

# WORLD PIPELINES®

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### Experimental procedure – full-scale testing

Two configurations of the pipe were tested: leaking and non-leaking. The leaking configuration was tested first using four different repair configurations. Composite wraps were applied and subsequently tested to their maximum pressure on a test spool designed to simulate a failed weld. The test pipe set-up is shown in Figure 4. The test pipe was held together during the full crack simulation by two 10 cm long welds located at the 140° and 220° circumferential locations. Following the through wall leaking testing, a full circumferential weld was applied and two more tests were performed. The weld thickness in this second test set-up was 15% of the pipe thickness to simulate an 85% wall loss defect.

These demanding conditions required a bidirectional woven carbon fibre solution to ensure the integrity of the pipeline for the requested 20 year design life in the face of external corrosion, weld defects, metallurgical defects, or other anomalies (such as leakage or axial separation) that could compromise the safety of these pipelines in harsh field conditions. After composite repair installation, depicted in Figure 1, the following test procedure was performed:

- 1 A minimum of 24 hours after curing, the Shore D hardness was recorded and confirmed to be above 80.
- 2 Additional strain gauges were mounted to gather additional data during the test.
- 3 The assembly was completely filled with a water/antifreeze mixture such that it remained in a liquid state at -20°C.
- 4 The assembly was cooled until the temperature of the liquid was an average of -20°C.
- 5 Strain gauge data recording was initiated during cooling, along with data recording from an electronic pressure transducer.
- 6 The pressure was slowly increased at a rate of approximately 5 bar/min, pausing at multiples of 5 bar for a 3 min. hold.
- 7 If 32 bar was reached without failure, the pressure was held at 32 bar for 30 min.
- 8 If no defects were discovered, the pressure was increased as before in 5 bar increments until pressure reached 50 bar or wrap experienced failure. ☺



Figure 4. Welded pipe set-up.



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