Expression of Interest (EOI)

Ref: HY/HPEP/EOI/GT-OEM/2018/0001 **Dated: 08-03-2018**

BHEL EOI DOCUMENT NO.: HY/HPEP/EOI/GT-OEM/2018/0001

EOI Notification number: NIT_37466

BOOKLET FOR EXPRESSION OF INTEREST (EOI)

FOR

PRE-QUALIFICATION OF GAS TURBINE VENDORS FOR UPCOMING CPP at APL Namrup, Assam, INDIA

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NOTE :

This is not a RFQ but an EOI hence, prices need not be submitted.

Expression of Interest (EOI)

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SECTION-1 : INVITATION FOR EXPRESSION OF INTEREST (EOI)

Subject: Expression of Interest (EOI) from GT OEM for supplying Industrial type Gas Turbine Package for upcoming APL Namrup project.

1.0 Introduction:

Bharat Heavy Electricals Limited **(**BHEL) is a major Public Sector Undertaking in India, a Maharatna company and has been the bedrock of India's Heavy Electrical Equipment industry since its incorporation in 1964. It is serving core sectors of Indian economy, viz. Power, Transmission, Industry, Transportation (Railways), Renewable Energy, Oil & Gas, Water and Defence with over 180 product offerings to meet the needs of these sectors. For More details about the entire range of BHEL's products, Systems and operations, please visit **www.bhel.com**.

2.0 EOI: BHEL's Requirement :

M/s Assam Petro-chemicals Ltd. (APL) is one of the State Public Sector Undertaking of the Government of Assam ,India. Incorporated in 1971, the company is a pioneer in the field of petro-chemicals as it was the first to manufacture petrochemicals in India using natural gas as feedstock.

M/s Assam Petro-chemicals Ltd. (APL), intends to set up a 500 TPD Methanol plant at Namrup, Assam,India. M/s Engineers India Limited (EIL) has been retained by M/s APL for License, Engineering, and Procurement & Construction Management (LEPCM) services for the Methanol Plant.

M/s EIL may float a formal **Request for Quotation (RFQ)** by the end of March 2018.

The requirement calls for Design, Engineering, Supply ,Erection & commissioning of one number Industrial type Gas Turbine (GT) of 4.0 MW (Min) site rating (@37.8°C ambient temperature, 80% RH) for the CPP at M/s APL Namrup on single point responsibility. The STG, HRSG, UB, BOPs and other auxiliaries will be supplied by BHEL .

Since, BHEL does not have GT of 4.0 MW rating in the manufacturing range; The GT that meets EIL requirements shall be outsourced.

BHEL as EPC bidder shall **manufacture generator for gas turbine** and supply STG, HRSG, UB, BOP and E&C for the project by sourcing GT from a GT OEM. In this regard, BHEL is presently seeking Expression Of Interest (EOI) Ref: HY/HPEP/EOI/GT-OEM/2018/0001 from GT OEMs for supply and installation of one number Industrial type Gas Turbine (GT) of 4.0 MW (min) site rating for the upcoming CPP at M/s APL Namrup.

3.0 Mode of selection and Instruction to bidders:

GT OEMs are requested to submit their response against this EOI in the prescribed **Pre-Qualification criteria format** below in Clause 7.0. Upon receipt of Expression of interest from the GT OEM in the Pre-Qualification format below, BHEL will scrutinize the information and if found acceptable, BHEL will qualify the OEM for sending detailed RFQ upon receipt of RFQ from M/s EIL.

BHEL will float the RFQ to qualified GT-OEM in this EOI Ref: HY/HPEP/EOI/GT-OEM/2018/0001 for entering into a "Pre-bid Tieup". Priced offers received from vendors qualified at EOI stage shall be evaluated to select the GT OEM for the required Gas Turbine Equipment, such that the offer from the GT-OEM selected for entering into "Pre-Bid Tie Up" with BHEL shall result in the most competitive offer from BHEL to end customer (APL) and complies to scope, quality and delivery requirements. Upon placement of LOI by end Customer i.e. M/s APL on BHEL, BHEL will place PO for GT package as per the Pre-bid NIT agreements between BHEL and the Selected GT OEM.

4.0 Scope of Work:

Design, detailed engineering, procurement, supply, fabrication, inspection by Third Party Inspection agency (TPI), testing at shop as applicable and delivery up to CIP Mumbai Seaport for Gas Turbine Package.

GT-OEM to provide supervision services for Erection and Commissioning and conducting performance guarantee test at site. The Installation and Performance Guarantee test at site shall be performed by BHEL under the supervision of GT OEM supervisor.

Gas Turbine shall be Industrial type, suitable for outdoor installation with minimum site rated power of 4.0 MW (min) on Natural gas fuel corresponding to site rated temperature of 37.8 Deg C and 80% RH. The Gas Turbine shall be designed as per API 616. The Gas Turbine shall be capable of withstanding full load rejection without over speed trip while running on natural gas fuel.

M/s Engineers India Limited (EIL) has issued the DESIGN BASIS/ PHILOSOPHY (Job no. A672) regarding Captive Power Plant (CPP) requirement for APL Namrup project vide document A672-011-02-43-DB-01 Rev -0 and Miscellaneous process Data Sheet for GTG and its auxiliaries vide document No: A672-011-02-43-DS-1801 Rev. No.A. **The document is attached for reference and compliance with regard to GT OEM scope** (refer Clauses 2, 3, , 4.1, 4.6, 4.13, 6, 8, 10 etc.).

5.0 NOTE to Bidders :

5.1 Please ensure submission of Signed copy of **Pre-Qualification document in Clause 7** below ,duly enclosing all the required attachments viz. :

i) Technical details of Model selected along with catalogues etc. as per Sl 1(a) of Table in Clause 7
ii) Customer Work order /LOI/PO copy, as per Sl 1(b) of Table in Clause 7.
iii) Self Certification copy as per Annexure-A (Page 8)
iv) Reference List as per Sl 1(d) of Table in Clause 7
v) Financial statements as per Sl 2(i) of Table in Clause 7.
vi) Self-Certification as per Annexure-B (Page 9) for Clause 5.2.1 & 5.2.2
vii) Self-certified documentation as per Sl. 4 of Table in Clause 7.
viii) Any other documents relevant for the EOI may be submitted.

NOTE : The Expression of Interest is only for Pre-Qualification of GT OEMs willing to participate with BHEL as per Clauses above. Hence, no prices shall be submitted along with EOI.

5.2 General :

5.2.1 The bidders must not have been debarred / blacklisted by any Govt. Department, Agency, PSU / Institution / Agencies / Autonomous Organizations. The Bidder shall submit a self–certification by an

authorized person to this effect.The Bidder shall give the certification that the bidders and its Directors have paid all the statutory dues and that bidder and its Directors have not defaulted repayment of any dues to any Government or banks or financial institutions. Further, Bidder has not defaulted repayment to any public deposits or unsecured loans and the Bidder or its Directors are not under the Defaulter's list of Reserve Bank of India or in the Specific Approval List of Export Credit Guarantee Corporation(ECGC). (Refer "Annexure B" in this EOI document)

5.2.2 Bidder should not be under liquidation, court receivership or similar proceedings. (refer "**Annexure B"** in this EOI document)

5.2.3 BHEL will not be responsible for any costs or expenses incurred by the Bidder in connection with preparation or delivery of EOI.

5.2.4 BHEL reserves the right to reject any or all EOI received without assigning any reason.

5.2.5 In case of Foreign Bidders, if any of the documents in support of meaning EOI are not in English language, then the original document along with English translation shall be furnished. The EOI and all correspondence incidental and related to EOI shall be in English language. Any printed literature and document submitted in any other language should be accompanied by authenticated English translation, in which case, for purpose of interpretation of the EOI, English translation shall govern. Responsibility for correctness in translation shall lie with the Bidder.

5.2.6 Date & Time for Submission of Proposal (EOI): The due date & time for submission of Proposal (EOI) by the Bidder : refer BHEL Email .

5.2.7 Please refer Instruction to Bidders (ITB) in Section 2 of the document for compliance.

6.0 Contact Person & SUBMISSION OF EOI :

The proposal complete in all respect is to be sent with heading HY/HPEP/EOI/GT-OEM/2018/0001 Bid by **E-mail** per the EOI requirements to *nagg@bhel.in*. Since, this is not an RFQ and only an EOI, the price bid is NOT to be submitted.

Any clarifications regarding to the tender may also be obtained from

Mr. G Nageswara Rao
Dy Mgr / Gas Turbines Purchase
Administrative Building, IV Floor
BHEL, Ramachandrapuram
Hyderabad-502032, India
Phone: +91 40 23182154
E-mail: nagg@bhel.in

Note : Please ensure that the **email size** does not exceed **7 Mb**. If the size is higher than 7 Mb, please split the email in many parts and send the emails with heading as " HY/HPEP/EOI/GT-OEM/2018/0001 Bid- Part 1 of n ", " HY/HPEP/EOI/GT-OEM/2018/0001- Part 2 of n" , etc till ," HY/HPEP/EOI/GT-OEM/2018/0001- Part n of n "

7.0 Pre-Qualification Criteria: The following documents are essentially required for pre-qualification of interested GT suppliers.

Sl. No.	Pre-qualification criteria	Documentary evidence	Vendor confirmation (Yes/No)	Remarks
1.	a) Bidders may refer the technical parameters in Clause 4 above for selecting the appropriate Industrial Heavy Duty Gas Turbine	a) Brief **Technical details** of the selected model may be furnished.	Yes / No	
	b) The bidder shall submit documentary evidence to the effect that the proposed Gas Turbine manufacturer for the subject tender must have supplied at least one number Industrial gas turbine of capacity 4 MW(min) site rating (37.8°C & 80% RH) in a Fertilizer or Refinery or Oil & Gas or Process or Power Industry during last 10 years (i.e. from date of LOA/LOI/Work Order).	b)Copy of customer **Work Order/LOI/PO /** relevant Extract of Work Order	Yes / No	
	c) The manufacturer shall submit documentary evidence that the unit is in satisfactory operation for at least one year as on the date of issue of this EOI.	c) The vendor may submit along with EOI a self-certification in prescribed format (refer "**Annexure A"** in this EOI document) on company letter head indicating about having at least ONE (1) unit designed, manufactured, tested and supplied from the proposed manufacturing plant in the last TEN (10) years which has completed ONE (1) year of satisfactory operation at site as on bid due date for the offered model.	Yes / No	
	d) Manufacturer shall submit reference list of Industrial type gas turbines supplied.	d) Manufacturer shall submit **reference list** of Industrial type gas turbine supplied for the offered model.	Yes / No	
	e) **Additional supporting documents required later at RFQ stage only and not required at present along with EOI:** The offered model shall be identical in construction (i.e. number	Confirmation	Yes / No	

	of shafts, number of stages in compressor section, number of stages in each turbine section, mechanical design, material of construction of blades, nozzles, discs and combustors, cooling of blades, nozzles & discs, combustion system, starting system), type of turbine temperature control and performance at ISO conditions in terms of power rating for the type of fuel specified (liquid and/or gas fuel), heat rate, firing/cycle temperature, power turbine inlet temperature, exhaust temperature, overall pressure ratio, air flow and speed of each shaft. In case all the above parameters are not available from single past reference, more than one reference may be cited at RFQ stage to satisfy the above qualification requirement. In case certain improvements have been done the same can be considered provided vendor is having proven field experience for the same. Vendor to clearly highlight such improvements and shall furnish information of experience as per experience record proforma during RFQ stage. As an alternative, vendor may show to the satisfaction of purchaser, that the equipment is comprised of modules such as compressor, turbine, etc. each of which individually satisfies the requirements specified above.			
2.	Bidder shall submit turnover details, which shall be used for assessing financial status.	**i)** Complete audited annual financial **statements** including Balance Sheet, Profit & Loss accounts statement and all other schedules for 3 years including the immediate preceding financial year, **ii)Self-certification of not being under liquidation, court receivership or similar proceedings** (refer "**Annexure B"** in this EOI document)	Yes / No Yes / No	

Expression of Interest (EOI)

Ref: HY/HPEP/EOI/GT-OEM/2018/0001 **Dated: 08-03-2018**

3.	Technically qualified vendors will be shortlisted for sending detailed enquiry with NIT terms and conditions along with detailed specifications after entering into Non-disclosure agreement (NDA) and Prebid Tie-up with BHEL upon receipt of detailed tender enquiry from end customer.	Confirmation	Yes/No	
4.	Documents to be submitted i. Brief profile of the organization ii. Product profile iii. Experience list iv. Technical documentation v. Manpower resources vi. Quality system vii. Vendor/OEM should have ISO 9001. Bidders shall enclose the certifications in their offer.	**Self-certified documentation**	Yes / No	
5.	Please confirm that, you are not directly participating in the tender with APL for overall Package.	Confirmation	Yes / No	
	Note: 1. If any information given by the bidder is found to be incorrect at later stage, BHEL reserves the right to reject the bid submitted by bidder / cancel the award of order. 2. The vendors shortlisted, will be considered for registration with BHEL at www.bhel.com under supplier registration link. http://www.bhel.com/vender_registration/vender.php			
Bidder confirms that they are not under liquidation, court receivership or similar proceedings.				

Company Seal:	Authorised Signatory	
	Name:	
	Designation	
	Address	
	Phone no.	
	Email id	

Annexure-A : (To be submitted on Company Letter head)

TO WHOMSOEVER IT MAY CONCERN

This is to certify that our machine ….. (model name) …. Rating (…..MW) Supplied to …. (Name of customer)…. via (PO/WO number)….. has been operating satisfactorily as on date and has been meeting the guaranteed performance since (….xxx 20xx) and has had no major operational problems arising till date.

Date **Signature**

Company Seal

Expression of Interest (EOI)

Ref: HY/HPEP/EOI/GT-OEM/2018/0001 **Dated: 08-03-2018**

Annexure-B : (To be submitted on Company Letter head)

TO WHOMSOEVER IT MAY CONCERN

This is to certify that :

i) The bidder has not been debarred / blacklisted by any Government Department, Agency, Public Sector undertaking (PSU) / Institution / Agencies / Autonomous Organizations.

ii) The Bidder and its Directors have paid all the statutory dues and the bidder and its Directors have not defaulted repayment of any dues to any Government or banks or financial institutions. Further, Bidder has not defaulted in the repayment of any public deposits or unsecured loans and the Bidder or its Directors are not under the Defaulter's list of Reserve Bank of India or in the Specific Approval List of Export Credit Guarantee Corporation (ECGC).

iii) Bidder is not under liquidation, court receivership or similar proceedings.

Date **Signature**

Company Seal

SECTION -2 (ITB)
INSTRUCTION TO BIDDERS FOR SUBMISSION OF EXPRESSION OF INTEREST

1.0 INTRODUCTION
1.1 DEFINTIONS
1.1.1 'Owner' means M/s Assam PetroChemicals Limited, (APL), a company incorporated in India.
1.1.2. 'Consultant' – means M/s Engineers India Limited (EIL), a company incorporated in India.
1.1.3 EPC Bidder means M/s Bharat Heavy Electricals Limited (BHEL), a company incorporated in India.
1.2 SCOPE OF WORK
The brief scope of work, description of required equipment and pre-qualification criteria have been provided under Section – 1: Invitation for Expression of Interest.
1.3 RIGHT TO ACCEPT/REJECT
BHEL reserves the right to accept or reject any EOI and to annul the bidding process and reject all EOI at any time without thereby incurring any liability to the affected Bidder or any obligation to inform the affected Bidder of the grounds for the BHEL's action.

2.0 PREPARATION / SUBMISSTION OF EXPRESSION OF INTEREST
2.1 LANGUAGE OF EOI
The EOI and all correspondence incidental and related to EOI shall be in English language. Any printed literature and document submitted in any other language should be accompanied by authenticated English translation, in which case, for purpose of interpretation of the EOI, English translation shall govern. Responsibility for correctness in translation shall lie with the Bidder.
2.2 COST OF BIDDING
The Bidder shall bear all costs associated with the preparation or delivery of its EOI, participating in discussion etc. including costs and expenses related with visits to BHEL's office and the site (s). BHEL will in no case be responsible or liable for those costs and expenses regardless of the outcome of the bidding process.
2.3 DOCUMENTS COMPRISING EOI
2.3.1 The EOI must be complete in all respect leaving no scope for ambiguity. It is in the interest of Bidder to submit complete and comprehensive proposal leaving no scope for BHEL to raise any further questionnaires. BHEL may evaluate the Bidder on the basis of document submitted in the first instance in order to adhere to project schedule requirements.(refer Clauses 5 & 7-Section-1)
2.3.2 **Bidder shall submit the following for expressing their interest:**
i) Cover letter giving brief introduction and expressing interest to participate in bidding process.
ii) Pre-qualification criterion as per Pre-qualification Criteria **as per Clause 7 in Section-1 of EOI** along with supporting documents such as copies of work order, Self-Certifications, contract agreement, completion certificate (if available) etc.
2.4 SUBMISSION OF EOI
Bidders are required to send the complete proposal /EOI document as per Clause 5 and 6 in Section-1 of EOI along with all supporting documents duly signed & stamped on each page so as to reach at the email-id *nagg@bhel.in* within due date of **16.03.2018. Refer BHEL website (www.bhel.com)** for details. All corrigenda, addenda, amendments, time extensions, clarifications, etc. to the EOI tender will be hosted on BHEL website only. Bidders should regularly visit website to keep themselves updated**. Prices should not be furnished in EOI.**
2.5 EPC Bidder's RIGHT
2.5.1 BHEL reserves its right to call originals of the supporting document submitted for verification, if required and also to cross check any details as furnished by the Bidder from their previous Clients / Consultants etc. Bidder shall have no objection whatsoever in this regard and shall facilitate BHEL to obtain the same.
2.5.2 BHEL reserves the right to make use of available in- house data (their own or their Consultants) also for pre-qualification of Bidder(s) who have submitted EOI. The decision of BHEL will be final and binding on the parties.
2.5.3 This EOI intends to short list suitable GT OEMs for supply of Industrial type Gas Turbine Package for upcoming APL Namrup project(refer section-1 above)
2.6 CONTACTING BHEL
No Bidder shall contact BHEL on any matter relating to its EOI from the time of submission of EOI unless requested so in writing. Any effort by a Bidder to influence BHEL in the decision making in respect of EOI will result in the rejection of that Bidder.

B	**DESIGN SPECIFICATION & BEDB**
B-1	**CAPTIVE POWER PLANT DESIGN BASIS**

CAPTIVE POWER PLANT

PROJECT : INTEGRATED METHANOL AND FORMALIN PROJECT, NAMRUP, ASSAM

OWNER : ASSAM PETRO-CHEMICALS LTD.

PMC : ENGINEERS INDIA LTD.

JOB NO. : A672

_____ EIL **_____ APL**

Rev. No	Date	Purpose	Prepared by	Checked by	Approved by
0	19.12.2017	ISSUED FOR ENGINEERING	PM /SBC	AD	SS

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1. INTRODUCTION

M/s Assam Petro-chemicals Ltd. (APL), intends to set up a 500 TPD Methanol plant and integrated OSBL facilities for this methanol plant at Namrup, Assam, India. M/s Engineers India Limited (EIL) has been retained by M/s APL for License, Engineering, and Procurement & Construction Management (LEPCM) services for the Methanol Plant and EPCM service for the integrated OSBL facilities.

This document provides the basic definition of the Captive power plant (CPP) block including necessary guidelines and basis to enable EPC contractor to develop the design and engineering for the included systems and units for smooth execution of the project.

2. DESIGN DATA

2.1. SITE CONDITION

Altitude	124 Meter above mean sea level.
Temperature	Min. 5 deg C Max. 38 deg C
Site Temperature & RH for Gas Turbine, HRSG & Utility Boiler Design	37.8 deg C & 80 % R.H

For details refer BEDB Part B A672-999-02-41-ODB-1001

2.2. FUELS & FUEL SPECIFICATION

Gas Turbine:	
Normal Fuel	Natural Gas
Start-up Fuel	Natural Gas
Heat Recovery Steam Generator (HRSG)	
Normal Fuel	Natural gas
Utility Boiler (UB)	
Normal Fuel	Natural Gas
Fuel for pilot Start Up Fuel	Natural Gas

2.3. POLLUTION CONTROL

The stack pollutions level shall not exceed the following limits or the maximum limits as specified by CPCB/SPCB limits at the time of commissioning whichever is stringent.

For Combined Stack of GTG & HRSG at 15% O2 (Dry Basis)

NOx from GTG /HRSG : 100 ppm (V)

Total SOx emission from the HRSG stack : The SOX level from HRSG Stack depending on sulphur content in fuel (To be informed by the bidder).

Particulate matter : 5 mg/NM^3

CO : 100 mg/NM^3

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For UTILITY BOILER (with 3% O2 dry basis)

Sulphur Dioxide (SO2)	50 mg/NM3
Oxides of Nitrogen (NOx)	250 mg/NM3
Particulate Matter (PM)	5 mg/NM3
Carbon Monoxide (CO)	100 mg/NM3

2.4. NOISE LEVEL

Noise generated shall not exceed 85 dBA at 1 m distance from the source of individual equipment under normal range of operating conditions. However in the case of lifting of safety valves, during upset conditions, higher values of noise level (115 dBA) is allowed as per OSHA standard.

3. CAPTIVE POWER PLANT (CPP)

3.1 STEAM, BFW AND POWER DEMAND FROM CPP

Following is the case for which Steam, Power & BFW system is to be designed for:

Design Case: Production of 500 MTPD of Methanol

Estimated Total Power and Steam Requirements of Petrochemical complex for design case (excluding CPP internal consumption of power and steam) is given below:

3.1.1 Steam and Power

S. No	Case		HP Steam, TPH		MP Steam, TPH		LP Steam, TPH		Total Steam, TPH		Power (MW)	
			Nor	Design	Nor	Design	Nor	Design	Nor	Design	Nor	Design
1	Design Case	EOR	(-) 7.8	(-) 7.0	2.0	2.2	(-) 12.1	(-) 10.9	(-) 17.9	(-) 15.7	9.3	10.3
		SOR	(-) 14.7	(-) 13.3			(-) 5.1	(-) 4.6	(-) 17.8	(-) 15.7		

(-) sign indicates steam import to CPP for its utilization, (+) sign indicates steam demand from CPP.

3.1.2 BFW

	Continuous Consumption (TPH)
	Design Case-1 (For Both EOR & SOR)
Normal	0.1
With 10% Margin	0.11

3.2 Other Operating Scenarios:-

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3.2.1 Start Up

Steam export requirement from CPP during complex / methanol Plant start-up:-

- HP steam Requirement of 32 TPH and
- LP steam Requirement of 5 TPH.

GTG at its rated capacity shall supply the power to complex. DG as required for start up of GTG and its auxillaries shall be in vendor scope

3.2.2 Export of 12TPH steam at HP level shall be required immediately from CPP during

i) Emergency shutdown of complex / methanol Plant
ii) Total Power failure in the complex

During total power failure in the complex i.e. all power generating source shall be in trip condition and no power will be available from grid. Emergency power as required for supply of steam from utility Boiler shall be met from same DG (which is considered for start up of GTG & its auxillaries).

Internal power requirement for CPP is considered as 0.8 MW. In case, CPP internal power increases, the same shall be met by increasing rating of GTG/STG.

3.3 FUEL AVAILABILITY FOR CPP:- Natural Gas availability for utilization in CPP is limited for different cases as below:

	Natural Gas (Kg/hr.)
Design Case 1 SOR	1234
Design Case 1 EOR	1196

4. BRIEF PLANT DESCRIPTION

The Captive Power Plant (CPP) shall consist of 1 No. Gas Turbine Generator (GTG) along with Heat Recovery Steam Generator (HRSG), 1 No. Steam Turbine Generator (STG) and 1 No. of Utility Boiler (UB) along with system auxiliaries.

4.1 Gas Turbine Generator

Type	- Industrial Type
Quantity	- 1 No
Capacity (Minimum)	- 4 MW (min.) at site rated ambient temperature of 37.8 degC and 80 % RH at Generator Terminal
Fuels Used:-	
Startup fuel	- Natural gas
Normal	- Natural gas
Design code	- API 616

4.2 Heat Recovery Steam Generator

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Quantity	-	1 No.
Type	-	Natural circulation, single pressure & horizontal Having Fresh Air firing mode
Startup Fuel (during FD fan mode)	-	Natural gas
Pilot Fuel (during FD fan mode)	-	Natural gas
Steam Parameters	-	HP steam
	-	Suitable to match with HP steam header @36kg/cm2 (g) and 360 deg C at B/L
MCR Capacity (minimum)	-	10 TPH without Auxiliary firing at GTG base load and at site rated ambient temperature of 37.8 degC and 80 % RH
	-	10 TPH with Fresh air firing at site rated ambient temperature of 37.8 degC and 80 % RH
Design Code	-	Indian Boiler Regulation (IBR) latest Edition.

4.3 Utility Boiler

Quantity	-	1 No.
Type	-	Forced draught, Natural Circulation
Normal Fuel Used	-	Natural gas
Startup fuel	-	Natural gas
Fuel for Pilot	-	Natural gas
Steam parameters	-	HP steam
	-	Suitable to match with HP steam header @36kg/cm2 (g) and 360 deg C at B/L
MCR Capacity (minimum)	-	30 TPH
Turn down	-	Minimum 30% MCR (for superheat temperature and auto combustion control)
Design Code	-	Indian Boiler Regulation (IBR) latest Edition

4.4 Steam Turbine Generator

Quantity	-	1 No.
Type	-	Double Extraction (@ MP & LP Level), induction (@ LP level) cum Condensing Type

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Power Output - 7.1 MW (minimum) at Generator terminals

Design code - API-612

Inlet Steam - HP Steam

Induction steam - LP steam

1st Extraction - MP Steam

2nd Extraction - LP Steam

The Ratings / Capacities of the GTG, HRSG, UB and STG given above are only minimum. CPP EPC contractor shall be responsible for determining steam and power consumptions of all units under his scope, which along with design margins, shall be used to arrive at overall steam and power consumption figures. Equipment ratings shall be increased accordingly as required.

This shall be in line with the utilization of maximum steam available for CPP and with the minimum available fuel for the CPP as per Cl. No. 3.0 above.

4.5 SPECIAL DESIGN REQUIREMENTS FOR MAJOR EQUIPMENTS

4.6 Gas Turbine Generator

i) Gas Turbine shall be Industrial type suitable for outdoor installation with minimum site rated power of 4.0 MW on natural gas corresponding to site rated temperature of 37.8 Deg C and 80% RH. The Gas Turbine shall be designed as per API 616. The Gas Turbine shall be capable of withstanding full load rejection without over speed trip while running natural gas.

ii) GTG shall be designed to operate in both simple cycle as well as combined cycle mode.

iii) The Gas Turbine shall be capable of withstanding full load rejection without over speed trip.

iv) Oil mist eliminator to be provided with 1 working + 1 standby, both motor drive.

v) Diverter damper shall be electrically operated and shall be control/modulating type and to be controlled through CPP-DCS system.

vi) Lube oil temperature control should be from DCS panel.

vii) DC Motor driven emergency lube oil pump shall be provided for cooling down of GTG in case of power trip.

viii) GT suction air filter DP indication shall be made available in DCS.

ix) Necessary HC detectors shall be provided in GT enclosure. Indication of these analyzers to be made available in existing DCS.

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x) GTG shall be provided with Black start facility. Facilities (i.e. cooling water, nitrogen etc.) as required for black start of GTG shall be considered with-in CPP. Instrument air as required for black start shall be available at battery limit. Required power for black start of GTG along with other required facilities for start-up shall be by DG which is in vendor scope.

xi) GTG water wash drain shall be routed to Storm water sewer.

xii) Gas turbine shall be capable of firing with Natural Gas from 30% to 100% load on continuous basis.

4.7 Heat Recovery Steam Generator

i) The Heat Recovery Steam Generators shall be of natural circulation, unfired (during normal operation), single drum and single pressure type. HRSG shall be designed as per IBR (Indian Boiler Regulation) Latest Edition. HRSG shall be of Horizontal type.

ii) HRSG shall be capable of generate 10 TPH of HP steam at rated parameters without GTG exhaust and with fresh air firing mode. Change over from GTG exhaust to fresh firing mode shall be a planned operation through DCS.

iii) HRSG shall be capable to generate steam at required parameters for use in STG with GTG exhaust from 30% GTG base load to 100% GTG base load at all ambient conditions. Steam generated with GTG exhaust from 30% GTG base load to 100% GTG base load at all ambient conditions shall be fully utilised in STG.

iv) Diverter damper and Guillotine dampers shall be electrically/hydraulically/pneumatically operated suitable for both fresh air firing mode operation as well as GT exhaust mode and shall be control/modulating type.

v) Drum Level control basically with 30% and 100% control valves operating based on HRSG load from drum level control signal. 1x30% and 2x100% automatic feed water control valves shall be provided.

vi) Steam drum shall be designed with minimum 2 minutes of capacity of storage between normal water level and low-Low trip level. Sufficient residence time shall be provided in steam drum between Low-Low trip and drum bottom so that steam generating coils never run dry even in upset scenarios like low level trip in steam drum.

vii) Steam drums shall be designed for maximum internal pressure as well as full vacuum.

viii) In the steam drum the moisture carry over, with saturated steam from the drum shall not be higher than 0.02% during normal operation and not higher than 0.2% during upset conditions. The steam as measured at drum outlet shall have an impurity not greater than 0.02 mg /kg (ppm) silica.

ix) Steam drum shall be designed for maximum internal pressure as well as full vacuum.

x) Economiser shall be non-steaming at all loads and turndown. At low loads, lower ambient and during startups, provision shall be provided to avoid steaming in economizer.

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xi) Minimum Flue gas temperature at stack inlet should be 125 deg C. However it is to be ensured that stack inlet temperature shall be 20 degC above acid dew point at all operating condition.

xii) The design of HRSG shall ensure minimum pressure drop through the HRSG and the flow through the stack.

xiii) It is to be ensured that the tube metal temperature shall not be below the dew point temperature.

xiv) Skin thermocouples shall be furnished on super heater tubes, Steam drum, screen tubes for monitoring (in the control room DCS) metal temperature.

xv) Make-up water preheat shall be considered to recover maximum heat from exhaust. The make-up water preheat sections shall be designed with sufficient precaution so that no steaming occurs in these sections, however during start up and at low load operation of GT and whenever MUH is susceptible for steaming, MUH shall be bypassed. Make up water preheat section shall be of Stainless steel only. MUH bundles shall be drainable, bundles shall be designed for dry run.

xvi) The design of HRSG shall ensure maximum pressure drop of 250 mmWC through the HRSG and the flow through the stack.

xvii) Continuous on-line stack monitoring system consisting of sampling probes, piping, analyzers, etc. for analysis of SOx, NOx, HC, PM and CO shall be provided on the main stack of HRSG. Any other analyzers which are deemed necessary as per CPCB/SPCB guidelines shall also be provided. Stack Monitoring system readings shall be made available in DCS.

xviii) The height of GTG bypass stack shall be 30 Meters. The height of HRSG main stack shall be 30 Meters (Min.) or as per the formula given below whichever is higher.

H=14(Q)^0.3

Where, H= Stack Height in Meters

Q=Total SO2 emission in Kg/Hr.

Top of stack shall be at least 5.0 m higher than highest working platform within a radius of 30 m and at least 3.0 m higher than highest working platform for 30-50 m radius.

xix) Main stack for HRSG shall be made of steel.

xx) The stack design shall be such as to prevent flue gas inversion.

xxi) Continuous blow down rate shall be designed for 5% of MCR of HRSG. HRSG shall be equipped with associated continuous blow down tank and intermittent blow down tank. Flashed steam from CBD shall be recovered and utilized in deaerator. Intermittent blow down shall be led to IBD tank.

Blow down from IBD tank shall be cooled by quenching with cooling water upto 40 deg C and shall be pumped to ETP in water Block. Blowdown water Pressure at CPP battery limit shall be 10 kg/cm2(g) [hold].

Provision for quenching with service water upto 40 deg C shall also be provided.

Solenoid operated valves to be provided in CBD line from steam drum to CBD tank to avoid drying of HRSG.

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xxii) Following minimum Motor operated valves for HRSG shall be provided:-

- Main steam valve and its bypass.
- Start-up vent valve and its isolation valve.
- Continuous blowdown valve and isolation valve
- Emergency drain valve and its isolation valve
- 1st isolation valve of each feed control valve
- Economizer inlet valve
- Inlet, out let and by pass valves of MUH

xxiii) Following online analyzers as minimum shall be provided in SWAS system of HRSG system

- Silica, pH & Conductivity Analyzers for Superheated steam, Drum Water
- One Silica, Conductivity and pH analyzer at boiler feed water.

xxiv) Minimum Control & instrumentation for HRSG shall be as follows.

- Two out of three logic shall be provided for all instruments used for tripping of the HRSG.
- For steam drum, Three (3 Nos.) DP type level instruments shall be provided for three element drum level control system and for annunciation.
- For steam drum, two nos. of gauge glass (Bi-color Type) shall be provided at drum floor.
- One nos. of EWLI shall be provided and indication shall be provided at drum floor, control room and feed water control station.
- 2 out of 3 logic for trip for steam drum level shall be taken from additional two (2 Nos.) DP type level instruments and one EWLI

xxv) Necessary provision shall be made to keep the HRSG preserved for long duration. Nitrogen gas shall be used for water side preservation for long shutdown of HRSG & purging of natural gas line. Double isolating valves, NRV with blinding provision shall be provided to avoid back up of steam/ gas to nitrogen system during normal operation.

xxvi) For Positive isolation of HRSG, double isolation valves with drain facility shall be provided for HP steam (this includes one motor operated valve MSSV which is integral part of HRSG) and drain size shall be atleast 2" in between two valves. There shall be double isolation valves in BFP discharge line. In the HP steam & HP BFW line drain line there shall be two drain valves.

xxvii) Super heaters tubes shall be widely spaced arrangement with clear accessibility for effective cleaning.

xxviii) Necessary provision shall be kept in the design to prevent vibration of the super heaters assembly.

xxix) Manhole size shall be minimum 24"and opening from inside.

xxx) Steam water separators of high efficiency cyclone type backed up adequately by scrubbers or as per OEM recommendation with proven record shall be provided inside the steam drum. All internals shall be removable type.

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xxxi) Pollution monitoring nozzles (PMN), 6" NB size (with 1" inside lining) sampling nozzle shall be provided on the stack as per CPCB/MoEF/SPCB guideline and necessary ladders and platform for access to the same shall be provided. 4 no. such nozzles for stack diameter > 2 m and 2 nozzles for stack diameter < 2 m

xxxii) Height of steam drum manhole center line from access / maintenance platform shall be in between 950mm -1375 mm.

4.8 UTILITY BOILER (UB)

i. Boiler shall be of water tube, natural circulation and forced draft type.

ii. At low loads, lower ambient and during startups, provision shall be provided to avoid steaming in economizer.

iii. Drum Level control basically with 30% and 100% control valves operating based on UB load from drum level control signal. 1x30% and 2x100% feed water control valves shall be provided.

iv. The burner shall be low Nox type.

v. 2x 100% scanner air fan shall be provided for cooling of scanners of Boiler.

vi. Steam drum shall be designed with minimum 2 minutes of capacity of storage between normal water level and low-Low trip level. Sufficient residence time shall be provided in steam drum between Low-Low trip and drum bottom so that steam generating coils never run dry even in upset scenarios like steam drum trip.

vii. Steam drums shall be designed for maximum internal pressure as well as full vacuum.

viii. Economizer shall be non-steaming at all loads and turndown.

ix. Stack inlet temperature from each Utility boiler shall be not less than 125 degC.

x. The height of stack shall be in compliance with statutory requirement or as per the formula given below or 30 M whichever is higher.

H =14(Q)^0.3

Where, H = Stack Height in Meters

Q =Total SO2 emission in Kg/Hr.

Top of stack shall be at least 5.0 m higher than highest working platform within a radius of 30 m and at least 3.0 m higher than highest working platform for 30-50 m radius.

xi. Continuous on-line stack monitoring system consisting of sampling probes, piping, analyzers, etc. for analysis of SOx, NOx, HC, CO & PM shall be provided on each stack of UB. The analyzers and recorder shall be located in a suitable air conditioned enclosure near the stack. Any other analyzers which are deemed necessary as per CPCB/SPCB guidelines shall also be provided. Stack Monitoring system readings shall be made available in DCS.

xii. Continuous blow down rate shall be designed for 5% of MCR of Utility Boiler. UB shall be equipped with associated continuous blow down tank and intermittent blow down tank. Flashed steam from CBD shall be recovered and utilized in deaerator. Intermittent blow down shall be led to IBD tank.

Blow down from IBD tank shall be cooled by quenching with cooling water to 40 deg C and shall be pumped to ETP in water Block. Blowdown water Pressure at CPP battery limit shall be 10 kg/cm2(g) [hold].

Provision for quenching with service water upto 40 deg C shall also be provided.

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Solenoid operated valves to be provided in CBD line from steam drum to CBD tank to avoid drying of boiler.

xiii. Following minimum Motor operated valves with emergency power for Boiler shall be provided:-

- Main steam valve and its bypass.
- Start-up vent valve and its isolation valve.
- Continuous blowdown valve and isolation valve.
- Emergency drain valve and its isolation valve
- 1st isolation valve of each feed control valve
- Economizer inlet valve

xiv. Following online analyzers shall be provided in SWAS system of each Boiler system

- Silica, pH & Conductivity Analyzers for superheated steam, Drum Water
- One Silica, Conductivity and pH analyzer for boiler feed water.

xv. Minimum Control & instrumentation for each boiler shall be as follows.

- Two out of three logic shall be provided for all instruments used for tripping of the Boiler.
- For steam drum, Three (3 Nos.) DP type level instruments shall be provided for three element drum level control system and for annunciation.
- For steam drum, two nos. of gauge glass (Bi-color Type) shall be provided at drum floor.
- One nos. of EWLI shall be provided and indication shall be provided at drum floor, control room and feed water control station.
- 2 out of 3 logic for trip for steam drum level shall be taken from additional three (3 Nos.) DP type level instruments

xvi. O2 analyzer for measuring excess O2 in flue gas at Economizer outlet shall be provided for automatic control of the fuel /trim.

xvii. Burner interlock and operation shall be through dedicated BMS PLCs.

xviii. BMS PLCs shall be serially interfaced with the DCS and with the provision of Burner operation from DCS HMI as well as manual operation from local panel, whenever required by Operators.

xix. Local control panel shall be provided at each burner floor along with ESD monitors, push button and indications light etc.

xx. Burner startup shall be from the DCS without any manual intervention at field. However provision to start-up the burner from Local Control panel shall also be provided.

xxi. Necessary provision shall be made to keep the boiler preserved for long duration. Nitrogen gas shall be used for water side preservation for long shutdown of boiler & purging of Fuel gas line. Double isolating valves, NRV with blinding provision shall be provided to avoid back up of steam/ gas to nitrogen system during normal operation

xxii. For Positive isolation of Boiler, double isolation valves with drain facility shall be provided for HP steam (this includes one motor operated valve MSSV which is integral part of Boiler) and drain size shall be atleast 2” in between two valves. There shall be double isolation valves in BFP discharge line. In the HP steam & HP BFW line drain line there shall be two drain valves.

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xxiii. The moisture carry over, with saturated steam from the drum shall not be higher than 0.02% during normal operation and not higher than 0.2% during upset conditions. The steam as measured at drum outlet shall have an impurity not greater than 0.02 mg /kg (ppm) silica.

xxiv. For meeting the emergency steam requirement (as per cl. No. 3.0), boiler shall be continuing operating at minimum load for all operating cases.

xxv. Manhole size shall be minimum 24"and opening from inside.

xxvi. Skin thermocouples shall be furnished on super heater tubes, Steam drum for monitoring (in the control room DCS) metal temperature. Battery limit Interfaces details requirement refer instrumentation specification.

xxvii. Steam water separators of high efficiency cyclone type backed up adequately by scrubbers or as per OEM recommendation with proven record shall be provided inside the steam drum. All internals shall be removable type.

xxviii. Height of steam drum manhole center line from access / maintenance platform shall be in between 950mm -1375 mm.

4.9 Deaerator

i. One dedicated (1x 100%) spray and tray type deaerator to be provided to meet feed water requirements of 1 Utility Boiler and 1 HRSG operating at MCR along with spray water requirement if any.

ii. This Deaerator shall be designed considering following:

- Storage capacity shall be suitable for 20 minutes hold-up between Normal level to low level for total rated flow for one Utility Boiler operating at MCR.
- Normal level of feed water storage shall be at 3/4th of the vessel diameter.
- De-aerator shall have vent condenser for energy economy. Internal vent condenser as required shall be supplied to limit the steam venting loss to less than 1%.
- The oxygen content of the deaerated water shall be limited to 7 ppb (m) (0.005 cc/liter) under all condition of operation. The free CO2 content of the water shall be zero ppm.
- LP steam shall be used for deaeration of water

iii. Following online analyzers as minimum shall be provided :-

- O2 analyzer at deaerator feed storage tank outlet.
- pH & Conductivity Analyzers for DM water line to deaerator

iv. Common suction header shall be considered for all BFPs.

4.10 Boiler Feed Water Pump

i. Following Boiler Feed water Pumps shall be provided.

- Boiler Feed Water Pump for HRSG & UB (common for both) :-

  No. of Pumps for Utility Boiler & HRSG - 2 Nos. (1w +1s).

ii. Auto Start facility shall be provided. Motor for these pumps shall be designed for the end of the curve operation. Minimum flow recirculation valve or auto recirculation valve shall be provided.

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iii. Boiler feed water pump suction strainer shall be provided with high DP alarm and trip.

iv. Reacceleration facility shall also be provided to these pumps.

4.11 Steam Turbine Generator

i) STG shall be double extraction at MP and LP level cum-condensing type conforming to API 612.

ii) Inlet steam for STG shall be at HP level.

iii) Extractions shall be at MP and LP level.

iv) Excess LP steam available during different operating cases in the CPP, based on pressure control excess LP steam shall be injected in the Steam turbine. However during some operating condition such as start-up etc, when no excess available, LP steam demand shall be met through extraction through same port.

v) Exhaust pressure - 0.12 kg/cm2(a) for Max condensing steam case. For other STG operating cases, exhaust pressure shall be based on OEM's design. The condenser shall have to be suitably sized to take care of load fluctuations. STG shall be designed to withdraw extractions even at minimum STG load without any governor hunting (in auto mode).

vi) STG shall be provided with overhead lube oil tank to ensure safe coast down, D.C. Motor driven emergency lube oil pump shall be provided to cool down for STG.

vii) STG condenser shall have provision for dumping LP steam directly into the STG - condenser in auto in case of tripping of STG.

viii) STG condensate shall be routed to DM/Condensate storage tank

4.12 Gas Conditioning system (GCS)

i) Natural gas shall be available at battery limit for GTG & UB Operation.

ii) For GTG operation, Gas conditioning system consisting of KOD (common for GTG, HRSG and Boiler), Gas compressor (1x 100%, in case required), Steam heaters (1electrical +1 steam heater), Gas filters (1W+1S) etc. shall be provided for GTG as a minimum. Gas KOD shall have LP steam coil provisioning. Steam condensate from KOD shall be routed to OWS.

iii) For Utility boiler & HRSG, Natural Gas after KOD (common for GTG, HRSG and Boiler) shall be let down (2 x100%) and shall be further conditioned as per requirements of HRSG and boiler burners.

iv) LP steam required for the steam heater shall be met internally.

v) Hydrocarbon gas detection system shall be provided near KOD, compressor, heater, filter, and other skids to detect the gas leakages. HC detector reading interface shall be provided in DCS.

vi) Natural gas line for GTG shall have 1 Working + 1 Standby filter. Mesh size of filter shall be suitable of GTG (as recommended by OEM) and piping work along with Valves after filter to burner shall be of stainless steel.

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vii) Natural gas line for Utility boiler & HRSG shall have 1 Working + 1 Standby filters/strainers. Location of filter shall be before Main trip valve and flow control valve. Mesh size of filter shall be suitable of UB burners (as recommended by OEM) however as a minimum strainer of 125 micrometre (0.005") mesh in Monel metal shall be provided. Piping work along with valves after filter to individual burner shall be in stainless steel.

viii) All gaseous fuel vents shall be connected Drain tank which shall also acts as Flare KOD. Gas condensate from the KOD/heater/Filter shall be routed to this drain tank/ flare KOD. Flare KOD shall be floated with the flare header at battery limit and drain from flare KOD shall be routed to OWS.

4.13 OTHER DESIGN CONSIDERATIONS FOR CPP CONFIGURATION

i) The process steam and plant power requirements have to be met by the CPP throughout the year. During design case (EOR/SOR – Normal/Design) all major equipment i.e. GTG, HRSG, Utility boiler and STG shall be in operation and may be in part load/turndown based on the requirement.

ii) The CPP shall be able to meet the requirements of steam and power for all the operating scenarios of New Complex.

For meeting start up steam requirements of complex, Utility boiler shall meet the required start up process steam demands at requisite pressure along with internal steam consumption of CPP.

Boiler capacity shall be decided by considering process steam demand at two levels during start-up of complex along with internal steam consumption within boiler. However minimum boiler capacity shall be 30 TPH.

iii) DM water make-up shall be available to the CPP at an ambient temperature from the DM Plant. The cold DM water from DM Plant shall be routed to the CPP B/L

DM water pressure available at CPP battery limit shall be 5 Kg/cm2g. DM water + maximum condensate (STG condensate + condensate available at CPP battery limit) as possible in different cases shall be stored in the condensate/DM water storage tank (hold up of 1 hour of UB MCR + HRSG MCR operation) and 1W+1S Pump shall be installed to transfer water to Deaerator and Make up water heater (of HRSG) as applicable. Provision of routing extra condensate from discharge of these pumps up to battery limit shall be provided.

Provision for diverting DM water directly to deaeator with split range level control valve shall be provided to route DM water directly to deaerator for UB operation during total power failure (Black-out) case.

Deaerator drain shall be routed to condensate/DM water storage tank after stabilizing at atmospheric pressure.

The makeup water preheater (i.e. Fresh DM water make up shall be preheated in a separate preheater bank in the HRSG) shall be designed for maximum heat recovery from the flue gas, while ensuring that the metal surface temperatures are above acid dew point under all conditions. The design of the make-up water preheater section of HRSG and its control shall ensure the following:-

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- ✓ There shall be no steaming inside the make-up water preheater section even at low flow and turndown.
- ✓ Adequate approach temperature to deaerator is maintained for proper deaeration.

iv) GTG shall be designed to run at 5 degC inlet temperature & also the HRSG, Generator & associated electrical & Mechanical system shall also be designed in compatible with the GTG Operation at 5 deg C.

v) Provision shall be kept for control of steam and power load sharing between various steam generators and power generators respectively.

vi) Burner operation of UB shall be from DCS only with the provision of local manual operation.

vii) All Steam safety valves exhaust shall be provided with Silencer except for safety valves in deaerator.

viii) PRDS (HP/MP & HP/LP) operation shall be configured to operate in Auto based on pressure level of respective header pressure. Auto vent control valve with motor operated isolation valve are also to be provided at HP & LP headers.

Each Pressure reducing valve of PRDS is to be provided with a motorized isolation valve in the upstream, by-pass globe valve, isolation gate valve and 2x 100% safety valves in the downstream header.

HP-LP PRDS capacity sizing shall be done for LP steam internal requirements without considering any import of HP and LP steam during complex/plant start-up case for which only UB shall be operating at MCR and GTG/HRSG shall be under shutdown condition.

HP-MP PRDS capacity sizing shall be done for Max MP steam export and max MP steam internal requirements without considering any import of HP and LP steam during STG trip condition.

ix) The minimum following corrosion allowances to be adopted by package vendor:

For CS Tube	:	1.5 mm
For A.S Tube	:	1.0 mm
For Pipes	:	3.0 mm up to first isolation valve Main steam line of UB & HRSG and remaining as per PMS
All CS plate	:	3.0 mm
For Drum Internal	:	1.5 mm

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x) All sampling lines shall be made of stainless steel material.

xi) All SWAS analyzers shall be located in one common air conditioned room. All the SWAS analyzer indications shall be provided at DCS.

xii) All CEMS analysers shall be housed in container with suitable HVAC system.

xiii) Start up and shutdown facilities of all auxiliary equipment in the system shall be provided from both local as well as remote (from DCS/PLC). Separate PLC shall be considered for Balance of Plant.

xiv) All utility lines including Fuel Gas line, DM water, raw water, instrument air, plant air, service water, N2 line shall have flow, temperature & pressure measuring instruments.

xv) For all utilities double isolation valves along with spectacle blind (positive isolation) at the interface battery limit shall be provided.

xvi) Noise in control room shall be restricted below 65 dBA

xvii) Chemical dosing system shall be provided as follows:-

a) DM water system & Boiler Feed Water - LP chemical for pH control (Ammonia)

- Chemical dosing skid will comprise of one common solution preparation tank with agitator, Separate metering tank for each consumer, separate dosing pumps (1W+1S for each DM water system & Boiler Feed Water system), necessary suction filters, valves, relief valves, connecting pipes, discharge pressure gauges/switches, fittings and flushing lines for cleaning the complete system

b) HRSG & Utility Boiler drum-HP chemical Tri sodium Phosphate (common Skid)

- Chemical dosing skid will comprise of one common solution preparation tank with agitator, Separate metering tank for Utility Boiler & HRSG, separate dosing pumps (1W+1S for each UB & HRSG), necessary suction filters, valves, relief valves, connecting pipes, discharge pressure gauges/switches, fittings and flushing lines for cleaning the complete system

c) Boiler Feed Water-LP chemical (carbohydrazide - separate skid)

- Each Chemical dosing skid will comprise of one solution preparation tank with agitator, one metering tank, dosing pumps, necessary suction filters, valves, relief valves, connecting pipes, discharge pressure gauges/switches, fittings and flushing lines for cleaning the complete system.

d) All associated interconnecting piping work of dosing system shall be from stainless steel material.

e) All dosing pumps/tanks shall be installed inside a shade with roof.

f) For chemical dosing system, running indication of individual dosing pump and the tank level shall be provided at DCS.

xviii) Black out operation of Boiler

- In case of total power outage (tripping of all electrical generators), boiler should sustain operation for minimum 1 hour. The following minimum steam turbine drives are envisaged for the same:-

  i) Boiler Feed Water Pump.

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ii) 1 x 100 % FD Fan.

Lube oil systems of the BFP, FD fan etc. shall be suitable designed to meet to sustained boiler operation in case of total power failure.

- Boiler shall be designed to operate uninterruptedly during sudden total power outage even without emergency power for 30 sec to 2.0 minutes till the time emergency DG supply within CPP scope is restored.
- Instrument air and DM water required for Boiler operation shall be made available to CPP from outside battery limit during black out operation.
- Cooling water as required for Black out operation shall be considred within CPP complex. Cooling tower shall be considred within CPP complex for start up, Normal and Black out operation
- Fuel gas available during black out shall be Natural gas. Following are the minimum MOVs required on emergency as well as normal power for Utility boiler:-

  i. CBD inching valve

  ii. Scanner air fan

  iii. Main steam stop valve and its bypass valve.

  iv. Economiser inlet valve.

  v. 1st isolation valve of FEED control station.

  vi. Start-up vent for each UB.

  However for sustain operation of Boiler during black out, UPS as required shall also be considered in design.

xix) For HRSG PGTR, Flue Gas Enthalpy values shall be considered based on ASME PTC 4.4.

xx) Steam enthalpy values shall be as per IAWPS-IF97 ASME Industrial Formulation.

xxi) Local instruments, gauges, panels etc. shall be provided for efficient operation and monitoring of various parameters such as pressure, temperature, draft, level etc. as applicable for the following:

(i) Gas turbine exhaust gas
(ii) Flue gas path
(iii) Feed water
(iv) Saturated and superheated steam
(v) Natural gas
(vi) Auxiliary steam
(vii) Instrument air
(viii) Cooling water
(ix) Nitrogen
(x) DM water
(xi) condensate
(xii) Flare
(xiii) Service water

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5. DESIGN MARGINS ON VARIOUS EQUIPMENTS

Boiler Feed water Pump (For Boiler & HRSG feed water pump)	Capacity: 10% on flow based on MCR condition Head: For calculation of Head, following cases (case -1 & case-2) will be evaluated and maximum value of head will be selected. Case-1: 110% MCR flow and Pump TDH with drum normal operating pressure. Frictional drop to be calculated on 100% MCR flow with 15% margin on frictional pressure drop. Frequency margin (3% as per clause 3.2.1) on calculated TDH would be applied for this case only. Case-2: 100% MCR flow and Pump TDH considering steam drum maximum safety valve set pressure with 3% accumulation. Frictional drop to be calculated on 100% MCR flow with 15% margin on frictional pressure drop.
Forced Draught Fan of Boilers	Capacity: 10% on flow based on MCR condition. Head: 20% on head based on MCR condition
Burner	10% on capacity based on MCR condition

6. SPARING PHILOSOPHY

The following shall be the sparing philosophy for the major equipment :-

BFW pump Utility Boiler & HRSG	-	2 Nos. (1W+1S), One Turbine Driven and one Motor driven. One (1 No.) Standby motor driven pump shall also have auto change over facility. Provision to install another Motor/turbine driven BFP (in future) shall be provided.
Blow down pumps	-	2 operating (one for each IBD) + 2 standby (one for each IBD) (All motor driven)
FD Fan for Utility Boiler	-	1 x 100% Dual Drive (Motor + Steam Turbine)
FD Fan for HRSG	-	1 x 100% -Motor Driven
LP Chemical dosing skid (Ammonia)	-	1 no. (Common for BFW system & DM water system)
LP Chemical dosing Pumps	-	2 operating (one each for BFW system &

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(Ammonia)		DM water system) + 2 standby (one each for BFW & DM water system) (All motor driven)
LP Chemical dosing skid (carbohydrazide)	-	1 no.
LP Chemical dosing Pumps (carbohydrazide)	-	1 operating + 1 standby (All motor driven)
HP Chemical dosing skid	-	1 no. (One common for HRSG and UB)
HP Chemical dosing Pumps (Per skid)	-	2 Nos. operating (one each UB & HRSG) + 2 standby (one each UB & HRSG) (All motor driven)
DM Water/ Condensate transfer pumps	-	1 operating + 1 standby (All motor driven)
Sealing air fans (GTG) - if applicable	-	1 operating + 1 standby (All motor driven)
Sealing air fans (HRSG)	-	1 operating + 1 standby (All motor driven)
Scanner cooling Fan for HRSG	-	1 operating + 1 standby (1 No. AC with provision for emergency power + 1 No. DC) Additionally Instrument air provision (Auto cut in/off) with suitable connection to each scanner is also to be provided for cooling in case of tripping of both scanner air fans
Sealing air fans (For Utility Boiler)	-	1 operating + 1 standby (All motor driven)
Scanner cooling Fan for UB	-	1 operating + 1 standby (1 No. AC with provision for emergency power + 1 No. DC) Additionally Instrument air provision (Auto cut in/off) with suitable connection to each scanner is also to be provided for cooling in case of tripping of both scanner air fans
Condensate Extraction pumps (STG Condensate)	-	1 operating + 1 standby (All motor driven)
PRDS (HP/MP)	-	2 Nos. (2 x100%)
PRDS (HP/LP)	-	2 Nos. (2 x100%)

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7. UTILITIES

Utilities & process steam shall be terminated at their respective battery limits. The following services shall be available for the CPP Block.

- HP Steam
- LP Steam
- Service Water
- DM Water
- Plant Air
- Instrument Air
- Nitrogen
- Natural gas.
- Flare
- Treated water

8. SPECIFICATIONS

8.1 NATURAL GAS

Natural gas will be supplied from pipeline from gas receiving station. Composition and conditions are given below :

S. No.	Component	Units	Natural Gas
1	H2	Mole fraction	0.00
2	N2	Mole fraction	0.005
3	CO	Mole fraction	0.00
4	METHANE	Mole fraction	0.923
5	ETHANE	Mole fraction	0.0417
6	PROPANE	Mole fraction	0.0079
7	ISOBUTANE	Mole fraction	0.0001
8	n-BUTANE	Mole fraction	0.001
9	ISOPENTANE	Mole fraction	0.0003
10	n-PENTANE	Mole fraction	0.0005
11	HEXANE	Mole fraction	0.0005
12	CO2	Mole fraction	0.002
13	SULPHUR (H2S AND MERCAPTANS)	ppm Max	10

8.2 DM WATER QUALITY

S. No.	Parameter	Specification
1.	pH	6.5-7.0
2.	Conductivity at 20 deg. C, Micro-mho/cm	< 0.2
3.	Total Hardness, ppm	Nil
4.	Total suspended solids	Nil
5.	Total (reactive) Silica as SiO_2, ppm	0.02 max

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6.	Total Iron as Fe, ppm	0.03 max
7.	Total Copper, ppm	0.003 max
8.	Turbidity, NTU	Nil
9.	$KMnO_4$ value at 100deg C, ppm	1 max
10.	Sodium, ppm	0.01 max
11.	Oil	Nil
12.	Total dissolved solids, ppm	0.1

8.3 STEAM QUALITY

S. No.	Parameter	Specification
1.	pH	> 8.3
2.	Cation Conductivity at 25 deg. C, micro-mho/cm	0.2 max
3.	Total Fe, ppm	0.02 max
4.	Copper, ppm	0.003 max
5.	Total SiO_2, ppm	0.02 max
6.	Na + K, ppm	0.01 ax

8.4 BOILER FEED WATER QUALITY (AFTER DEAERATOR AND CHEMICAL DOSING)

S. No.	Parameter	Specification
1.	pH	8.5-9.5
2.	Cation Conductivity at 25 deg. C or ambient temperature, micro-mho/cm	≤ 1 after addition of Hydrazine and Morpholine.
3.	Total Hardness	Nil
4.	Total suspended solids	Nil
5.	Dissolved Oxygen, ppm	0.005
6.	$KMnO_4$ value at 100 deg. C, ppm	5 (max)
7.	Total SiO_2 (Reactive), ppm	0.02 max
8.	Copper, ppm	0.003
9.	Total Fe, ppm	0.03max
10.	Total dissolved solids, ppm	0.5 max
11.	Turbidity, NTU	Nil

8.5 COOLING WATER QUALITY

Make up water quality

Make-up water required for the cooling towers is supplied from RWTP.

Parameters	Unit	Value
pH	-	6.5-7.5
Total suspended solids	Mg/l	<1
Turbidity	NTU	<1
TDS	Mg/l	330
Oil/grease	Mg/l	BDL
Total hardness as CaCO3	Mg/l	130
Ca hardness asCa ion	Mg/l	20
Mg hardness as Mg ion	Mg/l	19.2

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MO- Alkalinity/Bicarbonates	Mg/l	151
Chlorides	Mg/l	50
Sulphates	Mg/l	11.8
Sodium	Mg/l	35
Total iron	Mg/l	<0.3
Total SiO2	Mg/l	6.35
Silica colloidal	Mg/l	BDL

Design Quality and Control limits of Re-circulating Cooling Water

Parameters	**Unit**	**Normal**	**Max.**
pH		7.0-7.8	8
TDS	Mg/l	1320	1350
Total suspended solids	Mg/l	<5	10
Turbidity	NTU	<5	10
Total Hardness as CaCO3	Mg/l	512	520
Ca Hardness as Ca ion	Mg/l	80	85
Mg hardness as Mg ion	Mg/l	76.8	80
M-Alkalinity	Mg/l	100	120
Chloride as Cl	Mg/l	200	210
Sulphates	Mg/l	552	560
Total Iron	Mg/l	<1.2	1.2
Sodium	Mg/l	140	150
Silica total	Mg/l	25.4	30

9. CHEMICAL DOSING SYSTEM

10.1 Carbohydrazide shall be dosed inside the deaerated water storage tank through spargers laid at bottom of the tank to maintain 0.4 to 1.2ppm of each of the chemical on 100% basis of BFW.

10.2 Ammonia dosing point shall be at the suction of BFW (sufficiently away from pump to ensure pH elevation before admitting BFW into the pump). Ammonia dosing rate shall be approximately 2mg/l (neat) based on BFW flow in BFW pump suction Dosing rate shall be adjusted to maintain the pH of condensate to > 8.3.

10.3 Analytical grade Tri-sodium phosphate (TSP) as PO4 mg/l @ 2 mg/l (approx) based on BFW flow rate shall be dosed into drum to maintain the boiler water pH in the specified range. The PO4 in the boiler water shall be 15-20 ppm.

10. BATTERY LIMIT CONDITIONS

(Steam Conditions of Inlet Streams to CPP)

Steam level	Units	Min.	Normal	Max.	Mech. Design.
HP Steam					
Pressure	Kg/cm^2g	34	35	36	44/FV
Temperature	^oC	340	350	360	420
LP Steam					

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Pressure	Kg/cm^{2}g	3.0	3.5	4 (Note-1)	10/FV
Temperature	^{o}C	160	175	200	225

(Steam Conditions of Outlet Streams from CPP)

Steam level	Units	Min.	Normal	Max.	Mech. Design.
HP Steam					
Pressure	Kg/cm^{2}g	35	36	37	44/FV
Temperature	^{o}C	350	360	370	420
MP Steam					
Pressure	Kg/cm^{2}g	16	17	19	21/FV
Temperature	^{o}C	250	270	280	290
LP Steam					
Pressure	Kg/cm^{2}g	3.5	4.0	4.5	10/FV
Temperature	^{o}C	175	200	210	225

BATTERY LIMIT CONDITION AT CPP FOR NATURAL GAS

Gas	B/L Condition	Units	Minimum	Normal	Maximum	Mechanical design
Natural Gas	Pressure	Kg/cm2(g)	9	14.2		20
	Temperature	Deg C		30	-	65

For Other Utilities, Refer BEDB Part B A672-999-02-41-ODB-1001, Rev 0 (Attached as Annexure 1)

11. BUILDING AND SHED:-

Following building and sheds need to be considered:-

i. STG Shed with EOT
ii. SWAS room

12. ATTACHMENT

Sl. No.	Doc. No.	Description
1	Annexure-1	BEDB Part B A672-999-02-41-ODB-1001

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PROJECT	INTEGRATED METHANOL AND FORMALIN PROJECT	CLIENT:	ASSAM PETRO-CHEMICALS LIMITED
UNIT	CAPTIVE POWER PLANT	JOB NO.: A672	UNIT NO.: 011
ITEM NO	011-GTG-01	SERVICE:	GTG AND IT'S AUXILLARIES

ITEM NO. : **011-GTG-01**
ITEM DESCRIPTION : **GTG**

GENERAL DESCRIPTION :

GTG SYSTEM SCOPE SHALL CONSISTS OF FOLLOWING:

* 1 NO. GAS TURBINE GENERATOR (GTG)
* ASSOCIATED BY-PASS STACK, GAS SILENCER, EXPANSION JOINT, DIVERTER DAMPER, GUILLOTINE DAMPER FOR GTG
* AIR INTAKE SYSTEM, IT's INSTRUMENTATION AND CONTROL SYSTEM AND ASSOCIATED FACILITIES.
  DG SET FOR BLACK START OF GTG.
* FUEL GAS CONDITIONING SKID.
* INSTRUMENT AIR/NITROGEN SYSTEM REQUIRED FOR BLACK-START OF GTG

A) GAS TURBINE GENERATOR (GTG)

1 SERVICE : POWER GENERATION

2 TYPE : INDUSTRIAL GAS TURBINE GENERATOR (GTG) DESIGNED TO OPERATE BOTH IN SIMPLE CYCLE AND COMBINED CYCLE MODE

3 QUANTITY : ONE

4 POWER GENERATION (MINIMUM) : 4.0 MW AT GENERATOR TERMINAL (NOTE-2)

5 FUEL TYPE : MAIN FUEL - NATURAL GAS
START-UP FUEL - NATURAL GAS

6 TURN DOWN : 30 - 100%

7 HRSG : YES
TO BE INSTALLED AT GTG EXHAUST

8 BACK PRESSURE AT GTG BATTERY LIMIT : 250 mm WC (MAXIMUM)

9 FUEL SPECIFICATION : REFER ANNEXURE-1

10 SITE CONDITIONS : REFER CPP DESIGN BASIS (Doc. No.-A672-011-02-43-DB-01)

11 FUEL GAS PARAMETERS AT B/L FOR NATURAL GAS :

	PRESSURE (KG/CM2G)				TEMPERATURE (DEG C)			
	MIN	NOR	MAX	DESIGN	MIN	NOR	MAX	DESIGN
NATURAL GAS	9	14.2		20		30		65

12 OTHER UTILITY B/L CONDITIONS : REFER CPP DESIGN BASIS (Doc. No.-A672-011-02-43-DB-01)

13 BLACK START FACILITY

GTG SHALL HAVE BLACK START FACILITY. REQUIRED POWER FOR BLACK START OF GTG SHALL BE THROUGH DG WHICH SHALL BE IN VENDOR SCOPE. 'ALL OTHER UTILITIES AS REQUIRED (SUCH AS COOLING WATER, N2 ETC) FOR BLACK START OF GTG SHALL BE CONSIDERED WITHIN CPP AND SHALL BE IN VENDOR'S SCOPE.

NATURAL GAS AND INSTRUMENT AIR AS REQUIRED SHALL BE AVAILABLE AT BATTERY LIMIT.

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UNIT	CAPTIVE POWER PLANT	JOB NO.:	A672	UNIT NO.:	011
ITEM NO	011-GTG-01	SERVICE:	GTG AND IT'S AUXILLARIES		

B) EXHAUST GAS SYSTEM

THE EXHAUST GAS SYSTEM SHALL COMPRISE OF EXHAUST GAS DUCTING BEYOND THE GAS TURBINE EXHAUST FLANGE INCLUDING EXPANSION JOINT, BYPASS STACK WITH SILENCER, DUCT SUPPORT, DIVERTER DAMPER, GUILLOTINE DAMPER, THERMAL INSULATION AND CLADDING AND OTHERACCESSORIES.

I) DIVERTER DAMPER

DRIVE : ELECTRICALLY/ HYDRAULICALLY/ PNEUMATICALLY OPERATED-CONTROL/ MODULATING TYPE TO FACITILATE SMOOTH COMMISIONING AND START-UP OF HRSG.

SEALING : 100% SEALING ON FLOW WITH SEALING AIR.

II) GUILLOTINE DAMPER

DRIVE : ELECTRICALLY OPERATED WITH MANUAL OVERRIDE.

SEALING : 100% SEALING ON FLOW WITH SEALING AIR.

III) BY PASS STACK

STACK HEIGHT : 30 m (MINIMUM)

C) EMISSION NORMS

THE STACK POLLUTIONS LEVEL SHALL NOT EXCEED THE CPCB/APCB LIMIT AT THE TIME OF COMMISSIONING, WHICHEVER IS STRINGENT FOR ALL OPERATING LOADS OF GTG & HRSG.

HOWEVER AS A MINIMUM THE MAXIMUM LIMIT OF COMBINED EMISSION (COMBINED POLLUTANT FROM GTG & HRSG) AT 15% O2 SHALL BE AS FOLLOWS:

NOx FROM GTG/ HRSG	:	100 PPMvd
PARTICULATE MATTER (PM)	:	5 mg/Nm3
CO	:	100 mg/Nm3
SOX	:	BY VENDOR

D) GAS CONDITIONING SKID (GCS)

GAS CONDITIONING SKID FOR NATURAL GAS SHALL CONSIST OF MINIMUM EQUIPMENTS SUCH AS KOD (COMMON FOR GTG, HRSG & UB), GAS COMPRESSOR (1x100%, IF REQUIRED FOR MINIMUM/NORMAL NG PRESSURE), STEAM HEATER (1 ELECTRICAL + 1 STEAM HEATER), GAS FILTERS (1W + 1S) ETC AND ANY OTHER EQUIPMENT/INSTRUMENT/FACILITIES AS REQUIRED FOR SMOOTH AND TROUBLE FREE OPERATION SHALL ALSO BE CONSIDERED BY THE VENDOR. FUEL GAS LINE ALONG WITH ALL PIPE FITTINGS, VALVES, CONTROL VALVES ETC IN FUEL GAS LINE SHALL BE OF STAINLESS STEEL (SS) AFTER FILTER. GAS KOD SHALL HAVE LP STEAM COIL PROVISION. ALL GASEOUS FUEL VENTS SHALL BE CONNECTED TO FLARE HEADER. STEAM CONDENSATE FROM KOD SHALL BE ROUTED TO OWS

HYDROCARBON GAS MONITORS SHALL BE PROVIDED NEAR KODS, GAS CONDITIONING SKID ETC AS REQUIRED WHERE THERE IS SOURCE OF GAS LEAKAGE EXPECTED. HC DETECTOR READING SHALL BE PROVIDED IN DCS.

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UNIT	CAPTIVE POWER PLANT	JOB NO.: A672	UNIT NO.: 011
ITEM NO	011-GTG-01	SERVICE:	GTG AND IT'S AUXILLARIES

E) WATER WASH SKID

ONE NUMBER WATER WASH SKID SHALL BE PROVIDED TO ENABLE ONLINE AS WELL AS OFF LINE WATER WASH OF GAS TURBINE COMPRESSOR.

ONLINE WATER WASH : AS PER GAS TURBINE MANUFACTURER RECOMMENDATION

OFFLINE WATER WASH : AS PER GAS TURBINE MANUFACTURER RECOMMENDATION

F) WATER INJECTION SKID

WATER INJECTION SKID IF REQUIRED MAY BE PROVIDED FOR MEETING NOX EMISSION LIMIT FROM GAS TURBINE THROUGH INJECTION OF DM WATER. IN NORMAL OPERATING SCENARIO, USE OF DM WATER IF REQUIRED SHALL BE RESTRICTED TO THE EXTEND FOR NOX CONTROL ONLY. POWER AUGMENTATION THROUGH WATER INJECTION IN NORMAL OPERATION SHALL NOT TO BE CONSIDERED.

G) UTILITIES (INSTRUMENT AIR /NITROGEN ETC.) FOR BLACK-START OPERATION

VENDOR SHALL PROVIDE ALL REQUIRED FACILITIES (i.e. COOLING WATER, INSTRUMENT AIR, NITROGEN ETC.) AS REQUIRED FOR BLACK START OF GTG. COOLING WATER SHALL BE THROUGH EMERGENCY COOLING TOWER (WITHIN SCOPE OF CPP VENDOR)

H) DIESEL ENGINE GENERATOR (DG set) AND ITS AUXILIARIES

VENDOR SHALL PROVIDE ONE NO. DG SET ALONG WITH ALL REQUIRED AUXILIARIES, ELECTRICAL, INSURUMENTATION & CONTROL SUITABLE FOR BLACK-START OF GTG. ALL REQUIRED ELECTRICAL LOAD SHALL BE CONSIDERED INCLUDING GAS COMPRESSOR IF REQUIRED FOR MINIMUM NATURAL GAS PRESSURE AS PER OEM DESIGN

I) GAS COMPRESSOR (IF REQUIRED)

1 x100% COMPRESSOR FOR NATURAL GAS SHALL BE PROVIDED, IF REQUIRED TO BOOST THE MINIMUM / NORMAL NATURAL GAS PRESSURE FOR GTG. ALL GAS CONDENSATE SHALL BE CONNECTED TO OWS WHILE VENT SHALL BE CONNECTED TO FLARE.
REFER CL. 8.8 OF BEDB PART-B (A672-999-02-41-ODB-1001) FOR REQUIREMENT WRT SELECTION, DESIGN AND SPARE UNIT
DRIVE : MOTOR

J) GUARANTEE PARAMETERS

THE FOLLWING SHALL BE THE PROCESS PARAMETERS TO BE GUARANTEED BY THE VENDOR

GTG OUTPUT (MW) @ GENERATOR TERMINAL : 4.0 MW (MINIMUM) WITH NATURAL GAS @ 37.8 DEG C AND 80% RH

K) SPECIAL REQUIREMENT

1 GTG SHALL BE DESIGNED TO OPERATE IN BOTH SIMPLE CYCLE AS WELL AS COMBINED CYCLE MODE.
GTG SHALL ABLE TO RUN ON SIMPLE CYCLE MODE FOR UNLIMITED PERIOD AND IT SHALL BE POSSIBLE FOR HRSG (DOWN STREAM OF GTG) TO UNDERGO ANNUAL INSPECTION AND MAINTENANCE WHEN GTG RUNS ON SIMPLE CYCLE MODE.
GTG SHALL BE DESIGNED SUCH THAT HRSG CAN OPERATE ON FRESH AIR FIRING MODE UPTO ITS MCR WHEN GTG IS UNDER MAINTENANCE. GTG SHALL ALSO BE DESIGNED SUCH THAT IT CAN START AND SYNCHRONISED UPTO BASE LOAD WHEN HRSG OPERATING IN FRESH AIR FIRING MODE AND SMOOTH INTRODUCTION OF GTG EXHAUST INTO THE HRSG i.e. SMOOTH SWITCH OVER WITHOUT ANY TRIP OF HRSG MODE OF OPERATION FROM FRESH AIR FIRING MODE TO GTG EXHUST MODE AND VICE VERSA.
ALL REQUIRED INSTRUMENT/CONTROL/LOGIC AS REQUIRED FOR SWITCH OVER OF HRSG OPERATION FROM FRESH AIR FIRING MODE TO GTG EXHAUST MODE OR VICE VERSA SHALL BE PROVIDED BY THE VENDOR. HOWEVER SWICHOVER SHALL BE THROUGH REMOTE MANUAL OPERATION IN DCS.

2 OIL MIST ELIMINATOR FOR THE GAS TURBINE TO BE PROVIDED WITH STAND BY FACILITY. BOTH WILL BE MOTOR DRIVEN.

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NOTES:

1 GAS TURBINE SHALL BE CAPABLE OF FIRING WITH FUEL AS NATURAL GAS FROM 30% TO 100% LOAD ON CONTINUOUS BASIS.

2 GTG SHALL BE CAPABLE OF DELIVERING MINIMUM 4.0 MW POWER @ GENERATOR TERMINAL AT AMBIENT TEMPERATURE OF 37.8 DEG C AND 80% RH WITH NATURAL GAS FUEL.

3 THE INTERNAL POWER CONSUMPTION FOR GTG TO BE INDICATED BY PACKAGE VENDOR.

4 CPP INTERNAL POWER REQUIREMENT IS CONSIDERED AS 0.8 MW, IF THE SAME IS MORE THAN 0.8 MW, CAPACITY OF THE STG/ GTG MAY BE INCREASED ACCORDINGLY.

5 NO OTHER POWER ENHANCEMENT SYSTEM (CHILLER, HUMIDIFIER, ETC.) SHALL BE CONSIDERED.

6 THE GENERATOR, ALTERNATOR AND ELECTRICAL SYSTEM SHALL BE SIZED FOR GTG BASE LOAD OPERATION AT MINIMUM AMBIENT TEMP.

7 THE GAS TURBINE SHALL BE CAPABLE OF WITHSTANDING FULL LOAD REJECTION WITHOUT OVER SPEED TRIP WHILE RUNNING ON NATURAL GAS.

8 EFFULENT AFTER WATER WASH SHALL BE ROUTED TO STORM WATER SEWER .

9 PACKAGE VENDOR TO IDENTIFY THE EQUIPMENTS THAT REQUIRE EMERGENCY POWER CONNECTION.

10 ALL REQUIRED INSTRUMENTATIONS FOR SAFE AND SMOOTH OPERATION & MONITORING OF GTG SYSTEMAND PERFORMANCE TESTING SHALL BE IN PACKAGE VENDOR'S SCOPE.

11 ISOLATION VALVES SHALL BE PROVIDED TO THE EQUIPMENT.

12 DC MOTOR DRIVEN EMERGENCY LUBE OIL PUMP SHALL BE PROVIDED FOR COOLING DOWN OF GTG IN CASE OF POWER TRIP.

13 REFER CPP DESIGN BASIS (DOC NO.-A672-011-02-43-DB-01) AND BEDB PART-B FOR GENERAL REQUIREMENT.

14 REFER BATTERY LIMIT P&ID (P&ID NO.- A672-011-02-43-1111) FOR BATTERY LIMIT ISOLATION VALVES AND INSTRUMENTATION.

15 BIDDER TO PROVIDE ALL BATTERY LIMIT FLOW RATES AND OPERATING CONDITIONS REQUIREMENTS IN ITS BIDS

16 VENDOR TO ALSO FURNISH GTG EMERGENCY POWER REQUIREMENT IF ANY FOR SAFE SHUTDOWN.

17 VENDOR TO FURNISH GTG DETAILS i.e. FUEL FLOW, EXHAUST FLOW/TEMPERATURE, EXHAUST GAS COMPOSITION ETC AS PER ANNEXURE-2

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ANNEXURE 1

SL. NO.	COMPONENT	UNIT	NATURAL GAS
1	H2	Mole Fraction	0
2	N2	Mole Fraction	0.005
3	C	Mole Fraction	0
4	METHANE	Mole Fraction	0.923
5	ETHANE	Mole Fraction	0.0417
6	PROPANE	Mole Fraction	0.0079
7	ISOBUTANE	Mole Fraction	0.0001
8	n-BUTANE	Mole Fraction	0.001
9	ISOPENTANE	Mole Fraction	0.0003
10	n-PENTANE	Mole Fraction	0.0005
11	HEXANE	Mole Fraction	0.0005
12	CO2	Mole Fraction	0.002
13	SULPHUR (H2S AND MERCAPTONS)	ppm Max	10
14	LCV	Kcal/NM3	8783
		Kcal/kg	11190

ANNEXURE-2

GTG Exhaust Data for Natural Gas																
Ambient temp.	deg C	Minimum (5 deg C)					(37.5 deg C)					Maximum (38 deg C)				
RH%		87%					80%					80%				
Load condition (@ Generator Terminal)		30% of base	50% of base	75% of base	Base load	Peak	30% of base	50% of base	75% of base	Base load	Peak	30% of base	50% of base	75% of base	Base load	Peak
GT Fuel		NATURAL GAS														
GT output (@ Generator)	MW															
GT output (@ Shaft)	MW															
GT Aux Power requirement	MW															
GT heat rate	KJ/KWh															
GT heat consumption	GJ/h															
Fuel consumption	Kg/h															
Exhaust flow	t/hr															
Exhaust temp.	deg C															
Exhaust analysis																
N2	% vol.															
CO2	% vol.															
O2	% vol.															
H2O	% vol.															
Ar	% vol.															
SO2	ppmv															
SO2	kg/h															
Nox as NO2	ppmvd@15%O2															
Nox as NO2	kg/h															
PM	mg/NM3															
CO2	mg/NM3															
CO	mg/NM3															
Ni+V	mg/NM3															