



**SULZER**

# **Sulzer Pumps**

## **Retrofit: Increasing the Efficiency of Pumps**

**Technical and economic optimization**

**motralec**

4 rue Lavoisier . ZA Lavoisier . 95223 HERBLAY CEDEX  
Tel. : 01.39.97.65.10 / Fax. : 01.39.97.68.48  
Demande de prix / e-mail : [service-commercial@motralec.com](mailto:service-commercial@motralec.com)  
[www.motralec.com](http://www.motralec.com)

The **Heart**  
of Your  
Process





Performance Through People

## Retrofit: Increasing the Efficiency of Pumps

Sulzer Pumps is one of the world's leading manufacturers of centrifugal pumps. Renowned for high quality products, services and innovative solutions, we are dedicated to improving your processes and business performance. Our Customer Support Services team will quickly respond to your service needs and is focused on ensuring reliability for all your rotating machinery. Our global network of service centers makes Sulzer Pumps your ideal local service partner.

### Improve pump performance and efficiency

Wherever pump operating problems occur in your process Sulzer Pumps has the expertise to solve them. Our modernization concept has repeatedly proved itself by not only addressing the problems of existing pumps, but also the system in which they operate. The performance, efficiency and eco friendliness of retrofitted pumps can deliver improved performance, lower CO<sub>2</sub> emissions and considerable power savings.

Up-rating of process machinery may be carried out at many levels – from small increases in capacity and improved reliability to major upgrades of complete operating systems. An important goal is to increase the efficiency of the pumps. This not only has a significant economical effect but also an ecological one. Because less power is

needed to drive the pump, emissions of CO<sub>2</sub> to the atmosphere are reduced. The most flexible design for retrofit is the barrel casing pump by allowing the cartridge to be interchanged with an upgraded design. However, impressive upgrade results are also possible with axially split multi-stage pumps. Reasons for an up-rate vary from modernization of old or obsolete equipment to changes in operating requirements and under performing equipment. The retrofit should enhance the eco-efficiency of the pump. The essence of all upgrades is to maintain the existing boundary parameters and utilize the maximum amount of the original parts to ensure considerable, consequential savings in time and cost. Therefore, in many cases, significant benefits for the process are possible with little or no impact on the original footprint area, drive system, utility supplies, skid/site interfaces and control instrumentation.

We also seek to improve the mechanical characteristics of the pump such as vibration levels, thrust loading, operating temperatures, etc. These can be proven along with the new hydraulic performance during factory tests utilizing of a test barrel and associated equipment. The upgraded cartridges can be tested to industry standard codes and specifications as per new original equipment.

**Reduce  
environmental  
impact.**



## Retrofitting other manufacturers' designs

With our in-house specialist re-engineering techniques, it is possible to retrofit any make or type of pump, allowing the enhancement of non-Sulzer installations. Once the need to up-rate existing equipment has been established, a feasibility study is performed to establish the scope of the upgrade to meet the end user and system requirements. From this, a simple cost vs. benefits analysis can be performed that typically demonstrates significant savings. Typical examples of payback periods for multi-stage pumps would be 20 to 60 days for a high flow unit, one to two years for increasing the pump efficiency and two to three years for increasing the Mean Time Between Repair (MTBR).

The following are examples of typical upgrades that delivered substantial benefits for our customers.



## Re-adjust the best efficiency point

Three oil export pumps were originally manufactured by Sulzer for the Norwegian sector of the North Sea. After continuous operation to the right of the best efficiency point, the operator injected a drag reducing additive (DRA) to increase the throughput of the 3 x 50 % units. The DRA lowers the system resistance allowing additional flow to be pumped to shore. The cost of injecting DRA was in excess of 500,000 USD per calendar month. Sulzer Pumps were able to retrofit the existing pumps with high-flow, high-efficiency cartridges, reclassify the drive motors and provide service personnel to manage the change out. The exchange took less than four days thus minimizing the scheduled loss of production. Thanks to the retrofit, an additional total flow of 20,000 barrels per day was achieved.

## Improvement of reliability, availability and pump efficiency on boiler feed pumps

Boiler feed pumps play a decisive part in thermal power stations. As the largest individual power consumers in the system, they demand about 3 to 5 % of the energy generated by the station. Besides high efficiency, the most important factors are service life, availability and operational reliability. During the past three decades, increasing power station unit output resulted in a considerable rise in feed pump energy consumption. Additionally although most of these plants were designed for base load operation, the feed pumps were subject to cyclic operation during their lifetimes. To solve feed pump problems in existing power stations is a highly complex process. Experience shows



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that while a pump in one power station operates satisfactory, whereas a machine of the same design causes permanent trouble in another. Power station boiler feed pumps operate only as well as their design is matched to all system requirements. Thus, knowledge of system parameters and operating conditions is the major prerequisite to analyze pump problems. Simply replacing a non-running pump by a new one, even of a different make, is not always the best technical and economic solution.

## Reliable power for Moscow

The standardized 300 MW power stations that supply Moscow with electricity were equipped with nineteen Soviet-made main boiler feed pumps. They were experiencing poor balance device life due to the disc/counter disc design (no thrust bearing) and locating the balancing disc using a shaft screw. The operating life of the pumps between major overhauls on occasion did not reach 10,000 hours.

With the help of Sulzer Pumps retrofit know-how the inner pump cartridge was replaced, providing improved mechanical properties and a significant increase of pump efficiency of over 10 %.

The operational lifetime between overhauls was extended to more than 50,000 hours, even after 40,000 hours operation no decrease in efficiency was apparent.

## 22 % increase in oil revenue on axially split pipeline pumps

After operating the Western Route Export Pipeline for over one year with Sulzer axially split multi-stage pumps installed the Azerbaijan International Operating Company (AIOC) and the Georgian Pipeline Company (GPC) wished to increase throughput by taking advantage of an increased pipeline design pressure and lower oil viscosity in the summer months. Sulzer Pumps were able to retrofit the existing main oil line pumps to provide an additional 26,000 barrels per day. This was achieved with higher flow, high efficiency pump hydraulics avoiding the need to up-rate the drivers or auxiliary equipment. In order to prevent any disruption to pipeline operation, the up-rated pump hydraulics were supplied in kit form and installed on site avoiding transporting the pumps to a service center. The resulting substantial increase in oil production delivered project payback within a matter of days.





### 21 % additional flow on a FPSO

Before commissioning of the BP Schiehallion FPSO (Floating Production, Storage and Offloading) vessel, it was realized that there was a severe bottleneck in the seawater injection system. A possible option to remove the bottleneck was to install an additional fourth skid (of the same duty) with the obvious constraints of space, weight and money. After an in depth feasibility study, Sulzer Pumps was able to upgrade the injection sets to provide 21 % additional flow utilizing the same drive system. The cost of the retrofit was one fifth of the cost of the new skid option and provided the predicted generation of additional oil revenue from approximately 250,000 USD per day.

**Increase efficiency and reliability.**

### Design and efficiency improved on key North Sea platform

One of the largest non-Sulzer offshore seawater injection pumps in the world did not meet the client's expectations with regard to maintenance intervals and operational efficiency. Sulzer Pumps were commissioned to perform a detailed study to evaluate whether enhancement of the design could address these two areas of concern - the results were quite amazing: Not only could the mechanical design of the existing pump be significantly improved, but the pump efficiency could be increased by a massive 8 %. This equates to approximately 8 % less CO<sub>2</sub> emissions, which matches the reduction that Norway has pledged to achieve. The pumps now operate successfully with reliable high efficiency Sulzer Pumps cartridges.

### Improved reliability, reduced running costs and environmental protection

A major German chemical company had environmental problems with visible leakage and consequent release of toxic media from the mechanical seal of a heavy duty process pump. As there were also re-occurring problems with high levels of vibration and unacceptable maintenance intervals, Sulzer Pumps were asked to investigate upgrading the pump.





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A fully sealed magnetic drive to replace the mechanical seal was suggested. Magnetic couplings are an optimum technical solution wherever toxic, aggressive or otherwise environmentally sensitive fluids have to be pumped. The process benefits for the operator were:

- no risk of leakage
- no emissions
- no cooling required for temperatures up to 250° C
- no buffer fluid systems
- no maintenance required
- unlimited lifetime
- lower vibration level.

Retrofitting with Sulzer Pumps magnetic couplings visibly reduced maintenance costs and solved the environmental problems by completely eliminating the mechanical seal. Matching the hydraulic to the required duty reduced vibration levels to normal limits.



## Barrel pump retrofit increases Californian refinery production

A southern Californian refinery continually reviews its process stream to increase the throughput of one of its existing units. One of the key restrictions was an 11 stage barrel casing pump originally supplied by Sulzer Pumps in the 1980's. The pump had been previously upgraded with maximum diameter impellers during the 1990's to enhance output. Following other process modifications a further increase in performance was required beyond the capability of the existing hydraulic components.

A thorough review of the new performance requirements together with projected future needs was undertaken by our Southern California service center. The proposal to the customer resulted in the following retrofit elements

- New high flow cartridge delivering increased performance using the existing barrel
- Sulzer standard clearances to increase efficiency and minimize the increase in power needed
- Hydraulic fit coupling adopted to simplify maintenance and eliminate the use of heat to remove the hub
- Motor up-rated by 15 % to drive the pump at the new duty while retaining the existing baseplate
- Shaft modified to accept power inputs of 30 % over the original to allow for future up-rates of the new hydraulic as demand on throughput increases

The newly retrofitted pump was fully tested before installation to prove hydraulic and mechanical performance and ensure speedy installation and re-commissioning. On start up performance exceeded the customers' expectations, in particular the increased efficiency is resulting in significant power savings.



## New life for Campos basin offshore platform

After 26 years operation coupled with the natural depletion of the field, the Cherne offshore platform operated by Petrobrás needed to upgrade the four existing Sulzer water injection pumps. The goal was to increase injection flow without modifying the overall installation as major changes would result in significant loss of production during shut-down. The solution was to use the same pumps but fitted with new high flow hydraulics increasing throughput by 20 % at the same operating pressure. There was also a significant increase in efficiency allowing the existing electric motor to be retained. The retrofit also delivered lower operating vibration levels and an overall improvement in pump operation.

## Economy and ecology

Cost-effective solutions are available for existing installations to increase their MTBR, pump performance and efficiency. State-of-the-art Sulzer Pumps hydraulics are able to meet many varying demands and are readily installed in non-Sulzer equipment. Close working relationships between the Sulzer Pumps engineers and the end user are essential to identify optimum solutions and project key success factors. Retrofitting not only delivers economic advantages but ecological improvements as well. For instance, up-rating gas turbine driven pumps for increased flow often allows the operator to run two instead of three pumps while still meeting process requirements. This allows one of the gas turbines to be held as a stand by unit, reducing overall power requirements and CO<sub>2</sub> emissions by one third.

**Minimize  
maintenance  
costs.**



To learn more about Sulzer Pumps retrofit services please contact your local Sulzer Pumps representative



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