

CERAMICSPEED

bearings

Timeline for the development of ceramic ball bearings for industrial applications:

1970-80 Silicon nitride balls for ball bearings are invented.

1980-90 NASA spots their potential and analyses their advantages and disadvantages in depth. The production process enters a new phase (HIP) and by the early 1990s the quality which we recognise today is achieved. In 1993 NASA discloses the fact that they use hybrid bearings for the engine components of spacecraft.

1996 Ceramic ball bearings are first used by the Formula 1 industry. Today most bearings found in an F1 car are hybrid bearings. This includes high-speed spindle bearings which currently also employ ceramic balls.

1998 In partnership with SKF, Jacob Csizmadia develops a set of hybrid bearings for inline skates which he uses to attempt his 24 hour world record.

2000 Several large bearing manufacturers launch hybrid bearings focused on applications in electric motors.

2001 Jacob Csizmadia introduces hybrid bearings to the Tour de France.

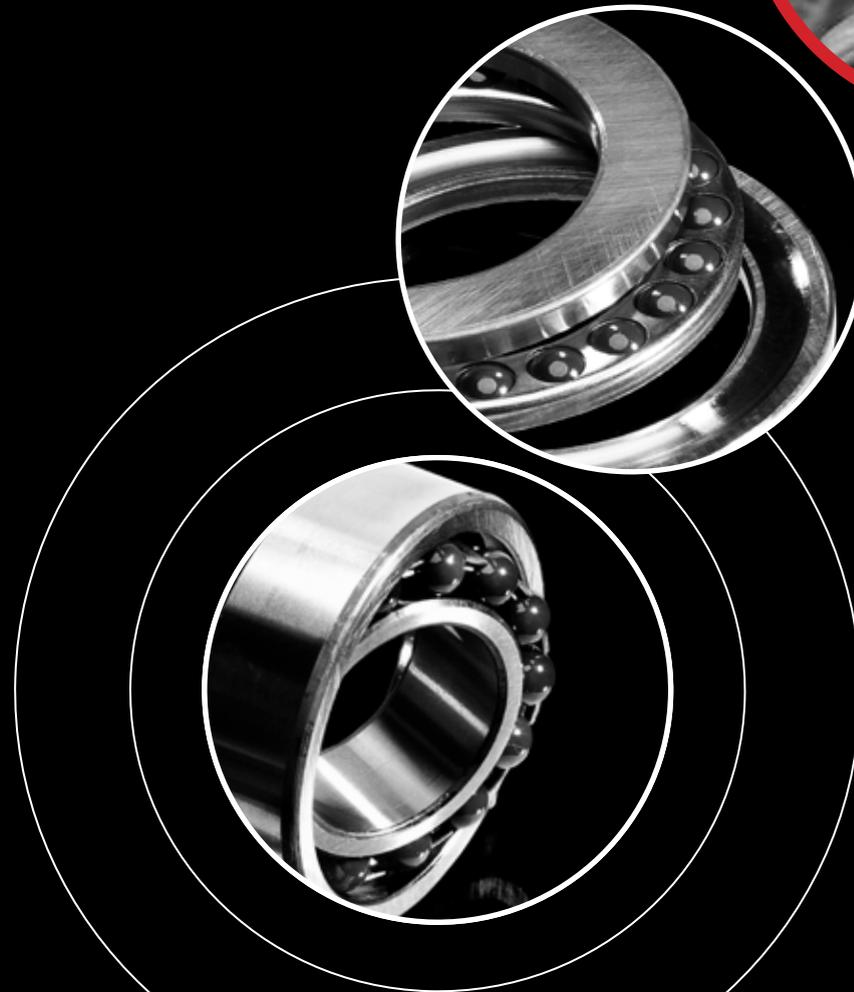
2004 Jacob Csizmadia founds CeramicSpeed and hybrid bearings become available for many applications in sporting and industrial sectors.

2010 CeramicSpeed documents 4-8 times longer service life in ceramic ball bearings in industrial use.

2011 CeramicSpeed launches the LongLife series in its industrial product range. A range of products which makes it possible to replace conventional steel bearings in most industries. Resulting in unparalleled operational safety and service life.



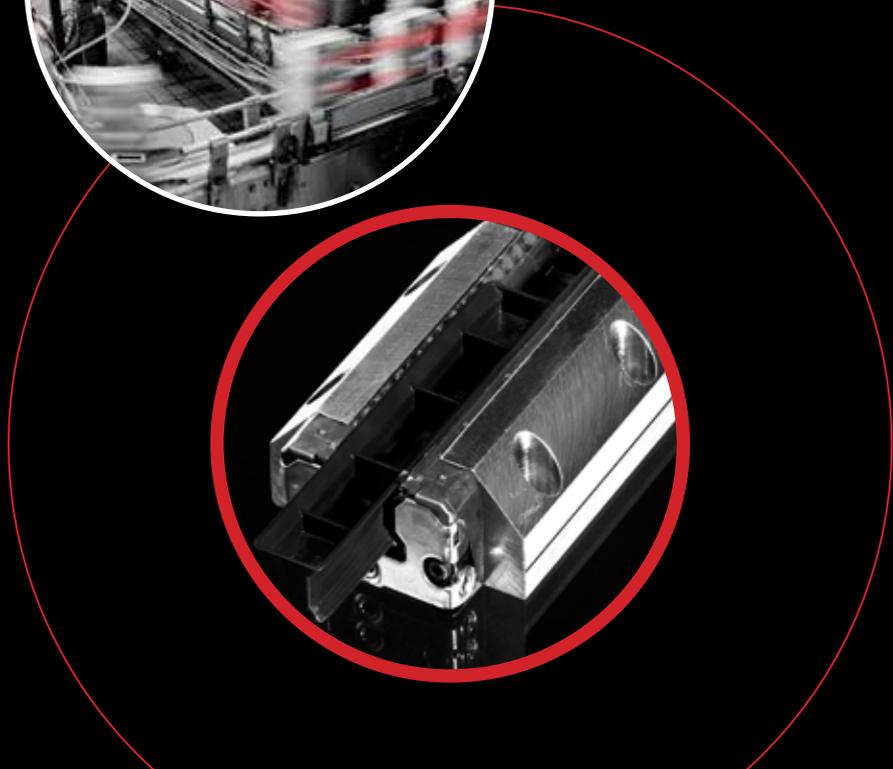
Since 2006 CeramicSpeed has been an official sponsor of the Pro Tour. Today we are the official sponsor of and bearing supplier for several of the Tour's largest cycling teams, including Saxo Bank-SunGuard.



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CERAMICSPEED
bearings



industry



We brought space technology

“down to earth”

CeramicSpeed develops and manufactures a wide range of bearings which generate considerable financial and operational advantages in all industries.

Based on NASA's experience gained from their space explorations in the 1990s, CeramicSpeed today produces hybrid bearings with top grade Silicon Nitride Ceramic balls for everyday industrial uses. These bearings surpass traditional steel bearings in every way. Formula 1 racing were amongst the first to adopt hybrid bearings with ceramic ball technology in the early 1990s.

CeramicSpeed's founder, Jacob Csizmadia, first encountered the obvious advantages of hybrid bearings in 1998 when breaking the 24 hour in-line skating world record. At the 2001 Tour de France Jacob introduced hybrid bearings to professional cycling.

The ongoing development process has now been brought completely down to everyday use in industry. For more than ten years CeramicSpeed has focused on the development and composition of High-Tech components in hybrid bearings. The result is high quality, well documented performance across a wide range of industries thus placing CeramicSpeed, on a worldwide basis, at the forefront of this particular field.



....creating possibilities for savings in the universe of industry

CeramicSpeed offers unique hybrid bearing solutions with CeramicSpeed balls made of Silicon Nitride and other components specially designed e.g. cages, seals etc. Four Long Life series plus a custom build line cover virtually any industrial application, whatever the requirement for types, sizes, and properties of the bearings.

A product range that outperforms standard bearings in every way.

Bearings that last the longest - cost the least

Whether your equipment is brand new or has been operating for some time, bearings often represent a fraction of the total costs of the assembly. Conversely the cost of servicing will be considerably higher than the cost of the bearing itself, the man hours and production downtime needed for maintenance are two key factors that deliver the potential saving by fitting longer lasting bearings.

4-8 times longer lifespan

99.4% of CeramicSpeed's hybrid bearings solutions last a minimum of 4 times longer than the standard bearings they have replaced. In 50% of the cases up to 20 times longer. Consequently, the initial higher price of the hybrid bearing is usually recovered somewhere between the first and second standard bearing replacement. For

bearings with an expected lifespan of 1-2 years, this represents significant operational savings. Longer lasting bearings also offer other advantages and fewer problems. Other advantages – or less hassle, if you like!

Improved operational economy can be summed up as follows:

- Simplified maintenance planning with longer bearing replacement intervals, cutting down on interruptions to output capacity.
- Reduced service costs as the cost of labour far exceeds the value of the bearing - try multiplying by a factor of 4-8 plus.
- Increased productivity
- Reduced risk of bearing failure with greater reliability.
- Increased performance. Specifically optimised bearings result in a better and more uniform production flow.

Jacob Csizmadia, founder of CeramicSpeed, has focused on development of ceramic bearings for more than 15 years

CeramicSpeed – the hard facts...



Ceramic balls are amazingly hard without being brittle. They withstand easily a hard blow from a hammer that would mark and dent a steel ball.

Ball bearings are often regarded as a minor element of the complete production line. A low-tech component with a given service life, not given much attention...

...CeramicSpeed would like to change that view!

CeramicSpeed looks at all possibilities on behalf of industry. We regulate the specially designed hybrid bearing's components to optimise service life for any purpose and in any environment and to reduce maintenance costs.

The most crucial element in CeramicSpeed bearings are the Silicon Nitride ceramic balls with their unique properties outperforming steel balls in all areas.

	Density [g/cc]	Hardness [Vickers]	Elastic Modulus [GPa]	Thermal Expansion Coefficient (10 ⁻⁶ K) [RT to 800C]	Max Usage Temperature [°C]	Surface Finish Grade 5 [micron]	Material Fatigue, Life Wear Resistance	Electrical Resistivity [Ω-cm]
Steel Balls	7.6	700	190	12.3	320	0.02	-	10 ⁻⁸
Silicon Nitride Si₃N₄	3.2	1600	310	3.7	1000	0.005	< 10x	10 ¹⁴
Difference	58% Lighter	128% Harder	63% Stiffer	-70%	+680°C	400% Smoother	< 10x	10¹⁶=Insulator 0=Superconductor

1:1 TEST Ceramic balls are hard without being brittle. They easily withstand a hefty blow from a hammer. Test it yourself!

...The facts speak for themselves

Reduced weight

Silicon Nitride is 58% lighter than steel, lowering inertia and reducing wear on the bearing's other components. Maximum revolutions can be increased up to 50%.

Hardness

Silicon Nitride balls are 2.3 times harder than steel.

Increased Rigidity and Less Vibration

CeramicSpeed balls expand less than a quarter of steel ball expansion. Also, they are rounder and smoother resulting in a more precise bearing with considerably less vibration.

Reduced Lubrication

CeramicSpeed balls are 400% smoother than steel and the frictional coefficient against steel is only 0.2 compared with steel on steel at 0.8.

Scuffs and Micro Welds

No scuffs and micro welds occur as the surface smoothness of ceramic balls has a polishing effect.

High Resistance to Pollution and Corrosion

CeramicSpeed balls do not corrode and they actually act to crush pollution in a bearing, therefore small damages occurring on the raceways are polished.

Low Friction

CeramicSpeed balls are lighter, rounder and smoother than steel balls therefore they have lower friction leading to lower energy loss. If all other components of the bearing are also optimised then an extremely low friction is achievable with a corresponding increase in service life.

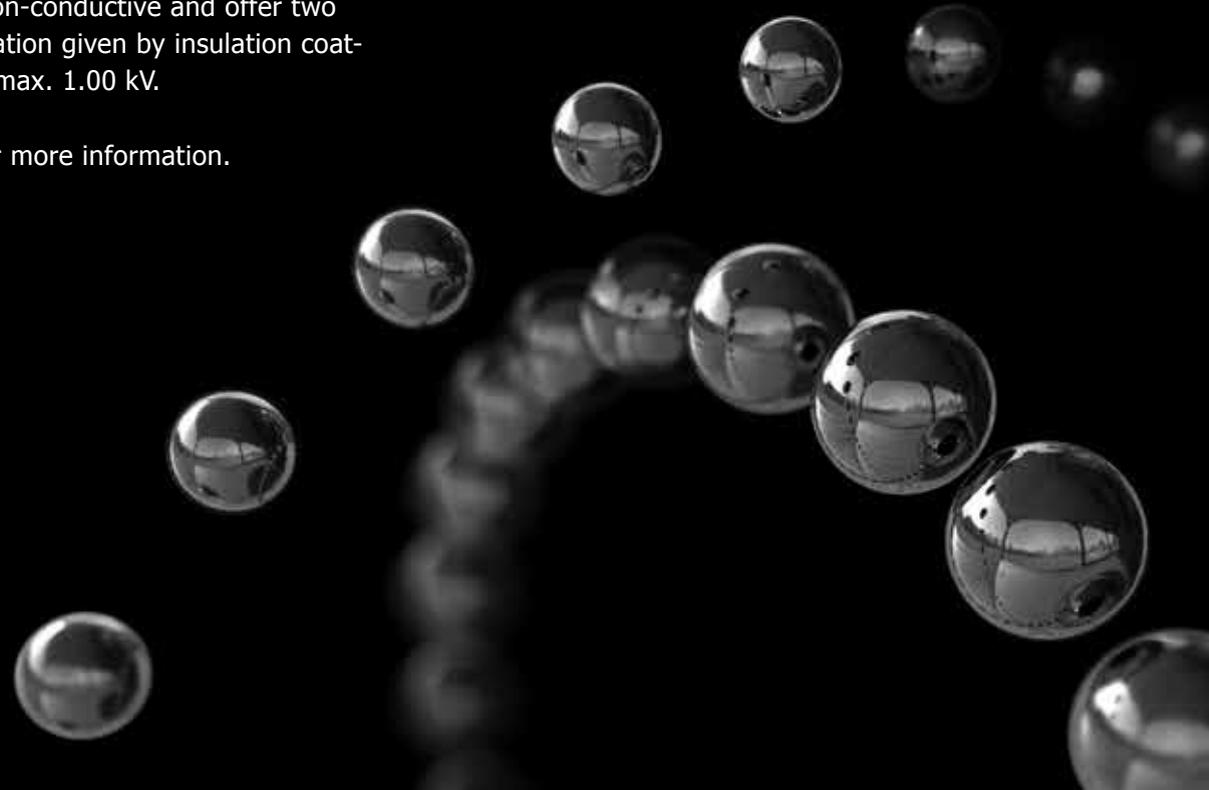
Insulation

CeramicSpeed balls are non-conductive and offer two and a half times the insulation given by insulation coatings. min. 2.5 kV against max. 1.00 kV.

See ceramicspeed.com for more information.

A traditional ball bearing is typically composed of steel parts.

- A CeramicSpeed hybrid bearing however consists of steel rings, ceramic balls, special lubricant with bearing case and seals of a synthetic material like PA, POM, or Teflon etc.



Ceramic bearings
work in all
environments...

CeramicSpeed's hybrid bearing solutions are developed and geared to the specific use and environment in which they will be placed.

An extremely focused development process and a large number of successful industry solutions have combined to produce CeramicSpeed's four LongLife series covering many of the current applications relevant to today's production industry. If any of the LongLife series does not meet your specific needs in any application, then we will be happy to provide a bespoke solution, custom built - just for you!



...also in your unique field
and specific situation

Every environment is unique, but whether, wet, hot, dirty or otherwise, it is a fact that the tougher the challenge, the more advantages there are with CeramicSpeed bearing solutions.

LongLife Xtreme

Bearings for polluted environments where particles may enter the bearing. The robust ceramic balls simply crush the invasive particles. Combined with optimal lubrication the impact on the raceways is considerably reduced. Ceramic bearings last a minimum of 4 times longer than standard bearings.

LongLife Insulate

Ceramic balls are non-conductive with an insulating capacity of at least 2.5 kV - considerably more in larger bearings. Bearings with an insulation coat typically have an insulation capacity of 1.00 kV, and this providing that the coating is completely undamaged after fitting and handling.

LongLife HighTemp

Ceramic ball bearings with high tech components offer a unique high temperature programme up to 350 degrees Celsius. Ceramic balls expand only a quarter compared to steel balls and there is no danger of welding to the raceways, thereby shimming is avoided and higher revolutions possible for the service life of the bearing.

LongLife Corrotec

This type of hybrid bearing is taking over where stainless steel bearings are failing. The combinations of stainless steel raceways, ceramic balls, synthetic ball cages and special seals plus appropriate lubrication provide a unique bearing in terms of service life. A much longer maintenance free life especially in wet and corrosive conditions.

LongLife Custom Build

If the required bearing is not found in the four LongLife series the solution is offered through the CustomBuild line geared to constant challenges. It is her new unique solutions are developed in close cooperation with our customers.



	Shaft diameters from 5-200 mm	Track Ball Bearings Series: 618, 619, 60, 62, 63 and 64	Angle Contact Bearings Series: 718, 719, 70, 72, 73, OJ2 og OJ3	Spherical Bearings Series: 108, 1213, 22 and 23	Pressure Bearings Series: BA and 51	Y/UC Bearings Series: YAR/YAT/YET/UC etc.	Linear guides Series: Linear, screw nuts, etc.
LongLife Series	CeramicSpeed Xtreme	F S E	F S E	F S E	F S E	F S E	F S E
	CeramicSpeed Insulate	F E	F E	F E	F E	F E	F E
	CeramicSpeed HighTemp	F	F	F	F	F	
	CeramicSpeed Corrotec	F S	F S	F S		F S	
Custom	CeramicSpeed Custom Build	F S E	F S E	F S E	F S E	F S E	F S E

F Foodstuffs approved lubricant. Bearings are supplied with food grade lubricant for their entire service life when this is desired or required.

S Low speed bearing supplied with increased lubrication.

E Energy saving bearing. Our bearings are more energy effective than standard bearings. When required this can be further optimised as first parameter.

CERAMICSPEED
bearings



CeramicSpeed is the answer to future hybrid bearing solutions...

Do you have questions?

If you have not heard of CeramicSpeed hybrid bearing solutions before, a series of considerations and questions may quickly arise...

Which technical risk do I face?

The short answer is: NONE! CeramicSpeed bearings lack NONE of the parameter of your current solution. Only performance improvements are delivered, so there is no technical risk – just a lot less technical problems!

Should I change anything?

CeramicSpeed hybrid bearings solutions have the same outside geometry and are mounted in the exact same manner as the bearings you use today. The new bearings require no special adaptations of surrounding components, which also means that you can always switch back.

What is the probability of improvements and savings?

The improvement potential is very high. Over 99% of all CeramicSpeed bearings last more than 4 times longer than the standard bearings they replace. The extra cost is usually recouped by the first or second saved replacement – 50% of our bearings are in service 8-20 times longer than normal bearings.

How do I achieve the full benefits of CeramicSpeed bearings in my company?

We are geared towards this and would gladly assist you in creating an overview of your current bearings. We can prepare a practical strategy and feasibility study for exchanging the bearings in your production facilities:

1. The current situation
 - Which bearings are replaced and how often?
 - What are the corresponding costs?
 - Which other cost advantages may be achieved with fewer bearing replacements?
2. Identification of initial procedures to maximize total economic potential
3. Bearing strategy
 - Prioritising key areas
 - Plan of action

Can I get a quick financial overview?

In an ongoing collaboration with our industrial customers we have developed an payback calculator which quickly and easily produces the financial benefit of CeramicSpeed hybrid bearings. The calculator provides clarity of timing, investments, savings and payback.

Can CeramicSpeed guarantee the effect?

- Yes, certainly! CeramicSpeed bearing solutions beat traditional bearings in all fields. Consequently we are not at all concerned in guaranteeing: If you do not easily achieve longer service and economic gains in switching from traditional steel bearings to CeramicSpeed hybrid ones, we shall – at no cost to you – evaluate the performance, re-engineer a and modify the bearings.

When everything performs as expected, you obviously get all the gains. We call it our NO RISK Guarantee.



CeramicSpeed has already made an impact in several industries

CeramicSpeed bearings can be found in various industrial sectors:

Food industry

Working with foodstuffs often represents a tough bearing environment with high temperature differences and fast operating speeds. Situations in which CeramicSpeed easily shows it's worth securing significant savings and simplifications of maintenance schedules. CeramicSpeed bearings are supplied with food industry approved lubrication in all types of bearings.

Chemical industry

Bearings operating in slow turning and corrosive environments are subjected to heavy wear. Here, CeramicSpeed's hybrid bearings seriously fit in. Our case history in these industries shows service life improvements of 8-20 times compared with traditional steel bearings.

Agriculture

Soil, water and manure are not friendly to bearings and cause more frequent replacements along with inconvenient work disruptions. With CeramicSpeed bearings you achieve considerably fewer stoppages of expensive equipment and machinery which has to work when the situation and the livestock requires it.

Automotive

Moving equipment like fork lift trucks and hydraulic lifts etc. are often subjected to heavy handed use. By switching to CeramicSpeed bearings our customers have achieved reduced service and maintenance costs for wheel, tower and strut bearings. For the full assembly of machinery and equipment these are very substantial savings.

CeramicSpeed makes an impact!



Electric motors

The potential leak currents in electric motors with inverters can damage the bearing. However, silicon nitride balls are non conductive and withstand a minimum of 2.5 kV as opposed to 1.0 kV in insulation coated traditional bearings. Furthermore the CeramicSpeed bearings have 4-8 times longer service life, lower operating temperature and lower energy consumption.

Utility and supply

In certain industries reliability is paramount. In that context CeramicSpeed bearings represent a cheap insurance by their documented 4-8 times longer service life and by substantially reducing unscheduled stops.

Arla Food

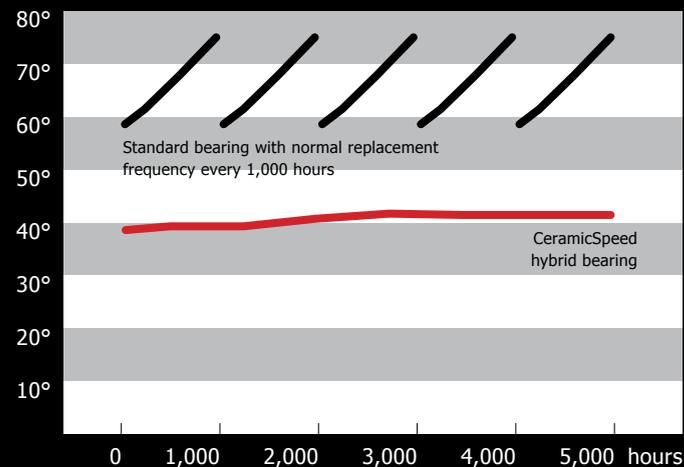
Electric motors

In 2008 Ove Raabjerg Nielsen, an Arla Foods Hoco supervisor addressed CeramicSpeed with a wish to improve operating reliability of a milling plant running at 5,000 rpm. The traditional bearings were replaced every 1,000 hours and the motor permanently monitored to cut out when bearing temperature reached the critical 80°C.

With a simple switch to CeramicSpeed hybrid bearings – upgraded with foodstuffs approved lubrication – the electric motor now operates with a constantly lower temperature, approximately 35°C under the critical limit. Noticeable this is throughout the service life, which currently is 5 times longer.

The bearings temperature performance

Degrees Celsius over operation time in hours



Arovit Petfood

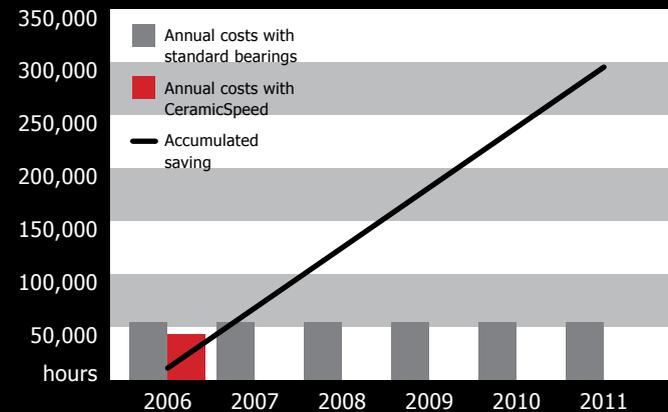
Twist ties for bags

Until 2005 it was routine procedure to replace the twist tie machine bearings at Arovit Petfood every third month.

Today, some six years later, the first CeramicSpeed bearings, installed in 2005, still operate. Till now they have lasted more than 20 times longer than the old steel bearings. The investment in CeramicSpeed bearings of around DKK 40.000 (€ 5,500) was recouped in direct costs in less than one year.

CeramicSpeed bearings investment

Annual costs and accumulated savings in DKK



In 2011 the new bearings have not only saved Arovit over DKK 250,000 (€ 35,000) but also a great deal of hassle. Consequently the company's maintenance supervisor, Mr. Jørn-Erik Johannesen has instigated that CeramicSpeed bearings have also been introduced in many of the factory's other machines.



Grundfos

Since 2005 Grundfos (pumps) has used CeramicSpeed hybrid bearings in electric motors when and wherever particularly demanding conditions apply; i.e. with leak currents, imbalances, vibration, pollution or other factors where standard bearings have an unsatisfactory short service life.

The additional cost of CeramicSpeed bearings is substantially lower than the cost of a service call to replace standard bearings.