



***ANSI/ASME
Mark 3™ /Prima3™
Power End Programs***



Experience In Motion



LifeCycle Advantage™ Rotating Equipment Management

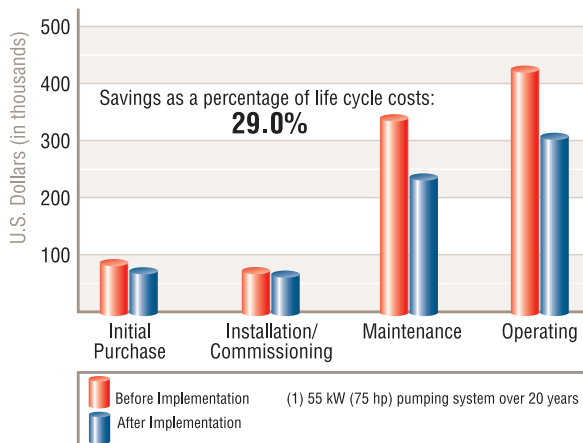
Cost Saving Efficiencies

The Flowserve LifeCycle Advantage program helps pump users realize significant reliability and performance gains which result in increased profitability. A proprietary equipment management process, LifeCycle Advantage is customized to meet each customer's unique operating requirements and their rotating equipment and mechanical seal needs.

LifeCycle Advantage focuses on metrics-based programs that optimize management and operation of rotating equipment with an emphasis on:

- Reliability
- Energy efficiency
- Inventory
- Safety
- Operations and maintenance
- Procurement
- Technical solutions

Estimated LifeCycle Advantage Cost Savings⁽¹⁾



Building Value and Profitability

LifeCycle Advantage is a partnership between Flowserve and its customers. It is designed to reduce total cost of equipment ownership and improve operating profitability. It consists of five integrated modules:

- Equipment performance
- Inventory optimization
- Strategic procurement
- Technical support
- Training/consultation

Power End Programs

An integral part of LifeCycle Advantage, the Flowserve power end programs offer ANSI pump users the opportunity to optimize the return on their equipment investment, significantly reduce inventory cost and streamline procurement and maintenance activities. Program benefits are available to those using ANSI standard pumps, regardless of original manufacture.

**ANSI Power End
Repair, Upgrade
and Exchange
Programs
Through
LifeCycle
Advantage**



Reliability by Design and Implementation

Now all ANSI pump users can enjoy the performance and reliability benefits of the latest Flowserve Mark 3™ ANSI 3A™ power end, regardless of original manufacture.

- Worn Mark 3 and older Mark 2 power ends are automatically upgraded to the contemporary Mark 3 design.
- Pumps with non-Flowserve power ends can be replaced with adaptable Prima³™ power ends or restored to original OEM condition. Prima³ power ends incorporate all the performance benefits of the Mark 3 design.

Saving Money Through Simplification

Standardizing on Mark 3 and Prima³ power ends significantly reduces inventory stores by eliminating hundreds of individual part numbers. Likewise, procurement administration is drastically reduced and maintenance time is minimized.

Pump users who currently do in-house power frame rebuilding must coordinate several steps to achieve quality repair that meets Flowserve “as new” standards. These include:

- Skills and procedural training
- Specialized fixtures and gauges
- Tool-gauge calibration
- Inventory management
- Cleanliness controls
- Upgrade evaluation-decision

All this disappears with the Flowserve power end program.

Three Simple Steps

The three-step repair, upgrade and exchange program from Flowserve includes:

1. Remove used power end
2. Install new/refurbished power end from inventory
3. Return used power end and reorder new/refurbished power end from Flowserve

Power End Programs

Repair

Remanufacture ANSI power ends to original OEM specifications, regardless of original manufacture

Exchange

Eliminate “out of stock” situations by exchanging worn power end with new/refurbished unit

Upgrade

- Flowserve pumps automatically upgraded to ANSI 3A power ends
 - Worn Mark 3
 - Mark 2 Groups 2 and 3
 - Mark 2 Group 1 with Prima³ power end and SealSentry™ seal chamber technology
- Non-Flowserve pumps
 - Prima³ standardization to simplify mechanical seal inventory

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Profitability in Partnership

Flowserve power end programs provide a unique partnership opportunity to implement the industry's best practices in rotating equipment and mechanical seal management. Highly flexible, these programs can be customized to a customer's specific needs.

The objective of these programs is to enhance profitability through:

- Increased pump availability with less pump downtime and process interruption
- Lower operating costs
 - Energy efficiency
 - Lower installation cost
 - Elimination of in-house repair issues
 - Inventory reduction from 26 parts to one power end
- Reduced transaction costs

Guaranteed Reliability

For those standardizing on Mark 3 and Prima³ power ends, they will enjoy automatic upgrade to latest and best available ANSI 3A technology. They will also receive the benefits of a limited lifetime warranty.

Those participating in the remanufacture program will receive refurbished power ends to "as new" OEM specifications.

Flowserve power end programs deliver:

- Lower life-cycle costs
- Predictable fixed cost
- Automatic power end upgrade
- Management and maintenance simplicity

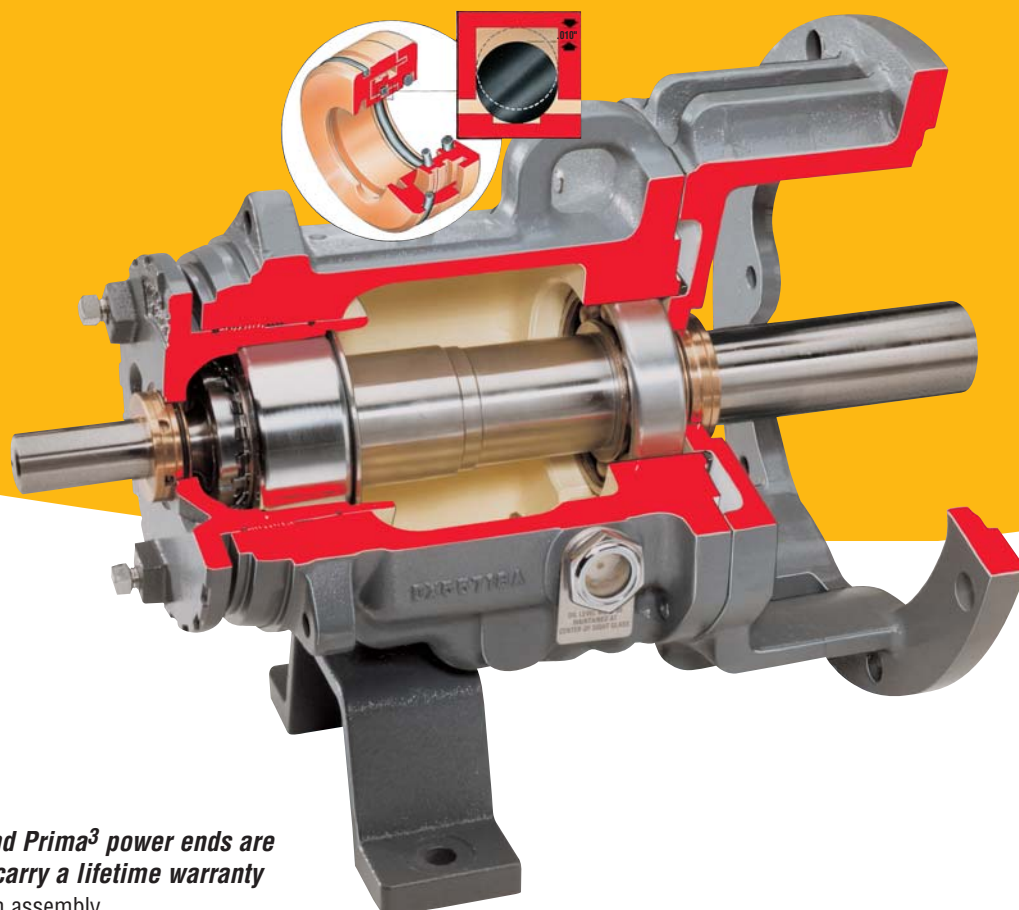
Services Provided

Flowserve power ends can also be delivered complete with mechanical seal, bearing adapter, foot-piece, SealSentry seal chambers and the Mark 3 reverse vane impeller.

Refurbished power ends will undergo the following procedures:

- Disassemble, clean and sandblast the power frame
- Dimensionally check all bearing housing bores and shaft diameters
- Check dimension and surface finish conformance of shaft diameters at mechanical seal and at coupling
- Ultrasonically clean bearing housing and component before reassembly
- Visually inspect all components for wear, corrosion and damage. Repair or replace as required
- Install new bearings and shaft assembly, record shaft run-out, end play and radial play to assure conformance with Flowserve and ANSI specifications
- Power end assembly in clean room environment
- Dial indicate and record all bearing housing and register fits to Flowserve and ANSI specifications
- Replace components, hardware, fasteners and gaskets including the shaft, foot-piece and bearing housing as needed
- Paint power frame with urethane enamel (special paint and colors additional)
- Update nameplate stating part number, material, date and serial number
- Retention of inspection records of as-built power frame assembly
- Package in protective carton and labeled to customer shipping instructions

**Mark 3
and Prima³
Power Ends
Design
Features**



Mark 3 ANSI 3A and Prima³ power ends are so advanced they carry a lifetime warranty

- Certified clean room assembly
- Inpro/Seal's VBXX non-contact Vapor Block Bearing Isolator keeps lubricants in and contaminants out
- Magnetic drain plug collects metallic contaminants
- Plug replaces top vent
- Lubrication options
 - Synthetic lubricants can allow up to three years between oil changes
 - Oil mist systems
 - Shielded and grease lubricated bearings (two-year MTBPM guarantee)

Unique External Micrometer Shaft Adjustment

- Accurate impeller clearance setting in 20 seconds
- Superior to jackscrew designs as perpendicularity is maintained through metal-to-metal fit inherent with machined thread construction
- Threads protected with O-rings

Large 25 mm (1 in) Diameter Reflective Sight Glass to accurately gauge oil level. May be installed on either side or both sides

Rigid Foot Design

Ductile Iron Frame Adapter meets ANSI B73.1

Critical Shaft Surfaces ground to a surface finish of 0.4 micron (16 µin) ensure the secondary sealing ability of mechanical seals

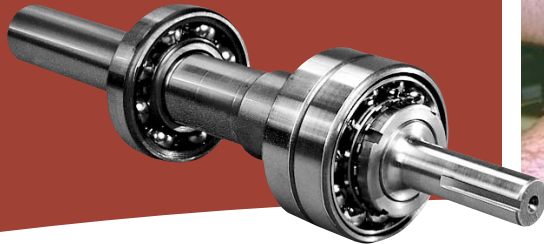
Run-Out of < 0.03 mm (0.001 in) at mechanical seal allows seal faces to run true

Metal-to-Metal Construction assures a true running and concentric shaft, extending bearing and mechanical seal life

* Note: Adherence to proper installation, operation and maintenance program is necessary for lifetime warranty. Contact your Flowsolve representative for detailed terms and conditions.



**Mark 3 and
Prima³
Power Ends
Technical Data**



The Heart of the Pump: Shaft and Bearing Design

Flowserve offers the largest shaft and bearing components available in standard ANSI pumps. The following comparison of a Prima³ Group 2 power end with that of a major competitor demonstrates the benefits of heavy-duty design.

Bearings (see Table 1)

Greater load handling rating means extended MTBPM.

Extended bearing life comparison is the ratio of the load ratings to the third power or:

$$I.B. = \left| \frac{6078}{5398} \right|^3 = 1.43 (+43\%)$$

$$O.B. = \left| \frac{8709}{7439} \right|^3 = 1.61 (+61\%)$$

Bearing Span

Increased bearing span reduces the radial loads which also extends bearing life. The increased span with the Prima³ power frame reduces the bearing loads as follows:

I.B. bearing load reduction = -6%

O.B. bearing load reduction = -10%

Table 1 - Bearing Comparison

Bearings are designed to last up to 61% longer.

Group II	I.B. Bearing	Dynamic Load Rating	O.B. Bearing	Dynamic Load Rating
Flowserve	6310	6078 kg (13 400 lb)	5310	8709 kg (19 200 lb)
Major Competitor	6309	5398 kg (11 900 lb)	5309	7439 kg (16 400 lb)

Shafts (see Table 2)

Solid shafts are recommended over shaft sleeves because they reduce the harmful effects of deflection and vibration. While shaft sleeves may simplify maintenance, solid shafts reduce it.

Proper selection of wet end materials of construction and mechanical seal design offset positive features of the shaft sleeve option.

The formula $I = L^3/D^4$ offers an index of deflection to compare pump designs where:

I = index of deflection

L = length of shaft overhang from bearing

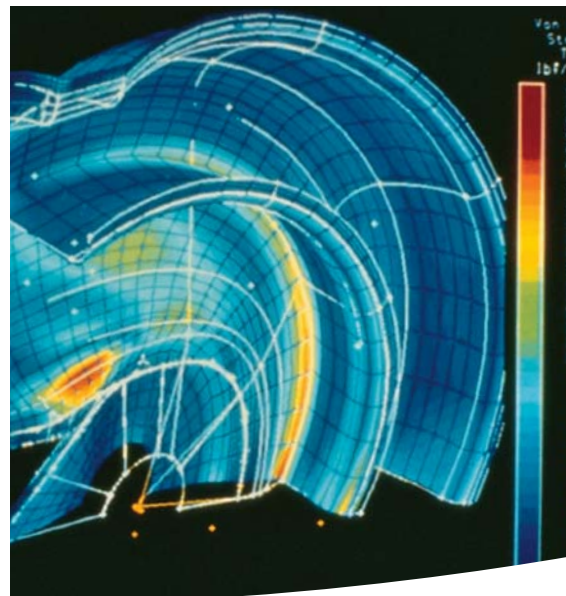
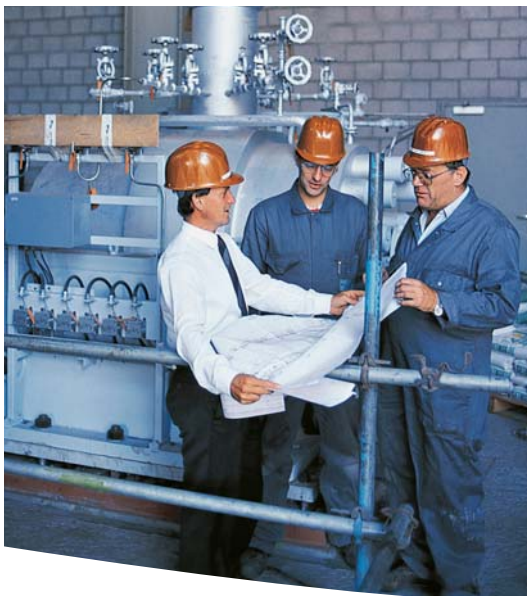
D = rigid shaft diameter

Note: The Deflection Index provides an approximate comparison of shaft stiffness. A detailed analysis should be made to determine actual shaft deflection.

Table 2 - Deflection Comparison

43-252% greater stiffness, indicated by lower index numbers, results in longer MTBPM.

Group II	Over-hang Length	Solid Shaft Diameter	Deflection Index	Shaft Dia. w/sleeve	Deflection Index
Flowserve Retrofit	203 mm (8 in)	45 mm (1.75 in)	55	38 mm (1.5 in)	101
Major Competitor	213 mm (8.375 in)	45 mm (1.75 in)	63	38 mm (1.5 in)	116



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.

Pumping Solutions

Flowserve is providing pumping solutions which permit customers to continuously 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 inquiry.

Dynamic Technologies

Flowserve is without peer in the development and application of pump technology, including:

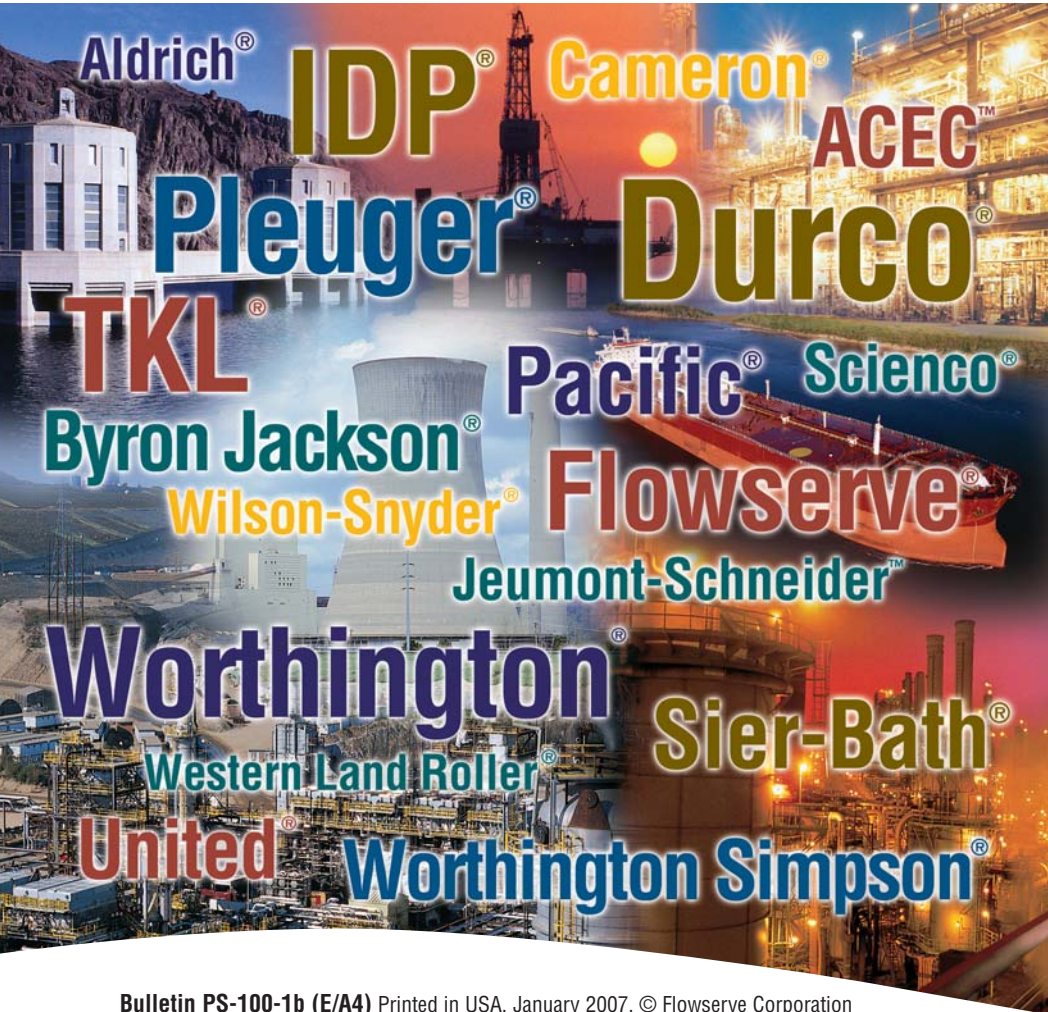
- Hydraulic engineering
- Mechanical design
- Materials science
- Intelligent pumping
- Manufacturing technology

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 bearing single stage
- Between bearing multistage
- Vertical
- Submersible motor
- Rotary
- Reciprocating
- Nuclear
- Specialty



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