



Total Purity Solutions

Cleaning with Liquid & Supercritical CO₂

- innovative method to clean umbilicals and control lines

The importance of both clean oil and clean systems is critical for e.g. subsea production. Huge challenges at extremely high costs associate with the maintenance to keep up with well efficiency, and thereby, avoid complications with contamination in and around the pumps and to avoid worst-case scenario - breakdowns and production loss.

The ever changing oil prices call for greater deep-water equipment reliability and system cleanness. By integrating this Liquid and Supercritical CO₂ Flush Technology, the system is provided lower tolerances within the Subsea solenoid valves.



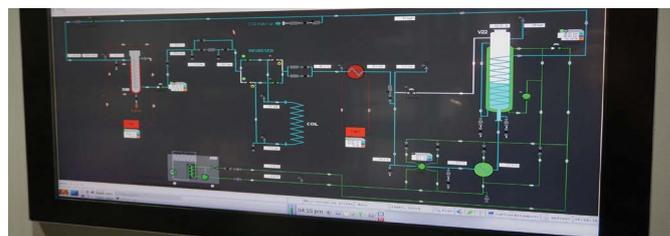
▲ Wax from pipe extruding is one of the results from cleaning a new "clean" umbilical with Liquid and Supercritical CO₂ Flush Technology

"Proof of Concept" - Reliability and Constant Care

Ocean Team has developed this patented cleaning system, which, by the use of CO₂ in a liquid and supercritical state, is able to maintain a turbulent flow inside pipes as narrow as 1/4" in its diameter and even longer than 30 km (20 miles)! Proof of concept was given during a 6,500 m, 1/4" OD Dual Control-line test with 3rd party supervision and results exceeding all expectations.

This method is revolutionary! A conventional cleaning of these often very long and narrow pipeline conditions is insufficient, as the turbulent flow, which is necessary while performing a successful cleaning, cannot last throughout the

entire pipe system. In this case a conventional flushing only cleans the fluid, **not** the pipe system. Dealing with subsea systems under these conditions require a turbulent flow with pressure losses above 30000 PSI. A much greater pressure than the system's design pressure is able to withstand!



"The Innovative Revolution"

The unit is built on the latest technical advances in industrial PC controls and includes a 24" color touch display for easy and intelligent control. Via internet connection, it is possible to create remote Technical Support. After cleaning completes, it is possible to draw a complete Log File of the work flow



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Please note that dirt and contaminating particles generate inside the umbilicals and control lines already during the initial production. This is why it is extremely important and economically advantageous to clean the pipelines prior to installment.

Problems Associated with Unclean Umbilicals and Control-lines are Often Seen As:

- Operational disruptions
- Hydraulic leaks
- Valves, not opening or closing incorrectly
- General malfunctions or defect hydraulic components
- High pressure loss and blockages

Problems, like the above, might lead to unforeseen shut-downs, down time and major economic consequences. The importance of clean oil inside a clean system cannot be stressed enough! 80% of all fluid transfer system failures are due to contamination.

The most important component inside a subsea umbilical and control line system is the oil! Most people consider a new oil as clean, but - it is not! Normally, a new oil has a standard purity of AS 4059 Class 8-12, yet, a purity level of NAS 1638 Grade 6/AS4059 Class 6 is mandatory, when used inside umbilicals and control lines.

Supercritical CO₂ is the Solution!

CO₂ in a liquid and supercritical state has a viscosity 10 x lower than water and a carrying capacity similar to oil. Flushing through a 13 km, 1/4" OD control-line shows a pressure drop of only 150 bar at a remarkable Reynolds no. of 19000. Together with the separation effect inside the SCCO₂ unit, the method reaches a never before experienced cleanliness of NAS1638 Grade 3/AS4059 Class 3. By flushing with CO₂ in a liquid and supercritical state, the system lifespan and reliability improves significantly resulting in great economic effect and that be with-out damaging the envi-

ronment. Besides, this exact method of cleaning is the only one capable of dissolving wax and grease inside the system, while releasing all bound particles.

Real Life Experience Strengthen All Statements

Latest job utilizing the SCCO₂ unit was performed on a North Sea platform as one last try to dissolve a potential blockage inside a one way diesel line towards a well before replacing the entire well system. We were given the chance to prove the units adaptability and solvent effect and used only 3 days to reach a break-through by manipulating the CO₂, its density and solvent effect. This experience revealed major possibilities for extreme problem solving when it comes to contamination and blockages inside long and narrow pipeline conditions.

Advantages in Relation to Conventional Cleaning Methods

A cleaner system with great operational reliability is:

- Faster and more efficient
- Environmentally friendly
- Simple, flexible and easy to use equipment
- Cost saving
- Extends the life of the system
- Degreasing and removing particles within the same operation

