SCUBA cylinder(s).

The SCBA/SCUBA cylinder fill control system shall include a regulated panel with all the components, devices and piping arrangement necessary to direct supplied compressed high pressure breathing air to the air storage system and the SCBA/SCUBA cylinders being filled.

Additionally, a regulated auxiliary outlet to fill remote air storage systems shall be provided. All high pressure regulators must be designed so that they cannot be accidentally reset in accordance with NFPA 1901, 2009 Edition specifications. The regulator knob shall be of the “push-to-reset” design that spins freely if accidentally moved.

- A cascade control system shall be included for the number of banks specified below to permit filling or drawing down each air storage cylinder independently of each other and while filling SCBA/SCUBA cylinders. The system shall include a by-pass valve to permit filling SCBA/SCUBA cylinders directly from the compressor.

As a minimum, the air control panel must include the following:

- Inlet pressure gauge.
- Adjustable, 0-6000 psig self-relieving regulator.
- Regulated outlet pressure gauge.
- Storage fill /*by-pass* valve.
- SCBA/SCUBA cylinder(s) fill control valve.
- SCBA/SCUBA cylinder(s) fill pressure gauge.
- SCBA/SCUBA cylinder(s) panel mounted fill hose(s) vent valve.
- Auxiliary outlet with flow control valve and CGA fitting.
- Four (4) bank cascade control with “To” and “FROM” valves and gauge per bank

Air Reel Package

Appliance shall include a built-in 50' spring rewind reel. Controls shall be placed on the flow control panel. An additional 50' extension hose shall be included. A storage compartment shall be part of the appliance cabnetry.

Dimensions and schematics

Floor dimensions and air space clearance needs to be listed in the proposal. Schematics and brocures shall be included in the proposal that represents the compressor being proposed.

Pricing

Pricing shall be in a sealed envelop separate from the proposal.