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Abstract

This document provides a detailed description of the technical specifications and the current condition of a GE Frame 5001P gas turbine, serial number SN 281896.

The unit, with a rated power output of 24,100 kW, is presented together with relevant operational data, maintenance history, and supporting documentation in order to provide a comprehensive overview of its present state and suitability for continued service or transfer.

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1. Introduction

This document provides an overview of the main technical and operational characteristics of a gas turbine currently available for transfer, as well as its present condition.

The opportunity specifically concerns:

- a complete gas turbine, liquid-fuel fired, including all auxiliary systems

The report therefore includes:

- key technical data of the unit,
- a summary of maintenance activities and current condition,
- supporting documentation (certificates, test reports, and manuals), aimed at assessing the full availability of the plant for transfer and commissioning at a new site.

2. Main data

GT 1	
Manufacturer	General Electric
Model	*GE Frame 5001P*
SN	*281896*
Nominal power	*24.1 MW*
Commisioning	1981
Decommisioning	2023
Speed (rpm)	5100
Generator	
Manufacturer	General Electric
Model	P5AZ
SN	447309
Alternator type	Syncrono
Power (MVA)	30.4
Voltage Generation (Kv)	11.5
Nominal stator current (A)	1526
Frequency (Hz)	50
Operating speed (rpm)	3000
Full load cooling	Air
Power factor	0.85
Control	
Type	Mark II

Table 1 Main Data

3. Operating hours

Detailed operating hours since 1981

	TG	
	N° Couplings	Cumulative hours
Tot	8378	69156

Table 2 Operation hours

4. Maintenance

4.1 Major inspection May 2005

Operational Data at the Time of the Intervention

- Total operating hours: 18,892 h
- Total starts: 7,859 (of which 4,054 were hot starts)
- Emergency shutdowns: 422

Maintenance Activities Performed:
The major inspection focused on the turbine, compressor, and combustion system.

Combustion Section:
- All liners, crossfire tubes, retainers, fuel nozzles, and transition pieces were replaced to ensure optimal performance and prevent failures due to wear or thermal fatigue.

Turbine Section:
- First- and second-stage turbine blades (buckets) were replaced due to erosion and foreign object damage (FOD).
- First- and second-stage nozzles were replaced to address cracking and erosion issues.
- Shrouds for both stages were replaced due to wear.

Compressor Section:
- First-stage stator ring (R0) replaced because of excessive clearance.
- Stator clearances adjusted with new shims.
- Comprehensive cleaning and non-destructive testing (NDT) performed on rotor and stator components.

Inlet Guide Vanes (IGV):
- Bushings, thrust washers, and elastic washers were replaced.
- Clearances and backlash were checked after installation.

Bearings and Couplings:
- Main bearings (radial and thrust) were replaced.
- Axial and radial clearances were measured and verified.

Other Relevant Works:
- **Starting system:** torque converter repaired, hydraulic cylinders and bearings replaced.
- **Liquid fuel system:** new piping, filters, and pumps installed.

- **Lubrication system:** filters replaced, pumps overhauled, leaks repaired.
- **Cooling system:** heat exchangers and thermostatic valves replaced.
- **Air intake system:** sandblasted, repaired, and repainted.
- **Exhaust stack and plenum:** welded repairs and new insulation applied.
- **Platforms, roof, and panels:** replaced or restored due to severe corrosion.

4.2 Combustion Inspection October 2018

Operational Data at the Time of the Intervention:

- Total operating hours: 23,383 h
- Total starts: 8,725
- Emergency shutdowns: 467

Key Activities Performed:

- Complete disassembly of the combustion chamber, transition pieces, and turbine/compressor casing.
- Installation of new shims in the CDC casing due to migration of old ones.
- Inspection of IGVs in accordance with TIL 1068.
- Installation of 10 new retainers (the remaining 10 were inspected with NDT based on customer decision).
- Replacement of liners, crossfire tubes, fuel nozzles, and transition pieces.
- Replacement of the bleed valve gasket (component itself not replaced).
- Minor repairs: cracks on the compressor casing, misaligned seals on turbine shrouds.

4.3 Residual Life Assesmssment (RLA) April 2023

Objective and Scope of Inspection:

- Assess the structural integrity of the rotor and critical areas subject to thermal stress and Low Cycle Fatigue (LCF), specifically:
    - Interface between the Distance Piece and the first-stage turbine wheel.
    - Interface between the first and second-stage turbine wheels.

Inspection Techniques Used:

- Visual inspection
- Measurement of blade platform clearances
- Hardness testing (Brinell)
- Phased array ultrasonic testing (PAUT)
- Supplementary non-destructive inspections (Eddy Current Inspection, ECI)

Main Findings:

- General mechanical condition was good, but the following issues were identified:
    - Visible corrosion on the dovetail of the first-stage turbine wheel.
    - Oxidation and corrosion on first- and second-stage blades and nozzles due to liquid fuel usage.
    - Minor porosity/pitting observed on rotor flanges and components.

Ultrasonic Testing (PAUT):

- **First-stage turbine wheel:**
  - Repetitive linear anomalies detected between the first-stage wheel and Distance Piece, near bolt holes.
  - Estimated depth > 0.10"
  - UT signal amplitude: 80%–200% of screen
  - **Recommendation:** Immediate removal of rotor from service for detailed workshop evaluation.
- **Second-stage turbine wheel:** No significant anomalies detected.

Hardness (Brinell) Measurements:
- First-stage wheel: 274–301 HB → material integrity confirmed.
- Second-stage wheel: partial measurements up to 274 HB.

Blade Platform Clearances:
- Measurements with installed blades were within limits, but it is recommended to measure with blades removed to verify locking and retention pin condition.

4.4 Conclusions

- The structural condition of the rotor is compromised due to PAUT indications in critical areas (rabbets).
- Immediate removal from service is strongly recommended.
- Further detailed inspections and analyses in the workshop are required before returning the rotor to operation.
- Continued operation could result in severe structural risks.

5. General conditions

The plant is in overall sufficient condition and had operated regularly until 2023. Its continuous operation until that year demonstrates that the main systems were functioning correctly and that the plant maintained an acceptable level of efficiency. However, the general condition of the equipment shows significant signs of corrosion, particularly on exposed surfaces and structural components. Since 2023, the machine has remained open and has not been properly preserved.

5.1 Main Tranformer

Figure 1 Main Transformer

5.2 Exciter transformer

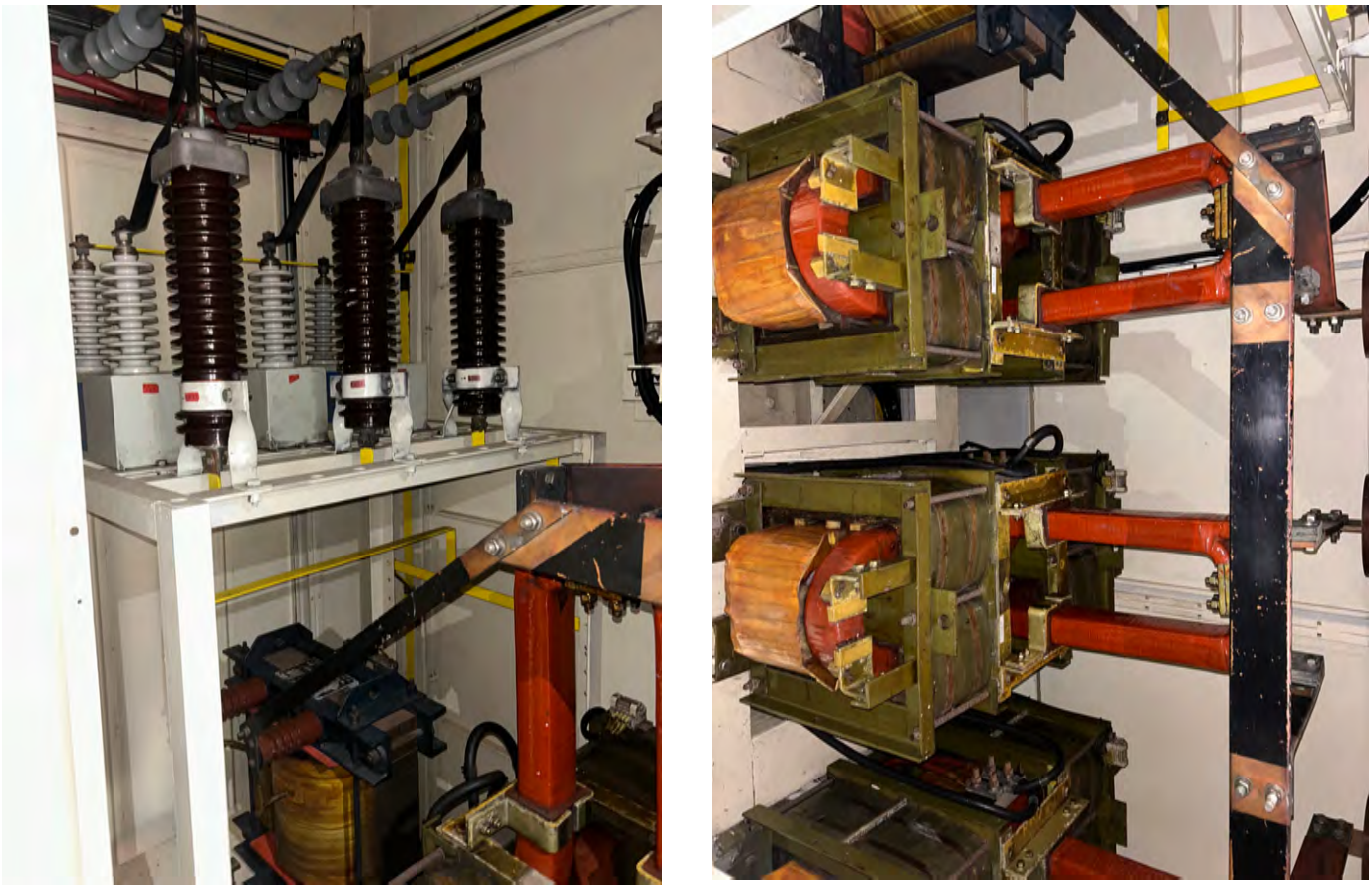

Figure 2 Exciter transformer

5.3 Combustion Chamber

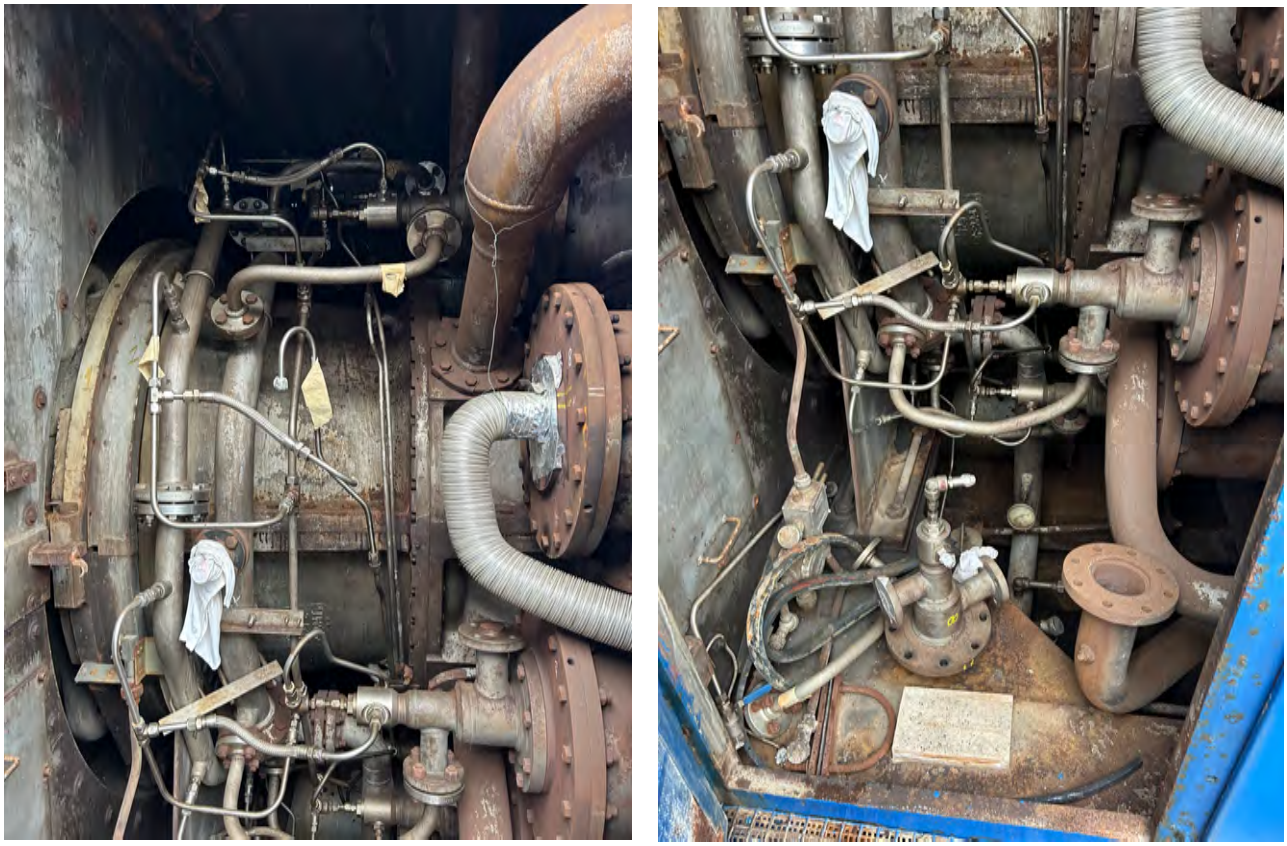

Figure 3Combustion chamber

5.4 Start Engine

Figure 4 Start engine

5.5 Reduction gearbox

Figure 5 Reduction gearbox

5.6 Generator

Figure 6 Generator

5.7 Exciter

Figure 7 Exciter

5.8 MCC and control cabinet

Figure 8 MCC and control system

5.9 Diesel pump system

Figure 9 Diesel pump system