

# Technical Paper

## Major Overhaul of a 60 MW Steam Turbine - Generator and Balance of Plant at a Geothermal Power Plant

In early 2007, PT Sulzer Hickham Indonesia was awarded a major overhaul project at a geothermal power plant owned by a joint venture of government power plant and government oil and gas companies. It was a new challenge for Sulzer Hickham, Indonesia to carry out a major overhaul of the steam turbine – generator unit complete with balance of plant. A further challenge was the reblading and in-situ machining of the generator rotor to be executed under time and geographical constraints



*Hot well pump removal for overhaul*

The geothermal power plant is situated on a beautiful plateau, on Java

Island around 2,500 meter above sea level. This power plant was originally built in 1995, commissioned in 1998



*Hard scale deposit behind turbine inlet nozzle*

and went into commercial operation in 2002. With one unit of an Italian manufactured steam turbine – generator, the unit can supply 60 MW to provide electrical power fulfilling high demands for electricity in Java. The steam supply is fed from four active well pads to supply 450 ton/hour steam to run the unit continuously. This double flow condensing type steam turbine operates under high and cyclic stress while being exposed to wet steam,

containing corrosive gasses for long periods of time. Hard scale deposits are frequently found during casing

opening, in addition to erosion/corrosion problem of the steam path parts, i.e. nozzles, diaphragms, blades.

Several borescope inspections had been performed to determine the steam turbine rotor condition prior to performing major overhaul. The main scope of work for the shop repair comprised blade replacement of the 1st, 2nd and 3rd stages of both Drive End and Non-Drive End and welding repair of nozzle and diaphragms

stage 1 to 3 of both sides. High metal spots and dents in the coupling holes required in-situ reaming to repair the coupling bolt holes in addition to finish grinding of new replacement coupling bolts.



*Removing rotor from casing*

Two large mobile cranes - 150 ton and 45 ton were specially requested and transported to site. The Sulzer Hickham, Indonesia crew and tool containers, office and storages were mobilized to site prior to plant shut down. It took five working days to prepare the steam turbine rotor for lifting from the casing. The rotor was packaged into a container and secured prior to transporting to the workshops for the scheduled 60 days repair period.

One of the two hot well pump units was also transported to the workshop for a complete overhaul. While the rotor repair was ongoing in the workshop, the site crew continued the major overhaul work on the balance of the plant, i.e. rock muffler, various valves, steam purifier installation, generator unit, condenser, various pumps and motors, and ejectors complete with all electrical and instrumentation to be checked, calibrated and tested. On the cooling tower, two cells of air drifted fillers were removed and replaced with new incoming cells

together with recoating of 2 x 9 set fan blades and recoating of the basin.

The original plan was to remove the generator rotor from the casing for the first complete inspection since its installation. A special design struc-

ture was added and generator roofs were dismantled to have access to remove the generator rotor. The generator rotor was removed and positioned on rotor stands. A temporary strong tent and several heaters were constructed to provide the generator



*In-situ machining*

rotor with enough heating during the inspection period. The rainy season with frequent hard rain, storms and damp conditions were an additional challenge for the team on site. During the generator rotor inspection, it was found that the oil seal areas and exciter ring has undergone significant

radial rubbing which require machining repair, preferably on site. This was another challenge for TSID to perform in situ machining. A special team for in situ machining was mobilized. The activities included surface leveling of soil, setting up turning device, V-block support platform and under-carriage of lathe machine. The generator rotor was reassembled after a final inspection was performed.

The site work for balance of plant was almost finished when the steam turbine rotor and a complete set of repaired diaphragms went back to site for reassembly. It took 24 days to complete the reassembly including in-situ reaming of the coupling holes and start up/commissioning. The unit is now running smoothly with vibration levels five times lower than pre-shutdown. With a steam supply of 300 ton/hour the unit is able to produce 45 MW in contrast with pre-shutdown condition when it produced 40 MW with 400 ton/hour steam supply.

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