An article featured in the March 23, 1998 issue of AIR CONDITIONING, HEATING & REFRIGERATION NEWS

How to protect all acr systems when using the new refrigerants

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Here are the answers to your questions about the application of system protectors with the new refrigerants.

System protectors as a whole can be generally grouped into three different categories:

1. Liquid line filter-driers;
2. Suction line filter-driers; and
3. Moisture-liquid indicators.

Filter-driers in the typical air-conditioning or refrigeration system are designed to perform several functions.

One, as their name implies, is to filter out contaminants effectively, two, to dry the refrigerant to avoid ice particle formation and oil degradation, and three, to remove acids formed as a product of moisture, oil and heat.

Refrigerants & Oils I

Until recent years it has been easy to apply filter-driers by the capacity of the filter-drier to handle the amount of refrigerant in the system without exerting an undue amount of pressure drop.

Filter-driers perform their duty with the use of three different materials.

- Molecular sieve, which is just that, a sieve comprised of a material that has pores of the appropriate size and consistency to trap the water molecule flowing with the refrigerant oil.
- Activated Alumina, which has slightly larger pores of the proper size and shape to trap acid molecules.
- Activated Charcoal, which has the characteristic of removing paraffin or wax.

First, let's look at the different types of liquid line filter-driers available on the market today.

LIQUID LINE

Loose fill driers are just as the name states, loosely filled with molecular sieve material which is held in the shell with mesh screens at either end. Commonly these driers are made of copper and are designed for use in domestic refrigerators and do not offer much in the way of filtration.

Molded core filter-driers are a mix of the molecular sieve material, activated alumina and sometimes charcoal which is mixed with a binder, poured into a mold and baked. These filter-driers use the blended core as the filter bed and do not require a separate filter to accomplish 40 micron filtration levels. Since the outside of the core is used as the filter bed there is a possibility that the trapped particles can be washed through the core and proceed downstream to the rest of the system.

Compacted bead filter-driers (Figure 1) are a blend of beads of molecular sieve material and activated alumina which is held in place between two fiberglass pads which are compressed by a steel spring to prevent attrition through turbulence.

Figure 1. ALCO EK liquid line filter-drier (compacted bead)

Filtration is accomplished by the installation of a thick fiberglass pad at the inlet which has a 40 micron filtration rate. This pad holds more particulate at a lower pressure drop than the molded core and holds it from passing downstream to the desiccant bed and the system beyond.

Of the three styles of filter-driers molded core and compacted bead offer the best of all three functions necessary for a good filter-drier. Of the two the compacted bead style can be formulated to meet any system or refrigerant-oil requirement without sacrificing the integrity of the desiccant bed.

Activated Charcoal is not a component of the compacted bead filter drier as waxing is rare in systems above -30°F with mineral oil, as the floc point where paraffin is coagulated out of the oil is well below that.

APPLICATION

POE oils are made by a reaction between Ester Acids and Alcohol, where the by-product is POE lubricant and water. If the water levels are reintroduced to levels above 75 PPM the POE may revert to its component parts and create acids and a small amount of alcohol.

Keeping this in mind, the moisture and acids must be removed as soon as possible to prevent the possibility of system damage.

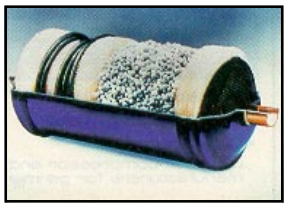

Figure 2. ALCO UK liquid line filter-drier for POE applications.

Another key consideration is that POEs and the new refrigerants are pretty good solvents and will clean the

inside of a system of anything that will come loose. It is therefore necessary to have a filter-drier with additional filtration capacity to remove the fine particles in both new and retrofit applications.

Molded core filter-driers are bound by the porousness of the core to 40 microns and have a limited capacity to trap and hold solid contaminants.

Finally, there are acidic additives to the POE that the oil manufacturers find necessary to increase lubricity and miscibility that should not be removed by the filter-drier.

There must be a filter-drier capable of performing all of the tasks at hand, with these attributes.

- Greatly improved filtration capabilities.
- Greater than normal moisture removing characteristics.
- Smaller than normal acid removing characteristics.

One filter-drier answers all of these needs (Figure 2), by offering a standard lay-in-size with increased shell size and twice the filtration capacity of the standard EK or molded core filter-drier.

The UK compacted bead filter-drier starts off with a 20 micron filter which is capable of trapping and holding 27 grams of dirt and grit (16 cubic inch size) compared to 13 grams for the standard EK and 3 grams for the molded core style (see Figure 3).

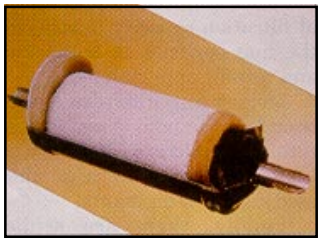

Figure 3. ALCO ADK liquid line filter-drier (molded core style)

The UK's moisture capacity for a 16 cubic inch drier is increased to 610 drops of moisture at 75° R-22, compared to 206 for the EK, and 144 for the molded core style filter-drier.

And finally, the UK filter-drier has approximately 5,000 milligrams acid removal (16 cubic inch size), compared to 6,500 for the EK and 8,000 for the molded core.

Although the EK and molded core filter-driers will fill the space in a POE system, the UK will address the moisture problems that create acids with the greatest speed. At the same time, handling the acids already created by oil breakdown, and filtering the refrigerant thoroughly first before the desiccant bed is reached.

MOISTURE-LIQUID INDICATORS

Not all moisture-liquid indicators are alike. Their purpose is two-fold, to get a visual indication of the state of the refrigerant at that point in the system, and to indicate if the refrigerant is dry.

Figure 4. ALCO ALM moisture liquid indicator

ALCO manufactures two different styles of moisture-liquid indicators:

1.) A yellow-to-green indicator (see Figure 4); and
2.) A red-to-blue four step indicator (see Figure 5).

The yellow-to-green indicator should be used primarily for mineral oil systems where oil break-down is not as big a problem as with POEs. The reason is that the yellow-to-green change occurs at 150 ppm water at 125° with R-134a. This indication level is 75 ppm above the threshold at which POEs may break down and form system-harming acids.

Figure 5. ALCO AMI moisture liquid indicator

The red-to-blue indicator in our AMI moisture-liquid indicator gives a more accurate indication of moisture levels with all refrigerants:

- 1st level 190 ppm;
- 2nd level 150 ppm;
- 3rd level 85 ppm;
- 4th level 60 ppm (based on R-134a and POE at 125° liquid temperature).

When the indicator changes from the third level to the fourth level, you can be reasonably assured that the system is well below the breakdown point of the oil.

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