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From: ARM, Inc. <dspohn@arminc.com>
Sent: Monday, September 26, 2016 3:16 AM
To: dspohn@arminc.com
Subject: O2 Purity, Where was Britain in 1752?, Aging Asset Options



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Innovative High Purity Gas Supply System Solutions

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Dear Dan,

Here it is September and we've celebrated Labor Day with BBQs and gatherings of friends. The 9th month of the year, and yet its name origin is old Roman Septem, or the number 7. Seems no one liked winter back then, so the Romans just left the days that are now January and February unnamed and unnoticed, making September their 7th month. Apparently they feared that if they named those months, it would give them power and they didn't like winter so why add to the misery it brought! Not surprising, given they believed Septem was ruled by the god Vulcan and expected fire, eruptions and earthquakes. If they ignored that time there was no chance a god (and they could develop nasty dispositions) could rule months of cold weather....

I was looking for interesting things that happened in September to include in this ramble and came across a little known fact: absolutely nothing happened in British history between the 3rd and 13th of September in 1752. Hmmmm, maybe the British were off, celebrating Labor Day a century or two early, or the entire country went to Spain on holiday. In reality, it is because on Sept 3, 1752 the British abandoned the Julian calendar for the Gregorian calendar and that day on the Gregorian calendar happened to be, Sept 13th.

But that's not what I wanted to talk about.....

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ARM's Signs Distributor Agreement with Yarbrough

ARM is happy to announce entering into a distributor agreement with Yarbrough Southwest Assoc. Inc. They cover the western, and Southwestern US including California, Oregon, Washington, Arizona, Nevada, Idaho, New Mexico and Texas. The Northeast including New York, Pennsylvania, Vermont and Massachusetts. They will also be distributing ARM products internationally from their location in Taiwan.

Yarbrough SOLUTIONS WORLDWIDE We are excited to be working with Yarbrough, check them out on the web at www.yswsemi.com, e-mail info@yswsemi.com.

Oxygen Use, from Antifreeze to Rocket Engines!

This month's technical article is contributed by Brian Warrick, VP of Technology at ARM Inc.

This tech brief is the second in a series focusing on how gases are produced and how purification may improve the quality or yield of products manufactured using gases.

In the last tech brief, we focused on how air is separated into nitrogen, oxygen, argon, and rare gases. In future briefs, we'll discuss argon and rare gases in more detail and then shift to hydrogen, hydrocarbon gases, and then then into more specialized gases like ammonia, hydrochloric acid, silane products, etc. If you have a specific product which you are interested in learning more about, please feel free to email or call Dan or myself and we'll write a brief based around your interests.

This month my focus is on a gas which has recently become near and dear to my heart. Following my last tech brief, I was quite surprised to learn that as a young 40 something year old both of my hips required replacement due to a genetic issue. After two surgeries and hospital stays, I now have first-hand experience of the importance of oxygen in the medical industry. Therefore, this month I will focus on the usage of oxygen beyond medical, the risks associated with oxygen and where purification is recommended.

This month's brief comes with a survey, which I would greatly appreciate you filling out and returning to us. I am currently developing purification technology which reduces nitrogen and argon from percentage and high part-per-million (PPM) levels to low/sub part-per-billion (PPB) levels. The short survey asks if nitrogen and/or argon impacts your manufacturing process in order to help us target marketplaces for this new product offering.

Oxygen Generation

Oxygen, as we covered within the last tech-brief is most commonly separated from air using membrane, pressure or vacuum pressure swing adsorption, or cryogenic technologies.

While oxygen is critical for medical applications, when handling this gas it is vital to use critical care. Personally, I prefer to work with hydrogen as opposed to oxygen. Oxygen will react with hydrocarbon residue and can be dangerous when flow changes rapidly due to adiabatic compression. Personally, I have seen pipeline explosions due to stainless steel tubing which was not properly oxygen cleaned and due to particle impingement.

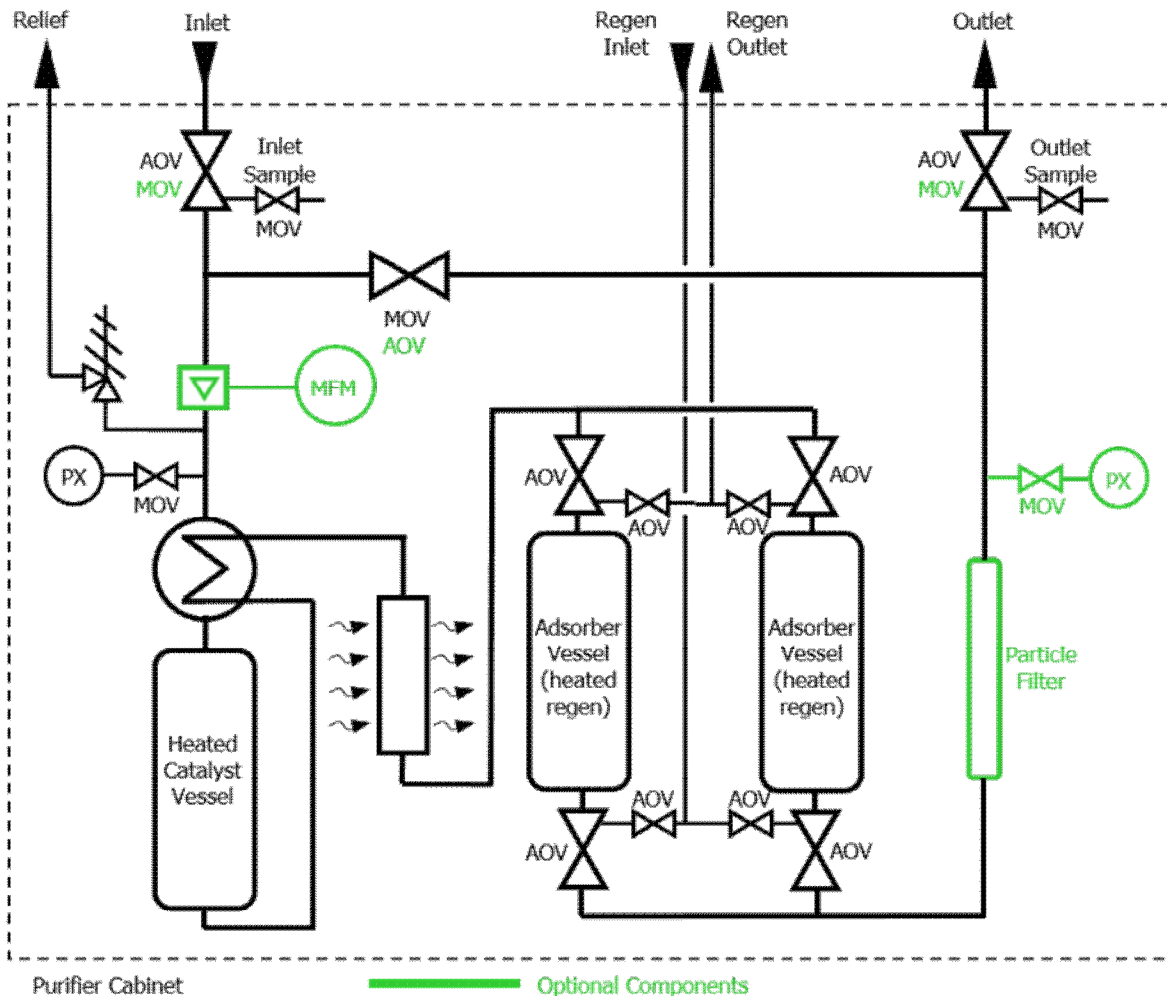
Industrial applications of oxygen are wide. A majority of oxygen production is used in steel production by reducing the sulfur and carbon content in iron alloy to create a higher purity steel. Oxygen is reacted with ethylene in the production of antifreeze and a starting block for many products we use in our daily life. Further, oxygen is used to compliment fuel sources in welding and cutting applications as well as rockets. For other 40 somethings or older, you'll remember Challenger. On another personal note, I was in high school when the accident occurred and a teacher from my little high school in Colorado had been a finalist to make the ride that disastrous day.

On a smaller scale, oxygen is used in the production of many specialty gases, photovoltaic devices, home lighting, and microelectronics. Most everyone knows that your smartphones contain high-tech micro electric devices, but many of the integrated circuits produced around the world are used in more boring, larger linewidth applications in our everyday life. The computers in your car may not be state of the industry, but still require the use of oxygen during production. Even that electric knife you use once a year to carve the thanksgiving turkey has an integrated circuit which required high purity oxygen.

How is Oxygen Purified?

If you recall from the last tech brief, oxygen may be separated cryogenically from air and the purity depends entirely on relative boiling points of oxygen and other constituents within air. For oxygen production, it turns out that hydrocarbons, argon, and to some extent nitrogen will be present within oxygen. If you were to order semiconductor grade argon or nitrogen, the purity would be in the range of 5N, but with oxygen, it's in the range of 2N5 or 99.5% pure. That's quite a difference. Oxygen purity depends upon the ASU design and in many cases, the oxygen may contain percent to high PPM levels of argon and nitrogen and low PPM of hydrocarbons (primarily as methane (CH₄)). In many applications, the presence of inert and rare gases has little to no impact on production and yield. However, for some industry leading production methods, the presence of these impurities directly impacts device performance and/or yield.

Traditional oxygen purification is accomplished by passing impure oxygen through a heated precious metal catalyst in which the hydrocarbons, hydrogen, and other carbon containing compounds are converted to moisture and carbon dioxide. This hydrocarbon pure gas then passes through adsorbents which further reduce the remaining contaminants to PPB/PPT levels. ARM offers a wide range of solutions to purify your oxygen to whatever impurity level is required.



Now, back to the inert and rare gases. Presently, there is no commercial, large scale purification technology for reducing these impurities. For users who require this extremely ultra-high purity gases, they rely on gas suppliers who use distillation methods to create rare gas free oxygen. Such plants are few and far between and as a result, end users may face costs well in excess of \$10 per hundred CF.

ARM has developed purification technology which reduces nitrogen and argon content via a device located downstream of your on-site oxygen storage tank. Using this innovative technology, industrial grade oxygen can be purified to 7N or higher.

At the beginning of this brief, I noted a questionnaire was included. ARM would greatly appreciate you time to answer the following questions in a return e-mail to bwarrick@arminc.com

1. Do you require oxygen at a purity greater than 2N5 (99.5% pure)?
2. What is your oxygen purity requirement?
3. Do you require removal of inert (N₂) and rare gases (Ar)? If so to what levels?
4. What is your industrial marketplace?

Latest Installation & Start-up!

ARM is completing a job that includes a couple of high purity subsystems along with an O2 purifier.

The purifier is being refurbished under ARM's "Tech Refresh" program. Tech Refresh is an option ARM offers in-lieu of purchasing a totally new purifier. The O2 purifier for this customer is an existing SAES model PS6-MG60 ARM acquired in an asset purchase in the past.



A "Tech Refresh" typically keeps the hard components like high purity stainless steel vessels, plumbing, valves etc. An evaluation of the product life cycle of the hard components is conducted and if required obsolete components are also replaced.

ARM's Advantage Series control and instrumentation package is then installed. The Advantage Series control and instrumentation includes an Allen-Bradley PLC and touchscreen HMI, all software and any instrumentation hardware to implement the fully automated process control program. Once implemented the customer has 3 levels of access, "Operator", "Technician" and "Engineer", that allow full access at the appropriate level for operation, maintenance and if required/desired adjustment of process control parameters such as operating/regen temperatures, times, and alarm set points.



The benefit of a "Tech Refresh" versus a new bulk purifier include lower cost and quicker turn around. Assets for the ARM Tech Refresh option can be pre-owned ARM inventory, an existing asset that can be sent to ARM for refurbishment, or an asset that is acquired from a third party.

If you have such an asset, or the need for purification but not the budget for new, send us an [e-mail](mailto:sales@arminc.com) or call 719-538-5959. We can provide a ROM price based on the make and model to help you decide to pursue Tech Refresh or a new purchase.

Also part of this job is a Transfer Hose Docking Station, providing a continuous purge of a permanently installed liquid gas transfer hose. Use of the transfer hose docking station provides improved cleanliness as the continuously purged transfer hose will not introduce atmospheric contaminants that a truck hose can, and it reduces particulate generation that can end up in the tank.

Fabricated from stainless steel this component can easily live in any environment with little to no maintenance required. If your facility leases the tanks from the gas supplier, and this is of interest, pass on this newsletter to your gas supplier and have them contact ARM at sales@arminc.com. If you own your tank contact ARM direct and we can provide a quote.



Completing the order is a Pressure Control and Filtration Module. This module is designed for gas pad installation in an unprotected environment. The facility where this will be installed has 2 liquid tanks now and 2 vaporizers, the dual path with included automated valves and PLC controlled switch-over, allows for uninterrupted gas flow during peak demands. The parallel path design also provides redundancy and eliminated downtime for routine servicing such as filter cartridge replacement. Electrical controls are housed in a suitably rated NEMA enclosure integral with the stainless steel structural tube frame.

ARM's is much more than a supplier of point-of-use purifiers, our skill and experience covers all aspects and equipment from the gas source to the gas use point. Send us an [e-mail](mailto:sales@arminc.com) or call 719-538-5959 for additional information on these or any of ARM's UHP solutions.

Thanks for reading this far!

We understand that there is very little time in the day to read all the newsletters that make it to your inbox. We will strive to not be 'that company' spamming the world with useless information seemingly every other day for no better reason than some webinar told them that is what they should do.

As noted above if you opt out we will honor your request. If you do tho, you may want to like us on Facebook or follow us on Linkedin so you can keep your inbox clear, but still keep in touch with what is going on with ARM Inc. in the gas world.

Sincerely,

Dan Spohn
ARM, Inc.



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