

# Filter Driers: Just the Facts

Learn which filter drier is right for you.

Most filter drier manufacturers say that installing a high-quality filter drier is worth the added cost to ensure proper system protection. But what does quality mean in the world of filter driers? What specifications are important and what criticisms are valid? Though filter driers are often viewed as very basic products with no differences, each manufacturer has chosen a specific design for a reason. To make sense of the various claims, it is important to understand what happens inside a filter drier.

## Inside the filter drier

A filter drier is designed to protect a system from moisture, acids, and solid contaminants. Moisture can clog an expansion device with ice, reduce system efficiency due to the thermodynamic properties of water, or, combined with high temperatures and pressures and oils in the system, can form acids, which damage the compressor and other components. Solid contaminants can clog expansion devices and prematurely wear out compressors. Quite simply, filter driers should be judged on their ability to protect the system in which they are installed.

If you look inside several driers, you will see similarities and differences, beginning with the desiccant core. Some manufacturers use desiccant beads while others use a solid core. Many contractors have heard of beads coming loose or dust developing from beads rubbing together. In response, most current steel-shell driers are robust enough to hold beads in place and some manufacturers use beads that have been coated to prevent the beads from breaking down from friction and creating dust. However, coating the beads limits the rate of moisture adsorption, which compounds the issue of unused space around the beads, resulting in a lower desiccant volume than solid core designs.



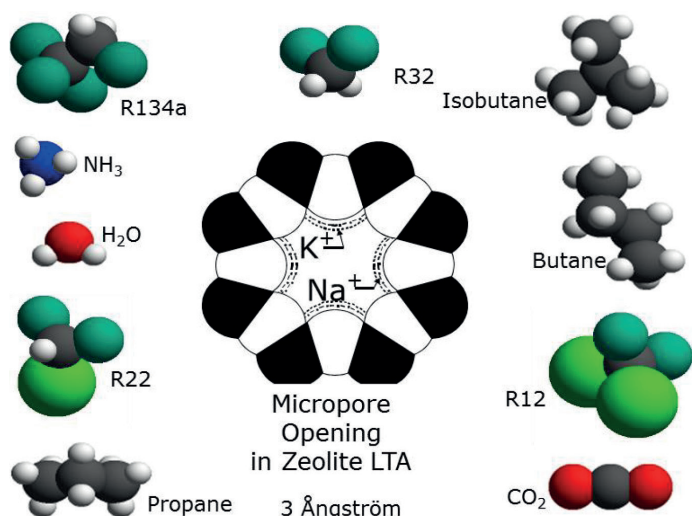
*Danfoss Filter Drier Cut-Away*

Solid cores are made of loose fill that is mixed with a binding agent to mold the core into a shape strong enough to stand on. To avoid compromising drying capacity, the binding material should be kept to an absolute minimum. For example, Danfoss uses about 6% binding material compared to 20% for another leading solid core brand. Cores generally have a divot at one end to draw the refrigerant through the core, rather than letting it flow around, ensuring good contact with the drying material, though the work happens at the molecular level.



You may have noticed the word adsorption was used above instead of absorption. Desiccant molecules do not absorb moisture, which would mean moisture is dissolved into the core, but they adsorb moisture, which means water molecules are caught and bonded to the desiccant. Molecular sieve is a compound with pockets perfectly suited to catch water molecules, but too small to capture refrigerant molecules. This compound varies in quality between manufacturers and the quantity of core material is less important than the quality: some manufacturers need twice as much material to accomplish the same drying capacity. So, the next time you hear that one brand has more desiccant than another, ask instead about moisture capacity.

Molecular sieve is highly efficient at capturing moisture, but not acid. Many filter drier manufacturers offer a blend with either activated alumina or charcoal to capture acid. Most OEMs choose 100% molecular sieve driers, since they have controlled manufacturing environments where risk of contaminants entering the system is minimal. For aftermarket service, Danfoss recommends a blend of molecular sieve and activated alumina for both high moisture and acid adsorption capacity as servicing a system means the risk of contamination.



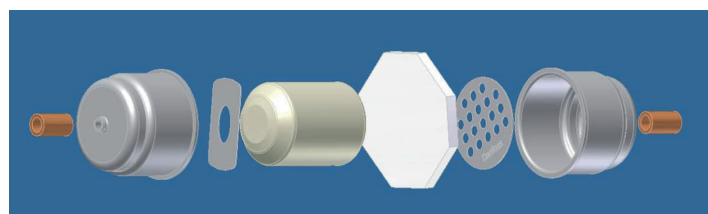
*Molecular sieve has micro-pores perfectly suited to capture water molecules, but allows larger refrigerant molecules flow freely)*

One important point is that materials like activated alumina that adsorb acid are polar and can capture other polar substances, like oil additives. This behavior is a property of the material, not any manufacturer's particular product, so Danfoss recommends using pure oils without additives with filter driers with acid adsorption capabilities. While a combination of oil additives and a desiccant blend filter drier will not harm a system, some acid capacity will be occupied by the oil additives and any benefit that you may expect from the additive will be diminished.

There are several filter materials available today. Fiberglass is highly efficient but can be an irritant, so some component manufacturers choose to work with other materials. You may have heard that fibers from filters can come loose and clog expansion devices. This happened with early designs, though the major manufacturers producing steel shell driers have addressed this with additional filtering screens. Felt pads are another common and effective filter.

## Performance

The two most important factors in filter performance are dirt capacity and filter efficiency. The drier needs to capture contaminants without clogging, which creates a pressure drop, and it needs to filter small enough particles to prevent problems. Danfoss research has shown that particles smaller than 25 microns pass harmlessly through a system, with no danger to any components. But filter driers with 20-micron filters clog faster, creating an efficiency-zapping pressure drop without any benefit to the system.



*Danfoss solid core filter drier exploded view- flow is from left to right*

Copper spun driers generally have loose beaded desiccant and fibrous filters. Though they generally cost less than steel driers, drying and filtration capacity also tend to be lower. In all but the smallest systems, OEMs prefer steel shelled driers, both due to the more robust construction and performance and to avoid the price volatility of copper.

## Choosing right

So how can you decide if a filter is a quality product? Look for the right level of moisture capacity, acid capacity, and filtration that you need. For contractors, that means a high-quality solid core steel drier in order to have high moisture capacity, a blend of molecular sieve and activated alumina for both water and acid adsorption, and a 25-micron filter with sufficient dirt capturing capacity. Otherwise, you may end up with less protection than you bargained for.

If you would like to know more about Danfoss filter driers, visit our website at [www.danfoss.com/filterdriers](http://www.danfoss.com/filterdriers).

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