



Installation, Operation and Maintenance Manual

2-15 Hp “Oil-Less” Scroll Medical Air Systems

This unit purchased from: _____

Date purchased: _____

Model number: _____

Serial number: _____

Option(s) included: _____

Any information, service or spare parts requests should include the machine serial number and be directed to:

BeaconMedæx

1800 Overview Drive
Rock Hill, SC 29730

Telephone: (888) 4-MEDGAS
Fax: (803) 817-5750

BeaconMedæx reserves the right to make changes and improvements to update products sold previously and support materials without notice or obligation.

Issue Date: February 4, 2009
MAN 01- 002

Table of Contents

Safety Precautions

1.0 General Information

- 1.1 SPC (Single Point Connection) Base Mount Standard Components

2.0 Installation

- 2.1 Inspection Upon Receiving
- 2.2 Handling
- 2.3 Location
- 2.4 Space Requirements
- 2.5 Piping
- 2.6 Wiring

3.0 System Operation

- 3.1 Prestart-up
- 3.2 Initial Start-up
- 3.3 Normal Start-up
- 3.4 Normal Operation
- 3.5 Normal Shutdown
- 3.6 Emergency Shutdown/Alarms

4.0 Trouble Shooting

5.0 Maintenance

- 5.1 Maintenance Schedule
- 5.2 Replacement Filter Elements
- 5.3 Maintenance Kits

6.0 Inspection/Replacement Procedures

- 6.1 V-belts
- 6.2 Air Intake Filter
- 6.3 Readjustment of Cut-out and Cut-in Pressure

7.0 Replacement Parts

8.0 Specifications

9.0 Maintenance Record

Table of Contents (continued)

Appendix A - Desiccant Dryer

- A.1 General Information
 - 1.1 Drying Cycles
 - 1.2 Prefilter
 - 1.3 Automatic Drain Valves
- A.2 Operation
 - 2.1 Initial Start-Up
 - 2.2 Procedure to Switch Off Dryer
 - 2.3 Normal Start-Up
 - 2.4 Maintenance Shut Down
- A.3 Trouble Shooting
- A.4 Maintenance
 - 4.1 Maintenance Schedule
- A.5 Replace/Repair
 - 5.1 Desiccant Replacement Procedure (1-5 hp)
 - 5.2 Desiccant Replacement Procedure (7.5-20 hp)
- A.6 Dryer Specifications

Appendix B - CO Monitor

- B.1 Introduction
- B.2 Specifications
 - 2.1 Monitor
 - 2.2 Sensor
 - 2.3 Display
 - 2.4 Annunciator Lights at Monitor Display
- B.3 Operation
 - 3.1 Alarms
- B.4 Maintenance
 - 4.1 Repair Policy
 - 4.2 Maintenance Schedule
 - 4.3 Calibration
 - 4.4 Sensor Checkout and Changing
- B.5 Trouble Shooting
- B.6 Accessories and Replacement Parts

Appendix C - Ceramic Dew Point Monitor

- C.1 Introduction
- C.2 Specifications
 - 2.1 Monitor
 - 2.2 Sensor
- C.3 Operation
 - 3.1 Alarms
- C.4 Maintenance
 - 4.1 Repair Policy
 - 4.2 Maintenance Schedule
- C.5 Trouble Shooting

Safety Precautions

Pressurized air from the system may cause personnel injury or property damage if the unit is improperly operated or maintained.

Operator should have carefully read and become familiar with the contents of this manual before installing, wiring, starting, operating, adjusting and maintaining the system.

Operator is expected to use common sense safety precautions, good workmanship practices and follow any related local safety precautions.

In addition:

- **Before starting any installation or maintenance procedures, disconnect all power to the package.**
- All electrical procedures must be in compliance with all national, state and local codes and requirements.
- A certified electrician should connect all wiring.
- Refer to the electrical wiring diagram provided with the unit before starting any installation or maintenance work.
- Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.
- Notify appropriate hospital personnel if repairs or maintenance will affect available compressed air levels.
- Air inlet must be placed in an area free of toxic or hazardous contaminants. It must be kept away from ETO exhaust vents, vacuum exhaust vents, areas close to automotive exhausts, etc., in accordance with NFPA 99.
- Prior to using the **LifeLine®** Scroll Medical Air System, the medical facility must have a Certifier perform all installation tests as specified in NFPA 99. The medical facility is also responsible for ensuring that the Medical Air meets the minimum requirements as specified in NFPA 99.
- This is a high speed, rotating piece of machinery. Do not attempt to service any part while machine is in operation.
- To prevent automatic starting, disconnect all electrical power before performing any maintenance.
- Do not operate unit without belt guards, shields or screens in place.
- Make sure that all loose articles, packing material, and tools are clear of the package.
- Check all safety devices periodically for proper operation.
- Never operate a compressor with its isolation (shutoff) valve closed or without its relief valve in place. Damage to the compressor may occur.
- **Do not add lubricating oil of any kind to the compressor.** Absolutely no oil is required for proper operation.
- The "Hand" mode of operation should only be used for emergencies such as a PLC malfunction and should not be used for normal operation.
- Electrical service must be the same as specified on the control panel nameplate or damage to the equipment may occur.
- Vibration during shipment can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten as necessary.

1.0 General Information

1.1 SPC (Single Point Connection) Base Mount Standard Components

System Design

The LifeLine® Scroll Medical Air SPC (Single Point Connection) system consists of a single point connection, base mounted design consisting of two compressors, two motors, duplexed desiccant drying system with purge control, duplexed line filters and regulators, integral pre-wired control panel and corrosion resistant air receiver. Each system has a maximum base size of 34" x 47.50" (86 x 121 cm), and is fully compliant with the latest edition of NFPA 99. The complete package is pre-wired, pre-piped, and assembled on one common base with single point connections for electrical, intake air, discharge air, and condensation drain.

Compressor Module

The compressor is a continuous duty rated scroll type compressor. The design is single stage, air-cooled, consisting of one fixed and one orbiting scroll sealed with PTFE tip seals between the scroll halves and rated for 120 psig discharge pressure. The scrolls are protected from dust or contamination with a two part face seal. Orbiting bearings for 7.5 and 15 horsepower scrolls are grease filled and permanently sealed type bearings requiring no lubrication at any time. Orbiting bearings for 2, 3, 5 & 10 horsepower scrolls are grease filled and require grease lubrication, see section 5 for recommended grease intervals. The drive bearing is grease filled and lip sealed for its maintenance interval. The scroll case is constructed of diecast aluminum. Maximum heat dissipation is achieved through an integral cooling fan and air ducting.

Compressor Drive and Motor

The compressor is v-belt driven and protected by an OSHA approved totally enclosed beltguard. A pivoting motor mounting base that is fully adjustable with one adjusting screw is incorporated to achieve belt tensioning. The motor is a NEMA rated, open dripproof, 2HP/1800RPM or 2-7.5HP/3600RPM, with 1.15 service factor suitable for 208 or 230/460V electrical service.

Intake Piping

Each compressor has a piped intake manifold with one "hospital type" inlet air filter with threaded opening for remote intake connection. The inlet filter removes dust from the incoming air through cyclonic action and through an element.

Discharge Piping

Each compressor is equipped with an integral air-cooled aftercooler designed for a maximum approach temperature of 10° F complete with automatic solenoid drain valve. Each compressor is equipped with a wired high discharge air temperature shutdown switch. The compressor discharge line includes a flex connector, safety relief valve, isolation valve and check valve. The discharge piping of each compressor incorporates an integral valve to provide load-less starting and rapid air evacuation between the check valve and scroll discharge at shutdown to produce less than 1/4 revolution of reverse rotation of the scroll. The discharge air piping is made of brass and/or stainless steel. The discharge flex connector is braided, 304 stainless steel, brass, or bronze.

Isolation System

The compressor and motor shall be fully isolated from the system base by means of a four-point, heavy duty, isolation system for a minimum of 95% isolation efficiency.

1.0 General Information (continued)

1.1 SPC (Single Point Connection) Base Mount Standard Components

The **LifeLine**® Scroll Medical Air SPC (Single Point Connection) system consists of a NEMA 12, U.L. Labeled control system, duplexed desiccant drying system, duplexed final line filters, duplexed final line regulators, and combination dew point/CO monitor. All of the above are factory piped and wired in accordance with NFPA 99 and include valving to allow complete air receiver bypass, as well as air sampling port.

Dryer

Each desiccant dryer is individually sized for peak calculated demand and capable of producing a 10°F (-12°C) pressure dew point. Dryer purge flow is minimized through a demand-based purge saving control system that includes a **441™** transfer valve utilizing two ceramic slide plates that is covered by a 10-year factory warranty. The inlet to each dryer includes a mounted prefilter with automatic drain and element change indicator.

Control System

The mounted and wired control system is NEMA 12 and U.L. labeled. This control system provides automatic lead/lag sequencing with circuit breaker disconnects for each motor with external operators. The control panel also includes full voltage motor starters with overload protection, redundant 120V control circuit transformers, phase reversal protection, visual and audible reserve unit alarm with isolated contacts for remote alarm, hand-off-auto lighted selector switches, pressure gauge, and duplexed runtime hour meters. Automatic alternation of both compressors based on a first-on/first-off principle with provisions for simultaneous operation if required, automatic activation of reserve unit if required, visual and audible alarm indication for high discharge air temperature shutdown with isolated contacts for remote alarm are included.

Final Line Filters and Regulators

Fully duplexed final line filters rated for 0.01 micron with element change indicators, along with duplexed final line regulators, are factory mounted and piped.

Dew Point Hygrometer/CO Monitor

The factory mounted, piped and wired, dew point hygrometer and CO monitor include remote alarm contacts. The dew point sensor is a ceramic type with system accuracy of $\pm 2^\circ \text{F}$. The CO sensor is a chemical type with system accuracy of $\pm 2 \text{ PPM}$ (at 10 PPM) for carbon monoxide. The dew point alarm is factory set at 39°F (4°C) per NFPA 99, and the CO alarm is factory set at 10 PPM. Both set points are field adjustable. High CO and high dew point conditions are indicated with visual and audible alarms.

Air Receiver

The vertical air receiver is corrosion resistant, ASME Coded, National Board Certified, and rated for a minimum 150 PSIG design pressure. The tank piping includes a liquid level gauge glass, safety relief valve, manual drain valve, and a timed automatic solenoid drain valve.

2.0 Installation

2.1 Inspection Upon Receiving

The condition of the **LifeLine**® Scroll Medical Air system should be carefully inspected upon delivery. Any indication of damage by the carrier should be noted on the delivery receipt, especially if the system will not be immediately uncrated and installed. **LifeLine**® Scroll systems may remain in their shipping containers until ready for installation. If **LifeLine**® Scroll systems are to be stored prior to installation, they must be protected from the elements to prevent rust and deterioration.

DO NOT REMOVE the protective covers from the inlet and discharge connection ports of the unit until they are ready for connecting to the hospital's pipeline distribution system.

2.2 Handling

!!WARNING!!
USE APPROPRIATE LOAD RATED LIFTING EQUIPMENT AND OBSERVE SAFE LIFTING PROCEDURES DURING ALL MOVES.

The compressor package can be moved with either a forklift or dollies. Be sure that the orange spacers used to prevent the compressor and motor assemblies from floating are in place. These spacers will prevent unnecessary movement of the compressor and motor while moving and mounting the unit. Keep all packing in place during installation to minimize damage. Walk along the route the unit must travel and note dimensions of doorways and low ceilings. **LifeLine**® Scroll 2-7½ hp systems are designed to go through 36" doorways. **LifeLine**® Scroll 10-15 hp systems must be separated to go through 36" doorways. If this is necessary, carefully label all electrical connections that are removed for easier re-assembling at the final destination. Units should be placed to ensure easy access to perform maintenance and high visibility of indicators and gauges.

2.3 Location

The **LifeLine**® Scroll Medical Air system should be installed indoors in a clean, well-ventilated environment. Areas of excessive dust, dirt or other air-borne particulate should be avoided.

Secure the package to a flat, level surface capable of supporting the weight and forces of the unit. Make sure that the main base is not bowed, twisted, or uneven. Because of the internal flexible hose connections and spring isolators, **no special foundation is required**. However, the unit base must be securely bolted using all mounting holes provided in the base. If a raised concrete pad is used, the base must not overhang the concrete pad. A method to drain away moisture is necessary. If a gravity drain is not available, a connection to a drain is necessary. After securing the unit to the floor, remove the orange spacers from under the compressor/motor structure.

2.0 Installation (continued)

2.3 Location (continued)

The area should have an average ambient temperature of 70°F (21°C) with a minimum ambient temperature of 40°F (4.4°C) and a maximum ambient temperature of 100°F (37.8°C). (**Note:** At temperatures below 32°F the bare compressor will not be adversely affected, but freezing of the condensate can occur which could affect operation.)

Sound levels of 65 to 80 dbA are to be anticipated depending on the size of the package (duplex, triplex, quad). Though the sound levels are not excessive, they should be considered when locating the system.

2.4 Space Requirements

Scroll Medical Air systems should be placed to ensure easy access to perform maintenance and high visibility of indicators and gauges. It is recommended that a minimum space of 24" be allowed on all sides of the compressor system for ventilation and maintenance. A minimum space of 36" in front of the control panel is required by NEC code. A vertical distance of 36" is required above the unit for ventilation and maintenance.

2.5 Piping

2.5.1 Intake Piping

WARNING:
The air intake must be placed in an area free of toxic or hazardous contaminants; it must be kept away from ETO gas exhaust vents, vacuum exhaust vents, areas close to automotive exhausts, etc., in accordance with NFPA 99.

The air intake line must be piped to the outside in accordance with NFPA 99. To ensure that no restriction of airflow will occur, size the piping according to the following chart. All piping must be precleaned for medical gas in accordance with NFPA 99. The outside pipe must be turned down and screened to prevent contamination. The source of air is typically from outside the building. In hot humid areas, using the building's air-conditioned supply (per NFPA 99) may improve operating conditions of the system.

All of the 10-15 hp SPC systems have the necessary flex connectors for the air intake and discharge factory piped, and no further flex connectors are needed. However, for the 2-7½ hp systems, the customer must install the (one) intake flex connector.

2.0 Installation (continued)

2.5 Piping (continued)

2.5.1 Intake Piping (continued)

LifeLine Units	System Pipe Length (ft) - See Notes											
	25	50	75	100	150	200	250	300	350	400	450	500
Duplex 2 HP	1.25	1.25	1.25	1.25	1.50	1.50	1.50	2.00	2.00	2.00	2.00	2.00
Duplex 3 HP	1.25	1.25	1.50	1.50	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.50
Duplex 5 HP	1.50	2.00	2.00	2.00	2.00	2.50	2.50	2.50	2.50	2.50	2.50	3.00
Duplex 7.5 HP	2.00	2.00	2.00	2.50	2.50	2.50	3.00	3.00	3.00	3.00	3.00	3.00
Duplex 10 HP	2.00	2.50	2.50	2.50	2.50	3.00	3.00	3.00	3.00	3.50	3.50	3.50
Duplex 15 HP	2.50	2.50	2.50	3.00	3.00	3.50	3.50	3.50	3.50	4.00	4.00	4.00
Triplex 10 HP	3.00	3.00	3.00	3.00	3.00	3.00	3.50	3.50	3.50	3.50	4.00	4.00
Triplex 15 HP	3.00	3.00	3.00	3.00	3.50	3.50	4.00	4.00	4.00	4.00	5.00	5.00
Quad 10 HP	3.00	3.00	3.00	3.00	3.50	3.50	3.50	4.00	4.00	4.00	4.00	5.00
Quad 15 HP	3.00	3.00	3.50	3.50	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00

- Notes:**
- 1) All pipe sizes are based on the following: copper pipe (Type L), 14.7 psia, 70 deg F.
 - 2) The minimum pipe size must be maintained for the total length of the inlet pipe.
Use next larger size pipe in the event the minimum size is not available.
 - 3) When determining the total pipe length, add all the straight lengths of pipe together in addition to the number of elbows times the effective pipe length for that pipe size.
(See the table and example below.)

Effective Pipe Length Equivalent to each 90 deg Elbow										
Pipe Size (in.)	1.25	1.50	2.00	2.50	3.00	3.50	4.00	5.00	6.00	
Eff. Pipe Length (ft)	3.4	4.0	4.9	6.4	7.9	9.4	10.0	11.9	13.2	

Example:

Select the pipe size for a Duplex 10 HP with 20 feet of straight pipe and six elbows:

- A) Select the pipe size of 2" diameter for 20 feet of straight pipe.
- B) Determine the eff. Pipe length for an elbow of 2" dia. (EPL = 4.9 ft / elbow).
- C) Calculate the SYSTEM PIPE LENGTH {SPL (2.0" D) = 20 + (6 x 4.9) = 49.4 ft}
- D) Check this SYSTEM PIPE LENGTH to see if it exceeds the minimum pipe size. In this case it does, select the next larger pipe size from the table (D = 2.5").
- E) To double-check the pipe size, recalculate the SPL with the new diameter.
SPL (D = 2.5") = 20 + (6 x 6.4) = 58.4 ft, which is okay.

2.0 Installation (continued)

2.5 Piping (continued)

2.5.2 Discharge Piping

Minimum Discharge Pipe Size*

LifeLine Units	Pipe Size
Duplex 2 HP	1/2
Duplex 3 HP	1/2
Duplex 5 HP	3/4
Duplex 7.5 HP	3/4
Duplex 10 HP	3/4
Duplex 15 HP	1
Triplex 10 HP	1
Triplex 15 HP	1-1/4
Quad 10 HP	1
Quad 15 HP	1-1/4

*A larger discharge pipe size may be required depending on the length of distribution piping in the facility. However, the distribution pipe size should not be less than the minimum pipe size shown above.

2.0 Installation (continued)

2.6 Wiring

WARNING!
**BE SURE TO DISCONNECT ALL ELECTRICAL POWER FROM THE COMPRESSOR
BEFORE PERFORMING ANY ELECTRICAL PROCEDURES.**

Refer to the electrical diagram provided with the unit before starting any installation or maintenance work.

Do not operate compressor on a voltage other than the voltage specified on the compressor nameplate.

All customer wiring should be in compliance with the National Electrical Code and any other applicable state or local codes.

CAUTION: In the Duplex configuration, all voltages will be disconnected from the compressor modules using the circuit breaker. Opening the appropriate fused knife-switch disconnects disconnects control power. Turning off the appropriate motor circuit breaker disconnects motor power.

Refer to the wiring diagram(s) that came with the compressor system for pertinent wiring connections.

Electrical power for the Medical Air system must be supplied from the emergency life support circuit.

Check the control voltage, phase, and amp ratings before starting the electrical installation, and make sure the voltage supplied by the hospital is the same. The wire size should be able to handle peak motor amp load of all operating units, refer to the full load and compressor system amperes on the wiring diagram.

Check all electrical connections within the air system that may have loosened during shipment.

Qualified electricians only should make power connections to the control panel and any interconnecting wiring.

Ensure that the emergency generation system electrical supply is consistent with the air system's requirements.

Three-phase power supplied from emergency generator(s) must match that of the normal supply to allow for correct direction of the motor rotation at all times.

3.0 System Operation

3.1 Prestart-up

The contractor should notify **BeaconMedæx** two weeks prior to start-up date to schedule an appointment for an authorized technician to review the installation prior to start-up.

CAUTION: Failure to install the unit properly and have an authorized technician from **BeaconMedæx** start-up the system can void the manufacturer's warranties.

WARNING:

Prior to putting the LifeLine® Scroll Medical Air system into use, the medical facility must have a Certifier perform all installation tests as specified in NFPA 99. The medical facility is also responsible for ensuring that the Medical Air meets the minimum requirements for Medical Air as specified in NFPA 99.

Prestart-up and start-up procedures should be performed for a new installation or when major maintenance has been performed.

WARNING:

Have more than one person on hand during prestart-up and start-up procedures to ensure safety and to facilitate certain checks.

The main power source to the control panel should be OFF for the duration of the visual inspection.

Ensure that the equipment is installed on a solid level surface. Walk around the system to ensure that there is enough clearance on all sides to perform operational checks/actions and maintenance. The temperature of the area containing the modules should be approximately 70°F (21.1°C) with a minimum ambient temperature of 40°F (4.4°C) and a maximum ambient temperature of 100°F (37.7°C).

Check the inlet piping for proper size and connection to the compressor modules. Refer to section 2.5 in this manual.

Check all piping system joints that might have come loose during shipment and installation to ensure they are tight.

Check the air receiver, dryers, controls, and compressors for damage.

Check the drain valves on the air receiver and compressor modules.

Check all valves for full open and full close travel. Ensure that the systems valves are positioned for proper operation. (Refer to labeling on valve handles.)

Remove all packing material from the unit including the orange shipping blocks under the compressor module(s).

Check the electrical connections to the control cabinet.

3.0 System Operation (continued)

3.1 Prestart-up (continued)

Verify electrical service. Before starting the **LifeLine®** Scroll Medical Air system, check to see that voltage, amperage, and wire size are appropriate.

CAUTION: Electrical service must be as specified or damage to equipment may occur.

WARNING:

To prevent electrical shock, ensure that ALL electrical power to the system is OFF, including the disconnect switches and H-O-A switches on the control panel. The facility's supply circuit breaker should also be locked out.

Open the electrical cabinet by loosening the fasteners on the front.

CAUTION: Vibration during shipment and installation can loosen electrical terminals, fuse inserts, and mechanical connections. Tighten as necessary.

Check the electrical cabinet for any broken switches, lights, etc.

Check that all motor starter connections are tight and that there are no loose objects such as terminal lugs, screws, nuts, etc., in the cabinet.

3.0 System Operation (continued)

3.2 Initial Start-up

CAUTION: Complete the prestart-up procedure before continuing with the initial start-up procedure

WARNING:

To prevent electrical shock, ensure that **ALL** electrical power to the system is **OFF**, including the disconnect switches and H-O-A switches on the control panel. The facility's supply circuit breaker should also be locked out.

NOTE: DO NOT ADD OIL TO THE COMPRESSOR. The design of the **LifeLine®** Scroll compressor is totally oil-less. It is not necessary to fill the crankcases with oil.

WARNING:

Ensure that all loose articles, packing material, and tools are clear of the system.

Set the H-O-A switches are to O (OFF).

Check all voltages supplied to the **LifeLine®** system to ensure they are the required value and phases needed by the control panel.

Open the inlet isolation valve on each compressor.

Open the outlet isolation valve on each compressor.

Open the receiver isolation valves.

Close the receiver bypass valve.

Close the CO sensor isolation valve.

Close the dewpoint sensor isolation valve.

Close the inlet and outlet valves on **both** dryer/filter/regulator assemblies.

Close the outlet isolation valve.

Apply power to the system and turn the disconnect switches to "On".

Check for correct direction of rotation of each compressor by momentarily turning the H-O-A switch to the "Hand" position and observing rotation.

WARNING:

DO NOT RUN THE COMPRESSOR BACKWARDS!

Rotation direction arrows are located on the belt guard (rotation is counter clockwise, facing the compressor pulley). Correct the rotation, if required, by switching the motor leads at the starter.

REMOVE POWER BEFORE WORKING ON ANY ELECTRICAL CONNECTIONS.

3.0 System Operation (continued)

3.2 Initial Start-up (continued)

Start each compressor by turning the H-O-A switch to the "Auto" position. Allow each compressor module to operate for a short time (15 to 30 seconds) and check for any unusual noises or vibrations.

If everything appears normal, allow each compressor to run in the "Auto" mode until pressure builds in the air receiver. The lag compressor should stop when the panel gauge pressure reaches 105 psig. Pushing the reset button on the control panel can now silence the lag alarm. The lead compressor should stop when the panel gauge pressure reaches 110 psig. Check for any leaks in the piping up to the inlet isolation valves of the dryers. Repair leaks, if needed.

Open the inlet isolation valve on one of the dryers. The pressure reading on one of the gauges should be the same as the panel pressure gauge. The other gauge will normally read 0 psig, and airflow will be coming from the dryer purge exhaust muffler. It is possible, but unlikely, that the outlet dew point may be low enough to activate the purge saving feature at start-up. If the purge saving feature is activated, then both dryer pressure gauges will be at the same pressure as the control panel gauge and there will be no flow from the dryer purge exhaust muffler. Check for air leaks.

Adjust the pressure regulator to the desired pressure setting.

Open the outlet isolation valve of the dryer/filter/regulator group. Check for air leaks.

Open the dew point sensor isolation valve.

Open the CO sensor isolation valve.

Slowly open the outlet isolation valve to allow air to flow out to the hospital.

Adjust the pressure regulator setting if necessary.

If everything appears normal, open the inlet isolation valve of the other dryer/filter/regulator assembly. If the dryer pressures appear as expected, open the dryer/filter/regulator outlet isolation valve. Close the other dryer/filter/regulator inlet and outlet isolation valves.

CAUTION: Only one dryer/filter/regulator group should be on line at a time.

Adjust the pressure regulator to the desired pressure.

Adjust the pressure regulator setting, if necessary.

The dryer should purge until the dew point monitor reading is below minus 10°C. If dew point is below minus 10°C; both pressure gauges of the on-line dryer will read the same as the panel pressure gauge.

Observe the system for normal operation.

3.0 System Operation (continued)

3.3 Normal Start-up

Hospital shutoff valve - CLOSED.

Isolation (shutoff) valves - OPEN.

Receiver bypass valve - CLOSED.

One air dryer off line with valves CLOSED; the other air dryer on-line with the valves OPEN.

Main electrical power - ON.

Disconnect switches - ON.

H-O-A switches - AUTO (starting all compressor units).

Pressure gauge increasing to 110 psi.

Check that each compressor shuts down as it reaches its off-limit pressure.

Check that the mainline regulator is set for the desired output pressure and adjust if necessary.

Slowly OPEN the hospital shutoff valve.

Note: Opening the hospital valve may cause a pressure demand that brings the lag compressors back on-line. This is a normal sequence.

Note: The Medical Air system is now on-line and in the Normal Operating Mode (lead/lag operation).

To verify dryer operation, refer to Appendix A for desiccant dryers.

3.0 System Operation (continued)

3.4 Normal Operation

3.4.1 Controls

During normal operation, all H-O-A switches should be turned to the "Auto" position so that the PLC (Programmable Logic Controller) can effectively control the system. The PLC monitors the system pressure switch condition (see the table 3-1), starts and stops the compressors depending on changing pressure switch conditions, and automatically alternates the lead position between compressor units.

In a typical **duplex** system, one compressor will be able to handle the system load. The PLC will signal the lead compressor to start when the lead pressure switch (PS-1) closes at 90 psig with falling system pressure. If the one compressor can carry the load, then the system pressure will rise to 110 psig and PS-1 will open. At this point, the PLC will turn off the lead compressor. When the system pressure drops again and PS-1 closes the PLC will automatically sequence the lead role to the other compressor and will start it. This is also known as "first on/first off" instead of the more traditional "last on/first off". With the "first on/first off" sequencing technique, starts and stops on the compressor are minimized. If the lead compressor runs continuously in lead for more than 17 minutes, the PLC will automatically sequence the compressor attempting to evenly distribute the run time among all available compressors. If during operation, the second compressor is required to come on in addition to the lead compressor, the PLC will turn on the "Lag Alarm" (see Section 3.6).

In a **triplex** or **quadruplex** system, the operation is very similar to the duplex operation described above with the following differences. For each additional compressor, there is an additional pressure switch (see Table 3-1 below). With a triplex or a quadruplex system, the lag unit running alarm may not necessarily correspond to the third or fourth compressor coming on. To determine when the PLC turns on the lag alarm, it counts the number of units in the "Auto" position and makes a decision based on the pressure switch conditions. For example, in a quadruplex system with only 2 H-O-A switches in the "Auto" position, the lag alarm will turn on when the second unit is turned on (or the lag pressure switch PS-2 closes at 85 psig).

Note: For a compressor to be considered available to the system (PLC), its H-O-A switch must be in the "Auto" position.

Table 3-1 System Pressure Switch Factory Settings

* To adjust any of the pressure switch settings, refer to section 6.4.

System Pressure Switch	Start (Close)	Stop (Open)
Lead (PS-1)	90 psig	110 psig
Lag 1 (PS-2)	85 psig	105 psig
Lag 2 (PS-3) - Tpx and Qpx Only	80 psig	100 psig
Lag 3 (PS-4) - Qpx Only	75 psig	95 psig

For maintenance, or other reasons, the compressors can operate in the "Hand" position. In this condition, the compressor in the "Hand" position will start and stop depending on pressure switch conditions.

Note: Any compressor in the "Hand" position will start and stop depending pressure switch conditions.

3.0 System Operation (continued)

3.4 Normal Operation (continued)

3.4.2 Dryers

This fully automatic, heat-less type dryer alternately cycles the compressed process gas flow through two desiccant charged vessels where the gas' vaporous moisture content is adsorbed. One desiccant vessel is always on-line in a **drying cycle** throughout normal dryer operation. The opposite, off-line vessel is in a **regeneration cycle** for removal of the previously adsorbed moisture content, or in a purge saving cycle at line pressure.

When the dryer selector switch is in the "**continuous purge**" position, the dryer will shift towers every 30 seconds. At normal operating conditions, one tower is approximately 110 psig and the other tower is at 0 psig. Any condition other than this is not normal and will cause a high dew point condition. During tower changeover, the online chamber will exhaust, and the chamber that is regenerating (purging) will come to line pressure. There is no repressurization cycle. If the selector switch is on the continuous purge cycle, the dryer will use 15% of the system capacity to purge the dryer.

When the dryer selector switch is in the "**controlled purge**" position, the dryer purge is controlled by the dew point monitor and purging depends on the dew point condition. When the dew point reading is above the setpoint of -10°C , the dryer will function normally (one tower at 110 psig, one tower at 0 psig). When the dew point is below the setpoint of -10°C on the dew point monitor, closing the exhaust valve turns off purge. In this condition, both towers will be approximately 110 psig and the dryer will continue to shift towers. However, the off line chamber will remain at 110 psig until the dew point is above -10°C .

3.5 Normal Shutdown

H-O-A switches-OFF

Disconnect switches-OFF

Main power source-OFF

Hospital shutoff valve-CLOSED

Air receiver manual tank drain-OPEN

Pressure gauge decreasing to 0 psi (0 kPa)

Close air receiver manual tank drain when pressure decreases to 0 psi (0 kPa)

3.0 System Operation (continued)

3.6 Emergency Shutdown / Alarms

The following conditions may arise during operation.

High Air Temperature Shutdown - This will shut down the compressor in question and will not re-start until the appropriate red push button is pressed on the main control panel. Before allowing the unit to re-start, the condition should be checked (see "Compressor runs hot" in the Troubleshooting Section 4.0). Even after pushing the button, the unit may not re-start, depending on system sequencing and system pressure.

Motor Overload Shutdown - This will shut down the compressor in question and will not re-start until the reset button on the starter inside the main control cabinet is reset. See "Motor overheating" in the Troubleshooting Section 4.0.

Lag Unit Running Alarm - This alarm will activate if the last available compressor unit comes on. In the case of a duplex system, it will activate when the second compressor turns on or the lag pressure switch (PS-2) closes. To silence the alarm, press the amber push button. In the event the lag alarm is persistent, check to see if any leaks or valves are open downstream or reduce the system load.

Dryer Tower Switching Failure Alarm (Optional) - For units with this feature, there is one pressure switch that senses pressure inside each dryer tower for a total of four pressure switches. If the pressure in both towers of the same dryer fall below 50 psig, the "dryer fault" light will come on and the remote dryer switching failure contacts will change condition (refer to the wiring diagram that came with the unit for terminal numbers). A short time delay (1.5 seconds) is started when both pressure switches fall below 50 psig to eliminate false alarms during normal tower switching. To eliminate alarms during periods when the dryer is turned "off" for maintenance or other reasons, the dryer tower switching failure alarm is bypassed for that dryer. Please note there is only one set of remote alarm contacts that will be activated in the event that either dryer has an alarm condition.

Low Dryer Outlet Pressure Alarm (Optional) - For units with this feature, there is an adjustable pressure switch located upstream of the dryer check valve that will alarm if the pressure in that line drops below the 75 psig factory setpoint. In the event of an alarm, the "dryer fault" light will come on and a remote set of contacts will change condition (refer to the wiring diagram that came with the unit for terminal numbers).

4.0 Trouble Shooting

Problem	Possible Causes	Solution
Failure to start	Main power disconnected	Turn on main power
	Phase reversal monitor open	Change power supply phase on incoming power
		Check voltage dial setting on phase reversal switch
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Overload tripped on starter	Reset & check for system overload
	High temperature switch activated	Allow unit to cool; reset switch & check for over temperature condition
Power failure	Pressure switch open	Adjust or replace switch
	Loose or faulty connection	Check & tighten all wire connections
Compressor shuts off unexpectedly	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Overload tripped on starter	Reset & check for system overload
	Pressure switch out of adjustment	Adjust or replace
High temperature alarm	High inlet vacuum switch activated	Check for dirty/clogged inlet filter or inlet piping restriction
	High temperature switch activated	Allow unit to cool; reset switch & check for over temperature condition
Motor overheating	High temperature switch activated	Allow unit to cool; reset switch & check for over temperature condition
	Low voltage	Check for proper supply voltage
	V-belt too tight	Adjust belt tension
Compressor runs hot	Defective motor	Contact BeaconMedaes Medical Products
	Incorrect pressure setting	Adjust pressure switch
	Faulty check valve	Contact BeaconMedaes Medical Products
	Check if valve or line to receiver is leaking or plugged	Replace if necessary
	Intake filter clogged	Clean or replace

4.0 Trouble Shooting

Problem	Possible Cause	Solution
Low discharge pressure	System piping leaks	Repair leaks
	Defective pressure gauge	Replace gauge
	Pressure switch open	Adjust or replace
	No power to solenoid or solenoid stuck open	Check electrical connections
	Belts slipping	Adjust tension
	Intake filter clogged	Clean or replace
Compressor cycles too often	System undersized	Contact BeaconMedæ
	Incorrect pressure setting	Adjust pressure switch
	Faulty pressure switch	Replace switch
	System piping leaks	Repair leaks
	Check valve or line to receiver is leaking or plugged	Replace if necessary
	Both dryers on line	Valve off one dryer
	Water in air receiver	Drain air receiver
Compressor won't shut off	Pressure switch out of adjustment or faulty	Adjust or replace
Excessive belt wear	Belt tension	Adjust tension
	Belt alignment	Realign compressor & motor sheaves
Abnormal noise	Mounting bolts loose	Tighten bolts
	Belt tension	Adjust tension

Note: For air dryer trouble shooting, see Appendix A.

5.0 Maintenance

5.1 Maintenance Schedule

WARNING:
BEFORE STARTING ANY MAINTENANCE PROCEDURES, DISCONNECT ALL POWER TO THE PACKAGE.

Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.

Never perform any maintenance functions while the unit is in operation.

Maintenance Schedule

Item	Frequency	Action
Check condensate in tank	Daily	Open manual drain valve: check auto drain
Check operation of safety valve	Weekly	Manually release pressure
Check inlet air filter(s)	Weekly	Inspect and clean or replace
Check nuts, bolts, fittings, etc.	Monthly	Inspect and tighten
Check belt tension	Monthly	Inspect and tighten or replace
Check flow through orifice of dew point sensor	Every 6 months	Check for flow blockage
Check dew point sensor accuracy	Every 12 months	Verify dew point sensor accuracy (contact BeaconMedaes)
Calibrate CO monitor	Every 6 months	See Appendix B
Replace pre-filters & afterfilters	Yearly	Replace filter elements
Replace Dryer Desiccant	5 years	See Appendix A
Orbiting & Drive Bearing Lubrication * (2, 3, 5 & 10HP Scrolls Only)	10,000 Hours	Contact BeaconMedaes Customer Service Department
Replace Compressor Tip Seals *	10,000 Hours	Contact BeaconMedaes Customer Service Department

***An authorized BeaconMedaes Service Technician must perform compressor tip seals replacement. This replacement will be done by BeaconMedaes at no charge to the customer. Please contact BeaconMedaes Customer Service department at 1-800-756-2590 prior to 10,000 operating hours to schedule this maintenance. Please have the serial number of your compressor system available.**

5.0 Maintenance

5.2 Replacement Filter Elements (Individual)

Duplex

HP	Inlet	Qty.	Prefilter		Qty.	Afterfilter		Qty.
			(see note 1)	(see note 2)		(see note 1)	(see note 2)	
2-7.5	ELM 01 005	2	2901052400	ELM 22 001	2	2901052400	ELM 22 001	2
10-15	ELM 01 006	2	2901052700	ELM 22 002	2	2901052700	ELM 22 002	2

Triplex

HP	Inlet	Qty.	Prefilter		Qty.	Afterfilter		Qty.
			(see note 1)	(see note 2)		(see note 1)	(see note 2)	
10-15	ELM 01 006	3	2901053000	ELM 22 003	2	2901053000	ELM 22 003	2

Quad

HP	Inlet	Qty.	Prefilter		Qty.	Afterfilter		Qty.
			(see note 1)	(see note 2)		(see note 1)	(see note 2)	
10	ELM 01 006	4	2901053000	ELM 22 005	2	2901053000	ELM 22 003	2
15		4	2901053300		2	2901053300		2

Notes:

1. Supplied on units with serial number 188378 and greater.
2. Units with serial numbers prior to 188378.

Complete sets of replacement filter element kits are available that include all required filter elements for a given system. (See below)

5.2 Replacement Filter Elements (Complete Sets)

Kit Description	HP	Configuration	Kit Part No.		Kit Consists of:
			(see note 1)	(see note 2)	
Complete Set of System Filters	2-7.5	Duplex	4107400000	KIT 22-012	Inlet filter(s)
	10-15		4107400001	KIT 22-013	Prefilter(s)
	10-15	Triplex	4107400002	KIT 22-014	Afterfilter(s)
	10	Quad	4107400003	KIT 22-015A	
	15		4107400004	KIT 22-015	

Notes:

1. Supplied on units with serial number 188378 and greater.
2. Units with serial numbers prior to 188378.

Complete sets of replacement filter element kits include required quantities of filter elements for a given system.

6.0 Inspection/Replacement Procedures

6.1 V-Belts

Narrow type V-belts are used for this unit. Refer to Table 6-1a & 6-1b for the correct size.

6.1.1 Tension Check

Table 6-1a Belt size and Tension (for new belts)

Hp	Motor Sheave Diameter		Belt Size		TENSIONING		No. of Belts
	(see note 1)	(see note 2)	(see note 1)	(see note 2)	Defl. (in.)	Force (lbs.)	
2	4.17	3.15	SPZ925	3V X 375	0.25	5	1
3	2.95	4.50	SPZ875	3V X 400	0.25	6	1

Notes:

1. Supplied on units with serial number 262296 and greater.
2. Units with serial numbers prior to 262296.

Table 6-1b Belt size and Tension (for new belts)

Hp	Motor Sheave Diameter		Belt Size		TENSIONING		No. of Belts
	(see note 1)	(see note 2)	(see note 1)	(see note 2)	Defl. (in.)	Force (lbs.)	
5	3.35	3.65	SPZ 987	3V X 450	0.25	5	2
7 ½	5.00		3V X 475		0.25	6	2
10	3.35	3.65	SPZ 1060	3V X 450	0.25	5	4
15	5.00		3V X 475		0.25	6	4

Notes:

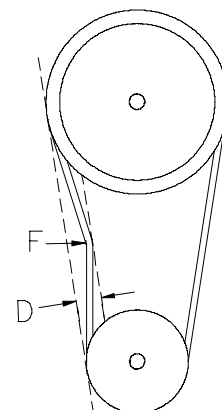
1. Supplied on units with serial number 188378 and greater.
2. Units with serial numbers prior to 188378.

WARNING:
BEFORE STARTING ANY MAINTENANCE PROCEDURES, DISCONNECT ALL POWER TO THE PACKAGE.

Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.

Never perform any maintenance functions while the unit is in operation.

Check the belt tension monthly. Disconnect the main power and remove the beltguard. As shown in the illustration at right, deflect each V-belt at the center of the drive span with a spring balance or tension meter at the tension force of Table 6-1. Then check that the average deflections at the proper tension force are approximately the same values as shown in Table 6-1.



6.0 Inspection/Replacement Procedures

6.1 V-Belts (continued)

6.1.2 V-Belt Tension Adjustment

If necessary, adjust the V-belts until the average deflections are within the values shown in Table 6-1.

To tighten the V-belts:

1. Remove the beltguard.
2. Loosen the two locking bolts securing the motor base.
3. Turn the belt tensioning adjustment rod on the motor base and rotate the motor downward until the proper tension and alignment is obtained. To check for correct alignment, place a straight edge on the faces of the two sheaves. Proper alignment is obtained when all the gaps between the straight edge and the sheaves are minimized and less than 1/8".
4. Check the belt tension again and make sure the tension is similar to the values listed in Table 6-1.
5. Replace the beltguard **before** operating the machine.

CAUTION: IF THE COMPRESSOR IS OPERATED WITH LOOSE V-BELTS OR IMPROPER SHEAVE ALIGNMENT, THE LIFE OF THE V-BELTS IS SHORTENED. EXCESSIVE TENSION CAN BREAK THE SHAFT OR REDUCE BEARING LIFE. BE SURE TO MAINTAIN PROPER V-BELT TENSION AND ALIGNMENT.

6.0 Inspection/Replacement Procedures

6.1 V-Belts (continued)

6.1.3 Changing the V-Belts

V-belts should be changed every 8,000 hours under normal operating conditions. If any damage is found, they should be replaced at once. To change the v-belts call the nearest **Lifeline®** distributor or follow the procedures described below:

To change the belts:

Remove the old belts:

1. Remove the beltguard.
2. Loosen the locking bolts securing the motor base.
3. Turn the belt tensioning adjustment rod on the motor base and rotate the motor upward
4. Remove the old belt(s)

Check and clean:

1. Check and clean all of the grooves of both the motor and compressor sheaves.
2. Check the tightness of bolts on the sheave bushings.

Installation of new belts:

1. Confirm the belt type and length.
2. Place the belt(s) into the grooves of both sheaves.
5. Turn the belt tensioning adjusting rod on the motor base and rotate the motor downward until the proper tension and alignment is obtained. To check for correct alignment, place a straight edge on the faces of the two sheaves. Proper alignment is obtained when all the gaps between the straight edge and the sheaves are minimized and less than 1/8".
6. Check the belt tension again and make sure the tension is similar to the values listed in Table 6-1.
7. Replace the beltguards **before** operating the machine.

6.0 Inspection/Replacement Procedures

6.2 Air Intake Filter

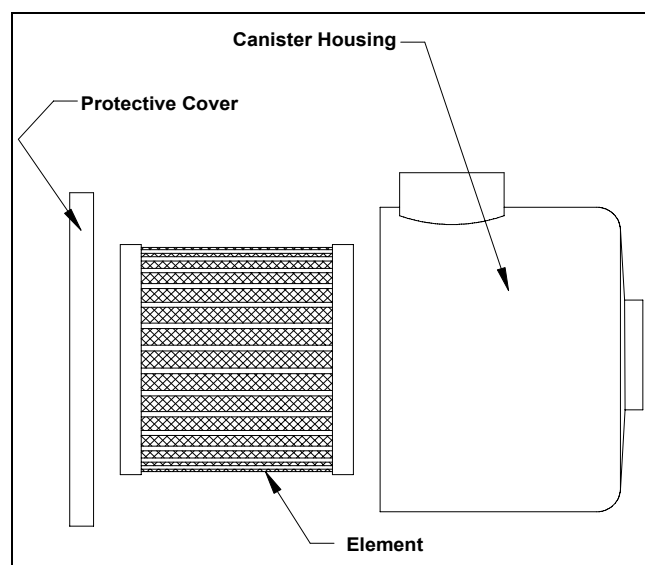
WARNING:
BEFORE STARTING ANY MAINTENANCE PROCEDURES, DISCONNECT ALL POWER TO THE PACKAGE.

Release all pressure from the package before removing, loosening, or servicing any covers, guards, fittings, connections, or other devices.

Never perform any maintenance functions while the unit is in operation.

The air intake filter element should be changed every 4,000 hours of operation under normal operating conditions. To change the filter:

1. Turn off the compressor being serviced and lock open the appropriate disconnect switches.
2. Close intake isolation valve
3. Remove the protective cover by loosening the wing nut (if applicable) and latches.
4. Remove the element.
5. Clean inside of housing.
6. Insert a new element (note orientation of the element).
7. Replace protective cover and tighten wing nut (if applicable) and latches.
8. Open intake isolation valve
9. Turn on the compressor



Air Intake Filter

6.0 Inspection/Replacement Procedures

6.3 Readjustment of Cut-out and Cut-in Pressure

The cut-out pressure refers to the discharge air pressure at which the unit will stop and is indicated by the gauge near the electrical cabinet.

!!WARNING!!
IT IS STRICTLY PROHIBITED TO READJUST DISCHARGE AIR PRESSURE TO MORE THAN THE SPECIFIED MAXIMUM PRESSURE (120 PSIG); NEGLECTING IT MAY CAUSE HIGH DISCHARGE TEMPERATURE SHUTDOWN, MAIN MOTOR OVERLOAD SHUTDOWN, OR SERIOUS COMPRESSOR BREAKDOWN.

The cut-in pressure refers to the discharge air pressure at which the compressor will start and is dictated by the pressure and differential setting of the pressure switch. The standard factory pressure switch settings for the lead pressure switch (PS-1) is 110 psig for cut-out (open) pressure and 90 psig for cut-in (close) pressure.

CAUTION

Generally, a narrower differential requires a larger volume of receiver, and vice versa. The recommended receiver volume in the instruction manual is based on the standard factory setting of 20 psig differential. If a narrower differential is desired, install a larger volume receiver; otherwise the cycle of start/stop may be shorter which could generate an undesirable effect on the unit.

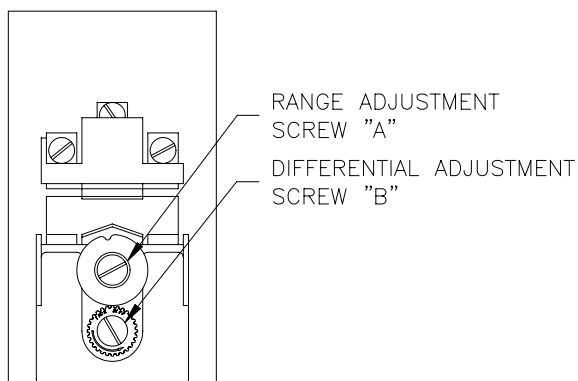


Fig. 6-5 Pressure Switch

Adjusting Instructions

FIRST - Adjust the range (screw "A") to the required cut-out pressure setting. Turning the screw clockwise raises the cut-in and cut-out pressure settings equally.
SECOND - Adjust the differential (screw "B") to the required cut-in pressure setting. Turning the screw clockwise will raise the cut-in pressure setting only. Differential is the difference between cut-in and cut-out settings.

Table 6-2 Factory Pressure Switch Settings

Pressure Switch	Close	Open
Lead (PS-1)	90 psig	110 psig
Lag 1 (PS-2)	85 psig	105 psig
Lag 2 (PS-3) - Tpx and Qpx Only	80 psig	100 psig
Lag 3 (PS-4) - Qpx Only	75 psig	95 psig

7.0 Replacement Parts

Any information, service or spare parts requests should include the machine serial number and be directed to:

BEACONMEDÆS
1800 Overview Drive
Rock Hill, SC 29730

Telephone: (888) 4-MEDGAS
Fax: (803) 817-5750

8.0 Specifications

8.1 System Specifications for 2-15 HP Base Mounted Scroll SPC Systems

Base Mounted Systems									
HP	DUPLEX			TRIPLEX			QUADRUPLEX		
	Capacity ¹		Receiver (Gallons)	Capacity ¹		Receiver (Gallons)	Capacity ¹		Receiver (Gallons)
	50 psig	100 psig		50 psig	100 psig		50 psig	100 psig	
2	7.0	6.5	80	NA	NA	NA	NA	NA	NA
3	10.4	9.6	80	NA	NA	NA	NA	NA	NA
5	17.2	16.0	80	NA	NA	NA	NA	NA	NA
7½	25.2	24.0	80	NA	NA	NA	NA	NA	NA
10	34.8	32.0	120	69.6	64	200	104.4	96	200
15	50.4	48.0	120	100.8	96	200	151.2	144	200

Notes: ¹ All capacities are shown as NFPA system capacities (reserve compressor on standby) and are shown in Inlet Cubic Feet per Minute (ICFM).

8.2 Base Mount Duplex Scroll SPC (Single Point Connection) Medical Air System

Model hp	2	3	5	7.5	10	15
Package hp	4	6	10	15	20	30
Max. Presssure (PSI)	120	120	120	120	120	120
Delivery (CFM) 100 PSI	6.5	9.6	16	24	32	48
RPM	2220 ³ 2247 ⁴	3151 ³ 3225 ⁴	2287 ¹ 3122 ²	3145	2279 ¹ 3122 ²	3133
Tank Size (min)	80 Gal	80 Gal	80 Gal	80 Gal	120 Gal	120 Gal
Intake Pipe Size(FPT)	1-1/4"	1-1/4"	1-1/2"	1-1/2"	2"	2"
Discharge Pipe Size (FPT)	1/2"	1/2"	3/4"	3/4"	3/4"	1"
Safety Valve Setting (PSI) pump	135	135	135	135	135	135
Max. Ambient Temperature	105°F	105°F	105°F	105°F	105°F	105°F
Dimensions (inches)						
Length	47.50	47.50	47.50	47.50	72.00	72.00
Width	34.00	34.00	34.00	34.00	67.00	67.00
Height	74.50	74.50	74.50	74.50	82.00	82.00
Weight (lbs)	1003	1031	1045	1195	2362	2405

Notes: ¹ Pump speed for units with serial number 188378 and greater.

² Units with serial number prior to 188378.

³ Pump speed for units with serial number 262296 and greater.

⁴ Units with serial number prior to 262296.

8.0 Specifications

8.3 Base Mount Triplex Scroll SPC (Single Point Connection) Medical Air System

Model hp	10	15
Package hp	30	45
Max. Presssure (PSI)	120	120
Delivery (CFM) 100 PSI	64	96
RPM	2279 ¹	3133
	3122 ²	
Tank Size (min)	200 Gal	200 Gal
Intake Pipe Size(FPT)	2"	3"
Discharge Pipe Size (FPT)	1"	1-1/4"
Safety Valve Setting (PSI) pump	135	135
Max. Ambient Temperature	105°F	105°F
Dimensions (inches)		
Length	72.00	72.00
Width	99.50	99.50
Height	85.00	85.00
Weight (lbs)	3468	3548

Notes: ¹ Pump speed for units with serial number 188378 and greater.
² Units with serial number prior to 188378.

8.0 Specifications

8.4 Base Mount Quadruplex Scroll SPC (Single Point Connection) Medical Air System

Model hp	10	15
Package hp	40	65
Max. Presssure (PSI)	120	120
Delivery (CFM) 100 PSI	96	144
RPM	2279 ¹	3133
	3122 ²	
Tank Size (min)	200 Gal	200 Gal
Intake Pipe Size(FPT)	2"	3"
Discharge Pipe Size (FPT)	1"	1-1/4"
Safety Valve Setting (PSI) pump	135	135
Max. Ambient Temperature	105°F	105°F
Dimensions (inches)		
Length	72.00	72.00
Width	99.50	99.50
Height	85.00	85.00
Weight (lbs)	3968	4068

Notes: ¹ Pump speed for units with serial number 188378 and greater.
² Units with serial number prior to 188378.

9.0 Maintenance Record

Model Number _____

Serial Number _____

Installation Date _____

Date of Service								
Hours								
Load								
Ambient Temp.								
Inlet Filter								
Belt Tension								
Misc.								
Serviced By								

Notes:

9.0 Maintenance Record

Model Number _____

Serial Number _____

Installation Date _____

Date of Service								
Hours								
Load								
Ambient Temp.								
Inlet Filter								
Belt Tension								
Misc.								
Serviced By								

Notes:

Appendix A - Desiccant Dryer

A.1 General Information

CAUTION: This manual is designed to serve as the operation and maintenance guide for your dryer. The contents of this manual should be carefully read BEFORE attempting any phase of operation or maintenance. Failure to follow the operating and maintenance procedures of the instruction manual could result in personal injury or property damage.

All information, specifications and illustrations within this manual are those in effect at the time of printing. The manufacturer reserves the right to change or make improvements without notice and without incurring any obligation to make changes or add improvements to products previously sold.

When requesting information, service, ordering of spare parts, etc., please reference all information supplied on the serial number plate located inside the dryer control panel or on the side of the dryer enclosure.

To facilitate maintenance, recommended spare parts for your specific dryer model are available. Failure to maintain recommended spare parts and filter cartridges might result in expensive and unnecessary downtime for which the manufacturer cannot be responsible. To request a quotation of, or place an order for, recommended or emergency spare parts, please contact your local distributor.

A.1.1 Drying Cycles

This fully automatic, heatless type dryer alternately cycles the compressed, process gas flow through two desiccant charged towers where the entrained, vaporous moisture content of the gas is adsorbed. One desiccant tower is always on-line in a drying cycle throughout normal dryer operation. The opposite, off-line tower is in a regeneration cycle for removal of the previously adsorbed moisture content or in a purge saving cycle at line pressure.

A.1.1.1 Continuous Purge

When the dryer selector switch is in the "continuous purge" position, the dryer will shift towers every 30 seconds. At normal operating conditions, one tower is at 100 p.s.i and the other tower is at 0 p.s.i. Any condition other than this is not normal and will cause a high dew point condition. During tower changeover, the online chamber will exhaust, and the chamber that is regenerating (purging) will come to line pressure. There is no re-pressurization cycle. If the selector switch is on the continuous purge cycle, the dryer will use 15% of the NFPA system capacity to purge the dryer.

A.1.1.2 Controlled Purge

When the dryer selector switch is in the "controlled purge" position, the dew point monitor controls the dryer purge, and purging depends on the dew point condition. When the dew point reading is above the setpoint of -10°C (14°F), the dryer will function normally (one tower at 100 p.s.i, one tower at 0 p.s.i.). When the dew point is below the setpoint of -10°C (14°F) on the dew point monitor, the purge valve will close. In this condition both towers will be approximately 100 p.s.i. and the dryer will continue to shift towers but the off line chamber will remain at 100 p.s.i. until the dew point is above -10°C (14°F).

Appendix A - Desiccant Dryer

A.1 General Information (continued)

A.1.2 Pre-filter

As the first line of defense against water contaminants, a coalescing pre-filter with an automatic drain is installed. The LifeLine coalescing pre-filter removes water aerosols from the gas stream before the gas enters the dryer. Liquids collected by the assembly's filter cartridge(s) fall to the housing sump and are drained by a float drain.

A.1.3 Automatic Drain Valves

As previously stated, the accumulated water collected by a pre-filter must be periodically drained from the pre-filter housing sump. An automatic drain valve is a recommended and reliable means of removing collected moisture from coalescing pre-filter housings and other components requiring periodic draining.

Appendix A - Desiccant Dryer

A.2 Operation

A.2.1. Initial Start-Up

1. Switch on the electrical supply to the dryer.
2. CLOSE the dryer isolation valves.
3. Check that the compressed air supply is **on**.
Let the system come up to pressure
4. Slowly OPEN the dryer inlet isolation valve.
5. Rotate the dryer selector switch to the "continuous purge" position. The dryer will now begin to cycle.
6. Check that purge air is flowing from the purge muffler.
7. Slowly OPEN the dryer outlet isolation valve.
8. Open the dew point and CO sensor (if supplied) isolation valves.
9. Check for airflow at the dew point sensor orifice.
10. Adjust CO regulator (if supplied) to obtain a flow rate of .5-.9 SCFM.
11. Operate the dryer for five to ten minutes with the source isolation valve **closed**.
12. During the conditioning run (see 11 above) test all joints to locate any leaks using leak detector spray or a suitable alternative. Tighten or repair any leaks and retest.

NOTE: Any small leaks on the dryer outlet side will cause a deterioration of the dew point.

13. Rotate the dryer selector switch to the "controlled purge" position. Verify proper operation as described in A.1.1.2.
14. On the completion of the conditioning run, **slowly open** the source isolation valve. The dryer will now be fully operational.

A.2.2 Procedure to Switch Off Dryer

1. Put second dryer on line by repeating steps 4 thru 7 above.
2. CLOSE the dryer outlet isolation valve.
3. SWITCH OFF the electrical supply to the dryer.
4. CLOSE the dryer inlet isolation valve. Dryer should de-pressurize

WARNING: Wait at least 2 minutes for pressure in the dryer to decay before performing any service to the dryer.

Appendix A - Desiccant Dryer

A.2 Operation (continued)

A.2.3 Normal Start-up

This procedure is to be followed when the dryer has been shut down for a short period during which time the desiccant has not been exposed to wet gas.

1. Start up the compressor if shut down.
2. Set the appropriate dryer selector switch to controlled purge.
3. Slowly OPEN the dryer inlet isolation valve.
4. Slowly OPEN the dryer outlet isolation valve.
5. Check operation of the dryer.

A.2.4 Maintenance Shut Down

1. CLOSE the dryer outlet isolation valve.
2. CLOSE the dryer inlet isolation valve.
3. Allow the dryer to continue to cycle until the purge exhaust fully depressurizes both chambers.
4. Switch off electrical power to the dryer by removing the fuse.

WARNING: Display prominent notices indicating that maintenance is being carried out.

Appendix A - Desiccant Dryer

A.3 Trouble Shooting

WARNING:

To protect the lives of patients, always notify the appropriate medical facility staff before performing any maintenance or service procedures on the air system. Compressed air levels may be affected during maintenance or service procedures.

WARNING:

Some of the following trouble-shooting checks are conducted while the dryer's electrical power supply is energized. THEREFORE, A POTENTIAL ELECTRICAL SHOCK HAZARD EXISTS. A qualified electrical technician should conduct these checks. The dryer's electrical power supply must be de-energized before any electrical maintenance or repair work is conducted.

WARNING:

Ensure that the dryer and associated pre-filter(s) and afterfilter(s) are valve isolated and fully depressurized before attempting to remove or disassemble any subassemblies or components. Failure to do so may result in serious personal injury and/or equipment damage.

CAUTION: Each component has been selected to compliment the performance of the other components of the system. Therefore, use of unauthorized parts or improper operation will degrade system performance.

IMPORTANT: Water molecules can diffuse through a pinhole size leak even though pressure inside the piping is several hundred PSIG. It is not at all uncommon to have a minute pinhole leak in a gas line cause an increase in dew point from -40°F to -10°F at a distance of forty or more feet downstream of the leak.

WARNING:

Compressed air can be dangerous unless safety precautions are observed in the use of compressed air and compressed air equipment. Completely vent the internal air pressure to the atmosphere before disassembling any subassemblies or components and before doing any work on compressed air equipment. To vent internal air pressure, follow the maintenance shutdown instructions.

Appendix A - Desiccant Dryer

A.3 Trouble Shooting

Problem	Possible Causes	Solution
Dryer not cycling	Main power disconnected	Turn on main power
	Power failure	Restore power
	Main fuse blown	Replace fuse
	Fuse blown in control circuit	Replace fuse
	Timer failure	Check and replace if defective
	Dryer selector switch in off position	Rotate switch to controlled purge position
	Loose or faulty connection	Check & tighten all wire connections
	Switching valve failure	Replace switching valve
Dew point degradation	Incorrect purge air flow	Check purge orifice for blockage. Clean or replace as required.
	Excessive system flow rate	Reduce inlet flow rate and/or increase operating pressure.
	Inlet air temperature is above the dryer's design inlet working temperature.	Check the compressor aftercooler and cooling system. Adjust as necessary to bring the dryer inlet temperature to less than the maximum design working temperature of 43°C (110°F).
	Liquids entering the dryer inlet	Isolate and depressurize the pre-filter assembly. Inspect pre-filter cartridges and end seals for loosening and/or damage. Tighten or replace as necessary. Inspect the pre-filter automatic drain valve. Ensure that it is not clogged, and is draining properly. Repair or replace as necessary, if a problem is noted.
	Purge muffler restricted	Replace muffler

Appendix A - Desiccant Dryer

A.3 Trouble Shooting (continued)

Problem	Possible Causes	Solution
Dew point degradation	Desiccant is contaminated. The “white” desiccant beads may appear discolored and dirty if contamination has occurred.	Shutdown and depressurize the dryer. Inspect the desiccant and replace if fouled. Inspect any existing pre-filter if fouling is noted.
	Union or other piping/component leaks at dryer outlet manifold or downstream of dryer outlet	Soap test the dryer outlet manifold and piping downstream of dryer. Repair all leaks noted.
Back pressure on a desiccant chamber during the regeneration cycle.	Dirty or fouled purge muffler	Switch off power and remove purge muffler and clean using an air nozzle, or replace.
	Outlet check valve leaking	Replace check valve

NOTE: The presence of backpressure will result in insufficient regeneration followed by dew point degradation. An off-line chamber’s pressure **MUST be less than 3 psig** throughout all regeneration cycles.

Appendix A - Desiccant Dryer

A.4 Maintenance

WARNING:

To protect the lives of patients, always notify the appropriate medical facility staff before performing any maintenance or service procedures on the air system. Compressed air levels may be affected during maintenance or service procedures.

WARNING:

Compressed air can be dangerous unless safety precautions are observed in the use of compressed air and compressed air equipment. Completely vent the internal air pressure to the atmosphere before disassembling any subassemblies or components and before doing any work on compressed air equipment. To vent internal air pressure, follow the maintenance shutdown instructions.

A compressed air dryer should give long and trouble free operation if the recommended preventative maintenance program is carried out.

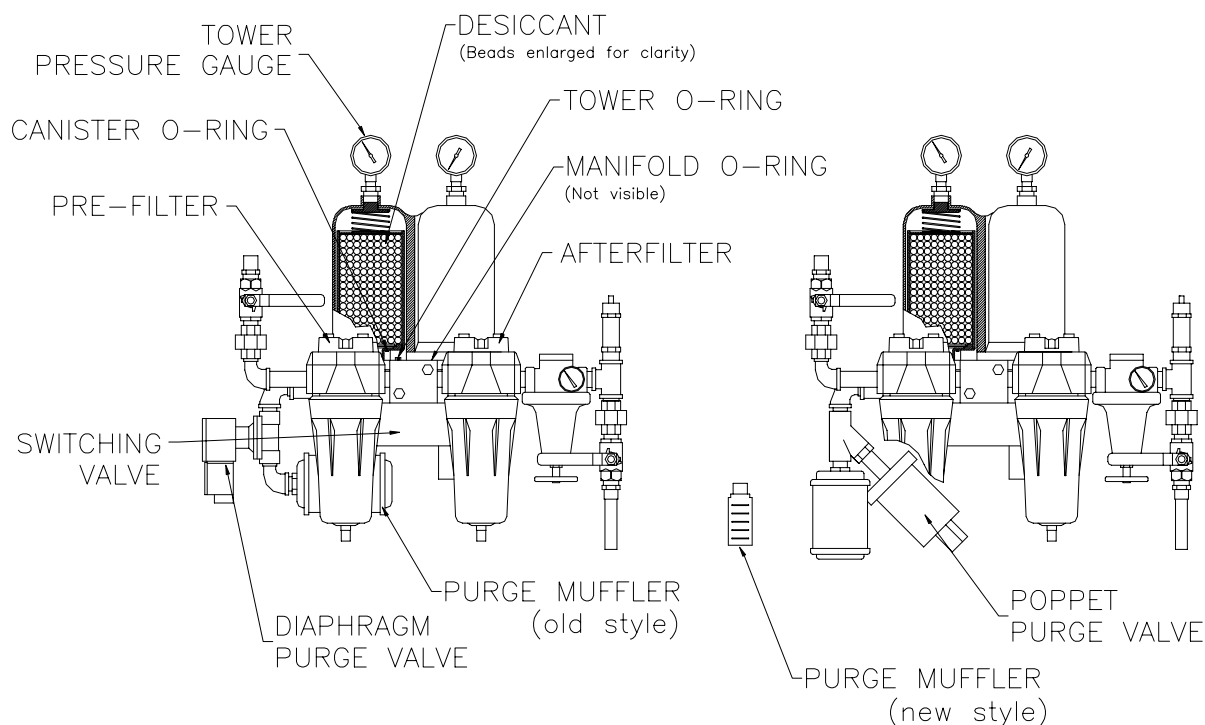
The following is a recommended schedule:

1. **Quarterly procedure** - Clean the auto drain in the coalescing filter. Monitor the backpressure on the purging tower. If the gauge reads more than 0 psig (when purging), check the purge muffler for blockage and replace if necessary.
2. **Annual procedure** - Replace all filter cartridges and purge muffler(s). Check the automatic drain function in the coalescing filter. Refer to chart located in Section A.4.1 for correct system size and part numbers. Contact your local distributor for parts.
3. **Five-year procedure** - Change all annual parts. Change desiccant, check valves, and purge valve(s) See chart in Section A.4.1 for correct system size and part numbers.

Appendix A - Desiccant Dryer

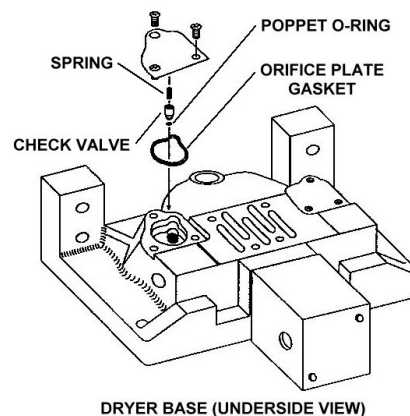
A.4 Maintenance

A.4.1 Maintenance Schedule



TYPE 1 DRYER SHOWN

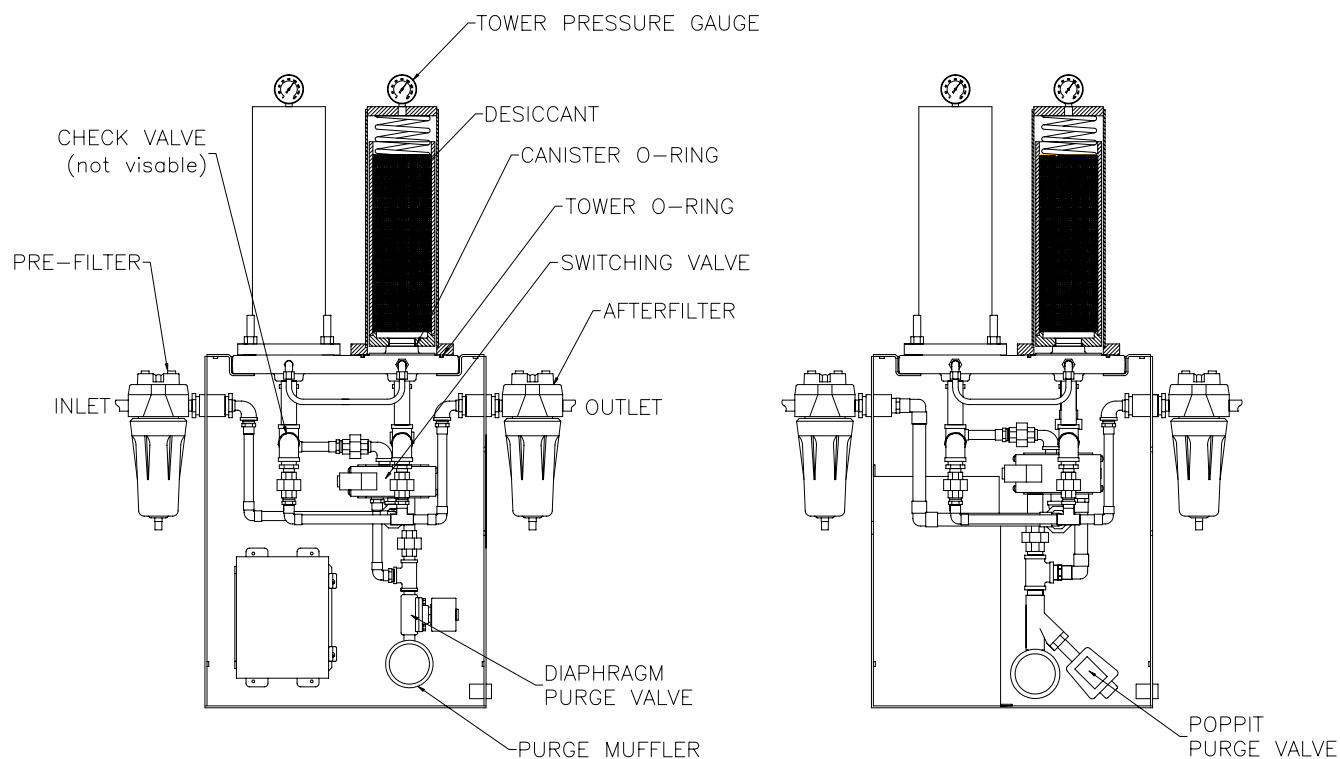
1-5 hp Duplex (Type 1 Dryer) 10-25 cfm			
Service Interval	Part number	Description	Quantity
Every year	(see section 5.2)	Pre-filter	2
Every year	(see section 5.2)	After-filter	2
Every year	MUF 01 006	Purge muffler	2
Every 5 years	DES 02 001	Desiccant Kit	2
Every 5 years	ORG 01 007	Poppet o-ring	4
Every 5 years	GKT 10 005	Tower gasket	4
Every 5 years	GKT 10 004	Canister gasket	4
Every 5 years	GKT 10 003	Manifold o-ring	4
Every 5 years	GKT 10 002	Orifice plate gasket	4
As needed	VAL 11 001	Switching valve	2
As needed	GAG 01 032	Tower pressure gauge	2
Purge valve (Refer to diagram for correct valve)			
Every 5 years	VAL 04 018	Diaphragm	2
Every 5 years	VAL 04 029	Poppet	2



DRYER BASE (UNDERSIDE VIEW)

Appendix A - Desiccant Dryer

A.4.1 Maintenance Schedule



TYPE 2 DRYER SHOWN

7-1/2 hp Duplex, 10 hp Duplex (Type 2 Dryer) 35 cfm			
Service Interval	Part number	Description	Quantity
Every year	(see section 5.2)	Pre-filter	2
Every year	(see section 5.2)	After-filter	2
Every year	MUF 01 006	Purge muffler	2
Every 5 years	DES 01 001	Desiccant	4 bags
Every 5 years	VAL 01 014	Check valve	4
Every 5 years	ORG 01 009	Tower o-ring	4
Every 5 years	ORG 01 010	Canister o-ring	4
As needed	VAL 11 001	Switching valve	2
As needed	GAG 01 032	Tower pressure gauge	2
Purge valve (Refer to diagram for correct valve)			
Every 5 years	VAL 04 018	Diaphragm	2
Every 5 years	VAL 04 029	Poppet	2

Appendix A - Desiccant Dryer

A.4.1 Maintenance Schedule

15 hp Duplex, 7-1/2 hp Triplex (Type 2 Dryer) 55 cfm			
Service Interval	Part number	Description	Quantity
Every year	(see section 5.2)	Pre-filter	2
Every year	(see section 5.2)	After-filter	2
Every year	MUF 01 006	Purge muffler	2
Every 5 years	DES 01 001	Desiccant	4 bags
Every 5 years	VAL 01 014	Check valve	4
Every 5 years	ORG 01 009	Tower o-ring	4
Every 5 years	ORG 01 010	Canister o-ring	4
As needed	VAL 11 001	Switching valve	2
As needed	GAG 01 032	Tower pressure gauge	2
Purge valve (Refer to diagram for correct valve)			
Every 5 years	VAL 04 018	Diaphragm	2
Every 5 years	VAL 04 029	Poppet	2

20 hp Duplex, 10 hp Triplex, 7-1/2 hp Quad (Type 2 Dryer) 75 cfm			
Service Interval	Part number	Description	Quantity
Every year	(see section 5.2)	Pre-filter	2
Every year	(see section 5.2)	After-filter	2
Every year	MUF 01 007	Purge muffler	2
Every 5 years	DES 01 001	Desiccant	4 bags
Every 5 years	VAL 01 014	Check valve	4
Every 5 years	ORG 01 009	Tower o-ring	4
Every 5 years	ORG 01 010	Canister o-ring	4
As needed	VAL 11 002	Switching valve	2
As needed	GAG 01 032	Tower pressure gauge	2
Purge valve (Refer to diagram for correct valve)			
Every 5 years	VAL 04 018	Diaphragm	2
Every 5 years	VAL 04 030	Poppet	2

15 hp Triplex, 10 hp Quad (Type 2 Dryer) 105 cfm			
Service Interval	Part number	Description	Quantity
Every year	(see section 5.2)	Pre-filter	2
Every year	(see section 5.2)	After-filter	2
Every year	MUF 01 007	Purge muffler	2
Every 5 years	DES 01 001	Desiccant	6 bags
Every 5 years	VAL 01 014	Check valve	4
Every 5 years	ORG 01 009	Tower o-ring	4
Every 5 years	ORG 01 010	Canister o-ring	4
As needed	VAL 11 002	Switching valve	2
As needed	GAG 01 032	Tower pressure gauge	2
Purge valve (Refer to diagram for correct valve)			
Every 5 years	VAL 04 018	Diaphragm	2
Every 5 years	VAL 04 030	Poppet	2

Appendix A - Desiccant Dryer

A.4.1 Maintenance Schedule

20 hp Triplex, 15 hp Quad (Type 2 Dryer) 155 cfm			
Service Interval	Part number	Description	Quantity
Every year	(see section 5.2)	Pre-filter	2
Every year	(see section 5.2)	After-filter	2
Every year	MUF 01 008	Purge muffler	2
Every 5 years	DES 01 001	Desiccant	9 bags
Every 5 years	VAL 01 013	Check valve	4
Every 5 years	GKT 10 008	Tower o-ring	4
Every 5 years	GKT 10 007	Canister o-ring	4
As needed	VAL 11 003	Switching valve	2
As needed	GAG 01 032	Tower pressure gauge	2
Purge valve (Refer to diagram for correct valve)			
Every 5 years	VAL 04 020	Diaphragm	2
Every 5 years	VAL 04 031	Poppet	2

20 hp Quad (Type 2 Dryer) 200 cfm			
Service Interval	Part number	Description	Quantity
Every year	(see section 5.2)	Pre-filter	2
Every year	(see section 5.2)	After-filter	2
Every year	MUF 01 008	Purge muffler	2
Every 5 years	DES 01 001	Desiccant	11 bags
Every 5 years	VAL 01 013	Check valve	4
Every 5 years	GKT 10 008	Tower o-ring	4
Every 5 years	GKT 10 007	Canister o-ring	4
As needed	VAL 11 003	Switching valve	2
As needed	GAG 01 032	Tower pressure gauge	2
Purge valve (Refer to diagram for correct valve)			
Every 5 years	VAL 04 020	Diaphragm	2
Every 5 years	VAL 04 031	Poppet	2

Appendix A - Desiccant Dryer

A.5 Replace/Repair

A.5.1 Desiccant Replacement Procedure (1 - 5 hp) (Type 1 Dryer)

WARNING:

Ensure that the dryer and associated pre-filter(s) and afterfilter(s) are valve isolated and fully depressurized before attempting to remove or disassemble any subassemblies or components. Failure to do so may result in serious personal injury and/or equipment damage.

WARNING:

Used desiccant material must be handled with special care. Desiccant is an adsorbent material. Used desiccant may contain chemicals and/or gases that are hazardous, toxic and/or flammable. It is recommended that all used desiccants be analyzed to determine content before disposal. Exercise proper care and procedures during handling and storage of used materials. All containers must be properly labeled and disposed of in accordance with local, state and federal regulations.

1. Shut down dryer. Close inlet and outlet isolation valves and turn off electrical power to the dryer.
2. Remove hex nuts, washers and cast tower assembly from manifold assembly.
3. Remove spring and perforated screen from top of canister
4. Unscrew desiccant canisters from manifold.
5. Dispose of used desiccant into suitable containers.
6. Replace desiccant and canister o-rings.
NOTE: DO NOT REMOVE DESICCANT FROM NYLON BAGS. Insert bag of desiccant into canister.
7. Replace tower O-rings. Set cast tower assembly onto manifold assembly.
8. Install plain washers and hex nuts. Tighten nuts in an X-pattern until towers are snug against the manifold. Torque to 15 ft-lbs.

Appendix A - Desiccant Dryer

A.5 Replace/Repair (continued)

A.5.2 Desiccant Replacement Procedure (7.5 - 20 hp) (Type 2 Dryer)

WARNING:

Ensure that the dryer and associated pre-filter(s) and afterfilter(s) are valve isolated and fully depressurized before attempting to remove or disassemble any subassemblies or components. Failure to do so may result in serious personal injury and/or equipment damage.

WARNING:

Used desiccant material must be handled with special care. Desiccant is an adsorbent material. Used desiccant may contain chemicals and/or gases that are hazardous, toxic and/or flammable. It is recommended that all used desiccants be analyzed to determine content before disposal. Exercise proper care and procedures during handling and storage of used materials. All containers must be properly labeled and disposed of in accordance with local, state and federal regulations.

1. Shut down dryer – close the inlet and outlet isolation valves and turn off electrical power to the dryer.
2. Remove hex nuts, washers and towers from manifold assembly.
3. Remove spring and perforated screen from top of canister.
4. Remove canister from manifold assembly, being careful not to spill any desiccant.
5. Dispose of used desiccant into suitable containers.
6. Remove any blockage that may have lodged in the perforated screens.
7. Replace canister O-rings. Set canister onto manifold assembly.
8. Install the perforated screen into the bottom of the canister.
9. Fill canisters with desiccant to one inch (1") from the top of canister. Install perforated screen.
CAUTION: DO NOT OVERFILL.
10. Set spring retainer on top of perforated screen. Install tower over the canister. Install plain washers and hex nuts. Tighten nuts in an X-pattern until chambers are snug against the manifold. Torque to 35 ft-lbs.

Appendix A - Desiccant Dryer

A.6 Dryer Specifications

Type:	Desiccant Heatless
Design pressure:	105 PSIG
Operating pressure:	60 PSIG minimum, 125 PSIG maximum
Maximum inlet air temperature:	43°C (110°F)
Ambient temperature:	4.4°C (40°F) minimum, 40.5°C (105°F) maximum
Pressure dew point capability @100 PSIG:	-12°C (10°F)
Normal DP operating range:	-8°C (17.6°F) to -12°C (10°F)
Differential Pressure @ 100 PSIG and 37.8°C (100°F):	2 to 8 PSIG
Desiccant:	Activated alumina
Control:	Fully automatic solid-state electric fixed cycle (1 minute)
Power:	120 volt 50/60 Hz 1 ph power (100 Watts)

Appendix B - CO Monitor

B.1 Introduction

WARNING:

Before starting any installation, maintenance or service procedures, disconnect ALL power to the system to prevent electrical shock hazard .

Before making or breaking any medical gas line connections, make sure the system is depressurized in order to avoid personal injury.

An alarm condition on the CO monitor display indicates a CO level exceeding the maximum set point, or a faulty CO sensor. Immediate action should be taken to reduce the possibility of CO in the Medical Air line.

B.2 Specifications

B.2.1 Monitor

The instrument's electronics are enclosed in a NEMA-4A polycarbonate case. The case is corrosion resistant, positively pressurized by the compressor supply line, and sealed except for a bleed hole to exhaust the compressor's air. The unit operates on 110 VAC power supplied from the system control panel. Alarm contact terminals are in the system control panel. Refer to the control panel wiring diagram.

Adjustment controls are not necessary since they are automatically performed by the microprocessor. The unit has two internal push buttons to set alarm levels and other set-up functions.

B.2.2 Sensor

The instrument uses a state-of-the-art electrochemical cell for detecting carbon monoxide. The sensor has a life expectancy of approximately two years. It is easily replaced and should be periodically calibrated as its output diminishes during its life especially during the final months.

B.2.3 Display

The readout is a one line eight character backlighted LCD display located on the front panel. The display shows the level of gas in PPM (parts per million) and flashes when in red alarm. It also displays prompt messages during calibration or warnings such as low flow.

Appendix B - CO Monitor

B.2 Specifications (continued)

B.2.4 Annunciator Lights at Monitor Display

Red Alarm

Indicates a level of gas above the red alarm point.

Yellow Caution

One of the following conditions:

1. Indicates a gas reading above the caution alarm point.
2. Indicates a low flow.
3. Indicates that the instrument is in the calibration mode or not calibrated and requires attention.

Green

Safe operational condition

Appendix B - CO Monitor

B.3 Operation

When power is turned on at the system control panel, the display will show introductory messages and a warm-up countdown. If the unit does not power up, check the electrical connections. If the start up does not occur, call the factory.

After the warm-up countdown, the instrument will display the gas level. The air regulator may be adjusted at any time to set the flow level from 0.5 to 0.9. If the low flow indication shows on the display, increase the flow; and then drop the flow to operational range to activate the low flow switch.

Caution: If the unit is reading a gas level, do not make any adjustments for a few hours until the unit has settled in. If calibration is attempted within the first fifteen minutes a TOO SOON message will occur on the display.

If gas readings remain high or below zero (-0), re-calibration may be needed. We also recommend checking the compressor's air intake. If not outside quality air, this may be the cause for high readings since inside air normally contains a few parts of carbon monoxide.

B.3.1 Alarms

WARNING:
Respond to alarm conditions immediately. An alarm condition on the CO display indicates a CO level exceeding the maximum set point. Immediate action should be taken to reduce the possibility of high CO in the Medical Air line.

Red Relay

If switched on, Red Relay activates when Red Alarm light is illuminated - Gas level above 10 ppm.

Yellow Relay

If switched on, Yellow Relay activates:

1. Gas level above 8 ppm.
2. In low flow after a two minute delay (delay required during calibration to avoid activating Yellow Relay).

During calibration the alarm relays are deactivated to eliminate any external alarms and remain shut off for one minute after calibration to clear test gas from the sensor. The alarm circuits are reactivated when the yellow light is off and the green light appears or after two minutes in low flow.

Audible Horn and Light

To avoid false alarms caused by communications equipment a time delay of 20 seconds has been included in the alarm circuit. A red alarm light may be present for a short time on the monitor display but will not trigger the system alarm light or horn until the alarm is present for 20 seconds. Pushing the "Horn Silence" button on the front of the control panel may silence the audible horn.

Appendix B - CO Monitor

B.4 Maintenance

B.4.1 Repair Policy

Do not use a unit which is not functioning properly until all necessary repairs have been made and the unit has been tested to determine that it is functioning in accordance with the manufacturer's published specifications. Contact **BeaconMedæx** at 1-800-756-2590 for service assistance.

Note: To ensure full reliability, have all maintenance and testing done by a qualified technician. If this cannot be done, maintenance and testing of those parts discussed in this manual may be undertaken by a competent, trained individual having experience in the repair of devices of this nature.

WARNING:

Electrical Shock Hazard. No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. Failure to follow proper repair procedures can result in serious injury.

CAUTION: No maintenance and testing should ever be undertaken or attempted by anyone not having general experience in the repair of devices of this nature. Also, to avoid damaging the unit or any of its components, no maintenance and testing should be undertaken by qualified individuals who are not completely familiar with the procedures in this manual.

Replace damaged parts with components from **BeaconMedæx**. Test the unit after installation of replacement parts to make certain that it complies with the published specifications.

B.4.2 Maintenance Schedule

Maintenance	Frequency	Action
Re-calibration	Every 6 months	See section B.4.3
Replace Sensor	Every 2 years	See section B.4.4

Appendix B - CO Monitor

B.4 Maintenance (continued)

B.4.3 Calibration

Although the unit was calibrated at the factory, it may require re-calibration due to handling. The only way to assure a gas sensor is properly operating is to place gas on it.

To calibrate the unit with gas, shut off the air from the compressor supply line with the regulator and a low flow message will appear with the supply line shut off. Connect the tank of test gas to the cal port connector on the instrument. Open the gas valve until the meter displays "CAL GAS" and a 60-second count down begins. Set the flow in the operating range of 0.5 to 0.9 CFH. If the compressor air supply line was not shut off, a message will appear SUPPLY OFF. If such a message occurs, shut off the supply air; and then reinitiate the cal process to activate the cal port switch.

After 60 seconds a gas reading will appear along with a COUNT NUMBER. With 20 PPM test gas applied the gas reading should be 20 and the count 70. At 70 counts with 20 PPM CO the unit will automatically set. The count number is used for trouble shooting (see trouble shooting section). After the unit auto-calibrates, a message will appear CO G SET indicating that the CO gain adjustment has been set for 20 PPM. Next an informational message on the automatic control pot value is displayed which also can be used for trouble shooting after the G (gain) SET message.

If an incorrect gas concentration is used or the sensor and instrument is not properly functioning, a message will appear CO G FAILED, PREV CAL, END CAL. This affords improper calibration protection and an effort should be made to understand why it did not calibrate (See trouble shooting section for assistance).

After proper calibration the next messages will be REMOVE CAL GAS, END CAL, SUPPLY ON. This prompts the calibrator to remove test gas and turn the supply on at the regulator.

In cases where zero gas calibration is needed, the unit can be automatically zeroed by inserting a small diameter wire in the zero cal opening near the cal port and pushing on a button switch. The hole is made inconveniently small so that an unbent paper clip may activate the switch but larger wire or devices will not. It also doubles as the supply line outlet of the compressor. There are two conditions where pushing the zero button will activate zeroing:

1. Holding the button for three seconds while air is coming from the supply line. In this case the zero button needs to be depressed until the zeroing message stops flashing and a solid zeroing message appears. The autozero process will begin without a countdown as it is assumed that air has been flowing from the supply line for more than a few minutes. If the supply line has more than one or two PPM of carbon monoxide, messages will appear BAD 0 AIR, PREV CAL, END CAL. The instrument is informing the user that it will not calibrate because of bad zero air; and it will use its previously zeroed cal setting. If the supply air is about 0 PPM concentration, the messages displayed will be CO 0 SET, END CAL which indicates that a new zero setting has been accepted and is now in use.
2. A second method for zeroing is to place zero test gas in the cal port similarly as described above with calibration gas, and the unit will initiate its calibration gas routine. However, the unit expects that 20

Appendix B - CO Monitor

B.4 Maintenance (continued)

B.4.3 Calibration (continued)

PPM CO or another cal gas concentration that was inserted in the setup mode is being applied in the cal port unless the zero button is pushed. Check to see that the message now says zero gas instead of cal gas as the 60-second countdown proceeds. Any time during the countdown the zero may be pushed to have the unit know that zero gas is being applied. If the button is not pushed, a bad air message will appear resulting in returning to the previous calibration. This is the error protection.

After the zero button is depressed, a ZEROING message appears and then RELEASE UNLESS ZERO INT message. Holding the zero button for 15 seconds will reinitialize a unit, which is used when replacing a sensor or as discussed in the trouble shooting section.

B.4.4 Sensor Checkout and Changing

To check a sensor's response, test gas has to be placed on the sensor. When it fails to show a gas response during calibration, a new sensor is required. Most sensors will last from one and one-half years to two and one-half years.

To replace the sensor, disconnect the power to the unit and remove the four corner screws and the electronics front cover as described in the mounting section. Next remove the three screws which hold the sensor block and unplug the sensor from its socket. Replace with a new sensor after being sure that the shorting-wire is removed from the new sensor. Re-assemble the unit and reconnect to power. Let the new sensor settle in for an hour prior to calibrating.

When calibrating with a new sensor, an initializing step is added to the calibration procedure that eliminates the error protection that is afforded after a sensor has once been calibrated. In effect this permits the sensor to be zeroed on any background air and caution needs to be taken that the air is free of carbon monoxide. If the supply line is not CO free, then obtain a tank of impurity free air test gas from **BeaconMedæ**s. To initialize the unit hold the zero button depressed for 15 seconds without the supply line air on or with impurity free air on the cal port. During the fifteen seconds the messages will read: ZERO CAL, RELEASE UNLESS ZERO INT, INIT-ING. Release the zero button when INIT-ING appears and the display will read: ZERO GAS REQUIRED. Flow zero gas from either the supply line or cal port and the unit will set its zero after 60 seconds. The instrument message will then read CAL GAS REQUIRED. When placing 20 PPM cal gas or another value selected in the set-up mode on the unit, it will calibrate after a minute and the next message will read END CAL, REMOVE GAS, SUPPLY ON. After turning the supply gas on, the unit will have the error protection and will be reading the carbon monoxide level of the compressor supply line.

Appendix B - CO Monitor

B.5 Trouble Shooting

WARNING:
Before removing the CO sensor, verify that line pressure has been valved off or reduced to atmospheric pressure.

Before servicing the CO sensor, do the following:

1. Unplug sensor(s) or turn off monitor.
2. Depressurize the CO sensor.

Note: Remote alarms will be activated.

Problem	Possible Causes	Solution
CO Alarm - 10 ppm or above	Inlet air to the medical air system is contaminated	Move air inlet location or remove source of CO contamination
CO Alarm (Red light on monitor) but not on control panel	Communications equipment interference	Observe monitor alarm light. Monitor alarm light should go off after communications interference is removed.
Monitor will not calibrate	Sensor depleted	Replace sensor

Count Numbers

Another set of numbers are displayed during calibration other than the gas concentration. These numbers are there to assist in trouble shooting in case zero or cal fails or other malfunctions occur. These other numbers are called counts.

The zero cal will not set if the counts are less than 46 or greater than 53 and when the unit sets at zero the number will read 50 $\pm$ 1 count. With 20 PPM cal gas the count number will be 70 $\pm$ 1 to set. If the computer cannot auto-adjust the readout to these values of 50 and 70, the zero or calibration will fail.

Zero Fail During Calibration

If a failure occurs during zero cal, it means the counts are not between 46 and 53. If the counts are above 53, a BAD AIR message occurs and the zero air should be questioned for CO content. When the count level is below 46, it may be a malfunctioning unit or during initial zero calibration (without the error protection) it was zeroed with a concentration of gas on it.

Another initialization will remove the 46 to 53 count restraint, and with known zero air the unit may be re-zeroed. If the counts never reach 50, the unit is malfunctioning, call the factory for further instructions.

Appendix B - CO Monitor

B.5 Trouble Shooting (continued)

Calibration Gas Fail During Calibration

With 20 PPM gas on the unit the gas reading should reach 20 PPM and 70 counts. If the reading does not reach 70 counts, use the appropriate following procedure.

1. If the counts or gas reading do not show any increase when the gas is applied, probably the sensor is expired or the test gas is zero concentration. Check hose connections to assure gas is flowing into sensor chamber.
2. If the counts are close to 70, a zero reinitializing with known zero gas will probably correct the problem. If the unit was initialized with more than couple PPM of CO, the cal will fail when 20 PPM test gas is applied.

CAUTION: Be sure that the air is zero CO concentration when zero initializing.

Appendix B - CO Monitor

B.6 Accessories and Replacement Parts

KIT 06 003 Calibration Kit.
Includes calibration connector and 20 ppm test gas (#7800-001) in carrying case.

Replacement Parts

SSR 01 005 CO Sensor - Chemical Cell
REG 01 014 Regulator

Test Gas

GAS 01 001 20 ppm Carbon Monoxide
GAS 01 002 Impurity Free Air

Appendix C - Ceramic Dew Point Monitor

C.1 Introduction

WARNING:

Before starting any installation, maintenance or service procedures, disconnect ALL power to the system to prevent electrical shock hazard.

Before making or breaking any medical gas line connections, make sure the system is depressurized in order to avoid personal injury.

Before removing the dew point sensor, verify that the source of line pressure has been valved off or reduced to atmospheric pressure.

An alarm condition on the dew point display indicates a dew point level exceeding the maximum set point, or a faulty dewpoint sensor. Immediate action should be taken to reduce the possibility of high dew point in the Medical Air line.

If the dew point sensor orifice becomes clogged, dew point readings may be inaccurate, allowing moisture to accumulate undetected.

The ceramic dew point hydrometer is a continuous, on-line instrument for the measurement of absolute moisture content in gas. The instrument consists of two component parts: monitor and sensor, each of which is calibrated to a single standard allowing combinations of sensor and monitor units to be totally interchangeable.

The ceramic sensor is manufactured from metalized ceramics using thin and thick film technologies to produce a sensor that is virtually chemically inert with inherently fast response, high calibration stability and high resilience to corrosive environments. The ceramic hydrometer measures moisture by monitoring the electrical response exhibited by the sensor to variations in the partial pressure of water vapor of the monitored gas.

Appendix C - Ceramic Dew Point Monitor

C.2 Specifications

C.2.1 Monitor

System Power Requirements: 10 Watts, 110 VAC (90-126 VAC), 50/60 Hz

System Operational Ambient Conditions: -20° to 50°C continuous, 0 to 90% RH

Electronic Accuracy (Repeatability, Hysteresis, Linearity): Dew point $\pm 0.5^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$)

Resolution of Display: Dew point: 0.1° ; CO: 1 ppm

Dew point Measurement Range: -80° to 20°C (-112° to 68°F)

C.2.2 Sensor

Sensor Accuracy (Repeatability, Hysteresis, Linearity): $\pm 2^{\circ}\text{C}$ ($\pm 4^{\circ}\text{F}$) (For a 2-year period, with clean hydrocarbon-free air supply. **BeaconMedaes** recommends quarterly verification of air quality.)

Operating Pressure Range: 0 to 150 psig (0 to 1,034 kPa)

Air Consumption: 0.2 - 0.5 LPM (0.42 - 1.0 SCFH) with 50 psi line pressure

Appendix C - Ceramic Dew Point Monitor

C.3 Operation

Although the correct operation of the sensor is not sample flow rate dependent, it is important to ensure that flow velocity through the sample source to the sampling block is high enough to avoid long time lags in response to changes in moisture at the sample source. **BeaconMedaes** has already installed an orifice to ensure the proper flow velocity. However, this orifice should be checked occasionally to see if it has any blockage.

C.3.1 Alarms

The dew point monitor is provided with separate sets of alarm contacts. Alarm relays are normally energized. Dew points that exceed setpoints shall cause an alarm condition. Loss of power will also cause an alarm condition. Alarm relays are rated for 5A @ 120V. When the dew point exceeds the alarm set point, the relay contacts are de-energized.

Alarm relays remain de-energized until alarm condition is cleared.

WARNING:

Respond to alarm conditions immediately. An alarm condition on the dew point display indicates a dew point level exceeding the maximum set point. Immediate action should be taken to reduce the possibility of high dew point in the Medical Air line. Prolonged exposure to condensing moisture can damage medical equipment.

Appendix C - Ceramic Dew Point Monitor

C.4 Maintenance

C.4.1 Repair Policy

Do not use a unit which is not functioning properly until all necessary repairs have been made and the unit has been tested to determine that it is functioning in accordance with the manufacturer's published specifications. Contact **BeaconMedaes** at 800-756-2590 for service assistance.

Note: To ensure full reliability, have all maintenance and testing done by a qualified technician. If this cannot be done, maintenance and testing of those parts discussed in this manual may be undertaken by a competent, trained individual having experience in the repair of devices of this nature.

WARNING:

Electrical Shock Hazard. No repair should ever be attempted by anyone not having experience in the repair of devices of this nature. Failure to follow proper repair procedures can result in serious injury.

CAUTION: No maintenance and testing should ever be undertaken or attempted by anyone not having general experience in the repair of devices of this nature. Also, to avoid damaging the unit or any of its components, no maintenance and testing should be undertaken by qualified individuals who are not completely familiar with the procedures in this manual.

Replace damaged parts with components from **BeaconMedaes**. Test the unit after installation of replacement parts to make certain that it complies with the published specifications.

C.4.2 Maintenance Schedule

Maintenance	Frequency	Action
Dew point Sensor: Check flow through orifice	Every 6 months	Check for proper flow
Sensor Accuracy	Every 12 months	Verify dew point sensor accuracy (contact BeaconMedaes)

Appendix C - Ceramic Dew Point Monitor

C.5 Trouble Shooting

WARNING:

Before removing the dew point sensor, verify that line pressure has been valved off or reduced to atmospheric pressure.

Before servicing the dew point sensor, do the following:

1. Unplug sensor(s) or turn off monitor.
2. Depressurize the dewpoint sensor.

Note: Remote alarms will be activated.

Problem	Possible Causes	Solution
Slow system response	Insufficient flow through dew point sensor.	Check flow
No power	No incoming power.	Verify line power is being supplied.
Erratic display	Unit defect.	Contact BeaconMedæx .
LED display does not work or has missing segments	Display board defect Loose connections	Contact BeaconMedæx . Check connections
High Dew point	Air is not being dried. Faulty monitor or sensor.	Verify that dryer is not being bypassed. Replace monitor or sensor