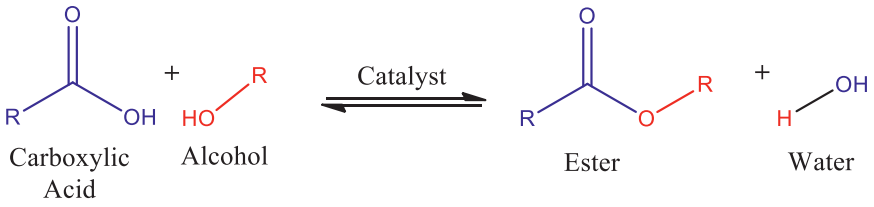
Safeguarding your future: tiny drier, major potential!

In a two-part article, Brad Bray of Evomart delves into the importance of filter driers on the life and efficiency of air conditioning, refrigeration and heat pump systems, and outlines new cost-effective product innovations.



Filters driers are small but relatively understated, with the perception of being insignificant. While simple in application, they provide protection to HVAC systems the world over. They sit under the radar, acting as a watchman within a system that runs 24/7. To understand the importance of this component, we need to understand what its purpose is and how it safeguards HVAC systems and maintains lubricant stability.

POE (poly olester synthetic oil) is commonly referred to as a universal oil. This oil serves as a lubricant to reduce friction and overheating of mechanical components, such as a compressor. Ensuring the compressor remains lubricated is vital. A compressor is known as the heart of a system, which fulfils two major functions:

1. Circulates refrigerant: For a fridge system to function, it requires a cooling medium to circulate around the system with the aim on moving heat energy from one source to another.
2. Applies pressure: HVAC systems rely on the pressure/temperature relationship to provide the necessary conditions for heat energy to move.

If a compressor fails, this is known as a burnout. Maintaining the life of the compressor is a refrigeration engineer's immediate priority, if this fails, everything will fail, resulting in a very costly repair.

Lubricants are used in systems with moving mechanical components, as the means of reducing friction and overheating which in turn may lead to component failure. HVAC systems may suffer a compressor burnout, which is where lubricant is unable to make its way back to the compressor or the oil has become sufficiently degraded where the lubricant is unable to provide its lubricating properties.

There are different types of lubricants: Mineral, PAG, Alkylbenzene and POE. For the purpose of this article, we are focused on POE. How are POE lubricants made? What is the impact of moisture has on the base lubricant? How does acid form within a system containing POE lubricants? Let's take a look at what POE is made-up form...

Esterification – "A chemical reaction resulting in the formation of at least one ester product."

The ester lubricant base is created with a parent carboxylic acid, which is heated with an appropriate alcohol with an acid catalyst (catalyst used to increase rate of chemical reaction). The occurring reaction is called esterification. Esterification is an equilibrium reaction of acids and alcohols that form an 'ester-product' + water. To complete ideal equilibrium (to maintain the ester product), water must be removed, otherwise a reverse reaction may trigger, called hydrolysis.

As with a set of scales, these reactions want to create equilibrium (balance) on both sides. On one side, we have carboxylic acids + alcohol, once heated and mixed, this creates our ester 'product', but it too creates water. When both sides are satisfied this creates equilibrium, see above:

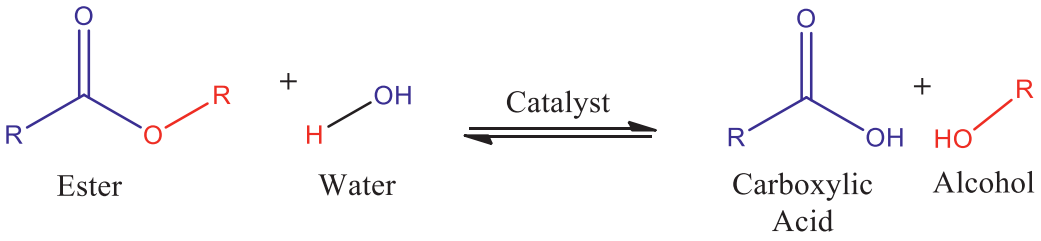
Hydrolysis – reverse reactions

POE lubricants are known as hygroscopic, meaning they are prone to absorbing water. Water sits on the ester side of our scale's analogy. As esters are formed during esterification, hydrolysis is the reversal of this reaction. POE lubricants are hydrolysed (broken down by reaction) by water.

If we use a refrigeration system as an example, if water is present within the circulating refrigerant, then the reverse reaction may begin, be-it very slowly, without much noticeable impact on the systems performance. If moisture is present within the cycle, this will eventually begin to produce carboxylic acid compounds and alcohol, by reverse reactions as the POE lubricant is hydrolysed by water, see top right:

The catalyst in this case is the hydroxonium ion, H3O+ , which is present in all solutions of acids in water. More acids that form accelerate the hydrolyses effect.

In principle, hydrolysis becomes self-catalysing, driving the equilibrium back the other way, into the base compounds that from the ester product. The catalyst acid forms and if left unchecked/treated, then these smaller reactions will begin



to accelerate, ultimately resulting in a compressor burnout.

Engineers are encouraged to perform acid checks regularly. This is where a sample of the system oil is removed and tested for traces of acids. If acids are present, then this needs to be addressed immediately, as to maintain oil stability and system health. The reverse reaction may be slow at first, then as equilibrium is achieved, the reverse reaction accelerates considerably. This is like starting at the top of the slide, as you proceed down the slide your speed increases, until you hit the bottom and fly off.

Effect of moisture on an HVAC system.

We have already discussed what impact moisture has on POE lubricants, by driving a reverse reaction of the ester product, forming acids via hydrolysis. Moisture has even more detrimental effects on a HVAC system, which include:

Corrosion – water is detrimental to compressor windings and pistons, creating rust.

Ice crystals – system low-side, temperatures in and around freezing may form ice crystals which intern may cause blockages and or stick.

Oxidise active metals such as copper.

Water in its liquid state become trapped within system pipework.

Moisture can permeate through plastic containers; for this reason producers ensure a moist-free environment and bottle this product in sealed metal cans. It is essential to ensure moisture levels are reduced, which may difficult to identify within a system, for this reason acid test kits are offered to identify acid compounds instead of moisture molecules. Moisture will remain undetected, so to effectively be able to identify whether the POE has hydrolysed, acids will be present and are detectable via an acid test kit.

The solution: filter driers

Filter driers, such as Dry All filter driers, are installed just in front of the thermal expansion valve on the liquid line. This is to ensure maximum liquid exposure throughout the drier, where the desiccants can absorb moisture and acids from the passing refrigerant.

Filter driers are genuinely made from a steel or copper housing, with a desiccant core inside. Different sized driers are available to cater for all system types. Depending on the system type will determine what fitting is needed, whether solder (sweat-type drier), flare- or compression- fittings. Below is an example of a traditional filter drier.

For larger systems, replaceable cores are available. Cores are the inside part of a drier, which can be changed without the need of the outer housing. A core shell (a permanently installed housing for the core), is installed onto the system, which can be isolated so the core can be replaced when necessary, see cores below:

Perfect team

We have discussed how a HVAC systems health is impacted by the stability of POE lubricant. We know it is vital to ensure moisture is removed to prevent hydrolysis and other corrosive properties. Testing for acid will indicate if a reverse reaction is occurring. The best safeguarding measure is to have installed and periodically replace the filter drier. These simple components are designed to absorb moisture and acid compounds, which maintains directly the health of the lubricant and therefore the health of the compressor.

For more information contact your preferred wholesale partner.

Proof is in the testing

We have a limited number of FREE samples on offer across 032S, 032F, 053S, 053F and Replaceable Drier Types. To trial your FREE sample or schedule a FREE onsite consultation. Register by visiting: https://www.dryall.co.uk

In the next issue of ACR Journal, Part 2 of this article will explore how POEs are protected during the manufacturing process, introduction of additives and what makes for good filter drier selection.