

- 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.



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



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 quantities 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 incl. 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	I		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, sanitaris, 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.	I	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, foot tracks	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
• Permit application documents			
• Documentation for operating permits	A	4	12
• Documentation for other permits	A	4	12
• Other documentation			
• Schedules of workshop tests	I	-	1 month ahead of test
• Quality assurance manuals	I	16	24
• Manual of Codes and Standards	I	16	24
• Operating manual	A	6 months ahead of pre-commissioning	1 month after COD of the 1 st Unit
• 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			
• Service and maintenance manual	A	6 months ahead of pre-commissioning	1 month after COD of the 1 st Unit
• maintenance procedures and instructions with description of all equipment and facilities			
• Equipment data sheets			

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
Generator	Copper loss at full load	kW
	Auxiliary power	kW
	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 $\pm$ % of rated voltage	%
Governor	Type	
	Model No.	
	Droop	%
Unit auxiliary power consumption	Deadband	Hz
	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. imodel software source codes (flects) 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.

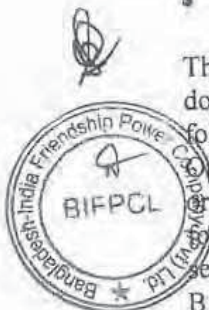
The Contractor is requested to provide Third Party Verification of structural documents, e.g. structural analysis, drawings and connecting details prior to submission for approval. These documents must contain all information necessary for the execution of the works.

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.

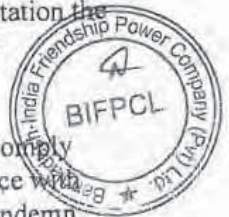
The results of the tests shall be made available to the Employer within 24 hours of obtaining the relevant test results. Acceptance of the relevant part of the work shall be subject to the performed tests showing satisfactory results. Individual construction completion certificates shall be issued by 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)	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. 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 supplies by the Bidder/Contractor) for the 230/400 kV OHL For detailed scope refer to Section B10.3.3 and B10.3.5.
TP2	OHL Protection	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	- 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). 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.
TP4	Earthing and	- 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)



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Designation	Category	Interface / Terminal Points
TP10	Fly ash	Outlet connection at: • 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: • 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: • 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

Designation	Category	Interface / Terminal Points
TP20	Construction Power	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. 2 terminals at 33 KV line at the border of the Power Plant Site Construction Power (Please refer to Section V.TS.B9.B9.A.2.1) 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 - Two (2) 5 MVA 33/11 KV step down transformers - Two (2) 11 KV switchgears 11 KV main ring, design according to plant layout, construction requirement and schedule 11 KV/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 For improved reliability these feeders shall be connected to separate 11 KV bus systems at 33/11 KV sub-stations. The electricity prices/power tariffs for the case of 33 KV voltage level are defined in the Annex C Further preliminary details regarding provided construction power system are shown in Annex C
	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 for 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

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,



manufactured and put into operation in accordance with the latest recognized rules of workmanship, modern engineering practice and with good standards of prudence applicable to the international electricity generation industry which would have been expected to accomplish the desired result at the lowest reasonable cost consistent with reliability, safety and expedition.

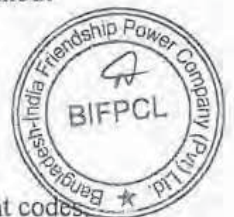
The regulations, standards and guidelines listed in the Specification as well as all applicable laws and governmental decrees, regulations, orders, etc. shall be observed in the design, calculation, manufacture, erection, installation, testing, commissioning and start-up of all parts of the Plant.

The following shall be considered in the design and engineering of the Plant facilities:

- All parts of the Plant shall be suitable in every respect for continuous operation at maximum output as well as part loads and expected transient operating conditions peculiar to the site and shall be able to safely withstand the stresses arising from the operating conditions without any reduction in its planned life.
- The Contractor shall familiarize himself with the conditions on site.
- Suitable and automatically acting protection and safety measures shall be provided for automatic load reduction or shut down of equipment in case of abnormal operating conditions.
- Switchover to stand-by units shall be automatically, as far as required for continuous Plant operation without interruption of Plant operation.
- In case of equipment and/or system shut down process conditioned drainage of components (such as pipelines, tanks, etc.) shall be performed automatically from the control room.
- Minor equipment which, in case of failure would cause a failure of a power generation unit and/or the Plant is to be provided with a stand-by facility in order to ensure further operation of the power generation unit or the Plant.
- All live, moving and rotating parts shall be provided with appropriate effective protection in order to avoid danger to the operating staff. All metal parts shall be electrically grounded.
- All equipment shall be designed to ensure start-up from any condition, i.e. from long term shut-down, cold, warm or hot condition without necessitating special or preparatory measures.
- The project language shall be English.

B0.6.2 Standards and codes

The work must be performed according to the most recent relevant codes, standards, accident prevention regulations and local rules and legal regulations.



All materials and equipment supplied and all work carried out as well as calculation sheets, drawings, quality and class of goods, methods of inspection, specific design features of equipment and parts and acceptances of partial plants shall comply in every respect with the applicable standards, codes and regulations to be chosen from the following:

• American Association of State Highway and transportation Officials	AASHTO
• American Concrete Institute	ACI
• American Gear Manufacturers Association	AGMA
• American Institute of Steel Construction	AISC
• American Iron & Steel Institute	AISI
• American Moving and Conditioning Association	AMCA
• American National Standards Institute	ANSI
• American Petroleum Institute	API
• American Public Health Association	APHA
• American Society for Testing and Materials	ASTM
• American Society of Civil Engineers	ASCE
• American Society of Heating, Refrigeration & Air Conditioning Engineers	ASHRAE
• American Society of Mechanical Engineers	ASME
• American Water Works Association	AWWA
• American Welding Society	AWS
• American Wire Gauge	AWG
• Anti-Friction Bearing Manufactures Association	AFBMA
• Architectural Institute of Japan	AIJ
• Association Francaise de Normalisation	AFNOR
• British Standards Institute	BS
• Chlorine Institute	CI
• Crane Manufacturers Association of America	CMAA
• Deutsches Institut für Normung	DIN
• Diesel Engine Manufacturers Association	DEMA
• European Norm	EN
• Expansion Joint Manufacturer Association	EJMA
• Fédération Européenne de Manutention	FEM
• Heat Exchanger Institute	HEI
• Hydraulic Institute	HI
• Illuminated Engineers Society	IES
• Institute of Electrical and Electronics Engineers	IEEE
• Instrument Society of America	ISA
• Insulated Power Cable Engineers Association	IPCEA
• International Electrotechnical Commission	IEC
• International Standards Organization	ISO
• Japanese Architectural Standard Specification	JASS



• Japanese Electrical Manufacturers Association	JEMA
• Japanese Electrotechnical Institute	JEC
• Japanese Industrial Standards	JIS
• Manufacturers Standardization Society	MSS
• National Association of Corrosion Engineers	NACE
• National Electrical Code (USA)	NEC
• National Electrical Manufacturer's Association (USA)	NEMA
• National Electrical Safety Code	NESC
• National Fire Protection Association	NFPA
• National Structural Code for Building	NSCB
• Occupation Safety and Health Administration	OSHA
• Portland Cement Association	PCA
• Properties of Water and Steam	IFC
• Scientific Apparatus Manufacturers Association	SAMA
• Society of Automotive Engineers	ASE
• Standards of Japanese Electrotechnical Committee	JEC
• Steel Structures Painting Council	SSPC
• Technische Vereinigung der Grosskraftwerksbetreiber	VGB
• Tubular Exchanger Manufacturers Association	TEMA
• Underwriters Laboratory	UL
• Uniform Building Code	UBC
• Verband Deutscher Elektrotechniker	VDE
• Verein Deutscher Ingenieure	VDI
• Vereinigung Deutscher Elektrizitätswerke (Association of German Power Plants)	VDEW
• Water Pollution Control Federation	WPCF



Generally, all internationally and nationally recognized standards as above will be applied, except if specific standards called for by:

- Occupational Safety Board of Bangladesh
- Department of Inspection for Factories and Establishments, Bangladesh
- Department of Environment, Bangladesh
- Bangladesh Power Development Board
- Bangladesh Energy Regulatory Commission
- Ministry of Power, Energy and Mineral Resources
- Bangladesh Fire Service and Civil Defence Ministry
- All relevant Bangladesh National Statutory Regulations
- Bangladesh National Building Code
- Bangladesh Standards
- Local Authorities.



All steam boilers and unfired pressure vessels together with associated pipework and fittings shall comply with the Bangladesh Boiler Act, 1923 with amendments.

All pressure parts shall be designed in accordance with applicable ASME codes.

All services, supplies and works shall comply with the requirements of the relevant laws of Bangladesh and the IFC/World Bank Group Standards and Guidelines in their latest edition, including but not limited to:

- Environmental Conservation Rules
- Bangladesh Energy Regulatory Commission Act;
- BERC Licensing Regulation
- BERC Technical Quality Standards;
- Bangladesh National Building Code;
- other applicable laws in Bangladesh;
- IFC Performance Standards on Environmental and Social Sustainability;
- IFC / World Bank Group Environmental, Health and Safety (EHS) General Guidelines ;
- IFC / World Bank Group EHS Guidelines for Thermal Power Plants;
- IFC / World Bank Group EHS Guidelines for Electric Power Transmission and Distribution.

It is the Contractor's responsibility to provide sufficient evidence that any national or other standard the Contractor proposes (other than those mentioned above) will ensure an equivalent or higher standard.

Immediately after effective date of the Contract the Contractor shall supply an indexed list of all standards, codes and associated standards referred to, to which the work is to be performed. A copy of all applied standards shall be forwarded to the Employer. The Contractor shall supply preferably two (2) searchable softcopies, else two (2) hardcopies each.

B0.6.3 Plant and equipment identification

The Contractor shall apply a plant identification system showing the name and number of each item of Plant and its respective arrangement drawing number and add any additional items necessary to fully identify the Plant.

All design submissions shall include a detailed labelling list indicating the label text, size of the lettering and fixing details for the approval of the Employer or its representative.

The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with



the VGB guideline RDS-PP (Reference Designation System for Power Plants - KKS system).

There is to be only one approved description for any one item of Plant and this must be used consistently for Plant, electrical and instrumentation designations throughout.

The Contractor shall supply all labels (Plant and Equipment Identification Plates), nameplates, manufacturer's equipment nameplate, instruction and warning plates necessary for the identification and safe operation of the Plant, and all inscriptions shall be in the English language and Bangla language.

All labels, nameplates, instruction and warning plates shall be securely fixed to items of Plant and equipment with stainless steel rivets, plated self-tapping screws or other approved means. The use of adhesives will not be permitted.

Nameplates for Plant and equipment identification and record purposes shall be manufactured from stainless steel or aluminium with a mat or satin finish, and engraved with black lettering of a size which is legible from the working position.

Warning plates shall be manufactured from stainless steel or aluminium, engraved red lettering on a white background and sited in the position where they afford maximum safety of personnel.

All equipment within panels and desks shall be individually identified by satin or mat finish stainless steel or aluminium labels.

Each circuit breaker panel, electrical control panel, relay panel, etc. shall have a circuit designation label on the front as well as on the rear panels engraved with black lettering in accordance with the circuit designation system. Circuit designations must be precise and convey complete information. There should be no doubt whatsoever for the operation as to which area of the Plant a particular feeder is supplying with power. Labels such as interconnector 1 or feeder 2 are not acceptable. Corridor type panels shall in addition have circuit designation labels within the panels.

Pipework systems shall be identified with a colour identification systems in conformity with the colours according to the Employer's specification, with colours at the nameplates and, if necessary by colour bands and with KKS numbering and plain language. The direction of flow shall be shown.

Each valve/instrument shall be fitted with a stainless steel or aluminium nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.

Where possible valve nameplates shall be circular and shall be fitted under the handwheel captive nut. They have to be of such a diameter that there is no danger for persons operating the valve or that they do not prevent lock-off of this valve; on check valves and small valves the Contractor may provide rectangular nameplates fitted to brackets on the valve or attached to a wall or steelwork in a convenient position adjacent to the valve.

B0.6.4 Marking and labelling

Each crate or package is to contain a packing list in a waterproof envelope. All items of material are to be clearly marked for easy identification against the packing list.

All cases, packages, etc. are to be clearly marked on the outside to indicate the total weight, where the weight is bearing and the correct position of the slings and are to bear an identification mark relating them to the appropriate shipping documents.

All stencil marks on the outside of cases are either to be made in waterproof material or protected by shellac or varnish to prevent obliteration in transit.

B0.6.5 Corrosion protection, coating and galvanizing

This specification shall be used for the corrosion protection of steel structures, components, pipings and equipment in general which are installed in confined areas (indoors) or outdoors.

Surface preparation, as well as protective coatings and coating systems are based on this specification in order to assure that structural parts of different suppliers will get a corrosion protection of similar and high quality.

Coating material shall only be supplied by manufacturers with international experience and their products can be obtained internationally.

Regarding maintenance work (storage), application and supervision of coating work, choice of coating suppliers should be minimized. At any rate, similar parts of structures/components (such as structural steel, containers, piping, etc.) shall only be coated with products of one individual manufacturer.

The materials and equipment used, the methods of application and the quality of work shall at all times be subject to the inspection and approval of the Employer or his Representative.

To mitigate crevice corrosion, the designs and construction of structures and equipment shall ensure that no collection of water occurs in crevices which could lead to crevice corrosion.

It is the responsibility of the Contractor to ensure that, for all supplied equipment (including that from sub suppliers):

- The protection system is perfectly suitable for the Site conditions and for the specific purpose.
- The shop paints provide a sufficient protection during transport, storage and erection.
- The shop paints are suitable for handling and erection conditions (slinging, Site welding works etc.) and are compatible with the Site finishing coats
- All necessary precautions are taken in order to prevent damage to paints during storage, handling, welding.
- The necessary repairs are carefully executed as soon as possible.
- The colour RAL number of the finishing coat has been approved by the Employer, including identification code for piping.
- Standardised equipment will be painted according to the manufacturer's standard.
- All corrosion protection and coating on site shall be done in a workshop specifically for the purpose of the application of corrosion protection and coating.

Codes and standards

Applicable standards are:

- Product data of coating manufacturer
- DIN 2403 Indication of pipe-lines according to flowing material
- DIN 4762 Surface roughness
- ISO 8503 Surface roughness
- DIN 8201 Part 1-9 tight blasting agents
- DIN 50976 Corrosion protection, hot dip batch galvanizing of single parts, requirements and testing
- DIN 55928 Part 1-9 corrosion protection of structural steel work through protective coatings and topcoats
- ISO 8501 Preparation of steel substrates before application of paints and associated products
- ISO 12944 Paints and varnishes – corrosion protection of steel structures by protective paint systems
- RAL Colour card
- ISO 8501-1 Preparation of steel substrates before application of paints and related products
- SSPC Vol. 1 and 2 Steel structure painting council

Surface preparation and cleaning of surfaces in the shop

Prior to blasting, areas have to be cleaned from oil, grease, paint residues, splatters, welding splashes and welding slag using a suitable aqueous degreaser, or solvent for more severe grease contamination. The cleaning should be to provide a "water break free surface".

Sharp edges have to be rounded off.

Contaminations caused by salts, acids and alkali solutions shall be eliminated by rinsing with water up to a pH value of 6-8. Soluble salt contamination is to be tested using the Weber Reilly test method (or similar approved) and pH is to be tested using universal indicator paper strips prior to continuation with the blasting.

The preparation of substrates shall be carried out on the basis of the specifications of ISO 12944 part 4 and ISO 8501. The preparation of steel before application of paint and related products shall be in line with ISO 11124 for metallic blast cleaning abrasives and ISO 11126 for non-metallic blast cleaning abrasives. No recycled blast grit may be utilised.

After blasting, an anchor profile of 25 - 50 μm shall be achieved. Blasted surfaces have to be provided with a prime coat of the approved coating system immediately within 4 hours of blasting. All blasting and priming must take place outside of the high humidity periods of the day (i.e. maximum relative humidity of 80%).

Cleaning to be performed on site

Steel work protected by shop primer after arrival on site must be cleaned of salt, sand, oil, etc. before the first coat of paint is applied on site. Shop primer damaged during transport must be rectified by blast-cleaning and coating before application of the site coats.

Wood surfaces shall be sanded clean. All nail holes shall be puttied and sanded before priming, unless the specific coating system allows for coating onto damp concrete, in which case only with approval from the Employer.

If a protective coating of concrete is required, concrete shall be allowed to cure before painting.

Transport and erection damages, as well as damages which result out of additional welding have to be repaired as soon as possible. The damaged areas have to be derusted with rotating or steel brushes, abrasive wheels, and abrasive blasting according to DIN ISO 8501-1.

Cleaning of prime and intermediate coats (if required)

To prevent contamination by mineral oil products, areas with prime and intermediate coat have to be treated with suitable cleaning agent. Cleaning has to be done free of residues, e.g. with alkaline detergents and thorough washing done with fresh water. Rusty spots have to be removed according to required purity. Metallic areas which are provided with temporary corrosion protection have to be cleaned. No oxidation products shall remain on the surface. Further care shall be taken that on hot components, no destructive or reaction products will be released when heating which could injure insulation.

Application procedure

When using the provided coating material, strict adherence to all application instructions given in product data of coating manufacturer is necessary. To obtain the maximum performance, technical data as well as application instructions for the individual coating material have to be strictly followed. For a multi-layer coating system each layer has to have a different colour shade in order to clearly identify number of coats applied. The last finish coat has to be applied in the specified colour shade.

All paintings shall be performed according to ISO 12944. The durability of all paintings shall be "high" which corresponds to 15 years.

The interval between applying the different coats has to follow according to supplier's precautions. Each layer has to be cleaned and released from spray dust before the next layer will be applied. Prior to applying a further layer, the last one has to be repaired. All coatings have to be applied without retarding.

Following application procedures are allowed:

- prime coats by airless spray
areas like disconnections, angles, corners, etc. which are difficult to be reached can be applied by brush or roller
- repair of prime coat by brush
- finish coats
 - at works by airless spray, roller or brush
 - at site by roller or brush or airless spray.

When applying coating systems by roller, rollers have to be of kind and quality which make an appropriate application possible.

Control areas in accordance with the coating supplier's instructions have to be applied. For this procedure, a schedule for control areas has to be prepared by the Contractor and coating supplier which corresponds with the requirements of the warranty agreement.

Number and performance of the control areas have to be done in accordance with ISO 12944 part 7 and have to be documented in writing.

No application shall take place either in the condition of the relative humidity not within the given limit or in case of poor weather conditions such as fog, dust, rain, snow, hail or when it can be assumed that such conditions of poor weather will arise within 2 hours after application.

Temperature of the coated parts has always to be above 5 °C and 3 K above dew point.

All specified dry film thicknesses (DFT) are minimum thicknesses.