



Floating production storage and offloading

The Framo advantage

At Framo, we're driven by the simple idea that pumps should never be isolated from the task they perform. It's a belief that revolutionized marine cargo handling. And today it's creating new possibilities for faster, safer and more profitable business in the oil and gas industry.

It's also an idea backed up by experience. Framo has proud roots that stretch back to 1938, and marine customers have put their trust in our unique pumping technology for over 50 years.

But even more important is the trust that customers place in us. That's why we see our designs through from start to finish at our own facilities in Norway, where we test each project in full scale before delivery.

Framo customers know they receive full support throughout the service life of their equipment. No matter the problem, our experts can be dispatched 24/7 to any location worldwide, and they stay until the issue is resolved.

With a global organization of 1200 dedicated employees, we are a partner you can rely on.



Think outside the pump room

From production to offloading, pumps are the heart of oil and gas processes. But traditional solutions with a central pump room mean wasted space, added risk and higher operational costs.

Framo pumps are different. Submerged inside the hull tanks, they eliminate the need for a massive internal pump room and extensive piping.

Specially designed for the harsh conditions of remote offshore areas, Framo FPSO systems offer high pumping power suitable for deep storage tanks. This is thanks to a hydraulic motor located close to the impeller and connected with a short, rigid shaft.

The total result is a powerful solution that reduces risk while saving both space and money. That's what it means to think outside the pump room.

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Floating production storage and offloading

FPSOs explore oil from remote and deepwater locations under harsh environmental conditions. The highest standards for safety and operation regularity apply to designs and equipment. A reliable cargo offloading system is key to FPSO production uptime.



Framo submerged offloading pumps use hydraulic drive technology developed through extensive experience from the tanker industry and further refined for FPSO applications.

The hydraulic motor is located close to the impeller, connected with a short rigid shaft. The motor and shaft assembly is continuously lubricated and cooled by the hydraulic drive oil.

The Framo pump design provides a technically sound construction that allows for transmission of high pumping power and that is suitable for deep storage tanks.

Framo offloading pumps are equipped with stepless capacity regulation, ensuring that the pump flow and head can meet any variation of FPSO pumping requirements.

In-tank offloading pumps provide safe offloading conditions. Pump room and in-tank suction lines are avoided. Each tank is effectively isolated for safe tank entry. International classification societies and regulative bodies advise the use of submerged offloading pumps for FPSOs.



SHELL Prelude



TOTAL Clov

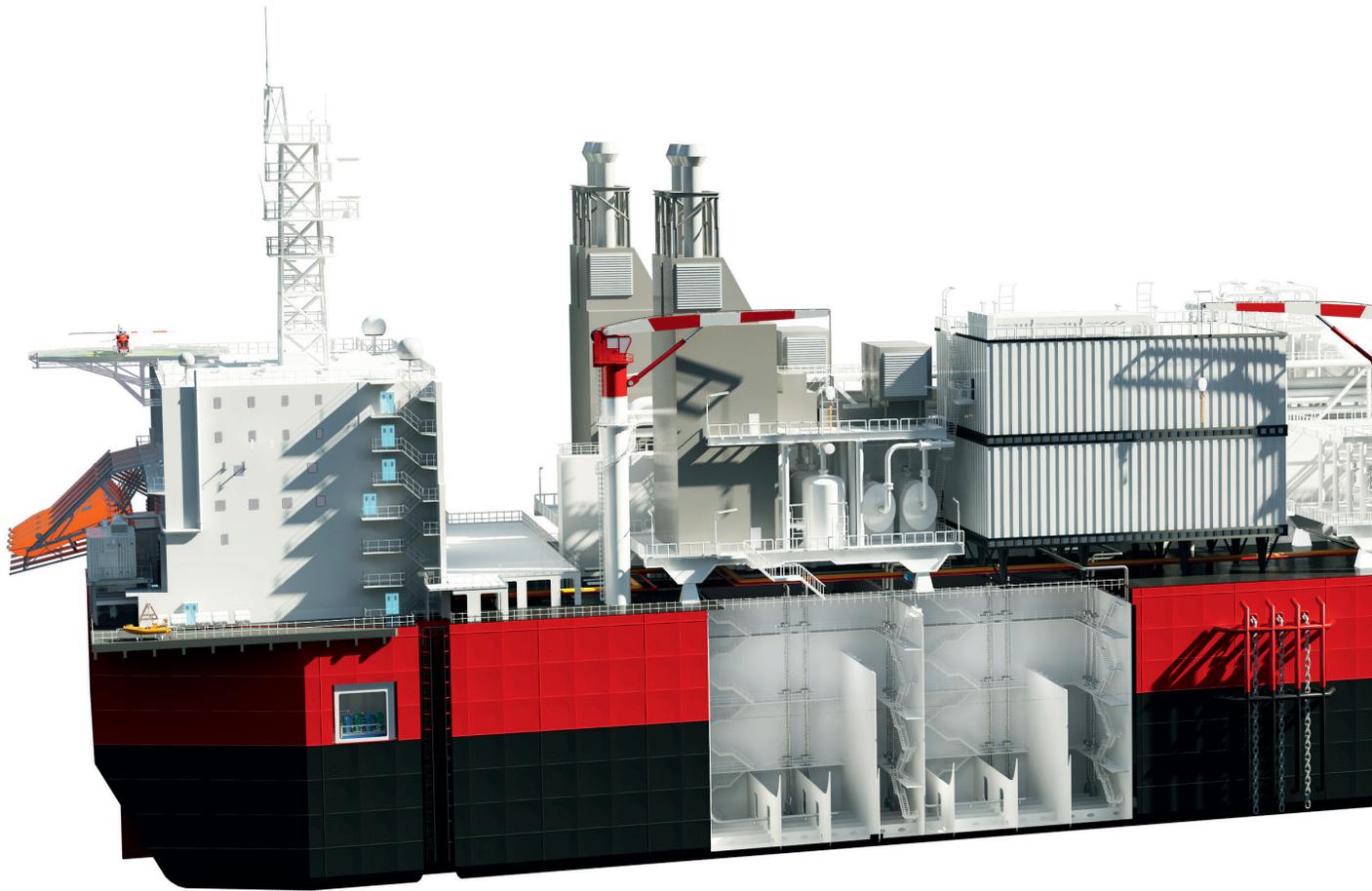
Operating conditions

- 50 – 250,000 bbls/day production rate
- 10 – 40 years of field operation
- Offload crude oil at required flow rate
- Crude oil transfer between tanks
- Shift produced water and skimmed oil from settling tanks
- Tank interior cleaning during offloading operations
- Effectively drain the storage tanks when required



FPSO/FSO

Framo FPSO and FSO pumping solutions provide high-efficiency performance with high torque for heavy-duty crude oil service.



Performance

Hydraulic power transmission offers a safe design that effectively avoids overload as well as over-speed, and pump capacity regulation means efficient tank stripping. Pump material selections are from AISI316L and 254SMO.

Field specific

Framo hull tank pump systems for FPSO applications are designed to field specific crude oil properties and projectspecific redundancy requirements.

Redundancy

System designs can be configured for 1x100%, 2x50% and 2x100% submerged pumps per tank, with hydraulic power systems to meet required pump duties.



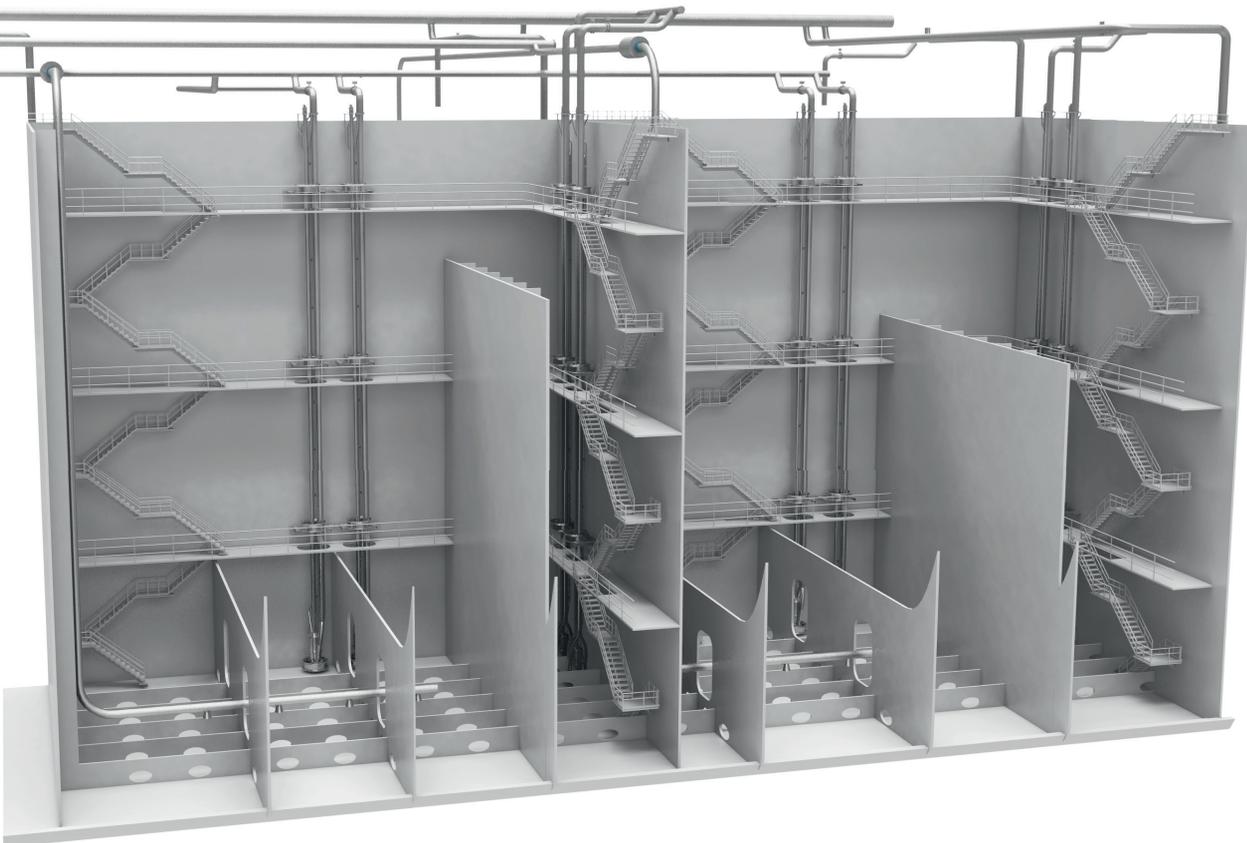
Pump system applications

Applications for Framo FPSO and FSO pumping solutions include:

- Cargo offloading
- Hull process tanks
- Slop tanks
- Slop skimming
- Produced water
- MEG systems
- Flow assurance chemicals
- Hull ballast and deballasting

Crude oil separation and processing

Framo submerged hull tank pumps save topside weight and space, and they can be used for a variety of crude oil and water processing duties. The systems are designed for continuous operation, with material selection for corrosive environments.



Crude oil wash and desalting tanks are equipped with submerged crude transfer pumps as well as water separation. Pumps are configured for 2 x 100%, with fully redundant hydraulic drive circuits.

Pump system applications

Available applications for crude oil separation and processing include:

- Crude oil wash tanks
- Crude oil desalting tanks
- Crude transfer tanks
- Produced water and settling tanks



PETROBRAS P58



TOTAL Pazflor



EXXON Usan

Chemical tanks

As offshore oilfield development projects move to deeper and remote areas, FPSO hull storage capacities can be utilized for process and flow assurance chemicals.

Submerged pumps are used for lifting chemicals to topside process. They can handle all chemicals and variations of specific weights and viscosity.

A chemical tank pump system can be combined with a Framo offloading system or installed with a separate hydraulic power system.

Pump system applications

Chemical tank-related applications include:

- MEG
- LDHI
- Xylene
- Inhibitors
- Dispergants
- Scavengers
- Drilling mud
- UREA





Flow assurance

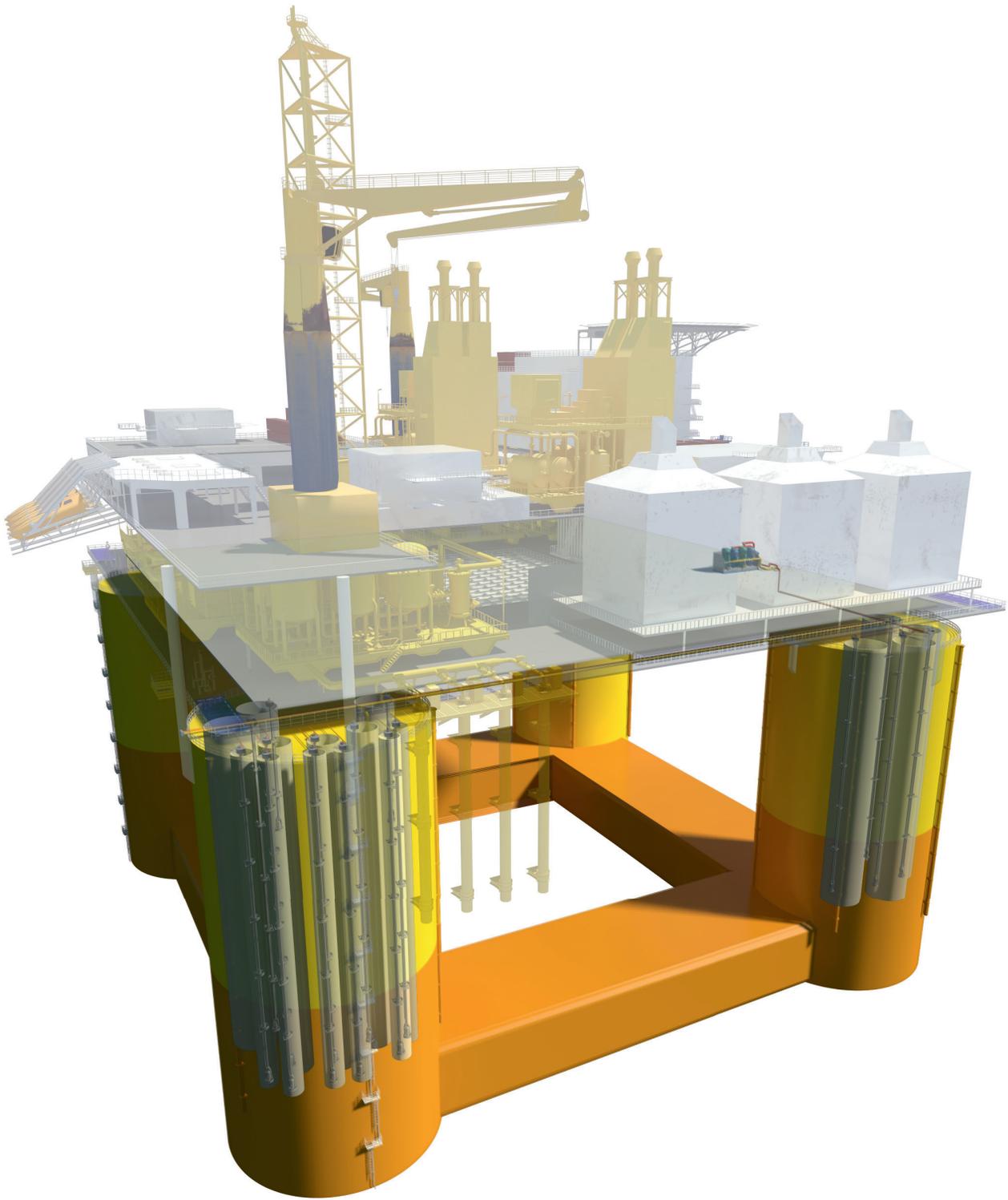
Hull-integrated storage tanks for Semis, TLPs and SPAR platform designs are a cost-efficient and space-saving concept. Deep water installations and multiple flowlines require large volumes of flow assurance chemicals.



Pump system applications

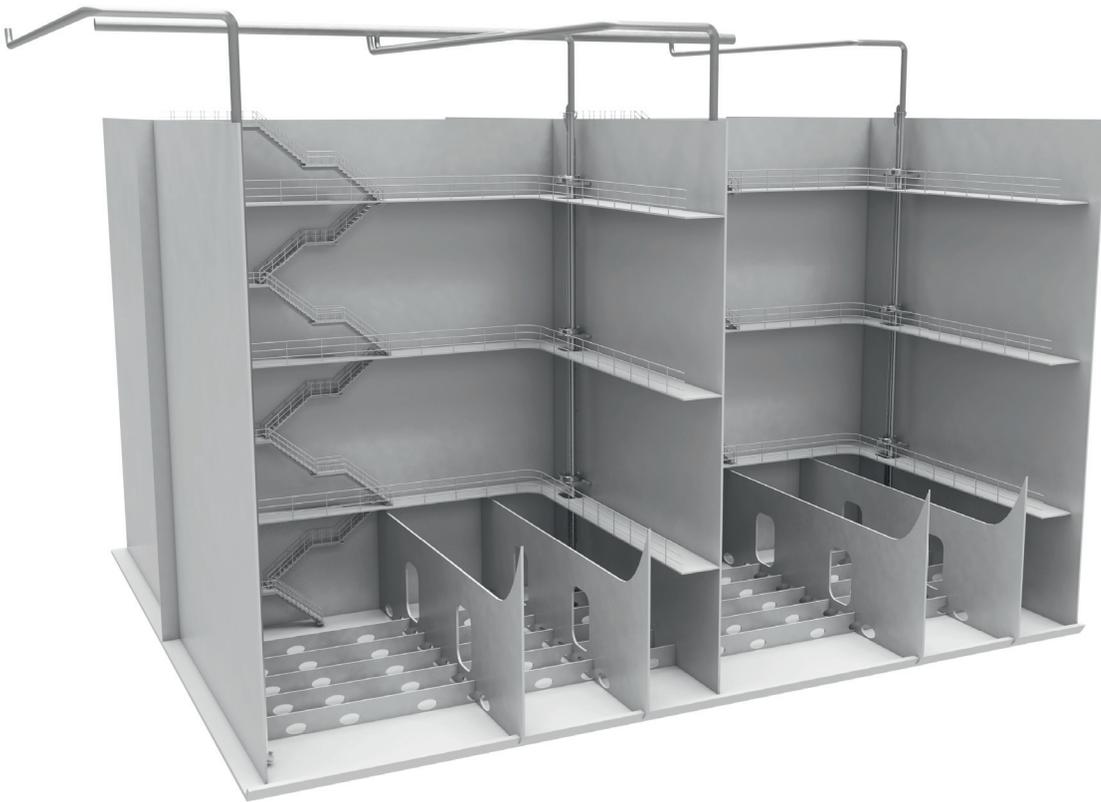
There are a number of application areas related to flow assurance, including:

- Dead oil
- METHANOL
- MEG
- LDHI
- Xylene
- Inhibitors
- Dispersants
- Scavengers



The submerged Framo pump

The submerged Framo pump is a vertical single-stage centrifugal pump powered by a close-coupled hydraulic motor for safe and efficient operation – a well-proven concept, improved and refined to meet a wide range of applications.



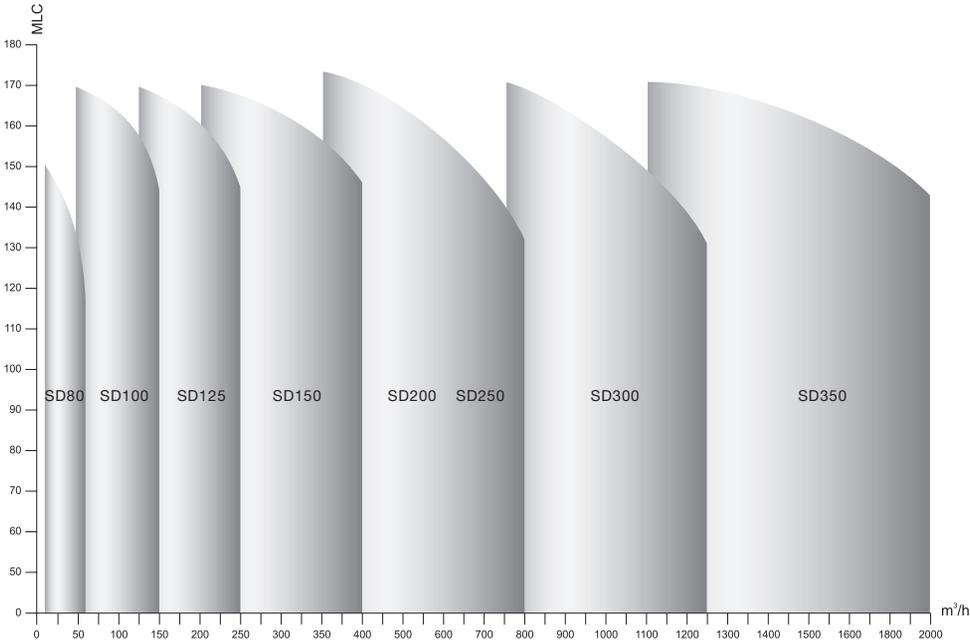
Performance

Submerged Framo pumps give high-efficiency performance with high torque for heavy-duty crude oil service. They provide effective removal of tank residues, and the hydraulic power transmission offers a safe design.

Design features

The high performance of Framo submerged pumps is secured through a number of important design features, including:

- Robust hydraulic drive
- Short rigid shaft
- Barrier fluid protection system
- Condition monitoring without tank entry
- Hydraulic oil drive medium, lubricant and coolant
- Framo unique shaft-seal construction



The hydraulic system

The Framo submerged pump system is powered by a centralized HPU and hydraulic pipeline system. Framo HPUs deliver efficient and reliable power transmission at low noise levels.

Hydraulic drive

The Framo hydraulic power units comprise a number of power packs, with full-flow hydraulic oil filtering and cooling. The hydraulic oil circuit features continuous oil purification and on-line oil quality monitoring. Key benefits of hydraulic drive include:

- Flexible design according to project requirements
- Low-voltage or high-voltage power supply
- Redundant solutions
- Low noise designs
- Well-proven hydraulic drive components

Hydraulic piping

Framo has developed a proprietary low-noise hydraulic piping system design to support Framo's commitment to overall system responsibility. All components exposed to open areas are made from stainless steel materials selected for high performance and minimized maintenance.



FRAMO service

Framo provides extended technical support during system installation, integration and completion. Our dedicated team of specialists offers support with regular field inspections, training instructions and condition monitoring services.



Framo Field Services

Framo services are located at strategic locations for offshore oilfield hubs. Spare parts and specialist service are guaranteed at all times. Available options for expert Framo service include:

- FRAMO dedicated FPSO service group
- Mechanical completion
- Training
- System upgrade bulletins
- Health care inspection
- Service and repair
- Spare parts

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