SeaShield

MARINE PROTECTION SYSTEMS

Long-term Corrosion Control for Jetty Piles & Marine Structures

Denso®

80 YEARS OF CORROSION PREVENTION

Denso SeaShield Marine Protection Systems

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.

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

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Pile Inspection:

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.

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

Denso SeaShield Marine Protection Systems

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

System Name	System Type	Description	Page
SeaShield 2000 FD	Petrolatum Inner Layer and HDPE Jacket	**A heavy duty system** for the protection of cylindrical, square and hexagonal steel concrete or wood piles	6-7
SeaShield 500	Epoxy Grout and GRP Form Jackets	**An extra heavy duty system** for the protection of steel, wood and concrete piles	8-9
Fiber- Form	Steel Rebar, Standard Grout and GRP Jackets	**An ultra heavy duty system** for the protection of steel, wood and concrete piles	9
SeaShield 100	Petrolatum Inner Layer and HDPE Jacket	**A medium duty system** for the protection of cylindrical, square and hexagonal steel concrete or wood piles	10-11
SeaShield 80	Petrolatum Inner Layer and Densopol 80 Tape	**A light duty system** for the protection of cylindrical, square and hexagonal steel concrete or wood piles	11
SeaShield Pile Cap	GRP Cap and Expanding Marine Foam	**A heavy duty system** for protecting the area between the pile top and the underside of the jetty deck	12

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

Cleaned piles ready for the application of the Petrolatum Inner Layer.

High pressure water jet under water.

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.

Applying Denso Marine Piling Tape.

Tape application underwater

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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.

SeaShield Series 2000 FD — Heavy Duty Outer Layer

Petrolatum Inner Layer + HDPE Jacket + Marine Grade Fasteners = SeaShield Series 2000 FD

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

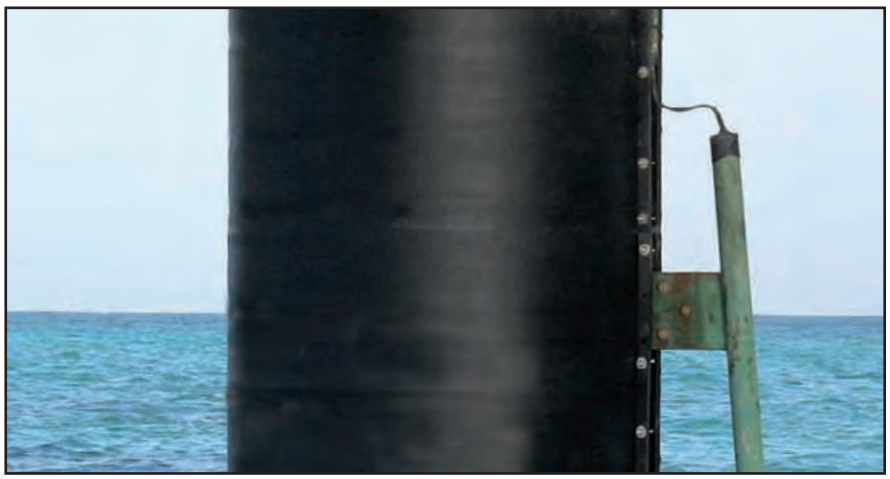
SeaShield Series 2000 FD heavy duty system provides protection for steel, concrete and timber structures in the splash and intertidal zones.

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

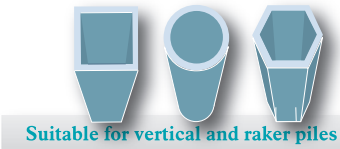
It can accommodate piles with cylindrical and hexagonal sections as well as support members and bracings.

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.



Suitable for vertical and raker piles with these cross sections

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SeaShield Series 2000 FD

Heavy Duty Outer Layer

Petrolatum Inner Layer + HDPE Jacket + Marine Grade Fasteners = SeaShield Series 2000 FD

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

As an optional extra, 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.

SeaShield Series 500 — Heavy Duty Pile Restoration

GRP Form Jacket + 550 Epoxy Grout = SeaShield Series 500

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

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 proteced 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.

The Epoxy Grout only requires basic pumping equipment.

GRP Forms are also available for H section piles.

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

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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SeaShield Series 500 — Heavy Duty Pile Restoration

GRP Form Jacket + 550 Epoxy Grout = SeaShield Series 500

GRP Forms stockpiled and ready for installation.

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

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 Fiber-Form — Heavy Duty Pile Restoration

GRP Fiber-Form Jackets + Steel Rebars + Standard Marine Grout = SeaShield Fiber-Form

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.

Suitable for vertical and raker piles with these cross sections

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.

SeaShield Series 100 — Medium Duty Outer Layer

Petrolatum Inner Layer + HDPE Jacket + Fastening Bands = SeaShield Series 100

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.

Installing the SeaShield 100 Jackets over the Petrolatum Inner Layer.

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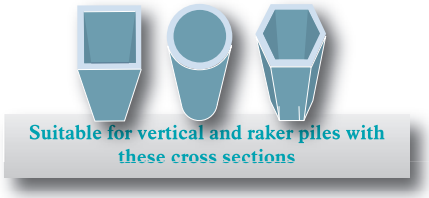
SeaShield Series 100 — Medium Duty Outer Layer

Petrolatum Inner Layer + HDPE Jacket + Fastening Bands = SeaShield Series 100



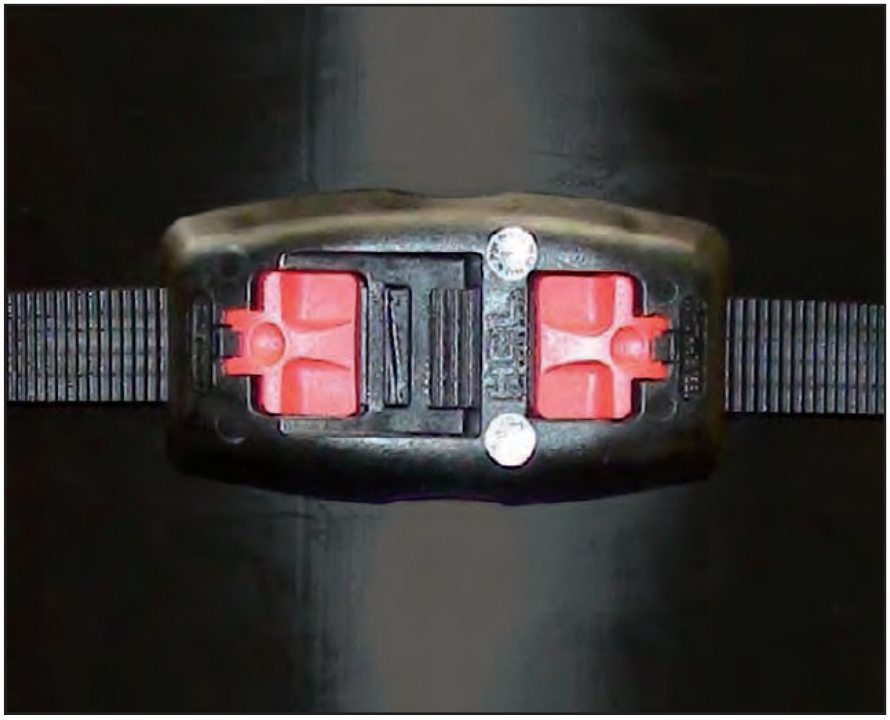
Suitable for vertical and raker piles with these cross sections

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.

Hexagonal pile protected with SeaShield Series 100 system.



Close up of 19mm band fixing.

SeaShield Series 80 — Light Duty Outer Layer

Petrolatum Inner Layer + Densopol 80 Tape = SeaShield Series 80

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.

Application of Densopol 80 Marine Tape over the inner petrolatum tape layer.

Suitable for vertical and raker piles with these cross sections

Cleaned pile ready for the application of the Seashield Series 80 System.

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SeaShield Pile Cap System

Pile Top To Jetty Deck Seal

Patent Pending

Description:

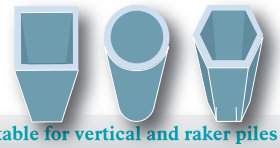
A tough, ultraviolet-resistant pre-moulded sectional cap that provides protection to the vulnerable area between the top of the pile and the underneath of the jetty platform. After any structural repairs have been carried out, the Pile Cap is bolted to the underside of the jetty deck and the bottom of 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

The Pile Cap is bolted to the underside of the jetty deck.

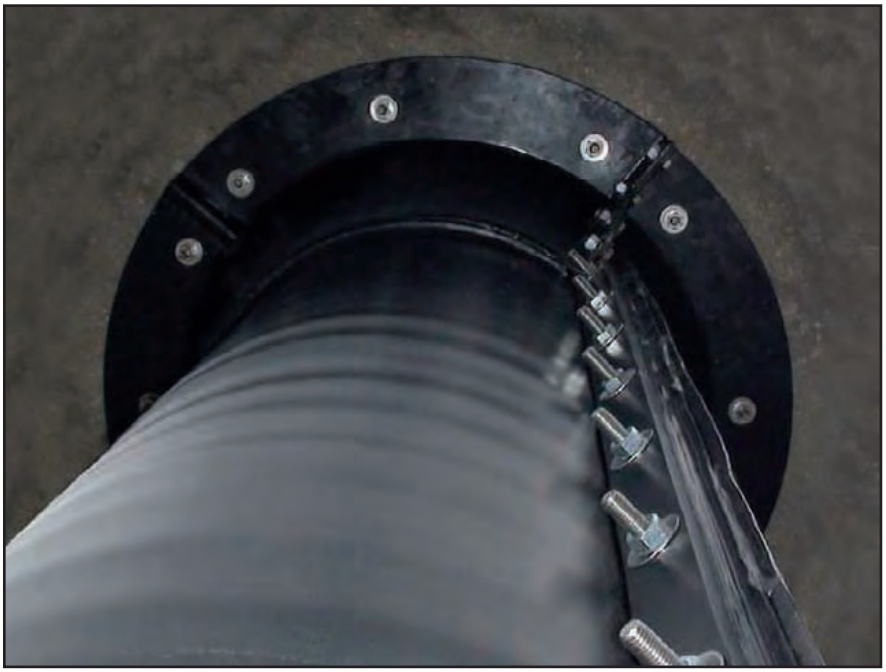
A 19mm band fixing is used to get a good seal over the existing SeaShield system.

Advantages:

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



Suitable for vertical and raker piles with these cross sections



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 .

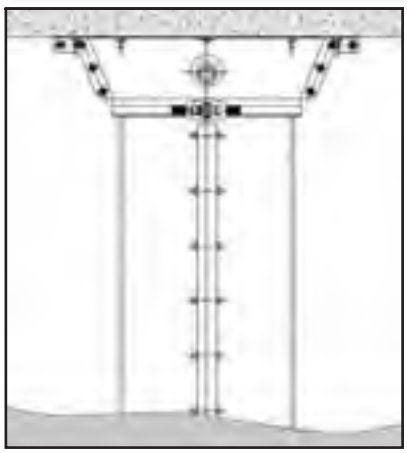


Diagram shows the interface between the SeaShield Pile Cap and SeaShield Jacket.

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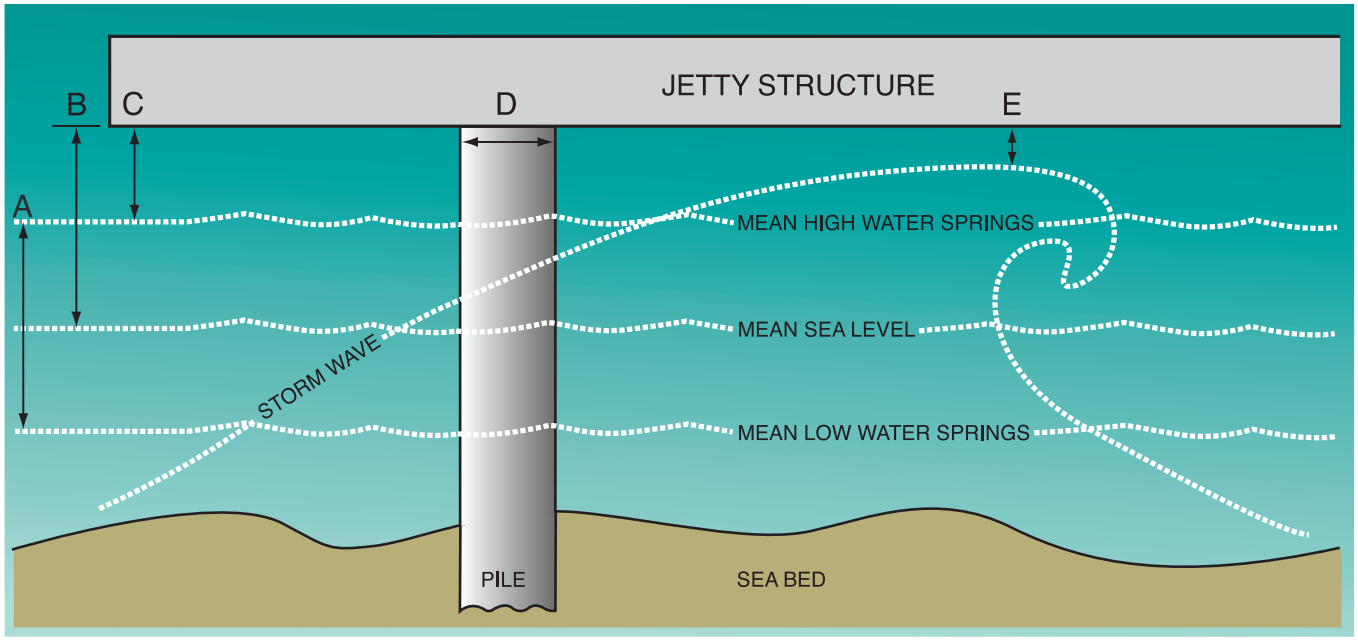
Example of SeaShield Questionnaire:

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.

1. **Jetty / Location - Name:**
2. **Jetty Owner:**
3. **Consultant:**
4. **Contractor:**
5. **Type of Structure / Materials Handled:**
6. **Location:**
   - ❒ Open Water Exposed
   - ❒ Open Water Sheltered
   - ❒ Harbour Exposed
   - ❒ Harbour Sheltered
   - ❒ Estuary
   - ❒ River
7. **Age of Jetty:**
8. **Pile Configuration:**
   - ❒ Round
   - ❒ Square
   - ❒ H Section
   - ❒ Hexagonal
   - ❒ Other
9. **Number of Piles:**
   - ❒ Vertical
   - ❒ Raker
10. **Total Height of Protection Required Per Pile:**
11. **Pile Dimensions:**
    - Diameter
    - Perimeter
    - Face Sizes
12. **Pile Material:**
    - ❒ Steel
    - ❒ Cast Iron
    - ❒ Concrete
    - ❒ Timber
    - ❒ Other / Comments
13. **Degree of Any Existing Corrosion:**
    - ❒ Heavy
    - ❒ Moderate
    - ❒ Light
    - ❒ None
14. **Degree of Marine Growth at this Location:**
    - ❒ Heavy
    - ❒ Moderate
    - ❒ Light
15. **Is Pollution Present:**
    - Please Comment
16. **Exposure to:**
    - ❒ Storms
    - ❒ Wind
    - ❒ Currents
    - ❒ Wave Action
17. **Obstructions on Pile:**
    - ❒ Cross Bracings
    - ❒ Pipes
    - ❒ Ladders
    - ❒ Brackets
    - ❒ CP Points
    - ❒ Other / Comments
18. **Access to Site:**
    - ❒ Vehicle
    - ❒ Water
    - ❒ Ladders
    - ❒ Scaffold
19. **Work Restrictions:**
    - ❒ Vessel Docking
    - ❒ Hot Working
    - ❒ Piles Nested Close Together
    - ❒ Other / Comments
20. **Max Tidal Flow (Knots):**
21. **Please Give Dimensions (Diagram Below):**
    - Dimension A
    - Dimension B
    - Dimension C
    - Dimension D
    - Dimension E



Since 1966 - Some Completed SeaShield Projects:

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

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

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

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

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

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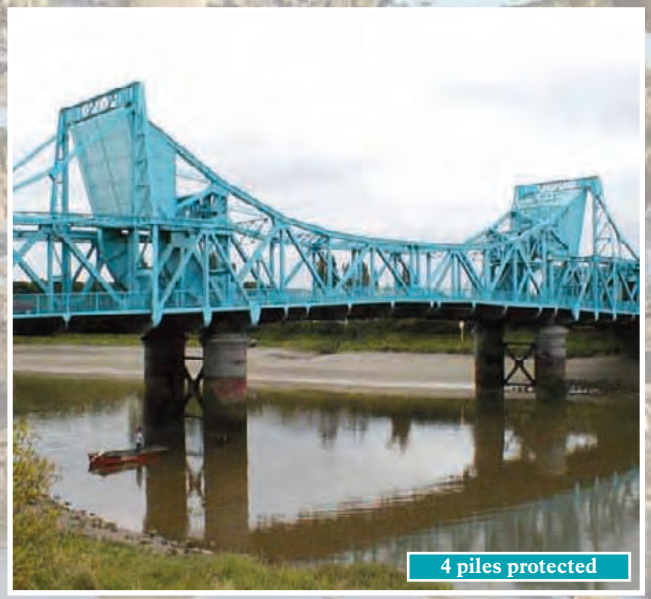
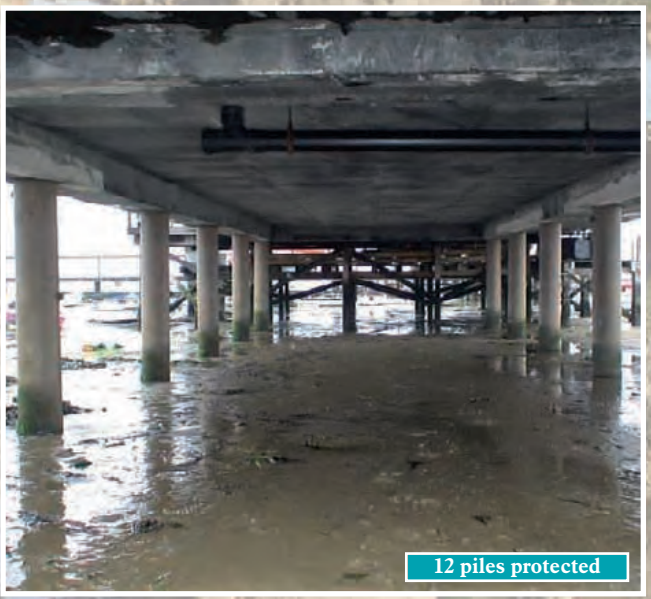
Since 1966 - Some Completed SeaShield Projects:

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

Above: RNLI Lifeboat Station, UK - SeaShield Series 500



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



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

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

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