

Full steam ahead

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Sulzer restores operational integrity of steam turbine on container ship

Container ships are the lifeblood of global supply chains, with the World Economic Forum estimating that 90% of goods are transported by sea.¹ For operators, it is essential to have vessels out at sea meeting schedules and returning profits. When a container ship owned by one of the top three global shipping companies required a steam turbine overhaul, a regional team of Sulzer experts collaborated seamlessly to deliver a turnkey repair. Innovative reverse engineering restored the operational readiness of the legacy steam turbine.

Ship-shape turbines

For a working vessel like a container ship, all maintenance must be completed within the timeframe that the ship is in harbor. Any delay risks increased docking fees from the shipyard, a failure to meet shipping schedules and lost profits. While many modern container ships use more efficient diesel engines, some older vessels still rely on steam turbines for propulsion, which require specialist servicing.

In a recent project, an 18-year-old 5 MW steam turbine of British original equipment manufacturer (OEM) origins installed on a 98'000-ton container ship had suffered damages due to operational wear and tear. The unit had been at a standstill for 2

¹ [<https://www.weforum.org/agenda/2021/10/global-shortagof-shipping-containers/>]

years due to a generator replacement, which delivers essential power for ship operations. With this complete, there was a window of opportunity to conduct repairs at the Port of Shanghai as part of the vessel's scheduled maintenance.

However, the UK turbine OEM couldn't provide support in China due to the absence of local manpower. The cost of flying in experts was an extra financial burden that the vessel owner didn't want to bear. Therefore, the vessel operator's central procurement team based in Singapore contacted Sulzer Singapore due to its OEM agnostic repair support and reputation for quality. Subsequently, Sulzer's technical team was dispatched to China and carried out a full inspection of the unit, which operates at speeds of 6'800 rpm.

Expert turbine assessment

Sulzer is a leading independent service provider (ISP) for all types of rotating equipment, including turbomachinery. The business has successfully serviced over 1'500 steam and gas turbines in Asia. Upon a methodological assessment of the turbine, Sulzer experts discovered the damage extended beyond the initial assessment of the vessel's maintenance team.

A combination of visual inspections, non-destructive testing and root cause analysis revealed damage to the 3rd, 8th and 9th stages of the turbine. The trailing edges of the 3rd stage had suffered impact damage, the 8th stage had blades that were bent and cracked and the 9th stage had visible cracks and a completely broken blade. Bolts on the upper cover diaphragm were damaged and the retaining rings couldn't be removed. In addition to this, the rotor journals had light scoring. It was also determined that the labyrinth seals would need to be replaced to ensure reliable running long into the future.

A local repair with international support

Sulzer teams in China, Singapore and Indonesia collaborated to determine the best approach for repair. A strong network of dedicated service centers across Asia and the rest of the world ensures that every project receives the best possible level of technical expertise and engineering capabilities, as local teams can tap into Sulzer's global community of experts.

The damaged stages were all re-bladed, with erosion shields added to improve service life. Sulzer's Purwakarta Service Center in Indonesia carried out the manufacture of new turbine blades in-house. To ensure the new blades were a perfect fit, the original components were reverse engineered. In total, 125 blades were produced for stage 3, 97 for stage 8 and 96 for stage 9. Preparation and logistical coordination ahead of the repair window ensured that all could be delivered to deadline.

Meanwhile, Sulzer's Suzhou Service Center completed the refurbishment of the labyrinth seals, as well as the reverse engineering and replacement of more than 50 parts and components such as studs, bolts, bearings, coupling, labyrinth seals and more. Additional engineering support was provided by Sulzer's Singapore Service Center. Additional repairs involved a complete replacement of the turbine journal and thrust bearing, as well as the polishing of the rotor journals to remove scoring.

Work was complicated by the constricted space onboard the ship, which made removing the turbine casing cover and rotor more challenging.

Ready to set sail

With all repair work complete, the turbine was reinstalled on the ship and commissioned. As a result, the vessel could return to sea on schedule and begin generating profits for the operator.

The repaired turbine is expected to offer an extended service life of up to 15 years, ensuring that the ship can continue to reliably deliver cargo long into the future. In addition, the customer was assured by Sulzer's international coordination and overall project management despite a rather sophisticated repair.

After some underwhelming experiences with other service providers, Sulzer was able to win the trust and confidence of the customer. Consequently, the shipping company is organizing additional turbine and generator maintenance jobs with Sulzer for its container ships that will be travelling through Asia over the coming months.

Image captions:



Image 1: An 18-year-old 5 MW steam turbine installed on a 98'000-ton container ship suffered damages due to operational wear and tear.



Image 2: Sulzer teams in China, Singapore and Indonesia collaborated to determine the best approach for repair.



Image 3: For a working vessel, all maintenance must be completed within the timeframe that the ship is in harbor.



Image 4: Following reverse engineering, Sulzer manufactured new blades and re-bladed the turbine in-house, among other repairs.

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About Sulzer

Sulzer is a global leader in fluid engineering and chemical processing applications. We specialize in energy-efficient pumping, agitation, mixing, separation, purification, crystallization and polymerization technologies for fluids of all types. Our solutions enable carbon emission reductions, development of polymers from biological sources, recycling of plastic waste and textiles, and efficient power storage. Our customers benefit from our commitment to innovation, performance and quality through our responsive network of 180 world-class manufacturing facilities and service centers across the globe. Sulzer has been headquartered in Winterthur, Switzerland, since 1834. In 2022, our 12'900 employees delivered revenues of CHF 3.2 billion. Our shares are traded on the SIX Swiss Exchange (SIX: SUN).

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