

Reeled pipelines

A cost-effective and faster pipeline installation method



Reeled pipelines

TechnipFMC continues to transform the offshore energy industry as a market leader in the installation of rigid pipelines by the cost and time efficient reel-lay installation method. We offer several rigid pipe products to meet the needs of operators who face a range of challenges in both shallow and deepwater fields, including flow assurance issues and transportation of highly corrosive fluids.

Benefits

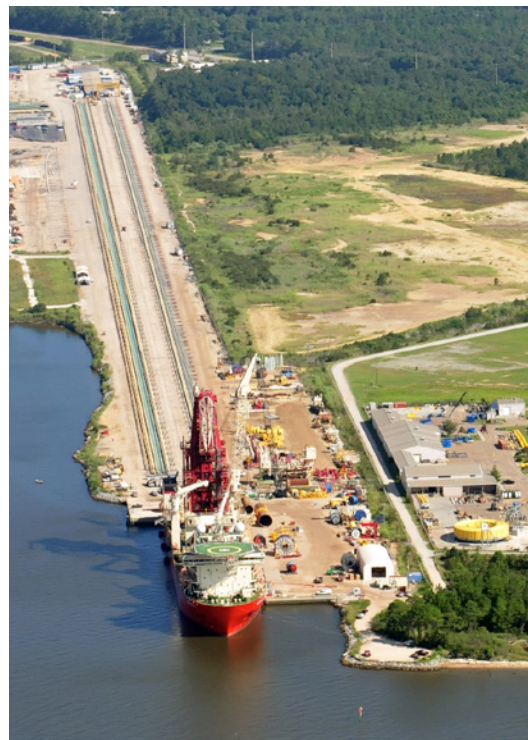
TechnipFMC's reeled pipeline technology provides numerous benefits, including a cost-efficient and faster installation process compared to other methods. Our onshore welding operations and non-destructive testing are off the critical path, enabling high quality weld production.

Our pipelines are manufactured from seamless or seam welded pipe in a wide range of material grades such as carbon steel, 13%Cr, duplex and superduplex. We also install bi-metallic pipelines in the form of clad pipelines where a corrosion resistant alloy (CRA) layer is metallurgically bonded to the carbon steel, or mechanically lined pipe (MLP) where a CRA liner is mechanically fitted within a host pipe. All pipelines are compatible with various polymer based coatings for corrosion protection and thermal performance.

We offer a complete range of products suitable for complex field developments, which are listed below:

- ▶ Single pipelines
- ▶ Pipe-in-pipe (PiP)
- ▶ Direct electrically heated pipelines
- ▶ Electrically trace heated (ETH) PiP
- ▶ Plastic lined pipelines
- ▶ Piggybacked pipelines
- ▶ Steel catenary risers (SCR)
- ▶ Free-standing hybrid risers (FSHR)

We also have extensive experience installing mid-line and end-structures as well as residual curvature sections for mitigation of lateral buckles.



TechnipFMC spoolbase facility in Mobile, Alabama, USA

Reeled pipe on Deep Blue



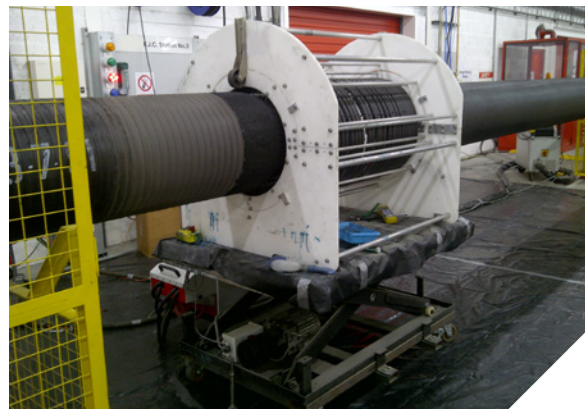
Reeled pipeline installation process



Welding at spoolbase



Grit blasting

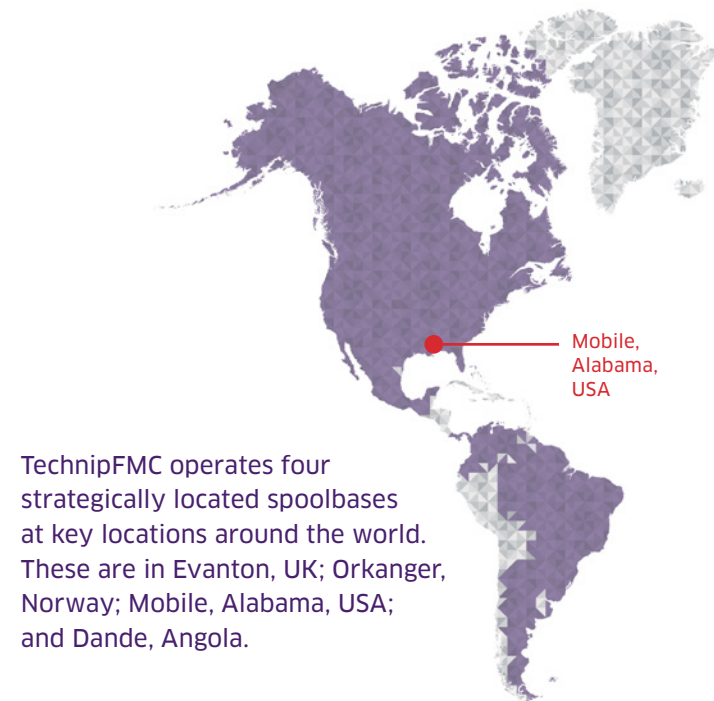


Induction coil heating before FJC

Installation by reel-lay is the fastest and most efficient method of installing offshore pipelines. The TechnipFMC vessels Deep Energy, Deep Blue and Apache II have been purpose built for this method. The installation involves fabrication of the pipeline at an onshore spoolbase, spooling and transportation on the lay vessel, and installation at the desired offshore location.

Spoolbases

Standardized fabrication practices are followed at all TechnipFMC spoolbases ensuring high quality production. Pipe joints, typically delivered in 12 meter lengths, are inspected, end-beveled and pre-heated. The pipe joints are aligned and girth welded together on a production line. Each weld is then inspected using non-destructive examination techniques; usually automatic ultrasonic testing or radiography. Finally, field joint coating is applied after grit blasting and heating the weld region. This process continues until the pipe joints are assembled into a pipe stalk of approximately 1 kilometer in length.



TechnipFMC operates four strategically located spoolbases at key locations around the world. These are in Evanton, UK; Orkanger, Norway; Mobile, Alabama, USA; and Dande, Angola.

Reeling process

The reeling process begins with spooling of the pipeline onto the vessel. A stalk is pulled from the spoolbase onto the vessel and then plastically bent in a controlled manner around the reel. The process continues until the second end of the stalk reaches the end of spoolbase causeway. The end of that stalk is then welded to the start of the next stalk. Non-destructive examination of the weld is performed and the field joint coating is applied. The process is repeated until the required length of pipeline has been spooled onto the vessel reel(s).

Our pipelay vessels Deep Energy and Deep Blue each feature two reels that enable sequential spooling. The two reels create extra capacity, allowing our vessels to carry longer lengths of pipelines, and also minimize spooling operation time.



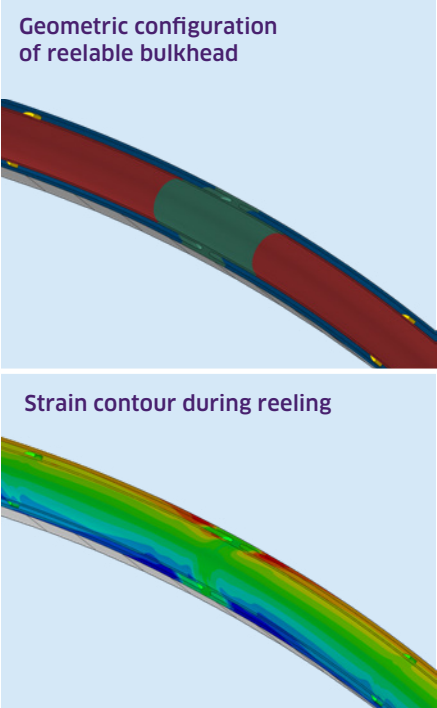
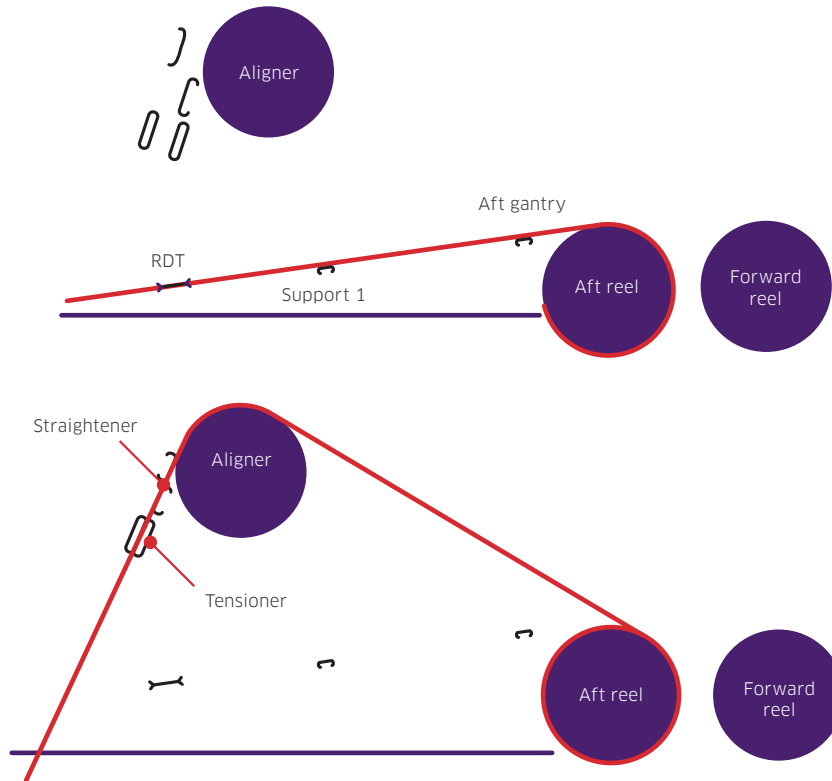
Reeling-off from Deep Energy

Once the required length of pipeline is reeled onto the vessel, the vessel departs from the spoolbase and sails to the offshore field location. The installation is initiated with an anchor and wire (or alternate method), and the pipeline is reeled off by passing over an aligner and then through the straightener system located on the vessel ramp (or tower). The pipe is reverse bent in the straightener system to remove the residual curvature from the reel. It then passes through tensioners which grip the pipe and apply an upwards force to maintain the catenary of the pipeline as it passes down from the vessel to the seabed.

Finite element analysis (FEA) and testing capabilities

TechnipFMC has the capability to assess the entire reeling process using in-house developed finite element analysis models, which accurately replicate the full reeling process. We additionally perform reeling assessments of complex pipeline arrangements involving mechanically lined pipe (MLP), electrically trace heated (ETH) PiP systems, PiP bulkheads, transitions and pawnsheads. We perform engineering criticality assessments of pipeline welds, including complex, dissimilar CRA materials, such as welds between clad and lined pipes. Alongside analysis, TechnipFMC has an extensive record of full scale testing which is usually performed for novel pipeline arrangements.

FEA models for assessing entire reeling process



Reelable bulkheads for PiP systems isolate and connect pipeline zones, prevent flowline rotation, save installation time and facilitate in-line tee (ILT) applications.

Auxiliary components

TechnipFMC uses a number of auxiliary components for installation of reeled pipelines, which improve efficiency of pipelay operations



The embedded pawnheads enable quick abandonment and recovery or laydown, optimizing the allowable weather window for installation.



Transition pieces connect pipelines with varying cross-section, allowing greater utilization of reel capacity.

Reeled pipe track record

TechnipFMC has an extensive track record of successful installation of rigid pipelines in shallow and deepwater fields throughout the world, including reel-lay in a maximum water depth of 2,956 meters. We have installed more than:

- ▶ 10,000 kilometers of reel-lay rigid pipelines with outer diameters from 2 to 18 inches
- ▶ 470 kilometers of plastic lined pipes
- ▶ 60 steel catenary risers, including pipe-in-pipe SCRs
- ▶ 200 kilometers of CRA clad and lined (MLP) pipelines
- ▶ 1,100 kilometers of pipe-in-pipe in more than 65 projects

Rigid Pipeline and Installation Technologies

David Kaye

+33 (0)1 85 67 77 62

david.kaye@technipfmc.com

TechnipFMC.com

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