LABORATORY ACTIVITIES RELATED TO MARINE CORROSION: SEARCH FOR DAMAGES CAUSES

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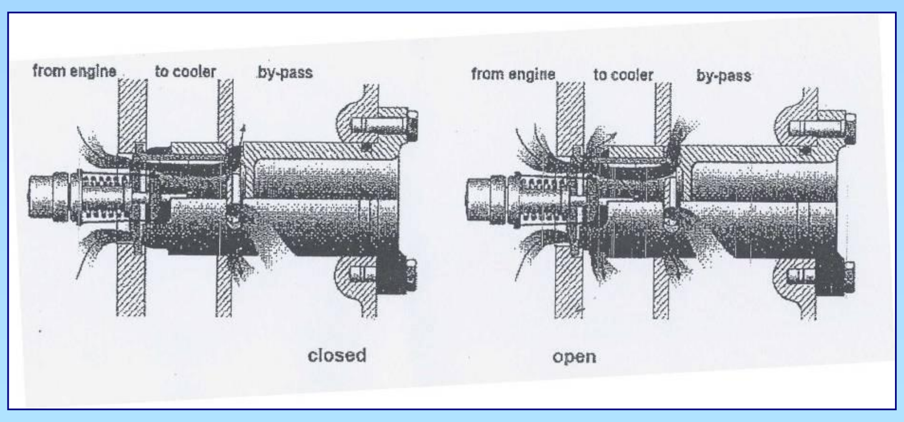
Galvanic corrosion / Erosion

Apparatus: Aluminium alloy items related to cooling system main engine.

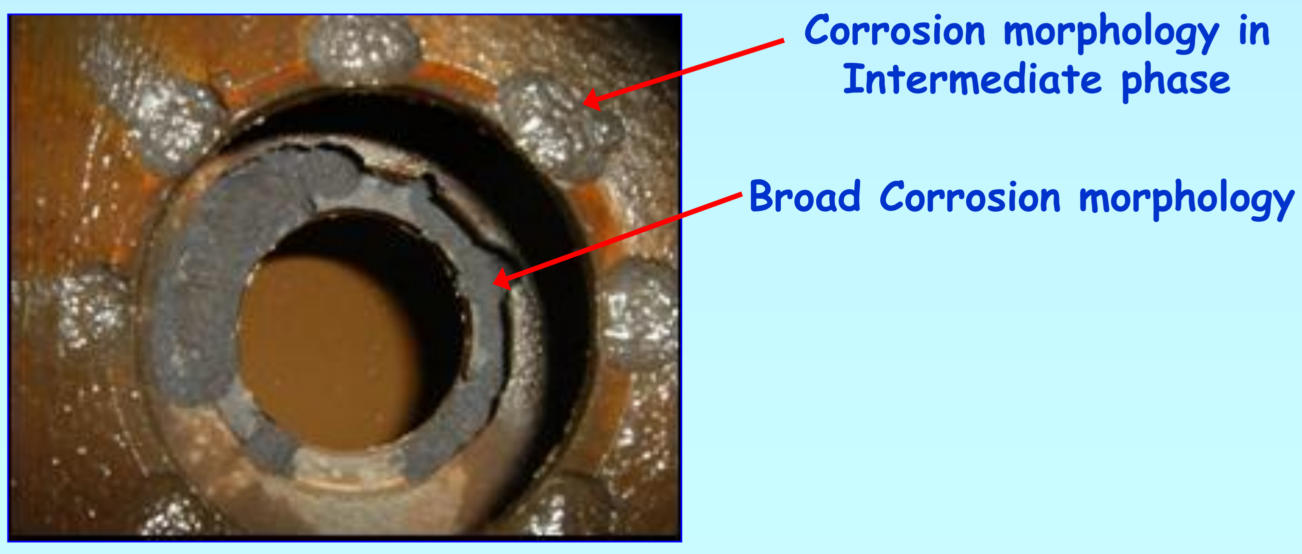


Thermostatic valves circulation fluid schemes (sketches)

Materials:

- pump cover: aluminium alloy GAlSi10Mg (ENAC 43100)
- thermostatic valves: copper alloy GCuSn5Zn5

Damage: Corrosion developed on pump cover of aluminium alloy in correspondence to thermostatic valves



FAILURES CAUSE: Corrosion erosion mechanism

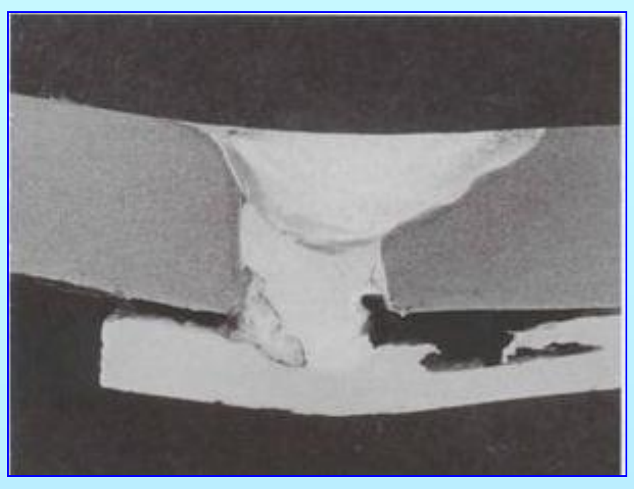
Contact between two materials which the redox potential are located to the extreme of oxidation potential scale.

Crevice corrosion - Screen conditions

Apparatus: Aluminium alloy hull

Material: the hull has been declared to be in AlMg ASTM B 209 type 5083

Damage: a water leakage from the drift has been observed. The subsequent inspection showed a completely flooded area, covered by deposits and the welded joints completely corroded.



Macrographic examination:

Crateriform morphology typical of a crevice corrosion located in correspondence of the interstice present at root of the welded joint between the weld metal and the backing strip material.

The macrographic examination (on a transverse section) after etching permitted to observe a significant asymmetry of the joint.

FAILURES CAUSES: Crevice Corrosion

-Low oxygenation conditions

-The sea water inlet in the drift, combined to the low oxygenation of the closed environment, has generated very aggressive conditions.

-The greater localization of the corrosion on the joints was imputable to the presence of narrow fissures and to the thermal conditions due to welding process which make the material most vulnerable to the oxidation trigger.

Microbiology Influenced Corrosion (MIC)

Apparatus: Propeller shafts in age hardening stainless steel S17400 Type 630.

Conditions: The vessels were partially embedded in the mud have been covered by mud, due to a river flood.

FAILURES CAUSE:

Crevice Corrosion/MIC

Some bacteria which use iron in their food cycle (sulphate reducing bacteria) find in the mud the ideal conditions for their development.

In this case, the observed colour variation are compatible with the proposed mechanism

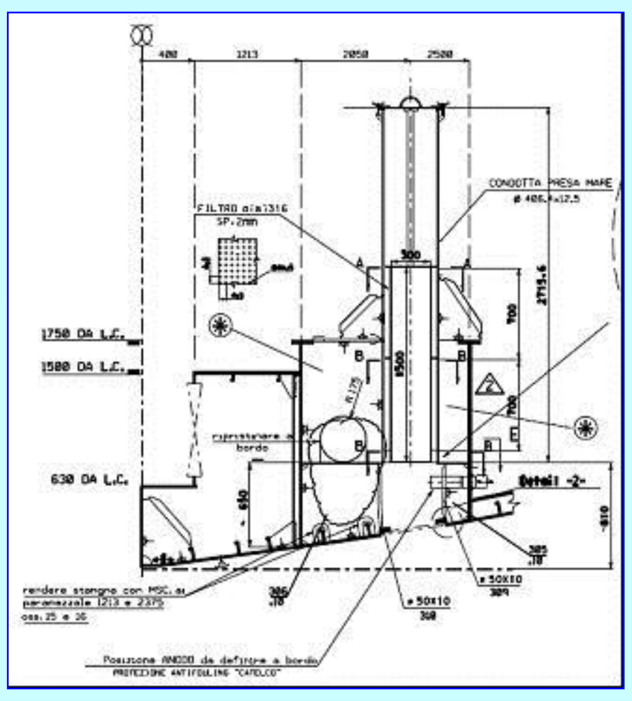
Multiple corrosive phenomena effects

Apparatus: Cooling sea water intake with removable filter

Materials:

-Pipe: carbon steel S355J2H (UNI EN 10210-1)

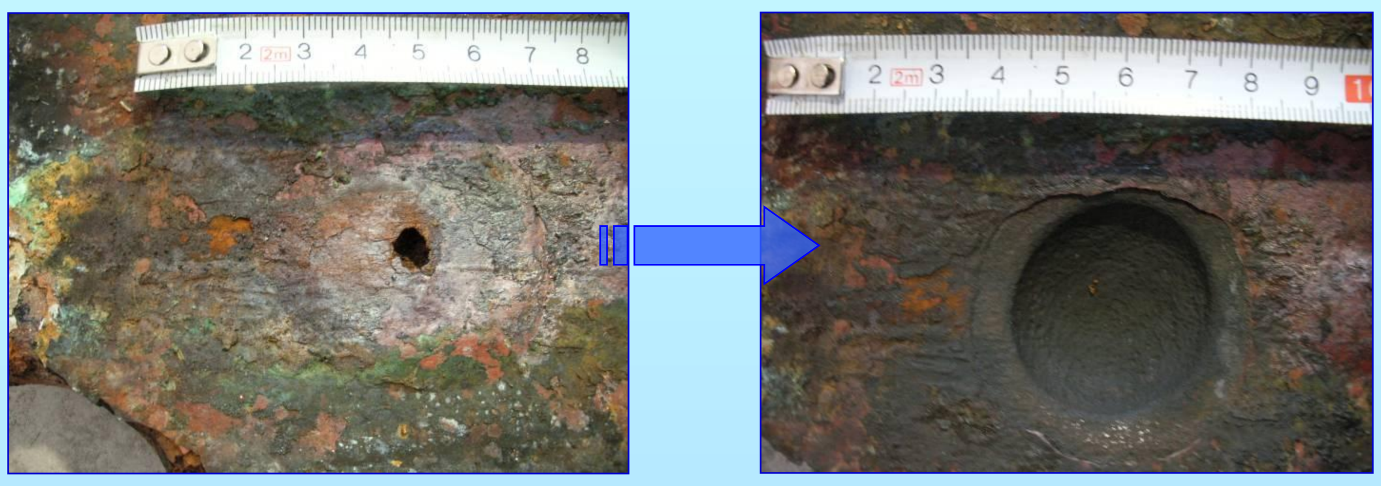
-Piping: copper-nickel alloy separated from the pipe by an austenitic stainless steel AISI 316L hub



Conditions:

- Antifouling protection of cooling line: Cathelco system which dissolves Cu ions at controlled rate
- Cathodic protection of Cu-Ni alloy with iron anodes inside the pipes

Damage: The carbon steel pipe was covered by deposits and seaweed: after the removal of the paint film, multiple pitting corrosions and craters have been revealed.



Electric Potential Difference Measures:

Full protection for aerobic conditions (EN 12473 – 2000).

FAILURES CAUSES:

-Stagnant conditions (possibility of anaerobic conditions)

-Anti-fouling not able for full protection in anaerobic conditions (-900 mV, EN 13473)

-The extensions of oxides and deposits on anodes surfaces was a minimizing factor for cathodic system efficiency

-Poor protection of the steel surface (poor paint film)

-Wide cathodic area (filter in stainless steel) stimulate the increase of corrosion rate in the anodic areas developed in the paint film lacunas.

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