



Power Generation

Combined Cycle • Fossil Fuels • Nuclear



Experience In Motion

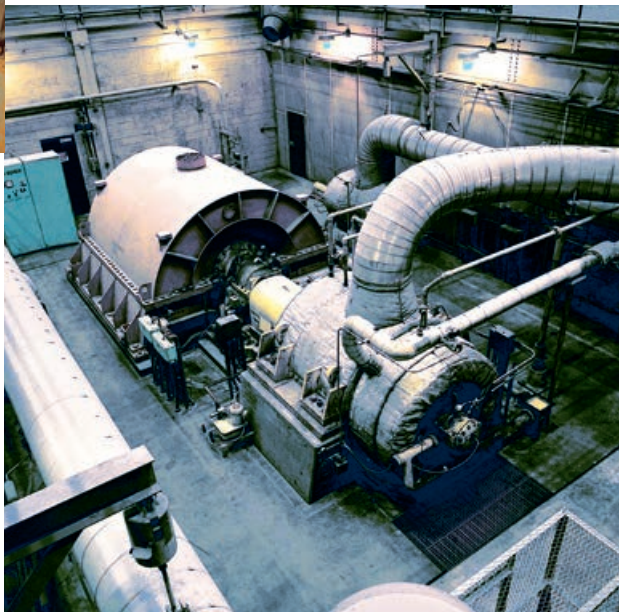


Pump Supplier to the World

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 Power Industry

Throughout its history, Flowserve has been closely identified with power generation. From the 1840 introduction of the first direct acting steam pump to the installation of the world's largest boiler feed pump at 52 200 kW (70 000 hp), Flowserve has pioneered virtually every significant advancement in pumping technology for the power generation 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

INNOMAG® Sealless 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
- Nuclear
- Specialty

Available Configurations

- Sealed and sealless
- Axially and radially split
- Volute and diffuser
- Close coupled and long 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.

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

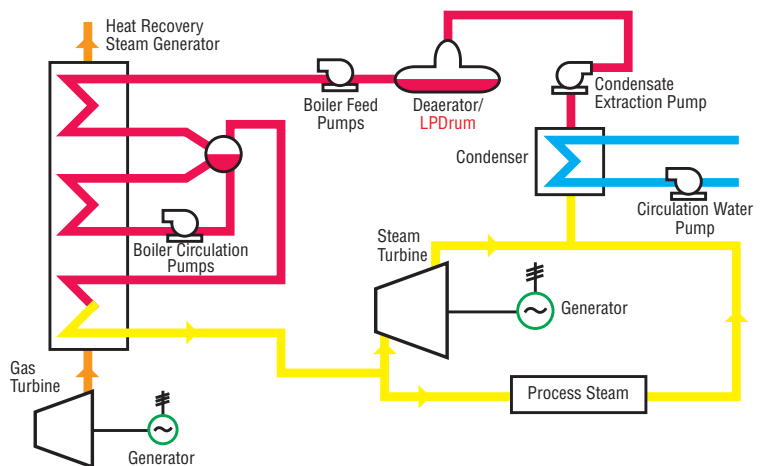


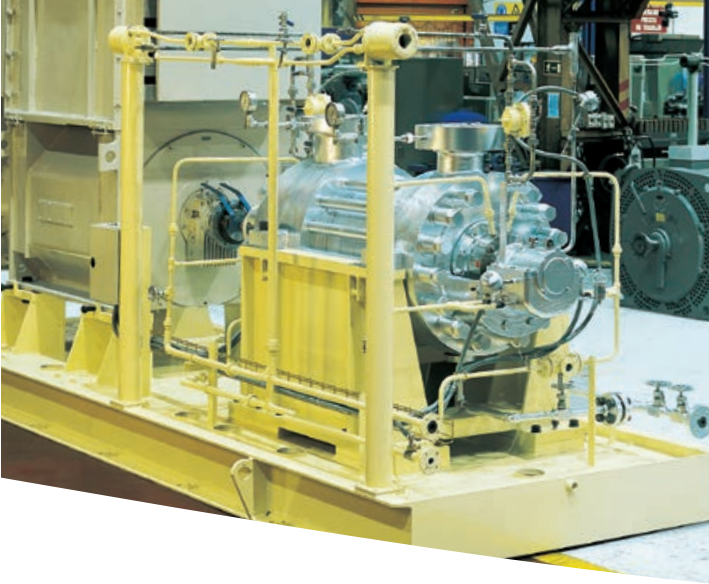
Flowserve partners with customers to respond to the dynamic business conditions that affect them. Flowserve works with customers to improve efficiency, maximize throughput and control process quality. Whether customer needs involve on-site technical assistance, equipment upgrades or broader project planning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



Combined Cycle

The combined cycle power plant with its inherently higher efficiency and lower environmental impact is, in many cases, the optimum choice of today's power generation industry. The Flowserve comprehensive lines of pump products and pumping systems are ideally suited for any combined cycle project, including co-generation of electrical power and steam.





Boiler Feed Water Services

The pinnacle of the Flowserve line for combined cycle boiler feed service is the multistage segmental ring pump, which provides exceptional hydraulic performance, optimum efficiency and superior reliability. Additionally, Flowserve offers a variety of horizontal multistage pumps for boiler feed service. These include: axially split volute pumps; and double case barrel pumps, in both diffuser and axially split volute configurations.

Condenser Cooling Water Service

Flowserve offers both horizontal and vertical pumps for condenser cooling water service. These are available in a wide range of hydraulic and material configurations. Non-pullout or pullout construction is available on vertical models.

Condensate Water Service

Vertically suspended, single- or double-suction, canned pumps with very low NPSHR provide workhorse duty in these difficult services. Horizontal pump designs are also available.



Auxiliary Services

Flowserve offers a complete line of horizontal and vertical pumps, including ANSI, ISO and API designs. These may be specified in a wide variety of metallic and non-metallic materials to satisfy virtually all plant-wide pumping needs.

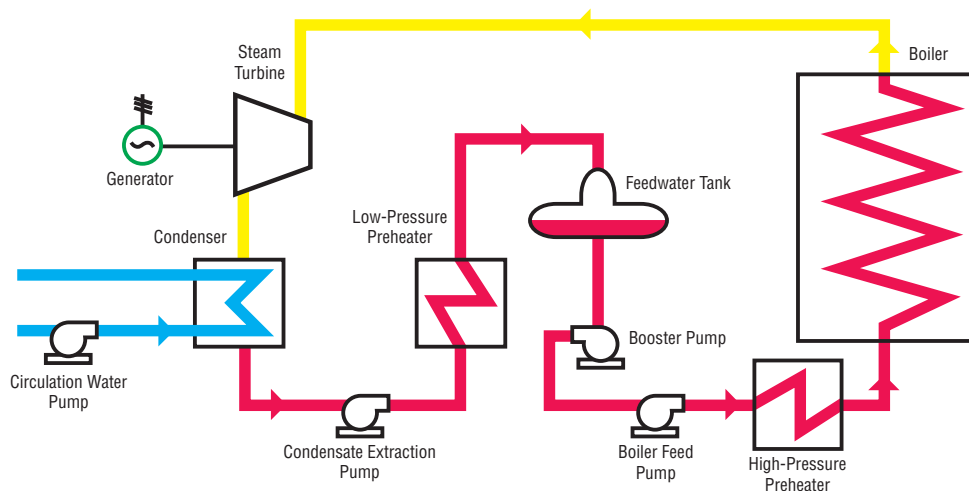


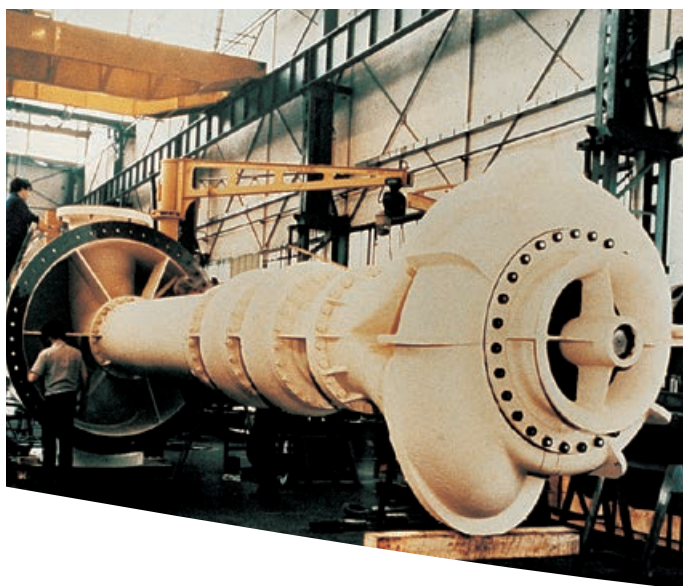


Fossil Fuel

Flowserve leads the market in supplying pumps and pumping systems for fossil fuel power generating plants. No other pump company in the world can match the Flowserve systems knowledge, hydraulic

expertise or application know-how. Simply stated, Flowserve offers the power industry's most comprehensive package of pump products, technical support and service.





Boiler Feed Water Services

Boiler feed is an extremely demanding service for pumps, and a boiler feed pump is one of the most critical pieces of rotating equipment in the steam cycle. Flowserve has repeatedly proven that it builds the highest quality, most reliable boiler pumps available.

Flowserve offers radially and axially split multistage pumps with single- or double-suction, first-stage impellers. Double case barrel pumps, in both diffuser and volute configurations, are available for the highest pressure applications. Axially split multistage volute type pumps and radially split ring section diffuser type pumps are available to handle moderate pressure applications.



Circulating Water Services

Flowserve offers both vertical and horizontal circulating pumps in a wide range of configurations, hydraulics and materials to meet any application requirement. Pullout or non-pullout construction is available on vertical pump models. Concrete volute pumps are also available for these services.

Condensate Water Services

Flowserve has a long and proven performance record for this critical service. Its versatile line of condensate pumps offers unsurpassed hydraulic coverage and a broad range of options to address system requirements. Both single- and double-suction, first-stage, vertically suspended pump designs are available.

Flue Gas Desulfurization Services

Flowserve designs and manufactures pumps for all FGD system services. Some of these services include: mill slurry, reagent feed, absorber recirculation, absorber bleed, demister wash and filtrate pumps.

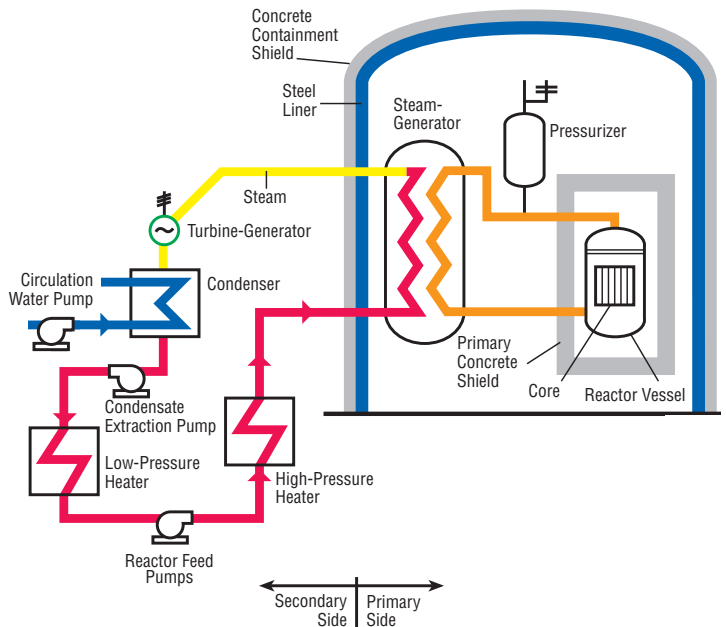
Auxiliary Services

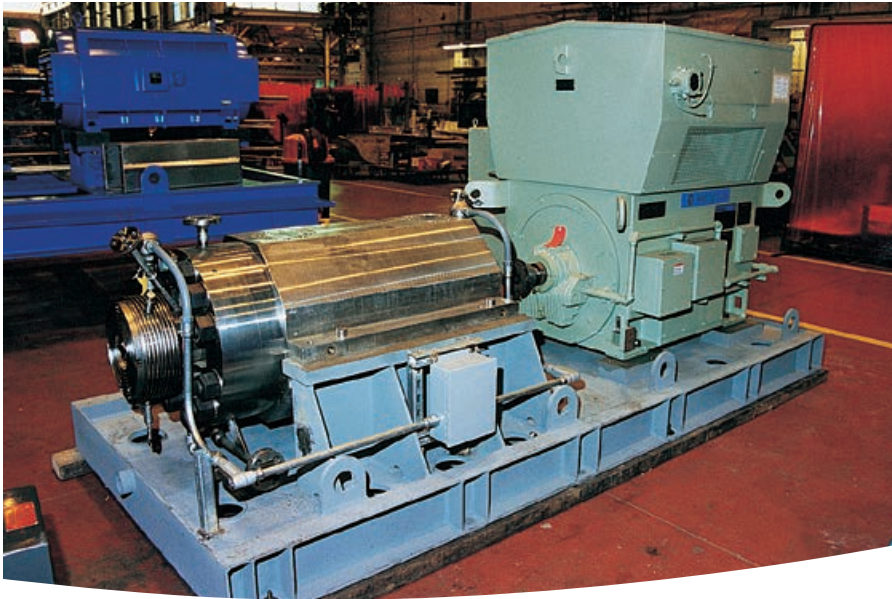
Flowserve offers an extensive line of pumps, including ANSI, ISO and API designs. They are available in a wide variety of metallic and non-metallic materials and in many design and hydraulic configurations to satisfy virtually all plant-wide pumping needs.



Nuclear

Flowserve experience as a nuclear specialist dates to the birth of the nuclear power generation industry when it provided innovative pumping and sealing technologies under both the Byron Jackson heritage name and the IDP heritage name. Today, Flowserve continues the tradition with products and services that remain on the leading edge of technological advances in nuclear power. Capabilities include ASME Section III, Class 1, 2 and 3 pumps and nuclear mechanical seals, plus full repair, upgrade and maintenance service, technical and engineering support.





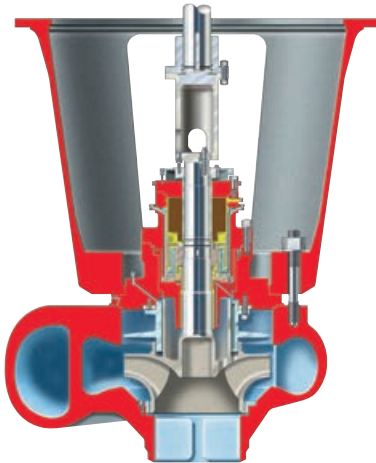
Primary Coolant Pumps and Seals

- Boiling water reactors
- Pressurized water reactors
- Heavy water reactors

Supplied or upgraded to rigorous technological and NSSS design standards

Nuclear Safety-Related Pumps

- Residual heat removal
- Containment spray
- Core spray
- Safety injection
- Charging and makeup
- Essential service water
- Auxiliary feed
- Miscellaneous nuclear



Conventional Pumping Services

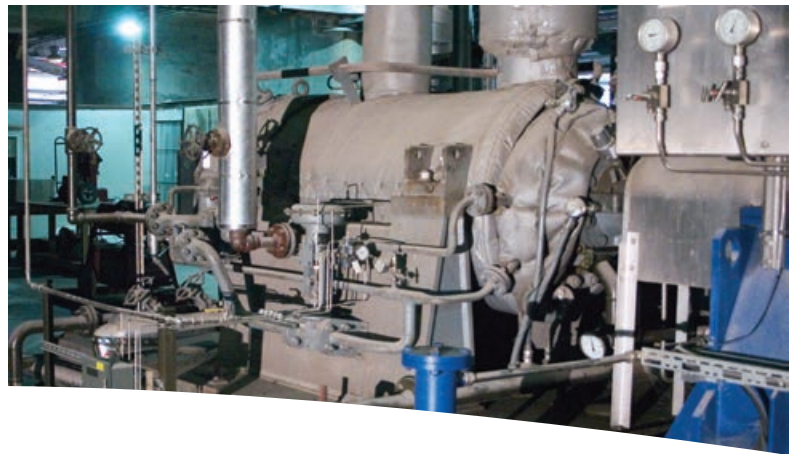
- Reactor feed
- Steam generator feed
- Circulating water
- Condensate extraction
- Booster
- Auxiliary services



Hot Shop Capabilities

Flowserve provides Hot Shop capabilities for ASME Section III, Class 1, 2, 3 Safety Related and other contaminated components.

- Decontamination
- Disassembly and inspection
- Non-destructive examination
- Root cause analysis
- Complete repair and upgrade service
- Reassembly
- Transportation



Boiler Feed Water Pumps

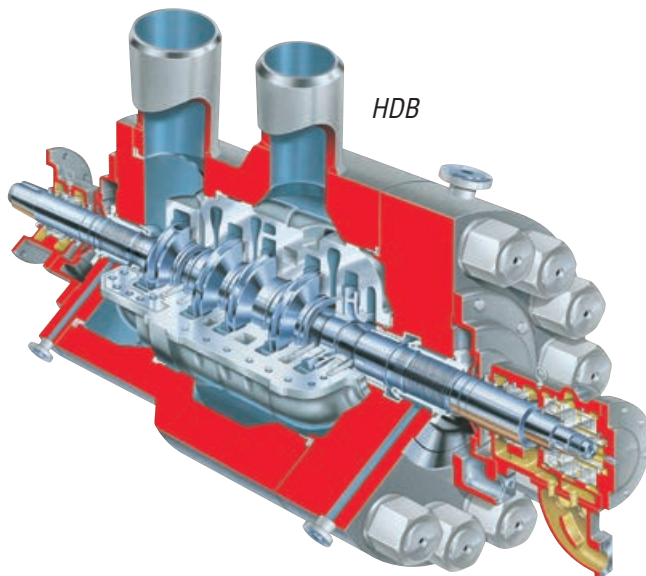
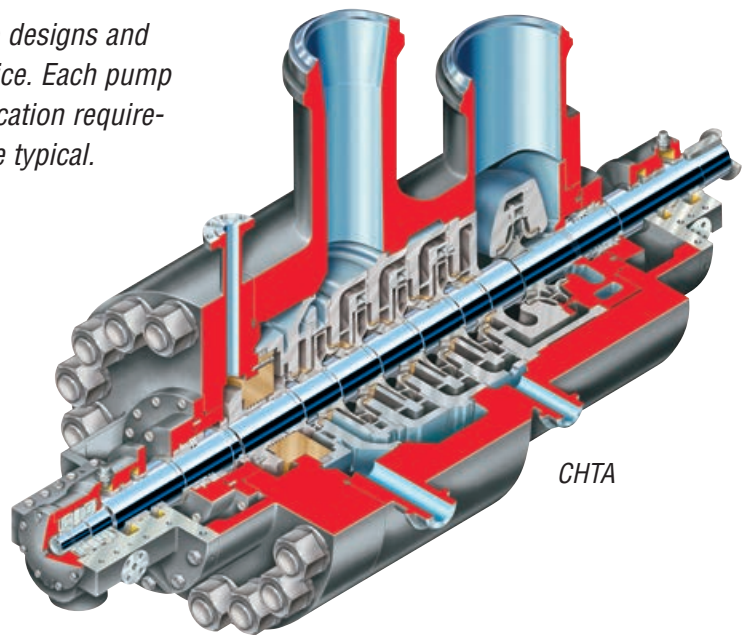
Flowserve offers numerous pump designs and models for boiler feed water service. Each pump is custom designed to meet application requirements. The parameters shown are typical.

Multistage, Double Case Diffuser Barrel Pumps

Between bearings, radially split, double case diffuser, multistage designs

Operating Parameters

- Flows to 5220 m³/h (23 000 gpm)
- Heads to 4270 m (14 000 ft)
- Pressures to 517 bar (7500 psi)
- Temperatures to 315°C (600°F)

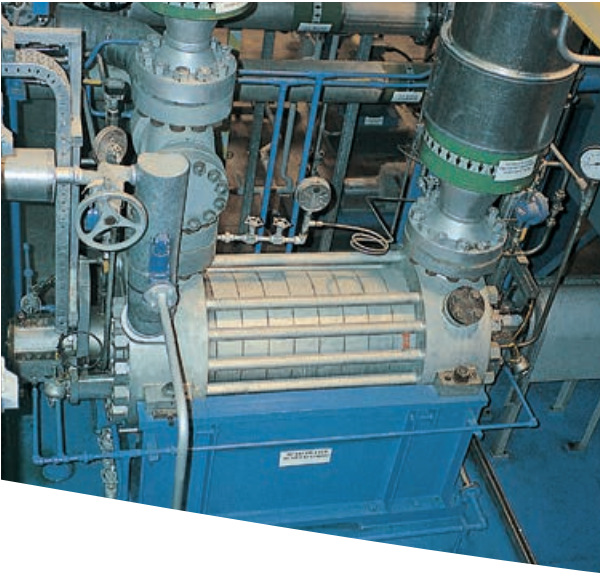


Multistage, Double Case Volute Barrel Pumps

Between bearings, radially split, double volute case, top-suction, top-discharge, multistage designs

Operating Parameters

- Flows to 5220 m³/h (23 000 gpm)
- Heads to 4270 m (14 000 ft)
- Pressures to 517 bar (7500 psi)
- Temperatures to 315°C (600°F)

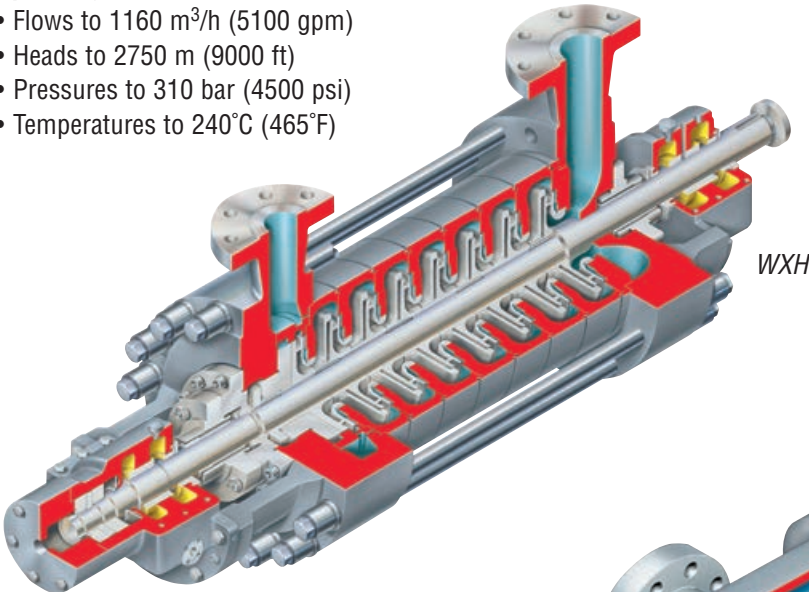


Multistage, Segmental Ring Diffuser Pumps

Between bearings, radially split, multistage designs

Operating Parameters

- Flows to 1160 m³/h (5100 gpm)
- Heads to 2750 m (9000 ft)
- Pressures to 310 bar (4500 psi)
- Temperatures to 240°C (465°F)

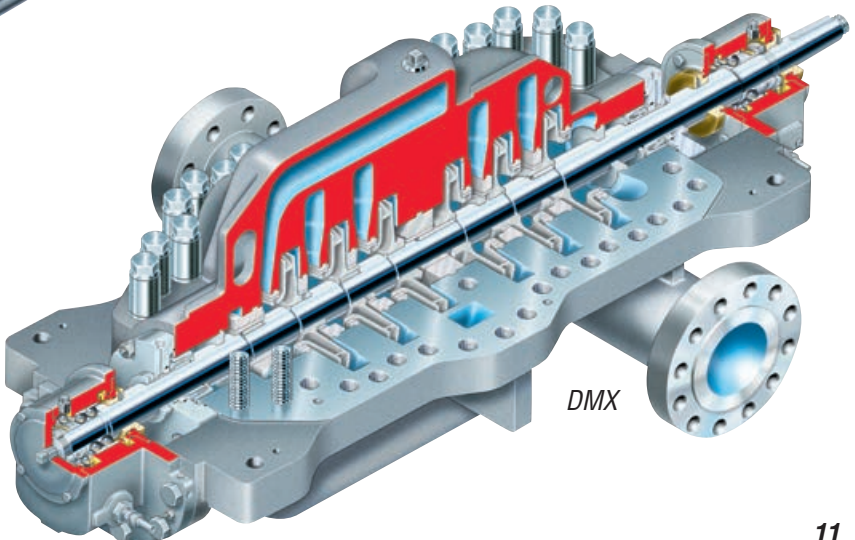


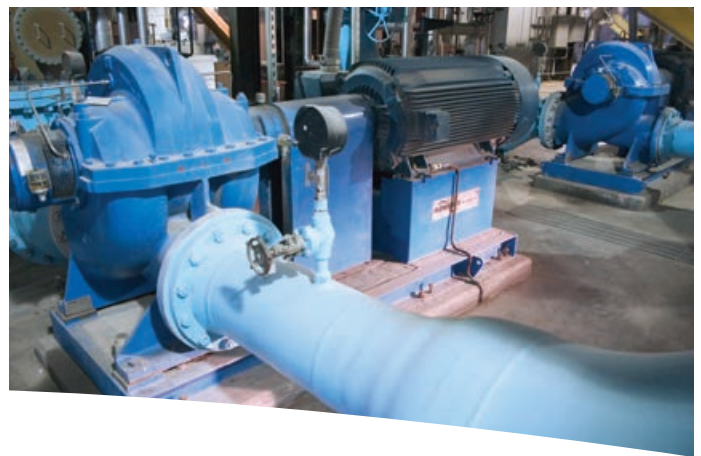
Multistage, Horizontal Split Case Volute Pumps

Between bearings, axially split, dual volute case, side suction, side discharge

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)





Circulating Water Pumps

Flowserve offers a broad range of wet- or dry-pit vertical circulating water pumps for cooling water service. Horizontal design pumps and concrete volute pumps are also available.

Vertical, Wet-Pit Pumps

Mixed-flow pumps specifically designed for extended operation in condenser cooling water service; pullout and non-pullout designs

Operating Parameters

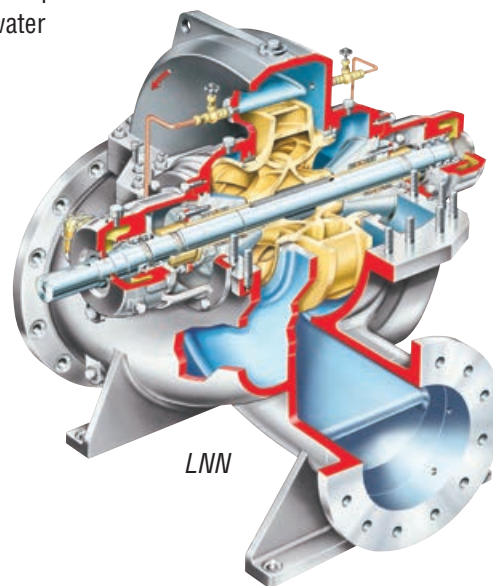
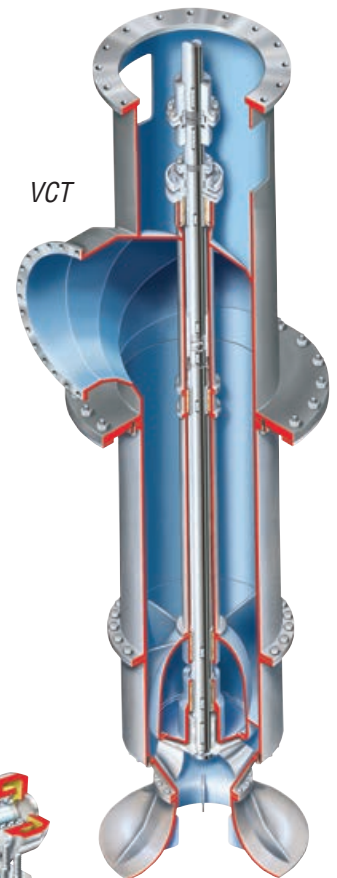
- Flows to 181 700 m³/h (800 000 gpm)
- Heads to 110 m (350 ft)
- Pressures to 5 bar (75 psi)
- Temperatures to 65°C (150°F)

Horizontal, Between Bearings, Single-Stage Pumps

Axially split, double volute, double-suction pumps specifically designed for extended cooling water and circulating water services

Operating Parameters

- Flows to 30 000 m³/h (132 000 gpm)
- Heads to 300 m (985 ft)
- Pressures to 40 bar (580 psi)
- Temperatures to 140°C (285°F)



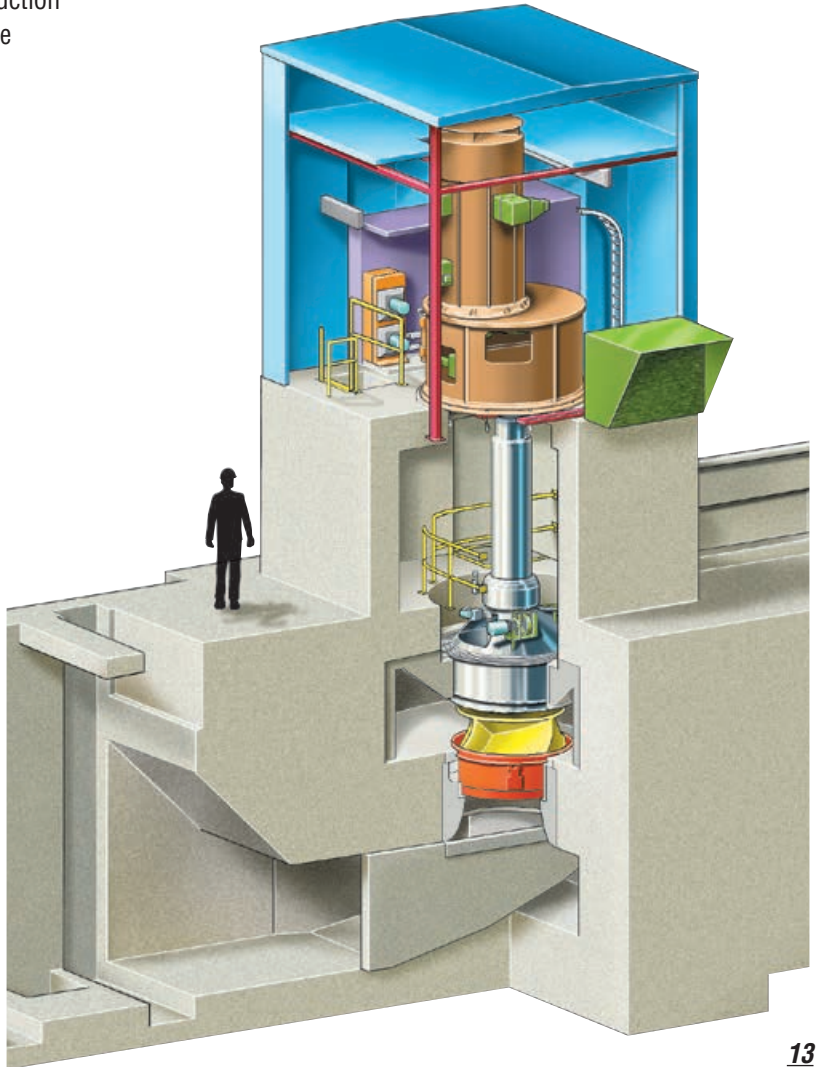
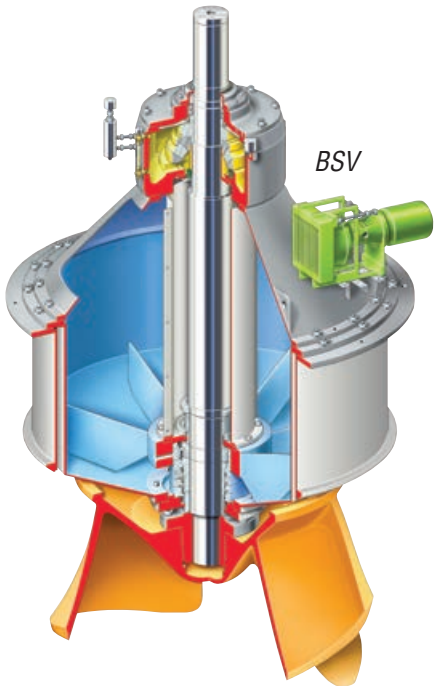


Concrete Volute Pumps

- Pump assembly integrated into civil construction
- Pre-fabricated concrete sections form intake structure for the pump
- Pump types
 - Mixed-flow, open impeller
 - Mixed-flow, closed impeller

Operating Parameters

- Flows to 200 000 m³/h (800 000 gpm)
- Heads to 60 m (197 ft)





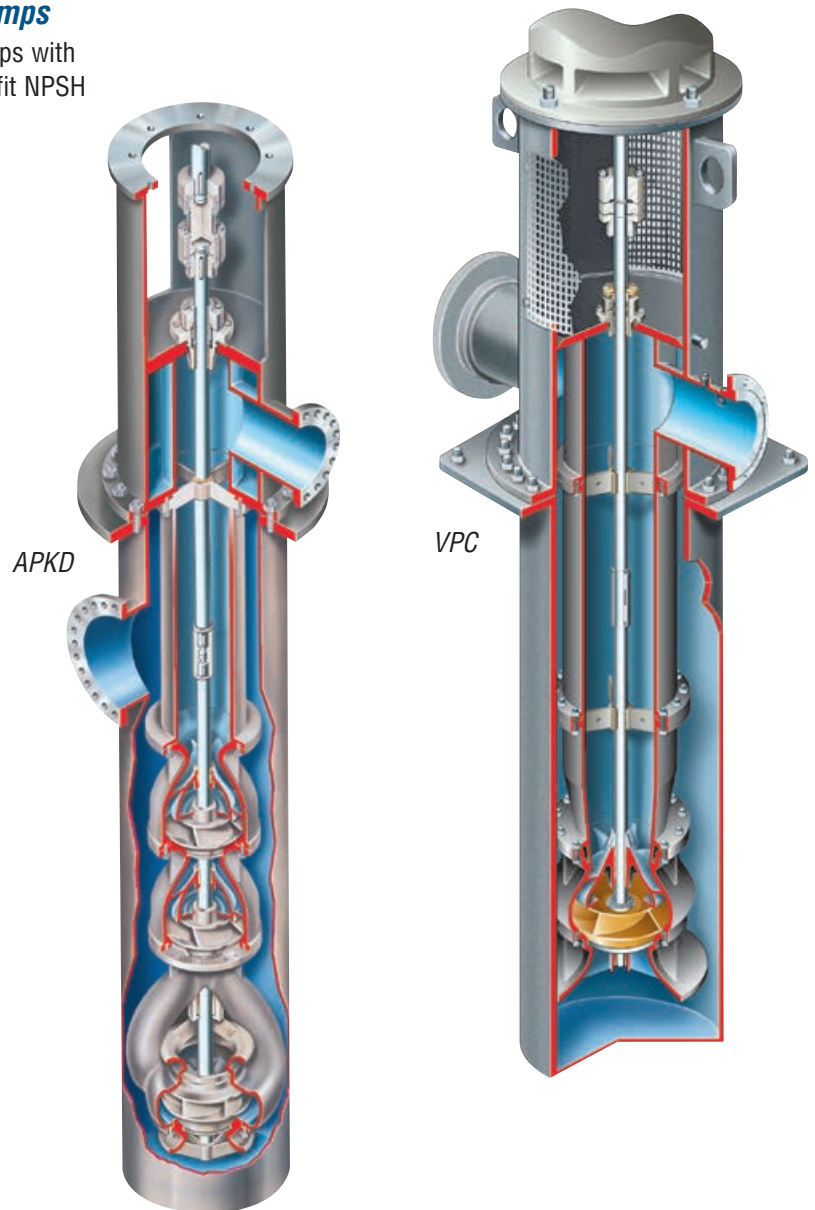
Condensate Extraction Pumps

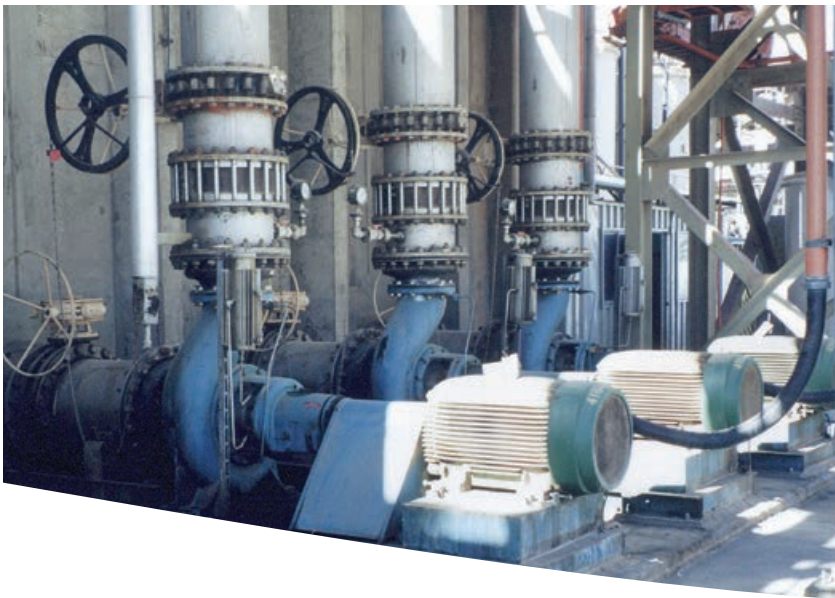
Vertical, Multistage, Canned Pumps

Multistage, mixed-flow, heavy-duty pumps with single- or double-suction, first-stage to fit NPSH requirements. Designed for continuous, extended operation.

Operating Parameters

- Flows to 13 600 m³/h (60 000 gpm)
- Heads to 1070 m (3500 ft)
- Pressures to 100 bar (1450 psi)
- Temperatures to 230°C (450°F)





Flue Gas Desulfurization Pumps

Flowserve offers a variety of horizontal type pumps for the difficult slurry handling services found in FGD applications.

Single-Stage Process Pumps

General purpose pump for slurries, light abrasives, severe chemical media

Operating Parameters

- Flows to 9085 m³/h (40 000 gpm)
- Heads to 100 m (330 ft)
- Temperatures to 150°C (300°F)
- Power from 2.2 kW (3 hp) to 600 kW (750 hp)

Rubber Lined and Hard Metal Slurry Pumps

Horizontal, single end suction pumps with tangential discharge nozzles for severe duty requirements

Operating Parameters

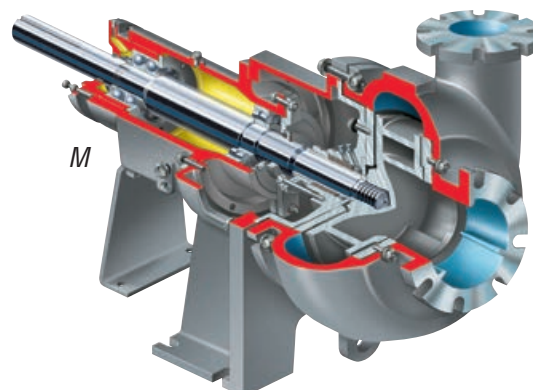
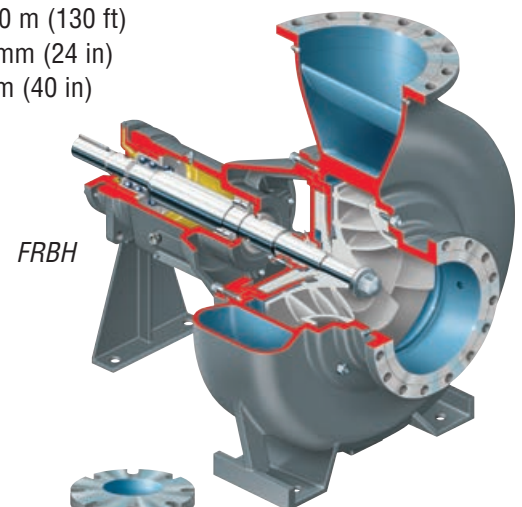
- Flows to 10 000 m³/h (44 000 gpm)
- Heads to 90 m (300 ft)
- Pressures to 50 bar (725 psi)
- Temperatures to 120°C (250°F)
- Solids from 2% to 70% by weight

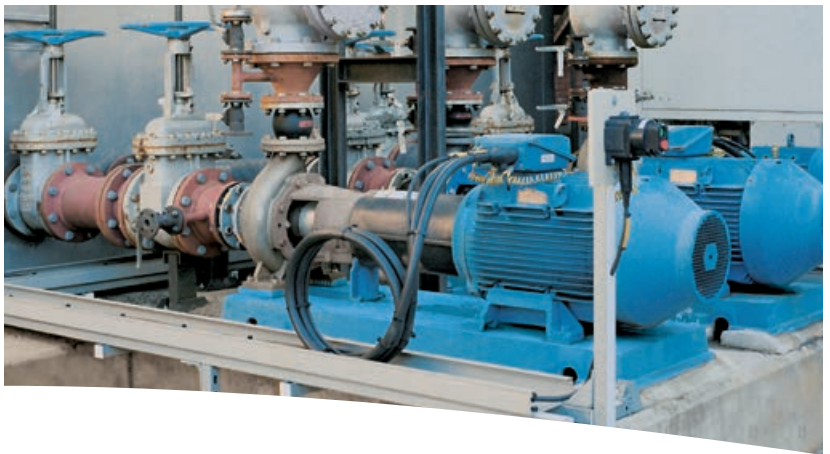
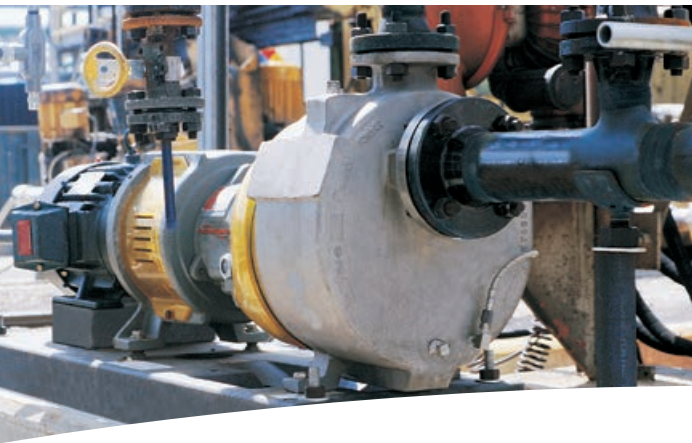
Absorber Recycle Pumps

Radially split pumps with front and back pullout design for recirculation services

Operating Parameters

- Flows to 17 500 m³/h (77 000 gpm)
- Heads to 40 m (130 ft)
- Sizes 600 mm (24 in) to 1000 mm (40 in)





Auxiliary Services Pumps

Flowserve can provide pumping solutions for virtually all power plant support services.

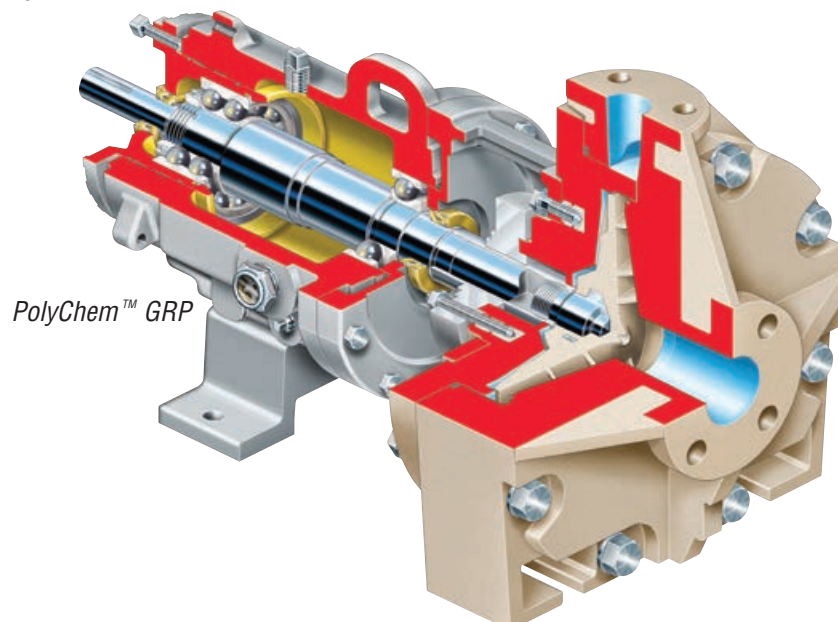
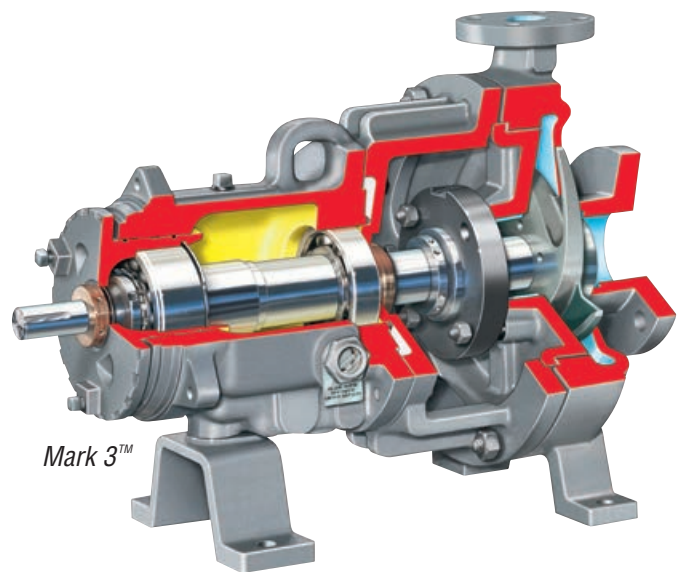
Chemical Process ASME (ANSI) and ISO Standard Pumps

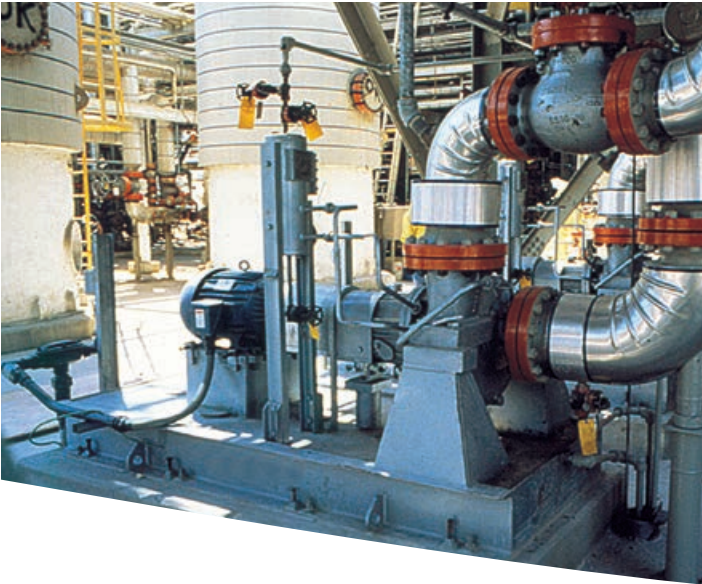
Alloy

- Low-flow, high-head
- Sealmatic sealless
- Unitized self-priming
- Recessed impeller solids, slurries handling
- Magnetic drive sealless
- In-line

Non-Metallic

- High-grade, engineered composite
- Fluoropolymer PFA lined
- Mechanically sealed
- Magnetically driven



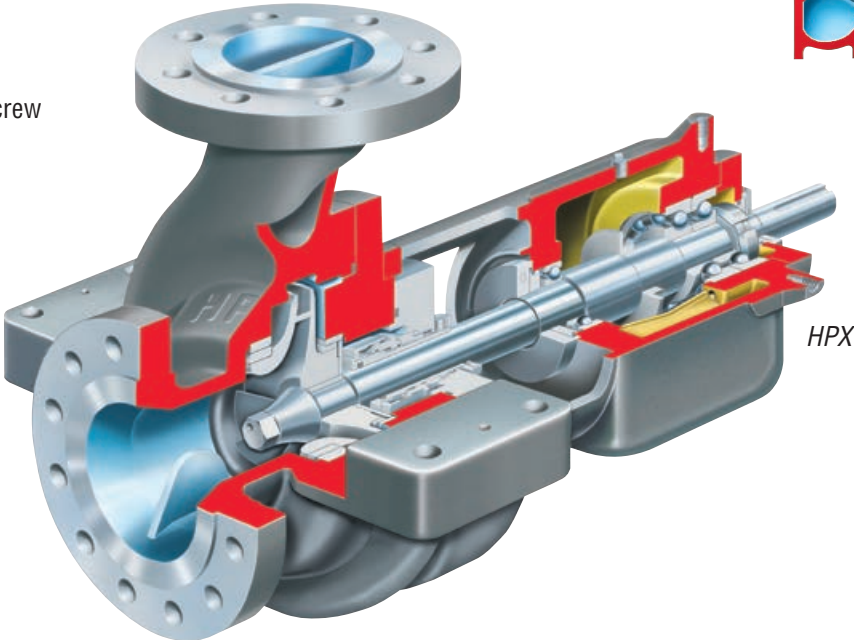
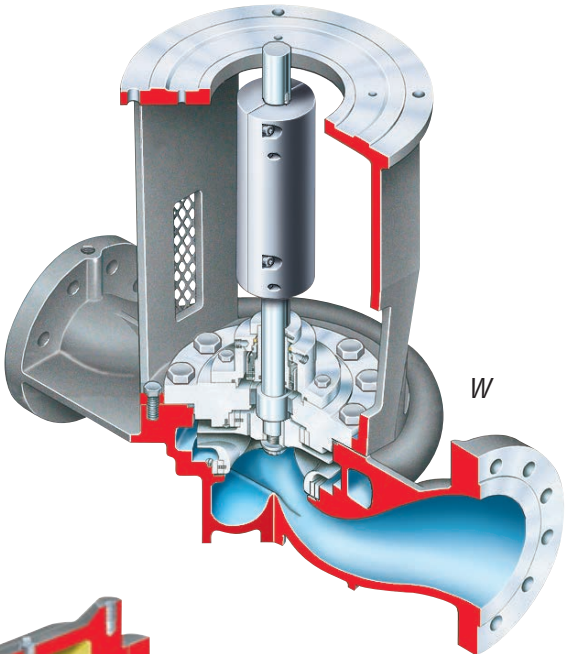


API Process Pumps

- Fully compliant with ISO 13709/API 610, latest edition
- Horizontal, overhung, centerline mounted
- In-line configuration with in-line suction and discharge nozzles
- Additional configurations
 - Radially split, single-stage, double-suction, dual volute
 - Low-flow, high head
 - In-line with a separate bearing housing
 - In-line modular design

Additional Pump Types

- Reciprocating pumps
 - Horizontal
 - Vertical
- Rotary
 - Gear
 - Twin screw





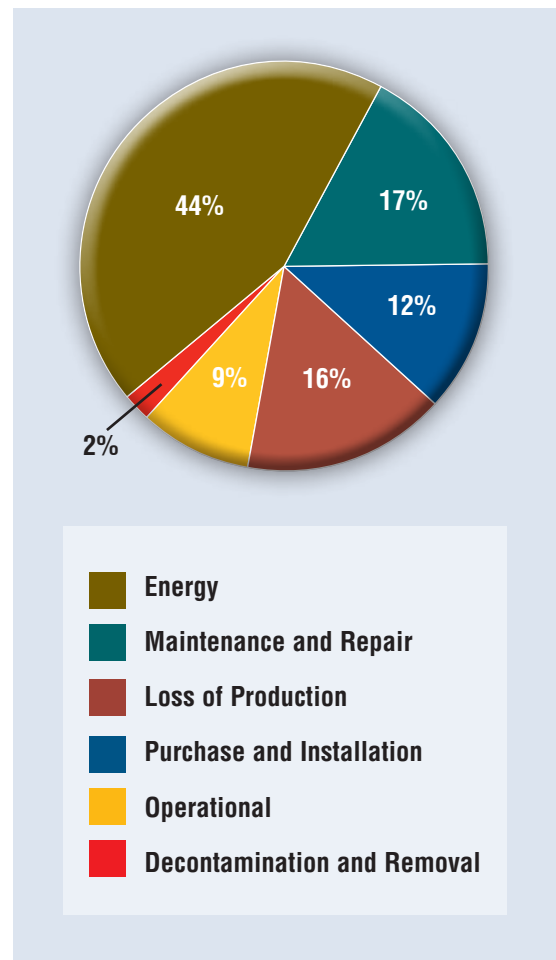
Life Cycle Cost Solutions

Typically, 90% of the total life cycle cost (LCC) of a pumping system is accumulated after the equipment is purchased and installed. Flowserve has developed a comprehensive suite of solutions aimed at providing customers with unprecedented value and cost savings throughout the life span of the pumping system. These solutions account for every facet of life cycle cost, including:

- Capital Expenses
 - Initial purchase
 - Installation
- Operating Expenses
 - Energy consumption
 - Maintenance
 - Production losses
 - Environmental
 - Inventory
 - Operating
 - Removal



Typical Pump Life Cycle Costs¹



¹ While exact values may differ, these percentages are consistent with those published by leading pump manufacturers and end users, as well as industry associations and government agencies worldwide.



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

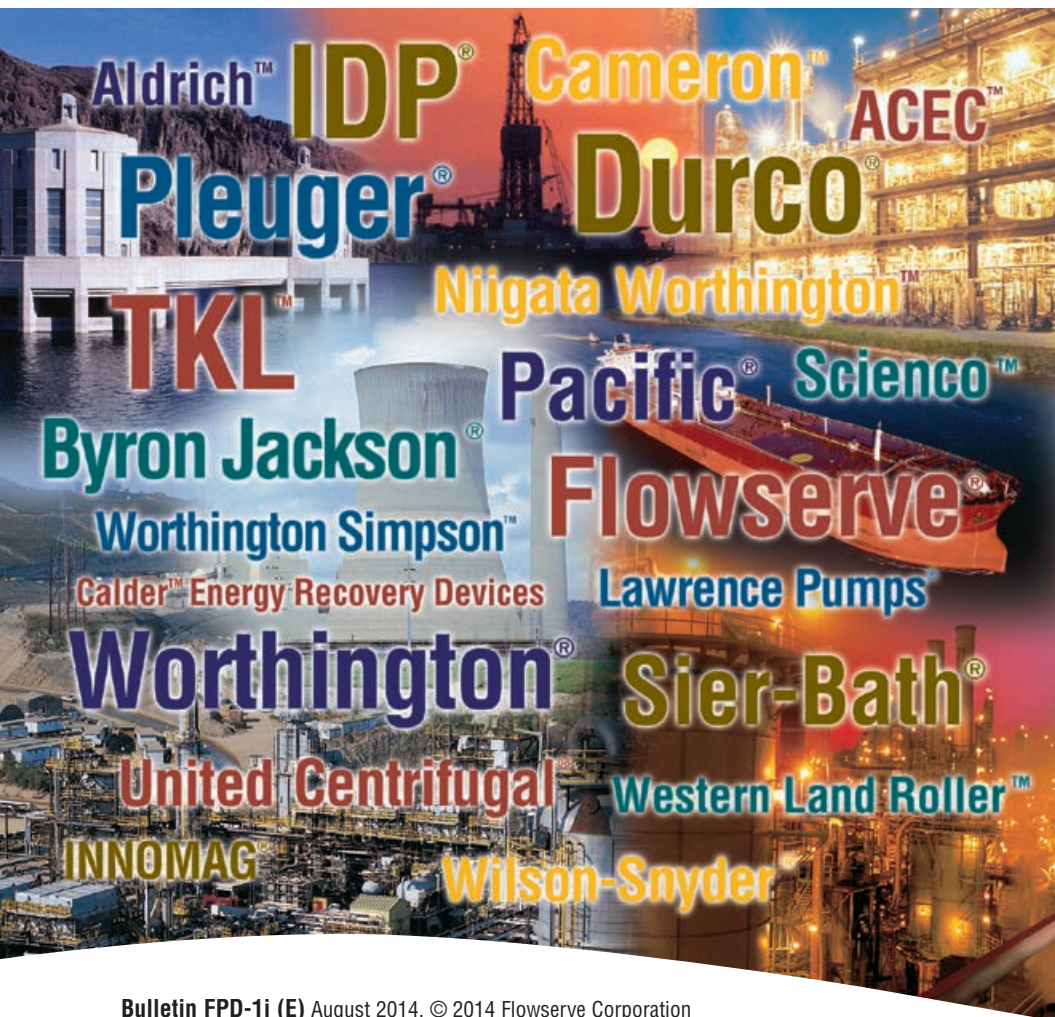
Flowserve engineers and technicians have been specially trained to help customers analyze, diagnose and solve those issues that cause problematic pump breakdowns and unscheduled outages. Engineers are equipped to collect real-time data, review performance problems, analyze data, and make recommendations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



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Bulletin FPD-1i (E) August 2014. © 2014 Flowserve Corporation

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