



BHARAT HEAVY ELECTRICALS LIMITED
(A Government of India Undertaking)

Heavy Power Equipment Plant (HPEP),
Hyderabad - 502032, INDIA

NOTICE INVITING GLOBAL TENDER FOR THE BELOW
REQUIREMENTS OF RAOZAN 400MW +/- 10% COMBINED CYCLE
POWER PLANT

A. SCOPE OF WORK AS PER ANNEXURE - 1 TO 8

B. SEPARATE PROPOSAL FOR LTSA SERVICE FROM OEM OF
GTG PACKAGE

BHEL DOCUMENT NO:
HY/HPEP/RAOZAN/2020/0001

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1. INTRODUCTION:

BPDB has invited tenders for setting up of 400 MW $\pm$ 10% CCPP at Raozan, Chittogram, Bangladesh through the end customer specification "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721".

BPDB tender document "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721" along with its clarifications, amendments shall be hereafter referred as end customer specification.

Refer end customer specification for complete information on this tender requirement. This document is the basis for BHEL's NIT preparation for sourcing of following equipment and its associated auxiliaries.

1. Gas Turbine & Associated Auxiliaries
2. Common Generator & Associated Auxiliaries
3. Steam Turbine & Associated Auxiliaries
4. Condenser, GSC & Condenser Air Removal System & Associated Auxiliaries
5. Gas booster compressor & Associated Auxiliaries
6. Heat recovery steam generator & Associated Auxiliaries
7. Distributed control system & Associated Auxiliaries
8. BFP Pump, Condensate Extraction Pump, Cooling Water Pump & Associated Auxiliaries

BHEL intends to source the major CCPP equipment package of 400 MW $\pm$ 10% capacity at site conditions (35 deg C, 1.013 mbar, 98% R.H.). The Combined Cycle unit shall be of single shaft arrangement having 1:1:1 (One GT + One HRSG + One ST) configuration with synchro-self-shifting (SSS) Clutch for simple cycle operation of the gas turbine as well as shall be equipped with the bypass stacks and diverter dampers to allow continuous and reliable simple cycle operation and shall be capable to run on Free Governing Mode Operation.

2. PRE-QUALIFICATION CRITERIA:

2.1. Bidder shall mandatorily include in their scope all the following equipment's while furnishing their techno commercial offer to BHEL:

1. Gas Turbine & Associated Auxiliaries
2. Common Generator & Associated Auxiliaries
3. Steam Turbine & Associated Auxiliaries
4. Condenser, GSC & Condenser Air Removal System & Associated Auxiliaries
5. Gas booster compressor & Associated Auxiliaries
6. Heat recovery steam generator & Associated Auxiliaries
7. Distributed control system & Associated Auxiliaries
8. BFP Pump, Condensate Extraction Pump, Cooling Water Pump & Associated Auxiliaries

2.2. BIDDER offer proposing the power plant having net output (Output at Generator Step up Transformer HT terminal) less than 360 MW at site condition will be considered as nonresponsive. Bidder to consider aux. power consumption value for the auxiliaries in BHEL scope to be 2.1% of the gross CCPP output. This will be used for bidder's net output evaluation. Bidder to share firm inputs/HBDs for the equipment's in their scope for overall CCPP net power evaluation by BHEL.

In case of NOT meeting above requirements, BHEL reserves the right to reject the BIDDER's offer.

3. SCOPE OF WORK AND SERVICES:

The scope of work and services indicated in the individual NIT of respective equipment's shall cover the requirements of design, engineering (including supply of all calculation & settings), manufacturing, inspection, testing, supply, delivery to the site, construction, erection installation, testing, commissioning, commercial operation and Warranty service including supply of spares & consumables for the first twenty four (24) months after satisfactory Operational acceptance and performance tests of Combined Cycle Generating Unit & associated equipment at Raozan, Chattogram, Bangladesh. Also, separate proposal has been sought for LTSA service from OEM of GTG package for GTG and their self-auxiliaries for 7 years after Operational acceptance of the plant.

Bidder shall refer below individual NIT of respective equipment's which are attached as Annexures in this document for their scope of work, services and other requirements before furnishing their techno commercial offer to BHEL:

1. NIT of Gas Turbine & Associated Auxiliaries (Annexure-1)
2. NIT of Common Generator & Associated Auxiliaries (Annexure-2)
3. NIT of Steam Turbine & Associated Auxiliaries (Annexure-3)
4. NIT of Condenser, GSC & Condenser Air Removal System & Associated Auxiliaries (Annexure-4)
5. NIT of Gas booster compressor & Associated Auxiliaries (Annexure-5)
6. NIT of Heat recovery steam generator & Associated Auxiliaries (Annexure-6)
7. NIT of Distributed control system & Associated Auxiliaries (Annexure-7)
8. NIT of BFP Pump, Condensate Extraction Pump, Cooling Water Pump & Associated Auxiliaries (Annexure-8)

Bidder shall mandatorily include following scope of supply and services:

S. No.	Scope of supply/Service	Description
1.	Spares & consumables during Warrantee period	Bidder shall provide all spares & consumables whether listed or not in the contract for smooth operation of the plant during Defect Liability Period. During the Defect Liability Period, Bidder shall also provide normal operation spares & consumables (Lube Oil, Air Filters, Chemicals & others), wear & tear spares, spares required for schedule/ unscheduled maintenance and services required for complete combined cycle power plant & their auxiliaries (with all electrical equipment and control system) except schedule inspections

		spares for GTG & their auxiliaries (Spares for day to day, unscheduled, breakdown & other maintenance shall also have to supplied). In preparation of the list the Bidder have to consider plant factor as 80% and 50 nos. start/stop per year. Bidder has to submit the detailed list with the tender. In case there is any spare items required during warranty period which is not part of the list then also bidder has to supply that spare parts. BIDDER will be liable for providing all spares, consumable and expertise service for day to days, unscheduled, breakdown maintenance of complete combined cycle power plant including GTG & their auxiliaries during defect liability period from the Operational Acceptance Certificate of the plant. Refer end customer specification for more details
2.	Special tools	Special tools including a Videoscope with 3D phase measurement & touch screen (Manufacturer country: Japan/USA/ England) required for installation and maintenance of the units and hand them over in good condition to the Board at the completion of the Project. A list of all such tools shall be incorporated in the offer. Worn out tools or damaged tools shall be replaced with new one without any cost. As well as Bidder shall provide Special lifting & handling appliances and dismantling & assembling tools for GT, Generator and others as required. Refer end customer specification for more details
3.	Training	As per end customer specification
4.	Operation & Maintenance During Warranty Period	As per end customer specification
5.	Supervision of Erection and Commissioning	Bidder to fill and submit the information requested in the below Table-1 & 2. BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be

		used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.
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Table-1 (TDI Service Details and Cost Evaluation)

S.No	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost	Remarks
1.	Gas Turbine	A1=780	B1	C1	D1=26	E1	F1	$A1 \times C1 + D1 \times F1 = G1$	These details are also be referred in Annexure-1
2.	Generator	A2=90	B2	C2	D2=03	E2	F2	$A2 \times C2 + D2 \times F2 = G2$	These details are also be referred in Annexure-2
3.	Steam Turbine	A3=250	B3	C3	D3=45	E3	F3	$A3 \times C3 + D3 \times F3 = G3$	These details are also be referred in Annexure-3
4.	HRSG	A4=300	B4	C4	D4=08	E4	F4	$A4 \times C4 + D4 \times F4 = G4$	These details are also be referred in Annexure-4
5.	GBC	A5=75	B5	C5	D5=15	E5	F5	$A5 \times C5 + D5 \times F5 = G5$	These details are also be referred in Annexure-5
6.	DCS	A6=180	B6	C6	D6=06	E6	F6	$A6 \times C6 + D6 \times F6 = G6$	These details are also be referred in Annexure-6
7.	PUMPS (BFP, CEP & CWP)	A7=30	B7	C7	D7=06	E7	F7	$A7 \times C7 + D7 \times F7 = G7$	These details are also be referred in Annexure-7
8.	Condenser, Ejector, Gland Steam Condenser	A8=120	B8	C8	D8=4	E8	F8	$A8 \times C8 + D8 \times F8 = G8$	These details are also be referred in Annexure-8

9.	Integrated Plant/system optimization, Tuning, Reliability Test, Performance Test, etc. and all other tests, services as required by end customer.	(To be quoted on Lump sum Basis covering all costs including but not limited to Mob-demob, air travel, local travel, boarding, lodging, meals, etc.) Proving the quoted performance to end customer is BIDDER's responsibility. Responsibility of BHEL supplied auxiliaries/systems shall remain with BHEL.	G9	
		(TOTAL)	(G1+G2+G3+G4+G5+G6+G7+G8+G9)	

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	Gas Turbine	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST
2.	Generator	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST
3.	Steam Turbine	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST
4.	HRSG	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST
5.	GBC	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST
6.	DCS	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

7.	PUMPS (BFP, CEP & CWP)	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST
8.	Condenser, Ejector, Gland Steam Condenser	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST
9.	Any other services not covered above. BIDDER to provide details.	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

ANNEXURE-1

**(NIT for Gas Turbine & Associated
Auxiliaries)**

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sec-A	Scope of Work & Services	
Sl. No.	Description	Confirmation from Bidder (YES/NO)
1	Bidder's major scope of supply, services for gas turbine, generator and their associated systems shall be as indicated below and conforming to end customer Specifications which are part of the enquiry documents (end customer Specification "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721", Clarifications & Addendums are enclosed)	
2	The gas turbine generating unit shall be of heavy-duty industrial packaged type with incorporating latest version of Dry Low NOx Combustion system suitable for indoor installation.	
3	The gas turbine shall be suitable for burning gaseous fuel (Natural Gas/RLNG) and able to operate in base load as well as peak load. Single shaft arrangement having 1:1:1 (One GT + One HRSG + One ST) configuration with synchro-self-shifting (SSS) Clutch for simple cycle operation of the gas turbine as well as shall be equipped with the bypass stacks and diverter dampers to allow continuous and reliable simple cycle operation and shall be capable to run on Free Governing Mode Operation.	
4	The following parameters are to be considered in plant design: Sub-Tropical Monsoon. Temperature: 5 deg C to 45 deg C Relative Humidity: 36% to 100%. Annual Rain Fall: 120 cm to 345 cm. Wind Velocity: As per Latest Wind Map. Seismic Horizontal ground Acceleration: As per BNBC approved latest Seismic Map Refer Clause 1.1 in Section 1 of Vol-2 of 2, PART A document	
5	Base plate/frame for all items/equipments in Bidder scope of supply including gas turbine, generator, off-base skids, auxiliaries, load gear box etc along with all items mounted on it required for normal operation of Gas turbine.	
6	All foundation hardware (including embedments & over the surface items) for all items/equipments in Bidder scope of supply including gas turbine, generator, off-base skids, auxiliaries, load gear box etc	
7	Sufficient spares required for commissioning as per Bidder experience/recommendation & furnish the list for the same. If however, any additional spares is consumed over and above the quoted commissioning spares, during commissioning, the same shall be provided free of cost, by the Bidder. Any leftover spares after commissioning shall be handed over to the owner.	

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Sl. No.	Description	Confirmation from Bidder (YES/NO)
8	Bidder shall provide all spares & consumables whether listed or not in the contract for smooth operation of the plant during Defect Liability Period. During the Defect Liability Period, Bidder shall also provide normal operation spares & consumables (Lube Oil, Air Filters, Chemicals & others), wear & tear spares, spares required for schedule/unscheduled maintenance and services required for complete combined cycle power plant & their auxiliaries (with all electrical equipment and control system) except schedule inspections spares for GTG & their auxiliaries (Spares for day to day, unscheduled, breakdown & other maintenance shall also have to supplied). In preparation of the list the Bidder have to consider plant factor as 80% and 50 nos. start/stop per year. Bidder has to submit the detailed list with the tender. In case there is any spare items required during warranty period which is not part of the list then also bidder has to supply that spare parts. BIDDER will be liable for providing all spares, consumable and expertise service for day to days, unscheduled, breakdown maintenance of complete combined cycle power plant including GTG & their auxiliaries during defect liability period from the Operational Acceptance Certificate of the plant. Refer Schedule-F of VOLUME 2 OF 2, PART B document	
9	LONG TERM SERVICE AGREEMENT (LTSA) proposal from the GTG Bidder shall be submitted with the Technical & Financial Proposal as per Vol 2 of 2 (Part C). Supply of Spares & Consumables and Required Works for Schedule Maintenance (CI, HGPI & MI or its equivalent inspections) & Un-schedule Maintenance for 7 (seven) years of GTG unit & their self-auxiliaries from the Original Equipment Manufacturer (Bidder) of GTG package. LTSA proposal including Price (This price will not be considered in financial evaluation) from Original equipment manufacturer. Refer Clause 24.3(d) in Section 2 of Vol-1 of 2 document Refer VOLUME 2 OF 2, PART C document	
10	Mandatory Spares as per end customer specification	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
11	Separate Lumpsum quote indicating required minimum number of man days for the below services upto warranty period: 1) Supervision of Erection and Commissioning of gas turbine, generator and their associated systems 2) DLN tuning 3) IDLN/Performance tuning/optimization (along with necessary instrumentation, equipment & services) to meet the requirements of output, heat rate, combustion dynamics, vibration, emissions, etc. 4) Any other additional services, if required. 5) Bidders to consider minimum 780 man days for TDI and any other Bidder site supervision services for Gas Turbine and it's auxiliaries. 6) Bidders to consider minimum 26 mob-demob instances for TDI and any other Bidder site supervision services for Gas Turbine and it's auxiliaries. 7) BIDDER to quote Per diem rate and mob-demob charges to be used for evaluation in combination with 5) & 6) above. 8) BIDDER to furnish recommended number of man days and number of mob-demob instances for information. 9) BIDDER shall confirm that these rates shall be valid even after consumption of the number of days and up to defect liability period by end customer. 10) Bidder to fill and submit TDI service details in Table-1 & 2 (as attached Annexure-1(TDI)) for the Gas turbine and its associated systems.	
12	Tests and Inspections shall include but not limited to: a. Dynamic balancing together with over-speed tests of the turbine and Compressor rotors b. Bench testing of all accessories c. No load operation of the turbine Refer Section 19 in (Vol-2 of 2, PART A) document for complete details	
13	Correction curves/data for output, heat rate, exhaust flow & exhaust temperature, demonstration of emission and noise. Refer Schedule-A of VOLUME 2 OF 2, PART B document	
14	Bidder to submit deviations (if any) along with price implication in case of withdrawal Refer format Schedule-G of (Vol-2 of 2, PART B) document	
15	Bidder to fill and submit performance guarantees in Schedule-A of VOLUME 2 OF 2, PART B document	
16	Bidder to fill and submit Technical Datasheet (Schedule-B) of VOLUME 2 OF 2, PART B document	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
17	Bidder shall conduct site performance test for gas turbine (not just supervision) with all necessary instruments. All the instrumentation, devices (with necessary calibration) and services required for conductance of performance test should be included in Bidder scope. Bidder should provide procedure for measuring parameters during test at site as required for proving guarantees and as per end customer specification. Refer Clause 19.3.2 in Section 19 of (Vol-2 of 2, PART A) document	
18	Bidder shall be responsible for the guarantees and shall make good incase of any shortfall in the performance without any time/price implication. Otherwise LD/Penalties shall be levied in accordance with end customer specification. Refer Appendix 8 (Functional Guarantees) in the (Vol-1 of 2) document	
19	Training as per end customer specification Refer Clause 2.15 in Section 2 of (Vol-2 of 2, PART A) document Refer Schedule-J of VOLUME 2 OF 2, PART B document	
20	Competent Engineers for the equipments in Bidder scope of supply for Operation & Maintenance During Warranty Period. Refer Clause 2.20 in Section 2 of (Vol-2 of 2, PART A) document	
21	Special tools including a Videoscope with 3D phase measurement & touch screen (Manufacturer country: Japan /USA/ England) required for installation and maintenance of the units and hand them over in good condition to the Board at the completion of the Project. A list of all such tools shall be incorporated in the offer. Worn out tools or damaged tools shall be replaced with new one without any cost. As well as Bidder shall provide Special lifting & handling appliances and dismantling & assembling tools for GT, Generator and others as required. Refer Clause 2.24 in Section 2 of (Vol-2 of 2, PART A) document Refer Schedule-E of VOLUME 2 OF 2, PART B document	
22	Spreader bar/slings/shackles for lifting of skids supplied by Bidder, as necessary for transportation/erection.	
23	Bidder shall supply necessary hardware, software for Remote Monitoring System (RMS). Bidder shall install Remote Monitoring System (RMS) at the Bidder Central Control room (GTG manufacturer) and provide necessary connectivity with Cyber Security facility. Remote Monitoring System (RMS) will be used for remotely monitor and Health Check-up of the GTG unit through Remote Monitoring System from Bidder Central Control room. Refer Clause 2.29 in Section 2 of (Vol-2 of 2, PART A) document Refer Section 23 document for details	
24	All on-base cabling (Signal, Control & Power) upto the Junction boxes for the respective skids which are in Bidder scope as per end customer specification	
25	Local Gauge Boards (SS316) and Local panels (SS316) for the respective skids which are in Bidder scope	
26	Instrumentation shall be as per end customer Specification.	
27	Electricals shall be as per end customer Specification.	

ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
28	All on base & interconnection piping among Bidder supplied skids, drain and vent piping upto terminal points as per end customer specification.	
29	Hardware/equipment required for Gas turbine Combustion Dynamics Monitoring/DLN Auto tuning/optimization, On Site Monitoring along with services till end of warranty period shall be supplied by Bidder. Required control hardware and software for these systems should be considered in the GT Control system which will be ordered separately by our sister unit BHEL-EDN.	
30	GT Control System (will be ordered separately by our sister unit BHEL-EDN)	
31	Hazardous Gas detection system and UV detection system shall be part of Bidder supply as per end customer specification. Refer Clause 16.3 in Section 16 of (Vol-2 of 2, PART A) document	
32	Inlet air system with Multi-stage (3 stage) filtration system Refer Clause 4 in Section 2 of (Vol-2 of 2, PART A) document Refer Clause 4.3.2.9 in Section 4 of (Vol-2 of 2, PART A) document	
33	The Bidder shall assess the potential impact of air quality, designs the air filter system appropriately and guarantees its long-term performance. Refer Clause 7 in Section 2 in the Vol-2 of 2, PART A document	
34	Exhaust system consisting of stack (as per environmental protection requirement but not less than 50 m), Hydraulic operated/controlled diverter damper, Motor operated Guillotine damper. Refer Clause 5 in Section 2 of (Vol-2 of 2, PART A) document Refer Clause 4.3.2.10 in Section 4 of (Vol-2 of 2, PART A) document	
35	Control Compartment (for GT) as per end customer specification Refer Clause 6 in Section 2 of (Vol-2 of 2, PART A) document	
36	Bidder shall also supply (a) Continuous Emissions Monitoring Module; (b) Remote Monitoring System and (c) standard weather station for measuring wind velocity & direction and ambient temperature, pressure & Relative Humidity. Sensors shall be installed in suitable location as per GT designer's recommendation and calibrated & interfaced with plant control system. Ambient Temperature, Pressure & Relative Humidity shall be used during performance tests. Refer Clause 7 in Section 2 of (Vol-2 of 2, PART A) document	
37	Painting, including finished coat and special paints required for corrosion protection and high temperature resistance. Export quality packaging suitable for long term storage shall also be required.	
38	Complete Vibration monitoring system for GT, Generator and Load Gear Box shaft and bearing vibrations as per end customer specification	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
39	On skid water wash nozzles & valves (motorized/pneumatic) along with on line & offline piping in Stainless steel 1) All instruments required for operation of GT Water wash 2) Operation control logics to be configured in GT Control system.	
40	Compressor Wet Washing System as per end customer specification Refer Clause 4.3.2.5 in Section 4 of (Vol-2 of 2, PART A) document	
41	Enclosures to be provided for the following: • Turbine compartment • Load Gear compartment • Exhaust compartment • Generator compartment • Lube oil compartment (Accessory compartment) • Gas compartment Acoustic enclosures with staircase, ladders and walkways, AC&DC lighting, door limit switches for all the skids to be supplied. All Enclosures should have facilities for equipment handling like mono-rail, hoist, chain-pulley blocks and accessories etc. Enclosure to be designed for sound attenuation and thermal regulation of the internal components. Enclosure to provide for necessary ventilation , fire detection and regulation and gas detection. Vendor to ensure the following requirements to be provided as a minimum. • Enclosure structure to be made of columns and beams with bracing. mounted panels suited to thermal, acoustical requirements and removable roof to be provided. • Provision of access control locks on the enclosure doors (one on each side per compartment) with safety override for operation from inside the enclosure. Control system Interlock to report incorrectly closed/open doors during machine operation. Doors to have glass window provision with tight seal covers • Interior lighting (Both AC & Emergency DC) suitable to 415V/50Hz/3φ (AC) and 125V DC. Lighting to be explosive proof. Switches to be externally mounted. • Enclosure shall be adequately ventilated utilising forced ventilation with louvers and bug screens as required for protection of the houses equipment from outdoor environmental conditions. The noise level at 1 (one) meter distance will not be more than 85 dB and less than 65 dB at 100 meters. Back draft damper and fire suppression medium dampers shall be provided at the inlet/outlet of the vent openings. • Module to be suitable for seismic load and wind loads as per end customer specification. • Co2 based fire protection system incorporating both flame and UV detection for release. Supply inclusive of CO2 piping and release nozzles etc. • Foundation hardware supply is part of vendor scope. • Enclosure panels designed to provide ease of access for removal of subassemblies. • Pipe/cable/conduits entry points to be suitably sealed. • All electrical and instrumentation items shall be explosion proof Ex-d with necessary approvals Refer Clause 4.3.2.12 in Section 4 of (Vol-2 of 2, PART A) document	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
42	CO2 fire extinguishing system with unit fire protection panel for the complete package being supplied by Bidder (as applicable). i. Gas turbine, exhaust and load gear ii. #2 bearing tunnel iii. Lube oil/gas module iv. Generator/Generator enclosure v. Any other location/area/zone as applicable. - Electronically operated, fully automatic CO2 flooding system with alarms & trip interlocks - All fire protection installations shall comply with the requirements of the codes of practice of the National Fire Protection Association, Boston, Massachusetts, U.S.A., as appropriate for the respective systems, to the approval of the Engineer. The codes and practice of the Japanese Fire Protection may also be considered. - The fire protection system shall comply with the requirements of National Fire Code No. 12A published by the National Fire Protection Association, Boston, Massachusetts, U.S.A. or equivalent. - 1X100% CO2 release mechanism - Remote weighing system for cylinders - Air-conditioned storage container for housing CO2 cylinders rack - Stainless steel distribution piping for all the protected areas - Field hardware like explosion proof manual call points, visual & audible alarms, pressure switches and junction boxes - Discharge nozzles in protected areas - Fire detection shall be by means of ultra violet flame detectors with a backup system utilising rate-of-rise temperature detectors. The use of smoke detectors shall be subject to specific approval by the Engineer as regards their type and location. All detectors shall be listed by FM & UL. - Provision for manual activation from main control room as well as from the field. - Design sizing calculation shall be provided for submission to customer - Approvals from statutory & local authorities shall be obtained - Explosion proof electricals (Ex-d) suitable for hazardous area. - Warning signs, alarms for attempted entry into protected areas without CO2 isolation - The control system for the fire protection shall be part of F&G Panel and shall be NFPA compliant. - Architecture, control philosophy and interface with remote systems shall be finalised during detailed engineering Refer Clause 4.3.2.13 in Section 4 of (Vol-2 of 2, PART A) document Refer Clause 16.3 in Section 16 of (Vol-2 of 2, PART A) document	
43	Fuel gas system dedicated to GT- Control valves, stop valve, manifold, nozzles, gas flow meter etc. suitable for DLN combustion system as per end customer specification	
44	Starting system (Motor/SFC) as per end customer specification Refer Clause 4.3.2.2 in Section 4 of (Vol-2 of 2, PART A) document	
45	Lube oil skid, Lube oil purifier, Temperature control valves for Lube Oil & Purge air 1) All electrical & instruments required as per end customer specification.	
46	Lube oil Mist eliminator 1) All electrical & instruments required as per end customer specification	
47	Ventilation system 1) All electrical & instruments required as per end customer specification Refer Clause 4.3.2.12 in Section 4 of (Vol-2 of 2, PART A) document	

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Sl. No.	Description	Confirmation from Bidder (YES/NO)
48	As per Bidder design, Electric motor driven exhaust frame blowers and #2 bearing cooling fans including piping and check valves, interconnecting piping etc. (if applicable)	
49	Turning gear along with hand turning shall be provided for use in case the automatic turning system fails to operate. Refer Clause 4.3.2.3 in Section 4 of (Vol-2 of 2, PART A) document	
50	Load gear box as per end customer specification Refer Clause 4.3.2.4 in Section 4 of (Vol-2 of 2, PART A) document	
51	Load coupling between Gas turbine and Load gear box including all necessary hardware, coupling guard, lifting equipment, device for coupling assembly/disassembly	
52	Accessory gear box (if required)	
53	Load coupling between Load gear box and generator including all necessary hardware, coupling guard, lifting equipment, device for coupling assembly/disassembly if required	
54	The lubrication system of the unit shall be equipped with the main oil pump, auxiliary motor driven oil pumps, delivery pipes, return pipes, reservoir, strainer, oil cooler, pressure gauges and thermometers, and all necessary oil piping for the system. Refer Clause 4.3.2.7 in Section 4 of (Vol-2 of 2, PART A) document	
55	125 V DC system shall consist of 2x100% battery and chargers each connected via individual fuses to dedicated 100% battery banks. Batteries shall consist of single cells connected to provide the appropriate voltage. Cells shall be valve-regulated type nickel-cadmium. The battery capacity shall be rated for safe plant shutdown (including emergency oil pumps and barring gear) plus operation of UPS for a minimum of five (05) hours without AC power. Each charger shall be capable of recharging the battery from fully discharged condition to 100% of the fully charged capacity in not more than 12 hours while supplying the design loads. Refer Clause 13.0 and 13.1 in Section 13 of (Vol-2 of 2, PART A) document	
56	415V AC GT Motor control centre as per end customer specification Refer Section 10 in (Vol-2 of 2, PART A) document	
57	Facilitate Employer and the Project Manager or their designated representatives to attend the test and/or inspection at manufacturing premises. Bidder shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses. Refer Clause GCC 38.2 in Section 4 (Particular Conditions of Contract) of (Vol-1 of 2) document	
58	All the documentation for the submission/review/approval shall as per end customer specification Refer Appendix 7 of (Vol-1 of 2) document	
59	Lubrication oil for flushing and for the initial filling as indicated in end customer specification All lubricant and chemical additives shall be supplied as indicated in end customer specification	

ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)												
60	Vibration severity of the units shall not exceed 8.0 mm/sec. In normal operation measured at any bearing pedestals both in vertical and horizontal plane. Refer Clause 3.5.5 of Section 3 in the Vol-2 of 2, PART A document													
61	The Critical speed of the rotor assembly as a complete unit shall be at least 20% above or below the operating speed range of the units. Refer Clause 3.5.6 of Section 3 in the Vol-2 of 2, PART A document													
62	Total trace elements in compressor wash water (after adding detergent) will preferable be limited as follows. <table border="0"> <tr> <td>No.</td><td>Trace Metal</td><td>For Million Parts of Water by weight</td></tr> <tr> <td>1</td><td>Sodium & Potassium</td><td>30 ppm</td></tr> <tr> <td>2</td><td>Calcium</td><td>10 ppm</td></tr> <tr> <td>3</td><td>pH</td><td>7.5 to 8.0</td></tr> </table> The Bidder shall design, manufacture and supply all the components (Viz. water tank, piping, valves, strainer, drains, manifolds, injection nozzles etc.) of the above mentioned compressor wet washing system of suitable grade of material to handle the above wash water without any deterioration. The Bidder shall clearly specify the proposed grade of materials of the above components. The Bidder shall provide complete system. Refer Clause 4.3.2.5 of Section-4 in the Vol-2 of 2, PART A document	No.	Trace Metal	For Million Parts of Water by weight	1	Sodium & Potassium	30 ppm	2	Calcium	10 ppm	3	pH	7.5 to 8.0	
No.	Trace Metal	For Million Parts of Water by weight												
1	Sodium & Potassium	30 ppm												
2	Calcium	10 ppm												
3	pH	7.5 to 8.0												
63	The casings of all the rotary parts on the main unit shall be spilt horizontally for easy dismantling and inspection. Lugs for lifting the upper casing shall be provided at points which will lift the casing half well balanced. Complete lifting gear together with lifting drawing and instruction shall be furnished. Refer Clause 4.3.2.14 of Section-4 in the Vol-2 of 2, PART A document													
64	Thermal insulation shall be provided where necessary and is to include such parts as the combustion chambers, exhaust ducts and hoods. Removable insulation blankets shall be provided in all parts where insulation must be removed for maintenance purposes. Refer Clause 4.3.2.15 of Section-4 in the Vol-2 of 2, PART A document													
65	Simple Cycle Net Power output at Site conditions (350C, 1.013 bar, 98% relative humidity) : 65% (±5% Variation is allowed) of CC net Power Output Refer Clause 2.2 in Section 2 in Vol-2 of 2, PART A document													
66	The Bidder shall guarantee the starting reliability of the Combined Cycle Plant including all ancillary equipment. The guaranteed reliability shall be stated in the Tender form together with the number of consecutive starts to which the Unit(s) will be subjected to demonstrate this reliability (This is for a starting reliability of 95 %, the Unit(s) shall be subjected to 20 consecutive starts of Which 19 shall be successful). The maximum speed rise after full load rejection is to be guaranteed. Refer Clause 3.2 in Section 2 in Vol-2 of 2, PART A document													

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
67	The gas turbine unit shall be equipped with an instrument air supply system which includes instrument air compressor, air reservoir, oil separator, air drier etc. and complete in all respect. Refer Clause 4.3.2.11 in Section-4 of Vol-2 of 2, PART A document	
68	Bidder shall furnish all the equipments, auxiliary systems, instruments, controls and safety devices as per the end customer specification. However, anything required over and above what is specified in the end customer specification for safe and satisfactory operation of the equipment package shall be included by the Bidder in their scope.	
69	If a requirement appears in more than once in specification, it will be commented when necessary only once in one of the instances.	
70	BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engineering coordination, and other charges . Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer, and required as per BHEL's NIT or required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.	
71	BHEL's scope of supply in GTG package (For information to Bidder): The information/specification to be shared by Bidder 1) All interconnecting control, power and instrumentation cables	
Sec-B	<u>Drawings and other documents:</u>	
S.NO.	DETAILS OF DOCUMENTS	
1	Authorization Certificates from the manufacturer (s) of main equipment that they will supply their machine/ equipment to BPDB through the tenderer for this project, in the event the tenderer concerned is not the manufacturer of the same. [TDS (ITT 24.2 r)]	
2	Certificate from the end users for Proveness of the offered equipment. [TDS (ITT 24.2 r)]	
3	Bidder declaration supported by Bidder Performance curve for corresponding GT model must have to be submitted from concern manufacturer with the Technical Proposal as per Form PG5A – 5a, Vol. 1 of 2 of tender document. [TDS (ITT 24.2 r)]	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
4	If higher capacity is offered (Net output more than 440 MW at site conditions), heat rate for 440 MW, 330 MW and 220 MW as per Bidder written declaration supported by Bidder heat rate/ load Vs efficiency curve for corresponding GT model and these values (440 MW, 330 MW and 220 MW) will be considered as 100%, 75% & 50% load respectively for evaluation. If Bidder doesn't submit heat rate curve and written declaration for output & Heat rate of corresponding GT model, then the proposal of that Bidder will not be considered for evaluation.	
5	Letter of Intent to provide LTSA service and complete LTSA proposal must have to be submitted with the Technical Proposal as per Form PG5A – 5b, Vol. 1 of 2 of tender document. [TDS (ITT 24.2 r)]	
6	Materials, Equipment and associated services from the following countries are not eligible: Israel	
7	The gas turbine generating unit shall be of well proven design and the offered model of gas turbine generating unit (evolution of frame will not be accepted) shall have satisfactory operating experience outside manufacturer's country for at least 2 (two) years.	
8	The Bidder shall include at least two (02) certificates from the end users on satisfactory performance of the Power plants as mentioned above, which were designed, engineering, supplied, constructed, tested & commissioned by the Bidder himself or as member in case of JVCA to establish the minimum required experience to Tender. The certificates shall mention the name of power plant, Plant Configuration, capacity, Contract value, Name of Partner (If Applicable), total operating hour and commissioning date of the power plant (make, model) supplied by the Bidder; issue date, name and address (Telephone/Fax/e-mail) of the end user duly signed in the official pad. These certificates must be notarized and have authentication from the Chamber of Commerce of the Bidder country or the Embassy/High commission of the end user's country situated in Dhaka. In absence of that, authentication from Bidder country's Embassy/High Commission in Dhaka.	
9	Manufacturer's Authorisation Letter (Form PG5A - 5)	
10	Manufacturer's declaration letter (Form PG5A – 5a)	
11	Letter of Intent (Form PG5A – 5b)	
13	Bidder shall first submit the completely filled-in Equipment Data sheets, Performance Curves, filled in Experience Record Proforma, Equipment Manufacturers Latest catalogues and their General reference lists, vendor list, Quality Plans for GT, Generator, LGB and other rotating equipments, any other documents as specified in end customer specification along with the offer.	
14	All the Equipment's name plate Data (Manufacturer Name & Technical Parameters), Technical Specification, Operational Manual including Bidder parts list & Drawings shall be in English language. Bidder has to handover all the Equipment's complete Technical Specification, Operational Manual including Bidder parts list & Drawings before performance test of the plant.	
15	Also all the drawings and documents at S.No 19 below shall be submitted by Bidder within 30 days from placement of PO, incorporating project specific title block which will be shared during detail engineering.	
16	The drawing and documents (ex. GA drawing etc) which require further engineering and integration by BHEL shall be furnished in Auto CAD format.	
17	Bidder to furnish all necessary functional and ordering specifications, system requirement documents and interface information for sizing of equipment in BHEL's scope of supply.	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
18	Following documents shall be submitted mandatorily along with bid but not limited: a. General Arrangement drawing of GT & its auxiliaries in native format (editable version like Auto CAD). Bidder shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc. b. Foundation loading drawings with static and dynamic loads and other relevant data for civil foundation for the equipments which are in Bidder scope of supply in native editable format. c. Utility consumption list (for Instrument air, Cooling water, Nitrogen, Fuel gas, Power etc.) as per format 02,03 & 04. d. Electrical load list including AC (HT, LT) Loads, DC loads (including starting current and starting time), UPS loads etc in the attached format 01. e. List of panels along with Dimension, weight, recommended location, clearance around equipment, heat load f. Single Line diagram for GT MCC g. Gas fuel specification and supply requirements at GT inlet h. Lube oil, cooling water, preservation and storage, water wash, water purity requirements i. De-rating curves of power output and fuel consumption VS ambient temperature, ambient pressure, humidity etc. j. Sub-vendor's list for all the equipment as per end customer specification k. Functional write up for normal operation l. Gas turbine Thermal performance data consisting of power, heat rate, exhaust flow, exhaust temperature, exhaust composition, emissions etc. m. Aux power along with list of auxiliaries n. Device list and P&ID's o. Description of training program including curriculum and training aids. p. A list and description of similar projects which the Bidder has successfully completed. q. Type test report of the equipment where applicable. r. A list of special tools and equipment for maintenance and overhauling of the machine/equipment to be handed over to BOARD s. Typical cable schedule for GTG and its associated auxiliaries. t. Typical cable interconnection diagram for GT & its associated auxiliaries.	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
19	Inputs Required by BHEL During Proposal Engg. Stage (for offer preparation by BHEL) 1. Mechanical General Arrangement drawings and outline drawings of all the equipment/Machine, foundation outline drawings etc. 2. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. 3. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 4. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 5. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 6. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. 7. bidder's recommendation of Codes and standards to be followed. 8. Grade of concrete and steel wherever applicable. 9. Machine/equipment erection philosophy and details. 10. Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 11. Equipment sizing and arrangement drawing of single shaft GT-ST-Generator and stack (along with auxiliaries) 12. Handling arrangement details of GT and its components and laydown space, generator rotor withdrawal arrangement 13. Detailed layout of accessory module of GT and all other accessories. 14. Suggestive layout of steam turbine and gas turbine building. 15. Supporting arrangement of air intake system. 16. Electrical Load List (in the attached Format 01 along with the DC Loads, their location, starting current, starting instant etc.) 17. The sizing calculation for Surge Capacitor for Generator and requirement of PTs and CTs for Generator protection. 18. Earthing Requirement of Equipment. 19. bidder electrical control philosophy 20. Cable Schedule 21. Any other input required for Project Engineering.	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
20	Inputs Required by BHEL During Detail Engg. 1. Mechanical General Arrangement drawings and outline drawings of all the equipment/Machine, foundation outline drawings etc. 2. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. 3. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 4. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 5. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 6. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. 7. bidder's recommendation of Codes and standards to be followed. 8. Grade of concrete and steel wherever applicable. 9. Machine/equipment erection philosophy and details. 10. Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 11. Equipment sizing and arrangement drawing of single shaft GT-ST-Generator and stack (along with auxiliaries) 12. Handling arrangement details of GT and its components and laydown space, generator rotor withdrawal arrangement 13. Detailed layout of accessory module of GT and all other accessories. 14. Suggestive layout of steam turbine and gas turbine building. 15. Supporting arrangement of air intake system. 16. Electrical Load List (in the attached Format 01 along with the DC Loads, their location, starting current, starting instant etc.) 17. The sizing calculation for Surge Capacitor for Generator and requirement of PTs and CTs for Generator protection. 18. Earthing Requirement of Equipment. 19. bidder electrical control philosophy 20. Cable Schedule 21. Any other input required for Project Engineering.	
21	Following documents and Drawings shall be furnished by Bidder for information/review/acceptance as per end customer specification, not limiting to:	
21.1	Gas turbine Thermal performance data as requested by BHEL within 10 days of placement of PO but not limited to : a. GT power b. Heat rate c. Exhaust flow d. Exhaust temperature e. Exhaust composition f. Emissions data g. Fuel flow & temperature data etc.	
21.2	GT exhaust flange outline drawings required for matching with the exhaust system being supplied by BHEL within 30 days of placement of PO.	
21.3	General arrangement of GT & it's auxiliaries in native editable format within 15 days of placement of PO. Bidder shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc.	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
21.4	Gas Turbine schematics and piping symbols within 30 days of PO.	
21.5	Foundation loading drawings with static and dynamic loads and other relevant data for civil foundation for the equipments which are in Bidder scope of supply in native editable format within 15 days of placement of PO.	
21.6	Utility consumption list (for Pneumatic air, cooling water, DM water, Nitrogen, Fuel, Power etc) within 30 days of placement of PO.	
21.7	Electrical load list including AC (HT , LT) Loads, DC loads, UPS loads etc within 30 days of placement of PO.	
21.8	List of panels along with Dimension, weight, recommended location, clearance around equipment, heat load within 30 days of placement of PO.	
21.9	Single Line diagram for GT MCC and LCI within 30 days of placement of PO.	
21.10	125V DC GT battery and charger sizing calculation within 30 days of placement of PO.	
21.11	Vendor drawings and documents for GTMCC AND 125 V DCDB within 90 days of placement of PO.	
21.12	Vendor drawings and documents for 125V DC Battery within 90 days of placement of PO.	
21.13	Electrical connection diagram of Junction Boxes and panels within 30 days of placement of PO.	
21.14	IO termination details (IO report) for GT Controls, Fire protection, UV fire detection , Vibration Monitoring, Haz Gas leakage monitoring system,Static Starting system etc. within 60 days of placement of PO.	
21.15	Earthing / grounding layout Drawing within 90 days of placement of PO.	
21.16	Interconnection piping and package connection details, piping specifications within 45 days of placement of PO.	
21.17	Gas fuel specification and supply requirements at GT inlet within 30 days of placement of PO.	
21.18	Lube oil, cooling water, preservation and storage, water wash, water purity, requirements within 30 days of placement of PO.	
21.19	Device Summary/Device List within 30 days of placement of PO.	
21.20	Overall sequence of operation of start-up/shutdown/normal operation within 90 days of placement of PO.	
21.21	Electrical outline drawing showing Junction Boxes / panel locations within 60 days of placement of PO.	
21.22	All other filled in Data sheets as per end customer specification within 90 days of placement of PO.	
21.23	Sub-vendors' list for all the equipment as per end customer specification within 30 days of placement of PO.	
21.24	Functional write up for normal operation within 90 days of placement of PO.	
21.25	PG test procedure and correction curves along with data points within 120 days of PO	
21.26	Generator specifications, drawings and construction documents, performance curves etc within 90 days of PO.	
21.27	All erection documents required for erection at site to make estimates (for eg.Packing List and Weights etc.) for Bidder scope of supplies.	
21.28	Bidder shall provide a bar-chart type schedule for the execution of the WORK for its scope and shall show the main activities with duration, their sequences, and the milestone events specified.	
21.29	6 sets of hard copies & 2 sets of soft copies - Drawings, datasheets, check lists, procedures and other necessary documents required for erection and commissioning of Gas turbine and auxiliaries supplied by Bidder	
21.30	6 sets of hard copies & 2 sets of soft copies (or no. of copies as agreed with end customer) - All customer documentation, Drawings, datasheets, check lists, procedures, etc. and other necessary documents required for O&M of Gas turbine and auxiliaries supplied by Bidder.	

BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project
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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
21.31	Type test reports, material test certificates, final and in process inspection reports, etc. where ever applicable during detail engineering	
21.32	Cable schedule for GTG & it's auxiliaries.	
21.33	Cable interconnection diagram for GTG & it's associated auxiliaries.	
Sec-C	Additional terms and conditions:	
1	Pertaining to Bidder's scope of supply, Bidder shall be responsible for answering to all end customer queries and attending any meetings if required until the issues are resolved and closed by end customer and provide all necessary data as required.	
2	Bidder to supply any other equipment which is not explicitly mentioned as in Bidder's scope of supply but mentioned in the end customer specification and is required for smooth and satisfactory operation of the Gas turbine package.	
3	Bidder shall provide detailed breakdown BOM for complete scope of supply.	
4	Bidder shall facilitate end customer or its representative to witness testing of equipments as per the list agreed and finalized with end customer.	
5	Bidder shall be responsible for compliance with complete specification issued by end customer including national standards as specified therein, limited to its scope of supply, and where not TECHNICALLY feasible shall get acceptance from the end customer	
6	Bidder shall be responsible for getting end customer acceptance on material selection, components selection/design and general engineering design practices used to design and procure Bidder supplied equipment, if end customer raises any queries on the same.	
7	Between BHEL and Bidder, each party shall be solely and exclusively responsible for its own scope of work. Both parties shall perform their respective scope in an integrated manner as and when required.	
8	Warranty/Defect liability period for the scope of supply shall be as per end customer specification requirements.	
9	It is responsibility of Bidder to comply end customer requirements indicated at all places in totality even if all the specific clauses are not indicated in this document.	
10	Bidder must comply end customer requirements on BACK to BACK basis for their scope.	
Sec-D	Terminal Points	
1	Utilities	
	Cooling water, Service Water, IA, SA: At one point near Gas Turbine Skid: (bidder to specify this location)	
2	Electrical	
2.1	415V AC supply at GT MCC incomer.	
2.2	6.6 kV AC supply at LCI transformer.	
2.3	220 V DC supply at GT MCC ACB control supply.	
2.4	125 V DC supply for GT loads	
2.5	AC UPS supply at GT loads.	

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ANNEXURE - I (Technical requirements for Gas Turbine)

Sl. No.	Description	Confirmation from Bidder (YES/NO)
2.6	Electrical Earthing: At Vendor's Equipment's earthing terminal	
2.7	Electronic Earthing	
2.8	Equipment Enclosure Illumination Power Supply(if required): At one location near Gas Turbine Skid.	

Annexure-1 (TDI)

TDI Service details for Gas turbine and its associated systems

Bidder to fill and submit the information requested in the below Table-1 & 2.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.No.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost
1.	Gas Turbine	A1=780	B1	C1	D1=26	E1	F1	$A1 * C1 + D1 * F1 = G1$

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	Gas Turbine	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

LOAD TITLE	RATING (KW / A)		FULL LOAD CURRENT FLC(A)	UNIT (U)/STN. (S)	Nos.		VOLTAGE CODE*	FEEDER CODE*	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME> 5 SEC (Y)	LOCATION (Tag. No.)	RATING & FLC CHECKED FROM MOTOR/VALVE APPROVED DATASHEET (Y/N)	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.	KKS NO.
	NAME PALTE	MAX. CONT. DEMAND (MCR)			SIZE CODE	Nos															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
NOTES: 1. COLUMN 1 TO 14 & 20 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)																					
2. ABBREVIATTIONS : * VOLTAGE CODE (7):- (AC) A=11 KV, B=6.6.KV, C= 3.3 KV, D=415 V, E = 240 V (1 PH), F = 110 V (DC) : G =220V, H = 110 V, J = 48 V, K = +24V, L= -24V																					
: **FEEDER CODE (8) :- U = UNIDIRECTIONAL STARTER, B = BIDIRECTIONAL STARTER, S = SUPPLY FEEDER, D = SUPPLY FEEDER (CONTACTOR CONTROLLED)																					
BHEL	LOAD DATA (ELECTRICAL)	JOB NO.								ORIGINATING AGENCY		PEM (ELECTRICAL)									
		PROJECT TITLE								NAME		DATA FILLED UP ON									
		SYSTEM / S								SIGN.		DATA ENTERED ON									
		DEPTT. /SECTION								SHEET 1/2		REV. R0		DE'S SIGN. & DATE							

SERVICE AIR REQUIREMENT

Format 02

[illegible]

INSTRUMENT AIR REQUIREMENT

Format 03

[illegible]



DOCUMENT TITLE COOLING WATER REQUIREMENT AUXILIARIES

DOCUMENT NO. PE-ID-999-179-N001

PROJECT TITLE

400 MW $\pm$ 10% COMBINED CYCLE POWER PLANT AT RAOZAN, CHATTOGRAM

Page 1 of 1

SL. No.	EQUIPMENT DESCRIPTION	NOS. PER UNIT		DMCW/CW QTY PER		DESIGN PRESSURE FOR EQUIPMENT	PRESSURE DROP (WITHIN T.P. INCL. CONTROL VALVE, PIPE AS APPLICABLE)	TEMPERATURE RISE	MAX./MIN. LIMIT ON ACW WORKING PRESS. (IF ANY)	WHETHER REQMT. CONSUMPTIVE IN NATURE	REMARKS
		WORKING	STANDBY	EQUIPMENT	UNIT						
		NO.	NO.	M ³ /Hr.	M ³ /Hr.	Kg/cm ² (g)	MWC	°C	Kg/cm ² (g)		

NOTES:

1. QUALITY OF COOLING WATER FOR TG AUXILIARIES SHALL BE PASSIVATED DEMINERALISED WATER ($P^H = 8.5$ TO 9.5) WITH DESIGN TEMPERATURE OF DMCW AT COOLERS INLET AS 41°C .
- 2 PLEASE PROVIDE PRESSURE DROPS AND TEMPERATURE RISE TO BE CONSIDERED ACROSS TERMINAL POINTS WHICH SHALL BE INCLUSIVE OF PIPING, VALVES, CONTROL VALVES (IF APPLICABLE), COOLERS ETC.

ANNEXURE-2

(NIT for Common Generator & Associated Auxiliaries)



BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 2 (Technical Requirements for Common Generator)

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
	A		SCOPE OF SUPPLY				
	A1		Generator, exciter & auxiliaries: Note: The scope shown below indicates the minimum requirements. As such, generator, exciter and auxiliaries are to be complete in all aspects and shall also fully meet the technical specification requirements in view of design, manufacturing, testing, quantity, quality, sub-suppliers, packing, supply, spares, training, tools & tackles etc. The generator & auxiliaries shall also be fully compatible with turbines and other interfaces, environmental conditions etc.				
		1.	Complete Generator (One generator for single shaft arrangement of gas turbine and steam turbine), consisting of stator, rotor, coupling bolts, end shields, H2/Air coolers and cooler housing, terminal bushings with terminal connectors, bearings, shaft seals (if applicable), oil catchers, all the instrumentation and diagnostic equipments, shaft grounding & shaft voltage monitoring brushes & system etc as per technical specification.	1	Set	Vendor	
		2.	Complete brushless exciter with base plate, air coolers, sound cover, stroboscope, air drier etc. Or Slip ring shaft assembly (separate / integral type-generator rotor shaft mounted) with suitable grinder etc. (in case static excitation system is provided).	1	Set	Vendor	
		3.	Speed reduction gear (if required) including clutch etc.	-	-	Vendor	Part of Gas Turbine NIT (separate document)
		4.	Structural steel base, foundation plates, foundation bolts etc. for fixing of generator & exciter with the foundation.	1	Set	Vendor	
		5.	Space heaters, suitable generator drying system for short & long shutdowns of generator.	1	Set	Vendor	
		6.	Complete generator auxiliaries (as applicable), viz. seal oil system, stator cooling water system, gas system, waste gas system, waste fluid system with all necessary equipments, tanks, coolers, valves, piping (for interconnection with generator), pipe fittings, hangers, supports, foundation embedment, gas analyzers, dew point meters and complete instrumentation etc. Note: 1) Generator auxiliary's coolers, driers, filters, pump motor sets and other critical equipments shall have suitable redundancy to meet operation, safety, specification requirements. 2) All flange-terminations in generator, exciter, coolers, auxiliary skids etc. shall be provided with counter flanges also.	1	Set	Vendor	
		7.	Fire protection system for generator & exciter	1	Set	Vendor	
		8.	Indoor/outdoor enclosure, generator & exciter acoustic enclosure.	1	Set	Vendor	
		9.	Empty H2, CO2, N2 cylinders for generator.	1	Set	Vendor	
		10.	Special maintenance tools and tackles	1	Set	Vendor	



BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 2 (Technical Requirements for Common Generator)

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
			(As specified in specification for maintenance, erection, commissioning, dismantling, assembly, special lifting, handling including a Videoscope with 3D phase measurement & touch screen (Manufacturer country: Japan /USA/ England) required for installation and maintenance of the units etc)				
		11.	Slings and beam for lifting of generator rotor.	1	Set	Vendor	
		12.	Generator & exciter lube oil/jacking oil supply lines/system integral with gas turbine lube/jacking oil system.	1	Set	Vendor	
		13.	Approach staircases/platforms for generator, exciter, valves, etc. for erection and O&M (as required).	1	Set	Vendor	
		14.	Testing of generator, exciter & auxiliaries in line with the spec.	1	Set	Vendor	
		15.	Transport fixtures & pedestals for stator, rotor etc. as applicable.	1	Set	Vendor	
		16.	Equipment and cable end lugs and glands, as applicable.	-	-	Vendor	
		17.	Equipment illumination system(including JB, Fixtures, conduits etc), as applicable.	-	-	Vendor	
	A2		C&I of generator, exciter and auxiliaries				
		1	Generator, exciter and auxiliaries C&I System Engineering viz. logics etc, local indication panels, Group/ Instrumentation cables for Generator Instruments, Generator Diagnostic systems,	-	-	Vendor	
		2	DCS, Control system of generator, exciter and auxiliaries in DCS.	1	Set	Vendor	Part of Control System NIT (separate document)
		3	Complete excitation system, AVR, Excitation transformer (if applicable) and power & control cables for excitation system etc.	1	Set	Vendor	Part of Control System NIT (separate document)
	A3		Consumables				
		1.	All consumables including first fill of generator seal oil system, lube oil system, first and subsequent fill of gas cylinders during commissioning, supply of paint required for final painting on generator, exciter & auxiliaries at site, all lubricants & chemical additives (as required) etc.	1	Set	Vendor	
		2.	Embedments for generator & exciter foundation, foundation covering, steel mesh for covering the openings for generator, exciter and auxiliaries, foundation consumables like cement etc.	1	Set	Vendor	
	A4		Spares/ International Standards submission				
		1.	All spares as per customer specifications. Note: 1. BIDDER shall submit, along with the Schedule of Prices, the itemized price list of	-	-	Vendor	



BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 2 (Technical Requirements for Common Generator)

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
			Mandatory spares for all equipment as per end customer specifications. 2. During warranty, contractor shall supply complete spares including O&M, normal wear & tear, consumables etc. required during 2 years' operation. Bidder to submit the detailed list with the tender. In case there is any spare items required during warranty period which is not part of the list then also bidder has to supply those spare parts. 3. BIDDER/ Vendor shall also confirm the Clauses as per end customer specification for O&M spares for defect liability period. As part of the EPC contract, the BIDDERS will be liable for providing all spares, consumable and expertise service for day to days, unscheduled, breakdown maintenance of complete generator, exciter & auxiliaries package during defect liability period from the Operational Acceptance Certificate of the plant				
		2.	Submission of national, international standards (as per specification)			Vendor	
	A5		Customer Training				
		1.	Overseas training	-	-	Vendor	
		2.	Training at the site for O & M	-	-	Vendor	
	A6		Erection and commissioning support				
		1.	Supervision of erection & commissioning by OEM expert/ Technical Direction for Installation (TDI) services to be provided as per customer specification: 1) Bidders to consider minimum 90 man days for TDI for Common Generator & Auxiliaries. 2) Bidders to consider minimum 3 mob-demob instances for TDI for Common Generator & Auxiliaries. 3) BIDDER to quote Per diem rate and mob-demob charges to be used for evaluation in combination with 1) & 2) above. 4) BIDDER to furnish recommended number of man days and number of mob-demob instances for information. 5) BIDDER shall confirm that these rates shall be valid even after consumption of the number of days and up to defect liability period by end customer. 6) Bidder to fill and submit TDI service details in Table-1 & 2 (as attached Annexure-1(TDI)) for Common Generator & Auxiliaries.	-	-	Vendor	
	A7		Document submission and resolution of interface issues				
		1.	All documents for submission to customer viz. engineering drgs/documents, O&M Manuals,	-	-	Vendor	



BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 2 (Technical Requirements for Common Generator)

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
			erection manual, commissioning manual, erection drawings, manufacturing, testing & field quality plans, resolution of customer queries/customer approval on drgs/documents etc				
		2.	Resolution of interface issues with interfacing agencies i.e. turbine, civil, BOP etc.	-	-	Vendor	
	A8		Any other requirement specific to generator, exciter and auxiliaries mentioned in customer specification.	-	-	Vendor	
	A9		Customer's LTSA requirement as per BPDB tender volume 2 of 2 (Part C)			Vendor	
			Important Notes				
	A10		Quality & Inspection 1. All works under the Contract shall at all times be open to examination, inspection, measurements, testing and supervision of the Project Manager, and the Contractor shall ensure presence of its representatives at such actions provided proper advance notice is given by the Project Manager. 2. No part of the Works shall be covered up or put out of sight without the approval of the Project Manager. The Contractor shall give notice in writing to the Project Manager whenever any such part of the Works is ready for examination and, the Project Manager shall attend to such examination without unreasonable delay. 3. For foreign manufacturer, Invitation letter from the manufacturer should be submitted to the Purchaser at least 03 (three) months prior to the schedule date of the witness and tests. 4. All Test & Inspection as per specification. 5. Vendor to submit Quality Plans, Sub-Vendor lists and any other documents as specified in end customer specification along with the offer. Quality Plans & Vendor lists are to be mutually agreed with end customer. Inspection & testing are to be carried out as per agreed quality plan. Witnessing of inspection to be mutually agreed with end customer.				
	A11		BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engineering coordination, and other charges. Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer, and required				



BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 2 (Technical Requirements for Common Generator)

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
			as per BHEL's NIT or required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.				
	B		EXCLUSIONS:				
		1.	Generator electrical protection, switchgear, CTs and PTs for metering & protection.	-	-		
		2.	Generator electrical, feeders, power cables (for auxiliary equipments & control panels etc.), generator, exciter, auxiliary equipments & piping grounding.	-	-		
		3.	Hydrogen generation plant (H2 generator). (As per Vol-2A, Page96/315, customer has mentioned "If H2 cooled Generator is proposed, Contractor has to supply, install 2x 100% capacity H2 Generator, 02 nos. of H2 compressor (for H2 storage bottles), H2 storage bottles, on line H2 analyzer, H2 dryer, CO2 system etc)	-	-		
		4.	Generator neutral grounding equipment's, Lightning arrestors / surge capacitors.	-	-		
		5.	DMCW system for supply of DM water to Turbine-Generator auxiliaries coolers.	-	-		
		6.	Compressed air system.	-	-		
		7.	Embedded parts for generator piping.	-	-		
		8.	Erection & commissioning at site.	-	-		
		9.	First and subsequent fill of H2, CO2, N2 cylinders.	-	-		
		10.	Final painting, touch-up painting at site.	-	-		
		11.	Bus duct between Generator terminals and Generator Transformer.	-	-		
		12.	DC supply system				
	C		Input required from vendor				
		1	Along with vendor's offer: In addition to inputs asked in technical specification, vendor shall provide all relevant documents for preparation of overall offer including offer for other interfacing items viz. transformer, DMCW system, bus duct, protection, neutral grounding etc. by BHEL. 1) Equipment sizing and general arrangement drawing of single shaft GT-ST-generator, exciter & auxiliaries, foundation/TG deck drawings, load data etc. 2) Handling arrangement details of generator stator & other components and laydown space, generator rotor withdrawal arrangement 3) Utility requirement (cooling water, service water, instrument air, service air etc as per attached Format 02, 03, 04) 4) Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 5) Generator & auxiliaries instrument list indicating operating values and alarm/trip setpoints, input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. 6) Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 7) Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 8) Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design.				



BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 2 (Technical Requirements for Common Generator)

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
			9) General Codes and standards to be followed. 10) Grade of concrete and steel wherever applicable. 11) Machine/equipment erection philosophy and details. 12) Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 13) Electrical load list (in the attached Format 01 along with the DC loads, their location, starting current, starting instant etc.) 14) Generator Surge capacitor requirements along with calculations. The sizing calculation for surge capacitor for generator and requirement of PTs and CTs for Generator protection. 15) Earthing Requirement of Equipment 16) Generator CT and VT Calculations 17) Generator datasheet, excitation data sheet. 18) Generator Relay Settings till end client approval. 19) Relay Catalogs. 20) Relay settings with address numbers along with software in downloadable CD/Pendrive. 21) OEM electrical control philosophy 22) Cable Schedule Any other input required for Project Engineering.				
		2.	During Detail Engineering 1) Equipment sizing and general arrangement drawing of single shaft GT-ST-generator, exciter & auxiliaries, foundation/TG deck drawings, load data etc. 2) Handling arrangement details of generator stator & other components and laydown space, generator rotor withdrawal arrangement 3) Utility requirement (cooling water, service water, instrument air, service air etc as per attached Format 02, 03, 04) 4) Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 5) Generator & auxiliaries instrument list indicating operating values and alarm/trip setpoints, input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. 6) Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 7) Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 8) Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 9) Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. 10) General Codes and standards to be followed. 11) Grade of concrete and steel wherever applicable. 12) Machine/equipment erection philosophy and details. 13) Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 14) Electrical Load List(in the attached format 01 along with the DC Loads, their location, starting current, starting instant etc.) 15) Generator Surge Capacitor requirements along with calculations. The sizing calculation for Surge Capacitor for Generator and requirement of PTs and CTs for Generator protection. 16) Vendor to supply the protection settings in a CD/Pen drive, along with the software which can be uploaded in the Generator Protection Relays. 17) Earthing Requirement of equipment. 18) Generator CT and VT Calculations. 19) Generator Datasheet, excitation data sheet. 20) Generator Relay Settings till end client approval. 21) Relay Catalogs.				



BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 2 (Technical Requirements for Common Generator)

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
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			22) Relay settings with address numbers along with software in downloadable CD/Pendrive. 23) OEM electrical control philosophy. 24) Cable Schedule. Any other input required for Project Engineering.				
			Terminal Points for Generator Equipment				
			1) Cooling water, Service Water, IA, SA: At one-point common for Steam Turbine, Auxiliaries and Generator (vendor to tap off above utilities from this terminal point for generator requirement): (OEM to specify this location) 2) Power Evacuation Point: At Generator Terminals (Terminal connectors), (CT by BHEL in run off Bus Duct) 3) 415 V Supply: Motor/ Equipment end TB. 4) 6.6kV Supply: Motor/ Equipment end TB. 5) 220 V Station DC Power Supply: Motor/ Equipment end TB. 6) 125 V/ 24 V DC/48 V DC Power supply: at 24VDC Distribution Board 7) XXX V AC UPS Power Supply: 240V AC UPS ACDB 8) 110/220 V AC Electrical Control Supply: Equipment end TB 9) Instrumentation Cables: In vendor's scope 10) Electrical Earthing: At Vendor's Equipment's earthing terminal 11) Electronic Earthing: As per OEM/Vendor. 12) NGR/ NGT connection: At Generator Neutral terminal 13) Equipment Illumination Power Supply (if required): At one location near generator equipment.				

**BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project****ANNEXURE - 2 (Technical Requirements for Common Generator)**

Rev	Sec	S.N	Description	Qty/ Set	unit	Scope	Remarks
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Annexure-1 (TDI)**TDI Service details for Common Generator and its Auxiliaries**

Bidder to fill and submit the information requested in the below **Table-1 & 2**.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.No.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost
1.	Common Generator	A1=90	B1	C1	D1=3	E1	F1	$A1 \times C1 + D1 \times F1 = G1$

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	Common Generator	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

ANNEXURE-3

(NIT for Steam Turbine & Associated Auxiliaries)

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)		
Sl. No.	Description	Confirmation from BIDDER (YES/NO)
Sec-A		
1	Bidder's major scope of supply, services for gas turbine, generator and their associated systems shall be as indicated below and conforming to end customer Specifications which are part of the enquiry documents (end customer Specification "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721", Clarifications & Addendums are enclosed)	
2	The gas turbine shall be suitable for burning gaseous fuel (Natural Gas/RLNG) and able to operate in base load as well as peak load. Single shaft arrangement having 1:1:1 (One GT + One HRSG + One ST) configuration with synchro-self-shifting (SSS) Clutch for simple cycle operation of the gas turbine as well as shall be equipped with the bypass stacks and diverter dampers to allow continuous and reliable simple cycle operation and shall be capable to run on Free Governing Mode Operation.	
3	The following parameters are to be considered in plant design: Sub-Tropical Monsoon. Temperature: 5°C to 45°C Relative Humidity: 36% to 100%. Annual Rain Fall: 120 cm to 345 cm. Wind Velocity: As per Latest Wind Map. Seismic Horizontal ground Acceleration: As per BNBC approved latest Seismic Map	
4	Synchro-self-shifting (SSS) clutch for simple cycle operation of the plant shall be in BIDDER scope as per clause 2.0 in Section 2 of (Vol-2 of 2, PART A)	
5	The steam turbine shall be supplied for indoor installation in the powerhouse. BIDDER to furnish maintenance weight requirement of the steam turbine for overhead electrical crane sizing.	
6	Steam turbine shall be of proven design and of the single line impulse, impulse reaction or reaction type, throttle or nozzle controlled, designed for high efficiency operation and suitable for coupling to and running in conjunction with the condenser supplied under this Contract. The steam turbine shall be of sliding pressure type with hot and cold start provisions.	
7	Steam turbine and associated auxiliary system shall be designed to operate safely at 47.5 to 52.5 Hz. The Contractor shall state limitations, if any, as to frequency, load, or duration for this mode or operation.	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
8	BIDDER to fill and submit performance guarantees in Schedule-A of VOLUME 2 OF 2, PART B document Following information may be noted by the BIDDER for preparation of Heat & Mass Balance diagram and finalizing the guarantees: - 1. MS line pressure drop – 4% of HPMS pressure at HRSG terminal point at 100% guaranteed load (for other loads, BIDDER to calculate accordingly) 2. RH circuit pressure drop (in case of reheat cycle only) – 10% of the HP Turbine exhaust pressure at 100% guaranteed load (for other loads, BIDDER to calculate accordingly) 3. Reheater pressure drop (in case of reheat cycle only) – 5% of the HPT exhaust pressure at 100% guaranteed load (for other loads, BIDDER to calculate accordingly) 4. Fuel Gas Heater flow may be suitably be accounted by the BIDDER for preparation of Heat & Mass Balance diagram.	
9	BIDDER shall provide all spares & consumables whether listed or not in the contract for smooth operation of the plant during Defect Liability Period. During the Defect Liability Period, BIDDER shall also provide normal operation spares & consumables (Lube Oil, Air Filters, Chemicals & others), wear & tear spares, spares required for schedule/unscheduled maintenance and services required for Steam Turbine and associated auxiliaries (with all electrical equipment and control system). In preparation of the list the BIDDER have to consider plant factor as 80% and 50 nos. start/stop per year. Refer Schedule-F of VOLUME 2 OF 2, PART B document Refer clause 22.1, section-22 of VOLUME 2 OF 2, PART A document	
10	Mandatory Spares as per end customer specification	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
11	Separate Lumpsum quote indicating required minimum number of man days for the below services upto warranty period: 1) Supervision of Erection and Commissioning of Steam Turbine and associated auxiliary systems 2) Any other additional services based on BIDDER recommendation, if required. 3) Bidders to consider minimum 250 man days for TDI and any other Bidder site supervision services for Steam Turbine and it's auxiliaries. 4) Bidders to consider minimum 45 mob-demob instances for TDI and any other Bidder site supervision services for Steam Turbine and it's auxiliaries. 5) BIDDER to quote Per diem rate and mob-demob charges to be used for evaluation in combination with 3) & 4) above. 6) BIDDER to furnish recommended number of man days and number of mob-demob instances for information. 7) BIDDER shall confirm that these rates shall be valid even after consumption of the number of days and up to defect liability period by end customer. 8) Bidder to fill and submit TDI service details in Table-1 & 2 (as attached Annexure-3(TDI)) for the Steam turbine and its associated systems.	
12	ST Control System (will be ordered separately by our sister unit BHEL-EDN)	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
13	Scope of steam turbine and its auxiliaries system shall include, but not be limited to the following equipment, components, features and accessories, as applicable and as specified in the end customer specification: a. Inlet stop valve (s) with coarse and fine mesh steam strainer b. Control valves with necessary bypass system d. Motorised drain valve for turbine casing, Gland steam, seal system and above/below stop valve seats e. Automatic gland steam seal system f. Shaft packing vent system g. Turbine exhaust hood water spray system and motorised vacuum breaker h. Steam turbine control i. Hydraulic system with duplex pumps, coolers, filters and integral fluid conditioning unit j. Over-speed governor with solenoid trip k. Lube oil system with tank, shaft driven/ Ac driven main lube oil pump, AC auxiliary lube oil pump, DC emergency pump, Jacking oil pumps, Hydraulic pumps, coolers, valves, oil conditioner, vapour extractor, gauges, pressure and temperature control devices n. Turning-gear, motor operated with provision for automatic engaging and manual cranking o. Insulation and lagging p. Foundation plates and bolts q. All Steam Turbine integral piping (prefabricated) like gland sealing and dump steam piping, steam interconnecting piping between equipments, leak-off steam piping to GSC. r. Special tools for turbine transportation, Erection & commissioning Refer also to Clause 2.6.1 in Section 2 of (Vol-2 of 2, PART A) documents.	
14	Interconnection piping between Steam Turbine and condenser shall be in BIDDER scope.	
15	Steam turbine lube oil system with Lube oil system with tank, shaft driven/ Ac driven main lube oil pump, AC auxiliary lube oil pump, DC emergency pump, Jacking oil pumps, Hydraulic pumps, coolers, valves, oil conditioner, vapour extractor, gauges, pressure and temperature control devices shall be as per clause 2.6.1-k in section 2 of (Vol-2 of 2, Part-A) document.	
16	Painting, including finished coat and special paints required for corrosion protection and high temperature resistance. Export quality packaging suitable for long term storage shall also be required. Refer Clause 2.6.3 in Section 2 of (Vol-2 of 2, PART A) document	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
17	Lubricating oil for flushing and for the initial operation as per Clause 2.6.3 in Section 2 of (Vol-2 of 2, PART A) document	
18	Steam Turbine and associated system noise enclosure shall be designed as per clause 4.3.2.12 in section 4 of (Vol-2 of 2, Part-A) document.	
19	Training as per end customer specification Refer Clause 2.15 in Section 2 of (Vol-2 of 2, PART A) document Refer Schedule-J of VOLUME 2 OF 2, PART B document	
20	Competent Engineers for the equipments in BIDDER scope of supply for Operation & Maintenance During Warranty Period. Refer Clause 2.20 in Section 2 of (Vol-2 of 2, PART A) document	
21	The Tenderer shall supply all relevant international standards (ISO, IEC, ASTM, IEEE, ASME, NFPA etc.) as per Clause 2.30 in Section 2 of (Vol-2 of 2, PART A) document	
22	Steam turbine coupling (as applicable) shall be in BIDDER scope of supply.	
23	Steam turbine drains shall be designed as per Clause 3.3.9 in Section 2 of (Vol-2 of 2, PART A) document	
24	Steam turbine and associated system shall be designed as per clause 6.2 in section 6 of (Vol-2 of 2, Part-A) document.	
25	Steam turbine supervisory equipment shall be as per clause 6.2.2 in section 6 of (Vol-2 of 2, Part-A) document.	
26	Steam turbine turning gear shall be as per clause 6.2.4 in section 6 of (Vol-2 of 2, Part-A) document.	
27	Steam turbine speed governing system and accessory equipment shall be as per clause 6.2.5 in section 6 of (Vol-2 of 2, Part-A) document.	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
28	Steam turbine mechanical protection devices shall be as per clause 6.2.6 in section 6 of (Vol-2 of 2, Part-A) document.	
29	Steam turbine Shaft Earthing Device shall be as per clause 6.2.7 in section 6 of (Vol-2 of 2, Part-A) document.	
30	Oil Purification Plant for Steam Turbine shall be as per clause 6.2.15 in section 6 of (Vol-2 of 2, Part-A) document.	
31	Steam turbine and associated system pipework and valves shall as per clause 6.4 in section 6 of (Vol-2 of 2, Part-A) document.	
32	BIDDER shall provide all lagging and cladding for turbo-generator unit as per clause 6.5 in section 6 of (Vol-2 of 2, Part-A) document.	
33	Wet steam Washing System (If required) for Steam turbine to be considered in BIDDER scope of supply. BIDDER to provide wet steam washing scheme and procedure.	
34	Control and Protection shall be as per section 11 (Vol-2 of 2, Part-A) of end customer specification	
35	Special tools, Special lifting & handling appliances and dismantling & assembling tools for Steam Turbine and associated auxiliaries shall be in BIDDER scope.	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
36	One set of special tools, gauges and equipment required for the normal maintenance of the Steam Turbine and associated auxiliaries shall be provided by BIDDER. One set of special lifting and handling appliances required for the normal maintenance (such as lifting of turbine casing, lifting of rotor) of the whole Plant and equipment shall be provided by BIDDER. Special tool list with unit price shall be submitted along with price schedule by BIDDER. Refer Clause 18.6.2 in Section 2 of (Vol-2 of 2, PART A) document	
37	Steam Turbine and ancillaries shall be tested on the factory, those tests shall include, but not be limited to the following : 1. Hydraulic tests 2. Mechanical tests 3. Electrical tests: (as per relevant IEC) Refer clause 19.2.3, section 19 in (Vol-2 of 2, PART A) document for complete details	
38	BIDDER shall conduct site performance test for steam turbine (not just supervision) with all necessary instruments. All the instrumentation, devices (with necessary calibration) and services required for conductance of performance test should be included in BIDDER scope. BIDDER should provide procedure for measuring parameters during test at site as required for proving guarantees and document.. Refer Clause 19.3.2 in Section 19 of (Vol-2 of 2, PART A) document	
39	Base plate/frame for all items/equipments in BIDDER scope of supply including steam turbine, off-base skids, auxiliaries etc along with all items mounted on it required for normal operation of steam turbine.	
40	All foundation hardware (including embedments & over the surface items) for all items/equipments in BIDDER scope of supply including steam turbine and associated auxiliaries system.	
41	Sufficient spares required for commissioning as per BIDDER experience/recommendation & furnish the list for the same. If however, any additional spares is consumed over and above the quoted commissioning spares, during commissioning, the same shall be provided free of cost, by the BIDDER. Any leftover spares after commissioning shall be handed over to the owner.	
42	Facilitate Employer and the Project Manager or their designated representatives to attend the test and/or inspection at manufacturing premises. BIDDER shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses. Refer Clause GCC 38.2 in Section 4 (Particular Conditions of Contract) of (Vol-1 of 2) document	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
43	List of Documents for Approval or Review shall be as per Appendix 7 of (Vol-1 of 2) document. BIDDER shall be responsible for all documents approval/Review for Steam Turbine and associated auxiliary system and provide all required documentation.	
44	All on base & interconnection piping among BIDDER supplied skids, drain and vent piping upto terminal points shall be in BIDDER Scope.	
45	IP/LP Steam Turbine Bypass station (As applicable) shall be in BIDDER scope of supply.	
46	All on-base cabling (Signal, Control & Power) upto the Junction boxes for the respective skids which are in BIDDER scope document.	
47	Local Gauge Boards (SS316) and Local panels (SS316) for the respective skids which are in BIDDER scope	
48	Steam Turbine instrumentation and control shall be as per clause 11.9, section 11 of (Vol-2 of 2, Part-A) document.	
49	E / P converters shall be provided to convert electronic control signals to pneumatic output signals. Converter accuracy shall be plus / minus 0.5% of output span.	
50	Offered instruments shall be suitable for area classification as applicable for this project/area/equipment.	
51	All Electricals requirements for Steam Turbine and associated system shall be as per end customer specification.	
52	Furnish Performance guarantee test procedure and correction curves/data for power output, heat rate, starting and loading time, date of completion, auxiliary power and noise. Refer Schedule-A of VOLUME 2 OF 2, PART B document	
53	BIDDER to submit deviations (if any) with respect to end customer customer specification as per the format Schedule-G of (Vol-2 of 2, PART B) document	
54	BIDDER to fill and submit Technical Datasheet (Schedule-B) of VOLUME 2 OF 2, PART B document	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
55	BIDDER shall be responsible for the guarantees and shall make good incase of any shortfall in the performance without any time/price implication. Otherwise LD/Penalties shall be levied in accordance with end customer specification. Refer Appendix 8 (Functional Guarantees) in the (Vol-1 of 2) document	
56	BIDDER shall furnish all the equipments, auxiliary systems, instruments, controls and safety devices as per the end customer specification. However, anything required over and above what is specified in the end customer specification for safe and satisfactory operation of the equipment package shall be included by the BIDDER in their scope.	
57	Equipment end cable lugs and glands for Steam Turbine and associated system shall be in BIDDER Scope.	
58	Equipment Enclosure Illumination System(including JB, Fixtures, conduits etc) for Steam Turbine and associated system shall be in BIDDER Scope.	
59	BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engineering coordination, and other charges . Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer, and required as per BHEL's NIT or required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.	
60	BIDDER to furnish Electrical load list (As per format-1), Service air (As per format-2), Instrument Air(As per format-3) and Auxilairy cooling water requirement (As per format-4) along with Bid.	
Sec-B	<u>Drawings and other documents:</u>	
S.NO.	DETAILS OF DOCUMENTS	
1	Authorization Certificates from the manufacturer (s) of main equipment that they will supply their machine/ equipment to BPDB through the tenderer for this project, in the event the tenderer concerned is not the manufacturer of the same. [TDS (ITT 24.2 r)]	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
2	Certificate from the end users for Proveness of the offered equipment. [TDS (ITT 24.2 r)]	
3	The Steam Turbine unit shall be of well proven design and the Offered or higher capacity of Steam Turbine manufactured by proposed manufacturer shall have satisfactory operating experience outside manufacturer's country for at least 2 (two) years.	
4	The BIDDER shall include at least two (02) certificates from the end users on satisfactory performance of the Power plants as mentioned above, which were designed, engineering, supplied, constructed, tested & commissioned by the BIDDER himself or as member in case of JVCA to establish the minimum required experience to Tender. The certificates shall mention the name of power plant, Plant Configuration, capacity, Contract value, Name of Partner (If Applicable), total operating hour and commissioning date of the power plant (make, model) supplied by the BIDDER; issue date, name and address (Telephone/Fax/e-mail) of the end user duly signed in the official pad. These certificates must be notarized and have authentication from the Chamber of Commerce of the BIDDER country or the Embassy/High commission of the end user's country situated in Dhaka. In absence of that, authentication from BIDDER country's Embassy/High Commission in Dhaka.	
5	Manufacturer's Authorisation Letter (Form PG5A - 5)	
6	Manufacturer's declaration letter (Form PG5A – 5a)	
7	Letter of Intent (Form PG5A – 5b)	
8	BIDDER shall first submit the completely filled-in Equipment Data sheets, Performance Curves, filled in Experience Record Proforma, Equipment Manufacturers Latest catalogues and their General reference lists, vendor list, Quality Plans for Steam Turbine and associated auxiliary equipments, any other documents as specified in end customer specification along with the offer.	
9	All the Equipment's name plate Data (Manufacturer Name & Technical Parameters), Technical Specification, Operational Manual including BIDDER parts list & Drawings shall be in English language. BIDDER has to handover all the Equipment's complete Technical Specification, Operational Manual including BIDDER parts list & Drawings before performance test of the plant.	
10	Also all the drawings and documents at S.No 16 below shall be submitted by BIDDER within 30 days from placement of PO, incorporating project specific title block which will be shared during detail engineering.	
11	The drawing and documents (ex. GA drawing etc) which require further engineering and integration by BHEL shall be furnished in Auto CAD format.	
12	Detailed C&I overview diagram with clear indication of all controls & scope shall be furnished mandatorily along with bid.	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
13	BIDDER to furnish all necessary functional and ordering specifications, system requirement documents and interface information for sizing of equipment in BHEL's scope of supply.	
14	Following documents shall be submitted mandatorily along with bid but not limited: a. General Arrangement drawing of Steam Turbine & its auxiliaries in native format (editable version like Auto CAD). BIDDER shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc. b. Foundation loading drawings with static and dynamic loads and other relevant data for civil foundation for the equipments which are in BIDDER scope of supply in native editable format. c. Utility consumption list (for Instrument air, Cooling water, auxiliary steam, Power etc.) d. Electrical load list including AC (HT, LT) Loads, DC loads, UPS loads etc. e. List of panels along with Dimension, weight, recommended location, clearance around equipment, heat load f. Lube oil, cooling water, preservation and storage, water wash, water purity requirements g. Steam consumption curve along with correction curve . h. Sub-vendor's list for all the equipment document. i. Functional write up for normal operation j. Aux power along with list of auxiliaries k. Device list and P&ID's l. Description of training program including curriculum and training aids. m. A list and description of similar projects which the BIDDER has successfully completed. n. Type test report of the equipment where applicable. o. A list of special tools and equipment for maintenance and overhauling of the machine/equipment to be handed over to BOARD	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
15	Inputs Required by BHEL During Proposal Engg. Stage (for offer preparation by BHEL): 1.Mechanical General Arrangement drawings and outline drawings of all the equipment/Machine, foundation outline drawings etc. 2. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. 3. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 3. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 4. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 5. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. 6. BIDDER's Recommended Codes and standards to be followed. 7. Grade of concrete and steel wherever applicable. 9. Machine/equipment erection philosophy and details. 10. Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 11. Equipment sizing and arrangement drawing of single shaft GT-ST-Generator and stack (along with auxiliaries) 12. Handling arrangement details of ST and its components and laydown space. 13. Suggestive layout of steam turbine and gas turbine building. 14. Suggestive layout of critical piping (main steam,cold reheat,hot reheat, LP bypass,HP bypass). 15. Allowable forces and moments at turbine nozzles for critical piping (MS, CRH, HRH). 16. Allowable forces and moments at HRSG nozzles for piping(MS, CRH, HRH, Feed Water). 17. Earthing Requirement of Equipment. 18. BIDDER electrical control philosophy 19. Cable Schedule 20. Any other input required for Project Engineering. Inputs Required by BHEL During Detail Engg. Stage:	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
16	1. Mechanical General Arrangement drawings and outline drawings of all the equipment/Machine, foundation outline drawings etc. 2. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. 3. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 3. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 4. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 5. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. 6. BIDDER's Recommended Codes and standards to be followed. 7. Grade of concrete and steel wherever applicable. 9. Machine/equipment erection philosophy and details. 10. Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 11. Equipment sizing and arrangement drawing of single shaft GT-ST-Generator and stack (along with auxiliaries) 12. Handling arrangement details of ST and its components and laydown space. 13. Suggestive layout of steam turbine and gas turbine building. 14. Suggestive layout of critical piping (main steam, cold reheat, hot reheat, LP bypass, HP bypass). 15. Allowable forces and moments at turbine nozzles for critical piping (MS, CRH, HRH). 16. Earthing Requirement of Equipment. 17. BIDDER electrical control philosophy 18. Cable Schedule 19. Any other input required for Project Engineering.	
17	Following documents and Drawings shall be furnished by BIDDER for information/review/acceptance document., not limiting to:	
17.1	Steam turbine Thermal performance data as requested by BHEL within 10 days of placement of PO but not limited to : a. Steam Consumption curve b. Correction curve for inlet steam pressure & temperature, Reheat pressure & temperature, exhaust pressure c. performance degradation curve	
17.2	Steam Turbine exhaust flange outline drawings (If required) for matching with surface condenser within 30 days of placement of PO.	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
17.3	General arrangement of Steam Turbine & it's auxiliaries in native editable format within 15 days of placement of PO. BIDDER shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc.	
17.4	Steam Turbine and associated auxiliaries piping & instrumentation diagram within 30 days of PO.	
17.5	Foundation loading drawings with static and dynamic loads and other relevant data for civil foundation for the equipments which are in BIDDER scope of supply in native editable format within 15 days of placement of PO.	
17.6	Utility consumption list (for Pneumatic air, cooling water, DM water, Nitrogen, Fuel, Power etc) within 30 days of placement of PO.	
17.7	Electrical load list including AC (HT, LT) Loads, DC loads, UPS loads etc within 30 days of placement of PO.	
17.8	List of panels along with Dimension, weight, recommended location, clearance around equipment, heat load within 30 days of placement of PO.	
17.9	Earthing / grounding layout Drawing within 90 days of placement of PO.	
17.10	Interconnection piping and package connection details, piping specifications within 45 days of placement of PO.	
17.11	Lube oil, cooling water, preservation and storage, water wash, water purity, requirements within 30 days of placement of PO.	
17.12	Device Summary/Device List within 30 days of placement of PO.	
17.13	Overall sequence of operation of start-up/shutdown/normal operation within 90 days of placement of PO.	
17.14	All other filled in Data sheets document. within 90 days of placement of PO.	
17.15	Sub-vendors' list for all the equipment document. within 30 days of placement of PO.	
17.16	Functional write up for normal operation within 90 days of placement of PO.	
17.17	PG test procedure and correction curves along with data points within 120 days of PO	
17.18	All erection documents required for erection at site to make estimates (for eg.Packing List and Weights etc.) for BIDDER scope of supplies.	
17.19	BIDDER shall provide a bar-chart type schedule for the execution of the work for its scope and shall show the main activities with duration, their sequences, and the milestone events specified.	
17.20	6 sets of hard copies & 2 sets of soft copies - Drawings, datasheets, check lists, procedures and other necessary documents required for erection and commissioning of Steam turbine and auxiliaries supplied by BIDDER	
17.21	6 sets of hard copies & 2 sets of soft copies (or no. of copies as agreed with end customer) - All customer documentation, Drawings, datasheets, check lists, procedures, etc. and other necessary documents required for O&M of Steam turbine and auxiliaries supplied by BIDDER.	
17.22	Type test reports, material test certificates, final and in process inspection reports, etc. where ever applicable during detail engineering	
Sec-C	Additional terms and conditions:	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
1	Pertaining to Bidder's scope of supply, Bidder shall be responsible for answering to all end customer queries and attending any meetings if required until the issues are resolved and closed by end customer and provide all necessary data as required.	
2	Bidder to supply any other equipment which is not explicitly mentioned as in Bidder's scope of supply but mentioned in the end customer specification and is required for smooth and satisfactory operation of the Gas turbine package.	
3	Bidder shall provide detailed breakdown BOM for complete scope of supply.	
4	Bidder shall facilitate end customer or its representative to witness testing of equipments as per the list agreed and finalized with end customer.	
5	Bidder shall be responsible for compliance with complete specification issued by end customer including national standards as specified therein, limited to its scope of supply, and where not TECHNICALLY feasible shall get acceptance from the end customer	
6	Bidder shall be responsible for getting end customer acceptance on material selection, components selection/design and general engineering design practices used to design and procure Bidder supplied equipment, if end customer raises any queries on the same.	
7	Between BHEL and Bidder, each party shall be solely and exclusively responsible for its own scope of work. Both parties shall perform their respective scope in an integrated manner as and when required.	
8	Warranty/Defect liability period for the scope of supply shall be as per end customer specification requirements.	
9	It is responsibility of Bidder to comply end customer requirements indicated at all places in totality even if all the specific clauses are not indicated in this document.	
10	Bidder must comply end customer requirements on BACK to BACK basis for their scope.	
11	Warranty/Defect liability period for the scope of supply shall be document. requirements.	
Sec-D	Terminal points	
1	Utilities	
	Cooling water, Service Water, IA, SA: At one point near Steam Turbine Skid: (bidder to specify this location)	
2	Electrical	
2.1	415 V Supply: Motor/ Equipment end TB.	
2.2	220 V Station DC Power Supply: Motor/ Equipment end TB.	
2.3	DC Power supply at one point near Steam Turbine	
2.4	AC UPS Power Supply at one point near Steam Turbine	
2.5	110/220 V AC Electrical Control Supply: Equipment end TB	
2.6	Instrumentation Cable: At Equipment JB's	
2.7	Electrical Earthing: At Vendor's Equipment's earthing terminal	
2.8	Equipment Illumination Power Supply(if required): At one location near Steam Turbine Skid.	
3	Main Steam	
a.	At inlet of HP Turbine inlet valve (HPT inlet valve in BIDDER scope)	

ANNEXURE - 3 (For Steam Turbine and associated Auxiliaries system)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
	b. At inlet of IP Injection valve (IP injection valve in BIDDER scope)	
	c. At inlet of LP Injection valve (LP injection valve in BIDDER scope)	
4	CRH (if applicable): Outlet of HP turbine nozzle (HPT nozzle in BIDDER scope)	
5	Seal Steam line from CRH: Inlet of seal steam control valve (Control valve in BIDDER scope).	
6	Steam Exhaust: Piping/ducting from Steam Turbine to Condenser shall be in BIDDER scope	
	Note: All Equipment internal (integral and its auxiliaries) piping shall be in BIDDER scope. Only interface piping between HRSG & STG shall be in BHEL scope. Other piping shall be by BIDDER.	

Annexure-3 (TDI)

TDI Service details for Steam turbine and its associated systems

Bidder to fill and submit the information requested in the below Table-1 & 2.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.No.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost
1.	Steam Turbine	A1=250	B1	C1	D1=45	E1	F1	$A1 \times C1 + D1 \times F1 = G1$

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	Steam Turbine	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

[illegible]

SERVICE AIR REQUIREMENT

Format 02

[illegible]

INSTRUMENT AIR REQUIREMENT

Format 03

[illegible]



DOCUMENT TITLE COOLING WATER REQUIREMENT AUXILIARIES

DOCUMENT NO. PE-ID-999-179-N001

PROJECT TITLE 400 MW ę 10% COMBINED CYCLE
POWER PLANT AT RAOZAN, CHATTOGRAM

Page 1 of 1

SL. No.	EQUIPMENT DESCRIPTION	NOS. PER UNIT		DMCW/CW QTY PER		DESIGN PRESSURE FOR EQUIPMENT	PRESSURE DROP (WITHIN T.P. INCL. CONTROL VALVE, PIPE AS APPLICABLE)	TEMPERATURE RISE	MAX./MIN. LIMIT ON ACW WORKING PRESS. (IF ANY)	WHETHER REQMT. CONSUMPTIVE IN NATURE	REMARKS
		WORKING	STANDBY	EQUIPMENT	UNIT						
		NO.	NO.	M ³ /Hr.	M ³ /Hr.	Kg/cm ² (g)	MWC	°C	Kg/cm ² (g)		

NOTES:

1. QUALITY OF COOLING WATER FOR TG AUXILIARIES SHALL BE PASSIVATED DEMINERALISED WATER ($P^H = 8.5$ TO 9.5) WITH DESIGN TEMPERATURE OF DMCW AT COOLERS INLET AS 41°C .
- 2 PLEASE PROVIDE PRESSURE DROPS AND TEMPERATURE RISE TO BE CONSIDERED ACROSS TERMINAL POINTS WHICH SHALL BE INCLUSIVE OF PIPING, VALVES, CONTROL VALVES (IF APPLICABLE), COOLERS ETC.

ANNEXURE-4
(NIT for Condenser Ejector, Gland
steam condenser & Associated
Auxiliaries)

ANNEXURE - 4 (Technical Requirements for Condenser, GSC & Condenser Air Removal System)
Project : 400MW BPDB RAOZAN CCPP

Sl. No.	Description	Confirmation from Bidder (YES/NO)
1	Bidder's major scope of supply, services for Surface condenser, Condenser air removal system and Gland steam condenser (GSC) shall be as indicated below and conforming to end customer Specifications which are part of the enquiry documents (end customer Specification "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721" is enclosed)	
2	Bidder shall be responsible for the complete design, engineering (including supply of all calculation), manufacturing, inspection, testing, supply, delivery to the site, supervision of erection and commissioning and Warranty service including supply of spares & consumables for the first twenty four (24) months after satisfactory Operational acceptance and performance tests of Surface condenser, Condenser air removal system and Gland steam condenser.	
3	BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engineering coordination, and other charges . Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer, and required as per BHEL's NIT or required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.	
4	a.The condenser shall be located underside or alongside the turbine, with water boxes and integral hotwell located under condenser shell. b.The condenser shall be equipped with backwashing facility. c.The source of condenser circulating water shall be from cooling tower basin only. d.The condenser shall be shop tubed.	
5	The absolute pressure at turbine exhaust, as stated by the contractor in 'TENDERER'S DATA SHEET' shall be obtainable with a condenser cleanliness factor of 0.8 with circulation water inlet temperature of 38 deg.C and with heat duty as established for the turbo generator at guaranteed gross output in accordance with specified parameters as stated in 'TENDERER'S DATA SHEET'. As per cl.no. 3.1, General of Volume 2 Of 2, (Part A) of customer specification "Cooling water Temperature from cooling tower at inlet of Steam Turbine Condenser and auxiliary cooling water Coolers is to be of 38 deg C at site condition (35 deg C, 1.013 bar, 98% R.H).	
6	The Surface condenser, Condenser air removal system and Gland steam condenser shall be supplied for indoor installation in the powerhouse.	
7	The following parameters are to be considered in plant design: Sub-Tropical Monsoon. Temperature: 5°C to 45°C Relative Humidity: 36% to 100%. Annual Rain Fall: 120 cm to 345 cm. Wind Velocity: As per Latest Wind Map. Seismic Horizontal ground Acceleration: As per BNBC approved latest Seismic Map	
8	Scope of Surface condenser, Condenser air removal system and Gland steam condenser shall include, but not be limited to the following equipment, components, features and accessories, as applicable and as specified in the end customer specification: a. Water expansion relief valves for condenser and GSC b. Atmospheric relief valve / bursting diaphragm for condenser. c. SS expansion bellow between LP turbine outlet and condenser inlet d. 2X100% ejector / 2 X 100% fan with motors for air evacuation from GSC e. Motorised steam inlet valve to air evacuation system, in case ATRS is envisaged. f. Nozzles at condenser equipment for vents(2 nos.) and drains(2 nos.) of external flash tanks (2 nos.). g. Nozzles (2 nos.) at condenser equipment for CEP suction. h. Nozzles (2 nos.) at condenser equipment for hotwell makeup. i. Nozzles (2 nos.) at condenser equipment for HP bypass valve downstream piping. j. Nozzles (2 nos.) at condenser equipment for HRH/IP bypass valve downstream piping. k. Nozzles (1 no.) at condenser equipment for LP bypass valve downstream piping. l. Nozzles (1 no.) at condenser equipment for CEP minimum recirculation. m. Nozzles (1 no.) at condenser equipment for GSC drain line. n. Nozzles (2 nos.) at condenser equipment for CEP discharge vent. o. Nozzles (1 no.) at condenser equipment for CRH emergency evacuation line. p. Inlet (2 nos.) and outlet (2nos.) nozzles at condenser equipment for cooling water inlet and outlet connections. q. Spare nozzles (2 nos. of 300NB size) at condenser equipment in steam space. r. Spare nozzles (2 nos. of 200NB size) at condenser equipment in hotwell space. s. Any other nozzles, as required during contract stage. t. Piping/ducting from STG to Condenser Refer Clause 2.6.1 in Section 2 of (Vol-2 of 2, PART A) document	

ANNEXURE - 4 (Technical Requirements for Condenser, GSC & Condenser Air Removal System)
Project : 400MW BPDB RAOZAN CCPP

9	Additionally, the following items shall also be in the scope of supply of this annexure a. Piping for air removal system, if any b. Vacuum breaker valve and piping c. Pressure, temperature and level instruments d. Cathodic protection system, if required. e. Equipment end cable lugs and glands f. Equipment Enclosure Illumination System (including JB, Fixtures, conduits etc) g. Motor operated vent valves shall be provided at the top of condenser waterbox to vent and shut the air automatically h. A motor operated reversing valve shall be provided for condenser backwash purpose.	
10	Painting, including finished coat and special paints required for corrosion protection and high temperature resistance. Export quality packaging suitable for long term storage shall also be required. Refer Clause 2.6.3 in Section 2 of (Vol-2 of 2, PART A) document	
11	Workshop equipment as per Clause 2.6.3 in Section 2 of (Vol-2 of 2, PART A) document	
12	Training as per end customer specification Refer Clause 2.15 in Section 2 of (Vol-2 of 2, PART A) document Refer Schedule-J of VOLUME 2 OF 2, PART B document	
13	Competent Engineers for the equipments in Bidder scope of supply for Operation & Maintenance During Warranty Period. Refer Clause 2.20 in Section 2 of (Vol-2 of 2, PART A) document	
14	The Tenderer shall supply all relevant international standards (ISO, IEC, ASTM, IEEE, ASME, NFPA etc.) as per Clause 2.31 in Section 2 of (Vol-2 of 2, PART A) document	
15	Condenser air removal system shall be designed as per Clause 3.3.10 and Clause 6.3.3 in Section 2 of (Vol-2 of 2, PART A) document	
16	Surface condenser shall be designed as per clause 3.3.4 in section 3 & clause 6.3.1 in section 6 of (Vol-2 of 2, Part-A) as per end customer specification	
17	Bidder shall provide all insulation, lagging and cladding, if required as per clause 6.5 in section 6 of (Vol-2 of 2, Part-A) as per end customer specification.	
18	Surface condenser, Condenser air removal system and Gland steam condenser shall be tested on the factory, those tests shall include, but not be limited to the following : 1. Hydraulic tests Refer clause 19.2.3, section 19 in (Vol-2 of 2, PART A) document for complete details	
19	Bidder shall conduct site performance test for Surface condenser, Condenser air removal system and Gland steam condenser with all necessary instruments. All the instrumentation, devices (with necessary calibration) and services required for conductance of performance test should be included in Bidder scope. Bidder should provide procedure for measuring parameters during test at site as required for proving guarantees and as per end customer specification. Refer Clause 19.3 in Section 19 of (Vol-2 of 2, PART A) document	
20	Base plate/frame and all foundation hardware (including embedments & over the surface items) for Surface condenser, Condenser air removal system and Gland steam condenser	
21	Sufficient spares required for commissioning as per Bidder experience/recommendation & furnish the list for the same. If however, any additional spares is consumed over and above the quoted commissioning spares, during commissioning, the same shall be provided free of cost, by the Bidder. Any leftover spares after commissioning shall be handed over to the owner. RCA for failure of any equipment to be done by the bidder and results to be shared with BHEL.	
22	As per tender, warranty period is 24 months. During warranty, contractor has to supply complete spares including O&M, normal wear & tear, consumables etc. required during 2 years operation. Bidder has to submit the detailed list with the tender. In case there is any spare items required during warranty period which is not part of the list then also bidder has to supply that spare parts.	
23	Bidder shall provide all spares whether listed or not in the contract for smooth operation of the plant during Defect Liability Period. During the Defect Liability Period, Bidder shall also provide normal operation spares, wear & tear spares, spares required for schedule/ unscheduled maintenance and services required for complete combined cycle power plant & their auxiliaries. BIDDERS will be liable for providing all spares, consumable and expertise service for day to days, unscheduled, breakdown maintenance of complete combined cycle power plant including GTG & their auxiliaries during defect liability period from the Operational Acceptance Certificate of the plant. Refer Schedule-F of VOLUME 2 OF 2, PART B document Refer clause 22.1, section-22 of VOLUME 2 OF 2, PART A document	

ANNEXURE - 4 (Technical Requirements for Condenser, GSC & Condenser Air Removal System)

Project : 400MW BPDB RAOZAN CCPP

24	Separate Lumpsum quote indicating required minimum number of man days for the below services upto warranty period: 1) Supervision of Erection and Commissioning of Surface condenser, Condenser air removal system and Gland steam condenser 2) Any other additional services, if required. 3) Bidders to consider minimum 120 man days for TDI and any other Bidder site supervision services for Surface condenser, Condenser air removal system and Gland steam condenser. 4) Bidders to consider minimum 4 mob-demob instances for TDI and any other Bidder site supervision services for Surface condenser, Condenser air removal system and Gland steam condenser. 5) BIDDER to quote Per diem rate and mob-demob charges to be used for evaluation in combination with 3) & 4) above. 6) BIDDER to furnish recommended number of man days and number of mob-demob instances for information. 7) BIDDER shall confirm that these rates shall be valid even after consumption of the number of days and up to defect liability period by end customer. 8) Bidder to fill and submit TDI service details in Table-1 & 2 (as attached Annexure-4(TDI)) for the Surface condenser, Condenser air removal system and Gland steam condenser.	
25	Facilitate Employer and the Project Manager or their designated representatives to attend the test and/or inspection at manufacturing premises. Bidder shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses. Refer Clause GCC 38.2 in Section 4 (Particular Conditions of Contract) of (Vol-1 of 2) document	
26	All the documentation for the submission/review/approval shall as per end customer specification Refer Appendix 7 of (Vol-1 of 2) document	
27	Furnish Performance guarantee test procedure and performance curves/data for power output, heat rate, starting and loading time, date of completion, auxiliary power and noise. Refer Schedule-A of VOLUME 2 OF 2, PART B document	
28	Bidder to submit deviations (if any) with respect to end customer customer specification as per the format Schedule-G of (Vol-2 of 2, PART B) document	
29	Bidder to fill and submit performance guarantees in Schedule-A of VOLUME 2 OF 2, PART B document	
30	Bidder to fill and submit Technical Datasheet (Schedule-B) of VOLUME 2 OF 2, PART B document	
31	Bidder shall be responsible for the guarantees and shall make good incase of any shortfall in the performance without any time/price implication. Otherwise LD/Penalties shall be levied in accordance with end customer specification. Refer Appendix 8 (Functional Guarantees) in the (Vol-1 of 2) document	
32	Bidder shall furnish all the equipments, auxiliary systems, instruments, controls and safety devices as per the end customer specification. However, anything required over and above what is specified in the end customer specification for safe and satisfactory operation of the equipment package shall be included by the Bidder in their scope. Bidder to explicitly mention such items in the offer.	
Sec-B	<u>Drawings and other documents:</u>	
S.NO.	PART -I - DETAILS OF DOCUMENTS (TO BE SUBMITTED ALONG WITH BID)	
1	Authorization Certificates from the manufacturer (s) of main equipment that they will supply their machine/ equipment to BPDB through the tenderer for this project, in the event the tenderer concerned is not the manufacturer of the same. [TDS (ITT 24.2 r)]	
2	Certificate from the end users for Proveness of the offered equipment. [TDS (ITT 24.2 r)]	
3	Materials, Equipment and associated services from the following countries are not eligible: Israel	
4	The Surface condenser, Condenser air removal system and Gland steam condenser shall be of well proven design and shall have satisfactory operating experience outside manufacturer's country for at least 2 (two) years.	
5	The Bidder shall include at least two (02) certificates from the end users on satisfactory performance of the Power plants as mentioned above, which were designed, engineering, supplied, constructed, tested & commissioned by the Bidder himself or as member in case of JVCA to establish the minimum required experience to Tender. The certificates shall mention the name of power plant, Plant Configuration, capacity, Contract value, Name of Partner (If Applicable), total operating hour and commissioning date of the power plant (make, model) supplied by the Bidder; issue date, name and address (Telephone/Fax/e-mail) of the end user duly signed in the official pad. These certificates must be notarized and have authentication from the Chamber of Commerce of the Bidder country or the Embassy/High commission of the end user's country situated in Dhaka. In absence of that, authentication from Bidder country's Embassy/High Commission in Dhaka.	
6	Manufacturer's Authorisation Letter (Form PG5A - 5)	
7	Manufacturer's declaration letter (Form PG5A – 5a)	
8	Letter of Intent (Form PG5A – 5b)	

ANNEXURE - 4 (Technical Requirements for Condenser, GSC & Condenser Air Removal System)
Project : 400MW BPDB RAOZAN CCPP

9	Bidder shall first submit the completely filled-in Equipment Data sheets, Performance Curves, filled in Experience Record Proforma, Equipment Manufacturers Latest catalogues and their General reference lists, vendor list, Quality Plans for Surface condenser, Condenser air removal system and Gland steam condenser, any other documents as specified in end customer specification along with the offer.	
10	Following documents shall be submitted mandatorily along with bid but not limited to: a. General Arrangement drawing, machine outline and foundation outline drawing of Surface condenser, Condenser air removal system and Gland steam condenser in native format (editable version like Auto CAD). Bidder shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc. b. Foundation loading drawings with dead load, live load, seismic, wind, dynamic and erection loads and other relevant data for civil foundation for the equipments which are in Bidder scope of supply in native editable format. c. Utility consumption (Instrument air/Service air/Cooling water etc) in the attached Format 02, 03 & 04. d. Electrical load list in the attached Format-1 along with DC loads, their location, starting current, starting instant etc. f. Cooling water, preservation and storage, water wash, water purity requirements g. Performance curves along with correction curve, if applicable. h. Sub-vendor's list for all the equipment as per end customer specification i. Functional write up for normal operation j. Aux power along with list of auxiliaries k. Device list and P&ID's l. Description of training program including curriculum and training aids. m. A list and description of similar projects which the Bidder has successfully completed. n. Type test report of the equipment where applicable. o. A list of special tools and equipment for maintenance and overhauling of the machine/equipment to be handed over to BOARD p. Input of Condenser cooling water flow and pressure drop across condenser at TP.	
11	Following foundation and electrical related documents are also to be submitted in bid stage a. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions etc. b.Details of EP's, insert plates, bolts, anchor assemblies etc along with their location, grade of material etc. c. Writeup/recommendation of manufacturer for civil design of machine foundation, recommendation of load factors and combinations, grade of concrete and steel , erection philosophy and details and any other information required for design of foundation shall also be provided during proposal and contract stage engineering. d.Handling arrangement details of condenser and its components and laydown space. e.Earthling requirement, electrical control philosophy and cable schedule. f. OEMs recommended codes and standards to be followed.	
S.NO.	PART - II - DETAILS OF DOCUMENTS (TO BE SUBMITTED AFTER PLACEMENT OF ORDER)	
1	All the Equipment's name plate Data (Manufacturer Name & Technical Parameters), Technical Specification, Operational Manual including OEM parts list & Drawings shall be in English language. OEM has to handover all the Equipment's complete Technical Specification, Operational Manual including OEM parts list & Drawings before performance test of the plant.	
2	Also all the drawings and documents at S.No 5 below shall be submitted by Bidder within 30 days from placement of PO, incorporating project specific title block which will be shared during detail engineering.	
3	The drawing and documents (ex. GA drawing etc) which require further engineering and integration by BHEL shall be furnished in Auto CAD format.	
4	Bidder to furnish all necessary functional and ordering specifications, system requirement documents and interface information for sizing of equipment in BHEL's scope of supply. The minimum information required is as follows a.Hotwell levels b.Bottom low-low level for CEP sizing c.Maximum tube removal space d.Weight distribution on supports e.Thermal movements f. Forces and moments on nozzles g.Cooling water nozzle and flange details h.Bypass and makeup details i. Top elevation of condenser for fixing exhaust hood height.	
5	Following documents and Drawings (final list as per agreed Master Document List) shall be furnished by Bidder for information/review/acceptance as per end customer specification, not limiting to:	
5.1	General arrangement of Surface condenser, Condenser air removal system and Gland steam condenser in native editable format within 15 days of placement of PO. Bidder shall also indicate weights of equipment, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc.	
5.2	Foundation loading drawings with dead load, live load, seismic, wind, dynamic and erection loads and other relevant data for civil foundation for the equipments which are in Bidder scope of supply in native editable format.	
5.3	Utility consumption (Instrument air/Service air/Cooling water etc) in the attached Format 02, 03 & 04.	
5.4	Electrical load list in the attached Format-1 along with DC loads, their location, starting current, starting instant etc. within 30 days of placement of PO.	

ANNEXURE - 4 (Technical Requirements for Condenser, GSC & Condenser Air Removal System)

Project : 400MW BPDB RAOZAN CCPP

5.5	a. Input of Condenser cooling water flow and pressure drop across condenser at TP. b. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions etc. c. Details of EP's, insert plates, bolts, anchor assemblies etc along with their location, grade of material etc. d. Writeup/recommendation of manufacturer for civil design of machine foundation, recommendation of load factors and combinations, grade of concrete and steel , erection philosophy and details and any other information required for design of foundation shall also be provided during proposal and contract stage engineering. e. Handling arrangement details of condenser and its components and laydown space. f. Earthing requirement, electrical control philosophy and cable schedule. g. OEM recommended codes and standards to be followed.	
5.6	Interconnection piping and package connection details, piping specifications within 45 days of placement of PO and Cooling water, preservation and storage, water wash, water purity, requirements within 30 days of placement of PO.	
5.7	Overall sequence of operation of start-up/shutdown/normal operation within 90 days of placement of PO.	
5.8	All other filled in Data sheets as per end customer specification within 90 days of placement of PO.	
5.9	Sub-vendors' list for all the equipment as per end customer specification within 30 days of placement of PO.	
5.10	Functional write up for normal operation within 90 days of placement of PO.	
5.11	PG test procedure and correction curves along with data points within 120 days of PO	
5.12	All erection documents required for erection at site to make estimates (for eg. Packing List and Weights etc.) for Bidder scope of supplies.	
5.13	Bidder shall provide a bar-chart type schedule for the execution of the work for its scope and shall show the main activities with duration, their sequences, and the milestone events specified.	
5.14	6 sets of hard copies & 2 sets of soft copies - Drawings, datasheets, check lists, procedures and other necessary documents required for erection and commissioning of Surface condenser, Condenser air removal system and Gland steam condenser supplied by Bidder	
5.15	6 sets of hard copies & 2 sets of soft copies (or no. of copies as agreed with end customer) - All customer documentation, Drawings, datasheets, check lists, procedures, etc. and other necessary documents required for O&M of Surface condenser, Condenser air removal system and Gland steam condenser .	
5.16	Type test reports, material test certificates, final and in process inspection reports, etc. where ever applicable during detail engineering	
Sec-C	Additional terms and conditions:	
1	Bidder shall answer all customer queries and attending any meetings if required till all documents in MDL are approved by tenderer or the end customer.	
2	Bidder to supply any other equipment which is not explicitly mentioned as in Bidder's scope of supply but mentioned in the end customer specification and is required for smooth and satisfactory operation of the Steam turbine package.	
3	Bidder shall provide detailed breakdown BOM for complete scope of supply.	
4	Bidder shall facilitate end customer or its representative to witness testing of equipments as per the list agreed and finalized with end customer.	
5	Bidder shall be responsible for compliance with complete specification issued by end customer including national standards as specified therein, limited to its scope of supply, and where not technically feasible shall get acceptance from the end customer	
6	Bidder shall be responsible for getting end customer acceptance on material selection, components selection/design and general engineering design practices used to design and procure Bidder supplied equipment, if end customer raises any queries on the same.	
7	Between BHEL and Bidder, each party shall be solely and exclusively responsible for its own scope of work. Both parties shall perform their respective scope in an integrated manner as and when required.	
8	Warranty/Defect liability period for the scope of supply shall be as per end customer specification requirements.	
9	1. Terminal Points a) Nozzles at condenser equipment for vents(2 nos.) and drains(2 nos.) of external flash tanks (02 nos.). b) Nozzles (2 nos.) at condenser equipment for CEP suction. c) Nozzles (2 nos.) at condenser equipment for hotwell makeup. d) Nozzles (2 nos.) at condenser equipment for HP bypass valve downstream piping. e) Nozzles (2 nos.) at condenser equipment for HRH/IP bypass valve downstream piping. f) Nozzles (1 no.) at condenser equipment for LP bypass valve downstream piping. g) Nozzles (1 no.) at condenser equipment for CEP minimum recirculation. h) Nozzles (1 no.) at condenser equipment for GSC drain line. i) Nozzles (2 nos.) at condenser equipment for CEP discharge vent. j) .Nozzles (1 no.) at condenser equipment for CRH emergency evacuation line. k) Inlet (2 nos.) and outlet (2nos.) nozzles at condenser equipment for cooling water inlet and outlet connections. l) Spare nozzles (2 nos. of 300NB size) at condenser equipment in steam space. m) Spare nozzles (2 nos. of 200NB size) at condenser equipment in hotwell space. 2. Utilities: Cooling water, Service Water, IA, SA: shall be provided at one point (OEM to specify location) 3. Electrical: a) 415 V Supply: Motor/ Equipment end TB. b) 6.6kV Supply: Motor/ Equipment end TB. c) 220 V Station DC Power Supply: Motor/ Equipment end TB. d) 125 V/ 24 V DC/48 V DC Power supply: EDN/ HPEP to comment e) XXX V AC UPS Power Supply: EDN to comment f) 110/220 V AC Electrical Control Supply: Equipment end TB g) Instrumentation Cable: EDN/HPEP to comment h) Electrical Earthing: At Vendor's Equipment's earthing terminal i) Electronic Earthing: EDN to review j) Equipment Illumination Power Supply(if required): At one location near Condenser.	

Annexure-4 (TDI)

TDI Service details for Surface Condenser, GSC & Condenser Air Removal System

Bidder to fill and submit the information requested in the below Table-1 & 2.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.No.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost
1.	Surface Condenser, air removal system & Gland Steam Condenser	A4=120	B4	C4	D4=4	E4	F4	$A4 \times C4 + D4 \times F4 = G4$

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	Surface Condenser, air removal system & Gland Steam Condenser	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

[illegible]

SERVICE AIR REQUIREMENT

Format 02

[illegible]

INSTRUMENT AIR REQUIREMENT

Format 03

[illegible]

ANNEXURE-5

(NIT for Gas booster compressor & Associated Auxiliaries)

List of Documents

S.No.	Description	Document Number	Bidder Response	Remarks
1	Specification for Gas Booster Compressors Package Supply	C2021001/05 Rev 03		Bidder to provide confirmation
2	Analysis of Natural Gas	Annexure-5A		Vendor to consider for GBC sizing
3	Manufacturer's Authorization Letter	Annexure-5B		Vendor to provide
4	Deviations from Specification	Annexure-5C		Vendor to provide
5	TDI Service Details	Annexure-5D		Vendor to provide
6	Electrical and Utility Requirements	Annexure-5E		Vendor to provide

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					REV No.: 03								
					PAGE 1 OF 14								
<u>SPECIFICATION FOR GAS BOOSTER COMPRESSORS PACKAGE SUPPLY.</u> PROJECT: 400 MW CCPP, RAOZAN, BANGLADESH SERVICE: Gas Booster Compressor QUANTITY: 3X50% <u>1. INTRODUCTION:</u> The present specification brings out the requirements to be met by Gas Booster Compressor Package vendor for 400 MW CCPP, Raozan, Bangladesh. The compressor package shall be designed, manufactured, tested and supplied to the extent applicable scope as per this specification. The offer shall bring out the technical requirements totally in conformity to the said customer specifications. The compressor is driven by motor. <u>2. APPLICABLE SPECIFICATIONS:</u> <table border="1"> <thead> <tr> <th>Specification</th> <th>Number</th> </tr> </thead> <tbody> <tr> <td>Material Requisition</td> <td>Tender Inquiry No. 27.11.0000.101.14.008.19-6721 date: 31.12.2019.</td> </tr> <tr> <td>Addendum-01 (Clarifications & Addendum no. 01)</td> <td>Memo No. 27.11.0000.101.14.008.20-1077 Dated 16-03-2020.</td> </tr> <tr> <td>Clarifications & Addendum No. 02</td> <td>Record Number: 27.11.0000.101.14.008.20-1511 Dated 15-05-2020.</td> </tr> </tbody> </table> Soft copy of material requisition is enclosed with the enquiry. <u>3. BRIEF DESCRIPTION:</u> The plant shall require centrifugal type gas booster compressors. The supply pressure of natural gas is in the range of 80 - 150 psig. The capacity of the compressors have to be 3 x 50% for maximum gas requirement of the plant including auto changeover system without interrupting operation of the plant with rated pressure & flow and at all modes of operation & at any temperature prevailing in the site of the GTG unit. The gas booster compressors have to be centrifugal type, 6.6 KV motor driven. Appropriate control, sealing, cooling & anti-surge system with all necessary ancillaries and auxiliaries shall have to be provided by GBC vendor. Main bidder to ensure that all the customer specification requirements are to be met by GBC vendor. Deviation, if any are to be provided as Annexure-5C.						Specification	Number	Material Requisition	Tender Inquiry No. 27.11.0000.101.14.008.19-6721 date: 31.12.2019.	Addendum-01 (Clarifications & Addendum no. 01)	Memo No. 27.11.0000.101.14.008.20-1077 Dated 16-03-2020.	Clarifications & Addendum No. 02	Record Number: 27.11.0000.101.14.008.20-1511 Dated 15-05-2020.
Specification	Number												
Material Requisition	Tender Inquiry No. 27.11.0000.101.14.008.19-6721 date: 31.12.2019.												
Addendum-01 (Clarifications & Addendum no. 01)	Memo No. 27.11.0000.101.14.008.20-1077 Dated 16-03-2020.												
Clarifications & Addendum No. 02	Record Number: 27.11.0000.101.14.008.20-1511 Dated 15-05-2020.												
COMP. FILE NAME													
Ref. Doc.													
<table border="1"> <tr> <th>Rev. No.</th> <th>Revisions</th> <th>Prepared</th> <th>Approved</th> <th>Date</th> </tr> <tr> <td>03</td> <td></td> <td>P SRIDHAR</td> <td>NEMA</td> <td>08.06.20</td> </tr> </table>		Rev. No.	Revisions	Prepared	Approved	Date	03		P SRIDHAR	NEMA	08.06.20		
Rev. No.	Revisions	Prepared	Approved	Date									
03		P SRIDHAR	NEMA	08.06.20									

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➤ Supply pressure of natural gas at gas booster compressor hall inlet is in the range of 3.6 to 8.54 kg/cm²(g) ➤ Pressure drop from gas booster compressor hall to gas turbine fuel skid is 6 kg/cm². This is to be considered while sizing the gas booster compressor. <u>4. Gas Booster Compressor Vendors:</u> The Gas Booster Compressor vendors shall be as follows: I. ATLAS COPCO, USA or Germany II. MAN TURBO, Germany III. INGERSOLL RAND, USA GBC vendors shall be strictly as per above list only. Alternative vendors are not acceptable. <u>5. Natural Gas Composition:</u> Typical Composition of natural gas is shown on Annexure-5A for Tender purpose only. However during design period the appropriate specification of natural gas shall be provided. BHEL will be responsible for gas conditioning & filtering as per requirement of GBC. No question shall be arisen regarding gas properties for any damage of GBC. <u>6. Control System for GBC:</u> Main bidder to ensure that complete gas booster compressor monitoring, control, alarms and trip inter locks including MMS and antisurge control shall be considered in finalizing the plant DCS specification. GBC vendor to provide preliminary IO count (±5%) along with offer. <u>7. Terminal Points for GBC Package:</u> A. Supply of natural gas in the pressure range of 3.6-8.54 kg/cm²(g) at one point near gas booster compressor hall. B. Discharge of natural gas at one point from gas booster compressor hall. C. All instruments shall be terminated at field JB in Compressor House. D. Cooling water: at one point near GBC hall (OEM to specify this location.) E. Instrument air: at one point near GBC hall (OEM to specify this location). F. 415 V Supply: Motor/ Equipment end TB. G. 6.6kV Supply: Motor/ Equipment end TB. H. 220 V Station DC Power Supply: Motor/ Equipment end TB. I. 110/220 V AC Electrical Control Supply: Equipment end TB J. Electrical Earthing: At Vendor's Equipment's earthing terminal K. Equipment enclosure Illumination Power Supply (if required): At one location near GBC Hall.				
COMP. FILE NAME				
Ref. Doc.				



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8. Scope of Supply:

GBC Vendor's proposal shall include, but not be limited to, equipment, materials and work specified in List of Scope of Supply and Work below.

For each Gas Booster Compressor			
Item Description		Confirmed By GBC Vendor (Yes/ No)	Remarks
1	COMPRESSOR		GBC Vendor to indicate applicable compressor international standard
1.1	Casing drain piping with Block valve and (X) Manifold piping with Block valve		Terminated at single point for all 3 compressors
2	SHAFT SEAL & SEAL SYSTEM		Vendor to indicate applicable international standard
2.1	Dry Gas Seals		DGS Type to be informed by vendor
2.2	Self-Acting (Dry) Gas Seal System		
2.3	Heat Trace For Primary Seal Gas Supply Line		If required (based on Vendor's recommendation)
2.4	All Piping/ Tubing with its Supports within Seal Gas Skid(s)		
2.5	Instrumentation within Console including Junction Box		
2.6	Wiring to Junction box within Console.		
2.7	Seal gas heater		If required (based on Vendor's recommendation)
2.8	Seal gas booster system		If required (based on Vendor's recommendation)
2.9	Nitrogen bottle bank in his scope with auto-change-over valve(s).)		If required (based on Vendor's recommendation)
3	Gear Unit		GBC Vendor to indicate applicable international standard
4	Electric Motor		
5	Coupling (s) and Guards (s)		Non sparking guards
6	Mating Flanges with Bolts, Nuts and Gaskets		At all terminal points
7	BASEPLATE for Compressor, Gear Box and Motor (X) Common () Separate (X) Non Skid Decking		
7.1	All Piping with its Supports within Baseplate(s)		



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For each Gas Booster Compressor

Item Description		Confirmed By GBC Vendor (Yes/ No)	Remarks
7.2	All Instrumentation within Baseplate(s) including Junction Box		
7.3	Wiring to Junction box within Baseplate		
7.4	Anchor Bolts and Nuts with Subplate, Shims (SS), Leveling Plate, Anchor Bolt Sleeve Grout Seal and Leveling Jackscrew for All Skid		
7.5	Template for Baseplate		If required (based on Vendor's recommendation)
7.6	Earthing lugs		
8	LUBE OIL SYSTEM (X) Common with (X) Compressor (X) Motor (X) Gear Box		- Vendor to indicate applicable international standard. - Vendor to provide complete lube oil system details along with P&ID.
8.1	All Piping with its Supports within Lube oil unit and other baseplate(s) for Compressor/Motor		
8.2	All Instrumentation and control within lube oil Console including Junction Box		
8.3	Wiring to Junction box within Lube Oil Console		
8.4	Lube Oil and other consumables		For 1st Fill and Flushing
9	MACHINE MONITORING SYSTEM for (X) Compressor (X) Motor (X) Gear Box		MMS shall be independent for each compressor train.
9.1	Vibration Probes and Oscillator-Demodulators for Each Radial Bearing and Its Terminal Boxes		(X) 2 per Bearing as per API 670
9.2	Axial Displacement Probes and Oscillator-Demodulators for Each Casing and its Terminal Boxes		
9.3	Keyphasor Probe and Oscillator-Demodulators and its Terminal Boxes		
9.4	Thrust Bearing Temperature Elements and Terminal Boxes		(X) 3 no Active / 2 no Inactive per bearing
9.5	Radial Bearing Temperature Elements and Terminal Boxes.		(X) 2 per bearing
9.6	Wiring to Junction Box from Primary Elements of Machine Monitoring		
9.7	Calibration Kit for MMSensors		One common set
9.8	MMSMonitor racks/ System with panel		

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COMP. FILE NAME	Ref. Doc.	For each Gas Booster Compressor				
		Item Description	Confirmed By GBC Vendor (Yes/ No)	Remarks		
			/ cabinet including the following			
		9.8.1	Vibration Monitor System			
		9.8.2	Bearing Temp. Monitor System			
		9.8.3	Monitor Rack		With applicable barrier	
		9.8.4	Power Supply Module () Simplex (X) Duplex			
		9.8.5	Communication Module () Simplex (X) Duplex		() Require output of hard wiring (4-20mA)	
		9.8.6	Relay Module		() for common alarm / trip (X) for individual alarm / trip	
		9.8.7	Display Module with Monitor and necessary software		MMS display Installed in local panel in field by GBC vendor.	
		9.8.8	Safety Barrier		() Zenner Barrier (X) Galvanic Isolator (IS)	
		9.8.9	Configuration Software and configuration laptop			
		9.8.10	Data Acquisition Device		(X) Interface with Purchaser's system () with personal computer () with printer	
		10	MAIN CONTROL SYSTEM PANEL			
		10.1	(X) DCS	NO	Complete compressor control including alarm, monitoring, shutdown and interlocks shall be implemented in DCS. DCS is not in GBC vendor scope.	
		10.2	Mounted on () Local (X) Remote Control Room () Other Location ()			
		10.3	Cabinet			
		10.4	Major Component in Control Panel			
		10.4.1	Control, Trip, Alarm and Start-Permissive Logic		() Implemented in Purchaser's system	
		10.4.2	CPU () Simplex (X) Duplex () Triplex			
		10.4.3	I/O Module () Simplex (X) Duplex () Triplex		I/O module shall be duplex for Close Loops while for monitoring it will be simplex	
		10.4.4	Power Supply () Simplex (X) Duplex () Triplex		As minimum	
		10.4.5	Communication Module		As minimum	

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COMP. FILE NAME	Ref. Doc.	For each Gas Booster Compressor				
		Item Description	Confirmed By GBC Vendor (Yes/ No)	Remarks		
			() Simplex (X) Duplex			
		10.5	Anti-Surging Control System (X) Integrated with DCS		GBC vendor shall provide complete control loops and logics, including antisurge control logic for implementation in DCS.	
		10.6	Local Instrument (Flow, Temperature, Pressure gauges and transmitters inclusive of cabling and junction box)		In GBC vendor scope for lube oil, seal gas, process and cooling water. Switches are not allowed. Transmitters shall be used.	
		10.7	Start / Stop Button			
		11	FIELD INSTRUMENTS AND CONTROL			
		11.1	Local Gauge Board (X) with Flame Proof Box () with Increased Safety Box		- For compressor: mounted on compressor skid - For LO & seal system: mounted on respective skid - Local operator panel: in field near skid (loose supplied)	
		11.1.1	Local Indicator		On local panel for critical parameters by GBC vendor	
		11.1.2	Wiring between Compressor Skid and Local Gauge Board			
		11.1.3	Annunciator			
		11.1.4	Common Alarm & Trip Lamp		On local panel for critical parameters by GBC vendor	
		11.1.5	Emergency Shutdown Button		On local panel by GBC vendor	
		11.1.6	Drive Start & Stop Button		On local panel by GBC vendor	
		11.1.7	Motor Running Lamp on Local Gauge Board		On local panel by GBC vendor	
		11.2	HMI (Human Machine Interface)			
		11.2.1	HMI - Local mounted		On local panel by GBC vendor	
		11.2.2	HMI - control room		By DCS vendor	
		11.2.3	Earth Lug with Internal Wiring			
		11.2.4	Hand held Communicator for Smart Transmitter (Hart Communicator)		1 no for all compressor train	
		12	Sunshade for instrumentation		For skids mounted outside compressor house. E.g. Lube Oil Unit, run down tank etc.	
		13	Block and Bleed Valve for Pressure Instruments			
		14	WINTERIZATION FOR EQUIPMENT			

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For each Gas Booster Compressor			
Item Description		Confirmed By GBC Vendor (Yes/ No)	Remarks
15	INTERCONNECTING PIPING AND WIRING		
15.1	Lube Oil Supply and Drain Piping between Compressor Baseplate and Lube Oil Console		
15.2	Seal Gas Piping or Tubing between Compressor Baseplate and Seal Gas Control System		
15.3	Instrument hook-up material for all instruments of GBC		
15.4	Wiring / cabling between instruments on Compressor Skid and Local Panel including cable gland, cable trays, tray installation material		
15.5	Wiring between instruments on Compressor Skid and Skid mounted JB including cable gland, cable trays, tray installation material for MMS		
15.5	Wiring between instruments on Compressor Skid and Skid mounted JB including cable gland, cable trays, tray installation material for Lube Oil System Instruments		
15.6	Wiring between instruments on Compressor Skid and Skid mounted JB including cable gland, cable trays, tray installation material for Seal Gas System Instruments		
15.7	Wiring between instruments on Compressor Skid and Skid mounted JB including cable gland, cable trays, tray installation material for compressor suction, discharge and antisurge system Instruments		
15.8	Equipment end lugs and glands.		
15.9	Equipment enclosure Illumination System (including JB, Fixtures, conduits etc), if required.		
16	SPARE PARTS		
16.1	Erection and Commissioning spares		Vendor's scope of supply shall include all commissioning spares (mechanical, electrical and instrumentation) for the each compressor package as deemed necessary by vendor. Vendor shall include the list of such spares in his proposal. Vendor to

COMP. FILE NAME	
Ref. Doc.	

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COMP. FILE NAME	Ref. Doc.	For each Gas Booster Compressor				
		Item Description	Confirmed By GBC Vendor (Yes/ No)	Remarks		
					note that in case any of the spare is consumed over and above the quoted commissioning spares, the same shall have to be replaced/supplied free of cost by the vendor. All commissioning spares not consumed are property of Client.	
		17	Spreader Bars/Sings/Shackles/ for transportation / erection.		If required as per vendor standard.	
		18	ACOUSTIC ENCLOSURE		i) Sound Level within 85 dBA @ 1m for complete unit from equipment surface. ii) In case enclosure is proposed, GBC vendor and Main bidder to check and include Fire and gas detectors and system, if required.	
		19	Inspection and Testing		i) Inspection and Testing shall be as per customer approved ITP. ii) Section-19, Part-A Volume 2.	
		19.1	Mechanical run test			
		19.2	Any other testing as per standard and as per approved quality plan			
		20	OTHERS			
		20.1	Process Gas Piping at inlet		Single tie-in will be provided for all 3 compressors. Further distribution for each GBC is in vendor scope.	
		20.2	Process Gas Piping at outlet		Single tie-in will be provided for all 3 compressors. Further combining each GBC discharge is in vendor scope.	
		20.3	Anti-surge piping		Completely in GBC vendor scope.	
		20.4	Bypass Cooler and separator			
		20.5	Temporary Type Suction Strainer		If required as per vendor recommendation.	
		20.6	Permanent type Suction Strainer		If required as per vendor recommendation.	
		20.7	Suction isolation valve			
		20.8	Discharge isolation valve			
		20.9	NRV is compressor discharge line			



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For each Gas Booster Compressor

Item Description	Confirmed By GBC Vendor (Yes/ No)	Remarks
20.10 Instruments in process gas lines		
20.11 Anti-Surge, suction throttle and depressurisation Valve		
20.12 Portable trolley mounted lube oil purifier complete with driver, flexible hose piping (15m each at suction & discharge), hose storage wheel, valves, motor cable of approximately 20m length, plug & socket to suit the area classification This shall be sized for purifying of complete quantity of reservoir lube oil in 12 hrs.		
20.13 Portable trolley mounted emptying/fill oil pumps for Lube Oil Reservoir complete with driver, flexible hose piping (10 m each at suction & discharge), hose storage wheel, valves, motor cable of approximately 20 m length, plug & socket to suit the area classification.		
20.14 Statutory approval All electrical equipment shall be certified for the hazardous area by authorities like CE, FM, UL, CMRI, ICIE, BASEEFA or equivalent.		

Common for 3 Gas Booster compressors

Item Description	Confirmed by GBC Vendor (Yes/ No)	Remarks
1 Special tools – 1 Set		To be included in base scope.
2 Performance guarantee of GBC compressors at site		
3 All the items required for auto changeover of the system without interrupting operation of plant		With rated pressure and flow and at all modes of operation & at any temperature prevailing in the site of the GTG unit
4 Supervision of Erection and Commissioning		Refer Annexure-5D
4.1 Vendor to indicate the number of man days required for "Technical Direction for Installation" services (supervision for site E&C etc.) for each GBC package and provide the per diem rate for the same.		Vendor to confirm that rates are valid till the end of defect liability period by end customer without any limitation on number of man days used.
4.2 Vendor to indicate the number of mobilization & demobilization required for each GBC package and provide the rate for each Mobilization &		Vendor to confirm that rates are valid till the end of defect liability period by end customer without any

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COMP. FILE NAME Ref. Doc.		Common for 3 Gas Booster compressors			
			demobilization.		limitation on number of man days used.
		5	Training		1) Schedule-J, Part-B, Volume-2 2) To be included in base scope and quoted as per Schedule No. 3 – 3C1 to 3C4
		6	Customer witness charges for Inspection and Testing		1) To be included in base scope in line with customer specification GCC 38.2, Volume 1 2) To be included in base scope and quoted as per Schedule No. 3 – 3B1 & 3B2
		7	Spare parts and Consumables supply for complete GBC package: 2 Years for Defect Liability period.		1) As per schedule-F, Part-B, Volume 2 2) To be included in base scope and quoted as per Schedule No.1 - 1K-1 & 1K-2
		8	Operation and maintenance services during Warranty period. (warrantee engineers for 2 years warranty period).		To be included in base scope and quoted as per Schedule No.3 – 3E
		9	Anything required over and above that is specified, as per customer specification shall be included by GBC vendor in his scope and mention the same in offer		
		10	Anything required over and above that is specified, for safe and satisfactory operation of the compressor package shall be included by GBC vendor in his scope and mention the same in offer		
		11	BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engg coordination and other charges. Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer and required as per BHEL's NIT or required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.		

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<u>9. GENERAL TECHNICAL CONDITIONS:</u> - Electrical equipment's shall be suitable for area classification. - GBC vendor shall provide Manufacturer's Authorization as per customer requirement. (Annexure-5B) - Defect liability period and conditions shall be as per customer specification. During warranty, vendor has to supply complete spares including O&M, normal wear & tear, consumables etc. required during 2 years operation. Bidder has to submit the detailed list with the tender. In case there is any spare items required during warranty period which is not part of the list then also bidder has to supply that spare parts. BIDDERS will be liable for providing all spares, consumable and expertise service for day to days, unscheduled, breakdown maintenance of complete combined cycle power plant during defect liability period from the Operational Acceptance Certificate of the plant - GBC vendor shall provide necessary sizing inputs for upstream and downstream engineering / equipment's. - GBC vendor to provide complete details for the interfacing such as Compressor GA drawing, Plot Plan, Machinery and Foundation Arrangement drawing, Electrical Load List(in the attached format along with the DC Loads, their location, starting current, starting instant etc.), Utility List, Weights and Dimensions, Terminal Points List etc. - The offer shall be complete in accordance with the referred specifications for the project. - GBC vendor shall submit quality plan for the compressor package components in line with specification. Material and shop test reports shall be submitted for all critical components like impellers, diaphragms, gear box, dry gas seal and couplings etc. - GBC vendor shall depute technical persons free of charge for technical discussions on performance, deviation etc., with customer during tender stage and also during design stage. - Final documentation shall be as per customer specification. - GBC vendor will check and inform whether Flare Header is required for GBC package. In case flare header is required and the same is not available at site, GBC vendor may propose any other alternative option for flare header. - Auto Changeover: GBC vendor shall provide detailed procedure for auto changeover of the system inline with customer specification. - Material, Equipment and associated services from the following countries are not eligible: Israel. - GBC vendor shall submit the following documentation after placement of order: - Filled in compressor datasheet - Performance curves - Compressor GA drawing - Coupling GA drawing - Dry Gas Seal GA drawing - Gear Box data sheet and Ga drawing - Cross Section of compressor - Lateral critical speed analysis - Torsional critical speed analysis				
COMP. FILE NAME				
Ref. Doc.				

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COMP. FILE NAME	x. Allowable nozzle forces and moments xi. Process Gas, Seal Gas, Lube Oil, Cooling Water PID's xii. Electrical Load List (in the attached format along with the DC Loads, their location, starting current, starting instant etc.) xiii. Utility Consumption List (in the attached formats) xiv. Lubrication Schedule xv. Machine Arrangement and Foundation xvi. Equipment Layout xvii. Auxiliary Equipment Foundation xviii. Suction Strainer GA drawing xix. Piping GA drawing xx. Piping isometric with BOM xxi. Lube Oil Console GA drawing xxii. Oil System Data sheet xxiii. Lube Oil Pump data sheet and GA drawing xxiv. Lube Oil Pump performance curves xxv. Lube Oil Pump Motor GA drawing and Curves xxvi. Lube Oil Pump Motor Data Sheet xxvii. Lube Oil Overhead Tank GA drawing (if applicable) xxviii. Lube Oil Purifier skid GA drawing xxix. Lube Oil Transfer Pump skid GA drawing xxx. Any other documentation required as per customer specification. xxxi. Supporting documentation to resolve technical issues with customer. xxxii. Interface Documentation xxxiii. Documentation (drawing & data required) for instrumentation: - Block / system architecture diagram for control systems. - Electrical Load List (UPS & Non UPS Power Supply and Feeder Requirement. - Heat Load for panels supplied by vendor to be mounted in control room. - Instrument index. - Filled in data sheet of all instruments, valves, MMSensors / system etc. (with sizing sheets), catalogues along with model decodification. - BOM, GA drawings & Wiring Diagrams for local PB panel, MMS cabinets. - Cause & effect diagram for instrumentation and logic sequence write up / control narrative/ functional loop schematic. - Logic diagram & logic writeup for compressor open loop monitoring, closed loop control and interlock & trips for implementation in DCS. - Logic diagram & logic writeup along with setpoints for compressor Antisurge, Performance & loadsharing (if applicable) control for implementation in DCS. - Anti-surge control valve sizing calculations and data sheet including utility requirement. - I/O Summary for DCS/ ESD / MMS with alarm & trip schedule. - Operator graphic details (HMI Screen) for Antisurge & Performance Control as applicable. - Instrument cable schedule (inclusive of wiring diagram for junction boxes including cable entry details) along with cable specification and datasheet. - Wiring diagram for junction boxes including cable entry details. - Instrument location, junction box location, Instrument tray / conduit layout, local PB panel location layouts. - Communication details (Modbus) for system related items for interfacing with DCS. - HART protocol specific information for vendor supplied instruments.			
	Ref. Doc.			

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18. Statutory body certificate for hazardous area for all field instrumentation. 19. Test / calibration / inspection certificate for all instruments/ panels. xxxiv. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. xxxv. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. xxxvi. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. xxxvii. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. xxxviii. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. xxxix. OEM's recommended Codes and standards to be followed. xl. Grade of concrete and steel wherever applicable. xli. Machine/equipment erection philosophy and details. xlii. Any other information/drawings/details besides above required for design of foundations and project Engg. shall also be provided by the vendor. xlili. Earthing Requirement of Equipment. xliv. OEM electrical control philosophy xlv. Cable Schedule xlvi. Any other input required for Project Engineering. <u>10. DELIVERY REQUIREMENT:</u> Main Bidder to align with GBC vendor in line with overall project schedule. <u>11. GBC guarantee parameters:</u> GBC vendor shall provide total power consumption guarantee of 2 running gas booster compressors at different load conditions: ➤ 100% Load ➤ 75% Load ➤ 50% Load <u>12. The GBC vendor offer should comprise as a minimum the following:</u> a. Filled in compressor data sheets b. Performance curves c. Compressor Overall dimension sketch d. Plot Plan e. Weights and Dimensions f. Machine Arrangement and Foundation drawing g. Utility List (as per Annexure-5E) h. Block / system architecture diagram for control systems i. I/O Count for DCS j. Electrical Load List (as per Annexure-5E) k. Table of Terminal Points l. Quality Plan				
COMP. FILE NAME				
Ref. Doc.				



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RECORD OF REVISIONS

[illegible]

COMP. FILE NAME

Ref. Doc.

Annexure-5A

ANALYSIS OF NATURAL GAS

Sl. No.	Subject/ Particulars	Content
1.	Chemical Composition	
a.	Methane (CH ₄)	92 to 97 Percent by volume
b.	Ethane (C ₂ H ₆)	0 to 6.50 Percent by volume
c.	Propane (C ₃ H ₈)	0 to 1.00 Percent by volume
d.	Butane (C ₄ H ₁₀)	0 to 1.00 Percent by volume
e.	Pentane (C ₅ H ₁₂) & higher HC	0 to 2.00 Percent by volume
f.	Hydrogen Sulphide (H ₂ S)	0.5 grains per 10 S. Cu. ft.
g.	Carbon Dioxide (CO ₂)	0 to 0.80 Percent by volume
h.	Nitrogen (N ₂)	0 to 0.60 Percent by volume
i.	Argon (Ar+O ₂)	0 to 1.00 Percent by volume
j.	Inert Gas	0 to 5.00 Percent by volume
2.	Physical Properties	
a.	Calorific Value (LHV)	35,350 kJ/Nm ³ .
b.	Temperature Range	15 ^o c to 60 ^o C
c.	Total Sulphur	20 grains or less in per 100 SCF gas
d.	Solid Substances	Free from solid material beyond 5 microns in size
e.	Specific Gravity (air=1)	0.55 to 0.67
f.	Water content	7 lbs per 100,000 SCF
g.	Liquefiable Hydrocarbons	Not more than 2 American gallons per 100,000 SCF
h.	Pressure Range	80 - 150 Psig

Annexure-5B

Manufacturer's Authorisation Letter (Form PG5A - 5)

[The Tenderer shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer. The Tenderer shall include it in its tender, if so indicated in the TDS as stated under ITT Sub-Clause 28.1(b)]

Invitation for Tender No:	Date:
Tender Package No:	
Tender Lot No:	
To: Name and address of Employer]	

WHEREAS

We *[insert complete name of Manufacturer]*,

who are official manufacturers of *[insert type of goods manufactured]*, having factories at *[insert full address of Manufacturer's factories]*, do hereby

authorize *[insert complete name of Tenderer]* to supply the following Plant and Equipment, manufactured by us *[insert name and or brief description of the Goods]*.

We hereby extend our full guarantee and warranty as stated under GCC Clause 42 of the General Conditions of Contract, with respect to the Goods offered by the above Tenderer.

Signed: *[insert signature(s) of authorized representative(s) of the Manufacturer]*

Name: *[insert complete name(s) of authorized representative(s) of the Manufacturer]*

Address: *[insert full address including Fax and e-mail]*

Title: *[insert title]*

Date: *[insert date of signing]*

Annexure-5C

SCHEDULE – G

DEVIATIONS FROM SPECIFICATIONS

The following is a list of deviations from Tender Documents

Clause No. and Page No.	Description and Reference to Documents submitted by Tender

Note : The Tenderer shall attach additional sheets as required

Annexure-5D (TDI)

TDI Service details for Gas Booster Compressors and its associated systems

Bidder to fill and submit the information requested in the below Table-1 & 2.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.No.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost
1.	Gas Booster Compressors Package (3X50%)	A5=225	B5	C5	D5=45	E5	F5	$A5 \times C5 + D5 \times F5 = G5$

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	Gas Booster Compressors Package (3X50%)	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

Annexure-5E

Format 01

[illegible]

SERVICE AIR REQUIREMENT

Format 02

[illegible]

INSTRUMENT AIR REQUIREMENT

Format 03

[illegible]



DOCUMENT TITLE COOLING WATER REQUIREMENT AUXILIARIES

DOCUMENT NO. PE-ID-999-179-N001

PROJECT TITLE 400 MW ६ 10% COMBINED CYCLE
POWER PLANT AT RAOZAN, CHATTOGRAM

Page 1 of 1

SL. No.	EQUIPMENT DESCRIPTION	NOS. PER UNIT		DMCW/CW QTY PER		DESIGN PRESSURE FOR EQUIPMENT	PRESSURE DROP (WITHIN T.P. INCL. CONTROL VALVE, PIPE AS APPLICABLE)	TEMPERATURE RISE	MAX./MIN. LIMIT ON ACW WORKING PRESS. (IF ANY)	WHETHER REQMT. CONSUMPTIVE IN NATURE	REMARKS
		WORKING	STANDBY	EQUIPMENT	UNIT						
		NO.	NO.	M ³ /Hr.	M ³ /Hr.	Kg/cm ² (g)	MWC	°C	Kg/cm ² (g)		

NOTES:

1. QUALITY OF COOLING WATER FOR TG AUXILIARIES SHALL BE PASSIVATED DEMINERALISED WATER ($P^H = 8.5$ TO 9.5) WITH DESIGN TEMPERATURE OF DMCW AT COOLERS INLET AS 41°C .
- 2 PLEASE PROVIDE PRESSURE DROPS AND TEMPERATURE RISE TO BE CONSIDERED ACROSS TERMINAL POINTS WHICH SHALL BE INCLUSIVE OF PIPING, VALVES, CONTROL VALVES (IF APPLICABLE), COOLERS ETC.

ANNEXURE-6

(NIT for Heat recovery steam generator & Associated Auxiliaries)



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III.	Vendor Qualification Requirement	2
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V.	Design Specification	3
VI.	Vendor Scope of Supply	3
VI A.	Supervisory Services (Erection and commissioning support)	7
VII.	Special Design Consideration	7
VIII.	C&I Exclusions	7
IX.	Terminal points	8
X.	Drawings and Documents submission for Bid, Post Order and Final As Built	10
XI.	Guarantee Schedule	13
XII.	Utility Requirements	13



I. INTENT OF SPECIFICATION

BHEL is currently working on an enquiry for the supply of 1 No. Outdoor Type, Natural/ Forced Circulation, Unfired, Triple Pressure (Reheat / Non-Reheat type) HRSG for upcoming 400 MW CCPP (1:1:1 Configuration) at Raozan, Chattogram, Bangladesh. BHEL invites offers from prospective vendors for design, supply, erection & commissioning of this HRSG whose technical details are mentioned in subsequent sections.

II. REFERENCE DOCUMENTS

This document must be read along with the following tender documents furnished by M/s. Bangladesh Power Development Board (BPDB), referred as owner hereafter.

- Invitation for International Tender
- Tender Document for Construction Of 400 MW $\pm$ 10% Combined Cycle Power Plant At Raozan, Chattogram (Volume 1 of 2)
- Tender Document for Construction Of 400 MW $\pm$ 10% Combined Cycle Power Plant At Raozan, Chattogram (Volume 2 of 2 – Part A + Part B + Part C)
- Clarifications & Amendments to the tender document furnished by the owner.

III. VENDOR QUALIFICATION REQUIREMENT

The Vendor must meet the Qualification Criteria specified in the following clauses of **Tender Document for Construction Of 400 MW $\pm$ 10% Combined Cycle Power Plant At Raozan, Chattogram (Volume 1 of 2):**

- Clause C: Qualification Criteria of Section –1 (Instruction to Tenderers), Pg.No.8
- Clause C: Qualification Criteria of Section –2 (Tender Data Sheet), Pg.No.40

Vendor must submit past reference list (covering year of supply, Client name, Plant Capacity etc.) of the similar type of projects executed in the last 10 years. Necessary records and documentation must be submitted along with the pre-bid stage offer submitted to BHEL.

In addition to the above clauses vendor must submit end user certificates as per Clause 3.3.1: Basic Equipment Requirements, Pg.No.31 of **Tender Document for Construction Of 400 MW $\pm$ 10% Combined Cycle Power Plant At Raozan, Chattogram (Volume 2 of 2-Part A):**



IV. CODES & STANDARDS

Codes & Standards applicable for the subject enquiry shall be as per the list specified in the tender documents furnished by the owner.

V. DESIGN SPECIFICATION:

Description	Units	Value
Rated Steam Flow at HRSG Outlet (HP, IP, LP, RH)*	TPH	To be decided by vendor to meet the rated STG output
Rated Steam Pressure at HRSG Outlet (HP, IP, LP, RH)*	kg/cm ² (g)	
Rated Steam Temperature at HRSG Outlet (HP, IP, LP, RH)*	deg.C	
Feed Water Temperature at HRSG Inlet (HP, IP, LP)	deg.C	
CRH Pressure at HRSG Inlet* (98% of the STG outlet pressure at 100% Load guarantee case)	kg/cm ² (g)	
CRH Temperature at HRSG Inlet* (0.50 deg C less than the STG outlet temperature at 100% Load guarantee case)	deg.C	
CPH Inlet/ Outlet Temperature	deg.C	
IP Eco outlet feed water flow for fuel gas heater	TPH	
IP Eco outlet feed water temperature for fuel gas heater	Deg C	

*** Applicable only if reheat cycle is offered by the VENDOR.**

VI. VENDOR SCOPE OF SUPPLY:

The HRSG shall be Outdoor, Natural/ Forced Circulation, Unfired, Triple Pressure (Reheat / Non-Reheat type) type suitable for 1:1:1 configuration single shaft arrangement.

Following are the list of major items that come under the vendor's scope of supply:

- HP, IP and LP Steam drums of fusion welded construction, with internals and supports.



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

- Spiral finned HP super heater modules (made up of seamless tubes & inlet/ outlet headers) with inter stage attemperator. Complete attemperator system including piping, fittings, valves, flow elements, controls etc.
- Spiral finned medium pressure re heater modules (made up of seamless tubes & inlet/ outlet headers) with inter stage attemperator. Complete attemperator system including piping, fittings, valves, flow elements, controls etc.
- Spiral finned IP and LP superheaters modules (made up of seamless tubes & inlet/ outlet headers).
- Spiral finned HP, IP and LP evaporators (made up of seamless tubes & inlet/ outlet headers).
- Water walls & headers (if applicable).
- Circulation system consisting of Risers, Collection Headers, Downcomers, Feeders, Distribution Headers.
- Circulating pumps (if required).
- Spiral finned HP, IP & LP economisers, based on applicability (made up of seamless tubes & inlet/ outlet headers).
- Spiral finned Condensate Pre Heater (CPH, made up of seamless tubes & inlet/ outlet headers), if applicable.
- HP/IP/LP Main Steam Line along with Safety Valve, Start-up Vent with silencer, NRV & MSSV with Integral Bypass Valve.
- Feed Water Pipe with NRV and Motorised Isolation Valve (with Integral Bypass Valve) at the HP/IP/LP Economiser Inlet.
- CPH Inlet/ Outlet Motorised Isolation Valves.
- Expansion Bellows to facilitate the penetration of pipes through the HRSG ducting.
- All the hangers & supports required for the heat transfer modules.
- Baffles to prevent gas bypassing the heat transfer sections.
- Gas Splitting arrangement for multi width HRSG to equally distribute the GT Exhaust.
- Vibration Snubbers and bumpers (if required) to prevent distortion of modules.
- Complete gas duct work with necessary expansion joints from HRSG inlet transition duct expansion joint to stack inlet including the expansion joint at stack inlet.
- Gas ducting internal insulation, internal liner & fixing components .
- Boiler integral piping, fittings, valves, drains (including drain headers) and vents as required by boiler code.
- Safety valves with silencers on HP/IP/LP drum, safety valve with silencer on HP/IP/LP superheater and direct water level gauges for HP, IP and LP drums as required by boiler code.



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

- Safety valve for the inlet and outlet line of medium pressure reheater circuit (based on use of RH Circuit).
- Safety relief valve for HP/IP/LP Economiser & CPH.
- Silencers at required locations.
- IP feed control station.
- Electrically operated stack closure damper at HRSG main stack (as per applicability).
- Complete boiler supporting structural steel, foundation bolts and anchor channels.
- Shelter for drum floor & operating floors with instrumentation.
- Module Lifting & Transport Structure.
- Stairs, Platforms and ladders as required.
- Blow down tanks along with blowdown lines, mountings, valves & fitting required.
- One number Chimney for HRSG including lightening arrestor and aviation lamps as per tender,
- One no. Nitrogen blanketing system.
- Equipment Handling Structure (if required).
- All IBR & Non-IBR Piping for the supply / discharge of the utilities from/to the HRSG with associated hangers, supports, pipe racks, insulation & insulation fixing sheet.
- Control Valves & Trip Valves used for the operation of the HRSG.
- Necessary painting.
- Acid Cleaning provision.
- Mechanical Sample Coolers along with pipes, fittings, valves & Cooling water connections.
- Dosing system complete with Mixing Tank, Metering Tank, Isolation Valves Forwarding pumps, NRVs, Safety Valves and suitable connection to the drum.
- HAZOP Study (as per applicability).
- 3D Modelling (as per applicability).
- Motor operated valves
- Flow Nozzles for Main steam and Feed water(all pressure levels)
- Drum shall be provided with 6 Nos tapplings for LT's(3Nos on each side) , 2Nos tapping for Direct water level gauges(DWLG 1No on each side) and 1 Nos tapping for Electronic water level indicator(EWLI).
- All Flow elements.
- All Trip valves and control valves.
- Pipe supporting arrangement and loading inside HRSG island
- 2 out of 3 shall be considered for all trips and controls.
- Instrument tapping's shall be provided along with root valves.
- Control system(DCS/PLC) --- *(Part of Control System NIT (separate document))*



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

- Equipment and cable end lugs and glands
- Equipment Illumination System (including JB, Fixtures, conduits etc)
- All the internal piping within HRSG shall be in the scope of VENDOR.
- Piping between HRSG and TG cycle, following interface piping shall be in the scope of BHEL:
 - HPMS – From HRSG HPMS terminal point to STG inlet stop valve(s)
 - CRH (if applicable) – From STG nozzle to HRSG CRH terminal point
 - HRH (if applicable) – From HRSG HRH terminal point to STG IPT inlet valve(s)
 - IPMS - From HRSG IPMS terminal point to STG IP injection valve
 - LPMS - From HRSG LPMS terminal point to STG LP injection valve
 - Condensate line – From GSC outlet to HRSG CPH inlet terminal point and from HRSG CPH outlet terminal to HRSG LP Eco inlet terminal point.
 - Feed Water suction – From HRSG LP Drum outlet terminal point to HP/IP BFP suction nozzle
 - Feed Water discharge – From HP discharge nozzle to HRSG HP eco inlet terminal point, From IP discharge nozzle to HRSG IP eco inlet terminal point

Note: IPMS (if reheat cycle is offered) – From HRSG IPMS outlet to CRH inlet piping, instrumentation, valves, fittings etc shall be in the VENDOR's scope.

- Special Tools & Tackles.
- Commissioning Spares
- Operation/O&M/Wear & tear spares (during 2-year warranty period).
- Mandatory Spares (as per BPDB list, if applicable).
- All consumables including first fill during 2-year warranty period
- Customer training (Overseas as well as on-site training)
- Submission of national, international standards (as per BPDB specification)
- Erection and commissioning support (Supervision of erection & commissioning by OEM TFA, OEM Expert as per customer specification).

Any other equipment, item which is not mentioned in the above list but required for the completeness of the HRSG as a total, shall be considered in the vendor's scope of supply.

BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engineering coordination, and other charges. Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer, and required as per BHEL's NIT or



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.

VIA. Supervisory Services (Erection and commissioning support):

Supervision of erection & commissioning by OEM expert/ Technical Direction for Installation (TDI) services to be provided as per following:

- 1) Bidders to consider minimum 300 man days for TDI for HRSG & Auxiliaries.
- 2) Bidders to consider minimum 8 mob-demob instances for TDI for Common Generator & Auxiliaries.
- 3) BIDDER to quote Per diem rate and mob-demob charges to be used for evaluation in combination with 1) & 2) above.
- 4) BIDDER to furnish recommended number of man days and number of mob-demob instances for information.
- 5) BIDDER shall confirm that these rates shall be valid even after consumption of the number of days and up to defect liability period by end customer.
- 6) Bidder to fill and submit TDI service details in **Table-1 & 2 (as attached Annexure-1(TDI))** for HRSG & Auxiliaries.

VII. SPECIAL DESIGN CONSIDERATION:

- HRSG Internal Lining and First few rows of heat transfer sections shall be designed to withstand the peak velocity value of GT Exhaust Flow profile.
- Steam drum internals shall be designed so that the total dissolved solids in steam leaving the drum will not exceed 0.1 ppm.
- Use of Materials which are prohibited by the tender documents must be avoided.
- Water Chemistry shall be maintained so as to ensure longevity of the boiler components & to meet the steam quality required at turbine inlet.

VIII. C&I EXCLUSIONS (Considered under BHEL scope)

- All Field Instruments (Pressure gauges, temperature gauges, Pressure transmitter, temperature transmitters, thermocouples, RTDs, Level gauges, Flow transmitters, Level transmitters, CEMS analysers, SWAS Analysers) other than Flow elements, Control valves, trip valves.
- DWLG
- EWLI
- Cables (Branch and Main)-
- Junction boxes



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

- Cable trays (Branch and Main)
- Impulse lines
- Instrument air distribution
- SWGR/MCC
- Above Ground Earthing of the equipment
- Illumination System

IX. TERMINAL POINTS

Sl. No.	Mechanical	
1.	Feed Water	
	HP Section	Suction (common for HP & IP) – From LP drum (within 10m from HRSG tentatively at 8.0 m elevation) Discharge - At the inlet of the ECO isolation valve located within 10m from HRSG tentatively at 8.0 m elevation
	IP Section	At the inlet of the ECO isolation valve located within 10m from HRSG tentatively at 8.0 m elevation
	LP Section	At the inlet of the ECO isolation valve located within 10m from HRSG tentatively at 8.0 m elevation
2.	Main Steam	
	HP Section	At the outlet of MSSV in the MS Line located within 10m distance from the Superheat outlet headers tentatively at 8.0 m elevation
	IP Section	At the outlet of MSSV in the MS Line located within 10m distance from the Superheat outlet headers tentatively at 8.0 m elevation
	LP Section	At the outlet of MSSV in the MS Line located within 10m distance from the Superheat outlet headers tentatively at 8.0 m elevation
3.	Reheat Steam	(if applicable)
	CRH Inlet	At HRSG Re heater Inlet Header tentatively at 8.0 m elevation
	HRH Outlet	At HRSG Re heater Outlet Header tentatively at 8.0 m elevation
4.	Condensate	
	CPH Inlet	At the inlet isolation valve of CPH, which is located within 5m from the CPH inlet header tentatively at 8.0 m elevation
	CPH Outlet	At the outlet isolation valve of CPH, which is located within 5m from the CPH outlet header tentatively at 8.0 m elevation
5.	HP Dosing System	At NRV located within 1m from HP/IP/LP drums
6.	Vents	1m above the highest point in the HRSG



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

7.	Gas Ducts	
	Gas Inlet	At the inlet flange of the HRSG
	Gas Outlet	At the Main Stack outlet
8.	Cooling Water	At One Point near HRSG (VENDOR to specify this location)
	Service Water	At One Point near HRSG (VENDOR to specify this location)
9.	Drain from Blowdown Tank	At the outlet of blow down tank drain at 60°C
10	HRSG Fill Water	At a point near the boiler first column tentatively at 8.0 m elevation
11	IP ECO Extraction for Fuel Gas Heater	At the outlet isolation valve of IP economizer, which is located within 2m from the IP economizer outlet header
12	Spray Water	At a point near the boiler first column
13	Instrument Air/Service Air	At One Point for HRSG (VENDOR to specify this location)

Electrical, Controls and Instrumentation

Electrical

Electrical actuators - Ends at the terminals.

415 V Supply: Motor/ Equipment end TB.

6.6kV Supply: Motor/ Equipment end TB.

220 V Station DC Power Supply: Motor/ Equipment end TB.

24VDC and 240V UPS: At Distribution board.

110/220 V AC Electrical Control Supply: Equipment end TB

Electrical Earthing: At Vendor's Equipment's earthing terminal

Electronic Earthing: As per Vendor's recommendations

Controls & Instrumentation

Test pressure pocket in pressure part - At the root valves

Test temperature pocket in pressure part - Thermowell with cap

Test pressure pocket in non pressure part - At the cap/plug of the opening in the duct

Test temperature pocket in non pressure part -At the cap/plug of the opening in the duct

Temperature element for indication/ control - Thermowell with cap

Transmitter for remote indication/ control - At the root valves

DCS/PLC- At the panel end.



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

X. DRAWINGS AND DOCUMENTS SUBMISSION FOR BID, POST ORDER AND FINAL AS-BUILT

- Documents mentioned in Schedule-C of Tender Document for Construction Of 400 MW $\pm$ 10% Combined Cycle Power Plant At Raozan, Chattogram (Volume 2 of 2-Part B).
- Filled in HRSG Datasheet as per Schedule-B of Tender Document for Construction Of 400 MW $\pm$ 10% Combined Cycle Power Plant At Raozan, Chattogram (Volume 2 of 2-Part B).

Additionally, following Drawings./Documents shall be submitted by the vendor for offer evaluation, Approvals during Post order and Final As-built submission

S. No.	Description	Offer	Post Order	Final As-Built
1	Brief Technical Offer covering all the major items considered in vendors scope of supply	Yes	-	-
2	HRSG G.A Drawing	Yes	Yes	Yes
3	HRSG Water & Steam Circuit P&IDs	Yes	Yes	Yes
4	HRSG Filled in Technical Data sheet	Yes	Yes	Yes
5	HRSG Performance at different GT Loads (Corresponding to different ambient conditions)	Yes	Yes	Yes
6	All the Terminal Point connection Details And terminal point parameters (flow, pressure, temperature at all guarantee points)	Yes	Yes	-
7	Quality Plan (Refer Note-1)	-	Yes	-
8	Recommended Area Classification Drawing	-	Yes	-
9	Proven Track Record with all details	Yes	-	-
10	Special Tools and Tackles	Yes	Yes	Yes
11	Instrument Schedules, , Auto control schemes, HRSG interlocks and protections	-	Yes	Yes
12	Electrical load list (in the attached Format 01 along with the DC Loads, their location, starting current, starting instant etc.)	-	Yes	Yes
13	Cooling water, Service Water requirement, Instrument Air, Service Air requirement (in the attached format 02, 03, 04)	-	Yes	Yes
14	Customer Feedback form of previous executed projects (Min. 2 Nos)	Yes	-	-
15	O&M Manuals including data books, Drawings, Test Certificates – 2 No. CD/DVD and 10 No. hard bound O & M manuals	-	-	Yes
16	As-Built Drawings and Documents- 2 No. CD/DVD	-	-	Yes



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

	and 10 No. hard copies			
17	i. Feed Water pressure at HP Eco inlet terminal point at all guaranteed loads ii. Feed Water pressure at IP Eco inlet terminal point at all guaranteed loads iii. Feed Water pressure at LP Eco inlet terminal point at all guaranteed loads iv. Condensate pressure at CPH inlet terminal point at all guaranteed loads v. Condensate pressure at CPH outlet terminal point at all guaranteed loads vi. IP feed water outlet pressure and temperature from IP eco terminal point for fuel gas heater at all guaranteed loads vii. HP, IP, LP drum inlet nozzle elevation viii. HP, IP, LP drum operating pressure ix. HP, IP, LP Economizer pressure drop x. HP, IP, LP Super heater pressure drop xi. Safety valve set point for HP, IP, LP drums and super heater headers xii. HRSG fill volume from HP, IP, LP economizer to drum xiii. HRSG fill volume from HP, IP, LP drum to stop valve xiv. CPH pressure drop & corresponding flow and fill volume xv. Terminal point location for steam lines, blowdown lines, feed water and CPH line xvi. Design Blowdown quantity for HP, IP & LP drums	Yes	Yes	Yes
18	i. Equipment sizing and arrangement of HRSG. ii. Suggestive layout of critical piping (main steam, cold reheat, hot reheat, LP bypass, HP bypass)	Yes	Yes	Yes
19	i. Allowable forces and moments at turbine nozzles for critical piping (MS, CRH, HRH) ii. Allowable forces and moments at HRSG nozzles for piping (MS, CRH, HRH, Feed Water)	-	Yes	Yes
20	I. Earthing requirement of equipment II. Cable Schedule III. VENDOR Electrical control Philosophy	-	Yes	Yes
21	IV. Mechanical General Arrangement drawings	-	Yes	Yes



ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

	and outline drawings of all the equipment/Machine, foundation outline drawings etc. V. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. VI. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. VII. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. VIII. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. IX. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. X. Codes and standards to be followed. XI. Grade of concrete and steel wherever applicable. XII. Machine/equipment erection philosophy and details. XIII. General Arrangement drawing of HRSG foundation plan, load data including DL, LL, equipment load, seismic, wind, erection and other misc. loads etc along with details of shear keys and anchor bolt assembly. XIV. Any other information/drawings/details besides above required for design of foundations and Project Engineering shall also be provided by the bidder during proposal or contract stage engineering.			
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Note:

- 1) Vendor to furnish Quality plan in the event of order placement for BHEL's & Owner's approval. HRSG components are subject to BHEL's/ BHEL TPI's & Owner's Inspection at vendor's works. Vendor shall provide all test facilities at vendor works for carrying out the same.



XI. GUARANTEE SCHEDULE:

Following information may be noted by the VENDOR for preparation of Heat & Mass Balance diagram and finalizing the guarantees: -

1. MS line pressure drop – 4% of HPMS pressure at HRSG terminal point at 100% guaranteed load (for other loads, VENDOR to calculate accordingly)
2. RH circuit pressure drop (in case of reheat cycle only) – 10% of the HP Turbine exhaust pressure at 100% guaranteed load (for other loads, VENDOR to calculate accordingly)
3. Reheater pressure drop (in case of reheat cycle only) – 5% of the HPT exhaust pressure at 100% guaranteed load (for other loads, VENDOR to calculate accordingly)
4. Fuel Gas Heater flow may be suitably be accounted by the VENDOR for preparation of Heat & Mass Balance diagram.

Guarantees shall be furnished as per the Guarantee Schedule furnished as per **Schedule-A of Tender Document for Construction Of 400 MW $\pm$ 10% Combined Cycle Power Plant At Raozan, Chattogram (Volume 2 of 2-Part B).**

XII. UTILITY REQUIREMENTS (to be furnished in attached Formats):

Following values of utilities required at Vendor Terminal Point (Refer Terminal Points mentioned elsewhere in this document) must be filled and submitted by the vendor along with the technical offer:

S. No.	Utility	Parameter	Value required at vendor terminal point (To be filled by Vendor)		
			Minimum	Normal	Maximum
1	Service Air	Flow (TPH)			
		Pressure (mmwc)			
2	Instrument Air	Flow (TPH)			
		Pressure (mmwc)			
3	Service Water	Flow (TPH)			
		Pressure (kg/cm ²)			
4	Cooling Water	Flow (TPH)			
		Temperature (°C)			
		Pressure(kg/cm ²)			

ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

Format 01
Electrical Load List

Format 01

[illegible]

ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

Format 02
Service Air Requirement

Format 02

SERVICE AIR REQUIREMENT

[illegible]



Format 03
Instrument Air Requirement

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ANNEXURE - 6 (Technical Requirements for Heat Recovery Steam Generator (HRSG))

Format 04

Cooling Water Requirement

[illegible]

**Annexure-1 (TDI)****TDI Service details for HRSG & its Auxiliaries**

Bidder to fill and submit the information requested in the below **Table-1 & 2**.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.N o.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost
1.	HRSG	A1=300	B1	C1	D1=8	E1	F1	$A1 \times C1 + D1 \times F1 = G1$

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	HRSG	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

ANNEXURE-7

(NIT for Distributed control system & Associated Auxiliaries)

BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project

ANNEXURE - 7 (Technical requirements for DCS Package)

Scope	Distributed Control System (DCS): A fully integrated unitary DCS has to be supplied for monitoring, control, display, alarm and recording of selected physical and electrical parameters associated with all relevant plant areas. All monitoring and control interactions shall be done via VDU, keyboard and Mouse/Track ball. No conventional control desk equipment shall be required in the central control room (CCR). The controls must be completely shared in Hardware and Software. Interconnections between the controllers shall be done via a redundant data bus. All signals shall be available on redundant data bus. The DCS must be reliable and unique, covering all automation functions of the power plant, which are: 1) HRSG control and protection 2) Turbine control and protection including Turbine supervisory instruments. 3) Hydraulic operated Diverter Damper control (GT Exhaust System). 4) Generator protection, excitation, voltage regulation and synchronisation systems. 5) Auxiliary system control. 6) Balance of plant control.
Notes	Details of control system requirements (i.e I/O Count,DCS sizing,Controller Grouping etc.) which has to be included in the unified DCS for the systems/packages which are not part of this NIT but in the scope of BHEL (i.e. various BOP packages in BHEL scope). Refer attachments 1 & 2 for inputs.

ANNEXURE

Sl. No.	Description	Confirmation from Vendor (YES/ NO)
Section-2	Scope	
1	Control and Protection Panels shall be provide as per Clause 2.9, Vol 2 of 2 Part-A.	
2	Training shall be provided as per end customer specification Refer Clause 2.15 in Section 2 of (Vol-2 of 2, PART A) document Refer Schedule-J of VOLUME 2 OF 2, PART B document	
3	Submission of Engineering Data shall be as per end customer specification. Refer Clause 2.16 in Section 2 of (Vol-2 of 2, PART A) document	
4	Testing of DCS system shall be as per end customer specification. Refer Clause 2.18 in Section 2 of (Vol-2 of 2, PART A) document	
5	Commisioning of DCS system shall be as per end customer specification. Refer Clause 2.19 in Section 2 of (Vol-2 of 2, PART A) document	

Sl. No.	Description	Confirmation from Vendor (YES/ NO)
6	O&M During Warranty Period for DCSsystem shall be as per end customer specification. Refer Clause 2.20 in Section 2 of (Vol-2 of 2, PART A) document	
7	Spare Parts and consumables during Warranty Period for DCSsystem shall be as per end customer specification. Refer Clause 2.23 in Section 2 of (Vol-2 of 2, PART A) document	
8	Special Maintenance Tools (if any) for DCSsystem shall be provided as per end customer specification. Refer Clause 2.24 in Section 2 of (Vol-2 of 2, PART A) document.	
9	Remote Monitoring System shall be provided as per end customer specification. Refer Clause 2.29 in Section 2 of (Vol-2 of 2, PART A) document.	
10	Simulator for Power Plant operation Training shall be provided as per end customer specification. Refer Clause 2.30 in Section 2 of (Vol-2 of 2, PART A) document.	
Section-7	Generator and Ancillary Equipment	
1	Exciter and Automatic Voltage Regulator shall be provided as per Clause 7.2 ,Vol 2 of 2 Part-A.	
Section-11	Control and Protection.	
1	Micro-Processor based Control & Protection System shall be provided as per Clause 11.1,Vol 2 of 2 Part-A.	
2	Local Controls shall be provided as per Clause 11.2 ,Vol 2 of 2 Part-A.	
3	GAS/ STEAM TURBINE GENERATING UNIT PROTECTION shall be provided as per Clause 11.3,Vol 2 of 2 Part-A.	
4	GAS TURBINE/ HRSG/ STEAM TURBINE GENERATING REMOTE UNIT shall be provided as per Clause 11.4,Vol 2 of 2 Part-A.	
5	INSTRUMENTATION AND CONTROLS shall be provided as per Clause 11.9,Vol 2 of 2 Part-A.	
6	Distributed Control System (DCS) shall be provided as per Clause 11.12,Vol 2 of 2 Part-A.	

Sl. No.	Description	Confirmation from Vendor (YES/ NO)
7	A fully integrated unitary DCS has to be supplied for monitoring, control, display, alarm and recording of selected physical and electrical parameters associated with all relevant plant areas. All monitoring and control interactions shall be done via VDU, keyboard and Mouse/Track ball. No conventional control desk equipment shall be required in the central control room (CCR). The DCS must be reliable and unique, covering all automation functions of the power plant, which are: a) HRSG control and protection. b) Turbine control and protection including Turbine supervisory instruments. c) Hydraulic operated Diverter Damper control (GT Exhaust System). d) Generator protection, excitation, voltage regulation and synchronisation systems. e) Auxiliary system control. f) Balance of plant control. The co-ordination necessary to achieve this objective shall be achieved by the provision of a single integrated control system, encompassing the entire contract scope. It shall be microprocessor based and use state of the art Distributed Control System (DCS) technology. The Contractor shall provide the necessary means of communication/interfacing between the third party systems and the DCS to facilitate the proper and efficient control of the whole Combined Cycle Power Plant. Refer Clause 11.11.1 in Section 2 of (Vol-2 of 2, PART A) document	
8	DCS system shall be designed as per Clause 11.11.2, Vol 2 of 2 Part-A.	
9	Acceptability of Control Systems shall be as per end customer specification Clause 11.11.3, Vol 2 of 2 Part-A.	
10	Acceptability of the Control System Design Group shall be as per end customer specification Clause 11.11.4, Vol 2 of 2 Part-A.	
11	Control Room Design Review shall be as per end customer specification Clause 11.11.5, Vol 2 of 2 Part-A.	
12	Central Control Room Operator Interface shall be provided as per Clause 11.11.6, Vol 2 of 2 Part-A.	
13	Combined cycle power plant controls shall be designed as per end customer specification Clause 11.11.6.3, 11.11.7, Vol 2 of 2 Part-A.	
14	Control System Technology and Design shall be as per end customer specification Clause 11.11.8, Vol 2 of 2 Part-A.	

Sl. No.	Description	Confirmation from Vendor (YES/ NO)
Section-19	Test and Inspection	
1	The following tests for the control and protection system shall be performed at the workshop. - General inspection - Measurement of insulation resistance - Dielectric withstands voltage test - Performance test of relay Error test of meter - Sequential operation test Refer Clause 19.2.8 in Section 19 of (Vol-2 of 2, PART A) document.	
Section-22	Spare Parts and Consumables	
1	Spares & consumables related to control system during Warrantee period shall be provided as per Clause 22.1 in Section 22 of (Vol-2 of 2, PART A) document.	
Section-23	Remote Monitoring System	
1	Remote Monitoring System shall be provided as per entire Clause 23 in Section 23 of (Vol-2 of 2, PART A) document.	
General		
1	All other general terms and conditions for the NIT shall be as applicable.	
2	Drawings, schedules and documents as applicable as per Section-B shall be prepared and submitted by vendor.	
3	Submission of national, international standards (as per specification)	
4	BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engineering coordination, and other charges. Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer, and required as per BHEL's NIT or required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.	
5	During Warranty , contractor has to supply complete spares including O&M,normal wear & tear , consumables etc. required during 2 years operation.Bidder has to submit the detailed list with the tender.In case there are any spare items required during warranty period which are not part of the list then also BIDDER has to supply those spare parts.	
6	As part of EPC contract , the BIDDER shall be liable for providing all spares,consumables and expertise service for day to days, unscheduled, breakdown maintenance of complete combined cycle power plant including DCS during defect liability period from the operational acceptance certificate of plant.	
7	Special tools and tackles for BIDDER's scope shall be handed over to OWNER as per Vol-1 of 2 and Vol-2 of 2 Part-A Pg 24.	
8	Vendor shall comply to all additional terms and conditions as per Section-C of end customer specifications	

Sl. No.	Description	Confirmation from Vendor (YES/ NO)
9	Erection and commissioning support Supervision of erection & commissioning by OEM expert/ Technical Direction for Installation (TDI) services to be provided as per customer specification: 1) Bidders to consider minimum 180 man days for TDI for DCS package. 2) Bidders to consider minimum 6 mob-demob instances for TDI for DCS package. 3) BIDDER to quote Per diem rate and mob-demob charges to be used for evaluation in combination with 1) & 2) above. 4) BIDDER to furnish recommended number of man days and number of mob-demob instances for information. 5) BIDDER shall confirm that these rates shall be valid even after consumption of the number of days and up to defect liability period by end customer. 6) Bidder to fill and submit TDI service details in Table-1 & 2 (as attached/ below Annexure-1(TDI)) for DCS package.	

Annexure-1 (TDI) (TDI Service details for DCS package)
Bidder to fill and submit the information requested in the below Table-1 & 2.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days (**A7=180**) and mob-demob instances (**D7=6**) and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.No.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs.(as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate converted in Rs.(as per BHEL ITB clause 16)	Total Cost
1.	DCS	A7	B7	C7	D7	E7	F7	$A7 \times C7 + D7 \times F7 = G7$

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mod Demob instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	DCS	BY BIDDER	BY BIDDER	BIDDER TO ATTACH LIST

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, meals, etc. and associated pocket expenses shall be in BIDDER's scope

ANNEXURE - 7 (Technical requirements for DCS Package)

BOQ for the systems to be controlled from Main Plant DCS

A	Location/ Name	Drive Type	Quantity(nos)
1	CW System	Bi-Directional -with Integral Starter	10
2		Modulating	--
3		HTUD	3
4		LTUD	--
5	ACW System	Bi-Directional -with Integral Starter	25
6		Modulating	--
7		HTUD	3
8		LTUD	3
5	DM CW System	Bi-Directional -with Integral Starter	10
6		Modulating	--
7		HTUD	5
8		LTUD	--
9	Plant water system	Bi-Directional -with Integral Starter	30
10		Modulating	--
11		HTUD	5
12		LTUD	20
13	Service water system	Bi-Directional -with Integral Starter	5
14		Modulating	--
15		HTUD	--
16		LTUD	5
17	Potable water system	Bi-Directional -with Integral Starter	5
18		Modulating	--
19		HTUD	--
20		LTUD	5
21	Chemical dosing System	Bi-Directional -with Integral Starter	10
22		Modulating	15
23		HTUD	--
24		LTUD	15
25	Cooling tower	Bi-Directional -with Integral Starter	4
26		Modulating	--
27		HTUD	--
28		LTUD	15
29	Main Plant(Regenerative)	Bi-Directional -with Integral Starter	150
30		Modulating	60
31		HTUD	10
32		Solenoid	20
33		LTUD	50

ANNEXURE - 7 (Technical requirements for DCS Package)			
BOQ for the systems to be controlled from Main Plant DCS			
B	Location/ Name	Input/ Output type	Quantity(nos)
1	CW System	Analog Input(4-20mA)	80
2		RTD	50
3		Analog Output	--
4		Binary Input	20
5		Binary Output	--
6	ACW System	Analog Input(4-20mA)	70
7		RTD	40
8		Analog Output	--
9		Binary Input	--
10	DM CW System	Binary Output	--
11		Analog Input(4-20mA)	70
12		RTD	60
13		Analog Output	--
14	Plant water system	Binary Input	10
15		Binary Output	--
16		Analog Input(4-20mA)	50
17		RTD	50
18	Service water system	Analog Output	--
19		Binary Input	10
20		Binary Output	--
21		Analog Input	20
22	Potable water system	RTD	--
23		Analog Output	--
24		Binary Input	--
25		Binary Output	--
26	Chemical dosing System	Analog Input	20
27		RTD	--
28		Analog Output	--
29		Binary Input	--
30	Cooling Tower	Binary Output	--
31		Analog Input	15
32		RTD	--
33		Analog Output	--
34	Main Plant(Regenerative)	Binary Input	50
35		Binary Output(24VDC)	90
36		Analog Input	--
37		RTD	20
38	Main Plant(Regenerative)	Analog Output	--
39		Binary Input	60
40		Binary Output	--
41		Analog Input	500
		RTD	300
		T/Cs	90
		Analog Output	--
		Binary Input	500
		Binary Output	--

ANNEXURE - 7 (Technical requirements for DCS Package)			
BOQ for the systems to be controlled from Main Plant DCS			

C	Offsite Package Name	Drive Type	Quantity(nos)
1	DM Plant	Bi-Directional -with Integral Starter	--
2		Modulating	5
3		SOL-S	190
4		LTUD	40
5	PT Plant	Bi-Directional -with Integral Starter	5
6		Modulating	--
7		SOL-S	40
8		LTUD	30
5	ETP	Bi-Directional -with Integral Starter	5
6		Modulating	--
7		SOL-S	--
8		LTUD	45
9	CW Treatment Plant	Bi-Directional -with Integral Starter	--
10		Modulating	--
11		SOL-S	--
12		LTUD	20
13	CLO2 Generator	Bi-Directional -with Integral Starter	--
14		Modulating	--
15		SOL-S	50
16		LTUD	30
17	CAS	Bi-Directional -with Integral Starter	--
18		Modulating	--
19		SOL-S	10
20		HTUD	5
21	HVAC	LTUD	5
22		Bi-Directional -with Integral Starter	70
23		Modulating	20
24		SOL-S	--
25		LTUD	70

ANNEXURE - 7 (Technical requirements for DCS Package)			
BOQ for the systems to be controlled from Main Plant DCS			

D	Offsite Package Name	Input/ Output type	Quantity(nos)
1	DM Plant	Analog Input(4-20mA)	110
2		RTD	--
3		Analog Output	--
4		Binary Input	50
5		Binary Output	50
6	PT Plant	Analog Input(4-20mA)	70
7		RTD	--
8		Analog Output	--
9		Binary Input	60
10		Binary Output	50
11	ETP	Analog Input(4-20mA)	70
12		RTD	--
13		Analog Output	--
14		Binary Input	60
15		Binary Output	20
16	CW Treatment	Analog Input(4-20mA)	50
17		RTD	--
18		Analog Output	--
19		Binary Input	30
20		Binary Output	20
16	CLO2 Generator	Analog Input(4-20mA)	60
17		RTD	--
18		Analog Output	--
19		Binary Input	50
20		Binary Output	20
16	CAS	Analog Input(4-20mA)	60
17		RTD	50
18		Analog Output	--
19		Binary Input	60
20		Binary Output	20
21	HVAC	Analog Input(4-20mA)	50
22		RTD	30
23		Analog Output	20
24		Binary Input	60
25		Binary Output	20

400MW RAOZAN CAPP PROPOSAL

ENGINEERING INPUTS FOR ELECTRICAL CONTROL SYSTEM [DOC. NO. PE-DC-RAOZAN-510-E002 REV 0 DATED 29/04/2020]

1.0 For electrical system [OTHER THAN MOTOR FEEDERS] of main plant, two types of controls systems are envisaged:

- CRT Control System [DDCMIS based]
- Hardwired Control System [Electrical Control Board]

Motor control is part of Process Control.

2.0 CRT Control System [DDCMIS based]

Following controls are envisaged in this system:

1. Closing and tripping of GT EHV Breaker
2. Dead bus closing, synchronising (where applicable) and tripping of 6.6kV Breakers of Unit Switchboard, 415V Breakers of main plant [All PCC Breakers, MCC I/C, B/C] ;
3. Trip Selection for planned changeover for 6.6kV Unit Switchboard & 415V switchgear of main plant;
4. Synchronising and tripping of Generator Circuit Breaker;
5. Field Breaker Close/Trip;
6. Excitation System Channel selection;
7. Excitation Lower/Raise Control;
8. Excitation on/off;
9. Emergency DG Start/Stop control;
10. Emergency DG speed & voltage Lower/Raise control;
11. GT OLTC Lower/Raise control;

[Circuit Breaker Controls for Motor feeders are part of Process control system].

In addition to above controls, facilities for status indication & mimic diagrams of electrical system, alarm annunciations, metering of required electrical parameters for generator are also envisaged.

All interlocks for permissive closing, tripping, synchronising, and changeover functions are realized in DDCMIS. For permissive closing conditions related to circuit breaker healthiness, hardwired contacts available in Circuit Breaker are directly used.

Protection trip is effected directly from hardwired trip relay contacts.

I/O points requirements for CRT Controls for main plant electrical controls system are given in **Annexure-I. [The requirement given is for one module consisting of 1 GTG and 1 STG unit].**

400MW RAOZAN CAPP PROPOSAL

ENGINEERING INPUTS FOR ELECTRICAL CONTROL SYSTEM [DOC. NO. PE-DC-RAOZAN-510-E002 REV 0 DATED 29/04/2020]

3.0 Electrical Control Board [ECB]

ECB is an hardwired control board [located in UCR], envisaged for following functions:

1. Mimic Diagram for Generator Circuit, 6.6kV Unit Switchboard, 415V GT PMCC & 415V STG PMCC & 415V Emergency switchboard;
2. Metering for Generator. Refer electrical system of customer's specification
3. Generator Excitation system metering, control & indication;
4. Breaker off/on/auto trip indication for circuit breakers forming part of mimic;
5. Emergency DG metering, start/stop, speed & voltage control;
6. Manual with check synchronism facility for:
 - Generator Circuit Breaker;
 - GT HV CB
 - Breakers associated with Emergency DGThe facilities include common check synchronising relay, synchronising meters, synchroscope & indicating lamps. Synchronising selector & control switches are also envisaged. All logic/interlocking for this purpose is built in DDCMIS.
7. Auto synchronising for Generator [Auto Synchroniser is part of ATRS];
8. Closing and tripping of EHV circuit breakers
9. Tripping of all breakers forming part of the mimic [for which synchronising/closing facility is provided on ECB];
10. Alarm Annunciation facia windows.

4.0 Transducer & AVT Panel [T&AVT Panel]

Electrical Panel (located in CER) contains the following:

1. Transducers
2. Auxiliary Voltage Transformers for synchronizing;

Requirement of devices for ECB & T&AVT Panel is given in Annexure-II. [The requirement given is for module consisting of 1 GTG and 1 STG unit].

IMPORTANT NOTE:

BOM IS GIVEN IN ANNEXURE-I AND ANNEXURE-II IS FOR ONE MODULE ONLY.

400MW RAOZAN CCPP PROPOSAL

ENGINEERING INPUTS FOR ELECTRICAL CONTROL SYSTEM [DOC. NO. PE-DC-RAOZAN-510-E002 REV 0 DATED 29/04/2020]

Annexure-I

TENTATIVE REQUIREMENT FOR CRT CONTROL SYSTEM [FOR MODULE CONSISTING OF 1GTG PLUS 1STG UNIT]

1. **BINARY INPUT & OUTPUTS:**

TOTAL NUMBER OF POINTS: **1250**

SOE POINTS: **200**

2. **ANALOGUE INPUTS:**

NUMBER OF POINTS: **150**

3. **INTERPOSING RELAY PANEL:**

ONE NUMBER INTERPOSING RELAY PANEL HOUSING ONE LOT OF INTERPOSING RELAYS [TYPE 'RE302' OF JYOTI MAKE OR EQUIVALENT].

400MW RAOZAN CCPP PROPOSAL

ENGINEERING INPUTS FOR ELECTRICAL CONTROL SYSTEM [DOC. NO. PE-DC-RAOZAN-510-E002 REV 0 DATED 29/04/2020]

Annexure-II

TENTATIVE REQUIREMENT OF DEVICES FOR ECB **[FOR MODULE CONSISTING OF 1GTG PLUS 1STG UNIT]**

SL.NO.	DEVICE	BRIEF DESCRIPTION	QUANTITY
A: FRONT MOUNTED DEVICES			
01	DIGITAL DISPLAY MODULE	3½ DIGIT, SEVEN SEGMENT LED DISPLAY, CHARACTER HEIGHT 10 MM	40
02	ANALOG DISPLAY MODULE		5
02	SYNCHRONISING METERS	ANALOGUE, 240° SCALE, 96X96 SIZE	4
03	SYNCHROSCOPE	ANALOGUE, 240° SCALE, 144X144 SIZE	1
04	SWITCH POSITION INDICATOR	FOR OPEN/CLOSE POSITION DISPLAY OF CIRCUIT BREAKERS / ISOLATORS	12
05	CONTROL SWITCH	TRIP - NEUTRAL - CLOSE POSITIONS, SPRING RETURN TO NEUTRAL	2
06	KEY-OPERATED SELECTOR SWITCH	THREE POSITION, LOCKABLE, STAYPUT TYPE WITH KEY REMOVABLE IN OFF POSITION [SYN. MODE SELECTOR]	2
08	AMMETER / VOLTMETER SELECTOR SWITCH	FOUR POSITION, NON-LOCKABLE, STAYPUT TYPE	10
09	PUSH-BUTTON MODULE WITH LEDs	WITH TWO PUSH-BUTTONS, TWO LEDs	10
10	PUSH-BUTTON MODULE WITH LEDs	WITH THREE PUSH-BUTTONS, THREE LEDs [TRIP SELECTION]	2
11	PUSH-BUTTON MODULE	WITH TWO PUSH-BUTTONS	8
12	RECESSED PUSH-BUTTON MODULE	WITH ONE PUSH-BUTTON	8
13	ILLUMINATED PUSH BUTTON MODULE	WITH ONE PUSH-BUTTON	10
14	RECTANGULAR LED MODULE	WITH TWO LEDs	10
15	RECTANGULAR LED	WITH THREE LEDs	10
16	ROUND LED	WITH ONE LED	10

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ENGINEERING INPUTS FOR ELECTRICAL CONTROL SYSTEM [DOC. NO. PE-DC-RAOZAN-510-E002 REV 0 DATED 29/04/2020]

17	MIMIC DIAGRAM	TO REPRESENT GENERATOR, GCB, GT & UAT CIRCUIT, EHV CIRCUIT, 6.6KV & 415V CIRCUITS.	ONE SET
18	ANNUNCIATION SYSTEM	COMPLETE IN ALL RESPECTS FOR 120 WINDOWS [TOTAL FOR TRIP & NON-TRIP], INCLUDING HOOTER, BUZZER AND ALARM ACCEPT / RESET / TEST/ SILENCE PUSH-BUTTONS	ONE SET
19	LABELS	APPROPRIATE FOR VARIOUS DEVICES & MIMIC DIAGRAM	ONE SET
B: INTERNALLY MOUNTED DEVICES			
20	CHECK SYNCHRONISING RELAY	TYPE `SKE` OF ALSTOM	1
21	AUX. & GUARD RELAY FOR CHECK SYNCHRONISING RELAY	TYPE `VAA11` OF ALSTOM	2
22	INTERPOSING RELAY	TYPE `RE301` OF JYOTI/EQVT.	6
23	SUPPLY SUPERVISION RELAY	FOR 220V DC, 24V DC (DUPLICATE SUPPLIES)	6
24	SUPPLY SELECTOR SWITCH	FOR 220V DC, 24V DC	2
25	PANEL ILLUMINATION & SPACE HEATING ARRANGEMENT	COMPLETE IN ALL RESPECTS	ONE PER SECTION
26	VOLTAGE SELECTOR SWITCH FOR GENERATOR SYNCHRONISING	SIX POSITION, NON-LOCKABLE, STAYPUT TYPE	3

TENTATIVE REQUIREMENT OF DEVICES FOR T&AVT PANEL **[FOR MODULE CONSISTING OF 1GTG PLUS 1STG UNIT]**

SL.NO.	DEVICE	BRIEF DESCRIPTION	QUANTITY
1	TRANSDUCER	FOR ELECTRICAL PARAMETERS, 4-20 mA, DUAL OUTPUT TYPE	60
2	SUPPLY SUPERVISION RELAY	FOR 240V UPS (DUPLICATE SUPPLIES)	3

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ENGINEERING INPUTS FOR ELECTRICAL CONTROL SYSTEM [DOC. NO. PE-DC-RAOZAN-510-E002 REV 0 DATED 29/04/2020]

3	SUPPLY SELECTOR SWITCH	FOR 240V UPS	1
4	PANEL ILLUMINATION & SPACE HEATING ARRANGEMENT	COMPLETE IN ALL RESPECTS	ONE PER SECTION
5	AUXILIARY VOLTAGE TRANSFORMER	LOW VOLTAGE [110V], SINGLE PHASE, RESIN CAST TYPE, FOR SYNCHRONISING CIRCUIT	12

NOTE : RAOZAN CUSTOMER SPECIFICATION TO BE FOLLOWED IN CONJUNCTION OF THIS INPUT.

ANNEXURE-8
**(NIT for BFP Pump, Condensate
Extraction Pump, Cooling Water
Pump & Associated Auxiliaries)**

ANNEXURE 8- PUMPS (BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
Sec-A	Boiler Feed Pump (BFP)	
1	Pumps OEM's major scope of supply, services for Pumps shall be as indicated below and conforming to end customer Specifications which are part of the enquiry documents (End customer Specification "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721" is enclosed)	
2	The boiler feed water pump of steam turbine generating plant shall be composed of 2 x 100% or 3 x 50% capacity(plus a margin to cover boiler swing) motor driven pumps	
3	Each pump shall be horizontal, multi-stage, centrifugal type. Provision shall be made for standby pump to run automatically on failure of the running pump. Pump shall be designed for continuous operation at the specified parameters.	
4	Base plate/ foundation equipments in PUMPs OEM scope of supply including .instruments are to be supplied by Pump OEM and all the instruments shall be mounted on a Local Gauge Board, which in turn shall be mounted on the pump base plate.	
5	Pumps shall be capable of operating on the minimum recirculation flow for extended periods of time.Pumps shall be capable of operating satisfactorily either alone or in parallel with each other. Difference in flows handled by the two pumps when operating in parallel shall not be more than 5% of the flow through any one pump.	
6	Pumps shall have stable performance characteristics at the operating speed and the discharge heads shall continuously increase with the decreasing flow through the points of minimum flow. The head rise from design to shut off shall be minimum 15% and maximum 30% of the TDH developed at the pump design point.	
7	The pumps shall be capable of with standing reverse rotation due to failure of discharge NRV with out causing any damage to bearings and mechanical seals.	
8	The rated pressure of the feed pump should be derived from the system resistance of the feed system at rated feed flow. This system resistance shall include a static portion, incorporating the drum design pressure, the pressure drop through the feed regulating valve and the height of the economizer.	
9	Each boiler feed pump shall be equipped with a minimum flow re-circulation system,consisting of a flow orifice, differential pressure transmitters and control valves. Recirculation water shall be returned to the Deaerator	
10	The feed water shall be circulated in each heat recovery steam generator drum by the circulating pump. The circulating pump shall take suction from the drum and shall discharge through the evaporator back to the drum. Each drum shall be provided with two local level gauges and two level transmitters. A level transmittershall send a signal to the level controller and to a recorder	
11	In the main header, a pressure transmitter shall indicate header pressure while a pressure switch shall be used to automatically initiate operation of a standby pump.Each boiler feed pump shall be equipped with a minimum flow re-circulation system, consisting of a flow orifice, differential pressure transmitters and control valves. Recirculation water shall be returned to the Deaerator	
12	Equipment end cable lugs and glands	
13	Equipment Enclosure Illumination System(including JB, Fixtures, conduits etc)	

BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project
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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
14	Terminal Point for BFP: 1. Piping: Suction and discharge nozzle. If BFP is with booster pump, then piping between Booster pump discharge & BFP suction shall be BHEL scope. 2. Utilities: Cooling water, Service Water, IA, SA: shall be provided at one point (OEM to specify location) 3. Electrical: a) 415 V Supply: Motor/ Equipment end TB. b) 6.6kV Supply: Motor/ Equipment end TB. c) 220 V Station DC Power Supply: Motor/ Equipment end TB. d) 24 V DC Power supply e) XXX V AC UPS Power Supply for UPS at distribution board(ACDB). f) 110/220 V AC Electrical Control Supply: Equipment end TB g) Instrumentation Cable: EDN/HPEP to comment h) Electrical Earthing: At Vendor's Equipment's earthing terminal i) Electronic Earthing: as per OEM recommendation for control system. j) Equipment Illumination Power Supply(if required): At one location near BFP.	
	CONDENSATE EXTRACTION PUMP (CEP)	
15	Pumps OEM's major scope of supply, services for Pumps shall be as indicated below and conforming to end customer Specifications which are part of the enquiry documents (End customer Specification "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721" is enclosed)	
16	The Contractor shall supply 2 x 100% or 3 x 50% capacity multistage, free suction centrifugal condensate pump, each complete with mounting flange, inner assemble, driving motor coupling and standard accessories for each turbine unit. The pumps shall be identical and all parts interchangeable	
17	The pumps shall have continuously rising head capacity characteristics. The discharge pressure shall be selected so that the pumps will meet the pump the design flow pressure drop requirements.	
18	The pumps shall be constructed of materials specially chosen to resist deterioration by pitting, or corrosion.	
19	All parts subject to wear shall be fitted with renewable liners, and all bearings shall be automatically lubricated.	
20	The pump gland and suction valve shall be suitable sealed to avoid the ingress of oxygen into the condensate. An emptying connection complete with drain piping shall be provided on the feed piping between the extraction pump discharge valve and the ejectors if supplied. A suitable strainer shall be provide to prevent any foreign matter being discharged from the extraction pumps to the feed system during the initial commissioning period.	
21	Equipment end cable lugs and glands	
22	Equipment Enclosure Illumination System(including JB, Fixtures, conduits etc)	

BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project
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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
23	Terminal Point for CEP: 1. Piping: Suction and discharge nozzle 2. Utilities: Cooling water, Service Water, IA, SA: shall be provided at one point (OEM to specify location) 3. Electrical: a) 415 V Supply: Motor/ Equipment end TB. b) 6.6kV Supply: Motor/ Equipment end TB. c) 220 V Station DC Power Supply: Motor/ Equipment end TB. d) 24 V DC Power supply e) XXX V AC UPS Power Supply for UPS at distribution board(ACDB). f) 110/220 V AC Electrical Control Supply: Equipment end TB g) Instrumentation Cable: EDN/HPEP to comment h) Electrical Earthing: At Vendor's Equipment's earthing terminal i) Electronic Earthing: as per OEM recommendation for control system. j) Equipment Illumination Power Supply(if required): At one location near CEP.	
	COOLING WATER PUMP (CWP)	
24	Pumps OEM's major scope of supply, services for Pumps shall be as indicated below and conforming to end customer Specifications which are part of the enquiry documents (End customer Specification "TENDER INQUIRY NO. 27.11.0000.101.14.008.19-6721" is enclosed)	
25	Condenser cooling water and cooling water for closed loop heat exchangers is supplied by 2 x 100% or 3 x 50% capacity horizontal/ vertical, circulating water pumps located in the pump house adjacent to cooling tower basin. Auto Changeover system among the pumps shall be provided.	
23	The circulating water pumps shall take suction from Cooling Tower basin and feed the cooling water to the condenser and cooling water to closed loop heat exchangers.	
28	Each water cooling pump shall be furnished complete with all accessories including electric motor drive, non-reverse rotation shaft couplings, baseplates, soleplates and all other accessories as required for a complete unit. The pump sets shall be so designed that they are capable of operating under reverse rotation, continuously. The basis to be taken is the case of full delivery pressure with fully open combined shut-off non-return valve. Reverse rotation protection (instrumentation) has to be provided	
30	Sufficient spares required for commissioning as per Pump OEM experience/recommendation & furnish the list for the same. If however, any additional spares is consumed over and above the quoted commissioning spares, during commissioning, the same shall be provided free of cost, by the Pump OEM. Any leftover spares after commissioning shall be handed over to the owner.	
31	Pump OEM shall provide all spares & consumables whether listed or not in the contract for smooth operation of the plant during Defect Liability Period. During the Defect Liability Period, Pump OEM shall also provide normal operation Refer Schedule-F of VOLUME 2 OF 2, PART B document	

BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project
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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
32	Tests and Inspections shall include but not limited to: i) Performance shall be carried out on each pump at rated speed to demonstrate Flow Vs head, Flow Vs Power, and Flow vs. efficiency. Measurement shall be done on at least eight (8) different points from shut off point to 120% flow. Test tolerances shall be as per HIS. No negative tolerance on head and efficiency is permitted. Vibration and noise levels shall be measured during the performance testing. ii) Vibration level shall not exceed the satisfactory limits specified for group "T" machines of VDI2056. Sound pressure level at a distance of 1.5 meters above floor level in elevation and 1 meter horizontally from the base of equipment shall not be more than 85 dba iii) Bearing temperatures and mechanical seal performance shall be recorded during the performance testing. iv) NPSH(R) test shall be carried out on one pump for 3% and 1% head drop condition to determine Flow vs. NPSH(R) curve. Measurement shall be done at least 4 different flows i.e. 60%, 80%, 100% and 120%. v) Strip down examination for the pump shall be carried out on one pump to check for damage/rubbing of components after carrying out performance test & NPSH (R) test.	
33	Pump OEM to submit deviations (if any) along with price implication in case of withdrawal Refer format Schedule-G of (Vol-2 of 2, PART B) document	
34	Pump OEM to fill and submit performance guarantees in Schedule-A of VOLUME 2 OF 2, PART B document	
35	PUMP OEM to fill and submit Technical Datasheet (Schedule-B) of VOLUME 2 OF 2, PART B document	
36	Pump OEM shall conduct site performance test for Pump (not just supervision) with all necessary instruments. All the instrumentation, devices (with necessary calibration) and services required for conductance of performance test should be included in Pump OEM scope. Pump OEM should provide procedure for measuring parameters during test at site as required for proving guarantees and as per end customer specification. Refer Clause 19.3.2 in Section 19 of (Vol-2 of 2, PART A) document	
37	Pump OEM shall be responsible for the guarantees and shall make good in case of any shortfall in the performance without any time/price implication. Otherwise LD/Penalties shall be levied in accordance with end customer specification. Refer Appendix 8 (Functional Guarantees) in the (Vol-1 of 2) document	
38	Training as per end customer specification Refer Clause 2.15 in Section 2 of (Vol-2 of 2, PART A) document Refer Schedule-J of VOLUME 2 OF 2, PART B document	
39	Competent Engineers for the equipments in Pump OEM scope of supply for Operation & Maintenance During Warranty Period. Refer Clause 2.20 in Section 2 of (Vol-2 of 2, PART A) document	
40	Special tools & tackles including a Videoscope with 3D phase measurement & touch screen (Manufacturer country: Japan /USA/ England) required for installation and maintenance of the units and hand them over in good condition to the Board at the completion of the Project. A list of all such tools shall be incorporated in the offer. Worn out tools or damaged tools shall be replaced with new one without any cost. As well as pump OEM shall provide Special lifting & handling appliances and dismantling & assembling tools for Pump as required. Refer Clause 2.24 in Section 2 of (Vol-2 of 2, PART A) document Refer Schedule-E of VOLUME 2 OF 2, PART B document	

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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
41	All on-base cabling (Signal, Control & Power) upto the Junction boxes for the respective skids which are in PUMP OEM scope as per end customer specification	
42	Local Gauge Boards (SS316) and Local panels (SS316) for the respective skids which are in PUMP OEM scope	
43	Instrumentation shall be as per end customer Specification.	
44	Electricals shall be as per end customer Specification.	
45	All on base & interconnection piping among pump OEM supplied skids, drain and vent piping upto terminal points as per end customer specification.	
46	Complete Vibration monitoring system for PUMPS as per end customer specification	
47	Facilitate Employer and the Project Manager or their designated representatives to attend the test and/or inspection at manufacturing premises. PUMP OEM shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses. Refer Clause GCC 38.2 in Section 4 (Particular Conditions of Contract) of (Vol-1 of 2) document	
48	All the documentation for the submission/review/approval shall as per end customer specification Refer Appendix 7 of (Vol-1 of 2) document	
49	Lubrication oil for flushing and for the initial filling as per end customer specification All lubricant and chemical additives as per end customer specification	
50	Pump OEM shall furnish all the equipments, auxiliary systems, instruments, controls and safety devices as per the end customer specification. However, anything required over and above what is specified in the end customer specification for safe and satisfactory operation of the equipment package shall be included by the PUMP OEM in their scope.	
51	Equipment end cable lugs and glands	
52	Equipment Enclosure Illumination System(including JB, Fixtures, conduits etc)	

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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
53	Terminal Point for CW Pump: 1. Piping: CW pump nozzle at inlet and discharge. 1. Utilities: Cooling water, Service Water, IA, SA: shall be provided at one point (OEM to specify location) 2. Electrical: a) 415 V Supply: Motor/ Equipment end TB. b) 6.6kV Supply: Motor/ Equipment end TB. c) 220 V Station DC Power Supply: Motor/ Equipment end TB. d) 24 V DC Power supply : for 24V DC at distribution board. e) XXX V AC UPS Power Supply: for UPS at distribution board(ACDB). f) 110/220 V AC Electrical Control Supply: Equipment end TB g) Instrumentation Cable: EDN/HPEP to comment h) Electrical Earthing: At Vendor's Equipment's earthing terminal i) Electronic Earthing: as per OEM recommendation for control system. j) Equipment Illumination Power Supply(if required): At one location near CWP.	
Sec-B	<u>Drawings and other documents for above pumps:</u>	
S.NO.	DETAILS OF DOCUMENTS	
1	Authorization Certificates from the manufacturer (s) of main equipment that they will supply their machine/ equipment to BPDB through the tenderer for this project, in the event the tenderer concerned is not the manufacturer of the same. [TDS (ITT 24.2 r)]	
2	Certificate from the end users for Proveness of the offered equipment. [TDS (ITT 24.2 r)]	
3	OEM declaration supported by OEM Performance curve for corresponding pump model must have to be submitted from concern manufacturer with the Technical Proposal as per Form PG5A – 5a, Vol. 1 of 2 of tender document. [TDS (ITT 24.2 r)]	
4	Materials, Equipment and associated services from the following countries are not eligible: Israel (also REFER to BPDB Clarification s & Addendum no. 02)	
5	BIDDERS to include all items as required by BHEL's NIT in their scope. Any item/equipment/system even specifically not indicated in BHEL's NIT document but required for reliable and satisfactory operation of BIDDER's supplied scope shall be supplied by BIDDER. In case BIDDERS are omitting any such items, BHEL reserves the right on its sole discretion to reject the offer or load the respective offer based on its experience/calculation plus 65% charges towards administrative, handling, engineering coordination, and other charges . Post evaluation, if any items not specifically indicated in exclusion list of BIDDER's offer, and required as per BHEL's NIT or required for reliable and satisfactory operation of BIDDER's supplied scope, BIDDER must supply those items without any time or cost implication to BHEL or end customer.	
6	As per tender,warranty period is 24 months. During warranty, contractor has to supply complete spares including O&M, normal wear & tear, consumables etc. required during 2 years operation. Bidder has to submit the detailed list with the tender. In case there is any spare items required during warranty period which is not part of the list then also bidder has to supply that spare parts	
7	BIDDER/ Vendor to confirm the Clauses as per end customer specification.	
8	As part of the EPC contract, the BIDDERS will be liable for providing all spares, consumable and expertise service for day to days, unscheduled, breakdown maintenance .	

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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
9	Separate Lumpsum quote indicating required minimum number of man days for the below services upto warranty period: Supervision of erection & commissioning by OEM expert / Technical Direct ion for Installation (TDI) services to be provided as per customer specification: 1) Bidders to consider minimum 30 man days for TDI for PUMPS (BFP, CEP,CWP) package. 2) Bidders to consider minimum 6 mob-demob instances for TDI or PUMPS (BFP, CEP,CWP) package. 3) BIDDER to quote Per diem rate and mob-demob charges to be used for evaluat ion in combinat ion with 1) & 2) above. 4) BIDDER to furnish recommended number of man days and number of mob-demob instances for informat ion. 5) BIDDER shall confirm that these rates shall be valid even after consumpt ion of the number of days and up to defect liability period by end customer. 6) Bidder to fill and submit TDI service details in Table-1 & 2 (as attached Annexure-8 (TDI) for PUMPS (BFP, CEP,CWP)	
10	Pumps unit shall be of well proven design and the offered model of Pumps shall have satisfactory operating experience outside manufacturer's country for at least 2 (two) years.	
11	The PUMP OEM shall include at least two (02) certificates from the end users on satisfactory performance of the Power plants as mentioned above, which were designed, engineering, supplied, constructed, tested & commissioned by the PUMP OEM himself or as member in case of JVCA to establish the minimum required experience to Tender. The certificates shall mention the name of power plant, Plant Configuration, capacity, Contract value, Name of Partner (If Applicable), total operating hour and commissioning date of the power plant (make, model) supplied by the PUMP OEM; issue date, name and address (Telephone/Fax/e-mail) of the end user duly signed in the official pad.	
12	Manufacturer's Authorisation Letter (Form PG5A - 5)	
13	Manufacturer's declaration letter (Form PG5A – 5a)	
14	Letter of Intent (Form PG5A – 5b)	
15	PUMP OEM shall first submit the completely filled-in Equipment Data sheets, Performance Curves, filled in Experience Record Proforma, Equipment Manufacturers Latest catalogues and their General reference lists, vendor list, Quality Plans for pump equipments, any other documents as specified in end customer specification along with the offer.	
16	All the Equipment's name plate Data (Manufacturer Name & Technical Parameters), Technical Specification, Operational Manual including OEM parts list & Drawings shall be in English language. OEM has to handover all the Equipment's complete Technical Specification, Operational Manual including OEM parts list & Drawings before performance test of the plant.	
17	Also all the drawings and documents at S.No 19 below shall be submitted by PUMP OEM within 30 days from placement of PO, incorporating project specific title block which will be shared during detail engineering.	

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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
18	The drawing and documents (ex. GA drawing etc) which require further engineering and integration by BHEL shall be furnished in Auto CAD format.	
19	PUMP OEM to furnish all necessary functional and ordering specifications, system requirement documents and interface information for sizing of equipment in BHEL's scope of supply.	
20	Following documents shall be submitted mandatorily along with bid but not limited: a. General Arrangement drawing of PUMP, maintenance space required, crane capacity (recommended) and crane hook approach from the grade level etc. b. Foundation loading drawings with static and dynamic loads and other relevant data for civil foundation for the equipments which are in pump OEM scope of supply in native editable format. c. Utility consumption list (for Instrument air, Cooling water etc.) d. Electrical load list including e. Performance Curves of Pumps	
20.1	Electrical outline drawing showing Junction Boxes / panel locations within 60 days of placement of PO.	
20.2	All other filled in Data sheets as per end customer specification within 90 days of placement of PO.	
20.3	Sub-vendors' list for all the equipment as per end customer specification within 30 days of placement of PO.	
20.4	Functional write up for normal operation within 90 days of placement of PO.	
20.5	PG test procedure and correction curves along with data points within 120 days of PO	
20.6	All erection documents required for erection at site to make estimates (for eg.Packing List and Weights etc.) for pump OEM scope of supplies.	
20.7	6 sets of hard copies & 2 sets of soft copies - Drawings, datasheets, check lists, procedures and other necessary documents required for erection and commissioning of Gas turbine and auxiliaries supplied by PUMP OEM	
20.8	6 sets of hard copies & 2 sets of soft copies (or no. of copies as agreed with end customer) - All customer documentation, Drawings, datasheets, check lists, procedures, etc. and other necessary documents required for O&M of Gas turbine and auxiliaries supplied by PUMP OEM.	
20.9	Type test reports, material test certificates, final and in process inspection reports, etc. where ever applicable during detail engineering	

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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
	Inputs Required along with OEM's Offer: 1. Input of Condenser cooling water flow and pressure drop across condenser at TP. 2. HBDs for guarantee load cases 3. LP drum operating pressure 4. Economizer pressure drop (if applicable) 5. Super heater pressure drop 6.Safety valve set point for drum and super heater 7. CPH pressure drop, flow and fill volume 8. Max. Blowdown quantity 9. HP, IP drum operating pressure 10. HRSG fill volume from economizer to drum only 11. Min. Pressure required for FG heater system 12.Pressure drop in IP Feed Control Station Inputs Required by BHEL During Proposal Engg. Stage (for offer preparation by BHEL): 1. Input of Condenser cooling water flow and pressure drop across condenser at TP. 2. HBDs for guarantee load cases 3. LP drum operating pressure 4. Economizer pressure drop (if applicable) 5. Super heater pressure drop 6.Safety valve set point for drum and super heater 7. CPH pressure drop, flow and fill volume 8. Max. Blowdown quantity 9. HP, IP drum operating pressure 10. HRSG fill volume from economizer to drum only 11. Min. Pressure required for FG heater system 12.Pressure drop in IP Feed Control Station 13.Mechanical General Arrangement drawings and outline drawings of all the equipment/Machine, foundation outline drawings etc.	

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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
20.10	14. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions etc. 15. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 16. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 17. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 18. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. 19. OEM's Recommended Codes and standards to be followed. 20. Grade of concrete and steel wherever applicable. 21. Machine/equipment erection philosophy and details. 22. Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 23. Handling arrangement details of BFP, CEP, CWP and its components and laydown space. 24. Earthing Requirement of Equipment. 25. OEM electrical control philosophy 26. Cable Schedule. 27. Electrical Load List (in the attached Format 01 along with the DC Loads, their location, starting current, starting instant etc.) 28. Utility consumption (Instrument Air/Service Air/Cooling Water etc) in the attached format 02, 03, 04. 29. Any other input required for Project Engineering. Inputs Required by BHEL During Detail Engg. Stage: 1. Input of Condenser cooling water flow and pressure drop across condenser at TP. 2. HBDs for guarantee load cases 3. LP drum operating pressure 4. Economizer pressure drop (if applicable) 5. Super heater pressure drop 6. Safety valve set point for drum and super heater 7. CPH pressure drop, flow and fill volume 8. Max. Blowdown quantity 9. LP drum operating pressure	

BHEL NIT for Sourcing of Complete Power Block Scope for Raozan project
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ANNEXURE - 8 (Technical requirements for PUMPS-BFP,CEP,CWP)

Sl. No.	Description	Confirmation from BIDDER (YES/NO)
	9. Min. drum operating pressure 10. HRSG fill volume from economizer to drum only 11. Min. Pressure required for FG heater system 12. Pressure drop in IP Feed Control Station 13. Mechanical General Arrangement drawings and outline drawings of all the equipment/Machine, foundation outline drawings etc. 14. Input related to machine/equipment like operating frequency range, permissible limits of vibration, permissible limits of amplitude, boundary conditions. etc. 15. Machine/Equipment Load data along with location of application of loads including dead load, live load, seismic, wind, dynamic, erection loads etc. 16. Details of EP's, insert plates, bolts, anchor assembly etc. along-with their location, grade of material etc. 17. Write up/recommendation of manufacturer for civil design of machine foundation i.e. design criteria etc. 18. Manufactures recommendation of load combinations and load factors to be used for machine/equipment foundation, structure foundation design. 19. OEM's Recommended Codes and standards to be followed. 20. Grade of concrete and steel wherever applicable. 21. Machine/equipment erection philosophy and details. 22. Any other information/drawings/details besides above required for design of foundations shall also be provided by the bidder during proposal or contract stage engineering. 23. Handling arrangement details of BFP, CEP, CWP and its components and laydown space. 24. Earthing Requirement of Equipment. 25. OEM electrical control philosophy 26. Cable Schedule. 27. Electrical Load List (in the attached Format 01 along with the DC Loads, their location, starting current, starting instant etc.) 28. Utility consumption (Instrument Air/Service Air/Cooling Water etc) in the attached format 02, 03, 04. 29. Any other input required for Project Engineering.	
Sec-C	Additional terms and conditions:	
1	Pertaining to PUMP OEM's scope of supply, PUMP OEM shall be responsible for answering to all end customer queries and attending any meetings if required until the issues are resolved and closed by end customer and provide all necessary data as required.	
2	PUMP OEM shall be responsible for compliance with complete specification issued by end customer including national standards as specified therein, limited to its scope of supply, and where not TECHNICALLY feasible shall get acceptance from the end customer	
3	PUMP OEM shall be responsible for getting end customer acceptance on material selection, components selection/design and general engineering design practices used to design and procure PUMP OEM supplied equipment, if end customer raises any queries on the same.	
4	Between BHEL and pump OEM, each party shall be solely and exclusively responsible for its own scope of work. Both parties shall perform their respective scope in an integrated manner as and when required.	
5	Warranty/Defect liability period for the scope of supply shall be as per end customer specification requirements.	

Annexure-8 (TDI)

TDI Service details for PUMPS (BFP,CEP,CWP) and its associated systems

Bidder to fill and submit the information requested in the below Table-1 & 2.

BIDDERS shall quote the per diem rates for TDI services and mob-demob charges. These rates quoted by bidders will be used for calculating the supervision charges for the indicated number of man days and mob-demob instances and shall be used for evaluation. The BIDDERS are to be requested to indicate their recommended number of man days and mob-demob instances for site supervision for each equipment for information. The BIDDERS also must confirm that the rates quoted by them shall remain valid till the end of defect liability period by end customer without any limitation on number of man days used.

Table-1 (TDI Service Details and Cost Evaluation)

S.No.	Equipment	TDI Services (Man Days)	Per Diem Rate (BY BIDDER)	Per Diem Rate converted in Rs. (as per BHEL ITB clause 16)	Number of Mobilization/ Demobilization to be considered	Rates for each instance of Mob + Demob (BY BIDDER)	Mob + Demob Rate Converted in Rs. (as per BHEL ITB clause 16)	Total Cost
1	Pumps	A8=30	B8	C8	D8=6	E8	F8	$A8 \times C8 + D8 \times F8 = G8$

Note: All expenditures including but not limited to air travel, boarding, lodging, Local transportation, Meals, etc. and pocket expenses associated with above services shall be in BIDDER's scope.

Table-2 (TDI Service details to be provided by BIDDERS for information)

S.No.	Equipment	Recommended number of man days to be quoted by BIDDER (for information)	Recommended number of Mob Demob Instances to be quoted by BIDDER (for information)	List of activities considered (BY BIDDER)
1.	PUMPS(BFP,CEP,CWP)	BY BIDDER	BY BIDDER	BIDDERS'S TO ATTACH LIST

ANNEXURE-9
(NIT for LTSA SERVICE FROM OEM
OF GTG PACKAGE)

4. SEPARATE PROPOSAL FOR LTSA SERVICE FROM OEM OF GTG PACKAGE:

Bidder shall submit complete LTSA proposal from GTG Package OEM for GTG and their self-auxiliaries for 7 years after operational acceptance of the plant as per requirements of end customer specification.