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THORDON BEARINGS INC.

THOR-COAT - CORROSION PROTECTION FOR ROTATING MARINE APPLICATIONS



THOR-COAT

Corrosion Protection of Dynamic Components

Protecting critical rotating metal components from harsh seawater corrosion is of vital importance to marine engineers. The highly developed marine coating industry offers many coatings that provide excellent results when applied to surfaces, such as tanks, which are for all intents and purposes, static. However, in rotating applications exposed to seawater, such as open system propeller shafts and rudder stocks, premature failure of existing coatings often occurs.

The fiberglass/epoxy-based coatings commonly used are quite brittle and not sufficiently flexible to withstand long term shaft flexure resulting from bending and torsional stresses that occur during operation. This failure usually occurs initially at the joint between the coating and shaft liner. Once the coating cracks, seawater often migrates along the shaft resulting in significant non-visible corrosion. This is a major concern with open system propeller shafts that, currently, must be withdrawn and inspected every 5 years. If there is evidence, or even suspicion, that the coating is

cracked or damaged, the shaft must be stripped, repaired if necessary and re-coated.

Thor-Coat Advantages

Thor-Coat, a new coating developed by Thordon Bearings, is specially formulated to address the problem of premature coating failure resulting from reversing rotational loading. A toughened, 2-part epoxy coating, Thor-Coat is three to nine times more flexible than existing products currently in use as propeller shaft coatings. In the test results summarized below, Thor-Coat was subjected to the full scale 180° bend and did not crack. All other products tested showed initial cracking at a much lower bend angle. In a propeller shaft application, or in other similar applications where a coating must be durable, yet flexible, Thor-Coat's enhanced elasticity and toughness provide enhanced corrosion protection over longer service periods.

Thor-Coat was specifically developed to complement Thordon's COMPAC water lubricated propeller shaft bearing system by providing corrosion protection for

Thor-Coat vs. Competitive Products: Test Results

	Thor-Coat	Product A	Product B	Product C	Product D
Recommended Coating Thickness	2.0 mm (0.08")	6.0 mm (0.24")	2.75 mm (0.11")	2.75 mm (0.11")	2.75 mm (0.11")
Abrasive Wear Resistance - Wet (ASTM G6)	0.015 mm (0.0006")	0.22 mm (0.009")	0.34 mm (0.013")	0.16 mm (0.006")	0.22 mm (0.009")
Wear as a % of Coating Thickness	0.75%	3.67%	12.36%	5.82%	8.00%
Conical Mandrel Bend (ASTM D522)					
% elongation	160%	44%	28%	17%	17%
Scale bend when initial cracking observed	none at 180°	90°	57°	34°	34°



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a ten-year period in service. At ten years, the shaft would be withdrawn to inspect the bearings and the Thor-Coat. Thordon is also working closely with the Classification Societies to develop approval for techniques, such as borescoping, that facilitate inspection at the five year docking with the shaft in situ.

Should Thor-Coat suffer impact damage, it tends to fail locally resulting in some of the coating remaining on the shaft continuing to offer corrosion protection. If the coating is damaged to the point where corrosion does occur, the corrosion is limited to the damaged area only and will not migrate along the shaft under the coating to unexposed areas. Localized damage can be easily repaired if necessary.

Applied to the exposed shaft of a rudder stock, Thor-Coat offers improved long term protection as it does not crack due to shaft flexing that occurs during normal operation.



Application/Removal

Application is straightforward, as Thor-Coat is a one-coat product. After combining Part A with Part B and mixing, Thor-Coat is applied with a brush and then troweled smooth using the film thickness gauge provided to check the consistency of the coating thickness. Smoothing Thor-Coat is simplified if the shaft can be mounted in a lathe and rotated.

Prior to applying Thor-Coat, the shaft must be blast cleaned, wiped down with solvent and allowed to dry. At 22°C (72°F) Thor-Coat cures hard dry in 32 hours. Thor-Coat should be applied at temperatures of 10°C (50°F) or higher. At temperatures less than 21°C (70°F) the recommended coating thickness of 2.0 mm (0.08") can be applied in one coat. At temperatures above 21°C (70°F), a second coat applied 5 hours after the first coat may be required to achieve recommended coating thickness. Full cure is achieved in 7 days at 22°C (72°F). Full application instructions are available from Thordon Bearings.

Thor-Coat is most easily removed from the shaft by machining. Other mechanical removal techniques that will not damage the shaft may also be used.

Comparative Test Data

Test Description	Thor-Coat	Product A	Product B	Product C	Product D
Recommended Coating Thickness	2.0 mm (0.08 in.)	6.0 mm (0.24 in.)	2.75 mm (0.11 in.)	2.75 mm (0.11 in.)	2.75 mm (0.11 in.)
Film Tensile Properties (ASTM 02370): Tensile Strength	> 15 MPa (2100 psi)	> 27.5 MPa (4000 psi)	>34.5 MPa (5000 psi)	> 26.0 MPa (3750 psi)	> 41.0 MPa (6000 psi)
Elongation at failure	60% in water	30%	30%	11%	3%
Adhesion (ASTM D1002): Lap Shear Strength	> 15 MPa (2100 psi)	10 MPa (1500 psi)	20 MPa (2900 psi)	16 MPa (2300 psi)	25 MPa (3600 psi)
Cathodic Disbondment (ASTM G8-90)	excellent <2.0 mm (< 0.08 in.)	good 5.5 mm (0.22 in.)	good 5.5 mm (0.22 in.)	good <5.0 mm (< 0.20 in.)	good <5.0 mm (< 0.20 in.)
Conical Mandrel Bend (ASTM D522) % elongation	160%	44%	28%	17%	17%
Scale bend when initial cracking observed	none at 180°	90°	57°	34°	34°
Impact Resistance-Falling Weight (ASTM G14)	>1500 mm·kg	>1500 mm·kg	>1500 mm·kg	>1500 mm·kg	>1500 mm·kg
Abrasive Wear Resistance (ASTM G6) Wear as a % of coating thickness	0.75%	3.67%	12.36%	5.82%	8.00%

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Description	Two component, 100% solids, high-build, corrosion protection coating for dynamic marine applications. Can be applied in single coat to 2 mm or 0.08", with exceptionally high flexibility, high strength and toughness, good abrasion resistance, and excellent corrosion protection and moisture resistance.					
Color/Appearance	Product	Light Grey	Part A (resin)	Off White	Part B (Hardener)	Light Black
Specific Gravity	Product	1.0 (after cure)	Part A (resin)	1.31	Part B (Hardener)	0.91
Solids Content	100% after cure (no volatile solvent added and no thinner recommended)					
Film Thickness	Recommended thickness is 2 mm (0.080")					
Theoretical Coverage	metric	0.5 m ² per liter (or per 1.07 kg) of Thor-Coat at 2 mm thick. (note: a 500 mm shaft diameter and 4 m coating length = 6.3 m ² and requires 12.6 liters or 13.5 kg of Thor-Coat)				
	imperial	20 sq. ft. per U.S. Gallon of Thor-Coat at .08" thick. (note: a 19" shaft diameter and 12' coating length = 59.7 sq. ft. and requires 3 U.S. gallons or 30 lbs. of Thor-Coat)				
Application Method	Brush and trowel. Ensure complete surface coverage with a brush, followed by further smoothing the coating using a brush, trowel, or roller.					
Curing Times	Temperature	22°C (72°F)	10°C (50°F)	30°C (86°F)	40°C (104°F)	
	Hard/tack free	32 hrs	-	16 hrs	8-10 hrs	
	Full Cure	5-7 days	> 21 days	48 hrs	24 hrs	
Limiting Cure Temperatures	Minimum 10°C (50°F). Surface temperature at least 3°C (5°F) above the dew point of surrounding air (i.e. no moisture condensation on the steel surface to be coated).					
Flash Point	> 100°C (220°F)					
Health and Safety Information	Provide ventilated conditions. Take normal precautions to avoid inhalation of product components and skin contact. Wear appropriate protection such as gloves, safety eyewear, and masks. Wash thoroughly with a suitable skin cleanser any skin areas where product comes into contact followed by washing with soap and water. Splashes in the eyes should be well flushed (at least 10 minutes) with water or a proprietary eye wash and medical attention sought.					
Storage	Store the unmixed resin and hardener components in sealed containers, in dry and mild indoor conditions (at 10-38°C or 50-100°F). Protect from frost/freezing and overheating.					
Shelf Life	Minimum 2 years at 22°C (72°F).					
Shipping Information	Not regulated. Non-flammable liquid. Can be shipped ground or air.					

Note: The information contained in this document is based on Thordon's many years of experience manufacturing and installing Thordon bearings worldwide. This information is offered as part of our service to customers. It is intended for use by persons having technical training and skill, at their discretion and risk. The company reserves the right to change or amend any specification without notice.

Thordon Bearings Inc., a member of the Thomson-Gordon Group of Burlington, Ontario, Canada, designs and manufactures a complete range of high performance, non-metallic journal bearing systems for ships, offshore oil rigs, hydro-electric plants, pumps and many other industrial applications. Reliability, long wear life and superior customer service have made Thordon the first choice for marine propeller shaft, rudder and deck equipment for repair, conversion or new build projects. Today, with over 25 years of trouble-free installations documented, Thordon marine bearing systems are the proven, reliable, environmentally friendly solution for ship owners, managers and yards that demand the best. Recognized internationally for high performance in marine applications, Thordon bearings are sold in over 70 countries worldwide.

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