

On site Nitrogen Generating system



NitroGEN Series

INSTALLATION, OPERATION, MAINTENANCE PSA Type Nitrogen Generating Plant

Retain this user manual for Future reference.

For more information regarding our products and services,
please visit

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Introduction

Congratulations on your purchase of a **TRIDENT PNEUMATICS PVT LTD. Pressure Swing Adsorption (PSA) type Nitrogen Generator**. This simple, turnkey machine provides a cost-effective means for on-site generation of nitrogen. The Nitrogen Generator is based on the latest PSA technology and utilizes Carbon Molecular Sieve (CMS) to separate the nitrogen from the other gases contained in air. The Nitrogen Generator uses two beds of CMS to separate compressed air into a high-pressure nitrogen product stream and lowpressure oxygen enriched waste stream. Pre-Filter and Fine filters are included to remove impurities from the feed air. Each Nitrogen Generator comes pre-tested and fine tuned to meet the customer specified nitrogen flow rate and purity.

Since the system contains very few moving parts, maintenance and repairs are minimal. Maintenance is simple yet necessary. Air compressor and filter maintenance procedures are especially important and should be followed carefully. If the recommended maintenance procedures are followed, your nitrogen generator will provide you with many years of reliable service.

About us

Trident is a leading manufacturer of Air treatment equipments like Oxygen Concentrators, Air Dryers, Automatic Drain valves, Filters and Custom made Air dryers as per customer requirement. We have our presence in the market for the past 25 years and have been supplying Air dryers and drain valves to global leaders ever since our incorporation in the year 1988. Information about our products and our company can be found at our web site: www.tridentpneumatics.com

Trident delivers sustainable solutions for increased customer productivity, through innovative products and services

We are committed to design and manufacture Compressed Air Dryers, Drain valves, Filters and other Air Treatment products for Industrial applications, Locomotives and Trucks and render services of excellent quality to meet customer expectation. We will continuously strive to improve our quality, customer satisfaction and profitability by means of teamwork, global bench marking and innovation."







Trident range of products are exclusively designed for various industries like:

- | | |
|---------------|----------------|
| 1. Textile | 6. Automobile |
| 2. Foundry | 7. Engineering |
| 3. Metallurgy | 8. Power |
| 4. Medical | 9. Aviation |
| 5. Coating | 10. Defence |

Safety Information

WARNING

Do not use this plant or any available optional equipment without completely reading these instructions and any additional instructional material such as user manuals, service manuals or instruction sheets supplied with this product or optional equipment. If you are unable to understand the warnings, cautions or instructions contact a professional, dealer or technical professional before attempting to use this equipment.

	Caution, Read the User Guide.	 Warning	Highlights actions or procedures which, if not performed correctly, could lead to electric shock.
 Warning	Highlights actions or procedures which, if not performed correctly, may lead to personal injury or death.		When disposing of old parts always follow local waste disposal regulations.
 Caution	Highlights actions or procedures which, if not performed correctly, may lead to damage to this product		Highlights information relevant to an operating procedure or process

- The operator must employ safe working practices and rules when operating the nitrogen generator.
- The owner is responsible for maintaining the unit in a safe operating condition.
- Completely depressurize the generator, tanks, and lines prior to performing any mechanical work, including changing the filters. The nitrogen must be vented to the outside or to a large, well-ventilated room to avoid suffocation due to lack of oxygen.
- Safety glasses should be worn if the cabinet door is open while the machine is operating.

NOTICE

Manual contains details about all the optional devices available with Nitrogen generators, some of them may or may not included with the generator. Kindly confirm the supplier scope, optional devices are available on request only.

The information contained in this document is subject to change without notice.

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1. GENERAL GUIDELINES

In order to ensure the safe installation, assembly and the operation of this on site Nitrogen plant, the following instructions **MUST** be followed strictly.

WARNINGS

This section contains the important information for the safe operation and use of this plant.

Warning	Make sure that your back up/ emergency Nitrogen supply system connected to the manifold system. Without secondary Nitrogen supply system, Don't use this Plant
Warning	Equipment must be placed in a well-ventilated area. Avoid inhalation of gases
Warning	Nitrogen Plant, you must follow the procedure for service and maintenance instructions.
Warning	All tubes, hoses and piping used for Nitrogen plant must be compatible with Nitrogen
Warning	Exhaust gas must be lead by piping out of the room to outdoor atmospheric air
Warning	The Panel contains electrical parts that may produce electrical hazard if not handled properly. To prevent electrical shock when servicing the plant, care must be taken. In general electrical installation and servicing is to be performed by trained or authorized personnel only
Warning	Nitrogen and Air reservoir must be de-pressurized and purged thorough with air to remove all Nitrogen before service or inspection. Always vent Nitrogen to outdoor atmospheric air. Make sure there is no smoking or open flame.
Warning	Smoking should not be permitted in the area where the plant is located
warning	Do not try to modify or enhance the performance of an Nitrogen plant in any way
Caution	Warranty will not covered <ul style="list-style-type: none"> ➤ If Inlet air temperature below 5 and or above 40 deg C. ➤ Water, oil, rust, scale and/or other foreign objects carry over in the inlet air due to damaged filter elements and/or failure in drains. ➤ If the Inlet air quality not comply with ISO 8573 class 4
Important	For safety, installation and operating etc. of compressor, dryer unit or other equipment refer to the concerned manuals of the equipment.

2.PRODUCT DESCRIPTION

Nitrogen Series Nitrogen generators are on-site Nitrogen gas generating plants. Our Nitrogen generators working on the Pressure swing adsorption technique.

The Trident Nitrogen Generator is designed to provide a constant supply of nitrogen gas, at a pre-selected purity, flow, and pressure, as specified. The system uses proven Pressure Swing Adsorption (PSA) technology with Carbon Molecular Sieve (CMS) to separate N₂ from the atmosphere air and store it at a high purity level. The process is completely regenerative which makes it reliable and virtually maintenance free.

- **ACCESSORIES WARNING:** Trident products are specifically designed and manufactured for use in conjunction with Trident accessories. Accessories designed by other manufacturers have to be tested before using it and however Trident is not recommend for use with our products. It is important to note that your compressor, refrigeration/Desiccant dryer and filtration system is an integral part of your total operation. It should be maintained in accordance with the manuals received with the compressor, refrigeration dryer and filtration system to ensure safe and clean air supply. An improperly maintained compressor, refrigeration dryer or filtration system could affect the operation of your Nitrogen generator. For use up to 24 hours a day, Trident will recommends high quality screw compressors only with external or internal refrigeration dryers and proper sized filtration systems.

2.1 NitroGEN Outstanding features and applications

- ✓ **High Reliability**
Low gas speeds through the molecular sieve beds, first-class components, stainless steel valve bodies and instrument air tubing, heavy-duty industrial PLC Manufactured to work. Always.
- ✓ **Lowest Energy Consumption**
Energy cost is your major expense, not depreciation. Fast pay-back assured.
- ✓ **Easy Integration**
Easy installation and integration with existing equipment: All system tie-in points are on one side.
- ✓ **Safe**
Heavy-duty adsorption vessels, designed and certified for an unlimited number of cyclic loads.
- ✓ **Customization**
An extended list of options allow you to define your specific Trident Twin-Tower PSA Nitrogen Generator adjusted to your individual need.

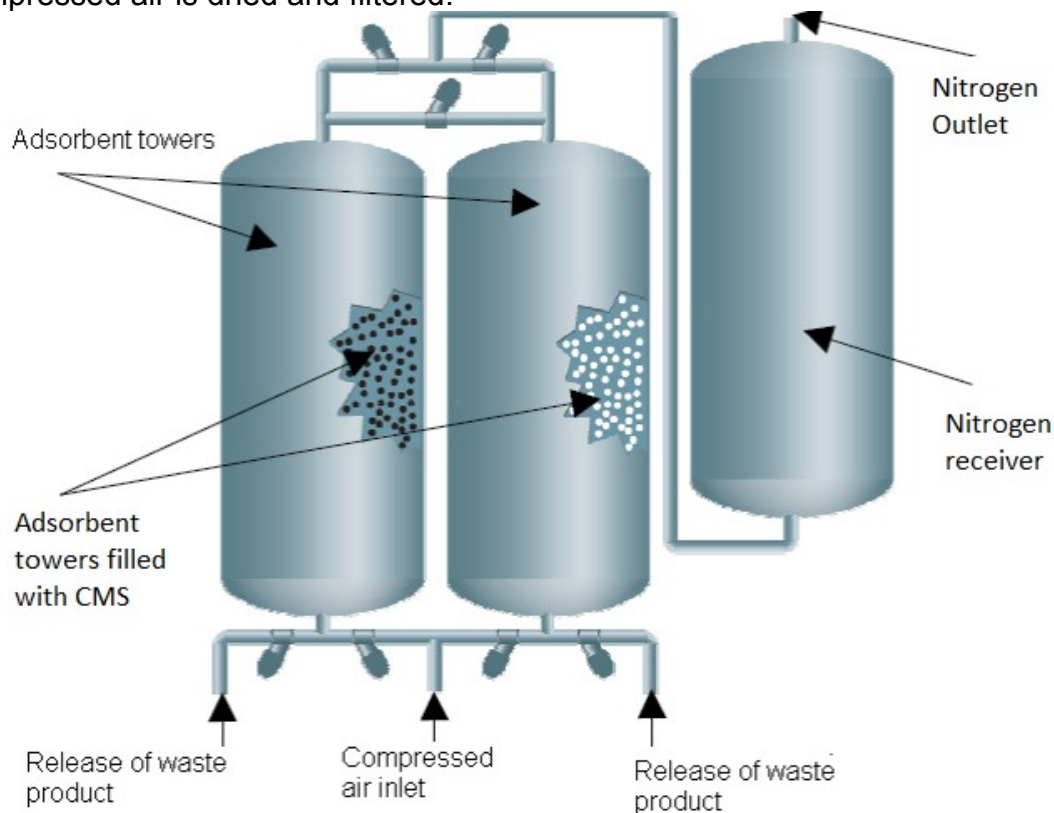
2.2 PSA Technique

Nitrogen PSA process can be described with following steps.

The PSA process starts as clean and dry compressed air enters the first cylinder (left). The unwanted gas is adsorbed by the pellets at high pressure, but the molecules you want pass through the sieves. The resulting high-purity gas is stored in the buffer tank.

1. Compression, drying and filtering of input air:

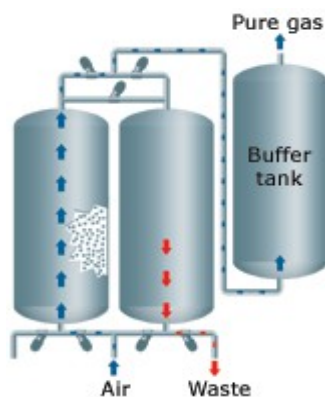
The ambient air is compressed by an air compressor. Before entering the PSA process the compressed air is dried and filtered.



2. Oxygen adsorption on CMS bed:

Our PSA units have two cylinders filled with Carbon Molecular Sieve. (CMS). Compressed and purified air flows through the cylinder, the CMS bed adsorbs oxygen, while nitrogen passes through to the nitrogen accumulation tank. The adsorption process is interrupted before the CMS becomes saturated with nitrogen by diverting the input air to the second cylinder, which at this point starts producing nitrogen.

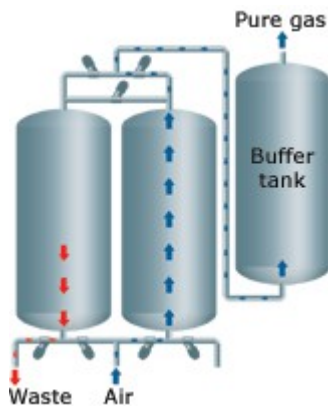
During this step of the cycle, the second cylinder (right) is cleaned.



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3. Next, the pressure between the two cylinders is equalized.



4. Oxygen desorption and CMS bed regeneration:

The CMS of the first cylinder (now saturated with oxygen) is regenerated by reducing pressure in the cylinder below that of the adsorption step. The adsorbed oxygen is released and vented into atmosphere. After this step it is again ready for another cycle.

5. Nitrogen accumulation in Surge tank:

Adsorption and desorption steps are repeated in the CMS tanks at equal time intervals. A constant flow of nitrogen is stored to nitrogen surge tank.

2.3 NITROGEN Specifications

Trident make Nitrogen generating plant are available at various models according to the users requirements of Nitrogen. The following table gives the available models of oxygen generator's from Trident.

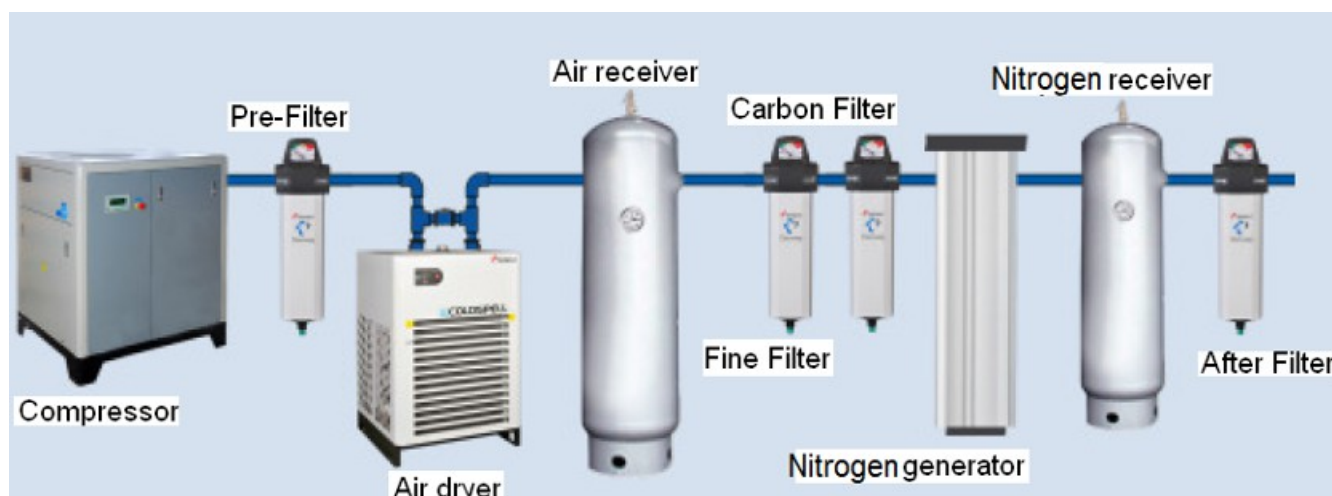
Specification

Nitrogen Purity	: 95 to 99.99%
Rated operating pressure	: 7 bar (g) (101.5PSI (g))
Max working Pressure	: 9 bar (g) (130.5 PSI (g))
End Connection	: 1/2" NPT
Air Inlet Temperature	: 104 deg F max
Voltage	: 100-240 VAC 50/60 Hz, 1 Ph

Nitrogen Models:

Rated Capacity at various Purity Level																
Nitrogen Purity %		99.99		99.9		99.5		99		98		97		95		Inlet air requirement
Oxygen Level %		0.01		0.1		0.5		1		2		3		5		
Model	Item code	Nm³/hr	LPM	Nm³/hr	LPM	Nm³/hr	LPM	Nm³/hr	LPM	Nm³/hr	LPM	Nm³/hr	LPM	Nm³/hr	LPM	Nm³/hr
Nitrogen 10	PG001	0.56	9.3	1.22	20.3	1.8	30.0	2.16	36.0	2.52	42.0	2.88	48.0	3.6	60.0	5.8
Nitrogen 20	PG002	0.81	13.5	1.77	29.5	2.6	43.3	3.12	52.0	3.64	60.7	4.16	69.3	5.2	86.7	8.3
Nitrogen 30	PG003	1.62	27.0	3.54	59.0	5.2	86.7	6.24	104.0	7.28	121.3	8.32	138.7	10.4	173.3	16.5
Nitrogen 40	PG004	2.43	40.5	5.3	88.3	7.8	130.0	9.36	156.0	10.92	182.0	12.48	208.0	15.6	260.0	25
Nitrogen 50	PG005	3.24	54.0	7.07	117.8	10.4	173.3	12.48	208.0	14.56	242.7	16.64	277.3	20.8	346.7	33.3

2.4 Nitrogen plant General Layout



2.5 Adsorbent Material

The adsorbent used in the Nitrogen series is produced by a unique manufacturing process. The benefits of using this high performance desiccant include:

- Uniform in size
 - ✓ Reduces pressure drop and channeling
- High crush strength
 - ✓ Allows rapid pneumatic loading of towers
- Low abrasion
 - ✓ The low abrasion ensures less dusting during transport, loading, and service life which reduces pressure drop and minimizes downstream valve and filter plugging, common with dustier products.

3. NITROGEN PARTS DESCRIPTION

Nitrogen Generator consists of the following, Some of them are optional devices

- 2 Adsorbent towers filled with CMS
- 1 Air dryer (Optional)
- 1 Pre filter
- 1 Fine filter (Optional)
- 1 after filter (Optional)
- 5 electronic control valve
- 2 Silencer
- Electronic auto drain valve (Optional)
- Pressure regulators (Optional)
- 1 Oxygen sensor (Optional)
- Manual Ball valves (Optional)
- Control panel
- 1 Pressure sensor (Optional)
- 1 Dewpoint sensor (Optional)

Adsorbent Towers

Trident Nitrogen plant has 2 Adsorber towers and which contains the Carbon Molecular Sieves. This desiccant bed adsorbs oxygen, and concentrates Nitrogen from the air during drying cycle. Pressure gauges are fitted on this towers to indicate the tower pressure and there is provision for refilling the desiccant.

Air dryer (Optional)

Moisture in compressed air used in Nitrogen plant causes problems in the operation of the desiccant beds as well as solenoid valves and can adversely affect the process and product being manufactured. In order to avoid the above said problem and to supply the dry air an air dryer is required in this plant. Trident make Coldspell refrigeration / Dryspell plus desiccant dryer eliminates any water vapour remaining in the compressed air coming at the outlet of the compressor house. The dryers have been designed for nominal standard inlet conditions as per ISO 7183 in order to obtain a dew point under pressure of +3 to +7 Deg C / -40 Deg C.

Air receiver (Optional)

Air receiver is connected in between the Air dryer and Adsorbent towers. This air receiver acts as a accumulator and the air supplied to this receiver must be dry air.

Pre-Filter

This filter avoids dust, dirt, foreign materials and moisture before entering into the molecular sieves bed and damaging the working. Trident make pre-filter(5micron) is used in this plant.

Fine filter (Optional)

This filter avoids dust, dirt, foreign materials and moisture before entering into the molecular sieves bed and damaging the working. Trident make fine-filter(1micron) is used in this plant.

After filter (Optional)

This filter avoids the desiccant particles from the adsorbent towers coming with the Nitrogen after production. Trident make fine-filter(1micron) is used in this plant.

Inlet feed air solenoid valves

This valves allows the inlet feed air between the two adsorbent towers during drying phase. Controls signals for valve operation is taken from the control panel.

Electronic control valve

These valves open for a period of when the absorber is pressurized to deliver Nitrogen to the Nitrogen receiver for use.

Mufflers

Mufflers are used for reducing the amount of **noise** emitted by the **exhaust** of the waste gases coming out from the adsorbent towers during regeneration phase.

Electronic auto drain valves (Optional)

Electronic auto drain valve (EDV) automatically removes condensate from the filters.

Pressure equalization valve

After pressurization cycle on one of the absorbers, the purge valve will open for a period and pressure equalization between the adsorber towers will take place.

Pressure regulators (Optional)

The air pressure regulator controls the inlet air pressure before entering into the adsorber tower in the inlet side and control the delivery Nitrogen pressure at delivery side.

Pressure gauges (Optional)

These gauges indicates the air pressure inside the adsorbent towers and receiver.

Non return valves

These valves prevents the back flow of Nitrogen into the adsorbent towers.

Oxygen sensor (Optional)

This sensor is used to indicate the product purity in terms of % of oxygen from the Nitrogen generator.

Dew point sensor (Optional)

This sensor is used to indicate the moisture level in the outlet product gas in terms of Pressure Dew point Deg C from the Nitrogen generator.

Ball valves (Optional)

These valves are used to open and shut off the inlet and product outlet from the receivers based on the requirement.

Exhaust solenoid pilot valves

This valves allows the waste air from the two adsorbent towers during regenerating phase. Controls signals for the valve operation is taken from the control panel.

Control panel

The control process the inputs and outputs to and from the system components and communicates with the touch screen.

4. DESCRIPTION OF OPERATION

The nitrogen generator works on the PSA principle. The desiccant adsorbs oxygen from the compressed air for generating the nitrogen. For proper removal Oxygen from the dry air regeneration of the desiccant is required. Regeneration is achieved by means of allowing a part of the the Nitroge from the supply outlet.

Cycle of Operations

The Nitro generator works based on the following phases,

- Drying
- Pressure Equalization
- Depressurization
- Re-pressurization and back pressurization

Drying cycle

The compressed dry air flows through the pre filter. The water particles and foreign materials get filtered by the filter. The filtered air flows in to the adsorber tower filled with the Molecular Sieves (CMS type). The sieves selectively adsorbs Oxygen, allowing Nitrogen to pass through at the desired purity level.

Pressure Equalization cycle

At the end of drying cycle the second adsorber tower is ready for the next drying cycle so in order to re-pressurize the tower to drying pressure by means of inlet air it take so much

time to save that energy the air in the tower 1 is fed in to the second tower and the pressures are equalized.

Depressurization

After drying for the preset cycle time, the desiccant bed will be saturated with oxygen. For successful removal of oxygen in the next cycle, this oxygen is to be removed from the desiccant. This removal of oxygen cycle starts with depressurization. In this cycle air inside the tower is vent out by the depressurization valve. The pressure is expanded to atmospheric pressure. The sudden depressurization brings out nitrogen molecules trapped in the sieves pores to the surface of the beads

Re-pressurization and Back pressurization cycle

At the end of drying cycle the second adsorber tower is ready for the next drying cycle so re-pressurization of the tower2 to drying pressure is necessary, this is achieved by allowing the inlet feed air and some amount pure nitrogen from surge tank to the adsorbent tower.

WORKING

- x Wet dirt atmospheric air is compressed in the compressor.
- x The air coming from the compressor is first fed into the inlet Pre-Filter, here the impurities present itself and water particles are removed.
- x After that in order to remove the water vapor present in the air it is allowed to flow through the refrigerant / Desiccant air dryer, where (2 to 7 deg c / -40 deg c) pressure dew point is achieved.
- x This dry air is stored in the air receiver under pressure.
- x On the first cycle drying phase dry air is allowed to adsorbent tower by means of inlet valve through the fine filter, Where the foreign materials and particles are removed from the air.
- x The compressed dry air flowing through mixed bed tower 1 is selectively adsorbs the Oxygen and delivers the nitrogen enriched air to the nitrogen surge tank.
- x Where the nitrogen is stored under pressure.
- x At this time the tower 2 is in regeneration phase.
- x Expansion of this gas to near-atmospheric pressure increases the ability of the purge air to strip the previously adsorbed oxygen from desiccant bed in tower 2. The absorbed gases exhausts through the opened two-way purge valve.
- x From the nitrogen surge tank the nitrogen is taken to the user end through the after filter.

The automatic cycling of the adsorption and desorption between the two beds enables the continuous production of nitrogen.

Trident make Nitrogen generator's have a failure alarm system.

In the touch screen display the alarms indicates the following,

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- If the purity of the Nitrogen drops under the rated purity level.
- If the pressure of the Nitrogen outlet drops under the rated pressure.

5. INSTALLATION

This section provides a step-by-step procedure for easy assembly of the Nitrogen Generator with optional air supply system and tanks.

Warning



Failure to follow these instructions can lead to serious injury or death.
This dryer should be only be used for drying filtered, compressed air.
Ensure inlet air to this air dryer is filtered.

Only experienced and licensed electricians that are properly trained in compressed air and separation systems should service or repair Trident products. Before start-up or performing any maintenance on any Trident gas separation product like Nitrogen and oxygen generator, air dryer, filter, drain system, or other equipment, you must first turn off and disconnect all electrical power and service to the equipment at the main disconnect switch. Also, be sure to bypass and depressurize the dryer to 0 PSIG. Do not start or operate the dryer if there is a leak. Make sure the dryer's protection rating is applicable to the installation conditions. Do not operate the generator at pressures and/or temperatures above the maximum allowable marked on the data label. Likewise, verify that incoming voltage matches the voltage marked on the data label. Do not lift the generator by its piping or control box or drop the generator. Doing so may damage the equipment.

5.1 UNPACKING, INSPECTING AND HANDLING

The **Nitrogen Generator** is shipped in a single wooden crate, including the accessory kit. If you ordered optional air receiver or product receiver tanks and other optional devices, these would be shipped in a separate crate.



WARNING: Lifting lugs on vessels, if present, are only for handling of the vessels if they are detached from the PSA unit or by the pipes. The PSA-unit is not to be lifted by the lifting lugs on vessels. The Nitrogen Generator must be lifted by the skid, with a suitable lifting device operated by a certified or trained operator. Take the necessary precautions to avoid units tipping over during handling.

Unpacking

The contents of the crate(s) should be inspected upon delivery to assure that no damage has taken place during transit. Save the carton and wrapping, as it may be necessary to return the generator in event of shipping damage. If any components are found to be damaged, the carrier should be notified immediately. The individual pieces should be checked against the packing list. If any discrepancy is found, contact your local distributor or TRIDENT PNEUMATICS PVT LTD. Please include the model number and the serial number with all correspondence. All the products from Trident will contains actual packing list itself, the onsite Nitrogen plant packaging contains the following parts, Please verify the same with the packing list, If any parts are missing, please contact your equipment provider.

- ◆ 2 Adsorbent towers filled with CMS
- ◆ 1 Air dryer (Optional)
- ◆ 1 Air receiver (Optional)
- ◆ 1 Pre filter
- ◆ 1 Fine filter (Optional)
- ◆ 1 Carbon filter (Optional)
- ◆ 1 after filter (Optional)

Inspection

- Inspect/examine exterior of the Nitrogen plant and accessories for damage. Inspect all components.

Storage

- Store the repackaged Nitrogen plant in a dry area.

5.2 PRE-INSTALLATION INSTRUCTIONS



IMPORTANT: for safe installation and operation etc. of compressor, dryer or other equipment refer to manuals concerned for the equipment.



Safety

Nitrogen Generator are intended for the separation of compressed air from nitrogen to Nitrogen. Under no circumstance should they be used to dry other gases.

The adsorbents used are non-toxic. However, they may cause respiratory problems if they are inhaled in dust form. The use of a dust mask is sufficient to protect personnel.

Trident make Nitrogen generators are pre - Assembled one. In the case of inbuilt air

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compressor there is no need for any connections. As in case of without air compressor in the unit proper pipe connection should be given, for the pipe sizes refer the models.

5.3 Installation Site requirements

- Install the generator in a closed clean, dry room protected from freezing.
- Access to the room should be restricted to personnel qualified in maintenance and operation.
- The room must be adequately ventilated.
- The generator must not be directly exposed to sources of heat.
- The temperature of the room must not exceed 43°C/109°F.
- Make sure that the generator is not near any equipment which does not comply with the electromagnetic compatibility directives and which may degrade generator operation.
- There must be a minimum distance of 3 feet between the dryer and any other equipment which uses electricity.
- Ensure that the generator is installed in the vertical position.
- Generator should be secured by bolting it down.
- Install a system of by-pass valves between the Generator inlet and outlet so the dryer can be serviced without having to interrupt the compressed air supply from the circuit. The upstream and downstream valves must be closed during installation.
- Connect a drain line to the Pre-filter auto drain outlet.
- Check for leaks after all connections have been made.
- Always pressurize generator before power up.

5.4 Electrical power requirements



Warning: The interior of the cabinet contains electrical parts that may produce electrical hazard if not handled properly. To prevent electrical shock, care must be taken when servicing this equipment. In general electrical installation and servicing is to be performed by trained or authorized personnel only.

1. 110-240V, 50 Hz, single phase,
Proper voltage must be provided to the generator at all times.
Maximum fuse on power supply 10 ampere.
Improper voltage will cause damage not covered under the manufacturer's warranty.
2. Power should be supplied to the unit from **a grounded electrical outlet with a 3-prong plug**. It is recommended to use a circuit that will not be accidentally turned off, as this will cause the unit to stop cycling. If power is off and the unit is being used, the product vessel will depressurize.
3. In order to prevent production stop and purity drop in case of electric power failure, a **UPS (power backup) is recommended as an option**.
4. Provide separate MCB connections for both the air dryer and Nitrogen Generator

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5. Connect the electrical power cable to an 110 - 240 V, single phase, 50 Hz grounded power supply.

5.5 Feed inlet Air Supply

Air from your compressor or feed air supply must be less than 45 Deg C, max, before it reaches the Nitrogen Generator. High feed air (operating) temperature will reduce the performance of the Nitrogen Generator and will cause damage not covered under the manufacturer's warranty. Low feed air (operating) temperatures may cause freezing of components and damage not covered under the manufacturer's warranty.



WARNING: The compressor, air buffer or other feed air supply and pressurized equipment must be fitted with adequate protective devices to protect against exceeding allowable limits of the concerned equipment e.g. safety relief valves. Feed air supply must be protected against exceeding the maximum allowable pressure. The safety relief valves on generator vessels and receiver tank (if supplied) are solely for the protection of these components.

The feed air quality must comply with ISO specification 8573-1:2010 class 1.4.1., e.g. maximum number of particles per m³ is as following:

Classes ISO8573- 1:2010	Particles				Water		Oil
	Number of Particles per 1 m³			Concentration mg/m³	PDP °C	Liquid g/m³	Aerosol mg/m³
	0,1 - 0,5 µm	0,5 - 1 µm	1 - 5 µm				
0	Stronger than class "1", according to specification of manufacturer/user						
1	≤ 20000	≤ 400	≤ 10		≤ -70		0,01
2	≤ 400000	≤ 6000	≤ 100		≤ -40		0,1
3		≤ 90000	≤ 1000		≤ -20		1
4			≤ 10000		≤ +3		5
5			≤ 100000		≤ +7		
6				≤ 5	≤ +10		
7				5 - 10		≤ 0,5	
8						0,5 - 5	
9						5 - 10	
X				> 10		> 10	> 10



WARNING: Use only pipes of correct size and suitable for operating pressure and fluid. Never use hoses, which are frayed, damaged or worn. Always use the correct type and size of connections. Make sure hoses are depressurized before disconnecting.



WARNING: All tubes and piping used for Nitrogen/oxygen must be compatible with oxygen and cleaned for oxygen service.

6. HOW TO START THIS GENERATOR?

When you complete the installation as described in the previous section, the Nitrogen generator is ready for easy start-up and operation.



Note: If the power is turned off unexpectedly, the unit will stop cycling. If your application is using Nitrogen when the power is off, the Nitrogen receiver will depressurize.

6.1 Initial Start Up

1. Make sure the ON/OFF switch on the control panel is set to OFF.
2. Connect the generator with the power circuit and Make sure the power circuit cannot be turned off accidentally.
3. Fully close the ball valve placed after the Nitrogen generator.
4. Turn ON the compressor & air dryer, and allow the air receiver to pressurize. Let the compressor keep running and observe that the compressor shifts to unloaded operation, when the compressor pressure has reached the pressure stop set point.
5. Now adjust the pressure regulator placed before the inlet ball valve to required set pressure. Carefully and gentle open for feed air supply to the generator.
6. Now switch ON the power circuit of the generator. In the control panel touch screen display press the cycle ON button.
7. Ensure that the drain system works properly by checking, that exhaust air appears from the drain water outlet .
8. Be aware that air and condensate might be exhausted automatically from compressor and air dryer during start up.
9. To obtain the design purity in the nitrogen surge tank Start the generator and let it run for about 15 minutes.
10. In the control panel display NITROGEN to the operator screen on that you can see the Nitrogen purity and pressure.
11. It takes some time to pressurize the Nitrogen receiver. After reaching the required Nitrogen pressure in the display open the outlet ball valve and set the

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rated flow of the generator's model.
12. Now the plant is ready for normal operation.



Note: Don't Overdraw the Nitrogen more than as specified in the generator's model. Because its lead to

- 1. Drop in Nitrogen purity**
- 2. Drop in Nitrogen pressure**

6.2 Normal Start-Up

Follow this procedure to start the generator for normal operation. If this is the first time the unit has been started, follow the Initial Startup procedure.

- Open the air isolation valve.
- Turn on the Main Power switch.
- Open any shut off valves in the product nitrogen line to the user's piping system. Allow the system purity to rise before using product.

6.3 Shutting Down the generator

- If there is an emergency press Emergency switch off button on the control panel.
- For Regular shut down during maintenance and below rated usage of the generator follow the procedure below:
 - Open the secondary Nitrogen supply.
 - Close the outlet ball valve.
 - In the control panel touch screen display press the cycle OFF button.
 - Switch of the compressor and as well as the air dryer.
 - Now switch Off the power circuit of the generator.
 - Now open the drain valve placed bottom of both the air and Nitrogen receiver and depressurize them.



Warning

Note: Please ensure that the adsorber towers, air and Nitrogen receiver are depressurized to zero pressure (Atmospheric pressure)

6.4 Extended Shut-Down

To shut down the Trident Nitrogen Generator for 24 hours or longer, complete all steps in Section 6.2 – Shutdown. In addition perform the following:

Fully close all manual valves to isolate the Nitrogen in the receiver, to prevent the loss of pressure in the receiver, in order to enable a normal Start-up. Turn off all electric powers, e.g. on compressor, air dryer and generator.

If generator is fitted with Oxygen sensor, close of the pressure reduction valve on Sensor inlet.

6.5 Start-up after an Extended Shut-Down

After an extended shutdown or an unexpected shutdown, such as an electric power failure, you must purge the Nitrogen receiver of any low purity Nitrogen before the Nitrogen generator can supply Nitrogen within the purity specifications.



IMPORTANT: When the generator is being started up for the first time, or after a long shut-down period, it is possible that the Nitrogen receiver tank is full of air. Before the generator can supply Nitrogen of design purity, any air in the Nitrogen receiver tank must be purged. Refer to step 14 above for guidance.

7.MAINTENANCE

This Nitrogen plant is specifically designed to minimize routine preventive maintenance. Only professionals of the healthcare field or persons fully conversant with this process such as factory trained personnel should perform preventive maintenance or performance adjustments on the Nitrogen generator.



Note: PSA Nitrogen generator are robust, reliable machines. To ensure uninterrupted, problem-free operation, regularly perform the inspections below.

A Detailed check list is added in this manual you can also refer it for the maintenance.

Every day:

1. Check for air and product leaks.
2. Check instrument air pressure.
3. Visually check control panel.
4. Record nitrogen concentration and flow rate; operating or ambient temperature, feed air pressure, product tank pressure, and sieve bed pressures throughout one cycle.
5. Verify that the automatic filter drain is working properly.

6. Manually operate air receiver drains.

Every month:

1. Calibrate optional oxygen analyzer as per manufacturer's instructions.
2. The drying and regeneration cycles function normally,
3. The silencers are not clogged.

Three months:

1. Operate safety valves. (If system contains)
2. Operate manual valves.
3. Check for leaks and repair if necessary.

Six months:

1. Change Pre, Fine After filter elements

Annually:

1. Install valve repair kits on flow control valve and equalizer valves.
2. Disassemble and inspect all air-operated valves; install repair kits if required.
3. Test all air pilot valves.
4. Check for air and product leaks.
6. Check O2 analyzer sensor for proper operation as per manufacturer's instructions and order replacement.

Three years:

1. Install repair kits in all pneumatically operated valves.



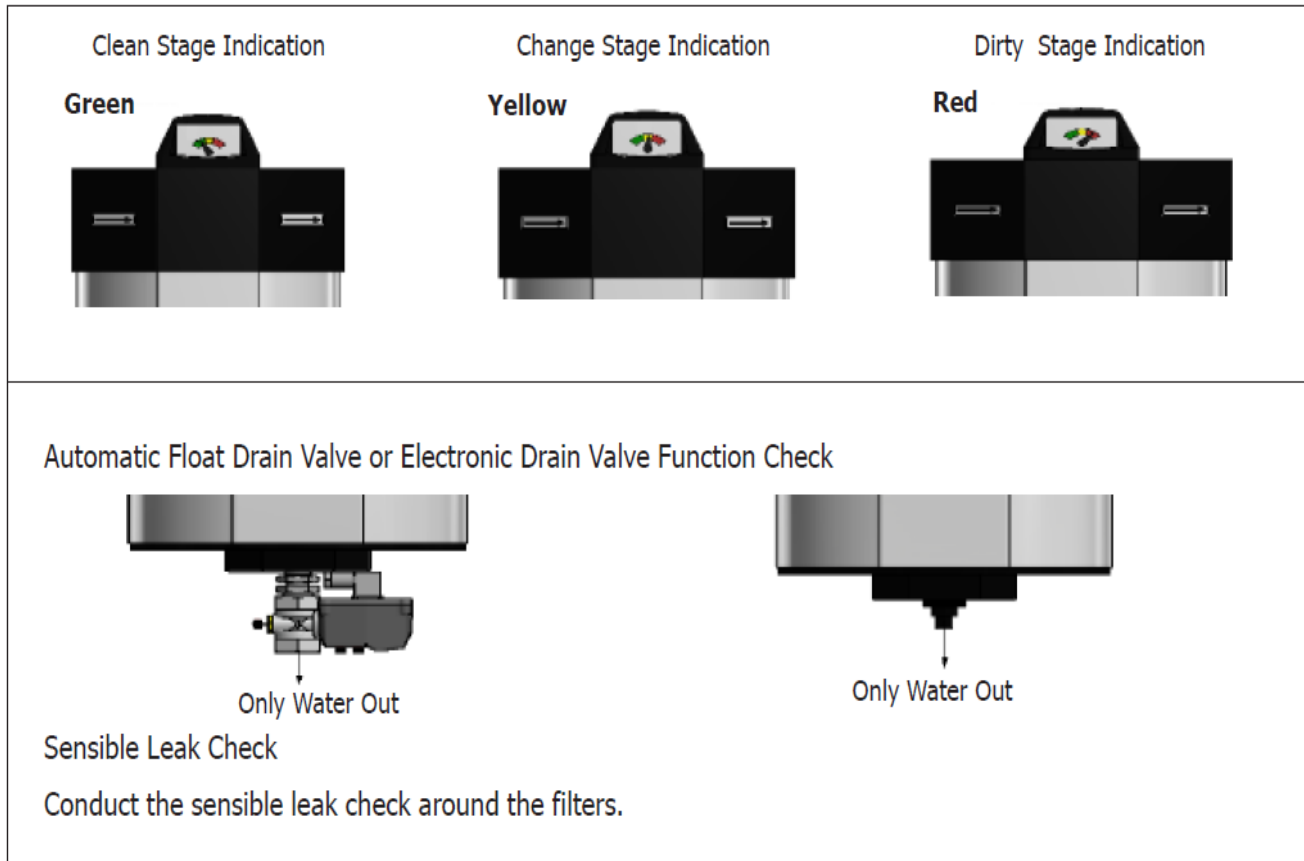
Note: During the entire operation, the compressor and the generator must be shut down. It is recommended for all personnel who are in the presence of the desiccant to wear dust masks.

Changing the Desiccant

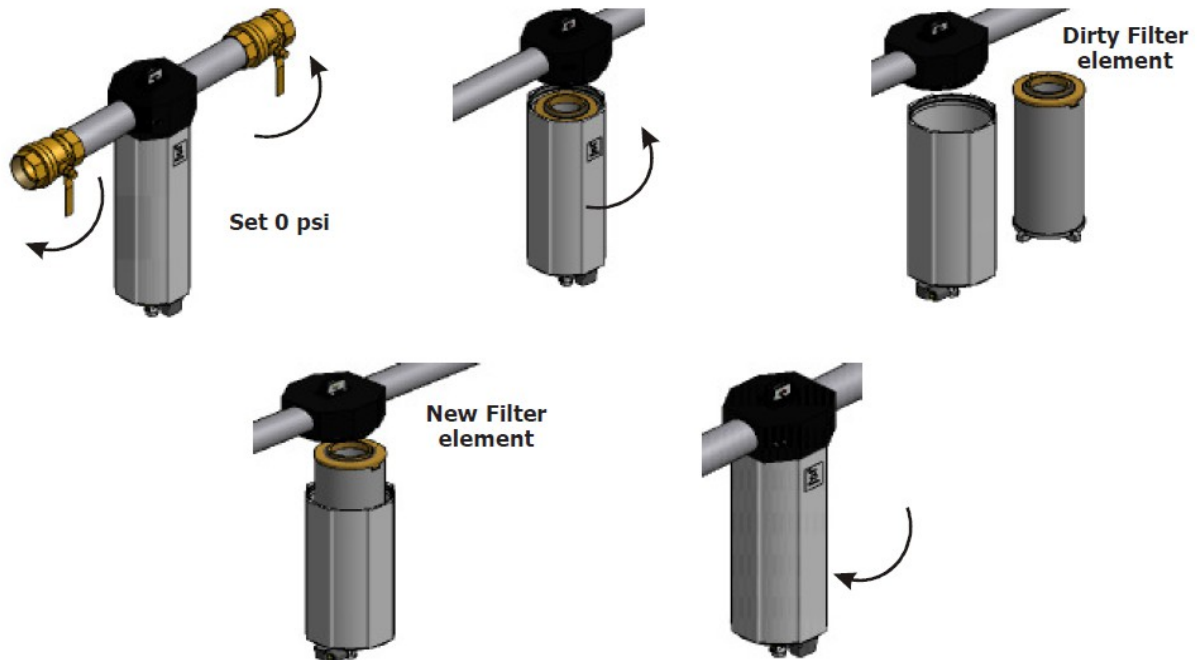
- ◆ Bypass the Nitrogen supply into the secondary line.
- ◆ Disconnect the power supply to the generator.
- ◆ Make sure the inlet air supply to the generator is closed.
- ◆ Depressurize the pressure in both towers
- ◆ Loosen the dummy present in the tower bottom desiccant port
- ◆ Remove the old desiccant and replace new desiccant one.

7.1 Replacing the filter element

1. Before replacing the element we need to check whether the replacement is required.



2. During the change Signal we need to prepare for the filter element change. The filter element must be changed at change stage indication.
3. If you are replacing a coalescing filter element, remove and discard the gasket where the top of the filter element connects to the filter housing.
4. If you are replacing a coalescing filter element, make sure a black gasket is attached to the top of the new element.
4. Check for leaks after all connections have been made. Do not start or operate the filter with leak.
5. If the Electronic Adjustable drain valve connection have been installed, must to ensure the input voltage supply.



For Air dryer maintenance Refer the Air dryers user manual supplied with the product.

7.2 Leak Test Procedure

Note: Every time, After completing maintenance work need to conduct leak test.

1. Shut off the nitrogen application/consumption.
2. Shut on the feed air supply.
3. Shut off the feed air supply.
4. Read and note the pressure in nitrogen receiver, Tower 1, Tower 2, if present and feed air tank.
5. Let the plant stand still (rest) and isolated in pressurized condition for an hour.
6. After an hour read and note the pressure in nitrogen receiver, Tower 1, Tower 2 if present and feed air tank.
7. Then determine an eventually pressure drop as the difference between the initial and final pressures taken before.
8. *The Leak Test is OK, if the pressure drop after one hour pressurized isolation is less than 0.1 bar. In case of leaks they must not cause more than 0.1 bar pressure drop per hour.*

7.3 Pressure Regulator Adjustment Procedure

1. Unlock lock on adjustment knob.
2. To increase pressure turn clockwise.
3. To decrease pressure turn counter clockwise.
4. Make small adjustments and let system cycle through one cycle before making another adjustment.
5. If readings are still incorrect, make another adjustment until you are within manufacturer's specifications.

8.TROUBLESHOOTING

The following problems may exist while using the Nitrogen plant. This section will give details about the problems and their remedy. Troubleshooting tree will help you to solve the problems

General troubleshooting

Before reviewing the troubleshooting chart, the following steps may be useful to isolate any malfunctions:

- x Turn the generator on. If unit does not turn on, refer to troubleshooting chart.
- x Make sure all filters are clean.
- x Make sure the unit is cycling properly. If the unit is not cycling properly, refer to troubleshooting chart.
- x If generator is not meeting specifications, make sure that the unit is leak free by testing all tubing connections and fittings with leak testing solution. Repair all leaks by tightening connections and fittings.
- x Review troubleshooting chart to isolate and repair any other malfunctions.

High Pressure Drop across Generator

- ✓ Pre-filter may be clogged. Check and replace filter elements.
- ✓ Check whether the generator is being overflowed.

8.1 TROUBLESHOOTING TABLE

This section enables the operator to determine the cause of operation problems and suggests remedies for the problems. If there are several likely causes, investigate the simpler solutions first. Regardless of the type of malfunction, a person who is thoroughly familiar with the system performs the troubleshooting best. If further assistance is required, contact your local distributor or Trident Pneumatics Pvt Ltd.

Symptom	Probable cause	Corrective action
Nitrogen generator Not cycling	Low voltage or low amperage	Check electrical source
	Circuit breaker tripped	Reset circuit breaker
	Fuse blown	Replace fuses located inside control panel
	Main power is OFF	Turn Nitrogen Generator power switch ON
	Low feed air pressure	Increase feed air regulator pressure
	Defective wiring	check wiring diagram / connections
Nitrogen generator runs contineously / Low product pressure	Defective N2 pressure sensor	Replace pressure sensor
	Excessive product usage	Check and reduce product consumption
	Product line leak	Conduct leak test / Repair leak
	Cycle pressure too low	Increase feed air regulator pressure
	Energy saving mode pressure setting too high	Check and reduce standby pressure settings
Low product Flow	Feed air flowrate is too low	Adjust air supply pressure and flow
Low product purity	Product flow too high	Decrease product flow

	Oxygen sensor malfunction	check and calibrate or replace the sensor
	Feed air pressure too low	Check and increase the feed air pressure regulator
	Control valves not opening / closing	Dirty or defective control valves; Clean or replace
		No pilot air signal; Check pilot valve using manual override; Replace coil or pilot valve
	Muffler clogged	Clean muffler
Filter drains remains open	Drain valve dirty	Clean valve
Filter drain does not open	Drain valve clogged	Clean valve
Low product dew point	Air dryer malfunction	Check and service as per the manufacturers manual given with the Refrigeration / Desiccant dryer
	Dew point sensor malfunction	Repair / Replace the sensor

2. Low Operating Pressure

Lower than normal operating pressure may indicate any of the following,

- A restriction in the suction air intake filter, which limits the amount of air pass through it to the generator. Clean the air filters free from foreign materials.
- An improperly operating circuit board or solenoid valve. Confirm that the circuit board and solenoid valves function properly.
- A leak in the unit, which allows system pressure to escape. Perform Leak test in the unit.
- A compressor with reduced output. Ensure that the Nitrogen concentration level at the desired liter flow is within Trident's specifications. If it is below specifications, replace or repair the compressor.

3. High Operating Pressure

Higher than normal operating pressure may indicate any of the following.

- A restrictive muffler, which does not allow the waste (purge) gas to exit the system

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freely. Operate the unit with the muffler disconnected to see if the operating pressure returns to normal.

- An improperly operating circuit board or solenoid valve. Confirm that the circuit board and solenoid valves function properly.
- A restrictive diffuser, which does not allow the inlet feed air as well as exhaust air from the generator. Check the diffuser and correct it.
- Contaminated sieve beds. Change the sieve beds.

Nitrogen – Detailed spares List

NITROGEN 10	Filter assembly with element T100Y
	Seal kit with desiccant Nitrogen 10
NITROGEN 20	Filter assembly with element T100Y
	Seal kit with desiccant Nitrogen 20
NITROGEN 30	Filter assembly with element T100Y
	Seal kit with desiccant Nitrogen 30
NITROGEN 40	Filter assembly with element T100Y
	Seal kit with desiccant Nitrogen 40
NITROGEN 50	Filter assembly with element T100Y
	Seal kit with desiccant Nitrogen 50

Break down kit

Controller - Nitrogen Generator (Model 10 – 50)	1 No
Control Solenoid valve (1 no)	1 No
Pressure Regulator (Optional)	1 No
Pressure Sensor (Optional)	1 No
Oxygen Sensor (Optional)	1 No

CHECK LIST

Note: Perform if applicable

Service Check List						
Activities	Frequency					
	Hourly	Daily	Weekly	Monthly	Half Yearly	Yearly
Check Compressor Pressure	✓					
Check Compressor oil level		✓				
Service compressor according to supplier instructions						✓
Check Nitrogen Pressure	✓					
Check rated nitrogen flow	✓					
Check Nitrogen Purity	✓					
Check Dew point at dryer outlet	✓					
Service Air dryer according to supplier instructions						
Check Air Dryer condensate drain	✓					
Check Tower pressure	✓					✓
Check drain on all Filter		✓				
Replace all filter element					✓	
Check pressure in Air tank	✓					
Check pressure in Nitrogen tank	✓					
Check Pressure safety valve					✓	
Calibrate all Pressure gauge					✓	
Calibrate Oxygen sensor						✓
Check solenoid valves for corrosion			✓			
Check pipes / hoses				✓		
Replace desiccant						
Leak test						
Check for Control panel working		✓				
Check exhaust gas sound				✓		
Check for all safety precautions		✓				

WARRANTY

Products of Trident Pneumatics Pvt Ltd are guaranteed to be free from defects in material and workmanship when installed and operated in accordance with the instructions outlined in the instruction manual.

Trident Pneumatics pvt. Ltd.'s obligation under this warranty shall be limited to repair or replacement (at the discretion of Trident) of defective Nitrogen returned to Trident Plant within one (1) year from the date of commissioning or 18 months from the date of invoicing which ever is occurring earlier.

Product	:
Model	:
Serial No.	:

Quality Assurance Dept

Trident Pneumatics Pvt Ltd
5/232, K.N.G Pudur Road, Somayampalayam,
Coimbatore 641 108. Ph: 0422 2400492, 2401373
Fax: 0422 2401376 e-mail: sales@tridentpneumatics.com
Website: www.tridentpneumatics.com

INSTALLATION & COMMISSIONING REPORT

PSA Type Nitrogen Generator

Customer : Contact person : Designation :	Model : Sl. No. : Phone : Fax :
-------------------------------------------------------------	------------------------------------------------------

(Please add any comments or remarks here found while unpacking)

1. INSTALLATION

a) Installation at :	Before / After Air Dryer	Tower Status	Yes / No
b) Inlet air Temperature :	Normal / High	Tower 1 and 2 Drying	Yes / No
c) Side clearance provided :	Yes / No	Depressurizing	Yes / No
d) Power Grounded :	Yes / No	Regeneration	Yes / No
e) Nitrogen Flow Outlet :	Normal / Faulty	Nitrogen Purity: Nitrogen Pressure:	
f) Change over sequence :	Normal / Faulty		

2. COMMISSIONING

Installation	Date of Completion
Commissioning	Date of Completion

Comments:

Customer	Installation Engineer
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Signature & Name of Installing Engineer	Dealers Signature & Seal	Customer's Signature & Seal