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
Liquid ring compressors

Liquid ring compressors are designed to compress all different kind of gases and vapours.

They are most commonly used in applications where safety, reliability and special process conditions are required. This well proved technology of our liquid ring compressors allows you to operate under the most severe process conditions with gases of Zone “0”.

The innovative SIHI® liquid ring compressors are available in single-stage, double-stage or multi-stage versions with a suction of up to 11000 m³/h (6475 cfm) and compression pressures from 1.5 bar (21.7 psi) to 12 bar (174 psi).

The metal components in SIHI® liquid ring compressors do not touch one another, which ensures a high level of operational safety, as well as low maintenance. As compression is undertaken via components that do not touch each other, there are no local rises in temperature. This means that liquid ring compressors offer the highest possible safety levels when compressing flammable substances.

Advantages

• Extremely robust
• Cold operation
• Excellent gas- and vapour-handling capability
• High volumetric flow rate
• Easy maintenance
• Effective heat exchange

Industries/Markets

• Chemistry
• Pharmacy
• Petrochemicals
• Plastics
• Foodstuffs
• Paper
• Biogas

Performance graphics
Medium and large liquid ring compressors with a compression pressure of up to 6.5 bar (94 psi) generally have a simple construction.

**Single-acting design**

A multi-bladed impeller is mounted eccentrically in a circular casing. When the casing is partially filled with liquid and the impeller is set into rotary motion, this causes the liquid ring to be formed concentrically to the casing axis as a result of centrifugal force.

This results in a volumetric expansion in the section of the outflowing liquid ring, thus causing the medium to be drawn in via the inlet port in the guide plate. In the area of the inflowing liquid ring, the volume is reduced, thus causing the medium to be compressed. On completion of compression, the medium is discharged via the outlet port in the guide plate.

<table>
<thead>
<tr>
<th>Technical data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake volume flow</td>
<td>11000 m³/h (6475 cfm)</td>
</tr>
<tr>
<td>Compression pressure</td>
<td>max. 6.5 bar (94 psi)</td>
</tr>
<tr>
<td>Shaft seal</td>
<td>mechanical seal, magnetic coupling</td>
</tr>
</tbody>
</table>
Liquid ring compressors up to 12 bar (174 psi)

For special applications, with compression pressures up to 12 bar (174 psi), liquid ring compressors employ a combination of a single and a double-acting design.

**Combined acting design**

For realisation of high compression pressures at large volumetric flow rates the liquid ring compressors are developed with a combination of single and double-acting design. The machines are working almost with a isothermal three-stage compression.

In the double-acting design the impeller is arranged concentrically in the casing. The particular shape of the casing allows the liquid ring to flow into and out of the impeller cells twice during each rotation of the impeller. This means that gases will go twice through the compressor stage.

<table>
<thead>
<tr>
<th>Technical data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intake volume flow</td>
<td>3400 m³/h (2001 cfm)</td>
</tr>
<tr>
<td>Compression pressure</td>
<td>max. 12 bar (174 psi)</td>
</tr>
<tr>
<td>Shaft seal</td>
<td>mechanical seal</td>
</tr>
</tbody>
</table>
Liquid ring compressors are commonly used in processes because of their ability to use any kind of service liquids. This feature makes the liquid ring compressors unique for special applications where process contamination is prohibit.

Liquid ring compressors require a fluid (preferably water) as an auxiliary or service liquid. Almost all gases and vapours can be compressed, even those containing dust and liquids.

The service liquid has the task of compressing the gas to be conveyed, sealing off the various discharge chambers from each other, lubricating the shaft seals and absorbing the compression energy as heat. Due to the intensive contact between the gas being conveyed and the service fluid, there is only a very slight rise in the temperature of the gas being conveyed, so that it can almost be described as an isothermal compression.

**Features**
- Can handle almost all gases and vapours
- Environmentally friendly because of nearly isothermal compression
- Oil-free, as no lubrication in the working chamber
- Additional liquid can be handled with the gas flow
- Easy maintenance and reliable operation
- Low noise and nearly free from vibration
- Incorporated central drain
- No metallic contact between the rotating parts
- Can be customized in accordance with customer specifications

**Performance Range**

<table>
<thead>
<tr>
<th>Compression pressure</th>
<th>Intake volume flow m³/h</th>
<th>Intake volume flow cfm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>5.8</td>
<td>208</td>
</tr>
<tr>
<td>3.5</td>
<td>14.5</td>
<td>527</td>
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<tr>
<td>6.5</td>
<td>35.7</td>
<td>1267</td>
</tr>
<tr>
<td>10.0</td>
<td>58.8</td>
<td>2094</td>
</tr>
<tr>
<td>145</td>
<td>145</td>
<td>5078</td>
</tr>
<tr>
<td>290</td>
<td>290</td>
<td>9670</td>
</tr>
</tbody>
</table>

- Liquid ring compressors for compression pressures of up to 6.5 bar (94 psi)
- Liquid ring compressors for compression pressures of up to 12 bar (174 psi)
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 Costs**

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.
To find your local Flowserve representative:

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