Energy Efficiency Engineering

CORROSION REPAIR AND PROTECTION PRODUCTS

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Executive Summary

Energy Efficiency Engineering is the sole distributor and lincencee of all CMP Fibalite products & Technologies for the region of Thailand.

After having gained extensive experience in the corrosion prevention, CMP Fibalite has developed its own product range.

With this balanced product range CMP Fibalite provides the maintenance market with sustainable solutions to prevent and/or resolve corrosion problems. This contributes to the extension of the life cycle of the plants and pipe fittings. Both in new construction projects (preventive) and existing maintenance projects.

Alucemp is the flagship single system product of CMP Fibalite, and the foundation of all CMP Fibalite systems.

This special corrosion inhibitor, immediately stops the corrosion process when applied, boasting lifetime references of 30 years with only one application (no touch ups).

Alucemp is a versatile corrosion inhibitor that can be applied in a very wide range of environments, with temperature ranges from -40 to 240°C, application temperatures up to 145°C, different volatile chemical environments.

Most importantly as a maintenance product it only requires an St2 surface preparation, this means only hand tools are needed.

This compared to conventional coatings will illuminate the sandblasting process, that is costly, time consuming and includes waste disposal.

Smart Save

Alucemp because of its long lifetime or long protection qualities against corrosion is a Smart Save for the asset owner.

The investment in Alucemp will prolong the asset life lifetime by up to 25-30%.

Besides the increase in reliability of the asset, Alucemp will enhance the safety and reduce breakdown of operational and structural components of the asset.

Cost-Quality Comparison

CMP Fibalite BV will give system guarantee's up to 10 years. This is unheard of in the coating and maintenance business. Most coating manufacturers will only guarantee the shelf life of their product if stored correctly. Normally, the contractor will give an application guarantee of 1-2 years, in most cases.

In the experience of most asset owners, the reapplication or maintenance work due to corrosion is an ongoing process that will require investment on a yearly or biyearly basis.

With the CMP Fibalite products we enable the asset owner to save up to 80% of their ongoing coating maintenance cost with a one stop solution, or one time investment in CMP Fibalite.

Some specific attention is given to very typical corrosion problem areas, and we described the typical solutions using CMP Fibalite Products.

CMP | FIBALITE

Alucemp
Corrosion Inhibitor Epoxy Coating

- Modified epoxy with Aluminium flakes and rust inhibitor.
- Alucemp can be applied on to a surface with hand tools preparation (St2) and on a surface temperature of 145°C.
- Withstand temperature range after curing between -40°C up to 240°C, stopping the process is not necessary during application.
- Alucemp is the ideal solution for corrosion on various metal surfaces.
- Alucemp is a high quality , surface tolerant, modified epoxy with low solvent, aluminium flakes and rust converters.
- Alucemp can be applied on to a surface with a cleanliness according to St2 (hand tools).
- Sandblasting and hot work is not necessary.
- Alucemp can be applied on a surface temperature of 145°C.

Ideal For :

- Pipelines.
- Corrosion Under Insulation (CUI).
- Welding joints and seams.
- Steel structures.
- Chimney and Flare line.
- Storage tanks.
- Hot valves.
- Metal equipment.

Type	Modified Epoxy with Aluminium Flakes
Curing mechanism	Two components Chemical curing
VOC and Solvent	Non-VOC, Low Solvent
System (primer, intermediate, Top)	Single product System (3 layers of Alucemp)
Surface preparation	St2, Minimum
Maximum surface application temperature	3 - 145^{o}C
Max. operational temperature	-40 up to 240^{o}C
Recoatable	After 2 hours
Anchor Pattern (Profile	Not required
Adhesion on steel	9Mpa (on St2 surface)
Lifetime	20-30 years (See reference)

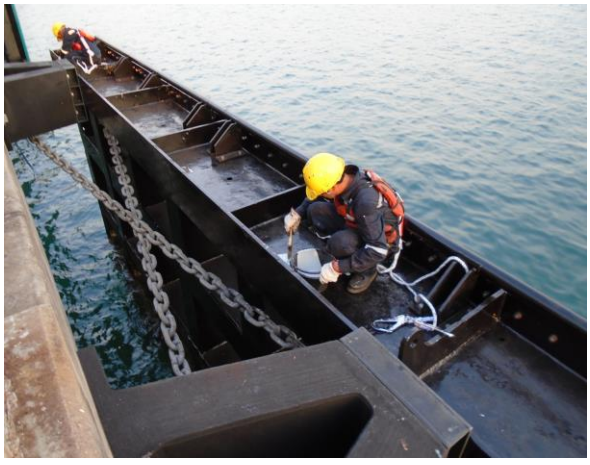
Cempoxit

High Build Epoxy for Splash Zones

- 100 % Solid extra high build epoxy for harsh environment application.
- Cempoxit can be applied on wet and high salt contaminated surfaces or even under seawater.
- Cempoxit is an ideal coating to protect steel and concrete surfaces from harsh environment, salt water, various chemical and abrasion.
- Can be used as single coating system and can be applied on other existing high build epoxy.
- Extra high build epoxy (100% solid content) for harsh environment application.
- Cempoxit can be applied on wet and high salt contaminated surfaces or even under seawater.
- Cempoxit is an ideal coating to protect steel and concrete surface from harsh environment, salt water, chemicals and abrasion.

Ideal For :

- Condensate pipelines.
- Splash zones & **Underwater Coating.**
- Jetty and Offshore.
- Harsh Chemical Environment.



Type	High Build Modified Epoxy
Curing mechanism	Two components Chemical curing
Solid Content	100% - Non Solvent
System (primer, intermediate, Top)	Single product System
Surface preparation	Minimum SP3, Recommend SP10
Dry Film Thickness	350 – 450 μm per layer (minimum 2 layers)
Max. operational temperature	-40 up to 120^{o}C
Application method	apply on wet surface, underwater, high chloride
Adhesion	Good on steel and concrete
Lifetime	10 – 15 years
Resistance	Harsh environment, chemicals, impact abrasion

Fibalite WearPad
Protection at Pipe Supports

- The Fibalite Wearpad is a pre-molded polyester scale and designed to protect a pipe against corrosion and erosion at the position of a pipe support.
- The Fibalite Wearpad is easy to apply in pipe racks and pipe streets with a special designed application tool.
- Application is possible in many industries such as the chemical and petrochemical industry, refineries and tank terminals etc.
- Fibalite Wearpads has standard dimensions.
- Typical for Fibalite Wearpad is the arch width of 150 degrees. **Special dimensions are on request.**

Ideal For :

- Prevention of Corrosion Under Support (CUS).
- Repair of Corrosion Under Support (CUS).
- Pipe racks in;
  - Refineries
  - Petro Chemical Plants
  - Tank farms
  - Power Plants
  - Ships

Chemical Resistance	Good (List available, on request)
Flexural constant (DIN 53457)	6,000 Mpa
Flexural strength (DIN 53452)	200 Mpa
Hardness (Shore D83)	60 ±3 Barcol
Impact resistance	80 kJ/m^2
Porosity (DIN 30670)	At 25kV no puncture
Tg Temperature	200^{o}C
Thickness	Up to 24” – 4.5 mm, 24” onwards 6 mm
Length	280 mm
Width	150° arch width

Fibalite

UV-curing GRP for surface protection

- Impregnated Glass Reinforced Polyester (GRP) sheet , specially suited as repair and protection system on to pipes and tanks surface for above and underground application.
- The Fibalite cures by UV.
- Fibalite is rated as a thick film (membrane) and is standard available on rolls of 10 m x 0.6 m x 1.5 mm.
- Other thicknesses are available on demand.
- Fibalite is, in uncured state, soft and pliable.
- It can be cut in any shape or size or trimmed on all surfaces to be wrapped, rolled or applied in another way.
- When cured it is an exceptionally strong, rot-free and extremely durable material with a heat resistance of 135°C, is impervious to water and resistant to many acids, chemicals, impact, pressure and erosion.

Ideal For :

- Pipeline repair and reinforcement.
- Tank wall or bottom repair.
- Insulated pipe and Insulation protection.
- Underground pipeline protection.
- Protect welding seams protection.

Material	Glass reinforced Polyester (GRP)
Curing mechanism	Ultra Violet light (UV)
Curing time	Within 60 minutes under UV
Tensile Modulus	8 GPa
Flexural Modulus	10.8 GPa
Compressive Modulus	9.03 GPa
Max. operational temperature	90^{o}C
Adhesion on steel	> 10 MPa
Lifetime	> 10 Years

Computane

Two component finishing paint

- A flexible coating which is resistant to UV and environment which makes great protection for final layer of any coating system.
- Excellent weather resistance.
- Very good cleanability.
- Resistance to water, oil, grease, many chemicals, solvents and detergents.
- Impact and abrasion resistant.
- Excellent durability in outdoor use.
- Easy to apply with Brush and/or Roller.
- Also, able to apply using Spray-Gun and/or Airless Spay.

Ideal For :

- Steel structures.
- Pipelines.
- Tanks.
- Railings.
- Walkways.
- Steel decks.
- Top coating for Alucemp.

Type	Two component solvent polyurethane
System (primer, intermediate, top)	Best for using as top coating of Alucemp
Reccomended layer thickness	35-40 μm Dry (is about 75 μm wet)
Colour	RAL Colours and Colours on demand
Appearance	Glossy
Application equipment	Brush, Roller, Spray-Gun, Airless spray
Application temperature	5 - 35^{o}C
Recoatable	After 16 hours (20^{o}C)
Resistance to	UV, water, oil, solvents and many chemicals

Corwrep ONE

Rubber anti corrosion sealant wrap

- Consists out of a special rubber anti-corrosion sealant.
- Coated with a three-layered sheet.
- good performance in anti-corrosion and waterproof.
- Strong and durable adhesion to the rubber sheet and substrate.
- High flexibility
- Good adhesion
- No curing time
- Easy to apply
- Self healing
- Durable
- Environmentally friendly
- Corrosion resistance
- Wide operating temperature range, -40°C to 85°C
- Good adhesion to factory applies pipeline coatings like PE, PP and FBE

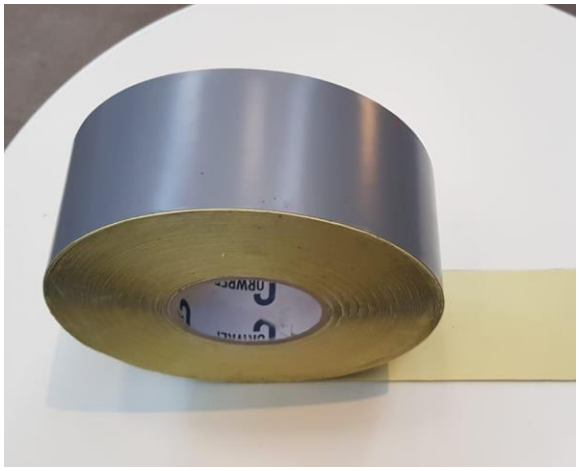
Ideal For :

- Rehabilitation of Pipelines.
- Miscellaneous Steel surfaces
- Girth Weld protection
- Ground outlets.
- Bridges and Steel infrastructure

Physical Properties	Value
Operating temperature	-40^{o}C to 85^{o}C
Tensile strength	≥45 Mpa
Thickness	≥0.8
Polymer characterization	CSM
Peel strength (23^{o}C) to Steel	≥60 N/cm
Peel strength (23^{o}C) to PE	≥60 N/cm
Peel strength (23^{o}C) to Backing	≥60 N/cm
Water permeability (0.3 Mpa, 5 min)	No penetration
Storage Temperature	-10^{o}C - 35^{o}C

Corwrep PVC
UV resistant Flexible lining wrap

- UV-resistant, flexible lining, finished with a rubber adhesive resin.
- Designed as a finish layer in the CORWREP VES or CORWREP VET (viscoelastic) anti corrosion lining system.
- good adhesion to the other surfaces as well as to its own backing.
- Excellent protection of the anti corrosion lining.
- Has excellent resistance to impacts.
- Cold application, no open fire.
- UV resistant.
- Flexible, good pliable.
- Easy to apply.



Ideal For :

- Protection of pipelines above ground.
- Protection of pipelines under ground.
- Protection of pipelines under water.
- Pipelines that are subject to mechanical impacts.

Physical Properties	Value
Application temperature	30°C to 80°C
Dielectric strength	15KV
Elongation	400%
Flame retardant properties	Self Extinghuishing
Maximum service temperature	85°C
Peel adhesion layer to layer	7.5 N/cm
Peel strength to wrapping band	4 N/cm
Thermal aging resistance	Excellent
UV resistance	Excellent
Water absorptivity	0.03%

Corwrep VAL
Three-layer composite wrap

- Three-layer composite technology that is coated with special waterproof adhesive on the sides of the aluminium foil product.
- Designed to protect the surfaces against corrosion, waterproofing, resistant against weather influences and sun light.
- High reflectivity to increase cooling capacity.
- High flexibility.
- Excellent adhesion.
- No curing time.
- Easy to apply.
- Self healing.
- Durable.
- Environmentally friendly.
- Corrosion resistance.
- Excellent UV aging resistance.
- Wide operating temperature range: -30°C to 80°C.
- Good adhesion to factory applied pipeline coatings like PE, PP and FBE.

Ideal For :

- Reflective lining for above ground pipelines.
- Steel substrates om Max. 80°C.
- Rehabilitation of pipelines.
- Miscellaneous steel surfaces.

Physical Properties	Value
Operating temperature	-30°C to 80°C
Tensile strength	≥10 Mpa
Peel strength (23°C) to Steel	≥50 N/cm
Peel strength (23°C) to PE	≥50 N/cm
Peel strength (23°C) to FBE	≥50 N/cm
Peel strength (50°C) to Steel	≥5 N/cm
Peel strength (50°C) to PE	≥5 N/cm
Peel strength (50°C) to FBE	≥5 N/cm
UV resistance	Excellent
Storage Temperature	10°C to 35°C

Corwrep VES / Corwrep VET
Solid Polyolefin coating wrap

- Visco elastic, high tack, self-healing, highly flexible, one single product material, which is suitable for the protection and rehabilitation of pipelines and girth welds.
- Corwrep VES is a lining system which always requires a finishing layer, this finishing could be a Corwrep PVC or Corwrep FLS layer.
- Surface preparation St2 (i.e., wire brush, sandpaper)
- Self-healing
- No curing time.
- Durable
- Extreme high chemical resistance
- Corrosion resistant
- Continuous temperature load of -30°C to 70°C
- Good adhesion to factory applied pipeline coatings like PE, PP and FBE
- < 400 mm width → Corwrep VET
- > 400 – 800 mm width → Corwrep VES

Ideal For :

- Rehabilitation pipes
- Girth weld protection
- Ground outlets
- Miscellaneous steel surfaces
- Piping through embankments

Physical Properties	Value
Operating temperature	-30°C to 70°C
Dielectric strength	20kV/mm
Electrical resistance	≥30kV/mm
Elongation at break	≥200%
Impact resistance	≥15J (with outer wrap)
Interlaminar shear	≥0.05 MPa
Water absorption	≤0.02%
Water Vapour Perm.	0.2 g/m^2/day

Cempgrade

Titanium-rich, solvent free resin

- A two-pack, titanium-rich and solvent-free resin.
- Curing to form an exceptionally hard and chemically inert compound
- Chemical Resistance: Excellent to acids (Sulphuric 10-50%, Nitric 10%, Hydrochloric 10%, Phosphoric 10-40%) and alkalis (Sodium Hydroxide 10-50%) and to other common chemicals (e.g. bleach 5%, ferric chloride). Also very good resistance to salts, petroleum, oils.
- Apply with a knife or spatula, within 30 minutes of mixing.
- Machine, drill, tap or file, as with pure metal, once product has cured.
- Ensure surfaces are clean and free of all loose contaminants, especially oil or grease.
- Supplied in multiple packs of 500g units.

Ideal For:

Repairing, filling or building up

- Metallic surfaces.
- Filling up pitting in (heavily) corroded pipe surfaces.
- Keyways.
- Housings.
- Shafts.
- Rams.

Adhesion to metal	24 N/mm^2
Compressive strength	130 N/mm^2
Curing time to Shore D 70 Hardness	4 hours at 20^{o}C
Curing time to Shore D 89 Hardness	24 hours at 20^{o}C
Density/SG	2.44
Solid Content	100%
Storage Life	3 years
Temperature limits	177^{o}C
Working Life	25 minutes at 20^{o}C

Cempfix
Adhesive for Fibalite WearPads

- Odourless, neutral material free of isocyanates based on MS Polymer.
- Especially engineered for precured Fibalite products.
- When used as adhesive, then performance is excellent for connect different kind of materials especially polyester on epoxy and steel.
- Cempfix is also suitable for sealing joints, connection joints, joints in shipping containers, several other applications in the industry and ship building.
- Cures with atmospheric moisture, fast into a 'rubber' seal, capable to absorb vibration.
- One component
- Long lifetime
- Can withstand high range of temperatures -40°C – 100°C
- Applicable in harsh conditions (tropical environment)
- No UV-influence
- High Flexibility

Ideal For :

- Adhesive for Fibalite Wearpads.
- Adhesive for cured Fibalite.
- Sealant for joints and edges.
- Absorbing temperature shocks and vibrations in pipeline

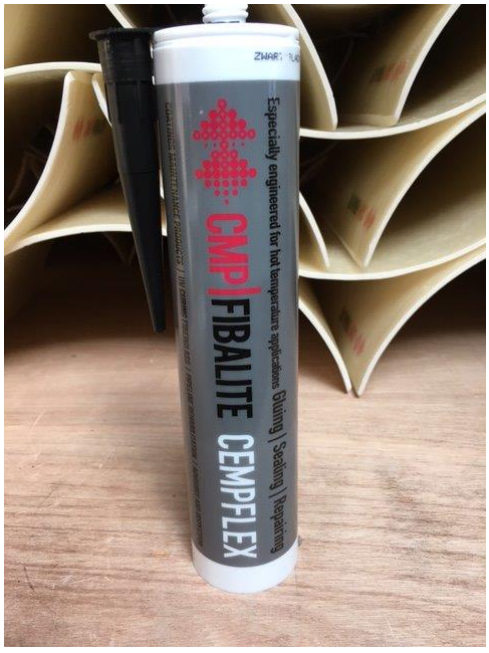
Design Life	15 Years
Elongation (DIN53504)	250%
Fire/toxic hazard	None
Shore-A hardness (3-s)	65
Storage Life	15 months (in normal conditions)
Temperature resistance	-40°C – 100°C (after curing)
Tensile strength (DIN53504)	2.9 MPa
Shear strength	2.7 MPa
Initial Tack (direct after application)	400 kg/m^2
Curing Time	24 hrs at 23°C
Application Temperature	+5°C - +40°C
Storage Temperature	+5°C - +25°C

Cempflex
Silicon Sealant

- Cempflex is an acid-containing, heat-resistant silicone sealant which cures under the influence of humidity to a permanent elastic rubber.
- Cempflex can seal at a high temperature (300°C) and can be used as a repair agent for conveyor belts, rubber belts, hoses.
- Application temperature from + 5°C to + 40°C.
- To be applied on dry, clean, grease- and dust-free surfaces.
- Surfaces/substrates must be cleaned of loose particles.
- Greasy and/or contaminated surfaces requires proper degreasing/cleaning with Cempclean.

Ideal For :

- Suitable as a heat resistant gasket for sealing engine and machine parts, drains, pumps, thermostats, hot plates and oven parts.
- Heat-resistant joint sealing in construction and industry, especially for joints that are subject to high temperatures and can absorb movement and vibrations.
- Flange Protection.



Material	Heat resistant Acetic acid curing silicone
Curing through (24 hours)	2mm
Max. movement capacity	25%
Elongation at break	400%
Hardness, Shore A	29
Tensile Strength	2.10 MPa
Modulus, 100%	0.50 MPa
Application Temperature	5 to 40^{o}C
Temperature resistance after curing	-60 to +300^{o}C

Structural Coating Protect & Repair

Challenge

- Steel structure damages from corrosion caused by humidity, corrosive chemicals and harsh environment which could lead to undesirable loss to assets.

EEE's Solution:

- Prepare surface with hand tools to St2 standard.
- No hot work and blasting required.
  Apply minimum 2 layers of Alucemp to stop and prevent corrosion.
- Apply Cemputane as finish coat for dry area.
- Apply Cempoxit as finish coat for splash and damp area.
- Full protection for your assets from further corrosion for the next decade.

Benefits:

- No hot work and blasting required.
- Can be done without stopping process.
- No corrosion anymore.
- Very easy to apply.
- Fibalite is much stronger than the traditional cladding.
- Faster to apply than conventional systems.




Corrosion Under Insulation (CUI)

Challenge:
Corrosion under insulation of insulated pipes and tanks caused by deterioration of insulation jacket and condensation.

EEE's Solution:
- Prepare surface with hand tools to St2 standard.
- Apply minimum 2 layers of Alucemp to stop and prevent corrosion.
- Fill up metal loss pitting with Cempgrade.
- Apply new insulation.
- Wrap over with Fibalite to seal off air and moisture.

Benefits:
- No hot work and blasting required.
- Can be done without stopping process.
- No corrosion anymore.
- Very easy to apply.
- Fibalite is much stronger than the traditional cladding systems.
- Faster to apply than conventional systems.

Corrosion Under Support (CUS)

Challenge:
Corrosion at contact point of pipe and support (Corrosion Under Support - CUS) which caused by accumulated water and pipe movement.

EEE's Solution:
- Lift pipe up 4 cm and clean surface with hand tools to St2 standard.
- No hot work required.
- Apply minimum 2 layers of Alucemp to stop and prevent corrosion.
- Apply Cempfix adhesive on Fibalite Wearpad.
- Installation of Wearpad without stopping process.

Benefits:
- No direct contact between pipe and support.
- No mechanical damage.
- No corrosion anymore.
- Reduce risks of leakages and explosions.
- very easy to apply.
- Full protection for pipe and support for over 10 years.

Pipeline Repair

Challenge:
Metal loss causes by corrosion and/or erosion which could lead to leaking.

EEE's Solution:
- Prepare surface with hand tools to St2 standard.
- Apply minimum 2 layers of Alucemp to stop and prevent corrosion.
- Fill up metal loss pitting with Cempgrade.
- Apply Fibagel as primer adhesive.
- Repair and reinforce with Fibalite Wrap.
- Suitable for metal loss up to 99%.

Benefits:
- No hot work and blasting required.
- No stops during application.
- No corrosion anymore.
- Reduce risks of leakages and explosions.
- very easy to apply.
- Suitable for metal loss up to 99%.

Underground / Soil-to-Air protection

Challenge:
Corrosion caused by moisture and chemical in underground soil with pressure which is difficult to inspect and could lead to serious damage in the future.

EEE's Solution:
- Prepare surface with hand tools to St2 standard.
- No hot work and blasting required.
- Apply minimum 2 layers of Alucemp to stop and prevent corrosion.
- Fill up metal loss pitting with Cempgrade.
- Apply Fibagel as primer adhesive.
- Repair and reinforce with Fibalite.
- Can be applied for pipeline, steel pile, directional drill, soil-to-air area.

Benefits:
- No hot work and blasting required.
- No stops during application.
- No corrosion anymore.
- Reduce risks of leakages and explosions.
- very easy to apply.
- Suitable for metal loss up to 99%.




Tank wall and bottom repair

Challenge:
Damages on tank wall and bottom from chemicals, moisture and environment.

EEE's Solution:
- Prepare surface with hand tools to St2 standard.
- Apply minimum 2 layers of Alucemp to stop and prevent corrosion.
- Apply Fibagel as primer adhesive.
- Repair and reinforce with Fibalite.

Benefits:
- No hot work and blasting required.
- No corrosion anymore.
- very easy to apply.
- faster to apply than conventional systems.
- Ideal to repair and prevent Corrosion Under Insulation.
- Fibalite is much stronger than the traditional cladding systems.
- faster to apply than conventional systems.

Flange Protection

Challenge:
Corrosion between flange gaps and crevices which is difficult to maintain.

EEE's Solution:
- Prepare surface with hand tools to St2 standard.
- Remove any weld splatter, weld slag, sharp edges, burrs, snarls, and any other sharp surface discontinuities prior to application of the primer layer.
- In salty environments, remove salt and dirt with high pressure water cleaning equipment.
- Degrease and remove the last dust particles from flange gap with CMP Fibalite Cempclean.
- Apply minimum 2 layers of Alucemp to stop and prevent corrosion.
- Inject High Temp Sealant "Cempflex" to fill the flange gap.
- Install Flange Wearpad for support protection, if necessary.

Benefits:
- No hot work and blasting required.
- No corrosion anymore.
- No dismantling of the flange connection required.
- faster to apply than conventional systems.
- Durable elastic sealing.
- Prevents further water/moisture ingress.

Splash Zone Protection

Challenge:
Corrosion caused by marine environment and mechanical damages from impacts.

EEE's Solution:
- Remove loosen old coating and barnacles (St3 standard).
- Apply minimum 2 layers of Cempoxit to stop and prevent corrosion.
- Wrap with Fibawrep for mechanical impact protection from floating objects and waves.

Benefits:
- Can be applied on Splash area's and Tifal Area's.
- Can be applied underwater.
- Creating a cofferdam is not required.
- No hot work and blasting required.
- Easy to apply using a brush.
- Durable.
- Suitable for application at 100% Relative Humidity.
- Overall, more efficient and cheaper than alternative systems/methods.