

SULZER

Sulzer Pumps

Pump Retrofits for the Oil and Gas Industry

The Heart of Your Process

Sulzer Pumps

Sulzer Pumps is a world leader in reliable products and innovative pumping solutions. Our advanced research and development, detailed process and application knowledge together with a comprehensive understanding of market demands keeps us consistently at the leading edge of technical development. Our global network of modern manufacturing and packaging facilities together with sales offices, service centers and representatives located close to major markets provide fast responses to customer needs.

Sulzer Pumps has a long history of providing innovative pumping solutions to business partners in the following industries:

- Oil and Gas
- Hydrocarbon Processing
- Pulp and Paper
- Power Generation
- General Industry
- Chemical Process Industry
- Water and Wastewater



Service center network provides local support for retrofit projects

Pump Retrofits – the Benefits

Reduce Energy Costs

Improving pump efficiency is crucial to minimizing operational costs. The overall cost of running pumps throughout their life is many times higher than the initial capital cost. Improvements in hydraulic design allow units to be retrofitted with custom Sulzer hydraulics reducing power consumption and overall cost of ownership.

Improve Reliability

Pumps in critical applications often need relatively high levels of maintenance or suffer from poor reliability. A Sulzer retrofit to exactly match duty requirements will increase component life and reduce maintenance costs. This optimization reduces the risk of unplanned outage, improving the availability of the entire system. Avoiding a single unscheduled outage can cover the investment needed for the retrofit.

Maximize Revenue Generation

Retrofitting the critical pumps in your production assets will minimize operation and maintenance costs. As field requirements change a Sulzer retrofit to re-rate a pump is a cost-effective answer to increasing throughput without the expense and time required to install new equipment. A retrofit has the additional benefit of maintaining existing pipework and foundation arrangements further reducing project cost and complexity.

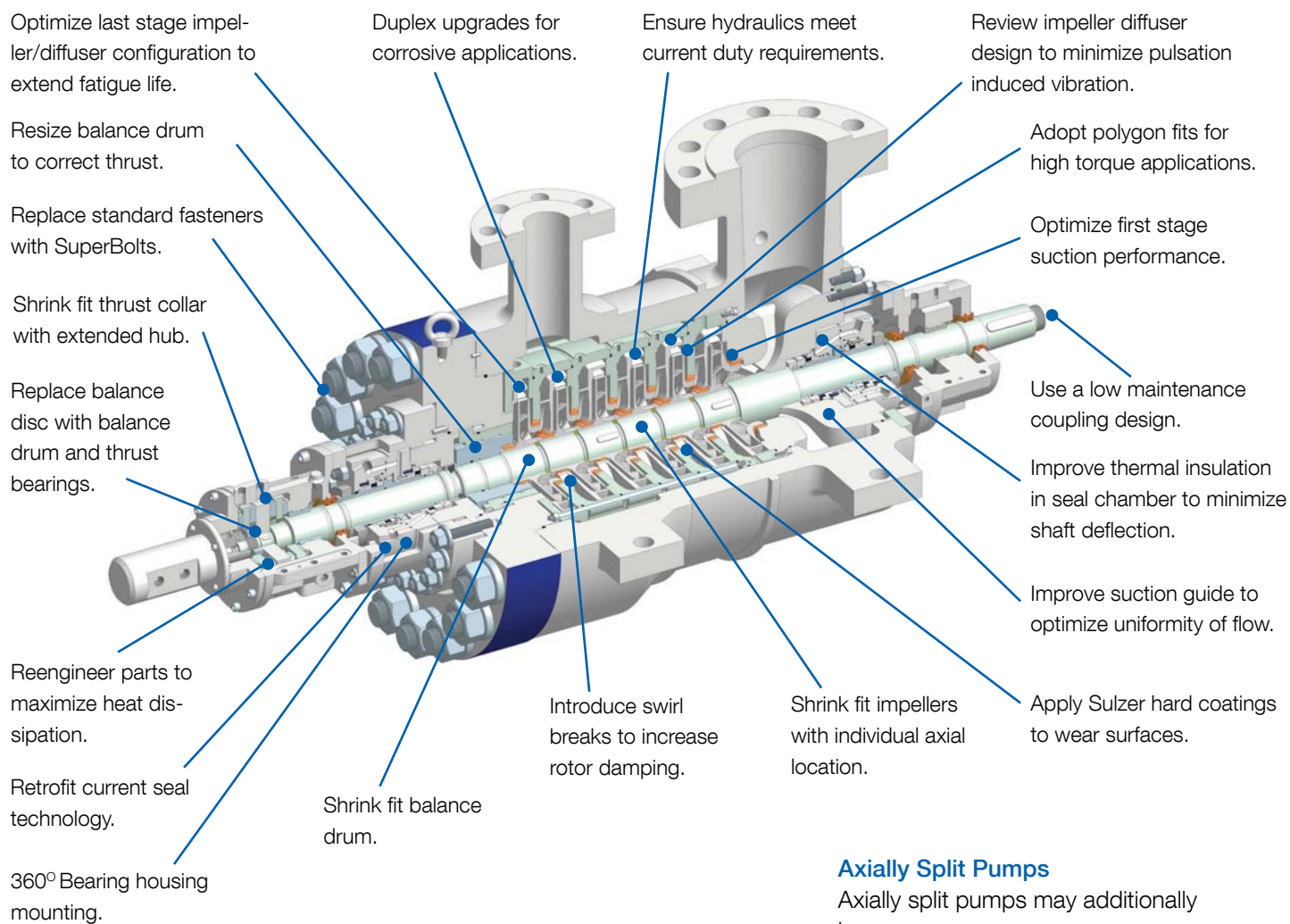
Unlocking the Solution – the Sulzer Retrofit Process

Sulzer Pumps is the Worlds leading supplier of custom engineered high energy centrifugal pumps to the petroleum sector. The advanced technology that helped create the highest power and pressure injection pumps built to date is also used in retrofitting Sulzer design upgrades to existing equipment of any age or original manufacturer. No other supplier can match this capability or experience.

Successful retrofit projects depend on a systematic approach tailored to the individual requirements of each application. As leader in the field, Sulzer Pumps has developed a structured set of guidelines to help customers identify the root cause of their operational problems, assess potential corrective options and finally select the best solution based on both technical and commercial criteria.

| | |
|--|--|
| 1 Define and agree on objectives | Clearly understood objectives are crucial to a successful project. Project objectives may include performance change, efficiency improvement or life extension. |
| 2 Set boundary conditions | Limitations have a crucial effect on the proposed solution and are clearly identified before proceeding. Boundary limits include time constraints, keeping existing infrastructure in place, budget, process demands and component interchangeability. |
| 3 Explore limiting factors in the existing system | Identify factors that may limit performance as defined in the objectives. This may include process conditions, system layout, operation methodology, maintenance practices, pump design and the materials used within the pump and process system. |
| 4 Develop hydraulic solution | With the knowledge gained from the previous steps, develop a unique hydraulic solution to meet or exceed the original objectives. |
| 5 Resolve mechanical constraints | Review mechanical constraints, such as materials and constructional features (e.g. bearing systems, shaft stiffness, pressure containing parts), and identify solutions to any restrictions they place on the original objectives. |
| 6 Review changes to auxiliary systems | After core hydraulic and mechanical modifications are identified, review any potential changes/upgrades to the auxiliary systems. Solutions proposed may include the removal, modification or introduction of new auxiliary systems. |
| 7 Review solution against objectives | Test the package of solutions to ensure they meet the original objectives. Resolve any conflicts before progressing to the next phase. |
| 8 Review cost/benefit analysis | Perform a full cost/benefit analysis to identify the project Pay-back. In some cases, provide scope options for varying levels of work with differing cost/benefit scope for the customer to fully assess the available options. |
| 9 Agree on optimum solution | Once the above work is completed the customer can make clear decisions based on the proposed solutions and the associated cost/benefit criteria. |

Upgrades for Horizontal Multistage Pumps

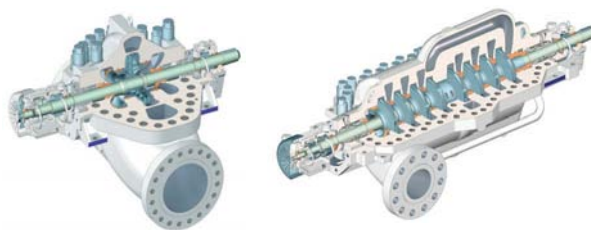


Axially Split Pumps

Axially split pumps may additionally have:

Volute inserts to modify hydraulic performance.

Modified center and casing bushings for improved life and, where required, reduced residual axial thrust.



Typical Problems

Injection

Injection pumps are often required to pump increasing flow rates as the well becomes depleted. They are also subject to erosive and corrosive attack. Maximizing capacity and ensuring the extended time between maintenance intervals delivers major improvements in field productivity.

Pipeline

Pipelines rely on pumps to maintain flow. The need for increased throughput is common and may be addressed through retrofit techniques. Another requirement is maximizing efficiency as energy costs are a major component of pipeline running costs.

Main Oil Line (MOL)

A platform MOL pump is critical to the effective operation of the whole asset. Retrofitting addresses the common need for increased output. MOL performance can be maximized while at the same time retaining the existing driver and pipework infrastructure.

Upgrades for Vertical Pumps

Retrofit separate thrust bearing for simpler maintenance and longer life.

Modify the seal arrangement to improve dry running capability.

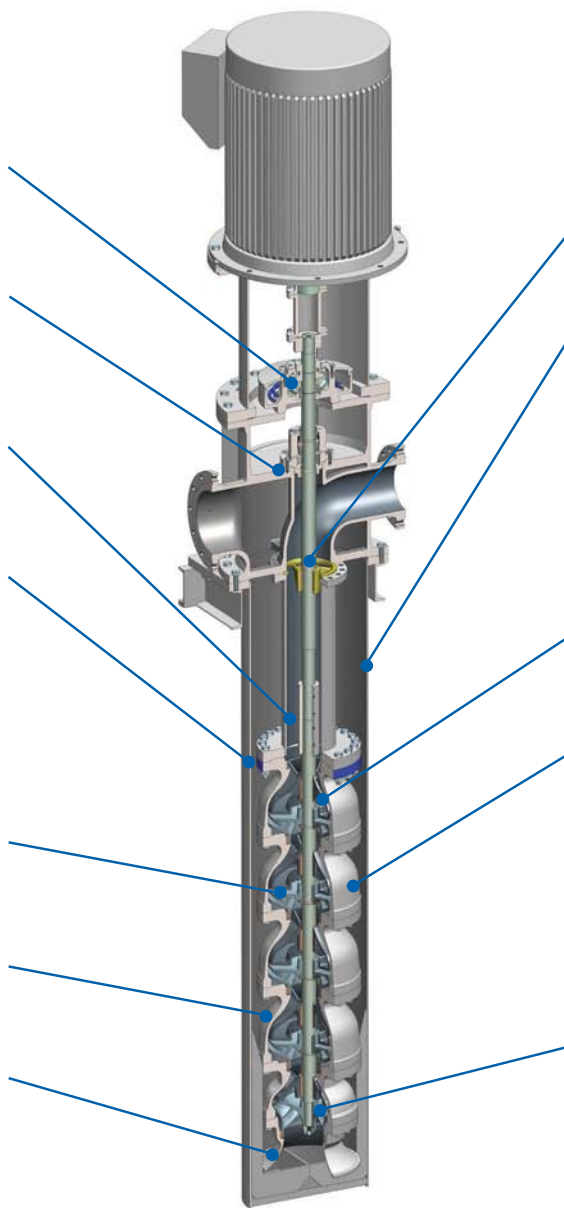
Replace shaft screw coupling with muff coupling design.

Fit electrical insulation to enable low cost rising main.

Upgrade bearing material to extend life.

Apply Sulzer hard coatings to extend wear life.

Review bell mouth and suction inlet design.



Increase 'Dry Running' capability of top bearings.

Fit cathodic protection.

Install bearing protection to prevent ingress of solids.

Replace materials with duplex stainless steel for corrosive applications.

Optimize first stage suction performance.

Typical Problems

Seawater Lift

Many older seawater lift pumps suffer from poor reliability due to materials of construction and design features not being optimized for offshore applications. Maintenance costs can be dramatically reduced and reliability improved by updating to the latest appropriate technologies.

Fire Fighting

Fire pumps spend most of their lives on standby. This condition brings with it many challenges including corrosive attack, marine growth and bearing problems. Targeted solutions to address local conditions will increase reliability ensuring the fire pump will operate reliably if needed.

Pipeline Booster

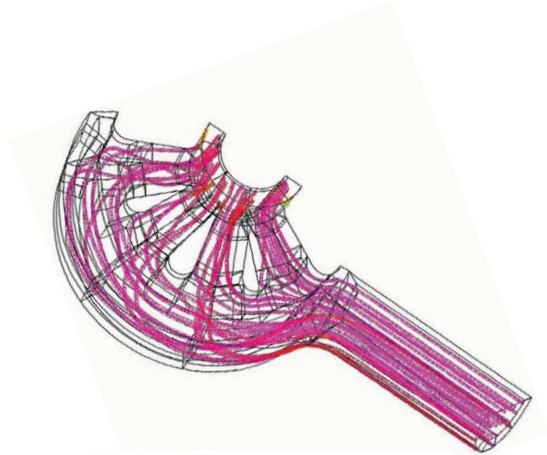
Vertical pumps are often used as pipeline boosters. Many older designs are not optimized for hydrocarbon pumping and require high levels of maintenance. Focusing on the bearing and seal design, reliability is improved and maintenance simplified.

The Sulzer Difference - Leading Expertise

Sulzer Pumps, in partnership with its sister companies Sulzer Metco and Sulzer Innotec, has a unique range of experience and technologies to support retrofit projects. As the world's leading manufacturer of engineered pumps for the Oil and Gas market we have a proven track record in continuously pushing forward the state of the art in pump design.

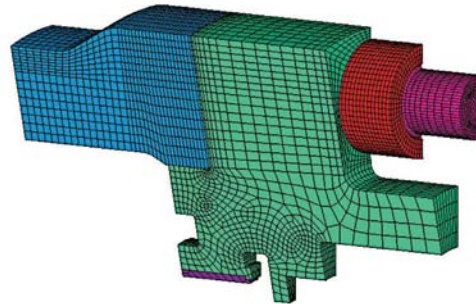
Hydraulic Design

- Dynamic Computational Fluid Dynamics using our own unique software solutions develops new hydraulic solutions to precisely meet application needs.
- Model testing both virtually and in the test lab to verify real world performance.



Mechanical Analysis

- Advanced rotordynamic modeling capabilities ensure rotating element stability and smooth running under all anticipated performance conditions.
- Finite Element Analysis allows component performance to be precisely studied.



Manufacturing

- In-house solid machining capability allows highly accurate parts to be made from solid material.
- Sulzer Innotec test laboratories perform model tests, erosion or corrosion tests, measure the performance of surface coatings and produce prototype hydraulics.
- Sulzer Metco's SUME Pump coating technology extends component life by reducing wear.



Testing

- Sulzer Pumps has extensive test facilities at all its manufacturing sites. Specialized test beds are available for a range of pump types enabling retrofit solutions to be fully tested before being put into service.
- Depending on the location, inverters allow soft starting, variable speed duties and operation at 50/60Hz speeds. Diesel engine or gas turbine (up to 30MW) drives can be accommodated. Dedicated vertical pump facilities allow testing of all sizes of vertical pumps.



Maintaining and Improving Pump Performance

Sulzer Pumps – Customer Support Services

The continuous availability and high operating performance of pumps is the key target for our customer support service organization.

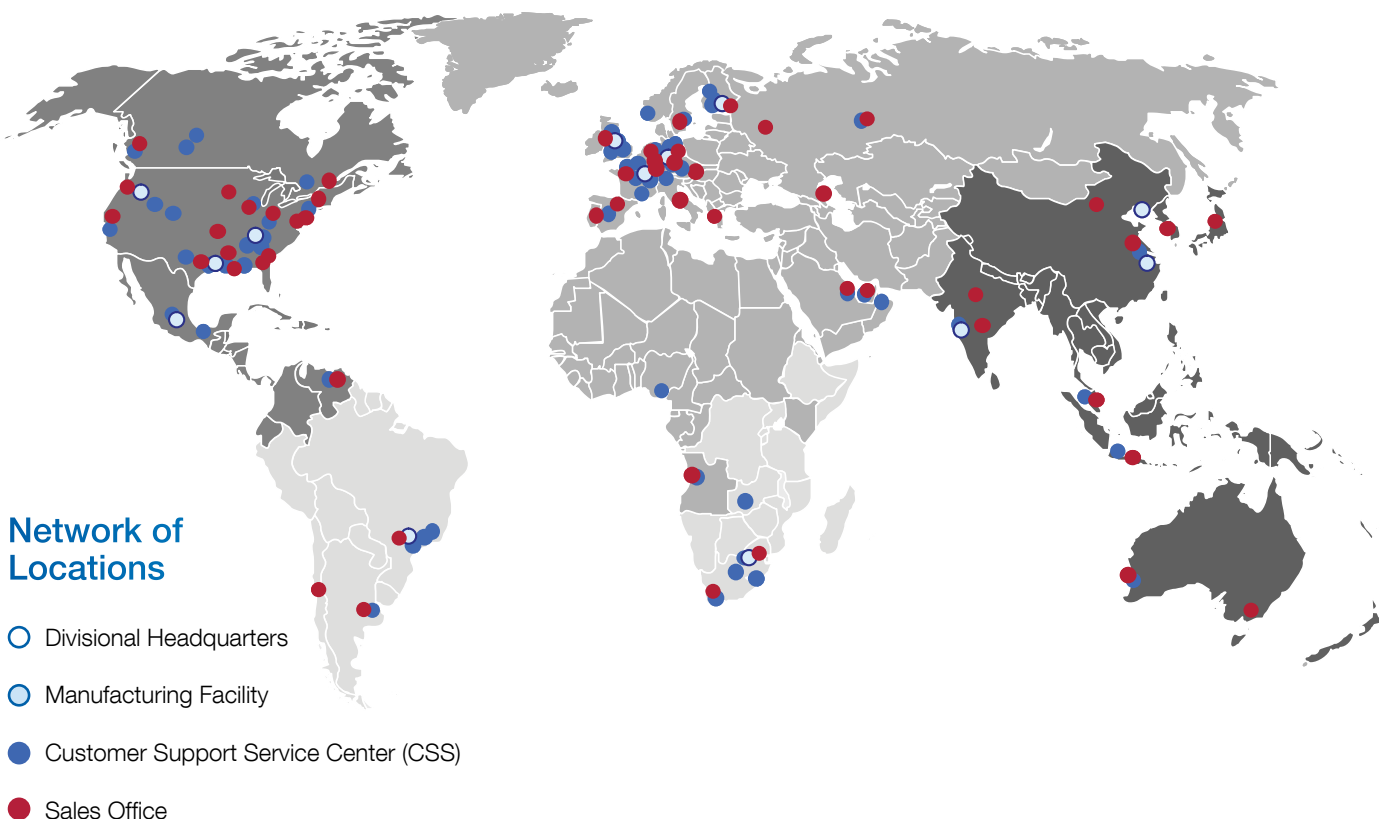
Through our highly experienced personnel and application knowledge, we provide a full range of innovative service solutions to our customers to keep their pumps running including:

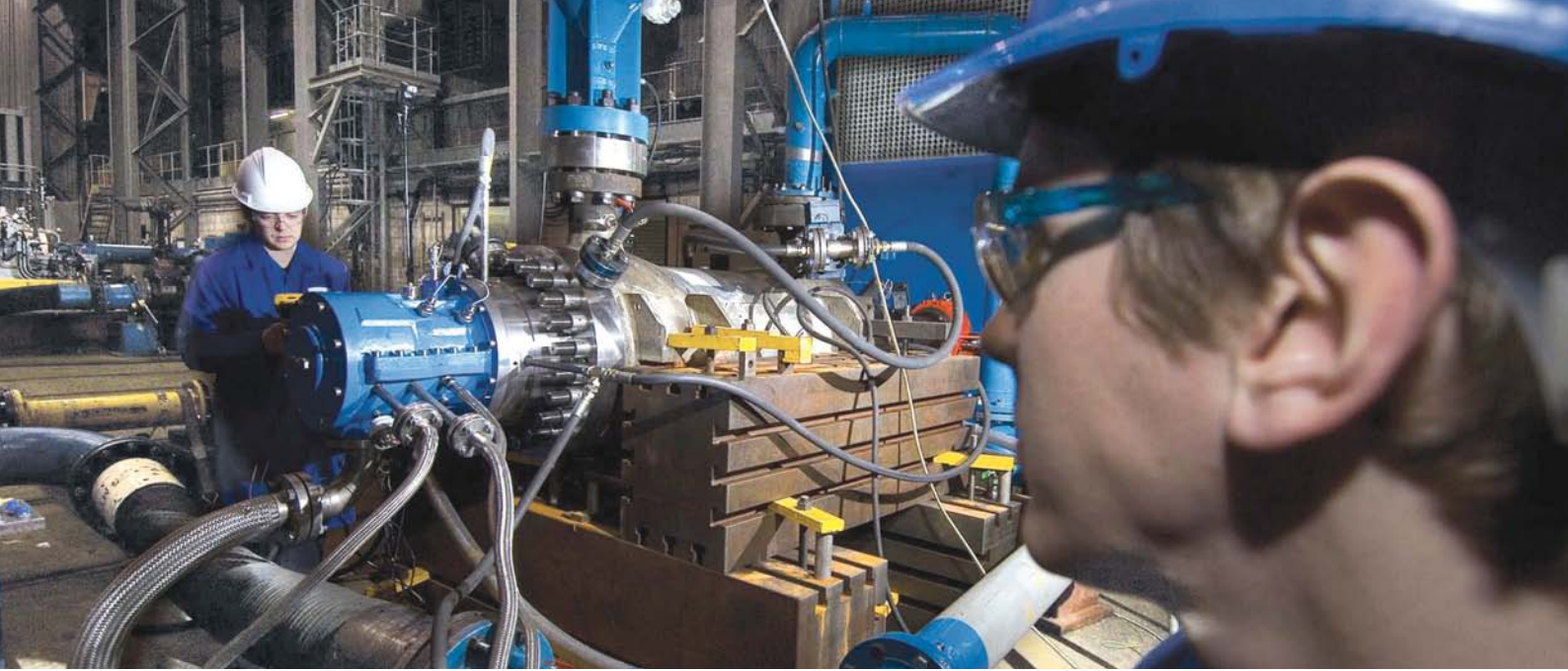
- Spare Parts
- Field Services
- Repair Services
- Retrofits
- Maintenance Agreements
- Operation Agreements

Online Retrofit Solution Finder

There are a wide range of conditions that can lead to pump related performance problems. Our online Retrofit Solution Finder is designed to help guide users to potential retrofit solutions for many common pump performance and process related problems. Using a simple navigation guide, users are quickly presented with potential solutions to their unique pump/process problems complete with downloadable information sheets and access to Sulzer Pumps retrofit experts for further information.

Visit www.sulzerpumps.com to access the solution finder.





www.sulzerpumps.com

E10056 en 10.2010 (1000), Copyright © Sulzer Pumps

This brochure is a general presentation. It does not provide any warranty or guarantee of any kind. Please, contact us for a description of the warranties and guarantees offered with our products. Directions for use and safety will be given separately. All information herein is subject to change without notice.