

COMPOSITE REPAIR FOR SUBSEA PIPE REINFORCEMENT

According to ISO 24.817 & ASME PCC-2



Figure 1: P3X30 primer application on defected area (step 2)



Figure 2: Composite plate application using F3XSS filler and ratchets belts (step 3)



Figure 3: Composite wrapping on progress (step 5)



Figure 4: Repair overview

PROJECT NAME **48 INCH OFFSHORE PIPELINE COMPOSITE REPAIR**
 PIPE DETAILS **48" oil line – max. op. temp. 35°C – op. pressure 18.2 bars**
 LOCATION **QATAR – Halul Terminal**
 3X / PEC SOLUTION **REINFORCEKIT® 4D SUBSEA (R4D-S)**

OVERVIEW

The objective of the repair, performed in April 2020 by **ALQODARA ALHANDASEYA (PEC)** and his partner **3X ENGINEERING Monaco (3X)**, was to **reinforce a 48" subsea pipe damaged by 2 dents**.

SCOPE OF WORK

According to ISO 24.817 and 3X repair calculations, 32 layers of R4D-S have been determined to reinforce the damaged pipe section (dent No. 1 measured 840mm x 445mm and dent No. 2 measured 770mm x 482mm).

Underwater, preliminary operations (pipeline excavation, concrete removing etc.) were performed prior to surface preparation by grit blasting to get a good surface profile (superior to 60µm).

The composite repair was then performed following 6 main stages (these steps are the same ones for the 2 dented defects):

- ① Before primer application, ratchet belts were installed over the pipe near the defect to ensure the good composite plate installation and tightening (step 3).
- ② **P3X30 primer** application right on the defect to ensure a good bonding of the composite plate (step 3).
- ③ **F3XSS filler** application on rigid composite plate. The plate was then given to the diver and positioned over the dent and fastened tightly with ratchet belts (previously installed – see step 1).
- ④ Another **P3X30 primer** layer was then applied on the whole surface of the repair to provide a good adhesion of the composite material with the surface before wrapping. No specific curing time was required.
- ⑤ Kevlar® tape impregnated with **R3X1050S resin** and wrapped around the pipe. The tape impregnation is performed using BOBIPREG (3X specific machine allowing a quick and regular impregnation resin/fiber). Thirty-two layers were necessary to repair the defect (i.e. 16 passes of 50% overlap) for a total of 3m repair length.
- ⑥ Finalization of the repair with reference plate positioning for traceability purpose and validation of the repair using hardness measurements.

RESULTS

The subsea reinforcement was successfully repaired using **REINFORCEKIT® 4D SUBSEA** product. This project was a great challenge due to the large diameter of the line and the shallow water position of the defects. Meantime, all the teams involved in the project faced with the international COVID-19 pandemic, with all the constraints and associated challenges (manpower, shipment of the material, quarantine time, etc.)