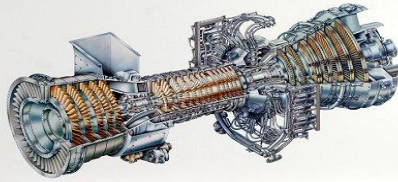


D & S Turbine International LLC



INDUSTRIAL POWER GENERATION EQUIPMENT

Typhoon SGT-100 – 4.9 MW / 5340 KVA 50Hz 11KV Dual Fuel Power Station



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INTRODUCTION

The Siemens SGT-100 single-shaft industrial gas turbine (formerly known as the Typhoon), is a proven unit for all electrical power generation and cogeneration applications.

This SGT-100 package is installed with a Dry Low Emission (DLE) combustion system, providing extremely low NOx levels with gas and liquid fuels. Furthermore, the turbine can operate either on gas or liquid, and can automatic changeover from primary to secondary fuel at any load (Dual Fuel).

The package was installed in 1998 and is in a very good condition and has only operated 14000hrs.

EQUIPMENT OVERVIEW

The SGT-100 package is a complete unit, capable of generating up to 4.9 MW ISO continuous at 50 Hertz.

The generator set package is very compact, providing a small footprint and high power-to-weight ratio. The package is easily transported, installed and maintained at site.

One (1) complete skid mounted package incorporating:

- Proven reliability
- Natural Gas - Liquid Fuel (Dual Fuel)
- Dry Low Emission (DLE) Combustion System
- Generator 4.9 MW, 5340 KVA 50HZ, 11KV
- Robust design operational in extreme climatic conditions
- Acoustic treatment
- Inlet air filter house
- Acoustic enclosure
- Exhaust stack and silencer
- Oil cooler skit
- Fuel forwarding skid
- Turbine control system (not skid mounted)
- Gas compressor



EQUIPMENT HISTORY:

- Manufacture year 1997 (cogeneration plant)
- The equipment was installed in 1998 as a cogeneration plant and was only in continuous operation for one year.
- The equipment was shut down and isolated in 1999
- In 2007 the equipment was taken into service as a Standby Power Plant and has proven its liability until 2010

Service

The equipment has been fully serviced by "Hans Kjellerup", a Siemens Certified Service Center and in 2007 the main and pilot burners were changed.

- Operating hours, package 14000 hrs
- Operating hours, gas generator and PT 14000 hrs

The SGT-100 Turbine engine core will be fully overhauled according to OEM specifications, before delivering to the new customer.

For information, the rotating elements are anticipated to operate for another full overhaul cycle, under normal operating conditions, depending upon service schedules being carried out at the appropriate time, conditions of fuel, and environment and ongoing maintenance.

TECHNICAL AND PERFORMANCE FEATURES OF THE SGT-100 TYPHOON POWER STATION

SGT-100 CONFIGURATION

Turbine Engine Core

Model Typhoon (6664 BHP ISO Base Load rating on gas fuel), single shaft, heavy duty industrial gas turbine complete with:

- Air inlet casing phased upwards air inlet flexible joint
- Gas generator assembly
- Dry Low Emission combustion chambers
- Combustor assembly incorporating 6 combustion chambers
- Exhaust outlet casing phased vertically upwards
- Exhaust outlet flexible joint

Underbase

- Turbine underbase of fabricated carbon steel construction, incorporates mounting points for all the turbine support systems
- Turbine mounting, allowing thermal expansion
- Retractable lifting tubes to facilitate heavy lift handling
- Lubricating oil tank integral to underbase
- Torque reaction between the turbine/gearbox and the generator are transmitted from the fabrication to the foundation through the multiple mounting pads and foundation bolting

Acoustic Enclosure

The turbine acoustic enclosure is provided over the turbine and gearbox and bolted to the turbine underbase. The enclosure reduces noise level from the machinery to a maximum of 80dB (A) SPL at 1 m distance measured at 1.2 m above ground level.

Enclosure incorporating:

- Internal lighting steel construction
- Access doors for personnel maintenance access
- Removable panels for maintenance access
- Acoustic enclosure ventilation inlet damper
- Acoustic enclosure ventilation outlet damper
- Acoustic enclosure ventilation air flow detector
- Acoustic enclosure ventilation system

Ventilation

- AC electric motor-driven ventilation outlet fan to Zone 2 classification, duct-mounted (Ex 'd' type)
- Pod type outlet silencer
- High efficiency pad type air filter
- Filter housing
- Ducting from turbine enclosure to filter house

Combustion Air Inlet System

Combustion air inlet filter system, for average sound attenuation to 80dB (A) SPL at 1 m distance measured at 1.2 m above ground level.

Combustion air inlet filter housing incorporating:

- High efficiency, single stage, pulse clean type
- Splitter type silencer
- Compensator and steel spacer from turbine to inlet compartment
- Filter housing
- Ducting from turbine enclosure to filter house

SGT-100 CONFIGURATION

Combustion Exhaust System

The exhaust system was rebuilt in 2007 to meet standby operational conditions. New ducting and silencer from turbine enclosure and to the exhaust stack was mounted, for average sound attenuation to 80dB (A) SPL at 1m distance measured at 1.2m above ground level.

Combustion exhaust system incorporating:

- Exhaust diffuser with flexible joint and transition ducting to enclosure roof.
- Silencer and support structure for an overall 80dB (A) rating
- Silencer mounting allowing for thermal expansion
- Compensator and steel spacer
- Exhaust stack 30 m (foundation necessary and not included)
- Ducting from turbine enclosure to exhaust stack

Lubricating Oil System

- Integral lubricating oil system, including all pipe work, serving the gas turbine, gearbox and AC generator unit
- Lubricating oil tank integral to underbase
- Lube oil pressure and temperature transmitters
- Main pump, gearbox-driven
- Auxiliary pump, AC electric motor driven (pre start and post shutdown lubrication)
- Emergency pump, DC electric motor driven (emergency cooling)
- Lubricating oil supply piping in stainless steel downstream of filters
- Duplex filters with manual changeover valve; differential pressure gauge and differential pressure transmitter
- Lubricating oil pressure gauge and transmitter oil tank temperature transmitter
- Oil tank level gauge
- Oil tank low oil level transmitter

Lubricating Oil Cooler

- Plate type water cooled oil cooler, suitable for high ambient temperature range



Lubricating Oil Breather

- Oil mist eliminator
- Lube oil breather piping external vent
- Stainless steel flame trap for mounting in the external breather piping

Starting System

- The starter system comprises of an AC motor driven main and boost hydraulic transmission pump assembly mounted in the underbase which via a hydraulic circuit drives the gearbox mounted hydraulic motor

Ignition System

- The ignition system comprises of a high energy spark generator mounted in the underbase and a retractable igniter assembly mounted on the centre casing with its igniter probe extendable into one flame tube. The units are connected with high tension leads enclosed in an armored conduit

SGT-100 CONFIGURATION

Gearbox and Coupling

- Direct coupled epicyclic type gearbox manufactured by Allen Gears giving an output shaft speed of 1,500 RPM.
- Low maintenance output coupling between gearbox and AC generator.

Gas Fuel System Only

- Gas fuel piping in stainless steel
- Off skid Block and vent valve
- Gas block valve, shutoff valve, emergency, rapid acting
- Gas regulator valve
- Gas throttle valve
- Gas fuel pressure relief valve
- Gas fuel pressure transmitter
- Gas fuel shutoff valve, manually operated

Liquid Fuel System Only

- Liquid fuel piping in stainless steel
- Block and thermal relief valve
- Duplex fuel filter permitting on line duty filter replacement, off skid
- AC motor driven liquid fuel pump
- Liquid throttle valve
- Solenoid-operated fuel shut-off valve
- Manual emergency shut-off valve

Dual Fuel Capability

- Changeover from one fuel to the other is automatic during operation and is initiated by pressing the appropriate push button
- Provision is also made for when the engine is running on gas, for an automatic changeover to liquid fuel, if the supply gas pressure falls below a site determined figure

Fire Protection and Gas Detection System

The acoustic enclosure is provided with a fire and gas detection, and a fire extinguishant system to protect the installation should a gas leak or fire be detected.

- Detection, operation and surveillance are operated by the control panel
- Two ultra-violet flame detectors in the turbine section
- One heat detector mounted in the enclosure

- Two gas detectors, installed at the enclosure vent outlet
- A single fire extinguishant CO2 bottle is positioned off skid
- Automatic extinguisher release and visible alarms

Turbine Compressor Cleaning System

- Cold turbine compressor wash system
- Mobile wash trolley, incorporating cleaning fluid/rinse tank fitted with integral pressure relief valve, air pressure control solenoid valve, air/ wash fluid flexible hose with quick release connections, and electrical cable
- Drain system incorporating automatic drain valve
- Pressure transmitter to monitor intermediate stage blow-off valves closing air pressure

AC Generator

- Brushless AC generator, voltage 11KV and frequency to 50Hz, to sound attenuation of 85dB (A)
- Generator cooling, duct ventilated design, air being ducted through an inlet filter into the generator casing and extracted from the casing by a boost fan mounted in the exit ducting
- Generator bearing temperature detectors
- Class F insulation / F total temperatures
- AC generator lube oil system provided by the gas turbine
- Underbase of fabricated steel construction
- Generator alignment jacking screws.
- The generator is suitable for a non-hazardous area

Data:

- Generator Manufacture GEC/Alstom
- Type Brushless 4-pole
- Rating 5340 KVA
- Voltage 11KV
- Frequency 50Hz
- Shaft speed 1500rpm

Drain System

Drain system incorporating:

- Off skid drain tank in stainless steel
- Drain tank high level transmitter
- Pipe work from turbine to drain tank in stainless steel

SGT-100 CONFIGURATION

HV Generator Circuit Breaker (New)

- 630A 11KV Generator breaker and outgoing feeder

Generator Control Panel (New)

- Automatic voltage regulator and generator protection according to local grid code.
- Automatic or manual synchronizing
- Electrical power production meter

Motor Control Centre (New)

- Motor control center for supply to AC and DC motors and solenoids

DC System/Batteries (New)

- UPS is running online with "double conversion" technology with the following operation:
AC input is filtered and then converted into DC that is used to recharge the batteries.
Should a power failure occur on the AC system, the UPS design maintains emergency DC-power to the DC-controller that controls the turbine DC supply
- Batteries 150 AH and 120 AH. Maintenance free batteries are mounted within a carbon steel battery storage cabinet located externally adjacent to control room

PLC Control system/Sequencer (New)

New PLC system of Siemens or Alan Bradley origin with local I/O chassis

- PLC controller for sequencing and turbine control and supervision
- Overspeed protection unit
- Emergency stop relay
- Industrial Ethernet switch
- Watchdog relay
- Hours run indicator
- Fired starts counter
- Operator control panel
- Fault monitoring
- Temperature monitoring
- Turbine casing vibration monitoring
- Turbine gearbox casing vibration monitoring
- Driven unit vibration monitoring
- Driven unit bearing temperature monitoring
- English language on front panels

- 20" monitor, SCADA system

- Remote control and troubleshooting via VPN router (requires access to internet)

Electrical Equipment

- Integral earth protection bonding
- Emergency 'Stop' push-buttons externally mounted on turbine under base
- Local stop push-buttons on turbine AC motors

Instrumentation

- Air inlet temperature thermocouples
- Exhaust outlet and power turbine exit temperature thermocouples
- Gas generator speed probe
- Power turbine speed probe
- Mechanical overspeed protection trip
- Casing mounted seismic sensor to turbine, gearbox and driven unit

Warranty

The Contractor shall be liable for defects in the goods in accordance with the contract conditions for a period of 12 months from first use.

OPTIONS

Options for SGT-100 Configuration

Redundant GCP:

- Redundant AVR and generator protection system

For compliance with local grid code:

- Grid Code compliance UCTE/ENTSO-E
- Block diagrams and dynamic system documentation according to IEEE Specification



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