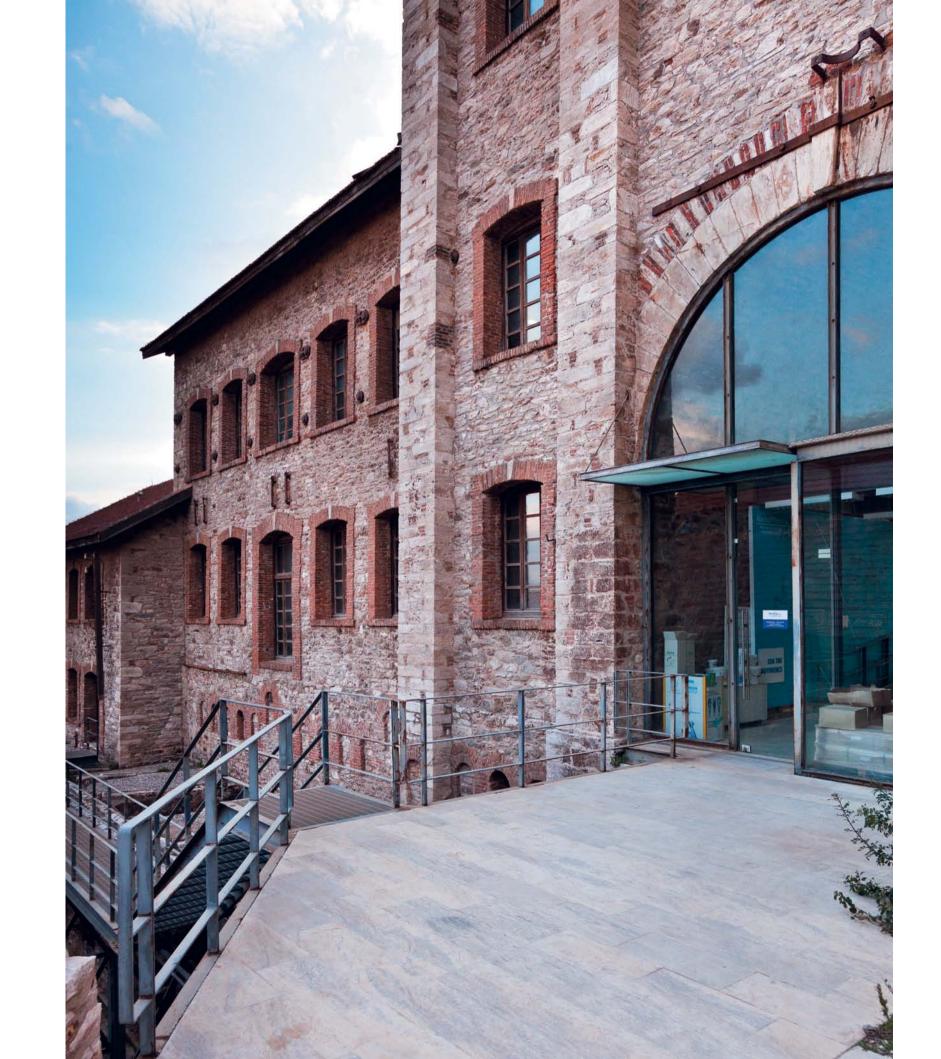


NANOPOWER FOR**SEA**ING THE COATINGS' FUTURE









With vast scientific knowledge, a 10+ year experience, a rich product portfolio of more than 50 products & many, large, international projects, **NanoPhos** is "building the world & crossing the oceans"

Since its establishment in 2005 in Lavrio, Greece, NanoPhos has been researching, developing, producing and trading "smart" materials to solve everyday problems with the power of nanotechnology. A broad range of patented, high-quality and environmentally friendly coating products adds functionality and unique properties in construction projects, industrial units, marine structures or vessels.

Numerous international **awards** underline the company's *efficiency, ecological* awareness (i.e. 2010 World Expo, the 100% Detail exhibition, the GAIA awards), or *innovative* character (the President's of Microsoft- Bill Gates- distinction in 2008). NanoPhos has also been selected as a National Champion for the 2016/2017 European Business Awards Innovation. NanoPhos received **"Technical Achievement Award"** during the 2017 Lloyd's List Greek Shipping Awards - 2017.

NanoPhos products are exported to:

The UK, Sweden, Denmark, Portugal, Spain, France, Italy, Romania, Cyprus, Egypt, Sudan, Saudi Arabia, Bahrain, UAE, Qatar, Iran, India, New Zealand, China, Japan, Mexico, Guatemala, Thailand, Malaysia and Singapore.

Gobal assesment of antifouling performance:

Singapore, Nagoya Gulf (Japan), Dubai, Norway, Italy, Malta, China, Mexico, South Africa.



Tune the NanoWorld to serve the MacroWorld of the Seas...

The leading role of nanotecnology

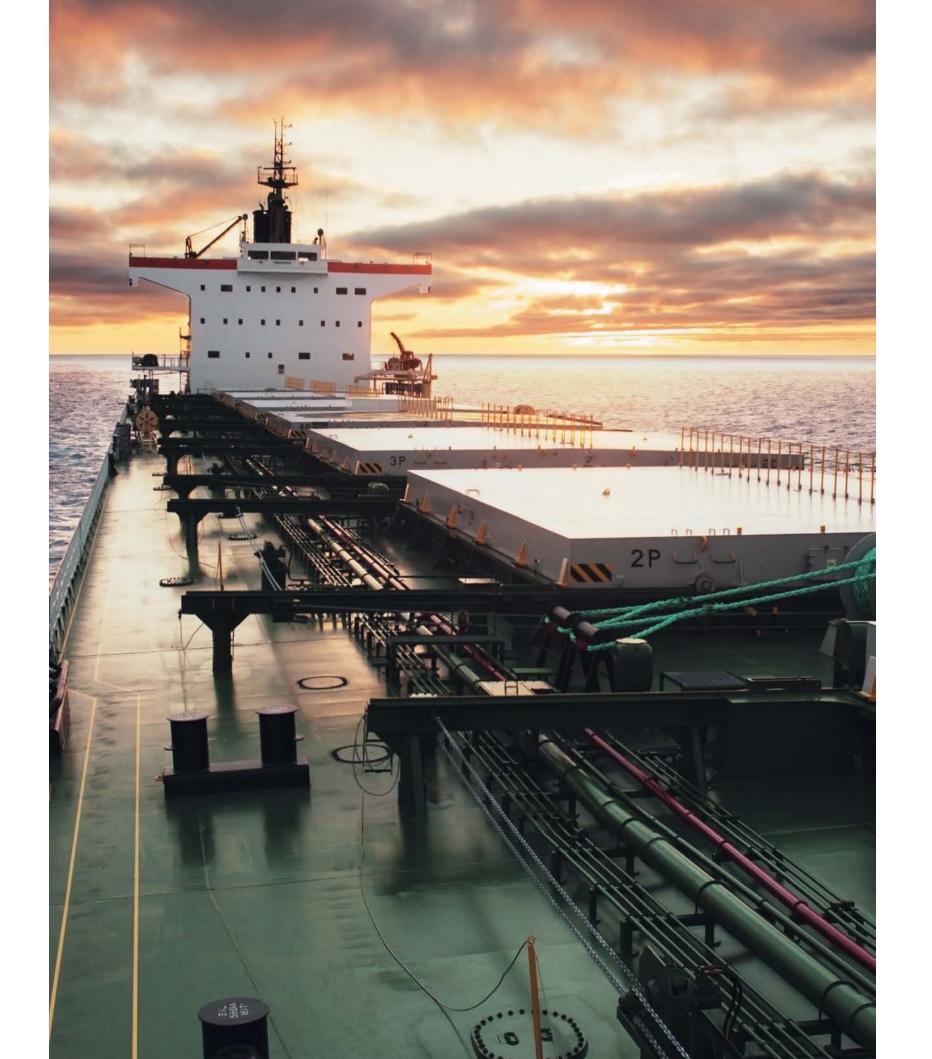
Nanotechnology refers to the scientific discipline, which deals with very small structures, typically sized from 1nm to 100nm. One nanometer (nm) is one billionth of a meter, (10-9m) — if earth was one meter in diameter, then one nanometer would have been the size of an apple!

Down to nanoscale, conventional materials develop unique physical (e.g. electrical or mechanical) and chemical properties, when exposed to external stimuli. That is how NanoPhos products differentiate to existing conventional coatings: The near-infinitely small nanoparticles penetrate deeply into the application surfaces to "dress" their application substrates, ensuring the repulsion and protection of intruding factors effectively against abrasion, friction, corrosion or adverse weather conditions.

By harnessing the power of nanotechnology, NanoPhos provides "intelligent" and proven solutions aiming at the effectiveness, durability, ecofriendliness:

- coatings to prevent the development of marine biofouling even in static/ idle conditions,
- anti-corrosion products for long-term protection that exceeds 15 years of operational life in the harshest environment, or even
- thermal insulating coatings for energy saving in heat exchange applications.

NANOPHOS MARINE



NanoPhos Marine takes a further step in the shipping industry with more than 30 products focusing on maintenance, cleaning & hull protection

NanoPhos has decided to extend its proven scientific knowledge and 10+ year experience to the field of shipping under the name NanoPhos Marine. After many years of research and laboratory experiments, extensive market research, deep insight into the common but persistent problems of marine industry, as well as respect to the eco-system, NanoPhos Marine has released nearly 30 innovative products, which focus on maintenance, cleaning and hull protection. Antifouling or anti-corrosion, thermal insulation, reduction of energy needs and decrease of maintenance costs are the main targets of our innovative and cost-effective products.

Core Benefits of NanoPhos Marine products:

PERFORMANCE



COST-EFFECTIVE





FUEL SAVING



REDUCTION OF DRY-DOCKING INTERVALS



ECO-FRIENDLY

Proud Memberships

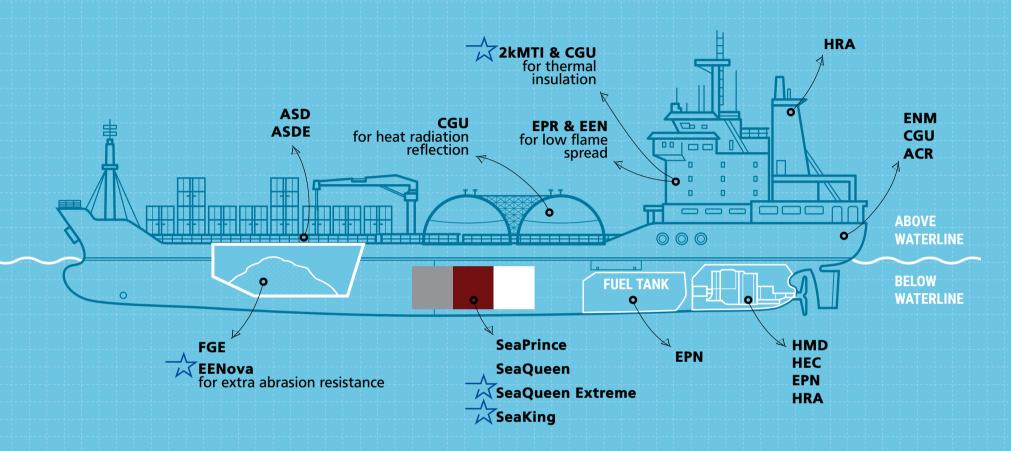
NanoPhos Marine is a proud member of the Hellenic Marine Equipment Manufacturers & Exporters (HEMEXPO) since 2014. A Green Award Incentive Provider since 2017.

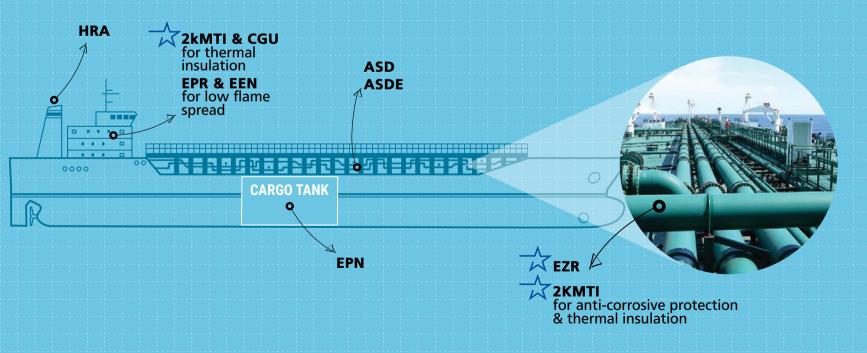


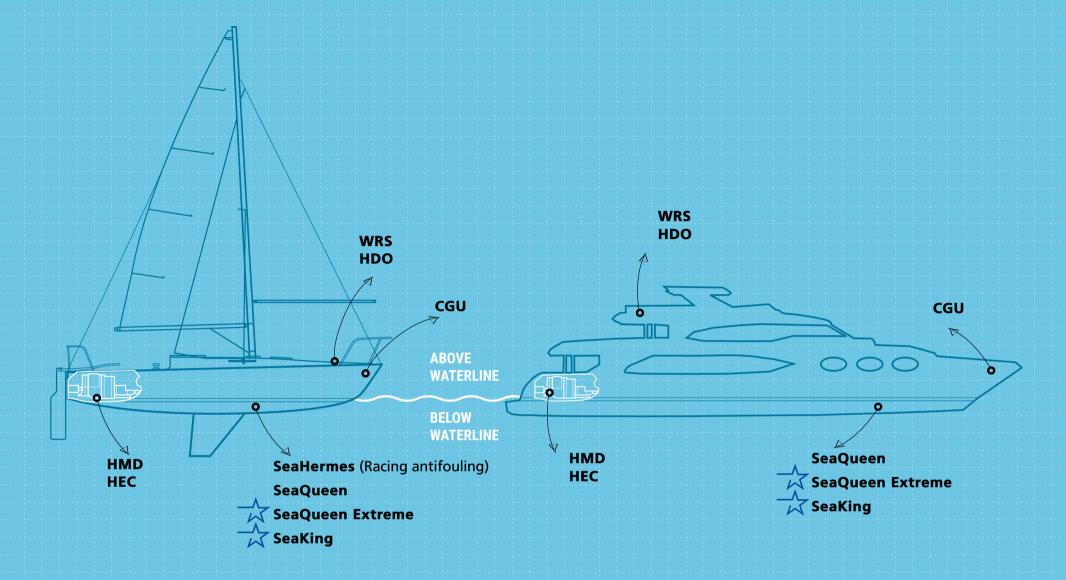




Technical Achievement Award «Lloyd's List Greek Shipping Awards» 2017







	PRIMERS BELOW WATERLINE [ANTIFOULING]		ABOVE WATERLINE	MAINTENANCE, CLEANING & CARE	THINNERS	STAR PRODUCTS	
	ECP Epoxy Construction	SeaPrince	ENM Enamel	HMD Heavy Duty Marine Degreaser	NTPA Thinner A	2kMTI Metal Thermal Insulator	
-	ETC Epoxy Tie Coat	SeaQueen	EEN Epoxy Enamel	HEC Heavy Duty Electric Cleaner	NTPB Thinner B	EENova Modified Polyamide Epoxy Coating	
	ESP Epoxy NanoZinc Shop	SeaQueen Extreme	ASD AntiSlip Deck Coating	ARC Gel Rust Remover		SeaQueen Extreme AntiFouling	
4	EPR Epoxy			ASDE AntiSlip Deck Coating Epoxy WRS Water Repelling Shine Protection			
	EZR Epoxy NanoZinc			HDO Deck Oil		InterCruise LFS	
	ACQ AntiCorrossive Quick Dry		PTC PU Top Coating				
	VPR Vinyl		FGE Food Grade Epoxy				
[EPR NOVA Abrasion Resistant Epoxy EPR NOVA GF Abrasion Resistant Epoxy on Glass Flakes		ACR Single Component Acrylic Enamel				
			EPN Phenolic (Novolac Type) Epoxy				
	EPR WBT Epoxy Water Ballast		HRA Aluminum Heat Resistant Coating				

12 | PRODUCTS

PRODUCTS | 13

PRIMERS

ECP – Epoxy Construction Primer





Two-component, epoxy shop primer, enhanced with rust-inhibiting pigments. Typer approved for weldability of coated steel surfaces. Highly-recommended for blast-cleaned steel-plate protection during the storage and building period. Applicable by both spraying and roller (manually).

ETC - Epoxy Tie Coat





Two-component, tar-free, epoxy sealer, with great anti-corrosive and adhesion properties, to enhance the end-result of the coating system.

ESP - Epoxy NanoZinc Shop Primer



Two-component, NanoZinc epoxy shop primer, for highest corrosion-protection requirements of grit blasted steel plates during storage and building period.

EPR - Epoxy Primer









surfaces. Approved by DBI, in accordance with the IMO requirements and standards for low-flame spread.











Two-component, high-build epoxy primer, with high-surface area of zinc nanoparticles. Excellent anti-corrosive performance in particularly demanding areas (e.g. ballast area). Ideal primer in combination with advanced coating systems for below or above the waterline protection.

ACQ - AntiCorrosive Quick Dry







Single-component, anti-corrosive primer for marine or industrial steel. Contains zinc phosphate and zinc oxide – no lead. Non-toxic, highly weathering-resistant Excellent for priming storage tanks, industrial plants, machinery and externally exposed steel

VPR – Vinyl Primer





Single-component, vinyl-based primer, formulated with anti-corrosive inhibitors. Applicable as a sealer to enhance compatibility with NanoPhos' antifouling coatings, or even on wooden surfaces.

EPR NOVA - Abrasion Resistant Epoxy Primer





Two-component, innovative, fast-drying epoxy polyamide primer, containing anti-corrosive pigments and built-in silicon elastomer nanoparticles for superior impact and abrasion resistance. Ideal for surfaces exposed to marine environment above and below the waterline. Excellent protection for Ice Class vessels. Compatible with all surfaces or coatings.

EPR NOVA GF – Abrasion Resistant Epoxy on Glass Flakes Primer





Two-component epoxy polyamide primer, enclosing anti-corrosive pigments and built-in silicon elastomer nanoparticles, reinforced with high content of glass flakes for high impact and abrasion excellent resistance. Fast-drying corrosion protective paint that smoothens rough surfaces. Ideal for surfaces exposed to marine environment above and below the waterline. Excellent protection for Ice Class vessels. Compatible with all surfaces or coatings.







10. EPR WBT - Epoxy Water Ballast Primer





Two-component enhanced epoxy primer /finish coat with superior anti-corrosive long lasting action. It is suitable for application in Water Ballast Tanks according to PSPC requirements or any other immersed area. Conforms with low fire spreadability requirements.

BELOW WATERLINE - ANTIFOULINGS

SeaPrince Antifouling





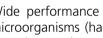


Multi-purpose, copper (I)-based, self-polishing, single-component anti-fouling formulation, with very good response to the fouling of the marine environment. Ideal solution for cost-sensitive projects. Lloyds' approved according to the strictest National and International Regulations of the International Maritime Organisation (IMO)

SeaQueen Antifouling







Wide performance range, copper (I)-based, self-polishing, single-component anti-fouling formulation. Great response to algae (soft fouling) and microorganisms (hard fouling) of marine environment. Ideal for vessels coming out of water in winter, or with speed up to 40kt. DNV-GL approved according to the strictest National and International Regulations of the International Maritime Organisation (IMO).

SeaQueen Extreme Antifouling







Innovative, tin & copper free, self-polishing, single-component anti-fouling coating. Excellent response to sea environments with high level of hard fouling. Ideal for vessels that move at very low speed or remain idled for extended periods. Saves fuels costs by reducing drag coefficient. Special for aluminum hulls or wherever copper formulations prove incompatible to substrate. Conforms to the strictest National and International Regulations of the International Maritime Organisation (IMO)-Lloyd's and ABS approved. NanoPhos proprietary technology reduces roughness of the coating below 30µm. to ensure lower friction, lower fuel consumption and better antifouling performance.

SeaHermes Transparent Racing Antifouling



Super-hydrophilic, transparent, single-component coating, based on titanium-dioxide nanoparticles. Creates a short living (6M), but extremely low surfacetension coating to reduce boundary effect & boost speed performance. Apart from surface tension, nanoparticles shape a unique micro-roughness to reduce friction or drag coefficient.

SeaKing Antifouling









The ultimate epoxy, tin-free, low-friction, superior-release & long-lasting, nanotechnology-driven, two-component coating. Based on PolyDIMethylSilixane modified epoxies, as the latest advance in marine coatings. Apart to their amphiphilic behavior and enhanced durability, they are coupled with glycol units to finely tune surface tension values that repel proteins or microorganism biological anchors. Saves fuels costs by reducing drag coefficient. Even though a fouling-realease coating, elements of antifouling performance are evident, without self-polishing erosion. DNV-GL approved according to the strictest National and International Regulations of the International Maritime Organisation (IMO).



ABOVE WATERLINE – PAINTS

1. ENM - Enamel



Alkyd-finish, long-lasting, single-component, anti-corrosive coating. Excellent for color stability and gloss retention for interior and exterior applications. Easily applicable due to its optimized rheology, even in the presence of high moisture levels. Excellent adhesion to alkyd primers, or most conventional top-coatings. Additional thermal insulation with the white-color option, through heat (infrared) reflection.

Polyamide, high-gloss, two-component, super-resistant paint, with excellent adhesion and performance against weathering. Approved by DBI (Danish Institute of Fire and Security Technology), in accordance with the International Maritime Organisation (IMO) requirements and standards

EEN - Epoxy Enamel









for low-flame spread.



Slip-resistance, single-component deck coating. High weather resistance, near zero gloss. Fast drying and low dirt pick-up. Does not yellow or flake, even in harsh weathering conditions. Anti-corrosive. Applicable even under adverse weather conditions.

ASDE – Antislip Deck Coating Epoxy





Two component epoxy anti-skid coating for decks or surfaces requiring extra anti-slip protection under considerable mechanical stress (i.e. vessel parking lots). Significant resistance to weathering conditions or demanding corrosive environment.

5. PTC - Polyurethane Top Coating



A high-gloss, protective, film-forming, two-component coating for the application on fiber-glass or inox surfaces. Prevents the accumulation of salt deposits for easier cleaning. Does not yellow or flake, even after prolonged exposure to UV and marine environment.

FGE – Food Grade Epoxy





Two-component, epoxy, high performance, food safe coating, Ideal for bulk transportation of food sensitive cargo (i.e. grains). Zero migration of food contaminants. Applicable on top of protective coating systems, to ensure food safety standards.

ACR – Single Component Acrylic Enamel Paint



ACR is a single component, solvent based, fast-drying, enamel paint formulation for exterior or interior application in moderately to severely corrosive ambient environment. It is a finishing coat with semi-glossy appearance. Resistant to salt water, splashes of aliphatic hydrocarbons or oils.

EPN - Phenolic (Novolac type) Epoxy





Two-component phenolic epoxy (novolac type) coating. Significant adhesive properties combined with particular extra chemical resistance against corrosive factors, such as sea water, hydrocarbons, crude oil, ketones, esters, alcohols, acids and bases. Recommended for engine rooms, shields, fuel tanks, oil hydrocarbons or any surface requiring enhanced protection against chemicals.

HRA - Aluminum Heat Resistant Coating





Single-component, silicon epoxy, aluminum-enhanced, heat-resistant coating with excellent resistance in high temperature environments (up to 600 °C), combined with anti-corrosive properties.



Applied on: Ocean Going Vessel





10. CGU - Cool Glossy Stain Resistant PU Enamel





Acrylic/ polyurethane, two-component coating, with outstanding color-retention abilities. Exceptional resistance to weathering, staining and corrosive environment. Ideal for exterior or interior applications, or whenever a superior gloss and color retention finish is desired. Applicable directly on gel-coat or an adhesive primer (i.e. EPR). Special nanostructured ingredients reflect incidental heat radiation, thereby enhancing the degree of comfort and "coolness" inside the hull. Ideal for the exterior of oil, LNG, LPG Tankers topside, as a heat migration solution or even as a repairing solution on gel coat.

MAINTENANCE, CLEANING & CARE

HMD – Heavy Duty Marine Degreaser





Biodegradable, water-based cleaner. Emulsifies, dissolves and removes heavy oil, grease and grime in engine rooms, motors, machinery and dock equipment Compatible with UV bath.

2. HEC - Heavy Duty Electric Cleaner

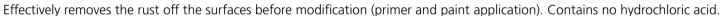




High-performance cleaner for electric components. Dislodges foreign elements. Prevents electric contact failure. Leaves no residues. Quick-drying formulation Suitable for use on any exposed sensitive electronic components and contacts (engine controls, data sensors and wiring).

ARC - Gel Rust Remover





4. WRS - Water Repelling Shine Protection



Nano-engineered product to repel sea water and prevent the adhesion of salt deposits on yachts, thus eliminating the deteriorating action of salts and preventing the shiny appearance of the hull.

HDO – Deck Oil



Unlike conventional teak oil, HDO is a binder-stabilized, deep penetrating, protecting formulation, ideal for marine hardwood surfaces (e.g. decks) with excellent UV protection. Feeds wood, restoring the natural oils lost through weathering. Leaves a wet look, long-lasting finish.

THINNERS

NTPA – NanoPhos Thinner A





Organic, solvent-based thinner for epoxy paint systems.

NTPB – NanoPhos Thinner B





Organic, solvent-based thinner for alkyd / acrylic / vinyl / PU paint systems

Applied on: Ocean Going Vessel



Yachting/Sailing



16 | STAR PRODUCTS

STAR PRODUCTS

1. 2kMTI – Metal Thermal Insulator



An innovative, epoxy, two-component, thermal insulating coating, utilizing spherical particles that impart exceptional insulate properties to a variety of substrates. Ideal for pipes, valves, tanks, structural steel, or other substrates, where thermal improvement and protection are desired. Part of a durable, anti-corrosive system, that bonds to the substrate, significantly reducing the issues associated with corrosion under insulation. Replacement solution for jacket insulation of steam / oil pipes, that require thermal insulation combined with the robustness of an epoxy coating.

EENova - Modified Polyamide Epoxy Coating



Unique for incorporating silicon elastomer nanoparticles ("nanopillows"), with a soft, elastomer core, that can adhere on resin binder. Although no abrasion resistance, strength or toughness is lost, the particles can reversibly act as energy storage units, absorbing the acute pressure of abrasive cargoes and impact incident.

SeaKing Antifouling





The ultimate epoxy, tin-free, low-friction, superior-release & long-lasting, nanotechnology-driven, two-component coating Based on PolyDIMethylSilixane modified epoxies, as the latest advance in marine coatings. Apart to their amphiphilic behavior and enhanced durability, they are coupled with glycol units to finely tune surface tension values that repel proteins or microorganism biological anchors. Saves fuels costs by reducing drag coefficient. Even though a fouling-realease coating, elements of antifouling performance are evident, without self-polishing erosion. DNV-GL approved according to the strictest National and International Regulations of the International Maritime Organisation (IMO).

InterCruise LFS





Water based, acrylic, single-component emulsion for masonry wall surfaces. Applicable on substrates treated with putty, (false) ceilings, gypsum boards, plasterboard, drywalls and floors. Leaves a velvet, long-lasting finish. Available in super matt finish for special applications. Can be tinted in a variety of colours. Due to its special composition (lead-free, resistant to washing and scrubbing) and flame spreadability ratings, it is strongly recommended for marine interior decoration applications (accommodation, halls, children's playrooms, kitchens, cruise ships interiors and others).

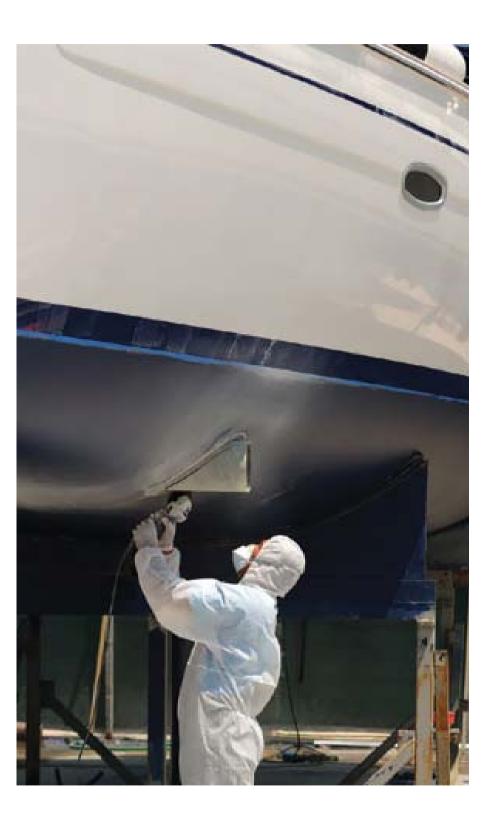
SeaQueen Extreme Antifouling







Innovative, tin & copper free, self-polishing, single-component anti-fouling coating. Excellent response to sea environments with high level of hard fouling. Ideal for vessels that move at very low speed or remain idled for extended periods. Saves fuels costs by reducing drag coefficient. Special for aluminum hulls or wherever copper formulations prove incompatible to substrate. *ABS Conforms to the strictest National and International Regulations of the International Maritime Organisation (IMO)-Lloyd's and ABS approved. NanoPhos proprietary technology reduces roughness of the coating below 30µm to ensure lower friction, lower fuel consumption and better antifouling performance.



How to select the right paint systems

When selecting a paint system, it is crucial to evaluate the conditions in which the application substrate of a vessel / facility is to operate.

Important factors must be considered:

- Surface preparation
- Vessel's type
- (speed, type of cargo, idle periods, geographical area of activity)
- Sea (water) environment (temperature, salinity, type of living organisms)
- Humidity & condensation development on coated surfaces
- Service temperature range and relevant gradients
- Mechanical wear challenges (e.g. abrasion, impact, friction coefficient requirements, high temperatures)
- Mechanical wear challenges (e.g. abrasion, impact, friction coefficient requirements)
- Service life expectations

The above-mentioned criteria define:

- the total nominal dry film thickness (DFT) of the applied coatings
- the recoating intervals and life cycle analysis of the coating system
- the ideal type / combination of the coating system

The loss factor LF, i.e. the percentage volumetric loss of paint during application, ranges from 10% to 35%, depending on application method, size, shape and roughness of the application substrate, physical losses.

The paint systems proposed in the tables that follow have been selected to the best of NanoPhos' Marine experience to meet application requirements and standards in an optimum combination of performance with cost of materials.

NanoPhos Marine technical team always remains available to fascilitate the development of the right coating system, but also provide on-site assistance during the application process. Please contact info@NanoPhos-Marine.com







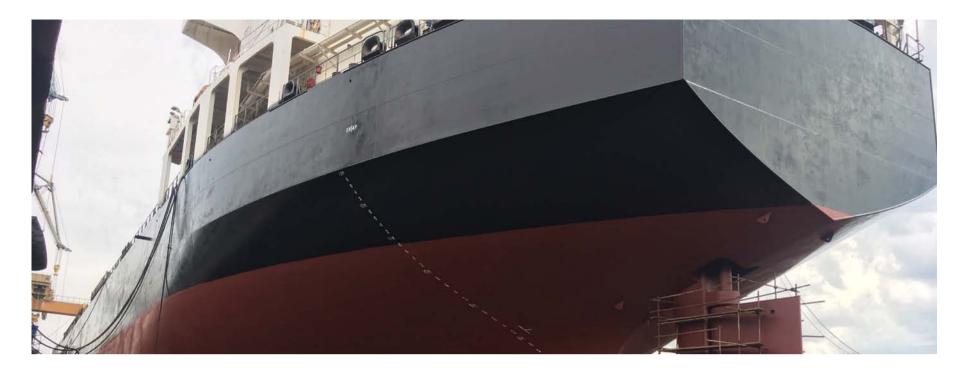


18 | PAINT SYSTEMS | 19



PCT Vessel - Ice Class, WorldWide L x W: 249.9m x 44m, Gross tonnage (GRT): 66.919 t, Deadweight (DWT): 117.055 t DRY DOCKING - AntiFouling System for 60 month protection - Spot Blasting Sa2 30%

		Cover (m			Dry Film Thickness (DFT) (µm)				Volume Solids (%)	Coverage (m²/L)	Loss Factor (%)	Quantities (Lt)
Products	Flat Bottom 7.625	Vertical Sides 3.900	Boottop Area 4.642	Top Sides 4.332	Flat Bottom	Vertical Sides	Boottop Area	Top Sides				
EPR Epoxy Primer	534	975	1.161	215	250	250	250	200	75	6-7.5	30	1.360
SeaQueen Antifouling	7.625	3.900	4.642		160	240	160		60	5.5-7.5	30	6.920
CGU Polyurethane Enamel				3.078				100	55	5.5	30	800
Thinner A												160
Thinner B												1.520
TOTAL					410	490	410	300				10.760

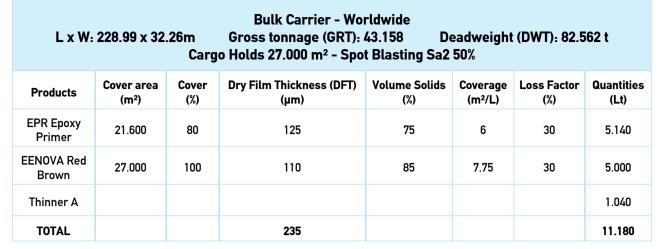


PCT Vessel (Tanker) - Mediterranean & Black Sea L x W: 182.5m x 27.34m Gross tonnage (GRT): 23.310 t Deadweight (DWT): 37.273 t DRY DOCKING - 60 month interval - Spot Blasting Sa2 20%

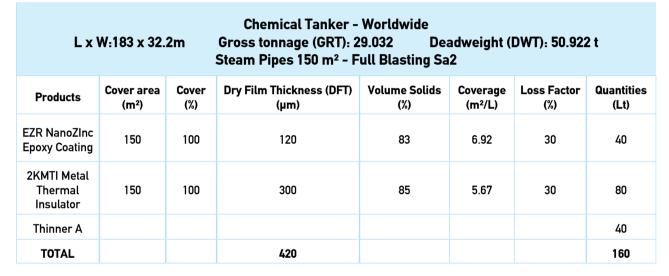
		Cover (m			Dry Film Thickness (DFT) (µm)				Volume Solids (%)	Coverage (m²/L)	Loss Factor (%)	Quantities (Lt)
Products	Flat Bottom 3.685	Vertical Sides 2.830	Boottop Area 2.310	Top Sides 2.795	Flat Bottom	Vertical Sides	Boottop Area	Top Sides				
Primer	1.106	900	800	950	250	250	250	200	75	6-7.5	30	1.720
ETC Epoxy Tie Coat	3.685	2.830	2.310		50	50	50		75	15	30	840
SeaQueen Extreme Antifouling	3.685	2.830	2.310		100	180	110		60	5.5-6.7	30	2.680
CGU Polyurethane Enamel				2.795				80	55	6.8	30	600
Thinner A												200
Thinner B												240
TOTAL					400	480	410	280				6.280

PAINT SYSTEMS | 21





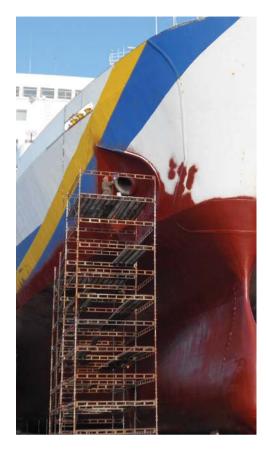






Deadweight (DWT): 3.630 t L x W: 130.5m x 14.6m UNDER WATER AREA - DRY DOCKING - 36 month interval - Full Blasting Sa2 Dry Film Thickness (DFT) Volume Solids Coverage Loss Factor **Quantities** Cover area **Products** (m²) (m^2/L) (%) (Lt) **EPR Epoxy** 2.210 200 75 7.5 30 440 Primer SeaQueen 200 60 2.210 30 1.100 Antifouling 140 Thinner A Thinner B 140 **TOTAL** 400 1.820

Frigate - Army Navy



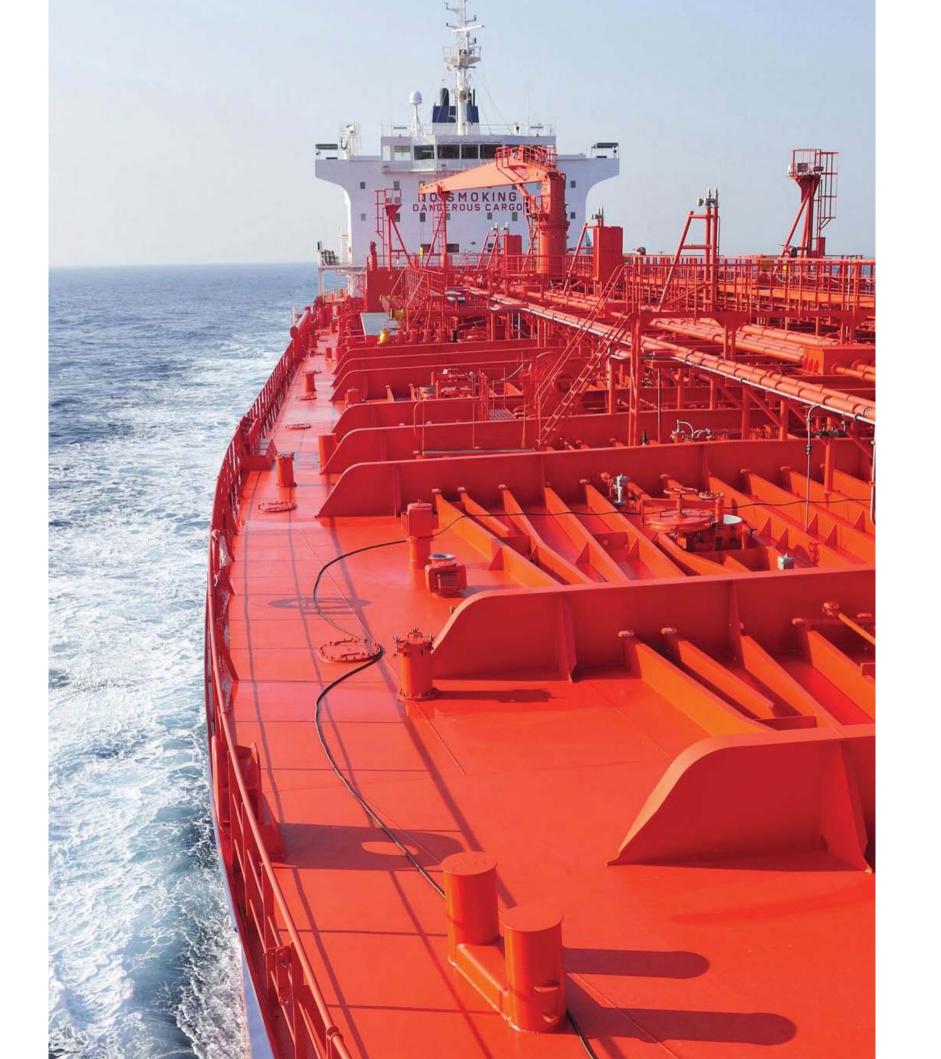
Ro-Ro Passenger Ship - Aegean Sea L x W: 142.48m x 23.5m Gross tonnage (GRT): 15.354 t Deadweight (DWT): 3.300 t DRY DOCKING - 24 month interval - Full Blasting Sa2

	Cover area (m²)			Dry Film Thickness (DFT) (μm)			Vol. Solids (%)	Coverage (m²/L)	Loss Factor (%)	Quantities (Lt)
Products	Flat Bottom 1.583	Vertical Sides 2.267	Boottop Area 449	Flat Bottom	Vertical Sides	Boottop Area				
EPR Epoxy Primer	1.583	2.267	67	240	240	240	75	6.25	30	1.800
SeaQueen Antifouling	1.583	2.267		120	200		60	5	30	1.540
EEN Epoxy Enamel			449			80	65	6.8	30	100
Thinner A										180
Thinner B										180
TOTAL				360	400	320				3.800



Ro-Ro Passenger - Aegean L x W: 192.91m x 29.4m Gross tonnage (GRT): 30.435 Deadweight (DWT): 7.622 t Decks 6.000 m² - Full ST2											
Products	Cover area (m²)	Cover (%)	Dry Film Thickness (DFT) (µm)	Volume Solids (%)	Coverage (m²/L)	Loss Factor (%)	Quantities (Lt)				
EPR Epoxy Primer	6.000	100	100	7 5	7.5	30	1.140				
ASD AntiSlip Deck Coating	6.000	100	100	60	6	30	1.430				
Thinner A							140				
TOTAL			200				2.710				

NOTEWORTHY PROJECTS

















































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