

**DIESEL-ELECTRIC**  
*6000 PSI*  
*Mobile Cylinder Charge Station (CCS)*  
*Trailer Mounted Compressor*  
*Dual Axle Trailer*

## **Bid Specifications**

This specification describes a mobile respiratory air compressor assembly that is dual powered by electric motor or a Diesel water-cooled engine. This system shall be used to charge self-contained breathing apparatus.

The air supplied by this charging system shall meet or exceed the requirements at Grade "E" breathing air as described in the Compressed Gas Association, Commodity Specification, G-7.1. The system shall meet all current NFPA, OSHA, NIOSH, State Industrial Safety and Vehicle Code requirement.

## **WARRANTY**

The equipment supplied shall be guaranteed to be new, of current design, and free of all defects in material and workmanship for a period of **one year(two years on the compressor block)** , based on prescribed service and maintenance.

## **AIR COMPRESSOR ASSEMBLY**

The assembly shall incorporate four stages. It shall be a reciprocating air-cooled compressor with relief valves and heat exchanger after each stage of compression. The compressor shall be a combination of, double-acting and single acting cylinder/piston design with three connecting rods. The cooling air shall be supplied from a fan assembly mounted on the flywheel that delivers not less than 6000 cubic feet of cooling air per minute. Lubrication shall be accomplished by means of a differential pressure/controlled splash system. **External pressure, (force-feed) oil pump providing oil spray into the fourth stage for lubrication is not acceptable.**

## **COMPRESSOR FEATURES**

Frame – The 100% cast iron designed to support the overhung crankshaft. Cylinders bolt directly to the cast iron frame. Frame is completely sealed yet allows for maximum accessibility.

Crankshaft – A unique overhung design supported by two heavy-duty ball bearings with replaceable crankpin bearing. Entire shaft is balanced with an integral counterweight to insure smooth trouble free operation.

Connecting Rods– Crankpin bearing inside the rod is precision ground requiring no alignment.

Cylinders – These are 100% cast iron, separately cast and individually bolted to the frame. The cylinders are precision honed for low oil carryover. Radial fins on the cylinders help remove heat and ensure 360 degree cooling of the cylinders.

Pistons – The first and second stages utilize a step type double acting piston, while the third stage utilizes a steeple type piston. The fourth stage uses a built-up, steeple type piston.

Rings – The first stage utilizes five compression rings and one oil control ring. The second stage utilizes three compression rings and one oil control ring. The third stage uses four compression rings and one oil scrapper ring. The fourth (final stage) using five compression rings and one oil scrapper ring.

Flywheel – The cast iron fan type flywheel with attached fan forces a “cyclone” air blast the deep finned cylinders, multi-finned intercooler, and finned tube aftercooler. The flywheel is balanced for vibration free operation. The fan is bolted to the flywheel and is available in several sizes to match ambient conditions.

Intercoolers – The intercoolers between stages are of finned tube construction, to provide maximum cooling area. They are located directly in the flywheel air blast, to remove the heat of compression between stages, keeping running temperatures and power loads to a minimum. The intercoolers are provided with a relief valve to prevent over-pressurization.

Intercooler Pressure Gauge – Pressure gauges are provided to display reading pressure in the intercooler(s). Abnormal pressures indicate when valve maintenance is required, eliminating costly tear down inspections.

Lubrication – Splash lubrication of running parts is simple and reliable. Lubrication dippers are integral with connecting rods and cannot come loose.

Inlet Filter – The filter has a durable carbon steel canister with baked enamel finish. A treated paper dry type) 10-micron inlet filter/silencer is standard.

Valves – The first and second stage shall have concentric ring valves that allow balanced and efficient inlet and discharge airflow. The third and fourth stages shall have concentric ring and plate valves that are of the cartridge type for ease of maintenance. All valves shall be made of premium grade stainless steel. Valve components are easily removable for inspection and maintenance.

Unloader – The unloader automatically bleeds the air from intercoolers and cylinders, providing a loadless start. This protects the motor from overload.

Burst Disc Discharge Relief Valve – The burst disc discharge relief valve, protects the system from any sudden, abnormal pressure surge. A conventional relief valve may not relieve have the capability to “relieve” quickly enough.

Low Oil Level Switch – Low oil level switch prevents the unit from operating when oil is low.

Air-cooled Aftercooler – Air-cooled aftercooler lowers discharge air temperature to within 15 degrees F. of ambient temperature.

Separator/Drain Traps – A drain trap is supplied between the second and third stage, third and fourth stage, and at the discharge of the compressor. The accumulated water and oil vapor is automatically removed.

Automatic Condensate Drain System – An automatic condensate drain system automatically drains the condensate traps during operation and when the compressor stops.

Compressor shall have piston rings on all pistons. The third and fourth stage pistons shall be connected to the guide piston by a concentric retainer, such that the compression piston is free of thrust loading, and always is in contact with the guide/drive piston to prevent damage caused by a free floating piston.

## PURIFICATION SYSTEM 65AL-4

1. The purification system shall consist of a mechanical oil/moisture separator and four chemical purification chambers (total of four). The chambers shall be designed to conform to the ASME code for Unfired Pressure Vessels.
2. Purification chambers shall be constructed in aluminum alloy 6082T6 as its anti-corrosive properties exceed all other chamber materials.
3. Purification system shall process a minimum of 84,000 SCF of air per cartridge set. Purified air shall be measured by the actual weight of Molecular Sieve. **Electronic dew point (DP) detection shall not be used as a means to claim extended chemical cartridge life.**
4. CO and dew point sensors shall not be installed in the purification chamber. **Sensors shall be installed downstream of all chambers so the sampled air is representative of that delivered to the B.A. cylinders.**

The purification system shall have the following minimum ratings:

1. 6000 PSI working pressure.
2. 4 to 1 safety factor.
3. 5 to 80 SCF minimum flow capacity.
4. 84,000 standard cubic feet of air purified per chemical cartridge set.

## CONTROLS AND MONITORS

All significant functions of the system shall be monitored and controlled by a controller. The operational status will be presented on an annunciator panel. In the event of an out-of-tolerance condition, the "controller" will "alarm" and stop the compressor. The "status" and/or "cause" will be indicated on the annunciator panel. All accumulated times on all significant time sensitive functions will be recorded and displayed on command. The system shall have the following as a minimum:

### FUNCTIONS / PARAMETERS MONITORED AND CONTROLLED CO & Dew Point Monitor

#### 1. COMPRESSOR ASSEMBLY

- a. Compressor start/stop (stop - advise normal and alarm abnormal condition)
- b. Discharge air pressure (stop - advise normal condition)
- c. Auto condensate drain control (cycle drain function, advise normal condition)
- d. Auto Drain/Cool Down Cycle \*\* (on each shutdown, pressure switch or Stop button; advise normal condition)
- e. Oil level and/or pressure (stop, alarm and advise abnormal condition)
- f. Give automatic service status for Air Sample, CO Monitor calibration and Purifier elements.
- g. Multi-level password feature for security.
- h. Downloadable history for diagnostic and performance evaluation.

\*\*COOL DOWN SYSTEM - The system shall have the capability of dumping all mechanical moisture traps every fifteen (15) minutes during compressor operation. Prior to shutdown, manually or automatically, it shall open and unload all moisture drain valves. It shall run for two to five minutes in order to cool and dry completely purge the system of all accumulated water and oil vapor.

#### 2. PURIFICATION SYSTEM

- a. Dewpoint monitoring/control (Constant monitoring) (stop, alarm and advise abnormal condition)
- b. Carbon monoxide monitoring/control (Constant monitoring) (stop, alarm and advise abnormal condition)
- c. Auto condensate drain control (advise status normal condition)
- d. "Purge" control, dumps the air exiting the purifier in order to clear up temporary alarm conditions (advise status normal condition)

### 3. HOUSEKEEPING

- a. Total time on compressor assembly (advise time on command)
- b. Time since compressor service (re-settable, advise time on command)
- c. Time since purification cartridge change (re-settable, advise time on command)
- d. Time on DP monitor cell (re-settable, advise time on command)
- e. Time on CO monitor cell (re-settable, advise time on command)
- f. Automatic calibration notification of CO monitors (advise procedure on command)

### 4. ALARMS (AUDIO/VISUAL)

- a. High discharge air temperature - with automatic compressor "STOP", the upper limit is factory set.
- b. High discharge air carbon monoxide - with automatic compressor "STOP",
- c. High discharge air moisture (dewpoint) - with a "WARN" to advise a pending filter (purification cartridge) change; an "ALARM" with automatic compressor "STOP",
- d. Low oil level and/or pressure - with automatic compressor "STOP".

### 5. SPECIAL FEATURES AND CONTROLS

- a. Prolonged run time control. Will stop the compressor assembly when pre-determined continuous run time has been exceeded. An audio/visual alarm and word advise is presented on the abnormal condition. "RESET" is required
- b. Time delay for false alarm recognition. Pre programmed to prevent false alarms from stopping the compressor or initial system setup and on purifier cartridge change.
- c. Demand Control \*(In Automatic mode)
- d. "Emergency Stop" control mounted on the main control panel.
- e. Back light control switch on panel.

### 6. DISPLAY

- |                          |                                   |
|--------------------------|-----------------------------------|
| a. Final Pressure        | "Storage Full" (up to 6000 PSI)   |
| b. Discharge Air Temp    | Up to 800 OF                      |
| c. Oil Level/Pressure    | "GO-NO-GO" alarm                  |
| d. Dew Point Level       | Up to 30 OF, down to minus 100 OF |
| e. Carbon Monoxide Level | 0 to 200 PPM                      |
| f. Timing Functions      | Hours and Minutes, calendar date  |

#### \*\* DEMAND CONTROL

The compressor will automatically respond to air "demand", keeping the air receivers at full pressure.

## CONTAINMENT FRAGMENTATION SHIELD

1. The charge system shall be a separate module. It shall be designed to safely and efficiently recharge breathing apparatus cylinders (BACs) in a protective containment "chamber" that will contain all fragments in the event of BAC failure. The resulting air blast shall be vented in a harmless direction such that any resultant air or particle flow will not cause injury or collateral damage to persons or property. **The containment chamber must have been tested to contain a one hour (90 cu ft) BAC for maximum safety per NFPA 1901.**
2. The design of the system shall be such that two BACs are charged within the "chamber" while two BACs are attached and made "ready" on the outside of the "chamber". When the first two BACs are charged, they shall be rotated out of the "chamber" as the "ready" BACs are rotated into the "chamber". Once the locks are engaged, the BACs automatically begin filling.
3. The charge adapters shall be the "rigid-fast-attach/quick release" type. The charge adapters shall be mounted 36 inches plus or minus four inches above ground/floor level, to provide an efficient ergonomic operation.
4. The device shall contain safety interlocks such that if the "chamber" is not closed and locked, air will not flow into the BACs. The "chamber" shall automatically lock and unlock by the operation of a single actuation lever. BAC charging shall be accomplished by presetting the air flow-control valve and pressure regulator to the required flow and air pressure and engaging the locks.

5. The control panel shall contain "safety" pressure gauges for air from the compressor, the air storage system, and the BACs being charged. Manual bleed valves shall be integrated into the charging circuit to provide a rapid and safe BAC disconnect.
6. An adjustable pressure regulator shall be provided to select the "charge" pressure for automatic BAC recharging.
7. Safety relief valve shall be incorporated to prevent over charging high pressure BACs. The system shall come with a 6000psi in, 5000 psi maximum out fill pressure regulator.
8. Where automatic control valves are used, manual by-pass valves shall be installed for emergency operation.
- 9 A "Full System Pressure" outlet port shall be provided at the rear of the control panel for additional devices to be added at any time.

## PERFORMANCE

This performance is based on charging a 30 minute, 4500 PSI, breathing air cylinder (BAC), from 0 to 4500 PSI at a rate not to exceed a pressure rise of 1500 PSI per minute (recommended by all BAC manufacturers). This rate will require three minutes to fill the BACs. This performance analysis shall include the necessary manipulations that are normal for that charge station. Mathematical computation of the compressor charge rate alone is not acceptable.

## AUTOMATIC SEQUENCE CONTROL

An Automatic sequence control valves shall be factory installed to manage the direction of airflow. When the storage and BAC pressure gauges equalize, the system shall prioritize the BACs. When the BACs are fully charged, the airflow is automatically redirected so as to fill the storage air receivers.

## AIR STORAGE SYSTEM

The air storage system shall be an integral part of the charge station. The cylinders shall be mounted in a Horizontal position, plumb as one volume. The system shall have ASME relief valves, isolation valves, drain valves, and pressure gauges as required by current federal and state OSHA codes. Each cylinder shall be rated for a minimum of; 5200 PSIG @ 4 to 1 safety factor, and have a capacity of 454 standard cubic feet @ 5000 PSIG or 7000 PSIG @ 3 to 1 safety factor, and have a capacity of 525 standard cubic feet @ 6000 PSIG. The system shall be equipped with ASME storage cylinders.

## LOW PRESSURE REGULATOR

A low-pressure outlet shall provide regulated air and shall have an adjustable pressure regulator to provide pressure to 200psi. The regulator shall be a heavy-duty type with solid aluminum body and rated for 6000psi-inlet pressure.

## MOBILE TRAILER UNIT

The complete mobile air unit shall be mounted on a **dual axle** trailer assembly with hitch assembly, tires, axle suspension and wheels. The axle shall be equipped with surge brakes and the trailer suspension shall be torsion bar design (axles shall be adjustable). **The complete mobile air unit shall be efficiently designed and mounted so that the complete assembly, including tongue shall not exceed 193" in length, 75" in width and 91" in height with light tower in stowed position.**

The entire trailer chassis shall be constructed from structural steel 2X5-inch channel C4 steel and 3/8 angle and with a web of 1/8 inch. The axles shall be a torsion bar design commensurate with the GVW rating (7000lb). Each corner of the trailer shall have lifting eyes, 3 inches in diameter, constructed from 5 inch wide flat bar by ½ inch thick. The tongue shall be constructed of 3X3-inch square tube, 1/4 inch thick. All structural steel shall be A36.

The complete assembly shall be a weldment with all joints 100% weld filled with penetration of at least 50% of the material thickness.

The mobile air unit components shall be housed under a protective cover with top and sides enclosed. Both sides of the cover shall have a single horizontally hinged lift up door with shocks to hold the doors open for component access and service. The compressor shall have wire guards installed for safety around the moving parts. The trailer can be operated with door closed.

The trailer wheels shall be Aluminum; tires shall be ST225/75R 15" highway trailer tires, with chrome center cap and lug nuts. The trailer assembly shall have all required FMVSS lighting wired to a weatherproof 7-pin trailer plug with pigtail located near the tongue of the trailer for easy connection to the tow vehicle. The tongue shall be equipped with a retractable caster tongue jack to aid in moving the trailer around and never needs to be removed for travel. The tongue shall be equipped with a 2 5/16-inch ball.

## **POWER SOURCES**

PERFORMANCE SPECIFICATION (230/60Hz)

35.8 Piston Displacement SCFM

20.5 ACFM @ 6000 PSI

25.5 SCFM Charging Rate (Formula from 0 PSI to 6000 PSI)

29.5 SCFM Charging Rate (Formula from 500 PSI to 3000 PSI)

6000 PSI Minimum Continuous Duty

20 H.P. Electric Motor-230 Volts /60Hz

915 RPM Compressor Speed Maximum

47 HP Water-cooled engine

## **COLD WEATHER PACKAGE**

Includes heating elements for engine water-jacket, compressor crankcase oil and for condensate drain valves. One centrally located 120VAC male inlet receptacle with standard household configuration, and an adjustable throttling curtain to control exiting warm air.

## **CALIBRATION KIT FOR CARBON MONOXIDE MONITOR**

Includes a calibration regulator and connection hose assembly, 1ea 20PPM calibration gas cylinder and 1ea ZeroPPM calibration gas cylinder with Material Safety Data Sheets for both. Complete instructions for proper calibration and a protective hard plastic carrying case that houses all kit components. The calibration gas cylinders volume shall be enough for a minimum of twelve calibrations when used according to the instructions provided.

## **LIGHT TOWER & GENERATOR**

The apparatus shall be equipped with an auxiliary 2 bearing generator, rated no less than 7.2KW single phase, 110/220 VAC outputs and speed not to exceed 1800 RPM.

The apparatus shall have a minimum of a 15-foot telescoping, pneumatic flood light tower, with four 300-watt quartz lights and optional pricing for LED lighting to meet or exceed the output of the four 300-watt quartz lights. The system shall have four pairs of outlet 110volts/15amps and one 220 outlet.

## **SPARE TIRE AND WHEEL ASSEMBLY**

Spare tire and wheel assembly, matching trailer tires and wheels, shall be mounted outside the enclosure for easy access. An appropriate lug wrench shall be provided.

## **SCUBA ADAPTER KIT**

Comes with CGA 346/347 type adapter and instructions to fill one SCUBA tank safely.

## **LOW & HIGH PRESSURE HOSE REEL**

A low-pressure hose reel shall be mounted and piped within the trailer assembly. Hose reel shall be rated for 300psi working pressure and shall be capable of holding 150ft of low-pressure hose.

Reel shall include:

Side disc with roller edges incorporating concentric reinforced ribs for extra strength.

Bearings to support the axle on each end of the reel to provide smooth rotation and eliminate weight on the swivel joint.

Swivel joint inlet to permit the reel to rotate freely while connected.

Reel to be equipped with electric rewind motor.

Rollers shall be provided to guide low-pressure hose on and off reel. A stop shall be supplied to prevent the end of the hose from being wound on the reel.

A high-pressure hose reel shall be mounted and piped within the trailer assembly. Hose reel shall be rated for 6000psi working pressure and shall be capable of holding 250ft of high-pressure hose.

Reel shall include:

Side disc with roller edges incorporating concentric reinforced ribs for extra strength.

Bearings to support the axle on each end of the reel to provide smooth rotation and eliminate weight on the swivel joint.

Swivel joint inlet to permit the reel to rotate freely while connected.

Reel to be equipped with electric rewind motor.

Rollers shall be provided to guide high-pressure hose on and off reel. A stop shall be supplied to prevent the end of the hose from being wound on the reel.

## **DELIVERY, INSTALLATION & TRAINING**

The complete system shall be assembled and tested as a complete system at the factory prior to shipment. A test certificate shall be part of the Operation manual (1 set) that shall be shipped with the system.

The system shall be delivered FCA seller's premise.

The system shall be set up, installed, and checked out at the user's destination by the distributor.

The user shall receive training by the distributor on the operation and maintenance of the system as required.