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Gas Turbine Overhaul Planning for Optimum Cost and Duration Execution in the Field and Workshop Refurbishments

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ABSTRACT

The Gas Turbine is power source for the majority of industrial plants, especially the oil and gas facilities. The Gas Turbine overhaul is a process that need to be planned in a professional manner to guarantee the continuity of the plant. The Gas turbine procedures explain inspections, replacements and checks, repairs & and refurbishments each one of those activities has its technical details and involves criticality. The target of this paper is to give the systematic approach to the overhaul project and heights the technical steps and anticipated durations and the interaction between the field works and overhaul workshop repairs. The Study will also give conclusion on the required manpower and equipment and special tools reports. The research is will introduce cost saving and technical excellence methods.

Introduction

The gas Turbine maintenance are combustion inspection and activity that takes around 8 days based on the recommendation of the original manufacturer's working hours, the second step of the maintenance is the hot gas path inspection which lasts for around 4 weeks the final maintenance activity is the gas turbine overhaul which takes from 10 to 12 weeks . the durations mentioned are the basic durations that does not include any workshop inspection works for the rotors or parts refurbishments or generator repairs and rewinding's. The Gas Turbine overhaul is a project activity that involves the check of the gas turbine parts mainly the combustion chamber , compressor and gas turbine . The works include a detailed plan for disassembly of the turbine enclosure to get the proper access , remove of stacks and structure then removal of the enclosure roof that is done through proper utilization of cranes and lifting equipment . The dismantled to get access to the shaft of the turbine and the combustor . the duration balance between the activities and any finding is a state of an art that will determine exactly the overhaul duration. The spares preparation and ordering is another challenge, especially with the long lead items like the blades and combustors that require a special manufacture process. The site safety and coordination of the team especially with the sensitive heavy lift conduct on the turbine is a success key

Objectives:

The purpose of this research is to formulate a Guide for the main activities that are required to execute the gas turbine outage and overhaul and identify the main technical points of concern. Conducting all Turbine & Generator repair and refurbishment works during the outage.

TECHNICAL SPECIFICATION OF SERVICES

The Services shall consist of the following parts:

1. Planning and Outage organization

2. Field Services at the Power Generating Plant.
3. Shop services at the Contractor's repair facilities

Planning and Outage organization

Providing all reasonable planning and pre-inspection arrangements to ensure the success of the works includes

- Coordination with Production for shutdown time.
- Loads planning with other turbines on service.
- Spare Parts study ordering and refurbishment.
- Arranging all previous reports and Original Equipment Manufacturer catalog & bulletins.
- Organizing the required equipment and Special heavy lift plan.
- Preparation and calibration of all special tools.
- Arranging all required scaffolding and special arrangements.
- Preparation of detailed safety Job plan.
- Prepare Final commissioning and assist in starting up.
- Checking all Gas Turbine Auxiliary system's functionality and operation.
- Confirm The Control & DCS system is perfectly operating
- Confirm that Synchronization and Switchgear are in good Function condition to the overhauled turbine.

Shop services at the Contractor's repair facilities

Refurbishments

Combustor baskets

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Replace spacer bands
- Special Coating

Transitions

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Replace spacer blocks
- Special Coating

Clamshells,

- Blast Cleaning
- NDT Inspection

- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Special Coating

Fuel nozzles

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Flow testing and calibration
- Special Coating

Vane segments

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Barrel Polish
- Special Coating
- Airflow testing

Ring segments

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Barrel Polish
- Special Coating

Turbine blades

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Barrel Polish
- Special Coating
- Air flow testing
- Moment weight & chart balance

Turbine blade

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Special Coating

Turbine, Generator & Exciter bearing

- Blast cleaning
- visual inspection
- Repair Babbitt indication
- white metal casting
- Assembly and Final inspection

Compressor diaphragms

- Blast Cleaning
- Inspection
- Erosion corrosion removal
- Repair diaphragm Nozzles
- Re-shape of diaphragm halves to geometry

Compressor blades

- Blast Cleaning
- NDT Inspection
- Cracks Tracking and Identification
- Special welding
- Replace spring clip
- Barrel Polish
- Special Coating
- Air flow testing
- Moment weight & chart balance

Field Services at the Power Generating Plant.

Combustor Inspection

Elimination of any component that may be accessed without requiring a cover lift from the compressor and turbine end. The parts should be carefully cleaned and inspected in compliance with the relevant service bulletin instructions. Inspections of non-removable components must be done in-place using a cover lift. Perform visual inspections of the turbine row-1 vanes, the compressor intake guide vanes (IGVs), the compressor row-I blades, and the compressor last-row outlet guide vanes (OGVs) while the turbine blades are still in the turbine.

Hot Gas Path Inspection

In addition to the lifting of the torque tube housing covers, compressor-combustor cylinder, and inlet compressor, gas turbine inspections also involve the turbine section (also known as the hot path examination). The diaphragms of the compressors must be taken out, cleaned, and examined. inspecting and cleaning the compressor discs and blades while they are in use. Inspections must also be done on the compressor, turbine bearings, and bearing seals. inspecting and replacing the interstage, static, and torque-tube seals as needed. The bearing housings for the exhaust, the exhaust section liner, and bearings

1. Major Inspection

In addition to the lifting of the torque tube housing covers, compressor-combustor cylinder, and inlet compressor, gas turbine inspections also involve the turbine section (also known as the hot path examination). The diaphragms of the compressors must be taken out, cleaned, and examined. inspecting and cleaning the compressor discs and blades while they are in use. Inspections must also be done on the compressor, turbine bearings, and bearing seals. Examine and replace the inter-stage, static, and torque-tube seals as needed. Cleaning, inspection, and crack repair are required for the exhaust section lining, exhaust bearing housings, and exhaust bearing housing supports. The extent of work will vary according on the type of inspection, whether the rotor is being removed or examined in-place.

GENERATOR AND GENERATOR ROTOR

Checking the generator, exciter, and AVR. After the maintenance is finished, the exciter and starting package must be removed and the generator rotor must be placed on the rotor stand the company provides, directly behind the generator body. Other tasks include disconnecting from the gas turbine, removing the end covers and bearing seals, removing the main bearings of the generator, and reinstalling the exciter and starting package into the stator. Perform routine testing and inspections of the PMG, exciter, and main generator rotor edges

Make sure to inspect the stator winding slots, punching, bore rings, end seals, and core bolts thoroughly. Use the tap test to see if the slot wedges are snug or loose. If required, replace the packaging and any loose wedges. changing gaskets, applying insulating resin or varnish, and After the generator body, position the generator rotor on the steel frame. Examine the rotor; removing the retaining rings may be necessary to determine the quality of the insulation. NDT the Ultrasonic Retaining Rings Put the retaining rings back on. If necessary, swap out the retaining rings

Test the stator Polarization Index. Conduct a Dielectric Discharge test on the stator. Perform a Step Voltage test on the stator. Measure DC Resistance in the Stator Phase Test Determine the Stator's Insulation Resistance Using Bolts Calculate the Insulation Resistance of Bearing Pads El Cid's Core Lamination Test RTD Calibration of Stators Insulation Resistance of Stator RID Test for Over Potential, Leakage Voltage, and Stator DC Dielectric Absorption Analysis of Stator Winding Slot Discharge Test Calculate the Resistance of the Stator Winding. Conduct a Polarization Index Test and measure the Stator Insulation Resistance. Quantify the DC Resistance of the Rotor Quantify the Unbalanced Rotor Pole Quantify the Impedance of the Rotor Calculate the Insulation Resistance of the Rotor

Conclusion

The Gas Turbine services is a techno-commercial exercise that requires the identification of the exact services and planning the spare parts and resources utilized in a manner that achieves the highest level of performance and decrease of down time and minimize expenditure.

The refurbishment of spare parts saves time and money and the identification of exact refurbishment and examining the spares fro reuse through refurbishment is a win factor for any Gas turbine service.

The Service graduate from combustion inspection to hot gas path inspection and finally major overhaul.

The Major overhaul will include both Gas Turbine and generator testing.

The findings and extra works are a determinate factor and it is recommended to proceed with research for quantifying such findings and the methods of handling it.

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