

# TECHNICAL INFORMATION

## Installation, Operation, and Maintenance Parker Balston® Models Nitrovap-1LV and Nitrovap-2LV Nitrogen Generators

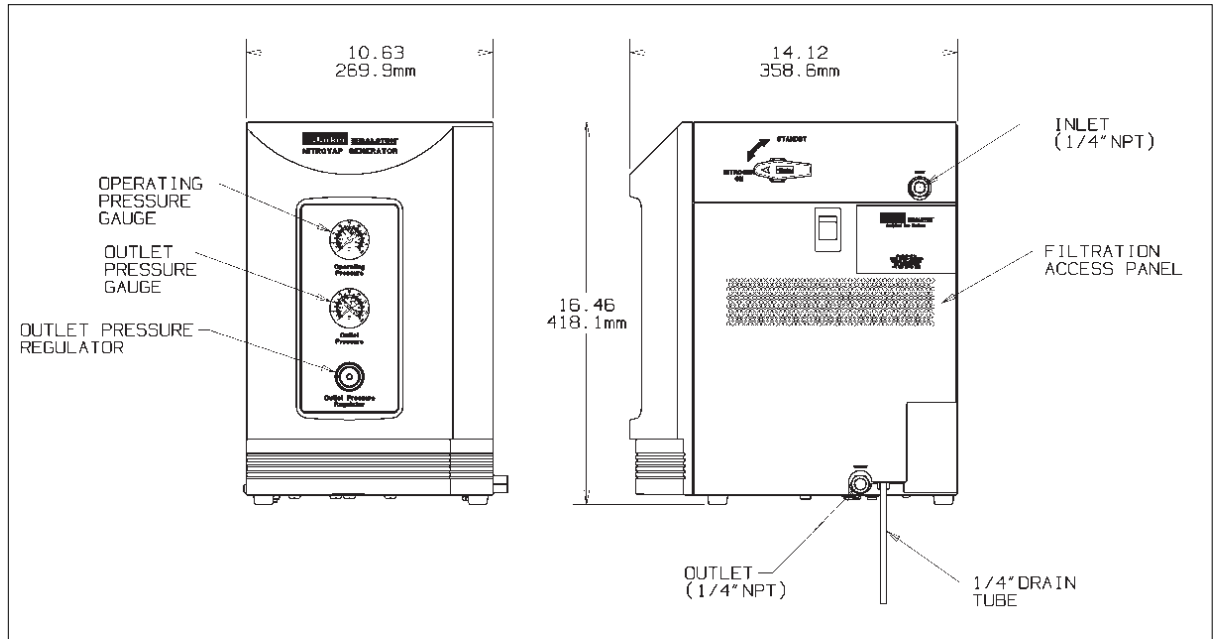


Figure 1 - Nitrovap-1LV and Nitrovap-2LV Nitrogen Generator

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, 8 AM to 5 PM Eastern Time or email at [balstontechsupport@parker.com](mailto:balstontechsupport@parker.com). For other locations outside North America, please contact your local representative.

### General Description

The Parker Balston Nitrovap Nitrogen Generator is a completely engineered system which will convert a compressed air supply into high purity compressed nitrogen. 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.

### Engineered System

The Nitrovap Nitrogen Generator includes all the components required to convert compressed air into high purity nitrogen (see Figure 1). The user need only connect a supply of compressed air to the inlet of the nitrogen generator and connect the outlet of the generator to the process requiring high purity nitrogen.

The flow schematic on page 2 (Figure 2) shows all of the major components of the system. The system can be broken down into four primary functional groups. These are: prefiltration, air separation, controls, and final filtration.

### Oxygen Monitoring



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

# Description

## Prefiltration

A coalescing prefilter is incorporated into the Nitrovap Nitrogen Generator to protect the membrane module from contamination. This filter is located behind the filtration access panel, and it removes liquids and particulate matter from the incoming air supply. The filter is equipped with a float drain which automatically opens to empty any liquids which accumulate inside the filter housing. The drain is connected to 1/4" O.D. plastic tubing which discharges to atmosphere at the back 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 inlet air enters the center bore of these fibers and travels the length of the fibers. As the air passes through the hollow fibers, oxygen and water molecules pass through the membrane wall at a higher rate than nitrogen molecules. This results in a high purity, dry nitrogen gas stream exiting the membrane module. 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 Balston Nitrogen Generator consist of an inlet pressure gauge, an outlet pressure gauge, and a pressure regulator (see Figure 1). The outlet pressure regulator allows the user to set the pressure of the emergent nitrogen process stream.

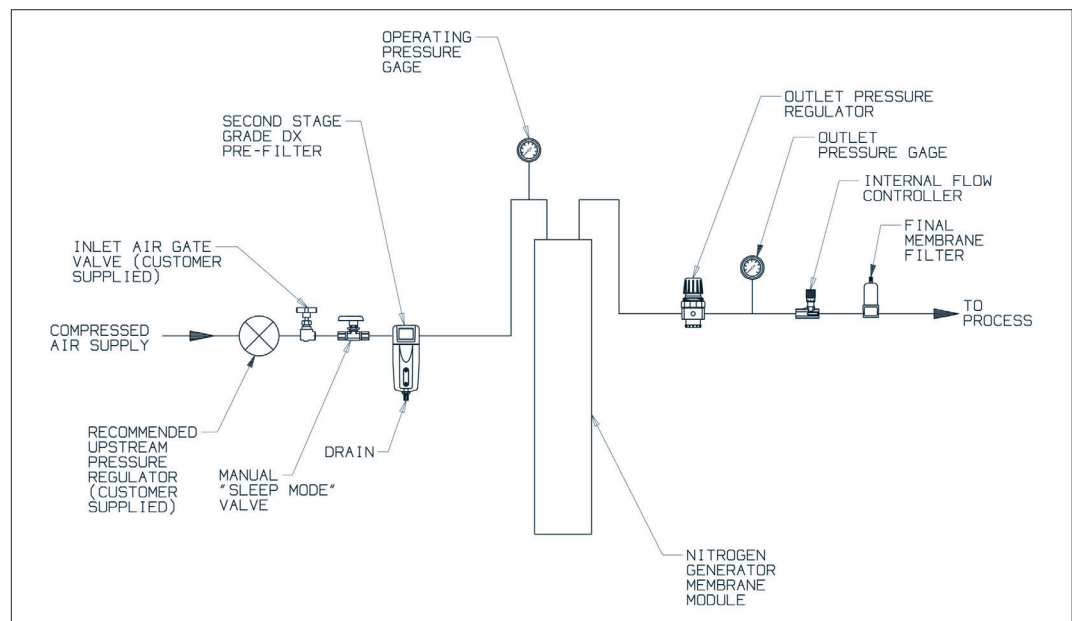


Figure 2 - Flow Schematic

# Installation

## General

The Nitrovap Nitrogen Generator is a free-standing unit but can be wall mounted.

The inlet and outlet ports are 1/4" female NPT. A 1/4" male connector which will withstand 150 psig (10 barg) and 90 SCFH (43 SLPM) should be used to connect to the inlet of the nitrogen generator. 1/4" pipe or 3/8" ID tubing is the minimum required line size to feed the generator.

The compressed air feed should be connected to the port labeled inlet. The port labeled outlet should be connected to the solvent evaporator or instrument. If the Nitrovap Generator is to feed gas to several instruments, a pressure regulator should be installed immediately upstream of each solvent evaporator instrument.

**Shutoff Valve** - A shutoff valve should be installed directly upstream from the nitrogen generator to facilitate routine maintenance and troubleshooting procedures.

## Location

**Pressure Regulator** - A pressure regulator should be installed directly upstream from the nitrogen generator to set and maintain the inlet air pressure. Maintaining a constant inlet air pressure is critical to the performance of the system.

The Nitrogen 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 60°F and 110°F (15°C and 43°C). Installation of the unit in an area where the ambient temperature exceeds 110°F(43°C) or falls below 60°F(15°C) may affect the performance and/or life of the system. Allow a minimum of 6" (15 cm) clearance on all sides of the generator.



**The environment surrounding the Nitrogen Generator should be adequately ventilated. The Nitrovap creates a 30% to 40% oxygen permeate stream which may pose a flammability problem in an oxygen-sensitive environment.**



**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.**

## Utilities

**Compressed Air** - The Nitrovap Nitrogen Generator requires a source of clean, dry compressed air for operation. The incoming air should be between 60°F and 110°F (15°C and 43°C) and be relatively free of water, compressor oil, hydrocarbons, and particulate matter. An oil content <0.01 mg/m<sup>3</sup> is recommended. The compressed air dewpoint is recommended to be 40°F (5°C) at 145 psi. The inlet pressure of the compressed air supply should be regulated to 60 psig to 145 psig (4.1 barg to 10 barg).



**The maximum operating pressure of the system is 145 psig (10 bar). Operating the Nitrogen Generator at pressures above 145 psig (10 bar) will result in damage to the membrane.**

**Note: Do not use high temperature air directly from the compressor!**

**The maximum operating inlet air temperature of the Nitrogen Generator is 110°F (43°C). If the inlet air temperature is above this specification, the longevity of the membrane will be reduced. Changes in inlet pressure or outlet flow requirements will alter the nitrogen purity.**

**Drain Lines** - The 1/4" plastic drain lines from the coalescing prefilter (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.

# Operation/Adjustment Procedures

## Startup

The inlet and outlet connections to the Nitrovap Nitrogen Generator must be checked for leaks prior to system start-up. After the system is properly installed and checked for leaks, the manual "sleep mode" valve can be opened to introduce compressed air to the system.

Adjust the outlet pressure regulator to achieve the desired outlet pressure.

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.

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 Nitrogen Generator should be maximized (within process and generator parameters) to optimize the operation of the membrane module.

## 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. The inlet air temperature and, more importantly, inlet air dewpoint, should 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 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), consult the factory for flow and purity information.

### Evaluation

The performance and operating conditions of the Nitrovap Nitrogen Generator should be checked at least once per week. This routine system check should include confirming pressure gauge reading stability and operating pressure setting, and checking the downstream flowmeter (if applicable) to ensure flows are consistent with the required nitrogen purity level.

The optimum performance of the Balston Nitrogen Generator is dependent on system parameters remaining stable and accurate; as such, the use of an oxygen analyzer to monitor system performance is highly recommended.

### 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 manual "Sleep Mode" valve. If this valve is left open, the system will continue to consume inlet compressed air. Closing the outlet valve will not prevent air consumption because the membrane module permeate ports are open to atmosphere.

## Maintenance



**To avoid system damage and/or personal harm, isolate the nitrogen generator from the compressed air supply and fully depressurize the system.**

**All maintenance activities for the Nitrovap Nitrogen Generator should be performed by suitable personnel using reasonable care.**

Required maintenance for the nitrogen generator consists of changing the prefilter and final filter cartridges, and calibrating the performance of the system. The prefilter and final filter are located behind the filtration access panel (see Figure 3). The recommended service schedule and replacement part numbers are outlined at the end of this section.

Replacement prefilter cartridges and final membrane filter cartridges may be ordered through your local representative. Part numbers and change frequencies are detailed on page 5.

### Follow-Up

The performance of the system should be reviewed on a monthly basis. This review should include checking the settings for inlet pressure, outlet flow rate, and outlet pressure. If these readings have changed from the original settings, adjustments must be made as described in the Adjustment Procedure section of this bulletin (see page 3).

## Cleaning

The product is not intended for use in dirty environments. If necessary, the Nitrovap Nitrogen Generator may be wiped clean with a dry cloth on an as needed basis.

## Filter Cartridge Replacement

All filter housings which require routine service are easily accessible when the filtration access panel is opened. The prefilter is a Parker Balston 2002N-0B1-DX assembly. Replace the filter cartridge with a Balston 100-12-DX filter cartridge. The final membrane filter is a Balston 74945-95 filter assembly. Replace this membrane filter cartridge with a Balston Grade GS 050-05-95 membrane filter cartridge.

For convenience, Parker offers a maintenance kit, P/N MKNITROVAP, which contains a one year supply of replacement filter cartridges.

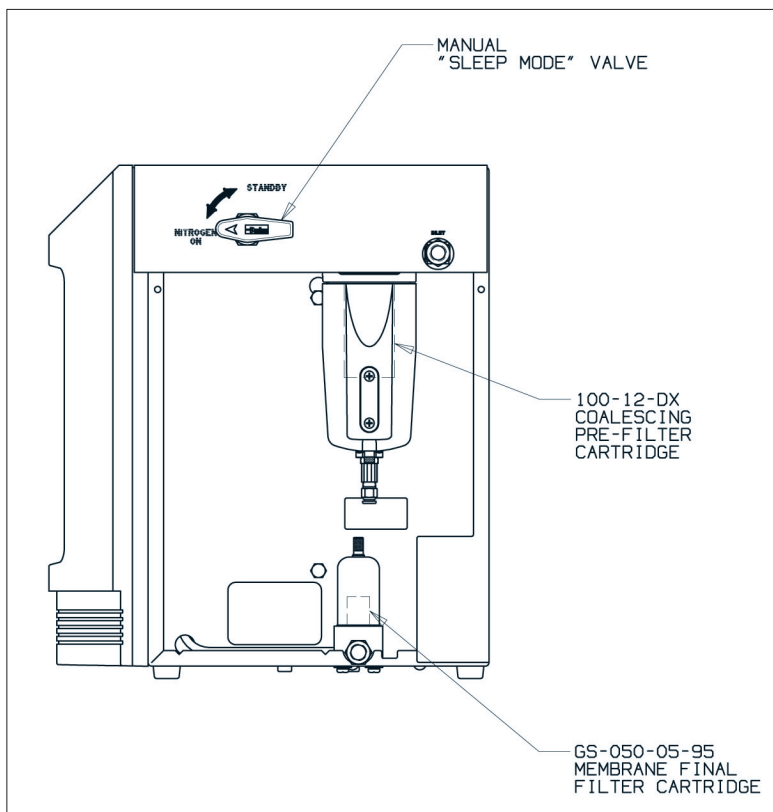


Figure 3 - Maintenance Items

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

The filter cartridge in the filter assembly is removed by: turning filter bowl 1/4 turn, lowering the filter bowl away from the filter head, and unscrewing the element retainer from the base of the cartridge. Insert the new filter cartridge and reassemble the housing in reverse order.

The time required to service all three stages of filtration is less than 15 minutes.

## Service Schedule

	1st Stage	Final Filter
Replacement Element	100-12-DX	GS-050-05-95
Change Frequency	Annual	Annual

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

# System Specifications

## Balston Nitrogen Generation System

Model Number	Nitrovap-1LV	Nitrovap-2LV
Purity (% Nitrogen)	90%	90%
Atmospheric Dewpoint	-20°F	-20°F
Particles > 0.01µm	None	None
Suspended Liquids	None	None
Commercially Sterile	Yes	Yes
Max. Operating Pressure	150 psig	150 psig
Maximum Pressure Drop @ 95% N <sub>2</sub> , 125 psig (8.6 barg)	20 psig	50 psig
Min/Max Ambient Operating Temperature	60°F / 120°F	60°F / 120°F
Recommended Ambient Operating Temp.	68°F (20°C)	68°F (20°C)
Max. Relative Humidity	80%	80%
Altitude	2000 m Max.	2000 m Max.
Min/Max Inlet Air Temp.	60°F / 110°F (15°C / 43°C)	60°F / 110°F (15°C / 43°C)
Maximum Recommended Inlet Air Temp.	68°F (20°C)	68°F (20°C)
Dimensions	11"x13"x16" (27cm x 34cm x 41cm)	11"x13"x16" (27cm x 34cm x 41cm)
Shipping Weight	43 lbs. (19 kg)	50 lbs. (23 kg)

## Nitrogen Flow and Inlet Air Consumption at 90% Purity with 10-15 psi Nitrogen pressure at the Solvent Evaporator

### Nitrovap-1LV Nitrogen Generator

Inlet Air Pressure (psig)	Nitrogen Outlet Flow (SLPM)					Inlet Air Requirement (SLPM)				
	Nitrovap Outlet Pressure setting (psig)					Nitrovap Outlet Pressure setting (psig)				
	40	70	80	100	120	40	70	80	100	120
80	70	115	X	X	X	150	195	X	X	X
100	70	115	130	X	X	175	210	230	X	X
120	70	115	130	155	X	190	230	255	280	X
145	70	115	130	155	185	210	255	275	295	335

### Nitrovap-2LV Nitrogen Generator

Inlet Air Pressure (psig)	Nitrogen Outlet Flow (SLPM)					Inlet Air Requirement (SLPM)				
	Nitrovap Outlet Pressure setting (psig)					Nitrovap Outlet Pressure setting (psig)				
	40	70	80	100	120	40	70	80	100	120
80	160	X	X	X	X	280	X	X	X	X
100	160	215	X	X	X	320	370	X	X	X
120	160	215	265	X	X	370	430	475	X	X
145	160	215	265	310	330	415	475	525	560	580

**Minimum Purity at Operating Temperature, Flow (SLPM) and Pressure (psig)**

**Nitrovap-1LV Nitrogen Generator**

Minimum Purity Percent N2	80 psig	90 psig	100 psig	125 psig	145 psig
99	15.8	18.2	20.2	25.0	29.4
98	24.0	27.6	30.7	38.3	44.6
97	31.8	36.6	40.6	50.8	59.0
96	39.0	45.4	50.4	63.6	73.2
95	48.2	55.1	61.2	77.1	88.8
90	95.0	110.0	130.0	160.0	160.0

**Minimum Purity at Operating Temperature, Flow (SLPM) and Pressure (Bar)**

**Nitrovap-1LV Nitrogen Generator**

Minimum Purity Percent N2	6 Bar	7 Bar	8 Bar	9 Bar	10 Bar
99	17.6	20.6	23.6	26.0	29.4
98	26.7	31.2	35.6	39.9	44.6
97	35.4	41.3	47.1	53.1	59.0
96	44.0	51.2	58.5	66.8	73.2
95	53.3	62.1	71.0	80.9	88.8
90	100.0	130.0	150.0	160.0	160.0

**Minimum Purity at Operating Temperature, Flow (SLPM) and Pressure (psig)**

**Nitrovap-2LV Nitrogen Generator**

Minimum Purity Percent N2	80 psig	90 psig	100 psig	125 psig	145 psig
99	31.6	36.4	40.4	50.0	58.8
98	48.0	55.2	61.4	76.6	89.2
97	63.6	73.2	81.2	101.6	118.0
96	78.0	90.8	100.8	127.2	146.4
95	96.4	110.2	122.4	154.2	177.6
90	190.0	220.0	260.0	320.0	320.0

**Minimum Purity at Operating Temperature, Flow (SLPM) and Pressure (Bar)**

**Nitrovap-2LV Nitrogen Generator**

Minimum Purity Percent N2	6 Bar	7 Bar	8 Bar	9 Bar	10 Bar
99	35.2	41.2	47.2	52.0	58.8
98	53.4	62.4	71.2	79.8	89.2
97	70.8	82.6	94.2	106.2	118.0
96	88.0	102.4	117.0	133.6	146.4
95	106.6	124.2	142.0	161.8	177.6
90	200.0	260.0	300.0	320.0	320.0

# Troubleshooting and Service



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

Symptom - Nitrogen Generator	Course of Action
<b>Loss of Outlet Pressure</b>	<p>Check that the flow control valve on the generator is fully open and control the flow with a valve at the process.</p> <p>Check operating pressure to assure that it is greater than 60 psig (4.1 barg).</p> <p>Check the system for leaks.</p>
<b>Loss of Outlet Flow</b>	<p>Check operating pressure to assure that it is greater than 60 psig (4.1 barg).</p> <p>Check setting of flow control valve. Adjust if necessary.</p> <p>Check the system for leaks.</p>
<b>Purity is Lower than Specified for Operating Conditions</b>	<p>Check setting of flow rate compared to specification.</p> <p>Check the operating pressure to assure that it has not varied from the original reading.</p> <p>Check the system for leaks.</p> <p>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.</p> <p>Calibrate oxygen analyzer (if needed).</p>
<b>Air Leak Through Drains of Prefilters</b>	<p>Check inlet pressure. It should be greater than 15 psig (1 barg) to seal drain.</p> <p>Remove tubing from the drain outlet, hold finger over drain opening for a few seconds to allow pressure to build and drain to seal.</p> <p>Remove bowl from filter assembly and rinse with water.</p> <p>If leak persists, replace automatic float drain (P/N 21552).</p> <p>To arrange for system service, contact the Technical Services Department at 1-800-343-4048, 8AM to 5PM Eastern Time or email at <a href="mailto:balstontechsupport@parker.com">balstontechsupport@parker.com</a>. For other locations outside North America, please contact your local representative.</p>

## Don't Forget To:

To activate your warranty go to [www.labgasgenerators.com/warrantyregistrations](http://www.labgasgenerators.com/warrantyregistrations). Keep your product certification in a safe place.

## Serial Numbers

The serial number label for the unit is on the left side of the generator, below the inlet port. For your own records, and in case service is required, please record the following:

DATE IN SERVICE \_\_\_\_\_ SERIAL NO. \_\_\_\_\_

## Explanation of Warning Symbols

### Symbol

### Description



Caution, refer to accompanying documents for explanation.



Caution, risk of electric shock.

**CELL: DRAFT**

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