

nano



NMG nitrogen gas generator
user guide

Experience.

Our team is comprised of and supported by individuals spanning all disciplines from research & development, engineering & manufacturing, marketing & sales and service & support. Our backgrounds are in air and gas purification and our experience in this field spans a wide range of industries. We combine this knowledge and experience to ensure our products and services are designed and provided to meet the objectives and expectations of you - our Customer.



Customer.

We recognize that our Customers are not only our valuable distribution partners who sell and support our products or the machine builders who depend on them as protection for their equipment. They are the contractors who install them, the manufacturers who use them in their processes and the service people who maintain them. At nano we have developed our products, packaging and support materials to ensure they exceed all of our Customers' expectations.



Service.

At nano we recognize that world-class customer service is the most important component to any successful business. Your business needs to exceed your customers' expectations to stand out from your competitors and our service must positively impact your business so you can be successful in doing so. Our commitment is simple... we will stand behind our products and ensure that our customer service is unrivaled in the industry.

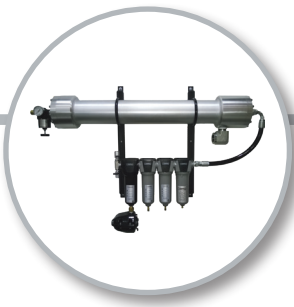


Experience. Customer. Service.

The logo for nano, consisting of the word "nano" in a bold, lowercase, sans-serif font. The logo is centered within a large, light gray circular frame.

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1.1 general information

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range: NMG nitrogen gas generator
models: NMG 115 - NMG 1317
doc no: 17-110-8004
issue: 005

1.2 manufacturers details and support

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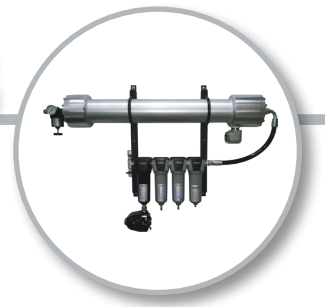
annotations



CAUTIONS: indicate any situation or operation that may result in potential damage to the product, injury to the user or render the product unsafe.



NOTES: highlight important sections of information where particular care and attention should be paid.



1.3 document introduction

This manual provides factory prescribed installation and maintenance procedures for a NMG nitrogen gas generator. The procedures illustrated in this document are only to be performed by authorized personnel. For further information regarding the procedures outlined in this document contact the manufacturer before proceeding. Be sure to read this document carefully before attempting to install or operate the nitrogen gas generator. This document should be permanently available at the installation site and be kept in an easily accessible place alongside the nitrogen gas generator.

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1.4 warranty guidelines

All products are supplied with an 18 months manufacturer's warranty from the date of shipment from the factory or 12 months from date of installation/start up, whichever occurs first and installed and maintained in accordance with the manufacturers guidelines. Only genuine service parts should be used and no modifications made.

1.5 packaging

NMG products are securely fastened to skid with inlet and outlet ports covered. Magnetic float drain (where applicable) will be shipped loose for installation in the field.

1.6 damage to packaging

Check immediately to establish whether damage has occurred to the external packaging and if the damage extends to the product inside. If there is damage to a product, contact the relevant supplier immediately.



In no circumstances must a damaged product be used in operation. Using damaged products can lead to irreparable functional faults or cause serious physical harm.



1.7 general safety

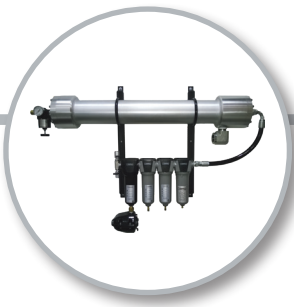
No modifications must be made to the product. Any modifications may reduce the operational safety of the product and invalidate the manufacturer's warranty. This could potentially result in damage to the product and serious personal injury.



For your own safety, when carrying out work on this product, all relevant national safety regulations must be complied with relating to pressurized and electrical systems.



WARNING: This product can expose you to chemicals including lead, which is known to the State of California to cause cancer and/or birth defects or other reproductive harm. For more information, go to www.P65Warnings.ca.gov.



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This product is only designed to operate at pressures stated in the technical specification. Do not exceed the maximum working pressure.

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1.8 personnel

Only authorized, competent and trained personnel are permitted to work on this product. This user guide is intended solely for such personnel and is to be used only as a reference; it should not be used to replace conventional training.

1.9 safe handling

Please ensure the relevant safe engineering practices and handling procedures are employed when handling, installing and operating this product. Ensure that the equipment is depressurized prior to carrying out any of the scheduled maintenance instructions specified within this user guide.



In no circumstances must a damaged product be used in operation. Using damaged products can lead to irreparable functional faults or cause serious physical harm.



Prevent electrical shock. Disconnect the equipment from all sources of electrical power before working on it. Use tools designed for work on electrical equipment.



Do not remove, repair or replace any item on the nitrogen gas generator while it is under pressure. Any faults or defects that could affect safety must be corrected before using the unit.



Prevent fires and explosions. Eliminate all possible ignition sources when making repairs. Do not permit open flames, sources of ignition or the carrying or use of matches, lighters or tobacco products in the vicinity of the compressed gas equipment. Store hazardous chemicals in accordance with MSDS instructions.



Prevent injury - Wear safety glasses and other appropriate safety protection when the MSDS dictates. Ensure that all tools and instruments used during the installation and maintenance are in good condition. Be aware that high-velocity gas may be released at vents and safety relief valves.



Protect equipment and plant personnel - Check all safety devices periodically to ensure continued reliability. Provide proper maintenance of all safety valves. Never bypass safety devices and never operate the equipment outside its specified limits.

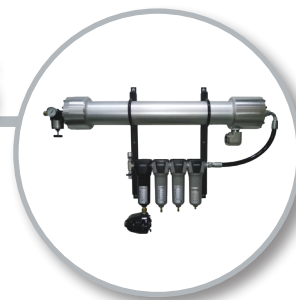


Follow posted precautions. Read all precautionary labels attached to equipment and posted in areas of the facility. Comply with all precautions before handling the equipment.

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Know evacuation routes - Know the evacuation route from the facility or, if one does not exist, develop an evacuation procedure. Obtain and review all applicable on-site evacuation plans. Situations may develop for which no written procedures exist. Think carefully before acting. Know the function of each valve and switch and its effect on the process and equipment. Carefully review all operating procedures before starting this equipment to ensure knowledge and understanding.



Periodic ASME vessel inspection. Have the associated pressure vessels inspected annually as per all applicable ASME codes.

1.10 fire response



Fire, and equipment damage caused by fire, may result in death. The release of gases due to fire or heating of gas handling equipment may result in exposure to gases with toxic or asphyxiant properties. It may also cause explosions or increase the rate of combustion. If fire is detected, follow the procedures in the Emergency Response Plan for your facility.

The items listed below are recommendations and are not intended to replace your facility's Emergency Response Plan. In case of fire:

- Turn in a fire alarm immediately and evacuate all personnel from the area except those engaged in fire fighting.
- Isolate areas where a fire or an explosion has occurred by closing equipment and/or facility doors.
- Follow appropriate fire-fighting procedures for the combustible materials involved (ref to MSDS - Section 7.1). Call the on-site gas manager for further instructions.
- If involved in fire fighting, use a self-contained breathing apparatus with a full-face mask.
- In the event of a fire in any electrical equipment, always use carbon dioxide or dry chemical powder. **Never use water for fighting an electrical fire.**

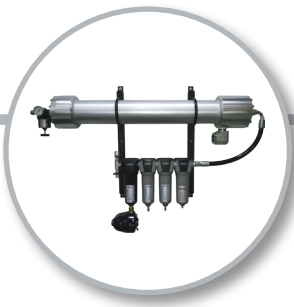
Two sources of fire exist: electrical and chemical.

ELECTRICAL: Failure of electrical components could initiate a fire in the system or ignite hazardous accumulations of flammable gases. Ground all equipment.

CHEMICAL: The use of chemicals, the hazards associated with their use, and precautions to be taken are described in the applicable MSDS. Use only spark-proof tools and explosion-proof equipment when working around flammable materials.



Always maintain a fire fighting system in good working condition.



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1.11 summary of known hazards

ELECTROCUTION



Electrical shock can kill. Use extreme caution if troubleshooting or servicing this equipment. Do NOT bypass safety interlocks. An electrocution hazard exists even after the equipment has been de-energized. Only qualified personnel who are in compliance with all applicable federal, state, and local codes shall perform the electrical wiring.

Adherence to the following guidelines helps guard against possible electrocution.

- Tampering or unauthorized substitution of components may adversely affect the safety of this equipment. Use only factory-approved components for repair.
- Turn off and disconnect the power before opening the equipment, or checking or replacing any component.
- Carefully follow all Hazardous Work Permit and Lockout Tag out procedures for your facility.
- Do not touch live electrical components inside the equipment; electrical shock caused by voltage in the control circuits can kill.
- Keep all equipment surfaces very clean. Normal industrial soot and dirt may constitute a combustible hazard. Do not allow grease or oil deposits on bypass interlocks or other safety devices.

1.12 special handling precautions

GASEOUS NITROGEN

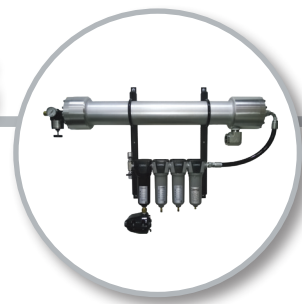


Nitrogen is an inert, colorless, odorless gas that can cause rapid asphyxiation and death in any confined area. Use extreme caution when working with nitrogen.

Never enter a confined area where nitrogen may be present until the area has been well ventilated and tested for breathable atmosphere using an approved gas analyzer. If dizziness, nausea, headache, or other symptoms of asphyxia occur, immediately move to a well-ventilated area. If someone stops breathing in an oxygen-deficient atmosphere, move the victim to a well-ventilated area and administer respiration. Call for medical assistance. Nitrogen, as a liquid or cold gas, may cause severe frostbite to the eyes or skin. Do not touch frosted pipes or valves. If accidental exposure to liquid nitrogen occurs, consult a physician at once. Immediately warm exposed tissue with warm water not to exceed 105°F (40.5°C). Never rub the exposed body part before or after rewarming.

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GASEOUS OXYGEN



Oxygen vigorously accelerates combustion. Materials that do not normally burn in air burn vigorously in enriched-oxygen atmospheres. Use only compressed gas cylinders, containers, and other apparatus specifically designed for use in oxygen service. Handle gaseous oxygen in well-ventilated areas to prevent excessive gas concentrations.

In the event of a leak, immediately evacuate all personnel from the danger area. Call your representative if the leak or accident involves oxygen storage tanks or delivery systems. The best course of action is to shut off the oxygen supply stream to eliminate the major source of oxygen. Gas cylinders typically contain less than 300 ft³. If a cylinder can be safely turned off, do so. If it cannot be reached safely, allow the cylinder gas to dissipate into the room while keeping the area evacuated and ventilated. Test the area for safe (19.5 to 23.5 percent) oxygen content prior to permitting personnel re-entry.

If clothing becomes saturated with oxygen gas, remove the clothing immediately and hang it in a well-ventilated area. Such clothing should not be considered safe to wear for at least 30 minutes since it will be highly flammable and easily ignited.

Oxygen, as a cold gas, may cause severe frostbite to the eyes or skin. Do not touch frosted pipes or valves. If accidental exposure to liquid nitrogen occurs, consult a physician at once. Immediately warm exposed tissue with warm water not to exceed 105°F (40.5°C). Never rub the exposed body part before or after re-warming.

Strategic location of the tank and vaporizers on our site can reduce the hazards associated with cryogenic oxygen. Recommended barriers to strategic locations for the prevention of vehicular traffic accidents near the tank and vaporizers.

Many materials, especially some non-metallic gaskets and seals, are combustion hazards, although they may be acceptable for use with other gases. Do not make substitutions for the recommended equipment. Be sure all replacement parts are compatible with oxygen and cleaned for oxygen service. Keep repair parts in clean, sealed plastic bags until ready for use. Tools used for servicing the oxygen equipment must be cleaned for oxygen service.

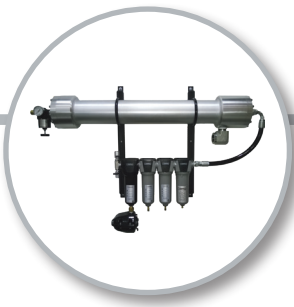


Open oxygen regulators and valves slowly. Opening them too quickly can cause fire in the piping system, including the vigorous consumption of metal components, due to the heat generated by the instantaneous compression of oxygen. Furthermore, metallic particles, loosened and carried at high velocities by the oxygen gas, can generate sparks by striking the pipe walls, thereby causing an oxygen fire.

The potential for oxygen system fires caused by rapid compression of oxygen or high velocity particles is minimized by carefully selecting piping and vessel materials of construction, installing filters, and cleaning all components for oxygen service prior to admitting oxygen.

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Protect oxygen valves and piping components from heat. An oxygen fire is more likely to occur when the piping components are hot. Oxygen valves, piping, and piping skids must be protected from direct exposure to heat by suitable shielding or insulation.

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Do not use oxygen as a substitute for instrument air. Do not refer to oxygen as “air”.



Any equipment to be used for oxygen service must be thoroughly cleaned. Residual equipment contamination can foul safety devices and may present a combustion hazard. It is imperative that all contaminants are eliminated in the equipment.

All areas where oxygen and oxygen equipment are used, handled or sorted must be kept clean to prevent ignition. Because even normal dirt and soot can support combustion, the exterior surfaces of all equipment used in oxygen service must be kept very clean. Use appropriate cleaning standards to ensure that equipment has been safely prepared for the application for which it is intended. Do not use cleaning agents that leave organic deposits on the cleaned surfaces. Always handle equipment that will come in contact with oxygen with clean gloves or with hands that have been washed clean of oil. Carefully inspect all cleaned parts. If any evidence of contamination is noted, clean the part again.

Do not place oxygen on asphalt surfaces or allow the formation of grease or oil deposits in the vicinity of oxygen equipment. Do not lubricate oxygen equipment with oil, grease, or an other unapproved lubricants.

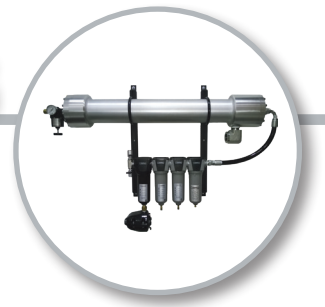
1.13 technical description

A complete range of high-purity membrane nitrogen generators capable of generating nitrogen gas up to 99.9% purity using proven membrane technology to separate nitrogen from the air.

1.14 product contents

When ordering a NMG nitrogen gas generator you will receive the following;

- 1 x water separator with external high capacity zero loss drain
- 1 x 1.0 micron coalescing filter w/internal float drain
- 1 x 0.01 micron coalescing filter w/internal float drain
- 1 x 0.003 activated carbon filter
- connecting pipework
- 1 or 2 membrane modules depending on generator purchased
- 1 x outlet regulator with gauge
- 1 x user guide



2.1 operation guidelines

Listed below are general guidelines to be used in the safe operation of membrane systems in indoor environments based on present day practices and are not intended to be used as comprehensive guidelines for all situations. Each customer must review their individual installation and proceed accordingly. For additional information refer to CGA pamphlet P- 8.1-1995, **Safe Installation and Operation of PSA and Membrane Oxygen and Nitrogen Generators**, and sections 2.2, 2.3, 2.4, 3.1 and 10.2.2.



It is important to understand that incorrect venting of membrane systems used inside buildings, rooms, etc., can result in hazardous conditions associated with oxygen-enriched or oxygen-deficient atmospheres. This can even occur in the operation of very small systems, i.e., laboratory environments. These units are generally not provided with remote venting, or atmospheric monitoring equipment. For additional information concerning these hazards and how to effectively deal with them, refer to CGA pamphlet P-14-1992, **Accident Protection in Oxygen-Rich and Oxygen Deficient Atmospheres**.

2.2 compressed air feed

The compressed air feed shall meet the minimum requirements (Section 4.2)

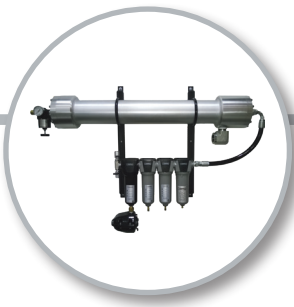
2.3 product and waste gas ventings

Membrane systems produce continuous product streams of oxygen and nitrogen gases (refer to Section 1 for safety precautions). If room ventilation is inadequate, these gases may accumulate to the extent that either an oxygen-enriched or oxygen-deficient atmosphere can exist. Warning signs/decals stating that high/

low oxygen content may exist, must be mounted outside of the room housing the membrane system and be located near any entrance. A small continuous product sample flow from the analyzer is typically discharged to the room, and it is also possible that additional small leaks around valves, analyzers and other equipment used on the nitrogen product pipeline can exist, and proper monitoring/warning needs to be in place.

Oxygen-enriched waste gas exits the system piping at atmospheric pressure and vent piping must be sized to prevent back pressure on the permeate gas. Vent lines must be piped to the outdoors, be at least 10 feet above grade and made of non-ferrous metallic material. If flexible tubing is used for a vent line, it must be supported and guarded to prevent damage. These lines must also be directed away from personnel and equipment.

Vent piping must be arranged so that the accumulation of rain, or foreign matter, cannot be introduced into the system. Additionally, this piping must be routed in such a manner that condensate cannot run backwards into the system. To eliminate the potential for condensing during shut down, vent lines must be kept warm.



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2.4 room ventilation

Room ventilation must be provided for any indoor membrane installation to ensure dissipation of any leaks and of the small analyzer sample flow. In cases where it is not practical to vent lines as discussed above, additional room ventilation must be provided to help dissipate the oxygen enriched, or oxygen-depleted gas, and help insure that the recommended maximum room temperature of 90°F (32°C) is not exceeded.

There are several methods for ventilating the required area and the method and equipment used are dependent upon the size of the room, the gases to be exhausted, and the source of make-up air.

2.5 atmospheric monitoring

A common method of monitoring the room oxygen content is by installing atmospheric analyzer equipment. Numerous types of oxygen analyzers can be used to satisfy this need.

3.1 receiving/placement

- All nitrogen generators are designed strictly for indoor use.
- Remove all packaging and visually inspect all components of the nitrogen generator and associated equipment for damage.
- Locate the nitrogen generator on a level, flat surface. Attach the nitrogen generator to framing, wall, fixture or floor using suitable fasteners.
- Before electrical power (if required) is supplied to the unit, inspect for loose or damaged wiring.

3.2 power requirements (if applicable)

Some NMG nitrogen gas generators require no power unless equipped with optional equipment.



Note: All electrical installations should comply with the NEC and local regulations.

3.3 product piping

- Install a minimum 1/2" nitrogen product supply line (not included) from the nitrogen generator to the application.

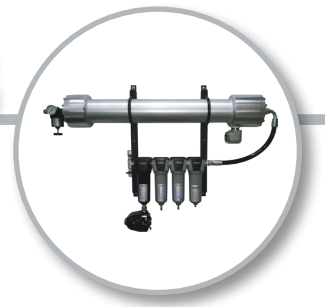
➤ Black iron pipe **shall not** be used for the nitrogen product supply line. Suitable product supply lines shall be copper, stainless steel or Eaton Synflex 3130 nylon hose or equivalent. Suitable ferrule fittings or back purged, brazed pipe connections are acceptable for copper and stainless steel. Soft soldering of pipe fittings **shall not** be used.

➤ Please refer to the "Tubing Install Guide" for tubing installation recommendations.

- Install compressed air supply line (not included) from the compressed air source to the nitrogen generator.

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3.4 product nitrogen tank (if applicable)

- The product tank(s) are shipped horizontal. Stand the tank(s) upright (vertical), near the nitrogen generator outlet.
- Install the safety relief and pressure gauge (included) in the corresponding openings provided on the tank.

➔The safety relief valve and pressure gauge are not installed prior to shipping so as to minimize damage during transport.

- Attach the tank(s) to the floor using suitable fasteners.

3.5 oxygen permeate/waste stream

- It is recommended that the oxygen vent (waste stream) be piped to the outside of the building.

➔The by-product of air separation in the production of nitrogen is oxygen. The by-product (waste stream) contains approximately 55-60% oxygen, 40-45% nitrogen and 1% other inert gases. If room ventilation is inadequate, it is recommended that the waste stream be piped to the outdoors.

- **The nitrogen generator oxygen venting system must be connected away from the personnel air intakes or ignition sources.**
- **If applicable, attach a ½" or larger hose from the O2 outlet (air separation vent) to the outdoors. The vent hose shall not be reduced in size.**

3.6 start up

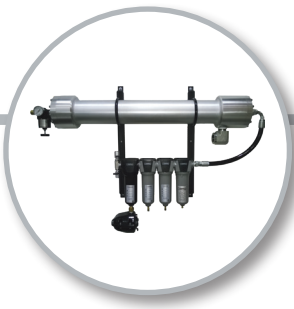
- When all applicable piping, waste stream piping and components have been installed please perform the following procedure.
- With the product valve closed, the pressurized feed air is introduced into the module at a maximum rate of 15 psig / sec and is regulated to the desired operating pressure of the module. Changes to feed air pressure within the operating range should be limited to 15 psig per second. Quickly pressurizing or depressurizing the system will damage the membrane, membrane fibers and or the pre filtration system.
- Open the product valve, if equipped, set the desired delivery pressure on the outlet regulator.

➔The nitrogen stream purity can be monitored using an oxygen analyzer. The nitrogen stream purity and flow rate can be adjusted by both the product valve and the feed gas pressure control device.

- At consistent temperature and pressure, it will take approximately 15-30 minutes for the membrane gas production module to reach stable performance.

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- The module should never be operated above its rating for maximum operating pressure.
- The module should never be subjected to a “reverse pressure” in which the waste (permeate) pressure is greater than the product pressure.

Operating Pressure Range

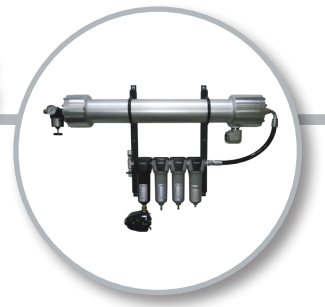
- 0 to 200 psig (0 to 14 barg)
 - Ambient Operating Temperature Range: 30 to 150°F (-1 to 65°C)
- The membrane gas production module can be operated within a temperature range as specified in Section 4.1. Changes in feed gas temperature within this range should be limited to 18°F (10°C) per minute. After achieving the desired operating temperature, it will take about 15-30 minutes for the membrane gas production module to achieve stable performance.

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4.1 technical specifications

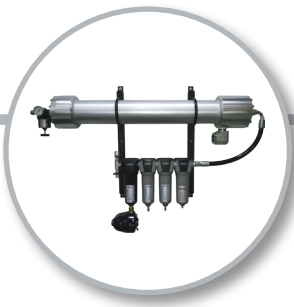
specifications	
maximum compressed feed air hydro carbon content	7 ppm/v
maximum compressed feed air H2O content	1500 ppm/v
maximum operating pressure	200 psig (14 barg)
minimum operating pressure	100 psig (6.9 barg)
maximum compressed air temperature	115°F (65°C)
minimum compressed air temperature	40°F (5°F)
maximum ambient operating temperature	115°F (65°C)
operating temperature range	40 to 115°F (5 to 45°C)
maximum pressurization rate	15 psi/sec

4.2 inlet air specifications

- Inlet air to this unit must meet the specifications of ISO 8573.1:2001 Class 4.4.4 (contain less than 1000 particles per cubic meter, pressure dew point of +38°F (+3°C), contain less than 5 ppm total oil as aerosol, liquid and vapor.
- Refrigerated air dryers required prior to the nitrogen generator
- Note: Inlet air to the air compressor must be free of vapors from: solvents (ex. paint, etc.), propane (ex. fork truck exhaust) and freon.

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4.3 flow rates

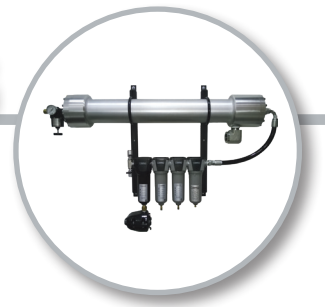
model	inlet (NPT)	outlet (NPT)	inlet air pressure	air inlet requirement and nitrogen flow by model flow scfh (feed scfm)						
				99.9% (0.1%)	99.5% (0.5%)	99% (1%)	98% (2%)	97% (3%)	96% (4%)	95% (5%)
				psig						
NMG 115	½"	½"	100	8 (1)	15 (1)	23 (1)	29 (1)	38 (2)	49 (2)	56 (2)
			125	12 (2)	21 (2)	32 (2)	42 (2)	56 (2)	67 (3)	77 (3)
			150	13 (2)	24 (2)	35 (2)	45 (2)	63 (3)	77 (3)	91 (3)
			200	20 (3)	35 (3)	56 (3)	70 (3)	95 (4)	113 (4)	134 (4)
NMG 130	½"	½"	100	16 (2)	30 (2)	46 (2)	58 (2)	76 (4)	98 (4)	112 (4)
			125	24 (4)	42 (4)	64 (4)	84 (4)	112 (4)	134 (6)	154 (6)
			150	26 (4)	48 (4)	70 (4)	90 (4)	126 (6)	154 (6)	182 (6)
			200	40 (6)	70 (6)	112 (6)	140 (6)	190 (8)	226 (8)	268 (8)
NMG 163	½"	½"	100	32 (5)	63 (5)	84 (5)	130 (6)	165 (7)	204 (8)	243 (9)
			125	44 (7)	87 (7)	116 (7)	176 (8)	226 (9)	278 (11)	328 (11)
			150	50 (8)	101 (8)	134 (8)	197 (9)	257 (10)	314 (12)	388 (13)
			200	73 (12)	146 (12)	194 (12)	293 (13)	388 (15)	459 (17)	529 (18)
NMG 1126	½"	½"	100	64 (10)	126 (10)	168 (10)	260 (12)	330 (14)	408 (16)	486 (18)
			125	88 (14)	174 (14)	232 (14)	352 (16)	452 (18)	556 (22)	656 (22)
			150	100 (16)	202 (16)	268 (16)	394 (18)	514 (20)	628 (24)	776 (26)
			200	146 (24)	292 (24)	388 (24)	586 (26)	776 (30)	918 (34)	1058 (36)
NMG 1317	½"	½"	100	159 (26)	317 (26)	423 (26)	600 (29)	776 (32)	953 (36)	1130 (39)
			125	212 (35)	424 (35)	565 (34)	812 (38)	1059 (43)	1306 (48)	1518 (52)
			150	238 (40)	476 (40)	635 (38)	918 (41)	1200 (48)	1447 (52)	1730 (58)
			200	357 (60)	715 (60)	953 (57)	1341 (60)	1765 (70)	2154 (78)	2542 (85)

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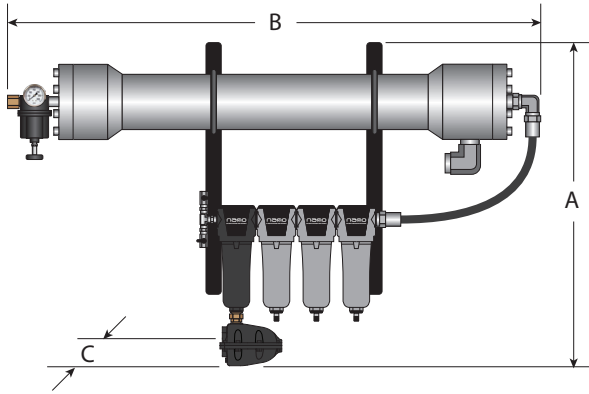


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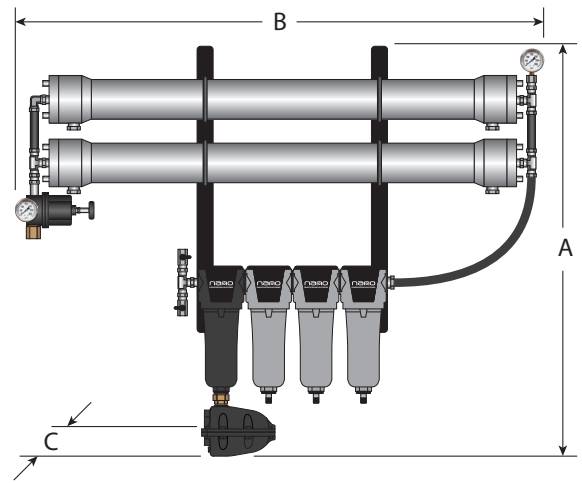
nitrogen gas generator



4.4 product dimensions



NMG 115, NMG 163
NMG 1317

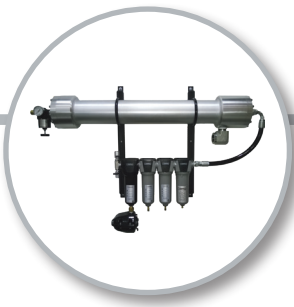


NMG 130
NMG 1126

model	dimension						weight	
	A		B		C		lbs	kg
	inches	mm	inches	mm	inches	mm		
NMG 115	26	660	29	737	12	305	25	11.3
NMG 130	26	660	29	737	12	305	30	13.6
NMG 163	40	1016	48	1219	12	305	40	18.1
NMG 1126	40	1016	48	1219	12	305	51	23.1
NMG 1317	34	864	53	1346	12	305	69	31.3

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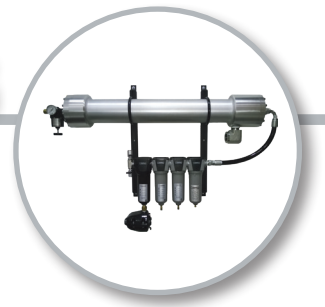
4.5 site location

When selecting an installation site for the NMG nitrogen gas generator, ensure the following conditions are met:

- Installation site is recommended for indoors.
- The ambient temperature must not drop below the pressure dew point of the compressed air provided to the system.
- The installation site should be able to support the weight of the NMG models.
- Ensure sufficient space around the product to allow access for operation and maintenance.

4





5.1 general preventative maintenance

Follow all safety precautions as defined in Section 1 of this manual and OSHA-CFR 191 0.147 when inspecting or making repairs to the nitrogen generator. Ensure that the nitrogen generator and all associated components are completely depressurized prior to undertaking any system maintenance. Lockout and tag out electrical circuits, relieve system pressure, and isolate piping components requiring maintenance before starting repairs. Perform preventive maintenance to correct potential difficulties before they become serious. Visually inspect all equipment before, during, and after use. Repair equipment damage as soon as possible. If equipment does not operate properly, stop operation immediately and investigate the cause of malfunction. All maintenance work must be performed by experienced personnel. Do not permit untrained personnel to install, inspect or maintain equipment. Use recommended equipment and materials when making repairs. Use only approved replacement parts, suitable and cleaned for operation.

This manual contains information to promote safety in the operation and maintenance of this equipment. It is not intended to supersede, replicate or replace any safety documentation or procedures provided from or established by official safety sources.

All persons involved with the operation or maintenance of this system – plant engineering, operations and management – must understand the potential hazards involved and observe the required safety precautions. Only trained, qualified and responsible personnel who have read and understood all manuals associated with this equipment should work with or around this system.

Your safety and the safety of equipment, nearby facilities and personnel require a proper safety attitude and an emphasis on safe work procedures. This is the essence of any good safety program. If at any time you identify safety deficiencies, immediately correct them and bring them to the attention of management. Before an accident can be prevented, it must be anticipated. Use pre-job discussions with your co-workers and supervisors to identify hazards and the means to avoid them.



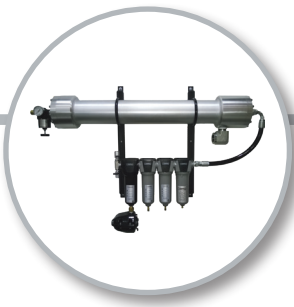
Failure to properly isolate equipment and piping, can cause asphyxiation, fire and/or explosion. Be sure to positively isolate the equipment from the gas supply and the process material before repair work is performed. It is not sufficient to simply close valves. Lines and tubing must be blanked or disconnected.



Depressurize supply gas piping before working on unit.



All personnel must be protected from hazards related to unexpected energizing, start-up, or release of stored energy during machinery/equipment servicing or maintenance. Strict equipment Lockout/Tag Out procedures ensure that all personnel are protected while performing necessary maintenance/servicing work.



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All pressure-regulated piping and vessels for this equipment shall include pressure relief devices (e.g., pressure relief valves) for over-pressure protection. These pressure relief devices must be maintained at regular intervals to ensure proper operation.



Before restarting the equipment, ensure that all parts of the equipment affected by repairs have been restored to their proper operating condition and that the lines have no leaks.

HIGH PRESSURE DEVICE

The gas production system operates with compressed air and may cause severe bodily harm, loss of life and/or property damage if not correctly installed, operated and maintained.

- ENSURE THAT ANY PART OF THE SYSTEM BEING WORKED ON IS DEPRESSURIZED.
- ENSURE THAT THE SYSTEM IS BEING MAINTAINED BY QUALIFIED PERSONNEL WEARING THE PROPER SAFETY EQUIPMENT INCLUDING BUT NOT LIMITED TO EAR PLUGS AND SAFETY GLASSES.

5

RECORDS

KEEP A RECORD OF WHEN MAINTENANCE WAS PERFORMED, WHAT WAS PERFORMED AND WHO PERFORMED THE MAINTENANCE.

The preventative maintenance is the responsibility of the owner of the equipment. All nitrogen generators require preventative maintenance to help ensure the life of the air separation membranes.

5.2 nitrogen generator maintenance

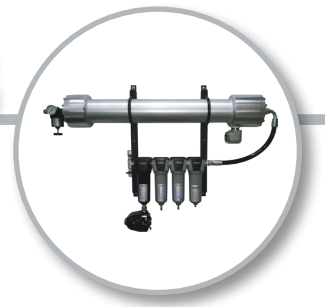
The nitrogen generator requires semi-annual preventive maintenance. The NMG Series of nitrogen generators incorporate a (4) four stage pre filtration system to help remove contaminants that may be present in the compressed air supply stream. The pre filtration system includes the following:

Centrifugal water separator

Coalescing filter – requires semi-annual replacement

Particulate filter – requires semi-annual replacement

Activated carbon filter- requires semi-annual replacement



5.3 pre filtration maintenance schedule

Please refer to section 5.5 of the manual for replacement procedures.

period	operation
daily	inspect pre filter # NF0070M01, NF0070M1 and NF0070AC or GF/GFN0070M1, GF/GFN0070M01 and GF/GFN0070AC for accumulation of water and/or oil
weekly	check all piping for leaks
4000 hours or 6 months	replace pre filter elements in NF0070M01, NF0070M1 and NF0070AC or GF/GFN0070M1, GF/GFN0070M01 and GF/GFN0070AC
8000 hours or 12 month	replace float drains in pre filters NF0070M01 and NF0070M1 or GF/GFN0070M1 and GF/GFN0070M01
8000 hours or 12 months	take compressed air sample and have compressed air analyzed to reduce the risk of compromising the air separation membranes

5.4 pre filtration maintenance

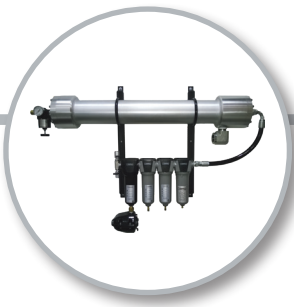
The maintenance items required for the filtration system can be obtained through nano-purification solutions. Please order your maintenance items (30) thirty days in advance of scheduled maintenance to ensure timely delivery and that the necessary service parts are on hand when the maintenance is performed.



When performing filter maintenance, refer to the enclosed instructions included in the maintenance kit.

Filter housings NF0070M01, NF0070M1 and NF0070AC or GF/GFN0070M1, GF/GFN0070M01 and GF/GFN0070AC require that their filter elements be replaced every six months.





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5.5 pre filtration cartridges / element replacement procedures

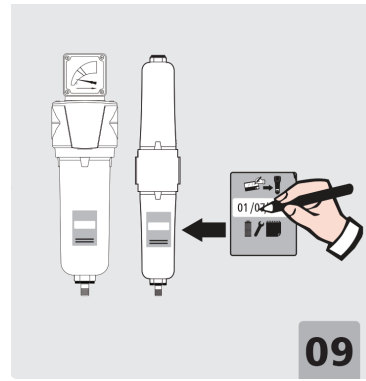
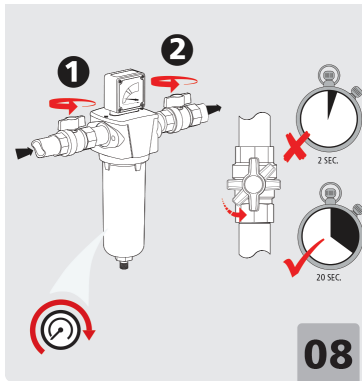
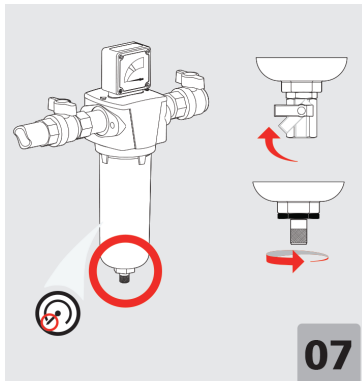
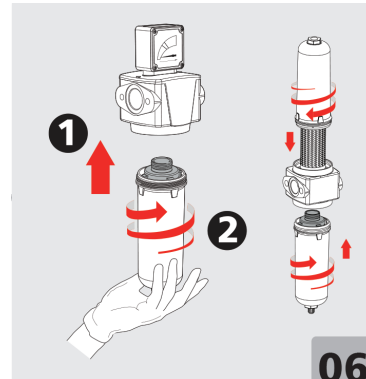
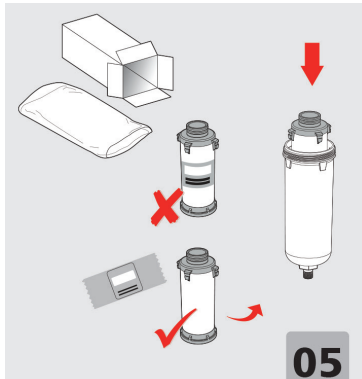
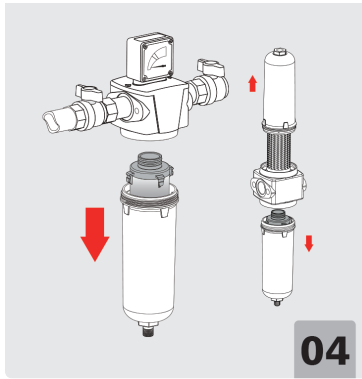
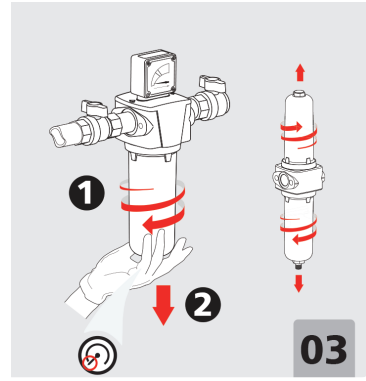
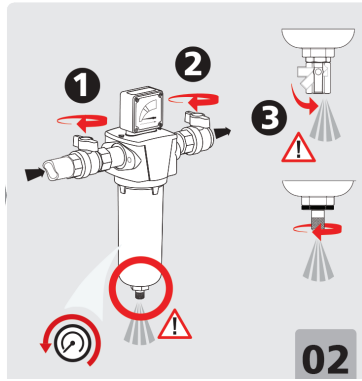
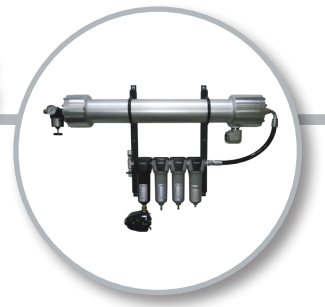
1. This procedure is expected to take 30-45 minutes.
2. Make sure the nitrogen generator is out of service and depressurized!
3. Please read carefully the following procedures for filter element replacement.
4. Remove the pre filter element bowls on the pre filters # NF0070M01, NF0070M1 and NF0070AC or GF/GFN0070M1, GF/GFN0070M01 and GF/GFN0070AC by grasping the filter bowl and unscrewing turning counter clockwise as shown in photo # 3 on page 23.
5. When loose remove the filter element bowl.
6. Remove the filter elements and bowl condensate drain from the filter bowls as shown in photo #4.
7. Dispose of spent filter elements according to local regulation.
8. Install new drains (# NDK1500 or GFDK1500) into filter bowls ((# NF0070M01 and NF0070M1 or GF/GFN0070M1 and GF/GFN0070M01) as shown in photo #7 on page 23.
9. Install PTFE based lubricant on the O-rings of new filter elements (# E0090M01, E0090M1 and E0090AC or GE0105M01, GE0105M1 and GE0105AC) and insert the new filter element into the filter bowl as shown in photo #5 on page 23.
10. Install filter bowls being sure to seat the bowl properly in the filter housing as shown in photo # 6 on page 23.
11. Record date that pre filter maintenance was performed.
12. Follow nitrogen generator start up procedure in section 3.6 of the manual.

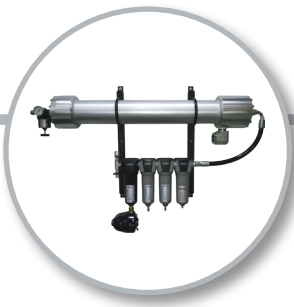
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5.6 pressure relief valve maintenance (if applicable)

Pressure relief or safety relief valves shall be located on the nitrogen generation piping system. Pressure relief valves require minimum monthly service. If a pressure relief valve is needed, nano-purification solutions can provide them.

Replace any pressure relief valve that is defective or not performing as per specifications.

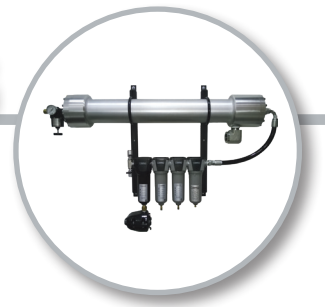
period	operation
monthly	operate all system pressure relief valves
annually	test all pressure relief valves
3 years	replace the pressure relief valves every 3 years

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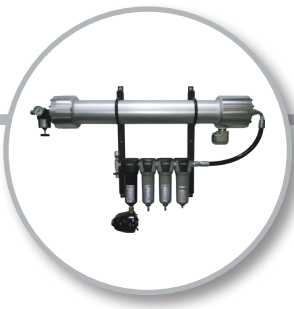
nitrogen gas generator



5.7 service record

part number		serial number			
installed by		installation date			
service interval	hours run (if applicable)	date	serviced by		comments / observations
			print	sign	
year 1					
year 2					
year 3					
year 4					
year 5					
year 6					
year 7					
year 8					
year 9					
year 10					
year 11					
year 12					

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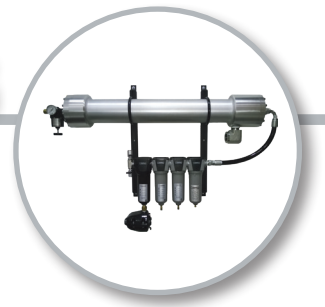
6.1 trouble shooting

problem	solution
nitrogen generator is not producing nitrogen	<p>ensure pre filter maintenance has been performed. follow procedure in section 5</p> <hr/> <p>follow procedure in section 2</p> <hr/> <p>ensure proper pressure is being delivered to nitrogen generator (80 psig (5.5 barg))</p> <hr/> <p>ensure quality of compressed air supply is not contaminated</p> <hr/> <p>ensure oxygen waste line is not blocked</p>
nitrogen generator is not producing desired purity	<p>ensure pre filter maintenance has been performed. follow procedure in section 5</p> <hr/> <p>ensure proper pressure is being delivered to nitrogen generator (80 psig (5.5 barg))</p> <hr/> <p>ensure quality of compressed air supply is not contaminated</p> <hr/> <p>ensure that flow control components are installed</p> <hr/> <p>ensure oxygen waste line is not blocked</p>
pressure loss is greater than 10 psig through nitrogen generator	<p>ensure that proper maintenance has been performed. follow procedure in section 5</p> <hr/> <p>ensure oxygen waste line is not blocked.</p>



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7.1 references

Table 1-1 is a summary of reference publications applicable to this equipment.

P-4631-F	MSDS for GN ₂	obtain from your gas supplier
P-4638-E	MSDS for GO ₂	obtain from your gas supplier
P-8.1-1995	safe installation and operation of PSA and membrane oxygen and nitrogen generators	compressed air gas association 4221 walney road - 5th floor chantilly, va 20151-2923





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