Laser Beam Path Purge with Nitrogen

Market Application Publication

Background:

A laser is often the most significant capital equipment purchase by a metal fabricator, and special attention must be paid to maximize its return on investment. Maximum throughput and cutting precision depends on the intensity of the laser. Light from the laser is transmitted through a plenum containing a series of mirrors. If foreign matter, such as dust or moisture, is allowed to accumulate on the mirrors, the intensity of the light focused on the metal and the ultimate effectiveness of the cutting process will decrease. Typically, compressed air or nitrogen circulates in the plenum to ensure that water, dirt, dust, smoke, haze, and solid particulate matter are absent, ensuring that the mirrors remain free of contamination. Moisture in the gas is especially troublesome, as it can adhere to the mirrors and allow particulate matter to accumulate.

Application:

Contamination in the beam path of a laser is a major issue for metal fabricators, and leads to significant downtime. Costly service contracts are typically utilized by laser manufacturers to safeguard against these downtime issues. It is not uncommon for the user to replace optics every 6 months, at a cost of thousands of dollars. Utilizing a clean, dry stream of nitrogen to purge the beam path area can prevent these issues and improve uptime. Liquid nitrogen has been used in the past, but can lead to a haze in the beam path area. A Parker Hannifin nitrogen generator, which separates nitrogen and oxygen from a compressed air supply, can often be the most cost effective way to supply this nitrogen. For lasers 3kw and below, dry air may be used (see MAP Laser Cutting).

Features and Benefits:

- Improves operation – minimize costly down time for cleaning or replacement of optics.
- Eliminate gray film accumulation on cutting lens & optics
- Save money by eliminating expensive gas cylinders & dewars.
- Easy to install and operate: pipe in compressed air, pipe out nitrogen
- Price of our nitrogen is constant. Supplier Nitrogen is subject to pricing increases, rental agreements, hazmat fees, delivery surcharges, local & state taxes, etc. A nitrogen generator offers long term price stability.
- Nitrogen has a very low boiling point, and is continuously evaporating when supplied as liquid in bulk tanks or dewars. It can cost thousands of dollars if these gases are not recaptured.
- Complete start up and testing procedure at the factory prior to delivery.
- Very little maintenance or monitoring required once system is up and running. Simple and straightforward operation.
- Proven technology with numerous references available. Over 10,000 successful generator installations.

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Case Study:

Donner Laser, in New Ulm, MN provides a variety of services to the metal fabrication industry. Their separate entity, DLC Manufacturing & Fabrication utilizes a 6KW Trumpf TruLaser 5040 to cut a variety of materials, including mild steel (1.5" thickness), stainless steel (1" thickness) and aluminum (1" thickness). DLC originally utilized liquid nitrogen supplied in a dewar, but believe that the cold temperature of the gas combined with the humid cutting environment produced a gray haze on the lens. After recurring issues with optics replacement and lens cleaning, DLC decided to install a Parker Hannifin nitrogen generator to purge the beam path area of their Trumpf laser. According to Brent Donner, President of DLC Manufacturing & Fabrication: "Since that installation in November 2008, DLC has not replaced a single beam delivery optic due to contamination or oxidation." The membrane generator is operating at 95% nitrogen purity, and has performed flawlessly regardless of the material that is being cut. Donner Laser has recently supplied this Parker Hannifin nitrogen generator system to some clients that were experiencing optics replacement issues, and are happy to report similar results in those installations.

Principal Specifications

HFX Series Membrane Nitrogen Generators

Model Number	HFX-1, HFX0-1	HFX-3,HFX0-3	HFX-5, HFX0-5	HFX-7, HFX0-7, HFX-9, HFX0-9, HFX-11, HFX0-11
Atmospheric Dewpoint	-58°F (-50°C)	-58°F (-50°C)	-58°F (-50°C)	-58°F (-50°C)
Commercially Sterile	Yes	Yes	Yes	Yes
Particles > 0.01 micron	None	None	None	None
Suspended Liquids	None	None	None	None
Min/Max Operating Press.(1)	60 psig/145 psig	60 psig/145 psig	60 psig/145 psig	60 psig/145 psig
Max. Press. Drop (at 95% N_2, 125 psig)	10 psig	10 psig	10 psig	10 psig
Recommended Ambient Operating Temperature	77°F (25°C)	77°F (25°C)	77°F (25°C)	77°F (25°C)
Min/Max Inlet Air Temp.	40°F/122°F (2°C/50°C)	40°F/122°F (2°C/50°C)	40°F/122°F (2°C/50°C)	40°F/122°F (2°C/50°C)
Recommended Inlet Air Temperature	77°F (25°C)	77°F (25°C)	77°F (25°C)	77°F (25°C)
Electrical Requirements (2)	None (2)	None (2)	None (2)	None (2)
Dimensions	12.8"w x 7.5"d x 16.3"h (32cm x 19.1cm x 41cm)	16"w x 16"d x 50"h (41cm x 25cm x 91cm)	16"w x 16"d x 50"h (41cm x 25cm x 91cm)	24"w x 20"d x 69"h (61cm x 51cm x 175cm)
Shipping Wt.	38 lbs. (17.3 kg)	75 lbs. (34 kg)	106 lbs. (114 kg)	250 lbs. (114 kg)

NOTES

1 Maximum operating pressure in Europe is 8 barg.

2 No electrical power required unless used with an electrical accessory, e.g., an oxygen analyzer.

Flow Rates (SCFH) @ 100 psig @ 68°F

Model	95	96	97	98	99	99.5
HFX Series Nitrogen Generators						
HFX-1	40	33	26	16	11	---
HFX-3	148	120	95	70	42	---
HFX-5	279	229	176	131	76	---
HFX-7	452	360	283	209	120	---
HFX-9	752	600	452	330	201	---
HFX-11	1201	992	780	572	248	---

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