Corporation
AMICO

MICROPROCESSOR BASED

DIGITAL MANIFOLD

ALERT-2

Installation and Maintenance Manual v5.7

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USER RESPONSIBILITY

The information contained in this Installation and Maintenance Manual, pertains only to the ALERT-2 microprocessor based digital manifold. This product will perform in conformity with the descriptions contained in this manual when assembled, operated, maintained and serviced in accordance with the installation instructions provided.

The manifold **must** be checked periodically. Parts that are broken, missing, worn, distorted or contaminated, **must** be replaced immediately. Should such repair or replacement become necessary, please contact Amico Corporation or their distributors.

Installing CO2 and N2O manifolds outdoors. Please refer to NFPA Code: 5.1.3.3.1.8 Central supply systems for nitrous oxide and carbon dioxide shall be prevented from reaching temperatures lower than the recommendations of the central supply system's manufacturer, but shall never be lower than -7°C (20°F) or greater than 54°C (130°F).

All Manifolds should not be repaired or altered without prior written approval by Amico Corporation or it's distributors. Failure to comply will void all warranty on the manifold.

Statements in this manual preceded by the words **WARNING**, **CAUTION**, **DANGER** and **NOTE** are of special significance. Please read these sections carefully.

WARNING: denotes steps which can prevent injury.

CAUTION: denotes steps which can prevent damage to equipment.

DANGER: denotes steps which can prevent electrical shock to equipment or to prevent serious injury and/or death.

INTRODUCTION

The AMICO digital medical gas manifold (ALERT-2) incorporates the latest microprocessor technology for the distribution and monitoring of medical gases. The manifold has been designed to provide user flexibility and reliability. This manual will enable the customer to install, use and maintain the manifold properly.

The amount of medical gas contained in the left or right banks is displayed on the face of the manifold cabinet. A digital display with large red LED's for clear visibility is provided to show the cylinder bank pressure in use and cylinder bank pressure in reserve at all times.

Under normal operating conditions, the green LED will be illuminated on the **Primary In Use** side. The **Reserve** bank will have an Amber LED illuminated on the **Bank Ready** side. If the gas cylinder pressure depletes on the primary side, an automatic switch-over will occur, rendering the reserve side in use to be illuminated and activated.

An alarm condition will occur when switch-over takes place, sending a signal to a master alarm or a remote buzzer, then causing the Red LED **Bank Empty** to be illuminated. This will inform the hospital personnel that the reserve side is in use and the empty cylinders need replacement.

FEATURES INCLUDE:

- Fully automatic self-contained shuttle-valve, with no electrical power required for switching.
- Input power 110 VAC to 240 VAC, 50 to 60 Hz.
- Microprocessor based control panel incorporates six LED's and illuminated digital LED display readable even in poor lighting conditions.
- Error message display for ease of maintenance.
- Pressure transducer for monitoring of cylinder pressure.
- Switch for (psi / kPa / BAR).
- Two limit switches for positive indication of bank in use.
- CGA gas specific header bar with integral check valves and cylinder pigtail assemblies.
- Dual line pressure regulators.
- High pressure header isolation valves.
- Manifold complies with NFPA-99.

DESCRIPTION OF THE MANIFOLD

SHIPMENT DETAILS

The package consists of one fully tested Alert-2 Series Manifold. Optional back support bracket, header bar assemblies, and pigtails are available.

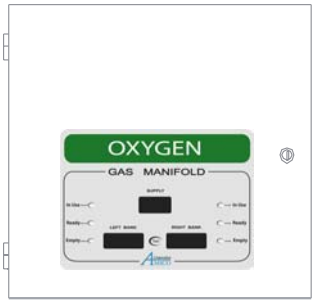
THE MANIFOLD ENCLOSURE

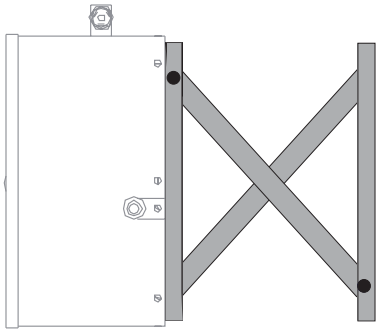
The Manifold enclosure contains the Switching Power Supply (110 to 240VAC) with a built-in fuse and terminal blocks. The enclosure on a standard manifold is NEMA-1 (General purpose applications only). The standard cabinet **MUST NOT** be mounted outdoors. An optional NEMA-4 (Water tight) enclosure must be used.

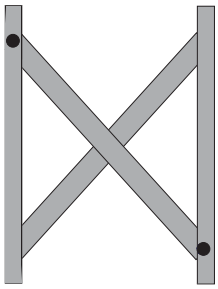
The Manifold also has a hinged door that has a pre-assembled circuit board located on the front of the enclosure. This design will reduce installation time and eliminate the risk of improper installation, since all the components of the manifold are connected and tested at the factory.

THE COLLAPSIBLE BACK BRACKET (optional)

The collapsible back bracket is designed to take up minimal space when requested to be shipped with the manifold. The bracket will position the manifold cabinet 12" from the wall, for double cylinder spacing.



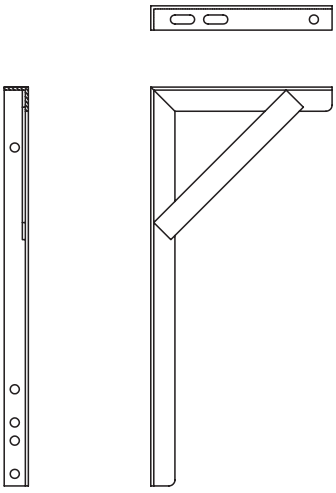




HEADER BAR WALL SUPPORT BRACKET

The manifold can support, at maximum, a 5 X 5 staggered header bar. While the straight header bar contains a wall support bracket on every second pipe in between each cylinder, a standard staggered header bar has a wall support bracket in place after every 4-5 cylinders, unless additional support is requested.

Note: The wall support bracket is designed to accomodate only those header bars that are directly mounted to the wall or one foot (12") away from the wall.



DESCRIPTION OF PARTS

The ALERT-2 manifold is divided into (4) main sections:

COMMON TO ALL MANIFOLDS

1. SHUTTLE VALVE ASSEMBLY

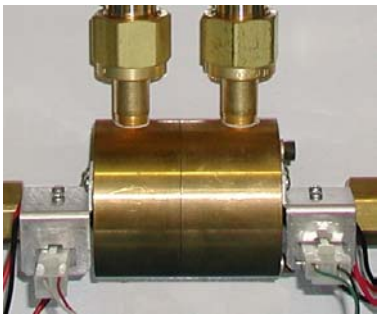
The shuttle valve assembly has been designed to facilitate the automatic switch-over from bank to bank. The shuttle valve is the heart of the manifold and forms the centre of the control apparatus to ensure uninterrupted flow of gas without change in the delivery pressure.

When the operating bank pressure falls to a predetermined level, the difference in pressures acting on either side of the shuttle valve causes change-over to the reserve cylinder bank.

Amico has two different types of shuttle valves:

Diaphragm type (LOW Pressure)

This shuttle valve consists of a machined brass body, in two halves. There are two threaded inlet connections and two outlet connections (nut and nipple CGA-540).

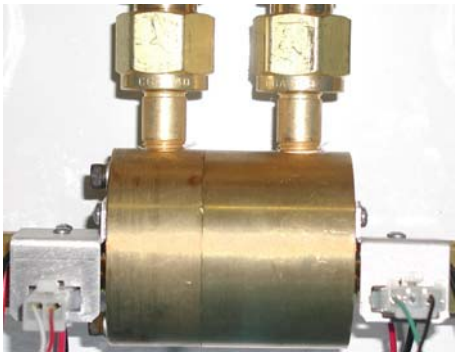


The shaft assembly consists of a stainless steel shaft and a nylon reinforced neoprene diaphragm, which is sandwiched between two seat plates. Neoprene seats are held against these plates by seat washers secured by nuts. The shaft assembly fits into the chamber formed by the body halves, which bolt together and squeeze the diaphragm sealing one side from the other.

The shaft is free to move from side to side with the diaphragm flexing back and forth. When pressure is introduced from one side, the shaft assembly takes up it's initial position with the pressurized side open. As the same pressure is allowed into the closed side, the shaft remains in the same position since the pressure acts on a reduced diaphragm area, which does not provide sufficient force to cause switch-over.

When the operating side pressure falls to a specific pressure, the force on the closed side overcomes the force on the open side and the shuttling occurs changing the supply from one bank to the other. The change in shaft positions is detected by limit switches, which signals the microprocessor that change-over has occurred.

Piston Type (HIGH Pressure)



The high pressure shuttle valve used for Nitrogen service is basically the same as the low pressure one, except for the replacement of the diaphragm shaft assembly by a piston shaft assembly.

Instead of squeezing a diaphragm between the two body halves to form the two pressure chambers, the sides are separated by an O-RING seal around the circumference of a piston. The piston shaft assembly slides back and forth in the cylinder bore, as shuttling occurs.

In both types of shuttle valves, the gas is delivered to them from one of the two operating pressure regulators upstream. Once passing through the shuttle valve, the gas goes to one of the line pressure regulators, which is capable of maintaining a constant delivery pressure despite the fluctuating inlet pressure caused as one bank becomes empty and the next takes over.

2. PRESSURE REGULATORS

There are two types of regulators in the Amico manifold: the Operating pressure regulator and the Line pressure regulator. Both types conform to NFPA 99.

Operating (Source) Regulators

There are two operating regulators on every manifold, one for the left bank and one for the right bank. The regulators should be set at the time of installation (factory preset to “0”). For Oxygen, Nitrous Oxide, compressed Medical Air and Carbon Dioxide service, the two operating regulators should be set at 150 psig [1034 kPa]. For Nitrogen service, the regulators are to be set at 275 psig [1896 kPa].

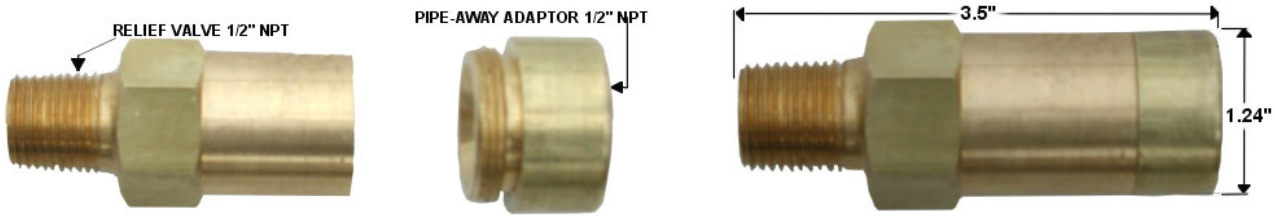
Line Regulators

There are also two line regulators on every manifold (unless a single line manifold is specified at the time of order). The line regulator is capable of maintaining a constant dynamic delivery pressure at the maximum designed flow rate of the system (factory preset to “0”). For Oxygen, Nitrous Oxide, compressed Medical Air and Carbon Dioxide service, the two line regulators should be set at 55 psig [379 kPa]. For Nitrogen service, the regulators are to be set at 170 psig [1172 kPa].

3. PRESSURE RELIEF VALVES

Pressure relief valves are installed downstream of all pressure regulators and are set at no more than 50% above the setting of the pressure regulator located immediately upstream. All pressure relief valves are capable of fully relieving the pressure at the set point and are upstream of any shut-off valve.

All pressure relief valves in the manifold have piping connections to allow for connection of vent lines to the outside of the facility.



Relief pressure settings vary with gas service as follows:

	Oxygen	Carbon Dioxide	Nitrous Oxide	Medical Air	Nitrogen	Liquid by Liquid Oxygen	Liquid by Liquid Nitrogen
Line pressure Relief valve	75 psi [517 kPa]	75 psi [517 kPa]	75 psi [517 kPa]	75 psi [517 kPa]	225 psi [1551 kPa]	75 psi [517 kPa]	225 psi [1551 kPa]
Operating pressure Relief valve	225 psi [1551 kPa]	225 psi [1551 kPa]	225 psi [1551 kPa]	225 psi [1551 kPa]	350 psi [2413 kPa]	350 psi [2413 kPa]	350 psi [2413 kPa]

4. PRESSURE TRANSDUCER

Pressure transducers monitor the supply pressure of a gas coming into the manifold cabinet. The gas pressure is converted into a signal that is transferred onto the digital LED front display. There are two transducers in the manifold cabinet, one for the left and one for the right pressure bank.

CONTROL COMPONENTS

The Amico manifold qualifies as a "*Cylinder System Without Reserve Supply*" as classified in NFPA 99, Clause 4-3.1.5. This is one category of the broader classification "*Central Supply System*" which encompasses many types of sources of supply to non-flammable medical gas piping systems.

As such, the Amico manifold is comprised of two banks of cylinders which alternately supply the pipeline, each having various control components. When the primary bank is exhausted, the secondary takes over automatically.

WARNING SYSTEM COMPONENTS

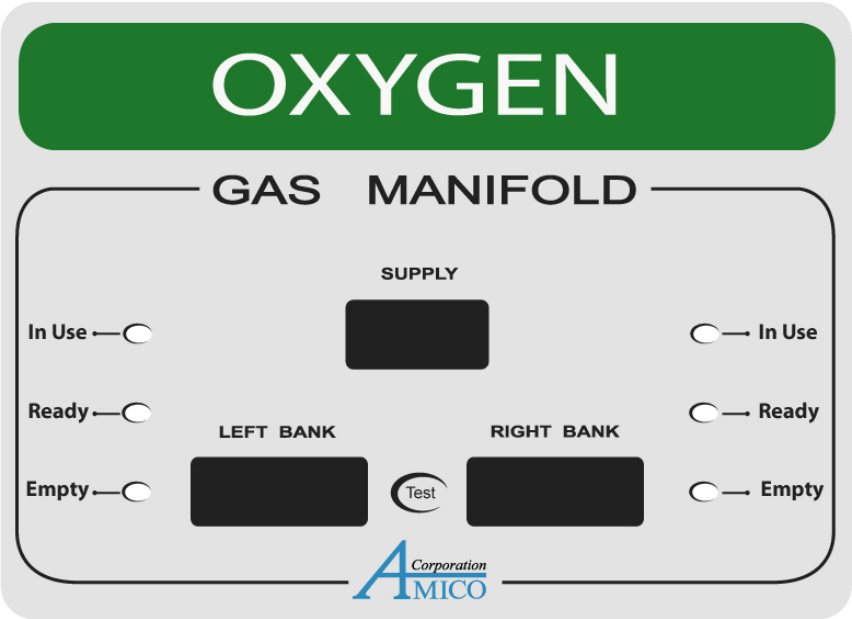
Forming an integral part of the Amico manifold control cabinet are a number of components whose function is to give continuous visual information as to the state of operation of the system.

1. Bank Change-Over Indicators

LED's on the face of the manifold are controlled by the microprocessor. The microprocessor interprets the various input signals (pressure in gas cylinders and bank switch-over), converting the information into a digital display.

The pressure coming into the manifold is measured by the pressure transducer. The transducer sends a signal to the microprocessor which then converts the signal to a digital display on the left or right bank.

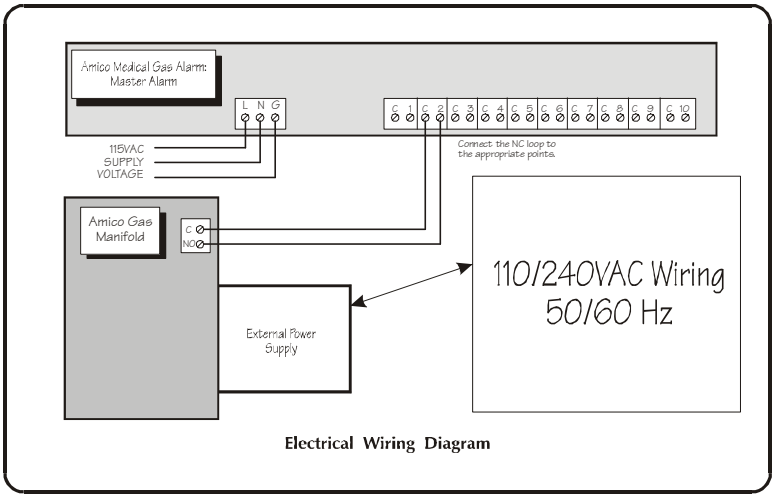
As the shuttle valve changes position (pressure controlled, not microprocessor controlled) from left bank to right bank, the limit switch is activated. This causes a signal to be sent from the limit switch to the microprocessor. The signal controls the status LED's of the left or right bank (IN USE, READY, EMPTY) and relay for remote monitoring.



OPERATING ALARM SYSTEMS

Operating alarm systems are mandatory according to NFPA 99. Amico supplies a complete range of operating alarm units which can be used in conjunction with the Amico manifold to provide the required visual and audible signals, in suitable locations, when change-over from the primary supply to the secondary supply occurs.

The manifold control cabinet contains the required circuitry to send a dry contact signal to the alarm unit when a bank is empty and change-over occurs. The normally closed internal circuitry is designed to alarm when there is an open circuit. The depletion of a bank triggers a relay, which renders the alarm circuit open and initiates the alarm signal.



Electrical Wiring Diagram

SAFETY FEATURES

Gas Service Identification

Amico manifolds are clearly labelled for the gas that they are intended to be used for. A large nameplate, indicating the appropriate gas is attached on the cabinet door. The two pipes extending from the top of the cabinet, one for main line pressure and one for the operating pressure relief, are labelled.

Function Identification

The indicator LED's on the door are clearly marked to explain their function.

Cylinder Connections

The Amico manifold is designed to assure that only cylinders containing the proper gas, can be connected to it. All cylinder extension bar connections as well as pigtail hose assemblies, comply with CGA Standard B96, "Compressed Gas Cylinder Valve Outlet and Inlet Connections".

UL Listing

The Amico manifold is UL Listed (UL SA9906).

INSTALLATION

RECEIPT AND LOCATION

The Amico manifold should be carefully examined upon receipt. If any damages are found, a claim should be filed with the transport company and Amico Corporation.

Any authorized dealers and distributors should also be notified immediately.

ASSEMBLY INSTRUCTIONS

Wall Mounting Instructions

The Amico manifold is shipped in a semi-assembled condition to facilitate packaging and installation.

Position the collapsible manifold support wall bracket (optional) onto the wall.

Mark the holes, drill and attach suitable anchors (not supplied by Amico) into the supporting wall (refer to **"Appendix K"**). Bolt the manifold support into position.

Attach the manifold control cabinet to the support using supplied bolts. The cabinet attaches to the front of the wall bracket.

Cylinder Bank Installation Instructions

CAUTION: This section contains important information necessary for proper installation of the cylinder banks. Read it carefully before installing cylinder banks.

Position the wall brackets, if required, to support the extension bars and bolt in place.

Connect the two high pressure inlet valve / header bar assemblies to the CGA connections on either side of the cabinet.

Secure the cylinder extension bar to the support using the U-bolts supplied as part of the assembly.

Remove the plug and chain assembly on each outlet connection on the cylinder extension bar. Attach the cylinder pigtails to the header bar connections, while ensuring the check valves are operating in the proper direction.

WARNING: To avoid contamination with particles or other potential hazardous materials, keep pigtails in plastic wrapping until such time as connection to gas cylinder is planned.

When the medical gas piping system has been tested in accordance with **Part 4-5 Testing of NFPA 99**, the manifold can then be connected to it.

The outlet pipes leading from the Amico control cabinet should be connected to their respective pipeline system connections. The connection to the relief valves should be made with a union (supplied by others) to facilitate change, if required.

An appropriate sealing compound that is suitable for the gas being transmitted shall be used for threaded connections.

WARNING: If downstream joints near the cabinet outlet are to be silver brazed, special attention must be given not to overheat the copper tubing, since this may alter the sealing compound used in the threaded joints leading from the control cabinet.

TESTING FOR LEAKAGE

The following instructions apply to leak testing to be preformed on the joints made during assembly and connection of the Amico manifold and not to tests previously made on the piping system.

The connections inside the Amico control cabinet have been inspected at the manufacturing plant and DO NOT require leak testing. In order to determine whether any leaks exist between cylinder extension bar sections or at the pipeline connections, the system must be pressurized using either oil-free dry air or oil-free dry nitrogen.

In the case of medical Oxygen, Nitrous Oxide or Carbon Dioxide Amico manifolds, the actual service gases **ARE NOT** suitable for leak testing due to their inherent dangerous properties. Leak testing must be performed using either oil-free dry air or oil-free dry nitrogen. In the case of either a Medical Air or a Nitrogen Amico manifold, the actual service gas may be used to perform the leak tests as follows:

1. Connect a cylinder of the manifold service gas to the end connection on each end of the cylinder extension bar using the copper cylinder connection hose assemblies (pigtails) supplied.

2. Make sure all other outlets are capped with the plug and chain assemblies supplied.

3. Make sure that the high pressure inlet valves of each bank are fully **OPEN**.

4. **"Slowly"** open the two cylinder valves closest to the cabinet, one at a time, to pressurize the cylinder extension bar and to pressurize the pipeline.

5. All outlets from the pipeline, downstream of the manifold, should be closed and thus there should be no flow from the manifold.

6. Check for leaks at all cylinder extension joints and at the joints where the pipes were connected to the pipeline, using a commercial leak detector, which is compatible with oxygen.

7. If any leaks are found, the system must be depressurized by bleeding through a convenient pipeline outlet and the faulty connections must be repaired.

8. The threaded pipe cylinder extension bar connections may be tightened one more turn, maintaining the horizontal location of the cylinder adapters or a further application of an oxygen service threaded sealant may be required.

9. If the brazed pipeline connections leak, they must be removed, cleaned and then re-brazed following the proper technique. All repaired joints must be pressure tested as previously.

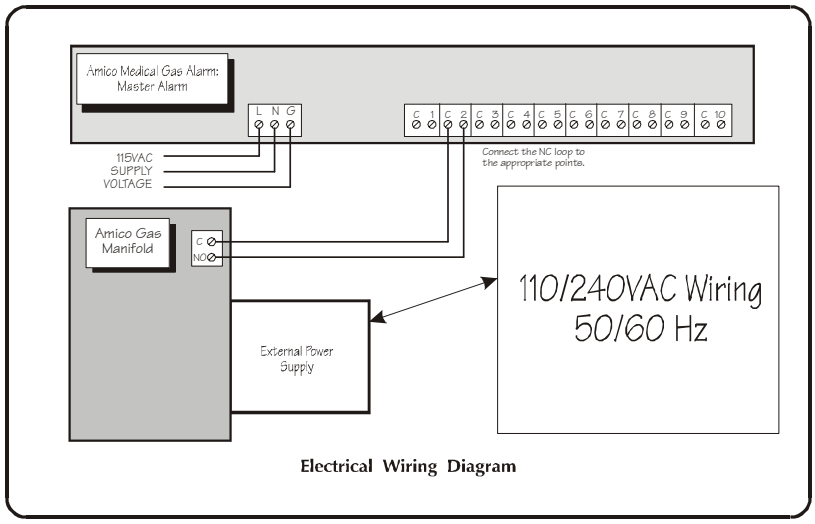
FINAL TESTING

Purging and analysing of the complete medical gas piping system shall be carried out in accordance with **NFPA 99, 4-5 Testing.**

ELECTRICAL HOOK-UP TO CLOSED CIRCUIT ALARMS

Once the Amico manifold has been installed and the source of supply for the medical gas piping is completed, the electrical connections can be made. The input power to the Amico manifold is 110-240VAC, 50-60Hz.

Connections from the Amico manifold to the Amico Master Alarm must be made from terminals marked **C** and **NO**, to the appropriate terminals (RESERVE IN USE) on the Master Alarm.



Electrical Wiring Diagram

DANGER: Electrical shock hazard. Ensure that the main power source is turned off during the connection of the exterior power supply.

CHECK-OUT OF INDICATOR FUNCTIONS

Introduce power to the Amico control cabinet. Ensure that all regulator handles have been backed off. With the high pressure inlet valves outside the cabinet both OPENED, S-L-O-W-L-Y open the cylinder valves on the cylinders closest to the control cabinet. After one minute, S-L-O-W-L-Y open all other cylinder valves. A pipeline outlet downstream of the manifold cabinet, such as a purge valve or terminal valve, should be opened and vented safely, to produce a dynamic flow condition for the indicator function check-out.

After opening the cylinder valves, set the operating regulators to 150 psig [1034kPa] for all gases, except for Nitrogen, 275 psig [1896 kPa]. Note that the operating regulator set first determines the “In Use” bank. When both banks are open, check the pressure to ensure that the correct pressure is indicated. The left hand and right hand Bank Pressures should both read full cylinder pressure while the line pressure should now be set at 55 psig [379 kPa] for all manifolds except for Nitrogen, 170 psig [1172 kPa].

Check the indicator LED for proper functioning. Only one Green LED, on the side which had it's operating regulator set first, should be lit and the other side should have an Amber LED lit.

Close the cylinder valve on the primary bank and watch the indicator LED to ensure proper functioning. The primary bank pressure should fall, while the secondary and line pressures stay constant. When the primary pressure falls to approximately 90 psig [621 kPa] for all gases except Nitrogen, 190 psig [1310 kPa], there should be a distinct sound of the shuttle valve switching over to the secondary supply. When the switching occurs, the line pressure will remain constant and the Green LED should reverse, with only one of them lit. The Red LED "Bank Empty" will become lit on the bank empty side.

With the Amico manifold wired up to the Amico Master Alarm, the change over from primary to secondary supply will cause an audible alarm buzzer and the appropriate indicator LED on the Master Alarm to illuminate.

MANIFOLD SET-UP

Once the Manifold and header bars are installed, the following procedure must be followed for the Manifold to operate properly.

1) Attach the gas specific pigtails to the CGA connections on the header bars and then ensure that full Cylinders are connected to the manifold.

2) With both operating regulator handles backed off fully, open the cylinder on any one side of the manifold. Make sure that the emergency shut-off valves on either side of the manifold are fully open, these valves should only be closed in case of an emergency.

3) Set the operating pressure to 150 psi (Oxygen, Nitrous Oxide, Carbon Dioxide, Medical Air) and 275 psi for (Nitrogen). After setting up the operating pressure set the Line pressure to 55 psi for most gases except for Nitrogen which is 170 psi by isolating one Line regulator at a time.

4) Open the cylinder on the other side of the manifold and set the remaining Operating Regulator as mentioned above.

Note: Operating regulators once set up, should not be reset at any time.

5) There is an overshoot between 10-30 psi once the IN USE side has emptied and a full cylinder is connected. Also, shortly before the bank switch-over occurs, there is an over-shoot of 10-30 psi on the operating regulator.

(Example: Operating regulator set @ 150 psi would show an increase in pressure indicating 160-180 psi).

6) This is normal in both cases (when full and when depleting) as once the IN USE side has emptied and a full cylinder is reconnected making the side that has emptied the reserve side. After switch-over occurs, the regulator will regulate itself and feed at 150 psi.