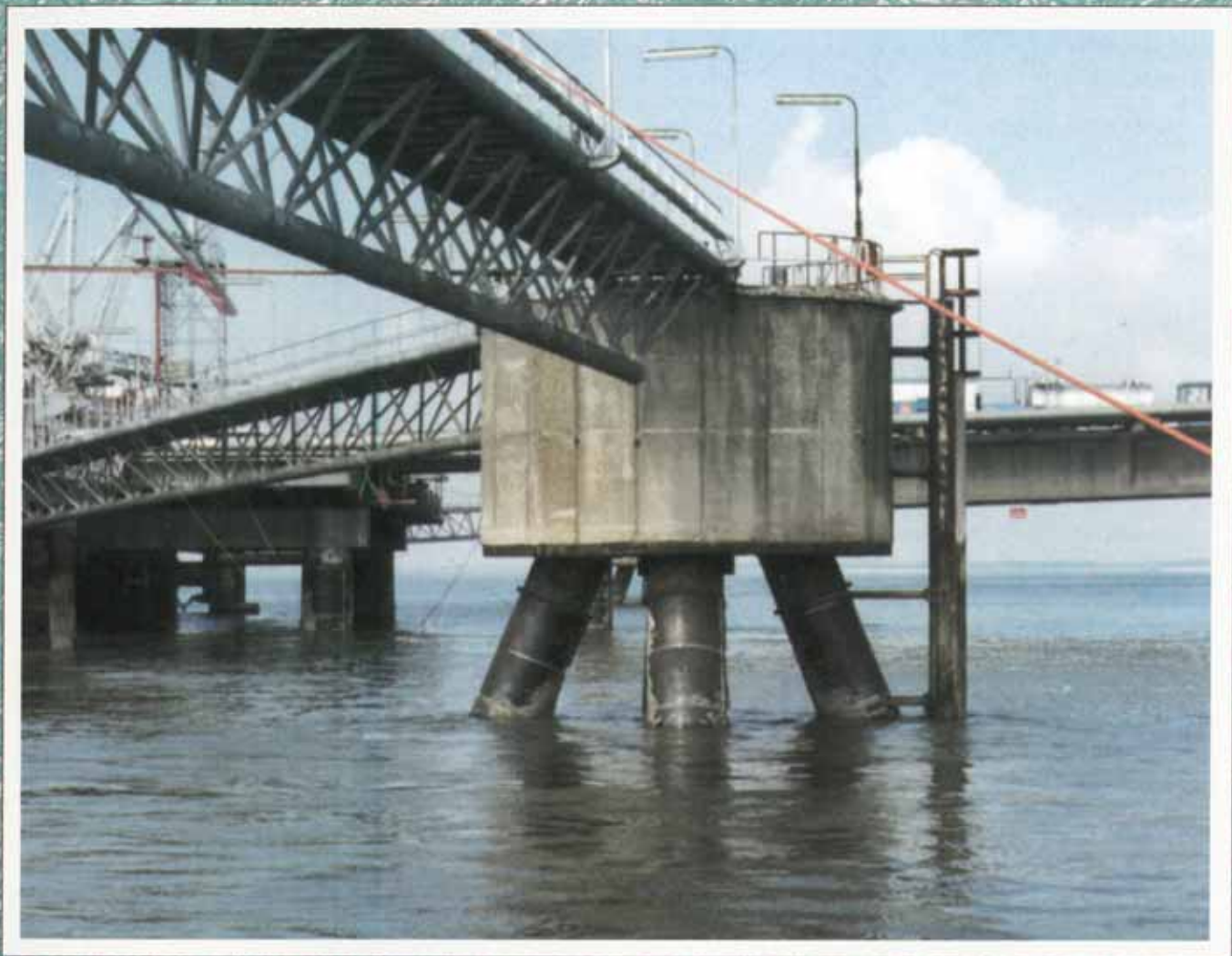


WINN & COALES INTERNATIONAL LTD

# Denso Digest



QUALITY & INNOVATION FROM 1883 INTO THE 21st CENTURY



Corrosion Protection Systems for Marine Structures

## Special Edition

- Systems suitable for steel, concrete or timber jetty piles
- Systems suitable for circular and hexagonal piles
- No drying or curing time between layers
- Easily removed to inspect pile condition



- Environmentally friendly
- Simple installation
- Protects against microbiological action
- Proven long-term corrosion prevention

### An Introduction to SeaShield Systems

Denso products provide effective long-term solutions to a wide range of corrosion prevention and sealing problems. The protection of the splash and inter-tidal zones of marine structures presents many special problems. We have worked closely with our overseas companies for many years to develop SeaShield Systems which can be applied above and below water to meet the exacting demands of marine environments.

The component common to all SeaShield systems is the waterproof coating consisting of a petrolatum based primer and tape containing water displacing agents, corrosion inhibitors and wide spectrum biocides. This effectively isolates the substrate from the surrounding environment. The system is also effective on concrete piles by preventing rebar corrosion; and on timber piles by preventing infestation by marine borers.

The waterproof layer is protected from physical damage by an outer protective coating selected to suit the environmental conditions at each particular site. The factors to be considered are: exposure to prevailing weather; currents; wave height; marine growth; pollution; risk of impact, abrasion etc.

The Winn & Coales group of companies offer a consultancy service built on worldwide experience in the protection of marine piles. We will advise on the most suitable SeaShield System or combination of systems, based on environmental and economic considerations, to meet specific requirements.

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## The SeaShield Outer Cover Options:



**SeaShield  
Series 100**

The waterproof anti-corrosion layer plus: A UV resistant, high density polyethylene outer cover with excellent impact, abrasion and chemical resistance. The covers are secured by circumferential bands and buckles made from non-degradable Delrin plastic or 316 stainless steel.



**SeaShield  
Series 200**

The waterproof anti-corrosion layer plus: A UV resistant outer jacket fabricated from either high density polyethylene or polypropylene, with excellent impact, abrasion and chemical resistance. The jackets are secured in position with bolts, washers and nuts made from marine resistant alloy.



**SeaShield  
Series 300**

The waterproof anti-corrosion layer plus: Pre-moulded fibreglass reinforced plastic (FRP) jackets in two matching halves. Extremely tough and can be moulded to fit non-symmetrical profiles. The jackets are secured with studs, washers and nuts made from marine resistant alloy.



**SeaShield  
Series 2000HD**

The waterproof anti-corrosion layer plus: A thick UV resistant HDPE jacket with extrusion welded flanges. The jackets are secured with marine resistant threaded fasteners.

## Don't Forget To Visit Our Website!

For more detailed information including full technical data, project case histories, literature and an online enquiry form to enable you to obtain our recommended solution for your specific application, please visit our website.

**New Website Devoted to the Protection  
of Jetty Piles and Offshore Facilities**



**SeaShield**  
[www.seashield.com](http://www.seashield.com)

## Protection For Port Of Corpus Christi

The Port of Corpus Christi located on the Texas Gulf Coast went through a seven-year test program to determine the type of system that would provide long-term corrosion protection for their Coal Loading dock Facility. Due to the durability and ease of installation the SeaShield Series 2000HD was selected as the system to be used on the project.

The project involved 5 feet of splash zone protection for 100 each 18", 24" and 30" diameter steel piles. First the piles were cleaned properly by removing all existing marine growth and rust. Next Denso Paste S105 was applied over the entire surface to be coated. Then, SeaShield Marine Tape was applied spirally with a 55% overlap, starting from the bottom and proceeding upward. Finally SeaShield Series 2000HD outercovers made from 60 mil HDPE and fabricated to the exact size were bolted and secured around the piles. The fastener bars are extrusion welded to the vertical length of the HDPE outercover, creating a one-piece system that does not require the use of straps. The outercover is wrapped around the pile and the holes on the fastener bar are aligned and secured with marine grade stainless steel bolts.

There are many benefits to the SeaShield Series 2000HD. Installation is quick and simple. The outercover provides a tough UV resistant tight sheath around the pile. More importantly the piles are protected with Denso petrolatum tape which has a proven 70 year history of providing protection against corrosion in severe environments.



- Below:** General view of loading dock.
- Centre left:** SeaShield Marine Tape applied over Denso Paste S105.
- Centre right:** SeaShield 2000 HD Jacket positioned over tape.
- Bottom:** The completed system.



## Port of Brisbane, SeaShield Protection For 4000 Piles

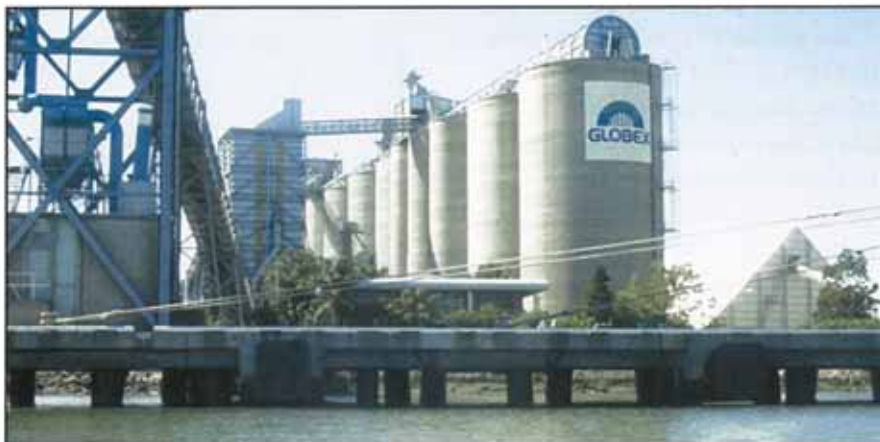


The Port of Brisbane has 31 operating berths and over 6,500m of quayline and is currently constructing a container / general cargo wharf on Fishermans Island adjacent to berth 7. The new wharf, berth 8, is expected to be completed mid 2002.

The Denso SeaShield 100 system was first installed for the refurbishment of the protective coating of the piles in 1987. The success of this prompted the specification of SeaShield as the preferred system for the prevention of corrosion to piling on all new wharves to be constructed. Approximately 4000 piles on several wharves are protected in this way.

*Below:* View of the grain wharf.

*Centre:* View of the coal wharf.



A recent inspection involving removing the outer jacket and tape in certain areas revealed no active corrosion under the system.

*Below:* View of the SeaShield protected piles.



## Mai-Liao Port Gets SeaShield Protection



Mai-Liao is the first privately funded industrial port in Taiwan and on completion it will handle 60 million tons of cargo per year. The owners looking at the long term maintenance costs, decided that the 5,692 tubular steel piles, ranging from 700 to 1000mm in diameter, should be protected against corrosion.

An evaluation programme was initiated to find a cost effective splash zone protection system. The choice was narrowed down to three systems and against fierce competition Parallel Industrial Co. Ltd were finally awarded the contract to supply and install the Denso SeaShield 300 system.

Key factors in the success of Parallel Industrial were; their long and reliable track record in splash zone protection; their confidence to give a 15 year warranty against further corrosion; Denso SeaShield's performance in the strict testing programme and an affordable price. The installation commenced in 1997.



*Above:* High pressure water cleaning of the pile.

*Right:* Installation of the SeaShield Jackets.

*Below:* The completed SeaShield system



## SeaShield Protects Lamma Island Jetty



In 1989 the SeaShield 80 System was installed on 290 steel piles of 800mm diameter for the Hong Kong Electric Co Ltd.

Eight years later, in 1997, inspection of the surface of a number of the piles showed them to be in excellent condition. In spite of the extreme weather conditions, including tropical typhoons, the only deterioration was minor damage to the outer covering by marine growth.

Pleased with the eight years of maintenance free protection, the Hong Kong Electric Company engineers enlisted the technical expertise of Advanced Trading and Engineering Ltd, Denso's representative in Hong Kong.

After detailed consultation the SeaShield 200 system was selected, as the robust construction of the protective jacket would give the twenty years service life the Hong Kong Electric Company engineers were looking for.



Above: View of the Hong Kong Electric Co. Ltd jetty.

Below: Lower section of the piles protected with SeaShield 200 system.



## Total Crude Oil Jetty Protection, Flushing



In 1991 and 1992, Total decided to protect some of the piles on their crude oil jetty located on the Westerscheld estuary in south west Holland.

The specialised contractor, Holland Diving International BV, installed a modified version of the SeaShield 200 system to 24 piles of 1.42m diameter and 8 piles of 2.5m diameter.

The installation was in the tidal zone where the original coating had begun to fail and corrosion was evident.

Later, in 1996, the upper sections of the piles were protected with SeaShield 100 system.

After 10 years service in the extremely rough weather conditions that occur in the Westerscheld estuary, the original installation is still performing well and has only suffered from occasional vessel impact damage.



**Above:** SeaShield 100 Jackets being installed above the SeaShield 200 system.

**Left:** The completed installation of the SeaShield 100 system.



## Oil Jetty Protection, Rotterdam

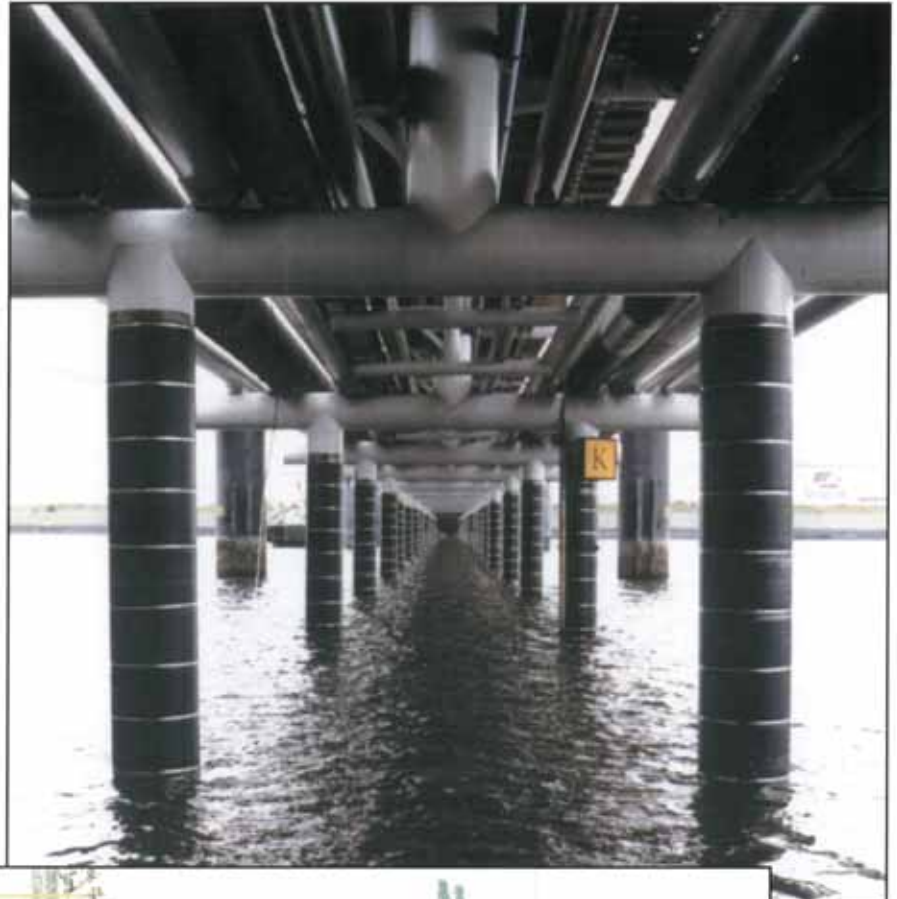


In 1987 Imbema Denso BV organised a demonstration of the SeaShield system on one of the oil jetties in Rotterdam, to be carried out by Holland Diving International BV.

The demonstration involved the installation of the SeaShield system, above and below water, on a pile where the existing epoxy coating had partially failed.

As a result of this demonstration and long term trial, in the summer of 2000, Vopak BV Rotterdam contracted Holland Diving International BV to install the SeaShield 100 system to 34 piles with a diameter of 700mm.

The project was completed in the autumn of 2001 with the installation on a further 6 piles of 700mm, 4 piles of 1000mm and 4 of 1,500mm diameter.



Right & Below: The completed installation of the SeaShield 100 system.



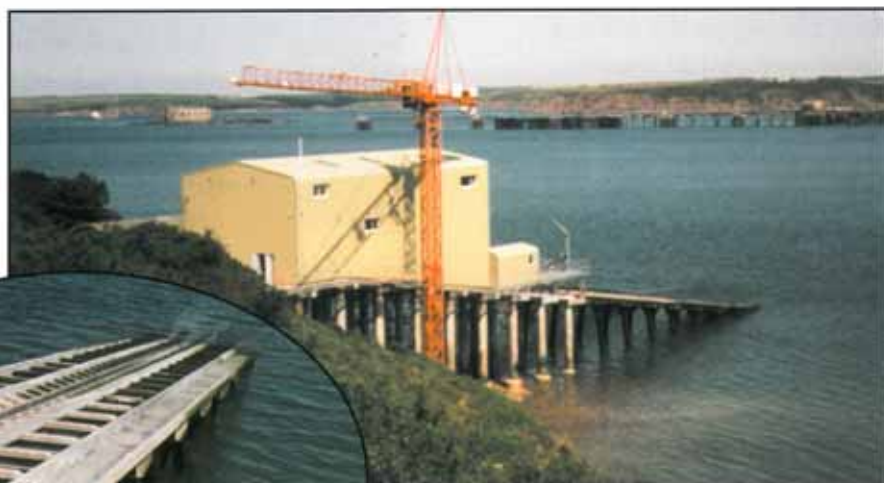
## 1992 RNLI, Angle - SeaShield Installation Revisited



In 1992 the lifeboat station at Angle was replaced with a modern up-to-date facility. The consultants at the time, Posford Duvivier decided to incorporate long term splash zone corrosion protection to the tubular steel slipway piles,

The SeaShield 100 system, secured with Densorin banding and buckles, was installed from the top of the piles to the shingle beach on those completely exposed at low tides and to 1 metre below water on those further out.

Ten years later the SeaShield is still in place giving long term protection.



Above: September 1992 - the new station under construction.



Left: September 1992 - the completed slipway with SeaShield protected piles

Below: February 2002 - the SeaShield protected piles.



## 1972 Herne Bay Pier- Steelwork Protection Revisited

In 1972 the newly installed steelwork supporting the pier deck was protected with a Denso petrolatum tape system. In 1994 a detailed inspection of the pier was undertaken and it was found that over the preceding 22 years, some of the tape in exposed positions was in need of replacement.

As the inspection revealed that the tape system had protected the majority of the steelwork from any major corrosion it was decided to replace the damaged sections with an improved version of the original tape system. In 1995, Canterbury City Council contracted Shutdown Maintenance Services of Rochester, who had applied the tape system in 1972, to carry out the refurbishment.

The City Engineers were so pleased with the improved system that they decided to replace all the original tape system over the following two



summer seasons. The contract was completed in 1997 and 5 years later in 2002 the new system is performing as well as anticipated and we look forward to a further refurbishment contract in 25 years.

*Above:* View of Herne Bay Pier.

*Left & Below:* The 1994 tape application photographed February 2002.



## 1984 Raynes Quarry Jetty- SeaShield Application Revisited



During the summers of 1984 and 1985 the SeaShield 200 system was installed on the 600mm and 850mm tubular steel piles of the aggregate loading jetty. The jetty faces into the Irish sea and is subjected to heavy winter storms which scour the piles with sand and gravel.

The SeaShield was installed to give extra protection against corrosion and severe abrasion. The installation has been inspected regularly over the past 18 years and the slight damage suffered from time to time swiftly repaired.

The occasional jacket has been damaged by flotsam and these have been replaced where necessary.

At the last visual inspection in February 2002 the system was as good as it was at the time it was installed.

**Right:** Raynes Quarry jetty - Summer 1995.

**Below:** Raynes Quarry jetty - February 2002.



## 1996 Victoria Dock Caernarfon- SeaShield Application, Revisited



Following on from the reliability shown by the SeaShield 200 system at the Raynes Quarry jetty, the consultants, Symonds, specified the same system for the new Low Water Landing Stage that was to be built to service pleasure boats plying the Menai Straits between the mainland and Anglesey.

The jetty was constructed in 1996 and the SeaShield 200 system installed on the tubular steel piles.

Six years later the system is still standing up to the strong currents and tides of the straits.



Right: Victoria Dock Caernarfon - Summer 2000

Far right: SeaShield Jacket installation 1996.

Below: Victoria Dock Caernarfon - February 2002



## The Proof is in the Testing

If, after reading the application stories on the preceding pages of this publication, you are still not convinced of the effectiveness of SeaShield systems, then please look at these photographs.

The pictures show important tests carried out on selected applications to establish the suitability and longevity of SeaShield in diverse marine environments. These tests are carried out regularly and form the basis for developing and improving the systems.

### Japan:

An inspection, 2½ years after the installation of a SeaShield system on an 8 year old jetty, shows no corrosion on the pile.



### Japan:

3 years after the sub-sea installation of this SeaShield system, the removal of a coupon of the tape reveals no detectable corrosion.



### Mexico:

An inspection of a SeaShield system 3 years after its installation in a dock at Baja, California in Mexico, shows no corrosion.



#### Pictures:

- Far left - The outer SeaShield jacket covered with barnacle growth is removed.
- Above - The petrolatum based Marine Piling Tape layer is shown to be intact.
- Centre - The Marine Piling Tape is removed showing a corrosion-free pile.

## USA: TEPPCO Inspection After 10 Years



In September 2001 Denso North America Inc. completed an inspection of the SeaShield Series 100 System on an 18" breasting pile at the TEPPCO Crude Pipeline Dock in Texas City, TX. The SeaShield Series 100 System was originally installed in December 1990. The system has been in continuous service for over 10 years.

Once the inspection of the substrate was complete the Denso S105 Paste was applied to the pile. The SeaShield Marine

The outercover was removed by cutting the Densorin and 5052 Aluminum straps. The 100 mil HDPE outercover was in excellent condition, with no visible damage or deterioration. The marine growth was minimal and was easily removed by hand scrapers.

The petrolatum tape was removed and revealed that the tape remained well impregnated with petrolatum compound. All overlaps were tightly sealed. After removal of the tape, the steel pile substrate was found to be in excellent condition. All corroded areas, which had been scraped to bare metal or tightly adherent rust during surface preparation indicated a complete transformation from iron oxide to magnetite, which is a stable, non-active form of iron oxide.



Above: Densorin banded Jackets after 10 years.



Above: Removal of the SeaShield Jackets.

Left: The pile surface with residues of petrolatum compound but no corrosion.



Piling Tape was then applied using a 55% overlap starting from the bottom up. The same outercover was installed and secured with new Densorin and 5052 Aluminum straps.

In summary, the SeaShield Series 100 System is providing complete corrosion protection of the metal substrate after 10 years in the splashzone.

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Front cover:  
The SeaShield 100 and 200 system protecting the  
Total Crude Oil Jetty, Flushing in Holland  
(see story page 8).



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Most Denso products are covered by patents and the words "DENSO", "DENSYL", "ARCHCO-RIGIDON", "DENSOPOL", "DENSOCLAD", "TOXSTRIP", "CORROCLAD", "SYLGLAS", and "PROTAL" are registered trade names in the UK and many other countries.

If your marine project calls for a liquid coating then check out...

## Denso Rigspray - An Easily Applied Liquid Coating For All New Or Maintenance Work

Rigspray is a one-coat glass flake reinforced polyester resin coating designed for the long term protection of steel structures exposed to corrosive marine environments. It is ideally suited for use in the oil industry on offshore structures in areas such as splash zones, underdeck areas, riser pipes etc.



The principal advantages of Rigspray are that it will cure rapidly and can be applied in a single coat up to 1mm dft. It can be fully submerged in sea water once the material has hardened without any adverse effects.

Rigspray has excellent resistance to abrasion and erosion and, if required, can be combined with a non-slip element for use on helidecks and main deck surfaces.

For further information - fax or post to your nearest Denso branch  
(fax numbers below, addresses are on page 2.)

SeaShield 2002

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