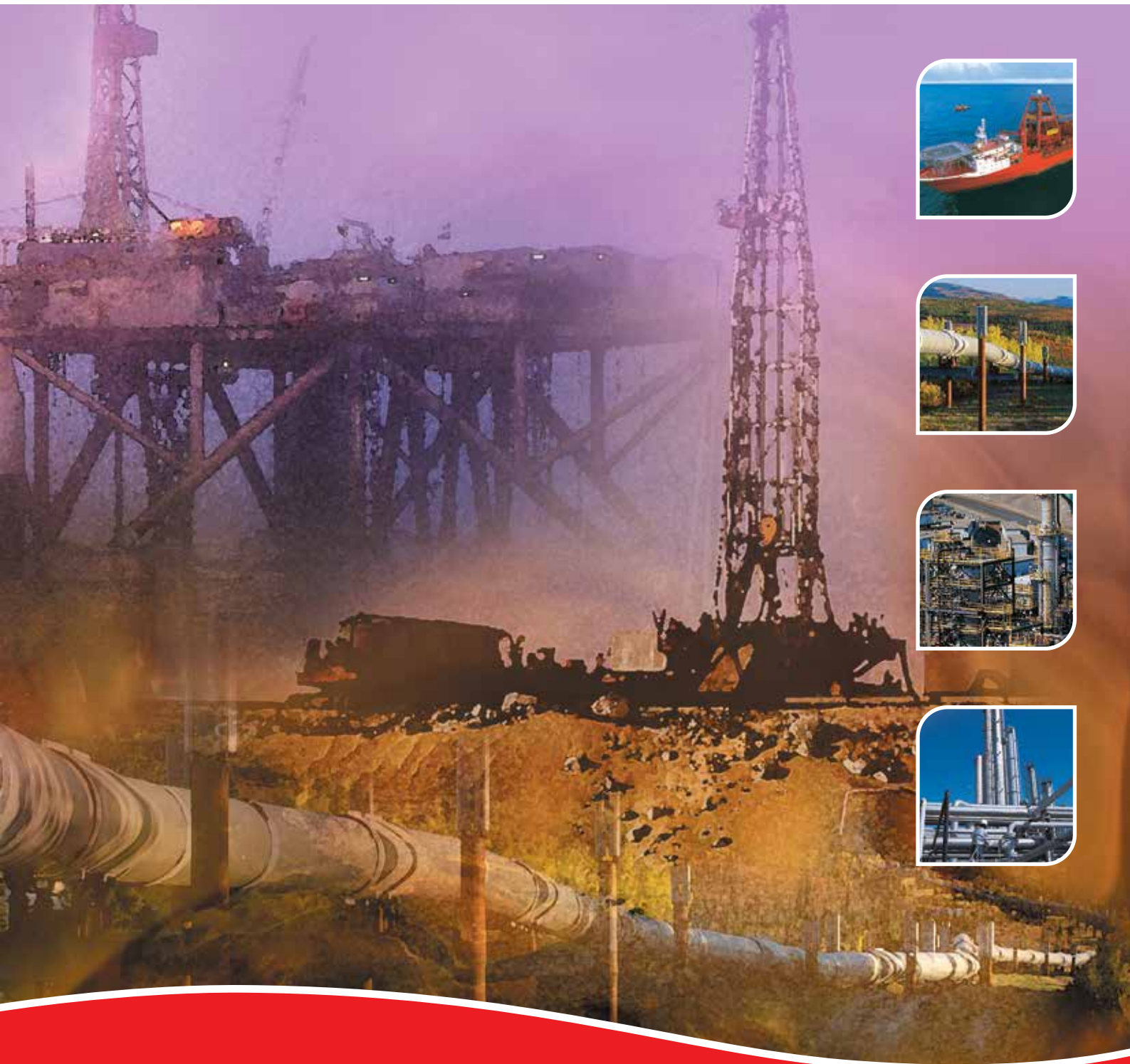




Oil and Gas Upstream and Pipeline

Offshore • Onshore • Synthetic Crude • LNG



Experience In Motion



Pump Supplier to the World

Flowserve is the driving force in the global industrial pump marketplace. No other pump company in the world has the depth or breadth of expertise in the successful application of pre-engineered, engineered, and special purpose pumps and systems.

Supplier of Choice to the Oil and Gas Industry

Flowserve offers the world's most complete line of ISO 13709/API 610 pumps with the widest range of hydraulic coverage, pressure and temperature capabilities. Its engineering expertise, applications know-how and installation experience are peerless. From 19th century lamp oil to the advent of the gasoline engine and the development of petrochemicals, Flowserve has proven itself to be the world leader in meeting the changing and demanding needs of the oil and gas industry.



Product Brands of Distinction

ACEC™ Centrifugal Pumps

Aldrich™ Pumps

Byron Jackson® Pumps

Calder™ Energy Recovery Devices

Cameron™ Pumps

Durco® Process Pumps

Flowserve® Pumps

IDP® Pumps

Lawrence Pumps®

Niigata Worthington™ Pumps

Pacific® Pumps

Pleuger® Pumps

Scienco™ Pumps

Sier-Bath® Rotary Pumps

TKL™ Pumps

United Centrifugal® Pumps

Western Land Roller™ Irrigation Pumps

Wilson-Snyder® Pumps

Worthington® Pumps

Worthington Simpson™ Pumps



Pump Designs

Flowserve offers a wide range of complementary pump types, built to recognized global standards and customer specification. These include:

- Single-stage process
- Between bearings single-stage
- Between bearings multistage
- Vertical
- Submersible motor
- Positive displacement
- Specialty

Available Configurations

- Sealed and sealless
- Axially and radially split
- Volute and diffuser
- Close-coupled and spacer-coupled
- Single- and double-casing



Committed to the Complete Pump System Life Cycle

For more than two centuries, Flowserve has served industries requiring solutions that add value and reduce costs throughout the life cycle of a pumping system.

- Oil and gas
- Power generation
- Chemical
- Water
- General industry

Flowserve partners with customers to respond to the dynamic business conditions that affect them. Flowserve works with customers to improve efficiency, maximize throughput and control process quality. Whether customer needs involve on-site technical assistance, equipment upgrades or broader project planning with full turnkey responsibility, Flowserve delivers professional, reliable results.





Offshore

Offshore production presents a host of unique pumping challenges, as the hunt for oil and gas has led to deep and often violent seascapes. This has made production much more arduous and hazardous. Flowserve offers extensive products and services to satisfy the pumping needs and specific requirements of offshore platforms and floating production, storage and offloading facilities (FPSOs). These include:

- Pumps fully compliant with ISO 13709/API 610 and API 676 latest editions as well as customer specifications
- Highly engineered, robust and reliable pumps adapted to offshore space and weight concerns, operating and environmental conditions
- Extended pump mean time between planned maintenance with authorized maintenance service, whenever and wherever required
- Innovative technologies such as subsea multiphase pumping systems and dynamic positioning thrusters



Offshore Production

FlowsERVE produces a complete line of performance-proven pumps for all offshore oil services. These include: water lift, ballast water services; process pumps to move and handle oil, gas and water; high-capacity, high-pressure pumps for crude oil transportation; and utility and fire protection pumps.

Water Injection

To maintain production levels, offshore oil producers are relying more heavily on water injection. Flow rates and injection pressures are increasing, as are the corrosion and erosion challenges. FlowsERVE offers several innovative barrel pump designs to address the industry's needs. Built to customer specifications often exceeding ISO 13709/API 610, these pumps are available with tandem and opposed impeller designs, ISO 21049/API 682 seal chambers and a variety of materials to suit application requirements.

Offshore Pipelines

Offshore pipelines are carrying an increasing amount of the world's oil and gas. Pumps for these services must be robust and unfailingly reliable. FlowsERVE offers a complete line of single and multistage pumps in either axial or radial split configurations. With a history of operating pumps at flows up to 12 000 m³/h (52 835 gpm) and differential heads to 7000 m (23 000 ft), FlowsERVE has the proven products for moving crude oil direct from the platform to marine terminals or waiting tankers.

Subsea Multiphase Pumping Systems

With its extraordinary experience and capabilities in hydraulic design, submersible motor technology and materials engineering, FlowsERVE is in the forefront of deep-water subsea pumping technology. These pioneering systems include advanced twin-screw pumping technology capable of handling high gas fractions and high torque submersible motor designs to provide reliable operation in subsea high-boost, multiphase applications.

Dynamic Positioning Thrusters

To offer the maneuverability and stability that offshore vessels need, the FlowsERVE tilted-shaft azimuthing thruster has been designed with the versatility to apply thrust in any direction. Its proven, variable pitch design provides both propulsion and steering of marine vessels for continuous, precise dynamic positioning. Applications include:

- Semi-submersible drilling rigs
- FPSOs
- Drill ships
- Crane vessels
- Pipelay vessels
- Other offshore vessels



Onshore

Oil- and gas-well drilling continues at a high level of activity worldwide but with ever-increasing difficulties of location, landscape and depth. It is these types of challenges which have made Flowserve a leader in the development and application of advanced pumping technologies for oil and gas applications.

Flowserve has made significant contributions to these advancements by designing the first centrifugal pumps for oil-field production along with automatic mainline and booster pipeline stations. Flowserve pioneered secondary recovery through high-pressure water injection and first applied submersible motor pumps in crude oil and LPG storage caverns.



Onshore Production

FlowsERVE provides a broad range of performance-proven, fully compliant ISO 13709/API 610 and API 676 pumps designed for oil-field upstream and downstream production facilities. These include: high-capacity vertical and horizontal pumps required for high-pressure water injection services; multiphase twin screw pumps for oil- and gas-field gathering; extraction pumps for steam-assisted gravity drainage (SAGD); and pumps for virtually all ancillary production-related applications.

Onshore Pipeline

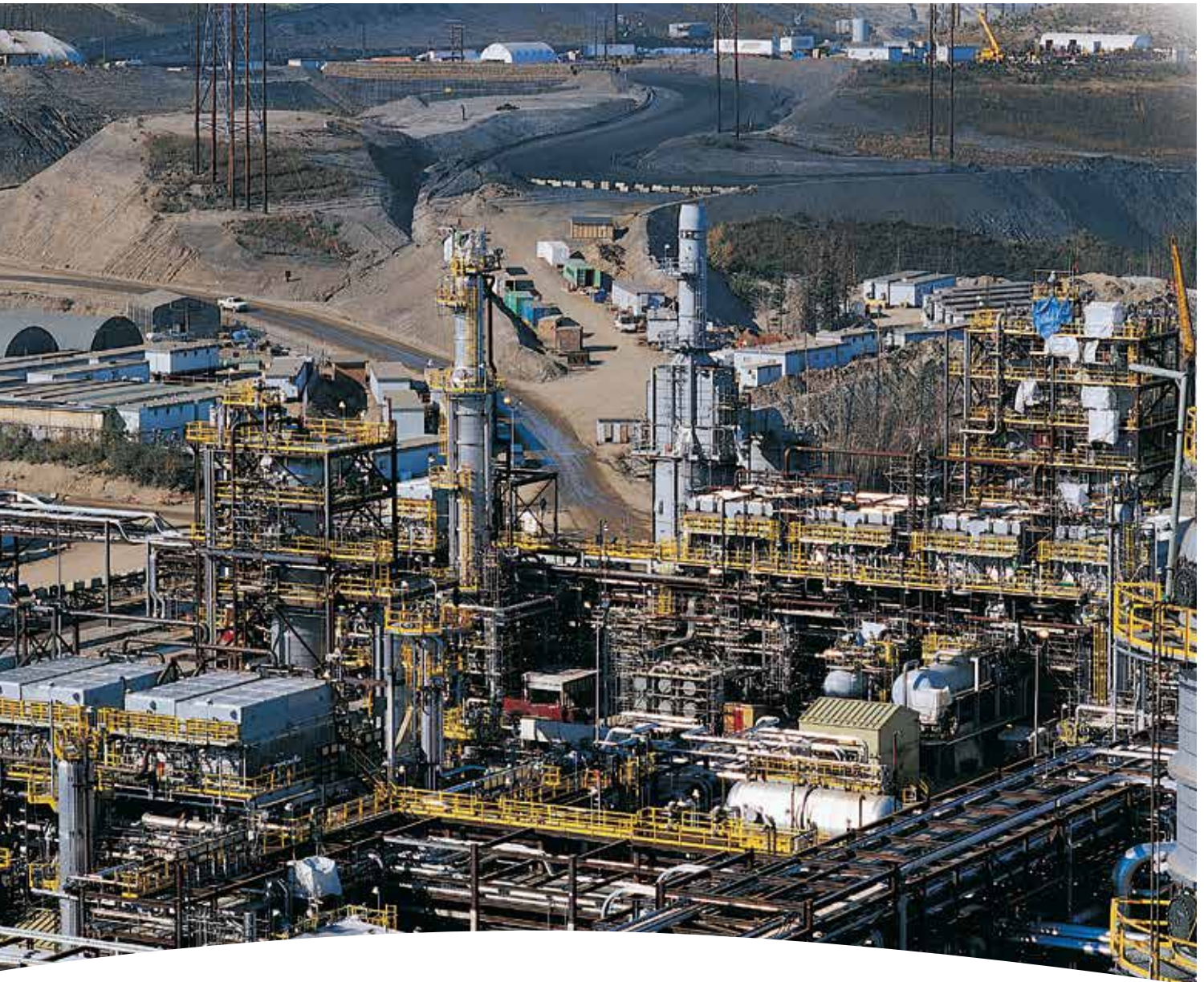
FlowsERVE is a leading manufacturer of petroleum pipeline pumps. The reliability of its single and multistage pumps has made them the products of choice for unattended mainline operation in some of the world's most inhospitable environments. Low NPSH pumps, in both horizontal and vertical configurations, are offered for booster-station service. And no other manufacturer offers the breadth of pumps for transportation, transfer, storage and cargo stripping.

Water and CO₂ Injection

Water and CO₂ injection are becoming increasingly critical to boosting onshore oil production levels. Operations require efficient pumps that can reliably perform under high pressures for extended periods. FlowsERVE boasts unrivaled expertise in developing and implementing pumping technologies for water and CO₂ injection. In 1984, FlowsERVE pioneered the use of pumps for high-pressure CO₂ injection service. Today, FlowsERVE offers several pump designs that have demonstrated proven reliability in these crucial applications:

- Single-stage, radially split, between bearings pumps
- Single and multistage, axially split, between bearings pumps
- High and ultra-high pressure barrel pumps
- Vertical, double-case pumps

FlowsERVE also offers sealing solutions using liquid or dry gas seals.



Synthetic Crude

With new process technologies and techniques, obtaining synthetic crude from the vast tar sand reserves is now economically feasible. To accomplish this, energy producers need pumping flexibility and reliability in both bitumen mining and extraction as well as the more traditional oil production and pipeline services. And, of course, these pumps must perform in often hostile and quite remote environments.

These processes require fully ISO 13709/API 610 compliant as well as rugged and reliable Flowserve industrial pumps.

General Applications

- **Mining** — Hard metal slurry and transport pumps
- **Extraction** — Axially split, multistage pumps for steam-assisted gravity drain (SAGD); hard metal froth pumps; low shear, single-stage process pumps; hard metal tailings pumps
- **Pipeline** — API process and pipeline pumps



Liquefied Natural Gas

Converting natural gas leaving the wellhead into liquefied natural gas (LNG) is not only good conservation policy but excellent and profitable business policy as well. Regardless of the process used to produce LNG, FlowsERVE has the liquid turbine expanders, charge and process pumps, service and utility pumps, and specialty pumps to accomplish the tasks.

General Applications

- **Charge and process** — Petroleum process pumps; between bearings, multistage, single- and double-case axially split, horizontal pumps; single-stage, horizontal pumps; vertical process can pumps
- **Cryogenic** — Vertical and horizontal cryogenic pumps, liquid turbine expanders
- **Desulfurization** — Single and multistage pumps
- **Safety and utility** — Between bearings, single-stage, axially split, horizontal pumps; vertical turbine and circulator pumps



Flowserve manufactures pumping solutions for all facets of oil and gas production, whether onshore or offshore.



Production Pumps

Flowserve manufactures pumping solutions for all facets of oil and gas production, whether onshore or offshore. Pumps are compliant with ISO 13709/ API 610, latest edition, and other applicable standards.

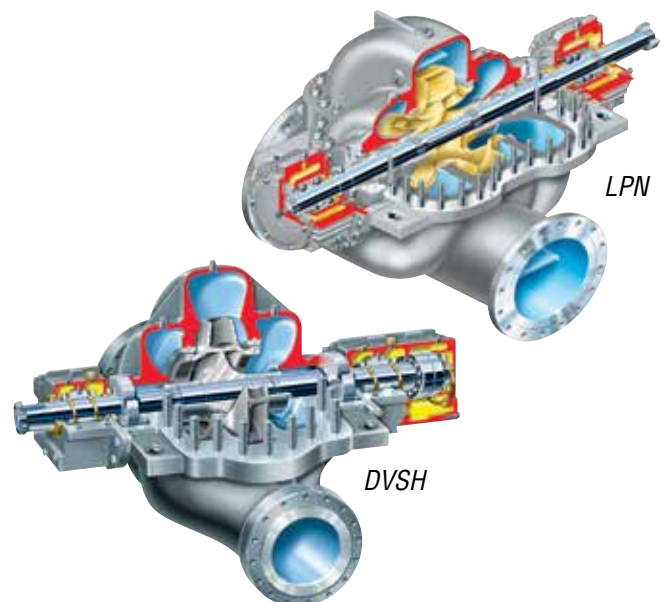
- **Seawater lift** — Submersible motor pumps and vertical line shaft pumps
- **Source water** — Submersible motor pumps; vertical, deep well turbine pumps
- **Water and CO₂ injection** — Between bearings, multistage pumps; high-energy barrel pumps; vertical double-case pumps
- **Water treatment** — Submersible motor pumps; process pumps
- **Utility** — Single-stage, double-suction, axially split, horizontal pumps; vertical in-line process pumps
- **Safety and firefighting (NFPA-compliant, UL-approved packages)** — Single-stage, double-suction, axially split, horizontal pumps; vertical turbine pumps
- **Gathering and separation** — Multiphase pumps; single-stage process pumps; high-pressure, multistage pumps; vertical process pumps; vertical turbine pumps; vertical circulators; rubber lined or hard metal slurry pumps; vertical and horizontal positive displacement pumps
- **Gas treating** — High-pressure, between bearings multistage pumps and single-stage process pumps; vertical and horizontal positive displacement pumps

Between Bearings, Single-Stage Axially Split Pumps (BB1)

Horizontal, axially split, single-stage, double-suction centrifugal pumps. Pump configurations include a vertical mounted option and selected sizes of bottom-suction models. Both API and non-API designs are available.

Operating Parameters

- Flows to 30 000 m³/h (132 000 gpm)
- Heads to 565 m (1854 ft)
- Pressures to 150 bar (2175 psi)
- Temperatures to 204°C (400°F)



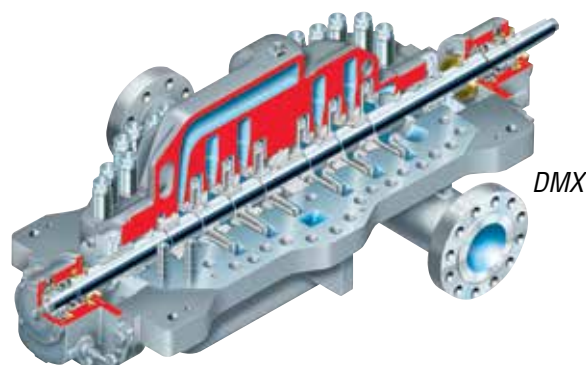


Between Bearings, Multistage, Axially Split Pumps (BB3)

Between bearings, axially split, double-volute, side-suction, side-discharge, multistage design. For water injection and disposal, as well as CO₂ injection.

Operating Parameters

- Flows to 2950 m³/h (13 000 gpm)
- Heads to 2130 m (7000 ft)
- Pressures to 275 bar (4000 psi)
- Temperatures to 204°C (400°F)



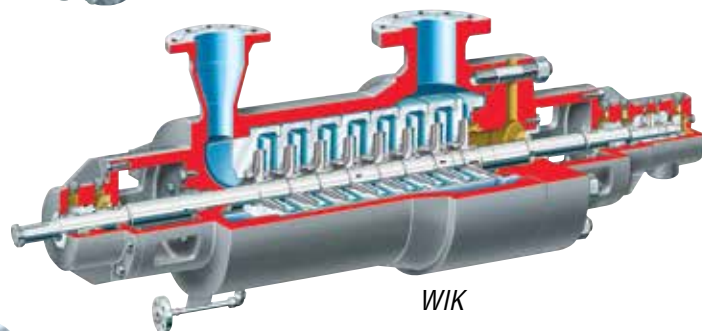
DMX

Multistage, Double-Case, Diffuser and Volute Design Pumps (BB5)

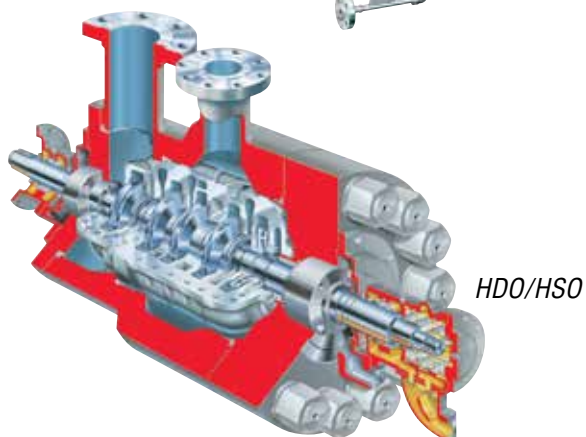
Single- and double-suction first-stage pumps for high-pressure services, including water and CO₂ injection. Fully compliant with ISO 13709/API 610, latest edition.

Operating Parameters

- Flows to 4000 m³/h (17 610 gpm)
- Heads to 7000 m (23 000 ft)
- Pressures to 650 bar (9425 psi)



WIK



HDO/HSO



Horizontal, Overhung Process Pumps (OH2)

End suction, top discharge, overhung, centerline mounted configuration. ISO 21049/API 682 seal chamber; fully compliant with the current edition of ISO 13709/API 610. High suction pressure, low-flow configurations available.

Operating Parameters

- Flows to 2000 m³/h (8800 gpm)
- Heads to 400 m (1300 ft)
- Pressures to 80 bar (1160 psi)
- Temperatures to 450°C (842°F)

Vertical, In-Line Process Pumps (OH3, OH4, OH5)

Designed for simplified piping and space savings with in-line suction and discharge nozzles. ISO 21049/API 682 seal chamber; fully compliant with the current edition of ISO 13709/API 610. Low-flow, high-head designs available.

Operating Parameters

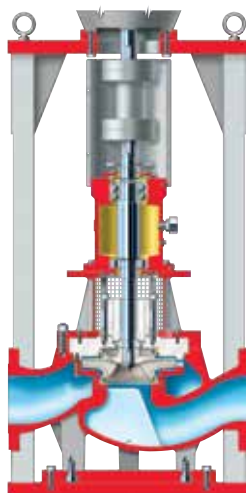
- Flows to 3400 m³/h (15 000 gpm)
- Heads to 440 m (1455 ft)
- Pressures to 60 bar (870 psi)
- Temperatures to 340°C (650°F)

Horizontal and Vertical Reciprocating Pumps

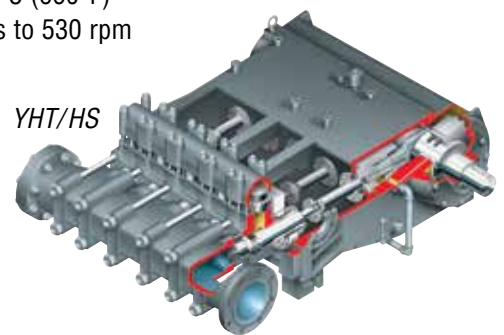
Sectionalized liquid end construction. Triplex, quintuplex, septuplex and nonuplex plunger configurations. Various plunger size/stroke combinations. Fully compliant with the current edition of API 674.

Operating Parameters

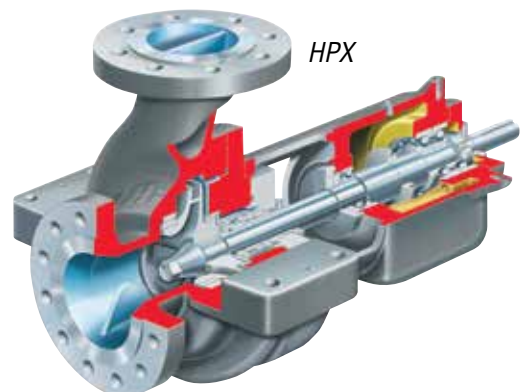
- Strokes from 75 mm (3 in) to 250 mm (10 in)
- Flows to 1140 m³/h (5000 gpm)
- Power to 3450 kW (4625 hp)
- Standard pressures to 619 bar (8975 psi); custom pressures to 2070 bar (30 000 psi)
- Temperatures from -40°C (-40°F) to 350°C (660°F)
- Speeds to 530 rpm



PVXM



YHT/HS



HPX



Deep Well Submersible Motor Pumps

Designed to meet subsurface, deep well or high-pressure boosting needs. Two designs available:

- Pleuger water-filled motor design with watertight insulated windings
- Byron Jackson oil-filled motor design with self-contained force feed, filtered, cooled oil circulation system

Operating Parameters

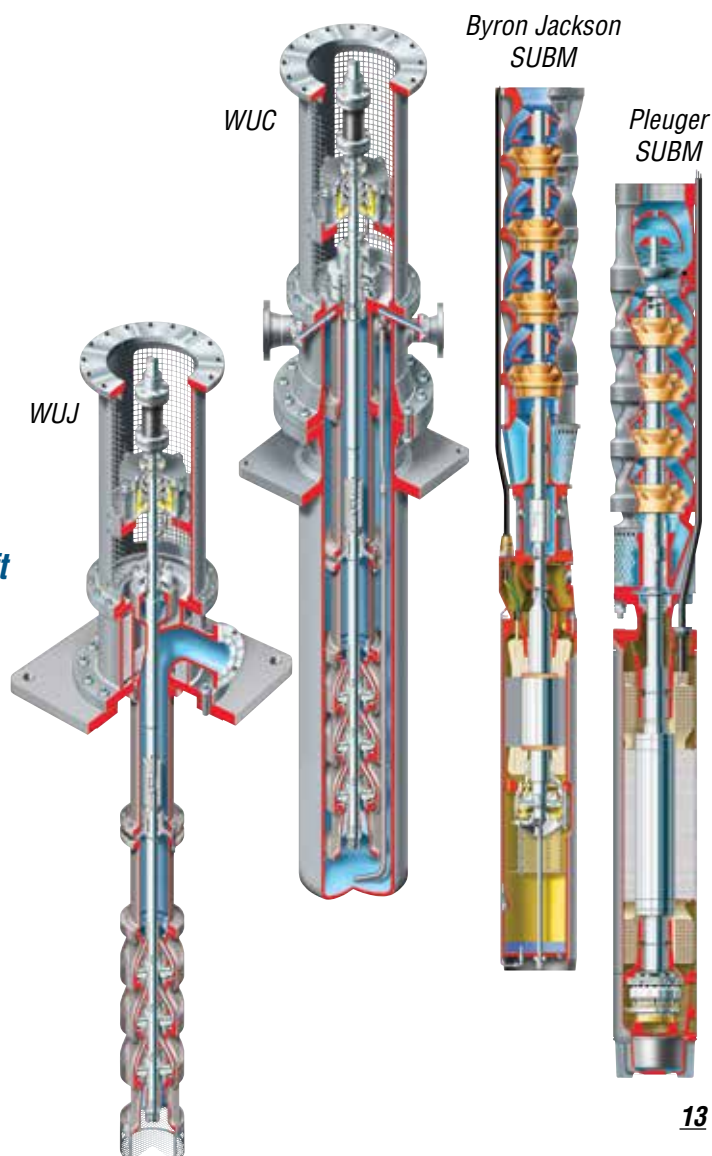
- Flows to 6000 m³/h (26 415 gpm)
- Heads to 800 m (2625 ft)
- Motor sizes to 5000 kW (6700 hp)
- Speeds from 200 to 3600 rpm

Single and Multistage, Vertical Lineshaft Pumps (VS1, VS6)

Single- or double-case configurations with above- or below-ground discharge, enclosed or semi-open impellers, and open or enclosed lineshafts. API and non-API designs are available.

Operating Parameters

- Flows to 13 600 m³/h (60 000 gpm)
- Heads to 2000 m (6560 ft)
- Pressures to 200 bar (2900 psi)
- Settings to 365 m (1200 ft)





Pipeline Pumps

Flowserve offers pumps for every conceivable pipeline application as well as for storage and transfer. Flowserve pipeline pumps are fully compliant with the latest edition of ISO 13709/API 610.

- **Pipeline and transportation** (in series or parallel) — Mainline and booster; between bearings single and multistage process pumps; vertical process pumps
- **Storage and transfer** — Between bearings, single-stage process pumps; vertical process pumps; submersible motor pumps; vertical in-line process pumps
- **Terminal** — Vertical in-line and vertical process pumps
- **Loading and offloading** — Specialty stripper pumps
- **CO₂ pipeline** — Between bearings single- and multistage pumps; heavy-duty multistage barrel pumps

Between Bearings, Single-Stage, Axially Split Pumps (BB1)

Double volute case, double-suction pumps for pipeline service and related heavy-duty service requirements

Operating Parameters

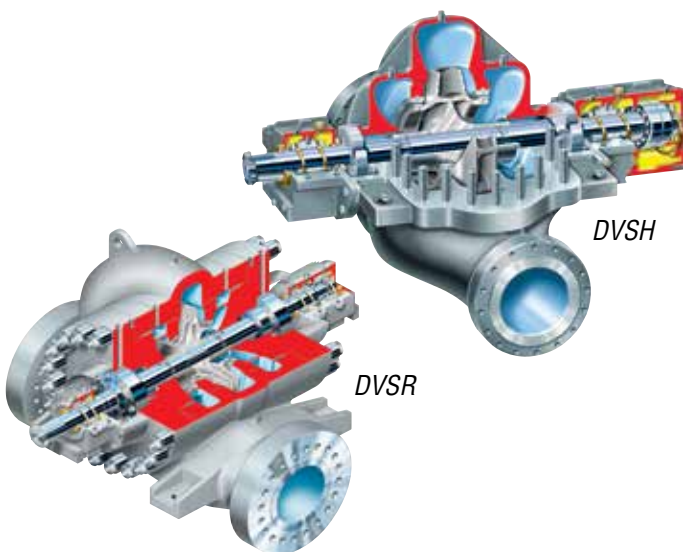
- Flows to 12 000 m³/h (52 835 gpm)
- Heads to 565 m (1854 ft)
- Pressures to 150 bar (2175 psi)
- Temperatures to 200°C (400°F)

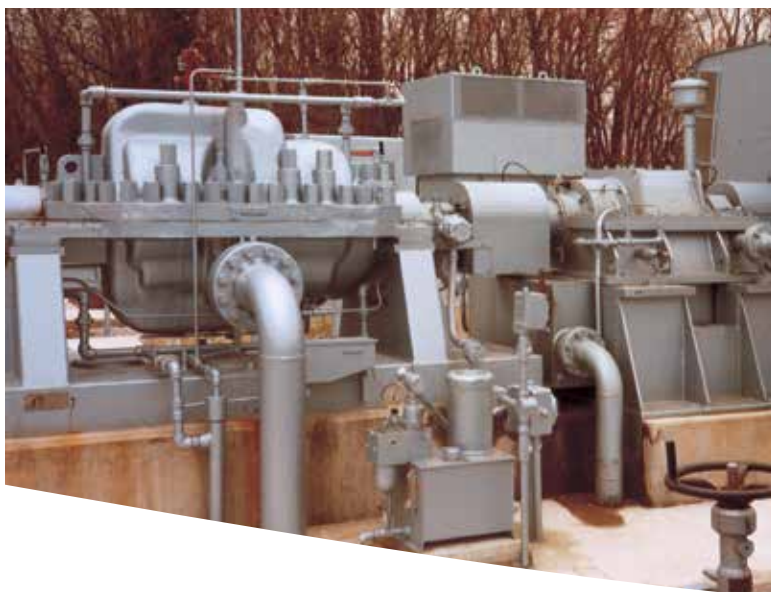
Between Bearings, Single-Stage, Radially Split Pumps (BB2)

Double volute case, double-suction pumps for CO₂ transportation and storage

Operating Parameters

- Flows to 3635 m³/h (16 000 gpm)
- Heads to 250 m (820 ft)
- Pressures to 260 bar (3750 psi)
- Temperatures to 200°C (400°F)





Multistage, Axially Split Pumps (BB3)

Between bearings, axially split, double volute, side-suction, side-discharge, multistage design. For high-pressure, heavy-duty pipeline applications.

Operating Parameters

- Flows to 2950 m³/h (13 000 gpm)
- Heads to 2130 m (7000 ft)
- Pressures to 275 bar (4000 psi)
- Temperatures to 205°C (400°F)

Vertical Turbine, Double-Casing Pumps (VS6)

High-pressure, heavy-duty, diffuser type, single or multiple stage pump for continuous duty in pipeline booster and transfer services. API and non-API designs are available.

Operating Parameters

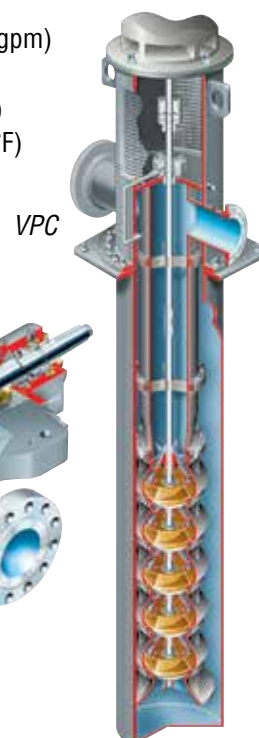
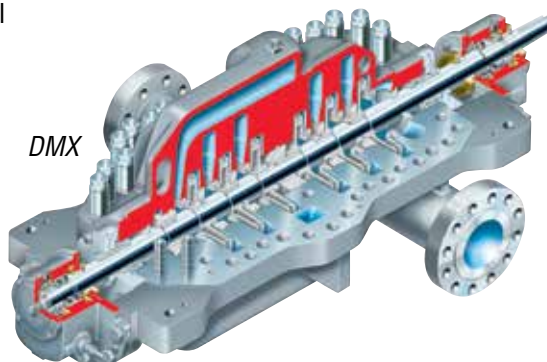
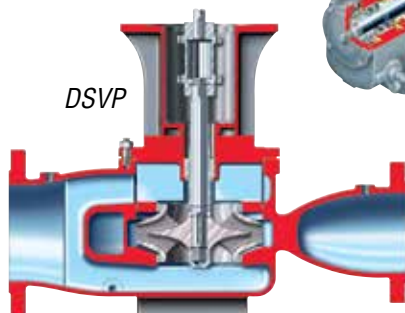
- Flows to 13 600 m³/h (60 000 gpm)
- Heads to 2000 m (6560 ft)
- Pressures to 200 bar (2900 psi)
- Temperatures to 350°C (660°F)

Vertical In-Line Pumps (OH3, OH4, OH5)

Single-suction, double-suction, in-line design for high flow, limited NPSHA. Tank farm, transfer and pipeline booster services.

Operating Parameters

- Flows to 3400 m³/h (15 000 gpm)
- Heads to 440 m (1455 ft)
- Pressures to 60 bar (870 psi)
- Temperatures to 340°C (650°F)





Specialty Applications

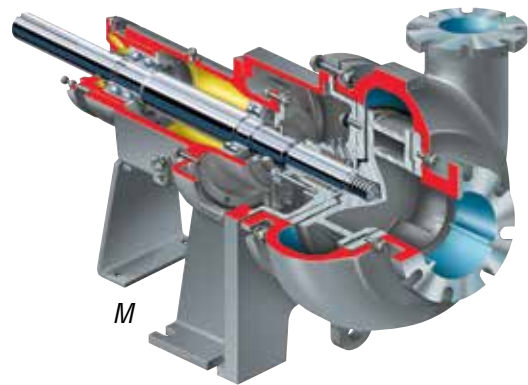
Flowserve has developed numerous specialty products specifically for the oil and gas industry.

Hard Metal Slurry Pumps

Horizontal, single-stage, end suction design with vertical tangential discharge nozzles for tar sand extraction services, including froth and tailings applications.

Operating Parameters

- Flows to 10 000 m³/h (44 000 gpm)
- Heads to 90 m (300 ft)
- Pressures to 50 bar (725 psi)
- Temperatures to 120°C (250°F)
- Solids from 2% to 70% by weight

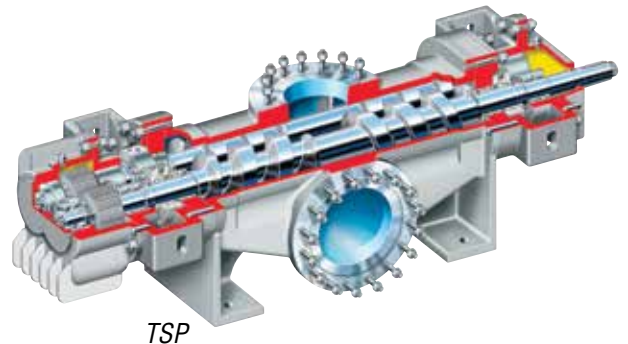


Twin-Screw Pumps

API 676 compliant twin-screw, double-suction design with ISO 21049/API 682 seal chamber for pipeline services and for loading and unloading of oil storage tanks and tanker vessels.

Operating Parameters

- Flows to 2550 m³/h (11 200 gpm)
- Pressures to 100 bar (1450 psi)
- Temperatures to 450°C (842°F)
- Viscosities to 55 million cP



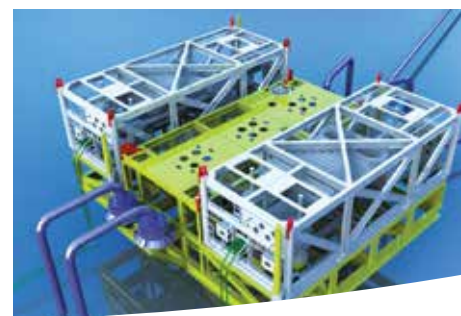
Multiphase Pumps

API 676 compliant twin-screw, double-suction design with ISO 21049/API 682 seal chamber for multiphase services

Operating Parameters

- Flows to 1990 m³/h (8750 gpm)
- Pressures to 50 bar (720 psi)
- Temperatures to 450°C (842°F)
- Viscosities to 8000 cP



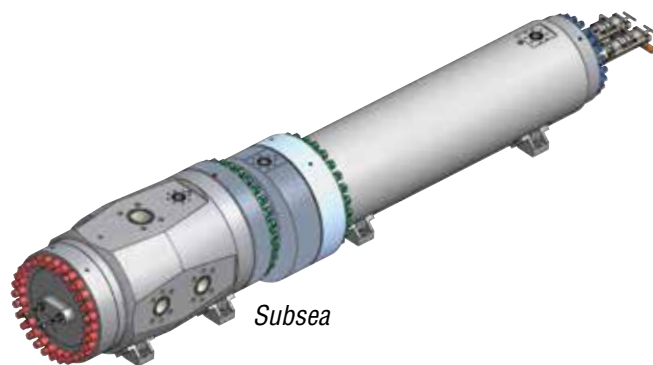


Subsea Multiphase Pump and Motor

The Flowserve multiphase twin screw pump and submersible motor is designed for use on the seabed as a boosting system that enables full field development of difficult-to-produce oil and gas assets.

Operating Parameters

- Pressure boost in excess of 170 bar (2500 psi)
- Displacement flow rates to 447 m³/h (90 000 bpd) at 1800 rpm
- Nominal speed of 1800 rpm (+10% overspeed)



Subsea

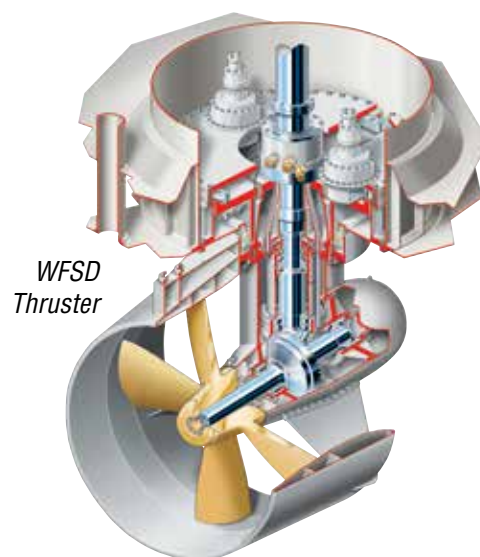
Dynamic Positioning Azimuthing Thruster

The Flowserve WFSD thruster is designed for optimum net thrust output and long service life. It incorporates many advanced features, including:

- 7° tilted propeller shaft reduces thruster-wall interaction.
- Duplex thrust bearing allows windmilling at any speed.
- Automatic pressure compensation system adapts differential pressure to draft.
- Fully redundant closed loop hydraulic steering system is standard.

Basic Design Parameters

- Up to 5 m (16.5 ft) propeller diameter
- Up to 4500 kW (6000 hp) input
- Four- or five-blade fixed pitch propeller (FPP)



WFSD Thruster

Flowserve is the world leader in the design and manufacture of cryogenic liquid expanders.



Cryogenic Liquid Expanders

Flowserve is the world leader in the design and manufacture of cryogenic liquid expanders. Since 1989, Flowserve has drawn upon its unmatched industry expertise and experience (in excess of 1 million operating hours) to develop a next generation design that provides considerable life cycle value to end users.

Operating Parameters

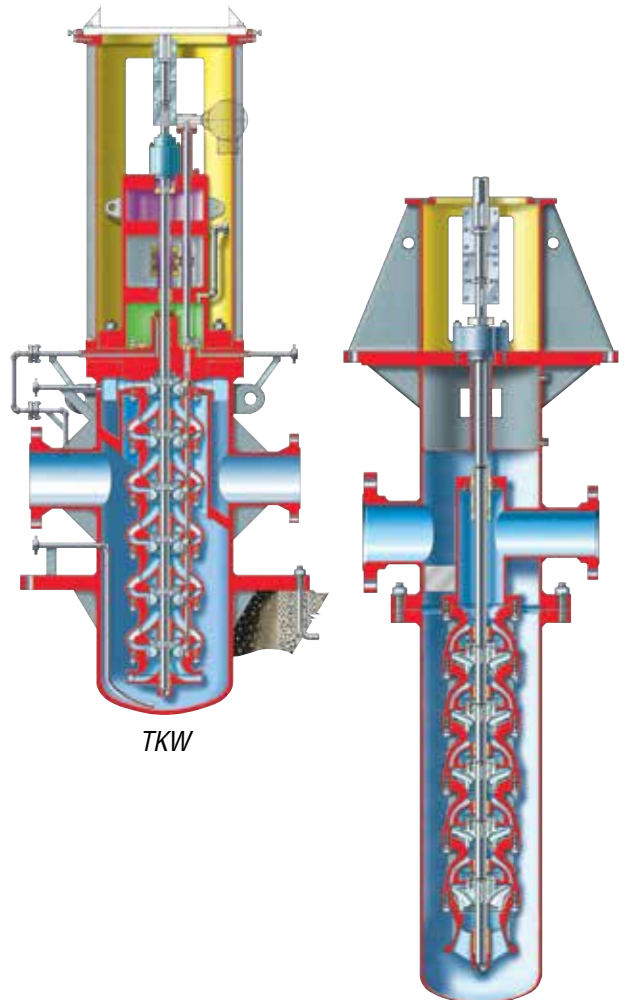
- Temperatures to -180°C (-290°F)
- Inlet pressures to 70 bar (1000 psi)
- Generator sizes to 3000 kW (4000 hp)

Cryogenic Pumps

Flowserve produces a full line of pumps, both vertical and horizontal, for low temperature service in LNG storage and transport. Available in standard designs.

Operating Parameters

- Flows to 300 m³/h (13 000 gpm)
- Heads to 1200 m (3900 ft)
- Pressures to 200 bar (3000 psi)
- Temperatures from -200°C (-325°F) to -45°C (-50°F)



TKW

WUC-LNG



Innovative Life Cycle Cost Programs

New Pump Selection

Flowserve provides front-end consulting services that balance initial procurement cost with longer-term operational concerns including equipment reliability and energy consumption. Proper upfront selection of a high-efficiency, high-energy pump can literally save millions of dollars in operating costs over the life of the system.

Turnkey Engineering and Field Service

Flowserve offers turnkey engineering capabilities to streamline capital expenses related to piping design, foundation engineering, electrical systems and instrumentation. Flowserve technicians can offer installation and commissioning solutions that significantly reduce installation time such as advanced laser alignment and ungrouted foundation solutions.

Energy Management

Pumping systems can comprise between 20% and 50% of energy usage in typical industrial plants and as much as 95% in pipeline systems. On behalf of its customers, Flowserve actively pursues hydraulic re-rates, pump upgrades and system enhancements that offer energy savings between 30% and 50% of existing levels. A typical improvement program may involve field assessments, analytical modeling and investment recommendations.

Pump Availability

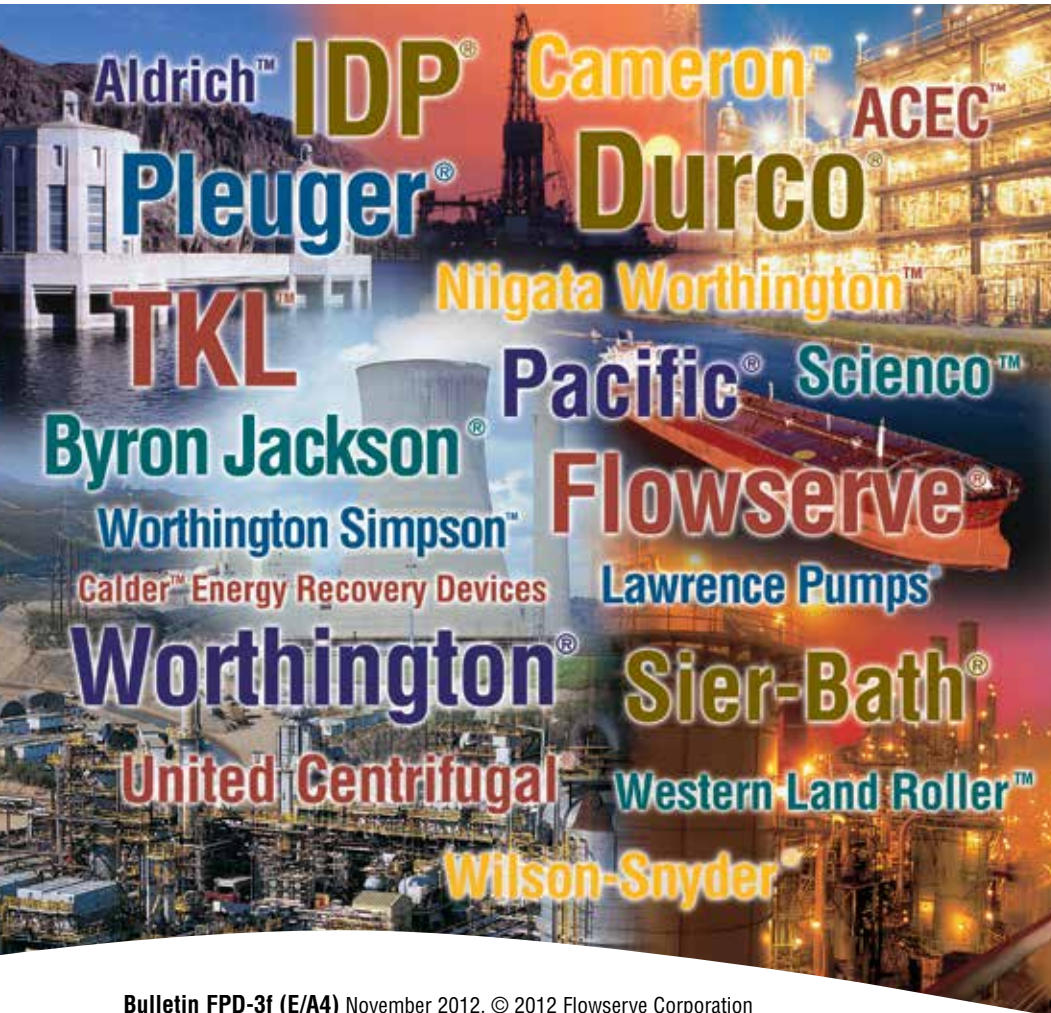
Flowserve engineers and technicians have been specially trained to help customers analyze, diagnose and solve those issues that cause problematic pump breakdowns and unscheduled outages. Engineers are equipped to collect real-time data, review performance problems, analyze data and make recommendations that result in improved pump system availability and higher profits.

Proactive Maintenance

Flowserve technicians are trained to provide services that go beyond simple reactive maintenance and repair. By analyzing failure modes, Flowserve can offer upgrades ranging from materials and coatings upgrades to hydraulic re-rates — all aimed at increasing pump reliability.

Inventory Management

Programs that help standardize materials, maximize interchangeability and increase part and assembly availability can have a significant impact on costs associated with spare parts inventory. Asset management experts from Flowserve can offer customized programs that reduce inventory levels while ensuring availability of critical parts.



Bulletin FPD-3f (E/A4) November 2012. © 2012 Flowserve Corporation

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