Long-term Corrosion Control for Jetty Piles & Marine Structures
Introduction:
Denso SeaShield comprise a range of systems developed to protect marine structures where corrosion is a major problem in splash zones, inter-tidal and subsea environments. These areas are extremely vulnerable due to the constantly changing mixture of air, temperature and chloride laden water, the perfect recipe for severe rusting. Once corrosion has begun, rough seas containing sand, shingle and debris coupled with infestations of marine growth, speed up the deterioration process. If nothing is done the structures can soon become unsafe and extremely costly to repair.

Important: SeaShield System Selection
To ensure that the correct SeaShield system is selected for the appropriate project, a Questionnaire is available for completion from our website, subsidiary companies or world wide agents to ensure that all of the relevant criteria are taken into consideration.

Why Use Denso SeaShield?

- Denso SeaShield systems have a 35 year proven track record for steel, wood and concrete jetty piles situated in highly corrosive environments including sub-sea conditions.

- Abrasive blast cleaning is not essential for steel surfaces as SeaShield systems are extremely surface tolerant and can be applied over chloride contamination and thin layers of rust.

- Cost effective long-term protection is achievable irrespective of cylindrical, hexagonal or square section structure designs.

*Patented SeaShield Inspection Hatches can be installed in our SeaShield 2000 FD system jackets to allow for easy monitoring of the pile surface. See page 7.*

Marine life forms such as barnacles and algae will soon colonise any structure.

Extremes of temperature, ice and heavy seas also take their toll on marine structures.

Need the SeaShield Questionnaire? Get it from www.denso.net or from one of our sales team on +44 (0) 208 670 7511
**Berthing Dolphins with Tightly Nested Piles Situated Close to Sea Level:**

In heavy seas, tremendous forces are created under these structures due to the rise and fall of the swell/wave action. A combination system comprising Denso Rigspray and SeaShield 2000 FD has been designed to provide long term protection in such stormy conditions. Please enquire for further details.

### Denso SeaShield Systems

#### Overview of the Range

<table>
<thead>
<tr>
<th>System Name</th>
<th>System Type</th>
<th>Description</th>
<th>Page</th>
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<tbody>
<tr>
<td>SeaShield 2000 FD</td>
<td>Petrolatum Inner Layer and HDPE Jacket</td>
<td>A heavy duty system for the protection of cylindrical, square and hexagonal steel concrete or wood piles</td>
<td>6-7</td>
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<tr>
<td>SeaShield 500</td>
<td>Epoxy Grout and GRP Form Jackets</td>
<td>An extra heavy duty system for the protection of steel, wood and concrete piles</td>
<td>8-9</td>
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<tr>
<td>Fiber-Form</td>
<td>Steel Rebar, Standard Grout and GRP Jackets</td>
<td>An ultra heavy duty system for the protection of steel, wood and concrete piles</td>
<td>9</td>
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<tr>
<td>SeaShield 100</td>
<td>Petrolatum Inner Layer and HDPE Jacket</td>
<td>A medium duty system for the protection of cylindrical, square and hexagonal steel concrete or wood piles</td>
<td>10-11</td>
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<tr>
<td>SeaShield 80</td>
<td>Petrolatum Inner Layer and Densopol 80 Tape</td>
<td>A light duty system for the protection of cylindrical, square and hexagonal steel concrete or wood piles</td>
<td>11</td>
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<tr>
<td>SeaShield Pile Cap</td>
<td>GRP Cap and Expanding Marine Foam</td>
<td>A heavy duty system for protecting the area between the pile top and the underside of the jetty deck</td>
<td>12</td>
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</table>
Denso SeaShield Series 2000 FD:
This System utilises a double wrap of Denso Marine Piling Tape but only requires the use of Denso S105 Paste when surface pitting exceeds 2mm in depth.

Denso SeaShield Series 80 and 100:
Both Systems utilise the same inner protective layer consisting of a coat of Denso S105 Paste followed by a double overwrap of Denso Marine Piling Tape.

Surface Preparation and Application of the Petrolatum Inner Layer:

Cleaning with a power tool.
Cleaning with a hand scraper.
Cleaning using a high pressure water jet
High pressure water jet under water.
Cleaned piles ready for the application of the Petrolatum Inner Layer.

Applying Denso Marine Piling Tape.
Tape application underwater

The Petrolatum Inner Layer provides optimum corrosion control for the pile surface.

The use of surface tolerant petrolatum products for the inner layer means that the substrate needs only hand or power tool cleaning to remove loose rust, loose coating and marine growth.

High pressure water jetting can be used to speed up the cleaning process.

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The Petrolatum Inner Layer Components:

**Denso S105 Paste**
A VOC free, soft petrolatum paste that contains water displacing additives, corrosion inhibitors and biocides.

**Denso Marine Piling Tape**
A thick, heavy duty tape made from a non-woven synthetic fabric impregnated and coated with a petrolatum compound containing inert fillers, water displacing agents and wide spectrum biocides.

The tape has a HDPE backing film. It is also specially formulated for application under water, or to wet surfaces. When applied spirally under tension it will displace water and develop a water resistant bond to metal surfaces.

Divers fitting a 2000 FD Jacket to a 1.3m diameter pile.

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**Description:**
A tough, ultraviolet-resistant jacket that provides protection to the tape inner layer against abrasion, wave action and accidental impact. The jackets are secured with 316 stainless steel fasteners.

**Uses**
SeaShield Series 2000 FD heavy duty system provides protection for steel, concrete and timber structures in the splash and intertidal zones.

Series 2000 FD can be used to encapsulate jetty piles, offshore riser pipes and exposed piping.

It can accommodate piles with cylindrical and hexagonal sections as well as support members and bracings.

**The Fastening Method**
The jacket joint is drawn together using a specially developed pneumatic clamp, allowing for easy fastening of the 316 stainless steel fasteners. The tension created by closing the jacket around the pile in this system is such that it pushes out any air between itself, the Petrolatum Inner Layer and the pile surface making it an exceptionally good seal between all of the system layers.

Cathodic protection systems are easily integrated into the SeaShield 2000 FD system.

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Advantages:

- Proven long-term corrosion prevention
- Surface preparation with mechanical and power tools or hp water jetting
- Can be applied to damp and immersed surfaces
- Easy and fast installation
- Increased hoop tension gives better adhesion
- One piece jackets
- Environmentally friendly
- Resistant to ice formation

Cross section showing the system on a hexagonal pile. The picture shows the inner tape layer and outer jacket conforming tightly under pressure to the pile's profile.

SeaShield 2000 FD - Inspection Hatches

Inspection hatches can be installed in the SeaShield 2000 FD jackets during manufacture. These hatches can be opened when required to check the surface condition of the pile beneath and easily re-fitted, restoring the SeaShield system back to its full integrity.

After removing the inspection hatch cover (1), the Marine Piling Tape is carefully cut and peeled back to observe the pile surface (2). To reinstall the hatch just push back the peeled tape adding Primer S105 to seal the tape down (3 & 4) and then push in a plug of Densyl Mastic to fill the void and finish the seal (5) before replacing the hatch cover.

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SeaShield Series 500

**Heavy Duty Pile Restoration**

**GRP Form Jacket + 550 Epoxy Grout = SeaShield Series 500**

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**Advantages:**
- Total encapsulation
- Easy to install
- Outstanding abrasion resistance
- Only requires inexpensive pumping equipment
- Optimum maintenance free service life
- Translucent GRP Forms enable internal grout level to be easily monitored
- UV resistant
- Meaningful long-term warranties available

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**Description and Uses:**

This robust, heavy duty Denso encapsulation system has been designed specifically for the repair and/or protection of coastal marine structures with moderate corrosion not requiring the addition of steel rebars. Jetty piles, bridge supports, offshore risers, conductors, pipework, jacket legs and structural member supports can all be protected with it.

To overcome the difficulty of working in a tidal or splash zone environment the systems can be applied in a series of stages.

Series 500 comprises translucent GRP Forms which are secured around the suitably cleaned substrate of the structure to be protected. Working from the bottom upwards, SeaShield 550 Epoxy Grout is then injected by pump, through special entry ports in the Forms until it completely fills the internal space between the Form and the substrate. When cured, the SeaShield 550 Epoxy Grout bonds exceptionally well to the substrate and the Forms which remain in place as a tough outer layer giving additional impact and abrasion resistance.

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*Suitable for vertical and raker piles with these cross sections*

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**Pumping the 550 Grout. Note the visible rising level seen through the Form.**

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**The Epoxy Grout only requires basic pumping equipment.**

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**GRP Forms are also available for H section piles.**

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*Get the SeaShield Questionnaire? Get it from www.denso.net or from one of our sales team on +44 (0) 208 670 7511*
GRP Forms stockpiled and ready for installation.

SeaShield 500 Components:

**GRP Form Jacket:**
High quality glass reinforced polyester outer jacket.

**Stand-offs:**
Non-corrosive grout spacers are used inside the jacket to maintain proper spacing around the piling when pumping or pouring the Epoxy Grout.

**SeaShield 550 Epoxy Grout:**
A three component water displacing epoxy resin/aggregate formulation with excellent flowability for easy application.

SeaShield 500 system still intact after withstanding a severe battering from this uprooted tree during a storm in the USA.

**Description and Uses:**
This extremely robust, extra heavy duty system is designed to be used on very badly corroded concrete piles where the use of steel rebars to reinforce the void between the pile and the Fiber-Form is essential. The void containing the steel rebars is then filled with standard marine grout to complete the system.

**SeaShield Fiber-Form + Steel Rebars + Standard Marine Grout = SeaShield Fiber-Form**

Placing the standoffs around the steel rebars before fitting the Fiber-Forms.

After fitting the Fiber-Forms the standard marine grout is injected by pump.
Advantages:

● Proven long-term corrosion prevention

● Surface preparation with mechanical and power tools or hp water jetting

● Can be applied to damp and immersed surfaces

● Easy and fast installation

● Each layer can be left between tides, no washing down necessary

● No drying or curing time between layers

● Environmentally friendly

Description:

A tough, ultraviolet-resistant jacket that provides protection to the Petrolatum Inner Layer against abrasion, wave action and accidental impact. The size and thickness of the jacket are customised to meet application requirements. SeaShield jackets are secured by a 19mm banding system selected for the intended environment.
**Description & Uses:**
Seashield Series 80 comprises the application of a double outer layer wrap of Densopol 80 Tape over the Petrolatum Inner Layer. The system offers basic economical protection for wood, steel or concrete piles. It is most suitable for use in sheltered areas away from heavy seas and strong currents.

**Advantages:**
- Easy and fast installation
- Basic economical protection
- Can be applied to damp and immersed surfaces
- Easily removed for inspection

**Description & Uses:**
Seashield Series 80 comprises the application of a double outer layer wrap of Densopol 80 Tape over the Petrolatum Inner Layer. The system offers basic economical protection for wood, steel or concrete piles. It is most suitable for use in sheltered areas away from heavy seas and strong currents.

**Uses:**
Seashield Series 100 can be used to encapsulate jetty piles, offshore riser pipes and exposed piping in the splash and intertidal zones. It can accommodate piles with cylindrical, hexagonal, and square sections, as well as support members and bracings.

**Advantages:**
- Easy and fast installation
- Basic economical protection
- Can be applied to damp and immersed surfaces
- Easily removed for inspection

**Description & Uses:**
Seashield Series 100 comprises the application of a double outer layer wrap of Densopol 80 Tape over the Petrolatum Inner Layer. The system offers basic economical protection for wood, steel or concrete piles. It is most suitable for use in sheltered areas away from heavy seas and strong currents. It can accommodate piles with cylindrical, hexagonal, and square sections, as well as support members and bracings.

**Uses:**
Seashield Series 100 can be used to encapsulate jetty piles, offshore riser pipes and exposed piping in the splash and intertidal zones. It can accommodate piles with cylindrical, hexagonal, and square sections, as well as support members and bracings.

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SeaShield Pile Cap System

Patent Pending

Description:
A tough, ultraviolet-resistant pre-moulded sectional cap that provides protection to the vulnerable area between the top of the pile and the underneath of the jetty platform. After any structural repairs have been carried out, the Pile Cap is bolted to the underside of the jetty deck and the bottom of the cap overlaps onto the chosen SeaShield system which has previously been applied to the pile. The overlapping section of the Pile Cap onto the SeaShield Jacket is securely fastened with a 19mm band fixing. The void area within the Pile Cap is then sealed with an expanding marine foam system.

Advantages:
- Long-term corrosion prevention
- Environmentally friendly
- Protects a vulnerable area which has previously been difficult to protect

View of the underside of the jetty deck, shows the complete encapsulation and degree of protection given to the pile with the use of this system.

Need the SeaShield Questionnaire? Get it from www.denso.net or from one of our sales team on +44 (0) 208 670 7511
Example of SeaShield Questionnaire:

Below is an example of the type information that is required before any specific SeaShield System can be recommended for installation. You can fill in the form online at www.denso.net.

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<td>1. Jetty / Location - Name:</td>
<td>11. Pile Dimensions:</td>
<td>17. Obstructions on Pile:</td>
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<td>2. Jetty Owner:</td>
<td>Diameter</td>
<td>Box Bracings</td>
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<td>3. Consultant:</td>
<td>Perimeter</td>
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<td>4. Contractor:</td>
<td>Face Sizes</td>
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<td>10. Total Height of Protection Required Per Pile:</td>
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![Diagram of Jetty Structure](image)

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Since 1966 - Some Completed SeaShield Projects:

Above: The Ford Island Bridge, Pearl Harbor, Hawaii - SeaShield Series 2000 FD.

627 piles protected

Above: Jetty, Milford Haven, UK - SeaShield Series 2000 FD.

400 piles protected

Above: LNG Jetty, Libya - SeaShield Series 2000 FD.

1000 piles protected

Above: LNG Jetty, Libya - SeaShield Series 2000 FD.

400 piles protected

Above: LNG Jetty, Libya - SeaShield Series 2000 FD.

3,333 linear metres protected

Above: Abbot Point coal loading jetty, Australia - SeaShield System.

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Since 1966 - Some Completed SeaShield Projects:


Above: Bridge supports in a river, UK - SeaShield System. 4 piles protected.

Above: Yacht Club, Poole, UK - SeaShield Series 500. 12 piles protected.

Above: Mining Jetty, Western Australia - SeaShield Series 2000 FD. 250 piles protected.

Above: RNLI Lifeboat Station, UK - SeaShield Series 500. 12 piles protected.

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Winn & Coales International Ltd

QUALITY AND INNOVATION FROM 1883 INTO THE 21st CENTURY

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