



Refrigeration lubricants: how to verify their quality?

Refrigeration lubricant is one of the most important elements to ensure that compressors in AC/R systems run smoothly and last over time. Choosing which one to use for a specific system is not easy: there are many different lubricants on the market, and it is wrong to believe that they are all the same.

The main lubricant features that contribute to the proper operation of the entire AC/R system are:

- good solubility with the refrigerant gas
- good fluidity at low temperatures
- high thermal stability
- good degradation stability
- high chemical stability with the refrigerant gas.

But what are the roles of refrigeration lubricants? Let's see them in detail.

1. The main function of a refrigeration lubricant is to adequately lubricate all the mechanical components of the compressor, that without proper lubrication, would wear out.
2. Besides lubricating, then, refrigeration lubricants also play a very important role in the operation and lifetime of the system: that of cooling and eliminating the heat generated internally by the compression of the refrigerant gas. During normal system operation, in fact, the internal components can reach very high temperatures and excessive heat would cause them to expand until they seize against one another.

A lubricant that does not provide adequate levels of lubrication and cooling, therefore, causes the compressor to operate less efficiently than it should and, in severe cases, can even lead to compressor damage or breakdown.

Quality and compressor oil: what are the factors to consider?

Quality compressor oils are characterized by:

1. Low water content

The presence of water in a refrigeration lubricant is the second most common cause of malfunctions and failures found in an AC/R system (after metal particles contamination due to mechanical wear of components).

An excessive presence of water and moisture in the system:

- leads to the development of acid and corrosion in the system



- acts as a catalyst on oil degradation, accelerating hydrolysis and oxidation
- reduces the oil's lubricating capacity, since it contributes to decreasing its viscosity
- it compromises the lubricant-refrigerant gas miscibility, leading to higher chances of foam formation.

2. Low acid content

Oxidation, hydrolysis, and degradation of the lubricant cause a high level of acid that contribute to corroding system components and, as a consequence, lead to refrigerant gas leaks.

When examining used refrigeration oil, a comparison with virgin oil values is essential.

The neutralisation numbers for refrigeration lubricants are very low and, more precisely, are < 0.1 mg KOH/g.

The neutralization number according to DIN 51558-1 is identical to the Total Acid Number (TAN) according to ASTM D974. Both are reported on the TDS and CoA of the refrigeration lubricant and are shown in mg KOH/g.

3. Good cooling capacity

There are essentially two problems on the market, and they are linked to inadequate additives: on the one hand, there are compressor oils that are unable to absorb heat at all, and on the other hand, there are compressor oils with a certain cooling capacity which, however, separate and break down at very high temperatures, making constant and frequent oil changes necessary.

4. Excellent compatibility with the refrigerant gas

Checking the compatibility of these two elements is particularly important, especially in the case of fluorine and/or chlorine-based refrigerants, in order to avoid adverse chemical reactions and the formation of water inside the system. The presence of moisture would lead to acid formation, with all the consequences already mentioned before (see point 2).

5. Good thermal and chemical stability

Exposure of refrigeration lubricants to high temperatures and for a long time can lead to decomposition processes that can cause serious problems.

Ageing stability is, therefore, an important criterion to consider when choosing a refrigeration lubricant.



Decomposition processes are generally complex chemical reactions catalysed by metals such as copper, iron, zinc, and aluminium. Well-known indicators of oil ageing are the increase in the neutralisation number (acid number) and the presence of metal and /or plastic particles produced by the deterioration of individual system components, which are chemically attacked by an overly acidic oil.

The chemical stability of a refrigeration lubricant, on the other hand, depends on several factors, but above all on the extremely low water content in the system. Refrigeration lubricants with an excessive water content (i.e. POE > 100 ppm; PAG > 500 ppm; MINERAL > 30 ppm) easily develop acid and undesirable secondary degradation particles.

6. Adequate refrigerant/lubricant solubility to ensure good system lubricity

The miscibility of the refrigerant gas in the lubricant is essential to ensure good system lubricity and its efficiency.

Phase separations can lead to various malfunctions, particularly in heat exchangers, evaporators, and manifolds. It is also important to check that the viscosity of the lubricant (at the high temperature of the compressor) is enough to effectively lubricate the compressor itself.

Therefore, refrigeration lubricants with excellent miscibility must be used, to obtain proper oil circulation in the system.

Errecom SPA takes this aspect into account when engineering its refrigeration lubricants, and it does so by studying the viscosity/pressure/temperature curves, which are specific to each lubricant-refrigerant mixture.

7. Formulations developed by well-known chemical companies and, above all, with experience and skills in additives

For over twenty years Errecom's R&D department, working with the main OEMs, has been studying and analysing the chemical decay of air conditioning and refrigeration systems, paying constant attention to finding the best additive formulations. It is this know-how that makes Errecom a reliable and safe partner in the field of refrigeration lubricants.

Errecom's refrigeration lubricants, in fact, are formulated with anti-foam and anticorrosive additives which improve their performance and make them a safe and reliable choice for the AC/R system.