

# The Challenges of Maintaining Equipment on Offshore Platforms

The operating environment of an offshore platform offers one of the toughest challenges to the maintenance engineer. The natural surroundings provide a permanently corrosive atmosphere, while the production operations demand very high standards of safety and reliability. Combined with the limited space and remote location of most offshore facilities, the task of delivering cost effective, efficient and durable equipment requires considerable expertise.

The offshore industry faces two main challenges – maintaining the existing assets in the field and creating new platforms that are capable of exploiting future oil and gas deposits. In each case industry expertise and engineering innovation will be required to deliver these goals.

## Current Challenges

When oil and gas platforms are commissioned the manufacturers of equipment installed on the facility provide an expected service life for each item, usually with the proviso of normal maintenance procedures being carried out regularly. However, over the years these production platforms will see many changes, not only in personnel but also in operating conditions and this can lead to a less efficient approach to maintenance and the suitability of the equipment for the current production schedule.

As many of these installations begin to reach the end of their projected service life, so the facility owners are faced with a decision about the future of the platform, which is often governed by projected oil prices. In the most optimistic circumstances owners may carry out a life extension assessment with a view to continuing operations. Less favorable conditions could see the asset being sold to a

low cost operator, which involves running the platform with minimal maintenance schedules.

The final option is to decommission the platform on the basis that it is uneconomic to operate. Changing oil prices will influence the final option. A more confident outlook will make the upgrade to existing equipment more appealing as it is often more cost effective than creating a new facility to continue the extraction process.

In addition to these more long term challenges, there are a considerable number of day-to-day issues that need to be addressed. Continuous processes such as corrosion, erosion and wear are very prevalent in this sector and require regular monitoring to prevent them from affecting efficiency and productivity. Without a properly managed preventative maintenance program in place, unexpected breakdowns could start to become commonplace and seriously impact performance.

At the same time, owners are looking to reduce operating costs, which may seem at odds with any additional investment in maintenance. However, capital expenditure to improve reliability is most often far outweighed by the costs incurred by an unexpected failure and the subsequent costs of lost production.

Ultimately, the goal is to improve reliability and efficiency while reducing downtime and energy consumption, at the same time as satisfying API, ATEX, and many other engineering standards. However, this seemingly impossible task can be achieved through the implementation of preventative maintenance techniques and the adoption of the latest engineering designs for pumps, motors, generators and turbines.



Life extension assessments will determine the level of maintenance support for a platform

### Potential solutions

In terms of maintenance, prevention is always better than a cure and adopting a carefully managed, proactive regime is crucial to identifying potential issues before they develop into problems. Two of the most prominent symptoms that occur prior to failure in mechanical and electrical equipment are excess vibration and heat so regular inspections of bearings, coils and electrical connections can prove invaluable.

While these inspections can usually be conducted without interrupting the production process, if symptoms are detected then more in-depth inspections will be required to determine levels of erosion and corrosion, especially in pumps. In many cases this will require considerably more resources in terms of skills and equipment to complete the task.

At this point the importance of engineering expertise should not be underestimated and the benefits of engaging an original equipment manufacturer (OEM), such as Sulzer, should not be overlooked. Taking pumps as an example, the huge variety of designs and complexity of these essential components require experienced engineering support, reinforced by extensive machining capabilities, to effect a reliable repair.

### Perfecting pumps

On every oil and gas platform there is a vast array of pumps, specifically designed for certain applications and all working together to complete the process of extracting and exporting fuel supplies. From water injection, and seawater lift pumps to firewater systems and crude oil offloading, each process requires a unique design of pump in order to deliver an efficient and reliable service.

Sulzer provides a complete, turnkey solution for the design, manufacture, installation and commissioning of every type of pump as well as providing expert engineering support in the field. The design and field engineers are also able to provide re-rating services that can modify the characteristics of a pump to match new production requirements. This is essential for platforms that need to maintain productivity and efficiency throughout the lifecycle of the oil field.



**In-depth refurbishment of legacy equipment requires considerable expertise**

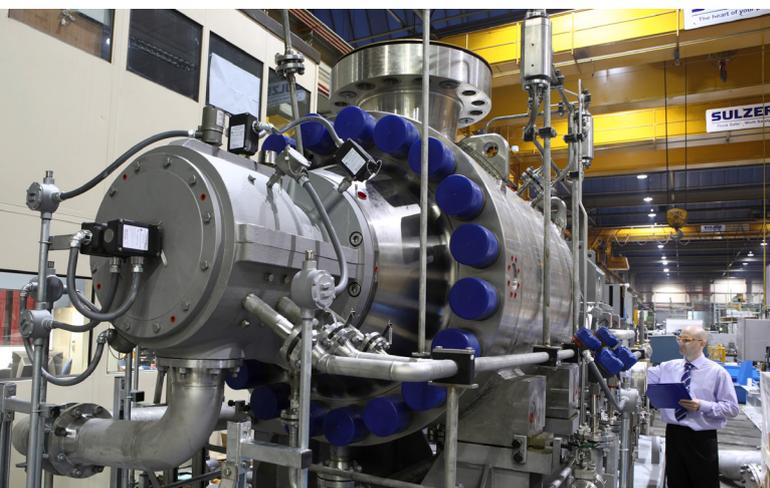
Recent developments in multiphase pump design from Sulzer's R&D center have tackled a number of issues:

- sub-synchronous vibrations related to two phase flow operation at part load
- redesign of the balance drum
- installation of a patented damping device

These improvements have significantly improved the reliability of the multiphase pump, especially in more difficult operating conditions.

In partnership with FMC, Sulzer is also developing the latest in subsea pumping technology. One of the most recent prototypes is a 3.2 MW high speed, multiphase subsea boosting unit that has been qualified following a fully submerged test at the company's test bed in Leeds, UK.

As a world leading pump manufacturer, Sulzer offers state-of-the-art, high performance pumping solutions for oil and gas production including subsea applications. With safety and reliability being key features of pump design, Sulzer pumps fulfill the latest ISO 13709 (API 610) standards and cover a broad range of requirements. The latest innovations have seen high performance technologies being applied to water injection, multiphase and gas-tolerant pumping solutions; all of which are validated in the test bed located at the Sulzer facility in Leeds, UK.



**OEMs are an excellent source of engineering expertise**

## Managing motors

Of course, every pump needs a power source and in all but the very largest cases, that is usually provided by an electric motor. These essential components need to be properly matched to their application in order to deliver efficiency and reliability. As with all platform equipment regular monitoring and maintenance is required to ensure continued performance.

The use of vibration analysis and thermal imaging equipment to determine any hotspots during normal operation can quickly determine any potential issues with a motor. In the event of a component requiring a repair, speed is of the essence in order to minimize any downtime.

Any motors that operate in potentially explosive atmospheres must be repaired and maintained using parts and procedures specified by the relevant standards. With health and safety of paramount importance on offshore platforms, it is essential that any repairs carried out on these motors are performed by qualified personnel.

A solid infrastructure is essential when dealing with such repairs. Sulzer for example has a fully qualified support network that can deliver onsite repairs on land, offshore or at sea; with the support of several manufacturing sites around the world that design and manufacture replacement parts including motor windings.

## Generators

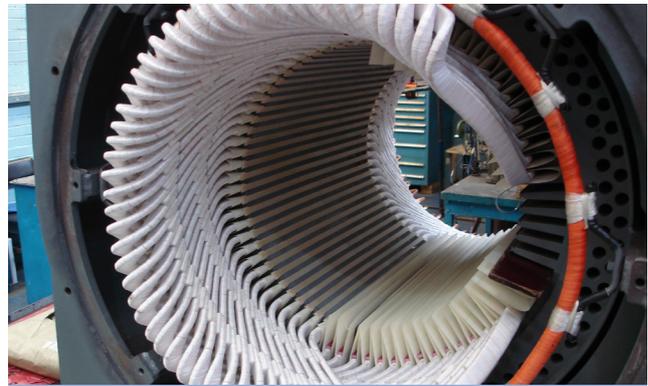
The motors that drive the pumps require an electrical supply which is most often created on board the platform by a generator. These critical plant items are also classed as rotating equipment and as such can be expertly maintained and repaired by Sulzer.

Preventative maintenance procedures, such as endoscope inspections, electrical testing and vibration analysis are vital in maintaining the performance of platform generators. In the event of a repair being required, the sheer size of these pieces of equipment may prevent them from being repaired onshore. In such cases, it is essential that engineers qualified in both generator repair and platform safety procedures can be dispatched quickly.

Sulzer has decades of experience in delivering generator repairs on both fixed platforms and marine vessels while minimizing the disruption to operations. In conjunction with its in-house coil manufacturing facility, Sulzer can provide a round-the-clock repair service that returns power generation equipment to normal service as quickly as possible.

For situations involving legacy equipment or obsolete pump lines, Sulzer has the ability to reverse engineer a large number of components, including coils. As part of the coil manufacturing process, Sulzer uses modern, class F insulation, allowing more copper to be used in the coil itself. The increased copper content reduces the losses in the generator, making it more efficient and improving output.

Recent advances in engineering design have also produced



Sulzer offers decades of expertise in generator repairs

some significant improvements in terms of reliability and efficiency for electrical generators and a very small number of companies, Sulzer included are fully equipped to remanufacture individual components and introduce improvements where opportunities present themselves.

## Tuning Turbines

Maintaining gas turbines using a well-planned servicing schedule allows improvements to be implemented, while keeping a vital facility at optimum performance and efficiency.

Scheduled shutdown periods are commonly used to complete any repairs, maximizing availability of the turbine. They also represent an opportunity to install upgrades and improvements that will ensure continued reliability in addition to maintaining or even improving performance; all of which can be managed and delivered by expert engineers from Sulzer.

- Many gas turbine hot section components have a limited lifetime. Oxidation, corrosion, material degradation and thermal cracking are the usual results of usage that determine operating life. Fortunately, new repair techniques, coating materials, inspection/testing procedures and tooling are available to restore components to a serviceable condition.
- Due to long standing experience with the repair and refurbishment of gas and steam turbines, Sulzer engineers have also developed individual repairs and improvements that can be applied to specific models in service, increasing reliability and performance by systematically addressing any known issues.
- Thermal barrier coatings can be applied to combustion liners, transition pieces and also blades and vanes to help them withstand the high operating temperatures of the gas turbine. More recent advances have seen the introduction of single-crystal (SX) materials for turbine blades, which are designed for higher turbine inlet temperatures over 2370 °F.

Sulzer offers many similar types of advanced component refurbishment solutions, demonstrating that a combination of expertise in material science, skilled engineering workmanship and highly developed in-house processes are essential for the reliable and cost-effective extension of the life of a gas turbine.



### Electromechanical excellence

As a world-class independent service provider, Sulzer has built a reputation for fast response times and on-time delivery of solutions; electromechanical services form the backbone of this success. Covering a wide range of individual skills, electromechanical services are vital to the on time delivery of each project and as such must be available at short notice.

The key is a wide knowledge base supported by an extensive network of service centers, equipped with the latest facilities to repair and refurbish large motors, generators and pumps. Providing dedicated field service teams and high quality engineering support, electromechanical services enable Sulzer to provide a turnkey solution anywhere in the world.

### Benefits

The combined facilities within the extensive worldwide Sulzer network can deliver projects either as part of a pre-planned maintenance scheme or in an emergency breakdown situation. From complete turbine overhauls to remanufacturing of pump components and generator overhauls to repairs and rewinds, the Sulzer engineers have the experience and resources to deliver.

Offering professional repair services for high criticality turbines and pumps, as well as 24/7 coil manufacturing and rewinding of high voltage generators and motors, Sulzer can deliver improved performance and enhanced reliability – helping to maximize topside production efficiency for its clients.

### Conclusions

With so many production processes involving a multitude of pumps, turbines and motors, it is critical to have a well-developed asset management system in order to reduce the amount of reactive maintenance on a platform. As these assets mature so an increased amount of intervention will be required and it is the responsibility of the site engineering team to ensure that the most cost effective solution is implemented.

This team can be supported by an expert maintenance provider to deliver a range of services from one-off repairs to round-the-clock support. Very often the value of this support is only really tested when an unexpected failure requires immediate attention. The pressure to deliver a robust repair is considerable when every day of lost production is being counted by the customer. Being able to call on specialist, in-house facilities such as high voltage coil manufacturing, at-speed balancing and expert field service teams is certainly an advantage.

Keeping all of the equipment on a platform operational and efficient requires a team that can tailor a comprehensive maintenance solution to suit each set of circumstances.

Every application is different but each one will require an approach that promotes preventative maintenance and minimizes reactive repairs.

Sulzer's global support network has considerable experience in maintaining and managing mature equipment by applying experience and the latest technological innovations to extend the life cycle of these vital assets and maximize productivity.