TESCORP
Compressor & Pump Specialists

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July 15, 2013

Norman Fire Department

Attn. Deputy Chief Bailey

Re: Compressor Quote

Bauer UN III-13H- E-3 – 10 hp, 6000 psi Breathing Air Station.

Station shall include a three position containment fill station, four ASME 6000 psi receivers, CO monitor and a regulated remote fill.

SEE ATTACHED SPECS

List price $51,798.00

Total Delivered Price including inside delivery and training
$ 45,968.00
Optional remote fill with 75 ft. hose reel and hose
Add $ 1,068.00

Delivery 6 to 8 weeks aro

Regards

Charlie Zurmehly

Specification for a breathing air station to refill self-contained breathing apparatus (SCBA) cylinders with purified air that meets or exceeds the requirements of CGA Pamphlet G-7, Compressed Air for Human Respiration, the requirements of ANSI/CGA G-7.1, Commodity Specification for Air, Grade E, and all other recognized standards for respirable air. The breathing air station shall be comprised, in part, of a high pressure compressor and purification system, storage system, cascade fill control panel and containment fill station. The station shall be designed for a maximum working pressure of 6,000[1] PSIG. All equipment shall be new and of current design and manufacture. Used or refurbished equipment is unacceptable. Specifications are subject to change without notice.

BAUER MODEL

UNIII/13H
UNICUS III

6000 PSI SERVICE

The breathing air station shall be supplied on a steel base frame of welded construction. The frame shall be designed for both the static and dynamic loads of the system and of sufficient size to adequately accommodate all of the station's components. The compressor, purification system, fill station and all tubing shall be incorporated into an appliance-like enclosure complete with sound attenuation. The enclosure panels shall be equipped with a slam-action latches and lift-off hinges making it simple to facilitate inspection and maintenance. The UNIII enclosure and base frame shall be finished with a baked on polyester powder coat paint for the ultimate in durability, corrosion resistance, and long life.

The station shall be designed for against-the-wall installation, operation and maintenance and single-point operator control from the front of the station. The design of the station shall permit unrestricted cooling air flow to the compressor and motor when installed against a wall. All system instrumentation, controls and access to the containment fill station shall be located at the front of the station. The depth of the fill station portion of the Unicus III is adjustable thereby allowing the Unicus III to fit through a standard 36" doorway. The station shall be designed for continuous duty operation indoors with room temperatures ranging between 40°F and 115°F[2]. Installation shall not require a special foundation; however, it is the responsibility of the purchaser to ensure the installation site has a solid and level foundation that can support the weight of the station, the availability of a qualified source of air for the intake of the compressor and adequate ventilation.

All piping and tubing shall be properly supported and protected to prevent damage from vibration during shipment, operation, or maintenance. Piping and tubing shall be installed in a neat and orderly arrangement, adapting to the contours of the station. All instrument tubing shall be 300 series stainless steel.

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[1] 5000 PSIG available; customer must specify 5000 psi pressure setting.

[2] Please consult the Bauer factory for applications outside of this temperature range.

The station shall be warranted free from defects in material and workmanship for a period of eighteen months from date of shipment or twelve months from date of start-up, whichever expires first. The warranty shall not impose limitations on the station's accumulated operating hours during the warranty period.

Performance Table

Model	FAD[3] SCFM	Charging Rate[4] SCFM	HP	RPM	Compressor Model	Purification System	Air Processing Capability[5] (cu ft)
UNIII/13H	10.8	13.0	10.0	1420	K12.14 II	P2 Securus	67,000

Table 2

Model	SCBA Fills in 1st Hour			
	From 2 ASME		From 4 ASME	
	2216 PSI 45 cu ft	4500 PSI 45 cu ft	2216 PSI 45 cu ft	4500 PSI 45 cu ft
UNIII/13H	38	25	63	45

The number of SCBA fills in 1st hour is calculated by using the following formula:

$$\frac{\text{FAD x 60 min/hr}}{\text{(SCBA volume at fill pressure) - (SCBA volume at 500 PSIG)}} + \text{SCBA fills from storage}^{6}$$

Compressor

The compressor shall be an air-cooled, oil lubricated, four stage, three cylinder, reciprocating compressor. The crankcase shall be cast of a high strength, aluminum alloy. The crankshaft shall be of a single piece forged steel construction, and supported in the crankcase by three long-life roller bearings. The connecting rods shall be of single piece design and constructed of a high strength aluminum alloy. Each connecting rod shall incorporate a roller bearing at the crank end and needle bearing at the pin end. The pistons shall be constructed of an aluminum alloy. Piston rings on the second and third stage are of cast iron; first and fourth stage rings shall be of a high strength polymide. The final stage shall incorporate a ringed, free-floating, aluminum piston, which is driven by a guide piston and the previous stage's discharge pressure. The cylinders

[3] Based on standard inlet conditions.
[4] Based on recharging an 80 cu ft cylinder from 500 to 3000 PSIG.
[5] Based on an inlet temperature of 67°F.
[6] Reference the Bauer Fillagraph for number of fills from storage.

shall be of cast iron construction with deep cooling fins on the external surface for optimum heat dissipation. The cylinders shall be arranged in a "W" configuration with the first and second stage sharing one common stepped cylinder. Each cylinder shall be located directly in the cooling fan's blast. The cylinders shall be removable from the crankcase. The compressor's flywheel shall be of cast iron construction. A multi-wing, high velocity cooling fan shall be integral to the flywheel.

An intercooler shall be provided after each stage of compression and an aftercooler shall be provided after the final stage of compression. The coolers shall be individually detachable from the compressor, located directly in the cooling fan's blast and made of a stainless steel. The aftercooler shall be designed to cool the discharge air to within 18°F of ambient temperature. A cool-down cycle shall not be required prior to stopping the compressor.

A separator shall be supplied after the second and third stages of compression, and a coalescing separator shall be supplied at the discharge of the compressor. An automatic condensate drain (A.C.D.) system shall be supplied for all of the separators. The drain solenoid shall be controlled by the PLC and factory preset to drain the separators approximately every fifteen minutes for approximately six seconds. The A.C.D. system shall unload the compressor on shutdown for unloaded restart. An exhaust muffler and condensate reservoir shall be supplied. The condensate reservoir shall have a high liquid level indication system to provide system shutdown and to alert the operator that the condensate reservoir is at capacity. The operator shall be alerted that the reservoir is at capacity via an audible alarm and a scrolling text display message on the panel mounted operator / compressor interface. Manually operated valves shall be supplied to override the automatic operation of the A.C.D. system for test and maintenance purposes.

The compressor shall be lubricated by a combination splash /mist and low pressure lubrication system. The final stage of compression shall be lubricated by a pressurized lubrication circuit. The other stages and the driving gear shall be splash/mist lubricated. The low-pressure lubrication circuit shall include a positive displacement oil pump, gear driven by the crankshaft, a non-adjustable oil pressure regulator, and a full-flow oil filter with replaceable element. A highly visible sight glass shall be included to check the oil level. The oil drain for the compressor shall be piped to the outside of the frame.

The compressor shall be equipped with an inlet filter with replaceable particulate element.

Prime Mover and V-Belt Drive

The single or three-phase electric motor shall be of the open drip-proof (ODP) design. The motor voltage and frequency shall be specified by the purchaser. The compressor and motor shall be mounted on a common base that is vibration isolated from the station's main frame. The compressor and motor shall be arranged in a vertical design. Power from the motor shall be transmitted to the compressor by a v-belt drive. The v-belt drive shall be designed to tension the drive belts automatically. Rotation arrows shall be affixed in a conspicuous place on the compressor.

Electrical Control & Instrumentation

The compressor control panel (CCP) shall include an across-the-line magnetic motor starter, fused transformer and PLC controller. The CCP shall be built in accordance with UL 508A, the standard for Industrial Control Panels and shall be affixed with a UL label.

The PLC compressor control system consists of a programmable logic controller for the monitoring, protection and control of the compressor systems.

Standard features of the CCP include:

- A NEMA type 4 electrical enclosure
- UL electrical panel
- Human Machine Interface (HMI) with **Multi-Color Touch Screen Display** incorporating vivid TFT (Thin Film Transistor) Technology and NOT limited by touch cells (Optional mounting configurations available-up to 25 ft remote)
- Emergency Stop Palm Button
- Home screen customizable with distributor contact information
- Real Time Clock (time and date)
- Compressor on / off
- Digital Display of Compressor Final Pressure
- Digital Display of Compressor Oil Pressure
- Digital Display of current Compressor Run Time
- Digital Display of Final Separator Cycle Count
- Compressor High Temperature Shutdown and Alarm
- Full support of the Automatic Condensate Drain system (interval and duration set points adjustable thru the HMI - password protected)
  - Digital Display of time to next ACD Cycle
  - Condensate Drain Reservoir full alarm
- Full support of CO monitor alarm functions (optional)
- Full support of SECURUS purification system moisture monitor warning and alarm functions
- Built in overtime timer set at 5 hours - optional times available
- Maintenance Timer (selectable between real time or compressor run time) to give Digital Display of all needed Preventative Maintenance Evolutions
- Motor overload alarm
- Nonresettable hourmeter
- Recoverable Run History (last 5 run periods)
- Recoverable Alarm History (last 5 fault shutdowns)
- Support of up to 5 Languages (to be specified at time of order; includes English, French, Spanish & Portuguese)
- Operator choice of display in BAR or PSI

For ease of Maintenance and Repair:

- PLC has removable Terminal Blocks for all functions
- Diagnostic EEPROM (Electrically Erasable Programmable Read-Only Memory) Capability
- Support of Two (2) Communication Protocols (optional)
    - o Ethernet Connection
    - o Analog Phone Modem
- Wiring shall be encapsulated within a split corrugated type loom. Each wire end connection shall be machine crimped and numbered.

The HMI shall have 22 adjustable system parameters secured by password protection. The HMI will provide display of all safety / fault shutdowns with a text read-out of up to three potential causes for the fault / shutdown.

The compressor oil pressure shall be monitored by a pressure transmitter and digitally displayed on HMI. The compressor shall shut down and a fault will be indicated on the HMI should the compressor's oil pressure drop below the factory preset value during operation. The oil pressure transmitter shall be by-passed during start-up to permit the oil pump to achieve the normal operating pressure.

The low oil pressure and final air pressure transmitters shall be equipped with sealed electrical connectors. The analog pressure sensors for oil pressure and final pressure shall have adjustable set point and dead-band thru the HMI (password protected).

A temperature switch shall be supplied on the head of the final stage of compression. The compressor shall shutdown and a fault will be indicated on the HMI should the final stage temperature exceed the tamper-proof set point during operation.

Fault shut downs shall not affect the ability to fill SCBA cylinders from the storage system as long as there is sufficient pressure in the storage to fill them.

Purification System

The purification system shall purify high pressure air to a quality that meets or exceeds the requirements of CGA Pamphlet G-7, Compressed Air for Human Respiration, ANSI/CGA G-7.1, Commodity Specification for Air, Grade E, and all other recognized standards for breathing air. Purification shall be achieved by mechanical separation of condensed oil and water droplets, adsorption of vaporous water by a desiccant, adsorption of oil vapor and elimination of noxious odors by activated carbon and conversion of carbon monoxide to respirable levels of carbon dioxide by catalyst.

The high pressure purification chamber shall have a working pressure of 6000 PSIG. The purification system shall utilize a replaceable cartridge. The purification system shall be designed so that the replacement of the cartridge can be accomplished without disconnecting system piping. The design of the chamber shall preclude the possibility of operating the system without the cartridge installed or with an improperly installed cartridge. A bleed valve shall be

provided to vent the purification system to facilitate replacing the cartridge. A pressure maintaining valve and a check valve shall be supplied downstream of the purification system to increase the efficiency of the purification system by maintaining a positive back pressure. A check valve shall be supplied between the coalescing separator on the compressor's discharge line and the purification system to maintain the positive pressure in the purification system when the compressor shuts down.

The purification system shall include Bauer's patented Securus Electronic Moisture Monitor System[7]. A sensor shall be located in the Securus purifier cartridge for direct monitoring of moisture levels. The Touch Screen Display shall indicate the status of the Securus cartridge. The Securus system shall warn the operator, in advance, of the impending expiration of the Securus cartridge via a scrolling text display message on the panel mounted operator / compressor interface. The compressor shall shut down automatically and the operator notified via audible alarm and scrolling text display message on the panel mounted operator / compressor interface should the operator fail to change the Securus cartridge within the warning period. The compressor shall not be capable of restarting until the used cartridge is replaced with a new one[8]. The moisture monitoring system shall be of a fail-safe design. Should the electrical contact between the display module and sensor be disconnected, an immediate fault shut down shall be effected. For absolute safety and highest quality breathing air, no manual override shall be supplied for the moisture monitor.

Cascade Fill Control / Instrument Panel

A steel instrument panel affixed with a non-glare Lexan→ overlay shall be installed on the front of the station. The overlay shall contain an embedded airflow schematic. The cascade fill control / instrument panel shall be hinged for easy maintenance and accessibility.

The cascade control panel shall be factory piped for four storage banks and designed to fill three SCBA cylinders either independently or simultaneously. The control panel shall include, at a minimum, a manual control valve and pressure gauge for each storage bank, an adjustable regulator for SCBA cylinder fill pressure complete with a pressure gauge for inlet and regulated pressure and a relief valve to protect the SCBA cylinders from overfilling, a manual control valve and pressure gauge for each fill position, a manual direction valve to allow the operator to select SCBA filling from either air storage or the compressor, provisions for factory or field modification to allow a different fill pressure at each fill position. The cascade system shall allow the simultaneous tasks of filling one storage bank while drawing down another during the SCBA fill process. Strategically placed tees and check valves preclude the need for individual "To" and "From" valves. Systems requiring individual "To" and "From" valves shall not be deemed acceptable, as they require more efforts to operate.

[7] U. S. Patent Number 4,828,589
[8] Replace all cartridges at the same time.

All control panel mounted pressure gauges shall have a 2 ½" diameter and be liquid filled. A fluorescent light shall be factory installed above the panel to provide a glare-free illumination of the control panel. An on/off switch shall be integrated into the operator / compressor interface for the light.

Air Storage

The air storage system shall include two receivers fabricated, tested and stamped in accordance to Section VIII of the ASME Boiler and Pressure Vessel Code. The receivers shall have a 3:1 safety factor at 6000 PSIG (7000 PSIG MAWP at 200°F).[9] Each receiver shall have a capacity of 491 cu ft at 6000 PSIG[10]. The receivers shall be mounted in a vertical configuration in a rack that is integral to the breathing air station's frame. The rack shall be designed to accommodate four identical receivers. The receivers shall be installed in accordance with 29 CFR 1910.169. The rack shall be designed to support the receivers in a secure manner and permit visual inspection of the receivers' external surface. Each receiver shall be supplied with a manual drain valve, an isolation valve and safety relief valve. For ease of maintenance and periodic inspection all the drain valves shall be piped to one convenient location within the Unicus III enclosure. Each receiver, or bank of receivers if additional storage is required, shall be piped to the cascade fill control panel to facilitate cascade filling.

Containment Fill Station

The front-loading, three position; containment fill station shall totally enclose the SCBA or SCUBA[11] cylinders during the refilling process.

The fill station's outer enclosure and door assemblies shall be constructed of formed ¼ inch thick plate steel. Venting shall be provided in the bottom of the fill station to allow the rapidly expanding air from a ruptured cylinder to escape from the fill station. The fill station shall be ergonomically designed for maximum operator convenience and safety for refilling cylinders. The fill station door and cylinder holder assembly shall tilt out towards the operator 45 degrees, providing unobstructed access to the cylinder holder to load and unload the cylinders. A chrome plated handle and heavy-duty gas spring shall be incorporated into the design of the fill station to assist the operator in opening and closing the fill station door. It shall take no more than approximately eighteen pounds of force to open or close the fill station door thereby eliminating operator fatigue.

Each cylinder holder shall be lined to prevent scuffing the outer surface of the SCBA cylinders. For complete operator protection, the fill station shall include a safety interlock system that will prevent refilling SCBA cylinders unless the fill station door is closed and secured in the locked

[9] DOT storage systems available.
[10] Capacity referenced to 70°F.
[11] SCUBAs up to 31" maximum overall length including valve, boot and fill yoke.

position. The automatic interlock will require no actuation of secondary latching mechanism on the outside of the fill station.

Three fill hoses shall be located within the fill station. Each fill hose shall be equipped with a bleed valve and SCBA fill adapter of choice. Fill hose retainers shall be provided to anchor the fill hoses when not in use.

Testing and Preparation for Shipment

The breathing air station shall be tested by the manufacturer prior to shipment

A manufacturer's nameplate shall be placed on the interior of the electric panel. The nameplate shall include, at a minimum, manufacturer's name, model number, serial number, compressor block number, and date of manufacture. Voltage, phase / frequency, and amperage are located on another label inside the electrical panel

The station shall be suitably prepared for motor freight transport. The station shall be bolted to a wooden pallet, wrapped in sheet plastic, and fully protected by a wooden crate. The compressor intake and similar openings shall be suitably covered. Component parts, loose parts or associated spare parts shall be packaged separately and shipped on the same pallet if feasible.

Documentation

A documentation package shall be supplied with the station. The documentation package shall include, at a minimum, an operation manual on CD, recommended spare parts list, warranty information and a start-up/warranty registration form.

The Operator's Instruction and Maintenance Manual for the breathing air station shall be as detailed as possible, outlining all operation and maintenance instructions. The manual shall include detailed illustrated drawings for the compressor block and all system components along with a complete parts listing for all illustrated components. Warnings and safety precautions shall be identified clearly in the manual.

Available Accessories

The following shall be SUPPLIED

- Two additional ASME receivers
- Carbon monoxide monitor with calibration kit
- Remote Fill with bulkhead fitting, regulator, pressure gauge, line valve, and quick connect coupling