Composite Solution Reinforces LF-ERW Seam Anomaly on Ethylene Line

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Louisiana

Pipe Details

- A 16-inch (406.4 mm) pipeline carrying liquid ethylene had a seam weld anomaly
- The seam defect was 1.5 inch (38.1 mm) long, 0.001 inch (0.025 mm) wide and 0.097 inch (2.46 mm) deep
- The repair area was 3 ft (1 m) long
- 1,336 psi Maximum Operating Pressure (MOP)
- Ambient Temperature 75°F (24°C)
- Pipeline Temperature 66°F (19°C)

Summary

A liquid ethylene line suffered from manufactured defects in the seam weld and needed a repair. The pipe could not be welded on or depressurized due to the nature of ethylene. To avoid this, the Atlas repair system was tested with great success. Due to this test program, this seam-weld crack was repaired with 24 layers of Atlas over a 3-ft length.

Benefits

- No hot work (eliminate the risk of autoignition)
- No interruption to operation
- Supported with testing

An asset owner located a low-frequency electric resistance weld (LF-ERW) seam anomaly on a buried 16-inch (406.4-mm) pipeline carrying liquid ethylene and immediately began looking for a repair. The crack-like damage covered an area 1.5 inch (38.1 mm) long, 0.001 inch (0.025 mm) wide and 0.097 inch (2.46 mm) deep on a pipeline operating at 1,336 psi and 66°F (19°C) in an environment where the ambient temperature was 75°F (24°C). A repair was needed quickly, but fixing the line with traditional welding methods was not possible because of the high combustibility of the ethylene.

CSNRI experts responded to this need with a custom-designed composite repair that uses a high-strength, high-stiffness carbon fiber specially designed for crack and crack-like repairs requiring strain reduction due to dynamic loading conditions. The resin for the Atlas wrap is premeasured, and the structural fabric is impregnated on site using conventional equipment. When the fabric is ready to install, technicians wrap the cloth around the damaged area of the pipe using the number of layers specified by CSNRI experts, who determine the repair thickness and length based on the pipeline and anomaly specifications.

Technicians prepared the pipe surface to a near-white profile and wiped it with acetone in preparation for the composite installation.

Installers applied a special two-part epoxy coating to the repair zone.

The next step was to cover the entire 3-ft (1-m) long area with 24 layers of 12-inch (304.8-mm) wide Atlas composite wrap, layer over layer with offset, to provide reinforcement along the LF-ERW seam weld anomaly. Once the team had securely placed all the layers of the composite, they covered the repair area with compression film, perforated it, and allowed the composite to cure.

When the cure was complete, the compression film was removed, and the line was fit for continued safe service. The repair area was later covered with a topcoat selected by the owner.

This entire repair was carried out in 2 hours and 45 minutes, restoring the line to safe service without introducing unnecessary hazards to the workplace and with no disruption to operations.

Two CSNRI supervisors and a team of installers from a local contractor mobilized to the site to carry out this seam weld repair. The first step was to prepare the pipe for the composite repair. Technicians removed the pipe coating and used a bristle blaster to achieve a surface profile equivalent to SA2.5. Next, they wiped the prepared pipe with acetone and applied special filler material to tented/voided areas. With the filler material in place, the team covered the repair area with a two-part epoxy primer and placed a fiberglass isolation layer with magnetic markers over the pipe so the repair area can be detected by an smart pig during future inline inspections.

The team installed 24 layers of composite cloth over a 3-ft (1-m) section of pipeline, then covered the repair area with constrictor wrap and perforated it to allow the composite to cure.