



# Technical Bulletin

by *The Purification X-pert*™ MICHAEL CASEY II

## ZERO AIR

### *Implementing Adsorption Technology To Produce Hydrocarbon Free Air*

Mixed gas diving is surfacing throughout the sport diver community and a fury of questions have been rising with it. Often, there are no pat answers for these curiosities and the craftsmen of the movement are just as bewildered for lack of defined instruction. Because of my involvement with purification products I am always being fielded with the “can we” questions at the air blending stage.

So, equipment and procedures aside, the focus here will be on the acceptance of enriching air (made by OIL LUBRICATED compressors which are already in place for standard diving air) with compressed oxygen. It is my opinion that this concept is viable, practical, and insurable yet there are precautions to be heeded. As you all know, petroleum products (A.K.A. Condensable hydrocarbons) will promote ignition or even explosion when encountering concentrated oxygen. In trace amounts, however, these hydrocarbon molecules pose an insignificant threat. The ACCUMULATION of these trace hydrocarbons in orifices along the air path do cause potential problems OVER THE COURSE OF TIME.

Reducing this potential seems to be a matter of effective Education on purification processes, installation of the Correct Equipment, careful monitoring of the results, constant Testing of the effectiveness, and meticulous Maintenance of the apparatus. The value of each of these subjects should not be underestimated.

Lets start with your education. An elementary beginning to the purification process might read like this, “The removal of contaminants from a compressed air (or gas) boils down to a means of squeezing it through a series of holes which are smaller than the selective contaminant”. There are many

approaches and levels of effectiveness to this end. Among them are coalescing, micronic filtration, and the heart of the process which is Adsorption.

#### *A) Coalescing*

Is a mechanical means of separating heavy fluid droplets from the compressed air stream. Usually, a porous barrier is placed in the flow path where it can abruptly and turbulently change the air pattern. This causes the heavier particles to be “thrown out” and impinge into the barrier. Effectively, this could remove 98% of the liquid substances including Condensable hydrocarbons. Coalescing is always the first stage of purifying air from an oil lubricated compressor.

#### *B) Micronic Filtration*

It deals with the removal of particulate matter from the air stream. These particles originate from many sources including dusting from the filter media themselves. The objection to the passing of these contaminants is obviously more mechanical in nature than for health reasons. Guarding your air quality is accomplished by sifting it through Micronic Barriers placed throughout a well balanced system.

#### *C) Adsorption*

It solves the balance of the contamination factor which only represents 2-10% and yet is the most critical. The adage applies, 80% of the effort goes to 20% of the problem.

Here, we get to the heart of this article. ADSORBENT MEDIA! You are familiar with this stuff, you’ve been using it for years, right? Charcoal, Alumina, and Desiccant. Simple

stuff, right? WRONG. In light of the many strains, qualities, grades, sources, and specialty adsorbents available today we have to look to the experts for direction on their best usage. The best source of information I have found has come from the laboratory at Lawrence Factor, Inc. whose ongoing research in this area is at the forefront of purification technology. Their testing has proven that adsorption techniques can get quite sophisticated and that it is also possible to produce virtually contaminant free air from oil lubricated compressors. They call this product "Zero Air". A word of caution: This is not a magic pill to cure our needs. These techniques combined with METICULOUS maintenance of your system are the key to success.

Counted among the recommended adsorbents are Molecular Sieves and Activated Carbon. These are most commonly used in hydrocarbon adsorption. Each, as noted earlier, is available in many grades and strains and when combined in various proportions and configurations will produce equally various results. In addition, the folks at

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Lawrence Factor claim that they have discovered some new adsorbents along with experimental approaches to their use. These products hold great promise in producing hydrocarbon free air.

Handling and implementation of adsorbents is an exacting science and requires sophisticated dispensing equipment as well as stringent quality controls. Without this knowledge and equipment, the media stands to become tainted with outside contaminants long before it ever reaches the purification system. This is a good reason to stick with professionally made and packaged cartridges. And, when it comes to hydrocarbon free air, it's an especially good reason to stick with professionally made cartridges.

The first requisite in installing a "Zero Air" system is to measure the average air quality produced by your existing compressor. This can be accomplished with the help of a competent lab. Again, the guys at Lawrence Factor have been instrumental in helping on this level since they maintain one of

the most sophisticated labs of this nature in the country. Experience has proven that an astounding 95% of all breathing air contains some level of volatile hydrocarbons and oil droplets. And remember, any amount more than zero has the potential to accumulate over time into a literal ticking bomb. These levels will show up in your air analysis. Given that these conditions remain consistent with some assurance and based on these results, a second stage "Zero Air" filter system is installed on a dedicated branch of your airline. This is the point at which you tap off a supply of hydrocarbon free air for use in your blending operation.

Since this approach is heavily dependent on meticulous maintenance and constant monitoring a critical human error factor enters the picture. Reducing the chance of mishap could be improved by adding electronic alarms to the system. Some other suggestions include a program of system breakdown and cleansing, enrollment in an air quality analysis program with an accredited lab, and installation of proper equipment. One of the loudest warnings heard (even though it seems counter economy) is, "DO NOT ROTATE CARTRIDGES". The explanation is that while the adsorbents effectively trap hydrocarbons they do have a higher affinity for other substances. So, if a partially contaminated cartridge is moved to a position further ahead in the air stream it stands to become overloaded and release hydrocarbons back into the airstream in favor of some other substance. Uh Oh!

This subject is much broader than my space allotment here. For details and advice on installing a "Zero Air" system I suggest contacting a professional organization who is involved in compressed gas purification. Several exist but I know that Lawrence Factor offers a complimentary Tech Line and has an eager staff willing to answer your questions. Contact them at: (305) 430-0550 or 4740 NW 157th Street, Miami Lakes, FL 33014

*Michael Casey II is an independent technical representative who has been active in the field of compressed gas filtration. His expertise comes from many professional associations within this field.*

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4740 NW 157<sup>th</sup> Street, Miami Lakes, FL 33014  
Phone: (305) 430-0550 Fax: (305) 430-0864  
email: L-factor@ix.netcom.com  
web page: www.lawrence-factor.com  
800-338-5493