DB1200-4000

Parker Dual-Bed Nitrogen Generation Systems

Installation, Operation, and Maintenance Manual

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Parker Dual-Bed Nitrogen Generation Systems
Models DB-1200 through DB-4000

Installation, Operation, and Maintenance Manual

⚠ **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.**

Photo likeness (other units may vary)

Typical set-up of the Parker Dual-Bed 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. For additional information refer to Warnings and Precautions section (page 32) of this manual or consult the factory for recommendations. If you have any questions or concerns, please call the Technical Services Department at 410-636-7200, 8AM to 5PM Eastern Time or email at balstontechsupport@parker.com (North America only). Please have the four-digit serial number ready. For other locations, please contact your local representative.

The DB-1200 through DB-4000 PSA Nitrogen Generator Series is intended to produce nitrogen from compressed air through a system based on pressure swing adsorption. Any other use will not conform with the purpose of the DB unit. Parker Hannifin will not accept any liability for improper use.

Table of Contents

General Description

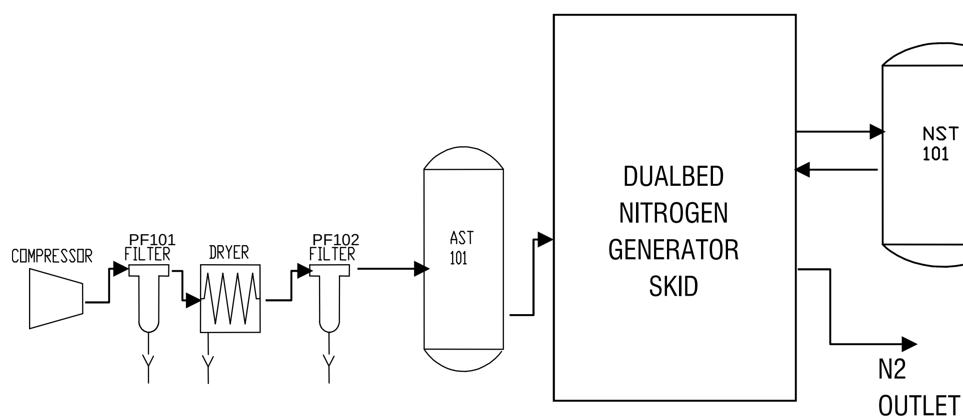
The Parker Dual-Bed Nitrogen Generators are completely engineered systems, which will convert a compressed air supply into 95-99.999% purity, compressed nitrogen. The units are based on state-of-the-art Dual-Bed Pressure Swing Adsorption (PSA) technology. The adsorption bed converts compressed air into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

Engineered System

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

Figure 1



Description

Pre-filtration

Refer to Figure 2. Two high efficiency coalescing filters (CF 101 and CF 102) are incorporated into the Nitrogen generator to protect the adsorption bed and valves from contamination. The coalescing filters are located towards the front of each unit. They remove trace liquids and particulate matter from the incoming air supply. These filters are equipped with automatic electric drains (CDV 104 and CDV 105) 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.**

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Nitrogen Generation

Refer to Figure 3 and 4. 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. 1 minute), 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 a Parker Grade DX filter. The final filter removes particulate contamination with an efficiency of 93% at 0.01 micron, assuring the user of clean high purity Nitrogen. The final filter is located in the rear of the unit behind the adsorption vessels.

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_2 content) at lower flow rates. Conversely, the same system will produce lower purity Nitrogen (high O_2 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: Purities higher than 99.9% require an oxygen analyzer upgrade and must be sampled directly from the Nitrogen Storage Tank (NST 101) using copper or S/S tubing to achieve the most accurate results.

NOTE: Nitrogen produced by PSA Nitrogen Generators contains Argon which is also inert. Therefore, when mentioning Nitrogen purities, the composition of the product gas

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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.

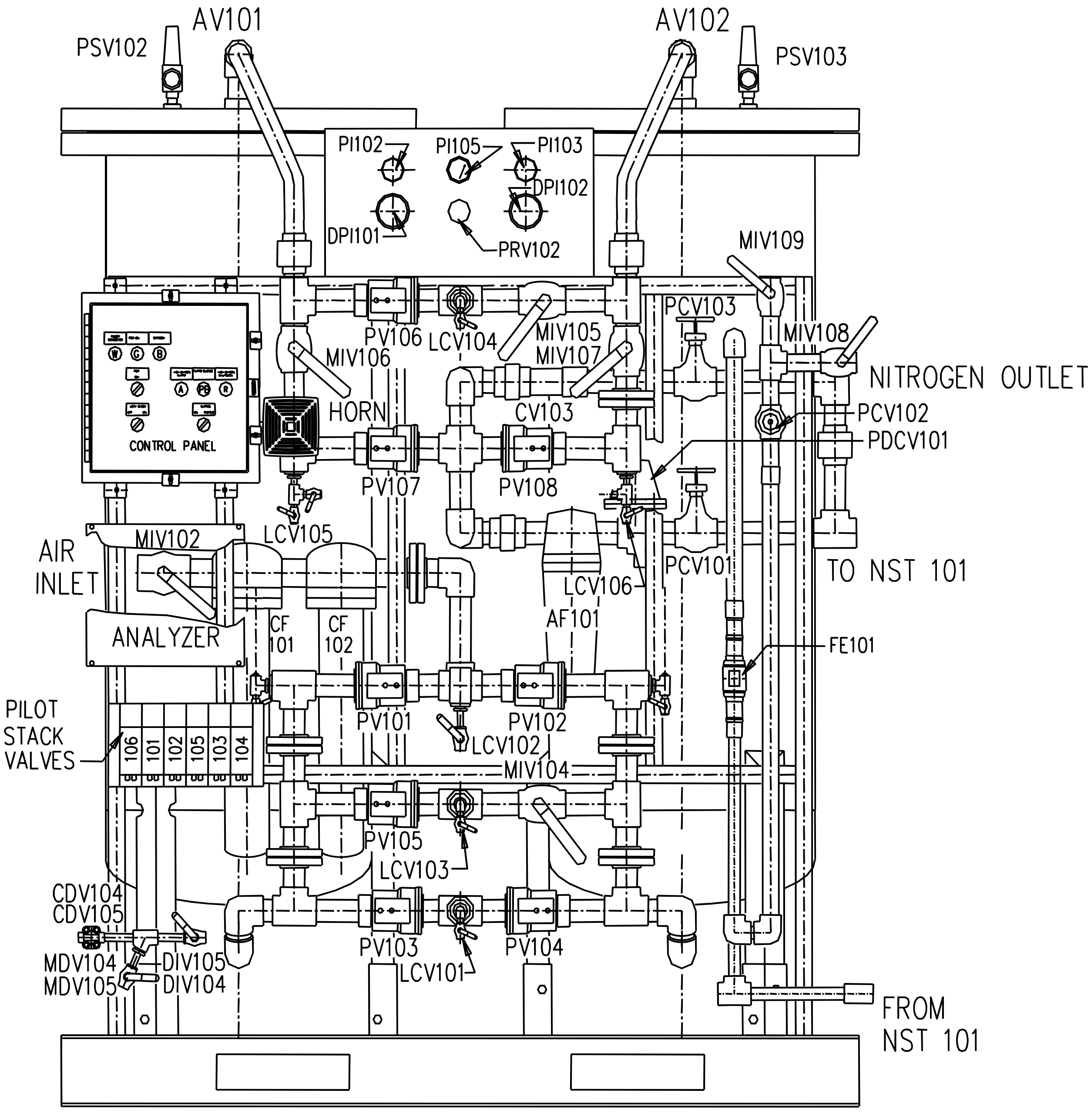

Figure 2: Typical control panel and component locations

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Installation

General

The Parker/Balston 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 Dual-Bed 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.

⚠ **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.**

⚠ **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 110 psig minimum to 135 maximum. If the compressed air supply pressure is less than 110 psig, purities and flows will vary from those shown on the Nitrogen **Flow Tables** provided in the **Principal Specifications** section of this manual. At air supply pressures greater than 110 psig, the performance of the generator will be optimal. Consult the factory for flows and purities at pressures higher or lower than 110 psig. 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 PSA beds. Compressed air consumption rates at different outlet flows and purities are detailed in the **Principal Specifications** section at the end of this manual. An air storage tank is necessary to store air for peak air demand. An existing central bank may be used, or if a dedicated air compressor is being used for the DB, a properly sized storage tank will be required.

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**

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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 Nitrogen Generation Systems.

Piping – Stresses and vibration that may occur during transit have been found to cause piping leaks in some situations. Before operating the unit, make sure all connections appear secure. 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.

Drain Lines - The 1/4" plastic drain lines from the optional pre-filter(s) (PF 101 & PF 102 - Fig. 1) should be piped away to an appropriate disposal container. The drainage, consisting primarily of water and compressor oil, should be disposed of properly according to local regulations. One-quarter inch tubing can be used for the condensate drains on the Nitrogen Generator skid. Although no condensate should normally collect in these filters, the tubing attached should be run separately into the proper collection disposal container.

Operation

Pre-Start Procedure

The DB 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. 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 "2A," and Ground to terminal block "G." Refer to Figure 4. For optional 220VAC transformer, connection can be made inside junction box JB-1 at terminals A & B.

2. 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.** Connect compressor piping AND particulate filter (PF 101) to air surge tank (AST 101) according to diagram in Figure 1. Set compressor to unload at 125 psig and load at 110-115 psig.

3. Connect air surge tank (AST 101) to DB nitrogen generator as shown in the flow diagram in Figure 1.

4. Secure all filter elements.

5. Close the following valves:

    - all MDV's

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- all LCV's
- MIV 102 – inlet valve
- MIV 108 – outlet to process
- MIV 109 – vent valve
- MIV 120

6. Open the following valves:
   - all DIV's
   - MIV 103-107
   - MIV 111-119
   - MIV 121
   - MIV 123
   - MDV 104 & 105 (partially open)
7. Verify settings of PCV 101 and PCV 103 are the same as per PSA TEST DATA RECORD if not already secured.
8. Turn on feed air and allow pressure to build up in AST 101.
9. Slowly open MIV 102.
10. On control panel switch "Oxygen Alarms On/Disable" to "Disable" position

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

11. Energize the oxygen analyzer and 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.
12. If applicable verify oxygen analyzer high and low alarm set points.
13. Turn the "PSA Off/On" switch to the "On" position.
14. The generator will initially adsorb (pressurize) for approximately 15 seconds. During the adsorption cycle the Nitrogen Storage Tank will begin to pressurize.
15. Once there is sufficient pressure in the nitrogen surge tank (NST 101), adjust the Outlet Pressure until outlet pressure gauge indicates the desired setting.
16. Open vent valve MIV 109.
17. Open PCV 102 and set the outlet flow to one-half the design flow rate based on the desired purity. Refer to the Nitrogen Flow Tables.

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18. Verify outlet pressure reading. Adjust if necessary.

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.

19. After 2 hours of undisturbed operation or once the xygen content is at acceptable levels, close MIV 109 and properly connect outlet port (MIV108) to the application if not already done.
20. Turn the “Oxygen Alarms On/Disable” switch to “On” position to activate alarms.
21. Open nitrogen outlet valve MIV 108.

Normal Start-Up

1. Open the inlet air ball valve MIV 102 to pressurize the system, set the inlet air pressure to between 110 psig and 125 psig.
2. Turn the “PSA Off/On” switch to the “ON" position.
3. Calibrate the Oxygen Analyzer if equipped.
4. Open MIV 109.
5. Allow oxygen level reading to stabilize.
6. Adjust the Outlet Pressure and Flow Rate based on individual system requirements (refer to **System Adjustment** section below).
7. Close MIV 109 and open MIV 108.

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. Flow rates at various purity levels are shown on page 35 of this manual. Refer to the flowmeter technical information for more details and specific operating instructions.

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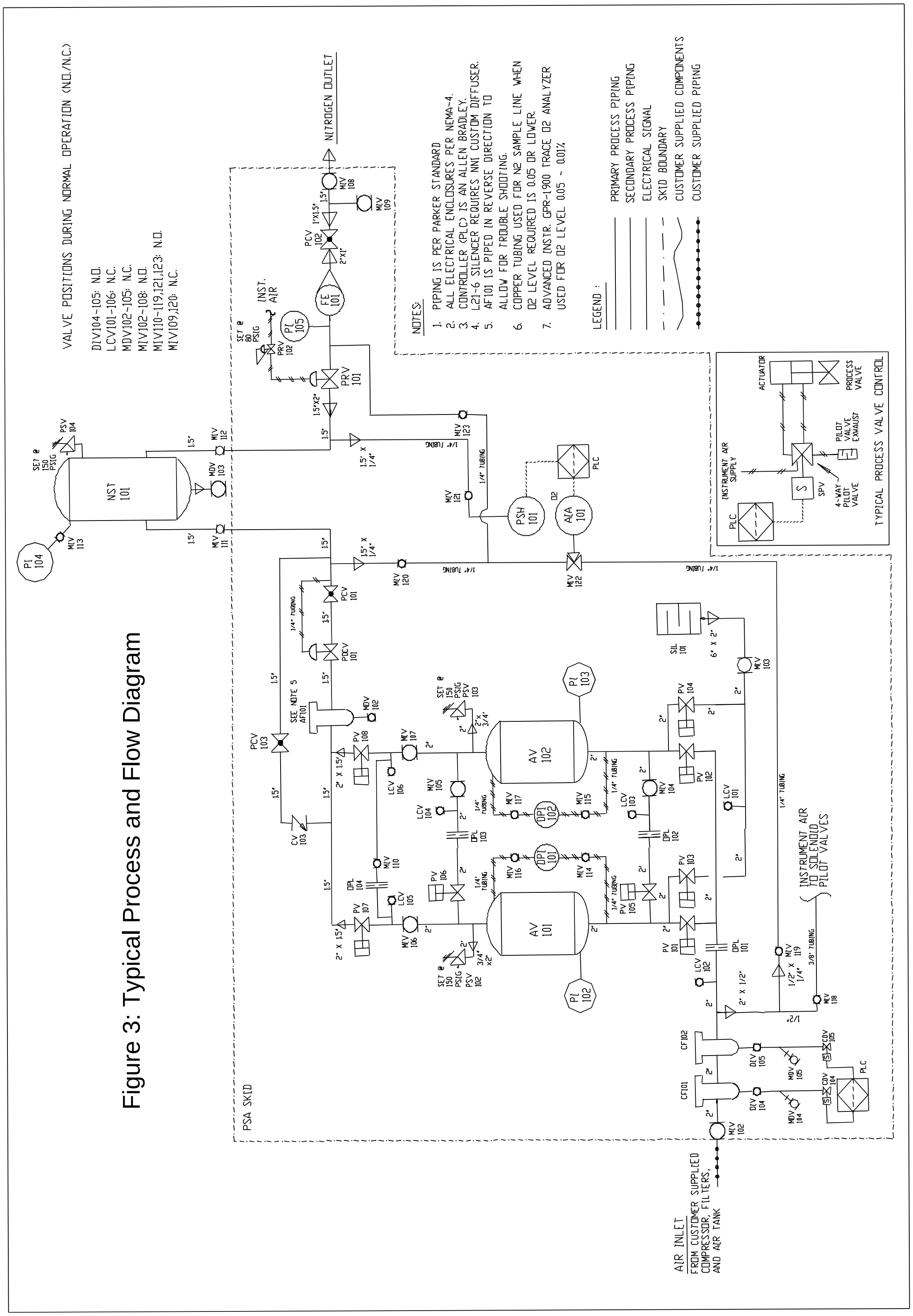

Figure 3: Typical Process and Flow Diagram

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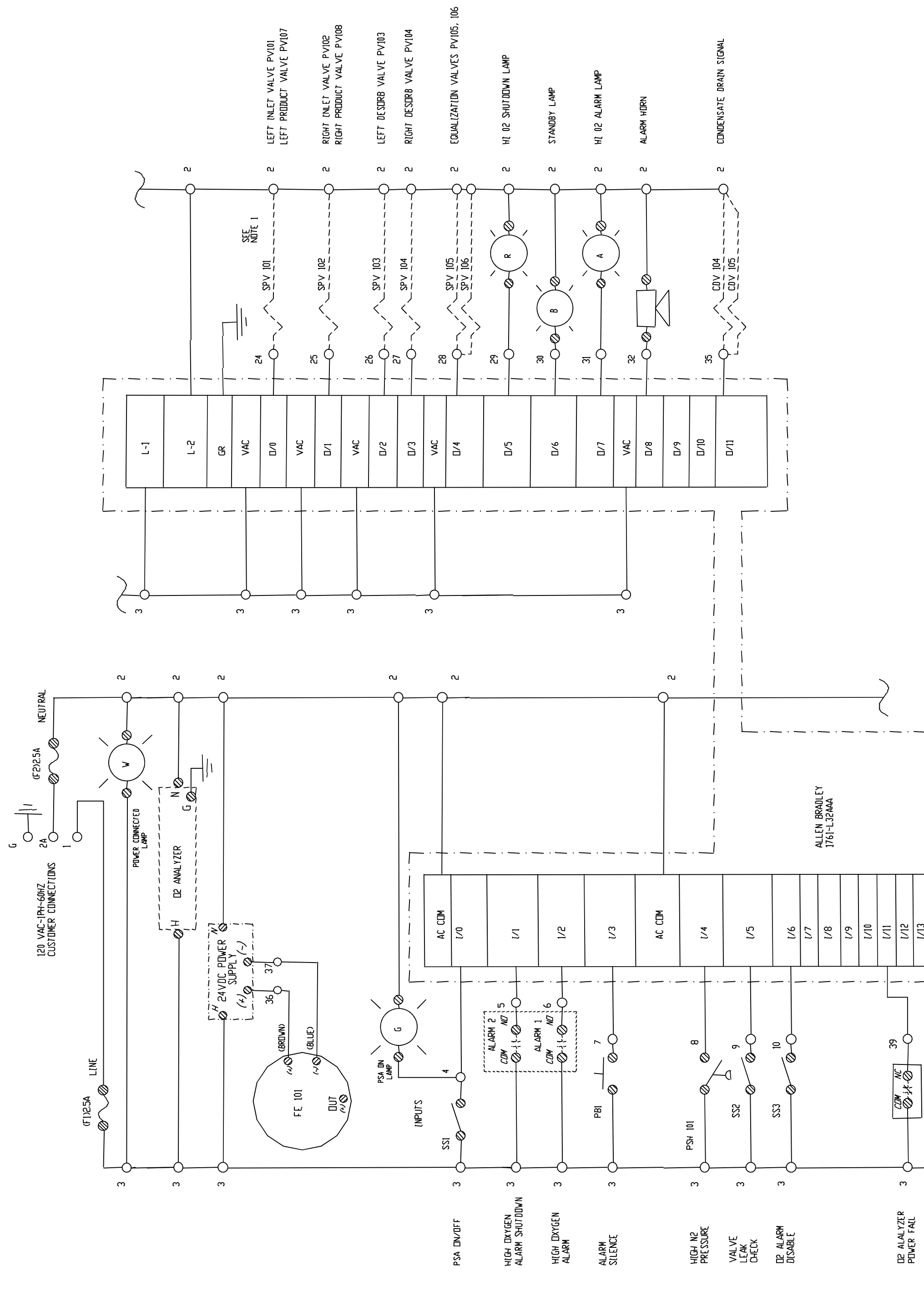

Figure 4: Typical Wiring Diagram, 120/1/60

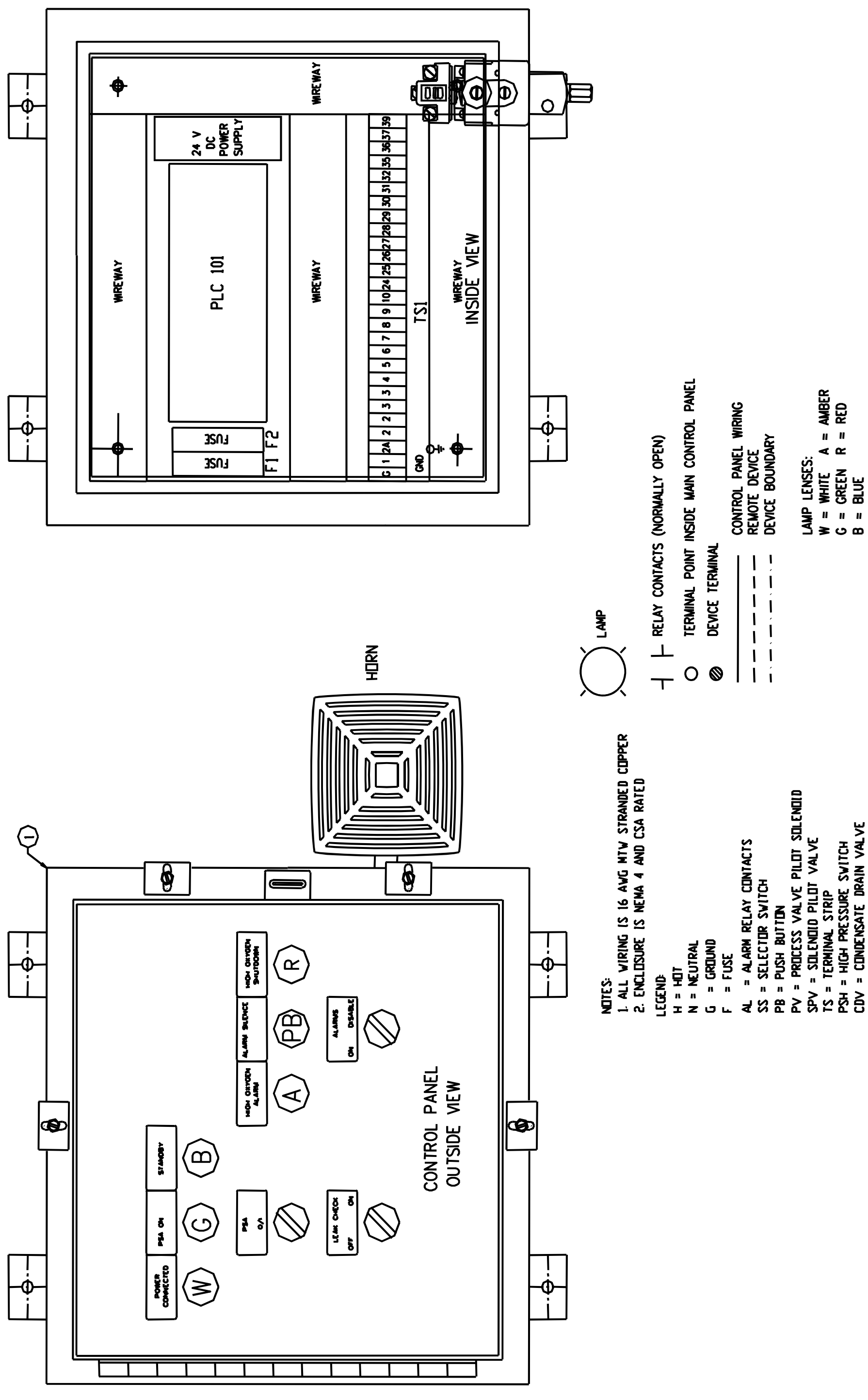

Figure 5: Typical Control Panel, 120/1/60

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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 system is 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 no nitrogen is being consumed. In such situations, the pressure switch sends a signal back to the PLC which causes the Dual-Bed to shut down. Once the pressure in NST 101 drops below the set point of the pressure switch the Dual-bed will automatically start and resume normal cycling. Essentially, the Dual-Bed 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.

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.

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Total Shutdown

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

⚠ **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 DB unit must be de-energized and depressurized before performing any maintenance procedures.

Stand-By Pressure Switch Setting

For the Dual-Bed nitrogen generator to switch to stand-by mode, the pressure switch (PSH 101) has to 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 (figures 4 & 5) and Figure 6. 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 screw. 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 DB 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 DB unit follow the steps below.

1. With the DB unit cycling normally, close the outlet product control valve.
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). Note that input I4 in the PLC is illuminated. This lamp 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. Then turn the adjusting screw counter clockwise until the switch closes. Refer to Figure 6.

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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.

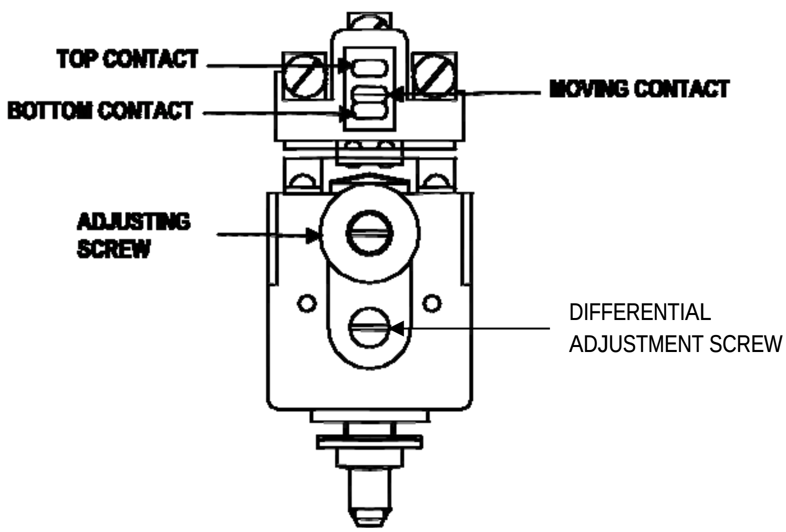
5. Let the nitrogen generator undergo further cycling (no flow - PCV 101 closed). Observe the pressure switch contacts or input 4 on the PLC.

6. If the pressure switch switches back to the open position (bottom contact not touching and I4 not illuminated) during DB cycling with no flow, turn the adjusting screw further in a counter-clockwise direction 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.

Figure 6



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Resuming Flow

For automatic start-up out of stand-by mode, open flow control valve to produce the normal flow rate. Once 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. Before flowing the product nitrogen into the application let the unit run for about 30 minutes for the oxygen content to stabilize.

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 DB unit 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 DB 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 screw will require a minor clockwise adjustment 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.

Maintenance

General

To ensure proper operation of the Parker DB Nitrogen Generator, 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)

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- 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

Refer to Figure 2 and 3. The coalescing filters are located inside the unit just after the inlet air connection. These filters are present for final filtration of the incoming air only. Any accumulation or oil or moisture in these filters should be an indication of possible CMS contamination. The second coalescing filter removes particulate contamination with an efficiency of 99.99% at 0.01 micron to ensure a high purity air supply to the generator. **Inspect filters every three months. Change the DB filter elements every six months or sooner depending on condition of the element**.

Procedure

Refer to Figure 2 and the flow diagram.

NOTE: Make sure that system is depressurized.

CF101 and CF102

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

6. Securely hold bottom portion of filter housing.
7. Push up gently against top portion, and twist counterclockwise (opposite direction of LOCK arrow).
8. Remove filter housing.
9. Unscrew round filter element retainer at the bottom.
10. Carefully pull out old filter element, and replace with new part.
11. 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.

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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.

Leak Check PV 105 (Figure 7)

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.
6.

Leak Check PV 106 (Figure 8)

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.

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Figure 7: Lower Manifold – Leak check valve PV 105

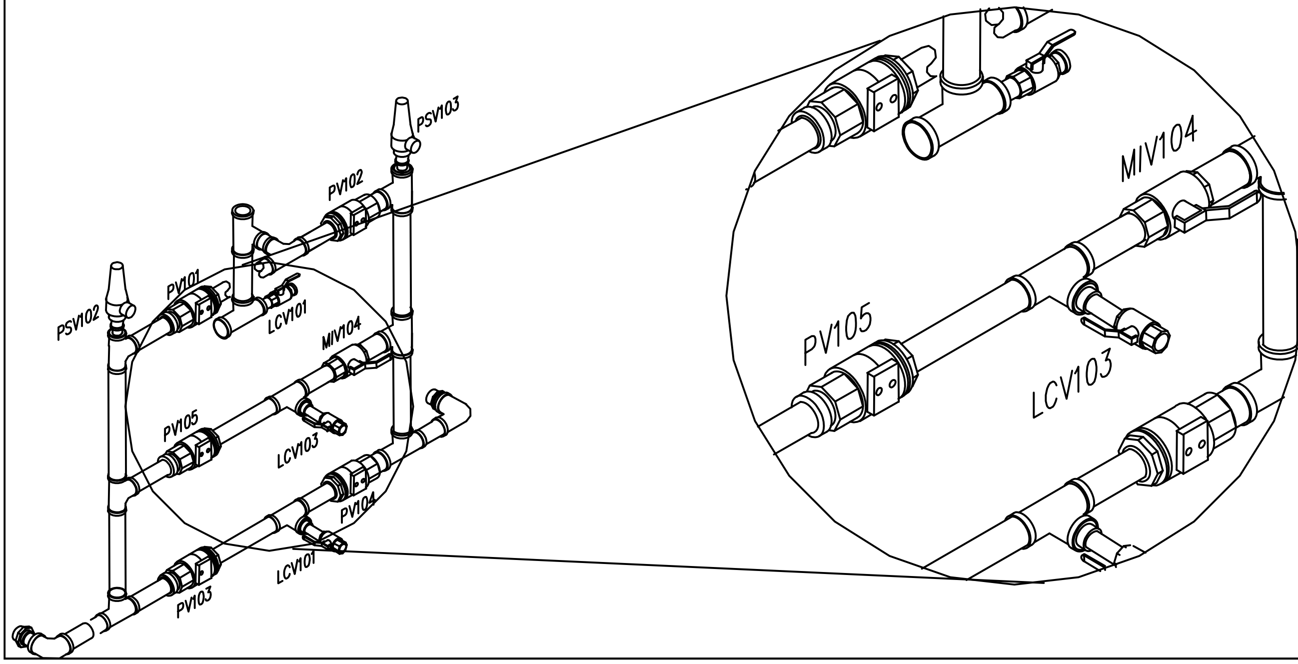
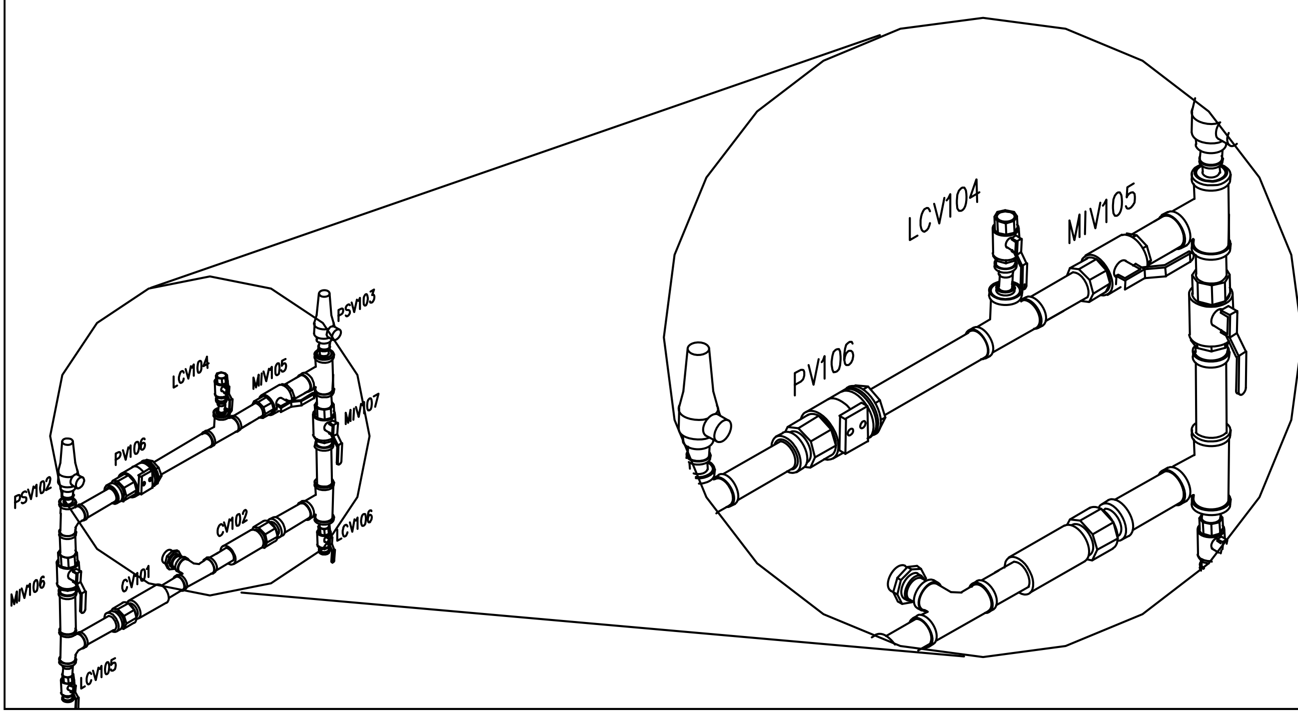


Figure 8: Lower Manifold – Leak check valve PV 106



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Leak Check PV 101 (Figure 9)

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 103 (Figure 10)

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 107 (Figure 11)

1. Open LCV 105 to depressurize manifold.

1. 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.

2. 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.

Leak Check PV 108 (Figure 11)

1. Wait until pressure in AV 102 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 106 to depressurize lower equalization manifold.

2. If there is no flow out of LCV 106 after initial depressurization, then PV 108 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 108 is leaking. b. If equilibrium pressure reading = PI 103 reading, then MIV 107 is leaking.

4. Close LCV 106.

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Figure 9: Lower Manifold – Leak check valve PV 101 and 102

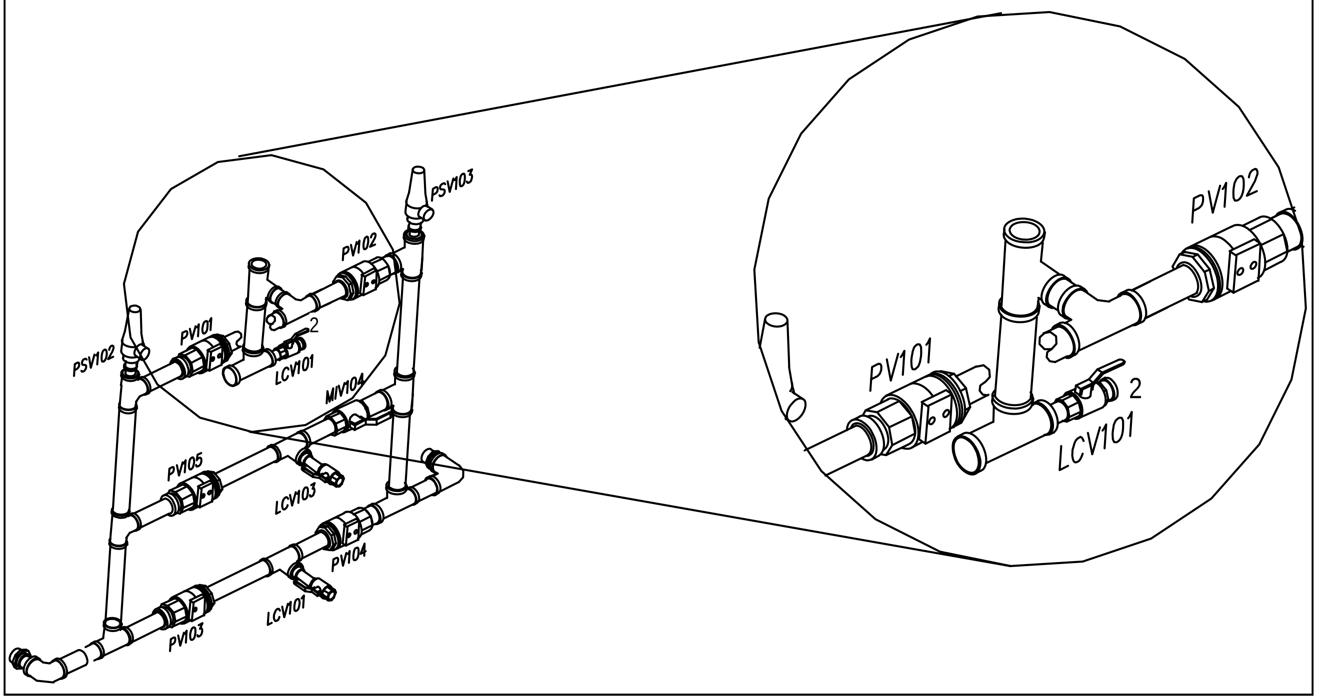
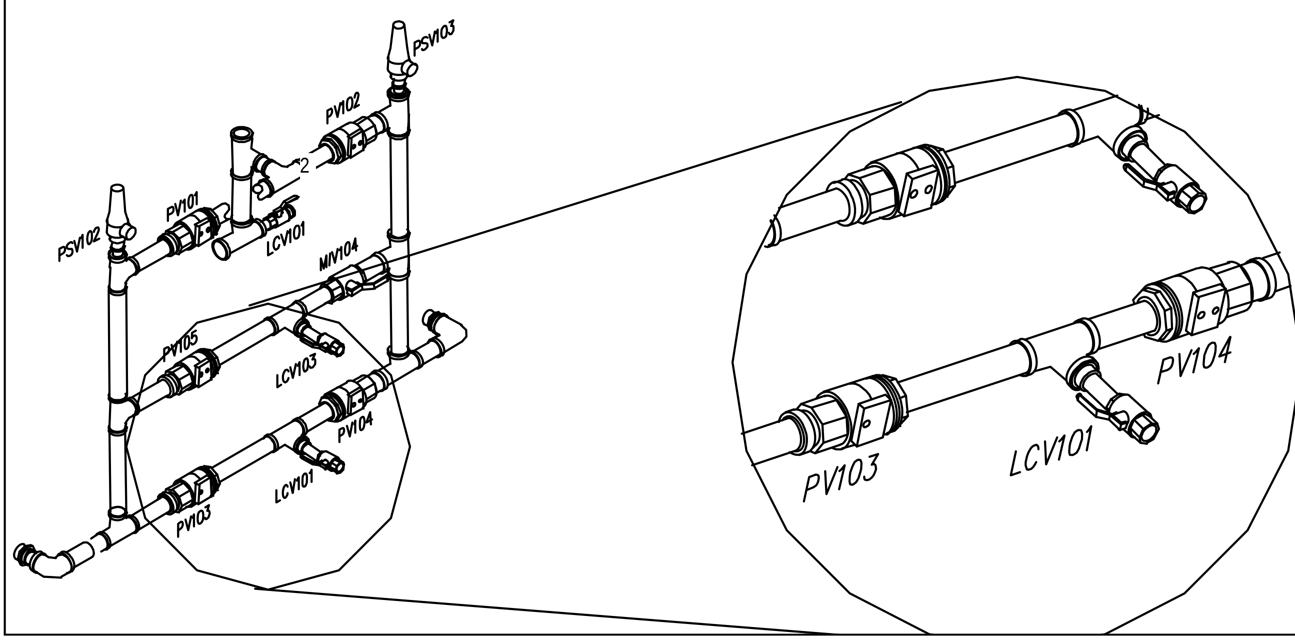


Figure 10: Lower Manifold – Leak check valve PV 103 and 104



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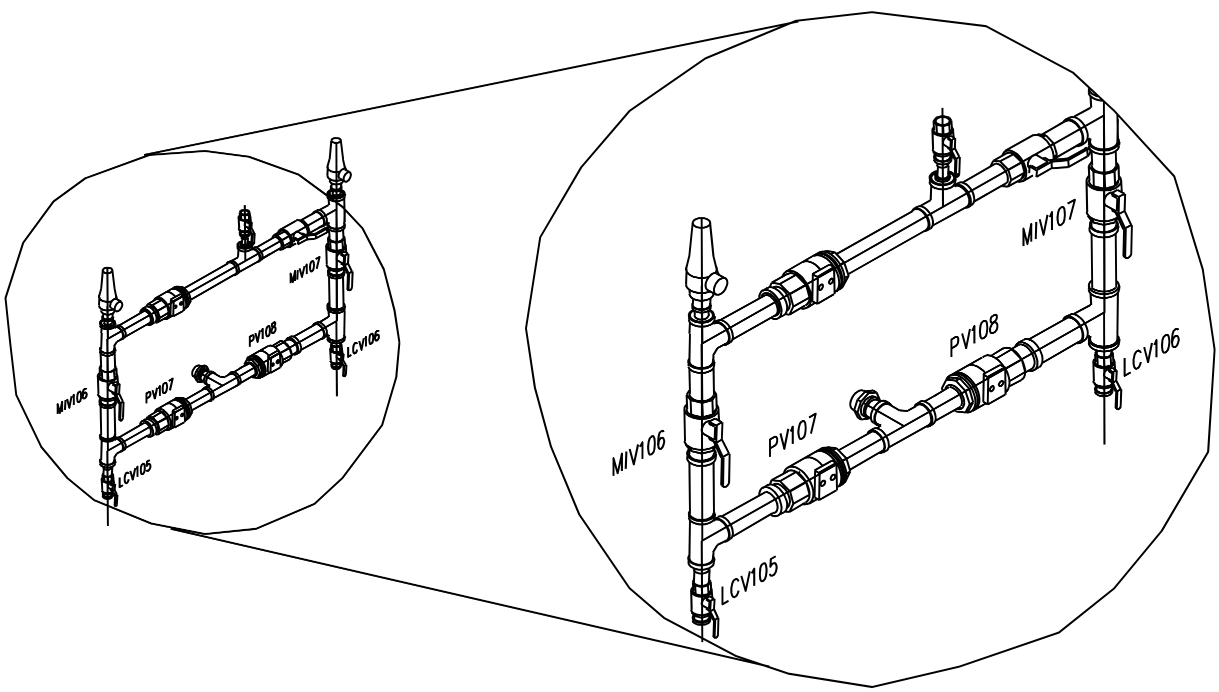
Leak Check PV 102 (Figure 9)

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 104 (Figure 10)

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 11: Upper Manifold – Leak check PV 107, PV 108



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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 and should be replaced annually, depending on the make and manufacturer of the analyzer. 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. After cell replacement, the proper calibration procedure must be performed.

Parts

Ensure that the replacement fuel is the correct model for the unit. The table below details the type of fuel cell needed for each type of oxygen analyzer:

Replacement Oxygen Monitor Fuel Cells	
Parker/Balston 72-730	72695
Advanced Instruments % Oxygen Analyzer	GPR-11-60-4
Advanced Instruments Trace Oxygen Analyzer	GPR-12-333

Tools Required

Phillips screwdriver
Calibrating tool or jewelers flathead screwdriver (for Parker/Balston Oxygen Analyzer)

Procedure

Consult the proper oxygen analyzer manual (shipped with DB unit) for steps to replace fuel cell and calibrate analyzer.

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 DB unit has eight process valves that 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.

Parts

	Description	Part number	Quantity
DB-1200 to DB-2500	Process valve rebuild kit (1-1/2 inch)	RKVA150VV	8
DB-4000	Process valve rebuild kit (2 inch)	RKVA200VV	8

Tools

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

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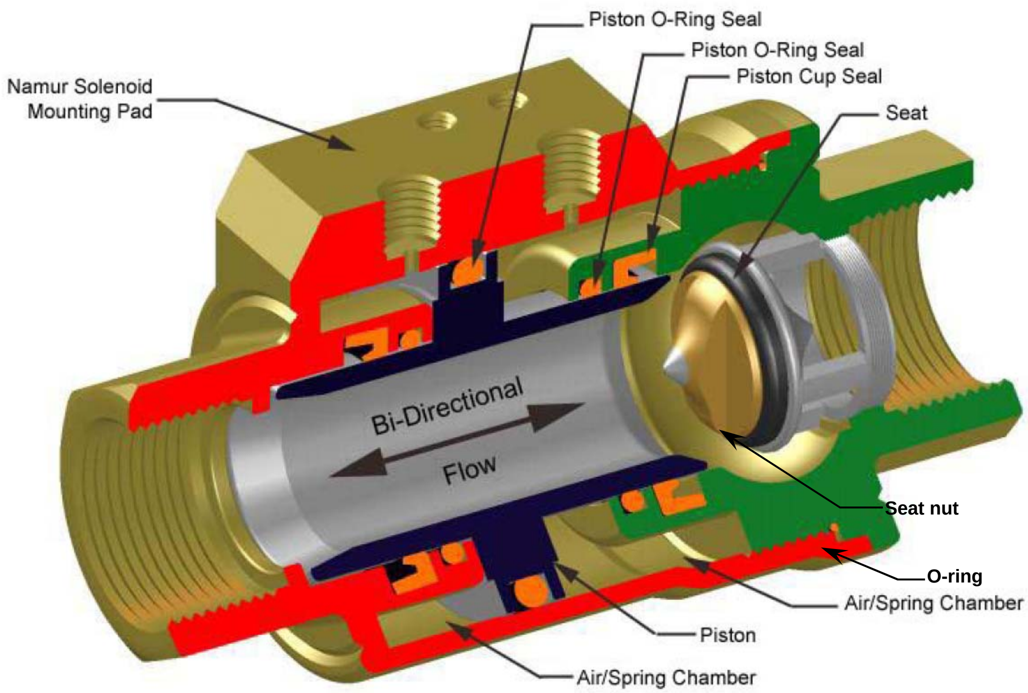
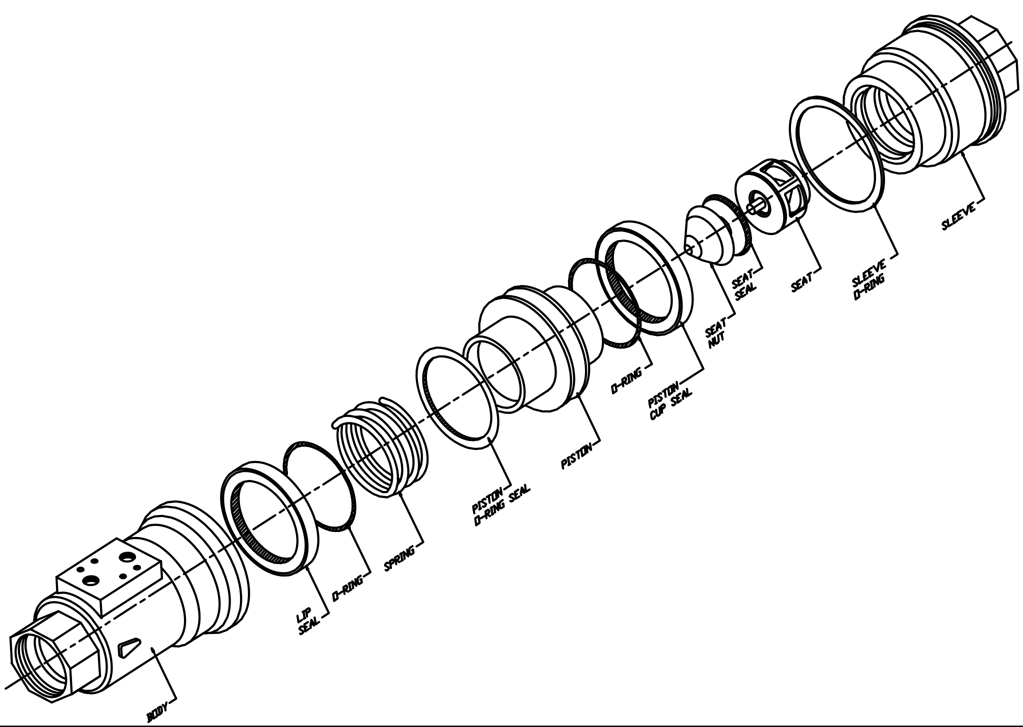
Figure 12: Typical Process Valve Components



Cutaway View (spring not shown inside spring chamber)



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Procedure

Refer to Figure 12 for details.

1. Locate process valves on DB unit, and remove carefully.
2. Disassemble valve components carefully.
3. Replace the o-ring seals, cup seals and valve seat as shown in Figure. 12.
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.

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.**

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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 (Figure 2).
2. Remove four mounting screws on pilot valve body using 4mm hex key (Fig. 13) to disengage from stack.

Figure 13: Typical Parker H-Series Pilot Valve

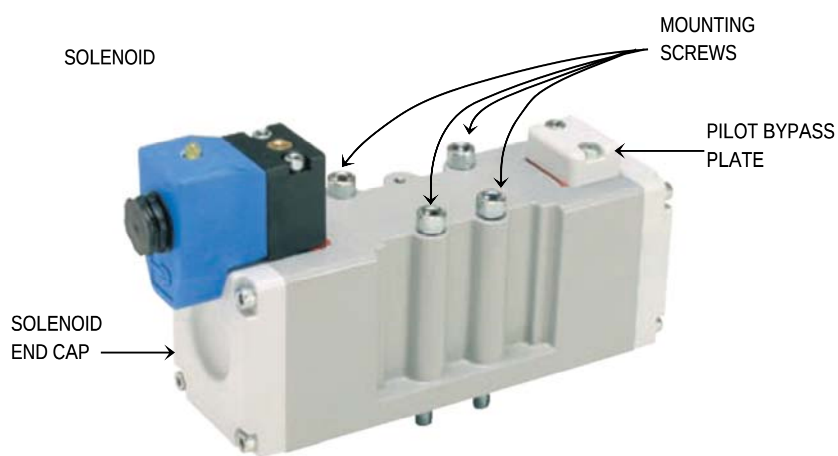

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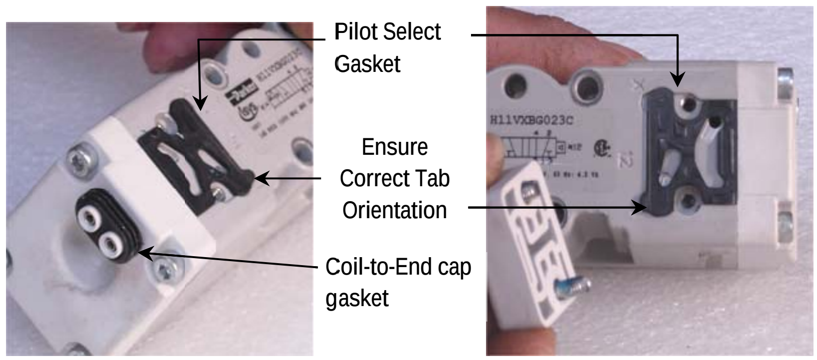
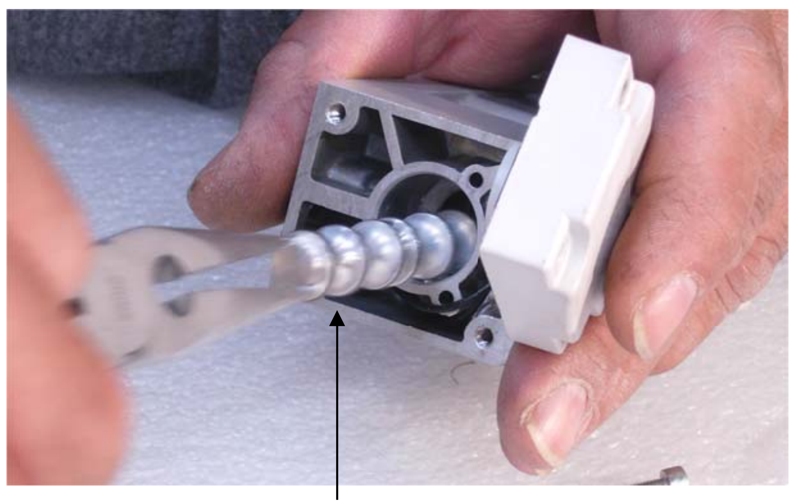
Figure 14: Two Pilot Select Gaskets - Orientation



Solenoid Side

Pilot Bypass Plate Side

Figure 15: Valve Spool Removal with Needle-nose Pliers



3. To change pilot select gaskets follow instructions supplied in service kit.

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⚠ **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 13).

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 14).

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.

f. Re-install solenoid pilot operator. Torque screws to 12-14 in.lb (1.4-1.6 Nm).

4. To change valve spool (Figure 15):

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.

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Ordering Information

Dual-bed Nitrogen Generator	DB-1200	DB-1600	DB-1900	DB-2500	DB-4000
Replacement Filter Elements & Valve Repair Kits	**P/N**	**P/N**	**P/N**	**P/N**	**P/N**
Pre-filter, 1st Stage (CF 101)	5/200-35-DX	5/200-35-DX	5/200-80-DX	5/200-80-DX	5/200-80-DX
Pre-filter, 2nd Stage (CF 102)	5/200-35-BX	5/200-35-BX	5/200-80-BX	5/200-80-BX	5/200-80-BX
Final Filter (AF 101)	5/100-18-DX	5/150-19-DX	5/150-19-DX	5/200-35-DX	5/200-35-DX
Process valve repair kit (PV 101-108) QTY. 8	RKVA150VV (6ea) RKVA100VV (2ea)	RKVA150VV (6ea) RKVA100VV (2ea)	RKVA150VV	RKVA150VV	RKVA200VV
Solenoid Pilot Valve Repair Kit (SPV 101-106) QTY. 6	PS4001CP	PS4001CP	PS4001CP	PS4001CP	PS4001CP
Replacement Oxygen Monitor Fuel Cells					
Advanced Instruments % Oxygen Analyzer	GPR-11-60-4	GPR-11-60-4	GPR-11-60-4	GPR-11-60-4	GPR-11-60-4
Advanced Instruments Trace Oxygen Analyzer	GPR-12-333	GPR-12-333	GPR-12-333	GPR-12-333	GPR-12-333
Fuses					
Main fuses (2 required) – 2.5 amp	TRM2-1/2	TRM2-1/2	TRM2-1/2	TRM2-1/2	TRM2-1/2
Advanced Instruments % Oxygen Analyzer	71385K23	71385K23	71385K23	71385K23	71385K23
Advanced Instruments Trace Oxygen Analyzer	71385K23	71385K23	71385K23	71385K23	71385K23
Maintenance kit (consisting of 2 of each filter element, 8 process valve repair kits, 6 solenoid valve repair kits and one oxygen analyzer fuel cell). These items are sufficient for one year of normal maintenance.					
Advanced Instruments % Oxygen Analyzer	MKDBOC1200	MKDBOC1600	MKDBOC1900	MKDBOC2500	MKDBOC4000
Advanced Instruments Trace Oxygen Analyzer	MKDBOD1200	MKDBOD1600	MKDBOD1900	MKDBOD2500	MKDBOD4000

For placing orders for filter elements and fuel cell for standard unit, call 1-800-343-4048.
For placing orders for valve repair kits, fuel cell for high purity unit, and other components, call 410-636-7200.

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Warnings and Precautions

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 Dual-Bed performance), shut unit down and find and correct problem(s) before restarting. If the Dual-Bed 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 Dual-Bed 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**.

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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 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.

Symptom – Oxygen Analyzer	Course of Action
Display Varies	Check process flow demand. Check sample lines for leaks. Recalibrate oxygen analyzer.
Limited range during calibration	Replace oxygen sensor.

To arrange for system service, contact the Technical Services Department at 410-636-7200, 8AM to 5PM Eastern Time or email at balstontechsupport@parker.com (North America only). For other locations please contact your local representative.

Serial Numbers

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

DATE IN SERVICE ________________________ SERIAL NO. ______________

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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 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.

Principal Specifications

Dual-bed Nitrogen Generator	DB-1200	DB-1600	DB-1900	DB-2500	DB-4000
Atmospheric Dew Point	-58 Deg F	-58 Deg F	-58 Deg F	-58 Deg F	-58 Deg F
Recommended Inlet Pressure (Min)	110 psig	110 psig	110 psig	110 psig	110 psig
Min/Max Ambient Temperature	40/95 Deg F	40/95 Deg F	40/95 Deg F	40/95 Deg F	40/95 Deg F
Inlet Port Size	1-1/2"	1-1/2"	2"	2"	2"
Outlet Port Size	1'	1"	1-1/2"	1-1/2"	1-1/2"
Electrical Requirements NEMA 4	- - - - - - - - - - - - - - - - 120v/1ph/50-60hz, 0.3 kW - - - - - - - - - - - - - - - -				
Dimensions	6.5' x 4' x 9'	6.5' x 4' x 7.33'	6' x 4.5' x 6.91'	6' x 4.5' x 7.5'	7' x 6' x 11'
Shipping Weights (lbs.)					
Generator	3,400	3,500	4,800	5,300	7,600
NST	570	670	670	740	1,360
Total	3,970	4,170	5,470	6,040	8,960

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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.

DB Flows (SCFH) and Air Consumption (SCFM) at Different Purity Levels

Model	99.999%	99.995%	99.99%	99.95%	99.9%	99.5%	99%	98%	97%	96%	95%
DB-1200	186	522	630	951	1,077	1,635	1,995	2,445	2,800	3,050	3,300
Avg. Air Demand	50 SCFM	57 SCFM	62 SCFM	68 SCFM	67 SCFM	76 SCFM	85 SCFM	92 SCFM	101 SCFM	107 SCFM	113 SCFM
DB-1600	248	696	840	1,268	1,435	2,178	2,652	3,250	3,732	4,066	4,400
Avg. Air Demand	66 SCFM	76 SCFM	82 SCFM	91 SCFM	89 SCFM	102 SCFM	112 SCFM	123 SCFM	134 SCFM	142 SCFM	150 SCFM
DB-1900	295	826	997	1,505	1,703	2,585	3,150	3,860	4.430	4,540	5,220
Avg. Air Demand	79 SCFM	90 SCFM	97 SCFM	108 SCFM	105 SCFM	121 SCFM	133 SCFM	146 SCFM	159 SCFM	158 SCFM	177 SCFM
DB-2500	389	1,088	1,312	1,981	2,243	3,402	4,150	5,088	5,836	5,984	6,880
Avg. Air Demand	104 SCFM	118 SCFM	128 SCFM	142 SCFM	138 SCFM	160 SCFM	175 SCFM	192 SCFM	210 SCFM	209 SCFM	234 SCFM
DB-4000	622	1,741	2,100	3,170	3,590	5,445	6,640	8,138	9,330	9,574	11,010
Avg. Air Demand	166 SCFM	189 SCFM	204 SCFM	227 SCFM	221 SCFM	255 SCFM	280 SCFM	307 SCFM	335 SCFM	334 SCFM	375 SCFM

NOTE: See items below regarding specified flows and purities.

1. **Air Consumption numbers given are average. Peak flows may be considerably higher. Values based on dedicated air compressor with corresponding Air Surge Tank @ 110 psig.**
2. **Nitrogen values are based on standard inlet conditions (110 psig, 60-100 deg. F). Consult factory for performance at different inlet conditions.**
3. **Some flows and purities may not be available at all outlet pressures.**

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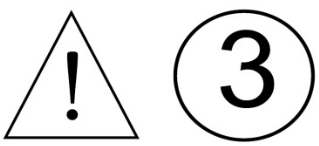
WARNING SYMBOLS

Symbol | **Description**

Caution, refer to accompanying documents for explanation.



Refer to the caution/warning note indicated for explanation.

Caution, risk of electric shock.

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