

SeaPrime™

Subsea MUX BOP Control System

New fault-tolerant and subsea reconfigurable control system that delivers three times more availability than other systems.



**3X more availability
than other systems**



Baker Hughes continually invests to safely advance technologies that make your operations run more smoothly, with higher uptime and lower costs.

Sometimes less is more

Our fault-tolerant **SeaPrime™ I Subsea MUX BOP Control System** is designed to increase reliability, simplify maintenance, and prevent costly stack pulls.

SeaPrime I is the first control system to include a reroutable smart redundancy feature that lets contractors continue drilling if critical components of a single POD are not available—reducing BOP downtime and the risk of a POD-related stack pull.

By simplifying access to critical components, utilizing only two pods, and rerouting hydraulic functions within a POD, SeaPrime I delivers three times more availability than existing systems.

Smart redundancy and subsea reconfiguration

SeaPrime I reconfigures critical hydraulic functions subsea, restoring functionality without a stack pull.

Fault-tolerant hydraulics

The process of rerouting hydraulic functions utilizes smart redundancy—or select spare functions—that are built into each SeaPrime I POD. This enables the system to self-heal and recover full functionality if one component becomes impaired.

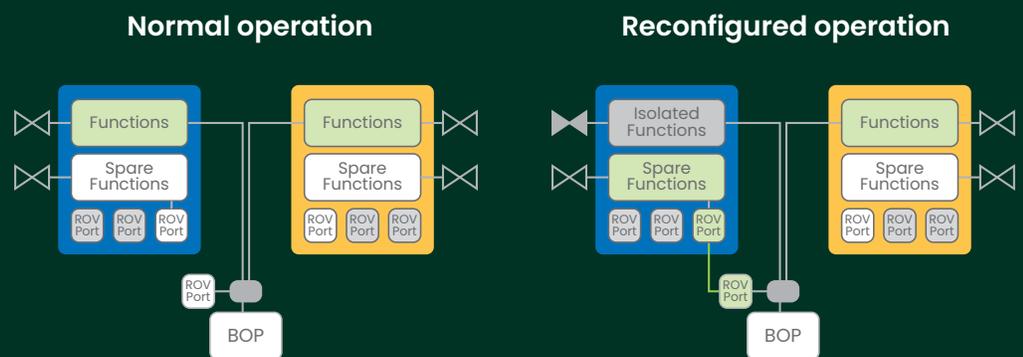
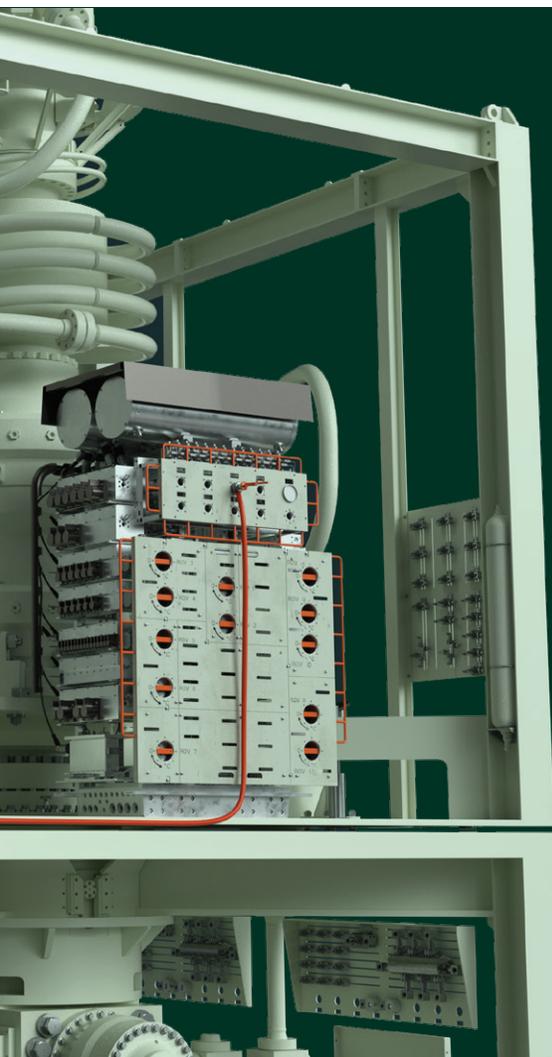
An ROV can be used to operate ball valves on the system to isolate functions. Flying leads are then connected between the SeaPrime I system and BOP panel to reroute functions, which are then re-assigned from the surface controller—all while remaining subsea.

Always in control

All four SEM controllers will remain online before, during, and after rerouting operations—providing uninterrupted controls and diagnostics. All sensors and solenoids are dual electrically isolated channels, enabling the system to maintain complete quad electrical redundancy.

Testing

Components are extensively tested and verified to meet the allocated reliability budget.



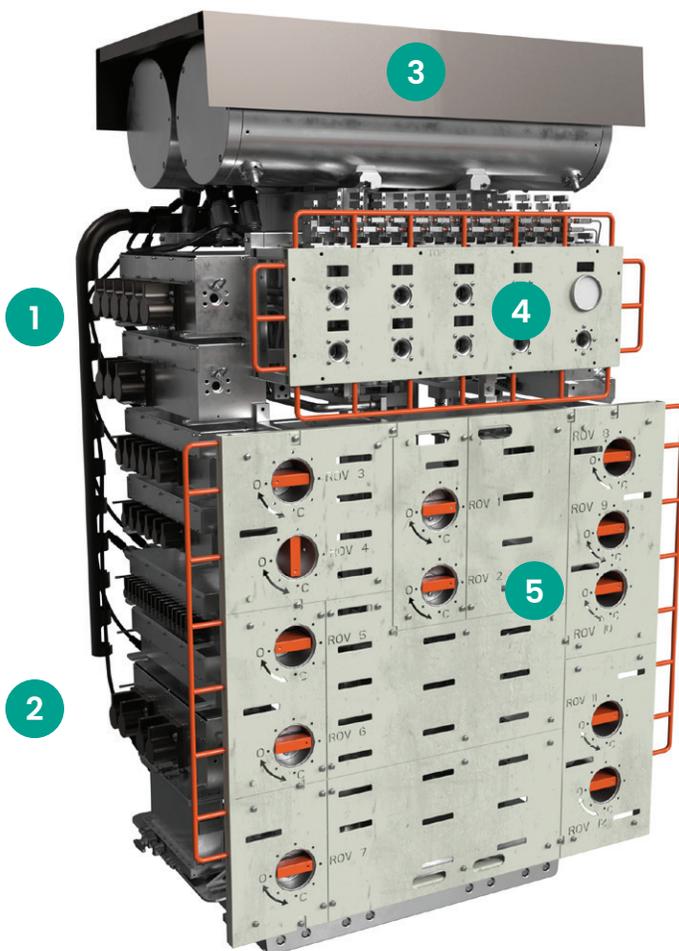
Reconfiguration process for SeaPrime I hydraulic functions

Designed for reliability

SeaPrime I was designed from the ground up using Baker Hughes proven “Design for Reliability” and “Reliability, Availability, Maintainability (RAM)” models, proven in the Aviation, Nuclear, and Power businesses, to drive system-level design and architecture.

Features and benefits:

- Two-POD design with smart redundancy
- Isolates and reroutes hydraulics within a POD, enabling the system to remain fully operational in the event of a critical failure
- Recovers drilling function redundancy using ROV-operated hydraulic bypasses and flying leads while staying subsea
- Improves access to serviceable components and reduces maintenance costs
- Eliminates 100% of pilot tubing, reducing potential leak points by 40%
- Isolates ground faults within each instrumentation bus
- Enables BOP stack flexibility for up to eight-cavity configurations



1. Manifold valve bank

- SPMs
- Solenoids (internal)

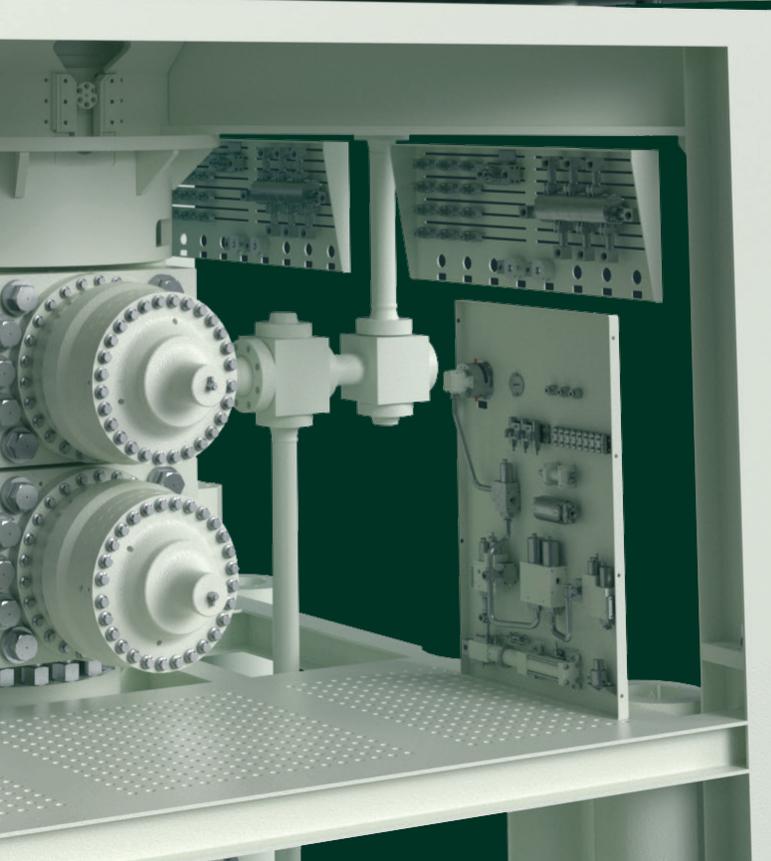
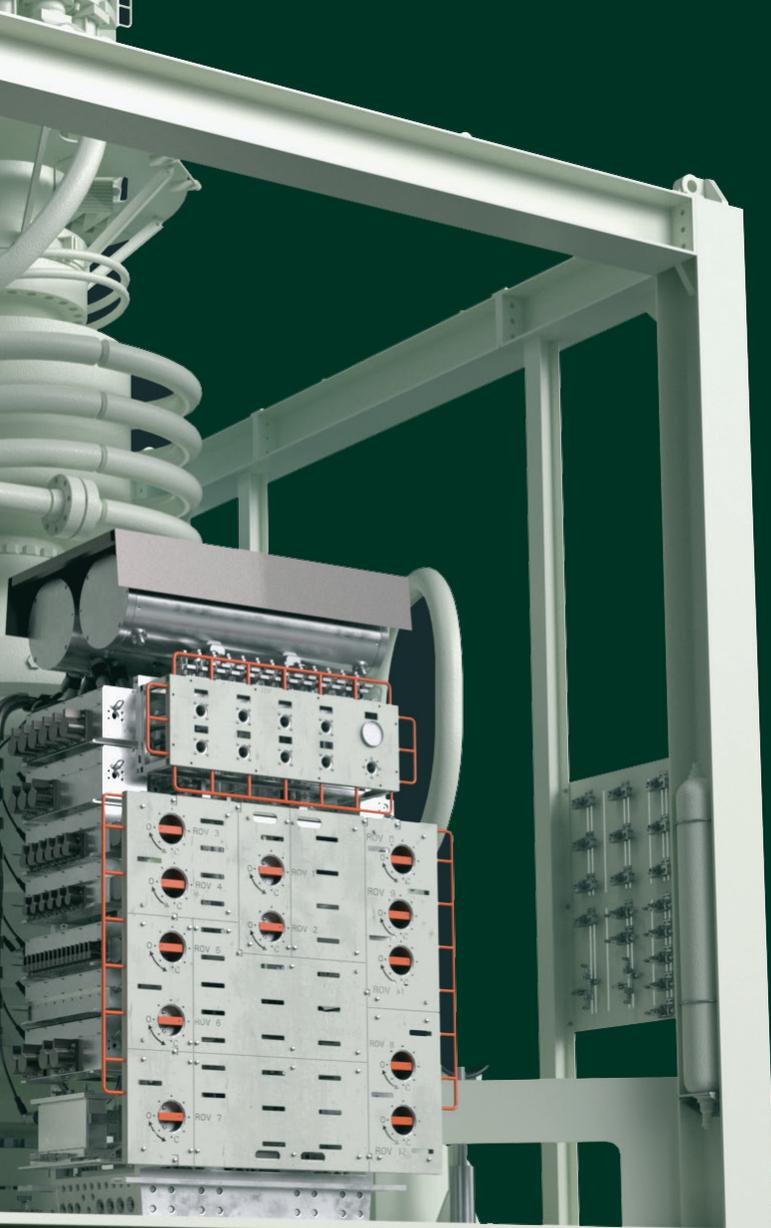
2. Spare valves

- SPMs
- Solenoids (internal)

3. Subsea electronics modules

4. ROV flying-lead hot stabs

5. ROV-operated ball valves



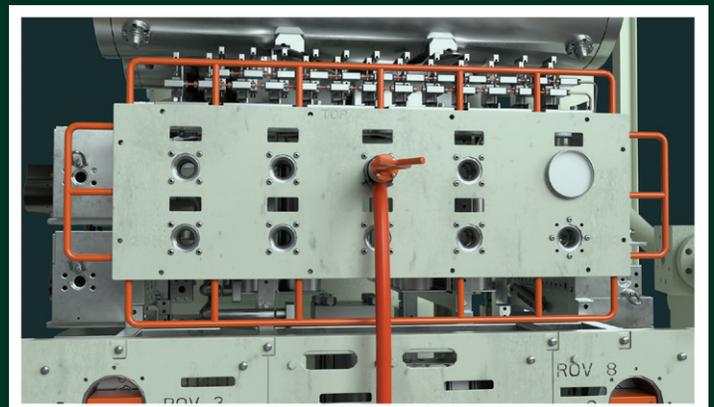
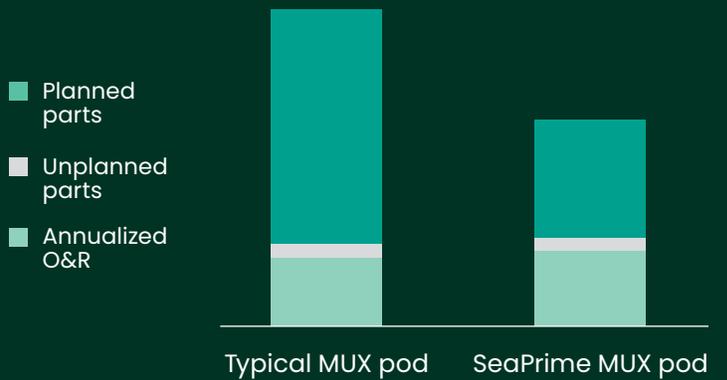
Reduce total cost of ownership

SeaPrime I is designed to reduce time required to maintain (with all serviceable components accessible from outside of the pod), thus saving costs during both planned and unplanned maintenance. With its inside-out design, total cost of ownership is reduced by at least 30% compared to systems currently used in industry.

10-year O&R

This means that the MUX pod can stay on the rig over 10 years, without a costly trip to onshore facilities for overhaul and repair.

Annualized total cost to own

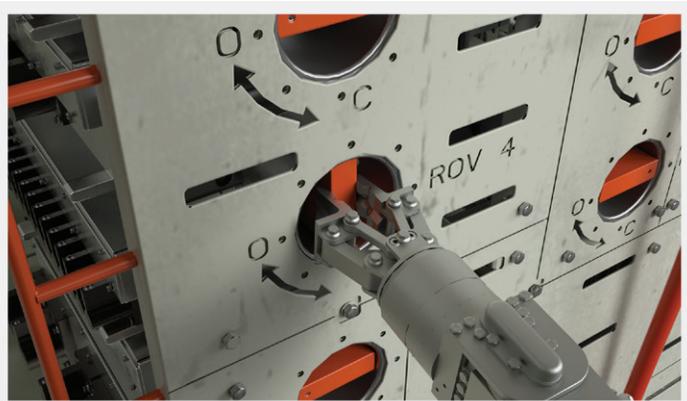


System design

Reliability	Designed to 99% drilling availability for API 53 and API 16D safety critical functions.
Hydraulic functions	Up to 128 hydraulic functions are available, sufficient to control a Baker Hughes BOP stack up to 8 cavities.
Footprint	136 x 85 x 55 in. (HxWxD)
Weight	30,000 lb per pod
Pod shop envelope	The SeaPrime pod is a single unit assembly with integral electronics and hydraulics that do not require separation. On the pod shop, it sits on a test stand adding just 23 inches in height. Lifting height is 175 inches (14.6 ft.), 3 feet access space recommended.
Environment	Rated to 12,500 ft. seawater depth, ambient temperature range of 20°F to 120°F (-7°C to 49°C)
Storage environment	Storage temperature between -20°C and 70°C (-4°F and 158°F)
Compatibility	<ul style="list-style-type: none"> • SeaONYX™ (version 2) MUX BOP surface control system • SeaLytics™ (version 3) BOP advisor • Ramtel+ BOP ram position and closing pressure instrumentation • HPHT probes at LMRP and lower stack
Retrofit	Retrofit to 15K stacks require a SeaONYX MUX cable and receivers. Baker Hughes will review stack-to-stack variations to ensure an easy changeover for existing rigs.

Mechanical design

Design for maintenance	SeaPrime is designed so that all serviceable components (SPM valves, solenoids, regulators) can be accessed from the outside of the control system, saving time to service.
Receiver	The SeaPrime receiver is designed to enable calibration-free interchangeable pods and LMRP stacks.



Electrical design

Control system	SeaPrime uses a commercial off-the-shelf PLC control system.
Electrical isolation	Circuits can be electrically isolated per each external cable, per sensor external to the pod, and per block of eight solenoids. Each individual circuit diagnostic can be monitored from the surface.
Redundancy	Solenoids have redundant coil solenoids, power and driver circuits.
Network	The SeaPrime control system is configured in a subsea ring network that allows quad redundancy of the SEM communication.
Auxiliary power and coms	SeaPrime offers an auxiliary power and coms socket that is isolated from the safety-critical functions. LMRP up to 400 W, lower stack up to 200 W. Communication bandwidth to surface controls: 100 Mbps.
Maintainability	The control system can be diagnosed without opening the SEM dome. The electronics are designed for 10 years of maintenance-free life. In the event that service is required, the SEM components are hot swappable in the moon pool in under 60 minutes.
MUX cable	Dual three-phase 600 VAC power with 12 independent fiber channels. A single cable is capable of supporting power and communications to all 4 SEMs.

Hydraulic design

Supply pressure	Supply pressure is 5,000 psi, regulated working pressure is 500-5,000 psi.
Architecture	Designed for fault-tolerant controls, including ROV stab bypass, regulator bypass, and eight spare functions that can be assigned while remaining subsea.
Regulators	Improved design developed with Design for Reliability, validated in custom high-flow test loop.
SPM valves	Improved design developed with Design for Reliability, validated in custom high flow test loop.
Fluid monitoring	Fluid filtration and clog monitor subsea. The fluid filtration system will give the POD NAS 6 to NAS 7 for 1 year without service.
Test and validation	Hyperbaric tested, shock and vibration tested, environmental tested to industry standards.

