

Component Damage, Failure, and Life Assessment

Authors : Abdullah Zaman Al-Merza

Abstract : Background: Gas Turbines are internal combustion engines that consist of many parts. The major part is the gas turbine rotor. This Part is the most expensive. Frame-5 gas turbine has two mechanically independent Rotors. Namely, the High Pressure (HP) Rotor and Low Pressure (LP) or Power Turbine Rotor. LP rotor is subjected to about 1/3 of heat energy while HP rotor is subjected to 2/3 of heat energy. The expected life of these rotors is limited due to operating at high temperatures. In our case, the GE Frame 5 gas turbine LP rotor's expected life is 200,000 hours, and it was declared scrap after the expected life elapsed. For the first time in KOC, we implemented GE Frame-5 GT LP Rotor Life Extension in KOC gas turbine units. BS140 & BS150 gas facility are composed of 10 units of GE Frame 5A/B gas turbine that was commissioned in 1978. We have 5 numbers of spare LP rotors that exceeded 200K hours and were officially declared scrapped by the vendor. Sequentially, 5 numbers of running LP rotors have already crossed 200K hours. Due to the unavailability of LP rotor spares, we are unable to carry out PM activity for 10 units. To do so, purchasing 5 new LP rotors will require a total cost of (KD 630,000 x 5) KD 3,150,000. In addition, BS140 /150 GT parts and components are excessively 45 years old. It is not economical to install brand-new LP Rotors in 45-year-old machines. Method of Approach: A decision has been taken to discuss with the vendor about the potential rotor life extension. We obtained a scope of work for life extension, and the vendor accepted it after a long discussion. We use existing KOC materials to reduce the repair cost from KD 630,000 to KD 73,000 per rotor. Results: The total cost savings for 5 LP rotors are KD 2,374,500. The vendor has given us a warranty for LP rotors to be in operation for another 100,000 hours, but it must be overhauled every 48,000 hours as normal practice. Additional benefits: We are also able to obtain a scope of work for the life extension of HP. This will result in further savings of KD 650,000 after we apply rotor life extension also for HP Rotor (GE 5B). The cost of life extension for the HP rotor was 450,000 KD, while purchasing of new HP rotor will cost us 1,100,000 KD. We made a saving of 650,000 KD to the company by optimizing the running life of the HP rotor.

Keywords : GE Frame-5, LP & HP rotor, rotor life extension, scrap to reusable

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