C-Ling®
Comprehensive Corrosion Prevention
Retrofitted sealing solutions for offshore wind turbines & other infrastructure

www.cwind.global
www.advancedinsulation.com

Advanced Sealing Technology
Driving Innovation Through Collaboration

Advanced Insulation and CWind have collaborated to provide C-Ling®, a retrofit corrosion prevention solution that successfully addresses the growing problem of failed cable entry points on offshore structures.

Advanced Insulation and CWind

C-Ling® was established in response to the growing requirements for corrosion prevention in the offshore wind industry. Combining extensive experience in offshore materials science and offshore wind O&M, C-Ling® gives asset owners a full engineering, production and installation solution for one of the biggest challenges the industry faces. Only C-Ling® allows operators to return assets to their original design intent.

C-Ling® is unique in that it enables asset owners and operators to quickly and effectively prevent corrosion, without the need for major offshore operations, costly vessel spreads or cable disconnection.

The C-Ling® solution has been designed with industry consultation to minimise the impact of unplanned corrosion.

Advanced Insulation are able to evaluate and model the levels of corrosion before assessing the future impact on structures, cables and life of field potential.

Utilising world leading chemistry, Advanced Insulation has developed and formulated the most effective and cost effective solution to minimise all associated risks.

CWind has a wealth offshore wind experience and the capability to install and monitor systems to immediately restore corrosion prevention functionality to assets, protecting them from further damage and reducing risk.

The collaboration brings together two industry experts to combat one of the biggest challenges the industry faces.

Andrew Bennion, Managing Director of Advanced Insulation, commented: “An opportunity to partner our ten years of expertise in material sciences with that of CWind, a leading asset management provider, presented itself in 2017.

“By joining forces with one of the market leaders in offshore engineering, installation and maintenance, we have significantly enhanced the product offering and can now identify, solve corrosion issues on offshore wind farms by installing C-Ling® in the most efficient plausible manner.”

Ian Bryan, Director of Corporate Development at Global Marine Group, commented: “At CWind, we see issues arising from corrosion in our offshore wind industry on a daily basis. Through this partnership we have created a unique offering giving asset owners peace of mind.”

Find out more about C-Ling® at: www.advancedinsulation.com
Advanced Insulation

Better products for challenging situations

The company’s products are qualified and utilised in a range of industries including oil and gas (offshore and onshore), LNG, industrial process plants, power, marine, nuclear and offshore wind.

Advanced Insulation offer a wide range of products designed, engineered and manufactured to enhance the safety and efficiency of clients’ operations worldwide.

Its senior management recognises that research and development, continuous improvement and innovation are key to the company’s growth.

As an extension of this ethos, Advanced Insulation invests 10% of its yearly revenue in research and development programs.

Advanced Insulation is a global supplier of Insulation, Passive Fire Protection (PFP), Composite Blast Walls, Cryogenic Spill Protection (CSP), Buoyancy and Cable Protection Systems

Power cable & asset management

With experience at over 40 offshore wind farms, CWind offer power cable and asset management supporting the offshore renewables industry during the construction phase and throughout the O&M life-cycle.

As part of the Global Marine Group, CWind have installed 857 inter array cables and completed 891 cable pull ins at sites right across Europe.

Find out more about C-Ling® at: www.advancedinsulation.com
Comprehensive Corrosion Prevention

Utilising the combination of corrosion prevention and offshore wind experience, C-Ling®, from Advanced Insulation & CWind, is redefining how the industry thinks about and deals with the challenge of corrosion.

C-Ling® Systems are designed, engineered and manufactured by Advanced Insulation and installed by CWind

C-Ling® utilises an innovative sealing interface, tolerant to manufacturing inconsistencies, marine growth, foreign objects and the ever changing subsea environment. C-Ling® provides a perfect hermetic seal, creating an oxygen depleted environment, inhibiting corrosion and reducing O&M costs to zero.

Utilising over 20 years of chemical and materials science, Advanced Insulation is able to substantiate the performance of the C-Ling system through rigorous testing at its state of the art laboratory and test facilities.

Once in situ, the material developed expands isotropically allowing it to fully seal, even where discontinuities, biofouling, sediments or joint movement exist.

The system is equipped with a samarium cobalt interface which provides up to 1 Te of initial force securing the system in place. On in situ, the unique hydrophilic material developed by Advanced Insulation expands isotopically fully sealing the foundation even where discontinuities, biofouling, sediments, foreign objects or joint movement exist.

Once sealed, the internal water column is increased beyond the highest astronomical tide, ensuring a positive pressure head is locks the system in place for the life of the project.”

Delivering Value

+ C-Ling® is the world’s only solution that allows operators to reseal foundations – reinstating the original design intent and extending life of assets
+ C-Ling® is quickly and easily installed over failed seals
+ C-Ling® is installed from the LWP, without additional HSE restrictions or work practices or costly offshore support vessels
+ Adaptable applications for all scenarios
+ Self-healing systems, meaning marine growth and manufacturing tolerances are no issue
+ Fast, safe and cost-effective installation, without the need for divers or disconnection of cables
+ A dedicated Engineering Team to design, test, endorse and guarantee each system

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Find out more about C-Ling® at: www.advancedinsulation.com
Applications and Installation

Sealing failures lead to irreversible corrosion damage internally within an asset weakening structural integrity. The proven C-Ling® design allows operators to extend the design life of failing assets.

C-Ling® Systems: Installed by CWind

CWind is part of the Global Marine Group and delivers asset management and power cable services topside and subsea, to the offshore renewables and utilities market.

With experience at over 40 offshore wind farms, CWind is known as a trusted partner for O&M operations improving the operational performance of offshore assets as well as a reliable power cable installation and repair provider.

C-Ling® Applications

C-Ling® is engineered to be used with:

+ J-Tubes
+ Monopiles
+ Floating foundations

Further applications include retrofitting to failed TP, grout seals and various topside gland seals.

C-Ling® is installed by CWind

CWind has a dedicated team of trained technicians, as well as one of the most fuel efficient fleets of crew transfer vessels (CTV) in the industry.

In addition to this, the company has its own in-house training facility, the National Wind Farm Training Centre (NWFTC), providing a comprehensive range of GWO accredited courses which ensures all the team are fully equipped to deal with the challenges of working offshore.

Installation

All C-Ling® systems are designed to be completely diverless. They can be installed from the lower working platform without the requirement to disconnect cables.

C-Ling® offers significant cost savings on installation, O&M and monitoring compared to all alternative re-mediation options.

All operations can be performed from the lower working platform with a three-man crew working from a CTV.

<table>
<thead>
<tr>
<th>No risk of damage to assets</th>
<th>No removal of or damage to cables, or heavy lifting</th>
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<tbody>
<tr>
<td>500x more efficient</td>
<td>On installation time and maintenance</td>
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<tr>
<td>Three man crew</td>
<td>Enabling multiple assets to be completed in a day</td>
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<tr>
<td>Fit and Forget</td>
<td>No electricity costs and minimal associated O&amp;M</td>
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Background of Re-mediation Efforts

Significant internal corrosion has been observed at several sites worldwide, triggering an industry-wide effort to remedy these failures.

Historically, offshore wind assets were protected from internal corrosion by way of a sealed environment. This was typically achieved using radially compressive seals at the cable entry aperture.

Unfortunately, this design was poorly understood and executed, leading to catastrophic failure of the sealing interface. This allowed the free exchange of oxygen and water in the internal water column.

Typically, re-mediation efforts have been limited to two options:

**GCP**
Galvanic Cathodic Protection
Via retrofit anodes

**ICCP**
Impressed Current Cathodic Protection
Commonly known as ICCP

These efforts have had limited success and in many cases, have exacerbated the situation; accelerating corrosion and creating a toxic internal environment.

Furthermore, the commissioning, monitoring and maintenance expense associated with these systems is a significant unplanned cost – running into the tens of millions of pounds.

Advanced Insulation believed there had to be a better, safer and more reliable and cost-effective solution so worked with industry leading experts to develop C-Ling®.
How Does C-Ling® Solve The Problem?

Retrofit Application

C-Ling® is the world’s first and only system that allows operators to reliably re-seal assets. The system has been designed to be retrofit around existing failed seals, providing a de-oxygenated internal environment as per the original design intent.

C-Ling® systems can be expertly installed by CWind crews requiring minimum intervention and without risk to cables, foundation or personnel. Engineered to be installed from the lower working platform the system is quickly and easily installed and positioned in place using cerelium cobalt interface, providing up to one tonne of pulling force.

Advanced Insulation’s unique hydrophilic material will then activate to engulf any marine growth, manufacturing tolerances or foreign objects which may be present, ensuring a perfect hermetic seal. The internal hydrostatic pressure is then increased providing, locking the C-Ling® system into place.

Hydrophilic Seal

C-Ling utilises unique hydrophilic technology developed by Advanced Insulation to ensure the system is suitable for all installation challenges.

The hydrophilic material can swell up to 1500% the size of its original volume to ensure any potential obstacles are engulfed and all leak paths are closed.

The hydrophilic compound has been engineered by Advanced Insulation to work from pH1 to pH14 and in any envisaged salinity.

Providing a secondary level of protection and additional assurance that the system will remain sealed throughout its project life.

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