REPORT

EPO-CHEM™ RA 500 Series

EPOXY SOLVENT-FREE SYSTEM

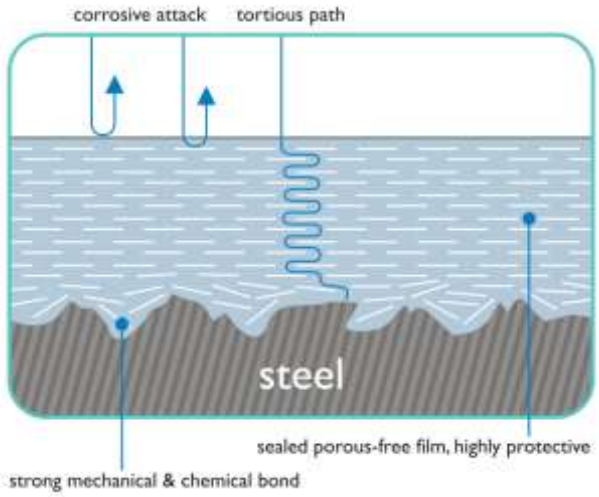
General Industry

December 2015

Contents

INTRODUCTION

Epo-chem™ RA 564 is suitable for a wide range of applications, including tanks, vessel linings and deck coatings.
Epo-chem™ RA 564 is a **solvent-free**, **wet tolerant** and highly chemical resistant epoxy single / topcoat. The glassflake systems have been utilised over the last 30 years as tank lining in the most aggressive environments because they offer total barrier against moisture and corrosive ions. These are typically applied as a 1-coat system or as a topcoat on the primers with DFT of 200-300µ. Minimum surface preparation standard required: SA2, WJ-2, ST3.



MATERIAL CHARACTERISTICS

- It has been designed to work in damp, humid and poorly ventilated areas that are typically found in ballast tanks.
- Used as a stripe coat to repair and protect high corrosion areas, i.e. welds and sharp edges. Adhesion test results on wet substrates far exceed industry norms attaining over 1300psi before cohesive failure.
- Wet tolerant – Can be applied on wet and soaking surfaces, no requirement for any dehumidification equipment.
- RA 500M is 100% solid (solvent-free), no requirement for any ventilation equipment.
- Reduces the risk of MIC (Microbiological Induced Corrosion) and SRB (Sulphate Reducing Bacteria) as it does not contain the nutrients contained in solvent-based coatings.
- Excellent chemical resistance.
- Coating compatible with virtually all coal tar epoxy or other traditional ballast tank coatings.
- Compatible with all shop primers.
- Unlimited over-coating intervals.
- Fast turn-around, can be put back into service almost immediately (as soon as touch dry, 6-12 hours) as the system is capable of 'continuing' to cure underwater.
- Glassflake technology ensures superb corrosion resistance and a long service life.
- Ideal for poorly and hand prepared surfaces - reducing the downtime and back-in service time.
- Apply in any environmental condition, no humidity restrictions.
- Zero VOC; no fire hazard or odour.
- Hot-work, e.g. welding, cutting and grinding can be carried out without interruption.
- No storage hazard.
- Preparation and application works can be carried out by ships' crew, riding crew, alongside quayside or in dry-dock.
- User friendly.

CUSTOMERS

Epo-chem™ RA 564 is specified and used by wide range of worldwide industries, including:

Petro-chemical and Oil & Gas Industry

BP

Grangemouth	Kinneil	Dalmeny	Finnart

Talisman Energy

Flotta Oil Terminal	Tartan Oil Platform	Clyde Oil Platform
Bleo Holms FPSO	Piper Oil Platform	Orkney Oil Terminal

Chevron Texaco

Chevron Refinery	Texaco Pembroke Refinery

Fairfield Energy

Dunlin Oil Platform

Total

North Alwyn Platform

British Gas

Armada Platform

Power Generation

Fiddlers Ferry Power Station	Hartlepool Nuclear Power Station
Cottam Power Station	Longannet Power Station
Loch Gair Power Station	

Food & Beverage

Edrington Brewery	Grant Distillery	Diageo Distillery
Cheese Manufacturing Plant (N. Ireland)		Food Manufacturing Plant (N. Ireland)

General Industry

British Sugar	Corus

CERTIFICATES AND APPROVALS

- ABS Certificate – RS 500P/RA 500M on bare steel and blast cleaned steel surfaces (Including on wet & rusty steel)
- Lloyds Approval:
  - Lloyds Approval – Ballast Tank Maintenance Coating – RA 500M
  - Lloyds Type Approval – IMO Resolution MSC.215 (82) PSPC for New Build – Bare Steel
  - Lloyds Type Approval – IMO Resolution MSC.215 (82) PSPC for New Build – Shop Primer
- NSF Certificate – Fresh Drinking Water (when used in conjunction with RS 500P)
- FDA Approval:
  - FDA Approval – Food Contact – RA 500M
  - FDA Approval – Potable Water – RA 500M

CASE STUDIES

CASE STUDY 1: Crude Oil Tank – BP Kinneil Oil Refinery

Case Study

Client:	*BP*	**Industry:**	*Petrochemical*
Scope:	*Crude Oil Tank*	**Date:**	*November 2008*
Location:	*BP Kinneil (Tank 3701)*	**Products:**	*Epo-chem™ RA 564* *Ceram-chem™ RH 500*

Overview

The internal floor area and 2m up the walls of a large diameter tank holding Crude Oil, required to be completely refurbished in a limited timescale during the plant shutdown. There was also a requirement for a long-term corrosion system that would last until the tank re-opened again in 10 years time.
This project was carried out by Hertel.

Challenge

After coming out of a long service, the tank floor was suffering from severe pitting and corrosion. Winter condition, cold weather and high humidity, combined with water ingress, added to the difficulties of this project.

Solution

First coat of **Epo-chem™ RA 564 solvent-free** glassflake epoxy system @ 500µ DFT by airless spray.
All deep pitting were filled with **Ceram-chem™ RH 500 solvent-free**, ceramic epoxy putty.
Second coat of **Epo-chem™ RA 564 solvent-free** glassflake epoxy system @ 500µ by airless spray.
Total DFT: 1,000µ

Outcome

The major technical benefits offered by utilizing this system ensured that the work was on time, within budget, with no major delays to the program and no impact on other contactors working in and around the tank. Similar tanks on site will now be refurbished utilizing the **Chemco solvent-free** epoxy system due to its great success.

Benefits

- No major delays to program
- Reduced H&S and Fire Precaution
- Reduced cost of plant and equipment
- Chemco International system will protect the steel substrate in excess of 10 years

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Photographs:

- Nos. 1 - 5 application complete.

Rev: March 2015

CASE STUDY 1: Crude Oil Tank – BP Kinneil Oil Refinery (cont.)

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Solvent-free • Water-based • Wet-tolerant
• Rust-tolerant • Zero VOC
• Tank & Pipe Linings • Under-water & Marine • Glassflake
• Rust Converters & Primers • Ceramic & Metal Repair • Anti-static, Conductive & Anti-slip Flooring
• Approved for Contact with Food, Drinking Water & Beverages • Damp or Green Concrete Primers
• Concrete Repair Systems • Elastomeric System
• High Temperature Systems • Fire Retardant • Insulation Systems

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CASE STUDY 2: Tank Refurbishment - BP Grangemouth Oil Refinery

Case Study

chemco

Client:	*INEOS*	**Industry:**	*Petrochemical*
Scope:	*Drain Tank*	**Date:**	*April 2010*
Location:	*BP Grangemouth, UK*	**Products:**	*Epo-chem™ RA 564* *Ceram-chem™ RH 500*

Overview

The main criteria of this project was to reinstate a 20 year old redundant tank back into service. his required the full internal floor area and 1m up the wall to be completely refurbished without the use of any hot-work and in limited timescale.

Challenge

Tank internals suffer from heavy corrosion, pitting and severe metal loss. Combined with the possibility of holes, open-top tank exposed to elements, high humidity, cold and rain adding to the difficulty of this work.

Solution

First coat of **Epo-chem™ RA 564 solvent-free** glassflake epoxy system was applied on grit blasted SA 2.5 @ 200µ by airless spray.
All welded areas and seams were filled using **Ceram-chem™ RH 500** high density ceramic epoxy filler.
The complete floor area was then fibre-glassed using **Epo-chem™ RA 500L** (special laminating grade of **RA 500 series**) and 450gsm of chopped strand mat in 2 overlapping layers.
Second coat of **Epo-chem™ RA 564 solvent-free** glassflake epoxy system @ 400µ was applied by airless spray.
Final coat of **Epo-chem™ RA 564 solvent-free** glassflake epoxy system @ 400µ was applied by airless spray.

Outcome

The major technical benefits offered by utilizing this system ensured the client that the work was on time, tank integrity established, within budget and with no delays to the program (many days saved). The use of this tank refurbishment system from **Chemco** will now be utilized for similar tank refurbishment projects on sites where hot-work is not feasible.

Cont'd

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Photographs:

- No. 1 tank before application
- Nos. 2 - 4 application in progress
- Nos. 5 - 6 completed application

Rev: March 2015

CASE STUDY 2: Tank Refurbishment - BP Grangemouth Oil Refinery (cont.)

Benefits

- No hot work
- Structural/tank integrity restored
- Huge cost savings compared to tank floor replacement
- No delays
- Reduced H&S and Fire Precaution
- Reduced cost of plant and equipment
- **Chemco** system will protect the steel substrate for minimum of 25 years

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CASE STUDY 3: Pipe Spool – Peterhead Power Station

Case Study

Client:	*Peterhead Power Station*	**Industry:**	*Power Generation*
Scope:	*Pipe Spools*	**Date:**	*April 2009*
Location:	*Peterhead, UK*	**Product:**	*Epo-chem™ RA 564*

Overview

The fabricator, Eurofab, required a very quick turnaround time with 25 years life expectancy for the internal/external protection of a number of large 48" pipe spools for Peterhead Power Station.

Challenge

The client required a coating system that would last at least 25 years and could be applied very quickly to the internal/external of large 48" spools.

Solution

Two coats of **Epo-chem™ RA 564 solvent-free** epoxy system @ 500µ per coat by airless spray was applied to both internal and externals of the spools.
Total DFT Internal: 1,000µ
Total DFT External: 1,000µ

Outcome

Epo-chem™ RA 564, when applied at such high thickness, would offer a complete corrosion protection for minimum of 25 years. The system has excellent impact and abrasion resistance as well as very high gloss. The contract was completed on time and within budget to the total satisfaction of the client.

Benefits

- No major delays to program
- Reduced cost of plant and equipment
- Reduced H&S and Fire Precaution
- **Chemco** system will protect the steel substrate in excess of 25 years

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Photographs:

- Nos. 1 and 2 Pipe spools before application.
- Nos. 3 and 4 Pipe spools after application.

Rev: January 2015

CASE STUDY 3: Pipe Spool – Peterhead Power Station

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CASE STUDY 4: Surface Walls – Cheese Manufacturing Plant

Case Study

Client:	*Cheese Manufacturing Plant*	**Industry:**	*Food & Beverage*
Scope:	*Surface Walls*	**Date:**	*December 2009*
Location:	*Northern Ireland*	**Product:**	*Epo-chem™ RA 500M*

Overview

The existing masonry production area walls (500m²) required a complete re-coat without any disruption to other areas of the plant. It also had to be carried out in a very tight timescale and have no odours.
The surface finish had to be easy to wash and decontaminate seamless with food contact approval.

Challenge

Working in a very restrictive area, limited timescale, minimal surface preparation, FDA approval, odourless product, combined with temperature variations added to the difficulty of the project.

Solution

Two coats of **Chemco Epo-chem™ RA 500M solvent-free, wet-tolerant** glassflake epoxy system @ 200µ per coat applied by brush and roller.

Outcome

The work was carried out on time, with no delays to the program and no impact on other contractors working in close proximity. Since this project was completed, the client has specified the same system for similar plants in Northern Ireland.

Benefits

- **Solvent-free**, odourless
- No major delays to program
- Reduced H&S and Fire Precaution
- No blasting or ventilation required
- Reduced cost of plant and equipment

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Photographs

- Nos. 1 and 2 before application
- Nos. 3 and 4 after application

Rev: March 2015

CASE STUDY 4: Surface Walls – Cheese Manufacturing Plant (cont.)

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CASE STUDY 5: Flooring Refurbishment – Food Factory

Case Study

chemco

Client:	*Food Manufacturing Plant*	**Industry:**	*Food & Beverage*
Scope:	*Production Floor*	**Date:**	*December 2009*
Location:	*Northern Ireland*	**Product:**	*Epo-chem™ RA 500M*

Overview

The main food production floor area of 400m² required complete removal of the existing paint system and recoated without any disruption to other areas of the plant. It also had to be carried out in a very tight timescale with no odours present during or after the application of coating system.

Challenge

FDA food contact approval with ease of decontamination with excellent resistance to daily wash. Working in a restrictive area with very short timescale and at varying temperatures, no ventilation feasible and limited surface preparation added to the difficulties of the project.

Solution

Two coats of **Epo-chem™ RA 500M solvent-free, wet-tolerant** epoxy system @ 200µ per coat by roller.

Outcome

The major technical benefits offered by utilizing this system ensured that the work was carried out on time, with no delays to the program and no impact on other contractors. Since the completion of this project, the client has specified the same system for similar plants in Northern Ireland.

Benefits

- **Solvent-free**, odourless
- No major delays to program
- Reduced H&S and Fire Precaution
- Reduced cost of plant and equipment
- Very fast and efficient

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Photographs

- Nos. 1 and 2 production floor before application
- Nos. 3 and 4 production floor after application

Rev: March 2015

CASE STUDY 5: Flooring Refurbishment – Food Factory (cont.)

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Solvent-free • Water-based • Wet-tolerant
• Rust-tolerant • Zero VOC
• Tank & Pipe Linings • Under-water & Marine • Glassflake
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CASE STUDY 6: Secondary Containment – Edrington Distillery

Case Study

Client:	*Edrington Distillery*	**Industry:**	*Food & Beverage*
Scope:	*Flooring*	**Date:**	*August 2008*
Location:	*UK*	**Products:**	*Epo-chem™ RA 564 & Easi-prime™ RX 500P*

Overview

Distillers and blenders of famous malt and blended whisky, the Edrington Group required a seamless coating system to comply with current legislation. The existing ceramic tile floor had to be retained due to cost and time limitation. Seamless, FDA food contact approval to comply with the legislation.

Challenge

Working in a live production area, minimal surface preparation, limited timescale, combined with application of coating on ceramic tiles and with no disruption to the operation. A **solvent-free**, odourless solution was required.

Solution

Easi-prime™ RX 500P, a water-based epoxy with excellent adhesion to ceramic tiles was applied @ 100µ followed by one coat of **solvent-free, wet-tolerant** glassflake topcoat **Epo-chem™ RA 564** @ 200µ by brush and roller.

Outcome

The work was carried out on time, within budget and with no delays to the complete satisfaction of the client.

Benefits

- No need to remove existing tiles
- No odour, no impact on personnel
- No disruption to production
- Reduced cost of contract
- Reduced H&S and Fire Precaution

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Photographs:

- Nos. 1 and 3 production floor before application.
- Nos. 2, 4 and 5 production floor after application.

Rev: March 2015

CASE STUDY 6: Secondary Containment – Edrington Distillery (cont.)

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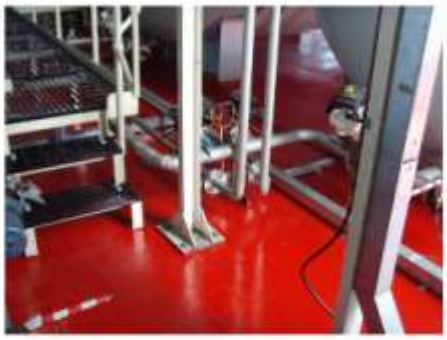

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CASE STUDY 7: Potable Water Tank – Basingstoke Hotel

Case Study

Client:	*Basingstoke Hotel*	**Industry:**	*Industrial*
Scope:	*Potable Water Tank Repair*	**Date:**	*October 2012*
Location:	*UK*	**Product:**	*Epo-chem™ RS 500P & RA 500M*

Overview

The potable water tanks were approximately 90 years old and were showing signs of corrosion damage. The client required these tanks to be restored to "as good as new" condition.

Challenge

The tanks had holes through their shell, floors and lower walls. The tanks were also located in a confined space on the roof of the building. Working within a strict time frame also added to the difficulty of this project.

Solution

Manual preparation was selected as the surface preparation method.
One primer coat of **solvent-free, wet & rust** tolerant **Epo-chem™ RS 500P** was applied first.
This was followed by two topcoats of **solvent-free, wet tolerant Epo-chem™ RA 500M**.

Outcome

The work was completed in three working days with no delays. The tanks were restored to "as good as new" condition resulting in huge cost savings for the client as they did not need to purchase new tanks.

This system is **NSF Certified** for fresh drinking water applications.

Benefits

- **Solvent-free** (odourless)
- Restored to "as good as new" condition
- Reduced H&S and Fire Precaution
- No grit blasting
- Substantial time and cost savings

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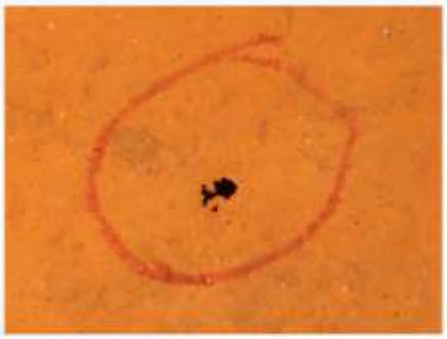

Photographs
- Nos. 1 & 2 Before application

*This project was completed by our approved contractor Specialist Coatings Ltd, UK

Rev: March 2015

CASE STUDY 7: Potable Water Tank – Basingstoke Hotel (cont.)

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Photographs

- Nos. 3 & 4 After priming
- No. 5 Completed application

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CASE STUDY 8: Swimming Pools – Navigator of the Seas

Case Study

Client:	*Royal Caribbean Cruise Lines*	**Industry:**	*Marine*
Vessel:	*Navigator of the Seas*	**Date:**	*February 2014*
Location:	*Bermuda*	**Products:**	*Epo-chem™ RS 500P & RA 500M*

Overview

The swimming pools on-board Royal Caribbean's Navigator of the Seas cruise vessel had to be refurbished as the existing tile system required regular maintenance and this was causing major problems.

Challenge

Removing the existing tiles and concrete backing to expose the steel. Utilising an alternative surface preparation method to grit blasting, which could not be considered due to problems of excessive dust contamination to the surrounding areas. The client was looking for a system offering a long-term solution which did not require regular maintenance. Working within a strict time-frame also added to the difficulty of this project.

Solution

Both mechanical preparation and water jetting were utilised as the surface preparation methods to St2 and WJ-3 standards respectively. Chemco's solvent-free, wet & rust tolerant primer Epo-chem™ RS 500P was applied followed by two coats of solvent-free, wet tolerant Epo-chem™ RA 500M.

Outcome

The project was completed in 20 days, much quicker than the given time -frame. The quality of the smooth, high gloss finish and the speed of the contract were to the satisfaction of all concerned. The surface preparation method utilised and the unique solvent-free properties of the Chemco system also allowed other work to continue nearby without disruption.

Benefits

- Solvent-free
- No grit blasting
- Reduced down-time and equipment cost
- Wet & rust tolerant properties of the Chemco system
- H&S compliant
- No disruption to other work
- Chemco system offers a long-term and easily repairable solution

Continued overleaf

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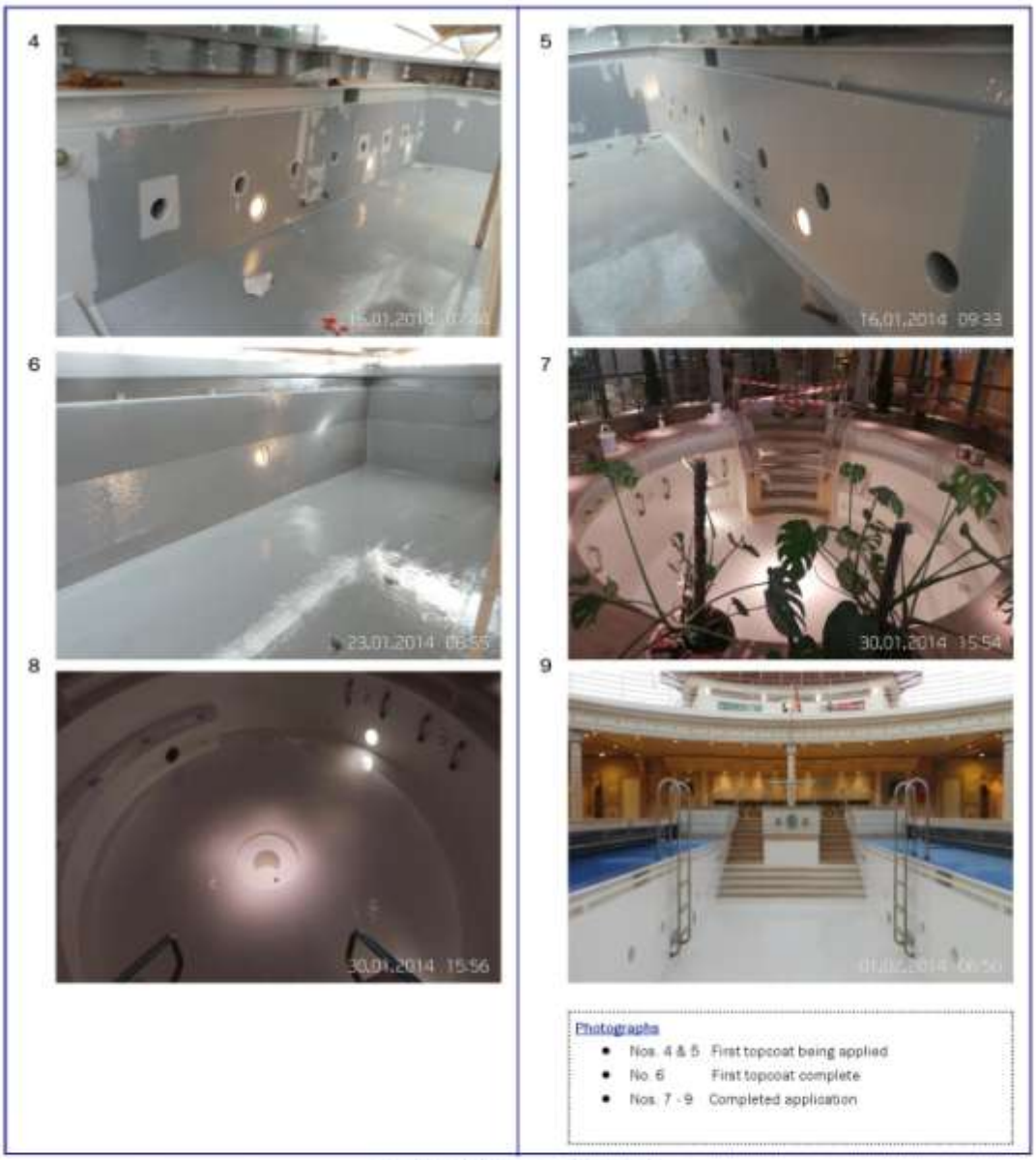
Photographs

- Nos. 1 & 2 After surface preparation
- No. 3 Topcoat being applied on top of primer

Rev: November 2015

Ref: M33

CASE STUDY 8: Swimming Pools – Navigator of the Seas (cont.)



Photographs

- Nos. 4 & 5 First topcoat being applied
- No. 6 First topcoat complete
- Nos. 7 - 9 Completed application

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CASE STUDY 9: Crude Oil Tank – BP Dalmeny

Case Study

Client:	*BP Dalmeny*	**Industry:**	*Petrochemical*
Scope:	*Crude Oil Tank*	**Date:**	*June 2007*
Location:	*Scotland, UK*	**Product:**	*Epo-chem™ RA 564*

Overview
Crude oil tank (75m diameter) internal lining required to be refurbished with a minimum 17 (12 + 5) years guarantee.

Challenge
To carry out the work in as short as possible time scale. Reduce cost and duration, as any tank out of service costs a huge amount due to the size and volume of these tanks. The work should also be carried out in a safe manner in a working tank farm.

Solution
Two coats of **Epo-chem™ RA 564 solvent-free, wet-tolerant** glassflake epoxy @ 500µ per coat by airless spray with no requirement for ventilation or dehumidification.

Outcome
The technical benefits offered by this system ensured that the work was carried out on time, within budget and with no H&S issues.

Benefits
- No major delays
- Min 9 days reduction in contract duration
- Reduced H&S and Fire Precaution
- Reduced cost of equipment
- **Chemco** system will protect the steel substrate in excess of 17years

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Photographs:
- Nos. 1, 2 and 3 crude oil tank after application.

Rev: March 2015

CASE STUDY 10: Process Vessel – Flotta Oil Terminal

Case Study

chemco

Client:	*Talisman Energy (UK)*	**Industry:**	*Petrochemical*
Scope:	*Process Vessel*	**Date:**	*May 2007*
Location:	*UK*	**Products:**	*Epo-chem™ RA 564* *Ceram-chem™ RH 500*

Overview

A large process vessel, operational temperature at around 55°C, required to be completely refurbished without any disruption to other contractors working adjacent to this area. It also had to be carried out in a very tight timescale and in cold and very damp conditions during the plant shutdown.

Challenge

Working within a very tight timescale, severe pitting and corrosion, high humidity, confined space and other contractors working adjacent to the vessel refurbishment added to the difficulty of the project.

Solution

First coat of **Epo-chem™ RA 564 solvent-free** glassflake epoxy system @ 500µ DFT by airless spray.
All deep pitting were filled with **Ceram-chem™ RH 500 solvent-free**, ceramic epoxy putty.
Second coat of **Epo-chem™ RA 564 solvent-free** glassflake epoxy system @ 500µ by airless spray.
Total DFT: 1,000µ

Outcome

The major technical benefits offered by utilizing this complete system ensured that the work was carried out on time, within budget, with no major delays to the program and no impact on other contractors working in close proximity.

Benefits

- **Solvent-free**
- No delays
- Reduced cost of plant and equipment
- Reduced H&S and Fire Precaution
- **Chemco** system will protect the steel substrate

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Photographs:

- The process vessel after application.

Rev: March 2015

CASE STUDY 11: Pipework Leak Repair – Alcan Primary Metals

Case Study

chemco

Client:	*Alcan Primary Metals*	**Industry:**	*Industrial*
Scope:	*Leaking Pipe Work*	**Date:**	*January 2003*
Location:	*England, UK*	**Product:**	*Epo-chem™ RA 500 Series*

Overview

Chemco were requested by the senior mechanical engineer at Alcan Primary Metals to provide a repair system, that would not require a process shut down, to a leaking section of 60" (1,500mm) diameter of their main cooling water pipe work. The pipe work carries seawater which is used for cooling on the main condensers. The problem was perforation, close to both the VJ coupling and the pipe flange adjacent to a butterfly valve. Photograph 1 shows the extent of the leakage and the pressure involved.

Challenge

Carrying out this repair whilst on load. Isolation of this section of pipe work would result in the station having to shut down one of the generation units with considerable loss of revenue. **Chemco** carried out an inspection to assess the safety implications, feasibility and techniques to be employed in this critical contract. The decision was taken that by utilising **Chemco** special wet-tolerant polymer technology and mechanical engineering, the problem can be sorted in a very quick and cost-effective manner.

Solution

The decision was taken to manufacture a split clamping ring, designed to fit between the VJ coupling and the flange. Utilising the amazing ability of **Epo-chem™ RA 500** to cure and seal underwater, the area of damage was reduced by the clamp ring being secured, leakage was reduced to a few drops per minute. Further applications of specially reinforced **Epo-chem™ RA 500** laminating resin, developed for application in wet conditions, stopped the leak completely. The patch repair was completely successful until the next scheduled shut-down. Photograph 2 shows the successful sealing of the leak.

Outcome

A very costly shut-down was avoided at an extremely low cost. The contract was carried out in a safe, efficient manner and within budget.

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Photographs:

- No. 1 The leakage of the pipe.
- No. 2 The sealed pipe.

Rev: March 2015

APPENDIX 1

CERTIFICATES AND APPROVALS

1.1 ABS Certificate – RS 500P/RA 500M on bare steel and blast cleaned steel surfaces (Including on wet & rusty steel)

CERTIFICATE NUMBER
14-LD1135810A-PDA-01

DATE
23 January 2014

ABS TECHNICAL OFFICE
London Engineering Department

CERTIFICATE OF DESIGN ASSESSMENT

This is to Certify that a representative of this Bureau did, at the request of

CHEMCO INTERNATIONAL - SCOTLAND

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate.

PRODUCT: **IMO PSPC Approved Seawater Ballast Tank Coating**

MODEL: **RS 500P/RA 500M ON BARE STEEL AND BLAST CLEANED STEEL SURFACES.**

This Product Design Assessment (PDA) Certificate 14-LD1135810A-PDA-01, dated 23/Jan/2014 remains valid until 22/Jan/2019 or until the Rules or specifications used in the assessment are revised (whichever occurs first).

This PDA is intended for a product to be installed on an ABS classed vessel, MODU or facility which is in existence or under contract for construction on the date of the ABS Rules or specifications used to evaluate the Product.

Use of the Product on an ABS classed vessel, MODU or facility which is contracted after the validity date of the ABS Rules and specifications used to evaluate the Product, will require re-evaluation of the PDA.

Use of the Product for non ABS classed vessels, MODUs or facilities is to be to an agreement between the manufacturer and intended client.

AMERICAN BUREAU OF SHIPPING

Andrew Worrall
Engineer

1.2 Lloyds Approval – Ballast Tank Maintenance Coating – **RA 500M**

RECOGNISED CORROSION CONTROL COATING

Certificate No. **MATS/3810/2**

This certificate is issued to the company named below. The corrosion control coating described has been recognised for use as a tank coating in constructions built under Lloyd's Register survey. This recognition is subject to Lloyd's Register being informed of any changes in or modifications to the coating and the product being used in accordance with the manufacturer's instructions, and the relevant requirements of Lloyd's Register's Rules and Regulations.

Company	**CHEMCO INTERNATIONAL LTD. UNITED KINGDOM**
Trade name	**EPO-CHEM RA 500M**
Type of coating	**Epoxy**
Applicability	**Salt Water Ballast Tanks, Void Spaces**
Surface preparation	**ISO 8501-1, Sa 2.5**
Number of coats	**1*- 2**
Dry film thickness	**250-600 microns**
Remarks	*** Additional stripe coat to be applied to all welds, edges and other changes in section. This recognition is applicable to vessels not within the scope of IMO Resolution MSC.215(82) 'Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-side Skin Spaces of Bulk Carriers' adopted on 8th December 2006.**

Valid until **1 October 2017**

Date **18 September 2012**

R Dawson
Surveyor to Lloyd's Register EMEA
A subsidiary of Lloyd's Register
Group Limited

1.3 Lloyds Type Approval – IMO Resolution MSC.215 (82) PSPC for New Build – Bare Steel

Lloyd's Register
TYPE APPROVAL

Protective Coatings for Water Ballast Tanks and Double-side Skin Spaces

Certificate No: **MNDE/2011/4217**

This is to certify that the protective coating system manufactured at the plant below is in compliance with IMO Resolution MSC.215(82) *Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-side Skin Spaces of Bulk Carriers* (PSPC) adopted on 8th December 2006.

This approval is granted in accordance with the PSPC, IACS Regulations and LR Rules. The surface preparation and application requirements specified in the product technical data sheet (PTDS) have been reviewed and comply with the PSPC. This approval does not cover properties other than corrosion prevention, such as service life, safety or toxicity etc.

The approval is subject to Lloyd's Register being informed of any changes in the product's formulation, specification or status of manufacturing quality control accreditation. Periodic auditing of the manufacturer's quality control and assurance systems will confirm compliance. Lloyd's Register reserves the right to withdraw or re-issue this certificate.

Manufacturer:	**Chemco International Ltd.** **East Shawhead Industrial Estate,** **Coatbridge,** **Scotland,** **United Kingdom**
Coating system:	**Epo-chem™ RS 500P / Epo-chem™ RA 500M**
Product codes:	**RS 500P / RA 500M**
Curing agents:	**HR 500P / HF 500M**
Applications	**Water ballast tanks and double-side skin spaces**
Notes:	1. Surface preparation and coating application should be carried out in accordance with the manufacturer's PTDS. 2. Product approved for use with the compatible shop primers listed on page 2, or on clean blasted bare steel.
Date of issue:	**26 May 2011**
Date of expiry:	**1 June 2016**

Richard Dawson
Surveyor to Lloyd's Register EMEA
A member of Lloyd's Register Group

Issue No. 1

Lloyd's Register
TYPE APPROVAL

Protective Coatings for Water Ballast Tanks and Double-side Skin Spaces

Certificate No: **MNDE/2011/4217**

Compatible Shop Primers:

Primer	Product Code(s)	Manufacturer
Bare steel only		

End of list

Issue No. 1

1.4 Lloyds Type Approval – IMO Resolution MSC.215 (82) PSPC for New Build - Shop Primer

Lloyd's Register
TYPE APPROVAL

Protective Coatings for Water Ballast Tanks and Double-side Skin Spaces

Certificate No: **MNDE/2011/4217**

This is to certify that the protective coating system manufactured at the plant below is in compliance with IMO Resolution MSC.215(82) *Performance Standard for Protective Coatings for Dedicated Seawater Ballast Tanks in all Types of Ships and Double-side Skin Spaces of Bulk Carriers* (PSPC) adopted on 8th December 2006.

This approval is granted in accordance with the PSPC, IACS Regulations and LR Rules. The surface preparation and application requirements specified in the product technical data sheet (PTDS) have been reviewed and comply with the PSPC. This approval does not cover properties other than corrosion prevention, such as service life, safety or toxicity etc.

The approval is subject to Lloyd's Register being informed of any changes in the product's formulation, specification or status of manufacturing quality control accreditation. Periodic auditing of the manufacturer's quality control and assurance systems will confirm compliance. Lloyd's Register reserves the right to withdraw or re-issue this certificate.

Manufacturer:	**Chemco International Ltd.** **East Shawhead Industrial Estate,** **Coatbridge,** **Scotland,** **United Kingdom**
Coating system:	**Epo-chem™ RS 500P / Epo-chem™ RA 500M**
Product codes:	**RS 500P / RA 500M**
Curing agents:	**HR 500P / HF 500M**
Applications	**Water ballast tanks and double-side skin spaces**
Notes:	1. Surface preparation and coating application should be carried out in accordance with the manufacturer's PTDS. 2. Product approved for use with the compatible shop primers listed on page 2, or on clean blasted bare steel.
Date of issue:	**17 January 2012**
Date of expiry:	**1 June 2016**

Richard Dawson
Surveyor to Lloyd's Register EMEA
A member of Lloyd's Register Group

Issue No. 2

Lloyd's Register
TYPE APPROVAL

Protective Coatings for Water Ballast Tanks and Double-side Skin Spaces

Certificate No: **MNDE/2011/4217**

Compatible Shop Primers:

Primer	Product Code(s)	Manufacturer
Interplate 937	NQA933, NQA934, NQA936	International Paint Ltd.
Sigmaweld 190	179171, 179172	PPG Protective & Marine Coatings
Cerabond 2000	N/A	Chugoku Marine Paints, Ltd.
Nippon Ceramo *(Nippe Ceramo)*	N/A	Nippon Paint Marine Coatings Co., Ltd.

End of list

Issue No. 2

1.5 NSF Certificate: Fresh Drinking Water System (when used in conjunction with RS 500P)

NSF International

789 N. Dixboro Road, Ann Arbor, MI 48105 USA

RECOGNIZES

Chemco International Ltd

Facility: Coatbridge, United Kingdom

AS COMPLYING WITH NSF/ANSI 61 AND ALL APPLICABLE REQUIREMENTS.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.

Certification Program Accredited by the American National Standards Institute

Certification Program Accredited by the Standards Council of Canada

This certificate is the property of NSF International and must be returned upon request. For the most current and complete information, please access NSF's website (www.nsf.org).

September 26, 2014
Certificate# C0184107 - 01

David Purkiss
General Manager, Water Systems

1.5 NSF Certificate: Fresh Drinking Water System (when used in conjunction with RS 500P) (cont.)

NSF International

OFFICIAL LISTING

NSF International Certifies that the products appearing on this Listing conform to the requirements of NSF/ANSI Standard 61 - Drinking Water System Components - Health Effects

This is the Official Listing recorded on September 26, 2014.

Chemco International Ltd
13-23 Hagmill Road
East Shawhead Industrial Estate
Coatbridge ML5 4XD
United Kingdom
+44 1236 606060

Facility: Coatbridge, United Kingdom

Trade Designation [1] [2] [G]	Protective (Barrier) Materials for Potable Water Contact Size Restriction	Water Contact Temp	Water Contact Material
Tanks			
Epo-Chem RA 500	>= 1000 gal.	CLD 23	EPOXY
Epo-Chem RA 500 UM	>= 1000 gal.	CLD 23	EPOXY
Epo-Chem RA 500M	>= 1000 gal.	CLD 23	EPOXY

[1] All RA500 products are used with Epo-Chem EB 500P primer.

[2] Colors: <only capitalize the first color, put the colors in alpha order>
Number of Coats: Primer 1, Top Coat 1
Maximum Field Use Dry Film Thickness (in mils): Primer: 10; Top coat: 25; Total system: 35
Maximum Thinner: 5% TS Thinner
Recoat Cure Time and Temperature: Primer cure time is 2 hours at 30°C
Final Cure Time and Temperature: 48 hours at 30°C
Special Comments: Primer: Mix Ratio is 4.18:0.82 (Part A:Part B) by weight Top Coat: Mix Ratio is 3.67:1.333 (Part A:Part B) by weight

[G] Product is Certified to NSF/ANSI 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

Note: Additions shall not be made to this document without prior evaluation and acceptance by NSF International.

1 of 1

C0184103

789 N. Dixboro Road, Ann Arbor, Michigan 48105-9723 USA
1-800-NSF-MARK / 734-769-8010
www.nsf.org

1.6 FDA Approval – Food Contact – **RA 500M**

SMITHERS PIRA

Food Contact Plastics
Certificate of Conformity with the Test Requirements of USA FDA Code of Federal Regulations (CFR21) Section 175.300 (Resinous and Polymeric Coatings).

Certificate no: 2013/5091

Product Name:	*'RA 500M'*	**Date of Issue:**	17 October 2013
Manufacturer/ Supplier:	Chemco International	**Pira Reference No:**	13A12J5514
Address:	East Shawhead Industrial Estate Coatbridge Scotland ML5 4XD		

Samples of the above product have been found to comply with the following requirements, as specified in sections (1) of the USA FDA Code of Federal Regulations CFR21 Section 175.300 (Polyethylene Phthalate Polymers).

- The chloroform soluble portion of a distilled water extract of the food contact surface of the sample shall not exceed 0.5 mg per square inch when tested using extraction conditions of 24 hours at 120°F.
- The chloroform soluble portion of an n-heptane extract of the food contact surface of the sample shall not exceed 0.5 mg per square inch when tested using extraction conditions of 0.5 hours at 70°F.

Accordingly, the above sample is in compliance with the test requirements specified in the USA FDA Code of Federal Regulations CFR21 Section 175.300 (1) and is suitable for use in packaging, transporting or holding all non alcoholic foods, at temperatures not to exceed room temperature.

Certified by: **Allison Chambers**
Senior Analytical Chemist
Analytical Services

Smithers Pira | Cleeve Road | Leatherhead | Surrey KT22 7RU, UK | +44 (0)1372 802000 | www.smitherspira.com

1.7 FDA Approval – Potable Water – **RA 500M**

SMITHERS PIRA

Food Contact Plastics
Certificate of Conformity with the Test Requirements of USA FDA Code of Federal Regulations (CFR21) Section 175.300 (Resinous and Polymeric Coatings)

Certificate no: 2013/5093

Product Name: *'RA 500M / RP 500'*

Date of Issue: 17 October 2013

Manufacturer/ Supplier: Chemco International

Pira Reference No: 13A12J5514

Address:
East Shawhead Industrial Estate
Coatbridge
Scotland
ML5 4XD

Samples of the above product have been found to comply with the following requirements, as specified in sections (1) of the USA FDA Code of Federal Regulations CFR21 Section 175.300 (Polyethylene Phthalate Polymers).

- The chloroform soluble portion of a distilled water extract of the food contact surface of the sample shall not exceed 0.5 mg per square inch when tested using extraction conditions of 24 hours at 120°F.
- The chloroform soluble portion of an n-heptane extract of the food contact surface of the sample shall not exceed 0.5 mg per square inch when tested using extraction conditions of 0.5 hours at 70°F.

Accordingly, the above sample is in compliance with the test requirements specified in the USA FDA Code of Federal Regulations CFR21 Section 175.300 (1) and is suitable for use with fresh drinking water, at temperatures not to exceed room temperature.

Certified by: **Allison Chambers**
Senior Analytical Chemist
Analytical Services

Smithers Pira | Cleeve Road | Leatherhead | Surrey KT22 7RU, UK | +44 (0)1372 802000 | www.smitherspira.com
Smithers Rapra and Smithers Pira Ltd | Registered in England & Wales No. 6781324 | Registered Office: Shawbury, Shropshire, SY4 4NR

APPENDIX 2

TEST REPORTS

2.1 JE Test Report

PAINTING REPORT

JOB NO.:	Cmp/1547	REPORT NO.:	000
UNIT:	G3	INSPECTION DATE:	13/09/02
JOB TITLE:	PAINT TESTING ON LEAD COATED AND WET PIPE.		

DESCRIPTION OF ITEM (State Drawing Nos. where applicable):

Test Carried Out On 8" Pipe with 4off different paints Supplied by chemco international paint.

(1) RA 500——————EPOXY SOLVENT-FREE SYSTEM .
(2) R I 500——————EPOXY SOLVENT-FREE SYSTEM .
(3) RL 500——————EPOXY SYSTEM WITH ADDED SOLVENT.
(4) RS 500——————EPOXY SOLVENT-FREE SYSTEM .

SUMMARY

RA-500——RI——RS——————. Are all 100% volume solids.
RL-500 ——————90% volume solids.
RA 500 looks to be the better coat when applying, and can be seen to be flashing off within 30 min. (very good).
RI 500 A Bit Harder to apply but as seen good overall coat. (good).
RL 500 This application found to sag during application using brush,(more care when applying). (good).
RS 500 This coat same as RI 500 When applying found to be a bit hard to apply. (good).

OBSERVATIONS

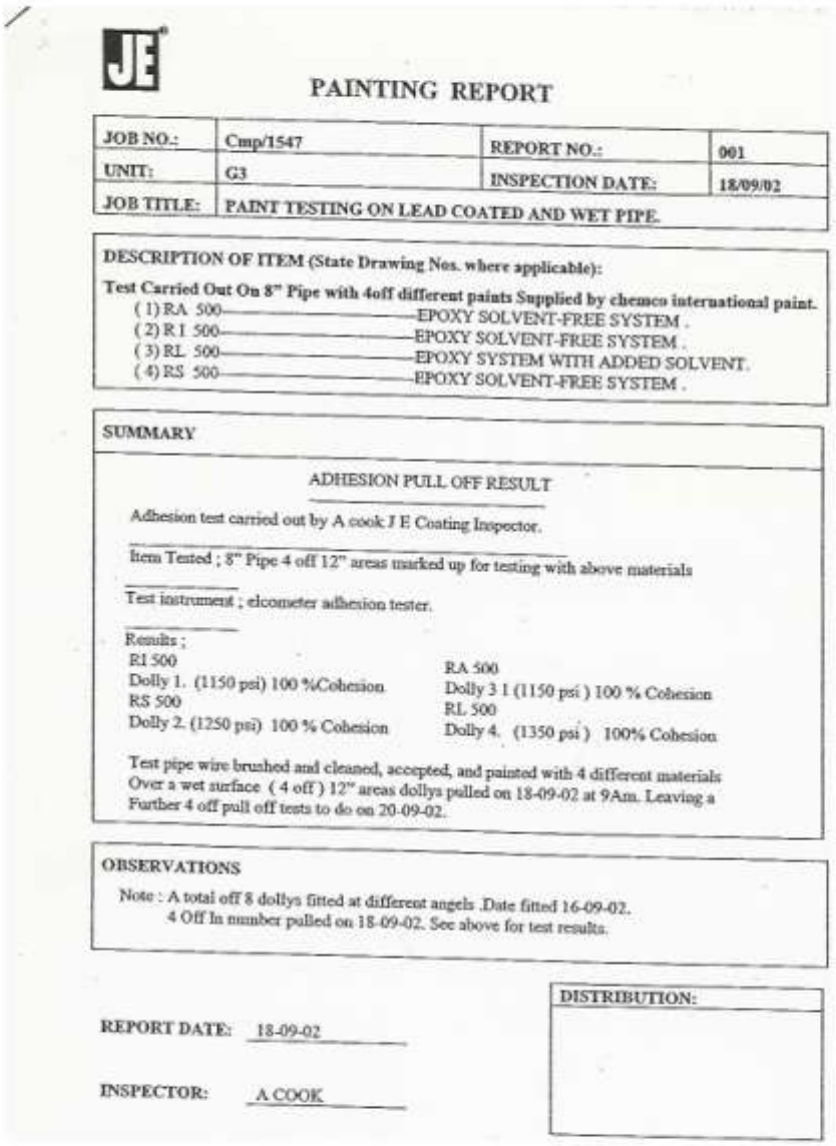
Four parts off an 8" lead coated pipe were prepared for coating. this pipe was also seen to be wet
Prior To paint application.
Remove all loose material .
To final wire brush.
To clean down.
To apply to all four areas coating with different material (all areas coated on 13-09-02) .
Today 16-09-02 dollys were attch to these areas for adhesion testing which will
Be carried out on 20-09-02.

DISTRIBUTION:

REPORT DATE: 13-09-02

INSPECTOR: A COOK

2.1 JE Test Report (cont.)



JE

PAINTING REPORT

JOB NO.:	Cmp/1547	REPORT NO.:	001
UNIT:	G3	INSPECTION DATE:	18/09/02
JOB TITLE:	PAINT TESTING ON LEAD COATED AND WET PIPE.		

DESCRIPTION OF ITEM (State Drawing Nos. where applicable):

Test Carried Out On 8" Pipe with 4off different paints Supplied by chemco international paint.

(1) RA 500——EPOXY SOLVENT-FREE SYSTEM .
(2) R I 500——EPOXY SOLVENT-FREE SYSTEM .
(3) RL 500——EPOXY SYSTEM WITH ADDED SOLVENT.
(4) RS 500——EPOXY SOLVENT-FREE SYSTEM .

SUMMARY

ADHESION PULL OFF RESULT

Adhesion test carried out by A cook J E Coating Inspector.

Item Tested ; 8" Pipe 4 off 12" areas marked up for testing with above materials

Test instrument ; elcometer adhesion tester.

Results ;

RI 500
Dolly 1. (1150 psi) 100 %Cohesion
RS 500
Dolly 2. (1250 psi) 100 % Cohesion

RA 500
Dolly 3 1 (1150 psi) 100 % Cohesion
RL 500
Dolly 4. (1350 psi) 100% Cohesion

Test pipe wire brushed and cleaned, accepted, and painted with 4 different materials Over a wet surface (4 off) 12" areas dollys pulled on 18-09-02 at 9Am. Leaving a Further 4 off pull off tests to do on 20-09-02.

OBSERVATIONS

Note : A total off 8 dollys fitted at different angels .Date fitted 16-09-02.
4 Off In number pulled on 18-09-02. See above for test results.

REPORT DATE: 18-09-02

INSPECTOR: A COOK

DISTRIBUTION:

2.1 JE Test Report (cont.)

PAINTING REPORT

JOB NO.:	Cmp/1547	REPORT NO.:	002
UNIT:	G3	INSPECTION DATE:	20/09/02
JOB TITLE:	PAINT TESTING ON LEAD COATED AND WET PIPE.		

DESCRIPTION OF ITEM (State Drawing Nos. where applicable):

Test Carried Out On 8" Pipe with 4off different paints Supplied by chemco international paint.

(1) RA 500——————EPOXY SOLVENT-FREE SYSTEM .
(2) R I 500——————EPOXY SOLVENT-FREE SYSTEM .
(3) RL 500——————EPOXY SYSTEM WITH ADDED SOLVENT.
(4) RS 500——————EPOXY SOLVENT-FREE SYSTEM .

SUMMARY

ADHESION PULL OFF RESULT

Adhesion test carried out by A cook J E Coating Inspector.

Item Tested ; 8" Pipe 4 off 12" areas marked up for testing with above materials

Test instrument ; elcometer adhesion tester.

Results ;

RI 500
Dolly 1. (1150 psi) 100 %Cohesion
RS 500
Dolly 2. (1300 psi) 100 % Cohesion
RA 500
Dolly 3 (1150 psi) 100 % Cohesion
RL 500
Dolly 4. (1450 psi) 100% Cohesion

Further test carried out to same painted areas (different locations) .
Test carried out to 09.00 hrs on 20-09-02

OBSERVATIONS

Note : After 7 Days Further 4 Dollys Pulled , see results above.

DISTRIBUTION:

REPORT DATE: 23-09-02

INSPECTOR: A COOK