



Ammonia ISO Modules

Bob Ford

Welcome to another Podcast from Air Products.

Hello, I'm Ed McKendry. We're here once again with Bob Ford, the manager of BSGS (Bulk Specialty Gas Supply) at Air Products. Bob has 21 years with Air Product and during that time, his involvement with specialty gas all over the world. Over a decade of that time, as an innovator for bulk specialty gas supply. Bob is a published author of many articles and holds 8 patents related to BSGS. Once again Bob, thank you for being here.

Well thanks for the introduction Ed.

Bob, we're here today to talk about an aspect of bulk specialty gas supply, specifically ammonia ISO modules. Tell us, what is an ISO module?

An ISO module in general is a container that's meant for goods to be exported. In the case of ammonia, it's actually a tank of 20 foot length, 8 foot diameter holding 26,000 pounds, surrounded by a frame that could easily be handled at the port to be shipped overseas. But it could also be utilized, of course, domestically.

In an article that you recently wrote in "Gases and Technology Magazine," in fact, in January–February '06 issue, you discuss the ammonia ISO as being pretty unique. What makes it unique?

Well Ed, the 8 patents alone would stipulate that it's unique, but the 2 main facets of this container that really make it different is the ability to deliver 1 part per billion moisture specification where traditionally for specialty gases the specifications have been 1 part per million. But also the capability of this ISO for high flow rate of over 1600 LPM makes it extremely unique.

Tell me in what kind of applications a flow rate like that is necessary.

Actually there're a couple of applications today that drive this need. First of all is LED manufacturing where they utilize large quantities of ammonia for the manufacture of gallium nitride and gallium aluminum nitride, but also the flat panel display manufacturers going to generation 8 size glass which is analogous to a California king size mattress. It requires huge amounts of ammonia gas for their silicon nitride process, but, keep in mind, these high flow rates we still have to maintain the product purity.

And speaking of purity, you mentioned earlier that this product can be available at 1 PPB, why is that type of purity required?

For the LED manufacturers, they have noted that their luminosity of the device has been impacted by oxygen-bearing compounds—moisture being the primary one. But also we're starting to get inquiries from the IC market that's looking for higher purities of ammonia as well.

You also mentioned earlier that heating the ISO is required; tell us a little bit about that.

Well ammonia was the original refrigerant before Freons had come along and, as such, has properties that require heat, as we call heat evaporation, to convert the liquid ammonia into a vapor. That requirement has to be done in energy equilibrium. Otherwise, you could have liquid phase impurities introduced into the vapor phase.

Let me explain. If you have a large energy deficit and the best way to demonstrate that would be to put a pot of water on the stove and put it on a low setting—the water would just gently evaporate, but if you put it on a high setting—you would actually get a rolling boil and if you look above that liquid, you will see little droplets of water entrained in the steam. In the case of ammonia, those liquid droplets or aerosols as we call them would contain moisture at concentrations of 100 to up 200 times higher concentration that it would be in the vapor phase—that would be very detrimental to customer's processes.

So if I come across an ISO module of ammonia and I look at the size of that module, thinking that you have to heat that big module, isn't that a challenge to heat that ISO container?

Actually Ed, we've made it easy. The design of the ISO module is such that there are 4 zones of heating each independently controlled. Actually only 3 of those zones are required for the peak flow rate of 1600 LPM, I mentioned earlier. We hold a zone of heating in reserve for the purposes of redundancy adding to the reliability of the source of supply. In fact what we're trying to do here is make sure that the right product is delivered at the right pressure and flow rates for the customer's process.

All right, we've just discussed a lot of details about ammonia ISO supply with bulk specialty gas systems. Can you summarize this for our listeners? What the benefits would be.

Well the first benefit, Ed, is the flow capacity of the ISO module being 1600 LPM. It's the only viable source package for these large ammonia requirements. Being the large economy size, 26,000 pounds of product gives the lowest cost of actual ammonia, but there is designed in reliability and consistency to ensure the flow rate and the product purity are delivered to the process tools. But last and most important, being outside the fab and with fewer ISO change outs compared to an equivalent volume of cylinders—safety is greatly enhanced.

All right, well Bob, thank you very, very much again for this information and how could people get more information on this subject?

Well Ed, they can actually contact me direct at fordrw@airproducts.com.

So once again, you can contact Bob Ford directly if you have any questions on bulk specialty gas supply at fordrw@airproducts.com. We'd like to thank you for listening today and remind you for additional information of BSGS and other subjects, please visit on or website at airproducts.com/electronics. There you can subscribe to receive other Podcasts and presentations.

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