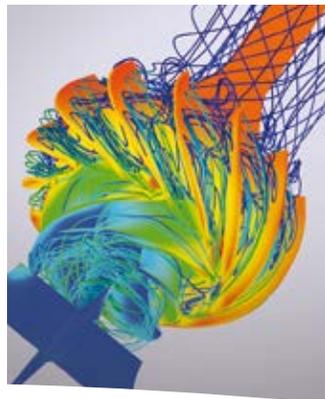




***SIHI® Pumps
For High Temperature Systems***



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.

Life Cycle Cost Solutions

Flowserve provides pumping solutions that permit customers to reduce total life cycle costs and improve productivity, profitability and pumping system reliability.

Market-Focused Customer Support

Product and industry specialists develop effective proposals and solutions directed toward market and customer preferences. They offer technical advice and assistance throughout each stage of the product life cycle, beginning with the initial inquiry.

Broad Product Lines

Flowserve offers a wide range of complementary pump types, from pre-engineered process pumps to highly engineered and special purpose pumps and systems. Pumps are built to recognized global standards and customer specifications.

Pump designs include:

- Single-stage process
- Between bearings single-stage
- Between bearings multistage
- Vertical
- Submersible motor
- Positive displacement
- Vacuum & Compressor
- Nuclear
- Specialty

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

SIHI® Pumps

TKL™ Pumps

United Centrifugal® Pumps

Western Land Roller™ Irrigation Pumps

Wilson-Snyder® Pumps

Worthington® Pumps

Worthington Simpson™ Pumps



Handling hot media liquids in all safety

Many industrial processes require heating or cooling to control their process characteristics. Only when pre-defined parameters of the processes, like temperature are obtained, the process can be started.

Maintaining a constant temperature level or changing temperature conditions can easily be done by the use of indirect heating by means of thermal fluids. To obtain the exchange between the user and the heater, thermal fluids are warmed up and circulated in closed loops.

The operating temperatures of these thermal fluids loops varies mostly from 100 °C (212 °F) up to 400 °C (752 °F). Dependent from the temperature, many different thermal fluids are available on the market.

To circulate these thermal fluids, volute casing pumps are widely used. Depending from the temperature and heat transfer media, different type of pumps are developed to circulate the fluids in the most efficient and economical way.

Industries / Markets

- Chemistry
- Pharmaceutical
- Energy
- Plastics manufacturing
- Paper production
- Wood processing
- Building systems
- Floor coverings

Applications

- Hot water circulation
- Thermal oil circulation
- Heating
- Increasing pressure
- Heat transport



ZLN



ZDI



ZEN



ZTN



ZTK



CBE

Hot water pumps
for up to 150 °C
(302 °F)



ZLN – The standard hot water pump

Up to a temperature of 140 °C (284 °F) and when properly selected, the ZLN, a standard water pump as per EN 733, can be used with uncooled, balanced mechanical seals.

Product circulation ensures that the mechanical seal is permanently surrounded by the medium, thus preventing dry running.



ZLN

ZDI – The hot water inline pump

The economical inline design is becoming increasingly popular in hot water applications, because it can be installed inline in any pipeline system and thus compensates for pipeline forces in an ideal manner. The ZDI uses a stub shaft connection, which permits use of a standard motor for a compact design.

The maximum pumping temperature for the uncooled ZDI hot water design is limited to 150 °C (302 °F). The process design makes it possible to disassemble the complete pump without having to separate the pump casing from the pipeline system.

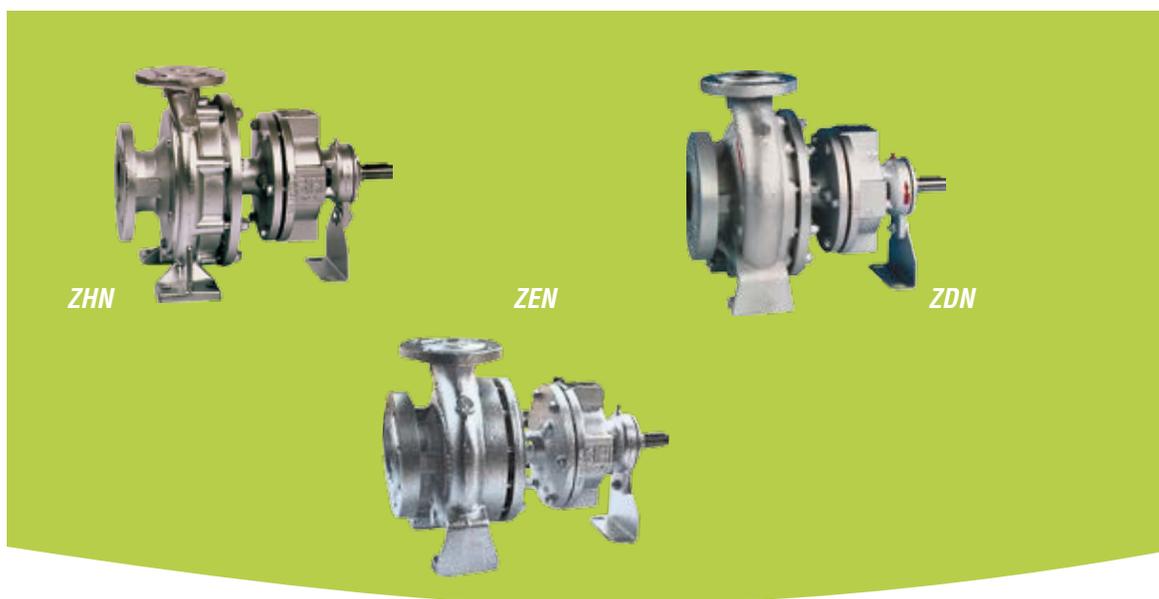


ZDI

Technical data

Technical data	ZLN	ZDI
Flow rate	1800 m ³ /h (7926 US gpm)	140 m ³ /h (616 US gpm)
Delivery head	140 m (459 ft)	60 m (197 ft)
Temperature	140 °C (284 °F) un-cooled	150 °C (302 °F) un-cooled
Casing pressure	PN 16	PN 25
Material	Ductile iron	Ductile iron

Hot water pumps
for up to 230 °C
(446 °F)



Handling hot water requires very special pump designs as the operating pressure increases exponentially with the temperature increase. Special developments of the seal housing are integrated to achieve exceptional long MTBF times by guaranteeing the optimal seal faces lubrication under all circumstances.

Many pump and mechanical seal manufactures offering standard pumps with uncooled mechanical seals up to 180 °C (356 °F). Praxis however has proven that the poor lubrication characteristics of water under these extreme pressure and temperature conditions lead to short MTBF times of the equipment.

The combination of uncooled sealing device and the special pump construction make this pump design unique in its kind. It is not only offering the saving of the use of cooling water, but also increase the MTBF time to a normal expected life time of a mechanical seal.

ZHN, ZDN, ZEN – The hot water pumps

In the volute casing pumps ZHN, ZDN, and ZEN, the mechanical seal has been moved to the drive side or “cold end” of the pump. In this way, a double heat barrier results in a more favourable temperature decrease on the drive side. Even at a temperature of up to 230 °C (446 °F), the use of an uncooled mechanical seal is no problem because the temperature in this area does not exceed 100 °C (212 °F). This eliminates the need for cooling water and the installation costs for external cooling of the shaft seal.

In hot water applications, however, it is not enough just to place the seal on the “cold end”, because this medium tends to vaporise during heating.

Due to centrifugal forces, gas bubbles are deposited on the smallest rotating parts. In general, this means the sliding surfaces of the mechanical seal. The pumps counter these physical conditions by using a gas separator in the area of the mechanical seal. At the highest point, there is a collecting chamber for the resulting gases. This space can be vented by means of a valve both when the system is at a standstill and when starting up of the plant.

Technical data

Technical data	ZHN	ZDN	ZEN
Flow rate	600 m³/h (2642 US gpm)	600 m³/h (2642 US gpm)	600 m³/h (2642 US gpm)
Delivery head	90 m (295 ft)	90 m (295 ft)	90 m (295 ft)
Temperature	180 °C (356 °F) un-cooled	207 °C (404 °F) un-cooled	230 °C (446 °F) un-cooled
Casing pressure	PN 16	PN 25	PN 40
Material	Ductile iron	Ductile iron	Ductile iron, cast steel

Hot water pumps
for up to 350 °C
(662 °F)



In opposite to water, organic or synthetic heat transfer media offer the option of heating, cooling or controlling temperature without high system pressures. Operating at temperatures of up to 350 °C (662 °F) is possible in pressure less systems, and the upper temperature limit is currently 400 °C (752 °F).

In connection with developments in the area of heat transfer installations and their liquids, the standard DIN 4754 has been compiled. Among other things, this standard specifies the safety requirements and the operation of pumps in thermal oil circulation systems. Here, too, volute casing pumps as per EN 733 have become the technology of choice.

ZTN, ZTK, ZTI – The thermal oil pumps

For thermal pumping at temperatures of up to 350 °C (662 °F) in thermal systems, the models ZTN, ZTK and ZTI have been developed. The higher requirements for operational safety, environmental friendliness and reduction of operating costs have been met consistently in these designs. The same goes for the contents of the standards DIN 4754 and EN 733. All pressure loaded components are made of tough materials such as GGG 40.3 (Ductile iron).

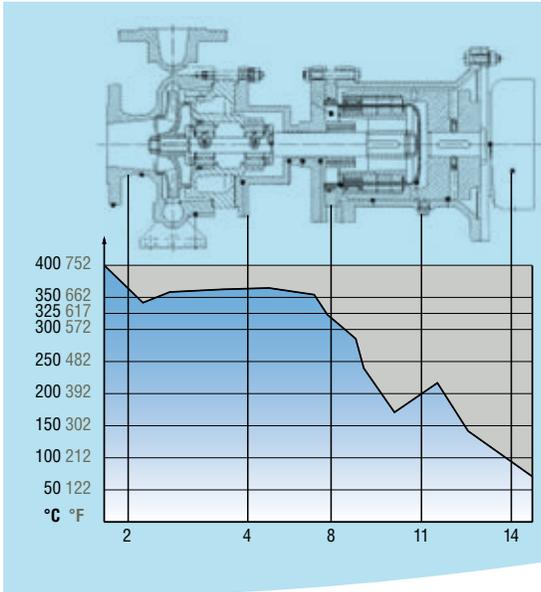
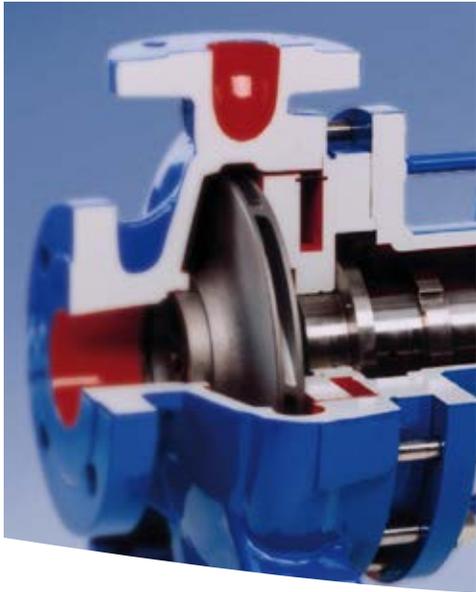
The heat barrier located behind the hydraulic system can be used to substantially reduce heat losses. In addition, the pumps have a thermally isolated bearing carrier. A sliding sealing cartridge compensates any expansion that occurs due to heat, thus preventing distortion between the pump and cooling. An additional throttle gap achieves a favourable decrease in temperature with regard to the shaft seal. This makes it possible to use simple, uncooled shaft seals.

The models differ only in the form of the pump casing. While the ZTK has a volute casing with axial intake and radial discharge connection, the ZTI has an inline casing, which can be installed directly in the pipeline system. Both pumps are designed as compact assemblies.

Technical data

	ZTN	ZTK	ZTI
Flow rate	1000 m ³ /h (4403 US gpm)	200 m ³ /h (880 US gpm)	200 m ³ /h (880 US gpm)
Delivery head	90 m (295 ft)	60 m (196 ft)	60 m (196 ft)
Temperature	350 °C (662 °F) un-cooled	350 °C (662 °F) un-cooled	350 °C (662 °F) un-cooled
Casing pressure	PN 16	PN 16	PN 16
Material	Ductile iron	Ductile iron	Ductile iron

Thermal oil pump with magnetic coupling up to 400 °C (752 °F)



Based on an increasing environmental consciousness, tighter regulations (such as TA-Luft, German Technical Instructions on Air Quality Control) and the justified demand for more safety, sealless pumps are increasingly being used. In particular, when pumping synthetic heat transfer media, which can be classified as hazardous to health, magnetically coupled pumps have become the technology of choice. A hermetically sealed magnetic coupling, however, is also the optimal solution when it must be ensured that the heat transfer medium does not come into contact with the atmosphere, especially with oxygen.

CBE –The compact magnetically coupled pumps up to 400 °C (752 °F)

Up to a temperature of 300 °C (572 °F), the CBE in close-coupled design has proven to be a good solution. This magnetically coupled design is not only hermetically sealed, but also requires no maintenance. The highly wear-resistant silicon carbide/tungsten carbide sleeve bearings result in long service life, and the deep drawn containment shroud with a wall thickness of 1.6 mm offers additional full safety. The magnets are made of high-quality samarium cobalt (SmCo). They are characterized by a high magnetic energy density, magnet size and can withstand high temperatures loads.

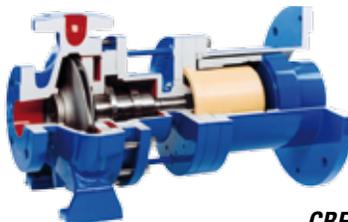
For temperatures of up to 400 °C (752 °F), a design with a heat barrier where a “dead ended” magnetic chamber is used. The heat barrier separates the pump thermally from the magnetic coupling and prevents the flow of heat into the magnet chamber. To ensure that additional heat is not generated by eddy current losses in the isolation shroud, a shroud of industrial ceramic (zirconium oxide) is used. This material is not conductive and will not generate any additional heat in the magnet chamber with the highest possible efficiency.

Technical data

	CBE
Flow rate	650 m ³ /h (2862 US gpm)
Delivery head	150 m (492 ft)
Temperature	max. 400 °C (752 °F) uncooled
Casing pressure	PN 25
Material	Ductile iron, stainless steel



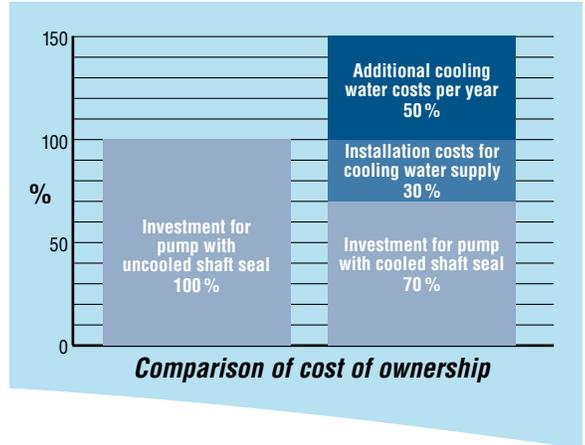
CBE 300



CBE 400

Advantages

- Uncooled shaft seal
- No cooling water costs
- Low installation costs
- Longer service life
- High efficiency
- Simple maintenance
- Low life cycle costs



Hot water pumps in detail

Long lasting efficiency

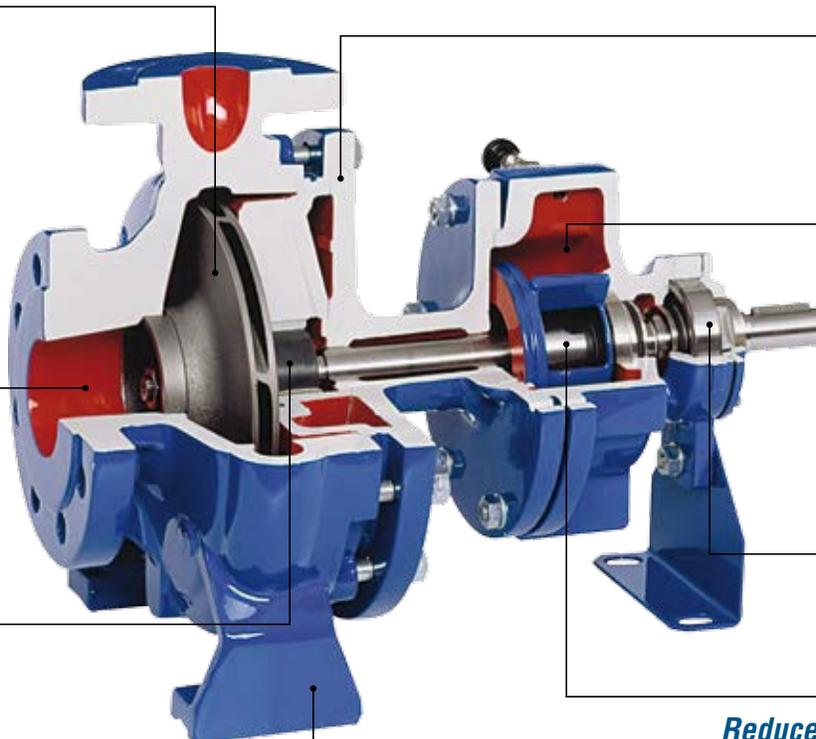
- Closed impeller permitting 'neck' wear-rings to be retrofitted

High efficiency & low power

- Advanced fluid dynamic design

Low NPSH

- High quality impeller and suction profile



Simple removal

- Back pull-out design

Un-cooled seal

- Vapour separation and removal in this unique seal chamber
- Large volume seal chamber located at cool drive-end
- Low shaft deflection

Long life

- Anti-friction bearing

Robust rotating assembly

- Long-life ball bearing
- Sleeve bearing

Reduced spare parts cost

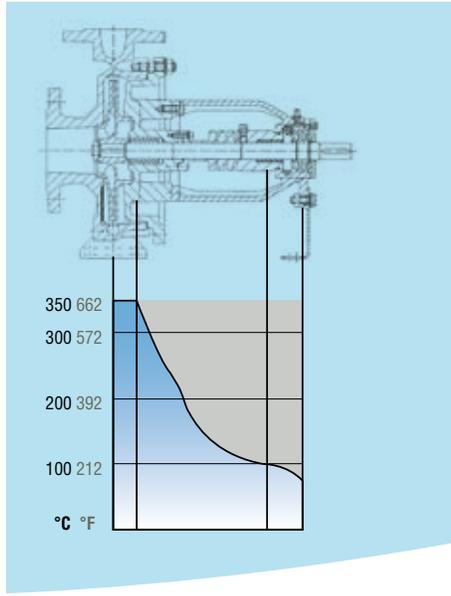
- Standard mechanical seal to DIN 24960

Stable with temperature fluctuations

- Provision for thermal expansion

Advantages

- Uncooled shaft seal
- Reduced heat losses
- Thermally isolated bearing carrier
- Improved safety
- High efficiency
- Simple maintenance
- Low life cycle costs



Thermal oil pumps in detail

Long lasting efficiency

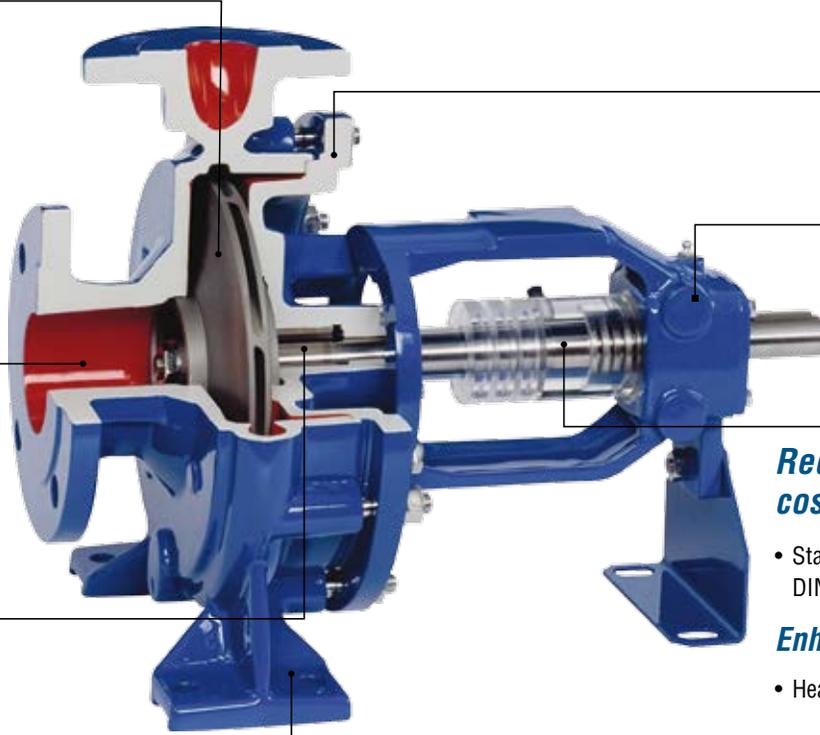
- Closed impeller permitting 'neck' wear-rings to be retrofitted

High efficiency & low power

- Advanced fluid dynamic design

Low NPSH

- High quality impeller and suction profile



Simple removal

- Back pull-out design

Triple protection

- Mechanical seal backed by lip seals and bearing assembly

Reduced spare parts cost

- Standard mechanical seal to DIN 24960 and basic lip seals

Enhanced seal life

- Heat dissipation with air-fin cooling

Robust rotating assembly

- Long-life ball bearing
- Sleeve bearing

Stable with temperature fluctuations

- Provision for thermal expansion

Hot water and thermal oil pumps



Hot water pumps

up to 150 °C (302 °F) uncooled



ZLN



ZDI

up to 230 °C (446 °F) uncooled



ZHN



ZDN



ZEN

Thermal oil pumps

up to 350 °C (662 °F) uncooled



ZTN



ZTK



ZTI

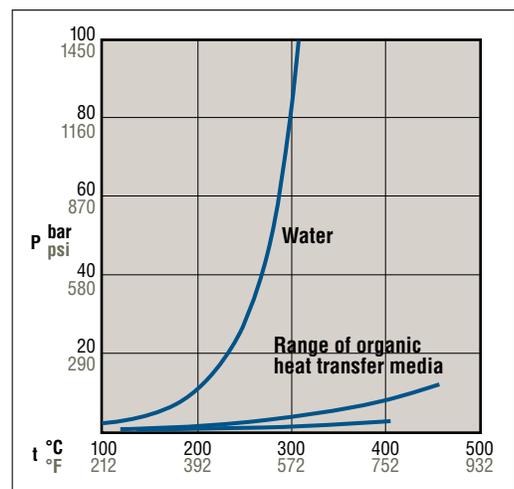
up to 400 °C (752 °F) uncooled



CBE

Because of its low environmental impact and high specific-heat capacity, water is preferred in the temperature range for up to about 200 °C (392 °F).

Due to the steam pressure, which increases greatly as the temperature rises, organic liquid heat transfer media are preferred in the temperature range from 200 °C (392 °F) to 400 °C (752 °F).



Global Service
and Technical
Support



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

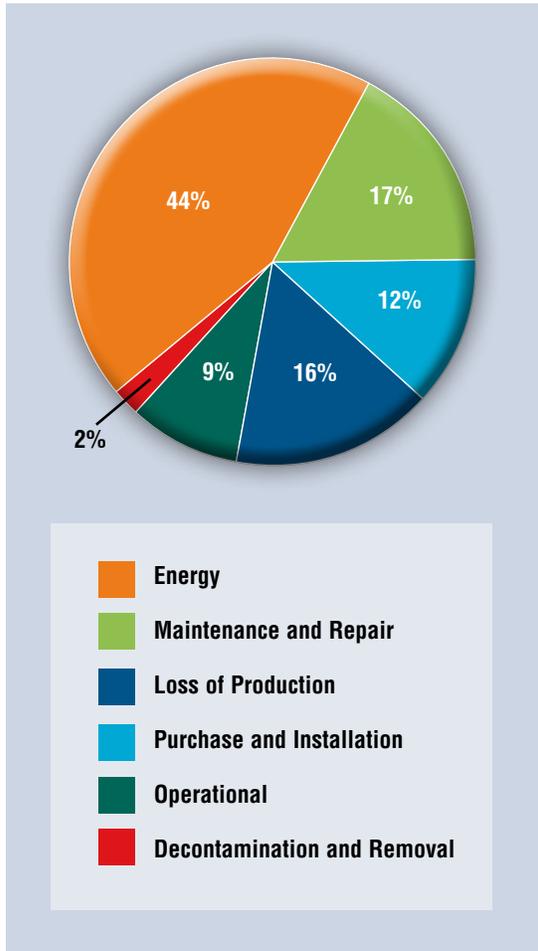
Operating Expenses

- Energy consumption
- Maintenance
- Production losses
- Environmental
- Inventory
- Operating
- Removal

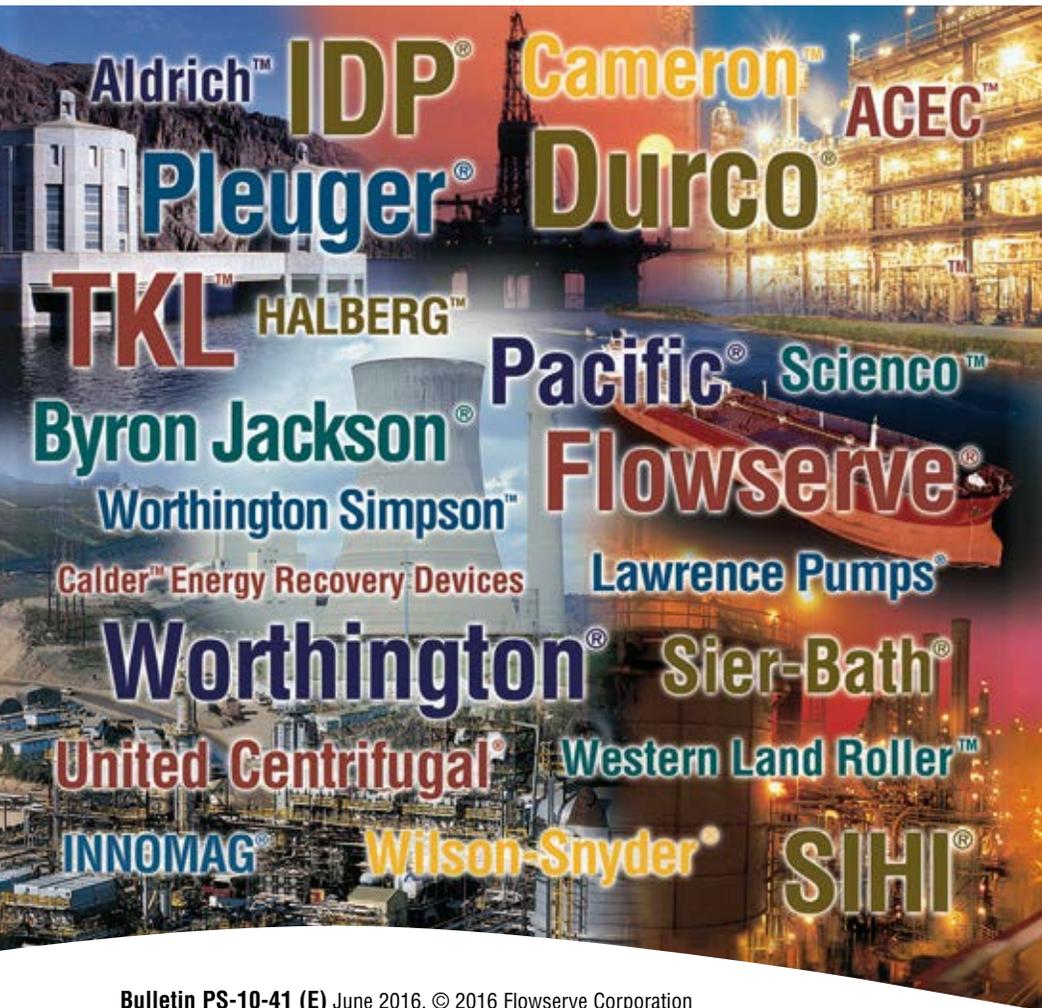
Innovative Life Cycle Cost Solutions

- New Pump Selection
- Turnkey Engineering and Field Service
- Energy Management
- Pump Availability
- Proactive Maintenance
- Inventory Management

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.



USA and Canada

Flowserve Corporation
5215 North O'Connor Blvd.
Suite 2300
Irving, Texas 75039-5421 USA
Telephone: +1 937 890 5839

Europe, Middle East, Africa

Flowserve Corporation
Parallelweg 13
4878 AH Etten-Leur
The Netherlands
Telephone: +31 76 502 8100

Latin America

Flowserve Corporation
Martín Rodríguez 4460
B1644CGN-Victoria-San Fernando
Buenos Aires, Argentina
Telephone: +54 11 4006 8700
Telefax: +54 11 4714 1610

Asia Pacific

Flowserve Pte. Ltd.
10 Tuas Loop
Singapore 637345
Telephone: +65 6771 0600
Telefax: +65 6862 2329

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To find your local Flowserve representative:

For more information about Flowserve Corporation,
visit www.flowserve.com or call +1 937 890 5839.