Case Study

Hypoxic Chambers

Focus:
A company that specializes in producing custom built simulated high-altitude chambers that partners with professional sports leagues, such as the NBA and NFL, to provide premier athletic training.

Problem:
Altitude chambers require an atmosphere with reduced oxygen content.

Solution:
The company designed their simulated altitude chambers to use Parker HiFluxx nitrogen membranes to create hypoxic environments for athletic training.

Impact:
The customer is able to produce three types of hypoxic chambers for altitude simulation only, altitude with temperature and humidity, and extreme altitude with temperature and humidity. These three different variations of chambers allow athletes to reach their peak performance potential at a reasonable cost.

Project Name: Hypoxic Chambers
Location: Port St. Lucie, Florida

Summary
In 2021, the customer began looking for local support in the United States for their hypoxic chambers. Their European sister company uses many Parker components in their systems. Since there was an existing partnership, Parker was a clear choice to work with in the North American market. Using nitrogen to modify the atmosphere was required to create these hypoxic environments.

Challenge
Hypoxic chambers can simulate a wide range of altitudes, humidity levels and temperatures. Gaseous nitrogen is a safe way to reduce oxygen levels in the chambers and is typically chosen for this process. The air in Earth's atmosphere is made up of 78% nitrogen, 21% oxygen and other trace gases. In order to simulate the air at higher altitudes, Nitrogen is pumped into the chamber to reduce the oxygen content in the air. Due to the varying size of these chambers, each chamber requires a different peak nitrogen flow rate that is carefully calculated.

Solution
Working with a local Parker distributor, three different HiFluxx nitrogen membranes were sized and selected to support various hypoxic chambers. Nitrogen membranes produce gaseous nitrogen with purities up to 99.5%, and the nitrogen is produced by converting air from a standard compressed air supply on-site. Additionally, Parker membranes have a small system footprint, deliver instant purity at startup, and have no moving pieces. These membranes provided the customer a cost-effective, reliable, and safe alternative to high pressure cylinders or liquid nitrogen delivered by gas companies.

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Parker hollow-fiber membrane modules produce nitrogen gas from compressed air to offer a cost-effective, reliable and safe alternative to traditional cylinder or liquid nitrogen. Nitrogen is used as a clean, dry, inert gas primarily for removing oxygen from products or processes. Parker modules can be built into a custom-made nitrogen generator or can be integrated into your production process to provide an on-demand, continuous supply of nitrogen gas, which can be used in a wide range of industries including food, beverage, pharmaceutical, laboratory, chemical, heat treatment, electronics, transportation, oil and gas, mining and marine.

Benefits:

Fewer membrane modules needed per nitrogen system
More nitrogen per fiber is produced from Parker hollow-fiber membranes than anyother in the world

Use of low pressure standard industrial compressor
No high-pressure compressor needed to obtain required nitrogen flow

Energy savings
Operation at a low pressure requires less energy

Factory membrane aging, pre-delivery
No performance decrease over time due to fiber aging

Reduced CO_2 emissions
No heater required to open polymer membrane structure, thus reducing the energy consumption

Robust fiber
Most tolerant fiber to particle contamination

Large membrane diameter
Lowest membrane module pressure drop

Flexible mounting arrangements
Can be mounted horizontal or vertical

Strong engineering plastic
Life-expectancy of ten years or more

Quick start-up time
Required nitrogen purity is produced instantly, no time needed to heat-up

Low noise operation
Radiated noise generated by membrane technology is extremely low

No maintenance required
No user serviceable parts

Small system footprint
Fewer modules needed to produce nitrogen requirements

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