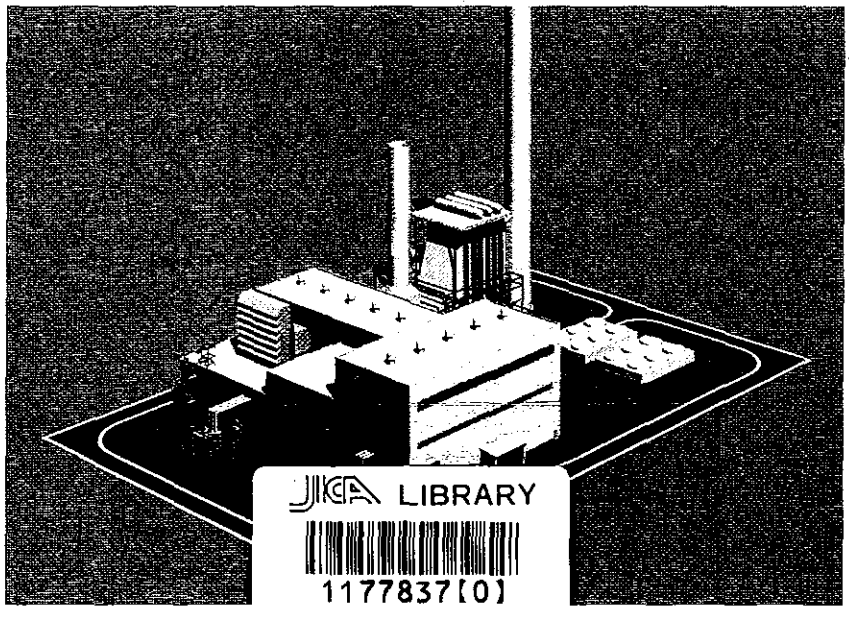
State Joint Stock Company "Uzbekenergo"

Tashkent Thermal Power Plant Modernization Project

Tender Document For Engineering, Procurement and Construction Of 370MW Combined Cycle Power Plant

Volume III

Schedule of Performance and Technical Particulars



October, 2003

Tokyo Electric Power Services Co., Ltd.

MPN
CR (3)
03-086

State Joint Stock Company "Uzbekenergo"

Tashkent Thermal Power Plant Modernization Project

Tender Documents for Engineering, Procurement and Construction of 370MW Combined Cycle Power Plant

Document No. TMP - 0002

Volume Ⅲ

Schedule of Performance and Technical Particulars

October, 2003

Tokyo Electric Power Services Company, Ltd.

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SECTION 1 GUARANTEED PERFORMANCE AND ANTICIPATED VALUES

1.1 GUARANTEE CONDITIONS

We, the undersigned, hereby guarantee the following performances declared in this Section when tested on site in accordance with the standards agreed under the following guarantee conditions:

	Parameter			Power Generation	Cogeneration
a)	Ambient temperature	°C	:	16.0	3.0
b)	Barometric pressure	kPa	:	96.0	
c)	Relative humidity	%	:	52.0	65.5
d)	Circulating cooling water temperature	°C	:	12.0	6.0
e)	Blow-down	%	:	0	
f)	Make up water	%	:	0	
g)	Pressure and temperature of water and steam		:	Equal to rated values with which the cycle is designed.	
h)	Voltage, power factor, frequency at generator terminals		:	Equal to rated values	
i)	Fuel gas		:	Both Shurtan and Bukhara gases	
j)	Fuel gas temperature at terminal point	°C		14.0	10.0
k)	Fuel gas pressure at terminal point	kPa(g)	:	600	
l)	Rated speed of generator		:	3,000rpm	
m)	Gas turbine inlet temperature at the full load	°C	:	As per declared by the Bidder in Section 1 "Guaranteed Performance and Anticipated Values" of Volume III	
n)	Hot water supply temperature at heat exchanger outlet	°C	:	-	110
o)	Water temperature at the heat exchanger inlet	°C	:	-	70
p)	Hot water supply flow rate	m^3/h	:	-	875
q)	Hot Water Supply Energy	Gcal/h			35.0

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1.2 PLANT PERFORMANCE OF POWER GENERATION
(New and Clean Conditions)

1.2.1 100% Load of Power Generation

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for the Plant"	kW		
6.1	Generator Transformers	kW		
6.2	Unit Transformer	kW		
6.3	Auxiliary Transformer	kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for the Plant"	kW		
8.0	Plant Net Power Output (*)	kW		
9.0	Plant Net Thermal Efficiency (*)	%		
10.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
11.0	Peak to Peak Relative Shaft Vibration Level (*)			
11.1	Gas turbine/generator	μm		
11.2	Steam turbine/generator	μm		
12.0	Steam Turbine Condenser Back Pressure	kPa		
13.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
14.0	Heat Recovery Steam Generator			
14.1	HP Steam Flow	kg/s		
14.2	HP Steam Pressure at SH Outlet	bar		
14.	HP Steam Temperature at SH Outlet	°C		
14.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
14.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
14.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
14.7	IP Steam Flow at HRSG outlet	kg/s		
14.8	IP Steam Pressure at HRSG Outlet	bar		
14.9	IP Steam Temperature at HRSG Outlet	°C		
14.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
14.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
14.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
14.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
14.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
14.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
14.16	HRSG Gas Side Pressure Drop	kPa		
14.17	HRSG Outlet Gas Temperature	°C		
14.18	HRSG Inlet Exhaust Gas Flow	kg/s		
14.19	HRSG Inlet Exhaust Gas Temperature	°C		
14.20	Feed Water Heater Inlet Temperature	°C		
15.0	Steam Turbine			
15.1	HP Turbine Inlet Temperature	°C		
15.2	HP Turbine Inlet Pressure	bar		
15.3	IP Turbine Inlet Temperature	°C		
15.4	IP Turbine Inlet Pressure	bar		
15.5	LP Turbine Inlet Temperature	°C		
15.6	LP Turbine Inlet Pressure	bar		
16.0	Others			
16.1	Condenser Back Pressure	kPa		
16.2	Condensate Pump Outlet Temperature	°C		
16.3	Deaerater Outlet Max. O_2 Content	cc/l		
16.4	Deaerater Outlet Max. CO_2 Content	cc/l		
16.5	Condenser Outlet Max. O_2 Content	cc/l		
16.6	Steam Purity at Drum Outlet	ppm		
16.7	Dryness Fraction at Drum Outlet	%		
16.8	Silica Content in Steam as SiO_2	ppm		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
16.9	Sodium Content in Steam as Na	ppm		
17.0	Gas Turbine			
17.1	Compressor Ratio			
17.2	Compressor Discharge Pressure	bar		
17.3	Compressor Discharge Temperature	°C		
17.4	Compressor Inlet Air Flow	kg/s		
17.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
17.6	Turbine Back Pressure	kPa		
17.7	Compressor Inlet Pressure drop	kPa		
17.8	Exhaust Temperature	°C		
17.9	Compressor Enthalpy basis Efficiency	%		
17.10	Excess Air Ratio across Combustor			
17.11	Fuel Air Ratio across Combustor			
17.12	Combustor Efficiency	%		
17.13	Combustor Inlet Pressure	bar		
17.14	Combustor Outlet Pressure	bar		
17.15	Turbine Enthalpy basis Efficiency	%		
17.15	Gas Turbine Shaft Power Output	kW		
17.16	Gas Turbine Efficiency at Shaft End	%		
17.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

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1.2.2 75% Load of Power Generation

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for the Plant"	kW		
6.1	Generator Transformers	kW		
6.2	Unit Transformer	kW		
6.3	Auxiliary Transformer	kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Plant Net Thermal Efficiency	%		
10.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
11.0	Peak to Peak Relative Shaft Vibration Level (*)			
11.1	Gas turbine/generator	μm		
11.2	Steam turbine/generator	μm		
12.0	Steam Turbine Condenser Back Pressure	kPa		
13.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
14.0	Heat Recovery Steam Generator			
14.1	HP Steam Flow	kg/s		
14.2	HP Steam Pressure at SH Outlet	bar		
14.3	HP Steam Temperature at SH Outlet	°C		
14.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
14.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
14.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
14.7	IP Steam Flow at HRSG outlet	kg/s		
14.8	IP Steam Pressure at HRSG Outlet	bar		
14.9	IP Steam Temperature at HRSG Outlet	°C		
14.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
14.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
14.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
14.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
14.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
14.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
14.16	HRSG Gas Side Pressure Drop	kPa		
14.17	HRSG Outlet Gas Temperature	°C		
14.18	HRSG Inlet Exhaust Gas Flow	kg/s		
14.19	HRSG Inlet Exhaust Gas Temperature	°C		
14.20	Feed Water Heater Inlet Temperature	°C		
15.0	Steam Turbine			
15.1	HP Turbine Inlet Temperature	°C		
15.2	HP Turbine Inlet Pressure	bar		
15.3	IP Turbine Inlet Temperature	°C		
15.4	IP Turbine Inlet Pressure	bar		
15.	LP Turbine Inlet Temperature	°C		
15.6	LP Turbine Inlet Pressure	bar		
16.0	Others			
16.1	Condenser Back Pressure	bar		
16.2	Condensate Pump Outlet Temperature	°C		
16.3	Deaerater Outlet Max. O_2 Content	cc/l		
16.4	Deaerater Outlet Max. CO_2 Content	cc/l		
16.5	Condenser Outlet Max. O_2 Content	cc/l		
16.6	Steam Purity at Drum Outlet	ppm		
16.7	Dryness Fraction at Drum Outlet	%		
16.8	Silica Content in Steam as SiO_2	ppm		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
16.9	Sodium Content in Steam as Na	ppm		
17.0	Gas Turbine			
17.1	Compressor Ratio			
17.2	Compressor Discharge Pressure	bar		
17.3	Compressor Discharge Temperature	°C		
17.4	Compressor Inlet Air Flow	kg/s		
17.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
17.6	Turbine Back Pressure	kPa		
17.7	Compressor Inlet Pressure drop	kPa		
17.8	Exhaust Temperature	°C		
17.9	Compressor Enthalpy basis Efficiency	%		
17.10	Excess Air Ratio across Combustor			
17.11	Fuel Air Ratio across Combustor			
17.12	Combustor Efficiency	%		
17.13	Combustor Inlet Pressure	bar		
17.14	Combustor Outlet Pressure	bar		
17.15	Turbine Enthalpy basis Efficiency	%		
17.15	Gas Turbine Shaft Power Output	kW		
17.16	Gas Turbine Efficiency at Shaft End	%		
17.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. 75 % load shall mean that the gross power output is 75 % of that in 100 % load power generation.
3. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

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1.2.3 50 % Load of Power Generation

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0 6.1 6.2 6.3	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for the Plant" Generator Transformers Unit Transformer Auxiliary Transformer	kW kW kW kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Plant Net Thermal Efficiency	%		
10.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
11.0 11.1 11.2	Peak to Peak Relative Shaft Vibration Level (*) Gas turbine/generator Steam turbine/generator	 μm μm		
12.0	Steam Turbine Condenser Back Pressure	kPa		
13.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
14.0	Heat Recovery Steam Generator			
14.1	HP Steam Flow	kg/s		
14.2	HP Steam Pressure at SH Outlet	bar		
14.3	HP Steam Temperature at SH Outlet	°C		
14.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
14.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
14.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
14.7	IP Steam Flow at HRSG outlet	kg/s		
14.8	IP Steam Pressure at HRSG Outlet	bar		
14.9	IP Steam Temperature at HRSG Outlet	°C		
14.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
14.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
14.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
14.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
14.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
14.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
14.16	HRSG Gas Side Pressure Drop	kPa		
14.17	HRSG Outlet Gas Temperature	°C		
14.18	HRSG Inlet Exhaust Gas Flow	kg/s		
14.19	HRSG Inlet Exhaust Gas Temperature	°C		
14.20	Feed Water Heater Inlet Temperature	°C		
15.0	Steam Turbine			
15.1	HP Turbine Inlet Temperature	°C		
15.2	HP Turbine Inlet Pressure	bar		
15.3	IP Turbine Inlet Temperature	°C		
15.4	IP Turbine Inlet Pressure	bar		
15.5	LP Turbine Inlet Temperature	°C		
15.6	LP Turbine Inlet Pressure	bar		
16.0	Others			
16.1	Condenser Back Pressure	kPa		
16.2	Condensate Pump Outlet Temperature	°C		
16.3	Deaerater Outlet Max. O_2 Content	cc/l		
16.4	Deaerater Outlet Max. CO_2 Content	cc/l		
16.5	Condenser Outlet Max. O_2 Content	cc/l		
16.6	Steam Purity at Drum Outlet	ppm		
16.7	Dryness Fraction at Drum Outlet	%		
16.8	Silica Content in Steam as SiO_2	ppm		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
16.9	Sodium Content in Steam as Na	ppm		
17.0	Gas Turbine			
17.1	Compressor Ratio			
17.2	Compressor Discharge Pressure	bar		
17.3	Compressor Discharge Temperature	°C		
17.4	Compressor Inlet Air Flow	kg/s		
17.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
17.6	Turbine Back Pressure	kPa		
17.7	Compressor Inlet Pressure drop	bar		
17.8	Exhaust Temperature	°C		
17.9	Compressor Enthalpy basis Efficiency	%		
17.10	Excess Air Ratio across Combustor			
17.11	Fuel Air Ratio across Combustor			
17.12	Combustor Efficiency	%		
17.13	Combustor Inlet Pressure	bar		
17.14	Combustor Outlet Pressure	bar		
17.15	Turbine Enthalpy basis Efficiency	%		
17.15	Gas Turbine Shaft Power Output	kW		
17.16	Gas Turbine Efficiency at Shaft End	%		
17.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. 50 % load shall mean that the gross power output is 50 % of that in 100 % load power generation.
3. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

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1.3 PLANT PERFORMANCE UNDER COGENERATION
(New and Clean Conditions)

1.3.1 100 % Load of Cogeneration

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0 6.1 6.2 6.3	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for the Plant" Generator Transformers Unit Transformer Auxiliary Transformer	kW kW kW kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Hot Water Supply Energy	Gcal/h		
10.0	Plant Net Thermal Efficiency (*)	%		
11.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
12.0 12.1 12.2	Peak to Peak Relative Shaft Vibration Level (*) Gas turbine/genetator Steam turbine/generator	 μm μm		
13.0	Steam Turbine Condenser Back Pressure	kPa		
14.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
15.0	Heat Recovery Steam Generator			
15.1	HP Steam Flow	kg/s		
15.2	HP Steam Pressure at SH Outlet	bar		
15.3	HP Steam Temperature at SH Outlet	°C		
15.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
15.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
15.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
15.7	IP Steam Flow at HRSG outlet	kg/s		
15.8	IP Steam Pressure at HRSG Outlet	bar		
15.9	IP Steam Temperature at HRSG Outlet	°C		
15.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
15.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
15.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
15.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
15.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
15.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
15.16	HRSG Gas Side Pressure Drop	kPa		
15.17	HRSG Outlet Gas Temperature	°C		
15.18	HRSG Inlet Exhaust Gas Flow	kg/s		
15.19	HRSG Inlet Exhaust Gas Temperature	°C		
15.20	Feed Water Heater Inlet Temperature	°C		
16.0	Steam Turbine			
16.1	HP Turbine Inlet Temperature	°C		
16.2	HP Turbine Inlet Pressure	bar		
16.3	IP Turbine Inlet Temperature	°C		
16.4	IP Turbine Inlet Pressure	bar		
16.5	LP Turbine Inlet Temperature	°C		
16.6	LP Turbine Inlet Pressure	bar		
16.7	Extraction Steam Temperature	°C		
16.8	Extraction Steam Pressure	bar		
16.9	Extraction Steam Flow	kg/s		
17.0	Others			
17.1	Condenser Back Pressure	kPa		
17.2	Condensate Pump Outlet Temperature	°C		
17.3	Deaerater Outlet Max. O_2 Content	cc/l		
17.4	Deaerater Outlet Max. CO_2 Content	cc/l		
17.5	Condenser Outlet Max. O_2 Content	cc/l		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
17.6	Steam Purity at Drum Outlet	ppm		
17.7	Dryness Fraction at Drum Outlet	%		
17.	Silica Content in Steam as SiO_2	ppm		
17.9	Sodium Content in Steam as Na	ppm		
18.0	Gas Turbine			
18.1	Compressor Ratio			
18.2	Compressor Discharge Pressure	bar		
18.3	Compressor Discharge Temperature	°C		
18.4	Compressor Inlet Air Flow	kg/s		
18.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
18.6	Turbine Back Pressure	bar		
18.7	Compressor Inlet Pressure drop	bar		
18.8	Exhaust Temperature	°C		
18.9	Compressor Enthalpy basis Efficiency	%		
18.10	Excess Air Ratio across Combustor			
18.11	Fuel Air Ratio across Combustor			
18.12	Combustor Efficiency	%		
18.13	Combustor Inlet Pressure	bar		
18.14	Combustor Outlet Pressure	bar		
18.15	Turbine Enthalpy basis Efficiency	%		
18.15	Gas Turbine Shaft Power Output	kW		
18.16	Gas Turbine Efficiency at Shaft End	%		
18.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		
19.0	Hot Water Heat Exchanger			
19.1	Inlet Water Temperature	°C		
19.2	Inlet Water Pressure	bar		
19.3	Outlet Water Temperature	°C		
19.4	Outlet Water Pressure	bar		
19.5	Water Flow	kg/s		
19.6	Inlet Steam Temperature	°C		
19.7	Inlet Steam Pressure	bar		
19.8	Outlet Condensate Temperature	°C		
19.9	Outlet Condensate Pressure	bar		
19.10	Steam Flow	kg/s		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Hot Water Supply Energy shall be defined as the energy (enthalpy x flow) difference of the hot water between the inlet and outlet of the heat exchanger.
3. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

Signature :..... Company:..... Date:.....

1.3.2 75 % Load of Cogeneration

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for the Plant"	kW		
6.1	Generator Transformers	kW		
6.2	Unit Transformer	kW		
6.3	Auxiliary Transformer	kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Hot Water Supply Energy	Gcal/h		
10.0	Plant Net Thermal Efficiency	%		
11.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
12.0	Peak to Peak Relative Shaft Vibration Level (*)			
12.1	Gas turbine/generator	μm		
12.2	Steam turbine/generator	μm		
13.0	Steam Turbine Condenser Back Pressure	kPa		
14.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
15.0	Heat Recovery Steam Generator			
15.1	HP Steam Flow	kg/s		
15.2	HP Steam Pressure at SH Outlet	bar		
15.3	HP Steam Temperature at SH Outlet	°C		
15.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
15.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
15.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
15.7	IP Steam Flow at HRSG outlet	kg/s		
15.8	IP Steam Pressure at HRSG Outlet	bar		
15.9	IP Steam Temperature at HRSG Outlet	°C		
15.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
15.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
15.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
15.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
15.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
15.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
15.16	HRSG Gas Side Pressure Drop	kPa		
15.17	HRSG Outlet Gas Temperature	°C		
15.18	HRSG Inlet Exhaust Gas Flow	kg/s		
15.19	HRSG Inlet Exhaust Gas Temperature	°C		
15.20	Feed Water Heater Inlet Temperature	°C		
16.0	Steam Turbine			
16.1	HP Turbine Inlet Temperature	°C		
16.2	HP Turbine Inlet Pressure	bar		
16.3	IP Turbine Inlet Temperature	°C		
16.4	IP Turbine Inlet Pressure	bar		
16.5	LP Turbine Inlet Temperature	°C		
16.6	LP Turbine Inlet Pressure	bar		
16.7	Extraction Steam Temperature	°C		
16.10	Extraction Steam Pressure	bar		
16.11	Extraction Steam Flow	kg/s		
17.0	Others			
17.1	Condenser Back Pressure	kPa		
17.2	Condensate Pump Outlet Temperature	°C		
17.3	Deaerater Outlet Max. O_2 Content	cc/l		
17.4	Deaerater Outlet Max. CO_2 Content	cc/l		
17.5	Condenser Outlet Max. O_2 Content	cc/l		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
17.6	Steam Purity at Drum Outlet	ppm		
17.7	Dryness Fraction at Drum Outlet	%		
17.	Silica Content in Steam as SiO_2	ppm		
17.9	Sodium Content in Steam as Na	ppm		
18.0	Gas Turbine			
18.1	Compressor Ratio			
18.2	Compressor Discharge Pressure	bar		
18.3	Compressor Discharge Temperature	°C		
18.4	Compressor Inlet Air Flow	kg/s		
18.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
18.6	Turbine Back Pressure	kPa		
18.7	Compressor Inlet Pressure drop	kPa		
18.8	Exhaust Temperature	°C		
18.9	Compressor Enthalpy basis Efficiency	%		
18.10	Excess Air Ratio across Combustor			
18.11	Fuel Air Ratio across Combustor			
18.12	Combustor Efficiency	%		
18.13	Combustor Inlet Pressure	bar		
18.14	Combustor Outlet Pressure	bar		
18.15	Turbine Enthalpy basis Efficiency	%		
18.15	Gas Turbine Shaft Power Output	kW		
18.16	Gas Turbine Efficiency at Shaft End	%		
18.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		
19.0	Hot Water Heat Exchanger			
19.1	Inlet Water Temperature	°C		
19.2	Inlet Water Pressure	bar		
19.3	Outlet Water Temperature	°C		
19.4	Outlet Water Pressure	bar		
19.5	Water Flow	kg/s		
19.6	Inlet Steam Temperature	°C		
19.7	Inlet Steam Pressure	bar		
19.8	Outlet Condensate Temperature	°C		
19.9	Outlet Condensate Pressure	bar		
19.10	Steam Flow	kg/s		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Hot Water Supply Energy shall be defined as the energy (enthalpy x flow) difference of the hot water between the inlet and outlet of the heat exchanger.
3. 75 % load in cogeneration shall mean that the gross power output is 75 % of that in 100 % load of cogeneration
4. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

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1.3.3 50% Load of Cogeneration

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
6.1	Generator Transformers	kW		
6.2	Unit Transformer	kW		
6.3	Auxiliary Transformer	kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Hot Water Supply Energy	Gcal/h		
10.0	Plant Net Thermal Efficiency	%		
11.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
12.0	Peak to Peak Relative Shaft Vibration Level (*)			
12.1	Gas turbine/generator	μm		
12.2	Steam turbine/generator	μm		
13.0	Steam Turbine Condenser Back Pressure	kPa		
14.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
15.0	Heat Recovery Steam Generator			
15.1	HP Steam Flow	kg/s		
15.2	HP Steam Pressure at SH Outlet	bar		
15.3	HP Steam Temperature at SH Outlet	°C		
15.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
15.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
15.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
15.7	IP Steam Flow at HRSG outlet	kg/s		
15.8	IP Steam Pressure at HRSG Outlet	bar		
15.9	IP Steam Temperature at HRSG Outlet	°C		
15.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
15.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
15.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
15.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
15.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
15.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
15.16	HRSG Gas Side Pressure Drop	kPa		
15.17	HRSG Outlet Gas Temperature	°C		
15.18	HRSG Inlet Exhaust Gas Flow	kg/s		
15.19	HRSG Inlet Exhaust Gas Temperature	°C		
15.20	Feed Water Heater Inlet Temperature	°C		
16.0	Steam Turbine			
16.1	HP Turbine Inlet Temperature	°C		
16.2	HP Turbine Inlet Pressure	bar		
16.3	IP Turbine Inlet Temperature	°C		
16.4	IP Turbine Inlet Pressure	bar		
16.5	LP Turbine Inlet Temperature	°C		
16.6	LP Turbine Inlet Pressure	bar		
16.7	Extraction Steam Temperature	°C		
16.12	Extraction Steam Pressure	bar		
16.13	Extraction Steam Flow	kg/s		
17.0	Others			
17.1	Condenser Back Pressure	kPa		
17.2	Condensate Pump Outlet Temperature	°C		
17.3	Deaerater Outlet Max. O_2 Content	cc/l		
17.4	Deaerater Outlet Max. CO_2 Content	cc/l		
17.5	Condenser Outlet Max. O_2 Content	cc/l		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
17.6	Steam Purity at Drum Outlet	ppm		
17.7	Dryness Fraction at Drum Outlet	%		
17.8	Silica Content in Steam as SiO_2	ppm		
17.9	Sodium Content in Steam as Na	ppm		
18.0	Gas Turbine			
18.1	Compressor Ratio			
18.2	Compressor Discharge Pressure	bar		
18.3	Compressor Discharge Temperature	°C		
18.4	Compressor Inlet Air Flow	kg/s		
18.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
18.6	Turbine Back Pressure	kPa		
18.7	Compressor Inlet Pressure drop	kPa		
18.8	Exhaust Temperature	°C		
18.9	Compressor Enthalpy basis Efficiency	%		
18.10	Excess Air Ratio across Combustor			
18.11	Fuel Air Ratio across Combustor			
18.12	Combustor Efficiency	%		
18.13	Combustor Inlet Pressure	bar		
18.14	Combustor Outlet Pressure	bar		
18.15	Turbine Enthalpy basis Efficiency	%		
18.15	Gas Turbine Shaft Power Output	kW		
18.16	Gas Turbine Efficiency at Shaft End	%		
18.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		
19.0	Hot Water Heat Exchanger			
19.1	Inlet Water Temperature	°C		
19.2	Inlet Water Pressure	bar		
19.3	Outlet Water Temperature	°C		
19.4	Outlet Water Pressure	bar		
19.5	Water Flow	kg/s		
19.6	Inlet Steam Temperature	°C		
19.7	Inlet Steam Pressure	bar		
19.8	Outlet Condensate Temperature	°C		
19.9	Outlet Condensate Pressure	bar		
19.10	Steam Flow	kg/s		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Hot Water Supply Energy shall be defined as the energy (enthalpy x flow) difference of the hot water between the inlet and outlet of the heat exchanger.
3. 50 % load in cogeneration shall mean that the gross power output is 50 % of that in 100 % load of cogeneration
4. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

Signature :..... Company:..... Date:.....

1.4 PLANT PERFORMANCE OF POWER GENERATION AT MAXIMUM CAPABILITY CONDITIONS
(New and Clean Conditions)

1.4.1 100% Load of Power Generation

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0 6.1 6.2 6.3	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for the Plant" Generator Transformers Unit Transformer Auxiliary Transformer	kW kW kW kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Plant Net Thermal Efficiency	%		
10.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
11.0 11.1 11.2	Peak to Peak Relative Shaft Vibration Level (*) Gas turbine/generator Steam turbine/generator	 μm μm		
12.0	Steam Turbine Condenser Back Pressure	kPa		
13.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
14.0	Heat Recovery Steam Generator			
14.1	HP Steam Flow	kg/s		
14.2	HP Steam Pressure at SH Outlet	bar		
14.3	HP Steam Temperature at SH Outlet	°C		
14.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
15.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
14.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
14.7	IP Steam Flow at HRSG outlet	kg/s		
14.8	IP Steam Pressure at HRSG Outlet	bar		
14.9	IP Steam Temperature at HRSG Outlet	°C		
14.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
14.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
14.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
14.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
14.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
15.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
14.16	HRSG Gas Side Pressure Drop	kPa		
14.17	HRSG Outlet Gas Temperature	°C		
14.18	HRSG Inlet Exhaust Gas Flow	kg/s		
14.19	HRSG Inlet Exhaust Gas Temperature	°C		
14.20	Feed Water Heater Inlet Temperature	°C		
15.0	Steam Turbine			
15.1	HP Turbine Inlet Temperature	°C		
15.2	HP Turbine Inlet Pressure	bar		
15.3	IP Turbine Inlet Temperature	°C		
15.4	IP Turbine Inlet Pressure	bar		
15.5	LP Turbine Inlet Temperature	°C		
15.6	LP Turbine Inlet Pressure	bar		
16.0	Others			
16.1	Condenser Back Pressure	kPa		
16.2	Condensate Pump Outlet Temperature	°C		
16.3	Deaerater Outlet Max. O_2 Content	cc/l		
16.4	Deaerater Outlet Max. CO_2 Content	cc/l		
16.5	Condenser Outlet Max. O_2 Content	cc/l		
16.6	Steam Purity at Drum Outlet	ppm		
16.7	Dryness Fraction at Drum Outlet	%		
16.8	Silica Content in Steam as SiO_2	ppm		
16.9	Sodium Content in Steam as Na	ppm		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
17.0	Gas Turbine			
17.1	Compressor Ratio			
17.2	Compressor Discharge Pressure	bar		
17.3	Compressor Discharge Temperature	°C		
17.4	Compressor Inlet Air Flow	kg/s		
17.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
17.6	Turbine Back Pressure	kPa		
17.7	Compressor Inlet Pressure drop	kPa		
17.8	Exhaust Temperature	°C		
17.9	Compressor Enthalpy basis Efficiency	%		
17.10	Excess Air Ratio across Combustor			
17.11	Fuel Air Ratio across Combustor			
17.12	Combustor Efficiency	%		
17.13	Combustor Inlet Pressure	bar		
17.14	Combustor Outlet Pressure	bar		
17.15	Turbine Enthalpy basis Efficiency	%		
17.15	Gas Turbine Shaft Power Output	kW		
17.16	Gas Turbine Efficiency at Shaft End	%		
17.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

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1.4.2 75% Load of Power Generation

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for the Plant"	kW		
6.1	Generator Transformers	kW		
6.2	Unit Transformer	kW		
6.3	Auxiliary Transformer	kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Plant Net Thermal Efficiency	%		
10.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
11.0	Peak to Peak Relative Shaft Vibration Level (*)			
11.1	Gas turbine/generator	μm		
11.2	Steam turbine/generator	μm		
12.0	Steam Turbine Condenser Back Pressure	kPa		
13.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
14.0	Heat Recovery Steam Generator			
14.1	HP Steam Flow	kg/s		
14.2	HP Steam Pressure at SH Outlet	bar		
14.3	HP Steam Temperature at SH Outlet	°C		
14.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
15.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
14.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
14.7	IP Steam Flow at HRSG outlet	kg/s		
14.8	IP Steam Pressure at HRSG Outlet	bar		
14.9	IP Steam Temperature at HRSG Outlet	°C		
14.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
14.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
14.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
14.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
14.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
15.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
14.16	HRSG Gas Side Pressure Drop	kPa		
14.17	HRSG Outlet Gas Temperature	°C		
14.18	HRSG Inlet Exhaust Gas Flow	kg/s		
14.19	HRSG Inlet Exhaust Gas Temperature	°C		
14.20	Feed Water Heater Inlet Temperature	°C		
15.0	Steam Turbine			
15.1	HP Turbine Inlet Temperature	°C		
15.2	HP Turbine Inlet Pressure	bar		
15.3	IP Turbine Inlet Temperature	°C		
15.4	IP Turbine Inlet Pressure	bar		
15.5	LP Turbine Inlet Temperature	°C		
15.6	LP Turbine Inlet Pressure	bar		
16.0	Others			
16.1	Condenser Back Pressure	kPa		
16.2	Condensate Pump Outlet Temperature	°C		
16.3	Deaerater Outlet Max. O_2 Content	cc/l		
16.4	Deaerater Outlet Max. CO_2 Content	cc/l		
16.5	Condenser Outlet Max. O_2 Content	cc/l		
16.6	Steam Purity at Drum Outlet	ppm		
16.7	Dryness Fraction at Drum Outlet	%		
16.8	Silica Content in Steam as SiO_2	ppm		
16.9	Sodium Content in Steam as Na	ppm		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
17.0	Gas Turbine			
17.1	Compressor Ratio			
17.2	Compressor Discharge Pressure	bar		
17.3	Compressor Discharge Temperature	°C		
17.4	Compressor Inlet Air Flow	kg/s		
17.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
17.6	Turbine Back Pressure	kPa		
17.7	Compressor Inlet Pressure drop	kPa		
17.8	Exhaust Temperature	°C		
17.9	Compressor Enthalpy basis Efficiency	%		
17.10	Excess Air Ratio across Combustor			
17.11	Fuel Air Ratio across Combustor			
17.12	Combustor Efficiency	%		
17.13	Combustor Inlet Pressure	bar		
17.14	Combustor Outlet Pressure	bar		
17.15	Turbine Enthalpy basis Efficiency	%		
17.15	Gas Turbine Shaft Power Output	kW		
17.16	Gas Turbine Efficiency at Shaft End	%		
17.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

Signature :..... Company:..... Date:.....

1.5 PLANT PERFORMANCE OF COGENERATION AT MAXIMUM CAPABILITY CONDITIONS

(New and Clean Conditions)

1.5.1 100% Load of Cogeneration

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0 6.1 6.2 6.3	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for Plant" Generator Transformers Unit Transformer Auxiliary Transformer	kW kW kW kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Capability of Hot Water Supply Energy (*)	Gcal/h		
10.0	Plant Net Thermal Efficiency	%		
11.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
12.0 12.1 12.2	Peak to Peak Relative Shaft Vibration Level (*) Gas turbine/generator Steam turbine/generator	 μm μm		
13.0	Steam Turbine Condenser Back Pressure	kPa		
14.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

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Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
15.0	Heat Recovery Steam Generator			
15.1	HP Steam Flow	kg/s		
15.2	HP Steam Pressure at SH Outlet	bar		
15.3	HP Steam Temperature at SH Outlet	°C		
15.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
15.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
15.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
15.7	IP Steam Flow at HRSG outlet	kg/s		
15.8	IP Steam Pressure at HRSG Outlet	bar		
15.9	IP Steam Temperature at HRSG Outlet	°C		
15.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
15.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
15.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
15.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
15.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
15.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
15.16	HRSG Gas Side Pressure Drop	kPa		
15.17	HRSG Outlet Gas Temperature	°C		
15.18	HRSG Inlet Exhaust Gas Flow	kg/s		
15.19	HRSG Inlet Exhaust Gas Temperature	°C		
15.20	Feed Water Heater Inlet Temperature	°C		
16.0	Steam Turbine			
16.1	HP Turbine Inlet Temperature	°C		
16.2	HP Turbine Inlet Pressure	bar		
16.3	IP Turbine Inlet Temperature	°C		
16.4	IP Turbine Inlet Pressure	bar		
16.5	LP Turbine Inlet Temperature	°C		
16.6	LP Turbine Inlet Pressure	bar		
16.7	Extraction Steam Temperature	°C		
16.14	Extraction Steam Pressure	bar		
16.15	Extraction Steam Flow	kg/s		
18.0	Others			
18.1	Condenser Back Pressure	kPa		
18.2	Condensate Pump Outlet Temperature	°C		
17.3	Deaerater Outlet Max. O_2 Content	cc/l		
17.4	Deaerater Outlet Max. CO_2 Content	cc/l		
17.5	Condenser Outlet Max. O_2 Content	cc/l		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
17.6	Steam Purity at Drum Outlet	ppm		
17.7	Dryness Fraction at Drum Outlet	%		
17.8	Silica Content in Steam as SiO_2	ppm		
17.9	Sodium Content in Steam as Na	ppm		
18.0	Gas Turbine			
18.1	Compressor Ratio			
18.2	Compressor Discharge Pressure	bar		
18.3	Compressor Discharge Temperature	°C		
18.4	Compressor Inlet Air Flow	kg/s		
18.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
18.6	Turbine Back Pressure	kPa		
18.7	Compressor Inlet Pressure drop	kPa		
18.8	Exhaust Temperature	°C		
18.9	Compressor Enthalpy basis Efficiency	%		
18.10	Excess Air Ratio across Combustor			
18.11	Fuel Air Ratio across Combustor			
18.12	Combustor Efficiency	%		
18.13	Combustor Inlet Pressure	bar		
18.14	Combustor Outlet Pressure	bar		
18.15	Turbine Enthalpy basis Efficiency	%		
18.15	Gas Turbine Shaft Power Output	kW		
18.16	Gas Turbine Efficiency at Shaft End	%		
18.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		
19.0	Hot Water Heat Exchanger			
19.1	Inlet Water Temperature	°C		
19.2	Inlet Water Pressure	bar		
19.3	Outlet Water Temperature	°C		
19.4	Outlet Water Pressure	bar		
19.5	Water Flow	kg/s		
19.6	Inlet Steam Temperature	°C		
19.7	Inlet Steam Pressure	bar		
19.8	Outlet Condensate Temperature	°C		
19.9	Outlet Condensate Pressure	bar		
19.10	Steam Flow	kg/s		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Hot Water Supply Energy shall be defined as the energy (enthalpy x flow) difference of the hot water between the inlet and outlet of the heat exchanger.
3. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

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1.5.2 75 % Load of Cogeneration)

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1.0	Plant Gross Power Output	kW		
2.0	Gas Turbine/Generator Gross Power Output	kW		
3.0	Steam Turbine/Generator Gross Power Output	kW		
4.0	Power Losses of Generators	kW		
5.0	Fuel Consumption	kg/h		
6.0 6.1 6.2 6.3	Total Transformer Losses as per Section 1.6 "Auxiliary Power Loads for Plant" Generator Transformers Unit Transformer Auxiliary Transformer	kW kW kW kW		
7.0	Total Auxiliary Power Consumption as per Section 1.6 "Auxiliary Power Loads for Plant"	kW		
8.0	Plant Net Power Output	kW		
9.0	Capability of Hot Water Supply Energy (*)	Gcal/h		
10.0	Plant Net Thermal Efficiency	%		
11.0	Net Specific Energy (Lower Heating Value) of fuel used for thermal efficiency calculation	kcal/kg		
12.0 12.1 12.2	Peak to Peak Relative Shaft Vibration Level (*) Gas turbine/generator Steam turbine/generator	 μm μm		
13.0	Steam Turbine Condenser Back Pressure	kPa		
14.0	Airborne Noise Emission Level (*) at 1 m from Gas Turbine, Steam Turbine and Generators and 1.2m height above floor	dB(A)		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
15.0	Heat Recovery Steam Generator			
15.1	HP Steam Flow	kg/s		
15.2	HP Steam Pressure at SH Outlet	bar		
15.3	HP Steam Temperature at SH Outlet	°C		
15.4	Cold Reheat Steam Flow at HRSG inlet	kg/s		
15.5	Cold Reheat Steam Pressure at HRSG inlet	bar		
15.6	Cold Reheat Steam Temperature at HRSG inlet	°C		
15.7	IP Steam Flow at HRSG outlet	kg/s		
15.8	IP Steam Pressure at HRSG Outlet	bar		
15.9	IP Steam Temperature at HRSG Outlet	°C		
15.10	Hot Reheat Steam Flow at HRSG Outlet	kg/s		
15.11	Hot Reheat Steam Pressure at HRSG Outlet	bar		
15.12	Hot Reheat Steam Temperature at HRSG Outlet	°C		
15.13	LP Steam Flow to Steam Turbine at HRSG Outlet	kg/s		
15.14	LP Steam Pressure at SH Outlet at HRSG Outlet	bar		
15.15	LP Steam Temperature at SH Outlet at HRSG Outlet	°C		
15.16	HRSG Gas Side Pressure Drop	kPa		
15.17	HRSG Outlet Gas Temperature	°C		
15.18	HRSG Inlet Exhaust Gas Flow	kg/s		
15.19	HRSG Inlet Exhaust Gas Temperature	°C		
15.20	Feed Water Heater Inlet Temperature	°C		
16.0	Steam Turbine			
16.1	HP Turbine Inlet Temperature	°C		
16.2	HP Turbine Inlet Pressure	bar		
16.3	IP Turbine Inlet Temperature	°C		
16.4	IP Turbine Inlet Pressure	bar		
16.5	LP Turbine Inlet Temperature	°C		
16.6	LP Turbine Inlet Pressure	bar		
16.7	Extraction Steam Temperature	°C		
16.16	Extraction Steam Pressure	bar		
16.17	Extraction Steam Flow	kg/s		
18.0	Others			
18.1	Condenser Back Pressure	kPa		
18.2	Condensate Pump Outlet Temperature	°C		
17.3	Deaerater Outlet Max. O_2 Content	cc/l		
17.4	Deaerater Outlet Max. CO_2 Content	cc/l		
17.5	Condenser Outlet Max. O_2 Content	cc/l		

Signature :..... Company:..... Date:.....

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
17.6	Steam Purity at Drum Outlet	ppm		
17.7	Dryness Fraction at Drum Outlet	%		
17.8	Silica Content in Steam as SiO_2	ppm		
17.9	Sodium Content in Steam as Na	ppm		
18.0	Gas Turbine			
18.1	Compressor Ratio			
18.2	Compressor Discharge Pressure	bar		
18.3	Compressor Discharge Temperature	°C		
18.4	Compressor Inlet Air Flow	kg/s		
18.5	Temperature at the Inlet to 1st Stage Nozzle	°C		
18.6	Turbine Back Pressure	kPa		
18.7	Compressor Inlet Pressure drop	kPa		
18.8	Exhaust Temperature	°C		
18.9	Compressor Enthalpy basis Efficiency	%		
18.10	Excess Air Ratio across Combustor			
18.11	Fuel Air Ratio across Combustor			
18.12	Combustor Efficiency	%		
18.13	Combustor Inlet Pressure	bar		
18.14	Combustor Outlet Pressure	bar		
18.15	Turbine Enthalpy basis Efficiency	%		
18.15	Gas Turbine Shaft Power Output	kW		
18.16	Gas Turbine Efficiency at Shaft End	%		
18.17	Ratio of Compressor Power Requirement /Turbine Shaft Power Output	%		
19.0	Hot Water Heat Exchanger			
19.1	Inlet Water Temperature	°C		
19.2	Inlet Water Pressure	bar		
19.3	Outlet Water Temperature	°C		
19.4	Outlet Water Pressure	bar		
19.5	Water Flow	kg/s		
19.6	Inlet Steam Temperature	°C		
19.7	Inlet Steam Pressure	bar		
19.8	Outlet Condensate Temperature	°C		
19.9	Outlet Condensate Pressure	bar		
19.10	Steam Flow	kg/s		

Note:

1. Asterisked Items (*) shall be guaranteed.
2. The Hot Water Supply Energy shall be defined as the energy (enthalpy x flow) difference of the hot water between the inlet and outlet of the heat exchanger.
3. 75 % load in cogeneration shall mean that the gross power output is 75 % of that in 100 % load of cogeneration
4. The Bidder shall clearly state the definition when the gas turbine inlet temperature is given at other definition than the inlet to 1st Stage Nozzle.

Signature :..... Company:..... Date:.....

1.6 AUXILIARY POWER LOADS FOR THE PLANT

1.6.1 100 % Load of Power Generation

Item No	Name of Auxiliary for Plant Operation including Transformer	Power Load (kW)
	Total	

Signature :..... Company:..... Date:.....

1.6.2 100 % Load of Cogeneration

Item No	Name of Auxiliary for Plant Operation including Transformer	Power Load (kW)
	Total	

Signature :..... Company:..... Date:.....

1.7 EXHAUST GAS EMISSION LEVEL

1.7.1 100% Load of Power Generation

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1	NO_x (15% O_2 dry)(*)	ppmVD		
2	SOx (15% O_2 dry)	ppmVD		
3	CO (15% O_2 dry)(*)	ppmVD		
4	PM (15% O_2 dry)(*)	mg/Nm^3		

Note:

1. Asterisked Items(*) shall be guaranteed.
2. The Contractor shall submit the correction curves and formula to correct the as-measured values to the guarantee conditions for approval of SJSC "Uzbekenergo"/ Consultant.

Signature :..... Company:..... Date:.....

1.7.2 75% Load of Power Generation

Item No.	Parameter	Unit	Bukhara Gas	Shurtan Gas
1	NO_x (15% O_2 dry)(*)	ppmVD		
2	SOx (15% O_2 dry)	ppmVD		
3	CO (15% O_2 dry)(*)	ppmVD		
4	PM (15% O_2 dry)(*)	mg/Nm^3		

Note:
1. Asterisked Items(*) shall be guaranteed.
2. The Contractor shall submit the correction curves and formula to correct the as-measured values to the guarantee conditions for approval of SJSC "Uzbekenergo"/Consultant.

Signature :..... Company:..... Date:.....

1.8 AIRBORNE NOISE EMISSION LEVEL

Item No.	Parameter	Unit	Value
1.	Airborne Noise Emission Level(*) of the measurement points determined in advance on boundary of DC "TashTPP"	dB(A)	
2.	Airbone Noise Emission Level (*) at 1 m from the other equipment than specified in previous sections and 1.2m height above floor	dB(A)	

Note:
1. Asterisked Items (*) shall be guaranteed.

Signature :..... Company:..... Date:.....

1.9 LIST OF CORRECTION CURVES OR FORMULAE

Item No.	Name of Correction Curve	Bidder's Reference No.
1.	Correction curves of gross power output, fuel consumption and exhaust gas flow versus atmospheric pressure.	
2.	Correction curves of gross power output, gross thermal efficiency, fuel consumption and exhaust gas flow versus excessive pressure loss of inlet system.	
3.	Correction curves of gross power output, gross thermal efficiency, fuel consumption and exhaust gas flow versus excessive pressure loss of exhaust and HRSG system.	
4.	Curves of fuel consumption (%) with parameter of compressor inlet temperature versus gross power output (%)	
5.	Curves of gross power output, gross thermal efficiency, fuel consumption, and exhaust gas temperature at full load versus compressor inlet temperature.	
6.	Exhaust gas temperature and exhaust gas flow (%) with parameter of compressor inlet temperature versus gross power output (%) considering the effect of modulation of IGV.	
7.	Curves of exhaust gas temperature at design, plus/minus 25°C and plus/minus 50°C inlet temperatures versus compressor discharge pressure.	
8.	Correction curves (%) of gross power output, gross thermal efficiency and fuel consumption versus variation of hydrogen/carbon weight ratio from that in the guarantee conditions.	
9.	Correction curves of NOx emission level with parameter of relative humidity of the intake air versus compressor inlet temperature.	
10.	Correction curve of gross power output and gross thermal efficiency versus fuel gas pressure at the terminal point.	
11.	Efficiency curves of generator versus	

Signature :..... Company:..... Date:.....

Item No.	Name of Correction Curve	Bidder's Reference No.
	apparent power output (MVA) and power factor	
12.	Correction curves of gross power output, and gross thermal efficiency versus cooling water temperature	
13.	Curves showing relationship between gross power output with parameter of compressor temperature versus hot water supply energy in flow rate (m^3/h)	
14.	Any curves which are deemed necessary for correction of as-measured values.	
15.	Correction curve of required power to drive the fuel gas compressor versus variation of terminal gas pressure from 700 kPa to 1,080kPa with a parameter of gross power output (%)from the minimum controllable to rated gross power output.	

The correction curves specified above or equivalent curves required for correction of as-measured values to the guarantee conditions shall be submitted with the Bid.

Signature :..... Company:..... Date:.....

1.10 PUMP CHARACTERISTICS CURVES

The anticipated characteristic curves (i.e. Head, Efficiency, power and NPSH against flow rate) for the following pumps as a minimum shall be submitted along with the Bid .

Item No.	Name of Pump	Bidder's Reference No.
1.	L.P. HRSG feed pump	
2.	I.P.HRSG feed pump	
3.	H.P HRSG feed pump	
4.	Make-up water pump	
5.	Circulating Cooling Water Pump	
6.	Condensate extraction pump	
7.	Closed circuit cooling water pump	

Signature :..... Company:..... Date:.....

1.11 FUEL GAS COMPRESSOR

The Bidder shall provide the following characteristic curves with the Bid.

1. Head-Capacity Curve for speed parameters of 95%, 100% and 105% with constant required input power (kW) contour curves for the rated inlet pressure and temperature.

2. Required input power versus the gas turbine gross power output from 30% to full load for the rated inlet pressure and temperature.

3. Required input power versus the inlet pressure variation from minus 30% to plus 30% for the rated temperature

Signature :..... Company:..... Date:.....

Table of Contents

VOLUME III

SECTION 2 SCHEDULE OF TECHNICAL PARTICULARS

2.1 GENERAL INFORMATION

The Bidder shall provide with his Bid, data as marked with an asterisk (*). All other data shall be provided prior to placing an equipment order or 60-90 days after award of Contract whichever is applicable.
An electronic file of this document (Volume III) in Word 2000 format is provided for your convenience in filling out the requested data.

2.1.1 Training

In accordance with Article 3.5 "Description of Training" of Volume I, has the Bidder described its intended program of personnel training of SJSC "Uzbekenergo" in operation and maintenance of the power plant?

* Yes_____

No_____

2.1.2 Spare Parts

In accordance with Article 3.3 "List of Mandatory Spare Parts" and Article 3.4 "List of Recommended Spare Parts" of Volume I, has the Bidder included in his lump sum price them initial stock of SJSC "Uzbekenergo" for five (5) years of commercial operation and maintenance?

* Yes_____

No_____

2.1.3 Plant Operation and Maintenance Manuals

In accordance with Article 5.1.3 "Operation and maintenance Manuals" of Volume I, has the Bidder included in his lump sum price, submission of the required number of plant operation and maintenance manuals?

* Yes_____

No_____

2.1.4 Utility Requirements During Construction

The Bidder shall identify its requirements for the provision of fuel gas, power and heat loads, electric power, auxiliary steam and water during the construction phase.

Document No.*_____

2.1.5 Definition of Codes and Standards

Definition of Codes and Standards which the Bidder intends to apply for the equipment, materials, piping and cabling.

Document No.*_____

2.2 PROJECT MANAGEMENT AND CONTROL REQUIREMENTS

2.2.1 Project Management

2.2.1.1 Description

The Bidder shall describe the overall working relationships, arrangements and controls whereby the project manager will maintain a full awareness and control over all project activities.

Document No.*_____

2.2.1.2 Organization Chart

The Bidder shall provide an overall organization chart for the project team to identify the reporting responsibilities, structure, location and working arrangements to be adopted for the project.

Document No.*_____

2.2.1.3 Senior Project Personnel

2.2.1.3.1 Project Manager

Has the Bidder included in Article 3.8 "List of Key Personnel and Engineers" of Volume I detailed information on the qualifications and experience of the designated project manager?

* Yes_____

No_____

2.2.1.3.2 Site Manager

Has the Bidder included in Article 3.8 "List of Key Personnel and Engineers" of Volume I detailed information on the qualifications and experience of the designated site manager?

* Yes_____

No_____

2.2.1.4 Bidder's Main Project Office

The Bidder shall identify the location and describe the function of its main project office and identify areas of responsibility and methods of working to ensure project requirements are satisfied. This shall include an organization chart.

Document No.*_____

2.2.1.5 Project Personnel of SJSC "Uzbecenergo"

The Bidder shall comment upon the proposed role of the project team personnel of SJSC "Uzbekenergo" and describe the working relationships and processes that will be established for the interface with the project team personnel of SJSC "Uzbekenergo".

Document No.*_____

2.2.2 Project Construction

2.2.2.1 Description

The Bidder shall describe the construction, commissioning and testing process identifying areas of responsibility and methods of working to ensure overall control is achieved.

Document No.*_____

2.2.2.2 Organization Chart

The Bidder shall provide an overall organization chart for the construction process demonstrating reporting responsibilities, structure and working arrangements to be adopted for the project.

Document No.*_____

2.2.2.3 Senior Personnel

Has the Bidder included in Article 3.8 "List of Key Personnel and Engineers" of Volume I detailed information on the qualifications and experience of the senior personnel to be used for the construction process as identified by the organization chart manager?

* Yes_____

No_____

2.2.2.4 Safety

The Bidder shall provide specific information on its approach to safety for the project.

Document No.*_____

2.2.3 Project Control

2.2.3.1 Description of System

The Bidder shall provide full details on the project control system proposed and identify previous applications of this system on similar projects.

Document No.*_____

2.2.3.2 Description of Working Arrangements

The Bidder shall provide full details on the reporting responsibilities, structure, location and number of personnel and working arrangements for implementation of the project control process.

Document No.*_____

2.2.3.3 Senior Personnel

Has the Bidder included in Article 3.8 "List of Key Personnel and Engineers" of Volume I detailed information on the qualifications and experience of the senior personnel to be used for the project control process as identified by the description of the project control process?

* Yes_____

No_____

2.2.4 Project Purchasing/Contract Administration

2.2.4.1 Description

The Bidder shall describe the purchasing/contract administration process identifying areas of responsibility and how overall control and co-ordination will be achieved. This description must include an integration of the quality assurance process for the project.

Document No.*_____

2.2.4.2 Organization Chart

The Bidder shall provide an overall organization chart for the purchasing/contract administration process demonstrating reporting responsibilities, structure, location and working arrangements to be adopted for the project.

Document No.*_____

2.2.4.3 Senior Personnel

Has the Bidder included in Article 3.8 "List of Key Personnel and Engineers" of Volume I detailed information on the qualifications and experience of the senior personnel to be used for the purchasing/contract administration process as identified by the organization chart.

* Yes_____

No_____

2.2.5 Project Schedule

The Bidder shall submit a CPM Method Project Schedule in weeks from a Notice to Proceed. Milestone activities shall include key engineering activities, major equipment procurement and delivery, as well as major construction activities.

Document No.*_____

2.2.6 Key Milestone Table

The Key Milestones for the entire scope of the Works shall be submitted by the Bidder. The Date of Notice to proceed means the Date of Commencement of the Contract.

Key Milestone Table

No.	Key Milestone	Weeks after Notice to Proceed
1	Site mobilization	
2	Commencement of civil works	
3	Commencement of erection of GT building steel structures.	
4	Commencement of erection of ST building steel structures.	
5	Ex-work of gas turbine	
6	Ex-work of gas turbine generator	
7	Ex-work of HRSG heat transfer modules	
8	Ex-work of steam turbine and condenser	
9	Ex-work of steam turbine generator	
10	Ex-work of gas compressors	
11	Ex-work of hot water supply heaters	
12	Ex-work of generator main transformers, unit auxiliary transformer	
13	Ex-work of DCS system	

No.	Key Milestone	Weeks after Notice to Proceed
14	Successful energization of switchgears	
15	Installation of overhead traveling cranes of GT and ST buildings	
16	On-base of gas turbine and generator	
17	On-base of steam turbine and generator	
18	Site assembling of HRSG heat transfer modules	
19	Completion of erection of gas turbine/generator	
20	Completion of erection of fuel gas supply system	
21	Completion of erection of steam turbine/generator and condenser	
22	Completion of erection of circulating water system	
23	Completion of erection of closed cooling water system	
24	Completion of erection of HRSG	
25	Completion of erection of hot water supply system	
26	Completion of erection of 220 kV switchyard	
27	Completion of erection of DCS system	
28	Start of commissioning of Plant	
29	Start of guarantee performance tests	
30	Start of Reliability Test of Plant	
31	Complete delivery of mandatory and recommended spare parts	
32	Complete delivery of standard and special tools	
33	Complete delivery of all final as-built drawings	
34	Complete delivery of first draft of O&M Manuals	
35	Complete delivery of all final O&M Manuals	
36	Plant completion (Provisional acceptance)	
37	Successful completion of inspection at end of Defect Liability Period	
38	Final acceptance	

2.3 SITE REQUIREMENTS

2.3.1 Contractor Lay Down Area

The Bidder shall provide a drawing showing the proposed contractor lay down area labeling all required offices, warehouse facilities and areas for storage.

Document No.*_____

2.3.2 Erosion and Sedimentation Control

The Bidder shall provide a description of the methods to be used to control soil erosion on the site during construction.

Document No.*_____

2.3.3 Landscaping

The Bidder shall provide a description of the methods to be used for landscaping disturbed areas of the site after construction is completed.

Document No.*_____

2.3.4 Geotechnical

The Bidder shall provide a description of the methods to be used for the geotechnical investigation required.

Document No.*_____

2.4 SITE ENVIRONMENTAL REQUIREMENTS

2.4.1 Water Treatment System

Item No.	Parameters	Units	Design Values
1.	**Rating**		
1.1	Number of Stream		*
1.2	Net Capacity of One Stream	m^3/day	*
1.3	Water Balance		*
1.3.1	Inflow to Filtered Water Tank	m^3/day	*
1.3.2	Filter Backwash Waste	m^3/day	*
1.3.3	Filter Backwash Cycle Operation/Backwash	h/h	* /
1.3.4	Flow of Service Water	m^3/day	*
1.3.5	Inflow to Demineralized Water Tank	m^3/day	*
1.3.6	Demineralizer Regeneration Waste	m^3/day	*
1.3.7	Demineralizer Regeneration Cycle Operation/Regeneration	h/h	* /
1.3.8	Make-up to Steam Cycle	m^3/day	*
1.3.9	Cycle Leakage	m^3/day	*
1.3.10	Sampling Loss	m^3/day	*
1.3.11	Laboratory	m^3/day	*
1.3.12	Make-up to CCWS	m^3/day	*
1.3.13	Others	m^3/day	*
2	Product Water Quality		
2.1	Filtered Water		
	Total Suspended Solids	mg/l	*
2.2	Demineralized Water		*
	Specific conductivity at 25°C	µS/m	*
	Total iron as Fe	mg/l	*
	Total copper as Cu	mg/l	*
	Silica as SiO_2	mg/l	*
	Sodium as Na	mg/l	*
	pH		*

2.4.2 Liquid and Solid Waste

Identify liquid and solid waste streams for the Combined Cycle Power Plant. Liquid waste streams shall include demineralizer regeneration waste, HRSG blowdown, sanitary waste, GT water wash and plant drains.

Stream Description	Composition	Flow Rate	Disposition
*			
*			
*			
*			
*			
*			
*			
*			
*			
*			

2.4.3 Waste Water Treatment System

Item No.	Parameter	Units	Design Values
1	Treatment Capacity	m^3/h	
2	Treated Effluent Quality Limitations		
	Total Suspended Solid	mg/l	
	BOD_5	mg/l	
	Total Content of Mineral Salts	mg/l	
	Calcium	mg/l	
	Chlorides	mg/l	
	Sulphates	mg/l	
	Nitrate Nitrogen	mg/l	
	Nitrite Nitrogen	mg/l	
	Ammonia Nitrogen	mg/l	
	Mineral Oils	mg/l	
	Iron	mg/l	
	Copper	mg/l	
	Floating substances	mg/l	
	Smell, Odors	degree	
	Coloring		
	Temperature Rise	°C	
	pH		
	Coliform Count	count/l	
	Dissolved Oxygen	mg/l	

2.5 OPERATION AND MAINTENANCE REQUIREMENTS

2.5.1 Start-up Times

The Bidder shall submit times required for each type of start-up to full load from initiation of the start button (The time for purge and synchronization is not include. The condenser vacuum is established and the gas turbine is in state ready to start)

Type of Start-up	Required Time (min.)
Cold Start after stop of more than 36 hours	
Warm start after stop of less than 36 hours	
Hot start after stop of less than 8 hours	
Very hot start after stop of less than 1 hour	

The Bidder shall submit time required from initiation of the start button of the gas turbine/generator to full load when it will be operated as a simple cycle. (The time for purge and synchronization is not included in the star-up time)

Type of Time	Required Time (min.)
Acceleration time to rated speed	
Loading time to full load	
Unloading time to disconnection	

2.5.2 Normal Shutdown Times

The Bidder shall submit the time required for the normal shutdown from the full load to turning operation. In case any cooling period time is required, the time shall be included in the shutdown time.

Type of Shutdown	Required Time (min.)
Gas Turbine Simple Cycle Operation	
Combined Cycle Operation	

2.5.3 Maximum Under and Over Frequency Limits in Hz

The Bidder shall describe maximum under and over frequency limits in Hz under load operation.

*-_____to +_____

2.5.4 Minimum Controllable Load

The Bidder shall describe minimum controllable load.

GT simple cycle operation	*_____MW
Combined Cycle operation	*_____MW

2.5.5 Maintenance Program

Bidder shall provide a plant maintenance program outline describing types of inspections, cycle of inspections, spare parts planning and other major factors affecting individual component life and proper operation of major plant equipment.

2.6 QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

2.6.1 QA/QC Plan

In accordance with Section 6 of Volume II, the Bidder shall provide an Outline of its QA/QC Plan.

Document No.*_____

2.7 PROJECT DESCRIPTION

2.7.1 Plant Description

Provide overall description of proposed power plant including listing of all major equipment.

Document No.*_____

2.7.2 Site Plot Plan

Preliminary site arrangement drawing showing locations of all major equipment, systems and building facilities.

Document No.*_____

2.7.3 General Arrangement Drawings

Preliminary arrangement drawings showing location, overall arrangement and dimensions of major equipment.

Document No.*_____

2.7.4 Preliminary P&ID's

Preliminary P&ID's for all major mechanical systems.

Document No.*_____

2.7.5 One Line Diagrams

Electrical One Line Diagrams describing proposed electrical systems.

Document No.*_____

2.7.6 Heat Balance and Water Balance Diagrams

Heat Balance and Water Balance Diagrams for the power generation and cogeneration on Bukhara and Shurtan gas.

Document No.*_____

Bidder's Data Sheet

_____

Bidder's Name

The Bidder shall fill in all items and data listed. Asterisked (*) items are of special importance and shall not be omitted.

2.8 MECHANICAL

2.8.1 Combined Cycle Power Plant

Item NO.	DESCRIPTION	Bidder to fill in
1	**Make**	*
2	**Model No.**	*
3	**Type of Shaft Arrangement**	*

2.8.2 Gas Turbine and Auxiliary Systems

Item NO.	Description	Units	Bidder to fill in
1.0	**Gas Turbine**		
1.1	Make		*
1.2	Model No./Frame Size		*
1.3	Number of shafts		*
1.4	Allowable transmitting torque of drive shaft at rated speed	times	*
1.5	Ignition speed	rpm	*
1.6	Self sustaining speed	rpm	*
1.7	Rated Speed		*
1.8	Direction of Rotation		*
1.9	Maximum allowable load operation frequency without time limitation	(Hz)	*
1.10	Minimum allowable load operation frequency without time limitation	(Hz)	*
1.11	Total Shaft Length	m	*
1.12	Ist Critical speed combined with steam turbine and generator rotor	rpm	*
1.13	2nd Critical speed combined with steam turbine and generator rotor	rpm	*
1.14	3rd Critical speed combined with steam turbine and generator rotor	rpm	*
1.15	4th Critical speed combined with steam turbine and generator rotor	rpm	*
1.16	Between which critical speeds the rated speed exists		*Between_____and_____critical speeds
1.17	Electronic overspeed trip speed	rpm	*
1.18	Longitudinal section drawing		*
1.19	Start-up curves of main parameters including air and fuel flow rates versus rotating speed and load up to the full load		*
1.20	Weight (flange to flange)	kg	*

Item NO.	Description	Units	Bidder to fill in
1.21	Dimension (L × W × H)	m	*
1.22	Specific weight	kg/kW	*
2.0	**Air Compressor**		
2.1	No. of stages		*
2.2	Type		*
2.3	Direction of rotation		*
2.4	Casing split		*
2.5	Pressure ratio		*
2.6	Blade tip speed of first stage	m/sec.	*
2.7	Type of rotor construction		*
2.8	Number of variable vane stage		*
2.9	IGV angle variable range (open to close)	degree	*
2.10	Materials of construction		
	a) Inlet, front and rear casings		*
	b) Discharge casing		*
	c) Blade material (IGV, stationary and rotating)		*
	d) Blade coating		*
	e) Casing bolts & nuts		
	f) Discs or Rotor		
	g) Disc build-up bolts		
2.11	Height of the first stage rotor blade	m	
2.12	Diameter at the hub of the first stage rotor blade	m	
2.13	Height of the last stage rotor blade	m	
2.14	Diameter at the hub of the last stage rotor blade	m	
2.15	Characteristic map with a start-up curve up to the full load		*
2.16	Campbell diagram of the first stage rotor blade up to the fourth mode		*
2.17	Surge margin at the most	%	*

Item NO.	Description	Units	Bidder to fill in
	adverse condition		
2.18	Tensile stress at the blade root of the first stage rotor blade	N/m^2	
2.19	Bending stress at the blade root of the first stage rotor blade	N/m^2	
2.20	Number of the first stage stator blades		
2.21	Number of the first stage rotor blades		
2.22	Number of the last stage stator blades		
2.23	Number of the last stage rotor blades		
3.0	**Gas Turbine**		
3.1	Number of stages		
	a) High pressure turbine		*
	b) Low pressure turbine		*
3.2	Type		*
3.3	Type of casting split		*
3.4	Blade tip speed of last stage	m/s	*
3.5	Height of last stage rotating blade	m	
3.6	Turbine inlet temperature at base load		
	a) Absolute total temperature at inlet of 1st stage nozzle	°C	*
	b) Relative total temperature at inlet of 1st stage blade	°C	*
	c) ISO Reference Temperature	°C	*
3.7	Type of rotor construction		*
3.8	Materials of all stages' blades and nozzles:		*
	a) 1st stage blade		*
	b) 2nd stage blade		*
	c) 3rd stage blade		*
	d) 4th stage blade		*
	e) 5th stage blade		*

Item NO.	Description	Units	Bidder to fill in
	f) 1st stage nozzle		*
	g) 2nd stage nozzle		*
	h) 3rd stage nozzle		*
	i) 4th stage nozzle		*
	j) 5th stage nozzle		*
3.9	Materials of thermal barrier coating		
	a) Nozzle/blade coating 1st stage		*
	b) Nozzle/blade coating 2nd stage		*
	c) Nozzle/blade coating 3rd stage		*
3.10	Materials of discs		
	a) 1st stage disc		*
	b) 2nd stage disc		*
	c) 3rd stage disc		*
	d) 4th stage disc		*
	e) 5th stage disc		*
3.11	Nozzle air cooling (which stages?)		*
3.12	Blade air cooling (which stages?)		*
3.13	Design life of blades on a basis of EOH		
	a) 1st blade	h	*
	b) 2nd blade	h	*
	c) 3rd blade	h	*
	d) 4th blade	h	*
	e) 5th blade	h	*
3.14	Design life of nozzles on a basis of EOH		
	a) 1st nozzle	h	*
	b) 2nd nozzle	h	*
	c) 3rd nozzle	h	*

Item NO.	Description	Units	Bidder to fill in
	d) 4th nozzle	h	*
	e) 5th nozzle	h	*
3.15.	Number and Diameter of disc built-up bolts		
3.16.	Material of disc built-up bolts		
3.17.	Campbell diagram of the last stage rotor blade up to the fourth mode		*
3.18.	Tensile stress at the blade root of the last stage rotor blade	N/m^2	
3.19.	Bending stress at the blade root of the last stage rotor blade	N/m^2	
3.20.	Turbine cooling air flow diagram		*
3.21.	Height of the first stage rotor blade	mm	
3.22.	Diameter at the hub of the first stage rotor blade	m	
3.23.	Height of the first stage rotor blade	mm	
3.24.	Diameter at the hub of the first stage rotor blade	m	
4.0	**Combustion System**		
4.1	Type		*
4.2	No. of combustion liners		*
4.3	No. of fuel nozzles/combustion liner		*
4.4	Material of outer casing		*
4.5	Material of combustion liner		*
4.6	Material of transition piece		*
4.7	Type of seal between combustion liner and transition piece		*
4.8	No. of ignitors		*
4.9	Type of ignitors		*
4.10	No. of flame detectors		*
4.11	Type of flame detectors		*
4.12	Manufacture of flame detectors		*

Item NO.	Description	Units	Bidder to fill in
4.13	Type of air cooling system of combustion liner		*
4.14	Type of air cooling system of transition piece		*
4.15	Material of thermal barrier coating of combustion liner		*
4.16	Material of thermal barrier coating of transition piece		*
4.17	Design life of combustion liner on a basis of EOH	h	*
4.18	Design life of transition piece on a basis of EOH	h	*
5.0	**Governing System**		
5.1	Type of Governing		*
5.2	Governor make		*
5.3	Constant speed control functioning		*
5.4	Constant load control functioning		*
5.5	Automatic Frequency Control functioning		*
5.6	Range of speed regulation (droop)	% - %	*
5.7	Momentary speed variation on full load rejection.	%	*
5.8	Steady state governing speed band	%	*
5.9	Steady state governing load band	%	*
5.10	Dead band	%	*
6.0	**Bearings**		
6.1	No. of journal bearings		*
6.2	Type of journal bearings		*
6.3	No. of thrust bearings		*
6.4	Type of thrust bearings		*
6.5	Oil flow sight indicators provided?		*
7.0	**Vibration Detectors**		
7.1	Type		*

Item NO.	Description	Units	Bidder to fill in
7.2	Number		*
7.3	Location		*
7.4	Alarm setting value		*
7.5	Trip setting value		*
8.0	**Lube Oil System**		
8.1	Oil stage tank capacity (full)	l	*
8.2	Total oil in the system	l	*
8.3	Vapour extractor fans rating	kW	
8.4	Main lube oil pump capacity	l/min	*
8.5	Lube oil supply header pressure	bar (g)	
8.6	Reservoir coating		
8.7	Approx. loss of lube oil as vapour	l/hr.	
8.8	Recommended Grades of Lube Oil		
	a) *		
	b) *		
	c) *		
8.9	Main Lube Oil Pump		
	a) Manufacturer		*
	b) Type		*
	c) Driver		*
	d) Capacity	l/min	*
	e) Speed	rpm	
	f) Casing material		
	g) Shaft material		
	h) Shaft sleeve material		
8.10	Auxiliary Lube Oil Pump		
	a) Manufacturer		*
	b) Type		*
	c) Driver rating	kW	*

Item NO.	Description	Units	Bidder to fill in	
	d) Capacity	l/min	*	
	e) Rated speed	rpm		
	f) Suction pressure	bar (g)		
	g) Discharge pressure	bar (g)		
	h) Casing material			
	i) Shaft material			
	j) Impeller material			
8.11	Emergency Lube Oil Pump			
	a) Manufacturer		*	
	b) Mounting type		*	
	c) Driver rating	kW	*	
	d) Capacity	l/min	*	
	e) Rated speed	rpm		
	f) Suction pressure	bar (g)		
	g) Discharge pressure	bar (g)		
	h) Casing material			
	i) Shaft material			
	j) Impeller material			
8.12	Jacking Oil Pump (if applicable)		AC motor driven	DC motor driven
	a) Manufacturer			
	b) Mounting type			
	c) Driver rating	kW		
	d) Capacity	l/min		
	e) Rated speed	rpm		
	f) Suction pressure	bar (g)		
	g) Discharge pressure	bar (g)		
	h) Casing material			
	i) Shaft material			

Item NO.	Description	Units	Bidder to fill in
	j) Impeller material		
8.13	Air to oil cooler (if applicable)		
	a) Heat load	kcal/hr	*
	b) Type of cooler		*
	c) Inlet air temperature	°C	*
	d) Outlet air temperature	°C	*
	e) Lube oil flow rate	l/min	*
	f) Lube oil inlet temperature	°C	*
	g) Lube oil outlet temperature	°C	*
	h) Module fan type		*
	i) Number of fans		*
	j) Each fan drive motor rating	kW	*
	k) Heat transfer area	m^2	*
	l) Type of lube oil temperature control		*
	m) Heat transfer element sizes		
	- Outer diameter	mm	*
	- Inner diameter	mm	*
	n) Heat transfer element material		
	- Tubes		*
	- Fins		*
	- Tube plates		*
	- Header covers		
8.14	Water to oil cooler		
	a) Heat load	kcal/hr	*
	b) Type of cooler		*
	c) Water flow rate	l/min	*
	d) Inlet water temperature	°C	*
	e) Outlet water temperature	°C	*

Item NO.	Description	Units	Bidder to fill in
	f) Lube oil flow rate	l/m	*
	g) Lube oil inlet temperature	°C	*
	h) Lube oil outlet temperature	°C	*
	i) Uninterrupted oil flow changeover function provided?		*
	j) Type of oil temperature control		*
	j) Heat transfer element sizes		
	- Outer diameter	mm	*
	- Inner diameter	mm	*
	k) Material		
	- Tubes		*
	- Tube plates		*
	- Header covers		*
	- Shell		*
8.15	*Oil Filter*		
	a) Type		*
	b) Oil flow rate	l/m	*
	c) Element mesh	micron	*
	d) Element material		*
	e) Casing material		
	f) Allowable pressure difference	bar	
	g) Uninterrupted oil flow changeover function provided?		
9.0	**Intake Air System**		
9.1	First Stage Air Filter		
	a) Manufacturer		*
	b) Type of Filter		*
	c) Design Air Flow	m^3/s	*

Item NO.	Description	Units	Bidder to fill in
	d) No. of filter elements	Nos.	*
	e) Air flow per filter element	kg/s	*
	f) Air velocity - Design	m/s	*
	g) Dust loading capacity	kg/m^2	*
	h) Media Material		
	i) Expected life of filter material	h	*
	j) Dust removal efficiency for Arizona fine dust		*
9.2-	Second Stage Air Filter		
	a) Manufacturer		*
	b) Type of Filter		*
	c) Design Air Flow	m^3/s	*
	d) No. of filter elements		*
	e) Air flow per filter element	kg/s	*
	f) Air velocity - Design	m/s	*
	g) Dust loading capacity	kg/m^2	*
	h) Media Material		*
	i) Expected life of filter material	h	*
	j) Dust removal efficiency for Arizona fine dust		*
10.0	**Intake Air Silencer**		
10.1	Location		*
10.2	Type		*
10.3	Sound attenuation	dB	*
10.4	Design air flow	m^3/s	*
10.5	Velocity between baffles	m/s	*
10.6	Type of baffles		*
10.7	Baffle material		
	a) Perforated sheet		*

Item NO.	Description	Units	Bidder to fill in
	b) Sound absorption media		*
	c) Frame structures		*
10.8	Thickness of perforated sheets	mm	*
10.9	Baffle thickness	m	*
10.10	Baffle length	m	*
10.11	No. of silencers		*
11.0	**Inlet Air Ducting**		
11.1	*Material of Construction*		
11.2	Size	m x m x m	
11.3	Flow velocity in duct	m/s	*
11.4	Thickness in duct	mm	
11.5	Particulars of inside protection with suitable coatings		
11.6	Whether ductings are suitably designed to prevent undue vibration?		
11.7	Expansion Joints a) Type b) Number c) Material of Construction		
11.8	Necessary galvanised supports provided		YES/NO
11.9	Turning vanes at all bends provided		YES/NO
11.10	Manholes/access doors for inspection provided		YES/NO
12.0	**Control Oil System**		
12.1	Quantity required for hydraulic oil system	m^3/hr	*
12.2	Quantity required for trip oil system	m^3/hr	*
12.3	Hydraulic oil pressure	bar (g)	*
12.4	Trip oil pressure	bar (g)	*
12.5	Make up quantity	m^3/day	*
12.6	Oil reservoir		

Item NO.	Description	Units	Bidder to fill in
	a) Total quantity of oil in the system	m^3	*
	b) Capacity of the oil reservoir	m^3	*
	c) Operating capacity of the oil reservoir between high and low levels		
	d) Following instruments provided - Level indicators - High and low level alarms - Temp. indicator		YES/NO YES/NO YES/NO
	e) Oil reservoir tank material		
	f) Pump strainers - Type/make - Number - Size of the mesh - Material - Max allowable pressure drop	Microns bar	
12.7	Control oil pumps		
	Number		*
	Capacity	l/m	*
	Discharge pressure	bar (g)	*
	Materials of construction		
	Casing		
	a) Shaft		
	b) Impellers		
13.0	**Centrifugal Oil Purifier**		
13.1	Capacity	m^3/h	*
13.2	Motor Rating	kW	*
14.0	**Piping**		
14.1	Lube Oil supply piping material		

Item NO.	Description	Units	Bidder to fill in
14.2	Main lube oil filter element material		
14.3	Lube oil return/drain pipe material		
15.0	**Starting System**		
15.1	Type		*
15.2	Manufacturer		*
15.3	Number of starting device per power train		*
15.4	Max. allowable number of consecutive start attempts		*
15.5	Number of thyrister frequency converters per power train (if applicable)		*
15.6	Max. required power	kW	*
15.7	Self sustaining speed	rpm	*
16.0	**Turning Gear**		
16.1	Type		*
16.2	Method of engage/disengage		*
16.3	Speed	rpm	*
16.4	Rating	kW	*
16.5	Speed of engagement	rpm	*
16.6	Min. Pressure for turning gear operation.(Bearing oil)	bar (g)	*
17.0	**Gas Turbine Control**		
17.1	Turbine inlet temp. limit control provided?		*
17.2	Surging limit control provided?		*
17.3	IGV modulating control provided?		*
17.4	Acceleration control provided?		*

Item NO.	Description	Units	Bidder to fill in
17.5	Overspeed limit control provided?		*
18.0	**Water Wash Skid**		
18.1	On line water wash possible?		*
18.2	Water wash design flow		
	a) ON-line	l/m	*
	b) OFF-line	l/m	*
18.3	Water wash pressure		
	a) ON-line	bar (g)	*
	b) OFF-line	bar (g)	*
18.4	Water wash temperature		
	a) ON-line	°C	*
	b) OFF-line	°C	*
18.5	Water tank capacity	l	
18.6	Detergent tank capacity	l	
18.7	Water wash pump		
	a) Capacity	l/m	*
	b) Discharge Pressure	bar (g)	*
	c) Drive motor rating	kW	*
18.8	Permitted compressor discharge pressure drop on full load	%	*
18.9	Recommended detergent		*
18.10	Recommended water quality		*
19.0	**Fire Extinguisher of Enclosure**		
19.1	Capacity of CO_2 storage tank	l	
19.2	Storage tank pressure	bar (g)	
19.3	Discharge pressure	bar (g)	
19.4	CO_2 concentration for protection		
19.5	Areas protected		

Item NO.	Description	Units	Bidder to fill in
20.0	**Exhaust frame cooling blower (if any)**		
20.1	No. of blowers		
20.2	Blower		
	a) Capacity	m^3/min	*
	b) Exhaust pressure	kPa (g)	*
	c) Motor rating	kW	*
21.0	**Exhaust Gas Transition System**		
21.1	Transition Duct		
	a) Material		*
	b) Ceiling/Wall/Floor thickness	mm/mm/mm	*
	c) Cross section	m^2	*
	d) Anchored point		
	e) Weight	kg	*
	f) Design Gas Velocity	m/s	*
	g) Internal Design Pressure	kPa (g)	*
21.2	Silencer		
	a) Manufacturer		*
	b) Country of origin		*
	c) Materials		
	• Casing		*
	• Perforated sheet		*
	• Sound absorption		*
	d) Ceiling/Wall/Floor thickness	mm/mm/mm	*
	e) Noise attenuation	dB(A)	*
	f) Weight	kg	
	g) Pressure Loss	kPa	*
	h) Design Gas Velocity between acoustic panels	m/s	*

Item NO.	Description	Units	Bidder to fill in
21.3	Expansion Joint (Gas Turbine Side)		
	a) Manufacturer		*
	b) Country of origin		*
	c) Type and Model No.		*
	d) Material of construction		
	e) Design life	y	
	f) Allowable expansion	mm	
	g) Design internal pressure	kPa (g)	*
21.4	Expansion Joint (Bypass Stack Side)		
	a) Manufacturer		*
	b) Country of origin		*
	c) Type and Model No.		*
	d) Material of construction		
	e) Design life	y	
	f) Allowable expansion	mm	
	g) Design internal pressure	kPa (g)	*
21.5	Appurtenance		
	a) Number/Size of flue gas sampling ports		*
	b) Location of sampling ports		*
	c) Number/Size of effluent/Drain		
22.0	**Dimension of Gas Turbine**		
22.1	Total weight of gas turbine	t	*
22.2	Rotor weight	t	*
22.3	Upper half casing weight	t	*
22.4	Rotor length	m	*
22.5	Max. weight for site maintenance and part name	t	*
23.0	**Gas Turbine Control System**		

Item NO.	Description	Units	Bidder to fill in
22.1	Make		
22.2	Model No.		
22.3	CPU		
	a) microprocessor size	bit	
	b) Memory size	MB	
	c) No. of loops per controller		
	d) Back-up CPU	Y/N	
	e) Switch over time	ms	
	f) Scan time for open and closed loops	ms	
	g) Memory protection during power failure		
22.4	Power Supply		
	a) Model type		
	b) Supply voltage(s)	V	
	c) Redundant	Y/N	
22.5	Analogue Input Module		
	a) Model type		
	b) DC 4-20mA inputs with transmitter power supply		
	- No. of inputs/module		
	- SMART tx. interface	Y/N	
	c) DC 4-20mA inputs(4 - wire type)		
	- No. of inputs/module		
	- SMART tx. interface	Y/N	
	d) 3 - wire RTD inputs		
	- No. of inputs/module		
	e) Thermocouple inputs		
	- No. of inputs/module		
	f) Electrical isolation	Y/N	
	g) Broken wire monitoring	Y/N	

Item NO.	Description	Units	Bidder to fill in
	h) Earth fault isolation	Y/N	
22.6	Analogue Output Module		
	a) Model type		
	b) No. of outputs/module		
	c) Type of output signals		
	d) Electrical isolation	Y/N	
	e) Reverse polarity protection	Y/N	
22.7	Digital Input Module		
	a) Model type		
	b) No. of inputs/module		
	c) Interrogation voltage	V	
	d) Electrical isolation	Y/N	
	e) Earth fault isolation	Y/N	
22.8	Digital Output Module		
	a) Model type		
	b) No. of outputs/module		
23.0	**Electro-hydraulic Governor Control System***		
23.1	Make		
23.2	Model No.		
23.3	Type		
23.4	Signal Range (from/to other system)		
23.5	System Cabinet		
	a) Dimension (W x D x H)	mm	
	b) Grounding wire		
	c) Anti-vibration rubber	Y/N	
	d) Index of protection (IP)		
23.6	Function processing time	ms	
23.7	Signal transmission rate	MB	

Item NO.	Description	Units	Bidder to fill in
23.8	System redundancy	Y/N	
23.9	Control System block diagram with turbine interlock system	Y/N	
23.10	Power supply system block diagram	Y/N	
23.11	Interface device to DCS		
	a) Type		
	b) Make & Model No.		
	c) Transmission rate	MB	
23.12	Operating condition		
	a) Temperature	°C	
	b) Relative humidity	%	
23.13	Supply Voltage	V	
23.14	Hydraulic system	Y/N	
23.15	Control oil pressure	Bar (g)	
23.16	MTBF	h	
24.0	**Supervisory Instruments***		
24.1	Make		
24.2	Model No.		
24.3	Type		
24.4	Type, measuring range & accuracy		
	a) Speed		
	b) Vibration		
	c) Control valve position		
	d) Others		
24.5	System Cabinet		
	a) Dimension (W x D x H)	m x m x m	
	b) Grounding wire		
	c) Anti-vibration rubber	Y/N	
	d) Index of protection (IP)		

Item NO.	Description	Units	Bidder to fill in
24.6	Interface device to DCS		
	a) Type		
	b) Make & Model No.		
	c) Transmission rate	MB	
24.7	Operating condition		
	a) Temperature	°C	
	b) Relative humidity	%	
24.8	Supply Voltage	V	
24.9	System function block diagram	Y/N	*
25.0	**Marshalling/Relay Cabinets**		
25.1	Make		*
25.2	Model No.		
25.3	Type		*
25.4	Dimension (W x D x H)	mm	
25.5	Thickness	mm	
25.6	Grounding wire		
25.7	Index of protection (IP)		*
25.8	Number of cabinets		
25.9	Terminal		
	a) Type		*
	b) Conductor size	mm^2	
	c) Number of terminals		
25.10	Connector of pre-fabricated cable		
	a) Type		
	b) Manufacturer and Model No.		
25.11	Interposing relay		
	a) Type		*
	b) Manufacturer and Model No.		*

Item NO.	Description	Units	Bidder to fill in	
	c) Contact rating	A	*	
26.0	**Instruments**			
26.1	Transmitters*		Make	Model No.
	a) Pressure			
	b) Pressure (draft)			
	c) Temperature			
	d) Flow			
	e) Level			
26.2	Switch*		Make	Model No.
	a) Pressure			
	b) Pressure (draft)			
	b) Temperature			
	c) Flow			
	d) Level			
26.3	Local Gauge*		Make	Model No.
	a) Pressure			
	b) Temperature			
	c) Flow			
	d) Level			
26.4	Primary elements*		Make	Model No.
	a) Thermocouple			
	b) RTD			
	c) Flow orifice			

Bidder's Data Sheet

Bidder's Name

2.8.3 Fuel Gas Supply System

Item NO.	Description	Units	Bidder to fill in
1.0	**Terminal Point**		
1.1	Flange connections		
	a) Grade and type		
	b) Size	mm	*
	c) Rating	bar (g)	*
1.2	Pipe		
	a) Grade and type		*
	b) Size	mm	*
	c) Rating	bar (g)	
2.0	**Emergency Shut Down Valve**		
2.1	Manufacturer		*
2.2	Type (including actuation type) and designation		*
2.3	Quantity		
2.4	Connection / flange size and rating	mm	
2.5	Materials		
	a) Body		
	b) Stem / spindle		
	c) Seating		
	d) Sealing / packing		
	e) Disc / ball / gate		
	f) Flange fasteners (bolts, nuts)	mm	
3.0	**Gas Flow Metering Device**		
3.1	Flow meter		
	a) Manufacturer		*

Item NO.	Description	Units	Bidder to fill in
	b) Quantity		
	c) Type		*
	d) Accuracy on 50~ 100 % flow range as a whole device		*
	e) Materials		*
3.2	Pressure Transmitters		
	a) Manufacturer		
	b) Type		
	c) Quantity		
	d) Connection / flange size & rating		
	e) Transmitter type		
	f) Materials		
3.3	Temperature Transmitter		
	a) Manufacturer		
	b) Type		
	c) Quantity		
	d) Connection / flange size & rating		
	e) Transmitter type		
	f) Materials		
3.4	Strainer		
	a) Manufacturer		*
	b) Model No. / type		
	c) Quantity		
	d) Flow capacity	m^3/s	*
	e) Materials		
4.0	**Filter Separator**		
	a) Manufacturer		*
	b) Type		*
	c) Quantity		*
	d) Pressure rating	bar (g)	
	e) Flow rate	Nm^3/s	*

Item NO.	Description	Units	Bidder to fill in
	f) Number of stages		*
	g) Material of filter coalescer elements		*
	h) Material of mist eliminator		
	i) Separation / filtration efficiency with definition	%	*
5.0	**Knockout Drum**		
	Manufacturer		*
	Type		*
	Quantity		*
	Pressure rating	bar (g)	
	Flow rate	Nm^3/s	*
	Number of stages		*
	Material of mist eliminator		
	Separation efficiency	%	*
6.0	**Final Gas Filter**		
	a) Manufacturer		*
	b) Model No. / type		
	c) Quantity		
	d) Flow capacity	m^3/s	*
	e) Materials		
7.0	**Flow Proportion Control Valve**		
7.1	**Valves**		
	a) Manufacturer		*
	b) Type		
	c) Quantity		
	d) Connection / flange size & rating	mm	
	e) Materials		
	Body		
	Stem / spindle		
	Seating		

Item NO.	Description	Units	Bidder to fill in
	Sealing / packing		
	Disc / ball / gate		
	f) Flange fasteners (bolts, nuts)	mm	
	g) Thickness	mm	
7.2	Fittings		
8.0	Design Parameters		
	System design pressure	bar (g)	*
	System design temperature	°C	*
	Material of gas pipe		*
9.0	**Compressor Station**		
7.1	**Compressor**		
	a) Type / Model No		*
	b) Manufacturer		*
	c) Number Operating		*
	d) Number Standby		*
	e) Design Flow	Nm^3/h	*
	f) Suction Design Pressure	bar (g)	*
	g) Discharge Design Pressure	bar (g)	*
	h) Efficiency at Design Point	%	*
	j) Number of Stages		*
	j) Speed	rpm	*
	k) Required Shaft Power (Design)	kW	
	l) Required Shaft Power (at Design plus 10 Bar Suction Pressure and Design Flow)	kW	
	m) Material - Casing - Impeller - Shaft		*
7.2	Motor		
	a) Manufacturer		
	c) Type		*

Item NO.	Description	Units	Bidder to fill in
	d) Speed	rpm	
	e) Class/rating		*
	f) Power consumption at design	kW	*
7.3	Volume Chamber (if required)		
	a) Manufacturer		
	b) Type of tank		
	c) Volume	m^3	*
	d) Design pressure	bar (g)	*
	e) Design temperature	℃	*
	f) Thickness	mm	*
	g) Material of body		*
7.4	Oil Recovery Tank(if required)		
	a) Manufacturer		
	b) Quantity		
	c) Volume	m^3	
	d) Oil Separation Media		
	e) Filtration Size	micron	
	f) Type of coalescer		
	g) Type (Vertical or Horizontal)		
	h) Design pressure	bar (g)	
	i) Design temperature	°C	
7.5	Oil Separator(if required)		
	a) Manufacturer		
	b) Quantity		
	c) Volume	m^3	
	d) Oil Separation Media		
	e) Filtration Size	micron	
	f) Coalecser manufacturer		
	g) Type (Vertical or Horizontal)		
	h) Design pressure	bar (g)	

Item NO.	Description	Units	Bidder to fill in
	i) Design Temperature	℃	
	j) Oil content entrained in gas stream	ppm	
7.6	Bypass Gas Cooler (if required)		
	a) Manufacturer		
	b) Type of cooler(Shell /tube or Radiator)		*
	c) Cooling media(water or air)		*
	d) Quantity per four (4) compressors		*
	e) Heat rejection of each cooler	Mcal/h	*
	f) Inlet temperature of gas	℃	
	g) Outlet temperature of gas	℃	
	h) Inlet temperature of cooling media	℃	
	i) Outlet temperature of cooling media	℃	
	j) Number of cooling fans for radiator type		
	k) Materials		
	• heat transfer tube(fin)		
	• Tube size (OD/Thickness)	mm	
	• Shell		
	• Header		
	l) Heat rejection is enough for continuous no load operation?		Yes/No

Bidder's Data Sheet

Bidder's Name

2.8.4 Heat Recovery Steam Generator and Auxiliary Equipment

Item NO.	Description	Units	Bidder to fill in		
1.0	**General Information**				
1.1	Manufacturer		*		
1.2	No. of HRSG		*		
1.3	Type of HRSG				
	a) Horizontal / vertical gas flow		*		
	b) Natural circulation / forced circulation / Hybrid		*		
	c) Pressure levels		*		
1.4	Design Code - Pressure parts		*		
	- Steel Structural parts		*		
	- Performance testing		*		
2.0	**Design Conditions**		MCC 100 %	MCC 100 %	MCC 100 %
	- Fuel		Shurtan	Bukhara	Shurtan
	- Amb. Temp.	°C	3	3	3
	- Barometric pressure	kPa	96.0	96.0	96.0
	- Relative humidity	%	65.5	65.5	65.5
	Cooling water temp.	°C	6.0	6.0	6.0
	Heat supply	Gcal/h	0	0	100
	MCC : Maximum Capability Conditions				
3.0	**HRSG Gas Flow Path Data**				
3.1	Inlet Gas Flow	kg/s	*	*	*
3.2	Inlet Gas Temperature	°C	*	*	*
3.3	Gas Temp. at SH/RH Outlet				
	a) Reheater	°C	*	*	*
	b) HP superheater	°C	*	*	*

Item NO.	Description	Units	Bidder to fill in		
	c) IP superheater	°C	*	*	*
	d) LP superheater	°C	*	*	*
3.4	Gas Temp. at Evaporator Outlet		*	*	*
	a) HP evaporator	°C	*	*	*
	b) IP evaporator	°C	*	*	*
	c) LP evaporator	°C	*	*	*
3.5	Pinch Point Temperature Difference				
	a) HP evaporator	°C	*	*	*
	b) IP evaporator	°C	*	*	*
	c) LP evaporator	°C	*	*	*
3.6	Approach Point Temperature Difference				
	a) HP evaporator	°C	*	*	*
	b) IP evaporator	°C	*	*	*
	c) LP evaporator	°C	*	*	*
3.7	Exhaust Gas Temp. at Stack Inlet	°C	*	*	*
3.8	Pressure Drop of HRSG	kPa	*	*	*
4.0	**Feed Water Data**				
4.1	Feed Water Flow to HRSG	kg/s	*	*	*
4.2	Feed Water Temp. at				
	a) Deaerator inlet	°C	*	*	
	b) Deaerator outlet	°C	*	*	*
	c) LP Evaporator inlet	°C	*	*	*
	d) IP Evaporator inlet	°C	*	*	*
	e) HP Evaporator inlet	°C	*	*	*
4.3	Feed water Pressure at				
	a) LP economiser inlet	bar	*	*	*
	b) IP economiser inlet	bar	*	*	*
	c) HP economiser inlet	bar	*	*	*
4.4	Feed Water Pressure drop through				
	a) LP Economiser	bar	*	*	*

Item NO.	Description	Units	Bidder to fill in		
	b) IP Economiser	bar	*	*	*
	c) HP Economiser	bar	*	*	*
5.0	**Steam Data**				
5.1	Steam flow to turbine				
	a) HP Steam	kg/s	*	*	*
	b) IP Steam	kg/s	*	*	*
	c) LP Steam	kg/s	*	*	*
	d) Reheat Steam	kg/s	*	*	
5.2	Steam Pressure at				
	a) HP Superheater outlet	bar	*	*	*
	b) IP Superheater outlet	bar	*	*	*
	c) LP Superheater outlet	bar	*	*	*
	d) Reheater outlet	bar	*	*	*
5.3	Steam Temperature at				
	a) HP Superheater outlet	°C	*	*	*
	b) IP Superheater outlet	°C	*	*	*
	c) LP Superheater outlet	°C	*	*	*
	d) Reheater outlet	°C	*	*	*
5.4	Steam/FW Press. Drops across				
	a) HP Superheater	bar	*	*	*
	b) IP Superheater	bar	*	*	*
	c) LP Superheater	bar	*	*	*
	d) Reheater		*	*	*
5.5	Desuperheater Spray Water Flow				
	HP superheater	kg/s	*	*	*
	Reheater	kg/s	*	*	*
5.6	Blow down flow	kg/s	*	*	*
6.0	***Dimensions And Weights***				
6.1	Total weight of HRSG	t	*		

Item NO.	Description	Units	Bidder to fill in		
6.2	Weight of heaviest component during erection	t	*		
6.3	Weight of heaviest component for maintenance	t	*		
6.4	Overall dimension of HRSG				
	a) Overall length	m	*		
	b) Overall width	m	*		
	c) Maximum height	m	*		
6.5	Weight of filled water	t			
7.0	**Steam Drums**		LP	IP	HP
	a) Dia. x Length	m x m	*	*	*
	b) Total weight including internal fixtures	t			
	c) Effective water volume between				
	- High-High and High Level	min.	*	*	*
	- High and Normal Level	min.	*	*	*
	- Normal and Low Level	min.	*	*	*
	- Low and Low-Low Level	min.	*	*	*
	d) Design conditions - Pressure	bar (g)	*	*	*
	- Temp.	°C	*	*	*
	e) Material of drum		*	*	*
	f) Drum wall thickness	mm	*	*	*
8.0	**Economisers**		*LP*	*IP*	*HP*
	a) Type		*	*	*
	b) Heating surface	m^2	*	*	*
	c) Design conditions - Pressure	bar (g)	*	*	
	- Temp.	°C	*	*	
	d) Tube wall thickness	mm	*	*	*
	e) Materials - Tube		*	*	*
	- Header		*	*	*
	f) Tube OD	mm	*	*	*

Item NO.	Description	Units	Bidder to fill in		
	g) Fin material		*	*	*
	h) Fin height	mm	*	*	*
	i) Fin thickness	mm	*	*	*
	j) Fin pitch	mm	*	*	*
9.0	**Evaporators**		LP	IP	HP
	a) Type		*	*	*
	b) Heating surface	m^2	*	*	*
	c) Design conditions - Pressure	bar (g)	*	*	*
	- Temp	°C	*	*	*
	d) Tube wall thickness	mm	*	*	*
	e) Materials - Tube		*	*	*
	- Header		*	*	*
	f) Tube OD	mm	*	*	*
	g) Fin material		*	*	*
	h) Fin height	mm	*	*	*
	i) Fin thickness	mm	*	*	*
	j) Fin pitch	mm	*	*	*
10.0	**Superheaters/Reheater**				
10.1	LP and IP Superheaters		LPSH		IPSH
	a) Type		*		*
	b) Heating surface	m^2	*		*
	c) Design conditions - Pressure	bar (g)	*		*
	- Temp.	°C	*		*
	d) Tube wall thickness	mm	*		*
	e) Materials - Tube		*		*
	- Header		*		*
	f) Tube OD	mm	*		*
	g) Fin material	mm	*		*
	h) Fin height	mm	*		*
	i) Fin thickness	mm	*		*

Item NO.	Description	Units	Bidder to fill in	
	j) Fin pitch	mm	*	*
10.2	HP Superheater and Reheater		HPSH	RH
	a) Type		*	*
	b) Heating surface	m^2	*	*
	c) Design conditions - Pressure	bar (g)	*	*
	- Temp.	°C	*	*
	d) Tube wall thickness	mm	*	*
	e) Materials - Tube		*	*
	- Header		*	*
	f) Tube OD	mm	*	*
	g) Fin material		*	*
	h) Fin height	mm	*	*
	i) Fin thickness	mm	*	*
	j) Fin pitch	mm	*	*
11.0	**Safety Valves**			
11.1	LP Drum and Superheater		Drum	Superheater
	a) Number		*	*
	b) Type		*	*
	c) Proposed Pressure setting	bar (g)		
	d) Discharge capacity	kg/s		
	e) Provision of silencer	yes/no	*	*
11.2	IP Drum and Superheater			
	a) Number		*	*
	b) Type		*	*
	c) Proposed Pressure setting	bar (g)		
	d) Discharge capacity	kg/s		
	e) Provision of silencer	yes/no	*	*
11.3	HP Drum and Superheater			
	a) Number		*	*
	b) Type		*	*

Item NO.	Description	Units	Bidder to fill in		
	c) Proposed Pressure setting	bar (g)			
	d) Discharge capacity	kg/s			
	e) Provision of silencer	yes/no	*	*	
11.4	Reheater				
	a) Number		*		
	b) Type		*		
	c) Proposed Pressure setting	bar (g)			
	d) Discharge capacity	kg/s			
	e) Provision of silencer	yes/no	*		
11.5	Economizers (if applicable)		LP	IP	HP
	a) Number		*	*	*
	b) Type		*	*	*
	c) Proposed Pressure setting	bar (g)			
	d) Discharge capacity	kg/s			
12.0	**Blow Down System**				
12.1	Blow Down valve for Continuous Use		LP	IP	HP
	a) Size of valve	ND	*	*	*
	b) Capacity	kg/s	*	*	*
	c) Actuator		*	*	*
12.2	Blow Down valve for Intermittent Use				
	a) Size of valve	ND	*	*	*
	b) Capacity	kg/s	*	*	*
	c) Actuator		*	*	*
12.3	Flash Tank				
	a) Design pressure				
	b) Shell Material & thickness	mm			
	c) Tank diameter	mm			
	d) Tank height	mm			
12.4	Blow Down Tank				
	a) Shell Material & thickness	mm			

Item NO.	Description	Units	Bidder to fill in		
	b) Tank diameter	mm			
	c) Tank height	mm			
13.0	**Deaerator**				
13.1	Deaerating Heater				
	a) Manufacturer		*		
	b) Type		*		
	c) Design capacity	kg/s	*		
	d) Inlet feedwater temp.	°C	*		
	e) Outlet feedwater temp.	°C	*		
	f) Outlet oxygen content	wt. ppm	*		
	g) Materials - Shell		*		
	- Tray		*		
	- Spray valve		*		
	h) Type of water valve		*		
	i) Design pressure	bar (g)	*		
13.2	Storage Tank				
	a) Capacity at normal water level	m^3	*		
	b) Dimensions - Overall length	mm	*		
	- Diameter	mm	*		
	- Shell thick.	mm	*		
	c) Shell material		*		
	d) Weight - Empty	t	*		
	- Operating	t			
	- Flooded	t			
14.0	**Boiler Circulating Pumps**		LP	IP	HP
	a) Manufacturer		*	*	*
	b) Number		*	*	*
	c) Type		*	*	*
	d) Driver rating	kW	*	*	*
	e) Capacity	l/min.	*	*	*

Item NO.	Description	Units	Bidder to fill in		
	f) Circulation ratio		*	*	*
	g) Rated speed	rpm	*	*	*
	h) Suction pressure	bar (g)	*	*	*
	i) Discharge pressure	bar (g)	*	*	*
	j) Casing material		*	*	*
	k) Shaft material		*	*	*
	l) Impeller material		*	*	*
15.0	**Preheater/Economizer Recirculating Pumps**				
	a) Manufacturer		*		
	b) Number		*		
	c) Type		*		
	d) Driver rating	kW	*		
	e) Capacity	l/min.	*		
	f) Circulation ratio		*		
	g) Rated speed	rpm	*		
	h) Suction pressure	bar (g)	*		
	i) Discharge pressure	bar (g)	*		
	j) Casing material		*		
	k) Shaft material		*		
	l) Impeller material		*		
16.0	**Casing and Duct work**				
16.1	HRSG Casing		High temp. zone	Low temp. zone	
	a) Design pressure	kPa (g)	*	*	
	b) Casing plate materials		*	*	
	c) Casing plate thickness	mm	*	*	
	d) Insulation (internal or external?)		*	*	
16.2	Gas duct		Inlet	Outlet	
	a) Design pressure	kPa (g)	*	*	
	b) Design temperature	°C	*	*	

Item NO.	Description	Units	Bidder to fill in	
	c) Plate material		*	*
	d) Plate thickness	mm	*	*
	e) Insulation (internal or external?)		*	*
16.3	Expansion joints		Inlet	Outlet
	a) Number of expansion joints		*	*
	b) Type		*	*
	c) Design pressure	bar (g)	*	*
	d) Design temperature	°C	*	*
	e) Flexible connection material		*	*
17.0	**Main Stack**			
	a) Type		*	
	b) Height	m	*	
	c) Top inside diameter	mm	*	
	d) Exhaust gas velocity at 100 % max. capability condition	m/s	*	
	e) Material		*	
	f) Thickness	mm		
	g) Material of top ( ) meters		*	
	h) Material of internal lining		*	
	i) Thickness of lining	mm		
18.0	**Bypass Stack**			
18.1	Stack Proper			
	a) Type		*	
	b) Height	m	*	
	c) Top inside diameter	mm	*	
	d) Exhaust gas velocity at 100 % max. capability condition	m/s	*	
	e) Material		*	
	f) Insulation (internal or external)		*	
18.2	Silencer			
	a) Type		*	

Item NO.	Description	Units	Bidder to fill in	
	b) Material		*	
	c) Expected noise abatement	dB	*	
18.3	Diverter Damper			
	a) Manufacturer		*	
	b) Type		*	
	c) Gas pass dimensions (width x height)	mm	*	
	d) Design temperature	°C	*	
	e) Design pressure	kPa (g)	*	
	f) Materials - Frame		*	
	g) - Blades		*	
	h) - Liners		*	
	i) - Shaft		*	
	j) - Seal plate		*	
	k) Type of actuator		*	
	l) Closing/Opening time	s	*	
	m) Seal method		*	
	n) Guaranteed leak gas ratio	%	*	
	o) Total weight	t		
19.0	**Thermal Insulation**			
19.1	Casing		High temp. zone	Low temp. zone
	a) Material & thickness of insulation	mm	*	
	b) Material & thickness of cover plate	mm	*	
19.2	Ducts		Inlet	Outlet
	a) Material & thickness of insulation	mm	*	
	b) Material & thickness of cover plate	mm	*	
19.3	Piping			
	Material & thickness of insulation	mm		
	- HP Steam line	mm		
	- IP Steam line	mm		

Item NO.	Description	Units	Bidder to fill in
	- LP Steam line	mm	
	- Feed water line	mm	
20.0	**Platforms, Galleries and Stairs**		
	a) Width of Platforms	mm	*
	b) Width of Stairways	mm	*
	c) Material of grating		*
	d) Thickness and height of grating	mm	*
21.0	**Roof Canopy and Wall Cladding**		
	a) Material of Roof		*
	b) Material of Wall		*
22.0	Lifting Tackle		
	a) Type		*
	b) Number of unit		*
	c) Capacity	t	*
	d) Drive	kW	