

Raanaafoss Rehabilitated with Oil-Free Main Guide Bearing Solution

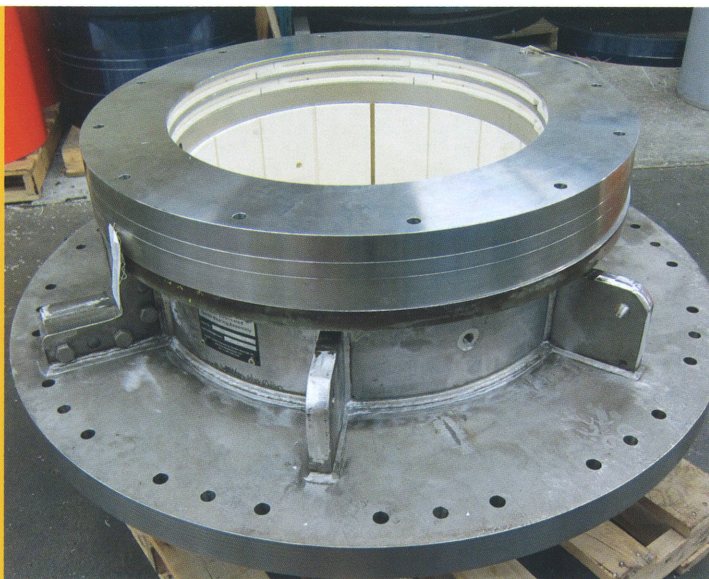
Well engineered, cost-effective and water lubricated main guide bearing solutions for rehabilitation project

Originally built in 1922, the Raanaafoss I Power Plant in Norway recently began a rehabilitation project to update the plant's performance and render it more environmentally friendly. In keeping with this goal, the plant, now called Raanaafoss III has been fitted with Thordon SXL water lubricated main guide bearings and segmented shaft seals.

The selection of a water lubricated solution for the lower guide bearing instead of the more traditional oil lubricated design allows the bearing to be lubricated with the same river water which is powering the turbine. This completely eliminates the risk of oil leaking from the bearing assembly,

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Thordon SXL water lubricated main guide bearing and segmented shaft seals installed in carrier

travelling down the shaft past the packing gland and contaminating the turbine's discharge or tailwater. Not only does converting a turbine from oil to water help protect the environment, it also brings operational and maintenance advantages over the original oil lubricated bearing system.

The series of new turbines, all supplied by Voith Hydro, are to be installed as an extension of the present turbine house. The scope of supply includes six vertical propeller turbines, each with a maximum output of 15.5 megawatts. Commissioning of the first unit was completed in December 2012 and the last unit will be operational by spring of 2016.

Voith Hydro, one of the world's largest turbine manufacturers, started 3 years ago performing a study to evaluate different upgrading possibilities for the old Raanaasfoss power plant. Voith turned to Thordon Bearings for complete turn-key water lubricated main guide bearing assembly.

Thordon was tasked with providing a design solution for the whole assembly using water as the lubricant instead of oil. The use of water as an alternative to oil lubrication is a long standing area of expertise for Thordon with their non-metallic bearings in operation in the hydro industry for over 30 years. The environmental impact was a concern for the project and Thordon's water lubricated bearings seemed to be the right fit for both their technical requirements and environmental mindset.

The bearing design for the Raanaasfoss units focused on providing a fully hydrodynamic bearing design with

adequate support to carry the expected loading while integrating Thordon's unique tapered keyset feature for fixing the polymer bearing directly into the fabricated stainless steel bearing housing without the use of adhesives or additional mechanical fastening. This eliminates the need for a separate bronze bearing carrier while still retaining the ability to replace the split bearing shell without requiring disassembly of the large bearing support housing. The reduction in the complexity and total number of components in the assembly results in quite a substantial savings in cost. The use of the Thordon tapered keyset greatly reduces downtime during bearing inspection or replacement as it facilitates easy removal of the polymer bearing shells without removing the shaft or bearing housing.

"Our previous experiences with projects of this nature are what helped position us as experts in the field. Our overall design proposal was selected because it met the technical

requirements, offered several unique design advantages, and provided an effective way to reduce cost by eliminating a large amount of bronze from the original design," says Greg Auger, Business Development Manager - Clean Power

Generation at Thordon Bearings. "Turbine designers who choose to use a hydrodynamic water lubricated main guide bearing solution will not only gain environmental advantage over their competitors but can find a cost and technical benefit as well."

The use of water as an alternative to oil lubrication is a long standing area of expertise for Thordon with their non-metallic bearings in operation in the hydro industry for over 30 years.

In order to maximize the effectiveness of the lubricating water being delivered to the bearing, the recommendation was made to fit a Thordon SXL segmented shaft seal above the bearing assembly to prevent entry of unfiltered river water into the bearing space. The open-loop design allows the water to be delivered to the top of the bearing, directed down through the bearing space, and then exit directly to the runner. This simplistic yet effective design prevents build-up of abrasives, cools and lubricates the bearing, and maintains a conditioned bearing space to ensure long and predictable bearing life. **NW**

Vertical Lift Pumps Now Fitted With Grease-Free SXL Bearings

During a routine statutory shutdown of PetroSA's offshore FA Platform in Mossel Bay, South Africa, existing rubber bearings in the vertical main seawater lift pumps were replaced with Thordon grease-free SXL pump bearings. The statutory shutdown is part of PetroSA's operating permit which allows opportunity for inspection and repair of critical equipment in order to ensure its integrity.

In total, 20 Thordon bearings were supplied for their 39m (128') vertical Ingersoll-Dresser pump which included 17 shaftline bearings and three bowl bearings. The initial need to overhaul the pump came from the poor performance experienced with the rubber bearings. The hope was to use the existing spiders even though they were worn from the previous rubber bearings turning in the housing. The local Thordon distributor - Alignment With Laser (AWL), pump manufacturer - Flowserve, along with Thordon engineering were able to create a solution that did not require new spiders to be purchased. Using the existing spiders, even though they had experienced wear, dramatically reduced the cost on the project. If the decision had been to go back to rubber bearings, new spiders would have been mandatory since they had worn to over the standard size.

Thordon SXL pump bearings are easy to machine and install. The bearings were machined at a local machine shop to sizes that were generated by the Thordon



PetroSA's Offshore FA Platform in Mossel Bay, S. Africa

Bearings Sizing Calculation Program and dry ice was used for quick and easy installation of the bearings into the housing. PetroSA was on hand to witness the first bearing being installed and to verify the fit of the bearing into the housing. With the success of this project, PetroSA are looking at other applications to incorporate Thordon grease-free SXL bearings. **NW**



Easy to install Thordon SXL pump bearings



Thordon SXL pump bearings installed into existing bronze

Roll-Off Trucks Just Keep on Rolling with HPSXL TRAXL Bearings



Kronos roll-off truck pulley system used in roll-off trucks

The roll-off trucks that pick up recycling bins, garbage bins and more, rely on a pulley system. Kronos Worldwide Inc. uses similar trucks to transport large containers of titanium dioxide, a fine white powder used in paints, plastics or paper to keep the products white and opaque.

Each pulley has a wire going through a bed that attaches to the bin and lifts it onto the truck. Inside this advanced mechanism, the bushings in the pulley sustain enormous pressure, up to 52 MPa (7,600 psi), from the heavy loads. Operators at Kronos based in Quebec, Canada, found that the pressure was too much for the bronze bearings.

"After just three weeks, the bronze bushing was completely worn," says Thordon distributor Jasmin Racicot of RMH Industries. This meant that every three weeks, a truck was out of commission and could not carry the materials. The company had to pay mechanics to change the pin and several other parts and repair the housing.

As per Racicot's recommendation, the customer agreed to try replacing the bronze bearing with a Thordon HPSXL TRAXL bearing.

"After the first three week trial," Racicot explains, "we anxiously went back to the plant to see how the bearing did. After the inspection, there was no sign of wear on the bearing."

After six months it was time for routine preventative

maintenance. The bearing was replaced as a precaution, though it still showed only moderate signs of wear. "In other applications, changing the bearing twice a year might seem like a lot but for us it is beyond excellent," says the customer, Francois Chagnon, General Maintenance Foreman for Kronos Canada, Inc. "What is so extraordinary is that just a thin, dry layer of Thordon material can withstand the heavy load whereas the greased, bronze bearing wore out in such a short time. With all of the breakages we have experienced in the past (picture a broken pulley cable!) we have made a giant leap."

Chagnon adds that the product works so well it has pleasantly surprised the skeptics, and even exceeded the expectations of Thordon representatives themselves.

"It is always satisfying to discover yet another brand new problem and prove that Thordon can fix it."

***Jasmin Racicot,
RMH Industries***

Racicot has also found that time after time Thordon products can be adapted to almost any industrial application and adds, "it is always satisfying to discover yet another brand new problem and prove that Thordon can fix it."

"I have many other applications where people told me it wasn't going to work," Racicot says. "And three years later the part is still working." **NW**



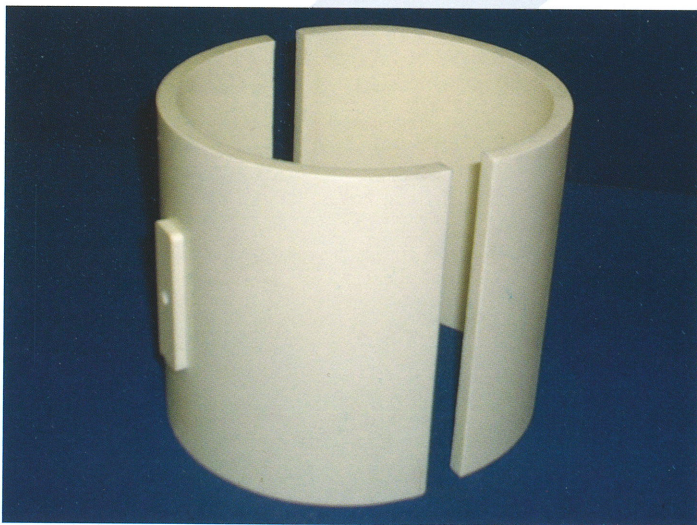
HPSXL TRAXL bearings installed in Kronos truck pulley

SXL and Thor-Flex Improve Bearing Wear Life for Water Purification Plant

The American Midwest is home to one of the world's largest water purification plants, pumping over 700 million gallons of water from Lake Michigan each year. For over 12 years, the plant has been fitted with Thordon SXL flocculator paddle wheel bearings and Thor-Flex chain conveyor wear shoes. As a result of the impressive wear life of both bearing grades, the plant continues to use Thordon bearings in its water purification plant applications.

Flocculator Paddle Wheel Bearings

In 2000, the plant engineer contacted Thordon to discuss an issue they were having with the bearing located in the flocculation system. The flocculation system consists of large concrete tanks filled with water that is agitated by large paddle wheels that rotate very slowly (approx. 3 rpm). Alum, a very abrasive coagulant is added to the water. The abrasive environment was causing premature wear of the phenolic laminate shaft bearings of the large paddle wheels that slowly mixed the water. There are over 500 paddle wheels at this particular water purification plant.

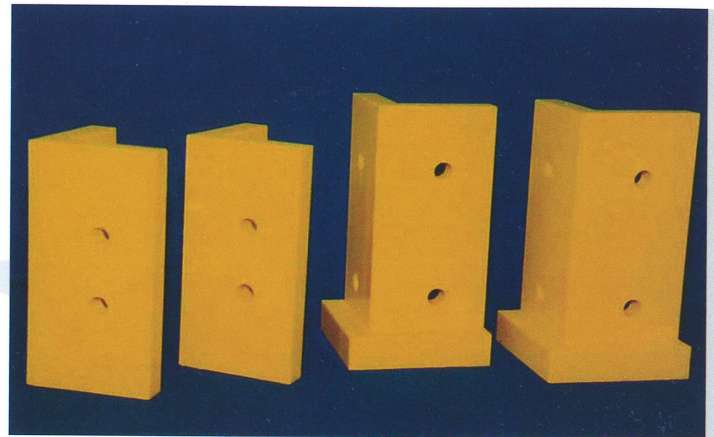


SXL Flocculator Paddle Wheel Bearing

Chain Conveyor Wear Shoes

Grit chambers are large settling tanks where the removal of organic solids takes place. The large tanks have chains and sprocket systems with scrapers or flytes spaced at intervals between them. Scum is removed from the top. The grit and settled solid material are scraped to one end of the bottom of the grit chamber for removal. The existing UHMWPE wear shoes are

the surface for the slow moving scrapers. This area in particular has been problematic for this type of application and with there being more than 14,000 wear shoes at this plant in three different sizes, performance and long bearing wear life is of the utmost importance.



Thor-Flex Conveyor Wear Shoes

After Thordon reviewed the operating conditions and environment, Thordon SXL bearings were recommended for the paddle wheels as SXL grade bearings offer low friction suited to slow speed shaft operating conditions and have excellent resistance to abrasion. Thordon Thor-Flex was recommended for the chain conveyor scraper wear shoes as it would ensure excellent wear resistance in low speed sliding wear pad applications. Thor-Flex also brings with it a much greater cut and gouge resistance than UHMWPE

Due to the impressive wear life, and extensive reference lists, the water treatment plant re-ordered SXL flocculator paddle wheel bearings for replacement in 2014 along with Thor-Flex chain conveyor wear shoes, providing a wear life of over 12 years. **NW**

For over 12 years, the plant has been fitted with Thordon SXL flocculator paddle wheel bearings and Thor-Flex chain conveyor wear shoes.

Thordon Rides the Trolley Bus



Typical Trolley Bus owned by Mass Urban Transit Company (MUTC) in Pardubice, Czech Republic

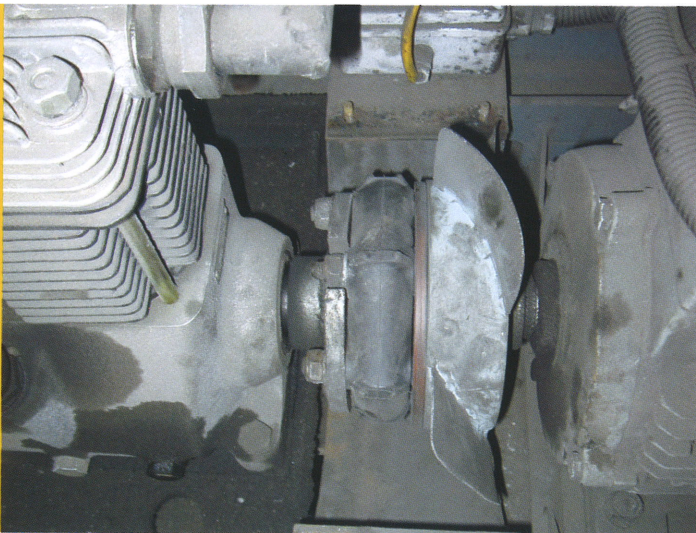
While Thordon's water lubricated materials have revolutionized marine applications, our durable materials are increasingly proving useful in other industries where dry run applications are common. The most recent example was in the Czech Republic, a nation with 13 trolley bus systems.

Mass Urban Transit Company (MUTC) in the city of Pardubice was spending far too much time and money on replacing parts of their Hardy Clutches, which consist of a carrier plate and three damper elements.

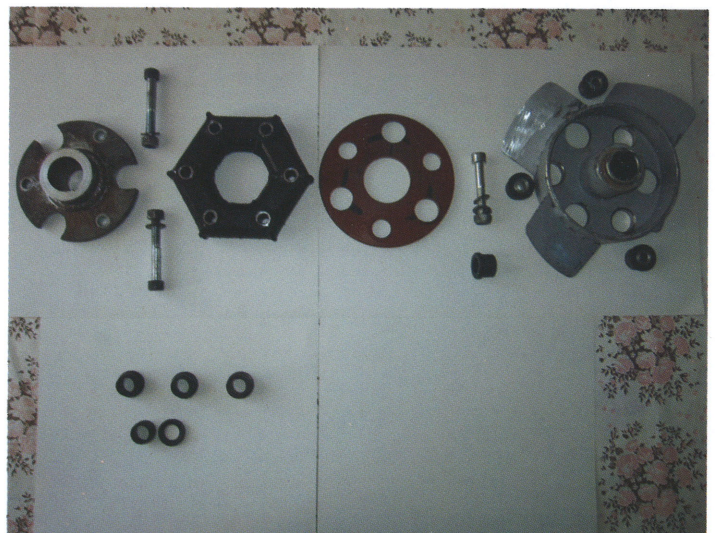
"We knew ThorPlas-Blue works better than bronze in many applications, but this was a bit of a special

case because it was fitted in a damper plate of an air compressor," says Maarten Jansen, Thordon's Regional Manager. "Normally, more flexible elements are used, by they did not last."

Thordon's Business Development Manager, Greg Auger recommended replacing the clutch's Pertinax part with Thordon's shock-resistant XL, and replacing the Tecamid part with the durable ThorPlas-Blue. Because Thordon materials had not been used in buses before, the only way to know if they would withstand the shock loads was to test them. The bus company agreed to try the parts for two months.



MUTC public trolley bus hardy clutch system



MUTC disassembled trolley bus hardy clutch system

"I was convinced we could increase the lifetime of this part by several times," says Jan Piroutek, Thordon's Czech representative. "The guys in MUTC Pardubice didn't believe that, so I agreed to deliver them three testing sets for free."

The first test piece was installed in the worst bus of the fleet, Bus #342, which had the shortest service interval. MUTC agreed to operate this trolley bus for two months with the Thordon parts. Because the Thordon bearing cost more than the original, the condition was that Thordon had to last at least twice as long.

After two months, Jan Piroutek travelled on the bus for its entire route, to the end station and back to the start. As the Thordon material is used in a compressor which is frequently switched on and off, he wanted to know the number of starts and stops along the route. With pen, paper and clocks, Piroutek listened and counted the number of times the mechanism ran through its cycle. To his surprise, the number was 550 cycles per day, the same count as two months before.

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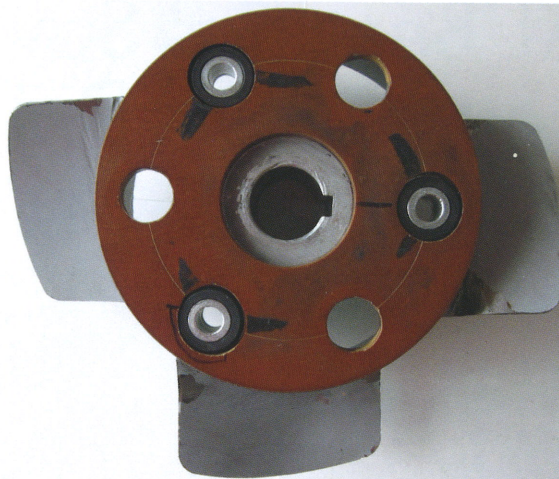
***Maarten Jansen,
Thordon Bearings***

"When they dismantled the Hardy clutch a week later," says Piroutek, "they found almost all Thordon pieces intact. Only ThorPlas-Blue had very small dimensional changes of less than 0.5 mm."

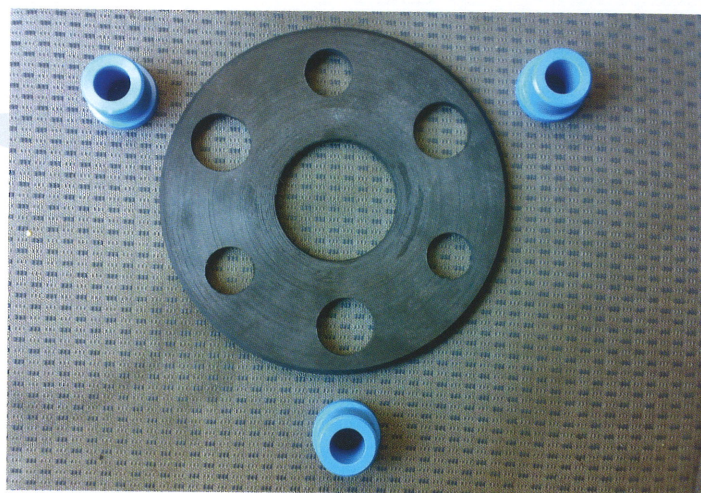
Another two and a half months later,

the technical manager asked Piroutek to do his next inspection of the clutch. He was certain they would have to replace the ThorPlas-Blue parts, but they were still working after 20 weeks of operation. With the old parts, Bus #342 had to be repaired every 3 to 4 weeks.

"Thinking outside the box" has led to another success for Thordon and its client, MUTC. "The test has worked out positively," says Maarten Jansen, "and we are currently testing with other bus companies as well and on different applications, with the aim to lengthen service intervals and save on repair and labour costs." **NW**



Replacement of clutch Pentinax part with Thordon XL



Replacement of clutch Tecamid parts with ThorPlas-Blue



Lifetime lubricated grease and oil-free ThorPlas-Blue bearings

SXL Bearings Save Pulp and Paper Mill Thousands of Dollars each Month



Cascades Canada Inc., Quebec Pulp and Paper Plant

Recycled paper is a dirty product to create. The pulp is made from post-consumer waste that is mashed into a slurry with plenty of water to filter out contaminants and debris. At the end of the recycling process, the residues are sent through a trammel which is a giant, turning horizontal cylinder that is 123 cm (48") in diameter with internal baffles with a bearing inside diameter of 39 cm (15½"). The residues coming through it contain metal wires, glass, plastic, sand, water and anything else that could be found in a recycling bin or on the ground. The bearing at the end of the cylinder is often submerged when the water level increases. Eventually the debris reaches the bearing, damaging the seal and eventually causing the bearing to fail.

At Cascades Canada Inc. in Kingsey Falls, Quebec, the bearing and seal failure was not only a huge problem but also very expensive. Between replacing the \$3,000 roller bearing and losing 2 days of production, the

disruption was costing the company between \$4,000 and \$5,000 every six months.

Joel Fortier, head of mechanical projects at Cascades Kingsey, believed there had to be a better way of doing business. He was already familiar with Thordon products, having used them in other equipment that handles recycled paper products, (including the machines that make the takeout coffee cup carriers at Tim Horton's™).

"Recycled materials are not very clean," Fortier says. "I use Thordon products more and more when I need a grease-free bushing because they can withstand the wear!"

Users in various industries have found that Thordon's SXL grade material is resistant to abrasive conditions, unlike metal or rubber. Since installing the SXL in December 2008, the roller bearing at Cascades is still going strong. No maintenance and no disruption.

"It's still rolling," Fortier says, "and it rolls continually 24 hours a day, 365 days a year." Fortier has come to know Thordon products almost as well as his distributor does. He is continually identifying ways to solve machinery problems in new and novel ways using Thordon products.

"I knew it would work," Fortier says. "I have even joked that if Thordon were edible, I would have it in my breakfast cereal every morning." **NW**


THORDON

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