

6500 KW COGENERATION POWER PLANT

GAS TURBINE:

Solar Taurus 70 soloNox
Base site rating: 6500 kw

Fuel: Natural gas
Fuel consumption: 67.78 MMBTU/HR
NOx < 15 ppm
CO < 25 ppm

GENERATOR:

Rating: 8125 kva, 4160 v, 3 phase, 60 hz
Speed 1800 rpm, air cooled , ODP

HRSG:

Rentech
Steam flow: 31,600 PPH
Steam pressure 150 psig

History: Built 2016 shutdown 2020, Total hours 24,879 ,Total starts 324, Hours.

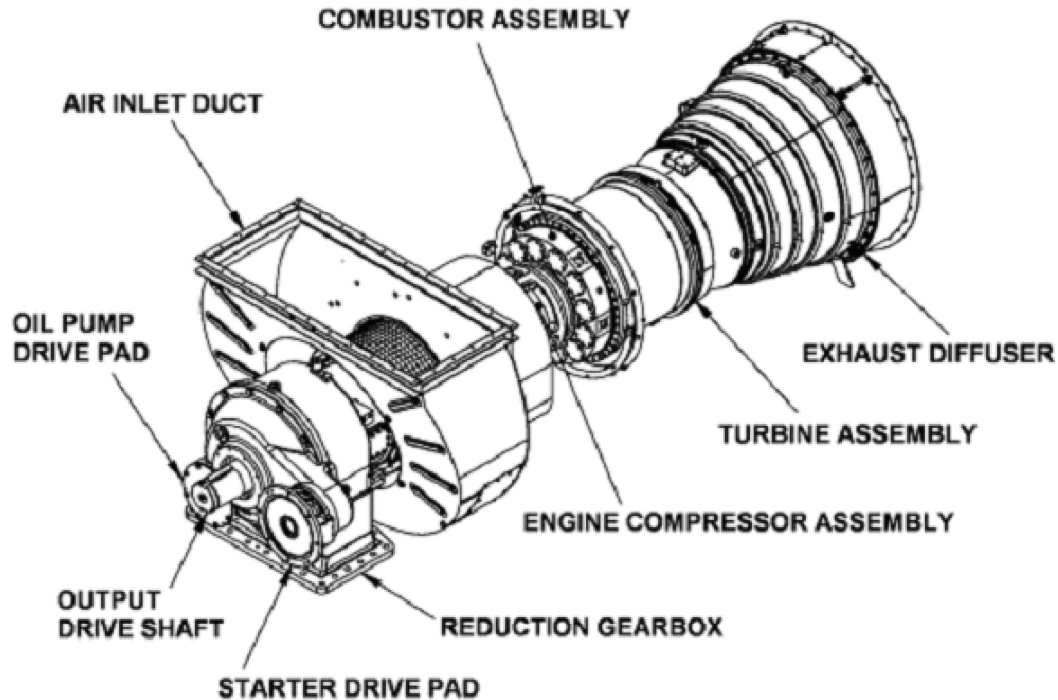
Complete outdoor enclosed unit with Donaldson Inlet air system, by pas stack, exhaust stack, fuel gas with gas compressor system, turbine control system, generator control system, Hydraulic start system. HRSG with economizer, water purifier with boiler feed water pump., generator breaker, NGR.





1.3 GAS TURBINE ENGINE

The SoLoNOx Taurus 70 is a self-contained, completely integrated prime mover of a single shaft, axial flow design. Its design embraces Solar's fundamental engineering principles of long life and low maintenance.



Taurus 70 SoLoNOx Gas Turbine Specifications:

Compressor	
Type:	Axial
Number of Stages:	14
Compression Ratio:	16.5:1
Combustion Chamber	
Type:	Annular; SoLoNOx
Ignition:	Torch
Number of Fuel Injectors:	12
Turbine	
Type:	Reaction, Axial Flow
Number of Stages:	3

3.1 GUARANTEED GENERATOR SET PERFORMANCE

Performance Conditions (See Note a)

Elevation	3980	feet
Design Ambient Temperature	65	Fahrenheit
Design Relative Humidity	38	%
Inlet Pressure Drop	4.0	in W.C.
Exhaust Pressure Drop	10.0	in W.C.
Turbine Operating Level	100%; Continuous Duty	

Power Output and Heat Rate (See Note b)

Gas Fuel		
Output Power	6,279	kW
Heat Rate	10,579	Btu/kW-hr (LHV)

Notes:

- (a) Generator set performance is guaranteed on the basis of the pressure drops indicated for the inlet and exhaust systems. These are assumed values. Losses through the Turbine Air Inlet System are based on the configuration described and a clean filter, but do not account for additional losses in site ducting -- particularly where the equipment will be installed in an existing building. Losses through the exhaust system are based on the known configuration of downstream waste heat recovery equipment. Deviations from these values will have a corresponding impact on performance observed at the project site. Intake air quality, gas fuel, and liquid fuel shall meet ES 9-98. Natural Gas fuel sulfur content shall be no greater than 0.1%.
 - (b) Output Power and Heat Rate is guaranteed on the basis of the referenced Performance Conditions listed above, by the Fuel Component Analysis section of this proposal (as applicable), and on the basis of the equipment being in new and clean condition as defined in Section 5.3 of this proposal; Guarantee Performance is demonstrated based on a standard San Diego factory test, corrected to:
 - > 0 feet above sea level
 - > 60% Relative Humidity
 - > 0 inlet duct loss; 0 exhaust duct loss
 - > 59° F, 80° F, or 100° F, depending on the local ambient temperature when the test is conductedElectric Output Power (and power used to determine Heat Rate) is referenced to the generator terminals, and is based on the generator operating at unity Power Factor (PF = 1.0). For multiple unit applications, it will be based on the average over the total number of units, not on an individual basis;
 - (c) Exhaust Energy is not guaranteed. Instead, "Expected Values" are provided in the following section entitled, "Expected Generator Set Performance".
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	Model TAURUS 70-10801S Axial
	Package Type GSC
	Match STANDARD
	Fuel System GAS
	Fuel Type SD NATURAL GAS

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	3980					
Inlet Loss	in H2O	4.0					
Exhaust Loss	in H2O	10.0					
		1	2	3	4	5	6
Engine Inlet Temperature	deg F	0	32.0	50.0	65.0	96.0	110.0
Relative Humidity	%	38.0	38.0	38.0	38.0	9.0	9.0
Gearbox Efficiency		0.9850	0.9850	0.9850	0.9850	0.9850	0.9850
Generator Efficiency		0.9700	0.9700	0.9700	0.9700	0.9700	0.9700
Based On 1.0 Power Factor							
Specified Load*	kW	FULL	FULL	FULL	FULL	FULL	FULL
Net Output Power*	kW	7821	7238	6854	6473	5562	5105
Fuel Flow	mmBtu/hr	78.01	72.68	69.43	66.43	59.78	56.91
Heat Rate*	Btu/kW-hr	9975	10042	10130	10262	10748	11148
Therm Eff*	%	34.208	33.978	33.682	33.251	31.746	30.608
Engine Exhaust Flow	lbm/hr	200114	191705	185828	179670	165831	158971
PT Exit Temperature	deg F	941	947	953	962	989	1009
Exhaust Temperature	deg F	941	947	953	962	989	1009

Fuel Gas Composition (Volume Percent)	Methane (CH4)	92.79
	Ethane (C2H6)	4.16
	Propane (C3H8)	0.84
	N-Butane (C4H10)	0.18
	N-Pentane (C5H12)	0.04
	Hexane (C6H14)	0.04
	Carbon Dioxide (CO2)	0.44
	Hydrogen Sulfide (H2S)	0.0001
	Nitrogen (N2)	1.51

Fuel Gas Properties	LHV (Btu/Scf)	939.2	Specific Gravity	0.5970	Wobbe Index at 60F	1215.6
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*Electric power measured at the generator terminals.

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Notes

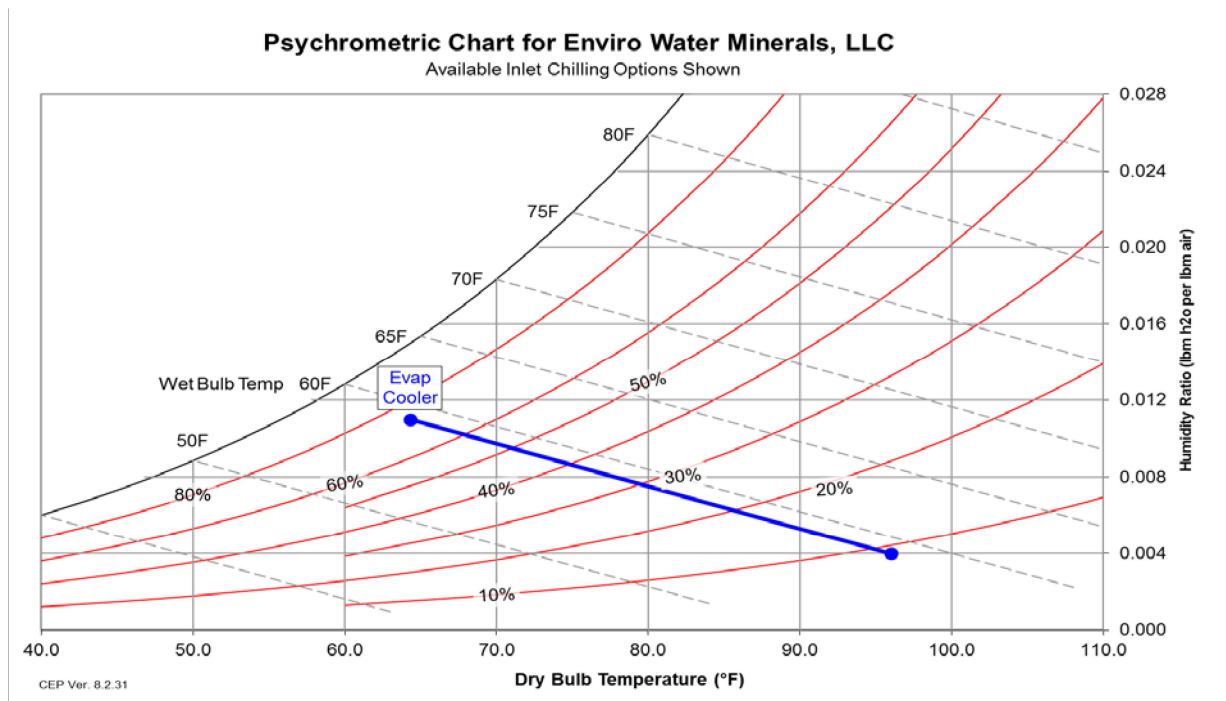
Expected Performance - San Diego NG - Without Evap Cooler

Effect of Typical Evaporative Cooler

Evaporation on Air Entering Gas Turbine and Resulting Performance

Case	Ambient				Post-Evap Cooler			
	Dry Bulb	Relative Humidity	Power	Heat Rate	Dry Bulb	Relative Humidity	Power	Heat Rate
	°F	%	kW	Btu/kW-hr	°F	%	kW	Btu/kW-hr
Spec Low Temp	0	38	7,821	9,975	Evap Cooler Off - Same as Ambient			
January Avg Low	32	38	7,238	10,042	Evap Cooler Off - Same as Ambient			
Avg Low Temp	50	38	6,854	10,130	Evap Cooler Off - Same as Ambient			
Spec Avg Temp	65	38	6,473	10,262	53	90	6,790	10,159
July Avg High	96	9	5,562	10,748	64	80	6,502	10,266
Spec High Temp	110	9	5,105	11,148	73	80	6,244	10,383

Psychrometric Chart for 96 degF Temperature and 9% Relative Humidity



1.6 GENERATOR DATASHEET

GENERATOR AND ASSOCIATED EQUIPMENT SPECIFICATION	
GENERATOR, SYNCHRONOUS, 3-PHASE	
Generator Construction/Cooling	Open Drip Proof (ODP)
Applicable Electrical Code	NEC/CEC
Hazardous Area Classification	Class I, Div II, Groups B, C, and D
Temperature Rating Point	40° C (104° F)
Voltage (V)	4160
Frequency (Hz)	60 Hz
Apparent Power (kVA)	8125
Real Power (kW)	6500
Cos Ø (power factor)	0.8
Insulation Class	Class F with VPI
Temperature Rise	Class B 80° C (144° F)
Duty Cycle	Continuous
ODP Generator IP Rating (If Enclosure is provided by Solar)	IP 34
Rotor	Salient, 4-Pole
Stator Windings	Form Wound, 3-Phase
Exciter	Brushless Pilot with PMA
Power Leads	6 / WYE Connection
Space Heaters - Stator	120V / 60Hz / 1 Phase
Bearing Type	Sleeve
Bearing Lubrication / Viscosity	See Lubrication System Section
Bearing Lube Temperature	60° C Design (90° C Alarm)
Pitch and Roll Application	No
Jacking Oil System	No
Waveform Deviation Factor (Maximum)	10%
Harmonic Content (Maximum)	3%
Short Circuit Capacity	300% Rated Current for Ten (10) Seconds
Overload Capability	150% Rated Current for One (1) Minute
	110% Rated Current for Two (2) Hours
Telephone Interference Factor	100/75
Over-Speed	125% Rated Speed for One (1) Minute

Vibration and Temperature Monitoring		
Vibration Monitoring	Proximity Probes, Two (2) per Bearing, Designated X and Y	
Stator Temperature Monitoring	100Ω Platinum @ 0°C RTD's – 2 Single Element per Phase	
Bearing Temperature Monitoring	100Ω Platinum @ 0°C RTD's – 1 Single Element per Bearing	
Terminal Box Information		
IP Rating	IP 20	
Terminal Box Type	Side Mounted, Left Side Viewed from Exciter End	
Terminal Box Entry	Bottom	
Terminal Box Material	Carbon Steel, Painted	
Terminal Box Devices	Qty	Ratio
Differential CT's (DFCT)	3	1600:5
Metering CT's	3	1600:5
Cross Current CT's	1	1600:5