

Boiler Layup

Market Application Publication



Background:

Boiler cycling (i.e. startup and shut-down) is more common in today's challenging business environment, primarily due to instability of natural gas prices and volatile energy demand. As cycling increases, proper layup of your Heat Recovery Steam Generator (HRSG) becomes much more critical. Problems associated with improper boiler layup include corrosion and pitting on both the gas & water sides of the HRSG, maintenance issues, startup delays and water chemistry delays. Nitrogen is an essential tool in helping to alleviate these issues, and has become the preferred technology since it doesn't introduce foreign chemicals to the boiler. A nitrogen generator, which separates nitrogen and oxygen from a compressed air supply, can often be the most cost effective way to supply this nitrogen.



Features and Benefits:

- 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.
- Your cost increases relative to usage with bulk, dewar or cylinder nitrogen. Costs decrease as usage increases with a nitrogen generator.
- Nitrogen has a very low boiling point, and is continuously evaporating when supplied as liquid in bulk or dewars. It can cost thousands of dollars if these gases are not recaptured.
- A nitrogen generator eliminates the contracts required from bulk gas suppliers. No more automatic renewals, automatic increases or 1-year written notice for contract termination.
- Ease of installation. Pipe in compressed air and pipe out Nitrogen.
- Contrast this with the installation requirements for a bulk tank, including a concrete pad, fence and significant square footage.
- 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.

Application:

A nitrogen blanket can be used in both the wet & dry layup of a HRSG. During wet layup, which is typically used for outages lasting ≤ 30 days, nitrogen is used to purge and blanket the steam spaces, often including the superheaters and reheaters. To minimize the amount of nitrogen required, it is best to inject it when drum pressure is between 2-5 psig. During dry layup, which is typically used for outages lasting > 30 days or shorter outages where freezing could occur, it is extremely important to thoroughly drain the unit and completely dry all surfaces. This helps to prevent corrosion, and will minimize issues during startup. A 5 psig nitrogen blanket (often through the drum vent) is the preferred method to ensure that surfaces remain dry and oxygen does not enter the unit.



Case Study:

In many combined cycle facilities, nitrogen is used during both short term and long term boiler layups. In a wet (short-term) layup, the HRSG is capped with nitrogen to maintain pressure between cycles. During dry (long-term) layup, the HRSG is purged and blanketed with nitrogen to protect the boiler tubes and other sensitive equipment from moisture. Nitrogen was being used in this fashion at Salt Valley Generating Station – Lincoln Electric System.

Boiler cycling and inadequate boiler layup caused corrosion and oxygen pitting related issues that produced delays at startup. These issues can produce leaks, corrosion fatigue (CF) and stress corrosion cracking (SCC). Proper boiler layup, utilizing nitrogen cylinders to blanket the HRSG was also

becoming cost prohibitive. To solve these issues, Salt Valley Generating Station installed a Parker Hannifin nitrogen generator for use during HRSG shutdown.

The Parker Hannifin nitrogen generator, designed to deliver a steady flow of gas at 99.9% purity, provided many improvements at Salt Valley. It eliminated the requirement for nitrogen cylinders, which can be expensive (on a cost/cf basis) and difficult to move within a facility. Inspection of the HRSG revealed that oxygen pitting and corrosion was minimized or completely halted. Startup times were decreased by 60 minutes during wet layup and 6-8 hours during dry layup. This reduced the corresponding startup costs by as much as \$45,000, depending on the cost of Natural Gas.



Specifications and Ordering Information:



Standard Package Includes:

- Fully enclosed cabinet with casters
- High efficiency coalescing and sterile air filters
- Oxygen analyzer available
- High oxygen alarms and dry contacts available
- Stand by mode
- Purity easily adjusted between 95%-99.999% with flow control valve
- Outlet pressure regulator
- 60 gal. vertical nitrogen storage tank

Principal Specifications - Models DB5, DB-10, DB-15, DB-20

Model Number	DB-5	DB-10	DB-15	DB-20
Feed Air Pressure (minimum)	110 psig	110 psig	110 psig	110 psig
Air Quality	Clean air without contaminants	Clean air without contaminants	Clean air without contaminants	Clean air without contaminants
Temperature	80°F	80°F	80°F	80°F
Electrical Requirements	120 VAC /lph / 60Hz	120 VAC /lph / 60Hz	120 VAC /lph / 60Hz	120 VAC /lph / 60Hz
Maximum Pressure	140 PSIG	140 PSIG	140 PSIG	140 PSIG
Temperature Range	60°F - 105°F	60°F - 105°F	60°F - 105°F	60°F - 105°F
Nitrogen Dewpoint	-58°F (-50°C)	-58°F (-50°C)	-58°F (-50°C)	-58°F (-50°C)
Commercially Sterile	Yes	Yes	Yes	Yes
Filtration Efficiency	99.99% @ 0.01u	99.99% @ 0.01u	99.99% @ 0.01u	99.99% @ 0.01u
Suspended Liquids	None	None	None	None
Ambient Pressure	Atmospheric	Atmospheric	Atmospheric	Atmospheric
Dimensions	28.5"L x 32.25"D x 78"H	28.5"L x 32.25"D x 78"H	28.5"L x 51.5"D x 78"H	28.5"L x 51.5"D x 78"H
Weight (with tank)	625 lbs	835 lbs	1245 lbs	1455 lbs
Inlet	1/2" NPT	1/2" NPT	1" NPT	1" NPT
Outlet	1/2" NPT	1/2" NPT	3/4" NPT	3/4" NPT

N2 Flow Rates (SCFH)

% N2	DB-5	DB-10	DB-15	DB-20
99.99	194	388	583	777
99.95	314	629	943	1258
99.9	365	730	1095	1460
99.5	512	1024	1536	2048
99	618	1235	1853	2470
98	770	1541	2311	3081
97	892	1783	2675	3566

Ordering Information - Models DB5, DB-10, DB-15, DB-20

	DBO-5	DBO-10	DBO-15	DBO-20
Dual Bed N2 Generator with O2 Analyzer	DBO-5	DBO-10	DBO-15	DBO-20
Dual Bed N2 Generator w/o O2 Analyzer	DB-5	DB-10	DB-15	DB-20
Maint. Kit for N2 Generator with O2 Analyzer	MKDBO-5	MKDBO-5	MKDBO-15	MKDBO-15
Maint. Kit for N2 Generator w/o O2 Analyzer	MKDB5	MKDB5	MKDB15	MKDB15
Oxygen Sensor	72695	72695	72695	72695

Specifications and Ordering Information:

HFX Series Flow Rates and Pressure Correction

Flow Rates (SCFH) @ 100 psig @ 68°F

Model	95	96	97	98	99
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

Pressure Correction Factors (at Indicated Operating Pressure (PSIG))

	58	73	87	101	116	130	145
HFX-1	.52	.65	.86	1	1.15	1.35	1.44
HFX-3	.54	.68	.85	1	1.14	1.3	1.43
HFX-5	.52	.65	.85	1	1.14	1.34	1.43
HFX-7	.53	.66	.86	1	1.14	1.32	1.43
HFX-9	.44	.65	.85	1	1.1	1.3	1.4
HFX-11	.44	.65	.85	1	1.2	1.4	1.6



Principal Specifications - HFX Series Membrane Nitrogen Generators

Model Number	HFX-2	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 (4 barg/10 barg) (1)	60 psig/145 psig (4 barg/10 barg) (1)	60 psig/145 psig (4 barg/10 barg) (1)	60 psig/145 psig (4 barg/10 barg) (1)
Max. Press. Drop (at 95% N ₂ , 125 psig)	10 psig (0.7 barg)	10 psig (0.7 barg)	10 psig (0.7 barg)	HFX-7, HFX0-7: 10 psig (0.7 barg) HFX-9, HFX0-9: 15 psig (1.03 barg) HFX-11, HFX0-11: 20 psig (1.4 barg)
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/110°F (4°C/43°C)	40°F/122°F (4°C/50°C)	40°F/122°F (4°C/50°C)	40°F/122°F (4°C/50°C)
Recommended Inlet Air Temperature	77°F (25°C)	77°F (25°C)	77°F (25°C)	77°F (25°C)
Inlet/Outlet Port Sizes	1/4" NPT	1/4" NPT	1/4" NPT	1/2" NPT
Electrical Requirements (2)	None (2)	None (2)	None (2)	None (2)
Dimensions	10.7" w x 13.4" d x 16.1" h (27.2cm x 34cm x 40.9cm)	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.	42.5 lbs. (19 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.

Parker Hannifin Corporation
 Filtration and Separation Division
 242 Neck Road, P.O. Box 8223
 Haverhill, MA 01835-0723
 phone 800 343 4048 or 978 858 0505
 fax 978 478 2501
www.parker.com/balston

