Fluid Metrics Compressor Oil Purifiers
Frequently Asked Questions

What is oil purification?

Oil purification is an advanced ***Proactive Maintenance*** technique designed to address the root cause of oil degradation and most routine compressor maintenance. Oil purification is proven to ***extend the service life and change intervals*** of compressor fluids and other critical components by removing the harmful contaminants that accelerate oil degradation, produce acids, and promote corrosion, wear and fouling. Oil purification has been used extensively in expensive turbine oil systems and other large industrial fluid applications. Now, this same proven technology is available on a smaller scale to purify rotary screw compressor fluids.

Why should I purify my rotary screw compressor's oil?

Simply put, oil purification is ***a better, less expensive, less time consuming way to maintain rotary screw compressors.*** Purification of rotary screw compressor fluids essentially maintains the compressor from the inside out by ***continuously reducing the harmful acidic and ultra-fine solid*** contaminants that are the ***Root Cause*** of most compressor maintenance and repairs. Oil purification is proven to increase the service life and extend the change intervals of compressor fluids, separators, bearings, valves, seals and other vital components. By increasing the service life of these components, oil purification produces ***operation & maintenance cost savings*** from reduced fluid, separator and parts purchases, lower separator energy consumption, reduced compressor maintenance and repair labor, reduced oil disposal and less equipment downtime.

How does the Fluid Metrics Compressor Oil Purifier (COP) purify the oil?

The Fluid Metrics COP combines ***Ion Exchange technology with ultra-fine particle filtration*** to continuously remove chemically reactive and catalytic contaminants that accelerate oil degradation and promote wear, corrosion, and fouling. Installed in a bypass loop in the compressor's main oil circuit, the Fluid Metrics COP continuously purifies a very small slip-stream of oil and does not replace or interfere with the compressor's main oil filter. Unlike portable filter carts that only provide temporary mechanical filtration, the Fluid Metrics COP helps ***maintain the oil in like-new condition*** by providing ***continuous mechanical and chemical filtration.***

What is Ion Exchange technology and how does it purify compressor fluids?

Ion Exchange technology relies on the electrical attraction of oppositely charged matter (ions) to selectively ***adsorb and neutralize*** materials. An Ion is an atom, or group of atoms, that has an electrically positive (cationic) or negative (anionic) charge. When compressor fluids degrade, they produce acidic compounds comprised of cationic Hydronium ions. The Fluid Metrics COP utilizes a specially formulated anionic media whose negative charge attracts the positively charged acid molecules. When oil containing acids comes in contact with Fluid Metrics' ion exchange media, the acid molecules are adsorbed by the media and removed from the oil. These harmful acid molecules are ***permanently bonded to the media which neutralizes the oil*** and ***controls Total Acid Number or TAN.*** Unlike other ion exchange processes, this is a one-way reaction where nothing is released back into the oil that would cause sludge or otherwise change or harm the oil.

How long has Ion Exchange technology been around?

Ion exchange technology was first used commercially in water purifying applications back in the year ***1915.*** Early ion exchange media were naturally occurring zeolite soils which were effective but had low adsorption capacity and selectivity and often leached unwanted material back into the fluid.

These short-comings led to the development of ***synthetic ion exchange*** media which are designed to have much greater adsorption capacity and selectivity while not adding any contaminants to the process fluid. Synthetic Ion exchange media are used extensively today in chemical, industrial, petrochemical, pharmaceutical, food processing, nuclear, mining and water treatment applications.

What Ion Exchange technology does Fluid Metrics use in its Compressor Oil Purifiers?

Fluid Metrics utilizes a proprietary high capacity anionic exchange media that undergoes a special process specifically developed for this application. Fluid Metrics' ion exchange media complies with ***Food Grade*** regulations and conforms to ***FDA regulation 21 CFR 173.25.*** This ion exchange technology has been extensively tested by The Dow Chemical Company, the world's leading maker of synthetic rotary screw compressor lubricants. Nearly three years of Dow testing ***proved conclusively*** that ion exchange technology is ***"extremely effective at removing acids and controlling TAN and pH"*** in synthetic compressor fluids; and, that this technology ***"did not contaminate or otherwise harm the treated lubricants in any way."***

Doesn't the compressor's standard oil filter provide adequate protection?

Standard compressor oil filters are ***full flow*** filters designed for relatively high flow rates and thus have to balance filtration efficiency (micron rating) with pressure drop. Because of this, most OEM oil filters are only rated for 10 microns nominal (***25 microns absolute***) which only provides a basic level of protection for bearings and ***does nothing to remove the ultra-fine solids and harmful acids*** found in compressor fluids. As a result, these highly reactive acidic and solid contaminants are allowed to accumulate in the oil which accelerates oil degradation, bearing, valve and seal wear, corrosion, and the fouling of separators and coolers. ***Standard filters ignore the root causes*** of compressor fluid and separator replacement and ***guarantees an expensive and never-ending cycle*** of high fluid, separator, and parts consumption.

How long will the oil last with a COP installed on my compressor?

Under normal compressor operating environments, purifying the oil with the Fluid Metrics Compressor Oil Purifier (COP) will extend fluid service life ***3-5 times the oil's rated service life***. Actual fluid life extensions will depend on a variety of factors including lubricant type, degree and type of contaminant loading, and compressor fluid operating temperature.

Can the COP harm my compressor's oil?

No. The COP is designed to selectively remove only the harmful acidic and fine solid contaminants and will ***not affect the oil's additives*** or introduce any harmful constituents into the oil.

What types of compressor fluids does the COP work with?

The Fluid Metrics COP is effective at extending fluid life and change interval of ***most of today's synthetic and hydro-treated compressor fluids.*** These include Polyglycol / POE, PAO, Food Grade PAO's, and Esters based fluids. Some of the more common OEM brand names that fall in this category are Sullube®, SRF®, Ultra Coolant®, AEON 9000®, QuinSyn Plus®, and HD Roto Fluid®.

Can the COP be installed on any brand compressor?

Yes. The COP purifies a small slip stream of the compressor's main oil flow and installs in bypass to the compressor's standard oil filter. The COP uses existing oil pressure to circulate the oil and needs less than 15 psig of differential pressure. Since the designs of compressor oil circuits differ among manufacturers, installation requirements will vary. Consult your Fluid Metrics' distributor for installation specifics.

How does the Fluid Metrics COP extend compressor fluid service life?

Compressor fluid service life, or the rate at which the oil degrades, is a function of fluid contamination and temperature. The Fluid Metrics COP combines ***Ion Exchange*** and ***Ultra-Fine Particle Filtration*** technologies to remove the acidic and fine solid contaminants known to accelerate oil degradation and reduce fluid service life. By removing these highly reactive and catalytic contaminants, the rate of the oil-degrading chemical reactions is significantly slowed and oil service life drastically extended.

How does the Fluid Metrics COP extend oil separator life in rotary screw compressors?

Oil separator life is generally determined by the pressure drop caused by fouling of the separator element(s) from ultra-fine solid contaminants. The Fluid Metrics ***COP reduces the number of ultra-fine solids*** that foul oil separators and increases pressure drop. In field tests conducted on highly contaminated compressor fluids, the COP reduced ultra-fine solids to levels with ***fewer ultra-fine particulates than brand new oil*** and drastically ***slowed the increase in separator pressure drop***. Reducing these solids keeps the separator elements cleaner; extends their service life; and lowers the compressor's energy consumption.

Exactly what is oil degradation?

Oil degradation is a series of ***harmful chemical reactions*** that occur between the oil's base stock, its additives, and foreign ***contaminants*** like oxygen (air), water (humidity), metal particles (rust & wear), chemical vapors, and many others. These reactions ***change the oil's chemical and physical properties*** which negatively impact the oil's performance ability and reduce its useful service life. ***Oxidation***, the chemical reaction of an oil molecule with oxygen, is the most common and most harmful of these reactions resulting in permanent chemical changes to the oil's base molecules. Once initiated, this ***auto-catalytic reaction is self-sustaining and continuously accelerates producing acids*** and other reactive byproducts. Evidence that compressor oil is oxidizing can be seen from increasing acid levels or TAN, decreasing pH, increasing viscosity, rust in filters, and varnish or sludge formation. Degraded oil that is left in the compressor too long can cause serious and catastrophic failure to rotary screw compressors.

Why do compressor fluids degrade?

In a word – Contamination. ***Contamination is the root cause of oil breakdown*** or degradation. Absent any contamination, most synthetic ***oils will last indefinitely***.

What is contamination?

Contamination is any foreign matter or energy that comes in contact with the oil. The most common contaminants include ***oxygen, acids, water, dirt, rust, wear metals, chemical vapors, pollution, and heat.*** In rotary screw compressors, the source of these contaminants can be external (ingested from the surrounding air), or internal (byproducts of chemical reactions, condensation, wear, and corrosion). Common external contaminants that should be avoided include acid gases like those found in diesel exhaust, boiler exhaust, and cooling tower exhaust. External contaminants can often be eliminated by installing a remote air inlet to obtain cleaner, drier, cooler air from a different source. Internal contaminants, and those external contaminants that are ingested by the compressor, can both be controlled by continuous oil purification.

How does the Fluid Metrics COP reduce compressor energy costs?

The Fluid Metrics COP ***minimizes separator fouling and pressure drop***. Compressor energy consumption (horsepower and kilowatts) is a function of compressor and motor efficiency, flow rate (cfm), and discharge pressure (psig). As a general rule, compressor horsepower increases 5 % for every 10 psig increase in compressor discharge pressure (or ½ % power per psig). The oil separators in rotary screw compressors create a pressure drop that can vary from 2 – 15 psig depending on separator design and the degree of fouling of the separator element(s). This pressure drop causes the compressor to work harder to maintain system air pressure wasting significant money in unnecessary energy costs. Fouling of separator elements is caused by the ultra-fine solid contaminants that are carried by tiny oil aerosols and impinge on the surface of the separator. The Fluid Metrics COP ***removes the ultra-fine solids*** too small to be trapped by conventional filters and ***minimizes fouling and pressure drop*** of separator elements.

Can anything be done to completely stop oil from degrading in rotary screw air compressors?

Not completely. However, the ***speed at which these oils degrade can be dramatically slowed*** by addressing the ***root cause of oil degradation - Contamination***. Oil degradation rates are drastically affected by temperature and contamination. By design, rotary screw compressors continuously pump oxygen, water vapor, and other reactive and catalytic contaminants into the oil while adding heat which elevates the oil's temperature. Minimizing the oil's operating temperature and its level of reactive contaminants will significantly slow the rate of oil degradation and dramatically extend its useful service life and change interval.

From a lubricant standpoint, how do oil-flooded rotary screw compressors compare to other rotating equipment applications?

Rotary screw compressors are one of ***the most severe applications possible for an industrial lubricant!*** Unlike other types of rotating equipment, oil-flooded air compressors are inherently open to the atmosphere and continuously ingest airborne solid and vapor contaminants forcing them into the oil. Oil flooded rotary screw air compressors are ***very effective dust collectors and wet gas scrubbers*** that strip solid and vapor contaminants from the ingested air and deposit them into the oil. Even barely detectable levels of airborne contaminants can be absorbed by the oil where they accumulate and ***concentrate to destructive levels***. Air compressor users are often unaware they may have a problem with airborne contaminants until a catastrophic failure occurs and post-failure oil analysis reveals the nature of contamination. Combine this continuous, forced-contamination with heat, constant aeration and agitation, and air compressor fluids are required to perform in one of the most aggressive environments possible.

What will happen if the oil is allowed to stay in the compressor past its useful service life?

Oil that has degraded past the manufacturer's recommended limits can cause ***catastrophic failures*** to rotary screw compressors. As oil degrades, its ability to lubricate, cool, and inhibit corrosion deteriorates and negatively impacts the performance and service life of every component that comes in contact with the oil. Depending on the type of oil, sludge and varnish can also form resulting in expensive ***failures to bearings and air-ends and extended compressor down-time***.

What can be done to control contamination in compressor fluids?

Effective contamination control is a ***three step process*** that begins with ***prevention***. Providing the cleanest, driest and coolest inlet air supply and maintaining the inlet air filters will reduce the external ingested contaminant loading to the compressor fluid. Next, compressor ***oil purification***, like the Fluid Metrics COP, that removes both the acidic and ultra-fine solid contaminants reduces the internal contaminant loading to the fluid. Lastly, ***maintaining compressor fluid levels*** by regularly adding

make-up oil helps replenish oil additives and prevent the concentration of contaminants caused when fluid volumes decline from oil carryover and leaks.

How do you know when it's time to change the oil in rotary screw compressors?

Oil analysis is the only way to know for sure when it's time to change the oil. Oil suppliers routinely provide general oil change guidelines like "every 8,000 hours, or once a year, or as determined by fluid analysis...whichever occurs first". Time based guidelines are never accurate as they ignore the compressor's actual operating conditions and environment. Some OEM "8,000 hour rated fluids" have been known to only last 2,000 hours in some environments while others have tested satisfactory at 10,000 hours. Without performing periodic fluid analysis, users are just guessing about the condition of their fluid and ***run the risk of either doing harm*** to their compressor by running their oil past its useful life ***or wasting money*** by changing their oil too often. Oil analysis is an easy, inexpensive way to accurately determine fluid change intervals. It is recommended that users consult their fluid suppliers to obtain their specific condemning values of the key chemical and physical parameters monitored by routine oil analysis.

What parameters are important in a rotary screw compressor oil analysis?

As a general rule, an effective oil analysis program should ***focus on leading indicators*** that anticipate and help prevent compressor problems rather than trailing indicators that only serve to alert the user to an existing problem. These leading indicators can vary depending on lubricant type but several parameters are universally important. They include ***TAN (Total Acid Number), pH, viscosity, and contamination***. Since most of today's new compressors are filled with Polyglycol based lubricants, the following comments are specific to Polyglycol based synthetic fluids and are intended to be general in nature. Consult your lubricant supplier for specific recommendations on testing and change-points for their fluid.

> ***TAN*** - Total Acid Number is a measure of the oil's acid level and is a good indicator of the remaining useful life of the fluid. New fluids will have a TAN value of around 0.10 and this value will increase as the fluid oxidizes and as a result of acid gas ingestion. The recommended oil change value based on TAN varies from 1.0 to 2.0 depending on the supplier. During normal oil oxidation, TAN values will increase gradually at a steady rate to a value of 1.0. Above 1.0, TAN values will begin to increases exponentially and can run-away in a relatively short period of time. It is a safer and more cost-effective practice to change the oil when TAN values are lower (between 1.0 and 1.2) rather than taking the risk that TAN values will run-away. If TAN values reach 2.0, it is generally recommended to drain and flush the compressor with a half charge of new fluid to remove any remaining acidic oil and minimize premature degradation of the replacement fill.
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> ***pH*** – pH is also a measure of the oil's acid level with new oils having a pH value around 8.0 which gradually decreases towards a value of 5.0 as the oil oxidizes. A rapid or excessive drop in pH, while TAN values are otherwise normal, is an indication that external acidic gases or other oxidizing agents are being ingested from the atmosphere. When the oil's pH value has dropped below a value of 4.5, the fluid should generally be changed to prevent corrosion.
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> ***Viscosity*** – Viscosity is a measure of the resistance of a fluid to flow. As oil degrades, its molecules will polymerize into larger molecules increasing its viscosity. A viscosity increase within 10% of the new oil viscosity is considered normal. An increase greater than 10% or a decrease in fluid viscosity is usually an indication of contamination or varnish or sludge formation with non-polyglycol based fluids. It is rare to change compressor fluids solely based on viscosity without other abnormal indications.

Contamination – Contamination monitoring is a broad term that from the standpoint of routine oil analysis can include ISO Particle Counts, DR Ferrography, Spectrochemical Analysis, Water Concentration (Karl Fisher or Crackle), Methanol Insolubility and many others. Of these, Spectrochemical and Water Concentration are low cost tests that are most commonly performed by oil analysis labs. In rotary screw compressor applications, testing for contaminants can often cause confusion in the interpretation of the results and should probably be left to very experienced users. For more detailed information on this topic, please refer to an article written by Daryl Beatty of Dow Chemical Company, “Oil Analysis Boosts Compressor Reliability” in *Practicing Oil Analysis Magazine* (November 2004).