



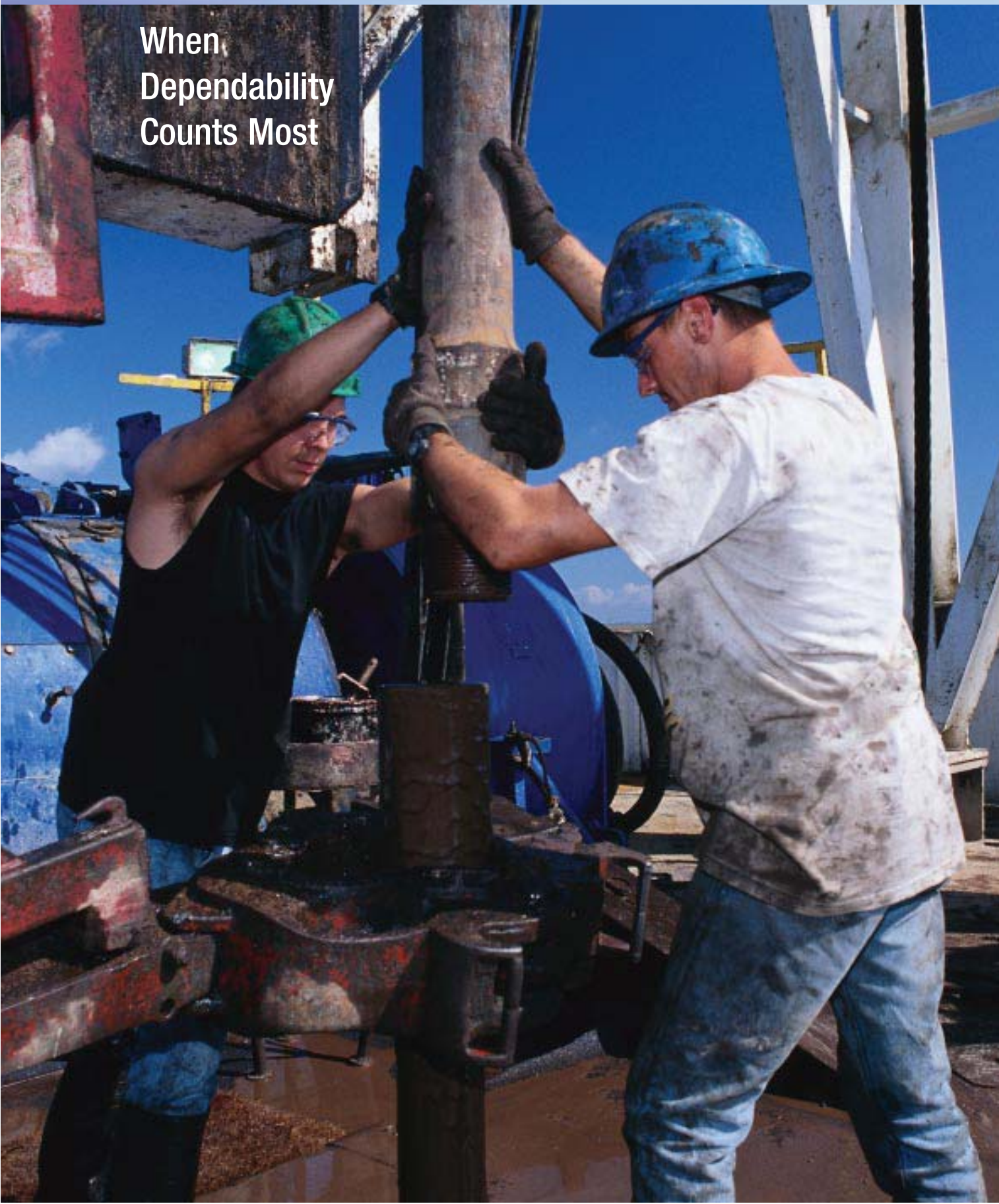
Pall Corporation

Pall Reliability Solutions for Offshore Platforms



Filtration. Separation. Solution.SM

When
Dependability
Counts Most



Pall Reliability Solutions for Offshore Platforms

Offshore platforms used for drilling or production are tightly run facilities with little margin for error. Equipment reliability is of paramount importance in keeping the operation on schedule. When equipment goes down, the ramifications are far greater than with its onshore counterparts. The equipment maintenance or the replacement of damaged parts is very costly and can involve substantial delays in getting the parts out to remote locations.

With decades of Offshore industry and application experience, Pall Corporation provides a variety of filtration and separation products and services specifically designed to solve reliability issues for both topside and subsea applications.

Meeting Critical Needs

Pall's large library of proprietary core materials is at the heart of our capabilities. We configure or modify these materials to separate, remove, or selectively capture even the most elusive contaminants.

Our ability to design, manufacture, install and service integrated systems that can cost-effectively treat all of the incoming, process and waste streams at sites anywhere in the world is exceptional in our industry. We can do this for customers in the offshore market or in any of the wide range of other markets that we serve - markets such as oil and gas production, oil refining, gas processing, chemical production, polymer processing, primary metals, pulp and paper, mining, food & beverage, and water treatment. By meeting critical customer needs, we build strong, lasting relationships that continue to grow year after year.

Total Fluid ManagementSM

Pall is much more than a filter company. We are fluid management specialists who strive to make our customers' operations more successful. Our Total Fluid Management (TFM) program consists of a wide range of filtration products and services designed to help maintain a specified level of fluid cleanliness, leading to improved operations and reliability of the systems involved. To this end, we have developed a comprehensive program that leverages our strengths and provides true value to our customers.

Services

We offer a variety of customized productivity and system services as part of our TFM program including:

- Cleanliness/process audits
- Commissioning
- Reliability engineering
- Laboratory and pilot testing
- Equipment rental
- Flushing and cleaning of hydraulic and lube systems
- Particle/contaminant measurement
- Remote monitoring
- Troubleshooting and system support
- Customized product development
- Training seminars
- System maintenance/service contracts

Quality Assurance Program

Pall's filter elements and housings are built to the highest standards based upon a commitment to excellence that incorporates subcomponent failure analysis and the latest ISO 9000 manufacturing standards. Pall's attention to quality translates into greater reliability in Offshore operations.

Applications: Topside

Application	Challenge	Solution
Compressor Protection	Fouling of valves and cylinders due to inlet gas aerosols. Wear and tear of rotating parts due to lube fluid contamination.	<ul style="list-style-type: none"> • Liquid/gas coalescers for inlet gas protection • Particulate filters to ensure lube and hydraulic fluid cleanliness
Turbine Protection	Deposit build-up on turbine blades causing imbalance and vibrations. Wear and tear of rotating parts due to lube fluid contamination.	<ul style="list-style-type: none"> • Liquid/gas coalescers for inlet gas protection • Particulate filters to ensure lube and hydraulic fluid cleanliness
Injection Water	Plugging of down hole formation by particulate contamination.	<ul style="list-style-type: none"> • Liquid particle filters to prevent solids from getting into the formation
Produced Water	Solid and hydrocarbon contamination can lead to issues with injection and disposal well plugging or environmental violations when discharged to surface waters.	<ul style="list-style-type: none"> • Lucid™ separator for bulk oil & solids separation • Membrane systems to break oil-water emulsions • Liquid/liquid coalescers for hydrocarbon/water separations • Liquid particle filters to remove solids
Surface Discharge Water	Environmental non-compliance by discharging off-spec water containing excessive oil content.	<ul style="list-style-type: none"> • Lucid separator for bulk oil & solids separation • Membrane systems to break oil-water emulsions • Liquid/liquid coalescers for condensate/water separations • Liquid particle filters to remove solids
Gas Sweetening	Amine regenerator reliability; contactor foaming; sulfur plant excursions; off-spec gas.	<ul style="list-style-type: none"> • Comprehensive amine systems reliability program • Liquid/gas coalescers to remove harmful aerosols from gas streams • Liquid/liquid coalescers to remove liquid hydrocarbons from rich amine • Liquid particle filters to remove solids from the amine stream
Gas Dehydration	Glycol regenerator reliability; contactor foaming; off-spec gas.	<ul style="list-style-type: none"> • Liquid/gas coalescers to remove harmful aerosols from gas streams • Liquid particle filters to remove solids from the glycol stream
Mercury Removal Unit (MRU) Protection	Fouling of MRU by liquid and solid contaminants leading to reduced bed life and poor mercury removal.	<ul style="list-style-type: none"> • Liquid/gas coalescers to protect MRU by removing harmful liquid aerosols including amine, glycol and hydrocarbon condensates • Gas particle filters to protect MRU by removing harmful solid aerosols including corrosion products and desiccants
Gas Re-injection	Plugging of down hole formation.	<ul style="list-style-type: none"> • Liquid/gas coalescers for liquid hydrocarbon, glycol removal • Gas particulate filters to remove solid aerosols
Hydrocarbon Condensate	Presence of water and solid contaminants. Corrosion issues in the presence of water.	<ul style="list-style-type: none"> • Liquid/liquid coalescers to remove water contaminant • Liquid particulate filters to remove solids
Sulfate Removal	Reduced life and fouling of sulfate removal nanofilters caused by solids and organics in the sea water.	<ul style="list-style-type: none"> • Liquid particle filters or microfiltration systems to protect nanofilters
Boiler Feed Water	Need for boiler quality feed water from surface water sources that contain high levels of solids.	<ul style="list-style-type: none"> • Microfiltration system followed by reverse osmosis
Potable Water	Need for reliable drinking water for use on-site.	<ul style="list-style-type: none"> • Microfiltration system followed by reverse osmosis

What Separation Equipment to Use for Topside Applications



Pall Liquid/Gas Coalescers

Pall liquid/gas coalescers have an advanced fiber medium matrix that contains increasing pore sizes that allow small droplets in the incoming gas to merge, or coalesce, into larger drops that are then easier to separate.

Pall liquid/gas coalescers perform with maximum removal efficiency and economy that reduces equipment downtime, labor and maintenance costs. The filter medium provides for single-stage coalescing to separate difficult liquid aerosols. Pall liquid/gas coalescers are also specially treated with a fluoropolymer coating to improve the drainage of liquids through the coalescer, allowing for smaller assemblies, and minimizing up-front capital costs. The treatment also lowers operating costs by allowing the coalescer to operate at a lower liquid saturated pressure drop and recover quickly from process upsets.

Products include:

- SepraSol™ liquid/gas coalescers
- SepraSol Plus liquid/gas coalescers

Pall Liquid/Liquid Coalescers

Pall liquid/liquid coalescers are designed to efficiently separate liquid/liquid emulsions and are constructed of a variety of polymer and fluoropolymers to ensure a wide range of compatibility. These high-efficiency coalescers are also designed to work with low interfacial systems without disarming or being compromised by the presence of surfactants. A patented vertical stack design is used with a coalescer – separator configuration to allow an even flow distribution, thus permitting a high flow rate in a smaller assembly. The long service life of Pall coalescer cartridges results in fewer change-outs, thereby reducing maintenance and disposal costs.

Products include:

- AquaSep® Plus liquid/liquid coalescers
- PhaseSep® liquid/liquid coalescers

Pall Gas Particle Filters

Pall gas particle filters (GPF) are used to remove small solid aerosols, including desiccant fines and Black Powder that can be made up of iron oxides, iron sulfides, and other particles in gas streams. These contaminants can foul instruments, valves, compressors, heat exchangers, and other critical system components. Removing these particles eliminates a primary source of the contamination that causes system failures. Pall gas particle filters are available with a pleated medium with high surface area for long service life and are available as coreless elements with depth filter technology.

Products include:

- Epocel® filters
- Ultipor® filters
- Coreless Profile® filters



Pall Liquid Particle Filters

Pall liquid particle filters are used to remove contaminant particles from a liquid stream. The presence of these particles can lead to excessive pump wear, heat exchanger fouling, contactor foaming, and regenerator fouling as well as a reduction in coalescer and carbon bed life. Removing these particles is an important part of an overall preventative maintenance program.

Products include:

- Ultipleat® High Flow filters
- Marksman™ filters
- Coreless Profile filters
- Nexis® filters
- Claris® filters



Pall Bulk Oil and Solids Separations

Pall has the ability to effectively remove gross levels of contaminant water or aqueous fluid in droplet form from liquid phase hydrocarbons and/or conversely, remove contaminant hydrocarbons from water or aqueous solutions.

Our latest separation technology is simple to install, compact, self-cleaning, and requires no auxiliary utilities, electrostatics, controls, or chemical additives to function. The hardware has no moving parts and is compatible with a broad range of fluids.

Products include:

- Lucid separator



Pall Membrane Technologies

Pall offers a broad range of cross-flow membrane technologies that can address a wide range of water purification needs, from rejecting emulsified oil droplets to removing dissolved salts.

Products include:

- Pall Aria™ hollow fiber microfiltration systems
- Pall Membralox® ceramic microfiltration and ultrafiltration systems
- Pall Disc Tube™ high-pressure reverse osmosis systems

Applications: Subsea

Application	Challenge	Solution
Hydraulic Power Units	Solid and water contamination build-up that can lead to pump failure affecting the operation of the control systems and valves throughout the system.	<ul style="list-style-type: none"> • High Pressure (HP) and Low Pressure (LP) stainless steel filter assemblies for particulate removal • Oil purifiers for water removal • Cleanliness monitors and water sensors to monitor contamination levels
Valve Actuator Control Panels	Solid and water contamination build-up that can lead to instrumentation failure and valve malfunction.	<ul style="list-style-type: none"> • HP and LP stainless steel filter assemblies for particulate removal • Oil purifiers for water removal • Cleanliness monitors and water sensors to monitor contamination levels
Subsea Well Control Systems Blow-out Prevention (BOP)	Solid and water contamination build-up that can lead to failure in extending the hydraulic rams that allow for the BOP.	<ul style="list-style-type: none"> • HP and LP stainless steel filter assemblies for particulate removal • Oil purifiers for water removal • Cleanliness monitors and water sensors to monitor contamination levels
Subsea Control Modules (SCM)	Solid and water contamination build-up that can cause hydraulic valves to malfunction.	<ul style="list-style-type: none"> • HP and LP stainless steel filter assemblies for particulate removal • Cleanliness monitors and water sensors to monitor contamination levels
Chemical Injection Systems	Solid contamination that can lead to wear of system components and plugging.	<ul style="list-style-type: none"> • HP and LP stainless steel filter assemblies for particulate removal • Cleanliness monitors to evaluate contamination levels
Directional Control Valves	Solid and water contamination build-up that can lead to loss of control over valves that malfunction.	<ul style="list-style-type: none"> • Stainless steel last chance filters for particulate removal • Oil purifiers for water removal • Cleanliness monitors and water sensors to monitor contamination levels
Seabed Ploughs, Tractors, and Remote Operated Vehicles (ROV)	Solid and water contamination build-up that can impede progress and lead to high maintenance of equipment.	<ul style="list-style-type: none"> • HP and LP stainless steel and carbon steel (subsea paint specification) filter assemblies for particulate removal • Cleanliness monitors and water sensors to monitor contamination levels
Hydraulic Reservoir LP Return	Solid and water contamination build-up that can lead to wear of system components, loss of hydraulic fluid properties ¹ and plugging of orifices and valves.	<ul style="list-style-type: none"> • Ultipleat High Flow filters and LP stainless steel filter assemblies for particulate removal • Oil purifiers for water removal • Cleanliness monitors and water sensors to monitor contamination levels
Reservoir Vent Valves	Build-up of solid contamination originating from vent air that can lead to wear of system components and plugging of orifices and valves.	<ul style="list-style-type: none"> • Air breather filters

¹ Fluid properties affected include compressibility, viscosity, and additive content that can lead to loss of component control and loss of fluid and component protection. Degradation of the fluid properties can lead to foaming, precipitation of solids, corrosion, hydrolysis of ester-based fluids, and potential build-up of water content.

What Separation Equipment to Use for Subsea Applications



Pall Lube Oil/ Hydraulic Fluid and Chemical Injection Liquid Particle Filters

Pall has developed a series of liquid particle filter products designed to meet the stringent cleanliness requirements for fluids used in subsea applications. Fluids that require high-efficiency filtration include those used for hydraulic and lube systems (oil base, synthetic and glycol) and the aggressive fluids used for chemical injection. Pall filtration systems will consistently meet or surpass SAE AS4059E or NAS 1638 class 6 cleanliness level requirements.

Pall's latest and most advanced product is the Ultipleat® SRT Series filter element. The Ultipleat SRT filter design combines a new high-performance medium with an innovative element construction to deliver the greatest possible overall performance and value.

Products include:

- Ultipleat SRT filters
- Rigimesh® sintered metal filters



Pall Oil Purifiers

Pall has developed a range of oil purifiers designed to remove free and dissolved water, free and dissolved gasses, and solid particulate contaminants from hydrocarbon-based lube and hydraulic fluid systems. The use of Pall purifiers has been found to reduce component wear, corrosion, fluid degradation, and loss of reliability.

Pall oil purifiers operate by using a highly efficient vacuum dehydration separation technology combined with high-performance solid particulate removal filters. The Pall purifiers can be used for all mineral and synthetic hydrocarbon-based control fluids and lubricants.

Products include:

- HNP, HVP, and HXP purifiers



Flushing with Pall Filters

The use of Pall high-performance filters during equipment flushing will significantly reduce the time required to achieve or surpass SAE AS4059E or NAS 1638 class 6 cleanliness levels. Flushing in a quick and efficient manner will result in cost savings for floating production storage and offloading (FPSO) vessels and oil platforms.

Products include:

- Ultipleat High Flow filters
- Ultipleat SRT filters



Pall Stainless Steel Housings

Pall offers a variety of hydraulic and lube filter housings designed especially for the challenging Offshore environment. These housings are constructed of stainless steel and are available in a range of sizes and pressure ratings (from the low to the high) to meet the needs of topside and subsea applications. Pall offers both glass fiber and stainless steel media elements to fit the housings. All housings feature easy filter removal for quick change-outs.

Products include:

- 2022 housings
- 2035 housings
- 2050/2060/2070 housings
- 9050/9051 housings
- 9687/9688 housings
- 9071 duplex housings



Pall Cleanliness Monitoring and Diagnostics

Obtaining accurate and reliable fluid contamination data quickly in order to detect abnormal conditions is a key factor in ensuring the efficiency of industrial processes and reducing downtime.

Pall's portable fluid condition monitoring devices resolve detection problems by giving site operators the ability to assess the contamination levels of even the most troublesome fluids reliably, simply, and quickly to prevent unnecessary and costly equipment downtime.

Pall's cleanliness monitors can confirm the cleanliness of almost any kind of system fluid. They use multiple mesh blockage technology to address the common problem of inaccurate or unreliable results when monitoring fluids that are dark, cloudy, or contaminated by water or air. Contamination levels can be reported as SAE AS4059E or NAS1638 classes or ISO cleanliness codes. Additionally, the unit can measure fluid temperature and dissolved water content.

Products include:

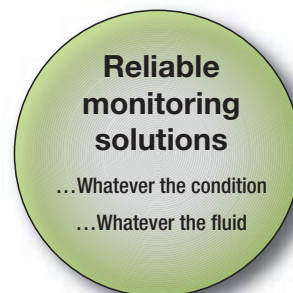
- PCM400 portable cleanliness monitors



Pall Water Sensors

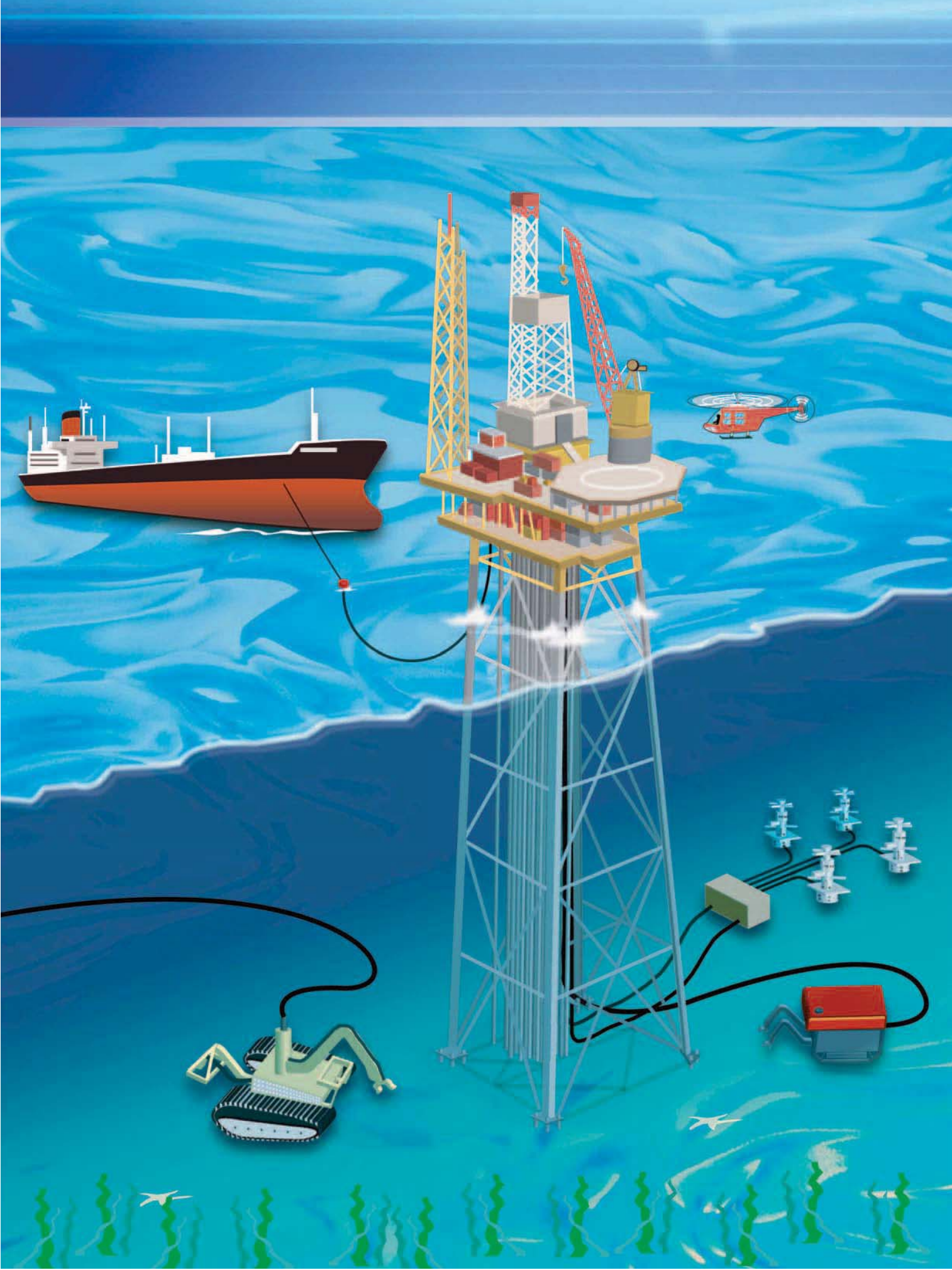
Wherever possible, hydraulic fluids and oils should be operated without the presence of free or emulsified water to prevent corrosion and fluid degradation.

Pall water sensors detect dissolved water in the fluid, displayed as a percentage of saturation or expressed as a parts per million (ppm) reading. Pall water sensor options include a handheld unit for "a-point-in-time" reading or a permanent unit that can provide continuous or timed monitoring directly from the system. Pall water sensors are also available in explosion-proof variants.

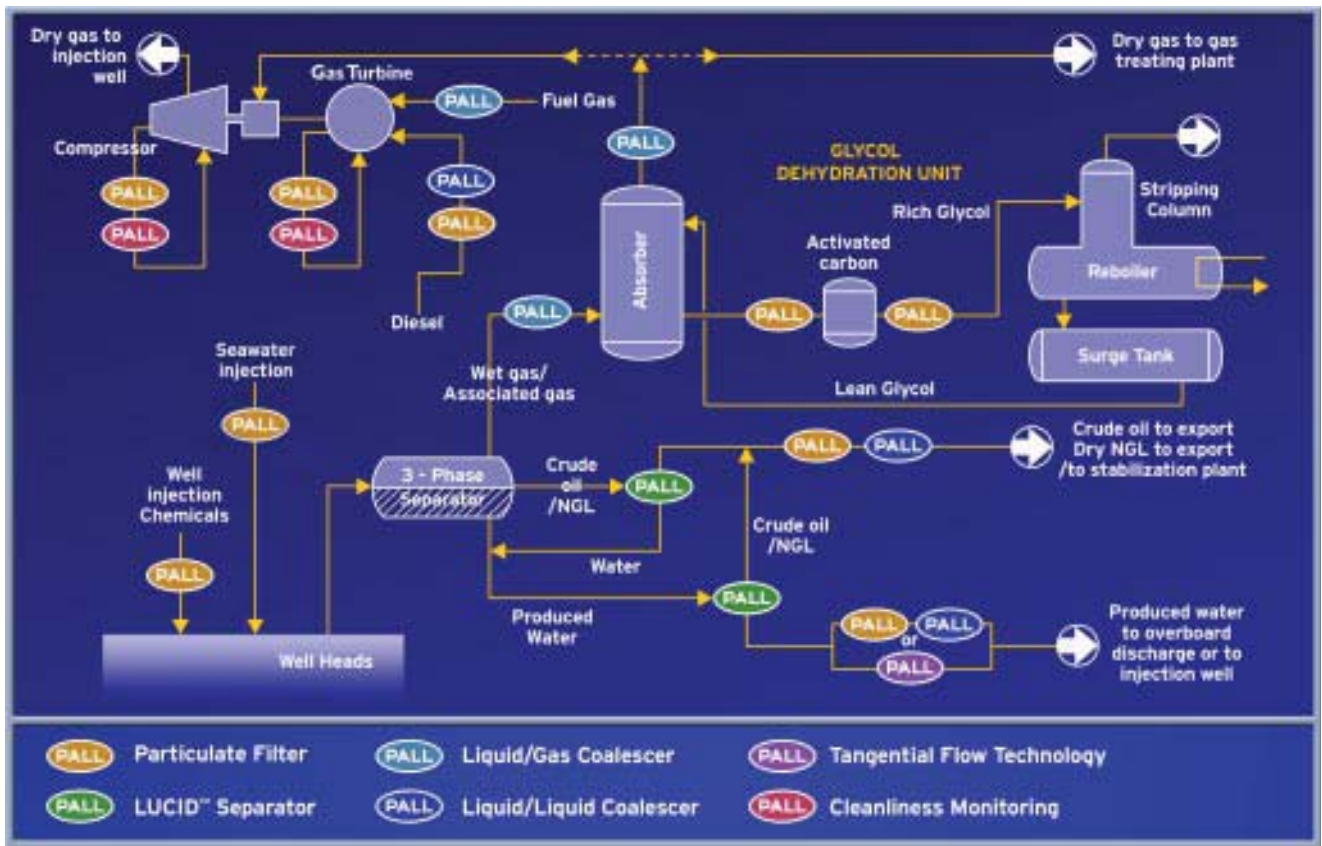


Products include:

- WS04 portable water sensors
- WS07X water sensors for hazardous environments



Pall Filtration and Separation Applications at Oil and Gas Production Plants



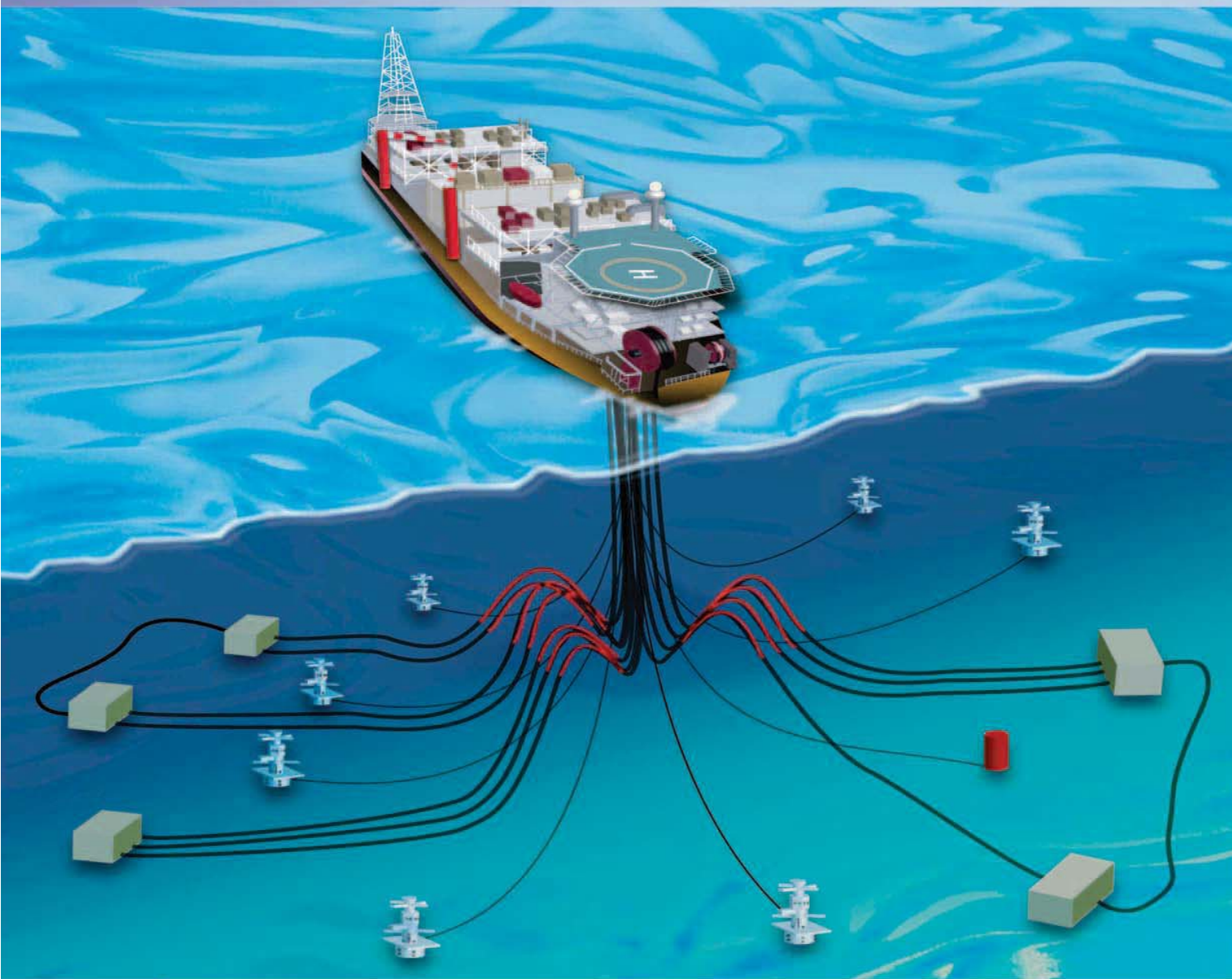
Pall Corporation – A Leader in Filtration Technologies

For more than 60 years, Pall Corporation has been solving complex contamination problems for diverse customers around the globe. With revenues of more than \$2 billion, Pall is the largest and most diverse filtration, separations, and purifications company in the world. Our products and services allow customers to meet regulatory requirements and increase output while reducing total cost of ownership. Our enabling technologies help make customers' products better, safer and even possible.

With offices in more than 30 countries, we are well-positioned to provide assistance to customers on the local level, as well as offer broad-based, worldwide support when needed. At the core of our support network is our Scientific and Laboratory Services Department (SLS), an extensive global network of scientists and engineers who are experts in their field.

We invite you to learn more about Pall's wide array of products and services. For more information, contact your Pall representative or visit us on the web at: www.pall.com.





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