Clean Dry Compressed Air

The Myths Surrounding Oil Free Compressors

Compressed air users are often convinced to install oil free compressors in place of their oil lubricated counterparts on the grounds of improved air quality and reduced costs for purification equipment and maintenance. Parker domnick hunter dispel the myths surrounding oil free compressors and the quality of compressed air they deliver.

Compressed air is not without its problems, with all systems suffering from performance and reliability issues. Most of these issues can be directly related to contamination in the compressed air system and not solely to the type of compressor used.

Myth 1 - The air compressor is solely responsible for contamination in the compressed air system.

In a typical compressed air system, compressed contamination comes from four different sources, these being:

- **Source 1 - Atmospheric Air**

Air compressors draw in huge amounts of atmospheric air, which continuously fills the system with contaminants such as water vapor, micro-organisms, atmospheric dirt & oil vapor.

- **Source 2 - The Air Compressor**

In addition to the contaminants drawn in through the compressor intake, the compressor also adds additional wear particulates from its operation. Additionally, oil lubricated compressors carry over liquid oil, oil aerosols & oil vapor from the compression process. Once through the compression stage, the after-cooler will also condense water vapor, introducing it into the compressed air in both a liquid and aerosol form.

- **Source 3 - Compressed air storage devices**

- **Source 4 – Compressed air distribution piping**

The air receiver (storage device) and the system piping that distributes the compressed air around the facility both store large amounts of contamination. Additionally, they cool the warm, saturated compressed air which causes condensation on a large scale, adding liquid water into the system. This saturated air and liquid water leads to corrosion, pipescale and microbiological growth.

Myth 2 - Oil free compressors provide contaminant free air.

Generally, there are ten contaminants found in a typical compressed air system that need to be removed or reduced for the system to run efficiently.

The ten contaminants are:

- **Water Vapor**
- **Atmospheric Dirt**
- **Liquid Water**
- **Rust**
- **Oil Aerosols**
- **Oil Vapor**
- **Microorganisms**
- **Liquid Oil**
- **Water Aerosols**
- **Pipescale**

Only two of these contaminants, liquid oil and oil aerosol are introduced by a lubricated compressor. The purification equipment required to reduce, or remove the remaining contaminants by virtue of their operation also remove liquid oil and oil aerosols. Therefore regardless of the type of compressor installed, the same level of purification equipment is required.

Myth 3 – Oil free compressors don't need purification equipment.

One common practice when installing an 'oil free' compressor is to omit some or all of the downstream filtration.

Purification equipment in a compressed air system will typically incorporate a dual filter set-up and it is often believed that one of these filters is a particulate filter and the other is an oil removal filter.

The two filters used are coalescing filters, and are actually the most important pieces of purification equipment in the system as they remove many different contaminants (Water Aerosols, Oil Aerosols, Atmospheric dirt, Microorganisms, Rust & Pipescale).

Both filters perform the same contamination removal functions; however they do so to differing levels of filtration. The first filter is a 'general purpose filter' which protects the 'high efficiency filter' from bulk contamination. This dual filter installation ensures a continuous supply of high quality compressed air with the additional benefits of lower operational costs and minimal maintenance compared to a single high efficiency filter.

Myth 4 – Oil free compressors do not use oil.

By design, oil free compressors do not use oil in the compression chamber and therefore oil does not contact the air being compressed. Oil is however used for the lubrication of moving parts and cooling of the machine. Typically oil-free compressors will utilize elaborate and complicated sealing systems to prevent the lubricating oil from entering the compressed air, however should the sealing mechanism fail, then there is the possibility of oil entering the compressed air system.

On certain designs, care must also be taken regarding the location of the compressor intake to prevent the ingesting of oil aerosols & vapor from the crankcase breather.

Myth 5 – Oil free compressors provide compressed air ISO8573-1:2001 Class 0.

ISO8573-1:2001 is the latest revision of the International Standard for Compressed Air purity. The standard provides differing classifications for air purity dependent upon the quantity of solid particulate, water and oil contamination present in a cubic metre of compressed air. Class 0 is the most stringent of the classifications and many compressor manufacturers claim oil free compressors are compliant with Class 0.

Class 0 is often misinterpreted as meaning zero contamination or contaminant free air. The following important points must be noted regarding Class 0:

- **Class 0 does not mean zero contamination.**
- **Class 0 requires the user and the equipment manufacturer to agree to contamination levels as part of a written specification.**
- **The agreed upon contamination levels for a Class 0 specification should be within the measurement capabilities of the test equipment and test methods shown in ISO8573 Pt 2 to Pt 9. If not, agreement is required on test method to be used and the accuracy of the method / equipment.**
- **The agreed Class 0 specification must be written on all documentation to be in accordance with the standard.**
- **Stating Class 0 without the agreed specification is meaningless and not in accordance with the standard.**
- **A number of compressor manufacturers claim the delivered air from their oil-free compressors is in compliance with Class 0. If the compressor was tested in clean room conditions, the contamination detected at the outlet will be minimal. Should the same compressor now be installed in typical urban environment, the level of contamination will be dependent upon what is drawn into the compressor intake, rendering the Class 0 claim invalid.**
- **A compressor delivering air to Class 0 will still require purification equipment in both the compressor room and at the point of use for the Class 0 purity to be maintained at the application.**
- **Air for critical applications such as breathing, medical, food, etc typically only requires air quality to Class 2.2.1 or Class 2.1.1.**
- **Purification of air to meet a Class 0 specification is only cost effective if carried out at the point of use.**

Myth 6 – Oil free compressors guarantee oil free air.

Atmospheric air typically contains between 0.05 ppm and 0.5 ppm of oil vapor from sources such as car exhausts and industrial processes. Oil free compressors use large quantities of atmospheric air containing oil vapor which can cool and condense in the compressed air systems. The use of oil free compressors does not guarantee oil free air.

Myth 7 – Oil Free Compressors lower overall cost of ownership.

It is often stated that using an oil free compressor reduces the users overall cost of ownership as costly filters can be eliminated, as is the need to change filter elements. System pressure losses are also slightly reduced, again lowering costs.

As purification equipment is based upon the contaminants entering through the compressor intake and contaminants added by the compressor and rust and pipescale in the compressed air system, no matter what type of compressor is installed, the same level of purification equipment is required. This negates the argument of lower overall cost of ownership.

Typically the purchase price of an oil free compressor is 45% – 50% higher than that of an equivalent lubricated compressor. Maintenance of the air end is generally more frequent than lubricated equivalents, and in some models, complete replacement of the air end is required after only a short number of years, which actually increases the overall cost of ownership significantly.

Myth 8 – Oil Free compressors with built in zero purge adsorbent dryers provide the same dewpoint as stand alone dryers.

Certain models of oil free compressor can be supplied with an integral zero purge adsorbent dryer, often at a significantly reduced cost compared to a stand alone unit.

Typically these dryers utilize the principle of "Heat of Compression" to regenerate the desiccant material. This often requires the compressor to work at full duty in order to regenerate the adsorbent material. If the compressor does not work at full duty, the adsorbent is unable to regenerate, resulting in fluctuating dewpoint's.

Typically the dewpoint associated with this type of dryer is dewpoint suppression i.e. the dewpoint of the air is suppressed a given number of degrees below the dewpoint of the air entering the dryer and as stated above, this fluctuates depending upon compressor usage.

Stand alone dryers are sized based upon worst case conditions of minimum inlet pressure, maximum temperature and maximum flow rate and will typically be selected to provide a pressure dewpoint of -4˚F, -40˚F or -100˚F (-20˚C, -40˚C or -70˚C), in-line with the requirements of ISO8573-1:2001. A constant pressure dewpoint of -14.8˚F (-26˚C) or better will inhibit the growth of microorganism within the compressed air system, therefore a PDP of -40˚F (-40˚C) is typically used in many applications, often beyond the capabilities of dewpoint suppression dryers.

Myth 9 – Oil Free Compressors provide Zero risk of contamination.

As contamination in a compressed air system comes from four different sources and not just the air compressor itself, an oil free compressor does not provide contaminant free air. This negates the argument for zero risk of contamination.

Myth 10 – Oil free compressors are the only type of compressor that should be used in the food industry.

The only standard currently in use world-wide relating to the quality of compressed air for use in the food industry is the BCAS Code of Practice for Food Grade Compressed Air.

The Code of Practice states:

- **Where lubricated or oil-injected compressors are in use and non-food grade oil is used and the HACCP process identifies a risk then the oil shall be replaced with food grade oils in-line with the procedures identified in the EHEDG Document 23**
- **Where oil-free compressors are used no lubricant is involved in the compression process therefore the procedures identified in the EHEDG Document 23 will not be required**
- **Oil free compressors that employ lubricants in those parts not involved in the actual compression of the air will still be subject to the HACCP process to determine the risks if any to the food production process**

Myth 11 – Oil free compressors are more environmentally friendly than lubricated machines.

Oil vapor drawn into the intake of an oil free compressor can condense into liquid oil that can mix with condensed water in the compressor, producing compressor condensate. It is the responsibility of the compressed air user to identify the legal requirements for oil in water discharges in their country and comply with those requirements, disposing of oily compressor condensate in a legal and responsible manner. Depending upon the discharge limits and the volume of oil vapor in the atmospheric air, the use of an on-site oil / water separator may also be required on oil free compressor installations.

Myth 12 – Filtration performance drops off as temperature increases, therefore oil free compressors should be used as they are unaffected by temperature.

Most manufacturers of purification equipment state filtration performance in accordance with the ISO8573 reference conditions of 68˚F (20˚C) and the performance of this filtration is affected by temperature; however oil vapor removal systems are sized based upon inlet temperature and oil vapor content, ensuring outlet air quality significantly better than ISO8573-1:2001 Class 1 for oil.