SEC
DUBA 1
SAUDI ARABIA
CCA22915 Rev:0

by: J. Casabianca
16-May-16

7F.05+7F.04 Multi Shaft
Ambient Conditions: 1.011 bar,a, 3.0 °C, 30.00 % RH
Natural Gas **7F.05 on NG at Base Load 7F.04 on NG at Base Load**
Gas Turbine: 7FA.05 + 7F.04- **Supp. Firing ON to HP Drum Limit, No Let down**
Steam Turbine: 2 x 40.3 in LSB **50 MJ/s of Solar To HRSG 1**
50 MJ/s of Solar To HRSG 2

1. Plant Performance

1.1 Power (kW)

Gas Turbine Power (7F.05)	223890
Gas Turbine Power (7F.04)	193730
Steam Turbine Power	299610
Gross Equipment Power *	717230
Equipment Auxiliary Power	6198
Net Equipment Power	711032

* Gross Power At Generator Terminals

1.2 Fuel

Fuel Type - Natural Gas
Specification - GEI 41040 Supplemental Specifications
Combustion System - DLN

Heating Value (kJ/kg)	LHV	46,406
	HHV(dry)	51,305
	HHV(dry)/LHV	1.1056
Duct Burner Heat Consumption (10^6 kJ/hr)	LHV	165
GT Heat Consumption (10^6 kJ/hr)	LHV	2,067

Fuel Type - Natural Gas
Specification - GEI 41040 Supplemental Specifications
Combustion System - DLN

Heating Value (kJ/kg)	LHV	46,406
	HHV(dry)	51,305
	HHV(dry)/LHV	1.1056
Duct Burner Heat Consumption (10^6 kJ/hr)	LHV	246
GT Heat Consumption (10^6 kJ/hr)	LHV	1,805

1.3 Heat Rate

1.3.1 Gross Equipment Heat Rate (kJ/kWh)	LHV	5,971.6
	HHV(dry)	6,602.2
1.3.2 Gross Equipment Thermal Efficiency (%)	LHV	60.3%
	HHV(dry)	54.5%
1.3.3 Net Equipment Heat Rate (kJ/kWh)	LHV	6,023.6
	HHV(dry)	6,659.7
1.3.4 Net Equipment Thermal Efficiency (%)	LHV	59.8%
	HHV(dry)	54.1%

1.4 Operating Conditions

Ambient Air Temperature (°C)	Dry Bulb	3
	Wet Bulb	-1.3
	Dew Point	-13.3
Ambient Relative Humidity (%)		30
Ambient Air Pressure (bar,a)		1.011
Site Elevation (m above MSL)		19
Compressor Inlet Temperature (°C)	Dry Bulb	3
Compressor Inlet Relative Humidity (%)		29.71
Steam Turbine Exhaust Pressure (mbar,a)		51.87

1.5 Equipment Auxiliary Power (kW)

1.5.1 Gas Turbine Generator (2 GT(s))

Dual Turbine Compartment Ventalation Fan	
Turbine Frame & Exhaust Frame Cooling Motor	
Bearing Area Blower; Cooling Air Fan N2 Bearing Area	
Dual Load Coupling Ventalation Fan	
Dual Exh Diffuser Enclosure Ventilation Fan Motor	
Lube Oil Pump Motor	
Hydraulic Oil Supply Pump Motor	
Dual Accessary Compartment (Lube Oil Module) Vent Fans	
Lube Mist Separator or Eliminator Fan Motor	
Air Conditioning - PEECC	
Air Conditioning - LEI	
Control, Lighting, Misc Heaters, Etc.	
Fire protection - water mist module vent fan	
Water mist module space heater, freeze protection	
APU Fan Motor	
APU Heat Tracing	
Battery Charger No. 1	
Single Phase Misc Loads, etc	
Liquid Fuel Pump	
Atomizing Air Compressor	
Liquid Fuel/Atomizing Air Ventilation Fan	
Water Injection Pump	
Gas Turbine Subtotal	1000

1.5.2 Steam Turbine Generator

Lube Oil / Seal Oil Pump Motor #1	
GSC Exhauster Blower Motor #1	
Heating/Cooling Circulating Pump Motor	
Hydraulic Fluid Pump Motor A	
Oil Conditioner Motor	
HPU Transfer Aux Filter Pump Motor	
Vapor Extractor Exhaust Motor #1	
EBPM Starter	
ESPM Starter	
ST <HMI>	
Mark VIe	
Steam Turbine Subtotal	125

1.5.3 Heat Recovery Steam Generator (2 HRSG(s))	
Instrumentation (other than CEMS) & Controls	20
Continuous Emissions Monitoring Systems (CEMS)	20
Bypass Stack Systems (sealing-air fans, etc.)	60
Duct-Burner Systems (control valves, blowers, etc.)	30
LP Economizer Recirculation Pump	163
HRSG Subtotal	293
1.5.4 Balance-of-Plant Equipment in GE Scope	
GE-Scope BOP Subtotal (Vacuum and HP BFW pumps)	4780
Total Equipment Auxiliary Power	6198

F1 % Molar Composition N2=4.00, CH4=85.10, C2H6=8.10, C3H8=2.80

Gas

Line Key
Air and Exhaust Gases
Fuel
Water
Steam

Data Cross Key
kg/s | bar,a
°C | kJ/kg

S15 21.6 | 130.0 — 380.0 | 2,952.8 — Steam from

W19 21.6 | 140.7 — 148.4 | 633.6

W12 .2 — 148.4 | 633.6

S18 9.2 | 4,979 — 151.7 | 2,747.4

W6 9.2 | 140.7 — 148.4 | 633.6

W25 108.7 | 15.22 — 112.6 | 473.4

W8 0.0

W20 0.0

F4 1.0 — 25.0

ATTEMPERATOR

HP 126.5 bar,a

LP 4,979 bar,a

HP SH | RH | Duct Burner | RH | HP SH | HP EV | HP EC | HP EC | LP EV | LPE

LP ECON BYPASS

G4 538.8 — 590.9

G5 539.8 | 1,011 — 105.0

W5 160.6 | 16.63 — 60.1 | 252.7

W7 52.0 — 112.8 | 474.8

102.6 | 122.9 — 542.8 | 3,458.1 — **S1**

S17 100.6 | 37.02 — 369.8 | 3,149.9

85.4 | 135.0 — 148.4 | 633.6 — **W15**

ATTEMPERATOR

S4 0.0

S5 100.6 | 37.02 — 369.8 | 3,149.9

From LP Drum Unit 2

S8 6.2 | 4,983 — 151.7 | 2,747.4

From LPE Unit 2

W10 104.8 | 15.27 — 107.0 | 449.5

W17 4.6 — 278.0 | 1,223.4

S6 100.7 | 34.86 — 526.9 | 3,511.4

W14 .2 — 148.4 | 633.6

W4 108.7 | 19.57 — 34.6 | 146.5

From other HRSG(s)

S21 101.8 | 121.3 — 546.1 | 3,468.3

S19 99.4

To other HRSG(s)

W18 4.6 — 35.8 | 161.2 — To Condensate Return

Fuel Heater

S9 0.0

W9 116.5 | 140.7 — 148.4 | 633.6

Off Base D/A

Operating Pressure 4.290 bar,a

From other HRSG(s)

S20 99.5 | 34.40 — 534.6 | 3,529.1

HP Pump

W13 112.4

HP Pump Unit 2

F2 12.4 — 185.0

W30 0.0

S2 204.3 | 120.5 — 543.7 | 3,462.8

S7 200.3 | 34.17 — 530.2 | 3,519.6

S14 204.0 | 5.619 — 277.2 | 3,015.8

To other HRSG(s)

W24 104.8 | 20.52 — 34.6 | 146.5

F3 0.0

S3 199.9 | 37.59 — 370.6 | 3,150.6

2 x 40.3 in LSB

GSC

From Fuel Heater

From Other Fuel Heater

W23 8.8 — 35.6 | 160.3

G3 538.8 | 1.050 — 592.0

HP

IP

LP

1 GT
7FA.05

223.89 MW per GT
0.85 PF
60 Hz

299.61 MW
0.85 PF
60 Hz

W3 204.7 | 22.58 — 33.8 | 143.7

G2 522.9 | 1.001 — 3.0

Inlet Filter, Inlet Conditioning and Bleed heat

G1 522.9 | 1.011 — 3.0

S10 204.0 | .05187 — 33.6 | 2,337.4

S12 0.0 — SPARGING STEAM

Condensate Pump

W2 204.7 | .05187 — 33.6 | 140.5

W28 24,082.4 — 28.7 | 113.7

CONDENSER

W22 0.0 — MAKEUP WATER

7 — 33.6 | 2,368.6 — SEALS & MISC.

Estimated Cooling Water Pressure Drop Across the Condenser 3.66 mWC

Assumed Cooling Water Salinity 4 %

W1 204.7 | .05187 — 33.6 | 140.5 — **S11**

W27 24,082.4 — Cooling Water 24.0 | 95.1

GT Exhaust Gas (molar)		
Ar	0.89	%
CO2	3.92	%
H20	7.51	%
N2	75.10	%
O2	12.57	%
Mole.Wt.	28.50	1/mole

SEC

7F.05+7F.04 Multi Shaft

Project:	Site:	
DUBA 1	**SAUDI ARABIA**	
Heat Balance:	**Rev.**	**0**
CCA22915NG	**J. Casabianca**	**16-May-2016**

Description:
7F.05 on NG at Base Load
Supp. Firing ON to HP Drum Limit, No Let down
50 MJ/s of Solar

Fuel Type: Natural Gas
LHV = 46,406.0 kJ/kg

Ambient Conditions:
Barometric pressure 1.011 bar,a
Air temperature 3.0 °C
Relative humidity 30.00 %

GENERAL ELECTRIC

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F1 % Molar Composition N2=4.00, CH4=85.10, C2H6=8.10, C3H8=2.80

Gas

Line Key
Air and Exhaust Gases
Fuel
Water
Steam

Data Cross Key
kg/s | bar.a
°C | kJ/kg

S15 21.6 | 130.0 / 380.0 | 2,952.8 — Steam from

W19 21.6 | 140.7 / 148.4 | 633.6

W12 .2 / 148.4 | 633.6

S18 6.2 | 4.984 / 151.7 | 2,747.4 — To D/A

W6 6.2 | 140.7 / 148.4 | 633.6

To D/A
W25 104.8 | 15.27 / 107.0 | 449.6

W8 0.0

W20 0.0

HP 126.5 bar,a

LP 4.984 bar,a

ATTEMPERATOR

F4 1.5 / 25.0

G4 468.0 / 596.7

HP SH | RH | Duct Burner | RH | HP SH | HP EV | HP EC | HP EC | LP EV | LPE

LP ECON BYPASS

G5 469.4 | 1.011 / 99.7

W5 161.0 | 16.70 / 60.1 | 252.7

W7 56.1 / 107.2 | 451.0

101.8 | 122.9 / 547.0 | 3,469.0 — **S1**

S17 99.4 | 37.02 / 369.8 | 3,149.8

84.2 | 134.9 / 148.4 | 633.6 — **W15**

ATTEMPERATOR

S4 0.0

S6 99.5 | 34.86 / 535.3 | 3,530.3

S5 99.4 | 37.02 / 369.8 | 3,149.8

W17 4.2 / 264.4 | 1,155.7

W14 .2 / 148.4 | 633.6

W4 104.8 | 19.64 / 34.6 | 146.5

Fuel Heater

W18 4.2 / 35.4 | 159.4 — To Condensate Return

W9 112.4 | 140.7 / 148.4 | 633.6 — From D/A

F2 10.8 / 185.0

W30 0.0

F3 0.0

G3 468.0 | 1.050 / 597.8

1 GT
7F.04-

193.73 MW per GT
0.85 PF
60 Hz

G2 454.7 | 1.001 / 3.0

Inlet Filter, Inlet Conditioning and Bleed heat

G1 454.7 | 1.011 / 3.0

GT Exhaust Gas (molar)		
Ar	0.89	%
CO2	3.94	%
H20	7.55	%
N2	75.09	%
O2	12.53	%
Mole.Wt.	28.49	1/mole

SEC

7F.05+7F.04 Multi Shaft

Project:	Site:
DUBA 1	**SAUDI ARABIA**
Heat Balance:	Rev. 0
CCA22915NG	**J. Casabianca** 16-May-2016

Description:
7F.04 on NG at Base Load
Supp. Firing ON to HP Drum Limit, No let down
50 MJ/s of Solar

Fuel Type: Natural Gas
LHV = 46,406.0 kJ/kg
Ambient Conditions:
Barometric pressure 1.011 bar,a
Air temperature 3.0 °C
Relative humidity 30.00 %

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