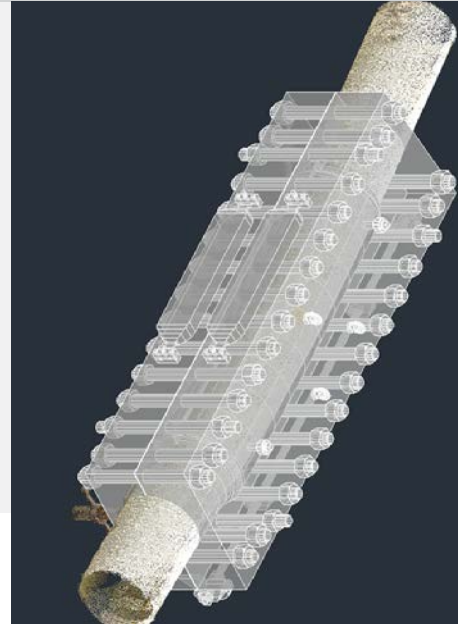


SUBSEA CLAMP+SLEEVE FOR BUCKLED PIPE

SITUATION:

Crimson Midstream, LLC needed to repair a buckled pipeline in the Gulf of Mexico's South Marsh Island Area Block 59. The deflection in the 10-inch crude oil pipeline was discovered during an in-line inspection.

The Bureau of Safety and Environmental Enforcement (BSEE) required the pipeline to be structurally reinforced due to its weakened cross section. Chet Morrison Contractors, LLC (Morrison) was hired to repair the damaged line and tasked Chapman Consulting with sourcing a custom fitting that included 3D scanning, engineering and drafting services.

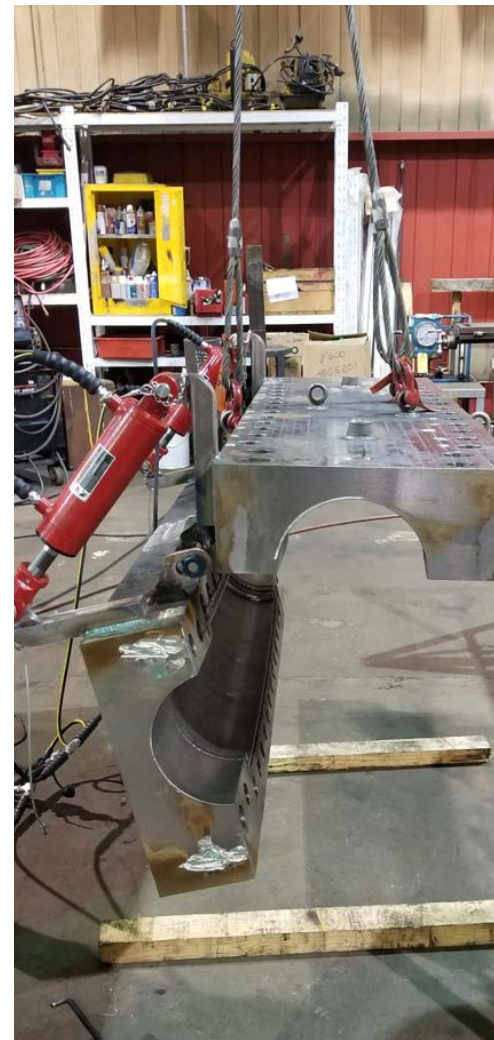


SOLUTION:

Chapman Consulting enlisted PETROQUIP – PLIDCO's stocking distributor that services Louisiana, Texas, New Mexico and Oklahoma – to provide the fitting. In order to begin this process, a dive company excavated the area around the bent pipe and produced a cast model of the damaged pipeline. This model was then 3D laser scanned using a state-of-the-art measuring system, enabling PLIDCO's engineering team to design and manufacture its custom Clamp+Sleeve fitting.

With approximately 49 inches between seals and a maximum allowable operating pressure of 1,500 PSI, PLIDCO's 10x72-inch Clamp+Sleeve fitting included a four-degree horizontal bend in its annulus, along with integral clamping ends to resist end pull and axial stresses. The selected elastomer seal material was compatible with crude oil and could withstand temperatures ranging from -20 to 225 degrees Fahrenheit. Designed to ASME Section VIII to ensure load transfer to the fitting, the custom Clamp+Sleeve also included lifting lugs, marine epoxy coating, xylan-coated studs/nuts and sacrificial anodes, as well as two one-inch vents and plugs per half.

In addition, a custom hydraulic closure system was designed so the fitting could be installed horizontally in the open position, with the top half pivoting on a hinge to bring the bottom half in line. This feature not only ensured proper positioning of the fitting, but also provided a safe work environment for the divers. Once the fitting was properly torqued and



secured on the line, it was then hydro-tested – enabling the pipeline to remain in service, while avoiding costly shutdowns.

Next, Liquid Bridge Seal, a sealant from the Ultra Seal product line produced by M&D Industries, was used to fill the void between the pipe and annulus of the fitting. This sealant can withstand temperatures ranging from 56 to 300 degrees Fahrenheit, does not fracture, and is not water or oil soluble. This process was performed to provide additional protection and assurance to the end user, but is not a requirement for most PLIDCO fittings.

RESULTS:

The Clamp+Sleeve fitting was installed at a depth of approximately 130 feet. A PLIDCO engineer and technician supervised the installation topside, thereby facilitating proper installation on the first attempt, while minimizing the project's total installation cost. The job took approximately 41 dives and three days, from the time the vessel was anchored until it returned to shore.

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