November 2001 / **Form 40-133**

SPORLAN

HFCs? POE Oils? Compatibility?

Q. A. the Catch-All®

Sporlan Valve Company *is the leader in the field of contaminant control since the introduction of the Catch-All® Filter-Drier over 50 years ago. The Catch-All's molded core, formulated with a blend of desiccants, continues to meet changing industry requirements.*

The Catch-All has been thoroughly evaluated for use in HFC-POE oil systems. This publication answers frequently asked questions about HFC systems and the Catch-All Filter-Drier. Knowledge of Catch-All design and HFC system chemistry confirms you've selected the most advanced filter-drier available.

Testing demonstrates materials used in the Catch-All are compatible and highly effective in R-410A systems.

1 How do the properties of HFC refrigerants affect system chemistry?

HFC refrigerants such as R-134a have a greater ability to absorb water than the traditional CFCs. At 32˚F, R-134a will hold 25 times as much water in solution as R-12. Therefore, dangerous moisture levels can be reached before freeze-up occurs at the expansion device, resulting in problems such as acid formation, copper plating and corrosion. The use of a Sporlan **See-All Moisture and Liquid Indicator** is recommended to monitor safe moisture levels in HFC-POE oil systems.

2 How do the properties of POE oil affect system chemistry?

POE oils have the ability to absorb 10 times more moisture than mineral and alkylbenzene oils used in CFC and HCFC systems. Careless handling of POE oil prior and during installation can result in atmospheric moisture being absorbed and therefore wet oil being charged into the system. Although POE oil is stable, the introduction of excessive amounts of moisture combined with heat can cause the formation of organic acids.

3 What materials are used in the standard Catch-All? What function do they serve?

A. Molecular Sieve

Molecular sieve is a desiccant having a porous structure that selectively removes (adsorbs) moisture from the refrigerant and oil. The pores (openings) are small and consistent in size, making it suitable for holding water molecules but not large acid molecules. Molecular sieve has the highest water capacity among the commonly used desiccants.

B. Alumina

Alumina is a white granular or beaded desiccant. Alumina's structure has pore sizes larger and more varied than molecular sieve. While not having the high water capacity of molecular sieve, it is ideal for removing large molecular contaminants such as organic acids and products of oil decomposition.

4 Is a special molecular sieve required for R-410A & R-407 series refrigerants?

R-410A and R-407A/B/C contain R-32 in their refrigerant blends. There has been discussion that a particular molecular sieve is required for these systems due to the chemical nature of R-32. Sporlan has extensively evaluated the compatibility and dry-down behavior of the molecular sieve used in the Catch-All. Testing demonstrates special desiccants are **NOT** required since the materials used in the Catch-All are compatible and highly effective in R-410A and R-407 series refrigerant systems. For additional information, consult Form 40-139.

5 How about the use of a Sporlan HH Series Catch-All on HFC-POE oil systems?

The HH Series Catch-All can be used in HFC systems to accomplish the same benefits established for CFC and HCFC systems. In the HH Series Catch-All, activated carbon is added to the standard desiccants. Activated carbon has the ability to remove contaminants such as varnishes, wax, and other breakdown products.

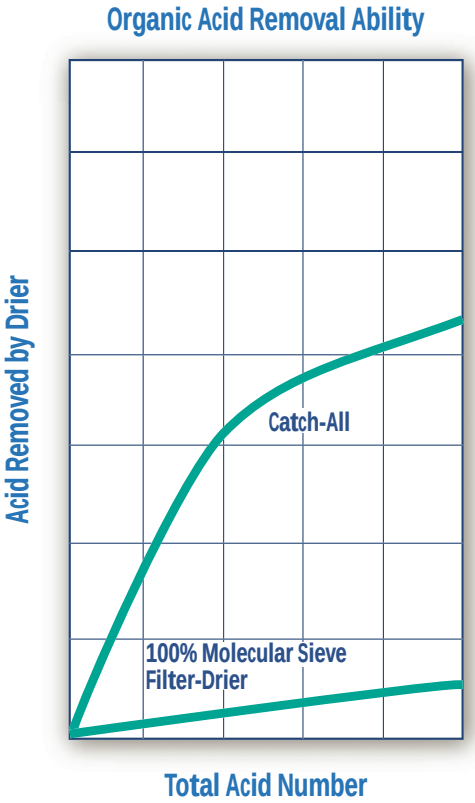
6 Which filter-drier is better, granular type (loose-filled) or the molded core?

While loose-filled filter-driers usually have a price advantage, they fall short when it comes to removing acids in a system. Furthermore, the possibility of desiccant breaking down into fine particles exists since the granular desiccant rubs against itself during turbulent refrigerant flow. In the Catch-All, the desiccants are bonded together in a porous core and desiccant breakdown is eliminated. Excellent filtration is another feature of the molded core design.

7 Would a 100% molecular sieve core (or loose-filled) filter-drier be better than the Catch-All?

Some manufacturers are promoting the use of 100% molecular sieve filter-driers for HFC refrigerant systems. Although it is logical to have increased moisture removal capabilities, these filter-driers **do not** effectively remove organic acids which can be generated within the system, see Figure 1. Over 50 years of experience has demonstrated the need for acid removal capability in a filter-drier. Based on testing and field experience, the molded core in the Catch-All has an **unsurpassed** balance of water and acid capacities when compared to similar competitive molded core and loose-filled filter-driers.

Figure 1



8 If molecular sieve removes moisture before it reacts with POE oil to form acid, is activated alumina necessary?

Yes.

In addition to moisture, experience has shown other contaminants and/or system application problems can alter system chemistry.

The potential for acid formation from various contaminants, and/or improperly operating systems, warrants the use of activated alumina in the Catch-All. Activated alumina removes acids before they react with other materials in the system.

As an example, a recent HFC-POE oil systems study statistically linked air in the test systems to acid formation. Acid was statistically linked to increased compressor wear. Since filter-driers will not remove air from a system, activated alumina will aid in maximizing compressor life by removing acids if they exist in the system. Conversely, a 100% molecular sieve filter-drier will not effectively remove these acids.

9 Does alumina (bauxite) cause harm to compressors in an HFC-POE oil system?

No.

There has been some concern that alumina used in the Catch-All (and other filter-driers) will cause harm to compressors. Although there has not been published data to support this claim, Sporlan has undergone extensive testing to understand alumina's behavior in HFC-POE oil refrigeration systems. Compatibility and system testing continues to support the use of the Catch-All in the liquid and/or suction line of these systems. **Testing shows the materials used in the Catch-All are a benefit, not a detriment, to compressor life.**

10 Does alumina remove additives from POE oil?

The theory that alumina removes additives from oil is not new. However, testing for additive removal by alumina is difficult because oil companies keep their additive formulations proprietary. Since it is difficult to test for these unknown substances, one reasonable way to address the problem is to work with the oil companies. Sporlan and a major oil company jointly investigated the interaction between the Catch-All and two separate POE oil/additive formulations. The two oil samples supplied were tested by

C-030 through C-600 and HPC-100 series Catch-Alls have a 650 psig working pressure for R-410A.

circulating each through a Catch-All at a controlled flow rate and constant temperature.

Based on the flow rate of oil, it was estimated that 24 hours under those conditions represents about six months of actual field service.

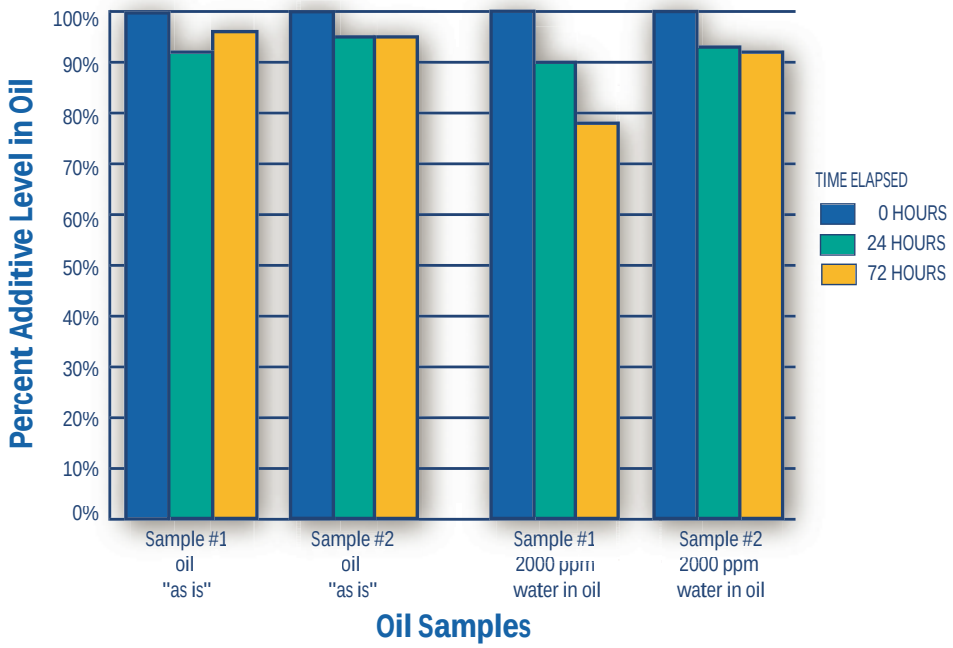
Two tests were conducted on each POE oil. One tested "as is" (as received), the other with the addition of 2000 ppm of water. The water addition to each oil formulation was to understand how additives behave in adverse moisture conditions.

Figure 2 illustrates the test results for both oil samples under the two test conditions. A possible explanation for the lowered additive level in oil Sample No. 1 with 2000 ppm water versus Sample No. 1 "as is" could be due to additive(s) interaction with excessive amounts of moisture. Nevertheless, the manufacturer of the oil confirmed that the reduction in the amount of additives under **both** test conditions is **not** detrimental to system materials or components.

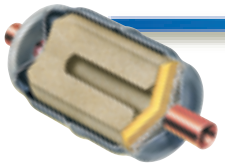
Additives in POE oil serve various purposes within the system. Some additives are formulated to circulate with the oil for a long period of time while others will dissipate in concentration. Therefore, an explanation for a small decrease in additive levels may be because some additives are **expected** to decrease over time.

Figure 2

Additive Level in POE Oil After Circulation Through Catch-All



Based on research, the features of the Catch-All are ideal for today's systems.



The Catch-All includes a blend of desiccants molded into a uniform porous core. A proper desiccant blend ensures the Catch-All handles the system chemistries of numerous applications, while the core design eliminates the possibility of desiccant attrition – a concern with granular type filter-driers.

For HFC-POE oil systems, it's the CORE that counts!

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