Abrasion Resistant Coatings for Ice Class Vessels
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Abrasion Resistant Coatings for Ice Class Vessels

Background

The Challenge of Ice

Coatings Performance Requirements

Typical Coating Specifications

Case Histories
Background

Although there has been a lot of recent attention regarding Arctic trading routes opening up and the effect on the shipping industry, the challenges of operating ships in ice conditions and the engineering required to do so safely has been known for a long time.
The Challenge of Ice

Ice damage to conventional coating resulting in corrosion
Coatings Performance Requirements

- Abrasion Resistance
- Corrosion Resistance
- Fouling Protection
- Performance at -50°C
- Impact Resistance
- High Film Build
- Low Frictional Resistance
- Smoothness
- Flexibility
- Resistance to Ice Adhesion
- Class Certification
- Shipyard application
Mechanical Properties

Various test methods are available to measure impact resistance, abrasion resistance, tensile strength and elongation of coatings.
Corrosion Resistance

Coatings also need to provide corrosion resistance during permanent sea water immersion and compatibility with cathodic protection systems.
Coating Chemistry

- The primary characteristics of mechanical properties and corrosion resistance are derived from the polymer system.

- High build, high solids content two component epoxy/amine systems preferred. Formulated to create a hard, impact and abrasion resistant film, but without becoming too brittle at low temperatures.

- Excellent adhesion to steel is characteristic of these systems.
Other requirements

Average Hull Roughness and Coefficient of Friction

Coating Performance Requirements
Class Recognition

Depending on Class Society and Ice Classification, use of a Recognized Abrasion Resistant coating may enable a reduction in scantling thickness.
Typical Coating Specifications

Factors to consider:

- Trading in first year or multi year ice?
- Classification society requirements with respect to specific ice class
- Ice class coating for ice belt only or full underwater hull?
- Use of antifouling system over ice coating?
  - Likely trading pattern?
  - Regional Legislation with respect to invasive species requiring antifouling systems
Antifouling or not?

Vessel without antifouling after 4 weeks stationary at quayside
Example Coating Specification

Steel preparation: Remove weld spatter and grind sharp edges and uneven welds


Coating scheme:
1 x 500μ dft Intershield 163 Inerta 160

Optional antifouling scheme:
1 x 75μ Intergard 263
Antifouling paint as specified
Application at Newbuilding
Case Histories – Ice Trial

SCF Yamal – Russian Arc7 class Ice breaking LNG carrier
In dock condition after ice trial

Intershield 163 Inerta 160
ice class coating

Antifouling applied over
abrasion resistant coating – fouling
control during newbuild fitting out
Yamal LNG – video clip

https://www.youtube.com/watch?v=HMSelzstcco
MV Monchegorsk

Russian Arc 7 class Container/Ore carrier – Murmansk/ Arkhangelsk/ Dudinka to N.Europe and N.Asia
MV Monchegorsk – 7 years in service
Timofey Guzhenko (2 years)
CCGS Henry Larsen

Pierre Radison Class icebreaker
Arctic Class 4
CCGS Henry Larsen – 2 years service
CCGS Louis St. Laurent

11,345 GT icebreaker

Arctic Class 4.
STQ Ferry

Approx 3 m ice belt with ice class coating
Summary

- Environmental changes are leading to increasing interest in shipping traversing Arctic waters

- Vessels trading through ice require special coatings that can resist ice damage in order to protect the hull from corrosion

- Fortunately, for over 30 years specialized coatings have been available with demonstrated excellent performance on ice trading vessels, including ice breakers, operating in Baltic, Canadian Arctic and Russian Arctic conditions.