



High-efficiency supply system Breakthrough technology for HBOT treatments



“Saint Peter’s Monroe Center has realized an annual savings of about 30% in oxygen based on a comparison to other systems.”

Tom Witte, Air Products, Engineering Manager



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greater efficiency,
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New hospital system reduces losses



Innovation is one of the reasons why Air Products has been a leading supplier of medical gases in North America since 1947.

An excellent example is the technology developed by the Air Products engineering team that reduces the loss of normally vented oxygen by as much as 30 percent from a compact, multi-cryogenic tank system that supplies hyperbaric oxygen therapy (HBOT) treatment centers.

This new technology is part of a system installed in September 2012 by Air Products at the Saint Peter's University Hospital's Wound Care Center® and Hyperbaric Services unit in Monroe Township, N.J. The Wound Care Center operates Monday through Friday with two hyperbaric chambers and offers HBOT treatments. HBOT increases the amount of oxygen in the blood to enhance wound healing and treats a variety of other conditions like diabetic ulcers, burns, carbon monoxide poisoning and anemia.

According to Thomas G. Witte, Air Products Engineering Manager for the company's North American projects, the wound care center is using 30% less oxygen each year based on a comparison to other systems.

The challenge at the Monroe Center

Witte said the Saint Peter's Monroe facility presented several challenges including space and height restrictions. Without space constraints, this system would have normally called for one 1,500-gallon tank.



However, the shortest 1,500 gallon tank was 17 feet high, but the height restriction was 12 feet. Additionally, the system had to meet NFPA 55 and was required by the A&E firm to be in a building.

Witte – the winner of the Compressed Gas Association's (CGA) 2012 Chart Industries Distinguished Service Award – and his colleagues worked with the A&E firm and were able to invent the multi-vessel, short, low-loss system, a successful alternative to a conventional one.

A conventional medical oxygen (cryogenic fluid supply) system for hyperbaric chambers and other hospital applications usually includes a single medical liquid oxygen (MLX) tank or dewars containing some gaseous oxygen in the headspace above the MLX. Witte said typically, MLX is withdrawn from the bottom of the tank and vaporized for end use.

“However, because many uses are intermittent, a conventional system may experience significant losses of cryogen or oxygen when the end use is temporarily stopped,” Witte explained, “we designed a system to meet these challenges to minimize any gaseous oxygen losses.”

He said that any liquid cryogen remaining in the supply lines and vaporizer takes on heat from the ambient environment. As the resultant pressure increase pushes some of the remaining liquid back into the tank, heat is carried with it – therefore increasing the vent losses. This causes the tank's pressure to rise. “Ultimately, the tank needs to vent to relieve some of the excess pressure buildup, resulting in the loss of cryogen, or MLX.”

Overcoming design challenges

With the facility design restrictions and the oxygen volume requirement, the Air Products team developed a system for the Monroe Center comprising three 750-gallon (1,500 liter) cryogenic storage vessels.

According to Gary Bean, Air Products Lead Project Engineer, the new proprietary system overcomes the problems usually encountered with multiple tanks by forcing them to draw product as a gas first, before removing any liquid from the tank.

“It is a low-loss system that uses tank heat leak in the form of gas first and does not add extra heat leak through pulled MLX from the tank to the vaporizers.”

The Air Products TELALERT® system remotely monitors product supply. The tanker driver calls ahead of the delivery, and leaves the required paperwork that needs to be submitted.

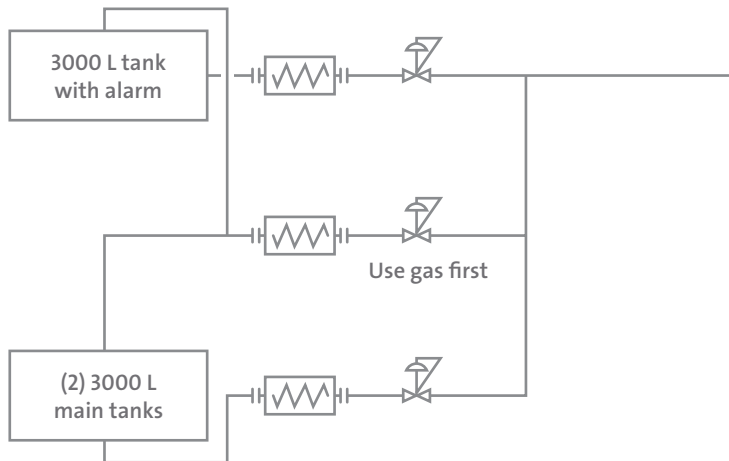




“Not only does this use the gas first, but in intermittent service, does not pull liquid oxygen from the tank and then send a portion back to the tank when customer demand stops. MLX in line to the vaporizer has nowhere to go when the customer shuts down, but back into the tank,” Bean explained.

“Depending on volume requirements, this technology could work with any multi-chamber HBOT center, as well as many other medical or industrial gases applications employing batch (intermittent) usage or start-and-stop consumption,” Witte explained. At start up, HBOT treatments require a quick, high flow injection of oxygen to prepare the chamber.

Figure 1. Saint Peter's Monroe Center system schematic

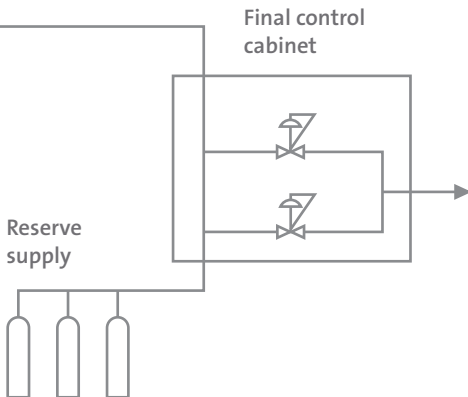


Optimizing the process for Monroe Center

The MLX in the line, which is not insulated at the Monroe Center, then brings any heat with it into the tank to vaporize more MLX into gas. Using this system, liquid oxygen is not withdrawn from the tanks at all, unless the gas from the tank will not keep up with demand.

The bottom line for Saint Peter's and future users of this system, stressed Bean, is that it really optimizes the process such that heat leak is added only when needed.

The Air Products' team also developed a special alarming sequence for the system since the main supply needs a 24-hour alarm according to NFPA 99 code. "We designed a sequence that would set alarm only when the reserve tank LOX level went below the preset delivery mark. And we still had the redundant gas storage."





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