

Delivering high-quality service on a tight schedule

# 160 MW steam turbine repair project

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Towards the end of 2007, a state-owned electrical company located in Medan, North Sumatera, awarded Sulzer Hickham Indonesia a contract to recondition a 160 MW steam turbine generator set on an emergency basis. A lube-oil failure had caused catastrophic damage to the journals, seals, bearings, and blades.

The unplanned shutdown of the unit had caused a significant shortage of power in the region because 2 gas turbines were being repaired and overhauled by Sulzer Hickham Indonesia at the same time.

This serious condition meant that the customer needed to have the reconditioning work completed on very tight schedule.

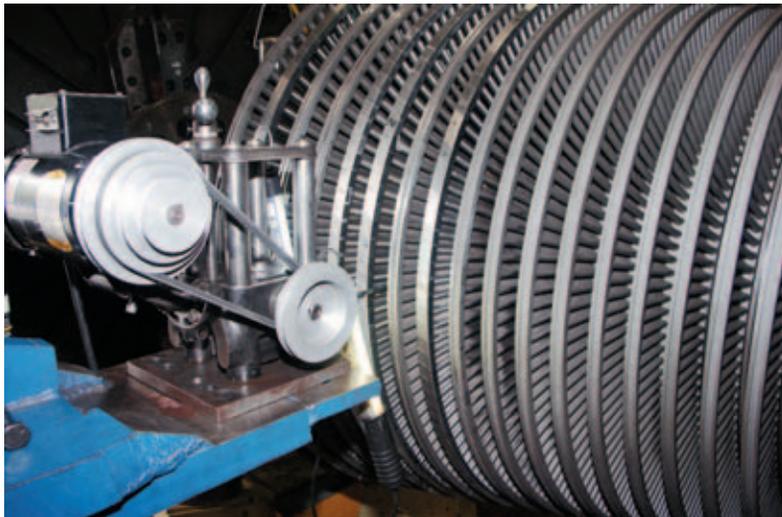
The work on the 2 gas turbine units also needed to be completed urgently.

## ► Serious damage at the power plant

The power plant has 4×65 MW steam turbines and 2 gas-fired combined cycle trains in a 4×2 configuration, comprising 4×130 MW gas turbines and 2×160 MW steam turbines, which produce a total of around 1100 MW when working at full capacity. Each 160 MW steam turbine unit consists of one high-pressure (HP) turbine and one low-pressure (LP) turbine that drive the generator unit. The HP turbine rotor is of a barrel-type rotor with 27 stages of rotor blades. The LP turbine rotor has a symmetrical double-flow design with 8 stages of rotor blades on each side. Both turbine rotors are connected in series and directly drive the generator rotor.

The customer reported that a lubrication failure during operation had caused the unit to shut down and had resulted in significant damage to all the rotors. Sulzer Hickham Indonesia was therefore called in to help conduct a site inspection in order to examine the impacts of the failure and the different repair options.

1 Re-blading work on the HP rotor.



The site inspection revealed that serious damage had occurred in the last 7 stages of rotating blades of the HP rotor, i.e., stages 19 to 27. The blades exhibited heavy damage as a result of radial rubbing. Other parts of the HP rotor, such as the seal strips, had also been damaged.

The shutdown had also caused considerable damage to the LP and generator rotor, with severe rubbing and cracks on the LP rotor journal and the generator coupling flange.

Among the stationary components, it was found that the stator blades on 26th and 27th stage of HP unit were in severely damaged condition, requiring blade replacement and total replacement of all seal strips.

## Repair work conducted on site and in the Sulzer workshop

To allow a more detailed inspection, the rotors and stationary components—with the exception of the HP turbine stationary components—were shipped to the Sulzer workshop. The repairs to the HP turbine stationary compo-



2 Welding process on the journal of the LP rotor.

nents, such as the replacement of stator blades and seal strips and the final machining, were to be performed on site since the construction would not permit the removal of the HP casing to the workshop within the required timeframe.

The as-received run-out inspection of the LP rotor in the workshop revealed that the failure had also caused the turbine rotor to bow very badly. Based on this full inspection, Sulzer Hickham Indonesia submitted a proposal for repairs. Its main scope was: replacement of the blade on 7 last-stage blade rows of the HP turbine rotor (Fig. 1) and replacement of the blade on the 2 last-stage stator blades of the HP turbine, as well as straightening of the LP rotor and weld repairs to the LP rotor (Fig. 2), total seal strip replacement,



3 Rewinding work on the generator motor.

repairs to the generator rotor coupling flange, and complete rewinding (Fig. 3).

#### A job well done on a tight schedule

The replacement of the stator blade and stationary seal strips of the HP turbine and the final machining were carried out on site. Sulzer Hickham Indonesia

designed a portable line boring machine specifically for the in-situ field machining process. The design, fabrication, and testing of the machine was completed in 4 weeks. The machine was then delivered to the site and the HP turbine stationary components were successfully machined to target size (Fig. 4).

The LP rotor was straightened and

the journals brought back to the original dimensions and specifications using the submerged-arc welding (SAW) repair process. Due to the LP rotor size—it weighed almost 50 tons—it was necessary to manufacture special fixtures so that it could be positioned vertically for the stress relief process.

Thanks to its experience, good preparation, and foresight, Sulzer Hickham Indonesia once again succeeded in providing a rapid solution. All the necessary repairs were completed within a very short timeframe, thus demonstrating the company's commitment to ensuring customer satisfaction.

The steam turbine rotors have now been delivered for on-site installation and commissioning, and the 2 gas turbines are operating at full capacity to meet the demand for electricity in the region. ◀

4 In-situ field machining of HP turbine stationary components.



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