Halliburton sets new deepwater record with subsea pipeline testing device

Custom-designed Subsea Pigging and Hydrostatic Testing Unit (SPHU) tested pipeline at depth of 2,500 meters and 16,300 psi

OVERVIEW

As operators drill in deeper water than ever before, they encounter higher pressures and temperatures than ever before and require heavier subsea pipe work.

Testing pipelines in these extreme conditions has also proven more challenging. The Halliburton Pipeline and Process Services (PPS) group recently helped an operator in the Gulf of Mexico test a line installed in water reaching depths of 2,500 meters (8,200 feet) and at pressures of 16,300 psi, new records for subsea pipeline testing.

But achieving these records required setting another one. The design of the PPS Subsea Pigging and Hydrostatic Testing Unit (SPHU) had to be modified to increase its pressure capability and accuracy in record time. PPS made the modifications in just six weeks and completed the test in just 20 days, despite a hurricane.

<table>
<thead>
<tr>
<th>CHALLENGE</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to pressurize beyond 16,300 psi</td>
<td>Custom-designed SPHU rated to 25,000 psi</td>
</tr>
<tr>
<td>As a safety precaution, the operator’s specs required the SPHU to pressurize 50 percent more than the 16,300 psi needed for the line. PPS needed to show the operator that the SPHU could operate at that extreme pressure and that all control systems would function.</td>
<td>To cope with the high-pressure environment, PPS installed an entirely new pressure system on the SPHU with new pumps and pipe work. The new system exceeded the safety requirements – it can now pressurize up to 25,000 psi.</td>
</tr>
<tr>
<td>Logging requirements</td>
<td>New transducers and software increased accuracy</td>
</tr>
<tr>
<td>PPS also conducted data logging. Pressure transducers had to be replaced to meet system requirements, but the new ones were not waterproof. PPS also had to modify the logging software to increase the accuracy of readings.</td>
<td>PPS found new pressure transducers to meet the operator’s requirements, then designed a new housing for them. PPS also modified the control panel and increased software accuracy by a factor of ten.</td>
</tr>
<tr>
<td>Redesigning SPHU in just six weeks</td>
<td>Working 12-15 hour days, 7 days a week</td>
</tr>
<tr>
<td>PPS needed to ship the SPHU unit to Houston from Angola, make the modifications, test the unit, and deploy it in just six weeks. Such an extensive, customized, redesigned solution would normally take up to 12 weeks to complete, but the operator did not have that much time.</td>
<td>PPS brought in experts from the United Kingdom and found local suppliers to help modify the SPHU. PPS then worked seven days a week using close cross-regional support to complete the redesign, modifications and surface pressure testing in just six weeks.</td>
</tr>
</tbody>
</table>
The operator needed to precommission a line on the sea floor, located at a depth 2,500 meters below the surface. The SPHU is designed to operate in subsea depths of up to 3,500 meters.

PPS increased the chemical payload of the SPHU from two cubic meters to six cubic meters through recent modifications and upgrades. With more of the chemicals commonly used for pipeline precommissioning onboard, the SPHU can now test longer pipelines.

PPS redesigned and modified the SPHU to conduct hydrostatic tests at up to 25,000 psi.

PPS flooded and tested the line in just 20 days, despite evacuating for four days due to Hurricane Isaac. The SPHU remained submerged during that time and was not damaged.

A CASE STUDY: Pressure testing subsea pipelines in the Gulf of Mexico

RECORD DEPTHS

2,500 METERS

INCREASED SPHU PAYLOAD BY 3X

WORK COMPLETED IN 20 DAYS DESPITE HURRICANE ISAAC
A CASE STUDY: Pressure testing subsea pipelines in the Gulf of Mexico

Custom-designed Subsea Pigging and Hydrostatic Testing Unit (SPHU) tested pipeline at depths of 2,500 meters and more than 16,300 psi

Operator wanted safe efficient solution to test line in deepwater well
An operator needed to pressure test a subsea line installed in a deepwater field in the Gulf of Mexico before commissioning it. The Halliburton Pipeline and Process Services (PPS) group recommended the use of its Subsea Pigging and Hydrostatic Testing Unit. The SPHU is placed directly on the seabed and operated remotely, simplifying the operation and saving time. The SPHU helps improve vessel efficiency since it operates independently from the vessel. And unlike conventional methods, the SPHU draws cool water from the ocean floor so no time is lost waiting for warm surface water to cool down before pressure testing can begin.

The SPHU has also been future-proofed to accommodate the oil industry’s push to drill in deeper water with higher temperatures and pressures. Recent upgrades increased the payload of the SPHU from two cubic meters of chemicals to six cubic meters of chemicals, enabling the unit to test longer pipelines than ever before.

SPHU used in record depths and pressures
The installed line was at a water depth of 2,500 meters (8,200 feet). The SPHU was already rated to depths up to 3,500 meters, easily exceeding the required depth for this project. However, the client required a safety margin for pressure that was higher than the SPHU’s design rating.

The operator specified hydrostatic test pressures of 16,300 psi plus a 50 percent safety margin. This required modifying the SPHU. The PPS team installed a high-pressure testing pump on the SPHU, and pipe work was altered to cope with the anticipated subsea pressure. The custom design provided for hydrostatic test pressures of up to 25,000 psi, exceeding the requirements of the operator.

Upgrades increased accuracy of SPHU logging data
PPS also made several upgrades to the SPHU to improve the accuracy of logging data gathered during the test. PPS teams installed new pressure transducers to meet the operator’s requirements. However, the transducers required a waterproof housing which, in turn, required redesigning the control panel. PPS modified measurement software to increase the accuracy of the data by a factor of ten, again to meet the operator’s unique requirements.
Completing 12 weeks of work in 6 weeks
PPS shipped the SPHU unit from Angola and teams from the UK came to Houston to complete the modifications. With close cross-regional support, PPS completed the upgrades to the SPHU in just six weeks, a process that normally would have taken twelve. To meet the client’s timetable, personnel worked 12-15 hour days, seven days a week, to make and test all the modifications required.

PPS completed pipeline testing in 20 days, despite hurricane
PPS then deployed the SPHU to the seabed, positioned it close to the subsea structures, and flooded the line using the SPHU flow-control system. The SPHU onboard pump circulated two pipeline fill-volumes of filtered seawater through the line on the ocean floor. The SPHU onboard metering system chemically treated the second fill-volume. Once the line was flooded, PPS reconfigured and pressure-tested it in accordance with the client’s specifications.

Hurricane Isaac interrupted testing. The vessel evacuated and left the SPHU on the seabed. When they returned four days later, they finished the operation and recovered the SPHU. The onboard data logger recorded the data from the flooding and testing operations. PPS provided the data to the client as soon as the unit returned to the surface. The total operation, even with a hurricane interrupting the process, lasted just 20 days.

Operator pleased with record-setting test
PPS successfully completed the precommission work, breaking new ground and setting depth and pressure records. The operator was pleased with the testing and the efficiency of the job. They were especially pleased with the ability of the SPHU to provide two complete changes of seawater before the pressure testing and still meet their schedule. That exceeded expectations. The operator now plans for PPS to test other pipelines in the Gulf of Mexico. Other operators in the region have also expressed interest in the unique deepwater capabilities of the SPHU.

“I am really pleased with this project, as we set a new depth and pressure record for the SPHU. It was an excellent team effort.”

Steve Arrington,
Global Operations Manager,
Halliburton Pipeline and Process Services