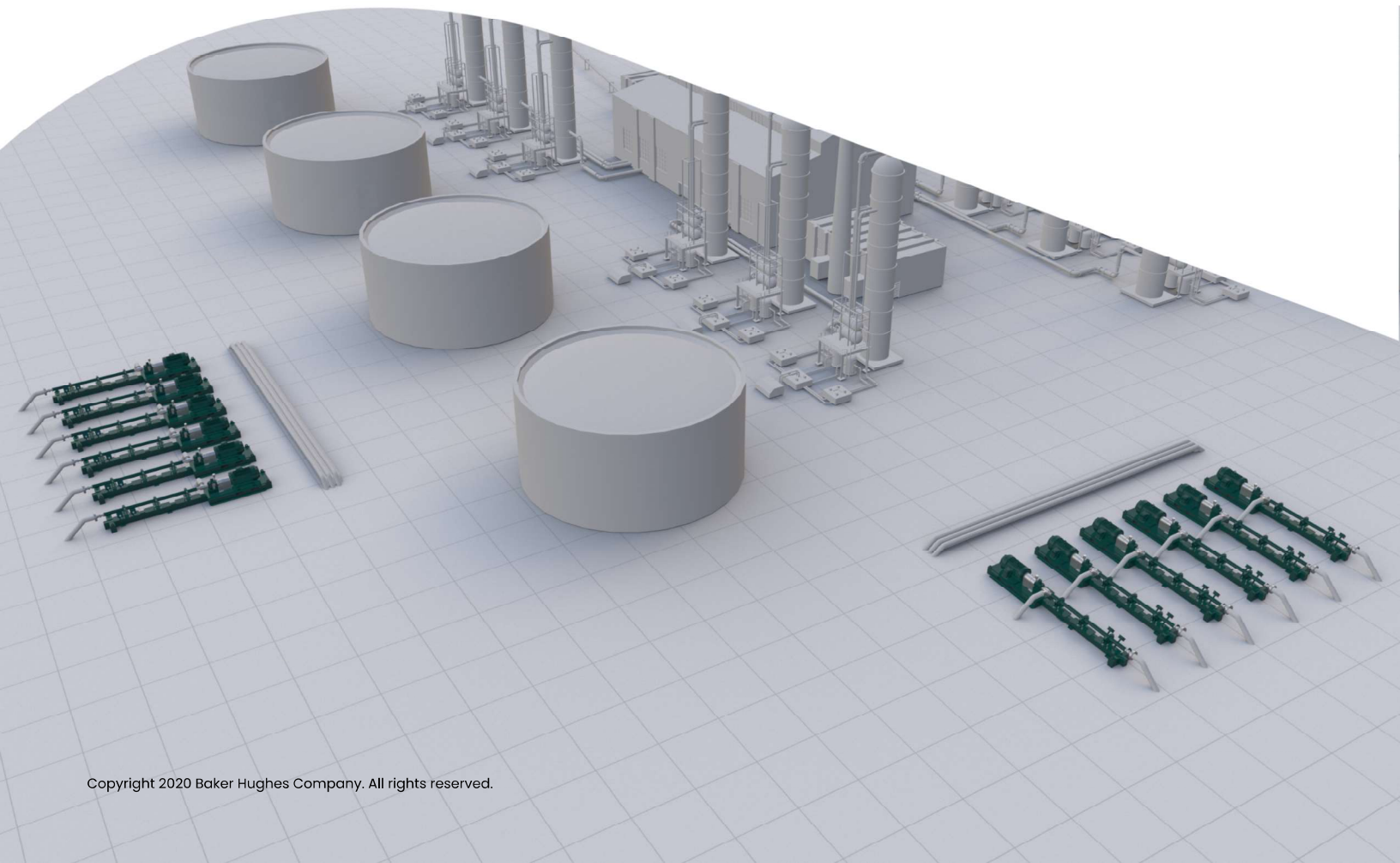


Artificial Lift Systems
Technical Catalog

HPump surface pumping systems

Confidential
Effective: January 2020



CONFIDENTIALITY

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We know that the life cycle of industrial pumps are often at the center of your decision making process. That is why Baker Hughes is your partner for the long run. We carefully consider the life-cycle operating efficiencies, power consumption, environmental impact and reliability of our pumps to ensure they will meet your needs now and in the future.



Improved surface pumping solutions

The drive for long-lasting, highly-reliable, environmentally friendly pumping solutions has led many customers to appreciate our HPump™ Horizontal Pump Systems. The HPump™ pump systems provide versatile, low-maintenance alternatives to many high-speed integral gear-driven centrifugal (OH6), positive displacement (PD) and vertical-turbine pump (VTP) models.

Pre-packaged units

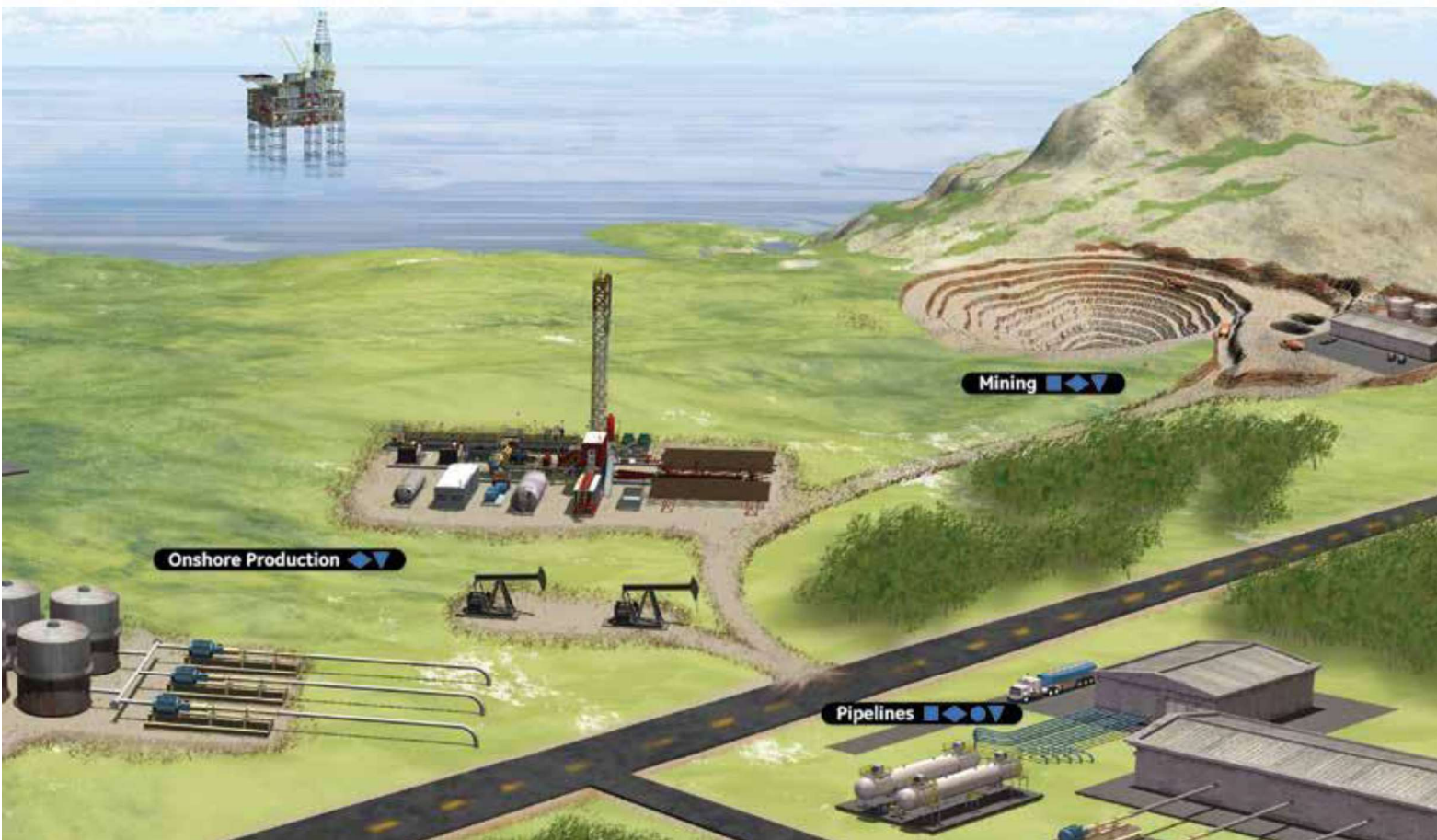
Our HPump™ pumps are available in gas, electric or diesel powered models and can handle up to 2,500 gpm (85,000 BFPD) and discharge pressures up to 6000 psi.

HPump™ systems are delivered to the job site pre-assembled—only requiring suction flange, discharge flange and power hookups. The HPump™ frame is pre-wired with instrumentation and cabling terminated in a central junction box. This frame, paired with the versatile design of our pumps, allows for easy on-site installation and maintenance with minimal site preparation.

Trouble-free service

The HPump™ pump is designed for years of trouble-free operation. There are no V-belts or packing to service. Routine maintenance consists of a quarterly lubricant change and component check. HPump™ units generate little to no vibration-related wear or stress on piping components and they are available with a variety of mechanical seal options (including API 682 seals).

The modular design makes HPump™ units suitable for a wide variety of applications, from routine water injection to mine dewatering and leaching operations. The Baker Hughes HPump™ pump is very reliable, highly-efficient and easily modified in the field, saving you maintenance time.



Pump

The drive for long-lasting, highly reliable, environmentally friendly pumping solutions has led many customers to appreciate our HPump™ Surface-Pumping Systems. Our HPump™ pump systems provide versatile, low maintenance alternatives to many API-style and positive displacement (PD) models.

Mechanical Seal

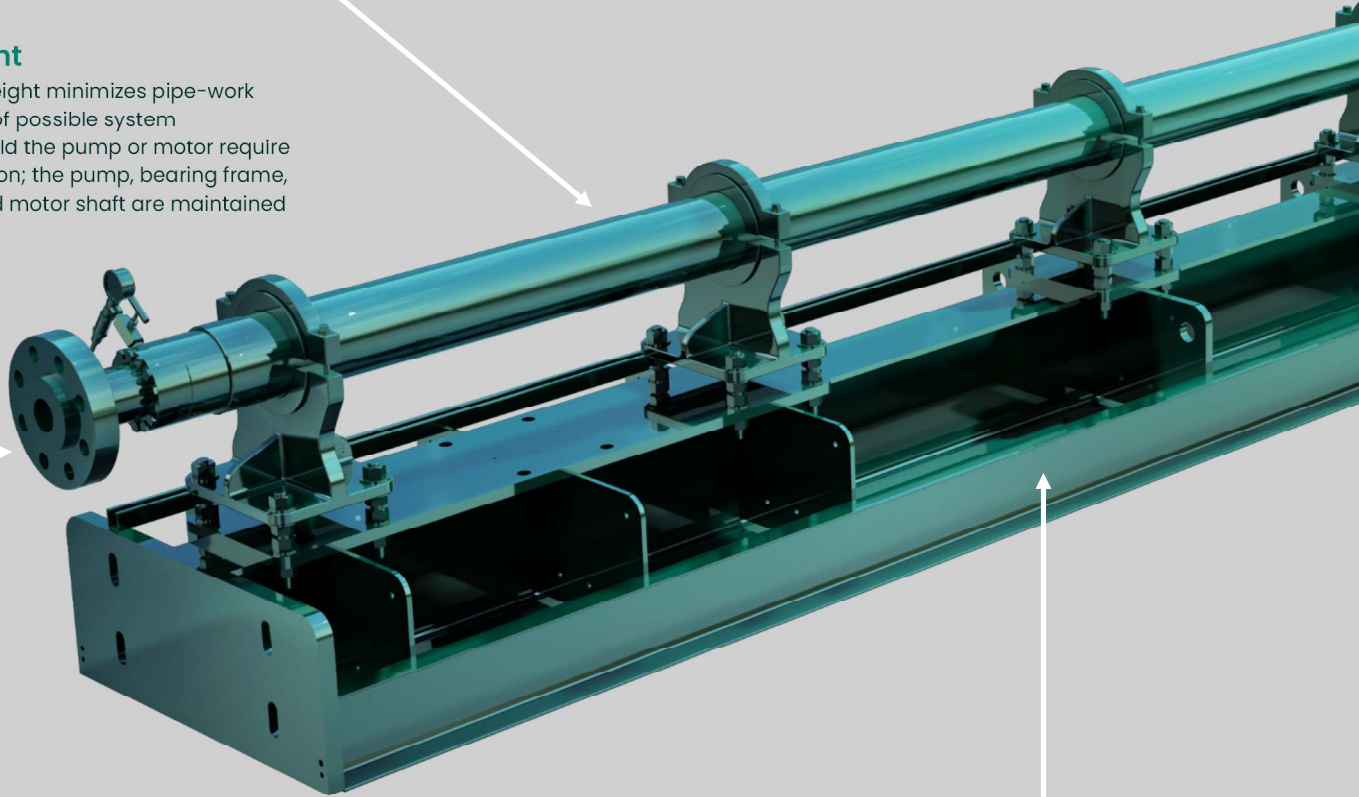
All units feature an optimized mechanical seal and stub shaft with silicon carbide faces that operates at suction pressure. Seals are available up to 3000 PSI. Options include API-682 cartridge type, as well as API flush and quench plans. The patented Front Pull-Out™ design allows for rapid change-out of the seal and/or stub shaft without disturbing the bearing frame and flexible motor coupling, thus avoiding realignment or the spacer coupling requirement.

Dual Access™ Thrust Chamber

The bearing-frame thrust chamber is an easily interchangeable module that is compatible with other HPump units regardless of the pump size. It features a low number of rotating parts for long, trouble free life, requires minimal maintenance, optimizes oil dispersion and reduces operating temperatures using an oil-ringing lubrication system, and includes a thermocouple to provide temperature monitoring and shutdown protection. Labyrinth shaft seals protect the internals from the environment without wearing the shaft surface.

Pipe-work Height

The fixed pipe-work height minimizes pipe-work changes in the event of possible system reconfigurations. Should the pump or motor require changing for any reason; the pump, bearing frame, suction, discharge and motor shaft are maintained at the same level.



Discharge Head

Standard flanges are ANSI-B16.5 class 300 through 2,500, lap joint type to allow for alignment with pipe work. Other connections/ flange standards are available.

Frame Extension

The frame can easily accommodate changing duty conditions or the re-deployment of an existing HPump™ unit for an entirely different application. Additionally, where limited site access (i.e., underground mines) exists, multiple component skids can be provided to facilitate portability and assembly.

EMF™ Frame

The frame features a rigid base for low vibration. Installation is simplified through the use of integral lifting lugs. The motor plate is predrilled and will support virtually all available motor options. Various other mounting features allow easy implementation of API seal flush plans, various electrical equipment, or other customer requests.

Flexible Coupling

A standard spacer-style coupling provides for long life and minimizes maintenance requirements. Other coupling types are available on request.

Motor/Prime Mover

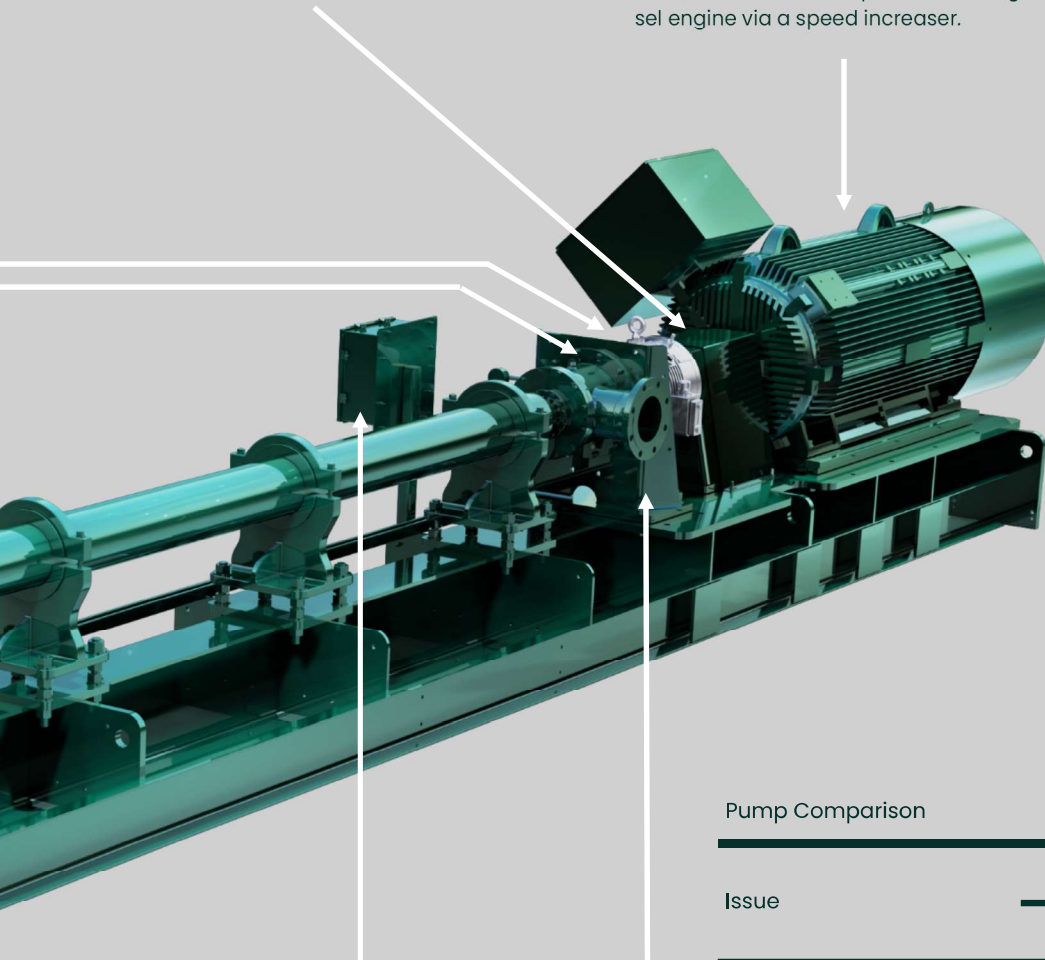
An industry standard 2-pole NEMA and IEC foot-mounted electric motor is used in configurations to suit local requirements for enclosure type, voltage, frequency, insulation class, hazardous area, etc. Other drive options include gas or diesel engine via a speed increaser.

Benefits

- Lower initial and whole life cost
- Short construction lead times
- Increased reliability and runtime
- Low noise and vibration levels
- Easy installation
- Remote monitoring and diagnostic capability
- Worldwide support

Applications

- Borehole mining
- CO2 injection/booster
- CO2 sequestration
- Condensate transfer
- Crude oil boosting/transfer
- Dust suppression
- Geothermal
- Hydraulic power fluid boosting
- Jet pumping
- Lean amine circulation
- Mine dewatering
- NGL boosting/transfer
- Offshore facilities fluid handling
- Pipeline boosting
- Process fluids transfer
- Produced water disposal/injection
- Water recycle/reuse
- Salt dome leaching
- Seawater disposal/waterflooding



Instrumentation/Control Package

The standard HPump™ instrumentation package includes suction and discharge pressure gauges and control switches, a vibration switch and bearing frame thermocouple. Other instrumentation and control options are available.

Suction Chamber

This chamber can be rotated in 45° increments. Standard flanges are ANSI-B16.5 class 150 through 2500. Other connections/flange standards are available.

Pump Comparison

Issue	Pump Type		
	HPump™	PD	BB3/4
Capital Cost	Low	Low	Moderate
Whole-life cost	Low	High	High
Uptime	High %	Low %	Moderate %
Downtime	Low %	High %	High %
Daily/weekly maintenance	No	Yes	No
Downtime per repair	Low	Moderate	Moderate
Cost of repair	Low	Moderate	High
Noise Level	Low	High	High
Vibration	Low	High	Low
Pulsation	Nil	High	Nil
Seal(qty)	Mechanical(1)	Packing(3 or 5)	Mechanical(1)
Environmental Leakage	Virtually Nil	High	Virtually Nil
Flow/pressure flexibility	High	Moderate	Low

PD= positive displacement reciprocating pump

BB3/4= 3 or 4 stage API-style between bearing pump

Dual Access™ thrust chamber design

Benefits

- Industry leading ease of service
 - Easily access your mechanical seal
 - Easily change your thrust chamber
- Minimize downtime with timely repairs when needed
- Proven reliability
- Lowest cost of ownership

Flexibility

Only Baker Hughes offers a patented Dual Access™ design. This allows you to easily access and service your mechanical seal in two ways:

- Through the suction
- From the motor or engine side

Applications



Crude Oil Transfer (North America)



CO₂ injection (North America)



Waterflood (North America)



Water injection

Onshore Production

As your partner, we understand the specific pump requirements for onshore production and provide global pumping solutions to maximize project investments. Our HPump™ pumps are employed in a multitude of onshore production applications including:

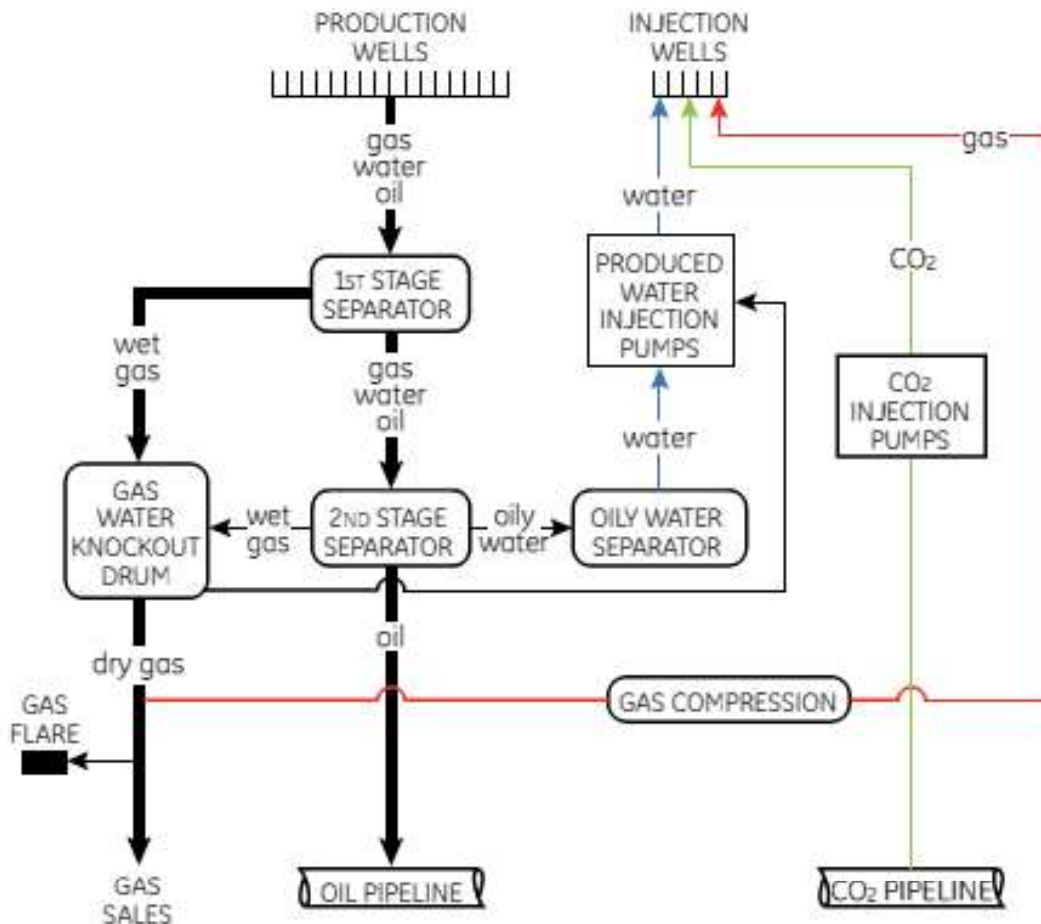
- Enhanced oil recovery systems (ex. CO2 handling and injection)
- Gathering systems
- Production systems for conventional fluids (oil and petroleum products)
- Separations Systems
- Produced water handling and treating
- Steam-generating plants/distribution systems for thermal recovery projects
- Storage systems
- Water Injection & disposal systems



Water injection (Middle East)



Produced water disposal (North America)



Typical onshore production flow diagram



Photo: Øyvind Hagen / Statoil

Offshore Production

Offshore fields account for approximately 35% of global oil and gas production. This is expected to increase as we continue to see growth in deep-water, remote and marginal fields. In these offshore applications, where pumps are used to inject, transfer and boost produced fluids, equipment reliability is critical to avoid downtime, increase run-life and improve operating efficiency.

Due to the requirements of deeper and further offshore applications, we developed a process to customize highly-reliable long service life pumping systems to meet your ship and platform mounted pumping needs. These HPump™ systems maintain your reliability expectations of Baker Hughes, while providing flexibility and responsiveness to application changes.

Offshore applications for the HPump™ pumps include:

- Crude Oil Transfer (platform to FPSO)
- Off-loading booster
- Seawater Injection
- Water Injection



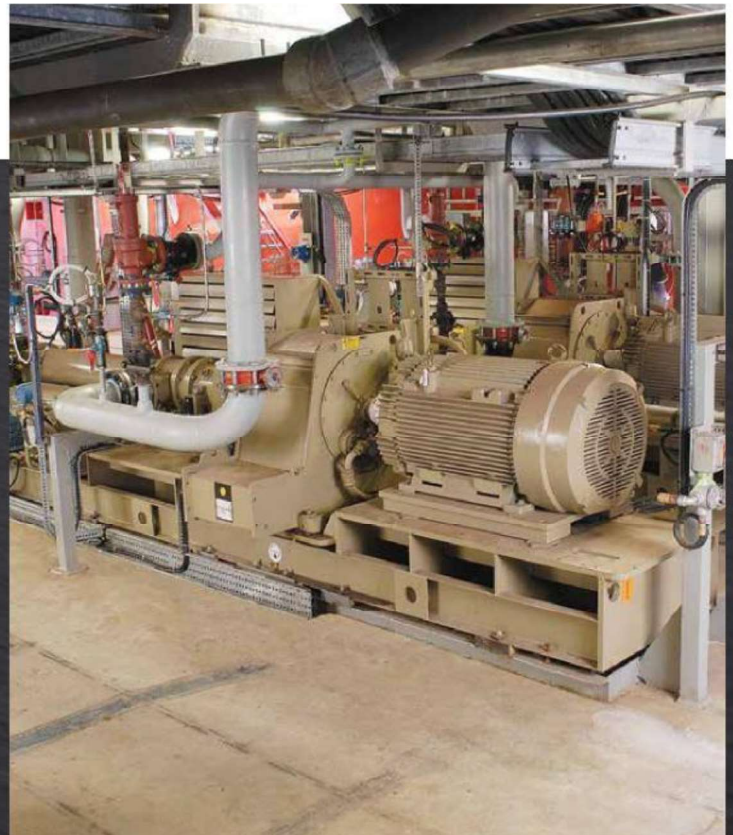
FPSO treated sea water injection (Africa)



FPU crude oil transfer (Gulf of Mexico)



FPU water injection (South America)



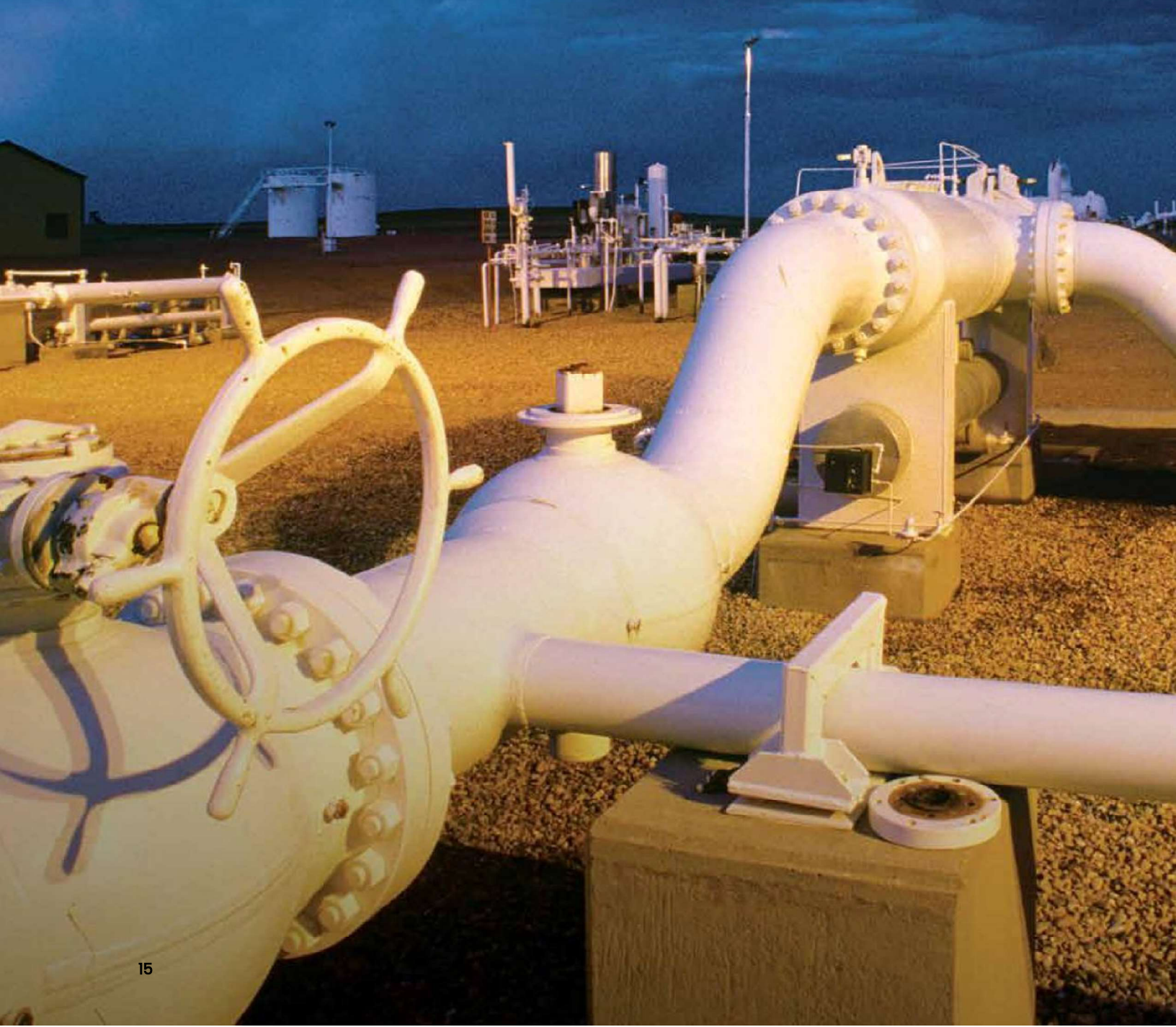
FPU crude oil transfer (South America)



Crude oil and Produced Water Injection (South America)



Ethane pipeline booster (North America)



Pipeline

Pipeline networks require high pressure pumps to move fluids over long distances. In certain instances, booster stations are needed to keep the pressure high enough so the fluid can reach its final destination.

Pipeline operators around the world have discovered that our HPump™ pumps provide versatile and low maintenance alternatives to split-case centrifugal and positive displacement pump applications. The Baker Hughes HPump™ pumps can boost, re-circulate and transfer a wide range of liquids through pipelines in oilfield and industrial applications including:

- Crude oil
- Light hydrocarbons (ethane, methane, butane, propane)
- CO₂
- Refined petroleum products (motor gasoline, aviation fuels, kerosene, diesel fuel, heating oil and fuel oils)
- Petrochemical feed stocks and products
- NGL (natural gas liquids)



CO₂ pipeline booster (North America)



Crude oil and Produced Water Injection (South America)



CO₂ pipeline booster (North America)



Hydrocarbon Processing

The process industries are among the world's largest users of industrial pumps. Refining, petrochemical and chemical process operations employ a multitude of methods that convert raw materials into finished products of value. Managing fluid flow (liquids and gases in motion) throughout a given operation is critical. To maximize your operating efficiencies, improve flexibility and create the potential to decrease environmental impact, we assess each of your applications in order to deliver the best possible pumping system.

Our HPump™ pumps are extremely reliable, high performance units and are well-suited to a wide range of high pressure, heavy duty applications including:

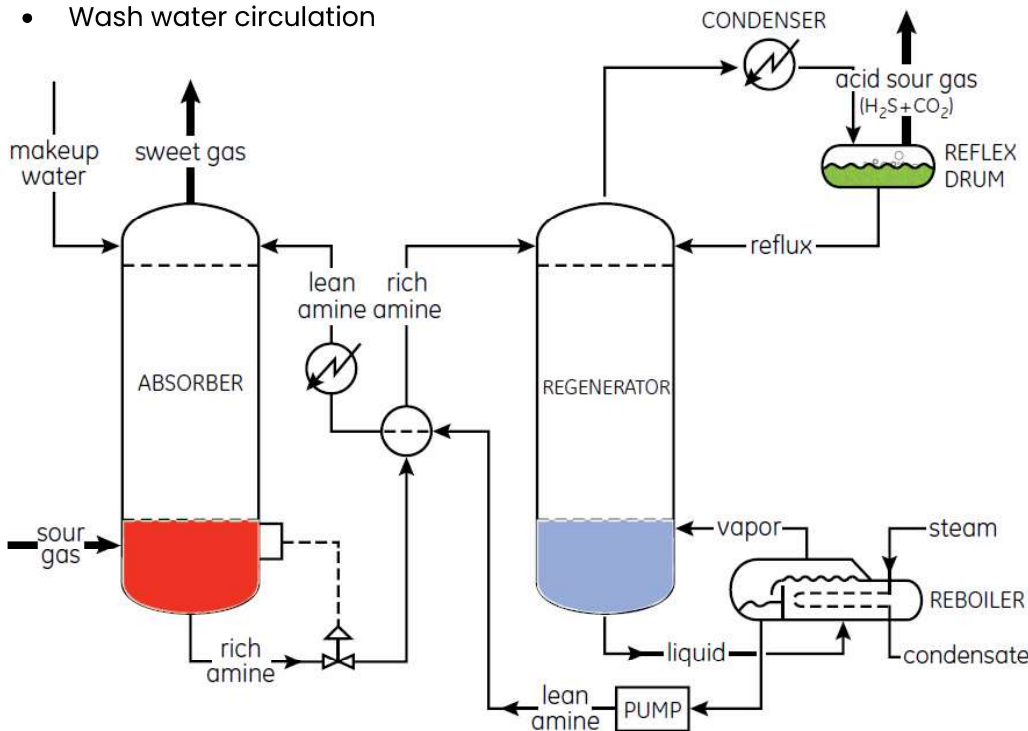
- CO₂ sequestration
- Condensate transfer
- Crude oil boosting and transfer
- Hydraulic power fluid boosting
- Lean amine circulation
- Liquefied/natural gas (NGL) boosting
- Liquefied/natural gas (NGL) transfer
- Process fluids transfer
- Wash water circulation



Mixed light hydrocarbons (North America)



Amine gas treating (North America)



Ethane Booster (North America)



Mining, Municipal, Industrial, and Geothermal

Effective water management is critical in mining and salt dome leaching operations. Our HPump™ pumps are available to the MMIG industry as portable skid-mounted units, trailer-mounted units and as multiple pumps in fixed installations at main pump stations and can be used in the following applications:

- Seawater transfer (to mines for processing)
- Mine de-watering
- Cavern (salt-dome) leaching
- Open pit and shaft mining
- Borehole mining

Mine Water Management

Mine operators must be able to manage water throughout the operation and quickly alleviate problems as they occur. Mine dewatering is usually undertaken to ensure the stability of mine walls during and after excavation, or to optimize mine production and increase operational efficiencies.

In many mines, the amount of water that must be pumped exceeds the mines' water consumption requirements. In this case, a majority of the excess water is discharged to our surface HPump™ water pumping systems, re-injected into aquifers, applied to crop land, or piped to power plants.

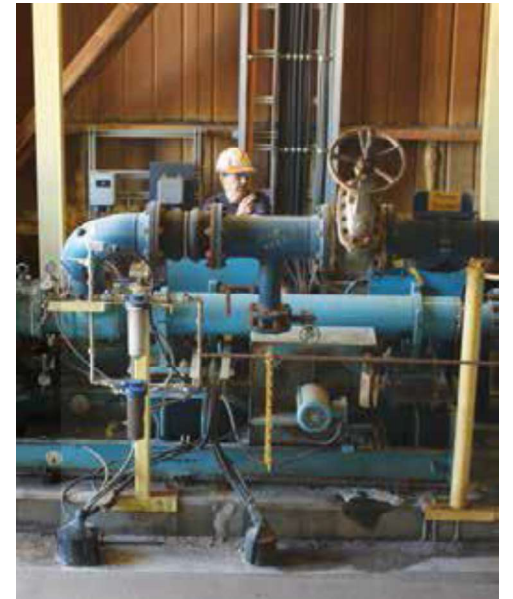
Cavern Leaching

There are numerous cavern leaching and/or formation jetting (borehole mining) applications. For example, a salt dome is a type of structural dome formed when a thick bed of water-soluble mineral sediments (mainly salt or halite) intrude vertically into surrounding rock strata, forming a diapir.

In salt dome leaching processes, our HPump™ pumps are frequently used to circulate water, absorbing the salt. A large underground cavern is formed after the salt has been leached and the water is removed. BHGE's HPump™ pumps are also used to re-inject materials such as oil, natural gas, hydro-gen gas or even hazardous waste into the empty caverns for storage.



Salt dome leaching/brine water (North America)



Mining operations (North America)



Water transfer installation (North America)

Case Studies

ESP/HPump systems save customer \$5.2 million USD in first year

A customer in the central US expressed interest in entering an exclusive provider agreement with Baker Hughes with the goal of improving disposal practices and electrical submersible pumping (ESP) system run life. The operator was using more than 200 Baker Hughes ESP systems and more than 20 **HPump™ horizontal surface pumping systems**.

Baker Hughes provided the most advanced ESP technology for downhole production along with surface disposal processes and equipment. By replacing triplex units and competitor horizontal pumps, Baker Hughes also anticipated reliability improvements in the operator's disposal practices.

Baker Hughes included its advanced ESP technology and HPump systems as part of an exclusive provider agreement.

The customer awarded Baker Hughes a three-year contract during which it agreed to use only Baker Hughes equipment. The customer's decision was based on product quality, level of service, and Baker Hughes' willingness to provide dedicated resources.

The exclusive provider agreement saved more than \$1 million USD in the first year in field service costs alone, a direct result of discount pricing and the use of dedicated field service labor. Baker Hughes also provided customized training, a master well database, biannual service reviews, and a dedicated account manager to increase value, operational quality, and consistency.

By reducing equipment pulls and downtime, this Baker Hughes solution saved the operator a total of \$5.2 million USD in the first year (\$2.6 million USD in workover costs, and \$1.6 million USD in deferred oil production).

Challenges

- Increase run life in more than 400 ESP systems and 22 surface pumping systems
- Consolidate purchasing so customer could consolidate vendors/increase savings through standardized equipment

Results

- Maximized production and increased run time through rod replacements and triplex conversions
- Saved \$5.2 million USD in the first year
- Improved run life of more than 400 ESP systems and 22 surface pump systems
- Increased reliability in disposal operations
- Saved time and additional costs with a centrally located manufacturing facility

HPump surface pumping systems in upstream oil and gas applications

Reduce downtime, maintenance requirements, and costs

The **HPump™ surface pumping system** from Baker Hughes, a GE company (Baker Hughes), delivers reliable, efficient transfer of surface fluids in the upstream oil and gas sector. This modular pumping system increases uptime, decreases maintenance needs, and lowers both OPEX and overall costs compared to positive displacement and split case pumps.

The HPump system uses adapted **CENtrilift™ electrical submersible pumping (ESP)** technology to deliver leak-free fluid transfer. The multistage centrifugal pump is combined with a horizontal thrust chamber (HTC) and an industrial foot-mounted electrical motor to provide a rugged, skid-mounted system. Baker Hughes HPump systems are easy to build and deploy. This reduces lead-time and components can be easily changed out as needed to improve uptime. Common upstream applications include water injection and disposal, CO2 injection, and jet pump power fluid operations. With global fulfillment and maintenance capabilities, HPump systems provide a cost-effective solution regardless of location. These systems are durable, simple, and customers routinely report up to 65% reductions in life cycle costs. HPump systems deliver dependable performance with minimal maintenance in multiple environments.

The proven HPump multistage pump system is rated up to 6,250 psig with a flow range from 250 to 130,000 BFPD, and the rugged HTC design can handle broad temperature variations in harsh environments. HPump components can handle solids and abrasives with abrasion-resistant materials and technology. Stages can be coated with optional materials, or designed with various metallurgies, to deliver optimal performance and fight buildup in the toughest applications.

Used with the HPump surface pumping system, the Baker Hughes **Electrospeed Advantage™ variable speed drive** provides precise control to enable performance across a wide operating range. This level of control extends system life and further reduces life cycle costs. To further enhance efficiency, Baker Hughes offers support for automation and key functions.

A common application for surface pumps in the upstream oil and gas sector is with secondary recovery using produced water injection, also called water flooding. In water flooding operations, produced water is injected into a reservoir to reestablish sufficient production pressure. This process can increase production and enhance overall reservoir recovery.

Applications

- Enhanced oil recovery (CO2 and water injection)
- Water disposal
- Frac water recycling
- Water transfer
- Crude oil transfer

Benefits

- Reliable, low-maintenance components
- Broad operating range
- Low-vibration design
- Cartridge seal design
- Adapts to changing fluid conditions
- Reduces field replacement time by 50% or more
- Abrasion-resistant technology and corrosion-resistant carbon materials
- Environmentally friendly design
- Can be painted to blend in with surroundings

The fluid used in water flooding is typically sourced from many different wells, and can contain mixtures of oil, gas, water, and contaminants such as H₂S and abrasive particles. This water can be highly corrosive and abrasive, and can cause scale buildup. The HPump system is rugged enough to deliver reliable performance in water flooding operations, regardless of water condition.

Varying pressure requirements and flow rates are typical in water flooding, but this dynamic environment can place a great deal of stress on surface pumps. HPump systems are designed to handle a wide range of pressures, temperatures, flow rates, and fluid types, effectively reducing OPEX, increasing production, and helping you adapt to changing well conditions.

Contact a Baker Hughes representative today or visit bhge.com/HPump to find out how our HPump systems can help you significantly reduce downtime, cut costs, lower maintenance expenses, and even improve production in your upstream oil and gas operations.

Baker Hughes Regions of Operation

Western Hemisphere

North America
Leduc, Alberta, Canada
Lloydminster, Alberta, Canada
Weyburn Saskatchewan, Canada
Anchorage, AK, USA
Dead Horse, AK, USA
Huntington Beach, CA, USA
Ventura, CA, USA
Bakersfield, CA, USA
Rangely, CO, USA
Dickinson, ND, USA
Minot, ND, USA
Enid, OK, USA
Lyndsay, OK, USA
Tulsa, OK, USA
Marshall, TX, USA
Midland, TX, USA
Evansville, WY, USA
Cody, WY, USA

Latin America
Comodoro Rivadavia, Argentina
Neuquén, Argentina
Mendoza, Argentina
Macaé, Brazil
Bahia, Brazil
Campeche, Mexico
Tabasco, Mexico
Iquitos, Peru
Maracaibo, Venezuela
Neiva, Colombia
El Coca, Ecuador
Quito, Ecuador



For more information contact your local Baker Hughes representative or email:

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Baker Hughes Regions of Operation

Eastern Hemisphere

APAC
Queensland, Australia
Perth, Australia
Szenzhen, China
Skehou, China
Tarim, China
Tanggu, China
Rajasthan, India
Mumbai, India
Duri, Indonesia
Labuan, Malaysia
Satthahip, Thailand

MENATI
Basra, Iraq
Erbil, Iraq
Ahmadi, Kuwait
Sabriyah, Kuwait
Nimr, Oman
Qurn Alam, Oman
Doha, Qatar
Dammam, Saudi Arabia
Dubai, UAE
Mussafah, UAE
Yemen
Hassi Messaoud, Algeria
Alexandria, Egypt

Europe
Oudkarspel, Netherlands
Aberdeen, Scotland, UK
Viggiano, Italy
Prescara, Italy
Celle, Germany

SSA
Douala, Cameroon
Pointe Noire, Congo
Port Harcourt, Nigeria
Doba, Chad



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