On Site Technical Advisory Services from Sulzer Hickham Indonesia

In cooperation with several of our customers, Sulzer Hickham Indonesia has been developing capabilities to provide on-site Technical Advisory Services. Locally based T/A's are well positioned to meet the needs of rotating equipment operators, some in remote locations, around the Indonesian archipelago, with shortened response time and lower cost. Two recent projects represent different service models available: a long term service agreement (LTSA) on US manufactured aeroderivative gas turbines and a short term outage specific technical services contract for a 600 MW steam power plant.

LTSA for Aeroderivative Gas Turbines*

The two units covered under this agreement were first commissioned in 1992. The units operate in combined cycle and can generate between 26 MW (dry) to 40 MW (steam injection). Maximum efficiency is obtained with steam injection and is in the range of 38%. The waste heat boiler utilizes the gas turbine exhaust gas to generate the steam and includes an exhaust diverter to alternately send the exhaust to the atmosphere.

The LTSA provides for direct service and consultation on the complex control system. With a very flexible design covering a wide range of operating conditions and parameters, control system maintenance and trouble shooting are key parts of the maintenance service provided. The unit has a large number of fuel control valves (FCV's) that require attention, including frequent manual stroking and integration to the digital control system (DCS). Both units currently operate with more than 50,000 hours on the packages and most of the original DCS equipment is obsolete. Working with the customer to update and upgrade the control system on a systematic basis is another task provided for under the service agreement. The vibration monitoring system and the DCS have both been upgraded to newer models that include the capability to trend data and provide for improved trouble shooting.

Additionally, spare parts management and purchasing advice is provided to the owners in order to manage and ensure that costs are kept within budget constraints.

Operational and on-line maintenance assistance is supplied to the owners on both routine and a call out basis. One of the tasks undertaken on a routine basis is management and control of compressor cleaning. To keep the unit running efficiently the turbine must be water washed on a 30 day cycle using the CDP (compressor discharge pressure) as a guiding parameter. When the CDP decreases around 5 – 8 psi (0.35 – 0.55 bar), the compressor is starting to get dirty. After the compressor is water washed, all the electronic components need to be checked and calibrated.

Every four months the unit is borescoped to look for damage and to see the level of degradation of the hot gas components. This unit is normally fired on gas, so the level of hot gas component degradation tends to be minimal.

These types of units require a hot end change out every 25,000 operating hours. Management and supervision of the change out process is also provided for under the service agreement.

Technical Advisory Services during a 600 MW steam power plant outage

In the second quarter of 2004, Sulzer Hickham Indonesia was asked to provide a Technical Advisor/Field Service Engineer to assist with coordination and planning and to act as technical liaison between the plant operators and the OEM during a 25,000 hour outage at a large coal fired steam turbine power plant. The length of time for the outage duration was of course a very important consideration for the operators of the plant. Planning, coordination and advice provided by an independent T/A acting on behalf of the operators was seen as an important consideration by the owners.

The 25,000 hour outage is far reaching as to the range of equipment that is to be disassembled, inspected, repaired or replaced if necessary, and reassembled. Major components, their subassemblies, and auxiliary equipment are all covered during this outage. For this outage work to be performed included the generator (hydrogen cooled), steam turbine, boiler feed pumps and drivers, and steam supply and control valves.

For the generator, the rotor first had to be removed from the stator, followed by the disassembly of the exciter system. The Generator Stator and Exciter Stator where fully tested for insulation resistance test, dissipation factor measurement, charge/discharge current measurement. Tan Delta test, and for loose wedges. The Generator and Exciter rotor where fully tested with an insulation resistance test.

All of these electrical components were tested and then readied for reassembly. As the generator is

Generator stator and rotor as well as the generator fan and H2 tubes during reassembly.

Turbine rotor and generator rotor ready mating together after alignment checks.

hydrogen cooled, the entire H2 system needed to be inspected and tested prior to reassembly. Following the cleaning and inspection works all the parts were to be stored for the final reassembly process in a controlled environment, so as to minimize contamination and corrosion. This factor was complicated by the fact that the plant is located directly adjacent to the Java Sea and 6 degrees below the equator, not the friendliest environment for sensitive electrical parts.

The turbine journal bearings had to be removed and dimensionally checked and NDT tested. The HP and LP steam stop valves and steam control valves were removed and checked. The bushings in the eight valves were found to be undersized. In order to carry out this work the valves were shipped to the Sulzer Hickham Indonesia facility, where the valves were rebuilt and new bushings were installed. After returning to the site, the valves were mechanically tested for correct operation, including the timing for opening and closing, and calibration and integration with the DCS

All the bearings were NDT inspected and several failed the inspections and were replaced with new ones from stock.

The turbine and generator rotors were reassembled into their casings and the alignment was carried out. After realignment, all the oil pressures to each of the bearing housings were set and the rotor turned easily by hand.

With regard to the ancillary equipment, the two steam driven and one electrically driven boiler feed water pumps had to be borescoped, the steam and control valves stroked and checked and the alignment checked. Once open, the motor driven boiler feed water pump was found to be worn beyond recommended operating limits. The old rotating element and parts were shipped to the Sulzer Hickham Indonesia facility for a full inspection and analysis of the damage suffered during operation. Additionally, the spare rotor and stationary components were also shipped to the shop for inspection. Prior to shipment the rotor was balanced.

After the inspection, overhaul, and replacement of parts, the unit was ready for commissioning. Initially the turbine was placed on turning gear for 12 hours to check for oil leaks and allowed to warm up slowly. All of the vibration levels and oil temperatures and pressures were continuously monitored and recorded throughout the start up process. When thermal stability of the unit was assured and all the checks were positive, the unit was slowly brought up to the operating speed of 3000 RPM.

With no problems encountered, the breakers were closed and the unit was gradually loaded over a 24 hour period to the full load of 630 MW's. The unit has operated at full load and is stable and the operator was pleased with the technical assistance provided by the on site T/A and the coordinated support given by the Sulzer Hickham Indonesia workshop.

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