Installation, Operation, and Maintenance Manual

Balston® HFX-1 and HFX0-1NA Nitrogen Generation Systems

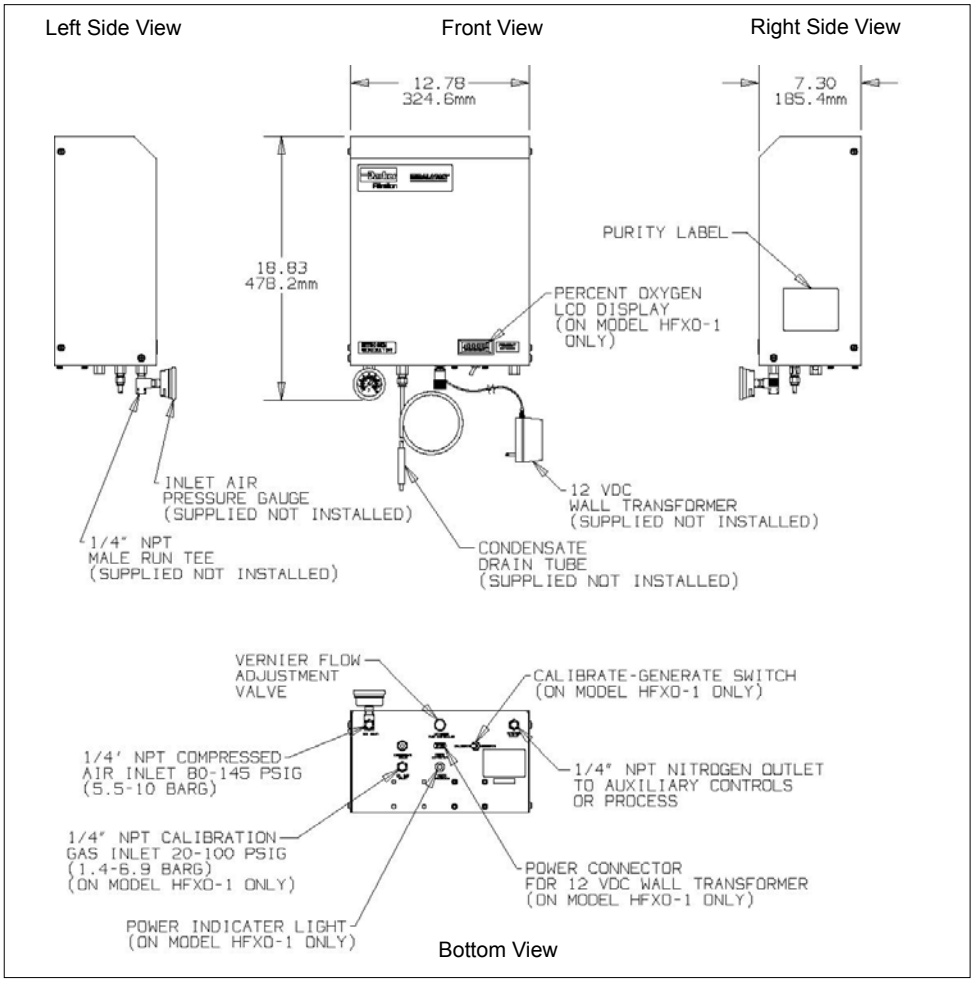

Figure 1 - HFX-1 and HFX0-1NA Overall Dimensions

These instructions must be thoroughly read and understood before installing and operating this product. Failure to operate this product in accordance with the instructions set forth in this manual and by other safety governing bodies will void the safety certification of this product. If you have any questions or concerns, please call the Technical Services Department at 800-343-4048, 8AM to 5PM Eastern Time (North America only) or email at balston-techsupport@parker.com. For other locations, please contact your local representative.

General Description

The Balston HFX-1 Series Nitrogen Generator is a completely engineered system which will convert a compressed air supply into 95% to 99% purity compressed nitrogen and monitor the purity of the emergent nitrogen stream. The system is based on state-of-the-art membrane separation technology. Hollow fiber membranes are used to separate air into a concentrated nitrogen output stream and an oxygen enriched permeate stream. To monitor the purity of the nitrogen stream, Parker Balston has incorporated an oxygen analyzer into the design of its HFX0-1NA Nitrogen Generation System.

Engineered System

The Balston HFX-1 Series Nitrogen Generators includes all the components required to generate high purity nitrogen from compressed air and monitor the purity of that nitrogen (see Figure 1). The flow schematic on page 2 (Figure 2) shows all of the major components of the system. The system can be broken down into five primary functional groups. These are: prefiltration, air separation, controls, final filtration, and nitrogen purity monitoring.

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Description

Prefiltration

Two stages of coalescing prefiltration are incorporated into the Balston HFX-1 Series Nitrogen Generator to protect the membrane module from contamination. These filters are located behind the front cover, and they remove liquids and particulate matter from the incoming air supply. The filters are equipped with float drains which automatically open to empty any liquids accumulated inside the filter housing. The drains are connected to 1/4" O.D. plastic tubing which discharges to atmosphere at the bottom of the nitrogen generator (see Figure 1).

Air Separation

Air separation takes place in the membrane module. This module consists of bundles of hollow fiber membranes. The compressed air enters the center bore of these fibers and travels the length of the fibers. As the air passes through these hollow fibers, oxygen and water molecules pass through the membrane wall at a higher rate than nitrogen molecules. The result is a high purity, dry nitrogen gas exiting the membrane module through the outlet. The oxygen enriched permeate stream exits the membrane module through ports on the side of the module at a very low pressure.

Final Filtration

Final filtration consists of a .01 micron (absolute) membrane filter. The final membrane filter will assure the user a clean, commercially sterile supply of high purity nitrogen.

Controls

The controls in the HFX-1 Balston Nitrogen Generator comprise: an inlet pressure gauge, a vernier flow control valve (see Figure 1). Proper use of these controls will assure the user of a 95% to 99% nitrogen outlet stream, depending on operating pressure and flow rate. The inlet pressure gauge, which is mounted to the inlet, measures inlet pressure. The Vernier Flow Control Valve is set to regulate the flow rate of nitrogen exiting the membrane module. The Nitrogen Purity Label on the side panel is used to determine the required vernier valve settings, based on inlet air pressure and required purity and flow. The flow control valve is used to set the flow rate through the system as determined by the user's required nitrogen purity.

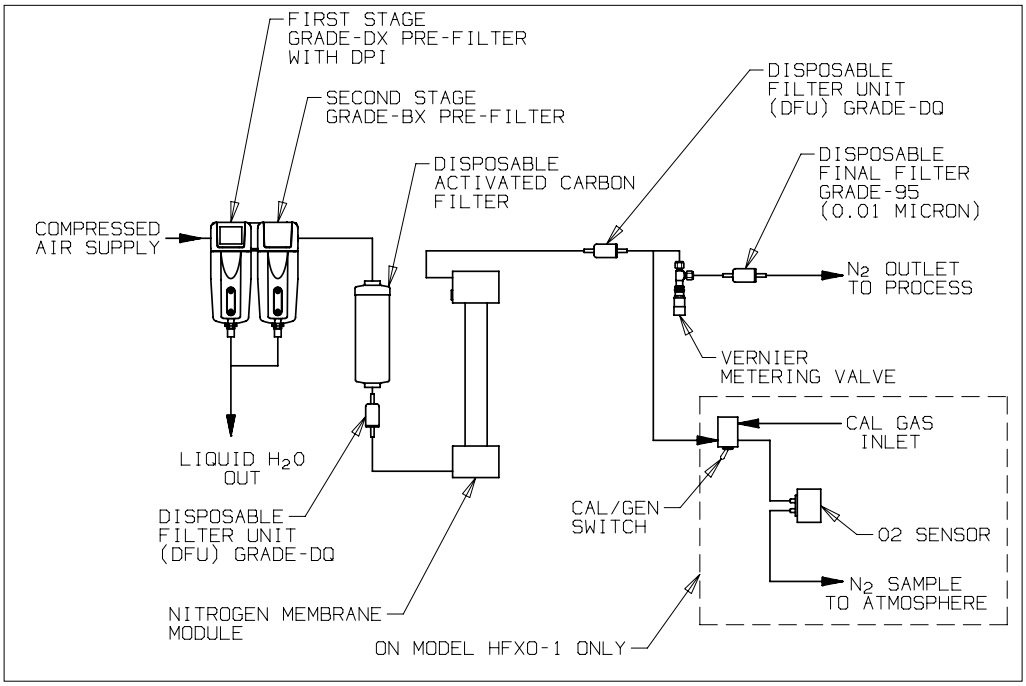

Figure 2 - Flow Schematic

Oxygen Monitoring

Note: In hazardous applications where the oxygen content is critical (i.e., blanketing explosive chemicals or packaging food for extended shelf life), an oxygen monitor and/or trace oxygen analyzer should be used in conjunction with safety interlocks and/or alarm systems to assure proper nitrogen purity levels at all times.

An oxygen analyzer has been incorporated into the design of the HFX0-1NA Nitrogen Generator to monitor the oxygen content of the nitrogen process stream. The unit is powered by a 120 VAC or 240 VAC, 50/60 Hz power supply. (**Note**: Main supply line voltage must be within 10% of nominal rated voltage for the generator.) The sensing device in the oxygen analyzer is a galvanic cell. The analyzer has an internal temperature compensation circuit to provide accurate readings within a specified temperature range.

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The oxygen analyzer has all the controls necessary to assure safe and accurate monitoring of the oxygen concentration in a process stream.

Calibration Controls - The Oxygen sensor in the Model HFX0-1NA is calibrated at the factory and should be within 0.1-0.2% of the actual Oxygen concentration. For critical applications, it is recommended that calibration gas (Primary standard) be used to periodically check the calibration of the Oxygen sensor. To calibrate the Model HFX0-1NA, connect calibration gas at a pressure of 20-100 psig to the calibration gas inlet port on the bottom of the generator as shown in Figure 1. Switch the Calibrate/Generate switch on the bottom of the generator to the "Calibrate" position. Let the reading on the LCD stabilize for a couple minutes and compare the reading on the display to the actual calibration gas concentration. For routine calibration, UHP Nitrogen (0.0% Oxygen) from a cylinder should be used to "Zero" the sensor and compressed air (20.9% Oxygen) should be used to "Span" the sensor. If higher accuracy is required in a specific range, a span gas such as 0.5% Oxygen in Nitrogen can be used instead of compressed air.

If adjustments are required, remove the Span/Zero adjust circuit board from the back of the LCD display and adjust the Span or Zero Potentiometers as shown in the Figure below. Re-connect the circuit board and compare the LCD readings to the calibration gas concentration. Repeat this process until the desired accuracy is achieved. Switch the Calibrate/Generate switchback to "Generate" and the generator is now ready to monitor the purity of the generated Nitrogen.

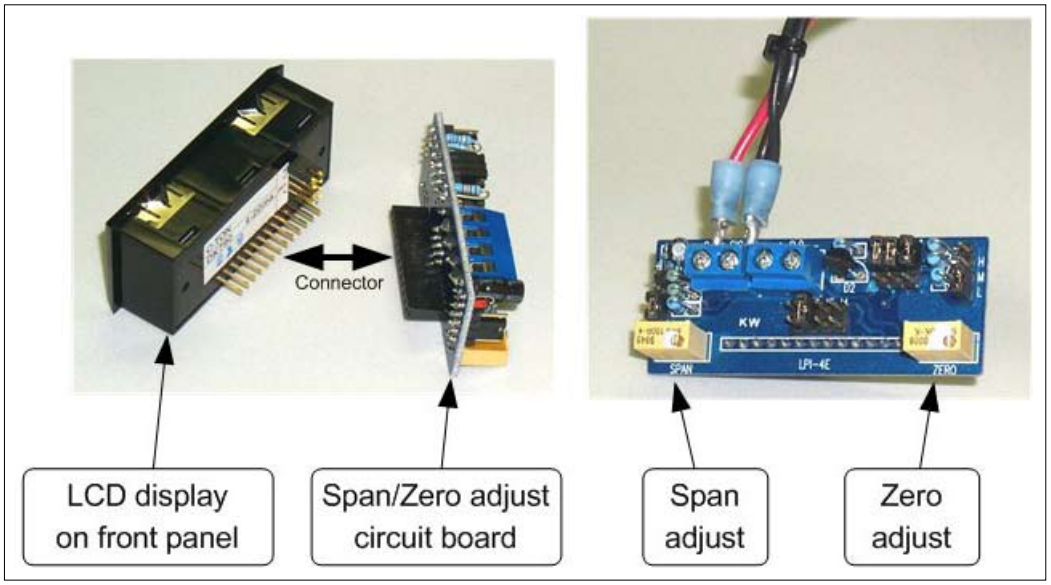

Figure 3 - Front Panel Controls

Installation

General

The Balston HFX-1 and HFX0-1NA Nitrogen Generators are wall-mounted units. Refer to Figure 4 for mounting dimensions.

The inlet and outlet on the HFX-1 are 1/4" female NPT. A 1/4" male connector which will withstand 145 psig (10 barg) should be used to connect to the nitrogen generator.

Shutoff Valve - A shutoff valve should be installed directly upstream from the nitrogen generator to facilitate routine maintenance and troubleshooting procedures. **Use only a gate valve or other slow-opening valve upstream from the generator.** Use of a valve which is not slow-opening will pressurize the membrane too quickly and may cause membrane rupture. Membrane failures resulting from improper valve installation will not be covered under warranty.

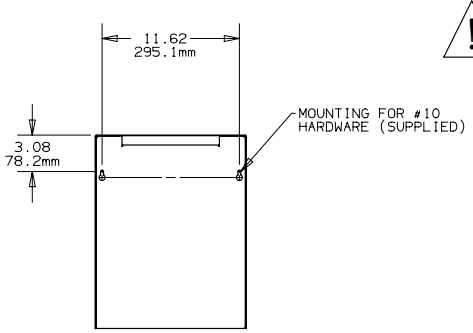

Figure 4 - Mounting Dimensions, Back View

Pressure Regulator - Install a pressure regulator directly upstream from the nitrogen generator to set and maintain the inlet air pressure. Maintaining a constant inlet air pressure is critical if a constant nitrogen purity and flow is required.

Flow Controller - If the application requires nitrogen at pressures higher than 10 psig (0.7 barg), install a flow controller downstream from the nitrogen generator, close to the point of use (see Adjustment Procedure section, pages 7-8).

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Location

The generator should be located indoors, protected from severe weather conditions, and free from excessive ambient dust or dirt. **Do not install the generator outdoors.** The ambient temperature of the air surrounding the generator must be between 59°F and 95°F (15°C and 35°C). Allow a minimum of 6" (15 cm) clearance on all sides of the generator.

The environment surrounding the nitrogen generator should also be adequately ventilated. The HFX-1/HFX0-1NA creates a 30% to 40% oxygen permeate stream which may pose a flammability problem in an oxygen sensitive environment.

Utilities

Compressed Air - The Balston HFX-1 Series Nitrogen Generator requires a source of clean, dry compressed air for operation. The incoming air should be between 60°F and 95°F(15°C and 35°C), have a dewpoint less than the ambient temperature, and be relatively free of water, compressor oil, hydrocarbons, and particulate matter. The inlet pressure of the compressed air supply should be regulated to 60 psig to 145 psig (4.1 barg to 10 barg).

Power - A 120 VAC or 240 VAC, 50/60 Hz power supply is required to energize the oxygen analyzer. (**Note:** Main supply line voltage must be within 10% of the nominal rated voltage for the generator.) The power receptacle for the wall transformer is located on the bottom of the unit (see Figure 1).

Drain Lines - The condensate drain port on the bottom of the generator (see Figure 1) should be piped away to an appropriate disposal container. The liquid in this drainage will consist primarily of water and compressor oil and should be disposed of properly.

Installation with a Receiving Tank

In many applications, the process flow requirements for nitrogen fluctuate with time. As noted earlier, if the flowrate of the emergent nitrogen stream varies, the purity level of the nitrogen stream also varies; therefore, it is important to keep the nitrogen flow as constant as possible. A receiving tank can be installed between the nitrogen generator and the process to accommodate fluctuations in nitrogen demand and maintain nitrogen purity.

If a receiving tank is to be used, a back pressure regulator and a check valve should be installed between the Balston Nitrogen Generator and the receiver tank (see Figure 6). The 72-460 Back Pressure Controller contains both of these components and may be ordered as an accessory for the Nitrogen Generator. The adjustable back pressure regulator, when set to the appropriate pressure, will maintain a constant pressure drop across the flow control valve. By controlling the pressure drop across the flow control valve, the nitrogen flow and purity will be kept constant. The check valve, when installed properly, will prevent any flow of nitrogen from the receiver upstream toward the generator, providing a more effective means of storing the emergent nitrogen.

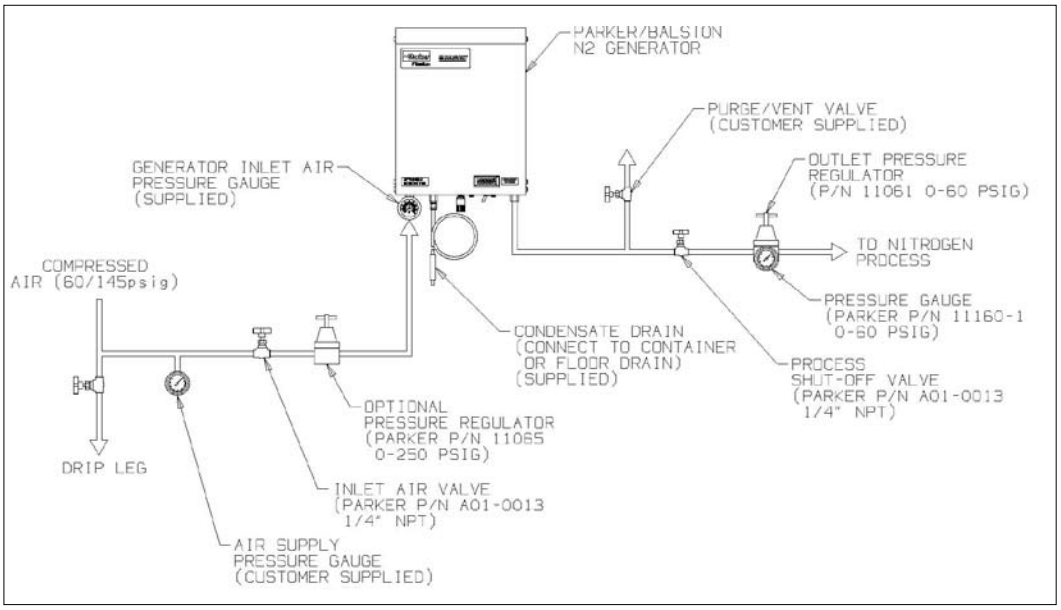

Figure 5 - Recommended Minimum Installation

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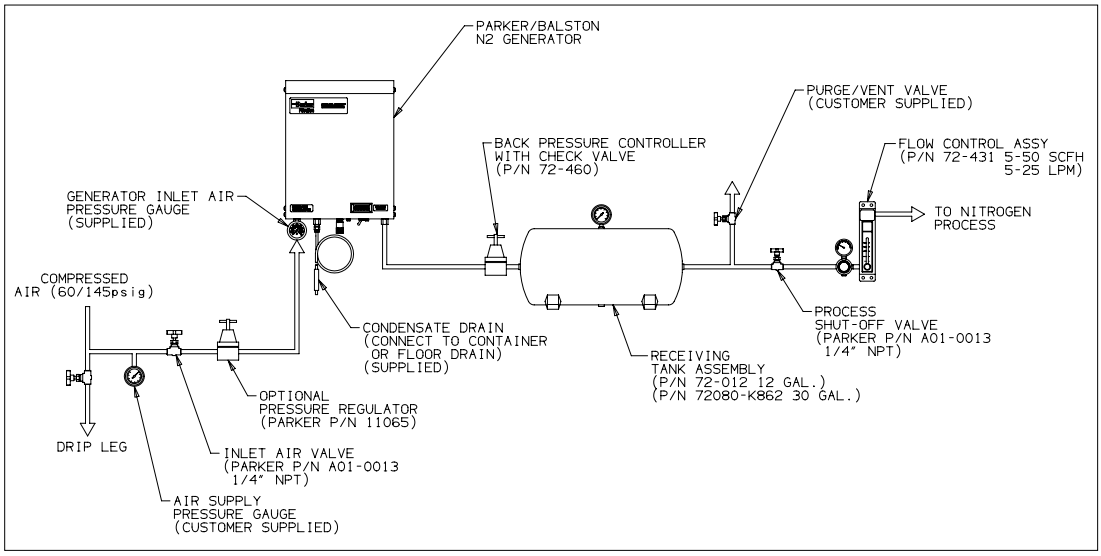

Figure 6 - Recommended Installation with a Receiving Tank for Surge Flows

Installation for Automatic Operation

For applications which have intermittent Nitrogen demand or have surge flow requirements (high flow needed for short time), one method of minimizing the compressed air usage is to install a receiving tank in conjunction with a solenoid valve and pressure switch as shown in Figure 7. The solenoid valve switches the compressed air supply to the generator ON of OFF depending on the signal it receives from the pressure switch. The solenoid valve will remain OPEN until the pressure in the receiving tank has risen to the pressure switch setting (70-80 psig, for e.g.). Once the receiving tank is fully pressurized, the solenoid valve CLOSES, isolating the air supply from the generator. As Nitrogen is withdrawn from the receiving tank, the pressure switch monitors the drop in pressure. When the “Cut-In” pressure is reached (50 psig, for e.g.), the solenoid valve will OPEN allowing more Nitrogen to be generated, thus re-filling the tank. A variety of flow control devices can be used to control the flow of Nitrogen from the receiving tank to the process as shown in Figure 7. Bear in mind that if installing Model HFX0-1NA (built in Oxygen analyzer) in this way, that the Oxygen reading on the display will only be valid WHEN the generator is actually producing Nitrogen. If the receiving tank is fully pressurized and the solenoid is OFF, the Oxygen sensor will not receive a Nitrogen sample. In this case, one could consider plumbing a sample line from the receiver tank itself to the Calibration gas input of the generator and leaving the Calibrate/Generate switch in the “Calibrate” position. In this way, the Oxygen display would continuously read the Oxygen content of the generated Nitrogen stored in the tank, regardless of whether or not the generator was “generating”. During initial start-up, there will be air (20.9% Oxygen) present in the receiving tank. Leaving the exit port of the receiver tank OPEN to atmosphere for a short time (10-15 minutes) during start up will allow the air to be flushed from the tank.

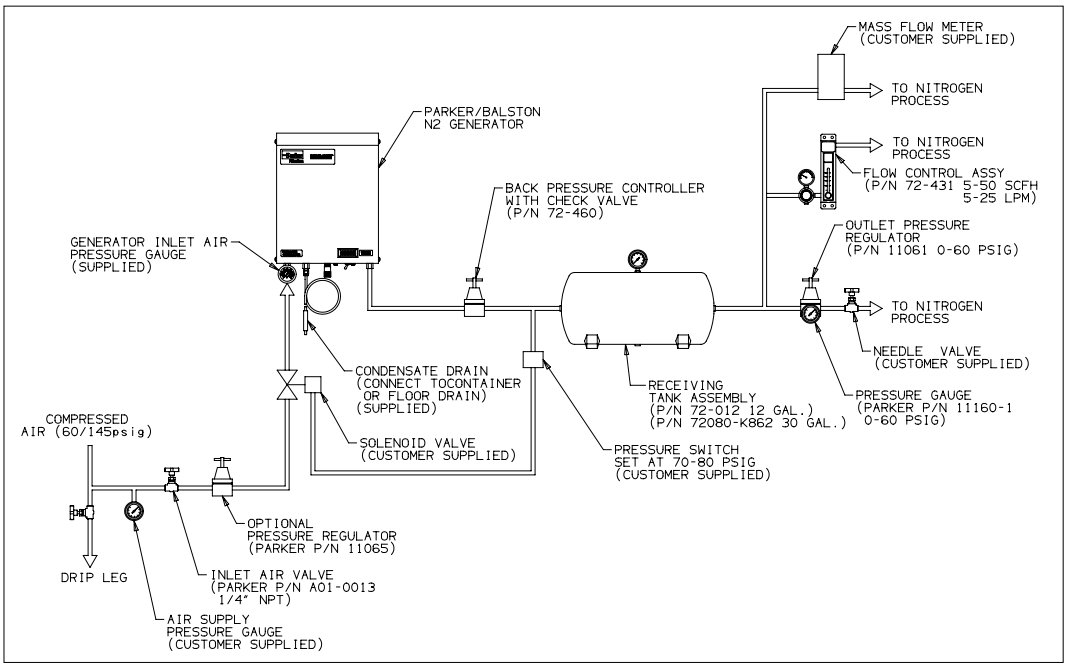

Figure 7 - Model HFX-1 and HFX0-1NA Recommended Installation for Automatic Operation to Minimize Compressed Air Usage

Operation: Calibration

Startup

Plug the 12 VDC wall transformer into a nearby wall outlet. (**Note:** There is no power switch on the generator. The oxygen analyzer is energized when the generator is plugged in.)

The inlet and outlet connections to the Balston HFX-1 Nitrogen Generator must be checked for leaks prior to system start-up. After the system is properly installed and checked for leaks, the inlet gate valve can be opened to introduce compressed air to the system.

During start-up and adjustment of the system, the nitrogen produced by the system will vary in purity. If the application for the nitrogen is critically dependent on purity, the nitrogen produced during start-up or adjustment should be vented.

If the outlet nitrogen flow is closed, the system will still consume compressed air. The inlet air is simply vented to atmosphere through the permeate ports of the membrane module.

Oxygen Analyzer Calibration
(HFX0-1NA only)

CAUTION: the oxygen analyzer may not provide accurate readings unless calibrated on a regular basis.

The oxygen analyzer is calibrated prior to shipment; however, Parker strongly recommends checking the calibration of the unit prior to initial start-up. After the initial start-up, the analyzer should be calibrated on a bi-weekly basis until a suitable schedule is determined, based upon the level of accuracy required by the application.

There are two methods of calibrating the oxygen analyzer: the two point method and the single point method. In the two point method, the first point in the calibration range is set to zero using a zero gas (zero percent oxygen), and the second point in the range is set to a known percentage of oxygen using a span gas (known quantity of oxygen, per gas supplier) or compressed air (20.9% oxygen). In the single point method, only one point in the calibration range is set, using either span gas or compressed air. Maximum accuracy in oxygen concentration monitoring will be achieved if the oxygen concentration in the span gas is within the range of the expected oxygen concentration in the process stream and the pressure of the gas closely approximates the pressure of the nitrogen gas (See Figure 3 for calibration controls).

The procedure for the **two point calibration method** is as follows:

1 Throw the toggle switch on the bottom of the unit to the "calibrate" position.

2 Connect a tank of zero gas to the port. (Gas pressure 20-100 psig)

3 Allow the zero gas to flow through the unit until the reading on the oxygen concentration display stabilizes.

4 Adjust the zero potentiometer if necessary until the oxygen concentration display reads zero.

5 Disconnect the zero gas from the calibration port, and connect a tank of span gas or a source of clean compressed air.

6 Allow the reading to stabilize, and adjust the span potentiometer until the reading on the oxygen concentration display reads the known percent (span gas) or 20.9% (compressed air).

7 Disconnect the calibration gas and switch the toggle switch to the "generate" position to resume sampling the nitrogen stream.

The procedure for the **single point calibration method** is as follows:

1 Switch the toggle switch on the bottom of the unit to the "calibrate" position.

2 Connect a tank of span gas or a source of clean compressed air to the calibration port.

3 Allow the gas or air to flow through the analyzer until the reading on the oxygen concentration display stabilizes.

4 Adjust span potentiometer if necessary until the reading on the oxygen concentration display reads the known percent (span gas) or 20.9% (compressed air).

5 Disconnect the calibration gas and return the toggle switch to the "generate" position to resume sampling the nitrogen stream.

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Operation: Adjustment Procedure

System Adjustment for Desired Outlet Purity

The user must determine the nitrogen purity, flow rate, and pressure required by the application prior to adjusting the system for desired outlet nitrogen purity and flow rate. The inlet air pressure must be constant in order for the system to supply nitrogen of consistent purity to the application. The inlet pressure to the Balston Nitrogen Generator should be maximized (within process and generator parameters) to optimize the operation of the membrane module. The required inlet air flow rate and all flow and purity specifications for different operating conditions are shown in the specifications listing below.

Flow adjustments are made according to the values on the Nitrogen Purity label attached to the side of the generator (and shown below). All flow rate/purity charts are based on the **inlet pressure** of the generator. In order to minimize the difference between the inlet pressure and operating pressure, it is important to perform routine maintenance (change filter elements) at least once per year.

TYPE HFX-1/HFX0-1NA NITROGEN PURITY/FLOW CHART

HFX-1/HFX0-1NA Minimum Purity at Inlet Pressure and Flow

Inlet Pressure PSIG	MINIMUM PURITY PERCENT N_2									
	99		98		97		96		95	
	No. Revs	SCFH	No. Revs	SCFH	No. Revs	SCFH	No. Revs	SCFH	No. Revs	SCFH
80	6.5	8.4	7.5	13	9.5	21	12.5	26	15.0	32
100	6	11	7.0	16	9.0	26	12.5	33	15.0	40
120	6	13	7.0	19	9.5	31	13.5	39	NA	NA
145	5.5	15	6.5	23	9.0	37	13.0	47	NA	NA

1. NO. REVS = FULL TURNS OF NEEDLE VALVE.
2. MINIMUM PURITY IS SHOWN IN PERCENT NITROGEN. ALL NITROGEN PURITIES ARE ±0.5%. IF A MORE ACCURATE READING IS REQUIRED, THE HFX0-1NA OR AN EXTERNAL OXYGEN ANALYZER IS RECOMMENDED. ALL DATA SHOWN IN THE TABLE IS BASED ON AN OPERATING TEMPERATURE OF 68°F.
3. ALL FLOWS SHOULD BE VERIFIED WITH AN AUXILIARY FLOWMETER AT THE POINT OF USE.

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HFX-1/HFX0-1NA Minimum Purity at Inlet Pressure and Flow

Inlet Pressure BAR	MINIMUM PURITY PERCENT N_2									
	99		98		97		96		95	
	No. Revs	SLPM	No. Revs	SLPM	No. Revs	SLPM	No. Revs	SLPM	No. Revs	SLPM
5.5	6.5	4.0	7.5	6.0	9.5	10	12.5	12	15.0	15
7	6	5.0	7.0	7.5	9.0	12	12.5	15	15.0	19
8	6	5.9	7.0	9.0	9.5	15	13.5	19	NA	NA
10	5.5	7.1	6.5	11	9.0	18	13.0	22	NA	NA

1. NO. REVS = FULL TURNS OF NEEDLE VALVE.
2. MINIMUM PURITY IS SHOWN IN PERCENT NITROGEN. ALL NITROGEN PURITIES ARE ±0.5%. IF A MORE ACCURATE READING IS REQUIRED, THE HFX0-1NA OR AN EXTERNAL OXYGEN ANALYZER IS RECOMMENDED. ALL DATA SHOWN IN THE TABLE IS BASED ON AN OPERATING TEMPERATURE OF 68°F.
3. ALL FLOWS SHOULD BE VERIFIED WITH AN AUXILIARY FLOWMETER AT THE POINT OF USE.

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Atmospheric Pressure Applications
(<10 psig/0.7 barg)

If the Balston Nitrogen Generator is being used to deliver nitrogen at or near atmospheric pressure (e.g. purging or blanketing applications), use the following procedure for start-up and adjustment of the system.

1 Open the (customer installed) inlet air gate valve.

2 Adjust the (customer installed) inlet air pressure regulator until the Inlet Pressure Gauge (see Figure 1) shows the pressure reading required to achieve the purity and flow to match the application (see Purity/Flow label above).

3 Adjust the Outlet Pressure Regulator (customer installed) until the Pressure Gauge on the regulator reads less than 10 psig (0.7 barg).

4 Consult the Nitrogen Purity Label on the side of the HFX-1 to determine the proper vernier valve setting for the required process nitrogen purity and inlet air pressure.

5 Allow the system to reach equilibrium at the desired flowrate, pressure, and purity parameters. This should take approximately 15 minutes.

6 Check the purity readings on the oxygen display (Model HFX0-1NA only) on a routine basis. If the nitrogen purity level falls below the desired level, readjust the flow control valve until the proper nitrogen purity level is reached. (Note: If more than minor adjustments of the flow control valve are required to reach the desired purity level, please see the Troubleshooting section of this manual for further guidance.)

Operation: Adjustment Procedure

Elevated Pressure Applications
(>10 psig/0.7 barg)

If the Balston HFX-1 Series Nitrogen Generator is being used to deliver nitrogen at an elevated pressure (>10 psig/0.7 barg), use the following procedure for start-up and adjustment of the system. (Note: In elevated pressure applications, the customer should install a flow controller downstream from the Nitrogen Generator, as detailed in the Installation section of this manual.)

1. Open the (customer installed) inlet air gate valve.
2. Adjust the (customer installed) inlet air pressure regulator until the Operating Pressure gauge (see Figure 1) shows the pressure reading required to achieve the purity and flow to match the application (see Purity/Flow label, page 7).
3. Turn the flow control valve to its fully open position
4. Set the outlet pressure regulator (see Figure 1) to the desired outlet nitrogen pressure.
5. Consult the Nitrogen Purity Label on the control panel of the HFX-1 to determine the proper vernier valve settings for the required process nitrogen purity and operating air pressure.
6. Allow the system to reach equilibrium at the desired flowrate, pressure, and purity parameters. This should take approximately 15 minutes.
7. Check the purity readings on the oxygen analyzer (Model HFX0-1NA only) on a routine basis. If the nitrogen purity level falls below the desired level, readjust the downstream flow controller until the proper nitrogen purity level is reached. (Note: If more than minor adjustments of the downstream flow controller are required to reach the desired purity level, please see the Troubleshooting section of this manual for further guidance.)

Receiver Tank Applications

After all the components have been properly installed (see Figure 5), the following procedure should be followed to ensure optimal operation of the entire nitrogen supply system.

1. Set the inlet pressure to the Balston Nitrogen Generator using the customer-provided pressure regulator, and initiate the air flow through the system.
2. Set the flow control valve to its fully open position.
3. Close the shut-off valve to the process and open the vent valve downstream from the receiving tank to prevent substandard nitrogen from entering the process.
4. Fully open the outlet pressure regulator on the nitrogen generator, and adjust the back pressure controller until the outlet pressure gauge on the nitrogen generator reads 10 psig (0.7 bar) less than the desired nitrogen storage pressure. Maximize the storage pressure to minimize the size of the receiving tank needed.
5. Set the flow control valve on the front panel of the nitrogen generator to the proper reading, as specified by the Nitrogen Purity Label.
6. Purge the entire system for 5 minutes, venting the initial nitrogen stream through the vent valve to atmosphere.
7. Close the vent valve, open the process shut-off valve, and initiate the flow of nitrogen to the process.

The use of a receiving tank upstream from the process, as detailed in this literature, significantly reduces the effects of fluctuating nitrogen demand on the purity of the emergent nitrogen process stream from the Balston Nitrogen Generator.

Temperature Equilibrium

If the temperature of the inlet air to the Balston Nitrogen Generator differs from the temperature of the module (i.e. ambient temperature), the system must be allowed to reach temperature equilibrium before a constant purity of nitrogen is delivered from the system. If the temperature difference is 10°F-20°F (5°C-11°C), this equilibrium period may be as long as 60 minutes. The inlet air temperature and, more importantly, inlet air dewpoint, must not be higher than the temperature of the system or condensation of water within the system may occur, resulting in inefficient performance of the system and/or damage to the membrane.

Operation

Performance of the Balston HFX-1 Nitrogen Generator is highly dependent on the temperature of the inlet air. The data on purity and flow rate presented in this bulletin is based on an inlet air temperature of 68°F (20°C). If the temperature of the inlet air at the point of use for this system varies from 68°F (20°C) by more than 5°F (3°C), the factory must be consulted for flow and purity information.

Evaluation

The optimum performance of the Balston Nitrogen Generator is dependent on system parameters remaining stable and accurate; therefore, the system should be checked at least once per week. This routine system check should include correcting any changes in the vernier valve settings, confirming pressure gauge reading stability and operating pressure setting, checking the downstream flowmeter (if applicable) to ensure flows are consistent with the required nitrogen purity level, and calibrating the oxygen analyzer.

System Upsets

System upsets relative to pressure or flow rate will result in variations in purity of the outlet gas. System upsets relative to temperature, dewpoint, or hydrocarbon content of the inlet compressed air may result in variations of the system performance. These types of upsets should be eliminated from the compressed air delivery system to assure consistent performance of the Balston Nitrogen Generator.

Shutting Down

Proper shutdown of the Balston Nitrogen Generator can be accomplished by simply closing the inlet air gate valve and turning off the oxygen analyzer. If the inlet valve is left open, the system will continue to consume inlet compressed air. Closing the outlet flow control valve will not prevent air consumption because the membrane module permeate ports are open to atmosphere. To avoid this, the system can be set up for automatic operation as shown in Figure 7.

Maintenance

To avoid system damage and/or personal harm, isolate the Balston Nitrogen Generator from the compressed air supply and fully depressurize prior to performing any maintenance activities.

All maintenance activities for the Balston HFX-1 Nitrogen Generator should be performed by suitable personnel using reasonable care. Replacement parts locations are shown in Figure 8.

Required maintenance for the Balston HFX-1 Nitrogen Generation System consists of changing the prefilter and final filter cartridges (every year), changing the galvanic cell in the oxygen analyzer (2 years), checking the performance of the system, and calibrating the oxygen analyzer. The recommended service schedule and replacement part numbers are outlined at the end of this section. The calibration procedure for the oxygen analyzer is outlined on pages 3 and 6. The analyzer should be calibrated on a regular basis, as dictated by the application.

Replacement prefilter cartridges, activated carbon scrubbers, final membrane filter cartridges, and replacement O_2 sensors may be ordered through your local representative. For convenience, these replacement items have been packaged into a maintenance kit for each generator. Maintenance Kit part number MK75005 contains one Balston Grade DX prefilter cartridge, one Balston Grade BX prefilter cartridge, one activated carbon scrubber, one Balston Grade GS membrane filter cartridge, and two DFU's.

Filter Cartridge Replacement

The only tools required to change the prefilter cartridges and the final membrane filter cartridge is a Phillips head and a flat head screwdriver. All filter housings which require routine service are easily accessible when the cover is opened. (Remove the six screws.) The two coalescing prefilters are Balston DX and BX filter assemblies (see Figure 7). Replace these filter cartridges with Balston 100-12-DX and 100-12-BX filter cartridges. When replacing the prefilter cartridges, be sure to install the proper grade filter in the proper housing (the housings are labeled). The final membrane filter is a Balston Grade 95 filter assembly. Replace this membrane filter cartridge with a Balston 9933-05-95 DFU membrane filter cartridge.

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Changing the Filter Cartridge

A Microfibre filter cartridge continues to filter at its original efficiency as long as it is kept in service. The life of the filter cartridge is determined by the increase in flow resistance caused by solids trapped within the depth of the cartridge. The filter cartridge should be changed when the flow falls below an acceptable level, or the pressure drop becomes too high. The pressure drop through the cartridge should not exceed 10 psid. The filter cartridge cannot be cleaned by back-flushing, because the solids are trapped in the depth of the cartridge, not on the surface. The time required to service all three stages of filtration should be less than 15 minutes.

Oxygen Sensor Replacement (Model HFX0-1NA only)

Disconnect generator from power supply before replacing oxygen sensor.

The oxygen sensor degrades over time and should be replaced every two years (P/N 22840-K862). The only tools needed for this replacement are a Phillips screwdriver and a small flathead screwdriver. The procedure for changing the sensor is outlined below and takes approximately 10 minutes.

1. Remove cover.
2. Disconnect wires from Oxygen cell by removing orange connector.
3. Remove the sample plug from the Oxygen cell by gently twisting the sample plug
4. Remove the old sensor by using needle nose pliers to remove the panel nut holding the sensor on the bracket.
5. Install the new sensor with new sample port plug. Tighten panel nut to secure sensor to bracket.
6. Re-connect tubing from Calibrate/generate valve to the new sample port plug.
7. Reinstall orange electrical connector to Oxygen sensor.
8. Calibrate sensor as outlines on pages 3 and 6.
9. Replace cover.

Cleaning

The product is not intended for use in extremely dirty environments. If necessary, the HFX-1 Nitrogen Generator may be wiped clean with a dry cloth on an as needed basis. **Do not use water, aerosols, or other cleaning agents to clean the unit. Use of any liquid detergent to clean the generator could present an electrical hazard.**

Service Schedule

	1st Stage	2nd Stage	Final Filter	Activated Carbon Scrubber	Oxygen Sensor
Replacement Component	100-12-DX	100-12-BX	9933-05-95	1/7825-08-000	22840-K862
Change Frequency	1 Year	1 Year	1 Year	1 Year	2 Years

Replacement Parts

Maintenance Kit	MK75005

Note: To ensure consistent product performance and reliability, use only genuine Balston replacement parts and filter cartridges.

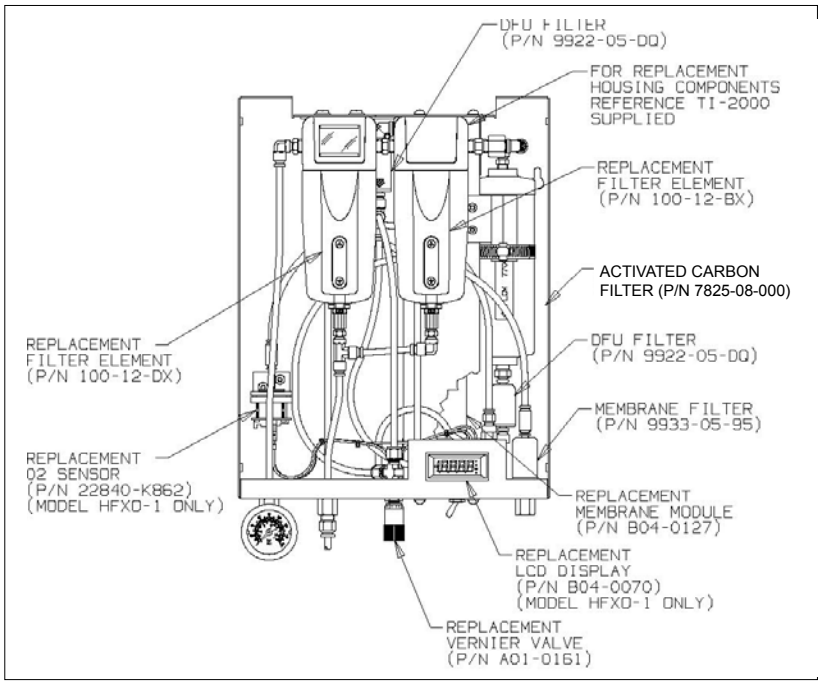

Figure 8 - Maintenance Items, front view with cover removed

System Specifications

Balston Nitrogen Generation System

Model Number	HFX-1, HFX0-1NA
Purity (% Nitrogen)	95.0-99.5
Atmospheric Dewpoint	-58°F (-50°C)
Particles > 0.01µm	None
Suspended Liquids	None
Commercially Sterile	Yes
Max. Operating Pressure	145 psig / 10 barg
Min./Max. Ambient Operating Temp.	60°F/95°F (15°C/35°C)
Recommended Ambient Operating Temp.	68°F (20°C)
Min./Max. Inlet Air Temp.	60°F/95°F (15°C/35°C)
Recommended Inlet Air Temp.	68°F (20°C)
Max. Relative Humidity	80%
Altitude	2000 m Max
Electrical Requirements (HFX0-1NA only) (1)	120 VAC, 60 Hz
Dimensions	19" x 13" x 7" (48 cm x 33 cm x 19 cm)
Shipping Weight	36 lbs. (16 kg)

1 Main supply line voltage must be within 10% of nominal rated voltage for the generator.

Oxygen Analyzer (Model HFX0-1NA only)

Display	LCD
Accuracy	±0.5% Full scale calibrated span, after 30 min. stabilization
Min./Max. inlet pressure (calibration port)	20 psig/100 psig (1.4 barg/6.9 barg)
Sensor type	Galvanic cell
Sensor life	up to 2 years
Response time	Less than 30 seconds
Digital display	00.0 to 25.00% O_2
Span concentration	0.00 to 25.00% O_2
Required calibration	2 weeks (recommended)
Analog output	4 to 20mA (consult factory)

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System Specifications

Maximum air consumption at various purities and pressures

Inlet Pressure psig	Inlet Pressure barg	Nitrogen Purity %	Maximum Inlet Air Required SCFH	Maximum Inlet Air Required SLPM
145	10	95	156	74
145	10	98	101	48
101	7	95	108	51
101	7	98	70	33
73	5	95	71	33
73	5	98	45	21

Cautions

1 The Balston HFX-1/HFX0-1NA Nitrogen Generator should be installed in an area with adequate ventilation to reduce the flammability of the oxygen-rich permeate stream. The system should not be located in an area where the permeate stream poses the risk of explosion or combustion.

2 **Nitrogen is nontoxic and largely inert. It can act as a simple asphyxiant by displacing oxygen in air. Inhalation of nitrogen in excessive concentrations can result in unconsciousness without any warning symptoms such as dizziness, fatigue, etc.**

3 The **maximum** operating pressure of the system is 145 psig (10 barg). Operating the nitrogen generator at pressures above 145 psig (10 barg) will result in damage to the membrane.

4 The **recommended** operating inlet air temperature for the nitrogen generator is 68°F (20°C) or less. If the inlet air temperature will be higher than the ambient temperature, the compressed air should be cooled and filtered, to remove water and oil, prior to heating for introduction to the nitrogen generator. **Do not use high temperature compressed air directly from the compressor.**

5 The **maximum** operating inlet air temperature of the Balston Nitrogen Generator is 95°F (35°C). If the inlet air temperature is above 95°F (35°C), the longevity of the membrane will be reduced and the warranty will be void.

6 The drain lines from the first two stages of filtration should be piped away to an appropriate collection vessel or waste treatment system to avoid any possible re-entrainment of liquid in the emergent filtered air which feeds the membrane module.

7 Changes in inlet pressure or outlet flow demand will alter the nitrogen purity.

8 Use of any valve other than a gate valve on the inlet air supply may cause damage to the membrane module.

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Troubleshooting and Service

All troubleshooting and service activities should be performed by suitable personnel using reasonable care.

Symptom - Nitrogen Generator	Course of Action
Loss of Outlet Pressure	Check that the flow control valve on the generator is fully open and control the flow with a valve at the process. Check operating pressure to assure that it is greater than 60 psig (4.1 barg). Check the system for leaks.
Loss of Outlet Flow	Check operating pressure to assure that it is greater than 60 psig (4.1 barg). Check setting of flow control valve. Adjust if necessary. Check the system for leaks. Check filter elements. Replace if necessary.
Purity is Lower than Specified for Operating Conditions	Check setting of flow rate compared to specification. Check the operating pressure to assure that it has not varied from the original reading. Check the system for leaks. Measure the temperature and dewpoint of the inlet air. The recommended temperature is 68°F (20°C) and the recommended dewpoint 60°F (15°C) or lower. Calibrate oxygen analyzer (if needed).
Air Leak Through Drains of Prefilters	Check inlet pressure. It should be greater than 15 psig (1 barg) to seal drain. Remove tubing from the drain outlet, hold finger over drain opening for a few seconds to allow pressure to build and drain to seal. Remove bowl from filter assembly and rinse with water. If leak persists, replace automatic float drain (P/N 21552).
Symptom - Oxygen Analyzer	**Course of Action**
Display varies	Check process flow demand. Check sensor light. Check sample lines for leaks. Recalibrate oxygen sensor.
Limited range during calibration	Replace sensor (P/N 22840-K862)

To arrange for system service, contact the Technical Services Department at 1-800-343-4048, 8AM to 5PM Eastern Time (North America only) or email at basltontechsupport@parker.com. For other locations, please contact your local representative.

Remember To:

Complete and mail your registration card.

Keep your product certification in a safe place.

Serial Numbers

Each major component in this unit has a serial number. A serial number for the entire unit is attached to the bottom panel, near the outlet port. For your own records, and in case service is required, please record the following:

DATE IN SERVICE _____ SERIAL NO. _____

WARRANTY (NORTH AMERICA ONLY)

(FOR INFORMATION CONTACT YOUR LOCAL REPRESENTATIVE)

Parker Hannifin guarantees to the original purchaser of this product, that if the product fails or is defective within 12 months from the date of purchase, when this product is operated and maintained according to the instructions provided with the product, then Parker guarantees, at Parker's option, to replace the product, repair the product, or refund the original price for the product. This warranty applies only to defects in material or workmanship and does not cover: ring and valve wear on compressors, routine maintenance recommended by the instructions provided with this product, or filter cartridges. Any modification of the product without written approval from Parker will result in voiding this warranty. Complete details of the warranty are available on request. This warranty applies to units purchased and operated in North America.

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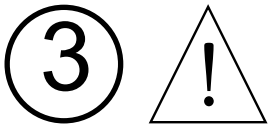
Explanation of Warning Symbols

Symbol	Description
	Caution, refer to accompanying documents for explanation.
	Refer to Installation and Operation Manual, warning note #3 for explanation.
	Caution, risk of electric shock.

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