

BHARTIYA RAIL BIJLEE COMPANY LTD.

4x250 MW NABINAGAR TPP

TECHNICAL SPECIFICATION

FOR

LIME FEEDING/DOSING SYSTEM
(WASTEWATER NEUTRALISATION SYSTEM FOR FGD)

SPECIFICATION NO.: PE-TS-463-571-A102



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PROJECT ENGINEERING INSTITUTE BUILDING
SECTOR-16A, PLOT NO. 25, NOIDA, INDIA**



4x250 MW BRBCL NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION

SPECIFICATION No: PE-TS-463-571-A102
SECTION
REV. 00
SHEET : 1 OF 1

CONTENTS

SECTION - I

SUB- SECTIONS	TITLE	Page No.
Sub-Section-A	INTENT OF SPECIFICATION	4-6
Sub-Section-B	PROJECT INFORMATION	7-30
Sub-Section-C	TECHNICAL SPECIFICATIONS	31
Sub Section-C1	SPECIFIC TECHNICAL REQUIREMENT	32-49
Sub Section-C2	CUSTOMER SPECIFICATION	50-159
	C2 - A PROJECT SPECIFIC GENERAL REQUIREMENTS INCLUDING:	
	FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	51-62
	GENERAL TECHNICAL REQUIREMENT ALONGWITH DRAWINGS/DOCUMENTS SUBMISSION PROCEDURE & PACKING PROCEDURE	63-149
	LP PIPING	150-166
	QUALITY ASSURANCE	167-180
	C2 - B PAINTING SPECIFICATION	181-213
Sub Section-C3	TECHNICAL SPECIFICATION (ELECTRICAL PORTION)	214-263
Sub Section-C4	TECHNICAL SPECIFICATION (C&I PORTION)	264-388
Sub Section-D	ANNEXURE-I LIST OF MAKES OF SUB-VENDOR ITEMS	389
	ANNEXURE-II MANDATORY SPARE LIST	390-394
	ANNEXURE-III INSPECTION AND TESTING	395-401
	ANNEXURE-IV INPUT DRAWINGS (PID/ MECHANICAL LAYOUT DRAWINGS SHOWING LOCATION OF EQUIPMENT/ PLOT PLAN)	402-410
	ANNEXURE-V MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	411-418
	ANNEXURE-VI PACKING PROCEDURE	419-422
	ANNEXURE-VII SEA-WORTHY PACKING PROCEDURE	423-475
	ANNEXURE-VIII PIPE & VALVE MATERIAL SPECIFICATION	476-481

SECTION – II

SUB SECTIONS	TITLE	Page No.
Annexure-1	LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	483
Annexure-2	COMPLIANCE CUM CONFIRMATION CERTIFICATE	484-485
Annexure-3	PRE BID CLARIFICATION SCHEDULE	486
Annexure-4	DEVIATION SHEET (COST OF WITHDRAWAL)	487
Annexure-5	SCHEDULE OF GUARANTEES	488-489
Annexure-6	LIST OF MAKES OF SUB VENDOR ITEMS	490
Annexure-7	LIST OF TOOLS & TACKLES	491
Annexure-8	EQUIPMENT DATA SHEET/ SCHEDULE (TO BE FILLED BY BIDDER)	492-498
Annexure-9	LIST OF COMMISSIONING/RECOMMENDED SPARES	499-500

905/2020/PS-PEM-MAX



4x250 MW BRBCL NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION

SPECIFICATION No: PE-TS-463-571-A102

SECTION: I

REV. 00

SECTION - I



4x250 MW BRBCL NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
INTENT OF SPECIFICATION

SPECIFICATION No: PE-TS-463-571-A102

SECTION : I

Sub Section: A

REV. 00

SHEET 1 OF 3

SECTION-I

SUB-SECTION-A

INTENT OF SPECIFICATION

	4x250 MW BRBCL NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION INTENT OF SPECIFICATION	SPECIFICATION No: PE-TS-463-571-A102	
		SECTION : I	
		Sub Section: A	
		REV. 00	
		SHEET 2 OF 3	

1.0

INTENT OF SPECIFICATION

1.1

The specification covers Supply part, Services part and supply of Mandatory spares. Scope of Supply shall comprise of design (i.e. Preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor’s works, painting, maintenance tools & tackles, fill of lubricants & consumables (till handing over), mandatory spares along with spares for erection, start-up and commissioning, proper packing, forwarding, shipment and delivery of all equipment at site. Services part covers **supervision services** for erection & commissioning, trial run at site and carrying out Performance guarantee tests at site. Training of customer/ clients O&M staff covering all aspects of the Lime feeding/dosing system (LDS) and inclusive of training for Operation & Maintenance (6 days) at Site, training of customer’s personnel at manufacturer’s works (6 man-days including lodging and boarding), troubleshooting etc. shall be part of services to be provided by supplier. Services also include handing over of LDS package complete with all accessories in flawless condition to the customer, for the total scope defined for lime dosing/feeding system as per BHEL NIT & tender technical specification, amendment & agreements till placement of order for Lime Feeding/Dosing System (LDS) of Flue Gas Desulphurization (FGD) plant of **4x250 MW BRBCL NABINAGAR TPP, Aurangabad, Bihar** of Bhartiya Rail Bijalee Company limited (BRBCL).

1.2

There are four (4) units of each 250 MW and each unit is envisaged with one (1) FGD system. Two (02) Sets of lime feeding / dosing system (1 working + 1 standby) common for all three units shall be provided. Dosing pumps after the neutralisation tanks shall be common (1 working + 1 standby). Supplier to read/refer P&ID/ technical specifications in conjunction with data sheets, as enclosed with the specifications.

1.3

The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply, erection and commissioning (Supervision of E&C by supplier & E&C by BHEL), performance and guarantee/demonstration testing of **LIME FEEDING / DOSING SYSTEM**.

1.4

The Bidder shall offer only proven design, which meets the Provenness criteria indicated in the NIT. Necessary document evidences shall be submitted along with the bid. If bidder doesn’t meet the specified provenness criteria, their bid may not be considered for further evaluation.

1.5

It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to the highest standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to the purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance.

1.6

The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or

	4x250 MW BRBCL NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION INTENT OF SPECIFICATION	SPECIFICATION No: PE-TS-463-571-A102	
		SECTION : I	
		Sub Section: A	
		REV. 00	
		SHEET 3 OF 3	

schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing. Similarly, the extent of supply also includes all items required for completion of the system for its safe, efficient, reliable and trouble free operation and maintenance shall also be in supplier's scope unless specifically excluded and notwithstanding that they may have been omitted in drawings / specifications or schedules.

1.7 The general term and conditions, instructions to tenderers and other attachment(s) referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to the compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.8 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Section-III of the specification **within 10 days of receipt of tender documents**. In absence of any such clarification(s), in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further, in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.9 The bidder's offer shall not carry any section like clarification, interpretations and /or assumptions.

1.10 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Section -II); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/it's customer.

1.11 In the event of any conflict between the requirements of two clauses of this specification & requirements of different codes/standards and between respective clauses of sub-section C & sub-section D, more stringent clause as per the interpretation of the owner shall apply.

1.12 In case, all the above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.13 For definition of words like Contractor, bidder, supplier, vendor, Customer/ Purchaser / Employer, consultant, please refer relevant clause of General Conditions of Contract (GCC).

	4x250 MW BRBCL NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION PROJECT INFORMATION	SPECIFICATION No: PE-TS-463-571-A102	
		SECTION : I	
		Sub Section : B	
		REV. 00	

SECTION: I

SUB-SECTION: B

PROJECT INFORMATION

CLAUSE NO.	PROJECT INFORMATION		
1.00.00	BACKGROUND Details of proposed Stage / Units Project name : Nabinagar TPP No. of Units x capacity : 4 x 250 MW Project setting up by : NTPC(FOR BHARTIYA RAIL BIJLEE COMPANY LTD.) The SG with ESP package and TG package of the subject project is being executed by M/s. BHEL.		
1.01.00	LOCATION AND APPROACH Project Location : (i) Place : Nabinagar : (ii) District : Aurangabad : (iii) State : Bihar Latitude and Longitude of project location : North : 24 deg. 42' 30" (N) East : 84 deg. 05' 36" (E) Nearest Railway station : Dehri-On-Sone Distance of project location from the Railway station : 30 KM (Approx.) Nearest MajorTown : Aurangabad Distance of the town from the Project site : 50 KM Nearest CommercialAirport : Gaya Distance of airport from the project site : 100 KM Nearest Highway : National Highway-2 Distance from nearest highway point to the site : 25 KM Vicinity plan : Vicinity plan of the project enclosed at Annexure-I. Any other information : Further to the information given in this sub-section, Bidders are advised to visit the project site and collect data on local site conditions.		
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
			PAGE 1 OF 29

CLAUSE NO.	PROJECT INFORMATION		
1.02.00	LAND REQUIREMENT		
	Total area of land acquired for the project	:	1700 Acres
	Any other information	:	Approximately 1700 acres of land has been identified near Dhundhua village for the Plant, Township and Ash Disposal Area. In principle commitment for the availability of land for Plant, Township and Ash Disposal Area has been obtained from Revenue Department, Govt. of Bihar vide letter dated 29.3.2003. Further, Central Coalfields Ltd., (CCL) vide their letter dated 29.05.03 have indicated that Central Mine Planning & Design Institute Ltd (CMPDI) have confirmed that plant location along with its other allied infrastructure are not coming on coal bearing area.
1.03.00	WATER		
	Nearest Water Source	:	The project site is located near the river Sone which is the only source of water for the project. Therefore, the make up water requirement for the project is proposed to be drawn from the pondage created by Indrapuri Barrage, which is about 3 kms from the proposed site.
	Proposed water requirement for the Stage	:	60 Cusec
	Proposed source / arrangement to the meet the water requirement	:	The project site is located near the river Sone which is the only source of water for the project. Therefore, the make up water requirement for the project is proposed to be drawn from the pondage created by Indrapuri Barrage, which is about 3 kms. from the proposed site. The make up water requirement for the project operating on cooling towers is about 4300 cubic m/hr with ash water recirculation system and about 5900 cubic m/hr. with once through ash water system. Water Resource Department, Govt. of Bihar, accorded in-principle clearance of 60 cusecs of consumptive water from upstream of Indrapuri Barrage vide their letter dated 06.03.03.
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
			PAGE 2 OF 29

CLAUSE NO.	PROJECT INFORMATION		
1.04.00	COAL and WATER, Utility details: (i) Coal Quality Parameters and Fuel Oil Characteristics Source: Pachra and Pachra south blocks in North Karanpura coalfields Requirement: 5 MTPA The Coal quality parameters and Fuel Oil Characteristics are enclosed at Table-1, & Table-2A & 2B of this Sub-Section. Water data (ii) Process water: Process water quality based on COC in Table-3. (iii) Clarified water: Clarified water quality is indicated in Table-3. (iv) DM water for Equipment cooling water system. DM water quality is indicated in Table-4.		
1.05.00	Steam Generator and ESP data: refer Table-5		
1.06.00	Drawings are enclosed as per Table-6 for initial overview to the Bidder.		
2.00.00	NOT USED		
3.00.00	RAILWAY SIDING For bringing the equipment and material to the power house through rail, railway siding is proposed to be constructed from nearest railway station.		
4.00.00	METEOROLOGICAL DATA Meteorological data of the nearest observatory Dehri station is enclosed as Annexure-II to this subsection.		
5.00.00	CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for embankments. A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for		
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
			PAGE 3 OF 29

CLAUSE NO.	PROJECT INFORMATION											
	the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I. Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values. The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 to Part 4). Damping in Structures The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for: <table><tr><td>Steel structures</td><td>2%</td></tr><tr><td>Reinforced Concrete structures</td><td>5%</td></tr><tr><td>Reinforced Concrete Stacks</td><td>3%</td></tr><tr><td>Steel stacks</td><td>2%</td></tr></table> Method of Analysis Since most structures in a power plant are irregular in shape and have irregular distribution of mass and stiffness, dynamic analysis for obtaining the design seismic forces shall be carried out using the response spectrum method. The number of vibration modes used in the analysis should be such that the sum total of modal masses of all modes considered is at least 90 percent of the total seismic mass and shall also meet requirements of IS:1893 (Part 1). Modal combination of the peak response quantities shall be performed as per Complete Quadratic Combination (CQC) method or by an acceptable alternative as per IS:1893 (Part 1). In general, seismic analysis shall be performed for the three orthogonal (two principal horizontal and one vertical) components of earthquake motion. The seismic response from the three components shall be combined as specified in IS:1893 (Part 1).				Steel structures	2%	Reinforced Concrete structures	5%	Reinforced Concrete Stacks	3%	Steel stacks	2%
Steel structures	2%											
Reinforced Concrete structures	5%											
Reinforced Concrete Stacks	3%											
Steel stacks	2%											
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 4 OF 29								

CLAUSE NO.	PROJECT INFORMATION	
	The spectral acceleration coefficient shall get restricted to the peak spectral value if the fundamental natural period of the structure falls to the left of the peak in the spectral acceleration curve. For buildings, if the design base shear (V_B) obtained from modal combination is less than the base shear ($\bar{V}_B$) computed using the approximate fundamental period (T_a) given in IS:1893:Part 1 and using site specific acceleration spectra with appropriate multiplying factor, the response quantities (e.g. member forces, displacements, storey forces, storey shears and base reactions) shall be enhanced in the ratio of $\bar{V}_B / V_B$. However, no reduction is permitted if $\bar{V}_B$ is less than V_B. For regular buildings less than 12m in height, design seismic base shear and its distribution to different floor levels along the height of the building may be carried out as specified under clause 7.5, 7.6 & 7.7 of IS:1893 (Part 1) and using site specific design acceleration spectra. The design horizontal acceleration spectrum value (A_h) shall be computed for the fundamental natural period as per clause 7.6 of IS:1893 (Part 1) using site specific spectral acceleration coefficients with appropriate multiplying factor given in Appendix-I. Design/Detailing for Ductility for Structures The site specific design acceleration spectra is a reduced spectra and has an in-built allowance for ductility. Structures shall be engineered and detailed in accordance with relevant Indian/International standards to achieve ductility.	
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
		PAGE 5 OF 29

CLAUSE NO.	PROJECT INFORMATION	एनटीपीसी NTPC	
	APPENDIX – I <u>SITE SPECIFIC SEISMIC PARAMETERS FOR DESIGN OF STRUCTURES AND EQUIPMENT</u> The various site specific seismic parameters for the project site shall be as follows: 1) Peak ground horizontal acceleration : 0.16g 2) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') to obtain the design acceleration spectra a) for ordinary moment resisting steel frames designed and detailed as per IS:800 : 0.04 b) for braced steel frames designed and detailed as per IS:800 : 0.03 c) For special moment resisting RC frames designed and detailed as per IS:456 and IS:13920 : 0.024 d) for RCC chimney : 0.08 e) for Liquid retaining tanks : 0.048 f) for Steel chimney, Absorber tower : 0.06 g) for design of structures not covered under 2 (a) to 2 (f) above and under 3 below : 0.04 3) Multiplying factor to be applied to the site specific horizontal acceleration spectral coefficients (in units of gravity acceleration 'g') for design of equipment and structures where inelastic action is not relevant or not permitted : 0.08 Note: g = Acceleration due to gravity The horizontal seismic acceleration spectral coefficients are furnished in subsequent pages.		
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
			PAGE 6 OF 29

CLAUSE NO.	PROJECT INFORMATION				
	APPENDIX – I				
	HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS In units of 'g' for New Nabinagar project				
	Time Period	Damping Factor (as a percentage of critical damping)			
	(Sec)	2%	3%	5%	
	0.000	1.000	1.000	1.000	
	0.030	1.000	1.000	1.000	
	0.050	1.750	1.607	1.443	
	0.100	3.737	3.060	2.374	
	0.104	3.904	3.174	2.443	
	0.123	3.904	3.401	2.753	
	0.150	3.904	3.401	2.753	
	0.200	3.904	3.401	2.753	
	0.250	3.904	3.401	2.753	
	0.300	3.904	3.401	2.753	
	0.350	3.904	3.401	2.753	
	0.400	3.904	3.401	2.753	
	0.450	3.904	3.401	2.753	
	0.500	3.904	3.401	2.753	
	0.516	3.904	3.401	2.753	
	0.550	3.662	3.401	2.753	
	0.600	3.357	3.142	2.753	
	0.607	3.320	3.105	2.753	
	0.670	3.006	2.813	2.493	
	0.700	2.877	2.693	2.386	
	0.750	2.685	2.513	2.227	
	0.800	2.518	2.356	2.088	
	0.850	2.369	2.218	1.965	
	0.900	2.238	2.094	1.856	
	0.950	2.120	1.984	1.758	
	1.000	2.014	1.885	1.670	
	1.050	1.918	1.795	1.590	
	1.100	1.831	1.714	1.518	
	1.150	1.751	1.639	1.452	
1.200	1.678	1.571	1.392		
1.250	1.611	1.508	1.336		
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	
PAGE 7 OF 29					

CLAUSE NO.	PROJECT INFORMATION				
	APPENDIX – I				
	HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS In units of ‘g’ for New Nabinagar project				
		Damping Factor (as a percentage of critical damping)			
	Time Period				
	(Sec)	2%	3%	5%	
	1.300	1.549	1.450	1.285	
	1.350	1.492	1.396	1.237	
	1.400	1.439	1.346	1.193	
	1.450	1.389	1.300	1.152	
	1.500	1.343	1.257	1.113	
	1.550	1.299	1.216	1.077	
	1.600	1.259	1.178	1.044	
	1.650	1.221	1.142	1.012	
	1.700	1.185	1.109	0.982	
	1.750	1.151	1.077	0.954	
	1.800	1.119	1.047	0.928	
	1.850	1.089	1.019	0.903	
	1.900	1.060	0.992	0.879	
	1.950	1.033	0.967	0.856	
	2.000	1.007	0.943	0.835	
	2.050	0.982	0.920	0.815	
	2.100	0.959	0.898	0.795	
	2.150	0.937	0.877	0.777	
	2.200	0.915	0.857	0.759	
	2.250	0.895	0.838	0.742	
	2.300	0.876	0.820	0.726	
	2.350	0.857	0.802	0.711	
	2.400	0.839	0.785	0.696	
	2.450	0.822	0.769	0.682	
	2.500	0.806	0.754	0.668	
	2.550	0.790	0.739	0.655	
	2.600	0.775	0.725	0.642	
2.650	0.760	0.711	0.630		
2.700	0.746	0.698	0.619		
2.750	0.732	0.685	0.607		
2.800	0.719	0.673	0.596		
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	
PAGE 8 OF 29					

CLAUSE NO.	PROJECT INFORMATION				एनटीपीसी NTPC
	APPENDIX – I				
	HORIZONTAL SEISMIC ACCELERATION SPECTRAL COEFFICIENTS In units of 'g' for New Nabinagar project				
	Time Period	Damping Factor (as a percentage of critical damping)			
	(Sec)	2%	3%	5%	
	2.850	0.707	0.661	0.586	
	2.900	0.694	0.650	0.576	
	2.950	0.683	0.639	0.566	
	3.000	0.671	0.628	0.557	
	3.050	0.660	0.618	0.548	
	3.100	0.650	0.608	0.539	
	3.150	0.639	0.598	0.530	
	3.200	0.629	0.589	0.522	
	3.250	0.620	0.580	0.514	
	3.300	0.610	0.571	0.506	
	3.350	0.601	0.563	0.499	
	3.400	0.592	0.554	0.491	
	3.450	0.584	0.546	0.484	
	3.500	0.575	0.539	0.477	
	3.550	0.567	0.531	0.470	
	3.600	0.559	0.524	0.464	
	3.650	0.552	0.516	0.458	
	3.700	0.544	0.509	0.451	
	3.750	0.537	0.503	0.445	
	3.800	0.530	0.496	0.439	
	3.825	0.527	0.493	0.437	
	3.850	0.523	0.490	0.434	
	3.900	0.516	0.483	0.428	
	3.950	0.510	0.477	0.423	
	4.000	0.504	0.471	0.418	

CLAUSE NO.	PROJECT INFORMATION										
6.00.00	<u>CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT</u>										
	All structures shall be designed for wind forces in accordance with IS:875 (Part-3) and as specified in this document. See Annexure – B for site specific information. Along wind forces shall generally be computed by the Peak (i.e. 3 second gust) Wind Speed method as defined in the standard. Along wind forces on slender and wind sensitive structures and structural elements shall also be computed, for dynamic effects, using the Gust Factor or Gust Effectiveness Factor Method as defined in the standard. The structures shall be designed for the higher of the forces obtained from Gust Factor method and the Peak Wind Speed method. Analysis for dynamic effects of wind must be undertaken for any structure which has a height to minimum lateral dimension ratio greater than “5” and/or if the fundamental frequency of the structure is less than 1 Hz. Susceptibility of structures to across-wind forces, galloping, flutter, ovaling etc. should be examined and designed/detailed accordingly following the recommendations of IS:875(Part-3) and other relevant Indian standards. It should be estimated if size and relative position of other structures are likely to enhance the wind loading on the structure under consideration. Enhancement factor, if necessary, shall suitably be estimated and applied to the wind loading to account for the interference effects. Damping in Structures The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for: <table><tr><td>a) Welded steel structures</td><td>: 1.0%</td></tr><tr><td>b) Bolted steel structures</td><td>: 2.0%</td></tr><tr><td>c) Reinforced concrete structures</td><td>: 1.6%</td></tr><tr><td>d) Steel stacks</td><td>: As per IS:6533 & CICIND Model Code whichever is more critical.</td></tr></table>				a) Welded steel structures	: 1.0%	b) Bolted steel structures	: 2.0%	c) Reinforced concrete structures	: 1.6%	d) Steel stacks
a) Welded steel structures	: 1.0%										
b) Bolted steel structures	: 2.0%										
c) Reinforced concrete structures	: 1.6%										
d) Steel stacks	: As per IS:6533 & CICIND Model Code whichever is more critical.										
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 10 OF 29							

CLAUSE NO.	PROJECT INFORMATION			
	ANNEXURE-B SITE SPECIFIC DESIGN PARAMETERS The various design parameters, as defined in IS: 875 (Part-3), to be adopted for the project site shall be as follows: a) The basic wind speed “V_b” at ten metres above the mean ground level : 47 metres/second b) The risk coefficient “K₁” : 1.07 c) Category of terrain : Category-2			
7.00.0	FOUNDATION SYSTEM AND GEOTECHNICAL DATA			
7.00.01	Geotechnical data and foundation system for the respective project are enclosed at annexure-III. The corresponding bore logs are enclosed at annexure-IV.			
7.00.02	The available soil data is of vicinity of proposed structures, therefore, bidder shall carryout his own detailed soil investigation for facilities under this package and shall be as per the scheme approved by owner. The scheme for geotechnical investigation shall be as given at Clause 7.07.00 and shall be approved by owner before execution. Geotechnical investigation work shall got executed by the Contractor through the agencies as mentioned in Clause No. 7.07.03. However, no time extension shall be given on account of soil investigation carried out by the Bidder. The geotechnical investigation report shall be prepared with detailed recommendations regarding type of foundation and allowable bearing pressure for various structures/ facilities and other soil parameters. The report shall be submitted for Owner's approval prior to commencement of design of foundation.			
7.00.03	The Bidder should note that nothing extra whatsoever on account of variation between soil data collected by Owner and that found by the Bidder during geotechnical investigation by him or during execution of works, shall be payable.			
7.00.04	Tank Foundations			
	a) The tanks shall rest on flexible tank pad foundation, resting on sand with concrete ring wall to retain sand. Base of the concrete ring wall shall not rest on the expansive soil, if any. b) Entire loose/ soft soil inside the concrete ring wall shall be removed and shall be filled with sand. Sand for filling shall be clean and well graded conforming to IS 383 with grading Zone I to III. c) Sand shall be spread in layers not exceeding 30cm compacted thickness over the area. Each layer shall be uniformly compacted by mechanical means like plate vibrators, small vibratory rollers, etc to achieve a relative density of not less than 80%. d) Other requirements of tank foundations shall be as per IS 803 and as specified elsewhere in the specifications.			
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
PAGE 11 OF 29				

CLAUSE NO.	PROJECT INFORMATION			
7.02.00	Foundation System The requirements for the foundation system to be adopted are as given in subsequent clauses. Depending upon the depth of competent strata/stratum, type of structures, functional requirement of facility, extent of cutting / filling, suitable foundation, open or pile shall be adopted with approval of owner.			
7.02.01	General Requirements a) All structures/equipment shall be supported either on suitable open foundations (isolated, combined, raft) or pile foundations depending on type of structures/facilities, sub-strata, topography etc. b) The roads, ground floor slabs, trenches, pipe pedestals, channels/drain and staircase foundation with foundation loading intensity less than 4 T / M2 may be supported on open / shallow foundations resting on virgin / controlled compacted filled up soil. c) No other foundation (other than as mentioned in (b) above) shall rest on the filled up ground / soil. d) No foundation shall rest on the black cotton soil. e) Before execution of work the bidder shall ensure that there is no obstruction to underground/overground facilities like sewer lines, pipe lines etc. Any such damage and remedial/ rectification measures shall be at the contractors cost. f) Bidder shall also ensure that there is no damage to existing nearby foundations and the foundations pertaining to this package are not placed at shallower depth than the nearby foundations. If required depth of foundation is deeper than the existing foundations, proper protection shall be provided to existing foundations. g) All foundations shall be designed in accordance with relevant parts of the latest revisions of Indian Standards. h) The water table for design purpose shall be considered at Finished Ground Level. i) A combination of open and pile foundations shall not be permitted under the same equipment / structure / building. j) Foundation for equipments on ground floor For equipments of static weight upto 1.5 T, the equipment may be supported on the ground floor slab by locally thickening the slab. Thickening of the ground floor slab shall be done upto an extent of about 0.6 m beyond the plan area of the equipment on all the sides. Further, the load intensity below the equipment shall be limited to 4T/m2. Other requirements of floor slab and compaction below the floor slab shall be adhered, as specified elsewhere in the specifications. For equipment of static weight more than 1.5 T, the equipment foundation shall be taken to the founding level or shall be built up with PCC from the level as mentioned in the Table 1. The pedestal of equipment foundation or the foundation Block shall be isolated from the adjoining floor slab by providing bitumen impregnated fiber board of minimum 50 mm thick, conforming to IS: 1838 all around the equipment pedestal for the full depth of the floor slab.			
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 12 OF 29

CLAUSE NO.	PROJECT INFORMATION			
7.02.02	Open Foundations In case open foundations are adopted, following shall be adhered to. a) The minimum width of foundation shall be 1.0 m. b) Minimum depth of foundation shall be 1.0m below Ground Level. c) It shall be ensured that all foundations of a particular structure/ buildings/ facility shall rest on one bearing stratum. d) Wherever the intended bearing sub-strata is virgin soil stratum but the actual stratum encountered during foundation excavation consists of filled up soil at founding level, under such cases either the foundation shall be lowered completely into the virgin stratum or the filled up soil upto the virgin layers shall be removed and built up through PCC (1:4:8) up to designed foundation level.			
7.02.03	Pile Foundations – (a.) In case piles are adopted, following shall be adhered to : i) The pile foundation shall be of RCC, Cast-in-situ bored piles as per IS:2911. Pile boring shall be done using Rotary Hydraulic Rigs/conventional tripod rig. Two stage flushing of pile bore shall be ensured by airlift technique duly approved by the Employer. If required, temporary or permanent MS liner may be provided for piling. ii) The minimum diameter of pile shall be 600 mm. The allowable load capacity of the pile in different modes (vertical compression, lateral and pullout) shall be as per approved geotechnical report & as enclosed in relevant annexure: iii) Only straight shaft piles shall be used. Minimum cast length of pile above cutoff level shall be 1.0 m. iv) The contractor shall furnish design of piles (in terms of rated capacity, length, diameter, termination criteria to locate the founding level for construction of pile in terms of measurable parameter, reinforcement for job as well as test piles, pile load test arrangement, locations of initial test piles etc.) for Engineer's approval. v) The piling work shall be carried out in accordance with IS:2911 (Relevant part) and accepted construction methodology. The construction methodology shall be submitted by the Contractor for Engineer's approval. vi) Number of initial load tests to be performed for each diameter and rated capacity of pile shall be subject to minimum as under. Vertical Lateral Minimum of 2 Nos. in each mode. Uplift vii) The initial pile load test shall be conducted with test load upto three times the estimated pile capacity. In case of vertical compression test (initial test) the method of loading shall be cyclic as per IS:2911 (relevant part).			
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 13 OF 29

CLAUSE NO.	PROJECT INFORMATION			
	viii) Load test shall be conducted at pile Cut-off Level (COL). If the water table is above the COL the test pit shall be kept dry throughout the test period by suitable de-watering methods. Alternatively the vertical load test may be conducted at a level higher than COL. In such a case, an annular space shall be created to remove the effect of skin friction above COL by providing an outer casing of suitable diameter larger than the pile diameter. ix) Number of routine pile load tests to be performed for each diameter/allowable capacity of pile shall be as under : i) Vertical : 0.5% of the total number of piles provided. ii) Lateral : 0.5% of the total number of piles provided. x) The routine tests on piles shall be conducted upto test load of one and half times the allowable pile capacity. Piles for routine load tests shall be approved by the Employer. xi) In case, routine pile load test shows that the pile has not achieved the desired capacity or pile(s) have been rejected due to any other reason, then the Contractor shall install additional pile(s) as required and the pile cap design shall accordingly be reviewed and modified, if required. xii) Testing of piles and interpretation of pile load test results shall be carried out as per IS:2911 (Part-4). Contractor shall ensure that all the measuring equipment and instruments are properly calibrated at a reputed laboratory / institute prior to their use. Settlement / movement of the pile top shall be made by Linear Variable Differential Transducers (LVDT) having a least count of 0.01mm. xiii) The test load on initial test piles shall be applied by means of reaction from anchor piles / rock anchors alone or combination of anchor piles / rock anchors and kentledge with concrete blocks.			
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 14 OF 29

CLAUSE NO.	PROJECT INFORMATION			
	xiv) Low Strain Pile Integrity test shall be conducted on all test piles and job piles. This test shall be used to identify the routine load test and not intended to replace the use of static load test. This test is limited to assess the imperfection of the pile shaft and shall be undertaken by an independent specialist agency to be approved by Engineering department of Owner. The test equipment shall be of TNO or PDI make or equivalent. The process shall confirm to ASTM. xv) High Strain Dynamic Load Test may be carried out for routine load testing of working piles. However, at least two numbers of static routine vertical load tests shall be carried out on pile on which high strain dynamic load test has already been carried out for establishing the correlation between the two tests. In case of discrepancy if any between dynamic and static vertical load tests, then additional static routine vertical load tests shall be conducted as decided by the Engineer and the results of static routine vertical load shall prevail. Number of routine vertical pile load tests as per clause 7.02.03 (ix) shall be total of static routine vertical load test and high strain dynamic load tests. The procedure to carryout the test shall be submitted to the Engineer. The test and equipment shall conform to ASTM D4945-00. The test shall be conducted by an experienced independent test agency approved by the owner. Field data shall be submitted to the site engineer and shall include force velocity curves, pile capacity, simulated static load test curve, net and total pile displacement, pile integrity. A (Case pile wave analysis) CAPWAP or equivalent software analysis shall be conducted on the field data for correct capacity estimation and to evaluate end bearing and skin friction components of the pile. xvi) From load considerations, single pile may be used under a column/tower. In that case, pile shall be connected with tie beams at pile cut off level in both directions. xvii) Contribution of frictional resistance of filled up soil if any, shall not be considered for computation of frictional resistance of piles. xviii) Reinforcement for job piles shall be designed as following: (a) Compression + bending piles: For these piles, the allowable safe pile capacities in compression and bending shall be considered. (b) Tension + bending piles: For these piles, the actual pile forces to be considered. However, maximum 3 types of combinations for varying percentage of tension capacity + bending case may be designed & adopted by contractor for the entire scope of work under this package.			
7.03.00	Special Requirements			
7.03.01	Details of treatment for foundations / underground structures required to counteract soil / water chemical environment shall be as per detailed geotechnical investigation to be carried			
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
PAGE 15 OF 29				

CLAUSE NO.	PROJECT INFORMATION			
	out by contractor. Contractor shall carry out chemical analysis during detailed geotechnical investigation and required treatment shall be provided accordingly.			
7.04.00	Excavation, Filling and Dewatering			
7.04.01	For excavation works, comprehensive dewatering with well point or deep wells arrangement if required, shall be adopted. Scheme for dewatering and design with all computations and back up data for dewatering shall be submitted for the owner's information. The water table shall be maintained at 0.5m below the founding depth.			
7.04.02	Excavation for shallow foundations shall be covered with PCC immediately after reaching the founding level. In case of any local loosening of soil or any loose pockets are encountered at founding level during excavation the same shall be removed and compensated by PCC M7.5. The final layer of about 300 mm thickness above the founding level shall be excavated by suitable means, so as to avoid disturbance to founding stratum.			
7.04.03	Backfilling around foundations, pipes, trenches, sumps, pits, plinths, etc. shall be carried out with approved material in layers not exceeding 300 mm compacted thickness (higher thickness of layers upto 500mm with heavy mechanical compacting equipment) and each layer shall be compacted to 90% of standard proctor density for cohesive soils and to 80% of relative density for non-cohesive soils Rock pieces having size less than 150 mm and interstices filled with soil may be used for backfilling around foundation, plinths etc. and shall be compacted to minimum of 85% of original stack of material after filling the interstices.			
7.04.04	Founding level for trenches/channels shall be decided as per functional requirement. The bottom of excavation shall be properly compacted prior to casting of bottom slab of trenches / channels.			
7.04.05	CBR tests for pavement/road design shall be carried out by the Contractor after earth filling (if applicable) has been completed upto the formation level.			
7.04.06	The contractor shall take all necessary measures during excavation to prevent the hazards of falling or sliding of material or article from any bank or side of such excavation which is more than one and a half meter above the footing by providing adequate piling, shoring, bracing etc. against such bank or sides. Adequate and suitable warning signs shall be put up at conspicuous places at the excavation work to prevent any persons or vehicles falling into the excavation trench. No worker should be allowed to work where he may be stuck or endangered by excavation machinery or collapse of excavations or trenches.			
7.05.00	EXCAVATION IN ROCK Excavation in rock shall be carried out by mechanical means and if blasting is required for founding of some of the structures under this package, control blasting only shall be carried out.			
7.05.01	Controlled blasting shall be done by a specialised agency duly approved by Engineer. All controlled blasting shall be done by using time delay detonators (i.e. excel type).			
7.05.02	a) Contractor shall engage an agency expert in blasting such as, NIRM (National Institute of Rock Mechanics), CMPDIL, Central Institute of Mining and Fuel Research Dhanbad, Dept. of Mining of Govt. Institutions etc. to design detailed blasting scheme and get the same approved from Engineer before carrying out the blasting			
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
PAGE 16 OF 29				

CLAUSE NO.	PROJECT INFORMATION			
	operation. All blasting shall be done as per the approved blasting scheme & initial blasting operations shall be done under the supervision & guidance of the representative of the blasting expert. b) All the statutory laws, (Explosives Act etc.) rules, regulations, Indian Standards, etc. pertaining to the acquisition, transport, storage, handling and use of explosives, etc. shall be strictly followed. c) The Contractor shall obtain Licenses from Competent Authorities for undertaking blasting work as well as for procuring, transporting to site and storing the explosives as per explosives act. The Contractor shall be responsible for the safe transport, use, custody and proper accounting of the explosive Materials. d) The Contractor shall be responsible and liable for any accident and injury / damage which may occur to any person or property of the project or public on account of any operations connected with the storage, transportation, handling or use of explosive and blasting operations.			
7.06.00	Sheeting & Shoring The contractor shall ascertain for himself the nature of materials to be excavated and difficulties, if any, likely to be encountered in excavation while executing the work. Sheet piling, sheeting and shoring, bracing and maintaining suitable slopes, drainage, etc. shall be provided and installed by the Contractor, to the satisfaction of the Engineer.			
7.07.00	Geotechnical Investigation The Contractor shall carry out detailed geotechnical investigation in the areas under his scope for establishing the sub-surface conditions and to decide type of foundations for the structures envisaged, construction methods, any special requirements/treatment called for remedial measures for sub-soil/ foundations etc. in view of soft sub-soils, aggressive sub-soils and water, expansive/swelling soils etc. prior to commencement of detailed design/drawings. The Contractor shall obtain the approval for the field testing scheme proposed by him from the Owner before undertaking the geotechnical investigation work.			
7.07.01.00	Scheme of geotechnical Investigation			
7.07.02.01	Field test shall include but not be limited to the following: Boreholes, Standard Penetration Test (SPT), Dynamic Cone Penetration Test (DCPT), collection of disturbed samples (DS) and undisturbed soil samples (UDS), Trial Pits (TP), Plate Load Tests (PLT), Electrical Resistivity Test (ERT), In situ field permeability tests, collection of water samples, etc.			
7.07.02.02	The diameter of borehole shall be minimum 150 mm in soil and 76 mm in rock. The diameter of UDS sampler shall be 100 mm minimum. Core drilling in rock shall be done by using hydraulically feed rotary drill & double tube core barrel with diamond bit.			
7.07.02.03	The minimum tests are indicated in Clause No. 7.08.00. Adequate number of tests shall be conducted up to sufficient depth for complete determination of subsoil conditions. The depth of boreholes shall be as specified in Appendix A. SPT shall be carried out in all types of soil deposits and in all rock formations with core recovery up to 20%, met within a borehole. This test shall be conducted at every 3.0 m interval or at change of strata, up to the final depth. SPT 'N' of 100 and above shall be referred as refusal. UDS shall be collected at every 3.0 m interval or at change of strata up to depth of borehole. UDS may be replaced by additional SPT, if SPT'N' value in the strata is above 50.			
7.07.02.04	Laboratory tests shall be done as per relevant IS codes. The laboratory tests, not be limited to the following shall be conducted on disturbed and undisturbed soil samples, rock samples & water samples collected during field investigations in sufficient numbers.			
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP
PAGE 17 OF 29				

25

CLAUSE NO.	PROJECT INFORMATION					
	2	Crusher House	Minimum 2 Nos.	Depth of boreholes shall be 25m to 35m.	boreholes shall be as mentioned in column "Depth of Borehole" or 5m continuous in rock with RQD > 25% whichever is earlier.	
	3	Gypsum and Lime storage area	Minimum 10 Nos.	Depth of boreholes shall be 15m to 25m		
	4	Other Structure/Facility	Minimum 2 Nos. boreholes under each area / facility	15 to 20 m		
	5	Chimney	Minimum 2 Nos.	30 to 35m		
	b) Other Field Tests (Minimum)					
	1	Cyclic Plate Load Test (CPLT)	3nos	Test Depth from 2 to 4 m		
	2	Trial Pit (TP)	5 Nos.	Depth - 3 m		
	3	In Situ Permeability Test In Boreholes	In minimum 3 Nos. of boreholes	Tests shall be conducted at depths of 1.0m, 3.0m, 5.0m, 8.0m and 12.0m.		
	4	ERT	Minimum 10 Nos.			
	• Depth and location of Boreholes and other field tests (PLT, ERT, field permeability tests etc.) shall be approved by Owner before execution of geotechnical investigation work. • Investigation in any other building / structure / facilities / trestles which are not mentioned above shall also be carried out, if required, by the bidder for the facilities under his scope.					
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 19 OF 29	

CLAUSE NO.	PROJECT INFORMATION	एनटीपीसी NTPC																							
	Annexure-III SOIL DATA AND FOUNDATION SYSTEM Employer has carried out geotechnical investigation in the areas near to this package. Logs of representative boreholes to be used for bidder's information in the vicinity of proposed area are enclosed with this Annexure-II. The bidder is required to carry out geotechnical investigation as per the clause no. 7.07.00 and ascertain the pile capacity and bearing capacity. The onus of correct assessment / interpretation and understanding of the existing subsoil condition / data is on the Bidder. Ground water table is encountered at a depth of about 11.0 to 13.0m below natural ground level (NGL) at the time of investigation. Fluctuation may occur in ground water table due to seasonal variation. The natural ground level is varying as per enclosed contour/spot level drawing. a) The foundation system to be adopted for different structures shall be as given in Table – i below Table – i: Net Allowable Bearing Pressure <table><tr><th>STRUCTURE</th><th>TYPE OF FOUNDATION TO BE ADOPTED</th></tr><tr><td>FGD and related structures</td><td>Open/Piles</td></tr></table> b) During design the Allowable Bearing Pressure shall be as furnished in Table-ii. Bidder is required to carry out geotechnical investigation in this area. The allowable bearing pressure shall be adopted after approval of geotechnical investigation report by owner. However, the maximum allowable bearing pressure shall be as per the approved geotechnical report and shall be limited to the values as furnished in Table-ii. Table – ii: Net Allowable Bearing Pressure <table><tr><th rowspan="3">Structure</th><th rowspan="3">Founding Level in RL</th><th colspan="3">Net Allowable Bearing Pressure T/m²</th></tr><tr><th colspan="2">Isolated / Strip</th><th rowspan="2">Rafts (width > 6m) for 75mm settlement</th></tr><tr><th>width upto 6 m for 25mm settlement</th><th>Width upto 6m for 40mm settlement</th></tr><tr><td rowspan="2">FGD and related structures</td><td>2.5 m below NGL</td><td>8.0</td><td>9.0</td><td>10.0</td></tr><tr><td>3.5 m</td><td>10.0</td><td>12.0</td><td>14.0</td></tr></table>	STRUCTURE	TYPE OF FOUNDATION TO BE ADOPTED	FGD and related structures	Open/Piles	Structure	Founding Level in RL	Net Allowable Bearing Pressure T/m ²			Isolated / Strip		Rafts (width > 6m) for 75mm settlement	width upto 6 m for 25mm settlement	Width upto 6m for 40mm settlement	FGD and related structures	2.5 m below NGL	8.0	9.0	10.0	3.5 m	10.0	12.0	14.0	
STRUCTURE	TYPE OF FOUNDATION TO BE ADOPTED																								
FGD and related structures	Open/Piles																								
Structure	Founding Level in RL	Net Allowable Bearing Pressure T/m ²																							
		Isolated / Strip		Rafts (width > 6m) for 75mm settlement																					
		width upto 6 m for 25mm settlement	Width upto 6m for 40mm settlement																						
FGD and related structures	2.5 m below NGL	8.0	9.0	10.0																					
	3.5 m	10.0	12.0	14.0																					
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 20 OF 29																						

CLAUSE NO.	PROJECT INFORMATION																								
	below NGL 4.5 m below NGL	12.0	15.0	17.0																					
	The net allowable bearing pressure higher than above mentioned values shall not be permitted. At intermediate levels the bearing capacity shall be same as the net allowable bearing pressure corresponding to the immediate shallower level mentioned above.																								
c)	Permissible Settlement of Foundations: For open foundations, the total permissible settlement and differential settlement shall be governed by IS: 1904 and from functional requirements whichever is more stringent. However, total settlement shall be restricted to the following: <table border="1"> <tr> <td>Isolated, Strip & Raft (Mill foundations/machine foundation)</td> <td>25 mm</td> </tr> <tr> <td>Isolated & Strip (Other than Mill foundations/machine foundation)</td> <td>40 mm</td> </tr> <tr> <td>Raft (widths greater than 6 m) (Other than Mill foundations/machine foundation)</td> <td>75 mm</td> </tr> </table> In case the total permissible settlement is to be restricted to less than as above specified from functional requirements, then the net allowable bearing pressure shall be reduced after review in consultation with Engineer.					Isolated, Strip & Raft (Mill foundations/machine foundation)	25 mm	Isolated & Strip (Other than Mill foundations/machine foundation)	40 mm	Raft (widths greater than 6 m) (Other than Mill foundations/machine foundation)	75 mm														
Isolated, Strip & Raft (Mill foundations/machine foundation)	25 mm																								
Isolated & Strip (Other than Mill foundations/machine foundation)	40 mm																								
Raft (widths greater than 6 m) (Other than Mill foundations/machine foundation)	75 mm																								
d)	The diameter of pile, minimum length and maximum allowable capacity of piles shall be as given below: <table border="1"> <thead> <tr> <th rowspan="2">Area/ Location</th> <th rowspan="2">Pile Diameter (mm)</th> <th rowspan="2">Minimum Length of Bored Pile Below Cut-off Level (m)</th> <th colspan="3">Safe Load Capacity in</th> </tr> <tr> <th>Vertical Comp. (MT)</th> <th>Pullout (MT)</th> <th>Lateral (MT)</th> </tr> </thead> <tbody> <tr> <td rowspan="2">FGD and related structures</td> <td>600</td> <td>18.0</td> <td>140.0</td> <td>45.0</td> <td>7.0</td> </tr> <tr> <td>760</td> <td>19.0</td> <td>250</td> <td>75.0</td> <td>12.5</td> </tr> </tbody> </table> - Cut off Level (COL) is assumed at 3.0 m below FGL (RL(+) 127.0m). If the COL is shallower than the assumed COL, then the length of the pile shall be increased accordingly.					Area/ Location	Pile Diameter (mm)	Minimum Length of Bored Pile Below Cut-off Level (m)	Safe Load Capacity in			Vertical Comp. (MT)	Pullout (MT)	Lateral (MT)	FGD and related structures	600	18.0	140.0	45.0	7.0	760	19.0	250	75.0	12.5
Area/ Location	Pile Diameter (mm)	Minimum Length of Bored Pile Below Cut-off Level (m)	Safe Load Capacity in																						
			Vertical Comp. (MT)	Pullout (MT)	Lateral (MT)																				
FGD and related structures	600	18.0	140.0	45.0	7.0																				
	760	19.0	250	75.0	12.5																				
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2		SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP																					
				PAGE 21 OF 29																					

CLAUSE NO.	PROJECT INFORMATION	एनटीपीसी NTPC																			
e)	The criteria for Pile Termination (founding level) shall be as given below: The termination level of the pile shall be decided based on the following criterion i) Minimum length of the pile below COL (cut off level) shall be as specified above ii) The minimum pile length for each group of piles shall be determined based on the nearest borelog. Pile shall be socketed into yellowish weathered sand stone. A socketing length of four (4) times the diameter of the pile into rock with rock core recovery ≥ 20% shall be ensured for 600 mm & 760 mm dia piles. For pile termination, SPT 'N' values shall be used from the nearby borelog data. The boreholes are in the bidder's scope and shall be conducted as per the enclosed scheme. iii) However, in no case the length of pile shall be less than the minimum length determined as in (i) or (ii) above whichever is longer, for that pile group.																				
g)	Special Requirements: i) Chemicals in ground water and subsoil, as observed during investigation are: <table><tr><th>Chemical</th><th>SO₃</th><th>Chlorides</th><th>pH</th></tr><tr><td>Ground Water</td><td>18 to 30 ppm</td><td>50-82 ppm</td><td>7.26 – 7.44</td></tr><tr><td>Sub-soil</td><td>0.011 to 0.023 %</td><td>0.02 to 0.064 %</td><td>7.3 – 7.62</td></tr></table> ii) In view of the above, the following shall be adopted. <table><tr><td>Cement Type</td><td>As specified elsewhere in the specifications</td></tr><tr><td>Concrete Grade</td><td>As specified elsewhere in the specifications</td></tr><tr><td>Type of Reinforcement</td><td>As specified elsewhere in the specifications</td></tr><tr><td>Cover to Reinforcement</td><td>As specified elsewhere in the specifications</td></tr></table>	Chemical	SO ₃	Chlorides	pH	Ground Water	18 to 30 ppm	50-82 ppm	7.26 – 7.44	Sub-soil	0.011 to 0.023 %	0.02 to 0.064 %	7.3 – 7.62	Cement Type	As specified elsewhere in the specifications	Concrete Grade	As specified elsewhere in the specifications	Type of Reinforcement	As specified elsewhere in the specifications	Cover to Reinforcement	As specified elsewhere in the specifications
Chemical	SO ₃	Chlorides	pH																		
Ground Water	18 to 30 ppm	50-82 ppm	7.26 – 7.44																		
Sub-soil	0.011 to 0.023 %	0.02 to 0.064 %	7.3 – 7.62																		
Cement Type	As specified elsewhere in the specifications																				
Concrete Grade	As specified elsewhere in the specifications																				
Type of Reinforcement	As specified elsewhere in the specifications																				
Cover to Reinforcement	As specified elsewhere in the specifications																				

LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP	PAGE 22 OF 29
---	---	--	------------------

CLAUSE NO.	PROJECT INFORMATION			
	Table-3			
	<u>DESIGN CLARIFIED WATER ANALYSIS</u>			
	S.No	Constituent	As	mg/l (except pH & turbidity)
	1.	Calcium	CaCO ₃	131
	2.	Magnesium	CaCO ₃	52
	3.	Sodium + Potassium	CaCO ₃	65
	4.	Total Cations	CaCO ₃	248
	5.	Chloride	CaCO ₃	20
	6.	Sulphate	CaCO ₃	93
	7.	Nitrate	CaCO ₃	10
	8.	Alkalinity	CaCO ₃	125
	9.	Total Anions	CaCO ₃	248
	10.	Iron(total)	Fe	0.3
	11.	Total Silica	SiO ₂	22
	12.	pH value	---	7.0-8.2
13.	Turbidity	NTU	10	
Note: Clarified water is used for CW system as make up & the CW system is expected to operate at about 5.0 – 5.5 Cycles of Concentration (COC) with suitable chemical treatment program using acid, scale & corrosion inhibitor dosing. As CW blow down water is tapped from CW system, the water quality of CW blow down shall accordingly be arrived by the bidder.				
Table-4				
ANALYSIS OF DM WATER				
Sl.No.	Characteristics	Value		
1.	Silica (Max.)	0.02 ppm as SiO ₂		
2.	Iron as Fe	Nil		
3.	Total hardness	Nil		
4.	pH value	6.8 to 7.2		
5.	Conductivity	Not more than 0.1 µs/cm		
LOT-IA PROJECTS FLUE GAS DE-SULPHURIZATION (FGD) SYSTEM PACKAGE TECHNICAL SPECIFICATIONS SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2 SUB-SECTION-II-A11 PROJECT INFORMATION NABINAGAR TPP PAGE 27 OF 29				



4x250 MW BRBCL NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION

SPECIFICATION No: PE-TS-463-571-A102

SECTION : I

Sub Section : C

REV. 00

SECTION: I

SUB SECTION: C

TECHNICAL SPECIFICATION

	4x250 MW NABINAGAR TPP		SPECIFICATION No: PE-TS-463-571-A102	
	LIME FEEDING / DOSING SYSTEM		SECTION : I	
	TECHNICAL SPECIFICATION		SUB-SECTION : C1	
	SPECIFIC TECHNICAL REQUIREMENT		REV. 00	
			SHEET 1 OF 18	

SECTION: I

SUB-SECTION: C 1

SPECIFIC TECHNICAL REQUIREMENT



4x250 MW NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-463-571-A102	
	SECTION : I	
	SUB-SECTION : C1	
	REV. 00	
SHEET 2 OF 18		

1.0	SYSTEM DESCRIPTION
------------	---------------------------

The purpose of the specification is to provide complete Lime feeding/dosing system (LDS) for use in waste water neutralization in Flue Gas Desulphurization (FGD) plant for NABINAGAR TPP of 4x250 MW, under the scope of this tender.

Lime dosing system is provided to dose lime solution in wastewater tank of FGD system to increase pH from acidic zone to neutral (or slightly basic pH) (i.e. from 5.5 to 7.0) and after mixing of the effluent (using agitator/re-circulation system of the pumping system), the effluent shall be discharged once the waste water has been neutralized to desired pH. The lime dosing is envisaged to be done in wastewater tank continuously.

Lime powder is to be stored in sacks in storage room provided at the ground floor of Gypsum Dewatering Building. Lime powder is filled manually in surge hopper/(s), which shall feed lime to vibrating feeders/Bucket Elevators (Bucket conveyor). Bucket elevator discharges lime powder in lime silo, from where the lime powder is fed to neutralisation tank via outlet chute/pipe using rotary feeder and screw conveyor provided at the bottom of lime silo. The lime is being dissolved in service water inside neutralization tank with the help of the motorized agitator (provided in neutralization tank). The dilute solution of lime prepared in neutralisation tank is then fed to the wastewater tank by means of lime slurry pumps (1W+1SB - common for LDS). The dosing is controlled as per requirements of desired pH in wastewater. (Tentative range of neutralization is from pH 5.5 to pH 7.0).

All piping, valves & instrumentation up to the employer's terminal point shall be in the supplier's scope. Supply of complete lime storage, feeding & dosing system shall be in supplier's scope. The complete waste water neutralization system shall be automated and controlled from the control room (DCS control system-by BHEL).

2.0	TECHNICAL INFORMATION	
1.2.1	Quantity of Lime Feeding/Dosing System	Two (2x100%) Lots (one working +one standby) & Common (1W+1SB) dosing pumps for LDS
1.2.2	Quantity of water to be neutralized	40 m ³ /hr.
1.2.3	Purity of Lime	83 %

3.0	SCOPE OF SUPPLY & SERVICES
------------	---------------------------------------

The specification covers Supply part, Services part and supply of Mandatory spares. Scope of Supply shall comprise of design (i.e. Preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles, fill of lubricants & consumables (till handing over), mandatory spares along with spares for erection, start-up and commissioning, proper packing, forwarding, shipment and delivery of all equipment at site. Services part covers **supervision services** for erection & commissioning, trial run at site and carrying out Performance guarantee tests at site. Training of customer/ clients O&M staff covering all aspects of the Lime feeding/dosing system (LDS) and inclusive of training for Operation & Maintenance (6 days) at Site, training of customer's personnel at manufacturer's works (6 man-days including lodging and boarding), troubleshooting etc. shall be part of services to be provided by supplier. Services also

	4x250 MW NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-463-571-A102	
		SECTION : I	
		SUB-SECTION : C1	
		REV. 00	
		SHEET 3 OF 18	

include handing over of LDS package complete with all accessories in flawless condition to the customer, for the total scope defined for lime dosing/feeding system as per BHEL NIT & tender technical specification, amendment & agreements till placement of order for Lime Feeding/Dosing System (LDS).

Design: Includes basic engineering, detail engineering, preparation and submission of engineering drawings/calculations/datasheets/quality assurance documents/field quality plans, storage instructions, commissioning procedures, Erection & assembly Drawings, operation & maintenance manuals, performance guarantee test procedures and assisting BHEL in obtaining time bound approval from BRBCL.

Supply: Includes manufacturing/fabrication, shop floor testing, stage inspections, final inspections, painting, packing & transportation, customer clearance/port clearance (as applicable) and any other statutory clearances and delivery at site.

Services: following services are included in vendor’s scope-

- Supervision of Erection and Commissioning of the complete Lime feeding/dosing system at project site is in bidder’s scope. Detailed Erection and commissioning procedure, check list shall be submitted by successful bidder and same shall be followed by BHEL for erection and commissioning of the system at site.
- Trial run at site and carrying out Performance guarantee tests at site & handover in flawless condition of the package to the customer is in bidder’s scope.
- Training of customer/ client O&M staff covering all aspects of the Lime Feeding/Dosing system - operation & maintenance (6 days) at Site is in bidder’s scope.
- Training of customer at manufacturer’s works (6 man-days) including lodging and boarding) is in bidder’s scope.
- TA/DA, boarding and lodging of bidder’s personnel shall be borne by the bidder and shall be inclusive in supervision portion.
- During implementation of logic and FAT of BHEL DCS, bidder will depute his concerned representative for technical support as and when required by customer / BHEL. Bidder to attend regular engineering meeting with BHEL and Customer fortnightly in BHEL or Customer office as decided during detail engineering. Vendor will depute his entire concerned engineering representatives along with the project manager for discussion and approval of engineering drawings/ documents during detailed engineering to meet project’s various milestones and completion schedule, without any price implication to BHEL and Customer. Meeting can be held at site also.
- Visits shall be planned by BHEL site team and prior intimation shall be sent to supplier for visit to site for supervision services. Bidder shall be informed at least 10 days in advance for the requirement of visit at site. Visiting team shall consist of one or two expert of bidder as deemed necessary by them.
- Relevant requirements as per GTR, GCC, ECC & SCC etc.



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 4 OF 18

Supplier's scope covers complete Lime Feeding/Dosing system including start-up spares and required special tools. Supplier to refer enclosed progressive 'GA of Gypsum Dewatering building' drg. No.- 0270-109-PVM-B-047. Supplier to note that Lime preparation/neutralisation tanks shall be placed on ground level. Slurry feeding/dosing pumps shall also be placed on ground level for further dosing lime to Waste Water Tank (00 HTM 05 BB 001)- refer 'P & ID -Waste Water System' drg no.- B240-00449 to B240-00451- 3-Sheets

The scope of supply for complete Lime Feeding/Dosing system shall include but not limited to the following:

S.No	Scope of work for Lime Dosing/Feeding system
Lime Feeding/Dosing system for neutralization shall be complete with following-	
1.	Entire Lime Feeding/Dosing System as per cloud marked portion of P&ID (drg no.- B240-00449 to B240-00451, 3 sheets), Equipment Data sheet (Section-II, Annexure-8) & other Technical Specification requirements enclosed with this specifications.
2.	2- Nos of Surge hopper shall be supplied (sloping portion lined with SS 304).
3.	2-Nos of Vibrating feeder shall be supplied for feeding Lime from surge hopper to Bucket elevator.
4.	2-Sets of Continuous Discharge Type Bucket Elevator shall be supplied with standard components like buckets (SS-304), belt, drive/tail pulleys with shaft & bearing assemblies, middle/top/bottom casings, take up unit, drive base frame, drive unit – geared motor, chain for final power transmission, zero speed switch, complete with supporting steel structure, platforms, ladders, railings, and holdback as applicable along with all accessories and necessary hardware to handle/ discharge lime from ground level to Lime silo. Chute for feeding lime from bucket elevator to the lime silo shall be supplied.
5.	2- Nos of Lime Silo (MS with SS 304 lining on conical portion) complete with supporting steel structure, platforms, ladders, railings, level switches, air relief devices, etc. shall be supplied. Aeration pads/ flexible vibro pads/ electro-magnetic vibrators for conical portion of silo shall be supplied as per system requirement to ensure free flow of lime from silo to onward equipment.
6.	2-Nos. of self-cleaning bag filter system of suitable capacity along with blowers, automatic/on-load cleaning system, etc. shall be supplied.
7.	2-Sets of flange of 250 NB/suitable size for connecting silo to inlet chute of downstream equipment (Valve/ Rotary feeder / screw conveyor) shall be supplied.
8.	2-Nos of Manual gate/ KGV shall be supplied for isolation purpose /control the feeding of lime from lime silo to downstream equipment.
9.	2-Nos of Motorized Gates/KGV shall be supplied to control the feeding of lime from lime silo to screw conveyor
10.	2-Nos of Rotary vane feeder/ Rotary air lock feeders (MOC –Stainless Steel) along with gear box, motor, etc shall be supplied.
11.	2-Nos of Screw Conveyor shall be supplied. Screw conveyors shall be complete with screw flight with pipe, trough, end plates, inlet/outlet standard chutes, end shafts with bearings & plumber blocks, drive base frame, dust seals, drive geared motor, output coupling, zero speed switch and necessary hardware along with all accessories to handle/ discharge lime to neutralization.
12.	2-Nos of Neutralisation Tank (MSRL) with SS dissolving basket, Agitator of SS construction with motor, reduction gear and its mounting arrangement, drain, manholes, level transmitters, level gauges, etc shall be supplied.



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 5 OF 18

S.No	Scope of work for Lime Dosing/Feeding system
13.	2-Nos Lime Slurry Pumps (1W+1S after Neutralisation tank) shall be supplied.
14.	Process water piping from TP outside building to neutralisation tanks along with overflow and drain piping of tanks, back-flushing pipeline along with valves, fittings, etc shall be supplied.
15.	Lime slurry piping from Neutralization Tanks to feeding/dosing pumps inlet & from feeding/dosing pumps outlet to Waste water tank inlet along with re-circulation line with all required valves, fittings, etc shall form part of supply.
16.	All Interconnecting pipe/ ducts, valves and all chutes (inlet and discharge) for complete lime feeding system shall also be supplied.
17.	Painting and Rust Prevention during shipment and construction shall be ensured by bidder.
18.	Inland/export seaworthy packing as applicable and transportation of complete lime feeding/dosing system to site.
19.	Special tools & tackles as applicable.
20.	Erection and start-up spares as applicable.
21.	Installation, operation and maintenance manuals.
22.	Bidder to quote for the Recommended Spare Parts (for 24 months operation) with break up price (shall not be part of evaluation/PO).
23.	All instruments as required for the complete lime dosing/feeding system shall be supplied.
24.	Inspection and testing at site
25.	Any other items required for completeness of the equipment other than items covered in the exclusions.
26.	Mandatory spares as per attached list in specs at Section I-D-Annex II.
27.	Supervision of E & C of the complete Lime feeding/dosing system

4.0 BASIC DESIGN

This section covers the Design manufacturing and performance requirement of the Lime feeding/dosing system and accessories.

4.1 BUCKET ELEVATOR SYSTEM

1 General Requirement

The type (Centrifugal/Continuous) of the Bucket Elevator shall be chosen by Bidder for the material and conditions specified. The Bucket Elevator shall be sized to handle the design capacity at the specified material bulk density & maximum material size. The equipment shall be complete with all necessary sub-systems and components and shall be designed and supplied in conformance with the attached datasheets, site conditions, specific Employer's requirements and applicable International, National, State and Local codes. The Equipment shall be complete in all aspects and all items required for erection/smooth operation shall be in Bidder's scope, unless otherwise noted in exclusions. Sizing of the equipment and components shall be the responsibility of the Bidder, based on the service conditions specified.

2 Codes and Standards

All design, fabrication, testing, supply and erection, if applicable, shall conform to the latest edition of all the relevant standards and regulations issued by the governing bodies. Bidder shall follow the applicable INDIAN/INTERNATIONAL codes by the following Organizations:

	4x250 MW NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-463-571-A102	
		SECTION : I	
		SUB-SECTION : C1	
		REV. 00	
		SHEET 6 OF 18	

EN European Norm
IEC International Electro Technical Commission
ISO International Organization for Standardization
DIN German Institute for Standardization (To be used when no EN standards exist)
Other internationally acceptable standards/codes, which ensure equal or higher performance than those specified, shall also be accepted. Nothing in this specification shall be construed to relieve the contractor of the required statutory responsibility. In case of any conflict in the standard and this specification, the decision of the Employer shall be final and binding.

3 Design Criteria
The equipment shall be designed for continuous twenty-four-hour service. The Equipment shall be designed for service in a heavy duty industrial application, handling abrasive materials in a dusty environment. The Bucket Elevator should be sized to handle the design capacity as indicated on the Data Sheet with the minimum material bulk density and a maximum bucket filling of 75%.

4 Casing
Casing to be self-supported, dust-tight construction and capable of supporting head shaft, drive, and service platform. Head section is to be split and equipped with handles or lifting lugs for easy removal. Access and inspection doors are to be provided. Intermediate sections are to have a minimum plate thickness of 4 mm. Boot section to be fabricated of minimum 6 mm steel plate, with front and rear access panels. A beam is to be provided in casing for servicing internal gravity take-up. The beam may be located either in the boot section or intermediate section as applicable.

5 Buckets
Size, capacity and type of buckets and appropriate reinforcement necessary for the application shall be adequately sized. Provide pin holes in bottom of buckets for air relief, as necessary, when handling materials such as Lime. Bucket width is to be a minimum of four times the maximum particle size.

6 Belting
Belting shall be provided as specified elsewhere in the specification.

7 Pulley
Drive and guide pulleys shall be provided as specified elsewhere in the specification and shall be at least the minimum recommended for belt conveyor pulleys.

8 Head Shaft and Bearings
The bearings on head shaft to be antifriction type with one bearing fixed and the other expansion. All bearings are to have an L10 life of 60000 hours.

9 Foot Shaft and Bearings
The tail shaft is to be of hardened steel with tool steel sleeves operating in heat treated white iron bearings. All bearings are to have an L10 life of 60000 hours.

10 Take-up
Take-up shall be screw or internal gravity type with guide rails and weights included.

11 Drive
Bucket elevator drive should be sized as follows:



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 7 OF 18

Minimum power for drive, either:

100% bucket filling @ minimum material bulk density, or

75% bucket filling @ maximum material bulk density, whichever is greater.

12 Inspection and Access Doors

Inspection doors and access doors shall be loose-hinged type with quick-opening jamb bar fasteners and gaskets enclosed and retained in the door. Access doors shall be 1.5m minimum.

13 Dust Vent

A dust collecting vent in the head section and boot section shall be furnished with drilled flanges. Bidder quote is to include recommended vent volumes for the boot and head sections of the elevator. The Pick-Up velocity shall not be greater than 2.5m/sec.

14 Drive Equipment

The Drive Equipment for Bucket Elevator shall be as specified elsewhere in the Specification.

4.2 SCREW CONVEYOR

- 1 Necessary overload protection guard for geared motor and drive chain to be provided.
- 2 Zero speed switch not required. However, speed sensing flag to be provided.
- 3 The motor and Gear reducer should be mounted such that there is not vibration during operation of the conveyor.
- 4 All fasteners shall be of Gr. 8.8 and reputed make.
- 5 The data as per Annexure-8 to be filled in by vendor (in the same format only).

4.3 LIME SILOS

Contractor shall provide 2x 100% Lime Storage Silos for feeding lime to the Lime Neutralisation tanks. The lime storage silo shall be of minimum 24 hr. capacity (refer tentative dimensions in data sheet & attached sketch) and shall be complete with supporting steel structure, platforms, railings, ladders, power operated outlet gates, level switches, air relief devices, etc. For dust free operation each silo should be provided with a covering arrangement and a self-cleaning bag filter system of suitable capacity along with blower, automatic/on-load cleaning system, etc. The storage silos and hopper cones shall be fabricated of minimum 10 mm thick carbon steel with a SS lining of grade SS304 of minimum 4 mm thickness in the complete cones to ensure reliable discharge of material. The design of storage silos shall confirm to IS 9178 or any other proven international standards. The storage silo shall be capable of feeding the lime by motorized rotary feeding system to the Lime Neutralization tank.

4.4 NEUTRALISATION TANK

Contractor shall provide 2x100% Lime Neutralization tanks (lime preparation/dosing tanks) which shall be of minimum 8 hr. capacity (refer tentative dimensions in data sheet & attached layout) made of carbon steel with rubber lining.



4x250 MW NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-463-571-A102	
	SECTION : I	
	SUB-SECTION : C1	
	REV. 00	
	SHEET 8 OF 18	

Lime Neutralization tanks shall be designed, fabricated, erected and tested in accordance with the IS:803, latest edition. Additional Corrosion allowance of 3mm on the minimum tank shell thickness as calculated by IS:803, latest edition shall be provided by the Contractor. Tanks shall be made from IS:2062 quality mild steel plates of tested quality. The tanks shall be of welded construction. Interior surface of the tanks shall be lined with replaceable chlorobuty/bromobutyl rubber lining of minimum 5 mm thickness and the outside surface shall be coated with paint as approved by the Employer. The tanks shall be provided with SS dissolving basket, Agitator of SS construction with motor, reduction gear and its mounting arrangement, drain, manholes, over flow & inlet level control valves, level transmitters, level gauges, etc. Coarse-screen(s) at suction-side of the lime dosing pumps (pumps installed after the neutralisation tank) shall be provided.

4.5 AGITATORS (2nos, 1 in each Neutralisation Tank)

Agitators shall be supplied in neutralisation tanks to prevent caking and settlement of particles out of the lime slurry. Agitators shall be designed for continuous operation unless otherwise specified. Vertical agitators shall be used in Neutralisation tank. The design of the agitators shall be of proven type.

Standard type agitators with suitable characteristics shall be used wherever practical. The agitators shall be complete with motor, gearbox, agitator shaft, coupling, safety guards, mechanical seal, impeller, support legs, agitator-mounting flange including bolts nuts and gasket etc.

All agitator parts and accessories in contact with the stirred fluid shall be constructed of materials specifically designed for the conditions and nature of the stirred fluid and be resistant to erosion and corrosion. The material for the shaft and agitator blades shall be in accordance with Alloy 926 or better. This does not release the Contractor of the responsibility for selecting the correct materials. Each agitator and its associated equipment shall be arranged in such a manner as to permit easy access for operation, maintenance and agitator removal without interrupting plant operation.

To prevent mechanical blocking load start-up after standstill of pumps, piping and agitators for slurries shall be applied with C-hose connection. Lifting lugs and eyes and other special tackle shall be provided as necessary to permit easy handling of the agitators and their components. Static and dynamic (as far as applicable) balancing of all agitators shall be carried out after assembly.

All agitator parts and components shall be designed and calculated for fatigue life, considering maximum bending loads, induced by fluctuating hydraulic forces and torsional loads, based on the installed motor power. All exposed moving parts shall be covered by guards.

The shape of the impeller blades of agitators shall be designed to avoid wear on the impellers which will affect the agitator performance as specified for a minimum period of 2 years of continuous operation under design conditions for the range of application specified in the specification. In order to avoid excessive wear impeller tip speeds must not exceed 12 m/s. Belt drives (if applied) shall be



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 9 OF 18

properly designed to provide a minimum lifetime of 2 years under design conditions. Detailed calculation is to be submitted by bidder in support of selected rpm of agitator.

4.6 LIME FEEDING/DOSING PUMPS

The Contractor shall offer only proven design lime feeding/dosing pumps which were in successful operation in similar application at previous installations. The design, manufacture, installation and testing of the pumps shall follow the latest applicable Indian / International (ASME / EN / Japanese) Standards.

The pumps shall be designed for continuous operation. The pump shall be capable of delivering the rated flow at rated head with margins.

All the slurry pumps shall be provided with motorized suction and discharge valves. In addition, flushing water lines with motorized/pneumatic valves shall be provided for each pump for automatic flushing of the pump after each shut down. The process water lines shall be provided with pneumatic/motorized valves as per the proven practice of the Bidder. The pump casing should be radially split to allow easy removal of impeller.

All the pump wear parts in contact with the slurry shall be provided with replaceable rubber/elastomer liners suitable for the fluid handled. The Bidder can also offer a hi chrome alloy line pump if the Bidder has previous experience of the same for similar applications. The material used by the contractor shall be proven in previous installations.

The material and thickness of the liners shall ensure a minimum service life of 2 years before replacement. All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 14000 hrs. The design of the shaft shall ensure that the operating speed is at least 20% above the critical speed of the shaft. The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption (if/as applicable). The shaft shall be supported on heavy duty ball/roller bearings.

4.7 LIME SLURRY LINES, VALVES & INSTRUMENTS

Lime slurry pipes shall be designed to keep the velocity above the settling velocity under all operating conditions. The contractor may provide a recirculation line with motorized isolation valve/restriction orifice made of erosion resistant material for the above purpose.

All the pipes handling slurry shall be provided with replaceable rubber lining of proven quality. The Contractor can provide slurry pipes of size lower than 3" made up of abrasion resistant FRP material (silicon carbide coating on slurry exposed surface) if it has previous experience of providing the same.

The isolation valves provided in all the slurry lines shall be of knife gate type/butterfly type unless specifically mentioned. Motorized actuators shall be provided for valves requiring frequent

	4x250 MW NABINAGAR TPP		SPECIFICATION No: PE-TS-463-571-A102	
	LIME FEEDING / DOSING SYSTEM		SECTION : I	
	TECHNICAL SPECIFICATION		SUB-SECTION : C1	
	SPECIFIC TECHNICAL REQUIREMENT		REV. 00	
			SHEET 10 OF 18	
operation as indicated in the relevant scheme. The valves shall be of proven type and the contractor shall submit a detailed valve schedule for employer’s approval. Reference list for previous installations for similar application shall also be furnished to the employer. Bidder shall provide all necessary arrangements for purging & flushing of all the process pipelines, equipment etc. 4.7.1 PIPING, VALVES AND ACCESSORIES: Complete engineering and supply of interconnected piping (slurry, air and water pipes) along with valves, rubber lining (wherever applicable shall be supplied in erectable condition i.e., no rubber lining to be done at Site), supports, gaskets, fasteners and accessories which is integral to Lime feeding/dosing system (LDS) – One (1) set* which is broadly defined below: a. Service water piping from service water line taping to Neutralization Tank inlet. b. Slurry piping from Neutralization Tank to Waste water tank c. Process water piping from TP outside building to wash tanks along with overflow and drain piping of tanks. d. Instrument air piping from TP outside building up to equipment related to the system 4.7.1.1 Expansion Joints at suction and discharge of each pump/other equipment, as applicable: One (1) set* 4.7.2 Instruments for the entire Lime feeding/dosing system including integral piping as defined at 4.7.1 above (minimum requirement for each Lime feeding/dosing system is given in the P&ID): One (1) set* 4.7.3 SCOPE OF SUPPLY (ELECTRICAL): For Electrical scope, refer Electrical specification (Sub-section- C3 of Section-I) in conjunction with cloud marked portion of P&ID (drg no.- B240-00449 to B240-00451, 3 sheets) 4.7.3.1 All motors shall be provided with suitable double compression cable gland. Bidder shall provide cable glands and lugs for all equipment in his scope. Cables shall be terminated using double compression type cable glands and solder less crimping type tinned copper cable lugs. Bidder shall provide junction box. The Junction box shall have provision for installing glands of suitable size on the bottom of the box. <u>All LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615</u> 4.7.4 SCOPE OF SUPPLY (C&I): For Control & Instrumentation (C&I) scope, refer C&I specification (Sub-section- C4 of Section-I) in conjunction with cloud marked portion of P&ID (drg no.- B240-00449 to B240-00451, 3 sheets) 4.7.4.1 Control System: Control system shall be DDCMIS/ DCS which shall be BHEL scope. Each equipment shall be furnished with required instrumentation and electrical accessory devices mounted and connected to a junction box/ cabinet. 4.7.5 Electric and C&I common equipment including but not limited to i. Local control panel, if required ii. LV, HT Motors (as applicable) iii. Junction Box iv. Instruments v. Push buttons				



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102	
SECTION : I	
SUB-SECTION : C1	
REV. 00	
SHEET 11 OF 18	

- 4.7.6** First fill lubricants: All the first fill and one year's toppings requirements of consumables such as grease, oil, lubricants, servo fluids etc. which will be required to put the equipment covered under the scope of specifications into successful commissioning/initial operation and to establish completion to facilities should be provided by contractor/supplier. Also refer Clause 10.5 of this sub-section.
- 4.7.7** Painting and rust prevention during shipment and construction.
- 4.7.8** Inland/Seaworthy packing (refer Annexure-VII, Sub-section: D of Section-I) as required & forwarding to project site.

4.8	APPROACH AND HANDLING FACILITIES
------------	---

Proper approach shall be provided for access to all equipment during normal operation and maintenance. Equipment requiring monitoring during regular operation shall be approachable from the ground floor through staircase. Staircase with minimum width of 1200 mm shall be provided for approach to elevated structures at 5m height from the nearest platform. Below this height a vertical ladder with minimum clear width of 600 mm may also be acceptable. Platform with a minimum clear width of 1000 mm shall be provided all around the lowest absorber spray levels and mist eliminators. Similar platforms shall be provided at subsequent elevations if they are more than 3000 mm apart from each other. An adequately sized manhole with platform (min. 2 sq. m) shall be provided above each spray level. Ladders/staircase shall be provided for the access to the platform. A 1500 mm space shall be provided around all pumps. Minimum Headroom (free height) under all floors, ducts, walkways and stairs shall be 2.50 M.

- 4.9** Mandatory spares as defined as Annexure-II, Sub Section-D of Section I.
- 4.10** Recommended spare parts list to be furnished (is not part of scope of supply/evaluation).
- 4.11** Any other items required not covered above but required for the completeness of the system; same shall be included in the offer and shall be supplied by the Bidder/supplier. Bidder shall refer to the P&ID enclosed in Annexure-IV, Sub-Section-D of Section-I for the items under the bidder's scope. All the items indicated in the P&ID are minimal requirements.

*One set means complete requirement for lime feeding/dosing system.

5.0	TERMINAL POINTS
5.1	Process water & instrument air will be provided at one location, located at 5 m from building boundary. Further piping from terminal point to LDS system utilities are in bidder's scope.
5.2	Inlet at Lime feeding surge hopper
5.3	Lime dosing inlet flange of waste water tank
6.0	EXCLUSIONS
6.1	Waste water tank and all other items which are outside cloud marked portion of P&ID (drg no.- B240-00449 to B240-00451, 3 sheets)
6.2	All civil construction.
6.3	Ventilation in area/building.
6.4	Other exclusions control system (excluding Junction box) and as mentioned in Electrical & C&I parts of this specification



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 12 OF 18

6.5	Process water, Instrument Air, Service Air upto terminal points.
6.6	Monorail beams for electrical hoists

7.0 CODES & STANDARDS AND OTHER REQUIREMENTS

The design of Lime Feeding system shall conform to the latest edition of International codes accepted by the Buyer according to good engineering practice.

List of codes/standards recommended: (The list is not exhaustive)

S.No	Description	Material	Design & others
1	Piping	AISI, ASTM, ASME, DIN, EN, BS or Equivalent	AFNOR, ANSI, API, ASME, ASTM, AWWA, BS, DIN, EN, EJMA
2	Machinery	AISI, ASTM, ASME, DIN, EN, BS or Equivalent	AFNOR, AFBMA, AGMA, ANSI, API, ASTM, AWS, BS, DIN, IEC, HI, HEI, ISO, NEC, NEMA, EN, TEMA, VDI
3	Instrumentation	AISI, ASTM, ASME, DIN, EN, BS or Equivalent	AFNOR, ANSI, API, ASME, BS, DIN, EN, IEC, IEEE, ISA, ISO, NC
4	Electrical	AISI, ASTM, ASME, DIN, EN, BS or Equivalent	BS, VDE, IEC, EN, ANSI, IEEE, NEMA
5	Civil	AISI, ASTM, ASME, DIN, EN, BS or Equivalent	AFNOR, ASCE, ASNT, BS, DIN, EN, ANSI, ACI, AISC, AWS, SSPC
6	Structural Steel	SA/IS2062	BS/EN 1993 (Eurocode-3) or Equivalent international codes.

The design, materials, construction, manufacture, inspection, testing and performance of Lime Feeding system shall also comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment is to be installed. It is the supplier's responsibility to fully comply with the latest version of changes in regulations, codes and standards. GB Standards are not acceptable.

If there is a conflict between this specification and a referenced document or between the codes and standards the most stringent shall apply.

7.1 In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India as well as of the locality where they will be installed, including the following:

- a) Indian Electricity Act
- b) Indian Electricity Rules
- c) Indian Explosives Act
- d) Indian Factories Act and State Factories Act

	4x250 MW NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-463-571-A102	
		SECTION : I	
		SUB-SECTION : C1	
		REV. 00	
		SHEET 13 OF 18	

e) Indian Boiler Regulations (IBR)

f) Regulations of the Central Pollution Control Board, India

g) Regulations of the Ministry of Environment & Forest (MoEF), Government of India

h) Pollution Control Regulations of Department of Environment, Government of India

i) State Pollution Control Board.

(j.) Rules for Electrical installation by Tariff Advisory Committee (TAC).

(k.) Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996

(l.) Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998

(m.) Explosive Rules, 1983

(n.) Petroleum Act, 1984

(o.) Petroleum Rules, 1976,

(p.) Gas Cylinder Rules, 1981

(q.) Static and Mobile Pressure Vessels (Unified) Rules, 1981

(r.) Workmen's Compensation Act, 1923

(s.) Workmen's Compensation Rules, 1924

(t.) BRBCL Safety Rules for Construction and Erection

(u.) BRBCL Safety Policy

(v.) Any other statutory codes / standards / regulations, as may be applicable.

7.2 Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

a) Bureau of Indian standards (BIS)

b) Japanese Industrial Standards (JIS)

c) American National Standards Institute (ANSI)

d) American Society of Testing and Materials (ASTM)

e) American Society of Mechanical Engineers (ASME)

f) American Petroleum Institute (API)

g) Standards of the Hydraulic Institute, U.S.A.

h) International Organization for Standardization (ISO)

i) Tubular Exchanger Manufacturer's Association (TEMA)

j) American Welding Society (AWS)

k) National Electrical Manufacturers Association (NEMA)

l) National Fire Protection Association (NFPA)

m) International Electro-Technical Commission (IEC)

n) Expansion Joint Manufacturers Association (EJMA)

o) Heat Exchange Institute (HEI)

p) IEEE standard

q) JEC standard

7.3 Other International/ National standards such as DIN, VDI, BS, GOST etc. shall also be accepted for only material codes and manufacturing standards, subject to the BHEL Customer's approval, for which the bidder shall furnish, adequate information to justify that these standards are equivalent or superior to the standards mentioned above. In all such cases, the bidder shall furnish specifically the variations and deviations from the standards mentioned elsewhere in the specification together with the complete word to word translation of the standard that is normally not published in English.

	4x250 MW NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION SPECIFIC TECHNICAL REQUIREMENT	SPECIFICATION No: PE-TS-463-571-A102	
		SECTION : I	
		SUB-SECTION : C1	
		REV. 00	
		SHEET 14 OF 18	

- 7.4 Two (2) English language copies of all national and international codes and/or standards used in the design of the plant and equipment shall be provided by the Contractor to the Employer within two calendar months from the date of the Notification of Award.
- 7.5 In case of any change in codes, standards & regulations between the date of bid opening and the date when vendors proceed with fabrication, the BHEL shall have the option to incorporate the changed requirements or to retain the original standard. It shall be the responsibility of the Contractor to bring to the notice of BHEL such changes and advise BHEL of the resulting effect.
- 7.6 All items of equipment shall comply with the stipulations of Inspectorate of Factories and other statutory bodies of Government of India and Chief Electrical Inspectorate of the State in which the plant site is located, wherever applicable. Wherever required, the successful bidder has to obtain the necessary approvals from statutory authorities and other concerned agencies. All cost on these accounts shall be borne by the successful Bidder.

8.0 COMMON REQUIREMENTS FOR PUMPS	
a)	All the pump wear parts in contact with the slurry shall be provided with replaceable rubber/elastomer liners suitable for the fluid handled. The Bidder can also offer a hi-chrome alloy line pump if the Bidder has previous experience of the same for similar applications. The material used by the contractor shall be proven in previous installations.
b)	The pump shall be provided with seals of proven type and shall be designed for minimization of seal water consumption. The shaft shall be supported on heavy-duty ball/roller bearings.
c)	All pumps shall be designed to withstand a test pressure of 1.5 times the maximum possible pump shut off pressure under maximum suction pressure conditions.
d)	Product water flushing lines and drains are to be supplied for each pump handling the prevailing water to avoid corrosion if the pump is out of operation for extended periods.
e)	Pumps must be carefully set to ensure that the net positive suction head available under all operating conditions will be adequate. The NPSH Values are to be referred to the least favorable operating conditions- lowest atmospheric pressure, lowest level of water on the suction side of the pump and highest temperature of the pumped fluid. An adequate safety margin of normally greater than 1 m to the max NPSH required shall be provided.
f)	All pumps shall be fitted with suction and discharge pressure gauges. Pressure gauges shall be with diaphragm seal for slurry application. Pressure gauges for other medium shall be with gate valves. All the wetted parts shall be SS 316 or equivalent.
g)	Venting valve shall be fitted to all pumps at suitable points on the pump casing unless the pump is self-venting due to the arrangement of the suction and discharge nozzles. Drainage facilities shall be provided on the pump casing or adjacent pipe work to facilitate the dismantling of pumps.
h)	Design pumps not to be damaged during reverse rotation at up to 150% of design RPM, at full discharge head in the event that a pump trips while the other operating pump remain on line.
i)	Pumps shall have stable head-capacity characteristics curve from run-off to shut-off. Shut-off head should be minimum 125% of Best Efficiency Point (BEP).
j)	Selection of Duty point should preferably be at BEP (Best Efficiency Point) or slightly at the left of BEP. Selection of Duty point beyond 115% of BEP will not be acceptable. It should be noted that head variation is due to level variation in tank. Pump has to run in the system without compromising its NPSH requirement at lowest water level in tank. Hence, when tanks are filled-up

4x250 MW NABINAGAR TPP LIME FEEDING / DOSING SYSTEM TECHNICAL SPECIFICATION SPECIFIC TECHNICAL REQUIREMENT		SPECIFICATION No: PE-TS-463-571-A102 SECTION : I SUB-SECTION : C1 REV. 00 SHEET 15 OF 18	
	and are at normal water level, pump will operate at the right of BEP, pump’s operating zone should be considered accordingly.		
k)	External flushing is required to remove the accumulated particles and all related information should be mentioned in datasheet.		
l)	Pump should have adjustment provision of axial clearance between casing and impeller for maintenance of performance at best efficiency when there is wear in between impeller and casing.		
m)	In case rubber or nonmetallic linings are used, these will be two piece molded under pressure and adjusted to the screwed metallic clamping which have been welded to the casting.		
n)	Each pump will have a coupling of adequate size, designed for full load and capable of supporting start –up on overload moments. Each half of the coupling will be factory mounted and locked to its shaft. The coupling must be able to accept the adjustment of the impeller.		
o)	The pumps shall have mechanical seals of cartridge type with self-lubrication sliding ring cartridges. The static part will be mounted on the seal plate with circumferential ring (O-ring) or another flexible sealing ring. Built in seal design will not be accepted.		
p)	The sealing areas shall be designed in such a way so that solids do not precipitate in them or affect the cooling or affect the adjustment and mechanical functioning of the seals. Seals which do not need jet cleaning are preferred.		
q)	Pump induced vibration due to flow pulsations shall be avoided through suitable design.		
r)	Each rotating equipment shall be first statically balanced and then dynamically balanced according to ISO 1940 (in the case of impellers this shall be done before and after mounting of the service rotor shaft).		
s)	All the wear parts of the pump shall be guaranteed for a minimum wear life of not less than 25000 hours.		
t)	Coupling halves shall be machine matched to ensure accurate alignment. Couplings must have a rated capacity of at least 120% of the maximum potential power transmission requirement.		
u)	All rotating parts such as coupling shall be covered with suitable protective guards. Guards shall be easily removable type. Coupling shall be of flexible type made of cast steel. The bidder shall furnish both halves of the coupling. Both the Coupling halves shall be bored and keyed to fit shafts of the pump and the motor by bidder. The coupling between shafts shall be so designed that they become tight during pump operation.		
v)	A common base plate shall be provided for pump assembly & Motor and the same shall be rigidly constructed, adequately braced and provided with finish pads for mounting pump.		
w)	Pump manufacturer is to supply base plate along with Foundation bolt & Nut, “Taper wedge” and the necessary fastener for Pump and Motor with Base plate. Even if Motor is excluded from their scope, necessary fastener for motor foot with base plate will remain in pump scope of supply in order to avoid any problem.		
x)	Limit of connection: The buyer (BHEL) has an intention to minimize interface for utilities as much as possible. The bidder shall consider this requirement in the planning stage of layout for the equipment. The bidder shall provide the header piping for utilities.		
y)	Nameplate: All equipment shall be provided with name plates indicating the item number and service name. Nameplates shall be of 304 Stainless steel plate and placed at a readily visible location. Nameplate of main equipment shall have enough information, which will be confirmed during engineering phase. Stainless steel nameplates for all instruments and valves shall be provided.		
z)	Rotation arrows shall be cast in or attached with stainless steel plate on each item of rotation equipment at a readily visible location.		



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 16 OF 18

aa)	Unless otherwise specified, all equipment items where the weight exceeds 15 kg shall be provided with suitable lifting lugs, ears or ring bolts or tapped holes for lifting rings. Minimum shock factor for lifting lugs shall be 2.0. The position of lifting lugs and reference dimension shall be shown on GA and/or outline drawings. NDT shall be conducted for lifting lugs. When any spreader bars are required for lifting and laydown, the bidder shall provide spreader bar with equipment.
bb)	Skid Mount/Transportation: Equipment shall be fabricated as skid mount design as much as practical to minimize erection at the site.
cc)	Two pieces of stainless steel earth lugs shall be provided with equipment diagonally. The position of earth lugs shall be shown on each GA and/or outline drawing.
dd)	Provide double nuts for anchor bolts.
ee)	Bidder shall provide allowable vibration level on foundation in foundation drawings and/or general arrangement drawings.
ff)	If the driver/driven equipment train is in the resonance condition or any vibration problems occur, the bidder shall solve the problems in a timely manner.
gg)	Bidder shall provide the mating flanges with the necessary gaskets.
hh)	All the surfaces of the carbon steel should be rust prevented before shipment for the period of at least 12 months for storage and construction.
ii)	Bidder to provide capacity of crane or hoist required for safe material handling and the details of heaviest component to be handled.
jj)	The list of all Bought out items with makes and country of origin and contact details of the manufacturers to be mentioned along with offer to be submitted. Acceptance of makes shall be subject to BHEL's Customer's acceptance during the detailed engineering without cost and delivery implication to BHEL.

9.0		PROCESS WATER CHARACTERISTICS	
S.No.	Constituents	Unit	Water quality
1.	Calcium as CaCO ₃	ppm	131
2.	Magnesium as CaCO ₃	ppm	52
3.	Sodium+ Potassium as CaCO ₃	ppm	65
4.	Total Cations as CaCO ₃	ppm	248
5.	Chloride CaCO ₃	ppm	20
6.	Sulphate as CaCO ₃	ppm	93
7.	Nitrate as CaCO ₃	ppm	10
8.	Alkalinity as CaCO ₃	ppm	125
9.	Total Anions as CaCO ₃	ppm	248
10.	Iron(total)	Fe	0.3
11.	Total Silica	SiO ₂	22
12.	pH value	--	7.0-8.2
13.	Turbidity	NTU	10

Note: Process water will be used for preparation of Lime solution in neutralisation tank before dosing.



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 17 OF 18

10.0	SPARES, TOOLS & TACKLES
10.1	START UP & COMMISSIONING SPARES
	Start-up & Commissioning Spares shall be part of the main supply of the Lime feeding/Dosing system. Start-up & commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares required for successful operation till commissioning of Lime feeding/Dosing shall come under this category. Bidder shall provide an adequate stock of such start-up and commissioning spares to be brought by him to the site for the equipment erection and commissioning. The spares must be available at Site before the equipment's are energized. List shall be furnished by bidder along with bid as indicated at Section-III.
10.2	MANDATORY SPARES
	a) The list of mandatory spares considered essential by the BHEL's Customer/Employer (BRBCL) is indicated in Annexure-II of Sub Section-D of Section-I in the specification. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidder's design) in the 'Schedule of Mandatory Spares' whether or not he considers it necessary for the Employer 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 per unit of each item in their Bid. Whenever the quantity is mentioned in "sets", the bidder has to give the item details and prices of each item. b) 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. Also one set for the particular equipment. e.g. 'set' of bearings for a pump would include the total number of bearings in a pump. 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. c) The assembly / sub assembly which have different orientation (like left hand, right hand, top or bottom), different direction of rotation or mirror image positioning or any other regions which result in maintaining two different sets of spares to be used for subject assembly / sub-assembly shall be considered as different type of assembly/sub-assembly. d) The prices of mandatory spares indicated by the Bidder in the Bid Proposal sheets shall be used for bid evaluation purposes. Bidder to provide the split up price for mandatory spares during placement of order as per price format.
10.3	RECOMMENDED SPARES
	In addition to the spare parts mentioned above, the bidder shall also provide a list of recommended spares for 3 years of normal operation of the plant and indicate the list and total prices. This list shall take into consideration the mandatory spares specified in this Sub-Section and should be independent of the list of the mandatory spares.



4x250 MW NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION
SPECIFIC TECHNICAL REQUIREMENT

SPECIFICATION No: PE-TS-463-571-A102
SECTION : I
SUB-SECTION : C1
REV. 00
SHEET 18 OF 18

10.4	SPECIAL TOOLS & TACKLES
	Any special tools & tackles required for the entire equipment to disassemble, assemble or maintain the units, they shall be included in the quotation and furnished as part of the initial supply of the machine. List of special tools & tackles shall be decided by bidder as per his proven practice. When special tools are provided, they shall be packaged in separate, boxes with lugs and marked as "Special Tools for (tag / item number)." Each tool shall be stamped or tagged to indicate its intended usage. Levers and eye bolts for the removal of parts to be serviced shall be submitted with special tools. List shall be furnished by bidder along with bid as indicated at Section-III.

10.5	FIRST FILL OF CONSUMABLES
1	Bidder's scope shall include supply and filling of all chemicals, lubricants, grease, filters and consumable items for operation up to commissioning including top up requirements. All lubricants proposed for the plant operation shall be suitable for all operating and environmental conditions that will be met on site consistent with good maintenance procedures as instructed in the maintenance manuals.
2	Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. (as applicable) used which is expected to be utilized during the first year of operation. This additional quantity shall be supplied in separate containers.
3	Detailed specifications for the lubricating oil, grease, gases, servo fluids, control fluids, chemicals including items qualities and quantities required per month of the plant operation for the BRBCL/BHEL's approval herein shall be furnished within 2 months of placement of Order. On completion of erection, complete list of bearings/equipment giving their location and identification marks shall be furnished to BHEL along with lubrication requirements. All types of chemicals, consumables, lubricants and grease shall be readily obtainable locally and the number of different types shall be kept to a minimum. For each type and grade of lubricant recommended, bidder shall list at least three equivalent lubricants manufactured by alternative companies.

11.0	LIST OF REFERENCE DRAWINGS BY BHEL
------	------------------------------------

The drawings specified in in Annexure-IV, Sub-Section-D of Section-I are being provided along with the tender specification for estimation and calculation purpose of the bidder.

12.0	PAINTS / PAINTING
------	-------------------

Bidder shall follow BHEL/ Customer painting philosophy specified Sub-Section- C2-B Section-I in the specification. An approved painting Schedule (Doc. No. 0270-109-PVM-H-001, R2) is provided. However, for components where no specific requirement is stipulated, the bidder shall follow its standard practice suitable for operating condition and subject to customer approval.

13.0	BID EVALUATION CRITERIA FOR POWER CONSUMPTION
------	---

Bidder is required to quote GPC in the price schedule issued along with tender.



**4X250 MW BRBCL NABINAGAR TPP
LIME FEEDING / DOSING SYSTEM
TECHNICAL SPECIFICATION**

PROJECT SPECIFIC GENERAL REQUIREMENTS

SPECIFICATION No: PE-TS-463-571-A102

SECTION : I

SUB-SECTION : C 2A

REV. 00

SECTION: I

SUB-SECTION: C 2A

**CUSTOMER SPECIFICATIONS
PROJECT SPECIFIC GENERAL REQUIREMENTS**



**SECTION-I
SUB-SECTION-C2-A
FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES**

FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES



LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2

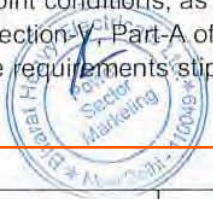
2050

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	
2.02.00	Test Instrumentation, Flow Measurement and their Calibration	
2.02.01	All instruments required for performance testing shall be of the type and accuracy required by the code and prior to the test, the Contractor shall get these instruments calibrated in an independent test Institute approved by the Employer and submit the same to Employer prior to commencement of test. All test instrumentation required for performance tests shall be supplied by the Contractor and shall be retained by him upon satisfactory completion of all such tests at site. All calibration procedures and standards shall be subject to the approval of the Employer prior to commencement of test. The protecting tubes, pressure connections and other test connections required for conducting guarantee test shall conform to the relevant codes. Tools and tackles, thermowells (both screwed and welded) instruments/devices including flow devices, matching flanges, impulse piping & valves etc. and any special equipment, required for the successful completion of the tests, shall be provided by the Contractor free of cost. The Performance test shall be carried out as per the agreed procedure. The detailed PG test procedure shall be submitted within 90 days of the date of Notification of Award and finalization of the PG test procedure shall be done within 180 days from the date of Notification of Award.	
2.02.02	The P&G test procedures shall be submitted for equipments/system & subsystem under Contractor's scope for all Guarantees as mentioned below, as per latest International codes / standard including correction curves, meeting the specification requirements along with sample calculations & detailed activity plan of preparation (including test instrumentation), conductance and evaluation of Guarantees.	
2.02.03	The Contractor shall submit for Employer's approval the detailed Performance Test procedure containing the following: (a) Object of the test. (b) Various guaranteed parameters & tests as per contract. (c) Method of conductance of test and test code. (d) Duration of test, frequency of readings & number of test runs. (e) Method of calculation. (f) Correction calculations & curves. (g) Instrument list consisting of range, accuracy, least count, and location of instruments.	
 LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2 SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES  PAGE 2 OF 24		

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	
2.03.00	(h) Scheme showing measurement points. (i) Sample calculation. (j) Acceptance criteria. (k) Any other information required for conducting the test.	
	Test Reports After the conductance of Performance test, the Contractor shall submit the test evaluation report of Performance test results to Employer promptly but not later than one month from the date of conductance of Performance test. Preliminary test reports shall be submitted to the Employer after completing each test run. Four (4) hard copies and two (2) soft copies on CD-ROM of each test report of final conducted test on each equipment/plant/system shall be submitted to Employer for approval.	
	2.03.01 Performance Guarantee Tests on the equipments/systems not covered in this Sub-section shall be carried out as per the procedure/test codes specified in respective detailed specifications.	
	2.04.00 Acceptance of Guarantee Test Results (i) For Category-I Guarantees In case during performance guarantee test(s) it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. In case the specified performance guarantee(s) are still not met but are achieved within the Acceptable Shortfall Limit as specified at clause 3.00.00 of this sub-section, Employer will accept the equipment/system/plant after levying liquidated damages as per clause 3.00.00 of this sub-section. However, if, the demonstrated performance guarantee(s) continue to be beyond the stipulated Acceptable Shortfall Limit, even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following: Reject the equipment / system / plant and recover from the Contractor the payments already made OR  	
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2 SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES PAGE 3 OF 24

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	
3.00.00	Accept the equipment /system/ plant after levying Liquidated Damages. The liquidated damages for shortfall in performance indicated in clause 3.00.00 of this sub-section shall be levied separately for each unit. The rates indicated in clause 3.00.00 of this sub-section are on per unit basis. The liquidated damages shall be pro-rated for the fractional parts of the deficiencies. (ii) For Category-II Guarantees In case during performance guarantee test(s) it is found that the equipment/system has failed to meet the guarantees, the Contractor shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the Employer and re-conduct the performance guarantee test(s) with Employer's consent. In case the specified performance guarantee(s) are still not met even after the above modifications/replacements within ninety (90) days or a reasonable period allowed by the Employer, after the tests have been completed, the Employer will have the right to either of the following: Reject the equipment /system / plant and recover from the Contractor the payments already made. OR Accept the equipment/system after assessing the deficiency in respect of the various ratings, performance parameters and capabilities and recover from the contract price an amount equivalent to the damages as determined by the Employer. Such damages shall, however be limited to the cost of replacement of the equipment(s)/system(s), replacement of which shall remove the deficiency so as to achieve the guaranteed performance. These parameters/capabilities shall be termed as "Category-II" Guarantees. AMOUNT OF LIQUIDATED DAMAGES (LD) APPLICABLE FOR GUARANTEES FOR EACH PROJECT The rate of liquidated damages and acceptable shortfall limits for different guarantees shall be as under and such liquidated damages shall be deducted from the Contract Price of the project.	
		
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES PAGE 4 OF 24

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES			
	NABINAGAR JV RLY-I (4X250 MW)			
Sl.No	Guarantee	Rate of Liquidated Damage (LD)	Acceptable Shortfall Limit with LD	
i)	For shortfall in guaranteed SO ₂ removal efficiency in percentage points under conditions stipulated in clause 4.01.00 (i) of Sub-Section-VI, Part A, Section-VI.	US \$ 21,045/- (US Dollar Twenty One Thousand Forty Five only) for every 0.1% point shortfall in SO ₂ removal efficiency from the guaranteed value	(-)0.25% point from the guaranteed SO ₂ removal efficiency.	
ii)	For increase in the limestone consumption of FGD system in T/hr under conditions stipulated in clause 4.01.00 (ii) of Sub-Section-VI, Part A, Section-VI.	US \$ 255,904/- (US Dollar Two Hundred Fifty Five Thousand Nine Hundred Four only) for every 100 kg/hr increase in Limestone consumption from guaranteed value.	(+)10% of the guaranteed limestone consumption.	
iii)	Auxiliary Power Consumption For increase in the auxiliary power consumption in KW guaranteed as per the requirements of clause 4.01.00 (iii), of Sub-Section-VI, Part A, Section-VI.	US \$ 2129/- (US Dollar Two Thousand One Hundred Twenty Nine only) for every KW increase in Auxiliary power consumption from the guaranteed value.	(+)1% of the guaranteed auxiliary power consumption	
NOTES APPLICABLE FOR EACH PROJECT: i) Each of the liquidated damages specified above shall be independent and these liquidated damages shall be levied concurrently as applicable. ii) If the contract currency is other than US dollars, then the liquidated damages shall be in equivalent amount in contract currency based on Bill selling exchange rate of State Bank of India prevailing on the date of award of contract.				
LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2  		
		SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES PAGE 15 OF 24		

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	
	iii) All these liquidated damages for short fall in performance shall be deducted from the contract price as detailed in accompanying General Conditions of Contract (GCC)/ Special Conditions of Contract (SCC) iv) Contractor's aggregate liability to pay Liquidated Damages (LD) for failure to attain the functional guarantee shall not exceed twenty five percent (25%) of the Contract Price. v) The LD values are applicable on per unit basis.	
4.00.00	GUARANTEES PARAMETERS	
4.01.00	Guarantees Under Category-I The Performance Guarantees which attract Liquidated Damages (LD) are as follows: The following shall be guaranteed by the Bidder under guarantee point condition of Sub- Section-V, Part-A of section- VI: (i) SO₂ removal Efficiency The Contractor shall Guarantee that SO₂ removal efficiency at guarantee point (as specified in Clause 1.00.00/2.00.00/3.00.00/4.00.00 Sub-section-V, Part-A of Section-VI applicable for respective project) shall not be less than the value specified under guarantee point conditions (as specified in Clause 1.00.00/2.00.00/3.00.00/4.00.00 Sub-section-V, Part-A of Section-VI applicable for respective project). (To be conducted as per the stipulation of Cl. no. 6.00.00 of this sub-section.) (ii) Limestone consumption of FGD system Limestone consumption of FGD system in kg/hr under guarantee point conditions (as specified in Clause 1.00.00/2.00.00/3.00.00/4.00.00 Sub-section-V, Part-A of Section-VI applicable for respective project) and SO₂ removal efficiency of not less than the value specified under guarantee point conditions (as specified in Clause 1.00.00/2.00.00/3.00.00/4.00.00 Sub-section-V, Part-A of Section-VI applicable for respective project) (iii) Auxiliary Power Consumption The Contractor shall guarantee the total auxiliary power consumption for the FGD plant in normal operation at the guarantee point conditions, as specified in Clause 1.00.00/2.00.00/3.00.00/4.00.00 Sub-section-V, Part-A of Section-VI applicable for respective project, inline with the requirements stipulated in clause 5.00.00 of this Sub-Section.	
 LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	 SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES PAGE 16 OF 24

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	
4.02.00	Guarantees Under Category-II The parameters/capabilities shall be demonstrated for various systems/equipments shall include but not limited to the following:- (i) Wet ball Mill capacity at rated fineness The contractor shall demonstrate the guaranteed capacity of each limestone pulverizer under the following conditions: i) Limestone fineness : 90% or higher (as per the requirement of the absorber) through 325 mesh. ii) Limestone Quality : All available quality from the specified range. (ii) Wet ball Mill wear parts guarantee Contractor shall demonstrate the life of wet ball Mill wear parts in line with requirements stipulated in Part B of the Technical Specification. The establishment of the above guarantee shall be based on the operating records available at the Power station and will be computed for each pulverizer based on actual total hours of operation. (iii) Wet ball Mill ball consumption Contractor shall guarantee ball consumption per ton of limestone throughput in line with requirements stipulated in Part B of the Technical Specification. Contractor shall furnish the minimum ball diameter below which the balls shall be replaced. (iv) Vacuum Belt Filter Capacity Contractor shall demonstrate the Designed Capacity of the Vacuum Belt Filters to dewater the quantity of gypsum with the specified purity and moisture content as specified in Part B of the Technical Specification. (v) Gypsum Purity The contractor shall demonstrate that the purity of the gypsum produced shall not be less than 90%, chloride content shall not be more than 100ppm and the moisture content shall not be more than 10% for guarantee point condition.  	
LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES PAGE 17 OF 24

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	
	(vi) Waste Water The Contractor guarantees that the maximum purge flow rate to waste water treatment system for the complete plant shall be 10m³/hr averaged over a 24 hour period from each unit. (vii) Performance characteristics of fans (capacity, head developed, etc.). (viii) Margins on fans in case Booster Fan is provided by the Contractor. Booster Fans - As specified in Part B of Technical Specifications (ix) Passenger cum Goods Elevator for FGD absorber & Limestone Grinding Building: Over load tests, travel and hoist speed checks. (x) Noise All the plant, equipment and systems covered under this specification shall perform continuously without exceeding the noise level over the entire range of output and operating frequency specified in Part-C of Section-VI of the technical specifications. 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. A minimum of 6 points around each equipment shall be covered for measurement. additional measurement points shall be considered based on the applicable standards and the size of the equipment. the measurement shall be done with slow response on the a - weighting scale. the average of a-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. corrections for background noise shall be considered in line with the applicable standards. all the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.	
 LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOCUMENT NO.: CS-0011-109(1A)-2	 SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES PAGE 18 OF 24

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
5.00.00	AUXILIARY POWER CONSUMPTION (PA) The unit auxiliary power consumption shall be calculated using the following relationship. $P_a = (P_{a1} + P_{a2} + \dots + P_{an}) / n$ $P_{an} = P_{un} + T_{Ln}$ P_a = Guaranteed Auxiliary Power Consumption. P_{an} = Auxiliary Power Consumption for unit # 1,2, --n. (Where "n" is the total no. of unit in project) P_{un} = Power consumed by the auxiliaries of the unit under test T_{Ln} = Losses of the transformers supplied by bidder based on works test reports. While guaranteeing the auxiliary power consumption the bidder shall necessarily include all continuously operating auxiliaries under this package. The auxiliaries to be considered shall include but not be limited to the following: a. Bucket Elevator b. Fan/Blower for Bag Filter c. Rotary Feeder d. Screw Feeder e. Agitator f. Dosing pumps g. Any other additional drive* * Bidder to consider any other equipment/drive not listed above but required for continuous operation of the system for calculation of auxiliary power . vi. Limestone Slurry Pump(s) vii. Vacuum Belt Filter, Vacuum Pump and its integral auxiliaries divided by the number of units in the project. viii. Power consumption of all working Booster water pumps (if provided) to ACW pumps after PHE divided by the number of units in the project. ix. Power consumption of Clarified water pump (if provided) and Clarified booster water pumps (if provided) divided by the number of units in the project.			
FGD LOT-I PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 1 OF 3	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
	x. Power consumption of Process water pump(s) divided by the number of units in the project. xi. Mist Eliminator Wash Water pump(s) xii. Power consumption of Belt filter wash water pump divided by the number of units in the project. xiii. Power consumption of total number of DM Cooling (normally working) Water pump to supply cooling water on the primary (DM) side of the plate type heat exchangers in the closed loop Equipment cooling water system divided by the number of units in the project. xiv. Power consumption of total number of Auxiliary Cooling (normally working) water pump to supply cooling water on the secondary side of the plate type heat exchangers in the closed loop Equipment cooling (unit auxiliary) water system divided by the number of units in the project. xv. Booster Fans. xvi. Power consumption of Limestone Slurry Tank Agitator(s) divided by the number of units in the project. xvii. Power consumption of Filtrate Pump(s) divided by the number of units in the project. xviii. Power consumption of Cloth Wash Water Pump divided by the number of units in the project. xix. Power consumption of Hydro-cyclone and Waste Water Pump divided by the number of units in the project. xx. Power consumption of all other continuous running Agitators divided by the number of units in the project. xxi. Air Conditioning System (*) Total Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of compressor and condenser fans of air cooled condensing unit, Air handling unit (AHU) fans for the Air conditioning system of FGD Control Room Building divided by the number of units in the project. xxii. Total Power consumption at motor input terminal of fan of UAF (*) divided by the number of units in the project. ((*) Above guaranteed power consumption values shall be at 20 deg C for centrifugal fans of AHUs and at 30 deg C for centrifugal fans of UAF and at an elevation of RL of site for both AHUs and UAF centrifugal fans.) xxiii. Total Power consumption (of working units) at motor input terminal at rated duty of Air compressor, Air drying plant (Heater and blower, as applicable) divided by the number of units in the project.			
FGD LOT-I PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 2 OF 3	

CLAUSE NO.	FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES	एनटीपीसी NTPC		
	The equipments listed above for calculating auxiliary power consumption are indicative. Any other equipment required for continuous operation of the system shall also be considered for calculation of auxiliary power consumption. Power consumption of all equipments provided on unitized basis shall be included in the unit auxiliary power consumption. For common station auxiliaries, the power consumption shall be assigned to each unit based on unit load for the purpose of calculating the unit auxiliary power consumption. xxiv. a) Power consumption of lime stone unloading, conveying, crushing , storage & reclaiming system (Single stream) except Lighting, Hoists, sampling unit, Sump Pumps, Elevators, , DE, Ventilation, SW System, Potable water system – for road unloading system. Duty factor for above system to be considered as 0.15. Accordingly, Pu for the same shall be duty factor x power consumption. xxv. Power consumption of Gypsum conveying system (Single Stream) except Lighting, Hoists, Sump Pumps, DE, Ventilation, SW System, Potable water system. Note : - The bidder shall furnish a list of equipments to be covered under auxiliary power consumption, which shall be subject to Employer's approval. - The equipments listed above for calculating auxiliary power consumption are indicative. Any other equipment required for continuous operation of the system shall also be considered for calculation of auxiliary power consumption. - Transformer losses (TL) shall be considered as per following (as applicable) – Aux/LT Outdoor/ LT Indoor Transformer: 100 % No load loss and 25 % of Copper Losses. - Auxiliary power shall be measured without SCR (De-NOx) system. - Auxiliary power shall be measured at the switchgear of the drives.			
FGD LOT-I PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-A BID DOC. NO.: CS-0011-109 (1A)-2	SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES	PAGE 3 OF 3	