



Comprehensive Guide
to
MARINE MAINTENANCE and REPAIR

USING SOLVENT-FREE, WET & RUST TOLERANT SYSTEMS

EPO-CHEM™ RS 500P and RA 500M

September 2019

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INTRODUCTION TO CHEMCO PRODUCTS

Chemco International, based in Scotland, UK, has been in the business of manufacturing specialist, problem solving and innovative anti-corrosion coatings for over thirty years.

Over the past three decades, **Chemco** has responded to the legislations and market demand by developing a range of unique, **solvent-free**, water-based, **wet & rust tolerant** and isocyanides-free coating systems. This range of products complies with all past and present environmental and H&S legislations.

In recent years, high cost of grit blasting, including strict environmental control required for application of conventional paint systems, has forced the industry to look at the alternative surface preparation methods and consequently for products which can be applied on damp/wet substrates. Utilising truly **wet & rust tolerant** specifically designed **Chemco** marine systems will enormously reduce the cost and duration of all contracts. Many forward thinking companies throughout the world have been utilising these technological breakthrough systems for more than 10 years with complete success.

It is through the most advanced coating systems that we can now not only comply with all legal legislations and help the environment, but reduce cost of maintenance as well as life cycle cost.

Chemco uniquely guarantee lower costs, in addition to the performance of the systems, for any applications, e.g. patch repair, complete refurbishment or new build.

EXECUTIVE SUMMARY

Vessels trading the high seas simply keep the world moving. Two thirds of the world's surface is sea water and quite simply 80% of the world's trading goods are carried by ships of all designs.

They are mostly built of steel and rely on coatings to prevent the onset of severe corrosion which can, if not maintained, reduce the vessel's lifespan dramatically and if ignored, can lead to costly steel replacement or downgrading by the insurers.

Epo-chem™ 500 series, solvent-free, wet & rust tolerant (primer) epoxy systems were designed with great flexibility; the main advantages being that any method of surface preparation, i.e. mechanical, HP and UHP water jetting, dry or wet grit blasting can be utilised.

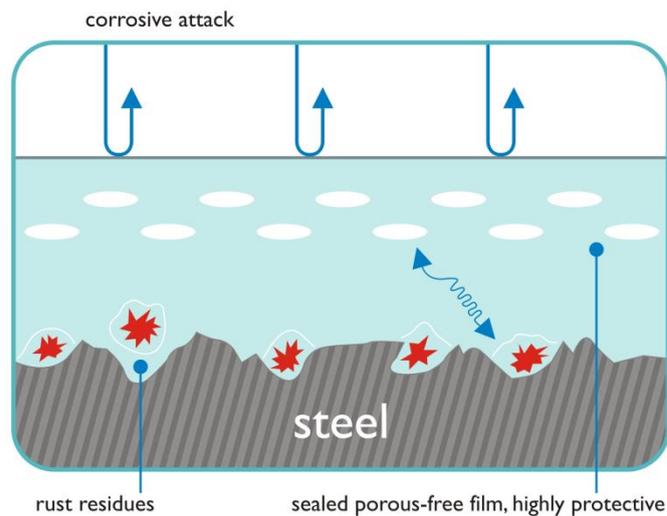
There would be no requirements for ventilation or dehumidification; reduced H&S consideration and no fire hazards for storage or application.

Chemco marine products have passed the most stringent **IMO** tests (uniquely on the **rusty** and **wet & rusty steel**) and have been approved by **Lloyds and ABS** for maintenance and new build (including on shop primed steel). They are also **NSF Certified** for potable water and **FDA Approved** for food and beverage, dry cargo and potable water.

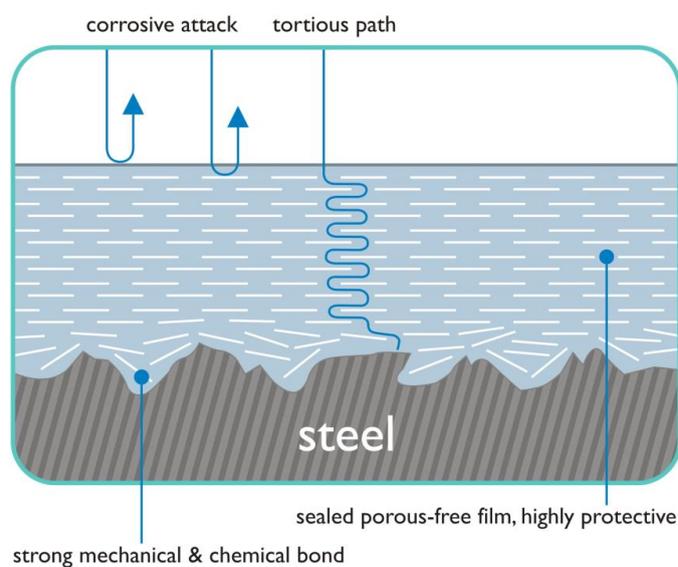
To understand the flexibility of **Chemco** coatings in preparation techniques and applications of the systems, **Chemco** have introduced this **Maintenance & Repair Guide** which includes product features and benefits, an understanding of corrosion, typical specifications by vessel area and FAQ's, with guidance for crew, contractors and dockyard personnel in all aspects of corrosion protection.

PRODUCT FEATURES

Epo-chem™ RS 500P is a 100% solid, **wet & rust tolerant** primer or primer-finish epoxy system. The use of special sacrificial fillers enables the system to be applied to surface standards as low as **WJ-4, St 2**. The system's long-term performance is based on sealing (porous-free film) and arresting the rust totally. It is typically applied as a one-coat system which can be over-coated by itself or with the topcoat **Epo-chem™ RA 500M**.



Epo-chem™ RA 500M is a 100% solid, **wet tolerant** and highly chemical resistant epoxy single/topcoat. The glassflake system has been utilised over the last 30 years as a tank lining in the most aggressive environments because it offers total barrier against moisture and corrosive ions. **RA 500M** is typically applied as a one-coat system or as a topcoat on the primers with DFT of 200-300 μ . Minimum surface preparation standard required: **Sa 2, WJ-2 or St 3**.



PRODUCT BENEFITS

- **Multi-Purpose**

Only two products are required to protect all tanks, i.e. ballast, oil, cargo, potable water (**NSF Certified and FDA Approved**) and dry cargo holds (**FDA Approved**), grey water, void spaces and cofferdams, as well as superstructure, pipes, decks and internal floors.

- **Solvent-free**

No build-up of solvent in confined spaces that can lead to fire. There is no requirement for extensive ventilation. Hot-work, e.g. welding, cutting and grinding, can be carried out without interruption. No odour.

- **New Technology**

Long-term corrosion protection is achieved utilising state of the art technology.

- **Reduced Life-cycle and Maintenance Cost**

Substantial upfront cost reduction; guaranteed long-term maintenance-free repairs, including patch repairs.

- **Major Cost Savings**

Reduced labour, surface preparation and equipment cost. Substantial reduction in docking times can be achieved. Preparation and application works can be carried out by ship's crew, riding crew, alongside quayside or in dry-dock.

- **Equipment and Space Savings**

No movement of large equipment is necessary, no requirements for large deck space. Staging, dismantling and movement can be achieved within hours of coating completion.

- **Flexibility on the Surface Preparation Standard or Method**

Choice of the most convenient and cost effective surface preparation, depending on availability or cost, e.g. dry grit blast, wet blast, HP water jetting (500-800 bar), Ultra High Pressure (UHP) water jetting, mechanical preparation (St 2-3).

- **No Humidity or Dew Point Restriction**

No requirement for dehumidification, ventilation or heating, thus substantial cost savings.

- **Fast Turn-around**

Coated tanks can be put back-into-service almost immediately, in less than 12 hours, as the systems are capable of "curing" underwater.

- **Non Flammable**
No storage or application hazards.
- **User Friendly**
Application can be carried out by brush/roller/spray with excellent edge coverage.
- **Compatibility**
Compatible with almost all existing ballast tank coatings, including coal tar epoxies.
- **Shop Primers**
Compatible with all epoxy shop primers.
- **IMO PSPC Approval – Ballast Tanks**
Lloyds and ABS Approved for New Build and Maintenance.
- **IMO PSPC Approval – Crude Oil Tanks**
ABS Approved for New Build and Maintenance.
- **FDA and NSF Approval**
Food stuff, non alcoholic beverage and potable water.
- **Excellent Chemical Resistance**
For use in aggressive chemical environment, e.g. sewerage, fuel, ballast and cargo tanks.
- **Unlimited Over-coating**
No over-coating interval restrictions offer enormous savings in refurbishment contracts; reduce failures and allows more flexibility to the contractor.
- **Reduction in Risk of MIC and SRB**
Solvent-free products do not contain the nutrients contained in solvent-based coatings for MIC (Microbial Induced Corrosion) and SRB (Sulphur Reducing Bacteria).
- **No Disruption**
Other nearby ongoing work can continue without disruption (including hot work).

CORROSION IN SEA WATER BALLAST TANKS

Corrosion of steel in a marine environment is an electrochemical process in which the steel reacts with its environment; the coating is acting as insulation between the two. When the coating is aged, it will lose its elasticity and begin to crack. A continuous wet environment, salt and oxygen, creates an ideal environment for severe rusting. The rust growth in a ballast tank can be 0.22mm/year and high temperatures speed up the corrosion. An area where diffusion is easy, such as edges and corners (where film thickness is low), will corrode the fastest; see photograph below.

Double bottom tank top after 7 years in service



Types of Corrosion in Ballast Tanks

Electrolytic Corrosion: Involving steel, sea water, oxygen and carbon dioxide.

Pitting Corrosion: The characteristic of this type of attack is that it is extremely localised and the penetration is deep in relation to the area attacked. Pitting is one of the most dangerous forms of corrosion as it often occurs in places (tank bottom) where it cannot be readily seen.

Microbial Induced Corrosion (MIC): This type of corrosion can occur within ballast tanks in sediments buried in mud. Microbes have been blamed for the excessive pitting to be found on the tank bottoms. All metals, even stainless steel, may be attacked from microbial induced corrosion.

Photographs of Corrosion in Ballast Tanks



Black slime deposit at surface can indicate MIC



Mud and sediments can contain MIC

MAINTENANCE AND REPAIR: WHY CHEMCO?

For the first time in industry, these products enable crew or riding crew to carry out work on areas in a **safe and cost effective** manner simply because there is no requirement for large specialist equipment such as compressors, ventilators, dehumidifiers or grit blasters. This is especially important for difficult access tanks such as ballast and potable water or void spaces.

Only **two products, RS 500P and RA 500M**, are used for the entire ship's refurbishment, including all tanks (ballast, fuel, waste, and potable water) decks, and structures. Both products are **solvent-free**.

Surface preparation can be carried out mechanically (chipping, grinding, scraping or by wire brush) to **St 2** or by water jetting with 500-800 bar machines to **WJ-4** using **RS 500P; St 3, Sa 2** or **WJ-2** if applying **RA 500M** direct to substrate - see next page at surface preparation standards.

Our innovative and proven **solvent-free, wet & rust tolerant** systems benefit the owners, operators and contractors; guaranteed savings compared to conventional paint system is now possible due to the advanced technologies the products offer.

SURFACE PREPARATION STANDARDS

The following standards have been prepared by the Swedish Corrosion Institute in co-operation with the American Society for Testing and Materials, ASTM, and Steel Structures Painting Council, SSPC, USA.

It is assumed that prior to treatment, the steel surface has been cleaned of dirt and grease and that the heavier layers of rust have been removed by chipping.

St 2 - Thorough scraping and wire-brushing - machine brushing - grinding - etc. The treatment shall remove loose mill scale, rust and foreign matter. Finally, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It should have a faint metallic sheen. The appearance shall correspond to the prints designated St 2.



Scraping and
wire-brushing

C grade steel – St 2



Scraping and
wire- brushing

D grade steel – St 2

St 3 - Very thorough scraping and wire-brushing - machine brushing - grinding - etc. Surface preparation as for St 2 but much more thoroughly. After removal of dust, the surface shall have a pronounced metallic sheen and correspond to the prints designated St 3.



Scraping and
wire-brushing
C St 3



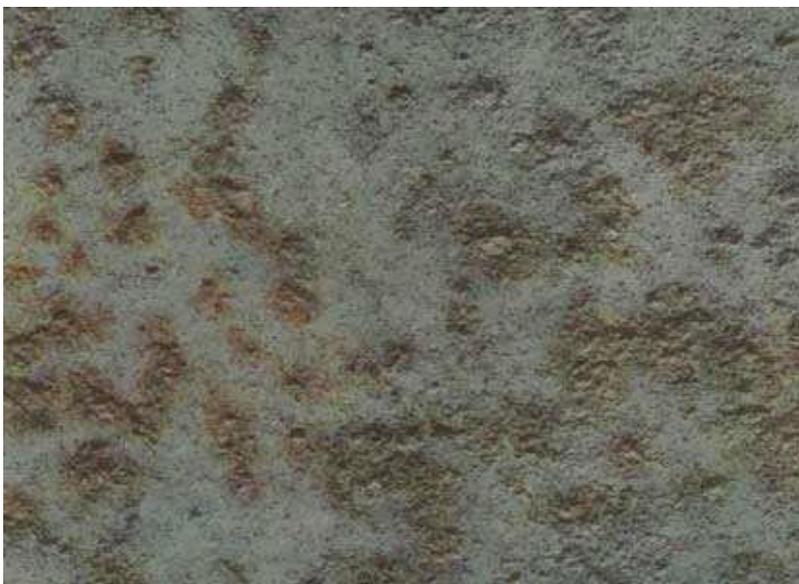
Scraping and
wire-brushing
D St 3

Sa 2 - Thorough blast cleaning. Almost all mill scale and foreign matter shall be removed. Finally, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It shall be greyish in colour and correspond in appearance with print designated Sa 2.



Blast cleaning

C Sa 2



Blast cleaning

C Sa 2

Water-jetting Standard



Old Coating - Initial Condition

Description:

A multilayer system with undercoat flaking and slight rust.



Standard: WJ-2

Description:

The surface shall be cleaned to a matte finish with at least 95% of the surface area free of all previous visible residues and the remaining 5% containing only randomly dispersed stains of rust, coatings and foreign matter.

Approximate requirements to achieve this standard:

1400 - 2000 bar @ 15 - 25 ltrs/min.

Approximate work rates:

8 - 12m² per hour.



Standard: WJ-3

Description:

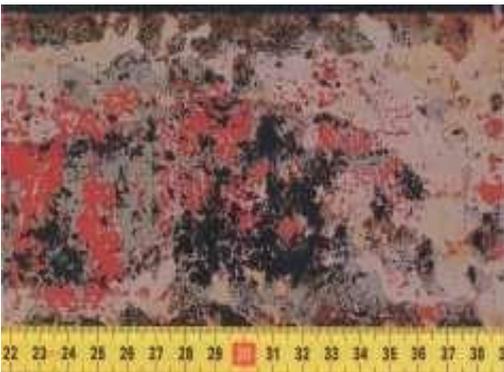
The surface shall be cleaned to a matte finish with at least 67% of the surface free of all visible residues (except mill scale) and the remaining 33% containing randomly dispersed stains of previously existing rust, coatings and foreign matter.

Approximate requirements to achieve this standard:

850 - 1000 bar @ 35 - 50 ltrs/min.

Approximate work rates:

8 - 12m² per hour.



Standard: WJ-4

Description:

The surface shall have all loose rust, loose mill scale and loose coating uniformly removed.

Approximate requirements to achieve this standard:

700 - 800 bar @ 35 - 50 ltrs/min.

Approximate work rates:

10 - 15m² per hour.

MAINTENANCE AND REPAIR GUIDE (STEP BY STEP)

1. TANK MAINTENANCE (BALLAST, POTABLE WATER, FUEL AND WASTE)

Below are instructions for the crew for surface preparation and coating application of ballast tanks using **Epo-chem™ RS 500P** and **RA 500M**.

Procedure:

- Remove mud and sediments
- Remove oil and grease
- Mechanically remove loosely adhering rust
- Smooth all rough edges of the existing coating
- Remove dirt and residues
- High pressure fresh water wash
- Check all tank compartments prior coating application
- Check the square metre (m²) to be coated and estimate the area
- Mix only the quantities of coating required
- Stripe coat all rusty areas, welds and sharp edges
- Large areas to be spray applied

Typical schemes below can be applied by brush/roller to a DFT range of 100-250µ per coat.

1st coat: 1 x RS 500P @ 100µ DFT, theoretical coverage: 6.25m²

2nd coat: 1 x RA 500M @ 250µ DFT, theoretical coverage: 3.1m²

Scheme 1: One-coat system: Total DFT 150µ (RS 500P) theoretical coverage 4.16m²

Scheme 2: Total DFT 350µ, RS 500P (100µ) and RA 500M (250µ)

The following must be adhered to:

1. The applied film must be pinhole free and continuous.
2. Re-coating interval is unlimited, re-coat as soon as the coating is touch dry.
3. Pot life: 40 minutes for **RS 500P** and 60 minutes minimum for **RA 500M** @ 15°C.
4. Do **not** use thinners.
5. Use an epoxy cleaner.

MAINTENANCE STEP BY STEP GUIDE

Surface preparation

Remove hard rust by power tools St 2-3 followed by fresh water jetting or pressure wash 500-800 bar (using fresh water).

De-rust and decontaminate with freshwater 500 bar rotation nozzle.



Mechanical power tool and de-rust to St 2-3 followed by high pressure freshwater washing.



Mechanical power tool de-rusting before high pressure washing.



Stripe coat

Stripe coating using RS 500P by brush ensuring all sharp edges and corners are covered with a minimum 100 μ DFT. Check for pinholes and ensure the film is continuous.



Ensure all rusted areas are stripe coated.



All welds are stripe coated regardless of the condition.



Second coat/topcoat

The final coat/full coat/topcoat is then applied to a minimum DFT of 150 μ (RS 500P).

The completed area with a stripe coat and topcoat of RS 500P, this area would now have a minimum 5 years life-expectancy.

Total DFT 150 μ minimum



Full system/topcoat

Once the primer coat (RS 500P) is touch dry then apply the topcoat RA 500M to a minimum DFT of 200 μ .

The topcoat RA 500M (light grey colour) applied, complete area with a stripe coat (RS 500P @ 100 μ) and primer coat (RS 500P @ 150 μ) and the topcoat (RA 500M @ 200 μ) this area would now have a minimum 15 years life-expectancy.

Total 350 μ DFT



2. DECK MAINTENANCE (INCLUDING CAR DECKS)

Procedure:

Remove oil and grease.

- Mechanically remove loosely adhering rust
- Smooth all rough edges of the existing coating
- Remove dirt and residue
- For large areas high pressure freshwater wash. For small areas mechanically prepare
- Check the square metre (m²) to be coated and estimate the area
- Mix only the quantities of coating required. Do **not** use thinners
- Spray application for large areas and brush/roller application for small areas

Typical Scheme 1, single fast cure coat:

RS 500P @ 1x200 μ DFT, Theoretical Coverage: 3.1m²/kg @ 200 μ

Typical Scheme 2, longer-lasting 2-coat system:

**Touch-up repair with RS 500P @ 1x100 μ DFT, Theoretical Coverage:
6.25m²/kg Full coat RA 500M @ 1x200-1000 μ DFT
Theoretical Coverage: 1.5m²/kg @ 500 μ**

MAINTENANCE STEP BY STEP GUIDE

This is a typical deck covered in heavy oil and grease. This must be removed before any surface preparation.



Mechanically prepare small areas to St 2.



Heavy rust areas can be HPWW to remove loose rust, dirt and salts.



Small areas can be mechanically prepared using wire brushes to St 2.



Apply RS 500P as single coat to area @ 1x200 μ DFT



3. CARGO HOLD MAINTENANCE

High pressure fresh water jetting >500 bar to remove loose rust, loose paint and any contaminants to a minimum standard WJ-4. Mechanical tools can be used for small areas; see photographs in examples section.

Typical Scheme: 5% spot repair **RS 500P** @ 1x100 μ DFT
5% stripe coat **RS 500P** @ 1x100 μ DFT
Theoretical Coverage: 6.25m²/kg @ 100 μ
Full coat **RA 500M** @ 1x250 μ DFT
Theoretical Coverage: 3.1m²/kg @ 250 μ

Please note: For abrasive cargo, heavy impact and heavy machinery use, higher standard of preparation will prolong the life of coating. For extreme condition, utilise Chemco abrasion/impact resistant Ceramic systems.

4. ENGINE ROOM MAINTENANCE

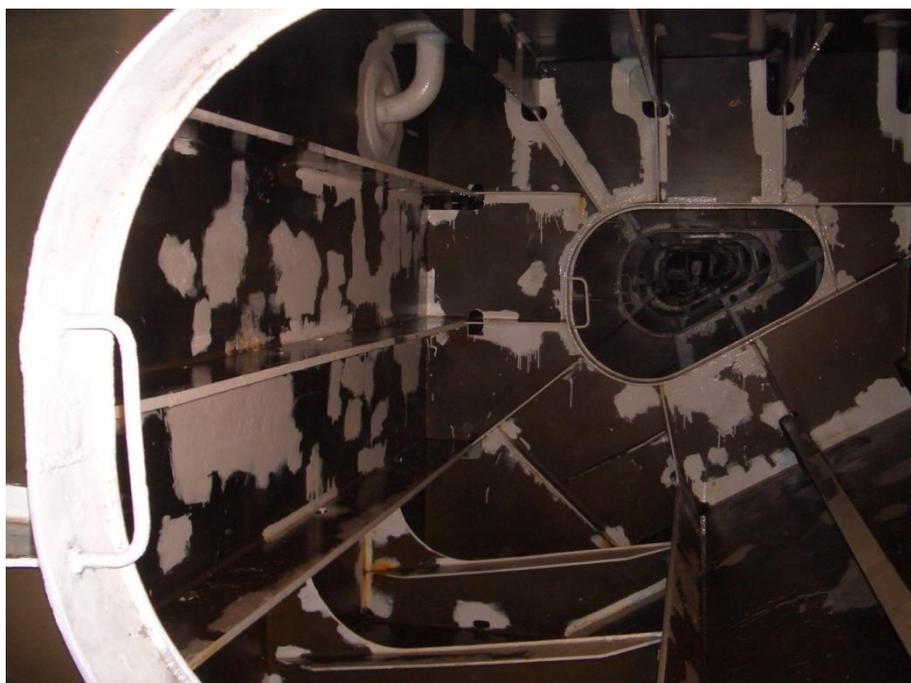
Follow same protocol as the deck maintenance, see photographs in examples section.

Typical Scheme: Spot repair and apply **RS 500P** @ 1x100m DFT
Theoretical Coverage: 6.25m²/kg @ 100 μ DFT
Full coat **RA 500M** @ 1x250 μ DFT
Theoretical Coverage: 3.1m²/kg @250 μ

EXAMPLES OF MAINTENANCE AND REPAIR

1. V. Ships - Yeoman Bridge, Yeoman Bontrup and Yeoman Bank

1.1 Patch repair on a mechanically prepared surface by ship's crew; existing coating: Coal-tar epoxy; Coating: 1 coat of RS 500P @ 200 μ DFT



1.2 Patch repairs in the shipyard (Poland), complete plate replacement under the conveyor, shop primed steel, weld area mechanically prepared, without removal of shop primer.

Coating system: 1 coat of RS 500P @ 100 μ and 1 coat of RA 500M @ 250 μ DFT.

Application by airless spray.



- 1.3 Complete work carried out by shipyard (Poland) on SA1 prepared surface (no humidity control) original paint was burnt in the whole aft end section of the ship.

Complete conveyor, pipe tunnels and bulkhead, total area 30,000m².

Coating system: 1 coat of RS 500P @ 150-200μ DFT.

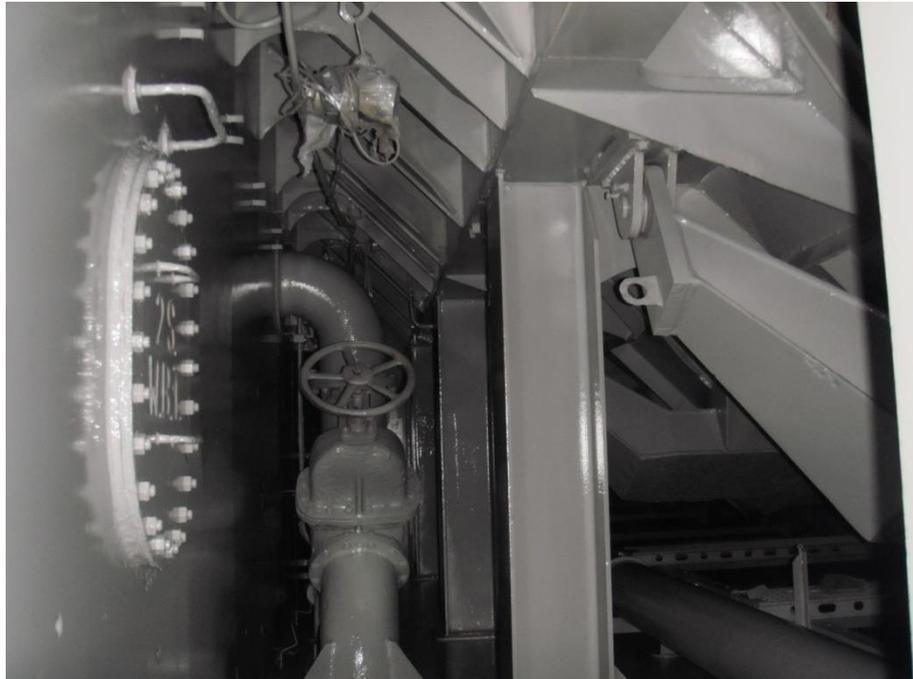
Application by airless spray.



Complete conveyor, pipe tunnels and bulkhead, total area 30,000m² (cont.)

Coating system: 1 coat of RS 500P @ 150-200 μ DFT.

Application by airless spray.



2. Patch repair by riding crew

Panamax Tanker

Contractors: MSTC Global - Van Zonderen Offshore BV

**Coating system: 2 coats of RS 500P @ 150 μ DFT per coat both spray and hand applied;
surface prep mechanical/power wash, application by brush and airless spray.**



Note: Surface preparation standard



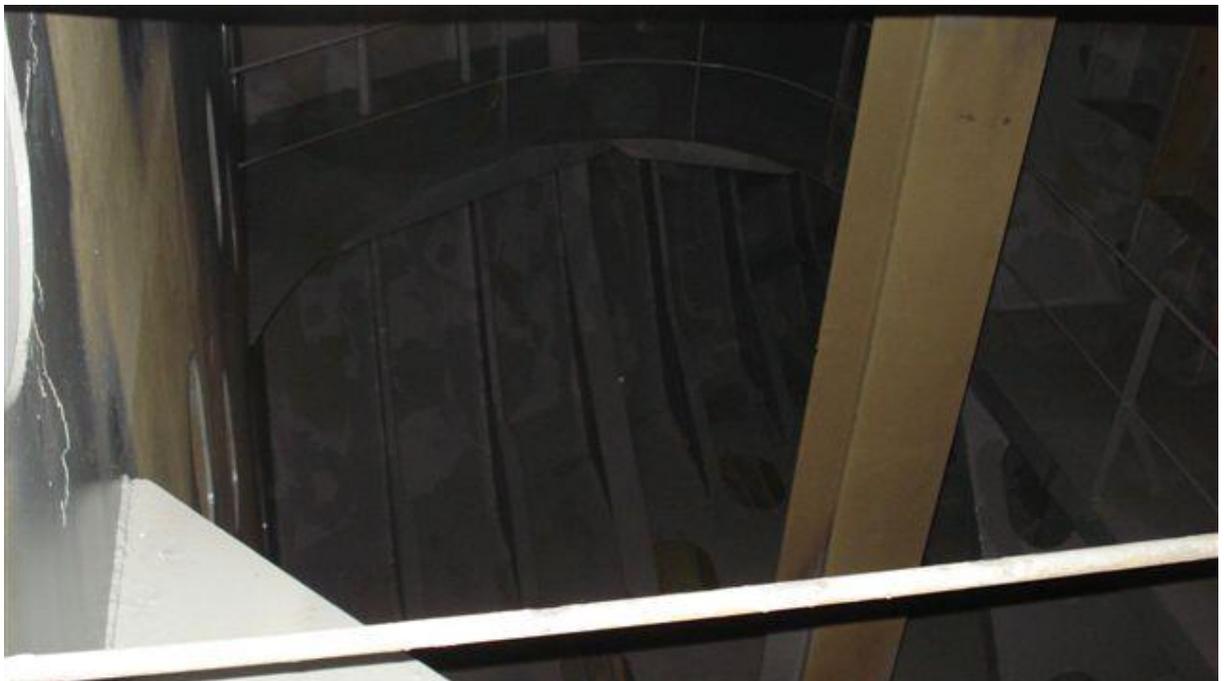
Spray application

Patch repair by riding crew (continued)

Brush application



Completed work – Forepeak



3. Examples of top side and other areas

3.1 Deck – Car ferry.

Patch repair of existing system.

**Coating system: 1 coat RS 500P @ 250 μ DFT.
Surface preparation mechanical, application by roller.**



Note: 1 coat, special colour

3.2 Deck – RoRo Ferry.

Complete coating in a fast 48 hours turn-around contract.

Coating system: 1 coat RS 500P to 250 μ DFT.

Surface preparation: Water jetting

Application: Airless spray.

Photograph below shows the condition of the coating after 7 years in service.



3.3 Engine room decks.

Surface preparation: degrease existing unknown paint system, mechanical spot repair.

**Coating system: 1 coat of RS 500P as patch repair and 1 coat of RA 500M @ 500-1000 μ DFT.
Application by brush and roller.**



Note: Thick section applied in 1 coat



Note: Existing paint system

3.4 Holds, surface preparation: water jetting.

**Coating system: 1 coat of RS 500P @ 100 μ DFT and 1 coat of RA 500M @ 250 μ DFT.
Application by airless spray.**



4. Super yacht ballast tanks
Shop primed steel (New Build).
No requirement to remove shop primer.

Coating system: 1 coat of RA 500M @ 300 μ DFT over nominated shop primer.



CASE STUDIES

CASE STUDY 1: Deck Refurbishment – RoRo Ferry

Case Study



Client: <i>Norbulk Shipping</i>	Industry: <i>Marine</i>
Vessel: <i>Ro-Ro Ferry</i>	Date: <i>March 2008</i>
Location: <i>Europe</i>	Product: <i>Epo-chem™ RS 500P</i>

Overview

Ship management company, Norbulk Shipping, required a coating with a fast turnaround for their Ro-Ro ferry service from Marseilles to North Africa where carriage of heavy traffic and fast turn-round is vital.

Challenge

The main traffic deck had severely deteriorated due to weathering and heavy traffic. Norbulk Shipping required a system that could be applied with minimum surface preparation, fast drying, high build, and quick cure to enable the refurbishment to be carried out in a very quick time of 48 hours so the ship could return to normal service.

Solution

Norbulk Shipping decided to utilise Epo-chem™ RS 500P solvent-free, wet & rust tolerant system with excellent adhesion to high-pressure washed surfaces, with fast drying/curing properties and good abrasion and impact resistance. One coat of Epo-chem™ RS 500P @ 200µ DFT was applied.

Outcome

The client has now taken management of four other Ro-Ro vessels and will utilise the Chemco system for all deck traffic areas. This has proven to offer long-term cost-effective, easy to repair by crew and cost effective protection.

Benefits

- Solvent-free
- No blasting required
- Application by crew
- Reduced cost of plant and equipment
- Reduced H&S and Fire Precaution



Photographs:

- Nos. 1-2 Deck Traffic Areas After Application

CASE STUDY 2: Ballast Tanks – MV Auxis

Case Study



Client: IBL - Ireland Blyth Ltd	Industry: Marine
Vessel: M/V AUXIS	Date: October 2013
Location: Durban, South Africa	Products: Epo-chem™ RS 500P & RA 500M

Overview

The ballast tanks of the vessel M/V AUXIS required a full refurbishment for over 6,000m² (double bottoms tanks, wings tanks and deep tank) after the original coatings had failed.

Challenge

Some areas of the ballast tanks were heavily corroded with limited access. There was also a very limited time-scale for completion of this project and as a result, grit blasting was not permissible.

Solution

Utilise water jetting as the surface preparation method to WJ-3 standards. Apply one stripe coat of solvent-free, wet & rust tolerant epoxy Epo-chem™ RS 500P followed by one full coat of Epo-chem™ RS 500P @ 200µ DFT. In some localized areas, where most of the existing paint was still adherent, one primer coat of Epo-chem™ RS 500P in all the bare steel areas was applied, followed by one topcoat of solvent-free, wet tolerant epoxy Epo-chem RA 500M applied @ 250µ DFT.

Outcome

The work programme was successfully completed, within the timeframe given and to the satisfaction of all concerned: Owner, Classification Society and Shipyard.

Benefits

- Solvent-free
- Environmentally friendly system (no grit blasting)
- Reduced H&S and fire precautions
- No dew point or humidity restrictions
- No overcoating limitations
- No delays
- No disruption to other on-going work (hot)

Continued overleaf

1



2



Photographs

- No. 1 Deep tank before surface preparation
- No. 2 Wing tank before surface preparation

CASE STUDY 2: Ballast Tanks – MV Auxis (cont.)

3 	4 
5 	6 
7 	<p>Photographs</p> <ul style="list-style-type: none">• No. 3 Double bottom tank after surface preparation• No. 4 Deep tank after surface preparation• No. 5 Double bottom tank after stripe coat• No. 6 Double bottom tank after full coat.• No. 7 Wing tank after full coat

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CASE STUDY 3: New Build (Shop Primer) – MV Lerrix

Case Study



Client: <i>Rix Shipping</i>	Industry: <i>Marine</i>
Vessel: <i>Oil Products Tanker</i>	Date: <i>2012</i>
Location: <i>UK</i>	Products: <i>Epo-chem™ RS 500P & RA 500M</i>

Overview

This Oil Products Tanker New Build, required to have the double skin ballast tanks (over 5,000m²) coated with an IMO PSPC approved product. The owners decided that they required a solution which did not require grit blasting or solvent-based paints as the work had to be carried out in confined spaces. Traditionally, shop primers need to be completely removed prior to the application of a coating system. The vessel was visited by its owners and Lloyds as this was the first New Build in the UK that was coated under the new IMO PSPC regulations.

Challenge

To find a coating system which could be applied without the removal of the shop primer and without grit blasting. Working in very tight, confined spaces also added to the difficulty of this project.

Solution

Water jetting (500 bar) was utilised as the surface preparation method to remove any contaminants from the shop primed surfaces and the weld areas were mechanically prepared prior to the application of the IMO Approved Chemco System. One stripe coat of solvent-free, wet & rust tolerant Epo-chem™ RS 500P was then applied, followed by one full coat, both @ 100µ. To complete the system, one topcoat of solvent-free, wet tolerant Epo-chem™ RA 500M was applied @ 250µ.

Outcome

The work was successfully completed and supervised by Baymarine's QA and Chemco's Technical Representative, meeting all the parameters for IMO and Lloyds Register for class certification.

Benefits

- Solvent-free
- No grit blasting
- Wet & rust tolerant properties of Chemco system
- Compatibility with shop primers (IMO Approved)
- Reduced H&S and Fire Precaution
- Substantial time and cost savings

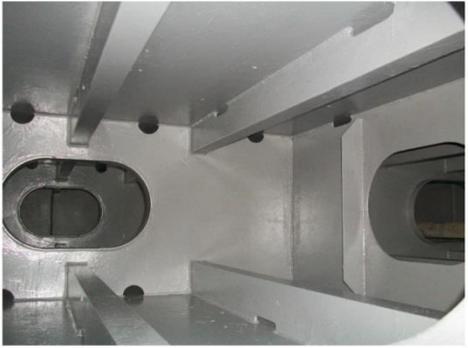
Continued overleaf



Photographs

- No. 1 Before application
- No. 2 Stripe coating

CASE STUDY 3: New Build (Shop Primer) – MV Lerrix (cont.)

<p>3</p> 	<p>4</p> 
<p>5</p> 	<p>6</p> 
<p>7</p> 	

Photographs

- Nos. 3-4 During priming
- No. 5 Priming complete
- Nos. 6-7 Completed application

East Shawhead Industrial Estate
Coatbridge ML5 4XD
Scotland United Kingdom
Tel: +44 (0) 1236 606060
Fax: +44 (0) 1236 606070
Email: sales@chemcoint.com
Web Site: www.chemcoint.com

CASE STUDY 4: Potable Water Tank Repair – Support Station 3

Case Study



Client: Aset Marine Services P/L	Industry: Marine
Vessel: Support Station 3	Date: March 2015
Location: Singapore	Products: Epo-chem™ RS 500P & RA 500M

Overview

Ten potable water tanks on Support Station 3 required to be patch repaired as the existing system had failed in some areas due to age.

Challenge

There could be no compatibility issues with the new coating system. Grit blasting was also impractical due to time and costs implications. The useful life of the coating system had to be extended to 15 years.

Solution

All areas which required to be repaired, including weld seams and edges, were mechanically prepared before being freshwater washed to remove salt and any other contamination. One coat of solvent-free, wet & rust tolerant epoxy Epo-chem™ RS 500P was applied to the prepared areas. This was followed by one topcoat of solvent-free, wet tolerant epoxy Epo-chem™ RA 500M.

Outcome

The repair works in the potable water tanks were successfully completed within the time frame given. The useful life of the tanks have been extended to the required 15 years.

Chemco uniquely offer guarantees on their patch repair work.

Benefits

- Solvent-free
- No grit blasting
- Patch repair work can be easily carried out - no compatibility issues
- Reduced H&S and Fire Precaution
- No humidity or dew point restrictions
- No disruption to other ongoing work (including hot work)
- No over-coating limitations
- Unique patch repair guarantees can be received

Continued overleaf

1



2



3



Photographs

- Nos. 1-3 After Surface Preparation

CASE STUDY 4: Potable Water Tank Repair – Support Station 3 (cont.)

4 	5 
6 	7 
8 	9 
<p><u>Photographs</u></p> <ul style="list-style-type: none">• Nos. 4-5 After Spot Repair• Nos. 6-9 Completed Repair Work	

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LEGISLATIVE CERTIFICATIONS

Epo-chem™ RS 500P and **RA 500M** have been extensively tested by independent laboratories in accordance with all regulatory bodies, including IMO. All products are Lloyds approved for both “Maintenance Coating” for 5 years and “New Build” for 15 years, see approvals in Appendix I.

Epo-chem™ RS 500P is the only **solvent-free** product which is completely surface tolerant and it can be applied on **WET & RUSTY** surfaces. All independent tests carried out indicate the amazing ability of the product for long-term corrosion prevention. **Chemco International** is the only company in the world who has carried out the **IMO RESOLUTION MSC.215 (82)** test on **RUSTY** and **WET & RUSTY** surfaces. All 3 tests were passed with **IDENTICAL** results. See results in Appendix V.

FAQ'S

Question 1: Can they be applied as a single coat with ultra high DFT?

The coating system(s) are 100% solid, high build system(s) and are normally applied up to 250-500 μ DFT per coat.

At present **Chemco** offer a 5 year guarantee with a single coat of 200 μ DFT, including patch repairs. Major commercial companies worldwide have and are using this system for patch repairs of existing conventional paint systems, including coal-tar epoxies. A letter of recommendation from a ship superintendent can be seen in Appendix II. Recently a 30,000m² project on the structure of a ship, as well as ballast tanks, were completed; huge cost, as well as time saving, was achieved by using a single coat system on the superstructure in the shipyard environment in Poland, see example in the maintenance section.

In fact, these systems have been utilised for a number of years by many major shipping companies; specifically a number of German companies who tested extensively before committing themselves to the whole fleet supply. A number of other major companies, e.g. V. Ships, have also utilised the above systems for almost all areas of the ship, see examples and attached letter of recommendation in Appendix II.

Question 2: What is the thickness retention over surface imperfections, e.g. edges?

The suggested products are designed as "edge retentive" systems because they are:

- **Solvent-free** (no shrinkage); solvent-based systems shrink and "pull" coatings away from the edge.
- Rheological; specifically designed thixotropic formula.
- As one-coat systems, they must have edge retentive qualities.

Question 3: Are the coatings surface tolerant?

Epo-chem™ RS 500P is the only **solvent-free** product which is completely surface tolerant and it can be applied on **wet & rusty** surfaces. All independent tests carried out indicate the amazing ability of the product for long-term corrosion prevention. **Chemco International** is the only company in the world who has carried out the **IMO RESOLUTION MSC.215 (82)** test on **rusty** and **wet & rusty** surfaces. All 3 tests were passed with **IDENTICAL** results. See results in Appendix V.

Question 4: What is the ionic permeability of these coatings?

These are **solvent-free**, high build systems offering very low permeability. **Epo-chem™ RA 500M** as a glassflake system has ultra low permeability.

Question 5: What is the pot life and cure times?

Pot life @ 25°C (77°F) of the products is approximately 1 hour.

The Key point is the cure time. It is well known that epoxies have quite a long cure time, usually 1-14 days. If faster cure is forced, the pot life shortens substantially, making application very difficult. The **KEY ADVANTAGE** of both products is to cure underwater; i.e. as soon as touch dry, i.e. within a few hours the tanks can be ballasted (it does not apply to chemical or fresh water tanks). For other tanks they are considered fast cure (depending on temperature) 24-72 hours.

Question 6: Can the coatings be applied by brush, roller or trowel?

Whilst all these products are designed for application by brush, roller or trowel, they have an additional advantage. The systems can also be airless spray applied (for major repairs or new build) by normal high pressure airless spray units. See examples in maintenance section, cargo holds using airless spray.

Question 7: Are the coatings single pack or 2 pack systems, how easily are they mixed?

These are 2 pack systems; however, there are no mixing issues as the 2 parts are supplied in premeasured quantities; hardener "Part B" (plastic container) is simply added to the resin "Part A" (metal container) and mixed. No part mixing is required or allowed.

Question 8: what are the pack sizes and are these available in convenient locations?

The products are sold by weight: are available globally, the pack sizes are approximately as follows:

Epo-chem™ RS 500P: Supplied in 5 and 20 kg composite packs.

Epo-chem™ RA 500M: Supplied in 5 and 20 kg composite packs.

Both pack sizes are available from stockists in key areas globally (please see the list of stockist worldwide).

Question 9: Can the coatings be supplied in smaller packs (e.g. 1 kg) for small touch up areas?

Yes, 1 kg units are available on request.

Question 10: Are these coatings compatible with conventional paints traditionally used everywhere on the ship?

The systems are compatible with all existing systems, including coal-tar, due to the **solvent-free** nature of the systems. There are very few products in the world that the systems may have compatibility issues, a simple compatibility test can eliminate any doubts. The products are also compatible with shop primers (listed under IMO cross over test).

Question 11: What are the VOC (Volatile Organic Compound) for these products?

The products are both 100% solid. The VOC calculation according to **European method** is **zero** but under American method **EPA Method 24** the VOC for both products is **less than 45** gms/ltr (as carried out independently by Research and Testing Inc. USA).

Question 11: What are the flash points of the products?

RS 500P:

Part A Flash Point: > 125°C (257°F)

Part B Flash Point: > 100°C (212°F)

RA 500M:

Part A Flash Point: > 105°C (221°F)

Part B Flash Point: > 110°C (230°F)

APPENDIX 1

AREAS OF A CRUISE SHIP COATED WITH CHEMCO

1.1 AREAS OF A CRUISE SHIP COATED WITH CHEMCO

THE FOLLOWING IS A COMPREHENSIVE LIST OF SPECIFIC AREAS ON CRUISE VESSELS WHERE CHEMCO COATINGS HAVE BEEN UTILISED:

- Sea Water Ballast Tanks
- Grey Water Tanks
- Sewage Tanks
- Potable Water Tanks
- Fuel Oil Tanks
- Boiler Tanks
- Hot Well Tanks
- Sulphur Fuel Residue Tanks
- Void Spaces
- Battery Rooms
- Fan Rooms
- Chemical Stores
- Steam Pipes (up to 150°C)
- Accommodation Spaces
- Lifeboat Davits - Scuppers
- Chain Lockers
- Food Preparation Rooms
- Firewall Supports
- Sea Inlet Boxes
- Engine Room Bilges
- Machinery Spaces
- Air Con Ducting
- Plenums
- Balconies/Main Decks
- Swimming Pools
- Pool Rooms
- Service Walkways/Passages
- Refrigeration Rooms
- Galleys
- Shower Rooms
- Outside Shell
- Superstructures
- Funnels
- Rudders
- Propellers
- Thrusters Compartments

A lot of the work listed above can be completed in-service, with the technical aspects of the Chemco coatings permitting them to be utilised in areas where most solvent-based systems simply cannot; due to passenger disruption or food/laundry work being in progress.

Equally a lot of the work can be done at refit and allowed to continue despite hot work taking place nearby. Utilising solvent-based systems H&S issues would be a major concern, culminating in long time delays at refits resulting in extensive costs being obtained.

APPENDIX 2
REFERENCE LETTERS

2.1 Reference Letter: V. Ships



*V. Ships UK Limited
Skypark
8 Elliot Place
GLASGOW G3 8EP
Ph: + 44 141 243 2435
Fax: +44 141 243 2436
www.vships.com*

4th December 2007

Dear Manni,

We have used Chemco moisture tolerant RS 500P epoxy for the repair and maintenance works in several of our managed vessels.

We have monitored these areas on routine inspections and are satisfied by the performance and intend using this coating for future works as a flexible coating for applications at sea and in dock.

Prior to application the steel substrates were prepared by mechanical cleaning and HP washing. The coating was then applied, in one coat, at a thickness of between 150 - 200 microns.

It is our view that solvent free epoxy coatings with moisture tolerant properties will become the norm for projects where time is the major constraint.

Yours sincerely,

Corinne Burley

*Fleet Manager
V. Ships UK Ltd.*

2.2 Reference Letter: Yeoman

M.V. Yeoman Bridge.

22nd April 2010

Re :- Chemco coatings

To whom it may concern

For the past five years we have been using Chemco as a protective coating after carrying out ballast tank repairs on both our two sister vessels – Yeoman Bridge and Yeoman Bontrup. The repairs consisting mainly of longitudinal fractures being gouged / welded and new soft nose brackets fitted. Shellplate renewals in drydock due to fractures. Shellplate / internal renewals due to tug / fender damage.

Preparation of the steel is by power tooling / wire brushing to remove any scale/gingering, and feathering of the original coal tar epoxy coating, which Chemco is compatible with. Although Chemco is moisture tolerant we always try to have the steel as dry as possible. Prior to application tins containing the primer and top coats are brought into a warm environment the day before to bring them up at least 10 degs C, as recommended by the manufacturer.

Application is by brush or roller, allowing 16 hours between primer and top coat.

Typical thickness when applied : –

Primer - 200 ~ 250 microns.

Top Coat – 200 ~ 250 microns.

We have been using Chemco now for five years and during that time we have nothing but praise for this product. Years after it has been applied, you can go to an old repair, and the chemco coating is as good as the day it was applied, with no signs of breakdown whatsoever. It is a first class product hence the reason we use it, and will continue to use it, and only it, in our ballast tanks.

Geoff McRorie



Yeoman Glensanda Marine Superintendent

2.3 Reference Letter: AET Shipmanagement



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We hereby confirm the use of CHEMCO **RS 500P** anticorrosive coating system for the refurbishment of the Sea Water Ballast Tanks of the "MT EAGLE ANAHEIM". This project took place in Huangpu – P. R. of China, in September/October 2014.

The goal was to carry out the refurbishment in the shortest possible duration cost effectively whilst achieving long term corrosion protection. Consequently Chemco specialist system was chosen due to the moisture (wet) and surface (rust) tolerance capabilities, both for "less demanding" surface preparation standards and for wet surfaces. Utilising this product enabled the use of Hydro-blasting for surface preparation without delays or downtimes.

The Technical support provided by CHEMCO International was vital to ensure the satisfactory completion of the project on time.

CHEMCO INTERNATIONAL LTD (GB556463226), supplied the below mentioned product from UK and also from stocks available in Singapore.

Supply Date	Designation (products)	Technical Characteristics
August and October 2014	RS 500P	Wet and rust tolerant, solvent-free epoxy

Houston Tx, USA, November 2014

A handwritten signature in black ink, appearing to read 'Abdul Majeed', written over a horizontal dotted line.

Superintendent Mr. Abdul Majeed
AET Ship Management (USA) LLC.