



**Operation Manual  
Nitrox Membrane System**

**215, 230 & 250 Series**

**Rated for 6 CFM, 10 CFM, 16 CFM, 20 CFM, 32 CFM  
and 50 CFM**

**Low Pressure Supply Option  
High Pressure Supply Option**



**WARNING**

This Operation Manual contains important safety information and should always be available to those personnel operating this equipment. Read, understand, and retain all instructions before operating this equipment to prevent injury or equipment damage.

If you have any questions on this equipment please contact Technical Support at:

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**Every effort was made to ensure the accuracy of the information contained within. NUVAIR however, retains the right to modify its contents without notice. If you have problems or questions after reading the manual, stop and call for information.**

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# 1.0 Introduction

This manual will assist you in the proper set-up, operation and maintenance of the Nuvair™ 215, 230 & 250 Series Nitrox Membrane Systems. Be sure to read the entire manual.

Throughout this manual we will use certain words to call your attention to conditions, practices or techniques that may directly affect your safety. Pay particular attention to information introduced by the following signal words:



## DANGER

Indicates an imminently hazardous situation, which if not avoided, will result in serious personal injury or death.



## WARNING

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



## CAUTION

Indicates a potentially hazardous situation, which if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.



## NOTICE

Notifies people of installation, operation or maintenance information which is important but not hazard-related.

## 2.0 Safety Warnings

Nuvair™ has taken extreme care in providing you with the information you will need to operate this system. However, it is up to you to carefully read this manual and make the appropriate decisions about system safety.



### WARNING

This equipment is used to provide breathing gas for the purpose of underwater life support. Read this manual in its entirety. Failure to heed the warnings and cautions contained in this document may result in severe injury or death.



### WARNING

The equipment you will be using to manufacture Nitrox (oxygen rich air) will expose you to both low and high-pressure gas. Gas, even under moderate pressures, can cause extreme bodily harm. Never allow any gas stream to be directed at any part of your body.



### WARNING

Any pressurized hose can cause extreme harm if it comes loose or separates from its restraint (or termination) while under pressure and strikes any part of your body. Use appropriate care in making and handling all gas connections.



### DANGER

Pure nitrogen is a colorless, odorless, tasteless gas that will not support life. Breathing high concentrations of nitrogen will cause death.



### WARNING

The nitrogen discharge from the Membrane System must be vented to the exterior of any closed building, boat, or similar enclosed space. If you allow this pure nitrogen to accumulate in an enclosed space, anyone entering this space will quickly lose consciousness and will die if not immediately resuscitated.



### WARNING

Do not use any form of mineral oil or synthetic lubricant not rated for Nitrox in any compressor in this system. Use only the recommended Nitrox Compressor Lubricant. Never mix the Nitrox Compressor Lubricant with other lubricants. Existing Lubricant and replace with the proper Nitrox Compressor Lubricant prior to installing the Membrane System. The use of improper Lubricants can lead to fire or explosions, which may cause serious personal injury or death.



### WARNING

Do not use this system to produce Nitrox mixtures containing more than 40% oxygen. Pumping Nitrox mixtures with higher concentrations of oxygen may lead to fires or explosions, which can cause serious personal injury or death.



## WARNING

Do not pump Nitrox mixtures at pressures above the compressor manufacturer's rating, and never above 3600 P.S.I. The system is not rated for pressures above 3600 P.S.I. Higher pressures may lead to explosions which may cause serious personal injury or death.



## WARNING

Some Compressors are not suitable for compressing oxygen-rich air, i.e., Nitrox. Use of an unsuitable Compressor may lead to possible Compressor damage and/or fires or explosion. This can lead to serious personal injury or death. If there is any doubt regarding the use of an existing Compressor, contact Nuair or the Compressor manufacturer before you connect your Membrane System to your machinery.

### 3.0 Safety And Operation Precautions

Because a Compressor is a piece of machinery with moving and rotating parts, the same precautions should be observed as with any piece of machinery of this type where carelessness in operations or maintenance is hazardous to personnel. In addition to the many obvious safety precautions, those listed below must also be observed:

- 1) Read all instructions completely before operating any Compressor or Membrane System.
- 2) For installation, follow all local electrical and safety codes, as well as the National Electrical Code (NEC) and the Occupational Safety and Health Administration (OSHA) standards.
- 3) Electric motors must be securely and adequately grounded. This can be accomplished by wiring with a grounded, metal-clad raceway system to the Compressor starter; by using a separate ground wire connected to the bare metal of the motor frame; or other suitable means.
- 4) Protect all power cables from coming in contact with sharp objects. Do not kink power cables and never allow the cables to come in contact with oil, grease, hot surfaces, or chemicals.
- 5) Make certain that power source conforms to the requirements of your equipment.
- 6) Pull main electrical disconnect switch and disconnect any separate control lines, if used, before attempting to work or perform maintenance on the Compressor or Membrane System. "Tag Out" or "Lock Out" all power sources.
- 7) Do not attempt to remove any Compressor or Membrane System parts without first relieving the entire system of pressure.
- 8) Do not attempt to service any part while Compressor or Membrane System is in an operational mode.
- 9) Do not operate the Compressor or Membrane System at pressures in excess of its rating.
- 10) Do not operate Compressor at speeds in excess of its rating.
- 11) Periodically check all safety devices for proper operation. Do not change pressure setting or restrict operation in any way.
- 12) Be sure no tools, rags or loose parts are left on the Membrane System, Heater, Compressor or Drive parts.
- 13) Do not use flammable solvents for cleaning the Air Inlet Filter or element and other parts.
- 14) Exercise cleanliness during maintenance and when making repairs. Keep dirt away from parts by covering parts and exposed openings with clean cloth or Kraft paper.
- 15) Do not operate the Compressor without guards, shields, and screens in place.
- 16) Do not install a shut-off valve in the Compressor discharge line, unless a pressure relief valve, of proper design and size, is installed in the line between the Compressor unit and shut-off valve.

- 17) Do not operate Compressor in areas where there is a possibility of ingesting carbon monoxide, carbon dioxide, nitrogen, or flammable or toxic fumes.
- 18) Be careful when touching the exterior of a recently run electric, gasoline, or diesel motor - it may be hot enough to be painful or cause injury. With modern motors this condition is normal if operated at rated load - modern motors are built to operate at higher temperatures.
- 19) Inspect unit daily to observe and correct any unsafe operating conditions found.
- 20) Do not "play around" with compressed air, nor direct air stream at body, because this can cause injuries.
- 21) Compressed air from this machine absolutely must not be used for food processing or breathing air without adequate downstream filters, purifiers and controls and periodic air quality testing.
- 22) Always use an air pressure-regulating device at the point of use, and do not use air pressure greater than marked maximum pressure.
- 23) Check hoses for weak or worn conditions before each use and make certain that all connections are secure.

The user of any Compressor or Membrane System manufactured by Nuvair is hereby warned that failure to follow the preceding Safety and Operation Precautions can result in injuries or equipment damage. However, Nuvair does not state as fact or does not mean to imply that the preceding list of Safety and Operation Precautions is all-inclusive, and further that the observance of this list will prevent all injuries or equipment damage.

## 4.0 Legal Precautions

It is highly recommended that a Nitrox fill log be maintained when filling Scuba cylinders to document the following information. This log must be of permanent binding style with no loose pages.

- Fill date
- Tank Number
- Supplier's check of oxygen content (%O<sub>2</sub>) plus signature and date
- User's check of oxygen content (%O<sub>2</sub>) plus signature and date
- Fill Pressure
- MOD (Maximum Operating Depth) in user's handwriting
- Nitrox certifying agency and card number



## 5.0 Theory of Operation

The Nuvair Nitrox Membrane System uses a Semi-Permeable Membrane to produce oxygen-rich air (Nitrox). A portion of the nitrogen in air is separated out, producing a Nitrox mixture containing between 24 and 40% oxygen (O<sub>2</sub>). The Nitrox is then delivered to a High Pressure (HP) Compressor to fill Scuba Cylinders or Storage Tanks or to a Low Pressure (LP) Compressor for pumping to surface-supply divers. This Compressor is described as the "Nitrox Compressor", but is also used for air.

The Membrane System requires a source of clean, pressurized, and heated air for separation. The two most common sources are HP Air Storage Tanks (HP Supply Option) or an LP Compressor (LP Supply Option). The air must be properly filtered to CGA Grade D or E air quality prior to entering the Membrane System so it will not damage or plug the Membrane fibers. Specifications for Grade D and E air are provided in the Appendix.

Standard systems are rated for maximum supply pressures of 5000 P.S.I.(345 bar) for HP Supply and 250 P.S.I.(17 bar) for LP Supply; higher ratings are available upon request. An Input Pressure Regulator reduces these pressures to acceptable levels for the Membrane. The air is then heated to a temperature that provides stability over a wide range of ambient conditions and is optimal for membrane permeation.

The heated air enters the Membrane, which is made up of thousands of miniature hollow fibers. The walls of these fibers are semi-permeable and designed for different gases to move through them (or permeate) at different speeds. The resulting gas mixture is known as the "permeate". As air flows through the hollow fibers, both oxygen and nitrogen permeate through the fiber walls. The oxygen permeates faster than the nitrogen, which produces permeate with an oxygen content greater than air. The gas that reaches the end of the hollow fibers without permeating is almost entirely nitrogen and is discharged. The flow rate of this discharge is set by the factory via a fixed orifice, which controls the permeate to contain approximately 44% O<sub>2</sub> under all operating conditions.

The permeate is a concentrated mixture that must be diluted with additional air prior to entering the Nitrox Compressor. It exits the Membrane at ambient to slightly negative pressure and travels into the Mixing Tube, where it mixes homogeneously with filtered outside air. The amount of dilution, and thus final %O<sub>2</sub>, is obtained by adjusting the Input Pressure Regulator. As pressure is increased, permeate flow increases, air flow decreases, and a higher %O<sub>2</sub> Nitrox is produced. As pressure is decreased, permeate flow decreases, air flow increases, and a lower %O<sub>2</sub> Nitrox is produced. This relationship between permeate flow and air flow exists because the total of these two flow rates will always equal the intake flow rate demanded by the Nitrox Compressor. The resulting Nitrox mixture is analyzed for %O<sub>2</sub> before entering the Nitrox Compressor for approximate content and again when pumping Nitrox for precise content.

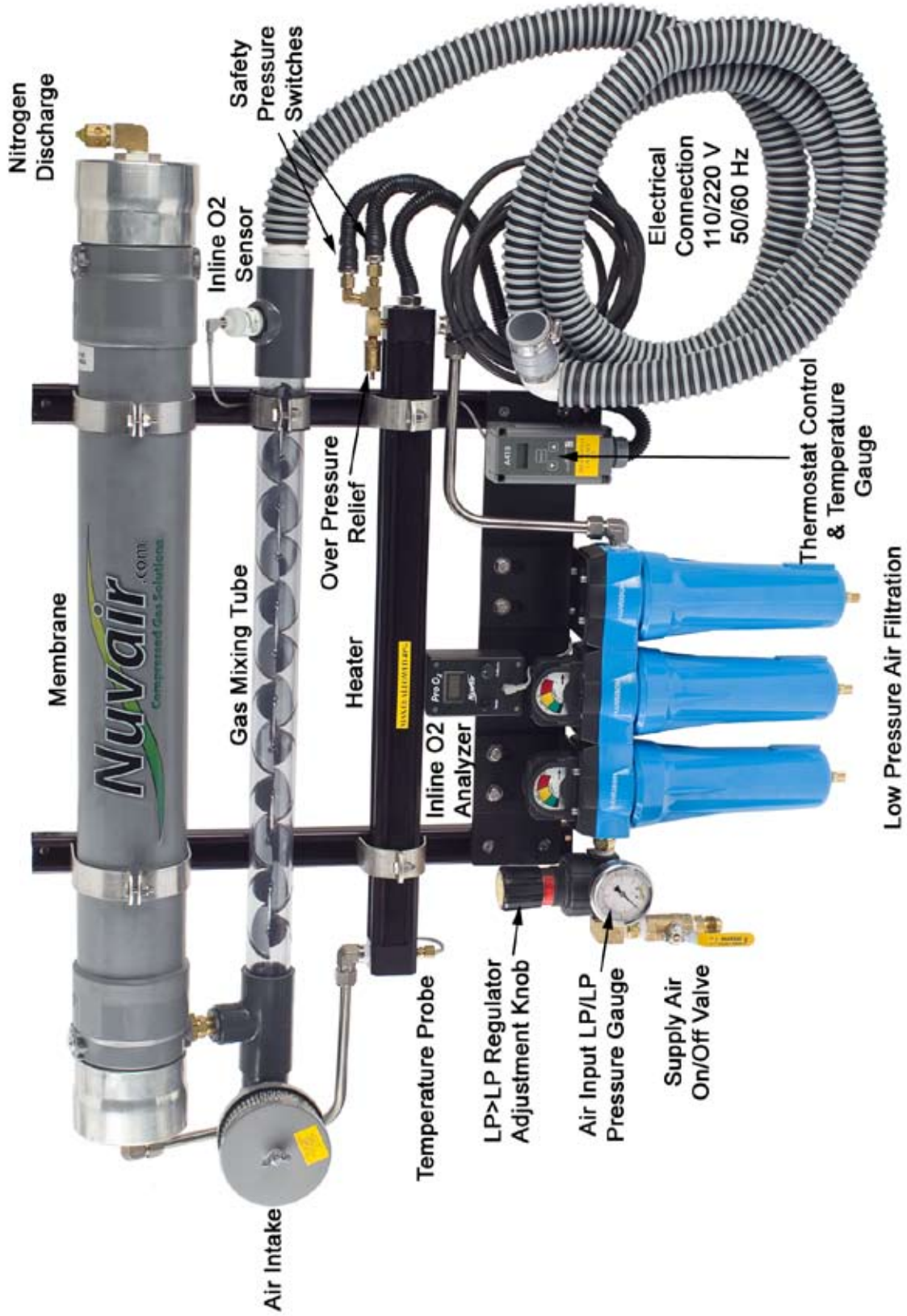
A unique feature of the Nuvair Nitrox Membrane System is that the input pressure that correlates to a specific Nitrox %O<sub>2</sub> is repeatable. If Nitrox with 36% O<sub>2</sub> is produced when the input pressure is at 125 P.S.I.(9 bar), then adjusting the Regulator to 125 P.S.I.(9 bar) during the next use will produce the same mixture.

## 6.0 System Components

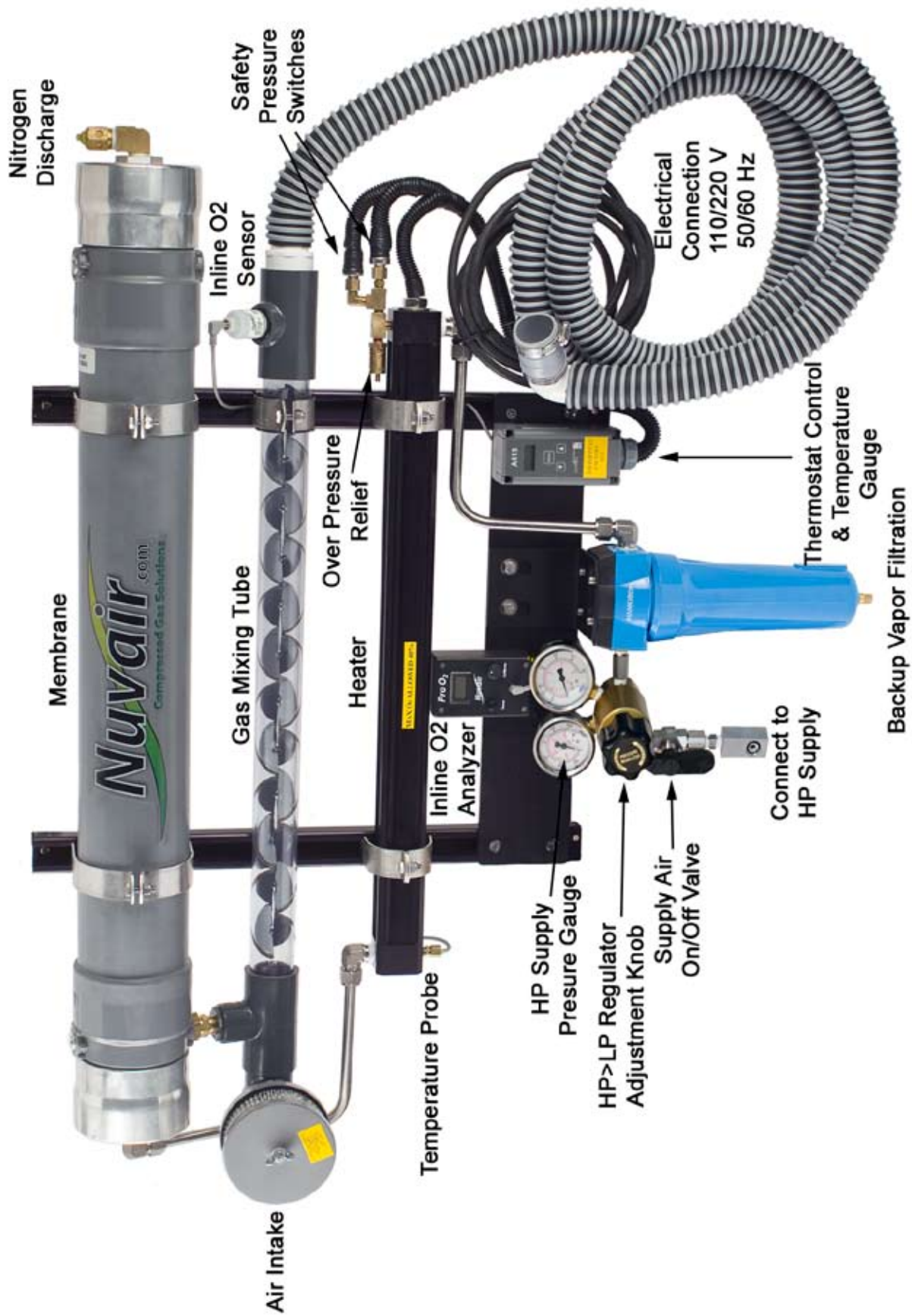
- On/Off Flow Valve
- Input Pressure Regulator with Pressure Gauges:
  - High Pressure>Low Pressure Regulator (High Pressure Supply Option)
  - Low Pressure>Low Pressure Regulator (Low Pressure Supply Option)
- Backup Oil Vapor Filter, 0.003 PPM (HP Supply Option)
- Heater including:
  - Thermostat Control
  - Digital Temperature Gauge
  - Pressure Switch
- Semi-Permeable Membrane
- Mixing Tube & Air Intake Filter
- Inline Oxygen Analyzer
- Compressor Intake Hose for Nitrox Compressor
- Nitrogen Discharge Hose (optional)
- Air Intake Hose (optional)
- Easy Mounting Bracket System
- Fill Oxygen Analyzer, including:
  - High Pressure>Low Pressure Regulator (High Pressure Nitrox Compressor)
  - Flow Restrictor, 3 L/min
- Nitrox Compressor Lubricant:
  - Nuvair 455 TM Food Grade Lubricant (standard)
  - Nuvair 751 TM Diester Based Lubricant (optional)
- Air/Nitrox Quality Analysis Kit

# 7.0 Component Identification

## Low Pressure Air Supply Membrane System



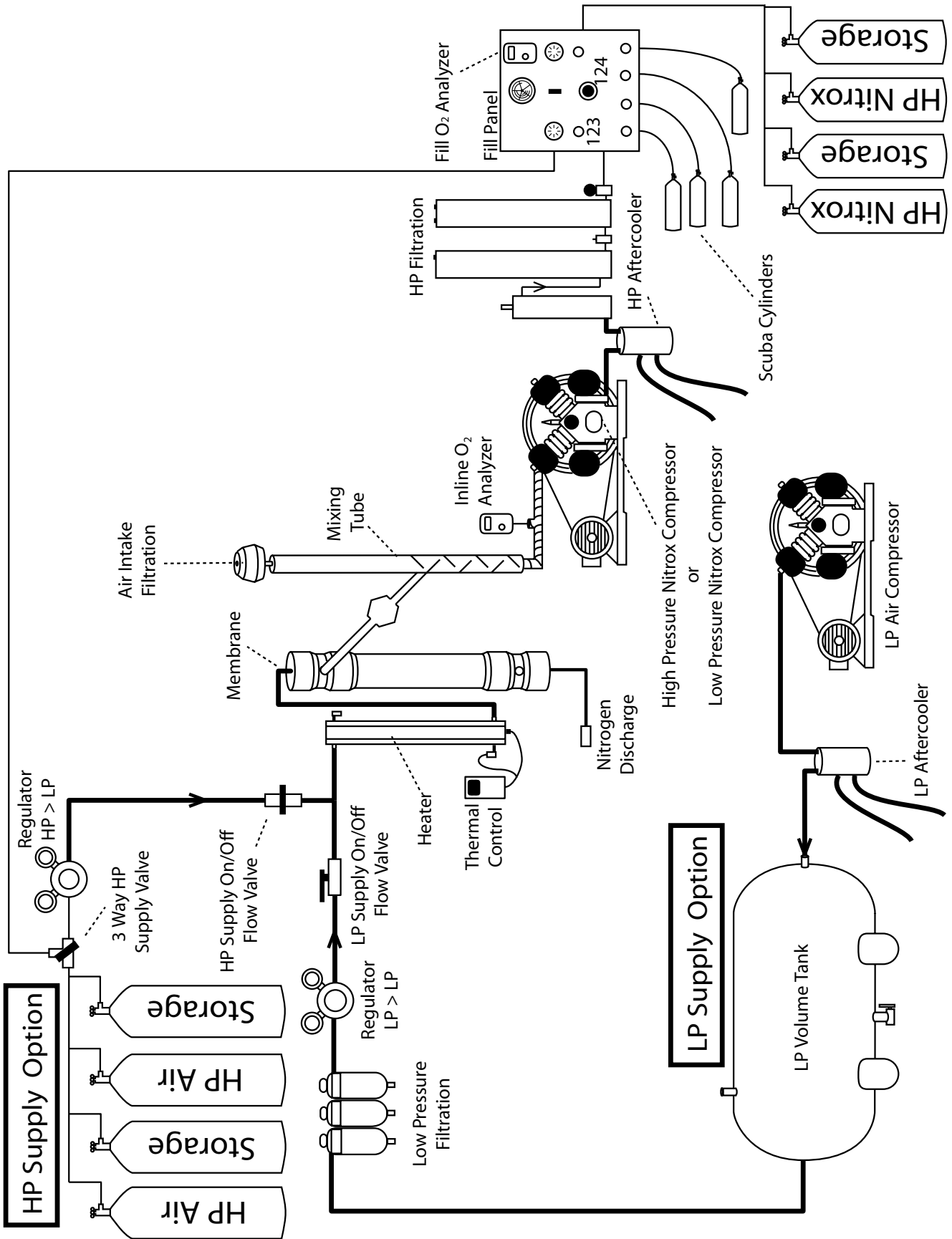
# High Pressure Air Supply Membrane System



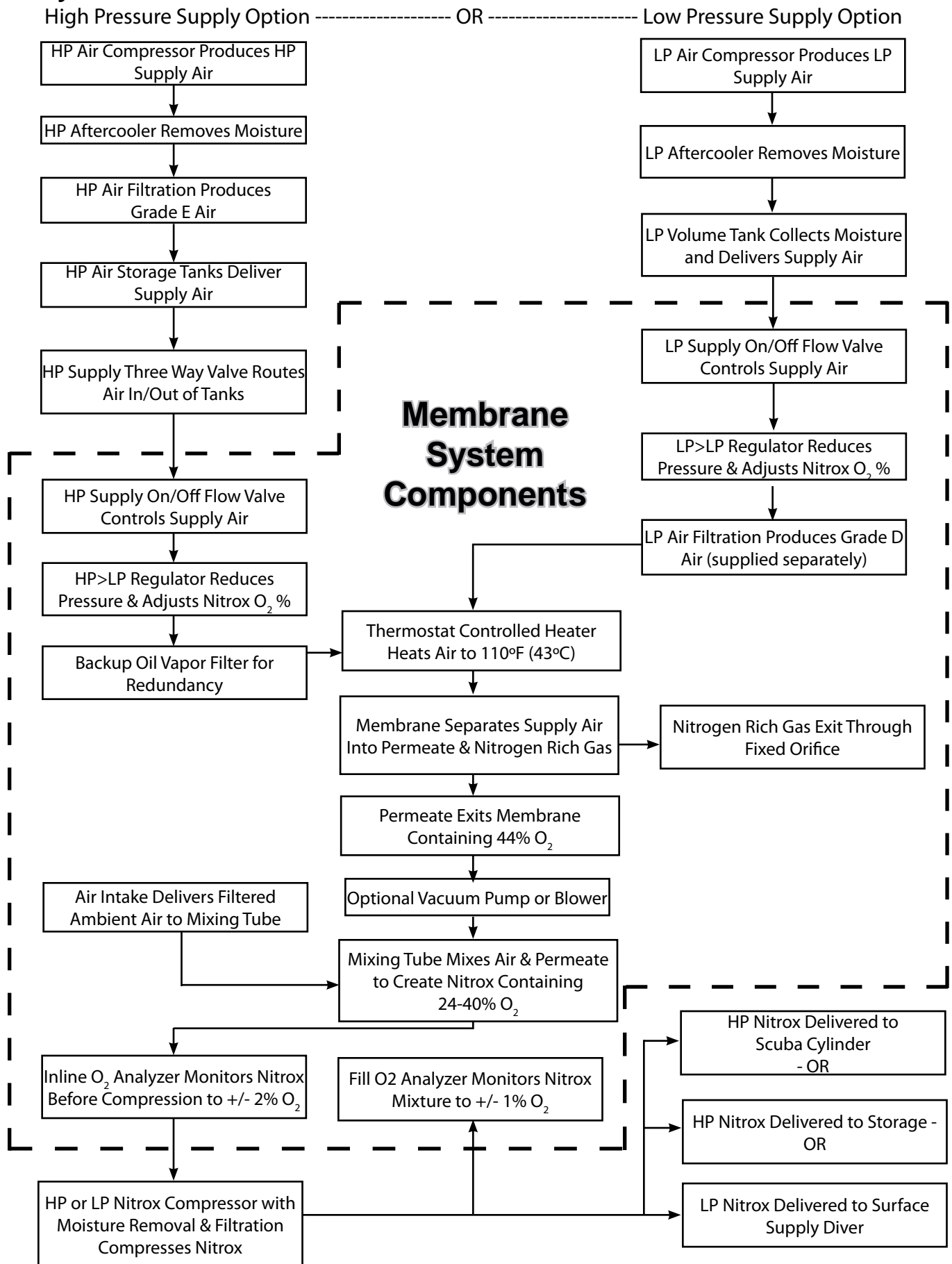


# 8.0 Membrane System Drawings

## 8.1 System Schematic



## 8.2 System Flow Chart



## 9.0 Membrane System Specifications

Membrane Model		Nuvair 6 CFM	Nuvair 10 CFM	Nuvair 16 CFM	Nuvair 20 CFM	Nuvair 32 CFM	Nuvair 50 CFM
Physical Specifications	Length	44 in 1118 mm	46 in 1168 mm	66 in 1676 mm	46 in 1168 mm	66 in 1676 mm	66 in 1676 mm
	Height	30 in 762 mm	32 in 813 mm	32 in 813 mm	38 in 965 mm	38 in 965 mm	45 in 1143 mm
	Depth	6 in 152 mm	6 in 152 mm	6 in 152 mm	6 in 152 mm	6 in 152 mm	6 in 152 mm
	Weight	39 lb 18 kg	44 lb 97 kg	50 lb 110 kg	58 lb 128 kg	70 lb 154 kg	90 lb 198 kg
Temperature Requirements	Heater Electrical Specification	7 A @ 110 VAC, 5 A @ 220 VAC, 50 or 60 Hz	7 A @ 110 VAC, 5 A @ 220 VAC, 50 or 60 Hz	10 A @ 220 VAC, 50 or 60 Hz	10 A @ 220 VAC, 50 or 60 Hz	10 A @ 220 VAC, 50 or 60 Hz	10 A @ 220 VAC, 50 or 60 Hz
	Membrane Temperature	110 +/-5°F 43 +/- 3°C	110 +/-5°F 43 +/- 3°C	110 +/-5°F 43 +/- 3°C	110 +/-5°F 43 +/- 3°C	110 +/-5°F 43 +/- 3°C	110 +/-5°F 43 +/- 3°C
Input	Operating Pressure	80-170 psi 6-12 bar	80-170 psi 6-12 bar	80-170 psi 6-12 bar	80-170 psi 6-12 bar	80-170 psi 6-12 bar	80-170 psi 6-12 bar
	Maximum Input Pressure	300 psi (21 bar)	300 psi (21 bar)	300 psi (21 bar)	300 psi (21 bar)	300 psi (21 bar)	300 psi (21 bar)
	Supply Air Volume Range	4-15 scfm 106-425 L/min	8-25 scfm 212-708 L/min	13-40 scfm 354-1133 L/min	20-50 scfm 566-1416 L/min	25-80 scfm 708-2266 L/min	40-125 scfm 1133-3540 L/min
	LP / HP Supply Air Quality	LP - Grade D HP - Grade E	LP - Grade D HP - Grade E	LP - Grade D HP - Grade E	LP - Grade D HP - Grade E	LP - Grade D HP - Grade E	LP - Grade D HP - Grade E
Out-put	Nitrox O <sub>2</sub> % Range	24-40%	24-40%	24-40%	24-40%	24-40%	24-40%
<b>Compressor Recommendations</b>							
LP Air Supply Compressor	Delivery @175 PSI for 40% O <sub>2</sub>	9-18 scfm 255-510 L/min	18-30 scfm 510-850 L/min	30-48 scfm 850-1359 L/min	48-60 scfm 1359-1699 L/min	60-96 scfm 1699-2719 L/min	96-150 scfm 2719-4248 L/min
	Horsepower - Electric	3-7.5 hp 2.3-5.6 kW	7.5-10 hp 5.6-7.5 kW	10-15 hp 7.5-11 kW	15-20 hp 11-15 kW	20-30 hp 15-23 kW	40-50 hp 30-38 kW
	Horsepower - Gas	5.5-9 hp 4.1-6.8 kW	11-13 hp 8.3-10 kW	20-24 hp 15-18 kW	N/A	N/A	N/A
	Horsepower - Diesel	5.5-9 hp 4.1-6.8 kW	10 hp 7.5 kW	27 hp 20 kW	27 hp 20 kW	40-50 hp 30-41 kW	54-75 hp 41-56 kW
HP Nitrox Compressor	Charging Rate	3-6 scfm 85-170 L/min	6-10 scfm 170-283 L/min	10-16 scfm 283-453 L/min	16-20 scfm 453-566 L/min	20-32 scfm 566-906 L/min	32-50 scfm 906-1416 L/min
	Horsepower - Electric	3-5 hp 2.3-3.8 kW	5-7.5 hp 3.8-5.6 kW	10-15 hp 7.5-11 kW	15-20 hp 11-15 kW	20-25 hp 15-19 kW	25-40 hp 19-30 kW
	Horsepower - Gas	5.5-6.5 hp 4.1-4.9 kW	6.5-11 hp 4.9-8.3 kW	13-18 hp 10-14 kW	20-24 hp 15-16 kW	N/A	N/A
	Horsepower - Diesel	6-6.7 hp 4.5-5.0 kW	9-10 hp 6.8-7.5 kW	11-18 hp 8.3-14 kW	18-27 hp 14-20 kW	27-35 hp 20-26 kW	35-50 hp 26-38 kW
LP Nitrox Compressor	Delivery @175 PSI	N/A	N/A	10-16 scfm 283-453 L/min	16-20 scfm 453-566 L/min	20-32 scfm 566-906 L/min	32-50 scfm 906-1416 L/min
	Horsepower - Electric	N/A	N/A	5 hp 3.8 kW	7.5 hp 5.6 kW	7.5-10 hp 5.6-7.5 kW	10-15 hp 7.5-11 kW
	Horsepower - Gas	N/A	N/A	9 hp 6.8 kW	11-13 hp 8.3-10 kW	13-18 hp 10-14 kW	20-24 hp 15-18 kW
	Horsepower - Diesel	N/A	N/A	9 hp 6.8 kW	10 hp 7.5 kW	27 hp 20 kW	27 hp 20 kW

## 10.0 Preparing Existing Compressors



### WARNING

Some Compressors are not suitable for compressing oxygen-rich air, i.e., Nitrox. Use of an unsuitable Compressor may lead to possible Compressor damage and/or fires or explosion. This can lead to serious personal injury or death. If there is any doubt regarding the use of an existing Compressor, contact Nuair or the Compressor manufacturer before you connect your Membrane System to your machinery.

### 10.1 Purification System

The purification system on the existing Compressor to which the Membrane System will be installed must produce breathing air appropriate for diving use. LP Compressors must meet the CGA Grade D standard and HP Compressors must meet the Grade E standard. These are the same standards applied to all breathing air compressors. Please make sure you place extra caution on timely replacement of the filters in the purification system to ensure these standards at all times. Specifications for Grade D and E air are provided in the Appendix.

A recent air quality test from your existing Compressor is highly recommended prior to installing the Membrane System. After installation, test a Nitrox sample using the Air/Nitrox Quality Analysis Kit provided. Quarterly testing is mandatory once the System is operational.



### CAUTION

Breathing Air Compressors must produce breathing air appropriate for diving use. Low-Pressure Compressors must meet the CGA Grade D standard and High-Pressure Compressors must meet the Grade E standard. Periodic air quality testing is mandatory to assure compliance

### 10.2 Replacement of Compressor Lubricant

For an existing Compressor to be used with the Membrane System, all traces of old Lubricant must be removed and replaced with Nitrox Compressor Lubricant. Nitrox Compressor Lubricant is compatible with both air and Nitrox.

- 1) Start Compressor and run for 10 minutes to warm Compressor Lubricant. Shut off Compressor, remove Lubricant, and replace Lubricant Filter if any.
- 2) Refill Compressor with the Nuair Air/Nitrox Compressor Lubricant supplied. Do not overfill.
- 3) After 10 hours, repeat Steps 1 and 2.



Nuair™ 455 Premium Synthetic Food Grade Air/Nitrox Compressor Lubricant (Standard)



Nuair™ 751 Premium Synthetic Diester Based Air/Nitrox Compressor Lubricant (Optional)



### CAUTION

After running the Compressor, the Lubricant will be very hot. Take care when removing the drain plug and draining the Lubricant to avoid burns.



## NOTICE

Recommended Nitrox Compressor Lubricant change intervals after the 10-hour flush are at 25, 50, and 100 hours. After reaching 100 hrs, change Lubricant in 100 hour cycles.

## CAUTION

Wear gloves when handling Compressor Lubricant. If contact with skin is made, wash the skin surface with soap and water.

## CAUTION

Always wear goggles when handling Compressor Lubricant. These materials can cause eye irritation. If you accidentally get Lubricant into your eyes, flush with fresh water for 15 minutes and contact a physician if irritation develops.

## CAUTION

Compressor Lubricant should be incinerated after use in a licensed facility in accordance with Federal, State, and local regulations.

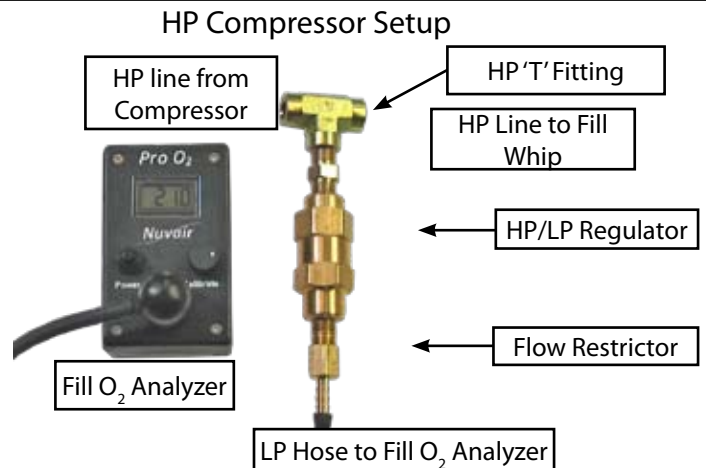
### 10.3 Installation of Fill Oxygen Analyzer

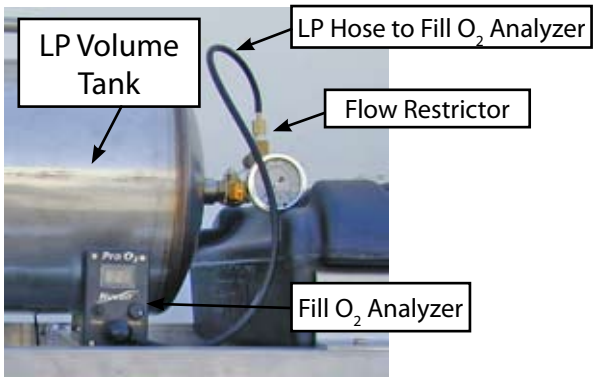
The Fill Oxygen Analyzer is installed where the Nitrox is pumping (Compressor Fill Whip, Fill Panel, etc.) to monitor the final oxygen content. A sample stream of Nitrox is delivered to the Analyzer to provide accurate results and prevent damage to the Analyzer. A Regulator (HP Nitrox Compressor only) and Flow Restrictor are used to control the pressure and flow of the sample stream. After installation, always use the Fill Oxygen Analyzer when pumping Nitrox to ensure proper oxygen content.

## WARNING

Never expose the Oxygen Analyzer sensor to pressures other than ambient or you may damage it and/or cause false readings. A damaged sensor will not provide accurate gas analysis. Inaccurate gas analysis can lead to serious personal injury or death when the gas mixture that was analyzed is used for breathing.

For use on a HP Compressor system, the sample stream is obtained at the Fill Whip location on the Compressor or Fill Panel. Tap into the Fill Whip manifold or install a HP "T" fitting, then attach the inlet of the Regulator/Flow Restrictor Assembly using HP hose and fittings as required (hose and fittings not included). Mount the Fill Oxygen Analyzer in a secure location, then attach the outlet of the Regulator/Flow Restrictor Assembly to the Analyzer using the hose provided.





For use on a LP Compressor system, it is important to sample the final flow just before the diver manifold. The sample stream is typically obtained at the LP Volume Tank output. The stream is routed to the Flow Restrictor and from there to the Fill Oxygen Analyzer. There are a wide variety of LP Compressor systems in use, so contact Nuair for detailed instructions.

## 11.0 Assembling and Installing the Membrane System

### 11.1 Assembly Precautions

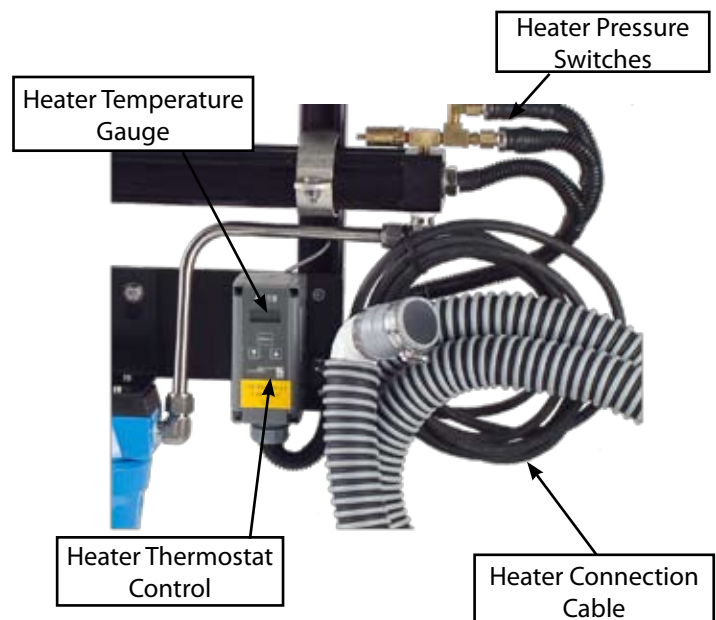
- 1) Please familiarize yourself with the components of the Nitrox Membrane System. Review Sections 6.0, 7.0. and 8.0.
- 2) Unpack the Membrane System and inspect for damage.
- 3) The Membrane System is designed to mount to a wall or bulkhead in a horizontal orientation.
- 4) The Heater Thermostat has been set in the factory. Do not adjust.
- 5) A 13 foot corrugated Compressor Intake Hose has been provided to connect the Membrane System to the Nitrox Compressor intake. If a longer hose is required, the diameter must also be increased. Contact Nuair for assistance.

### 11.2 Mounting the System

- 1) The Membrane System is designed to mount to a wall or bulkhead with the filters in an upright position. Check System Specifications in Section 9.0 to verify weight prior to selecting mounting location and hardware.
- 2) Hold the unit next to the wall where you want to install it and mark the spot to drill the holes.
- 3) Attach the unit to the wall with 4-8 screws that are appropriate for the weight of the unit (39-90 lbs.) and the material of the wall.

### 11.3 Connect Heater to Power Source

- 1) The supply voltage for the Heater is preset and marked on the Thermostat Control. Check System Specifications in Section 9.0 for complete power requirements.
- 2) Connect the Heater to a proper electrical source. Electrical wiring and connections should be made by a qualified electrician in accordance with all national and local electrical codes.
- 3) Temperature is preset at the factory to 110 +/- 5°F (43 +/- 3°C). Changes to the Thermostat Control should not be needed.



## NOTICE

The Heater Pressure Switch will not allow electrical power to flow to the heating element until the Membrane System is pressurized with supply air to a minimum of 80 P.S.I.

## CAUTION

Do not change the temperature setting on the Thermostat Control without contacting Nuair. Changes in temperature settings may cause Membrane damage.

### 11.4 Attaching the Air Supply

Connect the HP or LP supply air to the On/Off Flow Valve, making sure that Flow Valve is turned off.

## CAUTION

The air source for the Membrane System must be CGA Grade D or E quality to prevent damage to the membrane. Specifications for Grade D and E air are provided in the Appendix. Periodic air quality testing is essential.

HP Supply Option



Attach HP Supply Air to On/Off Flow Valve Fitting

LP Supply Option



Attach LP Supply Air to On/Off Flow Valve Fitting

### 11.5 Attaching Compressor Intake Hose

- 1) Only use the corrugated Compressor Intake Hose provided with the Membrane System. . If a longer hose is required, contact Nuair for assistance.
- 2) Attach the Intake Hose to the intake of the Nitrox Compressor and secure with the hose clamp provided.

## CAUTION

Do not use a Compressor Intake Hose longer than 13 feet to connect the Membrane System to the Compressor intake. Use of a longer hose will increase the amount of suction the Compressor must generate which can cause overheating and damage to the compressor.

Attach this end of Compressor Intake Hose to Nitrox Compressor



Secure Hose to Nitrox Compressor intake with Hose Clamp as shown on this Coltri HP Compressor.



## 11.6 Attaching Nitrogen Discharge and Air Intake Hoses (Optional)

The nitrogen discharge from the Membrane System must be isolated from the air intakes of the Membrane System and any nearby Compressor. This requirement will be met if the Membrane System is installed in a well ventilated room that meets industry standards for Compressor installations. If the Membrane System is installed in a closed building, boat, or similar enclosed space, the nitrogen discharge must be vented to the outside. An optional Nitrogen Discharge Hose may be needed. If your installation requires the use of a Nitrogen Discharge Hose, please contact Nuvaire for assistance.

The intake of the Membrane System, like any breathing air compressor, must be protected against the possibility of ingesting carbon monoxide, carbon dioxide, nitrogen, or flammable or toxic fumes. An optional Air Intake Hose may be needed. If your installation requires the use of an Air Intake Hose, please contact Nuvaire for assistance.



**DANGER**

Pure nitrogen is a colorless, odorless, tasteless gas that will not support life. Breathing high concentrations of nitrogen will cause death.



**WARNING**

The nitrogen discharge from the Membrane System should be vented to a well ventilated room or to open air with good circulation. Failure to isolate the discharge from the air intake of the Membrane System or any nearby Compressor could lead to incorrect Nitrox mixtures, resulting in serious personal injury or death. If you allow this pure nitrogen to accumulate in an enclosed space, anyone entering this space will quickly lose consciousness and will die if not immediately resuscitated.

## 11.7 Air/Nitrox Quality Testing

Before using your Membrane System and Compressor to pump Nitrox, test a sample of the Nitrox produced using the Air/Nitrox Quality Analysis Kit provided to verify compliance with CGA standards. Quarterly testing is mandatory once the System is operational.



Air/Nitrox Test Kit

## 12.0 Pre-Operation Instructions

### WARNING

Do not allow Nitrox to be discharged into the air storage system. Nitrox introduced into the air storage system could cause a diver to suffer from oxygen poisoning at depth. Oxygen poisoning is extremely dangerous and can lead to drowning.

### WARNING

Do not allow air to be discharged into the Nitrox storage system. Air introduced into the Nitrox storage system could cause a diver to suffer from decompression sickness if the Nitrox mixture is not analyzed properly before use.

## 12.1 Input Pressure Regulator

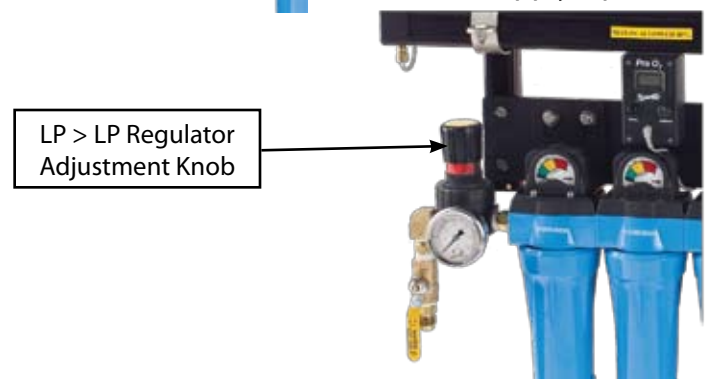
For the HP Supply Option, a HP>LP Regulator is used to reduce supply pressure to a typical Membrane System input pressure range of 80 – 300 P.S.I. For the LP Supply Option, a LP>LP Regulator is used to reduce supply pressure to a typical input pressure range of 80 – 250 P.S.I. Preparation of each regulator is identical:

- 1) Reduce input pressure to minimum pressure setting by turning the Regulator adjustment knob counter-clockwise (CCW) until it spins freely.
- 2) Turn Regulator knob clockwise (CW) until you first feel resistance, which means that the spring is starting to compress.



HP>LP Regulator Adjustment Knob

LP Supply Option



LP > LP Regulator Adjustment Knob



## 12.2 Oxygen Analyzer Calibration

Gas production must be monitored before entering the Nitrox Compressor (Inline Oxygen Analyzer) to obtain a rough estimate of %O<sub>2</sub> and prior to pumping Nitrox into a Scuba cylinder or Surface Supply System (Fill Oxygen Analyzer) for precise %O<sub>2</sub>. Both Oxygen Analyzers must be calibrated prior to each use.

Fill Oxygen Analyzer Provides Precise Reading



Inline Oxygen Analyzer Provides Rough Reading



### WARNING

Oxygen Analyzers must be calibrated before each use. See Oxygen Analyzer manuals for correct calibration procedures. Improper calibration of the Fill Oxygen Analyzer may result in the use of incorrect Nitrox mixtures, which may cause serious injury or death to the diver using the gas mixture.



### WARNING

At altitudes above sea level, a correction factor must be used when calibrating the Fill Oxygen Analyzer may not be achievable. See Fill Oxygen Analyzer manual for correcting Analyzer readings at various altitudes. Improper calibration of the Fill Oxygen Analyzer may result in the use of incorrect Nitrox mixtures, which may cause serious injury or death to the diver using the gas mixture.

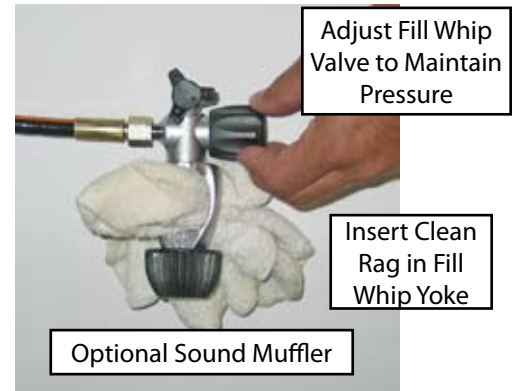


### WARNING

The Inline Oxygen Analyzer supplies oxygen readings that can vary +/- 2% O<sub>2</sub> due to heat, humidity, and pressure changes experienced in the Nitrox flow and therefore should only be used for rough estimates of %O<sub>2</sub>. The Fill Oxygen Analyzer supplies more accurate oxygen readings, within +/- 1% O<sub>2</sub>. For Scuba cylinder Nitrox fills, the user must always verify the final fill with a third independent Oxygen Analyzer.

#### High Pressure Nitrox Compressor System

- 1) Close Membrane System On/Off Flow Valve and return HP>LP Regulator to minimum pressure setting by turning adjustment knob CCW until it spins freely.
- 2) Slightly open fill whip valve on HP Nitrox Compressor to relieve any residual pressure, and then if desired insert clean rag in yoke to act as sound muffler.
- 3) Turn on HP Nitrox Compressor according to manufacturer's instructions.
- 4) Adjust fill whip valve so the running Compressor maintains



1500-2000 P.S.I. outlet pressure. Air will now be flowing past both Oxygen Analyzers for calibration purposes.

- 5) Monitor all gauges for proper operating range and check all connections for leaks.
- 6) Calibrate both Oxygen Analyzers in air while the Nitrox Compressor is pumping air. Refer to Oxygen Analyzer manuals included with Membrane System for details. Note that special calibration procedures may be required when operating at altitudes above sea level.

#### Low Pressure Nitrox Compressor System

- 1) Close Membrane System On/Off Flow Valve and return LP>LP Regulator to minimum pressure setting by turning adjustment knob CCW until it spins freely.
- 2) Slightly open bleed or dump valve on Surface Supply divers manifold to relieve any residual pressure.
- 3) Turn on LP Nitrox Compressor according to manufacturer's instructions.
- 4) Adjust valve flow so the running Compressor maintains 80 – 120 P.S.I. outlet pressure. Air will now be flowing past both Oxygen Analyzers for calibration purposes.
- 5) Monitor all gauges for proper operating range and check all connections for leaks.
- 6) Calibrate both Oxygen Analyzers in air while the Nitrox Compressor is pumping air. Refer to Oxygen Analyzer manuals included with Membrane System for details. Note that special calibration procedures may be required when operating at altitudes above sea level.

## 13.0 Producing Nitrox



### WARNING

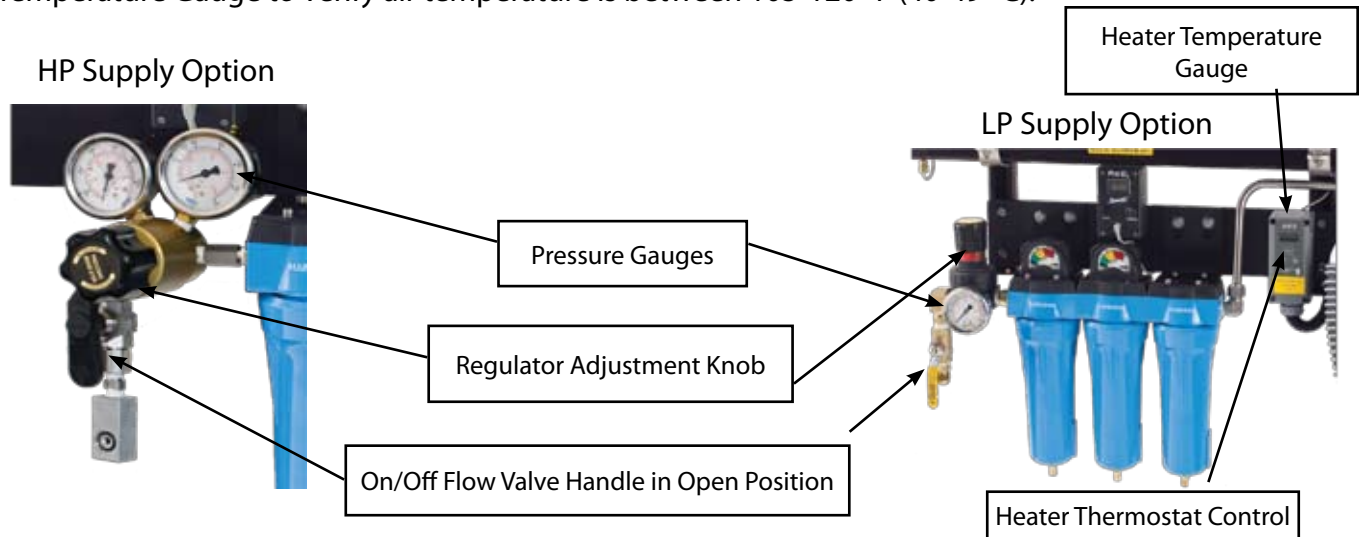
The equipment you will be using to manufacture Nitrox (oxygen rich air) will expose you to both low and high-pressure gas. Gas, even under moderate pressures, can cause extreme bodily harm. Never allow any gas stream to be directed at any part of your body.

The Membrane System can use either a LP source or a HP source of compressed air to produce Nitrox. If the LP Supply Option is used, the LP Compressor must be selected to provide the proper air volume and supply pressure. If the HP Supply Option is used, the Air Storage Bank must be sized to contain the supply air volume required to produce the volume and %O<sub>2</sub> of Nitrox desired. The higher the %O<sub>2</sub> desired in the final product, the greater the volume of Supply Air and the higher the input pressure required, as shown in the example below for a 10 cfm Membrane System:

Nitrox Oxygen Content Desired	Supply Air Volume Required to Produce 1 cu ft Nitrox	Input Pressure Range
32%	1.25 – 1.35 cu ft	90 – 100 P.S.I.
36%	1.60 – 1.70 cu ft	120 – 130 P.S.I.
40%	2.00 – 2.50 cu ft	150 – 165 P.S.I.

## 13.1 Flow to Membrane

- 1) Turn on air supply to Membrane System by opening HP Air Storage supply valve or starting LP Air Compressor according to manufacture's instructions.
- 2) Verify that Oxygen analyzer calibration is complete and Nitrox compressor is running.
- 3) Turn on Membrane System by slowly opening the On/Off Flow Valve.
- 4) Adjust input pressure to approximately 100 P.S.I to activate Heater Pressure Switch. Increase pressure by slowly turning the Regulator knob CW or decrease pressure by turning the knob CCW.
- 5) Verify that Heater Thermostat Control green indicator light is on. The light will remain on until operating temperature is reached and will then cycle on and off. When light turns off, check Heater Temperature Gauge to verify air temperature is between 105-120 °F (40-49 °C).



### CAUTION

The On/Off Flow Valve on the Nitrox Membrane System must be opened slowly. A sudden rush of gas can damage the Membrane and other system components.



### NOTICE

The Heater Thermostat Control green indicator light will stay on until operating temperature is reached.

## 13.2 Setting Proper Pressure

The input pressure to the Membrane System determines the %O<sub>2</sub> of the Nitrox mixture produced. As input pressure is increased, a higher %O<sub>2</sub> Nitrox is pumped. As pressure is decreased, a lower %O<sub>2</sub> Nitrox is pumped.

- 1) Increase input pressure by slowly turning the Regulator knob CW while monitoring the Pressure Gauges and Inline Oxygen Analyzer. As the pressure rises, watch the corresponding increase in the Analyzer %O<sub>2</sub> reading.
- 2) Increase or decrease pressure slowly until the Analyzer displays the %O<sub>2</sub> desired in the final Nitrox mixture.



Inline Oxygen Analyzer





## CAUTION

Do not increase the pressure setting on the input pressure Regulator to pressures above 300 P.S.I. This can cause damage to the Membrane.

### 13.3 Final Adjustments Before Pumping Nitrox

- 1) As the Nitrox initially makes its way through the running Nitrox Compressor, the %O<sub>2</sub> reading on the Fill Oxygen Analyzer will slowly increase to read approximately the same %O<sub>2</sub> as the Inline Oxygen Analyzer. This should happen within 3-5 minutes.
- 2) When the two Analyzers read within +/-1%, make any final adjustments to the Membrane System input pressure necessary to obtain the exact Nitrox %O<sub>2</sub> desired as indicated on the Fill Oxygen Analyzer.
- 3) The system is now ready to pump Nitrox.



Fill Oxygen Analyzer

### 13.4 Pumping Nitrox



## WARNING

The Inline Oxygen Analyzer supplies oxygen readings that can vary +/- 2% O<sub>2</sub> due to heat, humidity, and pressure changes experienced in the Nitrox flow and therefore should only be used for rough estimates of %O<sub>2</sub>. The Fill Oxygen Analyzer supplies more accurate oxygen readings, within +/- 1% O<sub>2</sub>. For Scuba cylinder Nitrox fills, the user must always verify the final fill with a third independent oxygen analyzer.



## WARNING

Do not use this system to produce Nitrox mixtures containing more than 40% oxygen. Pumping Nitrox mixtures with higher concentrations of oxygen may lead to fires or explosions, which can cause serious personal injury or death.



## WARNING

Do not pump Nitrox mixtures at pressures above the compressor manufacturer's rating, and never above 3600 P.S.I. The system is not rated for pressures above 3600 P.S.I. Higher pressures may lead to explosions which may cause serious personal injury or death.



## NOTICE

No oxygen cleaning of standard cylinders or plumbing is mandatory when using the Nitrox Membrane System to produce Nitrox containing a maximum of 40% oxygen. When filling oxygen clean cylinders, hyper-purification of the Nitrox is required using an optional Oxygen Compatible Air purification system available from Nuvaire.



## WARNING

Only provide Scuba cylinder Nitrox fills to customers who have proof of Nitrox training and certification. Improper use of Nitrox can be fatal.



## WARNING

Each Scuba cylinder belonging to a customer must be analyzed by that customer at the Nitrox filling facility, using an oxygen analyzer independent of those used with the Membrane System. An employee must witness that the customer has properly analyzed the gas in each cylinder, noted the maximum operating depth for that mixture, and signed and dated the fill log.

### High Pressure Nitrox Compressor System

- 1) When filling a Scuba cylinder, follow all industry standards. Do not exceed rated pressure of cylinder, and do not exceed 3600 P.S.I. under any condition.
- 2) With fill whip bleed valve open and Nitrox flowing, verify that Fill Oxygen Analyzer %O<sub>2</sub> reading equals the desired Nitrox %O<sub>2</sub>.
- 3) Close bleed valve, open cylinder valve, and fill cylinder. Monitor Oxygen Analyzers recalibrating as required, monitor heater temperature, and manually drain all Compressor condensate periodically or listen for proper operation of auto drains if equipped.
- 4) After filling is complete, close cylinder valve, vent the bleed valve, and remove the cylinder.
- 5) Test the Nitrox %O<sub>2</sub> in the cylinder using an independent Oxygen Analyzer such as the Nuair O<sub>2</sub> Quickstick. Calibrate Analyzer before use in accordance with manufacturer's instructions.
- 6) Repeat steps 1-5 until you have filled all Scuba cylinders.
- 7) Mark each tank with fill date, %O<sub>2</sub>, fill pressure, and MOD (Maximum Operating Depth)
- 8) Log every Nitrox fill to document the following information:
  - Fill date
  - Tank Number
  - Supplier's check of oxygen content (%O<sub>2</sub>) plus signature and date
  - User's check of oxygen content (%O<sub>2</sub>) plus signature and date
  - Fill Pressure
  - MOD (Maximum Operating Depth) in user's handwriting
  - Nitrox certifying agency and card number
- 9) When filling a HP Nitrox storage tank, verify that Fill Oxygen Analyzer %O<sub>2</sub> reading equals the desired Nitrox %O<sub>2</sub>. Open applicable line valves and tank valve, and fill with Nitrox. Do not exceed rated pressure of cylinder, and do not exceed 3600 P.S.I. under any condition. After filling is complete, close all valves.



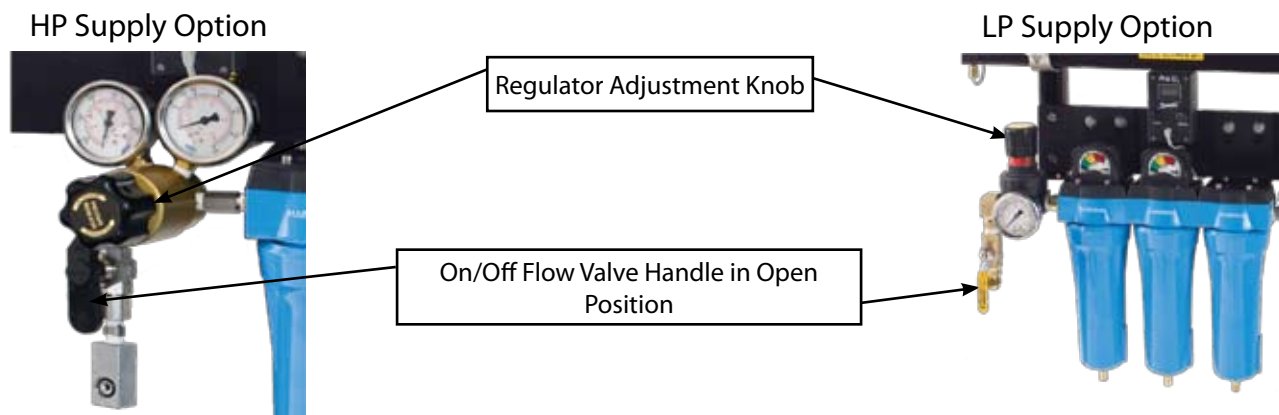
Use Independent Oxygen Analyzer for Verification

### Low Pressure Nitrox Compressor System

- 1) With Nitrox sample stream flowing, verify that Fill Oxygen Analyzer %O<sub>2</sub> reading equals the desired Nitrox %O<sub>2</sub>.
- 2) Begin delivery of Nitrox to divers. Monitor Oxygen Analyzers recalibrating as required, monitor heater temperature, and manually drain all Compressor condensate periodically or listen for proper operation of auto drains if equipped.
- 3) Continuously monitor an independent Oxygen Analyzer for %O<sub>2</sub> of the Nitrox being pumped to the divers. Notify Diving Supervisor immediately if it falls outside established limits. Always have emergency back up breathing gas.

## 13.5 Shutting Down

- 1) Shut off the Nitrox Membrane System by turning the Regulator adjustment knob CCW to reduce input pressure to minimum setting and then closing the On/Off Flow Valve.
- 2) Manually drain all filter, Compressor and tank condensate drains.
- 3) Turn off LP Air Compressor (LP Supply Option) or close HP Air Storage supply valve (HP Supply Option).
- 4) Turn off Nitrox Compressor when it has returned to pumping air, as determined by a Fill Oxygen Analyzer reading close to 20.9% O<sub>2</sub>.



## 14.0 Nitrox Operation Notes

### 14.1 Correlation of Input Pressure to Oxygen Content

After the 10 hour break-in period for your Nitrox Membrane System, you will notice that specific Nitrox %O<sub>2</sub>'s always match specific input pressures once the System has warmed up. These pressures will be repeatable. If you find that the Fill Oxygen Analyzer reads 36% O<sub>2</sub> when the input pressure is at 125 PSI, record this pressure or make a mark on the input pressure gauge indicating the %O<sub>2</sub>. Do this for each %O<sub>2</sub> that you normally make. The next time Nitrox with 36% O<sub>2</sub> is needed, adjust the Regulator to 125 PSI and wait for the Oxygen Analyzer reading to stabilize. You will find the analyzer reading to be very close to 36% O<sub>2</sub>, requiring only minor adjustments of the Regulator to achieve the exact desired O<sub>2</sub>.

### NOTICE

Use the Fill Oxygen Analyzer to verify the Nitrox oxygen percentage prior to pumping. When using the input pressure reading to obtain a specific oxygen percentage, minor adjustments of the input pressure Regulator may be required to obtain the exact percentage desired.

### 14.2 Hot Fills

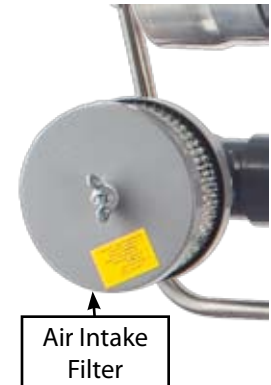
While in the process of filling HP Nitrox Storage Tanks, you may have a need to supply a walk-in customer with a Scuba cylinder fill of a different Nitrox mix. You can change mixes as follows:

- 1) With the Membrane System and Compressor operating, isolate the HP Nitrox Storage Tanks from the Nitrox Compressor by closing appropriate valves.
- 2) Record the Membrane System input pressure reading.
- 3) Slightly open fill whip valve on Compressor and adjust to maintain 1500-2000 P.S.I. outlet pressure.
- 4) Adjust the input Regulator to the pressure corresponding to the desired Nitrox %O<sub>2</sub> for the cylinder.
- 5) Allow the Fill Oxygen Analyzer reading to stabilize, make any minor adjustments necessary to achieve the desired %O<sub>2</sub>, and then fill cylinder in normal manner.

- When finished return Regulator to previous setting, and allow the Fill Oxygen Analyzer reading to stabilize. Make any minor adjustments necessary to achieve the desired %O<sub>2</sub>, and then resume filling Storage Tanks.

## 15.0 Maintenance

- Backup Vapor Filter (HP Supply Option): Change filter element every 200 hours. Contact Nuair for correct element part number.
- Semi-Permeable Membrane: No maintenance required. Service life exceeds 20 years if supply air filters are properly serviced to guarantee CGA Grade D or E standards.
- Air Intake Filter: Inspect every 3 months for visible particles. Change every 12 months or sooner if particles are visible.
- Oxygen Analyzers
  - IT Dr. Gambert (GmbH) Pick O<sub>2</sub>™ Oxygen Analyzer: No maintenance required. Sealed unit that becomes disposable when Oxygen Sensor is exhausted. See manual included with Membrane System.
  - Nuair Pro O<sub>2</sub>™ Oxygen Analyzer: Replace Oxygen Sensor and Battery as required. See manual included with Membrane System.



### DANGER

Do not swallow (ingest) either the electrolyte from the Oxygen Sensor or the Sensor itself. The Potassium Hydroxide chemical contained in the Sensor can cause severe injury or death. If electrolyte or the Sensor is swallowed, seek medical attention immediately.

### DANGER

If after handling the Oxygen Analyzer or Sensor, you find that your fingers or other parts of your body feel “slippery” or the skin or eyes sting, immediately flush affected area with clean, fresh water for at least 15 minutes. The stinging or slippery sensation is an indication of a leaking Sensor. The Potassium Hydroxide chemical contained in the Sensor can cause severe injury or death. Seek immediate medical attention if eye contact is made or skin stinging persists

The following items are not integral parts of the Membrane System, but proper maintenance is required to assure optimum performance of the Membrane System.

- Compressor Lubricant: Change Compressor Lubricants in accordance with manufacturer’s guidelines. Never mix Compressor Lubricants. For Nitrox Compressors, only use Lubricants rated for use with Nitrox.
- Supply Air Filters: When using the LP Supply Option, LP Filter Elements must be changed periodically in accordance with LP Supply System manual. When using the HP Supply Option, no additional action is required other than proper HP Breathing Air Filter maintenance.
- Breathing Air Filters: Change Nitrox Compressor Filter Elements in accordance with manufacturer’s guidelines to maintain CGA Grade D or E breathing air standards.
- Air/Nitrox Quality Analysis: Take breathing air/Nitrox samples quarterly for analysis to assure compliance with CGA Grade D or E breathing air standards.

## 15.1 Spare Parts List

Membrane System Components	Type	Part Number
HP Supply Backup Vapor Filter Element	Norgren F74V (old)	4341-01
	Hankison (old)	E1-20
	Hankison HF 1-20 (new)	E1-20
	Hankison HF 1-24	E1-24
Heater Assembly	1200 Watt, 28" Length	H1200
	2400 Watt, 38" Length	H2400
Heater Thermostat Control	110V/220V	A419
Heater Pressure Switch		3100-052
Membrane	215 Series	NUV215
	230 Series	NUV230
	250 Series	NUV250
Air Intake Filter Element	6 CFM	SC000345
	10-16 CFM	16CP
	20-50 CFM	20CP
Mixing Tube Assembly	Specify Length and Diameter	
Oxygen Analyzer	Pick O <sub>2</sub>	PIC02
	Pro O <sub>2</sub>	9450
	Pro O <sub>2</sub> Remote	9452
Oxygen Sensor	See Analyzer Owners Manual	
Compressor Hose Coupler	1-1/4"-1-1/2" to 1-1/4"-1-1/2"	PTC-150
	1-1/4"-1-1/2" to 1-1/2"	RDTC40X32
	1-1/2" to 2"	RC50X40
<b>Related Equipment Components</b>		
LP Supply Air Filter Element	Norgren B74G (old)	4338-04
	Norgren F74H (old)	4344-02
	Norgren F74V (old)	4341-01
	Hankison HF 7-20	E7-20
	Hankison HF 5-20	E5-20
	Hankison HF 1-20	E1-20
	Hankison HF 7-24	E7-24
	Hankison HF 5-24	E5-24
	Hankison HF 1-24	E1-24
Air/Nitrox Quality Analysis Kit	Specify: (1) CGA Grade Required (2) Single Use or Program Use	
Air/Nitrox Compressor Lubricant		
Reciprocating Compressor, Food Grade	Nuvair 455, 1 Gal	9406
Reciprocating Compressor, Diester Based	Nuvair 751, 1 Gal	9403
Rotary Screw Compressor, Food Grade	Nuvair 546, 1 Gal	9409
	(Other Sizes Available)	

## 15.2 Service Record Log

Date	Technician Name	Service Performed

## Supply and Breathing Air Specifications

All supply and breathing air must meet the following requirements of CGA G-7.1-1997. Supply air delivered to the Nitrox Membrane System must be purified to meet Grade D or E quality, and periodic air quality testing to assure compliance is recommended. All breathing air for diving produced by the downstream Compressor must be purified to meet Grade E quality, and periodic air quality testing to assure compliance is mandatory.

Item	Grade D	Grade E
Oxygen	19.5-23.5%	20-22%
Carbon Dioxide (maximum)	1000 PPM	1000 PPM
Carbon Monoxide (maximum)	10 PPM	10 PPM
Hydrocarbons (maximum)	Not specified	25 PPM
Water Vapor (maximum)	Not specified	Not specified
Dew Point (maximum) (1)	Not specified	Not specified
Oil & Particles (maximum) (2)	5 mg/m3	5 mg/m3
Odor	None	None

(1) Dew Point of supply air must be  $>10^{\circ}\text{F}$  ( $6^{\circ}\text{C}$ ) colder than coldest ambient air expected

(2) Supply air delivered to the Membrane System must contain  $<.003$  PPM Oil Vapor

All breathing Nitrox produced for diving must be purified to meet these same requirements, except for oxygen content. Nitrox oxygen content must measure within  $\pm 1\%$   $\text{O}_2$  of the specified value of the mixture using a properly calibrated Oxygen Analyzer (i.e. Nitrox produced with a target content of  $32\%$   $\text{O}_2$  must measure in the range of  $31\text{-}33\%$   $\text{O}_2$ ). Periodic air quality testing to assure compliance is mandatory.

Manual Updates		
Date	Name	Description of Change
12/01/2011	JF	Update of photos to Current Membranes
12/01/2011	JF	Updated MSD Sheets



## Material Safety Data Sheets

### Nuvair™ 455 Premium Synthetic Food Grade Air/nitrox compressor lubricant

Effective Date: 03/19/2010

#### I. Product Identification:

Trade Name: ..... Nuvair 455  
Chemical Name: ..... Polyalphaolefin  
Chemical Family: ..... Synthetic hydrocarbons/Esters

#### II. Components & Hazard Statement:

**This product is non-hazardous.** This material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

#### III. Physical Data:

Viscosity: ..... 100 cst. @40°C  
Specific Gravity (Water = 1.0): ..... 0.85  
Boiling Point: ..... N.A.  
Vapor Pressure: ..... Negligible  
Appearance & Odor: ..... Clear – with mild odor  
Solubility in Water: ..... Negligible

#### IV. Fire & Explosion Hazard Data:

Flash point: ..... 464°F / 24°C/ COC  
Auto ignition Temperature: ..... Not Established  
Flammability Limits: ..... Not Established  
Extinguishing Media: ..... Dry Chemical; CO2 Foam; Water Spray  
Special Fire Fighting Procedure: ..... Burning may produce irritating/noxious fumes. Firefighters should use NIOSH/MNSA approved self-contained breathing apparatus. Use water to cool fire-exposed containers to prevent pressure build-up.

#### V. Reactivity Data:

Stability: ..... This product is stable and will not react with water.  
Materials to Avoid: ..... Avoid contact with strong oxidizing agents, strong acids and strong alkalis.  
Hazardous Decomposition Products: ..... None under normal use.

#### VI. Health Information:

Eye Contact: ..... Flush eyes with water for 15 minutes. Call physician if irritation develops.  
Skin Contact: ..... Wash skin with soap and water.  
Inhalation: ..... Remove to fresh air.  
Ingestion: ..... First aid not normally required. If uncomfortable, call physician.

#### VII. Health Hazard Data:

Exposure Limit: ..... Not Applicable  
Effects of Overexposure: ..... Low oral and dermal toxicity. Prolonged or repeated exposure may cause irritation, nausea, and vomiting.

#### VIII. Employee Protection:

For general personal hygiene, wash hands thoroughly after handling material. Avoid contact with skin and eyes. Chemical impervious gloves are not required, but may be recommended for prolonged exposure. Use in a well ventilated area.

#### IX. storage, Spill, & Disposal Procedures:

storage: ..... Store in clean, dry area.  
Spills: ..... Use absorbent materials to soak up fluid.  
Disposal: ..... Incinerate this product and all associated wastes in a licensed facility in accordance with Federal, state, and local regulations.

#### X. Hazard Rating Information:

NFPA Health: ..... 0  
Flammability: ..... 1  
Reactivity: ..... 0  
Personal Protection: ..... B

This information contained herein is based on the data available to us and is believed to be true and accurate. Nuvair makes no warranty, expressed or implied, regarding the accuracy of this data or the results to be obtained from the use thereof. Nuvair assumes no responsibility for injury from the use of this product.



## Material Safety Data Sheet

Nuvair™ 751 Premium Synthetic Diester Based Air/nitrox compressor lubricant

Effective Date: 3/10/2010

Supercedes:

### I. Product Identification:

Trade Name: ..... Nuvair 751  
Chemical Name: ..... Diester  
Chemical Family: ..... Diester

### II. Components & Hazard Statement:

**This product is non-hazardous.** This material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

### III. Physical Data:

Viscosity: ..... 146 cst. @40°C  
Specific Gravity (Water = 1.0): ..... 0.94  
Boiling Point: ..... Not determined  
Vapor Pressure: ..... Negligible  
Appearance & Odor: ..... Amber / mild odor  
Solubility in Water: ..... Negligible  
Other Data: ..... Non-toxic USDA H-2 approved

### IV. Fire & Explosion Hazard Data:

Flash point: ..... 520°F / 271°C COC ASTM D-92  
Autoignition Temperature: ..... 765°F ASTM D-2155  
Flammability Limits: ..... Not Established  
Extinguishing Media: ..... Dry Chemical; CO2 Foam; Water Spray  
Special Fire Fighting Procedure: ..... Burning may produce irritating/noxious fumes. Firefighters should use NIOSH/MNSA approved self-contained breathing apparatus. Use water to cool fire-exposed containers to prevent pressure build-up.

### V. Reactivity Data:

Stability: ..... Stable under normal conditions.  
Materials to Avoid: ..... Avoid contact with strong oxidizing agents, strong acids and strong alkalis.  
Hazardous Decomposition Products: ..... None under normal use.

### VI. Health Information:

Eye Contact: ..... Flush eyes with water for 15 minutes. Call physician if irritation develops.  
Skin Contact: ..... Wash skin with soap and water.  
Inhalation: ..... Remove to fresh air.  
Ingestion: ..... First aid not normally required. If uncomfortable, call physician.

### VII. Health Hazard Data:

Exposure Limit: ..... Not Applicable  
Effects of Overexposure: ..... Low oral and dermal toxicity. Prolonged or repeated exposure may cause irritation, nausea, and vomiting.

### VIII. Employee Protection:

For general personal hygiene, wash hands thoroughly after handling material. Avoid contact with skin and eyes. Chemical impervious gloves are not required, but may be recommended for prolonged exposure. Use in a well ventilated area.

### IX. storage, Spill, & Disposal Procedures:

Storage: ..... Store in clean, dry area.  
Spills: ..... Use absorbent materials to soak up fluid.  
Disposal: ..... Incinerate this product and all associated wastes in a licensed facility in accordance with Federal, state, and local regulations.

### X. Hazard Rating Information:

NFPA Health: ..... 0  
Flammability: ..... 1  
Reactivity: ..... 0  
Personal Protection: ..... B

This information contained herein is based on the data available to us and is believed to be true and accurate. Nuvair makes no warranty, expressed or implied, regarding the accuracy of this data or the results to be obtained from the use thereof. Nuvair assumes no responsibility for injury from the use of this product.

## OWNER'S WARRANTY RESPONSIBILITIES

Failure of the owner to prevent equipment damage by complying with the procedures outlined below and in the Operation Manual will void the Nitrox Membrane System warranty.

### Installation:

- All set up requirements and procedures provided in the Nitrox Membrane System Operation Manual must be followed in their entirety including supply air cleanliness, Compressor preparation, and assembly and installation of the Membrane System.
- Supply air to the Membrane System must be properly filtered to CGA Grade D or E air quality to prevent damage to the Membrane. Prior to installing the Membrane System, an air quality test of the supply air should be performed and documented to assure compliance. During operation, testing should be repeated periodically.
- If there is any doubt regarding the suitability of a Compressor for compressing Nitrox, contact Nuair or the Compressor manufacturer before you connect your Membrane System.
- If an existing Compressor is to be used for compressing Nitrox, all traces of the old Lubricant must be removed and replaced with a Nitrox Compressor Lubricant approved by Nuair.
- To prevent Membrane damage, the Membrane System must be mounted with all filters in an upright position to assure proper filtration and draining of condensate.
- Electrical wiring and connections should be made by a qualified electrician in accordance with all national and local electrical codes.
- Do not change the temperature setting on the Heater Thermostat Control. Changes in temperature settings may cause Membrane damage.
- To prevent Compressor damage, only use the Compressor Intake Hose provided. If a longer hose is required, contact Nuair for assistance.

### Operation:

- To prevent Membrane damage, do not increase the pressure setting on the input pressure Regulator above 300 P.S.I.
- Do not use the Membrane System to supply a Compressor with Nitrox mixtures containing more than 40% oxygen. Compressing higher concentrations of oxygen may cause severe Compressor damage.
- Do not pump Nitrox mixtures at pressures above the compressor manufacturer's rating, and never above 3600 P.S.I. Compressing Nitrox at higher pressures may cause severe Compressor damage.
- To prevent Membrane damage, drain all low pressure filter and volume tank condensate on a daily basis.

### Maintenance:

- Change supply air filter elements on a schedule determined by filter capacity and ambient temperature and humidity. Contact Nuair if you need assistance establishing a schedule for your equipment and location.
- Replace Membrane System Air Intake Filter on a regular basis to prevent flow obstruction.
- Keep all nuts, bolts, fittings, connectors, and clamps tight.
- Keep a service record book showing that regular maintenance work has been carried out. If a warranty claim becomes necessary, it will aid in demonstrating that damage has not been caused by insufficient maintenance. Proof of maintenance may be required prior to determining the validity of a warranty request

# NUVAIR NITROX MEMBRANE SYSTEM WARRANTY

NUVAIR extends a limited warranty, which warrants the Nitrox Membrane System to be free from defects in materials and workmanship under normal use and service for a limited period. The specific Membrane Component of the Nitrox Membrane System is warranted according to the pro-rated terms as set forth below. All other Original Equipment Manufacturer (OEM) components used in the system are warranted only to the extent of the OEM's warranty to NUVAIR. NUVAIR makes no warranty with respect to these OEM components, and only warrants the workmanship that NUVAIR has employed in the installation or use of any OEM component. This warranty is not transferable.

NUVAIR will, at its discretion and according to the terms as set forth within, replace or repair any materials which fail under normal use and service and do not exhibit any signs of improper maintenance, misuse, accident, alteration, weather damage, tampering, or use for any other than the intended purpose. Determination of failure is the responsibility of NUVAIR, which will work together with the customer to adequately address warranty issues. When any materials are repaired or replaced during the warranty period, they are warranted only for the remainder of the original warranty period. This warranty shall be void and NUVAIR shall have no responsibility to repair or replace damaged materials resulting directly or indirectly from the use of repair or replacement parts not approved by NUVAIR.

### Pro-Rated Terms:

NUVAIR warrants the Membrane Component of the Nitrox Membrane System to be free from defects in material and workmanship for a period of thirty-six (36) months from date of installation or forty-two (42) months from date of shipment by NUVAIR, whichever may occur first. The warranty covers parts only and is prorated as follows:

- First Year ..... Repair or replacement free of charge
- Second Year..... Warranty allowance of 70% of the current Membrane Component list price
- Third Year ..... Warranty allowance of 40% of the current Membrane Component list price

A warranty registration card, supplied with system documentation, must be filled out and submitted to NUVAIR for the warranty to be in full effect. If the warranty registration card is not received within thirty (30) days of installation, the thirty-six (36) month warranty will begin with the date of shipment from NUVAIR.

### Maintenance Items:

Any materials which are consumed, or otherwise rendered not warrantable due to processes applied to them, are considered expendable and are not covered under the terms of this policy. This includes maintenance and consumable items listed as part of a suggested maintenance program included with system documentation.

### Return Policy:

Application for warranty service can be made by contacting NUVAIR during regular business hours and requesting a Return Material Authorization number. Materials that are found to be defective must be shipped, freight pre-paid, to the NUVAIR office in Oxnard, California. Upon inspection and determination of failure, NUVAIR shall exercise its options under the terms of this policy. Warranty serviced materials will be returned to the customer via NUVAIR's preferred shipping method, at NUVAIR's expense. Any expedited return shipping arrangements to be made at customer's expense must be specified in advance.

### Limitation of Warranty and Liability:

Repair, replacement or refund in the manner and within the time provided shall constitute NUVAIR'S sole liability and the Purchaser's exclusive remedy resulting from any nonconformity or defect. NUVAIR shall not in any event be liable for any damages, whether based on contract, warranty, negligence, strict liability or otherwise, including without limitation any consequential, incidental or special damages, arising with respect to the equipment or its failure to operate, even if NUVAIR has been advised of the possibility thereof. NUVAIR makes no other warranty or representation of any kind, except that of title, and all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, are hereby expressly disclaimed. No salesman or other representative of NUVAIR has authority to make any warranties.



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