Installation, Operation and Maintenance Instructions

PDC Manifold (Pressure Differential Changeover Station)

Part number 2205 8200 01

Revision 00

30 April 2018

BeaconMedæs®

Installation, Operation and Maintenance Manual

PDC Manifold (Pressure Differential Changeover Station)

This unit is 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:

BeaconMedæs
1059 Paragon Way
Rock Hill, SC 29730
Telephone: (888) 463-3427
Fax: (803) 817-5750

Part number 2205 8200 01
Revision 00
30 April 2018

Table of Contents

Safety Precautions

Protect yourself and others. Read and understand the following instructions before attempting to use this equipment. Failure to understand and follow these instructions could result in serious personal injury and/or damage to equipment. Because of the many potential hazards associated with gases, read the Material Safety Data Sheet for each gas you will be using.

- Know and understand the physical and chemical properties of the gas being detected.
- Observe general precautions for the use of gases.
- Observe safety precautions for the gas being used.
- Read and follow precautions on cylinder labels.
- Never use these manifolds with gases not compatible with the materials of construction. The use of gases not compatible with the materials of construction may cause damage to equipment or injury to personnel.
- If flammable gases are used with this equipment do not locate it near open flames or any other source of ignition.
- If toxic or flammable gases are used with this equipment, emergency equipment applicable to the gases in use should be available in the operating area.
- Many gases can cause asphyxiation by displacing oxygen in the atmosphere. Make certain the area where compressed gas equipment is operated is well ventilated. Provide a device to warn personnel of oxygen depletion in the work area.
- Do not release toxic or flammable gases in the vicinity of personnel. Use this equipment only in well ventilated areas. Vent gases to the outside atmosphere, and in an area away from personnel. Be sure that venting and disposal methods are in accordance with Federal, State, Provincial and local requirements. Locate and construct vent lines to prevent condensation or gas accumulation. Be sure the vent outlet cannot be obstructed by rain, snow, ice, insects, birds, etc. Do not inter-connect vent lines; if more than one vent is needed, use separate lines.
- Relief devices should be installed and properly vented in all gas handling systems to protect against compressed gas equipment failure and over-pressurization.
- Never connect this equipment to a supply source having a pressure greater than the maximum rated pressure. Refer to the Product Specifications for maximum inlet pressures.
- Never permit oil, grease, or other combustible materials to come in contact with cylinders, manifolds, and connections. Oil and grease may react and ignite when in contact with some gases – particularly oxygen and nitrous oxide.
- Cylinder, header, and master valves should always be opened very s-l-o-w-l-y. Heat of recompression may ignite combustible materials.
- Flexible hoses should never be kinked, twisted, or bent into a radius smaller than 3 inches. Mistreatment may cause the flexible hoses to burst.
- Do not apply heat. Some materials may react and ignite while in contact with some gases – particularly oxygen and nitrous oxide.
- Cylinders should always be secured with racks, chains, or straps. Unrestrained cylinders may fall over and damage or break off the cylinder valve which may propel the cylinder with great force.
- Oxygen manifolds and cylinders should be grounded. Static discharges and lightning may ignite materials in an oxygen atmosphere, creating a fire or explosive force.
- Welding should not be performed near nitrous oxide piping. Excessive heat may cause the gas to dissociate, creating an explosive force.
- Do not use leak test solution that contains ammonia. Solutions containing ammonia may cause brass tubing to crack.
- Always use oxygen compatible leak test solution on oxygen or nitrous oxide service equipment.

Abbreviations

C	Common
CGA	Compressed Gas Association
FT-LBS	Foot-Pounds
IN-LBS	Inch-Pounds
N/C	Normally Closed
N/O	Normally Open
NPT	National Pipe Taper
OSHA	Occupational Safety & Health Administration
PSIG	Pounds per Square Inch Gauge
SCFH	Standard Cubic Feet per Hour
VAC	Voltage, Alternating Current
VDC	Voltage, Direct Current
PCB	Printed Circuit Board

Disclaimer

BeaconMedæs shall not be liable for errors contained herein or incidental or consequential damages in connection with providing this manual or the use of material in this manual.

Manufacturer Statement

The information contained in this instruction manual has been compiled by BeaconMedæs, from what it believes are authoritative sources, and is offered solely as a convenience to its customers. While BeaconMedæs believes that this information is accurate and factual as of the date printed, the information, including design specifications, is subject to change without prior notice.

Warning

Our equipment is primarily intended for use in compressed gas systems. BeaconMedæs products are designed for use by persons technically trained in the proper use and safe handling of gas delivery systems. Due to the high pressure and hazardous gases employed in these processes, misapplication could result in injury or death. BeaconMedæs expressly warns against the sale to, or use of our products by, anyone other than professionally trained personnel. Do not use this equipment where pressures and temperatures can exceed those listed in this manual.

Through misuse, age, or malfunction, components used with inert, combustible, corrosive, toxic, or oxidizing gases can fail in various models. The system designer is warned to consider the failure modes of all component parts used with the above mentioned gases and to provide adequate safeguards to prevent personal injury or damage to equipment in the event of such failure modes. Adequate safeguards can be, but are not limited to:

- Pressure relief devices adequately piped to a safe location.
- Gas detection devices connected to a proper warning audible and visual alarm.
- Automatic shut-off valves and/or manual shut-off valves with an emergency stop push button.
- Self-contained breathing apparatus.
- Pipeline purge system with inert gas.
- Fire extinguishers and/or automatic sprinklers.

System designers must provide a warning to end users in the systems instructional manual if protection against a failure mode cannot be adequately provided for.

It should be recognized that warnings are valid for any equipment, regardless of manufacturer, and are not restricted to equipment manufactured by BeaconMedæs.

Design Changes

In line with our commitment to continuous improvement, BeaconMedæs reserves the right to make design modifications or discontinue manufacture of any equipment without prior notice.

Trademarks Used in this Manual

Buna-N, Delrin, Kalrez, Teflon, Tefzel, Vespel, Viton and Viton-A are trademarks of E.I. DuPont de Nemours & Company. Monel is a trademark of Inco Alloys International, Inc. Kynar is a trademark of Atochem North America, Inc. Snoop is a trademark of Nupro Company. Swagelok is a trademark of Crawford Fitting Company. Hastelloy is a trademark of Union Carbide Corporation. VCR is a trademark of Cajon Company.

1.0 General

1.1 Introduction

BeaconMedæs changeover stations are cleaned, tested and prepared for the indicated gas service and are built following National Fire Protection Association and Compressed Gas Association guidelines. The changeover station consists of a regulator module and two supply bank headers, one service and one reserve supply, to provide an uninterrupted supply of gas for the specific gas application. The regulator module is designed and built with features providing automatic changeover from the depleted "Service" supply bank to the "Reserve" supply.

Pressure gauges, alarm signal connections and lights show system status and alert the need to replace depleted cylinders. Features of the automatic system include an adjustable line regulator, hoses with check valves, rigid wall-mounted headers and complete mounting hardware.

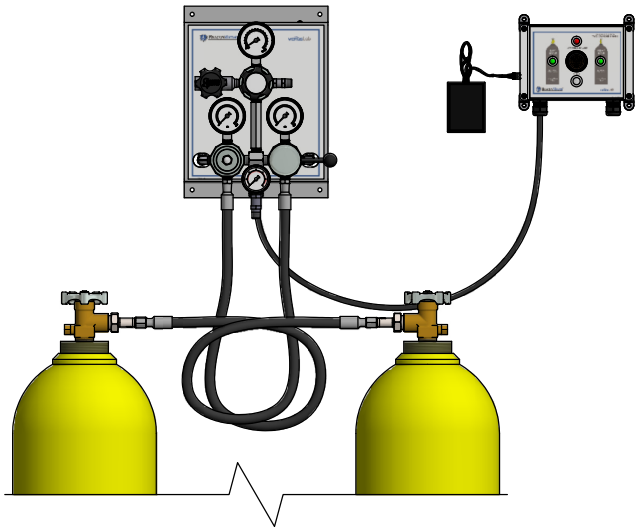


Figure 1.1 PDC3000

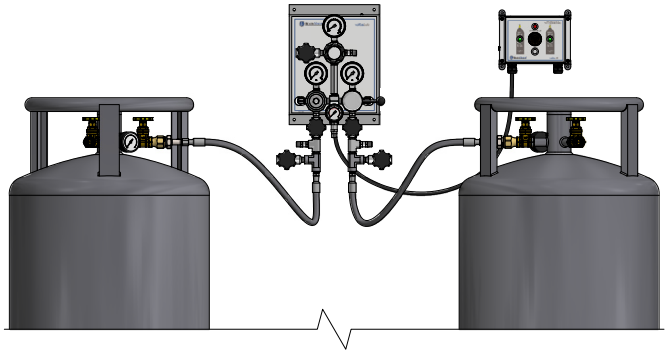


Figure 1.2 PDC350

1.2 Description

1.2.1 PDC Manifold

The PDC3000 and PDC1500 Series Pressure Differential Changeover Stations are designed to supply an uninterrupted flow of high purity gases from high pressure cylinders. The PDC1500 is for Carbon Dioxide service and includes heaters. The PDC350 Series is designed to supply an uninterrupted flow of high purity gases from liquid cylinders.

The system automatically changes from the supply bank to the reserve bank without an interruption in gas supply. A simple rotation of the primary bank selector lever resets the unit. Components are kept to a minimum to keep the unit as pure as possible. See Figure 1.1 and Figure 1.2.

1.0 General

1.2.2 Remote Alarm Box

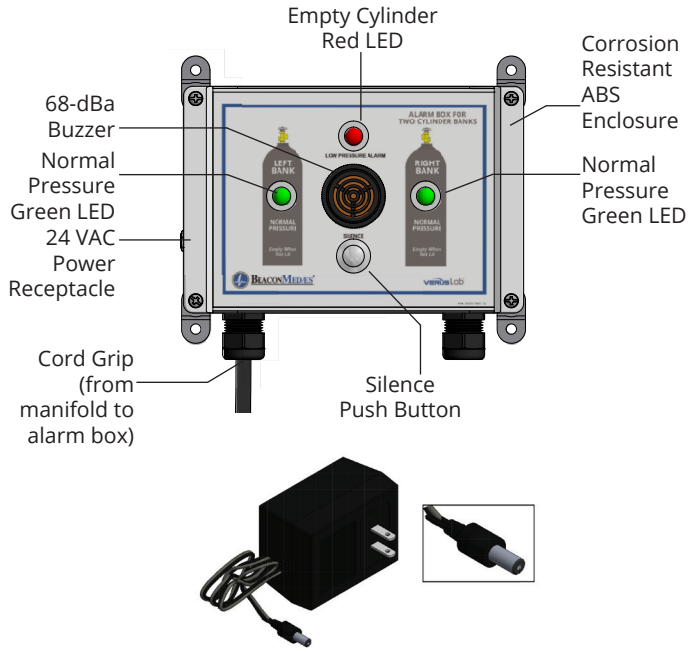
Internal pressure switches (hidden behind the mounting panel), red and green lights and a buzzer indicate bank status and the need to change out the depleted cylinder bank.

The Remote Alarm Box operates with a 24 VAC power source. The alarm function is initiated on an open circuit. The alarm box contains one green light per cylinder bank, one red light for both banks, and one buzzer and one silence button for both banks.

The green lights are illuminated as long as their respective cylinder bank pressures are satisfactory.

When a cylinder bank is depleted of gas, the green light turns off, the red LED illuminates, and the buzzer activates. Silence the buzzer by pressing the silence push button. The red LED will remain illuminated until the depleted bank is replaced. The Remote Alarm Box comes standard with a 24 VAC plug-in power transformer.

The alarm box has two alarm signals for remote annunciation: one normally open dry contact and one 24 VAC (hot) signal.



1.0 General

1.3 Ordering Information

PDC3000 [ ] – [ ] – [ ] – [ ] – [ ]

Material of Construction	Inscribe
Brass	B
Stainless Steel	S

Gas	Inscribe
Air - Compressed	346
Argon	580A
Helium	580H
Hydrogen	350
Nitrogen	580N
Oxygen	540

Options	Inscribe
Vent Valve	VV

Hoses & Pigtails	Inscribe
Teflon Core Hose	TCH
All Stainless Steel Hose	SSH

Number of Cylinders	Inscribe
1 Cylinder per Side	2
2 Cylinders per Side	4

PDC1500 **B** – **320** – [ ] – [ ] – [ ]

Material of Construction	Inscribe
Brass with Heater	B

Gas	Inscribe
Carbon Dioxide	320

Options	Inscribe
Vent Valve	VV

Hoses & Pigtails	Inscribe
Teflon Core Hose	TCH
All Stainless Steel Hose	SSH

Number of Cylinders	Inscribe
1 Cylinder per Side	2
2 Cylinders per Side	4

PDC350 **B** – [ ] – [ ] – [ ] – [ ]

Material of Construction	Inscribe
Brass	B

Gas	Inscribe
Argon	580A
Carbon Dioxide	320
Nitrogen	580N

Options	Inscribe
Vent Valve	VV

Hoses & Pigtails	Inscribe
Teflon Core Hose	TCH
All Stainless Steel Hose	SSH

Number of Cylinders	Inscribe
1 Cylinder per Side	2
2 Cylinders per Side	4

1.0 General

1.4 General Instructions

Changeover stations should be installed in accordance with guidelines stated by the National Fire Protection Association, the Compressed Gas Association, OSHA, and all applicable local codes. The carbon dioxide and nitrous oxide changeover stations should not be placed in a location where the temperature will exceed 120°F (49°C) or fall below 20°F (-7°C). The changeover stations for all other gases should not be placed in a location where the temperature will exceed 120°F (49°C) or fall below –20°F (-29°C). A changeover station placed in an open location should be protected against weather conditions. The changeover station should be located in a clean, well ventilated area which is free of oil and combustible materials.

Leave all protective covers in place until their removal is required for installation. This precaution will keep moisture and debris from the piping interior, avoiding operational problems.

All safety relief valves should be piped/vented to a safe and outside location.

1.5 Specifications

1.5.1 Manifolds

Gas	Refer to Part Number Matrix
Maximum Inlet Pressure	PDC3000 = 3000 PSIG PDC1500 = 1500 PSIG PDC350 = 350 PSIG
Flow (ft^3/min / psi inlet pressure (at standard conditions)	Cv PDC3000 = 0.06 Cv PDC350 = 0.06
Operating Temperature	-40°F to 100°F
Pressure Gauge Size	2” Dial
Inlet Connection	Gas Specific CGA Connection (Refer to Part Number Matrix)
Outlet Connection	1/4” F.NPT
Audible and Visual Alarm	Alarm Box
Header	1/2” Nominal Pipe Size (0.840” Outside Pipe Diameter)
Power Requirement	Alarm Box: 110 VAC, 1 Amp Heaters for CO2: 110 VAC, 150 Watt (2 Heaters = 300 Watts Total)
Flexible Hose Length	Cylinders: 36 inches Clusters/Bulk Packs/Cradles: 72 inches

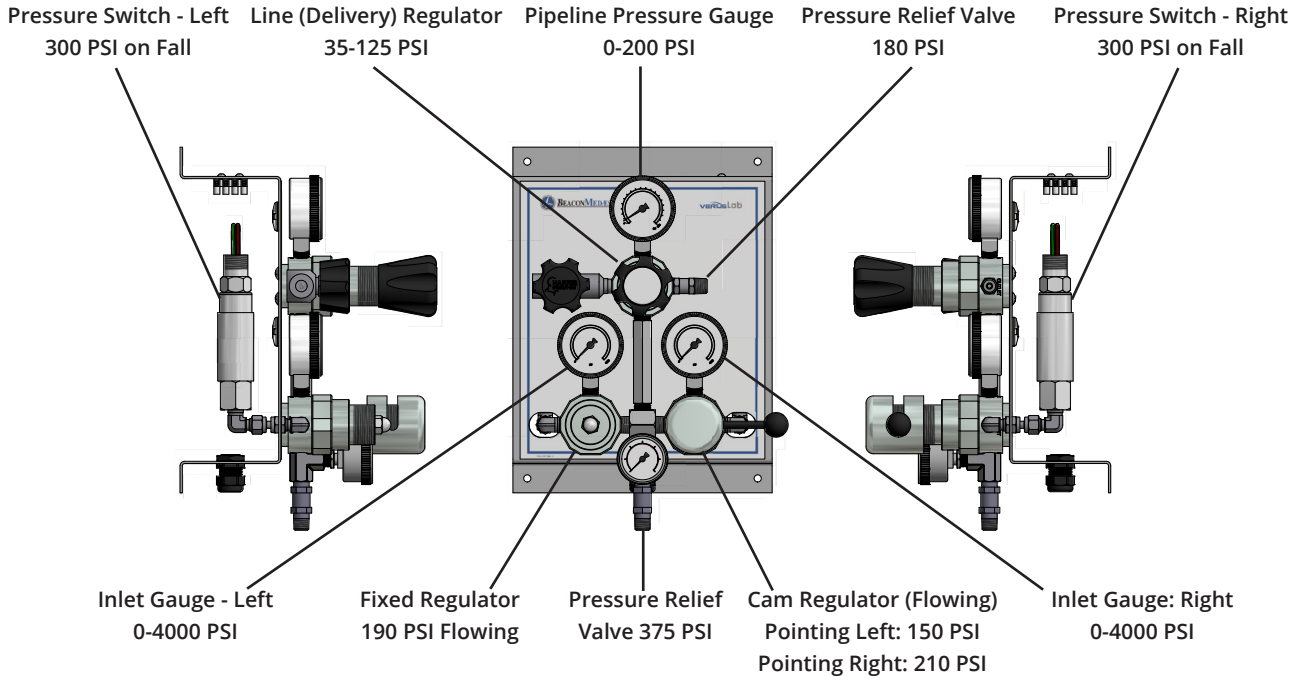
1.5.2 Alarm Box

Enclosure	ABS - Light Gray - NEMA 4X
Alarm Signal	24VAC - 750 mA
Dry Contact	Normally Open (3 Amp. @ 28VDC/ 277VAC when contact is in Close Position
Silence Push Button	Momentary Push Button - Chrome Plated Steel - 3/4” Diameter
Buzzer	Continuous Tone - 68 dBa Minimum at 3 feet
Power Transformer	Input: 120 VAC, 60 Hz, 32 Watts - Output: 24 VAC, 1000 mA

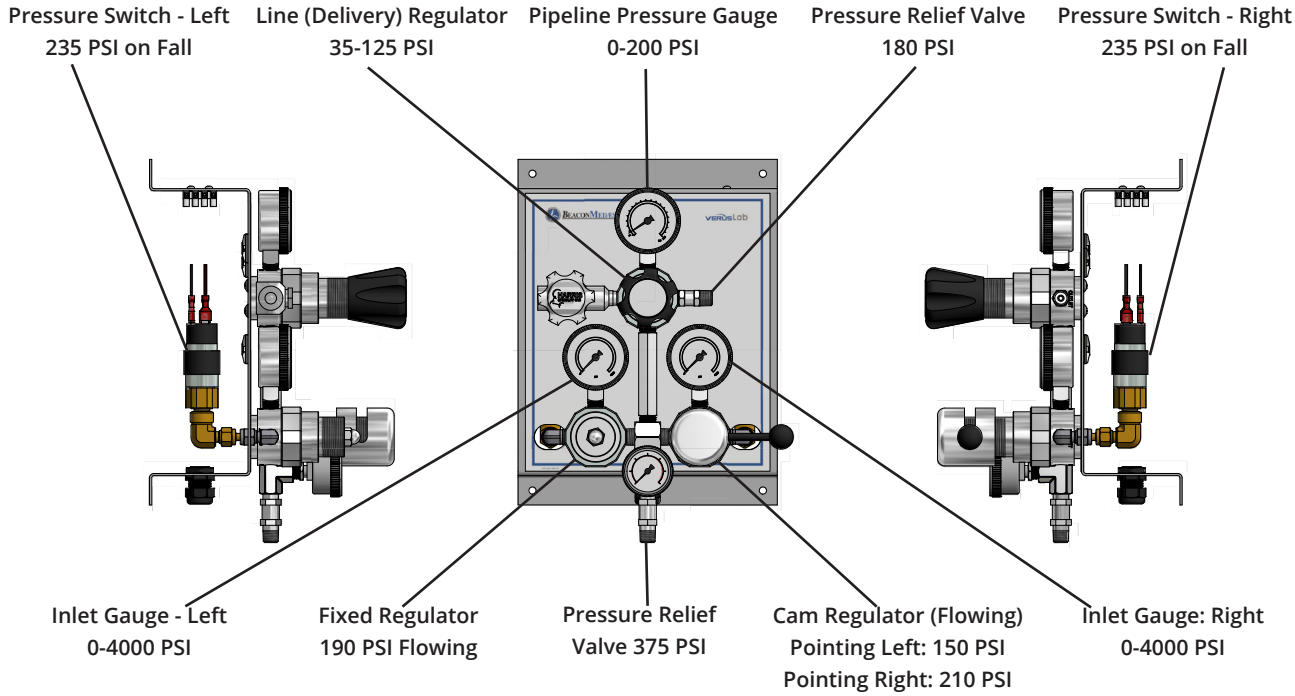
1.0 General

1.6 Standard Factory Pressure Settings

1.6.1 PDC3000: Stainless Steel

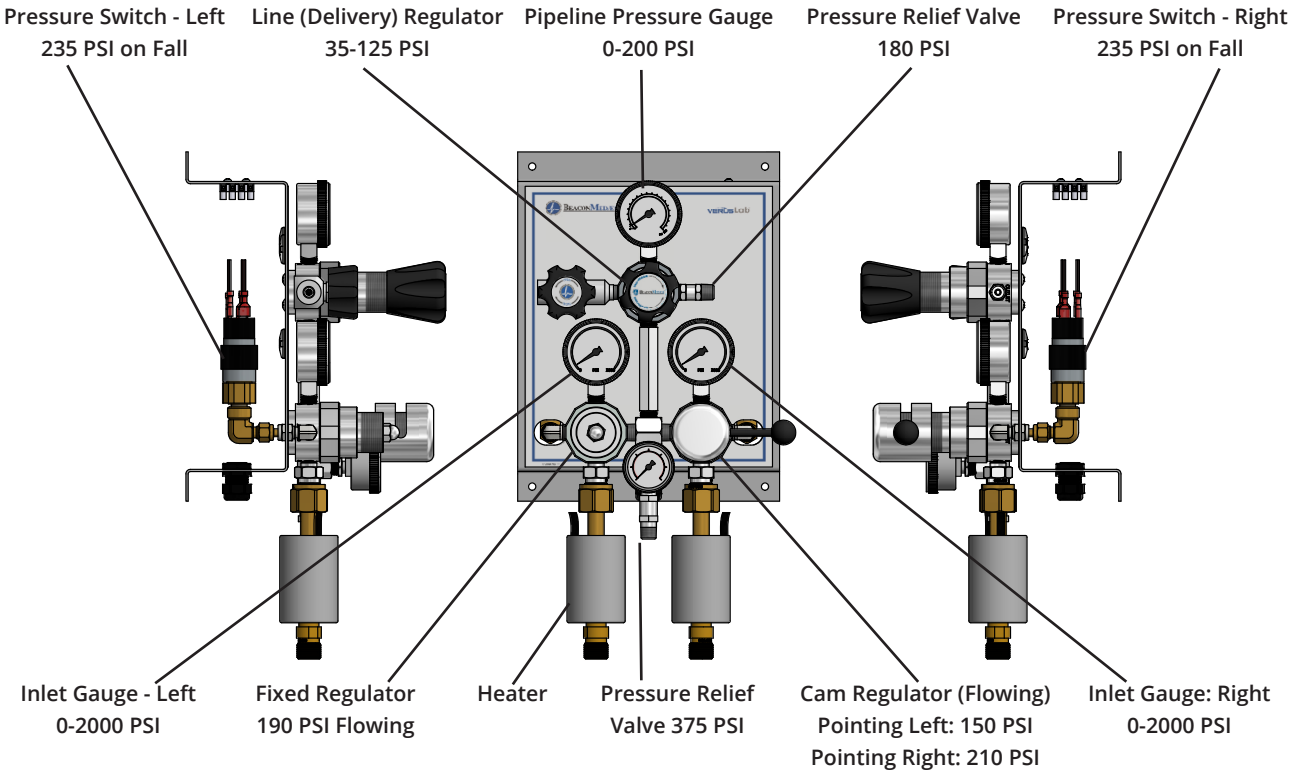


1.6.2 PDC3000: Brass

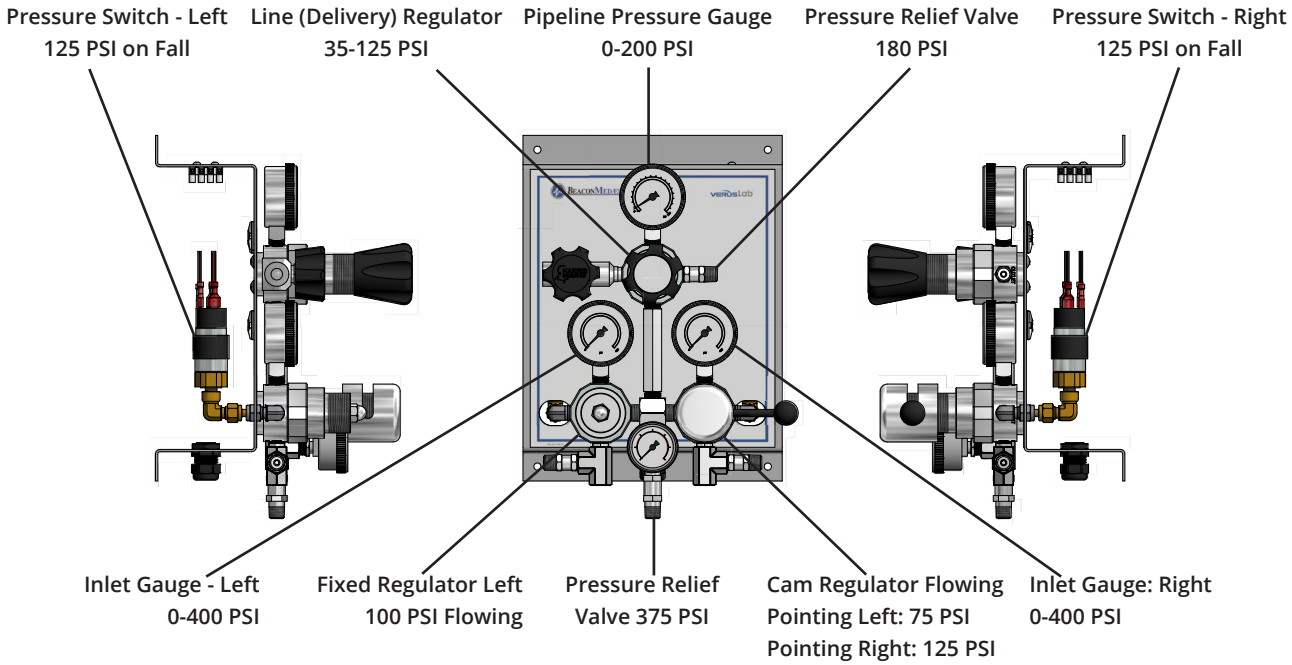


1.0 General

1.6.3 PDC1500: Brass



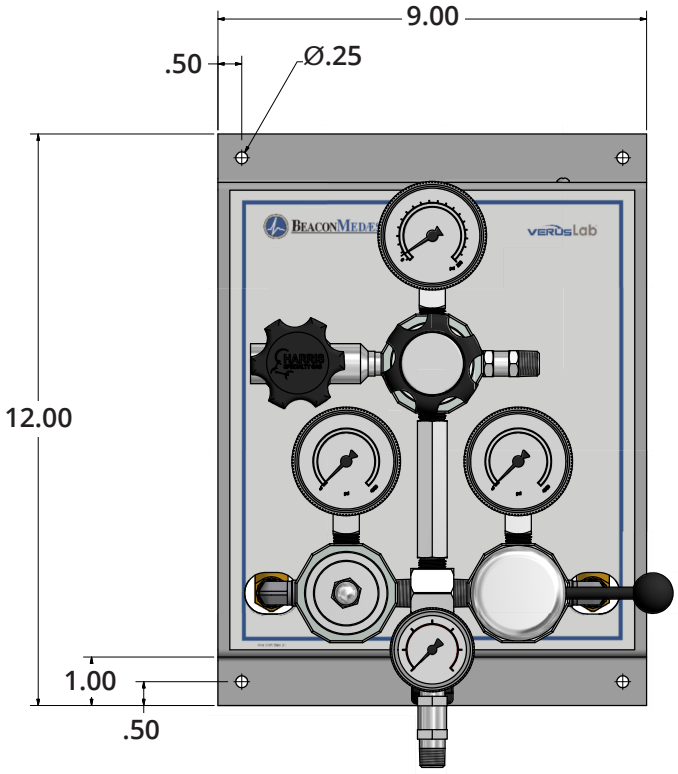
1.6.4 PDC350: Brass



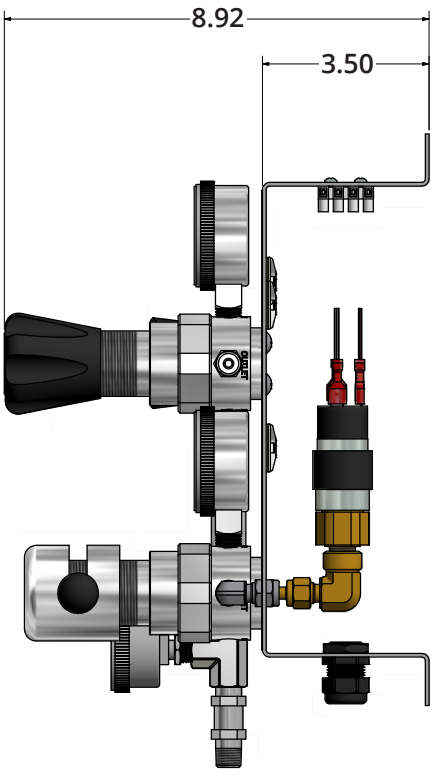
The above mentioned settings will vary upon which PDC Series Automatic Changeover Station is purchased. The specific settings of each piece of purchased equipment are indicated on their respective nametags.

1.0 General

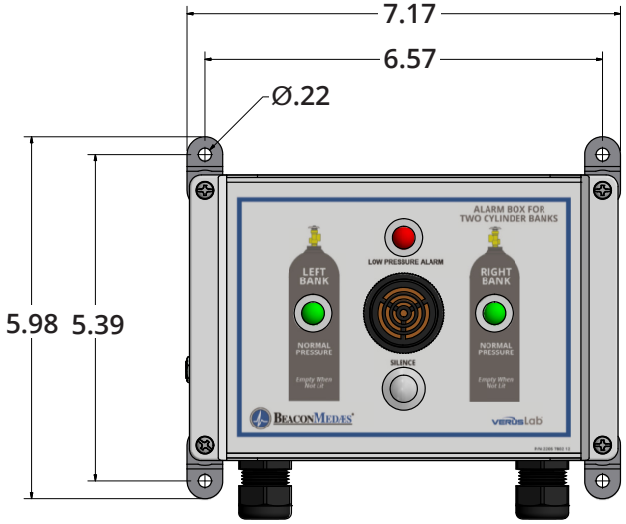
1.7 Dimensions (inches)

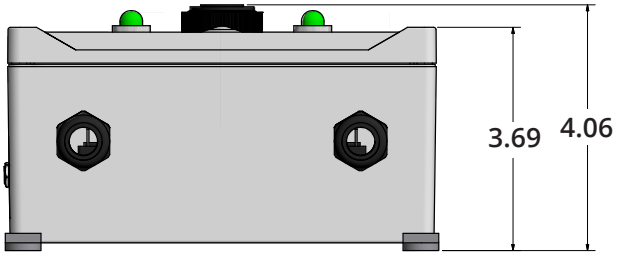


Front View



Bottom View

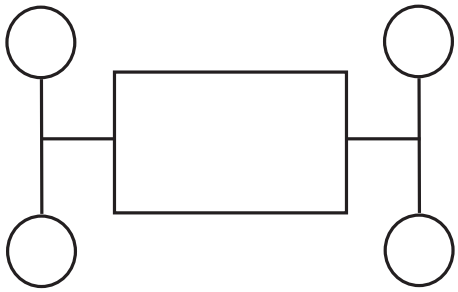




1.0 General

1.8 Header Configuration

For units with more than 1 cylinder per side.



Crossover Configuration

Wall mounting 10” center

1.9 Standard & Custom Configurations

Name Tag
Each piece of equipment bears a name tag telling you important information about:

- Gas service
- Alarm set points
- Pressure settings
- Model number
- Serial number

Flexible Hoses
Flexible hose pigtail selection is critical to get the best performance from your manifold. We offer two types of hoses/pigtails:

- Teflon Core Hose
- Stainless Steel Hose

As a standard feature, each hose has:

- Check valve in the CGA nipple
- Standard CGA nut and nipple

Hydrogen & Helium Flexible Hoses
Helium and Hydrogen are very small molecules that permeate through Teflon. All BeaconMedæs gas cylinder stationary discharging stations are mounted with stainless steel hoses for helium and hydrogen service.

Oxygen Service Equipment
All oxygen service equipment is cleaned per the requirements of CGA G-4.1.

CAUTION:

Remove all protective caps prior to assembly. The protective cap may ignite due to heat of recompression in an oxygen system.

2.0 Installation

2.1 Manifold Box

The PDC Series Changeover Stations can be used either with two cylinders by connecting the inlet flexible hoses directly to each of the cylinders or with several cylinders by connecting the flexible hoses to the ends of two single-row headers. The recommended clearance for a typical gas cylinder is 64" from the floor to either a header bar or a manifold box.

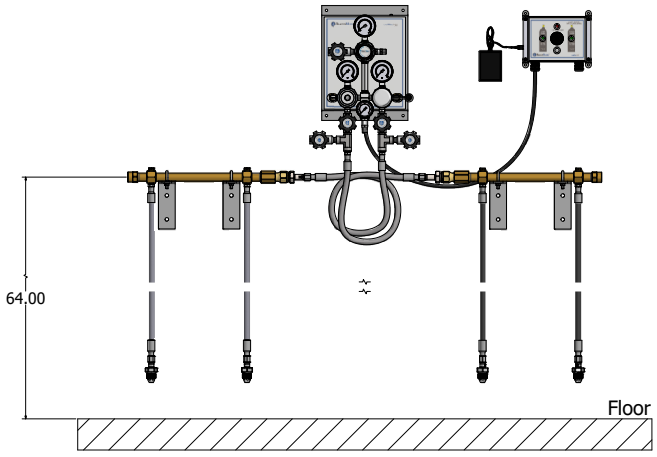


Figure 2.1 Manifold height

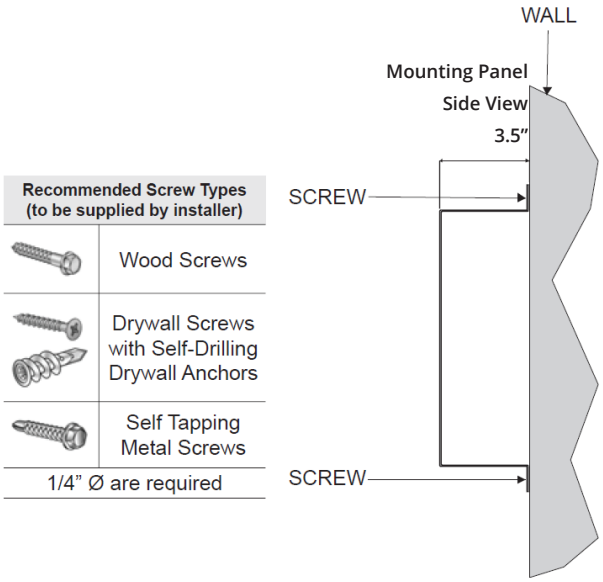


Figure 2.2 Manifold mounting

2.2 Alarm Box

The alarm box comes pre-wired to the regulator module. The alarm box is mounted with one wall mounting bracket to each corner. To locate the alarm box, please consider the following:

- The alarm box cable is about five feet long.
- The alarm box has to be easily accessible to an operator (to push the silence button).
- The alarm box requires 24 VAC. We have provided a plug-in power transformer that brings the power from 110 VAC down to 24 VAC. The alarm box must be located within reach of a wall power outlet (power outlet supplied and installed by others).

Figure 2.3 Alarm box mounting

2.0 Installation

2.3 Power Transformer

The remote alarm box comes with a wall plug-in step-down power transformer. The installation should be done as per the diagram shown below.

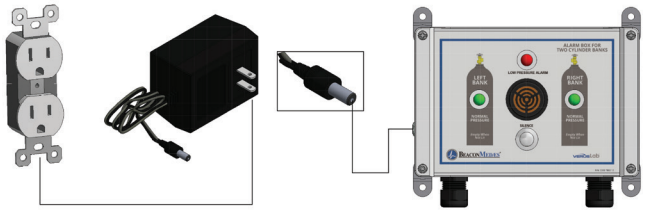


Figure 2.4 Power transformer assembly

2.4 Header Bars

The header bars (when required) are connected to the regulator module via two 36-inch long hoses (one per side). The header bars must be installed and leveled within reach of these hoses. The minimum radius of these hoses is 3-4 inches. DO NOT PUT PRESSURE IN KINKED HOSES. The connector at the end of each of the 36-inch hose corresponds to the special adaptor at the inlet of the header bars. Screw the hose connector to the adaptor, first by hand and then tighten using two pipe wrenches.

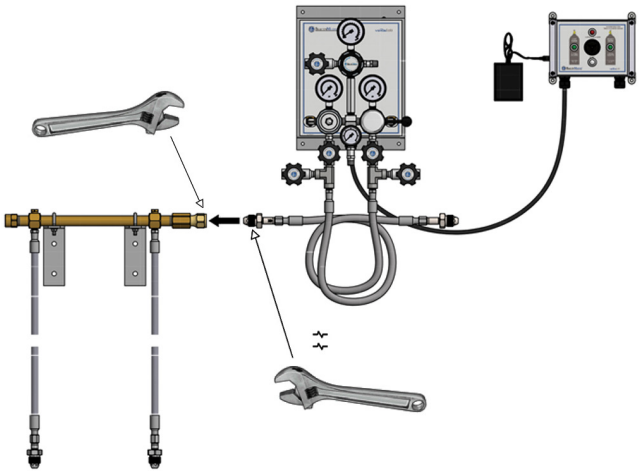
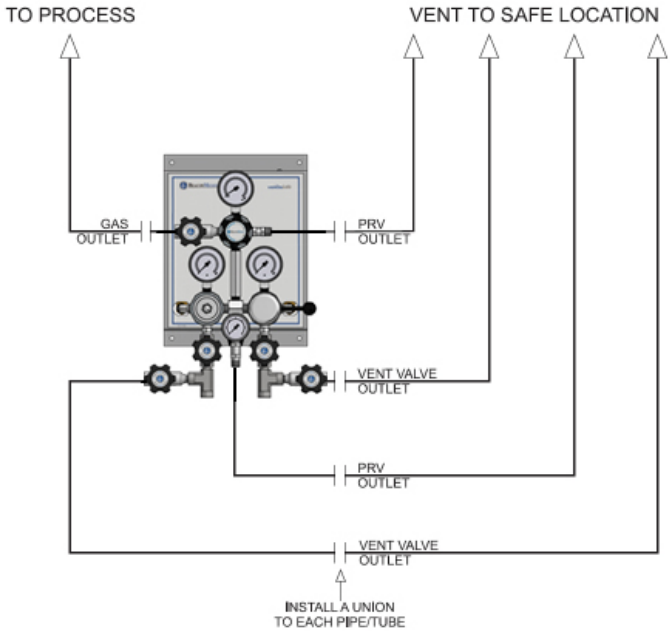


Figure 2.5 Header bar connection

2.5 Plumbing

In high purity piping installations, the quality of tubing and fittings are of paramount importance. Therefore, the piping installer should be familiar with and experienced in such critical applications. Below is a list of important points to consider:

- It is recommended to use stainless steel tubing over copper, and copper over soft tubing such as Teflon or nylon.
- Always verify material compatibility with the service gas.
- A good piping network is always protected against overpressure with a safety (pressure) relief valve (vented to a safe location).
- Always have a means to allow easy removal of the equipment off the wall such as unions or compression fittings.



Pipes (tubes) and fittings to be provided by others.

Figure 2.6 Plumbing connections

2.0 Installation

2.6 Connecting Cylinders

Each flexible hose has been installed on the header during quality control testing performed at BeaconMedæs prior to shipment. The inlet of the hose is a gas specific CGA fitting and attaches to the cylinder. The other end of the hose is a ¼" M.NPT connection and it has been connected to the header bar or to the regulator module by BeaconMedæs at the factory.

WARNING:

Care should be exercised when bending flexible hoses to connect them to cylinders. DO NOT PRESSURIZE A KINKED FLEXIBLE HOSE OR RIGID PIGTAIL!

1. Shut off all cylinder valves, header valves and master shut off valves on the depleted cylinder bank.
2. S-L-O-W-L-Y loosen and remove the hose connection from the depleted cylinders.
3. Remove depleted cylinders and replace protective caps.
4. Remove protective cylinder caps from full replacement cylinders.
5. Place and secure full cylinders into position using chains, belts, or cylinder stands.
6. Connect cylinder flexible hose to cylinder valves and tighten with wrench (see picture below).

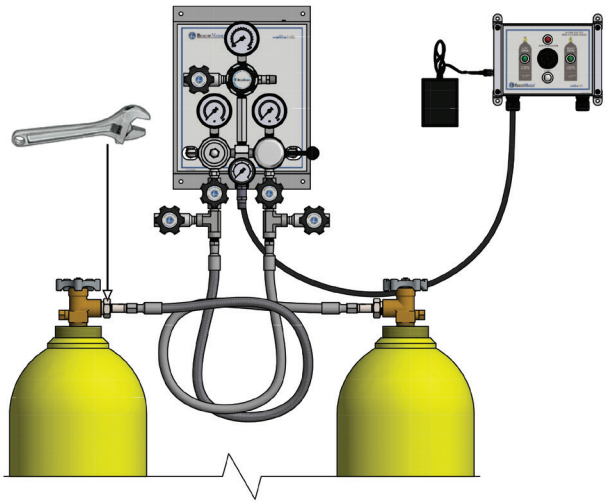


Figure 2.7 Connecting cylinders

7. Open master valves (aka isolation valve or block valve). S-L-O-W-L-Y turn each cylinder valve until cylinder is fully on.
8. On the alarm box, the red light should be extinguished.
9. The manifold supply bank is now replenished. If not already done, turn the priority bank selector to the opposite bank to make it the service bank.

NOTE: Failure to rotate the priority bank selector after installing new cylinders will result in a partially full reserve bank.

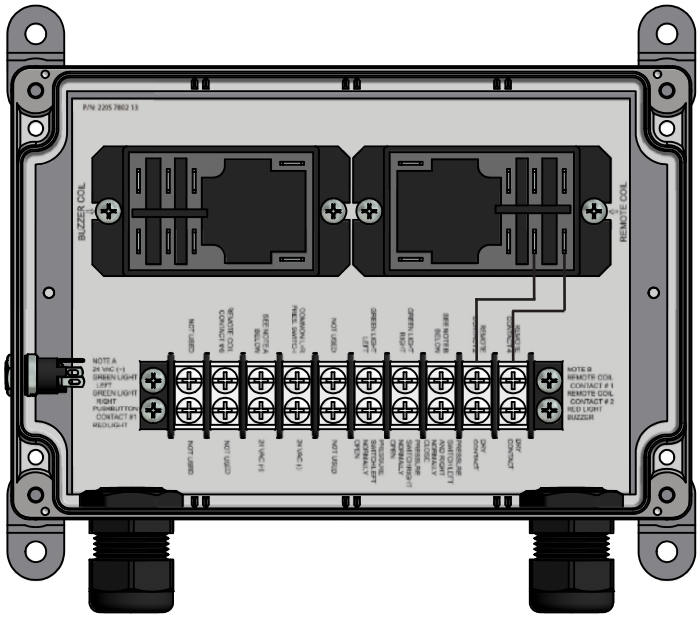
2.0 Installation

2.7 Alarm Box Wiring

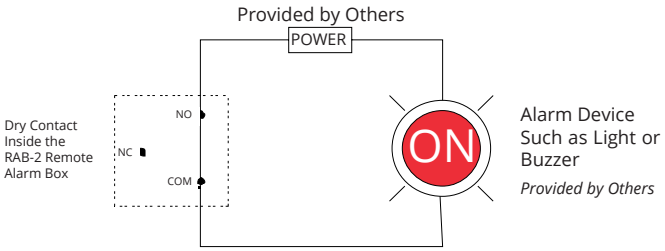
The alarm box is equipped with a dry contact allowing for an external/remote signal. Unless otherwise specified, the wiring installation and related hardware is performed in the field by others.

Remote Alarm Devices Actuation

As shown on the diagram below, the alarm box is wired on a Normally Open dry contact (relay). That means the electrical circuit remains open until an alarm (depleted bank) occurs.

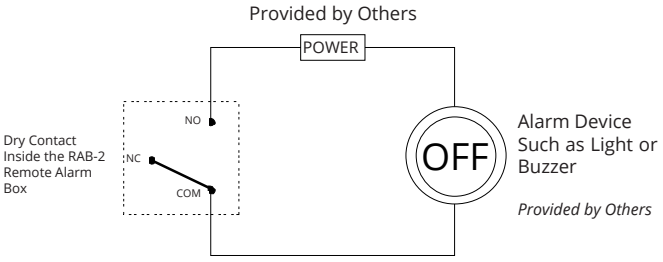


Alarm Condition



The content inside one of the gas cylinder banks is depleted (low pressure). The dry contact switches from the Normally Closed (NC) position to the Normally Open (NO) position. The electrical circuit is closed and the alarm device is actuated.

No Alarm Condition



In this situation, the gas cylinder bank pressure is satisfactory (i.e. not empty). The dry contact inside the alarm box is in the Normally Open position. The electrical circuit is open and the alarm device is NOT actuated.

Figure 2.8 Alarm box wiring

2.0 Installation

2.8 Master Alarm Box (Normally Closed Circuit)

The alarm box can also be connected to a master alarm box (such as a hospital alarm box) that works on a normally closed circuit to measure current continuity. In that case, the alarm box keeps the dry contact (circuit) closed unless there is an empty bank. The circuits open and the current continuity is broken and the master alarm box falls in alarm.

Because the alarm box is factory wired in a normally open position, the installer or the end user is required to change the wires in the field. As shown on the diagram below, the wire on Remote Contact 2 remains connected where it is on Pin 4 (the Common) but the wire on Remote Contact 4 has to be placed on Pin 3. The circuit is now on a Normally Closed mode.

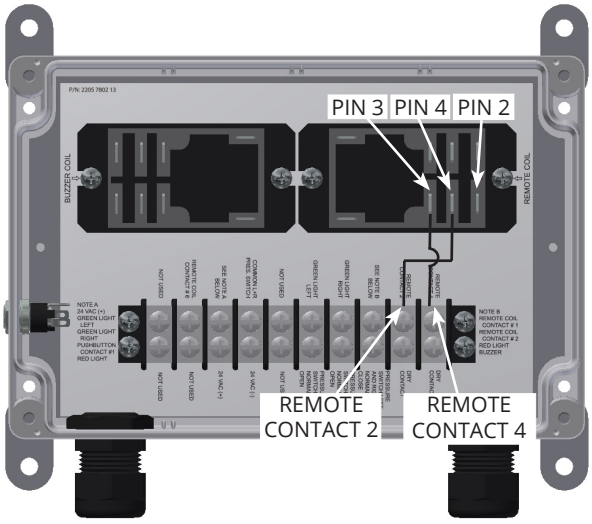
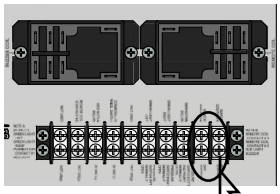


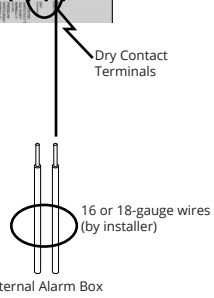
Figure 2.9 Master alarm wiring

External View
(Front)

Dry Contact Rating
Normally Open (3 Amp. @ 28 VDC / 277 VAC when Contact is in Close Position)

Internal View
(Mounting Panel)





3.0 Operation

3.1 Manifold Operation

The automatic changeover station consists of a regulator module and two supply bank headers, one service and one reserve supply, to provide an uninterrupted supply of gas for the specific gas application. The regulator module includes the components shown on the drawing below.

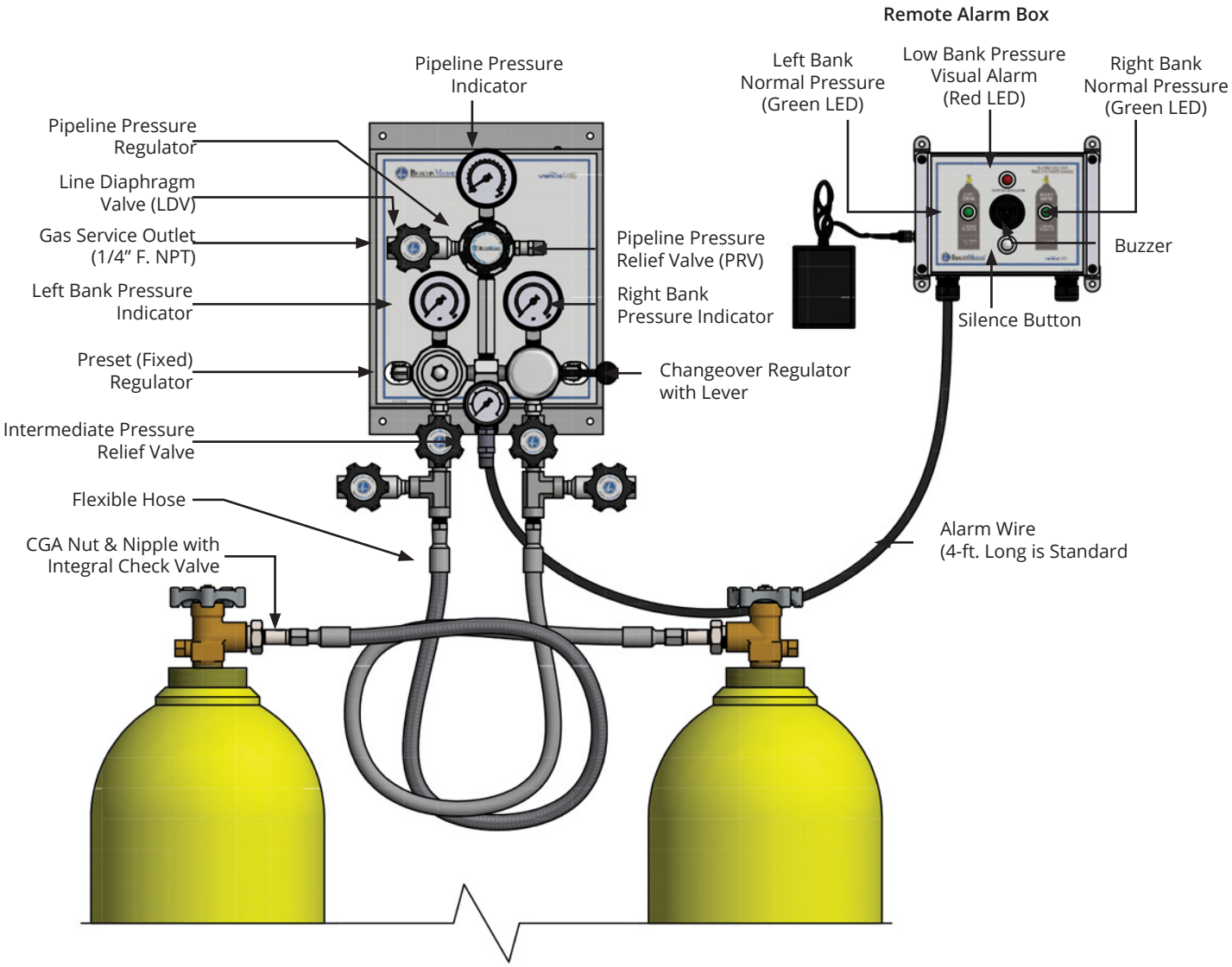


Figure 3.1 PDC3000

3.0 Operation

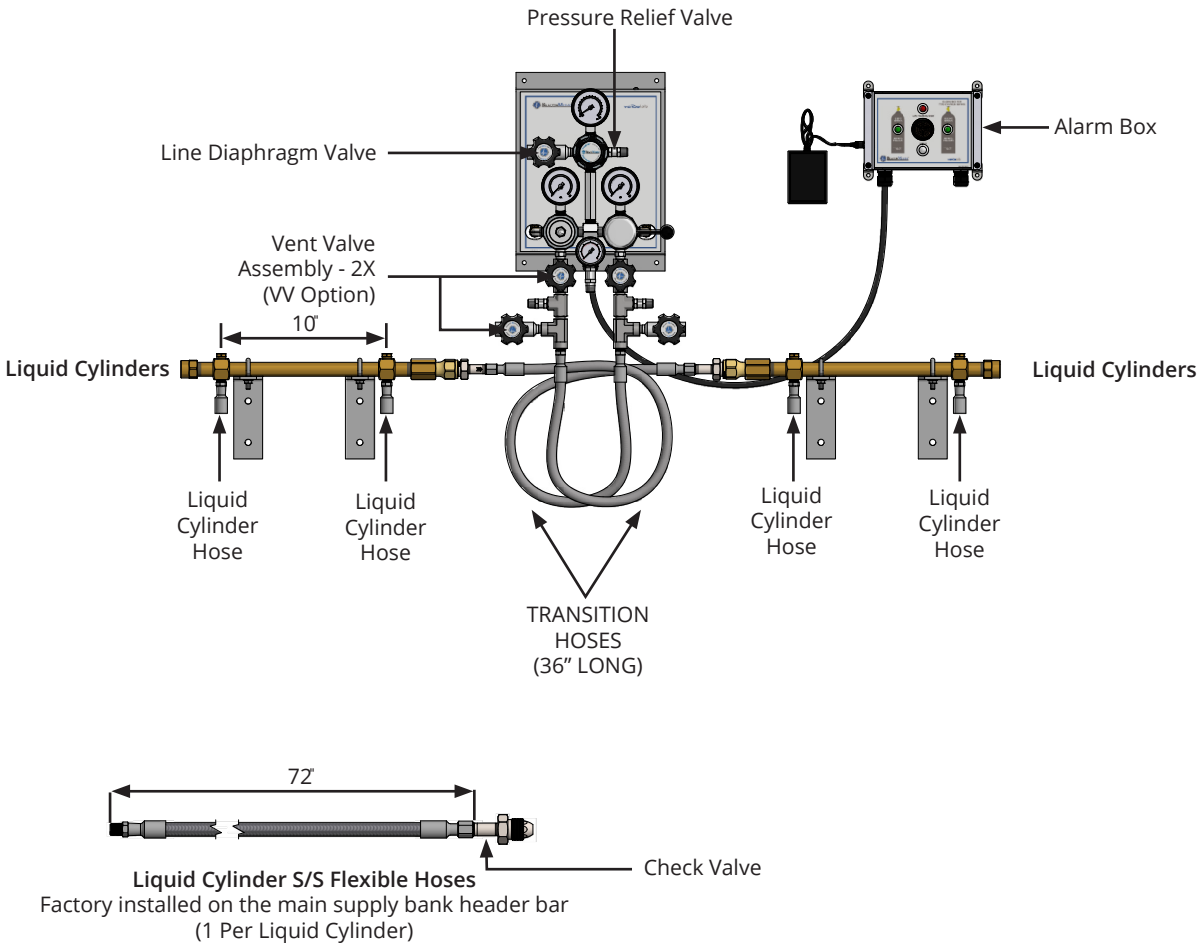


Figure 3.2 PDC350

The cylinder bank that supplies the piping system is known as the "Service" supply while the cylinder bank on standby is referred to as the "Reserve" supply. Gas flows from the cylinder through the hose, check valves, headers, and shut-off valves into the left and right inlets of the regulator module.

The PDC Series manifolds feature optional vent valves which permit the venting of air that may have entered the system when a cylinder is replaced.

The gas on the right bank flows into the changeover regulator (the regulator with the lever) while gas from the left bank flows into the fixed pressure regulator.

Pressure is regulated by the fixed regulator and the changeover regulator to the pressures noted in the adjustment specification table of this manual. The fixed pressure regulator is set midway between the maximum and minimum settings of the changeover regulator. The position of the primary bank selector handle (changeover regulator lever also called the

3.0 Operation

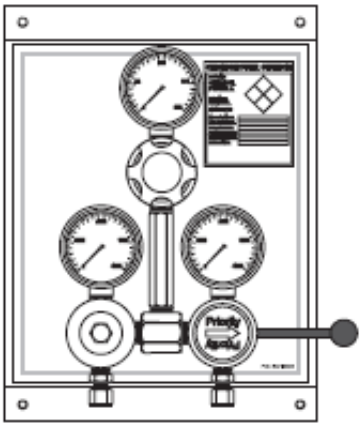
"primary bank selector handle") determines which bank is in service. When the primary bank selector handle is rotated clockwise (arrow pointing right) the changeover regulator setting is higher than the fixed-pressure regulator setting. Therefore, the right bank will be in "Service" and the left bank will be in "Reserve." When the changeover regulator lever is rotated counterclockwise (arrow pointing to the left), the changeover regulator setting is lower than the fixed pressure regulator setting. Therefore, the left bank will be in "Service."

When the gas pressure on the right bank drops to the set pressure of the fixed-pressure regulator, the left bank will start to flow. Conversely, when the primary bank selector handle is rotated counterclockwise (pointing left) the fixed-pressure regulator setting is higher than the changeover regulator set pressure. Therefore gas will flow from the left bank. When the gas pressure on the left bank drops to the set pressure of the changeover regulator, the right bank will start to flow. When rotating the primary bank selector handle you are altering the pressure setting of the changeover regulator above or below the fixed-pressure regulator setting. If the knob is not rotated all of the way until it stops the manifold will not function correctly. The line pressure regulator further reduces the pressure to the final pressure delivered to the gas piping system. The gas flows from the line regulator outlet to the pipeline distribution system.

Cylinder pressures for each bank are indicated on the gauges on the fixed-pressure regulator (left bank) and on the changeover regulator (right bank). The line pressure is indicated by the center gauge on the line regulator.

After replacing empty cylinders and opening the header isolation valve and cylinder valves, the operator should then turn the priority bank selector knob to the opposite cylinder bank. This will make the partially used "Reserve" bank the "Service" supply and the newly installed cylinders will become the "Reserve" supply.

When the lever is pointing to the right, the gas will come from the right bank until the cylinder is depleted.



Rotate the lever counter-clockwise to draw gas from the left side first. The gas will come from that side first until the cylinder is depleted. The gas will then come from the right side even if the lever is still pointing to the left. Rotate the lever to the right side to make it the side you want to draw gas from first.

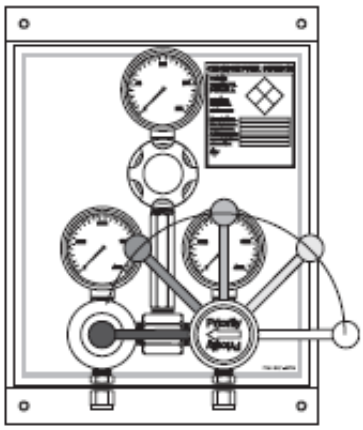


Figure 3.3 PDC Manifold Operation

With the PDC350 manifold, low pressure on the liquid cylinder side can be caused by either:

- An empty cylinder
- The economizer of the liquid cylinder is not properly adjusted (the liquid cylinder may not be empty)
- The flow of gas is too high for the capacity of the liquid cylinder pressure build-up regulator (cylinder may not be empty)

3.0 Operation

3.2 Vent Valve (Optional)

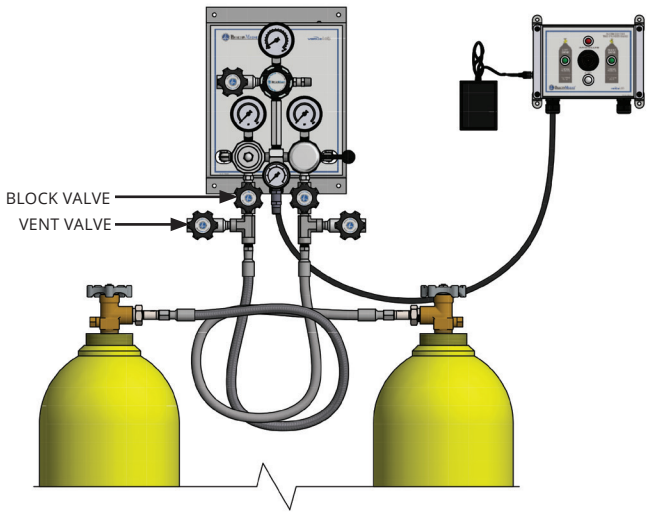


Figure 3.4 Manifold with vent valve

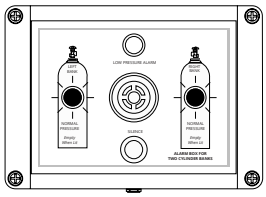
Purging, meaning to cleanse, is an important procedure which is often overlooked in many gas processes. Before initial and subsequent system startups, purging should be done to remove contaminants such as air and water vapor from the gas delivery system. To enhance operator safety, purging should also be done before changing out cylinders to remove residual toxic gases.

Block Valve
The block valve allows the operator to isolate the pressure regulator prior to a cylinder change. As such, the amount of air entering the system is limited to the area being purged. In the case of the PDC Series Changeover Stations, this area is very limited as all flexible hoses equipped with check valves at the inlet (hence keeping most of the contaminants outside the hose). This keeps downtime to a minimum since this small area can be purged rather quickly.

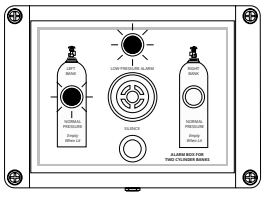
Vent Valve
The vent valve must be connected to a suitable disposal line. This allows the operator to remove the trapped service gas from the area being purged when the block valve has been closed.

3.3 Alarm Box

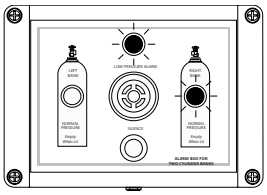
3.3.1 Visual Signals



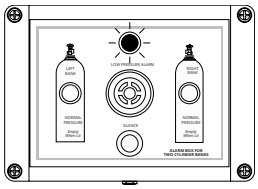
Left Bank: Normal Pressure
Right Bank: Normal Pressure



Left Bank: Normal Pressure
Right Bank: Low Pressure



Left Bank: Low Pressure
Right Bank: Normal Pressure



Left Bank: Low Pressure
Right Bank: Low Pressure

Figure 3.5 Alarm box visual signals

3.3.2 Audible Signals

The audible alarm is actuated each time a red light is activated. The silence button stops the buzzer but the visual (red) light remains illuminated.

3.4 Leak Testing and Purging

1. Connect the cylinders to the flexible hoses with the CGA nut/nipple end connections provided.

CAUTION:

Flexible hoses containing check valves can be pressurized with system pressure only up to the check valve seat. The threaded joints on the flexible hose, including the CGA connection, will not be pressurized with the process gas.

2. Use the process gas to leak test and purge the system. If the process gas is hazardous (flammable, toxic and/or corrosive) or sensitive to atmospheric contaminants, use clean dry nitrogen as a purge gas to leak test and purge the manifold system.

3.0 Operation

3. Isolate the downstream side of the regulator module by closing a downstream header isolation valve (block valve).

4. Stand to the side of the regulator module and slowly open the gas cylinder valves from the left side of the regulator module. Open the isolation valve located on the left side header and check inlet gauge for pressure into the control panel. Repeat the same procedure for the right side of the manifold.

5. On the PDC system, open the line regulator by turning the pressure adjusting knob clockwise until the desired pressure is indicated on the outlet gauge.

6. With cylinders connected, but with the cylinder valves closed, leak test all connections with either a soap solution or a gas leak detector such as Snoop®.

7. Purge both right and left sides of the changeover station if the process gas is hazardous or sensitive to atmospheric contaminants. Turn the bank selector handle to the desired primary side. This will allow gas to flow from that side first.

8. Vent the system to atmospheric pressure. Close both header isolation valves by turning the hand knobs fully clockwise. On the PDC Series, close the line regulator by turning the knob counterclockwise until it reaches the stop.

3.5 Start Up and Alarm Verification Procedures

1. Turn the primary bank selector handle to the right until you reach the end. S-L-O-W-L-Y open the right header valve (turn counterclockwise to open). S-L-O-W-L-Y OPEN ONE CYLINDER VALVE ON THE RIGHT BANK. The right bank pressure gauge should show the full pressure of the right cylinder bank. The right bank green “Normal Pressure” light will turn on. At that point, because the left bank is still un-pressurized, the red light should still be illuminated.

2. S-L-O-W-L-Y open the left header valve fully. S-L-O-W-L-Y open one cylinder valve on the left cylinder bank. The left bank pressure gauge will show the full pressure of the left cylinder bank. The left bank green “Normal Pressure” light will turn on. Both banks are now pressurized and the red light should turn off.

3. Create a slight flow of gas in the delivery pipeline system. Close the right cylinder valve to simulate a depleting right bank. Observe the following:

The right bank gauge pressure slowly falls and the control automatically switches over to the left bank.

- Delivery pressure remains constant.
- Green “Normal Pressure” light is turned off.
- Red “Low Pressure” light turns on.
- Buzzer turns on.
- Any remote alarms should be activated at this time.

4. S-L-O-W-L-Y reopen the right cylinder valve. Observe the following:

- Right bank pressure gauge returns to full pressure.
- Green “Normal Pressure” light turns on.
- Red “Low Pressure” light turns off.
- Buzzer shuts off.
- Any remote alarms should be cancelled.

5. Turn the primary bank selector handle to the left and repeat steps 3 and 4 of the procedure to simulate an empty left bank.

3.0 Operation

3.6 Cylinder Replacement

1. Shut off all cylinder valves and header valves on the depleted cylinder bank.
2. S-L-O-W-L-Y loosen and remove the flexible hose connections from the depleted cylinders.
3. Remove the depleted cylinders and replace the protective caps.
4. Remove the protective cylinder caps from the full replacement cylinders (high pressure cylinders only). With the valve outlet pointed away from you or anyone else, slowly open each cylinder valve slightly to blow out any dirt or contaminants which may have become lodged in the cylinder valve.
5. Place and secure the full cylinders into position using chains, belts, or cylinder stands.
6. Connect the flexible hoses to the cylinder valves and tighten with a wrench. DO NOT OVERTIGHTEN.
7. Open the header valves. S-L-O-W-L-Y turn each cylinder valve until each cylinder is fully on (open).
8. Observe the following conditions:

- The red ”Low Pressure” light turns off, and the green “Normal Pressure” light turns on.

9. The changeover station supply bank is now replenished. Turn the primary bank selector handle to the opposite bank to indicate the service bank. This will place the new cylinders in “reserve”.

For PDC350

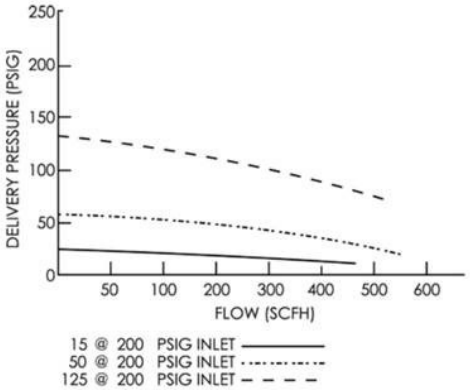
ABOUT THE LIQUID CYLINDER ECONOMIZER AND THE PRESSURE BUILDING CIRCUIT:

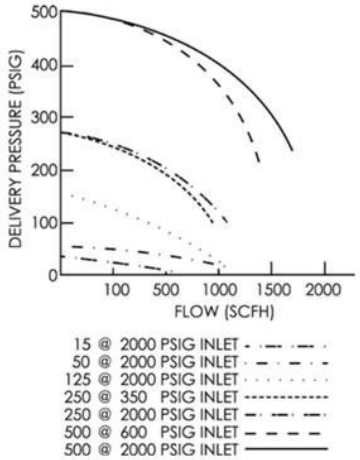
- The liquid cylinder you are using for this application is equipped with an economizer and a pressure building circuit. Sometimes the economizer and the pressure building circuit are operated independently and sometimes they are controlled by a single valve on your liquid cylinder (varies upon model, make and year of construction).
- You may experience with any given liquid cylinder that the pressure is not building up although the cylinder is fresh and full. In this case, three different scenarios are possible; the pressure build valve is closed, the pressure build regulator is set too low or the economizer is set too low.
- You may also experience a rapid increase in pressure of the liquid cylinder which results in venting product out of the liquid cylinder through the pressure relief valves. This situation might be caused by either a pressure build regulator set too high, a very low gas consumption from the liquid cylinder or a bad liquid cylinder vacuum.
- In any of the cases mentioned above, please contact your gas supplier for assistance.

3.7 Line Pressure Adjustment

The delivery line pressure can be increased by turning the line regulator knob clockwise, or decreased by turning the line regulator knob counterclockwise. To decrease the line pressure a flow must be created to allow the gas to escape. See FIG 3.1 for reference.

3.8 Flow Data





4.0 Service

4.1 General Maintenance

CAUTION:

Do not use leak test solution that contains ammonia. Solutions containing ammonia may cause brass tubing to crack.

Main control section

1. On a daily basis, maintain a record of the line pressure.

2. On a monthly basis:

- Check regulators and valves for external leakage.

- Check valves for closure ability

3. On an annual basis:

- Check relief valve pressure with either a soap solution or a gas leak detector such as Snoop®

Manifold header

1. On a daily basis, observe nitrous oxide and carbon dioxide systems for cylinder frosting and surface condensation. Should excessive condensation or frosting occur it may be necessary to increase the manifold capacity.

2. On a monthly basis:

- Inspect valves for proper closure.

- Check cylinder flexible hoses for cleanliness, flexibility, wear, leakage, and thread damage. Replace damaged flexible hoses immediately.

- Inspect flexible hoses check valves for closure ability.

3. Every 4 years

- Replace all flexible hoses

4.2 Shutdown

WARNING:

Hazardous gases must be discharged into a safety vent. Be sure to use a venting procedure that is environmentally acceptable and complies with Federal, State, Provincial, and local requirements.

1. Close all cylinder valves.

2. Vent the system pressure to 0 psig. If a hazardous gas is used, purge the entire system with clean, dry nitrogen gas. Continue purging until the hazardous gas level in the system is below the Threshold Limit Value (TLV) for the gas.

3. Close all system valves by turning the knobs fully clockwise.

4. On the PDC Series, close the line regulator by turning the knob counterclockwise until it reaches the stop.

4.0 Service

4.3 Troubleshooting

Problem	Possible Causes	Solution
LOSS OF CYLINDER CONTENTS		
Audible or inaudible gas leakage (unknown origin)	Leakage at manifold piping connection	Tighten, reseal or replace
	Leakage in downstream piping system	Repair as necessary
	Leakage at cylinder valve	Replace cylinder
	Gauge leaks	Reseal or replace
	Regulator leaks	Repair or replace
Venting at relief valve	Line regulator setting too high	Set delivery pressure to specifications
	Overpressure due to creeping or faulty regulation by either the changeover regulator or the fixed regulator	Replace regulator seat and nozzle components
	Overpressure due to creeping or faulty regulation by line regulator	Replace regulator seat and nozzle components
	Regulator freeze-up (Carbon Dioxide)	Reduce the flow demand or increase the number of supply cylinders. Tighten bonnet. Add heating capacity.
Gas leakage around regulator body or bonnet	Loose bonnet	Tighten bonnet or replace bonnet o-ring
	Diaphragm leak on regulator	Replace regulator or replace diaphragm
Gas leakage around valve stem on master valve	Valve diaphragm leaks	Tighten nut
	Faulty valve	Repair or replace valve

4.0 Service

Problem	Possible Causes	Solution
LOSS OF RESERVE BANK CONTENTS		
Both banks feeding	Fixed-pressure regulator seat leak	Replace regulator
	Fixed-pressure regulator set to open at too high a pressure	Adjust fixed pressure regulator per specifications
	Flow demand too high	Reduce flow demand
	Leaks in the manifold system	Leak test, tighten, reseal or replace fittings as necessary
No switchover	Fixed-pressure regulator set to open at too high a pressure	Adjust intermediate regulator per specifications
	Closed cylinder or shutoff valves	Open valves
	Fixed-pressure regulator defective	Replace or repair regulator
	Empty reserve bank cylinder	Replace cylinder
Premature switchover to reserve bank (PDC350)	Flow demand is too high	Reduce flow demand
	Leaks in the manifold system	Leak test, tighten, reseal or replace fittings as necessary
PIPELINE DISTRIBUTION		
Pipeline not at desired pressure	Line regulator not set correctly	Readjust line pressure regulator
Required gas flow not available	Line regulator not set correctly	Readjust line pressure regulator
	Flow demand too high	Consult factory

4.0 Service

4.4 Repairs

If the manifold or any part of the changeover station leaks or malfunctions, take it out of service immediately. Repairs should be made only by BeaconMedaes with the special tools, test equipment and trained personnel required to make a safe repair. Tampering with changeover stations voids the warranty. Please contact BeaconMedaes to arrange for any necessary repairs.

Repairs to changeover stations done after the initial warranty period has expired are chargeable to the customer. Upon receipt at the factory, the switchover manifolds will be inspected and you will be contacted with a repair cost estimate. No item will be repaired until approval is received. There will be an evaluation charge assessed for equipment not repaired. All repairs should be arranged through your BeaconMedæs supplier.

NOTE: All equipment being returned must be purged of all hazardous materials using a clean, dry inert gas (e.g. Dry Nitrogen) prior to return.

1059 Paragon Way Rock Hill, SC 29730
(888) 463-3427
Fax (803) 817-5750
www.beaconmedaes.com