Corrosion Management of Pin-Piles

Challenges for Offshore Wind

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Pin Piles: Oil & Gas vs Offshore Wind

Oil & Gas	Offshore Wind
Jacket typically installed before piles	Piles typically installed 1-2 years before jacket
Single structure Around 4 – 20 piles	Many (100+) structures 3 or 4 piles per jacket 400+ piles
Higher consequences of structural failure	Lower consequences of structural failure

[1] Adapted from ISO 24656:2022

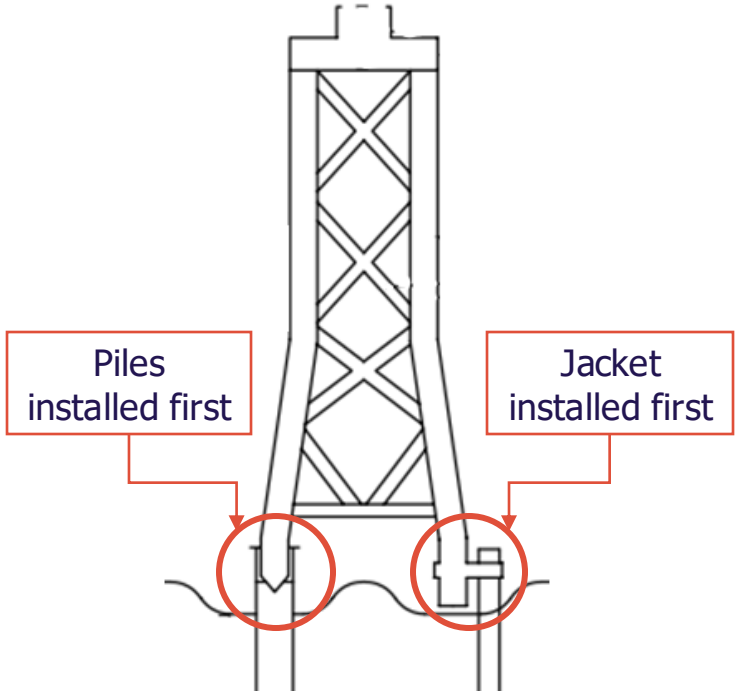


Illustration of wind turbine jacket with two pile options [1]

Risks

Seawater Corrosion

Microbially Influenced Corrosion (MIC)

Wall Thinning

Deep Pit Formation

Stress Concentration

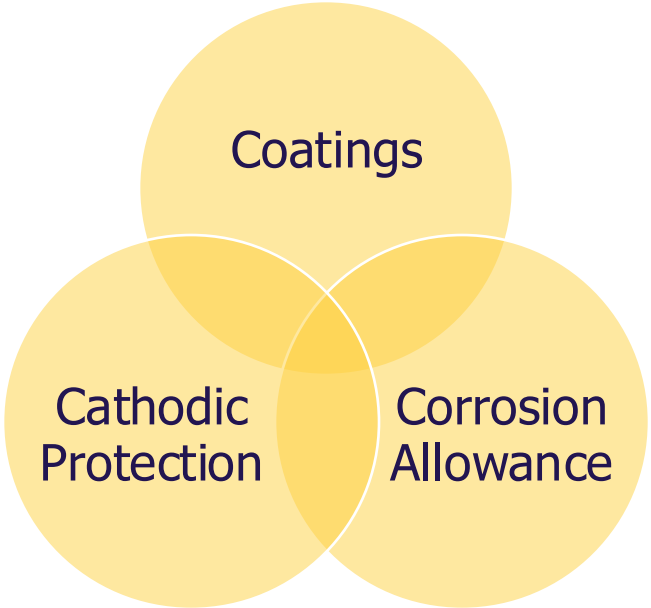
Structural Failure

Injury or Loss of Life

Environmental Damage

Financial Damage

Mitigations



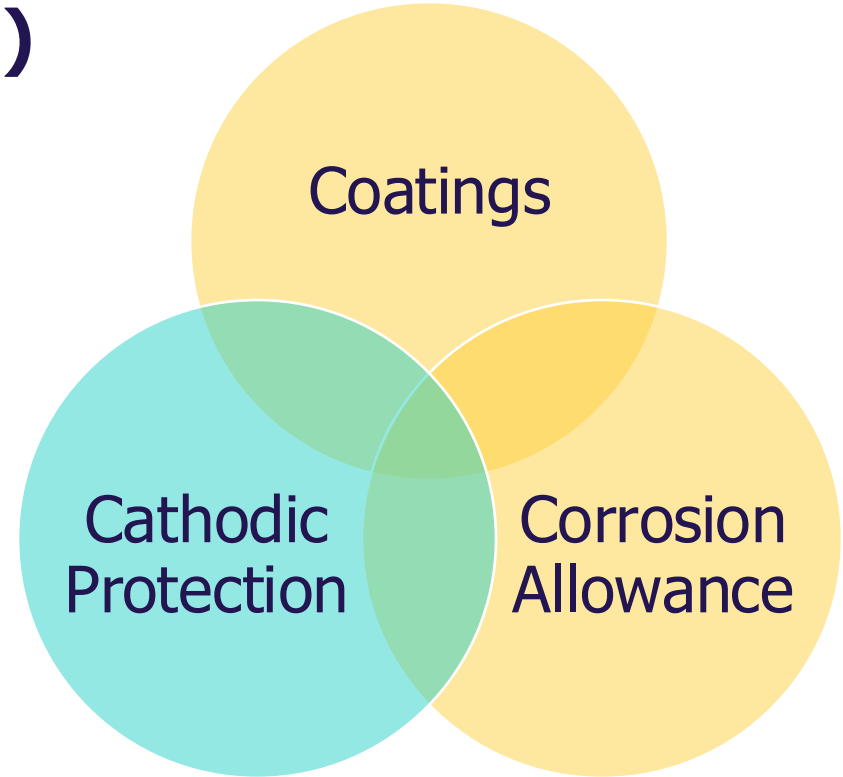
Cathodic Protection (CP)

Benefits

- Mitigates seawater corrosion and MIC (DNV-RP-0416 and ISO 24656).
- Long lifetimes aligned to 30 – 35 wind farm operation.

Challenges

- Only effective once jacket installed (1-2 years after pile installation)
- Temporary CP complex, costly and must withstand piling operations.
- In period without CP, MIC may lead to rapid formation of deep pits.
- Electrical connectivity to jacket requires attention in design and confirmatory survey.



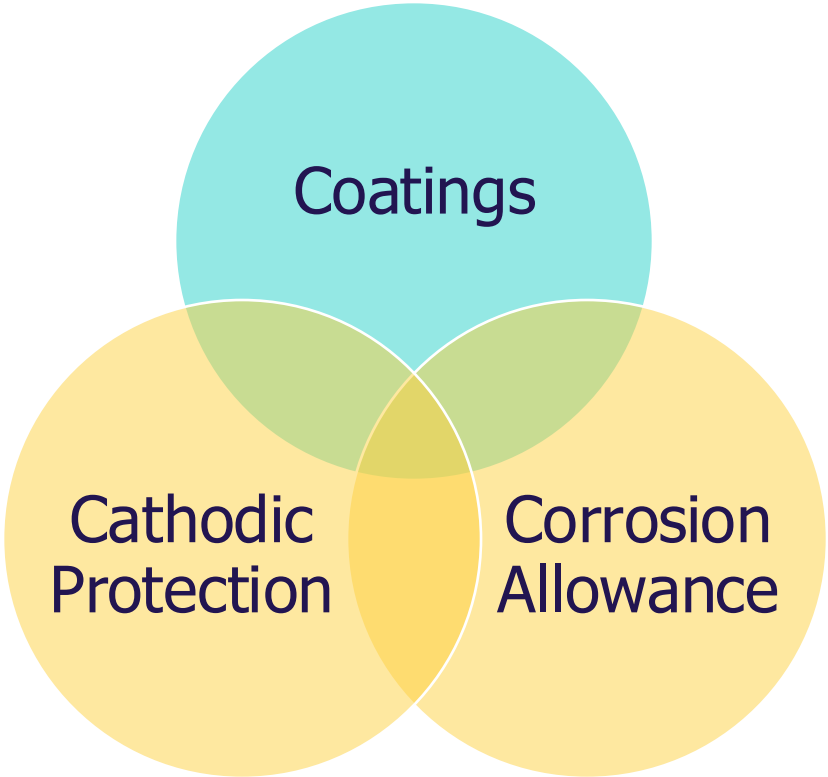
Coatings

Benefits

- Barrier protection against MIC (as per best practice in DNV-RP-0146).
- Effective immediately upon pile installation.
- Choice of durability including sacrificial coatings for temporary protection.

Challenges

- May be damaged during installation without practicable option for inspection and repair.
- Some coating damage assumed in CP design – but localised MIC in exposed area is a residual risk.
- Physical properties may affect pile-driving and grouting operations.
- Additional fabrication cost and complexity.



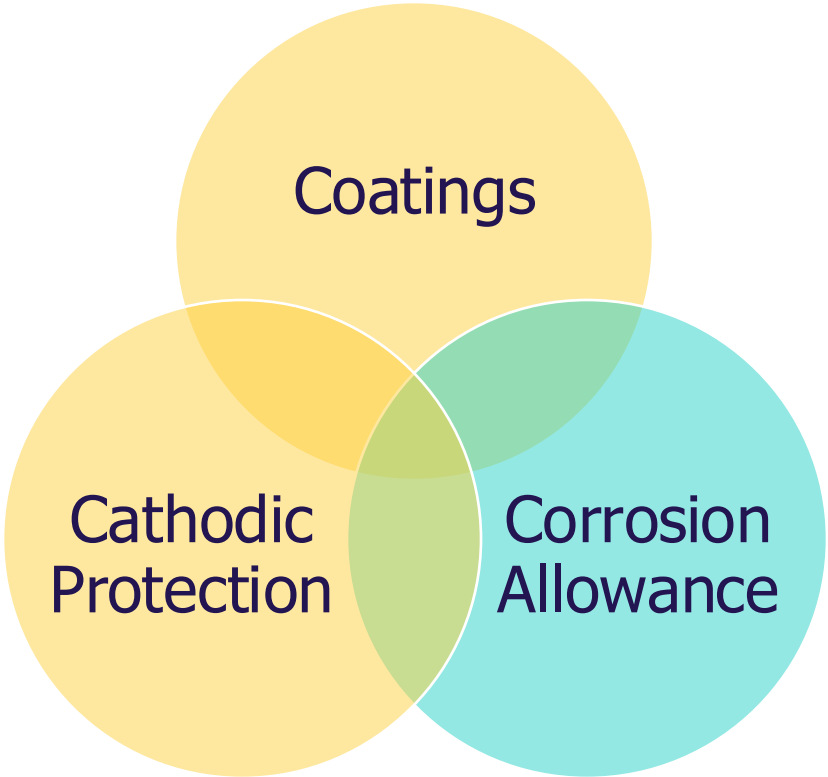
Corrosion Allowance

Benefits

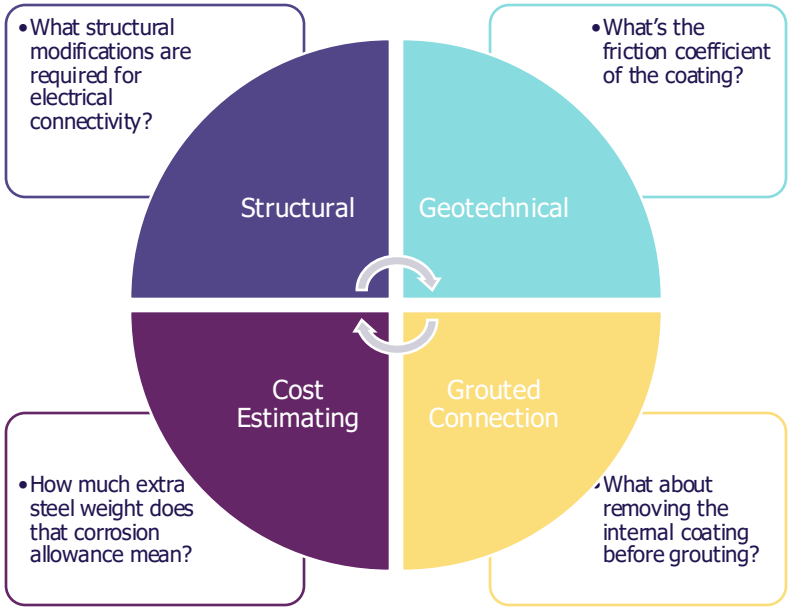
- Mitigates effect of wall thinning prior to jacket installation.
- Effective immediately upon pile installation.
- Simplest corrosion control measure.

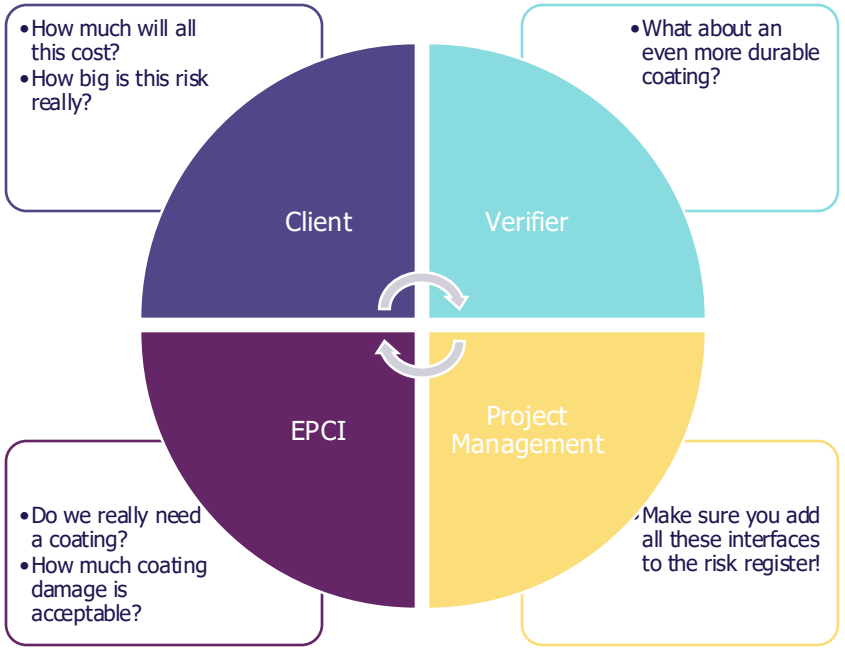
Challenges

- Results in larger and thicker piles, increasing costs.
- Does not mitigate effect of high stress concentration factor around deep pits (resulting from MIC).



Corrosion Engineering is Not the Whole Story…





What is the Answer?

Year	0-2	2-37+
Structures Installed	Piles Only	Piles + Jacket
Primary Mitigation	Coatings	Cathodic Protection
Other Mitigations	Corrosion Allowance	Coatings

For designers, operational data is essential for reducing uncertainty and delivering value.

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