SKF BeyondZero

Using refrigerant as lubricant to cut CO_2

Pure refrigerant lubricated bearings from SKF enable oil-free lubrication in large capacity chillers to increase energy efficiency

Environmental benefits

- Reduced CO_2 emissions
- Increased energy efficiency
- No need for oil maintenance

High nitrogen stainless steel rings, PEEK cage and silicon nitride balls made to high quality SKF specifications

For just one 500 kW chiller, replacing oil-lubricated bearings with pure refrigerant lubricated bearings from SKF would make them 8% more energy efficient and cut CO_2 emissions by 147 600 kg every year.

The above offering is part of the SKF BeyondZero portfolio of products, services and solutions designed to help our customers reduce environmental impact. To learn more, visit ***beyondzero.com***

Large capacity chillers use a refrigerant to cool water that is then circulated throughout a building to provide air conditioning or to cool an industrial process. Typically, these chillers are equipped with centrifugal compressors that rely on hydrodynamic bearings lubricated with a mix of oil and refrigerant.

An oil separation system is needed to maintain an oil rich mixture for bearing lubrication, while circulating as little as possible in the system. If oil is not needed, the oil separation system can be eliminated completely. Also, if oil is not needed, the heat transfer efficiency in the evaporator and condenser improves. The efficiency also improves since the oil circulated in the system is displacing refrigerant that could be used for cooling.

Pure refrigerant lubrication

For centrifugal compressors used in chillers, pure refrigerant lubricated bearings from SKF use the refrigerant itself as the bearing lubricant. At the heart of this breakthrough solution are SKF hybrid bearings which feature a combination of silicon nitride rolling elements, high nitrogen stainless steel rings and a glass fibre reinforced PEEK cage.

By eliminating the need for oil lubrication, pure refrigerant lubricated bearings from SKF can enable compressor designs that reduce system complexity and cost while improving reliability and energy efficiency.

In a 500 kW chiller, for example, replacing the oil-lubricated bearings in a gear-driven compressor with pure refrigerant lubricated bearings from SKF in a direct drive compressor would make the unit 8% more energy efficient. That efficiency increase equates to savings of 40 kW which corresponds to 147 600 kg of CO_2 emissions every year.

Proven through more than a decade of field operation, pure refrigerant lubricated bearings from SKF are already at work in industry-leading chillers, helping to lower energy consumption and costs, and eliminating oil-related environmental concerns.

Pure refrigerant lubricated bearings from SKF

A media-lubricated solution with hybrid bearings

Centrifugal compressors that use refrigerants have traditionally employed hydrodynamic bearings that are lubricated with an oil-refrigerant mix. SKF hybrid bearings allow just the refrigerant to be used as the lubricant, enabling this unique pure refrigerant lubricated solution.

Well suited to harsh compressor operating environments, SKF hybrid bearings feature ceramic rolling elements and rings made of a new grade of high nitrogen stainless steel and are heat treated in a process developed by SKF. The result is a steel with a much finer microstructure than conventional bearing steel, significantly enhancing fatigue resistance and corrosion protection.

Silicon nitride advantages

Silicon nitride rolling elements have a mass that is only 40% of steel rolling elements, a reduction that allows higher speeds, lower inertia plus more rapid starts and stops.

Silicon nitride's low coefficient of friction enhances wear resistance, allowing bearings to run cooler even when they are poorly lubricated. Ceramic rolling elements also act as a barrier to electrical current passing between inner and outer rings, thereby delivering a simple method of insulation.

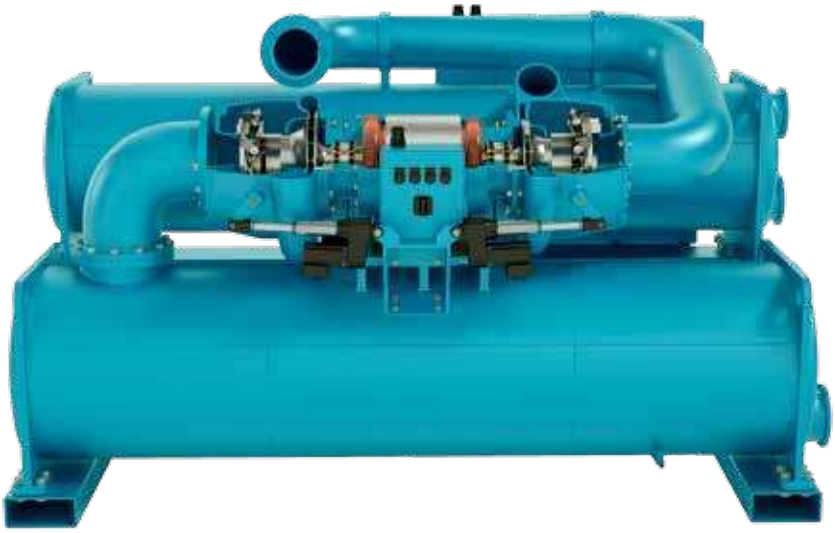
Enabled by these ceramic material advantages, SKF hybrid bearings open up a wide range of design possibilities for rolling bearings, including the pure refrigerant lubricated solution developed for centrifugal compressors in low-pressure, water-cooled chillers.

Bearing features

- High nitrogen stainless steel rings
- Glass fibre reinforced PEEK cages
- Silicon nitride balls
- Made to high quality SKF specifications

Operational benefits

- Increased energy efficiency
- Extended bearing service life
- Simplified installation
- Reduced operating temperatures
- No oil maintenance
- Lower lifecycle costs



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