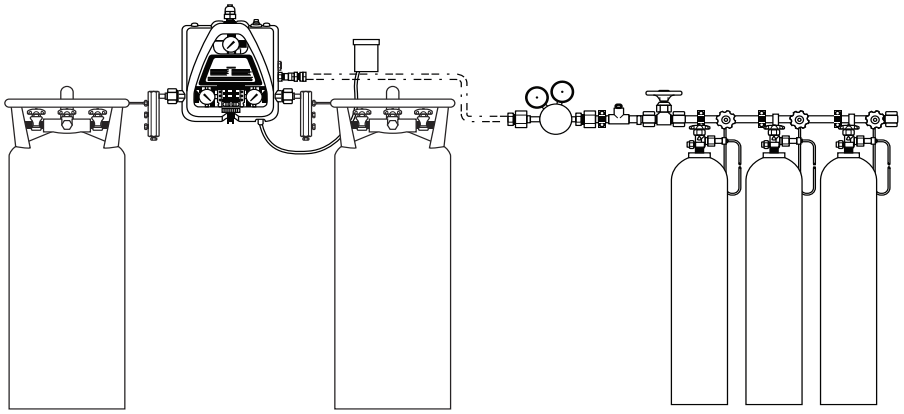
LIQUID TO LIQUID AUTOMATIC SWITCHOVER MANIFOLD



SAFETY AND OPERATING INSTRUCTIONS

Revision: AA	**Issue Date:** March 2024	**Manual No.:** 0056-3092

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WARNING

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment. While the information contained in this Manual represents the Manufacturer's judgment, the Manufacturer assumes no liability for its use.

Liquid to Liquid Automatic Switchover Manifold

Safety and Operating Instructions

Instruction Guide Number: 0056-3092

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Record the following information for Warranty purposes:

Where Purchased:_____

Purchase Date:_____ _____

Equipment Serial #:_____ _____

TABLE OF CONTENTS

SECTION 1: INTRODUCTION

1.01 HOW TO USE THIS MANUAL

Information necessary to perform maintenance and service 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. To ensure safe operation, read the entire manual, including the chapters on safety precautions and warnings.

Throughout this manual, the words WARNING, CAUTION, and NOTE may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

NOTE

NOTE conveys installation, operation, or maintenance information which is important but not hazard-related.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

1.02 RECEIPT OF EQUIPMENT

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to the location in your area.

For additional or replacement copies of this manual, please find contact information at www.ohiomedical.com, www.ohiomedicalparts.com.

1.03 DESCRIPTION

The Ohio Medical manifold system is designed to be fully automatic. The manifold gives 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 lights on the front of the manifold indicate the status of the gas supply. An external power supply converts 115 VAC to 24 VAC. A 24-inch (609,6 mm) cord connects the power supply to the manifold.

When the manifold changes from the primary bank to the reserve bank, the red light turns 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.

The built-in economizer circuit is designed to prevent gas waste through the cylinder vent system of the reserve bank while the manifold system is in operation.

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 30 VDC 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 turns OFF, the yellow light turns 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 Ohio Medical's two-year warranty. The switchover unit has a five-year warranty.

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SECTION 2: SAFETY PRECAUTIONS

FOR YOUR SAFETY

Installation and utilization of manifold and piping system must conform to federal, state , and local specification and regulation. The National Fire Protection Association Bulletin NFPA#99 outlines standards for the installation and operation of medical gas system hospital and home care facilities .copies can be obtained by writing National fire Protection Association , 470 Atlantic Avenue Boston, MA02210. Be certain to consult your fire marshal conerning regulations applicable to your location and particular requirements.

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

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

WARNING

***WARNING**: This product contains chemicals, including lead, known to the State of California to cause birth defects and other reproductive harm. **Wash hands after handling**.*

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 SLOWLY. 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 (127cm). 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.

SECTION 3: FEATURES AND SPECIFICATIONS

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

3.01 STANDARD FEATURES

1. Manufacturing - ohio medical 's quality system is registered by BSI to meet the requirements of ISO 9001.
2. Safety Standards and Codes - Ohio Medical 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

3. 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 [31026,4Kpa]).

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

5. Environmental Considerations – Ohio Medical manifold systems are manufactured to be used in indoor 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.

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

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

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

3.02 MATERIAL SPECIFICATIONS

Enclosure	• 12.8" w X 14.1" h X 5.0" d (32,5 cm W X 35,8 cm H X 12,7 cm 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.
Inlet Block Assemblies	• Brass CDA360
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	• 72" (1829 mm) flexible polyester cover, polyethylene lined

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
Economizer Circuit	• Copper tubing • Brass check valve body • Neoprene seat

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

Service or repair of apparatus should be performed only by a qualified repair technician. Improper service, repair, or modification of the product could result in damage to the product or injury to the operator. The term "Qualified Repair Technician" refers to repair personnel capable of servicing gas apparatus in strict accordance to Ohio Medical Part andService Bulletins.

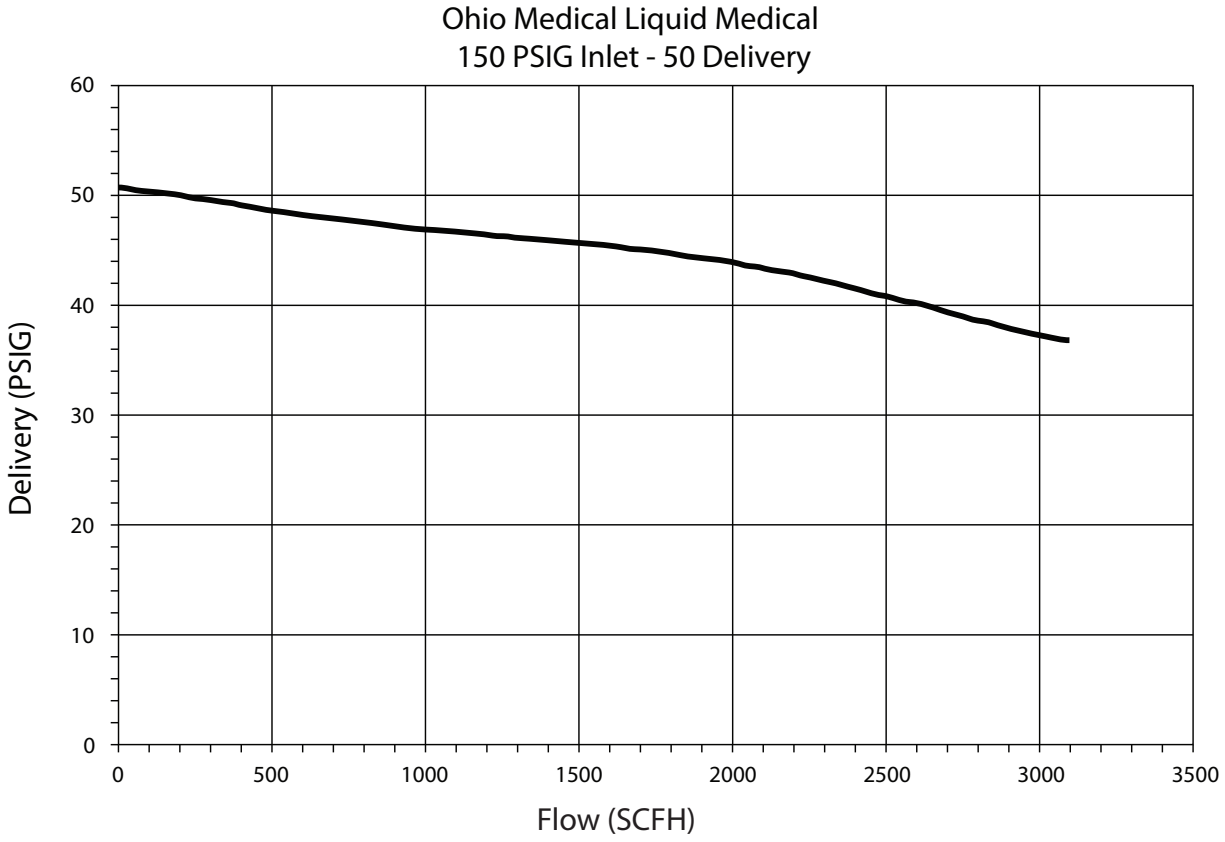
WARNING

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.

3.03 FLOW CONSIDERATIONS

The manifold is rated for 300 SCFH (8495 l/hr) of gas. Flow rate is listed for reference only. To properly operate manifold, the user must supply sufficient gas capacity to the manifold. One liquid oxygen or nitrogen cylinder will typically supply 325 SCFH (9203 l/hr) of gas. Two liquid cylinders will typically supply 575 SCFH (16282 l/hr) gas and three cylinders will supply 800 SCFH (22654 l/ hr). Carbon dioxide cylinders will typically supply 110 SCFH (3115 l/hr) maximum from each cylinder while nitrous oxide will typically supply 80 SCFH (2265 l/hr) from each cylinder. The user must make sure sufficient cylinder capacity is available to supply the flow rate desired.

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



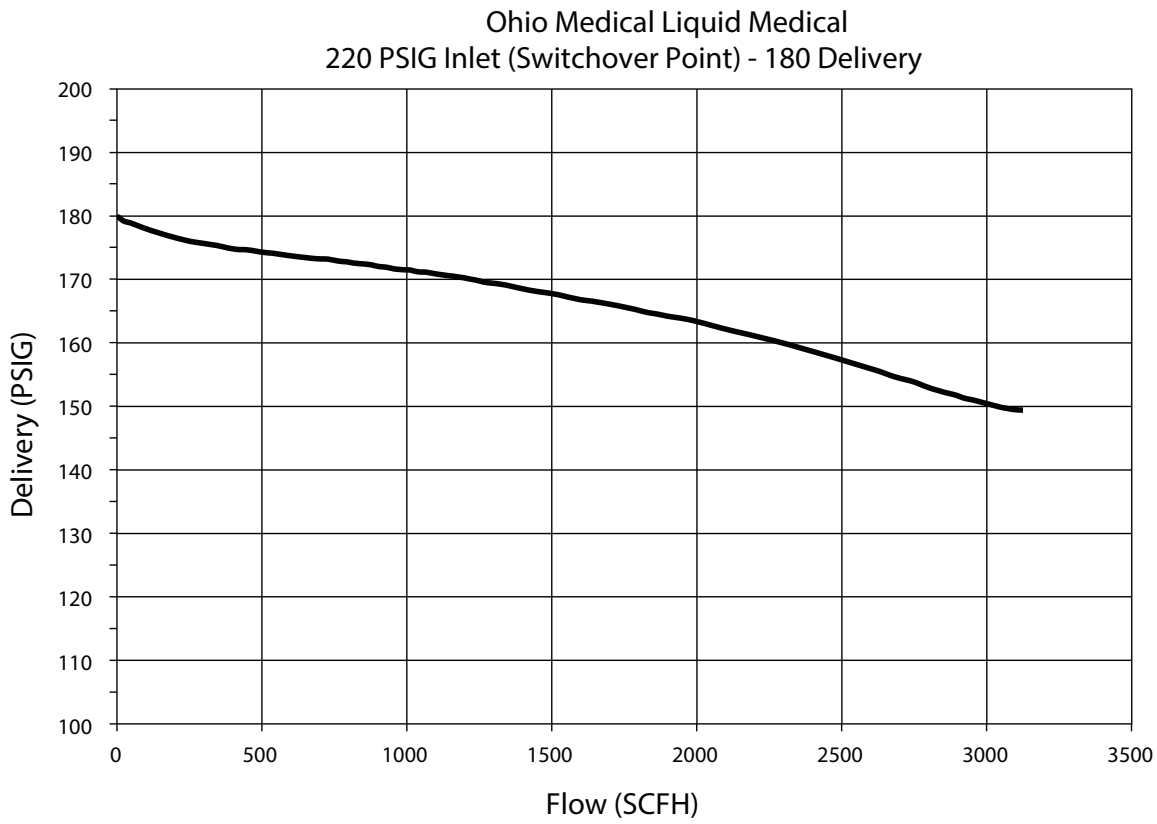
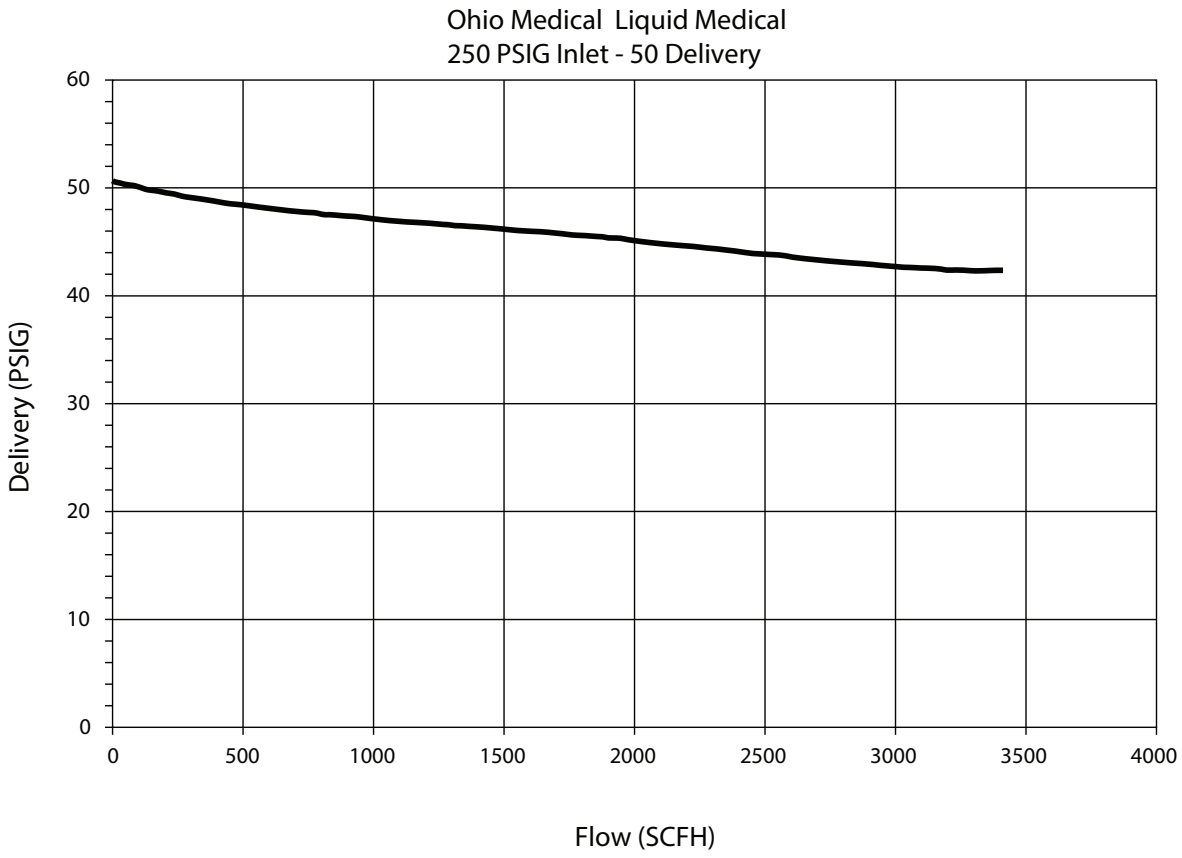


Figure 1: Performance Specifications



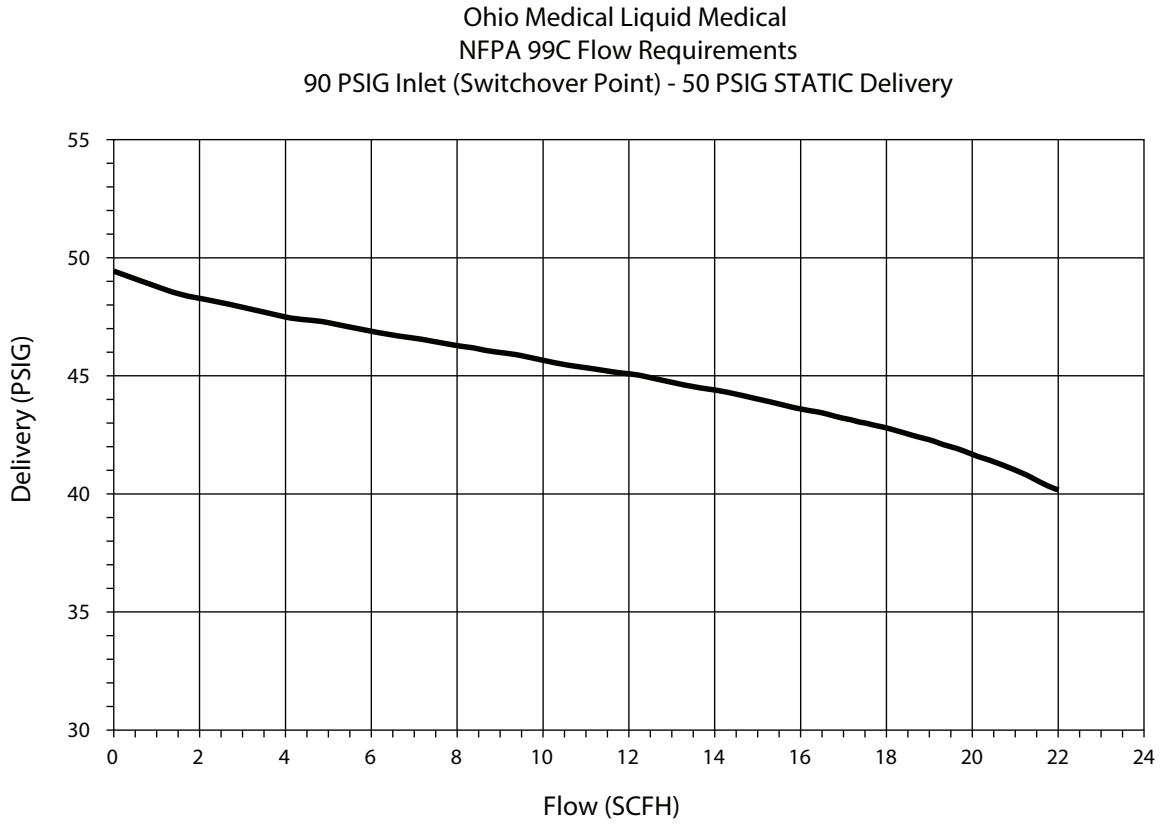


Figure 1: Performance Specifications

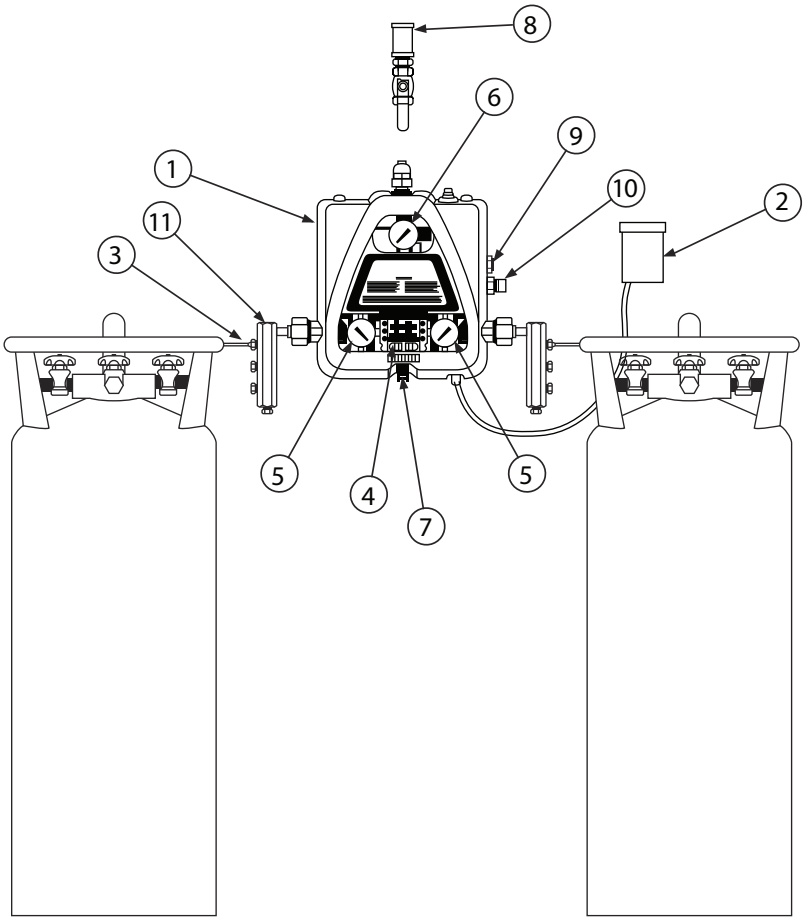


Figure 2: Key Elements

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) with built-in check valves. Control panel indicator lights (4) 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 (5) allow monitoring of left and right supply pressure as well as pipeline delivery pressure (6)

Cabinet latch (7) can be locked to help prevent tampering.

Bypass valve (8) is optional and is recommended for use during manifold servicing. Actuating switch port (9) for highpressure reserve.

HighPressure Back Up Monitoring Port (10) is for connecting a pressure switch to monitor the high-pressure back up pressure

Inlet block (11).

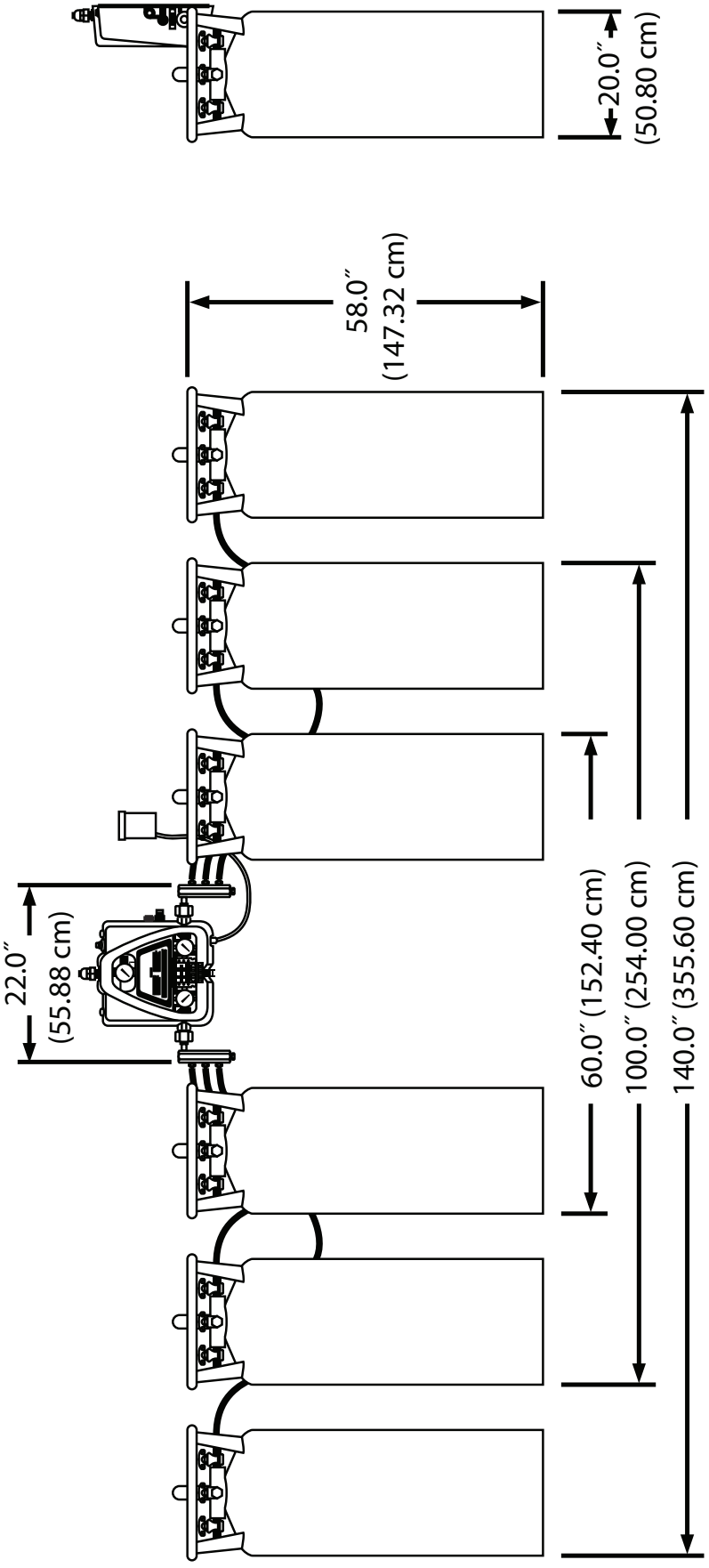


Figure 3: Overall Manifold Length

SECTION 4: MANIFOLD OPERATION

The basic manifold system consists of the pressure control cabinet (Manifold), two banks of cylinders, pigtails, line 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. Therefore, the second bank is in a static condition until the pressure in the primary bank reaches the switchover pressure setting. The intermediate pressure gauge monitors the condition of the manifold at any time, indicates the delivery pressure of the inlet regulator currently in use, and shows when switchover occurs (lights change from green to red).

At the switchover point, the reserve bank automatically becomes the primary and the red light turns ON to signal depletion of primary bank which must be replaced. Dry contacts inside the power supply box also open, activating a remote alarm, if one is attached. To determine which bank has been depleted, bank pressure can be read on the bank inlet pressure gauges and shows an empty or near empty condition, indicating the depleted bank.

When the depleted bank has been replaced with new cylinders, the red light turns OFF and the green light turns ON, and the depleted bank becomes the reserve bank allowing the cycle to be repeated. In case of power failure, the manifold continues to function, since power is used only for the red and green indicator lights and alarm.

Internal Components

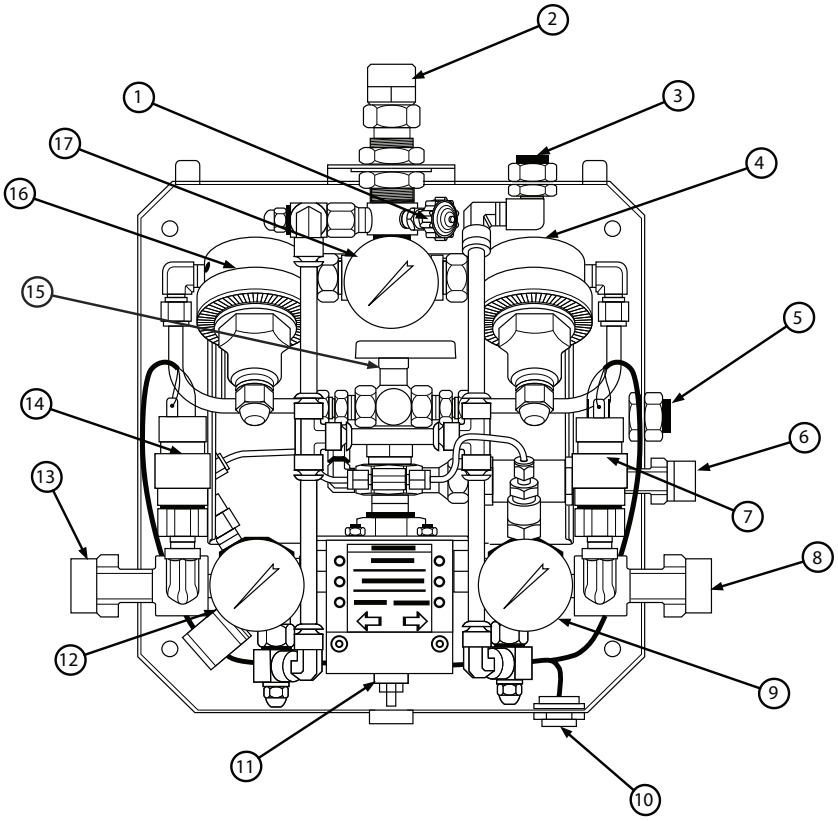


Figure 4: Internal Components

Item No.	Description
1	Bleed Valve
2	Outlet
3	Vent
4	Right Side Delivery Regulator
5	Pressure Switch Port
6	High Pressure Back Up Inlet Port (NFPA99 requirement)
7	Right Bank Pressure Switch
8	Right Bank Inlet
9	Right Bank Pressure Gauge
10	Electrical Connection from Power Supply
11	Manifold Switch Unit
12	Left Bank Pressure Gauge
13	Left Bank Inlet
14	Left Bank Pressure Switch
15	Diversion Valve
16	Left Side Delivery Regulator
17	Deliver y Pressure Gauge

SECTION 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 and 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 for optimal performance with the temperature range of 0°F to 140°F (-18°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.

See Figure 3 (page 12) for overall manifold length.

Refer to Figure 5 when following the instructions below:

1. Measure and mark a horizontal line approximately 58" (1473 mm) from floor for the bottom mounting holes in the manifold mounting plate. This determines the center line of about 61" (1549 mm) 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 depend upon wall construction.

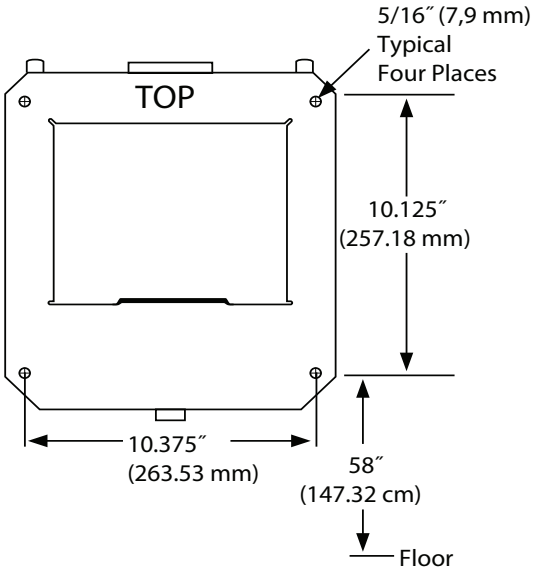


Figure 5: Mounting Plate

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. Attach each header to each manifold inlet connection. Attach the nut and plug to the end of each header.

NOTE

The rounded end of the plug is the sealing surface. Tighten all manifold fittings to 55-65 ft. lbs. torque.

5. Tighten all header mounting hardware.

6. 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.

7. 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 6).

8. For remote alarm electrical connection, use electrical wiring drawing shown in Figure 6.

9. 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 connected to the pipeline system.

10. 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.

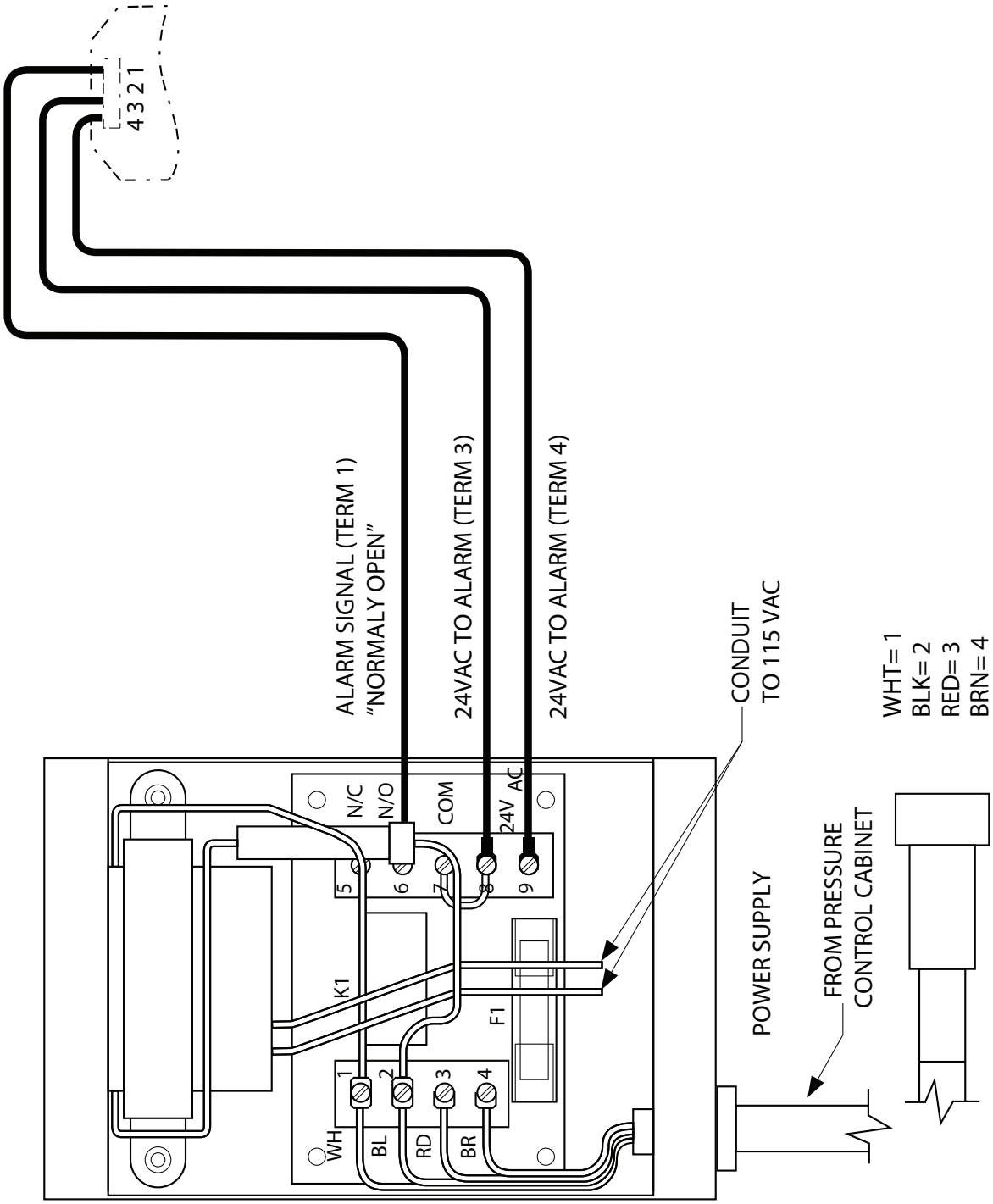


Figure 6: Remote Alarm Wiring

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SECTION 6: 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 "REPLACE CYLINDERS" light on the front of the manifold should light.

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.

4. Slowly apply pressure to one of the inlet sides of pressure cabinet.

NOTE

The first side pressurized becomes the primary side (green light illuminates) and the other side will be the reserve side.

5. Apply pressure to the other side of the manifold. When over 125 PSIG (861,8 kPa) of gas is applied, the red light on that side of the manifold should turn OFF and the yellow "READY FOR USE" light will illuminate.

NOTE

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

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SECTION 7: LEAK TEST

1. Turn OFF flow at the outlet of the pressure control cabinet.

2. Turn 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 Oxygen safe 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.

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SECTION 8: 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 (127 mm). 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.

NOTE

If the depleted cylinders are not going to be connected to the pigtails immediately, then the header valves must be turned OFF.

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. Observe the following conditions:

"REPLACE CYLINDERS" red light turns OUT.

"READY FOR USE" yellow light turns ON.

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

8.01 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
- Oxygen safe Teflon tape

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SECTION 9: INSPECTING MANIFOLD OPERATION

NOTE

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

NOTE

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, Carbon Dioxide, Nitrous Oxide	125 PSIG (861,8 kPa) minimum
Nitrogen	250 PSIG (1723,7 kPa) 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 are both illuminated. Yellow lights should not be illuminated. If the lights do not turn ON, examine electrical components as directed by the "Electrical System Troubleshooting Procedures" (Section 11.05).

6. Slowly pressurize the left inlet to test pressure specified above in Step 3. 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.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" (Section 10.05).

8. Open the bleed valve to initiate flow. Turn OFF right bank cylinder valves. Monitor the condition of the lights. At 110 ± 10 PSIG (758,4 ± 69 kPa) the red light on the right side will turn ON. The left side yellow light will turn OFF and the left side green light will turn ON. Immediately after this, at 90 ± 10 PSIG (620,5 ± 69 kPa), switchover will occur. The right inlet gauge will indicate the pressure at which the switchover occurred, and should read 90 ± 5 PSIG (620,5 ± 34,5 kPa). Turn OFF the bleed valve.

9. 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.

10. Open the bleed valve to initiate flow. Turn OFF left bank inlet cylinder valve. Monitor the condition of the lights. At 110 ± 10 PSIG (758,4 ± 69 kPa) the red light will turn ON and the green light will turn OFF. Immediately after this, at 90 ± 10 PSIG (620,5 ± 69 kPa), switchover will occur. The left inlet gauge will indicate the pressure at which the switchover occurred, and should read 90 ± 5 PSIG (620,5 ± 34,5 kPa).

11. Slowly open the LEFT bank inlet master valve again. Verify that the left side red light turns OFF and yellow light turns back ON.

12. Turn 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, repressurize both inlets, and repeat this step as necessary.

13. Close both inlet valves. Keep the bleed valve turned OFF.

14. Reconnect to downstream gas supply.

15 . Open both inlet valves.

Component Location

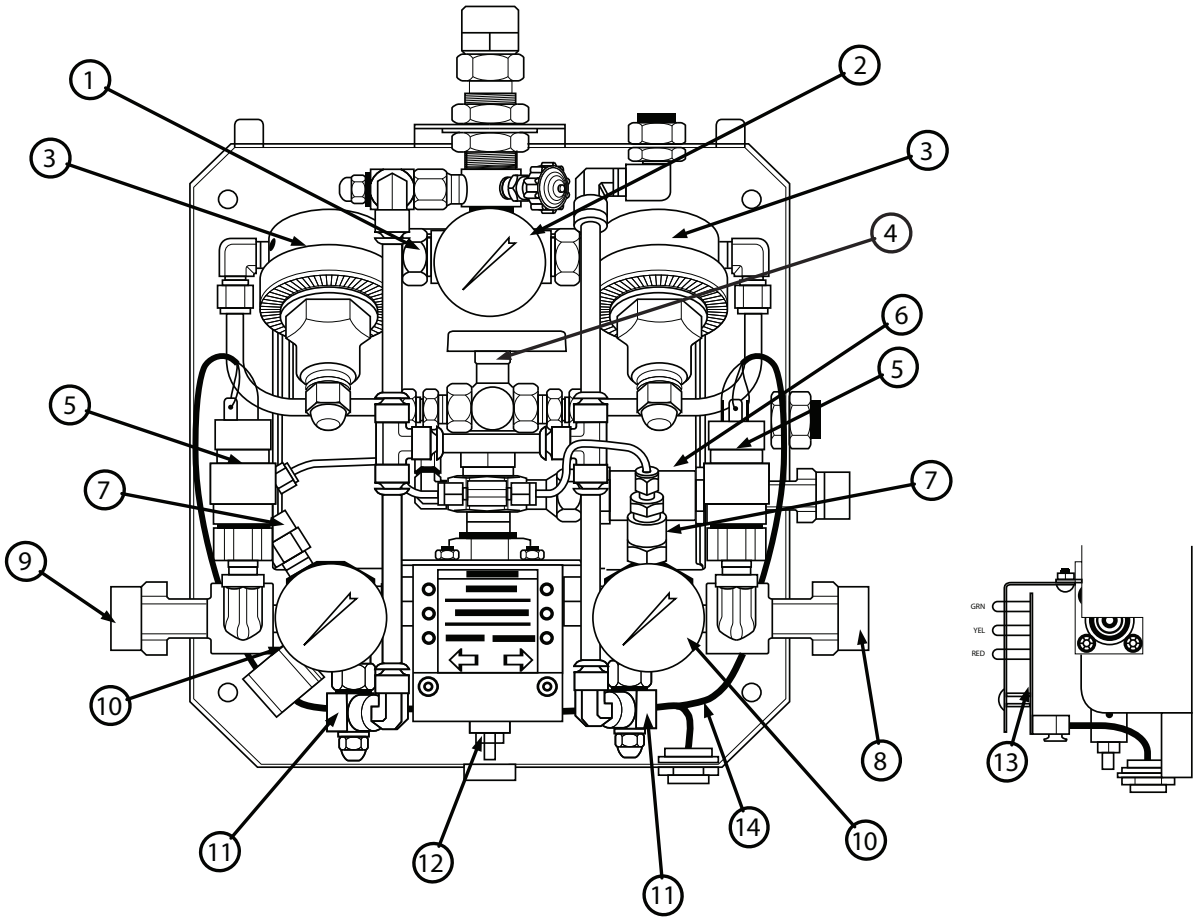

Figure 7: Component Location

Item No.	Part No.	Description
1	263079	Outlet Assembly (110 PSIG [758,4 kPa] gauge)
	263063	Outlet Assembly (400 PSIG [2757,9 kPa] gauge) Nitrogen
2	263065	Delivery Pressure Gauge 2" x 400 PSIG (2757,9 kPa)
	263064	Delivery Pressure Gauge 2" x 100 PSIG (689,5 kPa)
3	263066	L350E-AM Regulator - 2 per
4	263067	Diversion Valve
5	263087	Pressure Switch (110 PSIG [758,4 kPa] set) (2)
6	263088	High Pressure Reserve Check Valve
7	263089	Economizer Valve Assembly (2)
8	263090	Right Inlet Assembly
9	263091	Left Inlet Assembly
10	263068	Inlet Gauge 2" x 600 PSIG (4136,9 kPa) (2)
11	263075	Relief Valve (600 PSIG [4136,9 kPa]) (2)
12	263092	Switchover Assembly (90 PSIG [620,5 kPa])
	263069	Switchover Assembly (220 PSIG [1516,9 kPa])
13	263076	Control Board
14	263074	Wiring Harness

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SECTION 10: PROCEDURES

10.01 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.

DELIVERY 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. See "Internal Components" Figure 4.
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. Either discard or 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. See Figure 7.
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.

Switch Unit

1. Remove both the delivery regulator and inlet regulators as shown as described above.
2. Using a 1-1/2" open-end wrench, remove the nut from the switch unit and slide unit out of mounting bracket.
3. Send the Switch Unit to a qualified repair facility for reconditioning.
4. Reinstall the delivery regulator as described above.

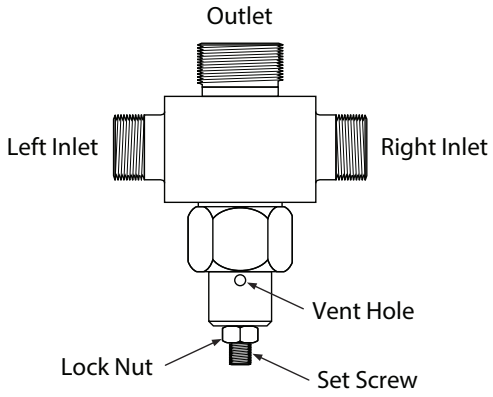

Figure 8: Switch Unit

Check Valve Outlet Assembly

1. Remove both left and right delivery regulators and diversion valve 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 9 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 (344,7-413,7 kPa) to female pipe port thread and check for leaks on each end. No visible leaks are allowed.

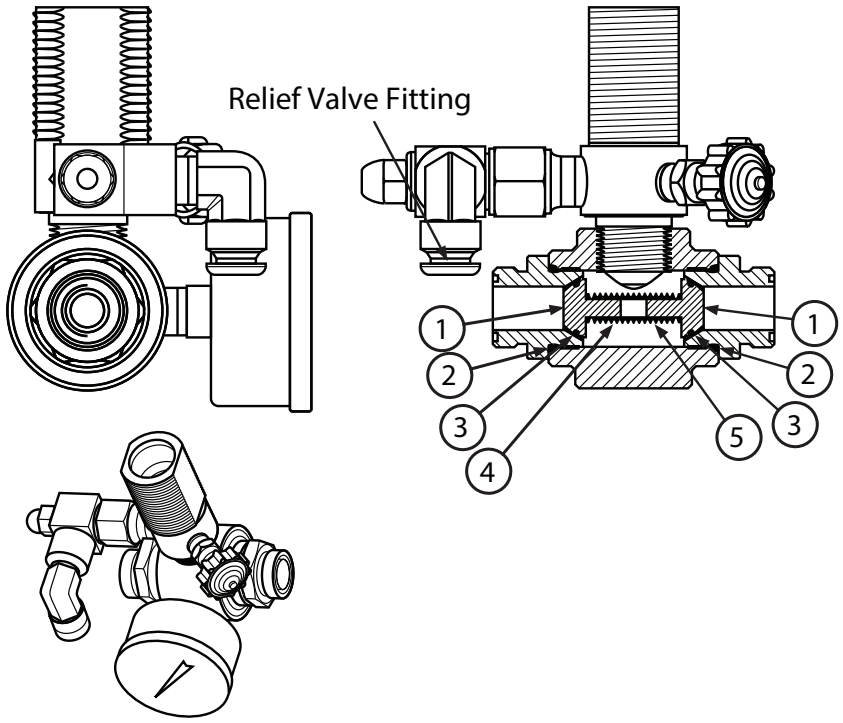

Figure 9: Check Valve Outlet Assembly

Item No.	Part No.	Description
1	263081	Seat
2	263082	O-Ring
3	263083	
4	263084	Spring
5	263085	Spring Guide

10.02 ADJUSTMENT SPECIFICATIONS

Factory Pressure Settings (PSIG)			
Pressure Switch	**Switchover Pressure**	**Delivery Regulator**	**Delivery Regulator Relief Valve**
110 (758,4 kPa)	90 (620,5 kPa)	50 (344,7 kPa)	400 (2757,9 kPa)
Adjustable Range (PSIG)			
70 - 250 (482,6-1723,7 kPa)	50 - 300 (344,7-2068,3 kPa)	20 - 180 (137,9-1241 kPa)	200 - 500 (137,9-3447,4 kPa)

Delivery regulator pressure is at the user's discretion. Factory preset is at 50 PSIG (344,7 kPa).

10.03 CHANGING SWITCHOVER UNIT PRESET

Reset the switchover point of the manifold by using the set screw located at the bottom of the switch unit (see Figure 8). Perform the following procedure when changing the switchover point:

1. Determine the current switchover point. 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 inlet Pressure Gauge will drop to the point at which switchover occurred and should be 90 ± 5 PSIG (620,5 ± 34,5 kPa).

NOTE

From the factory, high-pressure models have a set point of 90 PSIG (620,5 kPa) 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 90 PSIG (620,5 kPa), and you wish to have it switchover at 75 PSIG (517,2 kPa) instead, then the difference from old to new is a decrease of 15 PSIG (103,4 kPa). Note this value for your desired configuration.

3. One complete turn of the switch unit set screw (360˚) will change the switchover point APPROX. 30 PSIG (206,8 kPa). 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 15 PSIG (103,4 kPa) would require backing out the set screw APPROX. ONE HALF TURN.

Using a 7/16" wrench, loosen the set screw 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 (137,9 kPa) 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 (137,9 kPa) margin from the actual switchover point.

NOTE

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

10.04 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 VM1100 series are factory set to 110 PSIG (758,4 kPa).

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 10.

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

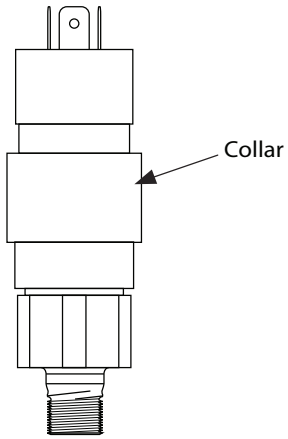

Figure 10: Pressure Switch

10.05 DELIVERY REGULATOR PRESET PROCEDURE

1. Loosen the 3/4" hex cap nut from the adjusting screw of the delivery regulator. Refer to Figure 11.

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.

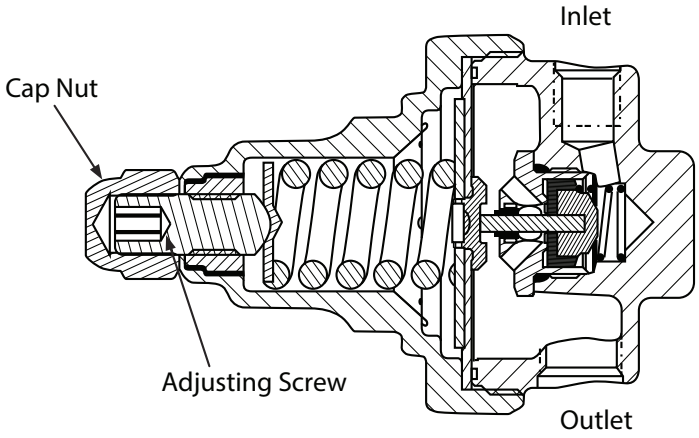

Figure 11: Delivery Regulator

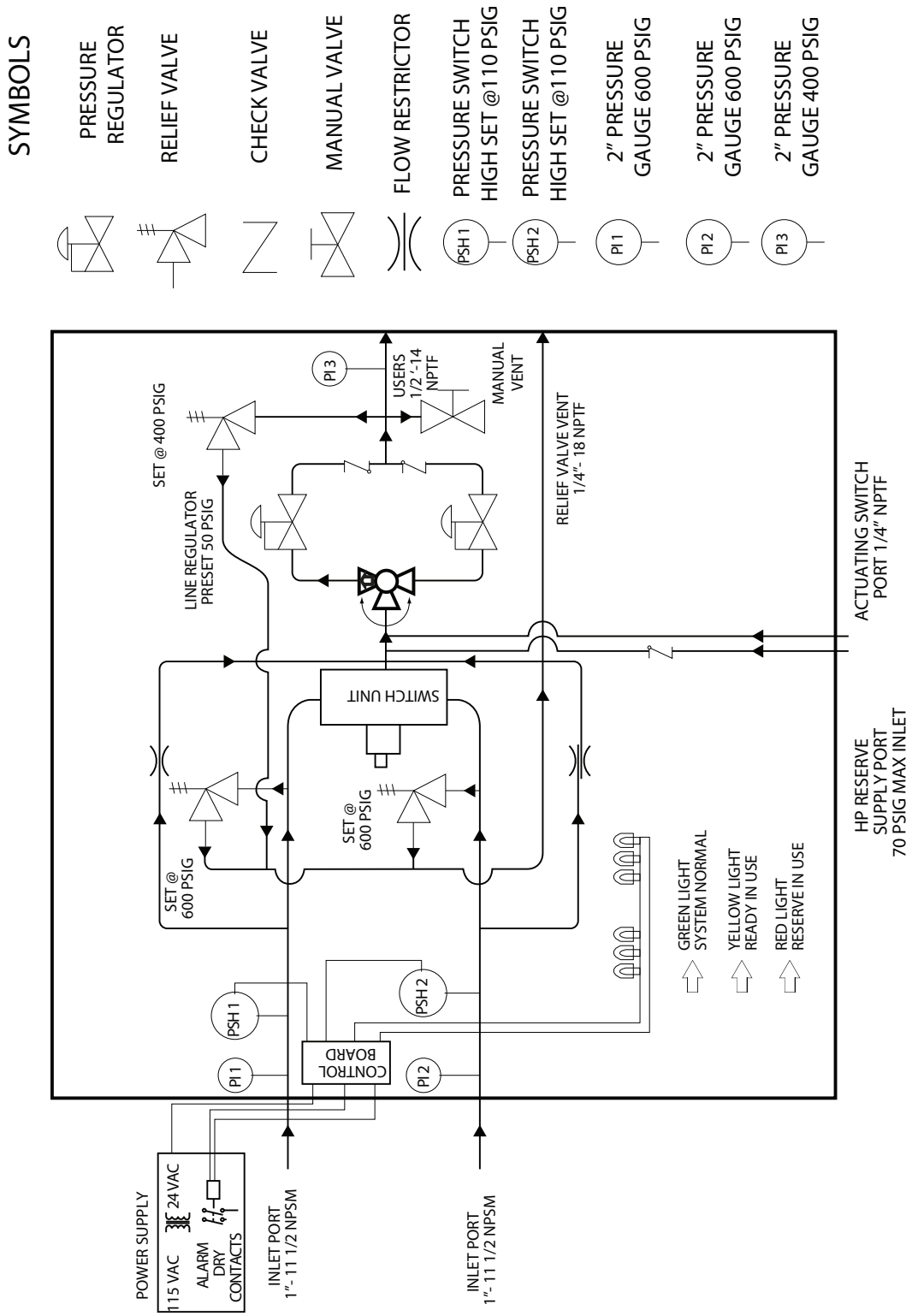

Figure 12: Wiring Schematic

SECTION 11: MAINTENANCE AND TROUBLESHOOTING

11.01 MAINTENANCE

1. Pressure Control Cabinet

Daily	• Record line 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. • If condensation or frosting occurs, 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

11.02 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.

11.03 ELECTRICAL CABLE TROUBLESHOOTING PROCEDURE

1. Examine the electrical cable inside the manifold control cabinet. The wiring schematic is shown in Figure 13. Look for loose wires, unconnected wires and any broken or damaged switches. Make sure the cable is firmly connected to the pressure switches.

2. Use a voltmeter to make sure the electrical cable has 24-30 VAC at pins 2 and 3. Replace cable if the 24-30 VAC is not reached and there is not obvious reason such as a broken wire or loose connection.

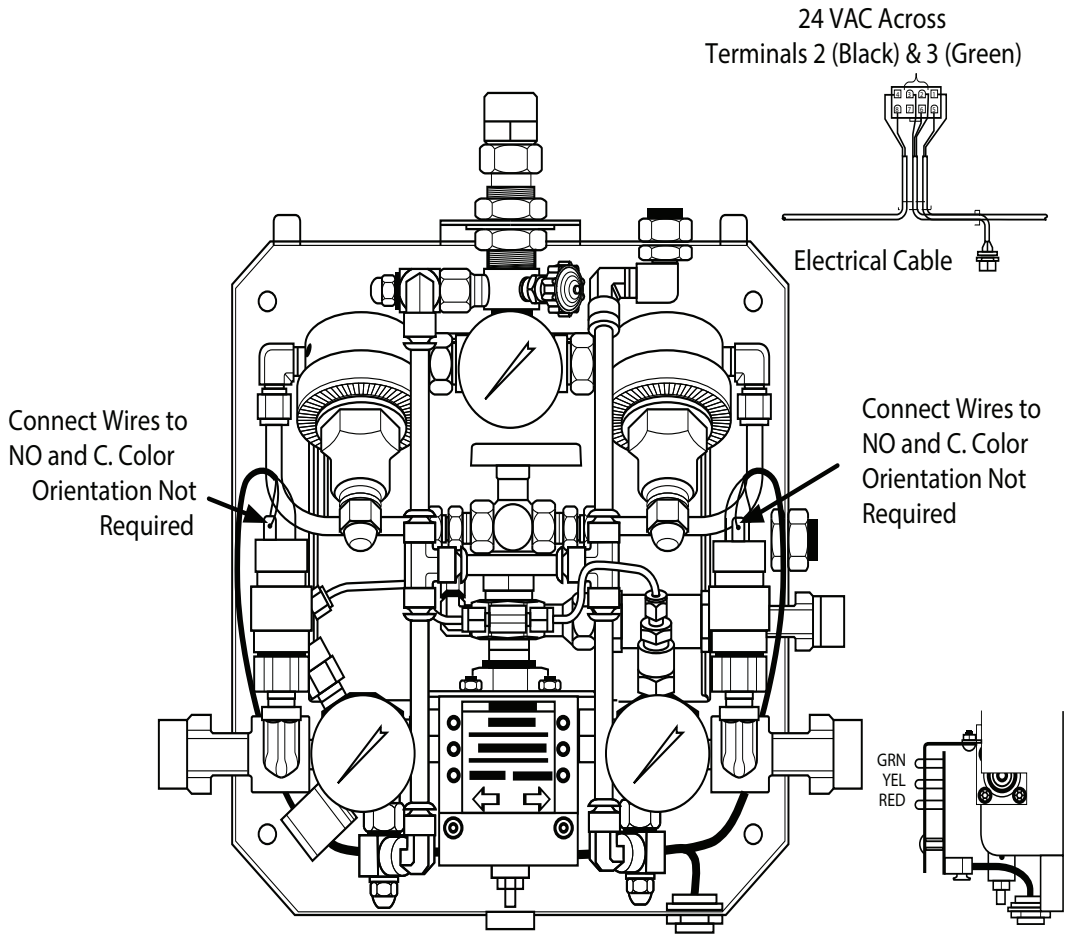

Figure 13: Wiring Diagram

11.04 CONTROL BOARD TROUBLESHOOTING PROCEDURE

1. Use a voltmeter to make sure the electrical cable has 24-30 VAC at pins 2 and 3 as shown in Figure 13.

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 in Section 9 to make sure the pressure switches are set properly.

3. Replace the Control Board. Remove the Control Board by removing the two screws underneath the bank indicator lights.

11.05 TROUBLESHOOTING

Problem	Possible Cause	Possible Solution
ELECTRICAL SYSTEM		
No indicator lights on front of panel come ON when power is connected	1. No power input 2. Internal wiring is disconnected 3. Fuse blown	1. Check power supply 2. Check all wiring connections 3. Check fuse in power supply
Red indicator light is ON but both banks are full	1. Defective pressure switch. 2. Master valves shut OFF	1. Replace pressure switch. 2. Open master valves
Red indicator light does not come ON when one back is empty and changeover occurs	1. Pressure switch set wrong 2. Defective pressure switch	1. Adjust pressure switch (see 10.04) 2. Replace pressure switch
Red indicator light turns ON when one bank is empty but changeover does not occur	1. Switch unit set wrong 2. Defective switchover unit	1. Reset switch unit (see 10.03) 2. Replace switchover unit
Green light does not turn ON even though bank is full	1. Defective pressure switch 2. Master valves turned OFF	1. Replace pressure switch 2. Open master valves
SWITCHOVER SYSTEM		
Both banks feeding	1. Leaking o-ring on switchover unit	2. Replace switchover unit
Will not switch over to reserve bank	1. Switch unit improperly set 2. Defective switchover unit 3. Setscrew has come loose on switchover unit 4. Reserve bank empty (check pressure on inlet gauges)	1. Reset switchover pressure (see 10.03) 2. Replace switchover unit 3. Reset switchover pressure (see 10.03) 4. Replace reserve bank
Inlet relief valve leaking	1. Spool regulator creeping (check intermediate pressure gauge) 2. Relief valve not shutting OFF	1. If gauge reads improperly replace or repair spool regulator 2. Replace relief valve
Banks not switching at same pressure	1. Defective switchover unit	1. Replace switchover unit
OUTLET REGULATOR		
Incorrect delivery pressure	1. Delivery regulator not set properly 2. Flow demand too high	1. Reset delivery pressure regulator 2. Check flow requirements
Delivery pressure creeping	1. Delivery pressure regulator not seating properly	1. Repair or replace delivery pressure regulator

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SECTION 12: STATEMENT OF WARRANTY

LIMITED WARRANTY: Ohio Medical warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Ohio Medical products as stated below, Ohio Medical shall, upon notification there of and substantiation that the product has been stored, installed, operated, and maintained in accordance with Ohio Medicals' specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Ohio Medicals' sole option, of any components or parts of the product determined by Ohio Medical to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Ohio Medical shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter the "Purchaser") for service interruption. The remedies of the Purchaser set forth here in are exclusive and the liability of Ohio Medical with respect to any contract, or anything done in connection therewith such as the performance or breach there of, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Ohio Medical whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY OHIO MEDICAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

This warranty is effective for the time stated in the Warranty Schedule beginning on the date that the authorized distributor delivers the products to the Purchaser. Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Ohio Medical repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the Purchaser. All returned goods shall be at the Purchaser's risk and expense. This warranty supersedes all previous Ohio Medical warranties.

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