




CUSTOMER :		PROJECT		SPECIFICATION :							
BIDDER/ VENDOR SYSTEM		TITLE		NUMBER :							
QUALITY PLAN		QUALITY PLAN		SPECIFICATION :							
SHEET 1 OF 9		NUMBER PED-506-00-Q-007_REV-03		TITLE							
SL. NO.	COMPONENT/OPERATION	CAT.	EXTENT OF CHECK	TYPE/METHOD OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	VOLUME III	REMARKS
		4	6	5	7	8	9	P	W	V	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL	MA	100%	VISUAL	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	11
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	MA	SAMPLE	MEASUREMENT	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
	1.SURFACE CONDITION	MA	-DO-	MECH. TEST	-DO-	-DO-	INSPEC. REPORT	3	-	2	
	2.DIMENSIONS	MA	100%	VISUAL	MANFR'S DRG./SPEC	FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
	3.PROOF LOAD TEST (EYE BOLT)	MA	SAMPLES	VISUAL	MANFR'S DRG./SPEC BOOK	RELEVENT IEC STANDARD/SPEC	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.2	HARDWARES	MA	100%	VISUAL	MANFR'S DRG./SPEC	FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
	1.SURFACE CONDITION	MA	100%	VISUAL	MANFR'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
	2.CHEM. & PHY. PROP.	MA	1/HEAT NO.	CHEM & MECH TEST	MANFR'S DRG./SPEC	RELEVENT IEC STANDARD	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
	3.DIMENSIONS	MA	100%	MEASUREMENT	MANFR'S DRG.	MANUFRR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	MA	100% CONTINUOUS	VISUAL	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
	1.MAKE SHADE, SHELF LIFE & TYPE	MA									
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
										BIDDER/ VENDORS COMPANY SEAL	

		CUSTOMER :				PROJECT :				SPECIFICATION :			
		BIDDER/ VENDOR SYSTEM				TITLE				NUMBER :			
QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03				TITLE				SECTION			
SHEET 2 OF 9		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)				VOLUME III				REMARKS			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	
1	2	3	4	5	6	7	8	9	10	11			
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS 4. INTERNAL FLAWS	MA MA MA CR	VISUAL CHEM. & PHYSICAL TESTS MEASUREMENT UT	100% 1/HEAT NO. OR HEAT TREATMENT BATCH NO 100% -DO-	- MFG. DRG. SPEC. -DO- ASTM-A388	FREE FROM VISUAL DEFECTS RELEVANT IEC STANDARD	-DO- SUPPLIER'S TC LOG BOOK -DO-	3 3 3 3	- - - 2	- - - 1	- 2	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING 2. PHYSICAL COND. 3. DIMENSIONS (WHEREVER APPLICABLE) 4. PERFORMANCE/ CALIBRATION	MA MA MA	-DO- MEASUREMENT TEST	-DO- SAMPLE 100%	- MANUF'R'S DRG./ SPEC. -DO-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY MANUF'R'S DRG./ SPEC. -DO-	-DO- INSP. REPORT	3 3 3	- - -	- - -	2 2 2	
BHEL		PARTICULARS		BIDDER/VENDOR									
		NAME											
		SIGNATURE											
		DATE											
												BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION :		
		SHEET 3 OF 9		BIDDER/ VENDOR	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	4	5	6	7	8	9	P	W	V	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11		
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2. DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND/OR SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH 2. ELECT. PROP. & MECH. PROP	MA	VISUAL	100%	MANUF'S DRG.	MANUF'S DRG.	LOG BOOK	3	-	2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
			MA	ELECT. & MECH. TESTS	-DO-	MANUF'S SPEC./ RELEVANT IEC STANDARD	RELEVANT IEC STANDARD	SUPPLIER'S TC	3	-	2	
			MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
			MA	ELECT. & MECH. TEST	SAMPLES	RELEVANT IEC OR OTHER STANDARDS	RELEVANT IEC OR OTHER STANDARDS	SUPPLIER'S TC & VENDOR'S INSPN. REPORTS	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			


		CUSTOMER :				PROJECT :				SPECIFICATION :			
		QUALITY PLAN		BIDDER/ VENDOR		TITLE		NUMBER :		TITLE		NUMBER :	
SHEET 4 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		REMARKS			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	
1	2	3	4	5	6	7	8	9				10	11
1.10	BEARINGS	3.DIMENSIONS 1.MAKE & TYPE & MODEL	MA	MEASUREMENT VISUAL	-DO- 100%	-DO- MANFR'S DRG./ APPROVED DATASHEET	-DO- MANFR'S DRG./ APPROVED DATASHEET	Log Book -DO-	3	-		2	
1.11	SLIP RING (WHEREVER APPLICABLE)	2.SURFACE FINISH 1.SURFACE COND. 2.DIMENSIONS 3.TEMP.WITH-STAND CAPACITY	MA	VISUAL MEASUREMENT ELECT.TEST	100% SAMPLE -DO-	- - MANUF'S DRG MANUF'S SPEC./ BHEL SPEC.	FREE FROM VISUAL DEFECTS -DO- MANUF'S DRG MANUF'S SPEC./ BHEL SPEC.	-DO- -DO- -DO- -DO-	3	-		2	
1.12	OIL SEALS & GASKETS	4.HV/IR 1.MATERIAL OF GASKET 2.SURFACE COND. 3.DIMENSIONS	MA	-DO- VISUAL VISUAL MEASUREMENT	100% 100% 100% SAMPLE	-DO- MANUF'S DRG/SPECS - MANUF'S DRG	-DO- MANUF'S DRG./ SPECS. FREE FROM VISUAL DEFECTS MANUF'S DRG	-DO- -DO- -DO- -DO-	3	-		2	
BHEL		PARTICULARS		BIDDER/VENDOR									
		NAME											
		SIGNATURE											
		DATE											
												BIDDER'S/VENDORS COMPANY SEAL	

		QUALITY PLAN		CUSTOMER :			PROJECT			SPECIFICATION :							
		SL. NO.	COMPONENT/OPERATION	SHEET 5 OF 9	CHARACTERISTIC CHECK	BIDDER/ VENDOR	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	TITLE	NUMBER :	
		2	3	4	5	6	7	8	9	10	11						
1	IN PROCESS			MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	-						
2.0	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS		MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-						
2.1		2.DIMENSIONS		MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-						
2.2	MACHINING	1.FINISH		MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-						
		2.DIMENSIONS		MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S DRG	-DO-	2	-						
		3.SHAFT SURFACE FLOWS		MA	VISUAL	100%	MANFR'S SPEC./BHEL RELEVANT STAND	MANUF'S DRG	LOG BOOK	2	-						
2.3	PAINTING	1.SURFACE PREPARATION		MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	BHEL SPEC. SAME AS COL.7	-DO-	2	-						
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)		MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-						
		3.SHADE		MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-						
		4.ADHESION		MA													
BHEL																	
PARTICULARS												BIDDER/VENDOR					
NAME																	
SIGNATURE																	
DATE																	
															BIDDER'S/VENDORS COMPANY SEAL		

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION :		
		SHEET 6 OF 9		BIDDER/ VENDOR	SYSTEM CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	REMARKS
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	3	4	5	6	7	8	9	10	VOLUME III	TITLE
1	2											
2.4	SHEET STACKING	1.COMPLETENESS 2.COMPRESSION & TIGHTENING 3.CORE LOSS & HOTSPOT	MA	MEASUREMENT	SAMPLE	MANUF'R'S SPEC.	MANUF'R'S SPEC.	MANUF'R'S SPEC.	Log Book	2	-	
			MA	MEASUREMENT	100%	-DO-	-DO-	-DO-	Log Book	2	-	
			MA	ELECT. TEST	-DO-	-DO-	-DO-	-DO-	Log Book	2	1*	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS 2.CLEANLINESS 3.IR-HV/IR 4.RESISTANCE 5.INTERTURN INSULATION 6.SURGE WITH STAND AND TAN DELTA TEST	CR	VISUAL	100%	MANUF'R'S SPEC./BHEL SPEC.	MANUF'R'S SPEC./BHEL SPEC.	MANUF'R'S SPEC./BHEL SPEC.	Log Book	2	-	
			CR	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	
			CR	ELECT. TEST	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	
			CR	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	
			CR	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	
			CR	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSITY 2.TEMP. PRESSURE VACUUM 3.NO. OF DIPS (NOT APPLICABLE IN CASE OF VPI)	MA	PHY. TEST	AT STARTING	-DO-	-DO-	-DO-	Log Book	2	-	
			MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	-DO-	Log Book	2	-	
			MA	-DO-	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	THREE DIPS TO BE GIVEN
BHEL												
PARTICULARS												
BIDDER/VENDOR												
NAME												
SIGNATURE												
DATE												
BIDDER'S/VENDORS COMPANY SEAL												

CUSTOMER :		PROJECT TITLE		SPECIFICATION :								
BIDDER/ VENDOR SYSTEM		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		NUMBER :								
SHEET 7 OF 9		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		TITLE								
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION		REMARKS
										P	W	
1	2	3	4	5	6	7	8	9	10	11		
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA	-DO- VISUAL	-DO- 100%	-DO- -DO-	-DO- -DO-	Log Book Log Book	2 2	- -	1 -	
2.8	BRAZING/COMPRESSION JOINT (IF APPLICABLE)	1.COMPLETENESS 2.SOUNDNESS	CR CR	-DO- MALLETT TEST & UT	-DO- -DO-	-DO- -DO-	-DO- -DO-	Log Book Log Book	2 2	- -	- 1	
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE 2.SOUNDNESS OF DIE CASTING	MA CR CR	ELECT. TEST DYN. BALANCE ELECT. (GROWLER TEST)	-DO- -DO- -DO-	-DO- MFG SPEC./ ISO 1940 MFG. SPEC.	-DO- MFG. DWG. MFG. SPEC.	Log Book Log Book Log Book	2 2 2	- - -	1 1 1	VERIFICATION FOR MV MOTOR ONLY
2.10	ASSEMBLY	1.ALIGNMENT 2.WORKMANSHIP 3.AXIAL PLAY 4.DIMENSIONS 5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE 6. RTD, BTD & SPACE HEATER MOUNTING.	MA MA MA MA MA MA	MEAS. VISUAL MEAS. -DO- VISUAL	-DO- -DO- -DO- -DO- 100%	-DO- -DO- MFG SPEC. MFG.DRG/ MFG SPEC. MFG SPEC. RELEVANT IEC STD	-DO- -DO- -DO- MFG. DRG/ RELEVANT IEC STD MFG SPEC. RELEVANT IEC STD	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	- - - - -	- - 1 - -	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
							BIDDER'S/VENDORS COMPANY SEAL					

SHEET 8 OF 9		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION :				
BHEL		QUALITY PLAN		BIDDER/ :		QUALITY PLAN		NUMBER :				
COMPONENT/OPERATION		CHARACTERISTIC CHECK		SYSTEM CAT.		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		TITLE				
SL. NO.	2	3	4	5	6	7	8	9	10	11		
				TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	P	W	V	
1	TESTS	1. TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT. TEST	1/TYPE/SIZE	IEC-60034/ BHEL SPEC./ DATA SHEET	IEC-60034/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
3.0		2. ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	§ NOTE - 2
		3. VIBRATION & NOISE LEVEL	MA	-DO-	100%	IEC-60034-14/ IEC-60034-9	IEC-60034-14/ IEC-60034-9	-DO-	2	1 ^s	1	§ NOTE - 2
		4. OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IEC STD.	INSPC. REPORT	2	1	-	
		5. DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	IEC-60034-05	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	§ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^s	1	§ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IEC-60034 & DATA SHEET	IEC-60034 & DATA SHEET	INSPC. REPORT	2	1 ^s	1	§ NOTE - 2
		9. EXPLOSION FLAME PROOF (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	VDE-0165/0170/0171	VDE-0165/0170/0171	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^s	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY § NOTE - 2
BHEL		PARTICULARS		BIDDER/VENDOR								
		NAME										
		SIGNATURE										
		DATE										BIDDER'S VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER : BIDDER/ VENDOR :			PROJECT TITLE QUALITY PLAN NUMBER PED-506-00-Q-007_REV-03			SPECIFICATION : NUMBER :			
	SHEET 9 OF 9 CHARACTERISTIC CHECK		SYSTEM : TYPE/METHOD OF CHECK			REFERENCE DOCUMENT ACCEPTANCE NORM			SPECIFICATION : TITLE			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	EXTENT OF CHECK	TYPE/METHOD OF CHECK	7	8	9	10	11	SECTION AGENCY P W V		
1	2	3	6	5	4	3	2	1	11	VOLUME III REMARKS		
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. IN CASE OF INSPECTION BY CUSTOMER/BHEL OR NOMINATED AGENCY, QUANTUM OF CHECK WILL BE ONE MOTOR OF EACH TYPE. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.												
Legends for Inspection agency 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER)/PACKAGE/SYSTEM CONTRACTOR 3. SUB-VENDOR (RAW MATERIAL/COMPONENT'S SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS NAME SIGNATURE DATE			BIDDER/VENDOR			BIDDER'S/VENDORS COMPANY SEAL			

B0

General Technical Specification

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B0. General Specification

Preamble

The Technical Specification is amended in accordance with following Technical Clarifications to Bidding Documents (“Clarification Batches”), which are already published on the BIFPCL’s Website:

- Clarification No. 1 (Clarification #01);
- Clarification No. 3 (Clarification #03);
- Clarification No. 5 (Clarification #05);
- Clarification No. 7 (Clarification #07); and
- Clarification No. 8 (Clarification #08).

Only technical clarifications with regard to content and consequently causing alterations of Scope of Services and Supplies, Technical Requirements, Data Sheets and/or Annexes are incorporated.

General clarifications such as “Subject to BIFPCL’s approval during Basic/Detailed Engineering” or “Details to be discussed during Engineering” are not incorporated as it is self-evident that Contractor’s design and engineering shall subject to Employer’s approval.

Already published Amendments (reference is made to Amendments No. 1 and No. 2) are not again incorporated/included in the amended Technical Specification. This applies for instance for:

- B3, B4 including Data Sheets (replacement of the original documents, refer to Amendment No. 1);
- B12.8 PV Plant and B12.9 Waste Management including Data Sheets (additional documents, refer to Amendment No. 2);
- Annex C, G-05 Health and Safety Manual (additional document, refer to Amendment No. 2); and
- Annex C, M-03 Design Limestone List (replacement of the original document, refer to Amendment No. 1).

In addition some parts of the Technical Specification are modified without reference to a published Clarification or Amendment. This applies for instance for:

- Annexes M-06, M-07, M-08 and M-10, which are revised according to Amendment of B3 and B4 and which shall replace the respective original Annexes.
- Annexes M-04 and M-12, which are revised according to the latest available river water sampling and analysis.

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B0.1 Subject of Specification

The Joint Venture of Bangladesh-India Friendship Power Corporation (pvt) Ltd (BIFPCL) intends to construct a 2x 660 M_w,^{e, gross} coal fired power plant (the Plant, the Maitree-STPP Project or the Project) in the district of Khulna for which BIFPCL firms as Employer, utilizing high availability, high efficiency steam cycle technology.

The Contractor shall cover all works for the engineering, procurement, construction and commissioning of the whole plant on a turnkey basis.

Two power units with steam generator, steam turbine generator and ancillary systems shall be proposed in a technology that enables the Contractor to guarantee a high net efficiency while achieving a high reliability (certain restrictions regarding the technology and the design parameters apply, as detailed herein). A second phase of the same capacity is foreseen as a future possibility, however, this Specification deals only with 2 x 660 MW_{e, gross} unless otherwise and expressly stated.

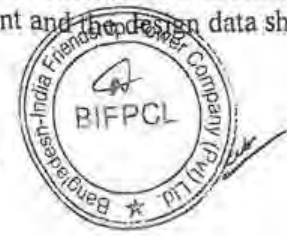
The Plant shall be built on a "green field" basis. It shall be conceptualized in accordance with the above criteria, the thermodynamic cycle adopted must be capable of working successfully over prolonged periods and the system shall be able to withstand severe shocks when connected to the Grid as specified in this Section B0. The steam cycle shall operate with once-through technology at supercritical.

The Plant shall be based on supercritical technology. The main steam (MS) pressure at turbine inlet shall be in the range of 250 to 270 bar(g). The MS temperature at turbine inlet shall be in the range of 568 to 600 °C. The reheat steam (RH) temperature at turbine inlet shall be chosen by the Bidder/Contractor accordingly. That means, a proposed plant with a MS pressure at turbine inlet between 250 and 270 bar(g) and MS/RH temperature at turbine inlet upto 600°C/600° will be acceptable.

The Plant shall be suitable to be operated with the specified fuel. Only proven equipment and materials shall be used.

With the Tender the Bidder shall provide evidence:

- that the proposed Plant is based on proven supercritical technology, with similar MS pressure, MS, RH temperature, design and materials; However, Reference plant of MS pressure and temperature at turbine inlet in the range of 242 to 270 bar(g) and 565 to 600 °C respectively, shall also be considered to qualify.
- that the proposed design of the steam generator and auxiliary equipment has been fully proven by extensive successful commercial operation (the experience base for main component and the design data shall be demonstrated by the Bidder);



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- that the proposed Plant is based on a reference plant(s) which shall be based on supercritical technology, which shall be of similar design and which shall use similar fuel as specified (The Bidder shall submit with the Tender detailed information on this reference plant(s) and shall allow the Employer and/or his representatives to contact and visit and examine the reference plant(s) in detail).

Regarding the Qualifying Requirements reference is made also to Section I IFB.

Transmission lines (OHL connections) from power plant to HV substation as well as transmission lines (GIL) within HV substation area are included in Bidder's/Contractor's scope of services and supplies. However, transmission lines for PGCB grid connection are out of Bidder's/Contractor's scope of services and supplies. For detailed scope at interface points refer to section B10.3.3 and B10.3.5.

The engineering design of the Plant shall be conceptualized in accordance with the above criteria, and therefore it is vital that the thermodynamic cycle adopted must be capable of working successfully over prolonged periods and the system shall be able to withstand severe load adjustments when connected to the Grid. The proposed Plant shall be based on a reference plant of equal size firing similar fuel, which shall have a proven track record. The Tenderer shall submit with the tender detailed information on this reference plant(s) and shall allow the Employer and / or his representatives to contact and visit and examine the reference plant(s) in detail.

The steam boilers shall be designed to burn coal from Australia, Indonesia, South Africa, Mozambique and potentially other countries and to burn high speed diesel for start-up and shut-down purposes. The Plant is designed for the coal range as per design coal list attached in the Annexes in Part C. The steam turbo-generators and thermal cycles shall be selected such, that the Plant heat rate would be optimized under consideration of the investment costs. The condenser cooling systems shall be realized with induced draft wet cooling towers. The turbine generators and all grid relevant parameters shall be designed in accordance with applicable Grid Code and the requirements of NLDC.



The Plant shall be equipped with suitable emission abatement technologies, consisting of primary measures for the CO- and NO_x-reduction, an electrostatic precipitator and a wet flue gas desulphurization plant operating with limestone.

The Project shall include the facilities for the export of the produced power consisting of switchyards, substations and transmission lines.

In addition the Plant shall include all auxiliary and ancillary systems required within the terminal points to render the Plant fit for purpose, this



shall also include workshops, admin and staff amenities buildings and the likes unless expressly excluded in this specification.

B0.2 General Plant Description

B0.2.1 General purpose of the plant

The Plant is intended to serve the increasing power demands of the electricity market in Bangladesh. It will be operated in base load operation but frequency support operation must also be possible.

The scope under the EPC turnkey contract shall cover all services and supplies required to meet the purpose of the Power Plant even if not expressly mentioned in the Bidding Documents. This shall include but shall not be limited to: design, engineering, manufacturing, shop testing, procurement, supply, transportation to site (location of use), handling, storage, insurance, taking any permit/approval required, erection, testing at site, commissioning, performance testing, training Employer's personnel and final completion of entire Power Plant inter alia including steam generators and auxiliaries, turbine generators and auxiliaries, all associated BOP packages, all civil, electrical and I&C works for the entire Power Plant as well as for the jetty and associated facilities and the 400kV/230kV substation as described in the Bidding Documents and complete in all respects for successful operation of both units of 660 MW to dispatch power from the Plant to the grid.

The Plant covers the following main systems and components (including all systems not specifically mentioned):

B0.2.2 General scope of supply

The following data are applicable per unit, unless they refer to common systems. For further information see the respective **Sections B1 to B12**.



- **Boiler systems (refer to Section B1)**
 - steam generator (supercritical once-through)
 - regenerative air preheater
 - coal pulverizers
 - coal bunker system
 - bottom ash extraction system (dry)
 - boiler fans (PA, SA/FD fans)
 - HP steam / feed water piping
 - HP bypass system
 - air system
 - auxiliary boiler .

- **Turbine systems (refer to Section B2)**




- steam turbine generator
 - LP bypass
 - condenser system incl. evacuation
 - Condenser cleaning system
 - LP/HP heaters
 - deaerator/feed water tank
 - condensate pumps
 - feed water pumps
 - water/steam piping system
 - drip collecting and pump system
 - EOT crane and hoists.
- **Flue gas treatment systems** (refer to Section B3)
 - dust filter system (ESP)
 - FGD system (based on wet limestone process)
 - ID fans
 - flue gas ducts.
- **Fuel and Ash handling system** (refer to Section B4)
 - coal handling system, including:
 - coal unloaders (grab type)
 - stackers
 - portal scraper reclaimers
 - coal yard (90 days capacity at BMCR with worst coal)
 - coal yard roof cover (take-out option)
 - coal dust suppression systems
 - coal crushers
 - Coal screens
 - emergency coal supply by front end loader
 - belt conveyors, junctions towers and other systems as required
 - coal blending silos
 - limestone handling system, including:
 - Stacker
 - limestone yard for 90 days
 - limestone transportation system from jetty to stockyard, as required
 - transportation from stockyard to limestone intermediate silo by front end loader
 - HSD handling, including:
 - HSD truck unloading station
 - HSD tanks
 - HSD transfer pumps and pipe distribution system
 - fly ash handling , including:
 - pneumatic fly ash transportation to intermediate fly ash silos
 - intermediate fly ash silos
 - pneumatic fly ash transportation fly ash storage silos at jetty
 - fly ash storage silos at jetty with truck and ship loading
 - bottom ash handling, including:
 - bottom ash transportation to intermediate bottom ash silos
 - intermediate bottom ash silos



- bottom ash storage silos at jetty with truck loading
- gypsum handling, including:
 - Gypsum storage silo at jetty with truck and ship loading
- common residue handling systems
 - transportation of limestone, bottom ash and gypsum from intermediate silos to storage silos at the jetty by pipe conveyor
 - discharge of fly ash and bottom ash via high concentrated slurry/solids disposal (HCSD) to the ash point.
- **Plant Water and Cooling Systems (refer to Section B5)**
 - Plant water intake channel
 - Plant water intake structures
 - Plant water screening plant
 - Plant water supply pumps
 - Plant water pre-treatment and storage
 - Main cooling water system
 - Cooling Water pump station
 - Induced Draft Cell Cooling Towers
 - Main cooling water collection basin
 - Desalination feed water supply system
 - Auxiliary cooling water system
 - Plant water discharge system
 - Cathodic corrosion protection systems.
- **Water Treatment Systems (refer to Section B6)**
 - Plant water pre-treatment storage and supply
 - Electrochlorination plants
 - Desalination plant
 - Potable water treatment plant
 - Demineralization plant
 - Condensate polishing plant
 - FGD Waste Water Treatment Plant (FGDWWTP)
 - Process waste water treatment facilities including oil separators
 - Sewage treatment plant for sanitary wastes
 - Chemical handling and storage facilities
 - Chemical dosing of cooling water and feed water conditioning
 - Monitoring system for the water/steam cycle.

Note:

The Desalination and Demineralization Plant shall be common for all the units.



- **Electrical systems (refer to Section B7)**

- All electrical components related to turbine / boiler / flue gas treatment system and BOP systems
- Power transformers incl. GT, SUT, UAT, all MV- and LV-T
- Switchboards and power distributions (busducts, cabling etc.)
- Emergency diesel, DC and safe AC Systems



- 400/230kV GIS including auxiliary and ICT.

Electrical works like illumination, communication, etc. outside plant boundary are not included in the scope of works.

- **I&C systems (refer to Section B8)**
 - All I&C components related to turbine / boiler / flue gas treatment system and BOP systems
 - Central DCS and decentralized PLC Logics
 - Power Plant training simulator.
- **Civil works (refer to Section B9)**
 - site surveys and investigations to ensure safe civil design and undisturbed construction
 - site preparation (incl. site filling works) and temporary site installation.

No grading activities outside the plant boundary shall be considered.

- all civil related works for the Power Plant including turbine/boiler/flue gas treatment system/cooling water system/electrical system/balance of plant etc.
- Marine Works including coal jetty, plant water intake and discharge.
- Power Plant related buildings and structures
- ancillary buildings such as admin building, canteen, storage and workshop building
- ash pond
- HVAC
- Biomass generation plant (use organic waste of Township and Power Plant)

It is to be noted that the biomass plant shall not produce power. The biomass plant is understood as waste segregation and treatment plant. (Refer to B12.9 in Amendment No. 2).

- Cranes.

- **Infrastructure (refer to Section B9)**

The following works are included in the infrastructure lot

- all internal roads incl. tie-in with existing roads at bridge and access roads to nearest township

Bridge and highway from bridge to Khulna-Mongla-Highway will be provided by GOB.

The Interface Point is at the roundabout.

Remark:

Access Road

GOB will construct a 6 Km road connecting the Site with Khulna-Mongla Highway. It is to be highlighted that:



- Bidder/Contractor cannot expect that the access road will be available when the site works start.
- Bidder/Contractor cannot expect that the access road will be suitable for the transportation of heavy equipment to Site.
- Site access and transportation of personnel, material and equipment etc. to Site shall be in the sole responsibility of the Contractor.
- Bidder/Contractor shall execute a transportation study to familiarize himself with the local and Site condition and to elaborate how equipment can be transported to Site.

All roads, except town ship roads are in Bidder's/Contractors' scope. Interface is the roundabout, whereas the roundabout itself shall be constructed by the Bidder/Contractor.

- fencing, gate house inside the boundary
- landscaping in all areas where Contractor work will be performed
- Infrastructure related works outside the boundary wall

Electrical works like illumination, communication, etc. outside plant boundary are not envisaged.

- underground services (non-pressurized - rain water discharge, domestic waste water
- rain water retention basin
- oil water separators.
- **Electrical Works 400/230 kV Substation (refer to Section B10)**
 - 400 kV gas insulated switchgear
 - 400 kV AIS equipments and accessories
 - 230 kV gas insulated switchgear
 - 230 kV AIS equipments and accessories
 - 230 kV XLPE Cables
 - 400/230 kV 520 MVA interconnection transformers
 - Substation Control and Monitoring System (SCMS)
 - 11/0.415 kV auxiliary power transformers
 - Telecommunication Equipment
 - AC/DC installations
 - Power and control cables, bus ducts
 - Tariff metering
 - Substation outdoor lighting
 - Earthing system & lightning protection system
 - Power & auxiliary systems for 400 kV and 230 kV area, incl. coordination with overall system
 - Fire detection, alarm and fire fighting system
 - Substation other supply and services.
- **Jetty structure (refer to Section B11)**
 - Retaining wall
 - Revetment and Shore protection.



- **Auxiliary plant systems** (refer to Section B12)
 - Compressed air system
 - Hydrogen system
 - Workshop and store
 - Chemical laboratory
 - Fire fighting system
 - De-dusting system
 - HVAC system

B0.2.3 Interface points

For interface points see below.

B0.2.4 Site conditions

The following information on local conditions is investigated or compiled by the Employer. The Contractor is hereby in no way relieved from his duties of carrying out all investigations required for satisfactory performance of his works. The Contractor shall perform his own Site visits and investigations, prior to Contract award in order to familiarize him with the existing conditions of the Site and the surrounding area.

Location, accessibility and present condition of the Site

The site for the Maitree-STPP Project is geographically located between 22° 37'0" N to 22°34'30" N and 89°32'0" E to 89°34'5" E, approximately 14 km northeast of the Mongla Port and 14 km northwest of the Sundarbans, is infringed by the Passur and Moidara Rivers to the west and south east respectively. The project requires an area of approximately 500 acres.

The topographical survey indicates a natural ground level of +1.15 to + 1.35 meters above sea level. A severe cyclone in 2009 raised the level to 4.47 meters and it was decided to raise the Plant level to +5.00 meters.

Politically, the site is located in Rampal Upazila of the Bagherat District in the Rajnagar Union

Currently, the Site is accessible by boat only.

The nearest inland port is Mongla port at around 14km direct distance

The proposed Khan Jahan Ali Airport is located at a distance of approximately 12 km from the project site.

Soil conditions

First soil investigations of the Plant site and adjacent areas have been carried out. For information only the findings of these initial soil investigations are attached in Part C Annexes.



In general the subsoil conditions can be described as follows:

- top layer filled sand (with unknown silt content) in Plant area
- underlying layers of clay
- underlying fine sand.

The Contractor shall conduct soil improvement measures at site. Beside other aspects, consolidation of filling shall be incorporated in soil improvement concept.

Seismic zone

Attention shall be paid to seismic parameters. Related to soil type as identified to Soil Investigation Report, the effect of local soils on earthquake ground motion shall be determined.

For site class "S1" and "S", as expected for the Project, site specific studies shall be carried out to determine the design acceleration response spectrum. During field study minimum the following tests shall be executed:

- Seismic cross hole test; and
- Seismic refraction test.

Based on these results a site specific Response Spectra shall be established. Peak spectral acceleration shall be determined, but shall be not less than 0.12g, as mentioned in BNBC 2012, Table 2.5.2.

Site climatic conditions

The Plant site is from the climatic point of view under maritime tropical conditions. The assumed meteorological conditions for the Site are as follows:

The project site is located in the country's South Central Zone consisting of three dominant seasons:

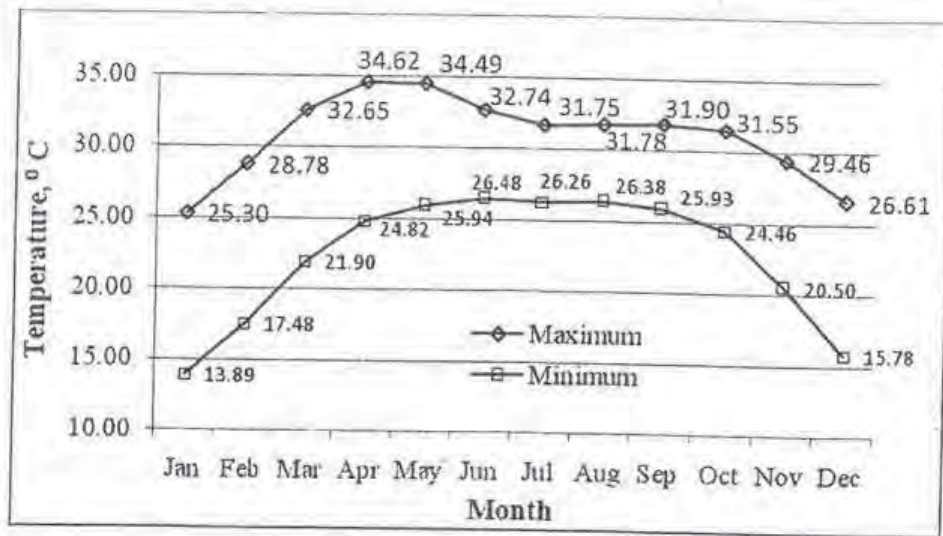
- summer season-March to May
- monsoon season-June to October
- winter season-November to February.

During the Monsoon Season occasional cyclonic storms can occur.

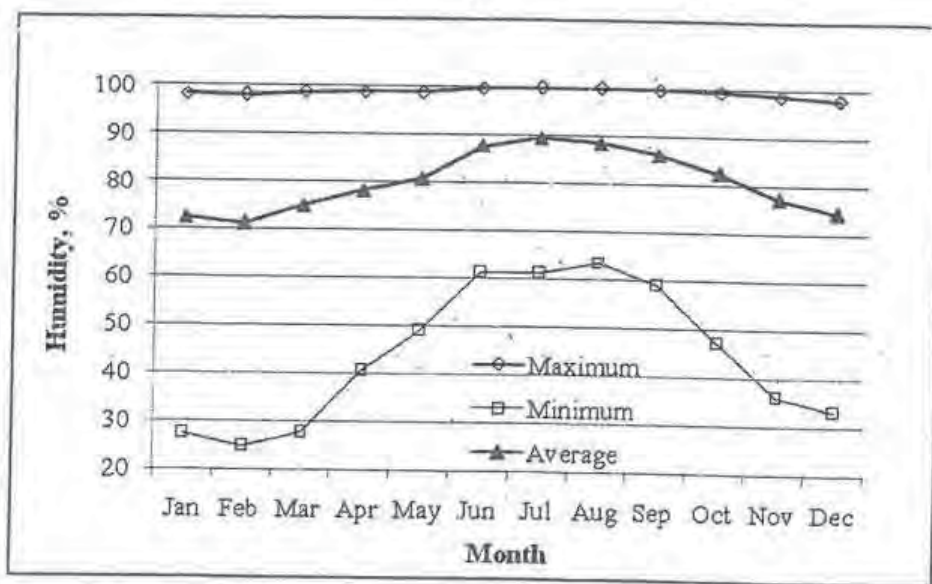
The climatic conditions in the area are continuously monitored by the Bangladesh Meteorological Department (BMD) at the Mongla Meteorological Station.

The temperature varies only slightly throughout the year with the highest temperature of 36.9°C and the lowest temperature of 12.2°C recorded in the period from 1989 to 2008. This distribution is depicted in figure below.



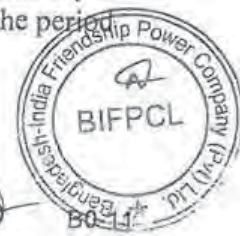


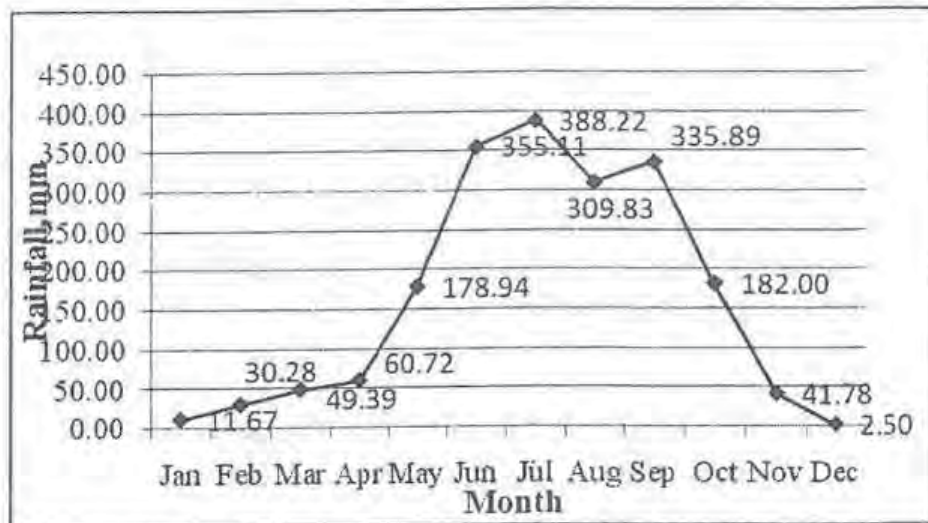
The relative humidity varies drastically during the Monsoon Season with 80% to 90% and the lowest levels of 20% to 30% during the Summer Season. The humidity profile recorded in the same period as the temperature is visualized in below figure.



The maximum rainfall occurs during the Monsoon Season by varying between 300 mm and 350 mm with almost no rainfall during the Winter Season.

The average evaporation in the project area varies between 3 - 5 mm/day with its peak of 16 mm/day during July. The average rainfall for the period between 1991 and 2008 is depicted in below figure.





Below definitions are to be used as typical data for the different climatically seasons at the site.

Average Site Condition ASC

Ambient Temperature: 27.3 °C
 Ambient Humidity: 87 %
 Ambient Pressure: 1007.6 mbar
 River Water Temperature: 29.8 °C

Summer Site Condition SSC

Ambient Temperature: 36.9 °C
 Ambient Humidity: 60 %
 Ambient Pressure: 1007.9 mbar
 River Water Temperature: 33 °C

Winter Site Conditions WSC

Ambient Temperature: 12.2 °C
 Ambient Humidity: 100 %
 Ambient Pressure: 1017.2 mbar
 River Water Temperature: 20 °C

Reference Site Conditions RSC

Ambient Temperature: 31 °C
 Ambient Humidity: 88 %
 Ambient Pressure: 1007 mbar
 River Water Temperature: 32 °C



Reference Site Condition shall apply for the Guarantee Values as well as for the Guarantee Tests/Performance Test. However, Plant must cope with the Site Conditions as specified.

Wet bulb temperature shall be calculated by Bidder/Contractor based on ambient temperature (dry bulb), ambient humidity and ambient pressure for the different cases.

Bidder/Contractor shall determine the wet bulb temperature for all site conditions and not only for reference site condition.

Design ambient conditions for Electrical Systems

- | | |
|---|--------|
| • Maximum design temperature (outdoor) | 45°C |
| • Maximum daily average ambient shade temperature | 38°C |
| • Maximum monthly average temperature (in the shade) | 34.6°C |
| • Maximum annual average temperature (in the shade) | 27.3°C |
| • Maximum design temperature of the electrical equipment installed indoors in air conditioned rooms | 40°C |
| • Maximum design temperature of the electrical equipment installed indoors non in air conditioned rooms | 45°C |
| • Minimum design temperature | 0°C |

Marine conditions

Two tides (e.g. flood and ebb) are regularly observed in the Passur River, which enters into the project site through numerous connected creeks.

The tidal range varies between 1.2 and 3.1 meters. The mean water level (CD) is about 0.87 meters (PWD=CD -1.17 meters). The mean high water level varies due to spring-neap tide conditions between +1.60 m and +2.6m PWD. The Highest High Water Level (HHW) is about +3.1m PWD and the Lowest Low Water Level (LLW) is about -1.4m PWD.

The marine conditions are detailed in **Section B11**, with details about:

- water levels
- waves
- currents
- river bathymetry, topography.



The salinity of the Passur River system varies with the amount of fresh water entering the system which is highly seasonal dependent. The surface water temperature ranges between 22.9°C and 33.0°C and the different water quality parameters are tabulated in **Part C Annexes**.

The marine conditions as recorded at Mongla Port Gauge Station (approx. 14 km south-east to the site) are as follows:

- | | | |
|----------------------------|-------|-------------|
| • Highest High Water Level | (HHW) | + 2.642 MSL |
| • Lowest Low Water Level | (LWL) | - 1.858 MSL |



The Power Plant shall be designed for 100 years flood condition based on data provided by relevant Organization in Bangladesh and taking into account the Highest Astronomical Tide (HAT), the maximum wave conditions (including storm surges) and the potential event of Cyclone. The Contractor is responsible to verify the worst conditions.

These reference data are with respect to LAT, which corresponds to the Chart Datum (CD). The site land data is however with respect to the Bangladesh Land Survey Datum (BLSD), which corresponds to approx. +1.55 m CD (hence the MLSD corresponds to MSL).

Design Wave Height 2.0 m
 Design Wave Period 6.0 sec
 Sedimentation and Siltation: Soft to stiff clay and alternations of very sandy and stiff clay.

The results of bathymetric investigations of the Passur River can be found in Part C Annexes.

A water analysis from the area adjacent to the site giving salinity and water quality is shown below:

Sl. No.	Date	Temp	pH	DO	Ca	Magnesium	Total Hardness	TDS	Chloride	Sulfate	NO ₃	NO ₂	BOD	COD	Salinity
1	7-Jan	27.4	7.74	3010	879	36	68.7	1545	1510	55	5.1	0.8	55	16	
2	7-Jan	27.1	7.72	3020	878.1	36	68.5	1570	1510	60	5.1	0.8	55	16	
3	7-Jan	27.8	7.71	3030	879	36	68.8	1545	1510	55	5.1	0.8	55	16	
1	11-Feb	29.8	7.66	4380	1262	36	182	2590	2180	210	4.7	1	76	23	
2	11-Feb	29.2	7.63	4380	1268	36	178	2590	2190	200	4.7	1	76	23	
3	11-Feb	29.1	7.65	4380	1263	36	179	2580	2180	200	4.7	1	76	23	
1	9-Mar	32.6	7.56	11780	2944.4	38	176	6080	5890	190	4.7	1.2	76	67	
2	9-Mar	32.6	7.57	11780	2945.2	38	178	6080	5890	190	4.7	1.2	76	67	
3	9-Mar	32.1	7.55	11780	2946.4	38	177	6080	5890	200	4.7	1.2	76	67	
1	17-Apr	32.6	7.59	25300	8273	36	185.6	12950	12700	250	4.6	0.7	136	15.5	
2	17-Apr	32.6	7.59	25300	8273	36	186.2	12950	12700	250	4.6	0.7	136	15.5	
3	17-Apr	32.6	7.59	25300	8273	36	184.8	12950	12700	250	4.6	0.7	136	15.5	
1	5-May	32.6	7.59	29300	9480	36	191.6	14900	14800	300	4.5	1.2	177	17.6	
2	5-May	32.9	7.54	29300	9470	36	191.6	14900	14800	300	4.4	1.2	177	17.6	

Figure 1 Water quality of the Passur River at Mongla point (Source: EIA-Report)



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Loc. no.	Date	Temp. (°C)	pH	EC (µS/cm)	Cl ⁻ (mg/l)	T. Alkalinity (mg/l)	Turbidity (NTU)	TSS (mg/l)	TDS (mg/l)	SS (mg/l)	DO (mg/l)	BOD (mg/l)	COD (mg/l)	Salinity (mg/l)
3	5-May	33.2	7.57	29700	9970	36	199.6	14900	14600	300	4.5	1.2	177	17.6
1	15-Jun	31.6	7.69	18000	5820	36	112.6	9200	9000	200	4.7	1.1	97	10.8
2	15-Jun	31.6	7.69	18000	5800	36	113.2	9200	9000	200	4.7	1.1	97	10.8
3	15-Jun	31.6	7.69	18000	5810	36	112.4	9200	9000	200	4.7	1.1	97	10.8
1	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
2	1-Jul	31.6	7.69	340	32.6	36	76.6	285	220	65	5.2	0.8	26	-
3	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
1	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
2	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
3	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
1	8-Sep	31.8	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
2	8-Sep	31.8	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
3	8-Sep	31.8	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
1	12-Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.8	0.7	22	-
2	12-Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.8	0.7	22	-
3	12-Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.8	0.7	22	-
1	5-Nov	24.6	7.79	340	38.6	36	36.6	210	170	40	5.6	0.7	22	-
2	5-Nov	24.6	7.79	340	38.6	36	36.6	210	170	40	5.6	0.7	22	-
3	5-Nov	25.6	7.79	340	38.6	36	36.6	210	170	40	5.6	0.7	22	-
1	12-Dec	21.5	7.72	320	62.6	36	72.6	320	260	60	5.1	0.9	25	0.4
2	12-Dec	20.9	7.71	320	62.6	36	73.6	320	260	60	5.1	0.9	25	0.4
3	12-Dec	21.1	7.72	350	62.6	36	71.6	320	260	60	5.1	0.9	25	0.4

Figure 2 Water quality of the Passur River at Mongla point (Source: EIA-Report)

Additional information on water quality parameters is shown in Part C Annexes.

Wind data

The project region is characterized by southerly winds from the Bay of Bengal during the Monsoon Season and north-westerly winds from the Himalayas during the Winter Season. During the Summer Season, the wind blows from south-southwest to north-northeast. The annual average wind speed amounts to 1.7 meter/second and the wind rose for the entire year is shown in Figure 5.5.

The wind load calculation for the buildings and structures shall be as per Bangladesh National Building Code -2012, Part 6, Chapter 2.4.

Basic wind Speed, V, shall be taken as 73 m/s, Three-second gust at 10 m above ground in exposure C, having a return period of 50 years.

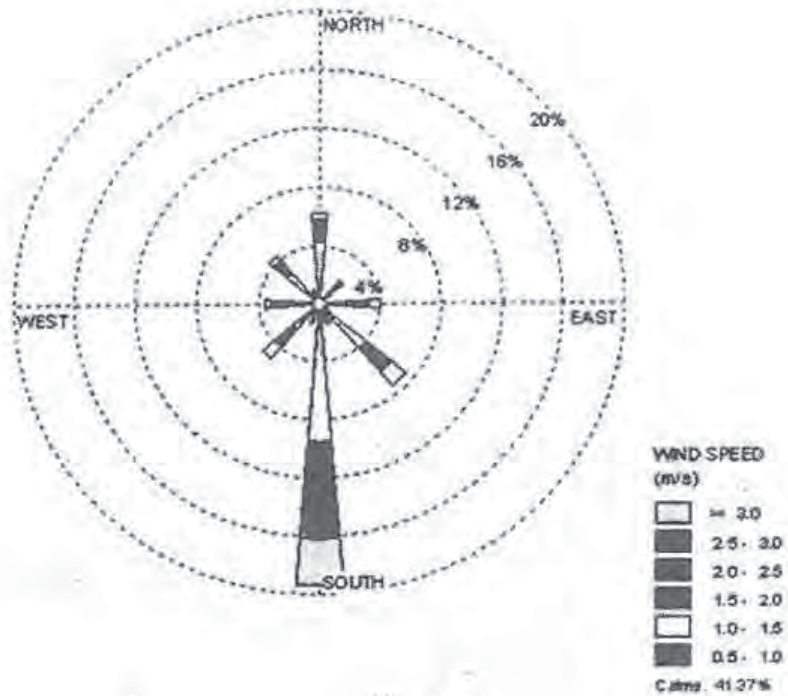
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B0.2.5 Configuration

Two (2) Plant units mainly consisting of steam generator, steam turbine generator, flue gas treatment plants and associated equipment represent the core components of the Plant. The configuration of the power units and all of its main components shall be chosen according to proven and reliable vendor configuration. In doing so, adequate safety clearances, fire compartments, favourable layout of the Plant components for monitoring and maintenance and all other requirements such as those during Power Plant construction shall be taken into account.

The cooling requirement of the Plant shall be accomplished by induced draught cooling towers. The coal unloading facilities and the ash and gypsum loading facilities to ships shall be incorporated in a new jetty structure. Other main items are the power island, the coal yard, ash pond and other balance of plant facilities.

B0.2.6 Layout



The existing conditions at the location of the Plant are shown in the site overview as per the indicative layout in **Part C Annexes**. The Tenderer shall perform own Site visits and investigations prior to bidding in order to familiarize himself with the existing conditions. The Contractor shall propose the Plant layout deemed most practical and cost optimized for the Power Plant.



An indicative general layout is shown in **Part C Annexes** where only the major Plant components have been indicated. The indicative layout takes into consideration the location of the river water intake and jetty, however the final layout is subject to hydraulic studies and optimizations by the Contractor. The design shall allow access vessels with a draught of 9.60m at the jetty. The vessels shall be suitable for transport of coal, ash, gypsum and limestone. The dredging works for the construction of the intake and outfall are part of the Contractor's scope.

The intake and outfall locations may change according to the permitting process, results of calculations or model tests or clarifications with the Contractor.

The substations for the export of the produced power are located in the northern portion of the Site. The EHV transmission lines to Dhaka and Khulna are not part of these Tender Documents.

Any costs for relocations or reconfigurations shall exclusively be borne by the Contractor.

The general layout enclosed in Section V TS, Part C is only indicative. Bidder/ Contractor shall elaborate the final layout, which shall be subject to approval by BIFPCL during basic/detailed engineering.

B0.2.7 Design requirements

This specification entails a functional technical specification (FTS). Hence, the Contractor is given as much freedom as possible in designing the main Plant components, characteristics and design data according to the Contractor's experiences and good engineering practice. One main acceptance requirement is that the Contractor's proposed design work shall be based on a very good reference basis. Prototype equipment and/or design features will not be accepted. All parts and equipment shall be arranged in such a manner as to facilitate surveillance by the operator and for ease maintenance, operation and control.

In the event of contradictions or discrepancies within B0 or between requirements in B0 and stipulations other parts of the Technical Specifications these shall be clarified by mutual consent before Contractor signature. In case contradictions have been not clarified the more stringent requirements shall apply.

The main design features (basic design reports, drawings, PFD, P&IDs, design data etc.) and the main vendors and subcontractors shall be subject to the approval by the Employer.

The main equipment/system subcontractors for: steam generator, steam turbine, main transformers, flue gas desulphurization plant shall be firm with the tender. Bidder's/Contractor's sub-suppliers and vendors shall



comply with Provennes Criteria as stipulated elsewhere in the bidding document.

The Employer has the right to refuse design features and vendors or subcontractors, if the Contractor cannot verify the reliability of the suggested design, vendor or subcontractor.

Following transformers shall be considered as "Main transformers":

- generator transformer
- unit auxiliary transformer
- start-up/stand-by transformer
- 400/230 kV interconnection transformers.

The Plant is expected to operate in base-load mode with high plant load factor. The design lifetime of the Plant shall be of not less than 30 years of operation or 200,000 full load operating hours, whichever is longer. The Plant and all its auxiliaries shall be designed to operate for the complete lifetime under the site conditions as described in **Section B0** and dedicated other part of this FTS.

All Plant equipment and material must be suitable for the range of ambient site conditions. In particular the saline atmosphere has to be considered.

The thermodynamic process of the Plant is to be optimized by the Contractor according to the proposed equipment. An economic optimal balance between investment, maintenance and operation expenses and Plant availability (planned and unplanned outages) shall be proposed.

The Contractor shall ensure a design of the Plant to achieve an average target availability of 90 % (regarding the definition and calculation of the availability please refer to Chapter B0.2.9.5). The Contractor shall accordingly provide for all systems:

- sufficient redundancies
- sufficient storage capacity
- appropriate adjustment of control parameters, and
- shall provide an appropriate spare part concept/proposal as further described under Chapter B0.3.7.

A stockyard capacity of 90 days at BMCR operation with design coal is envisaged

The stockpile height shall be approx. 10 m and the angle of repose shall be approx. 37°.

But is to be underlined that it is Bidder's/Contractor's sole responsibility to determine the actual coal yard dimensions (length, width, height angle etc.)



to achieve the envisaged stockyard capacity under consideration of the soil bearing capabilities and the selection of coal yard equipment.

The 90 days storage area is shown in Annex C-01. The extension for further 90 days storage shall be done on the areas which are marked as "construction laydown area" and "site installation".

Redundancy concept

All equipment shall be implemented with (n+1) redundancy - unless otherwise stated -, where n is the number of equipment required to maintain the maximum capacity of a unit. N+1 means that even in case of outage of the biggest component sufficient capacity is available to maintain the maximum capacity of the Power Plant unit.

For all components which are not redundant, the Contractor shall provide a maintenance and spare part concept to ensure that outage times are minimized and to ensure that the required availability is met (refer to Amendment No. 3 and Annexure I to Amendment No. 3, both already published on BIFPCL's Website). Each equipment whose unavailability due to a failure could result in damages to another equipment shall be backed up by a stand-by equipment, one of them being fed by an emergency source in case of external black out.

Failure of any single item of auxiliary equipment including the Power Plant's DCS and electrical systems shall not result in a reduction in power evacuated from the Power Plant.

Replacement and repair of redundant components shall be possible without interrupting Plant operation.

Future Extension

The Contractor shall ensure sufficient space to enlarge the coal storage capacity from 90 day storage to 180 day storage capacity.

All provisions to enable generally the later extension of the coal storage shall be implemented but no additional costs shall be incurred which are not immediately required for the first phase only, unless expressly mentioned here or in the respective parts of this specification.

B0.2.8 Fuel



The Plant shall be operated with imported sub-bituminous and bituminous coal as the principle fuel. Coal will be supplied via bulk carrier vessels (barges and vessels up to 25,000t, to be unloaded at the Coal Jetty.

The Plant will have to be able to be fully operational and in accordance with all guarantee parameters with all coals on a 100 % basis that comply with the coal characteristics as indicated in **Part C**.



For reference purposes, the list that contains the performance coal and the design range for the coals is included in **Part C Annexes**.

For start-up, low-load operation and shut-down, high speed diesel (HSD) shall be used. HSD will be supplied by truck. A typical analysis is given in **Part C Annexes**.

Special technical requirements for the HSD system are given in **Section B4**.

B0.2.9 Output, heat rate and availability requirements

B0.2.9.1 Guarantee definitions

The following guarantees are defined:

Acceptance Guarantees:

The acceptance guarantees must be met in all operating gases unrestrictedly. They are not subject to any correction. Acceptance Guarantees are specified in the Technical Schedules of **Section B0**. The acceptance guarantees are required to be achieved or executed as a condition precedent to Taking Over.

Special Guarantees:

These guarantees are subject to correction, e.g. for fuel characteristics or ambient conditions and if they are not met, they are subject to payment of performance damages. Special Guarantees are specified in the Technical Schedules of **Section B0**.

Minimum Acceptance level (MAL):

Minimum acceptance level (MAL) means the relevant minimum performance levels for the Plant as specified in the relevant part of the Technical Schedules of **Section B0**. The MAL are required to be achieved or executed as a condition precedent to Taking Over.

Liquidated Damages (LD)

Liquidated Damage means the monetary amount to be paid by the Contractor to the Employer if the Special Guarantees are below the Guaranteed Value but above Minimum Acceptance Levels.

B0.2.9.2 Plant output

Gross Electrical Power Output

The gross electrical power output per unit is determined at the turbine generator terminals to the isolated phase busbars, downstream of the connection for the excitation transformer.



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The gross electrical power output per unit shall be: **660.0 MW_{e, gross}** (plus excitation power requirement in case of static excitation) and shall be kept for the whole coal range.

Net Electrical Power Output

The net electrical power output per unit is determined at the off-take point in the switchyard that means at the high voltage (HV) terminals of the dedicated generator transformer (GT).

The net output is determined by subtracting the consumption of the auxiliary transformer including transformer losses from the gross output.

Export Power Output

The export power output of the Plant is determined at the tariff meterings of the Plant.

The export power output of the Plant equals the net power output of both units minus the losses of the interconnection transformers (ICTs) and start-up transformers.

Dependable Capacity

Dependable Capacity means - according to the Power Purchase Agreement (PPA) - at any given time the net amount of capacity at the tariff metering; either for the first generating unit or for the Plant, as the case may be.

MCR - Maximum Continuous Rating

MCR is defined as the maximum continuous rating (gross electrical power output) of one (1) power plant, coal within the coal range, under Reference Site Conditions (RSC), governor valves being throttled to provide frequency variation as required, boiler in normal operating mode including blow down (if applicable), auxiliary steam consumption (if applicable) etc.). All load percentages apply to MCR, unless otherwise noted.

The dedicated net electric power output at MCR with PF and RSC is:

- $P_{MCR-PF-RSC}$ in [MWe]

The dedicated steam generator load at MCR with PF and RSC is:

- $F_{MCR-PF-RSC}$ in [kg/s]

TMCR - Turbine Maximum Continuous Rating / VWO - Valves Wide Open (Peak Load)

TMCR/VWO is defined as the maximum continuous rating, at which the steam turbine is capable of operating under normal operating conditions (see MCR). However, when the governor valves are fully opened TMCR/VWO shall be at least 103% of MCR, i.e.:

- $P_{TMCR} = 1.03 \times P_{MCR}$



That means, Gross Electrical Power Output at

- MCR shall be 660 MW ((plus excitation power requirement in case of static excitation)
- TMCR shall be 679.8 MW.

BMCR - Boiler Maximum Continuous Rating

BMCR is defined as the maximum continuous steam generating capacity, at which the boiler is capable of operating under normal operating conditions (see MCR). BMCR shall be at least 105% of MCR, i.e.;

$$F_{BMCR} = 1.05 \times F_{MCR}$$

The steam flow at superheater outlet at BMCR shall be 105% MCR flow.
Reheater steam flow at BMCR shall be as per Heat Balance Diagram.

MNCR - Minimum Continuous Rating

MNCR is defined as the minimum rating of a power plant unit under normal, continuous operating conditions (see MCR) with coal fire only (without back-up firing with start-up/ignition fuel) with any coal within the coal range. MNCR shall be 30% of MCR.

$$P_{MNCR} = 0.3 \times P_{MCR}$$

B0.2.9.3 Net heat rate

The guaranteed Net Heat Rates of the Units and the Plant are to be given in the Technical Schedules of Section B0.

The competitiveness of the bid will be evaluated by considering the lowest life-cycle-costs of the bids, which will strongly be influenced by the Bid price on the one hand and the guaranteed Net Heat Rate on the other hand. The optimization criterion which may be utilized by the Contractor in the determination of the proposed power station design is the penalty imposed by not achieving the guaranteed Net Heat Rate as per the Contract.

The guaranteed Net Heat Rates refer to the following load points:

- 100% MCR
- 80% MCR
- 60% MCR
- 50% MCR



The „Net Heat Rate” is the heat rate for the dedicated unit. It is defined according to ASME PTC 46.

Performance Tests/Guarantee Tests at MCR shall correspond to rated pressure (with throttled valves); whereas for part load (i.e 80%, 60%, 50% MCR) the Performance Tests/Guarantee Tests shall be under modified sliding pressure (with 5% throttled turbine inlet valve(s)).

B0.2.9.4 Auxiliary power consumption, losses, own consumption,

Auxiliary Power Consumption

The auxiliary power consumption is the power that is required by the auxiliary power transformer of each unit.

ICT Losses and Start-up Transformer Losses

The losses of the ICTs and start-up transformers apply for the complete switchyard of the Plant.

Own Consumption

The own consumption is the sum of the auxiliary power of both units and the ICT losses and star-up transformer losses.

B0.2.9.5 Plant availability

The Contractor shall:

- a. design and configure all components of the Plant;
- b. propose spare parts stock, comprising as minimum requirement the Initial Spare Parts as requested in Amendment No 3 and Annexure I to Amendment No.3 (both already published on BIFPCL's Website; and
- c. propose maintenance works

in such a way that the average availability of each unit for a period of two year is not lower than 90 %.

The availability for the year means the yearly availability of the Dependable Capacity of each unit for dispatch by the Control Centre, calculated in accordance with the following formula:

$$AF_n = \frac{DC \times \text{hours in the year} - ((MO_{cap} \times MOH) + (FO_{cap} \times FOH) + (SO_{cap} \times SOH))}{DC \times \text{hours in the year}}$$

Where:

- AF_n Availability Factor for the year "n"
- DC Dependable Capacity of the Unit as per the Contract
- MO_{cap} capacity reduction during each maintenance outage in the year "n"
- MOH maintenance outage hours for each maintenance



	outage (MO_{cap}) in the year "n"
FO_{cap}	capacity reduction during each forced outage in the year "n"
FOH	forced outage hours for each forced outage (FO_{cap}) in the year "n"
SO_{cap}	capacity reduction during each scheduled outages in the year "n"
SOH	scheduled outages hours for each scheduled outage (SO_{cap}) in the year "n"
$\Sigma(MO_{cap} \times MOH)$	maintenance outage energy for the year "n"
$\Sigma(FO_{cap} \times FOH)$	forced outage energy for the year "n"
$\Sigma(SO_{cap} \times SOH)$	scheduled outage energy for the year "n"

B0.2.9.6 Maintenance intervals

The Plant shall be designed to follow at least the following requirements for maintenance intervals:

	Recommended outage duration (days)	Recommended intervals between maintenance outages (years)
Scheduled Maintenance (Minor Overhauls)	to be determined by Contractor, see B0 TS	> two years
Major Overhaul	to be determined by Contractor, see B0 TS	> eight years

It is meant that the Bidder/Contractor shall determine the final maintenance intervals which shall > 2 years for minor overhauls and > 8 years for major overhauls, supposed that the plant is operated with the specified fuels and according to the operation and maintenance manuals.

In case a minor or major overhaul has to be carried out in the first two years after PAC that means during the warranty period it will have an impact on the availability and as the case may be on the availability guarantee.

B0.2.10 Mode of operation

The Plant shall be designed for base load operation and is expected to participate in the system frequency regulation by free governor operation



All the equipment and the facilities shall be suitable for:

- Continuous and short-time operation under average ambient air and river water conditions present on site; and
- Continuous and short-time operation under extreme ambient air and river water conditions present on site.



The design of the Plant shall be based on the following operation and dispatching requirements:

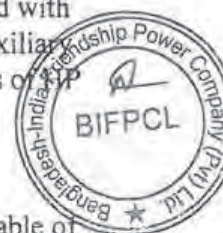
- It shall be capable of following the daily and seasonal demand profile of the electrical network.
- Full compliance with the conditions of the admissible air pollution is required within the power range.
- The power generation shall be fully dispatchable within the technical limits of the Plant to be specified by the Contractor but at least between MNCR and 100 % of the Net Output of the Plant at BMCR.

The units shall be operated as base load plant. It must be capable for following operation modes:

- Fixed/Constant pressure operation upto 40% MCR load;
- Sliding pressure operation from rated pressure down to 40% of rated with as well as without any throttle reserve. At any operating load, the throttle reserve shall be sufficient so as to achieve an instantaneous increase in turbine output by 5% (except MCR, 3% for MCR) of the corresponding load by opening turbine control valve wide open VWO/TMCR). The throttle reserve shall be adjustable to 0% for pure sliding pressure mode operation;
- Fixed/Constant pressure from 100% MCR to 103% MCR (TMCR/VWO) load. Consequently the plant shall be designed also for fixed pressure operation as much higher load than 40% upto to 100% load;
- start-up modes from notice to start to synchronization:
 - hot start: start-up following a continuous shutdown for a period of 8 hours or less in max. 3 hours;
 - warm start: start-up following a continuous shutdown for a period between 8 and 48 hours in max. 4 hours;
 - cold start: start-up following a continuous shutdown for a period more than 48 hours in max. 12 hours;
- shut-down mode;
- Each Unit shall be capable of automatic operation and control and full cyclic operation between MNCR and BMCR without restriction;
- operation without HP heater;

With all HP heaters out of service 100% el. load shall be generated with maximum cooling water temperature, 3% make up and normal auxiliary steam requirement being tapped from cold re-heat line. For bypass of HP heaters a full bypass shall be considered.

- house load operation;
- In case of sudden load throw-off, the steam generator shall be capable of automatically bringing down the steam generating capacity from BMCR to match with HP-LP bypass capacity;



- The Power Plant shall be designed for minimum rate of loading/unloading mentioned below without compromising on design life of pressure parts;
- step load change: Minimum $\pm 10\%$ /min;
- ramp rate: Minimum $\pm 3\%$ /min (MNCR to 50% BMCR);
Minimum $\pm 5\%$ /min (50% MCR to 100% BMCR).

In addition to the the following requirements shall be considered:

- Steam Generator (refer also to Bidding Documents, Section V TS, B1.3.1.1 Operational requirements): "The steam generator shall be operable in the variable (i.e. sliding or modified sliding) and fixed pressure mode";
- Steam Turbine (refer to Bidding Documents, Section V TS, B2.3.15 Control and monitoring equipment): "The steam turbine shall be capable of operating in both the sliding and fixed pressure modes. The Bidder/Contractor shall propose the operating regime which will maintain a highest efficiency of the Plant at various loads."

The Performance Tests/Guarantee Tests shall be executed for the load points as specified. Performance Tests/Guarantee Tests at MCR shall correspond to rated pressure (with throttled valves); whereas for part load (i.e 80%, 60%, 50% MCR) the guarantee test shall be under modified sliding pressure (with 5% throttled turbine inlet valve(s)).

For more detailed requirements refer also to Chapter B0.2.12.

B0.2.11 Electrical network connection conditions

The Plant shall comply with:

- the Essential Electrical Requirement of the PPA
- the latest edition of the Electricity Grid Code of the Bangladesh Energy Regulatory Commission; and
- the Great Britain Grid Code.

In case of contradictions or discrepancies the order of precedence shall be as follows:

- Essential Electrical Requirements of the PPA
 - Electricity Grid Code of the Bangladesh Energy Regulatory Commission
 - Great Britain Grid Code.
- Any other requirements of the Bangladesh Power Development Board (BPDB) or Power Grid Company of Bangladesh (PGCB) shall also be considered.

The Tenderers shall list all those grid connection requirements which cannot be met by the proposed Plant.



B0.2.11.1 Essential Electrical Requirements of the PPA

In this chapter essential electrical requirements for the grid connection and Plant operation are extracted from the PPA. For ease of reference, the relevant chapters/articles of the PPA are indicated.

PPA Section 11: Power Evacuation and Switchyard

11.1 Power Evacuation

The Company shall deliver power at the Delivery Point and BPDB shall evacuate power from the Delivery Point. In this regard, BPDB itself or through PGCB shall construct Power Evacuation Facilities at its own costs and expenses. The Company shall construct switchyard for evacuation of power, with the provision for termination of two 400 kV circuits and two 230 kV circuits of PGCB. This switchyard along with line breaker, CT, PT and other necessary equipment and associated relays, controls, protection, communication and instrument system situated within this switchyard, will be operated and maintained by the Company. The company will also construct connecting lines (U/G or O/H) from power plant to this switchyard. The Company shall provide suitable interface unit at the Company premises for communication links to the power grid SCADA system to accommodate the PGCB and the National Load Dispatch Center (NLDC) requirements. The communication interface unit provided in the Company premises shall be adequate to fulfil the PGCB/NLDC information requirement and may be in the form of RTU or a suitable Gateway on company switchyard automation network at a mutually agreed communication protocol (i.e. IEC-60870-5-101/104). The Company shall be responsible for construction of the interconnections between the switchyard and the Facility. The company Switchyard including the interconnecting link with the generation facility should have design standards as per Minimum Functional Specification. Line relays and controls at the switchyard shall be provided by the Company.

In addition refer to B10.

Only the "start up transformer" and the "future GT's" shall be connected by means of 230 kV cables. Connection between GT's and GIS switchyard shall be done by overhead line.

BPDB shall provide by no later than two hundred and seventy (270) Days prior to Scheduled Initial Operation Date, the following facilities to the Company for the purpose of Commissioning, synchronization and operation of the Facility:

- i. One number 230 KV D/C transmission line from the BPDB / PGCB 230 KV system, to be terminated at the specified point at the switchyard of the Facility;
- ii. (ii) Start-up power of not less than 50 MVA capacity, to be supplied to the Facility through this 230 KV transmission line, by no later



than two hundred and seventy (270) Days prior to Scheduled Initial Operation Date;

- iii. One number 400 KV D/C transmission line from the BPDB / PGCB 400KV system, to be terminated at the specified point at the switchyard of the Facility, with adequate capacity to evacuate entire power generated by the Contracted Capacity of the Facility, by no later than one hundred and eighty (180) Days prior to Scheduled Initial Operation Date;

11.2 Electrical

a. Communication link

The Company shall provide suitable interface unit at the Company premises for communication links to the power grid SCADA system to accommodate the PGCB and the National Load Dispatch Center (NLDC) requirements. The communication interface unit provided in the Company premises shall be adequate to fulfil the PGCB/NLDC information requirement and may be in the form of RTU or a suitable gateway on Company switchyard automation network at a mutually agreed communication protocol (i.e. IEC-60870-5-101/104).

The Company shall be responsible for construction of the interconnections between the switchyard and the Facility. The Company switchyard including the interconnecting link with the generation facility should have design standards as per Minimum Functional Specification. Line relays and controls at the switchyard shall be provided by the Company.

b. Control of Switchyard

Provision and installation of all control and signal cables between the company switchyard and the Facility shall be responsibility of the Company. Necessary interface shall be provided within the switchyard control facility for receiving the signals from PGCB grid control. It shall be responsibility of the Company to lay and terminate cables for this purpose.

All circuit breakers and disconnect switches shall be capable of being electrically controlled from the three control positions as follows:

- i. Local Control: Located adjacent to switching devices, to facilitate maintenance, inspection, and emergency operation.
- ii. Remote Control: Located at the switchyard control room, where switching devices are controlled by direct wire.
- iii. Supervisory Control: Located at the Load Dispatch Centre (NLDC) at Dhaka, for remote control and supervision via the tele-control systems to be supplied by the Company.

Also refer to B10.



The Company shall provide all the necessary control-selector switches, position indicating contacts, and interposing relays.

11.3 Electrical Protection, Communication and Instrument Systems

The Company shall provide a complete and comprehensive protection system for the generators/generator transformers/service transformers, transmission lines and the station electrical distribution systems. The Company shall undertake the installation of the protection relay panels within the control room, wiring between panels and switchyard equipment, and commissioning tests of the protection schemes.

The Company (in consultation with BPDB) shall provide suitable interface unit at the Company premises for communication links to the PGCB's SCADA system for Communication, control, monitoring and voice channels required for PGCB's National/Regional Control Center.

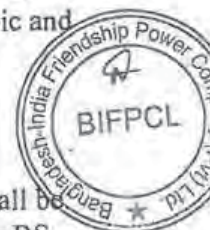
Communication, telemetry, fiber optical terminal, and tele-protection equipment (PLCC) shall be supplied and installed by PGCB at company switchyard end, matching with PGCB's remote substation end requirements. However, line trap and capacitive voltage transformer of required rating along with 48V DC/AC auxiliary supply at company switchyard end shall be provided by company. The wiring of all signalling and control circuits required for the system shall be cabled out to interface marshalling cubicles by the Company. The Company shall supply and install necessary cabling and cubicles. Cabling between the Company's cubicles and PGCB' LDC equipment shall be provided and installed by the Company.

PPA Schedule 1: Minimum Functional Specifications

3. ELECTRICAL REQUIREMENTS

3.1 Generators

- a. Each generator shall comply with IEC 34: Latest Edition and shall be rated to match [each][the] Steam turbine[s] and the steam turbine output over the full range of ambient temperatures. Generator and exciter windings shall possess insulation that is non-hydroscopic and of Class F type in accordance with IEC 85 standard.
- b. Not Used
- c. The quality management of the generator[s] and accessories shall be in accordance with the requirements of ISO 9001, EN 29001 or BS 5750 Part 1 or such other equivalent international quality standards and Prudent Utility Practices.
- d. Temperature detectors shall be provided (to be placed in the hottest zone as decided by manufacturer) to monitor the maximum operating temperature of the machine.
- e. The generator[s] shall be capable of operating within 48.5 Hz and 51.5 Hz and +/- 5% of nominal rated voltage within the power factor



range 0.85 lagging and 0.95 leading at the generator terminal. However, the combined variation in voltage and frequency shall not exceed 5%.

- f. Generator[s] shall have a minimum short circuit ratio complying with IEC 34.

3.2 Excitation System

- a. A continuous fast acting automatic excitation control system of proven design shall be provided to control each generator's voltage without hunting or instability over the entire operating range of the generators.
- b. The excitation system shall be provided with a fast acting MVAR limiter so as to prevent the generator output falling below safe limits. A power system stabiliser shall be incorporated in the excitation system of each generator. BPDB shall provide the settings for the power system stabiliser. The AVR shall be provided with but not limited to Quadrature Droop Compensation and Cross Current Compounding. Protection features, as part of the system shall include overvoltage, overcurrent, voltage transformer (VT) fuse failure, diode failure, overfluxing, and AVR power supply failure. A field shorting or discharge switch feature shall be included in the system as protection against over stressing the generator insulation in the event of a fault.
- c. Manual excitation control facilities shall be provided as back up to the automatic channel, and shall have an adequate range to allow for control of excitation for testing purposes. A true null balance shall be provided to allow for smooth excitation transfer between manual and automatic control.

Bidder's/Contractor's/OEM's standard and proven static excitation system with advanced dual channel digital voltage regulator system which do not require true null meter or follow up device for smooth AVR control transfer between auto and manual will be accepted.

The requirement related to on load tap changer is not applicable to excitation transformer.

3.3 Power and Auxiliary Transformers

The Facility shall include a main transformer for each generator, together with all protection, busbars and disconnectors where required. These main transformers shall be equipped with on load [to be discussed with BPDB] tap changers and shall be of OFAF (forced oil, forced air) or ODAF (oil direct, forced air cooled) or suitable type rated for the full continuous output of the generator.



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All service station auxiliary transformers (utilization voltage <650V) shall be OFAF, ODAF or ONAN cooled if located outside, or resin type design if situated inside the buildings.

3.4 Control and Supervision

- a. Supervisory control, monitoring, and data acquisition information shall comply with BPDB's system control concept and proposed/current system. BPDB shall provide all supervisory control, monitoring, and data acquisition circuits from BPDB's National/Regional Control Center, all of which shall conform to the Company's requirements.
- b. Manual synchronising facilities, with such check facilities shall be provided as a minimum for all circuits except for station/service transformer circuits.
- c. The Facility shall be provided with a central on-site control room (CCR) so that operators can control the generators and perform switching and load dispatch duties. A Distributed Control System (DCS) shall be provided to coordinate the control and supervision of the Facility including half hourly Dependable Capacity correction for Reference Site Condition
- d. The Facility shall be equipped with terminals to receive command from the BPDB load dispatch center to allow control from Load Dispatch Center.

3.5 Electrical Protection, Communication Instrument Systems

The Facility shall incorporate a protection system for generators, generator transformers, service transformers, and station electrical distribution systems as per Prudent Utility Practice.

Communication, control, monitoring, and voice channels will be provided between the Facility and BPDB's National/Regional Control Center by BPDB. The Company shall provide interconnection within the Facility for all such communication circuits/channels.

3.6 Power Tariff Metering

- a. The Metering System to be installed at the Facility shall include tariff metering and indicative metering.
- b. For each unit, the measurements, which are used for calculation of the main tariff metered energy, are taken at the outgoing side of the interconnecting lines (main and check) and Back-Up Metering System on the high voltage side of each generator transformer and station transformers, as applicable. The tariff meters installed will measure the net energy sent out from the facility. As provided in Section 12.1, the Back-Up Metering System shall also be of the same type and identical to the Metering System.



Main and check meters shall be provided on HV side of generator and start-up transformer as well as at the outgoing side of the interconnection lines (Reference is made to chapter B10.3.13).

- c. The tariff meters shall have separate facilities for recording the net inflow to the Facility and net outflow of energy from the Facility, and the aggregate of these parameters. This information shall be available for transmission to remote locations via the communication circuit to be provided by BPDB.
- d. Sufficient indicative metering facilities will be installed to allow efficient normal operating and maintenance procedures and automatic control functions to be conducted at the Facility. The metering shall be logged by the Facility's DCS.

PPA Schedule 1: Technical Limits and Contracted Characteristics

1.3 Frequency, Power Factor and Voltage Limits

- a. At rated voltage and frequency, the Facility will operate at 100% load with a power factor in the range 0.85 lagging to 0.95 leading at the generator terminals, which range shall not be exceeded. The curves from the manufacture(s) showing the Reactive Power capability of the generators form part of Schedule 2.
- b. The Facility will operate within the line voltage range used in practice by BPDB and in no case shall the Facility be required to operate more than +5% or less than -10% on the 400 kV high voltage system.
- c. The Facility shall operate within the frequency range 48.5 Hertz to 51.5 Hertz which range shall not be exceeded. The Facility shall be capable of continuous operation for the periods defined in Table 3,



Table 3: As per PPA

Frequency Range (Hz)	Minimum Sustainable Operation
48.5 to 51.5	Continuous
47.5 to 48.5	10 minutes
Less than 47.5	Trip Condition
Greater than 51.5	Trip Condition

B0.2.11.2 Essential Requirements of Electricity Grid Code of the Bangladesh Energy Regulatory Commission

In this chapter essential requirements for the grid connection and Plant operation are extracted from the BGC. For ease of reference, the relevant chapters/articles of the BGC are mentioned in brackets.



The full compliance with the BGC shall be proven by electrical system studies and investigations.

The ratio of X/R can be considered as 40 based on the table 10 given in IEEE C37.010.

It is to be emphasized that there are some discrepancies between the requirements of the BGC and the requirements of the International Electrotechnical Commission Standard IEC 60034. In case of contradictions the requirements and stipulations of IEC 60034 shall prevail.

The Tenderer shall discuss all deviations from the grid connection conditions, which will result in an economic advantage for the investment and the operation of the Plant.

B0.2.11.2.1 System performance (Section 5.4)

Each generating unit shall be capable of generating at full rated power output within following ranges:

	From	To
Frequency	47.5 Hz	52 Hz
Rated Voltage	-10%	+ 10%
Power factor	0.85 lagging *)	0.95 leading

*) This value deviates from the BGC and is chosen as common for generator of this size.

The Transmission System frequency shall normally be 50.0 Hz and shall normally be controlled in the range 49.0 – 51.0 Hz (50 Hz \pm 2%). The User shall however be subject to the grid discipline directed by the Commission.

Voltage variation on the Transmission System shall normally be \pm 10% during emergencies and \pm 5% during normal operation, in accordance with the provisions of Planning and Security Standards for Transmission System. Insulation coordination of the Users' equipment and rupturing capacity of switchgear shall conform to applicable Bangladesh Standards/Codes.

Protection schemes and Metering schemes shall be as detailed in the Protection & Metering Sections of the Code.

For new Power Stations the equipment within their site for data transmission and communications shall be owned and maintained by the respective Generator.



B0.2.11.2.2 Connection point (Section 5.6.1)

Unless specifically agreed with the Licensee the Connection point shall be the outgoing gantry of Power Station switchyard. The metering point shall be at the outgoing connection point. All the substation equipment including Protection, Control and Metering equipment owned by the Generator within

the perimeter of the Generator's site shall be maintained by the Generator. Other Users' equipment shall be maintained by the respective Users. From the outgoing feeder gantry onwards, the Licensee shall maintain all electrical equipment.

B0.2.11.2.3 Data requirements (Section 5.7)

Users shall provide the Licensee with data for this Section as specified in the Data Registration Section.

B0.2.11.2.4 Frequency management & responsibilities (Section 8.3 and 8.4)

Generators shall follow the dispatch instructions issued by the NLDC.

All Generating Units shall have the governor available and in service and must be capable of automatic increase or decrease in output within the normal declared frequency range and within their respective capability limit.

Under certain conditions the system frequency could rise to 52 Hz or fall to 47.5 Hz. All Generating Units should be capable of operating within the range and the NLDC informed promptly of any restrictions. Generators shall be responsible for protecting their Generating Units against damage should frequency excursions outside 52 Hz and 47.5 Hz ever occur. Should such excursions occur, the Generator should decide whether or not to disconnect his apparatus for reasons of safety of apparatus, Plant and/or personnel. The Generator shall inform the NLDC immediately after taking such action.

Sustained rising frequency

Under rising frequency conditions, the NLDC shall take appropriate action to issue instructions to Generators to arrest the rising frequency and restore frequency within normal range. Such instructions may include reducing generated output or de-synchronizing Generating Units from the Transmission System. When the frequency rises above 51.0 Hz actions must be taken immediately by the Generator. Under such condition, the Generating Units which were responsible for seeing frequency of the system shall decrease their Generating Output at a rate of - (minus) 2% per 0.1 Hz for departure of frequency above 51.0 Hz until the frequency is restored within the normal range. The Generator shall inform the NLDC immediately after taking such action.

Sustained falling frequency

Under falling frequency conditions, the NLDC shall take appropriate action to issue instructions to arrest the falling frequency and restore it to be within normal range. Such instructions may include dispatch instructions to Generators to increase output, to synchronize standby Generating Units to



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the Transmission System and/or instructions to Distribution Utilities to reduce load demand by appropriate manual and /or automatic load shedding.

When the frequency falls below 49.0 Hz the Generating Units which were responsible for seeing frequency of the system shall increase their Generating Output at a rate of + (plus) 2% per 0.1 Hz (if available) for departure of frequency below 49.0 Hz until the frequency is restored within the normal range. The **Generators** shall be responsible for protecting own units should frequency excursions occurs outside 47.5 to 52 Hz range. The **Generator** shall inform the **NLDC** immediately after taking such action.

All Generating Units that have been declared available shall be required to be synchronized and loaded in the event of the sustained low frequency below 49.0 Hz provided local and safety conditions permit. This action shall be performed without delay after failed attempts to contact the **NLDC**. The **Generator** shall inform the **NLDC** immediately after taking such action.

B0.2.11.2.5 Voltage management (Section 8.5)

The **Licensee** and **NLDC** shall carry out load flow studies from time to time to predict where voltage problems may be encountered and to identify appropriate measures to ensure that voltages remain within the defined limits. On the basis of these studies the **NLDC** shall instruct **Generators** to maintain specified voltage levels at interconnecting points.

The **Licensee** shall continuously monitor 400 kV/ 230 kV/ 132 kV transmission grid voltage levels at strategic substations. The **NLDC** and the **Licensee** shall regulate voltage levels within the prescribed levels.

The **NLDC** and the **Licensee** shall jointly take appropriate measures to control Transmission System voltages that may include but not be limited to transformer tap changing and use of MVAR reserves with Generating units within technical limits agreed to between the **NLDC**, **Licensee** and Generating units.

All Generating Units shall have Automatic Voltage Regulator (AVR) in service.

Generators shall inform the **NLDC** of their reactive reserve capability promptly on request. **Generators** shall make available to the **NLDC** the up-to-date capability curves for all Generating Units, as detailed in **Section 5**, indicating any restrictions, to allow accurate system studies and effective operation of the Transmission System.



B0.2.11.2.6 Monitoring of generation (Section 8.7)

For effective operation of the Transmission System, it is important that a **Generator's** declared availability is realistic and that any departures are continually fed back to the **Generator** to help effect improvement. The monitoring by the **NLDC** of Generating Unit output, and active and reactive reserve capacity, shall be carried out to evaluate the reliability and performance of plant.

The **NLDC** shall continuously monitor Generating Unit outputs and bus voltages (by SCADA). More stringent monitoring may be performed at any time, as detailed in the Testing Section, when there is reason to believe that a **Generator's** declared availability may not match the actual availability or declared output does not match the actual output.

Generators shall provide to the **NLDC** hourly generation summation outputs where no automatically transmitted metering or SCADA equipment exists.

The Generator shall provide other logged readings that the **NLDC** may reasonably require, for monitoring purposes where SCADA data is not available.

Generators shall submit data to **NLDC** as listed in Data Registration Section, termed as Frequency and Voltage Management.

B0.2.11.2.7 Contingency planning (Section 9)

Total System Blackout (Section 9.3.1)

NLDC shall instruct all relevant Generators having Power Stations with Black Start capability to commence their pre-planned Black Start procedure.

Remark: The Maitree-STPP shall **not** have Black Start capability.

Partial Transmission System Blackout (Section 9.3.2)

NLDC shall ensure with the **Licensee** and **Users** that security of the healthy part of the Transmission System is maintained.

NLDC and the **Licensee** shall gradually extend the healthy system to provide start-up power to appropriate Generating Units.

NLDC and the **Licensee** with close coordination with Distribution Utilities and **Generators** shall gradually restore demand to match generation as it becomes available.

All **Users** shall take care to ensure load generation balance is maintained all times under **NLDC's** direction.

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Special Consideration (Section 9.5)

During the restoration process following Transmission System blackout conditions, normal standards of voltage and frequency shall not apply.

B0.2.11.2.8 Protection (Section 12)**General Principals (Section 12.3)**

No item of electrical equipment shall be allowed to remain connected to the Transmission System unless it is covered by appropriate protection aimed at reliability, selectivity, speed and sensitivity. Guidelines mentioned in protection manuals may be kept in view.

All Users shall co-operate with the Licensee to ensure correct and appropriate settings of protection to achieve effective, discriminatory removal of faulty equipment within the time for target clearance specified in this Section.

Protection settings shall not be altered, or protection bypassed and/or disconnected without consultation and agreement of all affected Users. In the case where protection is bypassed and/or disconnected, by agreement, then the cause must be rectified and the protection restored to normal condition as quickly as possible. If agreement has not been reached the electrical equipment will be removed from service forthwith.

Fault Clearance Times (Section 12.5)

From a stability consideration the maximum fault clearance times for faults on any User's system directly connected to the Transmission System, or any faults on the Transmission System itself, are as follows:

Target Clearance Times:

- i. 400 kV : 100 ms
- ii. 230 kV : 160 ms
- iii. 132 kV : 160 ms.



Slower fault clearance times for faults on a Users system may be agreed to but only if, in the Licensee's opinion, system conditions allow this.

Generator Requirements (Section 12.6)

All Generating Units and all associated electrical equipment of the Generator connected to the Transmission System shall be protected by adequate and coordinated protection so that the Transmission System does not suffer due to any disturbance originating from the Generating Unit.

In the event of failure of the protection systems provided to meet the fault requirements detailed above, backup protection shall be provided by the Generator with a fault clearance time not slower than 400ms for faults on the Generating Unit's HV connections. The protection shall also cover EHV lines and transformers to the standards as for the Transmission System and



circuit breaker fail, pole slipping, loss of excitation, power system stabilizer and negative phase sequence tripping.

Transmission Line Requirements (Section 12.7/12.7.1/12.7.3)

Every 400 kV Line and 230 kV Line taking off from a Power Station or a substation shall have main protection and backup protection as mentioned below. The Licensee shall notify Users of any changes in its policy on protection from time to time.

- Two distance protections plus directional earth-fault protection (in directional comparison scheme) shall be provided as the Main-1 and Main-2 protection respectively.
- One stand alone directional 3-phase or 2-phase over-current relay and one directional earth-fault relay shall provide the backup protection.
- Three pole and/or single pole single shot auto-reclosing equipment shall be fitted, as appropriate, as considered by the licensee. All auto-reclosing equipment will be made inoperative for three phase trip-out and/or back-up protection operation.
- Both distance and directional earth-fault functions shall have compatible communication aided transfer trip scheme.

For short transmission lines Line Differential Protection along with backup Directional normal, Directional time-lag and/or Non-Directional Over-current and Earth-fault protection shall be provided as an appropriate protection scheme.

Relay Panels for the protection of lines of the Licensee taking off from a Power Station shall be owned and maintained by the Licensee. Generators shall provide space, connection facility and access to the Licensee for such purpose.

The Generator shall ensure that all common facilities needed for installing required protective relaying are made available to the Licensee.

Transformer Requirements - Generating Station/Transmission System (Section 12.9.1)

All windings of auto-transformers and power transformers of EHV class shall be protected by differential relays and REF relays as main protection. In addition there shall be one backup time lag 3-phase Over-current and Earth-fault protection relay. For parallel operation such backup protection shall have directional feature. For protection against heavy short circuits, the Over-current and Earth-fault relays should incorporate a high set instantaneous element. In addition to electrical protection, gas operated relays, winding temperature protection and oil temperature protection shall be provided. Over-voltage, thermal overload and over-fluxing protection should also be provided.



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Substation Busbar and Fire Protection (Section 12.10.1/12.10.2)

All Users shall provide adequate main and backup bus zone protection incorporated with Local Breaker Backup (LBB) or Breaker Fail Protection (BFP) for busbars in all 400 kV, 230 kV and 132 kV class substations.

Adequate precautions shall be taken and protection shall be provided against fire hazards to all Apparatus of the Users conforming to relevant Bangladesh Standard Specification and/or provisions in the Electricity Rules, 1937 and amendments thereof and other standard engineering practices.

Data Requirements (Section 12.11)

Users shall provide the Licensee with data for this Section as specified in the Data Registration Section.

B0.2.11.2.9 Testing (Section 14)**Introduction (Section 14.1)**

This Section specifies the responsibilities and procedures for arranging and carrying out Tests which have (or may have) an effect on the Transmission System or the Generator's or Distributor's systems.

Objective (Section 14.2)

The objective of the Section are to establish whether Generating Units can operate within their Generation Schedule and Dispatch parameters as registered under the Data Registration Section and that the Generator and Distributor comply with the Connection Section. It shall also establish whether each Generating Unit's declared availability capacity is as declared and that the requirements of the provisions of frequency, voltage management and reserve capability are met in accordance with the provisions of the Grid Code.

B0.2.11.2.10 Performance standards for transmission (Section 17)**Purpose and Scope (Section 17.1.1/17.1.2)***Purpose:*

- a) To ensure the quality of electric power in the Grid.
- b) To ensure that the Grid will be operated in a safe and efficient manner and with a high degree of reliability; and
- c) To specify safety standards for the protection of personnel in the work environment

Scope of Application:

This Chapter applies to all Grid Users including:

- a) the Licensee
- b) the System Operator/ NLDC
- c) generators



- d) distribution utilities, and
- e) any other entity (e.g. owners of HVDC converter, large furnaces, etc.) with a User System connected to the Grid.

Power Quality Standards (Section 17.2)

Power Quality Problems (Section 17.2.1)

For the purpose of this Article, Power Quality shall be defined as the quality of the voltage, including its frequency and the resulting current that are measured in the Grid during normal conditions.

A Power Quality problem exists when at least one of the following conditions is present and significantly affects the normal operation of the System:

- a) The System Frequency has deviated from the nominal value of 50 Hz.
- b) Voltage magnitudes are outside their allowable range of variation.
- c) Harmonic Frequencies are present in the System
- d) There is imbalance in the magnitude of the phase voltages.
- e) The phase displacement between the voltages is not equal to 120 degrees.
- f) Voltage Fluctuations cause Flicker that is outside the allowable Flicker Severity limits, or
- g) High-frequency Over-voltages are present in the Grid.

Frequency Variations (Section 17.2.2)

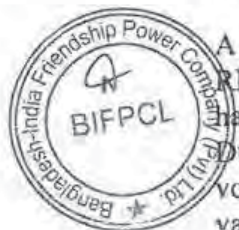
The nominal fundamental frequency shall be 50 Hz. The control of System frequency shall be the responsibility of the System Operator. The System Operator shall maintain the fundamental frequency within the limits of 49.0 Hz and 51.0 Hz during normal conditions.

Voltage Variations Section 17.2.3)

For the purpose of this Section, Voltage Variation shall be defined as the deviation of the root-mean-square (RMS) value of the voltage from its nominal value, expressed in percent. Voltage Variation will either be of short duration or long duration.

A Short Duration Voltage Variation shall be defined as a variation of the RMS value of the voltage from nominal voltage for a time greater than one-half cycle of the power frequency but not exceeding one minute. A Short Duration Voltage Variation is a Voltage Swell if the RMS value of the voltage increases to between 110 percent and 180 percent of the nominal value. A Short Duration Voltage Variation is a Voltage Sag (or Voltage Dip) if the RMS value of the voltage decreases to between 10 percent and 90 percent of the nominal value.

A Long Duration Voltage Variation shall be defined as a variation of the RMS value of the voltage from nominal voltage for a time greater than one minute. A Long Duration Voltage Variation is an Under-voltage if the RMS value of the voltage is less than or equal to 90 percent of the nominal voltage. A Long Duration Voltage Variation is an Overvoltage if the RMS



value of the voltage is greater than or equal to 110 percent of the nominal value.

The Grid Owner and the System Operator shall ensure that the Long Duration Voltage Variations result in RMS values of the voltages that are greater than 95 percent but less than 105 percent of the nominal voltage at any Connection Point during normal conditions.

Harmonics (Section 17.2.4)

For the purpose of this Section, Harmonics shall be defined as sinusoidal voltages and currents having frequencies that are integral multiples of the fundamental frequency. The Total Harmonic Distortion (THD) shall be defined as the ratio of the RMS value of the harmonic content to the RMS value of the fundamental quantity, expressed in percent.

The Total Demand Distortion (TDD) shall be defined as the ratio of the RMS value of the harmonic content to the RMS value of the rated or maximum fundamental quantity, expressed in percent. The Total Harmonic Distortion of the voltage and the Total Demand Distortion of the current at any Connection Point shall not exceed the limits given in Tables 17-1 and 17-2, respectively.

Harmonic Voltage Distortion

Voltage Level	THD*	Individual	
		Odd	Even
400 kV	1.5%	1.0%	0.5%
132-230 kV	2.5%	1.5%	1.0%
66 kV	3.0%	2.0%	2.0%

* Total Harmonic Distortion

Table 17-1: Maximum Harmonic Distortion Factor

Harmonic Current Distortion

Voltage Level	TDD*	Individual	
		Odd	Even
400 kV	1.5%	1.0%	0.5%
132-230 kV	2.5%	2.0%	0.5%
66 kV	5.0%	4.0%	1.0%

* Total Demand Distortion

Table 17-2: Maximum Harmonic Distortion



T.H.D of the line-to-line terminal voltage for the Generator shall be as per latest IEC 60034-3 (clause 9.11.2 - Limits (Total Harmonic Distortion (THD) for synchronous machines) will be accepted. As per this clause of IEC, it shall be limited to 5%. However, at the 400 kV and 230 kV grid connection points the requirements of the specification Section B0.2.11.2.10 shall apply.



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Voltage Unbalance (Section 17.2.5)

For the purpose of this Section, the Negative Sequence Unbalance Factor shall be defined as the ratio of the magnitude of the negative sequence component of the voltages to the magnitude of the positive sequence component of the voltages, expressed in percent. For the purpose of this section, the Zero Sequence Unbalance Factor shall be defined as the ratio of the magnitude of the zero sequence components of the voltages to the magnitude of the positive sequence component of the voltages, expressed in percent. The maximum Negative Sequence Unbalance Factor at the Connection Point of any User shall not exceed one (1) percent during normal operating conditions.

The maximum Zero Sequence Unbalance Factor at the Connection Point of any User shall not exceed one (1) percent during normal operating conditions.

Voltage Fluctuation and Flicker Severity (Section 17.2.6)

For the purpose of this Section, Voltage Fluctuations shall be defined as systematic variations of the voltage envelope or random amplitude changes where the RMS value of the voltage is between 90 percent and 110 percent of the nominal voltage. For the purpose of this Section, Flicker shall be defined as the impression of unsteadiness of visual sensation induced by a light stimulus whose luminance or spectral distribution fluctuates with time.

In the assessment of the disturbance caused by a Flicker source with a short duty cycle, the Short Term Flicker Severity shall be computed over a 10-minute period. In the assessment of the disturbance caused by a Flicker source with a long and variable duty cycle, the Long Term Flicker Severity shall be derived from the Short Term Flicker Severity levels.

The Voltage Fluctuation at any Connection Point with a fluctuating demand shall not exceed one percent (1%) of the nominal voltage for every step change, which may occur repetitively. Any large Voltage Fluctuation other than a step change may be allowed up to a level of three percent (3%) provided that this does not constitute a risk to the Grid or to the System of any User. The Flicker Severity at any Connection Point in the Grid shall not exceed the values given in Table 17-3.

	Short Term	Long Term
132 kV and above	0.8 unit	0.6 unit
below 132 kV	1.0 unit	0.8 unit

Table 17-3: Maximum Flicker Severity



Transient Voltage Variations (Section 17.2.7)

For the purpose of this Section, Transient Voltages shall be defined as the high-frequency Over-voltages that are generally shorter in duration compared to the Short Duration Voltage Variations. Infrequent short-duration peaks may be permitted to exceed the levels specified in Section 17.2.4 for harmonic distortions provided that such increases do not

compromise service to other End-users or cause damage to any Grid equipment. Infrequent short-duration peaks with a maximum value of two (2) percent may be permitted for Voltage Unbalance, subject to the terms of the Connection Agreement or Amended Connection Agreement.

B0.2.11.2.11 House load operation (not requested by the Grid Code of Bangladesh)

Each Unit shall successfully go to house load operation in the event of disconnection or complete isolation of such Unit from the Grid. Each Unit shall be capable of performing house load operation up to a maximum of 2 hours. A Unit that has achieved house load operation shall not be shut down without the prior consent of the NLDC.

1. Within such time, each Unit on house load operation shall be ready to be resynchronized to the Grid System and able to increase output in the usual manner.
2. In the event the Grid System is not energized, each Unit on house load operation shall have the capability to energize a dead bus and to start the other Unit, when instructed by the NLDC. Subsequently, upon instruction by the NLDC, such Unit shall be able to increase output in the usual manner.

B0.2.12 Facility technical limits

The following sections describe the minimum requirements regarding the facility.



B0.2.12.1 Unit start

The facility shall be able to achieve the following operating levels within the same period (in minutes) specified in the following table.

Conditions	Boiler firing to turbine start	Steam turbine start to synchronous	Notice to start to steam turbine synchronous	Synchronous to full load	Total
Cold start after more than 48 hrs outage	TBD	TBD	12 hours	TBD	TBD
Warm start after 8 to 48 hrs shutdown	TBD	TBD	4 hours	TBD	TBD
Hot start after 8 hrs shutdown	TBD	TBD	3 hours	TBD	TBD

Table B0-3: Required start-up times (minutes)¹

¹ To be determined by the Tenderer



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B0.2.12.2 Despatch ramp rates

Ramp rates of 3%/min to 5%/min are expected for the Power Plant when operating between 30% and 100% BMCR. Ramp rates of less than 5%/min are subject to Employer's approval.

The facility shall be able to achieve the following despatch ramp rates as specified in the following table:

Despatch ramp rates		(Excluding Pulverizer changing over time)	
		Loading (MW)	Ramp rates (MW/min)
Cold start	(0 to 7%)	0 – 42	TBD
	(7 to 30%)	42 – 180	TBD
	(30 to 50%)	180 – 300	TBD
	(50 to 75%)	300 – 450	TBD
	(75 to 100%)	450 – 660	TBD
Warm start	(0 to 7%)	0 – 42	TBD
	(7 to 30%)	42 – 180	TBD
	(30 to 50%)	180 – 300	TBD
	(50 to 75%)	300 – 450	TBD
	(75 to 100%)	450 – 660	TBD
Hot start	(0 to 7%)	0 – 42	TBD
	(7 to 30%)	42 – 180	TBD
	(30 to 50%)	180 – 300	TBD
	(50 to 75%)	300 – 450	TBD
	(75 to 100%)	450 – 660	TBD

Despatch ramp rates (per Unit)²

B0.2.13 Environmental impact requirements

Air pollution

The permissible exhaust gas emissions shall comply with the stipulations of the generating license granted. Compliance for the following pollutants shall be guaranteed and proved:

Emission	Unit	Maximum Threshold
Total PM	mg/Nm ³	50
Sulphur dioxide (SO ₂)	mg/Nm ³	200
Nitrogen oxide (NO _x)	mg/Nm ³	510

Table B0-5: Emission limits

Note:

- NO_x refers to oxides of nitrogen, referenced to NO₂

Reference conditions for NO_x, SO₂, and particulates are 6 % O₂, dry (i.e. zero moisture), 0 °C and 1013 mbar atmospheric pressure, that means, unit for emissions is mg/Nm³

² To be determined by the Tenderer



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The stack height shall follow the requirements of the Environment Conservation Rules, 1997 of Bangladesh.

Water pollution

Permissible emission limits for aqueous discharges into the river via the Plant Water Discharge System shall comply with the Waste Water Effluent Standards, see Technical Schedule of **Section B0** and IFC EHSG - TPP - Table 5 - Effluent Guidelines. If there are differences in effluent limits in the two guidelines the more stringent limit should be applied. But limit of TDS with 2100 ppm shall not be followed.

The findings of the Environmental Impact Assessment (EIA) shall be used for Plant design.

Other waste water which is not allowed to be discharged to the requirements waste water treatment plant will have to be disposed externally.

Soil contamination

The Plant should be designed, operated and maintained in such a way to prevent any soil contamination by oil and chemical spillage during subsequent operation and maintenance of the Plant.

Permissible noise levels

The Plant shall be designed and constructed inter alia in accordance with IFC Environmental, Health and Safety Guideline Thermal Power Plants (EHSG-TPP) to reduce the operating noise level as much as possible. No individual within the boundary of the Site shall be exposed to a noise level exceeding the limits stated in the EHSG-TPP and "The Sound Pollution (Control) Rules, 2006".

Far field noise under normal operation of the Plant measured along the Site boundary of the Plant towards the Township shall not exceed 50 dB(A) during daytime and 40 dB(A) during night-time.

For any other point of the Site boundary of the Plant the noise pressure level shall not exceed 60 dB(A) during daytime and 50 dB(A) during night-time. Day time is defined from 6:00 am to 9:00 pm. Night time is defined from 9:00 pm to 6:00 am.

During the engineering phase the Contractor shall award an independent Third Party to conduct noise propagation calculation to prove that the permissible noise levels at the Plant boundary are met.

In addition the statutory requirements of Bangladesh shall be followed as far as stricter as the other standards, such as EHSG-TPP.

Furthermore the following maximum noise pressure levels shall be not exceeded:

dB(A)

- At 1 m horizontal distance from equipment/enclosures and 1.5 m above operating floor 85
- Within turbine building 90 (Note 1 & 2)
- Steam generator 90 (Note 1)
- Within central control rooms in power plants 55.

Notes:

1. At normal operation
2. Generally at maximum 88 dB(A), exceptions are the turbine stop valve and control valves 95 dB(A) and turbine drive boiler feed pumps 97 dB(A).
3. Noise level from non continuous operating valves (like pressure control valve, water separator drain control valve, etc.) shall be limited to 90 dB(A).
4. The noise level for safety valves including ERV shall be limited to 115dBA for the safety valves provided with silencer as per OSHA standard. Noise level around Mill will be 90 dBA.
5. Noise level at the boundary fence as specified must be complied with.

High noise areas (areas with noise levels >85 dB(A)), which require that personal noise protecting gear shall be used when working in such high noise areas, shall be marked.

Electromagnetic Field (EMF)

In accordance with the EHSG-TPP the occupational EMF exposure shall be prevented or minimized.

All technical measures and the required equipment necessary to fulfil the EHSG-TPP shall be provided by the Contractor. Inter alia areas with expected elevated EMF levels shall be identified and marked.

Fire and explosion, electrical and chemical hazards

In accordance with the EHSG-TPP all technical measures to prevent, minimize and control physical, electrical and chemical hazards shall be include in the Contractor's scope of services and supplies.

- B0.2.14** Provenness Criteria for Critical Equipments and Sub-systems shall be as per Annexure-I of B0 (Refer Amendment no.05 to Bidding Documents).

B0.3 Supplies and Services**B0.3.1 General**

The scope of this specification covers all supplies and services required for meeting the purpose of the Plant, even if these are not expressly mentioned in the following.



The works include the following main components, where the detailed scope of supply is given in the corresponding Sections as listed below:

- **Section B1:** Steam generator plants
- **Section B2:** Steam turbine generator plants
- **Section B3:** Air and flue gas systems
- **Section B4:** Fuel and Ash handling system
- **Section B5:** Plant Water and Cooling Systems
- **Section B6:** Water treatment systems
- **Section B7:** Electrical works
- **Section B8:** Instrumentation and control works
- **Section B9:** Civil Works
- **Section B10:** Electrical Works 400/230 kV Substation
- **Section B11:** Jetty
- **Section B12:** Auxiliary plant systems

The corresponding Annexes and Attachments are contained in **Part C**.

The relevant costs of these supplies and services to be given in the price schedules are to be assigned corresponding to the individual items concerned for each of the sections. The costs of the common equipment and services have to be included in the corresponding Section prices.

B0.3.2 Scope of engineering services

The Engineering services refer to the complete specified Plant and covers following services:

- **Basic and detail engineering**

- **Permit engineering**

The Contractor shall actively participate in drawing-up of all required licensing applications.

All services shall be performed by the Contractor to affect the required permits to commence the works and operate the Plant, including but not limited to:

- preparation of all documents as required according to the pertinent laws
- clarifications with authorities
- participation in all clarification meetings
- construction permits
- boiler and pressure vessel approvals
- water/waste water permits
- operation permits
- fire fighting approvals
- and all other services as required.



Furthermore, all other required engineering and other services to meet the purpose of the Project and the agreed project time schedule shall be executed by the Contractor.

B0.3.3 Deputation of Engineers during the Warranty Period

At least seven (7) English speaking graduate engineers, (3 operation experts, 1 Turbine & auxiliary expert, 1 Boiler & auxiliary expert, 1 for I&C, 1 for Generator and Switchyard area expert), with adequate knowledge and at least fifteen years of relevant experience of pulverised coal fired power plant of 500 MW and above unit size including two years of relevant experience in power plant of same type and technology being offered here from the Contractor, shall be permanently at site during the Warranty Period that means two months prior to PAC of first unit of the Plant upto end of warranty period of second unit. They shall be competent to advise and lead the Employer's staff on all aspects of engineering, operation and maintenance.

B0.3.4 Common equipment and services

The following supplies and services are to be included in the corresponding Section prices:

B0.3.4.1 General

- Material and personnel costs for tests and inspections which are mandated in legislation

Employer/employer representative/TPA will be responsible for their respective expenses in connection with inspection, examination and testing.

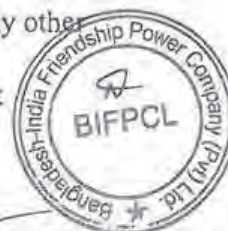
- Material and personnel costs for site inspections
- Declaration of conformity with requirements from Bangladesh and markings for all machines
- Engineering design of complete supplied equipment including interface coordination
- All as-built documents (on data carriers; data formats as requested by the Employer)
- Quality control plan and safety plan
- Complete documentation as set out in the tender specification
- Operating manual (5 hardcopies and 3 electronic copies)
- Detailed operating and maintenance instructions/manual (5 hardcopies and 3 electronic copies)
- A maintenance program for all equipment of the Plant instructions (5 hardcopies and 3 electronic copies)



- For all documents softcopy format shall be searchable pdf, however in addition all drawings, diagrams like P&IDs shall be supplied in ACAD or other editable format, and all lists in Excel format.
- All insurances, such as, but not limited to:
 - transport insurance, incl. marine cargo insurance
 - installation all risks,
 - third party liability,
 - automobile liability,
 - M.V. Policy for: motor vehicles, private cars & commercial vehicles,
 - CPM policy for heavy construction equipment,
 - Workmen's Compensation,
 - Employer's liability,
 - Group personal insurance, for contractor's & subcontractor's employees.

B0.3.4.2 Mechanical

- All necessary pipelines, valves, actuators
- All required line warm-up systems
- All connection and adaptation works for tie-in into general supply systems
- All necessary vents, drains and rinsing connections as well as tundishes with covers, as far as possible aggregated to common groups of on operating level
- All connection elements, screws, bolts, nuts, including gaskets and seals as necessary
- All temporary installations required for tie-in measures including post-weld heat treatment complete etc.
- All temporary pipework as required during connection measures
- Check of required existing structures, plant components and systems and their rehabilitation where they lie within the scope of supply, or definition of required measures in good time if they lie outside of the scope of supply
- All necessary support structures, hangers etc.
- All necessary base frames, mounting plates, grouted in parts, rag bolts, covers etc.
- All required steel parts embedded in concrete
- All couplings and coupling guards for electric motors and other drives
- All necessary lifting equipment and hoists (hooks and provisions for chain blocks to be provided for repair work where loads exceed 50 kg, hoists to be provided for repair work where loads exceed 200 kg, and electrical operated hoist for loads exceeding 2,500 kg)
- Required safety equipment, pressure relief valves etc.
- All thermal and noise insulation including cladding as well as any other noise attenuation measures
- Stairways, ladders, platforms, galleries and walkways to all plant components, including escape routes as necessary



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- All necessary steel structures, stairs, ladders on platforms weather protection
- All required ventilation or air conditioning equipment for safe operation of mechanical and electrical equipment, to be supplied
- All necessary corrosion protection measures for plant components and equipment stored or mounted on site up to the time of reliability test run
- Complete primer and top coatings conforming to colour code, clarified with the Employer
- Necessary noise abatements measures
- All required freeze protection and electric trace heating for outdoor installations
- Complete labelling of all plant components according to the Employers system and in plain language
- All fire protection measures
- All necessary lubrication systems
- Initial lubricant filling and sufficient lubricants for commissioning and reliability test run, minimization of lubricant types by screening and coordination with the Employer
- Water and demineralised water for pre-commissioning and commissioning activities,
- Provision of all connections and temporary pipework for acid cleaning, steam purging of the live steam line and flushing / cleaning of systems as necessary
- Flushing of all other lines including disposal of the effluents; protection with wood and/or plastic at all instrumentation and appendages to be installed during construction
- All standard accessories and auxiliary equipment which normally form part of the scope of supplies
- All necessary tests, inspections and works acceptances as well as all certificates and reports of these
- Exchange of filter elements following reliability test run
- Removal of temporary strainers
- Valve trims for purging and subsequent exchange
- Removal of any unused material
- Scaffolding for all work above ground level
- Necessary connection points for on line condition-based monitoring equipment.



B0.3.4.3 Substation control and monitoring system

At least but not limited to:

- all field equipment such as bay control units, bay protection equipments (described under chapter "Substation Control and Monitoring System) to be installed at the substation. The field equipment for the substation shall be interconnected by separate IEC 61850 fiber optic station busses in ring configurations. (The use of an IEC 61850 optical fiber link is required for all connections of equipments which directly interact with the station bus (the switches). In the particular case where, for example, the IEDs are wired to the BCU and only the latter is connected to the station bus, electrical links (preferably IEC 61850) are allowed for wiring connection of the IEDs with the BCU but an IEC 61850 optical fiber link between BCU and switches is required.
- all equipment to control and monitor the auxiliary equipment of the substation connected to the SCMS by redundant fiber optic links
- common bay unit / station computers
- operator and engineering workstations with TFT monitors and printers to be installed at the substation control room
- all equipment necessary for the implementation of an OPC server/client architecture between the substation and the Power Plant control rooms in order to allow the supervision and monitoring of the substation from the Power Plant DCS facilities. The OPC-server configuration shall be redundant
- Maintenance / service laptop which shall also be used for protection and disturbance analysis by respective log-in.
- data communication gateway to the National Load Dispatch Center (NLDC),
- energy meters for active energy (kWh) with accuracy of 0.2 S and for reactive energy (kVarh) with an accuracy of 0.5 S for tariff metering shall be provided for each outgoing line.

B0.3.4.4 Electrical



- All necessary electrical drives
- Complete installation material, that is wiring, cabling and piping material, all needed fastenings, conduits, brackets and other supports
- All required junction boxes and cubicles
- All field control boxes
- All cubicles, junction boxes, marshalling racks, terminal boxes, etc.
- Complete labelling of electrical equipment (also inside of cabinets)
- Lightning protection
- Electrical earthing of the equipment
- Cable and cable trays
- All necessary cables and wires for power, AC and DC instrument transformers, control, measuring, signals, etc.



- All necessary number plates for identifying the cables (numbering code to be determined)
- All necessary fixing materials
- All necessary fire protection materials for making good the cable openings through walls and ceilings as well as between switchgear and control, measuring, recording and switchgear cubicles, operating panels and desks, etc.,
- All necessary plastic protecting tubes for the cable runs
- All necessary materials for laying the cables in the ground
- All necessary cable connections including compression cable lugs, fixing and clamping materials, etc.
- All necessary cable sealing ends and cable connecting sleeves including fixing materials
- All necessary compression connectors.

B0.3.4.5 Instrumentation and Control

- All necessary control systems and auxiliaries
- All measurements and field control loops (thermometers, pressure gauges, transmitters, sensors, analyzers, local regulating devices, etc.) as well as all instruments for reliability test and checks for the duration of the performance tests
- Other special instruments/ systems like acoustic steam leak detection system (ASLD), acoustic pyrometer, communication systems, ambient air quality monitoring system (AAQMS), effluent quality monitoring system (EQMS)
- Complete installation material, that is wiring, cabling and piping material, all needed fastenings, conduits, brackets and other supports
- All required junction boxes and cubicles
- All field control boxes
- All instruments mounted on instrumentation racks
- All cubicles, junction boxes, marshalling racks, terminal boxes, etc.
- Signal exchange between local control system and DCS as well with instruments/control systems of other lots
- Complete labelling of I&C-equipment (also inside of control cabinets)
- Lightning protection
- Electrical earthing of the equipment
- Clarification of all logic interconnections: sequence, interlocking, protection, safeguarding for coordinated operation/start-up/shut down of individual items of equipment
- Cable and cable trays
- All necessary cables and wires for power, AC and DC instrument transformers, control, measuring, signals, etc.
- All necessary number plates for identifying the cables (numbering code to be determined)
- All necessary fixing materials



- All necessary fire protection materials for making good the cable openings through walls and ceilings as well as between switchgear and control, measuring, recording and switchgear cubicles, operating panels and desks, etc.
- All necessary plastic protecting tubes for the cable runs
- All necessary materials for laying the cables in the ground
- All necessary cable connections including compression cable lugs, fixing and clamping materials, etc.
- All necessary cable sealing ends and cable connecting sleeves including fixing materials.

B0.3.4.6 Civil

- All necessary surveying works including all soil investigations required for safe and reliable design and construction
- Preparation of site, demolition works, removal of underground obstacles
- Earthworks, drainage, excavation and refilling works
- Piling of structures to prevent subsidence
- Concrete and reinforced concrete works, masonry and earthing
- Concreting of maintenance platforms and lay-down areas
- Water proofing works for pressing and non-pressing water
- Fire protection during construction
- Roofing; non asbestos
- Plumbing
- Facade works/glazing works; non asbestos
- Non-load bearing walls/installation partitions/dry construction works
- Metalwork and blacksmith work/raised flooring/doors and gates/sheet metal work
- Flooring work
- Fire protection with plumbing; fire protector
- Painting/varnishing
- Craneway works
- Room air conditioning systems, where required, e.g. control cubicle rooms, etc.
- Potable water, service water and waste water
- Housekeeping during construction
- Staff facilities during construction
- Transport of all dumping material to dump locations
- Performance and interpretation of soil bearing tests
- Temporary fencing of construction site
- Site offices for Employer and Employer's representatives
- The Contractor's site office
- Landscaping of areas required under this contract.



B0.3.5 Packaging and transportation

- Suitable packaging and transportation of the entire scope of supplies,
- free construction site, on-site transportation and temporary storage including inspections and, if necessary, ensuring the prerequisites for transportation
- Disposal of packing and transportation material
- Customs clearance
- Crane or hoisting facilities at seaport and site
- Transportation to site
- Unloading at site.

B0.3.6 Erection, commissioning and testing

- Complete erection of the scope of supply up to operational readiness: This includes mobilization and provision of the required supervisory staff, skilled and unskilled personnel, as well as of installation scaffolding, cranes, hoists, equipment and materials, personnel accommodation, prescribed tests and inspections.
- Commissioning and optimization of all plant components as well as conducting all necessary measurements.
- Supervision of erection, commissioning and Reliability Test Run of complete supplied equipment.
- All testing as specified.

B0.3.7 Training

The Contractor shall provide comprehensive training for Employer's engineering, operating and maintenance staff (Employer's staff) covering all aspects of the Power Plant equipment and systems and operation and maintenance.

The Contractor shall train, instruct and supervise the Employer's staff to an adequate standard of knowledge and capability for good trouble shooting, repair and of the plant equipment as well as to an adequate standard for safe and efficient commercial operation of the Plant.

The training shall at least include:

- training at manufacturer's works during the assembly of the major plant items
- classroom and hands on training
- on the job training during erection, commissioning and reliability test run; and
- simulator training.

The Contractor shall submit the training plan for the classroom, on the job and simulator training including schedule, place, content of lectures etc. for



the Employer's approval no less than six (6) months in advance to the cold commissioning.

Post training assessment shall be carried out and documented. In case the results of the training are below the expectations, which have been agreed upon by both Contractor and Employer before training, the respective training modules shall be repeated in an improved way and the related cost for the repeated training shall be borne by the Contractor. In case the results are below expectations (to be agreed upon by both Contractor and Employer before training) the respective training modules shall be repeated in an improved way.

B0.3.8 Spare parts, tools, appliances, and consumables

B0.3.8.1 Spare parts

Reference is made to Amendment No 3 and Annexure I to Amendment No.3 (both already published on BIFPCL's Website).

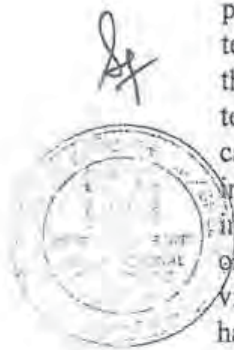
B0.3.8.2 Tools and appliances

The following tools and appliances shall be supplied under this Contract for use by the Employer:

- a. two (2) sets of all special tools and gauges required for the operation and maintenance of the Plant
- b. one (1) set of special lifting and handling appliances required for the operation and maintenance of the Plant
- c. suitable storage bins/racks/shelves for the above.
- d. Standard tools according to the relevant Technical Schedules.



For I&C e.g. following special tools and gauges shall be provided (including but not limited): pressure calibrator, portable pressure source, calibration pressure pump, deadweight testers, precision pressure gauges, manometers, temperature baths/calibrator, multimeters, RTD simulator/tester, thermocouple calibrator precision source and simulation equipment, direct temperature indicating meter, standard pH-tester, multi function process calibrator, loop calibrator, voltage/current/temperature reference generator, intrinsic safe multifunction calibrator, depth gauge, feeler gauge, dial indicators, portable handheld tacho meters, double channel digital storage oscilloscope, conductivity meter, electronic stethoscope, general purpose vibration meters, hand-held IR thermometers, humidity & moisture meters, hazardous and toxic leak detectors, field meters (leak and emission detectors), laser distance meters, US distance estimators, US handheld flow meters, US handheld level meters, portable sound level meter, anemometer, barometer, stop watch, standard technician tools etc.



One set of tool shall be handed over in new condition and one set shall be used by the Contractor for erection/commissioning.

Each tool or appliance is to be clearly marked with its size and/or purpose.

The tools and appliances supplied may have been used for erection and commissioning purposes by the Contractor, but shall be handed over in good working order.

Each set of tools and appliances under category (a) and (d) shall be suitably arranged in fitted boxes of mild steel construction, the number of boxes being determined in relation to the layout of the Plant and equipment in question. If the weight of any box and its contents should be such that it cannot conveniently be carried, it shall be supported on steerable rubber-tyred wheels.

Each cabinet and box shall be painted, fitted with a lock and clearly marked in white letters with the name of the item of equipment for which the tools and appliances contained are intended.

Suitable storage racks shall be provided for all portable lifting tackle in this contract.

Suitable lifting lugs, ears or ring bolts, or tapped holes for lifting rings shall be provided on all equipment items where the weight exceeds 15 kg.

All lifting tackle shall be stamped with a unique identification number and safe working load. A test certificate from an approved authority shall be supplied for each item of lifting tackle.

The Contractor shall provide a schedule of all lifting tackle and tools and appliances being supplied, for the approval of the Employer/Engineer.

The Contractor shall provide all runway beams, trolleys, lifting blocks, special slings etc. necessary for the safe and efficient handling and maintenance of the works. Particular attention shall be paid to high level equipment such as deaerators. Electrically operated hoists and runway trolleys shall be provided for all lifts in excess of 2.5 tons.

The tools and appliances with the appropriate storage racks, cabinets and boxes shall be handed over to the Employer at the time of taking over of the unit.

Where the Contract includes site erection, any special tools or appliances required solely for erection shall be provided by the Contractor for his own use and shall remain the property of the Contractor.

One set of tools shall be handed over in new condition and one set shall be used by the Bidder/Contractor for erection/commissioning.

For handling of the generator stator the following alternative is also acceptable: Tandem/combined operation of two turbine hall EOT cranes for which the necessary arrangements shall be provided. In such case the combined capacity of two EOT cranes shall not be less than the 105% of weight of generator stator, including the weight of lifting beam with swiveling equipment and slings. Main Turbine hall building civil and structural design shall be done accordingly.

Special lifting and handling appliances may be used by the Contractor for erection and commissioning, but shall be refurbished by the Contractor and shall be handed over to the Employer as per in new condition.

B0.3.8.3 Consumables

The Contractor shall supply all chemicals, reagents, resins, lubricants, grease, filters and consumable items for operation up to COD including top up requirement at the time of issuance of PAC/ declaration of COD. All lubricants proposed for the Plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.

All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and a number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, the Contractor shall list at least three equivalent lubricants manufactured by alternative companies.

The Contractor shall submit to the Employer the list and schedule of lubricants, greases, chemicals and consumables items including items qualities and quantities required per month of the Plant operation for the Employer's approval eighteen (18) months prior scheduled COD of the 1st Unit.

B0.3.9 Documentation

B0.3.9.1 Documentation with tender

General

- If a consortial bid is submitted, documents on the consortial agreement
- Description of options and alternatives offered
- Completely filled in price-, guarantee-, time-, and data schedules of the specification
- List of proposed makes and vendors
- Reference lists for delivery and installation of plants of similar type and size with separate references for the steam generator and steam turbine operating at same or similar parameters
- Requirements of grid code which cannot be met (if any)



- Description of means to accomplish primary frequency control according to grid code
- Description of means to accomplish secondary frequency control according to grid code
- Time schedule engineering for deliveries, erection/installation, commissioning and reliability test run
- Complete description of the Plant offered including description of the process and the equipment
- Layout drawings of the Plant
- Dimensioned drawings and sectional views of the principal plant components including materials
- Schematics of the principal plant systems
- General descriptions of individual systems and descriptions of operation including description of start-up, shutdown and emergency shutdown procedures
- All other documents necessary for comprehension of the offered plants and equipment
- Documents on the quality assurance system, including Quality Assurance Plan (The Quality Assurance Plan shall meet the requirements of ISO 9001:2000 and cover all activities under this FTS.)
- Training program and schedule for Employer's personnel
- Space requirement for lay down area, construction site and equipment
- List of personnel including qualification to operate the Plant and to perform day-to-day maintenance
- Initial Spare Part List as described under B03.7
- Equipment maintenance schedules for reliable centered maintenance.

Mechanical

- Process flow diagram of all systems
- Performance diagrams of main pumps and fans
- Plant and major equipment start-up curves for cold (all material on ambient temperature), warm and hot start up to MCR
- Water and waste water mass balances.

Steam Generator

Description for the equipment offered, giving information about:

- general outline of installation
- main control loops
- description of boiler protection system
- graphs showing the performance characteristic versus the load (flue gas temperatures, steam temperatures etc., including h-p-diagram)
- correction curves for ambient conditions and fuel variations
- material diagram showing material, dimensions, highest flue gas temperature and highest steam temperature, design material temperature and maximum admissible material temperature and design pressure for components of the steam/water system



- pulverizer performance diagram showing turn-down range of pulverizers and pulverizer outlet temperatures for different coal qualities.

Steam turbine generator

Description for the equipment offered giving information about:

- general outline of installation,
- main control loops,
- conclusive correction curves for steam turbine and cooling system with variations in:
 - power output with ambient temperature, humidity and river water temperature
 - specific heat rate with ambient temperature, humidity and river water temperature
 - generator efficiency vs. power output for varying power factor
 - degradation curves for the power unit and the Plant
 - diagram showing the output of the turbine, of the generator and of the generator transformer versus the ambient air temperature (from +10 °C to +40 °C), humidity (between 20% and 100%) and river water temperature (from +20 °C to +35 °C).

Electrical system



- Electrical single-line diagram for the Power Plant including LV, emergency, safes AC and DC power supply
- Electrical single line diagram for the 400/230 kV GIS
- Unit protection and measuring single line diagram
- Performance diagrams (circle diagrams) of generator, saturation curves, unbalanced load diagrams
- Diagram with the output of the turbine, the generator and the generator step-up transformer versus ambient temperature
- Preliminary lists of motors and electrical consumers including power demand
- Auxiliary power requirement of the plant unit
- Arrangement of generator bus duct up to generator transformer, H.V and L.V. Cubicles, unit auxiliary transformer
- General arrangement of main electrical equipment within the relevant buildings, rooms, etc., including cross-sections
- Arrangement of connection from generator transformers to 400 kV GIS
- Arrangement of connection from start-up/stand-by transformers to 230 kV GIS
- General arrangement of the 400/230 kV GIS substation including the related control building and connection 400/230 kV interconnection transformers to 400 kV and 230 kV GIS
- Architecture drawing of the 400/230 kV substation control and monitoring system
- Description of the individual protection relays with related reference lists
- Description of the main electrical equipment (e.g. generator, excitation, AVR, generator protection, generator step-up and unit auxiliary transformer, start-up/stand-by transformer, 400/230 kV interconnection

transformer, 400 kV reactors, 400/230 kV GIS, Substation Control and monitoring System, 400/230 kV protection systems, 11 kV switchgear, etc.)- with related reference lists.

Instrumentation & control system

- Control system architecture showing all components provided for this Plant in their actual structural arrangement
- Layout drawing central control room
- Description of hardware, software and design philosophy of the DCS
- Reference list for the DCS with indication of plant type, system architecture and size of the system
- Data sheets, descriptions and brochures of the offered BMS and BPS
- Data sheets, descriptions and brochures of the offered local control systems, in particular PLCs
- Data sheets, descriptions and brochures of the CEMS including (if applicable) common emission data evaluation devices
- Data sheets, description and brochures of the communication systems as specified in the relevant Sections of **Section B8**
- CCTV system philosophy description and configuration drawing
- Data sheets, description and brochures of the training simulator as specified in the relevant Section of **Section B8**
- Temporary list of all drives, such as unidirectional motors, MOV's, SOV's and remotely operated control valves
- List of modulating controls
- List of package systems (black boxes)
- Description of field equipment.
- Description of structure of the control functions including list of unit co-ordination level, functional group level, sub-group level
- Description of the interface to the boiler protection system and the steam turbine generator protection system
- Procedure for calculation of the availability of the DCS.

Civil

- Architectural outline drawings for all buildings and building structures showing the arrangement of the complete Plant, inclusive of all levels and Sections
- Site plan of the complete Plant showing all buildings, building elements, roads, landscaping etc.
- Schematic design of main buildings
- Typical concrete block pad and chimney foundation
- Typical pole foundation for HV towers
- Details, with calculations, for the main foundation system proposed
- Basic design of Site infrastructure
- Basic design of the chimney
- Basic detail of the coal storage yard
- Basic detail of the ash pond.



B0.3.9.2 Documentation after Award of Contract

The documents required for design, construction, installation, operation and maintenance of the entire Plant shall be submitted by the Contractor in good time so as to permit the Plant as a whole to be erected in compliance with the specified time table.

All documents, including the installation and operation and maintenance manuals as well as the related software shall be in fluent, legible English. In addition, operation and maintenance manuals shall be translated into Bangla and provided as paper copies and in electronic format.

The Contractor shall list all the drawings and submission schedule for the Employer's approval. Only the most important documents are listed below. These documents shall be submitted sufficiently in advance, so that corrections and amendments desired by the Employer as well as resubmission of the documents will not result in any delays with respect to the guaranteed time schedule. The Employer reserves the right to request from the Contractor additional drawings, documents, etc. as may be required for proper understanding and definition of the design and engineering of the Plant.

The overall responsibility with regard to completeness, correctness and suitability for the permit application process remains with the Contractor. In no case any comment, correction, amendment and approval (if any) by the Employer shall relieve the Contractor from this responsibility.

The drawings and documents to be submitted during this stage are listed in the various Sections and comprise the following. They shall be submitted within the specified time scale calculated in weeks after Award of Contract. Details shall be agreed according to the approval procedure for drawings and documents above.

The Contractor may propose modifications to the list as given below, in order to ensure timely completion of permit application documents and performance of the works according to the project's requirements and in accordance with the specified project time schedule. Any modification to this list shall be submitted for Employer's review and approval.

The Employer reserves the right to require detailed information on the progress of drawing and document preparation from the Contractor at any time during this stage.



Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
• General			
• Current list of drawings		4	every 1 month
• Complete list of documents		4	every 1 month

Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
with proposed submission deadlines			
• Progress reports	I	-	every 1 month
• Erection and installation progress reports	I	-	every 1 month after start of site activities
• Quality assurance procedure and program	A	with Bid	24
• structure of Contractors QA&QC manpower at site	A	with Bid	24
• indicative field quality plan for civil works	A	with Bid	24
• Plant layout	-	with Bid	16
• List of subcontractors/manufacturers	A	with Bid	12
• Proposed inspection and testing programs	A	12	24
• Noise propagation calculations	A	-	24
• Detailed program for commissioning	A	24	6 months ahead start pre-commissioning
• Studies / surveys regarding water intake and water discharge	A	12	24
• Detailed program of Reliability Test Run	A	24	6 months ahead start Reliability Test Run
• Detailed program of Performance Tests	A	24	6 months ahead start Reliability Test Run
• Testing documents/Report of results of all tests	A	2 weeks after test	6 months ahead start Reliability Test Run
• Training program	A	-	6 months ahead of pre-commissioning
• As-built-documentation including drawings of all equipment	A	-	1 month after COD of the 1 st Unit
• Declaration of conformance with all local regulations	I	-	latest with start of pre-commissioning
• Spare part lists	A	with Bid	18 months ahead of COD of 1 st Unit
• Time scheduling	A	with Bid	every 1 month
• Overall time schedule for design, manufacture, supply, assembly, erection and commissioning broken down for the principal plant components and all	A	with Bid	every 1 month

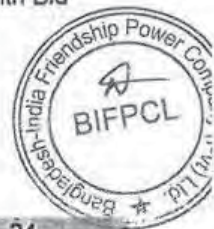


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Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
construction works, stating dates for completion of any preparatory work from others which may be necessary			
• Detailed erection, installation and commissioning schedule	A	12	2 months ahead of erection / pre-commissioning
• Mechanical Engineering			
• Arrangement drawings of principal components with ducts and platform layout	A	with Bid	12
• Arrangement drawings of auxiliary equipment (cubicles, etc.)	A	12	24
• Process flow diagrams	A	with Bid	12
• Piping and Instrumentation schematics and isometric drawings, including list of pipelines and valves, stating materials, nominal diameters and pressure, dimensions, insulation thickness of all pipes	A	8	24
• Plans of main pipelines including location of cable routes	A	8	24
• Characteristics of pumps, fans etc.	I	16	24
• Details of required auxiliary energy sources and consumables (e.g. electricity, steam, chemicals, instrumentation, air, working air) with condition data, required qualities and consumption values	I	16	24
• Water and waste water balances	A	with Bid	36
• Thermodynamic diagrams / heat balance diagrams	I	with Bid	24
• Start-up and shutdown diagrams with descriptions (cold, warm, hot)	A	with Bid	2 months before pre-commissioning
• Sectional and detail drawings of all components including materials	I	16	36
• Lifting plan for all lifting operations (repair, maintenance, etc.)	I	24	36
• Limits of coal and high speed diesel properties	I	-	with Bid



Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
• Design calculations of pumps, isolations, piping, etc.	I	12	36
• Water hammer calculation of plant water and cooling water system	I	8	12
• Hydraulic model test procedure of plant water and cooling water systems; institute to perform the tests	A	4	8
• Hydraulic model tests reports of plant water and cooling water systems	A	-	12
• Cooling Tower Recirculation Study	I	-	12
• Sedimentation Study	A	-	12
• Pulverizer performance diagram with pulverizer turn-down range	A	with Bid	12
• Material diagrams for pressure part	A	with Bid	24
• Reference lists with information on successful operating years for: - steam turbines - steam generators - pulverizers - firing systems / burners	A		with Bid
• System description of firing system	A	with Bid	24
• Final correction curves for Plant and equipment performance tests acc. to ASME PTC46 etc.	A		with Bid
Electrical Engineering			
• Electrical single line diagrams	A	with Bid	12
• List of motors and consumers	I	8	every 1 month, final after erection completion
• Electrical equipment sizing calculations (generator main connection, transformers, emergency diesel generators, safe AC and DC power supply, power cables, etc.)	A	12	24
• Cable list	I	16	every 1 month, final after erection completion
• Standard circuit diagrams for all different kinds of electrical	A	12	24



Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
consumers			
• Performance diagram (circle diagrams) of generator	I	with Bid	12
• Circuit diagrams for all individual electrical equipment	I	12	24
• Lists of equipment and devices	I	12	24
• Earthing and lightning plans with calculations	A	12	24
• Lightning protection plans with details of measuring locations and reports of measurements taken following commissioning		12	24
• EMC concept with coordinated overvoltage protection	I	12	16
• Arrangement drawings for switchgear and battery rooms, station service transformers, cable floors, etc.	A	12	24
• Diagram showing power output of plant generator and related transformer vs. ambient temperature from +20 °C to +40 °C	A	with Bid	12
• Block diagram generator/unit protection	A	12	24
• Block diagram AVQC for the generator	A	12	24
• Line plans of fire alarm system if applicable	A	12	24
• Arrangement drawings showing exact location of fire alarm devices if applicable	I	12	24
• Power and lighting installation plans including related calculation	I	16	24
• General arrangement drawings of the required cable trays, cable laying plans	I	12	24
• Dimensional drawings and erection drawings for generator, transformers, switchgear etc., including frontal and plan views	I	12	24
• Dimensional drawings of generator auxiliary equipment	I	12	16
• Dimensional drawings of switching cubicles, generator leads and star point cubicles, voltage regulation cubicles, excitation cubicles, generator circuit breakers, including	I	12	24



Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
equipment configuration			
• Calculation of mechanical stresses of switchgear rooms due to arcing faults	I	12	16
• Short circuit calculation and determination of protection relay settings for generator protection, 400/230 substation and auxiliary electrical supplies under consideration of protection of the entire system	A	12	24
• Protection and metering diagram for unit protection, start-up/stand by transformer protection, 400/230 kV GIS protection	A	16	24
• Load flow, system transient stability and motor start-up study	A	16	24
• Information for electrical system study by PGCB (see relevant part in Section B0)	I	8	16
• Generator charts and exciter characteristics	I	12	16
• Instrumentation and Control Engineering			
• Control system architecture showing all components and design concept redundancy	A	with Bid	24
• Operation and control philosophy	A	8	16
• Design concept earthing	A	16	24
• Design concept explosion protection	A	16	24
• List of packaged systems (Black Boxes)	A	with Bid	24
• Layout drawings central control room showing spatial distribution of desks and panels (3 D view)	A	with Bid (2D only)	24
• Layout of electronic rooms showing spatial distribution of cubicles and racks	A	16	24
• Description for all functional group controls, functional schematics (both in machine language and according to ISA-standard)	A	16	24
• DCS/PLC interface	A	16	24



Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
documentation, I/O point assignment			
• Engineering drawings of control valves, control dampers together with their actuators, orifices, nozzles, venturi nozzles	I	16	24
• External connection diagrams, terminal connection diagrams combined schematic and circuit diagrams	I	16	24
• Communication systems	A	16	24
• As built software programs for DCS, PLC or other systems			1 month after COD of the 1 st Unit
• Instrument list	A	16	24
• Cable routing plan	I	16	24
• Civil Engineering			
• 3D model of the complete Plant incl. all civil structures, all mechanical equipment, piping (> 50mm), electrical equipment (e.g. cable trays, HVAC, etc)	I	16	24
• 3D model clash checking and walk through	A	3 weeks after 3D model distribution	3 weeks after 3D model distribution
• General layout plan of the Plant site including all buildings and outdoor installations, roads etc. prepared on the basis of the topographical survey of the site	A	with Bid	12
• Detailed civil arrangement drawings of all buildings and structures, including plan-views and Sections (scale 1 : 100)	A	with Bid	12
• Architectural views (all sides) for all buildings of the Plant	A	4	12
• Arrangement drawings for external systems including all supply and disposal facilities, roads with manoeuvring areas; outdoor facilities (sewage, drainage, ducts and trenches, fencing and gates; tank farm, outdoor foundations etc.	A	4	24
• Detailed drawings and documents			
• Detailed foundation drawings	I	4	12



Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
for all buildings and structures (A. E., turbine, boiler and stack foundations etc.)			
• Detailed structural drawings for all buildings and structures (concrete and steel structures)	I	8	24
• Detailed architectural drawings	I	8	24
• Room books including external and internal finishes windows, doors, sanitaries wall cladding, roof etc.	A	8	24
• Detailed drawings for all internal services and installation works (HVAC; water, sewage, drainage, lighting)	I	8	24
• Detailed drawings with embedded parts, anchors, plates, fixings etc.		8	24
• Detailed drawings for outdoor installations and services (sewage, drainage; water, ducts, trenches, culverts, pipes, cable routes, manholes, pits etc.)	A	8	24
• Detailed drawings for roads including accesses, footpaths, fencing, gates, landscaping, bridges, pipe racks	A	8	24
• Checked and approved statical and dynamical analysis prepared for all buildings and structures of the Plant	I	8	24
• Detailed constructive description of individual buildings with regard to the structural design (structural systems, foundations etc.)	I	8	24
• Sectional elevations and roof plan	I	4	24
• Underground services and ducts with equipment appertaining to the services	I	8	24
• Principal details and Sections for traffic areas, especially for ramps and retaining walls	I	8	24
• Structural drawings pertaining to river water outfall and intake facilities	A	8	24
• Foundation drawings and other underground concrete works	I	4	24



Document	Purpose	Weeks after Contract Award	
		Preliminary	Final
<ul style="list-style-type: none"> Permit application documents <ul style="list-style-type: none"> Documentation for operating permits Documentation for other permits 	A	4	12
<ul style="list-style-type: none"> Other documentation <ul style="list-style-type: none"> Schedules of workshop tests Quality assurance manuals Manual of Codes and Standards 	I	-	1 month ahead of test
<ul style="list-style-type: none"> Operating manual <ul style="list-style-type: none"> operating procedures and instructions of the Plant with description of all systems, processes and functional groups as built documentation general and individual control concept description Plant and equipment protection and signal processing description with all alarm and trip signal settings all operating conditions including electrical grid supply and connection conditions 	A	6 months ahead of pre-commissioning	1 month after COD of the 1 st Unit
<ul style="list-style-type: none"> Service and maintenance manual <ul style="list-style-type: none"> maintenance procedures and instructions with description of all equipment and facilities Equipment data sheets 	A	6 months ahead of pre-commissioning	1 month after COD of the 1 st Unit



Purpose: A : for Approval
I : for Information



B0.3.9.3 Data and simulation models

The Tenderer shall submit the data of the Plant for transmission simulation to PGCB according to the Bangladesh Grid Code however minimum following data:

Components	Data	Value of data
Generator step-up transformer	Rating	MVA
	High voltage	kV
	High voltage connection	
	Low voltage	kV
	Low voltage connection	

Components	Data	Value of data
	Positive seq. Impedance	%
	Positive seq. Resistance	%
	Positive seq. Reactance	%
	Zero seq. Impedance	%
	Zero seq. Resistance	%
	Zero seq. Reactance	%
	MVA for base impedance	MVA
	Maximum tap	kV
	Maximum tap position	
	Minimum tap	kV
	Minimum tap position	
	Nominal tap position	
	Value of tap step	
	Core loss	kW
	Copper loss at full load	kW
	Auxiliary power	kW
Generator	Type	
	Manufacturer	
	Rated output	MVA
	Rated voltage	kV
	Connection	
	Inertia constant	
	X _d	%
	X' _d	%
	X _d	%
	X ₂ (Negative sequence)	%
	X ₀ (Zero sequence)	%
	MVA for base impedance	
Turbine	Type	
	Rating	MW
	Inertia constant	
	HP natural frequency and vibration band	Hz
	IP natural frequency and vibration band	Hz
	LP natural frequency and vibration band	Hz
Exciter	Type	
	Range ± % of rated voltage	%
Governor	Type	
	Model No.	
	Droop	%
	Deadband	Hz
Unit auxiliary power consumption	Real power auxiliary load	MW
	Reactive power auxiliary load	MVAR



The Tenderer shall also submit models for simulation studies which are compatible with the software used by PGCB. PGCB is using PSS@E software).

The simulation studies include, but are not limited to:

- a. power flow
- b. short circuit
- c. transient stability.

All characteristics and models shall operate in stable and accurate manner under all frequency range stipulated in this Part B0, including consideration on the following:

- a. large frequency variations upwards (increasing) up to 52Hz,
- b. large frequency variations downwards (decreasing) up to 47.0Hz,
- c. grid system faults,
- d. splitting of the grid system into islands.

All simulation models submitted for stability studies must be in the form of fully validated models for the software used by PGCB simulation. The models shall be provided complete with the following documentations:

- a. model software source codes (files) as well as object (binary) codes,
- b. description of the models including the engineering of model derivations,
- c. user operation manuals
- d. user application guides
- e. model block diagrams
- f. values of parameters
- g. input data format
- h. criteria for acceptable operation (threshold parameter values such as minimum steam pressure, maximum hydrogen pressure, etc).



The models shall represent closely the on-site response and setting.

Generator and excitation systems

The fully validated control block diagram representation of the software used by PGCB simulation model (including all limiters and power system stabilisers), shall be submitted to PGCB together with:

1. Explanation of all the symbols used
2. Clearly labelled sub-systems of control and protection, such as, Volt/Hz limiter, maximum field current limiter, stator current limiter, minimum field current limiter etc.
3. Input-output relationships, by giving:
 - a) Equations
 - b) Characteristics/Chart/look-up table
 - c) Other input/output relationship (if any).
4. Indication whether the parameters in the block diagram can be measured on the actual system.



Governor

The fully validated control block diagram representation of the software used by PGCB simulation model for the governor systems shall be submitted to PGCB together with:

1. Explanation of all the symbols used
2. Clearly labelled sub-systems of control and protection, such as, additional corrective control against frequency deviations (if any) and other controls (if any).
3. The following variables, states, and limits:
 - a) mechanical output
 - b) generator output
 - c) turbine speed
 - d) mechanical output of steam turbine (ST)
 - e) MW output of ST
 - f) shaft speed of ST
 - g) turbine steam pressure of ST
 - h) turbine steam pressure deviation of ST
 - i) turbine steam temperature of ST
 - j) main control valve position of ST
 - k) intercept valve position of ST
 - l) load limiter signal.
4. Tenderer shall inform values of limits and acceptability (or violation) criteria on the following:
 - a) reverse power (cause reverse power trip when violated)
 - b) Power Load Unbalance (PLU) (or similar) relay trip (if any which cause trip when set criteria is violated)
 - c) operational limits and criteria
 - d) others (if any which cause trip when violated).
5. Tenderer shall inform input-output relationships, by giving
 - a) Equations
 - b) characteristics/chart/look-up tables
 - c) other input/output relationship (if any).
6. Tenderer to inform whether the parameters in the block diagram which exist and can be measured on the actual system.



The above models and documentation shall be submitted in CD-ROM media (read only). One hardcopy of the same is also required to be submitted.

Due dates and versions for data submission and simulation models are as follows:

Due dates

90 days after signing of this Agreement

90 days prior to the Initial Operation Date of the First Unit

Type of data to be submitted

Committed Project Data

Contracted Project Data

Estimated Registered Data



Due dates	Type of data to be submitted
30 days after the Commercial Operation Date of the First Unit	Registered Data

B0.3.9.4 Requirements for documentation

Unless agreed otherwise, five (5) hard copies and three (3) sets of electronic copies of all documents are to be submitted in the English language. In addition, operation and maintenance manuals shall be translated into Bangla and provided as paper copies and in electronic format. Electronic Copies shall be submitted in primary original data format (e.g. DOC, XLS, DWG) as well as in a printable non-proprietary document format (e.g. PDF). Especially P&IDs shall be submitted as DWG files and PDF files.

The Contractor shall provide, install, operate and maintain a web based electronic data room / data server. The format and filing system shall be mutually agreed between Employer and Contractor.

All documentation shall comply with uniform documentation instructions according to Employer's requirements. Detailed requirements for documentation will be determined during contract execution by the Employer.

Contractor shall comply with Employer's directive concerning documentation requirements for implementation in an automated plant operation system.

The final documentation including but not limited to operating manuals, maintenance and service manuals, component documentation, assembly documentation, drawings and listing, etc. shall be submitted in the English language. In addition, operation and maintenance manuals shall be translated into Bangla and provided as paper copies and in electronic format.

Contractor shall also integrate and submit all the above data for each Unit into the PSS@E load flow raw data file ("raw data") and PSS@E dynamic raw data file ("dyr data") which are ready to be used for studies on operation and planning of the Grid System by PGCB using PSS@E (to be confirm by PGCB/BIFPCL)

Data for each Unit shall also include reactive power capability curve of the Facility, written in the format compatible to PSS@E activity GCAP. For this purpose, at least 10 (ten) pairs of data on the generator reactive power capability curve shall be provided for each Unit.

The final requirements for Transmission lines and Interconnecting Facilities documentation will be subjected to PGCB's approval which will be made known during execution stage.



B0.3.9.5 Approval procedure for drawings and documents

The Employer reserves the right to ask the Contractor to submit drawings and other documents for approval to the Employer or to its representative.

Before submittal of any such drawing or other document, the Contractor shall submit a detailed list comprising all drawings or other documents the Contractor will produce. Based on this list the Employer will decide which drawings or other documents will have to be submitted for approval, information or other purpose.

The documents for approval are primarily basic documents and all documents that are required to check that Contractual and operational requirements are met. It is expected that in total approximately 600 to 800 documents will be for approval.

When submitting drawings or other documents for approval, including any prepared by subcontractors, the Contractor shall certify in each case that he has examined such drawings or documents and that they comply with the requirements of the Contract.

The Contractor is requested to provide Third Party Verification of structural documents, e.g. structural analysis, drawings and connecting details prior to submission for approval. These documents must contain all information necessary for the execution of the works.

Approval of a drawing or other document will imply that:

- They have been examined and appear to be in accordance with the basic design concept of the project and meet the requirements of the specification.
- They have been examined in relation to compatibility of the items and equipment with the specification and respect of interconnections with other items, equipment or systems.
- The Contractor is not relieved of his responsibility under the Contract.

The Contractor is to arrange for the revision history of drawings and other documents as follows. The first revision shall be indexed by the letter "A" followed up by the respective letter in alphabetical order.

Once the drawing or document is approved for construction by the Employer or its representative the document shall be indexed with the number "0" followed up by the respective number in chronological order. Hence, the sequence of the revision index of a design document shall be as follows: A - B - C - [...] - 0 - 1 - 2 - [...]. Each revision is to be listed in the revision history with the respective date and a short description of the modification(s). In addition, all modification(s) shall be highlighted and/or marked up as specific and detailed as possible.



Furthermore, each drawing/document shall be indicated with a unique document number according to the following standard:

Maitree – Unit – KKS – DCC - 12345 – XYZ - REV

Where:

- Maitree - Project-Denomination
- Unit - 00 (for common), 01 (for unit 1), 02 (for unit 2)
- KKS - Function Key as per KKS system (1 to 3 letters)
- DCC - DCC code according to EN/IEC 61355
- 12345 - Document number
- XYZ - Sub-/Contractor number
- REV - Revision index

For each comment, the Employer will allocate a priority in the TCS (Technical Comment Sheet). The priorities range from 1 to 3 as follows:

- 1 - High Priority
- 2 - Medium Priority
- 3 - Low Priority

The TCSs are to be named with the above described identification key and the supplementary ending "... - RI" ("Revision Income") for TCSs being sent from the Contractor to the Employer and "... - RO" ("Revision Outcome") vice versa.

The Contractor shall be responsible for any discrepancies, errors or omissions in the drawings and other documents supplied by him, whether such drawings or other documents have been approved or not.

B0.3.9.5.1 Documents which require Approval from Grid Operator/BPDB

Documents especially test procedures and protocols, which are due to approval by the grid operator or BPDB required following specific times for submittal and approval.

B0.3.9.5.1.1 Testing Procedure and Protocols

At least one hundred and twenty (120) Days before the scheduled commencement of the testing and Commissioning of the Plant, the Contractor shall, upon request from BPDB, submit to BPDB detailed procedures and protocols to be used during the corresponding testing. BPDB shall have the opportunity to provide written comments, if any, on the proposed procedure and protocols within thirty (30) Days of receipt from the Contractor of said documentation. If BPDB fails to submit written comments to the Contractor within the thirty (30) Days stipulated above, it shall be deemed to have accepted the detailed procedure and protocols provided by the Contractor.



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On receipt of such comments, if any, the Contractor shall review and submit the final procedure and protocols, to be used for testing not later than sixty (60) Days prior to the scheduled commencement of the respective testing and Commissioning:

- a. if BPDB fails to submit written comments to the Contractor within the thirty (30) Days stipulated above, it shall be deemed to have accepted the detailed procedure and protocols provided by the Contractor; and 35
- b. if the Parties fail to reach agreement on the procedures and protocols within sixty (60) Days prior to the scheduled commencement of the respective testing and Commissioning,

the matter may be referred to the Engineer by either Party, and the Engineer shall make the decision on the protocol and procedures within the five (5) Days of the matter being referred to it, and such decision shall be binding on the Parties.

B0.3.9.5.1.2 Start-up and Test Schedules

At least ninety (90) Days before the scheduled commencement of testing and commissioning of the First Generating Unit or the Plant, as the case may be, the intended Start-Up and test schedule for such unit.

B0.3.9.5.1.3 Operating Procedures

- a. Not later than one hundred and twenty (120) Days before the then prevailing Scheduled Initial Operations Date, the Contractor shall, upon request from BPDB, provide BPDB with draft operating procedures dealing with all operation interfaces between BPDB and the Contractor including, but not limited to:

- method of Day-to-Day communication
- key personnel list
- clearances and switching practices
- outage scheduling
- capacity and energy reporting
- operating log; and
- reactive power support

which shall be consistent with this Agreement, the designs of the Facility (including the Metering System), the Technical Limits and Prudent Utility Practices (together, the "Operating Procedures").

- b. Within thirty (30) Days after BPDB's receipt of the draft Operating Procedures, BPDB shall notify the Company of any requested deletions, amendments or additions.



- c. The Company shall make any deletions, amendments or additions that BPDB reasonably requests unless they would be inconsistent with this Agreement, the Technical Limits, the designs of the Facility (including the Metering System), or Prudent Utility Practices and provide such revised draft to BPDB, which shall be treated as final Operating Procedure, not later than thirty (30) Days before the then prevailing Scheduled Commercial Operations Date.
- d. Not Used
- e. Either Party may, from time to time, request revisions to the Operating Procedures subject to agreement from the other Party.

B0.3.9.6 Quality control procedure

A comprehensive **quality control procedure / quality assurance programme** for all aspects of the works shall be prepared by the Contractor and shall be submitted to the Employer for approval.

The Contractor shall adopt suitable quality assurance programme (QAP) to ensure that the equipments and services under the scope of Contract whether manufactured or performed within Contractor's works or at his subcontractor's premises or at the site or at any other place of work are in accordance with the specifications. Such QAP shall be outlined by the Contractor and shall be finally accepted by the Employer or his authorized representative after discussions before the start of work. The QAP shall be generally in line with ISO Systems.

The quality assurance program shall consist at least of the following:

- testing during manufacturing
 - workshop inspections and testing
 - factory acceptance tests (FAT)
- testing at site
 - construction inspections and testing
 - erection / mechanical completion
 - pre-commissioning and commissioning tests (cold and hot commissioning)
 - optimization of overall Plant
 - final inspection and testing
 - Bench mark testing
- completion test
 - performance tests
 - reliability test run.



An outline of the proposed comprehensive quality assurance programme is to be provided with the Tender and is subject to review by the Employer.

The Contractor shall provide complete laboratory facilities and staff to perform the required tests. The facilities could be fully or partially on site. Arrangements could be made with an experienced testing laboratory to support the site laboratory, all subject to the approval of the Employer.

Only approved fully qualified and experienced staff shall carry out the quality control all in accordance with the approved quality control procedure.

The Contractor shall appoint a dedicated, experienced and competent QA&QC in-charge at site, preferably directly reporting to the project manager, supported as necessary by experienced personnel, to ensure the effective implementation of the approved QAP. An indicative structure of Contractors QA&QC manpower required to be deployed at site shall be submitted with the Tender.

The results of the tests shall be made available to the Employer within 24 hours of obtaining the relevant test results. Acceptance of the relevant part of the work shall be subject to the performed tests showing satisfactory results. Individual construction completion certificates shall be issued by the Contractor to certify the readiness for equipment erection (see Section B0).

The Employer may instruct tests at no cost provided either the overall frequency governed by the specification is not exceeded and the notification given to the Contractor is equal to that currently being provided by the Contractor for his normal testing in formality and warning, or the Employer has due cause to suspect a change in the quality, such concern having been advised to the Contractor. The Employer may instruct sampling, testing or both which satisfy only some or none of the above criteria.

The Employer shall have the right to carry out independent inspections and testing either using his own resources or those of a third party. Should the Employer require the results to determine the conformance with the specification then he shall notify and inform the Contractor.

As far as is practicable the Employer shall have free access to the site, fabrication areas and suppliers work at all times without notice. Should he discover unsatisfactory work then he will invite a formal joint inspection. Either after such an inspection or if the Contractor declines the invitation the Employer shall issue instructions with regard to the faults and their reparation.

Should any materials, items or complete parts of the works fail to comply with the requirements of this specification when tested in accordance with this Section the Employer may reject such materials or items, or condemn complete parts of the works, and demand of the Contractor such replacement or modification as may be necessary to ensure their compliance.



Should modification or adjustment be deemed a satisfactory alternative to demolition and /or removal, the Contractor shall submit full details in writing such modifications to the Employer for approval, and should such approval be forthcoming carry them out without undue delay.

If however, the Contractor is required to demolish and /or remove any such items or materials this shall be carried out quickly and with as little disruption to the works as possible.

No claims of any sort whatsoever will be entertained arising from the rejection of any part of the works through failure to meet this specification, and repairs, demolitions, removals, additional testing etc. Such modifications, removal, demolitions etc, shall be entirely at the expense of the Contractor. No extension of the Contract period shall be granted for such a reason.

If for any reason materials or other items are received or made on site before approval of them has been granted, these shall be transported, handled and stored separately or labelled in such a way in order to, wherever possible, prevent them being incorporated into the works or, should such prevention not be possible, to accurately define the part(s) of the works in which such materials or items were used.

Approvals previously granted for any materials etc. shall be withdrawn if they are not properly transported, handled or stored and otherwise protected against weather or contaminants which may adversely affect their properties and subsequent performance. The Contractor has the option of removing such materials or having them retested for approval.

The Contractor shall submit to Employer, the quality plans and field welding schedules (for field weld of pressure parts only), along with test procedures and WPS endorsed by designer wherever applicable, for checks to be done during manufacturing and erection, for review and approval by Employer.

B0.3.10 Options and Alternatives

B0.3.10.1 Option 3.1: Absorber made of concrete (Optional Offer)

Refer to Amendment No. 1, B3.

B0.3.10.2 Option 3.2: Combined Limestone System for Both Units (Optional Offer)

Refer to Amendment No. 1, B3.



B0.3.10.3 Option 4.1: Open coal stock yard (Optional Offer)

Refer to Amendment No. 1, B4.

B0.3.10.4 Option 4.2: Screw unloader (Optional Offer)

Refer to Amendment No. 1, B4.

B0.3.10.5 Option 4.3: Open limestone yard (Optional Offer)

Refer to Amendment No. 1, B4.

B0.4 Interfaces

The Contractor shall actively clarify all interfaces with the Employer, the Operator, PGCB and all companies, authorities and any other entity participating in the project.

B0.4.1 Battery limits of the plant

The interfaces for the Plant shall be as follows.

The Contractor shall actively clarify all details of the interfaces with the Employer, the grid operator (NLDC), the coal supplier, the fuel oil supplier, the limestone supplier and all other interfacing companies.


All mentioned equipment, connections, connection materials, counter flanges, shut-off valves, safety valves, seal up material and works are included in the scope of supply:

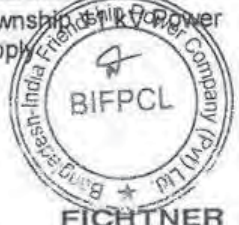
Designation	Category	Interface / Terminal Points
TP1	HV overhead transmission line (OHL)	<ul style="list-style-type: none"> 400 kV and 230 kV OHL conductors on the gantries for connection of the related GIS bushings. OHL conductors for connection of the Line Traps. <p>The Connection from the generator transformer to the 400/230 kV GIS shall be included in the Bidder's/Contractor's scope of supply. The 400 kV and 230 kV transmission OHL for power evacuation will be provided by PGCB. The limit of supply is at the take-off gantries (to be supplied by the Bidder/Contractor) for the 230/400 kV OHL For detailed scope refer to Section B10.3.3 and B10.3.5.</p>
TP2	OHL Protection	<ul style="list-style-type: none"> None



Designation	Category	Interface / Terminal Points
		<i>Remark: The 400 kV and 230 kV OHL protection on the Power Plant end (not on the remote end) shall be included in the scope of supply of the Maitree-STPP Project.</i>
TP3	OHL Telecommunication	<ul style="list-style-type: none"> • Terminals on the line traps for connection of the telecommunication equipment provided by PGCB on the related gantries • Terminals in the telecommunication panels provided by PGCB and located in the control building of the 400/230 kV GIS for connection of the cables for the signal exchange with the PGCB/NLDC and for the teleprotection. • Terminals in the telecommunication panels provided by PGCB and located in the control building of the 400/230 kV GIS for connection of the cables for auxiliary/control power supply (240V AC, 220 VDC and 48VDC). <p>The cabling between Contractor's cubicles and the telecommunication equipment provided by BPDB in the Control Building of the 400/132 kV GIS shall be in the scope of the Bidder/Contractor.</p>
TP4	Earthing and	<ul style="list-style-type: none"> • Terminals on the gantries for connection of the OPGW • Earthing bars in the control building of the 400/230 kV GIS for connection the protection and telecommunication panels.
TP5	Plant water intake	Intake from Possur river, all required supplies and services in scope
TP6	Plant water discharge	Discharge to Possur river, all required supplies and services in scope
TP7	Coal supply	Coal unloader at jetty (all coal vessel berthing, mooring and unloading facilities within scope of supplies and services)
TP8	Fuel oil supply	At and including Fuel Oil Truck Unloading Station near the Power Plant. All supplies and services in scope The road truck unloading station shall be positioned in the vicinity of the storage tank. Accordingly TP8 is located at the near of HSD oil storage tank. However, the unloading station is included in the scope of the Bidder
TP9	Limestone supply	Coal unloader at jetty (all coal vessel berthing, mooring and unloading facilities within scope of supplies and services) (common equipment with coal supply)



Designation	Category	Interface / Terminal Points
TP10	Fly ash	Outlet connection at: <ul style="list-style-type: none"> • ship loading from fly ash storage silos • Truck loading from fly ash storage silos • Truck loading from intermediate fly ash silos • ash pond All supplies and services in scope Complete ship loading system from silo with all accessories shall be in Bidder's/Contractor's scope
TP11	Bottom ash	 Outlet connection at: <ul style="list-style-type: none"> • Truck loading from bottom ash storage silos • Truck loading from intermediate bottom ash silos • ash pond All supplies and services in scope Complete ship loading system from silo with all accessories shall be in Bidder's/Contractor's scope.
TP12	Gypsum	Outlet connection at: <ul style="list-style-type: none"> • ship loading from gypsum storage silos • Truck loading from gypsum storage silos • Truck loading from intermediate gypsum silos All supplies and services in scope Complete ship loading system from silo with all accessories shall be in Bidder's/Contractor's scope
TP13	Raw water supply	Pipeline 1 m outside Plant boundary; interface with raw water supplier
TP14	Sewage water	Discharge to Passur river
TP15	Storm water	Discharge to Passur river, outside the Plant area; all required supplies and services in scope
TP16	Waste water for discharge	Discharge to Passur river There shall be no spill water from ash dyke to be discharged to Passur River without treatment. Seepage water from the ash dyke shall be recirculated to overflow lagoon with suitable drainage and pumping system.
TP17	Waste water and scheduled waste for disposal	Interconnection to facility external disposal
TP18	Chemicals supply	Chemicals receiving facility
TP19	Township 11 kV Power supply	Terminals in the 11 kV unit board of the Power Plant For the supply of the township redundant 11 kV feeders (2 x 100%), one from the 11 kV unit boards of each unit, shall be provided as



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Designation	Category	Interface / Terminal Points
TP20	Construction Power	<p>per section B7.1.1. Cables and raceways are out of Bidder's/Contractor's scope of supply, however, sufficient free space to be considered by the Bidder/Contractor for later installation of associated cables and raceways towards township area.</p> <p>2 terminals at 33 KV line at the border of the Power Plant Site</p> <p>Construction Power (Please refer to Section V.TS/B9/B9.4.2.1)</p> <p>Power supply for construction purposes will be provided at 33 KV voltage (2 no. of lines). The same will be extended to the Contractor for him to develop 33/11 KV sub-stations and construction power supply comprising of</p> <ul style="list-style-type: none"> • Two (2) 5 MVA, 33/11KV step-down transformers. • Two (2) 11 KV switchgears • 11 KV mainring, design according to plant layout, construction requirement and schedule. • 11KV/4.15 KV step-down transformers (number and sizes as required according to plant layout, construction requirement). • Two (2) 11 KV feeders (minimum 630 A) for usage of the Employer. <p>For improved reliability these feeders shall be connected to separate 11 KV bus systems at 33/11 KV sub-stations.</p> <p>The electricity prices/power tariffs for the case of 33 KV voltage level are defined in the Annex C.</p> <p>Further preliminary details regarding provided construction power system are shown in Annex C.</p>



Construction Water:

As described under Section B9 the supply of construction water is in the scope of Bidder/Contractor. It is not allowed to use ground water. For construction water shall be used only river water suitably treated for his purposes.



B0.4.2 Interfaces to electricity dispatcher

Communication, control, monitoring and voice channels will be provided between the Facility and BPDB's National/ Regional Control Center by BPDB. The Contractor shall provide interconnection within the Facility for all such communication circuits/ channels.

B0.4.2.1 Interface between the Power Plant and the NLDC

In order to link the Plant to the 400 kV PGCB National Load Dispatch Center (NLDC) the Contractor shall make available all analogue and digital signals in accordance with the requirements of the Bangladeshi Grid Code and as requested by PGCB and the Employer. These will include command signals from the NLDC to the Plant's automatic load control systems (AGC, see **Part B8**).

The Contractor shall liaise with NLDC to facilitate necessary interfacing with the SCADA System in NLDC. All necessary firmware and software with suitable communication link through serial interface (to match the protocol of the existing system) shall be provided by the Contractor. Necessary reconfiguration is to be done by the Contractor to establish logical link with the existing SCADA system in NLDC. Further, reconfiguration of the database and various display builder functions of the SCADA system in NLDC to accommodate additional signals are under the scope of work of the Contractor.

The following reserve requirements shall be taken into account:

- Min. 10% of the equipment installed shall be a reserve to enable handling of an additional 10% of signals without the need for equipment extensions.
- Min. 15% of the equipment installed shall be a reserve to enable handling of an additional 15% of signals by extending the equipment but without the need to modify the existing structure of any of the interface marshalling cubicles installed.



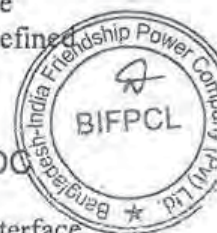
B0.4.2.2 Signal interface to NLDC for automatic generation control

The power plant shall be equipped with terminals to receive command from the BPDB load dispatch center to allow control from NLDC.

The NLDC shall be able to link to the Automatic Generation Control (AGC) via telecontrol facilities so as to act on the turbine load control, adjusting the latter by decrease/increase load commands. All measurement data to indicate if the target load has been matched shall be transmitted by the telecontrol system to NLDC. Type and initial number of signals are defined in **Section B8**.

B0.4.2.3 Interfaces between the 400/230kV substation and the NLDC

The Contractor (in consultation with BPDB) shall provide suitable interface unit for communication links to the PGCB's SCADA system for communication, control, monitoring and voice channels to accommodate the PGCB and the National/ Regional Control Center requirements.



The communication interface unit shall be adequate to fulfil the PGCB/NLDC information requirement. Communication to the National Load Dispatch Center shall be provided by data communication, utilizing both, the IEC 60870-5-104 and the IEC 60870-5-101 protocols. Settings shall ensure interoperability with the remote National Load Dispatch Center.

For possible future extensions, it shall be possible to interface with two remote control centers simultaneously by using dual port capability.

From the National Load Dispatch Center, all related high voltage apparatus of the substations shall be remote controlled and monitored. Necessary interface shall be provided within the substation automation system for receiving the signals from PGCB grid control.

All signals of the substation required for the control and monitoring from the remote National Load Dispatch Center shall be made available for data transmission via the gateway.

The scope of supply includes all required equipment and installations to enable the substation for the proper connection of the required control and monitoring signals. Communication, telemetry, fiber optical terminal and tele-protection equipment (PLCC) will be supplied and installed by PGCB at Company substation end matching with PGCB's remote substation end requirements. However, line trap and capacitive voltage transformer of required rating along with 48 VDC/AC auxiliary supply at Company substation end shall be provided by the Contractor. The Contractor shall supply and install the necessary cabling and cubicles. Cabling between these cubicles and the telecommunication equipment provided by PGCB shall be provided and installed by the Contractor.

The cabling between Contractor's cubicles and the telecommunication equipment provided by PGCB in the Control Building of the 400/230 kV GIS shall be in the scope of the Bidder/Contractor.

B0.4.2.4

Interfaces between the 400/230kV substation and the Power Plant

The Contractor is responsible for the construction of the interconnections between the substation and the Power Plant. Provision and installation of all control and signal cables between the substation and the Power Plant is within the responsibility of the Contractor.

The Power Plant shall be able to supervise and control the substation via an OPC client workstation installed in the Power Plant's CCR. The Contractor shall provide and install the OPC Server/Client architecture as well as all necessary equipment required for the proper translation of the native data (either acquired directly from the IEDs or from connectivity with the station bus) in OPC-format and the data provision at the OPC-client in the Power Plant control room via a TCP/IP communication link.



In addition the SCMS may communicate with the DCS either by serial communication link or by hardwired connection. In the former, dual redundant links and communication apparatus must be provided. However, the watchdog signalling logic must be hardwired so that this will continue to operate effectively even during SCMS failure.

B0.4.2.5 Interface to power transmission system (PGCB - Power Grid Company of Bangladesh)

The interface between the power transmission system of PGCB and Maitree-STPP will be the following points of the 400/230 kV GIS:

- 400 kV and 230 kV Interconnection:
 - 400 kV and 230 kV OHL conductors on the gantries for connection of the GIS bushings. The gantries shall be provided under the Maitree-STPP project.
- 400 kV and 230 kV OHL Protection, Control and Synchronization:
 - None.

Remark: *The 400 kV and 230 kV OHL protection on the Power Plant end (not on the remote end) shall be included in the scope of supply of the Maitree-STPP Project.*

- Telecommunication:
 - Terminals on the line traps for connection of the telecommunication equipment provided by PGCB on the related gantries
 - Terminals in the telecommunication panels provided by PGCB and located in the control building of the 400/230 kV GIS for connection of the cables for the signal exchange with the LDC and for the teleprotection.
 - Terminals in the telecommunication panels provided by PGCB and located in the control building of the 400/230 kV GIS for connection of the cables for auxiliary/control power supply (240V AC, 220 VDC and 48VDC).
- Earthing:
 - Terminals on the gantries for connection of the OPGW.
 - Earthing bars in the control building of the 400/230 kV GIS connection the protection and telecommunication panels



B0.4.3 Metering

Sufficient metering devices shall be provided to enable an energetic balancing of the power unit, all fuel consumers and additionally the Plant comprising gross and net electric power, coal flow, fuel oil flow, calorific value of fuels, fuels heat energy, electric power, specific heat consumption, etc. for tariff metering and internal balancing purposes.



Metering devices of electrical signals such as frequency, voltage, active power, reactive power, and energy shall be provided:

- i for the power unit for tariff metering at the switchyard
- ii for the power unit and additional the Plant for internal balancing purposes at all switchgears and all generators.

The final number and type of metering device, their accuracy and signal interface requirements shall be according to the Employer's requirements (see **Part B10** and **Annex E**) and the requirements of the relevant grid code.

B0.5 Technical Schedules

B0/TS	Design Conditions Design Data List of Major Equipment and Service Suppliers Guarantees
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B0.6 General Technical Requirements

B0.6.1 General requirements

The following directions, information and technical requirements for design, engineering, manufacturing, procurement, construction, commissioning, start-up and testing shall be observed as far as they are applicable for the equipment to be delivered. The requirements stated in this Section of General Technical Requirements are valid for all sections of the specification, except only where additional and/or special requirements are specified.

In case of a contradiction between different Sections of this specification or mentioned standards, the more stringent requirements shall be applicable to Contractor.

Any changes on the design of any part of the Plant, which may become necessary after signing of the Contract, have to be submitted by the Contractor in writing to the Employer for approval, being sufficiently substantiated and justified.

The Plant shall be new and clean, and designed, manufactured and arranged so that it will have a functional design and a pleasant appearance. All parts of the Plant shall be arranged in such a manner as to facilitate surveillance by the operator and to ease maintenance, operation and control.

The parts of the Plant shall be designed and arranged so that they can be easily inspected, cleaned, erected and dismantled without necessitating large scale dismantling of other parts of the Plant. They shall be designed,

