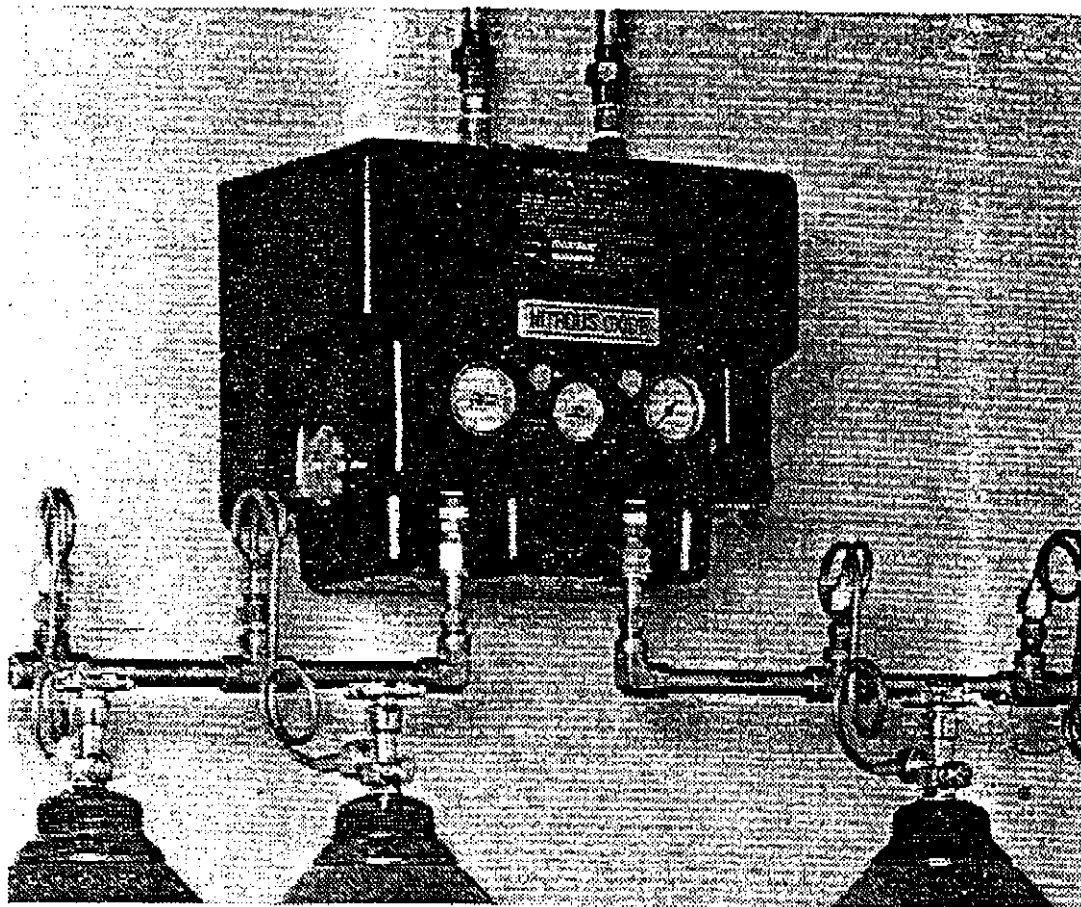


**FULLY AUTOMATIC
MODEL 2500
MEDICAL GAS MANIFOLD**

**SINGLE REGULATOR, SINGLE VENT
OPERATION & MAINTENANCE MANUAL**

***Allied Healthcare
Products, Inc.***

CHEMETRON Medical Div.
1720 Sublette Avenue
St. Louis, MO 63110
Telephone: (800)444-3954
Form Number: 88-00-1020
August 1990 S188-198-001



MANIFOLDS ARE AVAILABLE FOR THE FOLLOWING GASES:

- | | |
|--|---|
| <input type="checkbox"/> OXYGEN | <input type="checkbox"/> CARBON DIOXIDE |
| <input type="checkbox"/> NITROGEN | <input type="checkbox"/> MEDICAL AIR |
| <input type="checkbox"/> NITROUS OXIDE | <input type="checkbox"/> O ₂ /CO ₂ Less Than 7% |

COPPER PIGTAILS

<u>OXYGEN</u>	<u>NITROGEN</u>	<u>NITROUS OXIDE</u>
86-58-0001	86-58-0006	86-58-0003
<u>CARBON DIOXIDE</u>	<u>MEDICAL AIR</u>	<u>O2/CO2 < 7%</u>
86-58-0005	86-58-0004	86-58-0007

BRAIDED STAINLESS STEEL PIGTAILS

OXYGEN <i>Lower Only</i>	<u>NITROGEN</u>	<u>NITROUS OXIDE</u>
86-58-0011	86-58-0016	86-58-0013
<u>CARBON DIOXIDE</u>	<u>MEDICAL AIR</u>	<u>O2/CO2 < 7%</u>
86-58-0015	86-58-0014	86-58-0017

CAP & CHAIN

86-58-0051 O2 OXYGEN
86-58-0053 N2O Nitrous Oxide
86-58-0054 Air
86-58-0055 CO Carbon Dioxide
86-58-0056 N2 Nitrogen

ORDERING INFORMATION

Section 1.0

The 2500 Series Manifold has 1 outlet (line) regulator and 1 safety relief vent. The 2500 Manifold will shift banks and will automatically reset when the depleted cylinders are replaced.

Catalog Numbers	System	Gas
86-51-0001	Control Unit Only	Oxygen
86-53-0001	Control Unit Only	Nitrous Oxide
86-54-0001	Control Unit Only	Medical Air
86-55-0001	Control Unit Only	Carbon Dioxide
86-56-0001	Control Unit Only	Nitrogen
86-57-0001	Control Unit Only	O ₂ /CO ₂ less than 7%
86-59-0001	Control Unit Only	Special Gasses

Each system includes a control unit with supply and delivery gages, pressure switches for remote alarms and gas specific plug tails and header bars.

Replace the "XX" with the desired gas code number.

51 for Oxygen	53 for Nitrous Oxide
54 for Medical Air	55 for Carbon Dioxide
56 for Nitrogen	57 for O ₂ /CO ₂ <7%
59 for Special Gasses	

Catalog Numbers	System	Gas
86-XX-0002	1x1 Cylinder connection	Replace "XX"
86-XX-0004	2x2 Cylinder connection	Replace "XX"
86-XX-0006	3x3 Cylinder connection	Replace "XX"
86-XX-0008	4x4 Cylinder connection	Replace "XX"
86-XX-0010	5x5 Cylinder connection	Replace "XX"
86-XX-0012	6x6 Cylinder connection	Replace "XX"
86-XX-0014	7x7 Cylinder connection	Replace "XX"
86-XX-0016	8x8 Cylinder connection	Replace "XX"
86-XX-0018	9x9 Cylinder connection	Replace "XX"
86-XX-0020	10x10 Cylinder connection	Replace "XX"

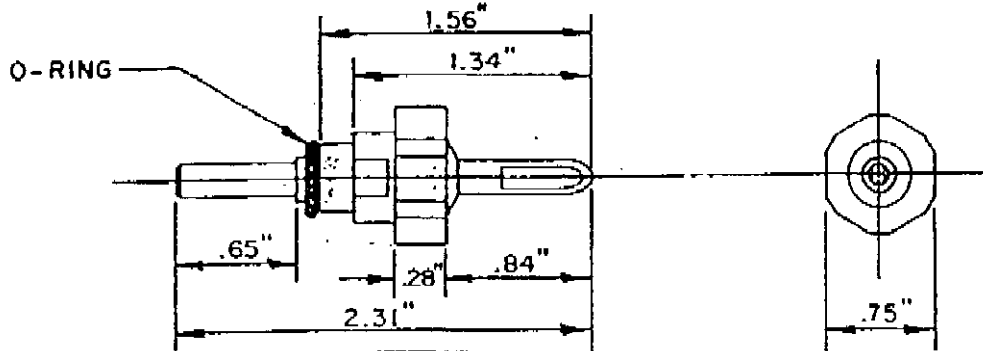
CHEMETRON Medical Division <i>Med Healthcare Products, Inc.</i>	PURCHASE SPECIFICATION	PART NO. S109-204-()
	TITLE REGULATOR SEAT	

Manufacturer must conform with this specification, and any change in the product supplied under this specification must receive prior approval of Chemetron Medical Products Division.

SHEET
1 OF 1

RELEASE # NZ768

REV.



DASH NO.	SOURCE PART NO.	SEAL MATL.
-001	9961	VITON
-002	9962	BUNA N

DIM. ARE FOR REF. INFO. ONLY

S109-204

02
 All els

2506
 1500

BODY MATERIAL: BRASS
 FINISH: NONE

NOTE: PART TO BE CLEAN FOR OXYGEN USE PER CMD PROCESS SPECIFICATION # PS-200 OR EQUIVELANT AND PACKAGE TO MAINTAIN OXYGEN CLEAN.

APPROVALS		SUGGESTED SOURCES	
DRN. B B 10/87	MFG. ENGR <i>[Signature]</i> 10/87	MODERN ENGINEERING CO. INC. 3500 BERNARD STR. ST. LOUIS, MO. 63103	
CHK. <i>SAS</i> 10/87	Q.A.N. <i>[Signature]</i> 10/87	OR ENGR APPROVED EQ.	
MECH. ENGR ENGR <i>SAS</i> 10/87	MFG. APPR <i>[Signature]</i> 10/87		
ELEC. ENGR	APPR <i>[Signature]</i> 10-11-87		

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3.0 INTRODUCTION

The 2500 Medical Gas Manifolds have been cleaned, tested and prepared at the factory for the specific gas indicated. All critical connections are gas specific and are designed to eliminate supply gas errors.

This manual is supplied to give the health care facility personnel installation, operation and maintenance instructions. Keep this manual in the manifold area for convenient reference.

The 2500 Medical Gas Manifolds come complete with control unit and right and left header bars. The installed system will automatically switch to the reserve banks when the primary bank is depleted. When the depleted cylinders are replaced with full ones the system will automatically reset itself in preparation for the next bank change. The primary side is the bank in use and the reserve side is the bank on standby. This designation will automatically change from left to right and right to left as each bank is depleted and, in turn, refitted with full gas cylinders.

Mechanical (electrically independent) indicators show a depleted bank by turning red. When the system is reset, by replacing the depleted cylinders, the indicator will turn green. If the manifold is connected to the health care facility's central alarm system that will also indicate the manifold has been reset.

The only manual activity the 2500 Medical Gas Manifold requires is the changing of depleted cylinders.

The 2500 Manifold is available in six standard models, each specifically designed for its gas service. The gas standard services offered are: oxygen, nitrogen,

nitrous oxide, medical air, O₂/CO₂ Less than 7% and carbon dioxide.

Manifolds may be obtained in these gas services, as standard units, up to 10 cylinders per side. Most other medical gasses can be obtained by special order. Larger manifolds can be obtained by ordering extra header bar sections. NFPA requires at least the number of cylinders for an average 24 hour day's supply per bank.

There are two methods of mounting the 2500 Manifold: either floor or wall (standard) systems. With the wall type, the control cabinet is attached to a wall bracket and cylinders stand next to the wall. The floor type may stand free, in the center of a room, with the control cabinet supported on a stand.

Three pressure gages on the front of the control cabinet indicate left bank, right bank and line pressures.

Heater Kits are available for use on nitrous oxide and carbon dioxide 2500 Manifolds where flow requirements are such that regulator frosting may cause pressure fluctuations.

4.0 DEFINITIONS

Shall: Is intended to indicate a requirement as stipulated by a standard or code.

Should: Is intended to indicate a recommendation or a suggestion or an item of advice but not required.

Note: Is intended to indicate additional information that might be helpful.

Caution: Is intended to indicate that there is a slight chance of bodily injury or property damage. There is also the possibility of a manifold shutdown if the "caution" is not heeded. This will be highlighted by an outline box.

Warning: Is intended to indicate that there is a moderate chance of bodily injury, death or property damage. This will be highlighted by an outline box.


Danger: Is intended to indicate that there is a high risk of bodily injury, death or property damage. This will be highlighted by an outline box.

5.0 SITE SELECTION

The proximity to the health care facility's central piping system is the obvious, but not the only, reason for choosing an installation site. Ventilation, temperature extremes, etc. must also be considered.

The manifold system shall be installed in a well ventilated area. None of the gas specific manifolds are designed for a flammable gas. Some of the gases will actively support combustion. The gases with high oxidizer content, such as oxygen, nitrous oxide and O₂/CO₂ less than 7% shall never have grease, oil, or other combustibles come in contact with any part of the system. Also, tools and hands should be kept clean and free of oil or grease. Spontaneous combustion may occur. There shall be no open flame in the manifold area. This includes matches, smoking material, pilot lights, etc. There shall be no spark generating equipment in the manifold area. This includes motors, switches, etc. The only exception is properly certified explosion proof items.

Even a gas as apparently harmless as nitrogen must be installed in a well ventilated area. If the nitrogen gas were allowed to build up to a point, in an unventilated area, where all the oxygen was pushed out, then a person entering this area would run the risk of suffocation. Both carbon dioxide

	WARNING
<p>The manifold system must be located in a well ventilated area. In a poorly ventilated area nitrous oxide can cause unconsciousness and death. Oxygen and O₂/CO₂ < 7% can greatly intensify a spark or fire. Carbon dioxide, nitrogen, argon and helium can cause suffocation.</p>	

and O₂/CO₂ less than 7% gasses contain carbon dioxide which is the primary waste gas the lungs try to exhale. The carbon dioxide in the blood must be removed before oxygen can be absorbed. Carbon dioxide inhaled in the air inhibits the lungs ability to remove carbon dioxide from the blood. As the carbon dioxide concentration increases so does the breathing difficulty. In the extreme case, a high concentration of carbon dioxide can cause the equivalent to suffocation even with some oxygen present.

Nitrous oxide is an anesthetic gas. In moderate to high concentrations it can cause unconsciousness. In low concentrations it can cause a reduction or loss of reasoning power which could be as hazardous as unconsciousness.

The health care facility's central forced air heating and air conditioning system should never have a return duct connected to the manifold area. A return duct could spread any manifold area problem to the rest of the health care facility. The manifold area should always be vented to the outside away from any intake ducts.

The manifold is designed to operate in a temperature range between 40 and 130°F. Relative humidity should be below 60%. If the humidity is high and the temperature is low, frost could form on the regulators under high flow conditions. If this condition continues indefinitely the frost and/or ice could interfere with the performance of the regulators.

Allied Healthcare Products offers a header bar heater kit that will preheat gas from the cylinders minimizing the frost problem. They can be added easily to any existing or new manifold system. Refer to the Optional Equipment Section of this manual or contact an Allied

NITROUS OXIDE VAPOR PRESSURE vs. TEMPERATURE

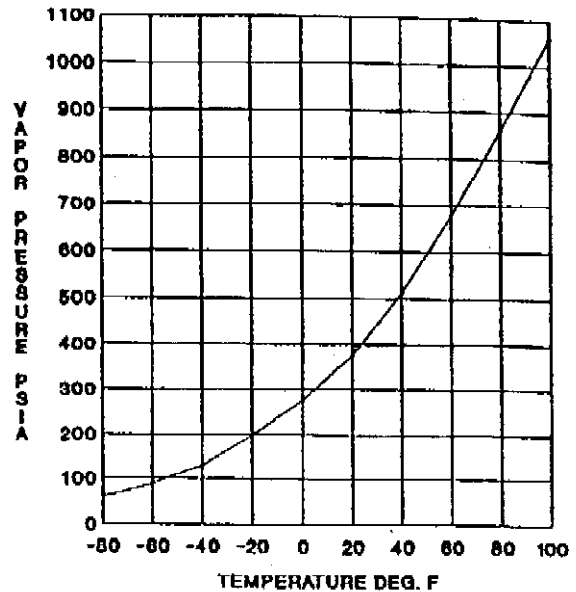


Figure 1

CARBON DIOXIDE VAPOR PRESSURE vs. TEMPERATURE

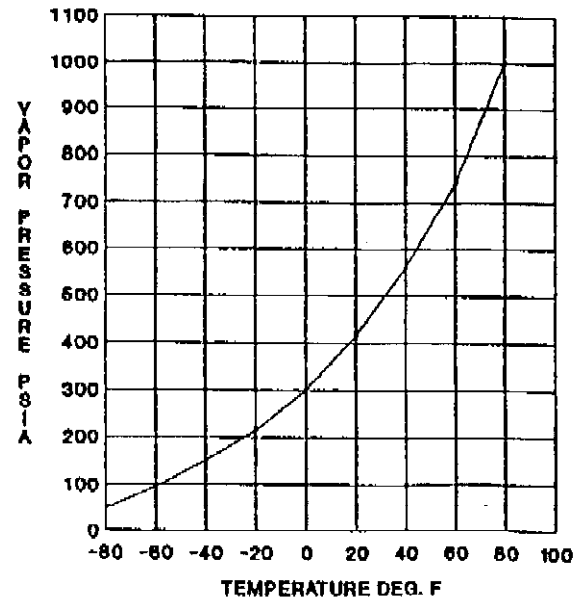


Figure 2

DIMENSIONAL DATA

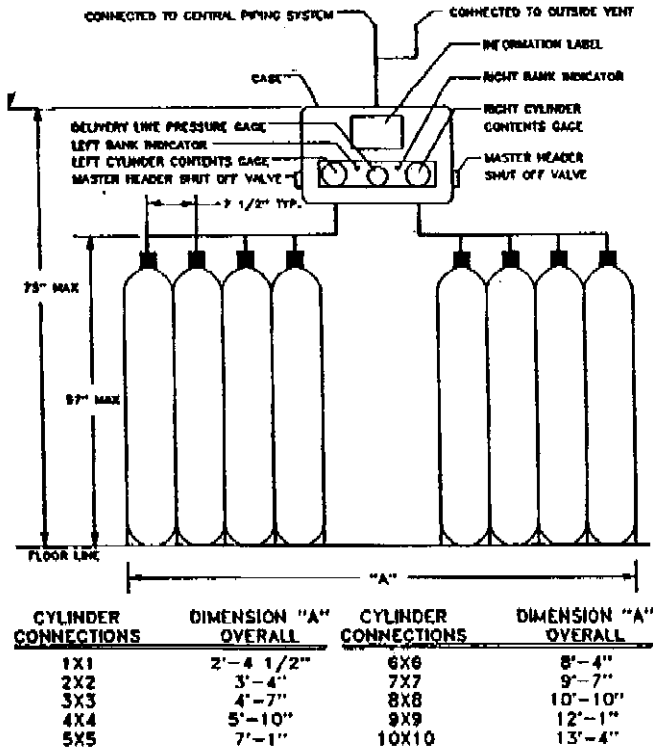


Figure 3

2500 MANIFOLD FLOW CHART NITROGEN AT 180 & 160 PSI

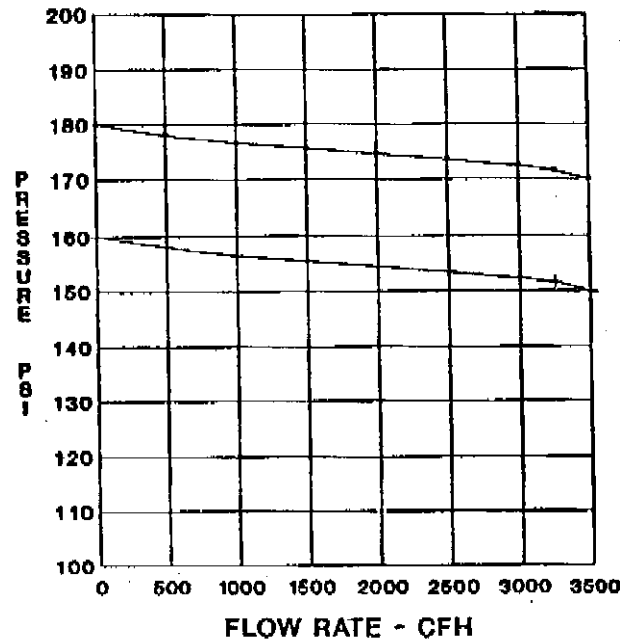


Figure 5

2500 MANIFOLD FLOW CHART O2, AIR, He2, Ar2 & O2/CO2 < 7%

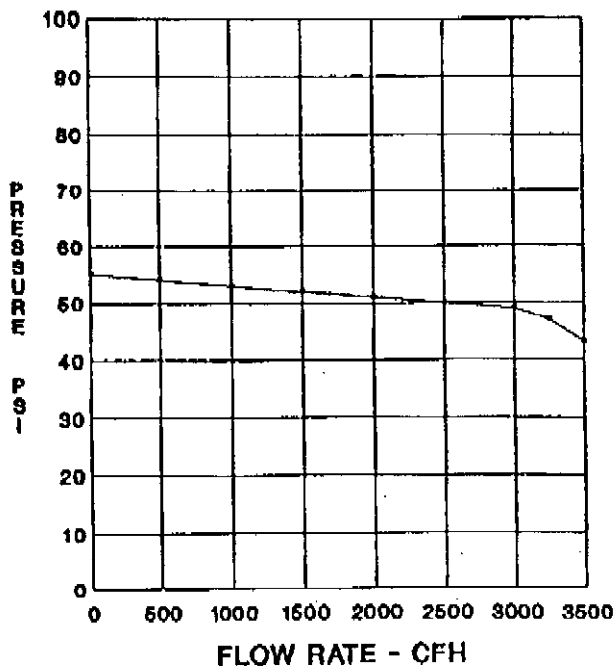


Figure 4

2500 MANIFOLD FLOW CHART N2O & CO2

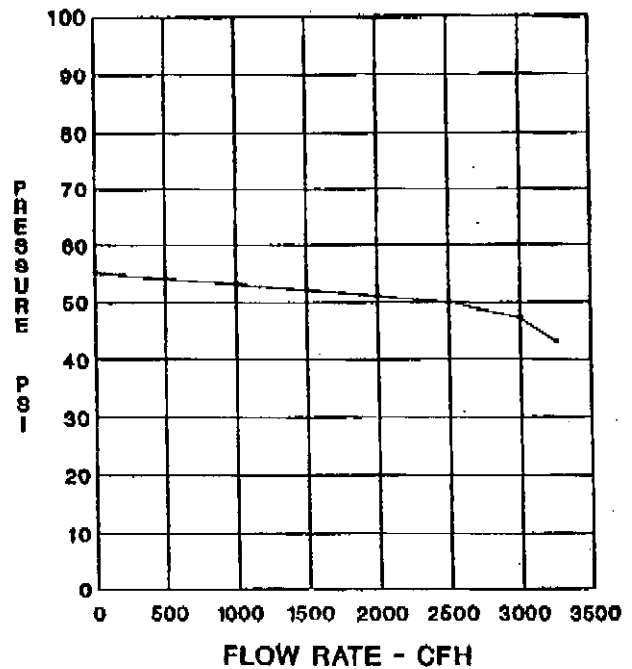


Figure 6

Healthcare Products Sales
Representative.

Since carbon dioxide and nitrous oxide are both liquid when in the compress gas cylinders, the phase change (from liquid to gas) cooling is added to the gas expansion cooling. Thus the frost will form much quicker with carbon dioxide and nitrous oxide than with nitrogen, oxygen, medical air, argon, helium and O₂/CO₂<7%. Under extreme conditions of high flow the cylinders could become chilled to the point where droplets of liquid would pass down stream and harm the manifold and other health care equipment. Even in moderate flow rate applications the purchase of header bar heaters must be seriously considered.

Site selection should also take into consideration the handling of both empty and full cylinders. The handling convenience to the manifold and the loading docks are important. In the case of carbon dioxide and nitrous oxide the temperature shall not go below 50°F. A cylinder pressure of at least 550 PSI is required to automatically reset the manifold when the spent cylinders are replaced. See Figs. 1 and 2 on page 6 for vapor pressure vs. temperature curves.

6.0 UNCRATING

All parts should be kept in their crates until they are needed for assembly. Check the gas type of the components to be sure they are the items ordered.

If damage is discovered during the unpacking and assembly process, contact the freight carrier and make a concealed damage report within 7 days. Allied Healthcare will assist the claims process as much as possible, but it is the responsibility of the receiver to file any claims.

NOTE:

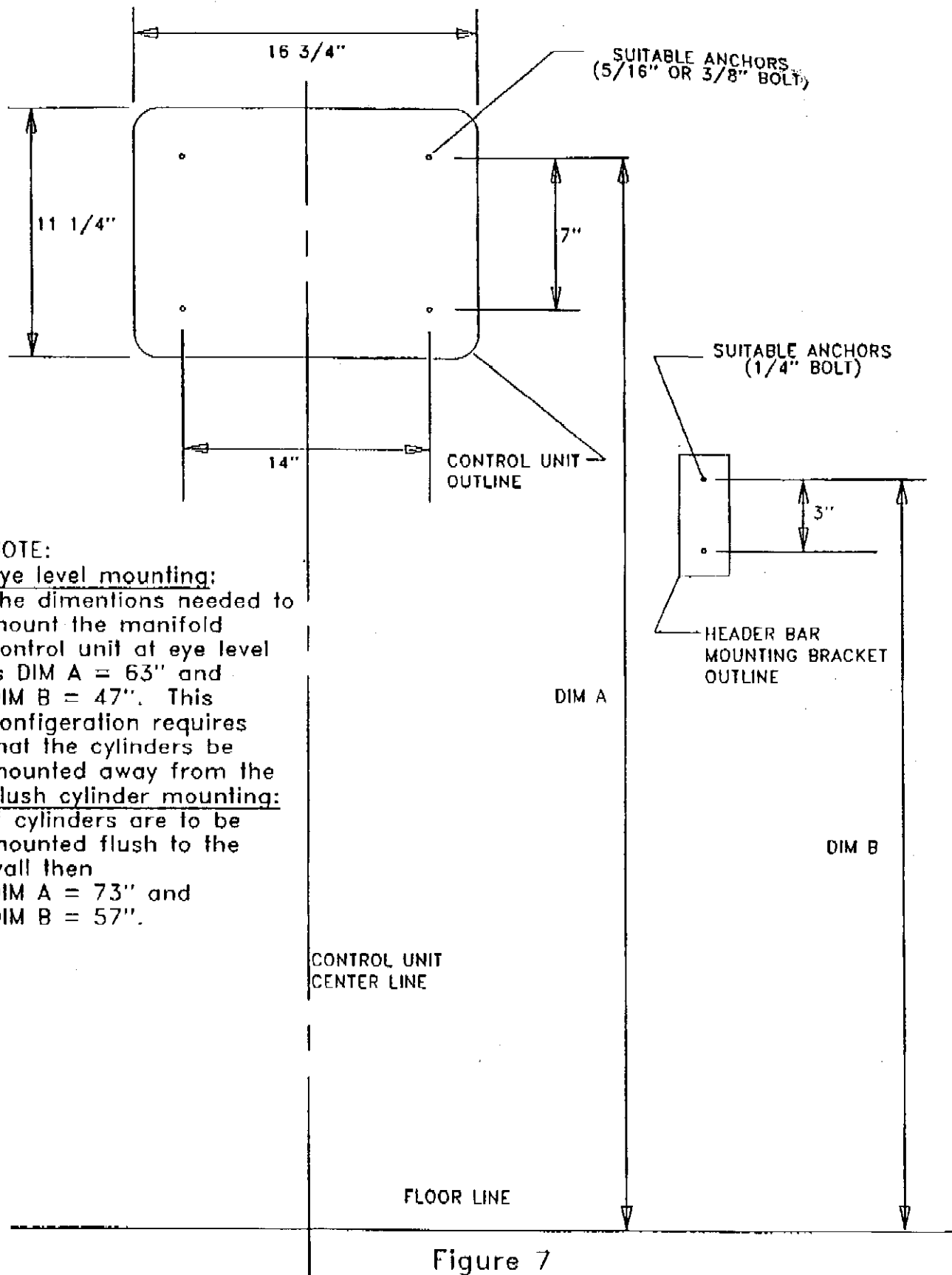
The cylinder bank indicators will be green until the initial pressurization of the Control Unit.

7.0 MINIMUM EQUIPMENT NEEDED

One Control Unit and a pair of single cylinder header bars is the minimum equipment needed to have a functioning manifold system. Most systems will require more than a single cylinder per bank. Always install a balanced set of header bars for each manifold system, i.e. an equal number of cylinders per bank.

Adding header bars and gas cylinders to each bank will not increase the maximum flow rate of the system but it will increase the time between cylinder changes i.e. double the number of cylinders (and header bars) and the time between cylinder changes will be doubled.

See the Manifold Accessories section of this manual for additional equipment for the 2500 Manifold such as a Bypass Kits, Header Bar Heater Kits, Stainless Steel Braided Pigtaills, etc.



NOTE:

Eye level mounting:

The dimensions needed to mount the manifold control unit at eye level is DIM A = 63" and DIM B = 47". This configuration requires that the cylinders be mounted away from the wall.

Flush cylinder mounting:

If cylinders are to be mounted flush to the wall then

DIM A = 73" and

DIM B = 57".

Figure 7

8.0 INSTALLATION

The 2500 Manifold meets the provisions of the National Fire Protection Association (NFPA) Specification 99C-1987. The installation of this manifold shall not deviate from these requirements. If local or special codes conflict with the NFPA requirements, the NFPA codes shall always prevail. If the code conflict cannot be resolved at the local level contact the Allied Healthcare Equipment Service Department or the Engineering Department to determine if a waiver is feasible.

8.1 CONTROL UNIT

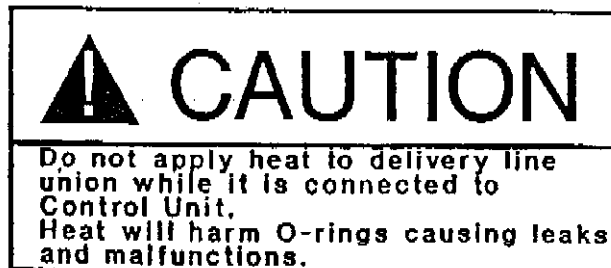
Remove the screws on either side and top of the control unit cover. Be sure to retain and store cover.

Suitable anchoring bolts will be necessary for mounting (bolts are not furnished with the unit, recommend 5/16" or 3/8" diameter bolts). Use four (4) mounting holes and preassembled spacers in the back mounting plate. Keep the cabinet both horizontally and vertically level. If necessary, shim behind the back plate.

Be sure the the right and left header bar valves are turned off. Later in these Installation Instructions you will be advised when and how these valves should be used.

NOTE:

The cylinder bank indicators will be green until the initial pressurization of the Control Unit.



8.2 PLUMBING

Connect the delivery line union, located at the top of the Control Unit, to the health care facility's central piping system. Allied Healthcare Products recommends that a main shut off valve be installed between the delivery line union and the central piping system.

Allied Healthcare offers a Manifold By Pass Kit. This kit comes with a ball valve to isolate the manifold Control Unit and allow it to be serviced without interrupting the gas service to the central piping system. For further information see the Optional Equipment Section of this manual or contact your Allied Healthcare sales representative.

Check for proper venting to atmosphere as required by job specifications and/or NFPA 99-1990. If the manifold is installed in an enclosed area, the safety relief valves must be vented to outside atmosphere. On top of the control unit (to the right of the hospital supply line) a safety relief valve with a 1/2" NPT pipe union has been provided to attach a vent pipe. Provisions must be made to install this pipe to the outside atmosphere.

8.3 ELECTRICAL

No electricity is required to power the 2500 Manifold. The gas pressure from the right hand cylinder bank is all that is needed to power all the 2500 Manifold's automatic functions.

Switches are available for signaling the central alarm system and can be connected at the health care facility's discretion. Two pressure switches (one for each cylinder bank) are wired to an internally mounted terminal block. The terminal block positions are labeled "normally open", "normally closed" and "common". This allows

a "cylinder bank full" or "cylinder empty" signal for any alarm system that needs dry contacts.

8.4 HEADER BARS

Divide the total quantity of header bar sections into two groups, one for the left bank and the other for the right bank of cylinders. There should be an equal number of outlets on each side of the manifold.

After the Control Unit has been mounted the header bars should be securely anchored to the wall (or Header Stand Kit) and carefully aligned and leveled. The union on each side of the bottom of the Control Unit provides for a gas specific header bar connection. Proper alignment is necessary to assure a leak free installation. Support all header bars with firmly anchored wall brackets (or Header Stand Kits).

Space the wall brackets (or Header Stand Kits) to conform to the size of the header bars. The first wall bracket (or Header Stand Kit) on either side of the Control Unit should be between the first two cylinder connections past the header bar elbow assembly. A wall bracket (or Header Stand Kit) should be placed every third cylinder connection thereafter. If the manifold system purchased has less than two cylinder connections per side, no wall brackets (or Header Stand Kits) are needed.

Connect the header bar assembly and header elbow to the master header

valve fitting on the Control Unit. Use one wrench on the Control Unit inlet connection and another on the header elbow nut. Hold the Control Unit inlet connection steady and tighten the header elbow nut. This will prevent any twisting of internal components of the Control Unit. Twisting of internal components may cause leaks.

Check the alignment and level of the Control Unit and header brackets. If there is an alignment problem loosen all the header bar mounting hardware. Adjust as needed and tighten.

8.5 HEATED HEADER BARS

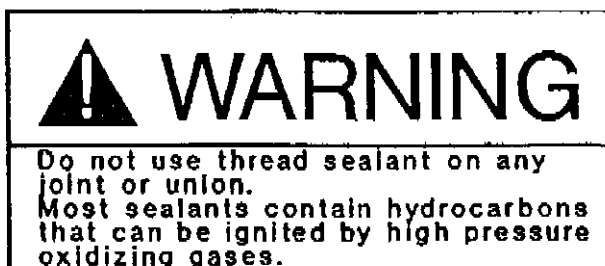
The physical characteristics and flow performance of nitrous oxide and carbon dioxide often create the need to heat the gas as it passes through the header bar or control unit. Low ambient temperature, high gas flow requirement, and high dew point of the gas will have a negative effect on the performance of any manifold. Allied Healthcare Products, Inc. offers a heated header bar that adapts easily to any existing or new manifold installation. Refer to the Optional Equipment Section or contact an Allied Healthcare Products, Inc's. Sales Representative for more information.

NOTE:

In order for the heater kits to be effective when used in CO₂ or N₂O service, they must be installed between the header bars and the Control Unit.

8.6 CYLINDER PIGTAILS

Allied Healthcare Products, Inc. offers two styles of flexible pigtails: Coiled copper (standard equipment) and braided stainless steel one (optional). Refer to the Optional Equipment Section or contact your Allied Healthcare



The shuttle valve will not change banks if the depleted cylinders are left in place on the reserve bank when the active bank is depleted to point that it is ready to shift banks. See caution below.

The Control Unit's safety system will prevent the shuttle from shifting under these conditions only to find that little, if any, gas is available in the reserve bank. As soon as one or more fresh cylinders are connected to a cylinder bank the shuttle valve will automatically shift to that bank and resume gas flow to the piped system.

9.5 FUNCTION IDENTIFICATION

The bank indicators and pressure gages on the cabinet face are clearly marked to explain their function.

The 2500 Manifold header bars are designed to assure that only cylinders containing the proper gas can be connected to them. All header bar connections and pigtail comply with CGA Standards.

10.0 TESTING FOR LEAKAGE

The following instructions apply to leak testing to be performed on the joints made during the on site assembly and connection of the 2500 Manifold. The connections inside the Control Unit have been inspected at the factory and do not require leak testing.



In order to determine whether any leaks exist between header bar sections or at the central pipe system connection, the system must be pressurized using either oil-free dry air or oil-free dry nitrogen. In the case of either a medical air or a nitrogen 2500 Manifold, the actual service gas may be used to perform the leak tests. In the case of oxygen, nitrous oxide or carbon dioxide 2500 Manifolds, the actual service gases are not suitable for leak testing due to their inherent dangerous properties.

Note:

Carefully "cracking" and then closing the cylinder valve before connecting it to the header bar minimizes the chance of dust and dirt entering the manifold system.

Connect a cylinder of the manifold service gas to the end connection on each end of the header bar using the pigtail assemblies supplied. With the high pressure Control Unit inlet valves of each bank closed, slowly open the two cylinder valves, one at a time, to pressurize both header bars. After waiting at least one full minute, slowly open the two high pressure Control Unit inlet valves, one at a time, to pressurize the system up to but not including the central piping system. There should be no flow from the manifold.

Check for leaks at all header bar extension joints and at the joints where the pigtails were connected to the header bars, using soapy

 CAUTION
The health care facility must have procedures in place to insure that depleted cylinders are replaced as soon as possible to assure a fresh bank awaits the next bank shift.
 WARNING
Sudden release of high pressure gas can cause bodily injury. Always bleed down pressure slowly. Always wear safety glasses when changing cylinders or servicing unit.

water or commercial leak detector which is compatible with oxygen. If any leaks are found, the system must be depressurized and the faulty connections must be repaired. Turn off both cylinders and bleed down the pressure. The leaking header bar or pigtail connections must be tightened, maintaining the horizontal location of the pigtail adapters.

All joints must be pressure tested again using the above procedures.

When there are no leaks, bleed the system and remove the test cylinders, pigtails and gas adapters. The system is now ready to accept cylinders of the proper gas and service the health care facility needs.

If gas conversion adapters were used to test the 2500 Manifold system, it is important that the gas conversion adapters and the nitrogen or medical air pigtails be removed from the area. Every precaution must be taken to prevent hazardous gas mixing by accidentally using these test adapters.

MODEL 2500 MANIFOLD STANDARD PRESSURE SETTINGS

SECTION 11.0

IN PSI

PART	MINIMUM	MAXIMUM
PRIMARY REGULATOR: NITROGEN ALL OTHER GASES	250 250	275 275
LINE REGULATOR: NITROGEN ALL OTHER GASES	165 50	195 55
MINI REGULATOR: NITROGEN ALL OTHER GASES	60 50	65 55

CAUTION All pressure adjustments shall be made by authorized personnel only. Incorrect pressures can disrupt gas delivery to line.

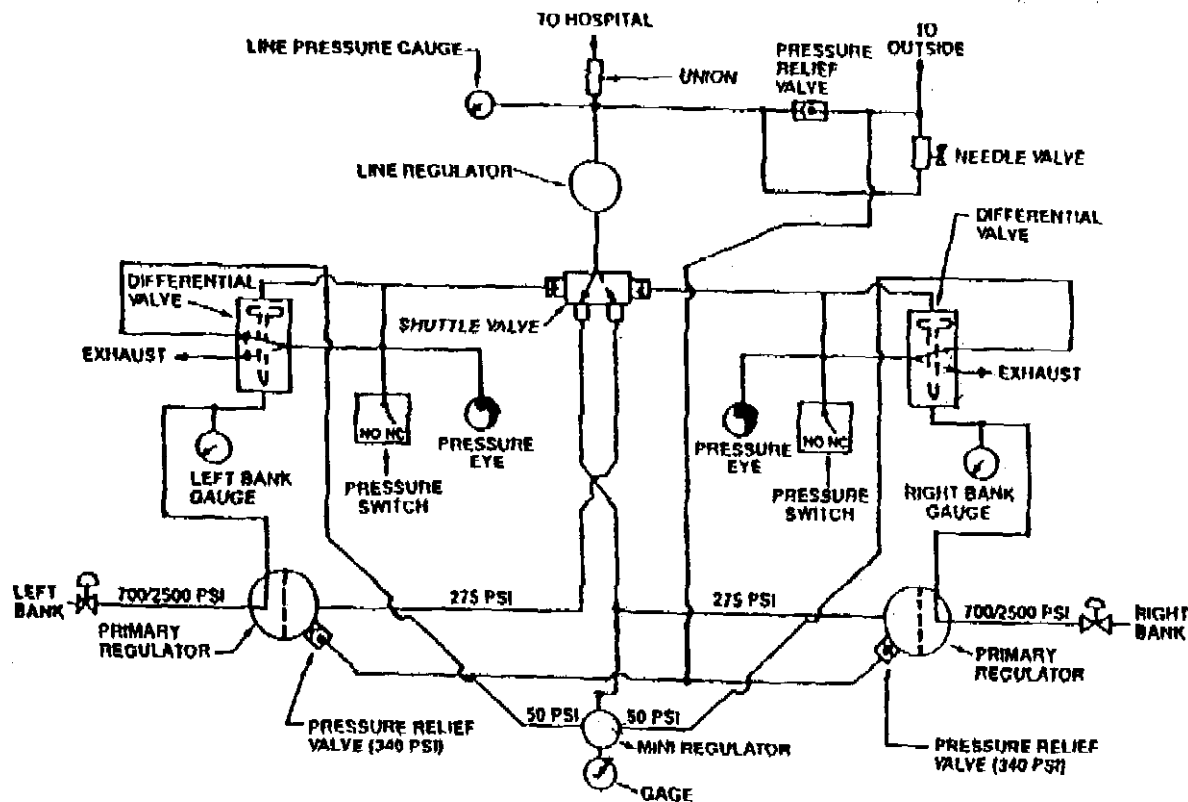


Figure 8 SCHEMATIC DIAGRAM

MODEL 2500 SERIES MANIFOLD ACCESSORIES

Section 12.0

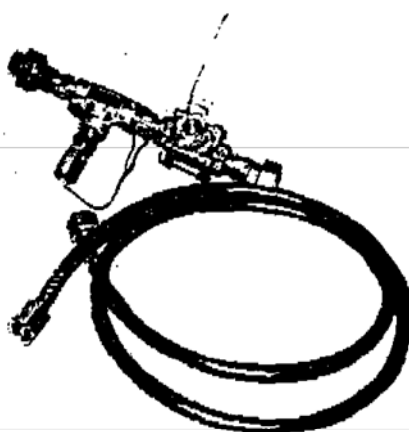
SERVICE BYPASS FITTING KIT

Installed after the mainline shut off valve, allows convenient point to supply distribution piping while manifold system is removed, repaired, or maintained. Fitting is CGA DISS gas specific with check valve, and kit includes 6-foot hose assembly for connection to large cylinder and regulator. *(cylinder & regulator required).

*(Note: Regulators below can be used with this kit).

Catalog Numbers:

- 86-58-0031 O₂
- 86-58-0033 N₂O
- 96-58-0034 Medical Air
- 86-58-0035 CO₂
- 86-58-0036 N₂
- 86-58-0037 O₂/CO₂ < 7%

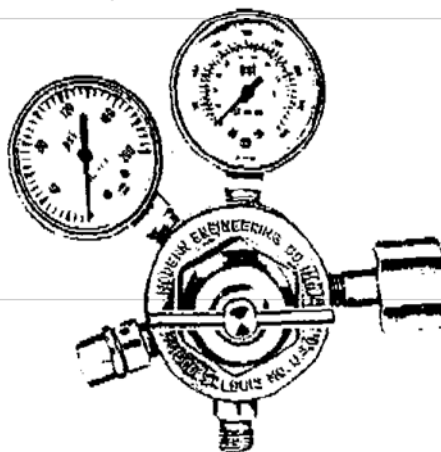


REGULATOR

Regulator is secured to large cylinder and set for proper pressure delivery (50 PSI for O₂, N₂O, Medical Air, O₂/CO₂ < 7%, 160-200 PSI for N₂) connecting pigtail from bypass kit completes required equipment to temporarily supply system.

Catalog Numbers:

- 86-58-0041 O₂ Regulator
- 86-58-0043 N₂O Regulator
- 86-58-0044 Medical Air Regulator
- 86-58-0045 CO₂ Regulator
- 86-58-0046 N₂ Regulator
- 86-58-0047 O₂/CO₂ < 7% Regulator

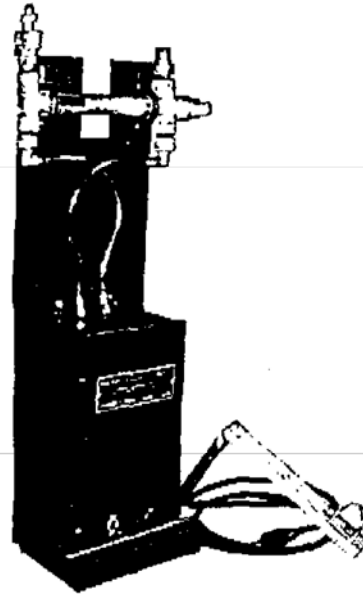


HEADER BAR HEATER KIT

Provides heat directly to gases and prevents liquids and ice crystals from entering and damaging manifold control under adverse conditions and/or high demand periods of operation. Available in 300, 600, and 1,000 cubic feet per hour (watts) for Nitrous Oxide or Carbon Dioxide service. 120V power required to each unit. All units are temperature controlled. Attaches to existing header bars without increasing space requirements.

Catalog numbers:

~~86-53-1011 300w N₂O~~
~~86-53-1012 600w N₂O~~
86-53-1013 1000w N₂O
86-55-1011 300w CO₂
86-55-1012 600w CO₂
86-55-1013 1000w CO₂

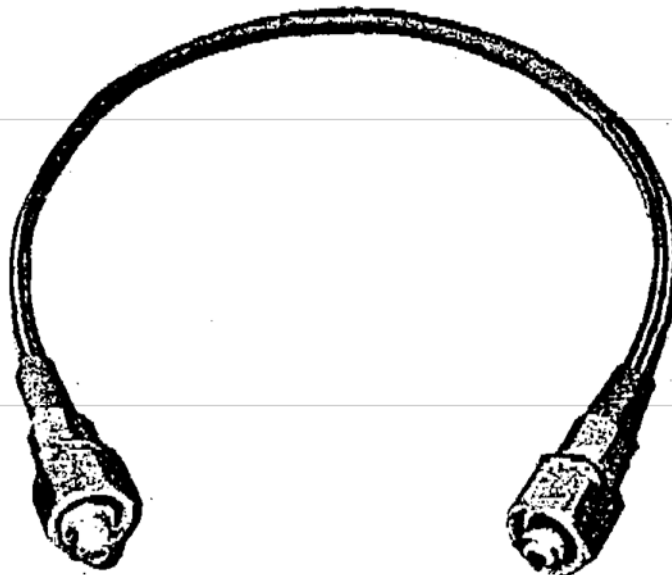


STAINLESS STEEL BRAIDED PIGTAILS

High pressure reinforced teflon hose consisting of one inner stainless steel braid; two layers of stainless steel spiral wrap plus an outer braid of stainless steel. Specifications include minimum bend radius of 3-inches maximum operating pressure of 3000 PSI, CGA fittings attached to the tubing are brass.

Catalog Numbers:

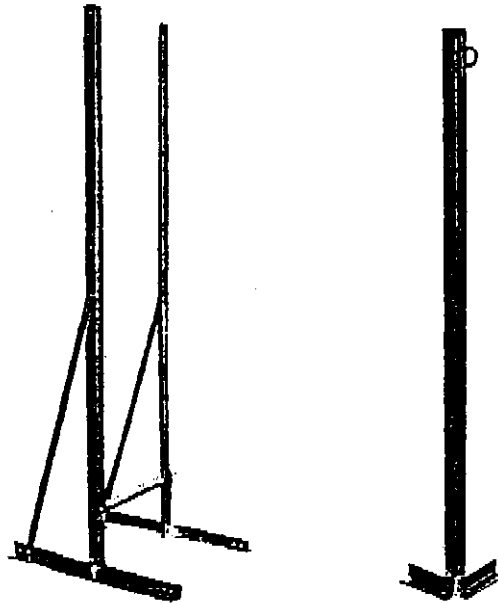
86-58-0011 O₂
86-58-0013 N₂O
86-58-0014 Medical Air
86-58-0015 CO₂
86-58-0016 N₂
86-58-0017 O₂/CO₂ < 7%



FREE STANDING SUPPORT

Provides a means of support when space dictates non-wall mounting. Mounting height is pre-determined. Support angles are 1 1/2 inch aluminum angle bolted to frame members. Some assembly is required.

Catalog Numbers:	Description
86-58-0038	Floor mount control unit stand
86-58-0039	Header stand kit, Qty. 2 (order one kit for every 6 cylinders on a manifold)



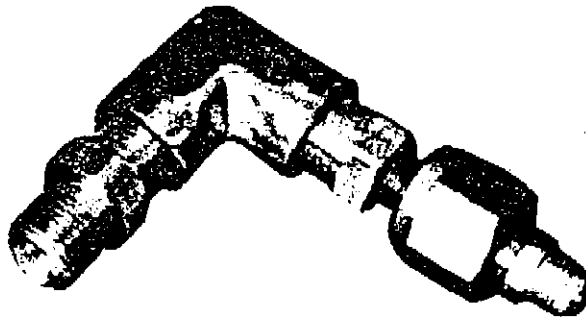
ELBOW ASSEMBLIES

Allows header bars to negotiate corners when space is not sufficient for complete manifold to be mounted to wall.

Elbows measure: 3" x 4"

Catalog Numbers:

86-51-1007	O ₂
86-53-1007	N ₂ O
86-54-1007	Medical Air
86-55-1007	CO ₂
86-56-1007	N ₂
86-57-1007	O ₂ /CO ₂ < 7%



REPAIR PARTS

Section 13.0

ITEM No.	CATALOG No.	DESCRIPTION	GAS	QUANTITY PER KIT
3-1	86-90-1513	LINE REGULATOR	OXYGEN	1
3-1	86-90-1514	LINE REGULATOR	NITROUS OXIDE	1
3-1	86-90-1515	LINE REGULATOR	NITROGEN	1
3-1	86-90-1516	LINE REGULATOR	CARBON DIOXIDE	1
3-1	86-90-1517	LINE REGULATOR	O2/CO2 Less than 7%	1
3-1	86-90-1518	LINE REGULATOR	MEDICAL AIR	1
3-2	86-90-2531	SHUTTLE VALVE	OXYGEN	1
3-2	86-90-2533	SHUTTLE VALVE	NITROUS OXIDE	1
3-2	86-90-2536	SHUTTLE VALVE	NITROGEN	1
3-2	86-90-2535	SHUTTLE VALVE	CARBON DIOXIDE	1
3-2	86-90-2537	SHUTTLE VALVE	O2/CO2 Less than 7%	1
3-2	86-90-2534	SHUTTLE VALVE	MEDICAL AIR	1
3-3	86-90-2541	LINE PRESSURE RELIEF VALVE	OXYGEN	1
3-3	86-90-2543	LINE PRESSURE RELIEF VALVE	NITROUS OXIDE	1
3-3	86-90-2546	LINE PRESSURE RELIEF VALVE	NITROGEN	1
3-3	86-90-2545	LINE PRESSURE RELIEF VALVE	CARBON DIOXIDE	1
3-3	86-90-2547	LINE PRESSURE RELIEF VALVE	O2/CO2 Less than 7%	1
3-3	86-90-2544	LINE PRESSURE RELIEF VALVE	MEDICAL AIR	1
3-32	86-90-2521	LINE PRESSURE NEEDLE VALVE	ALL	1
4-1	86-90-2551	HIGH PRESSURE REGULATOR	OXYGEN	1
4-1	86-90-2553	HIGH PRESSURE REGULATOR	NITROUS OXIDE	1
4-1	86-90-2556	HIGH PRESSURE REGULATOR	NITROGEN	1
4-1	86-90-2555	HIGH PRESSURE REGULATOR	CARBON DIOXIDE	1
4-1	86-90-2557	HIGH PRESSURE REGULATOR	O2/CO2 Less than 7%	1
4-1	86-90-2554	HIGH PRESSURE REGULATOR	MEDICAL AIR	1
4-13	86-90-2561	HIGH PRESSURE RELIEF VALVE	OXYGEN	1
4-13	86-90-2563	HIGH PRESSURE RELIEF VALVE	NITROUS OXIDE	1
4-13	86-90-2566	HIGH PRESSURE RELIEF VALVE	NITROGEN	1
4-13	86-90-2565	HIGH PRESSURE RELIEF VALVE	CARBON DIOXIDE	1
4-13	86-90-2567	HIGH PRESSURE RELIEF VALVE	O2/CO2 Less than 7%	1
4-13	86-90-2564	HIGH PRESSURE RELIEF VALVE	MEDICAL AIR	1
6-1	86-90-2571	HIGH PRESSURE HAND VALVE	OXYGEN	1
6-1	86-90-2573	HIGH PRESSURE HAND VALVE	NITROUS OXIDE	1
6-1	86-90-2576	HIGH PRESSURE HAND VALVE	NITROGEN	1
6-1	86-90-2575	HIGH PRESSURE HAND VALVE	CARBON DIOXIDE	1
6-1	86-90-2577	HIGH PRESSURE HAND VALVE	O2/CO2 Less than 7%	1
6-1	86-90-2574	HIGH PRESSURE HAND VALVE	MEDICAL AIR	1

86-90-1513	Line Regulator O2 only
86-90-1514	Line Regulator N2O
86-90-1515	Line Regulator N2
86-90-1516	Line Regulator CO2
86-90-1517	Line Regulator O2/CO2
86-90-1518	Line Regulator Air
86-90-2531	Shuttle Valve O2
86-90-2534	Shuttle Valve All others
86-90-2541	2500 Line Press relief valve O2
86-90-2544	2500 Line Press relief valve (except O2)
86-90-1547	1500 line relief valve 75 psi
86-90-1548	1500 line relief valve 250 psi
86-90-2551	Primary regulator O2
86-90-2553	Primary Regulator All others
86-90-2561	High Press relief valve O2
86-90-2564	High Press relief valve except O2
86-90-1572	High press hand valve N2O
86-90-1573	High press hand valve N2
86-90-1574	High press hand valve CO2
86-90-1530	100 psi panel mtd gauge
86-90-1531	300 psi panel mtd gauge
86-90-1533	4000 psi panel mtd gauge
86-90-1530	Mini regulator press gauge
86-90-1529	4000 psi panel mtd gauge
86-90-2522	Mini regulator
86-90-2581	Differential valve O2
86-90-2583	Differential valve N2O
86-90-2584	Differential valve Air
86-90-2585	Differential valve CO2
86-90-2586	Differential valve N2

86-90-2591	Pressure switch O2
86-90-2593	Pressure switch N2O
86-90-2595	Pressure switch CO2
86-90-2596	Pressure switch N2
74-13-9070	RIU switch 1500 @135 psi Ex. O2
74-13-9071	RIU switch 1500 @270 psi
86-58-0040	RIU switch 1500 @135 psi O2
86-90-2403	Differential kit all but O2

REPAIR PARTS

section 13.0 (continued)

ITEM No.	CATALOG No.	DESCRIPTION	GAS	QUANTITY PER KIT
7-2	86-90-1530	100 PSI PANEL MOUNT GAGE	OXYGEN	1
7-2	86-90-1530	100 PSI PANEL MOUNT GAGE	NITROUS OXIDE	1
7-2	86-90-1530	100 PSI PANEL MOUNT GAGE	CARBON DIOXIDE	1
7-2	86-90-1530	100 PSI PANEL MOUNT GAGE	O2/CO2 Less than 7%	1
7-2	86-90-1530	100 PSI PANEL MOUNT GAGE	MEDICAL AIR	1
7-2	86-90-1531	300 PSI PANEL MOUNT GAGE	NITROGEN	1
7-7-1	86-90-1529	4000 PSI PANEL MOUNT GAGE	ALL	1
12-1	86-90-2522	MINI PRESSURE REGULATOR	ALL	1
12-4	86-90-1530	MINI PRESSURE REGULATOR GAGE	ALL	1
15-0	86-90-2581	DIFFERENTIAL VALVE	OXYGEN	1
15-0	86-90-2583	DIFFERENTIAL VALVE	NITROUS OXIDE	1
15-0	86-90-2586	DIFFERENTIAL VALVE	NITROGEN	1
15-0	86-90-2585	DIFFERENTIAL VALVE	CARBON DIOXIDE	1
15-0	86-90-2587	DIFFERENTIAL VALVE	O2/CO2 Less than 7%	1
15-0	86-90-2584	DIFFERENTIAL VALVE	MEDICAL AIR	1
-0	86-90-2581	SWITCH, PRESSURE FOR ALARM	OXYGEN	1
9-0	86-90-2583	SWITCH, PRESSURE FOR ALARM	NITROUS OXIDE	1
9-0	86-90-2586	SWITCH, PRESSURE FOR ALARM	NITROGEN	1
9-0	86-90-2585	SWITCH, PRESSURE FOR ALARM	CARBON DIOXIDE	1
9-0	86-90-2587	SWITCH, PRESSURE FOR ALARM	O2/CO2 Less than 7%	1
9-0	86-90-2584	SWITCH, PRESSURE FOR ALARM	MEDICAL AIR	1

TROUBLE SHOOTING

Section 14.0

This section is intended to serve as a general guide for identifying the potential functional problems which could occur in operation of the 2500 Manifold.

Only some minor checks and repairs are recommended to be made in the field.

* When an asterisk appears beside the remedy or check, the recommended procedure is to replace the whole subassembly in questions, whether shuttle valve, regulator or other component, with a substitute until repairs are completed on the original subassembly.

Components removed from the 2500 Manifold system for maintenance must be serviced, repaired and tested by properly qualified medical service personnel only. Original manufacturer's parts, as supplied by Allied Healthcare Products Inc., must be used in the maintenance of 2500 Manifolds.

Trouble	Probable Cause	Remedy or Check
14.1 INDICATOR FAULTS		
14.1.1 Indicator eye shows red after depleted cylinders have been replaced.	Indicator eye stuck.	Check for color change using 50 psi pressure. If it won't respond, replace it.
	Low pressure line leak.	Tighten fittings.
	Shuttle valve shaft assembly hung up in center.	Close one bank high pressure inlet valve to cause shuttle valve to go to one side, then <u>slowly</u> reopen high pressure valve.
	All cylinder valves on one bank are closed.	<u>Slowly</u> open the valve on the cylinder nearest the bank high pressure inlet valve, wait one minute then <u>slowly</u> , one by one open the other cylinder valves.
	Bank High Pressure inlet valve is closed.	<u>Slowly</u> open high pressure inlet valve.
14.1.2 Indicator eye does not turn red when one bank is depleted and change over occurs.	Indicator stuck.	Check for color change using 50 psi pressure. If it won't respond, replace it.

Trouble	Probable Cause	Remedy or Check
14.1.3 The pressure switch does not respond to the replacement of depleted cylinders with fresh cylinders.	<p>Switch stuck.</p> <p>Low pressure line leak.</p> <p>Shuttle valve shaft assembly hung up in center.</p> <p>All cylinder valves on one bank are closed.</p> <p>Bank High Pressure inlet valve is closed.</p>	<p>Check for electrical change using 50 psi pressure. If it won't respond, replace it.</p> <p>Tighten fittings. If switch leaks, replace it.</p> <p>Close one bank high pressure inlet valve to cause shuttle valve to go to one side, then <u>slowly</u> reopen high pressure valve.</p> <p><u>Slowly</u> open the valve on the cylinder nearest the bank high pressure inlet valve, wait one minute then <u>slowly</u>, one by one then the other cylinder valves.</p> <p><u>Slowly</u> open high pressure inlet valve.</p>
14.1.4 The pressure switch does not respond when one bank is depleted and change over occurs.	Switch is stuck.	Check for electrical change using 50 psi pressure. If it won't respond, replace it.
14.2 PRIMARY (HIGH PRESSURE) REGULATOR FAULTS		
14.2.1 Gas leakage around primary pressure regulator body cap.	<p>Loose cap.</p> <p>Diaphragm leak.</p>	<p>Turn off high pressure valve and bleed down system. Tighten cap.</p> <p>* Replace regulator with substitute unit. Change diaphragm and edge seal o-ring.</p>
14.2.2 Relief valve venting.	<p>Over pressure due to creeping or faulty regulation caused by damaged regulator seat.</p> <p>Over pressure due to damaged regulator diaphragm.</p>	<p>* Replace regulator with substitute unit. Replace seat assembly.</p> <p>* Replace regulator with substitute unit. Replace diaphragm and edge seal o-ring.</p>

Trouble	Probable Cause	Remedy or Check
14.3 LINE PRESSURE REGULATOR FAULTS		
14.3.1 Over pressure alarm set off.	Line regulator set too high.	Set line regulator to the pressure specified.
	Defective line regulator.	Replace line regulator.
14.3.2 Under pressure alarm set off.	Line regulator set too low.	Set line regulator to the pressure specified.
	Defective line regulator.	Replace line regulator.
	Both supply and reserve bank cylinders are depleted.	Replace with full cylinders. (check manifold function).
	Delivery line shut off valve closed or nearly so.	Fully open delivery line shut off valve.
	Master Header valve not fully open.	Fully open Master Header valve.
	Excessive flow demand.	Reduce the flow demand or purchase another manifold system to handle the flow demand.
14.3.3 Unusual loss of cylinder pressure in the "supply" bank.	Leak in the central piping system.	Check and repair as necessary.
	Leak in the headers or pigtails.	Check and tighten all connections as necessary.
	One or more pigtails not connected to cylinders.	Pigtail check valves have an acceptable leak rate thus are not usable as long term seals. Use standard end caps on unused pigtails.
	Safety relief valve on primary (high pressure) regulator has opened.	* Inspect primary regulator seat and diaphragm. Replace if necessary.
14.3.4 Unusual loss of cylinder pressure in the "reserve" bank.	Leak in the headers or pigtails.	Check and tighten all connections as necessary.

Trouble	Probable Cause	Remedy or Check
14.3.4 (continued)	One or more pigtails not connected to cylinders.	Pigtail check valves have an acceptable leak rate thus are not usable as along term seals. Use standard end caps on unused pigtails.
	Safety relief valve on primary (high pressure) regulator has opened.	* Inspect primary regulator seat and diaphragm. Replace if necessary.
14.3.5 Required gas flow not available.	Line regulator not set correctly.	Set line regulator to the pressure specified.
14.3.6 Line pressure relief valve venting.	Line regulator set at too high of a delivery pressure.	Set delivery pressure as specified for the gas being used.
	Relief valve set at too low of a pressure.	Adjust to proper pressure (see Fig. 8). If it won't respond replace it.
	Over pressure due to creeping or faulty regulation caused by damaged regulator seat.	* Replace regulator with substitute unit. Replace seat assembly.
	Over pressure due to damaged regulator diaphragm.	* Replace regulator with substitute unit. Replace diaphragm and edge seal o-ring.
14.3.7 Gas leakage around the seat assembly.	Worn or missing o-ring on seat assembly.	Replace o-rings.
14.4 SHUTTLE VALVE FAULTS		
14.4.1 Shuttle valve shuttles before operating bank is depleted.	Internal o-ring leak in differential valve.	* Replace differential valve with substitute unit. Replace o-rings.
14.4.2 Both banks feeding.	Shuttle valve shaft assembly hung up in center due to low control circuit pressure.	Make sure the mini regulator is set at the proper pressure (see section 11). If the mini regulator is unstable: * Replace mini regulator with a substitute unit.

Trouble	Probable Cause	Remedy or Check
14.4.2 (Continued)	Shuttle valve shaft assembly hung up in center due to damaged o-rings.	* Replace shuttle valve with a substitute unit.
	Shuttle valve shaft assembly hung up in center due to differential valve malfunction.	* Replace differential valve with substitute unit.
14.4.3 Extremely loud or forceful shuttling of valve shaft assembly.	Leaking mini regulator allowing high pressure into the shuttle valve pilot side of shuttle.	* Replace regulator with substitute unit.
	Mini regulator pressure set too high.	Set mini regulator pressure per section 11.
14.4.5 Manifold favors one cylinder bank.	Piping leaks around the differential valves.	Tighten fittings.
	Faulty differential valve does not respond properly to bank pressure.	* Replace differential valve with substitute unit and repair.
14.4.6 Gas leakage.	Shuttle valve o-rings leaking.	* Replace shuttle valve substitute unit. Replace o-rings with new ones from shuttle valve repair kit.

NOTE:

Open all high pressure valves slowly. The pressure surge of opening a high pressure valve quickly could cause damage to any part of the Control Unit that responds to pressure changes i.e. gages, shuttle valves, etc.