Dan Spohn

From: ARM, Inc. <dspohn@arminc.com>
Sent: Friday, September 29, 2017 11:05 AM
To: dspohn@arminc.com
Subject: Coincidence (a funny word)? Xe Purifier readies to ship

Advanced Research Manufacturing 719-538-5959
Innovative High Purity Gas Supply System Solutions

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Dear Dan,

We are well over half way through the year and what do we know about the 17th year of the 3rd millennium, the 17th year of the 21st century and the 8th year of the current decade. Hmm, add that up (17+17+8) and you get 42, remember that.

If you write it out with old Roman numerals 2017 is MMXVII. M is the 13th letter of the alphabet, X is the..... never mind we won't go down that rabbit hole.

Let's spark up the way-back machine and see if we can come up with some interesting coincidences that might help explain our modern times....

Looking back 100 years, 1917 was the start of the 28th POTUS Woodrow Wilson's first term (he was a two termer). 2017 was the start of the 45th POTUS Donald Trump's first term (don't get excited, I'm making no predictions....)

"Woodrow Wilson" has 13 characters using 8 different letters, added together equals 21. He was born in 1856, 1 + 8 + 5 + 6 = 20. His opponent was "Charles Hughes", 13 characters using 9 different letters, added together equals 22.

"Donald Trump" has 11 characters using 10 different letters, added together equals 21!! He was born in 1946, 1+9+4+6 = 20!!! His opponent was Hillary Clinton born "Hillary Rodham" which has 13 characters using 9 different letters, added together equals 22!!!! Coincidence???

Now add "Woodrow Wilson" at 21 and "Donald Trump" at 21 you get 42!!!!! (see paragraph 1).
And who was the 42nd POTUS? Ha - Clinton!!!!
But that's not what I want to talk about....

In this issue.....

Purification Technologies: Pros - Cons - Comparisons

It's All About the Bonds.....

Have you ever wondered why a purifier search from an on-line chemical supplier offers purifiers with media X, while your industrial gas or purifier supplier recommends media Y? Purifier media selection is driven by the list of impurities removed, the main gas mixture, level of impurity in the supply and discharge streams, flow rate, pressure, etc.

The reality is that there isn't a universal purifier media, and you will benefit from discussing your gas purity requirements with a qualified supplier. It's like going to the store to buy a pair of pants. Gone are the days of just buying a pair of Dockers. There are skinny pants, relaxed fit, pants with elastic, and who the heck knows what classic fit is. And if you order online, you take the risk that when your pants are delivered, they don't fit. The same holds true for purifiers except you can't tell if you picked the right technology by taking a quick look in a mirror. With purifiers, it's all about how impurities are bonded to, or trapped by the purifier media.

Your supplier will begin by asking for the application specific information, as above. The recommended purifier's construction will then vary from a simple see-through tube with compression fittings, to an Aluminum housing, to an all welded Hastelloy (nickel alloy), Monel (nickel-copper alloy), or varying grade of Stainless-Steel vessel with high purity face seal fittings. Media enclosed within the housing is application specific and can consist of meso/microporous minerals (sometimes noted as zeolites), to high surface area metal on an organic or inorganic support, to exotic metal alloys.

As an example, let's consider the case of a helium carrier gas for gas chromatography applications. Depending on the detector used, carrier gas purity requirements may vary from PPM levels of moisture to removal of inerts, hydrocarbons, oxygen containing compounds, etc. to sub-PPB levels. For moisture removal, a glass tube containing a zeolite or other color changing material may be sufficient, but for low-PPB level removal of multiple gaseous species, one of more metals may be required, as well as operation at an elevated temperature.

Let's assume a FID application, which requires pure air. In this case, your supplier may recommend a heated catalytic media, which resides on an inorganic support to strip any carbon containing impurities from the air source. For the FID carrier, the recommendation may include a lithium, nickel, or other metal on a zeolite support. These media can be effective in reducing oxygenated impurities from the carrier gas.

When considering a DID application, the carrier gas may need to be nitrogen free. To reduce the nitrogen impurity from a helium carrier gas, a metal alloy is typically used. These metal

alloys operate at an elevated temperature (typically > 300°C) to efficiently reduce nitrogen and most gaseous impurities to sub-PPB levels.

What are the advantages and risks of different media? The tables below provides a comparison of advantages and disadvantages of each media category. Within each category, there are many choices of media and each has its own operating conditions. The information within this table is generic and in general applies to materials in each category.

Media	Features/Benfits	Typical Gases Purified						
		Ar	He	Kr	Ne	Xe	N2	H2
Zeolite	Relatively inexpensive High capacity Ambient temp Operation Regenerable	X	X	X	X	X	X	X
Metal on Support	Moderate cost Ambient temp operation Wide variety of gases purified Regenerable (based on support)	X	X	X	X	X	X	X
Metal Alloys	Relatively expensive Elevated temp operation High capacity Finite lifetime, non regenerable	X	X	X	X	X		

Media	Typical Impurities Removed								Risks/Concerns
	CO	CO2	H2	O2	H2O	N2	NMHC	THC	
Zeolite					X				Fairly inert, not much concern
Metal on Support	X	X	X	X	X		X		Possible exothermic reaction with high inlet O2 levels Outgassing from support if overheated during regen
Metal Alloys	X	X	X	X	X	X		X	Possible exothermic reaction with high inlet of certain reactive impuriies

NMHC - Non Methane Hydrocarbons THC - Total hydrocarbons

To point out the obvious, zeolites while inexpensive typically only adsorb or trap water molecules. Metal on support can remove many of the typical contaminants, but the do not remove light hydro-carbons or nitrogen. Metal alloys while typically more expensive, and probably come with the most concerns, also remove the most impurities.

Important to note: the data presented above is general and typical, but is not all things to all gases and all impurities. It is still highly recommended to discuss your particular application with your purifier specialist or supplier to assure you don't confuse 'classic fit' with 'relaxed fit'.
The link to our purifier information form is below, it outlines the information typically required to accurately recommend 'fit'.

Purifier Information Form

ARM Completes Xenon Purifier

ARM has completed testing, as is readying for shipment a multi-technology Xenon purifier. Designed to meet customer supplied specifications it utilizes multiple catalyst vessels and adsorber vessels (5 vessels in all) and includes real time O2 level monitoring.

Cabinet 1 (leftmost) houses the inlet valves, Xe purge plumbing, sample points, PLC and control hardware, and the inlet O2 level real time monitoring. Cabinet 2 houses the 3 heated catalyst vessels. Cabinet 3 houses a couple of ambient temp vessels and valves for catalyst vessel regeneration.

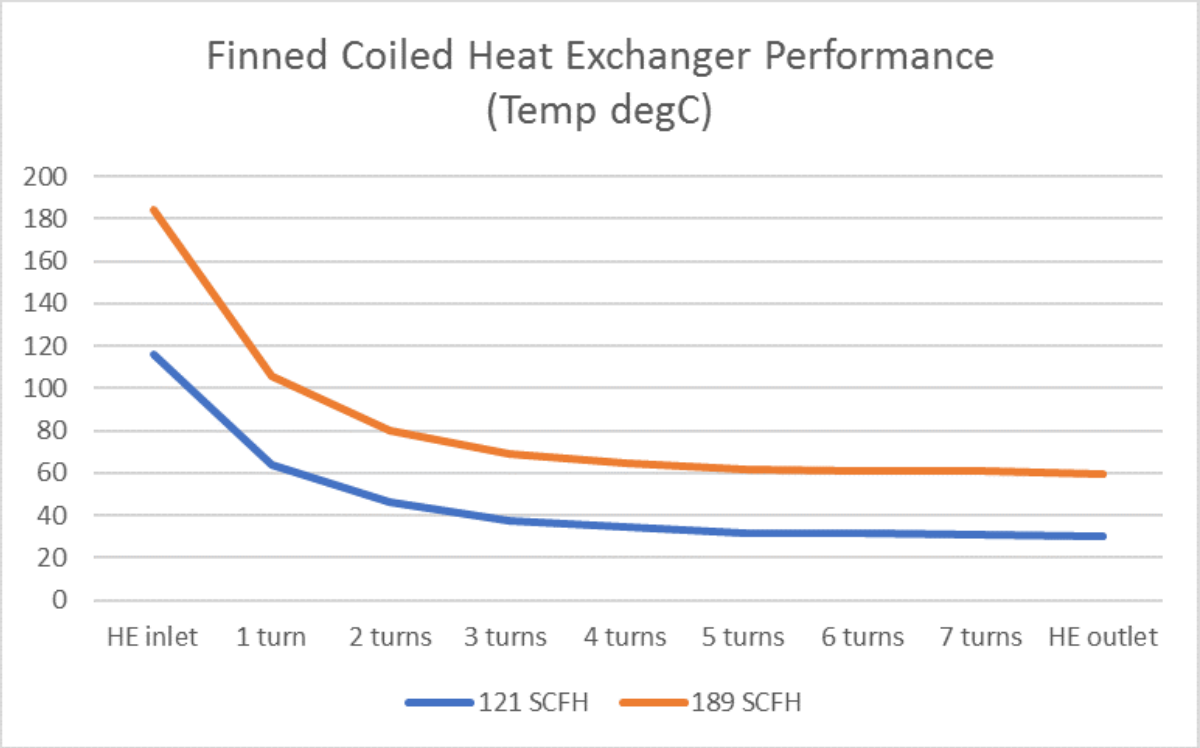
As 2 of the 3 catalyst vessels operate at temperatures well beyond what is typical for heated catalyst purifiers, ARM used Thermco furnaces and standard Thermco controls to maintain operating temperatures. Note the cooling coils between cabinet 2 and 3, theses were highlighted in the last newsletter (test data is presented in the article below).

The purifier removes SF_6, CF_4, C_2F_6, H_20, hydrocarbons, H_2, and CO_2 at a nominal flow of 25 CFH, up to 90 CFH max. Lifetime expectation of the non-regenerable vessel is 4 years of 24/7 operation at 90 CFH and 100 ppm inlet impurity load.

If you have need for purifying Xenon or any other Rare gas, contact ARM with your performance specifications and we will be happy to quote a solution.

New gas cooling design from ARM, Inc.

As promised in the last newsletter, basic test data for the cooling coils pictured is below.



The testing was limited by the lower design flow rate of the Xenon purifier described in the previous article, and having to use Argon for the testing. We did blend the Argon with Helium to improve convection heat transfer, but even at max flow the highest temp going into the cooling coils was only a little over 180 degC.

Still, the data shows that the first three turns account for a little over 90% of the total cooling at 189 SCFH, and nearly 100% of the total cooling at 121 SCFH. We are excited about the performance and now have an affordable air cooling solution that does not require forced air flow.

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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