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1.4 GUARANTEES UNDER CATEGORY-III

The parameters/capabilities to be demonstrated for various systems/equipments shall include but not be limited to the following:

1.4.1 Steam generator parameters with Blended Coal : The steam generator shall be run continuously for 168 (one hundred and sixty eight) hours with blended coal at 70 : 30 ratio between domestic coal and imported coal for demonstration of stable operation at rated parameters.

1.4.2 Steam turbine generator rated capacity at 89 mm Hg Condenser pressure.

1.4.3 Run back capabilities.

The automatic runback capability of the unit (boiler- turbine-generator) on loss of critical auxiliary equipment (such as tripping of one ID/FD/PA fan/airheater/BFP/ CEP etc) shall be demonstrated ensuring smooth and stable runback operation.

1.4.4 Rate of change of load and sudden load change withstand capability

The capability of boiler-turbine-generator in regard to ramp rate and step load change as specified shall be demonstrated.

1.4.5 Mill capacity at rated fineness

Performance testing shall be done on coal mills toward establishing its capacity specified at the rated fineness, applying corrections for the variation in coal characteristics i.e. HGI (Hardgrove Grindability Index) and total moisture. Capacity demonstration test shall be carried out for the following conditions:

- (a) Capacity output of one coal pulverizer (of Owner's choice) shall be demonstrated for establishing its capacity at 100% mill loading, at rated pulverized coal fineness with specified design coal with new set of grinding elements.

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1.4.32 Feed Water Heaters and Deaerator The following parameters shall be demonstrated: (a) Dissolved O₂ content in feed water at deaerator outlet without chemical dosing at all loads, not to exceed 0.005 cc/litre determined as per ASTM-D-888 – Reference method-A or Indigo Carmine method. (b) Free carbondioxide in deaerator effluent shall be non-traceable at all loads from zero to VWO with 1% cycle make up. (c) Continuous and efficient operation and performance of feed heating plant without undue noise and vibrations at all loads and duty conditions. 1.4.33 Automatic on-line Turbine Testing (ATT) system On-load testing of turbine protective equipments shall be demonstrated without disturbing normal operation and keeping all protective functions operative during the test. 1.4.34 Noise All the plant, equipment and systems shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified. Noise level measurement shall be carried out using applicable and internationally acceptable standards. The measurement shall be carried out with a calibrated integrating sound level meter meeting the requirement of IEC 651 or BS 5969 or IS 9779. Sound pressure shall be measured all around the equipment at a distance of 1.0 m horizontally from the nearest surface of any equipment/ machine and at a height of 1.5 m above the floor level in elevation. Corrections for background noise shall be considered in line with the applicable standards.		

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1.4.35 Condensate Polishing Unit (a) Effluent quality at outlet of each vessel at its rated design flow and design service length between two regenerations (with requisite correction curves for variation in the influent quality). 1.4.36 Superheater and Reheater Temperature Control Test This test shall be conducted to guarantee that SH/RH temperatures are maintained within +/- 5°C of rated temperature condition from 40% to 100% TMCR including conditions: HP Heaters out of operations, HP-LP Bypass operation. 1.4.37 Flue Gas Temperature demonstration The Bidder shall demonstrate that flue gas temperature at the entry and exit of various Boiler heating surfaces and also the variation across the cross section perpendicular to gas flow do not exceed the values considered for the pressure parts design at all loads of boiler. 1.4.38 Control & Instrumentation System Requirements Performance guarantee tests for closed loop control system shall be carried out at site to verify the integrated performance of the total plant C&I and to verify as to whether all the important parameters remain within stipulated permissible limits under all the operating conditions. In case during this tests or otherwise it is observed that the behavior/response of Contractor's system (drives actuators/valves etc.) is not satisfactory/acts as a limitation/restriction in achieving the permissible limits, the Bidder shall carry out all required modifications, rectification etc. in his system whatsoever so that the permissible limits can be achieved. He shall also depute his experts for associating in the above tests and also for carrying out the necessary modifications, rectification etc.		

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1.4.39 Balance of Plants: (Applicable for Sewage Treatment Plant) For Balance of Plants, functional guarantees like capacities and parameters (except power consumption at individual system level) shall be demonstrated as per the specification furnished under respective sections forming part of this specification. Wherever applicable, Owner may, at his sole discretion, consider shop test result as primary indicators of the performance. 1.4.40 Utility Consumption Bidder shall have to indicate and demonstrate utility (e.g. DM Water, Clarified Water etc) consumptions. 1.5 <u>TEST CODES, CONDITIONS ETC</u> 1.5.1 Steam Generator Efficiency (a) The steam generator efficiency (by loss method) shall be determined as per the requirements of BS EN 12952- 15, 2003 (by loss method) and other stipulations brought out hereunder. <table border="1" data-bbox="443 1223 1436 1870"> <tr> <td data-bbox="443 1223 539 1290">(i)</td><td data-bbox="539 1223 798 1290">Test loads</td><td data-bbox="798 1223 1436 1290">100% TMCR</td></tr> <tr> <td data-bbox="443 1290 539 1402">(ii)</td><td data-bbox="539 1290 798 1402">Test conditions</td><td data-bbox="798 1290 1436 1402">Boiler operating at rated steam parameter, excess air, coal fineness and firing design coal</td></tr> <tr> <td data-bbox="443 1402 539 1637">(iii)</td><td data-bbox="539 1402 798 1637">Ambient conditions</td><td data-bbox="798 1402 1436 1637">27°C dry bulb temperature and 60% relative humidity. The reference air temperature for the efficiency guarantee/ testing shall be taken as the temperature of air (i.e. 27°C) entering PA and FD fans</td></tr> <tr> <td data-bbox="443 1637 539 1870">(iv)</td><td data-bbox="539 1637 798 1870">Number of readings</td><td data-bbox="798 1637 1436 1870">Two sets of consistent readings for each of test loads. Average of the test efficiencies based on above two readings for each load shall be considered for guaranteed efficiency</td></tr> </table>			(i)	Test loads	100% TMCR	(ii)	Test conditions	Boiler operating at rated steam parameter, excess air, coal fineness and firing design coal	(iii)	Ambient conditions	27°C dry bulb temperature and 60% relative humidity. The reference air temperature for the efficiency guarantee/ testing shall be taken as the temperature of air (i.e. 27°C) entering PA and FD fans	(iv)	Number of readings	Two sets of consistent readings for each of test loads. Average of the test efficiencies based on above two readings for each load shall be considered for guaranteed efficiency
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(a) Condenser pressure shall be measured at 300 mm above the top row of tubes under VWO conditions, 1% make-up and design C.W. flow & design temperature. The condenser pressure shall be measured with a vacuum grid utilizing ASME basket tips. The grid is fitted at 300 mm above top row of condenser tubes. (b) Combined pressure drop in condenser tube, water box and inlet and outlet piping shall be measured in between intake and discharge point of the C.W. system with cleanliness factor of 0.9 and COLTCS in service. 1.5.8 Performance test for Feed Water Heaters and Drain Cooler Performance test for feed water heaters shall be conducted in accordance with the latest edition of ASME PTC-12.1. 1.5.9 Performance test for Deaerator Performance test for deaerator shall be conducted in accordance with the latest edition of ASME PTC-12.3. 1.5.10 For Balance of plant For the Balance of plant equipment, performance test shall be conducted as per the relevant codes. The results of the shop test shall be used wherever applicable as the base for conducting the test. 1.6 <u>TEST INTERRUPTIONS</u> In the event of a test interruption resulting from an Event of Force Majeure or Employer-Caused-Delay, contractor shall be entitled to relief as provided in the contract, provided that (except for certain interruptions of a Availability Test as specified below), the interrupted Performance test must be started again and test data that were collected during the interrupted test must be ignored. In the event of test interruptions as a result of Force Majeure or Employer-Caused-Delay during Availability test the test shall not be deemed a successful Performance Test where		

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(a) The total cumulative interrupted time during the test is more than twenty-four (24) hours (b) The total number of interruptions during the test is more than four (4) Except as provided above, the test resulting from Force Majeure or Employer-Caused-Delay shall be extended by an amount equal to the length of the interruptions, including time to return to steady-state operation. The test data for the period of interruptions shall be excluded from analysis and the test data that were collected both before and after the interruptions shall be included in the analysis. 1.7 TEST REPORTS The contractor shall prepare test reports for the Availability Test, Efficiency Test, Capacity Test and the Emissions Test in which the methods followed, instrument readings, graphs, observations, final results obtained etc shall be recorded. Amount of Liquidated Damages (LD) applicable for Category-I guarantees shall be as stipulated in Volume I. The contractor shall also prepare Heat Balance Diagrams and Correction curves for all tests. The contractor shall also furnish detail information about: (a) Start up trials of the equipments (b) Initial trial of total system (c) Trial operation (d) Procedure for performance guarantee/ acceptance tests.		

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5179/2020/PS-PEM-MAX

	TITLE:		SPECIFICATION NO. PE-TS-415-673-A001	
	1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6		SECTION : I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		SUB-SECTION: IA	
			REV. NO. 00	DATE :

TECHNICAL GUARANTEE:**SEWAGE TREATMENT OUTLET QUALITY:**

Minimum Guarantees to be demonstrated by bidder have been included below. However, in case the guaranteed parameters as per the latest MOEF, State pollution control board norms and Local authority requirement, are more stringent than the specified parameters given below, then more stringent outlet parameters must be followed and guaranteed by bidder.

OUTLET QUALITY (MINIMUM)		
S. No	Description	Value
a.	BOD ₅	Less than 10 mg/l
b.	COD	Less than 50 mg/l
c.	TSS	Less than 10 mg/l
d.	pH	7-8
e.	Coliform count	100 counts/ 100 ml
f.	NH ₄ -N	Less than 5 mg/l
g.	N Total	Less than 10 mg/l
h.	Residual chlorine	Not exceeding 0.5 mg/l
i.	Temperature	Ambient

NOTES: -

The treated sewage quality standards shall be achieved at average sewage flow rates as well as peak sewage flow rates.

5179/2020/PS-PEM-MAX

	TITLE.		SPECIFICATION NO. PE-TS-415-673-A001	
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ANNEXURE IV

DRAWING DOCUMENTS DISTRIBUTION PROCEDURE

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VOLUME II
SECTION – 6
ENGINEERING SERVICES

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2.0	DESIGN COORDINATION MEETING
3.0	GUIDELINES FOR ENGINEERING SERVICES
4.0	OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS
5.0	PLANT HANDBOOK
6.0	CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE

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1.0 <u>GENERAL</u> 1.1 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/ Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting, the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However, such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract. 1.2 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor. 2.0 <u>DESIGN COORDINATION MEETING</u> The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Mumbai or at Bhusawal site or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions. 3.0 <u>GUIDELINES FOR ENGINEERING SERVICES</u> 3.1 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz criteria for selection and sizing of all equipment and systems, design margins etc including that for structural steel		

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and civil work shall be outlined and these shall form the basis for the detailed engineering work. 3.2 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor. 3.3 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to any unit of 660 MW individually or severally, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date (s) or feedback (s) received during execution/operation of similar units. Such changes/modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor. 3.4 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner. 3.5 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires, the Bidder shall submit such data and information to the Owner. 3.6 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as		

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specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:		
4.6.1	Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.	
4.6.2	Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items and also finalisation of corresponding sub-contractors.	
4.6.3	Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner /Consultant for approval.	
4.6.4	Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis, as necessary.	
4.6.5	Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.	
4.6.6	Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.	
4.6.7	Sizing of all piping and equipment as per the stipulated design criteria, carrying out the flexibility analysis/dynamic analysis as necessary, hangers & support engineering.	

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4.6.8	Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.0 for the specific requirement in this regard.	
4.6.9	Certification and submission of final as-built drawings for all areas.	
4.6.10	Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.	
4.6.11	All erection and assembly drawings which may be required at site.	
4.6.12	For all bought out item packages, the Contractor shall provide complete material/ component list along with detail specification, drawings, component part number etc during detail engineering stage prior to final approval. Such approved drawing / document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD).	
4.6.13	Preparation of necessary documentation, design calculations etc required for submission to statutory authorities like IBR, Chief Electric Inspector etc.	
4.0	<u>OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS</u>	
4.1	The Contractor shall provide all necessary maintenance manuals and operating instructions at least six (6) months before the time of commissioning and before taking over of the plant and equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.	
4.2	The information provided, which shall be contained in loose leaf stiff backed covers, shall include :	
4.2.1	A complete inventory of all main items of plant, with identification details.	
4.2.2	Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps etc.	

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4.2.3	A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.	
4.2.4	A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.	
4.2.5	A lubrication schedule with all necessary drawings, diagrams to identify the lubrication points.	
4.2.6	Manufacturer's literature.	
4.3	The instruction manual shall be subject to the approval of Owner.	
4.4	The contractor shall submit the complete equipment list. The list shall be updated every three (3) months.	
5.0	<u>PLANT HANDBOOK</u> The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems, covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD/DVD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms.	
6.0	<u>CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE</u>	
6.1	Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document. The documents shall be divided into two categories:	

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(a) for approval and (b) for information/further engineering and co-ordination by the Owner. This document submission schedule shall require approval by the Owner/Engineer. 6.2 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation. All dimensions shall be in metric units. All notes, markings etc. shall be in English. 6.3 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Engineer. 6.4 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant: 6.4.1 List of sub-vendors (from Owner only) 6.4.2 System scheme and instrumentation diagrams 6.4.3 Design basis justifying selection of equipment & process parameters where not specified in the Contract 6.4.4 Equipment data sheets and general arrangement drawings 6.4.5 Predicted performance curves of equipment** 6.4.6 Materials of construction 6.4.7 Layout drawings		

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6.4.8	Operation logic diagrams	
6.4.9	Typical control circuit	
6.4.10	Drawings of Instrumentation and Control	
6.4.11	Any deviation from contract (by Owner)	
	** For all critical equipments (boiler and turbine auxiliaries etc), submission of this data shall be mandatory for approval of equipment data sheets / GA drawings.	
6.5	Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/Engineer.	
6.5.1	Equipment foundation drawings	
6.5.2	Equipment cross-section drawings, product literature etc which are of proprietary nature	
6.5.3	Various bills of quantity, schedules etc	
6.5.4	Piping fabrication drawings, isometrics etc	
6.5.5	Panel wiring diagrams	
6.5.6	Instruction/Operation manuals	
6.5.7	Service manuals and troubleshooting guide for C & I system including field instruments	
6.5.8	Cable schedule and interconnection chart	
6.5.9	Drive/feeder wise control scheme showing all external interfaces.	

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In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category. 6.6 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document: 6.6.1 Approved 6.6.2 Approved except as noted, forward final drawing 6.6.3 Approved except as noted, resubmission required 6.6.4 Disapproved 6.6.5 For information/reference only For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner / Engineer. For action stamp in category (b), further review by Owner / Engineer would not be necessary provided the Contractor agrees & incorporates the minor comments made on the document. Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer. The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements. The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.		

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6.7	Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.	
6.8	For review by the Consulting Engineer, the Contractor shall furnish three (3) prints of each drawing. Two (2) prints of such submission shall also be sent to the Owner. After review, one (1) stamped print will be returned to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CD's of all as built/final drawings for Owner / Consultant site.	
6.9	In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.	
6.10	For details of documentation for Civil, Structural and Architectural works, Volume VI may be referred.	
7.0	<u>TENDER STAGE DOCUMENT SUBMISSION</u>	
8.1	The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following:	
8.1.1	All Bid proposal sheets duly filled up. (The data mentioned in Bid proposal sheets is minimum required only. The Bidder shall submit the additional data asked for at any later stage).	
8.1.2	Detailed experience list and financial resources of the prime bidder, his collaborators/ associates in this bid as well as the sub-vendors proposed.	
8.1.3	Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.	

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Note:

- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However, the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Bidder has to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy / MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.
 - P&IDs.
 - Equipment lay out.
 - Equipment Cable tray layout.
 - Civil scope drawings.
 - Piping lay out drawing.

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ANNEXURE V

PAINTING SPECIFICATION

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15.0 PAINTING

15.1 GENERAL

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner.

All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in

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windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment. Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use. Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished. The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C. The Owner/Engineer shall submit the colour scheme during execution of contract for approval.		
15.2	<u>PREPARATION</u> Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying. Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed. The priming coat shall be applied without delay.	
15.3	<u>DAMAGED PAINTWORK</u> Any damaged paintwork shall be made good as follows:	

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15.3.1	The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal.	
15.3.2	A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage.	
15.3.3	The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming	
15.4	<u>PAINTING SYSTEMS</u>	
	The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.	
15.4.1	Surfaces subject to Weathering	
	All surfaces shall have a minimum of four coats of paint made up as follows:	
	(a) Primer coat	: 35 micron DFT
	(b) Tie coat	: 35 micron DFT
	(c) Finishing coat (Two Nos.)	: 35 micron DFT per coat
	(d) The total minimum DFT	: 140 micron
15.4.2	Surfaces Inside Buildings	
	All surfaces shall have a minimum of three coats of paint made up as follows:	
	(a) Primer coat	: 35 micron DFT
	(b) Tie coat	: 35 micron DFT
	(c) Finishing coat (Two Nos.)	: 25 micron DFT per coat
	(d) The total minimum DFT	: 120 micron

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The Contractor shall select the type and colour of primer & finish coat after approval by the Owner. For detail painting on building & structural steel elements, please refer Volume VI / A & B of this specification. 16.0 <u>COLOUR CO-ORDINATION & FINISH</u> 16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape. 16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification. 16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned. 16.4 Final colours and finishes shall be to the Approval of the Engineer.		

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**ANNEXURE VI
MANDATORY SPARE LIST
FOR SEWAGE TREATMENT PLANT**

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1.0 TOOLS & TACKLE

The Contractor shall supply with the equipment one complete set of special tools and tackles required for the erection, assembly, dis-assembly & maintenance of the equipment. These special tools shall also include special material handing equipment, jigs & fixtures for maintenance and calibration/ re-adjustment, checking & measurement aids etc. A list of such tools & tackles shall be submitted by the Bidder along with the offer. Detailed description of each tool/tackles, its function along with the equipment / part for which it is meant for and the price of each tool / tackles shall also be indicated in the offer. These tools & tackles shall be separately packed and sent to site before commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

2.0 SPARES

2.1 GENERAL

The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Owner reserves the right to buy any or all mandatory and recommended spares. The Contractor shall also state for each item of spares, both mandatory and recommended, the normal expected service life.

2.1.1 All spares supplied under this contract shall be strictly interchangeable with the parts which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs, as necessary.

2.1.2 Each spare part shall be clearly marked or labelled on the outside of the packing with the description. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

2.1.3 All cases, containers or other packages are liable to be opened for examination as may be considered necessary by the Engineer.

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2.1.4	All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be despatched before the despatch of the associated main equipment.	
2.1.5	The Bidder shall also guarantee supply of spare parts, which will be made, based on manufacturer's drawings on special order from the Owner for 30 years after commissioning of the plant.	
2.1.6	Warranty period for all kinds of spares shall be six thousand (6000) hours of operation, except normal wear or eighteen (18) months from the date of receipt at site, whichever is later. In case of failure or non-conformance to specifications, the Contractor shall replace them free of cost.	
2.1.7	Design & Engineering details of all spares (make, model, rating, drawing, data sheet etc.) shall be submitted to the Owner prior to dispatch from manufacturers' works.	
2.2	<u>RECOMMENDED SPARES</u>	
2.2.1	The Contractor shall provide a list of recommended spares giving unit prices and total prices for Three (3) years of normal operation of the plant. This list shall take into consideration the mandatory spares specified elsewhere in the specification and shall be a separate list.	
2.2.2	The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner and shall be finalised after mutual discussion.	
2.3	<u>START-UP COMMISSIONING SPARES</u>	
2.3.1	Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the	

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main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor to ensure smooth commissioning of the plant shall be subject to the Engineer's approval. 2.3.2 The Contractor shall submit a complete list of all such start-up spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner. 2.4 <u>MANDATORY SPARE PARTS</u> 2.4.1 The Owner considers some of the spares as essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above. 2.4.2 Since the components involved can not be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The Bidder shall include in his proposal, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage. During finalization of detailed engineering if some component, equipment, system, sub-system found to undergo change, then the Owner/Consultant shall revise the list for compliance by the contractor without any cost implication. 2.4.3 The mandatory spares should be supplied to the Owner at least one month before the trial run of the Unit. The despatch programme is subject to approval of the Owner/ Consultant after award of contract. 2.4.4 Criteria for selection of Quantity of Mandatory Spares:		

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2.4.4.1 The list of mandatory spares considered essential by the Owner is enclosed in Annexures of this specification. The Bidder shall indicate the prices for each and every item (except for items not applicable to the Bidders design) whether or not he considers it necessary for the Owner to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The Bidder shall furnish the population of each item. Whenever the quantity is mentioned in “sets”, the Bidder has to give the item details and prices of each item. 2.4.4.2 Whenever the quantity is indicated as a percentage, it shall mean percentage of total population of that item in the station (project) unless specified otherwise, and the fraction will be rounded off to the next higher whole number. Wherever the requirement has been specified a ‘set’, it will include the total requirement of the item for a unit, module or the station or as specified. Where it is not specified, a ‘set’ would mean the requirement for the single equipment/system as the case may be. Also, the ‘set’ would include all components required to replace the item; for example, a set of bearings shall include all hardware normally required while replacing the bearings. 2.4.4.3 The prices of mandatory spares indicated by the Bidder in the Bid Proposal shall be used for bid evaluation purposes. 2.4.4.4 Wherever quantity is specified both as a percentage and a value, the bidder has to supply the higher quantity until and unless specified otherwise. 2.4.4.5 For Mandatory Spares, refer Annexures of Mechanical, Electrical and C&I packages. 2.4.5 Owner will have the option to procure any or all of the mandatory spares at his discretion. 3.0 <u>ELECTRICAL LABORATORY AND TESTING EQUIPMENTS</u> The bidder shall furnish Electrical Laboratory & Testing Equipment as specified in Annexure D of this section & include any other equipment considered necessary for the satisfactory operation of the unit and associated 400 kV switchyard and other systems in the power plant.		

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MANDATORY SPARES LIST FOR SEWAGE TREATMENT PLANT

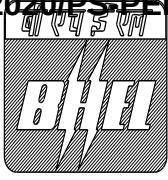
S.No.	EQUIPMENT	QUANTITY
MANDATORY SPARE LIST (MECHANICAL)		
1	LOW PRESSURE PIPING SYSTEM	
1.1	Valves	1 Lot (5% of the total population of each type, Size and class or minimum Two (2) of each type, size and class whichever is higher)
1.2	Valves including control valves	1 Lot (5% of the total population or minimum Two (2) of each type, material, size & Class, whichever is more)
Note: Complete valve along with actuator and all other accessories which are the part of original supply shall be also be supplied		
2	ELECTRIC HOIST	
2.1	Brake linings	Two (2) sets of each type
2.2	Rope guide and rope tighter	One (1) of each type
2.3	Limit switch	Two (2) of each type and size
2.4	Bearings for long travel wheels	Two (2) sets
2.5	Bearings for gear boxes for each type of hoist	Two (2) sets
2.6	Break liners for all the brakes	1 Lot (100% of total population of each type & size)
2.7	Oil seals	1 Lot (100% of total population of each type, size rating)
2.8	Brake springs for all brakes	1 Lot (100% of total population of each type, size rating)
2.9	Wire ropes for hooks	1 Lot (100% installed on each crane and hoist)
2.10	Solenoid coils for brakes	Two (2) sets
2.11	Overload relay for motors	Two (2)
2.12	Limit switches for hoists and travel mechanisms	Two (2) sets
2.13	Spare motors for hoists	Two (2)
2.14	Long travel machinery	
2.14.1	Gear wheel	One (1) set
2.14.2	Internal clip	Two (2)
2.14.3	Pinion	One (1)
Note: - "One (1) Set" is defined as 100% requirement for one hoist for the entire hoists of similar size & capacity.		
3	MANUAL HOIST	
3.1	Load chain wheel	One (1)
3.2	Load chain stripping fork	Five (5)
3.3	Hand chain wheel	Two (2)
3.4	Ratchet pawl	One (1)
3.5	Locking ratchet wheel	Two (2)
3.6	Guide roller	Two (2)
3.7	Brake disc	Two (2)
Note: - "One (1) Set" is defined as 100% requirement for one hoist for the entire hoists of similar size & capacity.		
4	VENTILATION SYSTEM	
4.1	Roof exhauster fans (for each type, rating and capacity)	1 Lot (5 % of total population or one (1) whichever is higher)

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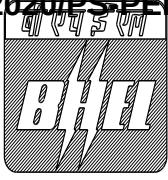
4.2	Supply air fans (wall mounted) (for each type, rating and capacity)	1 Lot (5 % of total population or one (1) whichever is higher)
4.3	Exhaust air fans (wall mounted) (for each type, rating and capacity)	1 Lot (5 % of total population or one (1) whichever is higher)
MANDATORY SPARE LIST (ELECTRICAL)		
5	415V MOTORS	
5.1	Terminal plates for motors upto 30kw for each rating	1 Lot (1 no. For each type & rating of Motor)
5.2	Terminal plates for motors above 30kw for each rating	1 Lot (1 no. For each type & rating of Motor)
5.3	Heaters	1 Lot (1 no. For each type & rating of Motor)
5.4	Greasing arrangements	1 Lot (1 no. For each type & rating of Motor)
5.5	Motor of each type and rating	1 Lot (10% of the installed quantity or minimum 1 number whichever is higher)
5.6	Bearings (DE and NDE)	1 Lot (1 no. For each type & rating of Motor)
5.7	End shield cover driving of non driving end	1 Lot (1 no. For each type & rating of Motor)
5.8	Cooling fan	1 Lot (1 no. For each type & rating of Motor)
5.9	Motor terminal block	1 Lot (1 no. For each type & rating of Motor)
5.10	Complete set of coupling	1 Lot (1 no. For each type & rating of Motor)
MANDATORY SPARE LIST (CONTROL AND INSTRUMENTATION)		
6	MEASURING INSTRUMENTS	
6.1	ELECTRONIC TRANSMITTERS	
6.1.1	Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level etc.)	1 Lot (10% or 2 no. of each type and model, whichever is more)
6.1.2	Electronic cards / PCB's for each type and model and model of transmitters	1 Lot (10% or 5 nos. of each type, whichever is more)
6.2	TEMPERATURE ELEMENTS	
6.2.1	RTDs of each type & length	1 Lot (10% or 2 nos. whichever is more)
6.2.2	Thermocouples of each type like K-type, R-type, metal etc and length	1 Lot (10% or 2 nos. whichever is more)
6.2.3	Thermowell for T/C & RTDs	1 Lot (10% or 1 no. of each type, rating, length used in the system whichever is more)
6.2.4	Process actuated switch devices Including all types of pressure, differential pressure, flow, temperature, differential temperature, level switch devices	1 Lot (10% or 1 no. of each type and model whichever is more)
6.3	INDICATORS/RECORDERS	
6.3.1	Digital Indicators of each model, type & range (including relevant digital indicators of electrical system)	1 Lot (10% or 2 nos. min. whichever is more)
6.3.2	Vertical Indicators of each type & model	1 Lot (5% or 1 no. of each model whichever is more)
6.3.3	Recorders for each type and model	1 Lot (5% or 1 no. whichever is more.)
6.3.4	Consumables for continuous recorders Charts Ink capsules	1 Lot (25 rolls per recorder/ 25 nos per recorder/ 20 nos. per recorder / Ink Pads /Pens.)
6.3.5	Consumables for multi point recorders	
6.3.5.1	Charts	1 Lot (5 nos. per recorder)
6.3.5.2	Ink pads	1 Lot (5 nos. per recorder)
6.3.5.3	Print mechanism/ print head assembly	1 Lot (10% or 5 nos. of each type whichever is more)

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6.3.6	Level transmitters (displacer type)	
6.3.6.1	Electronic cards / PCB's of level transmitters	1 Lot (10% of total quantity used or 1 for each type/rating whichever is more)
6.3.6.2	Level transmitters	1 Lot (10% of total quantity used or 1 for each type/rating whichever is more)
6.3.7	PD type flow transmitters	1 Lot (10% of total quantity used or 1 for each type/rating whichever is more)
6.4	SWITCHES	
6.4.1	Switches (Pressure, DP, Level, Flow, Temperature etc)	1 Lot (10% of each type of total nos. used in the system or minimum 1 no. of each type, model & range whichever is more)
6.5	Rotameter	1 Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more)
6.6	SOLENOID VALVE	1 Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more)
6.6.1	Assembly	1 Lot (10% of total quantity used or minimum 2 no. of each type whichever is more)
6.6.2	Coil	1 Lot (10% of total quantity used or 5 no. whichever is more)
6.7	E/P Converter	1 Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more)
6.8	SPECIAL INSTRUMENTS	
6.8.1	Nucleonic /non-nucleonic density meter, solid flow meter etc.	1 no. and spare parts as per manufacturer
6.9	Electrical Transducers	1 Lot (10% of total quantity used or minimum 1 no. of each type and range whichever is more)
7	PROCESS CONNECTION PIPING (for impulse piping /tubing, sampling piping/ tubing and air supply piping as applicable)	
7.1	Valves of all types and models	1 Lot (10% or 2 no. of each type, class, size and model whichever is more.)
7.2	2 way, 3way, 5way valve manifolds	1 Lot (10% or 2 no. of each type, class, size and model whichever is more.)
7.3	Fittings	1 Lot (10 nos. of each type)
7.4	Purge meters	1 Lot (10 % of each model or 2 Nos. whichever is more)
7.5	Filter regulators	1 Lot (10% of each model or 2 Nos. whichever is more)
7.6	Impulse pipe & tubing of all type	1 Lot (20 mtrs each type & size)
7.7	Impulse line root valve	1 Lot (10% of total quantity used or 4 no. whichever is more for each type and rating of each size)
7.8	SS tube	1 Lot (40 mtrs of each type/size)
7.9	Fitting for SS tube	1 Lot (40 nos. of each type/size)
8	INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD	
8.1	Pre fabricated cable of each type	1 Lot (10% of installed quantity)
8.2	Pre fabricated cable connector	1 Lot (10% or 1 no. of each type and model, whichever is more.)
8.3	Other cables	1 Lot (10% of each type, pair and size of actual installed quantity)

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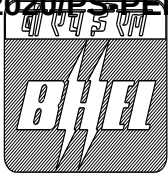
9	ELECTRICAL ACTUATORS	
9.1	Actuators	1 Lot (10% or 1 no. of each type, model and rating, whichever is more.)
9.2	Power unit for modulating actuator	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.3	DC-DC unit/power pack units	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.4	Electronic cards	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.5	Brake assembly	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.6	Brake coils	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.7	Position feed back transmitters	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.8	Control unit	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.9	Torque and limit switch assembly of each unit	1 Lot (10% or 2 nos. of each type, whichever is more.)
9.1	O-ring	1 Lot (1 set of each size)
9.11	Motor	1 Lot (1 no. of each type & rating)
9.12	Auxiliary contact	1 Lot (10% of total quantity used or 2 nos. whichever is more for each type and rating of each size)
9.13	Seal kit	1 Lot (1 set of each type & size)
10	CONDUCTIVITY	
10.1	Conductivity Sensor/cell for each type of Cell Constant	1 Lot (20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.)
10.2	Conductivity Transmitter Complete Set	1 Lot (20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.)
10.3	pH	
10.3.1	pH Sensor	1 Lot (20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.)
10.3.2	pH Transmitter Complete Set	1 Lot (20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.)
10.3.3	Sensor recharger	1 Lot (20% of the total no. used in the system or minimum 2(two) nos. whichever is higher.)
11	DISSOLVE OXYGEN	
11.1	Dissolve Oxygen Sensor Complete Set	1(one) no.
11.2	Dissolve Oxygen Analyser Complete Set	1(one) no.
12	OTHER HARDWARE	
12.1	Stainer each type	2(two) nos.
12.2	Sample Cooler	2(two) nos.
12.3	High Pressure Reducing Valve	5(five) nos.
12.4	Cation column	5(five) nos.
12.5	Pressure Gauge, Pressure Switch, Temperature Gauge, Temperature Switch, Isolating Valve, Solenoid Valve, Rota Meter etc.	1 Lot(10% of total quantity of each item and type/rating used in the system or minimum 1(one) no. whichever is higher.)
12.6	Annunciation System	
12.6.1	Each type of PCB	1 Lot (1(one) No. each)
12.6.2	Lamp Box with Facia & Lamps (LED type)	5 (five)Nos.
12.6.3	Hooter	1(one) No.

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12.7	Auxiliary/Power Contactor, Push Button, Indicating Lamp, Fuse etc. for Chiller Unit	1 Lot (10% of total quantity of each type of items used in the system or minimum 2(two) nos. whichever is more.)
13	RADAR TYPE LEVEL TRANSMITTER	
13.1	Transmitter/Receiver	1 Lot (10% or 1 no. of each type transmitter/ receiver)
13.2	Electronic card	1 Lot (10% or 1 no. of each type electronic card)
14	CONTROL PANEL AND LOCAL/ REMOTE CONTROL DESK (AS APPLICABLE)	
14.1	Recorder	1 Lot (1(one) No. each type and model)
14.2	Bar graph indicator	1 Lot (10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.)
14.3	Digital indicator	1 Lot (10% of total quantity used in the system or minimum 1(one) no. whichever is more for each type and model.)
14.4	Mosaic/Conventional Type Push button Station	1 Lot (10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.)
14.5	Mosaic Type Push button Station with LED Indication	1 Lot (10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.)
14.6	Mosaic Type LED Indication Station	1 Lot (10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.)
14.7	Simaphore Indicator	1 Lot (2(two)Nos. each type)
14.8	ANNUNCIATION SYSTEM (For offsite / Auxiliary Plants)	
14.8.1	Each type of PCB (for non-PLC driven system)	1 Lot (1(one) No. each)
14.8.2	Lamp Box with Facia & Lamps (LED type)	1 Lot (10% with minimum 2 nos.)
14.8.3	Hooter	1 (one) No.
15	Power cylinder	
15.1	Actuator Seal Kit	1 Lot (2(two) nos. for each type of Power Cylinder)
15.2	Gasket	1 Lot (2(two) nos. for each type of Power Cylinder)
15.3	Complete Set of Power Cylinder	1 Lot (1(one) no. each type for all application)
15.4	Position Transmitter complete set	1 Lot (10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.)
15.5	Power Cylinder Positioner complete Set	1 Lot (10% of total quantity used in the system or minimum 2(two) nos. whichever is more for each type and model.)
15.6	Complete Set of Solenoid Valve for Power Cylinder	1 Lot (2Nos. for each type & ratings)
15.7	Solenoid Coil for Pneumatic type Power Cylinder	1 Lot (5 Nos. for each type & ratings)
15.8	Position Limit Switch for Pneumatic type Power Cylinder	1 Lot (10Nos. for each type & ratings)
15.9	Air Lock Relay	1 Lot (10Nos. for each type)
15.10	Signal Air Booster Unit	1 Lot (2Nos. for each type)
16	Terminal block/ box	1 Lot (10% of total quantity used for each type and rating)
17	MCBs	1 no. of each type & rating
18	Relays interposing relay	1 Lot (10% or 2 nos. of each type and model

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		whichever is more)
19	Fuses	1 Lot (100 % of each type and rating)
20	Cooling fans for power supply	1 Lot (10% or 2 nos. of each type and model whichever is more)
21	MANDATORY SPARES NOT COVERED ABOVE	Bidder to supply 10% electronic modules/ cards or any other electronic components required for system.
Note:		
A)	If any item as listed above under mandatory spare list is not applicable, then bidder to supply its equivalent spares.	
B)	If any item which is considered as not applicable by bidder and if the same is found to be applicable during detailed engineering, bidder to supply the same without any cost implication.	

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	TITLE: 1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6	SPECIFICATION NO. PE-TS-415-673-A001	
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Notes:	
1	Wherever quantity has been specified percentage (%) the quantity of mandatory spares to be provided by the bidder shall be distributed into various ranges/size/rating/type (as the case may be) in the same proportion of the main population. In case the quantity so calculated happens to be fraction, the same should be rounded off to next higher whole number.
2	Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc., these shall cover all items supplied and installed and the breakup for these shall be furnished in the bid.
3	In case spares indicated in the list are not applicable to the particular design offer by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.
4	Interchangeability and Packings: All spares supplied under this contract shall be strictly interchangeable with parts for which they are intended for replacements. These spares shall include all mounted accessories like components, boards, add or items, fittings, connectors etc. and be complete in all respects so that the replacement of the main items by these spares does not require additional item. All electronic modules should be preset and/or preprogrammed for ready use at site. Alternatively, suitable instruction sheet indicating the details of required PCB jumper position, BCD which is setting, EPROM/ROM listing etc should be packed along with each module. Also a caution mark sign should be put on all such module which needs pre setting/ re programming before putting them in to service. The spare shall be treated and properly packed for long term storage.
5	Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.
6	Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished in the bid.
7	In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities.
8	Identification: Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification.

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TITLE :

1X660 MW BHUSAWAL THERMAL POWER
STATION UNIT -6

SPECIFICATION NO. PE-TS-415-673-A001

SECTION : I

TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT

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ANNEXURE VII

DRAWING / DOCUMENTS SUBMISSION SCHEDULE

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	TITLE : 1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6	SPECIFICATION NO. PE-TS-415-673-A001	
		SECTION : I	
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After award of LOI/LOA, following minimum drawing/documents shall be submitted by the bidder for BHEL/Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

For the Drawings/Documents Submission Procedure, please refer following Annexure-A. Bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. The number of drawing/documents to be submitted by the bidder shall be as per enclosed Annexure-V.

Every revised submission incorporating comments shall be resubmitted within 7 days.

BHEL shall provide observation / approval within 15 days from the date of document submission by bidder.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. Engineering meeting shall be held fort nightly, for which the bidder shall depute his concerned engineers along with project manager to PEM office or at customer office without fail.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account.

S. No.	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE FOR SEWAGE TREATMENT PLANT	SCHEDULE OF SUBMISSION FROM LOI (IN WEEKS)	SIZE
	MECHANICAL			
1.	PE-V0-415-673-A001	P&ID FOR SEWAGE TREATMENT PLANT*	4	A0
2.	PE-V0-415-673-A002	LAYOUT OF SEWAGE TREATMENT PLANT *	4	A0
3.	PE-V0-415-673-A003	PROCESS DESIGN & SIZING CALCULATIONS, PRESSURE DROP CALCULATIONS FOR STP*	4	A4
4.	PE-V0-415-673-A004	HYDRAULIC FLOW DIAGRAM & CALCULATION*	4	A1 & A4
5.	PE-V0-415-673-A005	THICKNESS CALCULATION OF VESSELS AND TANKS*	4	A4
6.	PE-V0-415-673-A006	SUB VENDOR LIST AND INSPECTION CRITERIA*	6	A4
7.	PE-V0-415-673-A007	CONTROL WRITE UP*	6	A4
8.	PE-V0-415-673-A008	TECHNICAL DATA SHEET AND GA DRG OF SCREW PUMPS	8	A4
9.	PE-V0-415-673-A009	TECHNICAL DATA SHEET AND GA DRG OF HORIZONTAL CENTRIFUGAL PUMPS	8	A4
10.	PE-V0-415-673-A010	TECHNICAL DATA SHEET AND GA DRG OF SUBMERSIBLE PUMPS	8	A4

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1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6

TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT

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11	PE-V0-415-673-A011	TECHNICAL DATA SHEET AND GA DRG FOR METERING PUMPS	8	A4
12	PE-V0-415-673-A012	TECHNICAL DATA SHEET AND GA DRG OF BLOWERS	8	A4
13	PE-V0-415-673-A013	GA DRAWING OF ATMOSPHERIC TANKS	10	A3
14	PE-V0-415-673-A014	DATASHEET AND GA DRG OF MEDIA TRAP, BASKET STRAINER AND SIMPLEX STRAINER AS APPLICABLE	10	A4
15	PE-V0-415-673-A015	DATASHEET AND GA DRG OF BALL VALVE	10	A4
16	PE-V0-415-673-A016	DATASHEET AND GA DRG OF SAFETY ITEMS	10	A4
17	PE-V0-415-673-A017	DATASHEET AND GA DRG OF AGITATORS	10	A4
18	PE-V0-415-673-A018	DATASHEET AND GA DRG OF BUTTERFLY VALVE	10	A4
19	PE-V0-415-673-A019	DATASHEET AND GA DRG OF DIAPHRAGM VALVE	10	A4
20	PE-V0-415-673-A020	DATASHEET AND GA DRG OF GLOBE VALVE	10	A4
21	PE-V0-415-673-A021	DATASHEET AND GA DRG OF PRV, SRV & NEEDLE VALVE	10	A4
22	PE-V0-415-673-A022	DATASHEET AND GA DRG OF GATE VALVE	10	A4
23	PE-V0-415-673-A023	DATASHEET AND GA DRG OF NRV	10	A4
24	PE-V0-415-673-A024	VALVE SCHEDULE	10	A4
25	PE-V0-415-673-A025	PIPING SCHEDULE	10	A4
26	PE-V0-415-673-A026	PAINTING SCHEDULE	10	A4
27	PE-V0-415-673-A027	DATASHEET AND GA OF MEMBRANE BIO REACTOR	12	A1
28	PE-V0-415-673-A028	CIVIL INPUT DRAWING OF INDUSTRIAL SHED	12	A1
29	PE-V0-415-673-A029	CIVIL INPUT DRAWING OF FOUNDATION OF EQUIPMENT INSIDE AND OUTSIDE OF INDUSTRIAL SHED	12	A1
30	PE-V0-415-673-A030	DATASHEET AND GA DRG OF OIL SKIMMER	10	A4
31	PE-V0-415-673-A031	DATASHEET AND GA DRG OF THICKNER	10	A4
32	PE-V0-415-673-A032	DATASHEET AND GA DRG OF CENTRIFUGE	10	A4
33	PE-V0-415-673-A033	MECHANICAL GA DRG OF RCC SUMPS INSIDE STP AREA	12	A1
34	PE-V0-415-673-A034	MECHANICAL GA DRG OF RCC SUMPS OUTSIDE STP AREA	12	A1
35	PE-V0-415-673-A035	PIPING LAYOUT INSIDE STP AREA ALONG WITH DETAILS OF SUPPORTS	16	A1
36	PE-V0-415-673-A036	YARD PIPING LAYOUT ALONG WITH DETAILS OF SUPPORTS	16	A0
37	PE-V0-415-673-A037	PG test procedure for STP	20	A4
38	PE-V0-415-673-A038	ENGINEERING BOQ	20	A4

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1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6

TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT

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39	PE-V0-415-673-A039	O& M MANUAL	20	A4
40	ELECTRICAL			
41	PE-V0-415-673-A101	ELECTRICAL LOAD LIST	8	A4
42	PE-V0-415-673-A102	DATASHEET OF MOTORS	10	A4
43	PE-V0-415-673-A103	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM INCLUDING JB LOCATION OF INSIDE AND OUTSIDE STP	12	A0
44	PE-V0-415-673-A104	EARTHING LAYOUT OF INSIDE AND OUTSIDE STP	12	A0
	CONTROL AND INSTRUMENTATION			
45	PE-V0-415-673-A201	LIST OF DRIVES, JB GROUPING AND I/O LIST	10	A4
46	PE-V0-415-673-A202	INSTRUMENT SCHEDULE	10	A4
47	PE-V0-415-673-A203	DATASHEET OF ANALYSERS	10	A4
48	PE-V0-415-673-A204	DATASHEET OF TRANSMITTERS	10	A4
49	PE-V0-415-673-A205	DATASHEET OF LOCAL INSTRUMENTS	10	A4
50	PE-V0-415-673-A206	DATASHEET OF SOLENOID VALVE	10	A4
51	PE-V0-415-673-A207	DATA SHEET AND GA FOR JUNCTION BOXES	10	A4
52	PE-V0-415-673-A208	CABLE SCHEDULE AND INTERCONNECTION DIAGRAM	12	A4
53	PE-V0-415-673-A209	INSTRUMENT INSTALLATION DRAWINGS/ HOOK UP DIAGRAM FOR INSTRUMENTS	12	A4
54	PE-V0-415-673-A210	LIST OF 230V AC UPS LOAD	12	A4
55	PE-V0-415-673-A211	POWER DISTRIBUTION SCHEME-230 VAC.	12	A4
56	PE-V0-415-673-A212	CONTROL LOGICS	12	A4
57	PE-V0-415-673-A213	GA OF AC & DC POWER DISTRIBUTION BOARD	10	A4
58	PE-V0-415-673-A214	DATA SHEET OF LIR FOR INSTRUMENTS	10	A4
59	PE-V0-415-673-A215	ALARM AND ANNUNCIATION LIST	10	A4
	QAP			
60	PE-V0-415-673-A301	QAP FOR THICKNER	9	A4
61	PE-V0-415-673-A302	QAP FOR CENTRIFUGE	9	A4
62	PE-V0-415-673-A303	QAP FOR HORIZONTAL CENTRIFUGAL PUMP	9	A4
63	PE-V0-415-673-A304	QAP FOR SCREW PUMP	9	A4
64	PE-V0-415-673-A305	QAP FOR METERING PUMP	9	A4
65	PE-V0-415-673-A306	QAP FOR BLOWER	9	A4

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TITLE : 1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6	SPECIFICATION NO. PE-TS-415-673-A001	
	SECTION : I	
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66	PE-V0-415-673-A307	QAP FOR ATMOSPHERIC TANK	9	A4
67	PE-V0-415-673-A308	QAP FOR BUTTERFLY VALVE	9	A4
68	PE-V0-415-673-A309	QAP FOR DIAPHRAGM VALVE	9	A4
69	PE-V0-415-673-A310	QAP FOR GLOBE VALVE	9	A4
70	PE-V0-415-673-A311	QAP FOR PRV, SRV & NEDDLE VALVE	9	A4
71	PE-V0-415-673-A312	QAP FOR GATE VALVE	9	A4
72	PE-V0-415-673-A313	QAP FOR NRV	9	A4
73	PE-V0-415-673-A314	QAP FOR MS/ CS PIPES	9	A4
74	PE-V0-415-673-A315	QAP FOR SS PIPES	9	A4
75	PE-V0-415-673-A316	QAP FOR BALL VALVE	9	A4
76	PE-V0-415-673-A317	QAP FOR HDPE PIPE	9	A4
77	PE-V0-415-673-A318	QAP/ ICL OF STP (FOR BALANCE OF ITEMS)	9	A4
78	PE-V0-415-673-A319	QAP FOR PVC PIPES	9	A4
79	PE-V0-415-673-A320	QAP FOR MOTOR	9	A4
80	PE-V0-415-673-A321	QAP FOR AGITATOR	9	A4
81	PE-V0-415-673-A322	QAP FOR MBR	9	A4
	MANDATORY SPARE			
82	PE-V0-415-673-A401	MANDATORY SPARES LIST FOR STP	14	A4

DRAWING/DOCUMENT SUBMISSION FOR ELECTRIC HOIST & CHAIN PULLEY BLOCK

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

ELECTRIC HOIST

S. No.	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE FOR ELECTRIC HOIST	SCHEDULE OF SUBMISSION FROM LOI (IN WEEKS)	SIZE
1	PE-V0-415-673-A500	MANUFACTURING QUALITY PLAN WITH SUB VENDOR LIST	8	A4
2	PE-V0-415-673-A501	GA DRAWING FOR ELECTRIC HOIST, DSL ARRANGEMENT AND PAINTING DETAILS	10	A4
3	PE-V0-415-673-A502	SCHEMATIC CIRCUIT DIAGRAM FOR ELECTRIC HOIST	10	A4
4	PE-V0-415-673-A503	MECHANISM SIZING CALCULATION	10	A4
5	PE-V0-415-673-A505	O&M MANUAL INCLUDING ERECTION PROCEDURE	16	A4

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	TITLE : 1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6	SPECIFICATION NO. PE-TS-415-673-A001	
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MANUAL HOIST (CHAIN PULLEY BLOCK):

S. No.	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE FOR CHAIN PULLEY BLOCK	SCHEDULE OF SUBMISSION FROM LOI (IN WEEKS)	SIZE
1.	PE-V0-415-673-A600	MANUFACTURING QUALITY PLAN	8	A4
2.	PE-V0-415-673-A601	GA DRAWING FOR CPB WITH DETAIL BOM WITH PAINTING DETAILS	10	A4
3.	PE-V0-415-673-A602	O&M MANUAL INCLUDING ERECTION PROCEDURE	10	A4
4.	PE-V0-415-673-A700	MANDATORY SPARES LIST FOR ELECTRIC HOIST AND CHAIN PULLEY BLOCK	14	A4

“*” Basic engineering documents.

Notes:-

- The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
- Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
- Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
- All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.: -
 - All drawings and documents shall indicate the list of all reference drawings including general arrangement.
 - All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
 - Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
 - All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.
 - Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3etc.
 - Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
 - All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
 - All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.

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**1X660 MW BHUSAWAL THERMAL POWER
STATION UNIT -6**

**TECHNICAL SPECIFICATION FOR SEWAGE
TREATMENT PLANT**

SPECIFICATION NO. PE-TS-415-673-A001

SECTION : I

SUB-SECTION:IA

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DATE :

- i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- j) Bidder to follow the following the drawing submission schedule:
- k) 1st submission of drawings from date of LOI as per the submission schedule.
- l) Every revised submission incorporating comments – within 7 days.
- m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

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	TITLE: 1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6	SPECIFICATION NO. PE-TS-415-673-A001	
		SECTION : I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT	SUB-SECTION:IA	
		REV. NO. 00	DATE :

ANNEXURE VIII

SEWAGE WATER ANALYSIS

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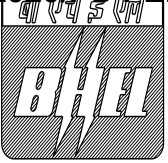
	TITLE:		SPECIFICATION NO. PE-TS-415-673-A001	
	1X660 MW BHUSAWAL THERMAL POWER STATION UNIT -6		SECTION : I	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT		SUB-SECTION:IA	
			REV. NO. 00	DATE :

SEWAGE WATER ANALYSIS

INFLUENT QUALITY (MINIMUM)			
S. No	Description	Unit	Value
a.	BOD ₅	mg/ l	300
b.	COD	mg/ l	600
c.	TSS	mg/ l	200
d.	pH		6.5 – 8
e.	Temperature		Ambient
f.	Oil & Grease	mg/l	20

Bidder to note that above influent sewage parameters are bare minimum. In addition to the above, bidder should consider additional influent parameters while designing of complete sewage treatment plant as per proven practice and guidelines issued by MOEF/ State pollution control board/ local authorities etc.

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ANNEXURE IX

LIST OF TOOLS & TACKLES (AS APPLICABLE)

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Bidder to consider necessary tools and tackles for mechanical, electrical and control & instrument as per their system requirement. In addition, bidder to adhere relevant clauses of tender specification also.

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ANNEXURE X

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

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Bidder to submit operation and Maintenance manual with minimum information as listed in below check list during contract stage.

CHECK LIST FOR OPERATION & MAINTENANCE MANUAL

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	Commissioning Activities (if not covered in				

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	separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				

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6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centers ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

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Bidder to consider necessary tools and tackles for mechanical, electrical and control & instrument as per their system requirement. In addition, bidder to adhere relevant clauses of tender specification also.

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ANNEXURE XI

SITE STORAGE AND PRESERVATION

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CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

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1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

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preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

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10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

- a. Rust preventive fluid (RPF)
- b. Rust protective paints
- c. Tarpaulin covers, in case of outdoor storage
- d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

- Ingress of moisture and corrosion damages.
- Damage to protective coating.
- Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

- In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
- Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

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4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i Closed storage with dry and dust free atmosphere. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii Semi-closed storage. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.



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iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as "scrap yard" slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



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The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

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Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

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Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

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Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

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Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self- life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self- life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

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Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

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5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

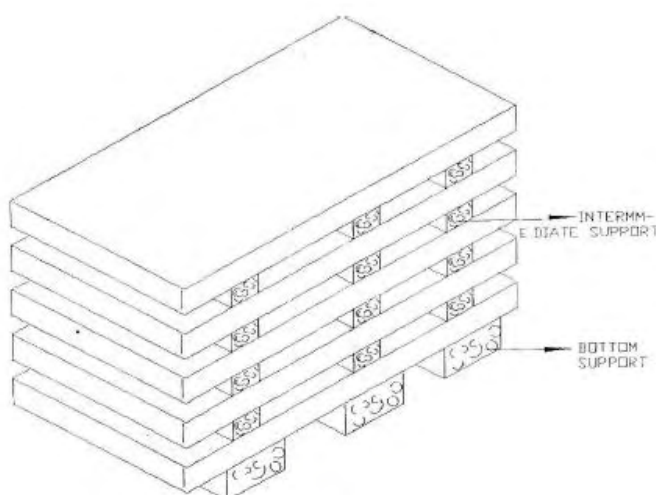


Figure – 1 – PLATE STACKING ARRANGEMENT

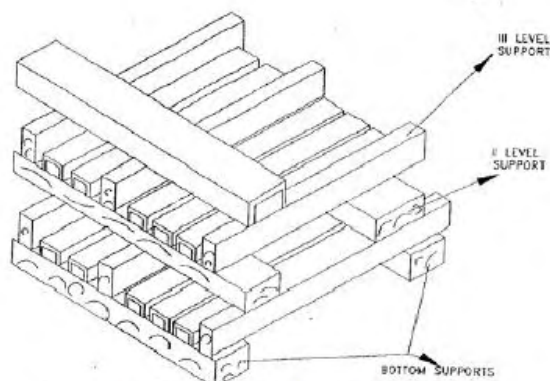


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

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ANNEXURE XII

GENERAL TECHNICAL REQUIREMENTS (GTR)

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	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
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GENERAL TECHNICAL REQUIREMENTS		

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1.0 <u>CODES AND STANDARDS</u> 1.1 Except where otherwise specified, the Plant shall comply with the appropriate Indian Standard or an agreed internationally accepted Standard Specification as listed in the Annexure to this Section and mentioned in detailed Specifications, each incorporating the latest revisions at the time of tendering. Where no internationally accepted standard is applicable, the Bidder shall give all particulars and details as necessary; to enable the Owner to identify all of the Plant in the same detail as would be possible, had there been a Standard Specification. 1.2 Where the Bidder proposes alternative codes or standards, he shall include in his tender one copy (in English) of each Standard Specification to which materials offered shall comply. In such case, the adopted alternative standard shall be equivalent or superior to the standards mentioned in the specification. 1.3 Wherever specified or required, the Plant shall conform to various statutory regulations such as Indian Boiler Regulations, Indian Electricity Rules, Indian Explosives Act, Factories Act etc. Wherever required, approval for the plant supplied under the specification from statutory authorities shall be the responsibility of the Bidder. 1.4 In the event of any conflict between the codes and standards referred above and the requirements of this specification, the requirements, which are more stringent, shall govern. 1.5 In case of any change of code, standards and regulations between the date of purchase order and the date the Contractor proceeds with manufacturing, the Owner shall have the option to incorporate the changed requirements. It shall be the responsibility of the Contractor to advise Owner of the resulting effect. 1.6 Successful Bidder shall furnish two (2) sets of latest of national/international codes and standards to owner.		

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2.0 <u>RESPONSIBILITY FOR DESIGN</u> 2.1 The Bidder shall assume full responsibility for the design of the whole and every part of the Plant, whether or not the design work was undertaken specifically in relation to the Contract and whether or not the Contractor was directly involved in the design work. 2.2 Notwithstanding the Owner's wish to receive the benefits of new, advanced and improved technologies, a prime requirement is that all the systems and components proposed shall have been already adequately developed and shall have demonstrated good reliability under similar or more arduous conditions elsewhere, at least for continuous two (2) years in two different power stations. 2.3 The successful bidder shall have to carry out surge analysis and other transient condition studies as may be necessary and as required by the Owner as per proven engineering practice. 2.4 The Bid shall include a detailed discussion on the development status of and the reasons for any changes made in proposed systems or components for the Plant, as compared with similar items previously supplied in other installations cited by the bidder as reference plants. 2.5 The Bidder may also make alternate offers, provided such offers are superior in his opinion in which case adequate technical information, operating feed back etc are to be enclosed with the offer, to enable the Owner to assess the superiority and reliability of the alternatives offered. In case of each alternative offer, its implications on the performance, guaranteed efficiency, auxiliary power consumptions etc shall be clearly brought out to the Owner to make an overall assessment. In any case, the base offer shall necessarily be in line with the specifications i.e. Base offer shall be as per the technical specifications and the same will be considered for techno-commercial evaluation. 3.0 <u>NAME PLATES (RATING PLATES)</u> 3.1 Instruction plates, nameplates or labels shall be permanently attached to each main and auxiliary item of Plant in a conspicuous position. These plates shall		

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	be engraved with the identifying name, type and manufacturers serial number, together with the loading conditions under which the item of Plant has been designed to operate.	
3.2	Items such as valves etc which are subject to hand operation, shall be provided with nameplates so constructed as to remain clearly legible throughout the life of the plant giving due consideration to the difficult climatic conditions to be encountered. Nameplates shall be securely mounted where they will not be obscured in service by insulation, cladding, actuators or other equipment. Direction of flow is also to be engraved.	
3.3	All trade nameplates and labels shall be in English language. All measurements shall be in M.K.S. Units.	
3.4	The size and location of nameplates shall be subject to Approval of the Engineer.	
4.0	<u>SAFETY AND SECURITY</u>	
4.1	The design shall incorporate every reasonable precaution and provision for the safety of all personnel and for the safety and security of all persons and property. The design shall comply with all appropriate statutory regulations relating to safety. All structures and equipment shall be designed and constructed to withstand every foreseeable static and dynamic loading condition, including loading under earthquake conditions, with an adequate margin of safety.	
4.2	Ready and safe access with clear head room shall be provided to all parts of the plant for operation, inspection, cleaning and maintenance.	
4.3	Escape routes and clear ways shall be provided to allow speedy evacuation of the plant in the event of fire or explosion and the plant layout shall allow for ease of access to all parts of the Works by rescue and fire fighting teams. The plant layout shall be designed to localize and minimise the effects of any fire or explosion. The recommendations of NFPA, OSHA and TAC etc as necessary shall be followed in all respects.	
4.4	The use of corrosive, explosive, toxic or otherwise hazardous materials shall be kept to a minimum during construction and the design of the plant shall	

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minimise the requirement for such materials during operation and maintenance. Where such materials must be used, all necessary precautions shall be taken in the design, manufacture and layout of equipment to minimise the resulting hazard and all equipment necessary for the protection and first-aid treatment of personnel in the event of accidents shall be provided. Particular attention is drawn to avoid the use of materials containing asbestos in any form.		
5.0	<u>GUARDS</u>	
5.1	Effective guards and fences must be provided to prevent injury to operators through accident or malpractice.	
5.2	Mesh guards which allow visual inspection of equipment with the guard in place are generally preferable. The guards shall be constructed of mesh attached to a rigid framework of mild steel rod, tube, or angle and the whole galvanised to prevent loss of strength by rusting or corrosion. The guards shall be designed to facilitate removal and replacement during maintenance.	
5.3	All drive belts, couplings, gears, sharp metallic edges and chains must be safely guarded. Any lubricating nipple requiring attention during normal running must be positioned where they can be reached without moving the guards.	
5.4	Guards for couplings and rotating shafts shall be in accordance with BS 5304-1975 or similar approved standard. All rotating shafts and parts of shafts must be covered.	
5.5	Suitable fencing shall be provided to enclose all openings or doorways used for the hoisting and lowering of machinery etc. This fencing must be securely fixed but quickly detachable when required. A secure hand hold must be provided on each side of the opening or doorway.	
6.0	<u>LOCATION AND LAYOUT REQUIREMENTS</u>	
The majority of plant and equipment shall all be of indoor installation. Layout should facilitate access for operation-maintenance and inspection of any one or more equipment / components at a time without disturbing the operation or installation of rest of the plant. Further, Bidder should comply with the criteria		

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given under the various equipment and system specifications as well as those stipulated in Annexure-B attached to this section. Enclosed General Layout and other tender layout drawings show the location of major installations and auxiliary buildings. The Bidder shall try to retain these locations as far as practicable. The layout of equipment within the powerhouse as shown in the tender drawings is indicative. The Bidder may, subject to Owner's approval alter the same to suit the space requirement of the equipment offered. Bidder may give as an alternative his own preferred layout clearly indicating the advantages and other implications, if any. Such alternative will not be considered for evaluating the bid, but may be considered with the successful Bidder if Owner / Engineer find the proposal more attractive in terms of techno-economic consideration. 6.1 While developing the layout of buildings the following criteria shall be given effect: 6.1.1 The minimum width of clear access corridors around equipment shall be one (1) meter. 6.1.2 Each building shall have an identified vacant space for equipment unloading and maintenance and preferably a separate bay altogether in buildings housing heavy equipment. Provision for handling equipment by monorail hoist and/or overhead crane shall be made as specified. 6.1.3 The plinth level with respect to the existing grade level shall be as indicated elsewhere in this specification. Finished Grade Level (FGL) above Mean Sea Level (MSL) for the plant area, CHP area and for PWS area inside plant to be developed. Mean sea level for the plant is 210 m. 6.1.4 The minimum clear height available between two consecutive floor slabs shall not be less than five (5) meters. A clear head room of two (2) meters shall be maintained between the floor and any overhead piping/cables or other obstruction. Adequate provision for natural ventilation and illumination shall be made as per good engineering practices.		

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6.1.5	There shall be at least two (2) main access doors, one on either side of each building, of which one shall be minimum three (3) meters wide with rolling shutters for equipment entry. For multistoried buildings, at least two (2) regular staircases diagonally opposite to each other shall be provided connecting all the floors and roof. These minimum requirements shall be augmented as required depending on the floor area, statutory requirements and TAC recommendations.	
6.1.6	All buildings shall have provision for toilet and associated effluent discharge system together with facility for drinking water. The criteria for ventilation, fire protection and illumination of building spaces specified elsewhere in this specification shall be complied with.	
6.1.7	All rail/road crossings for pipe/cable racks shall be done with minimum Seven (7) meters headroom from top of rail/road to bottom of rack. Similarly, top cover over underground pipes/cables shall be minimum one (1) meter.	
6.1.8	Cubicle for operating personnel shall be located at safe place near the equipment.	
6.1.9	Cable racks / pipe racks shall have hand railings in walkways on both sides at appropriate heights.	
6.1.10	Concept of various mechanical and electrical equipment location and building dimensions (including column-row spacing) as shown in Plot Plan/Floor Plan drawing are to be adhered as far as possible. Any departure from this suggestive layout is primarily not recommended.	
6.2	The following requirements for equipment layout shall be complied with:	
6.2.1	The regular basement floor is not acceptable in Boiler & Mill Bunker bay building. Further, local pits/trenches shall be avoided as far as possible.	
6.2.2	Mills shall be located by the side of Boiler. The width of Mill/Bunker building shall be 12.5 M and the length of the same shall be 10.5 M per Mill. A clear walkway of 1200 mm (min) shall be ensured between the mills/ its foundation/ mill reject vessel edge and inner face of mill bay column. Raw coal bunker shall be circular in shape unless otherwise approved.	

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6.2.3	Interconnecting walkways (minimum 2 m width) between main plant building and boiler (on either side of boiler) at Ground, Mezzanine, Operating, PRDS and Deaerator floor levels shall be provided. Also inter-connecting platform between Boiler and Coal Tripper floor level and roof of Mill maintenance floor level, Feeder floor level, Bunker Building at Mill bay shall be provided. Number of interconnecting platforms between Boiler and Coal Bunker building for each level / floor specified above shall be two (2) on each side of Boiler i.e. four (4)/floor.	
6.2.4	Two of the landing levels of the Goods Elevator shall preferably coincide with the feeder and tripper floor elevations. In case of difference in levels, electric hoists to shift goods from elevator floors to feeder/ tripper floors shall be provided.	
6.2.5	Fuel Oil (F.O.) piping shall be routed over trestles. The headroom for F.O. trestle in Boiler/ESP/ID fan/Chimney area shall be 8.0 M till the road behind chimney and 7.0 M in CD bay area. The headroom for F.O. trestle in outlying area shall be 3.0 M except at rail/road crossing where the headroom shall be 8.0 M.	
6.2.6	Clear walkways along A-row & B-row of TG building shall be provided as indicated below: (a) 1.5 m at all levels of AB Bay. (b) 3.5 m along B-row at operating floor level for interconnection with service Building & in front of control room.	
6.2.7	The layout of the steam turbine unit shall permit sufficient lay down area for all the parts/components to enable carrying out maintenance and overhauling operations.	
6.2.8	Steam turbine and generator (except stator) and other equipments located in the turbine hall shall be accessible by the EOT cranes for their handling during erection and maintenance. For all other equipment/components, suitable handling arrangement for erection and maintenance shall be provided.	

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6.2.9	In TG bay at crane rail level, walkway with handrails is envisaged for entire column sectional depth for full length of the building. In addition, it shall be ensured that on A-row and B-row columns, through walkway (without hindrance) of minimum 600 mm clear width is available from the face of the column to the handrail of the platform.	
6.2.10	Layout of facilities and equipment shall allow removal of Generator Stator, Generator transformers, Station & Unit transformers without disturbing equipments, piping, cabling, duct routed in the area.	
6.2.11	Adequate space and handling arrangement shall be provided for handling/removal of pumps, heaters, heat-exchanger, fans, mills during maintenance.	
6.2.12	Valves shall be located in accessible positions and operating/maintenance platforms shall be provided along with approach ladders & handrails for the same.	
6.2.13	While developing the layout, all fresh air ventilation louvers shall be considered 1000 mm from floor level and directed downwards at an angle. Ventilation fans on AB bay roof shall be kept staggered and shall not be near the centerline of turbo generator set.	
6.2.14	Each equipment room shall be provided with alternate exits in case of fire/accidents as per requirements of factory Act and Statuary bodies/Insurance companies.	
6.2.15	All other safety requirements as per the factories Act, Rules/regulations made under Electricity Act, 2003 and applicable codes/standards shall be observed while developing the layout.	
7.0	<u>OPERATION, MAINTENANCE & AVAILABILITY CONSIDERATIONS</u>	
7.1	Equipment/works offered shall be designed for high availability, high reliability, low maintenance and ease of operation & maintenance. The Bidder shall specifically state the design features incorporated to achieve high degree of reliability, availability, operability and ease of maintenance. He shall also furnish details of availability records in plants stated in his experience list.	

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7.2	Ample space for ease of operation and maintenance including equipment removal, tube bundle / cartridge / rotor pulling etc shall be provided. All valves, gates, dampers and other devices shall be located and oriented in such a way that they are accessible from operating floor levels. Where this cannot be adhered to, platforms and walkways with access ladders shall be provided to facilitate operation and maintenance.	
7.3	Motorised lifting devices, i.e. hoists, chain pulleys, jacks, etc. shall be provided for handling and carrying out maintenance of any equipment and/or part. Suitable beams, hooks etc. for this purpose shall be provided in the Buildings.	
7.4	Lifting devices like lifting tackles, slings etc. to be connected to hook of the hoist/crane shall be provided by the Bidder for lifting the equipment, accessories covered under this specification.	
7.5	All similar parts of the equipment shall be made to gauge and shall be interchangeable with and shall be made of same material and workmanship as the corresponding parts of the equipment. Where ever feasible, common components shall be employed in different pieces of equipment in order to optimize the spares inventory and utilization.	
8.0	<u>MATERIALS</u>	
8.1	In selecting materials of construction of equipment, the Contractor shall pay particular attention to the atmospheric conditions existing at the Site and the nature of material/ fluid handled. Wherever deviations are taken in respect of materials specified, the reasons shall be spelt out clearly in the proposal. All materials shall be new, and shall be of the quality most suited to the proposed application.	
8.2	In as far as is possible; materials shall be in accordance with Indian or international standard specifications and shall be used in accordance with Indian or International codes of practice. Where such standards or codes of practice are not available, sufficient information shall be provided to allow the Engineer to assess the suitability of the material for the particular application.	

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