SGT-400 12.9MW MOBILE GAS TURBINE GENERATOR PACKAGE

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1.0 SGT-400 Mobile Scope of Supply

1.1 Driven Unit

**Generator**
- 1800 RPM, Converteam Brushless AC Generator
- 12.9MW, 13.8kV, 3 phase, 4 pole, 60Hz, 0.8 power factor, salient pole
- 14015 kVA / 11212 kW
- Class F insulation, Class B temp rise
- TEAAC Generator cooling system
- NEMA 4 terminal boxes
- Onshore 2-coat paint system
- Pfisterer MV connectors

Certifications:
- Non-Hazardous, Safe Area rated
- IEC 60034

**Design Criteria:**
- VPI Stator
- Damper Windings
- Six (6) Leads for differential protection
- (1) Shaft bearing to be insulated
- (2) 100 ohm, Platinum Bearing RTD’s
- 2 x grounding pads
- Space heaters
- Brushless exciter with space heater
- Auxiliary box

**Line box with:**
- Earthing and grounding clamps
- (3) D/P CT’s
- (3) Generator protection CT’s
- (1) Cross current CT (AVR)
- (1) Neutral CT after the star point

**Standard Documentation:**
- General arrangement drawings
- Main Terminal box drawings
- Rotor drawings
- Critical speed figures
- Electrical schematics
- Equipment datasheets & Curves
- Test procedure & Certificate
- O & M Manuals (English language, 1set)
- 20 year Maintenance schedule
- Spares lists
1.2 Gas Turbine Package

**Dual Fuel Gas Turbine Engine**

- Core Engine – twin shaft design
- Nominal rating 12.9MWe
- Dry Low Emissions (DLE)
- 11 Stage, axial flow compressor (16.7:1)
- Variable Guide Vanes and stators
- (6) Reverse flow, combustion chambers
- (2) Stage, compressor turbine
- (2) Stage Power Turbine
- Hot Gas Interduct
- Power Turbine Rotor
- Power Turbine Stator
- Output Shaft Drive
- Exhaust Outlet Casing
- Engine Bearing Temperature
- Instrumentation
- Engine Vibration Detector
- Equipment arranged for hot end drive
- Automatic fuel changeover at any load
- Tilt Pad journal and thrust bearing

**Gas Turbine Skid (Underbases)**

- Fabricated carbon steel construction
- Gas Turbine Skid - Mounting assemblies for the gas turbine core, auxiliary gearbox, main gearbox
- Generator Skid - driven unit
- Standard multiple point mount system
- Integral carbon steel lubricating oil tank

**Start System**

- Hydraulic Motor and Pump - AC electric motor driven

**Lubricating Oil System**

- Gas turbine lubrication system utilizes VG46 lubricating oil
- Lubricating Oil System serving the turbine, gearbox and driven unit
- Lube oil module transmitters – Siemens standard smart type – Aluminum bodies
- Lubricating oil tank immersion heaters
- Lubricating oil system breather & Mist Eliminator
- Lube oil pumps:
  - Main Oil Pump – Turbine gearbox driven
  - Auxiliary Oil Pump – AC motor driven
  - Emergency Oil Pump – DC motor driven
- Lube oil pumps:
  - Main Oil Pump – Turbine gearbox driven
  - Auxiliary Oil Pump – AC motor driven
  - Emergency Oil Pump – DC motor driven
- Lubricating Oil Filter - Duplex - carbon steel body non-ASME
  - 2 x 99% @ 10 micron
- Lubricating oil system cooler
  - Air cooled, fin / fan heat exchanger (Non-API)
  - 1 x 100% Capacity cooling fan

**Gears, Couplings and Guards**

- Main Reduction Gearbox
  - 16,600kw, Star type Epicyclic, output shaft speed 1800 rpm
- Auxiliary Gearbox
  - Attachment drives for start system and lubricating oil pump
- Driven unit coupling, flexible element dry type
  - Coupling guards – non-sparking
  - Torque limiting device
Gas Fuel System
316L Stainless steel piping and Swagelok double ferrule compression type fittings
Pilot fuel flow control system with actuator
Main fuel flow control system with actuator
(2) Rapid-acting gas shut-off valves
Pressure transmitters - Siemens standard smart type – Aluminum bodies

Liquid Fuel System
AC motor driven liquid fuel pump
Duplex type, 10 micron, liquid fuel filter complete with differential pressure transmitter
On-skid fuel piping in stainless steel downstream of filter
Shut-off valves
Liquid fuel grounding
Independent control of primary, secondary and tertiary liquid fuel flows

Acoustic Enclosure
2-coat, painted carbon steel acoustic enclosure over the entire gas turbine
2-coat, painted carbon steel doors and 304SS hardware for personnel access and maintenance
Integral equipment lifting beam for maintenance
Integral support for combustion air inlet system and ventilation system
AC Internal lighting
Acoustic system transmitters - Siemens standard smart type – Aluminum bodies
Aluminum unpainted control panel weather canopy

Designed basis:
- 85 decibels or less @ 3 feet
- Internal area classification to meets Zone 2

Acoustic Enclosure Ventilation System
2-coat, carbon steel air inlet grill and weather hood
2-coat, carbon steel ventilation air inlet and galvanized outlet ducting and silencer
Air actuated, galvanized steel vent dampers and blades

1 x 100% negative pressure ventilation fan

Combustion Air Inlet System
2-coat, painted carbon steel, automatic pulse type, self-cleaning filters
2-coat, painted carbon steel, weather hood and filter assemblies
2-coat, painted carbon steel ducting, silencer and transition pieces
Flexible expansion joint
Integral support for combustion air inlet system
Stages accessible through a hatch in weather hood with lighting
PDT transmitter – Siemens smart transmitters – Aluminum bodies

Combustion Exhaust System
304 stainless steel expansion Joint
304 stainless steel exhaust diffuser, and silencer, cold supports to be carbon steel
Aluminum exhaust cladding for personnel protection only
5 meter, vertical exhaust stack mounted on top of GT enclosure
**Fire Protection System**
Det-tronics Safety Systems Controller
3 x Multispectrum Flame Detectors
2 x gas detectors in ventilation outlet
Sounder / Beacon Unit & Status Indicator with a bottle weigh station

**Fire Extinguishant**
Twin Shot CO₂ fire protection system GT enclosure only
Cylinders housed in a weather proof rack
Extinguishant system distribution pipework and nozzles
Enclosure interior piping - cabinet to package piping by others

**Package Auxiliaries**
Water wash cart for hot and cold wash of turbine compressor
Internal auxiliary drain tank
Siemens smart transmitters – Aluminum bodies
Instrument tagging – Arrow tags - Siemens standard P&ID references
Package finish to Siemens onshore standard

**Trailers**
(1) 3 Axle gooseneck trailer containing:
- Gas turbine Package
- Lube oil cooler
- Fire extinguisher cabinet
- Water wash module

(1) 5 Axle Trailer containing:
- Generator
- Main reduction gearbox

**1.3 Control System**

**Onskid turbine controls consisting of:**
- Siemens SIMATIC PCS7 400 PLC platform
- Siemens SITRANS P DSIII Pressure Transmitters
- Siemens SITRANS TH200 Temperature Transmitters
- Siemens SITRANS LG200 Wave Guide Level Transmitters
- Siemens SIMATIC NET Industrial Ethernet (SCALANCE X-100)
- Rosemount 68 and Smart Sensors (SSI) RTD(s)
- Bentley Nevada 1701 Machinery Protection System

**Onskid Generator Control Panel consisting of:**
- Automatic voltage regulator (Dual redundant)
- Automatic & manual synchronizer control
- Generator metering and electrical protection
- Active / Reactive load share controller
- Generator breaker and (1) Bus tie control
- Lockout Relay
- Safe Area rated

**Operator Interface:**
- Remote cabinet mounted Siemens PC with Video Display Unit, keyboard and mouse
- Operator display language – English language
- Safe Area rated
Local Equipment Room
Container (12.2m Long x 3.0m wide x 3.2m High) of carbon steel construction
External walls of corrugated carbon steel sheet
Internal Rockwool insulation

Containing the following equipment:
- Motor Control Center
- Fire Suppression and Alarm Panel
- Battery Cabinet with lead acid batteries
- Battery Tripping Unit and Batteries
- Inter Panel Cabling
- Auxiliary Transformer
- Medium Voltage Switchgear
- Neutral Earthing Resistor
- Auxiliary Control Panel
- Power and Lighting Distribution Board
- Diesel Generator for LER power distribution
- GPS Enclosure/Junction Box
- Fiber Optic Panel
- LV Connector Junction Boxes
- Elliott Bushings for feeders
- Pfisterer MV connectors

All cables connecting the Gas Turbine to the Local Equipment room. In addition to a set of plugs and sockets for the LV, control and MV cables. The plugs are located on the cables which are supplied loose.

1.4 Remote Monitoring System – STA-RMS™

Provision for data collection and remote communication from site allowing access to the following services:

- All equipment (Hardware) required for the STA-RMS service is provided in the standard scope of supply. The Termed Service Agreement will detail the service, monitoring and reporting.
- Connection via broadband internet connection (customer supply)
- Automatic recording of data values within the Control System:
  - Analysis of events
  - Analysis of downtime
  - Predictive trending
  - Anomaly detection
  - Software updates
- Accelerated troubleshooting support
- Customer notification reports
- Access to historic data
- Fleet and unit performance overview
- Driven unit monitoring

1.5 Testing, Inspections & Certifications

Testing Gas Turbine
The gas turbine core has already been assembled and tested, a certified test report is available

Driven Unit Test
The generator is already assembled and tested, a certified test report is available
1.7 Drawings and Documentation
Drawings and documentation per the attached standard Customer Document List (CDL)
Operator Manual - English language – CD version
Maintenance Manual – English language – CD version
Driven Unit Manual - English language – CD version

1.8 Packing and Delivery

Packing
Packing and preservation to suit destination and transport method

Delivery Terms
Delivered, FAS Port of UK, in accordance with ICC INCOTERMS 2010 Edition
2.0 SGT-400 Mobile Project Exclusions

Anything not listed in the scope of supply is specifically excluded from the proposal.

The following items are expressly considered to be excluded from our offering:

- Common synchronization panel
- Offskid drain tank(s)
- 3rd Party Inspections not specifically detailed within this proposal
- Package Lifting device(s)
- Gauge Panel
- Customer travel expenses to attend witness tests
- First fill of Lube Oil
- Consumables
- Power management
- Power System Stabilizer (PSS)
- Water wash cleaning fluid and Methane Gas Test kits are not included in spares lists.

The following items are typical onsite tools required for the commissioning of the equipment and not within the current Scope of Supply. If onsite support is limited, Siemens can provide these items as needed:

- Signal Generator
- Digital Multimeter
- Potentiometer
- Decade resistance box
- Standard hand tools
- Standard electrical tools and crimping kits
- Safety barriers, safety equipment

3.0 SGT-400 Mobile SGT-400 Secondary Data:

The following documents are available for further review of the standard SGT-400:

- SGT-400 Mobile Drawing Bundle
- SGT-400 Preliminary electrical one-line
- SGT-400 Preliminary Instrument List
- SGT-400 Tie-in Schedule
- Siemens Fluids Specification (Rev 7)
4.0 SGT-400 Mobile Performance at ISO Conditions

SGT-400
12.9MWe Standard PT Nozzle
ISO Performance with a 0.8 pf generator
Expected Data for New and Clean Engine

<table>
<thead>
<tr>
<th>Control Power By</th>
<th>speed</th>
<th>Ambient Temp (C)</th>
<th>15</th>
<th>Inlet Temp (C)</th>
<th>15</th>
<th>Altitude (m)</th>
<th>0</th>
<th>Ambient Press (bar a)</th>
<th>1.013</th>
<th>Humidity (%)</th>
<th>60</th>
<th>Power (%)</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inlet Loss (mmH2O)</td>
<td>0</td>
<td>Exhaust Loss (mmH2O)</td>
<td>0</td>
<td>Gearbox Efficiency (%)</td>
<td>99</td>
<td>Generator Efficiency (%)</td>
<td>97</td>
<td>Water/Fuel</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam/Fuel</td>
<td>0</td>
<td>Combusotor Type</td>
<td>ULE</td>
<td>Fuel Type</td>
<td>Gas</td>
<td>Fuel File</td>
<td>Standard Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PT Shaft Speed (rpm)</td>
<td>9500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

RESULTS:
Generator Output (kW) 12876
Heat Input (kW) 37039
Heat Rate (kJ/kW.h) 10355
Exhaust Flow (kg/s) 39.35
Exhaust Temp. (C) 555.3
Comp.Exit Pres. (bar a) 16.15
Water Flow (kg/hr) 0
Steam Flow (kg/hr) 0
5.0 SGT-400 Mobile Design Criteria

The SGT-400 Mobile Generator sets are designed for the following:

- IEC Electrical standards
- Operation within an ambient temperature range of +20 to +40°C
- Onshore applications
- Seismic Loading = Horizontal +/- 0.332g, Vertical 1 +/- 0.232g
- Wind loading to a Basic Wind Speed of 68.5 mph per BS6399-2
- Propane start assist included for operation on backup liquid fuel
- Base load on gas fuel with 3 to 40 starts per year, peaking operations with multiple starts will be considered high cycle operations and require additional maintenance depending on annual starts in accordance with Siemens Life Cycle maintenance programs.
- Due to weight of equipment, axle loadings are 12,000 kg on both trailers
- No lifting arrangements are provided, units are “Roll on / Roll off”
- Units are dual fuel and gas and liquid fuels must adhere to Siemens Fuel Specs

Liquid fuel guidelines:

- Units are not designed for liquid only operation
- Limit no load operation on liquid fuel to less than 40% day load
- Preferred operation is to run on gas 45 minutes prior to shutdown to burn off carbon deposit.
- It is recommended that the Customer to have a liquid fuel storage quality plan to ensure proper fuel conditions.
### 6.0 SGT-400 Mobile Utilities List

#### Electrical Requirements

<table>
<thead>
<tr>
<th>Description</th>
<th>Rating</th>
<th>Start</th>
<th>Run</th>
<th>Stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubricating oil tank heater (per heater)</td>
<td>6 kW</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Starter motor</td>
<td>112 kW</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Turbine enclosure lighting</td>
<td>0.3 kW</td>
<td>When required</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Enclosure ventilation fan motor (per fan)</td>
<td>22 kW</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Gen Vent fan motor (per fan)</td>
<td>30 kW</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>AC Lube oil pump motor</td>
<td>19 kW</td>
<td>X</td>
<td>-</td>
<td>X</td>
</tr>
<tr>
<td>Lubrication oil mist eliminator fan motor</td>
<td>8 kW</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Unit Control Panel - DC 24V</td>
<td>0.5 kW</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>DC lube oil pump motor</td>
<td>2.2 kW</td>
<td>When required</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Liquid Fuel pump motor (Option)</td>
<td>30kW</td>
<td>X</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Waterwash module pump motor</td>
<td>3 kW</td>
<td>When required</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Waterwash module immersion heater</td>
<td>6 kW</td>
<td>When required</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Lube Oil Requirements

For the lubrication oil specification please refer to the Siemens Fluid Specification 65/0027.

The grade of the oil is ISO VG46. Oils of other viscosity grades should not be used without consulting with Siemens. The oil must be clean, free from water, suspended matter, sediment and any other impurities.

- Maximum operating level: 1487 US Gal (5652 L)
- Minimum operating level (retention capacity): 1403 US Gal (5312 L)
- Working capacity: 1066 US Gal (4038 L)

Make-up oil - Maximum 7.9 gallons (30L) per week (approx) for continuous operation
**Gas Fuel Requirements**

Gas Fuel must be provided in accordance with the Siemens Fluids specification 65-0027. Additional the requirements are as below.

- **Supply pressure:** maximum 362 psig (24.97 barg)
- **Supply pressure:** minimum TBD
- **Supply temperature:** maximum 100°C
- **Supply temperature:** minimum TBD
- **Nominal Lower Calorific value (LCV):** 35 MJ/Nm³
- **Wobbe Index range (at gas supply temperature):** 37-49 MJ/Nm³

**Air Requirements**

The instrument air quality shall be in accordance with ISO 8573.1:2001 class 3.2.1. The supply pressure at the skid edge shall be 80-100 psig (5.5 - 6.9 barg), with a smooth pressure profile and maximum fluctuation of 1 bar/min. Temperature range shall be 32°F - 140°F (0 - 60°C).

**On Skid Valves**
- **Flow Rate:** 60 Nm³/h (37.3 scfm)
- **Duration / Frequency:** 0.5 second during turbine start
  - 0.5 second during turbine wash cycle

**Gas Fuel Block and Bleed Valve - Off Skid (Optional)**
- **Flow Rate:** 35 Nm³/h (21.7 scfm)
- **Duration / Frequency:** 0.5 seconds during turbine start

**Turbine Labyrinth Seals**
- **Flow Rate:** 70 Nm³/h (43.5 scfm)
- **Duration / Frequency:** 10 minutes (maximum) during turbine start
  - 2 hours (or until turbine is cool) on turbine shutdown
  - 1 hour during off-line wash cycle

**Notes**

For detailed compressed air specification requirements, please refer to section 2 of Siemens Fluids Specification 65/0027.

Air pressure must be available at the GT skid edge during operation to maintain valve positions. Failure of the instrument air supply during turbine operation will result in shutdown of the turbine package.

Under normal shutdown conditions, the air supply is maintained to pressurize the labyrinth seals in order to keep them clear of oil during lubrication of the adjacent bearings whilst cooling. The air pressure must be maintained during this cooling period to ensure oil does not migrate into the engine.

Frequency of washing requirements is dependent on site conditions and mode of operation by end user. For a ‘cold’ (off-line) wash, the engine must be cool (signal controlled by UCP) before a wash is carried out.
Fluid Requirements

Compressor Cleaning System

For Fluids specification, please refer to the Siemens Fluids specification 65-0027.

Recommended Frequency (Hot Wash): Every 48 hours running time
Recommended Frequency (Cold Wash): During Engine shutdown. Usually required every 3 months with regular hot washing, every week for cold wash only

Quantity of wash fluid: 22.8 US Gal (86.3 liters)

Recommended cleaning fluids are as follows:
- Airworthy ZOK-MX
- R-MC Power Guard

Cleaning fluid is to be diluted with demineralized water in a ratio of 1 part fluid to 4 parts water to make up the above quantity.

Following a cold wash, a rinse cycle is carried out with the same quantity of demineralized water only.

Manuals

Operation and Maintenance (O&M) Manuals will be provided on one (1) CD copy in the English language.

Operator Manual

Operators Manual (including routine maintenance) will be submitted upon or shortly following delivery of main equipment. Contains all the information required by someone receiving a new turbine package and detailed instructions for safely operating the turbine package equipment under normal and emergency conditions.

This manual will contain preventive maintenance and periodic servicing to be performed at specific intervals of time, or running hours, up to, but not including the twelve monthly service.

The content of the Operators Manual will include:

- Safety Information - Consists of two separate documents detailing Safety Instructions and Package Warning Signs.
  - Chapter 1: A brief description of the equipment and systems within the turbine package.
  - Chapter 2: Detailed information and instructions for the safe operation and control of the turbine. This chapter also specifies fault finding procedures.
  - Chapter 3: Consists of a Maintenance Schedule and procedures for maintenance tasks of a routine nature.
  - Appendix A: A glossary of terminology and abbreviations
  - Appendix B: Technical information presented on technical drawings and System Piping and Instrumentation diagrams.
  - Appendix C: Consists of a set of tables. Each table details the nominal settings, at commissioning, of the instrumentation within a particular system
  - Appendix D: Contains a list of Hazardous Materials, with the appropriate safety information, relating to substances likely to be used on the package.
  - Appendix E: Facilitates storage of Service Bulletins issued by Siemens.

Operating Instructions

Turbine Operating Instructions will be submitted upon or shortly following delivery of main equipment. The document will contain information and instructions for the safe starting, operation and stopping of the turbine.

The document contains no servicing information and can be used in conjunction with the Operating and Routine Maintenance Manual.
# 7.0 SGT-400 Mobile Document Schedule

<table>
<thead>
<tr>
<th>DOC NO.</th>
<th>DOCUMENT DESCRIPTION</th>
<th>DOCUMENT CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>B01/003</td>
<td>Package General Arrangement</td>
<td>External dimensions of package including Driven Unit, Combustion air inlet system, Gas turbine exhaust system, Enclosure and Ventilation system. Piping connections. Shows electrical connections and Control equipment/Generator Control Panels, package Weights &amp; C of G.</td>
</tr>
<tr>
<td>B01/004</td>
<td>Maintenance Equipment General Arrangement</td>
<td>Access requirements for maintenance activities. Weights of equipment and loads on customer offskid structures</td>
</tr>
<tr>
<td>B01/005</td>
<td>Package Foundations General Arrangement</td>
<td>Location and size of all foundation interfaces required for GT Package including Driven Unit, Magnitude and location of all anticipated static and dynamic loads on civil interface. Jacking loads &amp; positions</td>
</tr>
<tr>
<td>B01/009</td>
<td>Lubricating Oil Cooler General Arrangement</td>
<td>Supplier Drawing showing dimensions, connection sizes and locations, footprint, weight and mounting requirements/Interfaces.</td>
</tr>
<tr>
<td>B01/024</td>
<td>Combustion Filter General Arrangement</td>
<td>Supplier Drg showing dimensions and interface details</td>
</tr>
<tr>
<td>B01/025</td>
<td>Ventilation Filter General Arrangement</td>
<td>Supplier Drg showing dimensions and interface details</td>
</tr>
<tr>
<td>B01/035</td>
<td>Fire and Gas Extinguishant Cabinet Layout</td>
<td>Supplier Drawing showing dimensions, connection sizes and locations, footprint, weight and mounting requirements/Interfaces.</td>
</tr>
<tr>
<td>B01/036</td>
<td>Battery System General Arrangement</td>
<td>Supplier Drawing showing dimensions, connection sizes and locations, footprint, weight and mounting requirements/Interfaces.</td>
</tr>
<tr>
<td>B02/001</td>
<td>Layout of Siemens Supplied Equipment</td>
<td>External dimensions of GT installation including Driven Unit. Location of all auxiliary equipment relative to gas turbine package</td>
</tr>
<tr>
<td>B03/001</td>
<td>Auxiliary Equipment Foundations General Arrangement</td>
<td>Magnitude and location of anticipated static and dynamic loads from auxiliary equipment</td>
</tr>
<tr>
<td>C01/001</td>
<td>Gas Fuel System P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
</tr>
<tr>
<td>C01/004</td>
<td>Air Distribution P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
</tr>
<tr>
<td>C01/005</td>
<td>Lube Oil System P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
</tr>
<tr>
<td>C01/007</td>
<td>Core Instrumentation P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
</tr>
<tr>
<td>C01/008</td>
<td>Turbine Package P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
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<tr>
<td>C01/009</td>
<td>Fire And Gas System P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
</tr>
<tr>
<td>C01/012</td>
<td>Hydraulic Start P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
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<tr>
<td>C01/016</td>
<td>Water Wash Module P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
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<tr>
<td>C01/017</td>
<td>Extinguishant Bottle Rack P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
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<tr>
<td>C01/018</td>
<td>Generator P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
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<tr>
<td>C01/031</td>
<td>Engine Auxiliary Module P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
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<tr>
<td>C01/032</td>
<td>Core Auxiliary Module P&amp;ID</td>
<td>Piping &amp; Instrumentation Diagrams for the Gas Turbine Package &amp; auxiliary equipment</td>
</tr>
<tr>
<td>C03/001</td>
<td>Utilities List for Siemens Supplied Equipment</td>
<td>Electrical Load list, Requirements for fuel supplies, instrument air, lubricating oil and wash water.</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Details</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>C03/002</td>
<td>Fluids Specification</td>
<td>Specification for gas fuel, liquid fuel, lub oil, wash water, instrument air</td>
</tr>
<tr>
<td>C04/001</td>
<td>Piping Design Specification and Tie in Schedule</td>
<td>The tie in schedule lists the line conditions, size and ratings of all piping connections to the gas turbine package and auxiliary equipment</td>
</tr>
<tr>
<td>C10/003</td>
<td>AC Generator Data Sheets</td>
<td>AC Generator data sheets in Siemens format</td>
</tr>
<tr>
<td>E01/002</td>
<td>Site Electrical Interconnection Diagram</td>
<td>Showing recommended cabling types and installation guidelines for offskid cables</td>
</tr>
<tr>
<td>E02/001</td>
<td>Interconnection Cable List</td>
<td>List of offskid cables</td>
</tr>
<tr>
<td>E03/003</td>
<td>Motor Control Centre Drawings</td>
<td>Book of Drawings showing dimensions, footprint, weight and mounting requirements/interfaces.</td>
</tr>
<tr>
<td>E05/001</td>
<td>Single Line Diagram</td>
<td>Single line representation of the electrical system at relevant voltage levels.</td>
</tr>
<tr>
<td>R01/001</td>
<td>Operators Manual</td>
<td>See text for details</td>
</tr>
<tr>
<td>R02/001</td>
<td>Package Maintenance Manual</td>
<td>See text for details</td>
</tr>
<tr>
<td>R02/002</td>
<td>Illustrated Parts Catalogue</td>
<td>See text for details</td>
</tr>
<tr>
<td>R02/003</td>
<td>Installation &amp; Commissioning Manual</td>
<td>See text for details</td>
</tr>
<tr>
<td>U02/001</td>
<td>Control System Deployment Diagram</td>
<td>Siemens internally produced block diagrams showing distribution of all Control System elements</td>
</tr>
<tr>
<td>U03/001</td>
<td>Unit Control I/O &amp; Supervisory System Interface</td>
<td>Siemens internally produced drawing defining the interface between the Control System and all external interfaces.</td>
</tr>
</tbody>
</table>
8.0 Performance Guarantees

Gas Turbine Performance Guarantee

Datum Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevation</td>
<td>0 m</td>
</tr>
<tr>
<td>Inlet air temperature</td>
<td>15°C</td>
</tr>
<tr>
<td>Ambient pressure</td>
<td>1.013 bar</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>60%</td>
</tr>
<tr>
<td>Assumed intake duct losses</td>
<td>100 mm H2O</td>
</tr>
<tr>
<td>Assumed exhaust duct losses</td>
<td>75 mm H2O</td>
</tr>
<tr>
<td>Power turbine speed</td>
<td>100%</td>
</tr>
<tr>
<td>Gearbox efficiency</td>
<td>99%</td>
</tr>
<tr>
<td>Generator efficiency</td>
<td>97%</td>
</tr>
<tr>
<td>Engine rating</td>
<td>100%</td>
</tr>
<tr>
<td>Fuel</td>
<td>Standard Gas</td>
</tr>
</tbody>
</table>

Conditions

a.) The tests to establish the guaranteed performance shall be conducted at Siemens and be generally in accordance with ISO 2314. Any amendments to the procedure or method of measurement shall be agreed before commencement of the tests.

b.) If the tests are made anywhere other than at Siemens, then they shall be conducted in accordance with the Siemens’ site test procedure.

c.) Methods of correction for varying duct losses, ambient temperature, ambient pressure, and tolerance to cover errors in observation and measurement shall be agreed before commencement of the tests.

d.) Any site performance tests shall, unless otherwise agreed, be completed within one month of the date specified by the Contractor that the plant is ready for such tests or within 750 fired hours in accordance with a mutually agreed site performance test procedure. Such tests shall be carried out by Siemens when the goods are in a new and clean condition and in proper working order using the fuel(s) as agreed in the Contract and reflected in the procedure. Immediately prior to commencement of the performance test(s) the gas generator shall be cleaned by a cold crank wash in a manner acceptable to Siemens unless this requirement has been waived in writing. During the site performance test, the pressure drop across key components such as the combustion air inlet filter, downstream air inlet ductwork, and other major items of equipment must be measured.

e.) If the plant fails to achieve the guarantee figures, Siemens shall be given every facility to make good such failure at the earliest opportunity, and the plant shall be made available to Siemens for such purposes.

f.) The output of the gas turbine excludes the power consumed by all separately mounted gas turbine auxiliaries.

g.) Inlet air temperature means the average air temperature recorded by the RTD’s in the turbine inlet casing.
Guarantees

(A) Power Output

Subject to the conditions set out in Paragraphs number 1 and 2 above, the Contractor guarantees that the base rated power output at full load of the gas turbine generating set on test when operating at the datum conditions as set out in Paragraph number 1 above shall be as follows:

Output at Generator Terminals measured at the generator terminals and subject to agreed additional tolerances to cover errors in observation and measurement.

12,224 kW(e) (on gas fuel)

(B) Heat Rate

Subject to the conditions set out in Paragraph number 1 and 2 above, Siemens guarantees the exhaust heat of the gas turbine set on test when operating at the datum conditions as set out in Paragraph number 1 above shall be as follows:

10,779 kJ / kW.hr

(C) Emissions

Subject to the conditions set out in paragraphs number 1 and 2 above and when measured in accordance with EPA Standard 40 CFR 60, the Contractor guarantees that NOx emissions of the gas turbine at full load on test shall be as follows:

Gas Fuel
NOx emissions 25 ppmvd Corrected to 15% O2 dry flue gas
CO emissions 50 ppmvd Corrected to 15% O2 dry flue gas
UHC emissions 10 ppmvd Corrected to 15% O2 dry flue gas

Changes to emissions values are made for site-specific gases using established correction factors. Any fuel quality variation from the site gas specifications may result in a change in emissions signature and guarantee levels.

The emission values are referenced to dry exhaust gas at 15% Oxygen, and are highlighted as emissions produced by the Gas Turbine and shall not comprise the additional contribution due to existing impurities in the ambient air, fuel, i.e. are in addition to any background levels of the pollutants being measured. And do not include any contribution for example from HRSG, duct firing or SCR system.

Other Data

All other data given by the Contractor are bona fide estimates and as such, as the Contractor’s experience leads it to expect, will be obtained when the goods are operated in accordance with the conditions set out in the Contract. Notwithstanding the foregoing, the Contractor shall be under no liability for failure of the goods to achieve the bona fide estimates given.