

Deepwater installation is underway on the groundbreaking Independence project in the US Gulf of Mexico

Breaking records in deepwater installations

Highly complex deepwater projects, such as Independence in the Gulf of Mexico, require meticulous planning and cutting edge technology

The exploration and exploitation of India's oil fields is taking place in ever deeper waters. This makes the market increasingly interesting for Heerema Marine Contractors (HMC), a company that has many years of proven expertise in deepwater installations. Earlier this year HMC opened an engineering office in Bangalore to strengthen its engineering capacity and to support its operations in South Asia and beyond.

In 2006 and 2007 HMC established several industry records in deep water installation during the Independence Hub project in the Gulf of Mexico. HMC was hired for the installation of the Independence Hub floating production facility, including all risers.

Venturing into new waters

The Independence Hub is a platform installed at record water depth and also has the world's largest production capacity (at time of installation). It is located in

2,440m deep water at Mississippi Canyon Block 920 in the Gulf of Mexico. It is set among 10 ultra-deepwater natural gas fields and linked to them through a network of twelve 10-inch and four 8-inch flow line risers, a 20-inch export steel catenary riser (SCR) and twelve umbilicals. It will be possible to add more SCRs in future since the platform has excess capacity.

The Independence Hub is connected with the Tennessee Gas Pipeline on West Delta Block 68 by means of the Independence Trail Natural Gas Pipeline, a 215 km long and 24-inch pipeline. The Independence Trail will carry gas and condensate from the hub to the Tennessee Gas Pipeline for processing on shore.

The Independence Hub project was characterised by a whole series of records: the deepest moored floating production system at 2,440 m with the longest mooring lines of 3.8 km miles, the deepest subsea production well at 8960 ft, the deepest laid pipeline at 7912 ft,

the deepest installed suction piles at 2,440 m and the deepest and heaviest installed SCR producing the heaviest SCR loads of 800 t and installation.

Managing extreme depth

HMC was awarded the contract to install the Independence Hub, mooring lines and the SCRs. The company used its deepwater construction vessel Balder to carry out the installation.

The installation was split into three phases: first the installation of the suction piles, followed by the hull installation and lastly that of the SCRs.

The 12-leg taut polyester mooring system includes suction piles, pile chains, subsea connectors, bottom chains, polyester mooring ropes, H-links, and platform chains.

Mooring the hull

The 12 mooring assemblies each consisted of a suction pile, anchor chain, connecting shackles and a subsea

male connector. The components were assembled on board the Balder before being lifted and installed. The 27m long suction piles, weighing 180 t each, were installed at 2,442 m water depth, using Remotely Operated Vessels (ROVs) and transponders to verify orientation and position. All twelve piles were installed within the required tolerances for positioning, orientation and inclination.

The first component of each mooring line to be installed was the bottom chain with the subsea female connector. The Balder's two cranes, capable of a tandem lift of 6,300 t, laid out the entire 244-m-long bottom chain on deck to remove all twists and make the connection with the female connector.

The chain and connector were then lowered into the water and the upper end

The 12 mooring assemblies each consisted of a suction pile, anchor chain, connecting shackles and a subsea male connector

was secured in a hang-off platform for the attachment to the polyester mooring.

The Balder's Mooring Line Deployment Winch (MLDW) was used to install the polyester mooring line segments. They were connected to the bottom chain, after which it was released from the hang-off platform. The female connector of the bottom chain was

connected to the male connector on the mooring pile.

After the third segment was secured in the hang-off table, the platform chain was connected to the messenger chain already installed at the hull. The platform chain was then lowered and the messenger chain hauled in to transfer the mooring line load to the semisubmersible. This

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Liebherr-Werk Nenzing GmbH
P.O. Box 10, A-6710 Nenzing/Austria
Tel.: +43 50809 41-481
Fax: +43 50809 41-625
offshore.crane@liebherr.com
www.liebherr.com

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Logistics issues are a major concern for service providers on projects of such a grand scale

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sequence was performed with each mooring line, in total 12 times.

The Balder also installed two flow lines which were shorter than the water depth. One of the flow lines was 997m long and was installed in a water depth of 2,464m, and the other was 1,964m long and was installed in water of 2,662m deep.

Heaviest SCR load

The last part HMC was contracted to carry out was the installation of the SCRs. This comprised five 8-inch and two 10-inch SCRs and the 20-inch export SCR.

Each SCR consists of a steel pipe with an integrated flex joint and the SCR head on the pipe end. To avoid vortex induced vibrations the SCRs came pre-installed with strakes and fairings. They were laid out on the seabed prior to installation.

Installation of the SCRs involved some major acrobatics above and below

the water surface. The Balder used its Abandonment and Recovery (A&R) Winch to recover each SCR from the seabed at almost 2,500 m water depth and then moved over 2km away from the IHUB to raise the SCR's head some 25 m above the seafloor. The Balder then moved close enough to the hub to cross haul the SCR under the hull to move it to the correct side of the platform and transfer the load from the A & R winch to the cross-haul wire. In the case of the export SCR the load amounted to an unprecedented 800 t.

The Balder then reconnected the A&R winch to the SCR head for retrieval and transfer of the SCR to the IHUB. At the same time the Balder had to move further away from the IHUB to avoid interfering with the mooring lines.

The load had to be transferred from the winch to the portside crane. With the SCR raised to deck level the Balder crew

could remove the flex joint protection cover, the hang off collar protection, the flex joint lay-down tool and install the pull-in wire forerunner.

Finally the SCR was lowered into its porch and its spool piece connected to the IHUB. The load was then transferred from the crane to the IHUB itself.

The installation was not only carried out in unprecedented water depths, but also involved new techniques and methods required to successfully carry out the job. Innovative techniques were developed and the Balder's pipelay system was modified to cope with the deep water challenges. Moreover, the whole project, from the start of the contract negotiations until the end of the installation work took just over 18 months. ■

Author: Ron Rosenbrand, Heerema Marine Contractors