THORDON
NewsWORKS

ISSUE 2005-2

ENVIRONMENTALLY FRIENDLY BEARING SOLUTIONS

NEW THORPLAS® THERMOPLASTIC BEARING COMPLEMENTS THORDON'S POLYMER GRADES

Thordon Bearings Inc., a world leader in grease and oil-free bearing solutions has announced the introduction of ThorPlas® a new proprietary engineered (non-elastomer) thermoplastic bearing.

ThorPlas® has been formulated to complement the existing range of Thordon elastomer bearing grades and significantly expands the range of applications where Thordon bearings can be specified, while still maintaining many of the recognized Thordon performance benefits.

ThorPlas® offers the following advantages:

- **increased strength and rigidity allowing working pressures in an interference fit bearing up to 31MPa (4500 psi)**
- **improved ability to operate at elevated temperatures up to 80°C (175°F) in water**
- **improved chemical resistance in all major chemical product categories**
- **eliminates grease**
- **easily machined and no nuisance dust**
- **scrap can be recycled and reused**

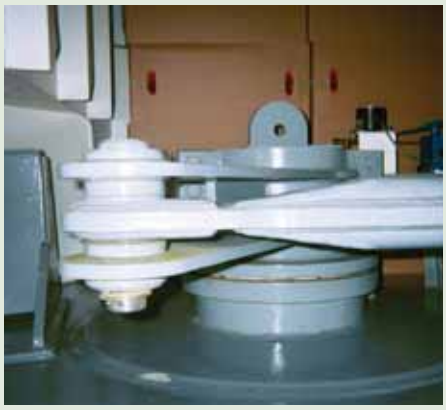
As part of Thordon's StageGate New Product Development program, Thordon has been test marketing ThorPlas® since 2003 and has many installations in operation and working successfully. Some of the test applications follow.

(...cont'd. on page 2)

THIS ISSUE

New ThorPlas®... *(cont'd. from cover story)*

End User: Kody Marine, LA, U.S.A.
Application: Rudder tiller arm bushings on workboat
Application Details:
Bearing sizes: 64 mm (2.52") x 51.5 mm (2.03") x 50.55 mm (1.99")
Pressure: ~ 20 MPa (3000 psi)
Previously greased; operating dry after ThorPlas® installation
Installation Date: April 2004
Note: Repeat orders for sister workboats after successful installation of ThorPlas®



End User: New York State Electric & Gas - Saranac River, NY, U.S.A.
Application: Wicket Gate Bearings
Application Details:
Horizontal turbine, 4.0 MW
Dimensions to suit: 57.15 mm (2.250") x 41.22 mm (1.623") x 38.1 mm (1.500").
Radial pressure: ~ 24 MPa (3,500 psi)
Installation Date: February 2003
Note: Thorseals also included to prevent debris from entering

End User: Berman Brothers, FL, U.S.A.
Application: Grapple Bearing - Scrap Metal Recycling
Application Details:
Four finger grapple bearings
Radial pressures: ~ 7 MPa (1,000 psi)
Bearing Dimensions to suit: 76.9 mm (3.028") x 57.6 mm (2.267") x 194.2 mm (7.647"). Dusty, dirty, high impact, required greasing
Installation Date: December 2003
NOTE: ThorPlas® bearings lasted 5 months compared to nylon's life of 3 weeks

End User: Automobile Manufacturer, U.S.A.
Application: Washline roller conveyor bearings
Application Details:
Bearing sizes: 44.5 mm (1.75") x 31.8 mm (1.25") x 38.1 mm (1.50")
Radial pressures: ~ 10.3 MPa (1500 psi)
Wet, dirty greased application
Installation Date: December 2004
Note: ThorPlas® elimnated greasing and second order placed

Typical Washline Roller Conveyor Bearings

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THORDON SXL BEARINGS STILL DOING THE JOB IN FORMER CIA RESEARCH VESSEL

Many ships have interesting histories. But none as intriguing at that of the *Glomar Explorer*. With a past that includes top secret operations for the CIA, the vessel was once involved in the recovery of a sunken Soviet submarine. The clandestine "cover story" at the time was that the ship was a commercial vessel owned by none other than Howard Hughes. A real-life story of Hollywood proportions.

Today, by contrast, the *Glomar Explorer* has a less exotic role. Originally built in 1973, it was converted in 1997 into a deep-water drilling rig and now operates primarily in the Black Sea. The ship features Thordon SXL propeller shaft bearings, installed at the time of the conversion. The bearings accommodate 467 mm (18.38") shaft diameters and are formatted in a stave configuration.

Refit and Inspection

After eight years of rugged operations, the vessel was brought in for an extensive refit. The facility used was the renowned Malta Shipyards, which employs over 1700 skilled tradesmen and has been providing services to the commercial shipping sector since the mid-1960s.

During the refit, the bearings were pulled out and inspected. "The job was not an easy one," says Geoffrey Azzopardi, Deputy Engineering Manager at Malta Shipyards. The tail shafts needed to be removed to check the condition of the shaft journals, stern tubes, and strut bearings - which were fitted with Thordon SXL staves.

"During the extraction process of the first tail shaft," says Azzopardi, "it was found that the forward diameter of the shaft was slightly larger than the rest." This made it difficult to extract through the aft bearing, since this had to be compressed all the way through the extraction process."

For the Thordon staves, it was a rough ride. In fact, it was expected that the staves would be damaged during the extraction process because of the compressive forces they would not otherwise sustain during normal operations.

Not so.

Upon inspection it was discovered, much to everyone's astonishment, that the staves absorbed the severe compressive stresses and still retained their physical properties. According to Azzopardi, there was "no physical damage. And after calibrating, the staves were found to be within tolerance!"

This outcome is not as surprising as it seems. Thordon SXL has an excellent reputation in demanding commercial vessel applications worldwide. Water-lubricated, and therefore oil-free, Thordon SXL features significantly longer wear-life that other non-metallic bearing choices, and high abrasion resistance due to its elastomeric properties. The material's twenty-five year track record and extensive list of references attest to its performance.

Glomar Explorer, converted to deep water drill ship in 1997

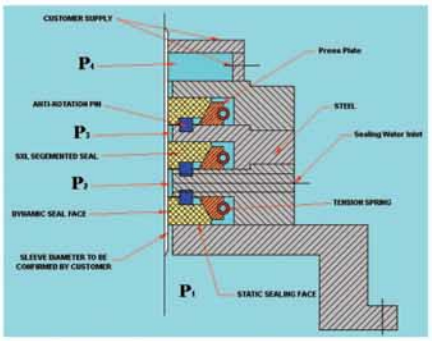
Low Wear. Long Life.

To avoid further strains, Azzopardi and his team removed the other bearings prior to shaft withdrawal. Again, after the necessary cleaning and calibrations were completed, all were found to be within tolerance. "We then re-assembled the same bearings to the satisfaction of the customer!"

If the *Glomar Explorer* could write its own autobiography, the ship would have quite a story to tell. First as a spy ship, then as a drill rig on the high seas. What's next? With long-lasting products like Thordon SXL to keep it going, this ship will have many more chapters left in its fascinating life.

MORE POLYMER SHAFT SEALS ORDERED BY CHINESE TURBINE INDUSTRY

Dongfang Electrical Machinery Co., Ltd. (part of Dongfang Electric Corp.) and Harbin Electric Machinery Co., Ltd. have recently placed additional orders for Thordon SXL elastomeric polymer segmented turbine shaft seals bringing the total on order or already installed in 2005, to six sets. The shaft seals sold by Proco International Co. Ltd., Thordon's exclusive Distributor in China, are/will be installed at the Kangyang, Sanbanxi, Xiafu, Baishan and Nalan power plants in China and the Tekeze Hydropower Plant in Ethiopia.



SXL Segmented Shaft Seal

Sealing large hydro turbine shafts from 400mm up to 2000+mm (16 up to 80 in.) diameter can be a maintenance challenge for power plant operators. Typically, turbine seals consist of two or three sets of stacked segmented carbon rings that can be difficult to install without breakage and can be subject to relatively short life if misaligned or subjected to abrasives.

Since its first shaft seal installation in 1982 at the Manapouri Power Station in New Zealand, Thordon Bearings has compiled a history of segmented shaft seal installations. In 2003, Thordon embarked on a program to further optimize it's segmented shaft seal design utilizing its proprietary SXL material. SXL is formulated using a tough elastomeric synthetic polymer alloy offering ease of installation, high natural abrasion resistance and good sealing performance.

SXL Segmented Shaft Seal References

Customer	Power Plant/Dam	Country	Seal Type	Turbine/ Pump	RPM	Shaft Diameter (mm)	Shaft Diameter (inches)	Install Date
Itaipu Binacional	Itaipu	Brazil	Axial			3770 mm	148.43	Oct. 2005
Dongfang Electric Machinery Co., Ltd	Nalan	China	Axial	Francis		892mm	35.12	Oct. 2005
Harbin Electric Machinery Co., Ltd.	Baishan	China	Radial	Pump Turbine	200	1015 mm	39.96	Aug. 2005
Harbin Electric Machinery Co., Ltd.	Xiafu	China	Radial	Francis	107	1170 mm	46.06	Apr. 2005
Harbin Electric Machinery Co., Ltd.	Sanbanxi	China	Axial	Francis	166	1532 mm	60.31	Mar. 2005
Dongfang Electrical Machinery Co. Ltd.	Tekeze Hydropower Plant	Ethopia	Radial			1160 mm	45.67	Mar. 2005
Dongfang Electrical Machinery Co. Ltd.	Tekeze Hydropower Plant	Ethopia	Radial	Francis	300	1160 mm	45.67	Mar. 2005
Harbin Electric Machinery Co., Ltd.	Kangyang	China	Axial	Horizontal	125	970 mm	38.19	Mar. 2005
Meridian Energy	Manapouri Power Station	New Zealand	Radial			910 mm	35.83	Jan. 2005
Infraserv Hochst		Germany				2060 mm	81.10	Oct. 2004
Harbin Electric Machinery Co., Ltd.	Nirji	China	Radial	Francis	107	1170mm	46.06	Jun. 2004
Harbin Electric Machinery Co., Ltd.	Etan	China	Radial	Kaplan	22.5	2380 mm	93.70	Nov. 2003
Dongfang Electrical Machinery Co. Ltd.	Fenshujiang	China	Radial	Horizontal	166	720 mm	28.35	Jul. 2003
Harbin Electric Machinery Co., Ltd.	Gongboxia Power Station	China	Axial	Francis		1820 mm	71.65	Mar. 2003
California Department of Water Resources	San Luis Dam	U.S.A.	Radial			940 mm	37.01	Mar. 2003
China Power Complete Equipment Co., Ltd.	Gongboxia Power Station	China	Axial	Francis		1820 mm	71.65	Feb. 2003
Harbin Electric Machinery Co., Ltd.	Huilong Power Plant	China	Radial	Pump Turbine	750	620 mm	24.41	Feb. 2003
US Bureau of Reclamation		U.S.A.	Radial	Toshiba Turbine		792 mm	31.18	Jan. 2003
Harbin Electric Machinery Co., Ltd.	Banglang	China	Axial	Francis		892mm	35.12	May. 2002
Harbin Electric Machinery Co., Ltd.	Kalun II	China	Axial	Francis		1526mm	60.08	Jan. 2001
Mighty River Power	Maraetai Power Station	New Zealand	Radial			635 mm	25.00	Jul. 1999
Snohomish Co. P.U.D., Washington	Henry M. Jackson Project	U.S.A.	Axial	Francis Turbine				Nov. 1998
Northern Wasco Co. P.U.D., Oregon	McNary Dam	U.S.A.	Radial			650 mm	25.59	Aug. 1998
LA Dept. of Water Power (LADWP)		U.S.A.	Radial			499 mm	19.65	Sep. 1997
Genesis Power	Rangipo Power Station	New Zealand	Radial			644 mm	25.35	Dec. 1996
Seattle City Light, Washington	Centralia City Light Power Plant	U.S.A.	Radial		400	337 mm	13.27	May. 1996
Central Arizona Water Conservation Distric	Havasu, Colorado River	U.S.A.	Radial	Hitachi pump	514	1067 mm	42.01	Jul. 1995
Mighty River Power	Aratiatia Power Station	New Zealand	Radial			755 mm	29.72	Jan. 1992
Hydro Quebec	Beauharnois Generating Station	Canada	Radial			1022 mm	40.24	Aug. 1988
US Bureau of Reclamation	Grand Coulee Dam	U.S.A.	Radial	Toshiba Turbine		792 mm	31.18	Mar. 1988
Meridian Energy	Manapouri Power Station	New Zealand	Radial			910 mm	35.83	Jan. 1982

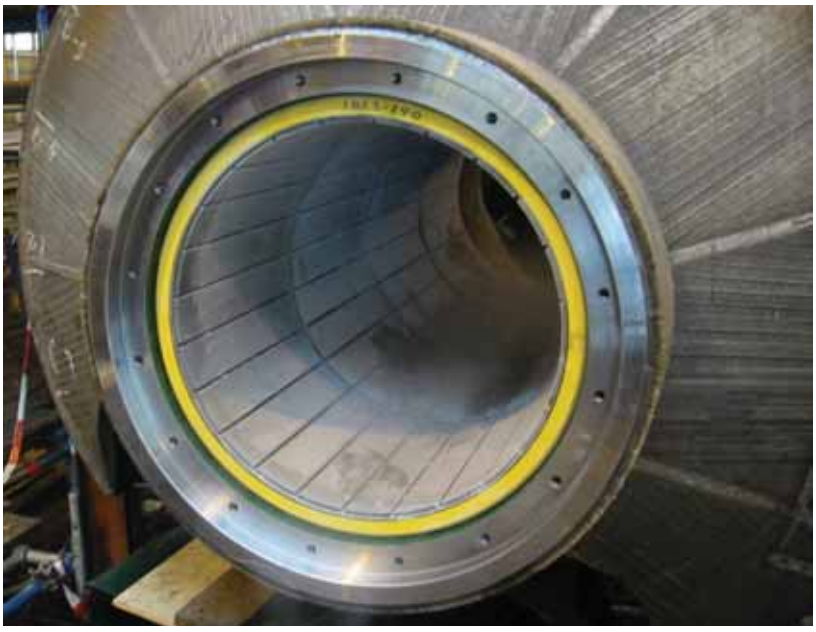
COMPOSITE BECOMING THE BEARING OF CHOICE FOR CUTTERHEAD DREDGES

Recently Built Jumbo Dredger, D'Artagnan, Owned By Société De Dragage International Of France Equipped With Thordon Composite Cutterhead Shaft Bearings And Intermediate Lineshaft Bearings

Thordon Composite cutterhead shaft bearings have been recently installed or ordered on six cutter suction dredgers in Europe, China and the Middle East.

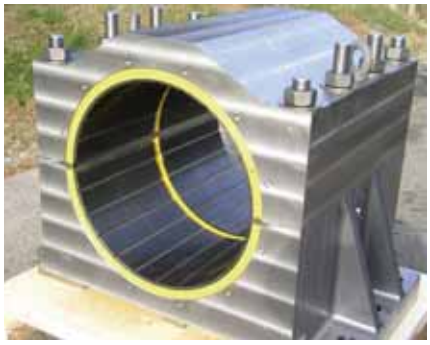
Thordon Composite is a tough two-component elastomeric polymer alloy bearing specifically formulated to provide superior wear life in very abrasive water conditions. Thordon Composite bearings operating in combination with a hard stainless steel shaft or hard coated shaft liner such as Ni-Cr-B, routinely outwear rubber bearings by a factor of two or more, significantly reducing maintenance downtime and costs over the operating life of the dredge.

"Archirodon Dredging Construction (Overseas) Co. S.A. of United Arab Emirates has been using Thordon Composite dredge bearings since 1999 and they have performed better than we expected", says Panos Zoglopitis, Mechanical Engineer for Archirodon Dredging Division. "These bearings last longer than rubber bearings. We have installed Thordon Composite on *CSD Pontos* and *CSD Aetos* and plan to continue using Thordon Composite bearings and staves."



Thordon Composite Cutterhead Shaft Bearing

Other Cutter Suction Dredgers to be equipped or having had Thordon installed recently, include *Zeeland II* owned by Van Oord Ship Management B.V., Netherlands, *Huta Sete 07* owned by Huta-Sete Marine Works Ltd., Saudi Arabia, *Jin Hang Jun 215* owned by Tianjin Waterway Bureau, China and CSD 8060 owned by Jan de Nul of Belgium. National Marine Dredging Company of U.A.E has also been using Thordon Composite dredge bearings since 1996 with installations on five of their dredgers.



Thordon Composite Intermediate Lineshaft Bearing For CSD D'Artagnan

The recently built jumbo dredger, *D'Artagnan*, owned by S.D.I. S.A. (Société De Dragage International), France, also has water lubricated Thordon Composite intermediate lineshaft bearings installed in addition to the Composite cuttherhead shaft bearings.

REPLACING GRIT TANK BEARINGS WITH SXL SAVES CUSTOMER $$$

Industry:
Sewage & Wastewater

Company:
Fields Point Wastewater Treatment Facility, Rhode Island, USA

Application:
Grit Tank Peak Cap End Bearings

Thordon Grade:
SXL

Fields Point Wastewater Treatment Facility

Problem

Fields Point Wastewater Treatment Facilty was replacing greased iron Peak Cap End Bearings two times each year in the Grit Tanks due to excessive bearing wear running against a steel shaft. Each Grit Tank required 4 small and 2 large bearing assemblies

The cost (USD) for the greased iron bearings and labor to maintain these bearings are as follows:

Cost of 6 iron bearings….....	$ 5,000.00
Cost of Labor (US$15/hour @24 hours)…	$ 360.00
Sub-total	$ 5,360.00
Annual Cost (twice per year)	$10,720.00

Thordon Solution

Thordon SXL bearings were installed in May 1996 by Thordon distributor, Johnson Packings of Massachusetts, and after 7 years of operation, the peak end cap bearings are still in service.

Savings to Customer

Due to the material properties of Thordon SXL, the customer has seen a tremendous return on investment in this application. Thordon SXL bearings have extended the life cycle compared to the original greased iron bearings by a factor of 14, and they are still in service today.

Cost of 6 Thordon SXL bearings……	$ 1,945.00
Cost of Labor (US$15/hour @24 hours)……	$ 360.00
Sub-total	$ 2,305.00
Annual Cost	$ 2,305.00
Savings to Customer over 7 years	
Iron bearings	$75,040.00
SXL Bearings	$ 2,305.00
Total Savings	$72,735.00

The Customer has saved $72,735.00 in the past 7 years by using Thordon SXL bearings and they are still in service!

Grit Tank Peak Cap End Bearing