MP1
Multiphase Twin-Screw Pump

Experience In Motion

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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

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.
The Flowserve MP1 double-suction, twin-screw, positive displacement pump was specifically engineered to handle the most aggressive challenges of today’s multiphase upstream oil field production while consistently providing high availability. The rugged and versatile MP1 readily accommodates rapid changes in oil well viscosities, water cuts, gas-to-liquid ratios and gas volume fractions which vary over the life of the oil field. The pump’s versatility, maintenance ease and reliability provide users with life cycle cost economies to optimize oil production.

Advantages Over Helico-Axial Rotodynamic Pumps

- Greater pressure boosts on high gas volume fractions
- Constant torque load on pump drive system
- Improved efficiency when pumping high viscosity products
- Positive displacement design eliminates gas vapor lock
- No flow conditioners required upstream of the pump
- Reduced wear due to lower speed operation
- Lower operating vibration and noise levels

Upstream Applications

- Surface pumping onshore and offshore
- Subsea ultra-deepwater pumping
- Down hole artificial lift for horizontal and vertical wells
- Water re-injection
- Wet gas compression
- CO₂ re-injection
- Flare gas re-injection
- Pipeline boosting

Benefits of the MP1

- Ease of Maintenance
  - Back pull-out design of rotating assembly
  - Split bearing bracket construction
  - Cartridge type mechanical seals
  - Tapered shaft mounting of coupling hub
  - No special tools required

- Versatility
  - High volumetric efficiency over a wide range of viscosities, gas-to-liquid ratios and gas volume fractions (GVF)
  - Gas slug and run-dry capabilities
  - High temperature operation
  - Multiple seal options

- Heavy-Duty Reliability
  - Robust cast casing design with flanged nozzles
  - Custom screw profiling for low pressure pulsations
  - Oversized and rigid integral shaft design
  - Through-bolt bearing bracket construction
  - Oversized bearings
  - Abrasion-resistant coatings

- Low Total Cost of Ownership
  - Individual serviceability of bearings and seals
  - Refurbishing program for shafts and casings
  - Replaceable rotating assembly
  - Replaceable inner casing

System Packaging

Flowserve engineers and technicians possess systems packaging expertise and can incorporate piping skids, variable frequency drives (VFD), control panels and power houses into multiphase pump systems.
The Flowserve MP1 is the most robust twin-screw pump in the oil and gas industry. Engineered for multiphase pumping, it features a double-suction, timed twin-screw configuration built in accordance with API 676, latest edition. The design of the MP1 was further refined to provide the highest overall efficiency and lowest operating vibration levels of any multiphase, twin-screw pump.

For improved reliability and prolonged life, the MP1 design incorporates separate oil reservoirs for bearings and timing gears. This construction is well suited to pump raw effluent, consisting of varying volumes of oil, water and gas, as well as solids and asphaltenes, from upstream wells without pre-gas separation.

**Operating Parameters**
- Flows to 1900 m³/h (8350 gpm)
- Pressure to 70 bar (1000 psi)
- Temperatures to 150°C (350°F)
- Viscosities to 200 million SSU
- Gas volume fractions from 0% to 100%
- Shaft tip speeds to 30 m/s (100 ft/s)

**Double-Suction Design** provides balanced hydraulic loads by channeling incoming flow to the screw inlets at each end of the pump. It also ensures mechanical seals are exposed only to pump inlet pressure.

**External Bearings and AGMA 11 Timing Gears** are in separate oil reservoirs to eliminate exposure to the pumped fluid, providing an ideal lubrication environment.

**Integral (One Piece) Non-Contacting Shaft Design** ensures the operating shaft deflection does not exceed the radial clearance between the shaft and inner casing.

**Versatile API 682 Seal Chamber** readily accommodates multiple seal types and meets HSE regulations without modification.

**Split Bearing Bracket Construction** facilitates maintenance of individual bearings and mechanical seals without disturbing components not in need of replacement.

**Modular Non-Welded Casing** is available in multiple standard and specialty alloys. The integral design of the nozzles in the outer casing ensures that any pipe loads are not directly applied to the inner casing to maintain a non-contacting shaft design.
**Large Volume Casing Trap for Liquid Re-Injection**

A dynamic liquid seal is required between the intermeshing screws when pumping multiphase mixtures with high gas volume fractions or during gas slugs. As such, the MP1 incorporates a large chamber between the outer and inner casings which captures liquid and re-injects it into the screw inlets via internal ports using the pump discharge pressure. This simple, reliable approach ensures the dynamic seal is always maintained. It also dissipates the heat of compression associated with multiphase pumping.

**Split Bracket With Through-Bolt Design**

A distinct maintenance feature of the MP1 is the split bearing bracket design which offers full-perimeter through-bolt construction for maximum support and stiffness. The bearing housing portion of the bracket can be separately removed to permit servicing of the bearings without disturbing the mechanical seals. Since the parting flange of the bracket is near the casing, maximum access is provided to the mechanical seals, each of which can be removed and replaced without disturbing the other on the adjacent shaft. The critical positioning of the bearing bracket assembly is maintained using hardened dowel pins so proper alignment is assured during reassembly.

**Lowest Operating Vibration Levels**

- Full radial load is supported between bearings to ensure a non-contacting design
- Integral screws cut 180° out of phase to reduce amplitude of pulsations
- Minimum of three pumping locks and special screw profiling to distribute pressure profile development
- Full perimeter through-bolt bearing bracket design
- Two-plane dynamic shaft balancing to ISO 1940 G2.5 level to minimize residual imbalance
- Maximum shaft tip speeds to 30 m/s (100 ft/s)

**Subsea Applications**

In partnership with Subsea 7, Flowserve continues to develop new technologies to deploy multiphase twin-screw pumps deep into the ocean. The result is a turnkey solution that involves design, manufacturing and installation of subsea pumps rated for depths and pressures exceeding those currently available.
Pre-Engineered Shaft Sealing Solutions

- Single cartridge mechanical seal with inboard restriction bushing supported by an API Plan 32 flush plan. Ideal for services with low H₂S levels and an external flush source.
- Single cartridge mechanical seal supported by a common lube oil system. Designed for remote, high GVF applications without an external flush source.
- Double cartridge mechanical seal supported by either an API Plan 53 or an API Plan 54 flush plan. Designed for applications with high HSE risks due to high H₂S levels or solids contents and where a reliable external flush source is not available.

Hard, Abrasion-Resistant Coatings

Hard coatings reduce corrosion and wear on critical parts. They also offer protection against galling during short-term upset conditions. The result is increased mean time between pump repair.

- Casing bores can be coated with overlays with a minimum hardness of 70 Rc.
- Screw outer diameters can be manufactured with abrasion-resistant coatings with a minimum hardness of 40 Rc.
- In-house testing lab to confirm pressure and velocity load handling characteristics of coatings.

Materials of Construction

<table>
<thead>
<tr>
<th>Component</th>
<th>Standard API Design</th>
<th>Upgraded API Design</th>
<th>Corrosion-Resistant API Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outer casing</td>
<td>Ductile iron or Cast steel</td>
<td>Cast steel</td>
<td>Ni-Resist or Cast stainless steel</td>
</tr>
<tr>
<td>Inner casing</td>
<td>Ductile iron</td>
<td>Cast steel</td>
<td>Ni-Resist or Cast stainless steel</td>
</tr>
<tr>
<td>Integral shafts</td>
<td>Carbon steel</td>
<td>Carbon steel or Stainless steel</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Seal plate half of bracket</td>
<td>Carbon steel plate</td>
<td></td>
<td>Stainless steel plate</td>
</tr>
<tr>
<td>Bearing housing half of bracket</td>
<td>Cast steel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Front cover; Gear housing</td>
<td>Cast steel</td>
<td></td>
<td></td>
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<tr>
<td>Rear caps</td>
<td>Carbon steel</td>
<td></td>
<td></td>
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<tr>
<td>Timing gears</td>
<td></td>
<td></td>
<td>Case carburized carbon steel</td>
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</tbody>
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MP1 Range Chart

[Graph showing flow rate and differential pressure for various MP1 models.]
**Service Dedication**

Flowserve Engineered Services focus on providing customers with uncompromising service and support, where and when needed. Dedicated to delivering the highest quality support, Engineered Services integrate pump and materials engineering knowledge with creative service solutions.

A worldwide network of service and repair centers staffed by highly skilled engineers and technicians is available around the clock, seven days a week to respond to customer queries, to evaluate and troubleshoot problems and to provide reliable solutions.

**Strength of Experience, Commitment to Excellence**

Flowserve has long served industries requiring superior equipment performance and service life.

- Oil and gas production
- Hydrocarbon processing
- Chemical processing
- Water resources
- Power generation
- Nuclear
- Mining and mineral processing
- Pulp and paper
- General industry

Flowserve is dedicated to maximizing equipment performance and providing reliability-centered maintenance programs for pumps and related equipment, regardless of manufacturer. Using the FlowStar.net™ asset management software, Flowserve engineers and technicians track performance and support improvement programs using a service life cycle cost business approach. The results are improved reliability and increased profitability.

**Business Partner**

Flowserve partners with customers to respond to the dynamic business conditions that affect them. Flowserve will work with customers to drive efficiency, maximize throughput and control process quality. Whether user needs involve on-site technical assistance or broader project planning with full turnkey responsibility, Flowserve Engineered Services will deliver professional, reliable results.
To find your local Flowserve representative:

For more information about Flowserve Corporation, visit www.flowserve.com or call USA 1 800 728 PUMP (7867)