

Efficient Bearings Reduce Energy Consumption

SKF has developed a new bearing family that reduce energy consumption by at least 30% compared to standard ISO products. The new family will be initially introduced for two types of bearings, deep groove ball bearings and tapered roller bearing, which are the most used bearing types in the world.

In addition, the company has developed a web-based application that can support a significant reduction in energy consumption and cost saving for process plants and manufacturing industries.

Further steps to reduce energy consumption for customers include the use of other SKF knowledge and technology in a wide range of applications from welding robots to automatic throttle control units for business jets.

And, within its own factories SKF has undertaken a series of activities to continually save energy.

“With these innovations we will be able to support industry in making a significant contribution to energy savings today and in the future”, says Tom Johnstone, President and CEO of SKF.

“The United Nations reported a couple of weeks ago about the world climate that shows we have a problem. There are many views and discussions on the subject. However each of us has to make their own contribution and this is the start of our contribution. We have developed and can offer technical solutions that can significantly reduce energy consumption”, Mr. Johnstone says.” In addition we are addressing our own energy consumption to reduce this and to reduce CO2 emissions.”

“Two years ago at the Annual General Meeting SKF launched its BeyondZero™ initiative. In short this means that the energy the energy savings from the products and solutions that SKF supplies to its customers will be greater than the SKF Group’s own energy consumption. It means more than being energy neutral – it means being energy positive. These new innovations launched today will contribute to us achieving our BeyondZero™ target.”

SKF energy efficient bearing

This new family of bearings reduce energy consumption by at least 30% and have the same service life as ISO rated products. Their lower friction generates lower operating temperatures that will improve lubrication conditions and contribute to long life.

The two new bearing types that are now introduced are the result of some years of very focused research and development to find a design that would substantially reduce the energy consumption while performing according to ISO standards. The SKF Group’s advanced research centres and laboratories have been deeply involved together with the company’s manufacturing centres.

The technical improvements that deliver the energy savings are design related and a combination of surface topography, raceway profiles, optimized internal geometry, a special polymer cage, lower friction grease and in the case of the tapered roller bearing also an optimized set of rollers.

The Energy Efficient family of tapered roller bearing will deliver energy savings on average of at least 30% and SKF will initially focus on industrial segments where applications exceed 1 MW power consumption. Such applications are in railway and transmissions in heavy industry, ships, wind energy, conveyors and extruders. First applications are expected to be in wind turbines.

An excellent example of the saving potential of these bearing is the wind turbines operating in the world at the end of 2006. If all bearings in the gearbox of all these turbines could be replaced by SKF’s Energy Efficient tapered roller bearings they would generate an estimated extra 770 million kWh per year. That is equivalent to the total energy consumption of 1 million Swedish households for one month.

The Energy Efficient family of deep groove ball bearings will also deliver energy savings of at least 30% Deep groove ball bearings are mainly used in lightly loaded applications and the first applications will be industrial electrical motor driving machinery in many segments.

An example of the saving potential of these bearings is the energy consumption in industrial motor driven systems in USA and European Union. If these motors used SKF Energy Efficient deep groove ball

bearings the estimated savings would be 2,460 million kWh per year. This is equivalent to the over 3 million Swedish households for one month.

SKF energy efficient solutions

SKF has focused for many years on developing products and solutions that help customers to reduce their energy consumption and thus also their costs.

Some example are:

- More than 90% reduction in energy consumption was achieved in welding robots when SKF replaced pneumatic actuators with compact SKF electromechanical actuators as the Enabling technology for welding tongs in automotive plants in Germany. With over 300 robots in a typical production line, making 4 million welding points per year, the total savings are very large.

These electromechanical actuators can also be used in other robotic applications in industries like Automotive, Aerospace, Semiconductors, Metalworking, Food and Beverage and many other industrial segments.

- One million litres of fuel can be saved per business jet lifetime with the SKF Automatic Throttle Control units. The Group has developed jets that allow a saving of 100 litres of fuel per flight hour, which is equivalent to one million litres over the lifetime of the jet.

The auto throttle takes over some pilot functions like thrust, rate of climb and speed during flight, adjusting as necessary to the reduced weight due to fuel burn off. Computerized automatic control is more fuel efficient than human piloting and the typical reduction in fuel using SKF ATC units is 5% per flight.

The SKF ATC units are FAA approved and installed on two lines of business jets.

“Client Energy and Environment Analysis Application” (CEEA).

SKF has developed a web-based application that can support a significant reduction in energy consumption and save costs for process plants and manufacturing industries. The application is called “Client Energy and Environment Analysis Application” (CEEA).

The CEEA establishes an “opportunity map” of the potential energy savings and identifies those likely to give greatest savings as a function of percentage saved, payback period and cost.

Even small percentage energy savings per ‘machine’ can deliver huge cost savings on common equipment like motors, pumps, fans, compressors etc. when considering the effect across the whole plant. For example; in a typical oil refinery there would be more than 1,000 pumps, and savings per pump could be up to 20%.

Reducing energy within SKF manufacturing

SKF is also continuously working with a number of programmes to reduce the energy consumption within its own facilities. These programmes cover everything from changing windows, improving insulation, detecting leaks of compressed air in piping systems, more efficient heating and ventilation, to new technologies for ventilation, to new technologies for heat treatment and grinding, changing to green energy – in the Goteborg factory carbon dioxide emissions were reduced by 60% - change to energy efficient pumps and motors, reduced use of compressed air, intelligent machine control etc. In 2005 SKF launched a target to reduce our CO2 emissions by 5% per annum. In 2005 the reduction was 7% and in 2006 the reduction was over 5%.

SKF working closely with Universities to address energy issues

Since a number of years SKF has been working together with MIT, Massachusetts Institute of Technology, to define new models to evaluate and measure the energy use of systems in order to improve the energy efficiency and develop new solutions. One example is the design of bearings where we evaluate the energy impact of any change in design along the life cycle; during manufacturing, in use and in the recycle stages.

SKF is also working closely with the School of Business, Economics and Law at Goteborg University and Chalmers University of Technology, to support 3 PhD's Sustainability.

Case Study

SKF energy efficiency solutions lower total operational costs

SKF Energy Efficiency Solutions lower total operational costs in many applications by reducing friction, reducing power consumption, and applying new technology, some of which can also eliminate costly ancillary equipment in pneumatic, hydraulic and oil related system. Solutions vary from very low friction bearing to actuator and control units for solar panel sun tracking systems, to advanced throttle control systems for the very rigorous demands of aerospace. Examples of solutions, using knowledge from one or more of SKF's five technology platforms; Bearing, Seals, Mechatronics, Lubrication Systems and Services are;

More than 90% reduction in energy consumption in welding robots with SKF electromechanical actuators. Compact SKF electromechanical actuators as the enabling technology for welding tongs in automotive plants in Germany. Energy saving is more than 90% calculated on the energy required per complete welding point. With over 300 robots in a typical production line, making 4 million welding points per year, the total savings are estimated at 13.5 million kWh per year. That is the equivalent of the total energy consumption of 17,000 Swedish homes for one month. As well as energy saving the electromechanical actuators also allow faster welding cycle speeds, better quality control of the process, reduced maintenance costs and more flexibility in adapting to production line change.

Electromechanical actuators can be used in robots in welding and other applications in the following industries; Automotive, Aerospace, Semiconductors, Metalworking, Food and Beverage and many other industrial segments. Large energy savings in industrial compressors with SKF technology. Three different technical solution delivered the following large energy savings in industrial compressors; saving of 700,000 kWh per year were made when SKF magnetic bearing replaced hydrodynamic bearing in a 12 MW natural gas pipeline compressor. That is the equivalent of the total energy consumption of 900 Swedish homes for one month. In addition there are cost and environmental benefits gained by eliminated oil related systems; pumps, coolers, filters and the need to dispose of used oil.

Magnetic bearing deliver torque by a shaft suspended in a magnetic field that can be controlled to vary the speed of rotation. The shaft has no contact with any other machine parts making the system almost friction-free. More than 1 million kWh were saved over a four air conditioning compressors fitted with SKF hybrid bearings. That is the equivalent of the total energy consumption of 1,200 Swedish homes for one month. Hybrid bearing can be lubricated by the refrigerant, making the application oil-free. Traditional systems use an oil/refrigerant mix to lubricate the bearings. Additional cost and environment benefits are made due to eliminating oil related system. Hybrid bearing have silicon nitride rolling elements in place of traditional steel rolling elements.

- Energy consumption reductions averaging 5% per machine were made by optimizing screw compressors for commercial air conditioning systems, using SKF rotor positioning technology. With an estimated base of 1 million systems and 100,000 added every year the potential savings are 2,500 million kWh, based on an average consumption of 200,000 kWh per year. That is the equivalent of the total energy consumption of 3 million Swedish homes for one month. Rotor positioning minimizes internal clearances in screw compressors thereby reducing leakage and improving overall efficiency. One million litres of fuel saved per business jet lifetime with SKF Automatic Throttle Control units.

SKF Automatic Throttle Control Units (ATCU) developed for business jets save an estimated 100 litres of fuel per flight hour that is equivalent to one million litres over the lifetime of the jet. That is also the equivalent of the total energy consumption of 12,000 Swedish homes for one month. The auto throttle takes over some pilot functions like thrust, rate of climb and speed during flight, adjusting as necessary to the reduced payload weight due to fuel burn off. Computerised automatic control is more fuel efficient than human piloting and the typical reduction in fuel using SKF ATC units is up to 5% per flight. The SKF ATC units for business jets are fully developed by SKF: hardware, software and interface to the digital engine computer that governs the engine speed and fuel supply. They are currently FAA approved and installed on two lines of business jets. 30-50% energy saving at EC Parliament building using SKF actuators.

SKF electromechanical actuators and control units allow self regulating sunblind systems to reduce energy consumption by 30-35% in the winter and 50% in the summer, at the European Commission Parliament building in Brussels. The energy reduction is part of the consumption by the building's Heating, Ventilation and Air Conditioning (HVAC) system and can reduce HVAC costs by an average of 40% per year. Considering that HVAC systems consume one third of the energy use in office buildings, the savings are quite significant. Typical savings for a 100,000 sq.m building have been estimated at 2.7 million kWh per year. That is the equivalent of the total energy consumption of 3,300 Swedish homes for one month. The sunblind system is a secondary glass façade that captures heat from the sun in the winter and deflects it in the summer. The SKF actuator and control units are linked to the buildings HVAC system management software and vary the angle of the blinds according to the sun's position and other factors such as clouds and nearby buildings.

Reference book:

Electrical India,
Vol 47 No.3, March-2007