

SUBSEA PIPE-IN-PIPE REPAIR CLAMP – DIVERLESS SOLUTION FOR HIGH-PRESSURE INNER-PIPE INTEGRITY

CASE STUDY

IN MANY DEEPWATER FIELDS, PIPE-IN-PIPE (PIP) SYSTEMS CARRY THE HIGHEST PRODUCTION PRESSURES. A SUDDEN LEAK ON THE INNER PIPE CAN HALT OPERATIONS AND COST MILLIONS EACH DAY. WHEN OUR CLIENT'S 10" NOMINAL INNER PIPE NEEDED A CONTINGENCY SOLUTION, CONNECTOR SUBSEA SOLUTIONS (CSS) STEPPED IN TO DESIGN A DIVERLESS CLAMP THAT COULD BE HELD IN CONTINGENCY, READY FOR IMMEDIATE DEPLOYMENT AS REQUIRED.

PROJECT BACKGROUND

When an international operator in West Africa requested an Emergency Pipeline Repair System (EPRS) clamp for their 10" PiP production line, CSS engineered a bespoke design tailored to PiP-specific repair scenarios, accommodating varying nominal pipe sizes whilst remaining simple enough to enable fully diverless installation.

The PiP clamp supplied was engineered to seal a leak on the inner pipe, including at a field joint location where the minimum available clearance occurs. It seats securely on the inner pipe within the minimal annular clearance of a standard field joint, ensuring sufficient clearance to the outer pipe even when accounting for nominal OD variations.

KEY CHALLENGES

PiP Geometry: The two concentric pipes left very little clearance at the field joint. The clamp therefore needed to avoid contact with the outer pipe yet still seal fully on the inner pipe.

Inner-Pipe Variations: Two nominal OD variants necessitated a seal that could accommodate a range of diameters without compromising performance.

Deepwater, Diverless Requirement: The project's deepwater environment necessitated deployment and activation entirely by ROV.

High Operating Pressure: At 317 barg, any leak could rapidly escalate. The clamp therefore needed to be rated well above this pressure to provide operator confidence.



01 // CSS MORGRIP® PiP Clamp



02 // CSS MORGRIP® PiP Clamp undergoing hydrotest during FAT

ENGINEERING SOLUTIONS

During a front-end engineering design (FEED) study, CSS evaluated several PiP repair concepts to address different potential failure modes, covering inner and outer pipe failures at field joints and along the main pipeline. Ultimately, the client opted for a streamlined clamp focused entirely on the inner pipe to provide contingency for the most likely failure scenarios.

Key features include:

- **Slim Profile Body:** Compact external dimensions allow the clamp to slide into the narrow annular gap without contacting the outer pipe. Small buoyancy elements were added to ensure the clamp remains correctly oriented once activated, allowing the crane to disengage smoothly.
- **Adjustable Landing Saddles:** Saddles can be fine-tuned to accommodate landing installation tooling on the inner or outer pipe, ensuring a precise fit at the field joint or another specified location.
- **Diverless ROV Guide Tooling:** Instead of gripping the pipe directly, the installation tooling was designed to gently guide the clamp along the field-joint ribs. Once in position, hydraulic lines would close the clamp around the inner pipe. After activation, the lines would be cut, allowing the tooling to float to be recovered.
- **Material Selection:** The clamp body was forged from F60, selected for its superior strength and corrosion resistance in deepwater environments.



03 // CSS MORGRIP® PiP Clamp including installation tooling

DELIVERY AND CONTINGENCY STOCK

Once fabrication and testing were complete, the clamps were shipped to the client. They now form part of the EPRS inventory, ready for immediate deployment should a pipe leak occur.



04 // CSS MORGRIP® PiP Clamp refurbished post-FAT

CONCLUSION AND CUSTOMER FEEDBACK

By engineering a specialised PiP clamp, CSS delivered an optimised and cost effective contingency solution for the client's high criticality pipeline. Its simplicity reduces manufacturing and maintenance costs, while the diverless installation tooling ensures reliable deepwater deployment. In practice, this lowers operational risk and gives the operator confidence that, should a leak occur, a proven clamp is ready for immediate use anywhere along the PiP system.



05 // CSS MORGRIP® PiP Clamp with bolt deployment basket