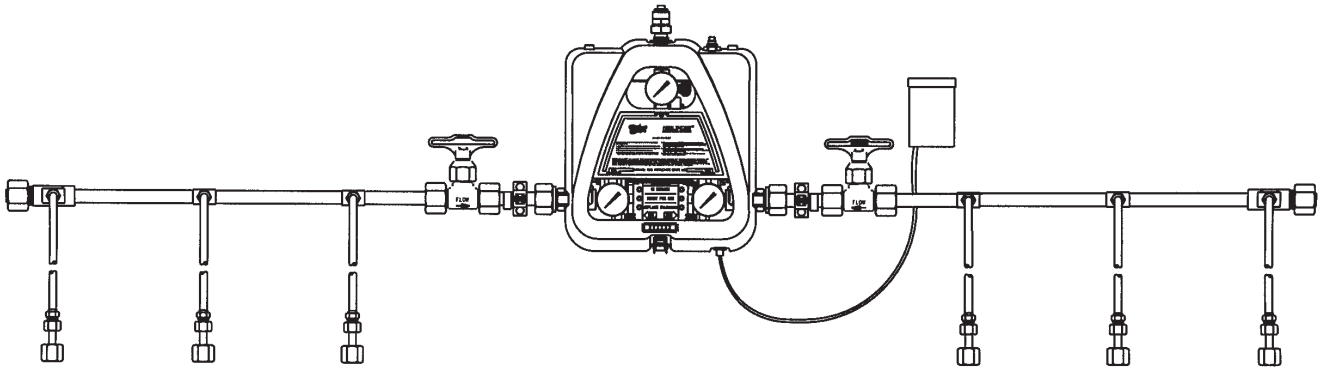
SQUIRE-COGSWELL/AEROS AUTOMATIC SWITCHOVER MANIFOLD

INSTALLATION, OPERATING AND SERVICE INSTRUCTION MANUAL

FORM NO. 0056-3089 Rev.2 EFFECTIVE Sept. 2001



Squire-Cogswell aeros

FOR YOUR SAFETY: Installation and utilization of manifold and piping systems must conform to federal, state, and local specifications and regulations. The National Fire Protection Association Bulletin, NFPA #99 outlines standards for the installation and operation of medical gas systems for hospital and home care facilities. Copies can be obtained by writing National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210.

Be certain to consult your fire marshal concerning regulations applicable to your location and particular requirements.

Read and understand these operating instructions before attempting to operate or service this equipment.

The information contained in this document is subject to change without notice

TABLE OF CONTENTS

TABLE OF ILLUSTRATIONS

INTRODUCTION

Information necessary to perform maintenance and service on the Squire Cogswell/ Aeros manifold system is contained in this manual. This information is intended for use by technicians or personnel qualified to repair and service this equipment.

The information contained in this document, including performance specifications, is subject to change without notice.

⚠ WARNINGS ⚠

Items in this manual that significantly affect safety are identified with the following headings. Please read and understand this manual, paying special attention to items identified with these headings, before attempting to operate or service this manifold.

⚠**WARNING** – Means there is a possibility of injury or death to you or others.
⚠**CAUTION** – Means there is the possibility of damage to the unit or other property.
NOTICE – Indicates point of interest for more efficient and convenient installation or operation.

⚠**WARNING** Personal injury or property damage can occur if you fail to follow the instructions in this manual.

⚠**WARNING** Working with high-pressure gas can be hazardous. Open all valves **S-L-O-W-L-Y**. Very high temperatures and pressures, with possible damage to the equipment, will result if valves are not opened slowly.

⚠**WARNING** DO NOT use a flame or "sniff" test for leaks.

⚠**WARNING** Never permit oil, grease, or other combustible materials to come in contact with cylinders, manifold, and connections. Oil and grease may react with explosive force while in contact with some gases, particularly oxygen and nitrous oxide.

⚠**WARNING** ALWAYS open cylinder, header, and manifold valves very slowly. When valves are opened rapidly, sudden pressurization will cause heat of recompression to occur. These temperatures and pressures can damage the manifold system and may cause injury to operator. **ALWAYS** open valves **slowly**.

⚠**WARNING** DO NOT kink, twist or bend pigtails into a radius smaller than 5 inches. If you do this, the pigtail might burst.

⚠**WARNING** ALWAYS secure cylinders with racks, straps or chains. Unrestrained cylinders may fall over and damage or break off the cylinder valve.

⚠**WARNING** Electrically ground oxygen and fuel gas manifolds and cylinders. Static discharges and lightning may ignite materials in an oxygen atmosphere, creating fire or explosions.

⚠**WARNING** DO NOT apply heat to any part of the manifold system.

⚠**WARNING** DO NOT weld near piping. Excessive heat may cause certain gases to dissociate, creating explosive force.

ABBREVIATIONS

C — Common
CGA — Compressed Gas Association
Ft. Lbs. — Foot pounds torque
In. Lbs. — Inch pounds torque
N/C — Normally Closed
N/O — Normally Open
NPT — National Pipe Taper
OSHA — Occupational Safety and Health Administration
PSIG — Pounds per Square Inch
SCFH — Standard Cubic Feet per Hour
VAC — Voltage, Alternating Current
VDC — Voltage, Direct Current

STANDARD FEATURES

Manufacturing - Squire-Cogswell/Aeros Instruments Inc. quality system is registered by BSI to meet the requirements of ISO 9000.

Safety Standards and Codes - Squire-Cogswell/Aeros Manifold Systems meet or exceed the following industry standards:

- Compressed Gas Association (Pamphlets V-1, E-1, G-1)
- American National Standards Institute (Pamphlet B57.1, B40.1)
- National Fire Protection Association (Pamphlet NFPA-51 and NFPA-99)
- Manifolds are UL Listed

Brazing Details – Manifold header joints are brazed for maximum strength and leak prevention. Brazed joints are 100% pneumatically or hydrostatically tested after assembly to at least 1.5 times their rated pressure (4500 psig).

Operating Temperature Range – Recommended operating range for manifold system is 0° to 140° F (-18° C to 60° C).

Environmental Considerations – Squire-Cogswell/Aeros manifold systems are manufactured to be used in outdoor semi protected locations. Do not expose control boxes to direct precipitation such as rain, sleet, snow, etc. Exposure to heavy saltwater environment will not cause the integrity of the system to degrade, but may degrade appearance of pressure gauges and surface finish.

Preservation – Each manifold is packaged in a heavy gauge cardboard box with foam supports internally to prevent damage during the shipping process. No special provisions are made to protect the manifolds from prolonged exposure to the elements.

Manuals – A Safety and Operating instruction manual is provided with each manifold system.

Cleaning – Components are cleaned for oxygen service to comply with the applicable sections of CGA Pamphlet G-4.1.

MATERIAL SPECIFICATIONS

Enclosure – 12.8" w x 14.1" h x 5.0" d

- Inlet: 1" 11" NPS (M)
- Outlet: 1/2 NPTF
- Material: ABS (Acrylonitrile Butadiene Styrene)

Electrical – Cabinet lights indicating status

- 115 VAC input, 24 VAC output. (Not required for manifold to operate.)
- Optional remote alarm system using dry contacts in power supply

Header Assemblies

- Heavy wall 7/8" O.D. CDA330 brass pipe is used for the header tube. Tees and crosses are either made from CDA360 or CDA377 brass and are silver brazed to the header tube.
- UL Listed

Header Fittings

- Body : Brass CDA377
- Check Valve Seat: Viton
- Seat Holder: Brass CDA360

Pressure Switches
- Body: Brass
- Seals: Buna N (Nitrile)
- (UL listed)

Connections
- Regulator inlets/outlets, tube ends, plugs, nuts: CDA360
- UL Listed

Relief Valve Tubing
- Nylon tubing

Delivery Regulators
- Body and Housing Cap: Forged Brass CDA377
- Seat: Urethane
- Seat Assembly Components: Brass CDA360 & 303 SST
- Friction Damper: Teflon
- Return Spring: 302 SST
- Diaphragm: Fabric Reinforced Neoprene

Face Seals
- Face seal: Brass CDA360
- O-Ring: Buna N (Nitrile)

Relief Valves
- Lower seat: Buna N (Nitrile)
- Upper seat: Brass CDA360
- Spring: TY 17-7 pH SST
- Adjustment Disc: 304 SST
- Body: Brass CDA360
- Cap: Brass CDA360

Pigtails
- CGA 540 Rigid copper or flexible teflon lined for oxygen
- CGA 326 flexible teflon lined for nitrous oxide
- CGA 580 flexible teflon lined for nitrogen
- CGA 346 flexible teflon lined for air
- CGA 320 flexible teflon lined for carbon dioxide

Heaters
CO2 and N2O Gas service
- 500 watt external electrical heater Standard
- 1000 watt external electrical heaters Optional

Inlet Regulators
- Body and Cap: Brass CDA360
- Seat: Nylon
- Piston: Brass CDA360
- O-rings: Buna-N (Nitrile)
- Spring: Chrome Vanadium

Switch Unit
- Body and end caps: Brass CDA360
- Switch piston: 316 SST
- Roller: 316 SST
- Pin: 304 SST
- Set piston: Naval Brass CDA485
- O-ring: Buna-N (Nitrile)
- Bumpers: Nylon

⚠**WARNING** Do not attempt to use this apparatus unless you are trained in its proper use or are under competent supervision. For your own safety, practice the safety and operating procedures described in this booklet every time you use the apparatus. Deviating from these procedures may result in fire, explosion, property and/or operator injury. All operations must conform to the applicable federal, state, county or city regulations for installation, operation, ventilation, fire prevention and protection of personnel. If at any time the apparatus you are using does not perform in its usual manner, or you have any difficulty in the use of the apparatus, stop using it immediately. DO NOT use the apparatus until the problem is solved.

⚠**WARNING** READ AND UNDERSTAND ALL THE SAFETY AND OPERATING INSTRUCTIONS CONTAINED IN THIS BOOKLET AND THE INSTRUCTIONS OF FOR ALL OTHER EQUIPMENT YOU ARE USING. If you do not understand these instructions, or have any question, contact your supervisor or dealer before attempting to use the apparatus.

FAILURE TO FOLLOW ALL THE INSTRUCTIONS MAY RESULT IN FIRE, PROPERTY DAMAGE AND/OR INJURY.

PRODUCT DESCRIPTION

The Squire-Cogswell/Aeros manifold system is designed to be fully automatic. The manifold gives an uninterrupted supply of gas to a hospital or clinic's medical gas pipeline. The manifold provides an uninterrupted supply of gas as the primary bank of cylinders is depleted. At a preset pressure, the manifold automatically switches to the reserve bank. The Squire-Cogswell/Aeros manifold is designed and manufactured to comply with the requirements of NFPA99.

The lights on the front of the manifold indicate the status of the gas supply. An external power supply converts 115VAC to 24VAC. A 24-inch cord connects the power supply to the manifold.

When the manifold changes from the primary bank to the reserve bank, the red light comes on indicating depletion of primary bank and that the depleted bank needs to be replaced with full cylinders. The manifold also closes contacts, which can signal a remote alarm location that the cylinders need to be replaced with full ones.

A five-terminal strip, inside of the power supply, connects to a remote alarm. An internal power supply relay provides dry alarm contacts that are rated for 3 amps at 30VDC or 2 amps at 250 VAC. No manual resetting is required when the depleted bank has been replaced and is pressurized. When the depleted bank has been replaced with new cylinders and repressurized, the red light goes off, the yellow light comes on and the replaced bank is now the reserve or secondary bank. The system eliminates the need for the operator to change switches or pressure upon cylinder depletion. This is a fully automatic system and comes with Squire-Cogswell/Aeros Instruments Inc.'s two-year warranty. The switchover unit has a five-year warranty.

NITROUS OXIDE/CARBON DIOXIDE FLOW CHARACTERISTICS

Nitrous Oxide and Carbon Dioxide are supplied in a liquefied state. As the liquid vaporizes in the cylinder, it turns to a gaseous state. Under normal conditions, gas pressure is at a normal 750 psig. Ambient temperature affects this pressure significantly.

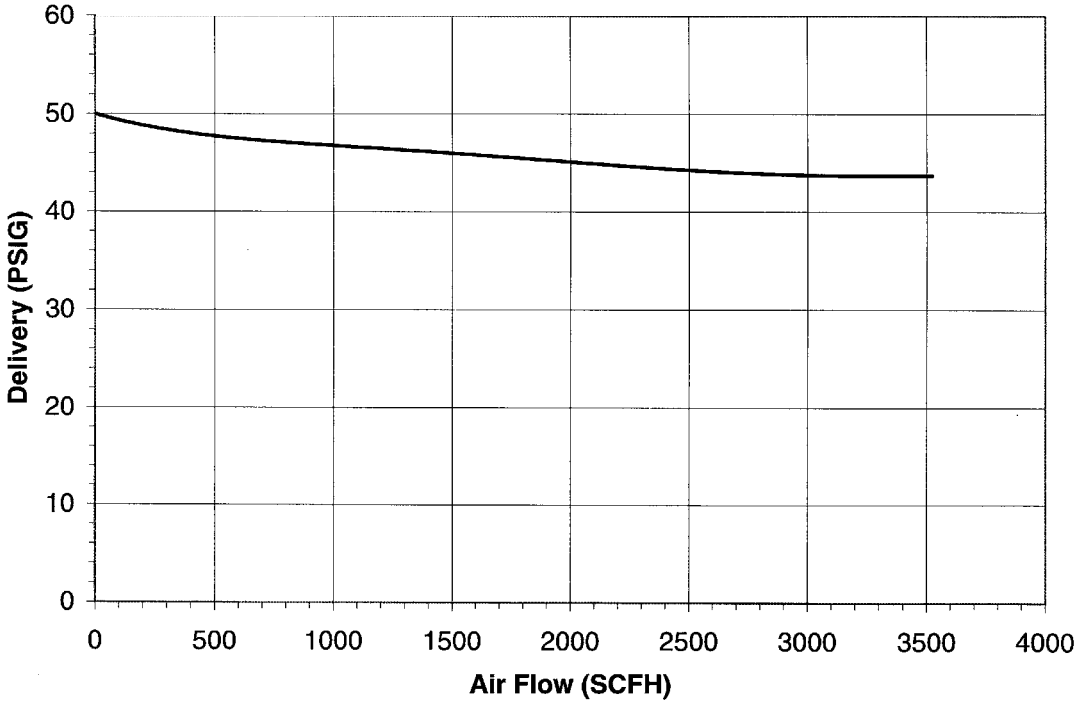
These cylinders are specified by how many pounds of liquid are in the cylinder. A standard "H" cylinder is usually a 50-pound cylinder. Most literature suggests the user should not withdraw more than 50 scfh of gas from a 50-pound cylinder. If more than 50 scfh is withdrawn, the gas pressure in the cylinder will decrease because the liquid cannot vaporize fast enough. When this happens, the liquid will begin to cool, and eventually, it will freeze solid. No gas will be delivered.

It is important for the user to size the manifold properly so that excessive flow does not occur during use. The most prevalent problem associated with nitrous oxide and carbon dioxide manifolds is that of freeze-up caused by excessive flow. Excessive flow is caused by trying to flow more than 50 scfh from a 50-pound cylinder.

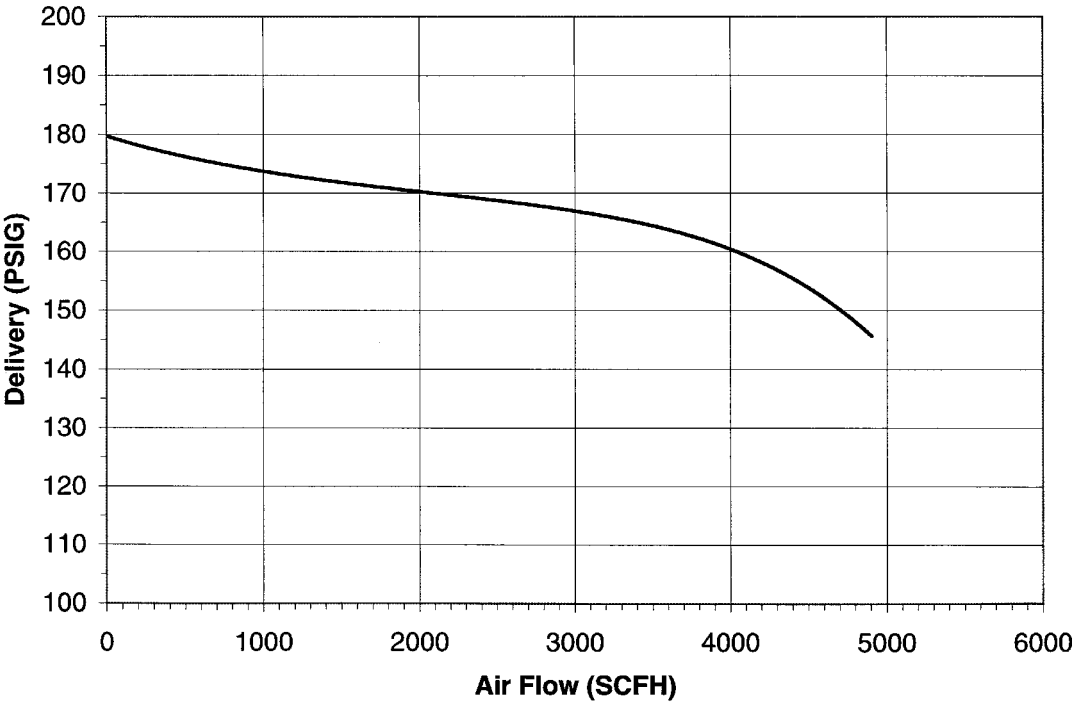
The Nitrous Oxide and Carbon Dioxide manifolds are equipped with an external 500 watt heater, which allows 500 scfh of flow or with two optional 1000 watt external heaters, which allow 1000 scfh of flow. See Figure 4. However, the proper number of cylinders is required to prevent the cylinders from freezing, causing premature changeover and loss of flow.

If you are unsure of the proper withdrawal rate for your cylinders, consult your gas supplier.

Squire-Cogswell/Aeros High Pressure Medical
500 PSIG Inlet - 50 PSIG Delivery

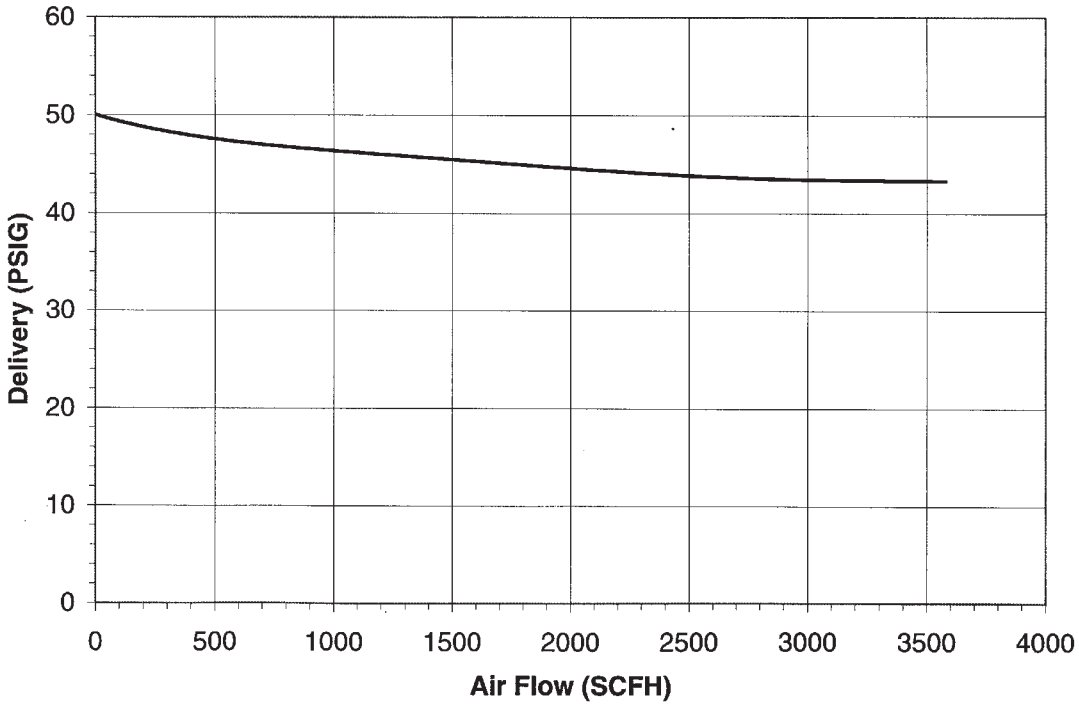


Squire-Cogswell/Aeros High Pressure Medical
500 PSIG Inlet - 180 PSIG Delivery

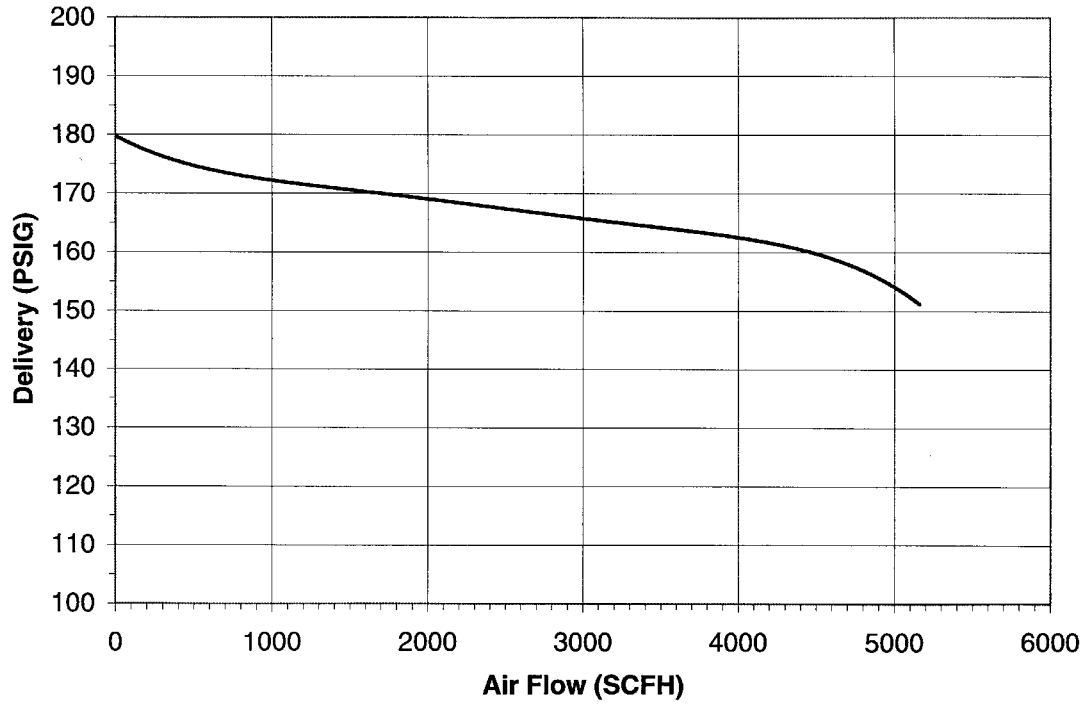


Performance Specifications
Figure 1

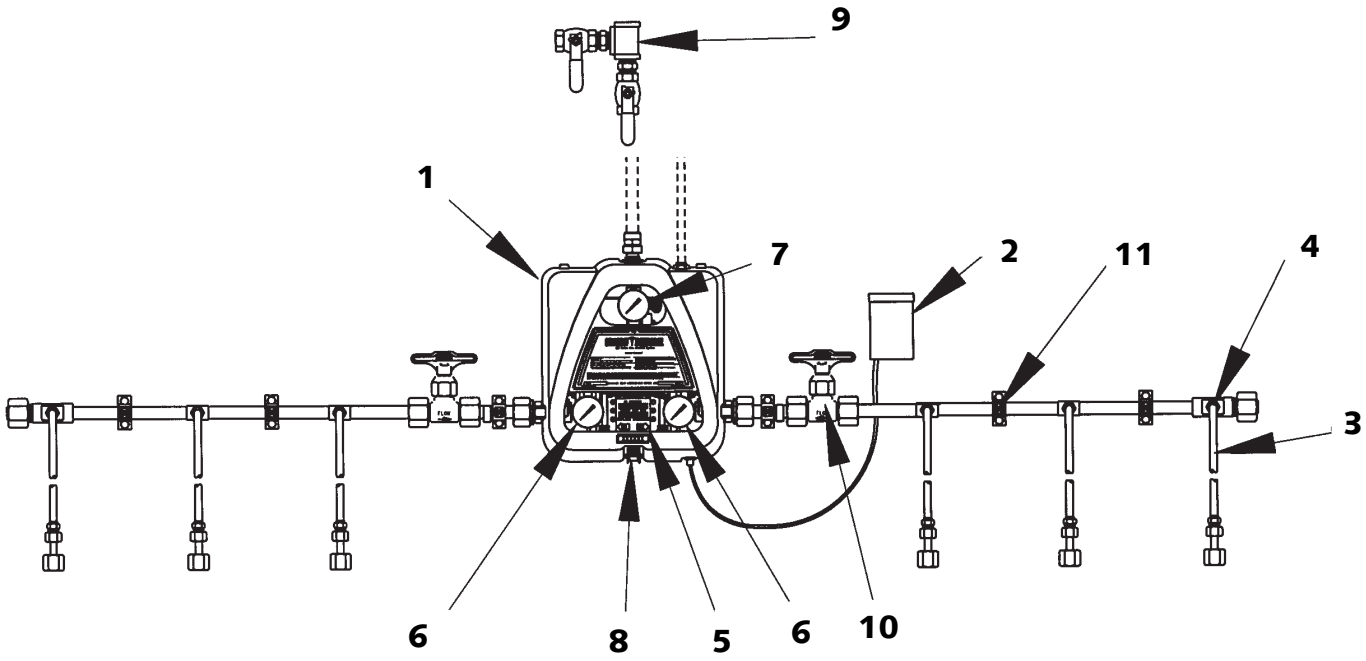
Squire-Cogswell/Aeros High Pressure Medical
2000 PSIG Inlet - 50 PSIG Delivery



Squire-Cogswell/Aeros High Pressure Medical
2000 PSIG Inlet - 180 PSIG Delivery



Performance Specifications
Figure 1



Key Elements
Figure 2

A pressure control cabinet (**1**) that maintains constant pressure to the pipeline and enables smooth uninterrupted switchover from the primary to the reserve cylinders.

A 115 VAC input, 24 VAC output power supply (**2**). Includes dry contacts for the local and remote alarm connections.

Flexible cylinder connections (**3**).

Headers with shut-off valve at each inlet port (**4**). Headers are modular construction to facilitate future expansion,

Control panel indicator lights (**5**) indicate status of the left and right cylinder banks. The **"IN SERVICE"** (supply side) is indicated by the green light while the reserve cylinder bank is indicated by the yellow **"READY FOR USE"**, a red **"REPLACE CYLINDERS"** indicates a depleted bank of cylinders.

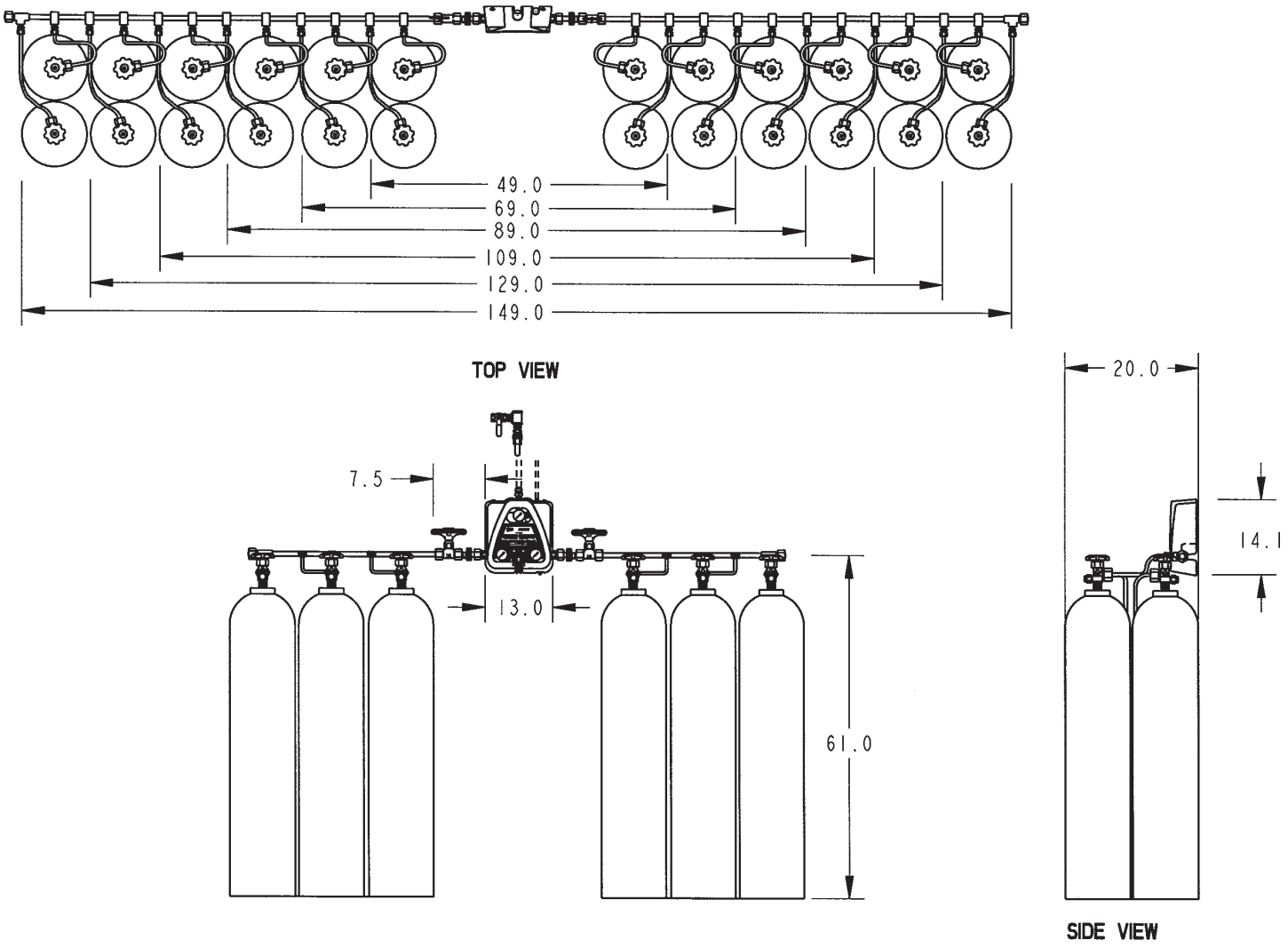
Individual pressure gauges (**6**) allow monitoring of left and right supply pressure as well as pipeline delivery pressure (**7**).

Cabinet latch (**8**) can be locked to help prevent tampering.

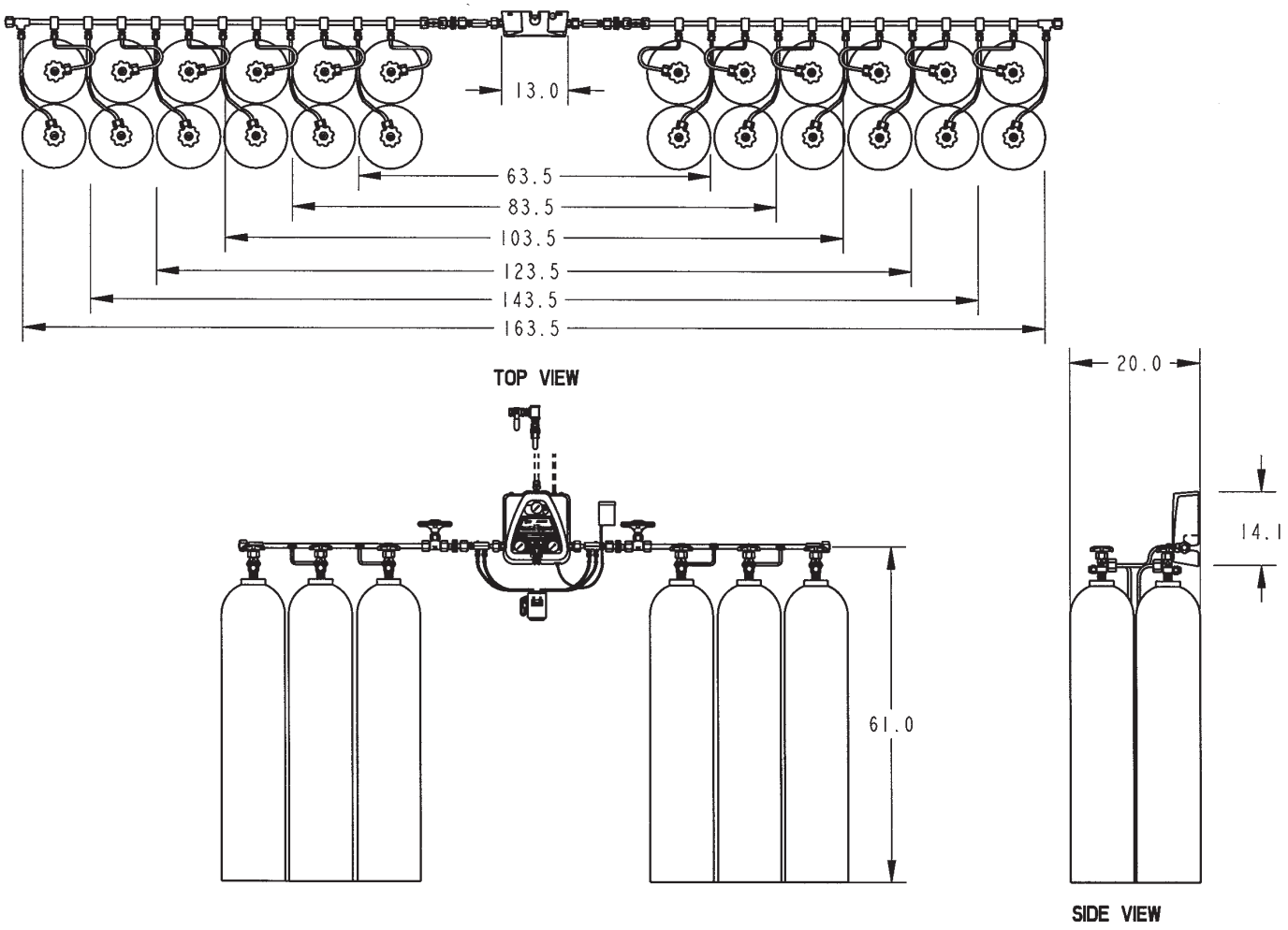
By pass valve (**9**) is optional and is recommended for use during manifold servicing.

Master valves (**10**) used to shut off gas in emergency situations. Should normally be left open.

Mounting brackets (**11**) used to secure headers to wall.



Manifold Overall Length
Figure 3



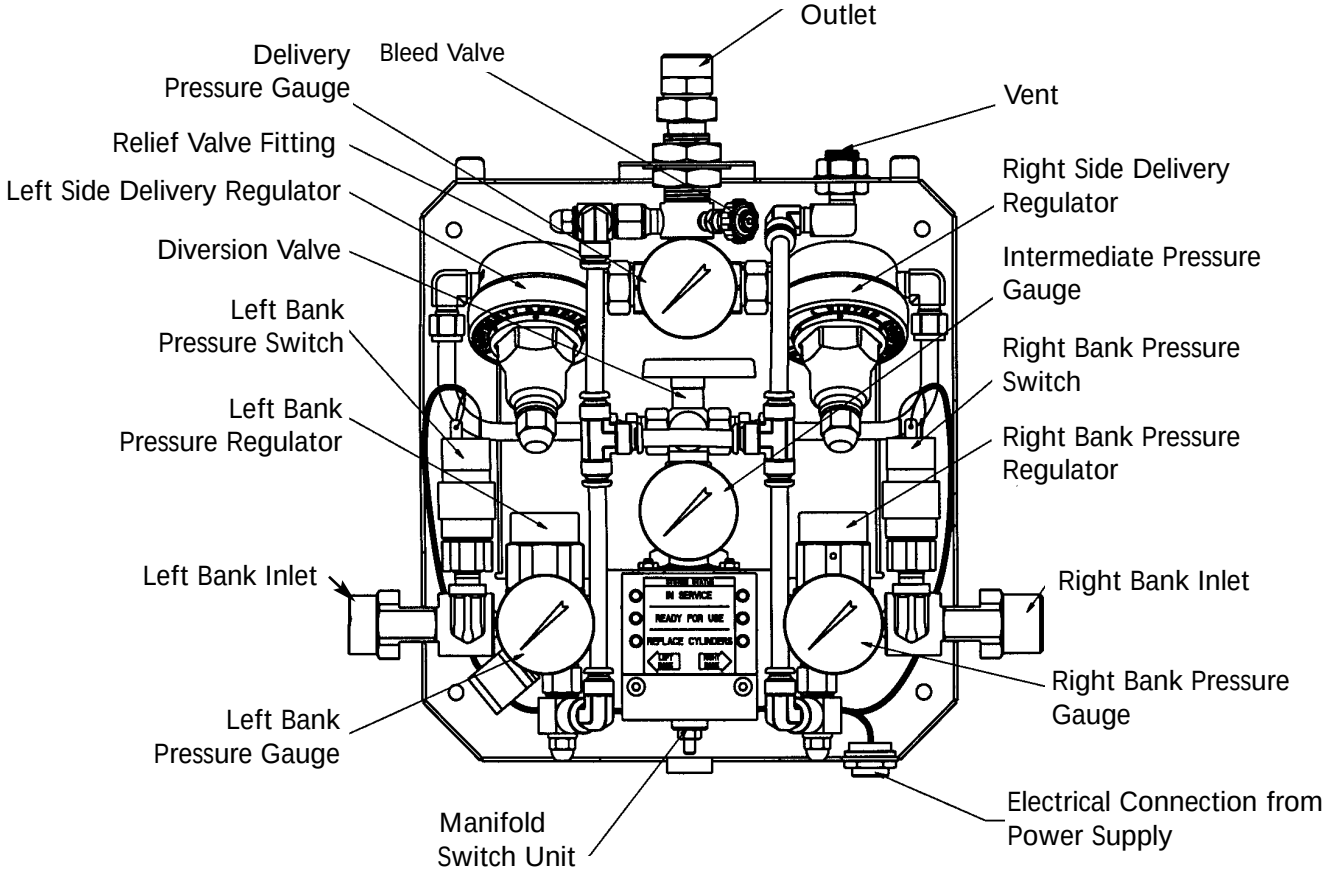
Manifold Overall Length with Heater
Figure 4

MANIFOLD OPERATION

The basic manifold system consists of the pressure control cabinet, two banks of cylinders, pigtails, delivery pressure gauge, and cylinder gauges for measuring the pressure in each bank. When the first bank is opened and pressure is applied to the pressure control cabinet, it automatically becomes the primary bank. When the second bank is opened, it becomes the reserve or secondary bank. The reserve or secondary bank is in a static condition until the pressure in the primary bank reaches the switchover pressure setting. The intermediate pressure gauge can be used to monitor the condition of the manifold at any time. It will indicate the delivery pressure of the inlet regulator currently in use, and will also clearly show when the lights change from green to red and when switchover occurs.

At the switchover point, the reserve bank automatically switches over to become the primary and the red light comes on signaling the primary bank has been depleted and must be replaced. Dry contacts inside the power supply box also open, activating a remote alarm if one is attached. The red light will indicate which bank has been depleted. Bank pressure can also be read on the bank inlet pressure gauges and will show an empty or near empty condition, indicating the depleted bank.

When the depleted bank has been replaced with new cylinders, the red light goes off and the yellow light comes on, and the depleted bank becomes the reserve bank allowing the cycle to be repeated. In case of power failure, *the manifold will continue to function*, as power is used only for the red, yellow and green indicator lights and alarm.



Internal Components
Figure 5

INSTALLATION

The manifold should be installed in accordance with guidelines stated by the National Fire Protection Association, Occupational Safety and Health Administration, and all applicable state and local codes.

⚠**WARNING** To avoid potential shocks do not attempt to hook-up or repair this device in the presence of water, such as rain. The power supply and cabinet should be properly grounded in accordance with the National Electric Code as well as state and local guidelines.

The equipment has been cleaned for oxygen service. Care must be taken during handling so that oil, grease, and dirt do not contact parts. If cleaning is necessary, refer to Compressed Gas Association Pamphlet G-4.1 "Cleaning Equipment for Oxygen Service" for directions.

The manifold components are designed to work best with the temperature range of 0-140° F (-18 o C to 60° C). Wider temperature variations may cause leaks or malfunctions to occur.

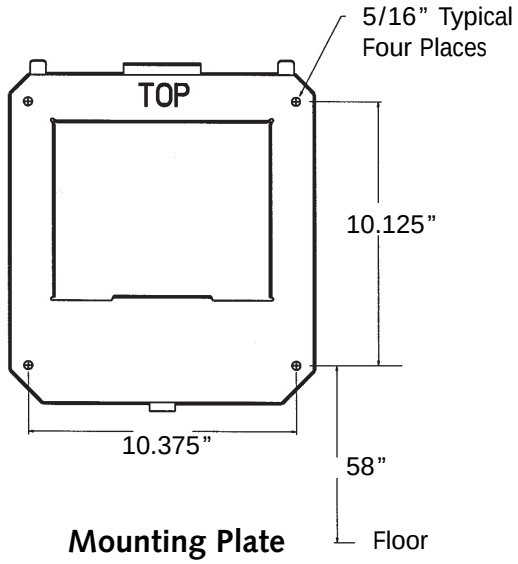
The pressure control cabinet should be mounted in a location protected from moisture. Water and excessive moisture will not affect the manifold headers and pigtails.

See Figure **3** (page 10) for manifold overall length.

Refer to Figure ***6*** when following the instructions below:

1. Measure and mark a horizontal line approximately 58" from floor for the bottom mounting holes in the manifold mounting plate. This will determine the centerline of about 61" for the inlets to the control box. (Wall mounting heights may vary depending on cylinder height, etc.)

2. Remove the cover from the pressure control cabinet by opening the latch on the bottom and lifting the cover up over the mounting tabs of the mounting plate. Securely attach the mounting plate to the wall. The type of fasteners used will depend upon wall construction.



Mounting Plate
Figure 6

3. Remove the nut and plug from each inlet of the pressure control cabinet.

⚠ **WARNING** Do not use any components if you detect oil, grease or damage. These items must either be cleaned, repaired or replaced by qualified personnel.

4. Hold each header in a level position and mark the location of each mounting bracket. Attach each mounting bracket to the mounting surface. The type of fasteners used will depend upon wall construction.

5. Attach each header to each manifold inlet connection. Attach the nut and plug to the end of each header. **Note**: the radiused end of the plug is the sealing surface. Tighten all manifold fittings to 55-65 ft. lbs. torque.

6. Tighten all header mounting hardware.

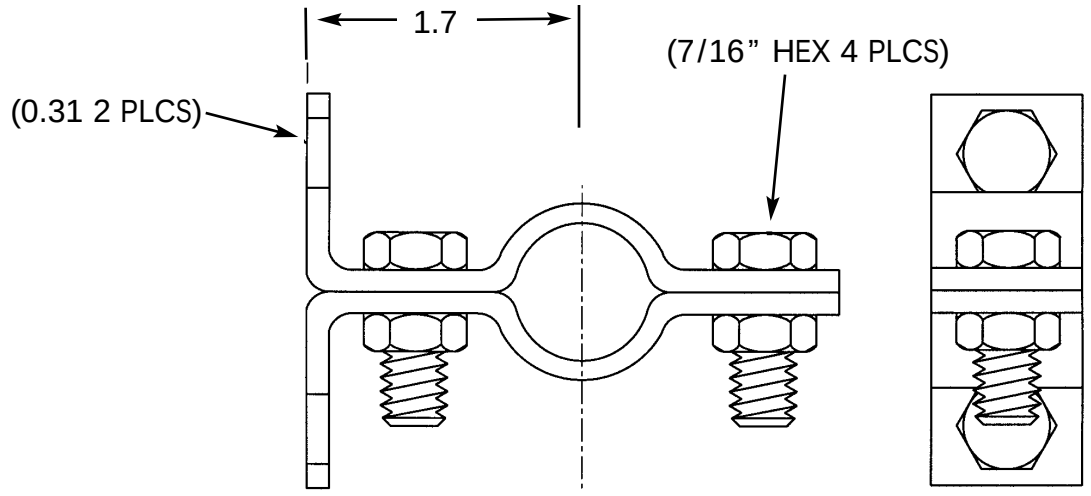
7. Pigtails supplied with this manifold have check valves built into the CGA adapter on the header. Attach each pigtail assembly to each CGA adapter and tighten to 15-25 ft. lbs. torque.

8. Mount the power supply in a location convenient to the pressure control cabinet. Using conduit connect 115 VAC power wiring to the free leads of the power supply as shown in electrical drawing (Figure **8**).

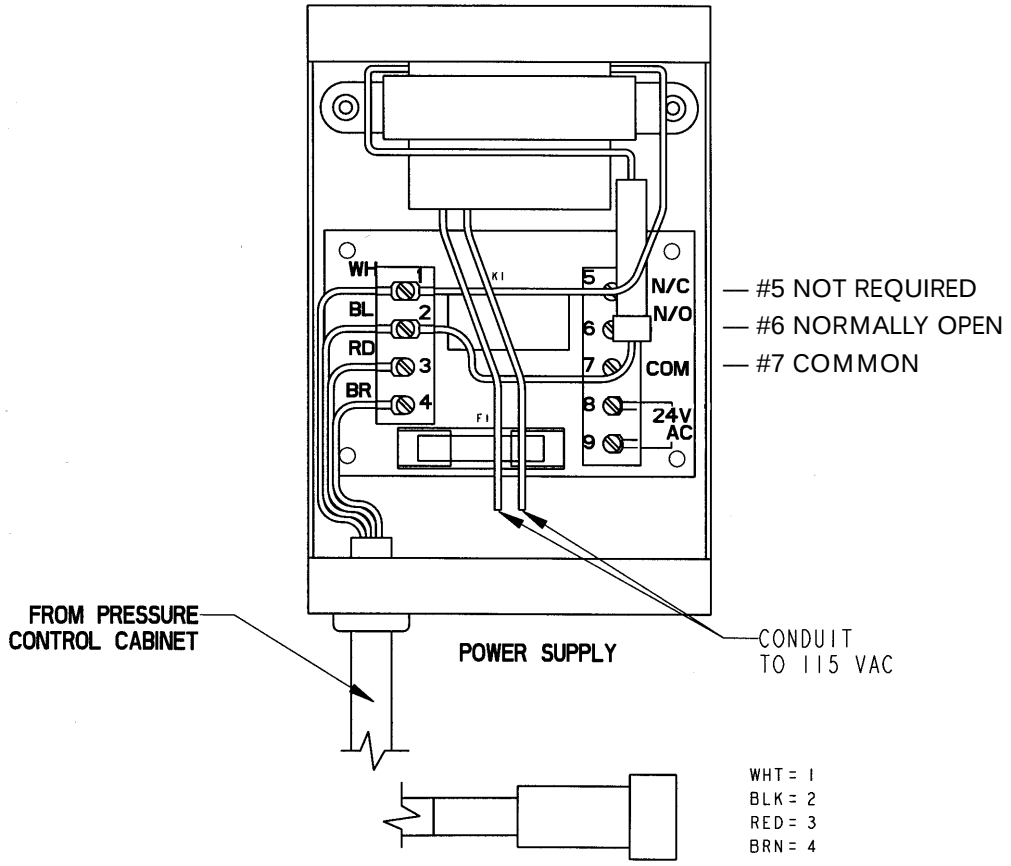
9. For remote alarm electrical connection, use electrical wiring drawing shown in Figure 8.

10. The outlet on the top of the manifold control box comes with an "O" ring face seal connection that has a 1/2 NPT female thread that is connected to the pipeline system.

11. The relief valve vent is located to the right side of the outlet and has a 1/4 NPT female port for connecting the vent piping to the outside.



Header Wall Mounting Bracket
Figure 7



Remote Alarm Wiring
Figure 8

MOUNTING HEATER

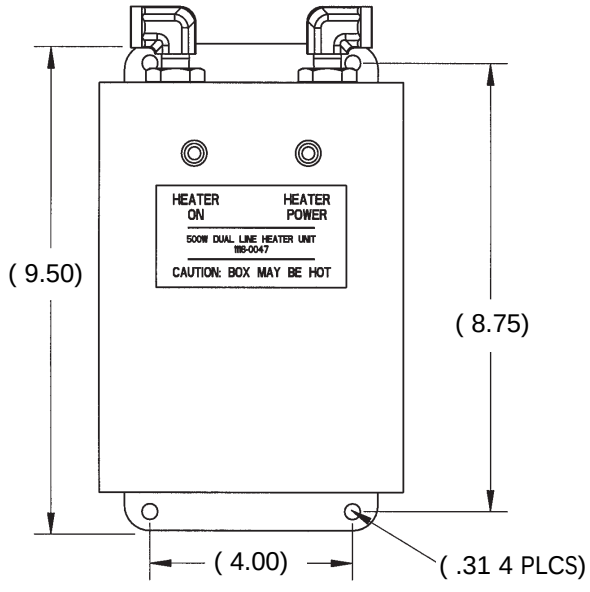
1. Install heater adapters (Figure **4**) to the each inlet on the pressure control cabinet.

2. Attach the heater pigtails to the heater adapters.

3. Position the heater underneath the pressure control cabinet making sure the heater is not hanging by the pigtails.

4. Hold the heater in a level position (Figure **9**) and mark the location of each of the four holes in the mount tabs of the heater enclosure.

5. Securely attach heater to the mounting surface. The type of fasteners used will depend upon wall construction.



Heater Mounting
Figure 9

INITIAL POWER-UP

⚠**WARNING** Make sure all the previous installation procedures are completed before beginning operation of the manifold.

1. Plug the circular four-prong plug from the power supply into the plug receptacle on the lower right bottom of the pressure control cabinet. Tighten the nut on the plug to secure the plug to the pressure control cabinet.

2. Apply 115 VAC to the power supply.

3. With no pressure applied, as soon as power is switched on, the red light on the front of the manifold should light.

4. **Slowly** apply pressure to one of the inlet sides of pressure cabinet. **NOTE:** The first side pressurized will become the primary side and the other side will be the reserve or secondary side. When over 350 psig of gas is applied, the red light should go off and the green **"IN SERVICE"** light should come on.

⚠**WARNING** At initial installation, the headers, manifold, and possibly any piping downstream of the manifold will be filled with ambient atmosphere. Provisions should be made to completely purge the entire system with the gas intended for service before the system is put into use. If this is not done an improper gas may be administered with injurious results.

5. When over 350 psig of gas is applied to both of the pressure control cabinet inlets, the red light should go off and the green light should come on.

NOTE: When both sides of the manifold are pressurized, perform leak test as outlined in the following section.

LEAK TEST

1. Shut off flow at the outlet of the pressure control cabinet.
2. Shut off all cylinders supplying pressure to the supply headers.
3. Monitor pressure on the four gauges on the pressure control cabinet.
4. If any of the gauges show a drop in pressure, a leak is present
5. Use an approved liquid leak detector solution to locate leaks.
6. If a leak detector is used to detect leaks inside the pressure control cabinet, use caution to ensure the solution does not get into electrical components.
7. If leaks are detected, bleed all pressure from the manifold **BEFORE** repairing the leak.
8. Disassemble and examine leaking joints that have metal-to-metal seals. If dents, scratches or other damage to the seals are the cause of the leak, replace damaged components. Reassemble the manifold and test again for leaks.
9. Remove the component at the leaking joints that have pipe threads. Remove the old tape and apply new Teflon tape to the pipe threads. Reinstall the component. **Slowly** pressurize the manifold and test for leaks again.
10. Disassemble leaking joints that have o-ring seals. Examine the o-ring. If the o-ring is cut, dented or otherwise damaged, replace it. Reassemble the joint. **Slowly** pressurize the manifold and test for leaks again.

⚠**WARNING** All leaking components **MUST** be repaired or replaced. **DO NOT** use the manifold if leaks are present.

CYLINDER REPLACEMENT

⚠**WARNING** Never permit oil, grease or other combustible material to come into contact with cylinders, manifolds and connections. Oil and grease may react with explosive force in the presence of some gases, particularly oxygen and nitrous oxide, resulting in damage to the equipment and possible injury to nearby personnel. Keep tools and equipment clean. Valves **MUST** be opened **slowly.** Pigtails must never be kinked, twisted or bent into a radius of smaller than 5 inches. Do not apply heat to any part of the manifold or cylinders. Close pipeline shut-off valve in emergency only.

1. Turn off all valves on depleted cylinders.

2. **Slowly** loosen and then remove the pigtail connections from the depleted cylinders.

3. Remove the depleted cylinders and reinstall protective caps.

4. Secure full cylinders in place using chains, belts or cylinder stands. Refer to Compressed Gas Association Pamphlet P-1 for more information.

5. Remove the protective caps from full replacement cylinders. **DO NOT** stand in front of the cylinder valve outlet. **Slowly** open and quickly close (cracking) each valve slightly to blow any dirt or contaminates which may have become lodged in the cylinder valve.

6. Connect the manifold pigtails to the cylinder valves and tighten with a wrench. **Slowly** open cylinder valve farthest from the manifold. Wait 60 seconds. **Slowly** open the remaining cylinder valves. Use an approved liquid leak detector solution to locate leaks.

7. The red light on the manifold should go out and the green light should come on.

8. The bank has now been replenished and is now in reserve.

RECOMMENDED TOOLS AND EQUIPMENT

- Combination wrenches 7/16", 1/2", 11/16", 3/4", 1", 1 5/16" and 1-1/2",
- 1/8", 1/4" hex wrenches
- Needle nose pliers
- Flat blade screwdriver, Phillips screwdriver
- Volt/Ohm meter
- Oxygen compatible liquid leak detector
- Teflon tape

INSPECTING MANIFOLD OPERATION

NOTICE: To perform these steps, the manifold outlet must be isolated from the downstream gas supply.

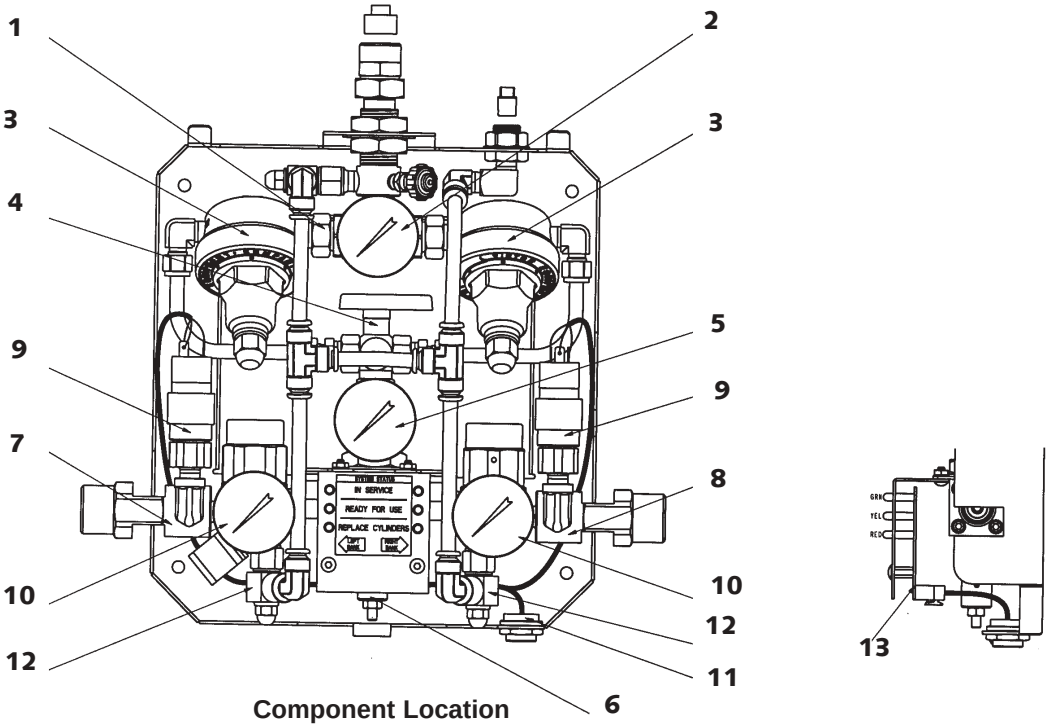
NOTICE: Refer to Figure **2** for a drawing showing individual manifold components.

1. Attach pressure source to manifold inlets.
2. Make sure the power supply connector is connected at the bottom right corner of the manifold cabinet. Apply 115VAC to power supply box. Both red lights will be on and all other lights will be off.
3. Slowly pressurize the right inlet to test pressure specified below.

   Recommended Minimum Inlet Test Pressure Requirements

   Oxygen, Breathing Air, Helium, Nitrogen……1800 psig minimum

   Nitrous Oxide, Carbon Dioxide……...500 psig minimum
4. Remove cover. Observe the pressure gauge on the Right bank inlet. NOTE: The first side pressurized will become the primary side and the other side will be the reserve side.
5. Verify that green light of right side and red light of left side is illuminated. Yellow lights should not be illuminated. If the lights do not come on, examine electrical components as directed by the Electrical System Troubleshooting Procedures.
6. Slowly pressurize the left inlet to test pressure specified above. Observe the pressure gauge on the left side inlet. The yellow light on the left side should be illuminated. All other lights on left side should be off.
7. Position the diversion valve so that the right side delivery regulator is activated. Open and shut the bleed valve several times. Verify the preset is at the pressure required by the customer. To change the preset, follow the DELIVERY REGULATOR PRESET PROCEDURE.
8. Position the diversion valve so that the left side delivery regulator is activated. Open and shut the bleed valve several times. Verify the preset is at the pressure required by the customer. To change the preset, follow the DELIVERY REGULATOR PRESET PROCEDURE.
9. Open the bleed valve to initiate flow. Shut off right bank master valve. Observe the Intermediate Pressure Gauge and monitor the condition of the lights. At 240 +/- 10 psig the red light on the right side will turn on. The left side yellow light will go off and the left side green light will come on. Immediately afterwards, at 220 +/- 10 psig, switchover will occur, followed by an immediate rise in pressure to the set point of the inlet regulator now in use (450-500 psig flowing). Shut off the bleed the valve.
10. Slowly open the RIGHT bank master valve again. Verify that the red light on right side turns off and the yellow light on right side turns on.
11. Shut off left bank inlet master valve. Observe the Intermediate Pressure Gauge and monitor the condition of the lights. At 240 +/- 10 psig the red light will turn on and the green light will turn off. Immediately afterwards, at 220 +/- 10 psig, switchover will occur, followed by an immediate rise in pressure to the set point of the inlet regulator now in use (450-500 psig flowing).
12. Slowly open the LEFT bank inlet master valve again. Verify that the left side red light turns off and yellow light turns on.
13. Shut off both master valves and the bleed valve. Monitor all four gauges for five (5) minutes. If any gauge drops, the manifold is leaking. Use leak detector on joints to check for leaks. Repair any leaks, re-pressurize both inlets, and repeat this step as necessary.
14. Close both inlet valves. Keep the bleed valve shut off.
15. Reconnect to downstream gas supply.
16. Open both inlet valves.



Component Location
Figure 10

ITEM	PART NUMBER	DESCRIPTION	QTY
1	263062	Check Valve/Outlet Assembly (100 psig gauge)	1
1	263063	Check Valve/Outlet Assembly (400 psig gauge) Nitrogen	1
2	263064	Delivery Pressure Gauge 2” x 100 psig	1
2	263065	Delivery Pressure Gauge 2” x 400 psig	1
3	263066	L350E-AM Regulator	2
4	263067	Diversion Valve	1
5	263068	Intermediate Pressure Gauge 2” x 600 psig	1
6	263069	Switchover Assembly (220 psig)	1
7	263070	Left Inlet Assembly	1
8	263071	Right Inlet Assembly	1
9	263072	Pressure Switch (270 psig set)	2
10	263073	Inlet Gauge 2” X 4000 psig	2
11	263074	Wiring Harness	1
12	263086	Relief Valve (1000 psig)	2
13	263076	Control Board	1
	263077	500 watt Heater (not shown)	1
	263078	1000 watt Heaters (not shown)	2
	263079	Accessory kit for 1000 watt heater above	2
	261675	Master Valves	2
	261669	CGA540 x CGA540 x 36” Pigtail (flexible) Oxygen	
	263080	CGA540 x CGA540 x 24” Pigtail (rigid) Oxygen	
	261670	CGA326 x CGA326 x 36” Pigtail (flexible) N20	
	261671	CGA580 x CGA580 x 36” Pigtail (flexible) Nitrogen	
	261672	CGA346 x CGA346 x 36” Pigtail (flexible) Air	
	262673	CGA320 x CGA320 x 36” Pigtails (flexible) CO2	

REPLACEMENT OF COMPONENTS

⚠**WARNING** DO NOT attempt to repair the regulator unless you have been trained in the proper repair procedures.

⚠**WARNING** Do not use any components if you detect oil, grease or damage. These items must either be cleaned, repaired or replaced by qualified personnel.

LINE REGULATOR ASSEMBLY

NOTICE: The line regulator may be removed and replaced while the manifold is in operation. Turn the diversion valve (Figure **5**) to point away from the regulator to be changed. A check valve upstream of the delivery regulator will contain the pressure, allowing the manifold to remain in operation.

1. Use a 1/2" open-end wrench to force the col lar back on the quick-connect fitting where the relief valve plastic tube is inserted and pull the plastic tube out. See Figure **5**.
2. Use a 1" open-end wrench to loosen and detach the face seal fittings from the regulator inlet.
3. Use a 1 1/2" open-end wrench to loosen and remove the nut on the outlet connection.
4. Remove the regulator assembly from the mounting bracket.
5. Remove all fittings from the line regulator.
6. Send the regulator to an authorized repair facility for reconditioning.
7. Reinstall new regulator assembly in the mounting assembly.
8. Replace o-rings at all opened face seals when replacing regulator assembly.
9. Connect the face seal on the inlet connection and using a 1" wrench tighten the nut securely.
10. Connect the relief valve tubing to the quick-connect fitting.

INLET REGULATOR ASSEMBLY

1. Use a 1/2" open-end wrench to force the collar back on the quick-connect fitting where the relief valve plastic tube is inserted and pull the plastic tube out.
2. Remove wires from pressure switch.
3. Move the vent tubing out of the way before loosening face seal.
4. Use a 1" open-end wrench to loosen and detach the face seal fittings from the switchover unit.
5. Remove inlet assembly from mounting bracket.
6. Send the regulator to an authorized repair facility for reconditioning.

Switch Unit

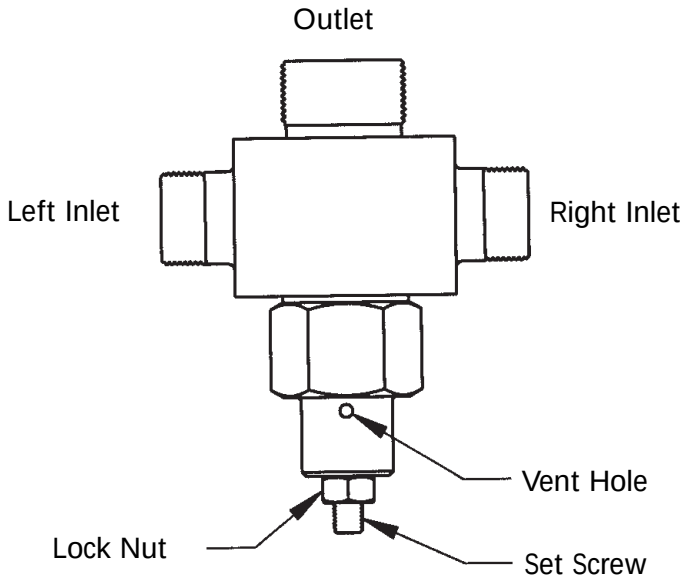
See Figure 11

1. Remove both left and right delivery regulators, diversion valve and inlet regulators as shown.

2. Using a 1-1/2" open-end wrench remove the nut from the switch unit and slide unit out of mounting bracket.

3. Contact Squire-Cogswell/Aeros to have the switch unit repaired or replaced.

4. Reinstall the line regulator and inlet regulators as shown.



Switch Unit
Figure 11

CHECK VALVE OUTLET ASSEMBLY

1. Remove line and inlet regulators as shown above.

2. Use a 1/2" wrench to force the collar back on the quick-connect fitting where the relief valve plastic tube is inserted and pull the plastic tube out.

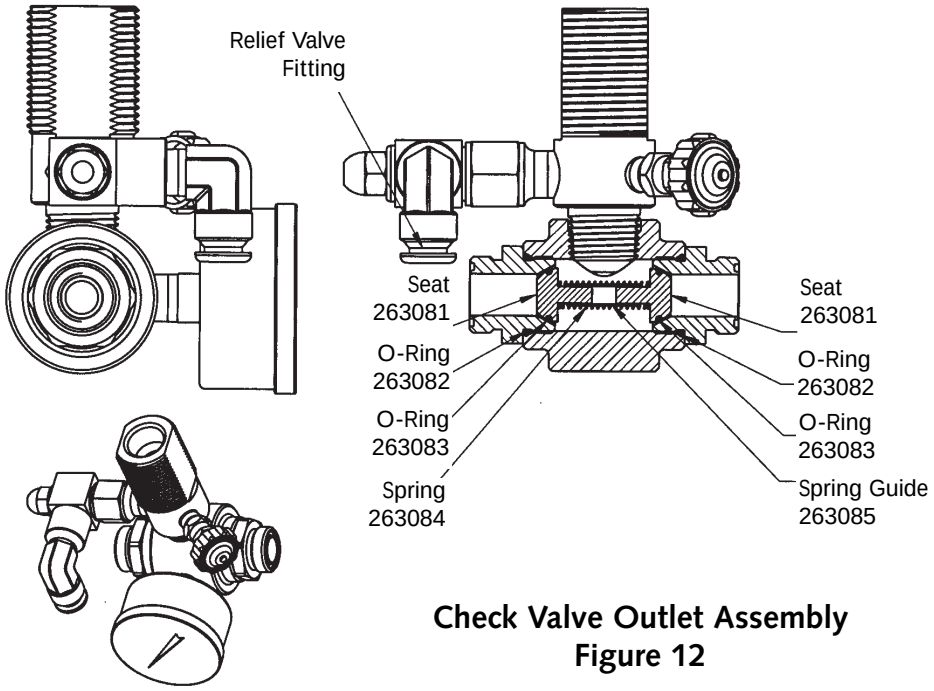
3. Using a 1 5/16" wrench, remove the face seal adapter from the outlet.

4. Using a 1 1/2" wrench, remove the nut from the outlet unit and slide the check valve assembly out of mounting bracket.

5. Remove the components of the check valve. See Figure **12** for a list of repair components.

6. Replace both seats, all four o-rings, spring, and spring guide.

7. Reassemble the unit and test the check valve by applying 50-60 psig to female pipe port thread and check for leaks on each end. No visible leaks when using a leak detector solution are allowed.



Check Valve Outlet Assembly
Figure 12

ADJUSTMENT SPECIFICATIONS

Nominal Factory Pressure Settings

Gas	Pressure Switch	Switchover Pressure	Line Regulator	Line Regulator Relief Valve
Oxygen	240 psig	220 psig	50 psig	75 psig
Nitrogen	240 psig	220 psig	180 psig	250 psig
Nitrous Oxide	240 psig	220 psig	50 psig	75 psig
Breathing Air	240 psig	220 psig	50 psig	75 psig
Helium	240 psig	220 psig	50 psig	75 psig
Carbon Dioxide	240 psig	220 psig	50 psig	75 psig

Adjustable Range

Gas	Pressure Switch	Switchover Pressure	Line Regulator	Line Regulator Relief Valve
Oxygen	100-1400 psig	50-300 psig	10-80 psig	60-200 psig
Nitrogen	100-1400 psig	50-300 psig	10-180 psig	200-500 psig
Nitrous Oxide	100-1400 psig	50-300 psig	10-80 psig	60-200 psig
Breathing Air	100-1400 psig	50-300 psig	10-80 psig	60-200 psig
Helium	100-1400 psig	50-300 psig	10-80 psig	60-200 psig
Carbon Dioxide	100-1400 psig	50-300 psig	10-80 psig	60-200 psig

Line regulator pressure is at the user's discretion.

CHANGING SWITCHOVER UNIT PRESET

Resetting the switchover point of the manifold is done using the setscrew located at the bottom of the switch unit (see Figure **11**). The following procedure should be performed when changing the switchover point:

1. Determine the current switchover point. This can be done by watching the Intermediate Pressure Gauge (Figure **5**) on the manifold. Close all cylinders on each side except for one. Force the manifold to switch over by closing off the cylinder valve of the side in use, and observe the respective gauge. The Intermediate Pressure Gauge will drop to the switchover point and then immediately return to the normal working pressure of the system (APPROX. 450-500 PSIG).

   NOTE: From the factory, high-pressure models have a set point of 220 PSIG NOMINAL.

2. Determine how far you wish to change the switchover point from its current value. For example, if the manifold has the factory setting of 220 PSIG, and you wish to have it switchover at 160 PSIG instead, then the difference from old to new is a decrease of 60 PSIG. Note this value for your desired configuration.

3. One complete turn of the switch unit set screw (360 degrees) will change the switchover point APPROX. 30 PSIG. Backing out the setscrew will **decrease** the switchover point, and screwing it in further will **increase** the switchover point. In the example mentioned above, to decrease the switchover point by 60 PSIG would require backing out the set screw APPROX. 2 FULL TURNS.

   Using a 7/16" wrench, loosen the setscrew locking nut. Then, using a 1/8" hex key wrench, turn the set screw the amount necessary for your desired switchover point. Lightly tighten the locking nut back up.

4. Now you must cycle the manifold back and forth to determine how close the switchover point is to the desired value. Opening and closing the cylinder valves, forcing the manifold to switch back and forth can do this. This should be performed with the system at a very low flow rate, so the manifold doesn't bleed down and switch over too fast, making it difficult to get an accurate reading of the switch point.

5. Re-adjust the set screw as necessary to fine tune the manifold to the exact switchover point desired (backing the set screw out to decrease the switch point, and turning it in to increase the switch point). Once the exact set point is obtained, securely tighten the locking nut, locking the setting in place.

NOTE: The manifold pressure switches, used to control the lights and alarm, are set from the factory at 20 PSIG NOMINAL above the switchover point. If you change the switchover point too much, the lights and alarm may not correctly represent when a switchover has occurred. To insure proper operation of the manifold, the pressure switches should always be reset to maintain the 20 PSIG margin from the actual switchover point.

Important! Pressure switches should always be set above the switch oversetting. Refer to the following section for resetting the pressure switches.

PRESSURE SWITCH SETTING PROCEDURE

1. When not pressurized, the pressure switches used in these manifolds are normally closed. When pressurized above their set point, they will be in the open condition.

2. The pressure switches on the Squire Cogswell/Aeros manifolds are factory set to 270 psig.

3. The pressure switches used have common, normally open and normally closed electrical contacts. The connections used are common and normally closed terminals. Remove the connectors from the spade connections on the pressure switch.

4. Use an ohmmeter to determine the condition of the pressure switch.

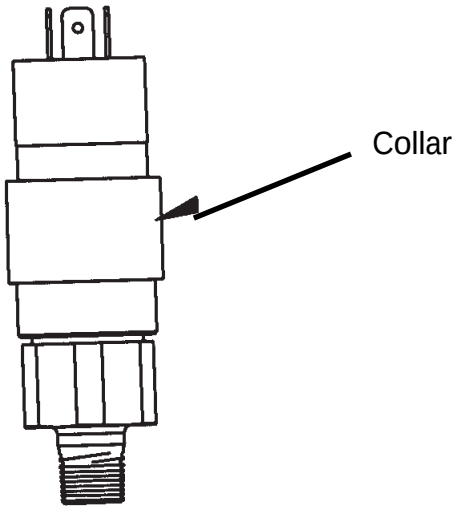
5. Gradually pressurize the pressure switch. When pressure reaches the set point, the state of the switch should change. On increasing pressure, the switch will open. On decreasing pressure, the switch will close.

6. Open the collar of the pressure switch by pushing it toward the spade connectors. See Figure **13**

7. Use a flat blade screwdriver to adjust the set point of the pressure switch. Turning clockwise or left will increase the set point. Turning counterclockwise or right will lower the set point.

8. Once the pressure switch is set to the correct point, push to collar back in place and reattach the wires.

9. If the pressure switch cannot be set, the switch must be replaced. The pressure switches are not repairable.



Pressure Switch
Figure 13

DELIVERY REGULATOR PRESET PROCEDURE

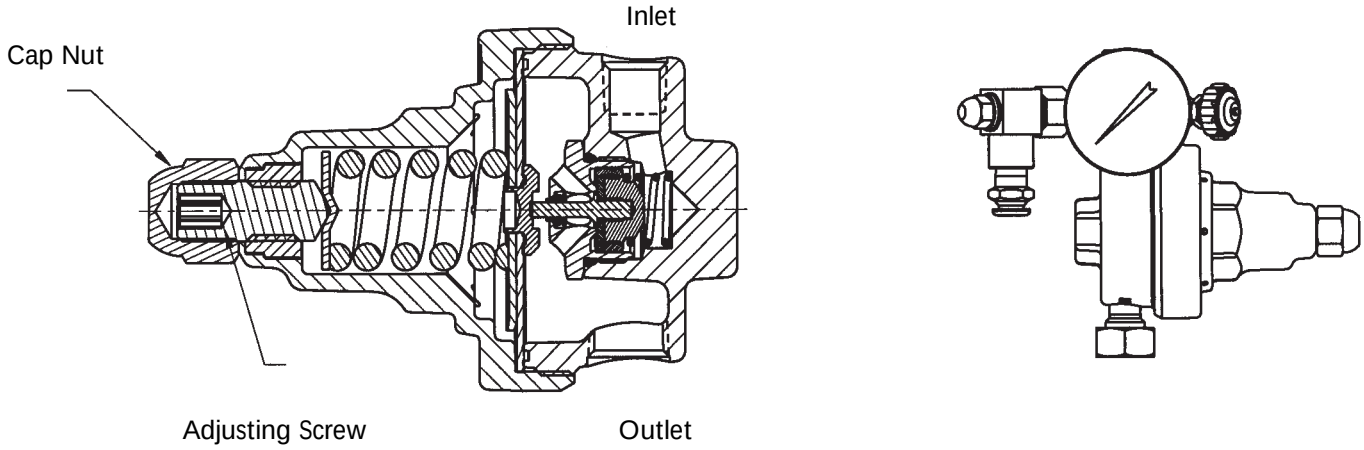
1. Loosen the 3/4" hex cap nut from the adjusting screw of the delivery regulator. Refer to Figure **14**.

2. Use a 1/4" hex key wrench to turn the adjusting screw to change the pressure. Clockwise rotation increases pressure while counterclockwise rotation decreases pressure. Use the bleed valve to bleed off excessive pressure.

3. The delivery pressure can be determined by monitoring the pressure on the delivery pressure gauge at the upper portion of the pressure control cabinet.

4. When pressure is properly adjusted, reinstall the hex nut on the adjusting screw. Tighten the hex cap nut securely.

5. If the delivery regulator cannot be changed properly, check the outlet pressure of the inlet regulators to verify 500 psig is being delivered. This can be accomplished by monitoring the intermediate pressure gauge. If the intermediate reads correctly, the delivery regulator must be repaired or replaced.



Delivery Regulator
Figure 14

SQUIRE-COGSWELL/AEROS MEDICAL HIGH PRESSURE MANIFOLD

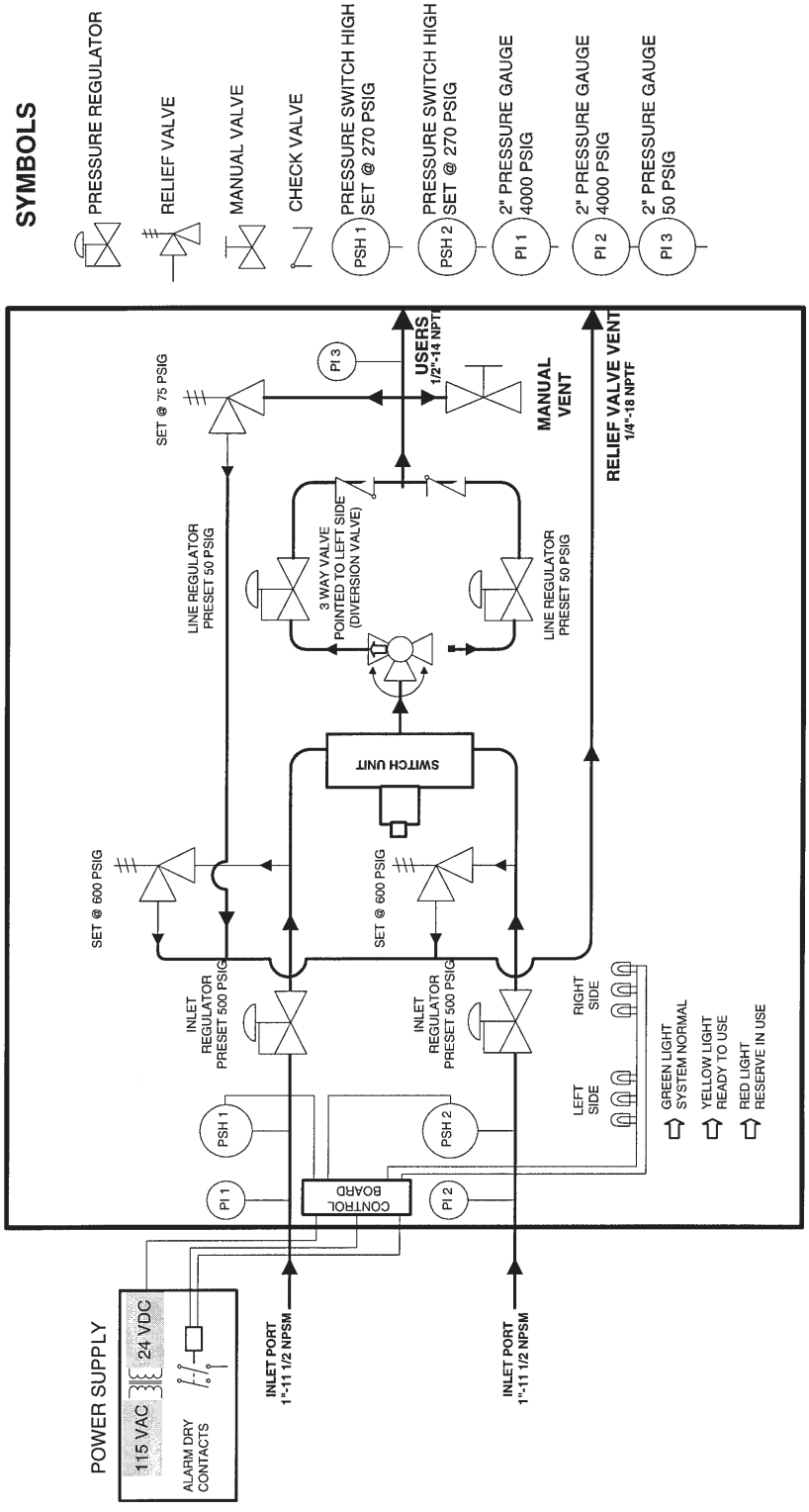


Figure 15

MAINTENANCE

1. **Pressure Control Cabinet**

   Daily

   Record delivery pressure

   Monthly

   Check Regulators and valves for external leakage.
   Check valves for proper closure.

2. **Manifold Header**

   Daily

   Observe Nitrous Oxide and Carbon Dioxide systems for cylinder frosting or surface condensation. Should condensation or frosting occur it might be necessary to increase manifold capacity or add external heaters to manifold.

   Monthly

   Inspect valves for proper closure
   Check cylinder pigtails for cleanliness, flexibility, wear, leakage, and thread damage. Replace damaged pigtails immediately
   Inspect pigtail check valves for closure.

   Every 4 Years

   Replace pigtails

POWER SUPPLY TROUBLESHOOTING PROCEDURE

1. Examine power supply. Make sure power is connected to 115 VAC.

2. Use voltmeter to determine that power supply is supplying 24-30 VAC (The power supply will supply a nominal 28 VAC with no load.) If this is not the case, examine the fuses (2) in the power supply. Replace with 3 A fuses if necessary.

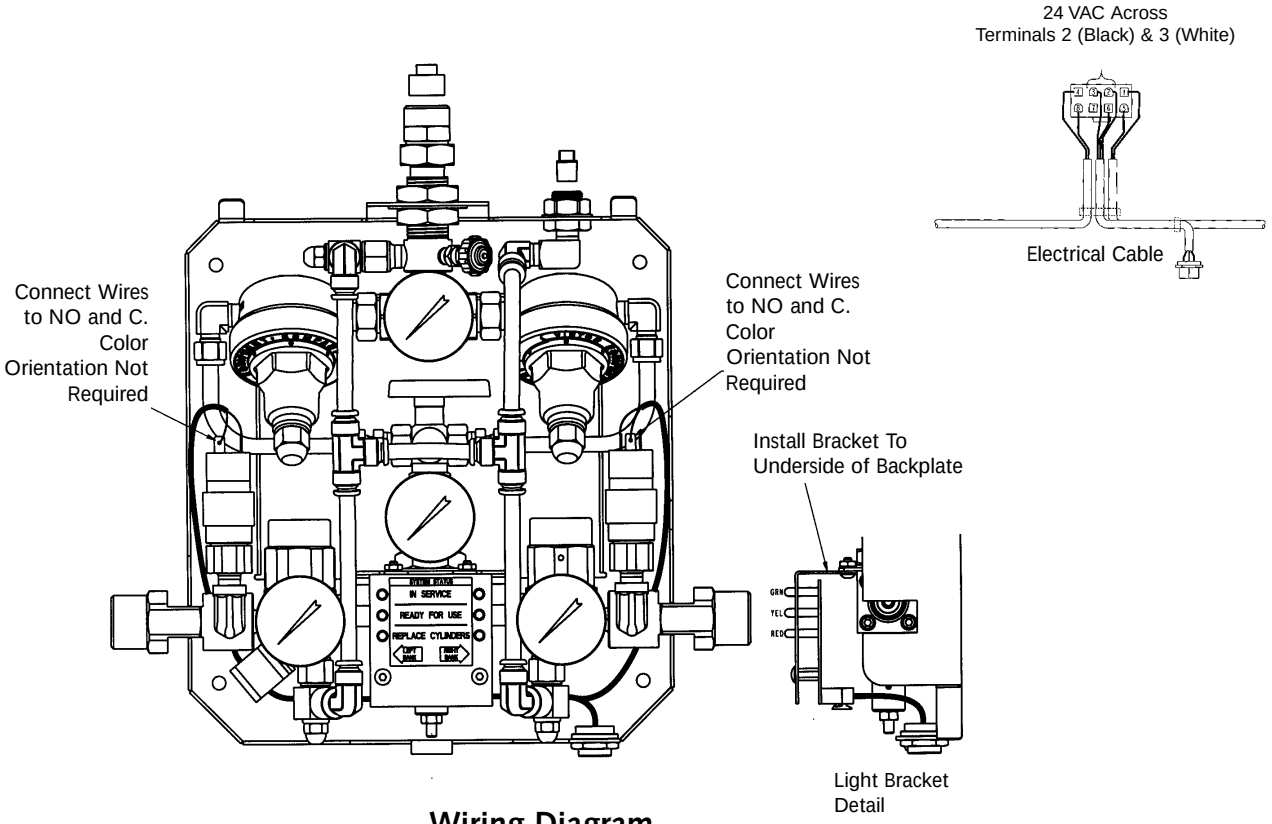
3. Make sure the power supply cable is attached securely to the manifold. Use voltmeter to confirm the 24-30 VAC is supplied at pins 1 and 2 of the power cord connector.

4. If the power supply is not supplying 24-30 VAC, replace it with a new one.

ELECTRICAL CABLE TROUBLESHOOTING PROCEDURE

1. Examine the electrical cable inside the manifold control cabinet. The wiring schematic is shown in Figure **16**. Look for loose wires, unconnected wires and any broken or damaged switches. Make sure the cable is firmly connected to the pressure switches.

.



Wiring Diagram
Figure 16

CONTROL BOARD TROUBLESHOOTING PROCEDURE

1. Use a voltmeter to make sure the electrical cable has 24-30VAC at pins 2 & 3 as shown in Figure **16**.

2. There are no repairable components on the Control board. If it is getting power, but it is not functioning properly, it must be replaced. Before replacing the Control board, perform the Inspecting Manifold Operation shown on page 17 to make sure the pressure switches are set properly.

3. Replace the Control board. The Control board can be removed by removing the two screws underneath the bank indicator lights.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	POSSIBLE SOLUTION
ELECTRICAL SYSTEM		
No indicator lights on front of panel come on when power is connected.	No power input. Internal wiring is disconnected. Fuse blown.	Check power supply. Check all wiring connections. Check fuse in power supply.
Red indicator light is on but both banks are full.	Defective pressure switch. Master valves shut off.	Replace pressure switch. Open master valves.
Red indicator light does not come on when one back is empty and changeover occurs.	Pressure switch set wrong. Defective pressure switch.	Adjust pressure switch (see page 23). Replace pressure switch.
Red indicator light comes on when one bank is empty but changeover does not occur.	Switch unit set wrong. Defective switchover unit.	Reset switch unit (see page 22). Replace switchover unit.
Green light does not come on even though bank is full.	Defective pressure switch. Master valves shut off.	Replace pressure switch. Open master valves.
SWITCHOVER SYSTEM		
Both banks feeding.	Leaking o-ring on switchover unit.	Replace switchover unit.
Will not switch over to reserve bank.	Switch unit improperly set Defective switchover unit. Setscrew has come loose on switchover unit. Reserve bank empty (check pressure on inlet gauges).	Reset switchover pressure (see page 22). Replace switchover unit. Reset switchover pressure (see page 22). Replace reserve bank.
Inlet relief valve leaking.	Spool regulator creeping (check intermediate pressure gauge). Relief valve not shutting off.	If gauge reads improperly replace or repair spool regulator. Replace relief valve.
Banks not switching at same pressure.	Defective switchover unit.	Replace switchover unit.
OUTLET REGULATOR		
Incorrect delivery pressure. Delivery pressure creeping.	Delivery regulator not set properly. Flow demand too high. Delivery pressure regulator not seating properly.	Reset delivery pressure regulator. Check flow requirements. Repair or replace delivery pressure regulator.

SQUIRE-COGSWELL/AEROS INSTRUMENTS, INC. HEALTHCAIR MEDICAL GAS PIPELINE EQUIPMENT LIMITED WARRANTY

1. **SQUIRE-COGSWELL/AEROS INSTRUMENTS, INC. warrants the HEALTHCAIR MEDICAL GAS PIPELINE EQUIPMENT** to be free of defects in material and workmanship for a period of twenty-four (24) months from the date of shipment or twelve (12) months from the date of start-up, whichever occurs first. Within said period Squire-Cogswell/Aeros Instruments, Inc. will repair or replace any part or component which is proven to be defective in either material or workmanship.

2. To obtain service within the warranty period, first contact the Squire-Cogswell/Aeros Instruments, Inc. Service Department.

3. Squire-Cogswell/Aeros Instruments, Inc's responsibility under this warranty shall be limited to providing at Squire-Cogswell/Aeros Instruments, Inc's sole discretion, new or replacemant parts to replace any component found to be defective within the warranty period. Installation of user replaceable items will be the user's responsibility.

4. Labor to repair any part or component proved to be defective within the warranty period will be provided at no charge for any item returned to our factory adequately packaged and insured with shipping costs prepaid. Standard surface freight shipping cost to return the repaired part or component to the user will be paid by Squire-Cogswell/Aeros Instruments, Inc.
    a Before returning any part or component to the factory, proper return authorization must first be obtained from Squire-Cogswell/Aeros Instruments, Inc. Service Department.
    b. The user will be required to issue a pruchase order for replacemant items. Upon receipt of the defective items, Squire-Cogswell/Aeros Instruments, Inc. will issue a credit to the user in the amount equal to the purchase order.

5. This warranty is valid only when the product has been properly installed according to Squire-Cogswell/Aeros Instruments, Inc. specifications, used in a normal manner and serviced according to factory recommendations. The warranty does not cover failures due to damage which occurs in shipment or failures which result from accidents, misuse, abuse, neglet, mishandling, alteration, misapplication or damage that may be attributable to acts of God.

6. Squire-Cogswell/Aeros Instruments, Inc. shall not be liable for incidental or consequential damages resulting from the use of this product. There are no expressed or implied warranties which extend beyond the warranties set forth above. Squire-Cogswell/Aeros Instruments, Inc. makes no warranty of merchantability or fitness for a particular prupose to equipment and to its parts and components.

7. **THE CONDITIONS OF THE BUYER'S RESPONSIBILITY ARE:**
    1. The equipment is stored properly before installation;
    2. The equipment is installed according to Squire-Cogswell/Aeros Instruments, Inc's specifica tions and installation procedures;
    3. The equipment is properly maintained and not altered unless by an authorized representative of Squire-Cogswell/Aeros Instruments, Inc.


Squire-Cogswell
aeros