

Horn Mountain: *A plan for success in deepwater*

A Supplement to:

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E&P
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COMPANY PROFILE:

Freeport Welding & Fabricating Inc.

Ultra-Tight Process Controls Assure Smooth Riser Interface

With Freeport Welding & Fabricating producing the Horn Mountain spar's upper riser stems and deck stopper assemblies to exacting specifications, the project's record-length riser assemblies were installed offshore without delay.

Production risers for each of the eight producing wells and the two water injection wells to be installed on the **Horn Mountain** truss spar were to be of record length. Since fabrication had to meet exacting specifications and close tolerances, the project team chose Freeport Welding & Fabricating Inc. to produce them.

Founded in 1964, Freeport Welding has provided fabrication and maintenance services for the marine, refining and petrochemical industries for more than 35 years.

With headquarters in Freeport, Texas, the company offers custom fabrication of American Society of Mechanical Engineers pressure vessels and American Petroleum Institute tanks, skids, cyclones, ductwork and heavy plate fabrication, with total fabricated weight capacity of up to 250 tons and diameters up to 26ft (7.93m).

Freeport Welding has developed a production system it calls 21st Century Fabrication, which amounts to a complete re-engineering of the fabrication process, from logging inquiries to estimating; and from writing quality plans, production plans, inspection reports and schedules, to cutting parts. The system makes use of the latest in computer technology, with 50 networked computers, including three in the shop. JobTrax™, a proprietary software system, allows for fast, up-to-date communication among departments and complete documentation of fabrication, welding and quality functions. All plate parts are cut directly on a numerically-

controlled burning table. Nothing in the shop is laid out or cut by hand, which results in the cutting of highly accurate parts, tighter tolerances, better fits and, consequently, better welds.

The fabrication of each upper stem/deck stopper assembly required state-of-the-art welding equipment and a large covered shop area, with plenty of overhead crane capacity.

Roy E. Yates, company president, said Freeport Welding had just moved into a new, 54,000-sq ft facility in July of 2000, and the six overhead cranes in the 300-ft-long [91.5-m-long] main shop area were configured uniquely to fabricate and assemble the various components, while maintaining the necessary close tolerances. Also beneficial to fabrication of the Horn Mountain riser components was the company's installed rail transport system, which allowed movement of each of the components through the fabrication bays under cover, transfer outside for exterior preparation and coating, and then back under cover for final assembly.

Having many large and unwieldy assemblies in process at one time, combined with time-sensitive completion objectives, created unique logistical challenges, Yates said.

"Nevertheless, welding was completed with a minimum of repairs," he said. "Critical process controls were used to ensure that quality was maintained and documented throughout the course of fabrication, assembly and testing."

Meeting the fast-track delivery



Three of the Horn Mountain truss spar's upper riser stems, one already fitted with its deck stopper assembly, prior to rail shipment.

schedule for the Horn Mountain project was critical, and compliance with stringent quality and dimensional specifications was essential, since final assembly of the riser systems was to be conducted offshore, where exact interfacing was vital, Yates said.

"The bottom line is that everything fit, and we delivered on-time," Yates said. "Our operating philosophy is based on the statement: 'When nothing but, top quality, performance, and know-how will do.'" ✦



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Topsides lift by Heerema.

the system," Daniel said. "Now they are offshore finishing the commissioning.

"The people actually operating the system were the core group of our commissioning organization," Daniel said. "It was a tremendous benefit."

Spar installation

BP contracted Heerema Inc. to install the Horn Mountain spar, including: installing the mooring system; towing the spar to its Gulf of Mexico location and attaching the moorings; lifting the pre-installed risers from the seafloor; setting the risers in hull porches; installing the riser tie-ins; and installing the topsides and top-tension riser buoyancy cans.

As with the other segments of Horn

Mountain, front-end engineering and planning played an important part in spar installation. Installation planning began in August 2000.

Installation was completed in two phases. The majority of the mooring system, suction piles, chain and wire were installed in March 2002. The remaining installations took place on location.

Righting the spar is similar to righting a deepwater jacket. When righting the spar, four compartments in a tank at the bottom of the truss section are flooded in sequence. That operation took about 12 hours.

One new innovation took place during the installation operation – the use of a fan-beam positioning system

for Heerema's *DCV Balder*. This operation allowed a dynamically-positioned construction vessel that relies on a global positioning system (GPS) signal to keep it on location. Additional positioning redundancy was required in the event the GPS signal were lost. This enabled the vessel to maintain a specified clearance from the spar.

The Horn Mountain spar is the deepest facility and is held on location by a nine-point mooring system. The first phase was installation of the suction piles. Six were 90-ft (27.45-m) long mooring lines and were installed to 87ft (26.54m) below the mudline, while three 95-ft (28.98-m) long lines were installed to 92ft (28.06m) below the mudline.

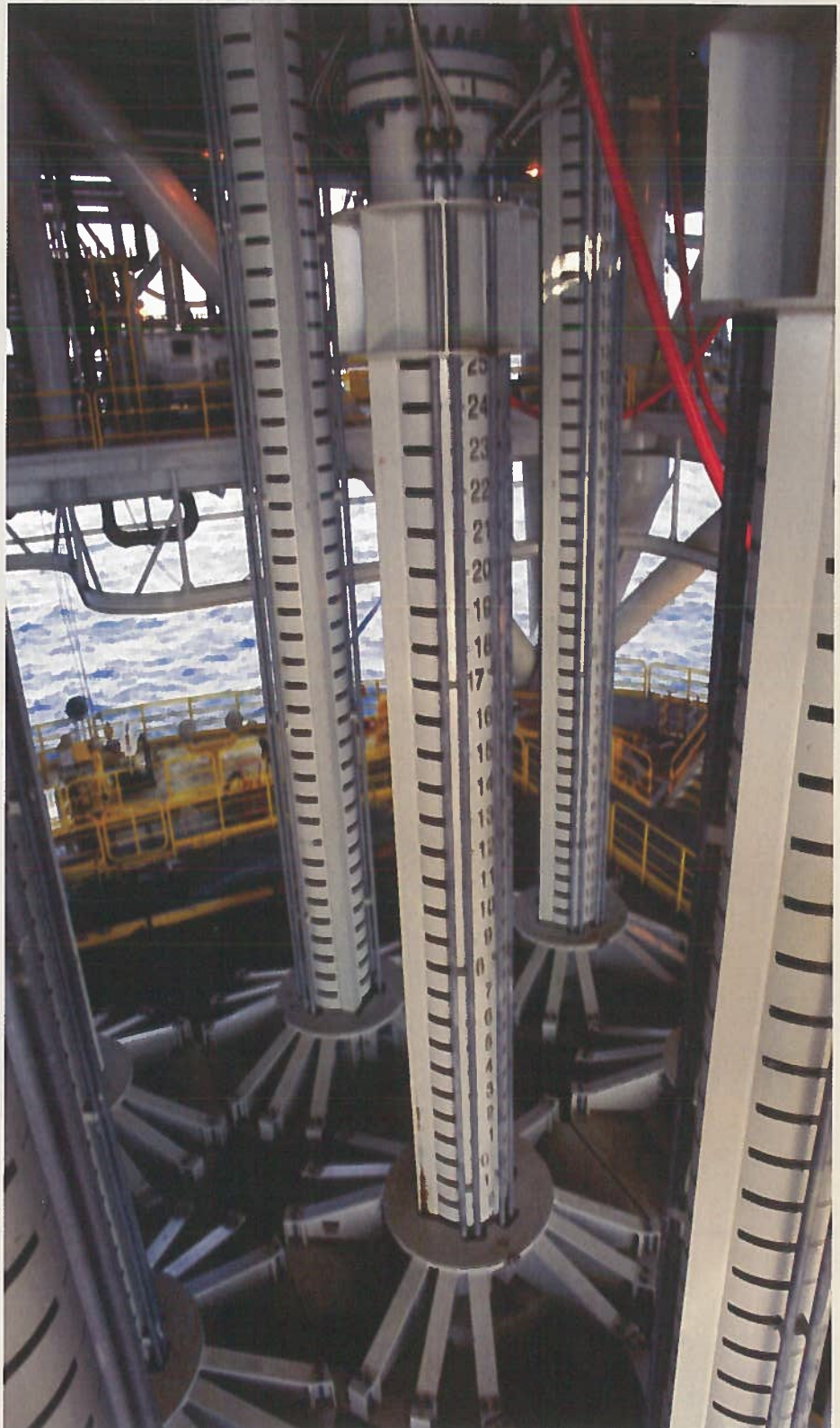
The remainder of the mooring system is comprised of link chain attached to the pile (pile chain), then about 7,000ft (2,135m) of spiral string wire and then another length of link chain (platform chain). The mooring system to the end of the spiral wire was installed and laid on the seafloor prior to the arrival of the hull.

The spar was towed from Pascagoula, Miss., and offloaded from the heavy lift vessel and then towed to the field via three tugs. After the spar was righted, the tugs held it in place until three of the mooring lines were attached. After attachment of the first three mooring lines, the hull was considered storm safe.

With the spar on location, the spiral strand wire was brought from the seafloor and the platform chain was attached. The platform chain was then fed through fairleads into the permanent chain jacks using temporary winches. Installation of the nine mooring lines took about 2 weeks.

The installation of the buoyancy cans that hold the risers in tension is a high-risk operation, said Mike Isenhower, construction manager for Horn Mountain project.

"Installing the mooring lines was an operation that needed careful engineering, but the operation that needed the most attention to the interface between engineering and planning was the installation of the buoyancy cans," Isenhower said, adding that the exhaustive planning paid off and the installation went very well. "Setting the topsides is perhaps the most dramatic operation, but it is actually one that is more standard. The mooring and the buoyancy can installations required much more engineering and planning. The mooring installations are fairly complex with numerous steps in the operation that have to be executed correctly."



High-tech risers connect the wells to the truss spar.

Top-tension risers

The Horn Mountain development