SULZER

Sulzer Turbo Services

Technical Paper

Repair of a Damaged Journal Bearing on a Generator Rotor

During the fall of 2006 Sulzer Elbar was asked to repair a damaged journal bearing of a rotor. Normally this would not be a particularly special job but this case was different because of the type of rotor, the turnaround time and the size.

History

Over a period of months Sulzer Elbar had been in touch with a Middle East customer regarding American manufactured component repairs. Having been granted a contract for overhaul of several types of gas turbines they were looking for a component repair partner and visited our facility in The Netherlands.

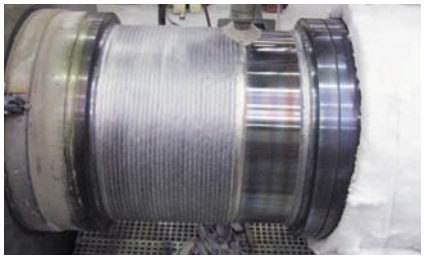
During disassembly of one of the gas turbines they very quickly noticed that there was a defective journal bearing on one side of the generator rotor. This rotor is almost 40 tons in weight and over 8 meters in length. Remembering the capabilities of Sulzer Elbar they contracted with us to execute the repair. Technically this was not an issue, logistically however, it was a problem as they requested the machine be back on line as quickly as possible. Sulzer Elbar was asked to do the complete repair in only two weeks, and to shorten the overhaul period as much as possible. It was decided that sea transport was not an option. This would add at least two months to the outage period.

Transport

When considering the weight and the size of the rotor, 40 tons and over 8 meters length, normal transportation was out of the question. Only a very large airplane, an Antonov 124-100, would be able to carry the rotor, packed in a sea container, to The Netherlands.

The aircraft arrived at Maastricht airport, some 80 km south of Sulzer Elbar. Unloading (Figure 1) was done in less then 90 minutes, after which the container travelled by truck to its final destination in Lomm. At our facility everything was ready to perform an incoming inspection, including a check on any visual defects, runout, hardness and electric measurements.

Figure 2: Welding set-up.



Repair

After the incoming inspection the rotor was put on a turning lathe and the total journal was machined. After inspection of the surface and the hardness the rotor was brought to the welding equipment (Figure 2). An MPI test was done to be absolutely sure that no more defects were present.

The welding was done by a submerged arc welding process, in combination with two manipulators, one

Figure 3: Journal after welding.

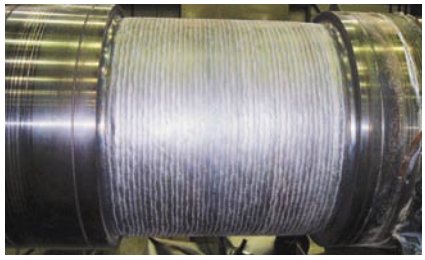


Figure 1: Unloading of generator rotor at Maastricht airport from Antonov 124-100.

for the rotor rotation, the other for the weld torch translation movement. This process was chosen because of the high quality weld and the high deposition speed (Figure 3). In preparation of the welding process itself Sulzer Elbar needed to find a solution to prevent heat transfer of the journal area to the copper windings and insulation of the generator. A job specific water cooling system was designed and installed on the rotor just next to the welding area and this successfully prevented over-heating of critical areas in the rotor.

Heat treatment

Before the final machining, the welded area had to be heat treated. Rather than doing this with the rotor in a horizontal position the rotor was placed upright into a vertical position. The heat treatment itself was done with electric heating of the welded area, using the same water cooling system again. Full process control was guaranteed registering the temperature profile with around twenty different thermocouples attached to the welded area and its direct surroundings. The total process of heating up, heat treatment itself and cooling down took around 24 hours.

Machining and final inspection

The next step was to machine the welded area and bring it back to its original shape. The only steps left after this were the balance check and the final inspection. For the balancing special bearings were made and during the process the cooling blades were also installed (Figure 4).

During the final inspection a last check on dimensions, run-out and cracks was done to make sure that everything was in order. After this the rotor was ready for shipment.

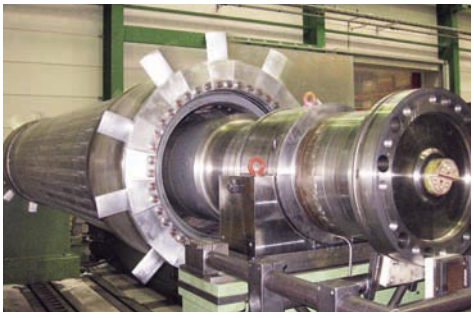


Figure 4: LS-balancing of the rotor.

Conclusion

With good planning, engineering and execution this challenging task was concluded successfully. Keeping in line with the steps laid down in an agreed quality plan Sulzer Elbar succeeded in executing this repair within the requested two weeks turnaround time.

Jan Hermans
Sulzer Elbar