

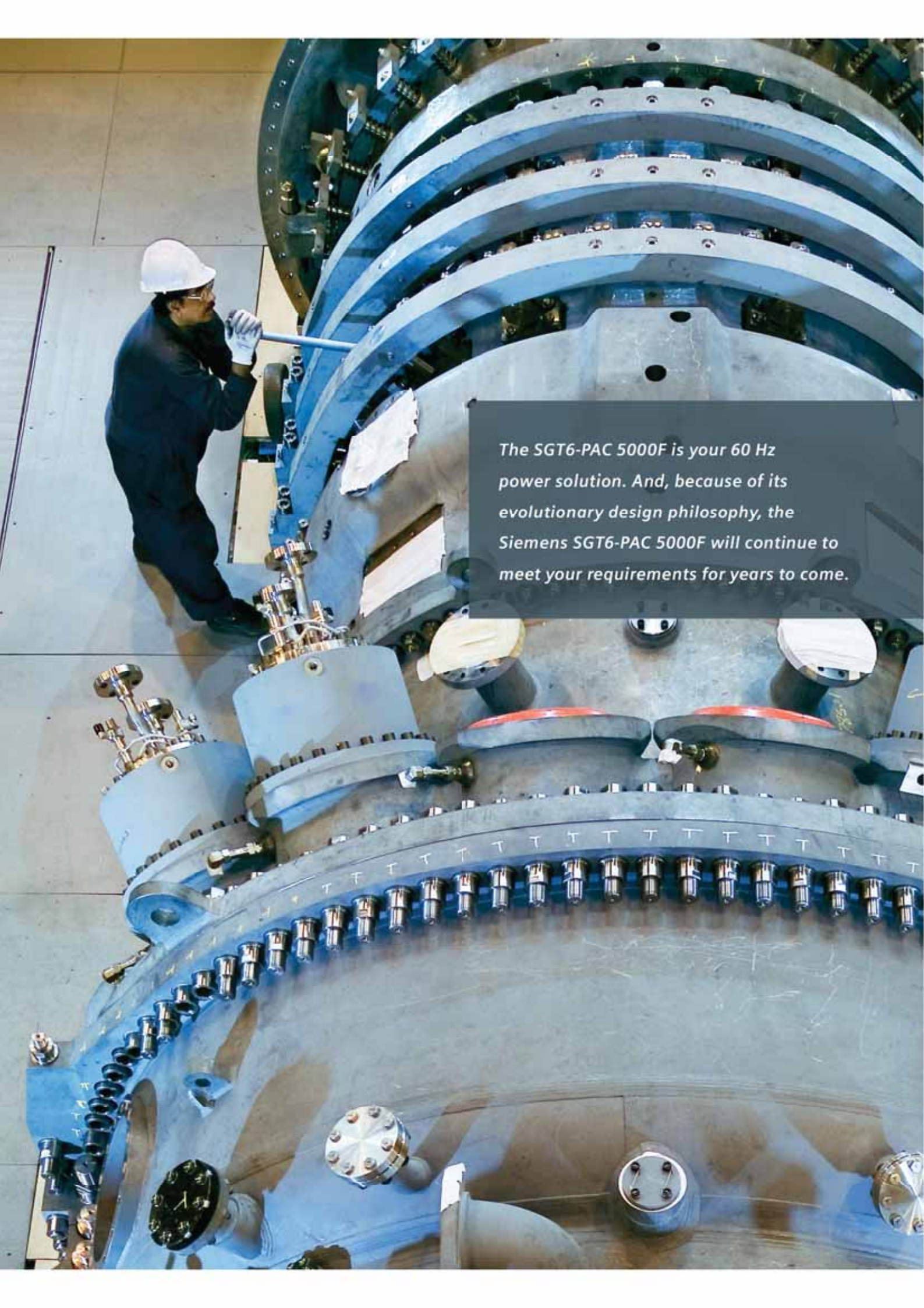
## Siemens Gas Turbine SGT6-5000F

Reliability with Flexibility

Answers for energy.

**SIEMENS**





*The SGT6-PAC 5000F is your 60 Hz power solution. And, because of its evolutionary design philosophy, the Siemens SGT6-PAC 5000F will continue to meet your requirements for years to come.*

## Revolutionary performance through evolutionary design

*At the forefront of the gas turbine industry, the uncompromising Siemens Gas Turbines (SGT™) continue to set reliability and continuous operation records. Packaged with the generator and other auxiliary modules the SGT6-5000F is the muscle within the stand-alone power generation package (SGT-PAC™) known as the SGT6-PAC 5000F. The 60 Hz SGT6-5000F gas turbine has more than 5.3 million hours of fleet operation and net combined cycle efficiencies of over 57.5%. These achievements are the result of successfully implementing increments of performance improvements into a proven technology platform.*

*The SGT6-PAC 5000F power generation system provides economical power for peaking duty, operational flexibility and load following capabilities for intermediate duty, while maintaining high efficiencies for continuous service.*

Key system benefits include:

- Most powerful 60 Hz F-class engine – capable of over 230 MW
- High simple and combined cycle efficiencies
- Single digit ppm NO<sub>x</sub> and CO capability
- Operational flexibility
  - 10 minute start-up capability
  - Cyclic capacity including daily start/stop
- Hot re-start capability – without time delay
- Foremost maintainability – easily removable blading and combustion components
- High reliability – 99% average
- Advanced service and maintenance technologies for increased availability

The SGT6-5000F gas turbine is ideally suited for simple cycle and heat recovery applications including Integrated Gasification Combined Cycle (IGCC), cogeneration, combined cycle and repowering. Flexible fuel capabilities include natural gas, LNG, distillate oil and other fuels, such as low- or medium-Btu gas.

The SGT6-PAC 5000F is your 60 Hz power solution. And, because of its evolutionary design philosophy, the Siemens SGT6-PAC 5000F will continue to meet your requirements for years to come.



## Siemens Gas Turbine SGT6-5000F

*As the heart of the SGT6-PAC 5000F, the SGT6-5000F gas turbine consists of three basic elements: axial-flow compressor, combustion system and turbine section. Incorporated into the advancements of this proven gas turbine design are features such as horizontally split casings, two-bearing rotor support, external rotor air cooler, and axial-flow exhaust.*

### Compressor

The compressor is a 13-stage axial-flow design, which achieves a 17 to 1 pressure ratio. The compressor is equipped with four stages of variable guide vanes to improve the low speed surge characteristics and part-load performance in combined cycle applications. The blade path design is based on an advanced three-dimensional flow field analysis computer model. Compressor vanes rows four through eight consist of mechanically assembled 60° segments while rows nine through 13 are individually removable from a T-root section of the vane carrier. One row of exit guide vanes is used to direct the flow leaving the compressor. Stationary airfoils utilize corrosion and heat resistant stainless steel throughout. All compressor rotating and stationary airfoils are coated to improve aerodynamic performance and corrosion protection. The compressor rotor is comprised of multiple discs equipped with Hirth Serrations on the single tie-bolt rotor.

### Combustion system

The combustion system consists of 16 can-annular combustors. Each combustor has an air-cooled transition piece, which directs the combustion gases to the turbine blade path.

### Turbine

The turbine section is comprised of four-stages, each containing a stationary and rotating row of blading. The turbine rotor, which contains the rotating blades, is constructed of four interlocking discs using Hirth Serrations on the single tie-bolt rotor.

### Rotor

The rotor is a single tie-bolt comprised of multiple discs equipped with Hirth serrations for torque transmission and is supported by two tilting-pad bearings. Design features include advanced materials, coatings and cooling schemes that are implemented throughout the turbine section to yield high turbine efficiencies and maintain long turbine component life.



### **Rotor air cooler**

A comprehensive cooling system is provided to supply cooling air to the high temperature areas of the turbine section. Rotor cooling air is extracted from the combustor shell. The air is externally cooled and introduced into the turbine section to be used for sealing purposes and to cool the appropriate rotating discs and rotating blades. This provides a blanket of protection from hot blade path gases.

In combined cycle applications, the "waste" energy removed from the cooling air is used to produce intermediate- and low-pressure steam which is introduced into the steam circuit to increase steam turbine output and cycle efficiency. Alternatively, this energy can be reclaimed for fuel heating or boiler feed water heating.

### **Inlet air system**

A side- or top-mounted inlet duct directs airflow into the compressor inlet manifold, which is designed to provide an efficient flow pattern of air into the axial-flow compressor. A parallel-baffle silencing configuration is located in the inlet system for sound attenuation. Air filtration is provided by a two-stage pad filter as the standard arrangement. Other filter systems are also available.

### **Generator**

The SGT6-5000F gas turbine is coupled to an open air-cooled (OAC) Siemens generator (SGen™) which is equipped with cooling air filtration, silencers, inlet and exhaust ducting, collector ring assembly, acoustical enclosure and necessary instrumentation. The isolated phase bus interfaces are near the non-drive end of the generator and the top of the enclosure. There are three main (line side) leads and three neutral leads. Internal cooling is provided via shaft-mounted blowers, which direct filtered ambient air through the generator's major internal components. Totally enclosed water-to-air-cooled (TEWAC) is available as an option.

### **Starting system**

The Static Frequency Converter (SFC) is used for starting the gas turbine. The SFC generates a rotating magnetic field in the generator stator that interacts with the magnetic field generated by the static excitation equipment (SEE) in the generator rotor to provide the torque required to rotate the turbine. Brushless excitation is available as an option.



#### **Exhaust system**

After passing through the combustor and turbine section, combustion gas discharges axially through a transition section which is an interface on the exhaust system. For heat recovery applications, the exhaust stack is deleted and the gases are directed to the heat recovery steam generator.

#### **Electrical and control package**

The electrical and control package contains equipment necessary for sequencing, control and monitoring of the turbine and generator. This includes the Siemens Power Plant Automation (SPPA™) system known as the SPPA-T3000 Web-based distributed control system, motor control centers, generator protective relay panel, fire protection system for the electrical package, battery and battery charger. The batteries are in an isolated section of the package and are readily accessible for maintenance.

#### **Lubricating oil package**

The lubricating oil package houses the common lube oil system for the gas turbine and generator.

#### **Gas fuel system**

The principal components of the gas fuel system are located within the gas turbine enclosure. Monitoring instrumentation is mounted on a fuel control panel located inside the turbine enclosure. Pressure gauges to locally monitor the fuel pressure are typically located on this panel.

## Net performance for the SGT6-PAC 5000F

Combustor type	ULN dry	DLN dry	DLN* steam augmentation
Fuel	Natural gas	Natural gas	Natural gas
Net power output (kW)	199,600	205,900	224,700
Net heat rate (Btu/kWh) LHV	9,102	9,081	8,802
Net heat rate (kJ/kWh) LHV	9,604	9,582	9,287
Exhaust temperature (°F/°C)	1088/587	1113/601	1114/601
Exhaust flow (lb/hr)	3,995,800	3,997,900	4,130,300
Exhaust flow (kg/hr)	1,812,400	1,814,400	1,873,400
Fuel flow (lb/hr)	84,500	86,900	91,971
Fuel flow (kg/hr)	38,340	39,400	41,717
Fuel	Liquid	Liquid	Liquid**
Net power output (kW)	190,700	191,100	-
Net heat rate (Btu/kWh) LHV	9,377	9,301	-
Net heat rate (kJ/kWh) LHV	9,893	9,813	-
Exhaust temperature (°F/°C)	1052/567	1045/563	-
Exhaust flow (lb/hr)	4,048,400	4,048,200	-
Exhaust flow (kg/hr)	1,836,300	1,836,200	-
Fuel flow (lb/hr)	96,946	96,741	-
Fuel flow (kg/hr)	43,974	43,881	-

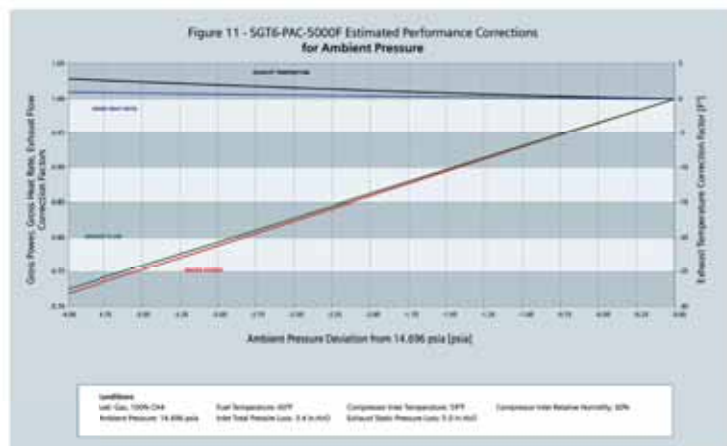
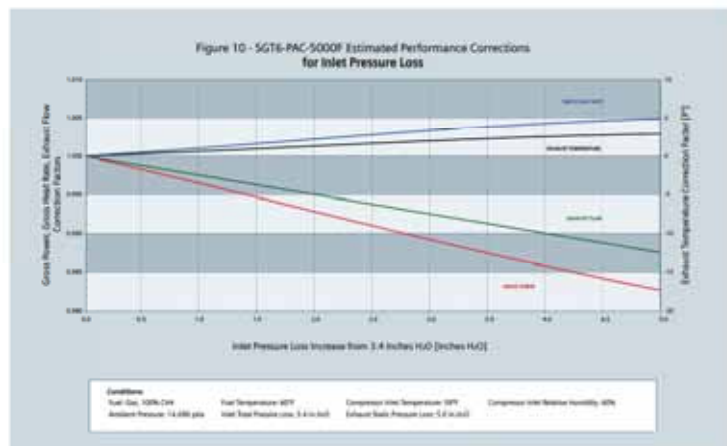
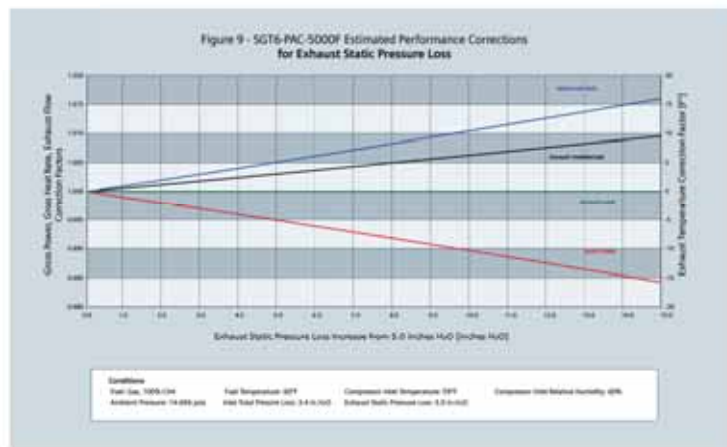
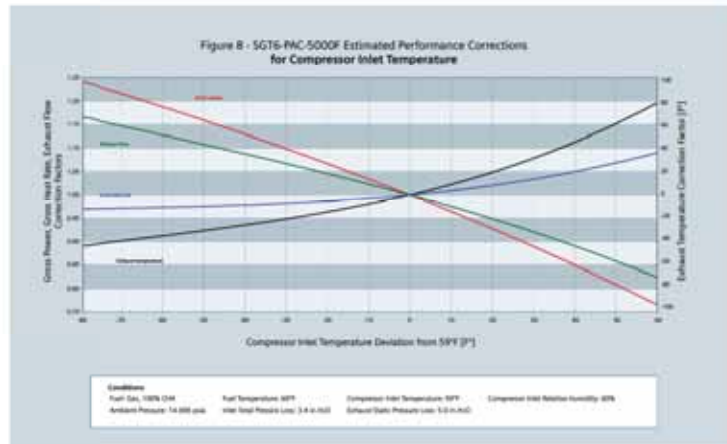
**Conditions:** Natural gas or liquid fuel meeting Siemens' fuel specifications. Elevation: sea level; 14.696 psia barometric pressure, 60% relative humidity, 59°F (15°C) inlet air temperature, 3.4 in. water (87 mm water) inlet loss, 5 in. water (127 mm water) exhaust loss, air-cooled generator and .90 power factor (pf).

\* Steam injected through the combustor section casing into the compressor discharge air to increase output.

\*\* Steam augmentation with liquid fuel available on a case-by-case basis.

# Correction curves

To estimate thermal performance of the SGT6-PAC 5000F at conditions other than those noted, the following correction curves may be used.





### **Compressor water wash skid**

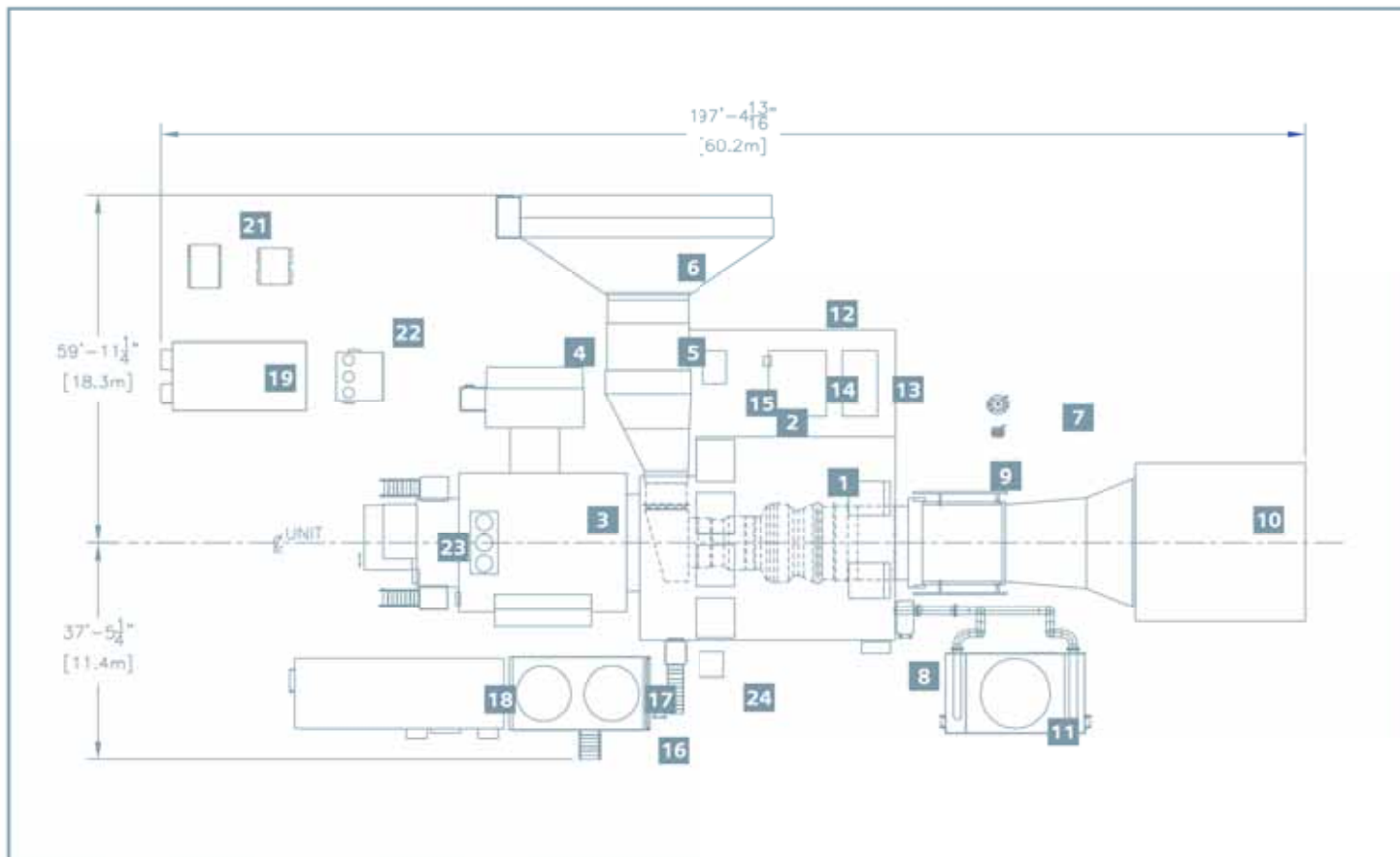
The compressor water wash skid is provided for both on-line and off-line compressor cleaning. This skid incorporates an AC motor-driven pump, piping, valves, strainer junction box, cabling, flowmeter and a detergent storage tank. These are assembled on a portable skid trailer with steel wheels attachable to a trailer hitch or clevis.

### **Cooler assemblies**

An air-to-oil fin-fan lube oil cooler (water-to-oil cooler is optional) is located above the lubricating oil package. An air-to-air cooler for turbine rotor cooling is placed adjacent to the exhaust stack. Other cooler options are available for combined cycle applications.

### **Pipe rack assemblies**

Piping for the SGT6-5000F power plant is designed and manufactured to minimize field work. Each of the major pipe assemblies is factory fabricated, requiring only a few field connections. The turbine pipe rack, located adjacent to the gas turbine in the turbine enclosure, contains piping and valves for the cooling air and lube oil supply and return.

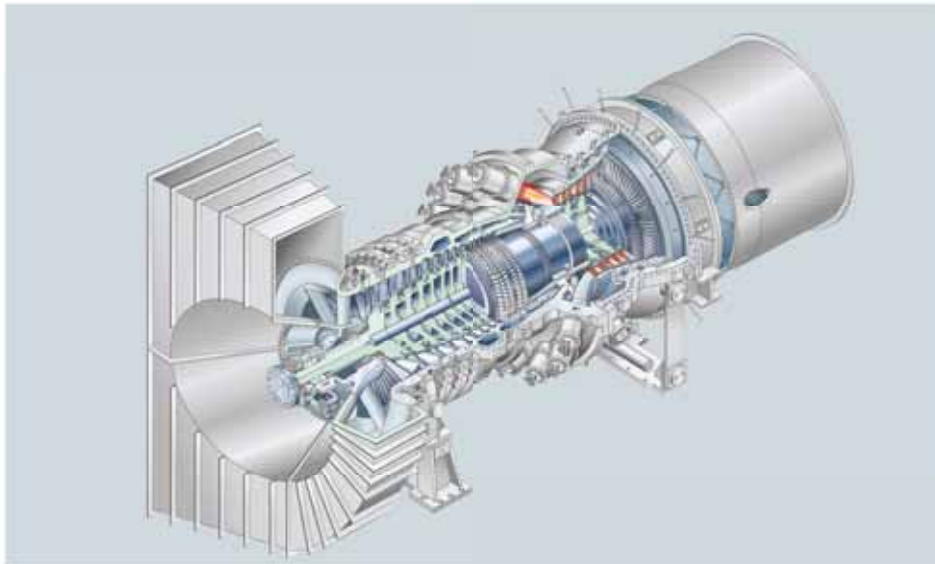


Key:		9.	18.	
1.	Gas Turbine (GT)	Exhaust Transition	Electrical Package	
2.	GT Enclosure	10.	Exhaust Stack	
3.	Generator (OAC)	11.	Rotor Air Cooler (Fin-Fan)	
4.	Generator Air Inlet Filter	12.	FOWI Acoustic Wall	
5.	Turbine Air Inlet Duct and Silencer	13.	NO <sub>x</sub> Control Injection Skid	
6.	Turbine Air Inlet Filter	14.	Fuel Oil Skid	
7.	Fuel Gas Main and Pilot Filter/Separators	15.	Control Oil Skid	
8.	FM-200® Fire Protection	16.	Lube Oil Package	
		17.	Lube Oil Cooler (Fin-Fan)	
			18.	Electrical Package
			19.	SEE/SFC
			20.	SFC Transformer
			21.	SEE Transformer
			22.	VT Surge Protection and SFC Switch Cubicle
			23.	Turning Gear
			24.	Instrument Air Compressor

### SSC6- 5000F plant arrangement technical data

SGT6-5000F Gas Turbine				
<b>Gas turbine</b>		<b>Generator</b>		
Rotor Speed	3600 rpm	Type	- Standard	Open air-cooled
Compressor			- Option	Totally enclosed water-to-air cooled
Number of stages	13	Frequency		60 Hz
Pressure ratio	17:1	Voltage		16.5 kV
Combustors		Insulation		Class F
Number	16	<b>Major weights</b>		
Type	Can-annular	Generator/without enclosure	530,000 lbs	240,400 kg
Turbine		Gas turbine	462,700 lbs	209,900 kg
Number of stages	4	Lubricating oil package	48,700 lbs	22,090 kg
		Electrical Package	50,000 lbs	22,680 kg
		Turbine rotor/lifting beam*	205,800 lbs	93,350 kg

\*Heaviest piece to be lifted after installation



*As an integrated technology company, Siemens supplies innovative solutions for the utmost efficiency and productivity along the entire energy conversion chain.*

*Siemens offers truly customizable solutions – everything from an equipment-only solution to a combined cycle power plant or simple cycle configuration.*

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Fossil Power Generation Division  
Order No. E50001-W220-A112-V2-4A00  
Printed in USA  
TD 2009210145047695F BR 0409.5

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