Enhanced Oil Recovery Systems

MAP Application Solutions

Background

After oil and gas wells are drilled, completed, and placed into initial (primary) production, only about 12-15% of the original oil in place is typically recovered because of the continually deleting drive pressure of the well. Techniques such as fracturing, stimulation, and gas lift are sometimes used to assist and sustain the initial gas drive. Secondary recovery methods, most often water flooding of the oil reservoir or natural gas reinjection, if available, can recover an additional 15 to 20 % of the trapped oil.

Since there may still be another 65 to 70% of the oil still in the formation, additional production techniques referred to as tertiary recovery are implemented. Gas injection using either carbon dioxide (miscible) or nitrogen (immiscible) increase the reservoir pressure to promote additional recovery, or steam is used to improve the permeability of the oil.

Application / Case Study

An independent U.S oil and gas producer was evaluating tertiary EOR options to recover additional oil reserves from depleted wells on one of its leases. Although there was a major CO2 pipeline delivering gas to leases in surrounding fields, the customer was faced with the need to install a secondary CO2 pipeline to their injector wells.

After evaluating the cost of the CO2 plus a percentage of production required by the supplier, it was determined that the cost of nitrogen production was less than CO2, and they kept 100% of the increased production as well. A 1000 scfm, 95% membrane system including all the feed air compression was purchased from Parker Hannifin, and the client provided his own boosters to inject the generated N2 to over 2000 psig into the depleted reservoir.

Feed air compressors (left), membrane container (center) and booster compressors (right) on customer's location

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Model FB-12ST15020 rated at 1500 scfm of 95% N2

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

Convenient operator controls in a spacious, temperature controlled enclosure to easily monitor continuous nitrogen flow rates, purities and pressures.

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

Parker's membrane air dryers provide dew point suppression to ensure dehydrated air is fed to the N2 membranes. No external dryers or additional electric demand is required.

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Performance Chart

Parker HiFluxx® Containerized Membrane Systems

N2 flow rates at 95% inerts, pressures in psig, external air dryer

Model Number	Flow Rate (scfm)(1)(2)	Feed Pressure	Delivery Pressure	Dimensions (L x W x H, ft)	Weight (lbs)
FB ST16010	150-500	175-180	140-150	8 x 10 x 8.5	6000-7500
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.

Principal Specifications

All Models	
Nominal Conditions - All Models	
Feed Pressure	100-125 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
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 contaminats

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