



User Manual

**EK76>Q325 LP**  
**Diesel or Electric**

**Nitrox System**

Revision 05.19

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## **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.**

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 Nuvair at 1-805-815-4044 for information.

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**Separate Manuals Included:**

- Nuvair Pro O<sub>2</sub> Oxygen Analyzer Operation Manual
- Quincy 325 Compressor Operation & Maintenance Instructions
- Kohler 9LD626-2 28.5 hp Manual
- Kubota Diesel Manual
- WEG Electric Motor Manual

## 1.0 Introduction

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.

This manual will assist you in the proper set-up, operation and maintenance of the Nuvair EK76>Q325 LP Nitrox System. 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

### 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 gas mixtures containing more than 84% nitrogen at surface pressures will lead to unconsciousness and may 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. Breathing gas mixtures containing more than 84% nitrogen at surface pressure will lead to unconsciousness and may cause death.

### 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. Remove all 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

The use of enriched air Nitrox does not eliminate the risk of decompression sickness (DCS) in diving. Decompression sickness can lead to permanent disability or death.

 **Warning**

Do not pump Nitrox mixtures at pressures above the HP Compressor manufacturer's rating, and never above 3600 psi (250 bar). The system is not rated for pressures above 3600 psi (250 bar). Higher pressures may lead to explosions which may cause serious personal injury or death.

 **Caution**

Ambient room temperature should never exceed 100°F (38°C) during operation of the Nitrox System. Operation at higher temperatures may lead to system damage and malfunction. A damaged membrane will not produce the correct Nitrox mixture which can lead to severe personal injury if the gas is used for diving purposes without proper analysis.

## **2.0 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 Nitrox 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. "Tag Out" or "Lock Out" all power sources.
- 7) Do not attempt to remove any parts without first relieving the entire system of pressure.
- 8) Do not attempt to service any part while System is in an operational mode.
- 9) Do not operate the 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 Nitrox System.
- 13) Do not use flammable solvents for cleaning the Air Inlet Filters or elements 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 in areas where there is a possibility of inhaling 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, or direct air stream at body, this can cause injuries.
- 21) Compressed air from this machine absolutely must not be used for food processing or breathing air without the properly maintained downstream filters, purifiers, 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 Nuair is hereby warned that failure to follow the preceding Safety and Operation Precautions can result in injuries or equipment damage. However, Nuair 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.

### **3.0 Legal Precautions**

It is highly recommended that a Nitrox log be maintained when using Nitrox on a job site to document the following information. This log must be of permanent binding style with no loose pages.

- ◆ Date and time of day
- ◆ Job Name & 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
- ◆ MOD (Maximum Operating Depth) in user's handwriting

Proper air/Nitrox gas analysis tested on a quarterly basis and comprehensive maintenance is the best way to assure proper, safe, and economical Nitrox production.



## 4.0 System Overview

The EK76>Q325 LP Nitrox package is designed to be portable yet rugged and open with good access to components, yet good moving part protection while it is running. This package is for use to supply low pressure surface supplied Nitrox or air direct to divers.

The operator should be able to produce Nitrox with a minimum of start-up hassles.

### LP>LP Nitrox:

- 1 x 250 Semi-permeable Membrane
- (2) O<sub>2</sub> Analyzers
- Air Supply and Regulated Air Input Gauges
- BP Regulator for adjusting O<sub>2</sub>% and air volume pumped by the EK76 compressor
- Air Intake Filter & Static Mixing Tube
- Hankison Series 20 LP Filtration to .003 PPM Oil Vapor and a 2<sup>nd</sup> set for divers
- Nuvair 455 FDA Approved Food Grade Compressor Lubricant in Q325 and Nuvair 546 in EK76 Rotary Screw compressor
- Aluminum Frame with Stainless Steel Compressor Plate
- Vibration Isolation Mounts
- 1 x Low-pressure Two Stage Compressor
- 1 x Low-pressure Rotary Screw Compressor
- 2 x 30 Gallon ASME LP Volume Tank with Drain & Gauges (Optional 2 x 60 gallon tanks)
- 2 x Air Cooler, 1x Oil Cooler
- Kohler Diesel, Kubota Diesel or WEG TEFC Electric Motor 25 hp

### Specifications:

- ◆ Produces 24% -40% Nitrox @ 17 cfm
- ◆ Upgraded Purification
- ◆ Mix Accurate To 1/10<sup>th</sup> Percent

### Low Pressure Feed Air Compressor Technical Data:

- LP Screw Compressor – using 18hp–34 cfm @175 psi
  - Maximum Block Output Pressure: 193 psi
  - Maximum Block Rated Output 58 cfm
  - Final System Discharge Pressure: 80-185 psi
  - Modulation Intake device
  - Rotary Screw Compressor
  - Lubricant: Nuvair 546
  - Condensate Drain Manual
  - Supplying Grade D Air to Membrane

## Final Low Pressure Nitrox/Air Compressor Technical Data:

- LP Compressor – 5hp–17 cfm @ 200 psi
  - Maximum Block Output Pressure: 200 psi
  - Maximum Block Rated Output: 18.64 cfm @ 175 psi
  - Final System Discharge Pressure: 155-200 psi
  - Dual Control Head unloaders
  - Number of Stages: 2
  - Number of Cylinders: 2
  - Package Free Air Delivered Max: 17 SCFM @ 40% O<sub>2</sub>
  - Lubricant: Nuvair 455
  - Condensate Drain: Manual
- ◆ Weight: 1450 lbs.(Electric) 2,650 lbs (Diesel)
- ◆ Dimensions (L x W x H): 76 x 38 x 66 in (Electric) 82 x 50 x 77 in (Diesel)

## Suggested Maintenance Intervals:

- Replace Nuvair 455 Lubricant: in Q325 200 Hours or yearly
- Replace Nuvair 546 Lubricant in EK76 Rotary Screw 2000 Hours or yearly
- LP Filtration Elements 100 Hours or yearly
- Refrigerated Air Dryer (option) LP Filter life extended to 250 Hours or yearly
- Replace Oil Filters (including internal) Annually

*(Nuvair recommends checking LP filter elements for moisture and proper operation daily.)*

## Typical Specification For Grade D Air:

- O<sub>2</sub> Percentage: 20-22
- CO<sub>2</sub>: 1000 PPM
- CO: 10 PPM
- Hydrocarbons: 25 PPM
- Odor: None

## Membrane Technical Data:

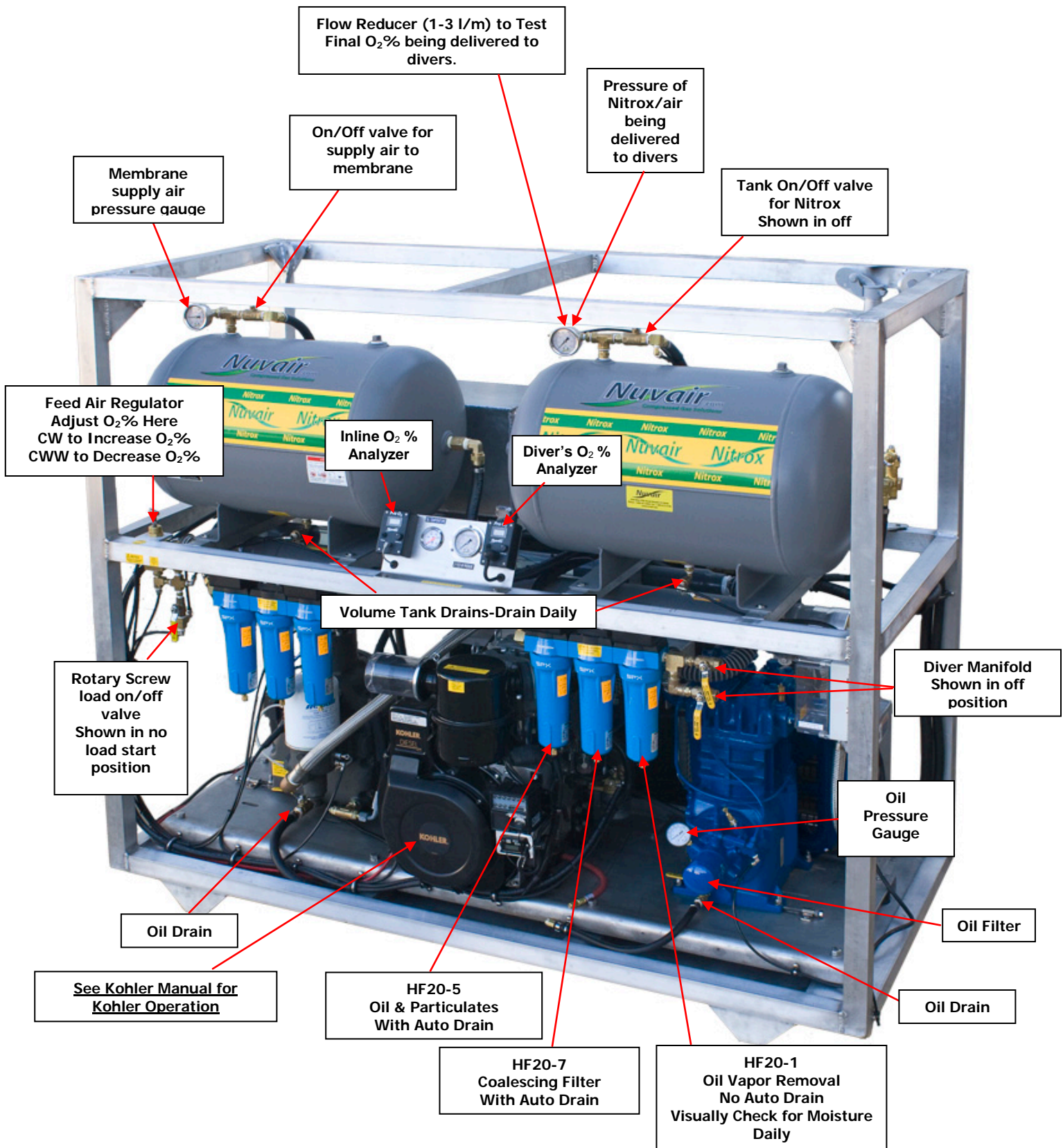
- ◆ Membrane Operating Temperature Range 90-120 Fahrenheit
- ◆ Input Operating Pressure Range: 100 - 300 psi
- ◆ Input Gas Composition: Grade D Air
- ◆ Input Gas Consumption: 20-34 SCFM
- ◆ Output Gas Delivery to Nitrox Compressor: Nitrox: 24% - 40%
- ◆ Lubricant: Nuvair 455 & 546

## **System Overview:**

The **EK76>Q325 LP** Nitrox production system is a self-contained, portable, low pressure delivery package capable of supplying Nitrox in oxygen percentages between 24% and 40% to the intake of the Q325 compressor. The Q325 compressor compresses this Nitrox for the diver's use.

The system utilizes two low-pressure compressors that are mounted together with 28.5 hp Kohler Diesel Engine, 37.4 hp Kubota Diesel Engine, or 25 hp WEG electric motor, and a permeable membrane system in a rigid, aluminum frame. The system components include: BP pressure regulator, low pressure air filtration, gas stream temperature stabilizer (heater), permeable membrane, mixing tube, air intake filter, in line sensor/o<sub>2</sub> analyzer, compressor intake porting and two low-pressure compressors. All of the component assemblies and parts are mounted to facilitate easy set-up, operation and transport.

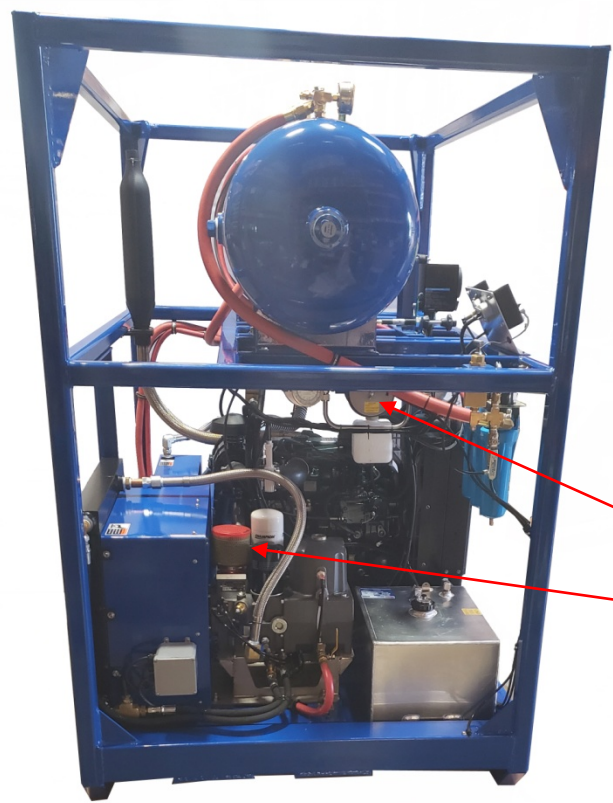
5. EK76>Q325 LP System Component Identification  
Kohler Diesel EK76>Q325



Diesel Exhaust.  
Keep exhaust away  
from compressor air  
intakes.  
Increase height if  
necessary  
**CO in Exhaust Can Kill**



Oil/Air cooler



Compressor Air  
Intakes. **Do not  
allow intakes to  
suck in exhaust  
from diesel.**  
Run separate  
suction hoses  
away from  
compressor if  
necessary.



**Kubota Diesel EK76>Q325**

Diesel Exhaust  
Keep exhaust away from  
compressor air intakes.  
Increase height if necessary  
**CO in Exhaust Can Kill**



Kubota Ignition and  
Engine Light Panel

Kubota Throttle  
Pull/Push Type

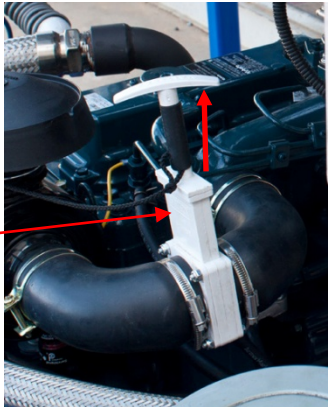
See Kubota Manual for  
Kubota Operation

Battery

Diesel Fuel Filter

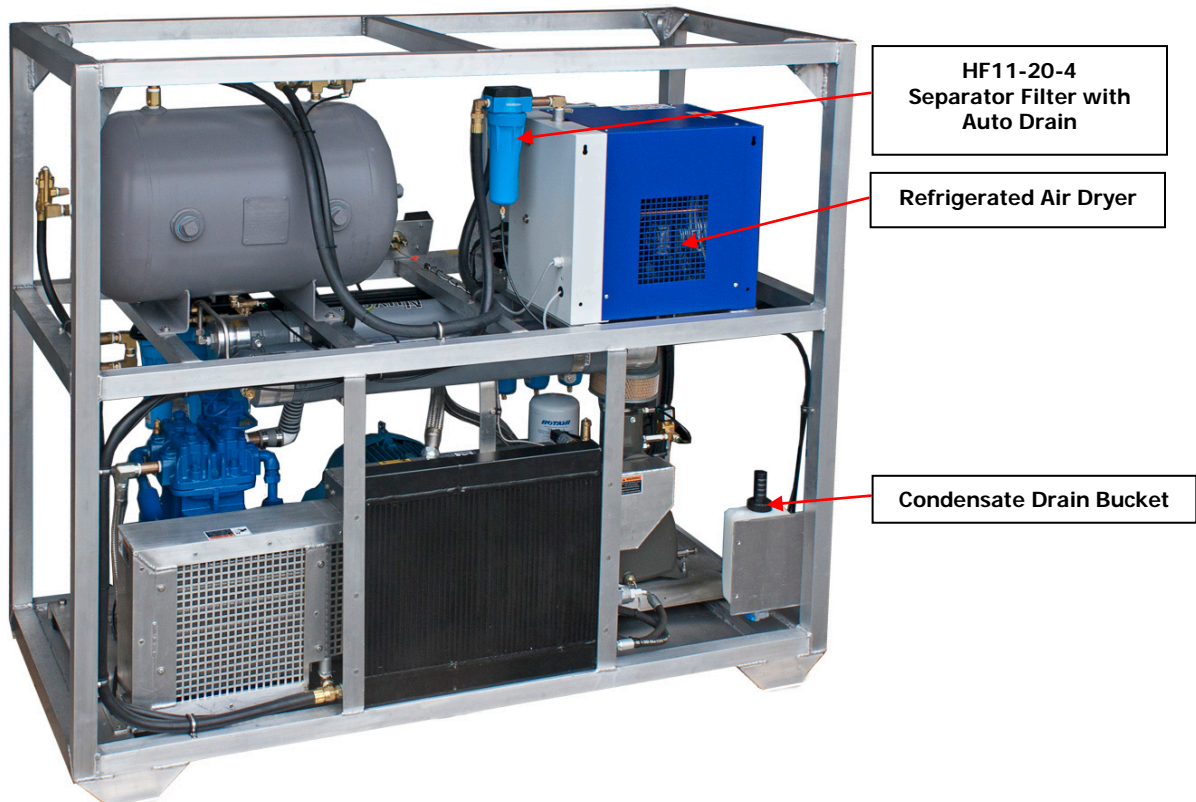
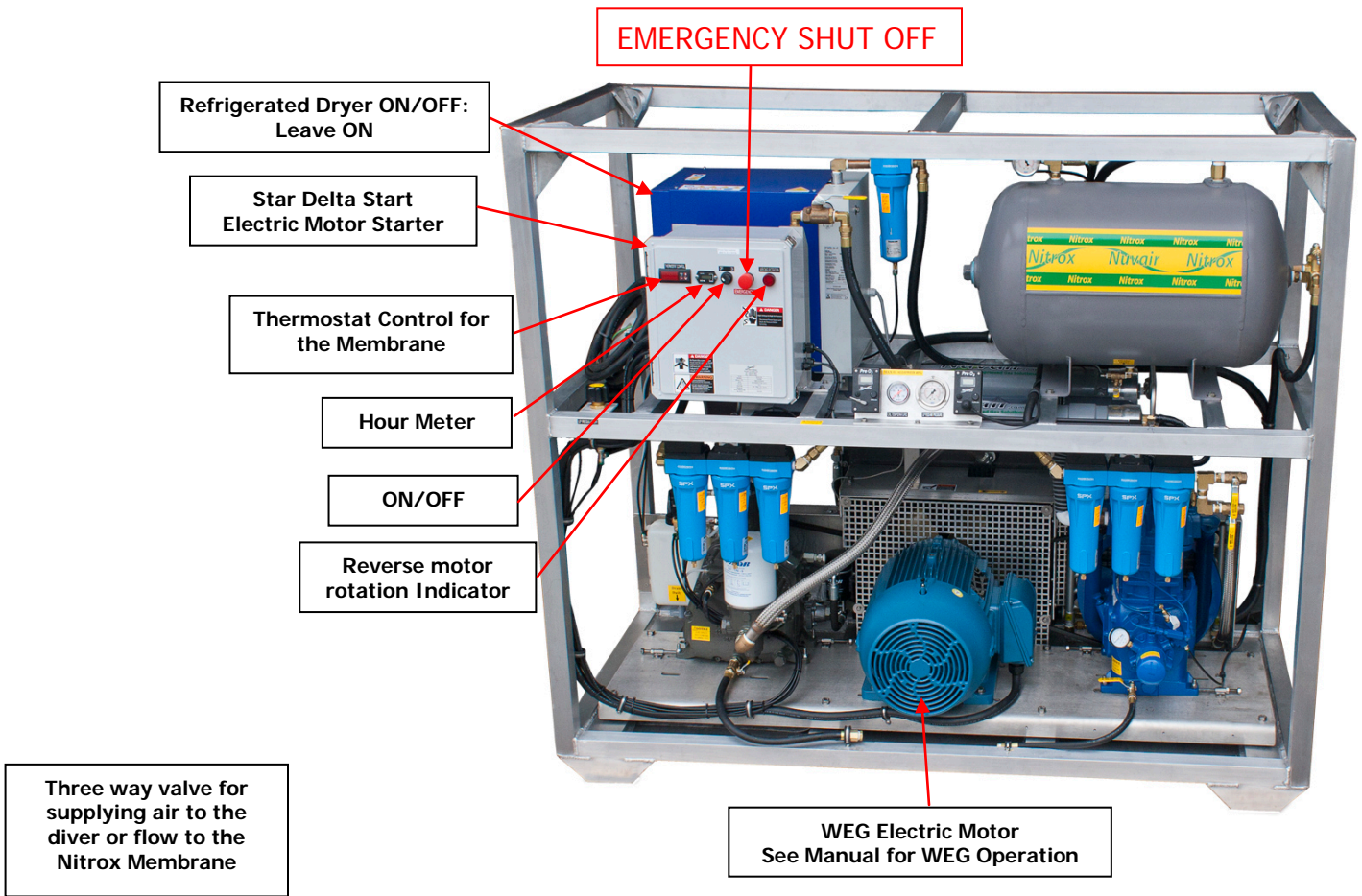
Diesel Fuel Pump

Fuel Tank  
Diesel Only



**Emergency Diesel Shut Off  
MUST BE in the OPEN (up)  
position to start motor**

**Electric EK76>Q325 with Refrigerated Air Dryer**



## **6.0 Theory of Operation:**

The EK76>Q325 LP is a turnkey package that produces oxygen-rich air (Nitrox) at low pressure of up to 200 psi for surface supply to divers.

The Nitrox System allows for efficient and cost effective Nitrox production without the hazards or expense of blending with stored high-pressure oxygen (O<sub>2</sub>). Instead, the system uses a Semi-Permeable Membrane to produce Nitrox from air. A portion of the nitrogen in air is separated out, leaving an oxygen rich Nitrox mixture.

The Nitrox System uses 2 x Low Pressure Compressors, 2 x Air Aftercoolers, 1 x oil cooler, 2 x Volume Tanks \*, and Filtration to provide the Membrane System with a source of clean, pressurized air for separation. The air is filtered to CGA Grade D air quality prior to entering the Membrane System so it will not damage or plug the Membrane fibers. Specifications for Grade D air are provided in the Appendix. It is then compressed for surface supply to divers.

The Membrane System is rated for a maximum supply pressure of 300 psi. (20 bar) and works well with the 200 psi (13.8 bar) maximum pressure from the LP Supply Compressor. A Back Pressure Regulator controls the amount of air and therefore the pressure that is pumped by the EK76 Rotary Screw Compressor. The air is cooled, filtered and then heated to a temperature that provides stability over a wide range of ambient conditions is optimal for membrane permeation and provides protection to the membrane from condensate.

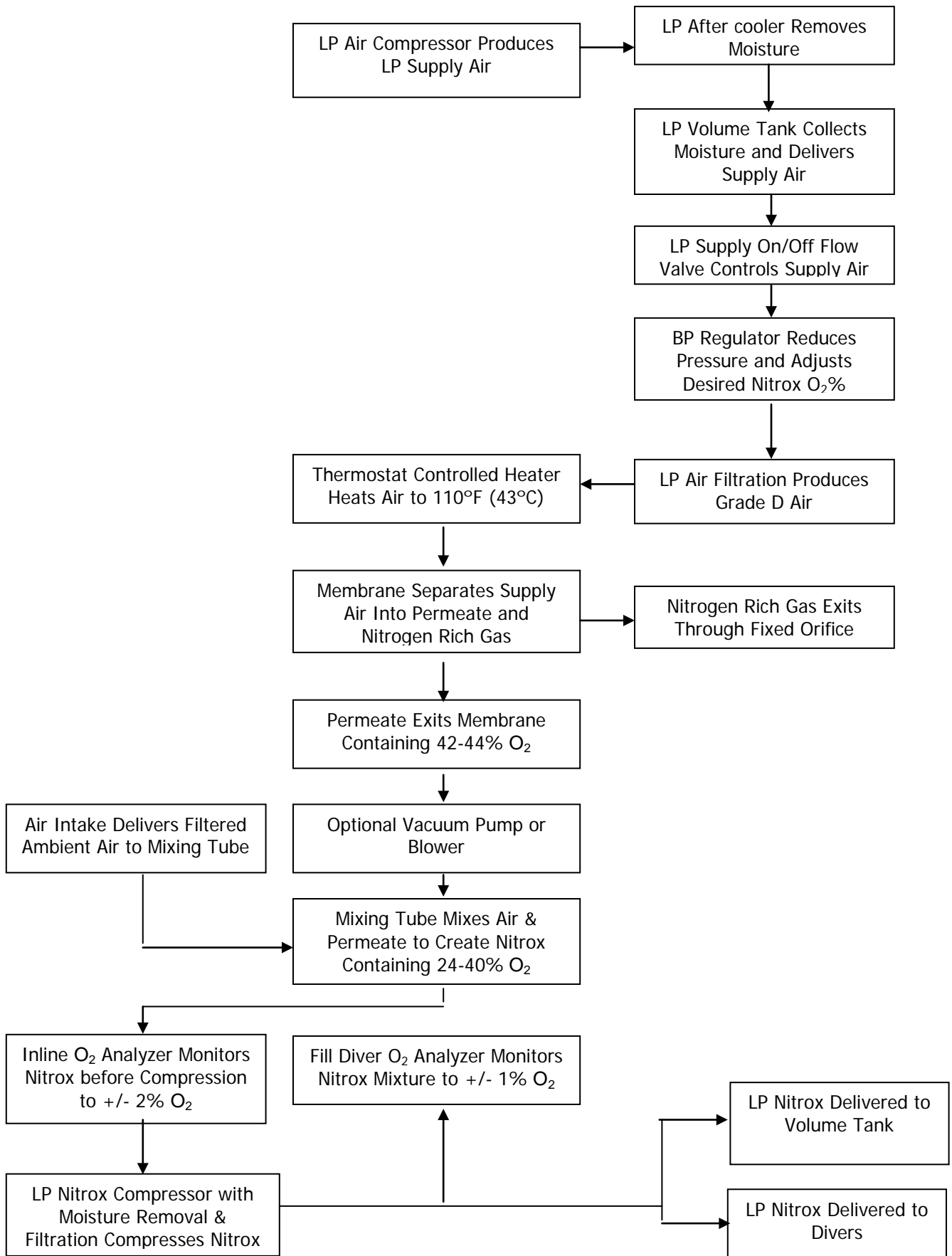
The heated air enters the Membrane, which is made up of thousands of miniature hollow fibers. The walls of these fibers are semi-permeable and designed for different gases to move through them (or permeate) at different speeds. The resulting gas mixture is known as the "permeate". As air flows through the hollow fibers, both oxygen and nitrogen permeate through the fiber walls. The oxygen permeates faster than the nitrogen, which produces permeate with 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 a constant 42-44% O<sub>2</sub> under normal 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 Back Pressure Regulator. As pressure is increased, permeate flow increases, air intake flow decreases, and a higher %O<sub>2</sub> Nitrox is produced. As pressure is decreased, permeate flow decreases, air intake 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 Nuvair Nitrox Systems is that the input pressure that correlates to a specific Nitrox %O<sub>2</sub> is repeatable. For example, if your Nitrox Compressor pumps 36% O<sub>2</sub> when the input pressure is at 125 psi (9 bar), then adjusting the Regulator to 125 psi. (9 bar) during the next use will produce the same mixture.

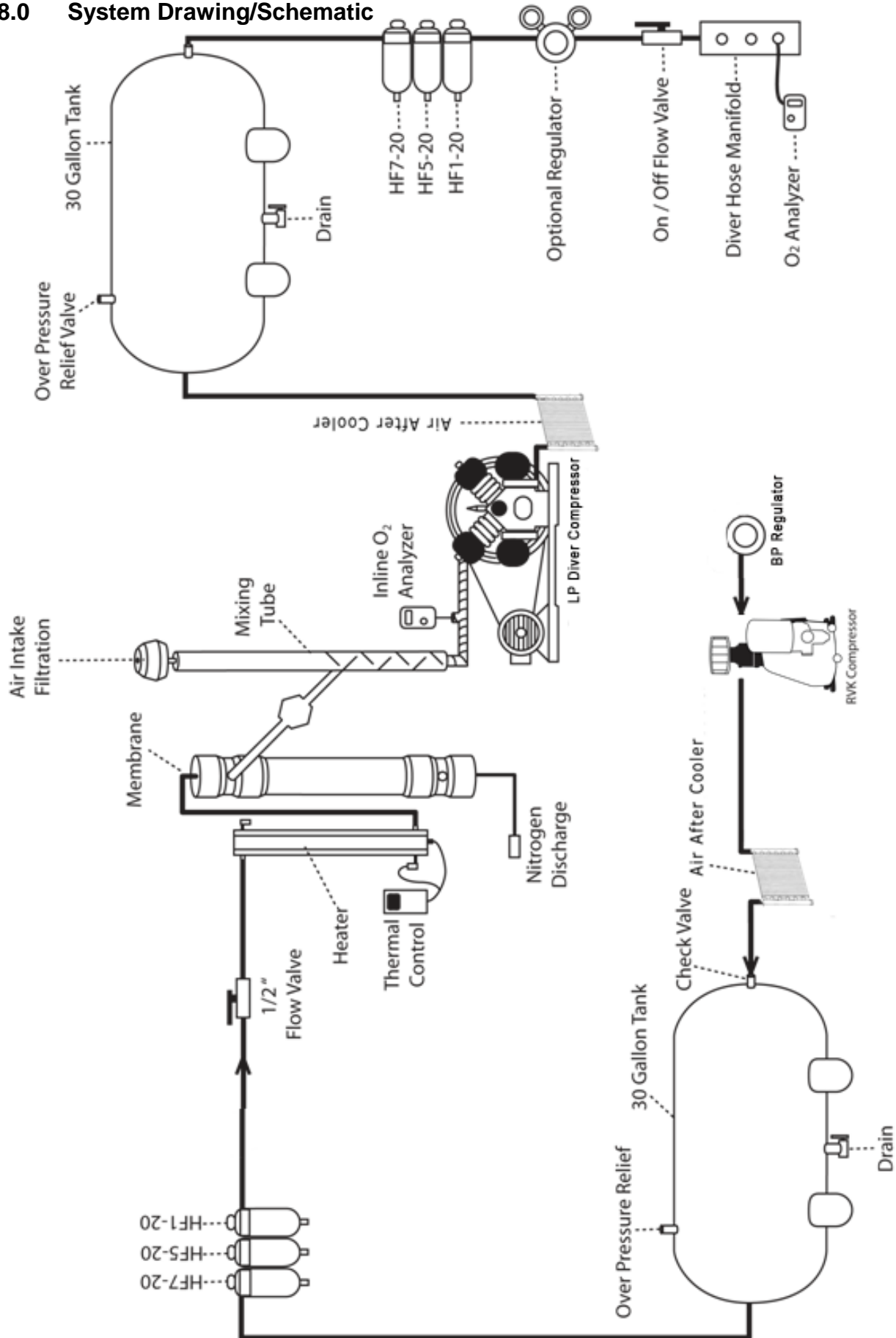
\* Optional refrigerated air dryer replaces one volume tank on electric package.

7.0 Membrane System Flow Chart





8.0 System Drawing/Schematic



## Notice

If any information in this manual conflicts with any of the other manuals call Nuvair before proceeding.

### 9.0 Assembly Preparation:

1. First familiarize yourself with the components of the system in the first section of the LP>LP Nitrox manual.
2. Please read and follow instructions in compressor manual.
3. Unpack the LP>LP Nitrox System and remove from the pallet.
4. Visually inspect the system to make sure there has been no damage\* during shipping.
5. Follow the remaining step-by-step instructions for initial set up and operation.

\*If damaged, please call Nuvair to file a damage report. Please take photos and supply detailed information about the damage.

### 10.0 Set-up and Assembly

#### 10.1 Power Connection

This package comes with a 12 volt battery. For the Kohler or Kubota electric start to function properly, **Red Is Positive!** Connecting the wrong leads may damage circuitry.

##### Electric Option:

A WEG 25 hp electric motor is supplied with the current and voltage specified at time of purchase. It is recommended a trained electrician help with connecting the Nitrox Compressor system to your power source.

**A. Kohler Engine Operation:**  
See Engine Manual

**B. Kubota Engine Operation:**  
See Engine Manual

**C. WEG Motor Operation:**  
See WEG Motor Manual and Electrical Schematic on page 30 of this manual.

#### 10.2 Air Intake and Mixing Tube:

- 1) The LP>LP membrane system is supplied with two air intake locations. They are all female pipe thread to allow for remote intake locations.
- 2) The Nitrox compressor air intake allows air to mix with the O<sub>2</sub> rich gases exiting the membrane permeate port.
- 3) The O<sub>2</sub> rich mix then passes by the inline sensor/analyzer where it is analyzed and an O<sub>2</sub>% reading is supplied to the operator on the inline O<sub>2</sub> analyzer.
- 4) The gas then enters into the intake of the Nitrox low-pressure compressor.
- 5) The O<sub>2</sub>% is determined by adjusting the BP regulator. Increasing the input air volume and pressure will increase the O<sub>2</sub>%. Decreasing the input will lower the O<sub>2</sub>%. With no input pressure the compressor will be pumping air.

## ⚠ Warning

Never expose the Oxygen Analyzer Sensor to pressure or you may cause damage and/or false readings. Damaged sensors will not provide accurate gas analysis. Inaccurate gas analysis can lead to serious personal injury or death.

### 10.3 Oxygen Analyzer Mounting and Connections:

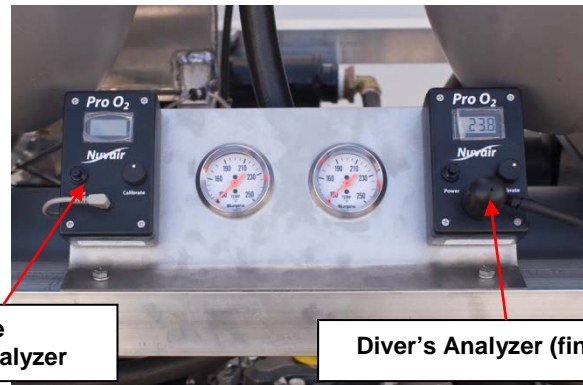
Two oxygen analyzers have been provided with your system. The analyzers are used to determine the oxygen percentages that you are producing.

For more information see Pro O<sub>2</sub> manual in appendix.

- A. The diver's (final) analyzer is installed to supply a reading just before the diver's air/Nitrox manifold.
- B. Calibrate the fill or diver's air/Nitrox (final) analyzer to 20.9% as follows:

Remove the fitting (cap) covering the sensor.

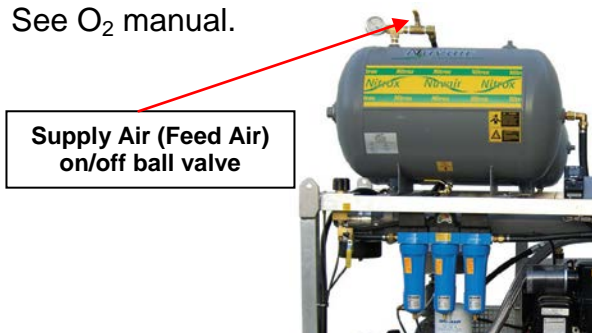
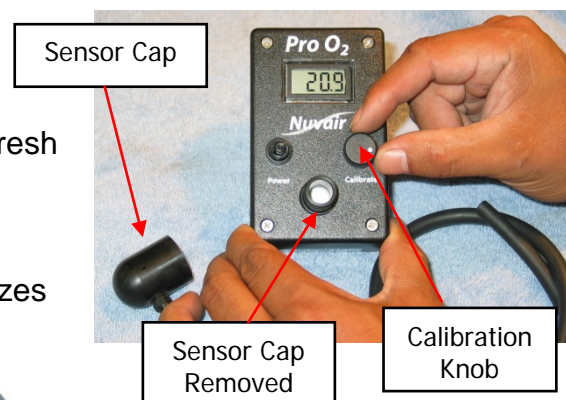
- Expose the sensor to ambient air for approximately (15) seconds.
- Adjust the potentiometer until the reading stabilizes to 20.9%. (see O<sub>2</sub> manual for heat and humidity adjustments)
- Reinstall the flow adapter cap to the analyzer.



The Final Analyzer Supplies the **IMPORTANT READING**.

- C. Calibrate the inline sensor/analyzer while both compressors are running, pumping air and pulling fresh air across the sensor. (This is when the feed air On/Off ball valve is closed)

Adjust the potentiometer until the reading stabilizes to 20.9%. See O<sub>2</sub> manual.



 **Warning**

Oxygen Analyzers must be calibrated before each use. See Oxygen Analyzer manuals for correct calibration procedures. Improper calibration of the Diver's Supply (Final) 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. 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**

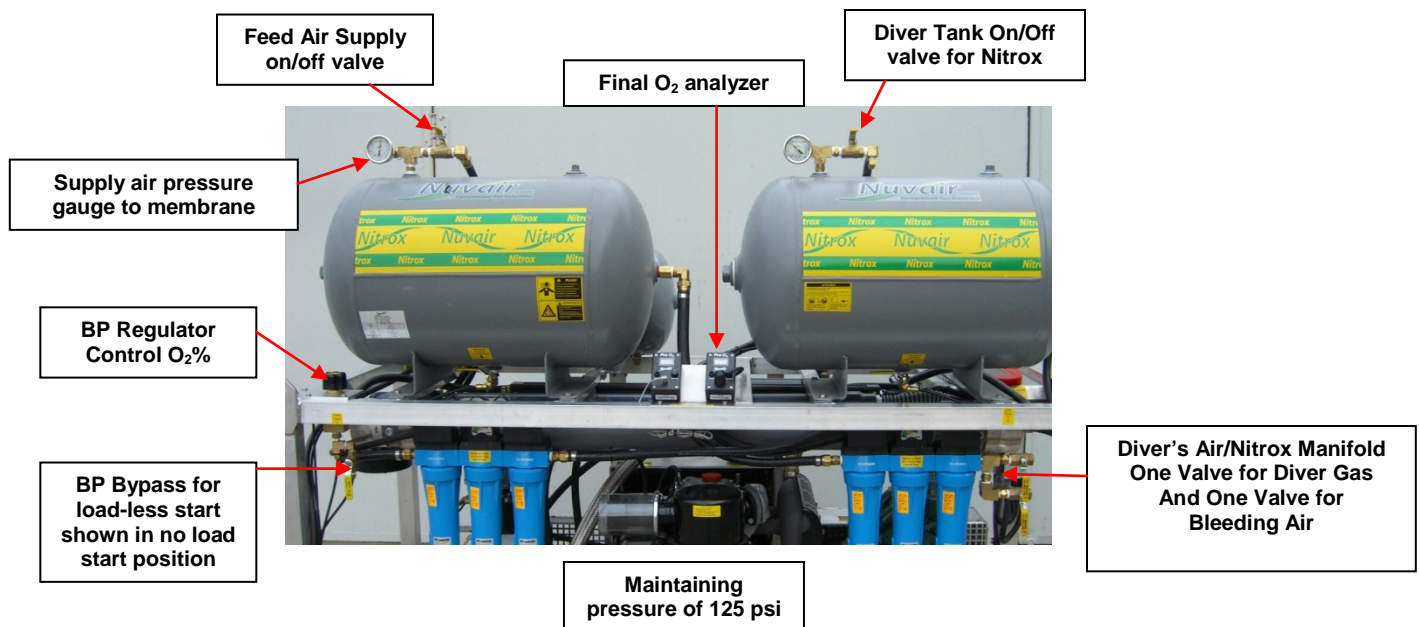
The Inline Oxygen Analyzer supplies oxygen readings that can vary +/- 2% O<sub>2</sub> due to heat, humidity, and pressure changes experienced in the Nitrox flow and therefore should only be used for rough estimates of %O<sub>2</sub>. The Inline O<sub>2</sub> analyzer could read 43% O<sub>2</sub> +/-2 when the Nitrox compressor is unloading and not pumping Nitrox. The Diver's Supply (Final) Oxygen Analyzer supplies more accurate oxygen readings, within +/- 1% O<sub>2</sub>

## 11.0 Operation

Once you have read through this manual, the compressor manuals, the diesel manual, the O<sub>2</sub> analyzer manual, made the necessary set-up connections, and you understand how the system functions; follow the steps below to operate the system:

1. Always check fluid levels before starting compressor and engine.
2. Close feed air supply on/off ball valve.
3. Set BP bypass for load-less start.
4. Open Diver tank on/off valve for Nitrox.
5. Start diesel as per instructions or electric motor.
6. Warm for a few minutes (Diesel engine).
7. Adjust throttle to run position (Diesel engine).
8. Set BP bypass to run (load) position and check to see the Feed Air Supply Valve is closed
9. Slightly open the ball valve on the diver's air/Nitrox manifold, maintaining a pressure of 125 psi or more in the diver's air/Nitrox volume tank and venting the remainder to the atmosphere.
10. While the compressor is pumping air through the diver's manifold valve, calibrate both O<sub>2</sub> analyzers as per instructions in the Pro O<sub>2</sub> manual and on page 18.
11. Slowly open the feed air supply valve and then slowly turn the BP regulator control handle clockwise to increase O<sub>2</sub>%. Watch the inline sensor O<sub>2</sub> analyzer (O<sub>2</sub> Manual page 18). Increase supply air pressure until the analyzer reads the O<sub>2</sub>% desired. The air pressure must exceed 80 psi to activate the heater for the membrane.
12. The Nitrox will slowly make its way through the compressor, volume tank and filtration. Allow the O<sub>2</sub>% to stabilize for 5-8 minutes.

**Step 13 Continued on next page**



## Caution

The On/Off Flow Valve on the Membrane System must be opened slowly. A sudden rush of gas can damage the Membrane and other system components. A damaged membrane will not produce the correct Nitrox mixture which can lead to severe personal injury if the gas is used for diving purposes without proper analysis.

## Notice

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

## Caution

Do not change the temperature setting on the Thermostat Control without contacting Nuvair. Changes in temperature settings may cause Membrane damage. A damaged membrane will not produce the correct Nitrox mixture which can lead to severe personal injury if the gas is used for diving purposes without proper analysis.

13. When both O<sub>2</sub> analyzers are within 1% of each other and O<sub>2</sub> analyzer is reading desired O<sub>2</sub>%.
14. Close the bleed manifold valve and open the diver's manifold valve.

## Warning

OSHA Regulations require an emergency backup source of breathing gas for the diver in case of an emergency or compressor malfunction.

15. Monitor compressor operation at all times. Note tank pressure on the first compressor; feed air input pressure on air going to the membrane, diver's Air/Nitrox tank pressure and O<sub>2</sub>%.
16. During the dive, monitor both analyzers to ensure they stay within 1% of each other. Lightly fine tune the input pressure to get the exact desired O<sub>2</sub>% on the final analyzer. The final analyzer indicates the O<sub>2</sub>% going to the diver. This is the important reading. During the operation the analyzer sensor may warm slightly and require recalibration. Remove the cap and recalibrate as per the manual. The inline sensor will also warm and start to supply a reading that is higher than the actual O<sub>2</sub>%. This sensor can only be recalibrated by turning off the air flow to the membrane while the compressor is running. This should never be done while divers are breathing the Nitrox. During this period rely on the final O<sub>2</sub> analyzer reading. A third analyzer should be used to check the final analyzer's accuracy at any time by removing the cap from the final analyzer and attaching it to another analyzer.
17. After completion (shut down), close feed air ball valve.
18. Turn the bypass valve to the unloaded position.
19. Lower the throttle and allow for a cool down on the diesel engine before shutting down. Or press off on the panel for an electric motor.



## 12.0 Pumping Nitrox

 **Warning**

The use of enriched air Nitrox does not eliminate the risk of decompression sickness (DCS) in diving. Decompression sickness can lead to permanent disability or death.

 **Warning**

The Inline O<sub>2</sub> Analyzer supplies oxygen readings that can vary +/- 2% O<sub>2</sub> due to heat, humidity, and pressure changes in the Nitrox flow and should only be used for rough estimates of %O<sub>2</sub>. **The Fill O<sub>2</sub> Analyzer supplies the accurate reading, within +/- 1% O<sub>2</sub>.** Use an additional o2 analyzer at the diver's manifold.

 **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.

 **Notice**

No oxygen cleaning of standard cylinders or plumbing is mandatory when using the Nitrox 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 Nuvair.

 **Warning**

Only provide Nitrox to divers who have proof of Nitrox training and certification. Improper use of Nitrox can be fatal.

 **Danger**

This system is not cleaned for oxygen service and not all components are compatible with gas mixtures containing greater than 40% oxygen. Pumping gas mixtures containing greater than 40% oxygen will lead to explosions which may cause severe personal injury or death.

 **Notice**

The Oxygen Analyzers may require re-calibration after 10-20 minutes of operation due to humidity and temperature change effects on the Sensor. To recalibrate, turn off the Membrane System On/Off Flow Valve and follow calibration instructions.

<b>GAUGE</b>	<b>RECOMMENDED SETTING</b>
<b>Compressor Gauges</b>	According to manufacturers recommendations
<b>Heater Temperature</b>	105-120° F (40-49° C)
<b>Ambient Temperature</b>	Less than 105 ° F (40 °C)
<b>Volume Tank Pressure</b>	155-175 PSI (11-13 Bar)
<b>Regulated Pressure to Membrane</b>	80-200 PSI (6-13.79bar) depending on Nitrox O2%.
<b>Fill / Diver Oxygen Analyzers</b>	Showing the proper reading for intended Nitrox Supply
<b>Nitrox Delivery Pressure</b>	<b><u>DO NOT</u></b> exceed rating of tank or 200 psi

**13.0 Operation Notes:**

- ◆ Utilizes standard Hankison series 20 filtration  
Do NOT use any substitute.
- ◆ Bleed condensate drain on the volume tanks daily.
- ◆ Do NOT use this system to produce greater than 40% oxygen concentration.
- ◆ Use only Nuvair 455 compressor lubricant in Q325 piston compressor and Nuvair 546 in the EK76 Rotary Screw compressor. **Do NOT substitute or Mix Lubricants.**
- ◆ Final discharge pressure is factory set. Do NOT alter setting.

**13.1 Correlation of Input Pressure to Oxygen Content**

After the 10 hour break-in period for your Nitrox system, you will notice that specific Nitrox O<sub>2</sub> percentages 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. (9 bar), 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, making sure system has warmed up first. The next time Nitrox with 36% O<sub>2</sub> is needed, adjust the regulator to 125 psi. (9 bar) 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 Diver’s Supply (Final) Oxygen Analyzer to verify the Nitrox oxygen percentage prior to delivery to divers. When using the input pressure reading to obtain specific oxygen percentage, minor adjustments of the input pressure regulator may be required to obtain the exact percentage desired.**



## **14. Maintenance**

### **14.1 Routine Maintenance**

#### **Warning**

**Use only the specified Nuvair Lubricants in this system. The use of incompatible lubricants presents a risk of fire and/or explosion, and may result in system damage. This can lead to severe personal injury and death.**

#### **Warning**

**Be sure that all pressure has been relieved from the system prior to opening any filtration canister. Failure to vent pressure from the system prior to opening the canister can lead to serious personal injury or death.**

#### **Caution**

**If the system is located in an area where there is high humidity and high heat, the life of all Filtration Elements may be as little as 35% of rated operating capacity. Check the compressor manual and Appendix for details on Filter Element Life Factors.**

- 1) Q325 Compressor Lubricant: Change compressor lubricant after the first 100 hour break in period and every 200 hours thereafter on the Q325. Only use lubricants rated for use with breathing Air/Nitrox systems such as Nuvair 455. Never mix Compressor Lubricants. See LP Compressor manual for details.
- 2) EK76 Rotary Screw Compressor Lubricant: Change after the first 100 hours and then every 2000 hours. Use only Nuvair 546 lubricant. The 546 lubricant is much thinner than the 455. Never mix.
- 3) LP Filtration Inspection: On a daily basis, inspect each Filter Bowl for the presence of moisture and each Element for any unusual degradation or wetness.
- 4) LP Filtration Elements: Change LP Filter Elements every 100 hours to maintain CGA Grade D air standards. Visual differential pressure (DP) indicators on the HF7 and HF5 filters assist with monitoring replacement intervals. See Section 14.3 for details. If the Nitrox system is operated in high humidity and/or high temperature, Filter Elements must be changed more often. See Appendix for details on Filter Element Life Factors.
- 5) Semi-Permeable Membrane: No maintenance required. Service life exceeds 20 years if LP Filtration is properly serviced to maintain Grade D standards.
- 6) Membrane System Air Intake Filter: Inspect filter element every 3 months for visible particles. Change every 12 months or sooner if particles are visible.
- 7) Oxygen Analyzers: Replace Oxygen Sensor and Battery as required. See manual included with Nitrox 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.

**14.2 Compressor Lubricant:**

Change Q325 with Nuvair 455 Nitrox rated lubricant every 200 hours or minimum once per year. Change EK76 oil with Nuvair 546 every 2000 hours or once per year.

Do not mix brands.

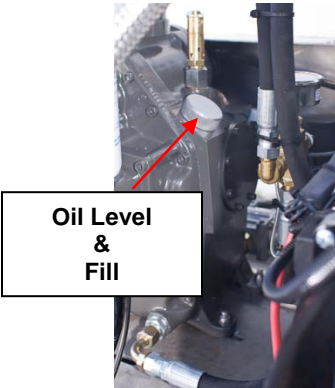
Change Oil Filters annually on both compressor blocks even if not used. The EK76 has 3 filters and the Quincy 325 has one. See appendix for filter part numbers.

- 1) Check oil levels (both compressors and engine) and diesel fuel level before operation.
- 2) Drain Volume tanks daily. Check filters for moisture daily.
- 3) Start and warm to operating temperature before Nitrox preparation.

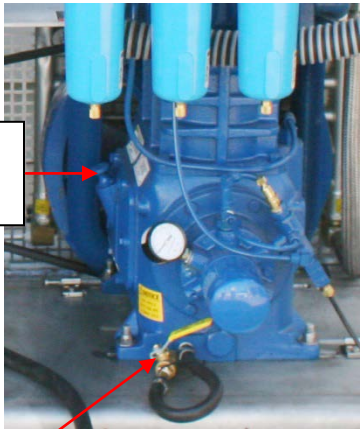
**Refer to Supplied Diesel Engine manual for proper oil and maintenance.**



Oil Drain



Oil Level & Fill



Oil Level & Fill

Oil Drain

## ⚠ Caution

Special attention needs to be given to the arrangement of the four LP Supply Air Filtration Elements and Bowls. Properly reinstall each Element and Bowl to the correct Housing. Improper sequence can cause damage to downstream components

### 14.3 LP Filtration

The use of Grade D or better supply air is critical to prevent the passing of any residual oil vapor into the Membrane System. Three stages of Hankison LP filtration are used to produce Grade D air:

- 1) Particle Removal to 1 micron
- 2) Coalescing & Water/Oil Vapor Removal to 0.01 micron
- 3) Oil Vapor Removal to 0.003 PPM

#### Filtration Inspection

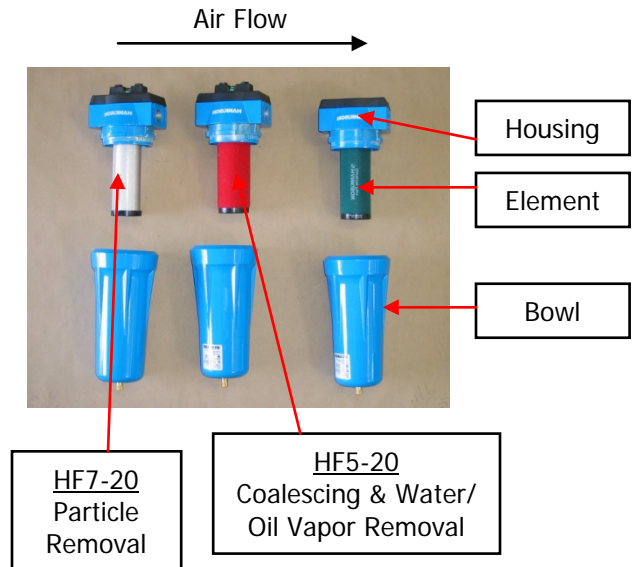
Open each Filter and inspect as follows:

1. Inspect Bowl for the presence of moisture. A high level of moisture build-up in the HF7 or HF5 Filter indicates improper operation of auto-drain floats. Any evidence of moisture in the HF1 Filter indicates the air is not cooling properly and moisture is not properly being removed. Excess moisture will prevent the final filter from operating properly.
2. Inspect Elements for any unusual degradation or wetness. Element degradation can indicate more serious problems. Contact Nuvaair for assistance.



HF7 & HF5 Filters with Auto-Drain Floats & DP Indicators.

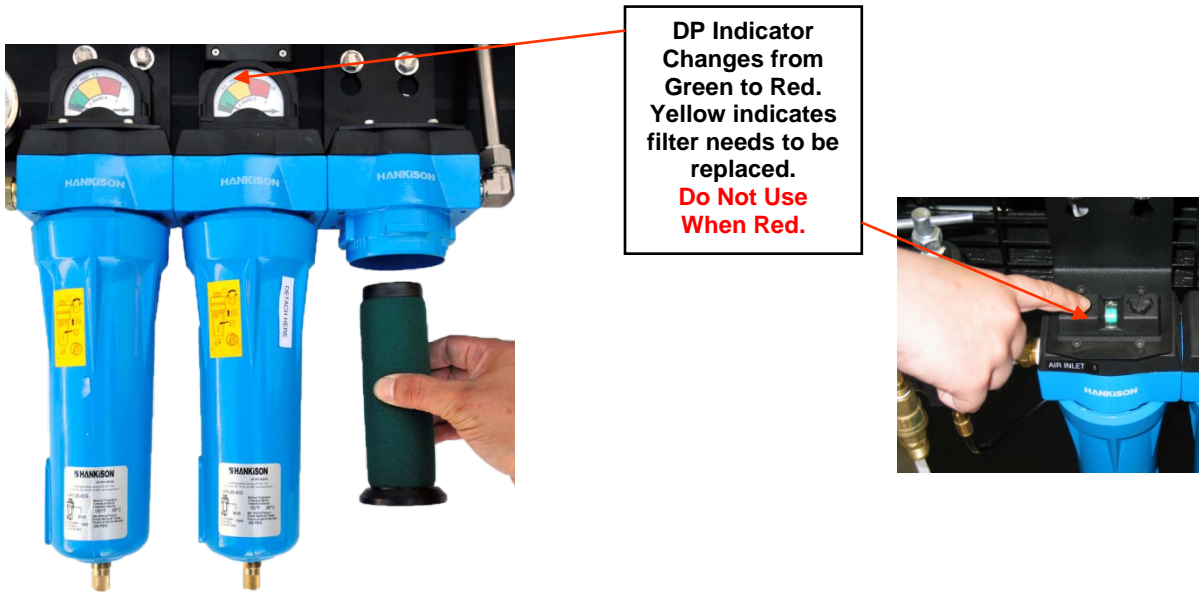
HF1 Filter with Manual Drain – Should not Contain Moisture



## Changing Filtration Elements

Change the LP Filter Elements **every 100 hours or once per year\***. If the Nitrox System is operated in high humidity and/or high temperature, Filter Elements must be changed more often. See Appendix for details on Filter Element Life Factors. Visual DP indicators on the HF7 and HF5 filters assist with monitoring replacement intervals.

- 1) Push up on the Bowl, rotate CCW, and lower to remove.
- 2) Gently rotate Filter Element and pull down off mounting post.
- 3) Replace Element and reassemble in reverse order.



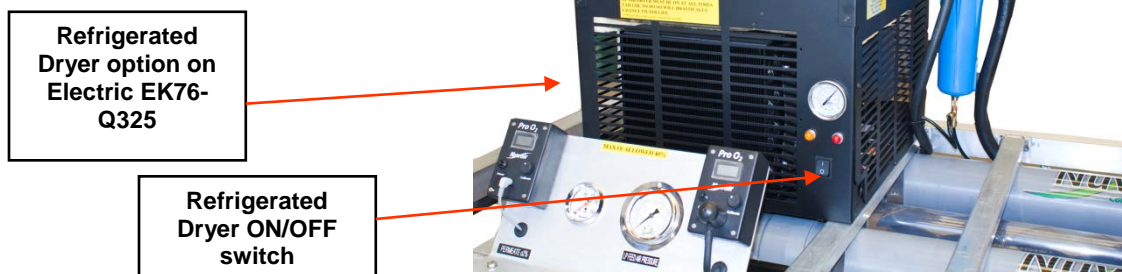
## Notice

The interior of the Filter Bowls can be cleaned with a diluted solution of Simple Green™ and flushed thoroughly with clean water. This will assist to prolong the life of the element, bowl, and auto drain.

### \*Electric Package optional Refrigerated Dryer:

When a refrigerated dryer is added to the system LP Filter elements do not require to be changed as often as 100 hours. The refrigerated dryer extends the life of these elements to **250 hours or once per year.**

**Refrigerated Dryer should be left on or turned on at least 20 minutes before operation of compressor.**



**14.4 Spare Parts List**

See Compressor manual for LP Compressor parts list. Other Nitrox System components and related items are listed below.

<b>Nitrox System Components</b>	<b>Type</b>	<b>Part Number</b>
Compressor Lubricant, Food Grade	Nuvair 455, 1 Gal (Other Sizes Available)	9406
	Nuvair 546, 1 Gal	9409
LP Filtration Element	Hankison HF 7-20	E7-20
	Hankison HF 5-20	E5-20
	Hankison HF 1-20	E1-20
Heater Thermostat Control		
Heater Pressure Switch		B16-947
Membrane	1 x 250 Series	
Air Intake Filter Element		FT-14-100
Mixing Tube Assembly	2 inch diameter, specify length	
Oxygen Analyzer	Pro O <sub>2</sub>	9450
	Pro O <sub>2</sub> Remote Panel Mount	9452
Oxygen Sensor	See Analyzer Owner's Manual	
Compressor Hose Coupler	1-1/4"-1-1/2" to 1-1/4"-1-1/2"	018578000476
	1-1/4"-1-1/2" to 1-1/2"	RDTTC40X32
	<b>Related Equipment Components</b>	
Air/Nitrox Quality Analysis Kit	Specify: (1) CGA Grade Required	
	(2) Single Use or Program Use	

<b>Compressor Components</b>	<b>Type</b>	<b>Part Number</b>
Quincy Air Intake Filter	Quincy	18P
Quincy Oil Filter	Baldwin	B474
Rotair	Intake Filter	162-574-S
Rotair	Pre Filter	157-172-S
Rotair	Air Oil Separator	157-170-S
Rotair	Oil Filter	099-013-S

**Appendix**

**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.

<b>Item</b>	<b>Grade D</b>	<b>Grade E</b>
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/m <sup>3</sup>	5 mg/m <sup>3</sup>
Odor	None	None

- Notes: (1) Dew Point of supply air must be >10°F (6°C) colder than coldest ambient air expected.  
 (2) Supply air delivered to the Membrane System must contain <0.003 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 +/- 1% O<sub>2</sub> of the specified value of the mixture using a properly calibrated Oxygen Analyzer (i.e. Nitrox produced with a target content of 32% O<sub>2</sub> must measure in the range of 31-33% O<sub>2</sub>). Periodic air quality testing to assure compliance is mandatory.

**Filter Element Life Factors**

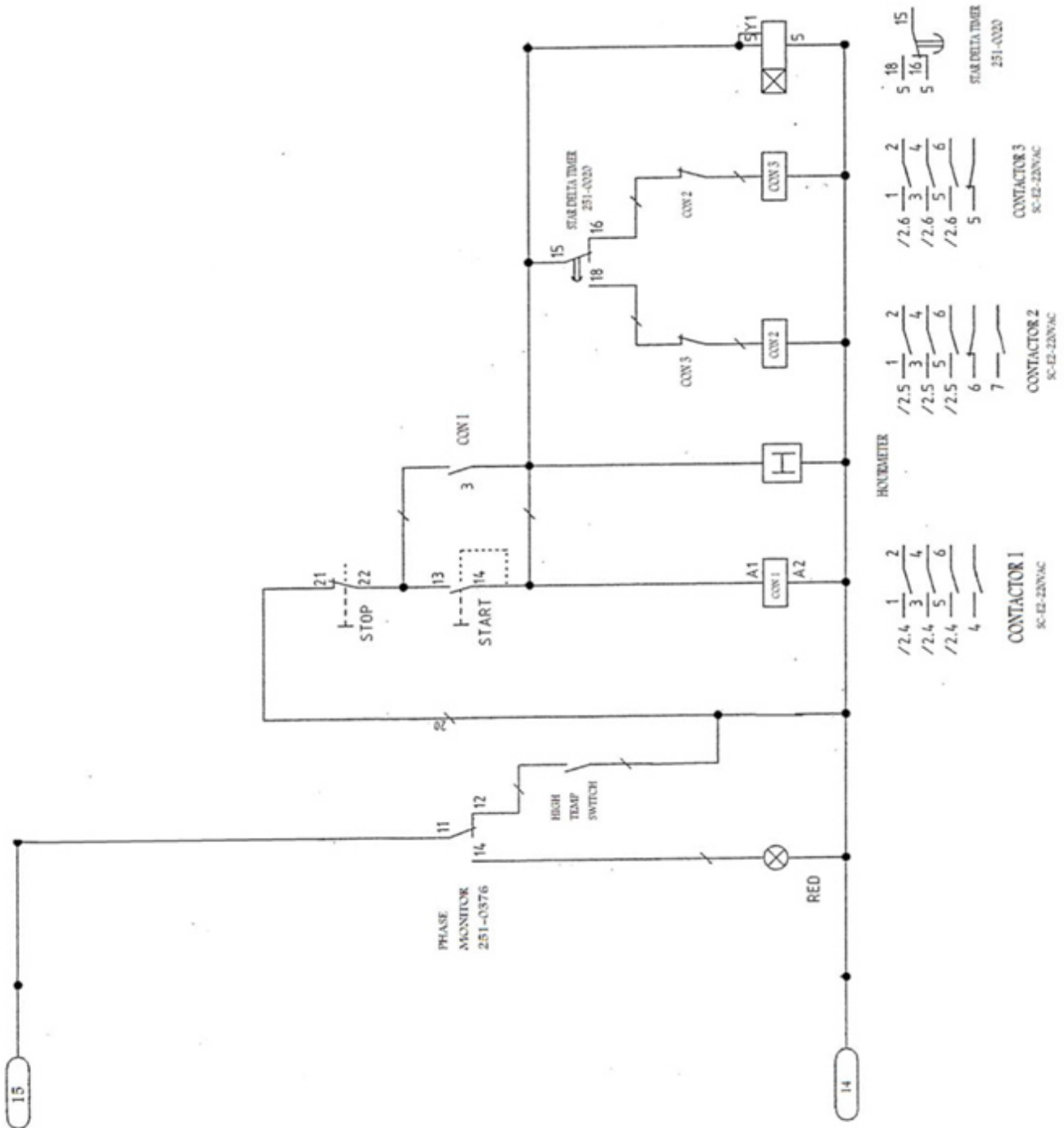
Breathing air filter element life is typically rated by manufacturer based on an air temperature of 80°F at the filter inlet. Under normal operation this temperature is 12°F (5°C) warmer than the ambient air, resulting in an equivalent ambient temperature rating at 68°F (20°C).

To determine element life at a different ambient temperature, multiply the rated life by the life factor listed below:

<b>Filter Temperature</b>	<b>Ambient Temperature</b>	<b>Filter Element Life Factor</b>
53°F (12°C)	41°F (5°C)	2.6 x Life
62°F (17°C)	50°F (10°C)	1.8 x Life
71°F (23°C)	59°F (16°C)	1.35 x Life
<b>80°F (27°C)</b>	<b>68°F (20°C)</b>	<b>1 x Life</b>
89°F (32°C)	77°F (25°C)	0.8 x Life
96°F (36°C)	84°F (29°C)	0.55 x Life
105°F (41°C)	93°F (34°C)	0.45 x Life
114°F (46°C)	102°F (39°C)	0.35 x Life



**EK76-Q325 400 Volt STAR DELTA Wiring Diagram.**  
**Electric motor option.**



## **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 System warranty.

### **Installation:**

- All set up requirements and procedures provided in the Nitrox System Operation Manual must be followed in their entirety including supply air cleanliness, Compressor preparation, and installation of the Nitrox System.
- Supply air to the Membrane must be properly filtered to CGA Grade D air quality or better to prevent damage to the Membrane. Air quality testing of the supply air should be performed periodically and documented to assure compliance.
- If there is any doubt regarding the suitability of a HP Compressor for compressing Nitrox, contact Nuvair or the Compressor manufacturer before you connect your Nitrox System.
- If an existing HP 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 Nuvair.
- 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 Nuvair for assistance.

### **Operation:**

- Do not use the Nitrox System to supply a HP 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 psi. Compressing Nitrox at higher pressures may cause severe HP Compressor damage.
- To prevent membrane damage, drain all low pressure filter and volume tank condensate on a daily basis.

### **Maintenance:**

- Change low pressure filter elements on a schedule determined by filter capacity and ambient temperature and humidity. Contact Nuvair 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 service record books 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 SYSTEM WARRANTY**

Nuvair extends a limited warranty, which warrants the Nitrox 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 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 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.

## **EK76 Rotary Service Information and Spare Parts**

***Only change the oil when the screw compressor unit is not in operation and is depressurized!  
Be careful when draining hot oil: Danger of scalding!***

**Important**

**Remove oil residues and other deposits from unit parts and from the coolers of compressors, which are exposed to hot compressed air, according to the operating instructions.**

*Note*

*Collect the waste oil, do not allow it to seep into the ground!  
Disposal in accordance with the regulations!  
Do not spill oil! Check for leakage!*

*With these compressors, the oil change intervals strongly depend on the degree of contamination of the circulating oil. It must therefore be taken care that no oil-deteriorating matter (dusts, vapors, gases) are transported through the air intake filter into the oil circuit of the compressor unit. Also a high content of humidity in the intake air and the formation of condensate within the machine affect the service life of the lubricant oil so that a reduction in the oil change intervals may become necessary. The specified oil change intervals refer to an intake air from a normal environment without a high content of foreign matter (dusts, vapors, gases).*

*When changing the oil, the waste oil is to be drained completely, since used oil reduces the service life of the new oil fill considerably.*

*Do not mix lubricating oils of different makes. When changing over to a new oil type, the oil in the oil circuit must be drained completely.*

For the oil change intervals, see maintenance schedule.

**When changing the oil, proceed as follows:**

- Switch the screw compressor unit off and ensure that it is depressurized, electrically isolate and locked off.
- Slowly open the oil filler cap, to depressurize the screw compressor by releasing any residual pressure in the unit
- Remove the oil filler cap
- Open the oil drain for the pressure reservoir and the oil cooler
- Drain oil at operating temperature
- Close the oil drain
- Fill in oil up to the marking "maximum oil level" (approx. 5 liters)
- Close the oil filler cap
- Let the screw compressor unit run for approx. 2 minutes
- Check for leakages
- Switch the screw compressor unit off
- Wait at least 5 minutes for the oil to settle and for the air to disperse
- Check oil level
- The oil level must be between the maximum level and minimum level marked on the oil reservoir.
- If required, top up oil

**Changing intervals for lubricants**

The operating conditions (e.g. coolant temperatures), the operating modes and the quality of the intake air (e.g. content of dust, content of gaseous foreign matter such as SO<sub>2</sub>, solvent vapors) have a strong influence on the oil change intervals.

<b>Rotary Screw Compressor Maintenance Items</b>		
Rotary Screw Air Intake Filter	EK76	A11207674
Rotary Screw Air Oil Separator	EK76	300KBA035
Rotary Screw Oil Filter	EK76	300KBA1446

**ADDITIONAL RECORD OF CHANGES**

It is the responsibility of the owner of this product to register their ownership with Nuvair by sending the warranty card provided to Nuvair. This card is to establish registration for any necessary warranty work and as a means of communication that allows Nuvair to contact the user regarding this product.

The user must notify Nuvair of any change of address by the user or sale of the product. All changes or revisions to this manual must be recorded in this document to ensure that the manual is up to date.

Nuvair will publish all new revisions of existing manuals on our website at:

**[www.nuvair.com/manuals](http://www.nuvair.com/manuals)**

<b>Change Date</b>	<b>Description of Change</b>
<b>07.18</b>	<b>EK76 information added</b>



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EK76>Q325 LP Nitrox System Manual  
Rev: 05.19