

Energy Efficiency Solutions

The SKF 18K concept gear unit: more power, less energy

More compactness – more torque

The 18K concept gear unit matches the power output of a larger conventional gear unit, allowing designers to effectively achieve volume reductions up to 15% – conversely, it enables higher torque levels, up to 15% more, without increasing gear unit size.

Weight savings

Designers could opt to maintain existing power output but reduce weight by 15–20%.

Energy savings

An overall energy savings from a typical application could amount to 10% or more coming from greater compactness, longer operation and reduced friction

Maintenance savings

Virtually no unplanned downtime, thanks to six online condition monitoring sensors. Maintenance costs are slashed by 90%.

The “impossible” design challenge

Meeting the energy challenges of the 21st century will mean rethinking what is “possible” and what isn’t, particularly in the area of industrial equipment design. To demonstrate how SKF Knowledge Engineering could be applied to create a more energy-efficient gear unit, SKF partnered with other industry-leading engineering centres to develop something previously considered impossible: a gear unit that provides a much higher power density (reduced size for a given torque), longer operation and virtually 100% reliability – while consuming less energy. SKF named this concept gear unit 18K, for *karat*, as it represents a golden opportunity for industrial transmission manufacturers and end-users.

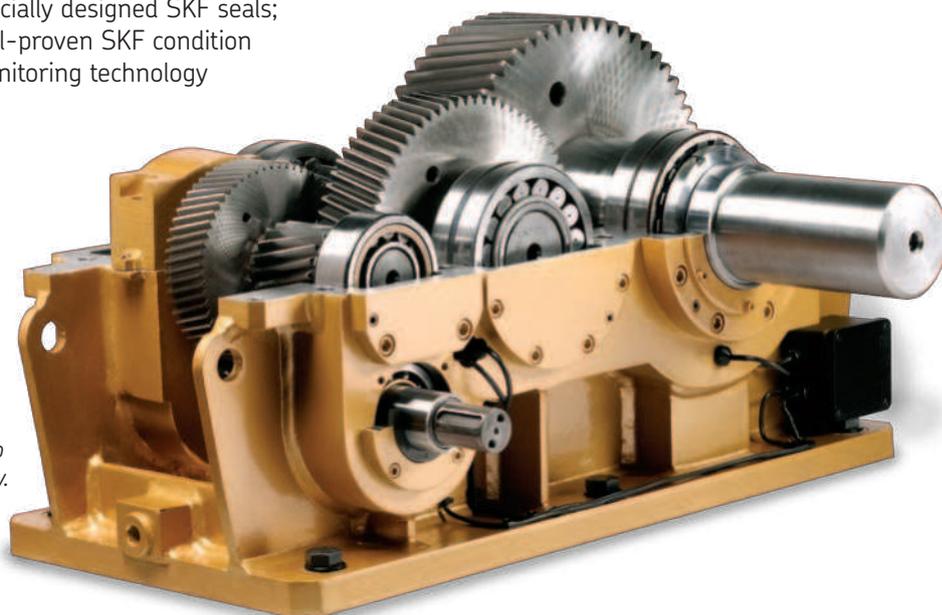
The unprecedented results

Using proprietary modelling and simulation tools, SKF looked at the interaction of all relevant components in a gear unit to assess and optimize overall system performance. The design benefited from an optimized case design; nine SKF Explorer performance class bearings of three different bearing types; specially designed SKF seals; well-proven SKF condition monitoring technology

and equipment; and a lubricant specifically selected in collaboration with a leading lubricant manufacturer. Combining engineering competence and a reliability-focused maintenance strategy completed the package. The final product delivered some truly remarkable benefits. (See sidebar.)

Potential applications

Though the 18K gear unit was developed to demonstrate the potential advantages of a completely optimized system, the concept has relevance in drivelines across a broad range of industrial applications. Regardless of unit size or application, the principles remain the same. Considering that gear units are important in every industrial process, an overall energy savings from a typical application could amount to 10% or more coming from greater compactness, longer operation and reduced friction. If the 18K concept were applied to existing gear units, the potential energy consumption on a global scale would be significantly reduced.



To develop the 18K concept gear unit, SKF worked with a leading manufacturer to create a 250-size gear unit that matched the power output of a conventional 280-size unit, transmitting up to 15% more torque with 10 to 15% less energy.



A systems approach to design optimization



Bearings

18K fully exploits the potentiality for increased powered density and energy efficiency offered by SKF Explorer class bearings. Four spherical roller bearings, three cylindrical roller bearings and two angular contact ball bearings from SKF Explorer range have been selected to solve the specific needs at each particular shaft position within the gear unit.



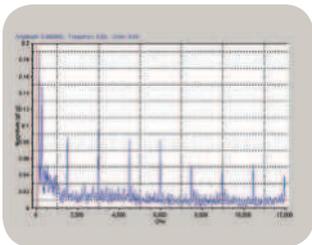
Seals

SKF radial shaft seals equipped on 18K utilize a new nitrile rubber compound engineered by SKF to solve the demanding requirements of industrial gear units. The result is outstanding service life and improved operational reliability.



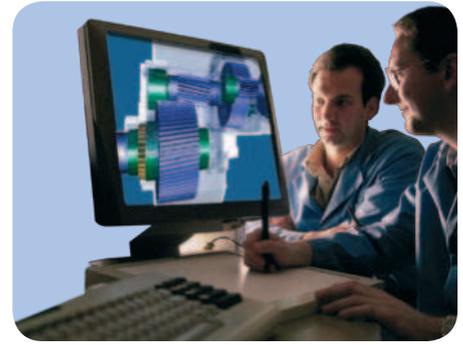
Lubrication

Collaborating with a leading lubricant manufacturer, SKF selected a high-performance oil capable of increasing service life in running conditions typical for industrial gear units.



Condition monitoring

18K features an integrated condition monitoring system with accelerometers and temperature, torque, and speed sensors. These, combined with a proactive maintenance strategy achieve overall efficiency at the end-user site over the entire gear unit life cycle.



Engineering knowledge

In developing the 18K concept gear unit, SKF deployed advanced system analysis, calculation and simulation tools, tribological and materials knowledge, plus machine condition monitoring expertise. SKF deployed a system approach to optimize the interaction of the case, shafts, gears, bearings, seals and lubricant for every vital position in the gear unit. Using proprietary SKF software, SKF engineers were able to use dynamic simulation to observe the behaviour of the complete system and, as a consequence, optimize the unit's performance.

In addition, SKF worked with an expert partner in gear technology to analyze gear behaviour and implement gear profiles able to transmit the given torque in the most compact and efficient way possible.