

END-TO-END SOLUTIONS

Emerson® EK Filter Drier White Paper

October 2007



Filter Driers – The First Line of System Protection

At first glance, filter driers on air conditioning or refrigeration systems are exactly what their name implies – front-line protection designed to filter out contaminants and dry the refrigerant to avoid ice formation and oil degradation. They also, of course, must remove acids formed as a by-product of moisture, oil and heat.

But all filter driers are not created equal. And all are not prepared to handle the change and challenge of environmentally friendly refrigerants.

Basically, three distinct types of filter driers blanket today's marketplace:

- **Loose fill driers** – filled with beaded desiccant held in the shell with mesh screens
- **Molded core filter driers** – a solid core of blended desiccant held together by a cured resin
- **Compacted bead filter driers** – a blend of beaded molecular sieve material and activated alumina held in place between two fiberglass pads, which are compressed by a steel spring

The Right Choice

Of the three styles, the compacted bead technology offers the best combination of features and functions to handle the array of filtering, drying and removal tasks asked of a state-of-the-art filter drier. The EK Filter Drier from Emerson Climate Technologies™ is the prime example. It is buffered by an initial 40-micron fiberglass filter that removes most of the contaminants and sludge, plus a 20-micron final filter that removes all remaining contamination.

The EK Filter Drier differs significantly from filters that have come before. For starters, there's the method of filtration. The EK Filter Drier uses a series of fiberglass media pads that capture and hold the various solid particles. The majority of filter driers made around the world, on the other hand, often simply use a molded desiccant core. The desiccants are glued together and used as the filter. This technique simply does not have the surface and depth capability to capture a large quantity of solid particles or collect the smaller particles that might get through the core.

It is that ability to capture all of the smallest possible particles that sets the EK Filter Drier apart from the rest. That's because the filter has been designed and built with a pioneering technology that includes a very fine final filter that allows the EK Filter Drier to boost efficiency into the 99.9+% range. This means only one particle out of 1,000 passes through the drier the first time it enters the filter. This is 100 times better than the average filter drier: 1/1,000 versus 1/10. One tenth equals just 90% efficiency. This patented pad also means there is minimal pressure drop; pressure drop is a problem that could eventually lead to lost efficiency and less cooling power.

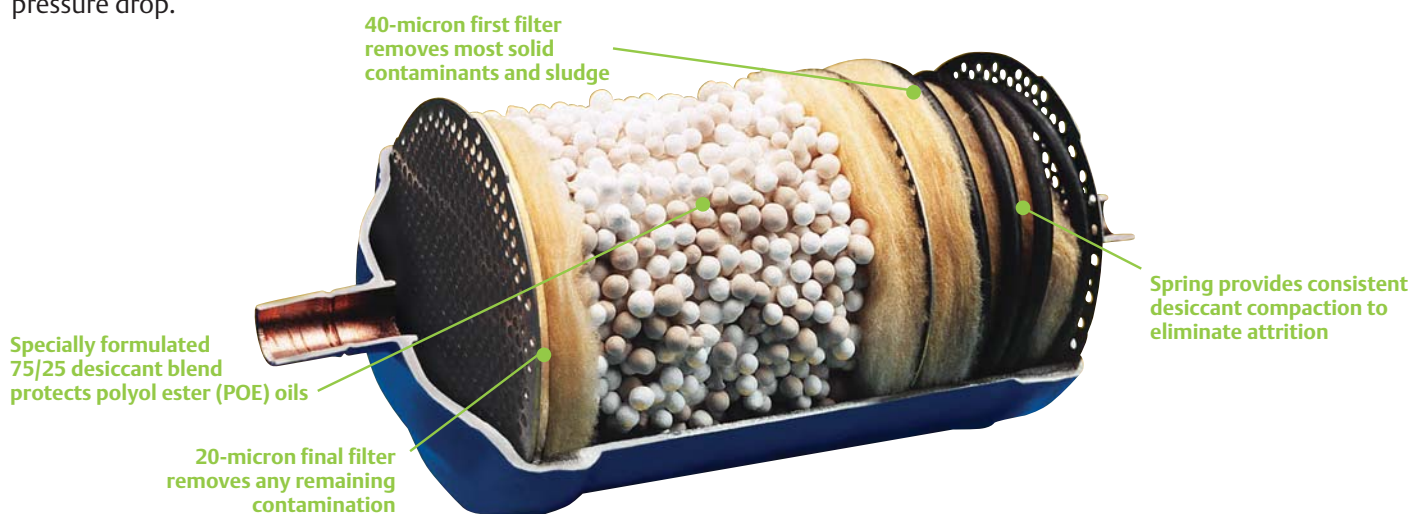
Added Advantages

Other unique EK Filter Drier features actually went against the conventional wisdom of its day. First, it accomplishes the primary filtration *before* the drying phase. The reasoning behind this approach is that by taking most of the dirt out ahead of the desiccants, the desiccants remain clean and better able to do their job of retaining water and acids. Second, the EK Filter Drier overcomes another flaw of earlier filters, which was the compacting of the beads by a spring at the filter's outlet end. This method meant the system flow tended to work in opposition to the spring and reduced the amount of compression on the beads. The beads themselves would become loose and roll against each other, eventually breaking down to create particles. Essentially, that turned the beads into mini-grinders that could wreak havoc on both the filter and the system. The EK Filter Drier turns the original concept around – it has a spring at the inlet end, allowing the spring to work with the refrigerant flow to better protect the desiccants. Laboratory and field testing results show that system vibration works to compact the desiccant bed and results in less bead movement. This reduces the possibility of damage even more. A secondary benefit is added filtration capacity. As the desiccant compacts there is more room to hold contaminants. This has been shown to increase filtration capacity by as much as 25%.

There is one other key EK Filter Drier design difference. Inside the spring at the inlet end are fiberglass pads that offer two-tiered filtering capabilities. The first tier is surface filtering action and the other is depth filtering. The surface of the pad captures dirt when it first enters the EK Filter Drier similar to a solid core style filter-drier. But the EK Filter Drier's filtering system has an irregular flow path through the depth of the pads that allows it to capture much more dirt than the thin wall of a solid core. Additionally, when cooling is no longer needed and the system shuts off, the force holding the dirt to the fibers of the pad is removed. The particles are released from the surface and move to lower flow areas of the filter-drier when the system restarts and refrigerant flow resumes. The high flow areas of the filter-drier remain clear for further filtering and minimizes the EK Filter Drier's pressure drop ensuring high system efficiency.

When it comes to its construction, the EK Filter Drier is buffered by two layers of fiberglass filters. The initial, 40-micron layer removes most solid contaminants and sludge, while the second, 20-micron final filter removes any remaining contaminants from the system. This double-layer protection ensures that the system will stay cleaner, longer, with a minimal pressure drop in the filter drier.

The EK Filter Drier final outlet pad is unlike any other on the market. It's what boosts the efficiency ratings and allows the filter to capture 100% of all particles, down to and including 20 microns. This filter "polishes" the refrigerant by removing the small sized particles that pass through the inlet filter. That means the EK Filter Drier delivers a lot of filtration compared to the amount of pressure drop.



New Challenges. New Solutions.

As the industry shifts to higher-pressure environmentally friendly refrigerants such as R-410A (for use with commercial and residential air conditioning applications), filter driers face a new series of challenges. Fortunately, the EK Filter Drier brings built-in benefits in this area as well. The newer HFC refrigerants use synthetic polyol ester (POE) oils, which demand a more effective filtration capability than did the previous mineral oil systems. Why? Because POE oil is more of a solvent than were traditional oils. POE does an effective job of stripping off and keeping afloat any particles that are on the surface of the tubing or left in the system when it was put together. That alone requires a better filtering alternative.

Another factor is increased water capacity. POE oils are extremely "moisture loving" (*hygroscopic* is the technical term). And that can create problems. When enough water is present, POE reverts to its original chemical – an organic acid and an alcohol. While the alcohol doesn't affect the system greatly, acids react with system materials and cause component failures and loss of cooling.

The EK Filter Drier has a blend of both high-water capacity desiccant, called molecular sieve, which traps water molecules flowing with the refrigerant, and a high-acid capacity desiccant, called activated alumina, which has slightly larger pores to trap and remove acid molecules. This blend was designed to meet the needs of POE oils to ensure long compressor life.

Meeting Tomorrow's Demands – Today

Compacted bead desiccant filter driers have additional advantages over competitive technologies; particularly those that use porous molded cores. In the latter case, whenever something is put on the surface to hold the core together it leads to added resistance to mass flow; water or acid does not flow through that media easily so the desiccant can capture it. And that, in turn, effectively reduces the capability of the desiccant to work. The good news: the EK Filter Drier desiccant is not molded together – so it provides 100% desiccant utilization, maximizing capability.

In addition, the maximum working pressure of the entire line of EK Filter Driers is 680 psig, the highest in the industry. Again, this is key when dealing with new refrigerants, especially R-410A, which has a very high pressure. The EK Filter Drier already has the working pressure capabilities to handle this increasingly viable refrigerant.

Emerson Climate Technologies, Inc. Recommended

Finally, Emerson Climate Technologies, Inc., the manufacturer of Copeland® compressors, recommends the use of no more than 25% activated alumina in the desiccant blend for new HFCs. This is because they use proprietary break-in lubricant additives for the initial startup of compressors and activated alumina can strip out these additives. The engineers from our Flow Controls division worked together with the engineers who design Copeland® compressors to resolve any compatibility issues surrounding the technologies.

Conclusion

Filter driers have a distinct mission: to take contaminants, moisture and acids out of refrigerants. They're critical to prolonging the life of compressors and refrigerants. How critical? A recent Air-Conditioning and Refrigeration Institute (ARI) study showed that even weak acids circulating could reduce a compressor's life. And while many filters may claim to be suitable solutions, only one – the EK Filter Drier – delivers the across-the-board protection capabilities the systems of today and the refrigerants of tomorrow demand.

About Emerson Climate Technologies

Emerson Climate Technologies, a business of Emerson, is the world's leading provider of heating, ventilation, air conditioning and refrigeration solutions for residential, industrial and commercial applications. The group combines best-in-class technology with proven engineering, design, distribution, educational and monitoring services to provide customized, integrated climate control solutions for customers worldwide. Emerson Climate Technologies' innovative solutions, which include industry-leading brands such as Copeland Scroll® and White-Rodgers®, improve human comfort, safeguard food and protect the environment.

About Emerson Climate Technologies - Flow Controls division

Emerson Climate Technologies - Flow Controls division is a leading manufacturer of valves, controls and system protectors commonly applied in air conditioning and refrigeration systems worldwide. The company continues to pioneer the control of refrigerant flow through innovative, high performance components, such as thermostatic expansion valves and filter driers. Emerson Climate Technologies - Flow Controls division is headquartered in St. Louis. For more information, visit Emersonflowcontrols.com