



COMPAREPAIRS

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Repairs and
Reinforcements with
Composite Materials

**Technology Overview and
Application Cases**

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Use of COMPA Repairs

- Leakage prevention (tightness restoration)
- Prevention of further corrosion development
- Strength reinforcement
- Reduction of crack growth
- Durability



Solution for corroded and cracked ship structures

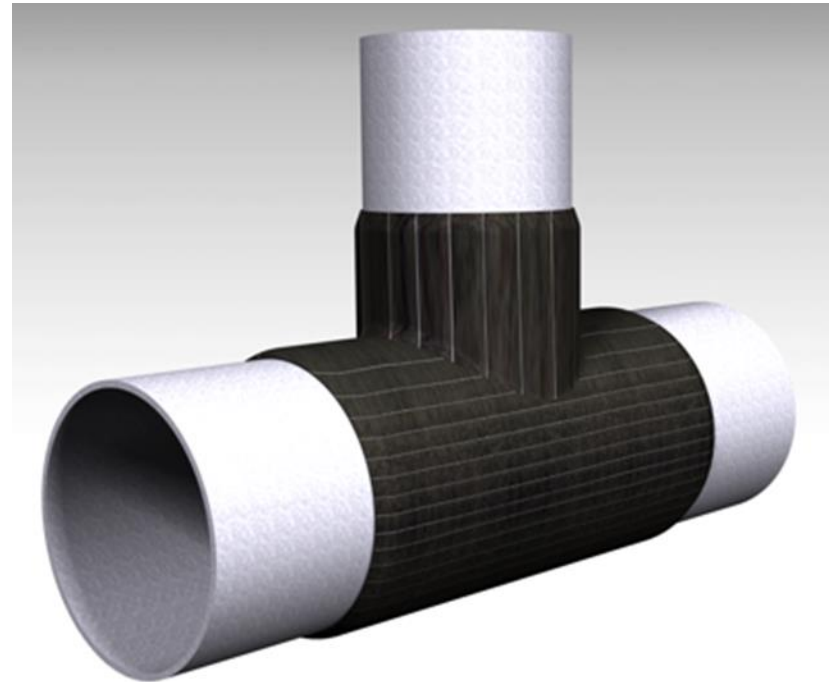
- Problems of corrosion and cracks on ships occur frequently
- Affecting different systems and structures: pipes, valves, decks, tanks...



COMPA Repairs

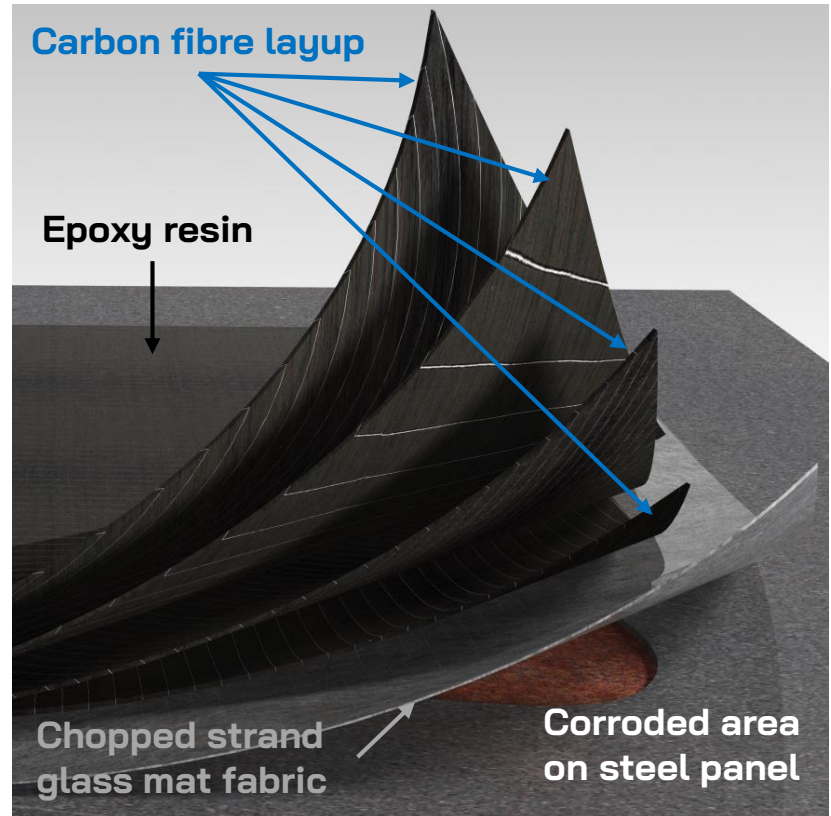
Composite repair technology

- Fast and reliable
- No hot works involved
- Done during port time or during voyage
- Applicable for complex shapes and structures
- Low added weight



COMPA Repairs technology

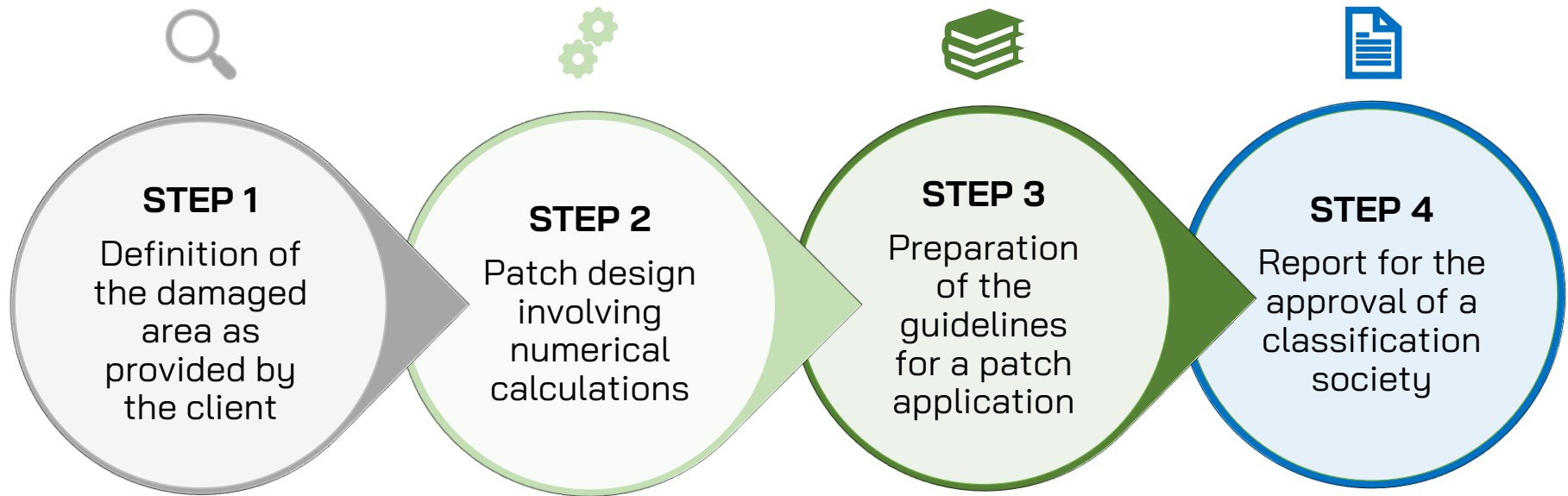
- Lamination of carbon and glass fibres reinforced by epoxy resin onto metal surface.
- Epoxy resin hardens and permanently bonds the fibres to the metal, resulting in a new layer of watertight and hard (strong) material.



Composition of COMPA repair

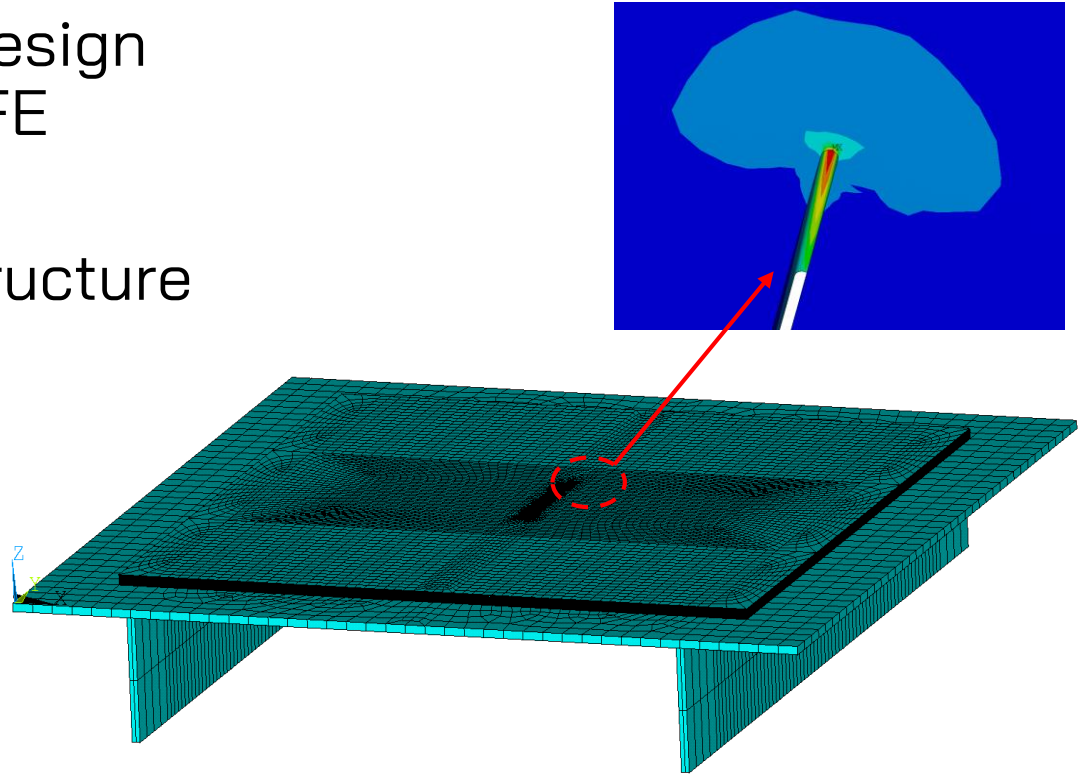
Sub-system	Component	Function
Damaged material	Substrate (metal or FRP)	Parent damaged material that is being repaired
Substrate-to-composite interface	Adhesive	Interface layer required for bonding of composite patch to the metal substrate
Composite patch	Glass fibres	Fabric of first layer of patch laminate; for prevention of galvanic corrosion
	Carbon fibres	Fabric of other layers; for achieving strength and stiffness
	Epoxy resin	Matrix material of patch laminate

COMPA Repairs process: design and engineering prior to repair application



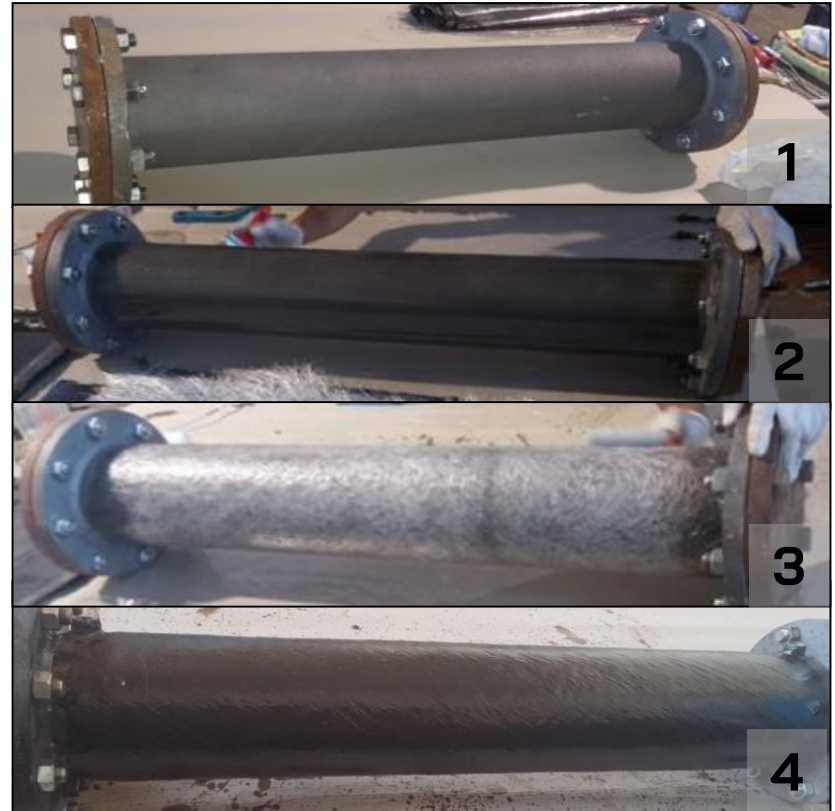
Numerical calculations for repair design

- Optimal patch design obtained using FE analysis
- Checking the structure behaviour



Steps of repair application process

- Surface preparation
- Application of the resin
- Application of the fibres (glass)
- Application of fibres (carbon) and corrosion protection (painting)



Approvals



- The company has received ISO 9001:2015 certificate for quality of management by [Bureau Veritas BV](#).
- COMPA Repairs technology received a Statement of Feasibility from [DNV-GL](#).
- The company is certified by an IACS member, [Croatian Register of Shipping](#) (CRS), for repairs of marine piping using COMPA Repairs.

Clients



COMPA Repairs cases of completed repairs

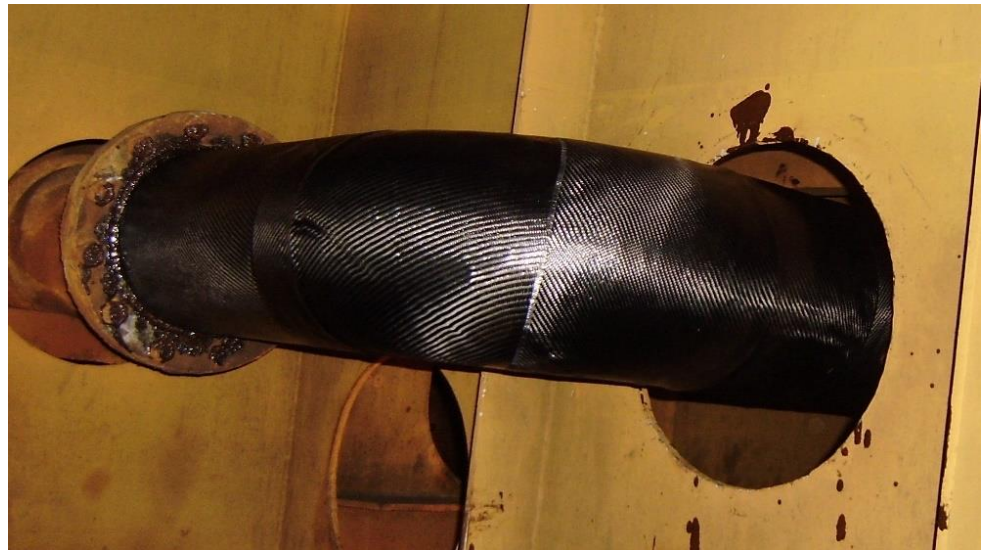
500m of BALLAST PIPING

Problem: 500m of corroded piping was leaking sea water.

Solution: The repair was conducted during the vessel's dry docking.

Repair Duration: 12 days

Class: BV and CRS



FLANGE ON MAIN SEA WATER INTAKE PIPE

Problem: Corroded flange was leaking sea water.

Solution: COMPA repair was conducted during the vessel's stay in port of Valencia.

Repair Duration: 4h

Class: RINA



SEWAGE TANK

Problem: Sewage tanks' plating and profiles have undergone extensive corrosion.

Solution: The repair of the 300m² was conducted during the vessel's dry docking in Luxor, Egypt.

Repair Duration: 3 days



AIR-CONDITIONING UNIT SPACE

Problem: Air-conditioning unit's steel flange and floor exhibited heavy corrosion.

Solution: The repair was conducted during the vessel's dry docking.

Repair Duration: 1 day

Class: GL



CLAPET VALVE

Problem: Two clapet valves have undergone extensive corrosion.

Solution: The repair was conducted during the vessel's dry docking.

Repair Duration: 1 day

Class: CRS



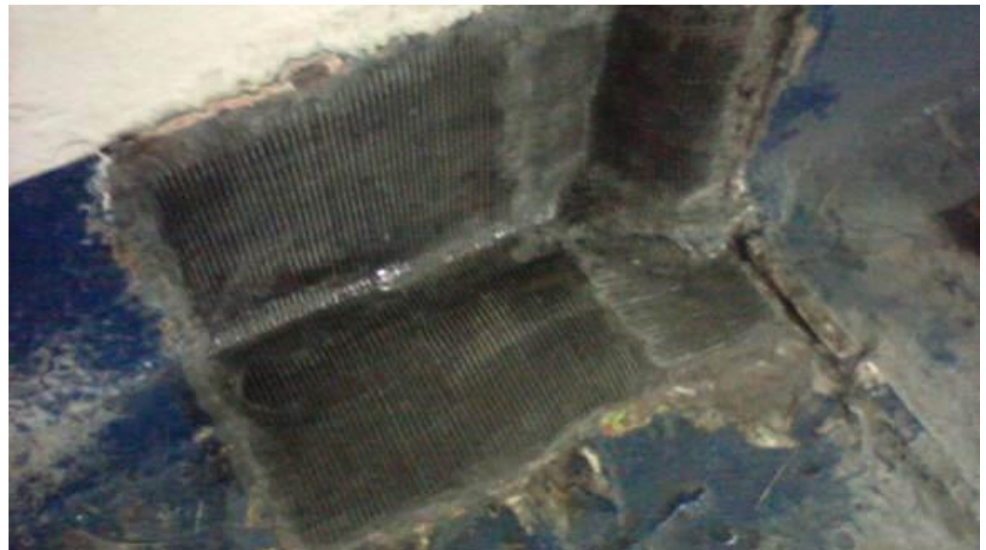
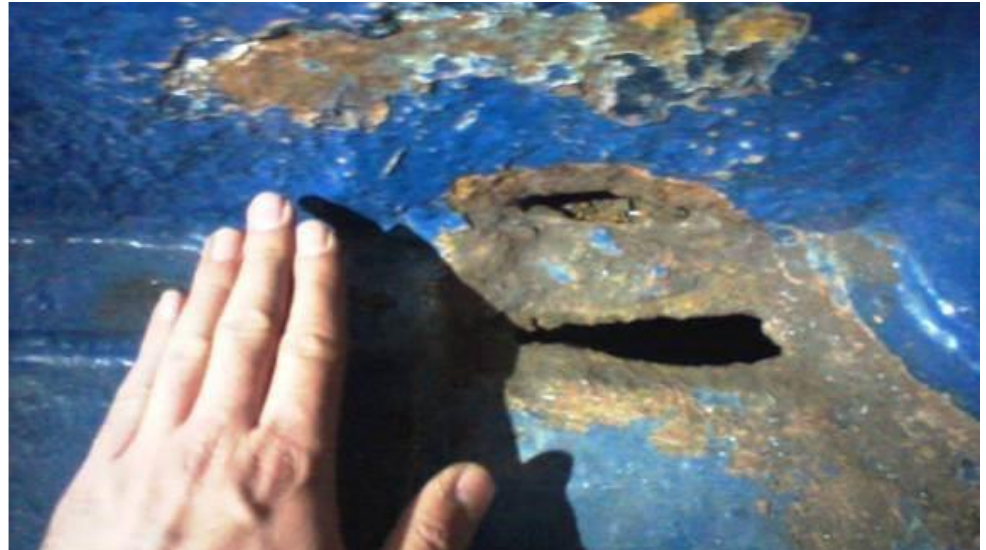
GARAGE FLOOR DETAIL

Problem: The damage on the garage floor was caused by severe corrosion in the corners where the water collects due floor inclination.

Solution: The repair was conducted during the vessel's dry docking.

Repair Duration: 1 day

Class: CRS



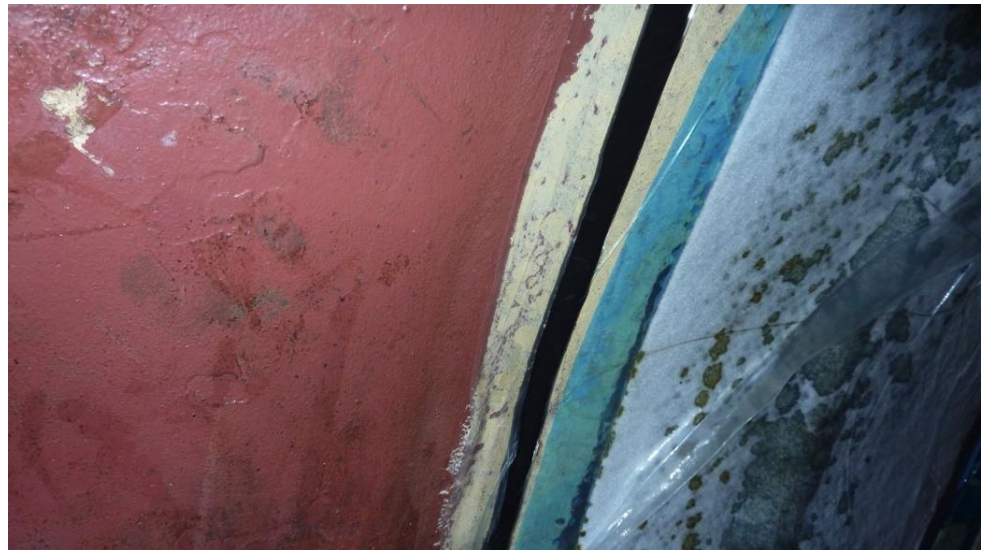
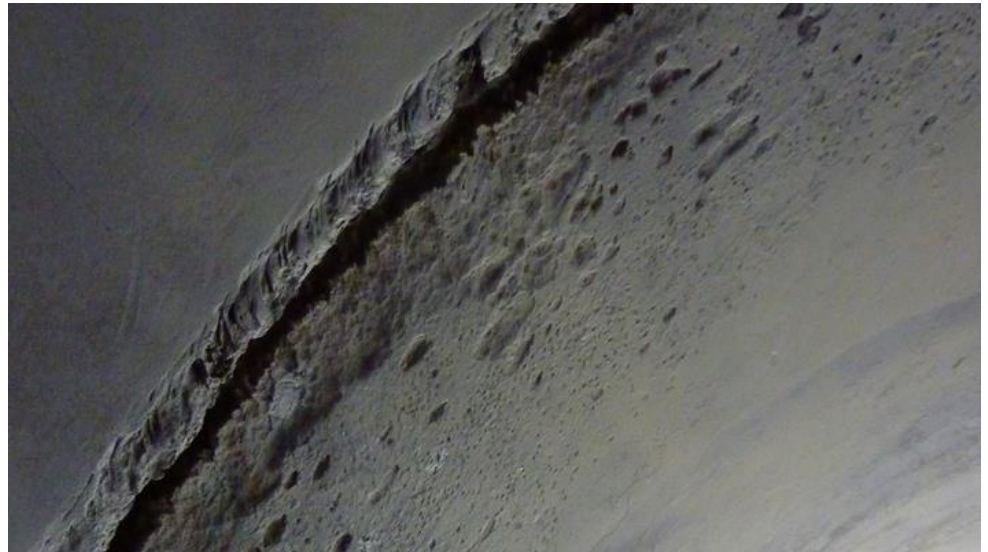
BOW THRUSTER TUNNEL

Problem: Bow thruster tunnel surface damage.

Solution: The repair was conducted during the vessel's dry docking.

Repair Duration: 1 day

Class: GL



20m OF THERMAL OIL PIPING IN KEEL TUNNEL

Problem: The mineral-oil pipes, located in keel tunnel, were heavily corroded.

Solution: The repair was conducted during the vessel's dry docking.

Repair Duration: 4 days

Class: GL



DECK UNDER AC STATION

Problem: Deck under AC station was leaking sea water.

Solution: The repair was conducted during the vessel's stay in port.

Repair Duration: 7h

Class: RINA



BULKHEAD OF THE BALLAST TANK

Problem: Heavily corroded bulkhead was leaking HFO.

Solution: The repair was conducted during the vessel's stay in Savona port.

Repair Duration: 7h

Class: RINA



Y-JUNCTION BALLAST INTAKE PIPE

Problem: Heavily corroded Y-junction was leaking sea water.

Solution: Conducted during the vessel's stay in Salerno port.

Repair Duration: 6h

Class: RINA



HFO TANK TOP

Problem: Cracked tank top was leaking HFO in rough seas.

Solution: Conducted during the vessel's stay in Savona port.

Repair Duration: 4h + 12h vacuuming

Class: RINA



BULKHEAD OF THE MDO FUEL TANK

Problem: Cracked bulkhead was leaking MDO.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 3h

Class: RINA



BULKHEAD OF THE HFO FUEL TANK

Problem: A heavily corroded bulkhead was leaking HFO.

Solution: Repair was conducted during the vessel's voyage from Le Havre to Antwerp.

Repair Duration: 1 day

Class: RINA



HFO TANK TOP

Problem: A heavily corroded bulkhead was leaking HFO.

Solution: Repair of 5 cracks was conducted during the vessel's stay in Antwerp port.

Repair Duration: 2 days

Class: RINA



SEA CHEST

Problem: Corrosion on the inner side caused leakage of the sea water.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 5h

Class: RINA



BALLAST TANK IN DOUBLE BOTTOM

Problem: Multiple bulkheads and the tank top were corroded and leaking sea water.

Solution: Repair was conducted during the vessel's voyage from Hamburg to Antwerp.

Repair Duration: 2 days

Class: RINA



BALLAST PIPE IN HEELING TANK

Problem: Flange connecting steel and fibreglass pipe was corroded and leaking sea water.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 6h

Class: RINA



BULKHEAD BETWEEN BALLAST AND HFO TANK

Problem: The bulkhead was corroded and it was leaking HFO into the ballast tank.

Solution: Repair's conducted during the vessel's stay in Antwerp port.

Repair Duration: 8h

Class: RINA



BALLAST PIPE IN ENGINE ROOM

Problem: Multiple pipes were corroded and leaking sea water.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 14h

Class: RINA



HEELING TANK FLOOR AND BALLAST TANK BULKHEAD

Problem: The ballast tank floor and bulkhead were corroded and HFO was leaking into the ballast and heeling tanks from adjacent tank.

Solution: Repair was conducted during the vessel's sail.

Repair Duration: 3 days

Class: RINA



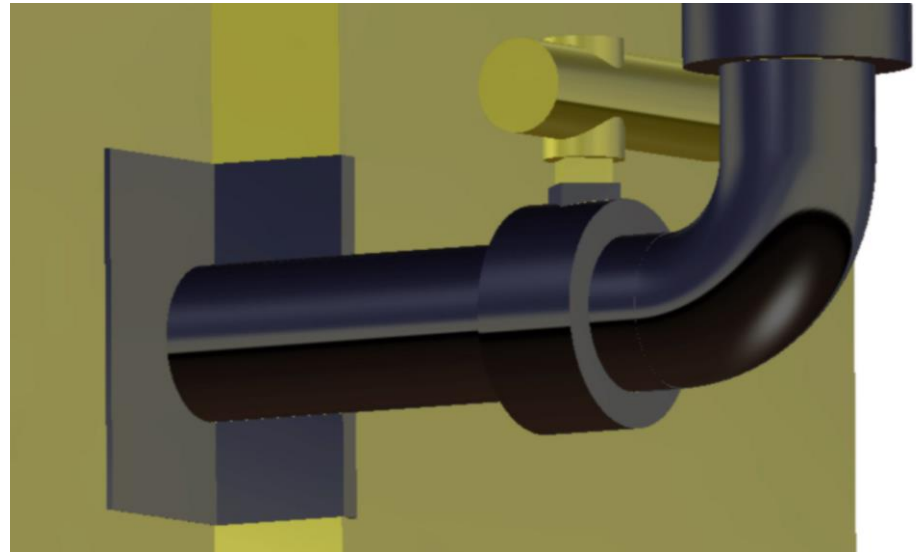
SEA WATER PIPE ON AN LNG CARRIER

Problem: Sea water pipe was corroded and leaking water.

Solution: Repair was conducted during the vessel's stay in Rotterdam port.

Repair Duration: 10h

Class: LR



SEA WATER PIPE ON RO-RO SHIP

Problem: Sea water pipe was corroded and leaking water.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 13h

Class: RINA



CORRODED MAIN SEA WATER PIPE

Problem: COMPA patches needed to be applied from the inside and the outside of leaking main sea water pipe.

Solution: Repair was conducted during the vessel's stay in Genova port.

Repair Duration: 6h

Class: RINA



SCRUBBER SYSTEM NaOH PIPE

Problem: The pipe was unsuccessfully repaired using glass fibres, so COMPA patch was applied to stop the leakage.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 5h

Class: RINA



THE ANTI-HEELING SYSTEM PIPE

Problem: The anti-heeling system had a large crack in the glass-fibre pipe and was leaking heavily.

Solution: Repair was conducted during navigation between Hamburg and Antwerp ports.

Repair Duration: 3 days

Class: RINA



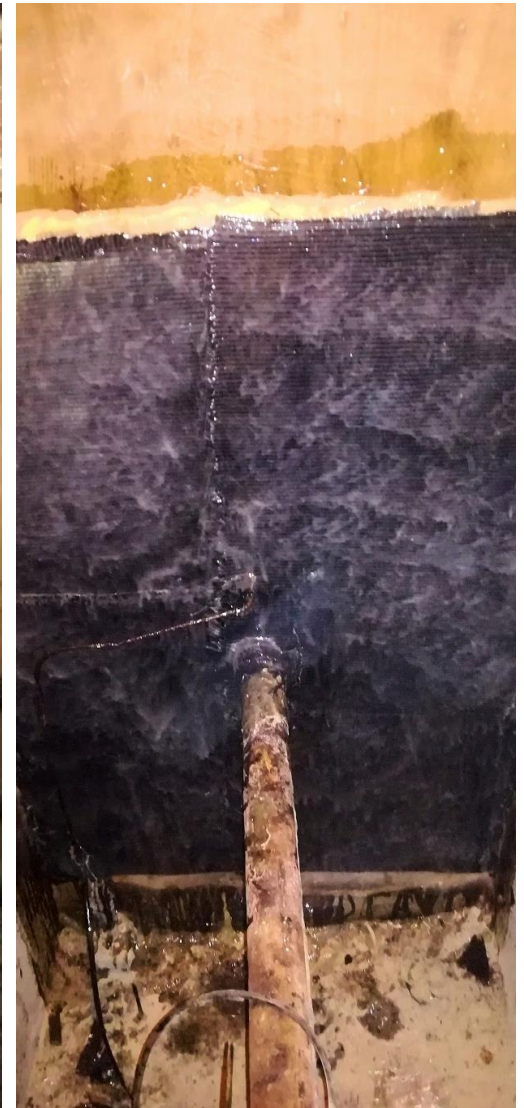
TANK BULKHEAD

Problem: The leakage of heavy fuel occurred on the blind manhole between water ballast and heavy fuel tank.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 3.5h

Class: RINA



LEAKING FUEL TANK

Problem: The crack appeared on tank plate between ballast and heavy fuel tank and the fuel was leaking into the ballast tank.

Solution: Repair was conducted during the vessel's stay in Genova port.

Repair Duration: 7h

Class: DNV-GL



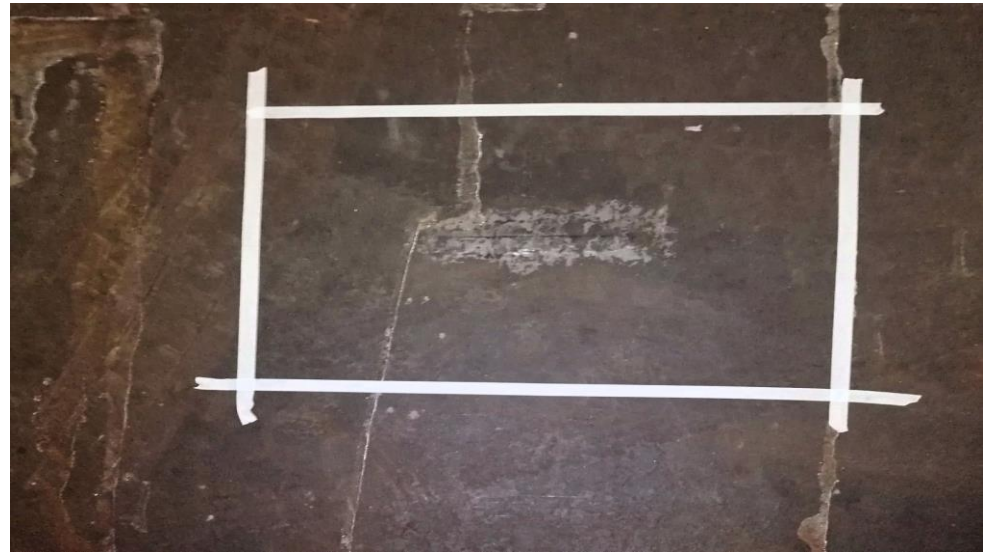
CRACKED HFO DOUBLE BOTTOM TANKS

Problem: Two cracks of about 30 cm in length appeared on the double bottom plating just above HFO tank.

Solution: Repair was conducted during the vessel's stay in Antwerp port.

Repair Duration: 4h

Class: RINA



FLANGE ON THE PROCESS TANK

Problem: Acidic medium caused the crack and the leakage of the flange of the process tank that is a part of the scrubber system.

Solution: Repair was conducted during the vessel's stay in Civitavecchia port.

Repair Duration: 5.5h

Class: RINA





COMPAREPAIRS

Thank You!



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