

Mine Inerting

Market Application Publication



Background:

Two primary uses for nitrogen in the mining industry are extinguishing coal mine fires and more recently to inert worked-out or abandoned areas of the mines if inadequate seals are installed as mandated by Final Standard 30 CFR Part 75 issued by the Mine Safety and Health Administration (MSHA) as of April 18, 2008.

The objective in extinguishing a coal mine fire is to reduce the oxygen content of the combustible gases below the lower limit of explosion (LEL). Specialty foams are sometimes injected with the nitrogen to help seal off air ingress to the fire and help cool the surface of the coal embers after the LEL has been achieved. Continuous injection is required for days, even months in some situations, so on-site nitrogen generation is often more cost effective than hauling liquid nitrogen to the location and vaporizing it at the mine's surface.

The recently promulgated regulation by MSHA for underground mine seals was developed to protect miners in active areas of the well from potential explosions in abandoned (worked-out) sections of the mines. These seals must be designed to maintain a tight seal to a minimum of 120 psig; otherwise they must be inerted and sampled daily if seal pressures are less than 120 psig. The new minimum seal pressure is now 50 psig, and 20 psig pressure-rated seals are no longer acceptable. Therefore, inerting the lower pressure mine seals to maintain an atmosphere containing 10% O₂ or lower is now mandated by Federal Regulations.



Features and benefits:

- Continuous on-site production of dry, inert nitrogen to your purity specifications
- High flow capabilities in a compact, easily transportable container
- Avoids the transportation logistics and costs associated with cryogenic-based N₂ supply
- Can process low pressure air from conventional lubricated or oil-free compressors
- Optional built-in membrane air dryer is available to process saturated feed air
- Simple process controls with N₂ flow, purity and pressure readouts and signal outputs
- Suitable for direct injection or as a carrier gas for foam to maintain an inert atmosphere
- Rapid set-up, start-up, and de-rigging on location within hours
- Low profile options available to locate generators in underground mines if needed



ENGINEERING YOUR SUCCESS.

Application/Case Study:

A major Appalachian coal mine operator was ordered to shut down an active mine until the worked-out areas of the mine were properly sealed and inerted. The responsible operator elected to inert the abandoned areas of the mine with two trailer-loads of cryogenic nitrogen, and later continuous nitrogen injection from membrane generators that separated compressed air into enriched nitrogen at the surface of the

mine through a 1000 ft. drill hole into the underground mine.

Because of the high cost of rental N2 after several weeks of continuous injection, the operator evaluated his current and future N2 requirements and elected to purchase the N2 generator and take additional steps to improve the effectiveness of the numerous seals in the abandoned mines. Another mine operator in Colorado, faced with similar mine clo-

sures, compared the cost of rental N2 to ownership, and elected to purchase a containerized Parker Hannifin membrane system based on superior value and equipment availability. These systems can be mobilized quickly to inject nitrogen anywhere it is needed on the mining complex, and allows the mines to continue production while abandoned areas are inerted per industry recommendations.

Principal Specifications

All Models

Nominal Conditions - All Models

Feed Pressure	100-190 psig
Feed Temperature	80°F to 100°F (26°C to 37°C)
Ambient Pressure	1 Atmosphere

Compressed Air Specifications - Low Pressure Membranes

Maximum Pressure	115 psig to 190 psig (dependent on membrane selected)
Temperature Range	60°F to 120°F (16°C to 49°C)
Recommended Dew point	40°F pressure dp or lower
Residual Oil Content	Trace
Particles	<.01 micron

Ambient Conditions

Temperature	40°F to 110°F (4°C to 43°C)
Minimum Membrane Temperature	35°F storage
Ambient Pressure	Atmospheric
Air Quality	Clean air without contaminants



Parker Hi-Fluxx Air separation membranes provide the highest productivities on the market, delivering high N2 flow rates in a compact configuration.



Parker Nitrogen Gas Generator System Designed Specifically for the Underground Mine “Long-wall” Low Profile, High Performance Packages

- Nitrogen Purity: 95% - 99.99%
- Standard Flows: 250 SCFM- 2500 SCFM
- Nitrogen Outlet Pressure: 75-175 PSIG



Parker Low Profile Underground Membrane Nitrogen Gas Generator Skid

Performance Charts

Low pressure models shown - pressures to 190 psig available

Parker HiFluxx[®] Containerized Membrane Systems

Model Number	Flow Rate (scfm)(1)(2)	Feed Pressure	Delivery Pressure	Dimensions (L x W x H, ft)	Weight (lbs)
FB-3 to 6 ST15020	300-750	100-115	75-100	20 x 8 x 8.5	10,000
FB-6 to 8 ST15020	750-1200	100-115	75-100	20 x 8 x 8	10,000
FB-12 to 15 ST15020	1500-2000	100-115	75-100	20 x 8 x 8	15,000
Consult factory	2000-3000+	100-115	75-100	(20-40) x 8 x 8	15,000-25,000

Notes:

- 1 Performance based on actual feed air flow, pressure, temperature and required N2 purity. Consult factory for higher N2 purities, flow rates, or delivery pressures.
- 2 Custom flow rates and packaging options available; consult factory.
- 3 High efficiency Pressure Swing Adsorption (PSA) Models also available - 250 to 1000 scfm - consult factory.

Parker Low Profile Underground Membrane Nitrogen Gas Generator Skids

Model Number	Flow Rate (scfm)(1)(2)	Feed Pressure	Delivery Pressure	Dimensions (L x W x H, ft)	Weight (lbs)
FB-ST16020-2-SK-LP	360	131	105	15 x 6 x 4	6,500
FB-ST16020-3-SK-LP	540	131	105	16 x 6 x 4	7,000
FB-ST16020-4-SK-LP	720	131	105	15 x 6 x 4	7,500
FB-ST16020-5-SK-LP	900	131	105	15 x 7 x 4	8,000
FB-ST16020-6-SK-LP	1080	131	105	15 x 7 x 4	8,500

Parker Low Profile Underground “PSA” Nitrogen Gas Generators

Model Number	Flow Rate (scfm)(1)(2)	Feed Pressure	Delivery Pressure	Dimensions (L x W x H, ft)	Weight (lbs)
DB-50-SK-LP	250	140	85	16 x 6 x 5	5,100
DB-72-SK-LP	350	140	85	18 x 6 x 5	5,800



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