OneSubsea Pumps and Subsea Processing Systems
OneSubsea™ offers unique and field-proven pumps and subsea processing systems. Our aim is to provide comprehensive technical solutions to help increase efficiency in subsea oil and gas developments worldwide through high-quality pump standardization as well as tailor-made systems.
OneSubsea supplies pump systems that incorporate the equipment necessary for integration with seabed production systems. Our subsea modules allow light intervention and simple integration with existing or new infrastructure. The subsea system can be safely operated from topside via the variable speed drives and pump control systems located in dedicated power and control modules or in local equipment rooms. In addition to standardized systems, we offer customizable solutions to meet our customers’ unique and individual challenges.

OneSubsea is your one resource for complete subsea pump systems, from pump internals to electric drive and control systems, from support structure to intervention aids, all backed by operational and aftermarket support. As a life-of-field solution, these systems allow any pump to be fitted into the standardized subsea interface, which gives our customers the option to replace one pump with a different type, according to the specific needs during the life of the development.
COMPLETE RANGE OF SUBSEA PUMPS

The initial approach to the OneSubsea multiphase pump systems focused on trial testing of various pump concepts, such as twin-screw and piston pumps, before incorporating the rotodynamic pumping principle known as the helico-axial design. This principle was developed in order to add energy to a fluid mixture of water, oil and gas (i.e., an unprocessed wellstream), and was arranged in a multistage unit. Today, we offer a complete range of pumps, including the more conventional centrifugal pumps, all of which are designed to meet a variety of market demands.

MULTIPHASE PUMP
The OneSubsea Multiphase Pump design is inherently robust and is wear-resistant to conditions where particles such as sand may be present, which is the case in most subsea production systems. The technology was developed to handle hydrocarbon flow at high gas volume fractions (GVFs) up to 100% mechanically and to 95% operationally.

The pump can generate a differential pressure of up to 2901 psi (200 bar), depending on the actual GVF at suction conditions. The pump design has been tested and operated on high-viscosity fluids.
**HIGH-PRESSURE PUMPS**

The pressure capabilities of the single-phase design can reach up to 4060 psi (280 bar), or 6525 psi (450 bar) if operated in series. All pumps are driven by an electric motor mounted on top, and the pump section at the bottom, in a vertical configuration. The pump/motor is fully encapsulated in a pressure housing designed for water depths to 9843 ft (3000 m) and pressures to 15,000 psi (1034 bar). The compact design is ideal for subsea installation and retrieval by light vessels.

Wet-mate power connectors are mated during installation of the pumps, and process inlets and outlets feature two clamp connectors operated by standard ROV tooling.

**HYBRID PUMP**

The OneSubsea Hybrid Pump is a combination of helico-axial and centrifugal technologies, ideal for use downstream from a separator where the GVF is kept consistently low. Characteristics of this pump include significant gas-handling capability and increased efficiency.

**SINGLE-PHASE PUMP**

As with the multiphase pumps, the dynamic pumping principle is used for the OneSubsea Single-phase Pump. The centrifugal design is used for single-phase applications or where the GVF is low.
SINGLE- AND DUAL-PUMP STATIONS

The OneSubsea pump stations have been developed with an emphasis on achieving a symmetrical, flexible and compact design. This design simplifies installation, optimizes pump performance and ensures compatibility with international standards for subsea equipment.

LIFE-OF-FIELD SOLUTION

The piping within the subsea pump stations can be configured to allow for a variety of pump operations, such as parallel, serial or individual, according to the client’s needs and the details of the field.

The interfaces between the pump and the pump station are standardized so that any pump type can be fitted into the same slot. This allows the operator to replace the pump with a different type (e.g., multiphase, centrifugal or hybrid), if necessary during the life of the field.

The pump station can be installed on mud mats or on a suction pile/anchor; it can be integrated in new field developments (i.e., greenfields) and can be easily retrofitted and adapted to existing production systems (i.e., brownfields). A dedicated umbilical connects directly to the module and includes:

STANDARD
- Power
- Barrier fluid supply
- Pump control lines

OPTIONAL
- Methanol lines
- Fiber-optic cables
- Chemical inhibitor lines

To ensure the correct and safe operation of the pumps and production systems, the pump stations are equipped with the following features:

- Production bypass
- Recirculation of flow from pump outlet (for start-up and minimum flow conditions)
- Mixing/slug suppression of inlet flow (for multiphase flow only)
- Isolation of pumps for intervention
- Monitoring of process pressure and temperature

RETRIEVABLE ITEMS INCLUDE:
- Pumps
- Choke insert
- Control modules
- Electrical and hydraulic jumpers
The OneSubsea raw seawater injection (RSWI) system provides a water injection system for installation in fields where topside facilities face challenges with respect to space and weight. The RSWI system reduces the amount of equipment needed to be installed topside. The seawater is filtered to the required level of cleanliness upstream the pump. The RSWI pump uses the same design as the OneSubsea single-phase pump, however different materials can be selected to ensure compatibility with the seawater.

**MAIN COMPONENTS:**
- Single-phase water injection pump
- Seawater filter (when required)
- Process system
- Subsea power system
- Variable speed drive for pump
- Connections
- Umbilical system
- Subsea pump control system (SPCS)
- Operator stations
The Multimanifold has been developed using the OneSubsea patented Multiport Selector, which provides a more compact test and production system for subsea developments. The Multimanifold applies the OneSubsea PhaseWatcher Subsea Multiphase Flow Meter utilizing Vx Technology for testing of individual wells, and can also include pumps, a control system and gas lift distribution. The subsea control system is capable of monitoring all components of the Multimanifold, and for some applications, also provides control of the wellheads that are tied into the module.

These features and capabilities help to provide a comprehensive subsea manifold arrangement, allowing operators to reduce contractual interfaces, in addition to offering a structure with an overall installation weight of up to 50% less than conventional manifolds.
The OneSubsea multiphase compressor is a counter-rotating wet gas compressor (WGC) based on a hydraulic and mechanical design specifically used for pressure boosting an unprocessed wellstream. The integrated and fully encapsulated design of the compressor unit also utilizes the well-proven design of the overall subsea pump system.
The compressor has three main parts: upper electric motor, compressor section and lower electric motor. As in the case of the pumps, a barrier fluid system is used to provide overpressure protection, lubrication and cooling of the compressor’s critical parts on a continuous basis during all mode of operation. All process, electrical power, auxiliary and instrumentation connections have been utilized in more than 25 subsea pumping projects.

**MAIN FEATURES:**

- The WGC can handle 100% liquid without any mechanical issues.

- A simple upstream flow conditioner for slug suppression and provision of homogenous feed to the compressor is included; i.e., no complex and costly preprocessing equipment is required.

- The WGC has 85% polytrophic efficiency and high wet gas polytrophic efficiency over a wide operating range (GVF and flow rates).

- High-reliability design features no surge or minimum flow limitations.

- High pressure ratio is possible due to the positive density effect.

- High efficiency and low discharge temperature are due to interstage mixing and cooling.

- The WGC concept is ideal for subsea applications with a compact design without any need for an auxiliary anti-surge control system, intercooler or inlet scrubber.
The OneSubsea SPCS is an electro-hydraulic subsea control system with high-speed fiber-optic communications. It offers seamless integration of subsea and topside control equipment and is tailor-made for monitoring, control and safeguarding of subsea boosting applications. The SPCS also ensures optimum operation of the subsea system with both high reliability and high availability, as well as expandability through industry-standard interfaces for other subsea or subsurface equipment.
THE SPCS HAS BEEN DEVELOPED IN ORDER TO PROVIDE:

• Fast-acting monitoring, control and safeguarding of subsea pumps and compressors

• Provision of a high data rate communication link for subsea instruments

• Performance of traditional production system operations

• Operation of subsea satellite and full field developments as part of the subsea production control system

In addition to the primary goal of ensuring the safe operation of the subsea equipment, two other objectives have helped drive the development of the OneSubsea SPCS. The first objective is to provide an open architecture that enables the inclusion of various instruments subsea for improved control and condition monitoring. This design offers local data storage with trend tools and the option to interface with the OneSubsea FRIEND® Remote Surveillance and Diagnostic System through Ethernet IP for remote monitoring and control.

The second objective is the ability to provide a high-capacity communication link with bandwidth control to take advantage of subsea instruments such as our multiphase flow meters and other data-intensive instruments. Backup communication also is possible through the use of high-speed power line modems superimposing the communication on the power supply lines.

OUR SPCS WAS DESIGNED TO OPERATE AS PART OF A WIDE RANGE OF SYSTEMS, INCLUDING:

• Subsea multiphase pump systems

• Subsea multiphase compression systems

• Subsea MultiManifold systems (including production trees control)

• Subsea RSWI systems (including water injection trees control)

The OneSubsea SPCS provides a fully integrated control system solution, enabling the signal paths to become short and robust for the system controller. A fast system response becomes increasingly important when operating high-power rotating equipment such as subsea pumps and compressors.
OneSubsea is at the forefront of developing subsea pump systems with electrically powered rotating machinery. We offer the required subsea power systems that are an integral part of the overall system.

However, before the development of what is now the OneSubsea boosting system, limited solutions were available for operating electrical equipment in subsea applications. In order to solve this problem, the necessary competence, knowledge and experience was developed in-house, which has been instrumental in successfully applying boosting systems in the industry.

Our boosting technology was designed to support satellite developments with tiebacks to existing facilities. One goal was to develop boosting systems for 31-mile (50-km) tiebacks. To achieve this, we began developing and improving solutions for driving pumps and compressors for both longer and shorter tiebacks. These developments and enhancements still continue today, with tiebacks approaching three times the distance that was set as the original target being analyzed.
In order to sustain the uptime of the pump system that operators expect today, it is critical to have the necessary tools to ensure a safe and efficient intervention. OneSubsea offers a range of intervention tools for pumps, modules and other subsea systems to help maintain and service the retrievable items from the pump stations.

Our intervention system enables the efficient access and deployment of pumps, pump modules, control modules, multiphase flow meters and choke inserts, in addition to transportation and test skids. These tools are specifically designed to:

- Mitigate hazards during topside handling
- Interface between the retrievable items and the running tools commonly found onboard intervention vessels

OneSubsea’s running tools are designed to ensure efficient deployment and soft landing at the subsea modules. They also allow for running with or without the aid of guide wires.
Drawing on the experience of its parent companies, OneSubsea’s umbilical systems continue to be critical components in subsea pump systems.

The combined power and control umbilicals form an integral and vital part of the pump system, being an important link between the topside power and control systems, and the complete subsea system.

**WE OFFER A FULL RANGE OF UMBILICAL SYSTEMS, INCLUDING:**

- Combined power and control umbilicals, both for dynamic and static service
- Power umbilicals (subsea cables)
- In-field power and control umbilicals

A typical combined power and control umbilical includes the following functional elements:

- High-voltage electric cables for power supply to the pump or compressor
- Low-voltage electric cables for power supply to the subsea control module and/or communication
- Hydraulic lines for control fluid, chemical injection and barrier oil supply for cooling the electric motor and lubricating the mechanical seals
- Fiber-optic lines for communication with the subsea control system
- Termination arrangement topside and subsea
TIE-IN AND CONNECTION SYSTEMS

OneSubsea offers tie-in and connection systems for diverless vertical and horizontal connections, covering a range from 6” to 24” nominal size. The systems are used for connections between subsea modules for both rigid and flexible flowlines and vertical risers.

**MAIN FEATURES:**

- Same standard porch and termination heads for vertical and horizontal connectors
- Flexibility to choose location of seal (inboard or outboard)
- Visual confirmation of sufficient alignment prior to clamping
- Simple ROV-carried tooling for stroking and hub cleaning, inspection and seal replacement
- Same tooling for vertical and horizontal connectors
- Possibility to combine with use of subsea winches (e.g., for riser pull-down)
- Simple and small tool spread and small crew for offshore operation