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Recommended liquid line filter dryers and moisture indicators for refrigeration and air conditioning systems with HFCs refrigerants and POE lubricants

1 Moisture removal capability

The introduction of HFC refrigerants, which are not miscible with traditional mineral oil and Alkylbenzene lubricants, has created the requirements for Polyol ester (POE) lubricants. POEs have some inherent characteristics that require special attention when using the lubricant. These two characteristics, lubricant decomposition/hydrolysis and hygroscopicity, are interactive in nature under certain conditions. This situation described above is aggravated by the POE's affinity for moisture. High moisture capacity dryers at low level of EPD (End Point Dryness or Equilibrium Point Dryness) can remove sufficiently the moisture from system to the safe level.

The most popular and effective desiccant in use today for removal of moisture from refrigerants and lubricants is Molecular Sieves, which can hold three to four times the water of other commercial adsorbents. Molecular Sieves are synthetically produced Crystalline metal Alumina-Silicates. The extreme high porous adsorbents have strong affinity for water. In contrast to the other adsorbents, the pores of any particular type of Molecular Sieves are precisely uniform in size.

Activated Alumina is the other adsorbent which is able to absorb water and remove acid.

Filter dryers having silica Gel are not able to absorb moisture at low level of EPD. It is recommended to use filter dryers with an adsorbent of minimum 70% Molecular Sieve and maximum 30% Activated Alumina by weight in portion regardless of dryer construction as block or beads.

For comparison of water adsorption capability of liquid line filter dryers and EPD (End Point Dryness or Equilibrium Point Dryness) of refrigerant in system, the following conditions are recommended (table 1):

Refrigerant	DIN 8948		ARI 710-86		
	EPD, [PPM]	Liquid temperature, [°C]	EPD, [PPM]	Liquid temperature, [°C]	Absorbed ppm ARI condition
R134a	50	+24°C / +52°C	60	+24°C / +52°C	
R404A	50				990
R407C	50		50	+24°C / +52°C	990
R410A	50				990
R448A/R449A	50 *		50*	+24°C / +52°C *	990
R513A/R450A	50 *		50*	+24°C / +52°C *	990
R452A	50 *		50*	+24°C / +52°C *	990
R1234yf	50 *		50*	+24°C / +52°C *	990
R290	15		15	+24°C / +52°C *	550
...					

*) ARI-Standard does not define all rating conditions for HFC refrigerants since the standard has not been revised for including new refrigerants.

Table 1: EPD & liquid temperature

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2 Moisture Indicators

In order to detect safe level of refrigerant dryness, it is **essential** to use sight glasses with moisture indicators capable to indicate dryness of system at 3% or lower level of relative humidity i.e. water activity.

Example:

A refrigerant with 1000 PPM water solubility at +24°C liquid temperature and 1500 PPM water solubility at +52°C liquid temperature, the sight glass with moisture indicator of 3% sensitivity will result the color change as follows:

3% x 1000 PPM = 30 PPM dryness i.e. color change at +24°C liquid temperature

3% x 1500 PPM = 50 PPM dryness i.e. color change at +52°C liquid temperature

To make it easier to select a liquid indicator, it is recommended that the user checks the "acceptable" maximum color values for each refrigerant. These maximum values should reflect the capabilities of existing products in the market

Refrigerant	Indication humidity level is "ok"	Indication humidity level is not "ok"
R134a	<30 ppm	>100 ppm
R290	<25 ppm	>500 ppm
...		

3 Flow capacity

For selection of size of filter dryers, the following subjects shall be considered:

- Due to environmental concerns and the reduction of charge in the system, the filters dryer should **always be as small as possible** and be **selected according to the refrigerant charge in the system**. Select the filter driers size which is able to safely dry the refrigerant charge in the system.
- **The selection of larger connection sizes with the same volume of filter dryers is recommended.** This insures a lower pressure drop across the filter dryer and prevents establishing of flash gas in the liquid line, which leads to improper performance of expansion valves i.e. poor system efficiency. **Larger connectors lead to lower pressure drops.**
- **It is recommended that filter dryers to be selected at 0.07 bar pressure drop** according to DIN 8949 and ARI 710-86. Check whether pressure drop is **below** 0,07 bar. If not select a larger connector size or if required a larger dryer size.

These recommendations are addressed to professionals, industrial, commercial and domestic refrigeration system manufacturers / installers. They have been drafted on the basis of what ASERCOM believes to be the state of scientific and technical knowledge at the time of drafting, however, ASERCOM and its member companies cannot accept any responsibility for and, in particular, cannot assume any liability with respect to any measures - acts or omissions - taken on the basis of these recommendations
