

Twister for Sub-sea Processing

Twister™ Supersonic Separator is a proven gas conditioning process. Condensation and separation at supersonic velocity is the key to achieving step change reductions in both capital and operating costs. Twister technology has no moving parts and does not require chemicals, ensuring a simple processing facility with a high availability, ideal for sub-sea gas processing.

Twister BV completed a feasibility study in 2002 for the development of a sub-sea gas processing system based on Twister technology. The project was granted funding from the Norwegian Research Council through the Demo 2000 programme and from AS Norske Shell. The purpose of the study was to investigate the feasibility of the Twister technology for sub-sea field application. Twister BV and various other partners secured an EU subsidy in 2004 for a four-year development programme to design, construct,

install and test the first pilot Twister sub-sea gas processing installation. A joint technology development co-operation agreement was signed with Petrobras in 2006 to further develop a sub-sea gas processing system using Twister technology. An onshore test is planned in Brazil during 2008 to allow Petrobras to gain operator experience. A sub-sea test is expected to take place during 2010. Twister sub-sea gas conditioning systems are expected to become commercially available by 2014.

"The ideal offshore development"

Twister for Sub-sea Processing

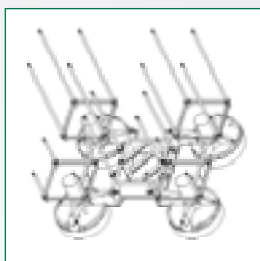
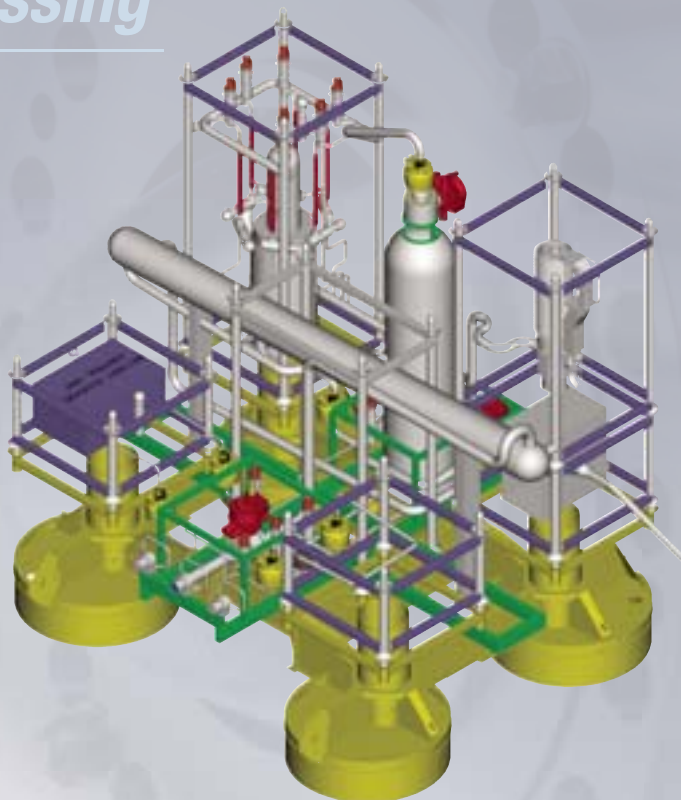
Benefits

Twister sub-sea dehydration and dewpointing enables dry, single-phase export from the wellhead, eliminating surface facilities and riser systems and avoiding flow assurance risks and limitations associated with wet, multiphase export systems.

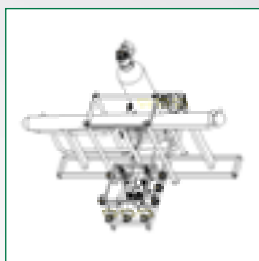
Benefits of sub-sea gas conditioning may include:

- Elimination of surface facilities
- Avoidance of riser systems
- Improved hydraulic performance of pipeline
- Slug prevention
- Hydrate prevention
- Corrosion prevention
- Pipeline cost savings
- De-bottlenecking
- Un-manned operation

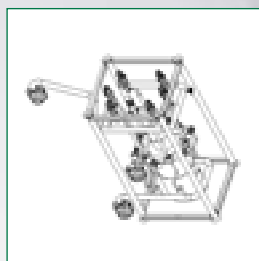
Subsea gas processing also enables the development of stranded gas fields.



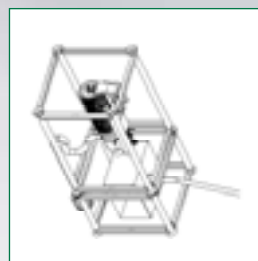
1. Template with four suction anchors, supporting and registering the interfaces for the manifold module and the other retrievable modules.



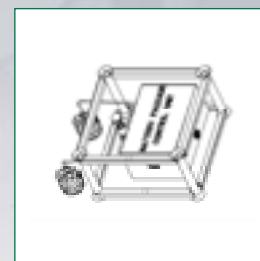
2. Manifold structure including the manifold piping with tie-ins, the Inlet Cooler and the Inlet Separator.



3. Twister unit with the Low Temperature Separator including electric heater, 6 Twister tubes and related piping and valves.



4. Seawater cooling pump unit with electric motor, installed on top of a transformer unit.

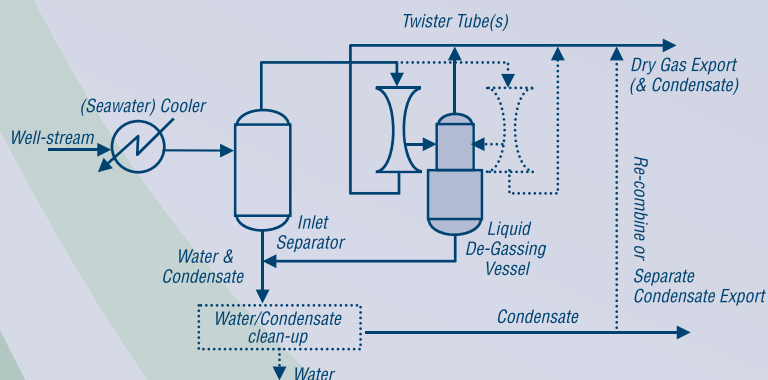


5. Control valve unit with control system and battery back up.

What is Twister?

Twister is a low temperature separation process using supersonic gas velocities, with a performance which can be optimised by improved heat integration using the cold gas exiting Twister, supplemented with air or seawater cooling if required. The inlet separator upstream of the Twister tubes is designed to remove produced liquids and prevents carry-over of slugs and solids. The following issues need to be considered when designing a gas conditioning system based on Twister technology.

- Twister is a fixed actual volumetric flow device. The gas velocity at the throat of the inlet nozzle will always be exactly Mach 1, fixing the flow through the tube. Turndown flexibility can be achieved by adjusting the operating pressure or by taking individual Twister tubes on/off line.
- Twister is a pressure ratio device. For any design pressure, the gas will expand to around 30% of feed pressure mid Twister and recompress to typically 75 - 80% of feed pressure exiting the Twister tube for dewpointing the gas. For NGL recovery applications, the gas will typically expand to around 20% of the feed pressure mid-Twister and recompress to around 50 - 65% of the gas feed pressure when exiting the tube.



Process Flow Diagram of a typical Twister System