Scope of Supply, Options and Exclusions

# Scope of Supply

Supply of One (1) SGT-300 trailer-mounted Gas Turbine Generator Packages with 4-Pole AC Generators for onshore mobile power application. Description in this section is given for one (1) package, unless explicitly stated all components are one set per package.

## Gas Turbine Engine

* + - SGT-300 Gas Turbine
    - Single-shaft arranged for cold-end drive
    - Gas fuel configuration
    - Dry Low Emissions (DLE) gas fuel combustion system

## AC Generator

* + - AC Generator in accordance with NEMA MG-1
    - Output 8533 kVA (357 A Current) at ambient
    - 13.8kV, 60Hz
    - 0.9 Power Factor, 4-Pole, 1800 rpm
    - ODP enclosure (IP-21 protection)
    - Class F insulation with Class F temp. rise limit.
    - Allowable Ambient Temp -20C to +50C
    - Class 1 Division 2 Group D T3 compliant
    - Shaft locking mechanism while transportation
    - Main Generator Terminal Box consists - Insulators, Busbars as well Support clamp
    - Neutral side Terminal box consists: 1x AVR CT, 3xMetering CTs, 3xProtection CTs, 1xECT and Start point Busbar with Insulators

## Gearbox

* + - Epicyclic reduction gearbox
    - High speed side flanged mounted onto gas turbine
    - Rated Power 10,000 KW, output – 1800 RPM
    - Attachments for main gear driven lube oil pump and starter motor

## Coupling and Guards

* + - Coupling guard - low speed – gearbox to generator
    - Drive coupling – flexible element dry type

## Monocoque / Dolly

* + - Complete GTG unit comprises one monocoque/structural frame mounted to 6 axle dolly,
    - 3+3 air ride single point articulating, low-profile double drop dolly.
    - Auto Leveling hydraulic jacks for unit leveling
    - No lifting equipment required for installation
    - RigMat provided for load distribution

## Combustion Air Inlet System

* + - Static clean filter house
    - Weather Louver, Filter Element and Frames
    - Silencer and ducting integrated in the combustion module
    - Standard grade (G4 and F9) Combustion air inlet pre-filters and filters with option for an HEPA ratings (F7 and E12)
    - Inlet Gas detectors included in the inlet system

## Combustion Exhaust System

* + - Exhaust collector and extension duct to enclosure wall, with thermal insulation.
    - Exhaust collector orientation: Axial
    - Exhaust transition duct and expansion joint
    - Internal baffling for noise suppression.

## Gas Turbine Enclosure

* + - Enclosure for weather and noise protection equipped with ventilation and lighting.
    - Maintenance openings and internal grating for service.

## Ventilation for Gas Turbine Enclosure

* + - Two (2) x 50% duty -ventilation fan, Class 1 Div 2 rated
    - Retention Damper, Silencer baffles, and ducting integrated

## Fire and Gas Detection System

* + - Multispectral infrared flame detectors for fire detection
    - Heat detectors
    - Point type infrared hydrocarbon Gas Detector’s at the combustion air intake (calibrated for methane.)
    - Point type infrared hydrocarbon Gas Detector’s at the turbine enclosure ventilation outlet (calibrated for methane.)

## Fire Extinguishing System

* + - 1 x 100% fire suppression system uses Hydrofluorocarbons
    - System distribution pipework and valves inside enclosure.
    - Manual release button located outside of enclosure (optional).
    - Audible and visible alarms.
    - System disabled function for transport

## Gas Fuel System

* + - Fast acting block and vent valve.
    - Gas fuel metering valve(s) with fast acting shut-off function.
    - Pressure and temperature sensors
    - Materials of construction: 316/L stainless steel piping, tubing and fittings

## Washing and Cleaning System

* + - Non-pressurized tank with capability to mix water and detergent.
    - One (1) mobile water wash cart per contract
    - Crank soak wash cleaning system

## Lubricating Oil system

* + - Common lube oil system for gas turbine, gearbox and generator.
    - Main pump – Gearbox driven
    - Auxiliary pump – AC Motor driven
    - Duplex lube oil filter
    - Temperature and pressure control valves
    - Bar-Plate lube oil cooler
    - Carbon steel reservoir instegrated into the structure
    - Submerged oil heating
    - ISO-VG 46 oil
    - Materials of construction: 316/L stainless steel piping, tubing and fittings.

## Starting System

* + - Onboard Hydraulic start system (powered by black-start generator)

oAC electric Starter motor oHydraulic pump oHydraulic Motor

## Instrument Air System

* + - Instrument air system comprises air compressor, dryer arrangement to supply all package air requirements
    - Compressor – 15 HP, 55CFM output at 125 psi rated
    - Dryer - Inlet/Outlet connections: 1-1/2" NPT-F, Filtration: Dual (3 micron) pre-filter pads & 10-micron post filter, Operating pressure (Min./Max.): 90 psig to 190 psig
    - Provision of a bypass air supply connections to utilize the local air system

## Electrical & Control system

### Local Electrical room (Power Control Room)

* + - Moduel is mounted on the Trailer, consisting of:

### Switchgear

* + - Siemens Medium Voltage 13.8 kV Switchgear
    - Hermetically welded enclosure, suitable for Indoor
    - 600A at 50 Deg C, 31.5kA, 15kV, Arc Resistance
    - Switchgear consists of Manual disconnect switch, 3xGen side PTs with dual secondary, 3xProtection

CTs, 3xLighting arrestors, 1xZero sequence CT, 3xFuse for 225kVA Transformer, 2xOpen Delta PTs on Load side for Synch,

* + - Arc Flash Monitoring Device with SEL-751A Protection Relay, Arc vent is on the front side
    - SWGR has arc monitoring by fiber eye and it is connected to protection Relay.

### MCC

* + - MCC is 480V, 600A with RVSS for starter motor.
    - LV Power meter and display on GT HMI
    - Phase sequence check Relay to verify before changeover to internal power.
    - Hand-Off-Auto Switch selection for easy maintenance
    - Auto changeover from BSG to internal power

Design wire duct between MCC and UCP to avoid lot of cables, so it will be internal panel wiring between two panels.

### MV Neutral Grounding System

* + - MV NGR connected at the 13.8kV Generator Neutral side Star point and this monitors Neutral Continuity and Ground fault
    - 8kV, 160Ohms, 50A for 6Sec, 110BIL, with Coupling Device
    - Ground CT - This can monitor Neutral continuity as well Ground fault

### LV Neutral Grounding System

* + - LV NGR is connected at the 480V side star point of 225kVA Aux transformer.
    - This will monitor Neutral Continuity and Ground fault
    - 600V, 55.4 Ohms, 10A continuous rating , with Coupling Device and Ground CT

### MV and LV Coupler

* + - MV Coupler: 15kV, Male on Trailer side
    - LV Coupler: (Black Start Generator): 480V, 400A, Male on Trailer side

### Auxiliary Transformer

* + - 13,800V:480V, 225kVA, 52A, Delta/Wye,
    - Consist of: RTD mounted inside MV middle phase winding to monitor winding temperature
    - Conduit installed inside Transformer to pass through the Generator ground cable for MV NGR.

### LV Transformer, Distribution Panel

* + - Transformer for 120-240V supply, 25kVA, 480:120-240V, 2 phase.
    - 100A, 18 circuit LV distribution board for 120-240V loads

### Battery Charger System

* + - Charger is 240V, 100A, 24V DC, 400AH
    - All interlocks with PLC, DC LO motor starter, DC distribution for whole skid
    - Batteries are mounted under MCC with draw out tray for easy maintenance

### Customer Interface Junction box, JB-C

* + - JB-C has all options for customer connections, Including control and communication signals
    - Customer can Open/Close SWGR, E- Stop, Volt, Freq, Raise/Lower etc. can be done on hardwire also.
    - Off skid Gas fuel skid plug to connector J3.
    - Analog signals has separate connector
    - Drain plug in stalled on bottom for any condensation.
    - Fixed hinged Door design for more secure during transportation

### Unit Controls Panel (UCP)

* + - Siemens PCS 7 micro-processor-based control, supervision and protection system onboard HMI.
    - Onboard human-machine interface (HMI) is mounted on UCP. Operator can operate the Unit from it.
    - Gas turbine speed and temperature control.
    - Vibration monitoring, PLC and Relay controls are inside UCP
    - Emergency stop only local control function.
    - Fire & Gas Controller also mounted in UCP.
    - Ethernet used for customer communication protocol
    - Indication lamps, E-stop also mounted on door.

### Generator Control Panel (GCP) with AVR

* + - GCP has all different options for Bus breaker, Grid breaker, indications. Interlocks with switchgear
    - Accept customer hard wire signals for Synch initiate.
    - Auto/ Manual Synchronization can be done easily.
    - MV & LV NGR monitor controllers are installed inside GCP, which will initiate the alarm to GT PLC in the scenario when Ground continuity breaks or ground fault.
    - Load share controller is inside GCP Automatic Voltage Controller (AVR) excitation control system
    - Generator protection relay
    - Automatic & manual synchronizing with other MPUs
    - Equal reactive power sharing with paralleled units through load sharing lines or CANBUS links between each GCP’s
    - Panel front controls and instrumentation
    - Dead bus closure of Generator Circuit Breaker (GCB) functionality
    - Remote control functionality through hardwired signals
    - Power monitoring
    - Interface for Power Management system

## Overall Package

* + - Single skid trailer structure with Gas turbine, Gearbox, Generator and other auxiliary systems
    - Package dimensions – 63 ft Length x 8.6 ft Width x 13.9 ft Height
    - Weight without tractor ~168,000 lbs.
    - Plug and play Power plant solution for 7.9 MW at ISO

## Factory Testing

### Gas Turbine Testing

* Gas Generator tested per Siemens’ Standard test procedure.

### Driven Equipment Testing

* Standard vendor testing for Gearbox.
* Standard vendor testing for AC Generator.

## Spares

* One set of commissioning and start-up spare parts per contract

## Installation and commissioning services

* Installation and commissioning offered on a daily rate basis.

## Customer Documentation

* Documentation in accordance with Fenek Industrial Machines and Equipments FZE standard
* Electronic Operation and Maintenance manual as Built delivery.

## Quality Assurance

* Inspection and Test Plan, QA and Certification in accordance with Fenek Industrial Machines and Equipments FZE standard

## Packing

* Packing and preservation to suit destination and transport method

# Design Basis

|  |  |
| --- | --- |
| **Variable** | **Value** |
| Minimum outdoor temperature | -4 ºF (-20 ºC) |
| Maximum outdoor temperature | 122 ºF (+50 ºC) |
| Altitude (Above Sea Level) | 0 – 6000 ft |
| Package location | Outdoor |
| Seismic loads | 0.5g accelerations in 2 directions simultaneously |
| Transport loads | 2 g accelerations, vertical only |
| Wind speed | 40 m/s 3s gust |
| Noise level (near field, normal operation) | 92 dBA average free-field weighted noise level or less at distance of 1.0 M (3 ft) from side of unit at elevation of  1.5 M (5 ft) above grade |
| Hazardous area classification: | Safe Area |
| Electrical Utility (for black-start) | 480V/3Ph/60Hz |

1. **Exclusions**

Fenek Industrial Machines and Equipments FZE does not accept any responsibility for items that are outside its scope of supply. The following items are specifically excluded from this proposal:

* Anything not specifically listed in the scope of supply
* Full load unit string test.
* Civil engineering design of any kind
* Building and civil works
* Installation of gas turbine generator set package.
* Site facilities
* Drains and/or vent piping from the gas turbine package to a remote point
* Fuel supply, storage and treatment other than specifically listed
* Natural gas fuel booster compressors
* Unitization of drawings
* Off-package gas fuel piping, filtering, coalescing, etc.
* Interconnecting piping between the gas turbine generator package for the natural gas fuel supply prepared for cold weather operations
* Trace heating of gas fuel piping
* Acoustic enclosure integrity test to check CO2 retention
* Site grounding
* Lightning protection
* Off-package site electric cabling
* Interconnecting control cables between the gas turbine generator package and site control room
* Emergency DC Lighting
* Emissions monitoring equipment
* Shipping to site
* Maintenance contract
* Maintenance Equipment
* Access Service Platforms for field servicing of Genset
* Training
* Special tools