

# COMPOSITE REPAIR SPECIALIST



- **TYPE OF DEFECTS :** Leaking crack & non-leaking crack
- **PIPE DETAILS :** 32" gas line – max. operating temp. 20°C – operating pressure 1160 psi (80 bar)
- **LOCATION :** MIDDLE-EAST
- **3X PRODUCT :** REINFORCEKIT 4D SUBSEA (R4D-S)

## OVERVIEW

The objective of the repair performed in August 2017 by 3X ENGINEERING (3X) and its local distributor was to **seal 2 cracks and reinforce the pipe integrity at 70-meter depth**.

## SCOPE OF WORK

- According to ASME PCC-2 and 3X repair calculations, it has been decided to make 2 different repairs as shown in Figure 1. Eighty-eight composite layers of **REINFORCEKIT 4D SUBSEA (R4D-S)** product have been determined to repair Defect No. 1 (external crack with through wall section) and 20 layers for Defect No. 2 (non-opened crack).

- Underwater, several preliminary operations have been performed prior to surface preparation to get a good surface roughness (between 60 µm and 100µm surface profile).

- 3X wrapping reinforcements have been performed following several stages. It is important to note that working at 70-meter depth requires saturation dive.

1/ For both defects, F3XUW9 filler has been applied to fill the cracks and reshape the pipe geometry.

2/ P3X32 primer applied under the composite plates and over the damaged areas (previously delimited on the pipe) to ensure good bonding.

3/ Composite plates application on both defects recovered with F3XSS filler and strongly maintained with ratchet belts for curing.

4/ P3X32 primer applied on the whole surface of the repair before wrapping.

5/ Kevlar® tape pre-impregnated with R3X1050-S resin (using special devices developed by 3X) wrapped around the pipe. Eighty-eight layers were necessary to repair Defect No. 1 (i.e. 44 passes of 50% overlap for 1,85-meter length repair). For Defect No. 2, 20 layers were applied (i.e. 10 passes of 50% overlap for 0,82-meter length repair).

## RESULTS

Pipeline has been re-pressurized a few days after repair without any problem known at the moment. This job was a great challenge because of the 70-meter depth. Even if 3X ENGINEERING is now experienced in subsea repairs this job is the first one performed at this depth.

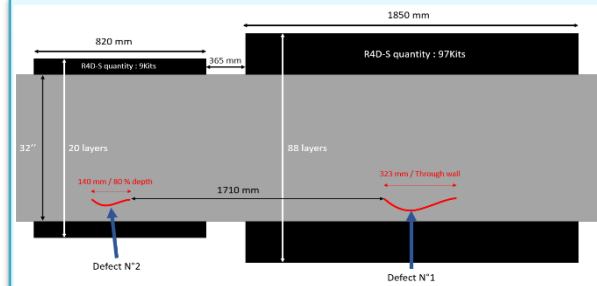


Fig. 1: Design of the repair



Fig. 2: F3XUW9 filler application



Fig. 3: P3X32 primer application using dispensing gun

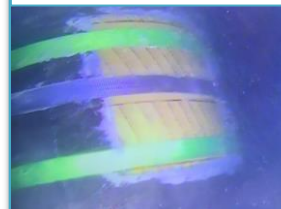


Fig. 4: Composite plates fixing



Fig. 5: P3X32 application before wrapping



Fig. 6: BOBIPREG - 3X specific machine for Kevlar® tape impregnation



Fig. 7: SUBSEA HANDLES - 3X specific tool to ensure proper tensile strength during tape application



Fig. 8: Repair overview



Fig. 9: Plate positioning for traceability