



SIWAREX WP231, SITRANS P220, SITRANS T

Automation and back of deck machines for laying pipelines on the sea floor



On a calm day in the North Sea, laying kilometers of pipeline or cables on the ocean floor is a tough job.

Even in slightly rougher weather, however, surging waves can increase dynamic loads on the line from a normal load of 25 tons upwards of 200 tons. Taking a tough job and making it even tougher.

Pipe- and cable-laying equipment in this environment needs to be rugged, but it also needs intelligence and precision.

With help from Siemens instrumentation and automation solutions, oil and gas operations in oceans worldwide are made safer and more efficient.

Deploying safety

Back of Deck (BOD) machines come in a huge range of size and function. Found on floating production, storage, and offloading vessels, these machines typically perform a variety of operations within the oil and gas industry, including:

- Laying and/or retrieving electrical cables on the sea bed
- Laying and/or retrieving pipes on the sea bed
- Lifting materials from supply vessels
- Transferring cables/pipes from storage reels to vessel reels/carousels (deployment reel)



Cable- and pipeline-laying machinery, like that on the stern of the ship, above, use weighing technology to monitor forces created by the moving cable or pipeline.

Safety is the most important factor when performing these operations, as pipe laying can only go ahead within a good weather window and less than a one-meter swell of water.

To help increase safe operations on board, operators used Siemens SIMATIC S7-1200 control systems to monitor the entire BOD machine's processes, including:

- Integrated Drive System (IDS)
- Motor speeds
- Drives
- Oil pressure and temperature
- Pipe/cable weight from load cells
- Pipe/cable unloading speeds

Weighing on the high seas

Part of any BOD machine responsible for transporting or deploying cables/pipelines is weighing technology. Load cells play a crucial role across the entire BOD machine. Several of the forces they measure include:

Back tension

Starting at the very back of the BOD machine, pipe is stored on board the vessel on a large reel. These cables and pipes can be up to ten kilometers in length, with pipelines made from heavy-duty materials like high-yield strength steel, sometimes even lined with cement.

Load cells measure the back tension of the reel, called the reel load. Think of the tug a kite makes on the spool of string as gusts of wind move it around the sky. The kite-flyer's body compensates for these forces or the spool would get ripped out of his/her hands.

Similarly, if the load cells measure too much back tension on the reel, the control system alerts operators well before machinery could be damaged.

Shear forces

Moving forward along the BOD machine, more load cells monitor the shear forces between the tensioner frame and the ship's deck. The tensioner's job is to control the tension of the pipe's catenary arc below the water, supporting the weight of the sag bend, where the pipe bends under its own weight.

Load cells are oriented to negate the tare weight of the machine, which is subject to the dynamics of the ship's pitch, roll, and heave on the ocean waves.

Total pipe weight

While operators join the long segments of pipe, it is necessary to hold back the already laid pipe using a lock-off clamp. Load cells here support the total weight of pipe that is overboard while the tensioner is offline during the pipe joining.

In each of these applications, many BOD machines have their load pins/tensioners connected to an amplifier, which sends information to the machine's PLC. These amplifiers, however, are quite costly. And, due to their large size, they also take up valuable panel space.

One UK company that manufactures these pipe-laying machines decided to try something different.

Rather than using an amplifier, operators installed a SIWAREX WP231 weighing module from Siemens. Commissioning the module with SIWATOOL software, users can perform load cell adjustments without using calibration forces or weights.



The SIWAREX WP231 weighing module is connected to the Back of Deck machine's load cells, delivering accurate, real-time monitoring as cables are being deployed.

The SIWAREX WP231 weighing module for static weighing applications integrates seamlessly into the SIMATIC control system, providing weighing information and calibration settings within the automation system's programming.

With the SIWAREX weighing modules and the integration into the automation system, operators save on calibration effort, providing real-time information from the entire BOD machine's load cells.

Smooth sailing for pressure and temperature

With the SIMATIC and SIWAREX weighing modules working so well, an opportunity for further automation in this environment came in the form of Siemens pressure and temperature transmitters.

Six to 12 SITRANS P220 pressure transmitters measure hydraulic oil pressure on the handling side of the pipe-laying rig. These transmitters continuously monitor the hydraulic oil pressure to ensure that overloading or damage to the pipe does not occur.

With two-wire input, the transmitters monitor pressure ranges between zero to 400 bar, depending on the flow rate of oil. The PLC monitors the set pressures of all hydrologic systems on the BOD machine, warning operators by alarming if pressures become too high or drop too low.

As well, SITRANS T transmitters measure oil temperatures in the machine's gearboxes. Since temperatures in this machinery can range anywhere between -20 and 100 °C, the transmitters will alarm if temperatures become too high or too low.

Benefits coming down the pipeline

With Siemens Totally Integrated Automation, instrumentation is the eyes and ears of the BOD machines and SIMATIC S7-1200 is the brains. Operators use Siemens SIMATIC S7-1200 PLCs to monitor each instrument, ensuring that processes are running smoothly.

The SIWAREX WP231 weighing module gives operators the accuracy they need to monitor the BOD machines at every stage of pipeline or cable laying.

For Back of Deck machine designers, Siemens instrumentation and control system provide the information their customers need. Making each day—rough weather or not—a bit easier for oil and gas operators.

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