Sulzer Turbo Services Reconditions Steam Turbines for a Pulp and Paper Mill

Supplying Energy for Growth

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The construction of new pulp and paper mills—as well as an increase in the capacity of existing plants—is becoming necessary as the demand for paper products grows. In the case of existing mills, an increase in capacity also results in higher energy requirements. In 2006, a pulp and paper company based in Sumatra, Indonesia, commissioned PT Sulzer Hickham Indonesia, a subsidiary of Sulzer Turbo Services, to recondition, rerate, and install 2 steam-turbine generator units in a pulp and paper mill. Sulzer Hickham Indonesia completed this turnkey project—from the foundation work through to the operational handover—making it possible to supply the energy required for a 44% increase in paper production.

The pulp and paper mill is located in a remote industrial timber plantation concession area on the island of Sumatra, around 480 miles from Jakarta. This area produces the raw materials required for the production of pulp. The mill is powered by three 37-MW steam turbine generator units, with 7 diesel engine units as backup. The steam is generated in 2 multi-fuel boilers with a capacity of 140 t/h that can burn bark, peat, palm shell, heavy oil, coal, and diesel oil, as well as by 2 recovery boilers with a capacity of 443 t/h and 110 t/h, both of which burn black liquor.

Implementation of Growth Plans

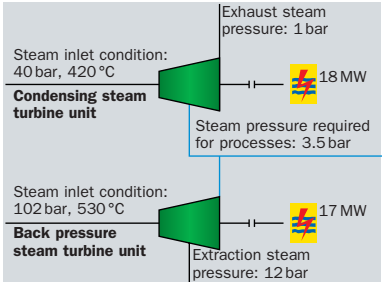
The company is currently implementing a plan to increase its pulp production capacity from 1800 to 2600 ADt/d (air-dry tons per day). In order to meet the resulting increase in power requirements, the company purchased 2 used Japanese steam turbine generator sets and transferred the entire units from Japan to Sumatra (Fig. 1). Unit 1 is an 18-MW steam turbine generator group consisting of a combined 10-stage extraction turbine with a condenser, as well as a 4-pole generator. The turbine is designed for steam inlet conditions of 40 bar/420 °C and 2.8 bar extraction pressure. Unit 2 is a 17-MW set that uses an impulse 10-stage extraction back pressure turbine with steam inlet conditions of 102 bar/530 °C and 2.5 bar back pressure.

Rerating the Turbine Unit

Pulp making and other processes in the mill—i.e., drying, heating, and cooking—require a steam pressure of 3.5 bar, which is taken from the extraction steam of the condensing steam turbine unit and the exhaust steam of the back pressure steam turbine unit (Fig. 2). In order to increase the extraction pressure of the condensing steam turbine unit from 2.8 to 3.5 bar, the engineers at Sulzer Turbo Services performed a rerating engineering study. In addition to the general information that was available from drawings, it was necessary to acquire data about annulus geometry and throat gaps, as well as blade profiles and other blade data, for the study (Fig. 3).

A specialized prediction program was used to model the performance of the unit 1 condensing turbine. According to the analysis, unit 1 can be operated while taking extraction steam of 3.5 bar downstream of stage 5 of the 10 stages. When the extraction pressure increases, the power output remains unchanged, despite a slight reduction in the efficiency of the turbine.

A corresponding study by the OEM of unit 2 indicated that it is possible to operate the back pressure steam turbine while exhausting pressure of 3.5 bar without modification, albeit with reduced power output.



2 Process steam of 3.5 bar is taken from the 2 steam turbine units as extraction steam (unit 1) and exhaust steam (unit 2). Sulzer Turbo Services carried out a study to demonstrate that they can operate safely at this condition.

1 Sulzer Turbo Services reconditioned and installed 2 turbine generator units that provide additional energy for a pulp mill on Sumatra, Indonesia. This image shows the setting of the generator casing.

3 The blade parameters required for the meanline modeling, including the hub and casing radius and axial locations of the leading and trailing edges of all blade rows, were acquired using a portable coordinate measuring machine (CMM).

Repairs in the Workshop

The 2 steam turbine rotors—including the complete casings, 2 generator units, and 1 reduction gear unit—were transported to the workshop of PT Sulzer Hickham Indonesia for inspection and reconditioning. The units were found to be damaged, with some components needing replacement. Unit 1 required the replacement of the eroded last-stage rotor blades and the damaged interstage labyrinth seals. The bearings had been damaged by heavy abrasion and were out of specification. Unit 2 required the replacement of the cracked thrust-end oil deflector and the damaged labyrinth seals. Similar to unit 1, the bearings had to be repaired.

On-Site Work at a Remote Location

Preparation work was carried out on site, starting from the foundation. The foundation was constructed with all of the facilities required for the units—i.e., the steam line, water line, instrument air, and overhead crane. Pre-engineering work included a check of the civil work on the foundation and a measurement check to verify the anchor bolt locations according to the original foundation drawings.

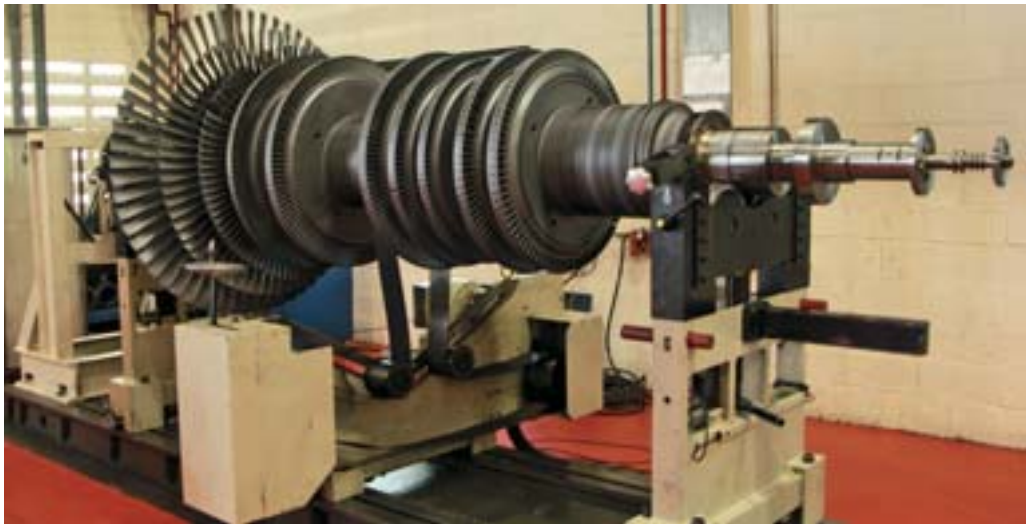
Sulzer Turbo Services carefully planned the installation schedule, manpower arrangements, tools, and preparation of equipment—all of which are key factors in the successful execution of a project. Working in a remote area with limited facilities presented a further challenge that all on-site personnel had to adapt to.

Power for Increased Production

Following the reconditioning and final balancing process in the workshop of PT Sulzer Hickham Indonesia, the 2 rotors and the generators for both units were transferred to the site (Fig. 4). After the completion of the foundation work and installation process, the turbines were reinsulated before the units were ready for precommissioning.

The existing boiler will deliver 110 t/h of steam to operate the rerated turbine unit 1, while a new oil boiler—which is due to be installed in April 2007—will provide 110 t/h of steam for unit 2. Once fully operational, the 2 new units will deliver sufficient power and process steam to meet the increased production capacity of the upgraded pulp and paper mill. ◀

4 Turbine rotor of unit 1, completely reconditioned and balanced.



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