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# Parker Dual-Bed & PSA Nitrogen Generation Systems

Installation, Operation, & Maintenance Manual

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ENGINEERING **YOUR** SUCCESS.

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 can lead to unsafe operating conditions and may void warranty. For additional information, refer to this manual or contact the factory for recommendations. Please have the dryer serial number and model ready when contacting the factory.

### **Factory Contact Information**

Phone 1-716-686-6400

For pricing, availability, and purchase orders: [GSFOrders@parker.com](mailto:GSFOrders@parker.com)

For technical support and aftermarket: [FAFparts@parker.com](mailto:FAFparts@parker.com)

For product applications and technical sales: [FAFQuotes@parker.com](mailto:FAFQuotes@parker.com)

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## Safety & Precautions

Use **EXTREME CAUTION** when working in the vicinity of the generator. Adhere to all warning labels on generator. Relieve pressure before servicing generator or associated equipment.

Disconnect power before servicing generator.

Always wear eye protection when in the vicinity of the dryer. Ear protection is recommended, especially if the dryer is being operated without mufflers. Even when mufflers are used, a desiccant vessel blowing down to atmosphere will raise particles, create more noise than during "normal" operation and may startle an individual not familiar with this portion of the operation.



**CAUTION:** Excessive oil or moisture levels in the inlet air will cause irreversible contamination to the Adsorption Vessel (CMS) material. If there is any indication or suspicion of excessive oil levels in the feed air (e.g., oil-saturated filter elements, dryer malfunction), find and correct problem(s) before installing Parker Dual-Bed Nitrogen Generators.

In the case of an overpressure situation there is a safety relief valve installed on each adsorption vessel and nitrogen surge tank designed to protect the equipment.

In the event of a power failure, the auto block valve will close stopping the flow of nitrogen. When power is restored, the generator will restart with desorption.

Automatic or manual drain valves will eject water, oil, particulates, and air under partial pressure when operated. Proper precautions must be taken.

Condensate drainage from compressed air systems may contain oil or other contaminants. Follow all applicable regulations for safe handling and disposal.

## Oil Contamination

Excessive oil levels in the inlet air are very detrimental to the Adsorption Vessel Carbon Molecular Sieve (CMS) material. Irreversible contamination of the CMS material is possible if oil levels are too high. If there is any indication or suspicion of excessive oil levels in the feed air (e.g., oil-saturated filter elements, dryer malfunction, or loss of performance), shut unit down and find and correct problem(s) before restarting. If the unit is allowed to run with high oil content in the feed air, a major loss in performance is possible, necessitating a partial or complete CMS bed replacement.

## Moisture Contamination

High moisture (water) content in the inlet air may be detrimental to the unit's performance. While not as serious as oil contamination, a loss in performance will result. If a dryer, coalescing filter, or automatic drain malfunction is observed or suspected, shut unit down and correct problem(s) before re-starting.

## Carbon Dust

A small amount of intermittent CMS (carbon) dust on the inside of final filter element does not present a problem. However, if accumulations of powder on filter element, or exhausting from the silencer during blow-down are observed, shut unit down **IMMEDIATELY** and contact factory. Excessive dust indicates physical deterioration of the CMS material, and will require replacement of carbon in the vessels.

## Initial Start Up

Before initial startup, check all filters to verify filter elements are secured in place. Elements tend to shake loose during transit. Serious loss in performance and carbon contamination may result if filter elements are loose and or if the o-ring gasket is not making a seal with the filter head assembly. Correct any problems before proceeding with startup.

## Adequate Ventilation

As Nitrogen is inert and can displace breathing air, it is imperative to avoid leaking or exhausting the gaseous product Nitrogen into a confined area where plant personnel may be present. Adequate ventilation should always be maintained in the area where the Nitrogen Generator is to be operated.



**CAUTION:** Before performing any maintenance on the system such as repairing valves or changing filter elements, make sure system is fully depressurized and isolated from the air system. Failure to do so can cause serious injury.

## Warning Symbols



Caution, refer to accompanying documents for explanation



Refer to the caution/warning note indicated for explanation.



Caution, risk of electric shock

## General Description

The Parker Dual-Bed Nitrogen Generators are completely engineered systems, which will convert a compressed air supply into 95-99.999% purity, compressed nitrogen. The units are based on state-of-the-art Dual-Bed Pressure Swing Adsorption (PSA) technology. The adsorption bed converts compressed air into a concentrated Nitrogen output stream.

## Engineered Systems

The Parker Dual-Bed Nitrogen Generators include all the components required to convert compressed air into high purity nitrogen. The user need only connect a supply of clean, dry compressed air to the inlet of the Nitrogen generator, and then connect the outlet of the generator to the process requiring high purity nitrogen. The system can be broken down into four primary functional groups:

- Pre-filtration
- Nitrogen generation
- Final filtration
- Controls

## Description

### Pre-filtration

Two high efficiency coalescing filters (PF 101 and PF 102) are incorporated into the Nitrogen generator AST to protect the adsorption bed and valves from contamination. The coalescing filters are located on the AST skid. They remove trace liquids and particulate matter from the incoming air supply. The AST is equipped with an automatic, zero loss drain trap to empty any liquids accumulated within the filter housing.



**CAUTION:** It should be noted that the pre-filters are present for final filtration of the incoming air only. The air supplied to the system should be clean and dry prior to reaching these filters. Any accumulation of oil or moisture in these filters should be an indication of possible adsorption or contamination. The amount of liquid present and the duration of moisture is strong evidence of contamination in the CMS Bed.

### Nitrogen Generation

The heart of the system is the pair of adsorption vessels loaded with Carbon Molecular Sieve (CMS). The CMS adsorbs Oxygen from compressed air, producing a Nitrogen stream which is collected in the nitrogen storage tank (NST 101). Essentially, one adsorption vessel will alternate between the adsorption and desorption phase. When one vessel (AV 101 or AV 102) is in its adsorption cycle the other vessel is in its desorption cycle.

The cycling of the system is controlled by a PLC (Programmable Logic Controller) which sends electrical signals to solenoid valves. The solenoid valves in turn, pneumatically actuate the process valves (controlling Air and Nitrogen flow). One of the two inlet air process valves (PV 101 or PV 102) is open, allowing air to enter the corresponding vessel to begin its adsorption cycle. The corresponding Nitrogen process valve downstream (PV 107 or PV 108) is also open, allowing the product nitrogen stream to leave the vessel during the adsorption process. At the same time, the desorption vent valve (PV 104 or PV 103) of the opposite vessel is open, releasing the oxygen-rich gas to the atmosphere during the desorption process. At the end of the adsorption cycle (approx. 98 seconds), the pressures in the two vessels are allowed to equalize (PV 105 and PV 106 open, while all feed, product, and desorption valves are closed). The vessel that had been in its adsorption cycle will then undergo desorption, and vice versa.

Since one Adsorption Vessel is essentially always in a production state (with the exception of the 4-second equalization period), a continuous flow of Nitrogen is produced. The system is equipped with a continuous Oxygen analyzer to monitor the product gas purity. After the initial startup, the Nitrogen Generator is designed to operate continuously.

### Final Filtration

The final filter on the Parker Nitrogen Generator is removes particulate contamination assuring the user of clean high purity Nitrogen. The final filter is located in the rear of the unit behind the adsorption vessels. An additional filter may be added to the outlet of the N2 generator if different filtration requirements are required such as a sterile grade filter.

### Flow/Pressure Controls

The flow and pressure controls are comprised of:

- an outlet pressure regulator (PRV 102)
- outlet pressure gauge (PI 105)
- outlet flow meter (FE 101), and
- flow controller (PCV 102)

Proper use of these controls will assure the user of a 95% to 99.99% purity Nitrogen outlet stream.

The outlet pressure regulator and gauge are used to set and monitor the Nitrogen outlet pressure from the generator.

The flow controller and flow meter are used to set and monitor the Nitrogen flow rate through the system.

The system will produce higher purity Nitrogen (lower O<sub>2</sub> content) at lower flow rates. Conversely, the same system will produce lower purity Nitrogen (high O<sub>2</sub> content) at higher flow rates. At higher flow rates, there will also be greater fluctuations in the Nitrogen Surge Tank pressure as the Dual-Bed goes through a full cycle of both Adsorption and Desorption phases.

**NOTE:** Nitrogen produced by PSA Nitrogen Generators contains Argon which is also inert. Therefore, when mentioning Nitrogen purities, the composition of the product gas is determined by the residual Oxygen content. Ex. 1% Oxygen in product gas is equivalent to  $100\% - 1\% = 99\%$  (Nitrogen + Argon).

### Electrical Controls

The electrical control on the Parker Dual-Bed Nitrogen Generator is an ON/OFF switch. The ON/OFF switch is located on the left side of the control panel. This switch is used to enable the Nitrogen generator to pressurize and start cycling.

Refer to appropriate electrical schematics that came with the unit.

## Installation

### General

The Parker Nitrogen Generation System is a freestanding unit. On each generator model, the air inlet port is located on the left side, and the: (1) outlet port to the nitrogen storage tank, (2) the inlet port from the nitrogen storage tank, and (3) the final product nitrogen outlet are located on the right side of the unit. Use connectors that will withstand 150 psig and the maximum flow rate of the system to connect to the Nitrogen generator.

### Location

The Parker Nitrogen Generation System should be located in an area where the ambient temperature is between 40°F and 95°F (4°C and 35°C). Installation of the unit in an area where the ambient temperature exceeds 95°F (35°C) or falls below 40°F (4°C) may affect the performance and/or life of the system and void the warranty. The environment surrounding the nitrogen generator should also be vibration-free, dry, and adequately ventilated. The generator creates an oxygen-rich permeate stream which may pose a flammability problem in an oxygen-sensitive environment. It is recommended to leave a minimum of three feet of space on all sides of the generator for maintenance.

If placed in storage, place in a location protected from the environment. If stored outside, it is recommended that the generator be underneath a shelter and be shrink wrapped or crated to protect against rain. Nitrogen generators should not be stored in a location exposed to freezing temperatures or direct sunlight. All plugs and flange covers should remain in place until the generator is ready to be installed.



**CAUTION:** 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. Install the generator in a well-ventilated area. This system is equipped with an automatic block and bleed system where the off-spec. Nitrogen can at anytime begin venting Nitrogen to the surroundings. This Nitrogen should be routed and vented to a safe space.



**CAUTION:** An oxygen-rich stream is released from the exhaust silencer. Oxygen enriched air leads to increased risk of fire in the event of contact with flammable products. Ensure that there is adequate ventilation at all times. Do not install the Dual Bed Nitrogen Generator where explosive mixtures may occur.

### Utilities

**Compressed Air** – The Parker Nitrogen Generation System requires a source of clean, dry compressed air for optimal operation. The compressed air should be of instrument quality and supplied at a pressure of 85 psig minimum to 135 maximum. At air supply pressures greater than 110 psig, the performance of the generator will be optimal. If the incoming air pressure is greater than 135 psig, the system may be damaged and the warranty will be void. The supply air should also be at room temperature and free of water, compressor oil, hydrocarbons, and particulate matter. Parker recommends a dedicated compressed air system which includes a compressor, an after cooler, and a refrigerated dryer to supply compressed air at a dew point of 40°F or better, a water separator, and final filtration. The compressor should provide enough airflow to prevent excessive pressure drops during the cycling of the adsorption beds. An air storage tank is necessary to store air for peak air demand.

**NOTE:** It is highly recommended that a qualified service technician from the compressor company set-up the feed air compressor when purchased with the package. Serious damage to the air compressor may result if improperly set-up.



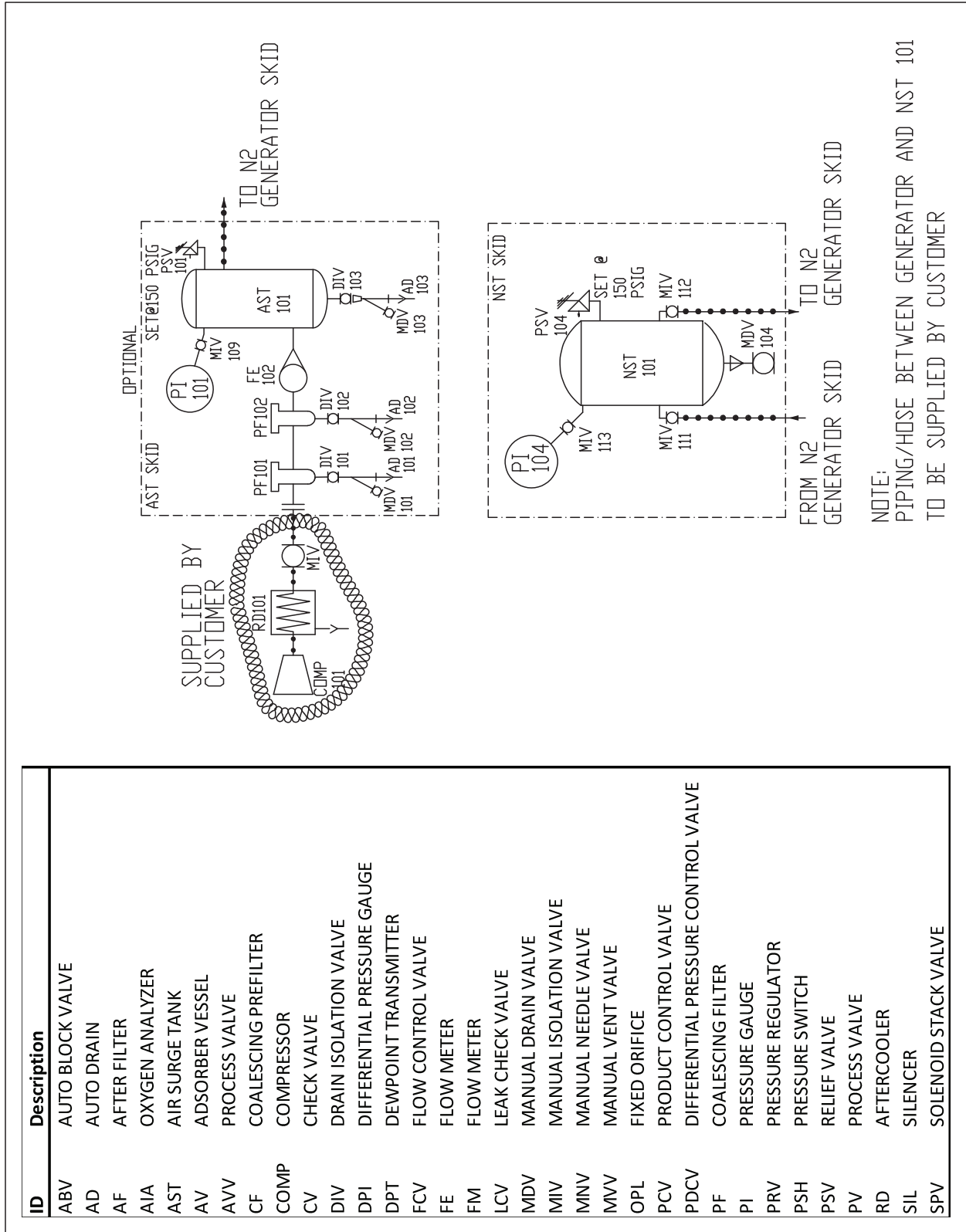
**CAUTION:** Excessive quantities of water, compressor oil, hydrocarbons, or particulate in the compressed air supply will contaminate the CMS material and valves. If contamination of the system occurs as a result of an inferior compressed air supply, nitrogen purity specifications will not be met and the warranty will be void.

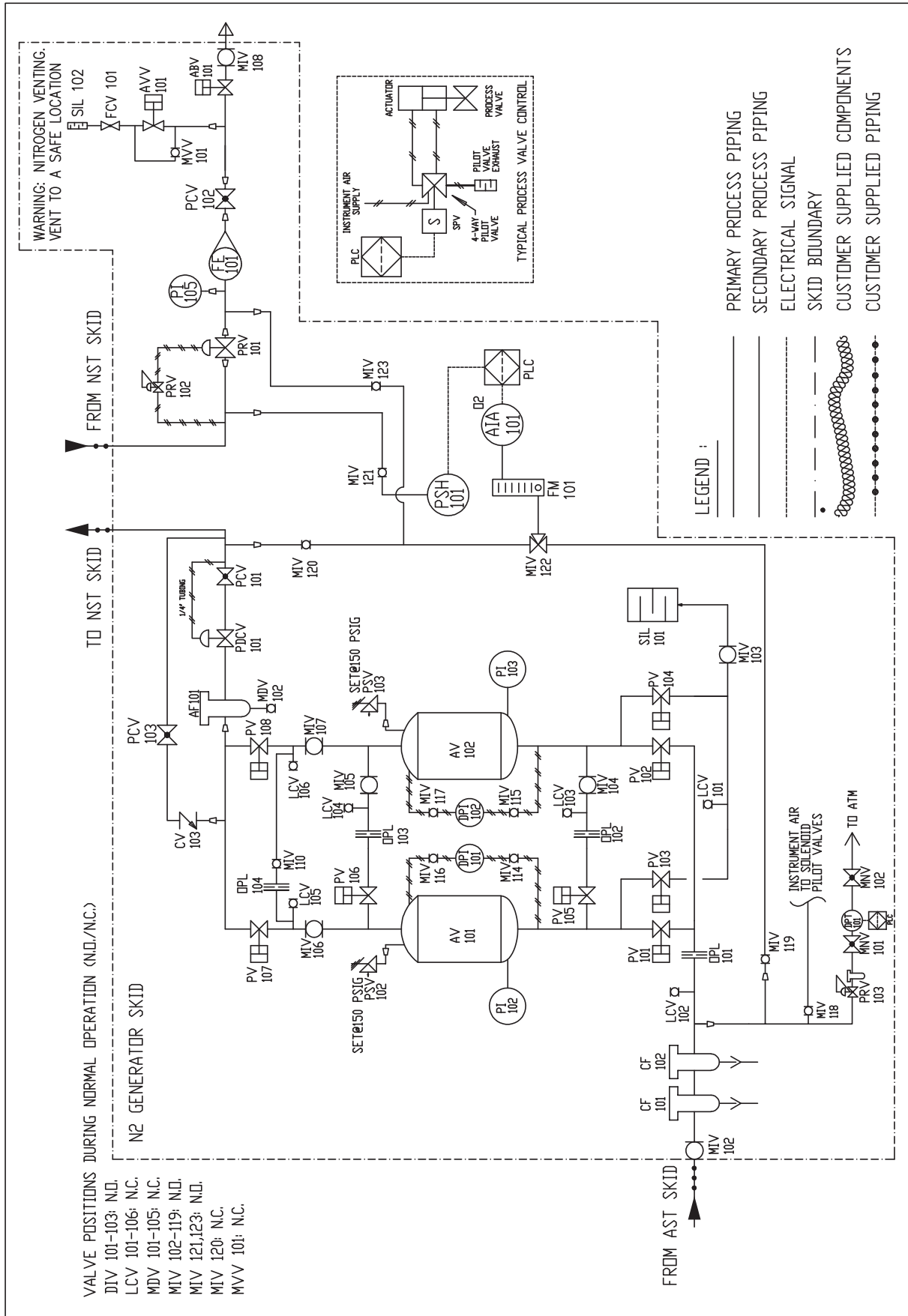
**Power** – A 120 VAC/60 Hz, 15 amp power source will be required to energize the Parker Dual-Bed & PSA Nitrogen Generation Systems.

**Piping** – Stresses and vibration that may occur during transit have been found to cause piping leaks in some situations. Verify that the relief valves are installed on the vessel lids. They may have been shipped loose to prevent shipping damage.

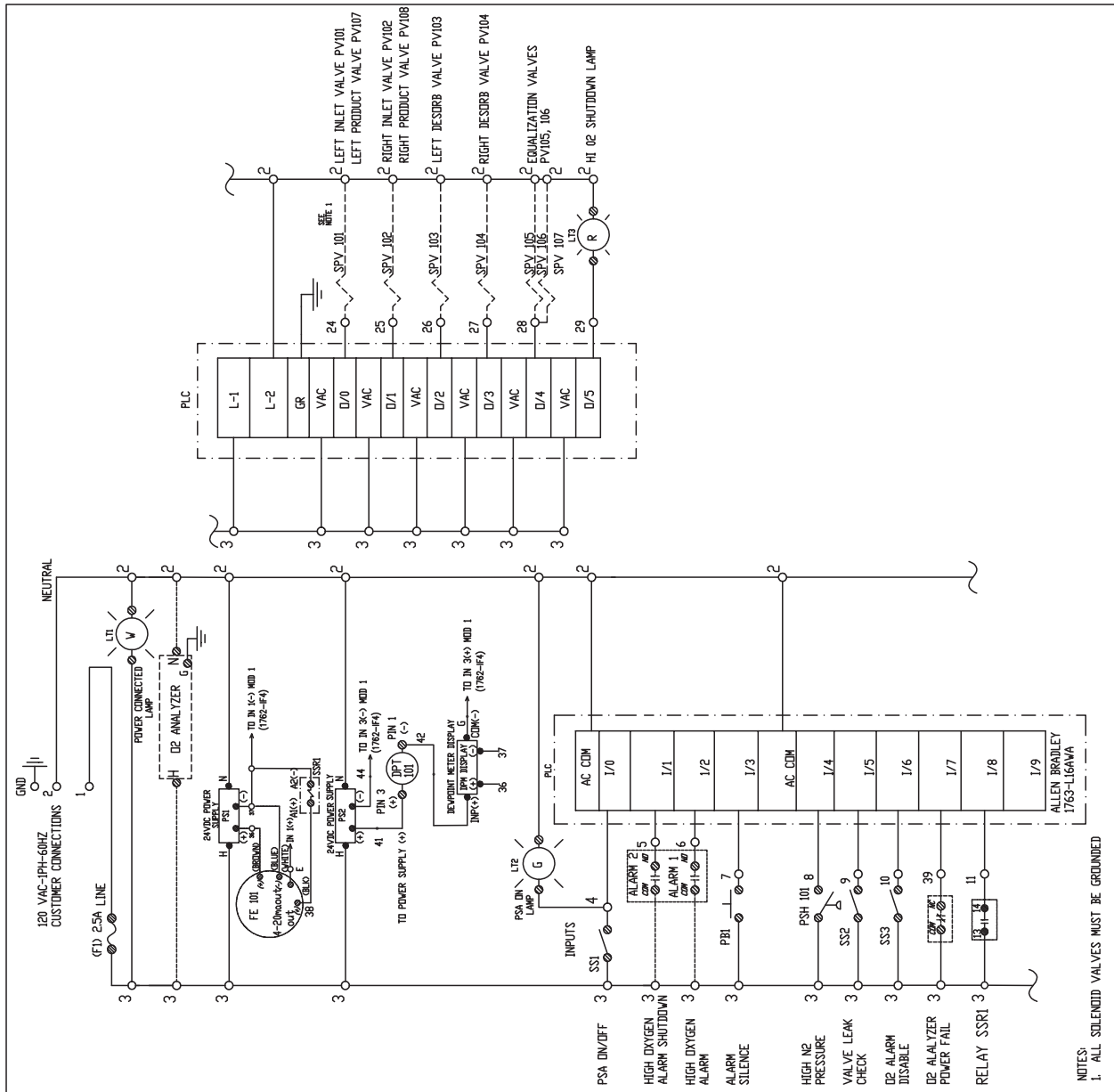
The inlet air and Nitrogen outlet piping should adapt to the inlet and outlet port properly. All piping and fittings used with the Nitrogen generator should be clean and rated to 150 psig minimally.

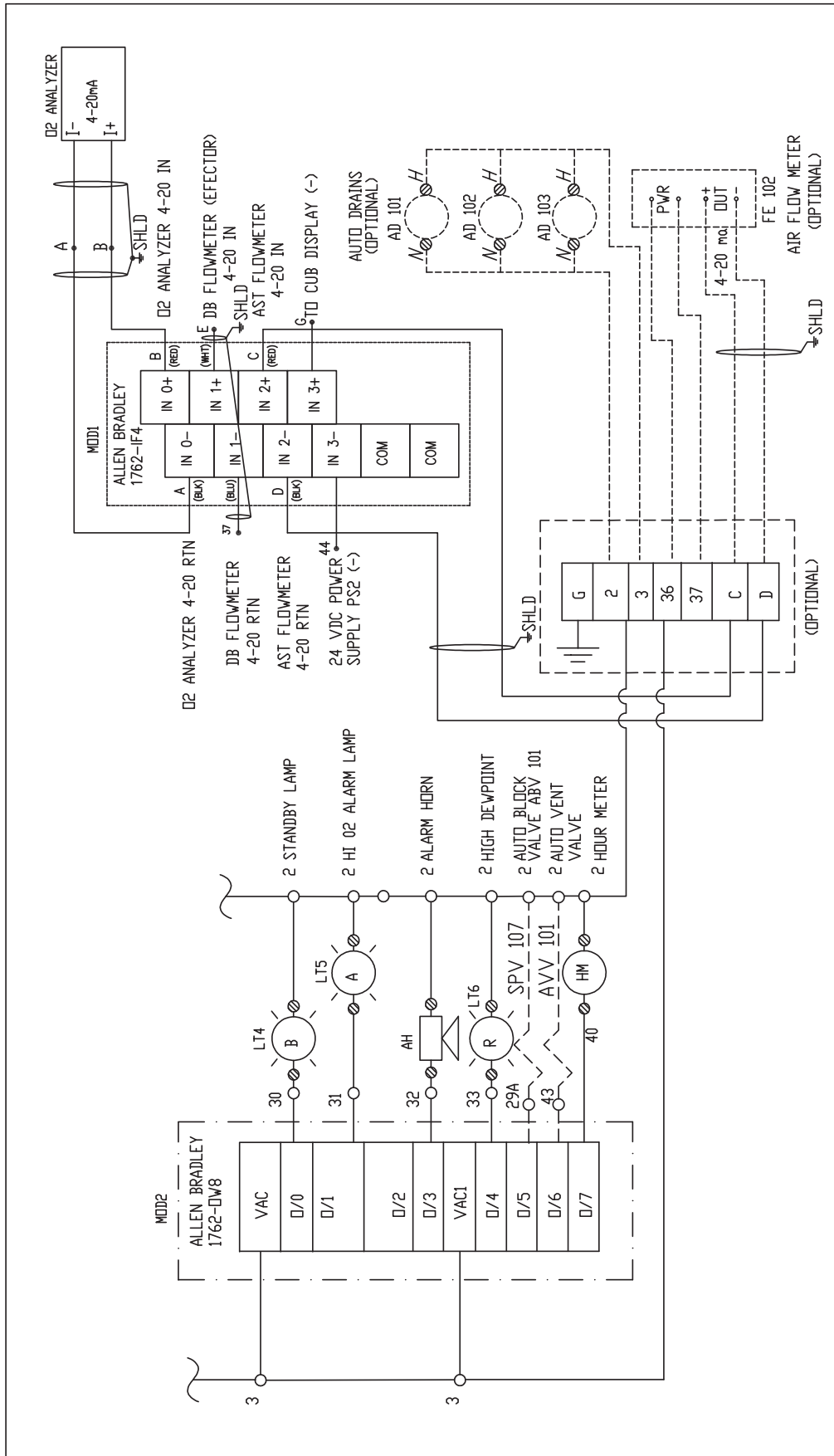
Typical P & ID





Typical Wiring Diagram





## Operation

### Pre-Start Procedure

The DB and PSA unit requires approximately two hours of startup time to achieve rated purity (longer if higher purities are desired). Nitrogen generated during this period should be vented to atmosphere to avoid contaminating downstream processes. After the inlet and outlet piping has been connected to the generator, plug the power cord into a 120 VAC/60 Hz power source. If high purity Nitrogen is already stored in Nitrogen Storage Tank, follow Normal Start Up procedure. Remove all shipping plugs found on LCV's, MDV's, and outlet ports of relief valves.

### Initial Start-Up

Follow the steps below after installation or any maintenance work on the DB unit.

1. Verify the following switches are in the positions below:  
PSA OFF/ON: Off  
Leak Check: Off  
Alarms: Disable
2. Check to ensure that a properly protected 120 VAC, 1-phase, 60 Hz power connection has been made to the PSA control panel. The connection is made at the terminal strip inside the Control Panel as follows: Hot wire to terminal block "1," Neutral on terminal block "2," and Ground to terminal block "G." When power is applied, the "Power Connected" lamp should illuminate.
3. Check to ensure that a properly protected power connection has been made to the compressor according to the manufacturer's instructions. **IMPORTANT:** Determine voltage specification of compressor. Follow compressor manufacturer's instructions (supplied with compressor) for proper set-up and operation.
4. Connect air surge tank (AST 101 – supplied as option) to nitrogen generator.
5. Secure all filter elements.
6. Close the following valves:
  - all MDV's
  - all LCV's
  - MIV 102 – inlet valve
  - MIV 108 – outlet to process
  - MVV 101 – vent valve
  - MIV 120
7. Open the following valves:
  - all DIV's
  - MIV 103-107
  - MIV 111-119
  - MIV 121
  - MIV 123
  - FCV 101 (partially open – should already be set from the factory)
8. Verify settings of PCV 101 and PCV 103 are the same as per PSA TEST DATA RECORD if not already secured.
9. Turn on feed air and allow pressure to build up in AST 101.
10. Slowly open MIV 102.
11. On control panel switch "Alarms" to "Disable" position



**CAUTION:** The user must read the oxygen analyzer manual for proper operation and important information about the device.

12. Turn the span/sample valve, MIV 122, to the "Span" position. Calibrate the analyzer to display 20.9 while flowing span air. Once calibrated, return the three-way valve to the "Sample" position. For detailed calibration instructions, refer to the Oxygen Analyzer instruction manual.
13. If applicable verify oxygen analyzer high and low alarm set points.
14. Turn the "PSA OFF/ON" switch to the ON position.

15. The generator will initially adsorb (pressurize) for approximately 15 seconds. During the adsorption cycle the Nitrogen Storage Tank will begin to pressurize.
16. Once there is sufficient pressure in the nitrogen surge tank (NST 101), adjust the Outlet Pressure until outlet pressure gauge indicates the desired setting.
17. The system will be in automatic vent mode. The flow on the flowmeter (FE 101) should be registering less than 2/3 of the rated flow rate of the generator. If the flow is higher, adjust FCV 101.
18. Verify outlet pressure reading. Adjust if necessary.
19. After 2 hours of undisturbed operation or once the Oxygen content is at acceptable levels, turn the "Alarms" switch to the ON position. Open MIV 108 to allow Nitrogen to flow to the process. Adjust PCV 102 to the desired flowrate. Turn the "Oxygen Alarms On/Disable" switch to ON position to activate alarms.

### Normal Start-Up

1. Open the inlet air ball valve MIV 102 to pressurize the system. Inlet air pressure to should be 110 psig as a minimum for the best performance.
2. Turn the "PSA OFF/ON" switch to the ON position.
3. Calibrate the Oxygen Analyzer with the "Alarms" switch in the "Disable" positioned.
4. Allow oxygen level reading to stabilize.
5. Adjust the Outlet Pressure and verify the Nitrogen flowrate based on individual system requirements is below the design flowrate.
6. Turn the "Alarms" switch to the ON position and verify MIV 108 is open.

### System Adjustment

After the Parker Nitrogen Generation System has been energized and pressurized, determine the outlet pressure and purity of Nitrogen required for the application. Set the flow parameters as follows:

1. **Pressure** – To adjust the outlet pressure from the generator, turn the outlet pressure regulator until the outlet pressure gauge displays the desired outlet pressure.
2. **Flow** – Set the outlet flow after setting the outlet pressure, by turning the flow control valve until the desired flow meter reading is displayed on the flow meter. Avoid exceeding the output capacity of the generator. If outlet capacity is exceeded, the Nitrogen generated will not meet purity specifications.

### Evaluation

The performance and operating conditions of the Nitrogen Generation System should be monitored on a routine basis, as dictated by the application. This routine system check should include:

- confirming Nitrogen purity stability
- adjusting flow meter reading (if necessary)
- confirming adsorption vessel cycling pressures
- checking outlet pressure

If any of these readings have changed significantly from their original settings, adjustments must be made as described in the System Adjustment section of this manual. If the Nitrogen purity must be altered during operation of the system, allow approximately 1 hour for the purity to stabilize.

### Temperature Considerations

The data represented in this manual is based on an ambient operating temperature of 77°F (25°C). The standard unit is designed to operate in the temperature range of 40°F to 95°F (4°C to 35°C). Please consult factory if the ambient temperature in the generator location will be outside this range.

### Standby Feature

The Dual-Bed and PSA systems are equipped with an energy savings feature called “Standby”. “Standby” is indicated by the illumination of the blue “Standby” lamp on the control panel. A pressure switch is integrated in the flow process to detect an elevated pressure in the nitrogen storage tank (NST 101) when nitrogen is not being consumed. In such situations, the pressure switch sends a signal back to the PLC which causes the generator to shut down. Once the pressure in NST 101 drops below the set point of the pressure switch and below 5 scfm of Nitrogen flow, the generator will automatically start and resume normal cycling. Essentially, the generator will start and stop based on nitrogen demand when the pressure switch is set properly. No special attention is required. Adjustment of the pressure switch may be required to compensate for varying inlet pressures. Refer to the “Pressure Switch Adjustment” section for proper setting.

Note: System will not go into “Standby” if the “Alarms” switch is in the “Disable” position.

### E.E.C.S. Feature

Energy Efficient Control System (E.E.C.S.) is an optional feature that causes the Nitrogen Generator to automatically extend the adsorption time when full flow is not required. As a result, the Adsorption vessels (AV 101 & 102) cycle less frequently which saves on the amount of air the system requires. This feature is disabled and defaults to a fixed time cycle when the “Alarms” switch is in the “Disable” position.

### Shutdown

There are two different shutdown procedures for the Parker Nitrogen Generation System. The Normal Shutdown procedure should be followed for filter maintenance, oxygen analyzer maintenance, and temporary operational shutdowns (i.e. overnight, weekends). After a Normal Shutdown, a supply of high purity Nitrogen gas will remain in the receiver tank and system start-up time will be reduced when the generator is restarted. The Total Shutdown should be followed for servicing the electrical valves, and for preparing the unit for shipment. After a Total Shutdown, the Nitrogen receiver is empty; therefore, the start-up time for the generator will be approximately 2 hours (follow Initial Start Up procedure).

#### Normal Shutdown

1. Turn the ON/OFF switch to the OFF position and allow two minutes for the Adsorption Vessels to safely depressurize as indicated on PI 102 and PI 103. When the PSA tower is completely desorbed, the Adsorption Vessel pressure gauges will read zero.
2. Close the inlet air ball valve MIV 102, and turn off feed air source.
3. Check to confirm that the, Adsorption Vessel pressure gauges, Nitrogen Storage Tank gauge, and outlet pressure gauge all read zero before attempting any maintenance.

#### Total Shutdown

1. Perform Normal Shutdown procedure.
2. Empty the Nitrogen receiver by opening the 2-way manual drain valve beneath the receiver tank.
3. Remove power from the unit (unplug power cord if equipped).



**CAUTION:** Pressure will remain in the adsorption vessel once the desorb valve is closed. DO NOT ATTEMPT TO PERFORM MAINTENANCE ON VALVES OR FILTERS WITH THE ADSORPTION VESSEL PRESSURIZED.

**NOTE:** It is normal for the adsorption vessels to slowly pressurize even when system is shut down. If maintenance is required, isolate unit from air system and process. Open LCV 102, 105 & 106 to bleed pressure. Close when finished.

All maintenance activities should be performed by trained personnel using reasonable care. The unit must be de-energized and depressurized before performing any maintenance procedures.

## Stand-By Pressure Switch Setting

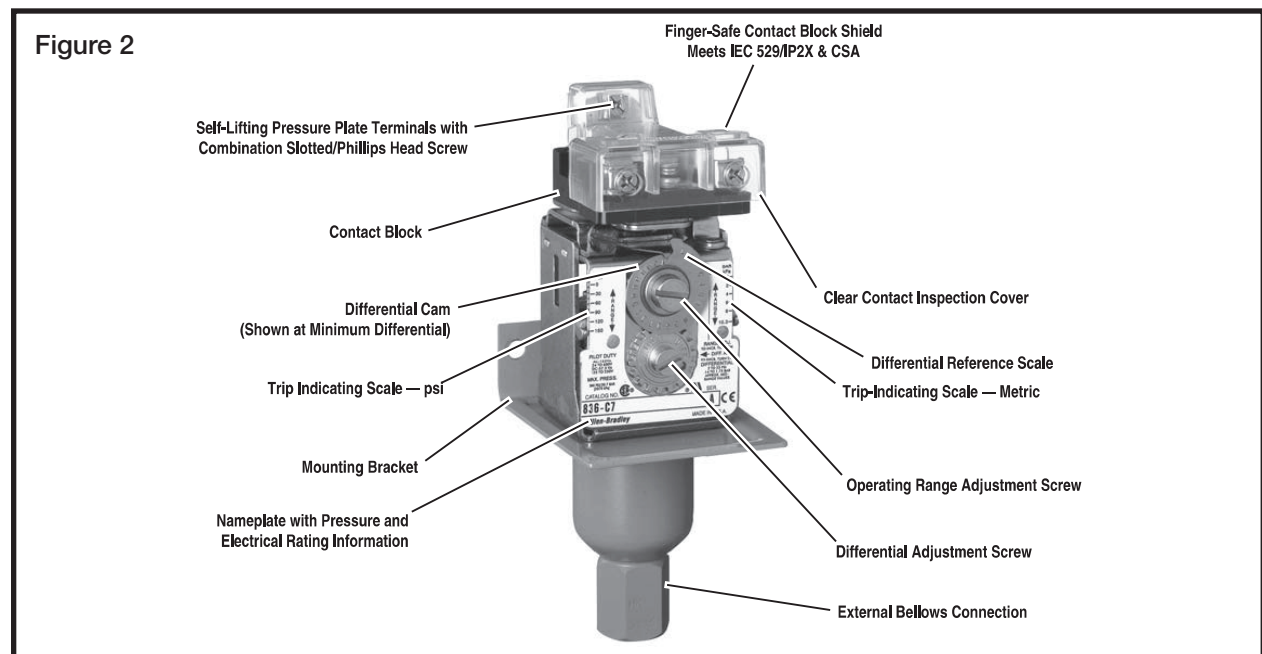
For the nitrogen generator to switch to stand-by mode, the pressure switch (PSH 101) must remain in closed (changed state) position for 10 minutes. This means that the pressure switch has to be set just below the lowest pressure point in the nitrogen storage tank during no flow. Refer to the electrical diagram and Figure 2. If the pressure switch is not set below the lowest pressure reading in the nitrogen tank during no-flow condition PSH 101 will open during the nitrogen tank pressure swing before 10 minutes has elapsed and the PLC will not set the unit to stand-by. The pressure switch is located inside the electrical junction box. A flat head screw driver is required to turn the adjustment wheel. Take great care in using tools around live terminals.

**NOTE:** During pressure switch adjustment, do not make any changes to the feed air system. If feed air supply has to be modified, it should be done prior to setting the pressure switch on the nitrogen generator.

**NOTE:** There may be a spike in oxygen content when the unit switches out of stand-by. It may be necessary to run the unit for up to 30 minutes to allow oxygen content to stabilize before flowing the product nitrogen into the application.

To set the standby feature of the unit follow the steps below. (Note: “Alarms” switch must be in the ON position.)

1. With the unit cycling normally, close manual isolation valve MIV 108.
2. Allow the nitrogen generator to cycle completely four to five times and the nitrogen tank to pressurize.
3. Locate pressure switch inside main control panel.
4. Turn the adjusting screw counter clockwise until the moving contact in the pressure switch just touches the bottom contact (closed position). Input I4 is illuminated when the pressure switch is in the closed position. If the switch is already closed, turn the adjusting screw clockwise until the contacts no longer touch or I4 is not illuminated. Then turn the adjusting screw counter clockwise until the switch closes or I4 is illuminated. Refer to Figure 2.



**NOTE:** It is important to stop turning the screw immediately when PSH 101 changes to the closed position. Continuing to turn after the changed state sets the pressure switch lower than what is in the nitrogen storage tank.

5. Let the nitrogen generator undergo further cycling (no flow – MIV 108 closed). Observe the input 4 on the PLC.
6. If the pressure switch switches back to the open position (I4 not illuminated) during DB cycling with no flow, turn the adjusting wheel further to the right until the pressure switch remains in the closed position (Input I4 illuminated) throughout the DB pressure swing cycles.
7. Once the pressure switch stays in the closed position throughout the DB cycling process, it is properly set.
8. After ten minutes have passed with the pressure switch in the closed position continuously, the nitrogen generator will go into stand-by mode, and the blue “Standby” light will illuminate.

### Resuming Flow

For automatic start-up out of stand-by mode, open manual isolation valve (MIV 108) to produce the normal flow rate. Once flow is sensed or the pressure drops below the setting of the pressure switch (PSH 101) the nitrogen generator will enter into its initial desorption cycle and then begin to re-pressurize and cycle normally.

### Verification

It is important to verify that the pressure switch does not stay in the closed position (Input 4 in PLC illuminated) for 10 minutes during normal flow conditions. If that is the case, then the pressure switch is set too low, and the nitrogen generator will go into stand-by during normal flow conditions (especially at higher purities).

1. After setting the pressure switch, open the flow control valve to produce the normal nitrogen flow rate.
2. Adjust PRV 102 to the proper outlet pressure required by the process. Readjust flow control valve if necessary.
3. While the generator undergoes the normal cycling process, observe the pressure switch and Input 4 on the PLC.
4. If the pressure switch closes (I4 illuminated), ensure that it will change state throughout the cycling process (i.e. I4 should switch on and off, but should not stay on for 10 minutes). If it does not change state, the unit will go into standby (pressure switch is set too low). If this is the case, the adjustment wheel will require a minor turn to the left until the switch is operating as required.
5. As a final check, turn off the flow and observe that the unit will go into standby. Then, turn the flow on and make sure it operates normally out of standby. At this point, the switch is set correctly.

**NOTE:** Subsequent changes in the feed air system may interfere with the current pressure switch operation. After making any necessary changes in feed air pressure, check for proper pressure switch operation.

### Automatic Block and Bleed

This N2 generator is equipped with an automatic block and bleed system. It is controlled through the secondary O2 alarm that is normally used for the high O2 shutdown alarm. In this application, the high O2 alarm signal is used to activate a solenoid that shuts down the nitrogen supply to the system and bleeds the process gas to atmosphere. The generator continues to run while bleeding the high O2 level gas to atmosphere. When the O2 level in the gas drops below the alarm set point, the system will automatically reset. The vent then closes and the blocking valve re-opens allowing nitrogen to again flow to the process. You can manually engage the auto block and bleed feature by simply turning the "Alarms" switch to the "Disable" position.

### Dewpoint monitoring

This N2 generator is equipped with a dew point monitoring system. The inlet air dew point temperature is displayed on the front panel. If the incoming dew point rises higher than 50 degrees F, the red alarm light will illuminate. If the dew point remains above 50 degrees for a pre-determined length of time, the generator will shut down to prevent

## Maintenance

### General

To ensure proper operation of the Parker DB & PSA Nitrogen Generators, maintenance tasks need to be performed regularly. The primary maintenance tasks required are:

- Checking the filter cartridges every three months and changing the filter cartridges (bi-annually)
- Changing the final filter cartridge (annually)
- Performing a valve leak check (bi-annually)
- Rebuilding the process valves (annually - sooner if purity problems arise)
- Servicing the solenoid pilot valves (annually)
- Changing the oxygen analyzer fuel cell (if equipped) annually

A summary of the replacement part numbers are shown at the end of this Maintenance section.

### Filter Maintenance

The coalescing filters are located just after the inlet air connection of the AST skid. These filters are present for final filtration of the incoming air only. Any accumulation of oil or moisture in these filters should be an indication of possible CMS contamination. The first and second stage filter, PF 101 & 102, removes particulate contamination with an efficiency of 99.5% at .5 micron and 99.97 at .01 micron respectively. This helps ensure high quality air is supplied to the system. Inspect filters every three months. Change the filter elements every six months or sooner depending on condition of the element.

### Procedure



**CAUTION:** Make sure that the system is depressurized.

#### PF101 and PF102

1. Remove 4 nuts holding the lower housing to the filter assembly.
2. Remove filter housing.
3. Unscrew round filter element retainer at the bottom.
4. Carefully pull out old filter element, and replace with new part.
5. Install fastener and filter housing.

#### AF101

1. Securely hold bottom portion of filter housing.
2. Push up gently against top portion, and twist counterclockwise (opposite direction of LOCK arrow).
3. Remove filter housing.
4. Unscrew round filter element retainer at the bottom.
5. Carefully pull out old filter element, and replace with new part.
6. Install fastener and filter housing.

### Electrical

The electrical components on the Nitrogen generator (PLC, solenoid valves) are virtually maintenance-free. Occasionally, an electrical component may have to be replaced as a result of normal wear and tear. If an electrical component must be replaced, please consult the factory.

## Valve Leak Check Procedure

Process valves and check valves can be checked for seat leakage without removal from the respective locations. Follow procedure below to determine if the following valves are leaking:  
PV: 101, 102, 103, 104, 105, 106, 107 and 108.

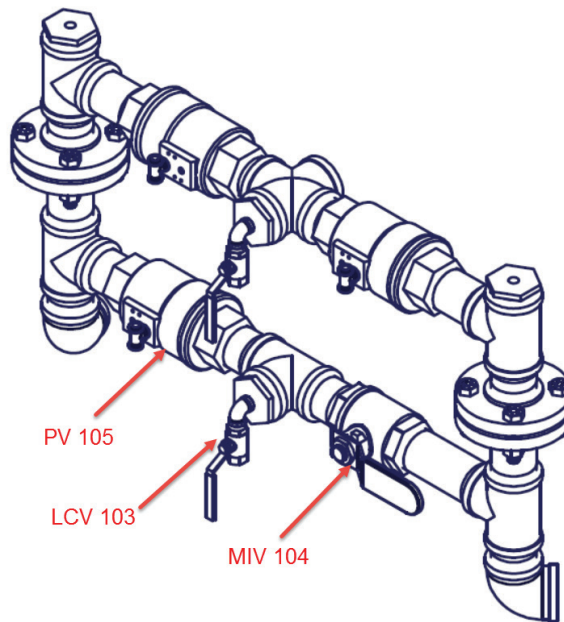
**NOTE:** When performing the leak check procedure it is recommended that the Oxygen Alarms be disabled to prevent nuisance alarm shutdowns. Enable the alarms only when the valve leak check procedure is complete, and the oxygen content has stabilized.

Both the left side and the right side must be pressurized in two separate steps to perform the leak test. Use the P&ID figures below and the stainless steel ID tags attached to each valve to properly identify the correct valve for each section of the procedure.

### Leak Check PV 105 (Figure 3)

1. Wait until pressure in AV 101 is at least 100 psig and pressure in NST 101 is at least 90 psig. Turn the "Leak Check" switch to the ON position.
2. Close the following valves: MIV 102-108, 110.
3. Open LCV 103 to depressurize lower equalization manifold.
4. If there is no flow out of LCV 103 after initial depressurization, then PV 105 is not leaking. If continuous flow persists after initial depressurization, PV 105 is leaking.
5. Close LCV 103.

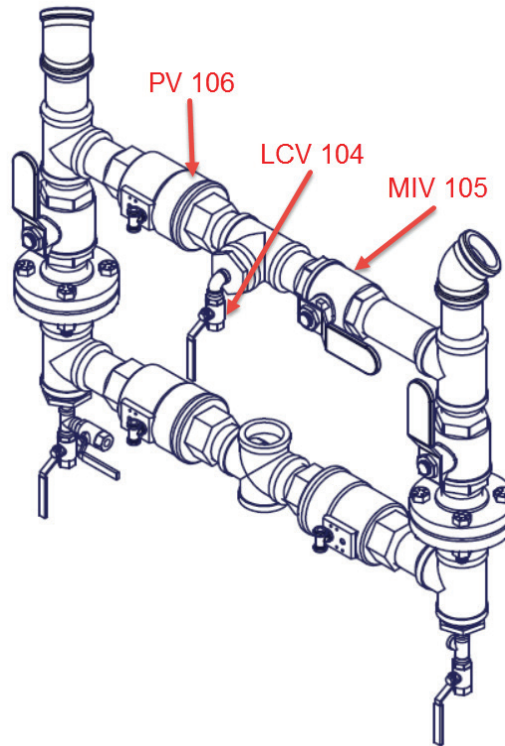
**Figure 3:** Lower Manifold -  
Leak check valve PV 105



### Leak Check PV 106 (Figure 4)

1. Open LCV 104 to depressurize upper equalization manifold.
2. If there is no flow out of LCV 104 after initial depressurization, then PV 106 is not leaking.  
If continuous flow persists after initial depressurization, PV 106 is leaking.
3. Close LCV 104.

**Figure 4:** Upper Manifold -  
Leak check valve PV 106

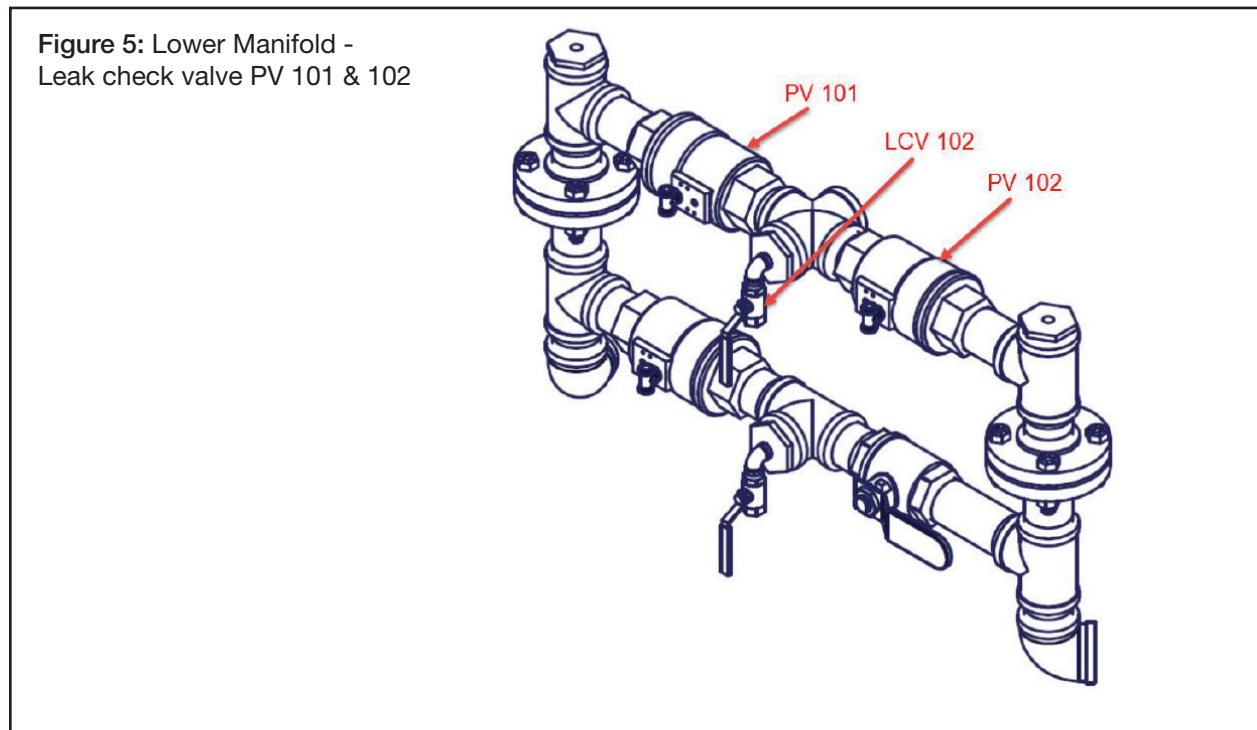


**Leak Check PV 101 (Figure 5)**

1. Open LCV 102 to depressurize feed air manifold
2. If there is no flow out of LCV 102 after initial depressurization, then PV 101 is not leaking.  
If continuous flow persists after initial depressurization, PV 101 is leaking.
3. Close LCV 102.

**Leak Check PV 102 (Figure 5)**

1. Open LCV 102 to depressurize feed air manifold
2. If there is no flow out of LCV 102 after initial depressurization, then PV 102 is not leaking.  
If continuous flow persists after initial depressurization, PV 102 is leaking.
3. Close LCV 102.



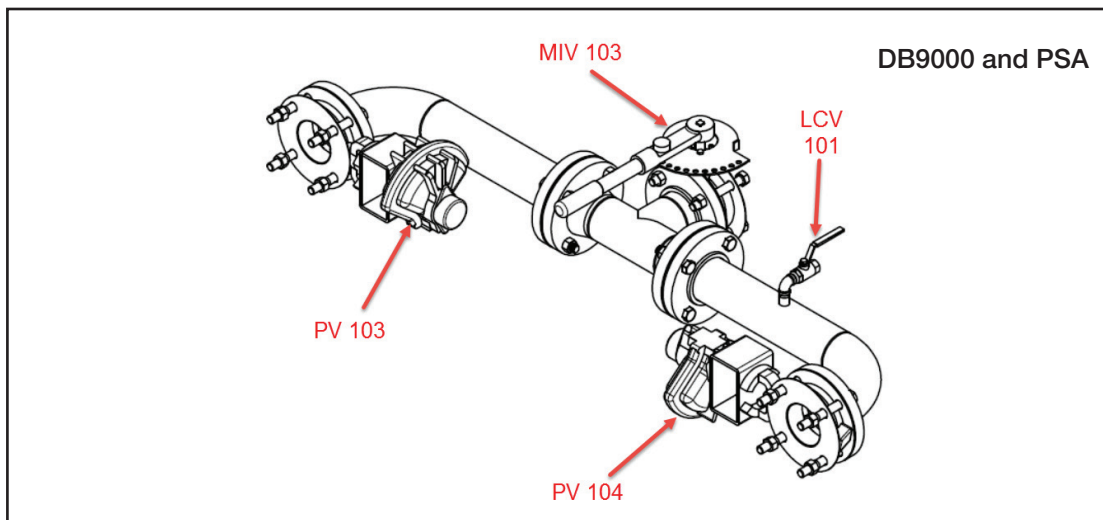
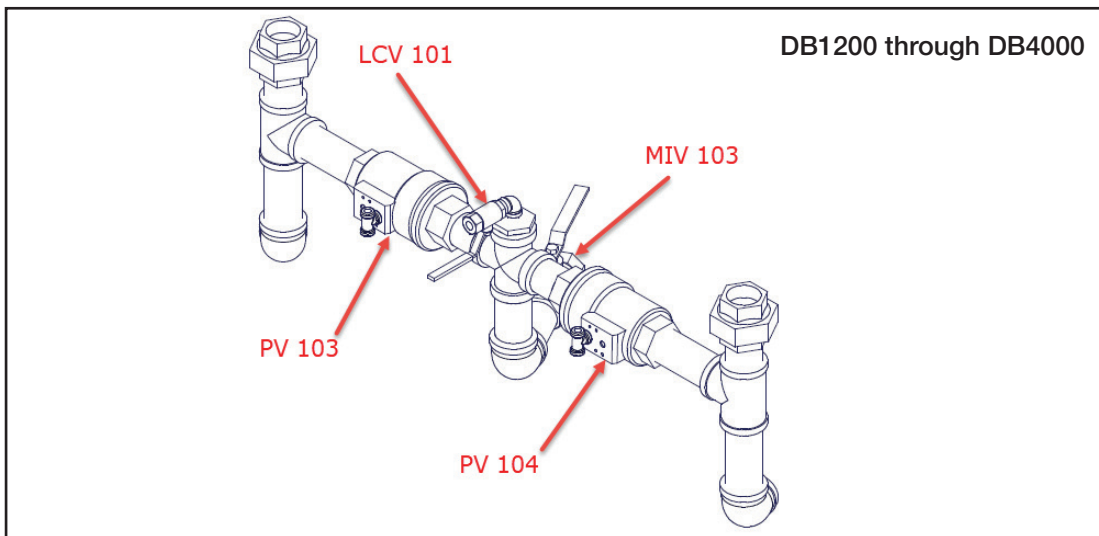
## Leak Check PV 103 (Figure 6)

1. Open LCV 101 to depressurize manifold.
2. If there is no flow out of LCV 101 after initial depressurization, then PV 103 is not leaking.  
If continuous flow persists after initial depressurization, PV 103 is leaking.
3. Close LCV 101.

## Leak Check PV 104 (Figure 6)

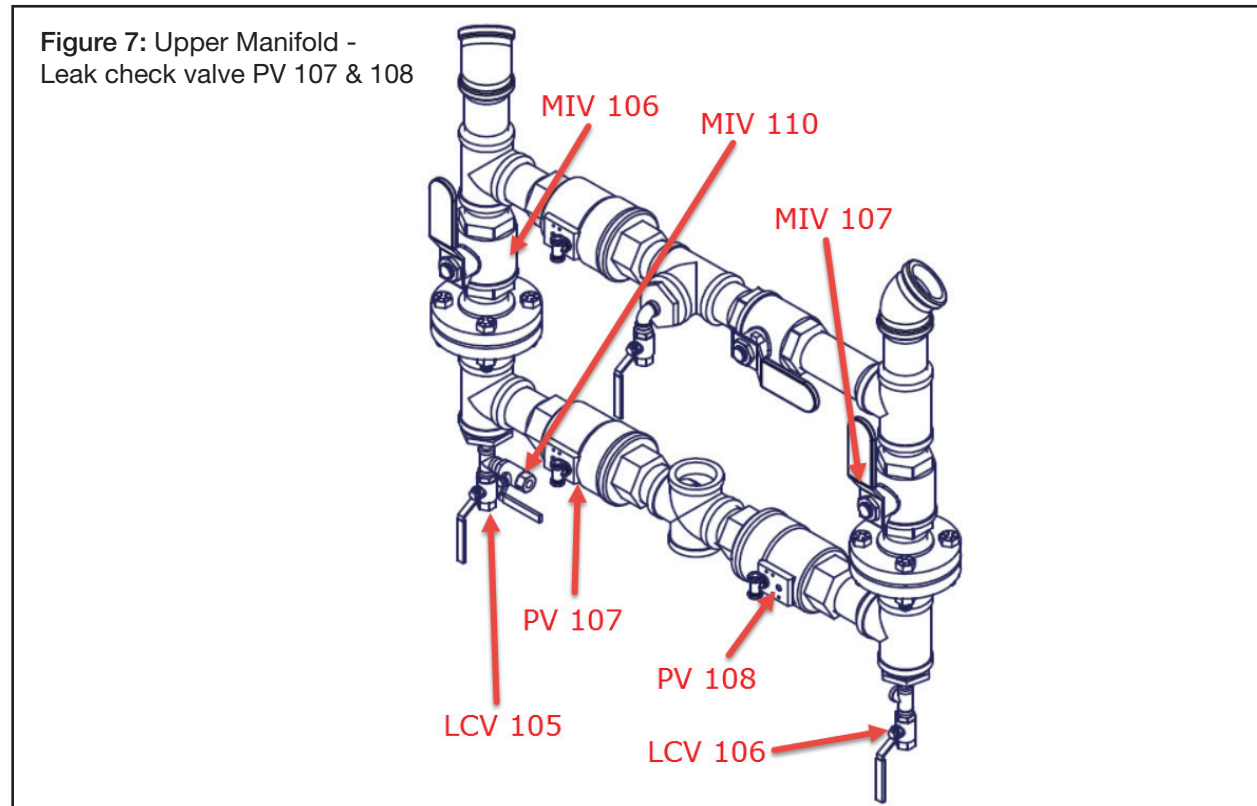
1. Open LCV 101 to depressurize manifold.
2. If there is no flow out of LCV 101 after initial depressurization, then PV 104 is not leaking.  
If continuous flow persists after initial depressurization, PV 104 is leaking.
3. Close LCV 101.
4. Open the following valves: MIV 102-108, 110
5. Switch "Leak Check" to the OFF position.
6. Perform electrical shutdown, and fix any leaks found in the steps above.
7. Repeat all of the above leak check steps until no leaks are found.

**Figure 6: Desorption Manifold -  
Leak check valve PV 103 & 104**



**Leak Check PV 107 (Figure 7)**

1. Open LCV 105 to depressurize manifold.
2. If there is no flow out of LCV 105 after initial depressurization, then PV 107 is not leaking. If continuous flow persists after initial depressurization, install a pressure gauge (0-160 psig) range in LCV 106 outlet.
  - a. If equilibrium pressure reading = PI 104 reading, then PV 107 is leaking.
  - b. If equilibrium pressure reading = PI 102 reading, then MIV 106 is leaking.
3. Close LCV 105.
4. Open the following valves: MIV 102-108, 110.
5. Switch "Leak Check" to the OFF position.
6. Perform electrical shutdown, and fix any leaks found in the steps above.
7. Repeat all of the above steps until no leaks are found.



### Adsorption Vessel Differential Pressure Monitoring Procedure

Differential pressures across the adsorption vessels must be minimal for proper operation of this unit. High pressure drops can be a sign of deteriorating carbon in the vessels. If high differentials are seen on DPI 101 and DPI 102, perform the following check.

1. Wait for the portion of the PSA cycle where the right adsorption vessel (AV102) is pressurized and the left adsorption vessel (AV101) is depressurized.
2. Reset the pointer followers on both adsorption vessel differential pressure gauges.
3. When the vessel pressures equalize, observe the left vessel DP gauge. A differential pressure may be observed at the start of the 4 second pressure equalization and again at the start of the pressurization. Record both of these differential pressure readings.
4. After the pressure equalization, record the right vessel DP reading for the pointer follower.
5. Reset the pointer followers on both adsorption vessel differential pressure gauges. Wait for the portion of the PSA cycle where the left adsorption vessel (AV101) is pressurized and the right adsorption vessel (AV102) is depressurized.
6. When the vessel pressures equalize, observe the right vessel DP gauge. A differential pressure may be observed at the start of the 4 second pressure equalization and again at the start of the pressurization. Record both of these differential pressure readings.
7. After the pressure equalization, record the left vessel DP reading for the pointer follower.
8. If any of the six readings taken above is greater than 5 psid, contact Parker-NNI and turn unit off immediately.

### Oxygen Analyzer

The fuel cell in the oxygen analyzer degrades over time. If large adjustments are required to calibrate the analyzer and calibration cannot be achieved, or if the reading continues to fall to zero, then the fuel cell needs to be replaced. Consult the proper oxygen analyzer manual (shipped with unit) for steps to replace fuel cell and calibrate analyzer. PPM fuel cells require calibration gas to calibrate.

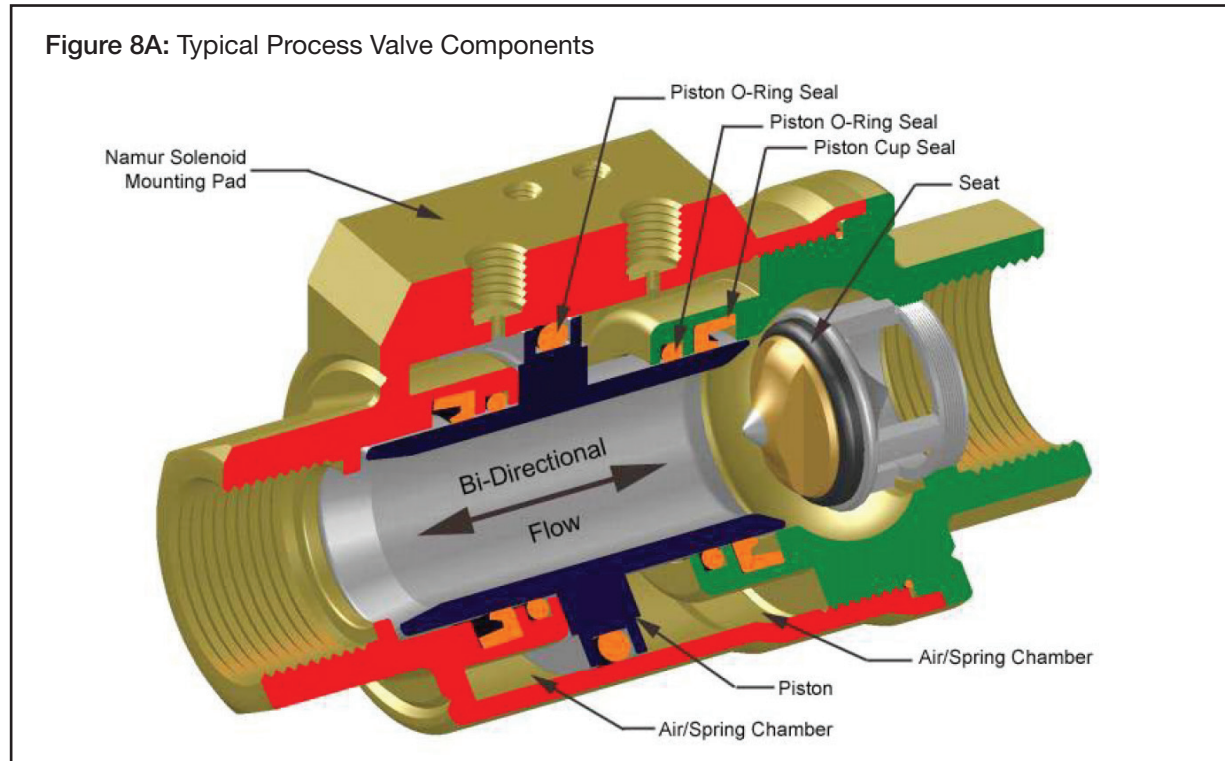
**CAUTION:** All maintenance should be done with the system power disconnected and fully depressurized. Failure to do so can cause serious injury.

## Process Valve Rebuild

Each generator has eight process valves that may need timely maintenance annually. The rebuild process mainly consists of changing the o-rings and valve seats. Order the appropriate valve rebuild kit and make sure that the working environment is free of moisture and other contaminants.

### Tools

- Phillips screwdriver
- Masking or painter's tape
- PTFE pipe paste
- Flathead screwdriver
- Thin-tip permanent marker
- Step ladder
- 5/32 hex key
- 7/8 wrench
- PTFE tape

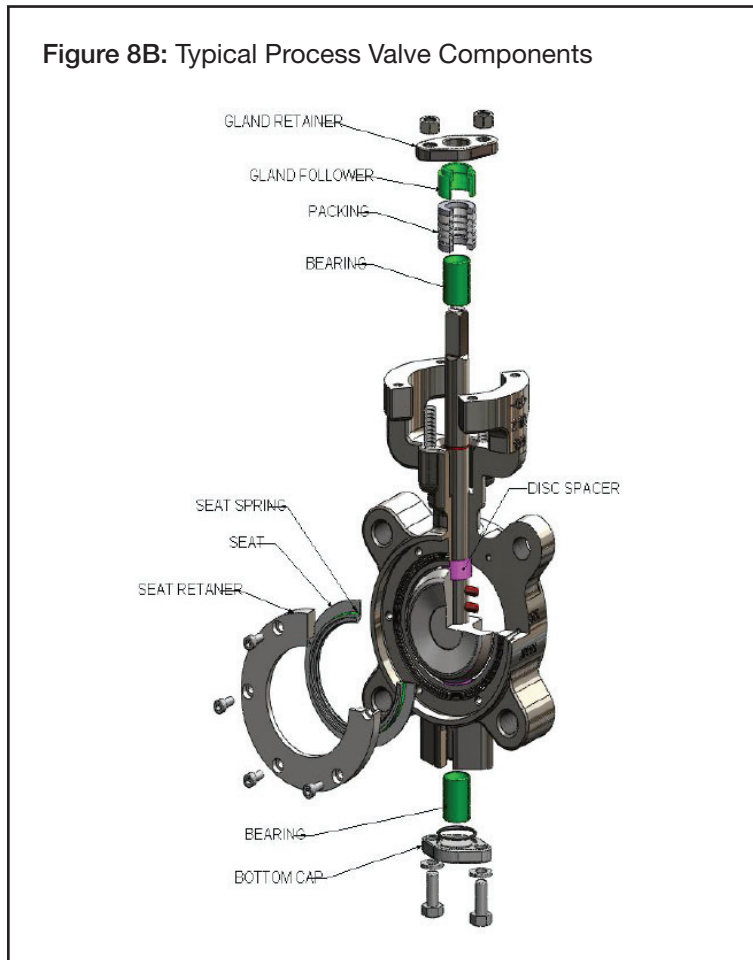


### Procedure

Refer to Figure 8A for details.

1. Locate process valves on the unit, and remove carefully.
2. Disassemble valve components carefully.
3. Replace the o-ring seals, cup seals and valve seat as shown in Figure. 8A.
4. Carefully install valve into manifold avoiding any contamination of the internal surface of the pipe or valve.
5. Perform leak check after rebuilding any valve.

Figure 8B: Typical Process Valve Components



### Procedure

Refer to Figure 8B for details.

1. Locate process valves on the unit, and remove carefully.
2. Remove the socket head cap screws.
3. Remove the seat retainer from valve face. Seat and spring should be attached to seat retainer.
4. Remove the seat and spring assembly from retainer.
5. Clean the retainer groove and valve body face of any debris.
6. Place spring around the seat groove and snap into the retainer.
7. Place seat retainer assembly back into valve and align bolt holes. Replace and secure cap screws
8. Perform leak check after rebuilding any valve.

Mark all tubing and hose connections before removal to ensure correct reassembly.



**CAUTION:** Pressure will remain in the adsorption vessel once the desorb valve is closed. DO NOT ATTEMPT TO PERFORM MAINTENANCE ON VALVES OR FILTERS WITH THE ADSORPTION VESSEL PRESSURIZED.



**CAUTION:** Excessive oil or moisture levels in the air will cause irreversible contamination of the CMS material in the Adsorption Vessel. Take extra care to prevent exposure of the CMS material to a moist environment during service. If there is any indication or suspicion of excessive oil levels in the feed air (e.g., oil-saturated filter elements, dryer malfunction), find and correct problem(s) before re-installing the nitrogen generator.

### Pilot Valve Maintenance

Pilot valve spools should be inspected every six months, and replaced if necessary. Otherwise the spool should be replaced on a yearly basis. Maintenance to the solenoid pilot stack valve consists mainly of replacing the aluminum spool and gaskets. A small pair of needle nose pliers may be needed to grab the spool on the Parker solenoid stack valve. When replacing the spool, make sure that it is installed the same way it came out. Failure to do so will result in valve/system malfunction.

#### Procedure

**NOTE:** Make sure that the system is depressurized.

#### Parker H-Series Pilot Valve

1. Locate solenoid stack valve below control panel.
2. Remove four mounting screws on pilot valve body using 4mm hex key (Fig. 9) to disengage from stack.
3. To change pilot select gaskets follow instructions supplied in service kit.



**CAUTION:** If the new pilot select gaskets are not oriented properly, the generator will not cycle properly. Take note of old gasket orientation before disassembly. Both tabs should be on the bottom pointing towards center of pilot valve body.

- a. Remove two solenoid screws using 3mm hex key (See figure 9).
  - b. Remove old gasket, taking note of orientation, and replace with new one. Ensure that new gasket is positioned properly. The tab on the gasket should be pointing to the etched "I," towards the bottom (Figure 10).
  - c. Replace coil-to-end cap gasket with new part, if supplied in kit.
  - d. Remove pilot bypass plate.
  - e. Remove old gasket and replace with new one. Ensure that new gasket is oriented properly. The tab on the gasket should be pointing to the etched "I," towards the bottom.
4. To change valve spool (Figure 11):
    - a. Remove solenoid end cap using 3mm hex key.



**CAUTION:** Note proper piston orientation.

- b. Remove piston. Refer to instructions supplied in service kit for additional information. Replace piston lip seal with new seal.
- c. Using needle-nose pliers, carefully grab end of spool firmly, and pull out of valve body.
- d. Lightly lubricate new spool with packaged lubricant, and insert spool back into valve body.
- e. Clean piston with clean lint-free cloth, and lightly grease with provided lubricant.
- f. Install piston correctly.
- g. Replace solenoid end cap, and torque screws to 12-14 in.lb (1.4-1.6 Nm). Replace coil-to-end cap gasket.

Figure 9: Typical Parker H-Series Pilot Valve

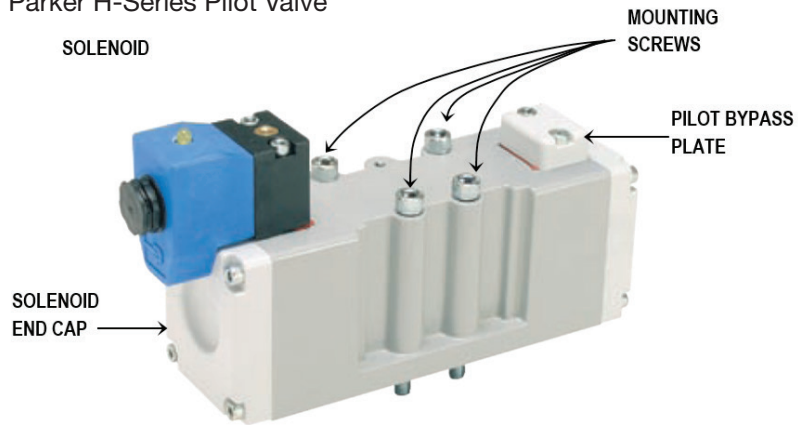


Figure 10: Two Pilot Select Gaskets - Orientation

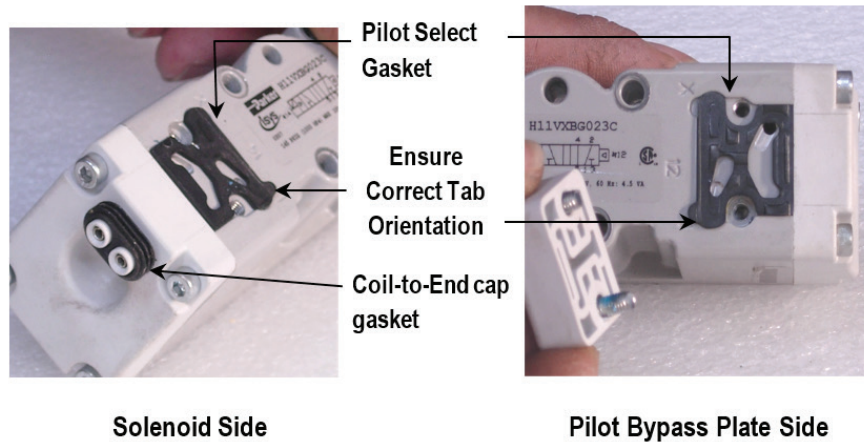
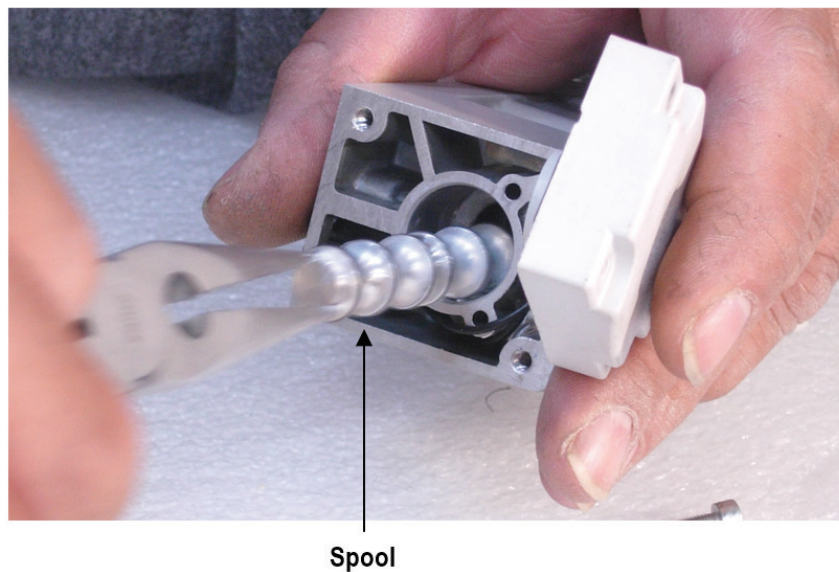


Figure 11: Valve Spool Removal with Needle-nose Pliers



## Replacement Parts Information

1 ea)	Final filter (CF 101)	verify on filter label
1 ea)	Final filter (CF 102)	verify on filter label
1 ea)	Final filter (AF 101)	verify on filter label
1 ea)	Process valve repair kit, 1 ½" NPT	verify on filter label
6 ea)	Process valve repair kit, 2" NPT	RKVA200VV
2 ea)	Process valve repair kit, 3" butterfly	H880313001
2 ea)	Process valve repair kit, 4" butterfly	H880413001
2 ea)	Process valve repair kit, 6" butterfly	H880613001
7 ea)	Solenoid valve repair kit (SPV 101-107)	PS4001CP
1 ea)	Fuel cell, Zirconia 0-25 Percent	02-444
1 ea)	Fuel cell, Zirconia 0-25 Percent	02-443

## Additional emergency spare parts

Certain maintenance parts are recommended to be on hand for when they are needed. These include filters, valve rebuild kits and oxygen analyzer fuel cells. Other parts may fail rarely but when they do the machine will be down until that item is replaced. Even if the part is in stock at our plant it can take from 1 to 3 days to get the part and have the machine back up and running. If it is imperative that your generator remain in service, we suggest you also keep the following parts in your stock.

5 ea)	Fuse, 2.5 amp, main controls	TRM2-1/2
1 ea)	Solenoid valve	H11VXBG023D
2 ea)	Solenoid coil	PS404123P
1 ea)	PLC, Allen Bradley	1763-L16AWA
1 ea)	Pressure regulator	R0002G00

To place an order or get a quotation for the above parts, please call 1-800-343-4048.

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 adjusted properly. Check inlet pressure to assure that it is greater than 110 psig. Check the system for leaks.
Loss of Outlet Flow	Check inlet pressure to assure that it is greater than 110 psig. Check setting of flow control valve. Adjust if necessary. Check the system for leaks. Check power. Check that PLC 'Run" switch is in the ON position.
Purity is Lower than Specified for Operating Conditions	Check setting of flow rate compared to Nitrogen Flow Tables Check the inlet air pressure to assure that it has not varied from the original reading. Check the system for leaks. Measure the temperature and dew point of the inlet air. The recommended temperature is 77°F (25°C) and the recommended dew point is 40°F (4°C) or lower. Calibrate Oxygen analyzer (if needed). Check inlet pressure to assure that it is greater than 110 psig.
Air Leak Through Drain of Pre-filter	Check inlet pressure. It should be greater than 15 psig to seal drain. 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.
Display Varies	Check process flow demand. Check sample lines for leaks. Recalibrate oxygen analyzer.
Limited range during calibration	Replace oxygen sensor.

### Serial Numbers

A four digit serial number can be found on the front of the nitrogen generator. For your own records, and in case service is required, please record the following:

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

## Warranty (North America only)

Please contact Parker Hannifin IGFG Division for current warranty policy, 800-343-4048.

**NOTE:** This unit was tested for leaks before it was shipped from the factory. Due to vibration and movement during transit, some leaks may appear in the piping. These are generally very small in nature and do not affect the performance of the unit.



# Worldwide Filtration Manufacturing Locations

## North America

### Compressed Air Treatment

#### Industrial Gas Filtration and Generation Division

Lancaster, NY  
716 686 6400  
[www.parker.com/igfg](http://www.parker.com/igfg)

Haverhill, MA  
978 858 0505  
[www.parker.com/igfg](http://www.parker.com/igfg)

### Engine Filtration

#### Racor

Modesto, CA  
209 521 7860  
[www.parker.com/racor](http://www.parker.com/racor)

Holly Springs, MS  
662 252 2656  
[www.parker.com/racor](http://www.parker.com/racor)

### Hydraulic Filtration

#### Hydraulic & Fuel Filtration

Metamora, OH  
419 644 4311  
[www.parker.com/hydraulicfilter](http://www.parker.com/hydraulicfilter)

Laval, QC Canada  
450 629 9594  
[www.parkerfarr.com](http://www.parkerfarr.com)

Velcon  
Colorado Springs, CO  
719 531 5855  
[www.velcon.com](http://www.velcon.com)

### Process Filtration

#### domnick hunter Process Filtration SciLog

Oxnard, CA  
805 604 3400  
[www.parker.com/processfiltration](http://www.parker.com/processfiltration)

### Water Purification

#### Village Marine, Sea Recovery, Horizon Reverse Osmosis

Carson, CA  
310 637 3400  
[www.parker.com/watermakers](http://www.parker.com/watermakers)

## Europe

### Compressed Air Treatment

#### domnick hunter Filtration & Separation

Gateshead, England  
+44 (0) 191 402 9000  
[www.parker.com/dhfn](http://www.parker.com/dhfn)

#### Parker Gas Separations

Etten-Leur, Netherlands  
+31 76 508 5300  
[www.parker.com/dhfn](http://www.parker.com/dhfn)

#### Hiross Zander

Essen, Germany  
+49 2054 9340  
[www.parker.com/hzfd](http://www.parker.com/hzfd)

Padova, Italy  
+39 049 9712 111  
[www.parker.com/hzfd](http://www.parker.com/hzfd)

### Engine Filtration & Water Purification

#### Racor

Dewsbury, England  
+44 (0) 1924 487 000  
[www.parker.com/rfde](http://www.parker.com/rfde)

#### Racor Research & Development

Stuttgart, Germany  
+49 (0)711 7071 290-10

### Hydraulic Filtration

#### Hydraulic Filter

Arnhem, Holland  
+31 26 3760376  
[www.parker.com/hfde](http://www.parker.com/hfde)

Urkala, Finland  
+358 20 753 2500

#### Condition Monitoring Parker Kittiwake

West Sussex, England  
+44 (0) 1903 731 470  
[www.kittiwake.com](http://www.kittiwake.com)

### Process Filtration

#### domnick hunter Process Filtration Parker Twin Filter BV

Birtley, England  
+44 (0) 191 410 5121  
[www.parker.com/processfiltration](http://www.parker.com/processfiltration)

## Asia Pacific

### Australia

Castle Hill, Australia  
+61 2 9634 7777  
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+86 21 5031 2525  
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[www.johnfowlerindia.com](http://www.johnfowlerindia.com)

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+66 2186 7000  
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Sao Paulo, Brazil  
+55 12 4009 3500  
[www.parker.com/br](http://www.parker.com/br)

### Pan American Division

Miami, FL  
305 470 8800  
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