Whitepaper

Energy efficiency in food refrigeration: the role of specialty lubricants

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Executive summary

In the food-processing industry, refrigeration systems are indispensable—but they are also among the most energy-intensive equipment in operation. High energy costs are a cost burden that can affect a company's profitability. As energy costs rise, those responsible in the industry are under increasing pressure to optimise performance. This Whitepaper explores how the strategic use of high-performance specialty lubricants in refrigeration compressors can significantly enhance technical reliability, reduce maintenance requirements, and enable measurable average energy savings exceeding 4%*. This is most likely to succeed when accompanied by a Klüber Energy Efficiency project.

Food refrigeration – a vital element in profitability considerations

Refrigeration is an element of paramount importance in many food production processes. All machines and components involved, in particular refrigeration compressors, must operate reliably around the clock to ensure safe food production and/or storage. At the same time, refrigeration accounts for a high proportion of a food company's energy bill, so it has a strong impact on the enterprise's profitability.

Refrigeration compressors and their lubricants – strong economic effect

Compressors are vital components of these refrigeration systems, and they operate under demanding conditions such as high pressure, yet are expected to work reliably in continuous operation over a long time.

For such smooth and trouble-free operation, compressors rely on lubricants that perform well under tough operating conditions: They have to cope with the pressures and temperatures encountered, and, most importantly, the refrigeration medium they work with, such as ammonia or CO_2.

* Based on the comparison of machine operation before and after implementation of a carefully selected Klüber lubricant under representative customer operating conditions. Energy savings were determined using Klüber's TÜV-certified methodology, based on ISO 50015 and IPMVP (EVO 10000-1:2022). Result derived from several hundred Klüber Energy Efficiency projects conducted at customer sites worldwide. Individual results may vary depending on equipment, operating conditions and application.

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The refrigerant used may have a corrosive effect inside the system, and a tendency to bring down the oil viscosity. Consequently, the oil may fail to protect the compressor system adequately, and excessive friction and wear may set in. This will in turn affect compressor operation, leading to higher energy consumption as well as the need to stop the compressor for maintenance. Production loss and high costs are the obvious consequences. In contrast, high-performance lubricants increase reliability and system efficiency, due to lower friction but also low oil-drag forming residue in the condenser.

Strategic effects on company goals

From a strategic perspective, the choice of lubricant can support broader business goals. Lower energy consumption and reduced maintenance costs contribute directly to the bottom line. Demonstrating a commitment to operational excellence enhances brand reputation with customers, investors, and regulators. Klüber Lubrication's solutions are backed by rigorous testing, certified compliance with ISO 50001, and a global support network – ensuring that performance gains are measurable.

How compressor oils influence system performance and energy consumption

The oil's role in a refrigeration compressor is not only that of a lubricant. It also supports thermal conductivity, helping to dissipate heat and maintaining optimal operating temperatures. In addition, proper lubrication helps keeping seals tight, refrigerant leakage down and system pressure up. Specially formulated lubricants have a higher viscosity index and ensure excellent cold flow behaviour. As a result we see lower evaporation loss and a more effective lubricant film, leading to less wear and longer equipment life.

And then there's the issue of energy consumption: As carefully selected compressor oils reduce friction and and have a positive thermal impact, they will help to bring down energy consumption. To maximise the energy-saving effect of high-performance compressor oils, however, it makes sense to consider the refrigeration system as a whole before switching over to a different lubricant.

Klüber Energy Efficiency – a program for systematic energy saving

Such an approach is offered by the Klüber Energy Efficiency program. With this solution, the energy savings potential of an individual industrial operation is systematically explored and then utilised by implementing lubrication-related improvements.

The Klüber Energy Efficiency solution is designed to prove and quantify the reduction of energy consumption after a changeover to a Klüber lubricant. At the outset, Klüber specialists will determine the saving potential of the machinery involved. During the project, they will measure power consumption before and after the oil change, provide a scientific analysis of the data and the actual savings in accordance with international standards. With this approach industrial companies can realise potential savings and reduce their energy costs.

Case examples

Grasso screw-type compressor:

Technical data:
– Nominal power: 400 kW
– Working hours per year: 6,500
– Oil sump volume: 150 l

Prior to changeover:
– Oil life: 6,000 hours

After changeover:
– Oil life: 30,000 to 40,000 hours
– Energy savings : approx. 7.6%

Mycom compressor:

Technical data:
– Nominal power: 355 kW
– Working hours per year: 8,000
– Oil sump volume: 300 l

Prior to changeover:
– Oil life: 8,000 hours

After changeover:
– Oil life: 35,000 hours
– Energy savings attained: approx. 4.3%

Operational benefits for maintenance and production

For those responsible for day-to-day operations, the benefits of high-performance lubricants are tangible. Reduced wear and thermal degradation mean longer intervals between oil changes and component replacements, as well as fewer unplanned shut-downs and maintenance interventions. Lubricants with excellent chemical stability reduce the risk of deposits and sludge, making system maintenance more predictable and less labour-intensive. They also improve sealing between compressor components, and exhibit lower drag within the system, minimising oil losses and contamination. These advantages not only improve equipment uptime but also free up valuable maintenance resources for other critical tasks.

Conclusion

In an industry where margins are tight and food safety is non-negotiable, every efficiency gain counts. Specialty lubricants may represent a small fraction of a refrigeration system's cost—but their impact on performance, reliability, and energy use is disproportionately large. By partnering with Klüber Lubrication, companies in the food industry can turn lubrication into a strategic advantage—one that supports operational profitability.

When a Klüber Energy Efficiency project is conducted, it becomes apparent how the right lubricant can become a powerful lever for operational and financial efficiency. These projects consistently show that switching to more energy-efficient oils can yield average energy savings exceeding 4%* – a significant figure when scaled across multiple systems and facilities.

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How to find the right lubricant supplier

Choose a specialist
Look for a supplier that offers tailored lubricant formulations specifically developed for refrigeration compressors in food-processing environments.

Look for energy-efficient solutions
A top-tier supplier should offer a structured program like the Klüber Energy Efficiency solution to help identify and implement energy-saving opportunities.

Demand proven performance
Ask for documented case studies showing real-world results such as energy savings, reduced wear, and extended service life.

Seek to obtain certificates
The completion of programs like the Klüber Energy Efficiency solution comes with the issuing of certificates, e.g. based on TÜV or DIN ISO 50001 specifications, that can be used with internal and external stakeholders as well as customers.

Verify food safety compliance
Ensure the supplier provides NSF H1-registered products and holds ISO 21469 certification for food-grade applications.

Expect expert support
Select a partner with global technical teams who can assist with product selection, implementation, and ongoing performance monitoring.

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