

Dan Spohn

From: ARM, Inc. <dspohn@arminc.com>
Sent: Wednesday, July 20, 2016 10:14 AM
To: dspohn@arminc.com
Subject: Face seal fittings, how tight is tight?



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

[Website](#) | [About](#) | [Bulk Solutions](#) | [Industries](#) | [Standard Products](#) | [Service/Maintenance](#) | [Contact](#)



Dear Dan,

Wow, where did the year go? The last issue was in August and here its November already.

With Thanksgiving this month I thought I'd do a little research and answer a question that has come to mind more than once. What is a Cornucopia?

Second only to the the Turkey as a symbol of Thanksgiving, is the Cornucopia! Interesting horn shaped basket full of fresh edibles representing a bountiful harvest. The origin of the Cornucopia I found out comes from mythology. Although there are many origin stories, the best-known is that of baby Zeus being cared for by the goat Amalthea, the Nourishing Goddess, while hiding from his father Kronus. Baby Zeus supposedly broke off one of Amalthea's horns, which then had the divine power to provide unending nourishment. As we approach this very American holiday I wish all enough of whatever you need.

[What's new?](#) [Major projects in process.](#) [High purity face seal fittings, what's the big deal?](#)

What's new?

Purity Testing

Purifiers typically do not include on board continuous purity analysis capability. Determining when vessel regeneration or replacement is required is usually a calculation based on the gas inlet impurity and the totaled flow through the purifier. Gas inlet impurity can vary depending on the gas source, and flow rate changes with production demand impacting total flow through the purifier. A flow totalizer would be ideal to accurately define the total flow number in the calculation. Without a totalizer, determining when to regenerate or replace a purifier vessel can be a guess at best. What do you do when your purifier has been in use for years and you are not sure of its effectiveness? Test a sample!

ARM Inc. offers analytical services that are cost effective and can definitively answer whether your purifier is a purifier or just a pressure drop in your gas line. Let us know the gas you are purifying and the source of the gas, and we can determine which impurity will likely be the first to break through. We can send a sample cylinder complete with instructions on how to collect an uncontaminated sample. With that sample back in our lab we can analyze for a specific break through impurity or do multiple impurity analysis and provide a written report of the results. Knowing that your purifier is still performing provides peace-of-mind in keeping production running at full speed.

Major Projects in Process

High Pressure Hydrogen

We are currently working an order for a high pressure (2700 psi) bulk Hydrogen purifier for a bottle filling application.

Flow Test Panel

This is a build-to-print order for a flow test panel involving valves, mass flow controllers, high purity piping assemblies, and other components for up to 6 gas streams Housed in a NEMA type wall mount enclosure.

If you have similar requirements and you would like to discuss, give us a call or drop us an e-mail.

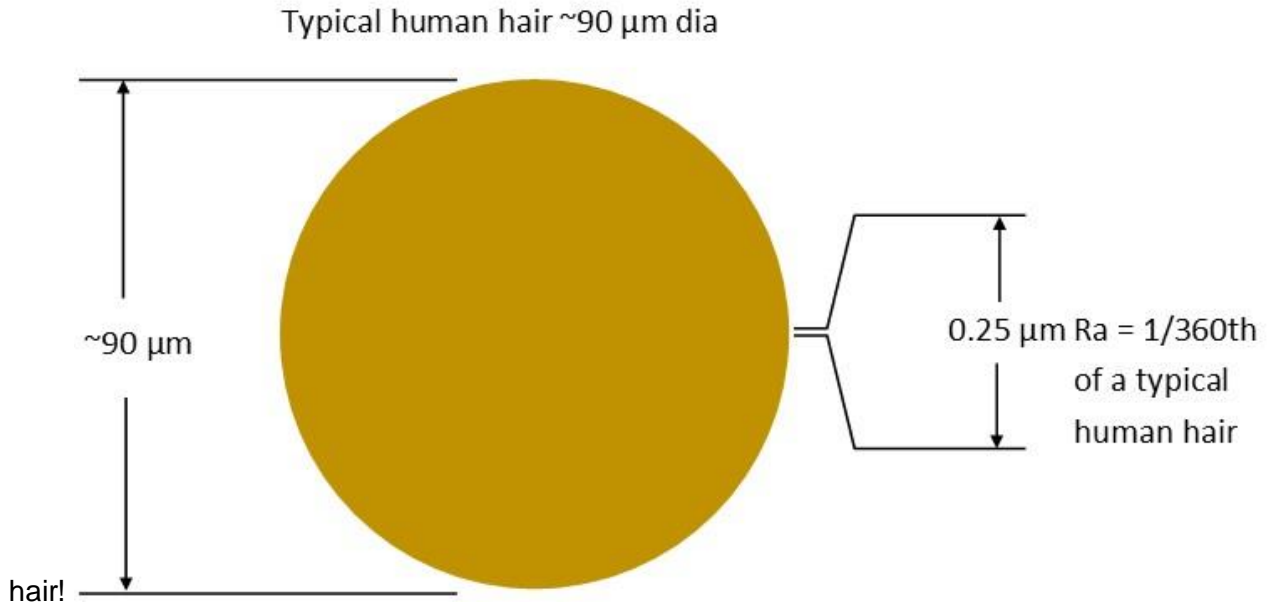
High purity face seal fittings, how tight is tight?

A purifier with every component and all plumbing sections welded together would provide the best assurance of purity from the supplier's factory to the end use, but it would dramatically increase the cost of maintenance such as replacing a failed component or spent purifier vessel. To accommodate servicing the various components in high purity applications face seal fittings are used with any component that may for whatever reason need to be removed for service or replacement.

A face seal connection consists of two fittings with toroidal seal rings machined into the face of the fittings, and male and female nuts that provide the sealing force between the toroidal seal rings and the flat metal gasket positioned between them. Unlike typical elastomeric O-ring seals that rely on the softness of the o-ring to fill scratches in the sealing surfaces, the face seal design works because of the precision machining used to fabricate the fittings and the surface roughness of the toroidal seal rings in the face of the fittings.

The roughness of a surface is typically defined by the term Ra. As described in ASME B46.1, Ra is the arithmetic average of the absolute values of the profile height deviations from the mean line, recorded within the evaluation length. Simply put, Ra is the average of a set of individual measurements of a surface's peaks and valleys.

A face seal fittings' toroidal seal ring is machined and electro-polished to a surface roughness Ra of 0.25 micrometers. So how deep is a .25 micrometer "scratch" in the sealing surface? An average human hair is ~90 micrometers in diameter. A 0.25 micrometer "scratch" in the surface is ~1/360th the diameter of a human



You would not be able to detect a "scratch" that shallow with the naked eye, let alone by running your fingernail across it. A molecule of N₂ is slightly larger than O₂ but both are close to 0.0003 micrometers in diameter. This means that the diameter of a N₂ or O₂ gas molecule is only ~1/1000 the depth of an average acceptable "scratch" in a 0.25 micrometer Ra finish.

So what does all this mean? A typical manufacturer's spec for leak rate of properly assembled metal gasket face seal fitting is 4×10^{-11} standard cc/sec of Helium, the smallest gas molecule. Leak rates for N₂ and O₂ would certainly be less due to being larger molecules. The typical recommended tightening for face seal fittings using stainless steel or nickel gaskets is to tighten the nut to finger tight, then with wrenches tighten an additional 45 degrees or 1/8 a full turn. The surface roughness (or smoothness might be a better way to describe it) of the sealing surfaces of face seal fittings and gaskets is paramount to making a leak tight seal. Care must be exercised to protect the sealing surfaces (both the fittings and gasket) from damage. When installing gaskets and making face seal connections, take care to avoid particulate contamination on the sealing surfaces. Particulate during gasket installation can make an indentation in the sealing surface, and can lead to failing a pressure decay test, which could lead to over tightening the nuts causing yet further damage. Particulate present may not cause a leak initially, but if the gasket is ever replaced, any indentation it leaves in the sealing surface may prevent a leak tight seal with a new gasket. If removing a component it is best practice to protect any exposed face seal fitting with a new gasket and mating blank fitting tightened per the manufacturer's recommendation. If that is not possible, using aluminum foil and/or a plastic dust cap will afford some protection.

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.



SUBSCRIBE TO LIST

FORWARD EMAIL

Copyright © 2015. All Rights Reserved.

ARM, Inc., PO Box 60518, Colorado Springs, CO 80960

[SafeUnsubscribe™ {recipient's email}](#)

[Forward this email](#) | [Update Profile](#) | [About our service provider](#)

Sent by dspohn@arminc.com in collaboration with



Try it free today

THIS IS A TEST EMAIL ONLY.

This email was sent by the author for the sole purpose of testing a draft message. If you believe you have received the message in error, please contact the author by replying to this message. Constant Contact takes reports of abuse very seriously. If you wish to report abuse, please forward this message to abuse@constantcontact.com.